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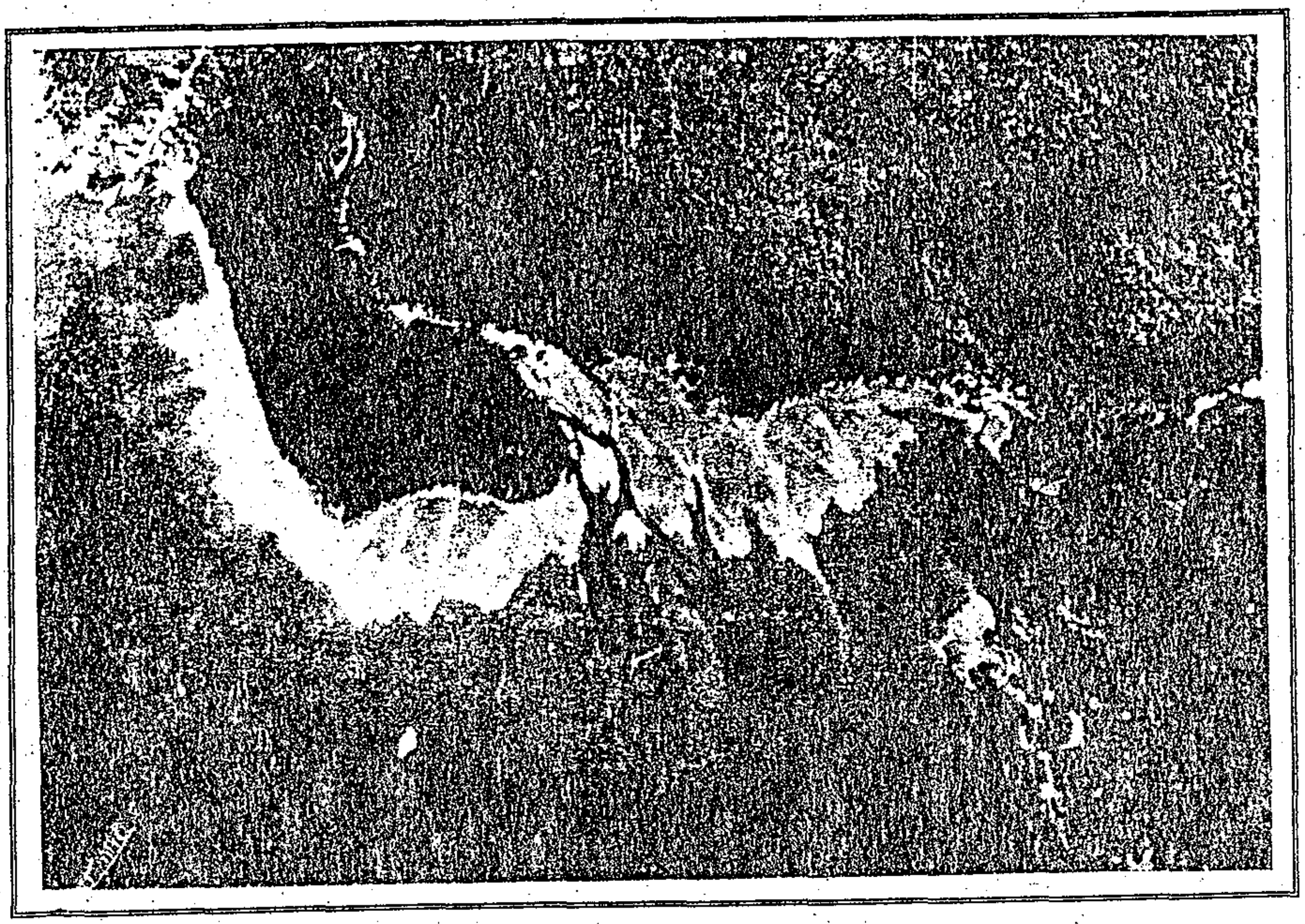
PHYSICAL AND CULTURAL LANDSCAPES OF SITKA NATIONAL HISTORICAL PARK SITKA, ALASKA



Prepared for the National Park Service
Sitka National Historical Park
by

Gregory P. Chaney, Robert C. Betts, and Dee Longenbaugh

Vanguard Research
P.O. Box 240635
Douglas, Alaska 99824

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GLOSSARY

arshin	Russian linear measure: 28 inches or 71.12 centimeters
barabara	'Lodge', from Kamchadal for 'summer house'
B.P.	"Before Present" (1950); used in reporting radiocarbon dating results.
cable's length	Nautical unit of length: 720 feet in the U.S. Navy; 608 feet in the British Navy [0.1 of a nautical mile]
cal.	Calibrated radiocarbon date
clast	Individual grain of detrital sediment greater than 2 mm in diameter.
cmbs	Centimeters below the surface
fathom	Unit of length equal to six feet; used chiefly in nautical and mining measurements
in situ	Original context, not redeposited from its original stratigraphic position
Kekur	Siberian term for a cliff or headland jutting out into the sea; in Alaska, a perpendicular cliff just off shore.
Kiksadi	A Tlingit clan (6 house groups in Sitka) which constructed the Indian River fort and fought the Russians in 1804
Kolosh	Generic Russian term for Native Americans from Alaska to California, not including Aleut and Eskimo peoples
nautical mile	1.15 of a statute mile or 6,072 feet
NPS	National Park Service
promyshlennik	Russian term for fur hunter and trader especially in Siberia and subsequently in Russia's American colonies
sazhen	Russian linear measure: seven feet or 2.13 meters.
Shisk Kee Nu	Tlingit name for Indian River fort. Also spelled as *Shiksi Noow* or *Shiskeenue*. Translates variously as "sapling" or "green wood" fort.
SNHP	Sitka National Historic Park
Swale	A long narrow depression between two beach ridges.
RAC	Russian American Company
statute mile	5,280 feet or 1609.35 meters
tephra	A collective term for all clastic volcanic materials which during an eruption are ejected from a crater or other type of vent and transported through the air.
toise	Old French measure of about 6 feet
verst	Russian linear measure: 0.66 miles, 1.06 kilometers

Notes:

1. English measurements have been used for elevation and horizontal distances in this report to maintain consistency with the topographic base map made available for this study by the National Park Service. Centimeters have been used for below surface measurements in stratigraphic profiles.

2. Spelling of Russian names generally follows *Russian America: A Biographical Dictionary* (Pierce 1990).

3. Russian Dates: From 1700 to January 26, 1918 the Julian calendar was in official use in Russia. In the 18th century that calendar was 11, and in the 19th century, 12 days behind the Gregorian calendar used in the West (Khlebnikov 1976: viii).

4. To aid general references, the Park was classified into two halves throughout this report using the Indian River as the dividing line. The terms east and west in reference to direction from Indian River are used in a general sense in this report since the river changes directions within the Park boundaries. For example, the east side of the Park contains the Russian Memorial while the west side contains the Visitor Center.

5. Elevations are given in feet above mean sea level (msl)

PROLOG

"Knowledge is Power"

Captain of 1st Rank Teben'kov
St. Petersburg 1852

I don't know of any other human occupation, even including what I have seen of art, in which the people engaged in it are so caught up, so totally preoccupied, so driven beyond their strength and resources.

Scientists at work have the look of creatures following genetic instructions; they seem to be under the influence of a deeply placed human instinct. They are, despite their efforts at dignity, rather like young animals engaged in savage play. When they are near to an answer their hair stands on end, they sweat, they are awash in their own adrenaline. To grab the answer, and grab it first, is for them a more powerful drive than feeding or breeding or protecting themselves against the elements.

Lewis Thomas "Lives of a Cell"

ACKNOWLEDGMENTS

We would like to thank Sitka National Historical Park archaeologist Gene Griffin for his assistance in many aspects of this research and especially for helping obtain supplemental National Park Service funding for radiocarbon dating and AutoCad mapping. The seven additional radiocarbon dates which were obtained with supplemental Park Service funding significantly augmented the data base for evaluating the chronology of the development of Park landforms. The assistance of Sue Thorsen in tracking down Park Service records and documents at Park headquarters in Sitka is also greatly appreciated. Sue also contributed information on a hearth feature she documented in the Park in 1992.

Jim Beget at the University of Alaska in Fairbanks ran the electronic microprobe analysis on two volcanic ash samples collected in Sitka National Historical Park and generously provided unpublished data of his own on other known tephra deposits in the vicinity of Sitka Sound. Comparison of the physical appearance of all the tephra samples collected in 1994 was made possible by Doug Swanston at the USDA Forest Sciences Laboratory in Juneau who provided space at the lab and use of a binocular microscope. The AutoCad maps produced by Kenwyn George at Technology Plus in Juneau greatly enhance the report graphics.

Hall Guttormsen with the USFS Chatham Area Supervisor's Office provided access to all aerial photography reviewed for this report and contributed his knowledge on the subject. In particular, the 1929 aerial photography proved to be of tremendous value to this report.

Richard Carstensen of the Discovery Foundation brought to our attention the exciting research which has recently been published concerning the Glacier Bay region. He donated several reprints of pertinent articles for our use.

Richard Dauenhauer at Sealaska Corporation in Juneau provided an unpublished English version of Lisianskii's account of the 1804 Battle of Sitka translated by Lydia Black and also translated early Russian charts and other Russian language material for this report. It was Dr. Dauenhauer who initially called our attention to Golovnin's 1818 chart of Sitka Sound, the only known early map which shows the location of the *Kiksadi* fort site at Indian River. John Hallum at the Isabel Miller Museum in Sitka assisted in tracking down and reproducing photographs of the Indian River delta taken from Mt. Verstovia in the early 1900s.

A Tlingit perspective on the 1804 Battle of Sitka and the nature of the Tlingit fort at Indian River was expanded from that provided only by written sources by Herb Hope in Anchorage and Herman Kitka in Sitka, who provided additional important information through telephone interviews. Andrew Hope III in Juneau generously provided unpublished information from an article currently in press written by Herb Hope, which is used in this report with the permission of Herb Hope.

John, Judy and Iris Neary of Lena Cove generously provided office space and encouragement during the early phases of compiling this report. Pat and Jake Yearty from Douglas Island generously contributed lodging and workspace which aided in researching the Russian History

portion of this report. Ruth, Steve and Ryan Johnson, in the final stages of compiling the manuscript, generously made available office space, supplies, lodging and provided constructive comments which all helped move this project along at a critical time.

ABSTRACT

The present study models the chronology of landform evolution within Sitka National Historical Park over the past 5,500 years and provides baseline data for future archaeological surveys in the Park. Aerial photography, cartography, published and unpublished literature, National Park Service topographic mapping data, and information collected during eight days of field work conducted in October 1994 are analyzed and a local uplift model is developed. Results from the analysis of 13 radiocarbon samples and analysis of volcanic ash identified in the Park provide a framework for landform evolution chronology.

Emergence of the oldest Park landform from the influence of storm waves is estimated to have occurred ca. 5,500 years ago. Nine feet of uplift was measured which has occurred during the last 1,700 years. A series of eight maps have been developed showing landform evolution from approximately 5,500 years ago to AD 1804. A long term uplift curve developed from field data implies a 2,000 year period without uplift between about 2,500 and 4,400 years ago. An episodic uplift of at least five feet appears to have accompanied a Holocene Mt. Edgecumbe eruption which deposited volcanic ash in the Park.

On the peninsula west of Indian River relic beach ridges and other evidence of sediment accretion in response to wave-driven berm development and regional uplift has been documented. The asymmetrical shape of the Indian River delta appears to have developed because the course of the river has been deflected eastward by storm waves from the Pacific Ocean which have pushed alluvium deposited at the river's mouth back into the river channel. Measurement of the slope and extent of five beach profiles along the seaward and Indian River sides of the Park peninsula provide baseline data for future comparison of erosion and accretion below established survey monuments. All large magnitude erosion that has occurred during historical times has resulted in response to near shore dredging which took place between 1939 and 1979.

Volcanic ash samples collected from five locations within the Park all appear to be physically similar when examined under a binocular microscope. Two representative ash samples, one from each side of Indian River, were analyzed by the Alaska Center for Tephrochronology at the University of Alaska in Fairbanks. The two volcanic ash samples submitted for analysis proved to be essentially identical in chemical composition and were correlated with other Holocene-aged Mt. Edgecumbe volcanic ash found in the Sitka region. Radiocarbon samples collected in the Park provide bracketing dates for this ash fall event of 4,000 ± 70 B.P. (cal. 2,485 BC) and 4,290 ± 70 B.P. (cal. 2,900 BC). Microprobe analysis of volcanic ash from Sitka National Historical Park shows this ash to be distinctly different from earlier Pleistocene ash deposits in the region.

During review of archival data to establish regional morphogenesis, it was discovered that Golovnin's 1818 chart of Sitka Sound shows the 1804 *Kiksadi* fort location. Recent translations of historical Russian documents combined with newly provided Native oral history provides strong evidence that the fort was located at or in the immediate vicinity of the area currently designated as the fort site by the National Park Service. Archaeological monitoring of the geomorphology fieldwork documented two unifacially worked cobble choppers, the first prehistoric stone tools of known provenience located within the Park boundaries. Other previously undocumented cultural resources and subsurface charcoal concentrations of suspected cultural origin are also documented.

SECTION ONE

1.0 STATEMENT OF PURPOSE

Life can only be understood backward, but must be lived forward.

Sören Kierkegaard

This report was compiled to satisfy the conditions of NPS contract 1443PX970094496. The contract's Scope of Work Statement is quoted below:

The purpose of the investigation is to provide information for proposed archeological surveys, provide base line data for natural resource management, and furnish information useful for park interpretive purposes and for the general public. Existing landform maps of the park are surficial, at best, and the timing and sequence of geomorphic evolution has not been defined. The primary purpose of this project would be to investigate and describe the park's morphogenesis and develop a chronology of significant landform building events.

The contract outlined a three phase research procedure:

1. Literature review: Prior to field work, all available relevant information concerning the park's geology and geomorphology would be reviewed. Where appropriate information on the park's archeology and history would be examined. Aerial photographs, maps, and other relevant data would also be obtained and analyzed for information on the rate and pattern of landform changes. Of particular interest is the erosion cycle along Indian River. The information gathered during this research would identify issues requiring field work clarification, to select an efficient sampling strategy and to refine the field investigation work plan.

2. On site field investigation and survey: Conduct a 2 person, 8 field day, geomorphological investigation of Sitka National Historical Park after the fall die back of vegetation. The two primary objectives of the field work would be to ground truth preliminary mapping efforts and to collect datable organic material from representative landforms for further analysis. Of particular interest for this study is the rate of emergence of the park as a result of isostatic rebound and tectonic activity. The study will attempt to correlate the stratigraphic profiles of various landforms within the park. Tephra (volcanic ash) locations within the park would be mapped and samples collected, and processed, for identification. If obtainable, a minimum of 6 organic samples would be collected for radiocarbon dating the context of local geology. If additional samples are located, the park may wish to provide for supplementary radiocarbon dating.

3. Report: The field data collected would be used to develop a landform evolution chronology. The research report will include a map of the extent and relative age

> of the park landforms, and will also include a map sequence depicting the evolution of park geomorphology. The cartographic products would be supported by a report which would summarize the geomorphological history of the park and provide an assessment of the relative and absolute ages as well as archeological potential of landforms. Where possible, maximum and minimum limiting dates will be presented for various landforms. Bracketing dates for one or more tephra horizons will also be provided if possible and the results of tephra analysis will be presented.

This project was undertaken with the general understanding that it would be a preliminary study to be used as a basis to support future research. Due to budgetary constraints, the investigation was not intended to be a final comprehensive geomorphological study of the Park. Therefore the study area was stratified into geographic units. Representative locations were selected within these units for intensive sampling and the results were extrapolated to other areas having similar attributes.

SECTION TWO

2.0 INTRODUCTION

Careful and correct use of language is a powerful aid to straight thinking, for putting into words precisely what we mean necessitates getting our own minds quite clear on what we mean.

William Ian Beardmore "Beveridge"

Sitka National Historical Park, located about a mile southeast of Sitka, is an extremely unique site in Southeast Alaska if not in all of North America (Figure 2.1,2.2). Here, at the mouth of Indian River, indigenous people built a large fortress armed with cannon for the specific purpose of defending against the establishment of European colonial government. The battle which took place at this location in the fall of 1804 involved hundreds of men on both sides all equipped with firearms. The Sitka Tlingit returned effective cannon fire at Russian ships anchored near the fort but the Russian forces emerged victorious from the battle largely due to Naval support from the *Neva*, one of the first two ships under Russian command to circumnavigate the globe. This pivotal battle gave the Russian American Company primary control of the North Pacific fur trade and established the southern stronghold of Russian America.

Equally as dramatic from a geomorphological perspective is the dynamic evolution of landforms within the boundaries of Sitka National Historical Park. During the course of this investigation a 4,500 year old volcanic ash horizon dating from the last eruption of Mt. Edgecumbe was identified within the Park and significant new chronological evidence was obtained documenting the rate of emergence of Park landforms. A series of radiocarbon dates collected within the Park provide new data on land emergence in the Sitka area. This allows estimates to be made for the rate of long term uplift which has been one of the most important factors in shaping the present Park landscape. Early cartography and aerial photography have provided dramatic evidence of the physical and cultural changes that have taken place in historic times and provide graphic evidence of the massive erosion which has resulted from the extensive dredging of Indian River and its delta in the 20th century.

Review of early Russian charts and documents has revealed new information bearing on the location of the Tlingit fort site at the mouth of Indian River as well as additional details relating to the battle of 1804. In the course of the geomorphology field work, the first stone tools of known provenience were discovered within the Park boundaries. Although further research is needed to clarify the extent and magnitude of discoveries made during this investigation, the groundwork is now established to provide guidance for diverse future research projects.

