PRELIMINARY REPORT ON THE ARCHEOLOGICAL SURVEY OF THE UPPER SUSITNA RIVER VALLEY, ALASKA IN CONNECTION WITH THE SUSITNA HYDROPOWER PROJECT, 1980

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Report to:

Secretary
Smithsonian Institution

and

U.S. Department of the Interior
Heritage Conservation and Recreation Service

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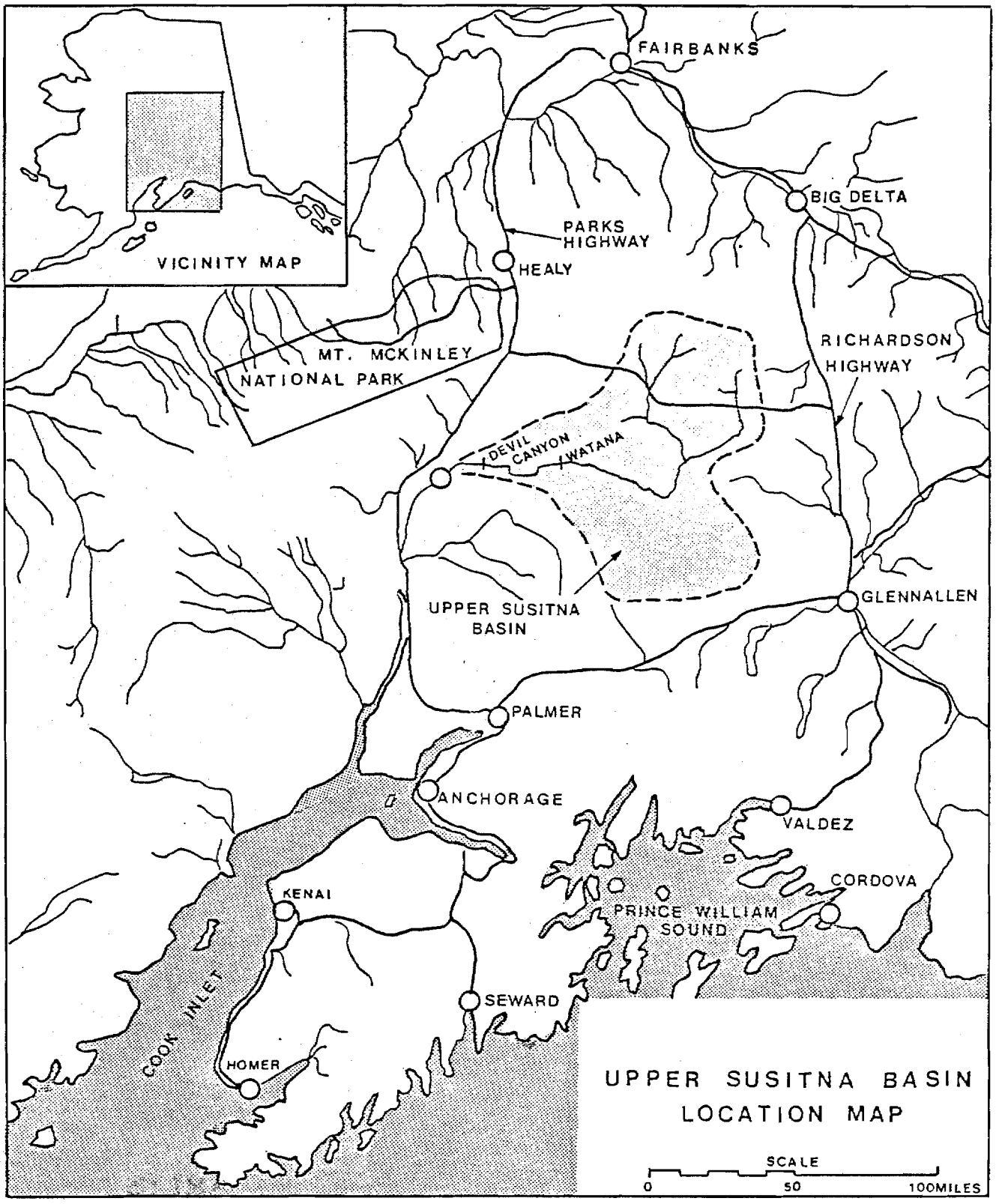
I. INTRODUCTION

The purpose of this two year study is to identify cultural resources within the Susitna Hydropower Project study area, access the impact of the project on these sites, and develop mitigating measures to avoid or lessen the impact of this project on cultural resources.

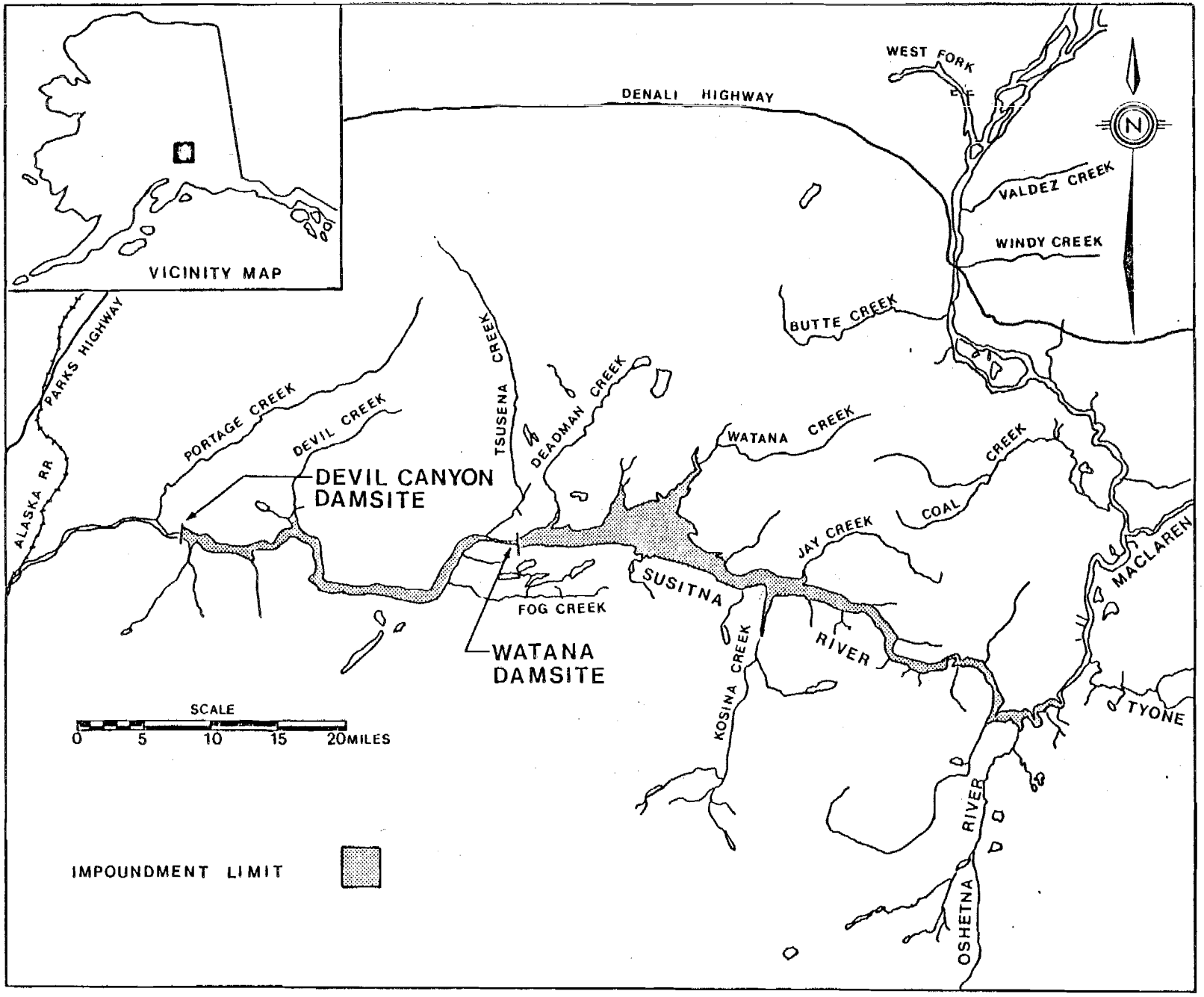
The study area for this cultural resource survey consists of those areas of the Upper Susitna River that are or will receive primary and/or secondary impact during pre-construction activities, construction, and operation of the two dams and support facilities proposed for the Susitna Hydropower Project (Map 1).

The primary plan under consideration at this time is a two dam system with dams at Watana (Map 2) and Devil Canyon (Map 2). It is anticipated that the Watana am will be built first and would consist of an 810 foot high earthfill structure located at river mile 165. The reservior would extend 54 miles upstream and have a surface area of approximately 43,000 acres (Map 2). The Devil Canyon dam would consist of a concrete thin-arch dam with a maximum structural height of 635 feet. The Devil Canyon reservior would inundate about 7,500 acres and 28 miles of natural river (Map 2). Transmission lines from the dams to Fairbanks and Anchorage would consist of approximately 365 miles of double tower lines (Corps of Engineers 1978). In addition several access roads and a railroad are proposed. However, the exact routes have not been determined at this time.

As specified by federal and state laws and regulations, cultural resources must be considered in connection with any federally funded or licensed project. Because the Susitna Hydropower project is a federally licensed project, the framework and authority, as outlined in these laws and regulations, have been incorporated into the present cultural resource study.



Map 1: Upper Susitna Basin.



Map 2: Location of Proposed Dams on the Upper Susitna.

In order to comply with these rules and regulations and provide the necessary data for securing the Federal Energy License required, the University of Alaska Museum developed a five step, two-year cultural resource program. These steps are as follows:

1. Preparation for field studies.
2. Reconnaissance level archeological survey of the project area.
3. Intensive testing of archeological and historical sites.
4. Analysis and final report preparation.
5. Curation of cultural and paleontological materials.

These five steps are aimed at fulfilling the two main objectives of the project which are:

1. Identification of archeological, historical and paleontological resources in the project area; and
2. Testing and evaluation of these resources in order to determine significance and propose mitigation measures to lessen the impact of ground disturbing activities on cultural resources.

All known historical and archeological sites have been plotted on 1:63,360 USGS maps. Archeological sites that could be relocated in the Watana Dam area were tagged with the appropriate state number.

A. DISCUSSION OF STEPS

Prefield Season Tasks--Step I

Prior to initiating field investigations during the summer of 1980, the University of Alaska Museum executed the following tasks:

-Applied for, and secured a Federal Antiquities Permit and state documents necessary for the archeological portion of the project. (Office of Archeology and Historic Preservation, Interagency

Services Division, National Park Service, U.S. Department of the Interior, Washington, D.C. 20204; State Archeologist's Office, State of Alaska, Department of Natural Resources, State Division of Parks, Anchorage, Alaska.)

-Conducted an exhaustive literature review of available documents that pertain to the history, prehistory, ethnography, geology, flora, fauna, and late Pleistocene and Holocene geology of the areas covered by this project.

-The results of the literature search were used to synthesize the regional and local cultural chronology of the study area as well as to provide the basis for the research design.

-Air photos of the study area were examined and their interpretation focused on the identification of probable areas containing cultural resources.

-Known historic and archeological sites were plotted on 1:63,360 scale maps and a preliminary aerial reconnaissance of the project area was conducted.

-Utilizing the information base produced by the above research, a research design was developed to include a sound professional sampling strategy specifically designed for the unique needs of this project.

-Following formulation of the research design and sampling designs, essential personnel for the field protion of the project were recruited.

Archeological Reconnaissance 1980--Step II

The purpose of this step was to identify, locate, and inventory archeological and historical sites. These sites will later be subject to more intensive study. As specified in 36 CFR 66 (Federal

Register, Vol. 42, No. 19), a reconnaissance level survey should be used only as a preliminary tool prior to intensive survey. The information gathered during Step II of this project will form the data base for intensive survey in Step III, scheduled for 1981.

As it is not the intent of a reconnaissance level survey to cover 100 percent of the study area, specific areas were selected for survey. Within these areas field crews implemented surface and subsurface testing procedures in order to locate, document, and inventory historic and prehistoric sites. This site-specific data will be used to develop and direct Step III studies. Aerial reconnaissance was conducted at the preselected areas in order to enhance site location during Step II. Available aerial photographs, as well as LANDSAT photos, were reviewed for all preselected areas to aid in locating potential site areas.

During Step II the dam impoundment, borrow areas, auger holes, bore holes, seismic lines and a proposed airstrip were also field surveyed. The proposed primary transmission route will be field surveyed at a later date, as part of the post-license application studies.

Intensive Survey--Step III

Step III, schedule for the 1981 field season, consists of intensive testing of sites located during the reconnaissance survey (Step II) of the project. Grids will be established at each site and a sampling scheme applied for testing. Each square selected for test excavation will be systematically excavated and all artifacts and features recorded, using standard archeological field methods. Site maps and soil profiles will also be prepared. Photographs will be taken to document artifacts and features in situ as well as to document the site and its location. Site limits will be recovered for analysis and evaluation. Based on the analysis of this material,

National Register criteria will be applied to determine if the site is eligible for inclusion in the National Register of Historic Places as specified in the Federal regulations that apply to this project.

Intensive testing will also provide the means for evaluating the effects of the preconstruction and construction phases of the Susitna Hydropower Project on cultural resources. Each site will be evaluated and recommendations as to mitigating measures will be made and incorporated into the final report.

