The 1989 EXXON VALDEZ Cultural Resource Program

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Abstract

The *Exxon Valdez* struck Bligh Reef in Prince William Sound on March 24, 1989, releasing an estimated 258,000 barrels of crude oil and oiling shores along the coast of Southcentral Alaska. A massive cleanup effort launched by Exxon Company, USA, to recover the oil and treat affected shorelines, risked disturbance to important archaeological and architectural sites in the oil spill area. The region is known to hold prehistoric and historic sites reflecting over 7000 years of Alaskan heritage, forming a record of occupation by Native, Russian, and American cultures. In compliance with state and federal laws, including the National Historic Preservation Act of 1966, the EXXON VALDEZ Cultural Resource Program was developed to minimize disturbance to cultural resources during the treatment effort.

The EXXON VALDEZ Cultural Resource Program employed 26 archaeologists, all with regional experience and M.A. or Ph.D. degrees in Anthropology, to implement the protection program. Because no complete inventory of cultural sites existed in the oil spill area, the first task was to find and record cultural sites in the potential impact area through reconnaissance survey, using archaeologists as one of the three specialists on the Shoreline Cleanup Assessment Team (SCAT) crews. Two-hundred sixty-one (261) cultural sites in the area were already entered in the Alaska Heritage Resource Survey (AHRS) system -- a statewide inventory of important archaeological and architectural sites maintained by the Alaska Office of History and Archaeology. As a result of the EXXON VALDEZ Cultural Resource Program, an additional 271 cultural sites were entered into the inventory. Reconnaissance and site protection efforts were conducted in the western half of Prince William Sound, the Kenai Peninsula, the Kodiak Archipelago, and part of the Alaska Peninsula. Over 5000 km (3000 mi) of shoreline were surveyed using reconnaissance methods, and 8000 km (5000 mi) of shoreline were videotaped from a helicopter.

In consultation with state and federal agencies and other parties, constraints on the treatment techniques were devised to minimize disturbance to cultural sites by treatment activities. Constraint options for specific sites included avoidance, access restrictions, and restrictions that treatment take place in the presence of an archaeological monitor. Under stipulations in nine state and federal cultural resource permits, collection of jeopardized artifacts was authorized but rarely employed. Two-hundred seventy-three (273) artifacts were retained. An educational program was developed to help protect sites, which used handouts, an instructional videotape, and field briefings to inform cleanup personnel of Exxon's cultural resource policy and procedures and the legal protection afforded cultural sites. A post-cleanup assessment program was implemented to document the condition of a sample of sites following treatment.

The EXXON VALDEZ Cultural Resource Program was successful in minimizing disturbances to cultural sites. No significant disturbance to cultural sites was directly caused by shoreline cleanup efforts. Nonmalicious disturbance, such as pedestrian traffic or littering (some of which was treatment-related), was documented at a total of 21 sites. Sixteen sites in the oil spill sample were vandalized during the summer of 1989, two of which were determined to have been vandalized by individuals associated with the treatment program. One vandal was apprehended and successfully prosecuted by the US Forest Service, with the cooperation of the EXXON VALDEZ Cultural Resource Program. In addition to the above accomplishments, the site protection effort resulted in a large body of information on site location and condition useful to state, federal, and private land managers for future cultural resource management.

This technical volume provides background on the natural and cultural environments, discusses the site protection efforts, and presents the results of the program. A second, confidential volume with restricted distribution contains details of site character and location.

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All the above groups and individuals, as well as many more who are unnamed, share the credit for the successful protection of cultural resources jeopardized by the oil spill treatment efforts.

Introduction

On March 24, 1989, the tanker *Exxon Valdez* grounded on Bligh Reef in Prince William Sound, Alaska (Figure 1), spilling an estimated 258,000 barrels of crude oil. Within ten days the oil had moved southwest through a series of islands, oiling shorelines in southwestern Prince William Sound (O'Donoghue 1989:14-15). Plans were made by Exxon Company, USA, to begin a shoreline treatment program to restore the oiled beaches. The US Forest Service (USFS), a major federal land manager in the region, advised Exxon that concern for cultural resources potentially affected by the operation was warranted. The Advisory Council on Historic Preservation (ACHP), citing emergency circumstances, declared that all cultural resources would be treated as potentially eligible to be named to the National Register of Historic Places.

To comply with state and federal laws, Exxon Company, USA, created and funded the EXXON VALDEZ Cultural Resource Program. This program obtained nine Archaeological Resources Protection Act (ARPA) and Special Use permits from the Alaska Office of History and Archaeology (AOHA), National Park Service (NPS), US Fish and Wildlife Service (USFWS), and USFS. These permits allowed Exxon to conduct archaeological surveys on state and federal land within the spill area and to document and protect cultural resources subject to potential damage by subsequent shoreline treatment activities. A total of 28 cultural resource specialists were employed by the program, including a director, two assistant directors, 21 field archaeologists, a laboratory manager, two laboratory assistants, and a program consultant. Using the Secretary of the Interior's Standards and Guidelines (Federal Register, 9/29/83, 48:190, p. 44736-44737), all supervisory and field personnel held, at a minimum, a graduate degree in archaeology or anthropology, plus regional experience.

Close cooperation and coordination with a number of state and federal agency personnel was essential for successful protection of cultural resources under emergency circumstances. Staff of the State Historic Preservation Office (SHPO), within the Alaska Department of Natural Resources (ADNR), played a key role in the process, as did the USFS, which served as a cultural resource advisor to the U.S. Coast Guard. The USFWS and NPS also assisted the program. As a result, a large proportion of the professional Alaskan cultural resource community interacted -- from their various institutional bases -- to minimize potential impacts to cultural resources in a compliance project of unprecedented scope and character. In addition, working relationships were established with individuals from the Kodiak Area Native Association (KANA) and Chugach Alaska Corporation (CAC). Credit for the success of the project must be shared among many parties and individuals. Reflecting this dynamic process, a Memorandum of Understanding (MOU) between Exxon Company, USA, and the USFS, SHPO, and CAC was signed in August of 1989. A Memorandum of Agreement (MOA) under Section 106 of the National Historic Preservation Act was developed to formalize the consultation process, and signed in May of 1990.

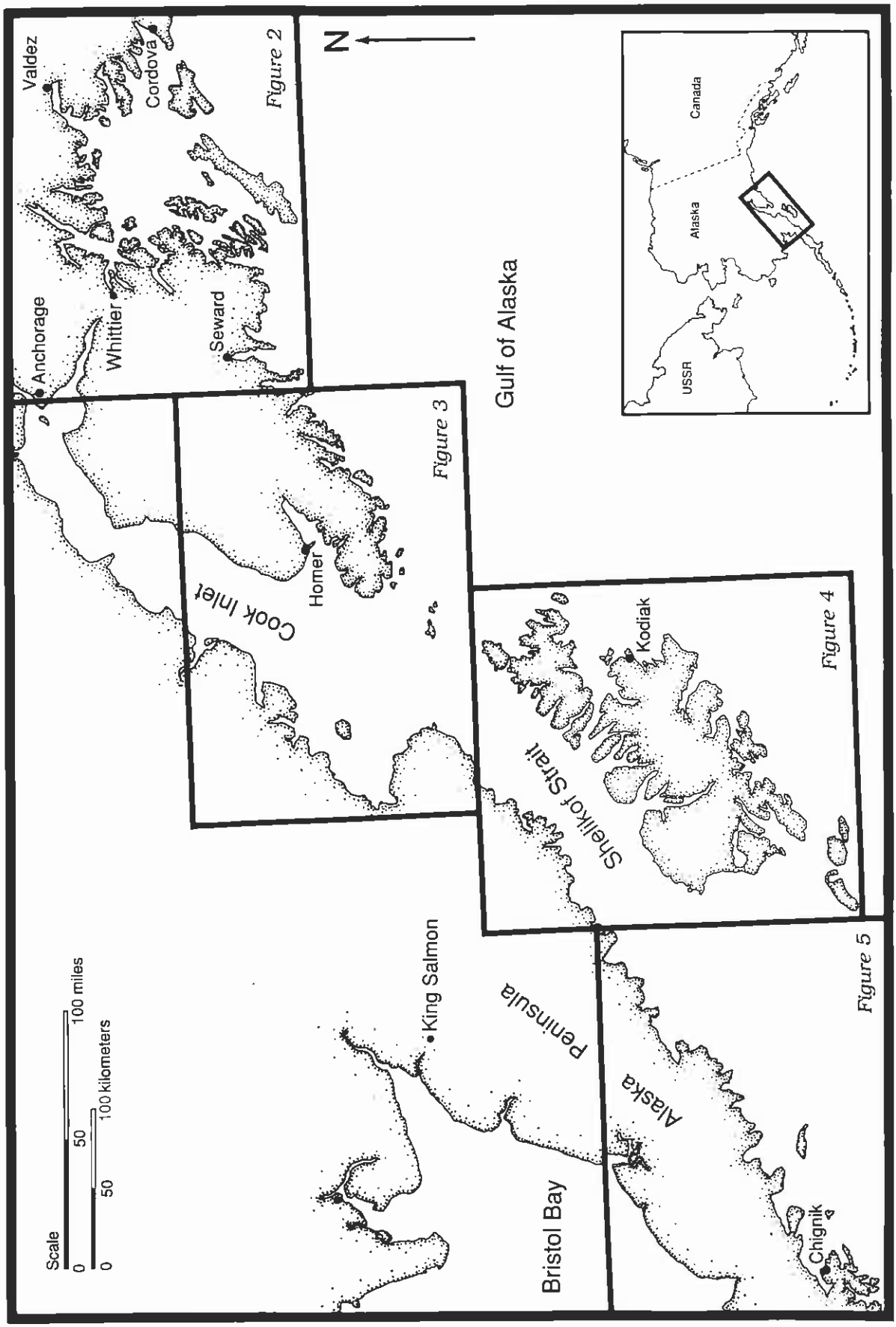
The concept for the EXXON VALDEZ Cultural Resource Program was outlined on April 4, 1989. The field schedule closely followed that of the oiled shoreline treatment program. On April 13, 1989, the first multi-disciplinary environmental assessment crew, consisting of an archaeologist and a coastal ecologist, surveyed shoreline segments on Naked Island in Prince William Sound just hours before the first technicians arrived to begin treatment activities. By September 15, 1989, after five months of work from Prince William Sound to the Alaska Peninsula, treatment operations were shut down in anticipation of winter storms and archaeological field work ended.

During the winter, this final report was prepared to satisfy the various permits from the four permitting agencies. Considerable data organization tasks were accomplished during this time as well. The director, assistant director, laboratory manager, and laboratory assistants were employed at the central Exxon offices in Anchorage to manage the winter phase of the EXXON VALDEZ Cultural Resource Program. As this report was being completed in the spring of 1990, archaeological fieldwork began anew to protect cultural resources during a second summer of treatment activity.

Figure 1

Southcentral Alaska:

Showing the Oil Spill Region and the Location of Areas Mapped as Figures 2 - 5



Applicable Federal and State Laws and Regulations

Federal and state laws protecting cultural resources were applied to the *Exxon Valdez* oil spill cleanup program. The major state legislation is the Alaska Historic Preservation Act, which prohibits unauthorized disturbance to paleontological, archaeological, or historical properties on state-administered lands, and provides a permitting system (administered by AOHA) for investigations. Compliance with federal law was also overseen by the SHPO as a function handled through AOHA. The Alaska land use permit authorizing "shoreline cleanup operations on all state-owned tide and submerged lands" included as stipulations that "all site specific shoreline cleanup work plans shall incorporate the timely recommendations of the State Historic Preservation Officer," and that "if, in connection with any of the operations authorized under this permit, EXXON, its officers, agents, employees, contractors, subcontractors or their personnel encounter any previously undiscovered paleontological, archaeological or historical sites or artifacts, field operations shall be suspended on that portion of the project area, and the Director of EXXON's Cultural Resource Program shall be immediately notified and the State Historic Preservation Officer notified within 24 hours."

Involvement of the SHPO as an agent for the ACHP follows Section 106 of the National Historic Preservation Act of 1966, as amended, which states that:

> the head of any Federal agency having direct or indirect jurisdiction over a proposed Federal or federally assisted undertaking in any State and the head of any Federal department or independent agency having authority to license any undertaking shall, prior to the approval of the expenditure of any federal funds on the undertaking or prior to the issuance of any license ... take into account the effect of the undertaking on any district, site, building, structure, or object that is included in the National Register .... the head of any such federal agency shall afford the Advisory Council on Historic Preservation ... a reasonable opportunity to comment with regard to such undertaking.

An "undertaking" is defined in 36 CFR 800 (Protection of Historic and Cultural Properties) as "any Federal, federally assisted or federally licensed action, activity, or program or the approval, sanction, assistance, or support of any non-Federal action, activity, or program." Given the involvement of federal agencies such as the USFS, National Oceanic and Atmospheric Administration (NOAA), Environmental Protection Agency (EPA), NPS, USFWS, and the Coast Guard (which--as the designated lead federal agency--became responsible for ensuring Exxon's compliance with federal law), the cleanup effort constituted such an undertaking.

The Section 106 review process established by the National Historic Preservation Act is implemented by regulations in 36 CFR 800, which formalizes a consultation process that allows pertinent parties the opportunity to comment on the effect that a federal undertaking might have on a cultural property. A provision (800.12) allows an agency to follow alternate procedures (36 CFR 78) in emergency undertakings, unless the undertaking will not be implemented within 30 days after the emergency. In the *Exxon Valdez* spill, 36 CFR 800 was followed with some modifications. Steps identified in the regulations include the inventory process, the determination of effect, and mitigation. One procedural modification occurred, within the inventory process, when the ACHP declared that all cultural properties would be treated as eligible to the National Register.

The process of deciding whether an undertaking will affect a cultural property eligible to the National Register is called determination of effect, which is made jointly by the land managing agency and the SHPO in consultation with other interested parties. When the effect is adverse -- that is, when it reduces the value or integrity of the cultural resource -- then mitigative measures are recommended to minimize or avoid the adverse effect. This Section 106 consultation process is routinely handled by the SHPO, with oversight by the ACHP, often through a MOA that identifies specific steps and considerations tailored to the particular undertaking.

For the *Exxon Valdez* undertaking, the inventory, determination of effect, and mitigation tasks were necessarily collapsed into a narrow time frame. The consultation process involved several different parties, and had to be conducted expeditiously so that the cleanup -- which in many cases needed to be done quickly to protect the natural environment -- could proceed. The MOA for the undertaking, which is usually in place prior to an activity, was developed in draft form after the cleanup began and was not signed in final form until May of 1990. As a result, much of the credit for site protection achievements is due, not to formal agreements, but to existing working relationships among the cultural resource community in Alaska that allowed efficient action and decision-making in an emergency situation.

Cultural resource compliance was also handled directly by each land-managing federal agency (USFS, USFWS, and NPS) through Special Use and ARPA permits. Most permits made reference to the National Historic Preservation Act. In addition to authorizing legitimate cultural resource investigations through a permitting system, ARPA provides for criminal penalties for individuals convicted of unauthorized disturbance to cultural resources on federally administered lands.

Since the signing of Executive Order 11593 in 1971, federal agencies have had the responsibility to "... locate, inventory, and nominate to the Secretary of the Interior all sites, buildings, districts, and objects under their jurisdiction or control that appear to qualify for listing on the National Register of Historic Places." However, with relatively vast holdings and limited staff, no federal agency in Alaska has completely inventoried the cultural resources under its jurisdiction. The USFWS, for example, with "77,000,000 acres of largely uninventoried National Wildlife Refuge lands," states that "planning and implementing comprehensive inventories remains a distant dream" (Diters 1989:4). Consequently, for lack of comprehensive inventory data on the cultural resources in the region of oiled

shorelines, the determination of effect and mitigation functions -- that were ultimately the responsibility of the Coast Guard to see carried out -- were necessarily preceded by an emergency site inventory effort. Thus all three tasks -- inventory, determination of effect, and mitigation -- involved the EXXON VALDEZ Cultural Resource Program as well as state and federal agencies.

The Shoreline Cleanup Assessment Process

As oil from the *Exxon Valdez* moved out of Prince William Sound and into the Kodiak and Alaska Peninsula areas, the scope of the treatment operation was expanded (Figure 1). Exxon command centers were established in Valdez, Seward, Homer, and Kodiak to coordinate the flow of information and organize the treatment effort. Working committees composed of representatives from state, federal, and other major land owner/managers, termed Interagency Shoreline Cleanup Committees (ISCC) in Valdez and Kodiak, and Multi-agency Committees (MAC) in Seward and Homer, were created to work with the Exxon command centers. Together with Exxon and the Coast Guard, they set treatment priorities in each region.

Aerial survey to determine the location and intensity of oiling was conducted independently by several different agencies, including the Coast Guard and Alaska Department of Environmental Conservation (ADEC). But the systematic ground survey, producing the data used by ISCC and MAC groups as a basis for specific cleanup recommendations, was administered by Exxon. A shoreline evaluation system was designed in which a Shoreline Cleanup Assessment Team (SCAT) crew, consisting of an oil geomorphologist, a biologist, and an archaeologist, surveyed sections of shoreline to obtain a range of oil, cultural, and biological data prior to treatment. Specifically, the oil geomorphologist characterized shoreline composition and degree of oiling, the biologist evaluated the impacts and potential impacts on flora and fauna, and the archaeologist assessed impacts and potential impacts to identified archaeological and architectural sites. For all but the Kodiak area, this was done prior to treatment. Acting upon a "Determination of No Effect" (to cultural resources) issued by the SHPO for certain kinds of low-impact treatment, some treatment was done prior to SCAT survey on the Kodiak Archipelago and Alaska Peninsula.

An early and important part of the SCAT process was the aerial videotape mapping program. Teams of three (a pilot, a navigator, and an oil geomorphologist who handled the video camera and narrated the tape) flew contiguous sections of shoreline in a helicopter to conduct initial assessments of shoreline character and the degree of oiling. This preliminary information was used by SCAT crews, up to seven of which were in the field at one time, to select shorelines for survey. The SCAT evaluations were sent back from the field to Valdez or Kodiak, where they were quickly analyzed to develop treatment recommendations and constraints that were in turn submitted to the ISCC/MAC for review, then forwarded to the Federal On-Scene Coordinator (FOSC) for approval. Due to obvious time constraints, this information flow was compressed into as short a time as possible. Complicating the process was the fact that much of the baseline cultural and environmental data had not been compiled by the respective land-managing agencies prior to the oil spill. As a result, inventory data for accurate shoreline assessment was collected in the midst of the emergency, a situation that can only be characterized as less than ideal. Over 8533 km (5300 mi) of shoreline were videotaped, and over 5474 km (3400 mi) of shoreline were subjected to SCAT evaluation in an oil spill encompassing parts of Prince William Sound, the Kenai Peninsula, Kodiak Island, and the Alaska Peninsula (Figures 2-5). Details of this effort are discussed in subsequent chapters.

Methods of Oiled Shoreline Treatment

For oil floating in accessible channels, waterborne skimmers and other craft were used to recover, process, and store the material before it was sent to a reclamation point. This activity had slight potential for disturbance of cultural resources. However, hundreds of miles of shoreline were oiled to varying degrees. Techniques selected to remove the oil depended on the amount and nature of the oil, the type of shoreline morphology and sediment, the biota present, and the technology available and authorized at that point in the season. Oil was removed from shorelines by hand-wiping rocks with sorbent pads, removing oiled vegetable matter and other debris by hand, skimming loose oil with rakes and shovels, and flushing with hot and cold water using hand-held hoses, stationary hoses, and mechanical-assisted hoses. All of these are discussed, along with their potential for impacts to cultural resources, elsewhere in this report.

The Cultural Resource Program

The EXXON VALDEZ Cultural Resource Program was an integral part of Exxon's SCAT approach. All personnel within the program, including the director and assistant directors, were independent consultants contracted for specific cultural resource services directly to Exxon Company, USA. The director and assistant directors were the primary liaison between Exxon and the various state and federal agencies and other parties with cultural resource interests.

Although cooperative communication and transportation arrangements were made frequently with state and federal agencies, the logistics for the program were coordinated by SCAT through Exxon offices in Valdez, Seward, Homer, and Kodiak. The response headquarters

Figure 2

Prince William Sound:

Showing Communities and Principal Islands and Bays

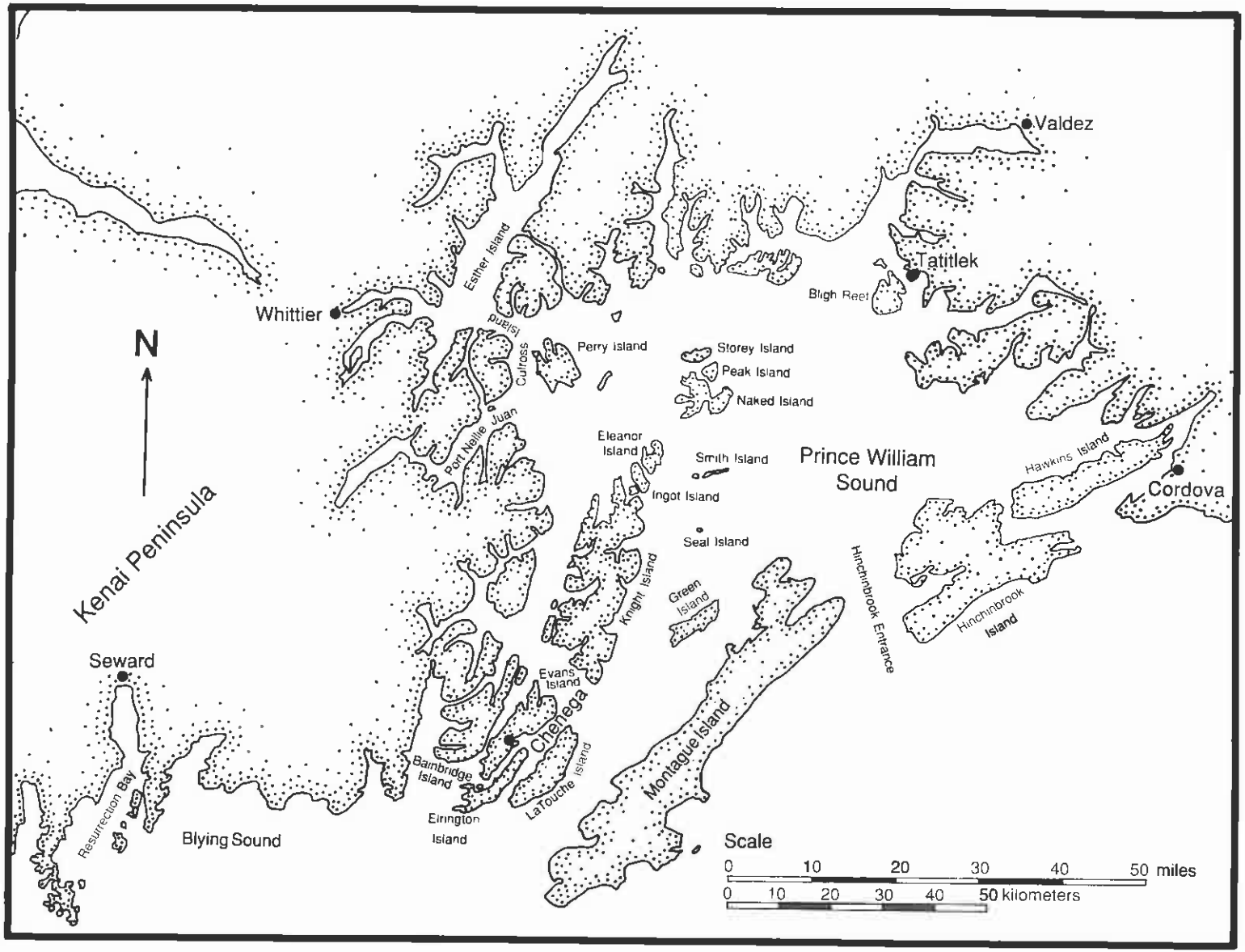


Figure 3

Outer Cook Inlet and the Kenai Peninsula:

Showing Communities and Principal Islands and Bays

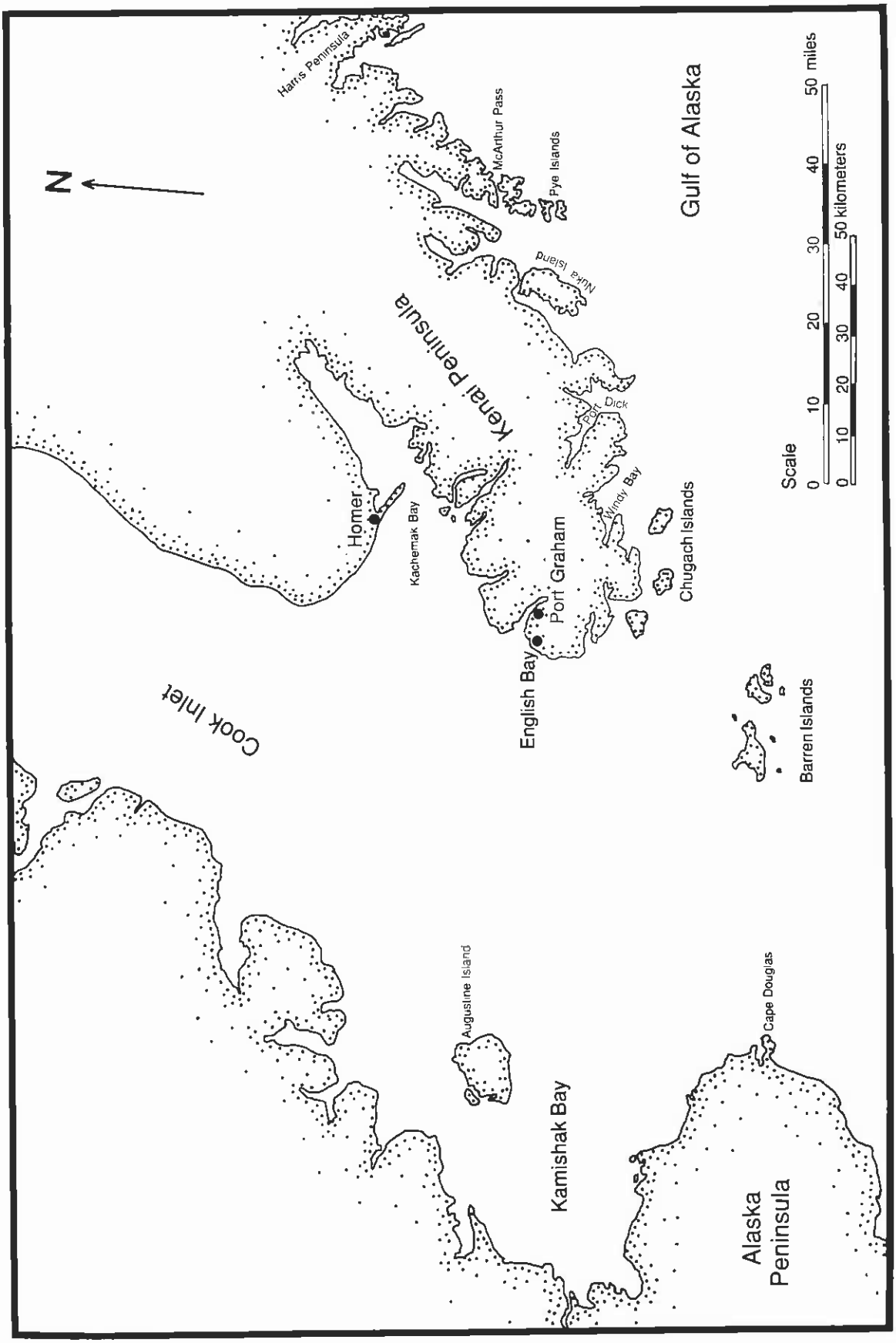


Figure 4

The Kodiak Archipelago

Showing Communities and Principal Islands and Bays

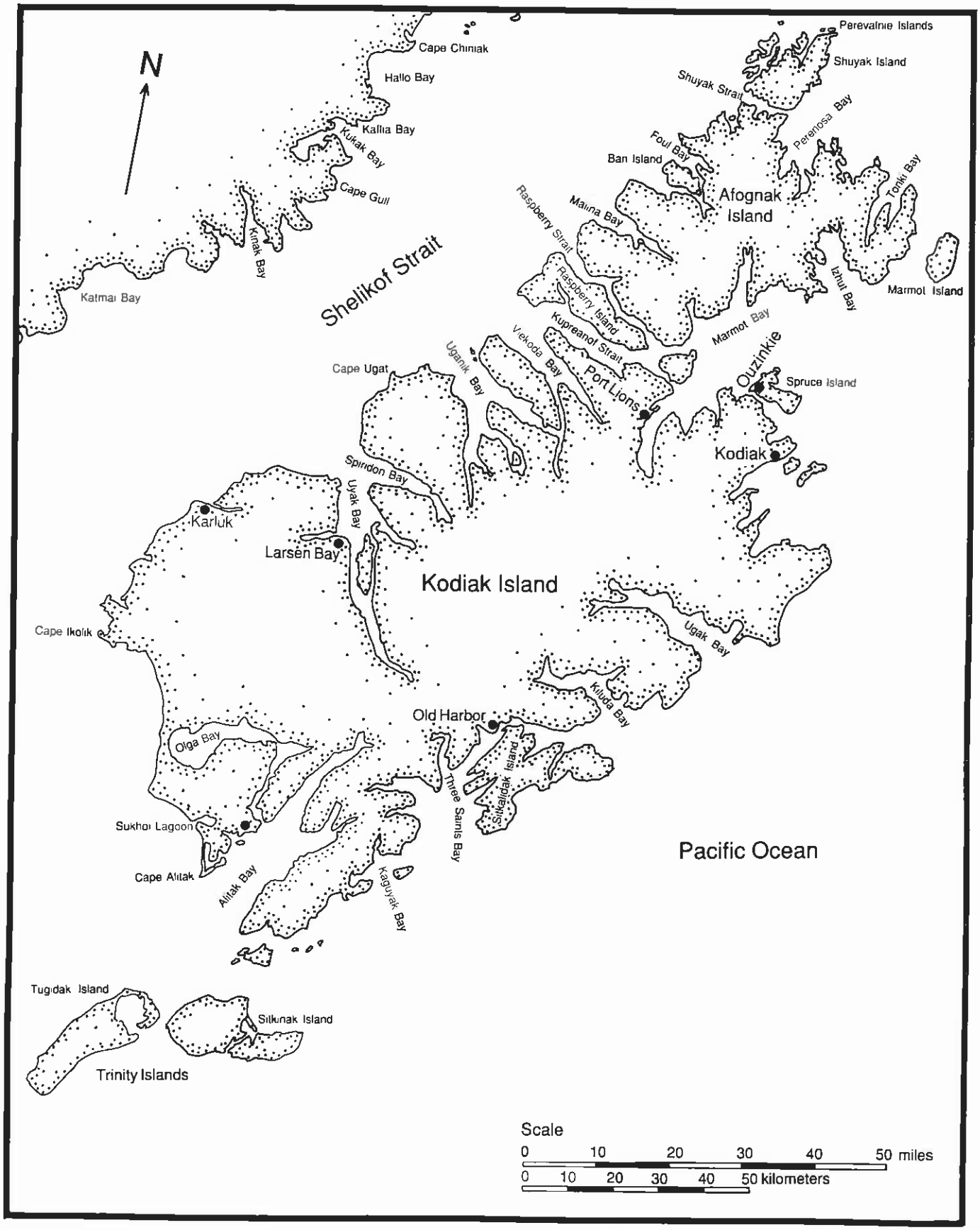
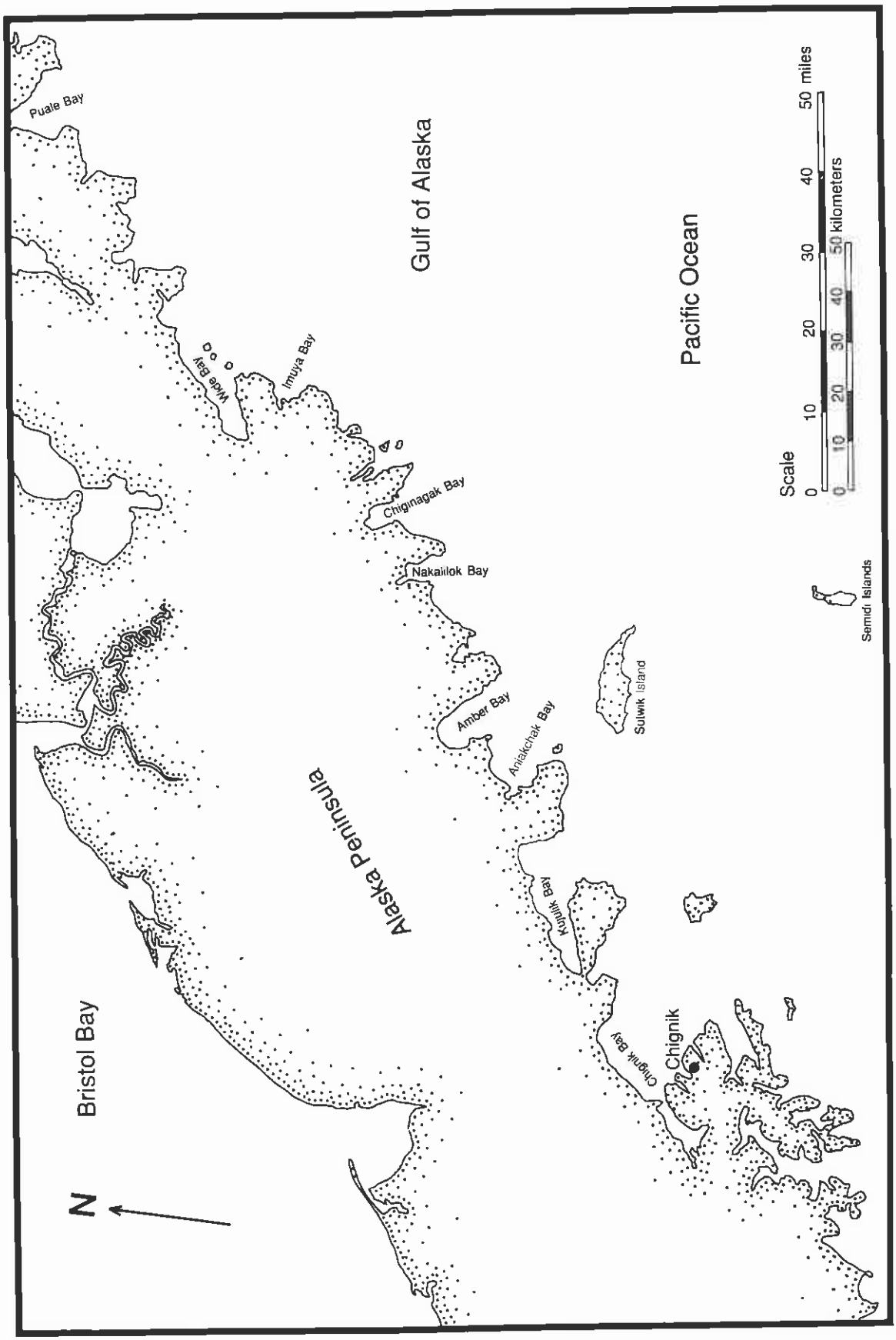


Figure 5

A Portion of the Alaska Peninsula:

Showing Communities and Principal Islands and Bays



for SCAT and the EXXON VALDEZ Cultural Resource Program was in Valdez, until a satellite headquarters was established in Kodiak midway through the summer. Official SHPO approval of specific cleanup techniques and archaeological constraints was handled by SHPO signatories in Valdez and, eventually, Kodiak.

Several different cultural resource tasks were handled by the program. Archaeologists were a critical component of each three-specialist SCAT crew, providing reconnaissance data on shoreline segments prior to treatment. They participated in the reassessment process, in which segments suspected to have undergone changes in biological or oiling characteristics since the original SCAT survey were resurveyed. Archaeologists administered the archaeological monitoring program, in which certain segments containing particularly sensitive sites were observed and inspected during treatment. Review mechanisms were established to evaluate the potential impacts to cultural resources of dispersant testing programs, bioremediation experiments and application, special long-term biological and oil persistence study sites, and other technical programs. A post-cleanup assessment program was put into place, in which selected cultural sites were inspected and documented at the end of the season after treatment activities were completed. An active educational program was developed to inform cleanup personnel of the potential for discovering cultural remains during shoreline treatment operations, of state and federal laws regarding any disturbance of cultural resources, and of Exxon's policy regarding such disturbance. Although state and federal agencies consistently advised on the most appropriate means by which to undertake these different tasks, it remained the responsibility of the EXXON VALDEZ Cultural Resource Program to carry them out.

Models for Conducting the Program

Several circumstances surrounding the EXXON VALDEZ Cultural Resource Program were unique, leaving few analogous projects from which direction could be taken. The emergency nature of the project required immediate access to state and federal agency representatives and the ability to make decisions with often only a few hours of lead time, using radio and radiotelephone communication systems that were not always reliable. Similarly, in the experience of the cultural resource specialists employed by both Exxon and the state and federal agencies, no precedents were available in which the identification, determination of effect, and mitigation steps were so collapsed in time for a project of such magnitude. The amount of contiguous coastal reconnaissance executed in a single season, exceeding 5000 km (3000 miles), is without known parallel. And finally, though there have been a number of marine and inland waterway oil spills and oil spill cleanup operations, both nationally and internationally, no literature was immediately available to indicate that any prior oil spill or oil spill cleanup project included a cultural resource compliance effort (although one example, described below, was found during the preparation of this report).

Two previous archaeological projects in Alaska approach the EXXON VALDEZ Cultural Resource Program in magnitude, although they were quite dissimilar in many respects, and neither was an emergency situation. The cultural resource survey conducted for the Susitna Dam project in central Alaska (Dixon et al. 1984) was comparable in terms of the number of specialists employed over a field season, but diverged in many ways such as its inland location, several years duration, emphasis on test excavation, level of detailed site description in the technical reports, and absence of a mitigation phase. The archaeological survey for the Trans-Alaska Pipeline was similar in that it was oil-related, the survey zone had a linear orientation, transportation and communication were difficult, and a cultural resource information program for construction personnel (Campbell and Cummings 1975) was developed. The differences between the oil spill and pipeline projects are significant, however, in that the latter was of several years duration, data recovery was used extensively as a mitigation option (Cook 1971), most of the project area was in Alaska's interior, and the number of field personnel employed was greater. In sum, there was little in the way of precedent for designing major elements of the EXXON VALDEZ Cultural Resource Program.

The single example of "oil spill archaeology" discovered in the literature consists of the following note by Benson (1978) in the *American Society for Conservation Archaeology Newsletter:*

> In the last week of June, 1978, a major oil spill occurred at the confluence of the Williamette and Columbia Rivers, Oregon. The Washington state shoreline and the Oregon shoreline were severely affected for several river miles downstream from the spill. It was necessary to use heavy equipment in clean-up operations in some areas of oil concentration on the shore.
>
> The Pacific Region Archeologist for the U.S. Fish and Wildlife Service, Charlotte Benson, was called in to advise in clean-up operations that could impact archeological sites in the spill area. The Coast Guard and the spiller, in charge of clean-up, were totally receptive to Benson's recommendations regarding acceptable clean-up techniques in sensitive areas, and to archeological monitoring of heavy equipment clean-up .... While damage to archeological sites as a result of the oil spill (or other disaster) cannot be prevented, additional damage caused by clean-up can be minimized by including cultural resources personnel in the response effort.

Benson's (1978) pioneering effort is an interesting precursor to the EXXON VALDEZ Cultural Resource Program, but no one in the Alaskan cultural resource community was aware of it when the site protection program was being developed in 1989.

Organization and Structure of the Report

This final report satisfies the reporting stipulations in the permits issued by the four permitting agencies. Rather than develop a separate report for each individual permit, it was agreed that one comprehensive report would satisfy all cultural resource permits. The report content and distribution were decided in consultation with interested parties through the Section 106 process under the National Historic Preservation Act. While there was general agreement on the need to describe the compliance background and site protection procedures, there were different opinions concerning the manner in which substantive results were to be presented.

Cultural resource managers and other professionals have for some time acknowledged the need to balance the dual responsibilities of distributing substantive results and protecting the integrity of cultural properties. The US Department of the Interior has specifically addressed the issue in a bulletin entitled "Guidelines for Restricting Information about Historic and Prehistoric Resources." Some would contend that details of site nature and site location distributed in professional archaeological reports are used by vandals to locate and destroy sites in their search for collectable and marketable artifacts. The degree to which this occurs probably varies from region to region around the world. In Alaska, in the absence of much systematic analysis of the subject, the opinion of most professional archaeologists and land managers is that the most serious looting is by local individuals who have an intimate knowledge of the lands and resources in their territory. This is certainly the case in one of the most extensive examples of looting in the state (Crowell 1987).

Documents outlining the planned report content were prepared and circulated for use in the Section 106 consultation process (Mobley 1989a). Considered were the degree of specificity warranted in site description, the site location, site photography, artifact description, artifact illustration, mapped site location, feature distribution, and predictive modeling. Guidelines were drawn primarily from compliance research in Alaska published or authorized by the four permitting agencies: ADNR (McMahan and Holmes 1985, Reger and Campbell 1986); USFWS (Dumond 1987, Smith 1984); USFS (Mattson et al. 1986; Moss et al. 1989; Ackerman et al. 1985); and NPS (Giddings and Anderson 1986, Griffin and Chesmore 1988, Reynolds 1987, Schoenberg 1985, Schaaf 1988). Schaaf's archaeological survey of the Bering Land Bridge National Preserve (Volume I) -- was particularly useful because it was enthusiastically endorsed by the Bering Straits Regional (Native) Corporation as a sensitively crafted report suitable for wide professional distribution. It served as a valuable model for the final report of the EXXON VALDEZ Cultural Resource Program, in light of concerns raised by CAC regarding the degree of secrecy necessary to adequately protect the integrity of the cultural resources. Another useful report for helping to determine the appropriate level of information distribution was that of Campbell and Cummings (1975), a widely issued guide to archaeological sites and artifacts developed for construction workers involved with the building of the Trans-Alaska Pipeline.

The distribution of the final technical report was also a matter considered through the Section 106 consultation process. The Secretary of the Interior's Standards and Guidelines state that: "results must be made available to the full range of potential users." A letter requesting a project-specific interpretation of that recommendation was sent to each of the four permitting agencies. Exxon's initial suggestion was that, in response to resolutions released to the radio and print media in August by CAC, Eyak (village) Corporation, and Chenega (village) Corporation, calling for restrictions on cultural resource information released about the Chugach region, Exxon would not print or distribute copies of the report except for the minimal copies required by the permitting agencies. Kodiak Area Native Association favored professional distribution, however, and eventually distribution lists were prepared by Exxon and the parties participating in the Section 106 process, and a general agreement was reached on the disposition of copies of the final technical report. Due to the unique, unprecedented circumstances surrounding this cultural resource compliance effort, the "full range of potential users" was considered to include Exxon/Esso in-house oil spill and environmental managers, oil spill and environmental managers in private industry and government both nationally and internationally, archaeologists and historians in Alaska, British Columbia, and the states of Washington, Oregon, and California, and cultural resource managers in Alaska, British Columbia, the United States, and elsewhere internationally.

The content, organization, and distribution of this final technical report reflect the discussions and decisions described above. Chapters and subsections include standard subject matter required as part of cultural resource reports, and also accommodate the diverse aspects of this unique compliance project. Following this introduction, the *Natural Environment* chapter presents a comprehensive discussion of the natural environment to create a context for understanding the archaeological survey process and resulting discoveries. The history and prehistory of the region are discussed in the *Cultural Background* chapter. The various parties and agencies involved in the project, particularly those owning land in the oil spill area, are described in the chapter entitled *Current Land Management*.

Details of the cultural resource program and its evolution as part of the SCAT process, are discussed in the section, *Objectives and Procedures. Sources of Potential Impacts to Cultural Resources* includes descriptions and photographs of the various treatment techniques used, and a discussion of potential impacts. *Educational Efforts* discusses the steps taken by Exxon to minimize cultural resource disturbance, through informing personnel of the character, significance, and legal protection of cultural resources. The *Site Protection Program* discusses specific procedures taken to protect cultural sites, and the results of those efforts.

Events that required special responses to protect specific cultural resources are considered under *Incident Reports*. Contributions to the understanding of past human behavior in the study area are discussed in the chapter entitled *Substantive Results*. Concluding the text is a summary which recapitulates the efforts and results of the EXXON VALDEZ Cultural Resource Program. Appendices provide important information too unwieldy to incorporate in the text, including the text of the MOU and the MOA, results of the monitoring and post-cleanup assessment programs, descriptions of the artifacts collected, and a list of acronyms used in this report.

Natural Environment

This chapter summarizes the features of the natural environment of the study area, extending from Prince William Sound to the Alaska Peninsula, including the Kodiak Archipelago. It provides an environmental context for the following chapters and background data to assess the effectiveness of the EXXON VALDEZ Cultural Resource Program. A summary of the physical characteristics of the region includes the general physiography, geology, and geomorphology, and emphasizes factors that affect shorelines. A discussion of climate, oceanography, and soils concludes the physical environment section. The discussion of the biological environment summarizes the region's terrestrial and marine fauna and flora, focusing on resources important to prehistoric and historic occupants of the area. The histories of climate, glaciation, and vegetation provide a framework for the cultural chronology chapters, and the chapter concludes with a summary of environmental factors that help explain the region's prehistory and the results of this project.

Physiography

The coastal areas affected by the oil spill span a number of Alaska's physiographic provinces. All of the study area lies within the Pacific Mountain System (Wahrhaftig 1965). For most of its length, the Pacific Mountain System consists of two broadly parallel ranges of mountains with an intervening lowland trough. Within Alaska, the Pacific Mountain System is subdivided into three physiographic provinces that reflect this topographic variability; the Alaska-Aleutian Province, the Coastal Trough Province, and the Pacific Border Ranges Province (Figure 6). The Pacific Border Ranges include several mountain ranges that border the Gulf of Alaska and the adjacent coastal shelf. Subdivisions of the Pacific Border Ranges Province in the study area include the Kodiak Mountains and the Kenai-Chugach Mountains. Only the westernmost subdivision in the Coastal Trough Province -- the Cook Inlet-Susitna Lowlands -- was directly affected by the spill. The Alaska-Aleutian Province, the northernmost of two arcuate mountain systems in excess of 6000 meters (19,500 ft) in elevation, also had coastlines affected by the spill in its Aleutian Range subdivision.

Prince William Sound is surrounded by mountains and islands of the Kenai-Chugach Mountains section. These massive, heavily glaciated mountains rise abruptly from the north, east, and west shores to altitudes of 2000 to 3000 meters (6500 - 9800 ft). In the northwest corner of Prince William Sound, Mt. Marcus Baker rises to 4017 meters (13,176 ft) only 20 km (12 mi) from the sea. The islands of Prince William Sound are southward extensions of the same mountain system. Southwest of Prince William Sound along the Kenai Peninsula, the Kenai Mountains rise equally abruptly from Gulf of Alaska waters to reach altitudes of 1000 to 2000 meters (3250 - 6500 ft).

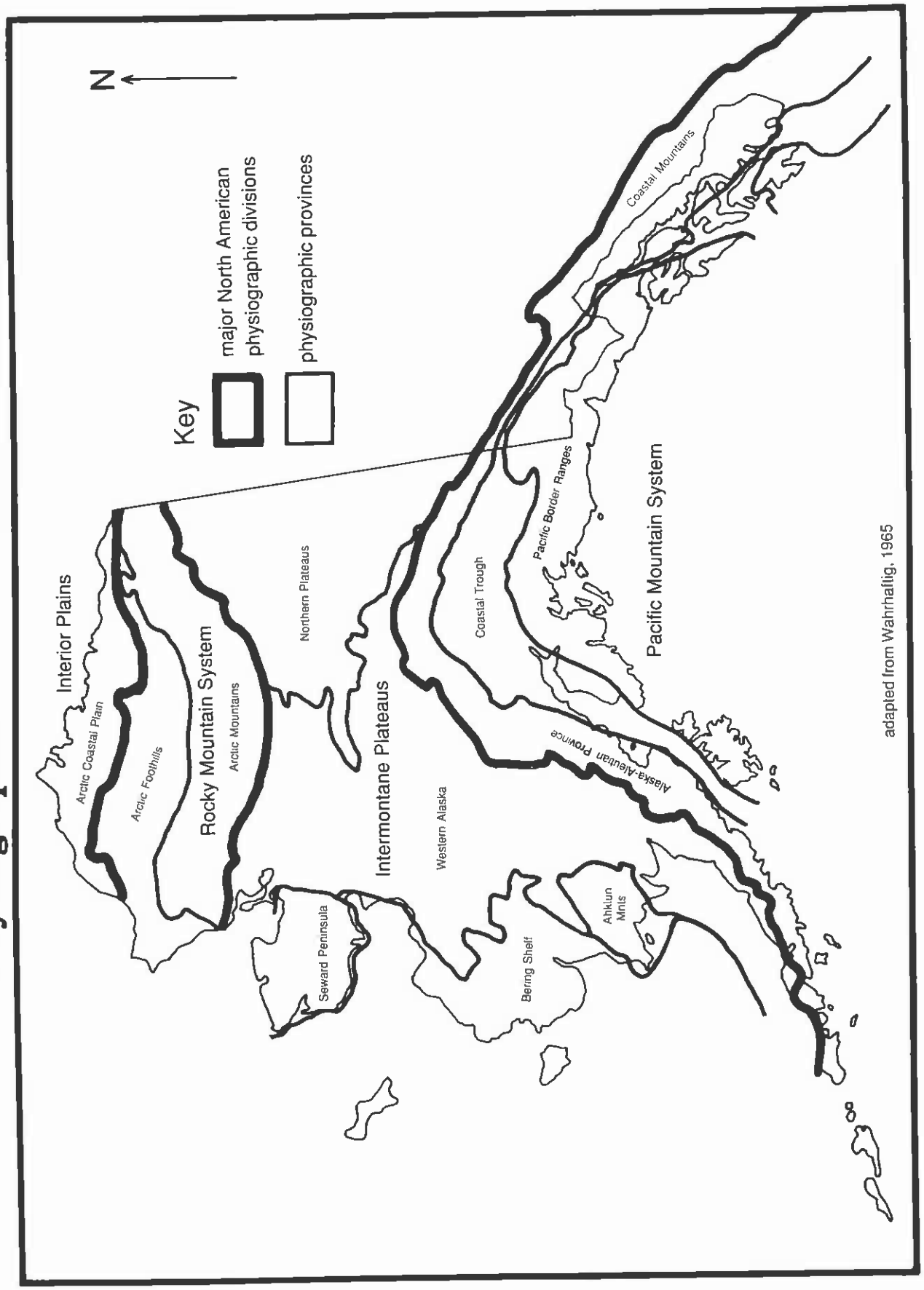
The Kodiak Mountains, which form Kodiak, Afognak, and the Trinity and Barren islands, are a structural and topographic extension of the Kenai-Chugach Mountains. Continuing the pattern of the Kenai Mountains, which decline in altitude to the southwest, the maximum altitude of the Kodiak Mountains is only about 1300 meters (4250 ft).

The Cook Inlet-Susitna Lowland section plunges beneath lower Cook Inlet and Shelikof Strait in areas directly affected by the 1989 spill. Lowlands on the west side of the Kenai Peninsula are generally less than 300 meters (975 ft) in elevation, though north of Kachemak Bay altitudes of 800 meters (2600 ft) are reached.

The Aleutian Range runs southwestward along the Alaska Peninsula from Kamishak Bay in the north to Pavlov Bay opposite the Shumagin Islands. The range consists of rounded ridges rising to altitudes of 1000 meters (3250 ft), topped by volcanic peaks that reach altitudes of 2500 meters (8200 ft). The Aleutian Range rises

Figure 6

Physiographic Divisions of Alaska



abruptly from Shelikof Strait, reaching its maximum height within 20 to 30 km (13 - 18 mi) of the coastline.

Geology

Regional Geology

The theory of plate tectonics provides a framework explaining the evolution of the North American Cordillera. Geological studies document a progressive accretion of continental crust along the active plate margins of the north Pacific coast (Atwater 1970, Ben-Avraham and Nur 1983, Coney et al. 1980). This process of accretionary tectonics (Saleeby 1983) accounts for most of the large scale structure of the Pacific Mountain System, though many details remain unresolved (Bruns 1983, Bruns and Keller 1984, Plafker 1984).

On a broad scale, the complex geologic structure of southern Alaska results from collision of the Pacific and North American plates over the past 200 million years. The plates are converging at a rate of 5 - 6 cm/yr (2 in/yr) (DeMets et al. 1987, Lahr and Plafker 1980), though the rate has not been constant (Pollitz 1988). This convergence results in lateral movement along the southeast Alaska coast, and subduction along faults of the Aleutian Arc, where the Pacific plate plunges beneath the North American plate (Coats 1962, Gehrels and Saleeby 1987, Perez and Jacob 1980, Plafker 1969, 1987). As the two plates converge, portions of both oceanic and continental crust are welded onto the continental margin. Accretion of these "tectonostratigraphic terranes" (Jones et al. 1983, Saleeby 1983) has formed the Peninsular, Chugach, and Prince William terranes (Figure 7) that comprise the study area and account for the major lithologic, structural, and tectonic features of the region. Major structural features of the region result largely from deformation as terranes collide, and major fault systems mark terrane boundaries. The active tectonic history of the region also accounts for the periodic volcanic eruptions, earthquakes, and tsunamis that have affected the occupants of the region since their arrival.

Bedrock Geology

The Kenai-Chugach Mountains area, including Prince William Sound and the eastern Kenai Peninsula, is composed of rocks of the Chugach and Prince William terranes. The shorelines of Prince William Sound are formed largely of Prince William terrane rocks (Figure 7), with a basal Orca Group of deformed marine sandstones, siltstones, and argillites, interbedded with pillow basalts from submarine volcanic flows (Plafker 1969:Figure 3, 1987:233; Plafker et al. 1982). These were metamorphosed by intrusive granitic plutons during the Eocene (Plafker et al. 1985). Montague and Hawkins islands, and most of Hinchinbrook Island on the southeast side of Prince William Sound, are composed of the sedimentary rocks of the Orca Group, as are Latouche and Green islands and the Naked Island group. On the west side of the sound, the shoreline from Culross Island south to Day Harbor is formed from the same unit, as are Chenega and Bainbridge islands. Glacier and most of Knight, Evans, and Elrington islands are composed of volcanic rocks of the Orca Group. Orca granitics make up most of Esther and Perry islands, and portions of Culross Island and the mainland. Most of the Kenai Peninsula's Pacific coast consists of rocks of the Chugach terrane, though the pillow basalts and intrusive granitic rocks of the Resurrection Peninsula are possibly part of the Ghost Rocks terrane (Plafker 1987:233-234). The Chugach terrane consists of at least two subterranes: late Cretaceous sandstones, mudstones, siltstones, slates, argillites, and oceanic basalts, as well as a Jurassic-early Cretaceous melange (a chaotic mix of rocks welded together at a plate boundary) of similar rocks (Cowan and Boss 1978, Plafker 1987:234-235, Plafker et al. 1982). The sedimentary or "flysch" facies, sediments deposited in the sea along continental margins, dominate the Chugach terrane.

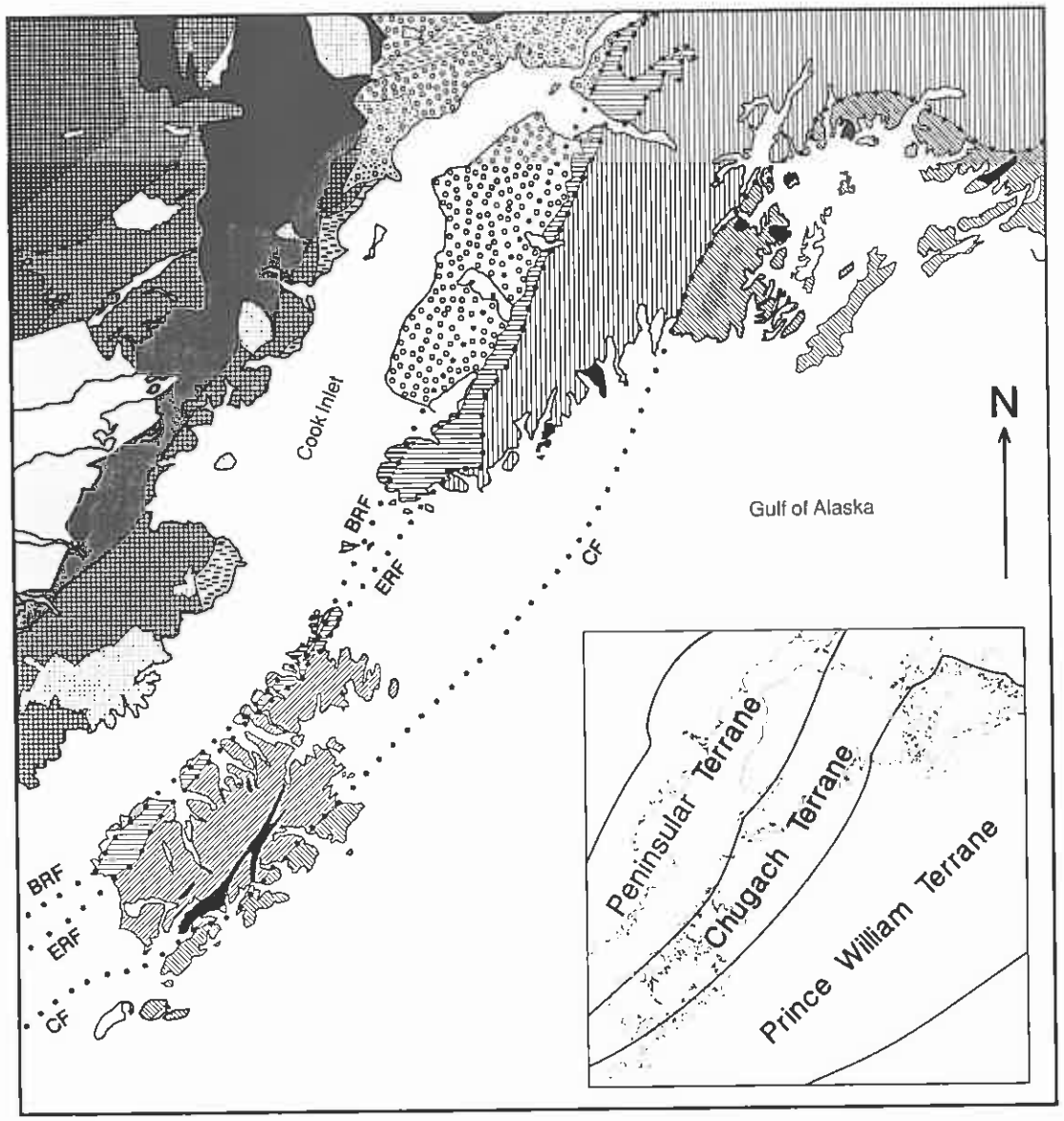
These are separated from the melange facies by the Eagle River thrust fault (Plafker et al. 1982). West of Culross and Esther islands, the coast consists of rocks of the Chugach terrane. Flysch comprises most of the coast from Day Harbor to the Chugach Islands, though melange exposures are found west of Nuka Island (Plafker et al. 1982). The Chugach terrane was also metamorphosed during the Eocene by granitic intrusions. The Harris Peninsula, the tip of the Aialik Peninsula, and the Chiswell and Pye islands are composed of these granitic rocks. The Chugach terrane is separated from the older Peninsular terrane by the Border Ranges fault (Figure 7), a long, arcuate fault that can be traced for more than 2000 km (1240 mi) from southeast Alaska to Kodiak Island (Fisher and von Huene 1984, MacKevett and Plafker 1974, Pavalis 1982). Most of the Border Ranges fault on the west side of the Kenai Mountains is covered by deposits of Quaternary age, but it is exposed on the east shore of Kachemak Bay where it separates the Chugach melange from Jurassic and Triassic metamorphosed limestones, shales, and cherts, and Triassic basalts, tephras, and tuffs of the Peninsular terrane (Plafker et al. 1982).

The bedrock of the Kodiak Archipelago consists of northeast-trending bands of rocks from three terranes accreted to Alaska by plate convergence along the Aleutian trench (Moore et al. 1983, Raymond 1980). The Peninsular terrane contains Triassic volcanic rocks and Jurassic granitics exposed along the Shelikof Strait coast (Sample and Moore 1987:Figure 1, Connelly and Moore 1979). The Chugach terrane is present in both its melange and flysch facies. The melange facies contains chaotic deep sea sedimentary rocks, gabbros, and ultramafic rocks of the Uyak complex (Raymond 1980), and forms a narrow band on the Shelikof Strait side of the island. The flysch facies contains arkosic sandstones and shales of the Kodiak Formation (Nilsen and Moore 1979), which makes up most of Kodiak Island. These were underplated to an accretionary wedge of Mesozoic rocks during the late Cretaceous and early Tertiary periods(Sample and Fisher 1986, Sample and Moore 1987). Pillow basalts, shales, argillites and mudstones of the Ghost Rocks Formation, separated from the Chugach terrane by the Contact Fault system, were emplaced during the Eocene by underthrusting and

Figure 7

Geology of the Western Gulf of Alaska

after Beikman 1980



Key

- Quaternary or Tertiary volcanic rocks.
- Tertiary granite and granodiorite.
- Tertiary basalts. Includes Lower Tertiary basalts of the Orca Group (PWS).
- Jurassic diorites.
- Quaternary alluvial, glacial, and beach deposits.
- Upper Tertiary continental deposits. Sandstone, siltstone, claystone. Includes upper part of the Kenai Group.
- Middle and Lower Tertiary continental deposits. Sandstone, siltstone, shale, claystone.
- Lower Tertiary interbedded sedimentary, volcaniclastic, and volcanic rocks. Includes Orca Group (PWS) and Ghost Rocks Formation (Kodiak).
- Upper Cretaceous graded beds of sandstone and shale of the Kodiak Formation.
- Cretaceous shelf deposits, sandstone, siltstone, shale and limestone.
- Cretaceous and Upper Jurassic flysch of the Chugach Terrane. Graywacke, slate, argillite, and interbedded basalts.
- Lower Cretaceous and Upper Jurassic(?) melange of the Chugach Terrane. Greenstone, limestone, chert, granodiorite, greenschist. Includes Uyak Formation (Kodiak).
- Cretaceous and Jurassic argillite, shale, graywacke, quartz, conglomerate, lava, and tuff.
- Jurassic sandstone, siltsone, shale, conglomerate, and graywacke. Includes Talkeetna, Kiagagulik, and Shelikof formations, and the Tuxedni Group.
- Upper Triassic limestone, tuff, conglomerate, and breccias.

BRF = Border Ranges Fault ERF = Eagle River Fault
CF = Contact Fault

underplating (Byrne 1986). Both episodes of accretion were accompanied by uplift (Byrne 1986) and increased volcanism and plutonism (Moore et al. 1983), including intrusion of Paleocene granitic plutons that form the mountainous backbone of the island. The Sitkalidak Formation, a band of Eocene and Oligocene sandstones, shales, and conglomerates, is found on the outer coast and the Trinity Islands (Nilsen and Moore 1979). Finally, Quaternary glaciomarine and tephra deposits cap much of the Kodiak Archipelago (Nilsen and Moore 1979).

The Aleutian Range of the Alaskan Peninsula is formed primarily from sedimentary and intrusive rocks of Mesozoic age, capped by Quaternary and Tertiary volcanics (Beikman 1980). The Jurassic Naknek Formation dominates the northern part of the peninsula, with sandstones, conglomerates, siltstones, and dark shales (Riehle et al. 1987a). The Upper Cretaceous Kaguyak Formation is a flysch deposit of interbedded siltstones and graywacke sandstones that represents an ancient submarine fan (Detterman and Miller 1985). Opposite Kodiak Island, Tertiary volcanic rocks form much of the coastline. The prominent Tertiary to Quaternary volcanoes of the Peninsula are composed chiefly of dacitic and andesitic lava flows, breccias, and tuffs. Pyroclastic deposits from the 1912 eruption of Novarupta and Mt. Katmai blanket large sections of the Peninsula and Kodiak Island (Hildreth et al. 1984).

Holocene Tectonics and Sea Level Changes

Short-term and long-term changes in relative sea level (the level of the sea relative to a given locality, excluding wave and tidal fluctuation) are a function of eustatic, isostatic, and tectonic processes. Eustatic changes are caused by either a change in the amount of water in the world's oceans, or a change in the volume of the ocean basins themselves. The cyclic growth and decay of continental ice sheets is eustatic, involving the net transfer of water from the oceans to land by evaporation and precipitation as ice sheets grow, and the transfer of water back to the oceans as ice sheets melt.

Isostasy is the equilibrium maintained by the "floating" of solid portions of the earth's crust (or lithosphere) on the denser and more plastic asthenosphere. As water is added to or removed from the ocean, the sea floor compensates by rising or falling due to the change in weight of the water above it. Glacio-isostasy is the local process whereby the land beneath an ice sheet is depressed due to the weight of the ice, and rebounds when the weight of ice is removed by deglaciation. In coastal regions glacial isostasy can have a major effect on relative sea level. Local tectonic events change relative sea level when shorelines experience vertical crustal movements.

These three major determinants of relative sea level change -- changes in eustatic sea level, isostatic crustal adjustments, and vertical crustal movements due to tectonics -- interact in complex fashions to produce equally complex histories of local relative sea level. Simultaneously during deglaciation, eustatic sea level is rising, isostatically depressed land is being uplifted, and vertical tectonic movements (either emergence or subsidence), may also be occurring, all at different and probably variable rates. Over the past several decades there have been numerous attempts to estimate postglacial eustatic sea level changes from various kinds of data (Coleman and Smith 1964, Curray 1961, Fairbridge 1961, Mörner 1971, Shepard 1963, Shepard and Curray 1967, Fairbanks 1989). But local models of sea level change in glaciated regions, which must take into account isostatic rebound and vertical tectonic movement, are difficult to construct.

The large-scale model of plate convergence and terrane accretion for southern continental Alaska provides a framework in which to view short-term tectonism in the region. Detailed investigations in the aftermath of the March 27, 1964, Alaskan earthquake brought forth a number of previously unknown details of Holocene vertical and horizontal crustal movements and their complexities (Plafker 1965, 1967, 1969; Plafker and Kachadoorian 1966; Plafker and Rubin 1967, 1978). Coincidentally, the geographic extent of tectonic effects from the 1964 earthquake (Plafker 1969:Figure 3) largely coincides with the areas evaluated by the SCAT process (Mobley and Haggarty 1989a, 1989b). The post-earthquake studies provide baseline data on recent shoreline changes that are critical to the evaluation of potentially threatened cultural resources. In addition to vertical crustal movements discussed below, horizontal movements due to the 1964 earthquake were detected by resurveying triangulation stations (Parkin 1969). Generally, Prince William Sound and the Kenai Peninsula moved south-southeast 9 to 20 meters (29 - 65 ft), and the distance across Montague Strait was shortened by 4.5 to 6 meters (14.5 - 19.5 ft). This horizontal displacement may have been responsible for some violent local waves produced in Prince William Sound (Plafker et al. 1969).

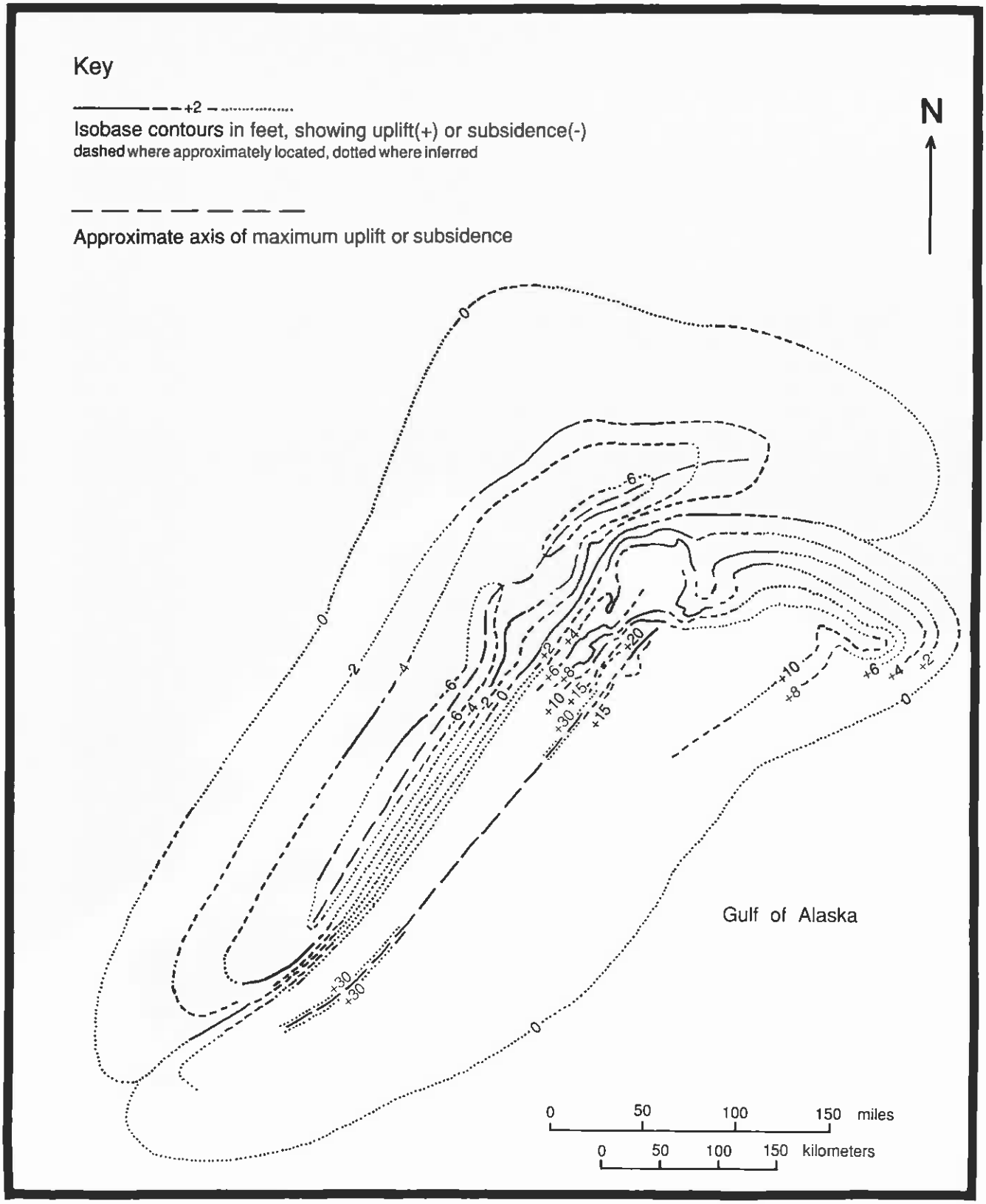
Studies of Holocene uplifting elsewhere along the north Pacific coast indicate a complex record (Clague et al. 1982, Mobley 1988, Mann 1986a), and the oil spill area is no exception. The record may be divided into coseismic vertical and horizontal crustal movements attributable to the 1964 earthquake, and Late Holocene submergence and emergence. Vertical displacements resulting from the 1964 earthquake are known largely due to studies by Plafker (1967, 1969), and Plafker and Kachadoorian (1966), who produced a detailed contour map of tectonic uplift and subsidence for the western Gulf of Alaska (Figure 8) based on a wide variety of data: 1) pre- and post-earthquake tide gauge readings; 2) position of the upper growth limit of barnacles and rockweed relative to sea level; 3) differences in pre- and post-earthquake upper growth limits of these taxa; 4) lower growth limit of terrestrial vegetation; 5) differences in heights of pre- and post-earthquake storm beaches; 6) estimates of sea level change by local residents; and 7) measured changes in elevations of tidal benchmarks.

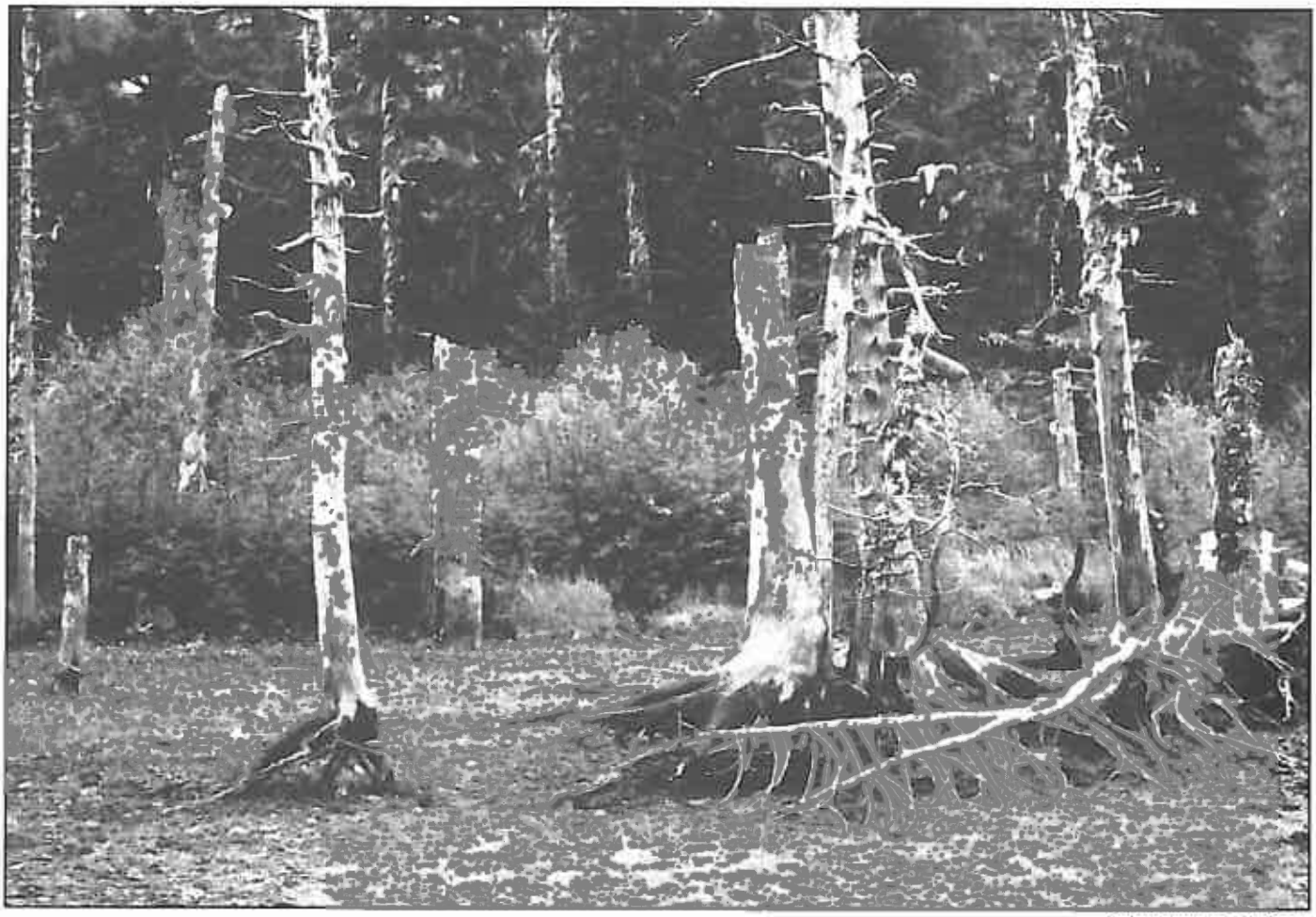
The zero isobase, or line of no vertical displacement, runs from the region of the earthquake epicenter near Esther Island in Prince William Sound southwest to the west coast of Kodiak Island, with uplift to the east and subsidence to the west of this line. The zone of uplift includes all of Prince William Sound except Port Valdez and the northwest corner of the sound, west of Perry

Figure 8

Tectonic Uplift and Subsidence in Southcentral Alaska Due to the 1964 Earthquake

from Plafker, 1969: Figure 3





Richard Reanier 9-4. Exxon

Figure 9. Dead standing trees subsided by the 1964 earthquake into the intertidal zone of a beach at Yalik Bay, near Kenai Fjords National Park. Erosion has removed soil from root zones.

Island; the portion of the Kenai Peninsula capped by the Sherman Icefield; and a narrow belt of headlands and islands on the east coast of the Kodiak Archipelago. The maximum recorded uplift was 11.5 m (37.8 ft) near Cape Cleare on Montague Island. The axis of maximum uplift runs down the center of Montague Island and continues southwestward across the Gulf of Alaska to end some 40 km (25 mi) off the east coast of Kodiak Island. Moving northwestward from the axis, the amount of uplift decreases rapidly across Montague Strait, then more gradually from Latouche Island to the zero-isobase.

The zone of subsidence includes most of the Kodiak Archipelago and the Kenai Peninsula, and the western portion of the Chugach Mountains. The maximum recorded subsidence was 2.5 m (8.2 ft) in Harriman Fjord in the extreme northwest of Prince William Sound. The axis of maximum subsidence runs south from this point across the Kenai Mountains, intersects the coast at Nuka Bay, and continues southwestward across the Gulf of Alaska to the mountainous crest of Kodiak Island. Southeast of the axis the amount of subsidence decreases toward the zero isobase; northwest of the axis the amount of subsidence decreases more gradually, reaching the zero-isobase along the west shore of Cook Inlet.

These vertical displacements had major effects on the geography of the region, many of which are still apparent 25 years later. A fringe of new land was added to southern Montague Island, and the Patton Bay and Hanning Bay faults were reactivated, with both faults indicating dip-slip components in excess of six meters (20 ft) (Plafker 1967). More than 2500 km (1550 mi) of coastline within Prince William Sound was uplifted, exposing and killing intertidal organisms (Barrett 1966, Baxter 1971, Hanna 1971) and exposing the former intertidal zone to colonization by terrestrial plants (Eyerdam 1971). Fluvial downcutting of exposed, unconsolidated deposits at stream mouths was rapid (Kirkby and Kirkby 1969, Stanley 1968), and storm berms were stranded above the high tide line (Stanley 1968).

Along the east coast of the Kenai Peninsula as much as 2.4 m (7.8 ft) of subsidence drowned shorelines and killed terrestrial plants through sea water exposure. Many dead, standing trees are still visible in the embayments and coves of the southeast coast (Figure 9). Numerous landslides, some extending to the shoreline, occurred in the Kenai Mountains (Plafker et al. 1969).

On Kodiak, subsidence occurred over most of the island due to tectonic downwarping and compaction (Plafker

and Kachadoorian 1966). Maximum subsidence of about two meters (6.5 ft) occurred on eastern Afognak and northeast Kodiak islands. Southern Kodiak experienced little subsidence, and Tugidak Island was apparently stable. Along the southwest coast of Kodiak, south of Ugak Island, uplifts of up to 0.75 m (2.4 ft) were recorded on islands and capes in a narrow zone. Numerous rockslides and landslides occurred along the southeast coast of Kodiak Island; many of these were reactivated older slides (Plafker and Kachadoorian 1966). Subsidence resulted in major changes in coastal morphology in the Kodiak Archipelago. There were many examples of drowned river mouths and estuaries. Lakes behind subsided storm berms became lagoons. Where unconsolidated deposits were lowered into the range of tidal action, rapid erosion began to occur and terrestrial plants were killed. Today on Afognak Island, there are still many examples of coastal trees killed by submergence.

In the first decade after the 1964 earthquake, tide gauge records from both the uplifted and downwarped zones showed some post-seismic recovery (Plafker and Rubin 1978:Table 2). Cordova, uplifted 189 cm (74 in) in 1964, had subsided 12 cm (5 in) by 1974. Seward and Kodiak, downwarped 110 and 170 cm respectively in 1964, emerged 14 and 34 cm (5.5 and 13 in) by 1974.

Study of the effects of the 1964 earthquake also revealed evidence of an earlier period of subsidence first noted by Vancouver in 1794. While anchored in Port Chalmers on Montague Island, Vancouver (1801:v. 5, 335-336) observed:

> The shores are in general low, and as has been already observed, very swampy in many places, on which the sea appears to be making more rapid encroachments than I ever before saw or heard of. Many trees have been cut down since these regions had been first visited by Europeans; this was evident by the visible effects of the axe and saw; which we concluded had been produced whilst Messrs. Portlock and Dixon were here, seven years before our arrival; as the stumps of the trees were still remaining on the earth where they had originally grown, but were even now many feet below the high water mark, even of neap tides. A low projecting point of land behind which we rode, had not long since afforded support to some of the largest pine trees in the neighbourhood, but it was now overflowed by every tide; and excepting two of the trees, which still put forth a few leaves, the whole were reduced to naked, dead white stumps of trees, with their roots still fast in the ground, and were also found in no very advanced state of decay nearly as low down as the low water of spring tides.

Plafker (1969:160) notes that since the low water of spring tides in this area is about four meters (13 ft) below the normal lower limit of tree growth in this area, Vancouver's observations indicate about this much submergence prior to 1794. In 1933, de Laguna (1956:Plate 4) observed dead and standing trees resulting from continued subsidence at Port Chalmers and evidence for subsidence at a number of archaeological sites in Prince William Sound. Elsewhere in the sound, others found similar evidence of subsidence prior to 1964 (Dachnowski-Stokes 1941, Grant and Higgins 1910:17-18, Moffitt 1954:292-294).

The shoreline emergence in Prince William Sound caused by the 1964 uplift revealed ancient dead trees in growth positions on beaches that had been submerged prior to the earthquake (Plafker 1969:Figures 38, 39; Plafker and Rubin 1967). Plafker (1969:Table 5) radiocarbon dated several of these and compiled other dated examples of short-term submergence, concluding that the rate of submergence for the region between Seward and Cape Suckling has averaged about 0.5 cm/yr (0.2 in/yr) since 930 B.P.

The radiocarbon record prior to 1000 B.P. is more complex. A rooted stump from a submerged beach in Columbia Bay dated to 1140 ± 250 B.P. showed 1.8 m (6 ft) of submergence, while a similar stump from Perry Island indicated only 3.4 m (11.2 ft) of subsidence since 3680 ± 300 B.P. (Plafker 1969:Table 5), suggesting variation in long-term subsidence rates.

A series of dates from raised marine terraces on Middleton Island, 100 km (62 mi) southeast of Prince William Sound, indicates successive uplift events at 1350 ± 200, 2390 ± 200, 3100 ± 250, and 4300 ± 250 B.P. (Plafker and Rubin 1978). Uplift of 3.5 m (11.5 ft) by the 1964 earthquake was responsible for the pre-1964 wave-cut platform emerging above the high tide line and forming a new terrace. These regional tectonic events may explain the lower rates of subsidence in Prince William Sound prior to 1000 B.P. Uplift after such periods of gradual subsidence would tend to erase some of the subsidence, lowering sea level toward its initial position. Such a model can

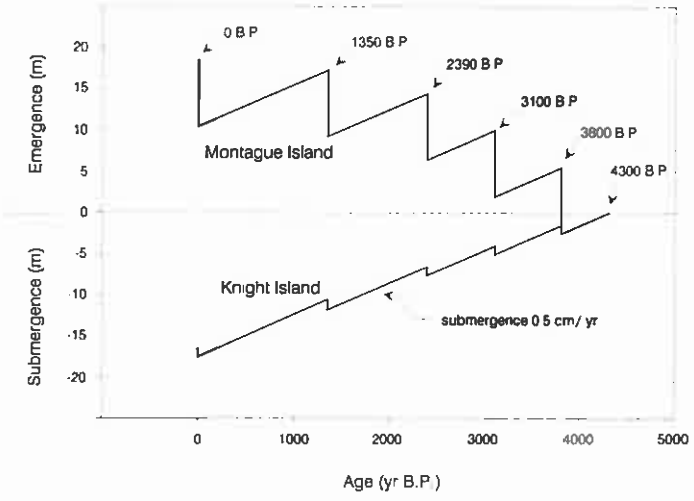


Figure 10. Model of Montague Island emergence and Knight Island submergence due to differential seismic uplift. A hypothetical beach on each island lies at sea level 4300 B.P. Montague Island uplift is 8 m and Knight Island is 1 m, similar to that of the 1964 earthquake. Submergence between seismic events is assumed to be 0.5cm/yr for both (Plafker 1969).



Richard Reanier 13:31, Exxon

Figure 11. Subsided archaeological site (AFG-128) destroyed by erosion in the Kodiak area, after subsidence following the 1964 earthquake. Shell, fire-cracked rock, and stone tools were visible in the intertidal zone in 1989.

also account for the evident differences in long-term vertical crustal movements in the sound. West of Montague Strait, relatively lower amounts of coseismic uplift, as reflected in the pattern of uplift from the 1964 earthquake, were insufficient to raise the land above its former position (Figure 10). On Montague Island, however, uplift on average exceeded the amount of prior subsidence, resulting in net emergence of the island (Figure 8). Supporting the model is an uplifted terrace on Montague Island, 6 m (20 ft) above the pre-1964 shoreline, that dates to 2070 ± 200 B.P. (Kirkby and Kirkby 1969, Plafker 1969).

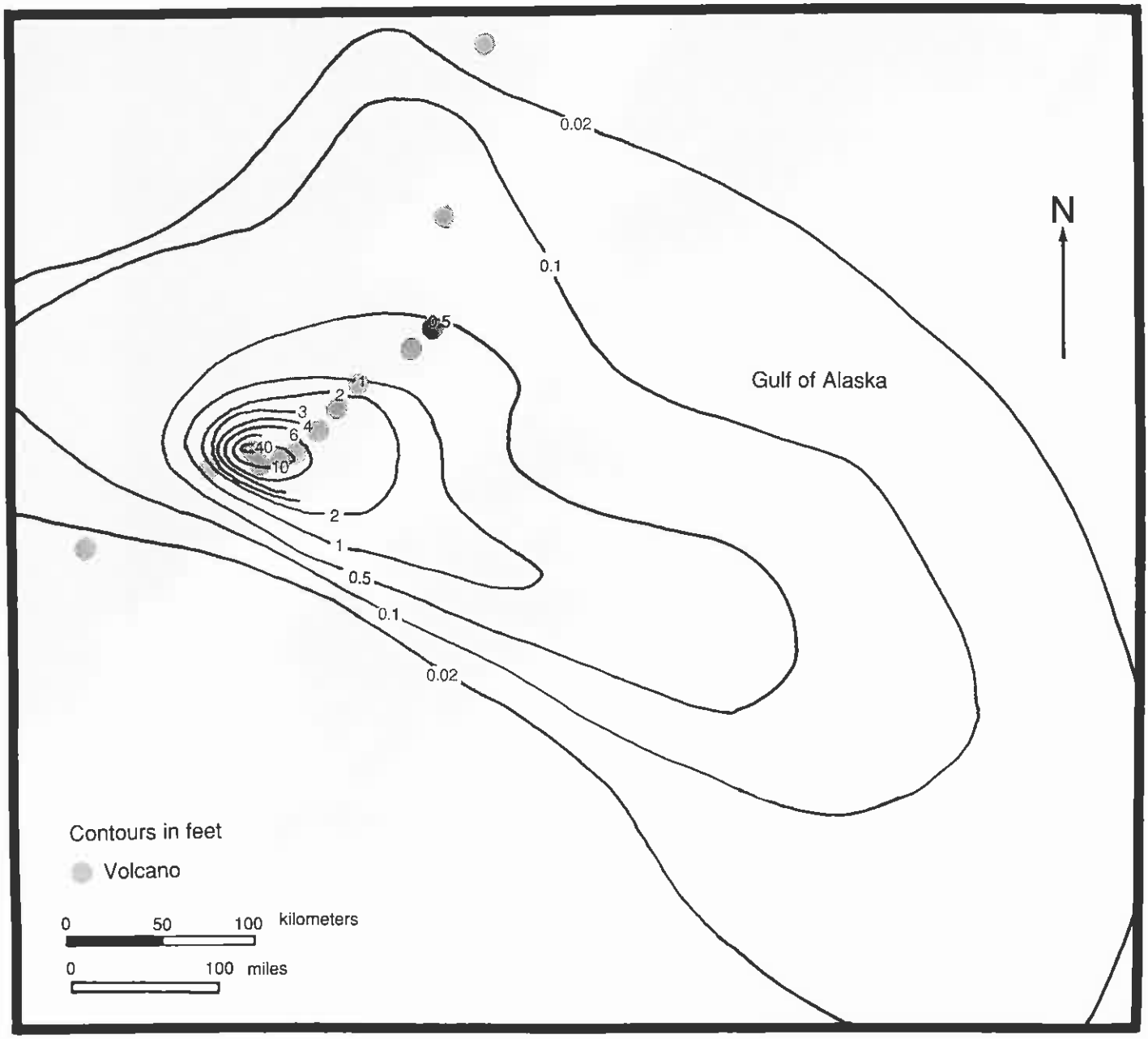
Geomorphological evidence of longer term patterns of vertical crustal movement tends to support the model outlined above. The shorelines of the islands and mainland of western Prince William Sound, especially of Knight Island, are highly convoluted, with deep embayments and numerous small islands. This pattern is typical of recently submerged coasts in which the former valleys have become embayments, and ridges extend out to form peninsulas. In contrast, the relatively uniform shoreline of Montague Island indicates long-term emergence. Even more dramatic evidence of submergence is evident along the southeast coast of the Kenai Peninsula, near the axis of maximum 1964 subsidence. Along the sinuous shores of peninsulas and coves are rugged alpine landscapes only a few meters above sea level. Cirque floors that presumably formed at nearly the same altitudes during the Wisconsinan glaciation reach altitudes of 250 to 300 meters (800 - 1000 ft) above sea level along the western shores of Prince William Sound, but along the Kenai Peninsula coast, cirque floor altitudes range from 250 meters (800 ft) above sea level to 100 meters (325 ft) below sea level (Plafker 1969:158), attesting to the deeply drowned character of the coast.

Kodiak also lies along the axis of maximum 1964 downwarping. The coastline contains many deep embayments and small islands, and, with the exception of the southeastern coast, is inferred to be a region of long-term Holocene subsidence (Plafker 1969:158, Plafker and Kachadoorian 1966). However, the archaeological record of coastal occupation extends back to at least 6000 B.P. (D. Clark 1984a:Table 1), indicating that, for at least the last half of the Holocene, rates of subsidence were far less than on the Kenai Peninsula and in western Prince William Sound. A number of archaeological sites in the area of greatest 1964 subsidence were lowered below the extreme

Figure 12

Distribution of Volcanic Ash from the 1912 Eruption of Mt. Katmai and Novarupta

from Wilcox 1959: Figure 62



high tide line and began to suffer erosion (Figure 11). The southeast coast of the Alaska Peninsula is thought to have been relatively stable during the Holocene (Plafker 1969), which is in accord with the 6000-year archaeological record from coastal sites on Shelikof Strait (G. Clark 1977).

Tephra

Soils in Prince William Sound and the southeast coast of the Kenai Peninsula display few Holocene tephra deposits, while the Alaska Peninsula and Kodiak have been blanketed by numerous ashfalls. The ash plumes of some major Aleutian Arc volcanoes, including the late Holocene eruption of Aniakchak Crater (Riehle et al. 1987b), have blown northward and missed the study area entirely. There are numerous tephra deposits in the region (Riehle 1985), but the sources of many remain unidentified (Ager and Simms 1984, D. Clark 1979, Dumond 1979:374-377, Nelson and Jordan 1988).

The 1912 eruption of Novarupta in Katmai National Park produced an estimated 20 km^3 of air-fall tephra

within 60 hours (Hildreth et al. 1984). The tephra plume moved generally southeast (Figure 12), blanketing the northern Alaska Peninsula and Kodiak Island (Wilcox 1959). Near the vent, pyroclastic deposits were as much as 250 meters (813 ft) thick (Hildreth 1983). At Takli Island, air-fall tephra thickness was about one meter (39 in), thinning rapidly to 15 cm (6 in) at Cape Douglas to the north and Cape Kubugakli to the south. To the southeast the 15-cm (6 in) isopach extended across Kodiak Island more than 100 km (62 mi) into the Gulf of Alaska (Figure 12). In the Kodiak Archipelago, deposits were thickest near Uganik Island, where they reached 0.5 m (1.6 ft). South of Uyak Bay very little tephra was deposited. Shuyak and northeastern Afognak islands also received only thin deposits, and only traces were recorded in the southern Kenai Peninsula. Post-depositional compaction and erosion has locally reduced the ash thickness by as much as 50% (Nelson and Jordan 1988:60).

Tephra deposits cover archaeological sites and lie interstratified within archaeological sediments (G. Clark 1977). The presence or absence of the 1912 Katmai ash is often useful in field situations for determining whether or not a particular feature is ancient or modern. Layers of tephra are useful for correlating both within and between archaeological sites.

Rock and Mineral Sources

Identifying sources of manufacturing materials can shed light on regional trade patterns, help identify sites used to exploit raw materials, and reveal patterns of raw material usage. Slate, commonly used as a raw material throughout most of Pacific Eskimo prehistory (D. Clark 1984a), is locally available throughout the region. Slate and argillite are common in the Chugach terrane, where they are exposed at sea level in north and northwest Prince William Sound, along most of the outer Kenai Peninsula, and in the Kodiak Archipelago. Argillite is also found in Orca Group rocks of the Prince William terrane that make up much of western Prince William Sound. De Laguna (1956:5) noted that the best slate in the sound came from this source. Argillite also is found in the Ghost Rocks terrane exposed on the Resurrection Peninsula east of Seward, and along the eastern coast of Kodiak Island.

In the Kodiak Archipelago, a locally abundant reddish colored chert prominent in Ocean Bay assemblages (D. Clark 1979) crops out along the Shelikof Strait. A quarry location identified during SCAT shoreline assessments on Afognak Island reveals that raw material is readily available at sea level from both beach and bedrock deposits. This chert is found in the Uyak Complex, a highly deformed, chaotic melange of gray chert and argillite, wacke, greenstone, radiolarian chert, and gabbroic and ultramafic rocks of Cretaceous age (Connelly 1978). The reddish chert is found in small tectonic blocks scattered through the Uyak Complex, so that archaeological quarries can be expected anywhere between the west end of Kodiak Island and the northern end of Shuyak Island. The Uyak Complex is part of the melange facies of the Chugach terrane, also exposed near the tip of the Kenai Peninsula, providing other possible sources of radiolarian chert (Plafker et al. 1982).

In Prince William Sound, the altered basalts, gabbros, and diorites of Glacier, Knight, Evans, and Elrington islands were the source of greenstone commonly used in the manufacture of splitting and planing adzes from the sound (de Laguna 1956:5). De Laguna reports five locations where native copper was available in the sound. In the eastern sound, copper has been reported at the head of Landlocked Bay in Port Fidalgo, along Orca Inlet between Cordova and Orca, northeast of Orca near the Scott Glacier, and in Port Etches on Hinchinbrook Island. In the southern sound native copper has been reported at the Bonanza Mine on Latouche Island, as were large pyrite crystals thought to have been used for making fire (de Laguna 1956:5). Hematite deposits are reported at two locations on the west coast of Hinchinbrook Island, on bluffs inside the lagoon south of Johnson Point, and above English Bay in Port Etches (de Laguna 1956:5).

Geomorphology

The geological processes responsible for mountain building, that result from accretionary tectonics and volcanism, are outlined above. In the western Gulf of Alaska coastal region mass-wasting processes that erode these mountain ranges are dominated by glaciation. Massive icefields surround Prince William Sound and cap the Kenai and Alaskan peninsulas. The annual freshwater influx entering the Gulf of Alaska from precipitation, rivers, and glacial meltwater exceeds the annual discharge of the Mississippi River system (Royer 1989), providing an ample sediment transport mechanism. Prominent sediment plumes visible on aerial photographs emanate from glaciers terminating in Prince William Sound and Kenai Peninsula fjords. The Copper River, which annually discharges a sediment load of 97 x 10^6 metric tons (107 x 10^6 tons) into the Gulf of Alaska (Reimnitz 1966), is building a Holocene sediment wedge in Prince William Sound via Hinchinbrook Entrance (Carlson and Molnia 1978). Copper River sediment also enters the sound via Hawkins Cutoff, between Hinchinbrook and Hawkins islands.

The geologic record reveals repeated glacial episodes since mid-Tertiary time that have left their marks on the region's landscapes. Glacier-carved fjords characterize the coastlines of Prince William Sound, the Kenai Peninsula, and the Kodiak Archipelago. Numerous cirques in the uplands and glacially striated bedrock at sea level attest to the erosional effects of former, more extensive glaciers. Glaciation has also left moraines in glacial valleys on land, and submerged at the bottom of fjords.

Pleistocene glaciation has overshadowed other processes in shaping the region's coastlines. These are primary coasts, with little major modification by coastal processes since the stabilization of eustatic sea level about 5000 or 6000 B.P. (Fairbanks 1989). In terms of energy input, the region lies within a storm-wave zone (Davies 1980), though not all coastlines in the region are affected



Richard Reanier 9-2, Exxon

Figure 13. High energy coastline on the exposed outer coast of the Kenai Peninsula.

directly. Tanner's (1960) division of coastal energy regimes into high, moderate, and low provides a way to predict recurrent patterns of sediment transport that may affect archaeological resources, without undertaking detailed process studies of each beach. There are examples of all three of Tanner's classes in the region, but moderate and high-energy coastlines are most common.

High-energy coastlines along the rugged, outer coast of the Kenai Peninsula are typical of the region (Figure 13). Stretches of rocky coastline are commonly interrupted by pocket beaches -- small beaches bordered by rocky headlands, that usually are composed of fairly coarse material (Figure 14). Where unconsolidated deposits form the shoreline, coastal erosion is more rapid and beaches may reflect grain size distributions of eroding of the cliffs rather than sorting by wave action. For example, at a rocky headland in the Kodiak area flanked by unconsolidated glacial drift (Figure 15), wave refraction is rapidly eroding the glacial deposit from both sides, leaving a narrow neck of land connecting the headland to the mainland. Due to erosion, only a narrow strip of cultural deposit remains at an archaeological site on the neck. This section of coastline subsided about one meter (3 ft) in the 1964 earthquake, accelerating the erosion that will soon destroy what is left of the site.

There has been limited systematic description of the Prince William Sound coastline. Studies conducted after the 1964 earthquake included coastal geomorphic investigations (Kirkby and Kirkby 1969, Plafker 1969,



Richard Reanier 12-18, Exxon

Figure 14. Pocket beach flanked by rocky shorelines on Uganik Island, in the Kodiak Archipelago.



Richard Reanier 11:21, Exxon

Figure 15. Rocky headland and wave refraction induced bluff retreat near Cape Uganik, in the Kodiak Archipelago .

Stanley 1968), but no coastline inventories were conducted. Evaluation of the effects of treated ballast-water effluent from oil tankers on the waters of Port Valdez produced excellent oceanographic baseline data for the port and narrows, but little in the way of shoreline studies (Muench and Nebert 1973, Sharma and Burbank 1973). Extensive studies of Alaska's continental shelves beginning in the 1970s under NOAA's Outer Continental Shelf Environmental Assessment Program did not include the entire sound, but produced detailed coastline studies of the southern sound and outer Kenai Peninsula (Hayes 1986) and the Kodiak Archipelago (Hayes and Ruby 1979).

In the Kodiak study of coastline oil spill vulnerability, Hayes and Ruby (1979) mapped nearly 4300 km (2700 mi) of shoreline and distinguished ten shoreline landform classes, with Class 1 being the least vulnerable to oil spills, and Class 10 the most vulnerable. The authors estimated that 86% of the shoreline is erosional, including straight rocky headlands, wave-cut platforms, and many mixed sand and gravel beaches and pure gravel beaches. An estimated 14% of the shoreline is depositional or constructional in character, including sandy beaches, and the tidal flats and salt marshes common at fjord heads and river mouths.

In an oil spill vulnerability study for southern Prince William Sound and the outer Kenai Peninsula, Hayes (1986) mapped over 2100 km (1300 mi) of shoreline, classified according to the system used in the Kodiak study. The project included the entire outer coast of the Kenai Peninsula, and Montague, Latouche, Elrington, Evans, and Bainbridge islands at the south end of the sound. Green and Little Green islands were included, but the study did not include the Knight Island group or coastlines to the north and west affected by the *Exxon Valdez* spill.

Similarities and differences between the two study areas are evident (Figure 16). Both have shorelines dominated by exposed rocky headlands and wave-cut platforms, with rocky headlands and gravel and mixed sand beaches in more sheltered environments. Sandy beaches are rare, as are tidal flats and salt marshes. The greater proportion of shoreline exposed to the Gulf of Alaska in the Kenai Peninsula/Montague Island area is reflected in the higher percentage of straight rocky headlands there, while Kodiak has proportionally more sheltered rocky headlands. The larger proportion of mixed sand and gravel beaches in the Kodiak area is probably due to the greater amount of sheltered coast there, and the

greater amount of coast formed in unconsolidated glacial deposits that provide a constant source of unsorted sediments as they erode.

Climate

Climate, the sum total of the weather experienced at a place in the course of a year, is the outcome of physical processes operating on geographic scales ranging from the planet to the microsite. This climatic review of southern coastal Alaska between the outer Alaska Peninsula and the Copper River Delta is arranged in order of decreasing geographic scale, and sets the stage for discussing climatic history by describing those processes which are critical in determining the modern climate. Variables important for people using marine resources are emphasized.

Air sinking in the subtropical anticyclone belt flows north between latitudes 30° and 60°, veering east under the influence of the Coriolis effect. These movements, part of the Hadley cell circulation, give rise to prevailing westerly winds that dominate airflow at temperate latitudes (Lamb 1972:76, Wendland and Bryson 1981). Cold air sinking in the polar anticyclone over the Arctic flows southwest to form the polar easterlies, meeting the westerlies at around 60° north latitude. The polar jet stream, the shifting zone of strongest flow in the upper westerlies, tracks the strongest thermal gradients along the front between polar and temperate airmasses, and winds its way around the hemisphere.

In their circuit around the northern hemisphere, the upper westerlies form Rossby waves -- changing patterns of long waves spanning a wide latitudinal band between the subtropics and the Arctic. These waves change in strength and position according to the vigor of hemispheric circulation driven by global temperature gradients. Mountain barriers and vast cold surface areas constrain Rossby waves into recurrent positions. For instance, a major trough typically develops over northeast Siberia in winter, in the lee of the mountains of central Asia, and moves out over the cool waters of the northwest Pacific Ocean in summer (Lamb 1972:84).

The circulation of air through Hadley cells and Rossby waves segregates airmasses into certain geographical areas. For example, continental polar air originates in anticyclones over interior parts of Alaska, northern Canada, and Siberia (Barry and Chorley 1976:Figure 4-1). Maritime polar air overlies the North Pacific Ocean above 55° north latitude and borders maritime tropical air along its southern edge between 30° and 50° north latitude. The borders between airmass types are critical places where most cyclonic storms develop.

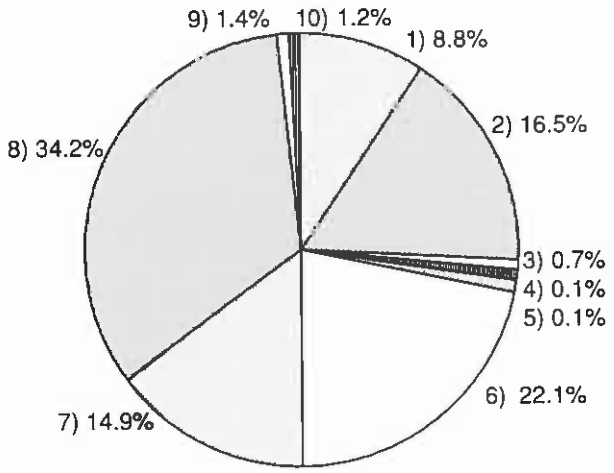
Cyclonic storms develop when unstable waves form in the atmosphere at fronts separating airmasses of differing temperature and moisture content. The Pacific Polar Front, which separates maritime tropical air from maritime polar air, generates storms in the North Pacific (Terada and Hanzawa 1984). Further north, the front in the northeast Pacific is an even greater producer of cyclonic storms, especially in winter when temperature differences are most pronounced (Wilson and Overland

Figure 16

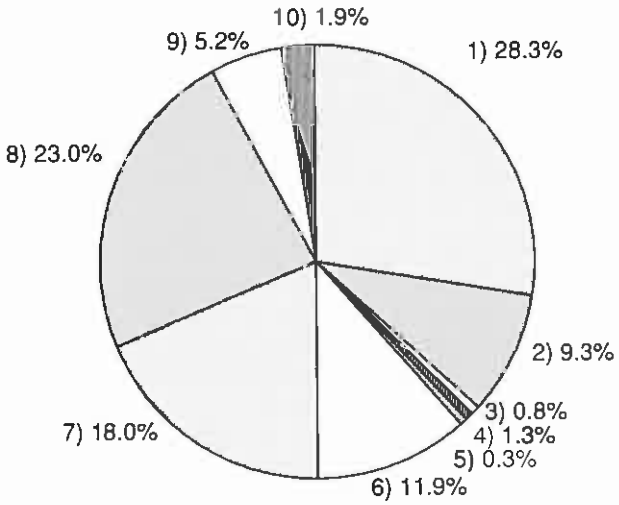
Shoreline Classes

Kodiak Archipelago and Outer Kenai Peninsula

after Hayes and Ruby, 1979 and Hayes 1986



Kodiak Archipelago



Outer Kenai Peninsula

Percent of study area shown for the following shoreline classes:

1) Straight rocky headlands
2) Wave cut platforms
3) Flat, fine-grained sandy beaches
4) Steeper, medium-to-coarse grained gravel beaches
5) Impermeable exposed tidal flats
6) Mixed sand and gravel beaches
7) Pure gravel beaches
8) Sheltered rocky headlands
9) Protected tidal flats
10) Protected salt marshes

Table 1

Climatic Summary of Western Gulf of Alaska

from Wise and Searby 1977

	Temperature, °C			Precipitation, cm	
	Mean Annual	Mean Maximum	Mean Minimum	Annual	Annual Snowfall
Valdez	2.2	6.4	-2.1	158.4	621.0
Cordova	3.3	7.6	-1.0	226.3	331.7
Whittier	3.7	7.0	0.4	445.2	670.1
Cape Hinchinbrook	5.4	7.5	3.2	239.6	240.5
Latouche	5.3	8.3	2.3	459.6	355.1
Seward	4.2	7.7	0.7	160.9	214.9
Homer	2.4	5.6	-0.8	70.7	257.8
Kodiak	4.8	7.4	2.2	144.0	241.3
Larsen Bay	4.4	8.4	0.3	58.5	55.9
Sitkanak	4.6	6.9	2.2	128.3	69.9

1987:34). Cyclone storm formation is most intense in the autumn and winter when Pacific storms typically affect the Alaskan coast at intervals of 48 hours or less (Hare and Hay 1974).

The movement of storms across the North Pacific is predictable and helps in determining regional climatic patterns. Cyclones generated off the coasts of Siberia and Japan typically track northeastward, crossing south of the Aleutians towards the coast of North America. Their periodic passage creates a semi-permanent low pressure area, the Aleutian Low (Wilson and Overland 1987:32), that exists approximately 25% of the time. Cyclonic storms entering the northern Gulf of Alaska from the southwest tend to stagnate, unable to cross the high coastal mountains into the interior. Some storms do reach the interior, but more frequently they move southeastward into British Columbia and Washington (Overland and Hiester 1980). Storms developing in the mid-Pacific have more variable trajectories than those spawned off of northeast Asia, but they too often move north into the Gulf of Alaska (Terada and Hanzawa 1984:447).

Several factors modulating these generalized storm tracks today may have been important in prehistoric times. During summer months, a high pressure system typically envelops the northeast Pacific and tends to deflect storm systems to its north, into the Bering Sea. As the eastern Pacific high-pressure system shrinks towards the southeast in the autumn, storm tracks in the north Pacific shift southward, in concert with the strengthening high pressure system that builds over the cold interior of Siberia during the winter months.

Changes in storm track positions in the North Pacific affect climate in downwind areas of Alaska by altering precipitation, temperature, and wind regimes. Snowfall in the Alaska Range increases when the position of the Aleutian Low shifts eastward, while snowfall on the Kenai Peninsula increases when the Aleutian Low shifts farther west (Fahl 1975). Storms generally diverge to the west and east of the Alaska Peninsula; westward-tracking storms move into the Bering Sea where winter extent of sea ice depends on how near storm tracks lie to the Siberian shore (Overland and Pease 1982).

Wind directions in the northern Gulf of Alaska are determined by the interplay of high and low pressure systems, superimposed on the prevailing westerlies of these latitudes. The movements of cyclonic storms into the Gulf of Alaska determine winter wind conditions over the southern Alaska coast (Wilson and Overland 1987:39). In the western gulf, wind direction is widely variable depending on whether the storm lies north or south of the Alaska Peninsula. For example, on western Kodiak Island, wind shifts of 180° within a twelve-hour period are common as cyclones pass northeastward to the south or north of the island.

In the northern Gulf of Alaska, winds are more predictable since storms must move either onshore or (more typically) eastward skirting the coastline. In the northern gulf, storm-generated winds are therefore usually southerly or southeasterly, although easterly winds are also frequent under the influence of a stagnating cyclone in the eastern gulf (Brower et al. 1977). Southeasterly winds during the winter months transport warmer air into the eastern and northern Gulf of Alaska, reinforcing the transfer of heat into this region by the Alaska Current (Wilson and Overland 1987:33). Periodically during the winter, cold, dry, continental air breaks out over the northern Gulf of Alaska, causing temperatures to plummet over the normally mild coastal areas and creating katabatic winds funneled south and east by topography. As storm frequency decreases during the spring, wind speeds also decrease to a low in mid-summer when the east Pacific high is usually strongest. Summer winds are

typically light except when storms enter the region (Brower et al. 1977).

The Gulf of Alaska is usually cloudy due to storms passing through the region. Clouds are also generated in winter by the flow of cold interior air over the warm waters of the Gulf. During the summer east Pacific high, fog and stratus clouds are frequent in a low-level temperature inversion created over the relatively cool waters of the gulf (Wilson and Overland 1987:41-42).

Precipitation varies along Alaska's southern coast (Table 1), with as much as 800 cm/yr (315 in/yr) in the coastal mountains (Royer 1983) and as little as 60 cm/yr (24 in/yr) in the rainshadow of the Kodiak Mountains (Karlstrom and Ball 1969, AEIDC 1974:34). Large parts of the coast between the Copper River Delta and the Alaska Peninsula receive 200 cm/yr (79 in/yr) (Royer 1983). Most precipitation falls as rain, even during winter (Brower et al. 1977).

Winter sea ice is rare in the Gulf of Alaska, confined to sheltered bays and areas of large freshwater outflow such as Cook Inlet and northwestern Prince William Sound (Brower et al. 1977). Shore ice occurs on either side of Shelikof Strait. No permafrost exists near sea level along the coast (Ferrians 1965).

Waves affecting the coast of southern Alaska are the product of local winds and far-traveling swells. On the southern Alaskan coast, processes of wave generation by local winds are complicated by the interaction between cyclonic storms and the high coastal mountains. Winds typically flow counterclockwise around cyclonic storms, staying roughly parallel to the isobars (Barry and Chorley 1976:86). However, when a cyclone abuts a narrow strait bordered by high mountains, these geostrophic winds are blocked, creating what amounts to a gap in the cyclone's wind field that can be filled by low level winds from a region of higher pressure, blowing perpendicular to the regional pressure gradient. This results in intense local winds blowing down straits such as Shelikof Strait and Cook Inlet (Overland 1984).

Katabatic winds occur when cold, high pressure winds spill over the mountain passes from the interior into the Gulf of Alaska and are funneled down fjords and straits, creating intense local wave action. Winds at the mouths of major estuaries are often dominated by such activity (Wilson and Overland 1987:47).

Temperatures along the coast of southern Alaska are cool in summer and warm in winter, relative to stations in the continental interiors at similar latitudes (Table 1). Within the western Gulf of Alaska, mean annual temperatures range from 2.2° C at Valdez to 5.4° C at Cape Hinchinbrook (36° - 42° F).

Oceanography

Three main currents control the circulation of ocean waters in the North Pacific and affect the climate of the Gulf of Alaska region. The Kuroshio Current carries subtropical waters northward along the east coast of Japan to merge with the eastward-flowing North Pacific Current (Masuzawa 1972; Terada and Hanzawa 1984:432-433). Off the coast of southern British Columbia, the North Pacific Current forks, sending a northward flowing branch, the Alaska Current, in a counter-clockwise route around the Gulf of Alaska (Reed and Schumacher 1987:Figure 3-1). Between Kayak Island and the mouth of Cook Inlet, the Alaska Current is renamed the Alaska Coastal Current (Reed and Schumacher 1987:66), referring to the convergence of the broad Alaska Current into a 40 km-wide (25 mi) stream running directly along the shore of the Kenai Peninsula (Royer 1989). Southwest of Afognak Island, a third name -- the Alaska Stream -- is applied. Flow in the Alaska Current/Coastal Current/Stream system is approximately 1/10 that of the Gulf Stream's, or 10,000,000 m^3/s (Royer 1989).

Warm waters flowing northward in the Alaska Current ameliorate the climate of southern and southeast Alaska. Meridianal heat transported into the North Pacific via ocean currents amounts to 114×10^{13} W/yr across 30° N latitude (Hastenrath 1980:Figure 10). Because of this oceanic heat transport via the Alaska Current, mean annual temperature at sea level in the Gulf of Alaska is relatively steady and warm, about 7° C (45° F)(Wilson and Overland 1987:41).

The Alaska Current system is driven by baroclinic flow along a cross-shelf density gradient created by the massive amounts of fresh water being discharged into the Gulf (Royer 1982:2021). Prevailing winds concentrate this fresh water near the outer shelf edge off southeast Alaska in a stream approximately 300 km (200 mi) wide flowing at a rate of about 30 cm/s (12 in/s). Along the Kenai Peninsula, the Alaska Coastal Current narrows to less than 50 km (31 mi) and attains speeds up to 100 cm/s (39 in/s)(Royer 1982, Reed and Schumacher 1987:65-66). West of Kodiak, the Alaska Stream widens to about 100 km (62 mi) and flows at about 100 cm/s.

Ocean water enters Prince William Sound largely through Hinchinbrook Entrance (Royer et al. 1979), and exits to the southwest between Montague and Latouche islands where surface waters merge with the Alaska Coastal Current. Water flow is predominantly to the southwest down Shelikof Strait (Reed and Schumacher 1987:67-71). Water movements are complex in lower Cook Inlet, but, in general, currents flow north along the east side and south along the west side.

Tides in the northwest Gulf of Alaska are semi-diurnal, with marked variation between successive low tides. The mean diurnal tidal range varies from 3.2 m (10.5 ft) at Seward to 4.2 m (13.8 ft) at Larsen Bay (Wise and Searby 1977). Maximum tidal range may reach 10 m (33 ft) or more in parts of the study area, often promoting intertidal resources of extensive area, but sometimes placing logistical constraints on marine travel or subsistence activities.

Wave heights also have practical implications for maritime societies. Waves in the open Gulf of Alaska have a mean significant wave height (mean height of the highest 1/3 of all waves) of between three and four meters (10 and 13 ft) between October and March, but decline to one to two meters (3 - 6 ft) from June to August. Maximum wave heights reach seven to nine meters in the same area (Wilson and Overland 1987). Tsunamis, caused by sea floor displacements during earthquakes, are also common

in the northern Gulf of Alaska. Such waves can traverse entire ocean basins at speeds as high as 900 km/hr (560 mph). Tsunami size is controlled by the magnitude and extent of the earthquake and the water depth at the source. As a tsunami enters shallow coastal waters, it slows and steepens. Heights can vary from several centimeters to tens of meters depending on the amount of wave focusing that occurs as it approaches shore (Wilson and Torum 1968).

Tsunamis are most common in the Pacific Ocean: 66 of the world's 84 tsunamis between 1928 and 1963 occurred there (AEIDC 1974:85). The Gulf of Alaska and Aleutian Islands are common sources for tsunamis due to the frequency of earthquakes. Another destructive wave is generated by landslides (often earthquake-triggered) striking the water, especially in semi-enclosed basins, such as the wave that destroyed the town of Valdez in 1964 (Coulter and Migliaccio 1966).

Soils

Reconnaissance soil mapping has been completed for the western Gulf of Alaska coastal region at a scale of 1:500,000 (Rieger et al. 1979). More detailed mapping is available for northeast Kodiak Island (Rieger and Wunderlich 1960) and north Prince William Sound (Sheehy 1975). Of the five major soil forming factors -- climate, relief, organisms, parent material, and time -- only the first and last are relatively constant throughout the region, which is divided roughly in half by differences in parent material and vegetation.

Soils of the Kodiak area and the Alaska Peninsula are formed largely of tephras -- layers of volcanic ash built up by periodic eruptions of Alaska Peninsula volcanoes. Soils of Prince William Sound and the outer Kenai Peninsula are formed from materials derived from local bedrock, glacial moraines, and outwash. The difference in parent materials is accompanied by temporal variation in soil genesis, since repeated volcanic eruptions have deposited new tephras in which new surface soils must form. Except for the consequences of uplift and subsidence on the continuity of soil formation on many coastal landforms, most soils in Prince William Sound and the Kenai Peninsula have been forming without significant interruption since deglaciation. The major vegetational difference is the absence of coastal forest on Kodiak and the Alaska Peninsula, except at their northern ends (Viereck and Little 1975).

These regional differences are reflected in the classification of soils in the two areas. The soils of Kodiak and the Alaska Peninsula are dominated by inceptisols -- poorly developed soils only slightly modified from the parent material and without diagnostic soil horizons. Soils of the Kenai Peninsula and Prince William Sound are dominated by well-drained and horizonated spodosols (orthods), where iron, aluminum, and carbon have moved from the upper to the lower soil horizons, forming a spodic horizon.

The Kodiak Archipelago and the Alaska Peninsula are dominated by typic and dystric cryandepts (inceptisols) formed in volcanic ash. Even in the spruce forests of Afognak Island spodosols have not developed (Rieger et al. 1979). In Prince William Sound; Montague, Hinchinbrook, Hawkins, Green, Latouche, Elrington, Evans, Naked, Glacier, and Bligh islands have soil associations dominated by humic cryorthods (spodosols) in well drained areas, and terric cryohemists (histosols -- mucky peats) in poorly drained areas (Rieger et al. 1979). The same assemblage dominates the outer coast of the Kenai Peninsula. In the sound, Bainbridge, Chenega, Culross, Esther, Perry, and the Knight islands have soil associations dominated by typic cryaquents (entisols) -- poorly developed, wet soils with no diagnostic soil horizons.

Vegetation

Great variety exists in the plant communities of the study area, from the coniferous forests dominating Prince William Sound and the Kenai Peninsula to the largely unforested areas of Kodiak Island and the Alaska Peninsula. Vegetation patterns vary both regionally and locally, and influence the distribution and diversity of terrestrial fauna, including humans. There have been temporal shifts in vegetation patterns, though the western limit of the Pacific Coastal Forest, at the tip of the Kenai Peninsula, appears to have been stable for several millennia. The narrow lowlands that exist between the sea and the glaciated Chugach and Kenai Mountains allow little room for lowland plant communities in the coastal zone. The coastal lowland ranges up to 100 km (62 mi) wide, and is frequently interrupted by wide fjords or glaciers. On the southeast coast of the Kenai Peninsula, the lowlands are limited to scattered pockets of habitat separated by partly vegetated mountain walls and fjords. Due to restricted surface area and steepening climatic gradients to the west, the southern Kenai coast marks the northern range of many plant species and plant community types (Viereck and Little 1972, Cooper 1942).

Prince William Sound

Lowland plant communities in Prince William Sound are dominated by the Pacific Coastal Forest, which covers much of the land below 100 meters (62 ft) in fjords and about 600 meters (1950 ft) on the open coast. The forest is dominated by Sitka spruce *(Picea sitchensis)*, mountain hemock *(Tsuga mertensiana)*, and western hemlock *(Tsuga heterophylla)*. Alaska yellow cedar *(Chamaecyparis nootkatensis)* is sparsely represented, and Sitka alder *(Alnus sitchensis)* occupies certain coastal forest habitats. Black cottonwood *(Populus trichocarpa)* is common on outwash fans. Some trees important in coastal forests to the south do not reach Prince William Sound today. These include western red cedar *(Thuja plicata)*, Pacific silver fir *(Abies amabilis)*, red alder *(Alnus rubra)*, and lodgepole pine *(Pinus contorta)*, all of which have northern limits in southeast Alaska (Viereck and Little 1975).

In favorable locations, hemlock and spruce trees reach heights of 15 to 30 meters (49 - 98 ft) at maturity, with diameters of about one meter (3.3 ft) (Fernow 1902; Heusser 1960, 1983). Spruce, hemlock, and yellow cedar reach ages of 300 to 800 years, and black poplar also typically survives for several centuries (Fowells 1965). Despite their small size, Sitka alders may live for hundreds of years as well. Spruce is most abundant at lower elevations in the outer portions of Prince William Sound, while hemlock is the predominant conifer in scattered forest patches of interior fjords (Cooper 1942, Heusser 1983). Black cottonwood is most abundant at locations sheltered from the sea, and on deep, immature soils such as recent moraines and gravel bars along braided streams. Sitka alder occupies early successional habitats for 50 to 100 years, but is more persistent in avalanche areas and the sides of fjords (Cooper 1942). Alder thickets often contain other plants that make human access difficult, including devil's club *(Echinopanax horridum)*.

The lowland forest understory contains relatively few shrub and herb species (Heusser 1960, Cooper 1942). Blueberry *(Vaccinium ovalifolium)* is the most common shrub in many areas and irregularly produces edible berries. Other common shrubs are *Menziesia ferruginea, Sorbus sitchensis, Sambucus racemosa, Echinopanax horridus,* and *Cladothamnus pyroliflorus*. Shrubs are common under the broken canopies of mature forest communities and near the tree line. They also form dense thickets on the borders of muskegs, especially on steep slopes where peats are thin. Characteristic forest floor herbs include *Dryopteris linnaeana, Blechnum spicant, Lycopodium annotinum, Streptopus amplexifolius, Listera cordata, Coptis asplenifolia, Rubus pedatus, Cornus canadensis,* and *Trientalis europaea* (Heusser 1960:51).

Muskegs are peat bogs dominated by sedges, sphagnum mosses, and stunted conifer trees' and occur on lands throughout Prince William Sound. Muskegs usually form on low-gradient landforms with restricted drainage, but they also form on steep slopes with thin soils. They often contain numerous shallow ponds several meters in extent. Even in summer, the water table lies within centimeters of the surface, making them poor living sites. Accumulations of peat in Prince William Sound are typically thin. Heusser (1983) cored nine muskegs, finding peat deposits no more than two to three meters (6.5 - 9.7 ft) thick. The oldest of these dated to about 10,000 B.P., indicating accumulation rates of less than 1 mm/yr. Heaths of the genera *Empetrum, Cassiope, Andromeda, Vaccinium,* and *Oxycoccus* are an important component of the muskeg vegetation and some (such as *Empetrum)* produce small berry crops. Characteristic herbs in muskegs are the butterwort *(Pinguicula villosa), Gentiana douglasiana, Fauria crista-galli, Tofieldia occidentalis,* and *Pedicularis parviflora.*

Alpine tundra is widely distributed at higher elevations, covering areas above treeline and below the level of permanent snow and ice. Shrubs and muskegs, often more frequent with higher elevation, form a transition between conifer and alpine zones containing Sitka alder, salmon berry *(Rubus spectabilis),* tall herbs *(Veratrum viride, Heracleum lanatum),* and the fern *Athyrium filix-femina.* Alpine tundra contains a variety of herbs, many of which are circumboreal in distribution (J. Anderson 1974). The heathers *Phyllodoce glanduliflora* and *Cassiope stelleriana* are most typical of this zone, along with *Leutkea pectinata, Lupinus nootkatensis, Valeriana sitchensis,* and *Sedum rosea* (Heusser 1960, Heller 1910). Along low-energy shorelines, forest communities often border salt water. Where wave-energy is high, salt water spray or occasional storm surf forms a supralittoral vegetative community dominated by rye grass *(Elymus arenarius),* with the herbs *Honckenya peploides, Atriplex drymariodes, Mertensia maritima, Potentilla* spp., and *Senecio pseudo-Arnica.* Also common are beach pea *(Lathyrus maritimus), Achillea borealis, Angelica lucida, Heracleum lanatum,* and strawberry *(Fragaria chiloensis)* (Eyerdam 1971). *Lupinus nootkatensis* often grows in profusion in backshore meadows. Tidal marshes are uncommon in Prince William Sound, but the few that exist contain several sedges and halophytic grasses *(Puccinellia* spp.).

Disturbed vegetation regimes in Prince William Sound are caused by earthquakes, glaciers, wind, avalanches, and occasional tsunamis and forest fires. Earthquakes can cause subsidence or uplift of shorelines, drowning forests or creating new nearshore habitat. Raised shorelines created by the 1964 earthquake are now covered with Sitka alder, tall herb and grass meadows, salmon berry, and young conifers. Glaciers scoured the fjords in Prince William Sound several times during the Holocene. Recolonization of these scoured landforms proceeds through stages dominated by alders and willows, with black poplar in places, then by spruce and hemlocks (Lutz 1930). Muskeg is often the end result of succession on low angle surfaces or on slopes with poor drainage or thin soils (Cooper 1942, Heusser 1960).

Kenai Peninsula

The south coast of the Kenai Peninsula can be divided into three vegetation and physiographic zones (Alaska Planning Group 1975:71-79). The eastern zone lies between Port Bainbridge and Resurrection Bay, where wide bays and broad alluvial valleys support Pacific Coastal Forest. From Resurrection Bay to Gore Point, the fjord-punctuated coast is more rugged and lowland vegetation is limited to a narrow band less than 10 km (6.2 mi) wide. The coastal forest is found in patches along this precipitous coast, except for more extensive stands near the lower Nuka River, on Nuka Island, and on the outwash plain of the Petrof Glacier. West of Gore Point, the landscape opens up and large forest stands blanket the wide valleys connecting the outer coast to the shores of Kachemak Bay. The same trees dominate the lowland forest here, except for yellow cedar (absent), and mountain hemlock, which is rare west of Resurrection Bay (Viereck and Little 1975). The treeline on the Kenai Peninsula is lower than in Prince William Sound: on headlands conifers reach altitudes of 200 to 300 m (650 - 1000 ft), but normally grow at lower elevations in fjords. Treeline rises again around Kachemak Bay, where conifers extend up to 400 to 600 meters (1300 - 1950 ft). Tree cover is patchy in the inner fjords, probably due to recent deglaciation, more extreme climate,

and a scarcity of surfaces flat enough for soil development and conifer establishment.

Trees are smaller along the Kenai coast than in much of Prince William Sound. The forest interior has dense shrubs, but diversity is low because forest *Vaccinium* species are absent west of Resurrection Bay (Viereck and Little 1975). Muskegs are less numerous, probably because of the scarcity of gentle slopes. Vegetation on the steep slopes of the Kenai coast has been affected by avalanches, where Sitka alder and tall herb communities are widespread. Wind disturbance is also common, especially in forests growing on shallow soils of the outer coast. On the Pye Islands, windthrows of 50 - 500 m^2 (530 - 5300 sq ft) were observed in 1989. The 1964 earthquake caused up to two meters (6.5 ft) of subsidence on the Kenai coast (Plafker 1969:Figure 3), killing thousands of conifers that now stand dead in the intertidal zone.

Above a mosaic of avalanche-track alder thickets and conifer patches, the alpine zone of the Kenai Peninsula is similar to that of Prince William Sound. Extensive alpine meadows cover the low mountains on the southeast tip of the peninsula.

Alaska Peninsula

The vegetation from Pavlof Bay on the outer peninsula to Kamishak Bay near the entrance to Cook Inlet consists of patches of Sitka spruce forest and larger areas of high brush in a matrix of tundra. Stunted groves of Sitka spruce occur in sheltered sites along the northwest side of Shelikof Strait (Viereck and Little 1975). Kenai birch *(Betula papyrifera kenaica)* grows on the peninsula (Viereck and Little 1972), but rarely exceeds two to three meters (6.6 - 9.8 ft) in height. Western hemlock and black cottonwood do not extend this far west, and mountain hemlock is rare (Viereck and Little 1975, Fowells 1965). White spruce *(Picea glauca)*, paper birch *(Betula papyrifera)*, and balsam poplar *(Populus balsamifera)* are found in interior areas, but not along the coast.

High shrub communities are dominated by Sitka alder and various willows, including *Salix arctica*, *S. glauca*, and *S. pulchra* (Heusser 1983, Hultén 1968, J. Anderson 1974). These shrubs form a mosaic with tall-herb tundra on better-drained slopes below 300 meters (1000 ft). Sitka alder may grow as clones in patches five to 15 meters (16 - 49 ft) wide, reaching heights of two to three meters (6.6 - 9.8 ft) and widths to 10 cm (4.0 in)(Heusser 1983). This tall-herb tundra, often mixed with high shrubs, contains the fern *Athyrium filix-femina*, the grass *Calamagrostis canadensis*, the umbel *Heracleum lanatum*, and the small herbs *Geranium erianthum*, and *Viola langsdorfii* (Heusser 1983).

Alpine tundra dominates the landscape above the high shrub tundra, though considerable variation exists due to slope, aspect, and wind regime (Heusser 1983). Prominent in this diverse community are *Empetrum nigrum*, *Dryas integrifolia*, *Salix reticulata*, *Silene acaulis*, and *Geum rossii*. Wet tundra is less diverse and dominated by sedges. Moist tundra occurs on areas of better drainage and contains a diverse assemblage of herbs and dwarf shrubs (Heusser 1983).

Along the shore, tall-herb meadows are dominated by *Heracleum lanatum*, *Lupinus nootkatensis*, *Calamagrostis canadensis*, and many smaller herbs. Rye grass *(Elymus arenarius)* and *Honckenya peploides* grow along sandy shores. In wind-swept settings like Cape Douglas, alpine-like associations occur at sea level, with Sitka alder taking on a dwarf form.

Kodiak Archipelago

The Kodiak Archipelago occupies a transition zone between coastal conifer forest and tundra. The northern end of Kodiak Island and the islands to the north contain dense Sitka spruce forest with devil's club and blueberry in the shrub layer. Sitka alder is abundant above treeline and in disturbed habitats. Black cottonwood is common along rivers in the forested zone and along the southwest coast of Kodiak Island (Viereck and Little 1972, Fowells 1965). Balsam poplar occurs on the northwest part of the island, and stunted black poplar grows as far southwest as Olga Bay and Grant Lagoon (Fowells 1965).

In other areas, the archipelago is treeless. Several willows grow on western Kodiak, along with *Betula kenaica*, which rarely exceeds three meters (10 ft) in height. Southwest of the spruce forest boundary, vegetation is similar to the Alaska Peninsula. Wet and moist tundra occupy valley bottoms, while high shrub and tall-herb tundra intermix on slopes below 300 meters (1000 ft) in sheltered areas and below 150 meters (500 ft) along the exposed southwest coast. Higher elevations support alpine tundra communities often dominated by *Empetrum nigrum*.

Wind-swept, low lying Tugidak Island in the far southwest of the archipelago supports only a few willow shrubs, and is otherwise covered by extensive heaths of *Empetrum* hummocks with tall-herb and grass meadows interspersed in sheltered valleys. Sitkinak Island, between Tugidak and Kodiak islands, supports a more shrub-rich vegetation than southwest Kodiak.

Fauna

Terrestrial Mammals

Land mammals are distributed unevenly across the study area (Table 2), with 34 indigenous taxa on the Kenai Peninsula, 31 in Prince William Sound, 30 on the Alaska Peninsula, and six on the Kodiak Archipelago. Detailed range maps have been published for many of the species (ADFG 1973, 1978). The differential distribution of land mammals in the region has influenced human subsistence and settlement strategies for thousands of years.

Land mammals native to the Kodiak area include brown bear, red fox, ermine, river otter, northern vole, and ground squirrel. The brown bat *(Myotis lucifugus)* also is present in summer. Thirteen mammals have been introduced historically (Rausch 1969:217), including the house

mouse, Norway rat, muskrat, red squirrel, snowshoe hare, marten, beaver, mountain goat, Dall sheep, black-tail deer, reindeer, moose, and Roosevelt elk. Apparently mink never became established on the islands (W. Clark 1958). Native mammals are distributed unevenly on Kodiak. For example, ground squirrels have a restricted distribution (Rausch 1953:124-125, Figure 10) and may have been introduced by Native peoples from the Semidi Islands (Osgood 1903). While 2000 to 3000 brown bears live in the Kodiak area (ADFG 1973), they are absent from the Trinity Islands (W. Clark 1958) and are scarce in areas of western Kodiak Island beyond the margin of shrub tundra vegetation. Kodiak brown bears congregate along stream courses and at the heads of bays during salmon runs from mid-June through October. The bears den between November and April on north-facing slopes in the subalpine uplands, generally at altitudes between 450 to 600 meters (1500 - 1950 ft).

Land mammals are much more diverse on the Alaska Peninsula, and include some large mammals (such as caribou and moose) that may have been significant prey species for hunter-gatherers. Brown bears range all along the Shelikof Strait shore of the Alaska Peninsula, where they congregate along salmon streams during the summer and fall spawning seasons. Moose are most common in the interior parts of the peninsula, but also range along the coast, especially at the heads of bays. Caribou are found on the Shelikof Strait coast, but calve on the Bristol Bay side of the peninsula. Wolves are present but not abundant.

The Kenai Peninsula has a diverse land mammal fauna including coyote, black bear, mountain goat, and Dall sheep. On the Kenai Peninsula coast, the range of brown bears is limited to areas east of the Aialik Peninsula. Black bears are found along streams at the heads of bays and fjords, especially Aialik Bay and the inlets west of Port Dick. Mountain goats range all along the coast in the rugged upland areas.

Prince William Sound has land mammal fauna similar to the Kenai Peninsula, though caribou, Dall sheep, and moose are not present. In Prince William Sound, brown bears are limited to Montague, Hinchinbrook, and Hawkins islands, and mainland shores east of Columbia Glacier. Black bears are found on all mainland shores of the sound, and on Latouche, Evans, Bainbridge, Chenega, Knight, and Culross islands. Moose occasionally are found at the heads of Port Valdez and Port Nellie Juan, but not in the sound proper. Mountain goats inhabit alpine environments along the north coast of the sound.

Marine Mammals

Cetaceans

Both baleen and toothed cetaceans are present in the Gulf of Alaska (Table 3). Seven of the world's nine species of baleen whales seasonally inhabit the area, including gray, humpback, minke, sei, fin, blue, and right whales (Strauch et al. 1980:228, Leatherwood et al. 1982). Baleen whales typically migrate from summer feeding grounds in polar waters to low-latitude winter breeding grounds (Slijper 1976). Most eastern Pacific gray whales migrate annually from wintering grounds off Baja California to summer feeding grounds in the Bering Sea. Gray whales swim past the southeast coast of Kodiak Island, along the Alaska Peninsula, and through Unimak Pass (Leatherwood et al. 1982, Hall 1979). Currently, as many as 12,000 gray whales make this journey annually. A similar migration is undertaken by large populations of humpback whales that winter off Hawaii and Baja California. As a result of commercial overhunting, only about 1000 humpbacks remain in the north Pacific (Leatherwood et al. 1982), though their numbers undoubtedly were once much greater. Small (7 - 10 m (23- 33 ft) long) minke whales also are sighted frequently in nearshore waters of the northern Gulf of Alaska, often entering bays and estuaries to feed. They also move southward in winter, though some individuals remain in the Gulf of Alaska (Leatherwood et al 1982). Large fin whales are fairly common in outer Prince William Sound (Hinchinbrook Entrance-Montague Island) in the summer months (Leatherwood et al 1982), but generally range farther offshore. Both the blue whale and the sei whale remain offshore in deeper waters (Leatherwood et al. 1982). Little is known about the distribution and habits of the once more numerous right whale in the North Pacific. A few probably summer in the Gulf of Alaska, but they seem to be pelagic and have rarely been sighted near shore. Commercial whaling records reveal that sei, fin, and blue whales were once abundant off southwest Kodiak Island (Nishiwaki 1966). Humpback and minke whales are common during the summer in Prince William Sound (Hall 1979).