The present study was undertaken by Vanguard Research under contract to the National Park Service. Eight days of field work conducted in late October 1994 focused on landforms contained within the Park boundaries (Figure 2.2). At the time of the fieldwork, topographic mapping had only been completed on the west side of Indian River. The 1994 field effort concentrated on the peninsula west of the river where available elevation data allowed development of a

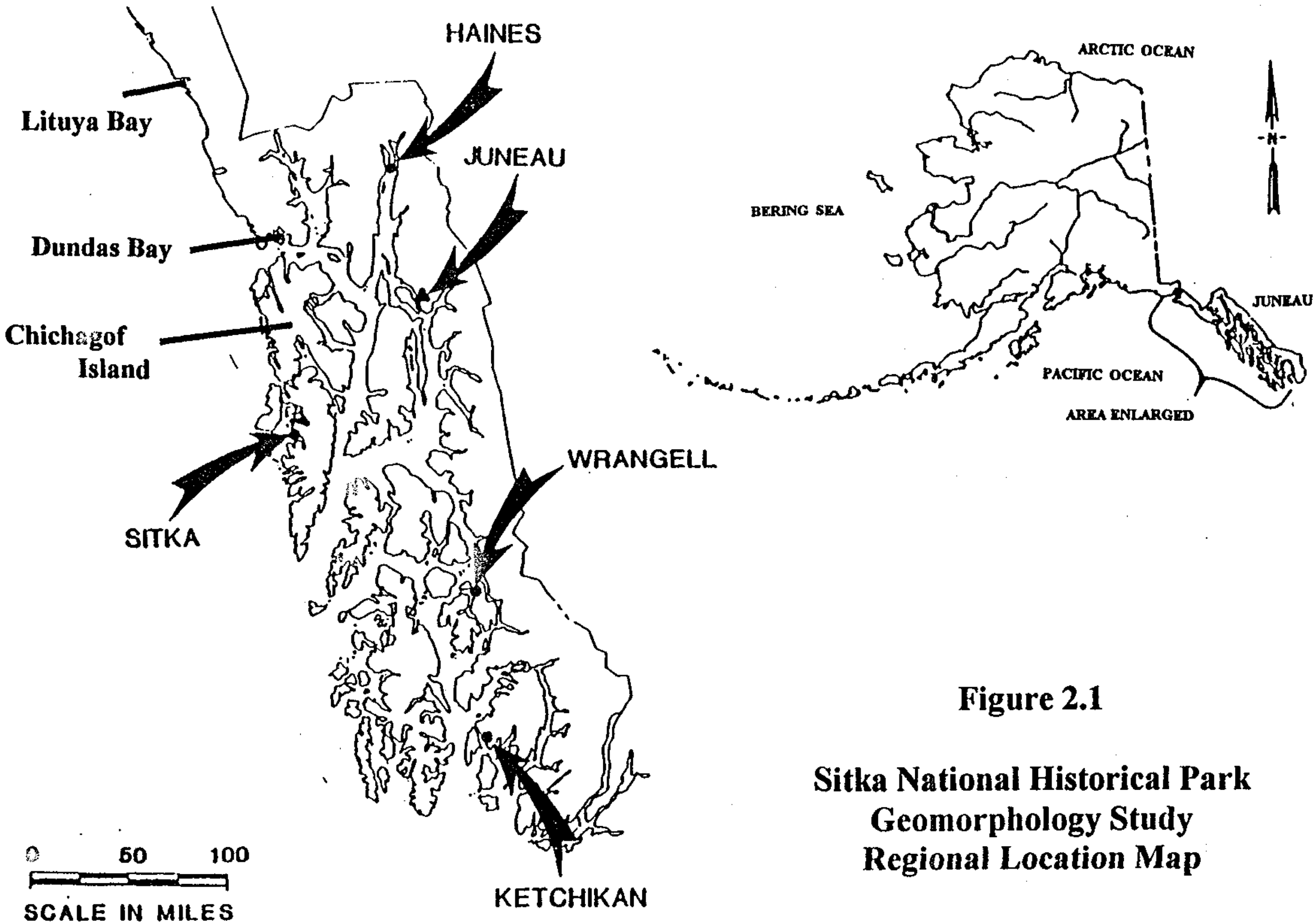


Figure 2.1

Sitka National Historical Park Geomorphology Study Regional Location Map

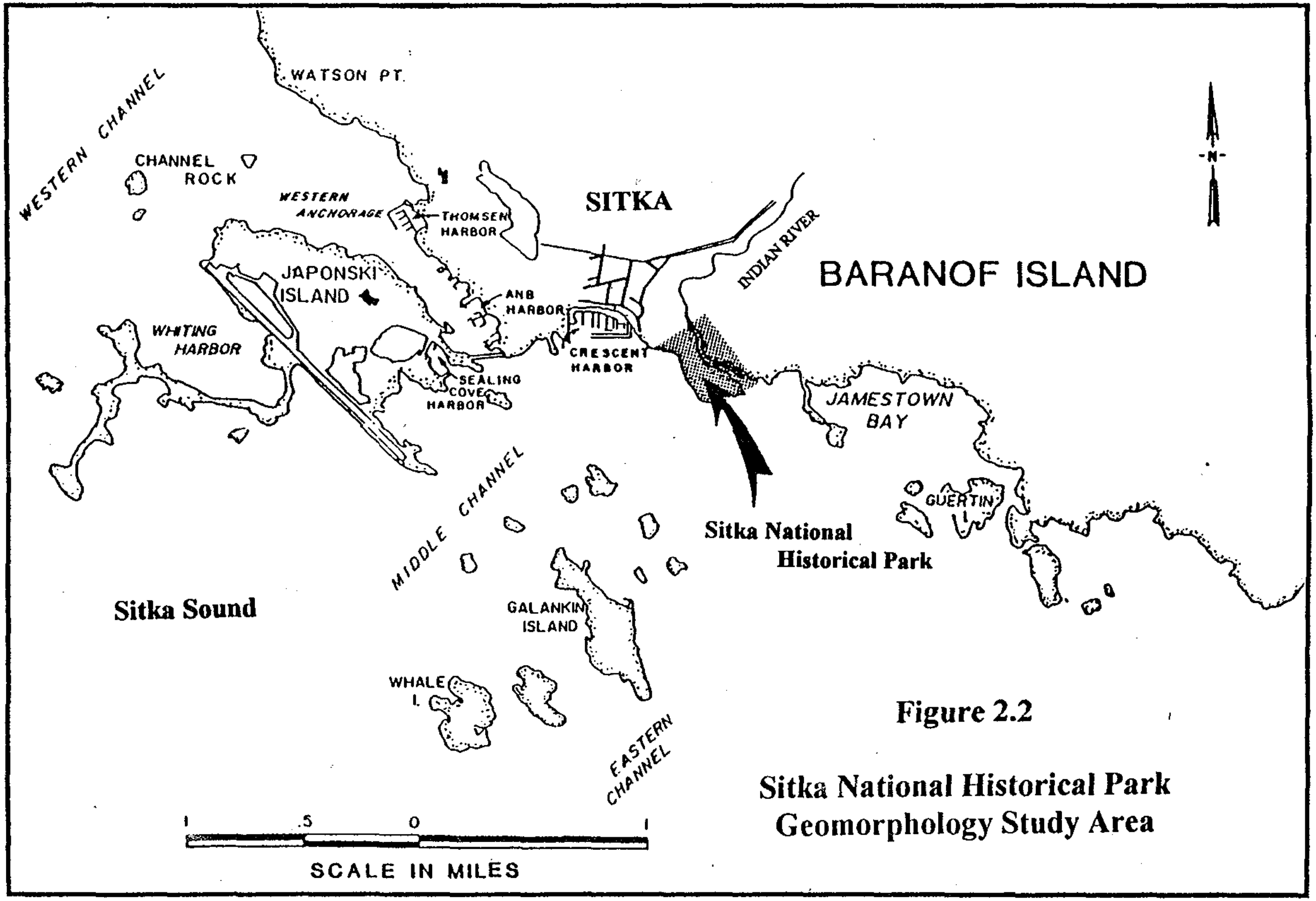


Figure 2.2

Sitka National Historical Park Geomorphology Study Area geomorphology model and sampling strategy prior to the fieldwork so that maximum data could be obtained in the field time available. Due to limited Park Service funds available for a geomorphology study, this research was undertaken as an initial effort to gain a preliminary understanding of Park geomorphology. It is expected that further research will refine both the chronology and landform mapping developed by this study. Many avenues of archival research were not pursued due to budgetary constraints. Consequently this study should be viewed as an initial phase of what is hoped will be a continuing geomorphology study of Park landforms.

One of the primary reasons the present geomorphology research was commissioned by Sitka National Historical Park was to provide a chronology of landform development events as a basis for developing a research design and survey strategy for future archeological surveys. To this end it was deemed to be of primary importance to determine the date when identifiable marine or river terraces were lifted above marine influences and thus the earliest date at which archaeological evidence of human activities could be preserved. Because of this, and because of the potential for subsurface testing to encounter cultural resources, the present research was approached from a geoarchaeological perspective. An extensive literature review was conducted to identify known or potential cultural resources within the Park boundaries and archaeological monitoring of all subsurface testing was an integral part of the field investigation.

Radiocarbon samples collected in the Park were dried and obvious contaminants removed immediately following the fieldwork. Fourteen samples were sent to Beta Analytic, Inc. in Miami, Florida for analysis. After processing by Beta Analytic one carbon sample was found to be too small for a standard radiocarbon determination and this sample was not run. A total of thirteen radiometric dates were obtained as a result of the field effort. A matrix of information on radiocarbon samples, dating results for individual samples, and calibration data sheets for each sample can be found in Appendix B. Five volcanic ash (tephra) samples were collected, two of which were submitted for microprobe analysis to Dr. Jim Beget at the Alaska Center for Tephrochronology located at the University of Alaska in Fairbanks. The results of the tephra analysis are included in Appendix C.

The results of the literature review and fieldwork that comprise the body of this report are presented in the following sections. Section Three reviews basic geomorphological concepts and development models relevant to the Study Area and provides the background to understand both the natural and artificial forces which have formed the present Park landscape. Historical documentation pertaining to the geomorphic evolution of past and present landforms is discussed in Section Four with particular emphasis on early charts and aerial photography. The field data collected in 1994 and interpretation of that data in terms of the chronology and morphogenesis of Park landforms is presented in Sections Five and Six which form the principal core of the report. The results of geomorphological investigations at 31 sample locations within the Park are presented in Section Five. Conclusions concerning local rates of land emergence and the evolution of park landforms are discussed in Section Six. Section Seven presents the results of the cultural literature review with a focus on the Battle of 1804 and subsequent historical events that may have left archaeologically discernible remains within the Park boundaries or may have impacted cultural resources in the Park. Cultural resources identified during the course of the geomorphology fieldwork and the site potential of both general landforms and specific locations are also discussed in Section Seven. Sources of additional documents and possible avenues for further research are identified in Section Eight.

A partial timeline for significant events which have physically affected the Park landscape compiled from *Sitka National Historical Park: An Administrative History* (Antonson and Hanable 1987) can be found in Appendix A. Three large format maps (Maps 1-3) referenced in the text of this report are submitted as separate maps. The most current version of the Sitka National Historical Park topographic map available in March 1995 at a scale of 1" = 100 feet and one foot contour interval was used as the base map on which to overlay information obtained by the present study. It is important to note that 1995 survey data for the east side of Indian River was still undergoing revision by Stragier Engineering, Inc. as of March 1995 and base map contour lines for this part of the Park are being revised. Map 1, included with this report as a separate large format map, shows the approximate area and time of emergence of landforms identified by this study and identifies sample locations discussed in the text of the report. Locations at which tephra samples were collected and the estimated distribution of tephra within the Park, is shown on Map 2. Map 3, a cultural resources map included in a removable appendix (Appendix D), identifies the location of artifacts, culturally modified trees (CMTs), subsurface charcoal of possible cultural origin identified in 1994, as well as other cultural features such as World War II gun emplacements and modern totem pole locations previously mapped by the Park Service.

SECTION THREE

3.0 GEOMORPHOLOGICAL DEVELOPMENT MODELS RELEVANT TO THE STUDY AREA

Observe always that everything is the result of change and get used to thinking that there is nothing Nature loves so well as to change existing forms and to make new ones like them.

Marcus Aurelius Antoninus

Interpretation of data gathered during this investigation is facilitated by a brief review of geomorphological development models relevant to the study area. Data collection and interpretation were conducted within the framework of the models discussed below. These models fall into two broad categories, those driven by natural forces and those resulting from human activities.

3.1. NATURAL FORCES

The boundaries of Sitka National Historical Park encompass the majority of the Indian River Delta. This landform is composed primarily of alluvium which has been reworked to various degrees by marine processes. For at least 9,000 years the Sitka area has experienced regional uplift (Yehle 1974:22). At some point during this uplift, the submerged delta was lifted above sea level and a series of uplifted beaches, floodplains and abandoned channels form the base upon which the Park currently rests.

3.1.1. Plate Tectonics

Southeast Alaska is seismically active and several strong earthquakes have been recorded. The region is located on a massive transform fault zone between the Pacific and North American Plates. The Fairweather - Queen Charlotte Fault lies 20 miles offshore from Sitka and in 1972 a 7.6 magnitude earthquake occurred along this active fault adjacent to Sitka. Although the Fairweather - Queen Charlotte fault system is primarily transform in nature, it is oriented so that the Pacific Plate is obliquely colliding with the North American Plate at a 20 degree angle. This orientation results in a 1 to 2 cm per year convergence and may explain part of the uplift noted in the Glacier Bay region (Horner 1990). For the Fairweather Fault a recurrence interval for earthquakes greater than magnitude 7.8 has been calculated between 67-85 years (Lisowski 1987). One or more very large earthquakes near Yakutat in 1899 resulted in a vertical offset of over 47 feet (Tarr and Martin 1912) and in 1958 another earthquake resulted in a vertical offset of 22.4 feet near Lituya Bay (Tocher 1960). Although these seismic events occurred relatively nearby, episodic land level changes have not been documented in historic times in the Sitka area. Evidence of prehistoric earthquakes is inferred by the large number of faults and lineaments in the region although major movement has not been documented along faults above sea level during Holocene times. This may be due to lack of data since structure is masked by thick vegetation. The linear nature of the course followed by Indian River has been interpreted as a possible fault running through the middle of Sitka National Historical Park (Yehle 1974, Figure 4).

Although bedrock outcrops are rare in the Park, unconsolidated Indian River alluvium rests on metamorphosed graywacke probably formed in the Cretaceous period (Yehle 1974:17). These rocks, formed near the equator, have been transported north on the Pacific Plate and have undergone vertical as well as horizontal displacement. The block of crust near Sitka has been uplifted 6 to 8 kilometers in the last 25 million years (0.03 cm/yr.) (Brew 1990).

3.1.2. Glaciation

The geomorphology of Southeast Alaska is dominated by the remains of massive glacial erosion but the chronology and extent of glaciation is poorly documented. The Wisconsin ice sheet probably retreated from Baranov Island before 12,100 B.P. (Mann 1986:252).

Although erosional features are evident, Pleistocene glaciers do not appear to have built large constructional landforms in the Sitka region. Glacial drift and erratics are distributed in a thin dispersed veneer over glacially polished bedrock. The only glacial moraine reported may be along the south side of the east fork of Indian River well up river from the Park boundaries (Yehle 1974:13). The USFS Ecological Inventory of Sitka National Historical Park included lateral moraine ecological units on either side of Indian River (Figure 3.1) The report concedes that this classification was based solely on landform shape and orientation since all deposits observed in these areas appeared to have been water born (USFS 1993:15). It is possible that these areas are morainely cored and capped by water born deposits although no direct observations of thick glacial deposits have been documented in the Park. The only natural assemblage of large boulders observed in the Park occurs above the banks of Indian River where it enters the Park's boundaries. The large boulders observed in this region may have been deposited by ice or may have been transported down river during violent floods. Further detailed research is needed to decipher the mechanism which deposited these boulders.