Analysis and Report Preparation--Step IV

This step is an integral part of each step of the project. It entails compilation of the individual reports for the other steps of the project as well as synthesizes all data recovered and makes appropriate recommendations for mitigation, if necessary. Step IV is specially aimed at the final analysis of the project in terms of sites located and documented during the other steps. The final report will include the location, description, and mitigation recommendation for each site reported during Steps I, II, and III. Step IV will include mitigation recommendations, if necessary, for the sites located, and an estimated budget for an archeological excavation that must be done prior to the start of actual construction of the Hydropower Project as sepcified by federal and state regulations. The overall effectiveness of the research design, field procedures, and analysis will be discussed. A full-scale report, including sections on the vegetation, fauna, geology, history, prehistory, and native population will be part of the report.

Recording of Recovered Collections and Supporting Documentation--Step V

Recording of recovered artifactual material and associated contextual data will be an ongoing program throughout the duration of the project. All recovered material and supporting documentation

will be housed at the University of Alaska Museum and registered in accordance with state and federal requirements pertinent to the preservation of antiquities.

II. SUMMARY OF METHODOLOGY AND RESEARCH STRATEGY

In preparation for field studies, a research design based on the current data base, literature review, and other pertinent information was developed. For this project, the research design integrates the current data base into a cultural chronological framework (Fig. 1), and develops a research strategy that is structured to gather data necessary to predict site locations in relation to physical and topographic features in the project area. Application of the reserach design has: 1) allowed the identification of many of the resources located in the project area; and 2) targeted areas demonstrating high probability of site presence.

The reconnaissance level archeological survey for the project consists of on-the-ground survey and testing. The sampling design employed during 1980 was a stratified random sampling procedure. Survey during the 1980 field season has been conducted in certain areas that are being directly affected by preconstruction activities such as seismic lines and trenches, borrow areas, access roads, drilling sites, and aircraft landing sites, as well as preselected sampling locales in the proposed impoundment areas for the Devil Canyon and Watana Dams.

The 1980 field season consisted of a reconnaissance level survey within selected sampling locales. Selection of the locales was based on the application of the data base. In total, 60 sampling locales were defined between Devil Canyon and the end of the impoundment area (Maps 4-9, Appendix A). Each sampling locale was numbered in the order it was identified, starting at Devil Canyon.

Within each sampling locale, surface reconnaissance and subsurface testing was conducted in an effort to locate historical and archeological sites. For each locale surveyed, maps depicting areas surveyed and the location of all test pits have been prepared. In addition, geological

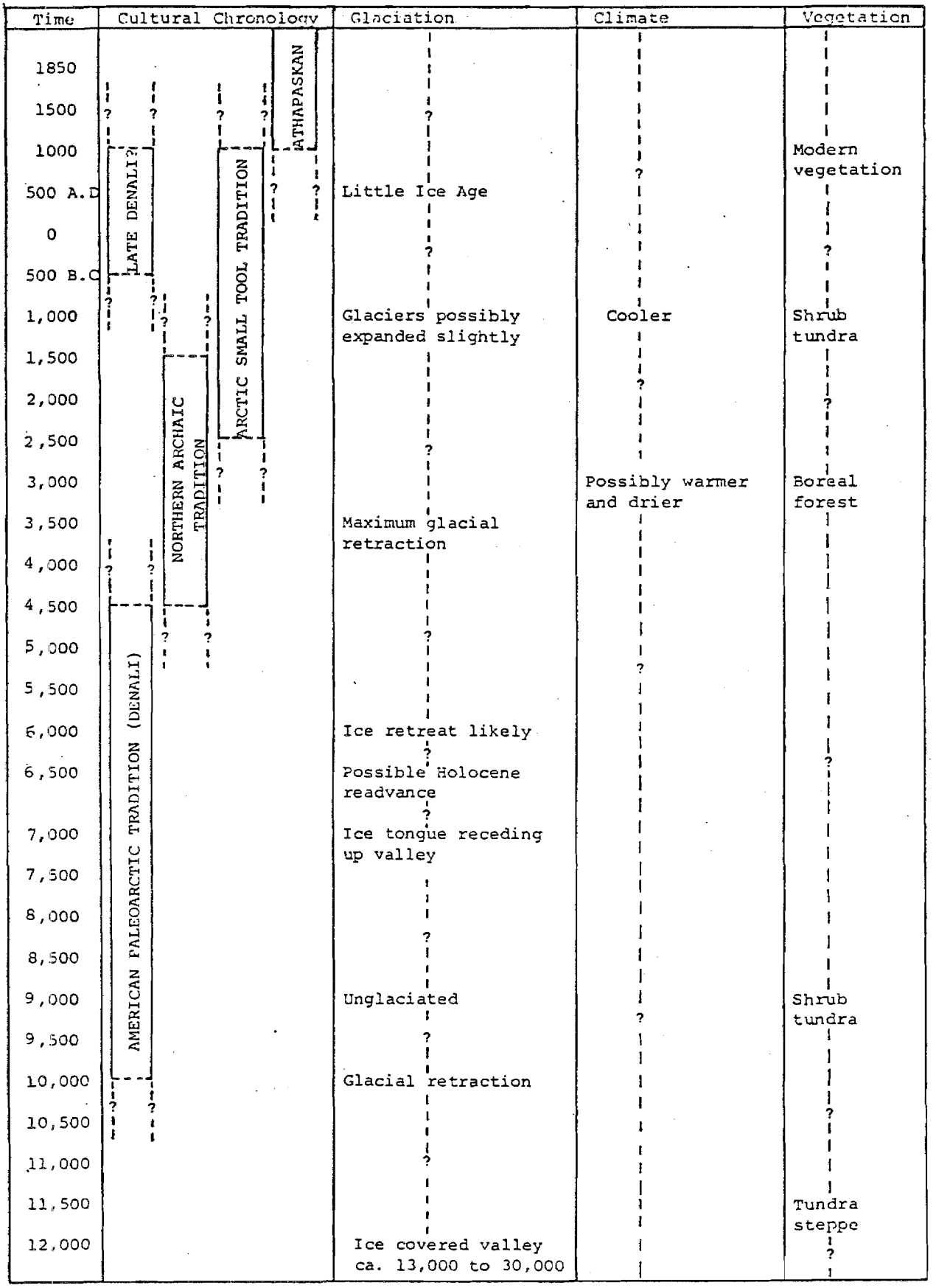


Figure 1. Speculative Cultural Chronology and Inferred Glacial, Climatological and Vegetational Regimes of the Susitna Valley.

unit evaluation forms have been completed for each locale surveyed. The purpose of the unit evaluation is to ground truth geological data as well as to provide data for developing sampling design for those areas not subject to survey in 1980.

For each of the 33 sites located during 1980, site evaluation forms have been completed in an effort to organize data collection. In addition, a site location map showing the location of sites in relation to major land forms, and a site specific map, showing the tests made and location of artifacts noted at each site has also been completed for each of the sites located to date.

Artifacts collected have been organized by test and site and forwarded to the University of Alaska Museum for cataloging and subsequent analysis.

An analysis of the data derived from the literature search focusing on site locales has established that archeological sites occur in a non-random pattern in relation to associated physical, topographic, and ecological features. Based on the analysis of site locational data from regions adjacent to the study area, the features characteristically associated with archeological site occurrence are:

1. Overlooks: Locales of higher topographic relief than much of the surrounding terrain. They are characteristically well drained and command a panormaic view of the surrounding region. It is generally inferred that overlooks served as hunting locales and/or possibly short term camp sites. Because these sites occur in elevated areas, soil deposition is generally thin and they are frequently easily discovered through subsurface testing or examination of natural exposures. Examples of sites ascribed to the Denali Complex which occur in this setting are the Campus Site, Donnelly Ridge, Susitna Lake, and the Teklanika sites. Northern Archaic Tradition sites also known to occur on overlooks are the Campus Site, some sites in the Tangle Lakes area, Susitna Lake, the Ratekin Site, and a site near the Watana Dam Project Area. Archeological sites ascribed to the Arctic Small Tool Tradition frequently occur on

overlooks; however, no positively identified Arctic Small Tool sites situated on overlooks have yet been reported from the study area or regions immediately adjacent to it. The Nenana River Gorge site, some of the Tangle Lakes sites, and Lake Susitna are all Athapaskan period sites which occur on overlooks.

2. Lake Margins: Sites ascribed to all defined traditions have been discovered on the margins of major lakes. It is generally inferred that they are frequently more permanent seasonal camps and that fishing, the exploitation of fresh water aquatic resources and large mammal hunting were the primary economic activities associated with these sites. These inferences are primarily based on the location of these sites rather than an analysis of faunal and artifactual material. Sites on lake margins may exhibit greater soil deposition than overlooks because of their lower topographic position. Sites in this setting are frequently discovered through sub-surface testing, the observation of surface features, or through the examination of natural exposures. Athapaskan sites on lake margins include those at Lake Minchumina, Healy Lake, Tangle Lakes, Lake Susitna, Lake Louise, and Lake Tyone. Archeological sites ascribed to the Arctic Small Tool Tradition are reported to occur on lake margins and an example is the Norton component reported at Lake Minchumina. At Lake Minchumina, Healy Lake, Tangle Lakes, Susitna Lake and Stephen Lake sites which may be ascribed to the Northern Archaic Tradition are known to occur on lake margins. Denali Complex sites which have been found near lakes include the Tangle Lakes sites, Lake Minchumina, Healy Lake, Long Lake, and Lake Susitna.

3. Stream and River Margins: Numerous sites have been reported along the banks or abandoned channels of streams and rivers. They vary from large semi-permanent seasonal camps to what appear to be brief transient camps. Soil deposition at such locales may be greater than either lake or overlook sites because of the low topographic setting of streams and an active agent (the stream or river) for soil deposition. Sites may be discovered through the examination of natural exposures, subsurface testing, and visual observation of cultural features. Denali

Complex sites reported along stream and river margins or abandoned channels include Dry Creek, Carlo Creek, and the Campus site. Northern Archaic Tradition sites found in this type of locale are Dry Creek and the Campus site. The Merrill site, which is ascribed to the Norton period of the Arctic Small Tool Tradition, is a former meander of the Kenai River. Athapaskan sites on stream and river margins include Dixthada, Dakah De'nin's Village and the Nenana River Gorge site.

It can easily be noted in the review of site locational data that many sites have been subject to reoccupation and share more than one of the defined physical, topographic, or ecological features characteristic of archeological site locales. It would appear that there may be a compounding effect in human utilization of a locale, if more than one of these major variables occur, thus possibly increasing the probability of its use and subsequent reuse. It is also recognized that this analysis is limited because it does not address known chronological and settlement pattern gaps in the archeological record. Additionally, sites such as caves, rock shelters, quarry sites, etc., are not reported immediately adjacent to the study area, although they may occur in the Susitna region. By focusing initial survey efforts in these locales as well as natural exposures, it is anticipated that most of the archeological sites which can be easily discovered will be found during initial stages of the project. thus providing maximum time for eveluation and planning to insure their protection.

However, a problem in the delineation of the topographic, physical and ecological features listed above is that a variety of specific settings are subsumed under these general categories and little precise detail about individual sites is available. One objective of the 1980 research strategy was to attempt to obtain more precise data relevant to prehistoric settlement patterns and the juxtaposition of individual sites in relation to the natural environment. It is anticipated that analysis of this data will increase predictability for locating archeological sites. Additionally, this examination may permit detailed analysis of shifting subsistence patterns during various cultural historical periods which in turn may enable correlation of changing settlement patterns with environmental changes.

Field work in 1980 gathered detailed information such as the kind of feature on which a site is located, topographic position and elevation, slope, exposure, view, stratigraphy, as well as details about the surrounding terrain. This specific kind of information should enable an analysis of settlement patterns in relation to lakes, streams, rivers and areas of high topographic relief. Kinds of streams, lakes, and rivers on which sites are found were recorded as well. A Site Survey Form was developed which outlined the specific kinds of information to be recorded. Similar information was also recorded at locales where test pits did not yield cultural evidence to facilitate analysis of areas where sites do not occur.

The present research is based on a two field season plan designed to provide feedback data throughout the project so that new data can be used to modify, refine and further develop the cultural resources investigations. The three primary objectives of the 1980 field research program were: 1) examination of the areas which will be immediately affected by the study of the Susitna Hydropower project (proposed airstrips, borrow areas, drilling locales, etc.); 2) survey and testing of the documented archeological site locales explicated above by systematically surveying the surficial geological/morphological units defined during the air photo analysis and interpretation; and 3) an on-the-ground evaluation of all the geologic/morphologic units within the study area.

The efforts of the 1981 field season will focus on: 1) survey of additional areas slated for construction or preconstruction disturbance; 2) testing of sites discovered during the 1980 field season to determine spatial limits, depth of deposits, stratigraphic placement of cultural materials, possible age and function of sites, etc.; and 3) the implementation of a sampling procedure applied to each of the strata developed from the analysis of the geologic/morphologic units.

Reconnaissance survey data collected in 1980 will be used to develop the sampling strategy employed in the second season, and to initially analyze archeological site distribution and locales within the project

area. The second season's sampling and intensive testing will provide a basis for the assessment of individual site significance, and obtain data which will hopefully enable a specific and thorough analysis of settlement patterns through time.