Six-toothed cetaceans are common in the northern Gulf of Alaska, including the Pacific white-sided dolphin, harbor porpoise, Dall porpoise, and killer, beluga, and sperm whales (Strauch et al. 1980). Sperm whales are primarily a low-latitude species, but range into the Gulf of Alaska in summer. They usually remain offshore in water more than 200 meters (650 ft) deep (Leatherwood et al. 1982). In the study area, sperm whales are most common off the southeast side of Kodiak Island (Fiscus et al. 1976). Off Alaska, beluga whales are found mostly in the Bering and Chukchi Seas, but an isolated population inhabits Cook Inlet, and they are occasionally sighted off Kodiak Island. Belugas are small (up to 4.5 m (15 ft) long) and live in turbid coastal waters including estuaries (Leatherwood et al. 1982). Pacific white-sided dolphins may be seen in the Gulf of Alaska during the summer in groups of several hundred. Harbor porpoises reside in subarctic waters year-round and are the most common cetacean in the study area, feeding in shallow bays and estuaries alone or in small groups (Leatherwood et al. 1982). The black and white Dall porpoises are the most common cetacean in Prince William Sound (Hall 1979), and frequent shallow coastal waters throughout the study area. Killer whales feed on other cetaceans, pinnipeds, birds, and fish. They are common in the Gulf of Alaska near and offshore, especially in fjords and passages of Prince William Sound and Kodiak (Hall 1979, Leatherwood et al. 1982).

Table 2

Land Mammals of the Kodiak, Alaska Peninsula, and Prince William Sound Areas

from ADFG 1973, 1978, Burt and Grossenheider 1976, Rausch 1969

Common Name/Taxon	Kenai	AK Pen	Kodiak	PWS
Masked shrew *(Sorex cinereus)*	X	X		X
Dusky shrew *(S. obscurus)*	X	X		X
Arctic shrew *(S. arcticus)*		X		
Northern water shrew *(S. palustris)*	X			X
Pygmy shrew *(Microsorex hoyi)*	X			
Little brown bat *(Myotus lucifugus)*	X	X	X	X
Tundra hare *(Lepus othrus)*		X		
Snowshoe hare *(L. americanus)*	X	X	I	X
Red squirrel *(Tamiasciurus hudsonicus)*	X	X	I	X
Hoary marmot *(Marmota caligata)*	X	X		X
Arctic ground squirrel *(Citellus parryi)*		X	I?	
Northern flying squirrel *(Glaucomys sabrinus)*	X			X
Beaver *(Castor canadensis)*	X	X	I	
Greenland collared lemming *(Dicrostonyx groenlandicus)*		X		X
Northern bog lemming *(Synaptomys borealis)*	X	X		X
Brown lemming *(Lemmus trimucronatus)*		X		
Tundra redback vole *(Cleithrionomys rutilus)*	X	X		X
Muskrat *(Ondatra zibethicus)*	X	X	I	X
Tundra vole *(Microtus oeconomus)*	X	X	X	X
Alaska vole *(M. miurus)*	X			X
Meadow vole *(M. pennsylvanicus)*	X			X
Longtail vole *(M. longicaudus)*				X
Meadow jumping mouse *(Zapus hudsonius)*	X	X		X
Porcupine *(Erethizon dorsatum)*	X	X		X
Gray Wolf *(Canis lupus)*	X	X		X
Coyote *(C. latrans)*	X			X
Red fox *(Vulpes vulpes)*	X	X	X	X
Alaskan brown bear *(Ursus arctos)*	X	X	X	X
Black bear *(U. americanus)*	X			X
Shorttail weasel *(Mustela erminea)*	X	X	X	X
Least weasel *(M. rixosa)*	X	X		X
Mink *(M. vison)*	X	X		X
Marten *(Martes americana)*	X	X		X
Wolverine *(Gulo luscus)*	X	X		X
Land otter *(Lutra canadensis)*	X	X	X	X
Lynx *(Lynx canadensis)*	X	X		X
Moose *(Alces alces)*	X	X		
Sitka black tailed deer *(Odocoileus hemionus)*			I	I
Roosevelt elk *(Cervus canadensis)*			I	
Caribou *(Rangifer tarandus)*	X	X	I	
Mountain goat *(Oreamnos americanus)*	X		I	X
Dall sheep *(Ovis dalli)*	X			

X=Present I=Introduced

Sea Otters

In the 1700s, sea otters were distributed continuously from Japan to Baja California and probably numbered between 100,000 and 150,000 animals (Scheffer 1972). Following intensive hunting in the late 18th and 19th centuries, sea otter populations declined to roughly 30,000 to 50,000 animals in 1965. Scheffer (1972) estimated that 5000 sea otters lived between the tip of the Alaska Peninsula and Cook Inlet. Sea otters inhabit shallow waters near rocky shorelines that possess diverse bottom faunas. They rarely leave the water, can dive to depths of 60 meters (200 ft) or more, and typically stay underwater for up to two minutes while feeding (Kenyon 1972). Sea otters eat molluscs, fish, and echinoderms,

Table 3

Marine Mammals of the Northwest Gulf of Alaska

from ADFG 1973, AEIDC 1974:Table 43, Brueggeman et al. 1989, Consiglieri et al. 1989, Hall 1979, Johannsen and Johannsen 1975, Science Applications, Inc. 1980

	Western Gulf	PWS
Baleen Whales		
Blue *(Balaenoptera musculus)*	R	-
Gray *(Eschrichtius robustus)*	M	R
Fin *(Balaenoptera physalus)*	C	M
Sei *(Balaenoptera borealis)*	C	R
Minke *(Balaenoptera acutorostrata)*	C	M
Humpback *(Megaptera novaeangliae)*	M	C
Right *(Balaena glacialis)*	R	-
Toothed Cetaceans		
White-sided dolphin *(Lagenorhynchus obliquidens)*	R	-
Killer whale *(Orcinus orca)*	M	C
Harbor porpoise *(Phocoena phocoena)*	C	C
Dall porpoise *(Phocoenoides dalli)*	C	C
Sperm whale *(Physeter catodon)*	C	-
Beluga *(Delphinapteris leucas)*	R	-
Beaked whale *(Mesoplodon stejnegeri)*	R	-
Goosebeak whale *(Ziphius cavirostis)*	R	-
Baird beaked whale *(Berardius bairdi)*	R	-
Mustelids		
Sea otter *(Enhydra lutris)*	C	C
Pinnipeds		
Steller sea lion *(Eumetopias jubatus)*	C	C
Northern fur seal *(Callorhinus ursinus)*	R	R
Harbor seal *(Phoca vitulina)*	M	C

R = rare M = moderately common C = common

and consume 1/5 to 1/4 of their body weight per day. When their populations are high they can have a significant impact on the structure of nearshore marine communities (Estes et al. 1978, Duggins et al. 1989).

Sea otters are common throughout the study area, though their abundance varies. Along the Alaska Peninsula, sea otters are abundant near the capes south of Wide Bay and in the Shakun Islets and rocks south of Cape Douglas (ADFG 1973). Around Kodiak, sea otters are especially abundant on the north and west shores of Afognak Island and on the Trinity Islands. They are less abundant on the outer coast of the Kenai Peninsula, with most animals concentrated west of Nuka Bay (Schneider 1976:Figures 33, 34). Prince William Sound has major populations around Latouche, Knight, Green, Montague, and Hinchinbrook islands (ADFG 1973).

Pinnipeds

Two families of pinnipeds inhabit the northern Gulf of Alaska: the Otariids (eared seals) and the Phocids (earless seals). Among the Otariids, Steller sea lions are common, with 40,000 to 50,000 animals estimated for the northwestern Gulf of Alaska in 1960 (Scheffer 1972). Steller sea lions typically establish rookeries and haulouts on exposed landforms with easy access from the sea and protection from predators. Major rookeries and haulouts occur on the east and north coasts of the Kodiak Archipelago, the Barren Islands, Blying Sound on the Kenai Peninsula, and on Latouche, Elrington, Perry, and Danger islands in Prince William Sound (ADFG 1973). East of Montague Island, uplift from the 1964 earthquake halved the size of the Fish Island rookery, while the Seal

Rocks rookery habitat was improved and sea lion use increased (Johannsen and Johannsen 1975:97).

Northern fur seals range throughout the study area and are especially common in June while migrating to their breeding grounds on the Pribilof Islands. Fur seals are scarce in the Gulf of Alaska between August and October. Southward migration continues at a slow pace through the autumn and winter months. Almost all of the one million members of the Pribilof herd migrate through the Kodiak area (Baker et al. 1963).

Harbor seals are the most abundant pinniped of coastal Alaska, often frequenting calmer fjords and estuaries. They haul out on icebergs along glaciated coasts or on isolated rocks elsewhere. Pupping occurs in May and June, and fur molting in August and September. Both processes require extensive haul-out periods. The Alaska Peninsula has high densities of harbor seals near Puale Bay, in Wide and Kukak bays, and in the Shakun Islets and Cape Douglas areas (ADFG 1973). Tugidak Island is the most important harbor seal haul-out area in the Kodiak Archipelago, but others occur in Ocean Bay and Alitak Bay, in Perenosa and Seal bays on Afognak Island, and on Ban and Shuyak islands. On the Kenai Peninsula, concentrations occur at fjord heads, especially in Nuka Bay and Day Harbor. Harbor seals are common throughout Prince William Sound, with concentrations in College and Harriman fjords, on Peak, Eleanor, Seal, and Perry islands, and elsewhere (ADFG 1973).

Intertidal Communities

The intertidal zone contains complex communities, the productivity of which varies throughout the study area. Three major factors control the distribution of intertidal organisms; wave energy, substrate type, and tidal range (Ricketts et al. 1968). Of these, substrate type and wave energy are critical for Gulf of Alaska shorelines. In the Kodiak area, nearly 80% of the intertidal substrate is bedrock or a mixture of gravel, cobbles, and boulders (Zimmerman et al. 1979:Table 1), with similar percentages for the outer Kenai Peninsula and Prince William Sound (Hayes 1986:Table 2).

Many rocky intertidal communities are productive, diverse, and vertically stratified. The three zones of Stephenson and Stephenson (1949) are applicable to rocky intertidal habitats of the study area (Zimmerman et al. 1979:Table 7, Haven 1971:86). A general model of rocky coast zonation in the Kodiak Archipelago (Table 4) has been adapted for other parts of the study area (Haven 1971, Johansen 1971). The supralittoral splash zone is typically marked by a black band of the lichen *Verrucaria maura* (Figure 17) which is submerged only at the highest spring tides (Johansen 1971:40). The green alga *Prasiola meridionalis* occurs in this zone, as do small populations of the snail *Littorina sitkana*.

The littoral zone can be subdivided into four distinct subzones (Zimmerman et al. 1979:Table 7). The upper littoral subzone is typified by discontinuous cover of the brown alga *Fucus distichus* (rockweed) and the red alga *Endocladia muricata*. Common invertebrates include the barnacles *Chthamalus dalli* and *Balanus glandula*. In inner Prince William Sound and other protected coasts, *B. glandula* typically is replaced by the barnacle *Semibalanus balanoides* (O'Clair and Zimmerman 1987:318). The littorine *Littorina sitkana* and the limpets *Collisella digitalis* and *C. pelta* also inhabit this zone.

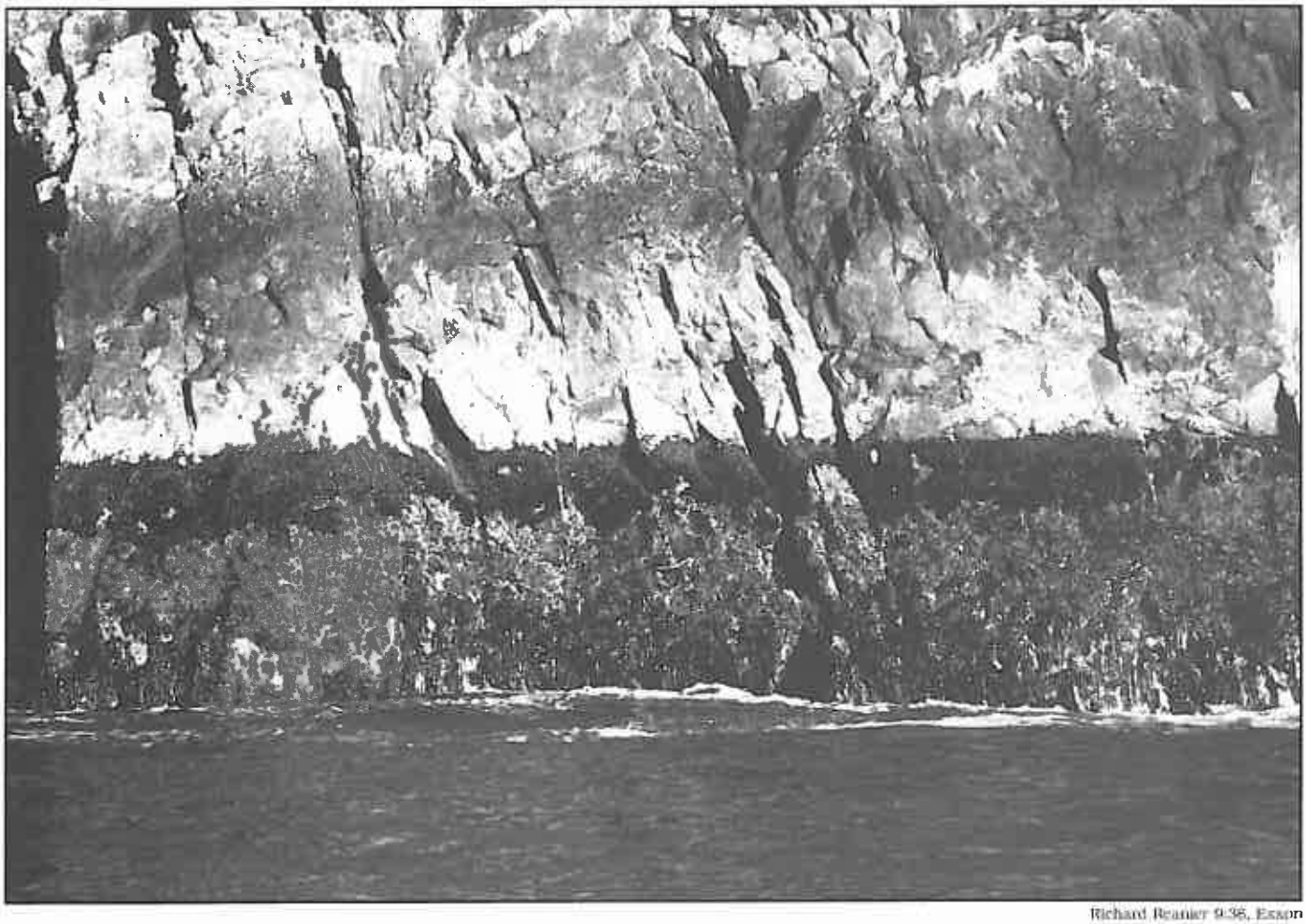
The mid-littoral zone is dominated by the canopy-forming *Fucus*. This brown alga can comprise up to 90% of the intertidal biomass and cover 50% of the surface (Lees and Rosenthal 1977, Zimmerman et al. 1979). The blue mussel is common in this zone, preferring protected habitats. *Semibalanus cariosus* is typically most abundant in the mid-littoral zone, along with the gastropods *Nucella lamellosa* and *N. lima*, that prey on mussels and barnacles. Below the *Fucus* zone is a prominent zone of red algae named for the dominant species *Rhodymenia palmata*. Here the rapidly growing green algae *Monostroma* and *Ulva* may be locally important, especially in disturbed areas. This zone marks the upper range of the chitons *Katharina tunicata*, *Mopalia mucosa*, and *Tonicella lineata*. *Balanus cariosus* occasionally forms dense beds here and the predatory seastars *Pisaster ochraceus* and *Evasterias troschelii* are common (O'Clair and Zimmerman 1987:320, Lees and Rosenthal 1977, Juday and Foster 1990:15-16).

The lowest of the littoral subzones is the *Alaria* zone, dominated by long-bladed brown kelps of this genus, with upper limits at mean lower low water. *Katharina tunicata* and sea urchins (*Strongylocentrotus* sp.) are common, along with the siliceous sponge *Halichondria panicea*, the red sea star *Henricia leviuscula*, and a number of taxa more abundant in adjacent zones. The sublittoral fringe extends from the lower spring tides to the lowest low water, the beginning of the true subtidal zone. This zone is dominated by several species of the large brown kelp *Laminaria*, which extend well into the subtidal. Many of the higher intertidal invertebrates have vertical ranges extending into the sublittoral fringe.

Beaches of unconsolidated sediments provide different habitats and community structures. On gravel to cobble substrates, the intertidal zone has many of the same species described for rocky intertidal communities, though diversity may be lower (Lees and Rosenthal 1977). *Fucus* can be abundant in the upper and mid intertidal zone, with *Mytilus* common in the lower intertidal. On sandy beaches, invertebrates are dominated by bivalves and segmented worms. Typical bivalves include butter clam (*Saxidomus giganteus*), littleneck clam (*Protothaca staminea*), Nuttall's cockle (*Clinocardium nuttalli*), soft-shell clam (*Mya truncata*), bent-nosed clams (*Macoma* spp.) and horse clam (*Tresus capax*). On sandy beaches in the Kodiak Archipelago and the Alaska Peninsula, razor clam (*Siliqua patula*) is often the dominant bivalve (Kaiser and Konigsberg 1977).

Fish

Gulf of Alaska waters support at least 287 species from 55 families of fishes (Table 5)(OSCEAP 1987:417).



Richard Reanier 9/38, Exxon

Figure 17. Intertidal zonation on a near vertical shoreline on the outer Kenai Peninsula. The upper, diffuse, dark band is the lichen Verrucaria. *The prominent black band below this is the mussel* Mytilus edulis. *Brown and red algae extend down to the waterline.*

Twenty-two families and 101 species of fishes are reported from the Kodiak Archipelago (Rogers et al. 1987:Table 13-1), where studies show increasing species richness near the mouths of bays. Many species inhabit the shallows in the summer, then move to deeper water in winter (Blackburn 1979, Blackburn and Jackson 1987). Estuarine bays are important nursery habitat, with more juvenile species found in the subtidal zone than in intertidal or pelagic habitats (Harris and Hartt 1977).

The waters of Prince William Sound host at least 72 species of fishes from 18 families (OSCEAP 1987:408). Species diversity is generally greatest in open, rocky habitat with abundant algal cover. Kelp and white-spotted greenling, black rockfish *(Sebastes melanops)*, and dusky rockfish *(S. ciliatus)* are typical inhabitants of these rocky habitats. In protected eelgrass habitats, Pacific tomcod *(Microgadus proximus)* and white-spotted greenling are common, as are starry flounder and yellowtail rockfish *(Sebastes flavidus)*. In these more sheltered habitats, fish are less abundant than along open, rocky shorelines. As in the Kodiak area, nearshore fish are less abundant and diverse in winter.

Throughout the study area, the late-summer abundance of nearshore fish includes species common in deeper waters at other times of the year. Pacific halibut, which spawn and winter beyond the shelf edge at depths of 300 to 1000 meters (975 - 3250 ft), rise in the spring to forage on the shelf, and enter shallow bays before returning to deeper water in the fall (OCSEAP 1987:424-425). Other seasonal visitors are herring, which spawn between March and June, depositing eggs in the intertidal and subtidal zones. Little is known about factors that control the timing, duration, and location of herring spawning, which vary from one year to the next (OCSEAP 1987:439-440).

Pacific salmon are the most abundant epipelagic fish in the Gulf of Alaska, probably constituting more than 95% of fish greater than 20 cm (8 in) in length (Rogers 1987:462). There are five salmon species that inhabit the gulf: pink *(Onchorhynchus gorbuscha)*, sockeye *(O. nerka)*,chum *(O keta)*, coho *(O. kisutch)*, and chinook *(O. tshawytscha)*. Other anadromous fishes include steelhead trout *(Salmo gairdneri)*, Dolly Varden char *(Salvelinus malma)*, and sea-run cutthroat trout *(Salmo clarki clarki)* (Tamm 1980:153).

Table 4

Rocky Intertidal Zones of the Northwest Gulf of Alaska

after Haven 1971, Johansen 1971, Zimmerman et al. 1979

Zone	Tidal Range	Biological Name	Characteristic Organisms
	Highest Spray		
Zone 1: Supralittoral		*Porphyra-Prasiola* zone	*Prasiola meridionalis* *Porphyra* sp. *Littorina sitkana* *Verrucaria maura*
	Mean higher high water		
Zone 2: Littoral			
Subzone 2A		Barnacle-*Endocladia* zone	*Littorina sitkana* *Chthamalus dalli* *Balanus glandula* *Semibalanus balanoides* *Collisella digitalis* *C. pelta* *Endocladia muricata*
Subzone 2B		*Fucus* zone	*Fucus distichus* *Mytilus edulis* *Semibalanus cariosus* *Nucella lima* *N. lamellosa*
Subzone 2C		*Rhodymenia zone*	*Rhodymenia palmata* *Monostroma* sp. *Katharina tunicata* *Semibalanus cariosus* *Pisaster ochraceus* *Evasterias troschelii*
Subzone 2D		*Alaria* zone	*Alaria* spp. *Halichondria panicea* *Katharina tunicata*
	Mean lower low water		
Zone 3: Sublittoral		*Laminaria* zone	*Laminaria longipes* *Lithothamnion* sp. *Corallina* sp. *Acmaea mitra*

Salmon spawn in summer and fall in streams, rivers, lakes, and the intertidal zone. After migrating to the sea as juveniles, surviving adults return to the spawning grounds where they were conceived, a life cycle that varies within and between species (Table 6). Maturing pink, sockeye, chum salmon, and steelhead are distributed widely in the Gulf of Alaska, but many coho and chinook salmon, cutthroat trout, and Dolly Varden inhabit coastal waters throughout their oceanic phase. Returning spawning populations move westward along the Gulf of Alaska coast following the Alaska Coastal Current before entering their natal waters. Prince William Sound salmon populations are dominated by pink and chum salmon, with pink the more numerous (Tamm 1980:Figure 8.5). Chums return to the sound in mid-July, where the run overlaps that of pink salmon returning in August (Rogers 1987:463). Pink salmon are also dominant in the Kodiak Archipelago, accounting for about 80% of the commercial salmon catch annually (Strauch et al. 1980:153). Pink salmon spawn in intertidal areas and at least 240 streams in the archipelago

Table 5

Marine Fishes of the Northwest Gulf of Alaska

after Strauch et al. 1980:Table 5.41

Epipelagic - *0 to 100 m deep*

Pacific herring *(Clupea harengus pallasii)*
Salmon:
- pink *(Oncorhynchus gorbuscha)*
- chum *(O. keta)*
- sockeye *(O. nerka)*

Capelin *(Mallotus villosus)*
Pacific sandfish *(Trichodon trichodon)*
Pacific sand lance (juvenile) *(Ammodytes hexapterus)*
Atka mackerel *(Pleurogrammus monopterygius)*

Littoral/Pelagic - *Nearshore waters < 25 m deep*

Pacific herring (seasonal)
Salmon (juvenile):
- pink *(Oncorhynchus gorbuscha)*
- chum *(O. keta)*
- sockeye *(O. nerka)*

Dolly Varden *(Salvelinus malma)*
Capelin (juvenile-seasonal)
Pacific sand lance (adult) *(Ammodytes hexapterus)*

Littoral-Sublittoral/Demersal - *Tidal nearshore zones, < 25 m*

Snake prickleback *(Lumpenus saggita)*
Pacific sandfish (juvenile)
Greenlings (adult and juvenile)
- Kelp greenling *(Hexagrammos decagrammus)*
- Rock greenling *(H. lagocephalus)*
- Masked greenling *(H. octogrammus)*
- Whitespotted greenling *(H. stelleri)*

Crescent gunnel *(Pholis laeta)*
Snailfish *(Liparis* spp.)
Juveniles:
- Flounders *(Pleuronectidae)*
- Rockfish *(Scorpaenidae)*
- Sculpins *(Cottidae)*
- Codfishes *(Gadidae)*

Coastal/Demersal - *< 50 km from shore, including bays > 25 m deep*

Pacific sand lance (juvenile)
Pacific cod (juvenile) *(Gadus macrocephalus)*
Pacific halibut (juvenile) *(Hippoglossus stenolepis)*
Yellowfin sole *(Limanda aspera)*
Rock sole *(Lepidopsetta bilineata)*
Dover sole *(Microstomus pacificus)*
Great sculpin *(Myoxocephalus polyacanthocephalus)*
Yellow Irish lord *(Hemilepidotus jordani)*
Red Irish lord *(H. hemilepidotus)*
Other sculpin *(Cottidae)*
Poaches *(Agonidae)*
Rock greenling *(Hexagrammos lagocephalus)*
Kelp greenling *(H. decagrammus)*
Whitespotted greenling *(H. stelleri)*
Masked greenling *(H. octogrammus)*

Table 6

Life History Data for Salmon of the Northwestern Gulf of Alaska

after Tamm 1980:Table 8.1, Figure 8.4

Characteristics	Species				
	Pink	**Sockeye**	**Chum**	**Coho**	**Chinook**
Freshwater habitat	Short streams	Streams rivers, lakes	Short or long streams	Streams, rivers	Large rivers
Time young spend in fresh water	< 1 month	1-4 years	< 1 month	1-2 years	3-12 months
Ocean life (years)	1.3	0.5-4	0.5-5	1-2	1-5
Year of maturity	2	3-7	2-6	2-4	3-8
Mature Length (cm)	50.8	63.5	63.5	61	91.4
Mature weight (kg)	1.8	2.7	4.1	4.5	10
Primary spawning	August	June-July	July-August	September	June-Aug.

from mid-July to mid-August. Sockeye salmon are second in importance on Kodiak, spawning near lakes where the fry remain for at least a year. The Karluk, Red, and Frazer river systems on southwest Kodiak Island are the primary spawning areas for sockeye. Chum salmon also have important runs around Kodiak, spawning in many of the same places as pink salmon. Coho and chinook salmon have relatively minor spawning populations in the archipelago. Spring and summer salmon outmigration continues westward along the Gulf of Alaska coast, then southward past Kodiak in a narrow band within 30 km (19 mi) of the coast.

Marine Birds

More than 147 bird species seasonally inhabit marine or estuarine habitats in the Gulf of Alaska (Table 7)(DeGange and Sanger 1987:479). The Copper River Delta is the most important nesting area in the region, and is used by over 20 million waterbirds during the spring migration. Over 9,000,000 seabirds of 26 species nest at over 800 locations in the Gulf of Alaska (DeGange and Sanger 1987:479). Breeding seabird concentrations are greatest in the western gulf due to an increase in offshore nesting habitat. Spring shorebird and waterfowl migration is dominated by western sandpipers *(Calidris mauri)*, dunlin *(C. alpina)*, and northern pintails *(Anas acuta)*, which probably constitute over 90% of the waterbirds using the Copper River Delta wetlands (Senner 1979:483). Of the 42 shorebird species known from the gulf, 15 breed there. Of these, breeding populations of the semipalmated plover *(Charadrius semipalmatus)*, American black oystercatcher *(Haematopus bachmani)*, spotted sandpiper *(Actitus macularia)*, least sandpiper *(Calidris minutilla)*, and red-necked phalarope *(Phalaropus lobatus)* are abundant (Isleib and Kessel 1973). Relatively few shorebirds winter in the gulf.

In contrast, large numbers of waterfowl winter in the region. Of 52 waterfowl species recorded in coastal areas, 39 have been observed in winter. Sheltered and largely ice-free Prince William Sound provides important winter habitat, with an estimated 50,000 ducks wintering there (DeGange and Sanger 1987:483). Twenty-eight species of waterfowl breed along the gulf coast (DeGange and Sanger 1987:481). Five loon species occur in the gulf, but only the common loon *(Gavia immer)*, red-throated loon *(G. stellata)*, and Pacific loon *(G. pacifica)* are known to nest there. Trumpeter swans *(Cygnus buccinator)* and tundra swans *(C. columbianus)* are common in the region; most tundra swans nest on the Alaska Peninsula and Kodiak. Of the five species of geese present, two are known to breed there; the Canada goose *(Branta canadensis)* and the white-fronted goose *(Anser albifrons)*.

Thirty-five species of ducks, including 22 that breed in the region, are known from the coastal Gulf of Alaska (DeGange and Sanger 1987:487). Of the migrant ducks, diving ducks such as goldeneyes *(Bucephala clangula, B. islandica)*, buffleheads *(B. albeola)*, and mergansers *(Mergus* spp.) are the earliest spring arrivals, while northern pintails *(Anas acuta)* are by far the most numerous. Mallards, harlequin ducks *(Histrionicus histrionicus)*, Barrow's goldeneyes *(B. islandica)*, and common mergansers *(M. merganser)* breed in the forested regions of Prince William Sound. Numerous non-breeding sea ducks are

found in summer, accounting for nearly half the ducks in Prince William Sound. Of the wintering ducks, oldsquaws *(Clangula hyemalis)* and black scoters *(Melanitta nigra)* are more numerous in the Kodiak Archipelago and mallards and goldeneyes less numerous than elsewhere in the western Gulf (DeGange and Sanger 1987:483-484).

Three Procellariiformes (tubenoses) -- the northern fulmar *(Fulmarus glacialis)*, the forked-tail storm-petrel *(Oceanodroma furcata)*, and Leach's storm-petrel *(O. leucorhoa)* -- breed in the Gulf of Alaska. The Semidi Islands southwest of Kodiak are important nesting areas for all three. The southern Alaska Peninsula and the Barren Islands also support colonies of storm-petrels. Three cormorant species are common in gulf waters, the double-crested, *(Phalacrocorax auritus)*, pelagic *(P. pelagicus)*, and red-faced *(P. urile)* cormorants. Nesting locations are similar for all three species along the outer coast from Kayak Island to the tip of the Alaska Peninsula. Four species of gulls breed along the gulf coast; the mew *(Larus canus)*, herring *(L. argentatus)*, glaucous-winged gulls *(L. glaucescens)*, and the blacked-legged kittiwake *(Rissa tridactyla)*. The glaucous-winged gull and the kittiwake are most abundant, with estimated breeding populations of 200,000 and 700,000 along western gulf shorelines (DeGange and Sanger 1987:496-497).

The pelagic distribution of seabirds varies seasonally. Shearwaters *(Puffinus griseus* and *P. tenuirostris)*, which breed in the southern hemisphere, are the most abundant birds from May through September (Strauch et al. 1980:190). Northern fulmars become the most abundant species in October, while in January and March, murres and other alcids predominate. The common murres are most abundant nearshore in winter, when tufted puffins and thick-billed murres are highly dispersed in the North Pacific (DeGange and Sanger 1987:505).

Terrestrial Birds

Spring migrations also bring numerous terrestrial birds to the western Gulf of Alaska (Table 7). Most move westward along the narrow coast, but some (e.g. passerines) move through alpine passes in the coastal mountains (Isleib and Kessel 1973:33). Bald eagles *(Haliaeetus leucocephalus)* migrate in April and May, and establish nests throughout the region in May and June. Isleib and Kessel (1973:35) estimate that 1800 to 2000 eagle pairs nest between Cape Fairweather and the tip of the Kenai Peninsula. Bald eagles congregate along salmon streams from mid-summer to fall to feed on spawned-out salmon, migrating out of the area from August to November.

Three species of ptarmigan inhabit southcentral Alaska, with willow ptarmigan *(Lagopus lagopus)* the most widespread. Rock ptarmigan *(Lagopus mutus)* are present throughout the study area, except for the central Alaska Peninsula (ADFG 1978). White-tailed ptarmigan *(Lagopus leucurus)* are relatively rare in the study area, and are absent from the Alaska Peninsula and the Kodiak islands. Spruce grouse *(Canachites canadensis)* are found on the mainland around Prince William Sound and on the Kenai Peninsula (Isleib and Kessel 1973:75), but are absent from most of the Alaska Peninsula and the Kodiak Archipelago (ADFG 1978).

Paleoenvironment of the Northern Gulf of Alaska

Glacial History

Detailed reviews of Alaska's glacial history have been published recently (Péwé 1975, Hopkins et al. 1982, Hamilton and Thorson 1983). Among the mountains ringing the Gulf of Alaska, glaciation began in the Miocene (Denton and Armstrong 1969, Plafker and Addicott 1976) as recorded in extensive glacio-marine units of the Yakutaga Formation in the eastern gulf and the Tugidak Formation in the western gulf (Nilsen and Moore 1979). Pleistocene and Tertiary glaciation also left its mark on the geomorphology of the continental shelf in the form of sea valleys and outer-shelf banks.

Terrestrial records of pre-Wisconsin glaciation are scattered and poorly dated in southern Alaska, though tills of this age are known on the Aleutians (Gard 1980), the Alaska Peninsula (Detterman 1986), around Cook Inlet (Schmoll and Yehle 1986), Kodiak Island (Karlstrom and Ball 1969), and near Lituya Bay (Mann 1986a). Illinoian (180,000 - 125,000 B.P.) glaciation in southern Alaska is thought to have been more intense than in the Wisconsin Stage. This may be due to greater precipitation during Illinoian times, when snowlines probably dropped 150 to 250 meters (500 - 800 ft) below late Wisconsin levels (Péwé 1975). Little is known about the magnitude and timing of Illinoian climate changes in Alaska.

Glacial drift dating to the Wisconsin Stage (70,000 - 10,000 B.P.) was deposited by several major glacial advances and is widespread in southern Alaska. Snowlines during the last glacial maximum (14,000 - 22,000 B.P.) were 300 to 600 meters (1000 - 2000 ft) lower than today (Detterman 1986, Péwé 1975). On the Aleutians, ice caps probably covered all the major islands during Late Wisconsin times. These ice caps calved into the Pacific Ocean and extended northward into the Bering Sea where they may have fed a floating ice shelf (Black 1976, Thorson and Hamilton 1986:176). Ice caps centered on islands spread over the continental shelf south of the Alaska Peninsula, and sent ice tongues northward across the peninsula (Weber 1985, Detterman 1986). Mountain glaciers on the Alaska Peninsula coalesced with these, forming a nearly continuous ice cover over the peninsula (Detterman 1986). To the northwest, this ice cap merged with grounded ice in Shelikof Strait (Karlstrom and Ball 1969, Hampton 1985), the mouth of Cook Inlet, and adjacent parts of the continental shelf (Karlstrom 1964). Mountain glaciers coalesced as an ice cap over the seaward side of the Kenai Peninsula, sending ice tongues into Kachemak Bay (Hamilton and Thorson 1983) and down fjords such as Nuka Bay (Von Huene 1966). Prince William Sound was probably covered completely by ice flowing off

Table 7

Abundance and Habitat Preference for Northern Gulf of Alaska Birds

adapted from Isleib and Kessel 1973: Table 1

Species	Abundance	Habitat									
		Tundra	Forest	Bog/ Marsh	Lakes	Rivers	Cliffs/ Bluffs	Beaches	Rocky Shores	Inshore Waters	Offshore Waters
Common loon	+++				XX*					XX	X
Yellow-billed loon	++									XX	X
Arctic loon	+++									XX	X
Red-throated loon	+++				XX*					XX	X
Red-necked grebe	+++									XX	X
Horned grebe	+++				XX*					XX	
Black-footed albatross	++									X	XX
Laysan albatross	+										XX
Northern fulmar	+++									X	XX
Pink-footed shearwater	++									X	XX
Sooty shearwater	++++									X	XX
Slender-billed shearwater	++									X	XX
Fork-tailed petrel	++++						XX*			XX	XX
Leach's petrel	++										XX
Double crested cormorant	+++				X		XX*		XX	XX	X
Pelagic cormorant	++++						XX*		XX	XX	X
Red-faced cormorant	++						XX*		XX	XX	X
Great blue heron	++		XX*	X	X	X		XX	XX		
Whistling swan	+++			XX	XX	X		X		XX	
Trumpeter swan	++			XX	XX*	X		X		X	
Canada goose	++++	X	X*	XX*	XX*	X		XX	X	X	X
Black brant	++			X				XX	X	XX	XX
Emperor goose	+			X				XX	X	XX	XX
White-fronted goose	+++			XX				XX	X	X	X
Snow goose	+++			XX				XX		XX	X
Mallard duck	+++		X	XX*	XX	XX		XX	X	XX	
Gadwall duck	+++			XX	XX	X		XX		X	
Pintail duck	++++			XX*	XX	X		XX	X	XX	X
Green-winged teal	++++		X*	XX*	XX	XX		XX	X	XX	
Blue-winged teal	+			XX*				X		X	
American widgeon	++++			XX*	XX	X		XX	X	X	X
Shoveler duck	+++			XX*	X	X		XX	X	X	
Ring-necked duck	+			X	XX						
Canvasback duck	++			XX*	XX			X			
Greater scaup	++++			XX*	XX	X		XX	X	XX	
Lesser scaup	+			X	XX						
Barrow's goldeneye	++++		XX*		XX	XX		X	X	XX	
Bufflehead	++++		X		XX	X		X		XX	
Oldsquaw	+++				X*					XX	X
Harlequin duck	++++		X*			XX		X	XX	XX	
Steller's eider	+							X	X	XX	
Common eider	+								X	XX	
King eider	+								X	XX	
White-winged scoter	++++				X*			X	X	XX	X

++++ = Abundant +++ = Common ++ = Uncommon + = Rare

XX = Primary preference X = Secondary preference * = Breeding record

Abundance and Habitat Preference for Northern Gulf of Alaska Birds

Species	Abundance	Habitat									
		Tundra	Forest	Bog/ Marsh	Lakes	Rivers	Cliffs/ Bluffs	Beaches	Rocky Shores	Inshore Waters	Offshore Waters
Surf scoter	++++				X*			X	X	XX	X
Common scoter	+++							X	X	XX	X
Hooded merganser	+				XX	X				X	
Common merganser	+++				XX	XX		X	X	XX	
Red-breasted merganser	++++			X*	X	X		X	X	XX	X
Goshawk	+++		XX*	X				X			
Sharp-shinned hawk	+++	X	XX*	X				X			
Rough-legged hawk	+	XX		XX							
Golden eagle	+	XX					XX				
Bald eagle	++++	X	XX*	XX	X	XX	XX*	XX	XX	X	
Marsh hawk	+++	X		XX*				X			
Osprey	++		X	XX	XX	X				X	
Gyrfalcon	+	XX					X	X			
Peregrine falcon	+			X			XX*	X	X	XX	
Pigeon hawk	+	X	XX*	X				X			
Sparrow hawk	+		XX	X							
Spruce grouse	+++		XX*								
Willow ptarmigan	+++	X	X	XX							
Rock ptarmigan	+++	XX*	XX				XX				
White-tailed ptarmigan	++	XX					XX*				
Sandhill crane	+++	X		XX				XX			
Black oystercatcher	+++						XX*	X	XX		
Semipalmated plover	++							X	X		
American golden plover	+++	X		XX				XX	X		
Black-bellied plover	+++	X		XX				XX	X		
Surfbird	+++							X	XX		
Ruddy turnstone	++++							X	XX		
Black turnstone	++++							X	XX		
Common snipe	+++	X	X	XX*				X			
Whimbrel	+++			X				XX	X		
Spotted sandpiper	+++			X	XX*			XX	X		
Solitary sandpiper	+++			XX	XX			X			
Wandering tattler	+++	X		X				X	XX		
Greater yellowlegs	+++			XX*	X			XX	X		
Lesser yellowlegs	++			XX*	X			XX	X		
Knot	++++							XX	X		
Rock sandpiper	+++							X	XX		
Pectoral sandpiper	+++			XX				XX	X		
Baird's sandpiper	++			XX				XX			
Least sandpiper	++++			XX*	X			XX	X		
Dunlin	++++			XX				XX	XX		
Short-billed dowicher	++++			XX*				XX	X		
Long-billed dowitcher	+++			XX				XX	X		
Semipalmated sandpiper	++			XX				XX			
Western sandpiper	++++	X		XX				XX	X		
Hudsonian godwit	++			XX				XX	X		
Sanderling	++							XX			
Red phalarope	++++							X	X	X	XX

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Abundance and Habitat Preference for Northern Gulf of Alaska Birds

Species	Abundance	Habitat								
		Tundra	Forest	Bog/ Marsh	Lakes	Rivers	Cliffs/ Bluffs	Beaches	Rocky Shores	Inshore Waters	Offshore Waters
Northern phalarope	++++			XX*	XX	X		XX	X	XX	XX
Pomarine jaeger	+++			X				X		XX	XX
Parisitic jaeger	++			XX*				XX	X	XX	XX
Long-tailed jaeger	+							X		XX	XX
Glaucous gull	++			X		X		XX	X	XX	X
Glaucous-winged gull	++++			XX*	X	XX	XX*	XX	XX	XX	XX
Herring gull	+++			X				XX	XX	XX	X
Mew gull	++++		X*	XX*	X	XX	X	XX	XX	XX	XX
Bonaparte's gull	+++		X*	X	X	X		XX	X	XX	X
Black-legged kittiwake	++++			X			XX*	XX	XX	XX	XX
Arctic tern	++++			XX*	X	X	XX*	XX	XX	XX	XX
Aleutian tern	++			XX*				X		XX	X
Common murre	+++						XX*			XX	XX
Thick-billed murre	+++						XX*			XX	XX
Pigeon guillemot	+++						XX*		X	XX	X
Marbeled murrelet	+++		X				X			XX	XX
Kittlitz's murrelet	+++						X			XX	XX
Ancient murrelet	++									XX	XX
Parakeet auklet	++						XX*			XX	X
Rhinoceros auklet	+						XX			XX	
Horned puffin	+++						XX*			XX	XX
Tufted puffin	+++						XX*			XX	XX
Great horned owl	+++		XX*	X			X				
Snowy owl	+	X		XX			X		X		
Hawk owl	++		XX*	X							
Great gray owl	+		XX*								
Short-eared owl	+++	X		XX*				X			
Boreal owl	+		XX*								
Saw-whet owl	+		XX*								
Roufous hummingbird	+++		XX*								
Belted kingfisher	++			X	X	XX	XX*	X	X	X	
Yellow-shafted flicker	+		XX								
Hairy woodpecker	++		XX*								
Downy woodpecker	++		XX*								
Northern three-toed woodpecker	+		XX*								
Thraill's flycatcher	+++		X	X							
Violet-green swallow	++++	X	X	XX	XX	X	XX*	XX		X	
Tree swallow	+++		XX*	XX	XX	X	X	XX		X	
Bank swallow	++			XX	X	X	XX*	X		X	
Barn swallow	+++			XX	X	X	XX*	X		X	
Cliff swallow	+			XX	X	X	XX*	X		X	
Gray jay	++		XX*								
Steller's jay	+++		XX*								
Black-billed magpie	+++	X	XX*	X			X	X	X		
Common raven	++++	X	XX*	XX	X	X	XX*	XX	X	X	
Northwestern crow	++++		XX*	X			X	XX	XX	X	
Black-capped chickadee	++		XX*								

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Abundance and Habitat Preference for Northern Gulf of Alaska Birds

Species	Abundance	Habitat								
		Tundra	Forest	Bog/ Marsh	Lakes	Rivers	Cliffs/ Bluffs	Beaches	Rocky Shores	Inshore Waters	Offshore Waters
Boreal chickadee	+++		XX*								
Chestnut-backed chickadee	+++		XX*								
Red-breasted nuthatch	+		XX*								
Brown creeper	++		XX*								
Dipper	+++				X	XX	XX*				
Winter wren	++		XX*								
Robin	+++	X	XX*	X			XX	X			
Varied thrush	++++	X	XX*	XX			X	XX	X		
Hermit thrush	++++	X	XX*	X			X	X	X		
Swainson's thrush	+		XX*								
Gray-cheeked thrush	+		XX*								
Golden-crowned kinglet	+++		XX*								
Ruby-crowned kinglet	++++		XX*								
Water pipit	+++	XX*		XX				XX	X		
Bohemian waxwing	++		XX*								
Northern shrike	++	X	XX*	XX							
Orange-crowned warbler	++++		XX*	X					X		
Yellow warbler	+++		X	X							
Myrtle warbler	+		XX*								
Townsend's warbler	+++		XX*								
Blackpoll warbler	+		XX*								
Northern waterthrush	+		X								
Wilson's warbler	+++		XX								
Rusty blackbird	++		X	XX				X			
Pine grosbeak	+++		XX*								
Gray-crowned rosy finch	+++	X	X				XX*	X			
Hoary redpoll	+		X	X							
Common redpoll	+++	X	XX*	X							
Pine siskin	+++		XX*	X							
Red crossbill	+		XX								
White-winged crossbill	++		XX								
Savannah sparrow	++++	XX*	X	XX*				X	X		
Slate-colored junco	++	X	XX*	X							
Oregon junco	++	X	XX*	X							
Tree sparrow	+	X	XX*	X							
White-crowned sparrow	++		XX	X							
Golden-crowned sparrow	++++		X	X					X		
Fox sparrow	++++	X	XX*	X					X		
Lincoln's sparrow	+++	X	X	XX*							
Song sparrow	++		X	XX*				XX	XX		
Lapland longspur	++	XX*		XX				XX	X		
Snow bunting	++	XX		X			XX*	X	X		

++++ = Abundant +++ = Common ++ = Uncommon + = Rare

XX = Primary preference X = Secondary preference * = Breeding record

the Kenai Peninsula and the Chugach Mountains (Grant and Higgins 1913, Moffit 1954, Coulter et al. 1965, Von Huene et al. 1976). Tarr and Martin (1914) proposed that the last glaciation covered the mountainous islands of inner Prince William Sound but left the ridges of Montague Island ice-free. These conclusions have not been confirmed by subsequent work, as research on the glacial geology of Prince William Sound has been remarkably sparse. The lowlands of the Alaska Peninsula were deglaciated by at least 10,600 B.P. (Detterman 1986:163), the Trinity Islands by 13,800 B.P. (W. Coonrad, personal communication 1988), and southwest Kodiak by 14,000 B.P. (D.H. Mann, oral communication 1989). The mountains of the central Kenai Peninsula were deglaciated by 14,500 B.P. (Rymer and Sims 1982). On the east side of Prince William Sound, ice retreat had occurred before 14,400 B.P. (Sirkin and Tuthill 1969, 1987). Deglaciation of upper Cook Inlet may have occurred by 15,000 - 16,000 B.P. (Schmoll and Yehle 1986). A basal date of 10,015 ± 125 B.P. for a peat bog in Port Wells suggests that some interior fjords of Prince William Sound were deglaciated by the end of the Pleistocene (Heusser 1983), and Port Valdez was deglaciated before 9500 B.P. (Williams and Coulter 1981). In southeast Alaska, the interior fjords were deglaciated by 14,000 B.P., while the outer islands may have been ice-free by about 16,000 B.P. (Mann 1986a).

A perennial topic of debate on the glacial geology of southern Alaska is the seaward extent of late Wisconsin glaciers, an issue relevant to discussions about the route of early human migration into North America. Opinions are especially diverse about ice extent in the eastern Gulf of Alaska, where reconstructions place the late Wisconsin ice margin anywhere from the present coast (Coulter et al. 1965) to the outer edge of the continental shelf (Hamilton and Thorson 1983), with several intermediate schemes also proposed (Prest 1984, Péwé 1975). In the western gulf, Péwé (1975) and Karlstrom (1964) suggest that grounded ice reached the outer continental shelf. Hollin and Schilling (1981) disagree, arguing that the thickness of such ice is incompatible with the presence of ice-free areas on Kodiak Island and in Cook Inlet.

Kodiak Island Refugium

Despite geological evidence that indicates extensive glaciation of the continental shelf adjacent to the Kodiak Archipelago (Hampton et al. 1987), geological reconnaissance suggests that a sizable ice-free area (refugium) existed on southwest Kodiak Island during the last two glaciations. Between Uyak and Olga bays, two moraine belts of differential preservation and topographic position extend nearly continuously around a central, hilly area (Karlstrom and Ball 1969). Within the moraine belts, U-shaped valleys and what appear to be remnants of older drift (Karlstrom and Ball 1969) record an earlier, more extensive glaciation that may have covered the entire landscape. The two moraine belts were constructed in part by a grounded ice stream flowing southward down Shelikof Strait and ice tongues descending from an ice cap centered in the mountains of Kodiak Island (Karlstrom and Ball 1969).

Ice invading from Shelikof Strait reached altitudes of 50 to 100 meters (165 - 325 ft) along the north coast of Kodiak (D.H. Mann, personal communication 1989). Lobes of the Shelikof Strait ice dammed large proglacial lakes in the ice-free valleys of Kodiak Island (Karlstrom and Ball 1969). The presence of nearly unweathered glacio-marine deposits overlain by post-glacial peats (W. Coonrad, personal communication 1988, D.H. Mann, personal communication 1990) or possibly end moraine (Capps 1937) on Tugidak Island indicates that Wisconsin glaciers reached the extreme southwest portions of the Kodiak Archipelago. Basal peats overlying glacial sediments near sea level on southwestern Tugidak Island date to 13,800 ± 350 years B.P. (W. Coonrad, personal communication 1988).

Stratigraphic sections along the Ayakulik River on western Kodiak expose three tills, the upper two interdigitated with proglacial lake sediments. Between the uppermost till and the overlying lake sediments, peats dating to 23,500 B.P. have been found (D.H. Mann, personal communication 1990). The fact that the lake beds overlying this till are undeformed by overriding ice indicates that glaciers have not extended into the interior valleys of western Kodiak Island since sometime before 23,000 years ago. These findings confirm Karlstrom's idea that a glacial refugium existed on parts of western Kodiak Island during the last glacial maximum. The fact that proglacial lakes occupied the interior valleys suggests that animals and plants surviving in the area would have inhabited ridges and hills protruding above the lake waters and the ice. Given the limited area of ice-free terrain (<100 km^2 (<38 sq mi)) and the arctic-alpine climate at the time, only an impoverished terrestrial biota could have survived in the Kodiak refugium (Karlstrom and Ball 1969).

In summary, the southern Alaska coast has been glaciated on multiple occasions since the mid-Tertiary. The most recent glaciation ended about 14,000 years ago over much of the region, but several millennia later in the interior fjords of Prince William Sound. During the last glacial maximum, ice covered most of the Alaska Peninsula and the inner continental shelf along the Pacific coast. Coalescent mountain glaciers over the Kenai Peninsula and the Chugach Mountains flowed across Prince William Sound, probably covering all but the highest island summits and terminating on the continental shelf. Local ice-free areas probably existed as mountain-top nunataks throughout the region, but were too small and climatically harsh to support a diverse biota. A relatively large ice-free area persisted on western Kodiak Island during the late Wisconsin, but its climate and geography may not have been conducive to the survival of a diverse biota.

Holocene Glacial History

The history of glacial fluctuations in Prince William Sound during the Holocene is summarized by Grove (1988) and Calkin (1988). Many glaciers in the sound attained their recent maximum between A.D. 1870 and 1900, after which they have been in retreat (Tarr and Martin 1914, Field 1975). No glaciers terminating on land in the Chugach Mountains are known to have advanced in recent decades or to have reached maximum positions

after A.D. 1900 (Field 1975:455). In contrast, several large glaciers which calve into tidewater have been nearly stationary or have advanced steadily since 1900. For instance, the Columbia Glacier stood near its maximum Holocene position between 1900 and 1979 (Post 1975). The Harvard, Harriman, and Meares glaciers in the northwest sound have been advancing since 1900 and have surpassed any terminus positions reached during the last few decades (Field 1975, Heusser 1983, Viereck 1967, Calkin 1988). The non-conformance of some calving glaciers to general trends of glacier advance and retreat is typical of tidewater glaciers, which respond to climate in a manner modified by unique glacial phenomena (Mann 1986b).

Snowlines may have risen as much as 230 meters (750 ft) along the eastern shores of the sound since the 1800s, but only about 80 meters (260 ft) in the southwest sound (Mercer 1961). These shifts may result from decreasing temperatures, increasing precipitation, or both. Little is known about the timing of earlier advances in the sound. The outermost moraine in College Fjord was deposited between 3200 and 2360 B.P. and the outermost moraine in front of the Meares Glacier after 4400 B.P. (Calkin 1988).

On the Kenai Peninsula, most glaciers reached their recent maxima between A.D. 1850 and 1900 (Field 1975), and have retreated since the turn of the century. The McCarty Glacier began to advance around 3400 B.P., reaching its recent maximum about A.D. 1860 (Post 1980). Tidewater glaciers in fjords of the Kenai Peninsula's south coast appear to have advanced and retreated independently of one another. Little is known about the Holocene history of glacier fluctuations on Kodiak Island or on the Alaska Peninsula.

In summary, the record of Holocene glacial fluctuations in the study area is poorly understood. The few dates available suggest that the area experienced Neoglaciation at the same time as other parts of Alaska and the world (Calkin 1988, Grove 1988). If so, glaciers probably began to advance by 7000 B.P., but were restricted in extent. At the height of the Neoglacial era (after 5000 B.P), five to ten cycles of advance and retreat probably occurred (Grove 1988). The latest phase of general glacial advance worldwide, the Little Ice Age, began around A.D. 1200 and ended in the late 1800s. Retreats described historically refer to the closing phases of the Little Ice Age in the region.

Paleooceanography

Sea surface temperatures in the Gulf of Alaska during the last glacial maximum were 3 - 4° C (4 - 7° F) lower than at present (CLIMAP Project Members 1981). Though winter sea ice was extensive off the coast of eastern Siberia, it probably did not occur in the Gulf of Alaska during the last glacial maximum (CLIMAP Project Members 1981). The general position of the North Pacific Polar Front changed little, perhaps by less than five degrees latitude, between the present and 18,000 B.P. (CLIMAP Project Members 1981, Thompson 1981). However, ocean circulation probably intensified and thermal gradients steepened between 40° and 50° N latitude (Moore et al. 1980, CLIMAP Project Members 1981). Based on evidence for increased seasonal sea ice in the Bering Sea and increased ice-rafting in the Gulf of Alaska, Sancetta et al. (1985) proposed that North Pacific surface waters may have cooled enough to decrease precipitation on the surrounding land masses during the last glacial maximum. Diatom data suggest a relaxation of temperature and salinity gradients along the North Pacific Polar Front about 14,000 B.P., with establishment of present oceanographic conditions by 8000 B.P. (Sancetta 1979). Radiocarbon and amino acid dating indicate an age of about 17,000 B.P. for the transition between sea ice and modern diatom floras in the Bering Sea (Sancetta et al. 1985).

Pollen Studies

Pollen studies provide a partial record of vegetation change and climatic history for the southern Alaskan coast. Published pollen diagrams span only the past 14,000 years in the region and most diagrams extend only to 10,000 B.P. Peat sections from the Shumagin Islands and the Alaska Peninsula record a major vegetation change at 10,000 B.P., from vegetation dominated by grass, *Artemesia)* and willow to one dominated by birch (*Empetrum),* and grass (Heusser 1983). Birch pollen becomes more prominent between 9500 and 8000 B.P., while an increase in alder pollen after 7000 B.P. may record the migration of alder to the outer Alaska Peninsula (Heusser 1985). The many tephra layers in pollen cores from this region are accompanied by significant changes in the pollen flora, indicating that volcanism has had significant effects on vegetation patterns.

On Tugidak Island, peat radiocarbon dated to 13,800 B.P. by Warren Coonrad of the USGS contained a pollen flora dominated by sedges (C.J. Heusser, personal communication 1988). Near Karluk on southwest Kodiak, Heusser (1960) obtained a peat core dating from 3470 B.P., with evidence for the continuous presence of alder in the vegetation since that time. Another peat section near Karluk (Nelson and Jordan 1988) extends the pollen record on western Kodiak to 4260 B.P. and indicates an essentially modern vegetation type since the mid-Holocene. One vegetation change apparent in Nelson and Jordan's (1988) diagram is a decrease of about 20% in alder pollen between 4260 and 2330 B.P., perhaps signifying a decline in alder in the vicinity of the bog with the onset of Neoglacial climatic cooling. From the Ayakulik River valley, a peat layer dated to 23,500 B.P. contained a pollen flora dominated by sedges and containing grains of willow and numerous herbs (D.M. Peteet, personal communication 1989). On eastern Kodiak, the pollen record extends back about 9000 years (Heusser 1960) and records a sedge-fern-umbell vegetation before about 8500 B.P., followed by a zone dominated by alder and birch lasting until 5000 B.P. (Heusser 1985). Later, birch-alder-heath vegetation probably dominated the landscape, with spruce-alder-sphagnum vegetation assuming dominance in the last 1000 years (Heusser 1985).

The oldest continuous pollen record from southern Alaska, from Hidden Lake on the central Kenai Peninsula, spans the past 14,000 years (Ager 1983). Though Hidden Lake is not in the coastal zone, its pollen record illustrates the complexity of vegetative change in southern Alaska following deglaciation. The earliest vegetation at Hidden Lake was herb tundra with a few shrubs of willow and ericads. This was replaced by a dwarf birch shrub tundra between 13,700 and 10,300 B.P. (Ager 1983). After about 10,300 B.P., the vegetation changed from birch shrub tundra to a mix of shrub tundra and deciduous forest dominated by poplar and willow. After about 9500 B.P., alder invaded the area, and spruce arrived by 8000 B.P. Mountain hemlock probably arrived between 5000 and 4000 B.P. The dominant species of the modern vegetation were in place after the mid-Holocene, and no further striking changes are present in the pollen diagram.

Pollen records from Prince William Sound start at 10,000 B.P. and record a sedge-dominated tundra vegetation until about 8300 B.P., after which shrub-alder tundra became widespread (Heusser 1983, 1985). The landscape remained unforested (except for alder thickets) until 3000 to 2000 B.P. (Heusser 1985, Ager 1983), when Sitka spruce, western hemlock, and mountain hemlock spread into the area from refugia to the south (Mann 1983; Heusser 1960, 1985). Based on increased peat accumulation rates, Heusser (1985) suggests that climate was cooler and wetter in Prince William Sound after 2000 B.P.

At Icy Cape, mid-way between Prince William Sound and Yakutat, sedge-heath tundra dominated between 10,800 and 10,000 B.P. (Heusser 1985, Peteet 1986). Shortly after 10,000 B.P., alder invaded the area and formed a shrub tundra until Sitka spruce colonized the area about 7500 years ago. The two hemlock species reached Icy Cape shortly after 4000 B.P., and little qualitative change in vegetation has occurred since. Vegetation records from further east along the Gulf of Alaska coast are similar to the Icy Cape record, except that the arrival times of conifer species are slightly earlier (Peteet 1986, Mann 1983).

In summary, pollen records from southern coastal Alaska indicate that tundra vegetation existed over much of the coastal landscape until 10,000 B.P., when alder expanded to form shrub tundra in many areas. Willow was probably an important component of this shrub tundra vegetation, based on the diversity of willow species now growing in the area and its under-representation in the modern pollen rain. This alder-shrub tundra probably resembled the shrub tundra vegetation found today on western Kodiak Island and the Alaska Peninsula, where mosaics of tall herbs and grasses grow around thickets of alder and willow. Shrub tundra persisted in many areas until conifers spread along the coast from the east. Thus, the densely-wooded character of much of Prince William Sound is a comparatively recent phenomenon. Only 4000 years ago the conifer forest was absent and terrestrial vegetation probably resembled that of western Kodiak Island. The climate has been essentially modern since the start of the Neoglacial at 5000 B.P.

Summary

It is difficult to capture in a few pages the essence of a region that extends for 900 km (560 mi) and encompasses some 9000 km (5600 mi) of coastline. Only after walking these shorelines for days or weeks does the immensity and environmental diversity of the region become clear. Prehistoric humans lived within this vast landscape, but used it on a scale measured in kilometers, not hundreds of kilometers.

The description of plate tectonics and terrane accretion outlines the mechanisms responsible for the complex geology of the region and for the regional tectonism that results in periodic seismic events like the 1964 earthquake. These seismic events alter the region's shorelines by uplift or subsidence and are a major cause of post-depositional alteration of archaeological sites. In areas of rapid uplift, only the most recent coastal sites will be near modern sea level, and older sites formerly subject to wave erosion may be lifted above the active beach zone to stabilize. In subsiding areas, many sites have been lowered into the intertidal zone and subjected to marine erosion. In the study area, both gradual and sudden vertical movements have occurred, sometimes alternating between subsidence and uplift, so some sites may have moved in and out of the sea more than once.

This complex sea level history has important implications for archaeological reconnaissance in the area. It encourages field survey of the intertidal zone as well as the uplands. The history of relative sea level change must be taken into account when interpreting the archaeological record, since an absence of ancient sites or a paucity of sites in general may be due to post-depositional destruction rather than human settlement patterns.

The extensive Holocene tephra deposits on the Alaska Peninsula and Kodiak Island also influenced the survey results. Thick tephra deposits from the 1912 eruption of Novarupta blanket the Alaska Peninsula coast and central Kodiak Island, masking the surface topography of some archaeological sites and reducing the visibility of shallow housepits and other surface features. Despite this problem, tephras can be excellent stratigraphic markers for dating archaeological sites, often being distinctive and laterally extensive (Dumond 1979). On Kodiak and the Alaska Peninsula, the 1912 Novarupta ash often helped distinguish recent ground features from older ones. Overburden of tephra can provide some protection against casual vandalism, since the deposits appear culturally sterile. Despite catastrophic eruptions on the Alaska Peninsula, Dumond (1979:389) believes that 10 or more tephra falls at Brooks River did not change the long-term course of cultural development.

A major ecological boundary occurs at the western margin of the coastal forest, near the tip of the Kenai Peninsula and the eastern end of the Alaska Peninsula. Spruce forests cover the northern part of the Kodiak Archipelago. The forest and tundra ecosystems differ in faunal diversity and productivity -- factors that may account for some differences in human population densities and adaptations. Pollen studies show that before 4000 B.P., upper Prince William Sound was unforested, and

that spruce arrived in Kodiak as little as 1000 years ago. Explanations of culture change and continuity in the region may take such environmental changes into account. At the survey level, vegetative cover plays a crucial role in site visibility. Thick, dense vegetation at the shoreline can obscure surface manifestations of sites and reduce visibility. In other cases, certain plants grow preferentially on archaeological middens and act as site "indicators." On Kodiak, for example, dense stands of cow parsnip and nettles often grow on shell middens, and are a valuable aid in identifying archaeological sites.

Modern faunal distributions can provide insights into prehistoric site distributions, especially in identifying optimum habitat, but care must be taken to account for recent range extensions and reductions. The coyote, for example, entered Alaska about 1915 (ADFG 1978), but is now found throughout the coastal and boreal forests. The northern shores of Afognak and Shuyak islands in the Kodiak Archipelago have very high densities of sea otters, and appear to have been optimal habitat for this species in the past. Sea otter populations elsewhere have yet to recover from commercial over-exploitation, however, and modern distributions may not be representative of prehistoric distributions. Past sea level changes have altered coastal habitats, and may have changed the distribution and productivity of optimum marine habitats (Johannsen and Johannsen 1975:97).

Coastal environments are not static, nor do coastal hunter-gatherers respond passively to environmental changes. Hunter-gatherers were active members of coastal ecosystems, adapting to local and regional environmental changes, while affecting the structure of the ecosystem in which they lived. For example, intensive sea otter hunting can reduce a sea otter population, increasing populations of sea urchins and other herbivores preyed on by sea otters (Duggins et al. 1989). This can result in increased predation on kelp by sea urchins, dramatically reducing the abundance of kelp beds. Since kelp beds provide critical habitat for many fish, as well as organic detritus for secondary production in intertidal and shallow subtidal ecosystems, declining kelp habitats can cause decreased productivity among nearshore fish and intertidal shellfish (Duggins et al. 1989). Thus, sea otter hunting can indirectly reduce the abundance of other intertidal organisms. Simenstad et al. (1978) argue, based on faunal evidence from prehistoric middens in the Aleutians, that these nearshore communities exist in two alternating stable states, one with sea otters, and one without.

To conclude, a number of environmental factors affect the interpretation and explanation of the archaeological record. There are potential biases in the record due to natural post-depositional processes. With a fuller understanding of the natural environment, more accurate assessments can be made of both the archaeological record in general, and the reliability of data produced by the EXXON VALDEZ Cultural Resource Program.

Cultural Background

This chapter summarizes the history and prehistory of the oil spill area, including Prince William Sound, the south coast of the Kenai Peninsula, the Kodiak Archipelago, and the Pacific coast of the Alaska Peninsula. The chapter begins with an ethnographic overview section, using linguistic and historical information to reconstruct the distribution of indigenous peoples and their ways of life at the time of historic contact, and to outline the different phases of the historic contact period. The archaeological overview section presents a broad, general chronology of the entire spill area. Three subsequent sections provide more detail on the regional archaeology of Prince William Sound and the Kenai Peninsula, Kodiak Island, and the Alaska Peninsula's Pacific coast. D. Clark's (1984a:143-145) table of C-14 dates has been used to help define chronological periods. Radiocarbon dates are expressed as uncorrected C-14 years before "present" (B.P.), recognized by international convention as A.D. 1950.

Ethnographic Overview

The study area falls within the larger ethnographic Pacific Eskimo region, which extends from the Copper River to the middle of the Alaska Peninsula and includes the outer reaches of Cook Inlet historically occupied by the Tanaina Athapaskans. Trade, warfare, ceremonial exchange, and occasional intermarriage led to a sharing of many cultural traits among the Pacific Eskimo, the Tanaina, and their Aleut, Eskimo, interior Athapaskan, Eyak, and Tlingit neighbors. The coastal inhabitants of this region have always depended on salmon and other resources of the sea and the coastal rivers. Though each group was culturally distinct, they shared many economic, artistic, technological, religious, and ceremonial practices. Systems of lineage affiliation and social ranking, which divided society into elites, commoners, and slaves, prevailed among all the cultures of Alaska's southern coast (Townsend 1980).

The events that followed the initial period of European exploration profoundly affected Native cultures. Nearly 150 years of European interaction passed before the detailed studies of Native ways of life by anthropologists Birket-Smith (1953) and Osgood (1976). By that time, the subsistence economy had been largely replaced by a cash economy with an increased reliance on manufactured goods and purchased foods. Populations were affected by introduced diseases, displacement, intermarriage, and sociocultural change brought about by the introduction of new religious orthodoxy and schools.

Language and Territories

Collectively, the Pacific Eskimos speak what linguists call the Pacific Yupik language (also termed Alutiq, Sugpiaq, suk/suk, and Sugcestun), one of five Yupik languages spoken from Siberia to southwest Alaska (Woodbury 1984:49-50). Pacific Yupik has two dialects, Koniag and Chugach. Koniag has two subdialects: one spoken on Kodiak and Afognak islands and one spoken on the Alaska Peninsula opposite Kodiak (Leer 1978, cited in Woodbury 1984:53). The Chugach dialect also has two subdialects: one spoken in the Prince William Sound area, and one spoken by the Unizkugmiut of the southern Kenai Peninsula coast. Other linguistic groups may once have been included in the Pacific Eskimo language group (D. Clark 1984b:185).

The Tanaina speak one of the most diverse and well-defined Alaskan Athapaskan languages, unintelligible to its neighbors, but similar to the Ahtna language of the Copper River area (Krauss and Golla 1981). Tanaina has two major subdivisions: an Upper Inlet dialect spoken near the head of Cook Inlet, and three Lower Inlet dialects. An Inland dialect is spoken in the Lake Clark area, the Iliamna dialect at the east end of Lake Iliamna, and an Outer Inlet dialect originally spoken on the Kenai Peninsula as far south as Kachemak Bay, and which spread to the west shore of Cook Inlet during the late 19th century. A major subdialect of the Outer Inlet dialect was spoken in Kachemak Bay (Townsend 1981:623).



Peter Pfiffner 1990, Exxon

Figure 18. Frame parts from a beached kayak, containing metal brads, SEW-474.

Traditional Maritime Adaptations in the Spill Area

Ethnographic settlement patterns reflect Pacific Eskimo and Kachemak Bay Tanaina adaptations to a maritime environment. These patterns were influenced by local variation in economic strategies, the seasonal and spatial distribution of resources, and geographic setting. Settlement was generally semi-sedentary, with much of the year spent in semi-permanent "winter" villages, and seasonal dispersals to a variety of specialized site locations. Middle to outer bay locations were usually preferred for permanent settlements because they supported higher densities of food resources than exposed outer coasts. Winter villages were usually situated in the protected setting of a small bay, or in the lee of a headland or small island (D. Clark 1984b:191; Townsend 1981:628). Fish camps or summer villages were typically located near the mouths of major salmon streams. Hunting and travel camps were constructed when and where needed. Defensive refuge or fort sites on steep-sided and inaccessible islands, or on rocky headlands, served as retreats in times of conflict. Other site types include petroglyph and pictograph sites, and rockshelters used for temporary occupation or burial.

Travel was primarily by water, in skin-covered kayaks (Figure 18) and large open umiaks. Pacific Eskimos developed the two-hatch kayak, later enlarged to a three-hatch form at Russian instigation (D. Clark 1984b:189). Kayaks and umiaks also were used by the Kachemak Bay Tanaina, who traded for the finished craft and replacement covers. Small wooden dugouts are reported for the Chugach, though their practical use remains uncertain (de Laguna 1956:160). Dogs were used as pack animals for overland travel, but the rugged terrain and dense vegetation prevented use of sleds.

The study area contains a wealth of coastal food resources for human inhabitants (see the previous chapter, *Natural Environment).* Nearly all the larger land mammal species were hunted, but their importance varied locally depending on the seasonality and availability of maritime resources.

Whales were prized by all groups for their blubber, meat, and oil. Large whales were hunted by the Koniag and some Chugach groups, but not by the harpoon line and float method of groups farther north. Instead, whales were speared with poisoned blades, then salvaged when they drifted ashore several days later. The Tanaina did not hunt large whales, but traded for blubber and oil. Stranded whales were considered an economic windfall for all.

Smaller whales, sea lions, porpoises, and seals were highly valued, and were usually harpooned in open water from kayaks. Seal-hunting also involved the use of decoys, nets, or ambush at haul-out locations. Sea otters, pursued for their valuable furs, were surrounded by groups of hunters and killed with harpoons or spears thrown from an *atlatl* (spear-thrower). This technique was apparently developed by Pacific Eskimos and was spread to the south by the Russians (D. Clark 1984b:189).

The importance of fish depended on local variation in species availability. For some groups, fish were a subsistence mainstay equal to sea mammals. Bottom fish like cod, halibut, and rockfish were taken in deep water with baited hooks or lures. During summer, halibut could be caught in the shallow waters of gently sloping beaches. The Tanaina are thought to have used fence-like drags to corral or seine fish along beaches, though the use of woven fish nets is unknown for any of the groups prior to contact (Osgood 1976). The Chugach favored herring, which they collected in huge quantities with fish rakes. The Tanaina reportedly considered herring to be too bony for consumption and, despite their abundance, shunned them in favor of eulachon. From May through early October, spawning streams were exploited by all groups. Fishing was concentrated in the lower stretches of streams, where salmon could be trapped, gaffed, harpooned, or speared as they concentrated behind weirs (D. Clark 1984b:190).

Shellfish (clams, mussels, sea urchins, chitons, etc.) are often portrayed as supplemental foods used in periods of scarcity. But the general reliability and abundance of shellfish during most of the year, along with their availability to women, children, and elderly individuals (Erlandson 1988), probably made them an important resource in many parts of the study area. Their impor-

tance is indicated by the huge quantities of marine shells in many village middens (D. Clark 1984b:190).

Contact History

The following discussion of significant historic events in the study area has been synthesized from D. Clark (1984b), Townsend (1981), Stanek (1985), Fedorova (1974), and Hassen (1978). The history of Russian and English exploration of the Alaska Peninsula, Cook Inlet, and surrounding areas, and the establishment of a Russian fur trading network in the region, are discussed in detail by Hussey (1971). D. Clark (1975b) also provides a valuable summary of research related to Pacific Eskimo groups.

The Exploration Period 1741 - 1783

Vitus Bering "discovered" Alaska in 1741 (Golder 1914), but it was almost 40 years before historic contacts began in earnest in southwest Alaska. In the interim, the Russians explored and tried unsuccessfully to trade with the Koniag (D. Clark 1984b:187). Expeditions to the Kodiak area were led by Glotov in 1761, Polutov in 1776, and Ocheredin in 1779, but they procured few trade goods and were driven off after brief stays by well-organized Koniag attacks.

The arrival of the English Captain Cook in 1778, the Spanish Lieutenant Arteaga the next year, and three ships of Russian fur hunters in 1783, marked the beginning of sustained contact between Europeans and the Native inhabitants of the study area (Birket-Smith 1953:11). In 1783, a large party of fur hunters commanded by P. Zaikov wintered in Prince William Sound, although there were encounters with hostile Chugach Natives (D. Clark 1984b:552). Prompted by the depletion of Aleutian sea otter populations and reports of abundant resources on Kodiak Island, Prince William Sound, and adjacent waters, a group of merchants headed by Shelikov and Golikov left Russia in 1783 to reorganize the fur trade in America.

The Conflict Period 1784 - 1799

The Shelikov-Golikov Company established a post at Three Saints Bay (Old Harbor) on Kodiak Island in 1784. With their superior weapons, Shelikov's men defeated the Koniags and prevented further resistence through threats and gifts, and by holding high-ranking hostages. The Koniags were divided into hunting parties and work crews, and compelled to take part in Russian explorations and the establishment of subsidiary posts at Karluk, Ugak Bay, Alitak, Afognak, and other locations.

The Three Saints Bay settlement demonstrated the potential for organized colonization in Alaska, becoming the headquarters of the later Russian American Company (RAC) from which exploration and colonization of Prince William Sound and Cook Inlet was launched. During 1785 - 1786, parties dispatched by Shelikhov explored the Alaska Peninsula and mapped Lake Iliamna and several portage routes to Bristol Bay. In 1793, Russian headquarters were moved to Pavlofski, the site of the modern town of Kodiak. The decade after 1785 was a period of bitter conflict between Shelikhov and rival Russian companies trying to gain control of the Cook Inlet fur trade, during which time the coast and interior of the Alaska Peninsula were largely ignored. Russian activities in the vicinity of the large Koniag village of Katmai are first mentioned in 1791 (Hussey 1971:157), and by 1795 a trading post was established there. Katmai was located strategically at the convergence of two important trails across the peninsula: Katmai Pass via Naknek Lake, and a second route via Becharof Lake.

In 1785, a Russian party exploring Cook Inlet took 20 Tanaina hostages. A fort was established at Alexandrovsk (English Bay) but was not occupied permanently. That same year, 52 *promyshleniki* (fur traders), 11 Aleuts, and 110 Koniags established a small post on Montague Island in Prince William Sound, engaging in three months of friendly trade with the Chugach. Between 1786 and 1787, the rival Lebedev-Lastochkin Company established the first permanent mainland post, Saint George (Kasilof), in Tanaina territory on the Kenai Peninsula, followed by a second post on the Kenai River in 1791. These outposts were the centers of an active and generally friendly fur trade between Russians and the Tanaina. A post was established at Fort Constantine in Prince William Sound by 1793, but only after numerous armed conflicts with the Chugach. In Cook Inlet, competition led to violence between both the rival companies and the Tanaina during the 1790s. Small Russian outposts were established in Cook Inlet and Prince William Sound in an effort to control the trade, but the English and Spanish continued their explorations and siphoned off much of the Chugach fur trade.

In the Kodiak area, Russian Orthodox missionary work began in 1794, with the arrival of clergy led by Archimandrite Iosaf Bolotov. Missionaries also were assigned to Prince William Sound outposts as early as 1794, establishing small chapels and teaching Christianity. The first Russian Orthodox church in America was consecrated at Pavlofski in 1796 (Kan 1988). Most of the surviving Natives eventually converted to Christianity.

Russian Fur Trade and Missions 1799 - 1867

To ensure their dominance in the fur trade, the Russians instituted a system of forced labor in which Native community leaders, or *toyons* (a Yakut word meaning elder) were appointed to supervise hunting and trapping activities (with cooperation gained through threats or gifts). To enforce this system, women and children were taken captive and held hostage in the village until the hunters returned with furs, which were traded to the companies for far less than their actual value. Some hostages, principally leaders, were taken to Kodiak. To provide for the Russian settlements, Native villagers were forcibly organized into crews of servants, laborers, and hunters.

Shelikov initiated with the Koniags a policy of mandatory service, which was formalized in the 1821 RAC charter. Half the male population between 18 and 50 years of age was obliged to work for the company at all times as sea otter hunters, whalers, bird hunters, etc., and the actual percentage of conscripts was apparently far higher. In addition, ownership of all existing Koniag slaves was assumed by the Russians, and new members were impressed into this class for real or fabricated violations of company regulations. Payment to Native workers was largely in food, clothing, and boots produced by the unrenumerated labor of women, children, and men unfit for sea hunting (L. Black 1977:99-101). Imported trade items (glass beads, iron knives and axes, tobacco, cloth, and ceramics) also entered the Koniag economy, though in relatively small amounts. In later years, the RAC attempted to ameliorate conditions for Native workers, and payments for sea otter pelts were increased. Privations caused by Russian domination on Kodiak included overwork and near-starvation in the villages due to the long absences of hunters on sea otter expeditions to Prince William Sound, Sitka, and as far away as California. Disease, malnutrition, and social disruption resulted in rapid population reductions, from about 9000 Koniags in 1784 to 3000 individuals by the mid-1800s (D. Clark 1984b). Beginning in 1840, the RAC began to consolidate the remaining Koniag on Kodiak Island into seven settlements (including Three Saints Bay, Ugak Bay, Karluk, New Valaam, and Afognak). Many of the more than 60 reported traditional villages on the island were abandoned at that time (Tikhmenev 1978:200).

Attempts to institute the same system were resisted more successfully by the Chugach and Tanaina, resulting in hostilities and a less comprehensive forced labor system. The early years of the fur trade created a growing Native reliance on the resources of the Russian settlements. A depletion of sea otters in Prince William Sound and the gradual shift of company attention to resources farther south also lessened the Russian desire to exert total control over the population. Though the Chugach and Tanaina were not necessarily forced to hunt for the company, they could not expect service at the company post if they sold their furs to independent traders. When they hunted for the company, they were paid fixed prices in beads and tobacco, though less than actual value. Later, cash payments were made and credit was extended, increasing dependence on company posts as debts grew.

Once the Chugach agreed to a Russian presence in Prince William Sound, Aleut and Koniag hunters were brought in. By 1803, the Chugach began to participate in sea otter hunts with the Aleuts and Koniags, frequently traveling southeast to Yakutat or Sitka. The Tanaina were also more active in the fur trade during the early 1800s, despite the local decline of sea otter populations. The Tanaina (and to some extent the Chugach) acted as middlemen for Russian trade with interior groups, often settling with their families near the Russian outposts.

Population dispersal, family separation, and increased interaction with Russian settlements severely disrupted Native ways of life and led to a rapid Native population decline through the spread of epidemic diseases (especially smallpox) in 1836 - 1840. Intermarriage with Russians and other Native groups led to the creation of a "Creole" population and a blending of cultural identities. By 1841, alcohol consumption had become such a problem that the Russians attempted to regulate it, eventually banning its sale to Natives in 1845.

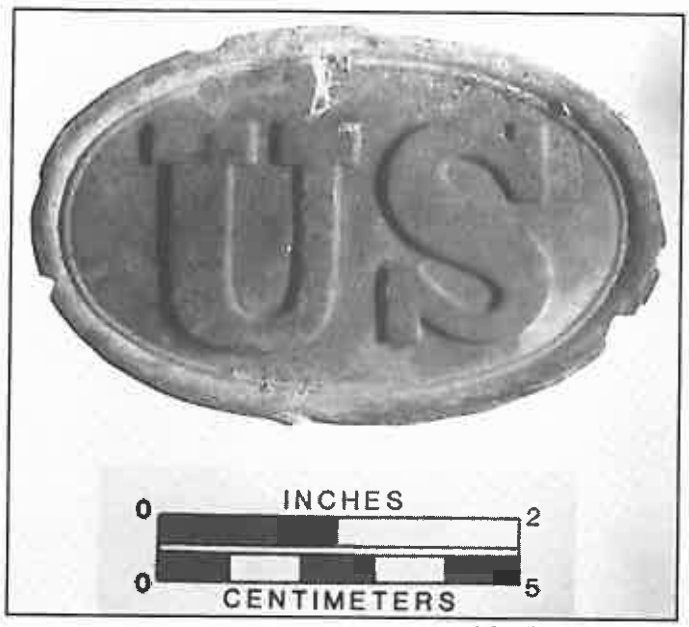
During this period, the Russian companies tried to develop commercial industries like agriculture, mining, fishing, and fur farming. In 1850, the Russians rediscovered coal near the entrance to Port Graham Bay, a deposit noted by English explorers some 60 years earlier. The RAC established a mine (Coal Village) there in 1855, exporting some 5000 tons of coal to Kodiak and as far as California before it closed in 1862. Gold and copper prospecting met with less success and these metals were not exploited widely by the Russians.

In the eastern project area, intensive missionization began in 1805 with the arrival of Hieromonk Nikoli at Nikolaevskiy Redoubt (Kenai), to establish a mission serving Cook Inlet, Prince William Sound, and the interior. To centralize the introduction of Christianity the inhabitants of coastal villages on the Kenai Peninsula were asked to relocate at Alexandrovsk. The church introduced a new set of beliefs and customs, many of which superseded Native traditions.

The American Period 1867 - 1930

The sale of Alaska to the United States in 1867 ended the RAC's dominance over the region. Its assets were assumed by the Alaska Commercial Company (ACC), which had to compete with other fur traders. Market forces led to rising fur prices, and the costs of some trade goods decreased. Increased hunting pressure and abandonment of earlier rotational hunting restrictions led to further decimation of sea otter stocks and resulted in increasingly diminished harvests. Competition for the remaining furs magnified the extended credit system retained from the Russians to secure Native business. A period of "wealth" prevailed, during which large debts accumulated and cash became the mainstay of the local economy. The fur market collapsed in 1897, followed by continued declines in fur prices and a concurrent increase in the prices of trade goods (Figure 19) at company stores. Outstanding debts were satisfied by collecting the seasonal harvest and ceasing further credit, resulting in great social and economic hardship for the Native population. The fur trade diminished further with the passage of the 1911 Fur Seal Treaty Act.

Headquarters of the ACC's Kodiak district were at St. Paul (formerly Pavlovski, later Kadiak and finally Kodiak). On the Alaska Peninsula, ACC posts were established at Katmai and Kaguyak (Douglas). Over the next 50 years, the ACC carried on the declining fur trade while expanding into commercial salmon fishing, salmon canning, merchandising, transportation, and other activities (Oswalt 1967b; Hinckley 1972). Other important industries on Kodiak included commercial whaling, raising sheep and cattle, and the ice industry on Woody Island (Elliott 1886; Chaffin et al. 1983).



J. David McMahan, AOHA

Figure 19. Belt buckle from SEL-130, Nuka Island.

Observers like Colyer (1869), Petrov (1884), Hinckley and Hinckley (1966), Londsdale (Krech 1989) and Elliott (1886) provide information on Koniag acculturation processes through the early American Period. The population was still dwindling under the burden of introduced diseases, including tuberculosis. Extensive intermarriage with Russian and American traders had occurred, resulting in the growth of a large "Creole" population. The influence of the Russian Orthodox Church remained very strong. On the other hand, traditional beliefs in hunting magic persisted, and masked hunting ceremonies were carried out as late as the 1870s (Pinart 1873). Alutiiq continued as the primary language, although most Koniags also spoke Russian or English. Because of the scarcity and expense of trade goods, many aspects of Koniag material culture continued with little change, including *bidarkas*, skin clothing, and hunting weapons. Koniag houses retained the traditional semi-subterranean, earth-covered construction, but in some cases glass windows, wooden doors, metal stoves, wallpaper, and purchased furniture such as beds, tables, chairs, mirrors, and clocks were added.

A major American influence on Native life adaptations was the commercial fishing industry in the 1880s. Initially, commercial fishing profoundly affected Native populations by disrupting the seasonal round of activity. Native employment opportunities were limited by the reliance of canneries on cheap immigrant labor, first Chinese and later Japanese, Mexicans, Filipinos, and Puerto Ricans. Natives who did secure cannery-related jobs were divorced from traditional subsistence activities. Regional settlement patterns were also influenced by cannery locations. Some villages grew overnight, while others were abandoned or depopulated during the fishing season. The greater availability of store-bought goods and permanent housing near canneries contributed to a more sedentary way of life. Like the fur trade, the fishing industry experienced a series of economic cycles tied to the availability and price of resources. The wane of salmon fishing was followed by exploitation of herring and halibut between 1911 and 1930, until fish stocks collapsed and the fishery ended.

The salmon fishing and packing industry emerged as the most important economic force in the lives of Kodiak islanders. Canneries were established around the Kodiak Archipelago, but massive operations on the Karluk spit were the most impressive, processing millions of salmon annually (Bean 1891; Moser 1899). Many of the more traditional aspects of Koniag life appear to have declined with the onset of the cannery era. The canneries introduced a wage economy for the first time, and other changes were hastened by the introduction of public schools and numerous government programs, as well as the extensive World War II military presence and the rise of new industries like crab fishing in the 1950s (Chaffin 1983; N. Davis 1984).

Employment opportunities for Koniag residents of the Alaska Peninsula were primarily at the Kodiak canneries (especially Karluk) directly across Shelikof Strait. The Chignik and Bristol Bay canneries were important, but were more distant and more reliant on Chinese labor. Although scattered shore facilities related to the fishing industry were constructed on the peninsula, no canneries operated east of Chignik until 1923, when the Kukak Bay cannery opened and operated through World War II (Hussey 1971:425).

In Cook Inlet, canneries monopolized the most productive fishing streams, preventing Native access to traditional subsistence sites. The canneries also purchased quantities of the annual subsistence catch, encouraging increased reliance during the winter months on food purchased from traders. In Prince William Sound, because of the region's inaccessibility and consequent transportation costs, canneries did not open until 1889, when several were established near the mouth of the Copper River. Canneries expanded rapidly in the sound at the beginning of World War I, but overfishing and falling prices caused many of these to close by the 1930s.

Chugach participation in the fishing industry was limited, and consisted of selling fish to canneries, operating salteries, and cutting poles for fish trap pilings. Natives rarely made enough money to completely abandon a subsistence lifestyle, yet they were irrevocably tied to the fishing industry for the cash component of their livelihood.

During the late 1880s, commercial fox farming developed in Prince William Sound. The Chugach did not often directly participate in these operations, but some interaction likely occurred, possibly involving the sale of dried fish as animal feed. Kachemak Bay became the center of the fox farming industry for southcentral Alaska in 1930, and local villagers were employed as laborers. During the 1920s farms appeared on Nuka, Elizabeth, and Passage islands. Fox farming provided a stable economic base for many families in southcentral Alaska until the price of furs dropped in the early 1930s.

Though mining had occurred sporadically since the Russian era, 1897 marked the beginning of nearly two decades of intensive prospecting and mining in Prince William Sound and the lower Kenai Peninsula. Copper was



Peter Phippen 5:3, Exxon

Figure 20. Aerial view of the Latouche Mine and town site, looking north.

found at Landlocked and Virgin bays that year, bringing thousands of prospectors to Valdez after the 1896 Klondike gold discovery. By 1910, over 100 mines were operating in Prince William Sound, mostly around Latouche and Knight islands in the west (Figure 20), the Ellamar region in the northeast, and Orca in the southeast. Except for a few mines near Valdez, most ceased operation by the late 1920s. Native employment in the mines was common, and others hunted, fished, or cut lumber to provision them. Such employment led to the settlement of Tatitlek near the mining town of Ellamar.

Gold was found in Nuka Bay in 1918, and active exploration, development, and mining continued from 1920 until the beginning of World War II. Mostly subtidal, chromite deposits were discovered at Claim Point around 1910. High chromium prices during World War I encouraged production of nearly 2000 tons before prices dropped and the mine closed. Coal was mined in Kachemak Bay in 1897, and from the coastal bluffs north of Homer between 1898 - 1902, 1915 - 1924, and 1945 - 1951. Limited hydraulic sluicing of beach deposits occurred near Anchor Point in the late 1880s and early 1900s.

Because the Russian Orthodox Church was subsidized by the Russian government, Alaska's sale created fiscal hardships and slowed the missionary effort. Many smaller churches turned to their Native converts for financial support. In 1894, the church established its first school at Nuchek in Prince William Sound to teach the Natives Russian and English. A second school was opened at Tatitlek in 1907, and Native schools were operating in Cordova and Chenega by 1927. Episcopal and Lutheran churches arriving in the early 1900s ministered principally to the Euro-American population.

During the Russian occupation, the Tanaina living near missions received little education. Limited schooling was provided at a few villages in Cook Inlet by the early 1900s. Schools were established at Portlock and Port Graham in the 1930s, but -- like the schools in Prince William Sound -- the focus was on teaching English and suppressing the traditional language. Schools, like churches, became a vehicle for replacing traditional practices with new concepts and value systems.

Advanced medical care was not available in this region until the late 1920s and early 1930s. Prior to this period the Native population was decimated by epidemics of diphtheria, measles, whooping cough, pneumonia, and influenza. Tuberculosis and venereal disease were pandemic. During the early 20th century, the remaining Native population condensed into a few small regional villages or migrated to larger non-Native communities. A recent example of population movement is the 1984 establishment of New Chenega Village on Evans Island, following the abandonment of the old village which was destroyed in the 1964 earthquake.

Contemporary Culture

In 1980, descendants of the traditional Pacific Eskimo were living in 15 villages, five towns, and the larger cities of Alaska and beyond. The 15 small villages are located on the coast (N. Davis 1984:198) of the Alaska Peninsula (Chignik, Perryville, Chignik Lagoon, Chignik Lake, and Ivanof Bay), the Kenai Peninsula (English Bay and Port Graham), Prince William Sound (Tatitlek and Chenega), and Kodiak Island (Ouzinkie, Port Lions, Larsen Bay, Karluk, Old Harbor, and Akhiok). Most Pacific Eskimo villagers speak English, though Pacific Yupik is still spoken by some. Village cash economies are based primarily on commercial fishing, local government jobs, and timber harvesting in forested areas. Each village maintains a distinct identity as a partially self-sufficient community living in relative isolation. Radio contact is maintained between villages and the nearest town, but travel to towns usually is limited to periodic pleasure or medical visits (N. Davis 1984:198).

Villagers still rely on local fish and game resources, combining them into a mixed cash-subsistence economy. Certain harvest methods, such as fish traps, remained in use until the early 1960s, when they were eliminated through regulation (Stanek 1985:i). Traditional hunting, fishing, and collecting areas are still used, many of which are associated with former occupation sites or historical events prominent in traditional history.

Major population shifts occurred among the Tanaina during the early 20th century. Today, only one mixed settlement, Seldovia, exists in the project area (Townsend 1981:625, 637).

Archaeological Overview

Ease of maritime travel and trade between the coastal peoples of southern Alaska promoted a regional unity of culture evident in history and over 11,000 years of prehistory (D. Clark 1984a, 1984b; Crowell 1988b). W. Workman (1980b:52) proposed that cultural sequences for various areas of the south Alaskan coast be subsumed into a larger North Pacific Maritime co-tradition, divided into a west sector (the Aleutians), a southeast sector (British Columbia and southeast Alaska), and an east sector including the Pacific coast of the Alaska Peninsula, the Kodiak area, outer Cook Inlet, and Prince William Sound. As defined by W. Workman (1980b:52), the east sector of the North Pacific Maritime co-tradition coincides with the Pacific Eskimo region and much of the current study area.

Paleoarctic Period 11,000 - 7,500 B.P.

Around the North Pacific Rim (Aikens and Higuchi 1982, Chang 1985), in Interior Alaska (Powers and Hoffecker 1989), and possibly in Southeast Alaska (Ackerman 1968) and British Columbia (Fladmark 1986), there is growing evidence for a biface tradition, older than 10,000 B.P., that precedes the more widespread and better documented microblade-bearing Paleoarctic tradition (Figure 21). Pre-microblade sites have yet to be identified on the southern Alaska coast, however, where the earliest known assemblages (at Ugashik Narrows) date to 9000 B.P. (Henn 1978:13).

Paleoarctic groups appear to have arrived from the north, part of a terminal Pleistocene/early Holocene dispersal from northeast Siberia to northwest North America (Dumond 1980, West 1981). Paleoarctic assemblages include microblades (used in composite bone knives and spearheads), wedge-shaped microblade cores, burins, and occasional bifacial points or knives. Many Paleoarctic sites of southern Alaska are at inland locations, and faunal remains suggest a focus on caribou, bison, horse, elk, and sheep. Three Paleoarctic sites have been identified on the north side of the Alaska Peninsula, for instance, including the 9000-year-old Ugashik Narrows Site (Henn 1978:13), the 8000-year-old Koggiung Site (Dumond 1981:103), and an undated microblade site (Igiugig) at Iliamna Lake (Dixon and Johnson 1971). At Ugashik Narrows, three early C-14 dates (8995 + 295, 8425 + 115, and 7675 + 260) suggest Paleoarctic occupation between 9000 and 7500 B.P. At Koggiung, the remnants of several hearths and artifact scatters appear to represent temporary hunting camps, C-14 dated to 7895 + 90, 7765 + 95, and 7475 + 60 B.P. (Dumond 1981).

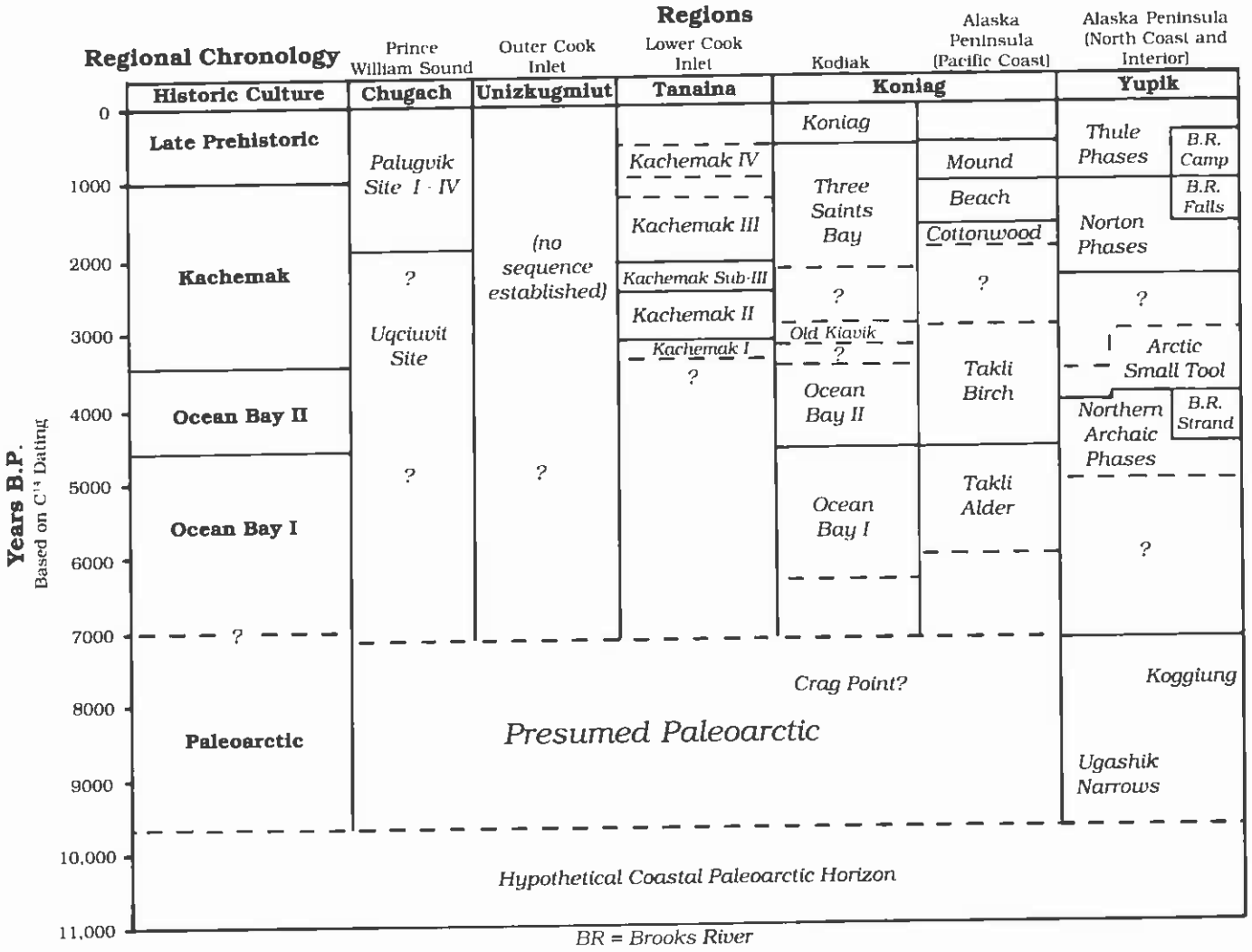
Recent research in the Kenai Peninsula, Interior, and upper Cook Inlet area (Reger 1985:255-257) has produced microblades, wedge-shaped cores, and other artifacts reminiscent of Alaskan assemblages dating between 8000 to 10,000 B.P. (McMahan and Holmes 1987:8), though the presence of side-notched points suggests a more recent affilitation.

Laughlin (1975) believes some Paleoarctic groups were maritime in character, inhabiting the south coast of the Bering Land Bridge (Beringia) before its submergence at 14,000 B.P. Most sites of this hypothetical, early coastal adaptation are thought to have been drowned by post-glacial sea level rise. A few coastal Paleoarctic sites are known from southern Alaska, though the adaptation is unclear because faunal remains are rarely preserved. All are located outside the study area: Anangula in the eastern Aleutians (Laughlin 1975); the Beluga Point Site on Turnagain Arm in Cook Inlet (Reger n.d.);. Groundhog Bay 2 (Ackerman et al. 1979); Hidden Falls (S. Davis 1988:194); and Heceta Island (Ackerman et al. 1985) in Southeast Alaska. The undated lowest level at Beluga Point contains microblades and microblade cores (Reger 1981) similar to Paleoarctic assemblages of the Alaska Peninsula (Dumond et al. 1976:19).

Early coastal sites on either side of the study area show that the south Alaska coast was settled by at least 9000 B.P. Unfortunately, the available data do not explain the relationship of Paleoarctic peoples with later cultural traditions, though microblades and burins continue in early Ocean Bay assemblages of the study area.

Figure 21

Cultural Chronology of Southcentral Alaska



Ocean Bay Period 7000 - 3500 B.P

The earliest evidence of an intensive maritime adaptation in the study area is associated with the Ocean Bay Period, beginning sometime between 6500 and 7500 years ago. On Kodiak, the earliest coastal phases are Ocean Bay I and II, paralleled on the Pacific coast of the Alaska Peninsula by the Takli Alder and Birch phases (Figure 21). No intact sites predating about 3800 B.P. have been found in Prince William Sound or outer Cook Inlet, possibly because of the effects of tectonic shifts in shoreline position.

Ocean Bay I and Alder phase lithic assemblages are composed almost entirely of chipped stone tools and lithic debris, including a variety of knives, projectile points, and processing tools. A transition to assemblages dominated by ground slate occurred around 5000 B.P. (D. Clark 1982a), marking the beginning of the Ocean Bay II and Takli Birch phases. The former continued until about 3500 B.P. on Kodiak, and the latter existed as late as 2800 B.P. on the Alaska Peninsula.

Bone tools and faunal remains are poorly preserved in Ocean Bay sites, though a maritime adaptation usually has been assumed based on site locations and associated tool kits. Recent excavations at the Rice Ridge Site on Kodiak Island have confirmed the maritime focus of Ocean Bay economies, indicating the presence of a fully developed maritime adaptation as early as 6500 B.P.

Kachemak Period 3500 - 1000 B.P.

Regional and temporal variants of the Kachemak culture span the period from about 3500 to 1000 B.P. over most of the study area, though they remain poorly defined in Prince William Sound and on the Alaska Peninsula.

During Kachemak times, the overall cultural unity of the North Pacific co-tradition is evident, but regional variations also are apparent (discussed later). In general, the Kachemak Period is characterized by increasing evidence of cultural complexity, coastal sedentism and population growth, with numerous large village sites, substantial shell middens, and the first semi-subterranean houses. Also apparent is a technological diversification probably related to the diversification of the subsistence base, especially among marine resources. The Kachemak Period also sees a pronounced elaboration of ritual treatment of the dead, possibly reflecting increases in social stratification. Stylistically distinctive artistic expressions in carved bone and pecked stone appear and may signal an increase in craft specialization and exchange. Ground stone tools continue to be important, and the first pottery appears, probably the result of diffusion from Norton cultures of the southern Bering Sea and Alaska Peninsula.

Late Prehistoric Period 1000 - 500 B.P.

After about A.D. 1000, further local diversification leads to the development of archaeological cultures clearly recognizable as the ancestors of the various cultures that inhabited the study area at the time of European contact. In the archaeological record, the late Prehistoric Period is indicated by the appearance of new implement types such as splitting adzes and triangular slate endblades, broad stylistic changes in bone and stone tools, increased use of ceramics and sweatbathing, occupation of larger houses and settlements, and marked changes in artistic expression and ceremonial practices.

Locally, the late Prehistoric Period consists of the Koniag Period (D. Clark 1974c) on Kodiak Island (now divided into several phases) and the Kukak Mound phase on the Alaska Peninsula. Cross-currents of cultural influence link North Pacific and Bering Sea cultures at this time, spurring debate over the relative contributions to Koniag culture made by diffusion and development in place. The late prehistoric record in Prince William Sound is fragmented and poorly dated, but historic Chugach culture was evidently the outcome of developments very similar to those unfolding on Kodiak (D. Clark 1988b).

In lower Cook Inlet, Kachemak IV sites and assemblages closely resemble those of the prehistoric Koniag, but appear to have been produced by an entirely different ethnic/linguistic group -- Tanaina Athapaskans who moved into the area and adopted Eskimo patterns of subsistence and material culture.

Historic Period 500 B.P. to Present

In the years following Russian contact in A.D. 1741, Native cultures of the study area were decimated by European diseases, warfare, subjugation and enslavement, and economic dependence. Native populations declined during the first half of the historic period, and traditional economic, social, and religious patterns were disrupted by the introduction of new diseases, vices, technology, and value systems.

Early Native sites of the Historic Period contain a valuable record of the gradually increasing influence of European contact on traditional societies. Many Native settlements of the region were abandoned during this period, and some villages consolidated to retain their economic viability. Native use of many sites has continued, especially of subsistence resource areas.

The introduction of an increasingly commercial European-style economy has resulted in a plethora of new site types dating to the Russian and American periods, including trading posts, churches, mines, fox farms (Figure 22), canneries, and military installations. Some of these preserve a record of strictly Euro-American adaptations, but many others contain valuable information on both Native and Euro-American cultures and their interaction.

The Archaeology of Prince William Sound and the Outer Kenai Peninsula Coast

Research History

Explorers and traders collected Native objects beginning in the mid-1700s (Bancroft 1959, de Laguna 1956:10, Fedorova 1974:31-38). Most early collections were poorly documented, but they focused scholarly attention on the Native cultures of the region. Other important sources of notes on Native life and material culture are the journals of Bering and Steller in 1741 (Bancroft 1959); Cook in 1778 (1790); Dixon in 1787 (1789); Portlock in 1787 and 1788 (1789); Sarychef in 1790 (1806-7); Meares in 1786 and 1787 (1791); Merck in 1790 (1980); Vancouver in 1794 (1801); and others. (See Pedersen 1983)

Prior to the sale of Russian Alaska to the United States, Tikhmenev (1978) consolidated varied data on the RAC into a historical encyclopedia spanning the period from 1783 to 1861. It contains valuable ethnographic data based on the materials of Khlebnikov, Lutke, Wrangell, Veniaminov, Vasil'ev, Glazunov, Teben'kov, Kostlivtsev, and Golovin (Fedorova 1974:8-9). Additional data on Native settlement, population, and material culture were collected during the U.S. censuses of 1880 and 1890 (Petrov 1884, Porter 1893).

Agents of the ACC collected mummies, masks, and other objects from rockshelters throughout Prince William Sound during the late 19th and early 20th centuries. A number of these undocumented remains were obtained by Dall (1878:32; 1884:124-128) and sent to the Smithsonian Institution. At least two mummies from the Palutat rockshelter were donated to the University of

California by the ACC headquarters in San Francisco, and a third was acquired by Ivan Petrov in 1878 (de Laguna 1956:91).

Scientific excavation and collection was first conducted by Jacobsen between 1881 and 1883 for the Könlige Museum in Berlin. Jacobsen collected masks and skeletal material from four burial rockshelters in Prince William Sound (de Laguna 1956:90). Apparently the rockshelters had been visited previously (possibly for the Smithsonian Institution) and intact remains were difficult to recover.

Stimulated by prospector reports that "there had been found in rockshelters petrified human bodies in petrified canoes" (three were displayed in the mining town of Ellamar), Meany (1906:459) made collections in Prince William Sound in 1905. Meany's observations established the persistence of rockshelter burial practices into the early Historic Period and documented the extent of casual collecting during this period. During the 1920s, four wooden masks were collected from a mainland rockshelter, one of which was examined by Hrdlicka in 1936. An adjacent rockshelter reportedly contained a number of wooden animal effigies that were not removed (McMahan and Holmes 1987:62).

Concerted anthropological research began in the 1930s, when much of the known cultural sequence and ethnography was documented. De Laguna conducted extensive survey and excavation in Prince William Sound and Kachemak Bay between 1930 and 1933. Excavations in Prince William Sound focused on Palugvik and the Palutat rockshelter. Stratigraphic associations at Palugvik are the basis for much of the area's known cultural sequence (de Laguna 1956:60-65). De Laguna was accompanied by Birket-Smith in 1933, who collected ethnological data from both the Chugach and the Eyak (Birket-Smith 1953, Birket-Smith and de Laguna 1938). Research in Prince William Sound waned in subsequent decades, except for brief surveys at Yukon Island and English Bay by Marsh (1956a, 1956b).

Nearly all recent anthropological work in Prince William Sound has consisted of archaeological survey and site inventory (West and Stern 1987). After nearly 50 years of inactivity, archaeological fieldwork recommenced in the Valdez area during 1969 and 1970 with construction of the Trans-Alaska Pipeline, though no sites were found at that time (W. Workman 1970). During 1975 and 1976, Lobdell (1975c, 1976b) surveyed the shores of Redwood Bay and parts of central and north Prince William Sound under contract to USFS. Beginning in 1976, NPS funded research by University of Alaska Fairbanks (UAF) anthropologists who,on behalf of CAC, collected traditional information and identified sites for selection under section 14(h)(1) of Alaska Native Claims Settlement Act (ANCSA). As part of the conveyance process, supposed village and cemetery sites were inspected to provide eligibility data. From 1978 to 1982, teams from UAF's Cooperative Park Studies Unit and the Bureau of Indian Affairs (BIA) visited sites throughout Prince William Sound. In recent years, these studies have been conducted solely by the BIA (Kent 1987, Dotter 1988a, 1988b).

Other sites have been documented in Prince William Sound by compliance and reconnaissance surveys.



Robert Betts P4:25, Exxon

Figure 22. Collapsed fox trap/feeding structure, SEW-482.

W. Mitchell and Johnson (1982) surveyed the shores of Hawkins, Hinchenbrook, Montague, and Esther islands including portions of Icy Bay and Port Wells. Also in 1982, surveys were conducted at Evans Island and Silver Lake (Stern 1982, Stern and Gibson 1982, Bacon et al. 1982). The following year, Ketz (1983) and Johnson (Ketz and Johnson 1983) surveyed along the outer coast of Montague Island, Patton Bay, Controller Bay, and Kayak Island. Mattson (1978, 1985a, 1985b, 1986, 1987), Diters (1982), and G. Clark (1976) conducted numerous surveys in the Chugach National Forest. Chugach Alaska Corporation sponsored several surveys and site inspections in Chugach National Forest during the 1980s to document subsistence and land use claims but the results are not all entered in the AHRS system or otherwise readily available. During 1987, joint research sponsored by CAC, NPS, and Alaska Pacific University tried to relocate sites on Kayak Island reported by the 1741 Bering Expedition (Frost et al. 1988). Most recently, Jensen (1989) has reported on a survey of proposed USFS roads and timber harvest units on Montague Island. Excavations at Uqciuvit (M. Yarborough 1989) were the first problem-oriented archaeological investigation in Prince William Sound in nearly 55 years. Except for site-specific testimonies collected by ANCSA

14(h)(1) researchers during the late 1970s and early 1980s (Ketz 1980), the only direct anthropological research among the Chugach has been that of Hassen (1974, 1978).

Sites on the south coast of the Kenai Peninsula are best known from the few surveys undertaken in the last decade. In 1983, NPS personnel assessed historic mining sites near Yalik Bay and identified several small house depression sites, then surveyed along the Resurrection River in Kenai Fjords National Monument (Shields 1983, Reynolds 1984). Staff of CAC reportedly inspected sites in Kenai Fjords National Park and Caines Head State Park at various times in the 1980s, but the extent of these activities is unknown. Arndt (1983, 1984) surveyed in the Seward area and BIA and NPS personnel conducted limited survey of properties in Seward during 1985 (Griffin 1985). McMahan and Holmes (1987) looked at the west coast of Nuka Island and portions of the adjacent mainland in 1986. Schaaf (1988b, 1988c) surveyed in the Verdant Cove and Box Canyon areas, and Klingler (AHRS 1989) recently completed limited testing near Yalik Point.

Prehistory of Prince William Sound

The cultural sequence for Prince William Sound is derived mainly from de Laguna's (1956) pioneering work of the early 1930s. Major excavation was limited to the Palugvik Site (COR-001), and to a lesser extent, the Palutat rockshelter (SEW-048) located near the eastern limits of the Pacific Eskimo area. Four stratigraphic units thought to represent at least 500 years of occupation prior to European contact were recognized at Palugvik, the deepest dated to 1753 + 105 and 1727 +/- 105 B.P. (Rainey and Ralph 1959:358). De Laguna (1956:60) noted little difference between the youngest and oldest layers at Palugvik other than changes in certain artifact type frequencies.

Chronology

De Laguna (1956:65) defined four cultural stages in Prince William Sound based on: diagnostic artifacts; presence or absence of European trade goods or skeletal evidence of European diseases; degree of bone and shell decomposition in middens; and the nature of trees growing on abandoned sites. The attributes of these stages, based on Hassen (1978: 37-38) and W. Workman (1978), are summarized in Table 8.

Excavations at the multicomponent Uqciuvit Village Site (SEW-056) have elaborated upon this cultural sequence. This site contains two locales (upper and lower) on two raised benches and along the base of a slope (M. Yarborough 1989). Approximately 3% of the site was excavated in 1988, yielding nearly 2200 artifacts, 1655 of which are trade beads. The remainder of the assemblage is dominated by slate and graywacke objects, including hammerstones, grinding slabs, and unfinished or broken artifacts (M. Yarborough 1989). The midden lacked quantities of shell or bone, but 4479 kg (9,854 lbs) of fire-cracked rock were recovered.

Preliminary analysis of the Ugciuvit data suggests relationships with Palugvik 1-2 and 3-4 levels, and a protohistoric component containing iron objects and trade beads (M. Yarborough 1989:6-7). A C-14 date from the base of the upper locale suggests that the area was originally occupied at a time contemporary with the Takli Birch phase (M. Yarborough 1989:7) or Ocean Bay II (about 4000 years ago), while occupation of the lower locale began about 2200 years ago. Intermediate occupation dates average to about 1000 B.P., and the uppermost levels dated to 295 + 90 and 200 + 90 B.P. M. Yarborough (1989:8) suggests that the intermediate and uppermost dates may fill the gap between the end of Palugvik 3-4 and the Protohistoric Period.

Archaeological Site Summary

Although prehistoric site density in Prince William Sound is quite low in comparison to other Alaska coastlines, the most common site types are rockshelters and villages. Village sites are invariably located close to the shore, on protected waters, and strategically situated for early detection of potential enemies. Rockshelters often contain middens and human remains attesting to their multiple function, and sometimes contain pictographs (de Laguna 1956:11). De Laguna (1956:92) also documented burials in village middens and on ledges of rocky islets or high cliffs. Disposal of the dead involved log or plank coffins, covering piles of stone, mummification, and possibly cremation. Smaller sites are known, consisting of stone artifacts in the intertidal zone, thin midden deposits, and culturally modified trees or CMTs (Figure 23) which may mark seasonal camps or procurement locales (AHRS 1989).

Little is known archaeologically about Prince William Sound dwellings. Ethnohistoric accounts suggest that both surface and semi-subterranean forms may have been used at winter villages, both constructed of logs and split planks chinked with moss. De Laguna noted that house-sized depressions were sometimes found at small midden sites, and discussed evidence for both surface and semi-subterranean forms at Palugvik (de Laguna 1956:58-60). M. Yarborough (1989:4) reports rectangular and square depressions and a linear berm at Uqciuvit. In contrast, nearly all recorded prehistoric sites on the Pacific coast of the Kenai Peninsula contain house depressions. These conform to the general pattern of defensive site distribution (Stanek 1985:53, McMahan and Holmes 1987:9).

Artifact Assemblages

Collections of artifacts from aboriginal sites in Prince William Sound contain a variety of woodworking tools, including splitting adzes (Figure 24), planing adze bits, axes, and small bone chisels. Also notable are barbed slate points similar to the Three Saints type (D. Clark 1970a:80); points with tapering stems and rudimentary barbs; stemless slate points; barbed, detachable, bone dart heads and barbed arrow points; foreshafts and socket pieces; notched ulus with ovoid to triangular blades; undecorated stone lamps; incised slate tablets; slate rods;

Table 8

Diagnostic Attributes of Cultural Stages in Prince William Sound

after Hassen, 1978:37-38 and W. Workman, 1978

Historic Period
after 1783

Appearance of small "Glacier Island" trade beads and other European goods associated with the beginning of Russian expansion into region, human bones with evidence of introduced disease, Christian burial practices.

Protohistoric Period
undated

Same assemblage as Younger Prehistoric with large blue "Cook type" beads (and presumably some iron).

Younger Prehistoric Period
undated

Less shell decomposition, emphasis on use of grooved splitting adzes, the appearance of stone picks, very small adze blades or scrapers, small ground chisels, barbed slate points, socket pieces with plain bases, the presence of war clubs, abundant fire-cracked rock (sweatbath refuse), presence of native copper, absence of European trade goods.

Older Prehistoric Period
before 1750 B.P.

Decomposed shells in midden, incised stone plaques, a relative abundance of planing adzes and smaller woodworking tools, a preference for simple stemmed slate blades and slender, awl-like slate points over barbed slate blades, chipped ulu-shaped scrapers, socket pieces with bifurcated bases, a greater abundance of bone or shell beads, a scarcity of fire-cracked rock, and the absence of native copper.

paddle-shaped scrapers; whetstones; stone saws; bipointed war picks; grooved stones; mauls or pestles; and mortars. Copper arrowheads and other objects occur in upper stratigraphic levels.



Robert Mack 5:9, Exxon

Figure 23. Culturally modified tree on Chenega Island.

Organic preservation is often good in rockshelters, and recovered materials include many objects associated with domestic activity (eyed needles, spoons, and awls); ceremony (decorated bone tubes, and ivory bear figures); and personal adornment (labrets, bone and shell beads, nose pins, and pendants). Sea otters comprise over half of the mammal remains from the only analyzed faunal assemblage, emphasizing the proximity of Palugvik to good hunting grounds (de Laguna 1956:47).

The manufacturing technology is dominated by sawing, incising, pecking, and grinding in a variety of lithic and organic mediums. Chipped stone is rare, represented primarily by a few blades and scrapers.

Discussion

In comparison to contemporary sites elsewhere in the Gulf of Alaska region, Prince William Sound collections lack or have few notched stones, bone wedges, adze hafts, chipped stone tools, boulder spalls, various grooved stones,

composite arrowheads, and decorated objects (W. Workman 1978:35). It has been suggested that Palugvik and contemporary sites of Prince William Sound are a regional variant of Kachemak Sub-III or III ((de Laguna 1956:258, 1975:156; D. Clark 1970a:92, Dumond 1977a:64). Prince William Sound objects absent in Kachemak Bay assemblages (stone axes, bipointed "war picks," slate chisels or carving tools, mauls or pestles, and dugout canoes) appear to share affinities with coastal cultures to the south (Reynolds 1984:25, W. Workman 1978:35).

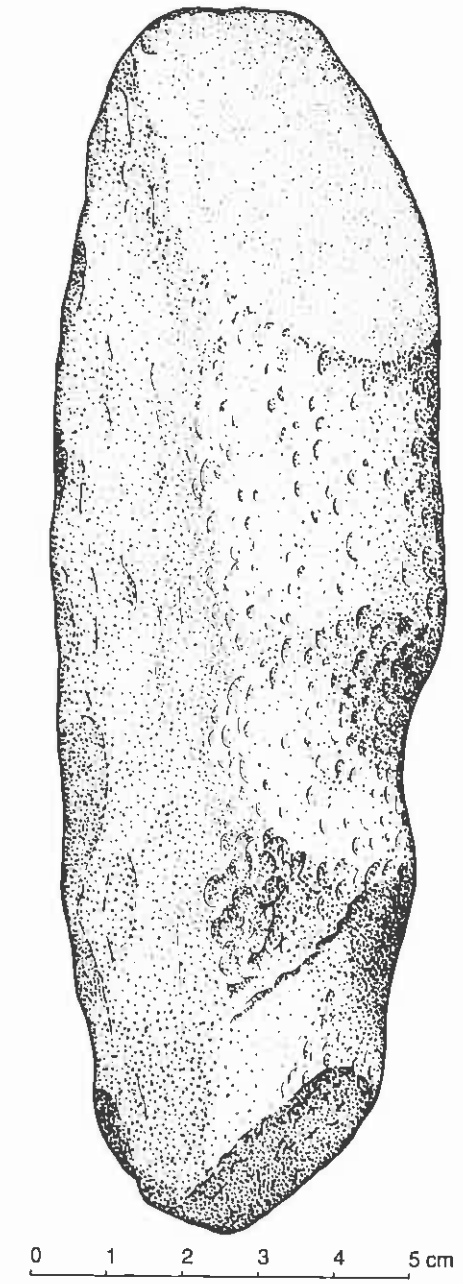


Illustration by Sarah Moore.

Figure 24. Splitting adze from SEW-072 (see appendix entitled Artifact Descriptions).

Prehistory of Outer Cook Inlet

Research History

The earliest archaeological work in outer Cook Inlet was Jacobsen's 1880s excavation at "Soonroodna," a possible Tanaina village in Kachemak Bay. Jacobsen (1977) found pottery, copper knife fragments, blue beads, and chipped stone points, but provided inadequate locational data. Pre-Athapaskan occupation of Kachemak Bay was shown in the 1920s by the discovery of stone lamps with human figures (Mason 1928:170-194, Marsh 1956a:113-115). With her excavations at Yukon Island and Cottonwood Creek in the 1930s, de Laguna (1975a:121) formulated a floating chronology for the region. In 1931 and 1932, Osgood (1976) collected ethnological data for the Cook Inlet Tanaina.

Recent research has illuminated the cultural sequence of the area and the origins of Pacific Eskimo maritime adaptations. In 1974, the Workmans and Lobdell began research in Kachemak Bay, starting with excavations at Cottonwood Creek (Lobdell 1975a, W. Workman 1977b, 1978) and Chugachik Island (K. Workman 1977). Later, excavations took place at the Yukon Island Bluff Site, and sites at Seal Beach and Aurora Spit (K. Workman 1975, 1978, W. Workman 1980b, W. Workman and Lobdell 1979). De Laguna returned to Kachemak Bay in 1978 to excavate the Yukon Island Fox Farm Site with K. Workman (de Laguna and Workman 1978).

Reger (1982) tested at Clam Gulch during 1978 and 1981. Zollars (1982, 1983) worked at Chugachik Island in 1981 and Aurora Lagoon in 1983. Homer's Pratt Museum has sponsored several field school excavations and assessed reported finds throughout the lower Kenai Peninsula in recent years (Ream and Weaver 1989). Excavations by Alan Boraas and Janet Klein (1988, 1989) at SEL-010 during 1987 dated late Kachemak and Tanaina occupation levels more precisely.

Erosion related to the 1964 earthquake prompted a resumption of survey along the Kachemak Bay and Kenai Peninsula coasts (W. Workman 1978:26), contributing new data on the condition and distribution of coastal sites. Kegler (1971) surveyed parts of Kachemak Bay State Park in 1970, and the Clam Gulch Site was recorded in 1972 by Dixon and Johnson (1973). Reger (1974:2) investigated 51 sites in Kachemak Bay, Port Graham, Koyuktolik Bay, Port Chatham, and Elizabeth Island. In 1975, the Cook Inlet Native Association inventoried regional historic and cemetery sites as part of ANCSA land claims research (Cook Inlet Historic Sites Project 1975). Lobdell (1976a) surveyed Cohen and Hesketh islands in Kachemak Bay. Sites in Halibut Cove were investigated by Zinck et al. (1977).

During the last decade, the emphasis of archaeological work on the lower Kenai Peninsula has shifted from problem-oriented excavation to compliance surveys and testing. A survey for proposed Port Graham community improvements took place in 1978 (Wiersum 1978). K. Workman (1979) surveyed the Homer small boat harbor for the Corps of Engineers and two development related surveys were conducted at English Bay in 1981 (C. West 1981, Wiersum 1981). Several surveys and limited testing

Table 9

Diagnostic Attributes of Cultural Stages in Kachemak Bay

after Stanek, 1985:32, Reynolds, 1984:22-28, W. Workman, 1978:27-31, and D. Clark, 1984a:137-140

Contact Period
post 200 B.P.

Presumed continuance of below with appearance of early trade goods becoming transitional to complete adoption of Euro-American material culture and dwellings, albeit with retention of selected organizational and utilization patterns.

Late Prehistoric
800 - 1100 B.P. to 200 B.P.

Termed Kachemak IV by de Laguna (1975:30, 126) from upper levels of Yukon Island sites and Cottonwood Creek. Later refined by Workman and Lobdell (1979). Poorly documented period when ancestral Tanaina Athapaskans replaced Eskimo people (W. Workman and K. Workman 1970), though ethnic association with assemblages remains problematic. Appearance of native copper and pottery, bone awls and chisels, splitting adzes, planing adzes, bilaterally barbed bone points, stemless triangular slate blades, ground slate scrapers, chipped stone industry emphasizing exotic material, stone wedges, plain stone lamps, sharply defined housepits with supplementary rooms, abundant fire-cracked rock suggesting use of vapor steam bath. Suggested relationships with Koniag occupations in the Kodiak Archipelago (Reger 1981:102).

Kachemak III
2000 - 1200 B.P.

Best known from Yukon Island and Cottonwood Creek, also present at Moose River (KEN-043) in the Kenai River area. This period represents the climax of the Kachemak tradition and is marked by a florescence of decoration on many artifact classes, personal adornment, and diverse mortuary practices suggesting differential wealth and social status. The assemblage is marked by a predominance of notched stones, decorated and anthropomorphic stone lamps, sawn slate, barbed and stemmed slate points, triangular slate points, splitting adzes, slate awls and rods, slate mirrors, notched ulus, varieties of barbed points and dart heads, bone and shell beads, incised decorations, wooden semi-subterranean houses with entrance tunnels, stone lined hearths. Strong affinities with Three Saints Bay phase on Kodiak Island (D. Clark 1966b:365), suggested association with Prince William Sound occupations.

Kachemak Sub-III
2400 - 2000 B.P.

Known principally from Yukon and Chugachik Islands, also appears at Merrill Site (Reger 1981:89). Thought to be a transitional period between Kachemak II and III, marked by a florescence in artifact types and numbers. Many notched stones, large stones grooved about circumference and over one end, increased working of slate with stone saws, polished barbed slate blades, slate awls, excavated hearth pits, incised decoration suggesting use of metal blades, and flexed burials with artificial eyes, labrets, and clay masks (de Laguna 1975:123-125). On Chugachik Island: numerous chipped stone bifaces, points and scrapers, later appearance of slate points, notched adze heads, potential for wooden semi-subterranean houses (W. Workman 1978:28).

Kachemak II
3200 - 2400 B.P.

Earliest dates are from the Kenai Peninsula outside Kachemak Bay. Known from Yukon Island, Chugachik Island, and the Merrill Site. Persistence of chipped stone and end grooved weights, large notched stones, drilled slate, barbed slate points, flexed burials with grave goods, disarticulated burials, appearance of semi-subterranean houses constructed of stone, wood, and whalebone suggest Norton culture influence (W. Workman 1982). Some elements may correlate with part of the Old Kiavik phase on Kodiak (D. Clark 1966b:363).

Kachemak I
3300 B.P. or earlier

Known from lowest levels of SEl-001. Dated at 2748 + 118 B.P. from a combined antler sample from the lowest level (Rainey and Ralph 1959:365-374). Challenged by de Laguna (1975:ix, 1962:166-167) on basis of probable sample contamination. Possible affinities with Old Kiavik complex of Kodiak Island dated to 3300 B.P. (D. Clark 1966b:370). Preference for chipped stone, absence of notched stones, large stone weights grooved about end, barbed points, and toggled harpoon forms exhibiting Norton culture attributes.

have been conducted since 1984 for development of the Bradley Lakes and other electrical transmission related projects (Mobley et al. 1985, Bacon and Maxwell 1986, Boraas 1989, Steele 1979). M. Yarborough (1987) identified historic properties associated with road and sewer projects near Homer in 1987. Ream and Bradley surveyed along the Sterling Highway between Anchor Point and Homer in 1989 (Ream and Weaver 1989). Cultural resources on Yukon Island have been assessed in several BLM studies in the last decade (R. King 1983, 1987, 1989).

Ethnological and linguistic studies in the 1970s and 1980s by Townsend (1981) and Kari (1988) have helped reconstruct early settlement patterns. Three years of fieldwork by ADFG between 1981 and 1984 have been compiled by Stanek (1985) to document historic and contemporary use of wild resources among Eskimo descendants in Port Graham and English Bay. J. Klein (1987) recently summarized the history of the Kachemak Bay area.

Chronology

The prehistory of Kachemak Bay spans only half the known sequence for the Kodiak area, presently spanning only 3300 years. The potential for earlier occupations is suggested by isolated side-notched and leaf-shaped chipped stone points, chipped stone bifaces, and other flaked material (de Laguna 1975:180-181). Small bifaces, bipointed and stemmed points, shouldered knives, and unifacial, angle-nosed scrapers from undated basal components at SEL-039 (Zollars 1982:1, Boraas 1989:9) have possible affinities with Brooks River phase material from the Alaska Peninsula (Dumond 1971:8, 30). W. Workman (1978:27) has suggested that interior hunting peoples may have occupied upland areas around Kachemak Bay for much of the Holocene period.

The Kachemak Bay sequence is summarized in Table 9. The 3500 year prehistory of the area is characterized by complex and poorly understood movements of two cultural groups, Athapaskan Indians and Pacific Eskimos. The Kachemak Eskimo tradition is thought to span the period from 3000 to 1200 B.P. (W. Workman 1977a) Major Kachemak assemblages come from Cottonwood Creek, Yukon Island, and Chugachik Island in Kachemak Bay, and Fish Creek, Kenai and Moose rivers, and Beluga Point on Cook Inlet (Reynolds 1984:22, Reger 1981:81-98). Kachemak cultures elaborate progressively through time, eventually amalgamating with Neoeskimo (Thule culture) to form Pacific Eskimo (D. Clark 1984a:140). In Kachemak Bay, Athapaskan occupations may follow a 400 year hiatus possibly related to resource depletion (Lobdell 1980:vii).

Archaeological Site Summary

Known archaeological sites in Kachemak Bay and the outer coast of the lower Kenai Peninsula are all coastal, consisting primarily of midden deposits containing shell and sea mammal bones. These sites are generally thin and limited in extent, but many may have been larger in the past, as artifacts on the beaches indicate that marine erosion has occurred. Several large sites (SEL-001, SEL-003, SEL-009, SEL-030, and SEL-041) have midden deposits three or more meters (over 9 ft) deep. Except for SEL-030, site density and size seem to be greatest on the south shore of Kachemak Bay, diminishing to the north and south. House depressions are known for only a few middens, suggesting the other to be semi-permanent villages and seasonal camps. Early house types are poorly documented, but appear to have been semi-subterranean with an entrance tunnel. Later houses are rectangular to square with an entrance tunnel located along one of the longer sides. Construction elements stress the use of wood, often represented by large post holes. Several have attached rooms, either directly connected to an outer wall or connected by a short tunnel (de Laguna 1975:32-34, 142-143).

Only one known site (SEL-075) is not associated with a midden, consisting instead of chert flakes and broken bifaces exposed in the rootwad of a wind-thrown spruce. Cortex flakes, biface breakage patterns, and the proximity to chert outcrops suggest it to be a quarry site (Reger 1973:12). A small midden (SEL-069) is located about 75 meters (245 ft) away. Rockshelters (SEL-005 and SEL-036) contain evidence of limited occupation and pictographs, but use of these for storage of ritual objects or mortuary purposes is unknown.

Excavations in Kachemak Bay have revealed an elaborate mortuary system beginning with Kachemak II and reaching a zenith during the Kachemak III. Early burials are flexed or disarticulated and accompanied by grave goods such as artificial eyes, labrets, and clay masks. Later burials exhibit a greater variety of mortuary practices, including fully articulated burials with or without grave goods, disarticulated individuals, multiple burials, dismembered or mutilated remains, burials with major skeletal elements missing, and scattered skeletal elements. Interment appears to have been shallow in all cases (Lobdell 1980:16). De Laguna (1975:42-50) notes the presence of trophy skulls (some with drilled holes or cut marks suggesting defleshing or possible cannibalism, (see also W. Workman 1978:30)), hematite and baked shale paint, bark wrappings, and probable burial in a squatting position or a box coffin. Some crania contain scratch marks inside the vault, indicating removal of the brain with a sharp object. At some Kachemak III sites, burials with abundant beads may indicate differential wealth and status, and a high position for some women (W. Workman 1978:29).

Skeletal analysis indicates the Kachemak people to be Pacific Eskimo, with close physical affinities to contemporaneous inhabitants of Prince William Sound and Kodiak Island, but markedly different from the later Koniag population (Lobdell 1980:262-263). Pathologies indicate that infant mortality was high and women may have lived longer than men, but the record may be skewed by mortuary practices (Lobdell 1978, 1980). Degenerative joint diseases are common in older individuals, but fractures were rare. Some evidence suggests periodic disease and nutritional stress, but this did not preclude the prolonged care and survival of the very sick.

Faunal analyses show that both Eskimo and Athapaskan groups in Kachemak Bay focused on marine resources. Small seals and porpoises appear to be the most important sea mammals exploited, while the extent of whaling is uncertain (Lobdell 1980:263). Fish were important, with halibut and cod comprising the bulk of the remains. Salmon do not appear in the quantities expected from ethnographic accounts of their importance -- a condition that may be due to cultural use and disposal patterns (Lobdell 1980:264). Large mammals are underrepresented, but the remains of smaller taxa (such as squirrel, hare, and marmot) occur throughout. Bird remains are nearly as abundant as mammal remains in some sites, but their probable dietary contribution has not been established. Comparisons of archaeological data with recent avian seasonal profiles suggest that birds were of prime importance in late winter to early spring (Yesner 1976:4, 11).

Shellfish comprise the vast majority of midden remains, but their importance has been estimated as low based on an assumed low yield-to-effort ratio. Erlandson (1988:14) has argued that shellfish can provide nearly all group members a reliable and efficient protein source characterized by low search, procurement, and processing times. It is interesting to note that site abandonment in Kachemak Bay often appears to correspond with increased sedimentation and presumed local extinction of rich shellfish beds -- a situation that would not appear to have affected the productivity of other taxa found in the middens (de Laguna 1975:41, W. Workman 1978:34).

Artifact Assemblages

Kachemak assemblages contain a variety of artifact types. Basic forms are pervasive through time, with changes primarily in frequency or morphological attributes. Changes in Kachemak assemblages include a gradual replacement of chipped stone with implements of sawn and ground slate, an increased frequency in objects of bone (possibly related to better preservation), an emphasis on personal adornment and objects associated with mortuary practices, and increases in ornamental elaboration of utilitarian objects. Kachemak attributes have been described in detail by de Laguna (1975:51-120) and others (Workman 1978:26-31, Lobdell 1980:11-15) and are only briefly summarized here.

Fishing implements include notched beach pebbles (small and large), grooved stones (with five types determined by groove location or pattern), pierced stones (many natural), fish hook barbs, and fish spear (leister) barbs. Maritime hunting tools are more abundant than terrestrial implements, though there may be some overlap. Hunting tools include chipped stone blades, double-edged slate blades, harpoon heads (both open and closed socket types), unilaterally barbed dart heads, socket pieces (single piece and composite), bone foreshafts, barbed lance heads, bone arrow heads with blade slits, and unilaterally and bilaterally barbed points.

Manufacturing tools are common, including woodworking tools such as grooved splitting adzes, planing adze blades, adze hafts (both bedded and socketed), slate knives, and wedges (whale bone and antler). Mauls may have been used to drive weir stakes or chisels. Stoneworking tools indicate the use of a variety of chipping, pecking, grinding, and sawing techniques. These industries are represented by hammerstones, thin slab saws, grinding stones (round or tabular), and bone flint flakers. Engraving tools are absent or unrecognized, though the decorated bone and antler objects suggest their use. Pumice whetstones and slate awls appear to represent bone working. The use of both hand and bow drills is implied from a variety of chipped stone and polished slate bits.

Domestic activities incorporated the use of stone lamps (some decorated with zoomorphic and anthromorphic figures), stone dishes, pottery vessels, a variety of ulus, spoons, and cutting boards. Skin working and sewing are represented by scrapers (bone and slate), boulder spalls, bone awls, bird bone needlecases, and eyed needles.

An emphasis on personal adornment is expressed by polished stone mirrors, bone and ivory pendants, fish vertebrae rings, buckles, clasps, labrets, ear plugs, nose ornaments, small zoomorphic carvings, copper bracelets, and beads of shell, stone, and copper. Ceremonial objects include labrets and eyes used in mortuary context, decorated ivory rods, and modified human bones. Trade networks are indicated by exotic lithic material, walrus ivory, and dentalium shells.

Discussion

W. Workman (1978:31-32) expressed uncertainty about Kachemak origins, but there is growing evidence that antecedent Ocean Bay cultures may have occupied Kachemak Bay. Typological evidence suggests colonization from Kodiak Island or the Alaska Peninsula. Kachemak I through III are a developmental continuum characterized by the gradual replacement of flaked stone with ground slate, the innovation of a fishing strategy emphasizing the use of large notched stones which become smaller over time, and the abundance of art, personal adornment, and burial ceremonialism. Despite extensive research in Kachemak Bay, some internal relationships have yet to be clarified, and assemblages showing a persistence of chipped stone technology remain problematical. K. Workman (1977:15) interprets the anomalies as evidence that the florescence of Kachemak III must have been very rapid, though de Laguna (1975:viii) cautions that regional and seasonal variation may explain some differences.

Some comparisons can be made between the Kachemak Bay sequence for Kodiak Island, with Kachemak III and the Three Saints Bay phase being especially similar (W. Workman 1978:32). An absence in Kachemak Bay of assemblages resembling the Koniag phase has been questioned (Reger 1981:102), and remains a problem for future research. Though far from identical, the Kachemak Bay and Prince William Sound assemblages also share some similar artifacts. Lobdell (1980:265) inferred shifts in hunting and fishing yields through time, based on stratigraphic changes in faunal assemblages from the Chugachik Island Site. Overuse of resources and dimin-

ished carrying capacity is seen as a rationale for abandonment of Kachemak Bay by 1200 B.P., with reoccupation by intrusive Athapaskan populations following resource recovery (Lobdell 1980:vii). Based on skeletal data, Lobdell (1978:42-44) suggested that Kachemak groups may have colonized Prince William Sound at this time. A lack of earlier comparative site data, the absence of many diagnostic Kachemak traits, and apparent differences in mortuary practices, however, suggest that Prince William Sound prehistory remains distinct from the Kachemak tradition of Kodiak and Kachemak Bay (W. Workman 1978:32).