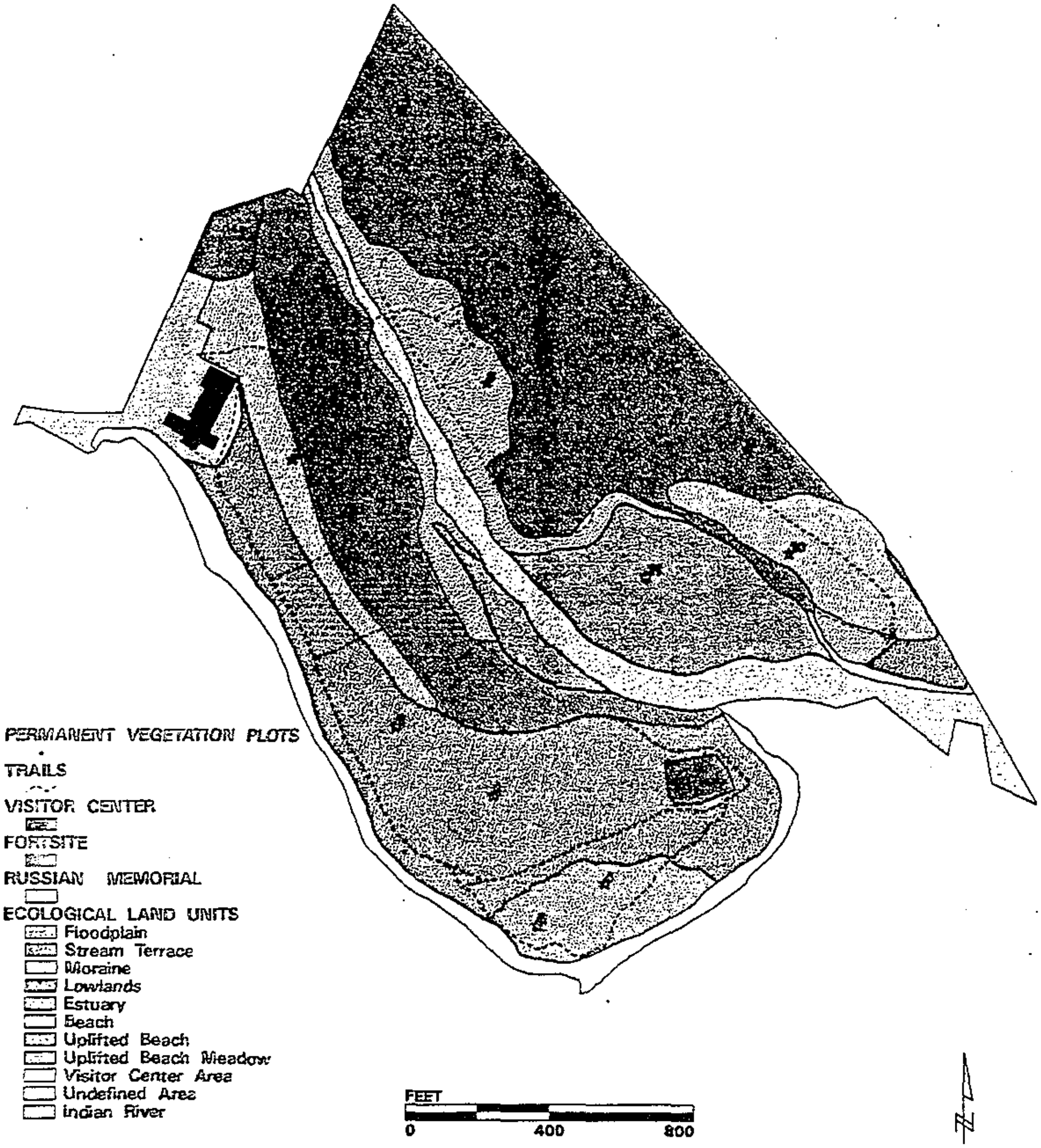
3.1.3. Local Sea Level Change

Regional uplift has traditionally credited unloading of glacial ice and subsequent isostatic adjustment as the force driving historical changing land levels in northern Southeast Alaska (Hicks and Shofnos 1965). The current rate of uplift derived from tidal gauge data between 1938 and 1980 for Sitka is minus 0.008 (± 0.0011) feet per year (Figure 3.2) (Hicks et al 1983:22). If this rate of uplift is projected 9,000 years into the past, ~70 feet of uplift would be indicated. However 9,000 year old tephra is found ~40 feet above present high tide level indicating a maximum uplift of ~40 feet has taken place since that time (Yehle 1974:13,22) (Figure 3.3). Other landforms and the general topographic pattern around Sitka suggest total land emergence of at least 50-65 feet (Yehle 1974:14). At this higher stand of sea level, all landforms within the Park would have been intertidal or sub tidal. Recent geophysical measurements in the Glacier Bay region indicate that the current regional uplift may be associated with elastic compression of crustal plates (Barnes 1990). If tectonic forces are partially responsible for land level changes in Southeast Alaska, then prehistoric land level changes may not be linearly correlated with glacial advances and retreats.

Further complicating matters is the potential for localized land level changes resulting from volcanic activity on Kruzof Island. Outpourings of these materials could have caused changes in volumes of magma chambers beneath adjacent areas. This mechanism could have caused

FIGURE 3.1

SITKA NATIONAL HISTORICAL PARK: ECOLOGICAL UNIT MAP



Reproduced from the Ecological Inventory of Sitka National Historical Park (USFS 1993)

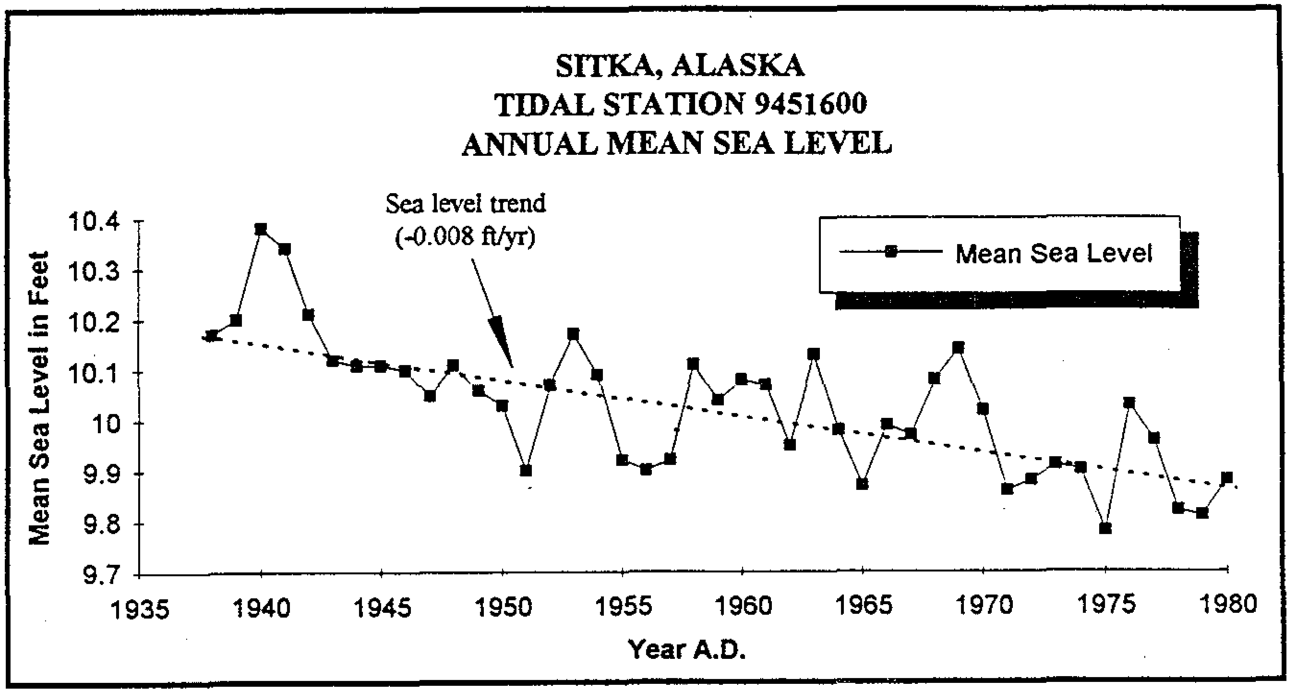


Figure 3.2. Tidal gauge data for Sitka, Alaska 1938 to 1980. Annual mean sea level trend -0.008 feet per year (Hicks et al 1983:22).

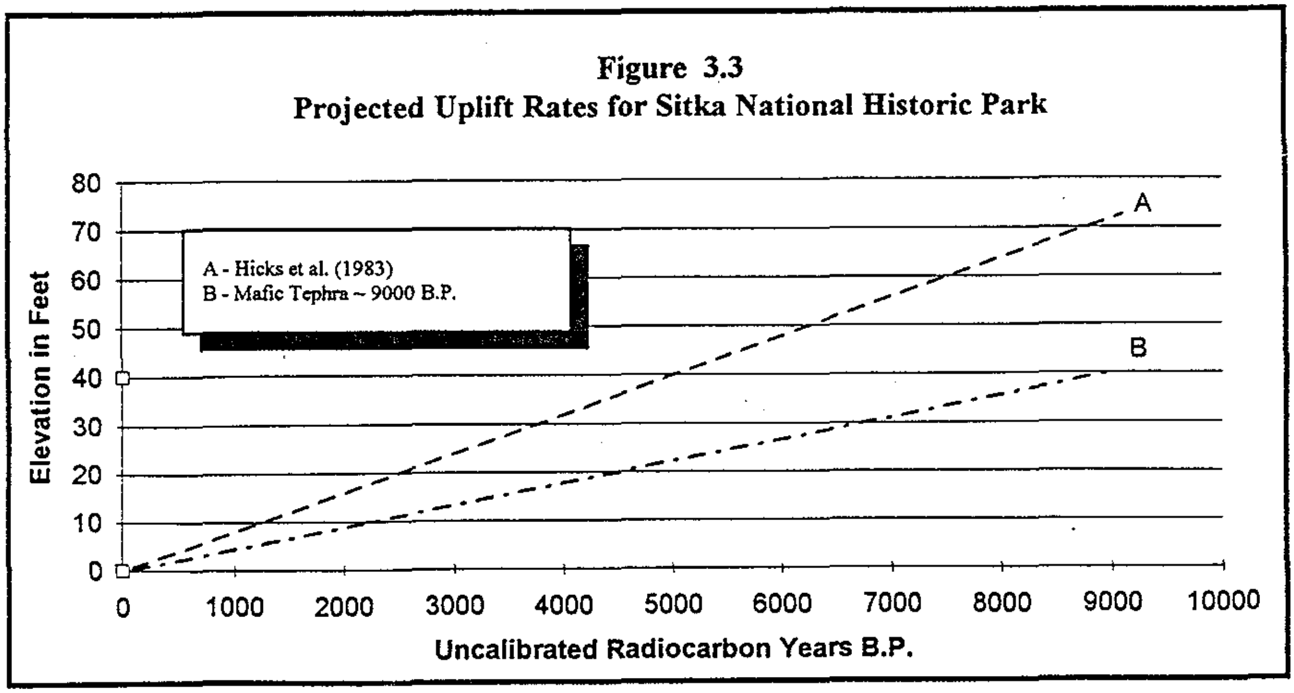


Figure 3.3. Long term uplift derived from Yehle's (1974) observations contrasted with current sea level trend projected into the past.

differential movement of land surfaces in the region (Yehle 1974 :14). Tephra in the region records evidence of past volcanic activities (Riehle et al. 1992). Tlingit legends also describe past eruptions (Reed 1958:14) and evidence of possible historic eruptions in 1796 and 1841-2 has been collected (Becker 1898:13).

The Wisconsin ice sheet probably retreated from nearby Chichagof Island by 12,100 B.P. but local sea level may have been 80 meters (260 ft.) higher than today (Mann 1986:252). Widespread uplift followed retreat of the ice sheet but Southeast Alaskan ancient sea level curves are poorly understood and are the subject of speculation (Putnam et al. 1994; Mason *in* Steffian et al. 1994) A complex reconstruction of local land and sea level changes has been modeled for the Alaska coastal plain near Yakutat (Molnia 1986) but its relevance to Southeast Alaska remains uncertain. Near the Brady Glacier, along Cross Sound, growth position stumps have been documented in the intertidal dating from 1960 ± 65 radiocarbon years B.P. These stumps indicate an elevated landscape at that time but exact measurements of the elevation of these trees compared to the elevation of living trees has not been reported. These land level elevational changes have formerly been attributed to localized isostatic mechanisms (Derksen 1976:41-6). A series of six terraces have been reported in karst terrain along Lynn Canal. These terraces have been interpreted as former shorelines which were subjected to periodic uplift events in that region (Mason *in* Steffian et al 1994:108-112).

Further complicating matters in locations like the Indian River delta is that compaction of unconsolidated sediments was commonly observed after the 1964 earthquake in Southcentral Alaska. This process causes unconsolidated sediments to have reduced elevations following major earthquakes. In some cases localized subsidence was observed even in locations which experienced uplift as a result of the 1964 earthquake (Stanley 1968, Chaney 1987:132-4). In December 1843 and March 1848 strong tremors, lasting six seconds and 25 seconds respectively, cracked stoves and knocked down chimneys in Sitka (Tikhmenov 1863:420-421).

3.1.4. Beach Development

The coastal zone is the most dynamic and complex physical environment on earth. In this relatively narrow band atmospheric, marine and terrestrial forces combine to produce an environment where change is normal. The physical processes which form beaches are unique because waves transport sediment along shore horizontally as well as uplifting sediments and depositing them in ridges. The surf zone is unique among erosional environments because sediment is actually forced upward against gravity while the net effect of all other erosional processes is that unconsolidated sediments move down slope. As a result, beach deposits do not follow the three most basic geological principles.

The basic principles of geology were first formulated in 1669 by Nicolaus Steno (Press and Siever 1982:28-31). These three principles form the basis for geological theory however they can be misleading if applied to beach stratigraphy (Figure 3.4). The primary principle is that of superposition which simply states that in sedimentary sequences the oldest deposits are located on the bottom and youngest are found on top. Unlike sediments which settle solely under the influence of gravity, beaches accrete seaward so the youngest beach ridges are located near the surf zone while older ridges are found farthest from the surf zone. The second principle is original horizontality which states that stratigraphic layers are originally deposited in flat layers. Although this is true when sediments settle under the influence of gravity alone, waves deposit material in long narrow ridges. The third principle describes original lateral continuity. This means that

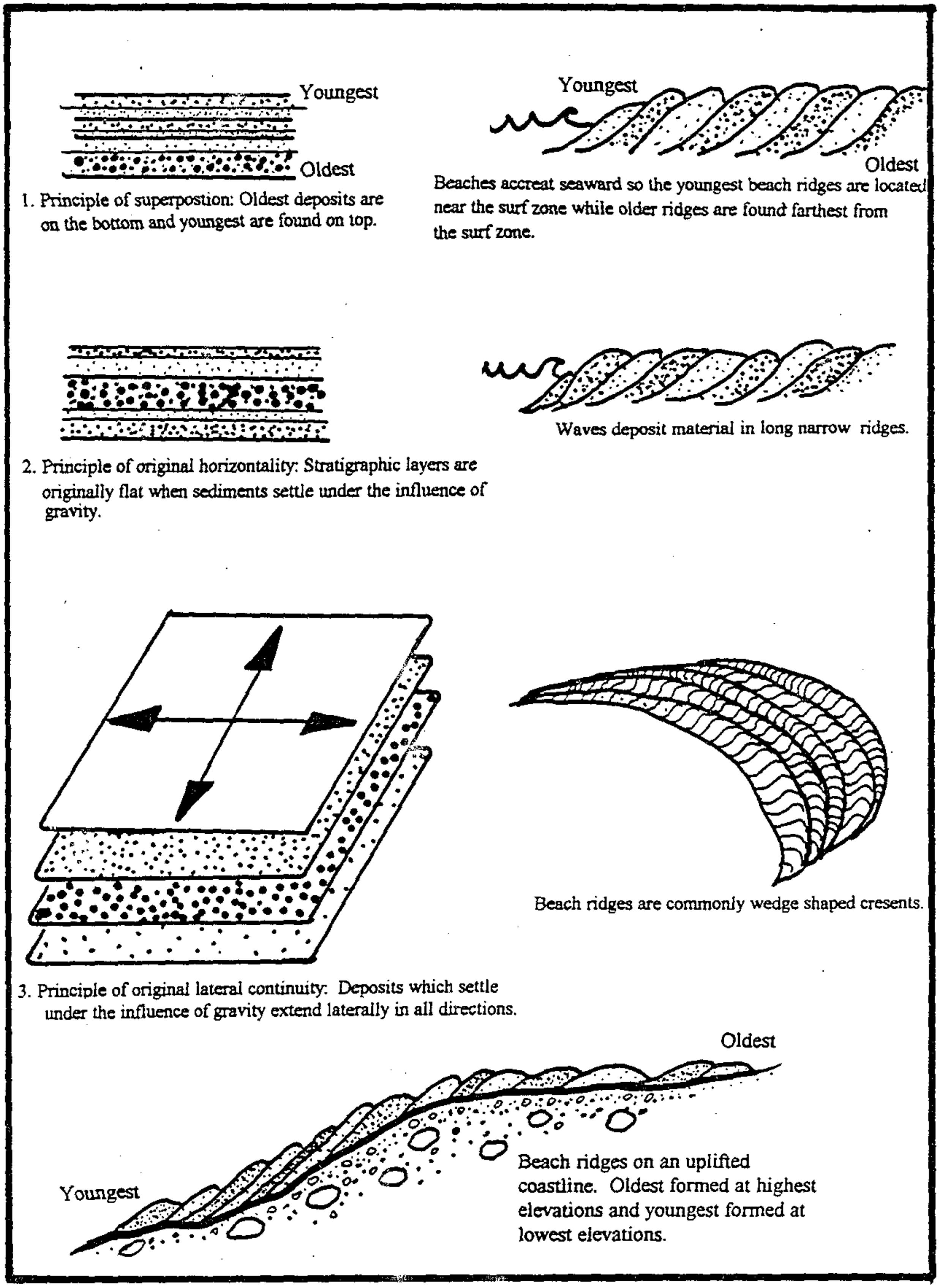


Figure 3.4 Steno's three principles of geology do not apply to beach ridge stratigraphy.

deposits which settle under the influence of gravity extend laterally in all directions. Beach deposits are unique because waves form beach ridges which commonly take the form of wedge -shaped crescents. The ramification of these differences is that unlike most sedimentary sequences, it is not possible to extrapolate the continuity of individual beds between distant stratigraphic profiles which consist of wave deposited sediments.

Beaches result from sediments which have been transported and deposited by waves. Waves sweep sediments up beaches in much the same fashion as a janitor's wide push broom sweeps dirt into a broad thin pile. If waves strike a beach at an oblique angle, sediments are transported along the shore as well as up the beach. Some of the sediment contained in the Park's beaches may have been transported along shore from Crescent Bay. A wave's energy dissipates as it runs up the beach and the entrained water then washes back down the beach carrying some sediment back with it. On coarse grained beaches sediment permeability is so great that much of the water from a wave percolates down through the beach and backwash is minimal.

Tides have the effect of rhythmically raising and lowering the wave attack zone. As the tide turns from ebb to flood and visa versa there is a period of slack water. During this time, water level is relatively constant and wave energy is delivered to this single elevation. This mechanism results in wave action being most effective at high and low tide. Storm tides allow waves to reach higher than during normal conditions. Beach sediments are frequently reworked with every passing storm so only the most vigorous storm and high tide combinations create beach ridges which are preserved. Lower ridges are soon reworked by waves from later storms.