During the second field season a sampling design will be used to test for subsurface archeological sites. The sampling design will be developed for the Devil Canyon and Watana Dam construction sites and impoundment areas, since the actual location of these have been established. The sampling design will follow standard stratified random sampling procedures for the defined sampling strata. The purpose of the 1981 sampling will be to test for archeological site occurrence in a representative number of randomly selected locales for each strata in an attempt to obtain additional data pertinent to prehistoric settlement and land use patterns within different physical and topographic settings through time. In addition to continued survey and sampling, testing will be conducted at sites located during both seasons. Testing is necessary to evaluate these sites for archeological significance, define the spatial and temporal limits, and propose mitigating measures.

III. PRELIMINARY RESULTS OF 1980 FIELD SEASON

A. RESULTS -- ARCHEOLOGY

Surface and subsurface sampling conducted within the selected sampling locales resulted in the location and recording of one historic and 32 prehistoric sites. Culture periods which may be represented include the Denali Complex, Northern Archaic Tradition/ Late Denali, Late Prehistoric Athapaskan, and Historic, all of which were predicted to occur in the Upper Susitna Valley by the research design/procedures manual developed for the cultural resource section of the Susitna Hydropower project. Preliminary data on the sites located are presented below.

Site UA-80-68

The site is located on a high ridge on the west side of Kosina Creek, approximately 1 km below the confluence of Kosina and Gilbert Creek (Map 7). The site location provides an excellent view of Kosina Creek to the south and much of the terrain to the north, east, and west for approximately 5 km. The site may consist of several loci (A, B, and C). However, further evaluation is needed to determine if these are actually individual loci of the same site or individual sites. For the present, they will be considered as loci of the same site.

Cultural material collected from this site includes approximately 228 flakes of various lithologies including rhyolite, chert, and basalt, four scrapers and the mid-section of a projectile point. A total of six tests were excavated at all three loci.

Charcoal from a possible hearth at locus B produced a date of (DICARB 1878) 1160 ± 100 years: AD 890.

Site UA-80-69

The site is located in borrow area E on the east bank of Tsusena Creek near its confluence with the Susitna River (Map 4). The view from the site is limited to the immediate areas of both Tsusena Creek and the Susitna River due to dense vegetation and low elevation.

Cultural material collected from the five tests made at this site is limited to fire cracked rock and faunal material. Test 1 produced a possible stone ringed hearth. A charcoal sample was taken from this feature produced a modern date (DICARB 1874).

Site UA-80-70

The site is located in barrow area E on the north shore of the Susitna River near an unnamed creek west of Tsusena Creek (Map 4). The view from the site is minimal due to its low elevation and dense vegetation. The sits consists of the remains of a log cabin and associated debris.

Artifacts noted on the surface include a frying pan, coffee cans, glass jars, stove pipe, canvas, cans, milled lumber, the rubber sole from a shoe, and various pieces of what appears to be a dog sled. The four subsurface tests made at the site did not locate any additional cultural material. Based on the type and condition of the log structure and the debris located in and near the cabin, the site likely represents a period between 1930 and 1950.

Site UA-80-71

The site is located on the northern border of barrow E west of a small stream on a point of land extending south along an old river terrace (Map 4). Without the dense vegetation, the view from this site would include the area south, east, and west of the site all the way to the Susitna River, a distance of some .5 km.

Only one artifact was recovered from the five test pits placed on the site, a large cortex flake between 20-30 cm below the surface. The age or function of the site is not known at this time.

Site UA-80-72

The site is located on hill south of the Susitna River and approximately 3.5 km SW of the mouth of Watana Creek (Map 5). The view from the site is excellent in all directions for a distance of over 10 km.

Most of the cultural material recovered was collected as surface material. However, two of the three tests produced a total of three flakes. Material types include chert, jasper, and a possible obsidian or smokey quartz flake. A core table was also collected. The age or function of the site remains to be determined.

Site UA-80-73

The site is located on a peninsula of land on the north shore of the Susitna River across from Goose Creek (Map 8). The location of the site provides a view up Goose Creek, as well as both upstream and downstream on the Susitna River.

The cultural material recovered includes one flake and one side scraper. In addition, a possible hearth was located in the eroding bluff face of the site. The age or function of the site is not known at this time.

Site UA-80-74

The site is located on a high knoll on the south shore of the Susitna River, approximately 1 km SW of borrow area E (Map 4). The view is very good in all directions with only minor obstructions in a few areas due to tall trees downslope.

Three test pits were excavated at this site, all of which produced cultural material. A total of 36 flakes were collected from these tests, the deepest being recovered from 28 cm below the surface. Test one produced nine large patinated pale green rhyolite flakes between 19 and 24 cm below the surface, several of which show retouch or use wear. Material types consist of rhyolite and basalt. Further testing is needed to establish site age and function.

Site UA-80-75

The site is located on the west side of the Susitna River on an esker approximately 2.5 km below the mouth of the Tyone River (Map 8). The view from the site is good in all directions, however, the view is limited by the fairly low elevation of the site.

To date, only two waste flakes have been recovered from this site. The age and function of the site is unknown at present.

Site UA-80-76

The site is located on a low terrace SE of the knoll on which UA-80-74 is located (Map 4). The best view from this site is north, towards the Susitna River. A small unnamed stream is located just east of the site.

A total of five test pits were excavated at this site. However, only test one produced any cultural material. This test produced a total of 219 waste flakes representing three material types; chert, quartz, and basalt. The age or function of the site is not known at this time.

Site UA-80-77

The site is located on the west side of Fog Creek, approximately 1 km above its mouth on a high river terrace (Map 4).

A total of five test pits were excavated on the site, four of which produced cultural material. In addition, cultural material was recovered along a game trail which traverses the site. Material collected includes side notched projectile points, several scrapers, a bifacial backed knife blade, a possible core tablet and two blades. In addition, over 400 waste flakes were recovered. Two charcoal samples were submitted yeilding dates of (DICAB 1877) 2310 ± 220 years: 360 BC and (DICARB 1880) 4720 ± 130 years: 2770 BC.

Site UA-80-78

The site is located on a high ridge system on the north shore of the Susitna River, approximately 3 km downstream from the mouth of Kosina Creek (Map 5). The location of this site provides an excellent view of the Susitna River upstream for almost 6 km and downstream for another 2 km.

A total of three test pits were excavated on this site but the only artifact recovered, an end scraper was recovered on the surface. The age and function of the site is not known at this time.

Site UA-80-79

The site is located on a high ridge system on the north shore of the Susitna River, approximately 3 km downstream from the mouth of Kosina Creek (Map 5). The location of the site provides a view of a small lake and surrounding terrain to the north of the site.

The one test pit excavated at this site did not produce any cultural material, however, surface material collected includes several scrapers and retouched flakes, as well as a possible notched hammer stone. Various lithologies are represented including basalt, rhyolite, chalcedony, and jadeite. The age or function of the site is not known at this time.

Site UA-80-80

The site is located on the outlet stream of a small lake on the north side of the Susitna River, approximately 3 km downstream from the mouth of Kosina Creek (Map 5). The view from the site is limited but does include portions of the outlet stream and the terrace below the lake towards the Susitna River.

A total of four test pits were excavated on the site, producing one brown chert biface. The age or function of the site are not known at this time.

Site UA-80-142

This site is located on an old river terrace west of the mouth of Tsusena Creek, in borrow area E (Map 4). The view from the site includes most of borrow area E.

The two test pits excavated at the site produced a total of five waste flakes. The age and function of the site are not known at this time.

Site UA-80-141

The site is located on an old river terrace on the north shore of the Susitna River, approximately 2 km downstream from Fog Creek (Map 4). Due to the dense vegetation and low elevation of the site, the view is restricted.

Of the two test pits excavated on the site, only test 1 produced cultural material, two rhyolite flakes. The age and function of the site are not known at this time.

Site UA-80-143

The site is located on a high ridge on the north shore of the Susitna River, approximately 3 km downstream from the mouth of Kosina Creek (Map 5). The location of the site provides an excellent view of several small lakes on the same ridge complex, as well as portions of the Susitna River.

The one test excavated at the site did not produce any cultural material, however, two specimens were collected on the surface, one waste flake, and a unifacial scraper. The age or function of the site is not known at this time.

Site UA-80-144

The site is located on a high ridge system on the north shore of the Susitna River, approximately 3 km downstream from the mouth of Kosina Creek (Map 5). The view from the site is excellent in all directions.

The one test pit excavated on the site did not produce any cultural material, however, two waste flakes were collected, and two more were noted on the surface. The age or function of the site is not known at this time.

Site UA-80-145

The site is located on a small terrace lobe approximately 11 km above the mouth of Watana Creek (Map 5). The view from the site is excellent in all directions.

Three of the four tests excavated on the site produced bone material. In addition, faunal material was recovered from the eroding slope on the northern portion of the site. No lithic material was recovered at this site. The age and function of the site are not known at this time.

Site UA-80-146

The site is located on a prominent knob on the south shore of the largest lake just east of Watana Creek (Map 5). The view from the site encompasses all of the lake as well as a distance of some 1 km in all directions.

Of the three tests excavated on the site only test one produced cultural mateiral, i.e., fifteen flakes representing several lithologies. The age or function of the site is not known at this time.

Site UA-80-147

The site is located on the south shore of the Susitna River across from the mouth of a clear water stream approximately 12 km upriver from Watana Creek (Map 5). The site is situated on an alluvial terrace approximately 40 m from the river and about 30 m above the Susitna River. The view from the site is limited to the immediate portions of the river.

Of the two tests excavated on the site only test one produced cultural material, i.e., two waste flakes, and burned bone fragments. The age or function of the site is not known at this time.

Site UA-80-148

The site is located on a small knoll 1.5 km west of Fog Creek approximately 6 km above the mouth of the creek (Map 4). The view from the site is excellent for some 300 m despite the low elevation of the knoll.

Only one waste flake was surface collected at the site although three small tests were placed on this feature.

Site UA-80-149

The site is located on a northeast trending ridge on the crest of a southeast facing slope overlooking the Susitna River between Goose Creek and the Oshetna River (Map 8). The view is excellent to the east and includes a good portion of the Susitna River.

The site is composed of two loci (A and B) located approximately 150 m apart. Surface collections at locus A include 27 waste flakes, 1 retouched flake, 2 blade-like flakes, and 1 biface fragment. Only one of the two tests excavated at this locus produced cultural material, i.e., 7 waste flakes. Locus B is located north of locus A but in the same topographic setting. A total of five waste flakes and a side notched projectile point base were recovered from the surface at this locus. Of the two tests excavated, only test one produced cultural material: 8 waste flakes and one end scraper fragment. Age and function of this site remains to be demonstrated.

Site UA-80-150

The site is located on a high terrace on the north side of the Susitna River on an unnamed creek between Watana Creek and Deadman Creek (Map 5). The view from the site is limited due to the dense vegetation.

No lithic material was recovered at the site but two of the three tests yielded burned bone. The age or function are unknown at this time.

Site UA-80-151

The site is located on one of several high hills on the north side of the Susitna River west of Kosina Creek (Map 6). The view

from the site is excellent providing not only a view of the immediate area but portions of the Susitna River as well.

A complete lanceolate point of siliceous rhyodacite was surface collected and five separate waste flake scatters were noted. The one test made on the site produced lithic material and burned bone fragments. The age or function of the site is not known at this time.

Site UA-80-152

The site is located on one of several high hills on the north side of the Susitna River west of Kosina Creek (Map 6). The view from the site is excellent to the north. However, the view in other directions is limited due to nearby hills.

The site consists of two locus (A and B). Locus A is the largest and contains two lithic scatters. The one test excavated at this locus yielded a possible hearth as well as lithic material and burned bone. Locus B is located approximately 100 m east of locus A. A number of lithic artifacts and burned bone fragments were collected at this locus including one complete chert lancolate projectile point. The age or function of the site is not known at this time.

Site UA-80-153

The site is located on the north side of the Susitna River west of Kosina Creek (Map 6). The view from the site is excellent and includes the valley to the north and most of the surrounding terrain.

Four lithic scatters representing several lithologies were noted at the site. In addition to burned bone fragments, two projectile point bases and an end scraper were also recovered. A charcoal sample taken from a possible hearth in test two produced a radiocarbon date of 2340 ± 145 years: 390 BC (DIC-1903).

Site UA-80-154

The site is located on the south side of the Susitna River on a high terrace approximately 22 km upstream from Kosina Creek (Map 7). The site provides an excellent view of the Susitna River for approximately 4 km in both directions.

Twenty-seven waste flakes representing various lithologies were recovered on the surface of this site. Another seventy were noted on the surface but not collected. Neither of the two tests placed on the site produced any subsurface material. The age and function of the site is not known at this time.

Site UA-80-155

The site is located on the northwest shore of the largest lake just west of Watana Creek (Map 5). The knoll on which the site is located provides an excellent view of the entire lake with the exception of a small portion obscured by a low knoll on the opposite shore.

Four tests were excavated at this site. However, test one produced the only artifact; a bifacially worked tool. The age of the site or its function is not known at this time.

Site UA-80-156

The site is located on a high ridge approximately 1 km north of the Oshetna River on the east side of the Susitna River (Map 8). The site provides an excellent view of the Susitna River to the north and south as well as portions of the Oshetna River.

Of the three tests made only test one produced any cultural material; one flake. The age or function of the site is not known at this time.

Site UA-80-157

The site is located at the mouth of an unnamed creek on the north shore of the Susitna River approximately 10 km upstream from the mouth of Watana Creek (Map 5). The view from the site is limited to the immediate area of the Susitna River.