Affinities with the Bering Sea Norton culture beginning as early as 3500 years ago have been proposed for the Kenai Peninsula (Reynolds 1984:26). K. Workman (1977:14) suggested connections with Chugachik Island material culture, and Lobdell (1978:41, 1980:262) noted physical similarities between Kachemak populations, Bering Sea, and Ipiutak peoples, including (for the latter) shared elements of burial ceremonialism. W. Workman (1981:15-16) noted that Kachemak assemblages contain many Norton traits, including inset blades, stemmed points, discoids and bifacial endscrapers, stone lamps, large netsinkers, harpoon forms, shaft smoothers, and grooved abraders. Pottery and exotic chipped stone diagnostics appearing about 1100 years ago in the upper levels of SEL-041 are seen as evidence of an intrusion of ideas (and perhaps people) from Norton-influenced cultures of the Alaska Peninsula (W. Workman 1981:15, Lobdell 1980:9). The Norton influence is less ambiguous in riverine sites farther north on the Kenai Peninsula (Reger 1977:5-9, 1981:89).

The period just before historic contact is poorly understood, and unresolved questions remain concerning the timing and nature of the Kachemak Bay Tanaina co-tradition, the degree of Thule (or Neoeskimo) influence in the area (Dumond 1977a:133-150), and why Kachemak sequences appear to terminate so abruptly.

The Archaeology of Kodiak Island

The Kodiak Archipelago, often referred to inclusively as Kodiak, includes Kodiak, Afognak, Uganik, Sitkalidik, Sitkinak, Tugidak, and many smaller islands. Kodiak was densely settled during much of its prehistory, which is known to span at least 7000 years. Despite sporadic survey coverage, some 650 AHRS sites were recorded for the Kodiak area prior to 1989, mostly along the coast and major salmon streams.

Research History

Observations on the settlement, subsistence, material culture, and religious life of the Koniag Eskimo first were recorded during the Russian period by missionaries, naval officers, fur traders, and natural scientists (Berkh 1974, Shelikhov 1981, Dmytryshyn et al. 1985, Merck 1980, Sauer 1802, Davydov 1977, Black 1977, Lisianskii 1814, Langsdorff 1813, Alekseev 1987, Holmberg 1985). Large ethnographic collections from the Koniag area were sent to the Museum of Anthropology and Ethnography in St. Petersburg (Dzeniskevich and Pavlinskaia 1988), and to other European museums (Birket-Smith 1941, Cole 1985, Rousselot 1988). Collections and contributions to Koniag ethnography continued to be made after Alaska became an American territory (Colyer 1869, Pinart 1873, Petrov 1884, Elliott 1886, Crowell 1988a, Krech 1989, and others). This large body of data has never been synthesized into a comprehensive historical ethnography of the Koniag people, though D. Clark provides a good summary (1984b).

Archaeological research on Kodiak began with Hrdlicka's survey of the island, and massive excavations at the Uyak Site (KOD-145) between 1931-1936 (Hrdlicka 1941, 1944, Heizer 1956). Hrdlicka focused on collecting a large skeletal sample to test for osteological differences between Kachemak and Koniag populations. His crude collection techniques limit the value of the Uyak artifact assemblage, though affinities with the Kachemak Bay sequence are apparent (de Laguna 1975).

Except for survey by D. Clark (1956) in the late 1950s, Kodiak archaeology was dormant until 1961 - 1964, when extensive surveys and excavations were carried out under the University of Wisconsin's Aleut-Konyag Prehistory and Ecology Project (D. Clark 1964, Laughlin and Reeder 1966). Clark's work on Kodiak during the 1960s and 1970s focused on sites of all time periods and documented a 6000 year chronology extending from early Ocean Bay to the Russian Period (D. Clark 1960b, 1964, 1966a, 1966b, 1970a, 1970b, 1974a, 1974b, 1979, 1985). Workman conducted research on the Chirikof and Afognak islands through the Aleut-Konyag Project (W. Workman 1966, W. Workman and Clark 1979).

Surveys and test excavations by government agencies, contracted archaeologists, the Bryn Mawr Archaeology Project, and others, have added substantially to the understanding of Kodiak prehistory. Between 1983-87 Bryn Mawr carried out excavations at a Koniag wet site (KAR-001) and other sites in the Karluk Lagoon area, along with surveys and excavations at Uyak Bay and the Crag Point Site (Jordan 1983, 1987, Jordan and Knecht 1988, Crowell 1986). This research provided new data on paleoenvironments of the area (Nelson and Jordan 1988), the Kachemak-Koniag transition, Koniag art and ceremonial objects, Kachemak and Koniag house forms and settlement patterns, and post-contact Koniag acculturation (Knecht 1985, Knecht and Jordan 1985). Surveys and excavations have been carried out in the Kodiak area for the USFWS (Nowak 1978, 1979; M. Yarborough 1978, Klingler 1980), NPS (Cassedy and Dekin 1983), AOHA (Klingler 1983, 1988; Reger 1982b, Crowell 1986, Dixon 1986, L. Yarborough 1976a, 1976b), BIA (Jesperson 1984, Crozier 1987, 1988), the Kodiak Electrical Association (Jordan et al. 1981, Jordan and Righter 1980, R. Knecht 1988), and the US Army Corps of Engineers (Reynolds 1986, 1988). Kodiak archaeology is in a very active phase, with growth in academic research, cultural resource management, and cultural heritage research and education.

The Prehistoric Sequence

Paleoarctic sites have yet to be found on Kodiak, although at least parts of the archipelago were deglaciated by 14,800 B.P. (see *Natural Environment)* and presumably open for settlement by Paleoarctic peoples. The earliest known inhabitants of Kodiak, about 7000 years ago, possessed a highly-developed technology for exploiting maritime resources. Evidence of earlier occupations may have been erased by a rise in post-glacial sea level and tectonic subsidence.

Ocean Bay I
7000 - 4500 B.P.

Sites of the Ocean Bay I phase indicate that maritime hunter-gatherers were present on the Kodiak Archipelago between 6500 and 7000 years ago. Ocean Bay I is named for a bay on Sitkalidik Island where KOD-119 was found by D. Clark (1966a) in 1963. The lower levels of the site yielded a previously unknown "pre-slate" horizon on Kodiak. Some slate tools and debris were found in the lower levels, but chipped stemmed points, bifaces, and other tools dominated. The base of the site was dated to 5503 + 78 B.P.. Though no identifiable faunal remains were preserved, sea mammal procurement is inferred from the presence of an oil lamp.

In 1970, Clark excavated at the Ocean Bay I "Chert Site" on Afognak Island (D. Clark 1979:62ff). The base of the site dated to about 5700 B.P. Large quantities of red chert debris and over 700 tools were recovered. Ground slate tool production appears to have begun about 5000 B.P. The middle and upper layers of the site are transitional between Ocean Bay I and II, and document the decline of the chipped stone industry and the increasing importance of ground slate.

Other Ocean Bay I sites have been investigated in recent years. A date of 6220 + 70 B.P. was obtained on charcoal from KOD-224 on Uganik Island (Nowak 1979). A late Ocean Bay I component (4900 + 100 B.P.) with stemmed points of chert and ground slate was excavated at Karluk (Jordan and Knecht 1988). Ocean Bay I components also were discovered at Uyak Bay in 1985 (Crowell 1986), and at Crag Point (KOD-044) in 1986, the latter producing a C-14 date of roughly 7000 B.P.

Until the 1987 discovery of the Rice Ridge Site on Kodiak Island, dated as early as 6500 B.P., no organic remains had been recovered from Ocean Bay sites. Ongoing excavations at Rice Ridge have produced about 30,000 Ocean Bay tools, including barbed and toggling bone harpoons, fish hooks, microblades, microblade cores, bone projectile heads slotted for microblade inserts, and stone lamps (P. Knecht, personal communication). Whale, seal, sea otter, and bird remains confirm the maritime subsistence that had long been assumed. The following summary of Ocean Bay I tool types and features does not address the unpublished Rice Ridge data.

Artifacts

Ocean Bay I chipped stone tools were made from a variety of lithic materials, most commonly red or mottled red and green chert. Chipped stone points with square to angled shoulders and tapering stems are diagnostic, along with smaller bipoints, large bifacial endblades (for lances?), and asymmetric sideblades (D. Clark 1979, Jordan and Knecht 1988). Microblade cores are wedge shaped, with minimal platform preparation. Other tool types include large linear flakes, chipped burins, boulder flakes, abraders and grindstones, scrapers, hafted mauls, and small pecked stone lamps. Slate was little used in early Ocean Bay I, but was chipped into knives or used in naturally-occurring forms. The slate industry gradually assumed more importance, and the technique of sawing out slate blanks followed by scraping and grinding came into use. Tools produced in this manner include stemmed points and long bayonets.

Structures and Features

Ocean Bay I house floors are oval to rectangular, with outer margins defined by post-molds. An example at Karluk had been excavated to a maximum depth of 25 cm, and was filled with concentrations of red ocher (Jordan and Knecht 1988:240). In general, floors are shallow or unexcavated, and superstructures were probably made of skin covers stretched over pole frames. Only a few Ocean Bay I features (rectangular and circular hearths and small pits) have been reported, and no burials have yet been discovered. Bright red or yellow ocher stains and lenses are common in Ocean Bay I deposits, and both Nowak and Clark report grindstones probably used to grind pigment. Middens are composed mostly of dark soil with charcoal stains, ash lenses, and relatively little fire-cracked rock. Bone and shell are usually absent, due to poor preservation.

Economy and Settlement Pattern

Rice Ridge will provide the first definitive data on Ocean Bay I subsistence. Preliminary data suggest a diversified subsistence economy focused on marine mammals and other maritime resources (P. Knecht, personal communication). Sites are presently too rare to provide a clear impression of settlement pattern, but riverine sites on the Afognak River and Karluk may have been summer - fall salmon fishing camps, while others (Ocean Bay, Uyak Bay) are in locations suitable for pelagic fishing and sea mammal hunting.

Ocean Bay II
4500 - 3500 B.P.

The upper levels of KOD-119 and AFG-011 (the Slate Site) on Afognak Island are the only described Ocean Bay II sites (D. Clark 1979). Ocean Bay II levels are also reported at KOD-305 in the Karluk River drainage (Jordan

1983) and at the Rice Ridge Site. The duration of Ocean Bay II is based on C-14 dates of 4480 + 160 for the base of AFG-011 and 3890 + 110 from near the top of the deposit.

Artifacts

Chipped stone tools are a minor element in Ocean Bay II assemblages. The upper levels of Clark's sites yielded only a handful of roughly shaped chert bifaces, along with a few scrapers and utilized flakes. Microblades and burins are absent. The transition to ground slate implements is a characteristic which distinguishes Kodiak from the Alaska Peninsula, where chipped stone tools are common at this time. In Ocean Bay II, the slate industry continues to use a "saw, snap, and scrape" method. Strips and rectangular blanks were created by deeply scoring slate slabs with large sharp-edged flakes of hard metamorphic rock ("boulder flakes" or "cobble spalls"). Scraps were snapped off and discarded, then blanks were edge-trimmed by percussion, scraped down with cobble spalls, and polished with whetstones. The end products include long, narrow bayonet blades (often stemmed), broad-bladed, stemmed flensing knives, small projectile points, and ulus. Blades occasionally have incised designs, and stem margins are often serrated. The Slate Site contained large quantities of sawn slate scrap and partially finished slate tools, leading D. Clark (1979) to suspect it was a "workshop" where slate tools were produced for use elsewhere. Other artifact types recovered at Ocean Bay II sites include boulder flakes, pecked stone lamps, notched pebbles, abrading stones, hammerstones, cobble mauls, and an adze bit.

Structures and Features

Along with vaguely defined pits and hearths, D. Clark (1979:138) excavated a large feature at AFG-011 interpreted as a deeply excavated housepit, with stone slabs, internal post molds, and two stone lamps. This structure may suggest a shift from tent-like dwellings towards more substantial and permanent semi-subterranean houses. Middens from this time period are composed of light to dark brown soil with charcoal stains, some fire-cracked rock, and volcanic ash lenses; red ocher is faint or absent and organic preservation is generally poor.

Kachemak
3500 - 900 B.P.

The Kachemak Period encompasses a long intermediate span in Kodiak prehistory that is marked by the first durable semi-subterranean houses, substantial coastal village shell middens, new technologies for fishing and maritime hunting, and intensification of warfare, trade, ceremonialism, artistic endeavors, and elaborate mortuary rituals. Population growth is evident, and dozens of Kachemak villages and several hundred smaller sites have been recorded in coastal and riverine locations.

The Kachemak culture was originally described by de Laguna for Cook Inlet (deLaguna 1975). Hrdlicka's massive excavations at the Uyak Site (KOD-145) demonstrated the presence of a close regional variant of Kachemak culture on Kodiak Island (Hrdlicka 1944, Heizer 1956). Hrdlicka's roughly defined "pre-Koniag" (Kachemak) strata, including the "lower" and "intermediate" midden levels, produced 7738 artifacts (Heizer 1956:Table 29). Uyak artifact types match material from all of de Laguna's Kachemak phases, and include many unique tools and art objects (such as bone figurines, amulets, and maskettes).

A better understanding of Kachemak chronology was developed by D. Clark (1966a), who defined two distinct Kachemak phases on Kodiak: Old Kiavik and Three Saints Bay. The Old Kiavik phase is represented by a single small assemblage (less than 500 artifacts) from the Kiavik Bay Site. A C-14 date of 3263 + 61 B.P. falls at the boundary between Kachemak I and II, and the assemblage shares elements with both Cook Inlet phases. W. Workman (1980b) estimates the duration of Old Kiavik as 3500-2100 B.P., though without data from other sites to support this estimate. Other probable Old Kiavik components, undated and represented by small artifact samples, exist at KOD-026 (D. Clark 1974b:26-49) and KOD-044 (D. Clark 1970a:74-75).

D. Clark (1966a, 1970a) used over 2000 items (including a diverse array of stone, bone, and wood implements), from KOD-083 and KOD-044 to define the Three Saints Bay phase. Data on feature types and burial practices were also recovered. This late Kachemak phase correlates typologically with much of de Laguna's Kachemak Sub-III and III, and is dated with confidence from 2100 to 900 B.P.

Recent Kachemak data come from research in the Karluk River area on west Kodiak (Jordan and Knecht 1988, Jordan 1987), and from Crowell's (1986) survey of the Uyak Bay area (later re-examined and tested during Bryn Mawr's 1987 season). Hrdlicka's Uyak Site provided new data on Kachemak house forms (Jordan 1987). A housepit with Kachemak and Koniag levels was excavated in 1987 by a BIA/KANA field school at KAR-029 in Larsen Bay (Crozier 1988).

Collections from much of this recent work are still being analyzed, but Jordan and Knecht (1988) have summarized 5000 KAR-031 artifacts from the Three Saints Bay phase, which they consider to be late Kachemak. They also suggest a developmental transition to Koniag culture at around 800 - 900 B.P. The earliest Kachemak stratum at KAR-031 (Layer 10) is dated to 2010 + 70 B.P. The KAR-031, Three Saints Bay, and Crag Point sites thus span a similar time period (2100 - 900 B.P.).

This review of Kachemak research on Kodiak points out the limited data available for the 1400 year span that separates the Ocean Bay II and Three Saints Bay phases. Kodiak's complex tectonic history may be responsible for a loss of coastal sites during this gap. A similar situation is evident on the Alaska Peninsula coast, where no sites are known for the period 2800 - 1800 B.P. (G. Clark 1977). As a consequence, the nature of the relationship between Ocean Bay and Kachemak remains in question.

Artifacts

Despite the temporal gap, the small Old Kiavik assemblage is sufficiently different from Ocean Bay II that D. Clark (1975a:217-219) thought cultural continuity between the two phases was unlikely. The distinctive Ocean Bay II method of slate tool manufacture was replaced by percussion flaking of slate combined with grinding into finished form. The long slate bayonets of Ocean Bay II are absent, and new ground slate projectiles include the "Three Saints Bay" barbed point (D. Clark 1966a:Figure 4g). These points have large, sharply-angled barbs and square stems that often are slightly concave at the base (D. Clark 1970a:80), and range from 3 to 10 cm (1 - 4 in) in length. Many examples have incised marks and geometric decorations, possibly "owner's marks" (Clark 1970a:Figure 3). Ulus and ground slate knives with serrated stems also are present. Stem serration is one of the few material traits that suggest continuity with Ocean Bay II.

Chipped stone tools (including bipoints, large leaf-shaped blades, and ulu-shaped scrapers) are more common in Old Kiavik than in Ocean Bay II (D. Clark 1966a:Figure 4). Though a few "blade-like flakes" were found, there is no microblade industry. End-grooved cobbles (D. Clark 1984a:Figure 4a), probably used as heavy fishing plummets, are diagnostic of the phase (see *Artifact Descriptions* appendix, artifact 49AFG-046-1, and Heizer 1956:Plate 30c-e). Notched pebble sinkers are abundant. Small polished greenstone adze bits are another new tool type which continues throughout the Kachemak Period. Undecorated pecked stone oil lamps, not unlike Ocean Bay examples, were used. Old Kiavik phase bone tools are poorly preserved at the Kiavik Bay Site but dart heads with wedge-shaped tangs and single pairs of bilateral barbs, small self-tipped toggling harpoons, foreshafts, and wedges were found (D. Clark 1966a:Figure 4).

Late Kachemak artifact assemblages are more diverse, with more attention to finish, detail, and ornament. Heizer lists 19 types of ground slate projectiles and knives from the lower levels at Uyak. The most common projectile is the Three Saints Bay barbed point with square stem, which continues through Kachemak into transitional Koniag (Jordan and Knecht 1988:Figure 33). This is the most common type in the Crag Point and Three Saints Bay collections (D. Clark 1970a:Figure 6) and one of the most common in the lower levels at the Uyak Site (Heizer 1956:Plate 44a-e). These points may have been used on killing lances or possibly on whale darts. Shouldered slate points with long serrated stems occur in early and late Kachemak, but drop out at the end of the Three Saints Bay phase at Karluk (D. Clark 1970a:Figure 5i, Jordan and Knecht 1988:Figure 9e). Various large and small stemmed slate points with square shoulders or small barbs (probably dart and harpoon endblades) often with incised designs, are also found in the early and middle Three Saints Bay phase.

Several new point types predominate at the end of the phase, foreshadowing the Koniag transition: small lanceolates; small, stemmed points with medial ridges; and long, narrow points with pronounced medial ridges and small barbs. This latter type, characterized by a diamond-shaped or "flattened lozenge" cross-section, is a wide-spread marker of the Kachemak/Koniag transition (Jordan and Knecht 1988:Figure 13L, D. Clark 1970a: Figure 6q). Medial ridging and drilled holes mark points from the end of the Three Saints Bay phase.

End-hafted ground slate knives with serrated or lugged stems continue in time from Old Kiavik into the Three Saints Bay phase. Blade forms range from narrow and pointed (D. Clark 1970a:Figure 5r) to broad and rounded (D. Clark 1970a:Figure 5k, Jordan and Knecht 1988:Figure 11n). Other large, broad, slate "flensing" blades have lashing holes drilled in their bases instead of stems (Heizer 1956: Plate 48c,f,h). Based on ethnographic analogy, such implements were probably used for sea mammal processing, while ulu knives (common throughout Kachemak) may have been used primarily for cutting and splitting salmon. Many ulus have drilled lashing holes, and one specimen from Karluk was recovered with its plain wooden handle intact (Jordan and Knecht 1988:Figure 11o). Three Saints Bay phase ulus generally have straight backs with semi-circular blade outlines and are untanged. D. Clark (1970a:Figure 11e-g) tentatively identifies several small polygonal slate knives from Three Saints Bay and Crag Point as inset blades for crooked knives. Other ground slate tools include rods (of unknown function) and pointed awl-like implements.

Chipped stone tools decline in frequency from the Old Kiavik phase to the Three Saints Bay phase. Small lanceolate, stemmed, and weak-shouldered points (arrow or dart tips) occur in small numbers in late Kachemak layers at KAR-031, Crag Point, Three Saints Bay, and Uyak. Some chipped knives are broadly side-notched (Jordan and Knecht 1988:Figure 9f,g). Chipped stone processing tools include boulder flakes, chipped slate scrapers, large U-shaped slate scrapers, and flake knives.

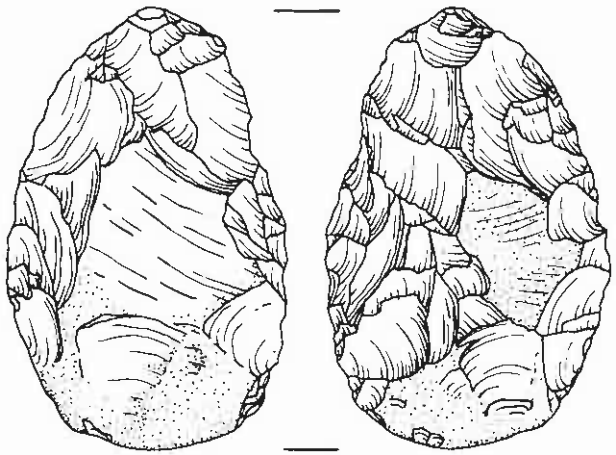


Illustration by Sarah Moore

Figure 25. Oval planing adze from KOD-368, typical of the Kachemak Period (see appendix entitled Artifact Descriptions).

Other stone tools include abraders, stone saws, hammerstones, mauls and small polished adze bits (Figure 25) chipped and ground from greenstone.

If the flat, bi-notched pebbles common in late Kachemak deposits were netsinkers, then their frequency in Kachemak sites attests to the importance of fishing in the economy. At KAR-031, these were found outside houses in closely-spaced alignments that suggested piled net storage. Larger grooved cobbles probably also served as net weights. Pecked metamorphic stone oil lamps are common in the Three Saints Bay phase, ranging from undecorated small prowed varieties to massive specimens ornamented with breasts, grooves, faces, human figures, and zoomorphic designs (Hrdlicka 1944, Heizer 1956, D. Clark 1960a, 1970a, 1984a).

Labrets from the Three Saints Bay phase occur in several forms: hat-shaped, flanged, spool-shaped, and bulls-eye. Labrets were made from jet, limestone, slate and bone (e.g., D. Clark 1970a:Figure 9, Jordan and Knecht 1988:Figure 9, 10, 14). Beads were made from jet, red slate, bone, and other materials. Jet was also made into buttons and nose rings.

Bone artifacts include processing tools, household equipment, fishing equipment, hunting weapons, and ornaments. In the first category are whalebone wedges, engraver handles, bird bone awls, needles, and open-bedded adze hafts. Two small carved plugs of jet and walrus ivory from KAR-031 are possible end caps for wood or bone needle cases (Jordan and Knecht 1988:Figure 9v,w). Household containers and implements include whale vertebra "dishes" and mortars, scoops, shovels, and decorated spoons. Bone fishing equipment includes compound fish hooks with straight barbs, possible gorges (D. Clark 1970a:Figure 8d), and lures or amulets. The lures/amulets are small, well-made carvings of fish, usually with holes or slits for suspension (Heizer 1956: Plate 83o-r,t,x; D. Clark 1970a:Figure 8k; Jordan and Knecht 1988: Figure 13j). Small toggling harpoons may also have been used to take salmon.

Late Kachemak dart and harpoon heads and related components (such as socket pieces, foreshafts, and finger rests) are morphologically even more diverse than that of the ethnographic Koniag, for whom Clark lists 12 types (D. Clark 1974a:74). Darts would have been launched with throwing boards, though no examples have yet been found. The proximal ends of darts were lashed to bulbed wooden shank pieces (like Koniag examples) designed to rest in the grooves of throwing boards (Jordan and Knecht 1988:Figure 10g). Very large barbed heads with endblade slots may have been used in poisoned dart whaling. Specimens have been recovered only at the Uyak Site (KOD-145), by Hrdlicka (Heizer 1956:Plate 54r,s,t,u) and Jordan (1987:8). Barbed heads of this type were used ethnographically by Aleut whalers, while Koniag whalers employed long, slate, bayonet tips (Black 1987, Crowell 1990). These finds contribute to the understanding of the complex history of the origins and techniques of North Pacific whaling.

Closed and open-socket toggling harpoon heads and foreshafts are also known for the Three Saints Bay phase. These are both self-tipped and slotted for endblades, and occasionally are engraved with marks or designs (Heizer 1956:Figures 38 & 39 and Plate 58, D. Clark 1970a: Figure 7c,d,e; Jordan and Knecht 1988:Figures 10 & 12). Other late Kachemak bone weapon types include barbed and unbarbed arrowpoints, daggers, clubs, leister prongs, and bird dart prongs.

Bone, tooth, ivory, and shell were used to manufacture ornaments, carvings, and ceremonial objects. The variety and craftsmanship exhibited by artifacts in these categories are hallmarks of the Three Saints Bay phase. Other ornament types were buttons, incised tube beads, pins, chains, pendants, and combs (Heizer 1956:Plates 80-85, D. Clark 1970a:Figure 9. See *Artifact Descriptions* appendix, artifact 49AFG-046-7). A variety of anthromorphic and zoomorphic bone amulets, maskettes, and figurines are found, along with carved bone dolls' arms with holes for cord attachment (Heizer 1956:Plate 83a-c). Small, seated human figures (Heizer 1956:Figure 82p) were probably hunting-hat ornaments like those seen on ethnographic examples from the Aleutians (Fitzhugh and Crowell 1988:Figure 203). At the Uyak Site an ivory plaque carved with bird heads and whales flanking a human face with a whale-tail mouth (Heizer 1956:Plate 85c) suggests that the mythological association of birds with Aleut-Koniag whaling magic (Black 1990) may extend several millennia into Kodiak's prehistory.

Few wooden Kachemak objects have been recovered to date, so many tool, container, and ornamental types probably remain to be documented. Two partial wooden masks have been found, however, reinforcing the impression that Kachemak life included a rich ceremonial aspect (D. Clark 1970a:Figure 11b, Jordan and Knecht 1988:Figure 12a). The recovery of small charred fragments of twined basketry at Three Saints Bay (D. Clark 1970a:80) establishes the use of this technique prior to the Koniag phase, for which there are a number of well-preserved examples of twined root basketry from KAR-001 (Jordan and Knecht 1988).

The final category of Kachemak artifacts to be mentioned is pottery. A few thick shards with mixed gravel, sand, and fiber temper were found at Crag Point, and KAR-031 produced plain gravel-tempered shards from a fat-encrusted, cylindrical vessel. The introduction of fiber-tempered pottery on Kodiak during the Three Saints Bay phase probably reflects Norton influence (D. Clark 1982b).

Structures and Features

Only recently have Kachemak houses been fully excavated on Kodiak, and these remain largely unpublished (Jordan 1987). Hrdlicka ignored most feature data in his Uyak Site excavations, though brief descriptions and floor plans of Kachemak houses were recorded by Heizer (1956:Figures 8-13). The shallow, semi-subterranean houses were square to rectangular, with a maximum size of about 3 x 4 meters (10 x 13 ft). A possible entrance chamber was present in one case, and small alcoves adjoined the corners of two others. The alcoves were apparently used for placement of burials. Internal features included corner and central post molds, slab paving, vertical slab hearths, and storage pits. D. Clark (1970a:75)

partially exposed a burned plank structure at Crag Point, wood from which dated to 2033 + 52 B.P.

Excavations at Crag Point in 1986 exposed entire house floors. A complete late Kachemak house floor measuring about 5 x 8 meters (17 x 24 ft) was removed, with a raised sleeping platform on one wall, numerous post molds, slate slab pavement, internal hearths, and a covered drainage ditch. Human burials were found in a side chamber (Jordan 1988a). At the Uyak Site, Jordan (1987) excavated five late Kachemak houses averaging 5 x 5 meters (17 x 17 ft) wide, with sunken entrance tunnels, raised sleeping platforms, central hearths, and clay-lined storage basins. Radiocarbon dates of 1310 + 70 and 1140 + 90 B.P. came from two of the structures. Crozier (1988) partially excavated a Kachemak house at KAR-029, but only preliminary results are available.

Parts of several late Kachemak square or rectangular houses were excavated at the Wet Site KAR-031 (Jordan and Knecht 1988:239), where floor deposits of compacted wood chips, grass, bone, ash lenses, charcoal, and fire-cracked rock averaged 30 cm (12 in) thick. Internal features included clay-lined and unlined storage pits, wooden floor planks, and cobble hearths. Exterior features included ash and charcoal dumps, piles of fire-cracked rock interpreted as sweat-bath rubble, gravel lenses, pits, post mold patterns suggesting racks, and bone dumps. Average Kachemak house size, calculated on a sample of 32 surface housepits at KAR-022 and KAR-046, is about 25m^2 (265 sq ft) (Jordan and Knecht 1988:232). Koniag houses average about three times as large, and usually include one or more side chambers attached to the main room by narrow passageways.

Clay-lined pits (probably for storing or fermenting of fish) are a common Kachemak feature on Kodiak. Heizer (1956:30) reports that such pits (15 - 62 cm (7 - 27 in) in diameter) were more common in the Kachemak layer of the Uyak Site than in the upper layer. Many had masses of fish bones inside and were covered with slate slabs. Such pits were used secondarily for burials and artifact storage.

The human burials and detached bones common in Kachemak middens indicate that treatment of the dead was varied and complex (Jordan 1988a). Flexed, articulated burials in shallow pits (some inside dwellings) predominated at the Uyak Site (Heizer 1956:12) and the Three Saints Bay Site (D. Clark 1970a:88). Facial plasters of white clay, labrets, artificial ivory eyes, drilled holes through jaws and pelvic bones, tooth extractions, cut marks on bones, and extra bones in graves are reported from some Kachemak sites, and parallels have been drawn between some of these practices and those of the Norton and Ipiutak cultures (W. Workman et al. 1980:393). Partial skeletons, burned bones, cache piles (such as stacked mandibles and pairs of hand and feet bones) and randomly scattered individual human bones (sometimes broken open) are also common, as are mass burials of up to 20 individuals. At the Uyak Site, such remains occurred most frequently in the late Kachemak levels, and the failure of these practices to carry through into the Koniag phase is an intriguing cultural discontinuity. Interpretation of this evidence includes suggestions of cannibalism or ritual treatment of war captives, but no detailed studies have been conducted.

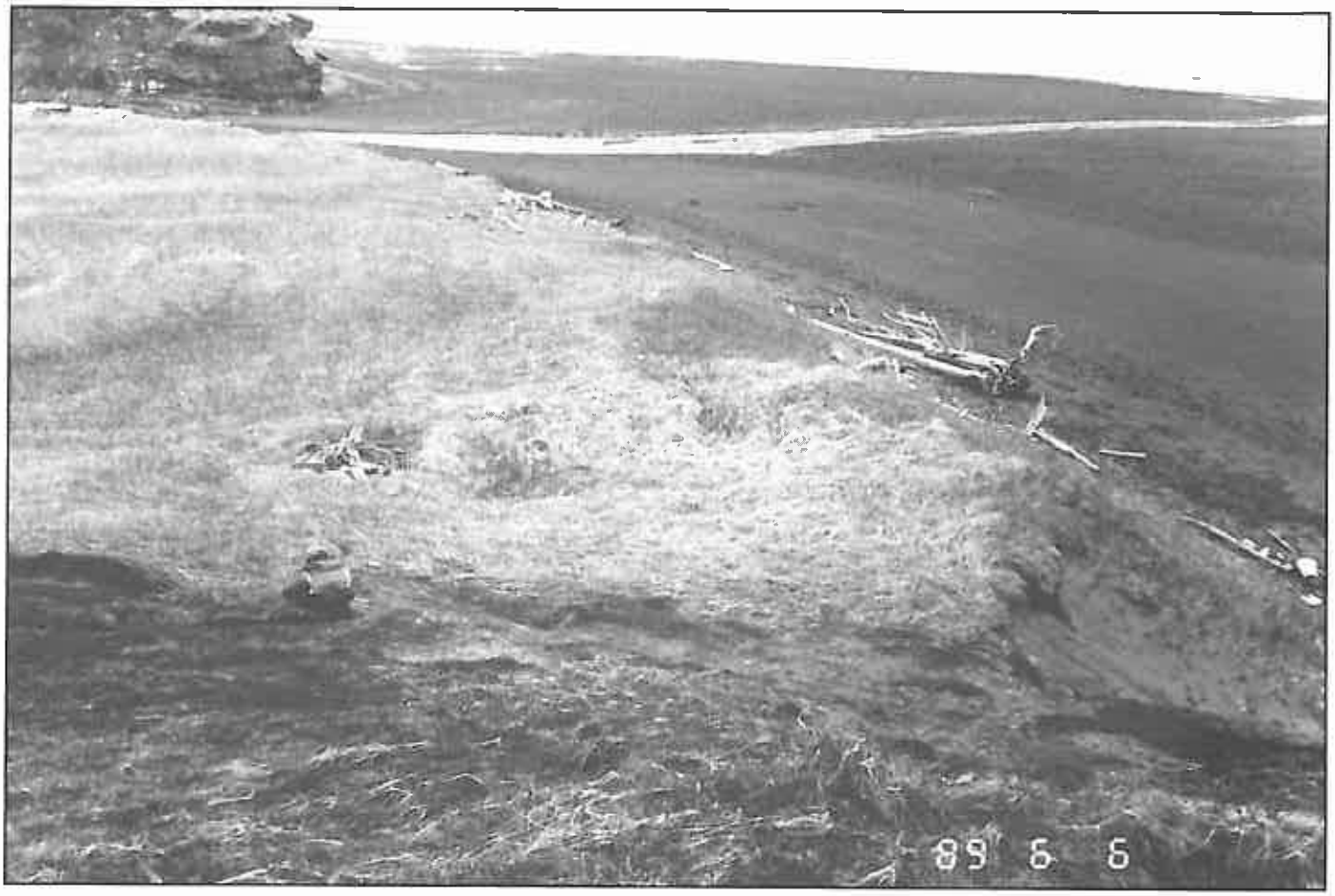
Economy and Settlement Pattern

Analyses of the Uyak Site fauna were confined to species lists, and only the bird remains were differentiated between upper and lower levels (Heizer 1956, Kellog 1936; Friedman 1934, 1935). Over 30 bird species (mostly sea birds and ducks) are reported for the lower levels. Many marine mammals are present, including small whales and porpoises, and modified bones from large whales. All Kodiak's endemic land fauna are also present: bear, river otter, fox, beaver, weasel, and mouse. Caribou, walrus, and black-tailed deer bones are imports from the mainland. An incomplete list of mollusks includes about a dozen species (Heizer 1956:28), and photographs of the midden (Heizer 1956:Plates 3-5) indicate that both the upper and lower levels contained thick shell lenses. No data on fish remains are provided. Amorosi's (1987, 1988) study of small samples from Uyak Bay indicate that Kachemak subsistence patterns around the bay were similar to those at the Uyak Site, reflecting the local abundance of resources.

D. Clark (1974a) provides a quantitative analysis of Kachemak mammal bone from the Old Kiavik, Crag Point, and Three Saints Bay sites. Harbor seal bones were most common, and other taxa include fur seal, sea lion, sea otter, porpoise, whale, river otter, fox, brown bear, artiodactyl (caribou, sheep, or mountain goat), and dog. Fox bones are unusually abundant, and Clark suggests their possible importance for fur, ceremonial purposes, or as pets (fox bones were often found in children's burials in the lower levels at the Uyak Site). Caribou antlers and possible remains from other artiodactyls are imports from the Alaska Peninsula.

Faunal remains from the Layer 10 housepit at KAR-031 (Jordan and Knecht 1988, Amorosi 1987) reflect the specialized fishing economy of prehistoric Karluk River settlements. The Karluk River and lake system supports the largest annual runs of salmon (five species) on Kodiak, but the coastal habitat at the river mouth is a relatively poor area for birds and sea mammals. Most (84%) of the 3900 Kachemak faunal elements were fish (salmon and cod); the remainder were pinniped, whale, porpoise, bird, bear, dog, and mollusks.

The combined data from the Karluk and Uyak Bay drainages provide the most detailed picture of prehistoric site distribution, resource distribution, and subsistence practices available for the Kachemak Period (Jordan and Knecht 1988:231-232 & Figure 2). Of 41 known Kachemak sites in this area, 12 are large villages with 10 or more surface housepits and/or at least one meter (5 ft) of midden deposits. (See Figure 26.) Large and small sites are distributed along the length of the Karluk, and at Uyak Bay are concentrated in outer and mid-bay locations where resource abundance is highest. Average Kachemak site density around Uyak Bay is about one site per ten kilometers. No sites have yet been found on the unprotected high energy coasts outside of the Uyak/Spiridon Bay system (Jordan and Knecht 1988:Figure 2). Kachemak site distributions throughout the Kodiak area suggest that site patterning using the Karluk-Uyak Bay area as a model may be projected for the entire coast. Analogy to the



Mike Yarborough 6:3, Exxon

Figure 26. Surface depressions at KAR-117 on the Alaska Peninsula, representing several different house-pits, possibly of different ages.

ethnographic Koniag suggests that large Kachemak sites are "winter" villages occupied year-round by at least part of the population. Smaller sites may represent spring, summer, or fall dispersals of family groups to hunting, fishing, or gathering locales. Ethnographic analogy suggests that winter was a time of intense ceremonial activity and feasting on stored food supplies. Support for this model of the seasonal round lies in the fact that Koniag settlements (though more numerous) exhibit the same locational patterning as Kachemak sites.

It is not known if the large inland Karluk River sites were occupied year-round or only during summer and early fall salmon runs. Nor is it known whether contrasting resource zones (such as Karluk and Uyak Bay) were exploited as part of the same seasonal round, or whether resident populations in each zone remained in place, perhaps exchanging surplus commodities via trade and ceremony. The currently held scenario follows a "Northwest Coast model," emphasizing local group territoriality in resource exploitation combined with a high level of kinship-regulated social and economic relations across inter-group boundaries. Some combination of seasonal movements and trade is most likely.

Prehistoric Koniag
900 B.P. - A.D. 1741

The Koniag tradition links the prehistoric past to the living culture recorded by 18th century Russian and European observers (D. Clark 1988a). Though archaeological components post-dating the arrival of the Russians are present at several sites discussed in this section, their contents are reserved for later discussion.

One of the central questions of Kodiak Island archaeology since Hrdlicka's work in the 1930s has been the nature of the Kachemak-Koniag transition or "Koniag ethnogenesis" (D. Clark 1974a:170). Though many cultural traits continue with relatively little change across the Kachemak-Koniag boundary, also evident are: shifting projectile point and harpoon head styles, increased use of ceramics and sweatbathing, adoption of new tools like the splitting adze, alteration in house form and size, radical changes in the content and media of ritual and artistic expression, simplification of mortuary practices, and possible changes in physical traits including cranial morphology. The timing, interdependency, and causes of these changes have been interpreted differently. To Hrdlicka (1944:433), the Koniags were migrants or invaders from southern Alaska, a broader-headed "simpler, cruder people"

who suddenly and completely displaced the Kachemak population. To D. Clark (1974a, 1984a), the Koniag horizon marks a complex "reworking" of Kachemak culture, caused by a combination of cultural diffusion and migration from Cook Inlet, Prince William Sound, and the Alaska Peninsula. Dumond (1977) advocates the importance of Bering Sea Neoeskimo influences on the late prehistoric populations of Kodiak Island and the Alaska Peninsula, pointing out that contemporaneous archaeological cultures in both areas look virtually identical. Jordan and Knecht (1988:274) see the Kachemak-Koniag transition as a process of culture change in place, to which outside people and influences made minor contributions. They argue that cultural unity of late prehistoric Kodiak and adjacent mainland areas resulted from northward diffusion from Kodiak, the most populous and culturally dynamic society in the region.

Hrdlicka's (1944) Kodiak survey documented numerous Koniag sites, and his excavations in the Koniag level at the Uyak Site produced over 3000 artifacts (Heizer 1956:Table 29) and human skeletal remains (Heizer 1956:Table 3). Abrupt changes in artifacts and skull shape at the Uyak Site may support Hrdlicka's theory of Koniag-Kachemak population replacement, but his excavation techniques and analytical biases may have prejudiced his results (D. Clark 1974a:175). The upper level of the Uyak Site has not been C-14 dated, but appears to include early Koniag through late pre-contact material.

Along with descriptions of the Uyak collection, Heizer (1956) published articles on Koniag poisoned dart whaling (1943), Cape Alitak petroglyphs (1947) (Figure 27), Koniag ceramics (1948-1949), incised figurine tablets (1951), and ethnographic materials (1952). Other papers on ethnographic Pacific Eskimo collections (Pinart 1872, Birket-Smith 1941, Fitzhugh and Crowell 1988) provide a basis for functional interpretation of many late prehistoric artifacts. D. Clark's work on the prehistoric Koniag has resulted in the publication of excavations at KAR-009 (D. Clark 1956), KOD-101 and KOD-099 in the Old Harbor area (D. Clark 1966a, 1966b, 1974a; McHugh 1962), KOD-043, KOD-026, and other sites near the town of Kodiak (D. Clark 1974b), and investigaitons of Koniag habitation sites and petroglyphs on Afognak Island (W. Workman and D. Clark 1979, D. Clark 1970b). The two Old Harbor sites, both occupied from about 400 B.P. until the early 1800s, produced about 4300 artifacts including 1300 ceramic sherds (Clark 1974a:52).

D. Clark distinguishes between "ceramic Koniag" (western Kodiak) and "aceramic Koniag" (eastern Kodiak), as contemporary facies of the same culture. Clark's aceramic eastern Kodiak sites are thought to be partly contemporary with KOD-099 and KOD-101, but to include older deposits that extend into the early Koniag phase (D. Clark 1974b:49). The collections from his aceramic sites (985 specimens) include a high proportion of incised slate pebbles (an early Koniag phase marker). Clark's (1974a) synthesis of Koniag origins and development was compiled without access to well-defined early Koniag assemblages which could throw light on the relationship with Kachemak occupation.

A large site (KAR-001) was tested by Milan (1974), who recovered a wooden Koniag figurine and other objects



Richard Knecht 4:22, Exxon

Figure 27. Petroglyphs on shoreline bedrock outcrops at Cape Alitak, XTI-018.

indicating exceptional organic preservation. The 1983 - 1987 excavations at the site (Jordan 1987, Jordan and Knecht 1988) uncovered 10 superimposed Koniag house floors and produced over 10,000 artifacts. KAR-001 is a "wet site," where wood, twined root basketry, grass, baleen, and hair have been preserved by constant water saturation. The deep, well-stratified midden allowed definition of three Koniag phases, including transitional and early periods poorly represented in Clark's material. The upper seven house floors belonged to a "late Koniag" phase multi-room structure that was rebuilt repeatedly during the last 100 to 150 years prior to Russian contact. These upper floors produced numerous ornaments (especially wooden labrets) and carved ceremonial objects (masks, maskettes, figurines and zoomorphic carvings, and drum handles), as well as examples of ethnographically known tools, weapons, armor, and containers. Late Koniag burials from the site are discussed by Utermohle (1988).

Underlying this series of occupation levels were two "early Koniag" house floors, the uppermost dated to 480 + 80 B.P. Ornaments and ceremonial objects were also abundant in these strata, especially slate pebbles incised with images of elaborately dressed and ornamented human figures and faces. A basal midden and

floor (740 + 80 B.P.) produced a transitional Kachemak-Koniag assemblage with few ornaments or ceremonial pieces, no incised pebbles, and a Kachemak-type single room structure. The KAR-001 research suggests that Koniag culture may have developed directly from Kachemak, propelled by social, religious, and demographic trends that culminated in the complex Koniag society present at Russian contact (Jordan 1988b).

Artifacts

A progressive reduction in the importance of chipped stone tools during the Kachemak tradition continues into the Koniag Period. Flaked slate bifaces and scrapers are common, but chipped chert bifaces and stemmed points are rare. Transitional and early Koniag ground slate points include types mentioned earlier for the late Kachemak tradition, including small lanceolates, barbed points with medial ridges, and Three Saints Bay style points (Jordan and Knecht 1988:Figure 16, D. Clark 1974a:Plate 17t-y). In the early Koniag phase, triangular endblades with basal facets appear (Jordan and Knecht 1988:Plate 18m, D. Clark 1974a:Plate 16a-h, Heizer 1956:Plate 44m-o), followed in late and post-contact Koniag times by triangular endblades with hollow-ground facets (D. Clark 1974a:Plate 16m-p). Other Koniag ground slate implements include tanged and untanged ulus, often with drilled holes for lashing on wooden handles; double-edged, pointed slate knives with broad stems (D. Clark 1974a:Plate 37, Jordan and Knecht 1988:Figure 24f); and occasional ground slate rods (Jordan and Knecht 1988:Plate 24m).

Like Kachemak examples, Koniag planing adzes were flaked and ground from greenstone. They tend to be longer (up to 20 cm (8 in)) and heavier, however, and were mounted on wooden hafts (Jordan and Knecht 1988:Figure 21q). A new form appearing during the late Koniag phase is the heavy grooved "splitting adze," usually pecked and ground from graywacke (Jordan and Knecht 1988:Figure 24i, D. Clark 1974a:Plate 31i-k). This style appears to have spread from the Northwest Coast area (D. Clark 1974a:92), and its adoption may be related to the heavier construction tasks involved in building large, multi-roomed late Koniag dwellings.

Notched pebble sinkers are much less frequent in Koniag than in Kachemak sites. Notched and grooved cobble sinkers may be functional replacements for pebble sinkers, or may indicate a new emphasis on the use of large-mesh nets to capture seals or sea otters. V-shaped salmon weirs (Jordan 1987:4) and compound salmon spear tips suggest a shift in emphasis from salmon netting to spear harvesting.

Pecked stone oil lamps were rarely decorated during Koniag times. The larger, more formal lamps are oval to subrectangular, and have wide flat rims and distinct wick shelves (Heizer 1956:Plate 26c, D. Clark 1974a:Plate 43d,e). Other Koniag stone tools include hammerstones, stone saws (used on bone and sometimes slate), boulder flakes (multi-functional cutting and scraping tools), ulu-shaped and U-notched scrapers, burnishing stones, and quartz crystal drill bits or engravers (D. Clark 1974a:95).

Overall, the Koniag stone tool inventory was less diverse than Kachemak. Percussion flaking was rare, slate points and knives were stylistically uniform and undecorated, and the more labor-intensive pecked stone implements (such as decorated oil lamps and grooved mauls) were no longer made. Few stone labrets were made during Koniag times, though wood labrets were common. This reduction in lithic artifact types, and a similar trend toward reduction in the complexity and artistry of carved bone artifacts, lay behind Hrdlicka's characterization of Koniag culture as "simpler" and "cruder" than Kachemak. However, the engraved slate pebbles, produced in considerable numbers and variety during the early Koniag, run counter to this trend (Heizer 1951, D. Clark 1964, Reinhardt 1981), and suggest instead a shift in emphasis. (See *Artifact Descriptions* appendix, artifacts 49AFG-026-1 and 49AFG-028-2.) There are strong resemblances between figurative pebble art and petroglyph designs at Cape Alitak (Heizer 1947) and the Afognak River area (D. Clark 1970b, W. Workman and D. Clark 1979), leading to the attribution of this art to the Koniag.

Koniag pottery is thick-walled and undecorated, with sand and gravel temper (Heizer 1948-9). The dominant vessel form is a large storage jar with a cylindrical upper wall and a conical base (D. Clark 1974a: Plate 5).

A laterally-barbed harpoon type dominates the bone tool assemblages in all known Koniag assemblages. This form has widely-spaced slender barbs and a wedge-shaped base with offset linehole (D. Clark 1974a:Plate 18c-f, m-o). Toggling harpoon heads are found in small numbers, most often with bilateral spurs (D. Clark 1974a: Plate 18a,b,p-r); none are slotted for endblades. A distinctive Kodiak Island version, probably used for spearing salmon, first appears in the transitional Koniag level at KAR-001 and continues into the Historic Period (Heizer 1956:Figures 41 & 42, Jordan and Knecht 1988:Figure 16b-d, D. Clark 1974b:Plate 21k). These composite harpoon heads were the most common weapons recovered from all levels at KAR-001.

Other Koniag bone weapon parts include foreshafts, socketpieces, finger rests, barbed and unbarbed arrowpoints (a few with endblade slots), and fish or bird spear prongs. One massive, barbed dart head fragment with a distal point bed, found at Rolling Bay (D. Clark 1974a:Plate 18l), resembles possible whaling darts from the Kachemak levels at the Uyak Site. The long, slate bayonet points used by Historic Period Koniag whalers are so far unknown in prehistoric Koniag levels. Composite fish hooks were made from both bone and wood (curved bone barbs without proximal lashing grooves are a diagnostic Koniag type). Occasional bone fish lures or amulets similar to Kachemak examples are also found (Jordan and Knecht 1988:Plate 23v).

Among household tools and containers, bone implements include wedges, whale vertebrae plates and bowls, awls, needles, spoons, ivory box or quiver lids (Jordan and Knecht 1988:Figure 20a), whale rib digging sticks, and rodent incisor "crooked knives." Bone, ivory, and teeth were occasionally made into labrets and tube beads, carvings or amulets (Jordan and Knecht 1988:Figure 28k), and "gaming pieces" (at Karluk), but little of the rich

Kachemak bone-carving tradition continued into the Koniag phase.

However, the large sample of wood artifacts from KAR-001 demonstrates Koniag carving skills and artistry in an alternative medium. KAR-001 has produced wooden dart shafts, throwing boards, bow parts, arrows, wound plugs, foreshafts, boat parts, and net gauges (Jordan and Knecht 1988:Figures 16-32). Armor rods and slats and wooden shield components testify to prehistoric warfare, which continued on in the historic period with enemies on the Aleutians, Alaska Peninsula, and Prince William Sound.

Household implements include ulu handles, bent and scarfed wooden boxes, wedges, scoops, engraving tool handles, fire drills, and twined basketry made of both split roots and baleen. Several ulu handles depict seals, and a bag handle is decorated with carved puffins (Jordan and Knecht 1988:Figure 30d). Wooden tally sticks and disks for a tossing game, as well as toy-like miniature versions of adult tools, weapons, and kayaks, indicate Koniag pastimes.

Dance masks used at winter feasts, shamanistic figurines, and labrets carved of wood, stone, and ivory (ethnographically worn as a display of rank) are found with increasing frequency through time at KAR-001. Jordan and Knecht attribute these trends to an intensification of ceremonial life, amid increasing complexity of the social and political environment. Masks and tiny maskettes represent a series of distinctive zoomorphic visages similar to ethnographic masks collected on Kodiak (Fitzhugh and Crowell 1988: Figures 368 & 441). Painted mask bangles, drum handles, and puffin beak rattles suggest masked ceremonial dances like those witnessed in the early historic era (Davydov 1977; Merck 1980). Anthromorphic wooden figurines, some depicted wearing labrets, are dolls or charm figures used by shamans. One figurine represents a woman in labor, her head inset with plugs of human hair (Crowell 1988b:Figure 165). Others suggest dual human and avian beings (Jordan and Knecht 1988:Figure 31).

Structures and Features

The ethnographic Koniag house, or *barabara*, is described in a number of early sources summarized in Hrdlicka (1944) and D. Clark (1984b). The large, square or rectangular main room (up to 8 meters (25 ft) on a side) was excavated to a depth of 1/2 meter (1.6 ft) or more. A log framework was erected over the hole and covered with boards, sod, and mud. The interior of the main room, which was used as a kitchen and multi-purpose activity area, had plank walls and flooring. Smoke from a central heating and cooking hearth exited through a roof hole. Up to three smaller side rooms, used for storage, sleeping, and sweatbathing, were attached to the main chamber by low tunnels. Side rooms were sometimes used for burials, after which they were sealed and collapsed. Unlike late prehistoric houses on the Alaska Peninsula, no entrance tunnels are present. According to Lisianskii (1814:193), Koniag households were extended kin groups that averaged about 18 persons. Based on 107 late prehistoric Koniag housepits at KAR-022 and KAR-046, Jordan and Knecht (1988:234) estimate an average interior space of 79m^2 (834 sq ft), about three times larger than Kachemak houses. Koniag houses are also more variable in size and configuration.

Excavations at Karluk indicate that large, multi-room houses appear during the early Koniag phase at about 500 B.P. The upper sequence of late Koniag housefloors suggests that rebuilding took place about once per generation. Interior features of the Karluk houses include wood-lined sunken storage boxes and covered sub-floor drainage ditches. No clay-lined pits were found at Karluk, though some are reported from the Koniag level at the Uyak Site (Heizer 1956:30). Floor deposits were packed organic layers containing wood chips, bone refuse, and abundant artifacts. Stone boxes made from flat slabs are a common Koniag feature type here and at other sites (D. Clark 1974a:153-158).

Ethnographic and archaeological data indicate that Koniag burials were usually simple flexed inhumations in board, rock, and/or whalebone-covered coffins (Heizer 1956:12-17, D. Clark 1974a:143-153, Utermohle 1988). Burials were usually placed in the village, often accompanied by hunting tools, beads, or other offerings. Other mortuary practices included burial in side rooms of houses, in abandoned housepits, surface deposition away from the village, secondary bundle burial, cremation, and rockshelter burial. The latter is associated with mummification and the ritual use of corpses in Koniag whaling magic (Pinart 1873). Burials in rockshelters have not been described archaeologically on Kodiak. Disarticulated skeletons and ritually-treated bones, so common during the late Kachemak phase, are rare during the Koniag Period.

Koniag middens usually contain large amounts of shell, well-preserved bone, the occasional preserved wooden beam, and thick lenses of burnt and shattered beach cobbles or slate (Figure 28). Koniag middens accumulated rapidly because of the large amounts of bulky rock and shell that were generated, and Koniag layers at some sites are up to five meters (17 ft) thick. At Karluk, the bulk of the midden matrix is composed of sod and wood chips.

Economy and Settlement Pattern

Koniag subsistence has been reconstructed with archaeological and ethnographic data. Faunal samples suggest that the prehistoric Koniags dined on virtually the same menu of fish, birds, sea mammals, and shellfish as their Kachemak predecessors (D. Clark 1974a, Amorosi 1988). Clark's analysis of mammal bone from Koniag levels at KOD-005, KOD-099, and KOD-101 demonstrates continuity with Kachemak harvesting patterns, except for fur seals, which were taken in very high numbers between about A.D. 1650 - 1800 (D. Clark 1974a, 1986). Intensive fur seal harvesting began well before Russian contact, and Clark believes it was caused by a shift in fur seal migration or feeding patterns that brought the seals closer to the coast.

As during the Kachemak Period, regional variations in subsistence are evident. Amorosi's analysis of faunal samples from KAR-001 housefloors and midden



Christopher Donta 6:28. Exxon

Figure 28. Shell eroding from a midden deposit into the intertidal zone at KOD-223, in the Kodiak area.

layers shows a strong predominance of fish (both salmon and pelagic species, especially cod), with low percentages of shellfish and bones of sea mammals and birds. Faunal remains from Koniag sites up the Karluk River will presumably consist largely of salmon. A different economy is evident in productive marine embayments such as Uyak Bay and Sitkalidik Strait, where faunal assemblages from both large and small sites are dominated by marine mammals (including whales), sea birds, pelagic fish, and shellfish (Amorosi 1988, D. Clark 1974a).

Hunting for marine mammals, including harbor seals, sea lions, porpoises, dolphins, sea otters, and whales, took place during April through July, and whaling would sometimes continue into August (Holmberg 1985:48). Fur seals passing along the east coast of Kodiak during their annual migration to the Pribilof Islands were hunted as early as February (Merck 1980:105). Bird eggs and young birds from sea bird rookeries were collected during March through June. Halibut and other pelagic species such as cod were caught before salmon were running (Sauer 1802:178). Plant foods like berries and Kamchatka lily bulbs could be harvested as summer progressed. The pursuit of these spring and summer subsistence activities caused much of the Koniag population to disperse from winter villages to scattered camps and small settlements along the coast.

The shift in primary activities from sea hunting to salmon fishing occurred during late June and July, as the most important salmon species (sockeye and pink salmon) began to run up the rivers in large numbers. Koniag salmon fishing was done at weirs with spears and fish harpoons, and it was possible to harvest huge quantities of fish at prime locations. Important spawning rivers like the Karluk, Ayakulik, and Afognak may have been exploited annually by groups whose winter settlements were quite distant. Major seasonal population aggregations along the Karluk are suggested by the hundreds of large Koniag housepits which line its banks (Jordan 1983, Jordan and Knecht 1988), and a similar settlement concentration is evident for the lower Afognak River (W. Workman and D. Clark 1979). Scores of minor salmon streams also attracted summer or fall settlement in proportion to the size of their salmon runs.

Salmon were split and dried or smoked to preserve them for winter use. At the end of the salmon season (October), the Koniags reoccupied their winter dwellings, and activities focused on social events and ceremonies. Shellfish and other marine invertebrates could be harvested at winter sites if stocks of fish, berries, and sea mammal oil ran low.

D. Clark (1987) provides a locational analysis of 32 Koniag winter villages known on Kodiak in 1805, when

they were mapped (and many visited) by Lisianski. All were in coastal settings, usually adjacent to the protected waters of small coves or lagoons. Proximity to salmon resources was not crucial in the selection of winter village sites; only four were near major salmon rivers. Rather, selection seems to have been based on proximity to winter and early spring resources (including shellfish beds, sea bird rookeries, and sea mammal concentrations), and the avoidance of inner bay areas which freeze during the winter. Most winter villages (21, or 66%) were located in the outer portions of bays and straits; 3 (9%) in the inner third of bays and straits; and 8 (25%) on outer coasts, including headlands and off-shore islands. Along with habitation sites, Koniag site types include fish weirs, petroglyphs, rockshelter burials, and "fortress" sites. The latter were defensive refuges on high, steep-sided islands or sea-stacks, usually near large villages. Up to several housepits are often found in such locations, but middens are thin or absent.

Archaeological Sites of the Historic Period

Many Russian Period, American Period, and historic Koniag sites are recorded on the AHRS, though relatively little research has been carried out at such sites. Clark and Workman reported on limited excavations at historic Koniag villages on Kodiak, Afognak, and Chirikoff islands (D. Clark 1974a, 1974b, 1987; W. Workman 1966; W. Workman and D. Clark 1979) and at Three Saints Bay (D. Clark 1970a, 1985, 1989). Knecht excavated an 1840s Koniag house at the resettlement village of Nunakakhnak, near Karluk (Knecht 1985, Knecht and Jordan 1985), and the Russian post at Karluk has been mapped (Jordan 1983). Excavations were also carried out at KOD-011, a Russian brick kiln site at Middle Bay dating to 1828 (Dilliplane 1980, 1981; Reger 1982). Excavations at the 18th century Erskine House in Kodiak also yielded Russian era artifacts (L. Yarborough 1977, Shinkwin and Andrews 1979).

In early post-contact assemblages, beads replace labrets as favored facial ornaments, but metal objects only partially replace traditional stone tools. Fragments of glass and imported ceramics also indicate trade. Firearms were rare, reflecting the initial reluctance of the Russians to supply arms to the recently subjugated Koniags. Traditional flexed burial is replaced by Christian extended interment in coffins. By the 1840s, the Koniags had access to muskets and a considerably expanded trade inventory, including English transfer wares and numerous iron tools, though ground slate ulus continued to be used (Knecht and Jordan 1985). American Period sites on Kodiak include abandoned Native villages, canneries, the Port Hobron whaling station, a fish hatchery and counting station on the Karluk River, the salt works at Saltery Cove, the ice works at Woody Island, fishing cabins, fox farms, cattle ranches, cemeteries, churches, and World War II military constructions such as Fort Abercrombie.

Prehistory of the Alaska Peninsula's Pacific Coast

Few sites are known for the Pacific coast of the Alaska Peninsula, and comparatively little research has been carried out there. A cultural sequence for the area was constructed by G. Clark (1977). Comparison of Clark's data with the work of Dumond (1981) and Henn (1978) on the Bristol Bay side suggests that the peninsula was a fluid border zone between the Pacific and Bering Sea cultural provinces.

Research History

Sources for the history and ethnography of the upper Alaska Peninsula are basically the same as for Kodiak (see Hussey's 1971 summary of the history of Katmai National Monument), but the Alaska Peninsula has received much less archaeological attention. Minor survey and excavation projects by Heizer (Hrdlicka 1944:131-133), Davis (1954), and Oswalt (1955) took place at Pacific coast sites in the Katmai area. These were followed by more extensive work by University of Oregon teams focusing on coastal and inland areas of the Katmai National Monument and the interior Ugashik area (Dumond 1981). University of Oregon teams have studied prehistoric ethnic boundaries and cultural history in the Naknek drainage (Cressman and Dumond 1962; Dumond 1964a, 1964b, 1965a, 1971, 1974b, 1981), Ugashik drainage (Henn 1978), and Amalik and Kukak bays on the Pacific coast (G. Clark 1977). Dumond (1972, 1974a, 1975, 1988b) also has produced a series of summaries of Alaska Peninsula prehistory. McCartney (1973, 1974) also made brief notes for the USFWS on sites from Cape Douglas to False Pass. Just beyond the geographic coverage of the present report is the Chignik River region, surveyed by Dumond (1983).

Unpublished reports are available for interior sites (Dumond 1988a, Shields 1984, 1988; Harritt 1988, M. Yarborough 1983), but little recent work has been done on the Pacific coast. Several new sites were recorded by Dumond (1987) as part of a study of resource distribution and site location for the USFWS. Prior to 1989, only 36 AHRS sites (22 prehistoric; 14 historic, some with prehistoric components) were recorded along the coast from Cape Douglas to Sutwik Island.

Paleoarctic

No coastal Paleoarctic sites have been identified on the Alaska Peninsula, though three interior sites are known from the Bristol Bay side. These include the 9000-year-old Ugashik Narrows Site (Henn 1978:13), the 8000-year-old Koggiung Site (Dumond 1981:103), and an undated microblade site (Igiugig) at Lake Iliamna (Dixon and Johnson 1971). At Ugashik Narrows, three radiocarbon dates suggest a Paleoarctic occupation between 9000 and 7500 B.P. Tools include microblades, wedge-shaped

microblade cores, blades, blade cores, flake cores, transverse burins made on flakes, endscrapers made on blades, and basally-thinned bifacial projectile points. No hearths or other features were found, and bone is not preserved. Caribou hunting was inferred from the artifact assemblage and current resource distributions.

Koggiung is located near the mouth of the Kvichak River at the head of Bristol Bay (Dumond 1981:103). Several hearths and associated lithic scatters appear to mark temporary camps on a dune top, possibly a hunting look-out station. Three C-14 dates on hearth charcoal range from 7900 to 7500 B.P. and are consistent with the Paleoarctic cast of the small artifact assemblage: blades and blade cores, large flake scrapers, a single small end and side-scraper, and a single biface tip. These Paleoarctic sites suggest that much of the Alaska Peninsula was settled as early as 9000 B.P.

The Prehistoric Sequence

Takli Alder
6000 - 4500 B.P.

The Takli Alder phase, roughly contemporaneous and broadly similar to Ocean Bay I assemblages on Kodiak, was defined by G. Clark (1977) from basal components at the Takli Site, the Hook Point Site, and the Kukak Isolated House Pit Site (G. Clark 1969a,b). At each, Alder levels were overlain by Birch phase deposits (see below). Radiocarbon dates bracketing the Alder phase are 4100 + 160 (upper) at Takli and 5650 + 115 and 5830 + 120 (lower) at Kukak. Other probable Takli Alder components are found at XMK-019 and XMK-030 in Kukak Bay (G. Clark 1977:83-84).

Artifacts

Clark's three Alder components yielded 746 stone and bone artifacts. The small sample may explain the absence of some types (such as pecked stone oil lamps) found in contemporary Kodiak sites or the later Birch phase. There is sufficient diversity of functional categories to support Clark's impression that his trenches sampled domestic dwelling and midden contexts rather than special-use areas. The dominance of chipped stone artifacts and the absence of ground slate tools are the definitive attributes of Alder components. A variety of stemmed and stemless points are present, including both large and small forms. One or more stemmed types were probably inserted into open-bedded, barbed, bone harpoon heads. Lanceolate or ovoid bifaces are also found, some symmetrical forms possibly being lance blades, while others were probably hafted knives. Informal flake tools (struck from discoidal flake cores) are common, supplemented by large "boat-shaped" core scrapers. No microblades or cores were found in Clark's excavated samples, though they occur elsewhere on the peninsula (G. Clark 1977:78).

A few stone awls and drills were found by Clark, as well as a single dihedral flake burin. Alder phase adzes have steeply beveled bits with cutting edges slightly curved in end-view. The lithic industry is completed by a few hammerstones and assorted whetstones and abraders, mostly tabular in form. G. Clark (1977:Plate 2:21) also illustrates a small, chipped stone fish or killer whale effigy.

The few bone tools recovered from the Alder levels include projectile heads, awls, and wedges. The bone projectile points are barbed rather than toggling types; no foreshafts were recovered. One point (G. Clark 1977:Plate 2:17) is unique to the Alder phase, with an open bed at the tip for a stone endblade and a small diamond-shaped projection to hold the stem lashing. It also has sharp basal barbs similar to Birch phase slate endblades.

Close comparisons may be drawn between Takli Alder and Ocean Bay I assemblages from the Kodiak Archipelago. Virtually all of the bifacial chipped stone forms in Takli Alder are present in D. Clark's (1979) Ocean Bay I assemblages, including stemmed points with sloping and squared shoulders, bipoints, and lanceolate knives. The two phases are similar enough to suggest close cultural ties and regular communication across Shelikoff Strait (D. Clark 1984a, Workman 1980b). Differences in the samples include a minor slate sawing and chipping industry on Kodiak, and edge-polished adzes on the Alaska Peninsula. Remnant microblade industries in both areas suggest possible technological roots extending back to Paleoarctic times.

In contrast, contemporary assemblages from the Bristol Bay side of the peninsula show few resemblances. Northern Archaic manifestations have been identified as the Ugashik Knoll phase (Henn 1978) and the Graveyard phase (Dumond 1981). Both are dominated by chipped side-notched points -- a diagnostic Northern Archaic element linking them to contemporary sites of the Alaskan Interior and coastal zone (D. Anderson 1984, Ackerman 1964).

Structures and Features

Structure and feature data from the Alder phase are scanty. A post mold pattern at Hook Point suggests a possible oval or round dwelling roughly eight meters (30 ft) in diameter, similar to Ocean Bay I dwellings on Kodiak. Alder middens are typically thin, with low fire-cracked rock and shell content. Distinctive features are lenses of red and yellow ocher similar to Ocean Bay I deposits on Kodiak. G. Clark suggested a geological origin for these, an explanation that no longer seems tenable, since the Kodiak examples are associated with house floors and other cultural features (Jordan and Knecht 1985).

Economy and Settlement Pattern

Because the number of known sites is small, Takli Alder settlement patterns are poorly understood. All known sites on the peninsula are five meters (17 ft) or more above current sea level. G. Clark attributes this to a selection for elevated landforms (for ocean viewing and insect avoidance), but changes in relative sea level also could account for this pattern. If so, undiscovered sites

may exist on raised terraces back from the beach, not readily identifiable by survey focused on the shore.

Faunal remains from the Alder levels at Takli include sea otter, seal, sea lion, and porpoise, with minor numbers of land mammals (caribou or moose, bear, and canid; see Grayson 1977, Dumond 1977b). Fish remains include halibut and flounder, while birds include cormorant, murre, goose, albatross, and lesser amounts of loon, fulmar, scoter, eagle, gull, and auk. Shellfish remains apparently were not identified. Dumond (1977b) concluded that Alder groups probably occupied the coast during summer, possibly moving inland to hunt caribou in the winter.

Takli Birch
4500 - 2800 B.P.

The Takli Birch phase was defined by G. Clark from cultural strata overlying Alder levels at Takli, Hook Point, and the Kukak housepit. The upper charcoal date for the Alder phase at the Takli Site (4110 + 160 B.P.) also estimates the beginning of the Birch phase (4500 B.P.) Terminal Birch dates at Takli are 2910 + 105 and 2810 + 100. Except for the Kukak Site, Birch components lack red ocher. Survey data suggest that Birch components may be present at several other sites in the Kukak Bay area (G. Clark 1977:83-84). Survey collections of about 300 artifacts were made at these sites (G. Clark 1977: Table 21), but most are assignable to later phases. The lower levels at the Kaflia Site also are identified as Birch phase, based on typological comparisons (Oswalt 1955, G. Clark 1977:83).

Artifacts

A variety of ground slate points and knives appears in the Birch phase. Chipped stone tools become relatively less important, ratios of chipped to ground stone tools dropping from 59 : 1 in the Alder phase to 1.8 : 1 in the Birch phase (G. Clark 1977). This shift is not accompanied by a decline in the variety of chipped stone tools, however, and almost all Alder forms continue into the Birch phase. Chipped stone forms (varieties of burins, engravers, drills, and scrapers are noted) actually increase in the Birch levels, though this may be explained partly by Clark's increased tool sample (2722 items). Flaked and ground greenstone adzes continue, but straight and gouge-like bits are added. A pecked stone maul, several large notched sinkers, and an undecorated oval oil lamp also were found.

The Birch ground slate industry used the saw, snap, and scrape process described by D. Clark (1979) for Ocean Bay II on Kodiak. Large amounts of sawn slate debris occur in Birch levels, along with numerous cobble spalls and tabular whetstones and abraders probably used for slate tool production. End products of the slate industry included points and endblades ranging from tiny stemmed types to narrow bayonet blades over 20 cm (8 in) long. The small stemmed points may have been hafted on arrow tips, the broad medium-length blades on lances or knives, and the lanceolate bayonets on spears or darts. Long slate blades were used on ethnographic Koniag and Chugach whale darts (Heizer 1943), and D. Clark (1979:221) suggests that Ocean Bay II bayonets may have had the same function. Several slate bayonet types have been also found at inland peninsula sites (Henn 1978, Dumond 1981, Townsend and Townsend 1961), where they may have been used in hunting caribou or other land game. Incised chevrons and parallel lines on some Birch, Ocean Bay II, and interior bayonet blades may have served as "owner's marks" that identified the weapons of individual hunters in solo and communal hunting situations. The use of such marks on hunting weapons is recorded ethnographically for Alaskan Eskimos (E. Nelson 1983), including Pacific Eskimo whalers (Davydov 1977). Various types of ground slate knives also appear in the Birch phase, including tanged ulus, broad-bladed stemmed knives, and end-hafted knives with asymmetric blades. Ethnographic ulus were used for salmon processing and skin scraping, while broad-bladed stemmed knives were "flensing knives" for sea mammal butchering.

Birch phase bone tools from the Takli Site show little change from the Alder phase. Bilaterally-barbed harpoon heads are the leading types, but unilateral forms also continue. Other Birch phase bone tools are awls, wedges, flakers, and hafts.

Artifacts found in excavated sites, hinting at the decorative practices of Birch phase people, include perforated pendants made from bear and sea lion teeth and mammoth ivory, rod-shaped bone and ivory pendants, a cylindrical bone bead, two types of labrets; hat-shaped jet labrets (G. Clark 1977:Plate III:25, V:51,52) and a single jet labret carved in the shape of a large canine (G. Clark 1977:Plate III:26).

Comparison of Alder and Birch phase assemblages suggests that the two periods are a continuous cultural development, punctuated by the adoption of ground slate tool production around 4500 B.P. The limited amount of excavation contributes to the impression that a fully developed slate industry and functionally diverse set of slate tools appeared suddenly as the Birch phase, whereas the actual situation is probably (like Kodiak), a gradual transition to slate tools (D. Clark 1979).

G. Clark (1977:37) sees suggestions of typological changes during the Birch phase, and proposes subdivision into early Birch (4500 - 3500 B.P.) and late Birch (3500 - 2800 B.P.) phases. He places the Hook Point and Kukak components of the tradition into early Birch, while the Takli Site, thought to have been most intensively used around 3000 B.P., is assigned primarily to late Birch. Square shouldered and unshouldered slate bayonets are more common in early Birch components (G. Clark 1977:Table 19), though small sample sizes weaken this conclusion. Ground slate knives increase in number and variety in late Birch, and labrets are confined to the upper level of the Takli Site, indicating their late appearance.

Several sites in the Bristol Bay drainage of the Alaska Peninsula have produced Birch-like slate assemblages. A 4500-year-old component at Lake Iliamna (Townsend and Townsend 1961) produced slate bayonets with barbs, notched stems, and incised decorations (D. Clark 1984a:Table 1). The Brooks River Strand phase

(4500 - 3900 B.P.) defined from a single site on Naknek Lake, produced barbed and stemless slate bayonets, a D-shaped oil lamp, and stemmed points and bifacial knives of chipped stone (Dumond 1981). A red ocher-stained tent floor depression with caribou bone fragments also was excavated at the site. As now defined (Dumond 1981), Brooks River Strand is almost identical to early Birch, and may represent interior hunting by Pacific coast groups (Dumond 1977:60). This interpretation is supported by interior sites containing slate artifacts manufactured by the distinctive saw, snap, and scrape method, yet lacking tool manufacturing debris.

Cultural exchange between coastal Birch populations and Arctic Small Tool groups that moved into the area around 3800 B.P. were minimal (Dumond 1969). Henn (1978:81) stresses the "frontier" nature of Arctic Small Tool cultures on the Alaska Peninsula, however, and the similarities of small contracting stem points in the Ugashik Hilltop and Birch collections. Obvious Pacific traits (such as slate grinding and oil lamp use) are unknown in the interior during the latter part of early Birch and all of the late Birch phase.

Structures and Features

Both the Takli and Hook Point sites produced evidence of Birch phase dwellings. The clearest example, from the lower Birch stratum at Takli, was a line of post molds representing an oval structure about five by seven meters in size (17 x 24 ft) wide (G. Clark 1977:Figure 11). Post mold and rock alignments exposed in test trenches indicated other round or oval structures, with rectangular and round rock-lined hearths, but it is unclear if the hearths were inside or outside the dwellings. Red ocher stains and fire-cracked rock are rare in Birch middens, and shell density may increase slightly over Alder deposits. Birch levels sometimes contain large amounts of flaked and sawn slate debris and tools.

Economy and Settlement Pattern

Current evidence suggests minimal changes in subsistence and settlement between Alder and Birch phases. Faunal remains from Birch levels at the Takli Site include seal, sea otter, sea lion, cormorant, and unidentified birds. Shellfish appear to be more frequent, but this observation was unquantified (G. Clark 1977). No land mammal bones (except marmot) were found, though inland caribou hunting may have been part of the seasonal round.

Cottonwood Phase
1800 - 1500 B.P.

The known cultural sequence for the coastal Alaska Peninsula is broken by a 1000-year gap between the Birch and Cottonwood phases. Moreover, G. Clark's (1977) definition of the Cottonwood phase is based on a small tool sample (552 items) from a single component -- the uppermost stratum at the Hook Point Site. Faunal remains were not preserved, so regional comparisons are limited to chipped and ground stone tools, and to the pottery that first appears in the region at this time.

Sites with probable Cottonwood components (G. Clark 1977:84) are XMK-028, XMK-029, XMK-030, and XMK-020 (Dumond 1971). All four were examined during SCAT survey of the Takli Island Archaeological District. Though no diagnostic tools were observed to confirm Clark's phase attributions, high shell content and excellent bone preservation (including whale bone) were noted at all but Hook Point. Human bone was eroding from XMK-030 (Gleeson 1988). These observations emphasize the inadequacy of Clark's sample for this period and suggest that future research would be productive.

Artifacts

Both chipped and ground stone tools continue to be used during the Cottonwood phase. Several chipped stone knife and projectile types fall into disuse, but the Cottonwood sample is too small to determine if a real reduction in diversity occurs. More importantly, few new types are present, suggesting cultural continuity across the 1000-year gap separating the Birch and Cottonwood phases. The most common Cottonwood types are small stemless arrowpoints and small points with contracting stems. A bifacial knife with a broadly-notched stem (G. Clark 1977: Plate 4:41) is unique for the Peninsula sequence, but it is identical to examples from Layer 10 at KAR-031 directly across Shelikoff Strait (Jordan and Knecht 1988:Figure 9f,g).

Retouched flakes, flake scrapers, flake cores, a few burins and engravers, and cobble spalls complete the chipped stone assemblage. Other items include whetstones, abraders, hammerstones, and flaked and edge-polished adze bits with asymmetric bevels. The meager ground slate projectile sample of five specimens includes barbed and unbarbed varieties. Ulu blades with drilled holes occur for the first time. The Cottonwood layer at Hook Point also produced a prowed and "breasted" oil lamp (G. Clark 1977:Plate VIII:5), a typical Kachemak type (Heizer 1956:Table 8 and Plate 23a).

Cottonwood pottery is a crude, undecorated ware tempered with vegetable fiber and occasional gravel inclusions. A cylinder with a flat bottom and slightly flaring walls is the only vessel form noted. This earliest Pacific coast pottery is identical to Norton wares of contemporary interior Alaska Peninsula groups.

The Cottonwood phase is contemporary to the earlier part of the late Kachemak (Three Saints Bay) phase on Kodiak, dated from 2000 - 1100 B.P. (D. Clark 1966a, 1970a), and with Kachemak III in Cook Inlet. The small size of the Cottonwood sample and the absence of bone artifacts make specific Kachemak comparisons difficult, though similar lamps, lugged knives, and house forms may be noted. The continuing importance of small chipped projectile forms (presumably arrow tips) throughout the Birch, Cottonwood, and Beach phases is a long-term characteristic of peninsula cultures -- probably because more terrestrial mammals are more available there than on

Kodiak, and consequently bow and arrow hunting was more important.

It appears that cultural interchange between Pacific coast and Bering Sea cultures of the Alaska Peninsula continued from the end of the Birch through the Cottonwood phase. The bi-directionality of this interchange is apparent; pottery spread south, while slate grinding diffused northward and gradually assumed an important role in northern lithic assemblages.

Structures and Features

The Cottonwood phase is marked by the adoption of a new and more substantial house type. Four rectangular house depressions were noted by Clark on the surface of the Hook Point Site. Only one of these was tested and can be definitely attributed to the Cottonwood phase, but the others were probably part of the same settlement. The partially excavated house was roughly five by six meters (17 x 20 ft) wide. It contained a large cobble hearth and a scatter of fire-cracked rock -- possibly sweat bath rubble (G. Clark 1977:Figure 16). Large post molds up to 40 cm (16 in) in diameter were recorded, indicating a large log superstructure probably covered with sod. It is not clear if the Hook Point housepits had entrance tunnels like Norton houses on the Bristol Bay coast or lacked them like Kachemak houses on Kodiak.

Economy and Settlement Pattern

There is no direct faunal evidence from the Cottonwood phase, but a maritime focus is evident from site locations, and the permanent construction of the houses suggests greater sedentism. A trend toward larger and more settled coastal populations characterizes the late prehistory of the entire Gulf of Alaska. Existing data are too sparse to characterize Cottonwood settlement patterns and coastal site density, but projections are possible based on analogies to the Kachemak tradition. Coastal site density may have been significantly higher than during Alder and Birch phases, due to population increase and a more intensive and probably year-round maritime subsistence. Most or all components of the seasonal round may be represented along the coast, though not necessarily at the same sites. Site density will vary with geography and resources, with the highest concentrations in complex bay and island systems which combine protected waters with high resource diversity. The open and exposed coast of many parts of the Alaska Peninsula should contain relatively few sites.

Beach Phase
1500 - 1000 B.P.

The Beach phase is contemporary with the late Kachemak (Three Saints Bay) phase on Kodiak and with Kachemak III in Cook Inlet (Figure 18). Data on the Beach phase come primarily from the huge, multi-component Kukak Site, with 89 house depressions spread along a series of parallel beach ridges in Kukak Bay (G. Clark 1977:Figure 10). Beach phase floors seem to be restricted to an elevated area at the southwest end of the site where W. Davis (1954) sampled the later prehistoric components. G. Clark excavated in nine Beach phase houses and one midden area at Kukak during 1964 and 1965. The housepits had been dug into sterile reddish beach sands, and contained up to a meter of cultural fill overlain by 25 to 80 cm (10 - 32 in) of Katmai ash. Separate midden deposits (up to 1.5 m (4.5 ft) thick) were found in only two restricted areas, suggesting secondary disposal practices by the site inhabitants.

Other Beach phase components discussed by G. Clark (1977) are XMK-026 and the upper stratum of the Kukak Isolated Housepit. Oswalt's (1955) test at the Kaflia Site produced several artifacts typical of the Beach phase, though a stratigraphically unmixed assemblage is not available for detailed comparison (G. Clark 1977:83). Possible Beach phase components have been identified at several other sites, including AFG-001 at Cape Chiniak, where there is a thick eroding midden and an adjacent cluster of nine housepits arranged similar to the Kukak Site (G. Clark 1977:84, Dumond 1964a:37-41, 1965a:14). Dumond, however, estimated a basal date of about 900 B.P. (Mound phase) based on ash chronology, and suggested that AFG-001 was initially settled later than XMK-006. Beach components may also be present at XMK-049 in Dakavak Bay, and XMK-029 and XMK-030 in the Takli Island area.

Artifacts

G. Clark's (1977) Beach phase sample included 857 stone and bone artifacts and 171 ceramic shards. Continuity with the Beach-Cottonwood sequence is suggested by many elements of the chipped stone inventory. Almost all new point forms, however, are identical to Brooks River Falls phase types, the contemporary interior Norton culture. These include contracting stem, barbed, contracting base, and concave base forms (Dumond 1981:Plate X). Norton-type asymmetric sideblades, drills, lancets, and polished burin-like tools also appear in the Beach assemblage.

The ground slate assemblage is varied and includes rectangular and oval ulus; double-edge knives (occasionally drilled) with broad, often spatulate blades; single-edge knives; barbed and stemmed points; very slender "needle" points; and ground slate rods. While some specimens are unique (such as the needle points), others have parallels in Kodiak-Kachemak assemblages. These include barbed points with diamond cross sections (D. Clark 1970a:Figure 6q, Jordan and Knecht 1988:Figure 13l); ground slate rods (D. Clark 1970a:Figure 6d,e, Jordan and Knecht 1988:Figure 14k); and spatulate slate knives (D. Clark 1970a: Figure 5k, Jordan and Knecht 1988:Figure 11n), which have parallels in the terminal Kachemak phase. The ratio of chipped to ground slate tools increases to 2.5:1. Other stone tools include adze blades; numerous small, flat notched sinkers; oil lamps (including decorated specimens); large cobble sinkers grooved around the middle; grooved cobble mauls (a

Kachemak type); and informal scrapers, cores, utilized flakes, whetstones, and hammerstones. Beach ceramics are identical to the Cottonwood plain fiber-tempered ware, with cylindrical, flat-bottomed vessel forms.

Bone hunting implements (G. Clark 1977:Plates V and VI) occur in a number of new forms, including bilaterally and laterally-barbed dart heads with wedge-shaped and conical tangs, some with (for the first time) basal line holes; tiny, self-armed, toggling harpoon heads with open sockets (Heizer 1956:Plate 58u,v); short and long harpoon foreshafts; barbed, pencil-like arrow heads, and several types of blunt bird points. G. Clark's (1977:VI-3) Type 8 "projectile points" may be compound fish hook barbs, and a shank was also recovered. Bone wedges, awls, flakers, hafts, bone spoons, and a knife made from a beaver incisor complete the utilitarian bone objects. Personal ornaments include rod-shaped bone pendants with tiny end knobs, cylindrical bone beads, an ivory button, a nail-shaped bone pin, and jet labrets.

Bone projectile points (absent in the Cottonwood sample) are also similar to Kachemak types, including laterally-barbed forms with drilled line holes (G. Clark 1977: Plate VI:5,6; D. Clark 1970a: Figure 7o,q). Large "pulley-like" labrets -- a late Kachemak form found in the lower level of the Uyak Site (Heizer 1956:Plate 79a) and Cook Inlet (de Laguna 1975:Plate 51:34) -- have been found on the peninsula at the Kaflia Site (Oswalt 1955:Plate 7:1) and at XMK-024 and XMK-028 in Amalik Bay (G. Clark 1977:Plate VII). Dumond's early view of coast-interior relationships on the Alaska Peninsula during the Beach phase was stated in his original synthesis of Alaska Peninsula prehistory:

> This phase, dated from A.D. 500 to 1000, is an exact contemporary of the Brooks River Falls phase of the Naknek drainage, and the similarity between the two is so great that one must conclude that people of the Naknek drainage had actually taken up residence on the Pacific coast, at least at the site on Kukak Bay where the bulk of the Beach phase collection was obtained. ... The close relationship at this time between Brooks River and the Pacific coast is still not reflected on Kodiak Island, again suggesting that contact across the Alaska Peninsula did not extend further into the Pacific zone (Dumond 1969a:1111).

The identity of Cottonwood and Falls phase cultures is supported by the similar frequency and forms of chipped stone points and sideblades in assemblages from both phases, and in ceramics, ground slate, oil lamps, polished jet labrets, and large numbers of notched pebble sinkers (Dumond 1981:147). Given the strong evidence of Cottonwood-Beach continuity, and the many similarities between Beach and Kachemak assemblages, it seems likely that this period was a time of increasing Norton-Kachemak interaction, with innovations flowing in both directions (D. Clark 1984a:141, Dumond 1988a:384).

Structures and Features

Beach phase houses excavated by G. Clark (1977:45) at Kukak include a rectangular (6.5 x 7 m (21 x 23 ft)) example with a central cobble hearth and clusters of large post molds in the corners of the dwelling. There was no evidence of an entrance passage or side chambers. The house may have been covered with planks and sod except for a central smoke hole. G. Clark tentatively identifies this as a *kashim* (men's ceremonial house) based on its size and the number of projectile points found on the house floor. However, at least 10 structures at the site are as large or larger (G. Clark 1977:Figure 10). A rock slab and tunnel "cold trap" entrance were noted in one house, and another contained a rectangular slab hearth rather than the more common scatter of fire-cracked cobbles.

Economy and Settlement Pattern

Architectural and faunal data at Kukak and other Beach phase sites suggest year-round occupation of solidly constructed semi-subterranean houses in permanent coastal villages. There is little doubt that Beach phase villages (and probably overall population) were larger than that of preceding phases. After a long period of development, ethnographic patterns of economy, settlement, and probably social organization appear to have been fully established.

Two lines of evidence point toward long-term occupation at Kukak: the rebuilding of houses resulting in stratified occupation floors, and the systematic disposal of waste in secondary middens, a behavior generally associated with lengthy occupation of residential sites. Beach phase faunal samples from Kukak include bones from at least 130 vertebrates (G. Clark 1977:Table 9). By decreasing frequency, marine mammals include seal, sea otter, porpoise, sea lion, and whale. Land mammals include ground squirrel, caribou or moose, fox, rabbit, deer, brown bear, beaver, wolf, black bear, and porcupine. If the sample is representative, a more balanced ratio (2.5:1) of sea and land hunting than in previous phases is indicated. The difference may be geographic rather than temporal, however; Dumond (1977b:106) notes the easier access to interior resources from Kukak than from Amalik Bay, where Clark's faunal samples from earlier phases were obtained.

Heavy use of shellfish is evident at Kukak and AFG-001 during the Beach phase (Dumond 1964b:39, 1977b:109). Intensive harvesting of anadromous and pelagic fish is indicated at Kukak, where cod and halibut bones predominate. The remains of marine birds and ducks (such as cormorant, murre, and goldeneye) also are common (Grayson 1977). Dumond (1977b:109) concludes that the faunal assemblage indicates year-round occupation at the Kukak Site.

Mound Phase
1000 - 500 B.P.

The Mound phase is the final prehistoric period of the Alaska Peninsula's Pacific coast sequence. G. Clark's description is based on a relatively small artifact sample (440 items) from his excavations in three housepits at

XMK-006 and the trench dug there by W. Davis (1954). Two virtually identical C-14 dates (775 + 95 B.P. and 775 + 110 B.P.) are all that have been obtained for the Mound phase, so the duration of the phase is based on cross-dating with the Brooks River Camp phase. The gap between the end of this phase and the beginning of the Russian contact period should be erased by future research. Other Mound phase components are reported for AFG-001, XMK-049, XMK-029, and XMK-030.

Artifacts

Traits distinguishing Mound components from the Beach phase include a shift from fiber-tempered to gravel-tempered pottery (Western Thule type), a change from cylindrical to globular containers, and the appearance of gravel-ware oil lamps. The chipped stone to ground slate tool ratio declines sharply, and many chipped stone types drop out altogether. Of the few bone tools recovered, none were new types. Other artifact types include oval stone oil lamps, numerous notched pebble sinkers, and undiagnostic flake scrapers, hammers, awls, and whetstones.

Coastal and interior sites on the Alaska Peninsula during this period contain nearly identical assemblages (Dumond 1981:153). A complex cultural blending is evident, combining older Pacific and Bering Sea cultural traits with new elements diffused southward by expansion of maritime Thule (Neoeskimo) groups from the Bering Strait region (Dumond 1977a, D. Clark 1984a, Workman 1980b). Thule artifacts, including gravel-tempered ceramics (Dumond 1969b) and triangular slate endblades appear on the peninsula after A.D. 1000. Dumond (1965b, 1987) identifies the diffusion of this material culture with the spread into the Pacific area of the Yupik Eskimo language (see also D. Clark 1984a). Jordan and Knecht (1988:274) dissent, noting that gravel-tempered ceramics occur as early as late Kachemak.

Structures and Features

Dumond (1981:6.18-6.22) excavated a series of Brooks River Camp phase houses in the interior. These are rectangular (averaging about 4 x 5 m (13 x 17 ft)) and semi-subterranean, with long entrance tunnels, rock slab cold traps, and interior hearths. Salmon and a variety of interior game animals (caribou, beaver, and porcupine) were consumed. On the Pacific coast, architectural data from the Kukak Site are limited, but indicate that the same house form was in use (G. Clark 1977:Figure 31). Brooks River Camp and Mound phase houses differ from Koniag dwellings on Kodiak in several important respects: average size appears to be smaller (20 m2 vs 79 m2 (211 vs 834 sq ft)), side chambers are lacking, and entrance tunnels are present. Fire-cracked rock is abundant in the upper midden layers at Kukak (W. Davis 1954, Dumond 1964a) and contemporary sites in the interior (Dumond 1981).

Economy and Settlement Pattern

Continuity of economy and settlement pattern is suggested between Cottonwood, Beach, and Mound phases. The small Kukak faunal sample is primarily sea mammal (porpoise, seal, sea otter, and sea lion), with minor representation of caribou and fox. Shellfish are common, fish are present (no taxa were defined), and cormorant was the only bird identified (G. Clark 1977:49). Given the similarity of interior and Pacific coast assemblages at this time, coastal sites like Kukak may have been linked with interior sites as seasonal components of a single subsistence pattern.

Archaeological Sites of the Historic Period

Archaeological documentation of the Russian Period is still lacking for the Pacific coast of the Alaska Peninsula, though a number of 18th-century village sites have been identified from historic accounts and early maps (Orth 1967, Teben'kov 1981). In some cases, limited archaeological survey data is available (W. Davis 1954, Dumond 1964a, 1965a). Assemblages, house forms, and midden characteristics of early historic Koniag sites are similar to those of Mound phase, with the addition of Russian trade items.

Katmai is the most important of the known early historic sites on the Pacific coast of the upper Alaska Peninsula. Katmai was a large Koniag winter village before the arrival of the Russians, and remained the most populous settlement during the Russian Period (Hussey 1971:157). As a trading post of the Russian American Company, Katmai was the only Pacific coast village with permanent Russian residents. Katmai was abandoned in 1912 after the eruption of Novarupta. W. Davis' (1954) survey showed the site almost completely buried by ash, and an elevated water table made subsurface investigation nearly impossible. Other early historic Koniag villages include Swikshak Bay (AFG-044), Kaguyak or Douglas, and Kukak. Kukak was visited and described by von Langsdorff (1813, II:233-237).

The Novarupta eruption forced evacuation of Katmai, Kaguyak, Ashivik, Swikshak, Kukak, Sutkum, and other villages on the coast of the Alaska Peninsula, and abandonment was permanent in most cases. Resettlement occurred primarily in the Chignik area.

Since 1912, coastal settlement in the upper Alaska Peninsula region has been sparse, confined mostly to isolated hunting and fishing cabins. The Kukak cannery was mentioned earlier in this chapter, and a razor clam cannery at Aniakchak Lagoon was used during the 1930s (NPS 1988a). The village of Kanatak had a brief period of growth in the 1930s due to oil drilling, but was abandoned in the 1950s (Dumond 1987). Other oil exploration sites may be present elsewhere on the Pacific coast. Interior cabins have been built and used by fur trappers, prospectors, and hunters (NPS 1988b).

Summary

The preceding sections emphasize the varying amounts of anthropological and archaeological research conducted in different parts of the oil spill area. The Kodiak area, with numerous large prehistoric sites, has been the subject of the most intensive archaeological research, followed by the Alaska Peninsula and the Lower Cook Inlet areas. In contrast, little is known about the archaeology of Prince William Sound, and almost nothing about the prehistory of the outer coast of the Kenai Peninsula. The limited research conducted in these latter areas, along with environmental and archaeological biases in the kinds of sites investigated, leaves substantial gaps in local archaeological sequences and inhibits regional syntheses.

Such data gaps and biases guarantee that local chronologies will undergo major revision as further investigations are conducted in the region. There is little reason to believe, for instance, that coastal areas of Prince William Sound, the Kenai Peninsula, and possibly Lower Cook Inlet were not occupied as early as those of the Alaska Peninsula and the Kodiak Archipelago (6500 to 7000 B.P.). It seems unlikely that cultural developments in the times and places encompassed by current data gaps will differ substantially from the broad patterns of cultural evolution that characterize the larger North Pacific coast of Alaska.

Existing data from the study area highlight broad similarities in cultural development, though significant local variation is apparent. Generally, the early prehistoric inhabitants of the study area focused on marine over terrestrial resources and lived in small coastal settlements that imply little social stratification. Throughout the region, a growing cultural complexity is apparent through time, with a progressive elaboration in technology, artistic expression, and probably ceremonialism. Tools and other artifacts associated with resource exploitation and other activities were not uniform, however, and population densities varied markedly through time and space. Future research will likely identify spatial and temporal variation in human adaptation resulting from the interaction of distinctive social and economic systems with various environmental factors (such as different carrying capacities) and demographic patterns.

Academic research, cultural resource inventory by various agencies and groups, and oil-spill-related research sponsored by Exxon and other parties continue in several parts of the study area. In the Kodiak area, P. Knecht continues excavation of Ocean Bay I and II components at the Rice Ridge Site, which has yielded faunal remains that may revolutionize our view of early maritime hunter-gatherers of the region. Also on Kodiak, K. Lightfoot and A. Crowell's excavations at Three Saints Bay should provide important new data on interaction between Russians and Koniag during the early Historic Period. Analysis of materials excavated from Kodiak Island sites in recent years by R. Jordan, R. Knecht, and others also will contribute new data on the prehistory and history of the area.

In Prince William Sound, analysis of the Uqciuvit collection (M. Yarborough 1989) will extend and refine the cultural chronology for the area. Continuing analysis by W. Workman and K. Workman of materials from Kachemak Bay will lead to a substantive body of data on lower Cook Inlet prehistory. On the southwest margin of the oil spill area, L. Johnson's research on the Shumagin Islands will provide new data on cultural and geological developments and their interactions. As data continue to accumulate from current and future research, archaeologists and the public can look forward to significant new findings and an increasingly sophisticated reconstruction of the prehistory and history of this diverse coastal region.

Current Land Management

Oil spill treatment involved activities in the intertidal and upland zones on both private and public lands. Each landowner or manager had somewhat different opinions and concerns about how Exxon intended to treat particular sections of shoreline. These interests varied according to, among other things, the location, resources, administrative structure, history, and purposes of their land-managing mandates. Because the details of the treatment program for specific shoreline segments had to be agreed on by Exxon, the Coast Guard, and each landmanager or owner, the different backgrounds of the landowners and managers were an important factor in the operation of the EXXON VALDEZ Cultural Resource Program.

There are eight major land-managing parties with significant land holdings in the general region affected by oil from the *Exxon Valdez* (Figure 29). Four parties manage public lands, and the other four hold private parcels. Public land managers within the oil spill area include one state agency and three federal agencies. The ADNR manages intertidal lands and certain upland parcels, although state ownership of the intertidal zone is contested by federal agencies (ADNR 1989, USFS 1989). The three federal agencies include the USFS (under the US Department of Agriculture), the NPS (under the US Department of the Interior), and USFWS (under the US Department of the Interior). USFS is responsible for the Chugach National Forest; NPS is responsible for Katmai National Park and Preserve, Aniakchak National Monument and Preserve, and Kenai Fjords National Park; and USFWS manages the Kodiak, Becharof, Alaska Maritime, and Alaska Peninsula National Wildlife refuges.

Most large private land parcels in the region affected by the oil spill are Native lands conveyed under ANCSA. Under that law, a system of for-profit corporations was established at village and regional levels, in part to select property from public lands to be transferred to private Native corporate ownership. Some of the lands selected have not been approved for transfer from federal ownership to Native ownership, further complicating land management issues for the oil spill treatment program. Initially, the regional Native corporations identified as having lands potentially affected by the oil spill were Cook Inlet Region, Inc.; Bristol Bay Native Corporation; Koniag, Inc.; and Chugach Alaska Corporation. As the oil distribution patterns became known, it became apparent that portions of shorelines adjacent to uplands owned by only the two latter corporations were significantly oiled. Aerial videotape reconnaissance did take place over lands owned by all four Native regional corporations.

Lands owned by Native village corporations are managed independently of the Native regional corporations. Details concerning these and other land-managing parties within the oil spill area are discussed in this chapter, with emphasis on the nature of their management mandates, their input into the development and implementation of the EXXON VALDEZ Cultural Resource Program, and their roles as participants in the joint cultural resource protection effort.

Exxon Company, USA, created and funded the EXXON VALDEZ Cultural Resource Program to facilitate compliance with state and federal laws. The program was responsible for obtaining nine Archaeological Resources Protection Act and Special Use permits from the four land managing agencies. These permits allowed reconnaissance level archaeological surveys on state and federal lands within the oil spill area, to document and protect cultural resources potentially threatened by proposed shoreline treatment activities. Permits obtained from specific agencies are discussed in the appropriate sections of this chapter.

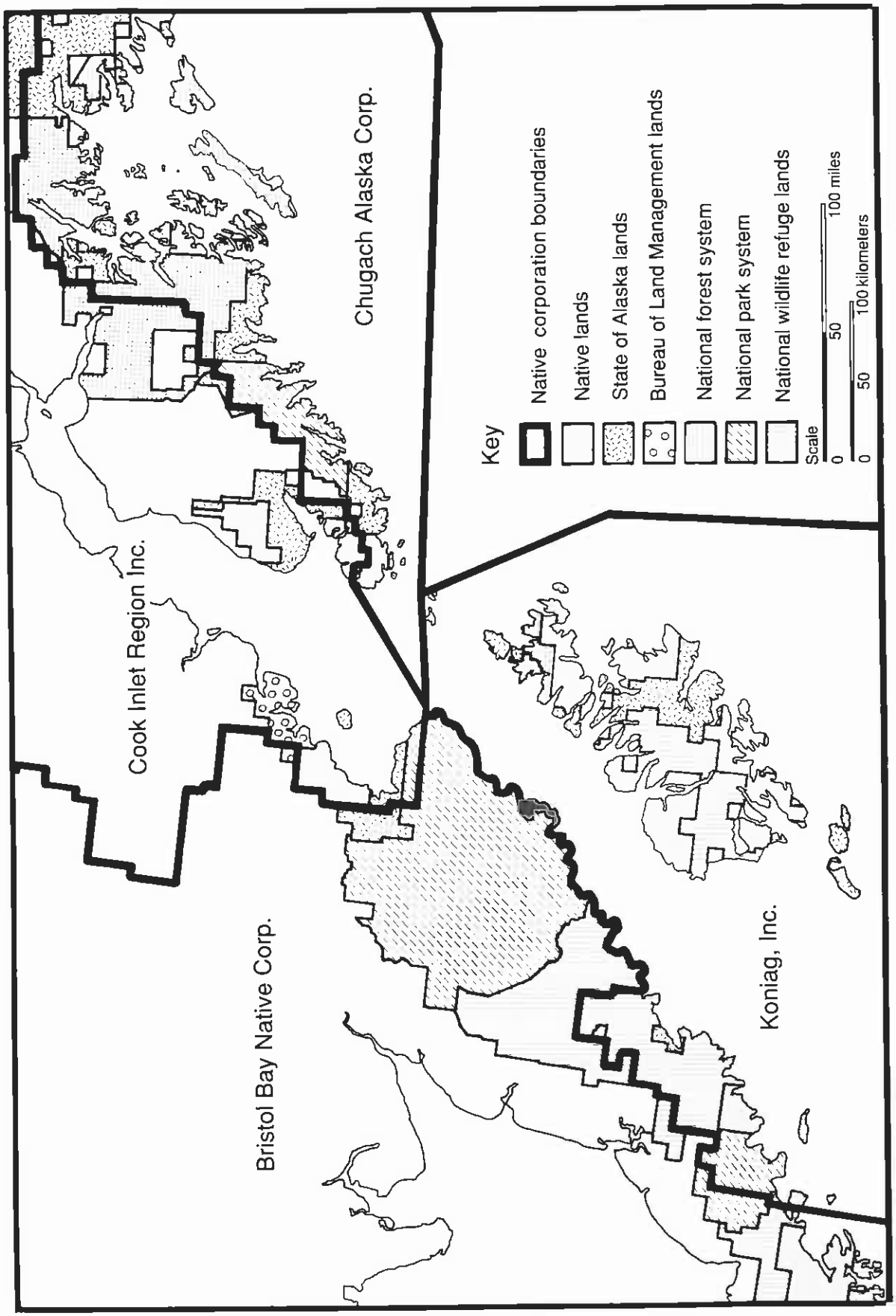
State of Alaska

The ADNR is responsible for the inventory and management of the state's surface and subsurface resources, excluding fish and game. The overall goal of the department is to contribute to the quality of life and economic health of the state "by protecting, maintaining, and encouraging wise development of the state's resources and making them available for public use" (ADNR 1988:2). The EXXON VALDEZ Cultural Resource Program interacted with ADNR primarily through the Alaska Office of History and Archaeology (AOHA), which is a section of

Figure 29

Major Land Owners in the Oil Spill Region

Adapted from Alaska Land Status Map, US Dept of the Interior, Bureau of Land Management, 1987.



ADNR within the Division of Parks and Outdoor Recreation.

In addition to its claim of jurisdiction over 69 million acres of tidelands and submerged land, the State of Alaska owns 85 million acres of uplands granted under the Alaska Statehood Act of 1959. State ownership of uplands in the oil spill area includes five major parcels and some smaller tracts (Figure 29). The five consist of: 1) a long stretch of shoreline on Blying Sound in the Gulf of Alaska just southwest of Prince William Sound, bracketed by the Chugach National Forest to the northeast and Kenai Fjords National Park to the southwest; 2) another stretch of shoreline along the Gulf of Alaska to the southwest of Kenai Fjords National Park, including Nuka Island and Gore Point; 3) Shuyak Island in the Kodiak Archipelago, and the northern tip of Afognak Island just south of Shuyak Island and across Peravalnie Passage; 4) a large area of shoreline on the east side of Kodiak Island, on both sides of Ugak Bay; and 5) lands between Kodiak Island and Raspberry and Afognak islands, on either side of Kupreanof Strait, at its junction with Shelikof Strait.

Access to state-owned tide and submerged lands during the 1989 field season was authorized April 21, 1989, under ADNR Land Use Permit SCV 89-004. Examination of these lands for historic, prehistoric and archaeological resources in the area of the oil spill was authorized July 18, 1989, under State of Alaska Field Archaeology Permit 89-5. The following stipulations were included in the permit: 1) a report was due January 15, 1990 (subsequently extended), following the guidelines established by the Secretary of the Interior (36CFR, Part 66); 2) the data was to be placed in the University of Alaska Museum in Fairbanks under a formal curation agreement; 3) all EXXON VALDEZ Cultural Resource Program field personnel were to meet or exceed standards established by the Secretary of the Interior (FR 48:190, p. 44739); and 4) provisions pertaining to cultural resources in the ADNR Land Use Permit SCV 89-004 were to be included as stipulations in the field archaeology permit.

The State of Alaska has claimed management responsibility for tide and submerged lands, recognizing that ownership of adjacent uplands is divided among many and varied private, state, and federal jurisdictions. Tide and submerged lands are defined by the state as all land between the mean high tide line and three miles offshore, which represents -- in terms of total area -- the majority of land potentially affected by the oil spill. The USFS does not concur with the state's view of ownership of the tidelands. This issue is currently under review before the Interior Board of Land Appeals and the US Supreme Court.

The Alaska Division of Parks and Outdoor Recreation administers state and federal grant programs for

Table 10

Responsibilities of the Alaska Office of History and Archaeology and the State Historic Preservation Officer

Responsibilities of the Office of History and Archaeology:

1) Administer the State Historic Preservation Program, which provides for the identification, evaluation, and protection of Alaska's prehistoric and historic resources;

2) promote the study and understanding of Alaska's history and prehistory;

3) sponsor, engage in, and coordinate fundamental research relating to the archaeology and history of the state;

4) issue permits for cultural resources investigations on state lands;

5) investigate and assess the information potential of reported historic, prehistoric, or archaeological resources;

6) locate, identify, and preserve information on sites threatened by public construction and improvements;

7) serve as a central clearinghouse for information relating to Alaska's cultural resources;

8) provide citizen input through the Historic Sites Advisory Committee and Alaska Historical Commission to the state's history programs; and

9) provide technical assistance to Alaska state parks.

Responsibilities of the State Historic Preservation Officer:

1) Prepare and implement comprehensive statewide preservation planning;

2) survey and inventory prehistoric and historic properties;

3) administer the National Register of Historic Places Program;

4) administer federal preservation grants for the state;

5) assist local governments in developing historic preservation programs;

6) assist state and federal agencies and local governments in carrying out historic preservation responsibilities;

7) participate in the review of federal and state undertakings that may affect historic properties; and

8) provide public information, education, training, and technical assistance in historic preservation.

historic preservation, and manages the Alaska State Park System, which includes historic sites. The AOHA section, one of six sections in the division, includes the office and staff of the SHPO, the regulatory agency for archaeological and historic resources. AOHA and SHPO have separate functions that, at times, tend to overlap, particularly in the field (Table 10). All of the primary functions outlined for AOHA came into play in one form or another during the course of the oil spill treatment program. Of the eight primary functions of SHPO, only the first three played major roles in the project.

Of the nine regular full-time and seasonal staff of SHPO, all carried out cultural resource responsibilities associated with the oil spill. Several people functioned as SHPO signatories in either Valdez or Kodiak, a task for which minimum personnel requirements were those of the Secretary of the Interior -- a M.A. degree plus regional experience. Two people served as field representatives in the Seward and Homer areas, and a third handled oil spill data at the SHPO office in Anchorage. Although all SHPO personnel were involved in one or more capacities in the oil spill cleanup effort, for some it was not their only responsibility, and staff rotation made it possible for them to address tasks associated with their regular duties. SHPO staff played a primary role in the development, implementation, and progress of the overall cultural resource effort.

Chugach National Forest

In size, the Chugach National Forest is second in the nation only to the Tongass National Forest in southeastern Alaska. It encompasses 5,936,000 acres (2,405,000 ha) of land from Resurrection Bay on the Kenai Peninsula to Cape Suckling southeast of Cordova (US Government Printing Office 1983). Until CAC and Chugach villages selected lands from it following the 1971 passage of ANCSA, the Chugach National Forest included essentially all of Prince William Sound. Afognak Island, in the Kodiak Archipelago, was also at one time part of the Chugach National Forest, but it has since been transferred and divided up among the state, USFWS, and Koniag, Inc. (USFS n.d.:23). Other amendments to the original Forest configuration have resulted in further reductions in size.

The Chugach and Tongass national forests together form Region 10 of the USFS, with regional administration in Juneau. The individual forests are relatively autonomous, and the forest supervisor of the Chugach National Forest has an office in Anchorage, as does the forest archaeologist. Within the first week of the spill, the Chugach National Forest began developing an administrative structure and presence in Valdez (Forest Service 1989b:38), and offices were rented to serve as an incident command center. John Knorr, the district ranger of the Glacier Ranger District in Girdwood, was named as incident commander. Exxon was urged by the Chugach National Forest to develop a cultural resource program to accommodate the shoreline treatment activities, and they provided Exxon with a list of individuals of potential value to such a project. By virtue of their land holdings in the oil spill area and previous experience with Section 106 procedures, USFS was acknowledged by FOSC Clyde E. Robbins, on April 30, to be the lead consulting agency for the US Coast Guard in the Section 106 compliance process under the National Historic Preservation Act.

In keeping with the USFS multiple use policy, the Chugach National Forest serves a number of interests. Timber production has been one consistent use, although it is not a major commercial focus in the Chugach National Forest. Historically, mining for gold and copper has been a major economic component in the region, and approximately 5,000 claims are still registered in the forest (USFS n.d.:22). As a result of the destruction of important salmon spawning streams by the 1964 earthquake, commercial fishery enhancement programs have intensified in streams and lakes within the Chugach National Forest.

Recent expansion in recreational use has demanded much of the management attention of the Chugach National Forest. Because of its beauty, range of resources, and accessibility, the Chugach National Forest has been subject to an influx of tourists and local residents warranting increased programs and policies specifically tailored to accommodate them. The Portage Valley Recreation Area, for example, now receives more than 400,000 visitors annually (USFS n.d.:4). Increased sport fishing and hunting have prompted expansion of fish and game management programs. Hiking, boating, and kayaking are all popular activities in the coastal portions of the forest. The Chugach National Forest was particularly concerned about the potential for oil and cleanup impacts to recreational use, although they were also concerned about the impacts to natural and cultural resources (USFS 1989b:38-39).

To monitor the cleanup program, USFS personnel at the incident command center provided continued support and interaction throughout the field season. The incident commander in Valdez was the major USFS contact from April through early September. The forest archaeologist served in a field survey capacity during the first ten days of the project, until additional Exxon SCAT archaeologists were available, after which he returned to the forest supervisor's office in Anchorage to supervise the development of a MOA under Section 106 of the National Historic Preservation Act. USFS archaeologist Gerald Clark, from the Region 10 office in Juneau, was in residence at the incident command center in Valdez to lend assistance during the month of August. Two archaeologists from other national forests helped the regional archaeologist in August, one lending office support in Valdez, and one making field observations in Prince William Sound from a resource advisory team (RAT) boat.

In April 1989, the EXXON VALDEZ Cultural Resource Program was given verbal authorization by USFS to examine Chugach National Forest shorelines and inland locales for cultural resources potentially affected by the *Exxon Valdez* oil spill. A formal request for an ARPA permit was made on May 24, and the USFS responded with Special Use Permit 4118.01 on June 12, 1989, to formalize the verbal authorization provided earlier.

National Park Service

The first national park in Alaska was founded in 1910 when Sitka National Historical Park was established to commemorate Tlingit culture and Russian-American settlement; other parks soon followed. In 1980, after nine years of planning and research, Congress passed the Alaska National Interest Lands Conservation Act to establish 10 new park units in the National Park System and expand three others. At present, the National Park System in Alaska contains more than 51 million acres (20 million ha), representing 13% of Alaska's land. Three of the state's 15 national parks occur within the oil spill region: Kenai Fjords National Park, Katmai National Park and Preserve, and Aniakchak National Monument and Preserve.

After the spill, but prior to the oil reaching the Kenai Fjords and Katmai shores, NPS conducted emergency baseline reconnaissances of coastal resources, including cultural resources (Gleeson 1989a, 1989b). With an awareness in part generated by the participation of NPS archaeologists in a joint Soviet/US oil spill exercise in 1988, they mobilized staff and other resources almost immediately upon notification of the spill, and as a result were able to hire archaeologists to help conduct pre-oiling assessments.

The NPS regional office in Anchorage has six full-time archaeologists on staff, several of whom were involved with the oil spill. Because the individual parks do not have resident cultural resource specialists, archaeologists at the regional office in Anchorage were major contacts for the EXXON VALDEZ Cultural Resource Program, as were park superintendents. In addition to involvement in their agency-sponsored pre-oiling baseline reconnaissances, NPS archaeologists independently cleared fuel depots on the Katmai coast and monitored some field operations out of Seward. At McArthur Pass, in Kenai Fjords National Park, NPS archaeologists evaluated a prehistoric site (SEL-188) that contained oiled artifacts in the intertidal zone. Other interaction with NPS officials occurred with Resource Protection Officers (RPOs) stationed as bear guards at cleanup localities.

Katmai National Park and Preserve

In 1918, six years after the volcano Novarupta collapsed in one of the most violent volcanic eruptions ever recorded, Katmai National Park and Preserve was established to ensure that the area remained a living laboratory for study of the cataclysmic event. Today, with most of the geothermal features silent, the boundaries have been extended to protect and preserve the Alaska brown bear and its habitat. The park encompasses an area of approximately 4 million acres (1.7 million ha), with administrative headquarters in King Salmon.

Archaeological investigation in Katmai National Park and Preserve was conducted under ARPA Permit 89-Katmai-ARO-003 and NPS Special Use Permit ARO-KATM-9500-019. The ARPA permit authorized archaeological survey, monitoring, and possible mitigation on lands threatened by the oil spill and subsequent treatment activity. The Special Use Permit authorized access to shorelines of Katmai National Park and Preserve, and Aniakchak National Monument and Preserve.

Kenai Fjords National Park

The 669,000 acres (271,000 ha) managed as Kenai Fjords National Park preserves a unique set of glacial features including the rugged fjord-dominated shoreline and the seaward interface of the Harding Icefield, one of four major ice caps in the United States and likely a remnant of the extensive Pleistocene ice masses that once covered half of Alaska. Prior to establishment of the park in 1980, approximately 75,000 acres (30,350 ha) were selected under ANCSA by the Port Graham and English Bay Native village corporations and by CAC. Conveyance of these parcels will remove most of the coastal lands from the park, reducing the park to its mountainous and glaciated uplands (Kizzia 1989:A14). The park headquarters is in Seward.

Investigations in Kenai Fjords National Park were carried out under ARPA Permit 89-Kenai Fjords-ARO-001 and Special Use Permit ARO-9845-9500-008. The ARPA permit authorized archaeological survey, monitoring, and possible mitigative treatment of archaeological sites potentially threatened by the oil spill and subsequent treatment activity. The Special Use Permit allowed subsurface shovel probes of suspected archaeological sites to test for artifacts or other evidence of human habitation. Under this permit, testing was also allowed to determine if any archaeological sites were adversely affected by the oil spill or treatment activity.

Aniakchak National Monument and Preserve

A large caldera (collapsed volcano) is the central feature of Aniakchak National Monument and Preserve, located in a remote part of the Alaska Peninsula about 125 miles (200 km) southwest of Katmai National Park and Preserve. The volcano's last eruption was in 1931, and parts of the preserve are in the early stages of plant succession. Relatively little recreational use occurs within the 600,000 acre (243,000 ha) preserve, but the coastal portion is rich in plant and animal life. The area is managed from NPS offices in King Salmon, and Special Use Permit ARO-KATM-9500-019 for Katmai also authorized work at Aniakchak.

US Fish and Wildlife Service

Under the jurisdiction of the Department of the Interior, the USFWS administers large tracts of land in Alaska. Alaska's national wildlife refuges comprise 77 million acres (30,800,000 ha), or 85% of the 91 million acres (36,400,000 ha) set aside in the United States

(Mobley 1984:3). Included within these 77 million acres (30,800,000 ha) are 18 million acres (7,200,000 ha) of designated wilderness. Refuges were first established in the 1900s to protect seabird nesting islands, but as public awareness grew, lands were added to existing refuges and new lands were set aside to accommodate a broader range of wildlife species. The Alaska National Interest Lands Conservation Act of 1980 created nine new refuges in Alaska, and added to those existing, effectively doubling the size of the National Wildlife Refuge System in the United States.

Collectively, the 16 refuges in Alaska exhibit diverse habitats that include unique combinations of mountains, glaciers, tundra, grasslands, woodlands, lakes, wild and scenic rivers, and pristine sections of rugged shoreline. They range in size from the 320,893 acres (129,861 ha) of the Izembek Refuge on the Bering Sea shoreline of the Alaska Peninsula, to 19.6 million acres (7,931,846 ha) in the Yukon Delta Refuge on Alaska's west coast. Of the 16 refuges in Alaska, four occur within the oil spill area: Kodiak, Becharof, Alaska Maritime, and Alaska Peninsula national wildlife refuges.

Generally, individual refuges are each administered locally by a refuge manager, but the Kodiak, Becharof, and Alaska Peninsula refuges are managed as a complex from headquarters in Kodiak. Archaeological expertise for all USFWS lands in Alaska is provided by one individual in the regional offices in Anchorage (Diters 1989:4-5). The EXXON VALDEZ Cultural Resource Program interaction with USFWS personnel was primarily through contacts with the regional archaeologist, the refuge managers, and RPOs deployed in the field.

Archaeological investigations conducted on USFWS lands were carried out under ARPA Permit R7(MAR)89-4 and Special Use Permit 50562. The ARPA permit allowed Exxon field personnel access to USFWS lands to conduct archaeological survey and limited testing at locations potentially affected by the oil or cleanup activities. Special Use Permit 50562 allowed access to lands immediately adjacent to the high tide line in each of the national wildlife refuges potentially affected.

Kodiak National Wildlife Refuge

The Kodiak National Wildlife Refuge was established in 1941 and consists of 1,865,000 acres (754,740 ha), comprising most of Kodiak Island and approximately 50,000 acres (20,000 ha) on Afognak Island. The refuge consists of rugged mountains covered with alpine vegetation, forests, and wetlands, all contained within an irregular coastline of bays, inlets, islands, and reefs. In addition to brown bear, the refuge is home to five other native land mammals: red fox, river otter, short-tailed weasel, little brown bat, and tundra vole. Other species (including Sitka black-tailed deer, snowshoe hare, mountain goat, and beaver) were introduced during the Historic Period. Over 200 species of birds occur in the refuge. An estimated 70% of the salmon harvested annually in the Kodiak region originate in refuge streams, and steelhead, rainbow trout, Dolly Varden, and Arctic char are also abundant.

Becharof National Wildlife Refuge

Becharof National Wildlife Refuge is named after Becharof Lake (the second largest lake in Alaska), and encompasses 1,200,000 acres (485,623 ha). The lake is surrounded by low rolling hills, tundra wetlands, and volcanic peaks, and functions as the primary nursery for the second largest salmon run in the world. Approximately one-third or 400,000 acres (161,875 ha) of the refuge is designated Wilderness area. Attracted by the massive salmon runs, the Alaska brown bear occurs in one of the largest concentrations in Alaska. Other land mammals include approximately 15,000 caribou that winter in the refuge, as well as moose, wolves, wolverines, river otters, red fox, and beavers. Sea mammals are common in the rich coastal waters, and the wetlands, coastal estuaries, rugged shoreline, and offshore islands provide a wide range of habitats for many different species of birds.

Alaska Peninsula National Wildlife Refuge

Dominated by the rugged Aleutian Range, the Alaska Peninsula National Wildlife Refuge contains 3,500,000 acres (1,416,400 ha) of active volcanoes, lakes, rivers, tundra, and rugged coastline. The faunal array parallels that of the Becharof National Wildlife Refuge; with larger land mammals including moose, caribou, brown and black bears, and wolves; marine mammals including whales, sea lions, seals, and sea otters; and large numbers of migratory waterfowl and sea birds. Many anadromous fish streams are located within the refuge.

Alaska Maritime National Wildlife Refuge

The Alaska Maritime National Wildlife Refuge includes more than 2400 islands, headlands, rocks, islets, spires, and reefs along the Alaska coastline. Of the 4,500,000 acre (1,800,000 ha) refuge, 2,640,000 acres (1,056,000 ha) are designated Wilderness. The most abundant fauna are sea birds; between 15 and 30 million birds (or 75% of the state's marine bird population) use the refuge lands. The refuge headquarters is in Homer, where it is central to two of the larger refuge parcels in the oil spill area; the Barren Islands at the mouth of Cook Inlet, and the Pye Islands near Kenai Fjords National Park. The third parcel of significant size located in the oil spill area consists of the Chiswell Islands, outside of Resurrection Bay, near Seward.

Native Groups

The political organization of Natives in Alaska is a complex web of traditional tribal governments, governments chartered under the Indian Reorganization Act, village and regional corporations formed by ANCSA, and other non-profit and for-profit associations formed under a variety of statuatory authorities. Natives can also hold

land privately as is the right of any US citizen, and also as a Native under the Alaska Native Allotment Act.

Thirteen regional corporations and more than 200 village corporations were established under ANCSA. Native corporations created under the act were provided with land and a series of cash payments as compensation for relinquishing aboriginal land claims in Alaska. The complementary land-ownership arrangements between village and regional corporations are exemplified by a provision in the act which assigns title of the subsurface estate on village corporation lands to the associated regional corporation. The primary responsibility of the village and especially regional corporations is the development and management of the lands conveyed to them under ANCSA, although some corporations also administer health and welfare programs for their shareholders.

Koniag Region

Koniag, Inc. is a regional corporation formally incorporated June 23, 1972. The regional and village corporations in the Kodiak Archipelago manage their assets on behalf of 3,400 Native shareholders. As of March 31, 1989, Koniag, Inc. had received interim conveyance or patent to approximately 160,000 acres (64,000 ha) of surface and 730,000 acres (292,000 ha) of subsurface estate on Kodiak Island, 664,000 acres (265,600 ha) of which are under village land selections of surface estate and 68,000 acres (27,700 ha) of which are located on the Alaska Peninsula (Koniag, Inc. 1990). In 1980, Koniag, Inc. relinquished all rights to its Alaska Peninsula holdings, except for the mineral rights mentioned above, in exchange for an ownership interest in a partnership with several Kodiak area village corporations. During 1989, approximately 253,000 acres (101,200 ha) of surface estate on Afognak Island were conveyed by the federal government to this partnership, referred to as the Afognak Joint Venture, which is considering timber development.

In addition to Koniag, Inc., there are several village corporations in the Kodiak Archipelago (Table 11). All the current village corporations have land holdings in the region potentially affected by the oil spill. While the local economies of the villages have traditionally focused on commercial fishing since the late Historic Period, some of the village corporations have also become involved with timber development, either on their own, like Afognak Native Corporation, or through the Afognak Joint Venture like Old Harbor and Akhiok village corporations.

In recognition of the importance of cultural issues to the people of Kodiak Island, Koniag, Inc. delegated to the KANA responsibility for all matters relating to Koniag history and culture. KANA was formed in 1966 as a nonprofit corporation by Koniag Natives, and now administers programs in health, education, social services, economic development, and cultural preservation. To maintain the cultural identity and self-esteem of Kodiak Island Natives, KANA has developed a number of cultural and historical programs to investigate and preserve oral histories, archival material, archaeological sites, and the Alutiiq language, and to communicate the results to the public through educational programs. Those programs include an annual heritage conference, co-operative research and training programs, a village anthropologist program, and the land and detailed plans for a modern museum and cultural center in Kodiak to properly house and curate objects and data pertinent to Koniag history and culture. On behalf of Koniag, Inc., KANA assisted in data acquisition and served in a liaison capacity through the efforts of the former association president and the cultural resource staff. One of KANA's cultural resource staff, who met the personnel standards of the Secretary of the Interior's Standards and Guidelines, was employed by Exxon during the season as a SCAT archaeologist.

Table 11

Original Koniag Region Village Corporations

formed under the
Alaska Native Claims Settlement Act
from Arnold (1976:330-335)

Village	Corporation	1974 Enrollment
Afognak	Natives of Afognak, Inc.	392
Akhiok	Natives of Akhiok, Inc.	100
Kaguyak	Kaguyak, Inc.	48
Karluk	Karluk Native Corporation	186
Larsen Bay	Nu-Nachk Pit, Inc.	201
Old Harbor	Old Harbor Native Corp.	335
Ouzinkie	Ouzinkie Native Corp.	333
Port Lions	Port Lions Native Corp.	112
Woody Island	Leisnoi, Inc.	296

Akhiok and Kaguyak have since merged to create Akhiok-Kaguyak, Inc., Afognak and Port Lions merged to create Afognak Native Corporation, Inc., and Karluk and Larsen Bay merged with Koniag, Inc.--the regional corporation.

Chugach Region

Chugach Alaska Corporation, the regional Native corporation for the Prince William Sound area, administers its 375,000 acre land settlement on behalf of nearly 2,000 shareholders. In addition to the large tracts of land selected under the general provisions of ANCSA, CAC took advantage of 14(h)1 of the act to select suspected Native historic places and cemetery sites in the Chugach National Forest. Those that have been confirmed are probably eligible for the National Register of Historic Places, according to a 1976 MOA between the ACHP and the SHPO (Griffin 1988:62). According to documentation from the BIA's ANCSA office, CAC applied for 270 14(h)1 selections, encompassing 19,240 acres, spread throughout their region in small tracts of a few acres each. Larger tracts of land held by CAC in the oil spill area consist of a parcel on east-central Knight Island, and most of Latouche Island (the remainder being held by Chenega Bay (village) Corporation). If village corporation entitlements are added to the

CAC entitlement, the total is 925,110 acres (370,044 ha), but not all conveyances have been made, including 14(h)1 selections and Port Graham and English Bay selections in Kenai Fjords National Park.

Like Koniag, Inc., CAC is a regional for-profit corporation. It has a diversified portfolio of investments and natural resource development projects managed in part through three subsidiary companies: Chugach Forest Products Inc., Chugach Fisheries Inc., and Chugach Development Corporation. In 1988, CAC earnings came from: "... interest income ... on escrowed funds from the sale of net operating losses and profits from ... Chugach Fisheries, Inc.", due largely to its acquisition of the Uganik Bay cannery on Kodiak Island (CAC 1988). Most of the village corporations have limited investments in the fishing industry.

Compared to the regional corporation, a greater amount of shoreline in the oil spill area is held by village corporations within the CAC region. Tatitlek (137,246 acres [54,989 ha] among 215 shareholders), Eyak (148,730 acres [59,492 ha] among 323 shareholders), English Bay (76,400 acres [30,560 ha] among 71 shareholders), Port Graham (111,642 acres [44,657 ha] among 190 shareholders), and Chenega (76,093 acres [30,437 ha] among 68 shareholders) are the five village corporations in the region, according to Arnold (1976:330-333) and CAC (1988). Tatitlek and Eyak corporations had no shorelines oiled by the spill, although their fishing based economies were affected. Chenega Village Corporation, with holdings on Chenega, Knight, Latouche, Evans, Flemming, and Bainbridge islands, and the mainland, had oiled shorelines that received treatment during the 1989 operations. English Bay and Port Graham village corporations own lands at the far southwest end of the Kenai Peninsula, and had oiled shorelines (and Native cleanup crews) on that portion facing the Gulf of Alaska.

A non-profit association (North Pacific Rim) is responsible for administering educational and health programs for CAC, but the regional corporation retains control over cultural resource matters. It was originally intended by Exxon that CAC contract directly to administer the EXXON VALDEZ Cultural Resource Program (Shaw 1989:8), but CAC was unprepared to administer the contract. Under a cost-reimbursable arrangement, Exxon did fund a CAC oil spill response effort in which the Native corporation deployed six individuals to: participate in the ISCCs in Homer, Seward, and Valdez; monitor cleanup activities at archaeologically sensitive segments from the multi-agency Resource Assessment Team (RAT) boats; conduct damage assessments on cultural sites located on CAC or village corporation property; and to otherwise oversee those activities. In 1989 CAC acquired two permits to conduct archaeological investigations on federal land to "document native occupation in relation to the oil spill and the 14(h)1 program of the ANCSA": Special Use Permit 4044.06 for the Chugach National Forest, and Special Use Permit ARO-98459500007 for Kenai Fjords National Park (Miraglia and Johnson 1990b). Joint field investigations, involving SCAT archaeologists and individuals from CAC, were conducted on occasion during the site protection effort.

Permission to access CAC and village lands for cultural resource protection purposes was requested in a formal letter from Exxon to CAC on May 2, 1989, but no written authorization was provided. To generally expedite cleanup and cultural resource protection, the USFS included language in the draft MOA (a different document from the MOU with CAC discussed below) between all parties under Section 106 of the National Historic Preservation Act, stating that "all parties will provide Exxon with the access, permits and support data necessary to expedite the Undertaking."

Interaction between the EXXON VALDEZ Cultural Resource Program and the villages in the Chugach region was limited. The regional corporation indicated that they spoke for the villages in regard to cultural resource matters, and this was eventually formalized in a MOU (initiated June 2 and finalized August 20, 1989) between CAC, the USFS, the SHPO, and Exxon, stating that "particular concerns of village corporations, and village and traditional councils within the Chugach Region, will be addressed by the CAC Oil Spill Response Team through the process provided in this MOU."

Other Native Organizations

Recognizing that oil-spill related activities could take place in other than the Koniag or Chugach regions, USFS included as consulted parties in the draft MOA (under Section 106 of the National Historic Preservation Act) the regional and village corporations and recognized tribal governments of the Cook Inlet (Cook Inlet Region, Inc.), Bristol Bay (Bristol Bay Native Corporation), and Aleut (The Aleut Corporation) regions. No SCAT work was conducted in the Aleut or Cook Inlet regions, and the SCAT survey conducted in the Bristol Bay region was all on state or federal lands. Communication was established by the EXXON VALDEZ Cultural Resource Program with Cook Inlet Region, Inc., and Bristol Bay Regional Corporation.

Table 12

EXXON VALDEZ Cultural Resource Program Permits

Archaeological Permit	Starting Date	Expiration Date
ADNR Land Use Permit SCV 89-004	4-21-89	10-30-89
State of Alaska Archaeology Permit 89-5	4-12-89	04-12-90
USFS Special Use Permit 4118.01	6-12-89	06-30-90
USDI-NPS ARPA Permit 89-KATMAI-ARO-003	6-08-89	06-08-90
USDI-NPS Special Use Permit ARO-KATM-9500-019	5-15-89	09-10-89
USDI-NPS ARPA Permit 89-KENAI FJORDS-ARO-001	5-30-89	05-30-90
USDI-NPS Special Use Permit ARO-9845-9500-008	6-08-89	09-08-89
USDI-USFWS ARPA Permit R7(MAR)89-4	4-12-89	04-12-90
USDI-USFWS Special Use Permit 50562	7-26-89	04-12-90

Summary of Interaction with Landowners and Other Parties

The EXXON VALDEZ Cultural Resource Program worked with a number of different parties to protect cultural resources during the oil spill treatment effort. Cultural resource investigations were conducted under nine permits issued by four agencies: ADNR (including the AOHA/SHPO), USFS, NPS, and USFWS (Table 12). Of the many Native groups having heritage interests in the oil spill region, two -- KANA and CAC -- were the most involved participants in the cultural resource protection process. Cooperation and assistance was also received from the BIA, the Bureau of Land Management, the US Army Corps of Engineers, and the Interior Department's Office of Environmental Project Review.

Objectives and Procedures

Objectives and Evolution of the Shoreline Cleanup Assessment Team

The objective of the EXXON VALDEZ Cultural Resource Program was to minimize disturbance to cultural resources, without unduly delaying the treatment judged necessary to protect the natural environment in an emergency situation. As discussed in the introduction, federal and state laws protecting cultural resources applied because the cleanup was a federal undertaking on federal and state lands. The need for cultural resource concern was identified by the USFS incident commander in an ISCC meeting on the morning of April 4. The framework for a cultural resource compliance effort, identifying the USFS and SHPO as major participants, was sketched out in a meeting between the USFS and Exxon later that day.

Exxon's intentions of incorporating cultural resource survey into the treatment program were declared in a memo of April 8 from Exxon SCAT Team Leader Andy Teal to the ISCC, stating that "Archaeological resources will be reviewed and as soon as possible, an archaeologist will be on site to assess the sensitivities." The State Land Use Permit (#SCV-89-004) from ADNR (signed April 21, 1989) affirmed the need for cultural resource concern, stating that "Exxon shall comply with all applicable federal, state and local laws and regulations thereunder, existing or hereafter adopted, affecting in any manner, shoreline cleanup operations conducted under this permit." Under contract, Alaska Heritage Resource Group's Glenn Bacon prepared a budget and proposal for mitigating the effects of cleanup operations on cultural resources, recommending that the cultural resource program be contracted to CAC to administer and execute (Bacon 1989). Exxon initially agreed with that recommendation, issuing an authorization to proceed on April 9. Under that arrangement, Charles M. Mobley began developing the EXXON VALDEZ Cultural Resource Program in Valdez on April 11.

A shoreline evaluation process was immediately perceived by the permitting agencies and ISCC to be an essential element to precede shoreline treatment. The early days and weeks of the program were a hectic pace of 14 to 16-hour days to accommodate the rapidly moving and changing oil conditions and the deployment of huge amounts of equipment and personnel. Chugach Alaska Corporation was administratively unprepared to arrange immediate employment of additional cultural resource personnel, and Exxon's *Daily Report* of April 13 carried the short announcement that Exxon was "attempting to locate additional archaeologists." VECO, the oilfield management company contracted by Exxon to implement the cleanup effort, quickly contacted two individuals to serve in this capacity, and the *Daily Report* of the following day (April 14) noted "two additional archaeologists on site this morning."

This was the status of the EXXON VALDEZ Cultural Resource Program at the time it was first characterized in print in the *Alaska Anthropological Association Newsletter* (Shaw 1989:8), which described it as a joint VECO/CAC venture. Eventually the employment arrangements for archaeologists participating in the EXXON VALDEZ Cultural Resource Program were consolidated through individual consulting contracts with Exxon, so that neither VECO nor CAC was directly involved in providing cultural resource services for Exxon's compliance purposes.

The archaeological, biological, and oil/shoreline assessment process evolved as the oil recovery and shoreline treatment program progressed, but its basic structure was in place very early in the field season. Several hours before treatment workers "hit the beach" at Naked Island in Prince William Sound on April 13, a two-person assessment team consisting of archaeologist Charles M. Mobley and biologist Dane Hardin visited the beach and worked out the rudiments of the SCAT process.

It was realized that day in the field that the biological and archaeological descriptions and recommendations needed to be specific to discrete portions of shoreline, hence the development of the "shoreline segment" term and concept, involving the use of a two-letter prefix and a number suffix (example: KN-113, indicating a specific portion of shoreline on Knight Island). The following day, USFS archaeologist John Mattson and biologist Ken Holbrook began fieldwork in company with Mobley and Hardin, to help standardize field observations and methods. Archaeological and ecological assessment forms were drafted, as was a form for information on the degree of oiling, to be filled out by the biologist. Soon thereafter, the archaeologists brought on by VECO were deployed in the field as part of three-specialist (oil, biology, and archaeology) SCAT crews.

The scope and magnitude of the cleanup operation expanded continually during the early months of the program, and the EXXON VALDEZ Cultural Resource Program was often hard-pressed to keep up with personnel needs. The need for archaeologists expanded from an estimated one archaeologist on April 8, to three archaeologists and a director on April 9 (Bacon 1989), and continued until 24 archaeologists were employed in a field capacity, in addition to the director and assistant director. All were not employed at the same time, however, nor were all deployed in the field simultaneously. There was flux in the personnel roster as some individuals dropped out to fulfill prior research obligations, to be replaced by newly-hired individuals. Sufficient personnel were necessary to satisfy a rotation schedule of approximately three weeks on and one week off.