3.1.5. River Dynamics and Delta Development

Sitka National Historical Park primarily rests on sediments carried to the site by Indian River. Indian River bisects the Park and in many ways is the centerpiece of the area. Rivers can be considered as "sleeping giants." Ninety percent of the time they are near base flow levels and lie comfortably within the confines of their banks. This relatively low water level is deceptive. Even though an observer visits a river frequently and may feel he "knows the river well" a river unusually fills its banks at least once a year. Most rivers overtop their banks every couple of years. During any given 10 year interval a major flooding event should be expected. Truly disastrous floods may have a recurrence interval exceeding 50 years (Hewlett 1982:157). The most significant factor to keep in mind is that most sediment is eroded, transported and deposited during flood events. These infrequent episodes of flooding are the primary events which sculpt river channels.

Rivers transport considerable volumes of sediment. The majority of sediment is transported during flood events when water volume and velocity may be many times higher than normal. When a river reaches sea level its velocity is reduced and as the stream disperses it loses its ability to transport sediment. This commonly results in a fan shaped delta. The primary source of sediment present within the Park has been contributed by Indian River. Some of this sediment has been deposited on floodplains but most was probably deposited subaqueously. Sediments deposited in the intertidal zone have been reworked by waves. Since the region has experienced long term uplift, most surficial deposits above sea level consist of river transported sediments reworked by waves.

Of major interest to this study is the asymmetrical shape of the Indian River delta. The course of Indian River appears to have been deflected away from the Pacific Ocean which supplies the dominate source of wave energy. Storm driven waves have probably pushed sediment deposited at the river's mouth back into the river channel. This process would have deflected the river's course landward. Meanwhile fluvial erosion would have worked against this deflection tending to maintain a relatively straight channel. These two forces have been locked in a dynamic battle since the delta was established. It should be noted that as the region has been uplifted, the numerous islands in Sitka Sound have provided ever greater protection from Pacific storm waves. In historic times construction of the airport runway has created an artificial breakwater. This artificial protection from storm waves renders modern observations of wave energy along the Park's shoreline too low to be used to form direct evaluations of prehistoric wave energy regimes.

The river's sediment supply has also probably declined over time. When the Pleistocene ice sheet retreated from the Indian River watershed, considerable unconsolidated material was probably washed downstream rapidly building up the wedge of sediment currently composing the delta. As the watershed became vegetated, sediment yield would have been reduced (Streveler 1969). The construction of dams across the river above the Park act as sediment traps largely eliminating coarse sediment supplied from upriver. In addition these dams are diverting water from the river which further reduces its present sediment carrying capacity.

3.1.6. Tephra Deposition

When volcanic ash is present in a soil profile it provides a valuable time specific stratigraphic horizon. Tephra is composed of fine airborne particles which mantle the landscape. The deposits are easily eroded and usually accumulate in low hollows or at the base of slopes. Therefore preservation is highly depended on micro environments. For example tephra falling on a forest would be shed away from tree trunks by radiating branches and would be thickest around the tree's outer perimeter. In contrast an ash fall on an open meadow would form a relatively uniform layer. Tephra falling on a bare slope would accumulate at the base of the slope. Therefore tephra deposits should not be expected to be continuous or of uniform depth even in an area where the ash fall was initially evenly distributed.

Pleistocene-aged mafic-tephra deposits above the altitude of 40 feet msl are widespread in the Sitka area and average five feet thick. This ash fall occurred before 8,570 ±300 B.P. and was probably deposited approximately 10,000 years ago (Reihle et al. 1992:187; Yehle 1974:22). Considering fragile tephra stratigraphy is destroyed by wave action, the absence of this tephra below 40 feet elevation is evidence of regional uplift. A thinner Holocene-aged ash deposit has been documented in the Sitka area which has been bracketed by uncalibrated radiocarbon dates of 4,030 ±90 and 4,310 ±140 B.P. (Riehle and Brew 1982:115).

3.1.7. Soil Development

Detailed descriptions of soils observed in the Park were compiled by USFS soils specialists for the Ecological Inventory (Figure 3.1)(USFS 1993). Although these descriptions are quite precise, the results were extrapolated over broad "Ecological Units." The boundaries of these units included several elevations and therefore specific soil types. In most cases soil descriptions presented in the USFS Ecological Inventory cannot be used to correlate soils with specific elevations. In addition, locations of individual soil pits were not identified so only regional generalizations can be drawn from the soil descriptions provided. Although a rough sequence of relative "Ecological Unit" ages was provided, the USFS Ecological Inventory did not attempt to date landforms or dwell on their morphogenesis.

The primary reason this geomorphology study was commissioned was to provide a chronology of landform development events as a basis for future archeological surveys. Due to budgetary constraints, it was deemed to be of primary importance to determine when identifiable terraces were no longer effected by marine influences and thus could have supported terrestrial vegetation. On well drained marine sediments, terrestrial vegetation becomes established as soon as it is uplifted beyond the highest tide level (Streveler et al 1993). This vegetation provides organic material which forms a layer of clast-free loam which rests on marine transported cobbles, pebbles and sand. It was the easily identifiable contact between terrestrial clast-free organic loam and marine clast-based soil that was systematically sought during this study. At each sampling site careful excavation down to the contact zone was conducted. Once the contact zone was identified, carbon based material lying directly on the contact zone was collected wherever possible to be used for radiocarbon analysis. Therefore soil observations were drastically simplified for the purposes of this study. Soils were classified primarily as clast-bearing or clast-free. This simplified classification scheme allowed the project to focus on the primary goal of landform age determination.

The strategy outlined above would not locate paleosols buried under water born sediments. The reason for the adoption of the shallow excavation policy was based on observations reported by past researchers in the Park. During excavation of the Russian Sailors' "Grave Site" on the east bank of Indian River, Hadleigh-West (1959:36) reported:

> It was noted immediately...the soil underneath the wooden structure took on the sterile appearance of the surrounding areas. This appearance did not alter significantly as the excavation went down. The soil color was medium gray, very gravelly, and intermixed with coarse sands. There was no evidence of either disturbance or of an abnormally high organic content. The excavation at the grave site was continued until a depth of about 8 feet was reached.

In the vicinity of the fort site Hadleigh-West (1959:41) described:

> Conditions for digging were poor in the extreme. The mantle of soil was quite thin, ranging from one or two inches to almost total absence. The underlying gravels were quite large... Although there was some intermixture of soil in the higher levels of the gravels, it generally was not sufficient to keep the walls of trenches from slumping and assuming the appearance of well-used drainage ditches... No evidence of stratification, either natural or cultural, was found. In test pits and trenches, an effort was made to maintain a system of excavation by arbitrary levels. Because of the difficulties of excavating gravels, plus the thinness of the cultural deposit itself, this had to be abandoned as unworkable.

The USFS Ecological Inventory soils scientists did not report the observation of any clast-free paleosols buried beneath clast-based soil layers. All of their test pits were excavated to depths of at least 40 inches or down to bedrock.

Sitka National Historical Park (SNHP) archaeologist Gene Griffin (personal comm.) reported that totem pole foundations along the seaward side of the Park were excavated to depths exceeding eight feet. These excavations did not reveal any major clast-free paleosols below the surface. One possible exception to this was the backhoe excavation of a totem pole foundation near the Visitor Center. An NPS videotape of the excavation was reviewed for this study. A layer of black film coated cobbles was observed at depth. A sample of the suspect paleosol had been collected by Gene Griffin. After review of the evidence available, it appears that this black coating resulted from deposition of minerals along a high water table. It is not possible to say definitively at the present time what the nature of this deposit is and it is possible that it represents an ancient paleosol. Since the actual stratigraphic sequence was only observed on video tape for this investigation, further research is recommended. What ever the nature of this deposit is, its depth made reinvestigation by hand tools impossible within the time available for the present study.

3.1.8. Floral Turbation

The most prevalent soil mixing force in rain forests is tree root growth (Rathje 1982:142). One ramification of this factor is that wood observed deep in a soil profile might be from a modern tree root or a root which penetrated an ancient soil profile and then died. It is very difficult to discern between a fragment of decayed root or a bit of wood which was deposited at the same time as the surrounding soil.

Uprooted wind thrown trees are common in the Park. Trees usually establish sufficiently strong root systems to cope with winds common in their locality. If adjacent trees are removed, wind loading may increase beyond the root system's failure threshold and the tree will fall. Soils entrained in the root systems of uprooted trees are unpredictably mixed (Figure 3.5). As a tree is blown over, a shallow crater is created exposing relatively ancient deposits devoid of soil development while younger soils are chaotically deposited primarily in the vicinity of the upturned root wad. In such a situation the principle of original horizontality is no longer valid. In addition, adjacent trees are then exposed to additional wind loading causing a "domino effect." While windblown trees are easily recognized as long as the wood remains intact, after logs decay they are impossible to recognize. Wind thrown trees have occurred in the historical past as indicated by Golovin (1983 [1861]:118) who stated:

> Centuries-old trees, felled by the wind, lie one atop the other. Some have already rotted and turned into loam; others disintegrate at a touch, and new trees grow on top of these fallen giants, not infrequently as much as 90 feet in height.

If wind thrown trees were common occurrences in the past, then stratigraphy of the effected region would be unpredictably mixed and stratigraphic interpretations which did not take this possibility into account would come to erroneous conclusions.

3.1.9. Faunal Turbation

Mixing of soil profiles by activities of various animals can destroy the original stratigraphy in any given location. Chipmunks were observed during the field study burying spruce cones for winter food supplies. While this is an undoubtedly beneficial survival strategy for rodents, it makes the geomorphologist uneasy to witness young carbon bearing material currently being systematically placed below the surface. Other animals such as bears could also have mixed near surface stratigraphy in the past. Insects and worms can also cause considerable disturbance over time but few of these organisms were observed during excavations in the Park and their influence within the Park's boundaries is assumed to have been relatively minimal. In the majority of cases the net effect of faunal turbation would be to place anomalously young carbon material at the clast bearing contact zone.

Figure 3.5 Wind thrown uprooted tree at sampling location "D-2". X: Soil entrained in root system. Y: Chaotically redeposited soils. Z: Shallow crater.

3.2. HUMAN FORCES

It is critical to understand that the setting at the mouth of Indian River is quite different today than it appeared during the battle of 1804. For those studying natural history, it should be remembered that the modern setting along the lower Indian River is largely artificial.

Several major modifications have been made by humans to the natural setting within the Park. Many of these construction projects have produced features of the same magnitude as natural forces. Two major issues should be kept in mind as prehistoric reconstructions are considered. The primary one is that artificially created landforms might be mistaken for natural ones. Convoluted and misleading reconstructions might be derived to explain the presence of terraces and ridges of human construction. A secondary concern is that modern wave energy, river water volume, offshore gradient, and stream channel have all been modified by human activities. These factors have combined to create a rather different modern environment than that which existed during the battle of 1804. The combination of impacts has prompted one researcher to comment that the lower reaches of Indian River represent one of the most highly modified river systems in the entire State of Alaska (Molnia 1980:2). Those human activities which may have created sites with high likelihood of associated cultural material are discussed in detail in Section Seven of this report but a brief review of significant ground disturbance activities which have modified landforms is provided below.

3.2.1. Dredging

During 1939 dredging began at the mouth of Indian River. As World War II approached and as the military began to prepare for the war effort, requirements for sand and gravel became ever greater. The Indian River delta provided the most readily accessible supply. By 1941 erosion along the banks of Indian River, intensified by gravel dredging activities, was becoming a serious problem but dredging continued. By October 1941 the Navy had dredged a pit 200 feet long, 30 feet wide and up to 30 feet deep at the river mouth. By the end of World War II over a million cubic yards of material had been removed from the river bed and near shore areas. This sediment removal oversteepened underwater gradients and lowered the river's base level. Massive subaqueous sliding and river bed erosion resulted. The need for gravel diminished in 1944 when military construction on Japonski Island was nearing completion and in April 1945 the Navy razed its gravel bunkers and all but one of the shacks used in dredging operations. Gravel dredging increased dramatically between 1954 and 1960 when at least 320,000 cubic yards of gravel were removed from the vicinity of the Indian River's mouth creating further erosion problems. Offshore dredging continued erratically until 1979 (Antonson and Hanable 1987:108-11).

3.2.2. Road Building

As early as 1869 a road was constructed to Indian River (Antonson and Hanable 1987:37). By 1881 a road was built on the far side of the River (Antonson and Hanable 1987:4,65,68). Some of the early road routes are still used today while others have been abandoned. Several trails have been constructed throughout the park over the years. The routes followed by many of these have probably not changed but some are no longer used. Abandoned roads and trails could easily appear to be narrow terraces, ridges or levies formed by natural processes. During excavation of the Russian Sailors "Grave Site" a layer of compact gravel was encountered:

> Over approximately the northern one-third of the feature was a layer of gravels of rather large size and well compacted. It was thought at first that this had been placed over the grave as a protective device and that, by some means, two-thirds of it had been removed... Subsequently it was decided that the gravel layer represented an edge of the bed of an old road... (Hadleigh-West 1959:53).

3.2.3. Bridges

Several bridges have been built in the Park since the 1880s. Most have washed away leaving little evidence they ever existed. However one low bridge supported by large concrete footings was built in 1966 (Figure 4.9a). This bridge was washed out 10 days after it was completed but a couple concrete footings still remain in mid stream. A gravel bar has developed on the down stream side (Figure 3.6). Additional concrete supports appear to have been incorporated into nearby riprap.

3.2.4. Totem Sites

Totems have been erected along the seaward side of the Park beginning in 1901. Totems require relatively large excavations to support their foundations. Many of the totems have been relocated several times. Any former totem site would have very disturbed stratigraphy.

Figure 3.6. Concrete bridge supports downstream from the present Park footbridge. These supports are thought to be from a footbridge destroyed during a flood event in the 1960s.

3.2.5. Power Transmission Line

At some point before 1919 a power transmission line was built along the seaward side of the Park (Figure 4.4, US Survey 1258). Although this power line was decommissioned in 1954 it is not certain that the bases of all the utility poles planted there were removed (Antonson and Hanable 1987:97). If the bases of any of these poles remain, they could be mistaken for trees which grew at a lower stand of sea level.

3.2.6. Asphalt Plant

A poorly documented hot asphalt plant was operated on the east bank of Indian River until 1958 when the surplus asphalt and debris were buried on site (Map 1). The fill was later "reforested". In 1969 Streveler was confused by this site and classified it as a "Badly trampled area" (Streveler 1969:3,10) He was not informed of the past history of the artificial terrace and assumed it was a natural feature. Since this deposit is out of equilibrium with local erosional regime, it has begun to erode. Timbers exposed by erosion at this location were observed during the field study (Figures 3.7, 3.9).

3.2.7. Erosion Control

Erosion control measures have a long history in the Park extending back at least to the 1920s (Antonson and Hanable 1987:70). The unconsolidated banks of Indian River were easily eroded during minor floods so throughout the years, various erosion control projects were conducted. Log

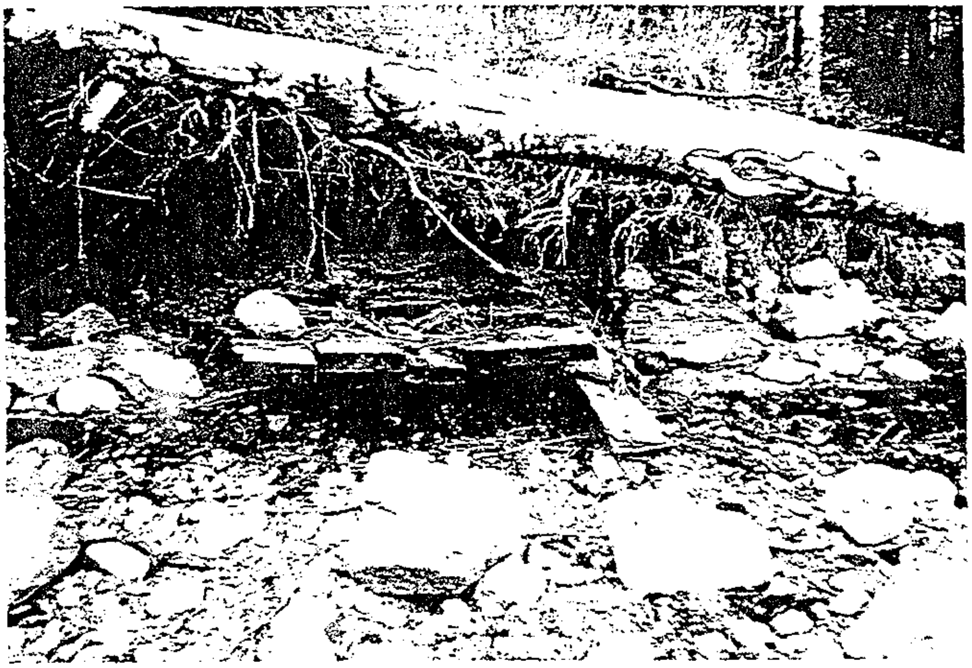


Figure 3.7. Remains of a buried asphalt plant on the east side of Indian River being exposed by shoreline erosion in 1994.

cribbing seems to have been the preferred early method of bank stabilization. These projects often centered around bridge abutments but bank stabilization occurred at various locations.

Considering the unusually high rate of modern land uplift, it is to be expected that the river would have continued eroding as its base level dropped. It is likely that since the historical record of Indian River channel began in the 1850s, the river has not been in equilibrium because of regional uplift. River course changes are normal in response to a changing environment but human expectations demand a static river channel. More detailed study of Park archives would be required to determine how much the river channel was altered or contained prior to the dredging which began in the late 1930s.