No lithic artifacts were recovered from the site. However, burned animal bones and fire cracked rock were recovered during subsurface testing in test one. This test may contain two separate hearths. A charcoal sample from this test produced a date of 280 ± 110 years: AD 1670 (BIC-1905).

Site UA-80-158

The site is located on the eastern edge of borrow area F on the north side of a large lake just east of Tsusena Creek (Map 4). The location of the site on a small knoll affords a view for several km in all directions.

Of the five test pits placed on the knoll only test one produced cultural material; five waste flakes. The age or function of the site is not known at this time.

Site UA-80-159

The site is located on one of several low hills on the north shore of the Susitna River approximately 4 km north of the mouth of Kosina Creek and about 4 km northwest of the mouth of Jay Creek (Map 6). The view from the site includes protions of the Susitna River as well as the immediate area surrounding the hill.

Two lithic scatters identified as locus A and B were noted at the site. Surface collections at locus A consists of 8 waste flakes of various lithologies, a point base and a biface fragement. One

projectile point fragment was found on the surface at locus B. The only test pit on the site was excavated at locus A and produced cultural material at a depth of 7 cm below the surface. The age or function of the site is not known at this time.

Site UA-80-160

The site is located on a low hill on the north side of the Susitna River approximately 4 km north of the mouth of Kosina Creek and 3 km west of Jay Creek. The view from the site includes portions of the Susitna River as well as the immediate area surrounding the hill (Map 6).

The site consists of two loci (A and B) which are separated by approximately 200 m. Most of the lithic material collected was collected from the surface. However, test one at locus A produced a waste flake from 10 cm below the surface. The age of the site or site function are not known at this time.

Sites UA-80-252, UA-80-253, UA-80-254, and Ua-80-255

Four additional sites were found after the field season and will be recorded during the 1981 field season and discussed in the 1982 final report.

B. RESULTS -- PALEONTOLOGY

Tertiary sediments exposed along Watana Creek one mile from the confluence with the Susitna River and extending approximately five miles upstream have been measured and sampled to date. Orientated samples have also been collected for paleomagnetic studies. In addition, paleoflora specimens have been collected from a number of locales along Watana Creek.

Sections of the tertiary basin have been measured, described, and sampled. A basal contact with Triassic deposits was found beneath Tertiary siltstones, sandstones and coals. Combustion of coal units in this section resulted in "baking" of adjacent deposits, from which extensive paleoflora collections were made. An additional collection of fossil flora was collected from a calcareous siltstone unit. Preliminary analysis is still in progress.

C. RESULTS -- GEOLOGY

Reconnaissance Air-Photo Mapping

During May a regional map of the Susitna Valley was prepared for a first-order interpretation of the geologic history and terrain-units to be studied by the archeologists. The map extended to at least 10 km and usually 15-20 km from the Susitna River. Units, which were defined completely from air-photo interpretation, were subdivided on the basis of age and surface characteristics. This map, though not detailed in the immediate vicinity of the Susitna Canyon, was used in the archeologic research design. Because this map is no longer being used in our study, it will not be discussed further.

Field Study

Field studies were carried out during June and August, and relied almost completely on helicopters for logistical support. Four major objectives of the field program were to ground truth and reinterpret the regional geo-archeologic map, to carry out a regional stratigraphic reconnaissance, to help interpret and describe significant archeologic sites, and to examine some of the more critical glacial-geomorphologic features in the region near the proposed impoundment area.

1. Aerial Reconnaissance. The first field objective was to get a regional overview of the Susitna Valley in order to become familiar with the distribution and range in surface landforms and deposits, and to examine the potential for stratigraphic work. In addition, this overview was necessary to examine the mapping done from air-photos in order to test its reliability and accuracy. This reconnaissance was done in conjunction with project archeologists in order to provide collective agreement on the basis for revised mapping. This joint examination allowed the geologist and archeologists to define the map units that best accommodate both needs.

2. Stratigraphic Reconnaissance. A second objective was to determine the number and quality of river bluff exposures that might provide stratigraphic information needed to interpret and date the major valley-forming geologic events. After a "fly-by" look at all river bluffs along the Susitna and all of the tributaries from the Chulitna River to the Tyone River, 25 exposures were selected for further study. Those not selected for further study were observed from the helicopters, and only briefly described. At each selected exposure the entire bluff face was examined, and a selected stratigraphic section was measured. The sediments were divided into significant natural units, and the character and height of each unit was described above "recent high water" which was used as an altitude datum. Study of each exposure resulted in a detailed sketch and description of units, including the character of the surface above the exposure. In addition to measuring and describing all units, as many as possible were sampled for various reasons. Organic matter in key units was sampled whenever possible for radiocarbon dating. Organic horizons with well preserved plant macrofossils were sampled for paleobotannical analysis. Some sediment units were sampled to obtain a representative sample of the unit lithology. In addition, many exposures contained one or more volcanic ash layers, which were occasionally sampled.

3. Archeologic Sites. During the field season the geologist visited many of the archeologic sites described, particularly those that were well stratified. Geologic descriptions of the sediment units and regional relationships at the sites greatly aided in site interpretation.

4. Geomorphic Reconnaissance. A final field objective was to examine the landforms within the study area. Major glacial moraines, deltas, lake plains, eskers, and terraces were described and their heights and gradients measured. Most examination was done from the air, but many glacial-geologic features were studied on the ground. Also the geomorphic character of each of the geo-archeologic terrain units within the impoundment area were briefly described from the air.

Revised Geo-Archeologic Terrain Unit Mapping

During June a week was spent refining the earlier map to make it more detailed, and therefore more useful for archeologic purposes. Twenty-six units were defined and mapped directly on the U-2 images. During the map revision much more attention was focused on surface relief and drainage characteristics of each unit than on its estimated age. This mapping was done within the field season because the archeologists needed to have the best possible data available for the remainder of the season. This mapping is not included in this report because it has not yet been transferred to the 1:63,000 scale base maps, and because another map revision is intended. However, verbal description of geo-archeological units is provided. It was realized during the field season that a new revision was necessary for two reasons. First, R&M Consultants are preparing a very detailed terrain-unit map for the proposed impoundment area which they agreeded to share. Also, the 1:2000 scale high-quality color air photos are now available. These larger-scale photos will allow refinement of the 1:120,000 scale maps used earlier.

Data Organization and Compiliation

Between September and December the field data was organized, clarified and tabulated where possible. All short written descriptions were transferred to the 1:63,360 scale base maps. All stratigraphic diagrams and descriptions were redrawn and edited, respectively. All samples were double-checked and curated, and a detailed list was prepared. All photographs were labeled and keyed to geologic steps and exposures. In addition, partial re-examination of the air-photos resulted in the beginning of a glacial-geomorphic map for the Susitna Region.

Investigation and Dating of Samples

Nine organic samples were submitted for radiocarbon dating, and all have provided good dates for key stratigraphic horizons. One faunal sample of a fossil mammoth(?) was examined and identified by University of Alaska scientists. One paleobotannical sample has been tentatively identified by the herbarium staff at the University of Alaska Museum. One tephra sample has been submitted to Pullman, Washington for bulk- and trace-element analysis.

Geo-Archeologic Terrain Unit Mapping

After regional reconnaissance mapping, which was partly illustrated in our August 5 semi-annual report (Subtask 7.06), the geo-archeologic units were revised and remapped. Units were crudely divided by age (Glacial and Holocene) into two first order categories. Second order categories include rock surfaces (R), drift (D), ice contact terrain (I), outwash (O), lacustrine (L), valley wall features (V), alluvium (A), slope deposits (S), and marshy bog areas (M).

Units mapped as glacial (G) in age include all erosional or depositional surfaces modified by ice during glaciation. The highest peaks in the study area, many of which stood above the limit, are

also included as glacial units because their surfaces were intesely affected by frost shattering and mass movement at that time. Units mapped as Holocene (H), include all those of non-glacial origin that clearly post date final ice wastage in the valley bottoms.

Rock surfaces (R) include all those modified by glacier erosion. Surfaces are commonly rounded, but include some open flat areas, and some very steep slopes. Drainage is usually excellent, and soil cover minimal. Tundra vegetation is usually thin and patchy. Unit R is divided into four subunits; hills (h), surfaces (s), valley walls (b), and drift covered (d). Subunit h indicates that the rock unit described occurs as part of an isolated hill or complex of hills. Subunit s indicates where horizontal or sloping bedrock exists in varying relief from S_1 (low local relief) to S_3 (high local relief). Subunit b is used where rock occurs as part of a broadly sloping valley wall, most commonly that of an abandoned glacial trough. Subunit d indicates where patchy drift occurs on rock surfaces, but where the bedrock structure still controls the local relief.

Drift surfaces (D) are those areas of low local relief thickly mantled with glacial till. Because the till is commonly dense, silt rich, and impermeable slopes are typically poorly drained and tussock covered. Subunit t indicates where the drift is thick, obscuring all bedrock structures. Local relief is very low, but gullying is common. Subunit P refers to patchy drift. Poorly drained areas dominate, but they are interspersed with well drained, usually high relief bedrock areas. Subunit U refers to undifferentiated drift. Surfaces generally are nearly flat and poorly drained, but commonly contain irregular zones of hummocky ice contact stratified drift (icsd) that are locally well drained.

Unit (I) indicates concentrations of ice contact stratified drift, which formed over broad areas by depositon associated with stagnant ice. Surfaces are generally gravelly, windswept, free of

dense vegetation, and very well drained. Ridges and mounds of irregular pattern are the most common, but elongate features such as individual glacial moraines and eskers are also included within this group because all features grade one into another. Subunit o refers to open hummocky areas where the icsd has subdued local relief. Broad swales and mounds form the dominant pattern. Surfaces are only moderately well drained and generally brush-covered. Subunit t indicates areas of tightly nested ridges and swales in a dense well-drained chaotic pattern. Subunit p refers to patchy areas of well drained gravelly icsd overlying bedrock. Relief is generally low, but sharp.

Glacial outwash O mantles areas of low gradient with little surface relief. Surfaces are generally well-drained and forest- or brush-covered. Subunit p indicates broad areas of continuous outwash plains. Subunit v indicates valley train deposits consisting of low flat valley-bottom outwash. Subunit f indicates fans of outwash, commonly at the mouths of tributaries that carried glacial meltwater.

Lacustrine (L) surfaces are generally low, very poorly drained areas mantled with fine grained lake deposits. Earthflows typically occur where slopes are greater than several degrees, but generally the surfaces are stable, and tussock-covered. The subunit m is used where lacustrine deposits mantle the underlying land forms, but not obscure them. Subunit s is used where the deposits are thick enough to obscure the underlying land forms completely.

Areas mapped as V indicate those steep slopes which resulted from either Holocene downcutting or from Holocene modification of existing steep slopes by colluviation. These areas are typically cut into bedrock, but thick deposits of drift form the upper parts of the valley walls in many areas. Subunit g is used where the valley walls along the Susitna River or in tributaries are densely

dissected by gullies. Terrain is very steep and irregular. Subunit s indicates where steep valley walls are not greatly dissected. These areas often contain a thick mantle of colluvium at the bases of slopes.

Alluvium (A) indicates coarse gravel surfaces of low relief that formed from fluvial deposition. Surfaces are generally well drained, thickly sloping, and exhibit gentle gradients. Subunit s refers to alluvial terraces along the Susitna River. These terraces commonly exhibit well defined overflow drainage channels. Recent alluvium that forms the forested gravel bars of the Susitna River was not mapped separately. Subunit t refers to tributary floor and fan alluvium. These terraces discontinuously mantle the floors of many tributaries.

Slope deposits (S) indicate those large areas thickly mantled by or modified by slope deposits or processes, respectively. These areas are invariably poorly drained, and are mantled by non-sorted mixed deposits. Subunit c indicates colluvial slopes, commonly near the base of steep valley walls. Subunit s indicate areas overlain by solifluction deposits.

Areas mantled by organic accumulations which occur in expansive bogs are indicated by Unit M. These areas are still essentially undrained, and contain numerous small ponds.

Stratigraphic Framework

River bluff exposures provided an excellent opportunity to partially interpret the evolution of the Susitna Valley. A brief description of the sediments exposed in the region is followed by a more detailed discussion of those exposures that have been radiocarbon-dated.

Portage Creek was the farthest west tributary studied. The creek exposes little sediment more than 20 km upstream, but sediments were common between 5 and 15 km upstream. They consisted of dense silty till, clay-rich lacustrine sediments and coarse outwash, and suggest that Portage Creek was at one time covered by a proglacial lake.

Between Portage and Devil Creek the valley walls are composed almost entirely of bedrock, but significant thicknesses of glacial sediment mantle the valley bottom and are exposed at river level. Just downstream from Devil Creek 5-20 m of coarse bouldery gravel overlies glacial till and oxidized fluvial sediments. Eskers are common at the surface. Just upstream from the proposed Devils Canyon damsite 30-40 m of silty icsd and possibly till occur to river level. These sediments collectively indicate that Devils Canyon was carved some time before glaciers left the area, and that much of the valley may have been carved prior to glaciation. The valley here carried glacial meltwater westward during subsequent ice stagnation.