The permitting agencies desired that all field personnel meet the Secretary of the Interior's "Standards and Guidelines", which state that, among other requirements, "the minimum professional qualifications in archeology are a graduate degree in archeology, anthropology, or closely related field," plus experience and other demonstrated abilities. It was made clear by the permitting agencies that the additional experience was to be in Alaska or Northwest Coast contexts, because there was minimal time to adequately acquaint archaeologists with unfamiliar archaeological manifestations common in the oil spill study area. These requirements limited the pool of potential SCAT archaeologists to seasoned professionals, many of whom were already tentatively committed to other endeavors. Nonetheless, many individuals agreed to assist in the site protection effort, usually on extremely short notice.

Major components of the cultural resource compliance effort were formulated jointly by the EXXON VALDEZ Cultural Resource Program, SHPO, and USFS. This involved day-to-day, and sometimes hour-to-hour, consultation in Valdez among the three parties. A brief research design for agency review was developed, but, once the oversight agencies were satisfied that a viable cultural resource compliance program was being implemented, a written design was delayed in favor of focusing energies on the major task at hand. Instead, a two-page "Work Plan" was circulated with the draft MOA.

Minor adjustments in the SCAT survey process, and thus the cultural resource survey, were made in the field at the discretion of the three-member SCAT crew, within the broader parameters established in agreement with state and federal agencies. Major changes occurred only in response to operational decisions and scheduling requirements, after considerable deliberation with the cultural resource agencies. The most significant shift occurred in the Kodiak region in August, when -- in order that oil evaluations of long, lightly or un-oiled shorelines be accomplished in a timely fashion -- SCAT crews were authorized to emphasize aerial over on-foot reconnaissance. This posed a problem for the archaeological evaluation, which required ground survey to acquire high-quality site location data. Recognizing that the archaeological data quality was diminished under such circumstances, yet recognizing also that few of the lightly or un-oiled shorelines so surveyed would actually receive treatment, shoreline cleanup program forms prepared for those segments had the following archaeological constraint: "If cleanup is conducted, a full archaeological assessment must be conducted prior to cleanup." This satisfied the need for cultural resource protection, yet facilitated rapid survey of extensive shoreline. As a consequence, the intensity of the cultural resource reconnaissance in the Kodiak region was lessened during the last weeks of the field season.

Other cultural resource tasks in addition to SCAT survey were assumed by the EXXON VALDEZ Cultural Resource Program as the need arose. These tasks included on-site monitoring during cleanup (as a mitigative response) and other measures. Post-cleanup assessments of selected archaeological sites were conducted to document their integrity after oil treatment had been completed. These and other components of the EXXON VALDEZ Cultural Resource Program are discussed in this report.

Logistical Factors Bearing on the Cultural Resource Program

Communication and transportation circumstances were always factors determining whether or not the tasks facing the EXXON VALDEZ Cultural Resource Program could be carried out safely and on schedule. Data were collected in the field by SCAT crews using a variety of craft, most of which were dedicated to that purpose. Much work was done using helicopters based at one of the four response centers (Valdez, Seward, Homer, or Kodiak); shorelines requiring pedestrian survey were walked while the pilot stood by. In the Kodiak area, where fast-moving

cloud banks are common, SCAT personnel (sometimes accompanied by agency archaeologists) were more than once forced by fog to lay-over for the night and bunk in close quarters aboard a vessel supporting the cleanup effort. Where weather circumstances or distance dictated, the survey was conducted using skiffs or inflatable craft to access the beach, with bunk accommodations aboard a larger vessel. An effective arrangement in this fashion was made in Prince William Sound, where the 80-ft (25 m) *Shorleave* served as such a "mother" vessel. With a computer and office space, the *Shorleave* was able to support two SCAT crews in the field and host strategy meetings with administrative personnel when necessary. The maximum number of SCAT support vessels in Prince William Sound was three.

Communication between Exxon command centers in Valdez, Seward, Homer, and Kodiak took place using telephones and FAX machines. Between the command centers and field craft, VHF radios provided the primary means of communication. Eventually Exxon installed radio communication repeaters throughout Prince William Sound, providing an alternate means of radio communication. Some of the larger "mother ships" deployed in Prince William Sound had on-board marine telephones, but the same telephone numbers also served the ships' FAX machines, so the lines received heavy use. Nonetheless, SCAT archaeologists regularly used those marine telephone lines for voice and FAX communication with the central command center in Valdez. Field data were regularly sent via FAX from the field to Valdez, so that they could be processed and submitted for SHPO and ISCC review, and ultimately FOSC approval. Hand-held radios sometimes were available for field crews to talk to their transportation craft.

Equipment was for the most part available throughout the season, except for cameras, which had to be replaced often due to heavy field use. Pressurized bear repellent was issued for use in the field, but most archaeologists -- having had years of field experience among heavy bear populations -- balked at being asked to work without the firearms to which they were accustomed. As a consequence, a Remington 870 12-gauge pump shotgun was issued to each SCAT crew, the arm-bearer generally being the archaeologist because he/she was used to carrying one in the field and was the individual most likely to be exposed to a surprise encounter in the upland fringe along the shoreline. Each authorized arm-bearer first underwent firearm safety and range training conducted by an instructor certified to teach the Remington 870. That particular weapon was chosen because it is the most common one personally used by Alaskan archaeologists, including those working on the EXXON VALDEZ Cultural Resource Program.

Safety was emphasized throughout the program. In addition to weapons training, a bear safety class was set up for SCAT personnel. Taught by ADFG specialist Larry Van Daele at Exxon's request, the program was so useful and popular that it was given a second time to additional personnel, and finally a third time when it was videotaped for wider distribution.

Procedures for Identifying Cultural Resources

Prior to field work, the SCAT archaeologists consulted the AHRS records available at the Exxon SCAT offices in Valdez and Kodiak in the form of hard-copy site forms and maps. After they became available midway through the field season, the archaeologists also consulted the ANCSA 14(h)1 records filed at the Valdez SCAT office. Additional cultural resource information pertinent to the site protection efforts, but not contained in either the AHRS or 14(h)1 records, was sometimes volunteered from other sources.

Survey was conducted by aircraft, boat, and on foot. Pedestrian survey was conducted on shorelines where there was oil and where safe access was possible. Wind and water conditions often prohibited landing air or water craft in very small "pocket beaches" where rocky, wave-swept shores may be interrupted by small beaches of 100 meters (325 ft) or less in length. The geomorphology varies greatly in the oil spill area (some surveyed areas on the Alaska Peninsula are more than 800 km (500 mi) from Valdez), and some regions are characterized by submerged glacially-modified coastlines with steep-sided fjords and few shores suitable for human habitation. Such areas were subject to less pedestrian survey and more helicopter and boat survey than were more hospitable coastlines.

Ideally, pedestrian survey was conducted both in the intertidal zone and just inside the treeline. The intertidal zone was scrutinized for surface artifacts and features by walking the beach, usually a few hours on either side of low tide. Sometimes a band of oil in the middle intertidal zone obscured the beach surface and made walking dangerous, forcing the survey to focus on the upper intertidal zone. The uppermost margin of the intertidal zone, sometimes termed the drift zone or storm berm, was often obscured by logs and other debris. As a measure of past land use intensity along the shoreline, and to record cultural features that could be affected by the treatment crews through incidental activities, archaeological reconnaissance was also conducted just inside the treeline. Walking among the trees, approximately 5 to 10 meters (17 - 35 ft) above the high tide line, the archaeologist recorded culturally modified trees (CMTs), historic structures, midden deposits, and other surface features. Natural erosional surfaces and soils exposed by uprooted trees were examined to obtain information about subsurface deposits.

When sites were found, the team took notes on the presence or absence of artifacts, features, and their distribution. Sketch maps were made as time allowed. Subsurface testing was limited to circumstances where cultural deposits or features were suspected but not confirmed; once a site was identified as of cultural origin, no further subsurface excavation was conducted. Shovels, trowels, trenching tools, and soil probes were used for subsurface testing; holes were approximately 30 cm (12 in) in diameter and were backfilled.

Cultural resource information collected in the field was recorded in field notes and on a cultural resource evaluation form (Figure 30). The survey methods were noted, justified, and mapped. Different types of cultural resources noted in the segment were described in field notes and identified on the form using a three-letter code (used as a protective measure to mask the exact nature of the artifacts and features, since the form was distributed to the agencies comprising the ISCC, which in turn circulated it through their individual agencies). The probability of undiscovered sites existing in the intertidal zone was estimated on a scale of one through five, where one was unlikely and five was likely. Criteria used to make that estimate included the presence or absence of upland cultural resources, whether the shoreline geomorphology showed evidence of uplift or downlift, and beach gradient and clast size, all tempered by the subjective opinion of the SCAT archaeologist.

Black and white photographs were taken of cultural features and the natural environment, and the roll and frame numbers were entered on the form. Video cameras (Figure 31) were sometimes used during the survey phase of the project, but were more often employed as part of the post-cleanup assessment process.

Daily schedules were arranged, when possible, to survey shorelines during the six-hour tide "window", consisting of the three hours on either side of low tide. The time when survey started and ended was recorded, so that tide levels could be reconstructed and to help determine the thoroughness of survey.

CULTURAL RESOURCE EVALUATION

Date_____Location_____Site_____

Location Prefix_____Segment #_____Length_____

Survey Method:

Air_____(A - indicate on map) Boat_____(A - indicate on map)

Ground_____(G - indicate on map)

Known cultural resources (AHRS #)_____Data Source_____

Oil conditions/beach visibility_____

Width of beach zone surveyed_____m Tree fringe surveyed_____

Cultural resources observed in beach zone (AHRS code)_____

Cultural resources observed in tree fringe (AHRS code)_____

General observations justifying survey method and site probability:

Shore Profile_____

Fresh Water Sources_____

Sea Exposure_____

Access/Safety_____

Probability of undiscovered sites in beach zone (circle one) 1 2 3 4 5

Monitoring during cleanup needed: yes/no Collection: yes/no

Photos: Color Roll #_____ Frames_____

B/W Roll #_____ Frames_____

Observer (s)_____

Time survey started_____ Time survey ended_____

Cultural resource considerations/constraints:

_____

_____

_____

Figure 30. Example of the cultural resource evaluation form, used to recommend cleanup techniques and biological and archaeological constraints to the SHPO, ISCC, and FOSC.

Procedures for Determining Effect

Early in the program, in an effort to streamline the treatment process, some operations (especially in Kodiak) proceeded on the premise that treatment of lightly oiled shorelines would have no effect on cultural resources if certain conditions were met. The following conditions for a "Finding of No Effect" were set forth in a letter of April 25 from the SHPO to the FOSC: 1) collection of debris will be done by hand; no mechanical devices or methods will be used; 2) surface disturbance, specifically the digging of holes or trenches, is prohibited; 3) supervisors will ensure that workers avoid going beyond the immediate cleanup area within the oil impacted zone; 4) if any archaeological sites or artifacts are discovered during this cleanup activity, they must remain undisturbed and the EXXON VALDEZ Cultural Resource Program Director and the SHPO must be notified as soon as possible. When a "Finding of No Effect" was to be requested for a lightly oiled shoreline, the SHPO was to be contacted for concurrence prior to treatment.

Questions about the definition of this "No Effect" treatment and the notification process arose throughout the season, especially in Kodiak and Homer. This was due in part to differences in interpretation between the Valdez office (overseeing operations in Prince William Sound) and the Anchorage office (overseeing operations in Seward, Homer, and Kodiak) of the Coast Guard, before all Coast Guard direction was centralized in Valdez. A modified process for determination of effect was implemented for most treatment in Prince William Sound, Seward, and Homer, and later in Kodiak.

The "Determination of Effect" process was largely one of information flow. Information collected in the field by SCAT archaeologists was provided to the central Exxon offices in Valdez (for Prince William Sound, Seward, Homer), and later in Kodiak. The information was organized by segment and assembled in two formats. The one-page cultural resource evaluation form (Figure 30), on which was entered basic resource data excluding specific site nature and location, was prepared in the field. This form was included with comparable oil and biological forms in the packet of data submitted to the ISCC. The second format consisted of a packet of confidential archaeological information containing a cultural resource evaluation supporting document cover sheet, a summary of the notes, a copy of the cultural resource evaluation sheet, field notes and maps, a segment location map, AHRS site forms for both known and new sites, and any other documents pertinent to the segment.

Both the SCAT field assessment and the archaeology background packets were reviewed and edited for consistency by SCAT personnel, including the members of the cultural resource program. Based on the nature and location of cultural resources in each segment, constraints were suggested that would allow treatment to proceed without damage to identified or potential sites. Through most of the field season these constraints were reviewed in Valdez by a SHPO representative with the authority to approve the treatment work order for each segment, based on whether following the constraints would minimize potential impacts on cultural resources.



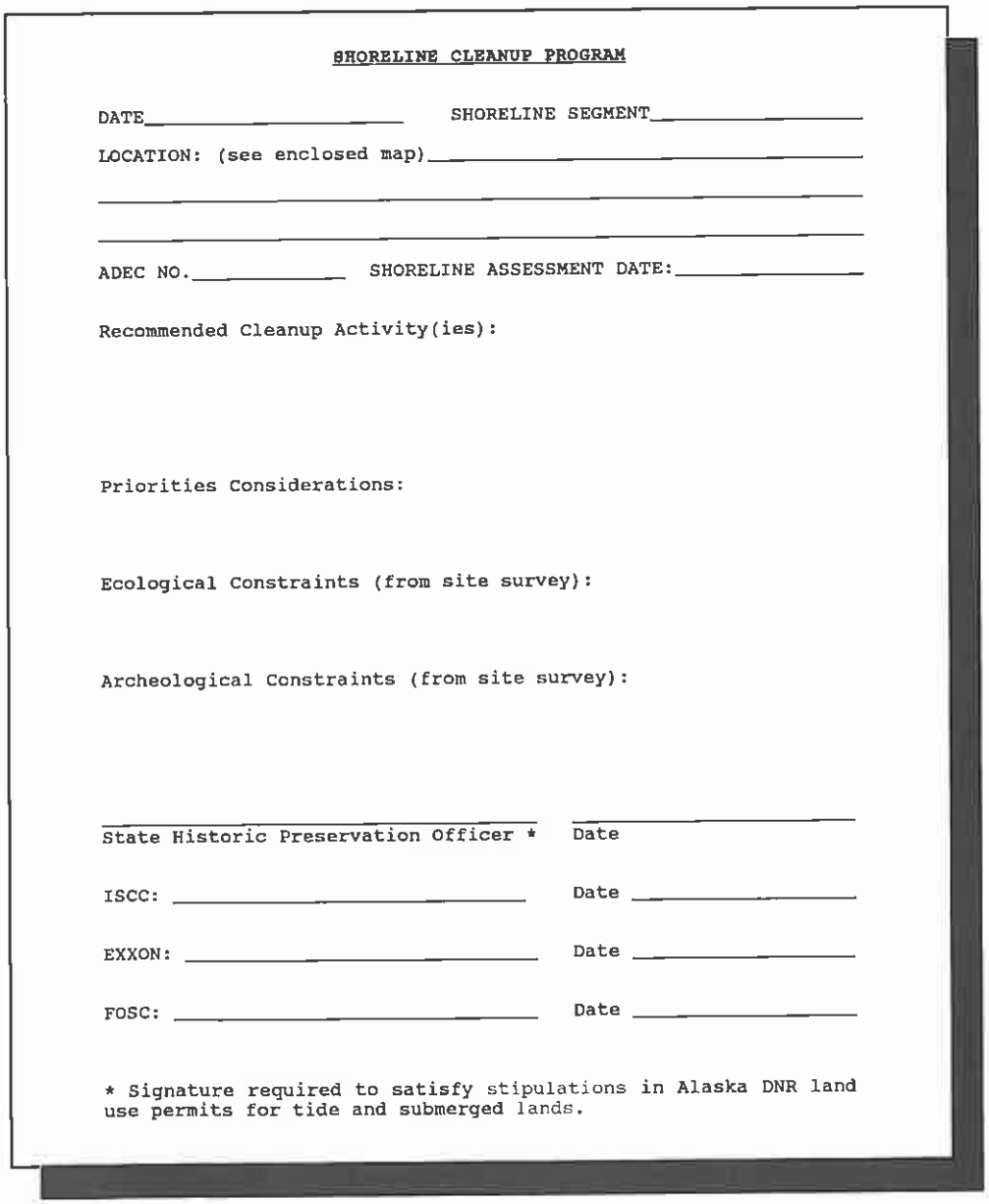
Robert Betts P13 12. Exxon

Figure 31. Special precautions were necessary to protect video cameras from the elements while filming sites during the cultural resource survey and post-cleanup assessment.

Later, when SCAT survey was expanded to the Kodiak area, a parallel SHPO signatory system was established in Kodiak. After the SHPO representative signed the individual segment work orders (shoreline cleanup program form, Figure 32), signifying agreement that the identified constraints would adequately protect the cultural resources present (given the treatment techniques specified), a group of SCAT biology/archaeology/oil-geomorphology reports for a contiguous set of segments (a "block") was forwarded to the ISCC for review. Federal and state agencies and other parties on the ISCC had five days to examine the proposed treatment techniques and cultural and biological constraints before meeting again to voice concurrence or reservations. Meanwhile, copies of the cultural resource documents were provided to the SHPO representative. Once the ISCC reviewed the block of segments, it was signed and forwarded to the FOSC, who approved it and sent it to Exxon for implementation.

Other Procedural Aspects of the Cultural Resource Program

Other options employed to protect cultural resources potentially affected by the treatment program -- including avoidance, mapping, artifact collection, monitoring, and education -- are discussed in more detail in subsequent chapters.



SHORELINE CLEANUP PROGRAM

DATE_____ SHORELINE SEGMENT_____

LOCATION: (see enclosed map)_____

_____

_____

ADEC NO._____ SHORELINE ASSESSMENT DATE:_____

Recommended Cleanup Activity(ies):

Priorities Considerations:

Ecological Constraints (from site survey):

Archeological Constraints (from site survey):

_____ _____
State Historic Preservation Officer * Date

ISCC: _____ Date _____

EXXON: _____ Date _____

FOSC: _____ Date _____

* Signature required to satisfy stipulations in Alaska DNR land use permits for tide and submerged lands.

Figure 32. Example of the shoreline cleanup program form, used in the field, that was then forwarded by Exxon to the ISCC and FOSC to support the technical recommendations for a given segment.

Sources of Potential Impacts to Cultural Resources

Sources of impact to cultural resources are receiving increased attention in archaeological literature, as more social scientists stress the need to control post-depositional processes that can modify the archaeological record and affect inferences made from artifacts, features, and contextual data (Schiffer 1976). Much of this work has been devoted to compliance situations; research has been conducted on the impacts to cultural resources of fire (Wein 1976:215-216, Eisler et al. 1978, Kelly and Mayberry 1981:81-84, Manuel 1980, Switzer 1974, Tayler et al. 1979, Racine 1981:81-84), timber harvest (Debloois et al. 1975, Gallagher 1978, Wood 1979), recreation (Mobley and Morris 1981:5-10, Bowers 1984, Flenniken and Haggarty 1979), military maneuvers (Briuer and Niquette 1983, Briuer and Show 1983), vandalism (Williams 1978, Crowell 1987), and a variety of other human activities (Wildeson 1982). This report may be the first to consider in detail the potential or actual impacts to cultural resources of oil spill treatment activities (Benson 1978).

After the release of oil into Prince William Sound from the damaged tanker, cultural resources were not directly threatened as long as the oil stayed on the water surface away from coastal shorelines. Cultural resources were at risk only when the oil floated to shore, adhering to surfaces throughout the intertidal zone. When the decision was made to remove oil from the intertidal zone to protect the natural environment, cultural resources were put at risk from treatment activities. Realizing that a variety of cultural resources was known to exist in the oil spill area, state and federal agencies raised concerns that treatment activities could disturb some sites.

The types and locations of archaeological and architectural sites made them potentially vulnerable to disturbance. Sites known to occur in the intertidal zone include stone and wooden fish weirs, petroglyphs, shipwrecks, piers and pilings associated with historical domestic and commercial facilities, and potentially the full range of features originally found in the uplands but now tectonically subsided into the intertidal zone. Cultural resources were known to occur in the adjacent uplands, where midden deposits, villages, rockshelters, culturally modified trees, historical domestic and commercial facilities, and other features are present. The range of physical materials incorporated into these sites includes stone, bone, shell, various metals, wood, textiles, leather, and other organic items.

The nature and location of known or suspected cultural resources, and the sources of potential impact, were both taken into account in devising specific constraints protecting cultural resources at each shoreline segment. The three major sources of potential impact are: 1) chemical and physical impacts resulting from oil in direct contact with artifacts or features; 2) treatment methods employed to remove oil from a shoreline; and 3) human activities incidental to the actual treatment methods. The treatment methods are further subdivided into manual techniques and mechanized techniques. A variety of equipment and techniques was employed in innovative ways to clean oil from the shoreline, and some of the details are explained here to provide the reader with insight into the technical aspects of the treatment program and thus their *potential* for disturbing cultural resources. *Actual* impacts on cultural resources are discussed later in this report.

Potential Physical and Chemical Impacts of Oiling

One physical consequence of oiling is that cultural resources can be obscured from observation (as in the case of oiled artifacts in the intertidal zone), or significant details



Morley Eldridge 8:3. Exxon

Figure 33. Prehistoric stone lamp in place amid oil at SEW-436.

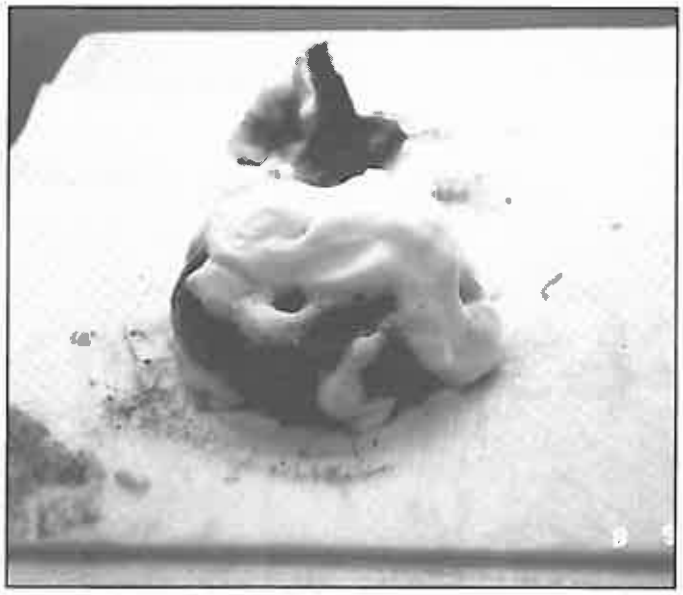
of the artifacts or features may become temporarily illegible. Although oil hardened into asphalt can resist natural forces for a while, eventually wave and tidal action remove most oil from shorelines and thus make oiled artifacts visible again, so that oiling is an impediment to observation only temporarily. Oiled stone or metal artifacts can be successfully cleaned using a detergent or commercial degreaser (Figures 33 - 36); no oiled artifacts of other materials were collected. Such washing could remove significant organic residues that would otherwise be useful for archaeological inference (Briuer 1976, Loy 1983, Hyland et al. 1990), but in an intertidal environment -- where mechanical movement can be high -- the longevity of such residues is questionable. Some agencies, such as the USFS, automatically stipulate in their special use permits that all artifacts must be washed prior to cataloging anyway.

Little research has been done on the potential chemical impact of oil on cultural resources. In discussing archaeological stabilization techniques, Thorne et al. (1987:40-41) propose that asphalt, diesel fuel, or kerosene could contaminate archaeological deposits, but the expected effects are not suggested. Of the many specialized



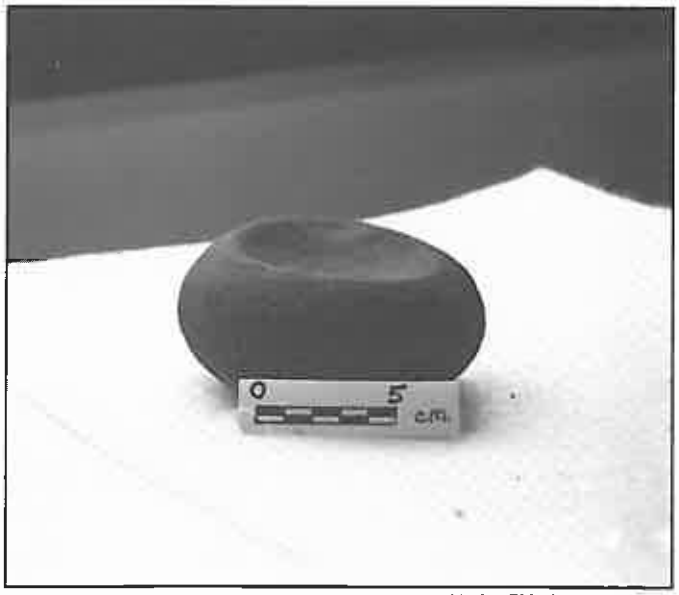
Morley Eldridge 8:17. Exxon

Figure 34. Recovered stone lamp from SEW-436 before cleaning off oil.



Morley Eldridge 8:25, Exxon

Figure 35. Stone lamp from SEW-436 during cleaning.



Morley Eldridge 8:31, Exxon

Figure 36. Cleaned stone lamp from SEW-436.

analytical techniques that can be applied to archaeological deposits to infer patterns of human behavior, a common one is the radiocarbon technique used to chronometrically date organic items. Several individuals, during the course of the 1989 cultural resource effort, questioned whether organic materials suitable for radiocarbon dating could be so dated after oiling. According to Exxon data, most of the volatile components present in North Slope crude oil evaporated before the oil reached shorelines, likely lessening penetration of oil into organic items. Lambert et al. (1989:427) discuss their work in removing nonbiogenic contaminants from bones in archaeological contexts, stating that "the problem of non-uniform contamination may be reduced or even eliminated for some elements by removal of 1-3 mm of the surface of the bone by physical abrasion," but this is a tenuous basis to suggest that the potential for radiocarbon dating oiled organic items would not be impaired. Oil differs from the contaminants studied by Lambert et al. (1989) in that it is biogenic, but David Von Endt (personal communication) of the Smithsonian Institution's Conservation Analytical Laboratory, believes that existing decontamination technology holds the firm possibility of removing foreign hydrocarbons to allow successful radiocarbon dating. Experimental confirmation is lacking.

The possibility of oil directly contaminating archaeological deposits is greatest for sites in the intertidal zone, but oil can also reach upland sites through extreme storm tide and wave conditions or regular pedestrian traffic by personnel involved with shoreline observation or treatment. Small amounts of oil can be transported from the intertidal to the near upland zone on the boots and clothing worn by cleanup workers, scientists, reporters, and others, and on oily debris bags or equipment stored temporarily on the surface of a site. Such "pedestrian" oiling was not common, and involved only minor traces of oil.

To summarize, the major potential physical impact of oiling is the obscuring of intertidal artifacts from observation, with the secondary possibility that solidification of oil could immobilize artifacts in the intertidal zone. Both of these effects would be temporary, as wave and tidal action would remove the oil over a period of months or years. The chemical impacts of oiling are not known; concerns have been raised about the loss of radiocarbon dating potential for contaminated organic items, but some specialists believe that oil can be removed from crucial samples so that they may be successfully dated.

Potential Impacts of Manual Treatment

Manual treatment was distinguished from mechanical treatment in several different contexts throughout the field season, sometimes using the terms "Type A" and "Type B", respectively. Mechanical treatments included those using heavy equipment, and systems designed to deliver water (varying in pressure, temperature, and volume) to assist in dislodging oil from the shoreline. Treatment operations in Prince William Sound were predominantly mechanical due to the greater concentrations of oil on the shoreline and the diversity of shoreline geomorphology. Non-mechanical methods were employed extensively in the Gulf of Alaska where shoreline oiling was less severe.

Manual methods included the removal of surface oil and oily debris by hand, rake, or shovel, and collecting the debris in containers that were subsequently removed for disposal (Figures 37 and 38). Manual methods also included the use of passive sorbents and the removal and burning of oiled driftwood. Although manual methods used no mechanized equipment to directly treat the shoreline, all-terrain vehicles were approved for some areas to transport debris containers to designated collection de-



Robert Mack 1:9, Exxon

Figure 37. Manual treatment using shovels to place oiled beach gravels into bags for removal.

pots. All lightly oiled shorelines where oil could easily be removed were generally approved for manual methods, except for tidal flats and salt marshes. Because of the potential for removing the upper surface of sediments, cleanup using shovels and rakes can expose and damage artifacts or features in the intertidal zone. The possibility of such damage is in part dependent on the energy of the shoreline environment, with higher energy coastlines having fewer older intertidal features intact.

Oleophilic materials placed in the intertidal zone were used to remove oil by absorption. Recoverable sorbent material was placed on the surface of the shoreline substrate and oil was soaked up at a rate dependent on the type of sorbent used. Although peat is an excellent sorbent, it was used only on an experimental basis. Plastic strips strung on lines or tied together into "pom-poms" were also used effectively in collecting oil (Figure 39). These materials can be used on any shoreline where oil is mobile and transport of the oil from the site is expected. The viscosity and thickness of the oil determines how much will be released by the substrate and subsequently caught by the sorbent material or pom-poms. Sorbents and pom-poms are for surface application only, so expected impacts were primarily those of pedestrian traffic in the intertidal zone and the possibility of inadvertent breakage of fragile surface artifacts.

The removal of oiled woody debris and logs from the shoreline was considered a manual technique, although it was often done with the help of chainsaws (Figure 40). Most of the debris came from the upper intertidal zone, where logs were cut into sections for removal to an on-site burning location or an off-site disposal location. Non-woody debris, such as plastics, sorbents, and oiled seaweed,was not burned on-site, because open burning of materials that give off black smoke was prohibited by ADEC. Burning of driftwood can create fire-cracked rock scatters that could be confused with prehistoric features of similar morphology (since fire-cracked rock is a common artifact class in prehistoric sites in the oil spill area). Personnel from the AOHA took responsibility for tracking approved burn sites and documenting any fire-cracked rock generated. Most approved burn sites were in the Homer area. In some cases, when fire-cracked rock of supposed prehistoric origin was known in the intertidal zone, specific constraints prohibiting fires were written for individual segments and submitted to the FOSC for approval.

Cultural resources were not jeopardized by burning of oil-soaked sorbents or other oily debris, because disposal of oily wastes was accomplished either through local incineration on a barge facility, or by transport elsewhere for high-temperature incineration. Biological constraints



Robert Mack 4:15, Exxon

Figure 38. Manual treatment using rakes to place oiled beach gravels into bags for removal.

included the need for appropriate air-quality controls (air quality permits were required by ADEC and EPA) and proper ash disposal.

An unanticipated impact of manual treatment was noted during the first two weeks of the treatment program, when Exxon cleanup crews and some local volunteer crews displaced cobbles and small boulders in the intertidal zone while wiping them by hand with sorbent pads (*Time* 1989, April 17, p. 66). The cobbles were sometimes replaced in the intertidal zone in neat rows parallel to the beach, creating rock alignments that could be subsequently confused with significant prehistoric or historic features. If they remain intact over the decades, such alignments could be considered significant historic features, in the manner that Bligh Reef has taken on new historic meaning.

Potential Impacts from Mechanical Treatment

Twelve mechanized treatment methods were used in the shoreline treatment program -- eight formally approved for use and four applied experimentally. Four general types of equipment were used in the mechanized treatment of oiled shorelines: 1) cold water landing craft; 2) maxi-barges; 3) omni-barges; and 4) hot water landing craft. Miscellaneous heavy equipment was also used on occasion to assist in the shoreline treatment. Shoreline treatment entailed three basic steps: 1) removal of oil from the shoreline; 2) containment of the removed oil, typically through a booming arrangement; and 3) collection of the removed oil, primarily through a skimming process. Removing oil from the shoreline holds the most potential for direct impact to cultural resources. Equipment specifications and application techniques are both relevant to cultural resource protection.

Description of Mechanical Equipment

In the initial stages of shoreline treatment, pumps and hoses were used to move water across shorelines and flush off oil that was still mobile. Deploying this type of equipment close to the often rocky and rugged shoreline requires shallow-draft, easily maneuverable landing craft vessels, or LCVs. About 60 LCVs of both military and civilian design were used throughout the spring and summer, ranging from 40 to 75 feet (12 - 23 m) in length and averaging 15 feet (five m) in width. They can be divided



Figure 39. Oil-soaked pom-pom.

into four categories: cold water LCVs, maxi-barges, omni-barges, and hot water LCVs. Two water delivery systems were often used together to remove oil from the shoreline -- a stationary deluge system and hand-held hoses.

The deluge system usually included a pair of pumps onboard the LCV capable of pumping about 1,000 gpm (3800 l/min) of ambient temperature seawater. Water was pumped from the LCV to a flexible header pipe stretched along the shore above the oiled section of beach. The header pipe had holes punched in it at one foot (30 cm) intervals to distribute water across the face of the beach and flush oil downslope. An advantage of this system was its simplicity of design and maintenance.

Beach crews (each containing about 20 people) used pressurized water from hoses attached to the LCV to loosen oil adhering to rocks in the intertidal zone and help flush it downslope. Another option on the LCV was the self-contained pressure wash units, consisting of a generator, pumps, heater, hoses, and a spray wand, to provide low volume, high pressure water using no external power supply. These units are small, relatively light, and easy to transport.

The maxi-barge was designed specifically for applications in Prince William Sound to increase the volume of water moved to the shoreline. The basic barge was an ocean-going type, about 50 feet (15 m) wide and ranging in length from 128 to 180 feet (39 - 55 m), with large, easily-assembled containers on deck for equipment storage. Unlike self-propelled LCVs, the barges required tugs to move them into position (usually parallel to the beach), and accommodated a crew of 25 persons per shift (2 shifts per day). The size of the maxi-barges allowed installation of unique features (not present on the LCVs) such as two heat exchange units to greatly increase hot water production, and two new delivery systems -- fire monitors and a manlift platform. The barge-mounted fire monitors could focus spray on rocky sections of shoreline otherwise inaccessible to beach crews. The manlift platform, similar in concept but capable of reaching to 70 feet (21 m), was equipped with a spray nozzle and a 4 inch (10 cm) hose connection. The fire-monitor and manlift platform helped direct pressurized hot water to specific shoreline locations.

Generally, the cold water LCVs were used in areas of limited access while the maxi-barges were better-suited to more open stretches of shoreline, and both were used on mobile oil. As oil weathered and became difficult to remove due to increased viscosity, increasing the amount of hot water for flushing shorelines greatly improved the overall efficiency of the treatment program. The omni-barge and the hot water LCV were designed specifically to accomplish that task.

The omni-barge, with its articulating arm and spray head, was the most distinctive piece of equipment used in the treatment program. The remote-controlled hydraulic boom (normally used to pump concrete on construction projects) was installed on the barge deck and equipped with a spray head and nozzles to reach otherwise inaccessible areas over 100 feet (30 m) away. Hoses could be run to shore from the end of the boom, preventing heat loss from immersion in cold water between the barge and the shore. By mid-July the hot oil trucks used originally as a heat source were replaced by higher capacity industrial heaters installed in groups of six (termed "six-packs"), thus increasing the heating capacity of the barges. The omni-barge was approximately the same size as the maxi-barge, though less seaworthy, and was made from cube-shaped flotation cells (called flexi-float sections) bound together to form a strong modular unit. Single or dual thrusters and a winch system allowed the barge to position itself along the shoreline. Four of the six heaters were used to supply 500 gpm (1900 l/min) of 140° F (60° C) water to the spray head or the fire monitors, leaving two back-up heaters.

The hot water LCV, commonly known as a "two-pack", had two industrial heaters capable of producing about 250 gpm (950 l/min) of 140° F (60° C) water distributed through hoses or bow-mounted monitors. Because the hot water LCV had much more maneuverability around rocks and irregular shores and was able to generate more hot water than a maxi-barge, over 12 hot water LCVs were deployed during treatment.

After the oil was washed from the intertidal area using the equipment described above, it was usually contained with booms (Figure 41). The typical booming arrangement at each shoreline for all LCVs, maxi, and omni-barges involved a primary boom deployed off the front of the vessel and a secondary boom off the stern. Once contained in the primary boom, the oil was moved toward a skimmer and collected. Many miles of containment boom, generally 18 to 24 inches (45 - 60 cm) deep, were deployed, retrieved, cleaned, and re-deployed numerous times during the treatment operation. Boom deployment was labor intensive, with beach crews and skiffs used to position the boom, often tying the ends to trees or other solid objects on shore. Due to tidal fluctuations of 15 feet (4.6 m) or more, the boom had to be positioned high enough onshore to accommodate high tide levels yet far enough into the water to handle low tide levels.

In addition to mechanical shoreline treatment, booms were also deployed ahead of traveling oil to prevent contamination of pristine shores where constrictions in



Robert Mark 1:18, Exxon

Figure 40. Oiled driftwood removal using chainsaws to reduce logs to manageable size.

the shoreline allowed booming of coves and bays, especially at sensitive resource areas such as hatcheries. Direct shoreline impacts of booming are restricted to the points where the ends of the boom are tied to shore -- where culturally modified trees or other cultural features could perhaps suffer rope scars or other effects.

The oil flushed from the intertidal zone was herded toward mechanical devices called skimmers, which collect floating oil using a variety of different methods. The skimmers used to collect oil from the *Exxon Valdez* spill ranged from the huge ocean-going Soviet vessel *Vaydaghubsky* to small skiffs trailing pom-poms, but most were commercially manufactured devices using sorbent, weir, or suction systems to remove floating oil from boomed areas. The skimming operation, being confined to the water, had no potential for direct impacts on cultural resources.

The wide range of equipment used in the oil recovery process was prompted by variable shoreline geomorphology, weather conditions, and oil characteristics. In total, over 60 LCVs, 13 maxi-barges, and 13 omni-barges were deployed. The pumps provided in excess of 200 million gallons (53 million l) of water per day, or the daily requirements of a city of one million people, while enough hot water was generated to serve a city of half a million people. Hundreds of smaller vessels supported the operation, and dozens of barges were committed to berthing, supplies, fuel, water, sewage treatment, and a host of other services. Most of the equipment used in the treatment operation was of standard manufacture, but it was often assembled in innovative ways out of the necessity to treat shorelines as efficiently as possible.

Mechanical Treatment Methods

The above equipment was combined in various ways to create different treatment methods. Eight methods were routinely employed during the treatment operations, and four were developed and applied experimentally. The potential impacts to cultural resources vary somewhat depending on the type of application.

Washing/Flooding with Cold Water (Deluge)

Using large volumes of ambient seawater at low pressure, this method washed surface oil from crevices



Figure 41. Boom arrangement to accommodate cold water flooding and cold water/low pressure washing.

and interstices to the water's edge for pickup. The water was pumped through hoses to a header pipe above the oiled zone and flowed downslope across the oiled beach surface carrying oil with it. The oil was then trapped by booms and picked up with a skimmer. On porous beaches of boulders, cobbles, gravels, or coarse sand mixed with sediment and rock, the water flows through the substrate and washes loose oil to the surface, but the method is not suitable for mud flats, creek mouths, or steep rocky shorelines. It was used where cobble or boulder shorelines had large areas of fluid oil penetrating the substrate, frequently in conjunction with other washing techniques such as low or high pressure, or cold or warm water washing (Figure 42). Potential impacts to cultural resources from the deluge method are lessened by the limited subsurface disturbance, which is comparable to normal wave action. However, the deluge method was usually used in combination with other techniques that have more potential for disturbing sediments and cultural resources.

Cold Water/Low Pressure Washing

This method removed oil adhering to rocks or buried in shallow layers in sand and gravel-sized sediments, by pumping cold water through hand-held hoses and keeping nozzle pressure low (less than 50 psi) through nozzle controls. The low pressure spray removed lightly-adhering oil and gently agitated the substrate to expose buried oil and move it downslope into the boomed area. Often used with deluge flooding and other techniques, cold water/low pressure washing was effective on most beaches with coarse sediments, but it was not useful for marshes and tidal flats unless pressure was kept low to minimize disturbance to the fine sediments. The method was used to flush floating or loose oil out of tide pools and crevices, or off attached organisms (such as mussels and barnacles) on rocky shorelines. The low pressure of this technique limits the potential for disturbing subsurface cultural materials, as little exposure occurs below the depth otherwise affected by normal wave action. However, if the technique is improperly applied -- if pressure is too high or if "deluge" flooding is not used -- it can drive oil deeper into the substrate.



Donald Abbott 18.2, Exxon

Figure 42. Personnel using a combination of treatment techniques; cold water flooding, cold water/low pressure washing, and sorbent booms.

Cold Water/High Pressure Washing

This technique was similar to low pressure washing except that the water pressure was greater (up to 100 psi), to remove oil adhering to rocks or buried in the substrate. It was primarily applied to boulder, cobble, and rock beaches, and was used to flush loose oil out of tide pools and crevices. This technique was appropriate where adherent oil had to be removed amid particularly sensitive biological communities, such as in fish spawning areas. Compared to low pressure washing, the higher pressure makes this technique potentially more destructive to surface or near-surface archaeological deposits because it thoroughly agitates near-surface sediments and can drive oil deeper into the substrate if improperly applied.

Warm Water/Moderate to High Pressure Washing

Heated seawater at moderate to high pressure (generally up to 100 psi) was used in this technique to mobilize weathered oil, sometimes with deluge flooding and additional low or high pressure techniques. It was most often applied to heavily oiled boulder, cobble, and rock shorelines, and was avoided on fine-grained beaches because the oil may percolate deeper into the sediments. This method was reserved for weathered oil that could not be removed with other techniques, or where oiling was sufficiently heavy to warrant short-term removal of organisms. Where biological communities needed protection, the technique was avoided because it can kill or remove organisms in the intertidal zone and -- if containment methods are insufficient -- contamination may be flushed into pristine lower intertidal zones. Potential impacts to cultural resources using this method are similar to those using cold water/high pressure systems, except that the hot water -- with the potential for forcing oil deeper into underlying sediments -- could allow oil to reach cultural features buried at a greater depth. This and the previously-discussed techniques were all judged suitable for cleaning concrete piling remains, such as SEW-435 (Figures 43 and 44).



Robert Betts P5:24, Exxon

Figure 43. Omni-barge cleaning pier remains at SEW-435.

Hot Flush with Hand Wands and Vacuum

High temperature water heaters (up to 170° F (77° C)) and high pressure wands (Figure 45) were sometimes used to dislodge trapped oil from otherwise inaccessible locations. Used without water flooding, this procedure requires that oil running off rocks and soil be removed immediately (to prevent percolation into adjacent sediments) using portable vacuums or the larger, centralized vacuum systems commonly referred to as "supersuckers." The method was used on inaccessible shores where warm water flushing was not feasible, and was not applied to sandy beaches or locations where the removal of attached organisms from the intertidal zone was unacceptable. The little sediment movement that occurs with this method lessens the potential for impacts to cultural resources, but the hot water and consequent warm oil raises the potential for subsurface oil penetration. Because of its portability (some units are essentially a backpack system), this equipment is useful in areas where a delicate touch is needed during oil removal and recovery (such as on intertidal petroglyphs).

Vacuum Systems

Vacuum systems used to remove free oil from the shoreline surface included a suction head, hose, pump, and oil storage tank. The equipment ranged from portable units tethered to 55 gallon drums, to large, truck-mounted supersuckers (stationed on barges) capable of lifting large rocks. The method was appropriate for all shorelines (including rocky headlands) holding large volumes of free oil, but was not used where foot traffic and equipment were restricted. When used properly, little substrate was removed, so potential impacts on cultural resources were minimal.

Hot Water Injection

Hot water injection removed oil from shoreline sediments by forcing hot water below the sediment surface and flushing it to the surface, using small diameter (2 in (5 cm)) well points driven into the substrate and connected to a manifold. Once the area had been boomed and the incoming tide had covered each well point, hot water was injected into the wells to float oil to the surface. Only mixed



Figure 44. Close-up of omni-barge cleaning pier remains at SEW-435. Robert Betts PS,13, Exxon

sand and gravel beaches were treated this way because the high porosity of gravel and larger-sized sediments resulted in small flushing radii around each well point. The method was appropriate for heavily oiled beaches where oil had penetrated below the level where agitation by high-pressure washing with fire hoses was effective, but it was not used in areas of biological sensitivity. The insertion of well points into sediments could disrupt a buried intertidal archaeological site; potential impacts would be limited to physical displacement of materials, and the possibility of downward penetration of oil into a cultural deposit.

Burning of Oiled Surfaces

Small hand-held weed burners were sometimes used to remove surface oil from oiled logs without disposing of the entire log. This method was reserved for circumstances in which: 1) oiled logs were sources of re-oiling for adjacent organisms; 2) physical removal of the logs was not desirable; or 3) the area received high recreational use. It was not used where adjacent habitats could be harmed from stray heat. Because organic artifacts and features may occur in the intertidal zone, there was the possibility of damage if care was not taken in using the weed burners. A wooden shipwreck, for example, could be at risk from unskillful use of this method.

Disking of Sand Beaches

A modified version of this method was used in Kodiak, but otherwise it was considered only for experimental application; both methods are discussed as one in this report. The objective was to break up lightly oiled layers and mix them throughout the upper sediment profile, thereby increasing exposure to wave and tidal action, microbial consumption, and natural photochemical oxidation. The technique is appropriate for lightly oiled shores that continually bleed or those with extensive pavement formation, but for the latter there is the potential for mixing large amounts of oil into the substrate and prolonging oil residence. The method is not suitable for shellfish-harvesting areas or anadromous fish streams because of the potential for continued release of oil into the water.

Disking holds a high potential for damaging surface and near-surface artifacts and features, as within an agricultural context such equipment is well-known to break and scar specimens and destroy archaeological



Exxon Public Affairs

Figure 45. Hot water wand of the type used for localized oil removal.

sediments. In archaeological literature, the layer of tilled soil known as the "plow-zone" is commonly recognized as having reduced information potential due to loss of spatial integrity. Beaches have a comparable zone, where normal wave and tide action destroys or reduces the spatial integrity of cultural materials in the uppermost sediments.

Sediment Removal

Oiled sediments can be removed manually using hand tools, or mechanically using motorized equipment, with sediment disposal in both cases occurring off-site. Sand, pebble, and cobble beaches can be treated this way, but it is feasible only when limited sediment is removed and where beach erosion will not result. Because this method requires considerable manpower and equipment, the technique has a significant environmental impact on the intertidal zone, and thus is not appropriate for certain environmentally sensitive habitats. All cultural materials (as well as natural organisms) in the direct work area are potentially affected, and buried features located in the area could be compressed or otherwise disturbed by heavy equipment.

Shoreline Removal, Cleaning, and Subsequent Replacement

In this treatment method (used only experimentally in 1989) oiled sediments are removed, cleaned, and replaced on the shoreline. The oiled substrate is put into a container and cleaned with hot water or a detergent solution (with physical agitation), then returned to the shoreline once all oil and toxic substances have been removed. This technique is applicable to sand, pebble, or gravel beaches, but a sizable backshore area is needed on which to station the cleanup equipment. The method can be used on shorelines where sediment removal is undesirable without replacement, or where other treatment techniques are ineffective, realizing that all organisms in the direct work area will be affected. It is generally unacceptable for herring and salmon spawning areas. Any cultural materials in the removed sediment zone would be destroyed, and the compressive forces of heavy equipment could crush or otherwise affect buried features located below or nearby.

Relocation to the Surf Zone

This experimental method uses the natural cleaning action of waves to remove oil which has penetrated deep into beach sediments (mainly gravels and cobbles). Oiled sediments are pushed into the surf/tidal zone to allow the waves to toss them back onto the high-tide berm. Moderate to high wave energy is necessary for the technique to be effective. It is not appropriate for environmentally sensitive shorelines or where natural flushing is seasonally low because the oil may be released into the environment without recovery. In the intertidal zone, all organisms that use the beach are either displaced or destroyed, and time is needed to restore the natural beach profile. As is the case with the two removal methods discussed immediately above, the relocation method has potential for severe disturbance of cultural resources in the removal zone.

Potential Human Impacts

Archaeological and architectural sites located in the uplands adjacent to treated shorelines were at risk only when people visited those uplands. Although a blanket restriction on uplands access by cleanup crews



Exxon Public Affairs

Figure 46. Spray system used to apply Corexit, a chemical dispersant.



Exxon Public Affairs

Figure 47. Backpack applicator for bioremediation treatment.

was in effect throughout the shoreline treatment phase, some degree of access was often required to efficiently undertake treatment activities. For example, on the Alaska Peninsula and elsewhere, bear guards (often personnel of the land-managing agency) were required in the uplands to provide adequate protection for treatment workers located on the beach. The human tendency to take short-cuts across spits and peninsulas to get from one beach to another can also cause pedestrian traffic across sensitive cultural sites. Until portable sanitary facilities were provided in quantity in the work areas, cleanup personnel sometimes used the immediate uplands for personal relief. During field testing of treatment options, large numbers of agency personnel, reporters, and other relatively independent individuals were present in selected work areas, and the restrictions on upland access were difficult to enforce under such circumstances. These activities held the potential for inadvertent human impacts to cultural resources, especially surface features.

Such impact is distinguishable from deliberate vandalism, which is the second form of human impact. Nationally, the most common forms of vandalism are "excavation; defacement; surface collection; removal of boards and timbers; shooting, removing, painting and chalking rock art; and theft of objects from buildings" (Williams 1979:108). Uncontrolled or unsupervised access to the immediate uplands, particularly where rockshelters, historic cabins, mine sites, and other surface features or subsurface deposits with surface exposures occur, can place such sites at risk to vandalism. This potential was recognized, and steps (discussed elsewhere) were taken to address the risk.

Gleeson (1989:4) suggests that one consequence of the oil spill cleanup program may be "increased looting as the density of site locations becomes better known to the general public." However, almost no baseline information has been collected by the land-managing agencies concerning the prior rate of unauthorized site disturbance in the oil spill region. Every year the cultural resource inventory in Alaska suffers degradation at the hands of unauthorized individuals (Morton 1989, Crowell 1987, Perala 1989), but little systematic study has been done. As a consequence, not only is it unknown whether Gleeson (1989:4) is correct, but, lacking baseline information concerning the rate of disturbance prior to the spill, it will be difficult to confirm or disprove the premise.

Potential Impacts of Chemical Treatment

Used only experimentally in 1989, chemical treatment increases the efficiency of oil removal through the application of weak chemical dispersants to the substrate (Figure 46). It is used as a presoak or flushing solution that wets the substrate so that other treatment methods can be more effective, and it can be used on any type of beach, particularly when flushing is difficult due to extreme viscosity, thickness, or penetration. In the intertidal zone, short-term toxic effects may occur to organisms in the substrate and nearshore water column. The exact effects on organic cultural artifacts and features are unknown, but would depend on the specific composition of the chemicals. Such chemicals would likely have little effect on inorganic features and items, such as rock or concrete.

Potential Impacts of Bioremediation

Bioremediation accelerates the degradation of oil by natural microbial communities, either through the addition of nitrogen and phosphorous fertilizer to increase the natural population of hydrocarbon degrading microorganisms, or through the inoculation of contaminated shorelines with increased levels of indigenous hydrocarbon degrading microorganisms. The former option was approved for use in the oil spill area (EPA 1989), and late in the season fertilizer was sprayed by hand on some oiled shorelines (Figure 47). An oleophillic fertilizer named Inipol was used on an experimental basis, and the slow release fertilizer Customblen was approved for wider

application. Inipol contains a saturated solution of urea as a microemulsion in oleic acid, stabilized by laureth phosphate and butyl cellosolve to produce a pH of 5.5. Customblen consists of ammonium nitrate, calcium phosphate, and ammonium phosphates encapsulated in polymerized vegetable oil; with the measured application rates used, soil pH is not significantly affected. Bioremediation can be used on any shoreline, but is less effective on exposed shorelines where nutrients are rapidly washed away. It may be used as a secondary treatment method to enhance the natural removal of oil left by physical treatment efforts.

Application of fertilizer to the intertidal zone puts cultural resources at minimal risk. Inorganic items, such as those of stone or concrete, would be little affected, but concern was initially raised about the extent to which natural weathering of organic items could be accelerated. After application to the intertidal zone, the fertilizer is diluted and washed away by subsequent tidal action within a very few days, and little subsurface penetration occurs. No bacteria, either indigenous or exotic, were added in the process, so only local organisms were increased (hydrocarbon degraders identified in Prince William Sound include *Pseudomonas sp., Acinetobacter calcoaceticus, Moraxella phenylpyruvica, Oceanospirillum sp., Alcaligenes/Flavobacterium/ Achromobacter sp., Vibrio sp., Arthrobacter/Brevibacterium sp.*, and *Trichosporon sp.)*.

Of the organic items generally present in archaeological sites in the oil spill area (charcoal, wood, bone, shell, ivory, metal, etc.), wood is one of the least resistant. When the question of potential impacts to cultural resources from bioremediation was posed to Exxon's chemist Roger Prince, he wrote:

> ... Wood's major component, lignin, is degraded by very few organisms. Indeed the only well characterized organisms that can metabolize lignin are the white rot fungi, which are very rare in marine environments, and their lignolytic activity is usually inhibited by the addition of nitrogenous fertilizer. ... Although one might expect Inipol to inhibit the degradation of lignin, it might potentially stimulate the degradation of the cellulose component of the wood and woven grasses; I would expect no significant effect ....

Direct experimentation with the effects of bioremediation on cultural resources is lacking, but the present information suggests that little degradation would be expected. As a consequence, bioremediation may be one of the more benign treatment methods in terms of impacts to cultural resources.

Potential Impacts of Boat Moorage

Large numbers of vessels ranging from small craft up to ships and barges several hundred feet in length were anchored in the oil spill area during the treatment program. Of necessity, this took place most often in sheltered bays where commercial or recreational vessels have traditionally anchored, and officially designated anchorages were favored. The potential impacts to submerged cultural resources, such as shipwrecks, were little greater than the potential threat from normal commercial and recreational use.

Deployment of various treatment systems along the shoreline required an increased number of boat landings (often with large landing craft) and close inshore anchoring, in excess of normal commercial and recreational activities. This raised the potential for disturbance of cultural resources on the marine floor near shore, although no quantitative data yet exist to evaluate the subject.

Summary

The possible impacts to cultural resources that could be brought about by the oil spill and cleanup techniques have been presented in this chapter. This is the first study focusing on oil spill cleanup impacts on cultural properties, and was conducted under emergency conditions lacking anticipation of the event. Baseline data compatible with data from studies of other sources of impact are not available, with the exception of results from the artifact experiment reported in this volume. Some of these potential impact sources were recognized at the onset of the cleanup program, while some became apparent only later.

Educational Efforts

Very early in the project it was realized that cleanup workers and supervisors would need to be informed about their role in cultural resource protection. A system was needed to teach field personnel that: 1) known cultural resources located in the cleanup area were sensitive and needed to be protected from the cleanup; 2) heretofore undiscovered cultural resources might be uncovered by cleanup, and would require similar protection; and 3) intentional disturbance of cultural resources was in violation of Exxon policy and state and federal laws. A mechanism was also needed to inform the many agency personnel and other officials about the site protection efforts, since: 1) many of those parties were conducting activities that could accidentally disturb cultural resources in the spill area; 2) there was the possibility that agency representatives acting in their own capacity might discover unrecorded cultural sites -- sites that could be further protected if the discoverer fed the information into the EXXON VALDEZ Cultural Resource Program; 3) other individuals with spill-related business in the area were bound by the same state and federal laws; and 4) the understanding and cooperation of other agencies was necessary to make the site protection program work. In addition, the press showed an interest in Exxon's site protection program, raising public awareness of the archaeological efforts. The result was a multi-faceted educational approach to cultural resource protection.

Methods

The methods used in the educational program included personal presentations, handouts, letters, videotape, and radio and newspaper interviews, depending on the audience. Information was provided to three main groups; cleanup personnel, agency personnel and other members of the ISCC, and the public.

Educating Cleanup Personnel

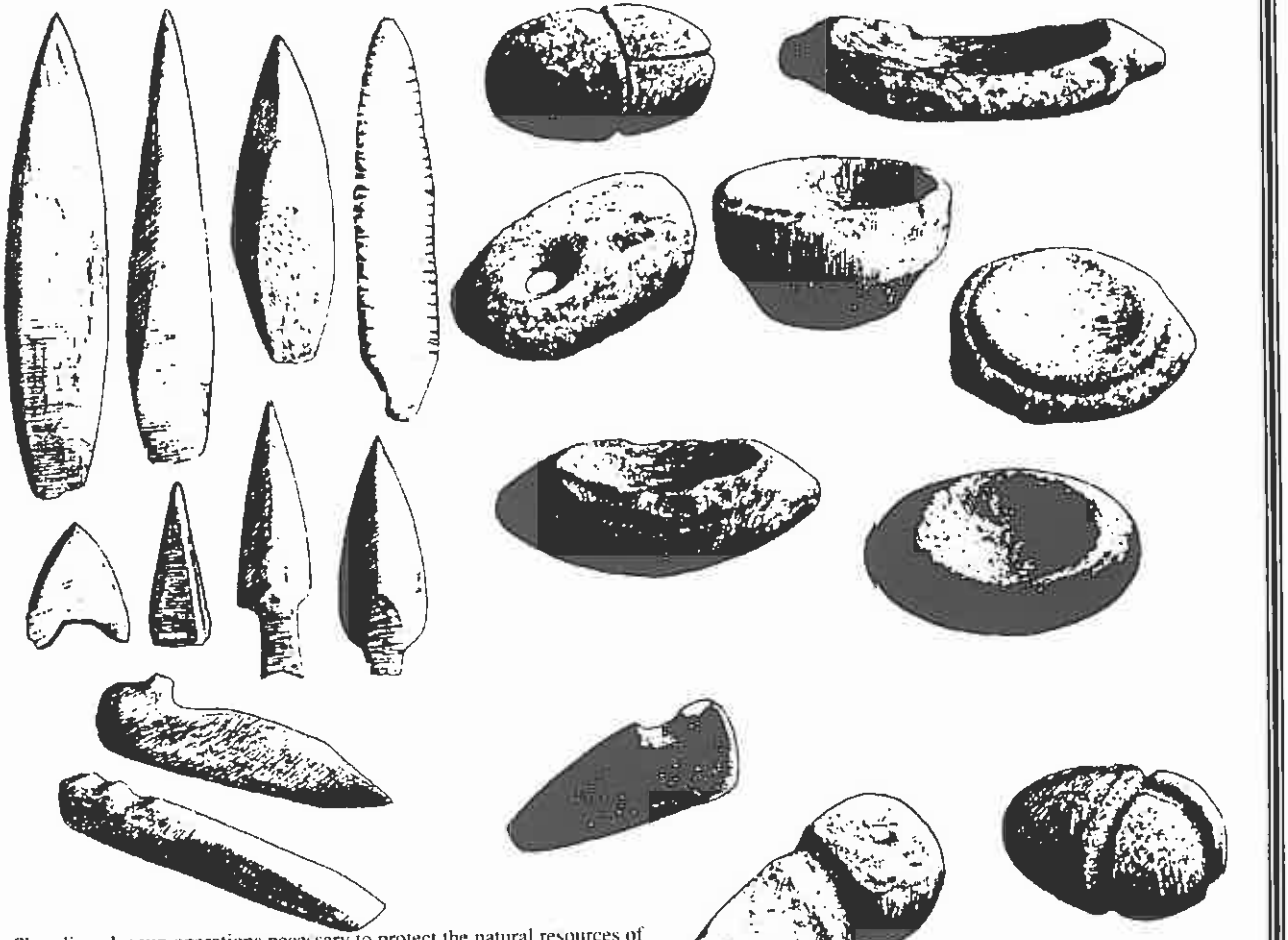
In April, Exxon developed a set of Area Response Plans for Cordova, Seward, Homer, and Kodiak, to standardize procedures and address common questions raised by oil spill workers and supervisors. Many different topics were discussed in the response plans, including channels of authority, cleanup techniques, and other matters. Although the exact language evolved through several different releases of the response plans, the essential steps which cleanup personnel were directed to follow on discovery of cultural resources were: 1) to leave cultural materials in place at the site of discovery and mark them with flagging tape; 2) to stop cleanup work in the surrounding vicinity immediately; and 3) to inform Exxon's Archaeological Director by the end of the work day. (Lethcoe and Nurnberger 1989:65) The response plans concluded the archaeological discussion with a statement concerning vandalism and Exxon's policy for workers caught intentionally disturbing cultural resources:

> Cleanup personnel should be aware that Exxon's policy is that anyone found vandalizing, moving, or taking away cultural materials will be subject to immediate dismissal from the work, and an incident report may be filed with law enforcement authorities, requesting prosecution under applicable law.

Following the discussion was a full-page illustration (Figure 48) showing common artifact types (hurriedly adapted from Stewart 1981) that might be encountered by cleanup personnel (a similar one-page illustration was developed and used for the same purpose by the SHPO).

To supplement the response plans, a 14-minute cultural resource awareness videotape was made which: explained the information in the response plans; listed the three steps to be followed in the event of unanticipated discoveries during cleanup; repeated the Exxon policy for

STONE ARTIFACTS WHICH MAY BE DISCOVERED BY BEACH CLEANUP CREWS



Shoreline cleanup operations necessary to protect the natural resources of the Homer area also have the potential for damaging evidence of its cultural heritage. Archaeological and architectural remains reflecting the region's rich history are present in the cleanup area. Through the cooperation of State and Federal agencies, Exxon and other teams of specialists are identifying the archeological and historical sites —the physical remains— that may be impacted by cleanup operations. Authorized shoreline cleanup procedures may uncover undiscovered archeological features or artifacts. To assist in their identification, drawings of stone artifact types that might be found in the intertidal area are included as part of this handbook. Your assistance in identifying such cultural resources will be appreciated by all the people involved with the Homer/ Lower Cook Inlet and the *Exxon Valdez* cleanup effort.

Cleanup personnel should be aware that Exxon's policy is that anyone found vandalizing or appropriating cultural materials will be subject to immediate dismissal, and an incident report will be filed with law enforcement authorities requesting prosecution under the Archeological Resources Protection Act.

Figure 48. Figure from the Homer/Lower Kenai Peninsula Response Plan showing common artifact types that workers might encounter during cleanup.



Anchorage Daily News. Used with permission.

Figure 49. Political cartoon from the Anchorage Daily News.

vandalism and explained the law; and described briefly the artifacts in the illustration. The possibility of encountering intertidal activity areas, such as fish weirs or drowned shorelines containing former upland sites, was illustrated using drawings done before the video camera. Over 120 copies of the videotape were distributed throughout the oil spill area.

Initially, copies of the videotape were distributed through VECO and Exxon Operations. A more direct method was for SCAT archaeologists -- particularly those specializing in a monitoring function -- to carry copies of the video in the field and play them for the cleanup crews on the berthing vessels. When an agent of ADNR apprehended a Port Graham Native crew collecting artifacts from the intertidal zone, Exxon issued a letter from Otto R. Harrison to all contractors (over 1000 at the time), reaffirming Exxon's policy on disturbance of cultural resources.

Educating Agency Personnel

Steps were taken to inform the many individuals not already directly involved with the cultural resource effort. People working in various official capacities for federal agencies, state agencies, Native organizations, community organizations, Exxon and its affiliates, emergency response teams, and other groups were contacted, although the approach was not systematic. Given the daily interaction with many of these people, numerous opportunities arose to casually discuss the EXXON VALDEZ Cultural Resource Program and the current status of site protection efforts. Memos and other documents circulated at the ISCC meetings were used officially to communicate information to the agencies. Cultural Resource Program updates were presented regularly at the "Science Meetings" held at the Valdez community center, where researchers of all affiliations held a regular forum to present synopses of their ongoing oil spill work. Because of the rapid turnover in agency staff, there was a steady stream of new people to be briefed on the site protection efforts.

Educating the Public

When queries by the press indicated a media interest in the EXXON VALDEZ Cultural Resource Program, a briefing package was compiled for distribution. The packet contained a personnel roster with individuals' credentials, a copy of Exxon's cultural resource policy, and a brief explanation of the program. Press releases were occasionally issued, reporting such items as the discovery of the buoy bell in Prince William Sound (see *Incident Reports).* Several newspaper articles were published by Valdez, Kodiak, and Anchorage newspapers (Jaeger 1989a, 1989b; Goforth 1989, Hall 1989), and some articles were

distributed nationwide through the Associated Press (Jenkins 1989, Pagano 1990). *Forum*, the popular publication of the National Trust for Historic Preservaton (1989), presented an article on oil spill archaeology. A political cartoon appeared in the *Ancorage Daily News* linking archaeology with the oil spill (Figure 49), and archaeological aspects of the oil spill also generated some interest in the "Letters to the Editor" column of a local newspaper.

Several news reports, including interviews with agency and Exxon archaeologists, were issued over the Alaska Public Radio Network. A request was received from Monitor Radio for a 45-second description of the site protection efforts to be aired on nationwide public radio, as part of a more comprehensive report on incidental benefits of the oil spill and cleanup. However, the interview was denied at the written request of CAC.

A public cultural resource presentation planned in Valdez for August 14 was also canceled at the request of CAC and two Chugach village corporations -- Chenega Corporation and Eyak Corporation. The presentation had been prepared on short notice to include photographs, handouts, videotape, maps, sample forms, posters, and the buoy bell and about thirty other artifacts, all screened to protect site location information. The intent was to explain the SCAT process and the cultural resource protection process, because it was apparent that -- despite other educational efforts -- considerable ignorance and confusion remained about why archaeologists were needed in conjunction with the cleanup program. Citing their lack of involvement in the planning for the program, the three Native corporations issued strongly-worded public statements to the press in opposition to the presentation, and it was accordingly canceled.

Near the end of the summer, as oil spill activity declined and tourism proportionately increased in Valdez, several requests were received for public lectures on the site protection efforts. Two lectures were given to classes in the Elder Hostel program at Prince William Sound Community College.

Educational efforts continued during the analysis and write-up phase of the EXXON VALDEZ Cultural Resource Program. A technical summary was published in the *Alaska Anthropological Association Newsletter* (Mobley 1989b), and a slightly different version was presented at the British Columbia Oil Spill Protection Workshop in September of 1989 (Mobley and Haggarty 1989a). In early 1990, Exxon helped to organize and financially underwrite the first Alaska Archaeology Week (April 2 - 8), in cooperation with state and federal agencies. Officially proclaimed by Governor Steve Cowper, Alaska Archaeology Week was a multi-media event intended to call public attention to cultural resources in Alaska, and to focus upon their significance and the importance of preserving them intact for public and scientific appreciation.



Richard Knecht 8/4, Exxon

Figure 50. Cleanup worker holding a stone lamp, found under an Exxon archaeologist's supervision, at XMK-058.

Effectiveness of the Educational Program

Although a comprehensive system for evaluating the overall effectiveness of the educational program is difficult to develop, it is possible to assess the degree to which cultural resource information was delivered to individuals in the cleanup effort. Archaeologists implementing the monitoring program were in the best position to carry out the educational tasks in the field and to evaluate their effectiveness. Direct contact between archaeologists and all levels of cleanup staff occurred in the field on an almost daily basis.

Archaeological monitors evaluated field personnel's knowledge of the site protection program primarily through conversation. Monitors used these encounters to further brief personnel and to discuss archaeology in general. The field supervisory staff of Exxon's operations group were all familiar with the existence and purpose of the EXXON VALDEZ Cultural Resource Program, the general provisions of the law, Exxon's policy on cultural resources, and the procedures to be followed when cultural remains were discovered during cleanup. New staff were briefed when they replaced experienced supervisors. Some cleanup workers contracted to Exxon through VECO, Norcon, or other companies, were less familiar with cultural resource issues. Following verbal presentations and circulation of briefing handouts and more videotapes, most field personnel became aware of Exxon's cultural resource policy.

Most beach cleanup crews appreciated the need for cultural resource conservation, although occasional indifferent reactions were evident. Personal contact between the Exxon archaeological monitors and the crews seemed to be the most effective mechanism for informing field personnel about the need for site protection. When appropriate, monitors described and displayed artifacts discovered during cleanup. These visual sessions provided a forum for explaining the importance of historic and archaeological sites in understanding the cultural heritage of Alaska (Figure 50). Monitors emphasized the information content of undisturbed cultural resources rather than the artifacts and features themselves, to lessen interest in illicit artifact collection. A balance was struck between informing the cleanup crews about the archaeological values of the immediate vicinity (to help protect the sites), and limiting the dissemination of site-specific information which could be abused.

Long-Term Effects of the Education Program

Public identification of archaeological sites carries the inherent danger of provoking malicious site disturbance, balanced by the benefits of an increased public awareness of the importance of leaving such resources undisturbed. The extraordinary number of people introduced to the spill area was a special concern given its remoteness and pristine nature, the high visibility of some sites, and the mobility of some personnel. Nonetheless, a certain minimum awareness of archaeological site identification was required for cleanup crews to comply with the standard cultural resource constraint: "If heretofore undiscovered cultural materials are uncovered during cleanup, contact Exxon's Archaeological Field Director and take actions prescribed in the Operational Guidelines for Shoreline Cleanup...." As a consequence, cultural resource protection was emphasized to personnel actively involved in beach operations. Because much disturbance of cultural resources is the result of curiosity rather than malice, education should help to protect this irreplaceable resource in the future.

The Site Protection Program

Although the entire EXXON VALDEZ Cultural Resource Program effort was devoted to minimizing disturbance to cultural resources, particular site protection efforts deserving elaboration are discussed in this chapter. These include the process of devising individual archaeological constraints for FOSC approval, the collection of artifacts as a mitigative strategy, and the monitoring program. All were critical elements needed to avoid potential impacts to cultural resources. The success of these efforts is, then, in part measured by the results of the post-cleanup assessment program.

Devising Archaeological Constraints

Archaeological constraints were stipulations placed upon the cleanup operation to design treatment with due regard for the cultural resources. Preliminary archaeological constraints were developed by the SCAT archaeologist in the field and entered on the Cultural Resource Evaluation form. Recommendations made by the field archaeologist were modified to standardize constraint language or take into account modifications in planned treatment. Further modifications were sometimes made at the suggestion of the SHPO signatories, and on several occasions the constraint language was subsequently altered by members of the ISCC. The final language to be implemented was entered on the Shoreline Cleanup Program form signed by the FOSC.

In most cases the standard constraint was judged sufficient: "If heretofore undiscovered cultural resources are uncovered during cleanup, contact Exxon's Archaeological Director and take actions prescribed in the Operational Guidelines for Shoreline Cleanup dated 4/21/89 as amended." Another common constraint restated the blanket project-wide prohibition on upland access by cleanup personnel, sometimes with more geographic specificity, such as "Cleanup personnel must be restricted to the seaward side of the driftwood line in the northern half of the segment." The potential problems with such specific language were twofold: that field personnel might view areas without such specific constraints as open to upland access, and that the specific constraints tacitly acknowledge and pinpoint sensitive cultural resources. However, given the blanket restriction on upland access, the degree of protection afforded by specific constraints was felt to outweigh the potential dangers.

In some cases, when there was potential for contamination of archaeological deposits by charcoal, or confusion of recent fire-cracked rock with archaeological specimens, building fires on the beach was specifically prohibited. Cleanup crews sometimes built fires in the intertidal zone to keep warm during breaks in the work effort, particularly during April and May. Fires were also built, following ADEC permission, as a decontamination procedure for beaches with quantities of oiled driftwood, primarily in the Homer and Seward areas. Records on the locations of such fires were kept by the state and Exxon, since not all locations originally permitted by the state were used (Table 13). Technical specifications made by the state included a maximum fire diameter of 15 feet (4.6 m). At several different burn sites, SHPO representative R. Joan Dale observed fire-cracked rock, charcoal, and burned nails resulting from a fire (Figure 51).

When cultural resources in the intertidal zone or immediately adjacent uplands were considered particularly sensitive to potential disturbance, an on-site archaeological monitor was recommended to protect the site during treatment. Historic structural remains, aboriginal rockshelters, and intertidal artifact scatters all at times warranted this constraint. The duration of the monitoring task depended on the length of time needed to treat the archaeologically sensitive portion of shoreline, varying from a single day to two weeks or more. A detailed discussion of the monitoring program is presented in a following section.

Occasionally, when the probability of hidden subsurface cultural remains was judged high, specific restrictions on the degree of sediment disturbance during treatment were made. For example, high volume/high



Rachel Jean Dale 16A, AOHA

Figure 51. Results of controlled debris burning in the intertidal zone. Note numerous burned nails, charcoal (left circle); cracked cobbles (center circle) and large fire-spalled cobble (right circle).

pressure techniques were sometimes prohibited, though such detailed technical constraints were identified only rarely.

Early in the project, before permits with landowning parties were finalized, no archaeological testing was allowed at upland locations judged likely to contain subsurface archaeological deposits. This sometimes left the SCAT archaeologist unable to field-check his or her intuition, and field notes sometimes contained statements such as, "This location has all the physiographic and environmental parameters often associated with a prehistoric camp site, but no surface evidence was noted." In such cases it was difficult to specify a constraint that would protect a buried cultural resource should one be present, in the event that treatment was to take place (many shoreline segments were surveyed in which no cleanup was recommended). A typical constraint might read "Archaeological re-evaluation with subsurface testing is required prior to cleanup if cleanup is required."

The strongest language used in the archaeological constraints was absolute prohibition of cleanup in certain portions of segments where cultural resources were too sensitive to risk disturbance, such as a rockshelter containing perishable remains. The "no cleanup" option was exercised only a few times. Physiographic features were used to help identify the shoreline in which treatment was to be avoided, and to mask the exact location of the cultural resource. Thus the constraint wording would read, "No cleaning in the vicinity of stream mouth," or, "No cleanup or access allowed in that portion of the segment from the light to the offshore rocks 2/5 of a mile to the south." The latter case, in which a portion of shore 2/5 of a mile (650 m) was omitted from treatment, was the longest portion of oiled shoreline so handled.

As the season progressed, cleanup techniques changed and program coordinators gained a more informed perspective on the potential for disturbance to cultural resources. Consequently, there was some evolution in the language and intent of the archaeological constraints as well. An example of this occurred early in the season in the Homer district. A small midden site (SEL-181) in the uplands, from which a dozen pieces of fire-cracked rock and a slate artifact had eroded into the intertidal zone, prompted an archaeological monitoring requirement. Treatment took place over many weeks, however, and after several weeks with a full-time archaeological monitor standing by on-site, it became apparent that the potential for disturbance had been overestimated.

Table 13

Locations of Controlled Fires to Burn Oily Debris

Location	Segment	ADEC Permitted	Used
Ushagat Island	US-10	Yes	Yes
Elizabeth Island	EL-1	Yes	Yes
Sleepy Bay	LA-20	No	Yes
Petrof Point	PP-1	Yes	Yes
Tonsina Bay	TB-1 & TB-3	Yes	Yes
Windy Bay	WB-1	Yes	Yes
Rocky Bay	RB-5	Yes	Yes
Port Dick	---	Yes?	No
Chugach Bay	CB-3	Yes	No
Yalik Glacier Beach	YG-2	Yes	Yes
Hoof Point	PY-6	Yes	Yes
Bear Glacier Beach	BG-1	Yes	No
Verdant Cove	HA-3	Yes	No

given the kinds of treatment being implemented and the sensitivity of cleanup personnel. With a limited number of qualified archaeologists available, the fact that other sites and segments needed attention encouraged redefinition of the monitoring constraint. With the agreement of the SHPO, a less intensive constraint was devised allowing for periodic visits by an archaeological monitor while treatment activities were being conducted in the vicinity. For cases in which the need for oil removal had not yet been decided, the language was made conditional: "If cleanup is conducted, inspection by an archaeological monitor is required."

One exceptional constraint, requiring detailed mapping of historic artifacts in the intertidal zone, was devised for the Latouche Mine (SEW-026). Although its implementation is discussed in detail later, it is mentioned here as an example of the process used to arrive at mutually acceptable constraints. The basic conflict was the presence of light amounts of oil (recommended for cleanup), amid numerous historic industrial and domestic artifacts in the intertidal zone. Given the complexity of the artifact scatter, the original recommendation made by Exxon's cultural resource director was that cleanup avoid cultural materials. This was unacceptable to the SHPO signatory in Valdez, who recommended that the material be surface collected. After hours of discussion, a compromise was reached:

> Archaeological monitor required prior to and during cleanup. Cleanup is to avoid historic archaeological material (to be flagged with an approximate 20 m buffer) in the intertidal zone, as per direction of on-site archaeological monitor. Monitor is to prepare a site map depicting location and nature of historic artifacts and features in the intertidal zone as per a Work Plan for Archaeological Monitoring.

This language was submitted to the ISCC for review, who approved it with one addition: "Notify Exxon Archaeological Director 48 hours prior to beginning work on this segment." The intertidal artifact scatter was mapped by an archaeologist over several days. Later, the Coast Guard judged the two segments to be so lightly oiled as to require no treatment, and none was conducted. But the example illustrates the consultation process by which constraints were devised to adequately protect identified resources in some of the more complex circumstances.

Artifact Collection

Artifact collection was limited to circumstances in which either the material was in a primary context within an exploratory test pit dug by the archaeologist, or the material was on the surface and in potential danger of damage or removal due to treatment operations. In the latter case, judgment was required on the part of the archaeologist in the field. If an isolated artifact was discovered in the intertidal zone slated for treatment, it was sometimes collected during the survey since the primary information potential could be realized if the artifact's location was plotted with sufficient precision (Figure 52). Conversely, if more than several artifacts were present, preservation in place was often considered desirable until site-specific mitigation options could be specified. Visibility and desirability (from a collector's perspective) of the artifacts, ease of mapping, and feasibility of later visitation were all factors taken into account.

Procedures for collecting artifacts varied, but in every case an attempt was made to document artifact locations using field maps that tied the locations into some permanent data points above the high tide mark. Field numbers were assigned, and the artifacts placed in individual plastic bags for transport back to Valdez. Cultural material collected in the Kodiak region was also sent back to Valdez for centralized processing. On occasion, artifacts were retrieved from the field by parties other than archaeologists with the EXXON VALDEZ Cultural Resource Program, such as agents of CAC or the SHPO's office.

Once received in Valdez, the collections were inventoried and stored in a safe deposit box. Laboratory procedures consisted of washing, labeling, and cataloging the artifacts. Most items were relatively clean, having been retrieved from the intertidal zone where they had been subjected to wave action for years. A few artifacts had been oiled, in which case -- after being photographed -- the items were scrubbed with a detergent. Because the artifacts were almost universally from surface proveniences, the presence of analyzable organic residues was not considered sufficiently likely to preclude washing.

Artifacts were labeled using the standard white base paint, black India ink, and a covering of clear nail polish. Catalog numbers followed the Smithsonian system, beginning with the number "49" to indicate Alaska, then the AHRS number (example, SEW-072), then the specimen number. Artifacts were numbered beginning with Specimen #1, with no attempt to determine whether artifacts had been collected earlier by other researchers



Michael Yarborough 19:12, Exxon

Figure 52. Chipped stone artifacts amid intertidal cobbles at AFG-117.

from previously known sites. Thus the possibility exists that there will be two artifacts with the same catalog number, for example 49SEW-072-1. To avoid confusion should this have happened, artifacts that could be confused with those of earlier collections were marked with an "X" (as in 49SEW-072-1x).

Once the artifacts were labeled and cataloged, they were photographed using still and videotape formats. New plastic bags were labeled to hold the specimens. A master catalog was compiled and included as an appendix in the interim report (Mobley and Haggarty 1989b). Then the artifacts were turned over to archaeologists William B. Workman and Karen Wood Workman for detailed description (see appendix entitled *Artifact Descriptions).*

Initially, several different perspectives on artifact curation were registered by the various cultural resource parties. The Special Use permit from the USFS stated the repository to be the Anchorage Museum of History and Art, while the State of Alaska permit specified the University of Alaska Museum. Interest in curating the cultural resource documents and/or artifacts was expressed by the Valdez Historical Museum, the Kodiak Area Native Association Heritage Museum and Cultural Center, the Anchorage Museum of History and Art, and the University of Alaska Museum. Chugach Alaska Corporation issued a statement that "CAC and several Chugach village corporations have passed resolutions which claim ownership to artifacts of Native origin (both historic and prehistoric) throughout the Chugach region." The curation matter was resolved through the Section 106 process, whereby the MOA states:

> Exxon shall enter into a curation agreement with the University of Alaska, Fairbanks for the housing and care of artifacts and records collected during the Effort, in keeping with 36 CFR Part 79. Information and artifacts collected from lands selected under the provisions of Section 14(h)(1) of the Alaska Native Claims Settlement Act will be curated in a state of trust in a certified depository as arranged by the responsible Federal land manager in consultation with the affected Native corporation until ownership has been resolved.

Signature of the MOA by signatory and consulting parties supersedes earlier stipulations and statements concerning artifact curation. Draft curation agreements have been developed with the University of Alaska Museum for the artifacts and site-specific supporting documents, and with the Archives of the University of Alaska's Rasmusson Library for the original documents, videotape, photographs, and other archival material.

The Monitoring Program

Monitoring of sites during cleanup was one protection option used as an archaeological constraint. The archaeological monitor actually had three functions: to assist cleanup supervisors in conforming to archaeological constraints, to educate cleanup personnel about Exxon cultural resource policy and procedures, and to make professional field decisions when faced with immediate conflicts between cultural resources and cleanup actions. In the first role, the monitor reviewed the FOSC-approved constraints with the Exxon supervisors and determined whether they were being followed. In the second, the monitor educated personnel on Exxon's cultural resource policy and the procedures to be followed whenever cultural material was discovered. In the third role, where treatment-related activities could affect sites, the monitor sometimes exercised professional judgment in directly advising on the means and extent of treatment in the vicinity of a cultural resource. Monitors provided professional guidance, allowing timely and efficient treatment with minimal impact to archaeological and historical sites.

Methods and Logistics

The methods for archaeological monitoring varied according to the cleanup techniques and the mobility of the cleanup crews. Crews treating shorelines in Prince William Sound and the Kenai Peninsula tended to work as large task forces (with, in Prince William Sound, considerable mechanical equipment) to remove oil, with many Exxon and agency supervisors. Because the degree of oiling was much lighter in the Kodiak and Alaska Peninsula areas, crews were smaller and more mobile, and were deployed with less supervision. There, for a number of weeks, authorized Native village crews worked without on-site Exxon supervisors, and both VECO and Native crews sometimes treated shorelines before they had received SCAT survey. As a consequence, archaeological monitoring in Prince William Sound and the Kenai Peninsula was segment-specific according to the constraints approved by the FOSC, while for Kodiak and the Alaska Peninsula, archaeological monitors were often assigned to specific cleanup crews. In this way, sites on Kodiak and the Alaska Peninsula were protected without waiting for the FOSC to approve particular archaeological constraints on an official Shoreline Cleanup Program form.

Circumstances calling for the monitoring constraint included: intertidal sites directly in the path of treatment, intertidal contexts having high potential for buried cultural resources and slated for mechanical treatment, and fragile upland sites prone to disturbance by virtue of their accessibility or contents. Lists of segments requiring monitors were updated periodically and used to keep in contact with Exxon supervisors regarding their cleanup schedules. Operational decisions based on sea conditions, personnel availability, equipment availability, and other factors often resulted in little advance notice being given to the cultural resource staff for imminent treatment of particular segments. In addition to the more than 20 task forces calling for monitoring, a monitoring effort was sometimes called for by Native village crews, crews working from the Kodiak road systems, and fishing boats and crews hired as boom tenders.

Transportation and communication difficulties were often more problematic for archaeological monitors than for archaeologists involved with SCAT survey, since the monitors were dispatched daily to be on-site during cleanup. Sometimes sudden bad weather prompted crews to switch quickly from their planned work area to protected segments reserved for bad weather (some of which had monitoring constraints), and transportation to the segment for an archaeological monitor was often unavailable because of the storm. When storms affected telecommunications systems, air and water courier services were used instead of the radio, radiotelephone, and FAX lines otherwise employed.

Monitors handled many different details in the field. At some sites, attention was not drawn to the archaeological activity, but usually supervisors and cleanup personnel were briefed on cultural resource policy, and the written handouts and videotapes were distributed (especially in Kodiak and the Alaska Peninsula). Monitors sometimes decided whether intertidal artifacts were best collected to allow treatment to proceed, or whether cleanup was best directed around artifacts and features. In the case of concrete-encased intertidal pilings at SEW-435, an archaeological monitor was present while an omni-boom washed oil from around the features (Figures 43 and 44). In Kodiak and the Alaska Peninsula, where subsidence and subsequent erosion have moved many artifacts into the intertidal zone, selected artifacts were sometimes removed from the intertidal zone in preparation for treatment, and returned to the base of the midden afterwards. When such artifacts were considered at risk unless collected, measurements from permanent shore features were used to record their original intertidal location. Monitors documented the condition of the cultural resources, and often did adjacent survey to determine if other, unknown sites might be at risk.

A number of forms were used to help document the monitoring process. Several different drafts of a monitoring data sheet (Figure 53) were used in the field to record applicable constraints, site character and condition, treatment methods, and the awareness and receptiveness of the personnel to cultural resource information. To accommodate the monitoring circumstances in Kodiak and the Alaska Peninsula, two additional forms were used: a segment monitoring log recording the dates of all monitoring for an individual segment, and an activity form which recorded briefings, site visits, logistical preparations, and other activities. Field notes were kept throughout the monitoring effort.

Monitoring Results

The monitoring program helped minimize cleanup disturbance to cultural resources. When written into the Shoreline Cleanup Program forms, monitoring became a

requirement as stipulated in the draft MOA. Monitoring documented compliance with constraints and often served as a mechanism for educating field personnel about cultural resource policies, while allowing cleanup to proceed with minimum disturbance to sites.

A total of 123 segments had monitoring constraints, and monitors were active at 75 of them (Table 14) Twenty-five of those designated for monitoring were not fully monitored because no cleanup was conducted. Communication or logistical difficulties prevented monitoring altogether at 13 segments.

Some segments were monitored not because they contained recorded archaeological sites, but because they were thought to have high potential for undiscovered sites, or were adjacent to segments with highly significant remains, or contained only CMTs (which are not assigned AHRS numbers by the AOHA). Four such segments are located in Prince William Sound, six in the Homer operations area, and seven in the Kodiak operations area (see appendix entitled *Site Monitoring Summaries).* No previously unknown cultural resources warranting AHRS site numbers were discovered during monitoring of these 17 segments. However, monitoring of other segments did result in refinement of site descriptions and locations, and some features were discovered warranting separate AHRS designations.

Monitors used various lines of evidence (identical to those used in post-cleanup assessment) to help determine the timing of vandalism and disturbance (the distinction between the two being that vandalism is obviously de-

EXXON VALDEZ CULTURAL RESOURCES PROGRAM
SHORELINE CLEANUP ARCHAEOLOGICAL MONITOR DATA SHEET

SEGMENT: _____ SUBDIVISION: _____ DATES: _____
MONITOR: _____

ARCHAEOLOGICAL/ECOLOGICAL CONSTRAINTS TO BE OBSERVED:
_____
_____
_____
_____

AHRS #'s: _____ (UPDATES NEEDED?: [ ] NO [ ] YES)
Nature of Sites: _____
_____
_____
_____

Condition of Sites:
Pretreatment (PHOTOS [ ] YES [ ] NO): _____
_____
_____
_____

Posttreatment (PHOTOS [ ] YES [ ] NO): _____
_____
_____
_____

IMPACTS TO CULTURAL RESOURCES: _____
_____
_____

PERSONNEL: Crew Size: _____
Supervisors: Exxon _____
VECO _____
Other _____: _____
Knowledge & Sensitivity of Crew to Cultural & Natural Resources:
_____
_____

ACTIVITIES:
Cleaning Methods: _____
Cleaning Schedule: _____
Vessels: _____

NOTES & COMMENTS: _____
_____
_____
_____

MONITORS:
Name: _____ Notebook: _____ Dates: _____
Name: _____ Notebook: _____ Dates: _____

PHOTOGRAPHS:
Type & Roll: _____ Frames: _____ Dates: _____
Type & Roll: _____ Frames: _____ Dates: _____
VIDEOTAPE: _____ TIME: __:__ / __:__ Dates: _____

ATTACHMENTS: [ ] NOTEBOOK PAGES [ ] PHOTO LOGS
[ ] SITE FORMS FOR _____ (MONFORM 3-25)

Figure 53. Example of the form used in the field to record monitoring activity.

Table 14

Numbers of Segments and Sites Considered in the Monitoring Program

	Prince William Sound	Seward	Homer	Kodiak	Total
Number of segments (and sites) with monitoring constraints	25 (26)	4 (5)	7 (7)	87 (166)	123 (204)
Number of segments (and sites) with monitoring constraints that were not cleaned	1 (2)	0 (0)	0 (0)	24 (35)	25 (37)
Number of segments (and sites) with monitoring constraints that were cleaned and monitored	21 (20)	4 (5)	5 (4)	45 (90)	75 (119)
Number of segments (and sites) with monitoring constraints that were cleaned and crews received briefings only	1 (2)	0 (0)	0 (0)	9 (13)	10 (15)
Number of segments (and sites) with monitoring constraints that were not monitored	2 (2)	0 (0)	2 (3)	9 (28)	13 (33)

liberate harm, while disturbance could be inadvertent -- degradation by foot traffic, for example). Factors such as the moisture content of exposed soil, compaction of exposed soil, water-sorting of exposed soil clasts, degree of wilting of dying uprooted vegetation, degree of revegetation, amount of slumping, amount of soil on objects suspected to have come from the disturbed area, and footprints, were all used to help determine the time of disturbance. A total of eleven sites appeared at the time of monitoring to have been recently (within the prior few months) vandalized (Table 15). Another eleven appeared to have suffered some recent disturbance at the time of monitoring (see the "Assessment" entry for sites in the *Site Monitoring Summaries* appendix). Many more sites showed evidence of vandalism or disturbance in years past, and several other sites not included in the monitoring program are known to have been recently disturbed or vandalized (such as SEW-469) (see *Post-Cleanup Assessment Summaries* appendix).

Overall, the monitoring program was a useful operation to help minimize disturbance to sites. The effort contributed to a clearer understanding, on the part of field supervisors and workers, of the archaeological constraints and cultural resource policies. The visibility and authority of Exxon and other agency archaeologists in the field undoubtedly encouraged individuals to be more careful and responsible in their activities near cultural sites.

Post-Cleanup Assessment

Methods

The post-cleanup assessment program documented the condition of particular sites after treatment in the segment had been completed. Boats and helicopters reserved for the program were used to inspect the sites, with some last-minute site monitoring and other cultural resource tasks worked into the schedule. Because the post-cleanup assessment of necessity took place at the end of the season, there was limited time available before the September 15 deadline for field operations (established to minimize the risk from winter storms). In addition to field notes, a post-cleanup assessment form (Figure 54) was used to record the site's location, description, original condition at the time of the SCAT survey, specific cleanup constraints, current condition (following cleanup), and the type and estimated timing of any disturbance noted.

The advantages of videotape to efficiently acquire and curate site condition information for long-term cultural resource management in Alaska has been pointed out (Mobley and Bacon 1986:26-27), and the technique was especially useful in Exxon's post-cleanup assessment program. It reduces the need for site maps, and allows visual inspection by other professionals to obtain supplementary opinions and assessments. With a narrative voice

Table 15
Recently Vandalized or Disturbed Sites

Vandalized	Disturbed
AFG-026	AFG-046
AFG-027	AFG-097
AFG-028	KAR-017
AFG-043	KOD-116
AFG-074	KOD-393
AFG-129	KOD-397
AFG-143	KOD-402
KOD-303	KOD-427
KOD-368	SEW-004
SEW-004	SEW-440
SEW-019	XMK-058

These sites were noted, at the time of monitoring, to have been definitely vandalized or disturbed within the prior few months (summarized from the Site Monitoring Summaries *appendix).*

track accompanying the visual record, the method can provide quick and relatively complete documentation. Although photographs were also taken, videotape was used extensively to document the condition of sites selected for post-cleanup assessment, especially in Prince William Sound.

The post-cleanup assessment site sample was configured to include variability in site morphology and visibility, degree of prior disturbance, location, and type of cleanup activity. Highly visible sites, or ones likely to contain artifacts or features commonly attracting vandals, were emphasized. This biased the sample in favor of midden sites and rockshelters, but other site types were selected as well, including those with standing structural remains. Sites evidently favored by vandals in years past were also emphasized. An attempt was made to obtain broad geographic coverage throughout the oil spill region. And some sites were included even though their segments received no cleanup activity, to compare disturbance at sites near cleanup activity with the condition of more distant sites.

Information on the prior condition of the sites comes from a variety of sources. Site records entered into the AHRS system before the spill sometimes have a comment on the site condition at the time of its discovery (almost invariably sometime between the mid-1960s to 1988). Further information is sometimes available in published and unpublished sources, but most of the literature and the AHRS records are too incomplete and outdated to be useful for establishing the pre-spill condition of sites. The NPS did collect some information on coastal site condition during the first few days of the spill, specifically to provide pre-oiling baseline information. The most extensive and systematic information comes from the SCAT survey and subsequent monitoring activities. The aerial shoreline reconnaissance videotape, although prepared primarily to collect information on the degree of oiling, also allows some observations on the integrity of those cultural resources with surfaces visible from the air (primarily in Kodiak and the Alaska Peninsula). All these sources together provide a bank of data with which to assess the integrity of cultural resources through time and determine what disturbances occurred during the 1989 cleanup program. The timing of disturbances was estimated using the above sources, and the same field criteria mentioned earlier for the monitoring program.

Post-Cleanup Assessment Results

Twenty-four sites were assessed in Prince William Sound, seven in Homer (plus three localities without AHRS site designations), none in Seward, and 26 in the Kodiak Archipelago and Alaska Peninsula (see Table 16 and the *Post-Cleanup Assessment Summaries* appendix). Two sites (AFG-028 and KOD-171) had been vandalized in the time since the last evaluation, and eight (KOD-224, SEW-004, SEW-439, SEW-440, SEW-442, SEW-443, SEW-469, and SEW-482) had received additional human disturbance such as pedestrian traffic. Natural erosion was observed at the majority of sites included in the post-cleanup assessment sample. The two vandalized sites were both in the Kodiak area, while all but one of the disturbed sites were in Prince William Sound.

Of the two sites recorded during the post-cleanup assessment as newly vandalized, KOD-171 had no previous site condition information, while AFG-028 had a long history of vandalism. The sorts of minor impacts recorded as disturbances are generally not severe enough to have been documented in previous publications or the AHRS files. With the SCAT survey, monitoring, and post-cleanup assessment information, some sites now have the timing of vandalism and disturbance events pin-pointed to within weeks, and sometimes days. To obtain a broader perspective on the condition of archaeological sites in the oil spill area in 1989, it is necessary to consider a broader array of site condition information.

Summary of Actual Impacts

By comparing the actual impacts with the potential impacts discussed in the chapter entitled *Sources of Potential Impacts*, some impression is gained of the degree to which sites were protected during the cleanup effort, compared to the amount of disturbance that could have occurred. Observations on the condition of sites were made during the SCAT survey, monitoring, and post-cleanup assessment programs, providing "snapshots" of site conditions at intervals during 1989. It is useful to summarize the general condition of the site inventory as it appeared from each of the SCAT, monitoring, and post-cleanup assessment samples.

Over the years, site condition has not been systematically entered into the AHRS computerized inventory, in part because the AHRS system is dependent on the quality of information provided it by the original site discoverers. Furthermore, information on site condition was not always recorded as part of the SCAT survey, especially early in the program, due to other priorities in the field effort. Many sites, when first discovered during SCAT survey, were observed to be actively eroding into the intertidal zone. Evidence of old vandalism, reflected by overgrown excavations and other attributes, was noted at a number of sites by the SCAT archaeologists. Incident reports were usually filed when recent vandalism or disturbance was documented by the SCAT survey (see *Incident Reports);* the exceptions (AFG-046, KOD-223, and KOD-427) are mentioned in the *Site Monitoring Summaries* or *Post-Cleanup Assessment Summaries* appendices.

Out of the 204 sites included as part of the monitoring program, eleven (5.3%) were found to have been recently (in the prior few months) vandalized, and eleven (5.3%) had suffered minor human disturbance (Table 15). Fifty-six sites (27%) were recorded as actively eroding (see appendix entitled *Site Monitoring Summaries*), and the actual number of eroding sites is probably much higher because erosion was not always systematically documented by the archaeological monitors.

The most systematic and complete evaluation of site condition was done as part of the post-cleanup assessment program. Four sites were found to have received additional vandalism in the interim since they were ob-

POST CLEANUP CULTURAL RESOURCE ASSESSMENT

AHRS #_____ Other Site # _____

Block _____ Segment _____ Beach # _____

Location _____ Land Owner _____

Site Type_____ Site Context: Beach / Upland

Easily Apparent to non-specialist: Yes / No

Cultural Resources Present (AHRS Code) _____

SCAT Archaeologist _____ Date _____

Pre Cleanup Photos: Color Roll #_____ Frames _____
B/W Roll #_____ Frames _____
Video: Y/N Tape #_____ Date _____ Time _____

Archaeological Constraints Approved by SHPO:_____

_____

_____

Cleanup in Immediate Site Vicinity: Y / N

Type: A / B Village / Task Force

Monitored: Y / N / Intermittent Collection: Y / N

Arch. Monitor (s) _____

Site Disturbance at Initial SCAT Assessment:

None / Natural Weathering & Erosion / Human Impact / Vandalism

Site Disturbance at Post Cleanup Assessment:

None / Natural Weathering & Erosion / Human Impact / Vandalism

Description of Disturbance and Estimated Time Frame: _____

_____

_____

Post Cleanup Documents (Field Notes Attached)
Photos: Color Roll #_____ Frames _____
B/W Roll #_____ Frames _____
Video Tape #_____ Date _____ Time _____

Assessment Archaeologist (s)_____ Date _____

Figure 54. Example of the form used in the field to record post-cleanup assessment.

Table 16

Site Condition Summary

Post-Cleanup Assessment Sample

Site #	AHRS	SCAT	MON	PCA
AFG-010	no data	--	--	ero
AFG-012	ero	--	--	ero
AFG-028	van	ero van+	ero van+	ero van+
AFG-046	ero imp	ero imp+ col	ero imp+ col	ero
AFG-061	ero	--	--	ero
AFG-104	new	ero	--	ero
AFG-105	new	ero	--	ero
AFG-111	new	ero	ero	ero
AFG-118	new	ero	ero	ero
AFG-120	new	ero	no data	ero
AFG-122	new	ero	--	ero
AFG-123	new	ero	--	ero
AFG-128	new	ero	ero	ero
AFG-129	new	ero van-/+	ero van+	ero
KAR-016	no data	ero	--	ero
KAR-017	ero	ero van-	ero	ero
KAR-097	no data	no data	ero	ero
KAR-116	new	ero	--	ero
KAR-128	new	ero	--	ero
KOD-083	tes	--	--	ero
KOD-171	no data	--	--	van+
KOD-223	ero	ero van-/+	--	ero
KOD-224	tes	ero	--	ero imp+
KOD-239	no data	no data	--	ero
KOD-245	no data	no data	--	ero
SEL-129	no data	ero	--	ero imp+
SEL-179	new	ero van+	ero	ero
SEL-180	new	ero imp+	ero	ero
SEL-181	new	ero	ero col	ero
SEL-207	new	ero	ero	ero
SEL-208	new	ero	--	ero imp+
SEW-004	ero tes col	ero van-	ero van+ imp+	ero imp+
SEW-019	ero	ero van+	ero	ero van+
SEW-073	van	ero van-	ero	ero
SEW-076	ero col	ero	ero	ero
SEW-077	ero col	ero	--	ero
SEW-241	ero	ero	ero	ero
SEW-248	ero	ero	ero	ero
SEW-249	ero	ero	ero	ero
SEW-435	new	ero	--	ero
SEW-439	new	ero	--	ero imp+
SEW-440	new	ero	ero imp+	ero imp+
SEW-441	new	ero	--	ero
SEW-442	new	ero imp-	--	ero imp+
SEW-443	new	intact	--	imp+
SEW-447	new	imp-	no change	no change
SEW-450	new	ero	ero	ero
SEW-451	new	ero	ero	ero
SEW-462	new	ero	--	imp+
SEW-469	new	new	--	van+ imp+
SEW-474	new	new	ero	ero
SEW-479	new	ero	--	ero

Site Condition Summary

Site #	AHRS	SCAT	MON	PCA
SEW-481	new	new	new	no change
SEW-482	new	new	ero	ero imp+
UGA-043	tes	ero	--	ero
XMK-058	new	ero imp+ tes-	ero imp+	ero imp+
Historic Pier	no data	ero	--	ero
TB-3/CMTs	new	ero	ero	ero
TB-4/CMTs	new	ero	ero	ero

Legend

AHRS = Site condition recorded in AHRS inventory
SCAT = SCAT Survey
MON = Archaeological monitoring
PCA = Post-cleanup assessment
col = Archaeological artifact collection
ero = Erosion, collapse, rusting, or other natural disturbance at site
imp = Unintentional human impact
new = Site newly recorded in 1989
tes = Archaeological testing at site
van = Vandalism
\+ = Recent, or change from earlier reporting
\- = Old occurrence
-- = Site was not included in sample.

served by the SCAT survey or monitoring archaeologist. Twelve sites had received minor human impacts, such as pedestrian traffic or personal litter, since they were observed earlier (Table 16). Some of the impacts tallied in the PCA column in Table 16 were actually recorded earlier during incidental site visits not directly related to the monitoring program.

Cumulatively, 16 sites in the oil spill sample were documented as vandalized during the summer of 1989. These consist of eleven sites identified in the monitored sample (Table 15); two additional sites (KOD-171 and SEW-469) included in the post-cleanup assessment sample, one additional site (KOD-223) appearing to have been recently vandalized when recorded by SCAT survey, and two sites (SEW-004, SEL-179) discussed in the chapter entitled *Incident Reports*. The cumulative sample of sites receiving human impacts (non-malicious disturbance) during the summer of 1989 includes eleven sites in the monitoring sample, one additional site (SEL-180) noted during the SCAT survey, and nine sites (KOD-224, SEL-129, SEW-004 (which also was vandalized), SEW-439, SEW-442, SEW-443, SEW-462, SEW-469 (which was also vandalized), and SEW-482) recorded as recently disturbed by the post-cleanup assessment, for a total of 21 sites. As discussed earlier in this chapter and in the appendices entitled *Site Monitoring Summaries* and *Post-Cleanup Assessment Summaries*, several of the 21 incidents of non-malicious disturbance to sites are attributable to contracted personnel working on oil spill cleanup activities. Of the vandalism incidents, only two -- pertaining to SEW-469 and SEL-179 -- were demonstrably attributable to oil spill workers, in both cases contracted to VECO.

Documenting the condition of these sites will provide baseline information for future cultural resource managers in the oil spill region. Of the 16 recently vandalized sites, all but five (AFG-074, KOD-171, KOD-223, SEL-179, and SEW-469) had a recorded history of vandalism, and the documentation for several of the others is not sufficiently complete to conclude that they had not been vandalized earlier. Many more sites that were not vandalized during the summer of 1989 showed evidence of old vandalism.

It would be remiss not to point out that the cumulative degradation from erosion is an extremely significant source of information loss from sites in the oil spill area. The cultural resource that was not suffering from erosion or weathering was the rare exception, no matter which sample -- SCAT survey, monitoring, or post-cleanup assessment -- is considered. It is estimated that over 90% of the sites may be actively eroding, with consequent loss of information. For example, based on measurements of drowned trees, SEL-188 at McArthur Pass was estimated in early 1990 to have lost up to eight meters of its shoreline, for an approximate figure of 475 square meters of site area lost to erosion since the 1964 earthquake (Mobley 1990:7). Natural erosion is probably the single most significant source of site degradation in the oil spill area, although vandalism and non-malicious human disturbance often accelerate natural erosion.

Incident Reports

Much of the activity of the EXXON VALDEZ Cultural Resource Program was handled systematically as part of the SCAT survey, monitoring, or post-cleanup assessment programs, but there were occasional events that required special treatment. Some of these were anticipated, such as the discovery during cleanup of archaeological materials, for which specific procedures were outlined early in the season. Other special circumstances included reports of vandalism, prompting individual responses by Exxon archaeologists. These incidents are discussed as individual events entailing significant effort on the part of the EXXON VALDEZ Cultural Resource Program.

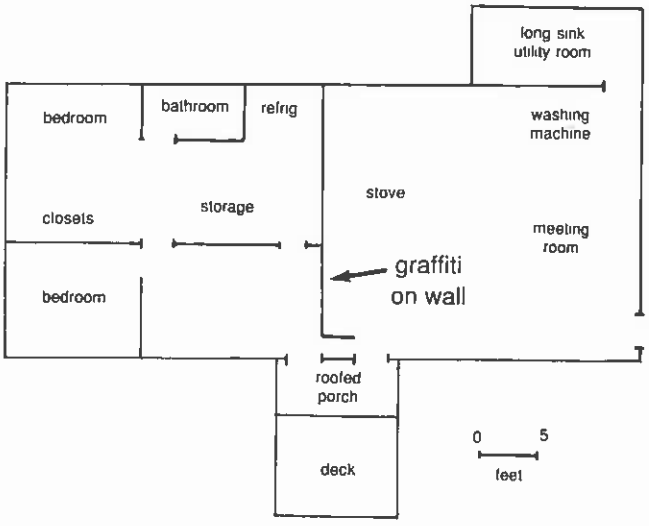
Reported Disturbance at SEW-019 (Old Chenega Village)

Until its abandonment in 1964, Chenega Village (SEW-019) was the only continuously inhabited pre-contact Native village in Prince William Sound (de Laguna 1956:30). Tsunamis from the 1964 earthquake destroyed low-lying structures and killed approximately 30 people (Orth 1971:203-204). New Chenega was eventually built in a safer location on Evans Island. Chugach Natives value the old village site on Chenega Island as both the traditional home of the Chenega people and the location of the 1964 disaster.

When SCAT survey took place on July 7, 1989, the archaeologist noted graffiti in the interior of one of the few remaining buildings. A detailed assessment done July 8 through July 11 documented a variety of structures, features, and artifacts in the uplands and intertidal zone. The seven structures that remain standing consist of a community building/schoolhouse, an outhouse, two cabins, and three buildings of uncertain function.

Graffiti defaced one wall of the largest room in the community building (Figure 55). Two examples of recent graffiti were noted amid earlier graffiti dated 1984, 1985, 1986, and 1987 (Figure 56). One group contained the name "Brockert" followed by a date and apparent affiliation "4-9-89 (Oil Spill Clean-up Crew)." On a second line was the invective "-Eat Humpies! Exxon sucks!!!" This group was connected by a heavy line to a second, which contained the name and date "Steven Lahn [or Cahn] 1989" together with some struck-out letters.

Figure 55
Plan of Community Building/ Schoolhouse, SEW-019
Showing Location of Graffiti

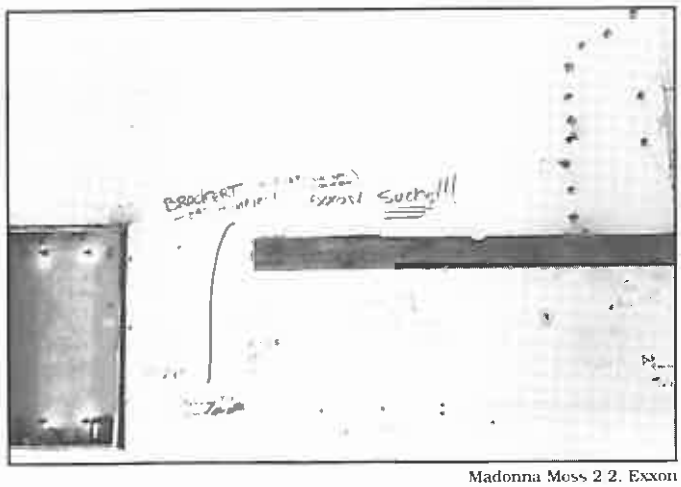


Large format photographs of the graffiti were filed with Exxon security on July 20, along with a request that they look into the matter, and a 48-hour hold on the information was requested by Security Chief Pat Shely to allow time for the investigation. Several days later, the photographs and other information were released to the SHPO and other concerned parties. Shely's summary of the investigation, dated October 25, stated that the matter came under the jurisdiction of the Alaska State Troopers and suggested that the crime be reported to civil authorities.

Whether the vandalism described above was committed by oil spill personnel is not known. The graffiti is self-dated April 9, 1989, at which time Exxon cleanup crews were not organized in Prince William Sound, although on April 1 volunteer crews were reinforcing booms installed at nearby Sawmill Bay (Hodgson 1990:15). Furthermore, it is unlikely that personnel employed by Exxon would publicly announce such opinions and sign them (Exxon security staff did not determine whether the named individuals were employed by Exxon contractors). This suggests that the people responsible for the grafitti may not have been part of the employed oil spill cleanup crew.

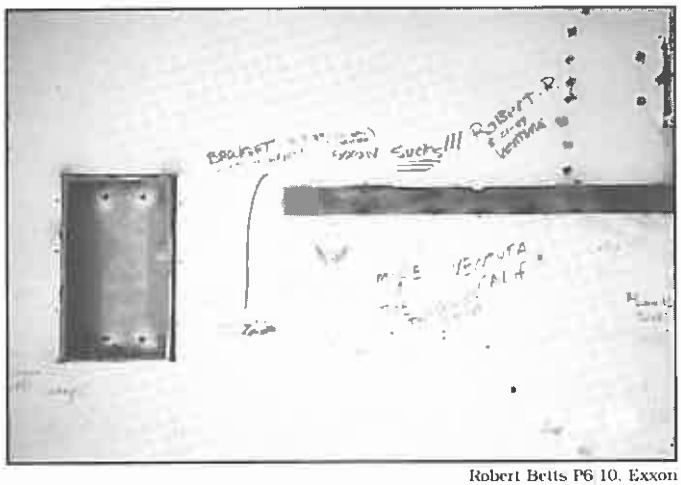
No additional vandalism was noted during the July inspection, but the post-cleanup assessment on August 22 found fresh graffiti added to the same wall (Figure 57). One entry consisted of "Robert R., 8-21-89 Ventura," which may reflect a return appearance by the individual responsible for the nearby graffiti reading "Rob Rowen 16, July 87." Another graffiti, next to an 8 1/2" X 11" hand-bill affixed to the wall, reads "Mike & Joe Ventura Calif Dos Guys 8-21-89". The hand-bill reads, "Dos Guys" over a winged emblem, below which is written "Its not a Club...We're a Gang Ventura, CA." Other than the new graffiti, no disturbance to SEW-019 was noted in the extensive post-cleanup assessment effort in August.

To summarize, the abandoned community building at Old Chenega Village has one wall which has been written on for years. The wall was written on in 1989, including one graffiti suggesting an association with Exxon's cleanup personnel. However, a discrepancy in the date of the graffiti, and doubts that oil spill workers would voluntarily sign their names to evidence of a crime, raise questions about the association.



Madonna Moss 2 2. Exxon

Figure 56. Graffiti in community building/ schoolhouse, SEW-019.



Robert Betts P6 10. Exxon

Figure 57. Additional graffiti in community building/schoolhouse on August 22, 1989, SEW-019.

Special Investigations at SEW-004

SEW-004 is a large rockshelter immediately above the storm tide of a small island in Prince William Sound. Collections of human remains and pre-contact artifacts were made in 1969 by an individual identified in the AHRS records as MacMaster. The site was revisited in 1981, when Cooperative Parks Study Unit investigators collected four ground slate points, two manos/pestles, lithic debris, wood fragments, and faunal remains (AHRS records, SEW-004). Cultural materials are thought to be approximately three meters (10 ft) deep. Erosion related to subsidence from the 1964 earthquake was noted in the midden deposits in 1981. The site was confirmed as a 14(h)1 site (BLM AA-10957), but has not yet been conveyed from the Chugach National Forest to CAC. The site is discussed in the appendices summarizing the monitoring and post-cleanup assessment results.

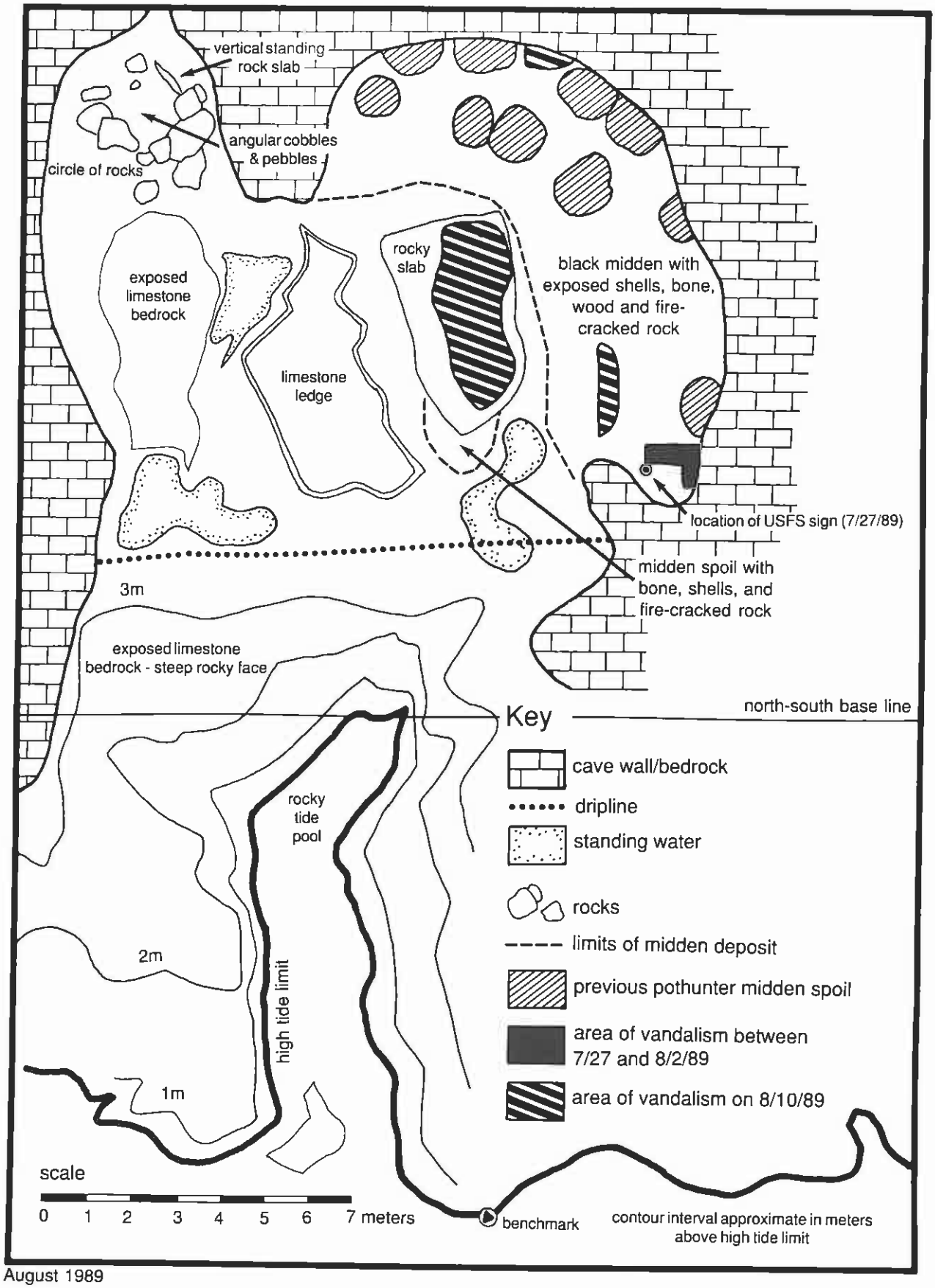
SCAT survey on May 7, 1989, assessed the erosion as minimal, noting that the midden was well above tidal activity, but evidence of fresh disturbance was observed and mapped along with the locations of other features and artifacts. Chugach Alaska Corporation investigators Rita Miraglia and Lora Johnson, inspecting the site on May 22, collected two slate points and re-mapped the disturbed areas. The artifacts were subsequently submitted to Exxon for curation at the request of USFS.

On May 22, historic vandalism of the site came to the attention of SCAT archaeologist Bill Andrefsky, who stated that:

> ...Team 5 met some local fishermen. They informed us that a large "cave" site was located on [the island]. This site, according to the fishermen,

Figure 58

Plan of SEW-004



August 1989

was well known by the locals, containing items such as ivory buttons and "spear points" and has been collected several times. They indicated that the site had many holes dug into it by collectors over the years.

To protect the site, a constraint was developed and implemented that read: "No cleanup or access allowed in that portion of the segment from the light to the offshore rocks 2/5 of a mile to the south." The site was intermittently monitored between July 23 and August 15, while cleanup activities were being conducted elsewhere on the Island. After an act of vandalism sometime between July 27 and August 3, the frequency of monitoring was increased in an attempt to catch the person(s). The site was fully recorded, as was a nearby second rockshelter containing undisturbed human remains and cultural deposits (SEW-481).

The first disturbance to SEW-004 recorded during the oil spill cleanup was the installation of a sign, by four USFS personnel, officially notifying the public of the protection afforded cultural resources under federal law. The sign was placed in the northeast corner of the rockshelter (Figure 58), to hide it from casual observers, and the metal post to which it was attached was driven 1.6 m (5.2 ft) into cultural midden. Within five days, a fresh hole 40 x 100 cm (16 x 40 in) in area and 20 to 40 cm (8 - 16 in) deep was dug directly below the sign, exposing stratified layers of shell, bone, and fire-cracked rock in a matrix of black silty loam. A pile of backdirt one meter (3.25 ft) in diameter contained fragments of clam and mussel shell, fire-cracked rock, large and small animal bones, a deer mandible, fragments of unworked slate, and a large unmodified cobble. A single set of footprints, measuring 29 x 10 cm (12 x 4 in), indicated that an adult wearing rubber boots had been there.

To keep track of visits to the site, all footprints on the dry floor of the cave were lightly erased with a trowel by the monitor, without disturbing the cultural deposits. Beginning August 3, Exxon officials with Task Force 6 provided a boat for the monitor to check SEW-004 on a daily basis; the site was visited at least twice daily, with a third evening inspection on three occasions. No new unauthorized visitation occurred until August 11, when additional vandalism was discovered. Much of the midden was covered in footprints and three areas clearly showed evidence of new disturbance. One area was centered below the sign, a second was found one meter (3.75 ft) west of the sign, and a third was located in the back portion of the cave along the north wall.

The first disturbance was a gouge 20 cm (8 in) wide and 10 cm (4 in) deep, apparently the result of boot scuffing. The second was along the top of the midden in an area sloping south towards the cave center, where the wall was partly sectioned by a 1.5 m (4.8 ft) long excavation. Stratified midden 20 to 30 cm (8 - 12 in) deep was exposed and the backdirt -- a black silt containing shells, fire-cracked rocks, and large and small animal bones -- was thrown downhill all the way to the base of the cave. The third area of disturbance was a hole measuring 20 x 30 cm (8 x 12 in) across and 25 to 30 cm (10 - 12 in) deep, dug along the north wall in the back portion of the cave. Laminated deposits of shell within a silt loam matrix were exposed, and the backdirt piled around the edges of the pit contained fire-cracked rock, clam shells, and spruce bark. The vandal had removed several vertebrae and long bones which had been previously lying on the surface of a large rock slab, and willfully scattered other exposed bones and shells.

Footprints on the swept floor and freshly disturbed deposits indicated that an adult wearing rubber boots was again responsible, although the tread was distinct from the bootprint in the first episode. The utility of the bootprint as incriminating evidence is low, because rubber boots are the common footwear of Alaska's coastal inhabitants, and were worn by almost all oil spill personnel regardless of agency affiliation.

Further checks made during the monitoring period between August 11 and August 15 revealed no more visits. On August 20, the post-cleanup assessment found new footprints, but no additional disturbance. The repetitious nature of the vandalism and the contempt for the USFS sign installed to protect the site suggest the person(s) involved had calculated disregard for federal and state laws.

Special Investigations at SEW-077

This site was first described by de Laguna (1956:31), who collected a few artifacts on the beach in 1930 and observed a "delapidated old Native hut" and a "frame building...used as a web house by the ... cannery." The SCAT survey on July 4, 1989, recorded a number of stone artifacts on the beach, prompting an archaeological monitoring requirement, but the cleanup inadvertently was not monitored. Concerns were raised by CAC that artifacts may have been removed from the beach during cleanup. These concerns led to a special site investigation and the inclusion of the segment in post-cleanup assessment.

The investigator observed the site at high tide on August 20, lacking scheduling and logistical flexibility to visit at low tide. Historic upland features were undisturbed except by natural deterioration, and two slate fire-boxes previously discovered to the west of the site were found intact.

Post-cleanup assessment on August 29 found the historic upland features undisturbed, as were the slate fire-boxes. About half of the intertidal zone was out of the water, but without a point-plotted intertidal artifact map, the archaeologist could not definitely state that no known artifacts had been removed. Nevertheless, several of the same artifacts and features noted in the SCAT survey were relocated, including a red jasper flake and a cluster of manuports and hammerstones (Figure 59). Many other prehistoric and historic artifacts were found on the beach, including the remains of a vessel about ten meters (33 ft) long with portholes and other fittings.

It seems unlikely that collectors at SEW-077 would have ignored these artifacts if the site was actually vandalized, and it is probable that no artifacts were taken from this site during oil spill cleanup.



Morley Eldridge 22:14, Exxon

Figure 59. Prehistoric artifacts from SEW-077.

Response to a Stone Lamp Discovery (SEW-488) by Cleanup Crews

One segment on northern Knight Island contained known AHRS Site SEW-236, a collapsed frame and log cabin in the uplands with associated debris, protected during cleanup by the standard constraints. During treatment, on July 22, a stone lamp was found on the beach by cleanup workers, who followed the requisite avoidance procedures and notified the Director in Valdez. An archaeologist immediately dispatched to the segment confirmed the reported object as an artifact, and the site was assigned AHRS number SEW-488.

The lamp was located on a short, steeply sloped beach bordered by narrow, rocky headlands, amid a 10 to 15 meter wide (32 - 49 ft) strip of beach left temporarily untreated by the cleanup crew. Crew member Eva Heffle, of North Pole, Alaska, discovered the artifact when she washed away a thin layer of pebbles from the surface and undercut a large cobble. The cobble rolled over to reveal a pecked depression. The object was brought to the attention of the crew and another Native woman identified it as an oil lamp.

The archaeologist surveyed the beach for additional materials, finding two more artifacts in the vicinity of the lamp. An elongated cobble with polish along one side was discovered 3 m (9.75 ft) northwest of the lamp and a small bone fragment with probable cut marks along one edge was found 10 m (33 ft) to the east. The three items were mapped, collected, and eventually cataloged, photographed, and prepared for permanent curation.

A 25 X 25 cm (10 X 10 in) shovel test, excavated on the beach near the stone lamp to help evaluate the depositional context of the sediments, revealed a 2 to 3 cm thick (1 in) lens of rounded to subrounded pebbles saturated in oil, lying above a 17 to 20 cm (7 - 8 in) layer of clean, moderate to poorly sorted pebbles and cobbles. The profile suggested that deposition was a result of high energy wave erosion and constant reworking of the beach substrate. This reinforces the conclusion drawn from the surface morphology of the beach, which is steep and composed of poorly sorted large cobbles and pebbles. The steep hillside above the beach was surveyed to locate a source for the archaeological materials, but none was found. A foot path

ran along the base of the hill, and a second path led up to a 50 meter (160 ft) bluff at the edge of which is historic site SEW-236. Culturally modified trees are scattered throughout this area. Because no additional cultural material was observed in the intertidal zone, and the probability of intact cultural deposits was low on this high energy beach, the cleanup supervisors were advised to continue treatment after the three artifacts were removed.

The Knight Island Burial Cave Incident (SEW-469)

The most complex cultural resource incident occurred on Knight Island in Prince William Sound, on uplands of the Chugach National Forest. To summarize the events, a rockshelter unnoticed during the SCAT survey was later vandalized by a VECO employee on the cleanup crew, who kept some human remains and left other skeletal elements lying about. Human skeletal material at the tide line was reported to Exxon by the on-site security officer as the recent remains of a drowning victim, but the Alaska State Troopers -- when called in to inspect the material -- exhumed two prehistoric graves in an undocumented rockshelter upslope. Later the RAT crew (Resource Assessment Team -- a multi-agency field crew overseeing the treatment) learned of the archaeological site and disturbance, and the information was forwarded to CAC, the USFS Incident Commander, and the EXXON VALDEZ Cultural Resource Program. Midway through a joint Exxon/CAC field investigation of the disturbance, the USFS ordered both parties out of the matter in preparation for a federal investigation by the USFS. The human remains came into the possession of CAC, who buried the material in the rockshelter and erected a large white cross. The original vandal later turned over his collection of skeletal material from the site to a University of Alaska Anchorage instructor, who forwarded it to CAC. CAC in turn informed the USFS, Exxon, and the SHPO, prompting another USFS investigation that resulted in the apprehension and conviction of the original vandal. The second collection of human remains was reinterred at the site by CAC. Because of the complexity and legal implications of the matter, it is discussed in more detail than other incidents.

Early Exxon Investigations

The SCAT survey was conducted on foot on April 30. According to the original Cultural Resource Background Documentation the result was "nothing found." On June 22, Exxon dispatcher Pat Joy on the vessel *Mt. Vernon* relayed a message to Director Mobley that a human skull had been found in the particular segment, operations had been shut down in the area according to procedure, and further information would be available later that evening. Mobley relayed that information to SHPO Judith Bittner and USFS archaeologist John Mattson within the hour. That evening, in a radio conversation, VECO Security Chief Tom Varnell of Task Force III told Mobley that "a few bones and a skull were found tucked under a log, and they looked old." When asked for more details, Varnell told Mobley that it had been at least one year since the death, but not over 50 or 60 years. When Mobley asked whether it looked like the remains had drifted in, Varnell said, "Yes," and further stated that he had called the Alaska State Troopers.

Mobley left a message mentioning the discovery with Jim Alexander of the Valdez Troopers' office, and the next day (June 23), called Trooper Rodney Pucak in Cordova. When Pucak said he would personally investigate, Mobley requested that -- rather than relying solely on the assessment of Varnell -- Pucak independently evaluate the disposition of the remains and notify him if the material appeared to be of an archaeological rather than forensic nature. USFS archaeologist John Mattson was informed of the matter's status on June 23 or 24. No further contact with Pucak occurred for several weeks, and no archaeologist visited the site.

On July 4, Coast Guard officer Dave Adams, stationed on the RAT boat *Ocean Ranger*, learned from VECO employee Eugene F. Wall of a rockshelter in which Wall and other VECO employees had found bones. Adams informed the skipper of the RAT boat *Tongass Ranger*, who in turn informed Lora Johnson of CAC. Johnson reported the information to USFS Incident Commander John Knorr, showing him a map on which the location of the rockshelter was plotted. She then telephoned Jim Haggarty (acting director in Mobley's absence), and the two made plans to visit the locale the next day.

The party visiting the rockshelter (eventually given the AHRS number of SEW-469) on July 5 consisted of archaeologists Jim Haggarty and Peter Phippen, and Lora Johnson of CAC. Access was facilitated by the USFS, using the RAT boat *Tongass Ranger*. Approximately one and one-half hours were spent by Haggarty, Phippen, and Johnson in making written observations, tape recorded comments, and photographs, before beginning a site map with the intent to plot surface features and artifacts. However, a radio message was relayed to the party from the *Tongass Ranger*, received via radio from USFS Special Investigator Mike Lorton, requesting that Exxon and CAC halt investigations and remove themselves from the rockshelter. The *Tongass Ranger* and a float plane were used to return to Valdez, after interviews with Dave Adams had been conducted to reconstruct some of the details mentioned above.

A debriefing meeting was held on July 6, attended by Haggarty, Phippen, Exxon supervisor A.R. Teal, CAC's Carl Yanagawa, SHPO representative Charles Holmes, and the USFS's John Knorr, Mike Lorton, and Linda Yarborough. At that meeting Lorton indicated that the matter would be handled as a special investigation by USFS. Individual incident reports prepared by Mobley and Haggarty were filed with USFS on July 12. Lorton filed an incident report on September 14, containing some details about events occurring in the intervening time, but additional information reported here has been gleaned from other sources.

Forest Service Investigations

Lorton and USFS archaeologist Linda Yarborough conducted field investigations from July 6 to July 9, confirming disturbance at the site. They interviewed State Trooper Pucak and VECO Security Chief Tom Varnell, who stated that they had together visited the site and removed some boards covering human remains, collecting the human bones beneath. Pucak filed an incident report (Case #890047360) stating that on June 24 he and Varnell observed:

> ... bones located in two areas the first area was approximately 50 feet above the water line. This area is a side of a hill. The bones found at the first site appeared to have been taken to the area by animals at this site small bones were found under leaves. The second site was located sixty yards south of the first site and twenty five feet higher in this site a human skull and other bones were found.

According to Pucak's report, photographs of the scene were also taken. Bones were collected for evidence (Table 17), and Lorton's report says boards covering the interment were collected as well. Linda Yarborough prepared a written report (L. Yarborough 1989) and collected a written statement from RAT boat participant Mark Franklin which provided observations on the condition of the site as well as details of the contact between the RAT monitors and Eugene Wall. Wall was said to have visited the site, observed animal and human remains including a human skull, and then, understanding its archaeological significance, to have directed the RAT team to the site.

Further developments occurred during the time that the USFS was conducting its special investigation. The human remains were sent by Pucak to the state crime lab in Anchorage, which pronounced them archaeological and returned them to Pucak. Pucak voiced the intent to send them to Exxon, but was persuaded by Mobley to return them to the crime lab for forwarding to the USFS, as owner of the property. Upon return to the crime lab, the remains were analyzed by John E. Lobdell (1989a) under contract to CAC, and came into the possession of CAC.

Table 17

Human Remains Recovered by the Alaska State Troopers at SEW-469

from Lobdell 1989a:2-3.

1	cranium	1	innominate
5	teeth	12	ribs
8	lower thoracic vertebrae	1	ulna
2	lower cervical vertebrae	1	patella
1	lumbar vertebra	1	astragalus
1	sacrum	5	carpals
4	proximal phalanges	6	metacarpals
1	metatarsal	2	proximal phalanx

The SHPO, Exxon, and USFS Region 10 archaeologist recommended against immediate reburial, but the Chugach National Forest favored it, and CAC reinterred the remains within the site on August 14. A hole had been dug several days before by CAC's Lora Johnson and Rita Miraglia, under the observation of Region 10 archaeologist Gerald Clark, resulting in the recovery of one artifact (not included in the analysis of this report). During reburial, the hole was found to be too small and was consequently enlarged by Johnson. A Russian Orthodox service was conducted in the presence of Chugach elders (Chugach Alaska Corporation 1989:16), and a white cross visible to passing boaters was installed in memoriam.

Later Exxon Involvement

SEW-469 was selected for post-cleanup assessment due to the sensitive nature of the incident and the need to map and fully document the remaining features. On August 31, surface features, human remains, numerous artifacts, and evidence of disturbance were documented with videotape, photographs, and written notes, and a scale map was made of feature locations. All skeletal and cultural material was left in place.

On August 29, Lt. John Myers, Commander of the Alaska State Troopers "B" Detachment, invited Exxon to a discussion with representatives of the State coroner's office, the Cordova magistrate's office, and CAC, to establish policy for determining jurisdiction and procedures when human skeletal material is found. Mobley responded on September 4 to suggest that such a meeting be expanded to include the SHPO, USFS, NPS, and USFWS. A meeting was held on September 13, at which the issues were addressed in an expanded multi-agency forum. Discussions continue between the State Troopers and the SHPO to work out procedures for archaeological and forensic consideration of human remains.

Apprehension of the Vandal

A new phase in the SEW-469 investigation was entered in October of 1989. On October 4, Dr. David Yesner, Instructor of Anthropology at the University of Alaska Anchorage, gave several human remains to CAC that he stated had been given to him by a former student who claimed to have collected them from a rockshelter on Knight Island while employed on the oil spill cleanup. The material consisted of a radius, two vertebrae, two phalanges, and an isolated tooth (Lobdell 1989b:2). CAC informed Exxon of this in a letter dated October 10. A second special investigation was launched by USFS under the direction of Law Enforcement Agent Andrew Gifford, resulting in the arraignment of Eugene F. Wall. Wall pleaded no contest to a charge of disturbance of government property (Title 16 USC 551 and 36 CFR 261.9(h)). The USFS recommended a sentence consisting of a $500.00 fine with $400.00 suspended, plus two years of unsuper-

vised probation. Judge John D. Roberts, magistrate for the United States District Court of Alaska, agreed, and pronounced sentence on November 14, 1989 (United States of America versus Eugene F. Wall, Case #F1595951/AL1). Following sentencing, CAC retained the skeletal material and reinterred it at the site, without the USFS archaeologist's knowledge, on January 15, 1990. CAC shortened the white cross and painted it a dark, reddish brown, so that it would be less visible to the public.

Concluding Remarks

Although this reconstruction is relatively detailed, some information is still missing as this report is being finalized. Missing items include the photographs taken by State Trooper Pucak, the incident report and other documentation collected by Forest Service Special Investigator Andrew Gifford, and primary documentation by CAC. The whereabouts of the artifact uncovered during the initial reinterment are unknown. The matter was reported in the local press under such front page headlines as "$100 fine for sound grave robber brings criticism from Native group" (*Anchorage Daily News* 12/6/89, p. 1), and received minor attention in the national press (*USA Today* 12/7/1989, p. 11A). The SEW-469 vandalism was the most complex site disturbance matter handled by the EXXON VALDEZ Cultural Resource Program.

The Windy Bay Incident (SEL-179)

An eroding shell midden, possible housepit depression, and intertidal lithic scatter located in Windy Bay (on the Kenai Peninsula) were given the AHRS site number SEL-179. Cleanup crews began operations in Windy Bay prior to SCAT survey on May 9. On May 5, SHPO representative David McMahan inspected cleanup locations on the outer coast for impacts to cultural resources. At a location considered by McMahan to have high potential for intertidal artifacts, a Native crew from Port Graham, under contract to VECO, was shoveling 20 to 30 cm (8 - 12 in) of gravel into bags for disposal. Survey by McMahan revealed no artifacts at this location, but one worker showed him a site around the point from the work area.

According to the incident report McMahan filed with the SHPO's office, the upper intertidal zone of that site (SEW-179) consisted of a concentration of fire-cracked rock eroding from a midden on the uplands. The worker volunteered to McMahan that he and other crew members had removed artifacts from the beach, and subsequently transported McMahan to his berthing vessel to view the artifacts. These included the distal portions of two ground stone axes or adzes, a slate ulu fragment, two hammerstones, and several other rocks which McMahan thought were not culturally altered (see the *Artifact Descriptions* appendix). Two crew members on adjacent boats showed McMahan a stone labret collected from this site and an ulu fragment from a different site. On the morning of May 6, McMahan surveyed the beach where the second ulu fragment originated, without finding more cultural material.

Later that morning McMahan returned to Homer, where he informed SHPO Judith Bittner and SCAT archaeologist Bruce Ream of the incident. Ream and Bittner apprised McMahan that the workers were in violation of Exxon's policy regarding cultural materials. During conversations with Ream and the SHPO later that evening, McMahan strongly advised against invoking the penalty for violation of the policy, namely firing the workers involved and halting cleanup work in the area, because he judged that they were genuinely unaware of the policy and state law despite statements included in the official Kenai Oil Spill Response Plan of April 23.

On May 7, McMahan and Ream, accompanied by State Parks Ranger Roger MacCampbell, returned to Windy Bay. MacCampbell informed the workers of the policy violation and requested that the artifacts be relinquished. The artifacts were handed over under protest and the party returned to Homer. The artifacts were retained by the SHPO and eventually forwarded to the EXXON VALDEZ Cultural Resource Program.

The segment was surveyed by SCAT on May 9, 1989, and cleanup was monitored May 7, 18 - 26, 28 - 31, and June 16 and 21. Post-cleanup assessment was conducted on August 7. No further damage to SEL-179 was recorded.

