A REVIEW

OF CULTURAL RESOURCE SURVEY AND CLEARANCE ACTIVITIES

NATIONAL PETROLEUM RESERVE IN ALASKA

1977 - 82

Edwin S. Hall, Jr.
U.S. Geological Survey

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I. INTRODUCTION

In June, 1977, the U.S. Geological Survey (GS) instituted a cultural resource survey and clearance program as part of the ongoing oil exploration program in the National Petroleum Reserve in Alaska. During that and the succeeding three years, an archaeologist employed by the GS, working in conjunction with BLM archaeological personnel, investigated areas of potential oil exploration activity. The purpose of the cultural resource survey was to insure that oil exploration activities did not adversely affect cultural resource sites. In the summer of 1981, the GS archaeologist reviewed all oil exploration activity areas utilized over the past four years, as well as many sites associated with the earlier Navy oil exploration effort, in order to assess the effectiveness of the cultural resource clearance program. This report briefly describes the 1977-1980 cultural resource survey and clearance program in terms of the assumptions on which the cultural resource survey was based, the survey and testing procedures employed, the results of the testing aspect of the program, the recommendations made to protect cultural resource sites and, finally, the extent to which the program met its goals of insuring that the cultural resources of the NPRA realize their full scientific potential.(1)

II. BACKGROUND

In February 1923, President William G. Harding signed an Executive Order to set aside a large portion of northern Arctic Alaska as Naval Petroleum Reserve No. 4. Stewardship of this huge area of potential petroleum reserves was assumed by the U.S Navy. The history of Pet-4 and the exploratory efforts of the U.S. Geological Survey and the Navy within the Reserve have been detailed by Reed (1958). After the period of large scale exploration, from 1944 to 1953, little work was done in Pet-4 until 1974 when Congressional funds permitted the Navy's program of seismic surveying and exploratory drilling to resume.

The Naval Petroleum Reserves Production Act of 5 April 1976 transferred the administrative responsibility of the Reserve, newly designated the National Petroleum Reserve in Alaska, to the Secretary of the Interior on 1 June 1977. The Secretary of the Interior subsequently delegated the GS to manage the continuing exploration program and to operate the various gas fields, while the Bureau of Land Management (BLM) assumed responsibility for surface management.

These two agencies signed a Memorandum of Understanding (MOU), effective 18 January 1977, to facilitate the interfacing of the responsibilities assigned by the Secretary of the

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(1) For an extended discussion of the issues raised in this report, the reader is directed to Hall (1977, 1978, 1979, 1980) and Hall and Gal (n.d.).

Interior. According to the MOU, the GS was required to produce a cultural resource inventory report for each season of field operations: "An intensive cultural resource inventory must be conducted on those sites and alternative sites identified for exploration operations that involve surface disturbing activities. This inventory shall be conducted under the requirement of a Federal Antiquities Permit by a qualified professional. The need for an intensive inventory may be waived only if it is determined by BLM that equivalent data are available or that something less than intensive data are available and acceptable. These inventory data should be prepared in the form of a report" (MOU 1977: B-3).

The format of this report was stipulated in Appendix I of the MOU: "The report should contain at a minimum the following:

a. Identification of the Federal Antiquities Permit under which the work was performed.

b. Description of data review and field inventory methods used, intensity of field inventories, the names of individuals employed in the work, and the commencement and termination dates of field inventory.

c. Identification of the project, and the BLM serial case file number, if any, for which the report is being written.

d. A general background discussion of cultural resources of the area.

e. Identification and description of specific cultural resource sites and values found, and the evaluation of their significance, and whether such sites might be eligible for placement in the National Register of Historic Places with specific citation to qualifying criteria under 36 CRF 800.10.

f. Site inventory records (BLM FORM 6230-2 or other acceptable form) completed for each cultural property inventoried with appropriate maps indicating the location of each site.

g. Suitable maps that clearly define all areas surveyed and intensity of survey in relation to identified cultural resources and the relationship of sites found to the project. Minimum acceptable base map should be with scale of 1:63,000 or other maps of sufficient detail.

h. Catalog of all cultural resource objects collected and indication of where they are stored.

i. Identification of the probability of finding additional sites and their probable significance.

j. Identification of the probable direct and indirect effects of the project upon known and unknown cultural resources.

k. Professional recommendations to realistically mitigate the direct and indirect adverse effects upon cultural resources which will result from the project."

The GS cultural resource survey and clearance program was designed to address the requirements stated in the MOU in relation to oil exploration activities in the NPRA for the period from 1977 to 1981.

III. DESCRIPTION OF THE AREA

The total area set aside by Executive Order 3797-A and now designated as the NPRA encompasses approximately 37,000 square miles (23,680,000 acres). The present boundary of the NPRA extends due south from Icy Cape on the Arctic Coast at approximately long. 162 degrees west to the drainage divide of the Brooks Range at about lat. 68 degrees 30′ N. From there it follows the divide in a direction slightly sough of east to about long. 155 degrees 40′W where the boundary turns due north and extends to the right bank of the Colville River. It follows that bank of the Colville to its mouth at approximately lat. 70 degrees 25′ 52"N and long. 151 degrees 11′ 00" W.

Three strikingly different physiographic provinces can be delimited within northern Alaska and the NPRA (Payne, et al. 1951; Solecki 1951). At its southern border, the Reserve impinges on the Brooks Range, a rugged belt of mountains ranging in height from four to ten thousand feet and stretching east and west across northern Alaska. The Brooks Range, considered by most geologists to be a continuation of the continental Rocky Mountains, has been divided into several subranges on the basis of regional topography. The divide of the DeLong Mountains forms the southern border of the NPRA. Within the NPRA, the Brooks Range Province is drained by the Kokolik and Utukok Rivers in the extreme west, and elsewhere by northward-flowing tributaries of the Colville River, including the Nuka, Kiligwa, Kuna, Ipnavik, Etivluk, and Nigu Rivers. Large lakes, such as Etivluk, Noluck, and Tukuto, fill many of the mountain valleys. Willows and other riparian species are found along the water courses, and various sedges, grasses, and flowering species cloak the valley floors and lower mountain sides.

The basin of the Colville, the largest river in northern Alaska, lies north of the Brooks Range Province. The Colville, along with its many tributaries, drains a series of east-west trending ridges. This area has been referred to as the Arctic Foothills Province (cf. Solecki 1951: 476). In some places the relief is considerable, reaching more than 3,000 feet, but the overall effect is one of long, sometimes steep, dry-topped ridges framed against the higher mountains to the south. Some of the rivers flow through deep, rock-rimmed channels; others,

especially tributaries toward the lower reaches of the Colville, spread out in braided, anastomosing, gravel-filled channels. The river banks and islands in the river channels support heavy willow growth, while numerous herbaceous species cover the rolling tundra.

The northernmost of the three provinces is the Arctic Coastal Plain. Low relief, sluggish meandering rivers, and myriad lakes create an almost flat, featureless landscape to the pedestrian traveler. Most of the streams, with the exception of the Meade, Kuk and Ikpikpuk Rivers, are small, and all drain northward to the Arctic Ocean. Along much of the coast, the land slopes almost imperceptibly into the sea, although low bluffs and cliffs do occur. Sedges and other hydrophilic species form the predominant ground cover, making summer foot travel exceedingly difficult across the marshy, hummocky ground. Willows and dwarf birches are found along streams and along lakeshores where high banks provide protection.

IV. CULTURAL RESOURCE IDENTIFICATION IN THE NPRA PRIOR TO 1977

Archaeological or cultural resource identification research has been carried out in the NPRA since the late 1800's. Table 1 comprises a listing of researchers who have conducted cultural resource surveys and/or archaeological excavations within the Reserve boundaries (see Hall 1981 for a complete listing of archaeological research in northern Alaska.) Examination of the table reveals that the early cultural resource research in the NPRA concentrated on the coast with relatively little work being accomplished in the interior, and that very few extensive archaeological excavations occurred anywhere in the Reserve, with only two in the interior.

V. KNOWN CULTURAL HISTORY PRIOR TO 1977

Given the paucity of cultural resource research in the NPRA prior to 1977, or in northern Alaska for that matter, it should be no surprise that only an extremely sketchy cultural historical framework could be created based on the available knowledge of the region's human history. A tentative outline of north Alaskan culture history, which incorporates evidence from the NPRA, was prepared by Anderson (n.d.) and is presented here as Table 2.

Table 1. Cultural Resource Identification Research in the NPRA.

RESEARCHER	YEAR	AREA	REFERENCE(1)	COMMENTS
Murdoch, J.(2)	1818-92	Barrow	Murdoch 1892	Bought artifacts, some of which may have been been archaeological; observed Birnirk site.
Stefansson, V.	1912	Barrow	Stefansson 1914 Wissler 1916; Ford 1959	Excavated at, and purchased artifacts from, Birnirk.
Van Valin, W.	1917-19	Kugusugaruk	Van Valin 1941; Mason 1916; Ford 1959	Excavated sites.
Rasmussen, K.	1924	Barrow	Mathiassen 1930	Purchased collection.
Hopson, A.	1928-29	Kugusugaruk and Nunavak	Ford 1959	Found Kugusugaruk completely excavated; excavated graves at Nunavak.
USGS Personnel	before 1930	Northwestern Alaska	Smith & Mertie 1930	Summarize cultural resource sites seen by USGS parties prior to 1930.
Ford, J.	1931	Several sites along coast west of Barrow; coast between Barrow and Barter Island.	Ford 1959	Began excavation at Birnirk; purchased artifacts from Nunagiak; briefly surveyed Beaufort Sea Coast.

Table 1. continued

Ford, J.	1932	Barrow and	Ford 1959	Excavated at Birnirk, Utkiavik, Koguk, Nunavak and Walakpa.
Ford, J.	1936	Coast between Kotzebue and Barrow; Point Belcher; Barrow	Ford 1959	Excavated at Nunagiak and Birnirk, examined Mitliktavik, Kilimatavik, Atanik and Pingasugaruk.
Larsen, H.	1942	Coast between Pt. Hope and some point beyond Wainwright	Larsen & Rainey 1948; Ivie & Schneider 1978	Survey and test excavations at lower and middle Utukok River, Icy Cape.
Thompson, R.	1947	Upper Utukok River	Thompson 1948	Located sites along river.
Solecki, R.	1949	Koklik and Kukpowruk River drainages; data collected from other USGS parties working in the National Petroleum Reserve in Alaska.	Solecki 1950, 1951	Survey.
Whittington, C.	1950	Confluence of Carbon Creek and Utukok River	Solecki 1952	Petroglyph discovered by U.S. Geological Survey party.
Carter, H.	1951	Barrow	Carter 1952, n.d.a., n.d.b.(3)	Excavated Birnirk.
Irving, W.	1952	Lower Colville River	Irving n.d.	Located one prehistoric site.

Table 1. continued

Carter, W.	1952	Barrow	Carter 1952, n.d.a., n.d.b.	Excavated Birnirk.
Carter, W.	1953	Barrow	Carter 1952, n.d.a., n.d.b.	Excavated Birnirk.
Ford, J.	1953	Point Belcher; Barrow	Ford 1959	Mapped Nunagiak and Birnirk sites.
Irving, W.	1954	Etivluk Lake and Upper Nigu drainage	Irving 1962, 1964	Survey and excavation.
Hamilton, T.	1960	Near Meade River village	Hamilton n.d.	Excavation.
Irving, W.	1961	Etivluk Lake and Upper Nigu drainage	Irving 1962, 1964	Survey and excavation.
Hall, E.	1964	Howard Pass proper	Hall field notes	Survey; results essentially negative.
Humphrey, R.	1965	Upper Utukok River	Humphrey 1966, 1970	Survey and some excavation.
Humphrey, R.	1966	Upper Utukok River	Humphrey 1966, 1970	Survey and some excavation.
Hall, E.	1967	Brooks Range and Arctic Foothills Province between Kokolik River and Chandler Lake.	Hall 1975	Survey.
Campbell, J. & Stanford, D.	1968	Arctic Coast from Barrow to Colville River.	Campbell 1970	Survey from air only.

Table 1. continued

Hall, E.	1968	Tukuto Lake, Etivluk drainage	Hall 1970, 1976a	Excavation.
International Biological Program	1968	Coast from Wainwright 40 miles N	Campbell 1970	Survey.
Stanford, D.	1968	Barrow and Walapka Bay	Stanford 1976	Mapped and tested Utkiavik site; excavated at Walakpa.
Stanford, D.	1969	Walakpa Bay	Stanford 1976; Campbell & Cordell 1975	Excavated at Walakpa, Coffin and Kahraok sites.
Hall, E.	1970	Tukuto Lake, Etivluk drainage	Hall 1970, 1976a	Excavation.
Hall, E.	1974	Extreme upper Utukok River drainage	Hall n.d.	Survey.
Cook, J.	1975	Northeast portion of the National Petroleum Reserve in Alaska	Cook n.d.a.	Air survey only.
Hall, E.	1976	Northeast portion of the National Petroleum Reserve in Alaska	Hall 1976b	Ground and air survey.
Schneider, W.	1976	Kuk River and Atanik	Ivie & Schneider 1978	Survey of Traditional Land Use Inventory Sites.(4)

Table 1. continued

Scott, G.	1976	Barrow	Scott n.d.	Analysis of mass burial.
Aigner, J. & Book, P.	1977	Barrow	Aigner and Book 1977	Archaeological impact report for construction in Barrow.
Bureau of Outdoor Recreation	1977	Lower and middle Utukok River	Ivie and Schneider 1978	Located a few archaeological sites.
Davis, C., Liuck, C., Schoenberg, K., Shields, H.	1977	Upper Ikpikpuk drainage, upper Colville River, Lookout Ridge area, Howard Pass	Davis et al 1981; Shields n.d.a.;	Intensive ground survey in limited areas.
Hall, E. & Gal, R.	1977	Selected locales across the National Petroleum Reserve in Alaska	Hall 1977; Gal, Bowers and Kunz n.d.	Ground and air survey; excavation of Tunalik site and two South Meade sites.
Hastings, W.	1977	Colville River	Hastings n.d.	Located one site.
Schneider, W. & Ivie, P.	1977	Coast between Utukok River mouth and Pingusugrak; Kuk, Utukok, and Ivasarak Rivers.	Ivie & Schneider 1978	Air and ground survey of Traditional Land Use Inventory sites.
Davis, C., Liuck, D., Schoenberg, K., Shields, H.	1978	Teshepuk Lake, middle Meade River, middle Utukok River, Noluck Lake	Davis et al 1981; Davis 1979; Schoenberg n.d. Shields 1979, n.d.b.	Intensive ground survey in limited areas.

Table 1 continued

Hall, E., & Gal, R.	1978	Selected locales across National Petroleum Reserve in Alaska	Hall 1978; Gal, Bower and Kunz n.d.; Kunz 1979; Bowers 1979	Ground and air survey; intensive survey in Otuk and Iteriak valleys; test excavation and collection at Lisburne Borrow #1 and #5, and Mesa site.
Schneider, W., Pedersen, S., Libbey, D.	1978	Meade and Inaru Rivers	Schneider et al 1980	Evaluation of Traditional Land Use Inventory sites.
Stern, R.	1978	Umiat area, middle Ikpikpuk River	Stern n.d.	Survey along river.
Aigner, J.	1979	Atqasak	Aigner personal communication	Archaeological clearance for Atqasak airport.
Aigner, J.	1979	Nuiqsut	Aigner personal communication	Archaeological clearance for Nuiqsut airport.
Bowers, P.	1979	Lisburne Borrow #1 (Iteriak Valley)	Hall 1979; Appendix B	Test excavation.
Cook, J.	1979	Nuiqsut	Cook n.d.b.	Survey of local roads.
Cook, J.	1979	Wainwright	Cook n.d.c.	Survey of local roads.
Davis, C.	1979	South shore of Teshekpuk Lake	Hall 1979; Appendix B.	Examination and collection of TES-104.

Hall, E., & Gal, R.	1979	Selected locales across National Petroleum Reserve in Alaska	Hall 1979; Gal, Bowers, Kunz, n.d.	Ground and air survey; test excavations of small sites near Walapka Bay and along coast of SW of Wainwright; completed excavation of South Meade sites.
Kunz, M.	1979	Mesa (Iteriak Valley)	Kunz, n.d.	Test excavation.
Slaughter, D.	1979	Siraagruk (coast N of Point Belcher)	Hall 1979; Appendix B	Test excavation.
Gal, R.	1980	Etivluk, Kinyiksukvik, Betty, Tukuto, Swayback and Liberator Lakes	Gal field notes	Set out photo panels for aerial survey of late prehistoric sites; located new site at Tukuto Lake.
Gerlach, S.	1980	Old shoreline bluff between Wainwright and Icy Cape	Gerlach field notes	Survey and test excavation.
Hall, E., & Gal, R.	1980	Selected locales across National Petroleum Reserve in Alaska	Hall field notes	Ground and air survey.
North Slope Borough	1980	Harrison Bay	Okokok personal communication	Evaluation of Traditional Land Use Inventory sites.
Slaughter, D.	1980	Siraagruk (coast N of Point Belcher)	Slaughter field notes	Test excavation.

Yarlborough, L.	1980	Barrow	Wilson personal communication	Survey for gas pipeline.
Gerlach, S.	1981	Croxton site, Tukuto Lake	Hall this volume	Test excavation.
Hall, E., & Gerlach, S.	1981	Selected locales across the National Petroleum Reserve in Alaska	Hall this volume	Review of construction areas associated with oil exploration programs; excavation at Croxton.
Hall, E., Dekin, A., Newell, R.	1981	Utkiavik site, Barrow	Hall field notes	Excavation.