The extensive dredging which took place at the mouth of Indian River had dramatic ramifications for the stability of the Indian River channel. During an October flood in 1941 a strip of river bank about [illegible]00 feet long and six to 40 feet wide is washed away (Antonson and Hanable 1987:108-9). In September of 1942 the entire bed of the lower river mobilized during a modest flood. The river bed dropped so much that large sections of the bank collapsed into the river and large sections of old growth forest were washed away. The erosion was so rapid and dramatic that the bridge spanning the river was washed away along with three service men, two of whom were drowned. This pivotal period began a new era for the Park's erosion control requirements. The new banks were very unstable and extensive damage had been done to Park resources including woodlands, trails, the bridge and a totem pole. In addition the *Kiksadi* fort site was in danger of being washed away (Antonson and Hanable 1987:108-10). In the wake of these major erosional events several erosion control projects were undertaken, however the river sediment transportation system had been so altered that erosion continued to accompany even modest flooding and most of these original projects were ineffective (Antonson and Hanable 1987:111).

During 1985-6 a very aggressive erosion control project was undertaken. This involved dredging the river channel to reroute water flow and the placement of large quantities of blasted rock in the river bed. Stream bank stabilization involved grading long sections of the bank and the placement of large blasted riprap (Figure 3.8, Map 1). In addition, areas of the beach which were threatened by wave erosion were also armored to various degrees with the addition of angular blasted rock (Figure 5.4). The net effect of this project has been to save the *Kiksadi* fort site as well as much of the trail system along the lower river and Lover's Lane from being lost to erosion (Antonson and Hanable 1987:131,137,155).

Figure 3.8. Indian River bank protected with riprap to prevent bank erosion. This fill creates an artificial stratigraphic profile along the river bank.

3.2.8. Trailer Court Fill

In 1979 the owner of the Arrowhead Trailer Court illegally put fill into the lower Indian River to enlarge the size of his property (Figure 3.9, Map 1). This fill was protected with heavy riprap and trailers were placed on the fill (Antonson and Hanable 1987:135) Although this structure is outside of the Park's boundaries, it is adjacent to and directly downstream from the Russian Memorial. The net effect of this fill on the hydraulic regime of the Indian River delta is difficult to discern without detailed research which is beyond the scope of this study. It seems probable that the minimum effect would be to deflect flood stage flow toward the fort side of the river. Whether this would significantly increase erosion along the riverbank adjacent to the fort site is difficult to say possible. It should be noted that this artificial projection into the river channel further changes the modern appearance of the delta compared to how it looked during the battle of 1804.

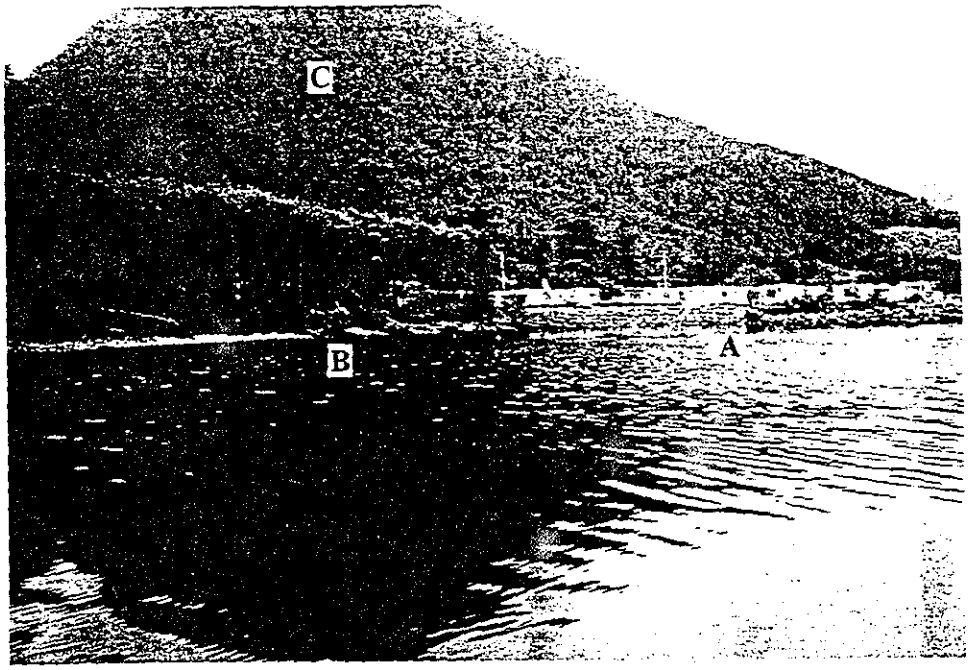


Figure 3.9. A: Arrowhead Trailer Court fill. B: Buried asphalt plant shoreline erosion. C: Mount Verstovia.

3.2.9. Dam Construction and Water Diversion

One invisible change to the hydraulic regime of Indian River has been the construction of dams upstream from the Park. This diversion of water for Sitka's water supply, hydroelectric power generation and a hatchery have significantly reduced the base flow of the river. Water supply reduction tends to reduce a river's erosional power, however the dams also trap sediment which produces a net deficit for the river's sediment budget. These dams probably do little to reduce flood level waters but would still effectively trap sediments supplied from the watershed during flood events. Considering these factors, it is likely that the dams above the Park on Indian River have increased the rate of erosion along the lower stretches of the river. The magnitude of this impact has not been determined and would require investigation beyond the scope of this study.

3.2.10. Construction of Buildings

A standing structure provides obvious testimony that the landscape has been modified by human activities (Figure 3.10). A far different situation exists when a building is torn down and the site is revegetated. The *Kiksadi* fort site, located within the Park, has received a great deal of attention but additional Russian buildings are known to have occupied various locations within the Park. Unfortunately their placement is poorly documented. Construction of buildings within the Park during the early American period seems to have been limited. The site of a replica Russian style blockhouse built in 1927 is well documented. This structure was bulldozed onto the beach and burned in 1959 (Antonson and Hanable 1987:20,71,115-6). The net effect of this activity would have been to remove any uplifted beach ridges in this area. Some structures were constructed by the military during World War II in connection with the gravel dredging operations (Antonson and Hanable 1987:87,108,110). We were unable to identify the former location of these installations for this investigation. In 1964 the Littlefield house located near the Park's entrance was acquired by the Park and in 1964 was burned by the Sitka Fire Department (Antonson and Hanable 1987:101).

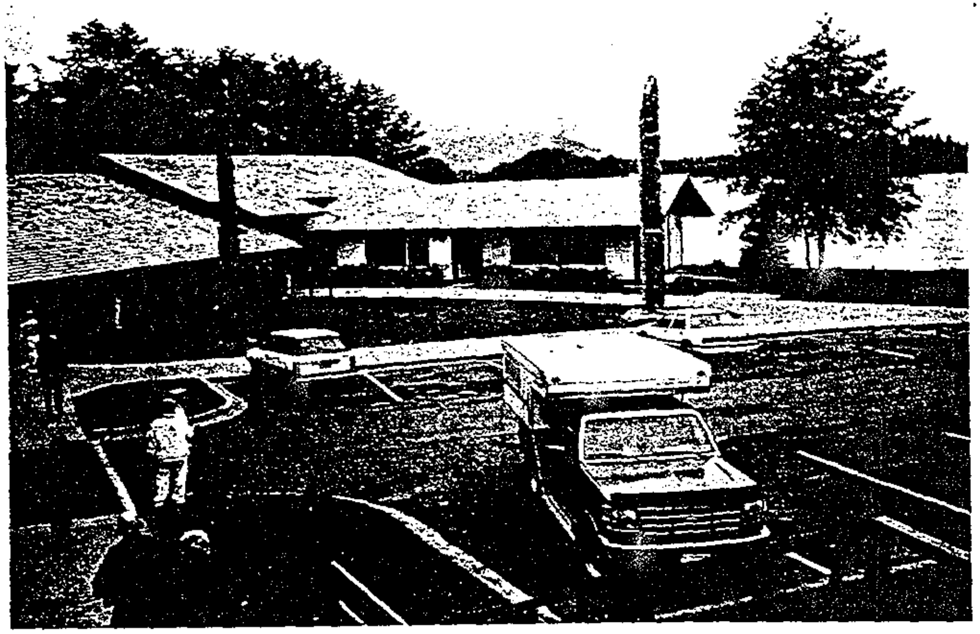


Figure 3.10. Sitka National Historical Park Visitor Center and Parking Lot.

3.2.11. World War II Gunnery Emplacements

In 1942 large portions of the Park were taken over by the US military. As part of the regional shoreline defense, machine gun pits were established in the Park (Antonson and Hanable 1987:19,78,89). These structures are still apparent in the Park as low mounds. The area around these installations was probably bulldozed in order to build these mounds. Surficial stratigraphy in the adjacent areas has probably been removed or mixed. It should also be noted that these mounds superficially resemble beach ridges (Figure 3.11).

3.2.12. Fort Site Preparation

The sedimentary sequence in the vicinity of the *Kiksadi* fort has been significantly modified in historic times. This subject is discussed in detail in Section Seven of this report however it is helpful at this point to summarize known ground disturbing activities which have taken place in this area. Of all the localities in the Park the *Kiksadi* fort site is the most likely to receive future archeological investigation due to its historical significance. Researchers attempting to interpret stratigraphy in this area should be aware of the scope of these human impacts.

The first known and most obvious modification occurred when the fort was constructed. It is not known what level of excavation was conducted in order to build the log palisade and houses drawn by Lisianskii in 1804 but it seems probable that surficial soils were disturbed. Baranov and descendants of the Tlingit defenders have described pit(s) dug inside the fort for refuge from the Russian bombardment (Hopkins 1987:15: Baranov [1805] 1979:141-2). After the battle the fort

Figure 3.11. Low mound of a World War II gunnery emplacement superficially resembles a relic beach ridge.

was burned or dismantled. By 1850 three Russian buildings occupied the area (Teben'kov 1852:Chart 38). Once again it is not known the extent to which the ground was disturbed during this period but during World War II machine gun pits and two or three bunkers were dug very near to the fort site itself. The full impact of these activities is uncertain at this time. Little is known of the early American activities in this area but Hadleigh-West (1959:42) reports:

> There are on file in the NPS office at Sitka photographs taken at the time of the erection of the replica poles at this point in the park. The ground, for what appears to be an extensive area, seems to have been bladed. In the background of the photograph is shown a bulldozer. The cultural deposit certainly gave evidence of the kind of mixture expectable (sic) under such circumstances.

The area impacted by Hadleigh-West's 1958 excavation of the site is comparatively well documented although there are several references to exploratory excavations which did not yield cultural material. The location and extent of these excavations was not documented. In 1970 trenches were dug in the fort site area for the totem pole treatment program. In 1980 the fort site was landscaped and the totem treatment trenches were filled in. 1985 saw the installation of riprap along Indian River to control the erosion of Indian River. Considering the long series of ground disturbing events which have taken place in this vicinity, little undisturbed stratigraphic evidence indicating landform evolution remains in this location. Any stratigraphy observed must be very carefully evaluated to be certain it is not located in an area which has been disturbed by one or more of the activities outlined above.

SECTION FOUR

4.0 HISTORICAL DOCUMENTATION OF GEOMORPHIC EVOLUTION

It requires a very unusual mind to undertake the analysis of the obvious.

Alfred North Whitehead

In order to understand rapidly changing coastal environments and predict their future morphology, detailed knowledge of historical developments is extremely helpful. Old maps and written records can be very useful for examining the long-term changes in coastal geomorphology (Komar 1976). Comparisons of archival aerial photographs are commonly used to trace the recent evolution of coastal features (Shepard and Wanless 1971). In order to discover the nature and extent of littoral developments within the study area it was first necessary to attempt to consolidate the record and identify the limitations of this archival data base.

One difficulty involved in intelligently discussing erosion along Indian River is the enormous volume of information which has been collected by the Park over the years. Several boxes of documents are currently in the archives related to this subject. The time required to simply review all the information available could have taken all of the time budgeted for this entire project. The strategy taken in dealing with this large quantity of data was to quickly browse through some of the more relevant documents and photocopy those which looked most pertinent. Aerial photography was reviewed at the USDA Forest Service Chatham Area Supervisor's Office and those photographs which appeared most helpful were rephotographed with a hand held 35 mm camera. These prints were then analyzed in sequence to observe the magnitude of significant developments. Several qualitative observations were made which could be greatly expanded upon with the proper quantitative photogrammetric techniques and equipment. This discussion is therefore limited to those topics which have not received much attention in the past and is only an introduction to what could be a very elaborate discussion.

4.1. EARLY CHARTS

Although several early explorers charted the coastal waters of Southeast Alaska, the first detailed chart of Sitka Sound was compiled by Lisianskii in 1805 (see Figure 7.3). This chart does not contain enough detail about the Indian River delta to be of use for reconstructing local landform development. The chart does show shallow water at the delta's edge but the river channel is not shown at all. The next chart available was engraved in 1818 and published by Golovnin in 1822 (see Figure 7.4). This chart, based on a survey conducted in 1809 shows Indian River, however the scale and accuracy of the Indian River delta on this chart make detailed comparison with later charts impossible. The high water line along the delta is shown and does not appear to have been radically different from later maps of the area. The most intriguing aspect of this chart is the depiction of the location of the *Kiksadi* fort. A full review of this important issue is provided in Section Seven of this report.

The first detailed chart depicting Indian River which was secured for this study is contained in Teben'kov's Atlas of the North Pacific published by the Russian American Company (Teben'kov 1852) (Figure 4.1). Chart 38 which encompasses Sitka Sound is dated 1850. The survey may have been conducted earlier than this. This chart clearly depicts the Indian River delta, lower river channel and high tide line. Cultural features (see Section Seven) are also represented. Shoreline detail appears to have been sketched in and is useful for its intended purpose as an aid to general navigation. This cartographic product has severe limitations when detailed scaled comparisons are attempted with later charts and aerial photographs. A couple of these limitations are listed below:

- The shoreline contains a large indentation at "A". No other map or aerial photograph displays this feature. The 1992 SNHP topographical map clearly shows upland contours which parallel the current shoreline in this area. Aerial photography taken in 1929 (Figure 4.2) shows a straight shore line in this area. Therefore it seems that this indentation represents a minor feature which became exaggerated.

- The southern half of the delta appears shorter and wider than in later maps. Therefore it seems there is a length to width scale discrepancy. This means that scaled measurements between points cannot be used with confidence. For example the seaward side of the delta along what is now "Lover's Lane" measures 1,120 feet (assuming scale in sazhens), later maps show the distance to be 1,500 feet. The width of the delta is more difficult to evaluate because the stream channel could have shifted. The 1850 map shows the width at its narrowest point to be 770 feet while modern maps show it to be closer to 500 feet. The Russian length to width ratio is 1½:1 while modern maps display a 3:1 ratio.

In spite of the above limitations, the area is quite recognizable and a certain amount of *qualitative information* can be discerned. The primary point to note is that the near shore shoal matches very well with the shoal shown on 1929 aerial photography. The lower river channel also follows the same general course although the upper channel's course is crudely depicted. If the original survey notes could be located, they would probably provide a wealth of additional data.

One difference that is noteworthy is the point shown at "B". This point is quite sharp while on maps compiled after 1879 and aerial photography it is rounded. This could have been a spit formed by wave action pushing material into the river's path. At some time between 1879 and 1908 it eroded away. This cycle of wave driven spit growth and subsequent river erosion probably happened numerous times since the delta's formation.

Two hydrographic surveys were conducted in the vicinity of Sitka in the late 1800s (NOAA 1992). Survey H-1439 at a scale of 1:15,000 was conducted in 1879 and Survey H-2174 at a scale of 1:10,000 took place in 1893. It is not known what level of detail they contain relevant to the Indian River and delta but if further geomorphology research is done in the Park these surveys should be procured of possible (see Section Eight, Table 8.1).