The "Windy Bay Incident", as it came to be called, resulted in Exxon and cleanup contractors placing greater emphasis on presenting cultural resources policy information to new cleanup workers. Accounts of the incident spreading through the work force resulted in a greater awareness of the policy and perhaps a higher degree of compliance.

The Ban Island Vandalism (AFG-129)

On July 14 a site (AFG-129) consisting of four housepits was recorded by SCAT survey of a spit and lagoon on Ban Island, in the Kodiak Archipelago. Fire-cracked rock, shell, and animal bones were eroding from the sandy berm. Past relic hunting was indicated by holes dug into the seaward side of the midden in four places, and by two housepits with sunken pits in their centers. The excavations seemed a year or so old, except for some more recent activity in the northernmost beach exposure where a portion of the midden had been freshly excavated. Perhaps coincidentally, fresh footprints led up to the site from the lagoon side of the spit, and a large "*" symbol had been drawn on the sandy lagoon beach as though someone had indicated a place to be picked up by an aircraft. The footprints were fresh on the evening of July 13 before the high tide (11:00 p.m.), and were partially obliterated by the morning of July 14.

On August 4, two SCAT archaeologists briefed individuals aboard the F/V *Alsea* in Foul Bay. The Exxon representative and ship's captain had been briefed on

archaeological procedures earlier at Sturgeon Bay on June 6 and 7. At 2:25 p.m. on August 5, the site was visited and videotaped as part of routine monitoring in the area. The side facing the bay appeared unchanged since July 14, but a freshly vandalized area was found on the lagoon side of the site. Five square meters (53 sq ft) of sod embankment had been systematically removed with a round spade, which left clearly visible marks in the Katmai ash. Vegetation on the removed sod blocks was still green, and leaves were just beginning to wilt. A single set of rubber boot tracks was observed on the beach. The vandalism had almost certainly occurred within the preceding 24 hours. By working on the lagoon side of the site, the perpetrator would have been hidden from the view of any vessel in the bay.

Upon returning to Kodiak, the two SCAT archaeologists met with Kodiak SCAT archaeology supervisor James Haggarty and Rod Harvey of Exxon security. After Harvey's superior approved on-site surveillance, the four flew in a helicopter to Ban Island, flying low for the last few miles to minimize detection. The pilot dropped the party of four on the gravel spit which lies 400 m (1300 ft) west of the site, then left immediately.

By 7:30 p.m., the team had hidden their float suits and other gear and taken up positions with good views of the site, particularly the recently vandalized area. Several vessels came and went during the evening. When darkness fell, the surveillance group built a fire, shielded with a large piece of plywood, on the beach just north of the site. Because of bad weather in Kodiak, the group was not picked up until the afternoon of the following day. No particularly suspicious activity was observed during the "stake-out."

On August 13, the SCAT aerial videotape reconnaissance team videotaped the site, recording no additional vandalism since August 5.

Post-cleanup assessment on August 27 found no new evidence of vandalism. Erosion was evident on both the bay and lagoon sides, with several meters of deposit exposed. Two areas of vandalism were apparent in the housepits, and two other areas of vandalism (appearing to have been prior to 1989) were visible in the cut banks. Recent vandalism was predominantly on the lagoon side of the site. No evidence was obtained to suggest the identity of the vandals.

The Cape Gull Incident (XMK-058)

The collection and disposition of intertidal artifacts from XMK-058, in Katmai National Park and Preserve, was an issue that helped define responsibilities for artifact collection during the cleanup. By the time SCAT survey was conducted on the shoreline, at 11:30 on June 25, 1989, cleanup by a 100-person work force was in progress. The SCAT archaeologist discovered artifacts in the intertidal zone but was prevented from observing the uplands by a NPS Resource Protection Officer (RPO) acting as a bear guard. The two collected eight artifacts (retained by the SCAT archaeologist and curated by the EXXON VALDEZ Cultural Resource Program) because they were endangered by cleanup, and documented the site quickly so the SCAT team could move to Swikshak. Exxon and VECO cleanup supervisors and crew chiefs were briefed on cultural resource policy and constraints, resulting in a total of almost three hours spent at the site.

On the following day (June 26), a second SCAT archaeologist monitored the work. The beach cleanup appeared to be less destructive than human traffic across areas of exposed midden (primarily by NPS officials, helicopter pilots, and supervisory personnel). Responsible NPS, VECO, and Exxon field personnel were briefed by the SCAT archaeologist on the need to restrict upland access.

On July 2 and 3, a third SCAT archaeologist monitored continuing cleanup activities by about 60 individuals on a beach immediately adjacent. A worker moving rocks found an oil lamp and turned it over to NPS field staff, prompting discussions about whether NPS officials or SCAT archaeologists were authorized to remove artifacts from the work area, including the state-administered intertidal zone. On the following day, a worker found a lamp preform and, at their request, turned it over to NPS officials, who indicated their intention of leaving the artifacts at the site after cleanup was completed.

Post-cleanup assessment on August 26 found natural erosion of the exposed midden. Some areas appeared to have been poked with a stick during the previous month or two.

Confusion about the disposition of artifacts was resolved by increased correspondence between NPS, SHPO, and the EXXON VALDEZ Cultural Resource Program, along with increased communication with NPS and Exxon field personnel. The NPS regional office in Anchorage was by that time working to issue the ARPA permit, and -- with the Park supervisor -- the Special Use permit for the EXXON VALDEZ Cultural Resource Program, but that information had not been transmitted to NPS field representatives in the Katmai area. Furthermore, the SHPO's suggestion -- that all artifacts collected as a site protection measure be temporarily curated together by Exxon as a body regardless of source -- had not yet been considered by NPS. The incident at Cape Gull prompted the conversations between parties that resulted in eventual agreement on these issues. The disposition of the artifacts retained by NPS representatives at the site is unknown.

The Izhut Bay Vandalism (AFG-026, AFG-027, and AFG-143)

On July 28, 1989, the assistant director, James Haggarty was notified by Exxon officials of reported vandalism to archaeological features at Izhut Bay, in the Kodiak region. Exxon supervisor Les Proctor had been informed by Calvin Smith and Homer Zumstein of the USFWS of significant vandalism to Site AFG-027. Sites AFG-026 and AFG-027, with a history of erosion and -- at

the former site -- a history of vandalism (Clark 1965:28, 104-105; 1974b:52, 57, 76-78), were known in the segment, but the very light oiling prompted only a cursory inspection by the SCAT archaeologist on July 15. As a consequence, a formal constraint was approved by the FOSC, requiring cultural resource survey before conducting cleanup in the segment.

Two SCAT archaeologists and SHPO representative David McMahan were met at Izhut Bay on July 29 by Smith and Zumstein, and transported by skiff to the F/V *Rebel* to obtain information from Les Proctor, Exxon representative. Proctor stated that when Team 6 arrived on July 26, a number of dip net boats were anchored, one just off-shore of AFG-027. The vandalized site had been found by Smith and Zumstein while scouting for oil, and they flagged the site and fed the information through Exxon channels until Haggarty was informed.

Departing the F/V *Rebel*, the investigative team went by skiff to AFG-027, where they found three major areas of recent vandalism along the beach exposure and two along the south side of the site, as well as an older hole in the upland portion. The three excavations along the beach front were extensive. The northern area had been excavated at least two meters (6.5 ft) back into the bluff, within the previous few days. Beneath a spruce tree, in the central hole, digging under the roots had undercut the bank by about three meters (9.75 ft), removing cultural deposits and ensuring the eventual toppling of the tree and accelerated erosion at the site. The southern hole showed fresh shovel marks cutting through the sod mat, and backdirt contained fresh green vegetation. The central and southern holes reflected renewed digging at previously vandalized areas. The damage was videotaped and photographed, and two salt and pepper shakers were found at the site.

The investigative team also inspected AFG-143, a new site located by Smith and Zumstein containing four housepits and a midden eroding into the intertidal zone. On the erosional face fronting the beach and in three of the four housepits were vandalized areas, two of which (one in the beach and one in a housepit) were recent. The site was documented by the archaeologists.

The last site evaluated was AFG-026, which consisted of an extensively eroding midden displaying recently vandalized areas on the erosion face and a hole dug in the top of the site. Under a large slate slab thrown out of the hole in the top of the site, slightly yellowed vegetation indicated the vandalism to be very recent, but more then a few hours old.

The F/V *Shearwater*, which had been in the area as part of the seiner group, under contract to Exxon to clean floating mousse since before July 26, was anchored about 100 meters (325 ft) off AFG-027 when the team began their site evaluation, but 20 minutes into the investigation the vessel pulled anchor and departed the bay. The skipper had been contacted earlier by Proctor regarding the vandalism, but since the vessel had been in the vicinity for a number of days, there was hope that the crew might have seen unusual activity that could help identify the vandals. On August 2, an incident report was filed with the Exxon Security Chief, requesting further investigation. Contact was also made with Afognak Native Corporation, Inc. -- the owner of the land upon which the sites are located.

On August 4, Rod Harvey of Exxon security and a SCAT archaeologist arrived at Izhut Bay to inspect the sites and question the captain and crew of the F/V *Shearwater*. Captain Joe Allen was questioned about the vandalism, but added no new information about the possible culprits. A request to search the vessel, made by Harvey to the captain, was denied. Crew member Mike Milligan was also unable to add any information about the vandalism.

Post-cleanup assessment of the sites, a few days later, failed when conditions prevented the crew helicopter from landing.

No evidence was recovered to indicate the identity of the vandals responsible for damage at the three sites.

The Spiridon Bay Incident (KOD-432)

On July 30, Jim Haggarty in Kodiak received two separate calls (one through the Kodiak Exxon Command Center and one through Exxon helicopter pilot Jim Watkins) concerning the reported discovery of human skeletal material and artifacts by a cleanup worker. The following day the pilot took a SCAT archaeologist to the F/V *Mar del Sud* in Larson Bay, and picked up the discoverer, Blaine Warner, to point out the site. In Spiridon Bay, a stone lamp, an abrading stone, and a human femur were located on a log where they had been left by Warner the previous day. The site is a one-meter thick (3.25 ft) midden, three to five meters (10 - 16 ft) above the high tide line, with shell and fire-cracked rock in the eroding bluff face easily visible from the beach. The previous day, Warner had discovered the three items eroding from the midden face and stacked them on the log, leaving them there after being informed by helicopter pilot Watkins that such action violated Exxon's cultural resource policy. Except for the single hole from which the femur was removed, and footprints, the site suffered no human disturbance. The SCAT archaeologist briefed Warner on cultural resource policy and provided him with the written policy statement and videotape. The femur and the lamp were reinterred in the hole from which the femur was removed, and the hole backfilled. A penny was included to record the disturbance. The site was recorded as KOD-432. Shortly thereafter, the lamp was collected as a protective measure by a team of SCAT and SHPO archaeologists.

The Perevalnie Passage Matter (AFG-046)

AFG-046 is a large midden and housepit site with a long history of vandalism noted by Clark (1965:30) and Klingler (1983). At the time of SCAT survey on May 23, 1989, the site showed evidence of both erosion and vandalism, with cultural remains (including human bone) in the

intertidal zone at the base of the eroded bluff. The site is easily visible from the water, and a monitoring constraint was approved by the FOSC. Cleanup supervisors were briefed on the need for care by the SCAT archaeologist on the day of the initial survey.

On May 24 and 25, immediately after the SCAT survey, an archaeological monitor oversaw cleanup at the site and instructed the crew on cultural resource policies and identification of artifacts. Artifacts were recovered from the oiled intertidal zone by the crew during treatment, and human skeletal material found on the beach was returned to the midden face and reinserted. Recovered artifacts were retained by Alaska State Park authorities, who forwarded them to the EXXON VALDEZ Cultural Resource Program.

Cleanup in the vicinity of AFG-046 from July 12 to 14 prompted continued monitoring, during which crew briefings were held to inform workers of cultural resource policies and artifact identification. Artifacts found in the intertidal zone were used to educate the cleanup crew, and were returned to the upper beach zone following cleanup. Although no vandalism was found and no direct disturbance by cleanup activities was noted, it was evident that pedestrian traffic on the slopes below the exposures was destroying the surface vegetation and hastening erosion.

On August 1, SCAT archaeologists visited AFG-046 and observed an individual on the vegetated upper section, near the housepits. The individual identified himself as "Steve" from a landing craft treating a neighboring beach, stated that he had been following a bear which was seen in the vicinity earlier in the day, and left the site on foot. When the SCAT archaeologists returned their attention to the site, they found a moist, soil-stained whale vertebra on the surface of the undisturbed housepit, suggesting that it had recently come from the midden deposit. Collections of bones and artifacts were stacked together on the slope. Hand and foot prints were observed at nearly every erosional exposure, and there were signs of poking into the slope to dislodge artifacts. Also noted was a beaten path between the lagoon on the passage and boats anchored in the bay. The SCAT archaeologists notified the Exxon representative of the damage and the monitoring constraint, and requested enforcement of the access restrictions. The identity of the individual found walking the site was not learned.

On another monitoring visit on August 4, two SCAT archaeologists briefed the crews, oversaw treatment activities, and made further notes on the site. Evidence of pedestrian traffic on the site was observed, and additional artifacts were noted in the intertidal zone. A human fibula was removed from the beach and, along with a coin (a US quarter), was replaced in a crack with other skeletal material.

On August 20, a SCAT archaeologist visited the site to discuss policy and constraints with the crew and videotape the condition of the site. No evidence of recent disturbance was noted since the previous visit. Post-cleanup assessment on August 29 found no new vandalism, although artifacts still remained in the intertidal zone and human bones were visible in the midden.

The Viekoda Bay Incident (KOD-427)

During a monitoring trip in Viekoda Bay, a SCAT archaeologist was informed by an Exxon representative that an archaeological site and a human skeleton had been found the previous day. The information had been included in the daily field report to the Kodiak Exxon Command Center, and the field personnel had followed the correct procedure by marking the area and keeping cleanup personnel away, but the Exxon Command Center in Kodiak did not inform the archaeologists at the SCAT offices. The Alaska State Troopers were also contacted by Exxon, and had the skeleton removed on July 8 as a forensic (as opposed to an archaeological) concern. Michael Machulsky of the Kodiak Island Search and Rescue Team was instructed to remove the material and interview the discoverers. He carefully removed and bagged the remains along with representative soil matrices, photographing the process at intervals, with the assistance of Lance Taysom of the F/V *Kilokak*. An Exxon supervisor also photographed the process, later turning the film over to the Alaska State Troopers as evidence.

The F/V *Kilokak* took the SCAT archaeologist to the location, where -- according to personnel on the vessel -- the skeleton was found in a rock cleft about one meter (3 ft) above the tideline, folded over with a portion of the upper torso including hand bones, skull, and portions of the jaw and teeth. The cleft is at the base of a ten-meter (33 ft) vertical rock face, with no evidence of midden development. Based upon the description and location, the archaeologist considered the remains unlikely to be archaeological. The crew of the F/V *Kilokak* mentioned a number of recent shipwrecks in the vicinity, and believed the individual to be a victim of drowning.

However, staff of the AOHA evaluating the remains at the Alaska State Crime Laboratory in Anchorage found midden remains and charcoal with the disinterred bones, suggesting a cultural origin. In the opinion of the state, the remains belonged to a middle-aged male from before the 1700s, based on worn teeth without fillings and other characteristics. Another field investigation made jointly by state and Exxon archaeologists confirmed the remains to have come from the Viekoda Bay Site.

Despite the conflicting impressions of the site available up to that time, the archaeological nature of the remains was immediately clear on August 3 when Exxon and state archaeologists reviewed photographs in the possession of the State Troopers. The Viekoda Bay material represents a Koniag Period rockshelter burial. The body was semi-flexed, with stone slabs placed around it, and the charcoal and shell adhering to the bone suggest that the whole feature was covered with imported midden material. The body was flexed at the knees and hips, with the feet brought up to the buttocks. The body rested on its left side, with its back to the bedrock, head to the north, and feet toward Viekoda Bay. Three large stone slabs formed a triangle enclosing the body, with a single slab at the feet.

Table 18
Results of the McAllister/Crozier Survey

McAllister #	AHRS #	Results
1	SEW-506	No cultural material.
2	SEW-507	Originally discovered by J. Johnson, visited by McAllister, was not located by Crozier.
3	SEW-430	Cultural material observed.
4	SEW-508	No cultural material.
5	SEW-509	No cultural material.
6	SEW-505	Cultural material observed.
7	SEW-510	No cultural material observed by Crozier, although 1990 survey data located a cultural rockshelter nearby which may have been the McAllister Site.
8	SEW-511	No cultural material, no natural lithic material observed either.
9	SEW-512	No cultural material.

Lobdell (1989c) analyzed the material for the Alaska State Crime Laboratory, identifying the remains as a young adult male, probably from pre-contact times. The race of the individual was probably Koniag Eskimo. Following forensic analysis, the remains were forwarded to KANA.

The Buoy Bell Discovery (SEW-494)

The discovery by cleanup crews, on July 8, of a large brass bell at Ingot Island resulted in special archaeological attention and the recovery of the bell and associated buoy parts. The material was uncovered in the intertidal zone during treatment, and the bell was removed, in violation of field procedures, to a nearby craft by Exxon supervisors before notification of cultural resource personnel. A SCAT archaeologist dispatched to the location a few hours later was able to identify the exact origin of the bell by the oxidation stain in the gravel on the beach, along with several ferrous metal (either steel or iron) objects left in place. The metal objects were excavated and removed from the oiled beach zone, and cleanup proceeded.

Specialists in marine navigation aids consulted to help identify the items included Coast Guard historian Bob "Doc" Scheina, Ken Black of Maine's Shore Village Museum, and Director Joe Leahy of the Valdez Museum. The bell, weighing 214 lbs (96.3 kg), is actually termed a 225-lb standard buoy bell, according to Coast Guard Aid to Navigation manuals. Casting marks are indistinct, but a date of "1809" or "1889" is suggested. Letters cast into the bell represent either "US LHE" (for United States Lighthouse Establishment), or "US LHS" (for United States Lighthouse Service), but again the marks are indistinct. The United States Lighthouse Establishment was formed on August 7 of 1789, becoming the Service in 1910, until eventually it was absorbed by the Coast Guard in 1939. Bells were often reused on buoys, so a 19th century casting mark on a bell in Prince William Sound is possible. A single bolt hole in the top of the bell is somewhat temporally diagnostic, since generally the evolution of the fastening went from one to three to four bolt holes, but there was considerable temporal overlap and no exact date is suggested. A large buoy float found on nearby Sphinx Island was originally thought to be related to the bell, but welded letters in the base of the float (C-42-417) indicate it to have been manufactured in 1942.

According to Ken Black, the buoy from which the bell came would have been unlighted and wave activated, with four clapper assemblies. Most of two clapper assemblies and parts of a third were recovered with the bell. The metal has laminae visible in it, and may be wrought iron. The metal balls coming into contact with the bell are about 8 cm (3 in) in diameter, attached directly to a long rod which in turn is shackled to another metal piece. Several other pieces of metal were recovered also.

Initially there was some confusion as to ownership of the artifacts. Because they were retrieved from the intertidal zone, the state considered them to be state property. However, the Coast Guard stated that they might retain a property interest in the material. Eventually there was agreement that the material would be curated along with other material as part of the EXXON VALDEZ Cultural Resource Program 1989 collections.

The Dennis McAllister/ Neil Crozier Survey

One incident during the field season resulted in a special survey, by the USFS, of several specific localities in Prince William Sound. On June 9, individuals from CAC informed the EXXON VALDEZ Cultural Resource Program that they were in contact with an agency official who had

provided them information about a number of heretofore unrecorded rockshelters in Prince William Sound, but that they could not divulge the information because the discoverer had requested that it not be released. Inquiries made to John Mattson of USFS resulted in a written interview (dated June 14, 1989), between Mattson and ADFG biologist Dennis McAllister, in which McAllister identified the locations of eight rockshelters and a lithic material source.

Neil Crozier, of the Bureau of Indian Affairs' Anchorage office, was detailed on special assignment to the USFS under Mattson to confirm the sites. Between June 19 and June 28, Crozier, with CAC's Lora Johnson and Rita Miraglia, inspected the locales identified by McAllister, as well as known site SEW-004. According to the notes that McAllister, Johnson, and Miraglia filed with Mattson, field maps were drawn of each rockshelter containing cultural material, test pits were excavated into interior sediments, and some shell and soil samples were collected.

The Crozier field effort was conducted under the auspices of the USFS, and was not administered by the EXXON VALDEZ Cultural Resource Program. However, the information was used to help protect cultural resources during treatment. Some of the sites reported by McAllister turned out to be devoid of cultural material, according to the investigators, although they had received AHRS numbers (Table 18). The fact that some locales contained no cultural material does not negate the value of McAllister's effort in discovering and reporting the sites to the land-managing agency.

Summary

The incidents reported above describe occurrences that were out of the routine pattern of activities, but that had to be responded to quickly. In practice, individual archaeologists assigned to a monitoring role were dispatched to the field as soon as possible to accommodate the individual incident. A quick response was necessary when cleanup crews discovered unforeseen cultural resources, so that the treatment activities would not be unduly delayed. A timely response was also necessary when vandalism came to light because, otherwise, the chances of apprehending the culprits were lessened. The incident response system, in most cases, resulted in minimal treatment delay and acquired information of use in further site protection.

Substantive Results

In compliance with federal and state laws, the primary objectives of the EXXON VALDEZ Cultural Resource Program were to systematically document cultural resources in the oil spill area and protect them from damage by spill cleanup activities. Laws protecting cultural resources exist in part because "the people of the United States treasure their distinctive roots and strive to perpetuate the richness of their cultural heritage in its intangible as well as tangible aspects" (Loomis 1983:iii). According to the US Department of the Interior, one of the applications of cultural resource survey is to "identify properties or areas whose study may provide information about the ... past, and contribute to scholarship, (and) which should be preserved or subjected to scientific investigation" (Derry et al. 1985:8).

In cultural resource management, the data potential and importance of an archaeological site is described by the term "significance", on which a substantial body of literature exists (K. Dixon 1977; Tainter 1979; Lynott 1980; T. King 1985; and others). On the federal level, significance is tied to eligibility to the National Register of Historic Places, and is defined in the *Codified Federal Register* (36 CFR 60) as follows:

> The quality of significance in American history, architecture, archeology, and culture is present in districts, sites, buildings, structures, and objects of State and local importance that possess integrity of location, design, setting, materials, workmanship, feeling, and association, and (a) That are associated with events that have made a significant contribution to the broad patterns of our history; or (b) That are associated with the lives of persons significant in our past; or (c) That embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or (d) That have yielded, or may be likely to yield, information important in prehistory or history.

In the emergency circumstances of the oil spill, the ACHP declared that historic properties would be considered eligible and significant, bringing virtually all sites within the oil spill area under the umbrella of federal statutes and guidelines protecting significant cultural resources. This blanket protection also relieved the EXXON VALDEZ Cultural Resource Program of the responsibility for evaluating the significance of individual sites or features according to National Register criteria.

As discussed earlier, few sites were investigated in detail, and field work consisted primarily of reconnaissance survey, limited surface collection, monitoring of cleanup activities in sensitive areas, incident investigations, and post-cleanup assessments. Nonetheless, a substantial amount of new data was collected concerning the characteristics of distribution and cultural resources in the spill area.

On the regional level, this new data consisted of: 1) 271 new sites recorded on the AHRS; 2) updated records on the location, nature, and condition of scores of previously recorded AHRS sites; 3) surface collections of temporally or functionally diagnostic artifacts from 30 AHRS sites; 4) revised chronological assignments for a number of previously recorded AHRS sites; 5) more substantial data collected at two Prince William Sound sites -- the historic Latouche Mine (SEW-026) and the prehistoric SEW-072; and 6) information from an experiment in which replicated artifacts were placed in the intertidal zone prior to cleanup at selected segments.

Researchers engaged in applied cultural resource studies (even under emergency circumstances) have a responsibility to employ an interpretive framework for data presentation, with the goal of clarifying both substantive results and implications for future resource management (Schiffer 1975:1-6). Wildeson (1982:76) argues that an interpretive framework is essential for impact assessment:

> ... it is crucial to have data on both the nature of the archaeological resource itself, and the purpose to which it is to be put. *These are the most important factors in defining a threshold of concern.*



Richard Reanier 3:4, Exxon

Figure 60. Extensive midden deposit exposed by vandalism at AFG-129, in the Kodiak area.

> and thus in assessing the nature of "effect" in any specific case. ... It is absolutely vital to have the specific, locally or regionally defined goals of archaeological resource management firmly in mind. ... That is, one must know the range of purposes for which sites are to be managed: scholarly use (what are the relevant research questions?); public interpretation (what are the relevant visual and access characteristics it is important to preserve?); "banking" for future use (what will it be used for in the future?); and other purposes, which will have their own sets of questions in need of answers. (Emphasis in the original.)

This chapter places the results of the data collected by the 1989 EXXON VALDEZ Cultural Resource Program in a broader interpretive framework based on the diverse environmental and cultural contexts of the study area. It includes: 1) an evaluation of some factors affecting the differential visibility and preservation of archaeological sites in the study area; 2) a discussion of the types of sites and features encountered; 3) an analysis of variation in site densities in various geographic areas of the spill region; 4) a discussion of patterns in the distribution of various site types across the study area; 5) a summary of the chronological implications of the data collected; 6) discussion of the artifact recognition experiment; and 7) presentation of information collected at SEW-026 and SEW-072.

The primary data for much of this chapter derive from the 271 new sites recorded in the oil spill area during EXXON's 1989 archaeological survey and monitoring program, along with existing and updated records for the 261 sites previously listed on the AHRS. With the number of sites now known for the oil spill area more than twice the pre-spill count, the relative frequencies of site types may reflect more accurately the composition of the regional site population. Both positive (where sites are) and negative (where sites are not) distribution data serve useful research and management goals.

The classification and comparison of sites within such a regional data base is not without problems. Most daunting is the fact that the quality of the data listed for individual sites on the AHRS data base varies greatly. Many AHRS site records are based on published accounts which provide inadequate data on site locations, ages, and functions. Spill-related field surveys were of variable intensity, and the time available for recording site attributes was sometimes brief. These and other problems limit



Donald Abbott 2-30, Exxon

Figure 61. Thin midden lens in erosion-cut bank at AFG-142, in the Kodiak area.

the vigor and specificity of inferences drawn from the data. Nonetheless, some tentative conclusions can be reached about the nature and meaning of site distributions across the study area.

Coastal Site Survey Biases

Factors influencing the ability of archaeologists to identify sites and accurately reconstruct settlement patterns include differential visibility of site types and environmental variables (such as vegetation cover, volcanic ash deposits, and shifts in sea level) that affect the likelihood of site discovery.

Differential Visibility of Site Types

The location, size, and function of prehistoric and historic sites, as well as the duration and intensity of their use, affect their potential for preservation and archaeological visibility. For millennia, the prehistoric inhabitants of the region appear to have depended on much the same resources and harvest techniques as their successors of the early Historic Period. Consequently, ethnohistoric information provides a useful framework for analyzing the evolution of regional cultural patterns and population growth.

Information on prehistoric subsistence is limited, but ethnographic information indicates that seasonal rounds included a relatively sedentary winter aggregation period, with dispersal to outlying subsistence camps during the late spring, summer, and early fall. "Winter villages" are typically large and highly visible sites with multiple house depressions, thick middens of shell, bone, and fire-cracked rock (Figure 60), and diverse artifact assemblages. Most winter villages were in protected settings, with good landing beaches and visibility for protection against enemy attacks. Secondary consideration seems to have been given to the proximity of shellfish beds, fishing grounds, sea mammal concentrations, and seabird colonies. Steep-sided "refuge" islands or forts, occupied at least during the late prehistoric period, are smaller and less visible. Rockshelters show evidence of use for mortuary, habitation, and ceremonial purposes.

Subsistence camps tend to be small but numerous. They occur in a variety of locations, corresponding in time and place with the availability of resources. The largest and most commonly recognized summer sites are



Morley Eldridge 7.16, Exxon

Figure 62. Culturally modified (bark-stripped) tree in Prince William Sound.

fishing camps, usually situated near the mouths of salmon streams. Fish camps usually have thin middens (Figure 61), with fishing and fish processing implements, wood cutting tools, little shell remains, and few or no house depressions. Large fishing villages along the Karluk River and other major salmon rivers in the Kodiak area are an exception, containing numerous house depressions and vast midden deposits. Stone and wood weirs were placed across salmon streams, intertidal channels, and mudflats.

Sea mammal hunting generally took place in exposed habitats accessible by boat. Isolated semi-permanent shelters, either small plank houses or semi-subterranean sod huts, were sometimes maintained on distant islands or bays with good hunting grounds. Other subsistence camps were made while traveling or while collecting seabird eggs, seaweed, land plants, or other resources. Many camps may have been on the beach beneath overturned boats, and ethnohistoric accounts include small, skin-covered shelters and natural depressions. Such ephemeral camps would have left little evidence of their locations and may be difficult to find.



Robert Betts P1421, Exxon

Figure 63. Detail of casting in a metal apparatus at SEW-497.

Terrestrial resources were also used, though evidence of interior settlement is minimal in most areas. Land mammal hunting camps were probably small and far from the shore. Medium and large land mammals tended to be hunted opportunistically, so kill and butchering sites may be found in nearly every land context. Kill sites are likely to consist of little more than a few cut-marked bones or discarded butchering tools and are less likely to be preserved or identified than coastal middens. The use of plants or trees for food or construction materials also leaves little archaeological evidence, except for relatively recent collection of bark, pitch, and cambium from trees (Figure 62).

Game trails along coastal bluffs were used in the past for overland travel between beaches much as they are today. Because they tend to funnel game, such trails are favored locations for setting traps. Evidence for prehistoric fur trapping is unlikely to have survived, but historic traplines may be identified by trap-wire scars and blazes on trees, and the remnants of horizontal set poles.

Historic development has also focused on the coast and its resources. Most major Russian-period settlements and small trading posts are known from the historical record, though their specific locations were not consistently identified. The more ephemeral and poorly documented camps of early explorers and traders who wintered in the region are even more difficult to locate. Similarly, little is known about the locations and extent of Russian mining, lumber, and shipbuilding sites. Evidence for these can consist of second growth forest and stumps indicating selective cutting, rocks or bricks used for ship ballast, broken crockery, or rusted implements on the beach.

The American Period saw the development of a commercial fishing industry, beginning in the 1880s with the establishment of canneries near the most productive salmon streams. Later, large, floating fish traps were built and anchored along the shore, many in locations known from the historic record. Evidence for these relatively conspicuous sites consists mostly of structural remains, rusted metal, machinery, and pilings in the backshore,



Charles Mobley 5.23, Exxon

Figure 64. Log cabin remains in Prince William Sound, SEW-439.

beach, and intertidal zones. Small commercial fishing sites consist of cabins and camps located behind beaches advantageous either for seining or setting gill nets.

Small mining sites are scattered through much of the study area, especially in the mineralized zones of Prince William Sound and the Kenai Peninsula. Mines are often located some distance from the shore, but abandoned equipment, structures, trash pits, and debris sometimes litter the backshore and intertidal zones. Such sites are usually in locations suitable for beaching large craft and off-loading equipment.

During the early 1900s, logging also was conducted from the beach. Much of this logging was selective in nature, and stumps (some with notches cut for springboards) in otherwise mature forest may mark these locations. Logging sites may also be identified by the presence of boom rafts, wire rope, and discarded metal debris on the beach and backshore (Figure 63).

Early regional development relied on water transport to and from commercial markets located along the western coast of the United States and British Columbia. A system of navigational aids consisting of markers, buoys, and lights was constructed and maintained early in the American Period to guide deep draft and commercial fishing craft operating in the area. Buoys were especially susceptible to storm loss and might be carried some distance from their original location before being deposited on a beach or backshore. Some locations of former navigation lights are defined by the remnants of piers (Figures 43 and 44) or access roads at the base of promontories and steep cliffs. During World War II, weather stations, defensive positions, and observation sites were constructed in strategic locations throughout the region. Generally, these occur on high bluffs and consist of concrete bunkers or gun emplacements.

Historic Native and Euro-American family settlements are often represented by isolated cabins. Many islands in Prince William Sound and the Kenai Peninsula possess cabins and other structures (Figure 22) associated with fox farms. On Kodiak, cabins sometimes mark the locations of former large Native settlements. Many of these sites are still seasonally occupied subsistence camps. The rich midden deposits support lush vegetable gardens. Throughout the region, cabins (Figure 64) used for subsistence fishing are associated with smokehouses and drying racks. The introduction of outboard engines and net fishing has led to the use of locations unsuitable in the past.



Figure 65. Culturally modified tree, in a drowned forest now in the intertidal zone, SEL-188.

Other Archaeological Biases

Although the most recent historic sites tend to be highly visible and are often the most readily identifiable class of cultural sites, they are generally under-represented in the AHRS. Most sites less than 50 years old are not eligible for the National Register of Historic Places. Until recently, historic sites were not systematically recorded by all archaeologists due to a limited awareness of their significance. As appreciation for the value of historic sites grows, and more American Period sites (fox farms, canneries, World War II facilities, etc.) annually exceed the arbitrary 50-year age limit, the number and diversity of historic sites entered into the AHRS will more accurately reflect the archaeological record.

Survey data for prehistoric or protohistoric sites tend to be biased toward large village sites with thick middens and clearly defined house depressions. Late prehistoric sites are more commonly identified because of poor faunal preservation in older sites, dense sweatbath rubble typical of late prehistoric sites, and progressive infilling or "melt down" of surface depressions with time. At multi-component sites, large accumulations of late prehistoric refuse may also obscure older site deposits, which may be unidentifiable without excavation. In contrast, seasonal camps or task-specific sites are generally smaller, with lower midden volume and density. This makes them more difficult to locate and more vulnerable to loss through natural and cultural processes. Though such small or low density sites are numerous, they have sometimes been ignored in favor of large village sites that contain concentrations of artifacts.

Environmental Factors in Site Preservation and Discovery

Differential site preservation is an important factor in the distribution of sites. Changes in relative sea level due to eustatic, isostatic, and tectonic shifts have erased parts of the archaeological record. Coastal submergence and erosion may explain the dearth of Paleoarctic sites in the region, since coastal sites of this age are most likely to have been located along shorelines drowned or destroyed by rising postglacial sea levels. In Prince William Sound and Kachemak Bay, no sites older than 3800 B.P. have been located and many coastal sites have subsided (up to



Figure 66. Wind-eroded deposit at KOD-385, in the Kodiak area, showing fire-cracked rock scatter amid coastal dunes.

four meters) over the past 3000 years (Figure 65). The same processes could explain the intertidal artifact scatters present in these areas. Elsewhere, uplift has preserved some sites, though often in settings unlikely to be scrutinized by shoreline reconnaissance. On Kodiak, for example, many Ocean Bay sites (post-7000 B.P.) are located on uplifted landforms several meters above sea level. In uplifted parts of Prince William Sound, the 1964 earthquake moved many coastal sites into wooded backshore locations beyond the view of survey focused on the immediate shoreline area.

Erosion plays an important role in revealing and destroying sites. Wave, wind, or stream erosion may expose subsurface sites, sometimes redepositing artifacts in intertidal or fluvial contexts. Eroding middens with high shell, bone, or fire-cracked rock content are especially visible (Figure 66), in some cases even from boats or aircraft, or on aerial videotape. Eroding areas also may expose stratigraphy or artifacts that help define the size, contents, age, and nature of a site. Despite these minor benefits, erosion in the study area is one of the most serious threats to sites -- many of which are in danger of complete destruction. Moreover, the cumulative effects of coastal erosion over the millennia may have already destroyed entire classes of sites, particularly those from earlier time periods.

Other discovery biases are created by variation in terrestrial and intertidal plants. Brush and trees obscure the ground surface on some terraces, backshore beaches, and intertidal areas, so that site detection requires systematic vegetation removal or subsurface testing. Differences in vegetation create regional survey biases between the unforested areas of Kodiak and the Alaska Peninsula, and the heavily forested areas of Prince William Sound, the Kenai Peninsula, Afognak Island and northeast Kodiak Island.

On the other hand, certain plant communities are associated with past human settlements and can aid in site detection. Clearings or patches of second growth forest, for instance, often identify historic sites and may be visible from great distances. Sites in unforested settings are frequently covered by lush growths of nettles, cow parsnip (wild celery), and elderberry. Even though these indicator species help to identify sites, a bias is created by their preference for denser middens and more recent sites. Changes in the unforested plant communities of the study area are probably related to the progressive depletion of organic midden nutrients over time, so vegetation differ-



Mike Yarbrough 6:9. Exxon

Figure 67. Large surface depressions probably representing a house pit at KAR-120, in the Kodiak area.

ences are less evident or absent on older sites and smaller, lower density middens. In unforested areas, there is also a seasonal site discovery bias created by the rapid and lush growth of annual vegetation during the spring and summer. Diagnostic plants are most helpful during May and June, before other annual vegetation grows to full height. Late summer grass growth in open areas obscures the ground and inhibits the detection of large and normally obvious cultural features (such as housepits).

Archaeological sites may also be obscured by sediment deposition. In 1912, portions of Kodiak Island and the Alaska Peninsula were blanketed by up to one meter of ash after the Novarupta volcanic eruption. Substantial amounts of ash may obscure housepits and other surface features dating to the Prehistoric and early Historic periods, seal off underlying middens, and impede the identification or interpretation of archaeological sites.

Tectonic uplift and subsidence have also caused changes in shoreline configuration that can lead to sedimentary deposition. Subsidence in parts of Prince William Sound, the Kenai Peninsula, and Kodiak has caused some streams to deposit deltaic sediments in former backshore areas. Such locations were often used for salmon fishing, and the remains of some fish camps may now be buried below sediment. New sand dunes or storm berms were also created as the land-sea interface changed. Sand dunes or storm-tossed gravels can partially fill house depressions or completely obscure former surfaces. Storm berms can trap water and create backshore ponds and marshes, where sites may be flooded or buried under sediment. The progressive formation of new beach ridges along many shorelines of the study area also isolates earlier sites on old beach ridges now located some distance from the coast.

Types of Sites Encountered

Cultural features reflect the antiquity and diversity of human activity in the study area. The categories used to classify cultural features are not mutually exclusive. The broadest subdivision is between historic and prehistoric sites, though some sites span both periods and some sites are of unknown date.

In collapsing the field data into a useful typology, numerous decisions had to be made to assign each site to a category. Features such as cache pits or housepits were generally assumed to be prehistoric, though some were used well into the Russian Period and later. Fire-cracked

rock (produced historically as well as prehistorically) is considered to be prehistoric unless otherwise indicated. Many recorded sites contain several feature types (Table 19), so tallying individual features is not immediately useful.

Selected cultural and environmental attributes of the 271 new AHRS sites recorded during the 1989 field survey are summarized (Table 20) according to five geographic areas within the oil spill region (Prince William Sound, the Kenai Peninsula, the Barren Islands, the Kodiak Archipelago, and the Alaska Peninsula). The Barren Islands are treated as a separate site sample because they constitute a discrete geographic unit, and because their position central to sea routes between the other four areas, creates a unique potential for prehistoric use.

Prehistoric Feature and Site Types

Prehistoric feature and site types are older and consequently consist primarily of archaeological, rather than architectural, remains. Surface depressions of characteristic shape and size are interpreted as housepits and cache pits. Archaeological excavations indicate that cache pits are generally smaller (1 - 3 m wide) than housepits (3 - 10 m wide). Both small and large surface depressions were sometimes found as isolated examples and given AHRS site numbers, though care was necessary (especially for smaller pits) to distinguish them from natural depressions caused by tree fall, beach ridge scouring, or other natural processes. Groups of housepits (Figures 26, 67) have been designated as villages for purposes of tabulation (Table 20), though some large sites without visible surface depressions may also have been villages. Ethnographically, subterranean houses were used by both the Chugach and Koniag, but archaeologically they are not common in the Prince William Sound area. Cache pits are generally absent from the Kodiak region, but are found elsewhere in the oil spill area. The reasons for this are not clear, but different food preservation techniques and regional variability in tectonic uplift and vegetation may be contributing factors.

Middens are deposits of artifacts and organic refuse, not always apparent on a site surface, but often visible in cut banks or steep erosional slopes (Figures 60, 61, 68). Shell is often the dominant organic material in the matrix, although bone or fire-cracked rock middens without shell do occur. Depending on the duration and intensity of occupation, midden thickness may range from a few centimeters to several meters. Because dense shell deposits are conspicuous, middens sometimes suffer more vandalism than other site types.

Midden refuse is commonly associated with a variety of site types, including open sites and rockshelters. Open sites with midden material are recorded in Prince William Sound, but they are more common on Kodiak and parts of the Alaska Peninsula, probably for reasons of visibility and population density. Severely eroded middens often leave extensive artifact scatters in the intertidal zone. Wind erosion is the dominant natural process affecting the integrity of other middens, where deposits in

Table 19

Types of Attributes Identified at Cultural Sites, with Abbreviations

--	Anchor
Barge	Wrecked or abandoned barge
--	Bead
BRL	Burial
--	Cache
--	Cave
CBN	Cabin
CBN/SU	Semi-subterranean cabin
Char	Charcoal
CHRCH	Church
CMT	Culturally modified tree
CMY	Cemetery
COF	Coffin
CRN	Cairn
CSP	Cache pit
--	Dam
Fauna	Faunal preservation at site
FCR	Fire-cracked rock
FXF	Features associated with the fox farming industry
HSP	Housepit
HTC	Hatchery
HTD	Historic artifact, domestic
HTH	Hearth
HTI	Historic artifact, industrial
HTM	Historic artifact, military
HTU	Historic artifact, unknown
IVY	Ivory
KYK	Kayak
--	Labret
LMP	Stone lamp
MDN	Midden
Metal	Metal
--	Mine
MWB	Modified whale bone
PAB	Prehistoric artifact, bone
PAC	Prehistoric artifact, copper
PAF	Prehistoric artifact, flaked
PAG	Prehistoric artifact, net-sinkers
PAO	Prehistoric artifact, obsidian
PAS	Prehistoric artifact, slate
PAU	Prehistoric artifact, unknown
Peat	Fossil peat
PET	Petroglyphs
PIC	Pictographs
PLG	Piling
PTY	Pottery
RCS	Recent campsite
RKS	Rockshelter
--	Road
--	Shell
SHP	Ship
--	Sod
--	Weir
WHB	Whale bone
--	Wood

Table 20

Primary Site Types and Attributes for 271 AHRS Sites

Recorded by Exxon's 1989 Cultural Resource Program

AHRS #	Type	Attributes	Affiliation	Environment
Prince William Sound				
SEW-434	Artifact scatter	Dam, HTI, CMT	Historic	Bay, protected
SEW-435	Lighthouse	PLG, HTI, CBN	Historic	Sound, exposed
SEW-436	Rockshelter	RKS, FCR, LMP, char, shell	Prehistoric	Cove, protected
SEW-437	Structure	CBN	Historic	Cove, protected
SEW-438	Structure	CBN, CMT	Historic	Cove, protected
SEW-439	Structure	CBN	Historic	Cove, protected
SEW-440	Artifact scatter	FCR, CBN, CMT	Pre/historic	Cove, protected
SEW-441	Structure	CBN, HTD	Historic	Cove, protected
SEW-442	Structure	CBN, RCS	Historic	Bay, protected
SEW-443	Rockshelter	RKS, FCR, CMT, char, shell	Prehistoric	Bay, protected
SEW-444	Artifact scatter	CMT, RCS, peat	Pre/historic	Pass, protected
SEW-445	Artifact scatter	CMT, PAF	Prehistoric	Pass, protected
SEW-446	Mine	HTI, CMT, mine	Historic	Bay, protected
SEW-447	Burial	BRL, FCR, HTD, Char	Historic	Sound, exposed
SEW-448	Shipwreck	Barge	Historic	Cove, exposed
SEW-449	Mine	PLG, CBN, HTD, HTI RCS, road, mine	Historic	Island, protected
SEW-450	Mine	Mine, HTI, HTD	Historic	Bay, protected
SEW-451	Structure	CBN, cache	Historic	Bay, protected
SEW-452	Fox farm	HTI, FXF	Historic	Cove, protected
SEW-453	Structure	CBN, CMT	Historic	Sound, exposed
SEW-454	Artifact scatter	HTI	Historic	Bay, protected
SEW-455	Shipwreck	SHP, HTD, anchor	Historic	Bay, protected
SEW-456	Structure	HTD, CBN	Historic	Penin, exposed
SEW-457	Structure	CBN	Historic	Bay, protected
SEW-458	Structure	CBN	Historic	Bay, protected
SEW-459	Fox farm	CMT, HTD, HTI	Historic	Cove, protected
SEW-460	Fox farm	FXF	Historic	Cove, protected
SEW-461	Structure	CMT, CBN	Historic	Point/bay, protected
SEW-462	Rockshelter	MDN, FCR, PAF, PAG RKS, shell, fauna	Prehistoric	Bight, protected
SEW-463	Structure	CBN, MDN, CMT	Historic	Point, exposed
SEW-464	Fox farm	FXF	Historic	Sound, exposed
SEW-465	Fox farm	FXF	Historic	Sound, exposed
SEW-466	Fox farm	HTD, FXF	Historic	Passage, exposed
SEW-467	Structure	MDN, CBN	Historic	Passage, exposed
SEW-468	Fox farm	HTI, FXF	Historic	Inlet, protected
SEW-469	Rockshelter	BRL, FCR, MDN, MAT RKS, Wood, Shell, Fauna	Prehistoric	Passage, protected
SEW-471	Artifact scatter	FCR, HTH, HTI, CMT, Char	Pre/historic	Island, protected
SEW-472	Artifact scatter	FCR, CMT	Prehistoric	Bay, protected
SEW-473	Structure	CBN, CMT	Historic	Strait, protected
SEW-474	Kayak	KYK	Historic	Sound, protected
SEW-475	Artifact scatter	Marker	Historic	Point, exposed
SEW-476	Artifact scatter	Marker	Historic	Point, exposed
SEW-477	Artifact scatter	HTH, FCR	Unknown	Bay, protected
SEW-478	Artifact scatter	HTI	Historic	Bay, exposed
SEW-479	Structure	CBN, HTD	Historic	Passage, protected
SEW-480	Mine	Mine	Historic	Strait, exposed

Pre/historic = Prehistoric and Historic

Primary Site Types and Attributes for 271 AHRS Sites

AHRS #	Type	Attributes	Affiliation	Environment
SEW-481	Rockshelter	BRL, PAF, RKS, shell, bone	Prehistoric	Sound, exposed
SEW-482	Fox farm	FXF, CMT	Historic	Strait, protected
SEW-483	Mine	CBN, HTI, MNE, road	Historic	Cove, protected
SEW-484	Structure	CBN, HTI, CMT, cache	Historic	Cove, protected
SEW-485	Structure	CBN, HTD	Historic	Forest, protected
SEW-486	Shipwreck	Barge	Historic	Strait, exposed
SEW-487	Shipwreck	SHP	Historic	Strait, exposed
SEW-488	Artifact scatter	LMP, PAG, fauna	Prehistoric	Passage, protected
SEW-489	Structure	CBN, HTI	Historic	Island, protected
SEW-490	Shipwreck	SHP, FCR	Historic	Harbor, protected
SEW-491	Artifact scatter	PAG, FCR	Prehistoric	Point, exposed
SEW-493	Buoy	HTI	Historic	Point, exposed
SEW-494	Buoy	HTI	Historic	Point, exposed
SEW-495	Rockshelter	RKS, wood, fauna	Prehistoric	Strait, exposed
SEW-496	Artifact scatter	HTI	Historic	Bay, protected
SEW-497	Sawmill	HTI	Historic	Bay, protected
SEW-498	Cannery	HTI, SHP, HTD, MDN	Historic	Bay, protected
SEW-499	Artifact scatter	RCS, HSP, HTD, HTI, SHP, CMT	Historic	Pond, protected
SEW-500	Artifact scatter	PAG	Prehistoric	Bay, exposed
SEW-502	Fish weir	FST	Prehistoric	Bay, protected
SEW-503	Fox farm	Weir	Historic	Cove, protected
XBS-016	Fox farm	FXF, HTD, HTI	Historic	Passage, protected
XBS-017	Structure	CBN	Historic	Bay, protected
Barren Islands				
AFG-099	Fox farm	FXF	Historic	Bluff, exposed
AFG-100	Fox farm	FXF, HTD	Historic	Lagoon, exposed
AFG-101	Structure	CBN	Historic	Valley, protected
AFG-103	Village	HSP	Prehistoric (Kachemak)	Isthmus, protected
AFG-104	Artifact scatter	FCR, PAS, PAF, MDN	Prehistoric	Cliff, exposed
AFG-105	Midden	FCR, shell, fauna	Prehistoric	Isthmus, exposed
AFG-106	Artifact scatter	PAF	Prehistoric	Stream, protected
Alaska Peninsula				
AFG-107	Depressions	HSP, SOD	Prehistoric	Bluff, exposed
AFG-108	Structure	CBN/SU, SOD, CBN	Historic	Bay, protected
AFG-109	Cannery	HTI, HTD, SHP	Historic	Lagoon, protected
AFG-110	Depressions	HSP	Prehistoric	Point, exposed
AFG-117	Midden	MDN, PAF	Prehistoric	Bluff, exposed
AFG-118	Depressions	HSP	Prehistoric	Cove, exposed
AFG-134	Cairn	CRN	Prehistoric	Cape, exposed
AFG-165	Cairn	CRN	Prehistoric	Cliff, exposed
ILI-058	Depressions	HSP	Prehistoric (Koniag)	Island, exposed
KAR-116	Structure	CBN, HTD, HSP	Historic	Pond/bay, protected
KAR-117	Structure	CBN, CSP, HTD, HSP	Pre/historic	Bay, protected
KAR-118	Structure	CBN, HTD, fauna	Historic	Stream/bay protected
KAR-120	Depressions	HSP	Prehistoric	Bay/dune, protected
KAR-121	Village	HSP, PAG, PAF, FCR, HTH, metal	Pre/historic	Bay/dune, exposed
KAR-122	Artifact scatter	PAF, FCR	Prehistoric	Cliff, exposed
KAR-123	Artifact scatter	PAF	Prehistoric	Cliff/point, exposed

Pre/historic = Prehistoric and Historic

Primary Site Types and Attributes for 271 AHRS Sites

AHRS #	Type	Attributes	Affiliation	Environment
KAR-124	Midden	MDN, FCR, fauna	Prehistoric	Bay, exposed
KAR-126	Artifact scatter	PAG, PAS	Prehistoric	Cliff, exposed
KAR-127	Midden	MDN, HSP, shell	Prehistoric	Creek/bay, protected
KAR-128	Artifact scatter	PAF, FCR	Prehistoric	Bluff/bay, exposed
KAR-129	Structure	CBN, HTD	Historic	Bluff/bay, protected
KAR-130	Depressions	CBN/SU	Historic	Bluff/bay, protected
KAR-131	Artifact scatter	PAF	Prehistoric	Point/bay, protected
KAR-132	Artifact scatter	PAO, PAF, FCR	Prehistoric	Point/bay, protected
KAR-133	Mine	MNE, HTI	Historic	Point/bay, protected
KAR-134	Structure	CBN, HTD	Historic	Bay, protected
KAR-135	Structure	CBN, HTD	Historic	Bay, protected
UGA-059	Village	HSP, MDN, char	Prehistoric (Koniag)	Bay, protected
XMK-058	Midden	MDN	Prehistoric	Cove, protected
XMK-059	Fort	MDN, HSP, FCR, shell	Prehistoric	Seastack, protected
XMK-060	Cannery	HTI, HTD, CBN	Historic	Passage, protected
XMK-061	Structure	CBN, HTD	Historic	Cove, protected
XMK-062	Structure	CBN, HTD	Historic	Bay, protected
XMK-063	Village	HSP	Prehistoric	Bay, protected
XMK-064	Fort	HSP	Prehistoric	Islets, exposed
XMK-065	Village	HSP, FCR	Prehistoric (Koniag)	Bay, protected
XMK-066	Village	HSP	Prehistoric	Bay, protected
XMK-067	Village	MDN, HSP, char	Prehistoric	Stream, protected
XMK-068	Village	HSP	Prehistoric	Stream, protected
SUT-017	Depressions	HSP	Prehistoric	Bay, exposed
SUT-018	Depressions	HSP	Prehistoric	Point, exposed
SUT-019	Structure	CBN	Historic	Lagoon, protected
SUT-020	Depressions	HSP	Prehistoric	Bay, exposed
Kenai Peninsula				
SEL-178	Depressions	HSP, CMT, MDN, FCR	Prehistoric	Spit, protected
SEL-179	Midden	MDN, FCR, HSP, PAS, CMT, labret	Prehistoric	Bay, protected
SEL-180	Artifact scatter	PAS	Prehistoric	Point/bay, protected
SEL-181	Fort	MDN, FCR, char shell, fauna	Prehistoric	Islet, exposed
SEL-182	Midden	MDN, FCR, PAF, shell	Prehistoric	Bay, protected
SEL-183	Fox farm	FXF, HTD	Historic	Lake/cove, protected
SEL-184	Fish weir	Weir	Prehistoric	Cove, protected
SEL-185	Structure	CBN, CMT	Historic	Bay, protected
SEL-186	Midden	MDN, FCR, shell,	Prehistoric	Bay, protected
SEL-187	Shipwreck	SHP	Historic	Bay, protected
SEL-188	Midden	MDN, PAG, PAS, IVY, CMT, HTI	Pre/historic	Cove, protected
SEL-194	Midden	MDN, FCR, PAG, PAS	Prehistoric	Point/cove, protected
SEL-195	Artifact scatter	PAF	Prehistoric	Islet, protected
SEL-196	Artifact scatter	FCR, PAG, CMT	Prehistoric	Cove, protected
SEL-197	Artifact scatter	FCR, PAS, CMT	Prehistoric	Cove, protected
SEL-198	Artifact scatter	FCR, char	Prehistoric	Cove, protected
SEL-199	Artifact scatter	FCR	Prehistoric	Cove, exposed
SEL-200	Artifact scatter	PAS, FCR, CMT	Prehistoric	Cove, protected
SEL-201	Artifact scatter	FCR, PAS, HTD	Pre/historic	Cove, exposed
SEL-202	Structure	HTI	Historic	Pass, exposed
SEL-203	Structure	HTI	Historic	Island, exposed
SEL-204	Artifact scatter	FCR	Prehistoric	Bay, protected

Pre/historic = Prehistoric and Historic

Primary Site Types and Attributes for 271 AHRS Sites

AHRS #	Type	Attributes	Affiliation	Environment
SEL-205	Artifact scatter	FCR, PAS	Prehistoric	Cove, protected
SEL-206	Artifact scatter	FCR, PAS	Prehistoric	Islet, protected
SEL-207	Depressions	HSP	Prehistoric	Cove, protected
SEL-208	Depressions	HSP, CMT	Prehistoric	Cove, protected
SEL-209	Depressions	HSP	Prehistoric	Lagoon, protected
XBS-015	Village	HSP, CMT, CSP, FCR	Prehistoric	Bay, protected
XBS-018	Midden	MDN, char	Prehistoric	Gulf, exposed
Kodiak Area				
AFG-093	Structure	CBN	Historic	Strait, exposed
AFG-094	Village	CSP, HSP	Pre/historic	Cape, exposed
AFG-095	Artifact scatter	PAF	Prehistoric	Bay, protected
AFG-096	Artifact scatter	PAF	Prehistoric	Bay, protected
AFG-097	Village	MDN, HSP, FCR, PAF, PAS, fauna	Prehistoric (Koniag)	Bay, protected
AFG-098	Artifact scatter	PAG	Prehistoric	Bay, protected
AFG-102	Fort	HSP, CSP	Prehistoric	Bluff, exposed
AFG-111	Artifact scatter	PAF, HTI	Pre/Historic	Cove, protected
AFG-112	Depressions	HSP, CSP	Prehistoric	Bluff, protected
AFG-113	Depressions	Char	Prehistoric	Bay, protected
AFG-114	Depressions	HSP	Prehistoric	Bluff, protected
AFG-115	Structure	CBN	Historic	Inlet, protected
AFG-116	Depressions	HSP	Prehistoric	Bluff, exposed
AFG-119	Village	FCR, HSP, char	Prehistoric	Bluff, exposed
AFG-120	Village	HSP	Prehistoric	Cape, exposed
AFG-121	Depressions	HSP, MDN	Prehistoric	Spit, protected
AFG-122	Village	MDN, HSP, shell, fauna	Prehistoric	Cape, exposed
AFG-123	Midden	MDN, FCR, HSP, shell, fauna	Prehistoric (Koniag)	Bay, exposed
AFG-124	Midden	MDN, FCR, HSP, shell, fauna	Prehistoric	Bay, exposed
AFG-125	Village	HSP	Prehistoric	Spit, protected
AFG-126	Village	HSP	Prehistoric	Bay, protected
AFG-127	Village	HSP	Prehistoric	Bay/spit, protected
AFG-128	Midden	MDN, FCR, PAF, PAS, PAG, shell	Prehistoric (Koniag)	Bay/isthmus, protected
AFG-129	Depressions	HSP, FCR, fauna	Prehistoric	Bay/spit, protected
AFG-130	Midden	MDN, shell, fauna	Prehistoric	Cove, protected
AFG-131	Depressions	HSP	Prehistoric	Bay, protected
AFG-132	Village	WHB, FCR, PAS, HSP, shell, char, fauna,	Prehistoric	Bay, exposed
AFG-133	Artifact scatter	HSP	Prehistoric	Bay, protected
AFG-135	Midden	MDN, FCR, PAS, PAG, shell, char	Prehistoric (Koniag)	Bluff, exposed
AFG-136	Cannery	PLG, HTI	Historic	Strait, protected
AFG-137	Village	MDN, FCR, HSP, shell, fauna	Prehistoric (Koniag)	Strait, protected
AFG-138	Village	HSP, WHB, shell, fauna	Prehistoric	Bay/point, protected
AFG-139	Midden	MDN, FCR, fauna, shell	Prehistoric	Bay, protected
AFG-140	Cannery	HTI, HTD	Historic	Strait, protected
AFG-141	Midden	MDN, shell	Prehistoric	Strait, protected
AFG-142	Midden	MDN, FCR, shell, fauna	Prehistoric	Bay, protected
AFG-143	Village	HSP, MDN, FCR, PAG, PAF	Prehistoric	Bay, protected
AFG-144	Midden	MDN, FCR, PAF, shell	Prehistoric	Strait, exposed

Pre/historic = Prehistoric and Historic

Primary Site Types and Attributes for 271 AHRS Sites

AHRS #	Type	Attributes	Affiliation	Environment
AFG-145	Village	HSP	Prehistoric (Koniag)	Bay, protected
AFG-146	Village	HSP	Prehistoric	Bay, protected
AFG-147	Cannery	HTI, HTD	Historic	Strait, protected
AFG-148	Village	MDN, HSP, FCR, shell, char,	Prehistoric (Koniag)	Bay, protected
AFG-151	Depressions	HSP	Prehistoric	Beach, protected
AFG-152	Shipwreck	SHP	Historic	Point, protected
AFG-153	Structure	CBN, HTD	Historic	Strait, protected
AFG-154	Village	HSP	Prehistoric	Strait, protected
AFG-160	Village	MDN, HSP, FCR, shell, char, fauna	Prehistoric	Point, exposed
AFG-161	Midden	MDN, FCR, shell	Prehistoric	Narrows, protected
AFG-162	Structure	CBN, HTD	Historic	Bay, protected
AFG-163	Midden	MDN, FCR, HSP, HSP, shell, char	Prehistoric	Bay, protected
AFG-164	Depressions	HSP, RCS, char	Pre/historic	Bay/spit, protected
KAG-014	Depressions	MDN, HSP, FCR,	Prehistoric (Koniag)	Bay, exposed
KAR-113	Depressions	MDN, HSP, HTD, FCR, char	Pre/historic	Lagoon
KAR-114	Village	HSP, CSP	Prehistoric	Lagoon, protected
KAR-115	Village	HSP, FCR	Prehistoric (Koniag)	Lagoon
KAR-125	Artifact scatter	PAF, PAS	Prehistoric (Kachemak)	Headland, exposed
KOD-366	Structure	CBN	Historic	Strait, exposed
KOD-367	Artifact scatter	CSP, FCR	Prehistoric	Bay, protected
KOD-370	Depressions	HSP, RCS	Prehistoric	Islet, protected
KOD-371	Midden	MDN, FCR, shell, char	Prehistoric	Passage, exposed
KOD-372	Depressions	HSP	Prehistoric	Bay, protected
KOD-373	Depressions	CSP	Prehistoric	Bay, protected
KOD-374	Midden	MDN, FCR	Prehistoric	Point, exposed
KOD-375	Midden	MDN, FCR	Prehistoric	Point, exposed
KOD-376	Midden	MDN, FCR, PAG PAS, fauna	Prehistoric	Bay, protected
KOD-377	Midden	MDN, FCR, char	Prehistoric	Cove, protected
KOD-378	Midden	MDN, FCR, char	Prehistoric	Strait, protected
KOD-379	Depressions	HSP	Prehistoric	Spit/lagoon, protected
KOD-380	Midden	MDN, PAS, PAF, char	Prehistoric	Strait, protected
KOD-381	Artifact scatter	FCR	Prehistoric	Bay, exposed
KOD-382	Village	HSP, MDN, FCR, shell, fauna, char	Prehistoric	Cove, protected
KOD-383	Fort	MDN, FCR, shell	Prehistoric	Seastack, exposed
KOD-384	Midden	MDN, FCR, PAF, PAS, PAG	Prehistoric (Kachemak)	Lagoon, protected
KOD-385	Village	FCR, MWB, PAG, HTH, shell	Prehistoric (Kachemak)	Dunes, exposed
KOD-386	Midden	MDN, FCR, PAG, PAS	Prehistoric	Cove/bay, exposed
KOD-387	Village	HSP	Prehistoric (Koniag)	Cove/bay, exposed
KOD-388	Midden	MDN, FCR, shell, fauna	Prehistoric	Cove/bay, exposed
KOD-389	Midden	MDN, FCR	Prehistoric	Cove/bay, exposed
KOD-390	Midden	MDN, FCR, char, fauna	Prehistoric	Cove/bay, protected
KOD-391	Depressions	MDN, HSP	Prehistoric	Cove, protected
KOD-392	Midden	MDN, FCR, HSP, char shell, fauna,	Prehistoric (Koniag)	Stream, exposed

Pre/historic = Prehistoric and Historic

Primary Site Types and Attributes for 271 AHRS Sites

AHRS #	Type	Attributes	Affiliation	Environment
KOD-393	Cannery	HTI, PLG	Historic	Bay, protected
KOD-394	Midden	MDN, FCR, shell, fauna	Prehistoric (Koniag)	Cove/bay, protected
KOD-395	Midden	MDN, FCR, char	Prehistoric	Bay
KOD-396	Village	HSP, MDN	Prehistoric (Koniag)	Point, exposed
KOD-397	Artifact scatter	HTD, HTI	Historic	Bay, protected
KOD-398	Village	HSP, shell	Prehistoric	Bay, protected
KOD-399	Village	MDN, HSP, FCR, shell, fauna	Prehistoric (Koniag)	Point, protected
KOD-400	Village	HSP, FCR, shell, fauna	Prehistoric (Koniag)	Stream/bay, exposed
KOD-401	Midden	MDN, HSP, FCR, shell, fauna	Prehistoric (Koniag)	Narrows, protected
KOD-402	Village	MDN, HSP, FCR, shell, fauna	Prehistoric	Narrows, protected
KOD-403	Depressions	HSP	Prehistoric	Bay, protected
KOD-404	Village	HSP, MDN, shell	Prehistoric	Bay, protected
KOD-405	Village	MDN, HSP, FCR, PAF, fauna	Prehistoric (Koniag)	Stream/bay, protected
KOD-406	Artifact scatter	FCR, PAG	Prehistoric	Cove, protected
KOD-407	Village	MDN, FCR, HSP	Prehistoric	Bay, protected
KOD-408	Midden	MDN, shell, fauna	Prehistoric	Bay, protected
KOD-410	Depressions	HSP	Prehistoric	Bay, protected
KOD-411	Midden	MDN, shell, fauna	Prehistoric (Kachemak)	Bay, protected
KOD-412	Midden	MDN, shell	Prehistoric	Point, exposed
KOD-413	Midden	MDN, FCR, shell	Prehistoric (Koniag)	Bay, protected
KOD-414	Village	MDN, HSP, FCR, PAS, PAF, shell	Prehistoric (Koniag) (Koniag)	Cape, exposed
KOD-415	Village	MDN, HSP, PAF, fauna	Prehistoric	
KOD-416	Midden	MDN, FCR, shell, fauna	Prehistoric	Point, exposed
KOD-417	Artifact scatter	FCR, PAF	Prehistoric	Point, exposed
KOD-418	Midden	MDN, LMP, shell fauna	Prehistoric (Kachemak)	Spit/bay, exposed
KOD-419	Midden	MDN, PAF, HSP, CBN, fauna, shell	Pre/Historic	Cove, protected
KOD-420	Village	HSP, MDN, FCR	Prehistoric	Cove/bay, protected
KOD-421	Midden	MDN, FCR, shell, fauna	Prehistoric	Bay, protected
KOD-422	Midden	MDN	Prehistoric	Bay, protected
KOD-423	Midden	MDN, FCR, shell, fauna	Prehistoric	Point/bay, exposed
KOD-424	Midden	MDN, HSP, shell, fauna	Prehistoric	Spit/strait, exposed
KOD-425	Midden	MDN	Prehistoric	Strait, exposed
KOD-426	Midden	MDN,FCR, PAF, shell	Prehistoric	Point, exposed
KOD-428	Midden	MDN, FCR, PAF, shell, fauna	Prehistoric	Tombolo, exposed
KOD-429	Fort	MDN, HSP, PAS, shell, fauna	Prehistoric (Koniag)	Bay, exposed
KOD-430	Midden	MDN, FCR, shell, fauna	Prehistoric (Koniag)	Cove, protected
KOD-431	Depressions	HSP	Prehistoric	Bay, protected
KOD-432	Village	HSP, MDN, BRL, PAG LMP, shell, fauna	Prehistoric	Bay, protected
KOD-433	Fox farm	FXF	Historic	Bay, protected
XTI-067	Village	HSP, MDN	Prehistoric (Koniag)	Bay, exposed
XTI-068	Artifact scatter	PAG, PAF, PAF	Prehistoric (Koniag)	Point/bay, exposed
XTI-069	Artifact scatter	HTI	Historic	Inland, protected

Pre/historic = Prehistoric and Historic



Figure 68. Cut bank with midden deposit eroding into the intertidal zone at KAR-101, in the Kodiak area.

sandy coastal dunes are scoured and wind-eroded until only durable items like fire-cracked rock and stone artifacts remain (Figure 66).

Rockshelters were found only where bedrock exposures supporting vertical faces and overhangs formed the shoreline -- conditions most common in Prince William Sound. Rockshelters may contain middens, human remains, pictographs or petroglyphs, and artifacts. Depending on the depth of the overhang and the amount of moisture reaching the interior, perishable items were sometimes preserved. A number of overhangs were examined in Prince William Sound, but only those containing evidence of human use were designated as rockshelters (Figure 69).

Fish weirs are an intertidal feature associated with traditional Native fishing. In Southeast Alaska, wooden stake weirs are known to date back to at least 3200 B.P. (Ream and Saleeby 1987:142; Moss et al. 1989, 1990). Though both wooden stake and rock alignment weirs have been reported in the study area, only rock weirs were found during the 1989 reconnaissance (Figure 70). They consist of linear or curvilinear alignments of medium size boulders, and are distinguished from natural rock distributions by context and symmetry. Two intertidal alignments were recorded, one in Prince William Sound and one on the outer coast of the Kenai Peninsula.

Pictographs and petroglyphs, the former created with a pigment, the latter by pecking on a rock surface, are collectively termed rock art. Pictographs weather and erode from exposure to the elements, so those now discernible are usually protected settings such as rockshelters or lesser overhangs (Figure 71). Most petroglyphs known in the study area are in the Kodiak region (Figure 72). Although several examples of rock art were documented during the 1989 survey, all but one had been recorded previously or were found at known sites.

Other prehistoric site types consisted of artifact scatters and isolated artifacts. During the survey, artifacts were classified by manufacturing technique. Flaked stone artifacts are made of relatively homogeneous rocks that fracture conchoidally and are formed by the controlled application of force. Slate tools were formed by cutting, snapping, and grinding, though some specimens also show evidence of chipping. Other ground stone artifacts, formed by pecking and grinding, include adzes, mauls, net weights, and other types (Figure 73). While these are the three main artifact categories, artifacts of bone, ivory, copper, and whale bone were noted at some sites.

Historic Features and Site Types

Many different types of historic features were recorded, sometimes alone, but more often in association with one another. Although the ACHP considered all cultural features to be potentially eligible to the National Register, some recent camps with hearths were clearly not old enough to qualify under normal conditions (Figure 74). The AOHA did not assign AHRS numbers to recent campsites, nor to CMTs unassociated with other evidence of human activity.

When the age of a structure was in doubt, an AHRS number was usually assigned. Most structures made of logs were given AHRS status, for example. Prince William Sound and the Kenai Peninsula have relatively more log structures, whereas in the many treeless areas of Kodiak and the Alaska Peninsula frame construction with milled lumber is more common (Figure 75). Frame cabins, found throughout the study area, were carefully assessed to determine whether the age of the structure warranted assigning an AHRS number.

Historic commercial features and sites in the oil spill area were almost exclusively of frame construction. Heavy milled timbers were necessary for mining facilities (Figure 76). Pilings in the intertidal zone were often part of dock facilities that serviced commercial sites (Figures 43, 44). Other historic features recorded included a road cut, stairs (leading from the shoreline up to a supposed World War II observation post), and cemeteries associated with nearby villages.

A specialized commercial activity in the oil spill area was fox farming, and several small frame structures found on islands appear to have been multi-functional fox traps (Figure 22). Each hut had a trap-door that was propped open during much of the year, while the building was used as a feeding station. During pelting season, a trigger was set to close the door when foxes came in to feed. Other domestic structures may also have been associated with fox farming or other commercial activities. A large coil of copper tubing found at one reported fox farm (SEW-248) supports local folklore proposing that some fox farms were used for other purposes during the 1930s prohibition of alcohol.

Artifact scatters and isolated finds resulting from historic activity (Figure 77) were noted throughout the oil spill area. Metal and ceramic were the most common materials observed. The codes used on shoreline cleanup program forms discriminated between domestic and commercial/industrial historic artifact scatters.

Several ship and boat wrecks were recorded as cultural sites, most of them in the intertidal zone (Figure 78). Most were assigned AHRS numbers, but little attempt was made to confirm the identity or antiquity of the wreckage. Several of the examples recorded were obviously barges, and may have been deliberately abandoned or beached. A unique example was a dismantled kayak frame, with metal brads that had been used sparingly for attachment, found almost completely overgrown by the mat of vegetation just above the storm tide line (Figure 18).



Robert Betts P11:22, Exxon

Figure 69. Rockshelter assigned AHRS number SEW-443, in Prince William Sound.

Features and Sites of Uncertain Age

Although 1989 reconnaissance data were usually sufficient to distinguish prehistoric from historic sites, there were some features and sites that could not be assigned gross temporal affiliations. These include most CMTs and some fire-cracked rock scatters, burials, and hearths.

Culturally modified trees are common in the forested regions of the study area, though they have received little research or management attention. The AOHA does not assign AHRS numbers to CMTs unless they are associated with other cultural remains, making it more difficult to study regional distribution, morphology, or



Peter Phippen 15:13, Exxon

Figure 70. Intertidal stone alignment interpreted to be a fish weir, SEW-492, in Prince William Sound.

function. Given their data potential, and the fact that CMTs often indicate the presence of less obvious archaeological features (Mobley 1989c:55-76), future cultural resource surveys may give them more attention than they have received in the past.

The only CMT research in the study area appears to have been an attempt to locate Steller's 1741 landing on Kayak Island in Prince William Sound (Frost 1987:13; Frost et al. 1988). The EXXON VALDEZ Cultural Resource Program recorded several hundred CMTs, including examples associated with 26 AHRS sites. Though historic CMTs can sometimes be identified by the size of the tree or the nature of the modification, it is difficult to identify the age of most examples. The primary species of worked trees in the oil spill region are spruce and hemlock. The speed of the inventory did not allow detailed observations on most CMTs, but some morphological variability was noted. Small, rectangular bark removals were observed, located anywhere from 50 cm to 1.5 m (19.5in-4.8ft) above ground (Figure 65). Bark-stripped examples also were noted, some with vertical cuts at the top and/or bottom, and some with a tapering upper scar indicating that the bark was pulled outward from the bottom and allowed to strip out naturally at the top (Figures 79, 80). A potentially useful source of data on both cultural land use and the timing of tectonic events are the drowned forests with CMTs observed in Prince William Sound and the Kenai Peninsula (Figure 65).

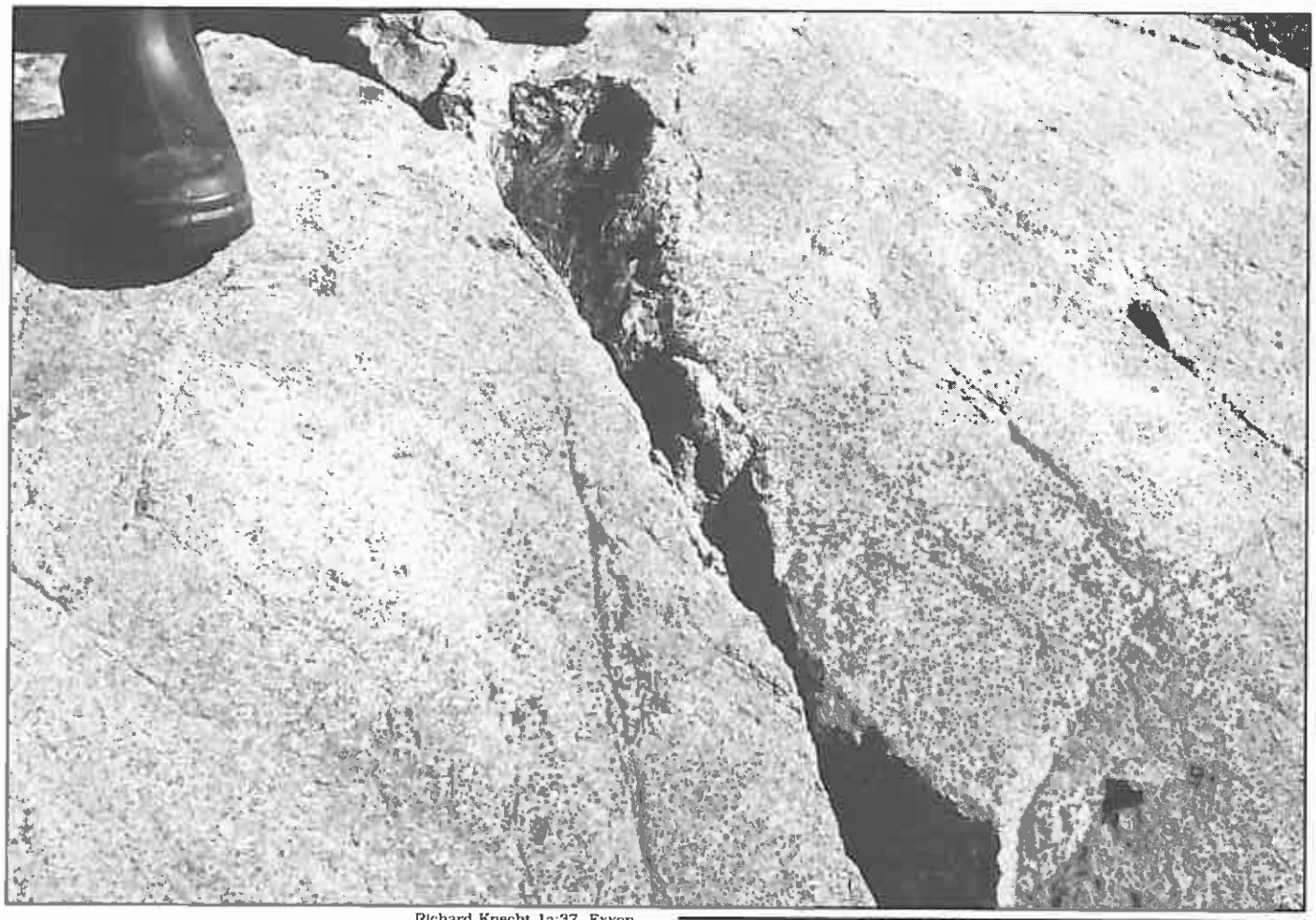
In the absence of associated diagnostic artifacts or features, fire-cracked rock scatters are also temporally ambiguous. For that reason, newly-created fire-cracked rock scatters from burning of oiled debris were a concern.



Morley Eldridge 6:11, Exxon

Figure 71. Pictograph in red at SEW-073, in Prince William Sound, showing what de Laguna (1956:54) observed in 1930 to represent men in a boat.

Most fire-cracked rock scatters recorded as AHRS sites during the 1989 field program had stratigraphic contexts or associated materials indicating relative antiquity. Chugach Alaska Corporation recorded a scatter of fire-cracked rock



Richard Knecht 1a:37, Exxon

Figure 72 (above). Petroglyphs on shoreline bedrock outcrops at Cape Alitak, XTI-018, in the Kodiak area.



Morley Eldridge 7:24, Exxon

Figure 73 (right). Stone tool with groove around, probably hafted for use as a percussion instrument, at SEW-241 in Prince William Sound.

on Naked Island that had no definitive temporal indicators (Miraglia and Johnson 1990b:41).

Associated material or context is also necessary to identify the antiquity of burials. In most cases such information was available, because the human remains form part of more extensive feature and artifact suites. However, rock cairns found during reconnaissance survey may or may not contain human remains, and though suspected to be prehistoric in origin, their antiquity is unconfirmed. Cairns were not normally recorded as AHRS sites unless they contained a considerable amount of lichen growth or other indications of antiquity.

Isolated hearths were not assigned AHRS numbers, though some could be older than suspected. In the Prince William Sound area, several recent "stone box" hearths were found with vertical stone slabs lining char-



Madonna Moss 11:19, Exxon

Figure 74. Tent frames recorded as a recent camp, with no AHRS number, in the Kodiak area.



Donald Abbott 14:3a, Exxon

Figure 75. Domestic frame structure in the Kodiak area, SUT-019.

coal or ash deposits. De Laguna (1956) noted similar slab-lined hearths in prehistoric Chugach sites, and the historic examples documented in 1989 may demonstrate a continuity between prehistoric to modern times.

Non-Cultural Observations

A variety of natural objects or features not directly associated with past human activity was noted by field archaeologists. Except for fossils, which are protected by the Alaska Antiquities Act, such natural features are not protected by cultural resource laws. Consequently, they were not inventoried systematically, and no special efforts to protect them were undertaken. Few fossils were reported by reconnaissance teams, though a deposit of shellfish fossils was noted in the Puale Bay area of the Alaska Peninsula. Drowned forests, submerged peat deposits, sources of lithic materials suitable for stone tool manufacture, barnacle (*Balanus* sp.) zones uplifted by the 1964 earthquake, and other environmental features (seal rookeries, salmon streams, shellfish beds, etc.) were also recorded in field notes. While none of these natural features are archaeological in nature, they may help identify environmental factors that conditioned prehistoric settlement or the formation of the archaeological record.



Charles Utermohle 5-10a, Exxon

Figure 76. Collapsed mine adit in the Kodiak area, AFG-149.

Survey Coverage

Archaeological survey of shorelines in the oil spill area, even at a limited reconnaissance level, provided large amounts of data about the presence and absence of cultural resources. Much of the study area had received only sporadic survey prior to the oil spill, so these investigations are an aid in plotting where sites are, and in estimating where they are not. In the future, this information will assist government agencies and Native groups to more effectively manage and protect cultural resources on the lands they administer. The site distribution data can also be applied to substantive research issues, such as reconstructing variation in settlement and land use through space and time. The raw survey data, covering thousands of linear kilometers of shoreline, are a major substantive contribution of the EXXON VALDEZ Cultural Resource Program. Two data sets were produced, reflecting two survey methods: aerial videotape reconnaissance, and shoreline reconnaissance.

Aerial Videotape Reconnaissance

Over 8000 km (5000 mi) of shoreline, from Naked Island in Prince William Sound to the Shumagin Islands of the Alaska Peninsula, were systematically videotaped from a helicopter. The videotape was used to document and evaluate the degree of shoreline oiling, characterize various intertidal substrates, and plan treatment activities.

High-altitude aerial photography has been used extensively by archaeologists, but the use of low-altitude videotaping to identify archaeological sites in a coastal environment is relatively new. Shoreline videotaping was conducted from altitudes of approximately 45 to 60 meters (150 - 200 ft) at air speeds of 60 to 80 km/hr (40 - 50 mph). Sections of shoreline were videotaped only when tide levels were below 0.9 meters (3 ft), allowing a two to three hour "tide window" on either side of daily maximum low tide levels.

Intertidal and near upland zones, recorded obliquely, are featured on the videotape. Still photographs, both black and white and color, were also taken to record prominent landscape features. Crew members included a



Paul Buck 21:16, Exxon

Figure 77. Isolated anchor in the intertidal zone of Montague Island.

navigator, who recorded local topographic features and other details of the flight plan; and a coastal geomorphologist who, in addition to operating the camera, provided a narrative of geological, biological, and oil conditions in the intertidal zone. To produce quality videotape documentation, it was essential that the pilot, navigator, and camera operator act in unison.

The effort produced a set of videotapes that document geomorphological, biological, and prominent cultural features of the coastline. The videotapes are generally of sufficient quality and scale to allow detection of certain types of archaeological sites in both the intertidal and near upland zone. Intertidal ship or boat wrecks show up well, as do historic structures (canneries, cabins, piers or pilings, etc.) and large machinery. A preliminary study of the potential of the videotapes indicates that they may be used to identify some prehistoric sites as well, especially in the unforested areas of Kodiak and the Alaska Peninsula, where distinctive vegetation communities are found on many shell middens. Prominent housepit features have been tentatively identified on the tapes, as have localized patches of lush vegetation characteristic of well-developed archaeological soils. One limitation of the tapes is that some bays unlikely to have been oiled were skipped or videotaped from distances that make the identification of cultural features impractical.

During the 1989 field season, coastline videotapes were occasionally viewed in advance of archaeological field reconnaissance, and were found to be a useful tool for the identification of high and low probability areas for cultural sites. Since videotaping was being conducted throughout the field season, however, many segments were surveyed prior to videotaping. Even when videotapes were available, the lead time for SCAT team deployment was often insufficient for previewing the videotapes. Given more response time, these videotapes could have assisted the archaeological reconnaissance both in compiling site data and in pre-field documentation of previously unknown archaeological sites. There is great potential for future archaeological applications of the tapes.

Field Reconnaissance

Conventional shoreline reconnaissance techniques were responsible for the discovery of most new sites added to the AHRS inventory. Over 5000 km (3000 mi) of shoreline were surveyed and assessed by seven SCAT teams deployed throughout the Prince William Sound, Seward, Homer, and Kodiak areas of the Gulf of Alaska. Three samples of AHRS sites can be defined: 1) those sites newly discovered and documented as part of the 1989 effort, 2) previously recorded AHRS sites that were revisited in 1989 and re-documented, and 3) previously recorded AHRS sites that were not updated in 1989. Factors complicating comparisons between the samples include: 1) some treated shorelines were not surveyed by SCAT teams, but new sites were later recorded during archaeological monitoring; 2) a few sites were recorded by Exxon archaeologists along shorelines where neither SCAT survey nor treatment was performed; 3) some new AHRS sites were recorded for the study area by other parties during 1989; and 4) a few previously recorded AHRS sites are located inland, beyond the bounds of the survey area.

To ensure compatability of the site samples, the definition of the oil spill sample excludes: 1) sites recorded by other parties after the inception of the 1989 EXXON VALDEZ Cultural Resource Program; 2) sites outside of the study area incidentally recorded by SCAT archaeologists; 3) interior sites more than 500 meters (550 yards) from investigated shoreline segments; and 4) areas not surveyed in 1989 as part of the SCAT program (except for a few isolated instances -- primarily in the Raspberry Strait area in the Kodiak region -- where 14 sites were recorded by archaeological monitors). Using this definition of the oil spill sample, 271 cultural properties are considered to be new sites. An earlier estimate that 230 known sites existed in the oil spill area (Mobley and Haggarty 1989b:26-8) was made before adjusting the definition of the site sample parameters, but the total is now 532. The confidential companion volume to this technical report contains AHRS forms and location maps for all archaeological sites known in the oil spill area.



Figure 78. Stern of the wrecked Unimak, *SEW-487, in Prince William Sound.* Peter Phippen 13:15, Exxon

Regional Variation in Site Density in the Study Area

One of the applications of the revised data base is an examination of regional variation in the density of prehistoric and historic sites in the Gulf of Alaska. Even before the 1964 earthquake caused major changes in Prince William Sound shorelines, archaeologists noted the relatively low density of prehistoric sites in the area (de Laguna 1956:36). Low population densities were also noted in the ethnohistoric accounts of early European visitors to Prince William Sound. An important substantive question is: Does the distribution of recorded AHRS sites support the notion that prehistoric site densities in Prince William Sound are lower than elsewhere in the study area? And if so, what accounts for the difference in site densities in the region?

Most sites can be assigned to the prehistoric or historic period using available data. Functional designations were also inferred from the available data, but for purposes of presentation in this report a ranking system was devised to help assign each site to a single type. The disadvantage of this approach is that it obscures the range of occupation and functions represented in large or multi-component sites. To compensate for the loss of information, additional attributes are listed separately (Table 20), but even the listed attributes mask considerable variability. For instance, all sites containing multiple housepits have been assigned to the village category, but sites noted as having unspecified depressions are simply listed as "depressions." As presented in Table 20, prehistoric artifact scatters include what would often be classified as lithic scatters, fire-cracked rock scatters, or open camps lacking middens. Rockshelters include all overhanging cliffs containing evidence of human use, including burials, artifacts, and middens.

The maps of gross regional site patterning (Figures 81 - 84) show previously recorded sites as open circles, and newly recorded sites as black circles . To help mask site locations, the circles are mapped none-too-precisely (each circle is equivalent to four km in diameter), and corresponding AHRS site numbers have been omitted. Larger circles represent locations where site density is higher, with the number of sites indicated in each circle. Relatively continuous stretches of shoreline in Prince William Sound were surveyed, but in other areas survey coverage was more sporadic and discontinuous. As a



Bruce Ream 6:10, Exxon

Figure 79. Culturally modified (bark-stripped) hemlock in Aialik Bay, outer Kenai Peninsula.



Bruce Ream 6:10, Exxon

Figure 80. Culturally modified (alcove) spruce in Aialik Bay, outer Kenai Peninsula.

result, areas where sites are not plotted are not necessarily devoid of cultural resources. This is especially true for the Alaska Peninsula, where only selected areas (where oil had been reported) were surveyed systematically by the SCAT crews.

In Prince William Sound, approximately 1600 km (1000 mi) of shoreline were surveyed in 549 designated segments, comprising most of the western half of the sound and including: 1) the shorelines of Naked, Lone, Perry, Smith, Eleanor, Ingot, Disk, Knight, Mummy, Squire, Latouche, Elrington, Evans, Seal, and Green islands; 2) portions of Culross, Chenega, Bainbridge, and Montague islands; 3) numerous smaller islands and islets; and 4) some shores of the adjacent western mainland. At the end of the 1989 season, the SCAT survey area contained 117 AHRS sites (69 or 59% new, 48 old; 46 or 39% prehistoric, 71 historic), for a site density of 0.073 sites per linear kilometer of coastline (Table 21). The total site density is equal to that of the Alaska Peninsula and exceeds that of the Kenai area by a significant margin. Historic site density in the Prince William Sound survey area is twice the regional average and much higher than in either Kodiak or the Kenai Peninsula area. In contrast, prehistoric site density is much lower than the Kodiak area or the regional average, though roughly comparable to the Kenai Peninsula.

Approximately 800 km (500 mi) of the more than 2560 km (1600 mi) of coastline that comprise the Kenai Peninsula were surveyed in 174 segments, most situated on the rugged, exposed outer coast of the Kenai Peninsula. The survey covered: 1) almost all offshore islands, including the Harbor Island group, Granite, Ragged, Rabbit, Outer, Nuka, East Chugach, Perl, Elizabeth, Barren, and Ushagat islands; and 2) adjacent peninsula headlands, harbors, and bays, including Day Harbor, Port Dick, Resurrection, Aialik, Two Arm, Nuka, Rocky, Windy, and Chugach bays. After 1989, the SCAT survey area contained 37 recorded sites (29 or 78% new, 8 old; 32 or 86% prehistoric, 5 historic), providing a site density of 0.046 sites per kilometer of coastline (Table 21). This is the lowest overall site density recorded for the study area, although the density of prehistoric sites exceeds that of Prince William Sound. The historic site density is the

Figure 81

Prince William Sound Cultural Resource Sites

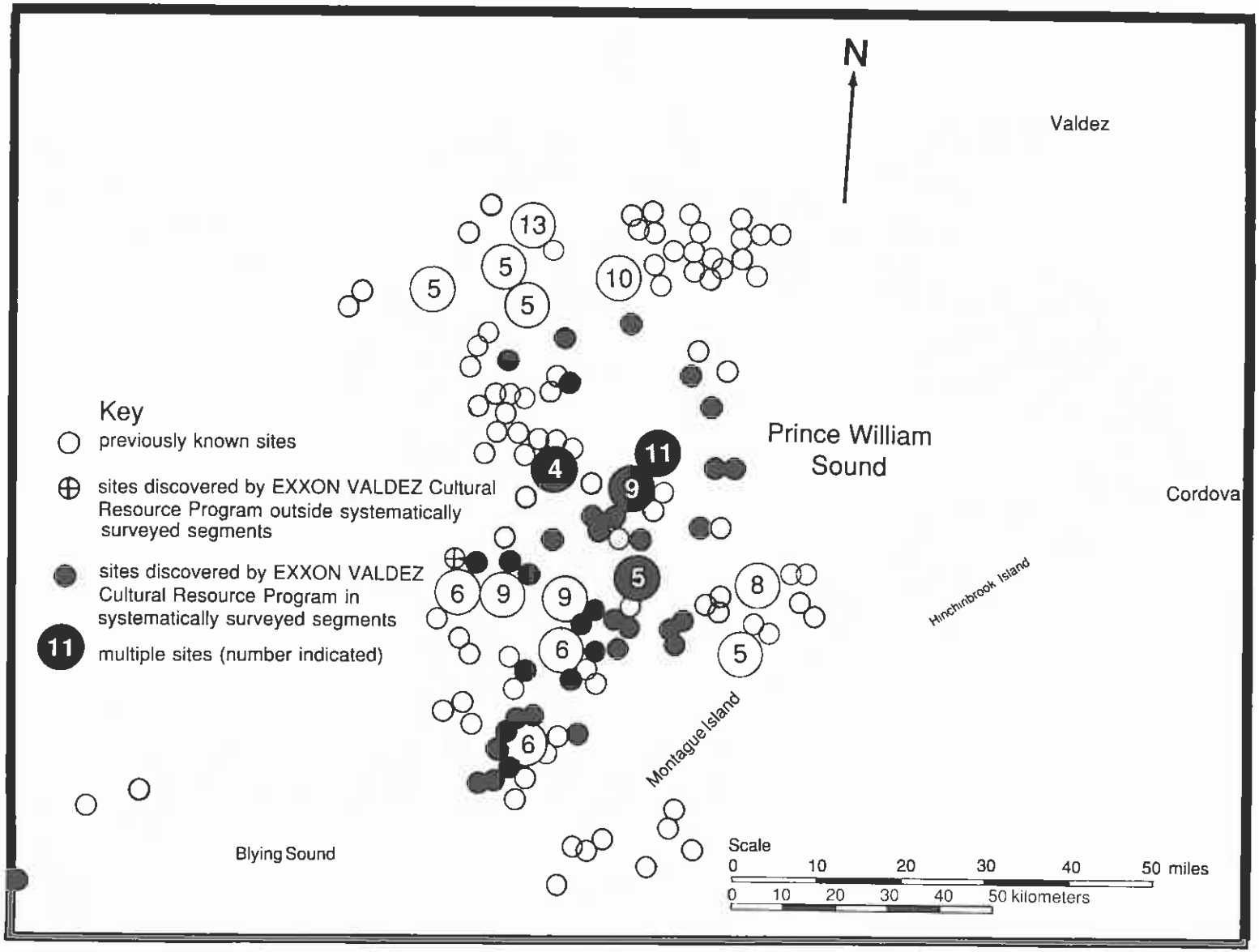


Figure 82

Outer Cook Inlet Cultural Resource Sites

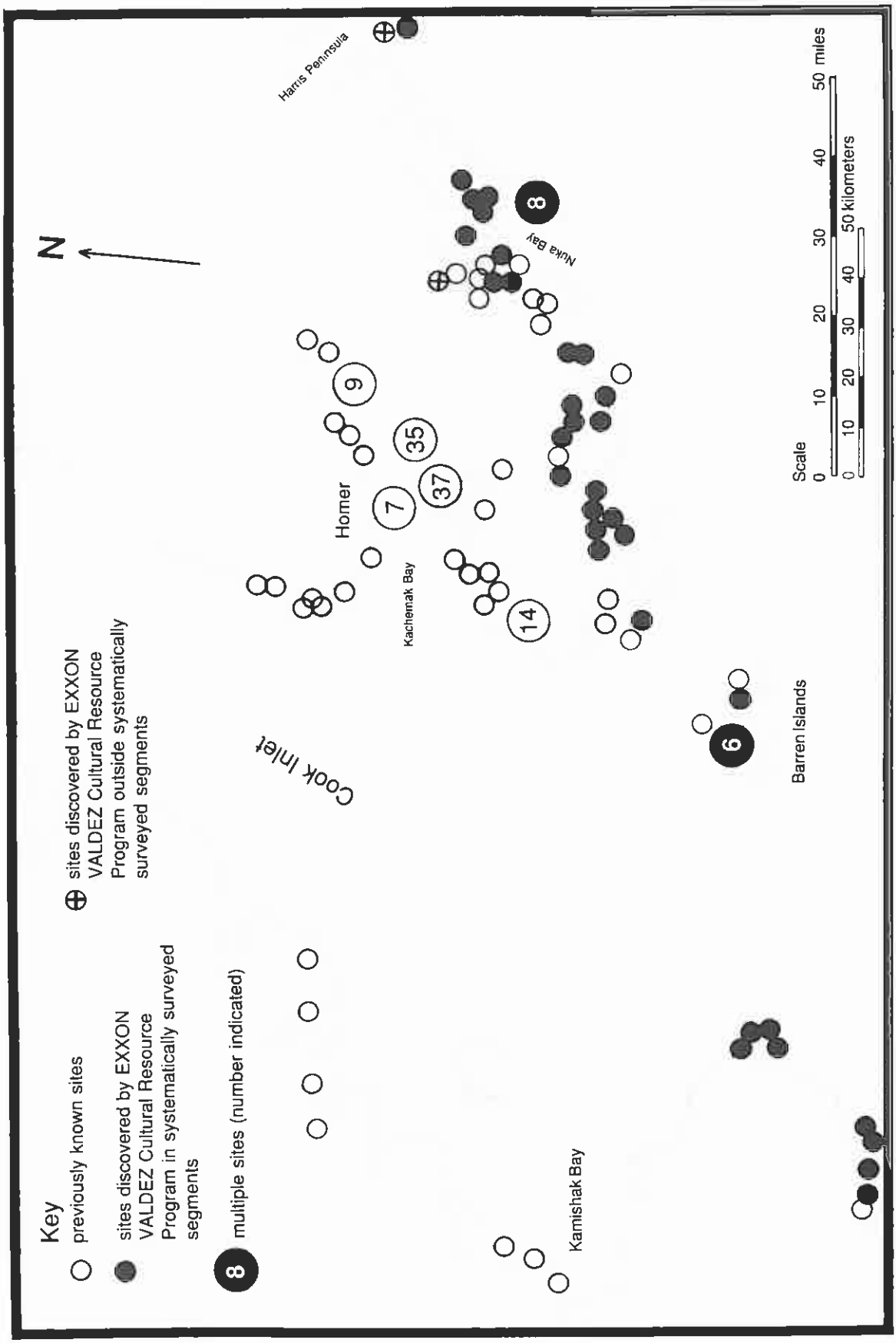


Figure 83

Kodiak Cultural Resource Sites

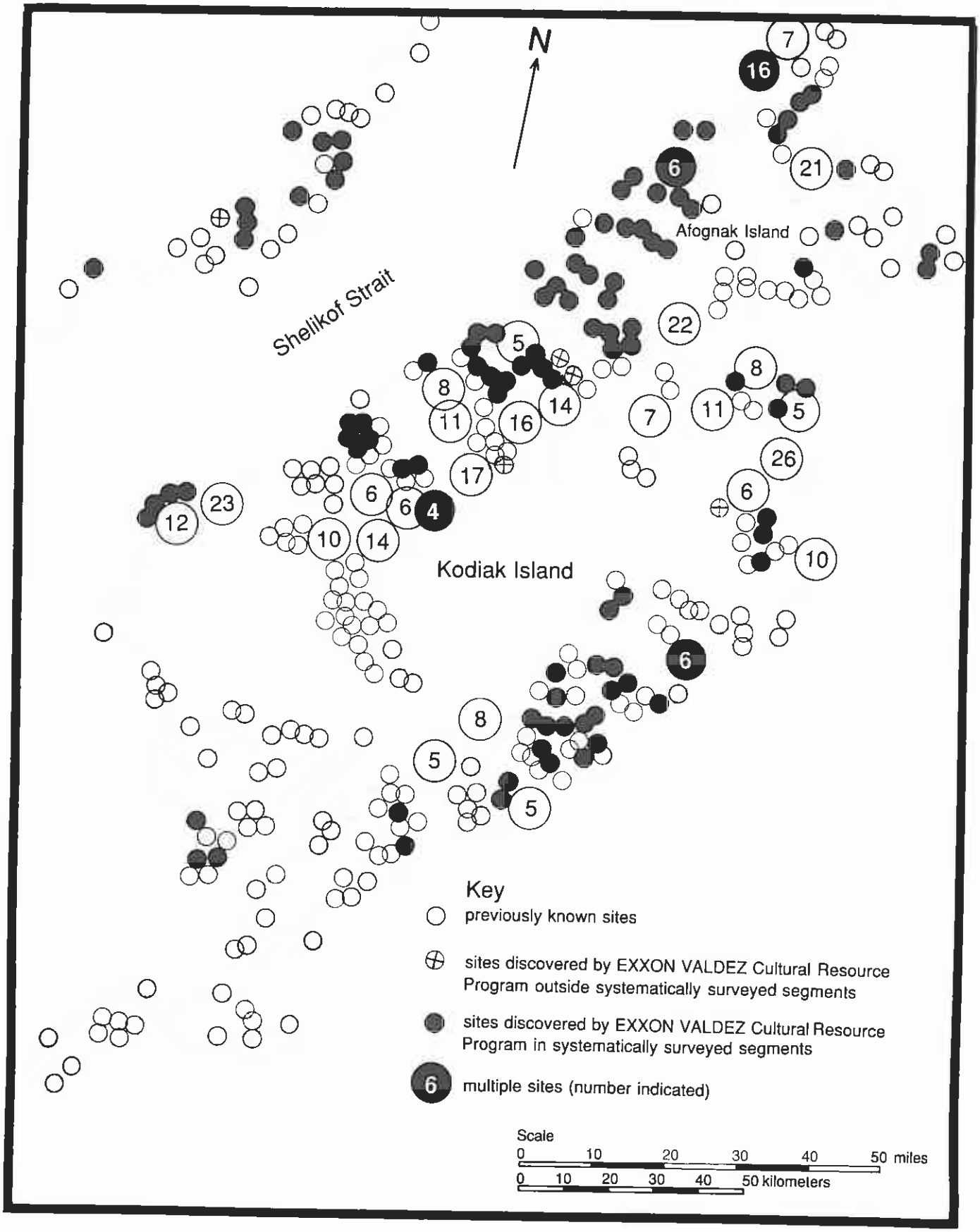


Figure 84

Alaska Peninsula Cultural Resource Sites

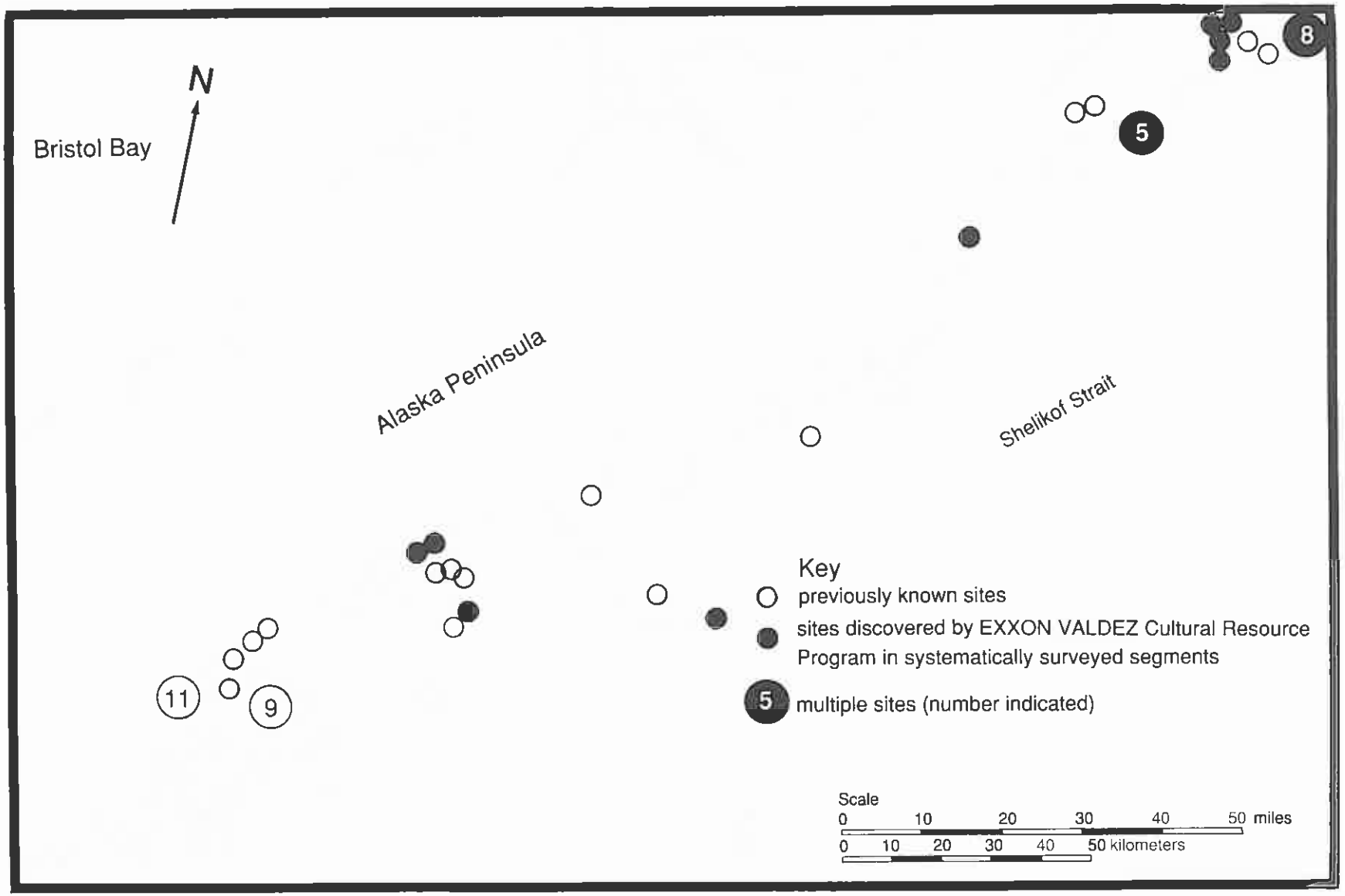


Table 21

Historic and Prehistoric Site Densities by Geographic Area

Geographic Area	Historic Frequency	Density	Prehistoric Frequency	Density	Combined Frequency	Density
Prince William Sound	71	0.044	46	0.029	17	0.073
Outer Kenai Peninsula	5	0.006	32	0.040	37	0.046
Kodiak Archipelago	21	0.011	272	0.136	293	0.147
Alaska Peninsula	22	0.021	54	0.052	76	0.073
Region totals	119	0.022	404	0.074	523	0.096

Densities expressed in sites per linear km of coastline; Barren Islands excluded.

lowest in the region, probably reflecting the remoteness of the area and a relatively low intensity of use during the historic period.

The Kodiak Archipelago contains over 4800 km (3000 mi) of coastline, much of it rugged and exposed to wind and wave action. Within the archipelago, roughly 2000 km (1270 mi) were surveyed. The survey area contained 293 coastal sites (123 or 42% new, 170 old; 272 or 93% prehistoric, 21 historic), a site density of 0.147 sites per kilometer of coast. This overall site density is by far the highest in the region -- approximately twice that of Prince William Sound and the Alaska Peninsula. The historic site density is only half the regional average, however, and roughly one-fourth that of the Prince William Sound sample area. The density of prehistoric sites is twice the regional average, and between 2.6 and 4.7 times that of adjacent regions.

On the Alaska Peninsula, about 1040 km (650 mi) were surveyed in 163 shoreline segments defined by operations personnel. The area surveyed included most of the rugged, exposed southeast shore of the Alaska Peninsula between Cape Douglas in the north and the Shumagin Islands in the south, as well as an isolated area near Chignik. After the 1989 season, the SCAT survey area contained 76 recorded archaeological sites (41 or 54% new, 35 old; 54 or 71% prehistoric, 22 historic), a site density of 0.073 sites per kilometer of coastline. Overall site density is moderate; the Alaska Peninsula survey area ranks second in the density of both historic sites (behind Prince William Sound) and prehistoric sites (behind the Kodiak area).

Simple site density figures cannot be directly equated with past settlement patterns or population densities, and should be regarded with caution. For example, the statistics do not control for the presence of multiple components at various sites, variation in the size or density of sites, or post-occupational factors that may skew the results. A number of sites in the region are isolated prehistoric artifacts or small, low-density scatters of chipped stone tools, for instance, and should not be ranked as equivalent to large village sites that may have been occupied successively over thousands of years. Other sites, where only historic features now are recorded, will undoubtedly be found to contain prehistoric components when excavation data become available.

Even so, the paucity of prehistoric sites in the surveyed portion of Prince William Sound is notable, particularly considering that some of the prehistoric sites entered into the AHRS inventory are based on oral information, and have never been confirmed in the field. The low density of prehistoric sites in Prince William Sound is especially apparent when compared to the Kodiak area, where coastal site densities may exceed 0.5 sites per linear km of coast in some large bays (Jordan and Knecht 1988:231, 234; Crowell 1988:134). Admittedly, these Kodiak figures reflect intensive survey and the accommodation of multicomponent sites, but it appears that there is more than sampling bias or survey intensity involved in the low prehistoric site densities of Prince William Sound. The high site density of the Kodiak area may have resulted from unusually rich concentrations of marine resources (including whales and dolphins, seals and sea lions, salmon and other fish, shellfish, and sea birds), which supported relatively high population densities throughout prehistory. The Prince William Sound area also may have been occupied at times by an inland-adapted people -- perhaps parallel to the Tsetsaut known ethnographically in Southeast Alaska (Boas 1895; Tharp 1972; Duff 1981) -- resulting in lower coastal site densities. Given the extremely active tectonic history of the region, it is possible that major sites of a coastal-adapted Prince William Sound people are now submerged, or elevated to uplands where they are less likely to be discovered. A 50% increase in the number of prehistoric sites in the Prince William Sound sample would bring the coastal site density figure within a range comparable to the outer coast of the Kenai Peninsula and the Alaska Peninsula.

Table 22

Primary Site Types by Geographic Area

For the Sample of Pre-Spill AHRS Sites

Site Type	Geographic Area: PWS #	PWS %	Kenai #	Kenai %	Barrens #	Barrens %	Kodiak #	Kodiak %	AK Pen #	AK Pen %	Total #	Total %
Prehistoric												
Village	2	6	3	50	-	-	50	38	4	13	59	29
Midden	1	3	-	-	-	-	35	26	4	13	40	19
Depressions	2	6	3	50	1	50	35	26	6	19	47	23
Lithic scatter	4	11	-	-	-	-	2	1	8	26	14	7
Rockshelter	5	14	-	-	-	-	-	-	-	-	5	2
Fish weir/trap	-	-	-	-	-	-	-	-	-	-	-	-
Fort/refuge	-	-	-	-	-	-	1	1	-	-	1	1
Rock art	-	-	-	-	-	-	1	1	-	-	1	1
Miscellaneous	13	*	2	*	-	-	37	*	2	*	54	*
Subtotal	27	56	8	100	1	50	161	94	24	71	221	85
Historic												
Cabin 16	46	-	-	1	50	5	4	4	13	26	13	
Fox farm	-	-	-	-	-	-	-	-	-	-	-	-
Cannery	2	6	-	-	-	-	1	1	1	3	4	2
Ship/boat wreck	-	-	-	-	-	-	-	-	-	-	-	-
Mining site	1	3	-	-	-	-	-	-	-	-	1	1
Church	1	3	-	-	-	-	3	2	2	6	6	3
Artifact scatter	1	3	-	-	-	-	-	-	2	6	3	1
Miscellaneous	-	-	-	-	-	-	-	-	-	-	-	-
Subtotal	21	44	-	-	1	50	9	7	9	28	40	15
Totals	48	100	8	100	2	100	170	100	33	100	261	

**Miscellaneous prehistoric sites include unconfirmed sites and indeterminate site types; percentages of specific site types in each area exclude uncertain sites, except for subtotals. Percentages rounded to the nearest whole number.*

Regional Variation in the Distribution of Site Types

It is useful to compare the regional distribution of site types as suggested by the pre-spill AHRS inventory (Table 22), with the sites discovered in 1989 (Table 23), and ultimately with the total array of sites now known for the area (Table 24). One significant difference is that while Kodiak area sites dominated the previously recorded inventory (65%), they make up a considerably smaller proportion (45%) of the new site sample, resulting in a more balanced regional data base. The overemphasis of Kodiak area sites in the previously recorded AHRS sample probably reflects the greater intensity of archaeological research on the Kodiak Archipelago.

In the figures for distribution of generalized site types previously recorded, (Table 22) specific percentages have been corrected by excluding unconfirmed sites or sites of unknown type (though these are included in the subtotals for historic and prehistoric sites). To the researcher evaluating the AHRS inventory prior to 1989, considerable variation is evident in the composition of the site samples for each geographic area. While prehistoric sites make up 85% of the sites in the regional sample, for instance, they constituted 56% of the Prince William Sound sample, 71% of the Alaska Peninsula sample, and 94% of the Kodiak sample. Samples from the Kenai Peninsula and Barren Islands were too small to identify significant patterns. The sample of newly-discovered sites repeats these patterns (Table 23), suggesting that they are not simply a function of investigative bias but may instead reflect differential land use intensities or site preservation.

Acknowledging that some site types may be under-represented where they are associated with larger sites (such as villages), several site types (fish weirs or

Table 23

Primary Site Types by Geographic Area

For the Sample of Newly-Recorded AHRS Sites

Site Type	Geographic Area: PWS #	PWS %	Kenai #	Kenai %	Barrens #	Barrens %	Kodiak #	Kodiak %	AK Pen #	AK Pen %	Total #	Total %
Prehistoric												
Village	-	-	1	3	1	14	35	28	7	17	44	17
Midden	-	-	6	21	1	14	42	34	4	10	53	20
Depressions	-	-	4	14	-	-	19	15	9	22	32	12
Lithic scatter	11	7	11	38	2	29	12	10	6	15	42	16
Rockshelter	6	9	-	-	-	-	-	-	-	-	6	2
Fish weir/trap	1	1	1	3	-	-	-	-	-	-	2	1
Fort/refuge	-	-	1	3	-	-	3	2	2	5	6	2
Rock art	-	-	-	-	-	-	-	-	-	-	-	-
Miscellaneous	1	*	-	-	-	-	-	-	2	*	3	*
Subtotal	19	28	24	82	4	57	111	89	30	70	189	69
Historic												
Cabin 19	29	3	10	1	14	5	4	10	24	38	14	
Fox farm	10	15	1	3	2	29	1	1	-	-	14	5
Cannery	1	1	-	-	-	-	4	3	2	5	7	3
Ship/boat wreck	6	9	1	3	-	-	1	1	-	-	8	3
Mining site	5	8	-	-	-	-	-	-	1	2	6	2
Church	-	-	-	-	-	-	-	-	-	-	-	-
Artifact scatter	5	8	-	-	-	-	1	1	-	-	6	2
Miscellaneous	4	*	-	-	-	-	-	-	-	-	4	*
Subtotal	50	72	5	16	3	43	12	10	13	30	83	31
Totals	69	100	29	100	7	100	123	100	43	100	271	

**Miscellaneous prehistoric sites include unconfirmed sites and indeterminate site types; percentages of specific site types in each area exclude uncertain sites, except for subtotals. Percentages rounded to the nearest whole number.*

traps, fox farms, rock art, forts, mines, canneries, and shipwrecks) are noticeable in their absence or scarcity in the pre-spill site sample. These site types were augmented considerably by the 1989 survey, with significant numbers of fox farms (14), ship or boat wrecks (8), canneries (7), mines (6), and Native forts (6) recorded. Two intertidal stone fish weirs -- the first documented in the study area -- were recorded, and the existence of others outside of the surveyed area was suspected. While no new rock art sites were documented, a previously unrecorded pictograph was discovered by AOHA archaeologist David McMahan during spill-related fieldwork. The general increase in the number of historic sites recorded is probably attributable to the explicit recognition by SCAT archaeologists of their eligibility for the AHRS. The increase in the number of forts in the study area may be due to a growing recognition that such defensive sites represent a discrete site type (Moss et al. 1989). The few fish weir and rock art sites (despite systematic focus upon the intertidal zone, where such features are usually encountered) may relate to differential preservation or changing sea levels.

Within the combined data base, several patterns raise important questions. For instance; What accounts for the extremely low number of village, midden, and depression sites in the Prince William Sound area, where they make up only 16% of the classifiable prehistoric sites? In contrast, such sites comprise 57% of the classifiable prehistoric sites within the Kenai Peninsula study area, 60% of those on the Barren Islands, 68% of the Alaska Peninsula sample, and 92% of the classifiable prehistoric sites in the Kodiak area. Perhaps the paucity of ethnographic data on Chugach houses reflects not just the dearth of ethnographic accounts, but also a low population density for a people with an architectural tradition favoring highly perishable structures.

Table 24

Primary Site Types by Geographic Area

For the Combined Sample Containing All Known Sites

Site Type	Geographic Area											
	PWS		Kenai		Barrens		Kodiak		AK Pen		Total	
	#	%	#	%	#	%	#	%	#	%	#	%
Prehistoric												
Village	2	2	4	11	1	11	85	33	11	15	103	22
Midden	1	1	6	17	1	11	77	30	8	11	93	20
Depressions	2	2	7	20	1	11	54	21	15	20	79	17
Lithic scatter	15	15	11	31	2	22	14	5	14	19	56	12
Rockshelter	11	11	-	-	-	-	-	-	-	-	11	2
Fish weir/trap	1	1	1	3	-	-	-	-	-	-	2	1
Fort/refuge	-	-	1	3	-	-	4	2	2	3	7	1
Rock art	-	-	-	-	-	-	1	1	-	-	1	1
Miscellaneous	14	*	2	*	-	-	37	*	4	*	57	*
Subtotal	46	39	32	86	5	56	272	93	54	71	409	77
Historic												
Cabin	35	35	3	9	2	22	10	4	14	19	64	14
Fox farm	10	10	1	3	2	22	1	1	-	-	14	3
Cannery	3	3	-	-	-	-	5	2	3	4	11	2
Ship/boat wreck	6	6	1	3	-	-	1	1	-	-	8	1
Mining site	6	6	-	-	-	-	-	-	1	1	7	1
Church	1	1	-	-	-	-	3	1	2	3	6	1
Artifact scatter	6	6	-	-	-	-	1	1	2	3	9	2
Miscellaneous	4	*	-	-	-	-	-	-	-	-	4	*
Subtotal	71	61	5	14	4	44	21	9	22	30	123	23
Totals	117	100	37	100	9	100	293	100	76	100	532	

**Miscellaneous prehistoric sites include unconfirmed sites and indeterminate site types; percentages of specific site types in each area exclude uncertain sites, except for subtotals. Percentages rounded to the nearest whole number.*

Conversely; What accounts for the relatively small proportion of historic sites on the Kodiak Archipelago, despite relatively intense historic settlement and archaeological research? It would not appear to be simply a statistical anomaly related to the extremely high number of prehistoric sites in the Kodiak area, since the absolute historic site density is low (Table 24). Also; What accounts for the lack of intertidal fish weirs or traps in the Kodiak area, despite extremely large salmon runs in several coastal drainages, the documented intensity of settlement and salmon harvesting along these rivers, and the presence of such features elsewhere in the study area and the North Pacific? It may be that prehistoric fish weir and trap technology in the Kodiak area was employed not in intertidal locations, but rather well up rivers, since undocumented weirs are said to be located in the Karluk River.

The answers to these and other questions must await further research and better data. The patterns identified should be regarded as tentative, considering the deficiencies in the current data base, differential site preservation and identifiability, and problems related to the collapsing of site attributes into categories which are not, in actuality, mutually exclusive. However, all regional site comparisons suffer from the biases of differential preservation and identifiability, and all classification systems rely to some extent on arbitrary categories and generalizations. While such problems are vexing, the spatial and temporal distribution patterns of various site types may serve as a model for future testing.

New Insights into the Regional Chronology

The regional distribution of archaeological sites provides clues about the distribution of human groups through time and space in the oil spill area, realizing that

Table 25

Chronological Comparison for Collected Sites

From AHRS Forms (Prior Perception) and
Artifact Descriptions *Appendix (Revised Perception)*

Site	Prior Perception	Revised Perception
AFG-026	Koniag phase	Koniag phase, post A.D. 1300
AFG-028	Kachemak/Koniag	Koniag phase, with post A.D. 1300 component
AFG-046	Koniag	Ocean Bay, early/late Kachemak, transitional Kachemak/Koniag
AFG-081	Koniag	late Koniag
AFG-095	(new site)	pre-late Koniag
AFG-096	(new site)	pre-late Koniag
AFG-097	(new site)	Kachemak, late Koniag
AFG-106	(new site)	pre-late Koniag
AFG-117	(new site)	pre-Koniag (Ocean Bay I?)
AFG-122	(new site)	Kachemak
AFG-128	(new site)	late Kachemak/early Koniag
AFG-143	(new site)	Koniag
KAR-121	(new site)	Kachemak, Ocean Bay
KOD-077	late Koniag	Kachemak, Koniag
KOD-115	Kachemak	Kachemak
KOD-116	late Koniag	late Koniag
KOD-368	(new site)	Kachemak, Koniag
KOD-376	(new site)	Ocean Bay II/Kachemak
KOD-385	(new site)	late Kachemak
KOD-415	(new site)	pre-late Koniag
KOD-432	(new site)	late Kachemak
SEL-179	(new site)	post-A.D. 1000
SEL-188	(new site)	post-A.D. 1000, historic
SEL-196	(new site)	post-A.D. 1000
SEW-004	unknown	post-A.D. 1000
SEW-072	late prehistoric	post-A.D. 1000
SEW-478	(new site)	Historic
SEW-494	(new site)	Historic
XMK-022	unknown	Ocean Bay/Koniag
XMK-058	(new site)	Kachemak

there are inherent limitations on the level of inference that the data allow. Lack of temporally diagnostic features or artifacts for most prehistoric sites is one obvious limitation, for example. In the Kodiak and Alaska Peninsula areas, however, housepit forms and diagnostic artifacts are fairly plentiful, allowing field archaeologists to make tentative chronological assignments for 27 prehistoric sites (Table 20). Though some of these may contain earlier components masked by later midden deposits and depressions, preliminary data suggest that 21 of the sites may be of Koniag origin, and six others tentatively from the Kachemak Period.

Tentative chronological assignments were also made for 30 prehistoric sites from which temporally diagnostic artifacts were collected (Table 25). Limited chronological control for 57 new sites in a region as large as the oil spill area provides a tenuous basis for re-examining existing archaeological reconstructions. Nonetheless, it is worth noting that of the 59 prehistoric components tentatively identified in the Kodiak and Alaska Peninsula areas alone, 36 (61%) have been assigned to the Koniag horizon, 18 (31%) to the Kachemak horizon, and 5 (8%) to the Ocean Bay horizon. These temporal distributions may support the notion that prehistoric population densities gradually increased through time in the Gulf of Alaska region, though differential preservation and visibility undoubtedly also contribute to the increasing number of sites through time.

An exciting contribution of the 1989 survey was the documentation of a number of prehistoric sites along the outer coast of the Kenai Peninsula. Due to the difficulty of air and water access, the area had received little archaeological scrutiny in the past. In the early historic period, the Native occupants of this area were considered ethnically distinct by the Chugach Eskimo, who called them the "Unizkugmiut." Historically it was said that "hardly anything more than the name is known" (Oswalt 1967:9), but geographically the area is central to the marine route for Pacific Coast migrations. Prehistoric communities located in such rugged terrain may have

served a critical role in the regional coastal economic system, and witnessed the travels of a variety of cultural groups in their traditional water-craft. Today (and probably in the past), McArthur Pass (near SEL-188) is a major marine travel route for both boats and sea mammal populations avoiding the outer waters around the Pye Islands. Prehistoric peoples inhabiting this strategic area undoubtedly had access to a wealth of marine resources and had contacts with a variety of groups traveling for trade, ceremony, raiding, and other activities.

Similarly, the Barren Islands, guarding the entrance to Cook Inlet and forming the logical way-station for small boat traffic between the Kodiak/Alaska Peninsula and Kenai/Prince William Sound regions, may hold valuable information about prehistoric cultural interchange. For a number of years archaeologists have hoped to conduct systematic archaeological survey on the Barren Islands. The islands are part of the Alaska Maritime Wildlife Refuge, and only two AHRS sites were previously recorded there, both historic structures probably related to commercial fox farming. The EXXON VALDEZ Cultural Resource Program discovered seven new sites, four of which are prehistoric. One of these (AFG-103) contains at least nine oval housepits (the largest 8 X 8 m (26 X26 ft)) and has been tentatively assigned to the Kachemak Period. Other prehistoric sites identified on the Barren Islands include midden deposits and an isolated core. This confirms the long-suspected prehistoric use of the Barren Islands, and documents important sites that may further understanding of the prehistory of the coast of Southcentral Alaska.

Special Investigations at SEW-026 Latouche Mine

The Latouche Mine (SEW-026) yielded substantive information beyond the level of reconnaissance data otherwise acquired by the EXXON VALDEZ Cultural Resource Program. Three contiguous segments on Latouche Island contained a complex of intertidal and upland features associated with the mine. On June 15, 1989, SCAT assessment documented the general nature and distribution of cultural resources in the intertidal zone and adjacent uplands, as well as the distribution of oil. The site was revisited on June 18 to flag sensitive areas and prepare a preliminary map. This information was used to devise segment constraints that read:

> Archaeological monitor required prior to and during cleanup. Cleanup is to avoid historic archaeological material (to be flagged with an approximate 20 m [67 ft] buffer) in the intertidal zone, as per direction of onsite archaeological monitor. Monitor is to prepare a site map depicting location and nature of historic artifacts and features in the intertidal zone as per a Work Plan for Archaeological Monitoring jointly applicable to [adjacent two segments]. Notify Exxon archaeological director 48 hours prior to beginning work on this segment [last sentence added by ISCC].

Between June 24 and June 28, Peter Phippen prepared a field inventory of historic artifacts and features in the intertidal zone, mapped, and photographed them. The decision not to collect artifacts was based on the limited oil and the belief that observed surface artifacts were simply a manifestation of a larger buried sample. As it turned out, the Coast Guard indicated that the shore contained insufficient oil to warrant cleanup, so no treatment took place.

The AHRS records assign the cultural features a single site number (SEW-026), known as "Latouche," "Beatson," or "Beatson's Wharf." However, historical literature and fieldwork during the summer of 1989 make it clear that the site can be subdivided into two distinct localities. The first is "Girwood," located in the northern section of the study area (Figure 85); the second is Latouche proper, located several hundred meters to the south (Figures 86 and 87). Artifacts and features of the Girwood site are discernable along approximately 200 m (650 ft) of shoreline, although at one time structures may have continued perhaps another 200 meters north (USGS 1951). Latouche proper extended for over 300 meters (1,000 ft) along the shoreline, and about 300 meters inland (USGS 1951). In addition to a recent camp site located at the north end of Girwood, the complex included domestic and industrial historic artifacts, pilings, and -- in the uplands -- CMTs and mine features. For this report, the areas are referred to as the Girwood and Latouche localities within SEW-026.

The 1989 investigation is apparently the first archaeological work reported at SEW-026, although de Laguna (1956:255) described materials in the region. In the sections that follow, prehistoric and historic use of SEW-026 will be described, followed by mention of the mineralogic and structural features that prompted human exploitation of the area. Field investigations at the Latouche and Girwood localities are reported, including a discussion of artifacts and features mapped during 1989. Potential research value and other qualities of the site are summarized.

History of the Latouche/Girwood Localities

Traditional Native Use

Latouche Island was named by Vancouver in 1794 after the famous French naval commander Latouche-Treville (Orth 1967:566). De Laguna (1956:255) presents information on traditional Native use obtained from Billy Paye, a Native of Latouche. Paye indicated that "Eskimo stone mining tools (probably the heads for mauls or splitting adzes) were found at the foot of the cliff" at the Latouche locality. These were probably destroyed or removed by later historic mining. In both periods, copper was the focus of mining activity.

Evidence for Native copper mining was noted as early as the turn of the century. Blamey Stevens (1909:179), director of the Reynolds-Alaska Development Company, suggested that:

Figure 85

Girwood Locality, SEW-026

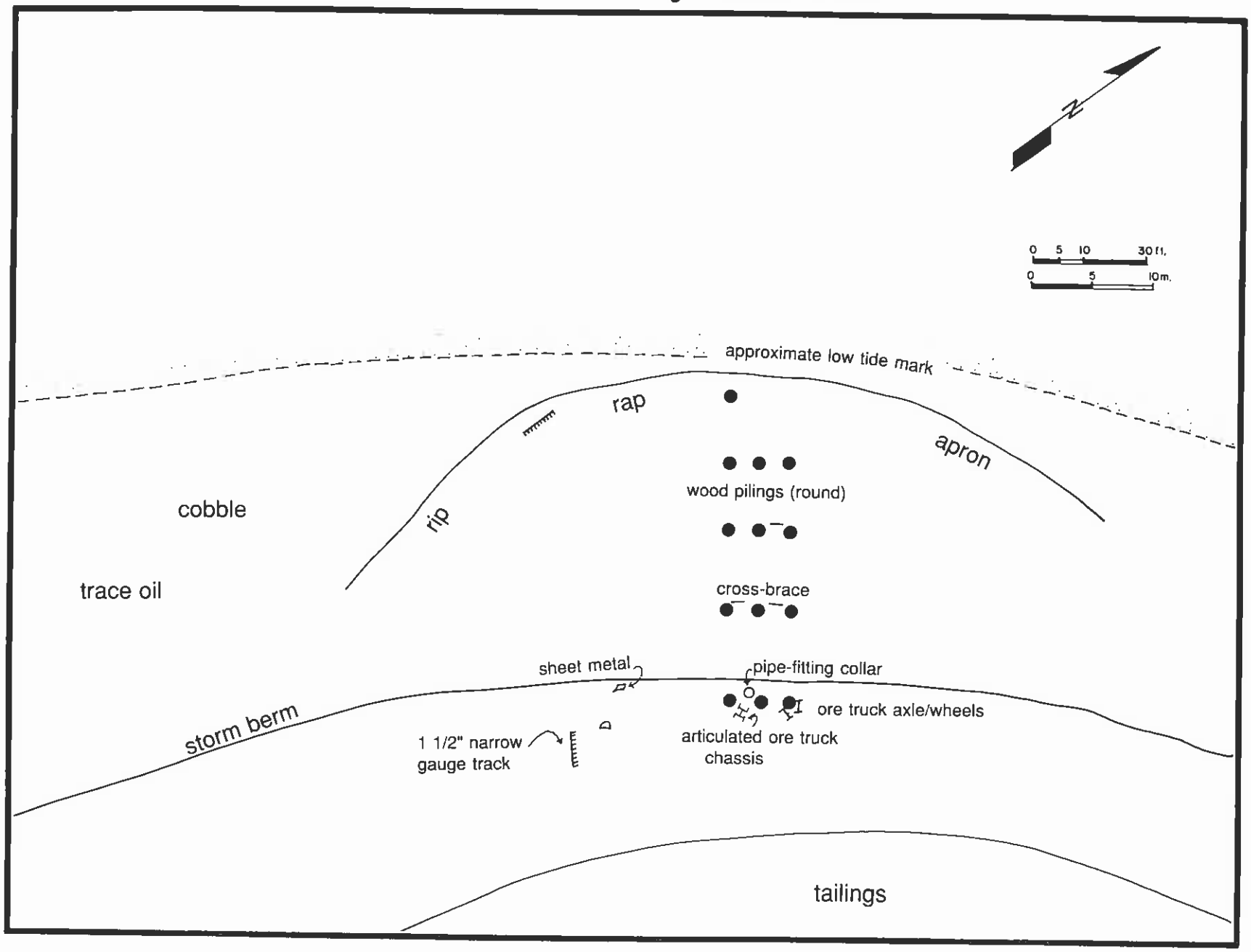




Figure 86. Panoramic view of Latouche locality (SEW-026), northeast portion.

> Copper has probably been mined in Prince William Sound for untold ages. At one mine, the Beatson's Bonanza, pits were found all over the croppings containing the remains of stone picks which had evidently been used to loosen up the decomposed croppings for the gathering of the native copper precipitated there.

Lincoln (1909:203) also argued that Native use of the mines was extensive:

> The aborigines were acquainted with the Big Bonanza ore deposit. Several wheelbarrow loads of stone hammers were discovered in the yellow soil at the base of the cliff in which the deposit outcrops. These hammers are notched for the accommodation of handles...Most of the hammers were badly broken through use and had evidently been employed to pound native copper out of crevices in the rock.

There was debate, however, as to whether the Chugach Natives exploited local copper for the manufacture of metal tools. Charles Hubbard, the mining engineer who first developed copper deposits on nearby Knight Island in 1907, discounted the idea that local Natives manufactured tools from the copper of the Prince William Sound area, "so they must have had some other purpose in mining it" (Barry 1973:7). Lincoln (1909:204) believed that the ore was used not for tools, but for the manufacture of paints:

> The Indians did not know that the deposit was of value for metal, but they picked up fragments of the ore and used them to produce a black stain. It was the use of chalcopyrite by an Indian for blackening his bidarky paddle that first aroused the interest of white men and led to the discovery of copper in Prince William Sound.

In contrast, Stevens believed that the copper deposits were used "for making shields, knives, and ornaments, some of which are still treasured by the natives" (Stevens 1909:179).

Stevens assumed that the Natives worked pure copper deposits, but Hubbard insisted otherwise because such deposits were rare; Prince William Sound deposits consist principally of copper sulfides, rather than easily-worked native copper (see discussion of mineralogy below). According to Hubbard, the deposits were "unsuitable for pounding into shapes ... the Prince William Sound copper ore needed sophisticated processing before it became useful metal" (Barry 1973:7). However, others have suggested that the Chugach had the technology to obtain copper metal from the sulfide ores, "if only because the use of copper by the natives of ... Prince William Sound was more intensive in the areas where copper sulfides are known to occur" (C.F. Herbert, cited in Barry 1973:7). Alternatively, it may be that the Natives were exploiting the "flinty" rock matrix associated with the copper deposits. Stevens (1909:179) describes how knowledge of the locality was first obtained by non-Natives:

> The Indians guarded the location of their mines with great secrecy, but in 1897 they became so innoculated with the gold fever of the white man that they were induced to disclose the places where their treasures were buried.

Beyond the early discoveries reported by prospectors and miners, however, there is no firm archaeological evidence that the Chugach traditionally mined in Prince William Sound.

Development of Commercial Mining

Documented historic use of the SEW-026 region began in July of 1897, when the first geological surveys



Peter Phippen 6:21, Exxon

Figure 87. Panoramic view of Latouche locality (SEW-026), southwest portion.

prompted considerable excitement among prospectors (Johnson 1918:204). A.K. Beatson and five others were led to the Latouche locality by an "Indian" (Lincoln 1909:204). In the spring of 1900, following the first ore shipment made the previous November, a "New York capitalist" purchased the property and placed it under the management of A.K. Beatson (Lincoln 1909:207). In February of 1902, the *Valdez News* reported that W.S. Amy had arrived with equipment and men to begin work on what had already become known as the "Bonanza" copper mine (Benson n.d.:3). The Alaska Copper Company reportedly purchased the property for $1,100,000. Additional claims were quickly made on either side of the Bonanza property by other "New York capitalists" (*Valdez News*, as reported in Benson n.d.:13).

A dispute eventually arose as to who owned the Bonanza mine, and in December of 1902 the *Valdez News* reported that Stephen Birch had actually purchased the property (Benson n.d.:3). Disputes continued into 1903, when the "Chittyna Exploration Company" sued the Alaska Copper Company for ownership. In response, Birch declared that the Alaska Copper Company would do only assessment work, so that limited money would be committed before reaching a settlement. The Alaska Copper Company won the suit in December 1903, and Birch declared in the *Valdez News* that "development will be done on the largest scale possible" during the following summer (Benson n.d.:4). At that time the mine was valued at $17,000,000, and by January of 1904 the company claimed to have thousands of tons of ore ready to be brought out in the spring (Benson n.d.:4). In *Ghost Towns of Alaska*, Balcom (1965) dates the establishment of Latouche to 1903. However, large scale production apparently did not occur until the spring of 1904, when the "Latouche Island Copper Mining Company" was formed by James A. Murphy from 29 claims on a ridge opposite the Bonanza mine. This was the only major operation based on the east side of Latouche Island. In 1905 the Bonanza mine received its first major competition in the form of the Reynolds-Alaska Development Company, which obtained the "Duke and Duchess mines" in the "Black Hills" property to the south of Bonanza Ridge through a lawsuit against J.D. Meenach (Benson n.d.:13). The company had Henry D. Reynolds as president, and Blamey Stevens as manager (Polk 1907). By that time, a distinct mining village was established at Latouche, including a boat landing (Orth 1967:566) and a post office (Baker 1906:398). George Barrack was an early postmaster (Polk 1907).

The Reynolds-Alaska Development Company in 1906 commissioned a detailed geological report which described the Bonanza mine as "among the leading copper mines of the Pacific coast" (Crosby 1906:2). The report solicited investors for the Reynolds mine, which began large-scale operations during 1906 (Benson n.d.:13). In that year the Bonanza mine was sold to Amalgamated Copper Company (Benson n.d.:4) and renamed the "Latouche Mining Company" (Polk 1907), but the property was known as "Beatson's Bonanza" after its owner, A.K. Beatson.

The year 1907 was described by Stevens (1909:181) as one of "great excitement" for mining in the region. By July of 1907, developers had constructed 3700 feet of tunnels (Grant and Higgins 1908:88) and shipped 9177 tons of ore (Lincoln 1909:201). Historical photographs document the loading of copper concentrate into steamships such as the *S.S. Salvor* at Latouche during 1907 (Johnson 1979); most of these belonged to the Northwestern Steamship and Alaska Coast companies of Seattle (Lincoln 1909:201). Steamships took the ore to a smelter in Tacoma, Washington (Bateman 1924:339), and returned with oil and coal to power the mines (Lincoln 1909:204). By 1907, Latouche had a dock, mine office, mess hall, hospital, ore bunkers, and two half-mile-long tramways from the dock to the mine (Grant and Higgins

1908:88). The population of Latouche had grown to 300, with Valdez as its banking center (Polk 1907:337-338).