(1) The list of references cited is not meant to be exhaustive. For further information, the reader may wish to consult Dekin (1978) and the "Current Research" section of the journal American Antiquity.

(2) Nearly every White explorer (and later White ethnographer) mentions important cultural resource sites. Such references are not included in the Table because, in most cases, subsequent evaluation of the sites was undertaken by an archaeologist or cultural resource specialist.

(3) n.d.a. and n.d.b. refer to the author's first and second undated publications respectively.

(4) Data on cultural resource sites included in the Traditional Land Use Inventory originally were collected through interviews with local resource experts, conducted by Flossie Hopson and Susie Franklin. This Table includes only references dealing with on-site evaluations of Traditional Land Use Inventory Sites.

VI. CULTURAL RESOURCE SURVEY AND CLEARANCE IN THE NPRA: 1977-81

The MOU between the GS and the BLM clearly stated that the Geological Survey was responsible for cultural resource surveys at proposed oil exploration locations and for recommendations to the prime drilling contractor, Husky Oil NPR Operations, Inc., to mitigate the impact of such activities on the cultural resources. However, as the GS and the BLM were jointly charged with providing the Secretary of the Interior with the data to "take necessary and appropriate measures to protect the subsistence, environmental, fish and wildlife, historical, and scenic values of the Reserve during such exploration activities," it seemed appropriate that the two agencies work together in the effort to locate, evaluate, and protect cultural resources within the Reserve.(2) Accordingly, the GS and the BLM/NPRA archaeologists agreed on a common, coordinated approach to cultural resource management within the Reserve. In the field, virtually all of the proposed oil exploration activity areas were examined by the GS archaeologist and either the BLM/NPRA archaeologist or one of his associates; a very few areas were evaluated by BLM archaeologists acting alone.

A. Field Methods Utilized by the GS/BLM

1. Preparation Before Entering the Field

Prior to each field season, the GS and BLM/NPRA archaeologists reviewed the survey and clearance procedures previously employed and determined appropriate tactics for the coming season. Issues discussed included difficulties arising in past seasons, potential problem areas during the coming season, the effectiveness of cultural resource protection measures proposed on the basis of past season's work, and the locations of known cultural resource sites in the general vicinity of proposed construction areas.

2. Seismic Line Clearance

Early in each field season, the GS archaeologist was provided 1:250,000 scale base maps depicting proposed seismic lines for the next winter's geophysical program. The practical difficulties of surveying 656 to 1832 miles of seismic lines for cultural resource sites are obvious, especially when one considers that: (1) the final line locations were not available when the archaeologists entered the field; (2) the map lines covered a true ground width of 200+ yards; and (3) the activities of the seismic program might not be exactly restricted to the 200 yard strips shown on the maps. Furthermore, the lines detailed on the maps represented only proposed seismic lines. Routes from where various seismic trains were stacked for the summer and from the end of one seismic line to the beginning of the next one were not indicated. In

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(2) The GS portion of this effort was confined to areas associated with oil exploration activities.

Table 2. Tentative Outline of North Alaskan Culture History As of 1977
(Modified from Anderson, n.d.)

Period	Date	Cultural Adaption	Possible Cultural Representatives	Examples of Sites in NPRA
I	Time of Bering Land Bridge to 600 BC	Full-time tundra hunting	Core and blade, fluted points, Kahroak	Sites along upper Utukok, Walakpa Bay
II	6000-2200 BC	Taiga-tundra hunting and fishing	Notched points	Upper Utukok River
III	2200 BC-AD 500	Seasonal and year-round coastal hunting and fishing	Arctic Small Tool Tradition; Choris-Norton	Etivluk Lake, Tukuto Lake, Walapka Bay; Tukuto Lake, Walakpa Bay
IV	AD 500-AD 1788	Prehistoric Eskimo	Birnirk; Thule; prehistoric Interior Eskimo	Barrow, Walakpa Bay; Barrow, Walakpa Bay; Tukuto Lake
V	AD 1778	Historic Eskimo	Historic Eskimo	Many locations within NPRA

addition, winter trails utilized by vehicles hauling supplies were not shown.

Given these difficulties, the most realistic approach to seismic line clearance appeared to be an archaeological survey that examined the previous winters' seismic lines as well as the newly proposed seismic lines. An examination of previously run seismic lines would indicate the nature and extent of actual and potential damage to archaeologically promising areas, while an examination of areas of high archaeological potential along the proposed seismic lines would identify cultural resource sites which could then be avoided.

Accordingly, various segments of earlier seismic lines were examined from the air for visible signs of damage in relation to varying types of ground cover and topography, including wet tundra, rolling upland tundra, willow-cloaked stream beds, and unvegetated ridge tops. Locations of high archaeological potential were then isolated along the seismic lines shown on the maps of the coming winter's program. These locations were chosen on the basis of topography and a knowledge of the environmental parameters of previously discovered archaeological sites within the Reserve; namely, stream crossings, dry knolls and benches with good views, and passes and ridgetops. Ground checks were made in all cases where either the GS or the BLM archaeologist thought an archaeological site might be present. While flying from one such location to the next, the pilot followed seismic lines as closely as possible in order to maximize the survey of the routes to be utilized.

A review of selected seismic lines in 1981 suggests that the overland movement of seismic trains will not cause damage to known or potential archaeological sites, assuming that sites with surface structures are avoided and the other environmental stipulations governing seismic activities in the Reserve are followed. However, it must be clearly understood that the potential for damage to cultural resource sites exists whenever and wherever ground vehicles operate in the Reserve. Examples of adverse effects caused by ground vehicles have been noted there (Hall 1977: 51-54; 1978: 49-50).

The known adverse effects of ground vehicle travel on archaeological sites lead to deliberation about the general conditions under which vehicular travel can potentially damage cultural resource sites; conclusions in this regard are notes in Table 3. In addition, Table 3 indicates the following methods of minimizing potential damage to archaeological sites whenever ground vehicles must operate in the Reserve: (1) vehicles should travel in the winter and should be confined, wherever possible, to tundra areas; (2) if travel must take place on bedrock or consolidated sand/gravel areas, it should only be when the ground is frozen and substantially snow covered; (3) wherever ground vehicles travel, all known archaeological sites must be avoided. Other types of environmental damage are not being considered here.

Table 3. Possible Types of Damage to Archaeological Sites As A Result of Ground Vehicle Travel(1)

Conditions At Archaeological Site	Extent of Possible Damage	Nature of Possible Damage
Summer	Moderate to Extreme	Breaking of cultural objects, loss of association between cultural objects, mixing of components in stratified site, erosion and complete loss of cultural objects, and lowering of permafrost table and subsequent deterioration of organic artifacts, etc.
Any subsurface, with or without ground cover; any ground cover.		
Winter		
Bedrock or consolidated sand/gravel with no sod cover or with thin sod cover with/without denuded areas		
Frozen ground and substantial snow cover	Probably none	
Frozen ground and relatively little snow cover	None to slight	Some breakage and/or slight lateral displacement of objects.
Unfrozen ground and substantial snow cover	None to slight	Some breakage and/or slight lateral/vertical displacement of objects.
Unfrozen ground and relatively little snow cover	Moderate to extreme, depending on whether vehicle runs in a straight line or turns	Breakage, lateral and vertical displacement; possible subsequent erosion with adverse effects.

Table 3 continued

Wet tundra or other unconsolidated ground; upland tundra; sites unlikely but if present		
Frozen ground and substantial snow cover	Probably none	
Frozen ground and relatively little snow cover	Slight to moderate	Damage to tundra can change thermal regime and cause subsequent erosion.
Unfrozen ground and substantial snow cover	Slight to moderate	As above.
Unfrozen ground and relatively little snow cover	Moderate to extreme	As above; potential for extreme erosion.
All seasons		
Any condition	Serious	Injection of fossil hydrocarbons into ground water because of leakage or spillage can cause contamination of organic material and eliminate the possibility of C14 dating.(2)

(1) This table is intended only as a general summary; experimental field studies would be necessary for a more detailed analysis. Obviously, the type of vehicle involved and the nature of the part of the vehicle that comes into contact with the ground surface, as well as vehicle load, driver skill, etc., will play a role in potential ground damage. This table is based on travel by heavily loaded, tracked vehicles, or vehicles pulling heavy loads on skids, as associated with the seismic program or the movement of drilling rigs, etc.

(2) Potentially this is the most serious problem connected with ground vehicle travel in the Reserve. Studies of the old Fish Creek Wellsite, where drilling took place 30 years ago, indicate that the effects of oil spills are pervasive and long term; soil samples from a depth of 40 cm. still retain a strong smell of diesel fuel and thaw in some cases reached 70 cm., nearly twice the thaw in adjacent unaffected areas (K.R. Everett, personal communication).

There can be no doubt, as evidenced by the discovery of damaged sites, that ground vehicle trails can have adverse effects on archaeological sites. However, many hundreds of miles of "tractor-trails" and other linear ground vehicle-caused scars criss-cross the NPRA landscape. These represent one legacy of the intensive oil exploration activities of the 1940's and 1950's when environmental stipulations governing ground travel were nonexistent. Such trails are shown on the GS quadrangle maps published in 1955 and are still clearly demarcated. They are so plainly visible that they serve as air nagivation markers. Thus it seems probable that most examples of trail damage to archaeological sites will be associated with these older trails.

Examination of the "trails" left by ground vehicle traffic associated with the recent seismic program suggests that the more stringent entironmental stipulations which now govern oil exploration did in fact work. Relatively little ground damage resulted from the seismic program, and correspondingly, little or no damage to archaeological sites occurred.

However, the operating restrictions governing winter vehicle travel do not mitigate the potential risk to cultural resource sites posed by actual drilling of seismic shot holes and possible fossil hydrocarbon spills. Avoidance of cultural resource sites will alleviate the former problem, though evidence from the Lisburne archaeological site, where a test core did almost no damage to the cultural manifestation, suggests that seismic drilling may not pose much threat to archaeological sites. The potentially adverse effects of fossil hydrocarbon spills can only be obviated by site avoidance.

3. Proposed Test Well Drilling Pad and Airstrip Clearance

In general, field procedure involved flying at low elevations over proposed drilling pads and airstrips. All flights were made with a helicopter which maintained an altitude and speed of the archaeologists' choosing and landed at their discretion. When the location in question was on low, wet sedge, tussock-covered ground, clearance usually was issued without further ground check. In the experience of archaeologists working in northern Alaska, sites normally occur on surfaces which are reasonable well drained and stable.

The view that wet, swampy areas have low cultural resource potential has been challenged by Lobdell (1979), who agrees in part with Davis's contentions (personal communication to Lobdell) that some sites may exist in poorly-drained areas if other potential is present. While little philosophical distance may separate the opinion that "wet tundra is of low cultural resource potential" from the claim that "some sites may occur in wet tundra under certain circumstances," practically, the two viewpoints are miles apart. Based on Davis's contention for example, one might advocate surveying of all land which might be impacted by oil exploration activities, regardless of cultural resource potential.

There is no denying that cultural resource sites can occur on wet swampy ground in Northern Alaska. The GS archaeologist reviewed many of the sites located by Davis (Davis, et al 1981) along the shore of Lake Teshekpuk, some of which were on wet ground. Most of these sites were historic or recent in origin, most were surface sites, and all apparently were directly related to the major resource possibilities offered by Lake Teshekpuk. If oil exploration construction areas are proposed anywhere near a major resource locus such as Lake Teshekpuk, ground survey should be undertaken even if the predominant ground cover is wet tundra.

Archaeological sites also can occur in wet tundra areas well away from a resource locus. The spot where a solitary caribou fell to a hunter's arrow, or the place where a sled broke down and had to be repaired, would not necessarily be confined to dry or well-stabilized ground. Sites of a temporary nature, or those representing specialized activities, can reveal much about human behavior in the past, but these sites are extremely difficult to locate under the best of conditions. Intensive surveys of given areas would not necessarily disclose the existence of less substantial sites unless there were obvious surface manifestations. Any subsurface testing program would be frustrated by the presence of permafrost. Furthermore, the statistical odds of encountering a temporary site within the limited area of a well site are enormous.

Thus to insure that no buried, ephemeral archaeological site exists within an area of wet tundra to be impacted by oil exploration activities would require an exceedingly time-consuming, expensive, and highly sophisticated testing program. Given the current state of the art, there would be no guarantee of successfully locating such a site even if it did exist. For these reason, areas of wet tundra were not intensively surveyed.

However, the construction of seasonal drilling pads does result in the complete destruction or burial of any archaeological site within the construction zone. For this reason, those construction areas with archaeological potential were thoroughly searched for cultural remains, by foot survey and, when appropriate, by testing. Further, wherever other cultural resources occurred in the immediate vicinity of the construction areas, they also were noted in the clearance reports so that they might be avoided during the construction process.

4. Proposed Winter Trail and Ice Road Clearance

Winter trails between well sites, as well as ice roads connecting each individual well site with its airstrip and water/material sources, were surveyed in much the same way as other potential construction areas. While winter trails may cause visible temporary damage to wet tundra, the presence of archaeological sites in low wet tundra areas is highly unlikely. Where winter trails cross dry ground, which is protected by a

solid ground cover, damage to a buried archaeological site is likely to be, at most, minimal but usually nil. However, winter trails crossing dry ground that is only partially vegetated can cause significant damage to exposed cultural material. The cultural objects themselves may be damaged as well as the associations between them, and erosion resulting from such trails can destroy standing or fallen, partially demolished structures such as sod houses.

Therefore, the GS/BLM survey of proposed winter trails concentrated on identifying the following dry ground areas: (1) locations that supported cultural structures; (2) locations that were partially vegetated and possessed archaeological potential; and (3) locations that were completely sod-covered but had high archaeological potential. Very few locations along the proposed winter trails met any of these criteria and had to be ground checked, primarily because the proposed trails were located in low, wet tundra areas wherever possible. In most cases where the trails crossed dry ground, the areas were completely sod covered and/or not likely locations for archaeological sites.

Furthermore, the conclusion that archaeological sites will not be seriously threatened by winter trail activity was predicated upon assumptions of normal operating conditions, no deviations from the cleared trail routes, and exact adherence to the other environmentally dictated stipulations placed upon winter trail use in the NPRA. Damage to cultural remains could have resulted at sites located near specific trails if the stipulations and the cultural resource protection measures had not been heeded.

In order to further protect cultural resources in the Reserve, the GS archaeologist proposed a number of general measures to be considered when planning and executing winter ground travel associated with seismic or exploratory drilling programs:

a. Trail routes other than those specifically cleared were not to be used without first acquiring archaeological clearance from the GS archaeologist.

b. All known archaeological sites were to be avoided. Some sites were posted and when in the vicinity of such a site, all personnel were advised to keep the phosphorescent orange side of the "Do Not Disturb - Archaeological Site" signs in view at all times; if the white or yellow side was visible, then the individual in question was on archaeologically sensitive ground.

c. All Traditional Land Use Inventory Sites were to be avoided. The GS archaeologist was to be consulted for appropriate mitigation measures in regard to trails that had to impinge on Traditional Land Use Inventory sites.

d. The coast south of Barrow is a critical archaeological zone. Therefore, the running of seismic lines or transporting of

supplies and equipment in the vicinity of this coast was not to be undertaken without a Native guide who was familiar with the location of the cultural resource sites.

e. Vehicles were to avoid traveling near or across Tukuto Lake, Swayback Lake, Etivluk Lake, or the large lake in the upper Nigu drainage (the Kinyiksukvik area). These lakes were not to be used as airstrips in winter except in emergencies. Activities in the area of Lake Betty were to avoid the archaeological zone along the southern shore, and activities in the vicinity of Liberator Lake were to avoid the southern and southeastern shores. These restrictions were based on the known presence of important cultural resource sites and on field observations of Tukuto Lake which disclosed that both spring flooding and ice shove can partially submerge an archaeological site, and if any accidentally spilled petroleum product were present on the ice or in the water, the site could be adversely affected.

f. Whenever possible, vehicles were to avoid dry, well-drained topography. If dry ground could not be avoided, vehicles were not to make tight turns while on it. Vehicles also were to avoid traveling along Lookout and similar ridges. If it were necessary to travel on these ridges, one track across unvegetated ground was deemed less damaging than several, from a cultural resource protection perspective. In areas of rolling hills, vehicles were to avoid traveling over rock outcroppings, knolls, mesas, buttes and similar features as much as possible. Finally, if at all possible, vehicles were to avoid climbing river banks near vantage points or long-stabilized gravel terraces, particularly in the vicinity of tributary streams.

g. Camps were not to be established on dry, well-drained areas or near the lakes noted above, unless the GS archaeologist was contacted to arrange for a ground survey.

5. Clearance of Staging Areas, Debris Burial Sites and Other Construction Areas.

Occasionally other construction areas associated with the oil exploration program, including staging areas and debris burial sites, required cultural resource clearance. The procedures employed were the same as described above for proposed test well drilling pad and airstrip clearance.

6. Concern for Indirect and Secondary Effects

A major concern of cultural resource managers has been the potential for damage to cultural resource sites resulting indirectly from a given construction project. Sometimes the damage does not occur until long after the completion of the project. The problem is one of indirect effects or secondary effects wherein effects are defined as "the events, activities and processes related directly or indirectly to a project's planning, construction, or use that have potential for altering archaeological resources" (Schiffer and Gumerman 1977: 292).