The next chart reviewed for this study was an extract of US Coast and Geodetic Survey Chart No. 8245, dated 1892 but the survey for this chart was probably conducted in 1879 (Figure 4.3)

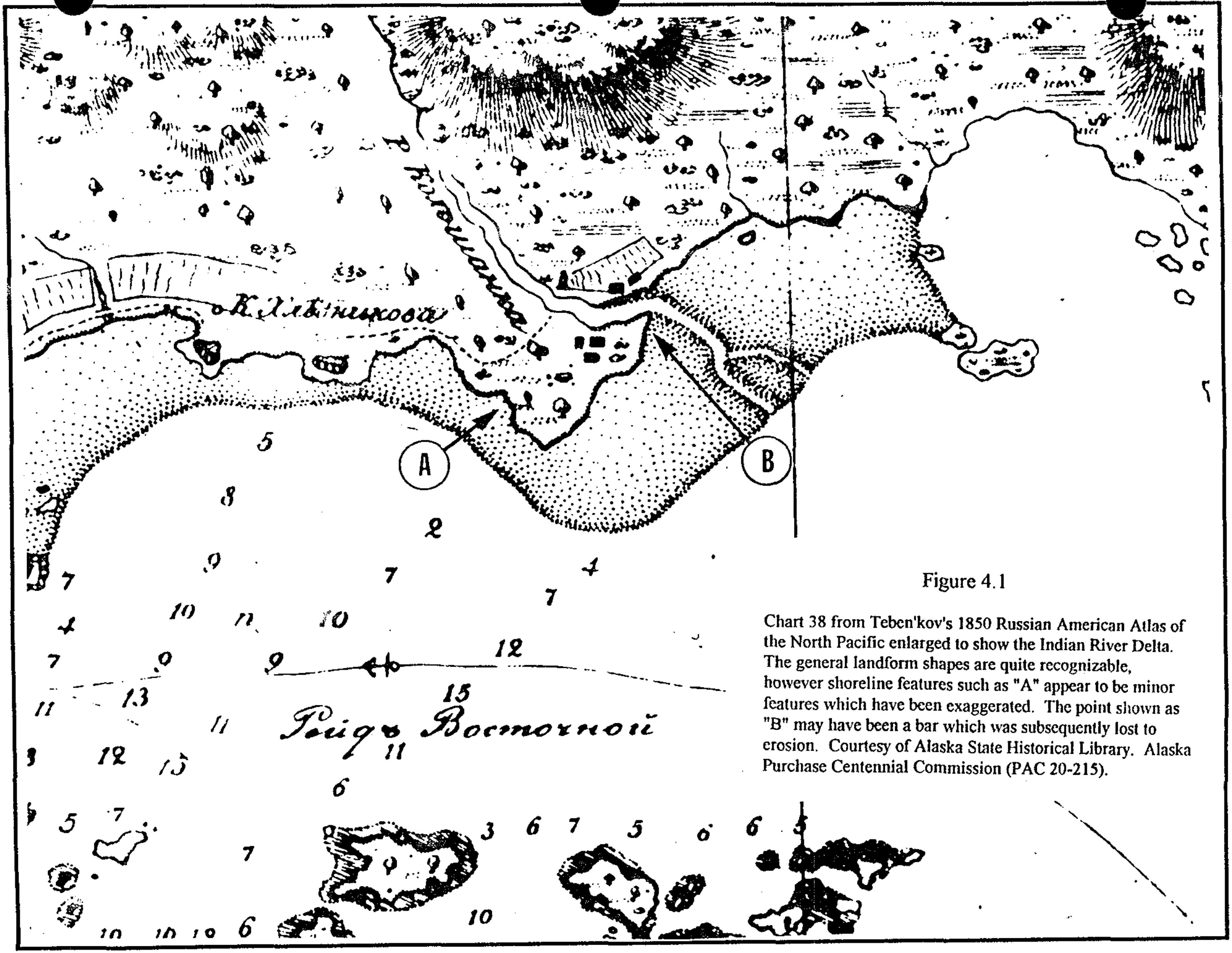


Figure 4.1

Chart 38 from Teben'kov's 1850 Russian American Atlas of the North Pacific enlarged to show the Indian River Delta. The general landform shapes are quite recognizable, however shoreline features such as "A" appear to be minor features which have been exaggerated. The point shown as "B" may have been a bar which was subsequently lost to erosion. Courtesy of Alaska State Historical Library. Alaska Purchase Centennial Commission (PAC 20-215).

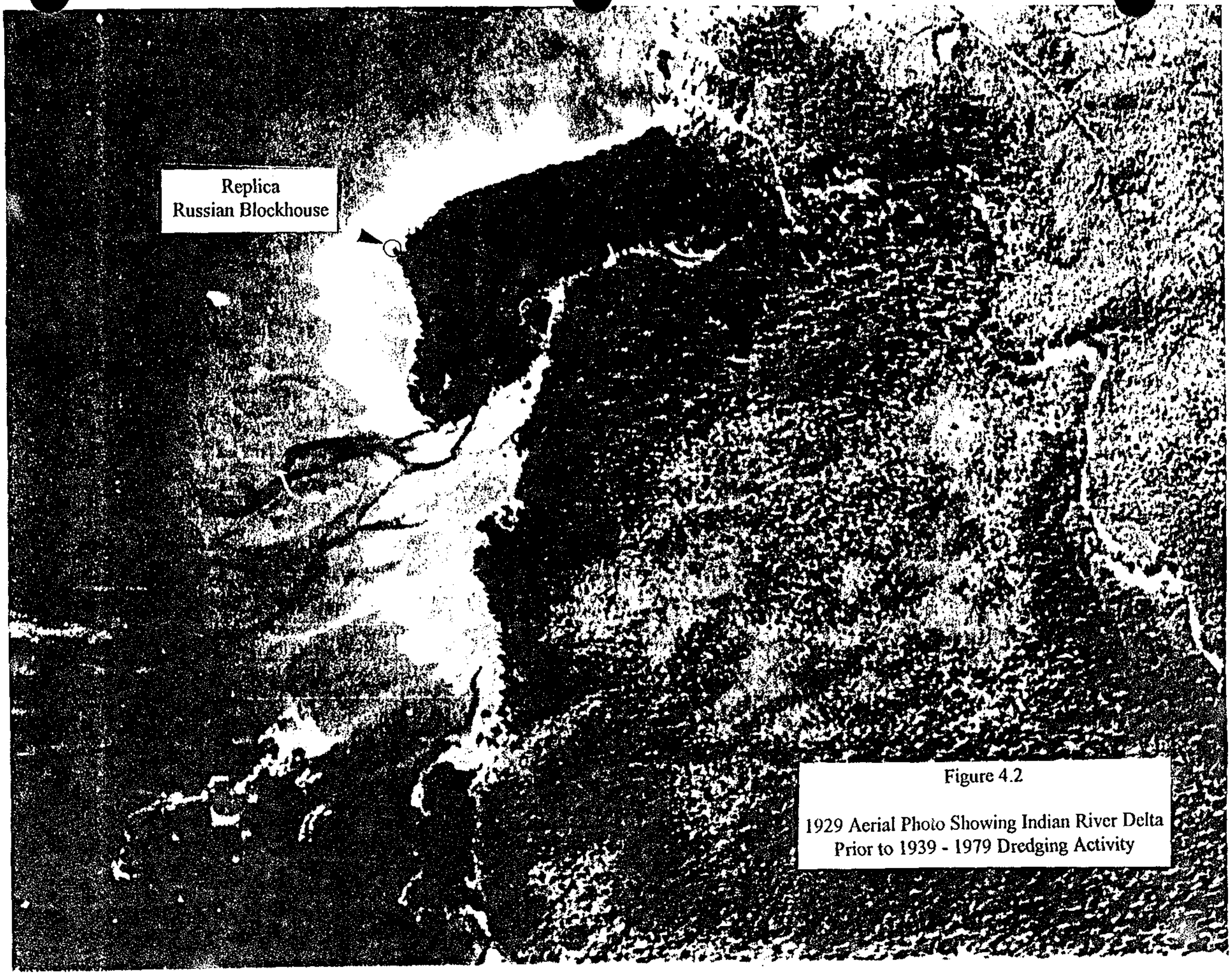


Figure 4.2

1929 Aerial Photo Showing Indian River Delta
Prior to 1939 - 1979 Dredging Activity

Figure 4.3. US Chart 8245 dated 1892 probably based on a survey conducted in 1879.

(Antonson and Hanable 1987: Appendix C). This chart also shows a sharp point adjacent to the fort site on the south side of the mouth Indian River. The lower river is shown hugging the southwest side of the channel and may have been eroding the southwest bank of the river at this time. No islands are shown in the river.

In 1908 a sketch map was compiled to delineate the proposed boundaries of the Sitka National Monument. This map was redrafted and used for the declaration defining the Park's boundaries (Antonson and Hanable 1987:10-5,54, Appendix C). The river channel depicted on this map contains only one small island (perhaps a river bar). The point shown in previous maps near the fort site is shortened and appears to have been eroded by the river. The west side of Indian River is labeled "Second Growth Forest." "Second Growth Forest" is also shown adjacent to the north side of the lower river channel.

The survey for the next known map was conducted on June 12 1919 (Figure 4.4)(US Survey 1258). This survey appears to have quite accurate shoreline detail although near shore shoal was not included. Of particular interest is the large wooded islands shown for the first time in the lower river channel. It seems unlikely that all earlier maps would have ignored these islands therefore it is assumed that they formed between 1908 and 1919. If the original notes for this survey could be obtained they might provide valuable insights.

4.2. AERIAL PHOTOGRAPHY

Aerial photography often provides the most dependable source of data for deriving erosion rates. Sitka National Historical Park is quite fortunate to have been documented by aerial photography dating from as early as 1929 (Table 4.1).

Table 4.1
Aerial Photography Available for Sitka National Historical Park

Date Flown	Agency (if known)	Photo Information	Scale (if known)	Comments
Ground photographs taken annually beginning ca. 1907.	Private Photographs	Luella Smith Collection at Isabel Miller Museum, Sitka, Alaska. Sitka Historical Society.	High Oblique	Oblique photos of Sitka taken annually from summit of Mt. Verstovia. Many include Indian River delta.
1929	U.S. Navy	USN-1 26A Flight lines 15 & 16, Photos V596,7 & V613-6		Black and White, excellent coverage of the Park.
August 15, 1948		SEA-123; 018,019,020	~ 1:32,000	Black and White, good coverage of Park
1957 or 1958	ALP	ALP-7 29-6&7	~ 1:16,000	Black and White, excellent coverage of Park
July 29, 1976	USDA	F16CN 32 02220 376, 79 & 80	1:16,000	Color, excellent coverage of Park
August 21, 1986	USDA	FS 58 8 610030 386-79		High altitude CIR

A high oblique photograph was taken ca. 1911 of Sitka from nearby Mt. Verstovia (Figure 4.5). The Indian River Delta is apparent in the foreground. General comparison of this photo with aerial photography taken in 1929 shows little change occurred in the 18 years separating these photos. Of particular interest to this study is the view of Sitka Sound and the Pacific Ocean

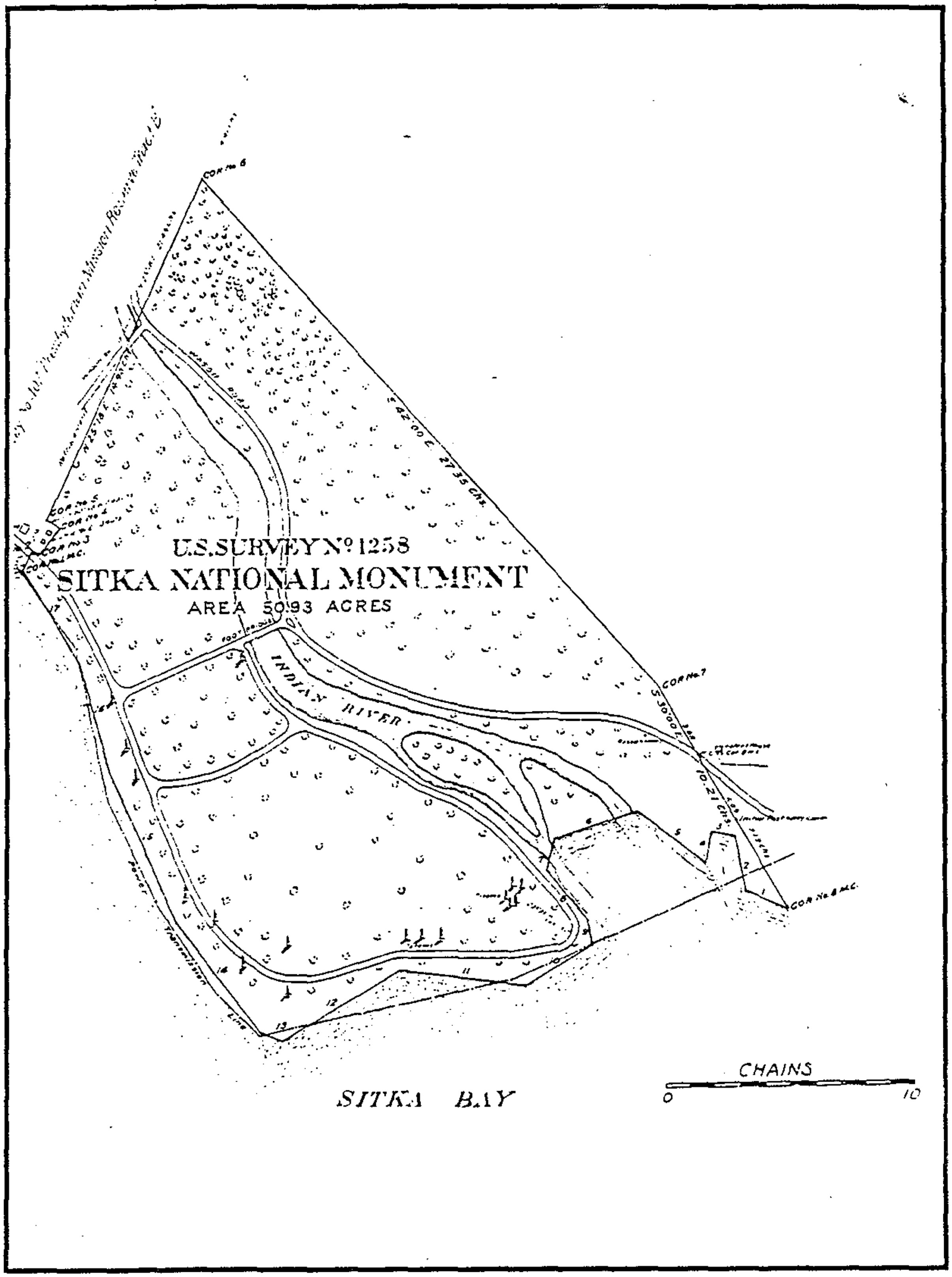
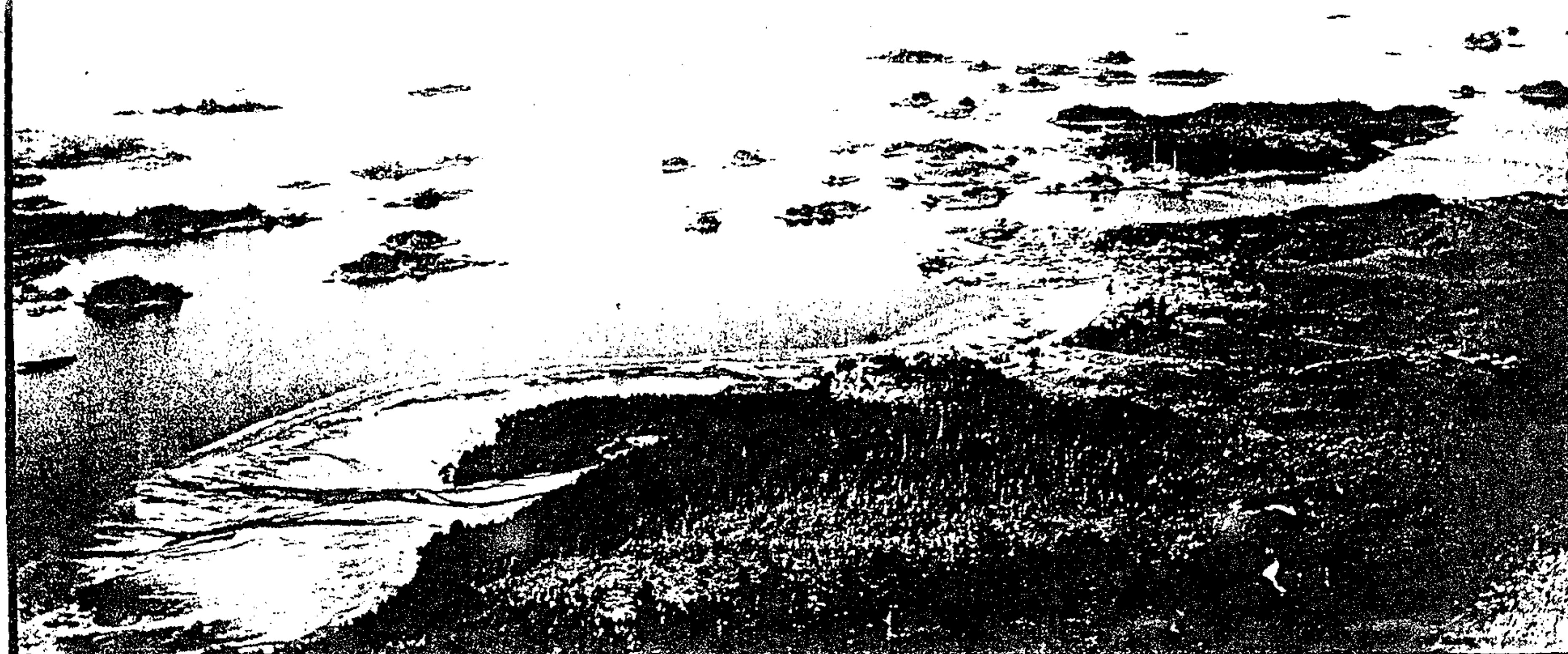


Figure 4.4. US Survey 1258 conducted June 12 1919. Large wooded islands shown in Indian River for the first time.

Figure 4.5

Indian River Delta from Mt. Verstovia ca. 1911.
Photo courtesy of Sitka Historical Society and the
Isabel Miller Museum, Sitka, Alaska.



beyond. From this perspective the small islands offshore from the Park can be seen partially blocking ocean swells. It is easy to imagine that as these islands emerged from the sea they would have provided progressively more protection from ocean waves. Therefore in the past when the region was at a lower elevation, the wave energy regime along the Indian River delta would have been greater. The photo also shows the Park's proximity to Mt. Edgecumbe, the source of tephra found in the Park.

The study of the Parks shoreline evolution is tremendously enhanced by the existence of aerial photography taken in 1929. This was among the earliest aerial photography missions undertaken in the world. Unfortunately the negatives of these historic photos are thought to have been destroyed in a fire. The only set of original prints currently known to exist is presently housed in the USFS Chatham Area Supervisor's Office in a locked set of fire retardant cabinets. Hall Guttormsen aided this project significantly by providing access to these exceedingly rare prints. It should be noted that these photos are not included on most (if any) aerial photography indexes. It is unfortunate that these aerial photographs were not available for use during the 1980 Erosion Control Study. The study concluded: "The documentation of long term erosion and erosion rates is made almost impossible by significant voids in the data..." Without baseline data, it was impossible for the erosional control study to determine the most significant changes which had occurred (Molnia and Smith 1980).