Besides the Beatson, Murphy, and Reynolds mines, at least four other companies by this time were established on Latouche Island (Polk 1907:337-338, Grant and Higgins 1908:88, and Stevens 1909:180) -- the Latouche Copper Mining Company (George Barrack, manager); the Latouche Extension Mining Company (also known as the Chicago Latouche Mining and Power Company; James Buzzard, manager, and George Buzzard, superintendent); the Latouche Consolidated Copper Company (James H. Denny, manager); and the Seattle Alaska Copper Company (George Terwilliger, president, and William Long, manager). Of the seven companies, "Beatson's Bonanza" and the Latouche Copper Mining Company to the north, (which became known as the "Blackbird" mine, in the area of the later Girwood settlement) are included in the AHRS definition of SEW-026. The Reynolds-Alaska Development Company properties were located immediately to the south, along the southwest slope of Iron Mountain and adjacent Fall Creek, and included a dock facility on Horseshoe Bay (Crosby 1906: 7).

With the success of the Reynolds mine, in mid-1907 a separate town of Reynolds was established, quickly including a bank, store, hotel, telegraph, and electric power plant (Johnson 1979). A mile-long corduroy (log-surfaced) road was constructed eastward from the dock to the mine (Grant and Higgins 1908:88). According to Stevens (1909:183), by the end of the year company founder Reynolds had become "mentally unbalanced" during the "panic of 1907," and "involved the company in bankruptcy," forcing reorganization of the company with Stevens as its head. Possibly as a result of the same economic panic, the Blackbird mine of the Latouche Copper Mining Company ceased operation.

During an economic upswing in 1909, the Beatson-Bonanza mine was sold to the "Alaska Syndicate" of New York, owned by the Guggenheims and J.P. Morgan, for a reported $4,000,000 (Rentel 1981). Merged into their "Kennecott Copper Corporation," the mine reportedly paid a dividend of $1,000,000 for a period of 9 months operation in 1912 (Benson n.d.:4). During 1915 a new oil flotation plant greatly increased the capacity of the mill (Johnson 1918:204). In 1917 the Kennecott Copper Corporation bought the less-productive "Chinega" mine located 1,000 feet to the north of the Bonanza mine (Johnson 1918:204). The USGS report on "Mining in Prince William Sound" (Martin 1919), described the Beatson-Bonanza mine in 1917:(144-145):

> Large operations were in progress at the Beatson Bonanza mine of the Kennecott Copper Corporation throughout the year; the enlargement of the milling plant to a capacity of 1,600 tons daily was in progress, with consequent changes in power plant and mine. An average force of 345 men was employed by the company during the year. A large amusement hall, including moving pictures, bowling alleys, and clubrooms for the use of the employees, was completed early in the year. Other surface improvements included a new store and warehouse, several new houses, a new compressor plant and building, and some small buildings and sheds. The head frame of the shaft was framed during the winter and erected in the spring. Three diesel engines were installed in the power plant. The capacity of the shipping bunkers was doubled. Additional crushing and flotation equipment was installed in the mill. A new shaft was completed and put in operation during the year, and a hoist capable of handling 5-ton skips was installed. The main haulage ways and drifts were widened to accommodate larger cars, and two 4 1/2-ton storage battery electric locomotives were installed. A 500-ton concrete ore pocket was also finished. A big manway raise was completed between the main level and the top of the ore bluff. Considerable diamond drill work was done during the year, some of it on the 100-foot level. No other work was done on this lower level during the year.

The "lower level" of the site, as described by Martin (1919: 145), is essentially the intertidal zone of SEW-026. Johnson (1918:204) also noted that the mill, power plant, and "other camp buildings" had been erected in the "tidewater" area. A 1917 building inventory at Latouche included a mess hall, staff house, company office, telegraph office, hospital, bunk houses, oil storage tanks, ore bunkers, and a snowshed-covered tram line (Johnson 1918:204). The power plant contained oil-fired boilers, steam turbines, air compressors, and dynamos (Johnson 1918:204).

The Blackbird claim of the Latouche Copper Mining Company was reopened in 1917 by W.A. Dickey as the "Girdwood" mine (Bateman 1924:338), described by Martin (1919:145) as follows:

> Considerable underground development work, done both on the main tunnel level and between this level and the surface has developed an ore-bearing zone reported to be from 12 to 50 feet in width and said to be traceable underground for 700 feet. During the year crosscuts and drifts were run to the extent of 300 feet, and four stopes were opened up. Operations were in progress from June to October, inclusive. In October about 25 men were employed. A new wharf was erected during the year, a new blacksmith shop was built at the mouth of the tunnel, and repair work was done on other buildings and the tram line.

From 1917 to 1923, "Girwood" (formerly Girdwood) thrived as a separate port facility, and included a dock, ore bunkers, mess halls, and a quarter-mile tramway from the dock to the tunnel. In 1923, however, the Girwood mine was purchased by the Kennecott Corporation (Bateman 1924:338). By then the population of Latouche had increased to 505, and a school and cemetery had been added (Polk 1923:322). Latouche had become a "regular port of call for ocean-going ships plying to southwestern Alaska" (Bateman 1924:338); mail was shipped five times a month, and Seward replaced Valdez as its banking center (Polk 1923:322). The Beatson mine was processing 1,500 tons of ore per day and producing over two million pounds of copper per year, and was considered the second largest copper mine in Alaska (Bateman 1924:338). The total copper production by that date was almost 100,000,000 pounds (Bateman 1924:340).

Figure 88

Geology of Southwest Prince William Sound

Dangerous Passage to Elrington Island

Adapted from Tysdal, RG and Case, JE, Geologic Map of the Seward and Blying Quadrangle, Alaska, 1979.

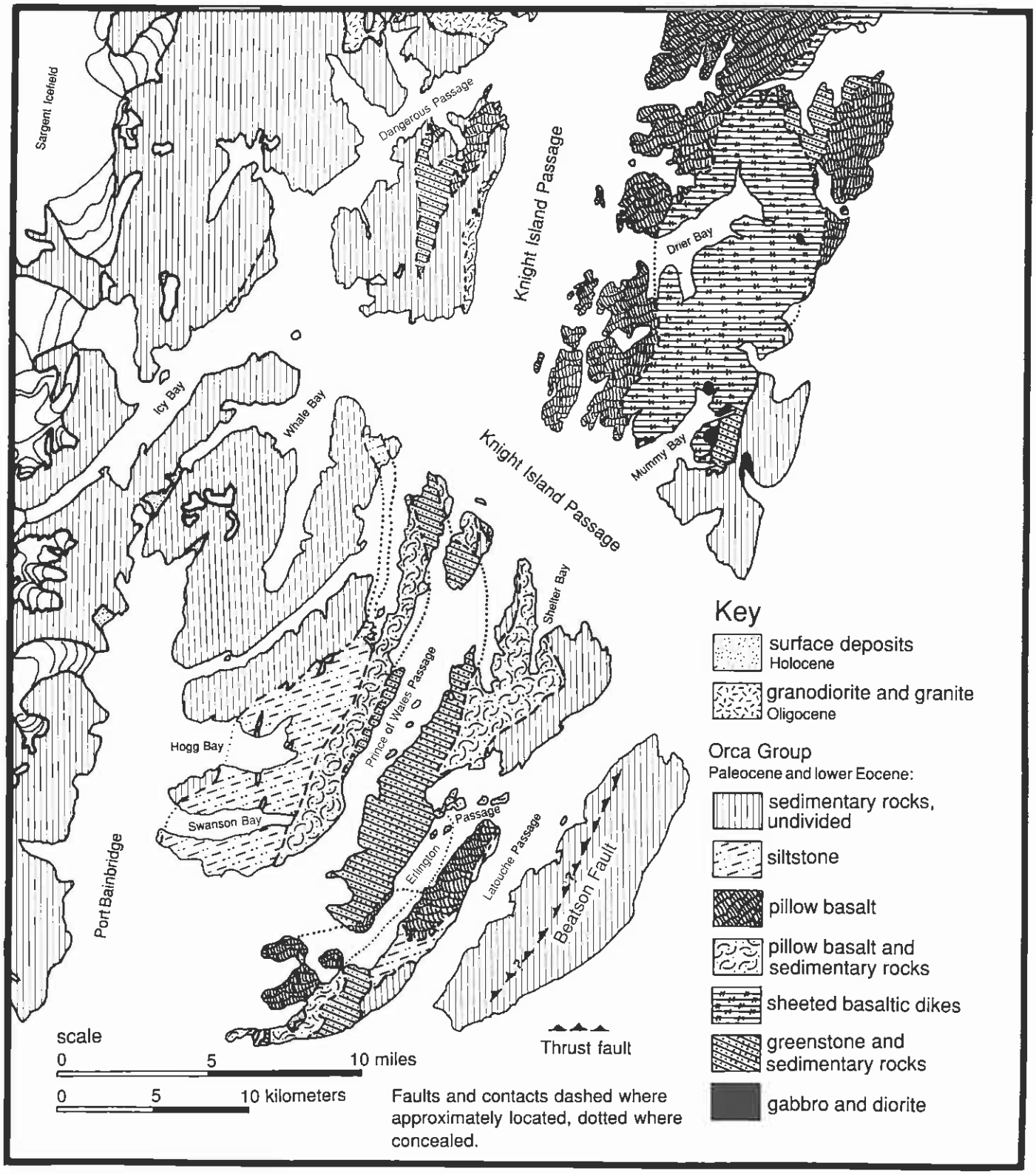


Figure 89

Feature Distribution at the Latouche Locality, Southwest Portion

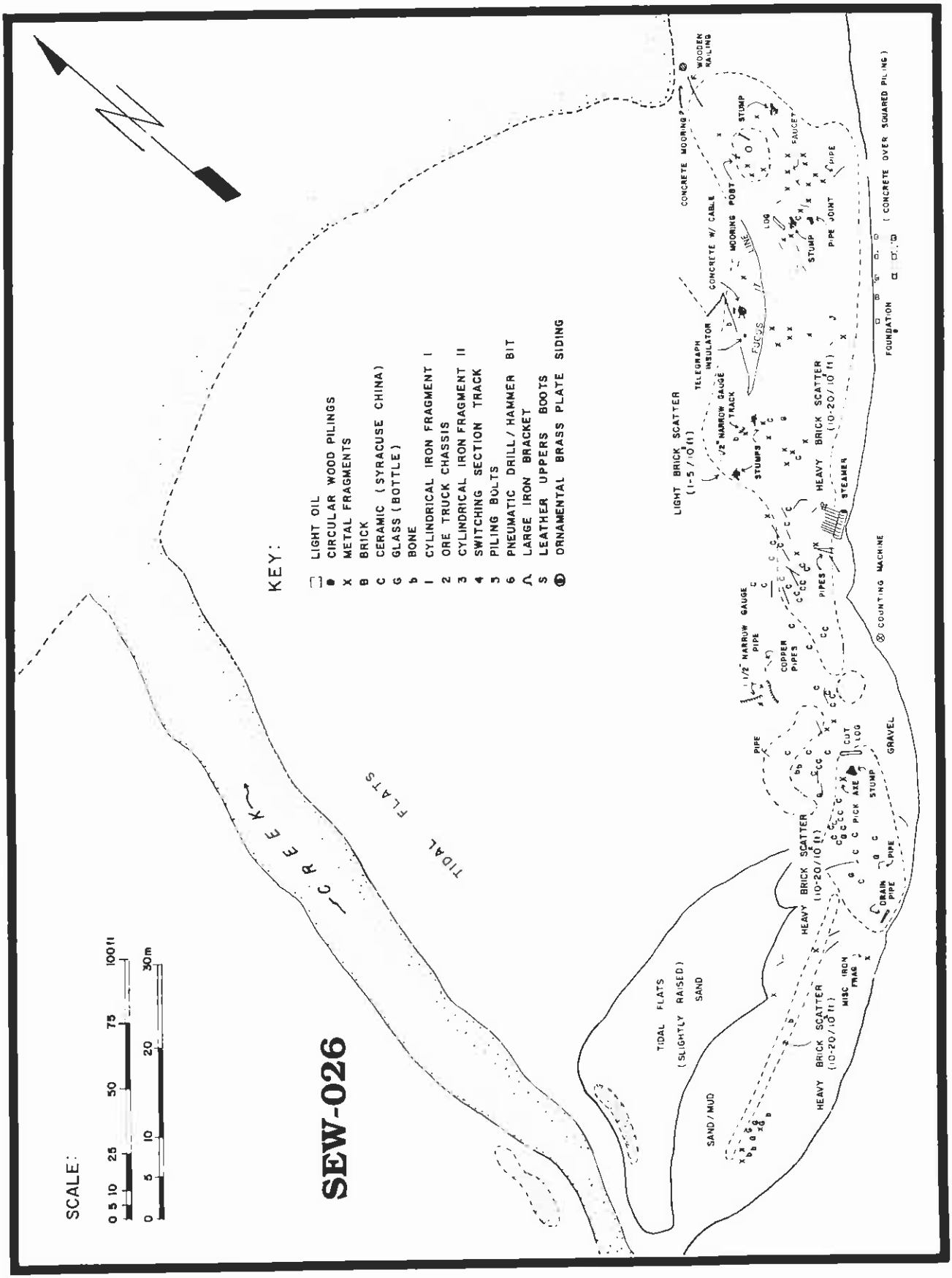
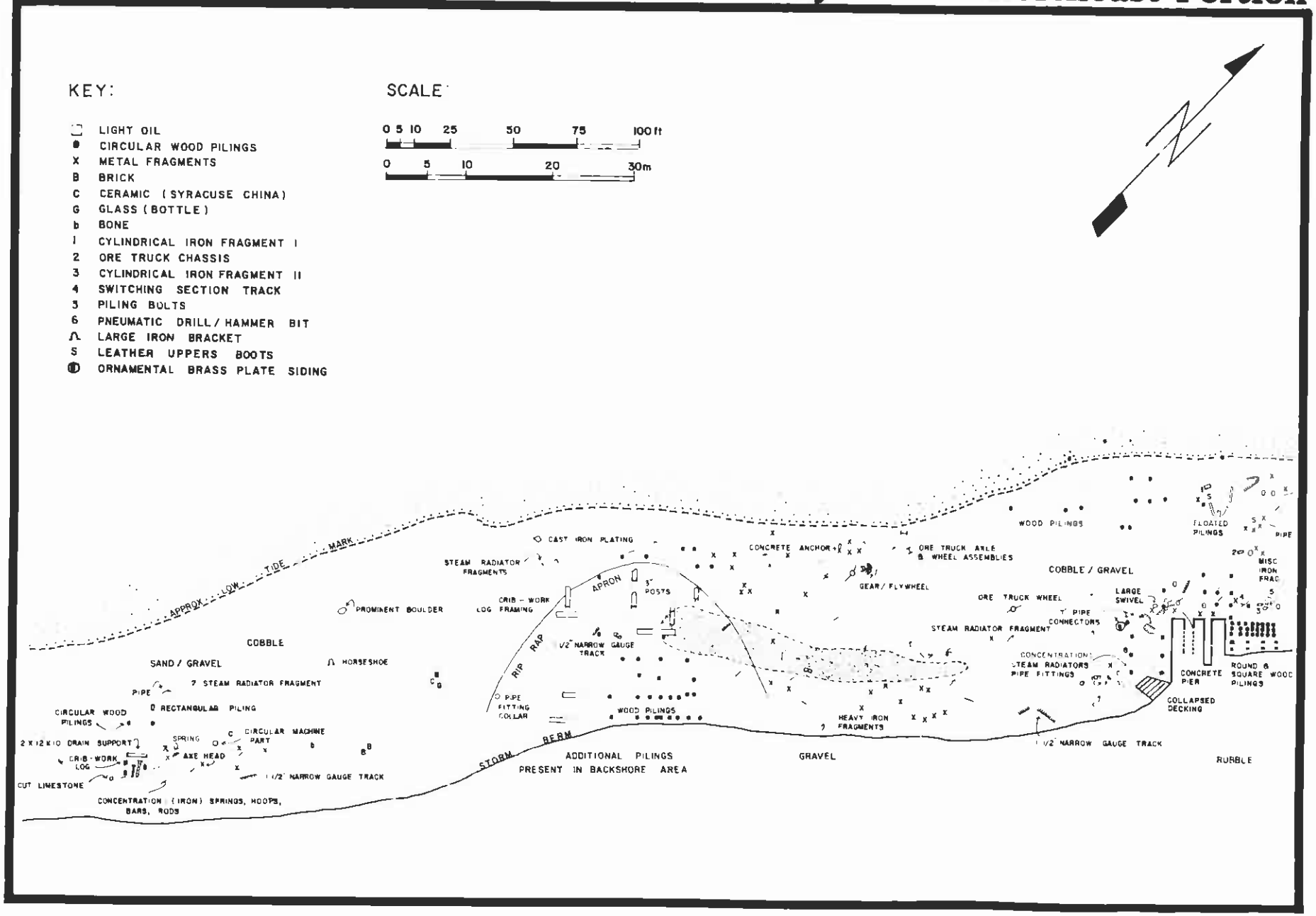


Figure 90

Feature Distribution at the Latouche Locality, Northeast Portion



The Decline of Commercial Mining

The Great Depression changed the fortunes of all the local mines. Balcom (1965) lists 1930 as the terminal year for the copper mining camp of Latouche, although Rentel (1981) identifies 1933 as the year in which the Beatson-Bonanza mine closed. By 1935 the population of Latouche had dropped to 339 (Alaska Directory Company 1935:189). A new restaurant and barber shop opened, and weekly mail service was instituted, but these improvements appear to have been the result of the opening of two fishing companies (the Chatham Straits Fish Company and the Shepard Point Packing Company) and three fox farms. The Culross Mining Company had the only active mine in the district. Fishing became the dominant industry in the region, and by the late 1940s Latouche was considered a fishing village. In 1951, the buildings of Latouche were reportedly in ruins, except for a commercial cold storage plant servicing the fishing industry (Heiner 1977). By 1953 the population had dropped to 19 (Couch 1953:53), and the post office closed in 1955 (Ricks 1965:39). About 20 buildings remained at the site in the early 1960s (Orth 1967:566). Sometime between the late 1960s and 1980s, all but a few of the remaining buildings were levelled by heavy machinery.

Geology of the Latouche/Girwood Localities

The geological circumstances which prompted historic and prehistoric mining at Latouche warrant mention. Copper-bearing deposits of the Prince William Sound region were originally produced by the same submarine volcanism that formed the rocks of the Chugach and Prince William terranes (Nelson 1989). These rocks are typically grayish-green metamorphosed sandstones and siltstones with igneous intrusions (Moffit 1954, Tysdal 1978), including the graywackes, argillites, schists, and "greenstones" described in the early part of the century (Schrader 1900; Crosby 1906; Grant 1906; Moffit 1908; Grant and Higgins 1909, 1910; Johnson 1918; Bateman 1924). Based on fossil molluscs and potassium/argon (K-Ar) dates, the Chugach and Prince William terrane rock units are classified late Mesozoic (Cretaceous) and early Cenozoic (Eocene) in age, respectively (Plafker and MacNeil 1966, Lamphere 1966, Jones and Clark 1973, Tysdal and Plafker 1978).

While copper-bearing deposits may be found throughout these rock series, they are particularly concentrated along the Contact Fault System which resulted from a terrane collision 50 million years ago (Nelson 1989). One segment of this fault system extends northward from Upper Russian Lake on the Kenai Peninsula to the Port Wells region of Prince William Sound (Moffit 1954, Tysdal 1978), and includes the so-called "Beatson Fault" on Latouche Island (Figure 88). That fault consists of a zone of sheared and shattered rock between the formations (Bateman 1924:348), in which various sulfides have precipitated in fissures and fracture planes (Lincoln 1909:208). This mineralized zone conforms in dip (65° W) and strike (25° N) to the surrounding rock, following the northeastward trend of the island system that was created by terrane collision. Investigators have demonstrated that the same continuous ore body, varying from two to forty feet in breadth, was exploited by all of the mines of western Latouche Island, including the Blackbird-Girwood, Chinega, Beatson's Bonanza, Reynolds, and Seattle-Alaska mines (Lincoln 1909:208; Johnson 1918:204; Bateman 1924:348).

Near the contact zone, the rocks surrounding the ore tend to be homogeneous, cryptocrystalline, siliceous, and extremely hard (Richter 1965). Early geological reconnaissance of the Bonanza ore body, for example, noted that it was "highly silicified, which makes it hard and resistant and causes it to outcrop boldly" (Crosby 1906:9). The ore deposits were described by Crosby (1906:3-4) as follows:

> The copper ores are, normally, the yellow sulfide (chalcopyrite) and cupriferous pyrite and pyrrhotite. Thanks to the recent and severe glacial erosion which the region has experienced, the ores are unoxidized except within a few inches, or, at the most, a few feet of the surface; and of secondary enrichments due to a downward-leaching of values there appears to be little evidence; but we may rather regard the ore bodies as the products of the primary concentration, and hence as not dependent for their values upon proximity to the surface.

In other words, both shallow and deep mining produced ore of equal quality in the region; the quality of mining areas depended solely upon the exposure of the mineralized zones. Assays of the Beatson ore showed it to contain an average of 2.2% copper (Bateman 1924:349); the nearby Reynolds mine ore body showed similar average values between 2 and 3% copper (Barry 1973:125).

1989 Field Investigations

Latouche Locality

Archaeological observations during the original SCAT survey noted the presence (from north to south) of: 1) a concrete loading dock with round wooden pilings; 2) the foundation of a historic building, containing a number of steam heat radiators; 3) a large tailings pile; 4) an older, wooden pier, consisting of a set of approximately 20 wooden pilings; 5) three historic building foundations; 6) a stream-driven winch; 7) a large boilerworks; and 8) other building foundations and features (Figures 89 and 90). Surface artifacts, including bricks and ceramic sherds, were scattered along the beach, but were particularly concentrated at the southern end of the site. In the reinvestigation of the Latouche locality by Phippen during June 24 - June 28, additional features were noted. In addition to untreated tree trunks (showing branch bases) used for pilings, some square pilings were also noted, apparently treated with an oil-based preservative. The concrete pier and other structures at the northern end of the site were found to be associated with considerable industrial debris, including: 1) a roller turbine; 2) a "Wizard" magneto, manufactured by the Hercules Magneto Co., Indianapolis; 3) several steam radiator fragments; 4)

two ore truck axle/wheel sets, manufactured in San Francisco; 5) narrow-gauge track, including a switching section; 6) pipe, pipe connectors, pipe fittings, and pipe brackets; 7) piling bolts and other "heavy iron fragments"; and 8) a brass faceplate for the side of a cash register. No ceramics or other evidence of domestic refuse was located in this northern area of Latouche.

To the south, additional industrial debris was associated with crib-work log framing, a riprap apron, and heavily weathered wooden pilings. These artifacts included: 1) large gears with attached flywheels; 2) a concrete anchor; 3) a skid; 4) a pipe-fitting collar; and 5) cast iron plating. Also found in this area were more ore truck axle/wheel sets, steam radiators, narrow-gauge rail, and miscellaneous pipefitting and other iron fragments.

The southernmost intertidal portion of Latouche was found to contain domestic artifacts. The ceramics noted by Wilson were found in at least five distinct areas. At least three sets of Syracuse china were identified, including two sets of plate fragments and a bowl fragment. A soup bowl of vitrified china from Clarksburg, West Virginia, was also found. Glass items included many fragments and one small bottle. Leather boot fragments were noted. Also itemized were an axe head, pick head with handle fragment (Figure 91), faucet, chain, and a horseshoe. Domestic cow bones were found. A large number of bricks and a cut limestone boulder were found toward the southern end of the site. Materials possibly related to passenger shipping include a wooden railing near the remains of a wooden dock, and a counting machine (for tallying tickets?). Also found in the same area were two steam radiators, produced by the US Steam-gauge and Valve Company of Boston. Further south, a concrete base with protruding cable and nearby telegraph insulator may be related to communications facilities. Other industrial materials in the south end of the site -- near a series of drainpipes leading down from above the storm berm -- include a concentration of springs, hoops, bars, and iron rods, as well as miscellaneous examples of steam radiator and copper pipe fragments. All of these were mapped (Figures 89 and 90).



Peter Phippen 8:23, Exxon

Figure 91. Pick head and handle, Latouche locality (SEW-026).

Girwood Locality

The Girwood locality consists of a moderate to low-angle cobble/gravel beach with some bedrock outcrops, and several small, widely-distributed streams. While not as large in area, the Girwood locality contains a number of interesting features (Figure 85). Initial archaeological fieldwork as part of the SCAT survey documented: a small (3 X 4 m (9.75 X 13 ft)) wooden structure with clapboard siding; rows of upright wooden pilings, spaced about two meters (6.5 ft) apart and extending perpendicular to the shore into the mid-intertidal zone; two large tailing piles and a series of smaller ones along the treeline; and historic industrial artifacts scattered between the pilings and tailings. At the south end of the locality (Girwood Point) is a flat-topped concrete pyramid that may have supported a navigation aid at one time. Structures immediately behind (east of) the tailings were noted, and historic objects included narrow-gauge tracks, cast iron radiators, and two articulated sets of ore truck axles and wheels.

Detailed mapping and photography at the Girwood site was done on June 28 at low tide. Bearings were taken from the tailings piles to the concrete monument (which was oriented almost magnetic north). The pilings to the north of the wharf were recorded as four parallel rows extending almost to the low tide mark, with at least two sets of pilings still cross-braced. In front of the pilings at the low tide mark was a semi-circular riprap apron. Artifacts distributed between the pilings and tailings (in addition to those noted earlier) included a winch-stand, ore truck chassis, pipe-fitting collar, and sheet metal. No domestic artifacts were found in this area.

Discussion

The field documentation was used to help prepare the discussion in this report. Detailed field maps prepared to scale by Peter Phippen were re-drafted and analyzed by David Yesner, with the aid of Geoff Mandel. The map of the Latouche locality (Figures 89 and 90) was compiled from six 8 1/2 x 11" field sketches. The map of the Girwood locality (Figure 85) was re-drafted from a single 8 1/2 x 11" field map. Artifacts were mapped in the field using an "eyeball" approach; measured-piece plotting was not conducted for either locality. Additional information to aid plotting was available from both field notes and photographs.

The photographic log and field maps clearly indicate at least 60 major concentrations of artifacts, as well as at least 15 major historic architectural features, including concrete piers and moorings, wooden decking, round and square wood pilings, wooden mooring posts, crib-work log framing, wooden railings, concrete/wood building foundations, riprap aprons, and tailings piles. Similarly, the Girwood locality produced evidence of a concrete wharf,

wooden pilings, riprap apron, wooden shed, tailing piles, and at least ten major artifact concentrations.

These materials suggest SEW-026 to have potential for reconstructing early 20th century mining history, although the upland information potential has not been assessed. Ceramics with maker marks allow fine-tuning of chronology (Worthy 1982), along with metal industrial items bearing maker marks such as the magneto, steam radiators, and ore truck wheels. Studies of the bricks (Gurcke 1987) and bottle fragments (Jones and Sullivan 1985) could also help provide a chronological framework, particularly in conjunction with archival data. Comparisons could be made with other early 20th century mining locales in Alaska, such as the Moore Cabin and House (Blee 1988) and the Mill Creek Dump (Rhodes 1988) in historic Skagway (Klondike Gold Rush National Historical Park). This would give a better understanding of the mining frontier phenomenon (Lewis 1984), particularly with reference to the Alaska/Yukon region (Burley 1985; Stevenson 1982, 1989). Stevenson (1989), for example, has shown how industrial artifacts associated with the historic Yukon mining district can be viewed systematically as symbols showing the relationship between distinct groups of miners ("sourdoughs" v. "cheechakos"). The bone preserved at the site could also allow dietary reconstruction (Jolley 1983, Lyman 1977). Taken together, these materials could help provide a framework for reconstructing early 20th century economy and social dynamics in southcentral Alaska.

Investigations at Site SEW-072

Protective measures implemented at SEW-072 (a prehistoric site in a small cove on the southwest coast of Knight Island in Prince William Sound) entailed mapping and some surface collection, resulting in substantive information beyond the level acquired for most other sites in the survey sample. The cove is divided into two beaches, separated by a large bedrock outcrop with a small creek located at the north end. Prehistoric inhabitants would have had a good gravel beach for boat launching and landing, a well-exposed view of outside waters to the west, and offshore rocks that may have afforded some protection. The open western exposure has probably promoted erosion of the site and displacement into the intertidal zone. According to de Laguna (1956:30), the site was originally reported by a local informant, who had found on the beach "several splitting adzes, planing adzes, an ax, a broken lamp, two fragments of copper blades, and a 'flat piece of shale with a long groove in it'" (probably a net or line sinker). The site may have extended for up to 200 meters (650 ft) along the shore, but artifacts were found scattered along 85 meters (276 ft) of the north beach (Figure 92). Large amounts of fire-cracked rock and numerous other artifacts were found throughout the upper and middle intertidal zones, ranging from five meters above mean low tide up to the mean high tide mark. More than ten CMTs were located in the adjacent uplands, with at least four greenstone cobble and pebble tools observed next to them. A recent camp was located at the north end of the site.

The original SCAT survey noted light oil with some mousse balls in the segment. The constraint submitted to the FOSC read "No cleanup recommended due to sensitive cultural materials in this segment .... If cleanup conducted, an archeological monitor is required .... " The FOSC approved no cleanup in the segment.

The 1989 efforts by the EXXON VALDEZ Cultural Resource Program appear to represent the first professional investigations reported at the site. As part of the survey documentation, 54 major intertidal artifacts were photographed and mapped, using four triangulation points (three on bedrock outcrops). All but ten of the 54 mapped objects were collected as a discretionary measure allowed under the permits issued by the State of Alaska, due to the visibility of the conspicuous tools on the beach surface and the fact that -- although not recommended for treatment -- the vicinity was a popular anchoring area for vessels being deployed as part of the treatment effort. The 44 collected artifacts are described by W.B. and K.W. Workman in the *Artifact Description* appendix.

Artifacts found in the intertidal zone at SEW-072 were all heavy objects that survived subsidence of the site and subsequent wave action. No copper implements of the sort described by de Laguna (1956:30) were observed. The artifacts can be classified into adzes, rods, chisels, grinding stones, hammerstones, other cobble tools, stone lamps, pigment mortars, and polished ground stone fragments.

Adzes form the largest category. All but one (of basalt) are made of the graywacke often called greenstone. Such splitting adzes are described in detail by de Laguna (1956:110). The analysis in the *Artifact Descriptions* appendix divides the specimens into grooved and ungrooved adzes, finished and unfinished adzes, and adze fragments. Similarly, hammerstones may be divided into hafted and unhafted types, cobble and cylinder types, and hammerstone fragments. The pigment mortar is the next most diagnostic artifact recovered at SEW-072.

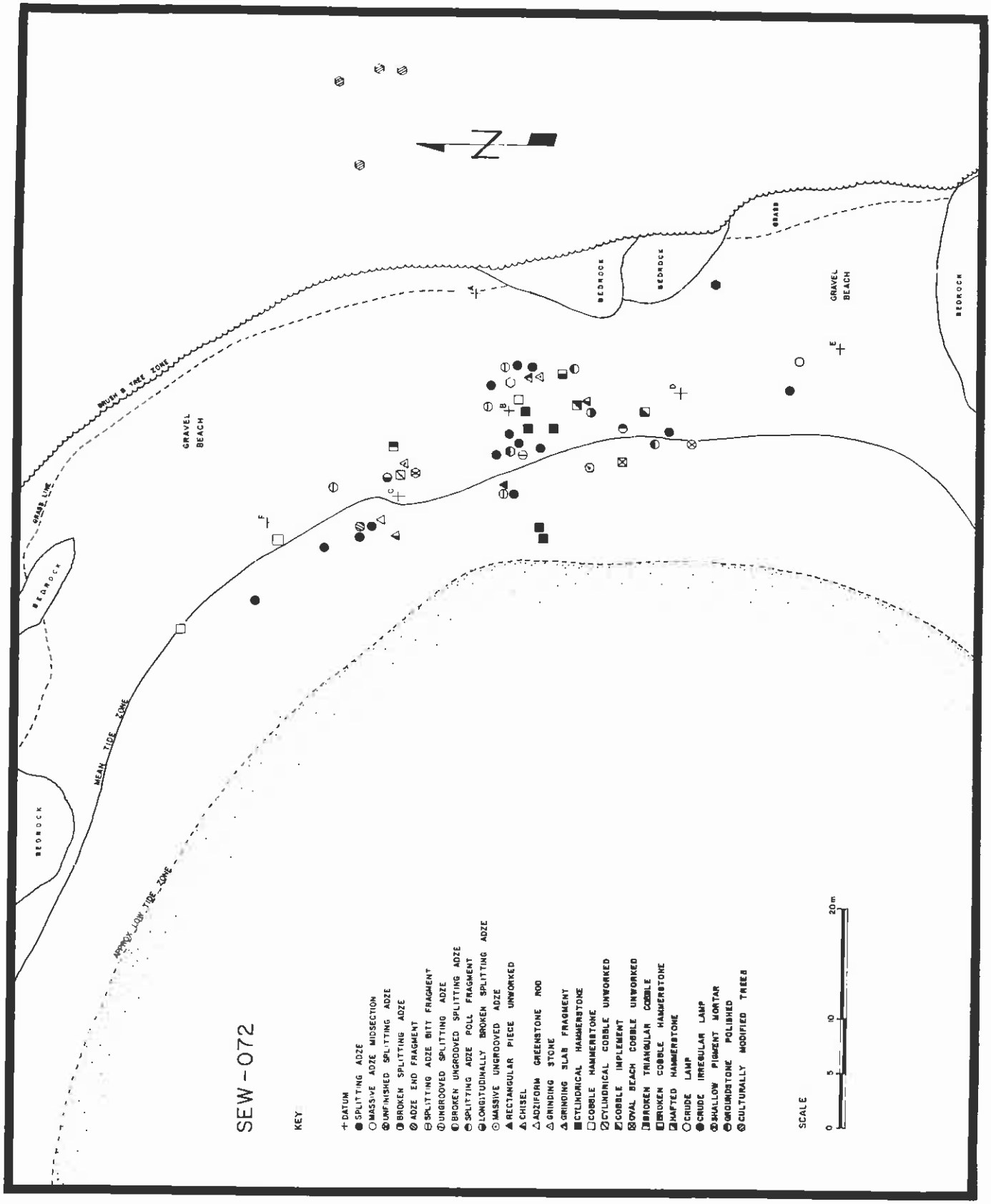
The large number of adzes might suggest an emphasis at the site on the manufacture and/or use of splitting adzes (presumably for wood-working purposes), but the ratio may also be due to differential retention in the intertidal zone in comparison with lighter materials. The artifacts recovered are probably somewhat earlier than the second millennium dates suggested for them elsewhere in the Gulf of Alaska (Clark 1974:92), although the copper items reported from the site by de Laguna (1956:30) are probably from that era (Workman 1980). Additional data from this site could help to develop a picture of prehistoric subsistence and settlement there, but no exposures of upland middens were noted. Unless buried site deposits remain in the area of the culturally modified trees, the site may now be totally subsided into the intertidal zone.

The Artifact Experiment

The potential of surface and subsurface cultural materials in the intertidal zone remaining unobserved by SCAT archaeologists was recognized at the beginning of the site protection program. As a consequence, procedures for cleanup personnel were established in the event

Figure 92

SEW-072



that cultural materials were discovered during treatment: a localized work shutdown leaving the cultural materials in place, and immediate notification of appropriate officials. An experiment was designed to test the extent to which cleanup crews might recognize prehistoric artifacts on an oiled beach and follow through in reporting them.

A set of stone tools, consisting of slate points manufactured to conform to prehistoric types, was placed on three oiled beaches scheduled for treatment. Cleanup supervisors were told that such a study was being conducted in Prince William Sound, but the location and timing of the placements were not revealed.

The exercise was based on the premise that, if the artifacts were noticed and reported, then the ability of crews to recognize and report such cultural material to their supervisors was verified. If they were not reported, however, it meant either that: 1) the artifacts were not noticed at all; 2) the artifacts were noticed but not recognized as cultural items; or 3) the artifacts were noticed and recognized, but not reported. It was realized that distinguishing among the three possible explanations would require skillful debriefings of the cleanup crews, to determine whether they had noticed the artifacts, but this turned out to be impractical. As a consequence, the conclusions to be drawn from the exercise are limited.

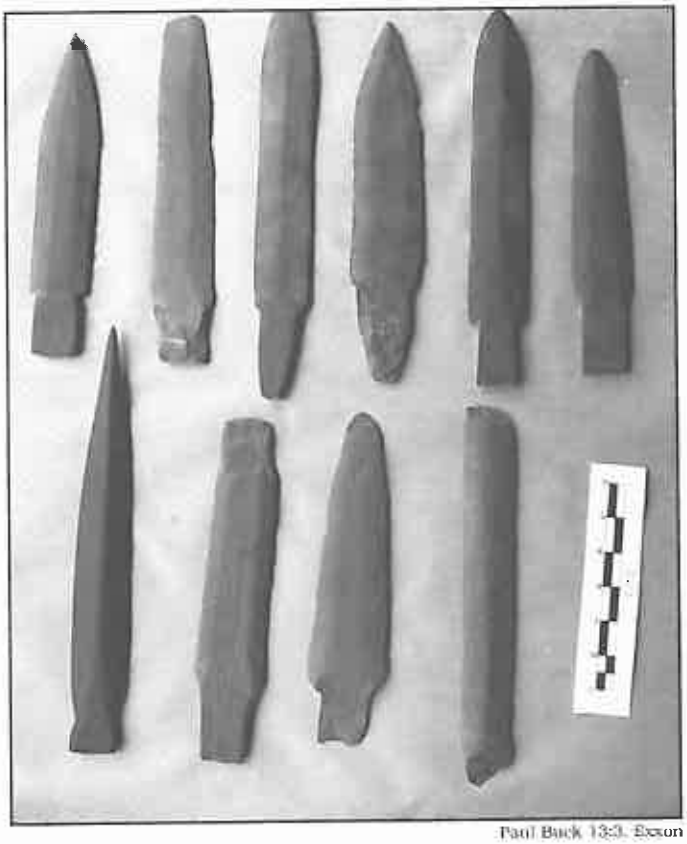
Information potentially applicable to other issues was also anticipated. Depending on the results of the exercise, information provided to supervisory personnel (or the ways in which that information was delivered) could be changed to more effectively educate the field crews and prevent harm to cultural resources. And it was thought that the exercise could provide information on the degree of disturbance suffered by surface artifacts during cleanup.

Because the exercise did not control for all variables, it should be considered a pilot study, useful for designing better experiments when crisis circumstances are not in force.

Manufacture of the Specimens

Using authentic items of prehistoric manufacture for the experiment was considered, since specimens of unknown origin -- and thus of limited scientific value -- are sometimes available, but this idea was discarded in favor of obtaining replicated specimens. The specimens had to be obviously of human manufacture, similar to authentic artifacts common in the oil spill area, and obtainable in a short time. Large, slate lance-like points were selected for replication and use in the experiment (Figure 93). Bob Heath, a graduate of Sheldon Jackson College, was contracted to manufacture the points. Slate was acquired from a blackboard that had been removed from use at Sheldon Jackson College and set aside as a source of raw material for art and archaeology projects. Heath made ten lance-like points, using a hacksaw and file to expedite the process.

After they were photographed intact, the artifacts were broken into several pieces and photographed again. The breaking process was also recorded on videotape. The artifacts were broken to increase the sample size (Figure 94) and make the specimens appear similar to those of an actual archaeological site in the intertidal zone.



Paul Buck 1989, Exxon

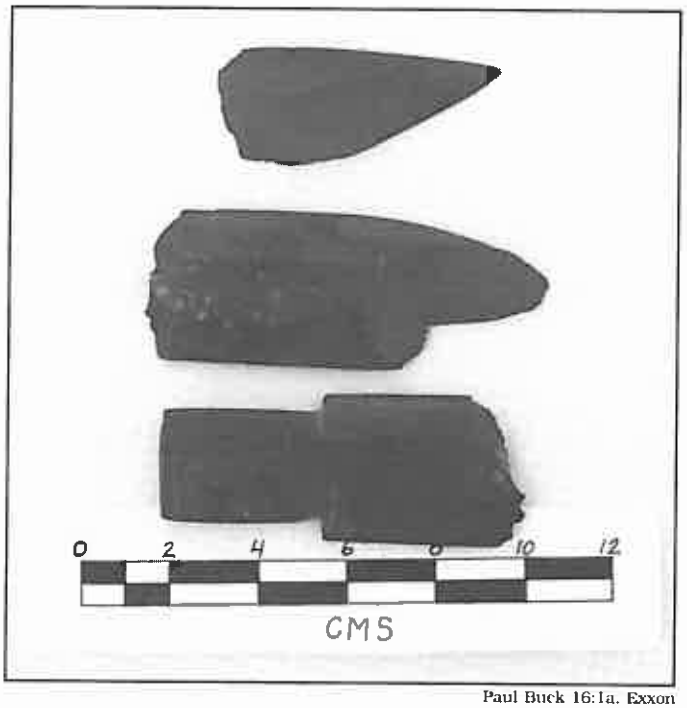
Figure 93. Replicated slate artifacts used in the artifact detection exercise, before deliberate breakage.

Artifact Placement and Recovery

On July 27, Exxon archaeologist Paul E. Buck and SHPO representative Rolfe Buzzell placed replicated slate artifacts at three locations on the east side of Knight Island: 1) Oyster Bay in Segment KN-211; 2) a large island at the mouth of Marsha Bay in Segment KN-702; and 3) the southern cove of Snug Harbor in Segment KN-408 (Figure 95). The three locations were selected because: 1) beaches had not been treated but were scheduled for treatment; 2) no known cultural resources were present (thus minimizing possibile confusion with prehistoric stone tools); and 3) adequate sketch maps of shoreline oiling were available.

Artifact Placement

Procedures for placing artifacts on the beach were uniform at the three test locations. Easily recognizable landmarks (usually in the supratidal or tree fringe zone) were needed for data points. Areas of heavy oiling were chosen, since they would receive priority during treatment. The artifacts were lightly oiled and placed within a one to two meter radius of one another, but were not buried



Paul Buck 16:1a. Exxon

Figure 94. Replicated slate artifact illustrating how it was broken prior to placement on the shoreline.

or intentionally hidden. Each test location was described in terms of clast size, beach morphology, and degree of oiling (Table 26). Photographs were taken of the artifacts and the landmarks used for orientation, to help relocate the artifacts.

Test Location #1 was located at Segment KN-211, west of an ill-defined outlet channel from a small lagoon lying to the south of Beach #4. A group of six artifacts was triangulated from two dead trees termed Marker #1 and Marker #2 (the artifacts were placed 16.5 m (53.6 ft) from Marker #1 and 27.8 m (90.3 ft) from Marker #2).

Test Location #2 was on the northeast side of a large, unnamed island at the mouth of Marsha Bay, in Segment KN-702, at a small, north-facing cove referred to as "Site A" in the SCAT report. The specimens were placed in a narrow, heavily oiled tidal channel in the mid-intertidal zone. The two landmarks used to triangulate location were a spruce tree just north of a conspicuously striated boulder, and a sharp-ridged angular boulder or outcrop two or three meters (6-10 ft) high jutting into the tidal channel. Six artifacts were placed 13.3 m (43.2 ft) from the tree and 5.2 m (16.9 ft) from the outcrop, and subsequently photographed.

Test Location #3 was in Segment KN-408, in the southern part of Snug Harbor, about 50 m (162 ft) north of the Unit 1/2 boundary. Five artifacts were placed 21.0 m (68.2 ft) from a steep bedrock cliff with two pronounced vertical cracks (Marker #1), and 27.2 m (88.4 ft) from a large rounded boulder about three meters (10 ft) high (Marker #2). Photographs were taken showing the relationship of the test location to landmarks.

Cleanup at the Test Locations

No one reported the discovery of any artifact from any test location during treatment. The timing, type, and intensity of cleanup at the three test locations may have affected the recovery of artifacts. The length of time between artifact placement and cleanup may have affected artifact visibility and recovery, since the specimens would have been subjected to relatively more wave and tidal action. Treatment activities in 1989 often took place several times within individual segments, however, to accommodate weather, reoiling, and recurrent "bleeding" of oil from shorelines. As a consequence, it is difficult to determine when the test locations were treated. According to the daily task group summaries for the three segments, Test Location #1 was 86% complete between August 18 and September 4, Test Location #2 was 86% complete between August 6 and August 14, and Test Location #3 was 84% complete between August 3 and August 13. Details on the specific portions cleaned in each segment were not recorded, but it seems that overall, Test Location #1 was not treated until substantially later than the other two locations.

A variety of treatment types was authorized for the three segments (Table 26). Segment KN-211 received hot water and high pressure flushing treatment, Segment KN-702 was subjected to vacuum treatment and manual debris removal, and Segment KN-408 was treated with hot water wand and vacuum systems as well as an omni-boom in the mid to high tide zones. But the information on cleanup completed at any particular portion of a shoreline segment is not as precise as one would prefer for the purpose of this exercise, because records are only segment-specific. Similarly, records do not allow estimates of the intensity of treatment effort at any one segment or portion of a segment.

Artifact Recovery

On September 4 and 5, 1989, Paul E. Buck and Morley Eldridge returned to the test locations and used photographs taken at the time of placement and metric tapes to relocate and collect the specimens. Two hours were spent searching at each location to eliminate bias introduced by differing amounts of search time.

Test Location #1 was underneath about 30 cm (12 in) of *Fucus* and other flotsam, in a portion of the segment that appeared to have been treated. Debris in a two meter (6 ft) radius around the estimated location of artifacts was removed, and the area searched on hands and knees for the replicated artifacts. Three of the six artifacts placed there were recovered.

In the area of Test Location #2, treatment had removed the larger cobbles to expose a gravelly substrate which was relatively free of oil, as though manual cleanup (shovels and rakes) had been used. Three of the six artifacts were recovered after removing overlying *Fucus* and small cobbles and inspecting the ground surface.

At Test Location #3, all large boulders and cobbles had been upturned by treatment, clearing most of the immediate area. Of the five artifacts placed there, one was recovered.

Figure 95

Artifact Detection Test Sites on Knight Island

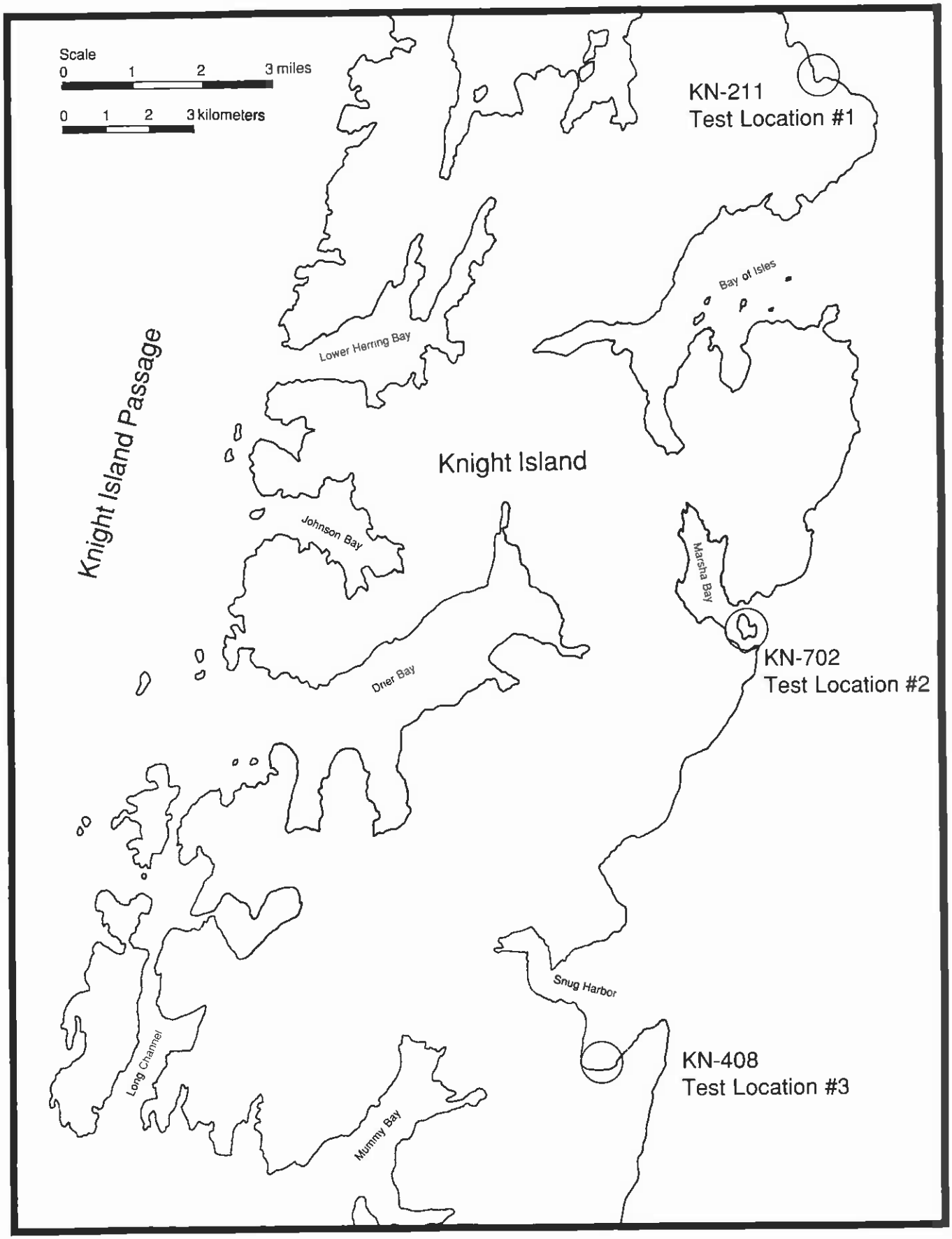


Table 26

Selected Characteristics of Artifact Test Locations

	Location #1	Location #2	Location #3
Segment #	KN-211 Beach #4	KN-702 Site A	KN-408, Unit 1
Wave Exposure	High	Med/low	Low
Oiling	Heavy	Heavy/moderate	Heavy
Oil Type	95% fresh	75% mousse	95% tar
Oil Coat	100%	70%	40%
Treatment	Hot water, high pressure flushing	Vacuum free oil: manual removal of oiled debris	Hot water wand and vacuum; omni-barge at mid-high intertidal zone
Artifacts Placed	6	6	5
Artifacts Recovered	3	3	1

Discussion

It is not possible to determine whether the artifacts were unnoticed, noticed but not recognized, or recognized but not reported. Furthermore, if artifacts were not observed, there is no way to determine whether this was due to: 1) poor surface visibility; 2) burial, destruction, or transportation by wave and tidal action; 3) burial, destruction, or transport by cleanup processes; 4) lack of cleanup in the exact location where the artifacts were placed; 5) removal of artifacts by non-cleanup personnel after placement but before cleanup activity on site; or 6) other possible occurrences. As a working explanation, it is likely that the attention of the crews was necessarily focused on the cleanup tasks to the exclusion of incidental artifact observation.

Of the 17 specimens placed at the three test locations, seven (41%) were recovered. The artifact test locations were accurately relocated with a metric tape, and a substantial area was carefully searched. The processes potentially responsible for the inability to recover the remaining 11 artifacts may be divided into cultural and non-cultural processes. Cultural processes may be intentional or unintentional; the artifacts may have been intentionally collected (by cleanup personnel, other spill-related individuals, or casual visitors to the test location either before or after cleanup), or transported a distance away from the test location by treatment activities. High pressure streams of water used to treat Segments KN-211 and KN-408 may have blasted the relatively light artifacts into new positions, or buried them. The artifacts may have been shoveled into bags and removed with other oily debris during manual treatment at KN-702.

Non-cultural processes include the effects of tidal and wave action. Tidal and wave effects may be most pronounced on high gradient gravel or sand beaches, where artifacts become entrained in rolling particles and carried down slope, up slope, or buried. The direction of the prevailing current may also determine cross-beach movement. Foyle (1988) examined the effects of tidal oscillation on the spatial patterning and particle size distribution of replicated lithic scatters on a low energy sand beach with a tidal fluctuation of about 4.6 meters (15 ft). She concludes that: 1) lithic scatters become less clustered through time, both due to loss of artifacts and transport by tidal actions; 2) in the six-week test period, virtually all the flakes became buried, mostly due to tidal sedimentary deposition; and 3) artifacts were preferentially moved not down slope, but rather up slope, toward shore.

These results cannot necessarily be transferred directly to other shores, especially those with different grain size or a predominantly erosional rather than depositional pattern. High energy storms may tend to move larger (but not smaller) clasts up and down slope on cobble and boulder beaches. Two of the three test sites were on large cobble or boulder beaches, where the artifacts would likely lodge between larger clasts before moving significant distances. Burial of the artifacts by wave or tidal action is also a possibility, although it would be difficult to discriminate from burial due to treatment. It is impossible to

defend one single reason explaining why only some of the specimens were recovered at the test locations.

Some of the recovered specimens were damaged. Three (specimen numbers RDH 89-1b, RDH 89-4b, and RDH 89-6c) were visibly chipped. Specimen 89-4b also was broken into two pieces, while RDH 89-1b also lost about one cm from the distal end. Specimen RDH 89-6c was battered into a much more rounded outline. The sources of the damage are not firmly identifiable. Two of the damaged artifacts come from Test Location #2, where wave exposure was medium or low, but this segment is the only one in which manual cleanup took place. The use of shovels and rakes to remove oiled rock and debris may account for the relatively greater artifact damage at Test Location #2.

Conclusions

The artifact discovery experiment accomplished only to a degree the three goals originally conceived: to provide preliminary scientific data about the efficacy and reliability of using non-archaeologists to assist in the identification of cultural resources; to provide information on the degree of disturbance suffered by surface artifacts as a result of the cleaning techniques; and to suggest additional ways to prevent harm to cultural resources during treatment of beaches oiled by the *Exxon Valdez*.

It seems unlikely that the replicated slate artifacts were recognized as prehistoric remains by cleanup crews. Manufactured of dark gray slate and covered with oil on an oily background, it is likely the artifacts were simply never seen. If so, one would infer that non-archaeologists should not be relied upon to locate archaeological sites.

Some, but not all, of the replicated artifacts were recovered after cleanup by professional archaeologists, despite the precise recording of locations. Failure to recover these specimens probably resulted from their transportation some distance from the original locations. Several possible transport agents have been suggested: wave and storm action, tidal fluctuation, and the mechanical effects of beach cleanup. Breakage of some of the specimens after placement was noted, but cannot be conclusively attributed to natural or cultural agents.

Summary of Substantive Contributions

Although its focus was on facilitating the oil spill treatment process, the site protection effort also collected some substantive information. Most of this was from the considerable number of new AHRS sites documented, more than doubling the size of the known site inventory in the oil spill area. Some of the more significant revelations include the confirmation of low prehistoric site densities in Prince William Sound, substantiation of a sizable prehistoric community on the Barren Islands, and documentation of additional villages on the outer Kenai Peninsula coast. Other substantive contributions include the mapping of intertidal features and artifacts at SEW-026 and SEW-072, and the execution of a pilot replicative experiment evaluating cleanup effects on intertidal artifact scatters. As with the site arrays resulting from most regional reconnaissance surveys, the full data potential of the newly-discovered site sample will only be realized over time.

Summary of Direct and Indirect Accomplishments

The EXXON VALDEZ Cultural Resource Program was successful in identifying archaeological and architectural sites in the oil spill area and minimizing disturbance from treatment activities. Extensive shoreline reconnaissance was conducted to identify cultural resources that could be at risk. The vulnerability of identified sites (as well as suspected buried sites) was assessed in relation to planned treatment, to determine potential effects on cultural resources. A variety of mitigative strategies was then employed to avoid disturbances to archaeological and architectural sites.

These direct accomplishments of the EXXON VALDEZ Cultural Resource Program were legally prescribed, but there are other indirect benefits which can be identified. Some of these include: increased international awareness of the utility of coastal resource inventories; expanded public perception of the significance of archaeological and architectural sites; increased cooperation among state and federal agencies in response to a cultural resource matter that encompassed many different public lands and agency jurisdictions; a more mutually shared appreciation for certain aspects of cultural resource management among the agency, academic, and applied components of the Alaskan cultural resource community; and an expanded data base for the purposes of both cultural resource management and substantive research. There now exists a model, developed and refined under emergency circumstances, for the protection of cultural resources during oil spill treatment operations.

Direct Accomplishments

Identification of Cultural Resources

Both archival research and field work were required to identify cultural resources potentially affected in the oil spill area. Although limited by the lack of a comprehensive inventory including all information possessed by federal agencies and Native groups, the EXXON VALDEZ Cultural Resource Program was able to make preliminary determinations of site presence with AHRS data. Reconnaissance-level field investigations were then used to confirm the presence or absence of sites. Realizing that cultural resource survey could not eliminate the possibility that cleanup crews would discover previously unknown sites, an educational program was developed to sensitize them to the potential for discovery of artifacts and features, and procedures were designed to immediately protect inadvertent discoveries and funnel information about finds into the cultural resource program.

Determination of Effect on Cultural Resources

Once the presence of cultural resources in a particular segment of shoreline was established, that information was used in conjunction with knowledge of the intended treatment methods to devise strategies for their protection. The relative significance of the cultural resource was not a factor in the level of protection afforded it, since the Advisory Council on Historic Preservation declared that -- given the emergency conditions and consequent lack of lead time -- all properties would be considered eligible to the National Register of Historic Places. An early programmatic "Finding of No Effect" was issued by the SHPO for some treatment circumstances, but -- because these circumstances occurred so rarely and required a rather confusing process for confirmation -- the Finding was not often cited for specific shoreline segments.

Instead, the reconnaissance level data were assembled along with archival information into a packet for each segment, and were used to support site protection recommendations made by the EXXON VALDEZ Cultural Resource Program. Those recommendations were first reviewed by the SHPO and -- when agreement was reached on the language -- forwarded to the ISCC. Recommendations were then made to the FOSC and eventually implemented by Exxon.

Mitigation of Impacts

Avoidance was the favored option among the variety of available mitigation options. Collection of artifacts was an option used sparingly to prevent site disturbance. Other mitigation options employed included on-site archaeological monitoring during treatment, education, artifact/site replication, and detailed mapping. The educational effort included a firm policy statement advising personnel that they would be dismissed if involved in deliberate disturbances to cultural properties, and that the relevant information would be passed on to state and federal enforcement authorities.

Using these mitigative strategies, the overall protection effort minimized disturbances to cultural resources while allowing treatment needed to protect the natural environment. Two cases of deliberate disturbance to cultural resources by oil spill personnel were confirmed; these are discussed as the Windy Bay and Knight Island Burial Cave incidents in the chapter, *Incident Reports*. The monitoring and post-cleanup assessment programs documented other vandalism in the oil spill area during the summer of 1989, but no firm association with oil spill personnel could be demonstrated. Other instances of minor impacts to cultural sites (primarily through inadvertent pedestrian activity over midden exposures) as a direct result of the oil spill treatment program were recorded, although agency activities contributed to some of these.

Indirect Consequences

The above summary of identification, determination of effect, and mitigation tasks considers points made in more detail elsewhere in this volume. Other consequences of the EXXON VALDEZ Cultural Resource Program (below) constitute indirect benefits of the site protection effort.

Cultural Resource Inventory in Coastal British Columbia

Because a considerable amount of the world's oil travels via tanker through international shipping lanes, there exists a multi-national collection of specialists that share technical information associated with major spills. Events on the scale of the Exxon Valdez accident or the wreck of the *Bahia Paraiso* in Antarctica attract worldwide attention to the possibilities of spill-related impacts on coastal environments, and expand global interest in oil spill contingency planning. In part prompted by the *Exxon Valdez* spill, the federal and provincial governments of Canada have begun a proactive cultural resource component in their oil spill contingency planning. Three contracts have been issued in British Columbia to inventory coastal archaeological sites for oil spill contingency planning, apparently in recognition that the absence of such baseline data is a liability when attempting to protect cultural resources in an emergency situation.

Public Awareness of Cultural Resource Management

Public interest in the oil spill was high during the treatment effort, with newspaper and radio articles focusing specifically on cultural resource efforts. The media attention devoted to archaeology gave journalists the opportunity to discuss the function of the EXXON VALDEZ Cultural Resource Program, and the quantity and quality of the archaeological staff. The types of cultural resources present in the oil spill area were often mentioned in detail, along with new discoveries such as the historic buoy bell. The significance to Alaskan heritage was emphasized, as well as the need to preserve the sites and artifacts intact for scientific retrieval and study. And, quite importantly, the laws and regulations protecting cultural resources were identified, as well as the consequences for violators.

Interagency Cooperation

Although the state and federal agencies charged with cultural resource responsibilities in Alaska have a long history of cooperation, the oil spill brought them together to address an emergency of unprecedented character and scope in Alaska. Overlapping responsibilities were evaluated and arrangements made to reduce redundancy. Tasks which did not routinely exist were identified and assumed by various parties. The consequent strengthening of communication between the agencies served the purpose of site protection very well within the oil spill cleanup effort.

Interaction Among the Archaeological Community

The general Alaska archaeological community has a history of collegiality similar to that of state and federal agencies with cultural resource responsibilities. However, there are many different perspectives and philosophies that can be brought to bear on cultural resource issues, and often the concerns of academic researchers, government cultural resource managers, indigenous peoples, and independent contractors and consultants are not mutually understood. The need to protect cultural re-

sources during the oil spill treatment effort provided a common concern that drew parties together in constructive ways, and helped create a shared perception regarding necessary actions.

The Expanded Data Base

The discovery of previously unknown archaeological and architectural sites, documenting their location and vulnerability to oil spill cleanup, was a critical element of the site protection program. Since all sites were deemed by the Advisory Council on Historic Places to be eligible to the National Register of Historic Places, (and thus legally significant, under federal law), the substantive information collected during the investigations is in a sense incidental to the site protection efforts. Information about the age, character, and location of the sites will be of great aid to land-managing agencies in developing site preservation strategies and programs.

Essential Elements of a Successful Program

Experience in developing and implementing a site protection effort such as this indicates that critical components include: 1) comprehensive cultural resource inventory information; 2) efficient communication with cleanup workers and supervisors in the field; and 3) effective cooperation with government agencies and others with roles in the site protection effort.

Comprehensive cultural resource inventory information is needed at the very beginning of an emergency site protection program. The necessity for comprehensive shoreline site inventory data to be collected (perhaps as a formal component of oil spill contingency plans) before spills take place is a major lesson to be learned from the cultural resource effort associated with the *Exxon Valdez* oil spill. State and federal agencies charged with managing those cultural resources on their lands were not able to provide high quality information about the presence and absence of archaeological and architectural sites along specific portions of shoreline (Vinson 1989:2). Furthermore, information about the location and nature of cultural resources inventoried under Section 14(h)1 of ANCSA, held by USFS, BIA, and CAC, was not made available to the SHPO or the EXXON VALDEZ Cultural Resource Program, as a matter of policy, "due to unresolved, controversial issues concerning land and data ownership" (Slaughter 1989:7), and other factors (Miraglia and Johnson 1990:3). Such circumstances could have put sites at more risk than was necessary. As with the need to conduct cultural resource inventories before emergencies occur, there would be advantages to working out programmatic information sharing agreements among cultural resource parties before the need for those agreements arises.

A second recommendation concerns education of cleanup personnel and the direct involvement of archaeologists in the field. Although video and print media were both used to sensitize personnel to the need for care in working around identified and undiscovered cultural resources, it is felt that the active presence of archaeologists in the field, emphasizing the message repeatedly, was the most effective means for ensuring that personnel understood and abided by the cultural resource regulations and laws.

A third important factor determining the relative success of a project such as this is the degree of interaction with the agencies responsible for monitoring compliance, and other concerned parties. Daily interaction with SHPO staff was critical to the timely development of site-specific mitigation strategies. Although faced with personnel shortages, government land-managing agencies set aside time to assist in the site protection program, and publicly announced their satisfaction with the site protection process (Gleeson 1989:4, Hall 1989). KANA, in a letter of June 27, 1989, echoed those sentiments. In general, however, CAC viewed the Section 106 process, as implemented by the government agencies, to be inadequate for addressing Native concerns, and a more provocative characterization appeared in an official publication of the regional corporation (CAC 1989:1,16). Similar reservations, in a broader context, have been raised over the years by Bacon (1989) and Gallagher (1988). The issue of satisfactory Native participation in the Section 106 process remains to be addressed by the Alaskan cultural resource community, working within the specific direction provided by the Advisory Council on Historic Preservation (1985).

Conclusion

The EXXON VALDEZ Cultural Resource Program, in cooperation with state and federal agencies, forged an effective site protection program amid an emergency oil spill cleanup effort of unprecedented size and scope. One of the first major tasks was to design and implement a reconnaissance level survey program to locate potentially affected archaeological and architectural sites, in the absence of adequate inventory data for the oil spill area. This information was then used to evaluate, with the SHPO, the degree of risk to cultural resources posed by specific treatment proposals. Constraints on treatment techniques for each shoreline segment were designed to protect both known and suspected cultural resources, and forwarded to the ISCC for review. Following ISCC review, the recommendations were sent to the FOSC for approval and subsequently implemented by Exxon Operations.

Mitigation options used during 1989 were diverse, the primary one being avoidance. Archaeologists monitored specific sites and crews during treatment of those sites considered to be most at risk. Artifacts were occasionally collected, and when warranted, site features were mapped in detail. An active educational program to inform cleanup personnel about the potential for cultural resource discoveries, the importance of following constraints, and the penalties for disturbance, was an important protection measure as well. Archaeologists responded with field inspections to individual incidents involving

such matters as unforeseen discoveries during cleanup and reported site disturbances. Exxon conducted post-cleanup assessment on a sample of cultural sites to evaluate the degree of disturbance. Although a number of cultural sites in the oil spill area were vandalized during 1989, only two incidents could be confirmed as the work of oil spill personnel. The large number of Exxon and agency archaeologists actively deployed in the field, plus their high visibility and authority, may in fact have lessened the amount of site vandalism in the region compared to prior years.

The cultural resource effort for the *Exxon Valdez* oil spill was a comprehensive cooperative endeavor involving many skilled researchers and others with various responsibilities and interests. The EXXON VALDEZ Cultural Resource Program, by working with these parties, minimized disturbances to cultural resources during the field effort of 1989, while at the same time allowing timely treatment efforts necessary to protect the natural environment.

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Appendix
Abbreviations and Acronyms

ADEC	Alaska Department of Environmental Conservation
ACC	Alaska Commercial Company
ACHP	Advisory Council on Historic Preservation
ADFG	Alaska Department of Fish and Game
ADNR	Alaska Department of Natural Resources
AEIDC	Arctic Environmental Information and Data Center
AHRS	Alaska Heritage Resource Survey
AOHA	Alaska Office of History and Archaeology
ANCSA	Alaska Native Claims Settlement Act
ARPA	Archaeological Resources Protection Act
BIA	Bureau of Indian Affairs
BLM	Bureau of Land Management
CAC	Chugach Alaska Corporation
CMT	Culturally modified tree
EPA	Environmental Protection Agency
FCR	Fire-cracked rock
FOSC	Federal On-Scene Coordinator
ISCC	Inter-agency Shoreline Cleanup Committee
KANA	Kodiak Area Native Association
LCV	Landing craft vessel
MAC	Multi-agency Committee
MOA	Memorandum of Agreement
MON	Monitoring
MOU	Memorandum of Understanding
NOAA	National Oceanic and Atmospheric Administration
NPA	National Park Service
OCSEAP	Outer Continental Shelf Environmental Assessment
PCA	Post-Cleanup Assessment
RAC	Russian American Company
RAT	Resource Assessment Team
RPO	Resource Protection Officer
SCAT	Shoreline Cleanup Assessment Team
SHPO	State Historic Preservation Office
USDA	US Department of Agriculture
USDI	US Department of the Interior
USFS	US Forest Service
USGS	US Geological Survey
USWFS	US Fish & Wildlife Service

EXXON VALDEZ OIL SPILL CLEANUP Control No. 89-412
Rev. 8

IN

PRINCE WILLIAM SOUND, THE GULF OF ALASKA AND BEYOND

MEMORANDUM OF AGREEMENT

WHEREAS, the Exxon Valdez Oil Spill (hereinafter referred to as the Oil Spill) is the focus of a massive cleanup effort (hereinafter referred to as the Effort) comprising both the overall cleanup operations (hereinafter referrred to as the Spill Response) and specific, localized physical and biological shoreline cleanup techniques (hereinafter referred to as Treatment), and

WHEREAS, the U.S. Coast Guard, Federal On-Scene Coordinator and lead Federal Agency (hereinafter referred to as the Coast Guard), pursuant to section 311 of the Federal Water Pollution Control Act, Executive Order 11735, and the National Contingency Plan (40 CFR Part 300) has recognized that the Effort may have an effect on prehistoric or historic districts, sites, buildings, structures, or objects (hereinafter referred to as Historic Properties) included in, or eligible for inclusion in, the National Register of Historic Places (hereinafter referred to as the National Register), and

WHEREAS, pursuant to the National Contingency Plan, the Coast Guard has requested the Forest Service, Chugach National Forest, U.S. Department of Agriculture (hereinafter referred to as the Forest Service) to properly advise and assist the Coast Guard in matters regarding the protection of Historic Properties, and

WHEREAS, the Coast Guard and the Forest Service have consulted with the Alaska State Historic Preservation Officer (hereinafter referred to as the SHPO), the Advisory Council on Historic Preservation (hereinafter referred to as the Council) and other interested parties concerning the preservation of Historic Properties, and

WHEREAS, the parties to this Agreement have agreed that the most appropriate means to provide protection for Historic Properties which may be affected by the Oil Spill or the Effort is to apply, as appropriate, the procedures set out in 36 CFR 800, which implement section 106 of the National Historic Preservation Act of 1966, as amended, and

WHEREAS, the Governor of Alaska declared the Oil Spill a disaster emergency under the authority granted by Alaska Statutes, Section 26.23.20, and

WHEREAS, the Spill Response operations have been conducted on an emergency basis with protection provided cultural resources through pre-Treatment surveys and consultation on Work Orders with the SHPO and the Interagency Shoreline

Cleanup Committees (hereinafter referred to as the ISCC) in Valdez, Seward, Homer and Kodiak, and

WHEREAS, the Oil Spill impact areas subject to pre-Treatment surveys, Spill Response operations and cultural resource protection are those shorelines, immediately adjacent uplands and open water areas in Prince William Sound and in the Gulf of Alaska and beyond, determined by the Coast Guard to be contaminated by the crude oil from the Exxon Valdez, and

WHEREAS, Exxon Company, U.S.A. (a division of Exxon Corporation), as contractor for Exxon Shipping Corporation, (hereinafter referred to as Exxon) is conducting Spill Response and Treatment activities under the coordination of the Federal On-Scene Coordinator, and

WHEREAS, Exxon currently is conducting Spill Treatment activities with due regard for the affected historical resources and in cooperation with the agencies having responsibility for said resources, and

WHEREAS, the unique Alaskan environmental conditions, numbers of concerned parties involved and lack of a viable data base may require that this Memorandum of Agreement (hereinafter referred to as the Agreement) be progressively revised, and

WHEREAS, the concurring parties and other Native corporations have been invited to consult and concur in the Agreement.

NOW, THEREFORE, the signatory parties agree that the Effort will be implemented with the following stipulations in order to take into account the effect of the Effort on Historic Properties.

A. GENERAL STIPULATIONS

1. For the purposes of this Effort and Agreement, all Historic Properties will be treated as being eligible for inclusion in the National Register. Necessity for rapid cleanup to minimize impacts to all resources precludes formal determinations of eligibility by any agency.

2. All archaeologists responsible for the identification, assessment of effect and mitigation will meet or exceed the minimum professional standards recommended by the Secretary of Interior (Federal Register, 9/29/83, 48:190, p. 44739).

B. SPECIFIC STIPULATIONS

The Coast Guard Will:

1. Direct Exxon's compliance with this Agreement so that the Shoreline Treatment Manual (hereinafter referred to as Appendix A), established on April 30, 1989, as amended, will be followed for the planning, execution and certification of the successful Treatment of shoreline contamination

from the Oil Spill. Changes in Appendix A will be made in consultation with the ISCC and the SHPO.

2. Direct Exxon's compliance with this Agreement respecting the development and implementation of a Work Plan (hereinafter referred to as Appendix B) for the Exxon Valdez Cultural Resource Program for the identification and protection of Historic Properties. Adverse effects will be minimized through data recovery where necessary within the Oil Spill impact area. Areas to be covered in Appendix B include the following:

a. Identification of sites through 1) a search of the published literature of the existing data base, 2) results of pre-Treatment reconnaissance surveys of shorelines and land based activities and 3) local sources of information.

b. Determination of the adequacy of documentation used to support Spill Response and mitigation recommendations will be evaluated by the SHPO (using the ISCC meetings for identification of disagreements on adequacy) in consultation with the adjacent upland owner or land managing agency. In cases judged inadequate by the SHPO, upland owner or land managing agency responsible for the property at issue, the Coast Guard will direct Exxon to gather supplementary data to reach an adequate level of identification or documentation of historic properties. Participation by private upland owners is discretionary on their part.

c. Review by the SHPO of all Shoreline Cleanup Program Assessments (hereinafter referred to as Block Assessments) prepared by Exxon, to evaluate the identification of sites and assessment of effects and Treatments to sites impacted by the Spill Response.

d. Review of the Block Assessments by the ISCC, in which the affected Native village or regional corporations have the opportunity to participate.

e. The regular monitoring of archaeological survey techniques, Treatment activities, and post-Treatment site conditions. This monitoring will be conducted by the Coast Guard, the Forest Service, Exxon, the SHPO and members of the ISCC.

f. The timely production and submittal of interim and final reports, conforming to the Secretary of the Interior's Standards and Guidelines (Federal Register, 9/29/83, 48:190, p. 44736-44737), as defined in the Work Plan.

3. Direct Exxon's compliance with this Agreement so that Exxon makes available to the SHPO the Cultural Resource Background Documentation for the various shoreline blocks and segments. This document transfer will occur at the time the

SHPO reviews each block to approve cultural resource recommendations or no less frequently than by the first and fifteenth of each month, whichever is most timely, to satisfy the State of Alaska Department of Natural Resources' (hereinafter referred to as the DNR) tidelands permit. After fieldwork is completed, revised copies of the Cultural Resource Background Documentation for the shoreline blocks and segments will be provided.

4. Direct Exxon's compliance with this Agreement so that as the survey, monitoring and post-assessment stages progress, Exxon provides copies of incremental submissions relating to shoreline blocks and segments to the SHPO as soon as they are generated. Access to photographs, videos and lists of artifacts will be provided as soon as possible, but not later than one month after approval for that segment's cleanup.

5. Direct Exxon's compliance with this Agreement so that Exxon follows the regulations of 36 CFR 296.18 regarding the requirements for confidentiality of archaeological resource information and for involving concerned Native groups in a timely manner.

6. Direct Exxon's compliance with this Agreement so that Exxon provides SHPO, and if requested, the responsible land owner or managing agency, with Shoreline Cleanup Assessment Team reports, field surveys and documentation at all command centers of data gathering (Valdez, Kodiak, Homer and Seward) when they are generated.

The Forest Service will monitor and advise the Coast Guard respecting Exxon's performance of its responsibilities under this Agreement, including Appendix B.

Exxon will:

1. Carry out Appendix B.

2. Make available to the SHPO the Cultural Resource Background Documentation for the various shoreline blocks and segments. This document transfer will occur at the time the SHPO reviews each block to approve cultural resource recommendations or no less frequently than by the first and fifteenth of each month, whichever is most timely, to satisfy the State of Alaska Department of Natural Resources' (hereinafter referred to as the DNR) tidelands permit. After fieldwork is completed, revised copies of the Cultural Resource Background Documentation for the shoreline blocks and segments will be provided.

3. As the survey, monitoring and post-assessment stages progress, provide copies of incremental submissions relating to shoreline blocks and segments to the SHPO as soon as they are generated. A copy of photographs, videos and lists of artifacts will be provided as soon as possible, but not later than one month after approval for that segment's cleanup.

4. Follow the regulations of 36 CFR 296.18 regarding the requirements for confidentiality of archaeological resource information and for involving concerned Native groups in a timely manner.

5. Provide the SHPO, and if requested, the responsible land owner or managing agency, with Shoreline Cleanup Assessment Team reports, field surveys and documentation at all command centers of data gathering (Valdez, Kodiak, Homer and Seward) when they are generated.

6. Exxon will provide the SHPO, land managing agency or upland owner, supplementary data to reach an adequate level of identification or documentation of historic properties in those cases where the SHPO, the upland owner or land managing agency, in consultation, determine that the documentation used to support Spill Response and mitigation recommendations is inadequate.

C. IT IS MUTUALLY AGREED AND UNDERSTOOD BY AND BETWEEN THE SAID PARTIES THAT:

1. To the extent of their respective authorities, all parties, other than Exxon will provide Exxon with the access, permits and supporting data necessary to expedite the Effort. Indexes or other finding aids of documents, photographs, videos, and artifacts will be made available to Exxon, the SHPO, and responsible landowners or managing agencies as they become available or are revised.

2. SHPO review of the Block Assessments and Work Orders will be done in an expeditious manner, waiving the standard DNR and 36 CFR 800 review periods.

3. Exxon shall enter into a curation agreement with the University of Alaska, Fairbanks for the housing and care of artifacts and records collected during the Effort, in keeping with 36 CFR Part 79.

4. Information and artifacts collected from lands selected under the provisions of Section 14(h)(1) of the Alaska Native Claims Settlement Act will be curated in a state of trust in a certified depository as arranged by the responsible Federal land manager in consultation with the affected Native corporation until ownership has been resolved.

5. Nothing in this Agreement shall be construed as holding any party responsible for the health and safety of the members of the others during any phase of the Effort.

6. Nothing in this Agreement is intended to modify in any manner the present cooperative programs of the parties with States, other public agencies or educational institutions.

7. All parties will execute this Agreement and carry out its provisions. This Agreement evidences that the Council has been afforded an opportunity to comment on the Effort and that consideration has been given to the effects of the Effort on Historic Properties.

8. At any time during implementation of measures stipulated in this Agreement, should any objection to any measure be raised by a member of the public or members of the ISCC, the Coast Guard, with the advice of the Forest Service shall take into account and consult as needed with the objecting party, the SHPO or the Council to resolve the objection.

9. Any party to this Agreement may request that the other signatories consider amending it. Amendments will be executed in the same manner as the original Agreement.

10. Any signatory party to this Agreement may terminate it by providing 30 days written notice to the other parties, provided that the other parties will consult during the period prior to termination to seek agreement on amendments or other action that would avoid termination. In the event of termination, the Coast Guard, with the advice of the Forest Service, will consult with interested persons, including the Council.

11. Unless terminated under the conditions set forth above, this Agreement and related plans shall remain in effect until the Coast Guard, in accordance with the National Contingency Plan, determines that the Spill Response has been completed. The Coast Guard will notify the Council of the determination.

IN WITNESS WHEREOF, the parties hereto have executed this Agreement as of the last date set out under SIGNATORY PARTIES below.

SIGNATORY PARTIES

U.S. Coast Guard
U.S Department of Transportation

D. E. [signature]
RADM David E. Ciancaglini, USCG
Federal On Scene Coordinator
Commander, Pacific Area

8 June 1990
Date

Forest Service, Chugach National Forest
U.S. Department of Agriculture

Bruce Van Zee
BRUCE VAN ZEE
Forest Supervisor

May 9, 1990
Date

Alaska Department of Natural Resources
Division of Parks and Outdoor Recreation

Judith E. Bittner — May 8, 1990
JUDITH BITTNER — Date
Alaska State Historic Preservation Officer

Exxon Company, U.S.A.
A Division of Exxon Corporation, as
Contractor for Exxon Shipping Corporation

[signature] — [illegible] 1990
OTTO R. HARRISON — Date
General Manager

Advisory Council on Historic Preservation

Robert D. Bush — 6/15/90
ROBERT D. BUSH — Date
Executive Director

CONCURRING PARTIES

National Park Service, Alaska Region
U.S. Department of the Interior

[signature] — 5/11/90
BOYD EVISON — Date
Regional Director

U.S. Fish and Wildlife Service, Region 7
U.S. Department of the Interior

p/p Walter O. Stieglitz — 5/9/90
WALTER O. STIEGLITZ — Date
Regional Director

Bureau of Indian Affairs, Alaska Area
U.S. Department of Interior

GEORGE A. WALTERS
Acting Area Director

5/22/90
Date

Chugach Alaska Corporation

MICHAEL CHITTICK
President

6/7/90
Date

CONSULTED PARTIES

Statewide Native Organization

Alaska Federation of Natives

Alaska Native Regional Corporations

The Aleut Corporation

Bristol Bay Native Corporation

Cook Inlet Region, Incorporated

Koniag, Incorporated

Alaska Native Village Corporations

Akutan Corporation

Atxam Corporation

Belkofski Corporation

Chaluka Corporation

Isanotski Corporation

King Cove Corporation

Ounalashka Corporation

Nelson Lagoon Corporation

Samak Corporation

Shumagin Corporation

St. George Tanaq Corporation

Tanadgusix Corporation

Unga Corporation

Bay View Corporation

Chignik Lagoon Native Corporation

Chignik River, Limited

Far West, Incorporated

Oceanside Corporation

Chenega Village Corporation

English Bay Corporation

Eyak Village Corporation

Port Graham Village Corporation

Tatitlek Village Corporation

Ninilchik Native Association, Incorporated

Seldovia Native Association, Incorporated

Afognak Native Corporation

Akhiok-Kaguyak, Incorporated

Leisnoi, Incorporated

Natives of Kodiak, Incorporated

Old Harbor Native Corporation

Ouzinkie Native Corporation

Other Native Organizations Consulted

Karluk IRA Traditional Council

Larson Bay Tribal Council

Kodiak Area Native Association

APPENDIX B

WORK PLAN FOR THE EXXON VALDEZ CULTURAL RESOURCE PROGRAM

7/27/89

This work plan, whose development, implementation, and revision (if necessary) has been or will be carried out under the supervision of the Coast Guard, applies, as appropriate, the procedures set out in 36 CFR Part 800, which implement section 106 of the National Historic Preservation Act, as amended. It provides details of the activities to be carried out by Exxon, under the direction of the Coast Guard with the advice of the Forest Service, pursuant to the Agreement. The Forest Service has developed the Agreement, and advises and assists the Coast Guard in its implementation. The implementation of the following procedures by Exxon is intended to identify and protect cultural properties per Stipulation B.2. (Coast Guard) of the Agreement, (Control No. 89-412).

IDENTIFICATION

Identification of known sites along shorelines that may be subject to Oil Spill Treatment is accomplished through examination of existing inventories, primarily the Alaska Heritage Resource Survey (AHRS) files maintained by the DNR. Requests have been made to other land-owning agencies and parties to provide any additional information not included in the AHRS files. Relevant data from existing inventories is provided to qualified Exxon archaeologists responsible for the field examination of the shoreline segments. The archaeologist serves on the Shoreline Cleanup Assessment Team (SCAT) at the pre-Treatment assessment stage identified in the Field Shoreline Treatment Manual and conducts necessary field examinations. Site specific data from existing inventories is provided only to qualified Exxon archaeologists who maintain its confidentiality. Exxon field crews (Treatment workers) or other contractors are not provided this information. Field data include maps and descriptions of the areas surveyed, detailed locations of the cultural resources found, and description of the resources sufficient to judge their susceptibility to cleanup impacts or other oil spill related activities. Should shore based facilities be required during subsequent Oil Spill Response or Treatment activities, intensive survey will be required in areas of proposed impact. Shoreline surveys are done at the reconnaissance level, using helicopter, boat or pedestrian means as appropriate. Subsurface testing during reconnaissance survey is limited to circumstances where environmental considerations suggest the likelihood of a buried site which is otherwise not confirmed by surface evidence. Investigations will be done according to standards published by the Secretary of the Interior (Federal Register, 9/29/83, 48:190, P. 44716).

DETERMINATION OF EFFECT

Cleanup of lightly oiled shorelines will have No Effect on cultural resources if certain conditions are met which are set forth in a letter of April 25 1989

from Judith E. Bittner, SHPO, to Vice Admiral C. E. Robbins, concerning a Finding of No Effect. When a Finding of No Effect is requested by the Coast Guard for a lightly oiled shoreline segment, the SHPO must be contacted prior to cleanup for concurrence. If an Oil Spill Treatment program is to be continued, the owner or manager of the immediately adjacent uplands will also be contacted for concurrence. Review of the determination of No Effect by the owner or manager of the adjacent uplands will be discretionary.

Treatment of more heavily oiled shorelines requires evaluation by a qualified Exxon archaeologist as part of the SCAT process. Specific shoreline Treatment techniques with appropriate constraints for cultural resources are then developed in consultation with the SHPO. If Oil Spill Treatment is to be continued, the land owner or land managing agency whose upland properties lie immediately adjacent to the shoreline to be cleaned will be consulted also. Consultations upon notification of constraint development is discretionary on the part of the adjacent land owner or land managing agency within a 24 hour period. Consultation is in part necessary to satisfy stipulations in the State's tidelands permit and in part necessary to address the concerns of adjacent upland owners and managers who are responsible for the protection and management of cultural resources that may extend into the uplands from the intertidal zone. Adequacy of the information and constraints for each shoreline segment is evaluated at that time and is approved by signature of the SHPO. Cleanup techniques and natural and cultural resource constraints for each segment are then reviewed by the Committees, and forwarded to the Federal On Scene Coordinator (FOSC) for approval.

MITIGATION

Mitigation techniques for cultural resources are identified as contraints for each individual shoreline segment, and are thus subject to approval by the SHPO, review by the Committees, and approval by the FOSC. Impacts may be mitigated by specific modifications to the Treatment techniques, avoidance of Treatment, monitoring of a site by an archaeologist during Treatment, or other approaches. The discovery of human remains in a continued Spill Response and Treatment effort will involve the documentation and notification of the appropriate land-owning agency, who will involve law enforcement and Native parties as appropriate. All steps necessary to avoid disturbance of human remains by Oil Spill related activities will be taken, as per the assessment and review process described above. When the reburial of human remains becomes necessary as a mitigative measure, Exxon will consult with the SHPO, Advisory Council, and appropriate Native corporation and land managing agency in determining a satisfactory solution to their disposition on a case by case basis.

Steps to be taken when heretofore unidentified cultural sites are discovered during Treatment are included in the Shoreline Treatment Manual. Oversight by members of the ISCC occurs at their discretion, with transportation provided by Exxon, and comments directed through the Coast Guard.

Reports on the cultural resource program shall follow standards and guidelines for archaeological and historic preservation as recommended by the Secretary of the Interior (Federal Register, 9/29/83, 48:190, pp. 44722-44723). A confidential interim report shall include descriptions of areas examined, resources documented, summaries of impacts on specific sites, and supporting maps. The final report shall be inclusive and will assess impacts to the cultural resources identified by the Spill Response operations. Specific site nature and location shall be included in appendix form.

Exxon shall file an interim report with the signatory and consulted parties to the Agreement not later than January 15, 1990. The final draft report, based upon the outline "A Tentative Report Outline for the EXXON VALDEZ Cultural Resource Program", prepared by Exxon's archeologist and dated July 27, 1989, shall be submitted no later than April 1, 1990 for comment and review. The SHPO, Coast Guard and Forest Service will complete their review and comment within 30 days. The final report shall be submitted no later than July 31, 1990.

7/31/89

Memorandum of Understanding

Cultural Resource Data Use and Review Procedures for Preparation of Segment Work Proposals

The signatory parties to this understanding agree to the following procedures concerning access to information, consultation among the parties, and input to the planning process to identify appropriate archaeological constraints for the segment Shoreline Cleanup Program signature sheet affecting cultural resources within the Chugach Alaska Corporation (CAC) region.

1. The Exxon Company, U.S.A. (Exxon) Shoreline Cleanup Assessment Team (SCAT) shall provide the parties, via the Interagency Shoreline Cleanup Committee (ISCC), with the tentatively identified regions for SCAT assessment approximately one week in advance of anticipated field surveys.

2. The Alaska Heritage Resources Survey (AHRS) files, shall be available for reference by CAC at the State Historic Preservation Office (SHPO) in Valdez.

3. CAC shall provide the SHPO and Exxon, in writing and with maps, all cultural resource information for the regions identified for SCAT assessment which is in its possession but not listed in the AHRS or BLM 14(h)(1) approved case files, to which Exxon already has access. This information shall be delivered to Exxon before SCAT surveys commence so the SCAT can use these data in the field. This information shall be marked confidential and will be used only for compliance purposes in the Exxon Valdez incident. It is understood that this information will be entered into the cultural resource inventories of the appropriate land-owning agency and the AHRS files.

4. The SCAT field surveys will take into account all information available from the AHRS and 14(h)(1) files, as well as input from the SHPO, USFS, and CAC. The SCAT field notes or the cultural resource evaluation supporting document cover sheet shall acknowledge the field observation, or lack thereof, of such input/data.

5. After the SCAT report is filed, Exxon shall develop recommendations to minimize cultural resource impacts in the segment work proposals based upon the total available data set.

6. The SHPO shall review each segment work proposal and the standardized information packet prepared by Exxon. The SHPO and Exxon shall discuss the recommended archaeological and treatment constraints to reach consensus.

7. At the conclusion of the consultation described in 6 above, Exxon shall provide the SHPO with three information packets for each proposed segment work plan consisting of items a-e listed below. SHPO shall insure that the USFS and CAC receive information packets in a timely manner.

a. Shoreline cleanup program signature sheet
b. Cultural resource evaluation form
c. Map showing segment location
d. Cultural resource evaluation supporting document cover sheet
e. SCAT archaeological field notes

8. Upon signing the shoreline cleanup program signature sheet(s) the SHPO shall deliver the sheet(s) to Exxon, which in turn shall sign them and make 14 copies for submission to the ISCC.

9. During the interim between receipt of an information packet and the ISCC meeting, at which that segment work plan is scheduled for approval, any party with a concern about the archaeological or treatment constraints in that proposed plan shall raise them with the other parties, as appropriate, with the intent of resolving any difference before the ISCC approval meeting.

10. Each party retains its individual rights to comment upon the proposed cultural resources constraints and treatments during the ISCC meeting at which the proposed work plan will be considered for approval.

11. Particular concerns of village corporations, and village and traditional councils within the Chugach Region, will be addressed by the CAC Oil Spill Response Team through the process provided in this MOU.

12. Any party to this understanding may withdraw its participation after 15 days written notice to the other parties.

Exxon Company, U.S.A.
(A Division of Exxon Corporation)
As Contractor for Exxon Shipping Co.

Date

United States Forest Service

Aug. 3, 1989
Date

Chugach Alaska Corporation

8-10-89
Date

State Historic Preservation Officer

Aug 9, 1989
Date

Appendix
Site Monitoring Summaries

Each site or group of sites that had a monitoring constraint or that was monitored for some other reason is reviewed in this appendix. The archaeological constraint approved by the ISCC is presented verbatim, although the letter and number designator for the segment (example: BG-03) is omitted to mask the location of the site. For the same reason, some place names are omitted from the constraint language. The monitoring activities and impact assessment are briefly described. Cases where incident reports were prepared or where post-cleanup assessment (PCA) was conducted are identified. In addition to the specific constraint listed, each segment had printed on its Shoreline Cleanup Program form the standard constraint, consisting of various versions of the following: "If heretofore undiscovered cultural materials are uncovered during cleanup, contact Exxon's Archaeological Field Director and take actions prescribed in the Operational Guidelines for Shoreline Cleanup dated 4/21/89 as amended."

AFG-001 (housepits)

Constraints: "No access above the active beach. Site should definitely be monitored by an archaeologist during cleanup."
Monitoring Activity: Exxon representative, cleanup supervisors, and NPS were notified of the constraints on 5/18/89. No work was undertaken at that time. Cleanup in the segment was monitored on 8/12/89. NPS Resource Protection Officers (RPOs) serving as bear guards restricted access to the uplands. AFG-001 was eroding with both artifacts and human skeletal material exposed. No signs of other disturbance were found. Site has been archaeologically tested in the past with several excavation units not backfilled. Removal of beach sediments had no effect on the upland site.
Dates: 5/18/89 (Knecht), 8/12/89 (Utermohle).
Assessment: No disturbance noted beyond natural erosion.

AFG-024 (midden), AFG-025 (midden and Russian settlement), and AFG-050 (Russian feature)

Constraints: "Inspection by an archaeological monitor is required while cleanup is conducted."
Monitoring Activity: None because no cleanup was done in the vicinity of the sites.
Dates: None.
Assessment: None.

AFG-026 (midden), AFG-027 (housepits), and AFG-143 (housepits)

Constraints: "Only one beach in this segment was ground-surveyed. If cleanup becomes necessary on any of the other beaches, a survey must first be conducted."
Monitoring Activity: Exxon representative and cleanup supervisor were briefed on constraints in the region on 7/19/89. On 7/28/89, vandalism to AFG-026 and AFG-027 was reported, and two monitors were dispatched the same day to evaluate it. Supervisors had flagged off both sites and kept cleanup crews from the area according to procedure. Damage was surveyed and photographs taken. On 8/4/89, an archaeological monitor and Exxon security inspected the contracted vessel F/V *Shearwater*, which had been in the vicinity of the disturbed sites, and questioned the crew (see incident report).
Dates: 7/19/89 (Dilliplane and Utermohle), 7/29/89 (Mack and Reanier), 8/4/89 (Knecht).
Assessment: All three sites suffered vandalism (and erosion) while cleanup activities were conducted in the area.

AFG-028 (midden)

Constraints: "Potential for disturbance of sensitive cultural resources balanced against degree of oiling argues against any cleanup. Monitor recommended if cleanup occurs."
Monitoring Activity: SCAT survey on 6/17/89 recorded erosion and recent vandalism in the form of holes and removed sod. The supervisor of boom tenders anchored in Kitoi Bay was informed. Monitoring on 8/1/89 revealed a recent hole 30 cm in diameter and 35 cm deep, near footprints, trampled grass, and a butane lighter.
Dates: 8/1/89 (Knecht and Utermohle).
Assessment: AFG-028 suffered vandalism before and during cleanup activities in the area (see PCA summaries).

AFG-029 (village)

Constraints: "If cleanup is conducted, inspection by an archaeological monitor is required during cleanup in the area of the salmon stream at the head of the bay."
Monitoring Activity: None because no cleanup was conducted.
Dates: None.
Assessment: None. SCAT survey recorded a hole dug into the site.

AFG-033 (housepits)

Constraints: "Inspection by an archaeological monitor is required during cleanup of the large bay at the east end of the segment."
Monitoring Activity: Cleanup was monitored on 8/10/89, with the USFWS archaeologist. No artifacts were observed in the intertidal zone.
Dates: 8/9/89 - 8/10/89 (Utermohle).
Assessment: Erosion was observed at AFG-033.

AFG-035 (midden), AFG-069 (housepit), AFG-070 (midden), and AFG-071 (housepits)

Constraints: "If cleanup is conducted, inspection by an archaeological monitor is required during cleanup."
Monitoring Activity: None because no cleanup was conducted.
Dates: None.
Assessment: None. SCAT survey found: a small test pit dug into AFG-035, no disturbance at AFG-069 or AFG-070, and a portion of the midden at AFG-071 eroding.

AFG-040 (cemetery)

Constraints: "Monitor required during cleanup activities."
Monitoring Activity: Cleanup was monitored by SHPO representative Dave McMahan. A monitor was also assigned on 7/11/89 to suggest possible approaches to mitigate natural erosion of cemetery.

Dates: 7/11/89 (Utermohle).
Assessment: Site is eroding. No disturbance to cemetery occurred during cleanup.

AFG-043 (village)

Constraints: "Archeological monitoring is required during cleanup. No cleanup activity should take place within 25 meters of wave cut terrace in south west half of segment. Cleanup crews are to remain on seaward side of drift wood piles."
Monitoring Activity: Exxon and NPS officials were briefed on constraints and policies on 5/18/89. Cleanup was monitored on 8/11/89. NPS RPOs serving as bear guards restricted access to uplands.
Dates: 5/18/89 (Knecht), 8/11/89 (Utermohle).
Assessment: Old vandalism noted in AHRS. During initial monitoring on 5/18/89, a small recent hole was discovered dug in the eroding midden of AFG-043. No disturbance occurred during cleanup on 8/11/89.

AFG-044 (midden)

Constraints: "If cleanup is conducted, an archaeological monitor is required."
Monitoring Activity: None because no cleanup was conducted.
Dates: None.
Assessment: None. SCAT survey on 6/23/89 observed erosion but no disturbance.

AFG-046 (village)

Constraints: "Site should be monitored during cleanup. Cleanup crew should be restricted to areas of oiled beach away from the eroded midden face."
Monitoring Activity: Initial monitoring occurred during SCAT survey of area on 5/24/89 - 5/25/89. Exxon representative and cleanup supervisor were informed of site and constraints prior to moving into region. Cleanup crew was restricted to the intertidal zone away from eroded portion of site, and was instructed on identification of artifacts and archaeological sites. After instruction, artifacts were retrieved from oiled debris bags, inventoried, and collected. From 7/12/89 - 7/14/89 the site was revisited and two cleanup crews in the vicinity were briefed on policies and restrictions. Cleanup was monitored and artifacts were retrieved from the intertidal zone. Artifacts and human skeletal material displaced through either natural erosion or human activity were replaced or reinterred at the base of the site. On the monitoring visit of 8/1/89, a vessel crew member was observed at the site, and there were signs of recent disturbance. The monitor reiterated to the Exxon representative the need to restrict access and the requirement for an archaeological monitor during any work. On 8/4/89, the monitor briefed the new Exxon representative and oversaw treatment of the re-oiled beach. On 8/20/89, the monitor briefed the Exxon representative in charge of a crew conducting a wide-ranging cleanup on the island. The condition of the site was videotaped at that time. No signs of recent disturbance were noted.
Dates: 5/24/89 - 5/25/89 (Knecht), 7/12/89 - 7/14/89 (Utermohle), 8/1/89 (Knecht and Utermohle), 8/4/89 (Utermohle and Wooley), 8/20/89 (Utermohle).
Assessment: Vandalism was first recorded at this site in 1983. Minor disturbance of eroded exposures was noted in early visits, and the site is actively eroding. Disturbance occurred while cleanup operations were being conducted in the region. Some artifacts were displaced (into oiled debris bags) by treatment activity, but were retrieved. An eroded portion of the site was heavily oiled but not treated due to its sensitive nature (see PCA summaries).

AFG-047 (housepits)

Constraints: "Inspection by an archaeological monitor is required during cleanup at north end of segment (Cape Current area)."
Monitoring Activity: Cleanup was monitored on 8/10/89, with the USFWS archaeologist.
Dates: 8/10/89 (Utermohle).
Assessment: No disturbance other than erosion was observed.

AFG-053 (midden) and AFG-072 (housepits)

Constraint: "If cleanup is conducted, an archaeological monitor is required in archaeologically sensitive areas of this segment."
Monitoring Activity: None because no cleanup was conducted.
Dates: None.
Assessment: None.

AFG-057 (housepits)

Constraint: "An archaeological monitor is required prior to and during any cleanup conducted in the inlet on the west end of segment."
Monitoring Activity: None because no cleanup was conducted.
Dates: None.
Assessment: None.

AFG-058 (midden) and AFG-059 (housepit)

Constraints: "An archaeological monitor is required during cleanup of beach area between Cape ... and north end of segment. No access to the forest/upland zone north of Cape ... by beach crews during cleanup."
Monitoring Activity: Cleanup was monitored.
Dates: 8/21/89 (Utermohle).
Assessment: AFG-058 was eroding into the intertidal zone, but there were no indications of disturbance. No work was conducted in the vicinity of the site.

AFG-060 (midden)

Constraints: "An archaeological monitor is required prior to and during any cleanup conducted in this segment."
Monitoring Activity: Cleanup was monitored, but it did not take place near the site. Additional survey was conducted.
Dates: 8/21/89 - 8/22/89 (Utermohle).
Assessment: No disturbance to cultural resources was observed.

AFG-064 (depressions) and AFG-102 (depressions)

Constraints: "No access to uplands."
Monitoring Activity: Crew was briefed on 7/10/89 concerning constraints and policies. Crew was revisited and briefed on 7/12/89.
Dates: 7/10/89 (Abbott), 7/12/89 (Utermohle).
Assessment: No disturbance was observed at the site.

AFG-065 (village), AFG-066 (midden), AFG-067 (Russian camp), AFG-076 (housepits), and AFG-077 (housepits)

Constraints: "Inspection by archaeological monitor required prior to and during cleanup activities in this segment. No access to the forest/upland zone by beach crews during cleanup."
Monitoring Activity: Cleanup was monitored on 8/13/89. Due to the close supervision of the crew, most sites in the area were visited only if cleanup was done there. No cleanup was required at AFG-067 although the site was visited. Oiled shore in front of the eroding midden at AFG-077 was surveyed, with no artifacts located in the intertidal zone.
Dates: 8/13/89 (Utermohle).
Assessment: Portions of AFG-067 and AFG-077 are eroding; no other degradation was observed.

AFG-074 (housepits) and AFG-075 (housepits)

Constraints: "If cleanup is conducted, an archaeological monitor is required prior to and during cleanup activity in this segment."
Monitoring Activity: None because no cleanup was conducted.
Dates: None.

Assessment: None. SCAT survey observed vandalism in the form of a number of holes dug into AFG-074. The condition of AFG-075 was not noted.

AFG-081 (depressions), AFG-082 (depressions), AFG-116 (depressions), and AFG-151 (housepit)

Constraints: "Monitor required if cleanup is conducted in the bay at the south end of the segment."
Monitoring Activity: Region was monitored on 9/1/89, with SHPO representative Dave McMahan. No cultural resources were found near the cleanup. Cleanup in June, prior to SCAT survey and issuance of work order, was monitored by State Parks Ranger Dave Caylor.
Dates: 7/23/89 (Utermohle), 9/1/89 (Utermohle).
Assessment: Caylor on 7/23/89 observed some disturbance of sites, but was unable to determine its origin. Vandalism was recorded at AFG-081 in 1983. No evidence of disturbance was observed in September.

AFG-083 (housepit)

Constraints: "An archaeological monitor is required during cleanup in this segment."
Monitoring Activity: Segment was monitored, but no cleanup was conducted near the site. Region was independently monitored by Alaska State Parks staff stationed in Big Bay.
Dates: 9/1/89 (Utermohle), 9/3/89 (Utermohle).
Assessment: No evidence of site disturbance was observed.

AFG-085 (midden)

Constraints: "Inspection by archaeological monitor recommended during cleanup of northeast 1/3 of the segment, to recommend on-site avoidance procedures that minimize disturbance to archaeologically sensitive areas."
Monitoring Activity: Crew was briefed on 7/10/89 concerning constraints and policies. Crew was revisited and briefed on 7/12/89 for monitoring, but they were leaving the area. On 8/20/89 the site was visited with an Exxon representative to identify sensitive areas should cleanup be continued.
Dates: 7/10/89 (Abbott), 7/12/89 (Utermohle), 8/20/89 (Utermohle).
Assessment: No evidence of site disturbance was observed beyond natural erosion noted by site discoverers in 1983, SCAT survey on 6/25/89, and visit on 8/20/89.

AFG-086 (housepits) and AFG-160 (housepits)

Constraints: "Inspection by archaeological monitor recommended during cleanup of Beach #1 to recommend on-site avoidance procedures that minimize disturbance to archaeologically sensitive areas."
Monitoring Activity: Crew was briefed on 7/10/89 concerning constraints and policies. A new site was documented during monitoring. Crew was revisited on 7/12/89 for monitoring but they were leaving the area. On 8/20/89 the site was visited with an Exxon representative to identify sensitive areas should cleanup be continued.
Dates: 7/10/89 (Abbott), 7/12/89 (Utermohle), 8/20/89 (Utermohle).
Assessment: No evidence of site disturbance beyond erosion was recorded at AFG-086 in 1983, during SCAT survey on 6/26/89, or by monitoring visit on 8/20/89. Minor erosion was recorded at AFG-160.

AFG-091 (housepit)

Constraints: "If cleanup is planned, a full archaeological assessment of this segment must be conducted."
Monitoring Activity: None because no cleanup was conducted.
Dates: None.
Assessment: None.

AFG-093 (housepit) and AFG-111 (artifact scatter)

Constraints: "Inspection by archaeological monitor recommended during cleanup of archaeologically sensitive portions of the segment. No access to upland zone by beach crews during cleanup."
Monitoring Activity: Treatment was monitored on 8/23/89, with a crew briefing, and again on 8/25/89.
Dates: 8/23/89 (Abbott), 8/25/89 (Abbott).
Assessment: No evidence of site disturbance was noted (see PCA summaries).

AFG-096 (isolated artifact)

Constraints: "Inspection by an archaeological monitor is recommended while cleanup is conducted."
Monitoring Activities: Exxon representatives were briefed on 7/30/89 concerning archaeological constraint in the segment. The segment consisted of an isolated artifact on the beach, and was cleaned without the monitor on-site.
Dates: 7/30/89 (Moss and Reanier).
Assessment: No data; PCA was attempted on 8/27/89 but the aircraft was unable to land.

AFG-097 (village), AFG-112 (housepits), and AFG-114 (housepit)

Constraints: "An archaeological monitor is required during cleanup in this segment."
Monitoring Activity: Region was monitored on 6/4/89 during initial cleanup, at which time AFG-097 was recorded and 12 artifacts were collected from the intertidal zone. SCAT survey on 8/11/89 discovered new sites AFG-112 and AFG-114, neither of which was disturbed. Region was monitored during final treatment on 9/1/89 and 9/3/89, with no cleanup conducted near the sites. Region was independently monitored during the summer by Alaska State Parks staff stationed in Big Bay.
Dates: 6/4/89 (Knecht), 8/11/89 (Wooley), 9/1/89 and 9/3/89 (Utermohle).
Assessment: No disturbance was noted at AFG-112 and AFG-114. Disturbance of housepits by prior recreational camping was observed at AFG-097.

AFG-104 (midden) and AFG-105 (midden)

Constraints: "Archaeological monitor required during cleanup of some parts of the eastern and western portions of the segment."
Monitoring Activity: Segment was not monitored.
Dates: None.
Assessment: (see PCA summaries).

AFG-117 (housepits) and AFG-118 (midden)

Constraints: "Archaeological monitor required during cleanup of beach adjacent to AFG-117. No access by beach crews to uplands."
Monitoring Activity: Cleanup of archaeologically sensitive areas was monitored on 8/30/89. NPS RPOs serving as bear guards restricted access to uplands.
Dates: 8/30/89 (Utermohle).
Assessment: No disturbance was observed (see PCA summaries).

AFG-120 (housepit) and AFG-123 (midden)

Constraints: "Archaeological monitor is required during cleanup in Beach 5 area at west end of segment. An archaeological monitor is also required in Beach 1 area if cleanup is planned in this area of the segment. No access to forest/upland zone by beach crews during cleanup."
Monitoring Activity: Crew was visited by the monitor on 8/4/89. USFWS archaeologist monitored cleanup. No cleanup was performed near the sites.
Dates: 8/4/89 (Utermohle).
Assessment: No disturbance was observed beyond erosion at AFG-123 (see PCA summaries).

AFG-122 (midden)

Constraints: "If cleanup is conducted' inspection by an archaeological monitor is required during cleanup in western third of segment."
Monitoring Activity: None because no cleanup was conducted.
Dates: None.
Assessment: AFG-122 was eroding into intertidal zone (see PCA summaries).

AFG-128 (village) and AFG-129 (village)

Constraints: "If cleanup is planned for this segment, an archaeological monitor must be assigned for specific sections within this segment."
Monitoring Activity: Task force was briefed on constraints in segment on 8/4/89. On 8/5/89, fresh vandalism was discovered during pre-cleanup videotaping of site. Observation on the night of 8/5/89 failed to identify culprits (see incident report). Condition of AFG-129 was videotaped on 8/5/89, 8/13/89, and 8/27/89 and AFG-128 on 8/29/89. No cleanup was conducted in the segment.
Dates: 8/4/89 (Utermohle and Wooley).
Assessment: SCAT survey on 7/13/89 - 7/14/89 documented signs of old and recent vandalism at AFG-129. No cleanup was conducted in the segment. Both sites were subject to erosion. Continued monitoring showed no additional disturbance (see incident report and PCA summaries).

AFG-132 (housepits)

Constraints: "No archaeological constraint prepared as segment was not surveyed as part of SCAT process."
Monitoring Activity: Monitor briefed Exxon and Coast Guard representatives of policies on 7/30/89, and surveyed for cultural resources. Crews were kept away from the site.
Dates: 7/30/89 (Moss and Reanier).
Assessment: The site was eroding but otherwise undisturbed.

AFG-136 (cannery), AFG-140 (cannery), AFG-141 (midden), and AFG-147 (cannery)

Constraints: "No archaeological constraint prepared as segment was not surveyed as part of SCAT process."
Monitoring Activity: Monitor briefed Exxon and Coast Guard representatives of constraints and policies on 7/20/89, and recorded AFG-141 while the shore was cleaned. On 7/30/89, the monitor returned during cleanup in the region and recorded three new sites.
Dates: 7/20/89 (Erlandson, Moss, and Utermohle), 7/30/89 (Moss).
Assessment: No evidence of disturbance was noted at AFG-141 beyond erosion. AFG-136 had been vandalized prior to recording. No data were collected on the condition of the other two sites.

AFG-137 (housepits) and AFG-154 (housepits)

Constraints: "No archaeological constraint prepared as segment was not surveyed as part of SCAT process."
Monitoring Activity: Monitor inspected cleanup.
Dates: 7/30/89 (Moss).
Assessment: No evidence of disturbance was noted at AFG-154; no data are available on the condition of AFG-137.

AFG-138 (housepits) and AFG-139 (housepits)

Constraints: "No archaeological constraint prepared as segment was not surveyed as part of SCAT process."
Monitoring Activity: Monitor briefed cleanup supervisors on policy, and located two new sites. No cleanup was done near the sites.
Dates: 7/20/89 (Erlandson, Moss, and Utermohle).
Assessment: Both sites were eroding and showed past human disturbance. Set net cabins are in the area.

AFG-162 (cabin) and AFG-163 (midden)

Constraints: "If cleanup is planned, an archaeological monitor will have to be assigned in archaeologically sensitive portions of the segment."
Monitoring Activity: Monitor briefed Exxon representatives on constraints in the segment. No cleanup was done in the segment.
Dates: 7/30/89 (Moss and Reanier).
Assessment: No data were collected on site condition; PCA was attempted 8/27/89, but aircraft could not land.

KAR-001 (village)

Constraints: "Standard constraint in force as segment did not have SCAT assessment prior to cleanup."
Monitoring Activity: Monitor discussed policies with Native crew leader, and distributed policy hand-outs.
Dates: 7/2/89 (Jordan).
Assessment: No data were collected on site condition.

KAR-016 (village), KAR-092 (village), KAR-094 (housepit), KAR-095 (housepit), KAR-097 (housepits), KAR-100 (monument), KAR-115 (housepits), and KAR-125 (depression)

Constraints: "If cleanup is conducted, an archaeological monitor should be present during cleanup of the northwest 1/3 of the segment."
Monitoring Activity: The monitors briefed the Native crew working in the area on 6/4/89, and the VECO crew on 6/22/89.
Dates: 6/4/89 (Wooley and Yarborough), 6/22/89 (Jordan).
Assessment: No evidence of disturbance was observed at KAR-016 or KAR-097. No data were collected on remaining sites (see PCA summaries).

KAR-017 (housepits) and KAR-101 (housepits)

Constraints: "Cleanup crews anchored in the northeast arm of the lagoon should be restricted to the active beach."
Monitoring Activity: Native crew was briefed by the monitor on 6/4/89. VECO crew was briefed on 6/22/89.
Dates: 6/4/89 (Wooley and Yarborough), 6/22/89 (Jordan).
Assessment: On 6/4/89, KAR-017 was eroding and evidence of old vandalism was visible. Footprints across the midden face from cleanup workers traversing the site were evident. No data were collected on the condition of KAR-101 (see PCA summaries).

KAR-098 (tent rings)

Constraints: "If cleanup is planned, a cultural resource assessment should be completed."
Monitoring Activity: Segment was cleaned without cultural resources assessment. The monitors briefed a Native crew working in the area on 6/4/89, and a VECO crew on 6/22/89.
Dates: 6/4/89 (Wooley and Yarborough), 6/22/89 (Jordan).
Assessment: No data were collected on site condition.

KAR-099 (cabin)

Constraints: "If cleanup is planned, a cultural resource assessment should be completed."
Monitoring Activity: Segment was cleaned without cultural resources assessment. Monitors briefed a Native crew working in the area on 6/4/89, and a VECO crew on 6/22/89.
Dates: 6/4/89 (Wooley and Yarborough), 6/22/89 (Jordan).
Assessment: No data were collected on site condition.

KAR-112 (cabin), KAR-121 (artifact scatter), KAR-122 (artifact scatter), and KAR-128 (village)

Constraints: "Inspection by an archaeological monitor is required in the southern half of the segment, including the small island offshore."

Monitoring Activity: No monitoring was conducted. NPS RPOs served as bear guards with cleanup crews, but whether cleanup occurred in the restricted region was not recorded.
Dates: None.
Assessment: Three new sites were observed eroding by SCAT survey of 7/10/89. No monitoring data exist for site condition (see PCA summar-ies).

KAR-113 (housepit)

Constraints: "Archaeological monitor required during cleanup of some parts of this segment."
Monitoring Activity: Monitor briefed a Native crew working in area on 6/4/89. Cleanup was monitored on 6/22/89.
Dates: 6/4/89 (Wooley and Yarborough), 6/22/89 (Jordan).
Assessment: KAR-113 was eroding at time of SCAT survey, but no further disturbance was observed during monitoring.

KAR-114 (housepits)

Constraints: "No access above the active beach zone."
Monitoring Activity: Monitors briefed a Native crew working in the area on 6/4/89, and a VECO crew on 6/22/89.
Dates: 6/4/89 (Wooley and Yarborough), 6/22/89 (Jordan).
Assessment: No data were collected on site condition.

KAR-116 (cabin)

Constraints: "Post-cleanup archaeological assessment required."
Monitoring Activity: None.
Dates: None.
Assessment: See PCA summaries.

KOD-001 (village) and KOD-400 (village)

Constraints: "Inspection by an archaeological monitor is required during cleanup in area of Beach #2."
Monitoring Activity: None. Segment was cleaned before issuance of the work order and without benefit of archaeological monitoring.
Dates: None.
Assessment: None.

KOD-032 (midden)

Constraints: "If cleanup is conducted, an archaeological monitor is required during cleanup."
Monitoring Activity: None because no cleanup was conducted.
Dates: None.
Assessment: None.

KOD-074 (village), KOD-199 (Russian site), KOD-386 (midden), KOD-387 (housepits), KOD-388 (midden), KOD-389 (midden), and KOD-090 (midden)

Constraints: "Inspection by an archaeological monitor is required while cleanup is conducted."
Monitoring Activity: None. Segment was cleaned before issuance of the work order and without benefit of archaeological monitoring.
Dates: None.
Assessment: SCAT survey on 7/22/89 recorded erosion at KOD-386, KOD-387, KOD-388, and KOD-389.

KOD-075 (housepits)

Constraints: "If cleanup is planned, inspection by an archaeological monitor is required in this segment."
Monitoring Activity: None because no cleanup was conducted.
Dates: None.
Assessment: None.

KOD-076 (midden)

Constraints: "Inspection by an archaeological monitor is required prior to and during cleanup."
Monitoring Activity: None. Segment was cleaned before issuance of the work order and without benefit of archaeological monitoring.
Dates: None.
Assessment: None.

KOD-077 (housepits), KOD-393 (housepits), KOD-396 (historic artifacts), and KOD-397 (cannery)

Constraints: "Inspection by an archaeological monitor is required prior to and during cleanup."
Monitoring Activity: KOD-077 was inspected after cleanup by a Native crew.
Dates: 7/31/89 (Erlandson and Moss).
Assessment: Historic sites KOD-393 and KOD-397 had been recently disturbed when recorded by the SCAT survey on 7/27/89. All the sites were eroding. KOD-077 was undisturbed when observed by the monitor.

KOD-078 (housepits) and KOD-080 (village)

Constraints: "Inspection by an archaeological monitor is required prior to and during cleanup."
Monitoring Activity: Monitors briefed Native crew on 7/31/89, after cleanup.
Dates: 7/31/89 (Erlandson and Moss).
Assessment: No data were collected on site condition.

KOD-079 (rockshelter)

Constraints: "Inspection by an archaeological monitor is required during cleanup."
Monitoring Activity: Monitors briefed Native crew on 7/31/89, after cleanup.
Dates: 7/31/89 (Erlandson and Moss).
Assessment: No data were collected on site condition.

KOD-111 (camp)

Constraints: "Inspection by archaeological monitor required during cleanup."
Monitoring Activity: None because no cleanup was conducted.
Dates: None.
Assessment: None.

KOD-114 (housepits), KOD-115 (midden), and KOD-116 (housepits)

Constraints: "Inspection by an archaeological monitor is required due to the archaeologically sensitive nature of this segment."
Monitoring Activity: Monitor briefed Native crew on 7/31/89, simultaneous with SCAT survey, while cleanup was proceeding.
Dates: 7/31/89 (Erlandson and Moss).
Assessment: At KOD-116, oil cleanup gloves were found resting on the eroding midden face and some cobbles were stacked on logs at the base of the talus slope. Both KOD-115 and KOD-116 were suffering from erosion.

KOD-118 (midden), KOD-119 (midden), KOD-120 (midden), KOD-121 (midden), and KOD-122 (midden)

Constraints: "Inspection by an archaeological monitor is required during cleanup of this segment. No access to beach ridge/upland zone by beach crews during cleanup."
Monitoring Activity: None. Segment was cleaned without benefit of monitoring.
Dates: None.
Assessment: SCAT survey found two new sites deflated into the intertidal zone.

KOD-223 (village), KOD-238 (midden), KOD-251 (housepits), KOD-401 (midden), and KOD-402 (housepits)

Constraints: "If cleanup is planned, an archaeological monitor must be assigned in culturally sensitive areas of the segment."
Monitoring Activity: None because no cleanup was conducted.
Dates: None.
Assessment: SCAT survey determined that all five sites in the segment were eroding. KOD-223 and KOD-402 showed recent disturbance, with KOD-223 having considerable vandalism (See PCA summaries).

KOD-241 (housepits)

Constraints: "If cleanup is planned, inspection by an archaeological monitor is required in the archaeologically sensitive portion of the segment."
Monitoring Activity: None because no cleanup was conducted.
Dates: None.
Assessment: None.

KOD-246 (housepits)

Constraints: "If cleanup is planned, inspection by an archaeological monitor is required in this segment."
Monitoring Activity: None because no cleanup was conducted.
Dates: None.
Assessment: SCAT survey found the site to be undisturbed.

KOD-247 (midden)

Constraints: "Standard constraint."
Monitoring Activity: Monitor briefed crews on constraints and policies on 7/9/89.
Dates: 7/9/89 (Utermohle).
Assessment: No change in condition from that observed by SCAT survey; site is severely eroding adjacent to set netters' cabins.

KOD-249 (midden)

Constraints: "If cleanup is planned, inspection by an archaeological monitor is required in archaeologically sensitive portions of this segment."
Monitoring Activity: None because no cleanup was conducted.
Dates: None.
Assessment: KOD-249 was eroding onto beach. No other disturbance was noted.

KOD-252 (housepits), KOD-253 (housepits), KOD-254 (housepits), KOD-403 (housepit), and KOD-413 (midden)

Constraints: "No access to the forest/upland zone by beach crews during cleanup."
Monitoring Activity: Monitor briefed cleanup crews on cultural resource policy on 7/9/89 and 7/10/89.
Dates: 7/9/89 - 7/10/89 (Utermohle).
Assessment: Four of the sites were eroding at the time of SCAT survey, and both KOD-252 and KOD-254 showed signs of human disturbance. No data were collected on site condition.

KOD-255 (housepits), KOD-414 (housepits), and KOD-415 (midden)

Constraints: "No access to the forest/upland zone by beach crews during cleanup."
Monitoring Activity: Monitor briefed cleanup crews in the region on cultural resource policy on 7/9/89 and 7/10/89.
Dates: 7/9/89 - 7/10/89 (Utermohle).
Assessment: All three sites were eroding at the time of SCAT survey. No disturbance was observed by the monitor.

KOD-277 (midden) and KOD-292 (midden)

Constraints: "If cleanup is planned, a full archaeological assessment must be conducted due to the archaeologically sensitive nature of this segment."
Monitoring Activity: None because no cleanup was conducted.
Dates: None.
Assessment: KOD-277 appeared stable and KOD-292 was eroding at time of SCAT survey.

KOD-289 (midden), KOD-290 (midden), and KOD-291 (midden and housepits)

Constraints: "If cleanup is planned, no access to the forest/upland zone by beach crews during cleanup."
Monitoring Activity: Monitor discussed regional archaeology with local set netters cleaning segment.
Dates: 7/8/89 (Knecht and Utermohle).
Assessment: No data were collected on site condition.

KOD-303 (midden)

Constraints: "Area not surveyed as part of SCAT process. Standard constraint in effect."
Monitoring Activity: Monitor briefed road crews on cultural resource policies.
Dates: 6/29/89 (Jordan).
Assessment: Monitor observed that KOD-303 had been recently vandalized. AHRS indicates old vandalism.

KOD-368 (village) and KOD-376 (midden)

Constraints: "Area not surveyed as part of SCAT process. Standard constraint in effect."
Monitoring Activity: Road crews were briefed on cultural resource policies on 6/29/89. KOD-376 was recorded while monitoring cleanup.
Dates: 6/29/89 - 6/30/89 (Jordan), 7/1/89 (Knecht).
Assessment: KOD-376 erosion of accelerated by off-road vehicle traffic. KOD-368 appeared to have considerable evidence of old vandalism, and some new vandalism.

KOD-409 (housepit) and KOD-427 (rockshelter)

Constraints: "Standard constraint in effect as no SCAT survey conducted before cleanup in region."
Monitoring Activity: Monitor briefed cleanup crews during cleanup on 7/10/89. Copies of archaeological guidelines were posted on berthing ships. Cleanup crew had found an archaeological site (KOD-409) and a human skeleton under a rock overhang (KOD-427) the previous day. Appropriate field procedures were followed although notification did not reach SCAT Kodiak office. Crews were restricted from areas and officials at Exxon Command Center in Kodiak were notified (see incident report). Monitor recorded KOD-409 and visited location of rockshelter (KOD-427) from which the skeleton had been disinterred (at the request of the Alaska State Troopers). KOD-427 was inspected on 7/31/89 with SHPO representative David McMahan, but no pedestrian survey was possible.
Dates: 7/10/89 (Utermohle), 7/31/89 (Knecht and Utermohle).
Assessment: KOD-409 was eroding but there were no signs of other disturbance. The skeleton was removed from KOD-427 as a forensic case at the request of the Alaska State Troopers. Identification as prehistoric did not occur until remains were examined in Anchorage. Photographs obtained from the Alaska State Troopers confirm the prehistoric nature of the burial. Site and context were totally removed during disinterment.

KOD-416 (midden), KOD-417 (midden), and KOD-426 (midden)

Constraints: "Restrict cleanup personnel from known archaeological sites."
Monitoring Activity: Cleanup supervisors were briefed on constraints by the monitor, with copies of the policy and educational videos distributed to supervisors on the two berthing vessels. Return monitoring visit on 7/19/89 indicated no cleanup activity planned for the segment.

Dates: 7/17/89 (Utermohle), 7/19/89 (Dilliplane and Utermohle).
Assessment: All three sites were eroding, with KOD-416 displaying old archaeological test units.

SEL-129 (village)

Constraints: "Site should be monitored during cleanup. Access to uplands should be restricted. Uplands should not be used as an equipment staging area or helipad."
Monitoring Activity: Monitoring planned by the SHPO representative to fulfill constraint was not done because of scheduling changes.
Dates: None.
Assessment: See PCA summaries.

SEL-179 (housepit, midden, CMTs, and intertidal artifacts) and SEL-180 (midden)

Constraints: "Archaeological monitor to be present during cleanup."
Monitoring Activity: An incident of artifact collection was investigated (see incident report). The sites were mapped and the segment was intensively surveyed several times. Construction of a helicopter fuel bladder was overseen.
Dates: 5/7/89, 5/18/89 - 5/26/89, 5/28/89 - 5/31/89, 6/16/89, 6/21/89 (Mack).
Assessment: No disturbance was observed during monitoring (see PCA summaries).

SEL-181 (refuge/midden)

Constraints: Originally the standard constraint was in effect. After a cultural site was reported by CAC, flexible monitoring requirements were agreed upon.
Monitoring Activity: The site was mapped, photographed, and described prior to cleanup, and three artifacts were collected from the intertidal zone. Adherence to constraints during cleanup was monitored.
Dates: 6/11/89 - 6/13/89, 6/22/89 (Mack).
Assessment: Rapid erosion was observed on the periphery of the site, but no disturbance was noted.

SEL-196 (artifact scatter)

Constraints: "Inspection by an archaeological monitor is required during cleanup of Site A."
Monitoring Activity: The monitor observed bioremediation in the site vicinity.
Dates: 8/20/89, 8/22/89 (Ludwig).
Assessment: No disturbance to the site was observed.

SEL-197 (artifact scatter)

Constraints: "Inspection by an archaeological monitor is required during cleanup at Site H".
Monitoring Activity: Monitor oversaw beach cleanup and briefed the crew concerning policy.
Dates: 8/31/89, 9/2/89 (Ludwig).
Assessment: No disturbance to the site was observed.

SEL-200 (artifact scatter and drowned CMTs) and SEL-201 (artifact scatter)

Constraints: "Potential damage to cultural resources argues against cleanup".
Monitoring Activity: The monitor saw that cleanup was not in recorded site areas and that no new sites were present.
Dates: 8/27/89 - 8/28/89 (Ludwig).
Assessment: These two sites have subsided and both are being rapidly eroded by wave action. No disturbance to the sites was observed.

SEL-202 (staircase and industrial debris)

Constraints: "Archaeological monitor required for Beach A."
Monitoring Activity: Crew was prevented from exploring the locally well-known World War II observation post.
Dates: 8/27/89 , 8/29/89 - 8/31/89 (Ludwig).
Assessment: No disturbance to the site was observed.

SEL-207 (village)

Constraints: "Archaeological monitor to be present during cleanup. Cleanup not to include disturbance of beach gravel."
Monitoring Activity: The segment was intensively resurveyed, and shovel skimming of oiled beach sediments was monitored.
Dates: 5/19/89, 6/16/89 (Mack).
Assessment: No disturbance of the site was observed (see PCA summaries).

SEW-004 (rockshelter) and SEW-481 (rockshelter)

Constraints: "No cleanup or access allowed in that portion of the segment from the light to the offshore rocks 2/5 of a mile to the south. Restrict access to uplands during cleanup operations."
Monitoring Activity: Sites were inspected frequently by the monitor observing cleanup in adjacent units. Both rockshelters were documented and mapped. A single cobble spall was collected from SEW-481 during monitoring.
Dates: 7/23/89 - 8/15/89 (Gallison; Gallison and Phippen).
Assessment: Vandalism at SEW-004 during monitoring was noted (see incident report and PCA summaries).

SEW-019 (Old Chenega Village) and SEW-039 (church)

Constraints: "No cleanup recommended due to visibility and fragility of Old Chenega Village remains. If cleanup is conducted, an archaeological monitor is required." The site straddled two segments, and for one the constraint was slightly modified to "archaeological monitor is recommended during cleanup of sensitive portions of the segment."
Monitoring Activity: None, due to no cleanup activity. Segments were resurveyed following discovery of grafitti in a building.
Dates: None.
Assessment: See site incident report and PCA summaries.

No AHRS # (CMTs near SEW-019)

Constraints: "Inspection by an archaeological monitor is recommended during cleanup of this segment."
Monitoring Activity: Crews were briefed by the monitor on constraints and policies. The site was twice inspected before cleanup by the monitor, once with a USFS archaeologist RAT member. CMTs and recent camp sites were recorded. The intertidal area was re-evaluated as having a low probability of undiscovered cultural remains. No monitor was present during beach treatment.
Dates: 8/6/89, 8/11/89, and 8/23/89 (Gallison).
Assessment: No cultural materials were noted in the intertidal zone or the forest fringe, and the probability of encountering materials was reassessed as low. No disturbance of cultural resources was noted.

SEW-026 (Latouche mine)

Constraints: "Cleanup is to avoid historic archaeological material (to be flagged with an approximately 20 m buffer) in the intertidal zone, as per direction of onsite archaeological monitor. Monitor is to prepare a site map depicting location and nature of historic artifacts and features in the intertidal zone per a Workplan for Archaeological Monitoring. Notify Exxon Archaeological Director 48 hours prior to starting work on this segment."
Monitoring Activity: A site map was prepared showing the location and nature of historic materials. The remains were also photographed. No cleanup occurred because the Coast Guard approved the segment without treatment.
Dates: 6/24/89 - 6/28/89 (Phippen).
Assessment: No impacts to cultural resources were noted (see discussion elsewhere in this volume).

SEW-068 (1930s artifact scatter not found by SCAT)

Constraints: "If cleanup is conducted, archaeological monitoring is required."
Monitoring Activity: None.
Dates: None.
Assessment: Unauthorized cleanup by Native crews apparently occurred here, with no known impact to cultural resources (see PCA summaries).

SEW-073 (rockshelter) and SEW-249 (rockshelter)

Constraints: "Archaeological monitor required during cleanup in the far southwest and far north portions of the segment."
Monitoring Activity: Only the beach adjacent to SEW-073 was cleaned, and this work was overseen by a monitor throughout. Pictographs were re-photographed. A lanceolate stone point was documented and left in place (subsequently collected during PCA). One cleanup crew member was dissuaded from collecting artifacts at SEW-073. SEW-249 was revisited and assessed.
Dates: 7/31/89 - 8/2/89 (Eldridge).
Assessment: Old vandalism was noted at SEW-073. No further disturbance was noted by the monitor. No disturbance was found at SEW-249 (see PCA summaries).

SEW-076 (midden)

Constraints: "Archaeological monitor needed onsite during cleanup of Panhat Point."
Monitoring Activity: Crew was observed and briefed during cleanup near the site.
Dates: 8/2/89 (Phippen).
Assessment: Less than five cm of beach gravel was removed, using rakes and shovels. No artifacts other than fire-cracked rock (FCR) were observed on the beach. There was minimal opportunity for disturbance during the two-hour cleanup (see PCA summaries).

SEW-077 (artifact and feature scatter)

Constraints: "An archaeological monitor is required prior to and during cleanup. Cleanup is to avoid historic and prehistoric material (to be flagged with an approximately 20 m buffer) in the intertidal zone, as per direction of on-site monitor. No access to the forest zone during cleanup."
Monitoring Activity: The site was not monitored due to communication problems.
Dates: None.
Assessment: See incident report and PCA summaries.

SEW-236 (cabin) and SEW-488 (artifact scatter)

Constraints: Standard constraint: "If heretofore undiscovered cultural materials are uncovered during cleanup, contact Exxon's Archaeological Field Director and take actions prescribed in the Operational Guidelines for Shoreline Cleanup dated 4/21/89 as amended."
Monitoring Activity: After a cleanup worker discovered a stone lamp in the intertidal zone, a monitor was dispatched to investigate. Systematic survey of the beach revealed two additional artifacts, and all three were documented, mapped, and collected as SEW-488. Survey in the uplands revealed one CMT and the previously recorded cabin.
Dates: 7/24/89 (Gallison).
Assessment: SEW-488 was reported through proper procedures as per the standard constraint. The beach is a high energy environment with an active beach zone, and no disturbance of cultural materials attributable to cleanup was observed (see incident report).

SEW-241 (artifact scatter and fox farm)

Constraints: "Archaeological monitor required sometime prior to and during cleanup of Cove #8."
Monitoring Activity: Prehistoric and historic remains were mapped, photographed, and left in place. Final cleanup at Beach #7 (across a narrow gravel spit from the archaeological site) was monitored.
Dates: 8/3/89 (Eldridge).
Assessment: Unauthorized access to the site by beach cleanup crews was noted, but no disturbance of the site was observed (see PCA summaries).

SEW-248 (fox farm)

Constraints: "Archaeological monitor required during cleanup of the southern half of segment."
Monitoring Activity: The uplands access prohibition was enforced, and the site was mapped.
Dates: 8/8/89 - 8/15/89 (Gallison; Gallison and Phippen).
Assessment: No disturbance was observed at the time of monitoring (see PCA summaries).

SEW-435 (lighthouse dock and cabins)

Constraints: "Avoid impacts to pilings area in intertidal zone. Avoid backshore activities near pilings area."
Monitoring Activity: No monitor was present during initial cleanup. Bioremediation was monitored. Additional mapping of features was conducted.
Dates: 8/23/89 (Betts and Gallison).
Assessment: No disturbance was noted (see PCA summaries).

SEW-436 (rockshelters) and SEW-437 (cabin)

Constraints: "No access to uplands allowed."
Monitoring Activity: A task force commander found a stone lamp on the beach near the rockshelters, and a monitor was dispatched to document and collect the artifact and survey the beach and uplands for additional cultural materials. A map was made of the rockshelters, the stone lamp location, and the cabin remains nearby at SEW-437.
Dates: 8/7/89, 8/15/89 - 8/16/89 (Eldridge).
Assessment: The stone lamp was oiled. Pedestrian traffic was observed at the rockshelters, but no disturbance was noted other than the small shovel tests made during the SCAT assessment.

SEW-440 (midden)

Constraints: "No access to uplands; no fires on beach or uplands; segment to be monitored during cleanup; cleaning methods to minimize sediment disturbance and movement of surface gravels (no high volume/high pressure techniques). Consultation with on-site archaeologist recommended."
Monitoring Activity: The constraints were enforced during initial beach treatment. Crew was briefed by the monitor, and the approved beach washing methods were modified in consultation with Exxon field staff. Initial monitoring included documenting old and recent cultural materials. Bioremediation treatment was observed by a monitor, who prepared a detailed site map.
Dates: 6/1/89 - 6/4/89 (Phippen); 8/21/89 (Gallison).
Assessment: Small fires were built at the south end of the site's beach, contrary to constraints. High pressure water was used due to the severity of oiling, and resulted in extensive erosion of beach lines. This change was made in consultation with the archaeological monitor. Neither departure from the constraints resulted in visible impact to the archaeological site. Slightly increased midden face erosion due to foot traffic was noted during bioremediation monitoring (see PCA summaries).

SEW-444 (CMTs, drowned forest and peat)

Constraints: "Cleanup work should be monitored closely by on-site archaeologist. Avoid damage to culturally modified trees (to be flagged by archaeologist) during cleanup operations. Consultation with on-site archaeologist during cleanup is recommended."
Monitoring Activity: Prior to cleanup, a search was made for intertidal CMTs. Locations of exposed peat deposits and drowned trees (none of which were CMTs) were mapped. Much of this deposit, which resulted from subsidence, is capped by a veneer of

gravels and cobbles. Uplands were surveyed for archaeological sites using a sub-surface probe. Several upland CMTs were recorded. The actual cleanup was not monitored.
Dates: 6/5/89 - 6/8/89 (Eldridge).
Assessment: Cleanup was postponed during monitoring. The segment was not subject to PCA, but monitoring showed the survey data to be in error -- CMTs were absent from the intertidal zone and no other sites were located in the forest fringe. Intertidal buried peats and trees occur in the region in non-cultural contexts.