Between Devil Creek and Fog Creek morainal deposits and till mantle the broadened valley floor. Eskers and ice contact drift are common, but exposures are generally poor. Between Fog and Tsusena Creeks exposures are better, but generally exhibit only lacustrine and morainal icsd over a dense till and bedrock substrate. Good exposures of glacial sediment become even more rare between Tsusena and Watana Creeks, as the valley walls steepen and bedrock occurs at the surface.

Near and upstream in Watana Creek significant thick masses of surficial sediment are present and excellently exposed. Lacustrine deposits typically occur above till throughout this area but large masses of icsd are also present. Between Watana Creek and the drainage of Clarence Lake, the valley is very broad, hence exposures are generally low. They exhibit lacustrine and morainal icsd, till,

and outwash, and become better exposed to the east. Between the Clarence Lake drainage, and the steep V-shaped canyon (V-Canyon) exposures of deltaic and ice contact sediments extend nearly the full height of the valley in some areas. Clearly the receeding glaciers deposited much material here, much of it in proglacially ponded lakes.

Between V-Canyon and Goose Creek sediments are exposed only near the base of the valley walls. There they exhibit interlayered till, lacustrine, and gravel units that suggest a complicated glacial history for this area. In the area of intense meandering of the Susitna River near the Oshetna River a number of excellent exposures are present. They contain lacustrine deposits, outwash, icsd, and till and indicate a prolonged glacial history in which outwash deposition was dominant. Deposition has been the rule here, rather than glacial erosion. East of the meander zone the valley opens up into a broad basin floored with glacial moraines and lacustrine deposits. Sandy deltaic and silty glaciolacustrine deposits are widely exposed.

Four exposures contained organic horizons that have been radiocarbon-dated (Table 1). These dated sediments provide a chronologic framework to which undated sediments and inferred events can be correlated.

Tyone Bluff is a 200 m long river bluff that exposes 53 m of deposits of variable origin (Fig. 1a). The oldest layer (Unit 1) is layered and rhythmically bedded silt and fine sand which is interpreted to be glaciolacustrine. Unit 2 is 13 m of ripple marked, cross bedded, and interbedded fine sand and silt that gradationally overlies Unit 1 and is interpreted as basin-margin lacustrine sediment. Detrital wood fragments from an allochthonous peat horizon in a fluvial lens near its top yielded a date of 31,070 $^{+860}_{-960}$ ^{14}C yr BP. Fine gravels of Unit 3 may represent continued fluvial deposition in the basin after it filled or possibly after it drained. The collagen

Table 1
RADIOCARBON DATES PERTAINING TO REGIONAL STRATIGRAPHY -
SUSITNA VALLEY

^{14}C yr BP	MATERIAL	LOCATION	SIGNIFICANCE
2210 ± 70 (DIC-1858)	Compressed Wood	Earthflow Bluff (2 km South Fog Creek)	Minimum age for valley-floor drift.
3200 ± 195 (DIC-1860)	Woody Peat	Tyone Bluff (1 km up Tyone River)	Close minimum age for tephra.
11,535 ± 140 (BETA-1821)	Peaty Silt	Thaw Bluff (2 km upstream from Tyone River)	Close minimum age for last glaciation.
21,730 ± 390 (DIC-1861)	Woody Peat	Tyone Bluff	Maximum age for last glaciation.
24,900 ± 325 (BETA-1822)	Large Wood Fragment	Oshetna Mouth (0.5 km west Oshetna River)	Recessional ice contact stratified drift.
29,450 ± 610 (BETA-1819)	Collagen from Mammoth(?) bone	Tyone Bluff	Interstadial gravel deposition.
30,700 $^{+260}_{-1230}$ (DIC-1859)	Large Wood Fragments	Earthflow Bluff	Maximum age for last glaciation.

Table 1 (Cont.)

31,070 $^{+860}_{-960}$ (DIC-1862)	Detrital Wood Fragments	Tyone Bluff	Fluvial reworking of basin-margin glaciolacustrine sediments.
32,000 ± 2735 (BETA-1820)	Detrital Wood Fragments	Thaw Bluff	Fluvial reworking of basin-margin glaciolacustrine sediments.

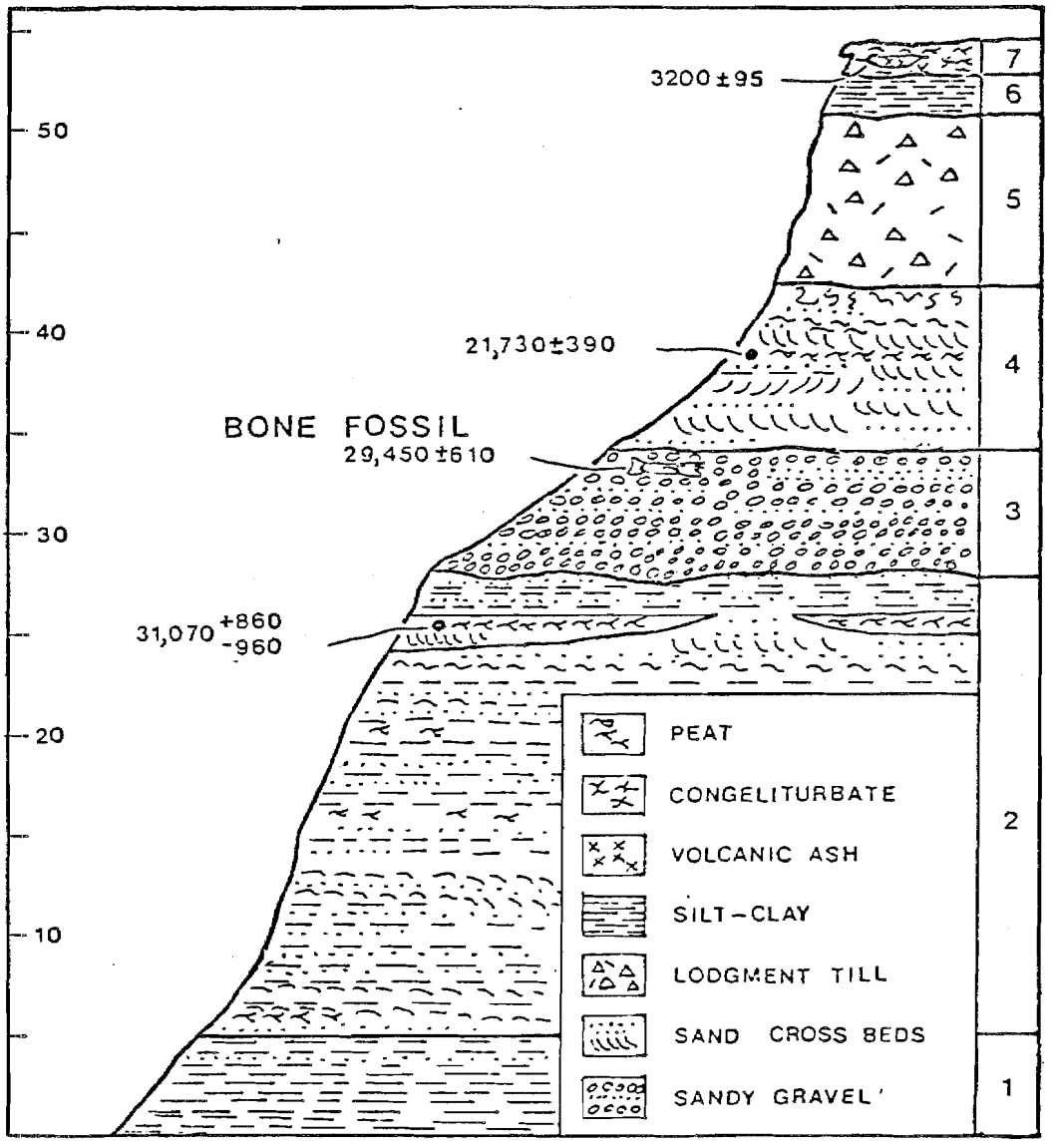


Figure 1a: Generalized Stratigraphic Section of Tyone Bluff.

fraction from a mammoth (?) limb bone from near the top of Unit 3 yielded a radiocarbon date of 29,450 ± 610 ^{14}C yr BP. Unit 3 grades upward into the cross-bedded sand of Unit 4. The upper 2 m of Unit 4 is silty possibly reflecting glaciolacustrine deposition. A date of 21,730 ± 390 ^{14}C yr BP was obtained from a peat horizon in Unit 4. Unit 5 is a 9 m-thick massive dense lodgment till. Unit 6 is laminated silt and clay with dropstones, indicating a glaciolacustrine origin. Unit 7 consists of silty organic colluvium that contains a white vitric volcanic ash layer near its top. The ash is overlain by a dense surface peat which yielded a basal radiocarbon date of 3200 ± 95 ^{14}C yr BP.

These deposits are interpreted to indicate the progressive filling or draining of a large proglacial lake followed by fluvial deposition and overriding of the area by glacial ice. During deglaciation the area was submerged below a vast proglacial lake. Reworking of the older sediments and ash deposition characterized Holocene time. The four radiocarbon dates indicate that glaciation may have been initiated sometime before about 31,000 yr BP but that the Tyone lowland was not ice covered until sometime after about 21,700 yr BP. Glaciers probably occupied the area for a long time, but clearly retreated prior to 3200 yr BP.

Thaw Bluff lies along the Susitna River about 1 km north of Tyone Bluff (Fig. 2). It exposes a lower massive unit of varved glaciolacustrine sediments, (Unit 2) the top of which was slightly reworked and contained small wood fragments that yielded a date of 32,000 ± 2735 ^{14}C yr BP. The cross-bedded fluvial sand of Unit 2 overlies the lacustrine deposits in sharp angular unconformity. The upper unit (3) in interpreted to be thaw lake sediments or organic fluvial silt that was deposited after glaciation of the region. It yielded a date of 11,535 ± 140 ^{14}C yr BP.

The lower lacustrine sediments of Thaw Bluff are clearly correlative to similar deposits in Tyone Bluff, and indicate glaciolacustrine conditions as early as 32,000 yr BP. The fluvial sand unit probably represents

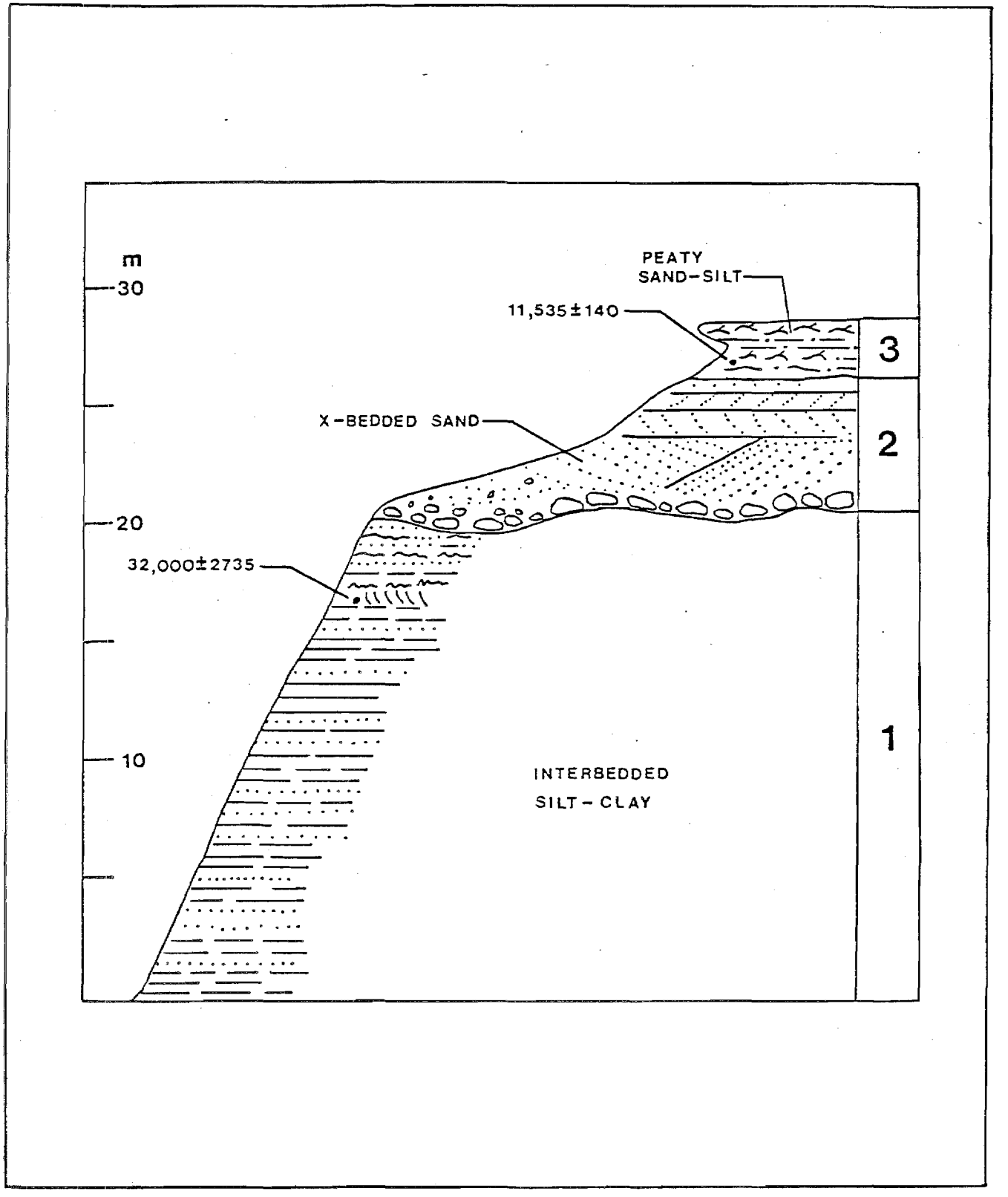


Figure 2: Generalized Stratigraphic Section of Thaw Bluff.

reworking of the bluff area during deglaciation. The date of about 11,500 yr BP indicates that this broad area, which was covered by at least several hundred meters of ice was completely deglaciated prior to Holocene time.