The photography taken in 1929 was experimental. Unlike most later systems, this mission employed a three camera system. Each flight line produced three photographs, one standard vertical photo in the center and a low oblique photo on either side (Figure 4.6). This unique arrangement provided coverage along a wide path of each flight line however the two outer photographs were systematically distorted. This distortion can be corrected with proper

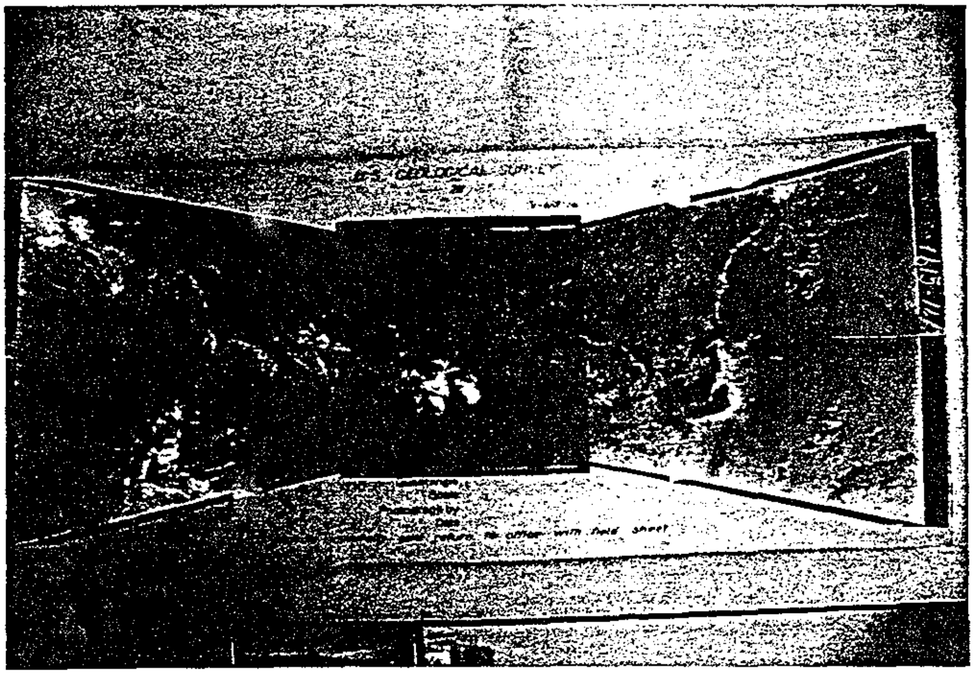


Figure 4.6 1929 aerial photography format used a three camera system resulting in a flight line three photographs wide. The outer two photographs are subject to systematic distortion.

photogrammetric equipment however detailed photogrammetry is beyond the scope of this project. The distortion present in the side photos is relatively minor and the photographs serve as an ideal baseline to evaluate shorelines prior to the massive dredging which began just ten years after these early photos were taken.

Sitka National Historical Park was included on at least two different flight lines. One of these flight lines corresponded with low tide and the other was taken at mid tide. The orientation of shadows is also different between the two flights which is particularly helpful along shaded river banks. [It is strongly recommended that the NPS copy these priceless photographs with a large format distortion controlled camera and place the negatives in the archives.] There were six photos taken in which the Park was shown. Stereoscopic coverage of the Park is excellent.

The next photography which was located for this study was taken in 1948. It is extremely likely that aerial photography was taken of the Sitka region during World War II but it was not contained in the aerial photography indexes reviewed. The method of referencing this imagery remains problematic but it is worth searching for. Aerial photography from this period could show the early effects of dredging. Since the World War II era was the most dynamic period of Indian River's geomorphological history, any aerial photographs from that time could provide valuable insights. The 1948 photography is good and shows the effects of dredging and erosion which took place in the preceding decade. Two large rectangular areas have been dredged along the intertidal zone adjacent to the seaward shoreline of the Park. The river channel at its mouth is straight and deep and appears to have been dredged. The river bed itself is much wider than in the 1929 photographs. This is apparently the result of the major dredging and subsequent erosion which took place at the mouth of the river.

The general evolution of the river's channel from 1948 through 1980 has already been studied (Molnia and Smith 1980). Aerial photographs taken in 1948 show the effects of dredging on the river channel and also the lack of impact on the lower delta. Unfortunately former erosion studies concentrated on the high water line and have mostly ignored significant developments in intertidal areas. Imagery taken in 1957 shows active dredging on the lower delta and by 1976 a large chunk of lower delta is missing (Figure 4.7).

While researching this segment of the project it quickly became clear that the erosion which began to plague the Park in the 1940s was not cyclical in nature. The term cycle implies a repetitive processes, usually seasonal, which is driven by relatively consistent forces. This concept also implies predictability. It is the nature of rivers to meander in their channels and to occasionally erode their banks. In an area where a river's base level is lowered, rivers tend to erode their beds. These processes were apparently active before the 1940s because Park administrators carried out various modest bank stabilization projects. However the primary factor which created the substantial erosion which plagues the Park even in the present, was river channel and near shore dredging conducted between 1938 and the 1970s.

Dredging created episodic impacts which the river system responded to quickly. The amount of sediment removed from the river channel during World War II exceeded a million cubic yards. For the purpose of illustration this equals a hole a football field long by a football field wide and a football field DEEP. Clearly unconsolidated sediments in an active river channel could not support such a hole. During seasonal flooding rapid and catastrophic adjustment took place. Large sections of old growth forest were undercut and washed away. Private sector dredging continued periodically after the war. Material removed during this period may have been as great as what

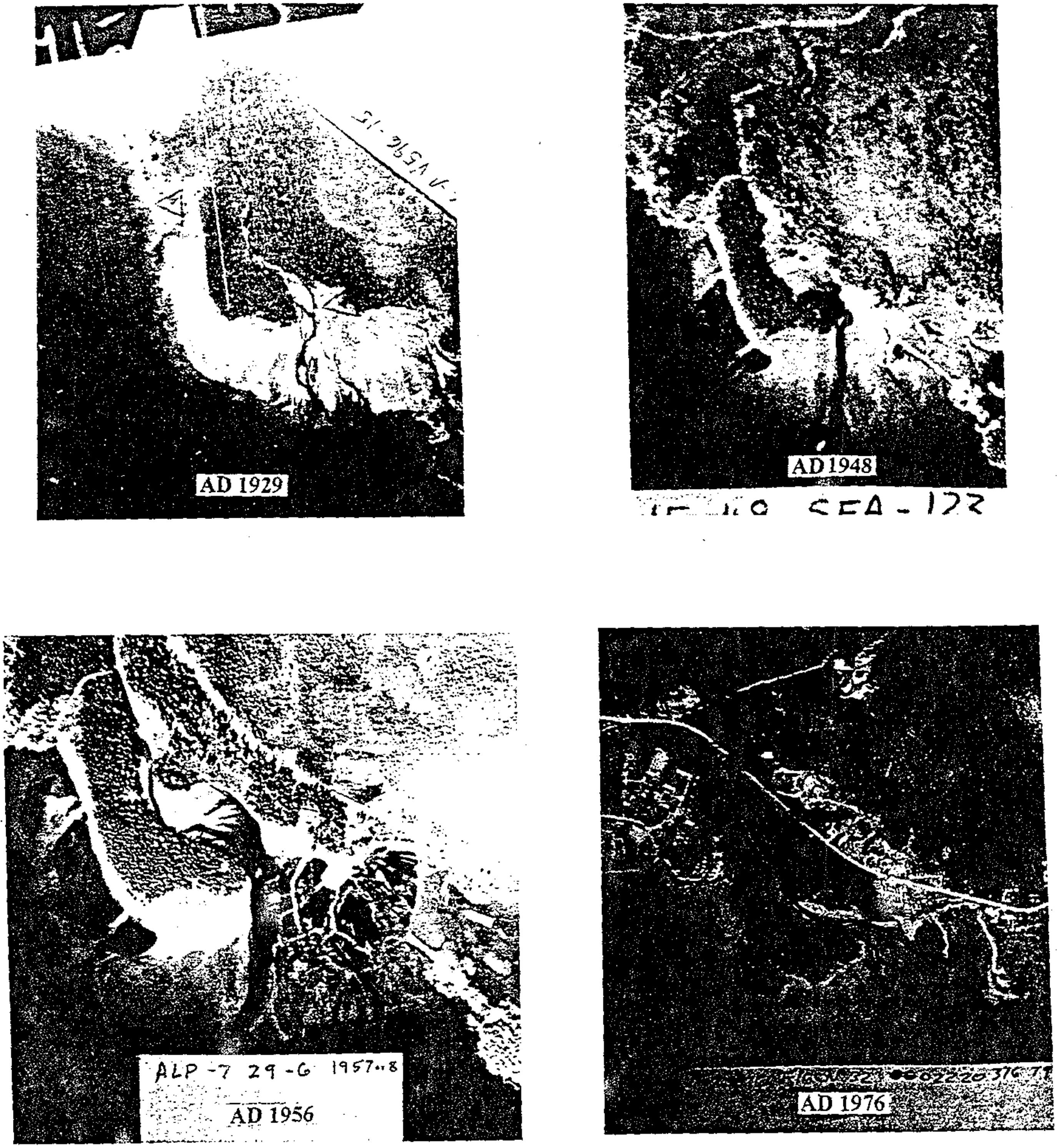


Figure 4.7 Aerial photography from 1929, 1948, 1957 and 1976 showing significant nearshore changes which have occurred since 1929.

was removed during the war. It is not surprising that the river continued to aggressively erode its channel until dredging was halted and massive shoreline stabilization was undertaken.

Perhaps the most efficient method of observing the significant changes which have occurred in the study area is to compare aerial photography taken in 1929 to that taken in 1976 (Figure 4.8) The photographs were taken at approximately the same scale and tide level. Several contrasting features are readily identified.

A: Uplifted Beach Meadow: This region was uplifted from the intertidal zone after 1929 so that it now supports terrestrial vegetation. This area is unique in the park because it was not dredged and represents an area of land which can be observed to learn about the local environment's natural response to uplift. This area can be used to model the evolution of local landforms which were uplifted in prehistoric times.

B: Modern Estuary: Even though this area now provides valuable habitat (Sundberg, 1981) it was created largely as a result of the river's response to dredging. This area was stripped of forest by 1948 and probably resulted from the dredging activities which took place in the adjacent river channel.

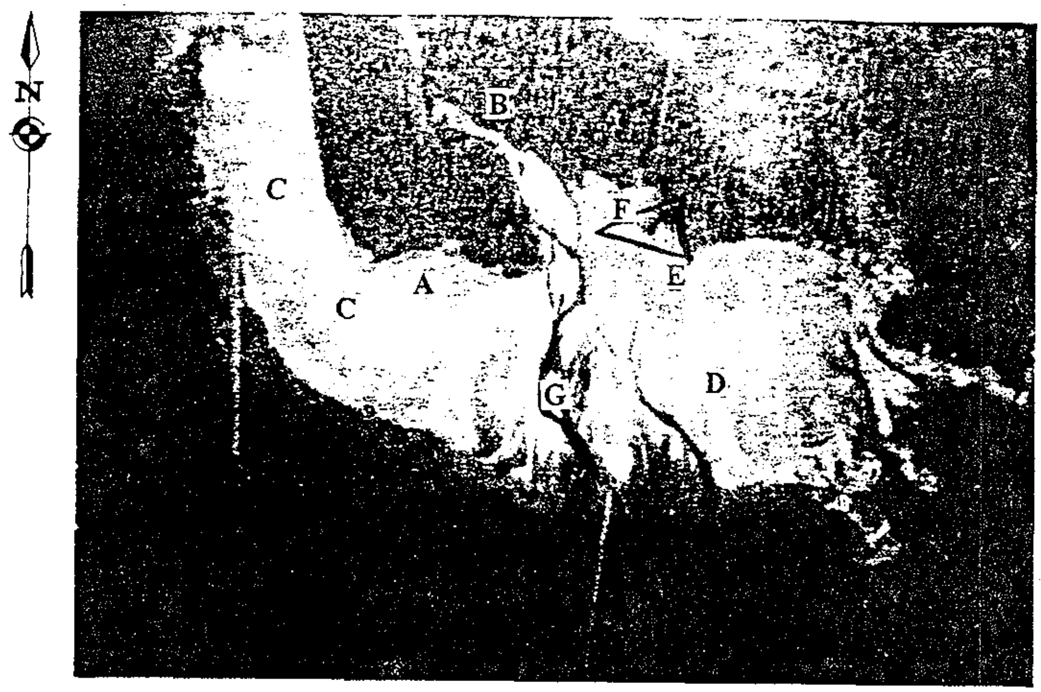
C: Beach Dredging: In 1929 this portion of the beach was a broad intertidal area. By 1948 two rectangular areas of sediment had been removed. The upland beaches immediately adjacent to these areas were still eroding during the 1994 field season. Some erosion control measures were undertaken in the 1980s which reduced this continuing impact (see also Figure 5.4). Although some of the angularity has been smoothed along the edges of these "borrow pits", they still remain dominate features on the beaches along the Park's seaward coastline.

D: Lower Delta Dredging: The removal of sediment from the lower delta dates from after 1948 and was in full swing by 1957. This massive "bite" out of the delta sharply contrasts with the broad shoal quite evident in 1929. Modern reconstructions of the 1804 battle must be aware of the radical changes in near shore morphology which have occurred since the battle.

E: Trailer Court Fill: This projection is quite obviously artificial even to the casual observer on the ground but the location of the former shoreline is completely obscured by its presence. This projection is currently deflecting the river's course slightly (see also Figure 3.9).

F: Buried Hot Asphalt Plant: A young even aged stand of trees currently occupies this site. In 1929 it appears to have been an intertidal area. The uplands adjacent to this site were much closer to tidewater than they are now. Since this fill was not in equilibrium with prevailing conditions it is still subject to erosion (see also Figures 3.7, 3.9).

G: Abandoned River Channel: In 1929 the river followed the shortest path to tidewater from it's mouth. This channel was dredged deep and straight during World War II to allow access to the river mouth where most of the dredging took place at that time. In spite of this channel "enhancement", the river abandoned this



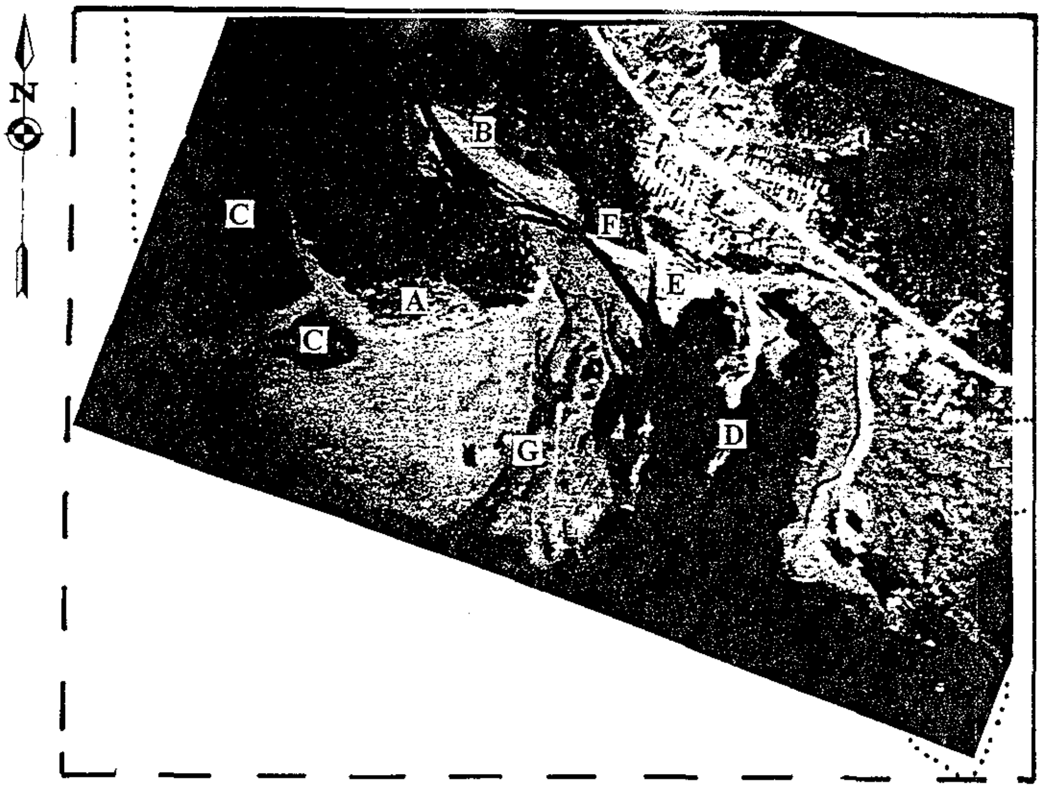


Figure 4.8 Comparison of 1926 and 1976 Aerial Photographs A: Uplifted Beach Meadow B: Modern Estuary C: Beach Dredging D: Lower Delta Dredging E: Trailer Court Fill F: Buried Hot Asphalt Plant G: Abandoned River Channel

course in response to the post 1948 dredging which shortened its path to the sea and significantly lowered its base level.