SEW-445 (isolated artifact and 20 CMTs)

Constraints: "Segment to be monitored during cleanup; consultation with on-site archaeological monitor recommended."
Monitoring Activity: Monitor briefed the cleanup crew on constraint and policies. Prior to cleanup, the beach was systematically surveyed. Beach crew was periodically contacted and the beach was inspected after cleaning began.
Dates: 6/5/89 - 6/7/89 (Eldridge).
Assessment: No disturbance to the site was observed.

SEW-447 (cairn in rockshelter)

Constraints: "No access to historic burial under rock pile in overhang at south end of Beach #2."
Monitoring Activity: A monitor inspected the site accompanied by the Exxon Supervisor. Site features were mapped and photographed.
Dates: 8/16/89 (Eldridge).
Assessment: Old disturbance of two other cairns was noted during monitoring, evidently originating long before 1989. No recent disturbance was noted (see PCA summaries).

SEW-450 (historic industrial camp) and SEW-451 (cabin)

Constraints: "Monitor required during cleanup of pilings area and among historic debris in intertidal zone in western portion of the cove. Cleanup crews should be restricted from forest zone."
Monitoring Activity: Monitor documented unauthorized visitation and discussed monitoring schedule with Coast Guard and Exxon. This area was reserved for poor weather activities and because of logistical difficulties, a monitor was not present during cleanup. A monitor did attend the site immediately before cleanup and PCA was done shortly after.
Dates: 8/11/89 (Eldridge).
Assessment: No disturbance observed by monitor (see PCA summaries).

SEW-463 (cabin)

Constraints: "Archaeological monitor required during cleanup of some portions of the southern part of the segment."
Monitoring Activity: A monitor toured the area with an Exxon supervisor just prior to cleanup, determining that no cleanup was needed near the specific site location. Further monitoring was judged unnecessary. Site features were photographed.
Dates: 8/11/89 (Eldridge).
Assessment: No disturbance was observed by the monitor.

SEW-474 (kayak remains)

Constraints: "Archaeological monitor required during cleanup of southern 1/5 of the segment."
Monitoring Activity: The uplands access prohibition was enforced. The site was mapped, and a scheme was implemented to draw attention away from the kayak location and reduce the threat of vandalism.
Dates: 8/8/89 - 8/15/89 (Gallison; Gallison and Phippen).
Assessment: No disturbance was observed by the monitor (see PCA summaries).

SEW-482 (fox pen)

Constraints: "Restrict access to uplands during cleanup operations. No crew access to south end of main...Island during cleanup of segment."
Monitoring Activity: Monitor briefed crew on constraint and policies, and enforced uplands access restrictions. SEW-482 was documented and mapped.
Dates: 8/1/89 - 8/15/89 (Gallison).
Assessment: No disturbance was observed by monitor (see PCA summaries).

SEW-497 (historic sawmill)

Constraints: "Archaeological monitor required during cleanup."
Monitoring Activity: The site was resurveyed and documented prior to cleanup. Little oil was present and permission was given the task force commander to hand clean without an archaeological monitor.
Dates: 8/27/89 (Betts, Eldridge, and Gallison).
Assessment: No disturbance was noted by monitor (see PCA summaries).

XMK-018 (midden), XMK-019 (midden), XMK-020 (housepits), XMK-021 (midden), XMK-022 (midden), XMK-024 (midden), XMK-026 (midden), XMK-027 (midden), XMK-028 (midden), XMK-030 (midden), and XMK-031 (housepits)

Constraints: "Inspection by an archaeological monitor is required during cleanup. No access to the forest/upland zone by beach crews."
Monitoring Activity: Exxon representative sought assistance of monitor in evaluating areas with oil. Discovery of XMK-022 postponed immediate cleanup on 8/21/89. Monitor and SHPO representative Dave McMahan met with crews on 8/22/89 to expedite treatment, and cleanup was monitored on 8/23/89. Area was surveyed for cultural material prior to cleanup, with a number of artifacts retrieved from the intertidal zone. Cleanup crew was briefed on policy and identification of artifacts using previously found examples. Cleanup was closely monitored with additional artifacts retrieved during manual treatment. Most artifacts were cleaned and left in their original location. Crew was briefed on 8/24/89, on board berthing vessel, using collected artifacts. Survey of other sites (XMK-018, XMK-020, and XMK-031) with Exxon representative and NPS RPO Ed Pontbriand revealed no recent disturbance. XMK-031 showed disturbance resulting from individuals traversing the midden face. No other disturbance was noted.
Dates: 8/22/89 (Reanier), 8/23/89 - 8/24/89 (Utermohle).
Assessment: XMK-022 was eroding. Some artifacts in the intertidal zone were oiled, and some realignment of artifacts after cleaning may have occurred. No other disturbance was noted. Only NPS RPOs and Exxon officials accessed upland areas.

XMK-058 (midden)

Constraints: "An archaeological monitor is required during cleanup. No access to upland zone by beach crews during cleanup."
Monitoring Activity: Segment was being cleaned at the time of SCAT survey on 6/25/89. SCAT archaeologist briefed Exxon and NPS personnel on constraints and policies. Five artifacts collected during SCAT survey while cleanup was in progress were turned over to NPS field personnel at their insistance (contrary to established policy), and their precise nature and whereabouts is unknown. Monitor arrived on 6/26/89, briefed crews on constraint and policy, and documented damage to midden face from Exxon and NPS officials traversing the site. NPS RPOs serving as bear guards restricted access to uplands. A stone lamp found in the intertidal zone was turned over to NPS field personnel at their request. Movement of rocks for cleaning resulted in the discovery of an oil lamp preform.
Dates: 6/25/89 (Jordan), 6/26/89 (Yarborough), 7/2/89 - 7/3/89 (Knecht).

Assessment: Site was eroding at the time of SCAT survey, and displayed square holes appearing to be unbackfilled archaeological units. The midden was disturbed by Exxon and NPS officials traversing the exposed face. Artifacts from the intertidal zone were retained by NPS field personnel. Movement and reorientation of boulders might lead to future misinterpretation as cultural features (see PCA summaries).

XTI-008 (housepits), XTI-055 (housepit), XTI-056 (housepits), and XTI-057 (uncertain)

Constraints: "Archaeological monitor required prior to and during cleanup. No access to forest/upland zone by beach crews during cleanup."
Monitoring Activity: None because no cleanup was conducted.
Dates: None.
Assessment: XTI-055 was recorded as intact by the SCAT survey.

XTI-009 (housepits)

Constraints: "Archaeological monitor required prior to and during cleanup. No access to forest/upland zone by beach crews during cleanup."
Monitoring Activity: None because no cleanup was conducted.
Dates: None.
Assessment: None.

XTI-017 (housepits) and XTI-068 (artifact scatter)

Constraints: "Archaeological monitor required during cleanup. Cleanup crews should be restricted to the active beach."
Monitoring Activity: None. Segment was cleaned by a Native cleanup crew without benefit of archaeological monitoring.
Dates: None.
Assessment: None.

XTI-054 (cabin)

Constraints: "Archaeological monitor required prior to and during cleanup. No access to forest/upland zone by beach crews during cleanup."
Monitoring Activity: SHPO representative approved monitoring of cleanup by an ADFG representative when logisitics did not allow an Exxon archaeological monitor to be present. Monitor was instructed on archaeological constraints and cultural resource policies prior to cleanup.
Dates: 8/20/89 (Wise, ADFG).
Assessment: No data.

XTI-060 (midden)

Constraints: "Archaeological monitor required prior to and during cleanup. No access to forest/upland zone by beach crews during cleanup."
Monitoring Activity: None because no cleanup was conducted.
Dates: None.
Assessment: XTI-060 was found undisturbed during SCAT survey.

No AHRS # (no cultural resources, Segment CC-1)

Constraints: "The conditions for Type A lightly oiled shorelines should be applied to the cleanup of this segment."
Monitoring Activity: Monitor briefed Exxon representative and cleanup supervisors on cultural resource policies and constraints. NPS RPOs serving as bear guards restricted access to uplands.
Dates: 5/17/89 - 5/19/89 (Knecht).
Assessment: No cultural resources were known in the segment, but proximity to a nearby site prompted monitoring. No disturbance was noted.

No AHRS # (no cultural resources, Segment CC-4)

Constraints: "Archaeology monitor required during cleanup. Cleanup personnel must be restricted to the seaward side of driftwood line in the north half of the segment."
Monitoring Activity: Monitor briefed Exxon and NPS personnel on constraints and policies on 5/18/89, but no cleanup was done at that time. Cleanup was monitored on 8/11/89. NPS RPOs serving as bear guards restricted access to uplands.
Dates: 5/18/89 (Knecht), 8/11/89 (Utermohle).
Assessment: No cultural resources were known in the segment, but proximity to a nearby site prompted constraint. No disturbance was noted.

No AHRS # (no cultural resources, Segment CI-1)

Constraints: "An archaeological monitor is required prior to and during cleanup activity in this segment."
Monitoring Activity: Monitor and SHPO representative Dave McMahan briefed the crew on constraints and policies.
Dates: 9/1/89 (Utermohle).
Assessment: No cultural resources were discovered in the segment.

No AHRS # (no cultural resources, Segment GR-008)

Constraints: "Archaeological monitor to be present during cleanup."
Monitoring Activity: The intertidal zone was resurveyed by the monitor after USFS reported chipped stone artifacts in the intertidal zone. The resurvey found no cultural materials, confirming the earlier SCAT survey results. Monitor briefed cleanup crew on the constraint and policies, and remained until cleanup was completed.
Dates: 5/24/89 - 5/26/89 (Phippen).
Assessment: No cultural resources were observed.

No AHRS # (no cultural resources, Segment KN-126)

Constraints: "Archaeological monitoring needed during cleanup if cleanup is conducted."
Monitoring Activity: Originally this locale was reported as a possible scatter of lithic debris and FCR, but resurvey by the monitor revealed no cultural resources.
Dates: 6/10/89 (Phippen).
Assessment: No cultural resources were discovered.

No AHRS # (no cultural resources, Segment KN-132)

Constraints: "Archaeological monitoring needed during cleanup of central 1/3 of segment if cleanup is conducted."
Monitoring Activity: A possible FCR scatter was originally reported at this locale in Segment KN-132. The beach and tree fringe were resurveyed, with negative results.
Dates: 6/10/89 (Phippen).
Assessment: No cultural resources were discovered.

No AHRS # (no cultural resources, Segment SL-16)

Constraints: "If cleanup is planned, a cultural resource assessment should be completed."
Monitoring Activity: Segment was cleaned without cultural resource assessment. Monitor briefed Native crew on constraints and policies on 6/4/89, and VECO crew on 6/22/89.
Dates: 6/4/89 (Wooley and Yarborough), 6/22/89 (Jordan).
Assessment: No cultural resources were discovered.

No AHRS # (no cultural resources, Segment SL-11)

Constraints: "If cleanup is planned, a cultural resource assessment should be completed."
Monitoring Activity: Segment was cleaned without cultural resource assessment. Monitor briefed Native crew on constraints and policies on 6/4/89, and VECO crew on 6/22/89.
Dates: 6/4/89 (Wooley and Yarborough), 6/22/89 (Jordan).
Assessment: No cultural resources were discovered.

No AHRS # (no cultural resources, Segment SL-12)

Constraints: "If cleanup is planned, a cultural resource assessment should be completed."
Monitoring Activity: Segment was cleaned without cultural resource assessment. Monitor briefed Native crew on constraints and policies on 6/4/89, and VECO crew on 6/22/89.
Dates: 6/4/89 (Wooley and Yarborough), 6/22/89 (Jordan).
Assessment: No cultural resources were discovered.

No AHRS # (no cultural resources, Segment SP-5)

Constraints: "If cleanup is conducted, an archaeological monitor is required prior to and during cleanup."
Monitoring Activity: None because no cleanup was conducted.
Dates: None.
Assessment: None.

No AHRS # (intertidal and upland CMTs, Segment TB-3)

Constraints: "Archaeological re-evaluation with sub-surface testing is needed prior to cleanup if cleanup is to be conducted."
Monitoring Activity: Additional survey and subsurface testing were conducted in the drowned and living forests. CMTs were described in additional detail.
Dates: 6/10/89 (Buck), 6/22/89 (Ludwig and Mack).
Assessment: Some drowned CMTs were reportedly oiled and scheduled for falling and burning. These trees could not be found, but crews were warned not to cut down any scarred trees (see PCA summaries).

No AHRS # (intertidal CMTs, Segment TB-04)

Constraints: "Minimize subsurface beach disturbance in areas where drowned trees or stumps are present. Access to uplands should be restricted. Archaeological monitor should be onsite when cleanup of Beach A in western portion of segment is conducted."
Monitoring Activity: The locale was intensively resurveyed for other cultural materials.
Dates: 6/23/89 - 6/25/89 (Ludwig).
Assessment: No disturbance was noted by monitor (see PCA summaries).

No AHRS # (no cultural resources, Segment UG-3)

Constraints: "Inspection by an archaeological monitor is required only if cleanup is planned."
Monitoring Activity: None because no cleanup was conducted.
Dates: None.
Assessment: None.

No AHRS # (no cultural resources, Segment UG-5)

Constraint: "Inspection is required only if cleanup is planned."
Monitoring Activity: None because no cleanup was conducted.
Dates: None.
Assessment: None.

No AHRS # (historic pier, Segment WB-12)

Constraints: "Inspection by an archaeological monitor is required in the NE end of the segment."
Monitoring Activity: None. Crews working in the region had been previously briefed on cultural resource policies. Work in the sensitive portion of segment was not indicated.
Dates: None.
Assessment: None (see PCA summaries).

No AHRS # (no cultural resources, Segment WB-14)

Constraints: "If cleanup is conducted at the head of the bay, inspection by an archaeological monitor is required."
Monitoring Activity: None. Work in the sensitive portion of the segment was not indicated.
Dates: None.
Assessment: None.

Appendix
Post-Cleanup Assessment Summaries

These brief descriptions of post-cleanup site condition identify specific conditions observed at individual dates. Pre-spill observations are referenced by author. Exxon observations are preceded by abbreviations: SCAT = SCAT survey, MON = monitoring, and PCA = post-cleanup assessment. A "n/a" (for not available) indicates that the condition was not mentioned and cannot be estimated with confidence. If the condition of the site was the same as during the prior visit, it is characterized as "no change." Additional comments are provided in "Remarks".

AFG-010 (camp)
Dates of Assessment and Condition: 1960s (D. Clark 1965:25, 91-94), n/a; 1970s (Workman and Clark 1979:245, 265-276, 295-298), n/a; PCA 9/1/89, erosion.
Remarks: PCA was conducted at this historic/prehistoric fish camp to determine the status of upland archaeological sites. There was evidence of camping on top of the site, and a little erosion at the shore face.

AFG-012 (midden)
Dates of Assessment and Condition: 1960s (D. Clark 1965:26, 96-98), n/a; 1970s (Workman and Clark 1979:245, 250-255), erosion; PCA 9/1/89, erosion.
Remarks: PCA was conducted to determine the status of upland archaeological sites. AFG-012 was eroding severely along a ten m long, three m high bluff. There was no sign of human aggravation of this erosion.

AFG-028 (midden)
Dates of Assessment and Condition: 1971 (D. Clark 1974b:57, 78-80), vandalism; SCAT 5/17/89, erosion, vandalism; MON 8/1/89, erosion, vandalism; PCA 9/1/89, erosion, vandalism.
Remarks: Vandalism was noted at the site when it was first reported a number of years ago. SCAT survey found the erosional face being advanced by vandalism, with fresh holes only a few days old. During the monitoring visit, new damage, in the form of a hole 30 cm in diameter and about 35 cm deep, was discovered. PCA revealed additional vandalism consisting of a hole dug by hand into the top of the deposit since the monitoring visit.

AFG-046 (village)
Dates of Assessment and Condition: 1965 (D. Clark 1965:30), erosion, vandalism; SCAT 5/23/89 - 5/24/89, erosion, vandalism; MON 5/24/89 - 5/25, erosion, disturbance; 7/12/89 - 7/14/89, collection; 8/1/89, disturbance; 8/4/89, disturbance; 8/20/89, no change; PCA 8/29/89, no change.
Remarks: This prehistoric village site has a documented history of erosion and vandalism (D Clark 1965:30; Klingler 1983). SCAT survey found the site severely eroded with artifacts and human skeletal material exposed in the intertidal zone. A series of monitoring observations during the season revealed repeated disturbance. On 8/20/89, the site was videotaped, and no new disturbance was noted. PCA on 8/29/89 found no new disturbance.

AFG-061 (covered bridge)
Dates of Assessment and Condition: PCA 9/1/89, erosion.
Remarks: PCA was conducted to determine the status of upland archaeological sites. The covered bridge was apparently moved by the 1964 tsunami. It was found twisted, rotting, and rusting, but no human disturbance was noted.

AFG-104 (midden)
Dates of Assessment and Condition: SCAT 8/13/89, erosion; PCA 8/13/89, no change.
Remarks: Much of this site has been destroyed by wave action.

AFG-105 (midden)
Dates of Assessment and Condition: SCAT 8/13/89, erosion; PCA 8/13/89, no change.
Remarks: This site is rapidly eroding. Estimates made at the time of SCAT survey suggest 3/4 of the site has been eroded by wave action.

AFG-111 (artifact scatter)
Dates of Assessment and Condition: SCAT 7/1/89, erosion; MON 8/23/89 - 8/25/89, no change; PCA 8/29/89, no change.
Remarks: Erosion was observed at the site, but no human impacts were noted. New site AFG-152 (shipwreck), found by crew member, was documented.

AFG-118 (artifact scatter)
Dates of Assessment and Condition: SCAT 8/26/89 - 8/28/89, erosion; MON 8/30/89, no change; PCA 8/30/89, no change.
Remarks: AFG-118 was found eroded but otherwise undisturbed during SCAT survey. No change was noted at the time of monitoring or PCA.

AFG-120 (housepits)
Dates of Assessment and Condition: SCAT 7/21/89, erosion; MON 8/4/89, n/a; PCA 8/28/89, no change.
Remarks: This new site was found eroding during SCAT survey. The monitoring briefing was done from a boat, without actually visiting the site. PCA found no change in condition.

AFG-122 (midden and depression)
Dates of Assessment and Condition: SCAT 8/7/89, erosion; PCA 8/29/89, erosion.
Remarks: The only degradation noted at this site, discovered during SCAT survey, was erosion. No cleanup occurred in the area.

AFG-123 (midden)
Dates of Assessment and Condition: SCAT 7/21/89, erosion; MON 8/4/89, n/a; PCA 8/28/89, no change.
Remarks: This new site was found eroding during SCAT survey. The monitoring briefing was done from a boat, without actually visiting the site. PCA noted natural erosion and undercutting at AFG-123. No cultural disturbance was noted.

AFG-128 (midden)
Dates of Assessment and Condition: SCAT 7/13/89, erosion; MON 8/4/89 - 8/5/89, no change; PCA 8/29/89, no change, collection.

Remarks: AFG-128 was discovered in a partially eroded state during SCAT survey. The site has subsided into the intertidal zone, resulting in fire-cracked rock and artifacts on the beach. No signs of human disturbance were noted, but the site is in danger of complete erosion in the coming years.

AFG-129 (village)

Dates of Assessment and Condition: SCAT 7/14/89, erosion, vandalism; MON 8/4/89 - 8/5/89, 8/13/89, vandalism; PCA 7/27/89, no change.
Remarks: AFG-129, discovered during SCAT survey, consists of housepits and midden eroding on the seaward side of a lagoon. During SCAT survey, old vandalism (one year or more old) was observed at four locations in the midden and in two of the housepits, and recent disturbance was also noted. A monitoring visit on 8/5/89 discovered more recent vandalism. PCA on 8/27/89 showed no new vandalism.

KAR-016 (village)

Dates of Assessment and Condition: SCAT 6/4/89, erosion; MON 6/22/89, no change; PCA 9/1/89, no change.
Remarks: Erosion was observed, but no human impacts were noted.

KAR-107 (village)

Dates of Assessment and Condition: 1940s (Hrdlicka 1944:105), n/a; 1960s (D. Clark 1965:59), erosion; 1980s (Jordan 1983:23 [identified as KAR-100], n/a; SCAT 6/4/89, erosion, vandalism; MON 6/22/89, no change; PCA 9/1/89, no change.
Remarks: Erosion at the site is recorded in AHRS files. During SCAT survey, old holes and recent footprints were observed, but no recent disturbance. PCA noted erosion but no new human activity.

KAR-097 (village)

Dates of Assessment and Condition: SCAT 6/4/89, n/a; MON 6/22/89, erosion; PCA 9/1/89, no change.
Remarks: Erosion but no human impacts were noted at the site.

KAR-116 (cabin)

Dates of Assessment and Condition: SCAT 5/10/89, natural deterioration; PCA 8/26/89, no change.
Remarks: This collapsed cabin was found during SCAT survey, with no change in condition of site at time of PCA .

KAR-128 (village)

Dates of Assessment and Condition: SCAT 7/10/89, erosion; PCA 8/26/89, erosion.
Remarks: This new site was suffering from severe erosion when noted by SCAT survey. Monitoring was required in the segment if cleanup took place in the vicinity, but treatment took place without a monitor. PCA was conducted to evaluate impacts to the site. Only natural erosion was found.

KOD-083 (village)

Dates of Assessment and Condition: 1960s (D. Clark 1970:73-111), archaeological testing; PCA 8/25/89, erosion.
Remarks: This prehistoric site with a superimposed historic Russian settlement was archaeologically tested in the 1960s. PCA was done to determine the status of archaeological sites in areas where no cleanup activities took place. There has been some natural erosion, but no evidence of recent disturbance.

KOD-171 (village)

Dates of Assessment and Condition: MON 5/31/89, intact; PCA 8/30/89, vandalism.
Remarks: There was no SCAT survey of this shore. Cleanup by a village crew occurred in the area. A brief monitoring visit on May 31 showed no evidence of recent vandalism. During PCA, two holes were found dug into the face of the site.

KOD-223 (village)

Dates of Assessment and Condition: 1940s (Hrdlicka 1944:127), n/a; 1960s (D. Clark 1965:65), n/a; 1970s (Nowak 1977:22-25, USFWS 1979), erosion; SCAT 7/9/89, erosion, vandalism; PCA 8/28/89, no change.
Remarks: Severe erosion is mentioned in the AHRS description of this site. SCAT survey revealed vandalism in all three areas of the site and an adjacent island, some of which was recent; the site shows signs of human impact over a period of many years. There was no cleanup in the segment, and no change noted during PCA.

KOD-224 (midden)

Dates of Assessment and Condition: 1977 (Nowak 1977:26-32, 1979), archaeological testing; SCAT 7/8/89, erosion; PCA 8/30/89, vandalism.
Remarks: This midden was archaeologically tested by Nowak in 1977 and 1978 (Nowak 1977:26-32, 1979). The site was only observed from a distance during SCAT survey, and no cleanup occurred in the area. PCA found the exposed erosional face to have suffered from human disturbance during the summer, at the top of the old archaeological bank cut. There was no disturbance on top of the midden.

KOD-239 (village)

Dates of Assessment and Condition: SCAT 7/7/89 - 7/8/89, n/a; PCA 8/30/89, erosion.
Remarks: SCAT survey provided no data on condition. No cleanup was conducted in the area. PCA noted only one small area of eroded midden at KOD-239. No human aggravation of the erosion was seen.

KOD-245 (small village)

Dates of Assessment and Condition: 1970s (USFWS 1979), n/a; SCAT 7/7/89 - 7/8/89, n/a; PCA 8/30/89, erosion.
Remarks: The condition of KOD-245 was not noted in the 1979 USFWS manuscript or SCAT survey. No cleanup was conducted in the area. PCA noted one portion of the bank was eroded back but it was unclear whether this was the result of human activity.

SEL-129 (village)

Dates of Assessment and Condition: 1985 (Reihart personal communication to K.W. Workman), n/a; SCAT 4/24/89, erosion; MON (see below); PCA 8/11/89, erosion, disturbance.
Remarks: Monitoring by the SHPO during cleanup, to fulfill approved constraint, was not done because of scheduling changes. Despite the constraint, a tent camp was erected here by unknown parties. When dismantled, a bear-proof barrel and a cobble pavement tent platform were left in the site, and remains of the tent frame and other rubbish were thrown into one housepit. PCA observed no other impact, and the rubbish was removed by Exxon.

SEL-179 (midden)

Dates of Assessment and Condition: SHPO inspection 5/4/89 - 5/6/89, vandalism, erosion; SCAT 5/9/89, no change; MON 5/7/89, 5/18/89 - 5/26/89, 5/28/89 - 5/31/89, 6/16/89, 6/21/89, no change; PCA 8/7/89, no change.
Remarks: Following unauthorized artifact collection (see Windy Bay Incident) and subsequent monitoring activity, no further impacts were observed by the PCA.

SEL-180 (midden)

Dates of Assessment and Condition: SHPO inspection 5/7/89, n/a; SCAT 5/9/89, disturbance; MON 5/29/89 - 5/30/89, no change; PCA 8/8/89, no change.
Remarks: When observed by SCAT survey, two depressions were being used as latrines. PCA noted no visible disturbance.

SEL-181 (refuge/midden)

Dates of Assessment and Condition: CAC 6/2/89, erosion; MON 6/9/89 - 6/22/89, no change; PCA 8/11/89, no change.

Remarks: PCA was made in a hovering helicopter due to high tide and rough seas. Midden and fire-cracked rocks were clearly visible, and there was no sign of disturbance.

SEL-207 (village)

Dates of Assessment and Condition: SCAT 5/6/89, natural weathering; MON 5/19/89, 6/16/89, no change; PCA 8/7/89, no change.
Remarks: PCA noted no disturbance.

SEL-208 (housepit)

Dates of Assessment and Condition: SCAT 5/10/89, natural weathering; CAC inspection 8/3/89, no change; PCA 8/7/89, 8/11/89, no change.
Remarks: An oiled debris dump was constructed on the site but was later removed. PCA noted no damage.

SEW-004 (rockshelter)

Dates of Assessment and Condition: 1969 (McMaster), collection; 1981 (BIA/CPSU AA 10957), erosion; SCAT 5/7/89, vandalism, erosion; CAC 5/22/89, collection, no change; MON 7/23/89 - 8/15/89, two incidents of vandalism, USFS sign placement; PCA 8/20/89, one unauthorized entry, no change.
Remarks: SCAT archaeologist William Andrefsky was informed on 5/22/89 by local fishermen that this site was well known to local collectors, who stated that the site had "many holes dug into it by collectors over the years in search of ivory buttons and spear points." The site location is mapped in NOAA's official oil spill sensitivity atlas for Prince William Sound (Research Planning Institute, Inc. 1983). The site would appear to have had a long history of disturbance, although no AHRS or USFS data exist concerning its prior condition. SCAT survey noted evidence of old and recent vandalism. Monitoring during the season recorded two incidents of vandalism. PCA recorded no new evidence of vandalism, although footprints indicated that someone had visited the site since 8/15/89.

SEW-019 (Old Chenega Village) and SEW-039 (church, part of SEW-019)

Dates of Assessment and Condition: SCAT 7/7/89, 7/8/89, 7/10/89, 7/11/89, natural weathering, graffiti; PCA 8/22/89, added grafitti.
Remarks: Abandoned after the 1964 tsunami (the church -- SEW-039 -- burned to the ground soon thereafter), structures have deteriorated except for one community building. SCAT survey noted recent grafitti dated 4/9/89 in the structure. PCA noted additional grafitti signed by "Dos Guys" of Ventura, California.

SEW-073 (rockshelter)

Dates of Assessment and Condition: 1930, 1933 (de Laguna 1956:31,90,103-105), vandalism (mummies removed); 1980 (CPSU/ANCSA AA11143), n/a; SCAT 6/25/89 - 6/26/89, vandalism, erosion; MON 7/31/89 - 8/2/89, no change; PCA 8/28/89, no change.
Remarks: Mummies were removed from this site prior to the 1930s, according to de Laguna (1956:31). Pictographs were recorded. The 1980 survey revealed a second ledge with human remains. The SCAT survey noted vandalism since 1980. No change was found at the time of monitoring or PCA. A lanceolate projectile point, mapped and left during monitoring, was collected by PCA.

SEW-076 (midden)

Dates of Assessment and Condition: 1930 (de Laguna 1956:31), erosion, collection; 1987 (BIA/ANCSA), erosion; SCAT 7/17/89; MON 8/2/89, erosion; PCA 8/29/89, no change.
Remarks: De Laguna (1956:31) implies slow erosion by terming the midden "exposed." No additional impact was noted during monitoring or PCA.

SEW-077 (artifact and feature scatter)

Dates of Assessment and Condition: 1930 (de Laguna 1956:31), natural deterioration, collection; SCAT 7/4/89, no change; PCA 8/29/89, no change.
Remarks: The SCAT survey recorded artifacts on the beach prior to cleanup. CAC stated that disturbance may have occurred during cleanup, because the cleanup was inadvertently not monitored as required. For logistical reasons, PCA was done at high tide when some intertidal lithics were covered, but the exposed portion displayed undisturbed artifacts, and upland features were undisturbed.

SEW-241 (artifact scatter and fox farm)

Dates of Assessment and Condition: 1980 (CPSU/ANCSA), natural weathering; SCAT 6/24/89, no change; MON 8/3/89, no change; PCA 8/28/89, no change.
Remarks: A prehistoric component was discovered at this site during SCAT survey. No impact was observed by monitoring or PCA.

SEW-248 (fox farm)

Dates of Assessment and Condition: 1980 (BIA/ANCSA), natural deterioration; SCAT 5/7/89, natural deterioration; MON 8/8/89 - 8/14/89, no change; PCA 8/20/89, no change.
Remarks: This historic site is a large complex of weathered, burnt, and collapsed buildings, boats, docks, and boardwalks. This site was unchanged during monitoring and PCA.

SEW-249 (rockshelter)

Dates of Assessment, and Condition: 1980 (BLM), natural weathering; SCAT 6/25/89 - 6/26/89, no change; MON 8/7/89, no change; PCA 8/28/89, no change.
Remarks: This rockshelter has remained unchanged since 1980. PCA noted no change.

SEW-435 (lighthouse dock and cabins)

Dates of Assessment and Condition: SCAT 4/13/89, natural weathering; MON/PCA 8/23/89, no change.
Remarks: The PCA was done concurrently with monitoring the final omni-barge treatment. No impacts were noted.

SEW-439 (cabin)

Dates of Assessment and Condition: SCAT 4/15/89, natural deterioration; PCA 8/26/89, disturbance.
Remarks: This small log cabin has partially collapsed, but up to nine log rounds remain. No vandalism was noted, but heavy foot traffic in this area had worn a notch in the center of one wall. The adjacent shoreline was used extensively for tests of treatment methods, witnessed by an unusually large number of media and agency personnel.

SEW-440 (midden)

Dates of Assessment and Condition: SCAT 4/23/89, erosion; MON 6/1/89 - 6/4/89, slight increase in erosion due to foot traffic; PCA 8/21/89, slight increase in erosion due to foot traffic.
Remarks: Lumber in the uplands, possibly a collapsed cabin, remained undisturbed. Minor erosion accelerated by foot traffic was observed.

SEW-441 (cabin and anchor)

Dates of Assessment and Condition: SCAT 4/23/89, natural deterioration; PCA 8/27/89, 9/2/89, no change.
Remarks: This site includes three upland cabins and an intertidal anchor. No impacts to the features were noted.

SEW-442 (cabin)

Dates of Assessment and Condition: SCAT 4/23/89, natural deterioration and human impact; PCA 8/27/89, disturbance from foot traffic.

Remarks: When this site was first recorded by SCAT, it had the remains of a campfire in its center. Accelerated collapse of the walls from two new footpaths, one crossing each axis of the cabin, was documented by PCA.

SEW-443 (rockshelter)

Dates of Assessment Condition: SCAT 4/28/89, undisturbed; PCA 8/27/89, disturbance.
Remarks: The site contained charcoal and midden when first recorded by SCAT survey. Kindling stacked against the wall may be quite old. The PCA noted a small fresh hole 20 x 15 x 10 cm that may have been of either human or animal origin. Toilet paper and feces were on the floor and two candy bar wrappers were present, one on the floor and one stuffed into the scar of a CMT just outside the rockshelter. Moss had been scraped off a large flat rock outside the dripline and a fire built on top of it.

SEW-447 (cairn in rockshelter)

Dates of Assessment and Condition: SCAT 5/24/89; MON 8/16/89, pre-spill disturbance noted; PCA 9/2/89, no change.
Remarks: A single undisturbed cairn burial was recorded by SCAT survey. During monitoring, evidence of at least one and possibly two additional cairns was noted. No change during the cleanup was observed by the PCA.

SEW-450 (historic industrial camp)

Dates of Assessment: SCAT 6/11/89, natural weathering, severe erosion; MON 8/11/89, no change; PCA 9/3/89, no change.
Remarks: No change was found in the content or condition of the historic artifacts and features at this site over the course of the cleanup. Much of the site appears to have been buried or destroyed by an avalanche about 15 years ago.

SEW-451 (cabin)

Dates of Assessment and Condition: SCAT 6/11/89, natural weathering; PCA 9/3/89, no change.
Remarks: PCA found no change in the content or condition of the cabin.

SEW-462 (rockshelter)

Dates of Assessment and Condition: SCAT 6/6/89, natural erosion; PCA 9/2/89, disturbance.
Remarks: This rockshelter is gradually eroding at its precipitous entrance, and large rockfalls have almost completely obscured any cultural material that would be evident on the surface. PCA noted recent toilet paper deposited on the outer rockshelter floor.

SEW-469 (rockshelter)

Dates of Assessment and Condition: Inspection (truncated) 7/5/89, vandalism; Inspection 7/11/89, no change; PCA 8/31/89, disturbance.
Remarks: SEW-469 was first reported by cleanup crews, by which time vandalism to human remains had apparently occurred. Human remains were subsequently disinterred by the Alaska State Troopers. USFS conducted an investigation into the incident (see incident report). Bones were reburied by CAC on 8/14/89, and a white cross erected in the rockshelter. PCA noted considerable recent trampling and cigarette butts.

SEW-474 (kayak remains)

Dates of Assessment and Condition: MON 8/6/89 - 8/12/89, erosion, natural deterioration; PCA 8/20/89, no change.
Remarks: When found during monitoring, the wooden and metal remains of this kayak frame were being gradually eroded and weathered. Brush was thrown over the feature as a protective measure.

SEW-479 (historic sawmill)

Dates of Assessment and Condition: SCAT 6/31/89, natural weathering; PCA 8/27/89, no change.
Remarks: Structural features in the uplands, were recorded as undisturbed by the PCA.

SEW-481 (rockshelter)

Dates of Assessment and Condition: MON 7/23/89 - 8/15/89, natural weathering; PCA 8/20/89, no change.
Remarks: This small damp rockshelter located 40 m north of SEW-003 was discovered while monitoring. PCA noted no disturbance.

SEW-482 (fox pen)

Dates of Assessment and Condition: MON 8/1/89 - 8/15/89, natural weathering; PCA 8/21/89, disturbance.
Remarks: A collapsed historic fox pen, recorded during monitoring, suffered a broken 2" x 8" board between 8/15/89 - 8/21/89, apparently from someone kicking it as they walked along the nearby trail.

UGA-043 (village)

Dates of Assessment and Condition: mid-1980s (Dumond 1987:129, 173), archaeological testing and collection; SCAT 7/24/89, erosion; PCA 8/26/89, no change.
Remarks: PCA noted no change in this site since SCAT survey.

XMK-058 (midden)

Dates of Assessment and Condition: SCAT 6/25/89, erosion and disturbance, collection; MON 6/26/89, 7/2/89 - 7/3/89, disturbance; PCA 8/26/89, disturbance.
Remarks: This site show signs of what may be past archaeological testing. Some artifacts were collected during survey as a protective measure. Monitoring noted that Exxon and NPS foot traffic was accelerating erosion on the midden face. PCA found minor recent disturbance of the midden face, possibly from probing with a stick.

No AHRS # (intertidal and upland CMTs in Segment TB-03)

Dates of Assessment and Condition: SCAT 5/7/89 - 6/8/89, natural weathering (subsidence); MON 6/10/89, 6/22/89, no change; PCA 8/8/89, no change.
Remarks: CMTs in the uplands, and drowned trees in the intertidal zone, raised the possibility of intertidal cultural material and prompted monitoring and PCA. No cultural material was noted, and no change in the CMTs was found by PCA.

No AHRS # (intertidal CMTs in Segment TB-04)

Dates of Assessment and Condition: SCAT 5/7/89, erosion; MON 6/23/89 - 6/25/89, no change; PCA 8/8/89, no change.
Remarks: No impacts to CMTs were noted by the PCA.

No AHRS # (historic pier in Segment WB-12)

Dates of Assessment and Condition: SCAT 7/28/89, natural deterioration; PCA 8/26/89, no change.
Remarks: This abandoned pier was mapped during SCAT survey, in association with an abandoned airstrip in the uplands. PCA found no change in the features.

Appendix
Artifact Descriptions

by William B. Workman and Karen Wood Workman
Illustrations by Sarah Moore

During 1989, the EXXON VALDEZ Cultural Resource Program accumulated 267 artifacts from 40 archaeological sites, in addition to bell and buoy parts collected as SEW-494. This appendix provides detailed descriptions and functional interpretations of the collected artifacts, grouped by site within each map quadrangle and described in serial order by catalog number. Linear measurements are in centimeters and weights are in grams. The following abbreviations are used: L = length; W = width; T = thickness; H = height (substituted for thickness for splitting adzes); Wt = weight. Brackets [ ] around a measurement indicate that the specimen is broken in a way that affects the measurement.

The focus of the analysis is descriptive, but the distribution of diagnostic artifacts has been traced where such work promised to shed light on the cultural affinities and minimum occupation span of the site. Distribution studies have been limited to the immediate area from which the artifacts were recovered, i.e. the Kodiak Archipelago, the Pacific coast of the upper Alaska Peninsula, Kachemak Bay, and Prince William Sound. Results are documented in the "Remarks" section. Suggested cultural affinities and (minimum) span of occupation are indicated in the "Cultural Affinities" section, but for most sites the available information is insufficient to permit cultural placement. Given the small and biased samples from most sites, all cultural and chronological attributions are tentative. Since the site inventories described are geographically scattered and the artifacts recovered are diverse, no typological framework has been generated for this report, though such an approach might be useful for the splitting adzes from Prince William Sound.

Artifact Descriptions

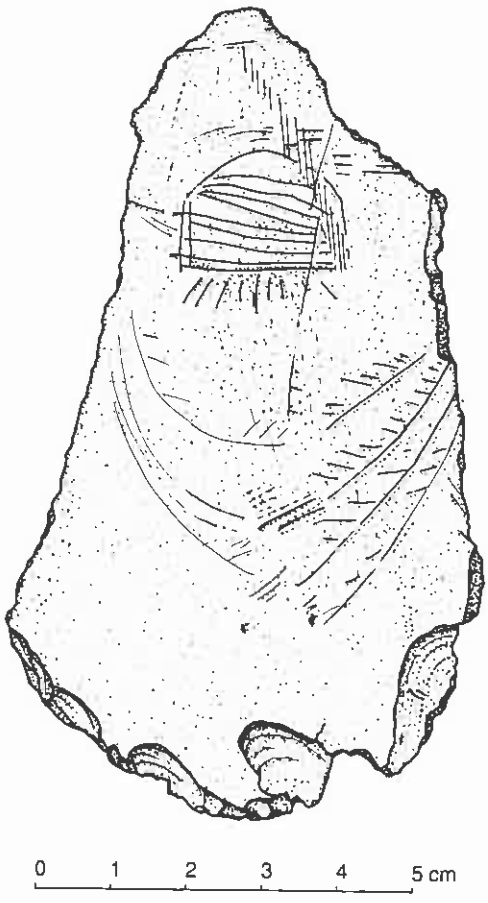
Afognak Quadrangle

AFG-026

Cultural Affinities: Material previously collected at this site suggests a late prehistoric (Koniag phase) occupation (D. Clark 1974a: 52,57,76-78), an assessment supported by the incised slate tablet found in 1989.

49AFG-026-1 — *Incised Slate Tablet (illustrated)*

Description: Irregular rectangular; intensive flaking on one face and all edges. Crude incised design near one end on minimally flaked face, which was also ground over 2/3 of its surface, includes a crude version of the standard face element. Various ticked lines and other design elements may represent clothing. Possibly made on a flaked and ground slate implement.
Material: Slate.
Measurements: L 10.67; W 6.26; T 0.42; Wt 41.7
Remarks: Incised slate figurines are known only from the late prehistoric Koniag phase on Kodiak. On the Karluk River, Jordan and Knecht (1988:271) dated the "figurine cult" between A.D. 1350 and A.D. 1500. These data suggest with some confidence that Koniag phase occupants were present at AFG-026 after A.D. 1300.



49AFG-026-1 Incised Slate Tablet

AFG-028

Cultural Affinities: Materials collected in the 1960s suggest a late prehistoric Koniag occupation, though several items may also pertain to the Kachemak tradition (D. Clark 1974a:57, 78-80). The incised slate figurine suggests a Koniag presence after A.D. 1300.

49AFG-028-1 *Eroded Wedge(?)*

Description: Small, fairly thin, rectangular rib segment. One rounded end apparently slightly beveled; the opposite straighter end battered. Rounded rectangular cross section.
Material: Whale bone.
Measurements: L 8.89; W 3.32; T 1.39; Wt 37.2
Remarks: Eroded.

49AFG-028-2 *Incised Slate Figurine (illustrated)*

Description: Rounded rectangular slate shingle with thick edges laterally and on top; convex base bifacially flaked. Rectangular cross section. One face bears a classic clothed figure with stylized mouth and eye brows. Beads(?) hang from the lower lip; clothing present. No design on the opposite face.
Material: Slate.
Measurements: L 12.54; W 5.84; T 0.97; Wt 116.7
Remarks: Late prehistoric Koniag, presumably postdating A.D. 1300 (see 49AFG-026-1).

AFG-046

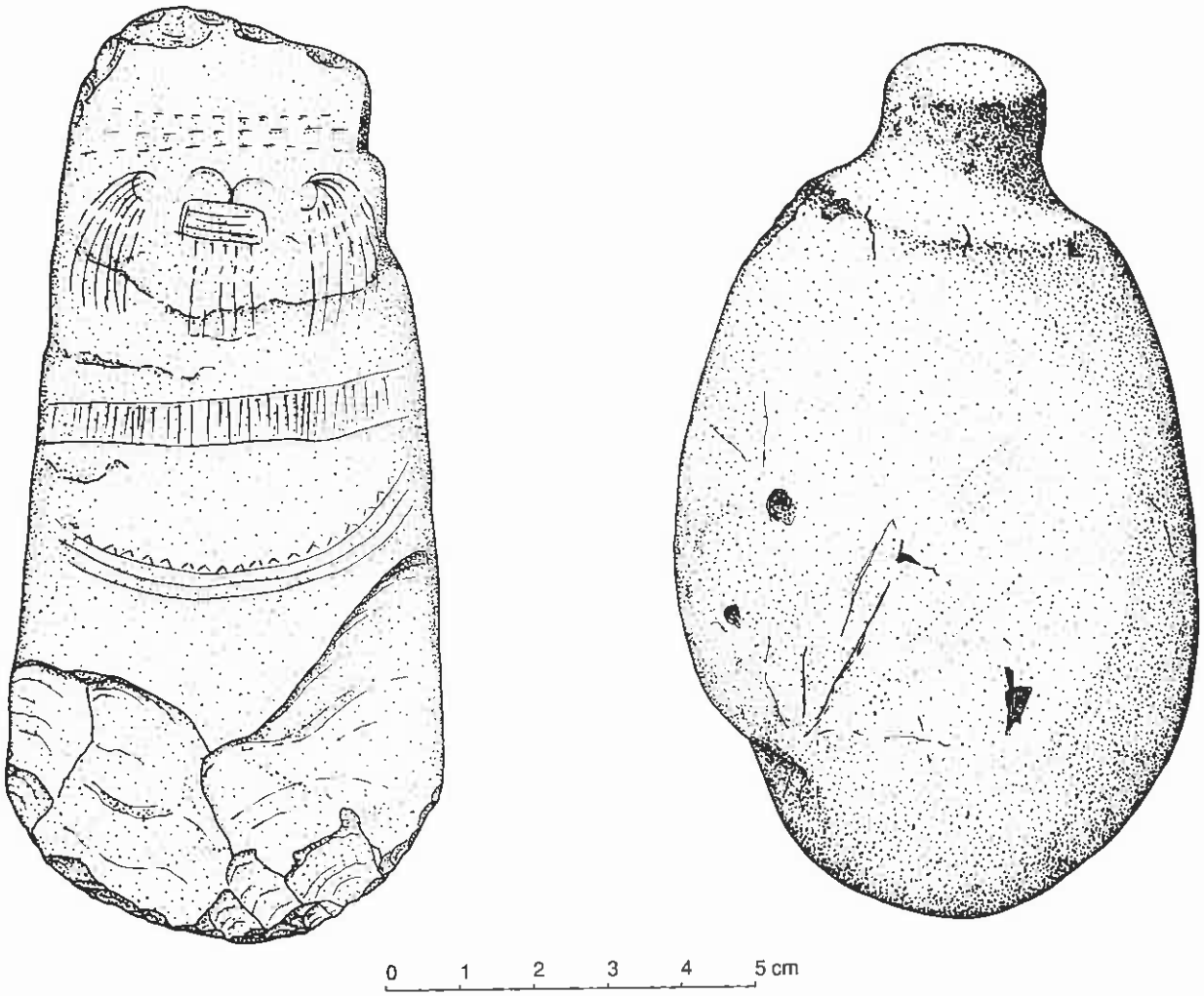
Cultural Affinities: This appears to be an important site with a long history of occupation. Several of the flaked stone artifacts (#31, #47) and possibly the slate "bayonet point" midsection (#16) may indicate an early (Ocean Bay) occupation. The stone plummet (#1) is a type characteristic of the earlier Kachemak tradition (Old Kiavak) while the ivory openwork carving (#7) and the straight compound fishhook barb (#13) suggest the later Kachemak tradition. The composite harpoon head (#52) might suggest a transitional Kachemak/Koniag date.

49AFG-046-1 *Stone Plummet with Narrow Cap (illustrated)*

Description: Flattened cylindrical cobble, one end pecked away leaving a small, rounded cap or knob. No trace of edge battering. Some short grooves on one face (significance uncertain) oriented at oblique angle to long axis. Some battering near the pecked neck on one edge.
Material: Soft stone with weathered-out inclusions.
Measurements: L 11.67; W 7.20; T 4.66; cap diameter 2.60; groove 2.44; Wt 551.2
Remarks: Early Kachemak tradition (D. Clark 1966:363, Figure 5-i,j, 1970:75, de Laguna 1975:55-56).

49AFG-046-2 *Lamp (illustrated)*

Description: Small oval stone lamp with very slight wick groove at narrower end. Fairly deep oil reservoir. External surface extensively shaped by pecking; little evidence for grinding of the reservoir or convex outer surface.
Material: Igneous or metamorphic stone (coarse and grainy).



49AFG-028-2 Incised Slate Figurine (left); 49AFG-046-1 Stone Plummet with Narrow Cap (right).

Measurements: exterior L 8.97; W 6.93; T 3.5; oil reservoir L 6.41; W 4.76; D 1.13; Wt 332.1
Remarks: Hunter's(?) lamp. Recently oiled.

49AFG-046-3 *Planing Adze Preform(?)*
Description: Large, relatively thin, bifacially flaked preform, rectangular in outline. Extensive primary flaking covers most of both faces; secondary bifacial flaking along both sides creates thin sharp edges. Convex, bifacially flaked single bevel bit. Poll area thin, bifacially flaked, somewhat irregular. Fairly thin, biconvex cross section. Fairly extensive ground patch on both faces near poll. No grinding in bit area. Flaking has removed some grinding.
Material: Basalt.
Measurements: L 10.46; W 5.01; T 1.21; Wt 101.1

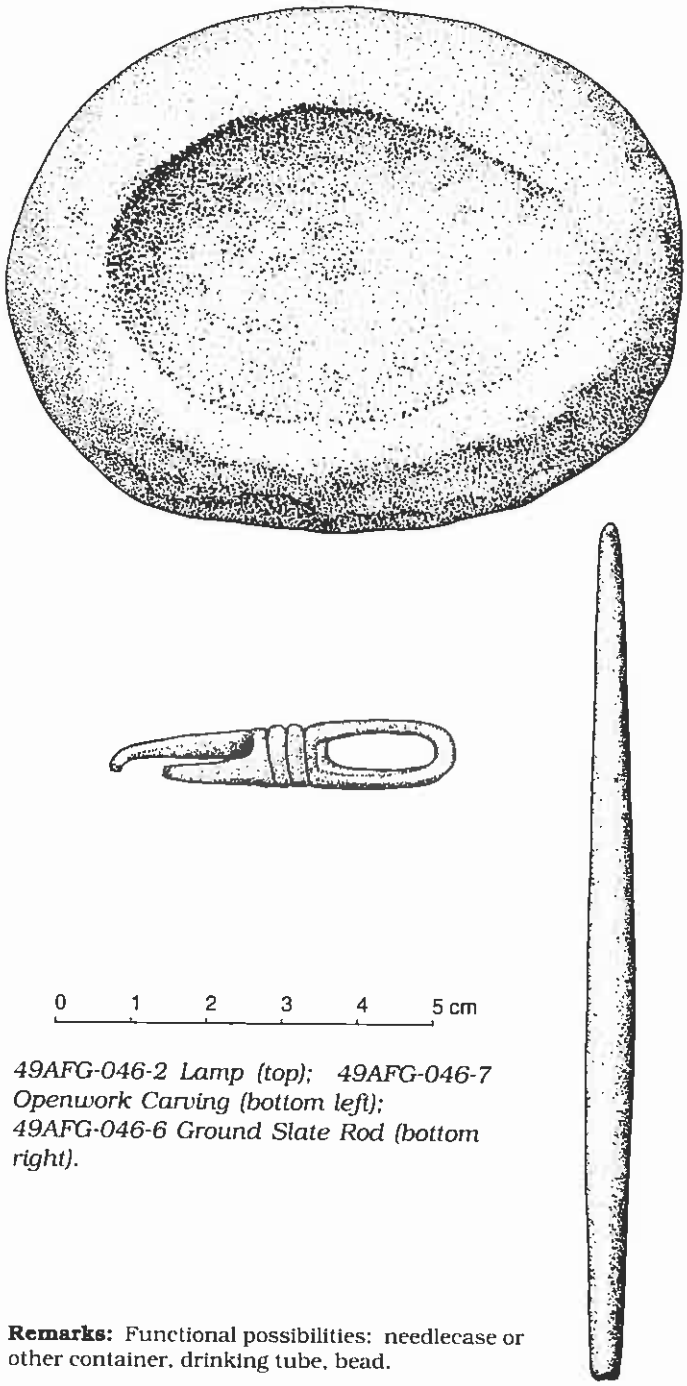
49AFG-046-4 *Bone Wedge*
Description: Extensively battered poll. Convex double-bevel working end. Surface highly weathered. Working end shows little damage. Plano-convex cross section.
Material: Whale rib, split(?)
Measurements: L 8.95; W 4.60; T 1.53; Wt 59.7

49AFG-046-5 *Edge-Battered Hammerstone*
Description: Thick, fairly flat pebble, rectangular in outline, with a rounded rectangular cross section. Extensively battered all around perimeter. Bifacial, deeply incised flakes removed along one side and some subsequent pecking of thin edge. Extensive pecking along opposite side and both ends.
Material: Igneous or metamorphic stone with inclusions.
Measurements: L 6.96; W 5.26; T 2.14; Wt 122.8
Remarks: Edges clearly put to some heavy pecking use. Notched/grooved stone or lamp preparation?

49AFG-046-6 *Ground Slate Rod (illustrated)*
Description: Slender, biconical slate rod; thickest in the middle, tapering toward both ends. Round cross section. Extensively ground over entire surface. One end (base?) thicker cross section and ground flat. Other end thinner cross section and proceeds with slight beveling to a blunt tip which is oval in cross section.
Material: Slate.
Measurements: L 11.26; Diameter 0.71; Wt 7.8
Remarks: Function unclear; possibly a highly blunted drill.

49AFG-046-7 *Openwork Carving (illustrated)*
Description: Slender, delicate piece consisting of two elongate oval openings separated by a midsection with three decorative grooves around it. Axes of openwork ends oriented perpendicular to one another so that only one at a time is visible. One oval has an opening of 0.51 cm at one end.
Material: Ivory.
Measurements: L 4.48; W 0.84; T 0.74; open ovals L 1.55 & [1.70]; W 0.49 & 0.47; W between central grooves 0.16 cm; Wt 1.5
Remarks: Specimen is somewhat similar to several carved Kachemak tradition objects from the Uyak Site on Kodiak (Heizer 1956:Pl. 81-w,x). It also bears an unmistakable, if generalized, similarity to various swivels, openwork carvings and linked objects associated with Ipiutak burials at Point Hope (Larsen & Rainey 1948:Pl. 58-71, Pl. 63-68, Pl. 66, 67, 68, 71, 72).

49AFG-046-8 *End Girdled and Polished Bone Tube*
Description: Straight midsection, girdled and snapped on ends, then polished smooth, as is surface. One surface flat, the remainder naturally rounded. Not decorated.
Material: Bird bone.
Measurements: L 5.76; W 0.85; T 0.68; Wt 2.9



49AFG-046-2 Lamp (top); 49AFG-046-7 Openwork Carving (bottom left); 49AFG-046-6 Ground Slate Rod (bottom right).

Remarks: Functional possibilities: needlecase or other container, drinking tube, bead.

49AFG-046-9 *Awl*
Description: Tip damaged, as is the articulated handle. Tip created by grinding an oblique facet across one surface.
Material: Humerus of medium-sized bird.
Measurements: L [9.61]; handle articular end W 1.75; shaft W 0.92; shaft T 0.62; Wt [4.4]

49AFG-046-10 *Laterally Barbed Point Tip*
Description: Simple, bi-bevel tip with only two, long, subdued barbs preserved; barbs outlined by a deep groove on each side. Barbs created by cutting angled grooves into the medial ridge defined by marginal grooves. Oval cross section, broken proximally.
Material: Interior piece of a land mammal bone.
Measurements: L broken; shaft W [0.66]; barb W [0.75]; T 0.58 length of barbs 1.66 (top) & 1.87
Remarks: Arrowhead?

49AFG-046-11 *Barbed Point Tip*
Description: Broken fragment, proximally end damaged on one surface. A single prominent barb, a sharp conical tip, and a sub-rectangular cross section. No lines or grooves.
Material: Dense land mammal bone.
Measurements: L [2.57]; barb W 0.61; shaft W 0.40; T broken
Remarks: Fishhook barb fragment?

49AFG-046-12 *Girdled Bone Fragment*
Description: Bone split longitudinally, girdled and snapped at one end, with a broad deep groove cut in one face 0.76 cm from girdled end. Medial groove 0.22 cm wide. Probably sawed rather than cut.
Material: Land mammal bone.
Measurements: Not taken; too fragmentary.
Remarks: Bead preform?

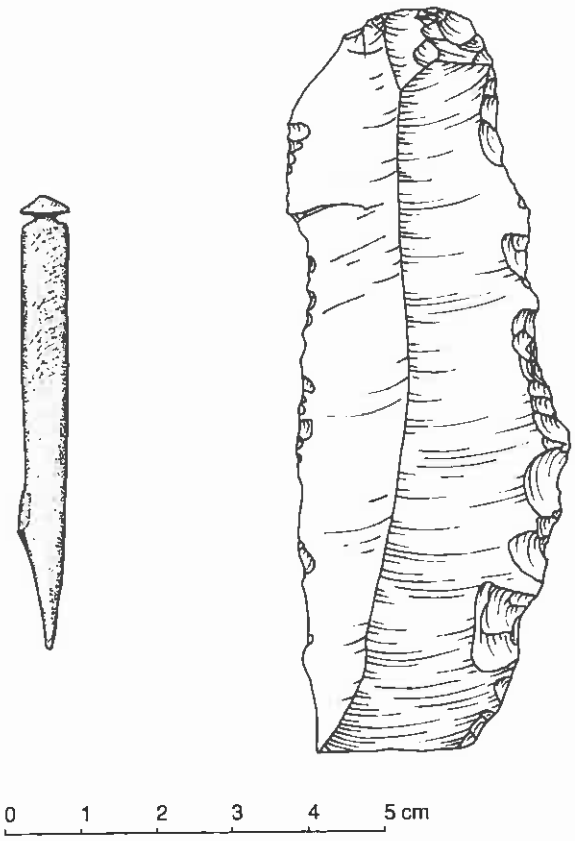
49AFG-046-13 *Compound Fishhook Barb (illustrated)*
Description: Straight shank with a slender sharp tip. Shaft has oval cross section and high polish. Single barb broken. Deeply grooved, conical basal knob.
Material: Bone.
Measurements: L 5.94; shank W 0.65; shank T 0.51; cap diameter 0.61 & 0.42 Wt 1.7
Remarks: The straight shank with basal groove is typical of the Kachemak tradition on Kodiak and in Kachemak Bay. Prince William Sound barbs are also straight, but lack the basal groove (de Laguna 1956:183, D. Clark 1974a:60).

49AFG-046-14 *Bone Awl*
Description: Straight radius, mid-section girdled and snapped and lightly polished at proximal end. Point created on distal end by grinding obliquely from one face. Highly polished, triangular cross section.
Material: Bird radius.
Measurements: L 5.73; W 0.28; T 0.26; Wt 0.4

49AFG-046-15 *Ground Slate Rod*
Description: Rounded, double-bevel spatulate tip. Edges and butt end thick and flat. Thick parallelogram cross section. Working tip definitely ground; lateral edges somewhat rounded by grinding. Apparently little grinding of flat faces but specimen so highly weathered that this is not certain.
Material: Slate.
Measurements: L 7.04; W 1.11; T 0.56; Wt 7.3

49AFG-046-16 *Ground Blade Midsection*
Description: Midsection elongate and slender, fairly thick, with a biconvex to plano-convex cross section. Straight parallel blade edges. Part of one edge shows extensive nicking (intentional?). Grinding striations, some oblique and some parallel to the long axis, were well preserved, thus specimen was not long on the beach, nor extensively water worn.
Material: Slate.
Measurements: L [6.11]; W [1.65]; T [0.51]; Wt [7.1]
Remarks: Proportions recall bayonet points of Ocean Bay II (D. Clark 1979:Fig. 18-a-d, Pl. 16-D-H, Pl. 17-E-H). Fresh-looking incisions (an x? and something else) may be bag retouch?

49AFG-046-17 *Retouched Flake Blade*
Description: Irregular dorsal retouch of one convex side creates a sinuous edge. Large, simple, flat striking platform. Distal end terminates in hinge fracture. Pronounced medial ridge. Thick plano-triangular cross section. Large bulbar scar. Some use nibbling of unretouched lateral edge.
Material: Patinated basalt.
Measurements: L 9.84; W 3.55; T 1.37; Wt 50.5
Remarks: Patination may indicate considerable age.

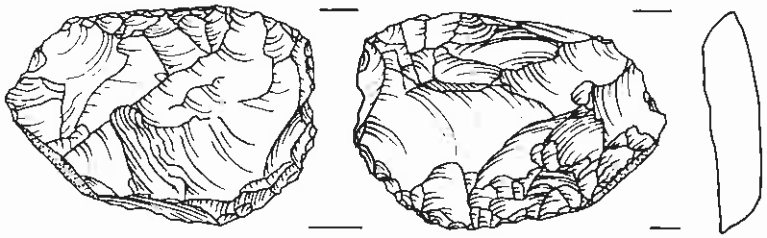


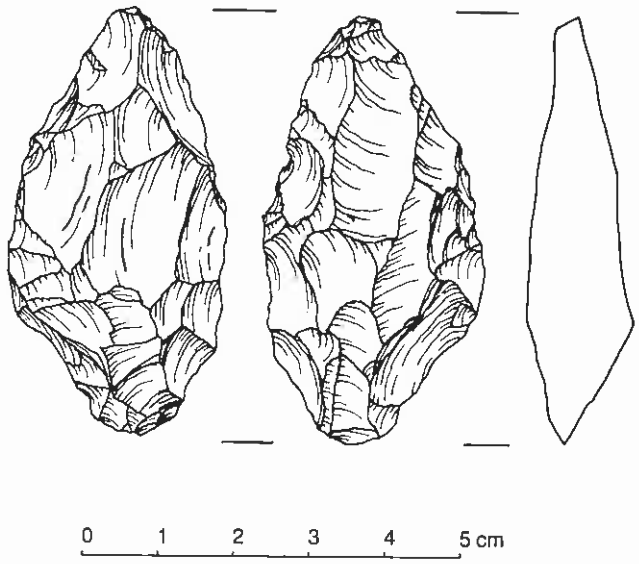
49AFG-046-13 Compound Fishhook Barb (left); 49AFG-046-17 Retouched Flake Blade (right).

49AFG-046-18 *Ground Slate Edge Fragment (Scraper?)*
Description: Convex, fairly blunt, beveled edge fragment (an ulu back? slate scraper?). Cut and snapped free hand on one end (not sawed). Trace of possible, blunt, ground back opposite convex edge; remainder of perimeter broken.
Material: Slate.
Measurements: L, W, & Wt not taken; T 0.46; arc of worked edge 5.20
Remarks: Unusually thick.

49AFG-046-19 *Edge-Battered Chert Chunk*
Description: Sub-rectangular outline and cross section, vitreous luster suggests heat treatment. Extensive edge battering along one side, but only one plausible flake removal scar.
Material: Red chert.
Measurements: L 6.28; W 4.26; T 2.01; Wt 63.3

49AFG-046-20 *Sub-Rectangular Stone Wedge (illustrated)*
Description: Paired, battered edges on fairly thick, long, straight sides. Probably due to thickness of flaked edges, battering and crushing is unifacial rather than bifacial and occurs on alternate faces. One end retains thick cortical patch; end obliquely opposite exhibits bifacial crushing. Wedge rotated. Rectangular outline, parallelogram cross section.
Material: Red chert, unusually lustrous; lighter and darker sections divided by curved line; material is homogeneous in each section.
Measurements: L 4.12; W 2.88; T 0.90; Wt 13.8





49AFG-046-20 Sub-Rectangular Stone Wedge (left): 49AFG-046-23 Small, Thick, Biface Preform (right).

49AFG-046-21 *Small Retouched Flake, Subconvex Edge*

Description: Small, parallel-sided flake, even dorsal retouch of one irregular denticulate convex side. Fairly straight side opposite has nibbling retouch/crushing of margin. Latter probably fortuitous. Distal end snapped. Dorsal surface suggests previous removals from several directions. Thin, damaged, striking platform.
Material: Red chert.
Measurements: L 3.76; W 1.82; T 0.44; Wt 3.6

49AFG-046-22 *Sporadically Edge-Nibbled Chunk*

Description: Thick, slender chunk with long sides roughly parallel, pointed at both ends. Thick, plano-triangular cross section. Some fire shattering apparent. Sporadic edge nibbling and flaking but artifact status in doubt.
Material: Red chert with quartz vein inclusions and dull, stony areas on predominately glassy surface.
Measurements: L 3.86; W 1.32; T 1.19; Wt 5.4

49AFG-046-23 *Small, Thick, Biface Preform (illustrated)*

Description: Broad, thick; two somewhat thinner ends coming to rounded points. Primary shaping spall scars cover both faces. Edges thin but not given secondary retouch. Irregular plano-convex cross section. Apparent shoulder probably represents inability to thin. Irregular oval.
Material: Basalt.
Measurements: L 5.61; W 2.98; T 1.32; Wt 21.1
Remarks: Unfinished point.

49AFG-046-24 *Edge-Battered Subtriangular Slate Piece*

Description: Patinated on both surfaces; darker material shows in edge flaked areas. Not ground. Main edges show haphazard flaking; differential patination suggests flake scars are of different ages.
Material: Slate.
Measurements: L 8.07; W 6.56; T 0.58; Wt 35.6
Remarks: Extremely doubtful artifact.

49AFG-046-25 *Subtriangular Slate Piece, Edge Flaked(?)*

Description: Sporadic, alternate face flaking on all three edges. Sporadic striations on both faces oriented in different directions, do not clearly document human shaping. Irregular cross section.
Material: Slate.
Measurements: L 8.50; W 4.75; T 0.93; Wt 36.3
Remarks: Problematic artifact.

49AFG-046-26 *Large Biface Tip (Preform)*

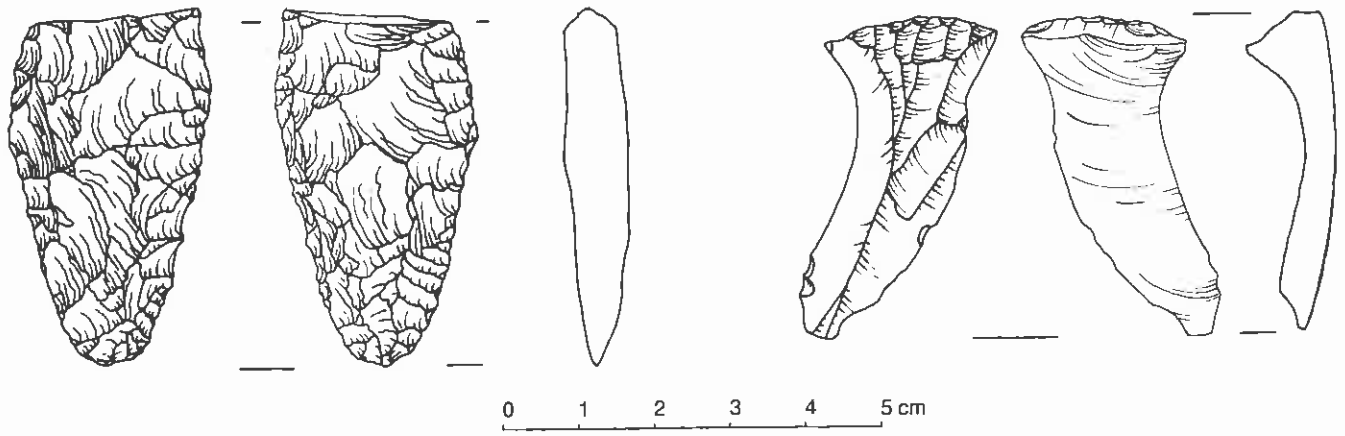
Description: Broad, thin tip. Convex edges converge to fairly sharp point. Bifacial flaking covers both faces but edge retouch minimal. Thin, biconvex cross section in tip area; thicker and irregular near proximal break. Broken proximally; no trace of base remains. Surfaces suggest thermal damage.
Material: Light colored (green-gray) igneous material with tiny olivine inclusions.
Measurements: L --; W [3.83]; T [0.83]; Wt [15.3]
Remarks: Late stage preform for knife or spear head. Non-homogeneous material appears to be a poor choice for flaking.

49AFG-046-27 *Rectangular Flake Blade*

Description: Thick, rectangular (in outline) flake; asymmetrically trapezoidal cross section. Large plain striking platform. Extensive battering and crushing of dorsal edge of platform associated with one successful and at least one unsuccessful attempt to remove flake oriented parallel to long axis. Distal hinge fracture. Sporadic unifacial edge nibbling, probably fortuitous. Retains traces of at least one previous removal perpendicular to long axis.
Material: Banded gray chert, fine grained.
Measurements: L 4.44; W 3.04; T 1.06; Wt 15.5
Remarks: Classic flake blade.

49AFG-046-28 *Large Rectangular Flake*

Description: Multi-faceted striking platform. No retouch along edges, one of which is very thick. At least one previous removal originating on distal end. Wedge shaped cross section. Projecting spur on one edge appears to be natural.
Material: Basalt, heavily patinated on all surfaces bu ɔt water or beach rolled, retains sharp edges.
Measurements: L 7.15; W 2.66; T 1.27; platform L 1.63; platform W 0.54; Wt 21.7



49AFG-046-31 Large Contracting Stem Biface (left); 49AFG-046-34 Flake Blade Core Fragment (right).

49AFG-046-29 *Flaked Planing Adze Preform(?)*
Description: Ovoid chunk, bifacially battered about edges. Some flake scar ridges on both surfaces are smoothed (beach-rolling?) but no clear evidence of face grinding. No clear working edge. Irregular biconvex cross section.
Material: Greenstone.
Measurements: L 5.73; W 3.65; T 0.91; Wt 27.9
Remarks: Material suggests adze preform; early stage of shaping?

49AFG-046-30 *Probable Stone Wedge*
Description: Subrectangular in outline, thick and irregular cross section. "Slice of bread" flake retains thick cortical platform. No cortex on dorsal face. Extensive edge crushing and battering of platform on one face paired with subconcave, bifacially flaked and battered edge opposite.
Material: Chert, green mottled.
Measurements: L 3.43; W 2.50; T 1.10; Wt 11.3

49AFG-046-31 *Large Contracting-Stem Biface (illustrated)*
Description: Slender biface, thick biconvex cross section. Single shoulder not offset. Contracting stem with rounded base. Broken distally. Many small parallel flake scars. Both surfaces extensively damaged, by fire?
Material: Glassy material; obsidian(?) badly fire damaged?
Measurements: L [4.63]; W 2.64; T [0.86]; shoulder H 2.62; Wt [13.1]
Remarks: Large stemmed point or knife.

49AFG-046-32 *Retouched Flake*
Description: Subrectangular flake blade. Dorsal edge retouch of one subconvex lateral margin. Large, plain striking platform. Medial ridge shows evidence of at least one previous removal from same platform.
Material: Basalt with large quartz inclusions.
Measurements: L 4.31; W 2.46; T 0.88; Wt 7.4

49AFG-046-33 *Flake*
Description: Rectangular in outline. Broad plain platform. Distal hinge fracture. Sporadic edge nicking probably fortuitous. Previous blows struck from various directions on dorsal surface, therefore not a classic flake blade.
Material: Basalt, patinated dorsally and ventrally.
Measurements: L 3.64; W 1.76; T 0.61; Wt 3.5

49AFG-046-34 *Flake Blade Core Fragment (illustrated)*
Description: Thick, parallel-sided flake blade removed from a core on which there had been three to five previous removals parallel to axis. Additional traces of one blow oblique to and one blow perpendicular to long axis. Large striking platform, essentially plain but with several flakes removed from front. Thick plano-triangular cross section.
Material: Patinated basalt.
Measurements: L 4.52; W 1.60; T 0.56; striking platform L 2.24; W 1.0; Wt 6.2
Remarks: Suggests controlled flake production technique.

49AFG-046-35 *Unretouched Distal Flake Fragment*
Description: Broad, thin, irregular flake. Striking platform area broken. Sporadic, unifacial nibbling of edges has removed patina, this presumably fortuitous and recent. Flake highly water-rolled and heavily patinated on both faces. Traces of previous removals perpendicular to long axis on dorsal face.
Material: Patinated basalt.
Measurements: L [2.91]; W 2.36; T 0.33; Wt [2.4]

49AFG-046-36 *Irregular Chunk*
Description: Sporadic damage of thin edges (not intentional retouch). One thick end presents a fresher surface. Removals from both faces on this end, cannot determine if intentional retouch. Water-rolled. Thick with irregular cross section.
Material: Unknown, highly patinated on both faces.
Measurements: L 2.46; W 2.01; T 0.67; Wt 3.8
Remarks: Problematic artifact.

49AFG-046-37 *Small Unretouched Side-Blow Flake*
Description: Broad, plain, cortical platform; no retouch, heavily water-rolled.
Material: Greenstone.
Measurements: L 1.27; W 1.69; T 0.39; Wt 0.96
Remarks: Material suggests association with adzes.

49AFG-046-38 *Possible Stone Wedge*
Description: Triangular outline and irregular biconvex cross section. Broken at one end. Sides converge to rounded point at opposite end. Localized unifacial crushing and battering on sides suggest possible light use as wedge.
Material: Red chert, lustrous but with dull impurities (stony inclusions in glassy matrix).
Measurements: L 3.46; W 3.45; T 1.44; Wt 18.2

49AFG-046-39 *Unworked Pebble*
Description: Flat, triangular beach pebble with broad band of resistant quartz near one end.
Material: Graywacke with resistant quartz band.
Measurements: Not taken.
Remarks: Not artifactual; possible curiosity?

49AFG-046-40 *Rectangular Worked Bone Piece*
Description: Rectangular outline. Rounded rectangular cross section. One end broken, opposite, subconvex end appears to have been ground flat. Rib split longitudinally on one face, revealing cancellous tissue. Other face dense bone with some damage. Probably adzed or crudely cut on both long sides.
Material: Whale rib.
Measurements: L [10.25]; W 3.74; T 1.19; Wt [35.2]
Remarks: Function unknown. Burnisher?

49AFG-046-41 *Possible Double-Edged Blade Tip or Base*
Description: Triangular piece, rounded point on one end; broad end opposite regular a break?. Distinct, plano-triangular cross section suggests part of large, double-edged slate blade, but specimen too weathered to permit certainty.
Material: Slate.
Measurements: L [5.44]; W [2.76]; T [0.57]; Wt [8.1]
Remarks: Problematic artifact.

49AFG-046-42 *Water-Rolled Flake Fragment*
Description: Small distal fragment. Edge nicking on both sides and end (may be fortuitous). Preserved dorsal surface suggests previous blows struck from several directions.
Material: Red chert.
Measurements: L --; W [1.8]; T [0.42]; Wt [1.5]
Remarks: Retouch is highly problematic.

49AFG-046-43 *Possibly Retouched, Broken Chert Flake*
Description: Thick badly edge-damaged flake. Retained bifacial retouch of portion of base, concave distal side suggests possible hafting as drill or graver. Extensive edge damage precludes certainty. Some localized crushing of damaged edges may be fortuitous. Edge damage in several places created extensive breakouts of lateral edges or sides. Extensively water-rolled.
Material: Red chert, lustrous.
Measurements: L 3.66; W 1.32; T 0.43; Wt 2.1

49AFG-046-44 *Large Biface Thinning Flake*
Description: Large, thin flake with rounded outline, broken distally. Thin, highly angled, bifacially retouched platform. Dorsal surface retains truncated remnants of scars, apparently struck from several directions.
Material: Basalt(?) highly patinated on all surfaces, including distal break.
Measurements: L [2.35]; W 2.49; T 0.33; Wt [2.5]

49AFG-046-45 *Small Endscraper(?)*
Description: Small chert chunk, fairly flat on one face; convex end a steep single bevel with crushing edge retouch; end opposite a fairly thick break.
Material: Red chert, lustrous.
Measurements: L 1.70; W 1.88; T 0.62; chord of possible working end 1.46; Wt 2.4

49AFG-046-46 *Thick Flake Endscraper(?)*
Description: Thick flake, square in outline; plano-triangular cross section. Both surfaces heavily patinated; extensively water-rolled. Platform area apparently broken. A number of dorsal removals on thick, sinuous, distal end. Edge extensively crushed also. End removals clearly younger than flake surfaces. Lateral edges also show bifacial crushing. Shape suggests possible endscraper, but nature of retouch and disparity of age suggest natural forces.
Material: Chert, gray-green.
Measurements: L 3.35; W 3.36; T 1.27; Wt 14.8
Remarks: Natural?

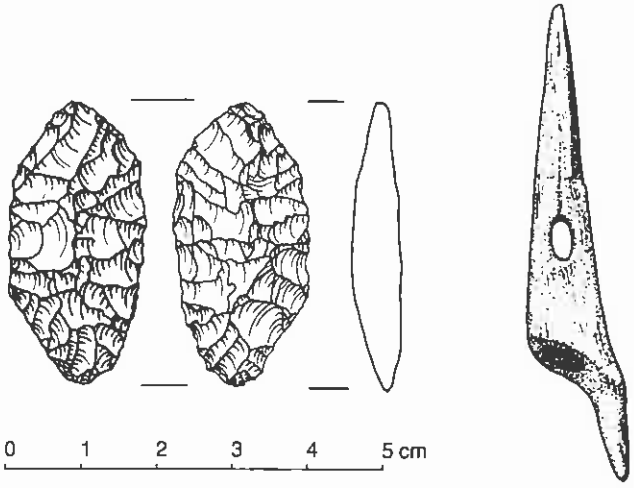
49AFG-046-47 *Small Asymmetric Biface (illustrated)*
Description: Both ends terminate in rounded points. One highly convex, bifacially retouched side opposes a bifacially retouched side comprised of three straight to subconvex segments. Fairly thick biconvex cross section, retouched over entire face on both sides.
Material: Red chert, with quartz vein.
Measurements: L 3.67; W 1.86; T 0.67; Wt 5.1
Remarks: Either a small knife or possibly a side blade inset (not projectile point).

49AFG-046-48 *Small Rectangular Ulu, Subconvex Blade*
Description: Small, rectangular ulu, one end straight and blunt; other edges blunted as well, but highly weathered. Tool could have been grasped in hand with index finger along blunt straight end. Ground.
Material: Slate.
Measurements: L 6.45; W 3.63; T 0.27; chord of working edge 5.50; Wt 12.0
Remarks: May be essentially complete, but water-rounding of edges precludes certainty.

49AFG-046-49 *End-Battered, Flat Cobble Hammerstone*
Description: Rounded rectangular outline and cross section. Narrow end heavily battered (flattened by pecking); no other obvious signs of use.
Material: Andesite(?) with plagioclase inclusions.
Measurements: L 9.60; W 6.98; T 3.18; Wt 348.0

49AFG-046-50 *End-Battered, Flat Cobble Hammerstone*
Description: Small, flat, oval beach cobble, battered flat on one rounded end. Traces of pecking in center of one face. Rounded rectangular cross section.
Material: Rhyolite(?) with small quartz inclusions.
Measurements: L 8.02; W 6.04; T 3.18; T of flat battered end 1.1; Wt 231.0
Remarks: Unusually broad, evenly flattened surface suggests systematic and/or specialized use.

49AFG-046-47 Small Asymmetric Biface (left); 49AFG-046-52 Composite(?) Toggle Harpoon Head (right).



49AFG-046-51 *Grooved Stone Fragment*
Description: Thick, rounded cobble fragment, broken both ends. Broad, crudely pecked, groove up to 3.8 cm wide girdling middle of fragment.
Material: Graywacke.
Measurements: diameter [7.38] X [7.24]; Wt [372.0]
Remarks: Probably unfinished; cannot tell from remnant if intention was a stone grooved round the middle, or a very large plummet.

49AFG-046-52 *Composite(?) Toggle Harpoon Head (illustrated)*
Description: Probable, uncompleted, composite harpoon with (missing) valve, though preserved part lacks knob or groove at end to attach valve. Oval line hole 0.62 cm long x 0.41 cm wide. Deep, counter sunk, round socket, 0.6 cm diameter and 0.68 cm deep. Elongate, pointed spur with oval cross section. Grooves appear to lead from line hole towards tip. Highly weathered. Distal end inset 0.44 cm in front of line holes, top convex, bottom concave.
Material: Land mammal bone.
Measurements: L 6.42; W 1.07; T 1.26; Wt 3.6
Remarks: Late type in Kachemak Bay (SEL-041).

49AFG-046-53 *Ground Slate Blade Edge Fragment*
Description: One convex side sharpened by grinding to double-bevel. Other side broken. Convex base bifacially flaked. Opposite end broken. Shaping striations mainly parallel long edge.
Material: Slate.
Measurements: L [3.58]; W [1.9]; T [0.21]; Wt [2.0]
Remarks: Possible convex based point; may just be an edge fragment of a larger blade.

49AFG-046-54 *Ulu Fragment(?)*
Description: End fragment of large implement formed by intersection of straight, beveled ground blade and irregular, flaked edge blunted by grinding. Ground edge blunted, rather than sharpened, by grinding. Remaining two edges broken.
Material: Slate.
Measurements: L & W not taken; T 0.27; Wt --
Remarks: Either the blade and one end of an unusual slate ulu or scraper or possibly the base and stem edge of a large double-edged slate blade.

49AFG-046-55 *Small Biface(?)*
Description: Highly weathered. Flake scars (if that is what they are) largely obscured. One fairly thin end comes to a rounded point; other broken. Thin edges, biconvex cross section.
Material: Highly weathered and pitted surface.
Measurements: L 4.11; W 1.42; T 0.59; Wt 3.8
Remarks: High degree of water-rolling. Dubious artifact.

49AFG-046-56 *Ulu Blade Fragment*
Description: Long, very slightly curved, double-bevel, ground blade. Convex end blunt; opposite two sides broken. Both faces steeply beveled near working edge. Blade somewhat blunt, perhaps due to wave action. Preserved shaping striations oriented parallel to blade.
Material: Slate.
Measurements: blade L 7.21; W 6.65; T 0.43
Remarks: Might be a scraper rather than an ulu.

49AFG-046-57 *Small Edge-Battered Slab*
Description: Irregular rectangular outline, fairly thin edges with sporadic bifacial battering. No clear worked/working edge. Highly water-rolled. Flake scars obviously of different ages. Fairly thin but irregular cross section.
Material: Greenstone.
Measurements: L 6.11; W 4.48; T 0.96; Wt 35.6
Remarks: Highly problematic artifact.

AFG-081

Cultural Affinities: The large adze blade and straight-bladed tanged ulu suggest the presence of a late prehistoric Koniag component at this site.

49AFG-081-1 *Straight-Bladed Tanged Ulu (illustrated)*
Description: Very slightly subconvex cutting edge. Rectangular back broken at one end, shaped by flaking, possibly later blunted by grinding. Rust and/or red ocher adheres to both surfaces. Whole piece broken at one end. Preserved end straight and probably blunted by grinding. Visible striations on both faces mainly oriented parallel to the long axis. Ground over all of both faces. Most intensively ground within 1.5 cm of working edge.
Material: Slate.
Measurements: chord of working edge L [10.36]; back L 6.45; W 3.82; T 0.51; back H 0.7; Wt 29.7
Remarks: A good Koniag type (D. Clark 1974b:105, Pl. 38-g, Pl 39-o). Probably rendered this small by repeated re-sharpening.

49AFG-081-2 *Retouched Boulder Spall*
Description: Small, thin, circular outline. Dorsal edge retouch over much of convex edge opposite point of detachment. Broken in one small area, retouched at that point. Edges still quite sharp, so not long in tidal zone. Side blow flake.
Material: Graywacke.
Measurements: L 6.7; W 5.9; T 1.06; Wt 52.5

49AFG-081-3 *Planing Adze*
Description: Several generations of barnacles encrusted on specimen. Fairly large, rectangular, originally flaked to shape, then extensively ground on both surfaces. Also ground lateral edges. Convex bit, double-bevel, but more extreme on one face. Poll is rounded and does not show extensive battering. Bit damaged on both corners. Remaining blade still quite sharp. Thick, somewhat irregular, rounded rectangular cross section.
Material: Greenstone.
Measurements: L 8.19; W 3.98; T 1.73; chord of bit [2.87]; Wt 86.4

AFG-095

Cultural Affinities: This material came from a lithic scatter on a cobble beach beneath steep vegetated slopes. Though the chert does not clearly display human workmanship, in conjunction with the hammerstone it suggests quarrying activity. Flaked stone artifacts are rare in the late prehistoric Koniag phase; presumably the quarrying activity took place earlier.

49AFG-095-1 *Hammerstone*
Description: Large, heavy, cylindrical cobble battered at both ends; flattened at one end through extensive use. Round cross section. Traces of pecking on sides near lightly utilized end.
Material: Graywacke.
Measurements: L 11.78; W 6.53; T 5.43; Wt 785.0

49AFG-095-2 *Unworked(?) Tabular Piece of Chert*
Description: Flat, tabular piece, irregular rectangular outline, rectangular cross section. No clear evidence of flake removal.
Material: Green chert, full of impurities.
Measurements: L 8.77; W 5.52; T 2.05; Wt 131.6

49AFG-095-3 *Unworked, Rectangular, Red Chert Block*
Description: Block of red chert. Irregular rectangular in outline; rectangular cross section. Cortex preserved on two thick lateral edges. Numerous fissures and other impurities. No convincing evidence of human modification.
Material: Chert, homogeneous.
Measurements: L 9.44; W 8.01; T 4.66; Wt 552.8

49AFG-095-4 *Unworked(?) Split Chert Block*
Description: Split chert block with two fresh surfaces. Cortex retained on both ends, back and side. Rectangular outline; irregular cross section. Several random flakes removed, but human action impossible to document.
Material: Chert, red center and green on both ends (cortical).
Measurements: L 6.33; W 5.38; T 4.15; Wt 248.5

AFG-096

Cultural Affinities: Isolated find, presumably predating the Koniag phase.

49AFG-096-1 *Sidescraper*
Description: Thick chunk. Two lateral edges converge to broad point. Unifacial retouch of one convex side, in edge area. Other lateral edge unifacially battered on same face. Back thick (on natural break?). Some edge nibbling on one edge of break. Irregular cross section; irregular outline.
Material: Red chert, vitreous.
Measurements: L 3.86; W 3.16; T 1.15; chord of retouched edge 3.16; Wt 16.9
Remarks: Thermal damage, potlids.

AFG-097

Cultural Affinities: Housepits observed on this site suggest at least two occupations, one of late prehistoric Koniag phase and another, Kachemak tradition or earlier. The older occupation is characterized by three smaller, poorly-defined housepits located on a higher terrace. The two triangular flaked adzes (#17, #18) are of particular interest since they strongly resemble a distinctive type characteristic of the I/IInd Millennium B.C. Birch phase on the Alaska Peninsula and have not been reported previously from Kodiak. The point base with a serrated stem (#10) predates the Koniag phase. The small notched stone (#9) and drilled slate ulu (#6) are compatible with a late Kachemak tradition or transitional Kachemak/Koniag occupation.

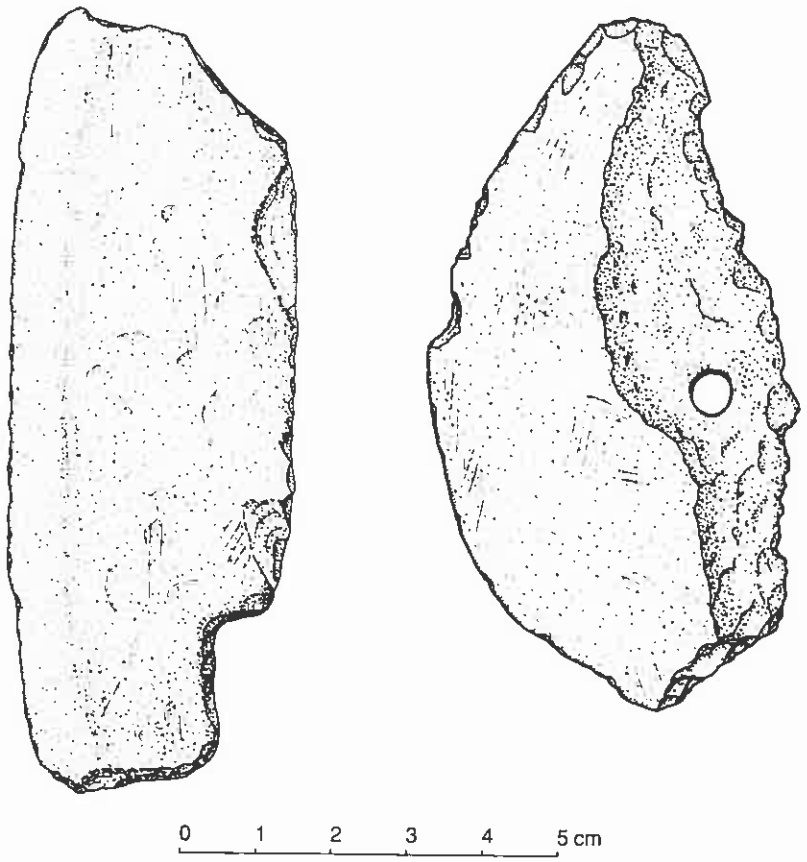
49AFG-097-1 *Small Rectangular Ulu*
Description: Subconvex double-bevel, ground blade. Angled back on thick natural break. One straight end also on thick break; other end thin and appears smoothed by grinding. Grinding largely confined within one cm of working edge.
Material: Slate.
Measurements: L 5.65; W 4.08; T 0.44; Wt 14.8
Remarks: This specimen could easily be held with the forefinger on the thick broken end.

49AFG-097-2 *Stemmed Point Fragment*
Description: Midsection of large ground slate point or knife (unfinished?). Asymmetric, non-prominent shoulders and broad, very slightly contracting stem. Broken proximally, distally and on one face. Parallel-sided, subconvex stem edges above shoulders flat ground rather than sharp. Abundant shaping striations on both faces oblique to long axis. One shoulder created by unifacial flaking of stem. Cross section too damaged for determination.
Material: Slate.
Measurements: L [7.69]; W 2.73; T 0.63; Wt [15.5]

49AFG-097-3 *Ulu Fragment(?)*
Description: Small rectangular piece, very slightly subconvex working edge opposes straight back created by free-hand angled cut. One straight end on flat natural break; opposite end broken. Preserved shaping striations parallel long axis.
Material: Slate.
Measurements: L [6.33]; W 3.31; T 0.30; Wt [10.6]
Remarks: Uluform, possibly re-worked from a larger ground slate implement.

49AFG-097-4 *Flaked and Ground Slate Fragment*
Description: Large, rectangular fragment, coarsely ground on one face. Both long edges broken; one irregular convex end unifacially flaked. Opposite end broken but retains 0.8 cm straight cutting edge, bifacially beveled 0.1 cm from edge.
Material: Slate.
Measurements: L [7.60]; W [4.37]; T 0.40; Wt [17.1]

49AFG-097-5 *Flat Cobble Hammerstone Chopper*
Description: Large, flat, oval outline, rounded rectangular cross section. Extensively battered around most of periphery. Multiple large flakes driven bifacially from one end, creating four cm of sinuous working edge.
Material: Graywacke(?)
Measurements: L 10.35; W 8.10; T 3.07; Wt 42.2
Remarks: This might also have been used as a weight; broad shallow notches in opposite ends might have permitted attachment to a line.



49AFG-081-1 Straight-Bladed Tanged Ulu (left); 49AFG-097-6 Small Ulu with Drilled Hole (right).

49AFG-097-6 *Small Ulu with Drilled Hole (illustrated)*

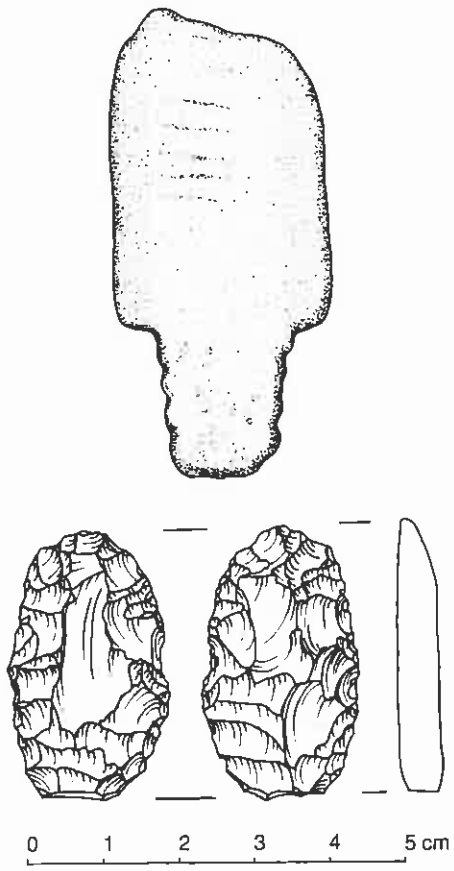
Description: Highly convex blade. Back damaged. Fire shattered? Working edge on one face also damaged. Single hole, 0.62 cm in diameter, biconically drilled in center near back. Drilling unusually true. Septum between two holes unobtrusive. Both ends damaged.
Material: Slate.
Measurements: L [9.08]; W [4.77]; T 0.49; Wt [25.7]

49AFG-097-7 *Large Flake from Planing Adze*

Description: Quadrilateral flake with extensive ground areas on dorsal surface. Convex, small end has a little grinding on very edge of ventral face.
Material: Greenstone.
Measurements: L 4.40; W 4.21; T 0.82; Wt 16.1
Remarks: This was struck from a large planing adze and the ground edge was perhaps re-utilized.

49AFG-097-8 *Double-Edged(?) Blade Midsection*

Description: Triangular fragment. One straight double-bevel ground edge, opposite long edge battered. Converges to probably fortuitous point. Broken proximally. Cross section indeterminate. Highly water-rolled.
Material: Slate.
Measurements: L [4.74]; W [2.32]; T [0.58]; Wt [7.3]
Remarks: Probably from a large double-edged blade. Eroded condition precludes detailed study.



49AFG-097-10 Serrated Stemmed Point (top); 49AFG-097-11 Small Oval Biface (bottom).

49AFG-097-9 *Notched Stone*

Description: Broad, rounded outline, flat, thin. Broad notches pecked (not flaked) in both ends.
Material: Graywacke.
Measurements: L 4.83; W 4.39; T 1.35; notch W 1.44 & 1.20; Bi-notch L 4.45; Wt 47.9

49AFG-097-10 *Serrated-Stem Point (illustrated)*

Description: Parallel-sided, offset, serrated stem. Three and four notches cut in thick-sided stem. Prominent rounded shoulders. Straight lateral blade edges. Broken distally. Base straight with rounded corners. Cross section thinly biconvex. Decorated with six and five lines perpendicular to long axis in center of each face. Lines vary between 0.6 and 1.0 cm. At least 15 small, shallow round pits of uncertain function on one face of stem. These do not appear to be natural weathering. Badly water-rolled.
Material: Slate.
Measurements: L [6.25]; shoulder W 2.98; T 0.54; stem L 1.93; Wt [14.9]

49AFG-097-11 *Small Oval Biface (illustrated)*

Description: Sides and one end convex, opposite end also rounded but a thick, unusual break. While rounded end is bifacially retouched, it has a steep unifacial bevel reminiscent of end scrapers. Broken end has paired crushings 0.5 cm in from edge. Two concave bladiform facets of uncertain origin also occur on break. Biconvex cross section.
Material: Red chert.
Measurements: L [3.48]; W 2.03; T 0.57; Wt [5.4]
Remarks: Shape suggests small hafted implement (knife or side blade) rather than a point.

49AFG-097-12 *Flat Cobble Hammerstone*

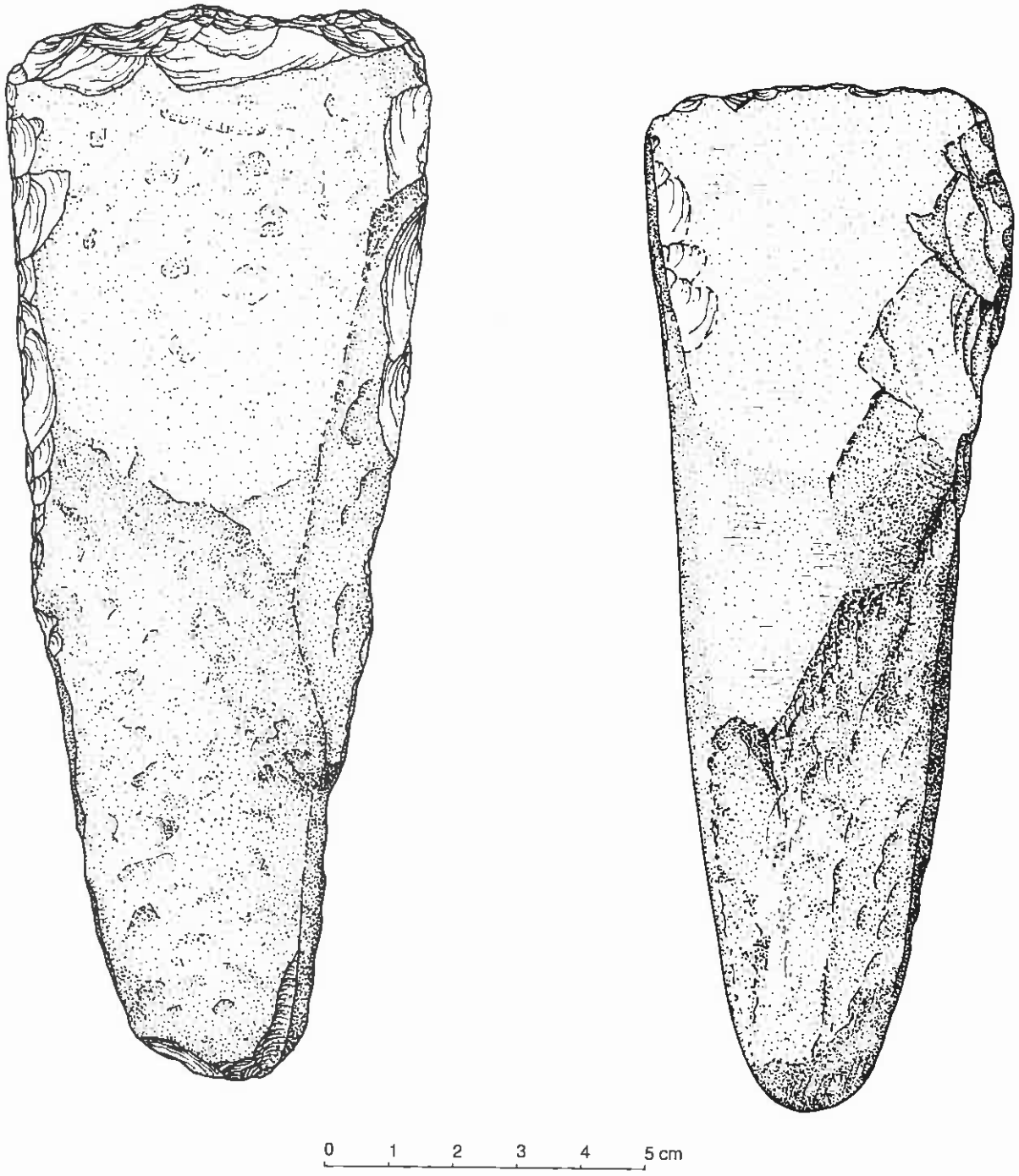
Description: Flat, rectangular cobble with rounded ends and lateral edges, yielding rounded rectangular cross section. Fairly thin, rounded, lateral edges show extensive damage in three discrete areas (from hammerstone use). These heavily utilized areas, located near ends, are about three cm long. Edge utilization removed two paired flakes in one of these areas. Light pecking of both ends as well.
Material: Chert(?), dark.
Measurements: L 11.16; W 3.75; T 1.98; Wt 141.1
Remarks: Exceptionally smooth cortical surface except where battered or pecked.

49AFG-097-13 *Edge-Ground Boulder Spall*

Description: Oval boulder spall. One convex lateral edge was intentionally bifacially ground. Edge grinding is confined to within 0.3 mm of edge. Ground edge is bluntly double-bevel rather than flat.
Material: Graywacke.
Measurements: L 10.50; W 5.95; T 1.64; arc of ground edge 8.32; Wt 124.1
Remarks: Curved and beveled nature of the ground edge suggests use other than as a saw. Striations of ground edge appear to run perpendicular to the edge axis, not parallel.

49AFG-097-14 *Worked(?) Slate Slab*

Description: Irregular rectangular slab of slate. One long side a thick natural break. Opposite, long edge sinuously straight, possibly beveled and blunted by grinding. One end is subconvex, fairly thin, and smooth. Opposite end a natural break. Extremely water worn.
Material: Slate.
Measurements: L 8.09; chord of worked(?) edge L 8.09; W 6.19; T 0.72; Wt 57.4
Remarks: Specimen is so weathered that identification as an artifact is uncertain.



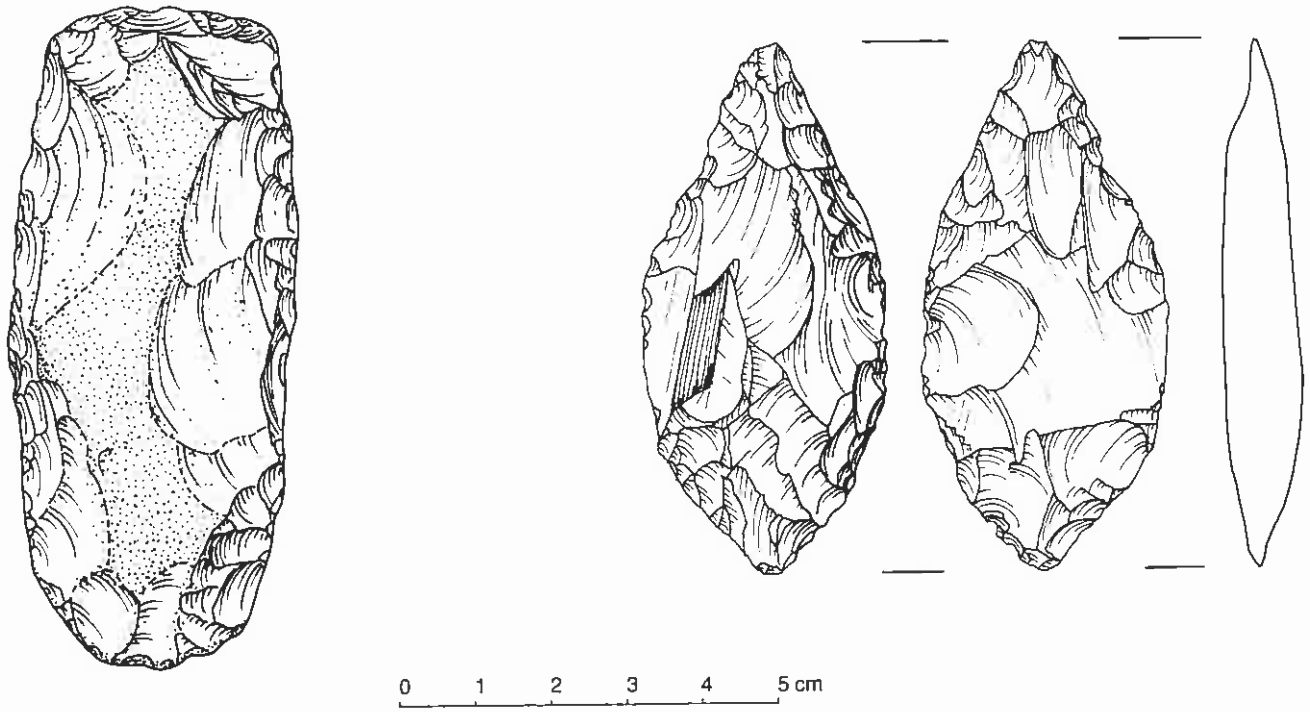
49AFG-097-17 Large Triangular Flaked Planing Adze Bit Preform (left); 49AFG-097-18 Large Triangular Planing Adze Bit (right).

49AFG-097-15 *Ulu*

Description: Small ulu, rounded rectangular outline. Back on a straight, thick, natural(?) break. Convex working edge extensively ground and beveled on both faces within 6 mm of edge. Convex ends flaked and perhaps blunted by light grinding. Shaping striations mainly perpendicular and oblique to long axis. Extensively ground only near working edge, where sharpening striations parallel long axis.
Material: Slate.
Measurements: L 7.93; W 4.50; T 0.34; Wt 19.2

49AFG-097-16 *Large Side-Blow Flake, Possibly Utilized*

Description: Large flake, irregular rectangular outline, sporadic edge nicking on all three thin edges, probable beach damage (darker color than main flake). Traces of cortex retained. Large platform of triangular outline, several facets, two large flakes previously removed in same direction and from same platform. Truncated scars of previous removals from several other directions as well. Water-worn.
Material: Basalt, patinated.
Measurements: L 4.45; W 6.04; T 1.07; platform L 2.27; W 1.06; Wt 22.2



49AFG-097-20 Flaked and Ground Planing Adze Bit Preform (left); 49AFG-117-1 Unfinished Bi-Pointed Biface (right).

49AFG-097-17 *Large, Triangular, Flaked Planing Adze Bit Preform (illustrated)*

Description: Flat, triangular outline. Parallelogram cross section. No grinding. Lateral edges bifacially flaked and battered. Some battering of rounded, relatively thin poll. Convex bit steeply, unifacially beveled. Bevel created by extensive retouch. Surface essentially flat.
Material: Basalt.
Measurements: L 16.49; W 6.53; T 2.11; chord of worked edge 6.35; Wt 318.2
Remarks: Presumably to be ground into an adze (see AFG-097-18). This type resembles triangular adzes or gouges confined to the ancient Takli Alder and Birch phases on the Alaska Peninsula (G. Clark 1977:153, Pl. I-33; Pl. III-12).

49AFG-097-18 *Large Triangular Planing Adze Bit (illustrated)*

Description: Triangular outline. Cross section thin and rectangular near bit, regular and thicker toward poll. Extensively ground on both faces and on one thick, rounded, lateral edge. Lateral edge opposite irregular and unground. Extensive, flat, single-bevel ground from 6 cm behind bit to bit. Bit subconvex and extensively battered on one face, removing presumed ground edge. Poll thin, rounded and ground from both faces creating blunt adziform end.
Material: Greenstone.
Measurements: L 15.6; W 5.5; chord of bit 5.5; T 3.44; Wt 378.5

49AFG-097-19 *Planing Adze Bit*

Description: Rectangular outline. Thick, plano-convex cross section. One lateral edge battered and ground flat two cm back from bit. Opposite lateral edge naturally rounded and ground flat, 5.5 cm back from bit. Convex ground bit with rounded corners. Steep, unifacially, ground bevel within one cm of edge. Flakes removed from both corners on steeply beveled edge (from use?). Poll area thick and broken. Both faces extensively ground, largely obliterating any shaping scars.
Material: Basalt, patinated.
Measurements: L [8.90]; W 3.80; chord of working edge 3.50; T 1.99; Wt [89.4]

49AFG-097-20 *Flaked and Ground Planing Adze Bit Preform (illustrated)*

Description: Slender, rectangular outline; biconvex cross section. Relatively thin, slightly convex lateral edges, flaked, battered and perhaps lightly ground. Thin, convex bit with rounded corners also flaked, primarily from one face (possibly re-sharpened?). Rounded, fairly thin poll, some flaking from one face. Large flake scars cover much of both faces; extensive medial ground patch preserved near bit on one face, near poll on opposite face.
Material: Greenstone, patinated.
Measurements: L 8.66; W 3.88; T 1.79; chord of bit 3.08; Wt 79.1
Remarks: Unfinished? being re-sharpened? (see AFG 097-19).

AFG-106

Cultural Affinities: Isolated find from excavated test pit, presumably predates the late prehistoric Koniag phase.

49AFG-106-1 *Flake Core*

Description: Irregular triangular outline. Thick, irregular trianguloid cross section. Three or more flake removals from broad, irregular platform. At least one removal from thin edge onto platform. Irregular keel opposite platform.
Material: Light colored igneous or metamorphic.
Measurements: L 7.29; W 5.02; T 2.82; Wt 86.4

AFG-117

Cultural Affinities: Only lithics were recovered at this site. Presumably they had weathered out from a (non-midden) paleosol buried one meter below the modern ground surface. The material doubtless predates the Koniag phase. Degree of patination of specimens like #3 would be compatible with the passage of many millennia and an Ocean Bay I placement.

49AFG-117-1 — *Unfinished Bi-Pointed Biface (illustrated)*

Description: Broad, fairly thick, biconvex cross section, pointed at both ends. Primary bifacial shaping retouch applied everywhere except middle of one of two convex sides, which is unretouched.
Material: Basalt.
Measurements: L 6.93; W 3.34; T 1.17; Wt 27.2
Remarks: Clearly unfinished.

49AFG-117-2 — *Large, Slender, Unfinished Biface Base*

Description: Slender but thick biface preform with irregular rounded base. Thick, plano-triangular cross section. Broken distally? Bifacial shaping spalls struck from both edges cover both faces. Little secondary retouch. Extreme patination of ventral surface of one flake suggests great antiquity.
Material: Basalt.
Measurements: L [6.76]; W [3.48]; T 1.72; Wt [42.2]
Remarks: Unfinished knife or spearhead.

49AFG-117-3 — *Massive Side-Blow Flake*

Description: Irregular rectangular outline. Possible bifacial retouch along irregular convex edge opposite platform. Thick, crust-like patina on both surfaces precludes certainty about retouch, nature of striking platform, etc. Recent edge batterings reveal black basaltic core.
Material: Basalt, with extremely patinated surfaces.
Measurements: L 7.46; W 9.31; T 1.65; Wt 105.3
Remarks: Most heavily patinated ventral surface ever observed by the authors.

AFG-122

Cultural Affinities: One small (4x4 m) housepit was observed on the surface of this site, compatible with a Kachemak tradition occupation. The nondescript artifacts collected here neither support nor argue against this tentative suggestion.

49AFG-122-1 — *Flat Cobble Chopper*

Description: Flat, rounded cobble, one subconvex end bifacially flaked and extensively battered. Traces of red ocher adhere to working edge and to both faces.
Material: Greenstone.
Measurements: L 7.68; W 7.57; T 2.47; Wt 243.8
Remarks: Despite flaking, straight, highly battered edge recalls edge-battered hammerstones.

49AFG-122-2 — *Sawed and Ground Ulu(?) Back(?)*

Description: Large, ground, slate fragment, irregular outline, fresh breaks on two edges. One edge is the flat, ground septum left by saw cut from both faces. Adjacent curved edge blunted by grinding. Preserved shaping striations parallel to long axis. Presumed working edge missing.
Material: Slate.
Measurements: L [8.27]; W 5.46; T 0.39; Wt --

49AFG-122-3 — *Highly Convex Ulu Edge Fragment*

Description: Thin, well finished fragment of large ulu. Highly convex sharp edge, double-bevel within 3 cm of working edge. Other three edges broken.
Material: Slate.
Measurements: chord of working edge 6.58; item is too broken for other measurements

49AFG-122-4 — *Large Ground Blade Fragment, Subconvex Edge*

Description: Well finished ulu(?) fragment. Visible striations oriented parallel to long axis. Broken on three edges.
Material: Slate.
Measurements: chord of working edge 7.49; too broken for other measurements

49AFG-122-5 — *Large Flaked and Ground Fragment(?)*

Description: One straight, lateral edge ground sharp, then flaked. Lateral edge opposite on break also flaked. Both ends broken. Striations on one face parallel long axis. Striations on opposite face have variable orientations (oblique, parallel, perpendicular).
Material: Slate.
Measurements: L [7.78]; W [6.28]; T 0.30; Wt [25.7]
Remarks: Specimen in process of being re-worked?

AFG-128

Cultural Affinities: The well-made point with diamond cross section should date around A.D. 1000. The well-made adze bit and the stemmed ulu also suggest that this site was occupied during late Kachemak/early Koniag phase times.

49AFG-128-1 — *Hammerstone/Whetstone*

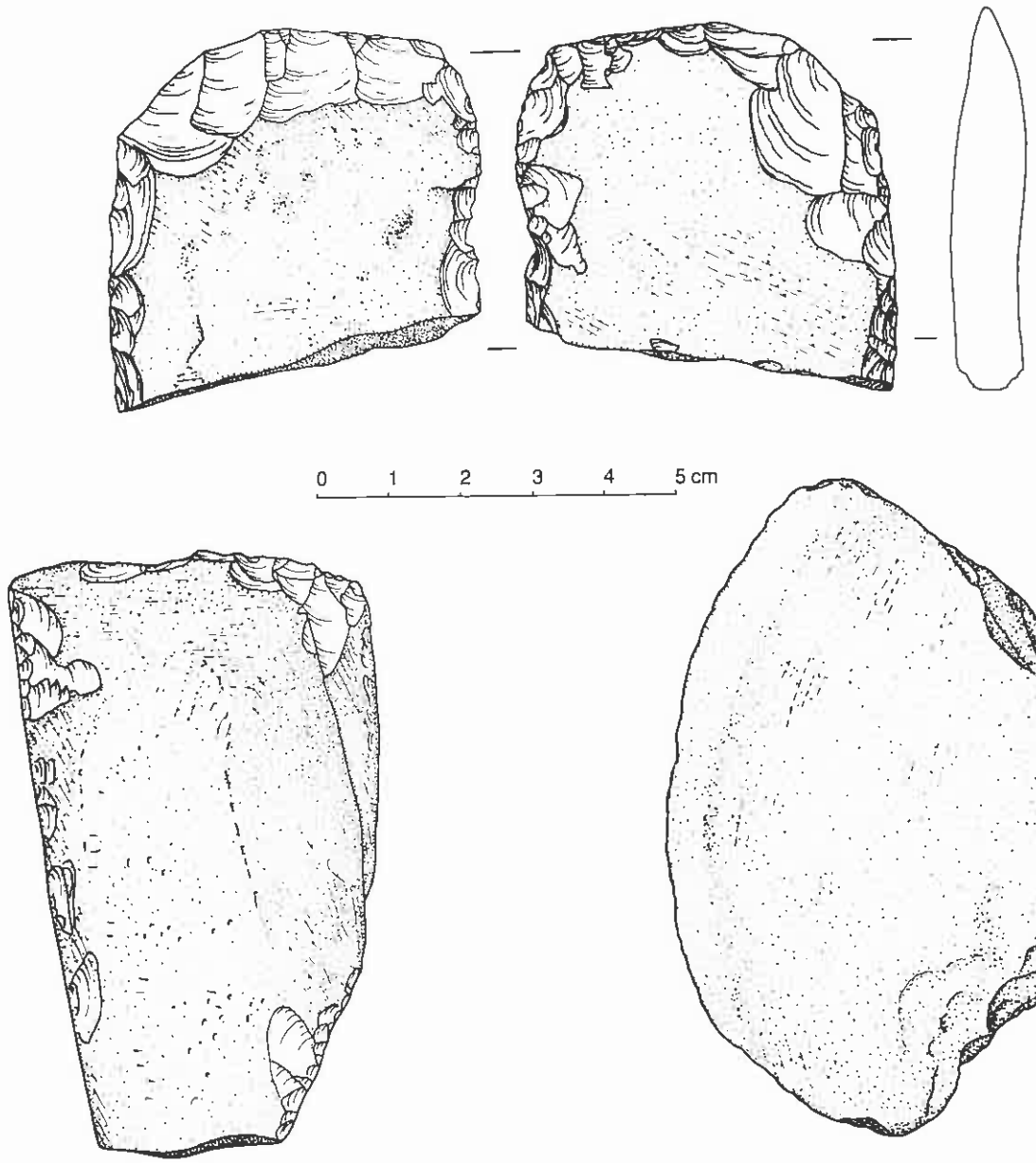
Description: Large, cylindrical, water-smoothed cobble. Irregular, rounded rectangular cross section. Limited pecked areas in center of two surfaces and near edge on one end suggest limited use as hammerstone and/or anvil. Examination under magnification reveals many striations oriented in different directions on major surfaces, suggesting specimen also used as whetstone for hard objects.
Material: Basalt(?)
Measurements: L 19.7; W 6.34; T 5.43; Wt 1209.2

49AFG-128-2 — *Planing Adze Bit Fragment (illustrated)*

Description: Subrectangular biconvex cross section. Three preserved edges convex to subconvex. Faces extensively polished. Polish removed in bit area by extensive bifacial retouch, almost certainly re-sharpening. Convex bit asymmetrically beveled. Lateral edges bifacially battered and flaked, not ground. Poll broken.
Material: Greenstone with light colored, softer-seeming impurities.
Measurements: L [4.64]; W 5.20; T 0.98; Wt [40.1]
Remarks: Same material as AFG 128-3; clearly being re-worked.

49AFG-128-3 — *Planing Adze Bit (illustrated)*

Description: Well-made bit, subrectangular outline, hexagonal cross section. Convex bit originally double-beveled and extensively damaged, presumably from use. One corner especially damaged, both faces. One lateral edge originally shaped by flaking, then ground flat; opposite lateral edge also ground flat and only flaked near the two ends. Thin poll shows no sign of intentional flaking. Extensive grinding both faces. Striations oriented perpendicular to long axis near bit, oblique further back.
Material: Greenstone with extensive light colored, softer-seeming impurities.
Measurements: L 8.33; chord of working edge W 4.97; T 1.41; poll W 2.63; Wt 69.4
Remarks: Symmetry and finish suggest late Kachemak tradition; same material as AFG 128-2. Heaviest bifacial damage in corner suggests that in use it led with this corner.



49AFG-128-2 Planing Adze Bit Fragment (top); 49AFG-128-3 Planing Adze Bit (bottom left); 49AFG-128-6 Ulu (bottom right).

49AFG-128-4 *Large-Stemmed, Straight-Bladed, Ulu End Fragment (illustrated)*

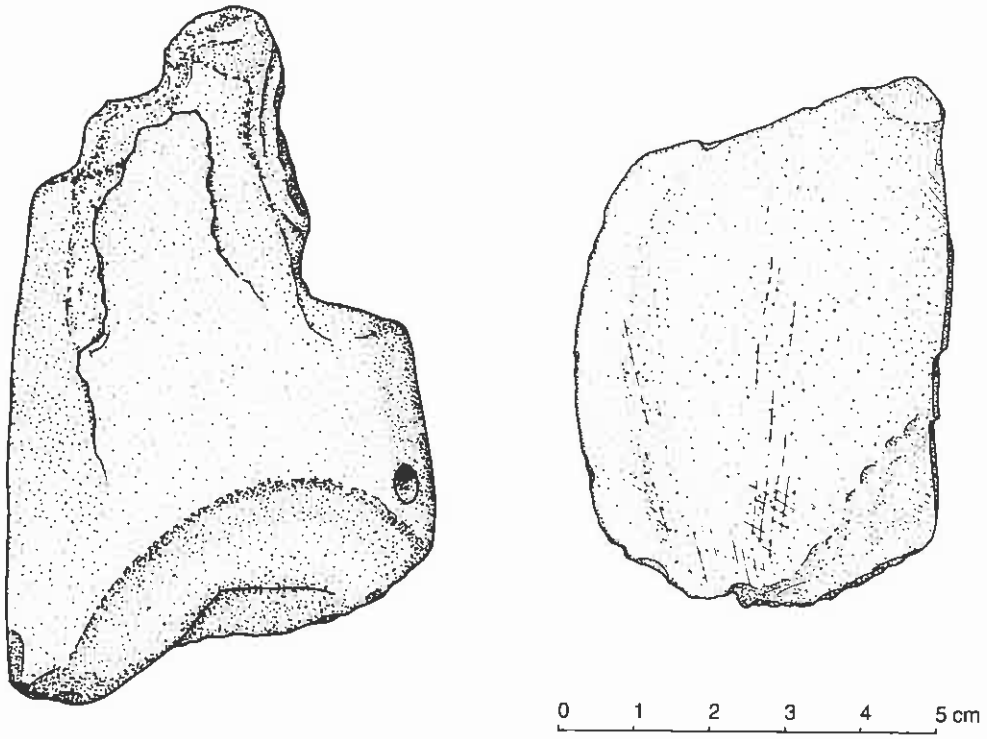
Description: Large ulu end fragment with rectangular projecting back. Top of back flat, possibly ground, and offset from end area by flaking. End irregular and extensively flaked (perhaps damaged). Top of end area blunted by grinding. Working edge essentially straight and bifacially beveled. One end broken. Object heavily water-rolled.
Material: Slate.
Measurements: L [8.26]; W [5.66]; T 0.75; chord of present working edge 6.98; stem Ht (offset) 1.3; Wt [37.6]
Remarks: Form recalls the Koniag phase (D. Clark 1974b:105, Pl. 38-F,G,J). Possibly re-worked from a larger piece.

49AFG-128-5 *Small Biface Tip/Base*

Description: Broad, slender, biface end fragment, convex edges converge to rounded point. Primary and secondary retouch cover entire surface on both faces. Highly water-rolled.
Material: Red chert.
Measurements: L [3.07]; W [2.77]?; T 0.59; Wt [5.1] (probably have its greatest width)
Remarks: Found in "isolated locality" 50 m north of the artifacts described above.

49AFG-128-6 *Ulu (illustrated)*

Description: Highly convex, double-bevel working edge. Back triangular, fairly thick, and a natural break. Some bifacial edge



49AFG-128-4 Large Stemmed, Straight-Bladed, Ulu End Fragment (left); 49AFG-128-7 Small Ulu, Convex Blade (center); 49AFG-128-9 Long, Slender, Stemmed Blade (right).

flaking on back, near two rounded ends which appear lightly ground. Grinding heaviest within one cm of convex edge.
Material: Slate.
Measurements: L 9.11; chord of working edge 9.11; W 7.03; T 0.62; Wt 40.6
Remarks: Presumably used in hand without a haft (back is too thick for hafting).

49AFG-128-7 — *Small Ulu, Convex Blade (illustrated)*

Description: Thick back, on natural break, opposes convex bifacially beveled working edge. One end broken; opposite rounded and essentially unworked. Fine honing within one cm of edge of blade; coarser shaping striations mainly oriented parallel to long axis.
Material: Slate.
Measurements: back L 5.87; chord of working edge 5.93; T 0.31; Wt 14.0

49AFG-128-8 — *Thin Planing Adze Fragment*

Description: Lateral(?) edge fragment, rectangular outline and cross section. Both faces extensively ground. Broken on three edges; fourth edge convex and thinned by bifacial flaking.
Material: Basalt.
Measurements: L [3.75]; W [3.61]; T [0.57]; Wt [14.0]
Remarks: Very thin for an adze.

49AFG-128-9 — *Long, Slender, Stemmed Blade (illustrated)*

Description: No discernable shoulders, but long, slightly contracting stem created by grinding lateral edges flat. Above stem, lateral edges still relatively thick (not sharp) and multiple striations parallel to long axis suggest point cut to shape. Subconvex base with rounded corners also ground flat. Subdued diamond cross section, flattened on one face by striations oriented perpendicular to long axis. Striations of several different orientations noted elsewhere. Tip slightly damaged.
Material: Slate.
Measurements: L 12.26; W 2.36; T 0.52; stem L 4.13 & 4.64; base W 1.43; Wt 15.8
Remarks: Note unusual shaping technique suggested.

49AFG-128-10 — *Straight-Bladed, Sawed Ulu End Fragment*

Description: Parallelogram outline. Subconvex, flaked back and end (flaked end reshaped on previous break). Straight, double-bevel cutting edge. One end broken. Sawed gash (V-shaped section) four cm long paired in middle of both faces. Purpose uncertain. Visible striations parallel to working edge.
Material: Slate.
Measurements: L 6.03; W [5.44]; T 0.71; Wt [36.4]

49AFG-128-11 — *Unfinished(?) Ulu*

Description: Rectangular outline with rounded ends. Convex, flaked back blunted by grinding. Straight edge opposite is result of break, and unsharpened. One end broken; convex end opposite break has a double-bevel blade remnant (broken lateral margin). There is a 1.38 cm cut or incipient saw mark near back and broken end. Coarse shaping striations perpendicular, parallel, and oblique to long axis intersect on both faces.
Material: Slate.
Measurements: L 11.38; W [8.50]; T 0.71; Wt [97.8]

AFG-132

Cultural Affinities: Insufficient data available.

49AFG-132-1 *Very Large, Flaked, Slate Biface End Fragment*

Description: Very broad, thin, end fragment. Two convex, bifacially flaked and battered sides converge to rounded tip. Retouch confined to edge area. Broken proximally. Hexagonal cross section. No grinding.
Material: Slate.
Measurements: L [9.20]; W 7.33; T 0.76; Wt [57.1]
Remarks: Early stage preform for large lance or knife?

AFG-143

Cultural Affinities: Presence of much fire-cracked rock on the beach and a fairly large battered adze tentatively suggest a Koniag phase occupation.

49AFG-143-1 *Edge-Battered Planing Adze*

Description: Rectangular outline with rounded ends. Fairly extensive grinding on both faces. One straight, lateral edge pecked flat; opposite straight, lateral edge thinner, bifacially battered and flaked. Bit originally convex; now extensively damaged with bifacial battering and flaking, both corners heavily damaged. Bit preserves remnant of fairly steep, single bevel ground edge. Rounded, thick poll bifacially battered and blunted by grinding. Irregular rectangular cross section.
Material: Greenstone.
Measurements: L 7.20; W 3.94; T 1.77; Wt 75.4
Remarks: D. Clark (1974b:91) notes that fairly large, extensively battered planing adze bits are typical of (though not necessarily confined to) the Koniag phase.

Karluk Quadrangle

KAR-121

Cultural Affinities: Lithic material from an eroding dune site on the Alaska Peninsula. Available evidence suggests a long span of occupation here. The core scraper (#10) and, possibly, the large piece of jet (#1) are known from the Birch phase, as is the decorated slate piece (#14). The copper artifact (#3) should date much later, after A.D. 1000.

49KAR-121-1 *Large Abraded Piece of Jet/Channel Coal*

Description: Irregular trapezoidal outline; irregular rectangular cross section. Broad top and parts of two sides extensively ground leaving coarse striations oriented parallel to long axis, presumably to shape piece. Some flakes also derived from opposite flat surface.
Material: Oil shale/channel coal/jet.
Measurements: L 6.38; W 4.51; T 2.00; Wt 34.2
Remarks: Material used only for jewelry (i.e., labrets and beads) as far as we know.

49KAR-121-2 *Small Ulu*

Description: Made on a somewhat contorted slate slab/flake. Convex working edge. Fine, double-bevel grinding confined to blade area. Some coarser, shaping striations on smoother face, oriented parallel to long axis. A 3 cm long segment of back blunted by light grinding. Ends irregular, somewhat inset from adjacent blade. Irregular face retains abundant red pigment, smoother face retains only traces.
Material: Slate with red ocher adhering, mainly to one surface.
Measurements: L 7.72; chord of working edge 7.72; W 4.72; T 0.68; Wt 25.8

49KAR-121-3 *Rectangular Copper Item*

Description: Small, rectangular outline; oval cross section. Two double-bevel, spatulate ends of uncertain function. Seam on one face indicates that bar was made by hammering and consolidating one or several copper sheets.
Material: Copper.
Measurements: L 3.63; W 0.60; T 0.41; Wt 3.0
Remarks: Material and technique of workmanship suggest date within the last 1000 years (McCartney 1988:67-70). Function uncertain.

49KAR-121-4 *Parallel-Sided Point Stem*

Description: Rectangular outline and cross section. Lateral edges ground flat, fairly thick. Straight base also ground flat, somewhat thinner. Broken below shoulder area (if any existed). One face extensively ground, striations oblique to long axis. Other face also ground but extensively damaged.
Material: Slate.
Measurements: L [1.82]; W [1.43]; T [0.36]; Wt --

49KAR-121-5 *Small Flake from Surface of Larger Retouched Piece*

Description: Irregular rectangular outline, plano-convex cross section. No clear platform. Truncated retouch scars on both lateral edges and on one end on dorsal surface.
Material: Jasper, mottled (dark green & gold).
Measurements: L 2.41; W 1.62; T 0.43; Wt 1.5
Remarks: From fairly small implement.

49KAR-121-6 *Large Rectangular Basalt Flake*

Description: Rectangular unretouched flake. Irregular trapezoidal cross section. Plain striking platform. Jagged distal end, but apparently unbroken. Truncated scars of several previous removals on dorsal surface, only one of which derives from present flake striking platform. Patch of reddish material (ocher? iron staining?) adheres to ventral surface. No edge retouch. Possible utilization nibbling of ventral surface of one straight, lateral edge.
Material: Basalt.
Measurements: L 7.12; W 3.30; T 0.74; striking platform 1.62 & 0.37; Wt 18.6
Remarks: Not a flake blade.

49KAR-121-7 *Planing Adze Preform*

Description: Oval outline; irregular biconvex cross section. Fairly straight lateral edges thin and bifacially flaked. Retouch confined to less than one cm from edge. Rounded poll battered and flaked, preserving some cortex. Limited cortex on one face in bit one-half of implement, otherwise not smoothed or ground.
Material: Basalt.
Measurements: L 8.64; W 5.23; T 2.13; Wt 113.6

49KAR-121-8 *Large Retouched Flake*

Description: Large transverse flake. Convex transverse edge bifacially flaked in edge area only. Two lateral, concave margins unifacially edge-retouched on alternating faces. Massive, oval, plain (cortical?) striking platform. Dorsal surface records previous blows from several directions.
Material: Basalt.
Measurements: L 7.07; W 8.81; T 0.98; Wt 49.6

49KAR-121-9 *Tabular Rectangular Chunk*

Description: Rectangular outline; irregular rectangular cross section. No clear bulb or platform preserved. Several large flake scars partially preserved on both surfaces suggest part of tabular flake core.
Material: Chert(?), patinated brown.
Measurements: L 8.35; W 5.71; T 1.77; Wt 108.0
Remarks: Same material as KAR-121-10 through 13

49KAR-121-10 *Massive Retouched Flake Chunk*

Description: Thick flake chunk, oval outline, thick plano-triangular cross section. One lateral side given ventral retouch, creating a sinuously straight working edge. Retouch confined within 0.5 cm of edge. Several large flakes removed from dorsal surface, suggesting additional use as a flake core. Platform is a thin, battered edge.
Material: Chert(?), patinated brown.
Measurements: L 8.13; W 5.63; T 2.79; chord of retouched edge 4.81; Wt 123.6
Remarks: Same material as KAR121-9, 11, 12, and 13. This form recalls massive core scrapers typical of the Takli Alder and Birch phases on the Alaska Peninsula (G. Clark 1977:135 - Type 2).

49KAR-121-11 *Massive Flake Chunk*

Description: Massive rectangular flake, possibly from flake core. Thick, plain, platform remnant(?). Traces of several previous removals on dorsal face, also possibly some fire damage. Broken ventrally on one side. Sporadic ventral nibbling of subconvex end, possibly from utilization. Irregular triangular to trapezoidal cross section.
Material: Chert(?), patinated brown.
Measurements: L 6.58; W 6.32; T 2.04; Wt 62.8
Remarks: Same material as KAR-121-9, 10, 12, & 13.

49KAR-121-12 *Utilized(?) Massive Flake Chunk*

Description: Rectangular outline; thick triangular cross section. Extensive fire damage on dorsal face and on one lateral edge of ventral face. Large, plain, striking platform. Sinuous end opposite striking platform has multiple concavities and some edge retouch on dorsal surface, possibly due to utilization.
Material: Chert(?), patinated brown, with tiny fossil shell inclusions.
Measurements: L 6.99; W 5.99; T 2.53; striking platform 1.78 X 1.21; Wt 84.9
Remarks: Same material as KAR121-9, 10, 11, and 13.

49KAR-121-13 *Columnar Flake Chunk*

Description: Slender, rectangular outline; thick, irregular trapezoidal cross section. Considerable thermal damage on dorsal surface. Plain striking platform creates unusual, highly obtuse angle with ventral face. Hinge fracture on end opposite. Sporadic edge nicking.
Material: Chert(?), patinated brown.
Measurements: L 10.77; W 3.44; T 2.63; Wt 82.9
Remarks: Same material as KAR121-9, 10, 11, and 12. Parody of a flake blade.

49KAR-121-14 *Edge-Flaked Fragment with Incised Design(?)*

Description: Rounded triangular outline, broken on one end, apparently unifacially flaked around rest of perimeter. One face heavily striated and preserves two sets of more or less parallel lines which intersect one another at (roughly) right angles, creating a series of rectilinear forms. Face opposite has a series of coarse striations oriented at various angles to one another, creating no obvious pattern, although marks often paired.
Material: Slate.
Measurements: L [5.32]; W [2.79]; T [0.33]; Wt [6.8]
Remarks: See also KOD-115-2. Similar decorations on slate are known from Palugvik 1 and 2 in Prince William Sound (de Laguna 1956:201-204, Pl. 19-1-4).

49KAR-121-15 *Transverse Retouched Flake*

Description: Side-blow flake of unusual outline, very slender. Two rounded ends. Highly convex transverse edge with extensive dorsal retouch (from heavy utilization?) confined to very edge. A few scars removed from ventral face. Part of proximal long edge has heavy, ventral edge retouch creating a number of small notches. Small, plain, striking platform.
Material: Red chert.
Measurements: L 3.26; W 7.37; chord of transverse edge 7.37; T 0.68; striking platform 0.72 X 0.62; chord of upper retouched edge 3.03; Wt 11.9

49KAR-121-16 *Battered Basalt Chunk*

Description: Irregular triangular outline; irregular biconvex cross section. One thick end broken, fire damaged. Opposite end retains flat area which recalls a striking platform though this is not a flake. One cm segment of one lateral edge near the break is crushed, otherwise no edge retouch.
Material: Basalt with large, rectangular, crystalline inclusions.
Measurements: L 4.72; W [3.08]; T [1.31]; Wt [15.5]

49KAR-121-17 *Broad, Thin, Biface End Fragment*

Description: Highly convex end, subconvex to convex lateral edges, biconvex cross section. Bifacial retouch from preserved edges covers most of the faces. A number of flakes removed from one face using the thick break as a striking platform. Purpose uncertain. Primary retouch only; little secondary edge retouch.
Material: Basalt.
Measurements: Not taken.
Remarks: Large biface or, possibly, planing adze preform.

KAR-122

Cultural Affinities: Insufficient data available.

49KAR-122-1 *Battered Chert Chunk (Core Fragment?)*

Description: Irregular triangular outline; irregular trapezoidal cross section. Most surfaces battered and with flake removals, but platforms and orientation of blows not usually clear.
Material: Chert, green/gray with angular inclusions.
Measurements: L 4.05; W 3.37; T 2.47; Wt 39.4

49KAR-122-2 *Rectangular Flake Core*

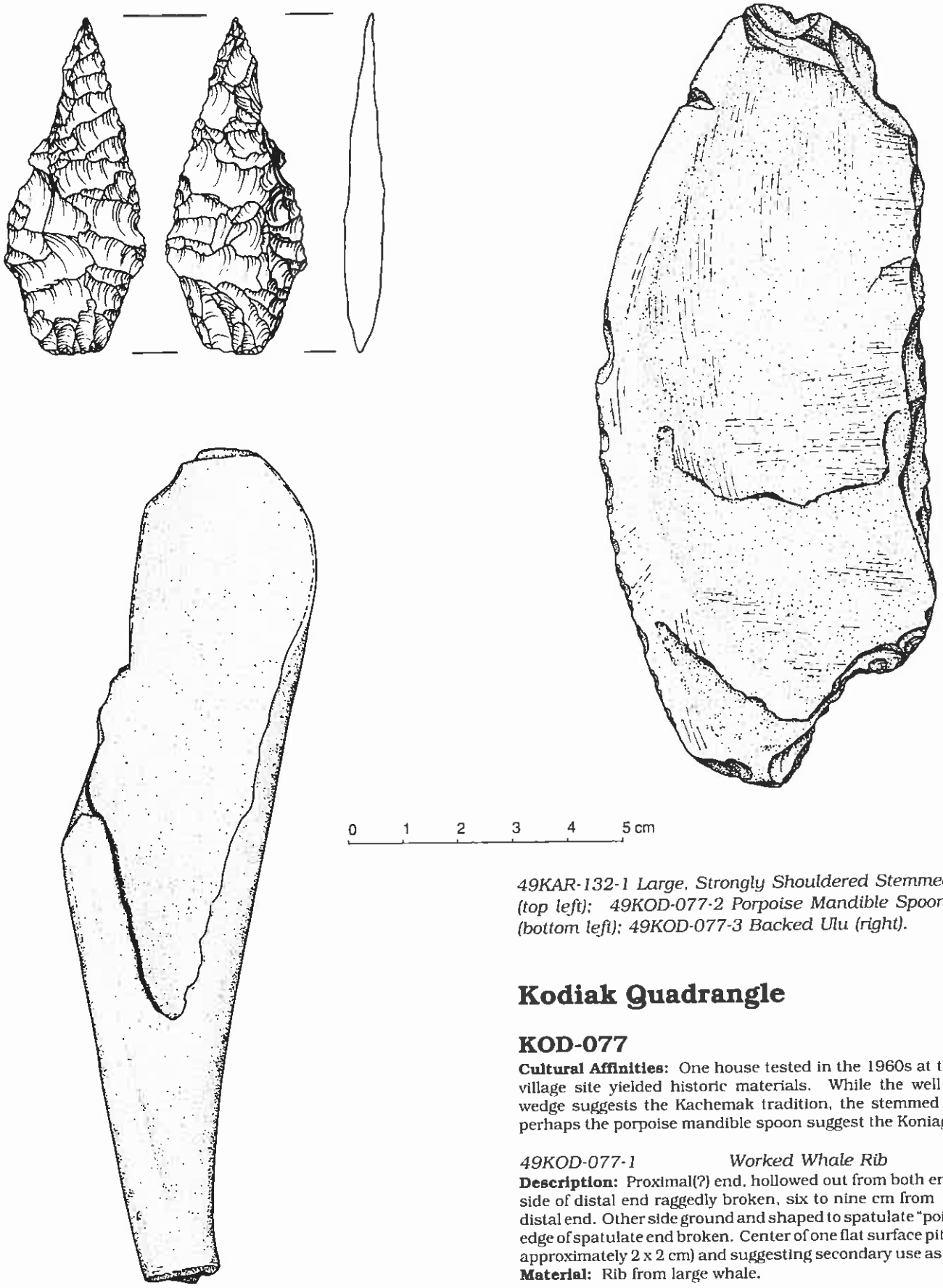
Description: Irregular rectangular in outline and cross section. One surface covered with rough cortex. A number of flakes detached from remaining surfaces using an adjacent, relatively flat surface as a striking platform. That this task was rendered difficult by the intractable nature of the material is indicated by the battered and crushed condition of several of the edges.
Material: Chert, mottled gray/green with various inclusions and impurities (may be a variant of the red chert).
Measurements: L 5.95; W 4.49; T 4.04; Wt 94.7

KAR-132

Cultural Affinities: Insufficient data available.