Indirect effects are a result of activities connected with the construction process but not caused by the actual construction process itself; secondary effects are "the result of other intended uses of a facility, or of other uses that might reasonably be expected" (Schiffer and Gumerman 1977: 293). (3)

There are two approaches that can be taken simultaneously to alleviate potentially adverse indirect or secondary effects. One involves combining a cultural resource education program with the enforcement of existing cultural resource protection laws. All personnel, even those peripherally associated with oil exploration activities in the Reserve, should be informed of the importance of not disturbing cultural resource sites and of reporting them to the appropriate authorities. At the same time, personnel should be made aware of Federal laws and regulations protecting sites.

The second approach is for cultural resource managers to intensively survey the vicinity of proposed construction activities, well beyond the limits of areas actually to be impacted by construction. Located sites can be left unmarked if there is no chance that construction activities or associated personnel will disturb them, or sites can be posted and periodically inspected by cultural resource management personnel if there is a possibility that the sites' existence might be discovered or that they might be disturbed by unforseen construction activities. However, if a site has obvious surface manifestations, including artifacts of potential interest to the casual collector, then it seems most appropriate that the site be carefully mapped and the more obvious artifacts removed to an appropriate depository. While it is difficult to be totally comfortable with the notion of collecting material from archaeological sites, separate from controlled excavations, for a number of reasons having to do with context and possible loss of important scientific data, this procedure is potentially less damaging than leaving obvious archaeological sites open to unauthorized and uncontrolled collecting.

Both of these approaches were utilized as part of the GS cultural resource clearance program in the NPRA. Efforts to educate personnel associated with the oil exploration program about the importance of cultural resources and the measures necessary to protect them included formal and informal discussions, a bulletin board presentation, and wide dissemination of the annual cultural resource survey and clearance reports (Hall 1977, 1978, 1979, 1980). Whenever a proposed wellsite or other construction location was surveyed, the possible ramifications of the proposed construction, in terms

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(3)Use of these concepts here does not correspond exactly with that of Schiffer and Gumerman, because they distinguish between the planning, construction, and operating stages of a project while, for the purposes of this discussion, the planning, construction, operation and abandonment stages of specific construction projects are lumped together.

of potential adverse indirect or secondary effects on adjacent cultural resource sites was firmly kept in mind. Some sites (Kolovik, for example) were posted while others (Mesa, for example) were mapped and surface-collected.

B. Survey, Testing Programs and Excavations Conducted by USGS/BLM.

During the 1977-80 summer field season, USGS/BLM archaeologists surveyed 5365+ miles of proposed seismic lines, 47 proposed test wellsites, 81 proposed borrow sites, 39 proposed airstrips, 2 proposed staging areas, 4 proposed burial sites, and over 2000 miles of proposed winter trails (Table 4.). Additionally, a number of other associated tasks were performed, ranging in diversity from posting known cultural resource sites in the vicinity of proposed construction areas to providing guided tours of cultural resource program activities for interested individuals from other governmental agencies.

Testing programs were carried out at several sites (Map 1): Lisburne Borrow #2 (KIR-097) Lisburne Borrow #5 (KIR-100), Carbon Otter Strip (XUR-229), Mesa (KIR-102), Siraagruk (WAI-095), Croxton (XHP-311), and the shoreline bluff sites (WAI-029, 031, 094, 097, 098, 099, 101-011). Testing at Lisburne #2 and #5 began when construction engineers indicated that the bedrock knolls on which the cultural material resided would be required to build the Ivotuk airstrip; later, when alternate borrow sources were designated, the testing operations were abandoned. Similarly, it became obvious that the Carbon Otter Strip was not to be utilized before extensive testing took place there. Initially the Mesa site was surface-collected because of its proximity to the Ivotuk airstrip and Lisburne wellsite; subsequently, after the site's importance was established on the basis of artifact analysis and a very early radiocarbon date, further work was done to determine the site's extent and the danger to its integrity of on-going natural erosion (Gal, Bowers and Kunz 1980). The historic site of Siraagruk was extensively tested over two field seasons in order to ascertain the resources and time necessary to test or excavate similar sites which are so common in the Reserve that future oil exploration activities will have to accomodate their protection (Slaughter 1980). The Croxton site, located on the southeastern shore of Tukuto Lake, was tested in 1981 for similar reasons, and because the cultural manifestation there was previously unknown in the interior (Appendix). Finally, a series of sites, all of which were small and most of which did not contain culturally assignable artifacts, were tested along the old Pleistocene shoreline bluff southwest of Wainwright; the testing program was conducted because this beach ridge is the most assessible source of construction material in the area and because the sites were of a type that is often ignored by archaeologists (Gerlach n.d.; Gerlach, Redding-Gubitosa and Reinhard 1981).

Six sites were excavated. Tunalik (WAI-091), Lisburne (KIR-096), South Meade #1 (XMR-091) and South Meade #2 (XMR-092) were

Table 4. Field Activities By GS/BLM Archaeologists In Conjunction With The NPRA Cultural Resource Survey And Clearance Program.

YEAR	PERSONNEL(2)	AREA TYPE INSPECTED(1)	# INSPECTED	OTHER ACTIVITIES(3)
1977	ESH, RG	Proposed seismic lines	1832 miles	
	ESH, RG, WW	Proposed test wellsite	14	
	ESH, RG, WW, MK	Proposed borrow sites	41	
	ESH, RG, WW	Proposed airstrips	9	
	ESH, RG, MK	Proposed staging areas	2	
	ESH, RG, WW	Proposed winter trails	several hundred miles	
	ESH, RG, WW, RL, MK, RS, GZ, RC			Excavation of Tunalik Borrow #2
	RG, WW, MK, RC			Excavation at South Meade sites
	MK			Inspection of 2 sites proportedly damaged by seismic activity

Table 4. continued

1978	ESH, RG, PB, RP, DS	Proposed seismic lines	1600+ miles	
	ESH, RG, MK, PB, DS, RP, SW	Proposed test wellsite	16	
	ESH, RG, MK, PB, DS	Proposed borrow sites	37	
	ESH, RG, MK, PB, DS, RP, SW	Proposed airstrips	17	
	ESH, RG, MK, PB	Proposed winter trails	several hundred miles	
	MK, PB, DS, RP, SW			Areal surveys: Lake Betty, Etivluk well-site, Otuk and Iteriak drainages
	MK, PB, DS, RP, SW, PF, GR, BS, RG, JG, TS, BW			Excavation at Lisburne #1
	MK, PG, DS, RP, SW			Testing at Lisburne #2 and 5, Mesa, and Carbon Otter Strip
	RG, JH, RL			Review of culture resource clearance program

Table 4 continued

1979	ESH, RG, PB, SW	Proposed seismic lines	1277 miles	
	ESH, RG	Proposed test wellsites	11	
	ESH, RG	Proposed borrow sites	3	
	ESH, RG	Proposed airstrips	6	
	ESH, RG	Proposed winter trails	several hundred miles	
	ESH, RG, MK, PB, SW, TS, GR, MC, MW			Excavation of Lisburne #1, South Meade site, BAR-095, and WAI-030
	DS, RP, MC, MW, PI WB, PB, SW, TS, GR			Testing at Siraagruk and Mesa
	ESH, RG, CD			Evaluation of archaeological site TES-014

Table 4. Continued

1980	ESH, RG	Proposed seismic lines	656 miles	
	ESH, RG	Proposed test wellsites	6	
		Proposed borrow sites	0	
	ESH, RG	Proposed airstrips	7	
	ESH, RG, PB	Proposed winter trails	several hundred miles	
	ESH, RG	Proposed debris burial sites	4	
	DS, DB, RC1, MC, JE, PF, TG, RJ, RP			Testing at Siraagruk
	SG, DR, KR			Survey and testing of "Beach Ridge" sites
	RG, MK, PB			Aerial photography study of late pre-historic sites
	ESH, CW			Review of NPRA sites
	PB, MK, RR			Testing at Mesa
	ESH, RG, EB			Survey for "seasonal concentration zones"

Table 4. continued

1981	ESH	All well-sites, etc. associated with USGS: 1977-81, US Navy: 1944-53 and 1976-77 programs	Review construction areas for damage to cultural resource sites.
	CG, PB, RC, EG, JK, DM, SM, DR, KR		Testing at Croxton site

(1) Numerous alternate wellsites, borrow sites, etc., which were never utilized were also surveyed for cultural resources.

(2) Not all the individuals listed were necessarily involved at any single point in time. USGS: DB = Diane Balmer, RC = Risa Carlson, MC = Melissa Conner, JE = Jan Eickmeier, PF = Pat Fall, CG = Craig Gerlach, TG = Tom Gillispie, EG = Eve Griffin, ESH = Edwin Hall, PI = Pam Ivie, RJ = Roy Johnson, JK = John Kershner, DM = Debbie Meier, SM = Steve Mrozowski, RP = Randy Peterson, DR = Donna Redding Gubitosa, KR = Karl Reinhard, DS = Dale Slaughter, MW = Melinda Wright; BLM: PB = Pete Bowers, RC = Ruth Croxton, RB = Robert Gal, JG = James Goodson, MK = Michael Kunz, RL = Ray Leicht, RR = Richard Reanier, GR = Georgeanne Reynolds, RS = Russell Sackett, BS = Becky Seleeby, TS = Tim Smith, BW = Brian Waitkus, WW = Wayne Wiersum, SW = Susan Will, GZ = Greg Zimmerman; USF&W: CW = Curt Wilson; Advisory Council: JH = John Hester; NPS: CD = Craig Davis; Smithsonian: EB = Ernest Burch.

(3) Not noted are inspections of old wellsites, seismic lines, etc.

originally designated as necessary borrow sites and excavation was initiated on that basis (Gal, Bowers and Kunz 1980). After the Tunalik excavation was completed, the borrow material was used to construct the Tunalik airstrip and test well pad. The other three borrow sites weren't utilized, but the archaeological excavations at each had reached the stage where completion was the most scientifically appropriate course of action. Both BAR-095 and WAI-030 were small, single component, specific activity sites. BAR-095 was excavated in its entirety because the site was actively eroding away and the cultural information it contained would have been lost if not recovered immediately. WAI-030, located on the same physiographic feature as the Tunalik and shoreline bluff sites, was chosen for excavation to validate some of the technological and artifactual associations postulated on the basis of the Tunalik material.

Two other aspects of the USGS/BLM cultural resource clearance program deserve mention. In the summer of 1980, USGS/BLM archaeologists joined Dr. Ernest Burch, of the Smithsonian Institution, to search for early historic Inupiat seasonal concentration zones in the NPRA. Seasonal concentration zones can be defined as geographic areas within which Inupiat gather regularly at certain seasons of the year for subsistence purposes. Unfortunately, it proved impossible to find physical manifestations of seasonal concentration zones reported to Burch by Inupiat informants, but the locations of several major nineteenth century settlements in the Chipp-Ikpikpuk area were isolated (Burch 1980).

Also in 1980 BLM archaeologists set out aerial photo panels at late prehistoric sites on the shores of six interior lakes. Subsequently, a number of flightlines were flown at each lake, resulting in 9" x 9" color infrared transparencies at a scale of 1:1800. Contour maps of the sites, vertically accurate to 2" are being prepared and will be cross-checked against contour maps of certain Etivluk Lake and Tukuto Lake sites created earlier by more traditional means. Preliminary results indicate that this relatively inexpensive, non-destructive method of ascertaining site extent and complexity holds great promise for cultural resource management (Gal 1980).

C. Evaluation of the USGS/BLM Cultural Resource Survey and Clearance Program

The success of the 1977-81 USGS/BLM cultural resource survey and clearance program can be measured in several ways:

1. Compliance with Cultural Resource Protection Laws and the USGS/BLM MOU

Cultural resource sites located on Federal land, as well as those located on other lands which may be affected by a Federally

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(4) For a discussion of the cultural resource protection laws, see Leicht 1980.

funded action, are protected by s suite of Federal Laws. (4) The USGS/BLM cultural resource survey and protection program was designed and implemented to meet the dictates of these laws. Throughout the course of the program, the value placed by the American public on the preservation of the nation's cultural heritage, as reflected by the existence of these cultural resource protection laws, was kept firmly in mind. Additionally, the MOU between the USGS and the BLM set specific requirements both for the cultural resource inventory research to be conducted in association with the oil exploration program, and for the yearly report describing the results of the inventory research. The USGS/BLM cultural resource survey and clearance program also met these requirements of the MOU (Hall 1977, 1978, 1979, 1980).

2. Clearance of Construction Areas and Overland Trails

The cultural resource program described above resulted in survey and clearance of all construction areas and overland trails (including seismic lines) associated with the oil exploration program in a manner that was efficient and economical, as well as responsive to legal requirements. While occasional delays in the summer construction survey program were attributable to cultural resource clearance activities, in general completion of the cultural resource program only minimally interferred with the oil exploration program. The requirement that cultural resource sites not be adversely impacted by oil exploration activities did not affect the nature and tenor of the winter exploration program. The total cost of the cultural resource program is estimated to have been approximately 1/10 of 1% of the total amount spent by the U.S. government on the entire oil exploration program, well within the 1% of total costs permitted by Federal law.

3. Protection of Cultural Resource Values.

The USGS/BLM cultural resource program provided for direct protection of the cultural resource values inherent in the archaeological sites which were discovered as a result of the program. Some resources were protected by identification of localities that were to be avoided during the course of construction or other oil exploration program activities; other sites were excavated in order to assure that their scientific potential was realized as fully as possible. However, in several instances, activities by oil exploration program personnel adversely impacted known cultural resource sites.

a. Negative Effects of the Oil Exploration Program

An examination of the few cases of actual damage to cultural resource sites in the NPRA that resulted from oil exploration activities over the five year program is instructive in terms of determining how well the cultural resource protection program worked and how future cultural resource protection programs conducted under similar circumstances might be improved.

a.1. Kolovik

The historic site of Kolovik is situated on slightly raised ground about 100 yards from the coast approximately four miles west of Camp Lonely (USGS Teshekpuk 1:250,000 quadrangle). The known cultural features of this former trapping and trading location consist of standing houses, collapsed structures, two whaleboats, and at least four surface burials.

Kolovik was plainly marked on current USGS maps utilized by the various agencies and organizations involved in the oil exploration program and the site's standing structures and whaleboats were plainly visible from the air or the ground during the summer months. The abandoned houses stand high enough to be visible under most winter operating conditions.

The presence of Kolovik and measures to avoid the site were noted in several clearance reports (Hall 1976, 1977). In 1976 a trail was cleared along the beach to the immediate north of the site. Through a series of misunderstandings, and because the beach trail apparently was unuseable under certain winter conditions, another uncleared trail was utilized around the site to the south during the 1976/77 and/or 1977/78 winter seasons. Additionally, several vehicle passes were made directly over the site during the latter season.

The damage to Kolovik included: (1) three well-marked sets of vehicle tracks, each the result of numerous passes, running across the site including one extending north to south along the eastern edge of the site area, one running almost directly south from the beach to split around the most obvious standing structure on the site, and one extending more or less east-west across the site some 250 yards in from the beach; (2) the smashed end of a post remnant (probably representing a fish or drying rack) located about 30 feet south-east from the standing house; (3) the smashed end of a post remnant (also probably representing a fish or drying rack) located about 50 feet north of that structure; and (4) several smashed and split boards from a wooden coffin representing a surface burial located about 200 yards south of the standing structures.

None of the trails involved in the damage at Kolovik were cleared for cultural resources and two of these trails ran perpendicular to both the cleared and uncleared, but apparently utilized, trails around the site. The available evidence indicated that vehicles associated with the exploration program operating out of Camp Lonely were responsible for the unauthorized trails.

Both the BLM and the USG archaeologist reported the damage at Kolovik to their appropriate supervisors. At the suggestion of the USGS Chief of Operations, all parties involved agreed that Husky would build a new coffin of aged wood that resembled the original as closely as possible in form and size and then, under

the USGS archaeologist's direction, the original coffin boards and all human remains (there were no grave goods evident) visible on the surface would be placed therein and the coffin sealed. This project was completed on 6 August 1978.

The present status of the damage at Kolovik is as follows: (1) the vehicle tracks are not deeply incised in the ground surface and should fade over time; (2) the broken surfaces of the damaged posts will age and blend in with the rest of site; and, (3) the coffin will age further and, in time, break-down and scatter like the others in the same area. In a sense the damage that occurred at Kolovik was slight and short term in nature. However, no adverse impact on a cultural resource site as important as Kolovik is acceptable, according to the precepts under which oil exploration was taking place in the NPRA, and damage to a site as visible and well-identified as Kolovik was an obvious error on the part of both the Operator and the monitoring personnel.

The Kolovik site should have been well-protected, in that it was clearly identified in pertinent clearance documents and under a specific avoidance stipulation. Further, the site should be clearly visible, even under winter conditions, and thus should have been strictly avoided according to the stipulations for winter trail construction and use on the NPRA.

Possibly Kolovik would have been better protected had it been posted with the standard "Do Not Disturb: Archaeological Site" signs (as it later was), as were utilized elsewhere in the vicinity of oil exploration construction activities in the Reserve. Failure to do so was based on the obvious nature of the site as a cultural resource, even to the layman, coupled with the clear mandate to all personnel to avoid cultural resource sites. It is unfortunate that the environmental monitors did not discover the damage when the trails were first being utilized and immediately inform the USGS of the problem.