Oshetna-mouth Bluff, which lies along the southern Susitna Valley wall just downstream from the Oshetna River, is an enigmatic exposure (Fig. 3). The bulk of the sediments to the upstream side are poorly sorted and bouldery, and are interpreted as ice contact drift deposited in a northerly direction from an active glacier. Discrete organic layers in the drift contained several large wood fragments which yielded a date of 24,900 ± 325 ^{14}C yr BP. These deposits grade downslope into sandy well washed, faulted deposits interpreted as ice-contact deltaic in origin. These sediments are underlain by a till layer interpreted as lodgment in origin, which in turn overlies clearly varved deformed glaciolacustrine deposits. A thin and poorly defined till layer occurs near the top of the bluff, but it cannot be determined whether this is a lodgment till or flow till layer. A large cut-and-fill wedge of coarse bouldery gravel to the north end of the exposure is interpreted as outwash that was deposited during deglaciation.

The drift containing the dated wood sample is interpreted as recessional in origin, yet it indicates active glaciation at a time in which nonglacial conditions were present at Tyone Bluff. It is possible that the Oshetna Valley glacier acted as a separate and out-of-phase glacier system with respect to glaciation of the lowland to the east. The till at the top of the exposure may be all that remains of a once more extensive till layer that may have formed when glacier ice innundated the entire area some time after 21,000 yr BP.

Earthflow Bluff is located 2 km south of the mouth of Fog Creek, about 70 km west of the other dated exposures (Fig. 4). Oxidized sandy fine fluvial gravel near the base of the exposure contains abundant pieces of large wood, and is interpreted as interstadial in character. A date of 30,700 $^{+260}_{-1280}$ ^{14}C yr BP was obtained from near the base of this

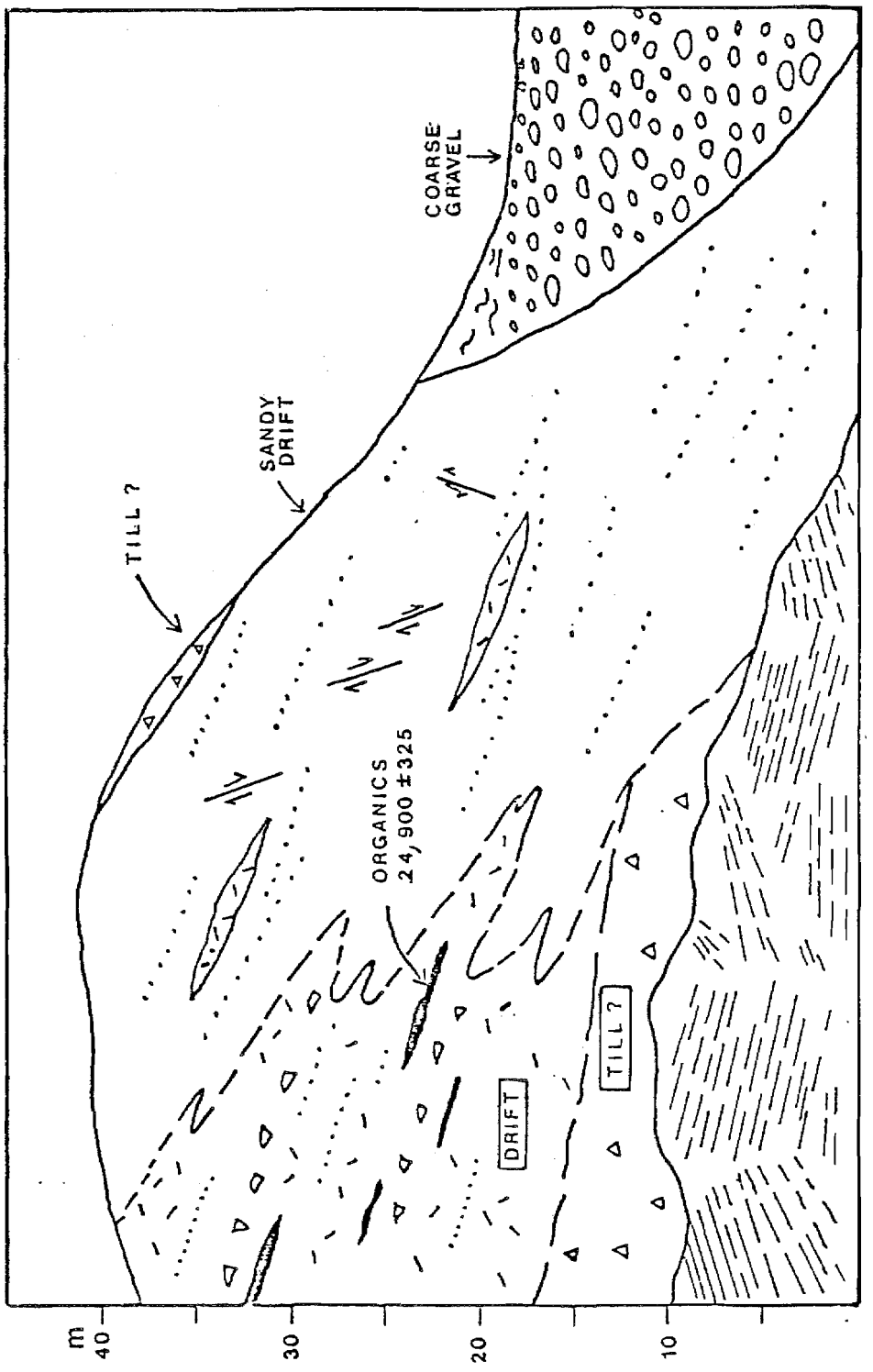


Figure 3: Generalized Stratigraphic Section of Oshetna-mouth Bluff.

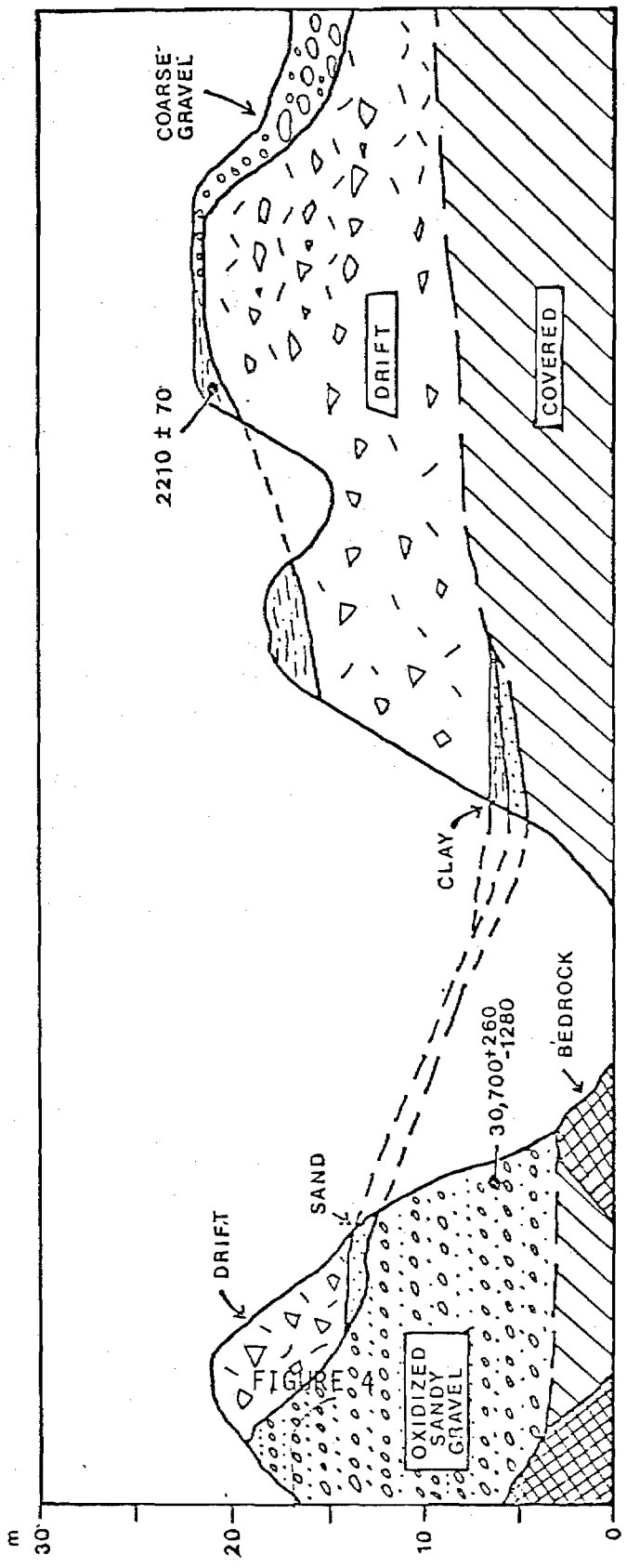


FIGURE 4

Figure 4: Generalized Stratigraphic Section of Earthflow Bluff.

unit. The interstadial sediments are overlain by thin horizons of well washed medium sand and laminated clay which are interpreted as spearate recessional ice contact facies. The bulk of the sediments at Earthflow Bluff are poorly sorted, bouldery and poorly washed sediments with a slight westerly dip. They are interpreted as a massive accumulation of ice contact drift deposited in the valley bottom during eastward glacier recession. Cut into and overlying the massive drift is an outwash terrace composed of bouldery gravel, which is interpreted to have been deposited during the final phases of glacial retreat from the valley. Overlying the gravel is a lens of organic-rich silty sand which is interpreted as pond sediments. A radiocarbon date of 2210 ± 70 ^{14}C yr BP from this horizon indicates that these sediments are late Holocene in age.

The oldest date from Earthflow Bluff indicates that nonglacial conditions there continued more recently than in the areas near the Tyone and Oshetna Rivers. Glacial conditions were not evident there until some time well after 30,700 yr BP. Glaciers advanced from the east, scouring much of the valley free of interstadial sediments and depositing till on the higher slopes. Eastward glacial retreat which occurred some time prior to 2200 yr BP was probably slow, as suggested by the large volume of morainal material in the valley bottom.

Preliminary Glacial-Geomorphologic Mapping

The location, orientation, altitude, and state of development of glacial moraines, ice marginal meltwater channels, lake shorelines, kame-deltas, eskers, and ice flow indicators can all be used to reconstruct the glacial hisotry of the region. These features are now being mapped on the U-2 images and transferred to a 1:250,000 scale base, but the map is not yet ready to be included in this report. A complete description of all glacial-morphologic features studied is beyond the scope of this report but a brief summary of them will be presented.

Deposits of at least two and possibly four major ice advances are recorded on hills which projected above all glacial limits. In areas where slopes are not too steep, such as near the headwaters of Jay Creek, these features are particularly well preserved.

Valley floor gradients, moraines, meltwater channels, and directional indicators resulting from the last major glaciation indicate that the pattern of glacial flow was very complex. Each major valley contained its own glacier system, and these merged to form large coalesced lobes in the broad floor of the Susitna Valley between Stephan Lake and Watana Creek. A major lobe of ice which advanced southward and eastward from the headwaters of the Susitna and Maclaren Rivers, respectively, innundated the lowland near the Tyone and Oshetna Rivers. This lobe of ice built upward until it spilled westward as a tongue of ice through the narrow canyon east of Kosina Creek. This tongue of ice may have been joined by an ice tongue which occupied Jay Creek.

Another major ice source was the southeast drainage valleys of Watana, Tsusena, and Deadman Creeks, which carried local valley glaciers as well as overflow ice drainage from the north. The Talkeetna River-Fog Creek area was another major ice source. Glaciers which decended these valleys merged to build a large northeast flowing ice lobe that may have extended across much of the broad valley bottom in this area. A portion of this lobe spilled westward through the Devils Canyon area where it merged with a large southeast-flowing glacier in the valley of Portage Creek. Glaciers in the valleys of the Oshetna River and Kosina-Tsisi Creeks may not have advanced to join the main ice stream, but ice drainage from these valleys spilled over low divides to join other systems.

The pattern of deglaciation was different for each separate system and very complicated. Several readvances have been recognized for some valley glacier systems. The great bulk of recessional ice contact drift, and the large number of recessional moraines indicates that retreat in many areas was progressive and systematic. In other valleys, particularly in the smaller systems, retreat must have been relatively rapid.

The widespread occurrence of eskers and other ice stagnation features over broad areas indicate that the ice may have stagnated over large areas during retreat. The gradient of eskers is commonly reverse relative to modern drainage, indicating that glaciers controlled drainage during retreat. Wisespread, lake deposits, particularly in the Fog Lakes-Watana Creek and Tyone-Oshetna River areas indicate that these areas were covered by large proglacial lakes during deglaciation.

Examination of moraines fronting cirques in the Kosina Creek-Black River areas indicate that Neoglacial advances were very small, not extending more than several km beyond the present glacier margins.