49KAR-132-1 *Large, Strongly-Shouldered, Stemmed Point (illustrated)*

Description: Markedly offset shoulders of obtuse angle; one sharp, and one rounded. Broad, contracting stem (lightly ground). Straight base with rounded corners. Very sharp tip with possible impact burination on extremely damaged distal edge. Opposite, subconvex, lateral edge carefully retouched on one face, leaving a series of parallel scars. Face opposite has more irregular flaking. Thick biconvex cross section.
Material: Ignimbrite or low-grade obsidian.
Measurements: L 6.00; shoulder W 2.65; T 0.76; shoulder H 1.68 & 1.44; stem W 1.19; Wt 8.3
Remarks: Perhaps broken in process of manufacture.



49KAR-132-1 Large, Strongly Shouldered Stemmed Point (top left); 49KOD-077-2 Porpoise Mandible Spoon (bottom left); 49KOD-077-3 Backed Ulu (right).

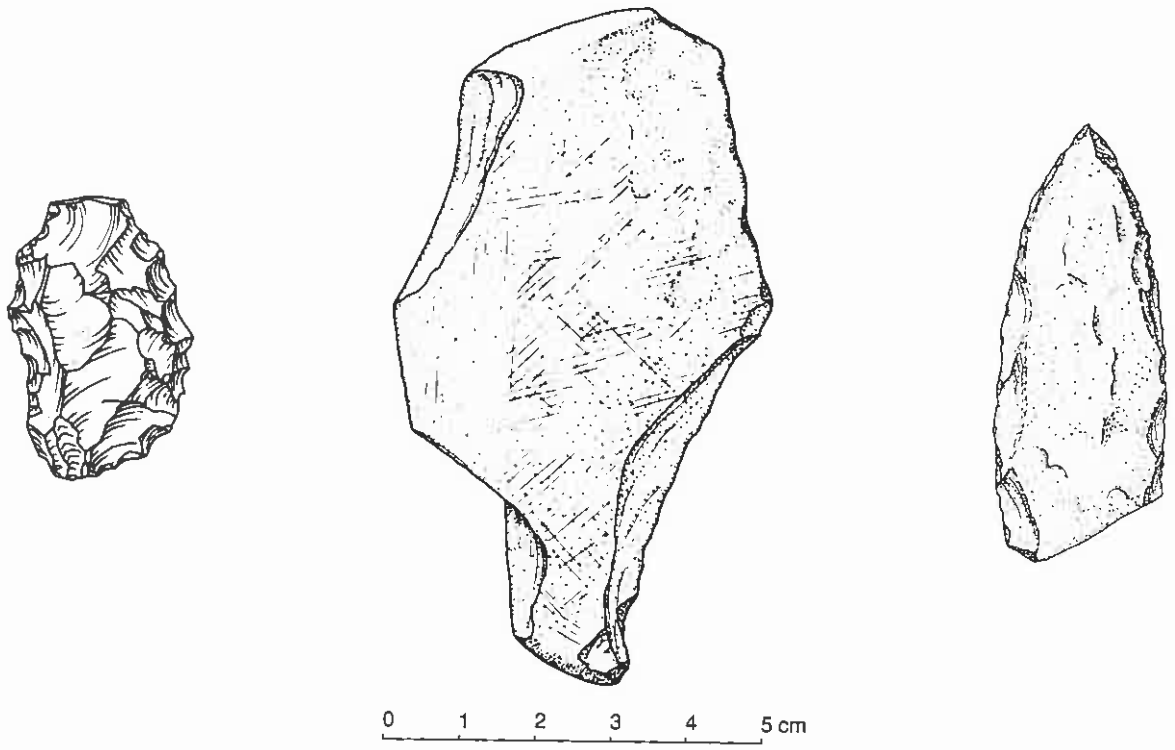
Kodiak Quadrangle

KOD-077

Cultural Affinities: One house tested in the 1960s at this large village site yielded historic materials. While the well-finished wedge suggests the Kachemak tradition, the stemmed ulu and perhaps the porpoise mandible spoon suggest the Koniag phase.

49KOD-077-1 *Worked Whale Rib*

Description: Proximal(?) end, hollowed out from both ends. One side of distal end raggedly broken, six to nine cm from rounded distal end. Other side ground and shaped to spatulate "point". One edge of spatulate end broken. Center of one flat surface pitted (area approximately 2 x 2 cm) and suggesting secondary use as an anvil.
Material: Rib from large whale.



49KOD-115-1 Oval Chert Uniface (left); 49KOD-115-2 Reworked, Multi-Edged Ground Blade with Rectilinear Surface Design (center); 49KOD-115-3 Flaked Point, Base Broken(?) (right).

Measurements: L 27.95; W 8.18; T 5.35; Wt 508.1
Remarks: Primary function uncertain. Flat, projecting edge not suitable for a wedge. Giant scoop or shovel-like tool?

49KOD-077-2 *Porpoise Mandible Spoon (illustrated)*
Description: Tooth-bearing end was cut, using girdle and snap technique, to yield a handle. End opposite had one surface removed, leaving a concave spoon surface. Edges of bowl ground flat. Perhaps bowl formerly wider and re-shaped after breakage.
Material: Porpoise mandible.
Measurements: L 15.05; W 3.65; T 0.82; Wt 17.2
Remarks: A few porpoise mandible spoons are known from the Koniag phase on Kodiak (D. Clark 1974b: 112). They appear to be absent from the Kachemak tradition.

49KOD-077-3 *Backed Ulu (illustrated)*
Description: Convex, bifacially ground and beveled working edge. One lateral edge indented by flaking, later blunted by grinding. Small ground notch (an obtuse angle) in upper corner of other end creates an asymmetric, offset back. Back edge flaked, lightly ground and sinuously straight. Grinding concentrated in half nearest working edge. Striations both perpendicular and parallel to long axis. Bifacial chipping along one half of working edge suggests heavy use/abuse.
Material: Slate.
Measurements: L 14.18; W 5.95; chord of working edge 13.5; T 0.47; L 9.87; Wt 62.6
Remarks: Large size and subdued stem back of this specimen recall late prehistoric Koniag specimens (D. Clark 1974b:Pl. 38, 39).

49KOD-077-4 *Bone Wedge*
Description: Rectangular outline; hexagonal cross section. Steep bifacial bevel creates unusually thin working bit, undamaged except on one corner. Lateral edges planed (adzed?). Flat, thick poll shows little evidence of battering and may be articulator surface of rib. Red ocher possibly present in gashes on outer surface. Rib split longitudinally.
Material: Whale bone.
Measurements: L 10.71; poll W 5.58; poll T 2.42; Wt 64.0
Remarks: Symmetry and careful finish suggest Kachemak tradition.

KOD-115

Cultural Affinities: Materials observed and collected at this diffuse midden site in the 1960s suggested a Kachemak tradition (presumably Three Saints Bay) affiliation. The flaked uniface and decorated slate object recovered in 1989 are in accord with this assessment.

49KOD-115-1 *Oval Chert Uniface (illustrated)*
Description: Small, thick, ovular flake chunk. Two convex edges with steep, unifacial, dorsal retouch. Edges serrated. One end fire damaged; maybe also dorsally retouched. Some truncated smoothing scars on ventral face at end. Opposite end retains remnant of apparently faceted striking platform. Thick, irregular plano-triangular cross section.
Material: Red chert.
Measurements: L 3.68; W 2.23; T 1.00; Wt 8.4
Remarks: Unifaces are rare on Kodiak.

49KOD-115-2 *Reworked, Multi-Edged Ground Blade with Rectilinear Surface Design (illustrated)*
Description: Unusual recycled(?) piece, irregular, multi-edged, angular outline. One straight edge segment ground blunt to serve as back. Short, (chord = 2.8 cm) convex edge with steep, bifacially ground bevel adjacent to back. A 1.6 cm long, subconvex working edge remnant opposite. Edge opposite back clearly broken, but a

Measurements: L 8.85; W 5.01; T 0.39; Wt 17.6
Remarks: Compare to surface design on KAR-121-14. Clearly re-worked from a larger, broken specimen (ulu?). Similar motifs occur in Palugvik 1 and 2 in Prince William Sound (de Laguna 1956:201-204).

49KOD-115-3 — *Flaked Point, Base Broken(?) (illustrated)*
Description: Stemless, two convex edges converge abruptly to a fairly sharp tip. Bifacial flaking of edge areas, secondary battering of edge areas as well (against anvil?). Base area is flat oblique break, some bifacial flaking/battering of one corner. No grinding. Thin biconvex cross section.
Material: Slate.
Measurements: L 5.76; W 2.26; T 0.45; Wt 6.8
Remarks: Probable double-edge ground slate blade/point preform.

49KOD-115-4 — *Broad, Double-Edged, Ground Blade Tip*
Description: Two convex edges converge to abrupt, damaged point. Sharpness of edges suggests tip rather than base. Two rounded, medial ridges give specimen subdued, diamond-shaped cross section. Originally highly polished, coarse shaping striations have been applied at an angle oblique to the long axis, on both faces over this original surface preparation (re-shaping?).
Material: Slate.
Measurements: L [3.22]; W [3.34]; T 0.58; Wt [6.2]

KOD-116

Cultural Affinities: This site apparently is the historic village of Oniginskoe or Anikin noted by Lisiansky in the early 1800s. The end-grooved cobble recovered here in 1989 is in accord with a Koniag occupation.

49KOD-116-1 — *Large Ulu*
Description: Classic, semi-lunar outline. All edges bifacially flaked. Extensively ground on both faces in edge area opposite back creating a highly convex ground working edge with a chord of 8.33 cms. Back thick and straight, created by flaking and battering, blunted by light grinding. Most intensively ground near working edge. Other shaping striations oriented obliquely to working axis. Retains traces of red pigment on both surfaces.
Material: Slate with red ocher stains.
Measurements: L 12.90; W 9.60; T 0.77; Wt 147.5

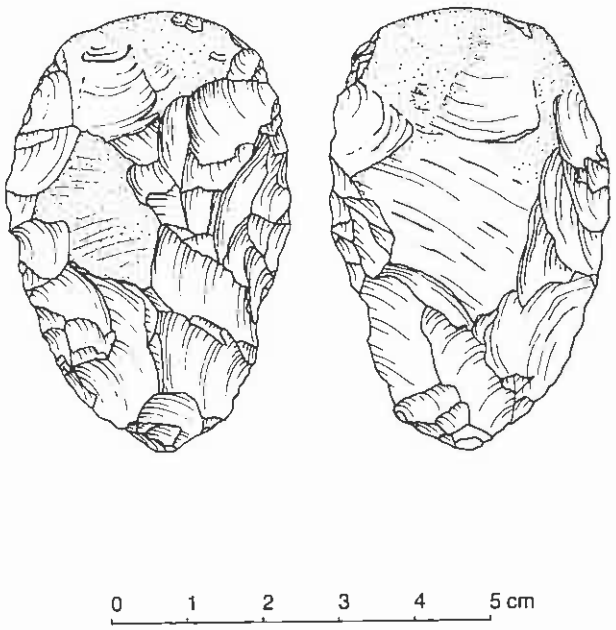
49KOD-116-2 — *Broken End-Grooved Cobble*
Description: Oval cobble, broken medially. Preserved end has one cm broad groove pecked across it. Several apparent cuts and striations on one face suggest use as an anvil or cutting board. A few peck marks on one face at break may represent a groove across now missing end.
Material: Graywacke, one face discolored (a red-gold).
Measurements: L [7.38]; W [6.68]; T [4.78]; Wt [270.9]
Remarks: Cobble grooved over both ends?

KOD-368

Cultural Affinities: The beautifully finished adze bit suggests a Kachemak occupation; the end-grooved cobble is a Koniag marker.

49KOD-368-1 — *Oval Planing Adze (illustrated)*
Description: Beautifully made planing adze bit. Highly convex, single-beveled bit, beautifully finished by grinding to high polish. Thin, convex lateral edges, bifacially flaked. Pointed, fairly thick poll, perhaps striking platform for original thick flake. Thick, plano-convex cross section. Edge relatively undamaged.
Material: Chert(?), patinated.
Measurements: L 5.79; W 3.27; T 1.22; chord of bit 2.85; Wt 30.6
Remarks: Finish recalls Kachemak tradition adzes (Clark 1974b:91).

49KOD-368-2 — *End-Grooved Cobble Fragment*
Description: Broken medially, perhaps also split longitudinally. 2 cm wide groove. Depth of groove 0.3+ cm. Pecked and battered across preserved end. Plano-convex cross section.
Material: Graywacke(?)
Measurements: L --; W [8.84]; T [2.69]; Wt [109.2]
Remarks: End-grooved cobbles are typical of the Koniag phase on Kodiak (D. Clark 1974b:76ff) and also occur in contemporary late prehistoric Mound phase on the Alaska Peninsula (G. Clark 1977: 162, 202).



49KOD-368-1 Oval Planing Adze.

KOD-376

Cultural Affinities: Similar huge, stemmed blades are known from both Ocean Bay II and the Kachemak traditions.

49KOD376-1 — *Huge, Stemmed, Double-Edged, Ground Blade Fragment (illustrated)*
Description: Parallel-sided stem asymmetrically at end of very broad, double-edged slate blade. Stem created by bifacial flaking. Shoulder/stem angle 90 degrees on one side, obtuse on other. Base damaged, apparently rounded and thin. Sporadic flaking as well as grinding along both straight edges. Coarse shaping striations oriented both parallel and at an oblique angle to long axis. Broken distally. Fairly thin, biconvex cross section.
Material: Slate.
Measurements: L [18.5]; shoulder W 7.07; T 0.68; shoulder H 6.67 & 6.81; Wt [127.2]
Remarks: Huge. Similar large, stemmed blades are known from Ocean Bay I, Ocean Bay II (D. Clark 1979:Pl. 2-o, 100 [Type 6], 157 [Type 7]) and the Kachemak tradition (Heizer 1956:Pl. 49-d, Type I-d). Unfinished or being re-worked? Stem looks unfinished.

KOD-385

Cultural Affinities: R. Jordan has termed this site a "late Kachemak whaling village," an assessment that appears to be in accord with the available diagnostic artifacts, in particular a classic Three Saints Bay style ground slate point.

49KOD-385-1 *Three Saints Bay Point (illustrated)*

Description: Nicely finished, approximately symmetric, barbed, double-edged slate blade. Broad, parallel-sided stem with stem edges thick and ground flat. Broken base with hexagonal cross section; cross section rectangular. Shaping striations oriented primarily perpendicular to long axis. Probable ownership marks on both faces. Convex blade edges, sharp tip. Incised lines perpendicular to long axis from apex of one barb slot across upper stem to where apex of other barb slot should have been to make symmetrical -- gauging mark?

Material: Slate.
Measurements: L [6.20]; barb W 2.37; T 0.53; stem W 1.41; Wt [9.0]
Remarks: Point is diagnostic of the Kachemak tradition (D. Clark 1970:80-83). See KOD-385-2 for another example of "gauging lines."

49KOD-385-2 *Stemmed Ground Point (illustrated)*

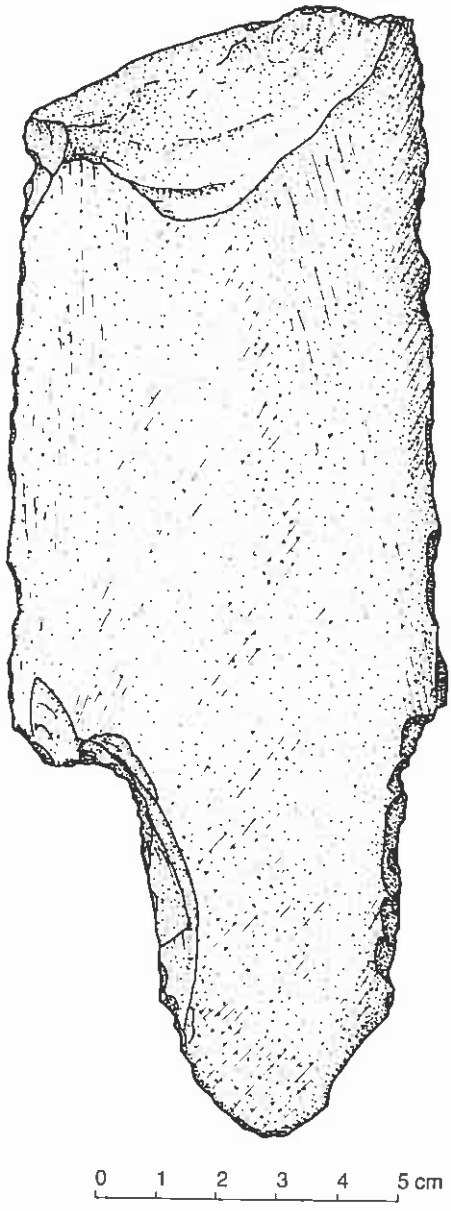
Description: Slightly offset, parallel-sided stem. Base broken. Stem edges thick, whittled longitudinally, leaving two-three flutes or facets. Subsequently faceted edges are coarsely ground. Non-prominent shoulders. Convex lateral edges converge to sharp tip. Fairly thick, hexagonal cross section. Possible ownership marks on both faces in form of several parallel lines perpendicular to long axis. On both faces, most distal line points at the two shoulders. On one face most proximal line appears to point to beginning of parallel-sided stem. Were these possibly gauge lines for shaping the stem? Shaping striations on both faces are mainly oriented at an oblique angle to long axis.
Material: Slate.
Measurements: L [7.20]; W 2.28; T 0.62; shoulder H [1.96] & [1.61]; stem W 1.76; Wt [11.1]
Remarks: Unusual stem and shoulder treatment. See also KOD-385-1 for "gauging lines" in shoulder area.

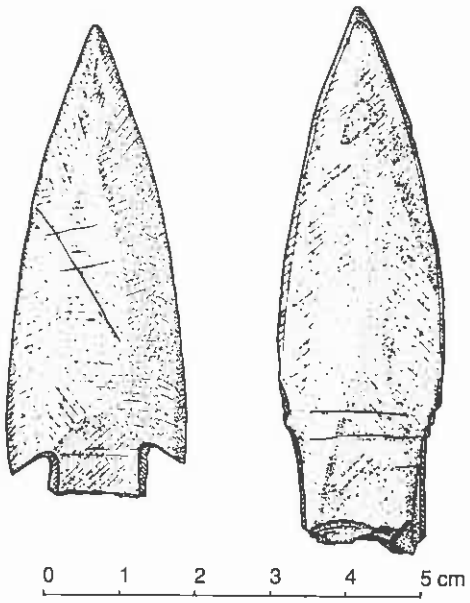
49KOD-385-3 *Long, Slender, Stemmed Flaked Biface (illustrated)*

Description: Broad parallel-sided stem. Base straight, with both corners broken. Sharp shoulders define obtuse angle with stem. Concavity in one subconvex margin just above shoulder. Fairly thick, biconvex cross section. Unusually long, slender, straight-edged blade. Tip broken.
Material: Basalt with rectangular glassy inclusions.
Measurements: L [5.80]; shoulder W 2.36; T 0.78; shoulder H 1.86 & 1.65; stem W 1.88; Wt [11.0]

49KOD-385-4 *Ground Ulu (illustrated)*

Description: Highly convex, double-bevel working edge, relatively straight back shaped originally by flaking portions, then ground





49KOD-376-1 Huge, Stemmed, Double-Edged, Ground Blade Fragment (left); 49KOD-385-1 Three Saints Bay Point (center); 49KOD-385-2 Stemmed Ground Point (right).

flat. Biconically drilled hole in center near back. Maximum diameter of hole is 0.76 cm on one side; 0.85 cm opposite. One, possibly broken, end blunted by light grinding. Both surfaces extensively ground. Overlapping striations in several orientations.
Material: Slate.
Measurements: back L 10.5; W 5.43; chord of working edge 11.4; T 0.50; Wt 43.0

KOD-415

Cultural Affinities: Presumably predates the late prehistoric Koniag phase.

49KOD-415-1 — *Slender Parallel-Sided Biface Midsection*

Description: Unusually straight, parallel-sided blade edges. Thick, biconvex cross section. Some irregularities of one blade edge preclude certainty that this was a stem. Extensive parallel retouch on all face edges. Thickness of specimen at both broken ends suggests that it was originally considerably larger than this preserved mid-section.
Material: Red chert, mottled with rectangular and light colored impurities.
Measurements: L [3.11]; W [1.82]; T [0.73]; Wt [5.3]
Remarks: Unusual format; compare with KOD-385-3.

KOD-432

Cultural Affinities: The only artifact collected at this site suggests a late Kachemak (Three Saints Bay phase) component.

49KOD-432-1 — *Grooved Lamp (illustrated)*

Description: Tear drop outline. Large bowl sloping gently down from narrow, rounded rim. Medial groove (for wick?) in bowl is 1.0+ cm wide and runs from pointed end to within four cm of back rim. Another, one-cm-wide groove, lies about circumference of lamp, on outer surface, below the rim. The narrow, rounded rim is damaged in several places and appears intentionally lowered at narrow end (for wick). The bowl was carefully smoothed after it was pecked, and perhaps chiseled into shape. The outer surface is rounded but with an extensive flat area on the bottom which renders lamp very stable. Three sets of thumb-sized, paired, pecked depressions 9 - 9.5 cm apart on edge of base where it curves to form sides. An additional pair of these depressions is found in the middle of the base 6 cm from front and back, beyond the flattened area.
Material: Graywacke.
Measurements: L 29.7; W 19.4; T 7.40; Wt exceeds 2600 g
Remarks: Found in possible association with human skeletal material. The careful workmanship and medial and circumferential grooves are typical of late Kachemak tradition lamps on Kodiak and in Kachemak Bay (Heizer 1956:34-38, D. Clark 1970:80, de Laguna 1975:64-66) and an example with both external and medial grooves was recovered in a temporally equivalent Cottonwood phase context on the Alaska Peninsula (G. Clark 1977:Pl.VIII-5).

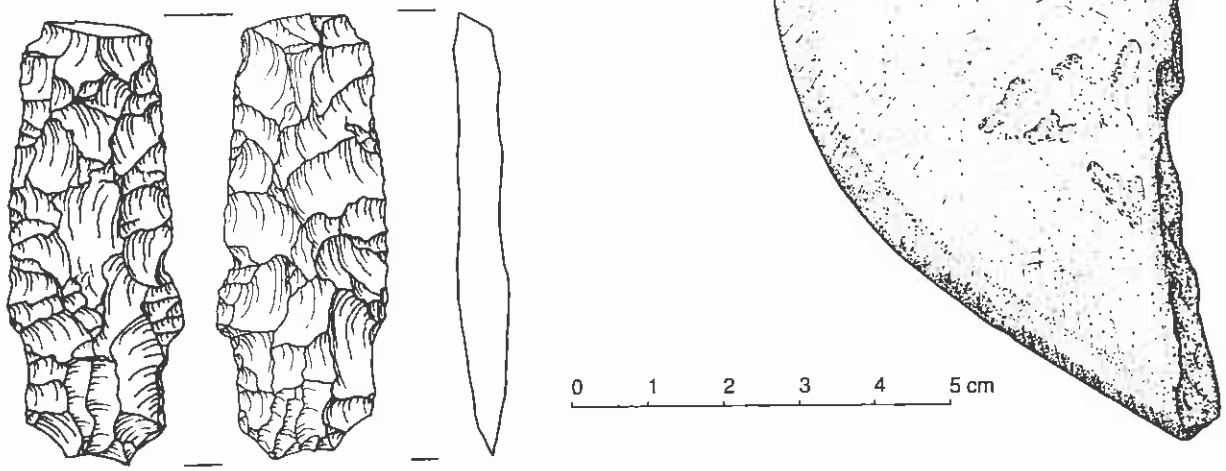
Seldovia Quadrangle

SEL-178

Cultural Affinities: Two house depressions, soily midden with fire-cracked rock. The available information does not permit cultural placement.

49SEL-178-1 — *Large, Damaged Planing Adze (illustrated)*

Description: Rectangular outline; fairly thin, biconvex cross section. Extensively ground near bit on one face; bit area on other face entirely removed by large flake scar, apparently originating from one lateral margin. Extensive edge nibbling, and crushing of remaining distal end on ground face, indicate probable use (as a gouge?) after destruction of bit. Lateral edges are bifacially flaked, fairly thin, ground flat after flaking. Several are very large flakes struck from these edges to no clear purpose. Thin, subconvex, bifacially flaked poll. Extensive grinding of both faces except where removed by subsequent flaking. Poll lightly ground.
Material: Greenstone.
Measurements: L 11.50; chord of "gouge" end 4.33; T 1.59; poll W 2.79; Wt 97.8



49KOD-385-3 Long, Slender-Stemmed Flaked Biface (left); 49KOD-385-4 Ground Ulu (right).

49SEL-178-2 *Ulu (illustrated)*

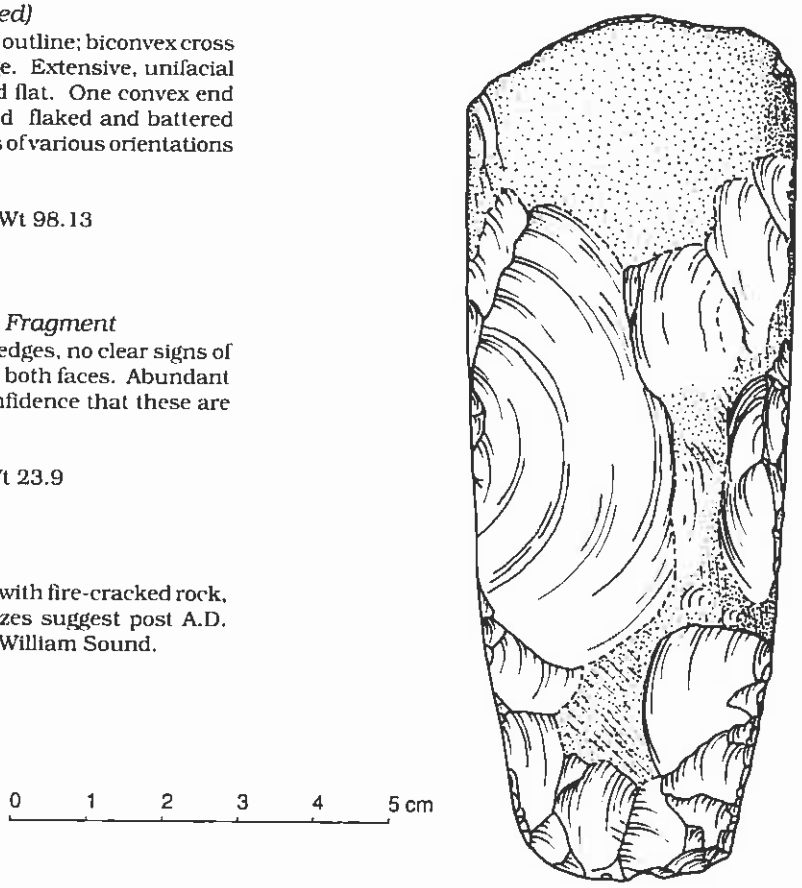
Description: Simple, rounded rectangular outline; biconvex cross section. Convex double-bevel working edge. Extensive, unifacial damage and flaking. Straight back ground flat. One convex end flaked and blunted by grinding. Other end flaked and battered bifacially, jagged. Coarse shaping striations of various orientations present over most of both faces.
Material: Slate.
Measurements: L 12.80; W 6.24; T 0.83; Wt 98.13
Remarks: Non-diagnostic.

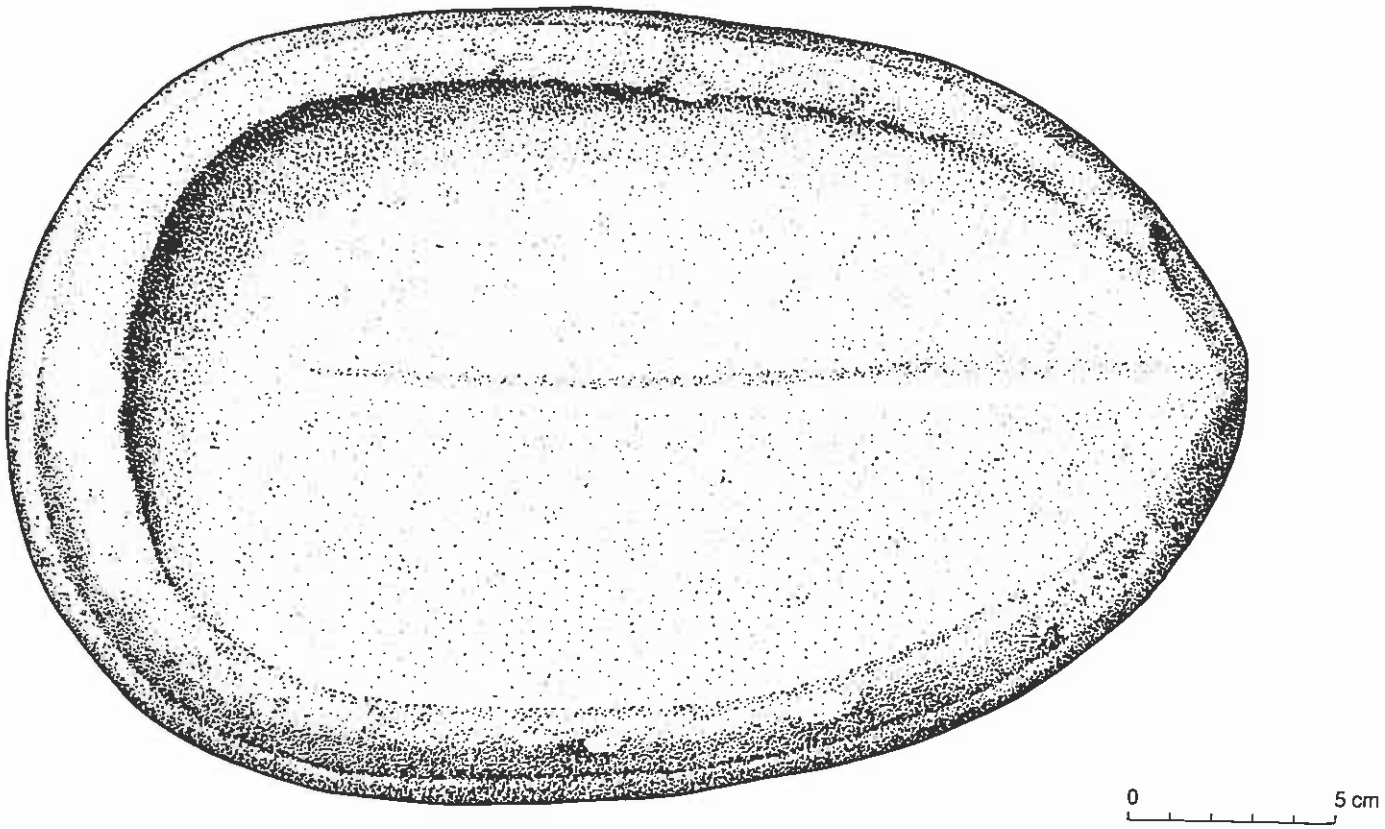
49SEL-178-3 *Coarse Slate Fragment*

Description: Rectangular outline; broken edges, no clear signs of flaking. Possible striations or cut marks on both faces. Abundant evidence for recent abrasion minimizes confidence that these are result of human activity.
Material: Slate.
Measurements: L 6.78; W 4.69; T 0.67; Wt 23.9

SEL-179

Cultural Affinities: Black, organic midden with fire-cracked rock, a possible house depression. Splitting adzes suggest post A.D. 1000 date and/or connections with Prince William Sound.





49KOD-432-1 Grooved Lamp (bottom); 49SEL-178-1 Large, Damaged Planing Adze (top).

49SEL-179-1 *Large Ulu Fragment*

Description: Damaged convex blade. Straight, flaked back blunted and flattened by extensive grinding. One end bifacially flaked and battered; opposite end broken. Both faces extensively ground. Striations on one face oriented parallel to back; on opposite face oriented both oblique and parallel to back.
Material: Slate.
Measurements: L [9.66]; W 6.52; T 0.57; Wt [48.]1

49SEL-179-2 *Ulu Fragment (illustrated)*

Description: Highly convex, damaged double-bevel blade. Straight back on break, ground smooth. Extensive damage to both faces. Preserved shaping striations oriented perpendicular to long axis. One end a continuation of ground working edge. Opposite end too damaged for assessment.
Material: Slate.
Measurements: L 7.29; W 4.07; T 0.40; Wt 12.2
Remarks: Re-worked from larger piece.

49SEL-179-3 *Large Medial Labret (illustrated)*

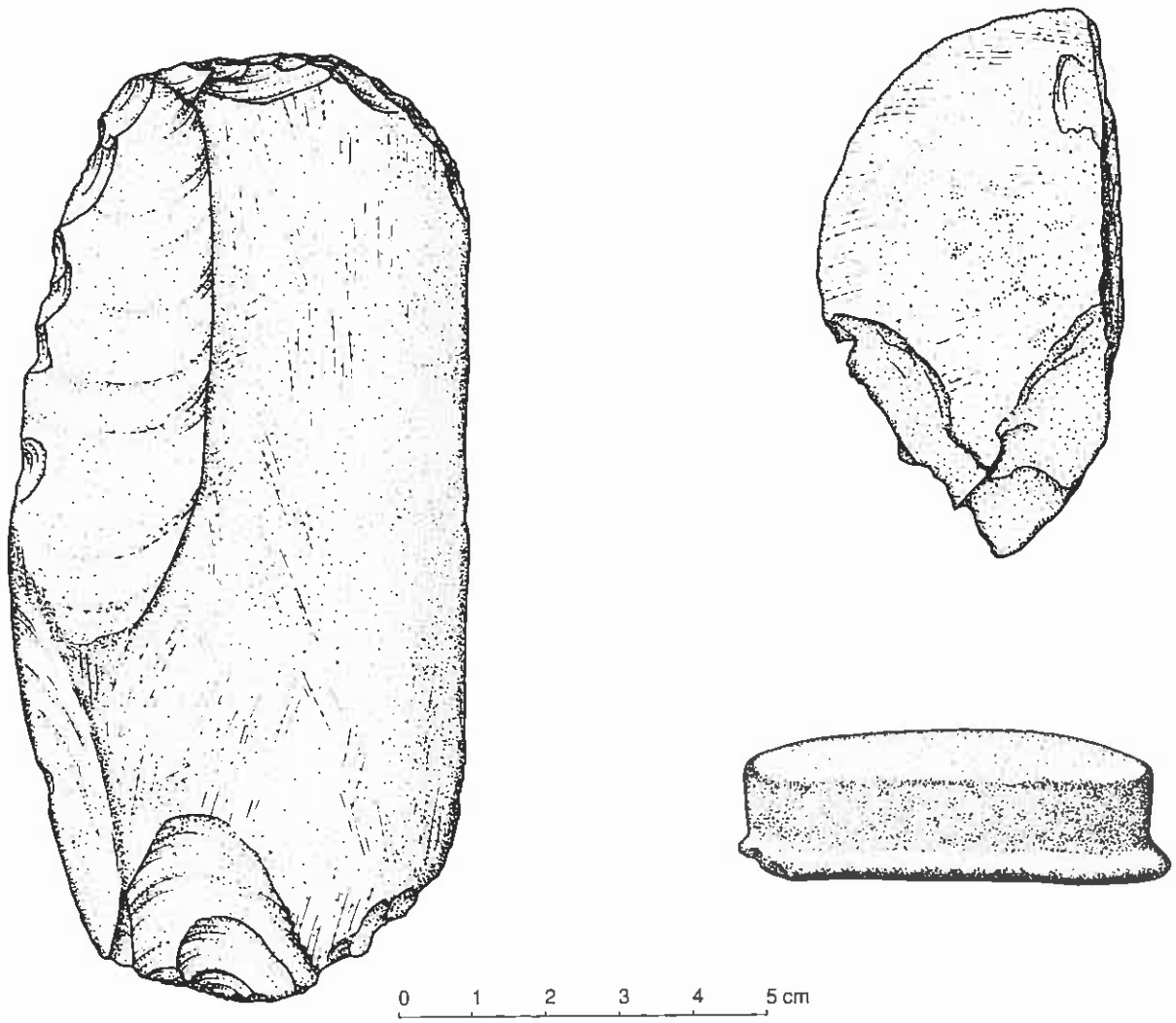
Description: Long, low stud; oval outline. Specimen as a whole has rectangular cross section. Elongate oval phalange, ends rounded points, one broken. Top of stud and bottom of phalange extensively smoothed by grinding.
Material: Marble with glittering inclusions.
Measurements: phalange L 5.86; stud L 5.48; W 1.42; H 1.87; Wt 27.8
Remarks: Inclusions glitter to create a striking effect.

49SEL-179-4 *Splitting(?) Adze Bit Fragment*

Description: Wedge-shaped. Rounded, convexo-triangular cross section. Highly convex bit; steep, single bevel from upper surface, slight bevel from bottom. Edge of bit use-battered but unbroken. Broken proximally. Surfaces highly polished, especially near bit. Polish superimposed on extensive pecking.
Material: Graywacke(?)
Measurements: L [7.94]; W [4.91]; arc of bit 2.11; H 3.06; Wt [92.9]
Remarks: Splitting adze in size, unusually narrow (pick-like) bit.

49SEL-179-5 *Splitting(?) Adze Bit Fragment (illustrated)*

Description: Wedge-shaped bit, broken proximally. Carefully shaped, rectangular cross section. Double-bevel bit, extensively damaged on one face at corner. Bit edge convex. All surfaces carefully polished. Polish superimposed on extensively pecked surfaces. Red ocher stains small area near broken edge.
Material: Graywacke.
Measurements: L [7.87]; W [5.44]; arc of bit 3.21; H [3.34]; Wt [172.9]
Remarks: Size suggests splitting adze. Unusual rectangular cross-section.



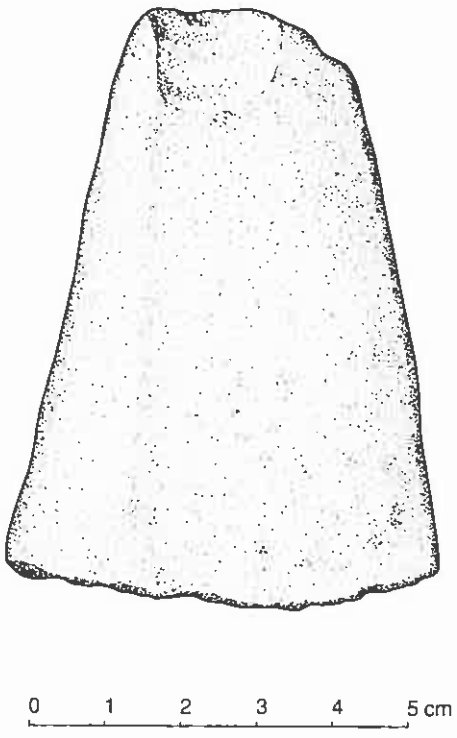
49SEL-178-2 Ulu (left); 49SEL-179-2 Ulu Fragment (top right); 49SEL-179-3 Large Medial Labret (bottom right).

49SEL-179-6 *Large Cylindrical Cobble*
Description: Battered flat at both ends by use as hammerstone. Plano-triangular cross section.
Material: Graywacke.
Measurements: L 17.1; W 6.88; T 5.74; Wt 1152.0

49SEL-179-7 *Large Edge-Battered Cobble/ Splitting Adze Preform*
Description: Massive, flattened cobble, rounded triangular cross section. Heavily pecked at one end and along thinner of two sides. Two concavities pecked into thinner side might be early stage in preparation of lashing grooves, but they are paired with an area roughened by pecking on thicker side and therefore might have been for finger holds. Both flat surfaces feel smoothed (ground?). No clear striations.
Material: Graywacke.
Measurements: L [15.3]; W [4.70]; H [7.11]; Wt [797.9]
Remarks: Edge battering could be finger holds for hammerstone/ maul function.

49SEL-179-8 *Unworked, Small, Flat Cylindrical Cobble*
Description: Highly polished surfaces, plano-triangular to flattened oval cross section. No evidence of utilization.
Material: Graywacke(?)
Measurements: L 9.10; W 3.20; T 2.36; Wt 78.7

49SEL-179-9 *Unworked, Small Flat Cylindrical Cobble*
Description: Broken at one end. Oval cross section. Possibly lightly utilized.
Material: Graywacke.
Measurements: L [9.44]; W 3.75; T 2.18; Wt 111.6



49SEL-179-5 Splitting (?) Adze Bit Fragment.

49SEL-179-10 *Unworked Flat Cobble*
Description: Flat cobble of unusual shape; unworked.
Material: Graywacke.
Measurements: L 14.1; W 6.66; T 3.48; Wt 430.5

49SEL-179-11 *Cobble Hammerstone/ Whetstone(?)*
Description: Highly polished, rounded rectangular cobble, plano-convex cross section. Narrow end battered. Numerous random scratches on both faces may reflect utilization as whetstone.
Material: Greenstone.
Measurements: L 7.20; W 5.66; T 2.75; Wt 174.2

49SEL-179-12 *Unworked, Small Flat Cobble*
Description: Oval outline and cross section. Green in color.
Material: Conglomerate.
Measurements: L 8.78; W 4.27; T 2.07; Wt 136.7
Remarks: Minimally utilized if at all.

49SEL-179-13 *Flaked and Ground Slate Blade (illustrated)*
Description: Rounded rectangular outline. One, subconvex, lateral margin extensively unifacially flaked, fairly thick. Opposite, subconvex, lateral margin thinner, bifacially ground, but resulting "working edge" intentionally blunted by grinding. Both rounded ends are blunted by flaking and grinding. One surface extensively ground; striations oriented parallel to long axis. Most of opposite surface covered by large flake scars. Grinding present only near thin edge.
Material: Slate.
Measurements: L 8.05; W 6.02; T 0.68; Wt 45.2
Remarks: Function uncertain; being re-worked? slate scraper?

SEL-181

Cultural Affinities: This site is a classic refuge island.

49SEL-181-1 *Elongated Ulu, Subconvex Edge, Ground Back (illustrated)*
Description: Large, plain ulu, double-bevel subconvex working edge. Straight back opposite flaked, then ground flat. One straight, angled end also ground flat (index finger rest?). Irregular convex end opposite thin and flaked, not ground. Ground over most of both faces. On one face visible shaping striations oriented parallel to long axis. On opposite face, shaping striations parallel to long axis near cutting edge, perpendicular and oblique towards back. Much of back area not facially ground.
Material: Slate.
Measurements: L 19.8; W 8.43; T 0.69; L of ground back 15.0; chord of worked edge 17.3; Wt 174.0

49SEL-181-2 *Unretouched Boulder Spall*
Description: Side-struck flake. Classic oval outline. Thinner, convex edge sporadically nicked, perhaps through use. Not retouched.
Material: Graywacke.
Measurements: L 14.15; W 8.70; T 2.02; Wt 275.5

49SEL-181-3 *Bird Bone Awl, Spatulate Tip*
Description: Curved ulna midsection from medium-sized bird. Proximal end irregular and broken. Distal end comes to blunt point, one face of bone cut away two cm from distal end. Edges of remnant ground smooth. Plano-rectangular cross section.
Material: Bird ulna midsection.
Measurements: L 11.03; W 0.56; T 0.68; worked end L 7.10; W 0.56; Wt 2.3

49SEL-181-4 *Flaked Cobble Implement*
Description: Flat, rounded rectangular cobble, one straight edge extensively bifacially flaked creating massive, sinuous cutting edge. Though bifacially flaked, edge has steep single bevel. Very

large spall removed from one corner on non-beveled face. Trapezoidal cross section.
Material: Graywacke.
Measurements: L 13.40; W 9.00; T 3.65; chord worked edge 7.48; Wt 665.8

SEL-188

Cultural Affinities: Field observations indicate presence of both a prehistoric and a historic (early 1900s?) occupation at this site. The collected Henry .44 shell represents the historic component, probably unrelated to the prehistoric occupation. The splitting adzes in the prehistoric component suggest a post A.D. 1000 date and/or cultural affiliation with Prince William Sound (D. Clark 1974b:92).

49SEL-188-1 — *Slender, Coarsely Ground Slate Scrap*

Description: Rectangular outline. Edges damaged but intentional flaking not documented. Straighter of two long edges appears blunted by light grinding. Numerous coarse striations oriented at an oblique angle to long axis on both faces.
Material: Slate.
Measurements: L 8.58; W 2.37; T 0.34; Wt 11.5

49SEL-188-2 — *Straight-Edged Ulu End Fragment*

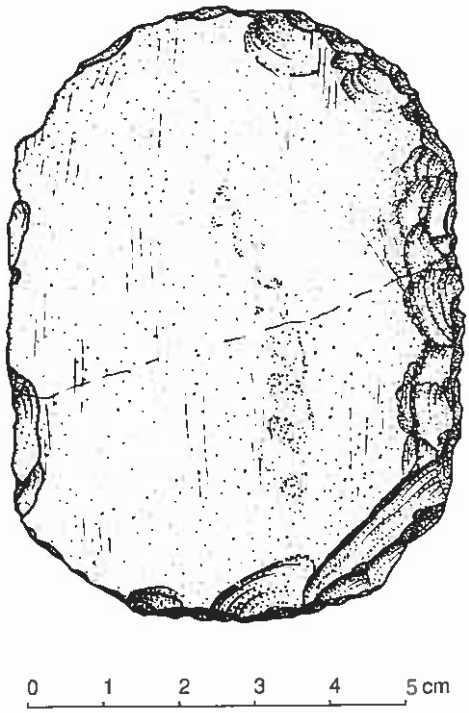
Description: Straight, double-bevel working edge. Irregular back opposite (on break?). Sinuous, unifacially flaked end blunted by light grinding. Coarse shaping striations parallel working edge on both faces. One end broken (apparently recently).
Material: Slate.
Measurements: L [5.61]; W [6.04]; T [0.39]; Wt [21.9]

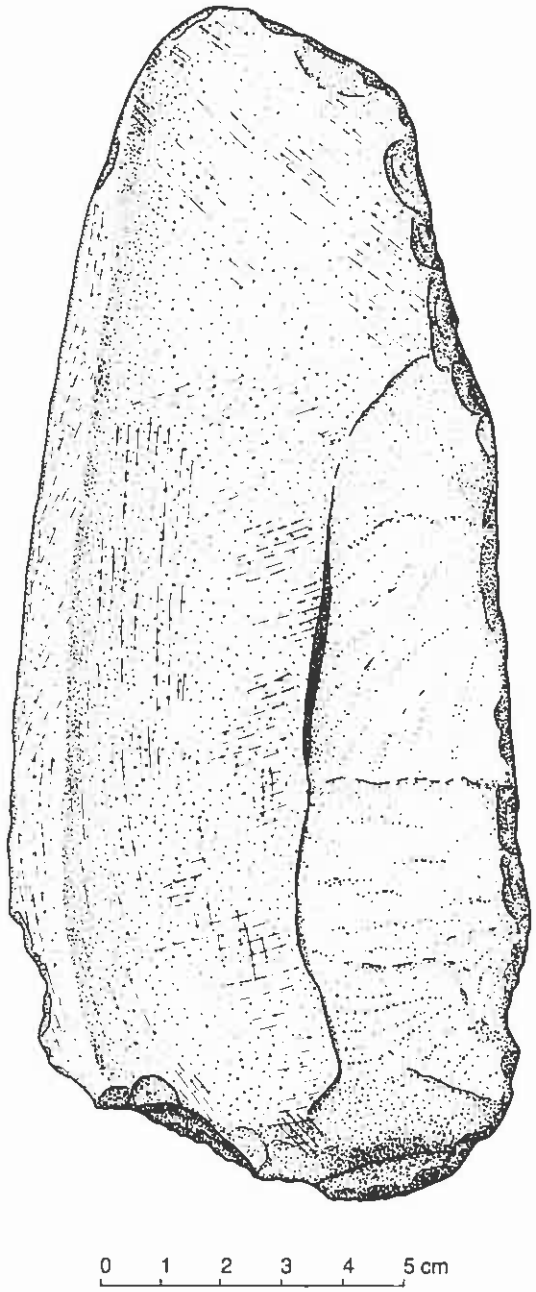
49SEL-188-3 — *Ulu Midsection*

Description: Subconvex, double-bevel working edge. Straight back on natural break. Both ends broken, apparently recently. Well finished on both faces. Visible striations parallel long axis.
Material: Slate.
Measurements: L [5.13]; W [6.50]; T [0.45]; Wt [22.5]

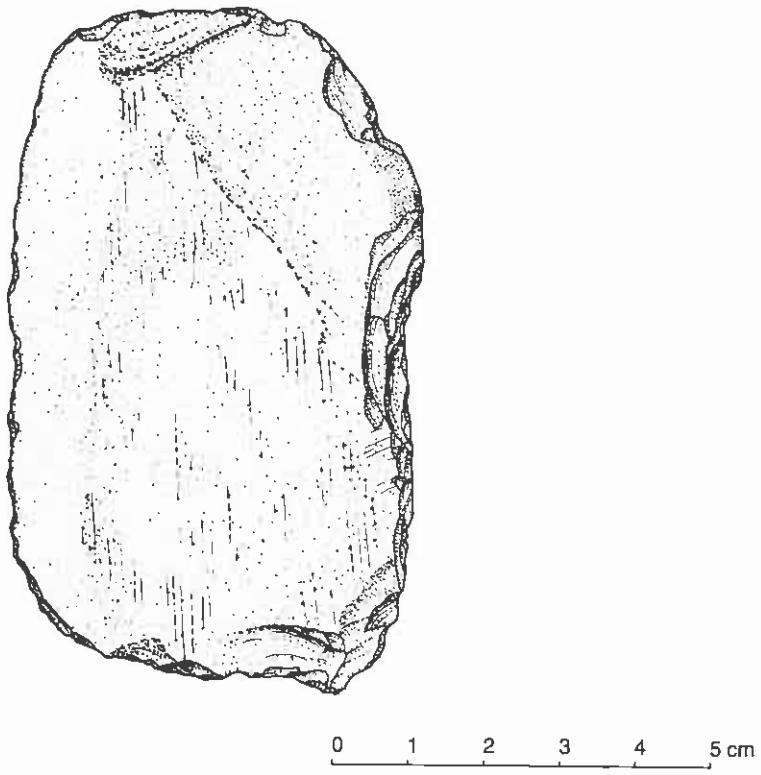
49SEL-188-4 — *Henry .44 Center-Fire Cartridge Case*

Description: Corroded; distal edges fragmented in scalloped fashion. No evidence for intentional modification.
Material: Brass.
Measurements: L 3.01; W 1.17; T 1.04; Wt --
Remarks: Unlikely to be in meaningful association with other artifacts from site.





49SEL-179-13 Flaked and Ground Slate Blade (left); 49SEL-181-1 Elongated Ulu, Subconvex Edge, Ground Back (right).



49SEL-188-5 Unfinished(?) Simple Rectangular Ulu (left); 49SEL-188-6 Large Adze Fragment Converted into Splitting Wedge (right).

49SEL-188-5 *Unfinished(?) Simple Rectangular Ulu (illustrated)*

Description: Rectangular outline, sub-convex working edge with double-bevel grinding; however, edge is flaked. Unfinished? Being re-sharpened? Straight back unifacially flaked and lightly ground. One subconvex end flaked; opposite subconvex end also flaked and blunted by light grinding. Coarse shaping striations parallel long axis on both faces.
Material: Slate.
Measurements: L 8.80; W 5.38; T 0.53; chord of working edge 7.89; Wt 42.2

49SEL-188-6 *Large Adze Fragment Converted into Splitting Wedge (illustrated)*

Description: Pecked and ground adze fragment with originally rounded cross section, split longitudinally. Plano-convex cross section at present. Former bit area (as indicated by extensive grinding of convex surface) converted to poll with original edge destroyed by heavy bifacial battering. New working end convex and unifacially beveled by flaking onto flat face. Extensive battering of both edges on flat face as well. Present form strongly suggests splitting wedge function. Extensive pecking of convex face over half of nearest, most recent, working edge.
Material: Greenstone.
Measurements: L 10.18; W 4.48; T 2.55; Wt 180.8

49SEL-188-7 *Splitting Adze with Double Groove (illustrated)*

Description: Narrow subconvex bit, double-beveled though more steeply from top (grooved) surface. Bit edge ground smooth rather than sharp. Some damage at corners. Rounded rectangular cross section. Bottom flat, top rounded. Two broad, shallow, pecked grooves set off central knob. Irregular suggestion of knob forward of distal groove. Poll is irregular, flattish break, unshaped. Pecked over most surfaces. Grinding largely confined within four cm of bit, some on bottom as well.
Material: Graywacke.
Measurements: L 23.22; W 4.10; knob H 5.90; H near poll 5.37; groove W 2.40 & 1.95; knob L 2.84 & 2.1; arc of bit 2.13; Wt 812.5

49SEL-188-8 *Splitting Adze with Single Hafting Knob (illustrated)*

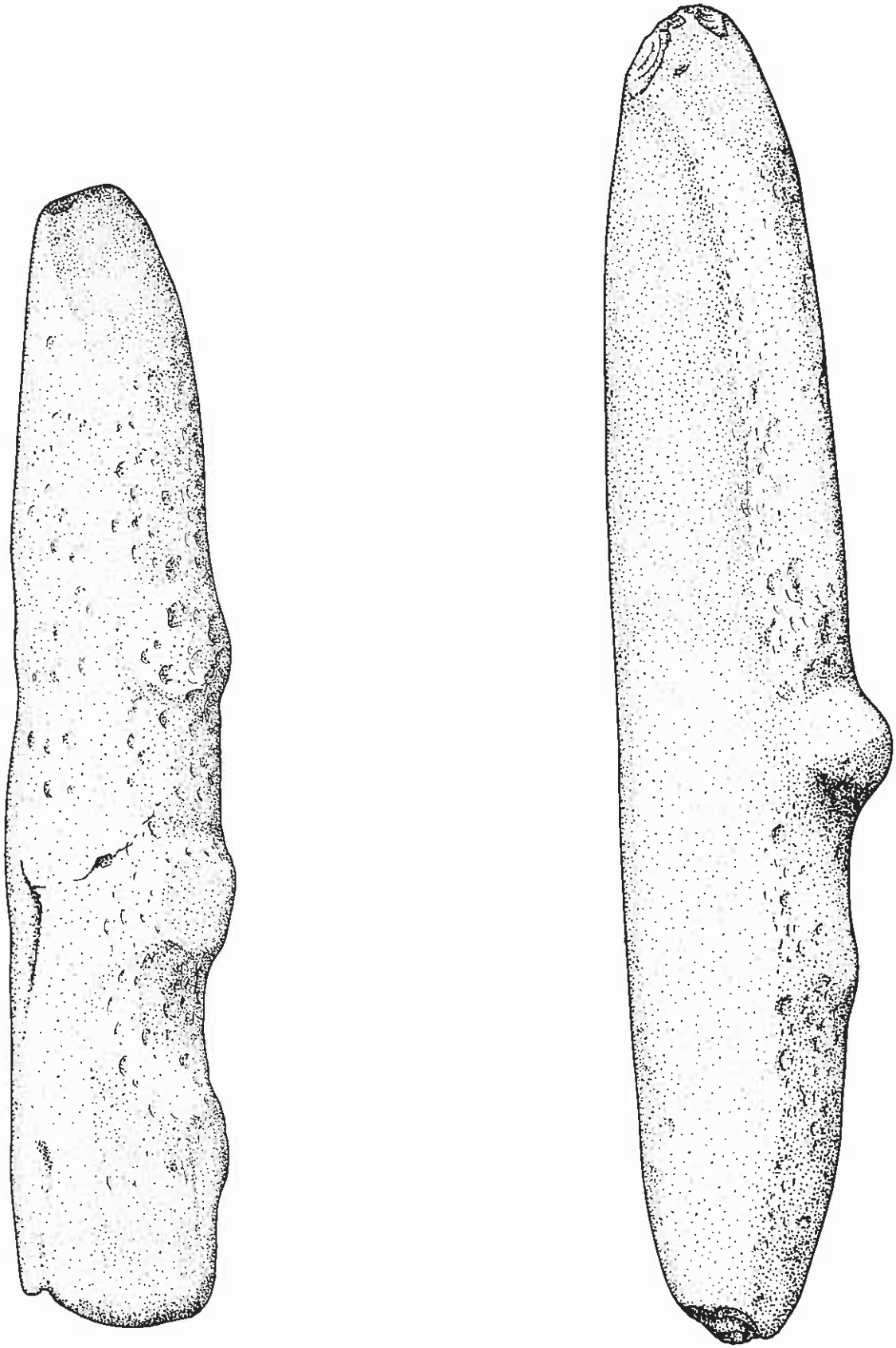
Description: Long, slender, high adze bit with narrow, convex, single-bevel working end (bifacially battered). Single hafting knob, without associated grooves, in approximate center. Pecked extensively over rounded top and on irregular, flat bottom and one side. Grinding largely confined to bit area and one flat side. Slightly trapezoidal cross section. Thin poll bifacially battered.
Material: Graywacke.
Measurements: L 27.70; W 3.68; knob H 6.15; body H 5.17; chord of bit 2.16; knob diameter 1.97; Wt 872.5
Remarks: Very narrow bit (pick?). Splitting adzes with a single knob for hafting are known from Koniag phase contexts on Kodiak (D. Clark 1979:281, Pl. 3-B, 1974a:73, Pl. 6-a), in Prince William Sound (de Laguna 1956:113-117; Pl. 11-6), and among the very rare splitting adzes in Kachemak Bay (de Laguna 1975:Pl. 18-3).

SEL-195

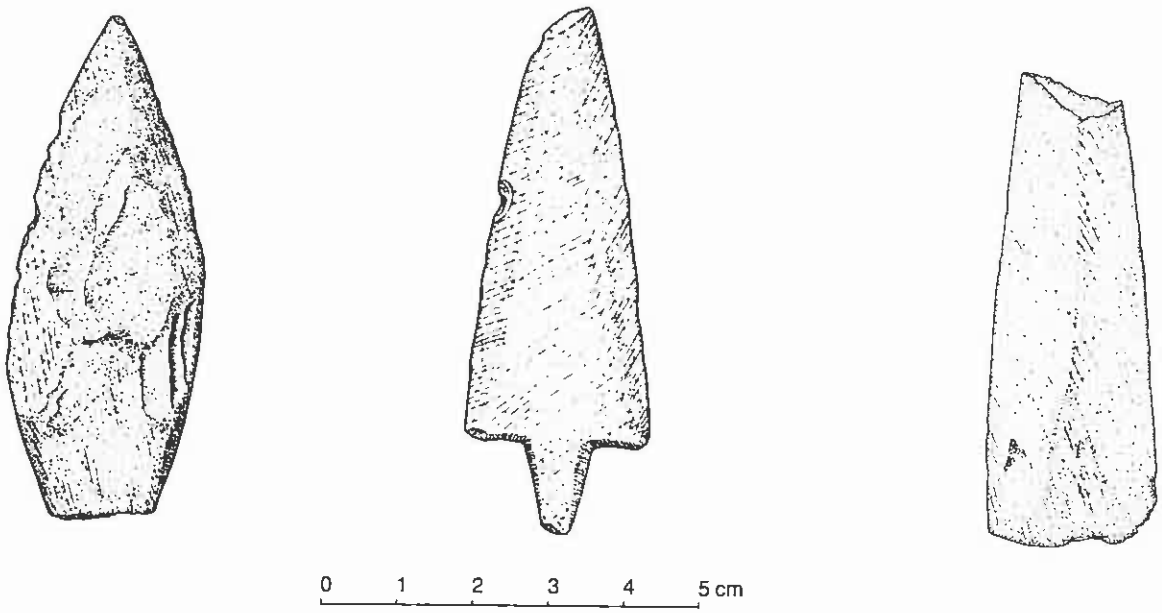
Cultural Affinities: Isolated find. Stone flaking (exclusive of slate) is very rare in the known prehistoric record from Prince William Sound.

49SEL-195-1 *Retouched(?) Flake Fragment*

Description: Large basalt flake(?) midsection, one, sinuously straight edge bifacially battered. Sporadic retouch/battering of adjacent subconcave edge and broken ends as well. Irregular rectangular outline. Thin plano-triangular cross section. Extensively



49SEL-188-7 Splitting Adze with Double Groove (left); 49SEL-188-8 Splitting Adze with Single Hafting Knob.



49SEL-197-1 Stemmed Ground Slate Point (left); 49SEW-004-1 Ground Slate Point with Pronounced Contracting Stem (center); 49SEW-004-2 Elongate, Butt-Faceted, Ground Slate Point (right).

water-rolled. Concentration of "retouch" on very edges does not inspire confidence about intentional nature.
Material: Basalt with large crystalline inclusions.
Measurements: L [3.59]; W [3.41]; T [0.55]; Wt [8.7]

SEL-196

Cultural Affinities: Splitting adze suggests a Second Millennium date and/or Prince William Sound cultural affinities (D. Clark 1974b:92).

49SEL-196-1 *Splitting Adze(?) Fragment*
Description: Distal fragment of large splitting adze. Beautifully preserved, straight, double-bevel bit (ax-like), pecked and extensively ground on two narrow edges, eight to ten cm back from bit. Bit is very sharp and shows remarkably little damage. Irregular sides show very little shaping. No preserved hafting grooves or knobs, precluding absolute certainty that this was a splitting adze. Irregular rectangular cross section. Poll area absent. Proximal termination in massive break.
Material: Greenstone.
Measurements: L 15.85; W 3.71; H 6.42; chord of bit 2.99; Wt 614.9

SEL-197

Cultural Affinities: Insufficient data available.

49SEL-197-1 *Stemmed, Ground Slate Point (illustrated)*
Description: Lanceolate outline, hexagonal cross section. Definite stem created by flat grinding of both edges. Shoulders completely inconspicuous. Straight, thin base, perhaps on break. Grinding confined to edge areas, creating steep bevel on all face edges, giving specimen hexagonal cross section. No clear evidence that specimen was flaked to shape before application of grinding. Sharp point slightly damaged.
Material: Slate.
Measurements: L 6.61; shoulder W 2.46; T 0.53; shoulder H 1.82 & 1.40; Wt 11.2

Seward Quadrangle

SEW-004

Cultural Affinities: The butt-faceted triangular point and, perhaps, the contracting stem point suggest a Second Millennium date.

49SEW-004-1 *Ground Slate Point with Pronounced Contracting Stem (illustrated)*
Description: Christmas tree outline. Broad triangular blade, subconvex lateral edges. Rounded blade corners. Short, highly contracting stem significantly inset from body of point. Stem edges ground flat. Lower edges of triangular body created by steep, double-bevel grinding. Cross section of body biconvex; stem rectangular to hexagonal. Thick tip presumably broken. Coarse shaping striations oriented obliquely to long axis on both faces.
Material: Burned slate(?)
Measurements: L [6.92]; shoulder W 2.38; T 0.43; max stem W 0.91; shoulder H 1.26 & 1.26; Wt --
Remarks: This somewhat unusual form is known primarily from late prehistoric contexts on Kodiak (D. Clark 1974a:Pl. 1-D, Pl. 12-F, Jordan & Knecht 1988:Fig. 13-6) though two examples from Karluk derive from a 4000 - 6000 year-old context (Jordan & Knecht 1988: Fig. 8-J,K). When the late prehistoric implications of 49SEW-004-2 are taken into account, comparison with the late prehistoric Kodiak forms seems most reasonable.

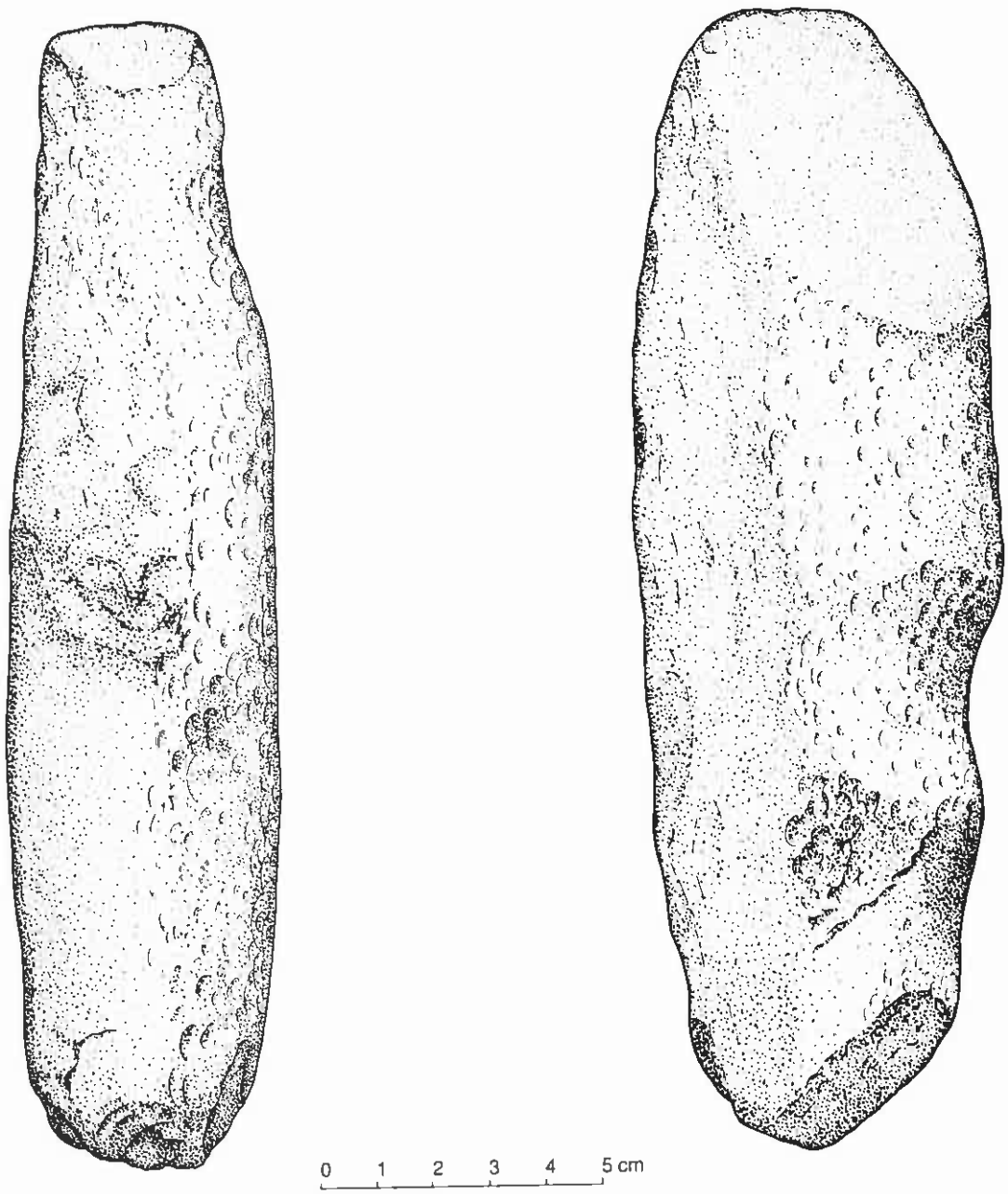
49SEW-004-2 *Elongate, Butt-Faceted, Ground Slate Point (illustrated)*
Description: Elongate triangular outline; tip broken; base appears broken, but remaining edge is subconvex and blunted by grinding. Triangular depressions ground in both faces near faceted butt. Sharp medial ridge on both faces above butt, giving distal, preserved portion of blade subdued diamond-shaped cross section. Coarse shaping striations oriented obliquely to long axis are preserved on both faces.
Material: Slate.
Measurements: L [6.25]; base W 2.18; T 0.44; L of butt facets (base to apex) 2.12 & 2.80; Wt 7.8

Remarks: Butt-faceted triangular end blades are a diagnostic Second Millennium type in the area (D. Clark 1974b:54).

49SEW-004-3 *Burned Cortical Spall*
Description: Irregular triangular outline, plano-convex cross section. Cobble cortex. Unworked and probably fire-altered.
Material: Gabbro.
Measurements: L 7.62; W 4.53; T 0.84; Wt 28.6
Remarks: Thermal fracture from fire-cracked rock.

SEW-072

Cultural Affinities: Site originally reported (through second hand information) by de Laguna (1956:30). Two, presumably late prehistoric, native copper implements were found there in the course of earlier work, associated with adzes and a broken lamp. The abundant 1989 material suggests a specialized site where splitting adzes were manufactured (and/or used) on a large scale. Unfortunately, with the possible exception of a pigment mortar (#34), nothing diagnostic except splitting adzes was recovered, so one must emphasize this category of tool. Typically SEL-072 splitting adzes have bottoms flatter than tops (and surfaces modified with grooves, etc., for lashing). The tops are often rounded and the sides frequently only minimally modified. Grinding is usually concentrated near the cutting edge (bit) on the top and bottom, with the sides near the edge only occasionally being systematically ground. The bits characteristically have a double-bevel, although in some cases the bevel from the top is more extreme. Many of the bits are heavily damaged, sometimes being



49SEW-072-1 Massive Ungrooved Adze (left); 49SEW-072-6 Splitting Adze (right).

virtually destroyed by flaking and battering onto one face. It is difficult to conceive of this pattern as resulting solely from use. Splitting adzes similar to these in all important respects were described long ago by de Laguna (1956:110ff).

Elsewhere in the Gulf of Alaska splitting adzes date from the Second Millennium, but in Prince William Sound they appear somewhat earlier (D. Clark 1974b:92). They have yet to be encountered in a Kachemak tradition context either in Kachemak Bay or on Kodiak. The native copper implements reported from this site by de Laguna should date at least one component to the Second Millennium (Workman 1976:150ff).

49SEW-072-1 *Massive Ungrooved Adze (illustrated)*

Description: Nicely shaped, double-bevel, subconvex bit, extensively ground on both faces 1.5 & 1.2 cm from bit. Little damage to working edge. No traces of knobs or lashing grooves. Top and bottom both rounded by extensive pecking, which extends onto adjacent areas on both sides. Thick, wedge shaped poll shows some battering.
Material: Greenstone with red stain (iron pigment ?).
Measurements: L 20.2; W 4.14; H 5.93; chord of bit 3.23; Wt 766.422
Remarks: Nicely made implement; not a classic splitting adze.

49SEW-072-2 *Massive Adze Midsection(?)*

Description: Rectangular outline, rounded rectangular cross section. Top and bottom are considerably broader than sides. Sides rounded by pecking, otherwise no strong suggestions of human workmanship. Broken at both ends.
Material: Greenstone.
Measurements: L [8.58]; W [6.27]; T [3.12]; Wt [309.8]
Remarks: Proportions wrong for a classic splitting adze, i.e. wider than high.

49SEW-072-3 *Unfinished Splitting Adze*

Description: Unfinished double-bevel bit. Top ground and bottom crudely battered. Bottom and top extensively pecked. Broad hafting groove, pecked on top and bottom, separates two knobs. Oval poll minimally battered. Edges of bottom rounded by pecking, giving it a biconvex cross section near bit and a more triangular cross section near poll. Grinding limited to top within 4.4 cm of bit.
Material: Greenstone.
Measurements: L 21.10; W 3.87; H 5.40; chord of bit 2.45; Wt 714.6
Remarks: Working edge does not appear to be finished.

49SEW-072-4 *Broken Splitting Adze*

Description: Cutting edge destroyed by breakage on bottom, flat face. Top extensively ground in bit area. Behind this, top extensively pecked, rounding corners and creating single, broad, shallow groove for hafting. Bottom irregularly flat and not worked. Poll area destroyed by breakage. Cross section varies from plano-convex near each end to plano-triangular in middle.
Material: Greenstone.
Measurements: L [22.2]; W 4.65; H 6.01; Wt [957.0]

49SEW-072-5 *Broken Cobble Hammerstone*

Description: Elongate cobble. Rounded plano-triangular cross section. One rounded end and one rounded lateral edge have seen light use as hammerstone. One end missing. Flat face and adjacent rounded edges stained red. Break appears fresh.
Material: Graywacke, pigment stained.
Measurements: L [10.26]; W 5.21; T [4.02]; Wt [255.8]

49SEW-072-6 *Splitting Adze (illustrated)*

Description: Double-bevel bit, lower face destroyed by flaking and battering. Retained edge fairly blunt. Extensive grinding 6.50 cm back from bit on top and 5.20 cm on bottom. Bottom flattened, and top rounded by extensive pecking, but top remains relatively broad. Three low knobs (most proximal one quite inconspicuous) are separated by two broad, shallow, hafting grooves, proximal groove smoothed by extensive grinding. Irregular, unshaped poll shows some battering. Rounded rectangular cross section with flat bottom and rounded top.
Material: Greenstone with red pigment.
Measurements: L 19.7; W 4.62; H 6.51; chord of bit 3.92; groove W (approx) 2.16 & 3.43; Wt 999.4
Remarks: Nicely made.

49SEW-072-7 *Adze(?) End Fragment*

Description: Rectangular in outline and cross section. Wider than high. Some pecking has rounded one edge on the upper (?) face. There is also a ground area near the break on this face. Otherwise, shaping is minimal. Convex end has a double-bevel and is battered on both faces. (Perhaps the early stages of bit formation? No grinding in this area.) No preserved traces of knobs or grooves. Broken obliquely.
Material: Greenstone.
Measurements: L [11.32]; W [3.89]; T [3.32]; chord of working edge 3.25; Wt [237.6]
Remarks: Perhaps the early stage of adze manufacture.

49SEW-072-8 *Splitting Adze*

Description: Double-bevel bit, battered blunt. Extensively polished 3.8 cm back from bit on top, and 4.31 cm on bottom. Pecked flat on bottom, rounded, almost pointed on top. Only one, low, hafting knob and portion of groove preserved; remainder broken out. Irregular rectangular, unshaped poll, perhaps some light battering. Plano-triangular cross section.
Material: Greenstone, very platy.
Measurements: L 17.6; W 4.44; knob H 5.41; chord of bit 3.36; Wt 688.5

49SEW-072-9 *Unworked(?) Rectangular Piece*

Description: Rectangular outline, irregular trapezoidal cross section. Possibly some crude battering at flat face on pointed end. No clear grinding or pecking
Material: Greenstone.
Measurements: L 13.78; W 5.17; T 2.69; Wt 266.4
Remarks: Adze material and general outline; little positive evidence of human workmanship.

49SEW-072-10 *Splitting Adze(?) Bit(?) Fragment*

Description: Broken proximally? One end steeply beveled and battered on one face; no grinding anywhere. Top(?) is rounded by extensive pecking; bottom(?) rounded by pecking within 5 cm of supposed working end. Rounded rectangular cross section. No grooves nor knobs retained. Poll area massively damaged.
Material: Greenstone.
Measurements: L [20.50]; W [5.44]; H 6.78; Wt [990.0]
Remarks: Unfinished adze?

49SEW-072-11 *Splitting Adze (illustrated)*

Description: Unusually highly polished, double-bevel bit. Bit subconvex, one corner extensively damaged by bifacial flaking. Highly polished on top to edge of groove 8.2 cm proximal of bit; on bottom 6.5 cm. Considerable polish of both sides in bit area as well. Extensively pecked on bottom, top and one side. Bottom flat with rounded corners; top rounded, narrows markedly toward poll. Plano-convex cross section in front; plano-triangular cross section near poll. Single, broad groove with knob behind. Wedge shaped poll with some battering.
Material: Greenstone.
Measurements: L 17.40; W 4.72; H 5.94; chord of bit 4.13; groove W 4.39; Wt 782.5
Remarks: Unusual and extensive high polish in bit area.

49SEW-072-12 *Lamp*

Description: Flat cobble with fairly deep, triangular basin present in middle of flatter face. Basin probably enlarged by pecking. Irregular natural concavity on rounded opposite face. Specimen has irregular plano-convex cross section. Bottom of lamp irregular and needed propping to stabilize.
Material: Graywacke.
Measurements: L 14.7; W 9.58; T 2.98; bowl L 7.86; W 5.27; depth 1.1; Wt 470.3

49SEW-072-13 *Cylindrical Hammerstone*

Description: Cylindrical cobble with rounded rectangular outline and rounded triangular cross section. Both ends fairly flat and used for pecking. Some pecking of thinner, lateral edge as well.
Material: Greenstone, red stained.
Measurements: L 8.57; W 5.04; T 4.53; Wt 316.6

49SEW-072-14 *Ungrooved Splitting Adze*

Description: Narrow, ungrooved splitting adze; subconvex, double-bevel bit destroyed by intensive flaking on one face. Grinding confined to top and bottom in bit area, 5.2 cm back from edge on both top and bottom. Both top and bottom rounded by extensive pecking, as is one side. Other side basically unmodified. Poll half of implement split longitudinally, perhaps before manufacture. No clear groove but battered area on top may have served hafting function. Straight, rounded poll only lightly battered. Rounded rectangular cross section.
Material: Greenstone.
Measurements: L 23.65; W 4.20; H 5.62; Wt 756.5

49SEW-072-15 *Adziform Stone Rod*

Description: Long, greenstone rod, triangular cross section. Ground on top and bottom within 4.2 and 4.7 cm, respectively, of end. Single bevel on one end, but no convincing working edge preserved. Some pecking of top and bottom to round corners. "Poll" is triangular and unmodified. No grooving.
Material: Greenstone.
Measurements: L 20.2; W 2.40; H 3.00; chord of working end 1.00; Wt 168.6
Remarks: Not a splitting adze; specialized wood working function?

49SEW-072-16 *Broken Ungrooved Splitting Adze*

Description: Double-bevel, steeper from topside. Extensively ground bit area extends 6 cm proximally from bit onto broad, fairly flat bottom. One side extensively ground near bottom. Subconvex bit with rounded corners. Working edge destroyed by unifacial battering directed onto more steeply beveled face (top). Top extensively damaged. No grooves or knobs retained. Poll broken. Several longitudinal breaks extend from poll towards bit. Trapezoidal cross section near bit. Specimen too damaged elsewhere for determination of cross section. Extensive pecking of bottom part of two sides.
Material: Greenstone.
Measurements: L 18.4; W 4.66; T 3.83; Wt 419.5

49SEW-072-17 *Splitting Adze (illustrated)*

Description: Nicely finished. Broad, straight, double-bevel bit with rounded corners. Some edge nicking of bit (not much damage). Extensively ground 5 cm back from bit on top and 6.5 cm on bottom. Some grinding of sides near bit as well. Both top and bottom rounded by extensive pecking. Rounded rectangular cross section. Single, very broad, shallow hafting groove on top, knobs lacking. Straight poll shows extensive unifacial battering.
Material: Greenstone.
Measurements: L 19.10; W 4.35; H 6.02; chord of bit 3.03; groove W 4.01; Wt 783.5

49SEW-072-18 *Splitting Adze, Poll Fragment*

Description: Minimal modification save for part of a fairly deep, broad, hafting groove retained near break. Irregular trapezoidal cross section. Massive poll shows no battering. Distal portion missing. Some pecking near poll rounds off top. Some pecking also flattens bottom.
Material: Greenstone.
Measurements: L [13.12]; W [4.52]; H [5.33]; groove W [2.92]; Wt [436.7]

49SEW-072-19 *Splitting Adze(?), Poll(?) Fragment*

Description: Flat bottom with grinding; considerably thinner top, giving piece plano-triangular cross section. Wedge-shaped poll extensively, bifacially battered. Broken obliquely, removing hafting area and bit.
Material: Greenstone.
Measurements: L [9.85]; W [3.82]; H [5.17]; Wt [223.2]

49SEW-072-20 *Splitting Adze (illustrated)*

Description: Top and bottom extensively polished within 6.5 and 4.8 cm of bit. Working edge destroyed by large spalls removed onto top face, largely removing grinding on top. One spall very large. Asymmetrical double-bevel with steeper bevel on top. Extensive pecking on top and bottom; sides little modified. Two, low, rounded knobs separated by broad shallow hafting groove. Poll bifacially flaked and battered to thin transverse edge. Rounded rectangular cross section.
Material: Greenstone.
Measurements: L 17.7; W 4.47; knob H 5.88; groove W 3.28; chord of bit 3.12; Wt 700.5

49SEW-072-21 *Unworked Cylindrical Cobble*

Description: Cylindrical cobble, broken longitudinally at one end. Not convincing as hammerstone. Some striations on face raise possibility of casual use as whetstone. Rounded, plano-convex cross section.
Material: Graywacke.
Measurements: L 13.84; W 3.45; T [2.64]; Wt 162.6
Remarks: Called "abrader" on bag.

49SEW-072-22 *Splitting Adze*

Description: Double-bevel working edge, only slightly convex, with rounded corners. Extensively polished within 7.7 cm of edge on top, 3.0 cm on bottom. One corner of bit missing, destroyed on ventral face. One complete and one partial lashing groove on top. Two knobs, distal one highly damaged. Top, bottom and portions of sides extensively pecked. Poll area highly irregular, triangular in shape, perhaps damaged. Highly irregular, rectangular cross section. Top, near bit, is quite broad, about same as bottom.
Material: Greenstone with red inclusions.
Measurements: L 19.0; W 4.75; H 5.16; chord of bit [estimated 3.5]; groove W 3.55; Wt 683.5

49SEW-072-23 *Irregular Lamp(?) (illustrated)*

Description: Made on flat, elongate beach cobble with highly irregular outline. Extensive, irregular bowl pecked into one face, minimally smoothed inside. No adhering carbon or pigment. Bottom irregular flat surface of cobble. Rounded, cortical rim on one side; essentially rimless on opposite side and two ends.
Material: Graywacke.
Measurements: L 20.75; W 8.89; T 2.58; bowl depth 1.40; Wt 284.3
Remarks: Clearly intentionally shaped, but very irregular form.

49SEW-072-24 *Chisel(?)*

Description: Rectangular outline, irregular rectangular cross section. Straight bit with grinding of both faces. Subconvex edge quite blunt and battered. Triangular, proximal end shows some battering. Piece appears extensively water-rolled. No traces of pecking preserved on specimen.
Material: Greenstone.
Measurements: L 8.67; W 2.33; T 1.83; chord of bit 1.92; Wt 51.9
Remarks: Chisel improvised on broken, split adze fragment?

49SEW-072-25 *Cobble Hammerstone*

Description: Rounded triangular outline and cross section. More pointed end and several of thinner edges extensively pecked, indicating serious use as hammerstone. Surfaces very smooth and in some cases lightly striated, perhaps indicating use as some kind of smoother or abrader as well.
Material: Graywacke(?)
Measurements: L 10.01; W 6.71; Wt 564.1

49SEW-072-26 *Cobble Hammerstone*

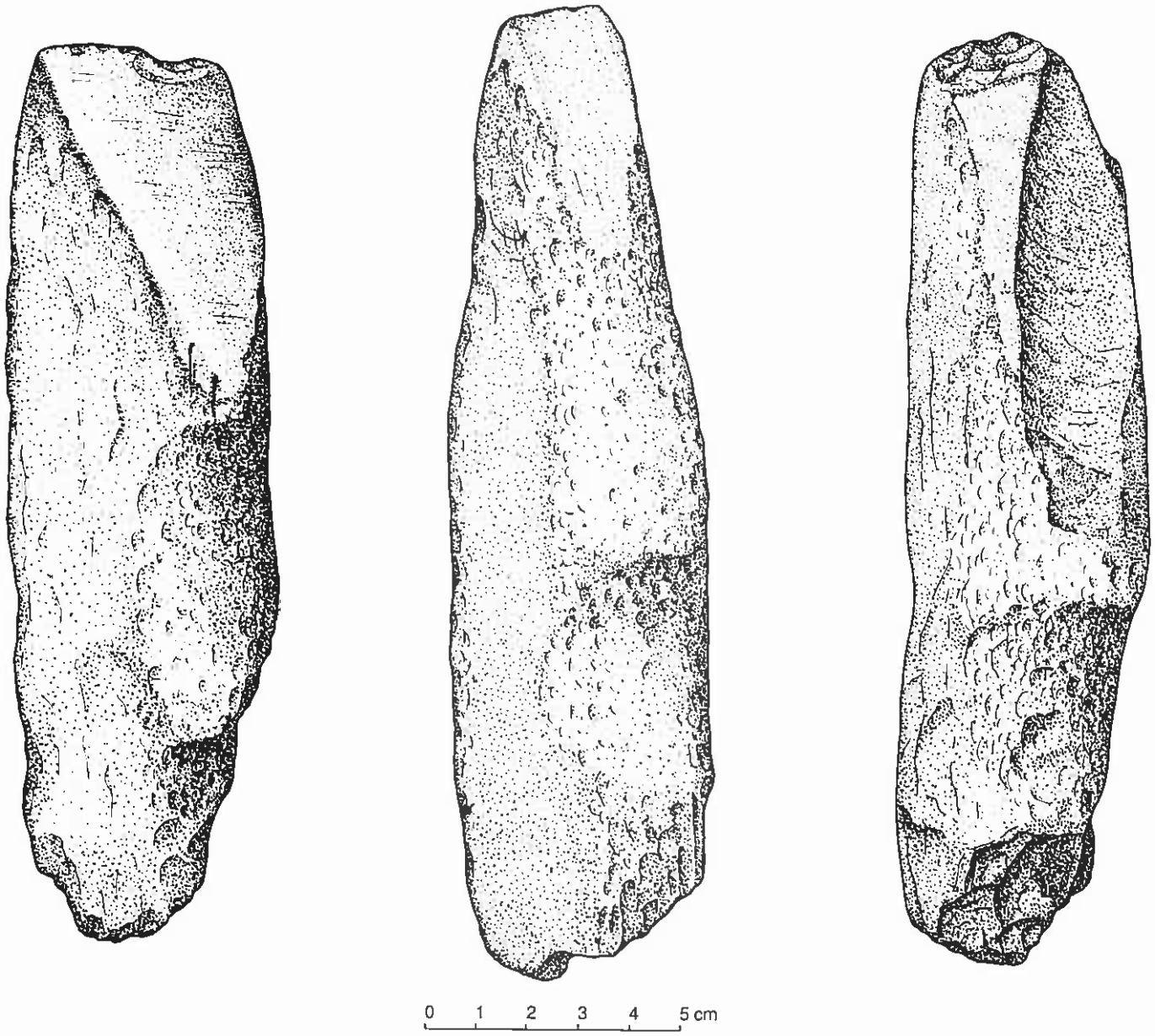
Description: Cylindrical cobble, somewhat broader at one end than at the other. Cross section a rounded parallelogram. Extensively battered on both ends and part of one lateral edge, near broad end. Lighter pecking on opposite lateral edge near broad end. Slight concavity in middle of one face appears natural but would have provided convenient thumb grip.
Material: Graywacke.
Measurements: L 13.50; W 6.56; T 4.43; Wt 556.7

49SEW-072-27 *Splitting Adze*

Description: Working end destroyed by breakage of bottom. Some grinding preserved near working end on top. Bevel of blade cannot be determined due to breakage. Extensive pecking of top, bottom and upper part of two sides. Two rounded hafting knobs separated by broad, shallow groove, ground smooth. Irregular, rounded poll shows little battering. Rounded rectangular cross section, broader on bottom than on top.
Material: Graywacke(?)
Measurements: L [23.95]; W 4.73; H on knob 6.70; chord of bit [3.60]; knob W 3.75; Wt 1038.0

49SEW-072-28 *Chisel(?) (illustrated)*

Description: Resembles bone wedge in outline and longitudinal section. Broad, thin, convex working end. Extensively polished in blade area. Lateral edges thin and smoothed by grinding. No pecking evident. Thick, triangular poll shows little evidence of heavy battering. Plano-triangular cross section. Extensively water-rolled.
Material: Greenstone with red stain.



49SEW-072-11 Splitting Adze (left); 49SEW-072-17 Splitting Adze (center); 49SEW-072-20 Splitting Adze (right).

Measurements: L 8.90; W 3.72; T 2.25; chord of bit 1.59; Wt 88.6
Remarks: Does not look like a planing adze or a piece from a splitting adze. Function uncertain. Does not appear sharp enough to be an effective chisel.

49SEW-072-29 *Longitudinally Broken Splitting Adze*

Description: Double-bevel blade, edge area destroyed by battering. Extensively polished within four cm of bit on top and bottom. Broken longitudinally for much of its length, thus preserved blade area very narrow. One, broad, lashing groove near back between two, low, rounded knobs. Broad flat poll, edges lightly battered. Cross section not determinable; probably rounded rectangular.
Material: Greenstone.
Measurements: L 19.3; W [37.1]; H [5.84]; groove W 2.70; Wt [573.2]

49SEW-072-30 *Splitting Adze(?) Bit Fragment*

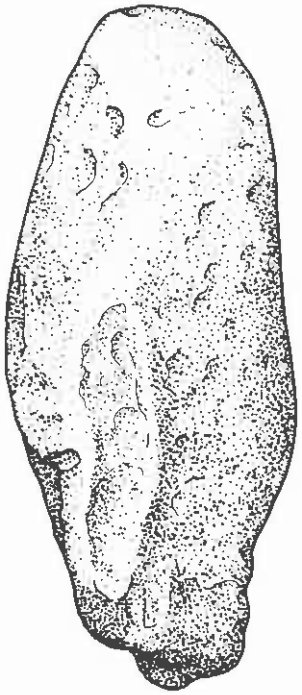
Description: Distal fragment, split longitudinally from splitting adze. Double-bevel blade extensively ground top and bottom. Destroyed by flaking and battering (primarily directed onto top?) Appears plano-triangular cross section. Broken proximally as well as longitudinally. Heavily water-rolled.
Material: Greenstone.
Measurements: L [7.52]; W [4.10]; H [2.27+]; chord of bit 3.38; Wt [115.3]

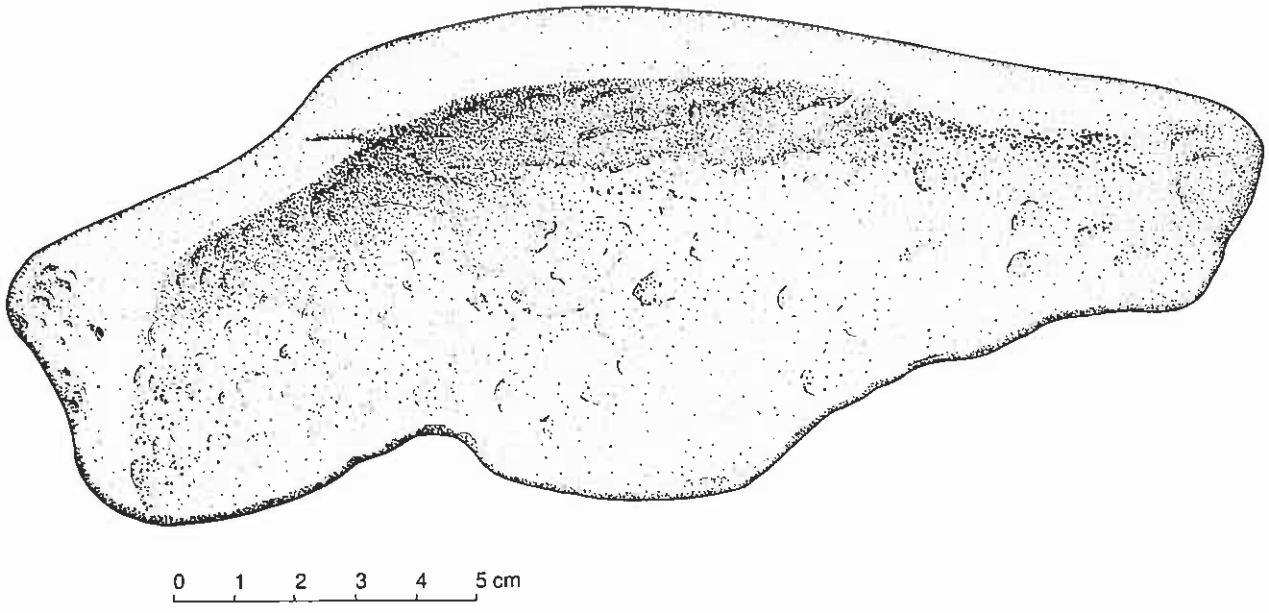
49SEW-072-31 *Splitting Adze(?) Bit Fragment*

Description: Double-bevel working edge extensively damaged on both faces. Top and bottom highly polished within 4.1 cm of working edge. Sides minimally polished or pecked. Top rounded by pecking proximal to ground area. Broken proximally. No hafting devices remain. Rounded rectangular cross section with broader, flatter bottom and narrower, rounded top.
Material: Greenstone.
Measurements: L [11.04]; W [4.02]; H [4.65]; chord of bit 2.55; Wt [248.5]

49SEW-072-32 *Splitting Adze*

Description: Massive, somewhat irregular splitting adze. Double-bevel working edge originally very highly polished (glassy) within 6 cm of edge, but polish has been removed by subsequent flaking, except on one side of upper surface. Bottom fairly broad, with highly irregular surface, extensively pecked. Top narrower, somewhat rounded, also extensively pecked pollward of grinding. Sides fairly flat, but show little modification by either pecking or grinding. Single, very shallow, broad groove occurs near back of implement. Irregular poll shows little evidence of shaping or battering. Irregular rectangular cross section, broader at bottom, narrower and more rounded at top.





0 1 2 3 4 5 cm

0 1 2 3 4 5 cm

49SEW-072-23 Irregular Lamp(?) (left); 49SEW-072-28 Chisel(?) (right).

Material: Greenstone with bright red stain.
Measurements: L 18.88; W 3.80; H near poll 6.88; chord of working edge 2.88; groove W 4.60; Wt 844.6

49SEW-072-33 *Splitting Adze (illustrated)*
Description: Extensively ground double-bevel, some grinding of one side within 3 cm of working edge as well. Working edge destroyed by unifacial flaking and battering proceeding onto bottom. Top and sides extensively pecked. Broad groove with prominent ridge-like knob on poll side. Rectangular poll, somewhat battered. Rectangular cross section. Relatively broad top, but lateral edges rounded.
Material: Greenstone.
Measurements: L 20.13; W 5.13; H at knob 7.04; chord of working edge 3.92; groove W 3.77; Wt 1110.4

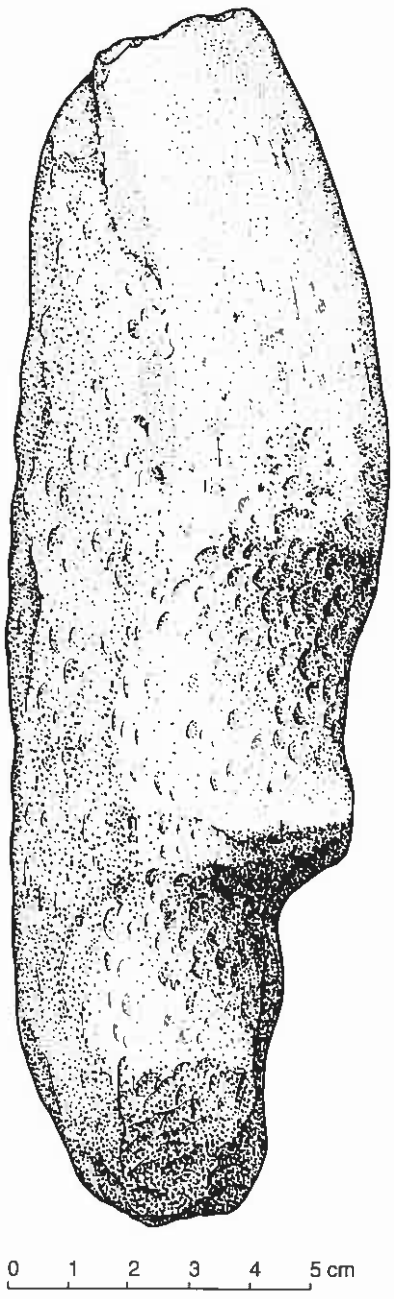
49SEW-072-34 *Shallow Pigment Mortar(?) (illustrated)*
Description: Small, rounded, rectangular beach cobble with rounded, triangular depression pecked in one face, possibly enlargement of natural cavity. Bowl area at least lightly ground. Reddish pigment adheres to bowl and adjacent face.
Material: Graywacke.
Measurements: L 8.03; W 7.07; T 3.80; bowl L 5.06; W 3.60; depth 0.66; Wt 298.2

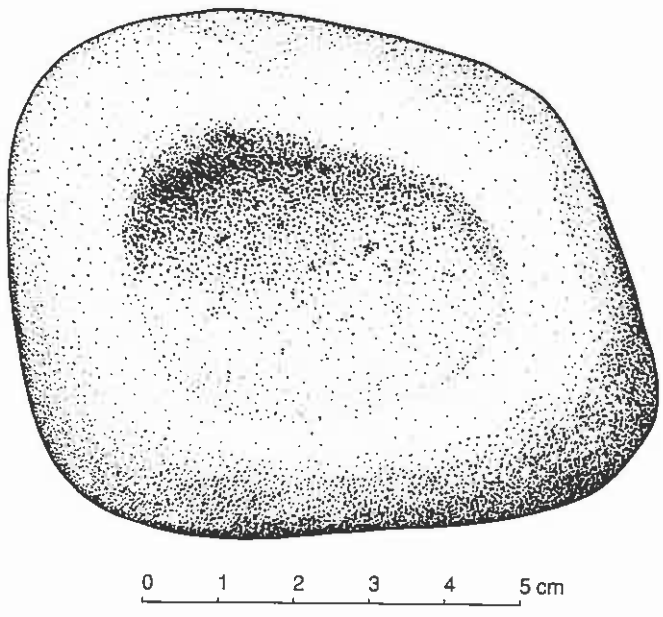
49SEW-072-35 *Hammerstone*
Description: Small, highly polished beach cobble, oval in outline and cross section. Both ends extensively utilized as hammerstone, one flattened from use. One lateral margin also heavily used/pecked. Other surfaces highly polished, but polish appears natural.
Material: Greenstone beach cobble.
Measurements: L 8.37; W 5.49; T 3.74; Wt 300.6

49SEW-072-36 *Cobble Implement*
Description: Fairly flat, oval cobble, one thick, lateral margin shows extensive bifacial flaking and battering, leaving a thick, beveled, lateral edge which was in turn used as a pecking stone. Sporadic peck marks elsewhere around edges, fairly heavily pecked at one end.
Material: Greenstone beach cobble.
Measurements: L 10.08; W 8.13; T 4.48; Wt 579.3

49SEW-072-37 *Grinding Slab Fragment(?)*
Description: Irregular, rectangular outline, one end rounded in longitudinal section. Rectangular cross section. Both lateral edges broken. Top and bottom very smooth and flat, one surface approaching sub-concave. Almost certainly used as a grinding slab, although striations not especially noticeable.
Material: Graywacke.
Measurements: L 13.1; W 6.27; T 4.48; Wt 523.9

49SEW-072-38 *Splitting Adze (illustrated)*
Description: Badly damaged, blunt working end, asymmetrical double-bevel, steeper bevel from top. Only lightly ground on top

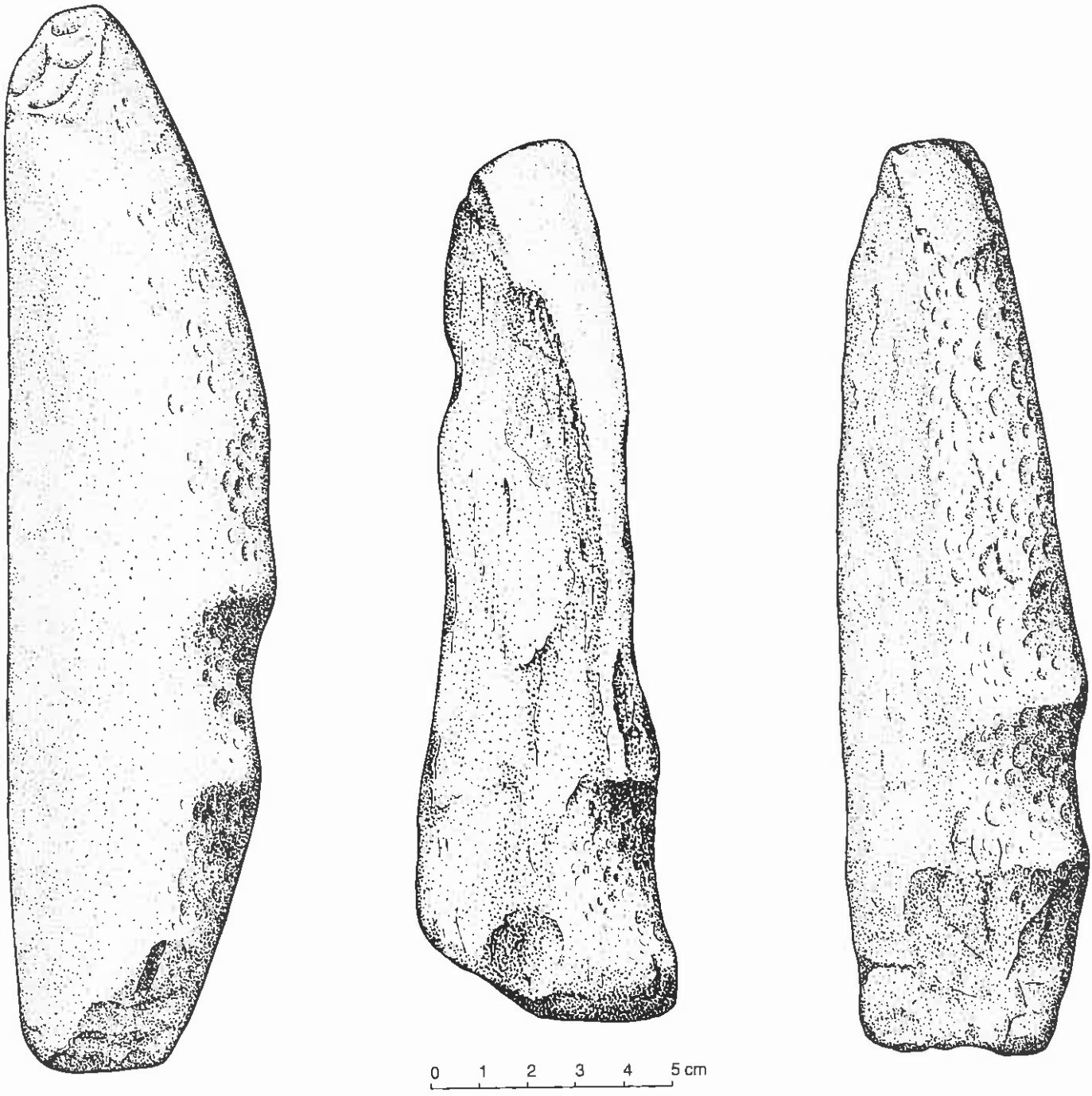




49SEW-072-33 Splitting Adze (left); 49SEW-072-34 Shallow Pigment Mortar(?) (right).

and bottom within 3.5 and 4.0 cm of working edge. Pecked extensively on all surfaces, but only lightly and sporadically ground. Two broad rounded knobs separated by broad shallow groove for hafting. Unworked (i.e. not battered) poll end has irregular sub-rectangular outline. Cross section rectangular with flatter bottom and more rounded top.
Material: Greenstone(?), light green with white inclusions.
Measurements: L 22.1; W 3.81; H 5.82; chord of working edge [2.92]; groove W 2.58; Wt 840.6
Remarks: Possibly unfinished or never utilized.

49SEW-072-39 Splitting Adze (illustrated)
Description: Narrow, convex bit with rounded corners. Bit oriented somewhat obliquely to long axis. Extensively ground, double-bevel bit totally undamaged. Grinding confined to top and bottom, extending 12.9 cm (top) and 8.9 cm (bottom) towards poll. Little grinding or pecking of sides. Single, broad, rounded groove on top. Broad, rounded rectangular, undamaged poll, not obviously shaped. Trapezoidal (approaching triangular) cross section (top very narrow). Broad, flat bottom.
Material: Greenstone with red.
Measurements: L 18.2; W 4.03; H at poll 6.25; chord of working edge 2.36; groove W 4.01; Wt 728.7
Remarks: Does not appear to have been used.



49SEW-072-38 Splitting Adze (left); 49SEW-072-39 Splitting Adze (center); 49SEW-072-40 Splitting Adze (right).

49SEW-072-40 *Splitting Adze (illustrated)*
Description: Highly polished, double-bevel working edge battered to very blunt (mostly on upper surface). Upper and lower faces ground within 3.2 and 6.0 cm of working edge, respectively. Sporadic grinding of high places on both lateral edges. Two rounded knobs on top define broad, rounded groove for hafting. Fairly narrow, extensively battered poll. Rounded rectangular cross section. Somewhat contorted in longitudinal section. Extensively shaped by pecking, especially on top.
Material: Greenstone, one-half lay in a bed of brilliant orange-red pigment.
Measurements: L 18.97; W 4.13; H on knob 6.36; chord of bit 2.22; groove W 2.17; Wt 776.5

49SEW-072-41 *Damaged Splitting Adze(?)*
Description: Polished surfaces of broad, double-bevel bit entirely removed by heavy bifacial flaking and battering. Heavy grinding confined to upper and lower surfaces within 4.5 (upper) and 6.8 (lower) cm of bit. Remainder of implement extensively modified by pecking. Irregular, oval poll area unshaped but not damaged. No knobs, grooves, or other obvious hafting aids. Rounded rectangular cross section. One massive flake removal may have destroyed the knob.
Material: Greenstone.
Measurements: L 18.80; W 4.62; T 5.86; chord of bit 3.72; Wt 852.5
Remarks: Cannot be certain of status as a splitting adze since knob was removed. Bit presumably being refashioned; only size and proportions suggest a splitting adze.



49SEW-072-44 Splitting Adze (?) Bit Area Fragment.

49SEW-072-42 *Probably Unworked Oval Beach Cobble*
Description: Oval outline, thickly plano-convex cross section. Flat surface roughened, possibly by light use or pecking. Other surfaces and sides quite smooth.
Material: Greenstone(?) light green with big white inclusions.
Measurements: L 10.68; W 8.58; T 7.69; Wt 1089.5
Remarks: Lightly used, if at all.

49SEW-072-43 *Broken Triangular Cobble*
Description: Massive cobble, rectangular in outline, very thickly triangular cross section. Flat base area has several concave depressions, at least one of which seems due to breakage of adjacent rock. No clear evidence of human shaping. Thin edge battered. Several large spalls removed from one side; again no clear evidence that humans were responsible.
Material: Graywacke.
Measurements: L 15.5; W 11.4; T 10.7; Wt 1915.2
Remarks: Highly problematic artifact.

49SEW-072-44 *Splitting Adze(?) Bit Fragment (illustrated)*
Description: Irregular, rectangular outline and cross section. Narrow, subconvex, double-bevel bit. Corners rounded. Bit area carefully ground on all four surfaces. "Cutting edge" rounded blunt but undamaged. Bottom, bit portion of top, and one side carefully ground; other surfaces irregular. No traces of knobs or lashing grooves. Proximal end is a highly irregular break.
Material: Greenstone.
Measurements: L [10.99]; W [2.84]; H [2.71]; chord of working edge 0.92; Wt [136.1]
Remarks: Not necessarily a splitting adze.

SEW-073

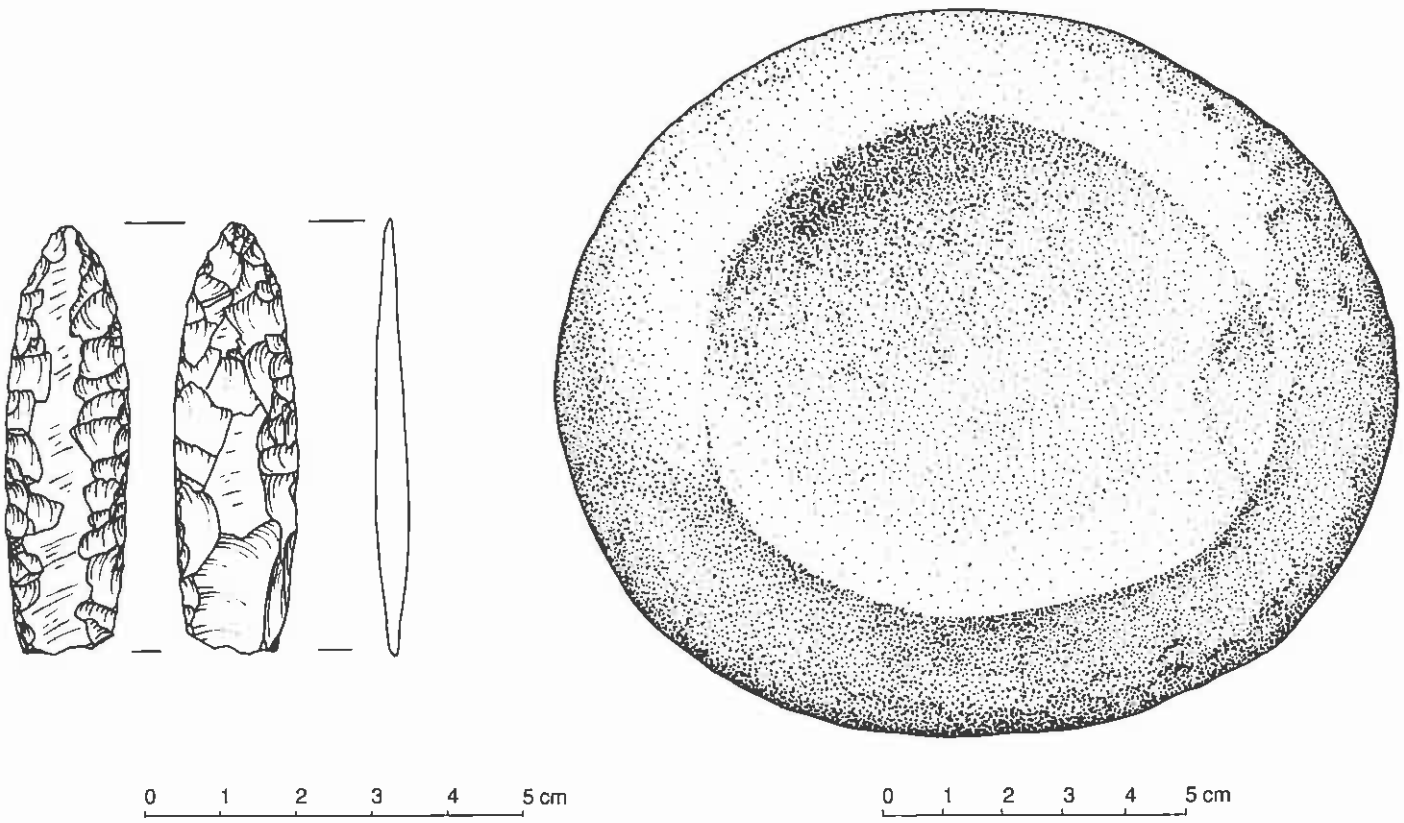
Cultural Affinities: Available information is insufficient for judgment.

49SEW-073-1 *Bifacially Flaked Lanceolate Point (illustrated)*
Description: Long, slender, lanceolate biface. Base either damaged or unfinished. Thin biconvex cross section. Rounded tip. Even, bifacial retouch covers one third of surface of point away from each edge.
Material: Basalt, banded (gray-white bands).
Measurements: L 5.64; W 1.67; T 0.47; Wt 5.4
Remarks: Non-slate flaked stone artifacts of any kind are unusual in Prince William Sound (de Laguna 1956:131).

SEW-248

Cultural Affinities: An early 1900s, non-Native fox farm is reported here. The available specimen, a dubious artifact, does not require recognition of a prehistoric component.

49SEW-248-1 *Problematic Boulder Spall*
Description: Rounded cortical surface present. No clear evidence (bulb of percussion, etc.) for detachment from cobble. Irregular rather than classic oval outline. Various edges battered and smoothed, but beach context precludes certainty that this was an implement. Plano-convex cross section. One straight edge flat but apparently not ground.
Material: Graywacke(?) petroleum saturated.
Measurements: L 9.80; W 8.82; T 1.76; Wt 178.0



49SEW-073-1 Bifacially Flaked Lanceolate Point (left); 49SEW-436-1 Cobble Lamp (right).

SEW-436

Cultural Affinities: Insufficient data available.

49SEW-436-1 Cobble Lamp (illustrated)
Description: Oval outline; fairly deep, ovular bowl pecked into gabbro cobble. Bowl interior smoothed by grinding. Edges shaped by considerable pecking. Base flat and smooth; striations suggest it was ground. All intersections (for example, bowl rim and sides) rounded rather than angular. Slight depression at narrower end of bowl might be for wick.
Material: Gabbro.
Measurements: L 13.91; W 11.80; T 5.80; bowl L 10.12; W 7.80; depth 1.17; Wt 1431.0
Remarks: Carefully made but undecorated.

SEW-478

Cultural Affinities: Isolated find of a single metal pulley wheel.

49SEW478-1 Pulley
Description: Six badly eroded spokes visible. Central hole made of brass and better preserved than iron exterior.
Measurements: Diameter 30.0; T 5.0

SEW-488

Cultural Affinities: Insufficient data available.

49SEW-488-1 Split Rib Fragment
Description: Split rib fragment of fair sized mammal (sub-whale). No clear human workmanship.
Material: Bone, rib.
Measurements: L 5.31; W 1.91; T 1.09; Wt 3.0

49SEW-488-2 Cobble Grinding Stone (and Anvil?)
Description: Oval outline, oval cross section. Extensively ground facet and several deep grooves on one face. Sporadic cut marks on other surfaces suggest secondary use as anvil. One side of stone, and part of face with ground patch, covered with reddish pigment. No hammerstone use apparent.
Material: Light colored, porous stone.
Measurements: L 10.25; W 7.26; T 5.78; Wt 660.9

49SEW-488-3 Crude Triangular Lamp
Description: Made on irregular cobble, one surface has deep, subtriangular bowl pecked into it (possible gouge marks also). Inner corners of bowl rounded instead of sharp. Small secondary depression at apex of bowl may be wick cavity. Interior of bowl not smoothed. Rim irregular and sides of bowl slope inward. Traces of oil in bowl appear modern. Base quite irregular, but not excessively tippy.
Material: Graywacke.
Measurements: L 17.9; W 14.98; T 6.14; bowl L 12.85; W 11.43; depth 2.24; Wt 2027.0

SEW-494

Cultural Affinities: Historic, American period.

49SEW-494-1 Buoy Bell
Description: Standard flared bell profile with a cast mounting-collar on the top. The collar is perforated by a central, vertical hole passing into the interior of the bell, through which a (presumably threaded) rod was passed (perforation now clogged with pebbles). Below the collar are indistinct letters in relief, appearing to be "US LHS" (indicating US Light House Service) and a date which may be 1809 or 1889.

Material: Bronze, with thin greenish patina.
Measurements: H 44.0; Diameter (at the flare) 51.0; T 4.5; Wt 96.0

49SEW-494-2 *Mounting Plate and Suspension Rod Assembly*
Description: A square, iron sheet with numerous perforations presumably where rivets (probably newly forged) were fastened. A centrally mounted, cylindrical iron rod and circular mounting collar extend perpendicularly from one surface, the opposite surface having an iron bar-stock stiffener.
Material: Iron.
Measurements: Mounting plate 50.1 square, T 1.0; Rod diameter 7.0 at proximal end, tapering to 4.5 at distal end; Rod mounting collar diameter 21; T 2.0.

49SEW-494-3 *Clapper Assembly*
Description: Rust has removed some of the original shape. Morphology and patterned exfoliation indicate hand forging and hammer welding. Y-shaped rod has bulb-shaped swelling serving as a clapper at the distal end, intended to strike the exterior of the bell. The top of the Y-ends are each curved into a yoke shape, with one end blunted and the other fashioned into a loop from which a swivel-eye is attached. The swivel-eye has a flared restricting collar forged about the midsection of the shaft, terminating in a barrel-shaped swivel ball. The whole assembly consists of a swivel and eye, a yoked shaft section, and a clapper.
Material: Iron.
Measurements: Clapper diameter 8.0; total yoked shaft length 1.3; rod diameter 1.5; yoke spread 30.0; swivel length 9.5; swivel flare diameter 5.5; barrel swivel diameter end 4.0

49SEW-494-4 *Clapper Assembly*
Description: See 49SEW-494-3.
Material: Iron.
Measurements: See 49SEW-494-3.

49SEW-494-5 *Clapper Assembly*
Description: See 49SEW-494-3.
Material: Iron.
Measurements: See 49SEW-494-3.

49SEW-494-6 *Structural Piece*
Description: Twisted and heavily corroded metal bar; L-shaped cross section with rivet holes at irregular intervals along one side. Probably a portion of the bell tower.
Material: Iron.
Measurements: L 1.7; W 4.0; T 0.25

Mount Katmai

XMK-022

Cultural Affinities: This small island (Takli) provided the type site for the early phases of the Pacific Peninsular prehistoric sequence. Slate blades with decorative barbing are known both from Ocean Bay and later contexts. Stones grooved over the middle and about one end are typical of the Kachemak tradition and its temporal equivalents, while flat-rimmed lamps (represented here by a somewhat dubious fragment) are typical of the Koniag phase. It is possible that a considerable temporal span is represented at this site.

49XMK-022-1 *Double-Edged, Ground Blade Midsection*
Description: Rectangular outline, irregular biconvex cross section. Both faces damaged. Straight, double-bevel lateral edges. Item broken on both ends and extensively water-rolled.
Material: Slate.
Measurements: L [4.67]; W 3.18; T 0.43; Wt [7.1]

49XMK-022-2 *Small Planing Adze Bit*
Description: Rectangular outline with rounded corners. Convex bit bifacially, with steeply unifacial bevel. Some flaking or damage of corners, otherwise blade thin and sharp. Grinding confined to within two cm of bit, otherwise item shaped by bifacial flaking. Lateral edges thin. Poll thick and unshaped, possible striking platform of original flake.
Material: Basalt.
Measurements: L 4.75; W 3.59; T 0.96; chord of bit 3.08; Wt 22.7

49XMK-022-3 *Double-Edged Barbed Blade*
Description: Very thin piece of slate. Slightly offset stem suggested, but apparently not finished. Straight blade edges notched at intervals of 1.8 cm, creating barbed effect, three on one side, one probable remnant on opposite side. Double-bevel ground on very edge of three notch side; single-bevel ground on one notch side. Otherwise, no grinding. Irregular trapezoidal cross section. Broken distally.
Material: Slate.
Measurements: L [8.03]; W [2.21]; T 0.17 (unusually thin); internotch L 1.82 & 2.25; Wt [3.5]
Remarks: Unfinished? Blade notching, while unusual, is known from Ocean Bay (D. Clark 1979:Fig. 6-A,D,G, Fig. 18-A-D, Pl. 10, 11, 16-D; G. Clark 1977:Pl. IV-2,3). One example occurs in a late prehistoric Koniag context on Kodiak (D. Clark 1974a:Pl. 1-B).

49XMK-022-4 *Unfinished Biface (Point)*
Description: Lanceolate outline, irregular cross section. One convex edge bifacially flaked and thin. Opposite edge bifacially flaked only near tip, remainder very thick (0.8 cm). Extensively battered in apparent unsuccessful attempt to thin this edge. Irregular thick base area. Extensive ground patches on both surfaces strongly suggest that item was formerly a planing adze which someone attempted to work into a point.
Material: Chert, gray-green banded.
Measurements: L 7.14; W 2.57; T 1.03; Wt 21.6

49XMK-022-5 *Retouched Split Cobble*
Description: Large, thick, triangular cobble spall, irregular biconvex cross section. One, fairly straight, lateral edge and rounded, distal end have unifacial edge retouch. Opposite, more convex, lateral edge is bifacially battered along proximal half, probably to create a back. Some secondary edge damage dating to long after implement discarded.
Material: Basalt.
Measurements: L 12.58; W 8.12; T 2.07; Wt 241.2

49XMK-022-6 *Planing Adze Preform/Reform*
Description: Oval outline, thick, biconvex cross section. Extensive bifacial flaking. Steep single bevel of one highly convex end. Opposite end also convex, battered (poll?). Lateral edges thin, and blunted in places by grinding. Ground patches on one face preserved near both ends.
Material: Basalt, olivine.
Measurements: L 7.09; W 3.80; T 1.39; chord of presumed poll 2.68; Wt 41.6
Remarks: Planing adze being shaped or re-shaped.

49XMK-022-7 *Ground Slate, Contracting Stem(?) Point Fragment*
Description: Triangular outline, rectangular cross section. Lateral edges ground flat. Rounded base unworked. Broken distally. Shaping striations largely obliterated by water-rolling.
Material: Slate.
Measurements: L [4.91]; W [1.38]; T 0.40; Wt 3.9
Remarks: Stem of a long, ground, slate point.

49XMK-022-8 *Large Cortical Retouched Flake*
Description: Large flake retaining significant amount of cortex at proximal end and near distal end. Ventral edge retouch of highly

convex, distal end. Dorsal edge retouch of one, subconvex, lateral edge. Sporadic nibbling and battering of opposite irregular edge. Rounded, plain (cortical?) striking platform and irregular cross section.
Material: Banded or zoned igneous or metamorphic stone.
Measurements: L 9.03; W 6.50; T 1.74; chord of retouched end 4.37; T of retouched end 0.22; Wt 83.2

49XMK-022-9 *Side-Struck Retouched Flake*
Description: Side-blow flake, with triangular outline, which converges to broken point at one end. Two convex sides have predominately dorsal retouch. Nibbling on ventral side suggests heavy utilization. Small striking platform destroyed by subsequent retouch. Plano-triangular cross section. Truncated dorsal scars suggest previous blows from several directions.
Material: Banded black and green metamorphic.
Measurements: L 2.72; W [5.00]; T 0.90; Wt 9.3

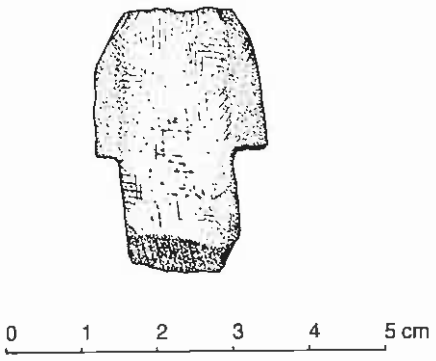
49XMK-022-10 *Double-Edged(?) Blade Fragment*
Description: Slender strip of slate, with fairly steep bevel along alternating face edges. Fragment ranges from pentagonal to parallelogram cross section. Coarse striations, oblique to long axis on ground edges. No true edge portion preserved.
Material: Slate.
Measurements: L [5.89]; W [1.03]; T 0.27; Wt [1.8]
Remarks: Probably from a fairly narrow, double-edged slate blade.

49XMK-022-11 Ground Point Tip or Base
Description: Convex lateral edges converge to rounded point. Broken proximally? Irregular convexo-triangular cross section. Extensively water-rolled.
Material: Slate.
Measurements: L [2.85]; W 1.26; T 0.29; Wt [1.2]

49XMK-022-12 *Thin Discoidal Retouched Flake*
Description: Round outline, broad, thin flake. Convex transverse edge has dorsal retouch. Other apparent edge retouch much more recent and probably fortuitous. Unusual faceted platform, perhaps reflecting some difficulty in detachment of this flake.
Material: Patinated basalt.
Measurements: L 5.92; W 6.38; T 0.84; chord of working edge 3.30; Wt 28.6

49XMK-022-13 *Cut Slate Scrap*
Description: Irregular rectangular outline, split longitudinally on one face. Two parallel, deeply incised cuts partially isolate a central strip 0.7 cm wide on opposite face. Broken at both ends. One cut has multiple parallel grooves. No visible grinding.
Material: Slate.
Measurements: L 2.01; W 1.82; T 0.14; Wt 0.6

49XMK-022-14 *Sharply Shouldered, Ground Point Fragment (illustrated)*
Description: Small slate scrap, apparently split longitudinally. One face retains no traces of workmanship. Prominent, rounded shoulders perpendicular to broad, parallel-sided stem. Shoulders approach barbs. Broad, parallel-sided stem. Lateral edges ground flat. Rounded basal corners. Subconvex base oblique to stem body. Single bevel near unground base. Broad blade with highly convex margins ground flat rather than sharpened. Broken distally, but curves in before break suggesting that body is largely present. Coarse shaping striations both parallel and perpendicular to long axis. Very thin, rectangular cross section.
Material: Slate.
Measurements: L [3.51]; W 2.27; T [0.14]; shoulder H 1.60 & 1.40; stem W 1.51; Wt--
Remarks: Probably unfinished. May be intended as a small transverse blade.



49XMK-022-14 Sharply Shouldered, Ground Point Fragment.

49XMK-022-15 *Lamp Rim Fragment*
Description: Small lamp fragment. Deep smooth bowl slopes inward from partially flattened rim. Bottom rounded. No adhering carbon. Infer rounded outline when complete.
Material: Sandstone.
Measurements: L [7.11]; W [3.87]; T [2.16]; bowl depth [1.20]; rim W 1.79; Wt [63.1]
Remarks: Lamps with wide flat rims, of which this is a somewhat dubious example, are diagnostic of the late prehistoric Koniag phase on Kodiak (D. Clark 1974b:114).

49XMK-022-16 *Cobble Grooved Over Middle and About One End*
Description: Oval cobble with crude, irregular groove over middle and about one end (and to opposite end on one face). One end and one side extensively battered, suggesting supplementary or prior use as hammerstone.
Material: Graywacke.
Measurements: L 8.61; W 6.90; T 4.92; Wt 407.9
Remarks: Very crude. Groove irregular; scarcely meets in the center. Such artifacts are typical of the late Kachemak tradition in Kachemak Bay (de Laguna 1975:55) and are known in temporally equivalent contexts on the Alaska Peninsula (G. Clark 1977:163, 203). Later examples are known on Kodiak (D. Clark 1974b:67).

49XMK-022-17 *Retouched Flake Blade*
Description: Large flake blade, rectangular in outline. Dorsal edge retouch of one, sinuous, lateral margin and of rounded distal end. Ventral edge retouch of large concavity on opposite, lateral edge. Dorsal and ventral retouch of short, subconvex segment just below striking platform on same side. Large, flat striking platform, plano-triangular cross section.
Material: Basalt.
Measurements: L 8.15; W 3.53; T 1.18; striking platform 2.08 & 1.16; Wt 28.5

XMK-058

Cultural Affinities: Midden site, no visible housepits. The medium-sized, notched stone and carefully made adze bit suggest the Kachemak tradition.

49XMK-058-1 *Massive, Tabular, Flaked Implement*
Description: Rectangular outline, thick, trapezoidal cross section. One face retains cortex. One, fairly thin, straight end bifacially battered in fashion reminiscent (on very large scale) of stone wedge. One edge of opposite very thick end has been partially destroyed by

battering, lending some support to this idea. Lateral margins very thick with their edges that show unifacial battering which has detached several fair-sized flakes.
Material: Basalt, patinated (olivine?).
Measurements: L 7.53; W 6.12; T 2.68; Wt 153.7

49XMK-058-2 *Planing Adze (illustrated)*
Description: Tapering, subrectangular outline, thin, flaked lateral edges, irregular, biconvex cross section. Extensive bifacial flaking. Both, subconvex, lateral edges bifacially retouched. Traces of grinding retained, but retouching has removed most of ground surfaces. Bit subconvex with rounded corners and double-beveled. Fairly thin.
Material: Greenstone.
Measurements: L 10.14; W 5.02; T 1.92; chord of bit 4.52; Wt 111.1
Remarks: Apparently being reshaped/resharpened.

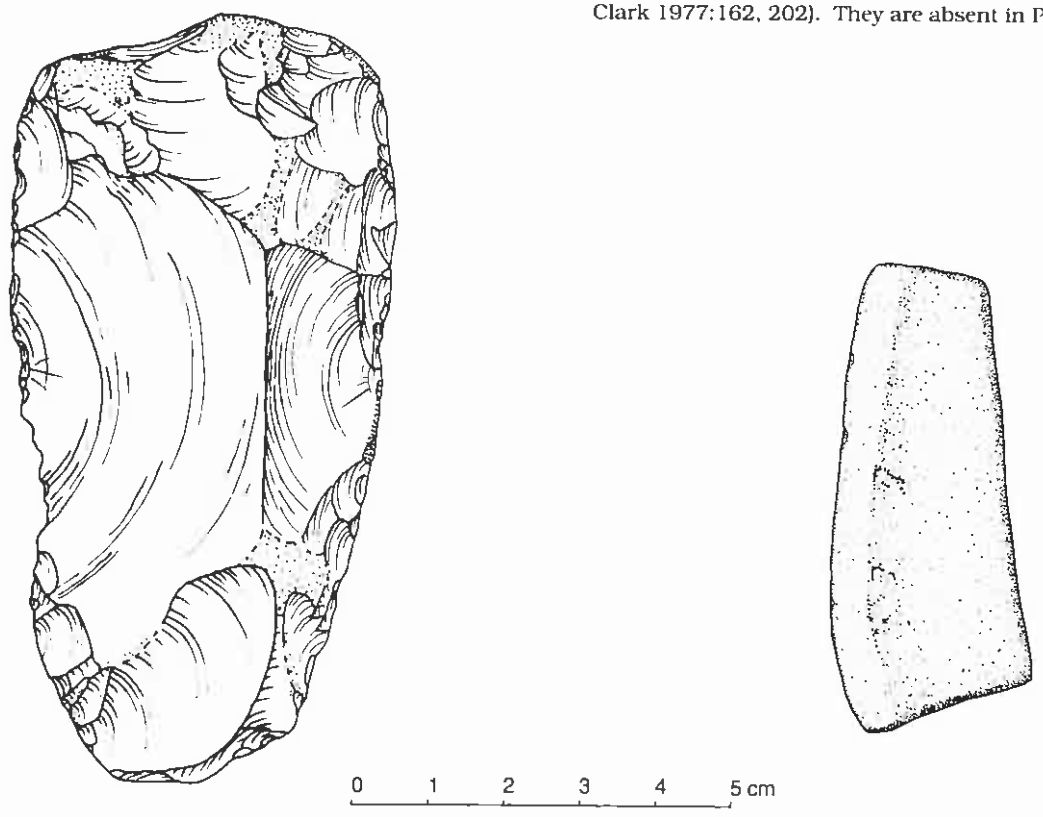
49XMK-058-3 *Ulu(?) Fragment*
Description: One sinuously straight side, bifacially flaked and ground. Straight end bifacially flaked and battered, perhaps lightly ground. Opposite side and edge broken. Both faces extensively ground within two cm of preserved edge.
Material: Green slate.
Measurements: L [5.60]; W [4.20]; T 0.42; Wt [13.6]

49XMK-058-4 *Possibly Ground, Tabular Stone Fragment (illustrated)*
Description: Irregular rectangular outline and irregular cross section. One convex side has a single bevel (not clearly created by grinding) and sporadic edge nicking, which has been almost obliterated by water-rolling. The other three sides are thick, flat, natural breaks. Highly water-rolled. No unambiguous traces of facial grinding.
Material: Siltstone(?) -- soft tabular cleavage.
Measurements: L 6.14; W 2.58; T 0.58; Wt 13.3
Remarks: Dubious artifact.

49XMK-058-5 *Double-Edged Ground Slate Blade Preform*
Description: Slender, pointed piece, triangular outline, parallelogram cross section. One convex side on angled break, with some subsequent unifacial edge battering. The opposite side, sinuously convex, created mainly by unifacial edge retouch. Straight base ground blunt. Numerous shaping striations both parallel and oblique to long axis.
Material: Green slate.
Measurements: L 10.93; W 3.27; T 0.73; Wt 29.5
Remarks: Double-edged blade being shaped from a large slate implement (ulu?).

49XMK-058-6 *Ulu (illustrated)*
Description: Convex, double-bevel working edge, fairly steep bevels within 5 mm of edge. Straight, thick back is on a break. One projecting edge blunted by extensive battering. One end subconvex, blunted by edge retouch. Opposite end broken. Extensively ground over both faces. Numerous shaping striations mainly parallel to long axis.
Material: Slate (dark).
Measurements: back L 12.30; W 5.23; T 0.53; chord of working edge [10.85]; Wt 58.6

49XMK-058-7 *Small Notched Stone*
Description: Flat, oval pebble. Notch bifacially battered into each end, and perhaps subsequently ground. Notch much cruder on small end than on large end.
Material: Schist(?)
Measurements: L 5.66; W 4.79; T 1.60; bi-notch L 5.28; Wt 64.7
Remarks: Notched pebbles are typical of the Kachemak tradition on Kodiak, and in Kachemak Bay (D. Clark 1974b:67), though they apparently lasted somewhat later on the Alaska Peninsula (G. Clark 1977:162, 202). They are absent in Prince William Sound.



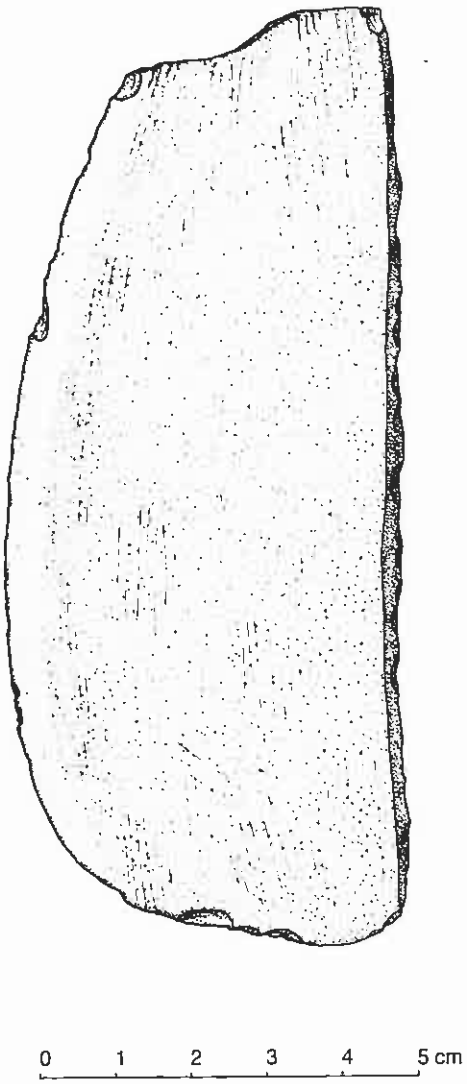
49XMK-058-2 Planning Adze (left); 49XMK-058-4 Possibly Ground, Tabular Stone Fragment (right).

Trinity Islands

XTI-068

Cultural Affinities: Insufficient data available.

XTI-068 *Ulu*
Description: Convex, double-bevel, ground blade. Beveling confined to cut area. Straight, damaged back. Sawed or cut on back, although no septa visible. Both ends damaged. More highly polished on one face than on opposite. Shaping striations, where preserved, oriented parallel to long axis.
Material: Slate.
Measurements: L 10.73; W 6.96; T 0.55; Wt 51.4



49XMK-058-6 Ulu.