A number of measures for protection of cultural resources during oil exploration activities in the Reserve may be derived from the incident at Kolovik: (1) Even obvious cultural resource sites should be posted; (2) the stipulations concerning cultural resources must be more firmly impressed on all operating personnel; (3) all contractor personnel must be given greater awareness that no activity which might result in adverse impact on a cultural resource site (and this includes any potentially surface disturbing activity or any activity that might result in an oil spill) can take place in an area not cleared for cultural resources; and (4) when activities potentially harmful to cultural resource sites are initiated, rapid action must be taken by supervisory personnel and/or environmental monitors in order to prevent or minimize adverse impact.

a.2. Nokotlek Point

This cultural resource site is located just south of the

active beach line on the western side of Nokotlek Point (USGS Wainwright 1:250,000 quadrangle). The known cultural features include a standing frame house, collapsed sod houses, and the remains of drying racks. The site is listed on the North Slope Borough Traditional Land Use Inventory as the site of Nukulik Point (Susie Frankson, personal communication): "(cabins, ruins, hunting/camping area). Sod house ruins of Abraham Itlaanik and Peter Panik. One (1) frame house belongs to Nayakik. Winter camping." A log leaning against the standing cabin bears the carved inscription "Bev Panik, 8/18/77".

The Nokotlek Point site is adjacent to a proposed but unutilized borrow for the Tunalik wellsite and thus was referenced in the 1977 clearance report (Hall 1977; 66 and Map WT-77-13-004) as a NSB:TLUI site that should be avoided.

In late July 1978 the existence of damage at the Nokotlek Point site was widely reported; the original account of the damage came from a Heritage Conservation and Recreation Service party that visited the site. In response to these reports the USGS and BLM archaeologists visited the site on 5 August and the latter returned on 8 August with Robert Harrison, of Husky Construction, and Robert Mallahan, of Bell, Herring and Assoc. These inspections indicated that a D-7 Cat had come along the active beach from the west and executed an 180 degree turn directly through the site, thence returning to the west. In the process the Cat apparently came up over the sod-covered bank with its blade slightly lowered and gouged a 6-inch deep scrape up the bank; the same process was repeated when the Cat turned 90 degrees to the west over a collapsed structure, probably one of the sod houses mentioned in the TLUI. Additionally the tracks of the vehicle dug in deeply elsewhere along its route while on-site.

The absence of damage at Nokotlek Point during the summer of 1977 and an analysis of the situation at the site suggested the damage there occurred during 1978, probably sometime in the spring. The only D-7 Cats in the vicinity at the time were associated with the Tunalik staging area at Husky Point, some two miles to the southwest of the cultural resource site. There seemed little doubt that someone from the Husky Point camp drove a Cat along the beach to Nokotlek Point, turned the vehicle up over the site and returned to Husky Point. Furthermore, the damage was deliberate, in the sense that the individual had to be aware of the site's presence as it is plainly visible from the beach at this point.

The Nokotlek Point site was not posted and need not have been as it was well removed from all planned, and archaeologically cleared, oil exploration activities including the proposed Tunalik #1 borrow. Additionally, the site was clearly visible and thus should have been avoided according to the NPRA stipulations. Point Numbers 2-4, derived from the Kokovik case, are also applicable here.

a.3. Nuwuk

The Nuwuk site is located at the tip of Pt. Barrow (USGS Barrow 1:250,000 quadrangle). The cultural resource is a late prehistoric/historic Eskimo village (cf. Ford 1959), now largely eroded away by the sea. Nuwuk is one of the better known archaeological sites in the Reserve.

In early August of 1978 a representative from Husky Oil NPR Operations, Inc., visited the Nuwuk site in the company of a Native individual from Barrow. They found a human cranium exposed on the surface in the back-dirt from a recent excavation in a portion of the site along the northwest shore of the spit. Both of the discovers' were concerned about the find and wished that it be handled properly both legally and morally. Thus, after considerable discussion, one of them brought the cranium to the USGS archaeologist with the request that arrangements be made for proper deposition.

The excavation which unearthed the human cranium was carried out by unknown persons, probably in search of artifacts for sale to tourists. However, despite the possibility of further damage to the cranium and despite the laudable concern of the discovers that it be treated with due respect, the cranium should have been left where it was found, in accordance with Federal, State and local laws as well as the NPRA stipulations.

In line with an informal agreement made during the summer of 1977 with the Magistrate of Barrow, the USGS archaeologist sent the cranium to her on 8 August with a description of the circumstances of its recovery (Hall to Brown, 8 August 1979). On the 29th day of that month she returned the cranium to Husky's representative in Barrow with the request that it be reburied where it was found (Brown to Christenson, 29 August 1979). Additionally, she noted that Husky personnel should be aware that there were a number of graves at Nuwuk and should respect the grave site by not disturbing or removing anything found there. The cranium was returned to Nuwuk as requested.

a.4. Conclusion

Consideration of these case studies led to adjustments in the cultural resource protection program during succeeding field seasons. Under the precepts of the FEIS, the MOU, and the GS cultural resource program, no damage to cultural resource sites as a result of oil exploration activities was deemed acceptable. However, given the magnitude of the oil exploration program, in regard to geographic scope, intensity of construction activities, and the number of involved personnel, the actual damage that did occur was minimal.

While not necessarily a negative factor in terms of preserving cultural resource values, the cultural resource program was perforce designed and implemented on a reactionary basis. The

general parameters of the program were set by Federal law and by the MOU between the GS and the BLM. The geographic locations of program operation were dictated by oil exploration activities. The specific methodology underlying the cultural resource surveys, the testing program, and the excavations was developed to protect cultural resource sites while facilitating timely completion of the oil exploration program as decreed by Congress. Despite these constraints, however, the GS cultural resource program provided both data and new methodological procedures pertinent to future management of cultural resources in the NPRA and did not excessively or unwisely expend those resources in the process (see Hall and Gal, in press, for further discussion of this issue).

b. Positive Effects of the Oil Exploration Program

b.1. Contributions to Our Knowledge of North Alaskan Culture History

The USGS/BLM oil exploration program in the Reserve, and the directly or indirectly associated cultural resource identification and protection efforts of the North Slope Borough, the National Park Service, the Heritage Conservation and Recreation Service, the Bureau of Land Management, and the U.S. Geological Survey have resulted in a measurably greater knowledge of the nature of human utilization of northwestern Alaska resources over the past 10,000+ years. The number of known archaeological sites in the Reserve was multiplied more than five times by the activities of various survey parties over the five year period, and the North Slope Borough Commission on History and Culture made considerable headway in identifying, describing, and accurately locating cultural resource sites which were known only to selected individuals with use or memory associations to specific sites. Analysis of the collected data will take several years, but a preliminary consideration of what is known suggests that human utilization of the many available resources in the NPRA was relatively more intense, during all periods of time over the past 10,000 years, than previously demonstrable; that we can expect to find evidence of past human activity anywhere in the Arctic Coastal Plain as well as along the Coast and in the Foothills; and that demonstrable modes of human resource use in the Reserve during the historic period have been both intense and extremely varied. The quantification of human resource utilization over time and a full understanding of its range of variation in time and space await further research and analysis.

The rapidly accumulating data on the prehistoric human utilization of the NPRA, and of northern Alaska as a whole, permits formulation of a tentative cultural historical sequence (Fig. 1) which is considerably more complex and comprehensive than Anderson (see Table 2) was able to offer based on the information available only five years ago. However, any cultural historical reconstruction, including that presented here, must be viewed with considerable skepticism, given how little is really known about the changing nature of human adaption over time in

A PROVISIONAL VIEW OF NORTH ALASKAN CULTURAL HISTORY

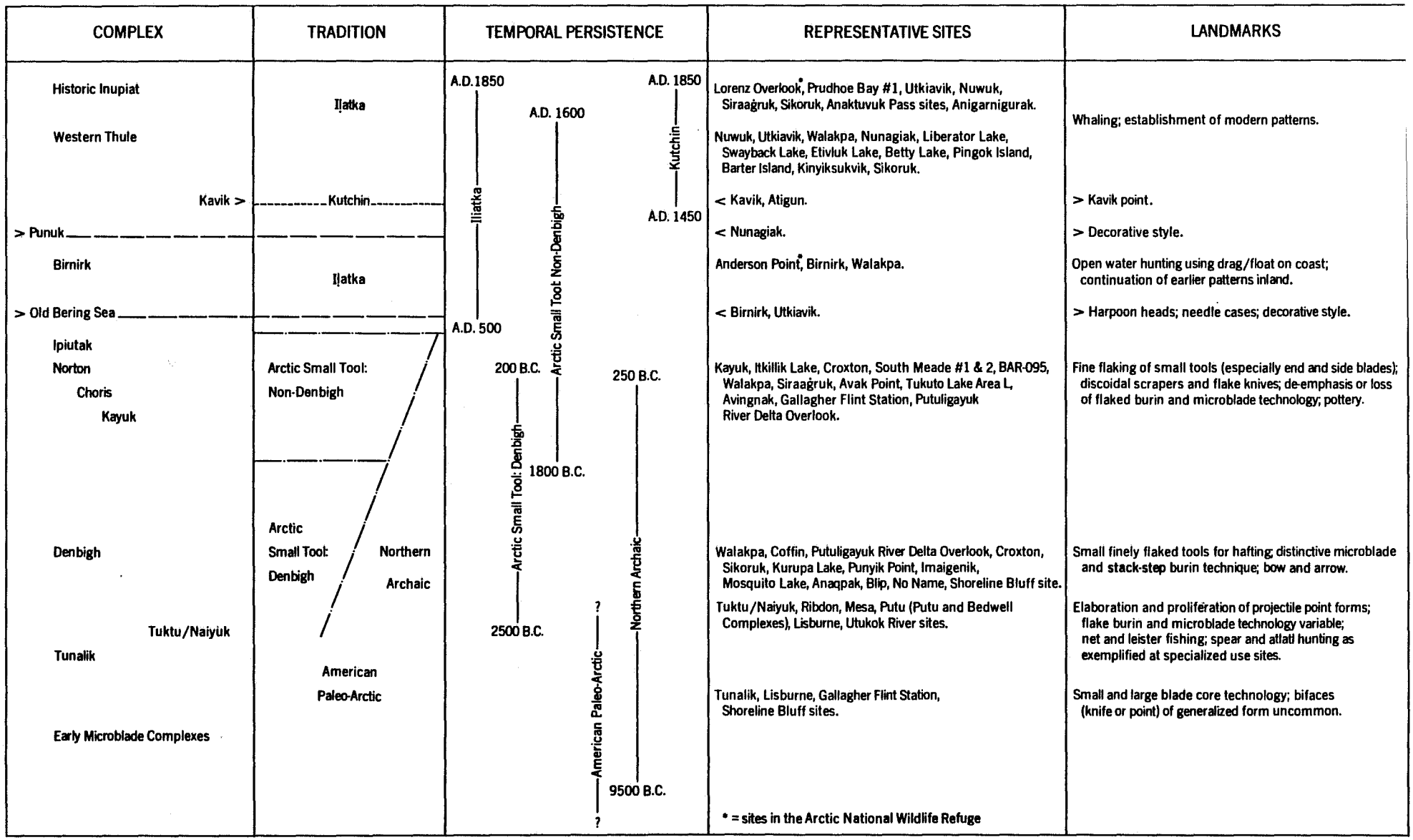

Figure 1. After Gal and Hall 1982

northern Alaska.

The more we learn about past and present cultural resource utilization, the better we will be able to protect both known and unknown cultural resource sites. By providing impetus for cultural resource site identification and analysis, the oil exploration program in the NPRA has contributed, and will contribute, to a better understanding of the course of human history in this important Arctic area.

b.2. The Development of Survey, Testing and Excavation Methodologies

Prior to the USGS/BLM effort, no comparable cultural resource progrm had been conducted in northern Alaska or, as far as is known, anywhere else in Arctic regions in conjunction with oil exploration. Therefore, the methodological procedures followed to assure that the utilization of seismic lines and winter trails, and the construction of testwell pads and airstrips, would not adversely affect cultural resource values had to be formulated on the basis of available knowledge about the area's cultural resources combined with certain assumptions about the effects of various oil exploration activities.

The survey procedures developed to provide cultural research clearance of seismic lines and winter trails have been described above. Each summer the USGS/BLM archaeologist reviewed selected seismic lines and winter trails, primarily those in areas of high cultural resource potential, used at various times throughout the course of the oil exploration program. No example of adverse affect to cultural resource sites was discovered that could be attributable to geophysical activities, except for the toppling of an inuksuk stone in the Kinyiksukvik area, or to the use of winter trails by construction vehicles, except for the instances described above. Therefore, the procedures developed by the USGS/BLM archaeologists for clearing such trails are believed to have been appropriate and sufficient. Similarly, the 1981 review indicated that the procedures employed to clear testwell pads, airstrips and burial sites described above provided for protection of cultural resource sites in the vicinity of construction zones.

Testing procedures were developed that allowed rapid and comprehensive evaluation of site significance in terms of National Register of Historic Places criteria, while at the same time providing the means to assess the labor and financial committment required if the site were to be excavated (see Hall and Gal n.d.; Bowers n.d.; Gal n.d.; Gerlach n.d. for further discussion of test procedures). Additionally, a number of techniques for exploring site extent without subsurface testing, or for recovering additional data bearing on site utilization, that had not been employed previously in northern Alaska, were employed as part of the testing program (eg. Gerlach, this volume).

The excavation procedures employed at sites where excavation for mitigation was dictated, as well as at Siraagruk and along the shoreline bluff, were intended to be state-of-the-art, and we believe that this ideal was achieved. Beyond the usual data collected in the course of an archaeological excavation, the USGS/BLM effort concentrated on determining the total areal extent of each site, the relationship between observed surface cultural material and the subsurface material discovered by excavation, the horizontal distribution of cultural material as a reflectance of activity areas and/or different occupations, and the amount of crew effort and money necessary to totally excavate various types of sites.

b.3. Dissemination of Knowledge

Ofter cultural resource values identified by mitigation programs do not achieve a full measure of protection, and the mitigation program itself falls short of expectations, because the knowledge potentially available from analysis of the survey, testing and excavation results is not made available to cultural resource managers, other professionals involved in cultural resource programs, or the interested public. All too frequently, the cultural resource managers receive a bare clearance report or, at best, a brief summary of the work completed is submitted to satisfy the dictates of the Federal Antiquities Act permit. The recovered data, and the knowledge their analysis might represent, are then consigned to oblivion.

As noted above, the USGS/BLM cultural resource program developed several new techniques for clearance survey and testing within the context of an oil exploration program in the Arctic. Survey, testing and excavation activities resulted in the recovery of new data pertinent to better understanding both north Alaskan cultural history and the changing nature of human behavior over time in the region. In particular, application of the testing and excavation procedures to small, essentially surface sites (cf. Gerlach n.d.) has opened a new avenue to understanding past human behavior in the Arctic.

The USGS/BLM cultural resource program provided information on its procedures and accomplishments, to special interest groups and to the general public, in a number of ways:

(a.) The extent, nature and results of each summer's clearance activities, as well as a preliminary description of sites tested/excavated and the materials thus recovered, were detailed in an annual report (Hall 1977, 1978, 1979, 1980). Copies were distributed to the Advisory Council on Historic Preservation, the Department of the Interior Consulting Archaeologist, The State Historic Preservation Office, the Heritage Conservation and Recreation Service, Federal, State, and local governmental agencies, and a number of professional archaeologists.

(b.) Yearly summaries of the NPRA fieldwork were published in the Newsletter of the Alaska Anthropological Association and in the Current Research section of American Antiquity, the journal of the National Society for American Archaeology.

(c.) Professional papers were delivered and distributed yearly at the Annual Meeting of the Alaska Anthropological Association and two papers were presented at the Annual Meeting of the Society for American Archaeology.

(d.) The papers mentioned above and other data on the USGS/BLM cultural resource program were made available to interested professionals.

(e.) An oversized issue of the Anthropological Papers of the University of Alaska, subvened by the GS and published in the Fall of 1982, is devoted entirely to papers reporting on all work conducted under the USGS/BLM program.

(f.) Numerous meetings to explain the cultural resource program and its results were held with representatives of the North Slope Borough. Slide lectures were made at a meeting of the North Slope Borough Comission on History and Culture, in North Slope Borough high school classes, and in the Fairbanks North Star Borough grade school classes.

(g.) A poster/slide display, with an accompanying pamphlet, explaining the NPRA cultural resource program was exhibited in Fairbanks and Anchorage and is scheduled for exhibit in Barrow,

(h.) A feature article on the Croxton site excavations (see Appendix) was presented in the Fairbanks News-Miner weekend edition and a photograph of the site appeared in Alaska magazine.

(i.) A display was set up on a bulletin board at Camp Lonely to inform all construction personnel of the cultural resource activities in the NPRA and to instill a measure of appreciation for the significance of those resources in order to enlist cooperation in cultural resource protection.

(j.) The USGS/BLM cultural resource program offered a number of graduate and undergraduate anthropology students the opportunity to pursue research in the Arctic and resulted in a trained cadre available for future work. Two master's theses and two doctoral dissertations will be based on research undertaken as part of the NPRA program.

(k.) During the course of the USGS/BLM culture resource program, several outside professional archaeologists were able to visit the NPRA to review the procedures being employed and the results obtained. In addition to non-program personnel from the Bureau of Land Management, visitors included scientists from the National Park Service, the U.S. Fish and Wildlife Service, the Advisory Council on Historic Preservation, The State Historic Preservation Office, the National Museums of Canada, and the

Smithsonian Institution.