Mammoth (?) Fossil Discovery

One of the most exciting finds of the 1980 field season was the discovery of a mammoth (?) fossil found *in situ* in fluvial gravels at Tyone Bluff (Fig. 1). The fossil, which was identified by R.D. Guthrie and George S. Smith of the University of Alaska, is the first reported occurrence for any Pleistocene mammals in southern Alaska. It yielded a radiocarbon date of 29,450 ± 610 yr BP, and clearly implies nonglacial conditions at that time. This discovery indicates that the range of mammoth should be extended about 200 km south of its present limit. It also suggests that mountain passes in the Alaska Range may have been deglaciated during mid-Wisconsinan time.

Holocene Volcanic Tephra

During reconnaissance study of terrain units and stratigraphic exposures, one or more white volcanic ash units were found to be widespread between Fog Creek and the Tyone River. The ash commonly occurred as a thin discontinuous mantle overlying gravelly prominences and immediately underlying the surface soil horizons. It was also found in many archeologic test pits between 2 cm and 40 cm below the surface. The ash also occurs widely as thin (2-5 cm) thick discontinuous lenses near the top of many river bluffs, where it ususally immediately underlies the surface peat horizon.

In only one instance, at archeologic site UA-80-74 near Fog Creek, two ash horizons were present, the lower one of which was much more poorly preserved. The singular common ash horizon found through much of the area from Fog Creek to the Tyone River is probably correlative to the upper ash at site UA 80-74. The date of 3200 ± 95 from Tyone Bluff was obtained from peat interfingered with the upper part of the ash lens, and therefore probably represents a close minimum age. The date of 4720 ± 130 ^{14}C yr BP from site UA 80-77 was obtained from a hearth 15 cm below the well developed single ash at this site, and probably represents a distant maximum age for this horizon.

These dates bracket the widespread ash layer closely between 3200 and 4720 yr BP, making it a very useful stratigraphic marker for late Holocene sediments. This horizon is already being actively used by the archeologists, and has great potential for other geologic studies, particularly the earthquake hazards program.

Summary of Geologic History

1. The Susitna Valley has been repeatedly innundated with extensive valley glacier systems that coalesced to form a minor mountain ice sheet. One or more pre-Wisconsinan glaciations have been recognized.

2. Much of the present valley was carved to the present river level prior to middle Wisconsinan time (> 31,000 yr BP). The direction of drainage at that time is presently unknown.

3. The valley bottom was extensively modified during the last glaciation which began some time after about 31,000 yr BP in the Fog Creek area, and some time after about 22,000 yr BP in the Tyone River region.

4. During deglaciation large areas were covered with stagnant ice, and meltwater drained freely below the surface, forming complex esker systems. The direction of meltwater flow, and the presence of till at river level suggests that Devils Canyon was carved prior to Holocene time. Glaciers retreated systematically over many areas leaving a number of periodically spaced massive recessional moraines.

5. Deglaciation of the Tyone River region was compplete by at least 11,500 yr BP. Because this area was covered by a large piedmont ice lobe, other areas may have been ice free even earlier. Thus, much of the Susitna Valley may have been deglaciated prior to about 12,000 yr BP.

6. During Holocene time the Susitna River has not greatly deepened its valley in most areas; rather it has widened the valley bottom slightly by lateral planation. Low-level alluvial terraces and tributary mouth alluvial fans have formed in widened portions of the valley. Many small streams tributary to the Susitna have greatly incised their their channels during Holocene time, resulting in steep irregular profiles characterized by waterfalls and rapids.

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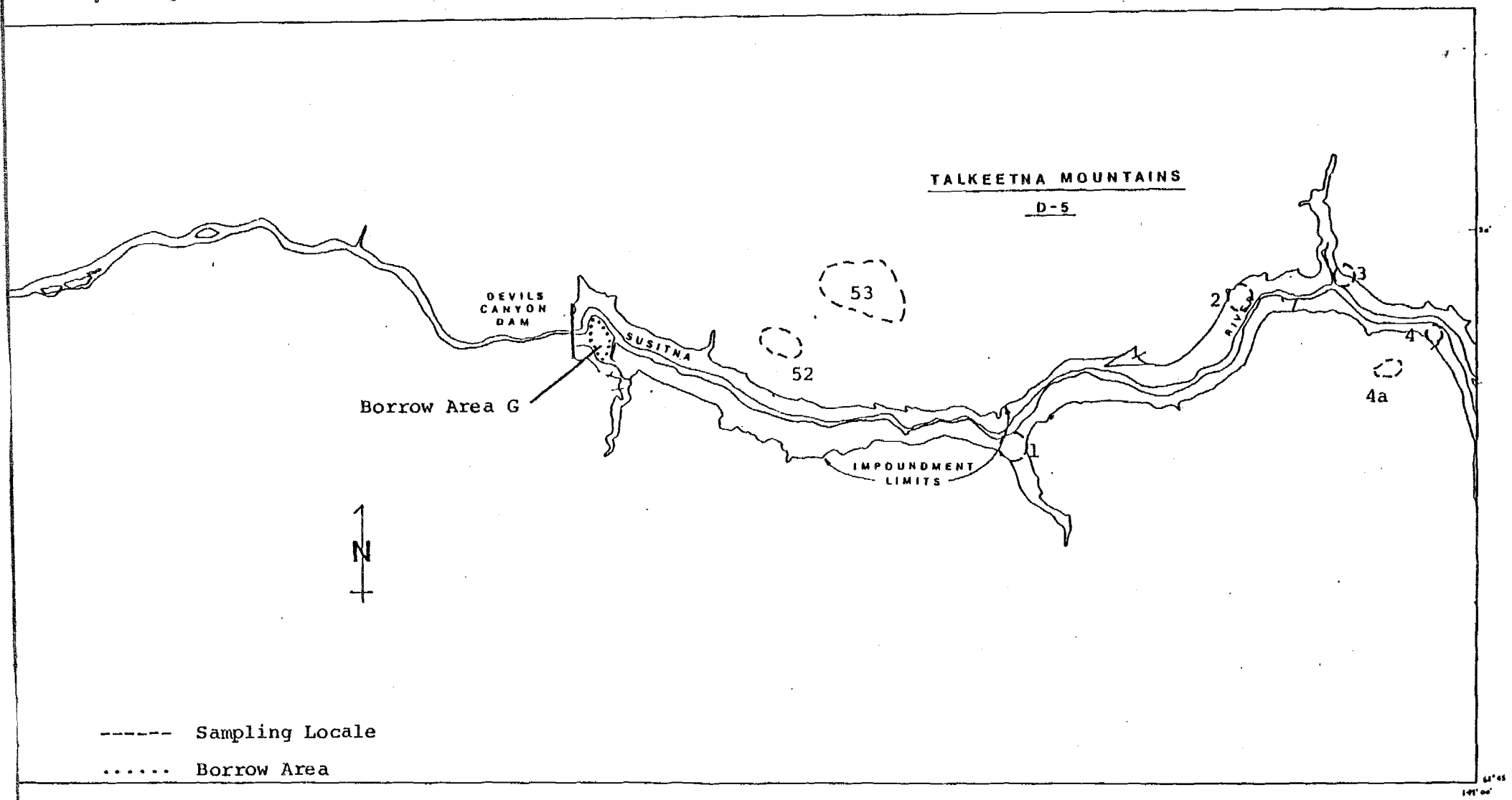
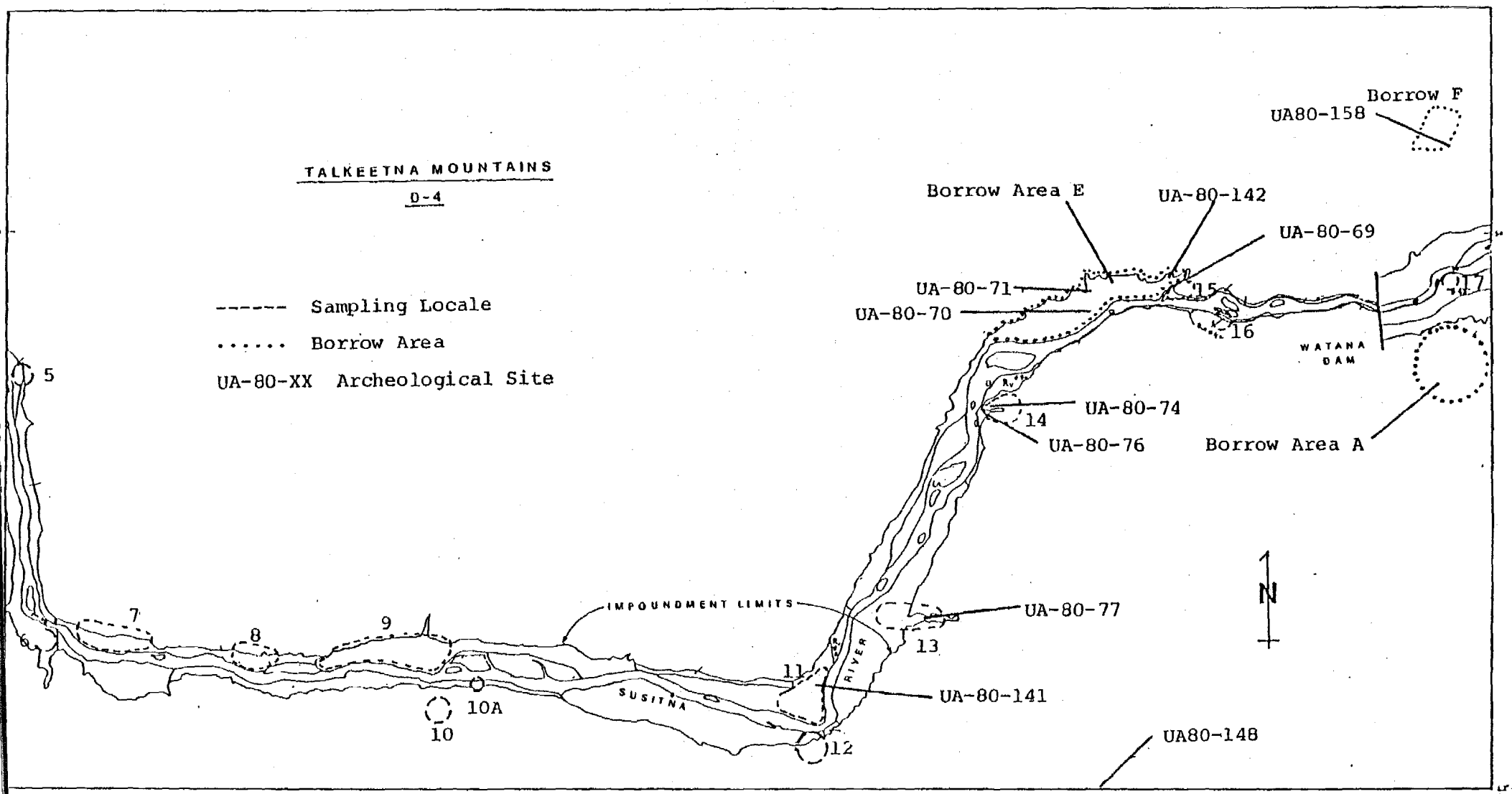
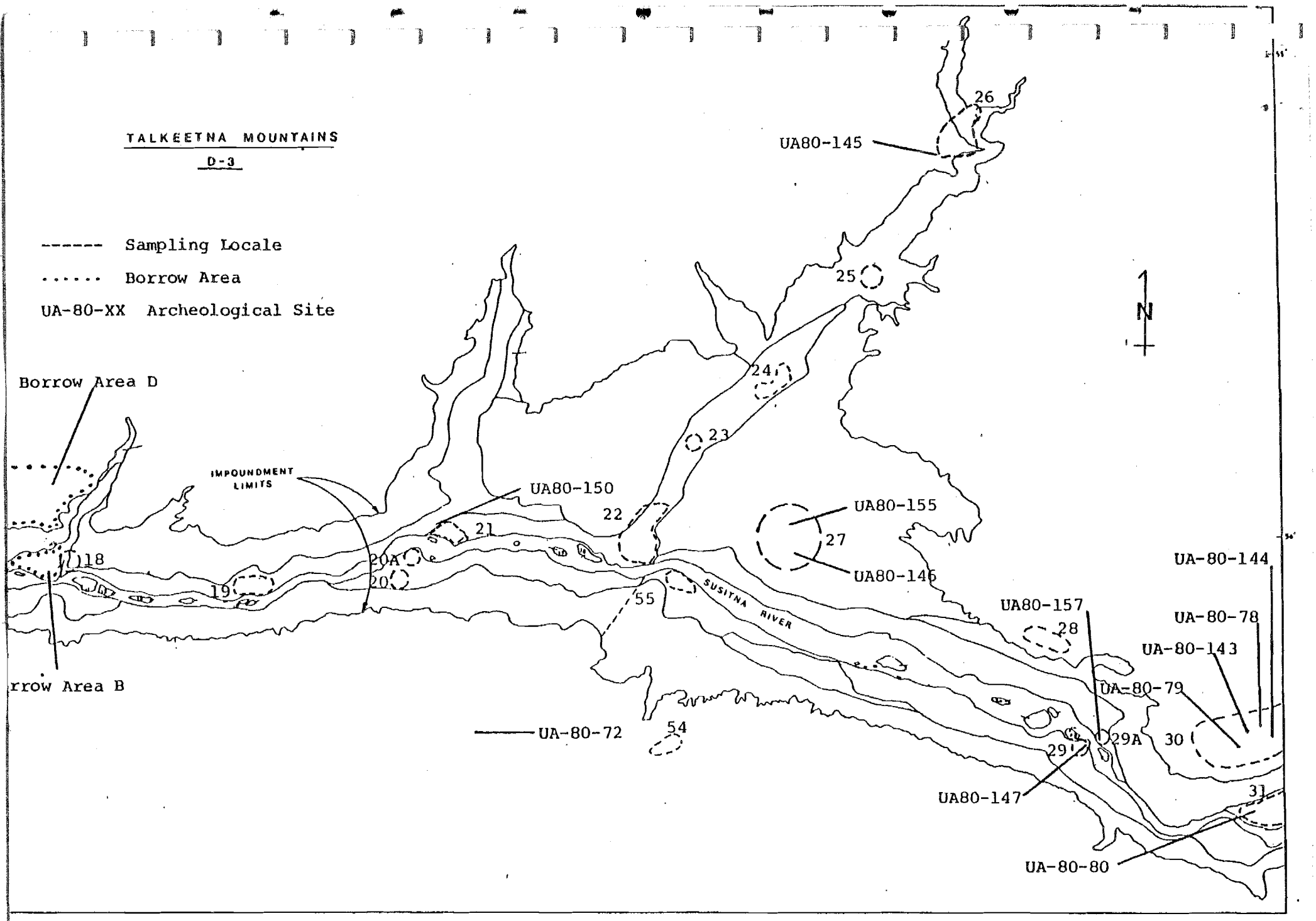
APPENXIX A -- MAPS