D. Problems Encountered by the USGS/BLM Cultural Resource Program

Any cultural resource program, and most particularly one in a region as unknown archaeologically as northern Alaska, encounters certain problems in application, and the USGS/BLM program in the NPRA was no exception. Often these difficulties arise from logistic and time constraints, other times from misunderstanings among the involved organizations about the force and thrust of the cultural resource protection laws and the procedures for cultural resource inventory and assessment. Such difficulties arose in the NPRA program and were magnified by the size of the Reserve and the scale of the oil exploration program. Additionally, the nature of the Arctic environment posed other problems which would not be encountered, at least not in the same magnitude, in more temperate regions.

While it would not be useful to detail all these problems, two deserve further comment. Problems of particular and continuing concern to the cultural resource program in the NPRA included a lack of knowledge of the effects on cultural resources of certain oil exploration activities and the difficulty of complying with the proscribed procedures for securing determination of excavation as an appropriate mitigation measure given the prevailing time constraints.

1. Effects of Construction Activities

The potential extent of damage to cultural resource sites as a direct result of the construction of an air strip or exploratory well pad, or the utilization of a borrow site, can be predicted with some certitude. However, problems arise when archaeologists attempt to predict the potential damage associated with ground vehicle travel. Table 3 represents a preliminary attempt to circumscribe possible types of damage as a result of vehicular travel under differing ground cover, subsurface, and weather conditions. Unfortunately, the table cannot be based on empirical data, because no experimental studies have been conducted. Observations of cultural resource sites disturbed by ground vehicle travel suggest the nature and extent of possible damage, but the prevailing weather conditions (depth of frost and the depth of snow cover) at the time the vehicles passed over the site are not known. Thus, until better data are forthcoming, archaeologists concerned with possible adverse effects of ground vehicular travel on cultural resource sites must err on the safe side by stipulating that vehicle travel in the vicinity of the sites take place only under optimum protective conditions.

2. Difficulty of Complying With Procedures

In order to adequately protect cultural resources nationwide, the Advisory Council on Historic Preservation had

codified a set of procedures that all Federal agencies must follow when engaged in cultural resource clearance of proposed construction areas. The procedures include consultation with the State Historic Preservation Office and the Advisory Council on Historic Preservation at the earliest possible stage in project planning. Unfortunately, the lack of an adequate cultural resource inventory for the NPRA, the accelerated oil exploration mandate from Congress, and the timing of field construction planning, which began only during the short summer field season immediately prior to the winter construction season, prevented orderly, useful consultation within the approved time frame. Effectively, survey for and evaluation of cultural resources had to be conducted concurrently each summer with field engineering design for the coming winter's construction.

The solution to the potential conflicts between cultural resources and engineering requirements inherent in this approach lay in evaluating many more locations (for airstrips, material sources, exploratory well pads, etc.) than would ever be necessary for construction purposes. In most cases,

> ...the concurrent consideration of alternate locations enabled project decision makers to select practical and economical engineering designs with little or no significant impact to the natural and cultural environment...(however) this process deferred the final decision on project location and resultant impacts. This deferral of final decision-making (with overall environmentally sound results) in those cases which involve areas of high cultural resource density as areas in which engineering or other environmental constraints are limiting factors, effectively reduces the archaeologist's time to complete field mitigating measures and to obtain the required concurrency in the adequacy of those measures from the State Historic Preservation Officer (SHPO) and the Advisory Council (Hall and Gal n.d. 28).

During the early stages of the program (1977-1978), cases of actual conflict between cultural resource site protection and engineering design requirements were resolved by excavating the sites in question with a stand-by archaeological crew provided by the BLM. To proceed in this manner, however, required concurrence from the ACHP and the SHPO on a case-by-case basis. Though the two agencies accepted the USGS/BLM archaeologists' recommendations and concurred with their proposed activities over the telephone, the entire procedure was not in accord with the guidelines intended to govern mitigation actions. In 1979 the civil construction requirements for exploration wells were revised and excavation for mitigation of impacts to cultural resource sites was not necessary during that or the succeeding field season.

In an effort to reduce the continuing friction between cultural resource protection measures and oil exploration activities in northern Alaska, the USGS and BLM archaeologists suggested, and the BLM archaeologist prepared, a Programmatic Memorandum of Agreement between the GS, BLM, and the Advisory Council. In the Agreement:

> ...the Advisory Council agreed to a significantly flexible alteration of procedures. Most of the sites encountered in the Reserve are surface, or shallowly-buried deposits of principally lithic materials. Due to the lack of archaeological work in most of the Reserve to serve as standards for evaluation, the significance of these sites cannot be determined without extensive test excavation or total excavation. Each of these sites therefore meets the National Register criteria of eligibility as likely to yield information important in prehistory of history. The Advisory Council has agreed to accept without review or comment, mitigation measures developed jointly by the SHPO and the GS and the BLM archaeologists for those sites whose eligibility is based on their likelihood of yielding information if the Council's Guidelines for Making "Adverse Effect" and "No Adverse Effect" Determinations for Archaeological Resources are followed (Hall and Gal n.d. 29-30).

For various reasons, the Programmatic Memorandum of Agreement was never finalized. Though it would not solve all of the problems associated with conducting a timely cultural resource program in conjunction with oil exploration activities, a similar agreement would be useful for coordinating cultural compliance actions in the future as exploration for fossil energy sources continues in northern Alaska.

VII. CONCLUSION

Impetus for the USGS/BLM cultural resource program arose from the necessity to meet the requirements of Federal law and, as well, from the concern the involved agencies held for cultural resources in the NPRA. The general parameters of the program were set by Federal law and by the Memorandum of Understanding between the US Geological Survey and the Bureau of Land Management. The geographic locations of program operation were dictated by oil exploration activities. The specific methodology underlying the cultural resource surveys, the testing program, and the excavations evolved over the course of the program in response to a number of considerations. The USGS and BLM archaeologists continually were faced with the necessity of balancing these sometimes conflicting considerations, which included Federal law, the requirements of the MOU, the lack of knowledge about cultural resources in the NPRA, the absence of data bearing on the effects certain oil exploration activities have on cultural resource sites, the limited field season,

complicated logistic problems magnified by the size of the Reserve, and the desire to spend public monies as wisely as possible.

During the summer of 1981, the USGS archaeologist re-examined all exploratory well sites, airstrips, borrow sites, burial sites, and other specific activity areas associated with the 1977-81 oil exploration program. Selected localities along winter trails, ice roads, and seismic lines which had been periodically monitored as part of the on-going clearance program were also visited, as were known cultural resource sites and areas of high archaeological potential in close proximity to trails and seismic lines actually utilized during the oil exploration program. No examples of adverse impact to cultural resource sites were observed except for the cases noted previously.

As with all things, time will be the ultimate judge of the USGS/BLM cultural resource program. For now, the available evidence indicates that the program met its major objective of minimizing damage to cultural resource sites in the NPRA. The knowledge gained during the course of the program, about human behavior over time in the NPRA and about the most appropriate methodological procedures for conducting a cultural resource program in northern Alaska, will provide guidance for further exploration, whether it be for new fossil energy sources or for understanding of the human past.

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Appendix A

A Summary of Archaeological Research at Tukuto Lake, National Petroleum Reserve, Alaska

S. Craig Gerlach

Brown University

A Summary of Archaeological Research at Tukuto Lake, National Petroleum Reserve, Alaska

S. Craig Gerlach
Brown University

Introduction

During the summer of 1981 the United States Geological Survey sponsored an archaeological testing program at Tukuto Lake in interior northern Alaska. Preliminary reconnaissance of the lake and test excavations at the Croxton site demonstrated the research potential of the area and produced a corpus of data immediately applicable to several problem areas in Northern Alaska prehistory. The 1981 test excavations at the Croxton site defined an occupation radiocarbon dated between A.D. 600-1400, a period that is only poorly represented in the archaeological record north of the Brooks Range divide. In addition, a stratigraphically distinct component of the Denbigh Phase of the Arctic Small Tool Tradition, was isolated and radiocarbon dated between 2470-1300 B.C. at the Croxton site. Finally, a previously unknown midden situated at the southern end of the lake was identified but was only minimally investigated at 1981. For approximately six weeks during the summer of 1982, a six person crew returned to Tukuto Lake to continue the testing program initiated by U.S.G.S. at the Croxton site (XHP-311) and at Locality L (XHP-312).

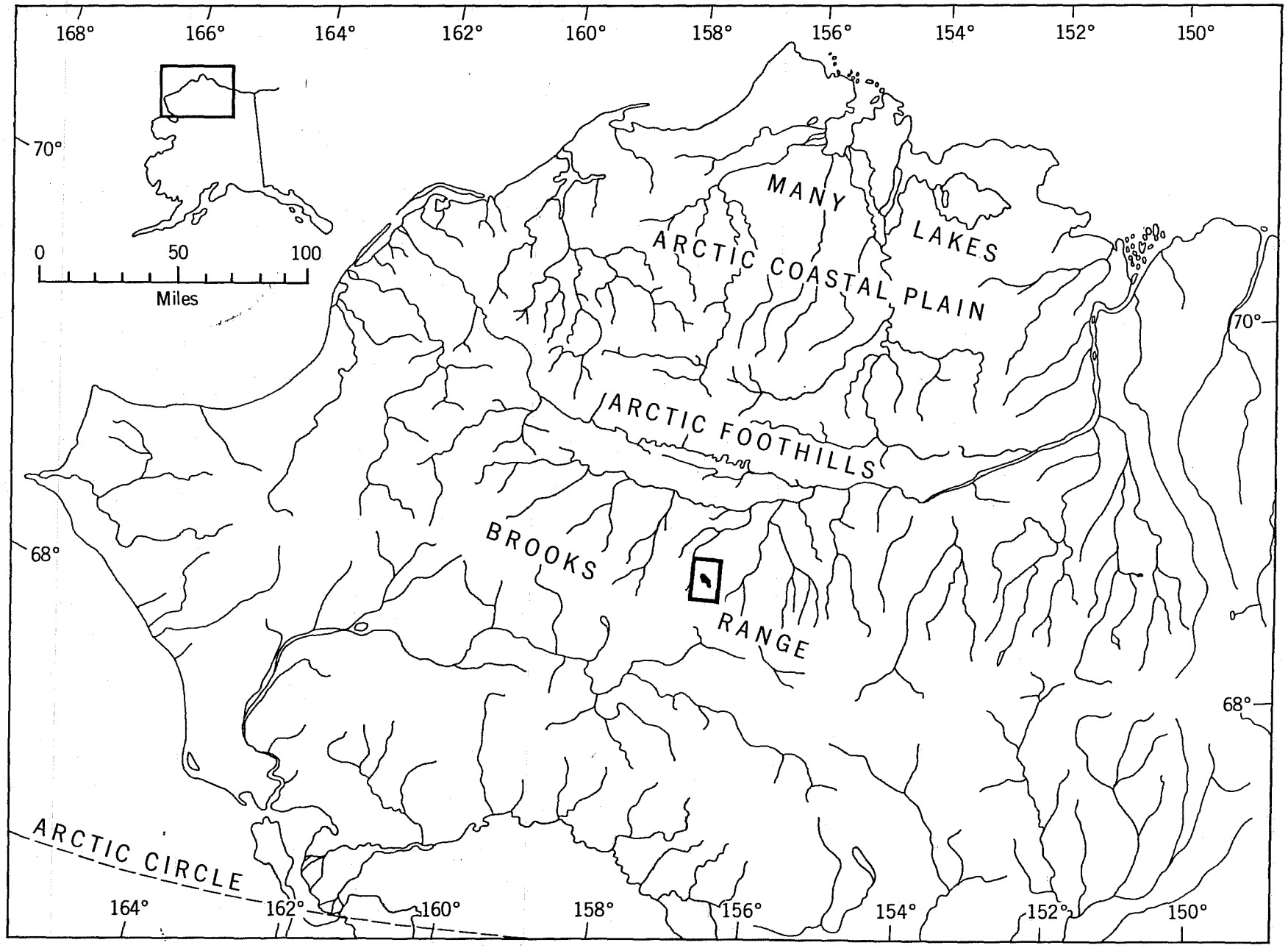
This paper presents a general review of the 1981 and 1982 field and laboratory programs, a description of the physical setting, previous archaeological research, testing strategies, and a discussion of the significance of the recovered cultural material. A progress report on the various specialized studies currently being undertaken by Tukuto Lake Project personnel is also provided. Because much of the cultural material recovered from the Croxton site remains to be analyzed, the interpretations advanced here should be considered provisional.

LOCATION AND SETTING

The Croxton Site is situated on the eastern shore of Tukuto Lake and consists of two closely related but distinct localities designated Areas J and K. In 1981, XHP-311 was named the Croxton Site in memory of Ruth Ellen Croxton, a commerical pilot and archaeologist who participated in the USGS/BLM cultural resource program and who worked on the Alyeska Pipeline Archaeology Project, north of the Brooks Range. Locality L (XHP-312), a spatially segregated midden, overlooks the outlet stream draining the lake on the southern end.

Tukuto Lake (68 degrees 30 feet N 157 degrees 02 feet W) lies nestled among the rolling hills of the Arctic Slope Foothills physiographic province at an elevation of 541 m a.s.l. (Figure 1.). It is approximately 2.75 x 1 km in size, is positioned about twenty miles north of Howard Pass, and is

Figure 1. Geographic Location of Tukuto Lake


168°
166°
164°
162°
160°
158°
156°
154°
152°
150°
70°
68°
0
50
100
Miles
MANY
LAKES
ARCTIC COASTAL PLAIN
ARCTIC FOOTHILLS
BROOKS
RANGE
ARCTIC CIRCLE

drained by a small stream that joins the Etivluk River just above it's confluence with the Nigu. The surrounding vegetation is moist tussock tundra and is comprised primarily of grasses (Graminae) and sedges (Cyperaceae), although shrubs, resin birch. (Betula glandulosa), alder, (Alnus crispa), willow.(salix), and heaths. (Ericales), are also present on the landscape. The climate is relatively severe with temperatures as low as -57 degrees C recorded at Umiat (Wiggins and Thomas 1962), the nearest station for which reliable weather records are available.

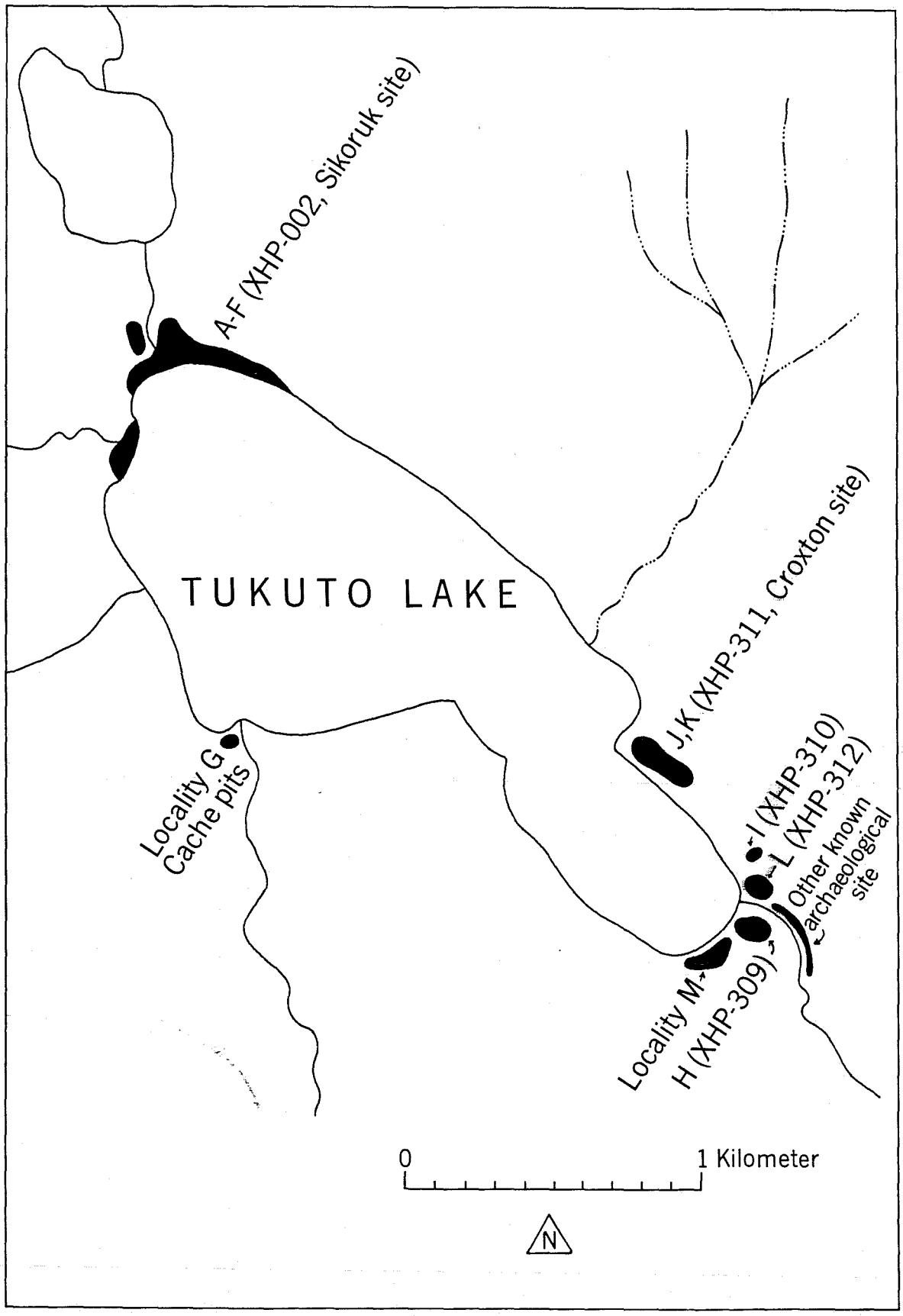
BACKGROUND - PREVIOUS RESEARCH AT TUKUTO LAKE

Previous research conducted at 1968 and 1970 by Edwin S. Hall, Jr., (Hall 1976:98-134) documented a rich late prehistoric/ early historic record at the Sikoruk site situated on both sides of the inlet at the extreme northern end of Tukuto Lake. Through the course of his research, he also demonstrated the existence of a number of separate areas scattered along the northern, southern and western margins of the lake. As observed by Hall (n.d.:2), Tukuto Lake is significant because the cultural resources are known to be clearly separated, either horizontally or vertically, or in terms of the cultural affiliations and specific behavioral episodes represented. While most of the localities defined and tested by Hall represent late prehistoric or early historic occupations, he tentatively assigned approximately two-hundred artifacts from one of his tested areas to the Arctic Small Tool Tradition (Hall 1976:105-106). Although the Denbigh occupation identified at Sikoruk (Localities D & E) appears to correspond to the stratigraphically lowest Denbigh component at the Croxton site, it is important to note that the time period A.D. 700-1300 is apparently represented by a hiatus in the occupational sequence at the Sikoruk Site.

In 1980, Bureau of Land Management archaeologists engaged in an aerial photogrametry project and an investigation of non-destructive site discovery procedures, isolated two previously unknown site localities at Tukuto Lake (Figure 2). The two new localities, those situated on the eastern shore, were designated "J" and "K" following the order established by Hall in 1968 and 1970. Areas J and K are now considered to be a single site, XHP-311, and together comprise the Croxton Site. In 1980, two radiocarbon dates were obtained from a single 4 x 4 ft test square in Area K and three dates from two test squares in Area J (see Table 1). The confirmed integrity of the deposit was enhanced by the recovery of well preserved faunal debris and a rich bone and stone tool inventory. It was clear that more detailed investigations were warranted, but apart from the three test squares excavated by the BLM field party, no other archaeological work was undertaken at Tukuto Lake in 1980.

Armed with the initial BLM assessments, a USGS crew of nine returned to Tukuto Lake in 1981 to test the prehistoric middens J and K. This project was part of an on-going cultural resource evaluation program conducted jointly by USGS and BLM and designed to locate, evaluate, and protect cultural

Figure 2. Relative Location of Known Prehistoric Prehistoric Sites at Tukuto Lake


A-F (XHP-002, Sikoruk site)
TUKUTO LAKE
J,K (XHP-311, Croxton site)
Locality G
Cache pits
I (XHP-310)
L (XHP-312)
Other known archaeological site
Locality M
H (XHP-309)
0
1 Kilometer
N

resources within the National Petroleum Reserve in Alaska (Hall 1977, 1978, 1979, 1980, 1981; Hall & Gal n.d.) Through the course of a ten week field season approximately one-hundred 4 x 4 ft and 2 x 4 ft squares were excavated. During the preliminary phase of the Croxton Site testing program, the primary goal was to sample the depth of the cultural deposit, develop an understanding of the vertical and spatial complexity of the site and to explore the nature of intra-site activity patterns. Because of the unexpected size and depth of the two site areas, the quantity of cultural debris encountered and adverse weather conditions confronted in 1981, our effort directed primarily toward the testing of Area J. Although about six test squares were excavated at Area K, the discovery of undisturbed living floors, occupational surfaces and numerous features at Area J indicated that this was an important location for the reconstruction of human behavior and our attentions were directed here.

From a culture-historical perspective, one important result of the 1981 test excavations at the Croxton Site (Area J) was the discovery of an occupation radiocarbon dated between A.D. 600 and 1400, (Table 1) a period for which there is little information for the interior north of the Brooks Range divide Preliminary anaylsis of the lithic and organic artifacts during the winter of 1981-82 revealed an assemblage typologically similar in some respects to the Ipiutak or "Ipiutak-like" materials from Desperation and Etivluk Lakes (Irving 1964), Feniak Lake (Hall 1973), Itkillik Lake (Kunz 1976), and Anaktuvuk Pass (Campbell 1962a, 1962b), yet still distinctive enough to raise questions about its cultural affiliations. Provisionally termed the Croxton Phase in 1981, this construct may not be applicable because of a stratigraphic and cultural hiatus within the so-called Croxton Phase occupation discerned in 1982. The term may eventually be retained for one of the two later cultural and stratigraphic horizons, but for the moment is being reserved until further analysis has been completed. It is worth noting that the improved weather conditions enjoyed in 1982, undoubtedly contributed to our ability to interpret and understand the stratigraphic details left unresolved in 1981.

Another important result of the 1981 testing program was the discovery of a lower stratigraphic unit radiocarbon dated to 2470 B.C., from Area J. A sealed hearth isolated in a test trench at the close of the 1981 season and associated with an undisturbed activity surface was only partially excavated. The recovery of a lithic industry provisionally assigned to the Denbigh Flint Complex and associated with well preserved faunal debris, abundant lithics, wood and organic artifacts, indicated that an earlier occupation was also present at the Croxton Site. A large quantity of carbonized willow twigs recovered from the hearth were later radiocarbon dated to ca. 1300-1400 B.C. (Table 1) The sealed hearth, the undisturbed activity surface and the radiocarbon dates confirmed the temporal integrity of the early Denbigh component at Area J.

One final contribution of the 1981 investigations was the discovery of another spatially segregated midden located at the southern end of the lake overlooking the outlet stream (Figure 2). Tukuto Lake Area L (XHP-312) was discovered by the USGS/BLM field party while "ground-truthing" color infrared reflectances suspected to signal the presence of cultural midden deposits (Gal 1982:179). Although not formally tested in 1981, limited shovel tests were excavated in order to sample the depth of the deposit, recover enough cultural material for historical assessment, and to establish the significance of the site. Two shovel tests isolated a hearth area from which side blades, caribou bone, flake debris and thin, well fired, check stamped organic temper potsherds were recovered. On the basis of typological similarities to certain coastal assemblages (Giddings 1964, Lutz 1970, Stanford 1971), it was felt that the XHP-312 occupation represented some phase of occupation temporally intermediate between the lowest stratigraphic unit (ca. 2470 - 1300 B.C.) and the upper midden (ca. A.D. 600-1400) of the Croxton Site, Area J. At that time the investigators knew that XHP-312 (Locality L) was deserving of more detailed investigations but were unable to do so because of time limitations and personnel constraints.

SUMMARY OF THE 1982 TESTING PROGRAM AT TUKUTO LAKE

During the summer of 1982 a six person field crew spent approximately six weeks at Tukuto Lake conducting test excavations at the Croxton Site (XHP-311, Area J) and at XHP-312 (Locality L). The field project was undertaken from July 15 to August 28, 1982. Utilizing the same location that was used in 1981, a base camp was established between the two midden areas (J and K) at the Croxton Site. This was done in order to minimize impacts on both the environment and the cultural resource. A considerable inventory of essential equipment was cached at the lake at the close of the 1981 season in anticipation of future research needs, and therefore it was possible to conduct the 1981 testing program on a relatively limited budget.

The research objectives and orientation of the Tukuto Lake project have been stated in detail elsewhere (Gerlach 1982a: 1-37). In view of the spatial, stratigraphic and temporal integrity of the sites under consideration, it was apparent that there was considerable potential for the resolution of culture-historical problems, for the reconstruction of behavior and activity patterns, and for modelling relationships between caribou populations and human procurement strategies through time. More specifically, the research objectives at the beginning of the 1982 season may be stated in summary form as follows (Ibid:10-11):

(1.) To gather enough data from the three at the Sikoruk site occupations at Tukuto lake (not including the late prehistoric) to be able to compare them with respect to subsistence procurement strategies, faunal resources exploited, population dynamics of the caribou herds through time, and the

behavioral correlates of the distribution and patterning of cultural debris at each locality. To examine the sites in terms of site function, pattern of utilization, seasonality, and in terms of the changing ecological dimensions between interior Inupiat populations and the natural landscape.

(2.) To further characterize the occupation and cultural sequence at the Croxton Site by:

(a.) Defining the material correlates of the latest occupation (A.D. 600 - 1400), by recovering additional material for radiocarbon dating, developing a better understanding of the relationship between features and living floors, further defining intra-site activity areas and patterning by sampling new areas, and by finishing block excavations started but left imcomplete in 1981.

(b.) To isolate and define the Denbigh component identified at the Croxton Site by investigating the activity surface defined but left largely undisturbed in the test trench. Additional radio-carbon dates were needed to insure the temporal integrity of the Denbigh deposit and it was imperative to recover a representative sample of faunal debris for comparative purposes. Finally, it was considered necessary to recover additional lithic and organic artifacts for culture-historical purposes, and to define the spatial distribution of debris across the occupational surface as an aid for the reconstruction of patterns of human activity.

(c.) To recover additional fauna from the lower and upper stratigraphic units, and to further explore the patterned co-variation between faunal debris and other items of material culture in an effort to understand the human behavioral, taphonomic, and geologic correlates of the depositional record through time.

(3.) Further investigations of XHP-312 (Locality L) were required to:

(a.) recover a representative sample of lithic and organic artifacts from discrete depositional episodes within the midden in order to clarify the nature of the occupation, historical relationships of the assemblage, and determine site function;

(b.) recover data from features, explore intra-site variation with respect to intra-site activity differences, and to establish patterns of co-variation between faunal elements and the lithic and organic tool assemblage represented;

(c.) recover additional material for radiocarbon dating to insure the chronological placement of the cultural material;

(d.) recover a representative sample of faunal debris for comparison to faunal debris recovered from the lower and

upper components at the Croxton Site. The modelling of relationships between caribou populations and cultural systems required the recovery of an appropriately collected and representative sample from each temporal phase under consideration.

In general, these objectives served to orient the 1982 test excavations at the Croxton Site (Area J) and at XHP-312 (Locality L). Methods and procedures successfully employed in 1981 were continued in 1982 and appropriate sampling strategies specifically designed for the discovery and illumination of spatially discrete activity areas were utilized. Recording procedures were tailored to the recovery of detailed distributional data on occupational surfaces and living floors and with respect to specific types of features. The systematic collection of soil, flotation, and pollen samples from excavation units and feature matrices, supplementary data recovery strategies utilized in 1981 was continued in 1982. A summary of testing procedures, data collection strategies, and research accomplishments for 1982 is provided below.

TESTING PROCEDURES: THE CROXTON SITE

The 1981 and 1982 test excavations at the Croxton Site proceeded from the premise that Areas J and K are related but spatially diverse, formed by a complex series of discrete depositional episodes, and distinguished by relatively well defined midden boundaries. In order to test these presumptions and to recover an adequate and representative sample, a variety of complementary methods and techniques were employed. The 1982 testing plan called for the completion of block excavations started the previous year and for the completion of a randomly selected sample of grid squares at Area J. Test excavations were not conducted at Area K in 1982.

The original research design (Gerlach 1981) required the use of both systematic and simple random sampling procedures to test for the presence at discrete activity areas within the Croxton midden. A variety of factors, however, restricted the completion of a statistically significant random sample in 1981. Utilizing a random numbers table, twenty units were chosen for excavation in 1981 and ten additional units were chosen in 1982. Although thirty test squares constitutes about a 15% sample, it should be noted that it is not a true random sample because only the universe bounded by two 100 foot blocks on either side of the main excavation area was tested. Nevertheless, this strategy served the purpose of demonstrating that the areas chosen systematically for excavation were indeed discrete areas of cultural occupation.

Investigating the potential of what appears to be an unexplored technique for the Arctic, a portable Geometrics proton magnetometer survey of a series of 100 x 100 foot blocks was conducted to locate areas of cultural disturbance, and as a basis for opening block excavations (Figure 3.) in 1981. While all of

the field data are currently being plotted as part of a computer mapping project (Bowers 1981; Huggins 1982) the technique was successful in isolating areas of cultural activity. In virtually every case where a test pit was excavated as a result of an anomalous magnetic reading, hearth areas, charcoal smears, or fire-cracked rock concentrations were encountered at depths ranging from between two inches and four feet below ground surface. Of the 98 squares excavated at Area J in 1982, 88 were chosen to complete block excavations started in 1981. A working map showing the completed excavation units is presented in Figure 4. Because the magnetometer allowed for the quick identification of activity areas in 1981, the 1982 testing program was designed to define the boundaries of these activity areas, discern the artifactual composition of the spatial aggregates, and to discriminate the relative density of artifactual and faunal composition stratigraphically within activity areas.

In summary, testing procedures and excavation methods at Croxton were geared to the discovery and/or definition of activity areas and features, and recording procedures were designed to establish precise spatial and stratigraphic relationships of all cultural debris encountered on activity surfaces and through the excavated levels. Fortunately, cryturbation or other post-depositional processes have not significantly altered the integrity of the various cultural/behavioral episodes represented by the Croxton midden accumulation. The largest excavation unit employed in both 1981 and 1982 was a 4 x 4 ft square, but in most cases provenience of all debris was recorded within 1 x 1 ft quadrants. Standardized four inch levels were the maximum vertical increments employed, although all levels were terminated at natural stratigraphic boundaries and upon encountering obvious activity surfaces. Where living floors or occupational surfaces were discovered, cultural and faunal debris was point plotted and both depth below datum and depth below ground surface recorded. In combination, these procedures yielded detailed distributional data, a better understanding of stratigraphic relationships, and defined the boundaries of some of the activity areas encountered within the midden at Locality J.

Apart from the use of precise recording and excavation procedures, several additional categories of data were systematically collected from the Croxton Site. The rationale and goals of these data collection strategies are described briefly below. In 1981 and 1982 these methods were considered supplements to the collection of all cultural and faunal material from within the tested area.

Soils

In 1981, the excavation of alternate but contiguous 4 x 4 ft squares provided a cross-sectional profile across the Croxton site and yielded information on soil structure, and intra and inter-zonal horizon and matrix attributes. These data should be helpful in establishing the climatic and geological processes