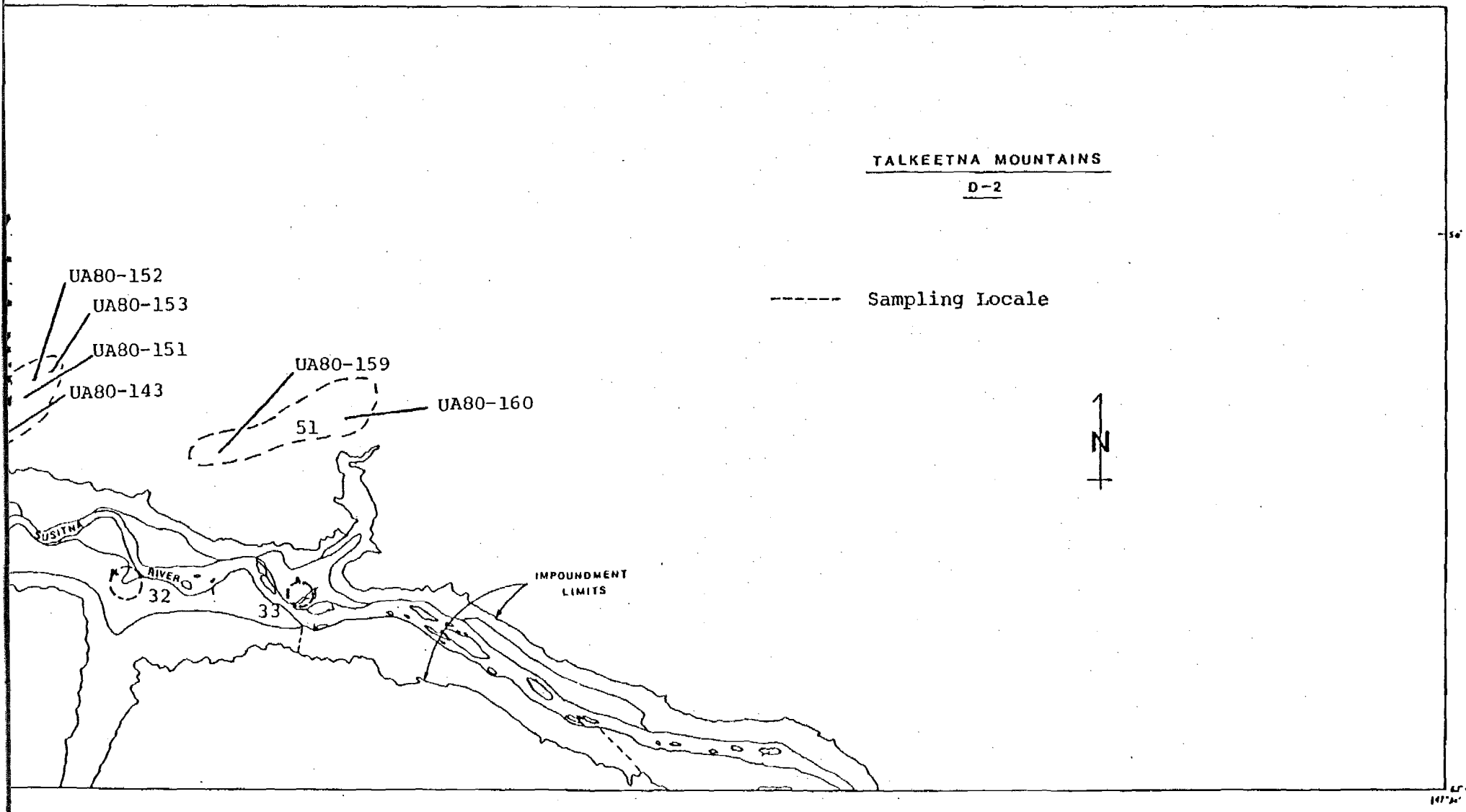
Map 3: Location of Survey Locales, Talkeetna Mts. D-5.



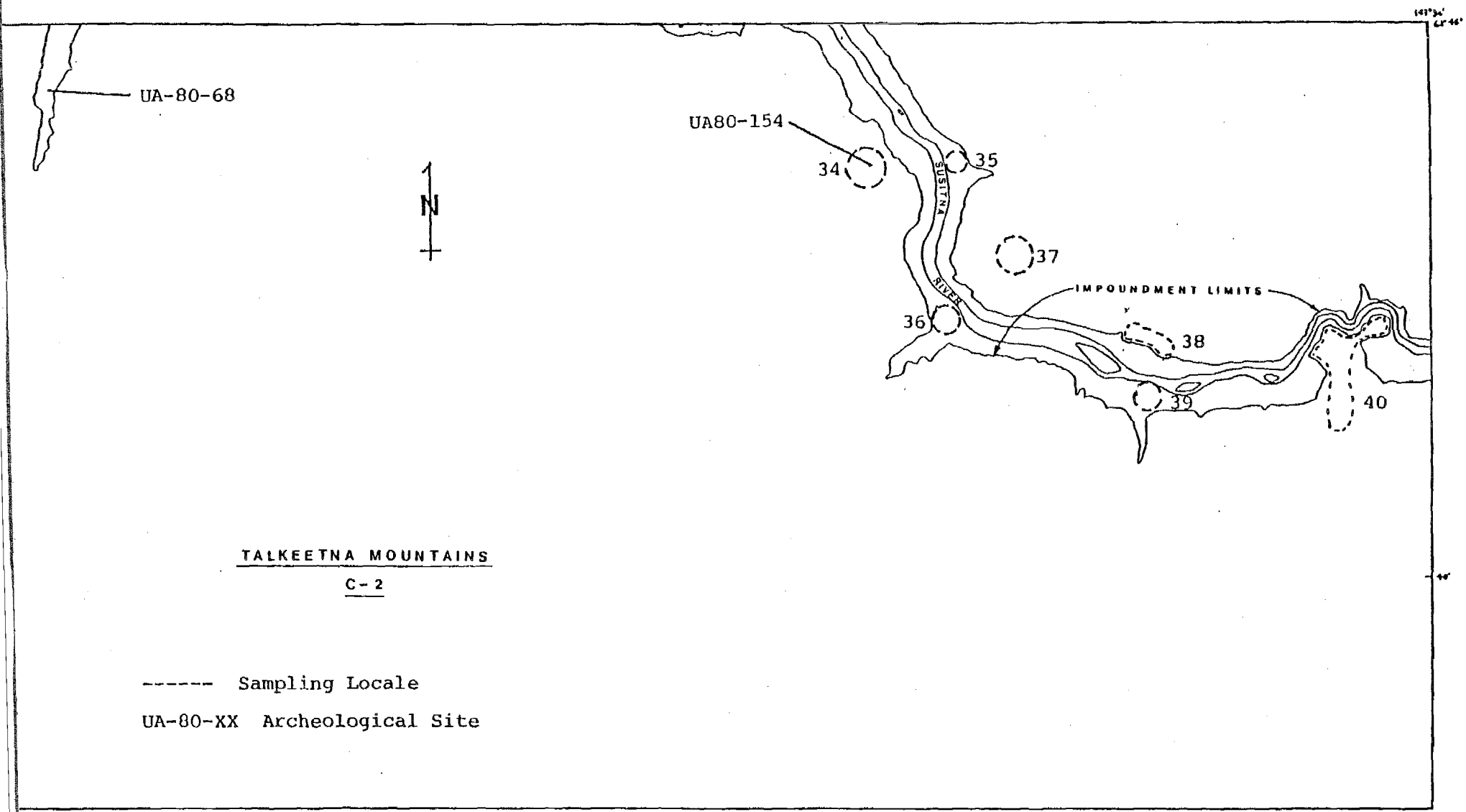
Map 4: Location of Survey Locales and Archeological Sites, Talkeetna Mts. D-4.



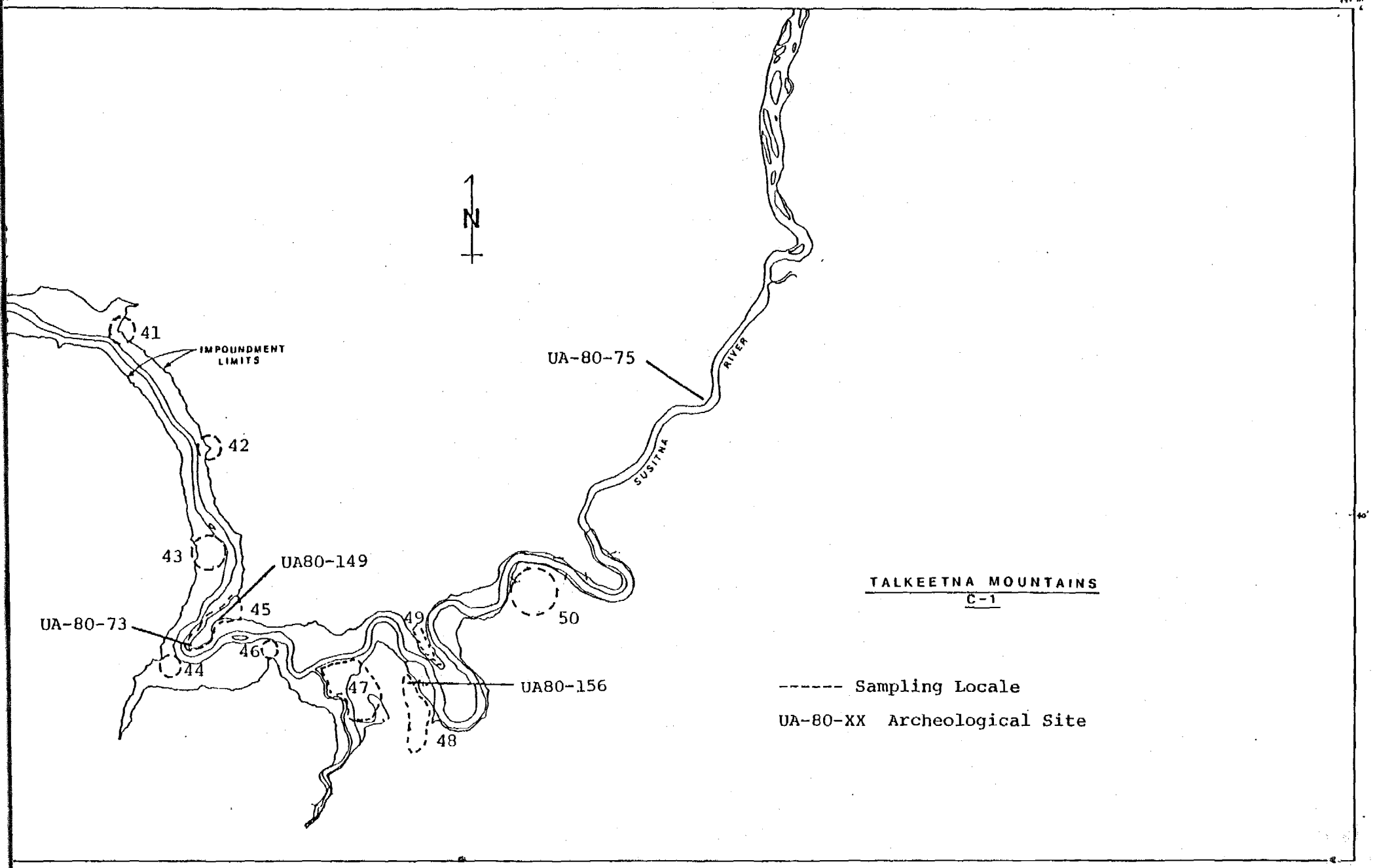
Map 5: Location of Survey Locales and Archeological Sites, Talkeetna Mts. D-3.



Map 6: Location of Survey Locales, Talkeetna Mts. D-2.



Map 7: Location of Survey Locales, Talkeetna Mts. C-2.



Map 8: Location of Survey Locales and Archeological Sites, Talkeetna Mts. C-1.