Figure 3. Magnetometer Blocks, XHP-311,

Areas J and K

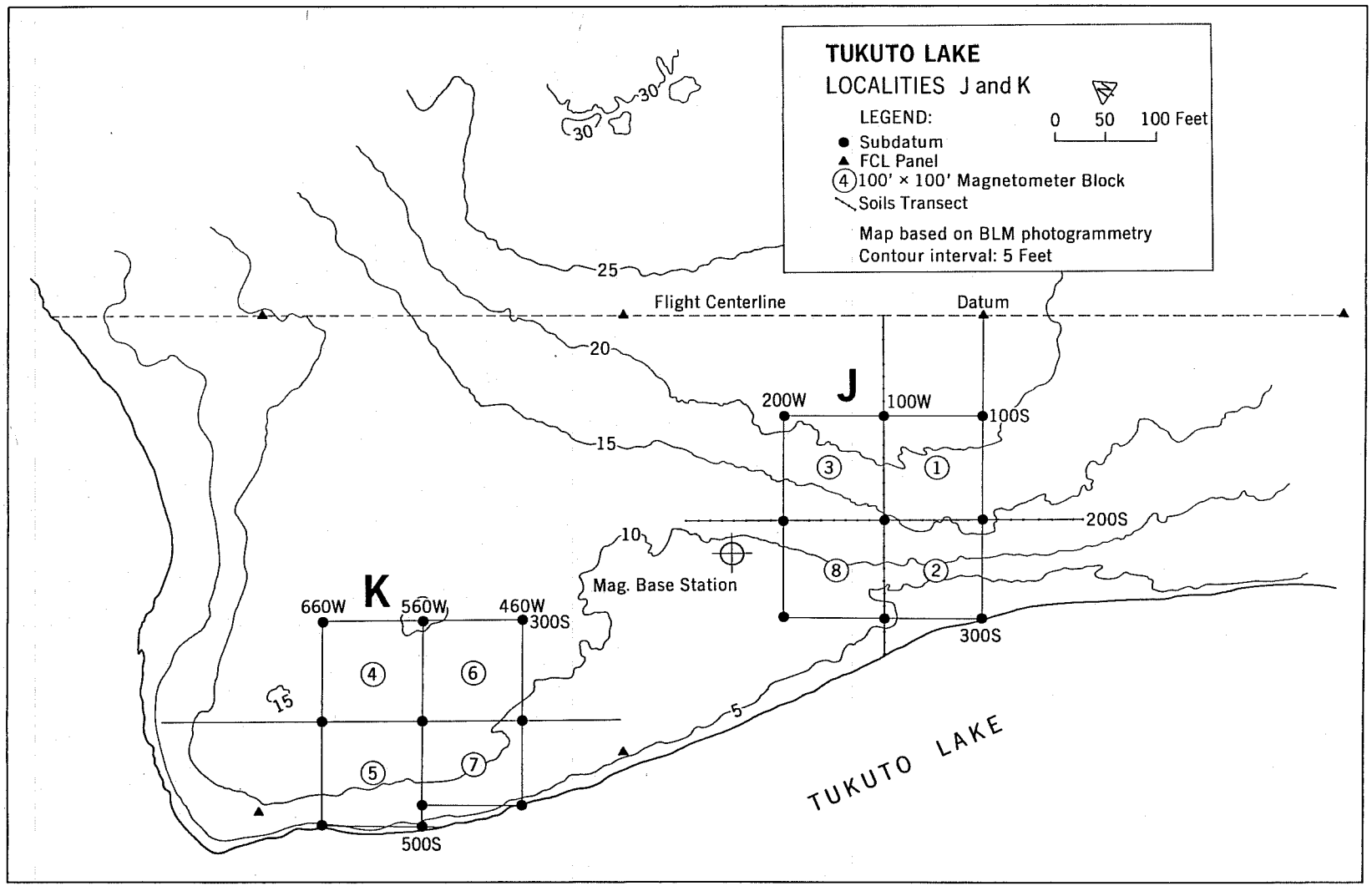
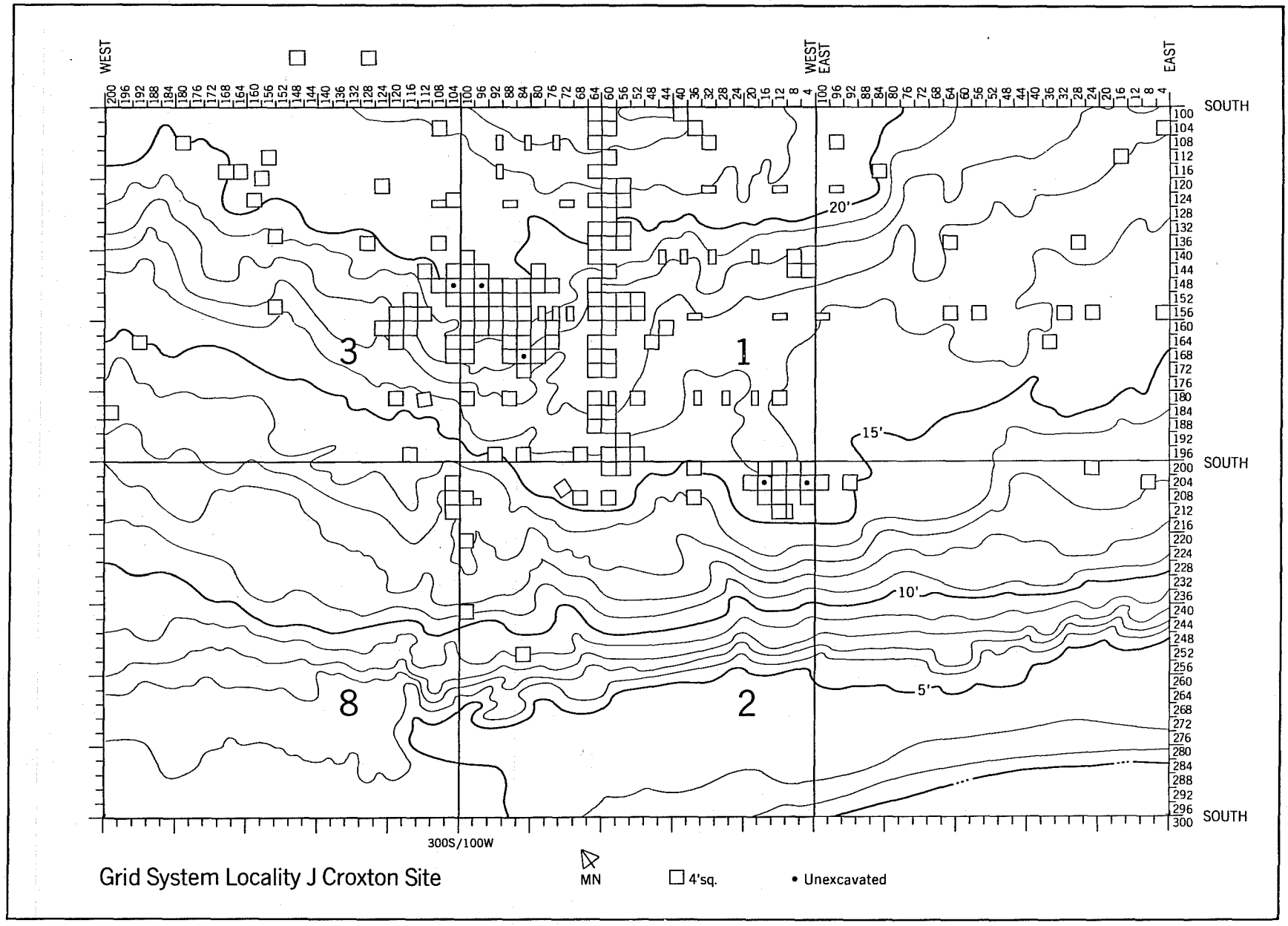

TUKUTO LAKE
LOCALITIES J and K
LEGEND:
0 50 100 Feet
Subdatum
FCL Panel
4 100' × 100' Magnetometer Block
Soils Transect
Map based on BLM photogrammetry
Contour interval: 5 Feet
Flight Centerline
Datum
J
200W
100W
100S
200S
300S
K
660W
560W
460W
300S
500S
Mag. Base Station
30
25
20
15
10
5
TUKUTO LAKE

Figure 4. Excavated Provenience Units at the Croxton Site, Area J

This is a preliminary working map and may be subject to correction.



Grid System Locality J Croxton Site

contributing to soil formation at the site. Supporting data is being sought through the analysis of numerous beetles and beetle parts collected from the soil matrix and by the analysis of pollen samples from the site.

In addition to the profile data, standardized soil samples were also taken from the Croxton Site. In 1981, a sample was collected from every level within each test square. This scale provided the data base for understanding chemical changes, both horizontally and vertically, and will undoubtedly aid in the reconstruction of activity surfaces and in defining the relationship between human disturbance and natural soil formation processes. During the 1982 field season, standardized soil samples were selectively collected from certain grid squares primarily for the purpose of organic matter and textural analysis, rather than specifically for chemical studies. Although the 1982 soil data remain to be analyzed, a preliminary report on a sample of the 1981 soil data is available upon request.

Palynology

Standardized one liter samples of soil were collected from every level of the site in 1981 for pollen analysis. A small percentage of these have been sub-sampled for pollen content by the Department of Geology at Brown University and a preliminary report is now available (Suter and Gerlach 1983). The pollen sampling program was originally designed and executed with two primary purposes in mind. First, to generate a palynological data base that will both monitor the local vegetation and, when compared to multiple sedimentary cores from Tukuto Lake, contribute to a better understanding of the changing relationship between local and regional vegetation patterns over the past five thousand years. Second, it has been hypothesized (Anderson and Gerlach n.d.) that the pollen samples from the site might be useful in isolating episodes of vegetation growth or changes in plant composition indicative of periods of soil enrichment resulting from intense cultural activity. Although pollen recovered from an archaeological site and pollen from a well dated pollen stratigraphic sequence are not precisely comparable, they are both necessary components of the Tukuto Lake palynology project.

The pollen sampling program was continued at Area J in 1982, but on a more limited and selective basis. Rather than collecting from every level within each test square, standardized pollen samples were collected at 5 cm intervals from stratigraphic columns within certain tested areas of the site. Approximately fifty additional pollen samples were recovered in 1982. These data will be used in conjunction with the soil chemistry and sediment analysis for the purpose of understanding stratigraphy and the relationship between soil formation processes and human disturbance.

Summarizing briefly, there is no statistically significant variability in the pollen assemblages identified in the Croxton

site pollen samples. The analyzed soil samples are dominated by pollen from birch, grass, heath and alder. Willow, spruce, sedge and minior herb types are present, but are less abundant. These pollen taxa are typical for arctic-alpine tundra or heathland vegetation. While some pollen types might be indicative of plants that grow well in sandy or disturbed areas (e.g. Artemesia, sedum, Caryophyllaceae, Leguminosae) such as middens, the fact that it has not been possible to identify these pollen types to the species level renders detailed ecological interpretations impossible. It is interesting that the pollen samples exhibit high percentages of birch and relatively low percentages of sedge pollen and spores. The paucity of the latter types is probably a function of differential preservation since these grains quickly decay. Differential preservation may also be responsible for an "artificial" increase in birch percentages.

Even with these minor discrepancies noted, the pollen assemblages from the Croxton site are similar to modern pollen samples collected in the NPR-A (Anderson 1982). The possible exception is herbs which tend to be less abundant in the more recent levels analyzed. Pending analysis of all pollen samples from the site, it may be hypothesized that variability between the Tukuto samples and contemporary analogues with respect to herbs, may signal local rather than regional differences in vegetation. Finally, the analyzed samples from Croxton may be categorized within Livingstones (1955, 1957) alder zone. The persistence of spruce pollen suggests that the samples post-date 5000 BP, and probably fall between 4000-3000 BP (Anderson 1982, Schweger 1976). These are the approximate dates for the initial invasion of spruce into the Kobuk lowlands and the 4000-3000 BP dates approximates the time of increased forestation of the region.

Flotation

In 1981 standardized (48 oz) flotation samples were consistently collected from each excavated level within every test square. This sampling strategy was employed primarily to insure that adequate controls would be available for the precise analysis of flotation samples recovered from features. Samples, or in many cases, the entire fill matrix from each of the excavated features at Croxton were collected in both 1981 and 1982. Because of the flotation sampling procedures utilized in 1981, it was not considered necessary to continue the systematic recovery of soil samples for flotation from all excavated levels in 1982. Instead, samples were collected only from features or from tested areas of the site where special archaeological situations warranted it.

The flotation samples from the Croxton Site are presently being processed at the Laboratory for Circumpolar Studies at Brown University. Experiments with a variety of chemical and water separation techniques are being conducted to insure maximum data recovery and a preliminary report will be available by March of 1983. Since this procedure has never before been employed in Arctic Alaska, there is the potential for contributing data on

analytical methods and the relative cost/benefit ratio of undertaking flotation analysis for this type of stratified Arctic midden. Of special interest at the Croxton Site is the potential for recovering fish remains including skeletal elements, scales and otoliths, that will make possible a more complete reconstruction of the subsistence resource base than a strictly large mammal faunal analysis will allow. At present, fish vertebrae, ribs, small mammal remains and seeds, have been identified in some of the processed flotation samples (Newby 1983).

THE CROXTON SITE: PRELIMINARY RESULTS

The 1981 and 1982 test excavations at the Croxton Site have resulted in the recovery of a significant body of data, including faunal and lithic materials, numerous bone and antler tools, and contextual, provenience and detailed distributional information that will establish the cultural context for the site. Although twenty-four radiocarbon dates from the Croxton Site (Area J) have been secured, additional charcoal and organic samples collected in 1982 remain to be processed. The published radiocarbon dates are presented in Table 1 and the provenience for the samples is listed in Table 2.

Cultural Components and Depositional History

The stratigraphic and cultural sequence at the Croxton Site is now generally well understood. However, the specific details of the depositional history, site formation processes, and the spatial arrangement and superposition of occupational surfaces within stratigraphic zones cannot be formulated until results of all of the studies in progress have been correlated. The cultural deposit is relatively shallow yet stratified, and in most of the tested areas occurs between ground surface and approximately three feet below ground surface. An exception to this was encountered in the test trench where the 1981 and 1982 tests isolated and defined a lower AST+ related activity surface between four and five feet below ground surface. Further testing in 1982 demonstrated that this surface consisted primarily of flaking debris scattered in a generally circular pattern around a well defined hearth area. Additional organic material was recovered from the hearth and will soon be submitted for dating, but it appears on the basis of present information that the hearth defines a single event, dating around 1300 B.C.

The original interpretation of three components at the Croxton Site was confirmed and strengthened by the 1982 test excavations. Precise interpretation is compounded, however, by the fact that within the distinct stratigraphic units there are several spatially overlapping cultural deposits representing, perhaps, seasonal occupations of limited duration. Distributional studies of faunal and lithic material from occupational surfaces will be correlated with geological and stratigraphic information in an effort to define the precise horizontal and vertical relationships of each surface.

The Croxton Site consists of a series of activity areas scattered across an upper and lower terrace. The two terraces probably represent abandoned shoreline deposits that formed during successive periods of rising and falling lake levels. Although the factors responsible for fluctuating lake levels over time are complex, one explanation is that levels at Tukuto and other Arctic Foothills lakes respond directly to increased solifluction associated with periods of relative cold. On the basis of preliminary observations made in 1982, Hamilton (personal communication; Gerlach field notes 1982:66-67) postulates a period of cold beginning about 3,000 years ago, increased solifluction, and a rise in lake level that resulted in formation of the upper terrace (see also Hamilton 1982a, 1982b) This interpretation is supported by the presence of a sorted cobble lens in the basal layer of the midden that is representative of the unvegetated ground surface prior to the earliest occupation of the site. The earliest component at the site appears to have been sealed by a culturally sterile layer of well-sorted gravel, but whether or not lake levels actually rose and deposited the gravel is unknown at present. At the end of 1981, we felt that the gravels were probably a result of glacial activity, but in light of the fact that both the upper and lower terraces are remnants of abandoned shorelines, it is reasonable to suggest that the gravel matrix is of lacustrine origin instead.

Features And Activity Areas

Features identified during the 1981 field season include several hearths, concentrations of burned rock small basin shaped pits, and cache pits located about 75 m south on the first terrace above the modern shoreline. One of the more interesting features excavated in 1981 was an elliptical area of cultural material defined by the presence of well preserved wooden pegs standing upright in an ancient ground surface. These pegs may have been used to stretch caribou hides or may represent remnants of drying racks. Numerous flake knives, large convex and biconvex core tools, debitage, retouched flake tools, bone tools, and numerous end and side blades were recovered in and around this area. Most of our attention in 1982 was directed toward defining the spatial boundaries of this activity area.

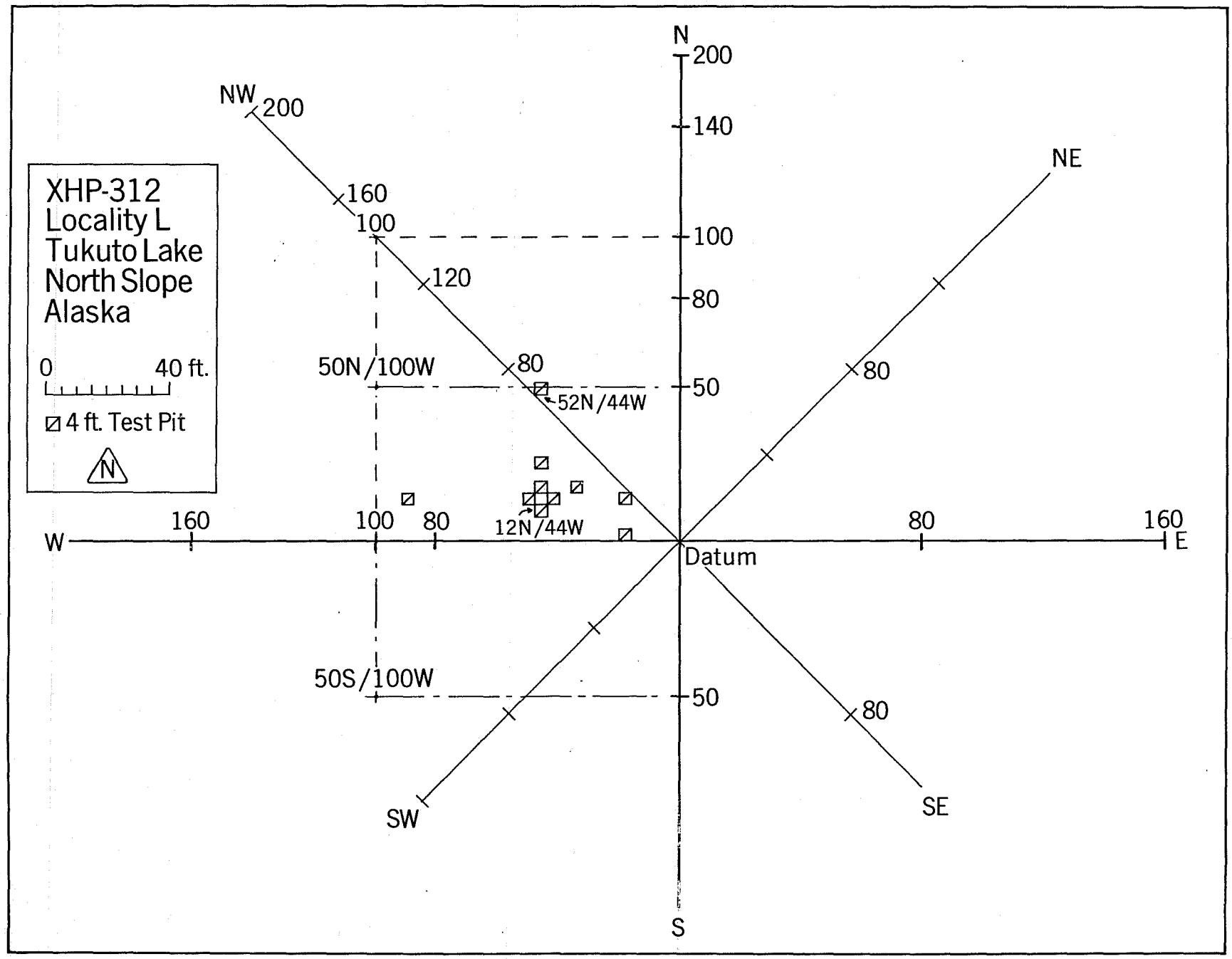
Two large depressions were investigated over the past two seasons of research, but house pits have not been identified at the Croxton Site. Although not necessarily to be expected at a site of this type, dwelling structures, if present at all, were probably temporary constructions of willow frames covered with caribou hides in the manner of the ichelik (Rausch 1951: 159-160; Ingstad 1954: 38-39), rather than the semi-subterranean house associated with the Late Prehistoric/Early historic Inupiat at Tukuto Lake. This interpretation is supported in part by the identification of sod blocks that may have been arranged across several occupational surfaces, and by the presence of hard-packed willow layers encountered throughout the same area. While willow

Figure 5. XHP-312, Locality L.

Grid System, Magnetometer Blocks,

and Location of Test Squares Excavated in 1982

NOTE: This is a working map and may be subject to change.


XHP-312
Locality L
Tukuto Lake
North Slope
Alaska
0
40 ft.
4 ft. Test Pit
N
NW
200
160
100
120
80
50N/100W
52N/44W
12N/44W
N
200
140
100
80
50
NE
80
160
100
80
W
160
80
E
Datum
50S/100W
50
80
SW
SE
S

flooring is a common feature of the caribou skin tent, rocks rather than sod blocks were more commonly employed to anchor the tent to the ground, except, perhaps during the winter months as remembered by the contemporary residents of Anaktuvuk Pass (Corbin 1976). Distributional studies, when completed, may help define those areas where temporary structures were located, if, in fact, the prehistoric Inupiat camped "on site", rather than somewhere else in the vicinity.

The Assemblage: Lithics, Organic And Faunal

The quantity of debris recovered from the Croxton Site over two field seasons is considerable by contrast to many other Brooks Range sites. Approximately 1500 lithic artifacts have been catalogued from the 1981 season and this represents but a fraction of the collection and does not include lithic debitage. It is estimated that an additional 500 - 1000 artifacts were recovered in 1982. Most of the lithic assemblage appears to be comprised of end and side blades, small flake knives, discoidals of varying sizes, and a variery of thick and thin, unfinished and finished bifaces and scrapers. Organic artifacts include tanged antler arrowheads, worked bone and wood pieces, an unidentified fragment of whale bone, birch bark basket fragments, needle cores and needles, antler wedges, and several leister prong fish spears. One rather intricately carved antler art piece was also recovered.

An estimated 1,000 to 2,000 pounds of faunal material was recovered in 1981 and an additional 1,000 pounds was recovered in 1982. Although analysis of this material is in progress, a report on approximately 4,000 bones collected in 1981 is available upon request (Spiess 1982; Spiess and Gerlach 1983). Caribou represent roughly 99% of the total faunal sample, but musk ox, dall sheep, duck, goose, dog, bear, and small mammals are also represented. The data on caribou seasonality indicates that the Croxton Site was utilized from late spring to late fall. This interpretation is based on the study of tooth eruption sequences, foetal bones, antler development, and tooth sectioning. At present, the faunal debris is being analyzed in terms of the refined stratigraphic sequence established in 1982, and with respect to breakage and discard patterns.

SUMMARY OF TEST EXCAVATIONS AT XHP-312 (LOCALITY L)

During the summer of 1982 a limited testing program was conducted at XHP-312. Over a fifteen day period, a permanent east-west and north-south baseline was established (Figure 5.), ten 4 x 4 ft test squares were excavated to sterile sub-soil, and a magnetometer map of sub-surface anomalies was completed. Although this site was considered an integral component of the overall project for 1982, cultural deposits within the tested area proved to be shallow and unstratified, and comprised primarily of flake debris & decomposed bone. The site appears to represent a series of overlapping depositional events scattered across at least a 200 square yd area and is representative of

more than one time period. Because of the unexpected size of XHP-312 and the amount of time that would have been required to sample the site so that the proposed research objectives would be satisfied the decision was made to direct the efforts of the field crew toward completion of test excavations at the Croxton Site instead.

At present, there are two radiocarbon dates available from the hearth area excavated in 1981. Radiocarbon assays of wood charcoal and peat and charcoal provided disappointingly late dates of ca. A.D. 1950 and 1610. (See Table 1.) Although peat is well recognized for yielding dates that are too recent, (Stehli, personal communication), the fact that another late prehistoric or early historic middens with associated house pits are in close proximity to XHP-312 may well be responsible for both radiocarbon contamination through the introduction of charcoal into the site and for the presence of late prehistoric artifacts recovered in 1982. While XHP-312 is still considered to have considerable research potential, a suitable testing strategy would have required more time than it was possible to allot in 1982.

SUMMARY

The Croxton Site, XHP-311, located Tukuto Lake in interior northern Alaska, was the focus of archaeological investigations during the 1981 and 1982 field seasons. The 1981 research was sponsored by the U.S. Geological Survey as part of a combined USGS/BLM cultural resource management program in the National Petroleum Reserve- Alaska, and the 1982 field work was supported in part by independent grants to the author. Several phases of investigation were conducted over two summers and involved a combined total of fifteen crew members for approximately sixteen weeks. In addition to the test excavations at the Croxton Site, a limited testing program was also undertaken at XHP-312, a separate midden located at the southern end of Tukuto Lake. Besides sub-surface testing, ancillary studies currently being conducted by Tukuto Lake Project personnel include computer enhancement of the magnetometer survey, soils, pollen, flotation, faunal, lithic and organic artifact analysis.

The Croxton Site is located on the eastern shore of Tukuto Lake and covers an area of at least 700 yards north-south by 400 yards east-west. Controlled surface collections were not made because most of the site, including both Areas J and K, is covered by moist tussock tundra. The complete sub-surface extent of the site is presently unknown since both the 1981 and 1982 investigations focused on the definition of discrete activity areas located at Area J on the basis of a proton magnetometer survey. Block excavations started in 1981 were completed in 1982. Preliminary results of the sub-surface testing program indicates that there was significant variation in the density of cultural material across the tested area, but until all of the debris is plotted by provenience unit the distributional details cannot be provided.

Excavation methods and sampling strategies used in both field seasons were designed for the discovery and definition of spatially discrete activity areas. Recording procedures were oriented toward the recovery of detailed distributional information on occupational surfaces and living floors. Excavation in both seasons was initiated by removing the overlying tundra mat, and then proceeding in 4 in levels until natural stratigraphic boundaries or distinct occupational surfaces were encountered. In 1981, all chipped stone, bone, and other possible cultural remains were mapped in situ as discovered. Because of time and personnel constraints, the 1982 provenience units were excavated by quadrants (1 x 1 ft squares) instead of mapping all material separately. During excavation of the quadrants only artifacts were plotted, with the remaining material simply being bagged by quadrant. Standardized soil, pollen, and flotation samples were collected for flotation, and in all cases, the fill from features was collected and returned to the laboratory and subjected to a variety of chemical and water separation techniques.

The 1981 interpretation of three cultural components at the Corxton site was confirmed by the 1982 research. Two components are represented by formation of an upper midden that occurs between ground surface and three feet below ground surface, and appears to have been most intensively occupied between A.D. 600-1400. Although most of the material recovered from the upper midden appears to be typologically similar in some respects to the "Ipiutak-like" materials from Desperation and Etivluk Lakes, Feniak Lake, Itkillik Lake and Anaktuvuk Pass, there remains enough differences to raise questions about cultural affiliations. Precise interpretation of the boundary separating the two components within the upper midden is compounded by the dense occurrence of several occupational surfaces within little more than 36 inches of cultural deposit. Although post-depositional processes do not appear to have seriously disturbed the integrity of the upper midden as a whole, the extent to which single surfaces have been disturbed by re-use of the site will not be understood until the problem of the vertical dispersion of cultural material is addressed, and the stylistic and morphological attributes of the assemblage(s) clarified.

The primary considerations in the interpretation of the third component at the Croxton site are the radiocarbon dates and the presence of a lithic industry provisionally assigned to the Denbigh Flint Complex. Test excavations in 1981 revealed a diffuse scatter of cultural debris throughout the lowest occupational horizon. Radiocarbon dates of 2470 and 1730 B.C. have now been secured for this horizon. Excavation in the test trench revealed a dense concentration of artifacts and debris scattered in a patterned arrangement around a single hearth radiocarbon dated between 1300 and 1400 B.C. The artifacts were found in close horizontal association, about four to five feet below ground surface, and represent a limited but intensive use of the site by representatives of the Denbigh Phase of the Arctic Small Tool Tradition. A problem which remains to be addressed is

the origin of the sterile gravel overlying the Denbigh component in this area.

Ongoing research with the Croxton site materials is directed toward clarification of the relationship between the two components contained within the upper midden and the lowest stratigraphic horizon. Changes in lithic assemblage attributes, bone breakage and discard patterns, and separation of the material by activity surface remain intergral components of the research. One crucial problem to be confronted in further studies is the extent to which vertical and horizontal displacement may have mixed assemblages within the upper midden. In addition to analysis of the lithic reduction systems in general, refitting analysis will form part of the research necessary to define the extent of horizontal and vertical displacement (see Hofman 1981a, 1981b).

Appendix A

Appendix A

Labelled Grid Units at the Croxton Site (XHP-311), Area J. The following numbered aluminum tags were attached to the N.E. stake of selected grid units and left in place as a permanent record. These data are on file with the Arctic Resource Area Manager, Bureau of Land Management, Fairbanks, Alaska.

Aluminum Tag Numbers	Grid Square
#715	104S/64W
#885	100S/60W
#892	120S/56W
#721	120S/52W
#824	132S/56W
#889	136S/56W
#776	152S/56W
#717	152S/52W
#819	156S/56W
#842	196S/52W
#846	196S/60W
#724	196S/68W
#832	136S/64W
#837	168S/64W
#723	172S/60W
#910	200S/56W
#728	200S/36W
#850	200S/16W
#862	200S/04W
#877	204S/100E
#726	208S/16W
#888	208S/16W
#902	204S/20W
#901	208S/36W
#893	208S/68W
#845	196S/84W
#896	196S/92W
#760	196S/116W
#746	192S/56W
#921	180S/88W
#914	180S/100W
#806	180S/120W
#714	172S/84W
#763	168S/80W
#998	168S/88W
#851	168S/100W
#767	164S/76W
#868	164S/84W
#820	164S/100W
#906	160S/76W
#811	160S/88W
#856	156S/12W
#871	156S/36W
#822	148S/100W

#805	148S/88W
#829	148S/76W
#876	124S/56W
#770	156S/52W
#920	144S/80W
#852	144S/96W
#815	124S/72W
#722	124S/88W
#924	120S/12W
#823	120S/32W
#750	120S/96E
#733	156S/100E
#810	168S/104W
#739	164S/104W
#774	164S/120W
#996	160S/116W
#865	160S/124W
#873	156S/112W
#769	156S/120W
#803	152S/116W
#814	152S/104W
#765	148S/108W
#863	144S/104W
#809	144S/112W
#813	136S/108W
#918	136S/128W
#816	124S/108W
#727	0 East

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Table 1. Radiocarbon Dates From The

1980 and 1981

Testing Program at Tukuto Lake

Table 1: RADIOCARBON DATES FROM THE 1980 AND 1981 TESTING PROGRAM AT TUKUTO LAKE (FROM GAL 1982: 159-180)

	SITE	LAB NUMBER	MATERIAL DATED	(YEARS B.P.) RADIOCARBON AGE	CULTURAL ASSOCIATION
1	Tukuto Lake Area J; XHP-311	DIC-2460	Wood Charcoal	Too small for counting	Small, thin end and side blades, discoids, flake antler arrowheads, leist parts, bone points, decorative art, knife si blades
2	Tukuto Lake Area J; XHP-311	DIC-2462	Wood Charcoal	Highly Modern	See No. 1
3	Tukuto Lake Area L; XHP-312	DIC-2470	Peat & Charcoal	340+-50	Test Pit #1: side blade thin, well fired, check-stamped, organic temper potsherds
4	Tukuto Lake Area J; XHP-311	DIC-2466	Wood Charcoal	Barely Modern	See No. 1
5	Tukuto Lake Area L; XHP-312	DIC-2467	Wood Charcoal-Large Sample	1950 A.D.	Test Pit 2 - hearth in center of indistinct depression c. 12 cm. from Test Pit 1 (see No. 3)
6	Tukuto Lake Area J; XHP-311	DIC-2464	Wood Charcoal	290-100	See No. 1

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7	Tukuto Lake Area J; XHP-311	DIC-2203	Charcoal & Peat	360+-175	See No. 1
8	Tukuto Lake Area J; XHP-311	DIC-2461	Wood Charcoal	550+-125	See No. 1
9	Tukuto Lake Area J; XHP-311	DIC-2459	Wood Charcoal	570+-45	See No. 1
10	Tukuto Lake Area J; XHP-311	DIC-2468	Wood Charcoal	580+-100	See No. 1
11	Tukuto Lake Area J; XHP-311	DIC-2205	Charcoal	670+-170	See No. 1
12	Tukuto Lake Area J; XHP-311	DIC-2206	Charcoal	710+-215	See No. 1
13	Tukuto Lake Area J; XHP-311	DIC-2458	Willow Sticks	750+-60	See No. 1
14	Tukuto Lake Area J; XHP-311	DIC-2021	Bone Fragments	790+-55	Test Square 1: triangular end blade, side blades, burin spall, flake burin, obsidian

15	Tukuto Lake Area K; XHP-311	DIC-2023	Bone Fragments	870+-50	Test Square 3: small, thin end and side blades, discoids, plano-convex flake core, antler flint flaker, flake knives, knife side blades
16	Tukuto Lake Area J; XHP-311	DIC-2207	Charcoal	910+-65	See No. 1
17	Tukuto Lake Area J; XHP-311	DIC-2019	Bone	980+-55	Test Square 2: discoids, Knife side blade; end and side blade fragments; large thin knife biface fragments burin spall; stack step bur
18	Tukuto Lake Area J; XHP-311	DIC-2463	Willow & Spruce Wood & Wood Charcoal	1040+-50	See No. 1
19	Tukuto Lake Area J; XHP-311	GX-8635	Wood Charcoal	1075+-120	See No. 1
20	Tukuto Lake Area J; XHP-311	GX-8634	Wood Charcoal	1135+-135	See No. 1
21	Tukuto Lake Area K; XHP-311	DIC-2022	Charcoal	1180+-45	See No. 15

Table 2: Provenience of Radiocarbon Samples

From the Croxton Site, Area J

TABLE 2. PROVENIENCE OF RADIOCARBON SAMPLES FROM THE CROXTON SITE, AREA J.

LAB NUMBER	GRID SQUARE	LEVEL	DEPTH BELOW DATUM	DEPTH BELOW SURFACE	RADIOCARBON DATES YEARS B.P.		EXCAVATOR
DIC 2464	204S/16W	2	101"	4-8"	290+-100 BP	AD 1660	SMS & SCG
DIC 2465	156S/88W	5	25.5-27		2210+-55 BP	260 BC	DRG
DIC 2466	156S/96W	3	63.5	12"	TOO SMALL		JEG
DIC 2467	LOCALITY L TEST PIT 2			6-8"	0+-40 BP	AD 1950	RG, PMB, SCG
DIC 2468	156S/100W	3	62-64"	9-11"	580+-180 BP	AD 1370	DRG
DIC 2469	132S/60W	5	56-72"		3350+-60 BP	1400 BC	PMB
DIC 2470	TEST PIT LOCALITY L			6-8"	340+-50 BP	AD 1610	
GX-8633	200S/12W	2	96-100"		1350+-140 BP	AD 600	SM
GX-8634	160S/92W	2	55-57"	5-7"	1135+-135 BP	AD 815	JEG
GX-8635	208S/12W	3	101-105"	6"	1075+-120 BP	AD 875	SM(?)
GX-8636	156S/94W	3	58.25-67"	12"	1670+-160 BP	AD 280	JEG
GX-8637	160S/96W	6	70-71"	20-24"	3680+-205 BP	1730 BC	RJC
DIC 2019	BLM TEST PIT AREA J.*				980+-55 BP	AD 970	MLK
DIC 2020	BLM TEST PIT AREA J.				1260+-65 BP	AD 690	PMB

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DIC 2021	BLM TEST PIT AREA J.*				790+-55 BP	AD 1160	PMB
DIC 2203	156S/64W	1	53"	5"	360+-175 BP	AD 1590	KJR
DIC 2204	100S/64W	5	35-39"	37"	4420+-410/430 BP	BC 2470	DRG
DIC 2205	152S/60W	2	75.5-79"	5-8"	670+-170 BP	AD 1280	JEG SCG
DIC 2206	180S/64W	3	81"	6-10"	710+-215 BP	AD 1270	RJC
DIC 2207	188S/64W	2	98-105.25"	4-8"	910+-65 BP	AD 1040	DM
DIC 2458	208S/104W	5	115-123"		760+-60 BP	AD 1200	ESH
DIC 2459	160S/92W	2		4-8"	570+-45 BP	AD 1380	JEG
DIC 2460	160S/96W	6	70-71"	20-24"	SAMPLE TOO SMALL		RJC
DIC 2461	152S/60W	3	55-57"	5-7"	550+-125 BP	AD 1400	KJR
DIC 2462	208S/12W	3	101-105"	6"	SAMPLE TOO SMALL		SM
DIC 2463	160S/96W	5	68.5"	16-20"	1040+-50 BP	AD 910	RJC

Abbreviations Used In Table 2

PMB = Peter Michael Bowers (BLM)

RJC = Risa J. Carlson (USGS)

SCG = S. Craig Gerlach (USGS)

SMS = Suzanne M. Suter

JEG = J. Eve Griffin (USGS)

DRG = Donna Redding Gubitosa (USGS)

ESH = Edwin S. Hall, Jr. (USGS)

MK = Michael Kunz (BLM)

DM = Debbie Meier (USGS)

SM = Steve Mrozowski (USGS)

KJR = Karl J. Reinhard (USGS)

RG = Robert Gal (BLM)

*Level data for BLM Test Pits not available at time this paper was written.