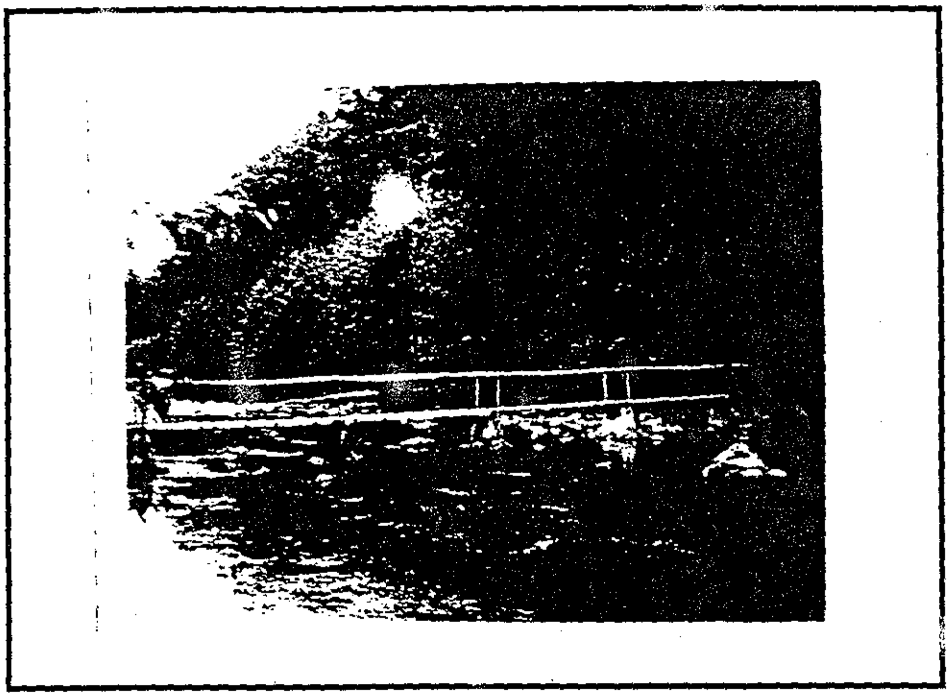
This comparison has necessarily been brief but illustrates the magnitude of some of the changes which have occurred along Indian River and it's delta in less than 60 years. Since stereoscopic aerial photography is available for all of the dates discussed, it would be possible to make accurate topographic maps of the areas which have changed over the years. These could then be compared with one another to derive quantitative measurements of volume of sediment removed and rates of change.

4.3. PHOTOGRAPHS AND EYEWITNESS ACCOUNTS

Perhaps the most intriguing aspect of documenting changes along Indian River is the rich collection of historical photographs which were taken in this area. In many cases it seems that if the original location of an old photograph could be relocated and the picture retaken, valuable information could be obtained. Although this technique is possible, it is very time consuming. Often the greatest difficulty is figuring out where the original photographer was standing. In some cases this is made even more difficult because some of the erosional changes have been so extreme that no recognizable landmarks remain.

Only one such attempt to retake an old photograph was undertaken as part of this study. The photograph of the 1966 foot bridge was selected because a couple of its large cement footings are still located in the river bed. It is unclear if they have washed down stream from their original location but it was assumed that they are resting close to the original bridge site (Figure 3.6). The attempt to relocate the original photographer's position was not entirely successful (Figure 4.9). This was due in part to the fact that it was not until the photograph was developed that a comparison of the two photographs could be made. This experience suggests that additional trips to a site may be required to find the proper original location of an old photograph.

Early historical drawings, sketches and descriptions are numerous. For example I.G. Voznesenskii drew a detailed sketch of the Indian River ca. 1845 (Blomkvist 1972:148, Drawing 35). If the perspective of drawings such as this one could be duplicated in the present, long term changes could be evaluated.



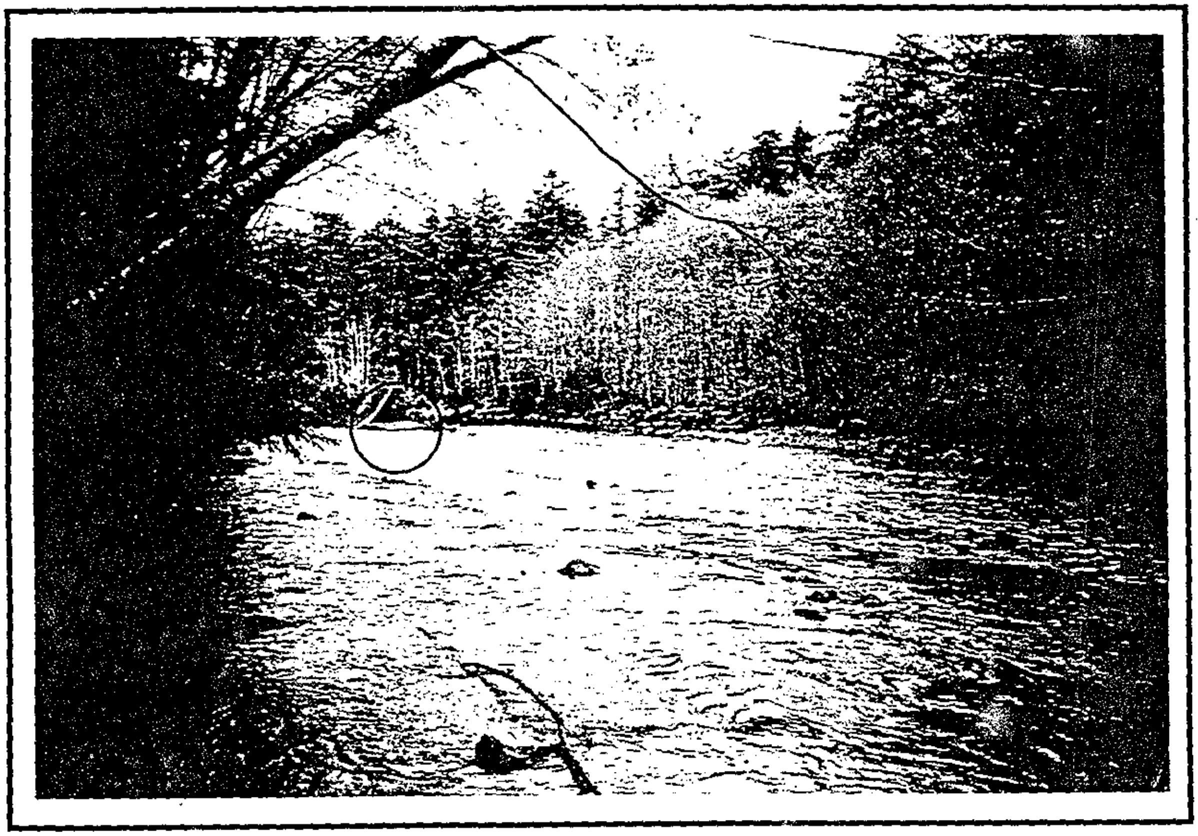


Figure 4.9 Attempt to retake a historical photograph. This 1966 footbridge was washed away 10 days after completion. Note circle around current location of bridge support in lower photo.

5.0 SECTION FIVE

FIELD DATA AND REGIONAL ANALYSIS

Here about the beach I wandered, nourishing a youth sublime, With fairy tales of science, and the long results of time.

Alfred Tennyson

5.1 INTRODUCTION

Sitka National Historical Park can be thought of as consisting of five primary geomorphological regions. These include:

1. **ACTIVE BEACH:** Marine processes dominate sediment transport and deposition.

2. **UPLIFTED BEACHES:** Once these were active beaches but they have been raised above the highest reach of modern storm waves.

3. **ACTIVE RIVER CHANNEL:** Sediment is currently being transported by fluvial processes.

4. **ABANDONED RIVER CHANNELS AND FLOODPLAINS:** Where sediment was deposited by fluvial processes in the past.

5. **BEDROCK OUTCROPS:** These are relatively rare but provide some structural control for the river channel.

In addition there is the possibility that glacially constructed moraine deposits are present in the Park. (See Section Three "Glaciation"). There is also the delta region which is a transition zone between fluvial and marine processes and could be classified independently but is included here as part of the beach.

Of these areas, the active beach and river channel have little potential of containing *in situ* archeological sites simply because they consist of sediments which are being reworked in modern times. Redeposited artifacts in confused context may be found in these locations but these findings would have to be evaluated very carefully on a site specific basis. Therefore little attention was given to these areas during the brief field time available. Bedrock outcrops occur in only one or two locations in the Park and were only briefly examined. Uplifted beaches received the largest proportion of our attention in the field because the area of the Park west of Indian River had been mapped at a scale of 1:1,200 with a one foot contour interval in 1992. By contrast, in 1994, the portion of the Park east of Indian River had not been mapped at all. In addition, given the evidence of regional uplift, locations of uplifted beaches were somewhat predictable while former river channel locations were completely unknown. Since the highest locations in the Park were also the most likely to contain tephra, additional time was spent there.

5.2. ACTIVE BEACH

In consideration of contract requirements, little time was spent on the active beach. The primary purpose of visiting the intertidal zone was to measure beach profiles from previously established erosion control survey monuments. These monuments had been established in locations which were adjacent to areas suspected to be susceptible to erosion.

Elevations for beach profiles were derived from elevation contours adjacent to monuments as printed on the SNHP Topographic Map. Therefore all elevations are given in feet above Mean Sea Level. It is important to note that tidal predictions are provided in feet above Lower Low Water and the USGS measures elevations above Mean High Water. All of these methods use different datums and it is important to be aware of which method was used when making comparisons between the results of different research projects.

During the course of compiling these profiles a relatively undocumented method of boulder movement was observed (Figure 5.1). In the roots of a drift log a boulder ~50 cm in diameter was observed. If the log remains on the beach and rots away, the boulder will be deposited along the storm surge line. The significance of this process is that large boulders could have been deposited on beaches in the past without glacial action or ice rafting. Therefore the term "drift log erratics" could be applied to boulders which appear in ancient beach or river deposits which were clearly not transported by other means.

Figure 5.1. Large boulder held in roots of drift log will be deposited on the beach when the roots decay. Therefore a "drift log erratic" will be deposited.

The method employed to survey these profiles was by necessity very simple. A tape measure was secured to the upland survey monument. The tape was then strung out over the seaward survey monument and onward to the water line. This method ensures that future researchers could relocate the starting point of these surveys and follow the same bearing. A 2x magnification "Davis White Hand Level" and stadia rod were used to measure elevation changes. Due to the inherent inaccuracy of the hand held level, elevations are only provided to the nearest foot. These profiles provide the Park with baseline data which could be remeasured in the future with simple instruments to establish the nature of erosion (or accretion) below any of these monuments.

5.1.1. BEACH PROFILES

Profiles of beaches were compiled from the following survey monuments on October 24 1994.

BEACH PROFILE 205-203 (Figure 5.2A)

From survey monuments
1992 TNH EROSION PT 205 (upland)
1992 TNH EROSION PT 203 (seaward)
Time: 9:15am

Table 5.1
Beach Profile 205-203

Distance (feet)	Elevation (feet)	Notes
0	15	TNH PT 205
9½	12	Edge of trail
26½	11	TNH PT 203
28	11	Edge of trail
34	8½	Drift logs & angular cobbles
49½	5½	Angular riprap
66	2½	Sandy surface
100	-½	Rounded cobbles
134	-2½	Water's edge

Comments: Surface of the beach is dominated by angular cobbles from the trail's edge 38 feet down the beach. These are not natural and were probably brought in as an erosion control measure. A tree growing on the tide line 22 feet to the north has exposed roots due to wave driven erosion (Figure 5.4).

BEACH PROFILE 207-206 (Figure 5.2B)

From survey monuments
1992 TNH EROSION PT 207 (upland)
1992 TNH EROSION PT 206 (seaward)
Time: 10:05am

Table 5.2
Beach Profile 207-206

Distance (feet)	Elevation (feet)	Notes
0	10	TNH PT 207
21	10	TNH PT 206
23½	10	Edge of grass
26	8	Base of cut slope
36	7	Drift logs
58	3	Granule / Pebble
100	1	Rounded cobbles

Comments: A tree growing along the high tide line has exposed roots due to wave erosion (Figure 5.5).

BEACH PROFILE 210-209 (Figure 5.3A)

From survey monuments
1992 TNH EROSION PT 210 (upland)
1992 TNH EROSION PT 209 (seaward)
Time: 10:50am

Table 5.3
Beach Profile 210-209

Distance (feet)	Elevation (feet)	Notes
0	11½	TNH PT 210
33	11	TNH PT 209
42	8	Angular riprap
60	4½	Angular cobbles and riprap
74	2½	Sand begins
85	1	Sand ends
100	½	Cobble / Pebble
114	-1	Cobble / Pebble

Comments: This area was armored as part of the bank stabilization project. Riprap and angular cobbles are common. Trees nearby have been undercut and are leaning seaward but this may have happened before the stabilization project because their roots are not exposed (Figure 5.6).

BEACH PROFILE 214-212 (Figure 5.3B)

From survey monuments
1992 TNH EROSION PT 214 (upland)
1992 TNH EROSION PT 212 (seaward)
Time: 11:05am

Table 5.4
Beach Profile 214-212

Distance (feet)	Elevation (feet)	Notes
0	12	TNH PT 214
23	11½	TNH PT 212 (gravel)
30½	9	Top of riprap
45	2½	Base of riprap
56	-½	Angular cobbles

Comments: This riverbank was armored as part of the bank stabilization project. The profile is completely artificial. It seems that the riprap is working well.

BEACH PROFILE 216-215 (Figure 5.3C)

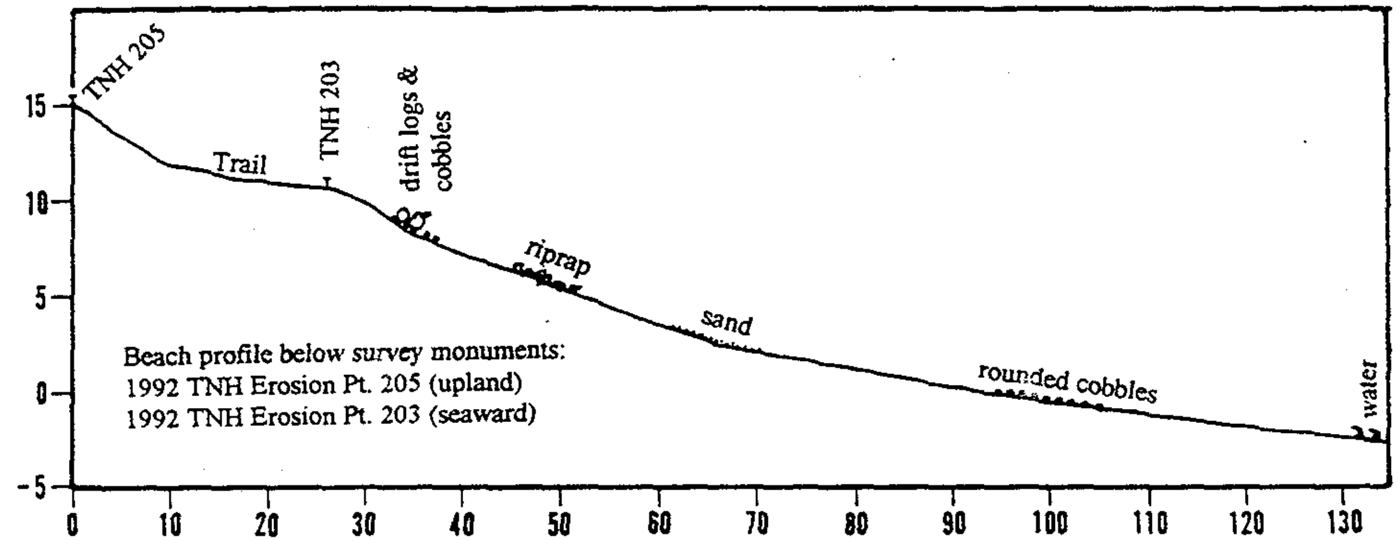
From survey monuments
1992 TNH EROSION PT 215 (upland)
1992 TNH EROSION PT 216 (seaward)
Time: 11:25am

Table 5.5
Beach Profile 216-215

Distance (feet)	Elevation (feet)	Notes
0	8½	TNH PT 216
15	8	Park bench
25.7	8	TNH PT 215 (trail edge)
31	6½	Top of slope, grass/riprap
44	-½	Riprap (water)

Comments: This riverbank was armored as part of the bank stabilization project (Figure 3.8). The profile is completely artificial. It seems that the riprap is working well. Base of riprap was not observed due to rising tide. The bank here receives the full force of the river current. Riprap is the only thing keeping this bank from rapidly eroding. It should hold unless the area is undercut or if the river cuts behind it. This does not appear to be a problem now but as the land continues to rise the river gradient will steepen causing the river to erode its bed and it could possibly undermine this bank. This problem will probably only concern future generations.

A



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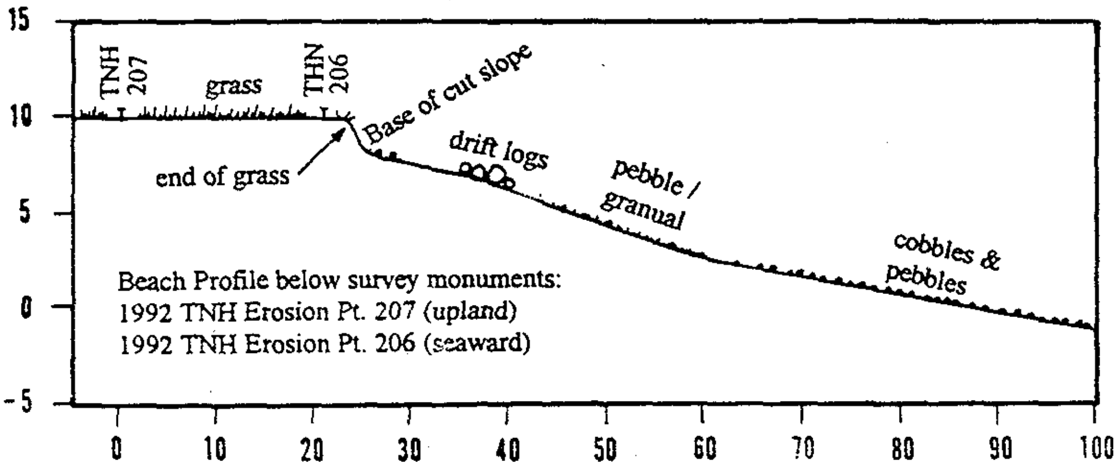


Figure 5.2 Profiles of beaches below erosion control survey monuments. October 24, 1994.

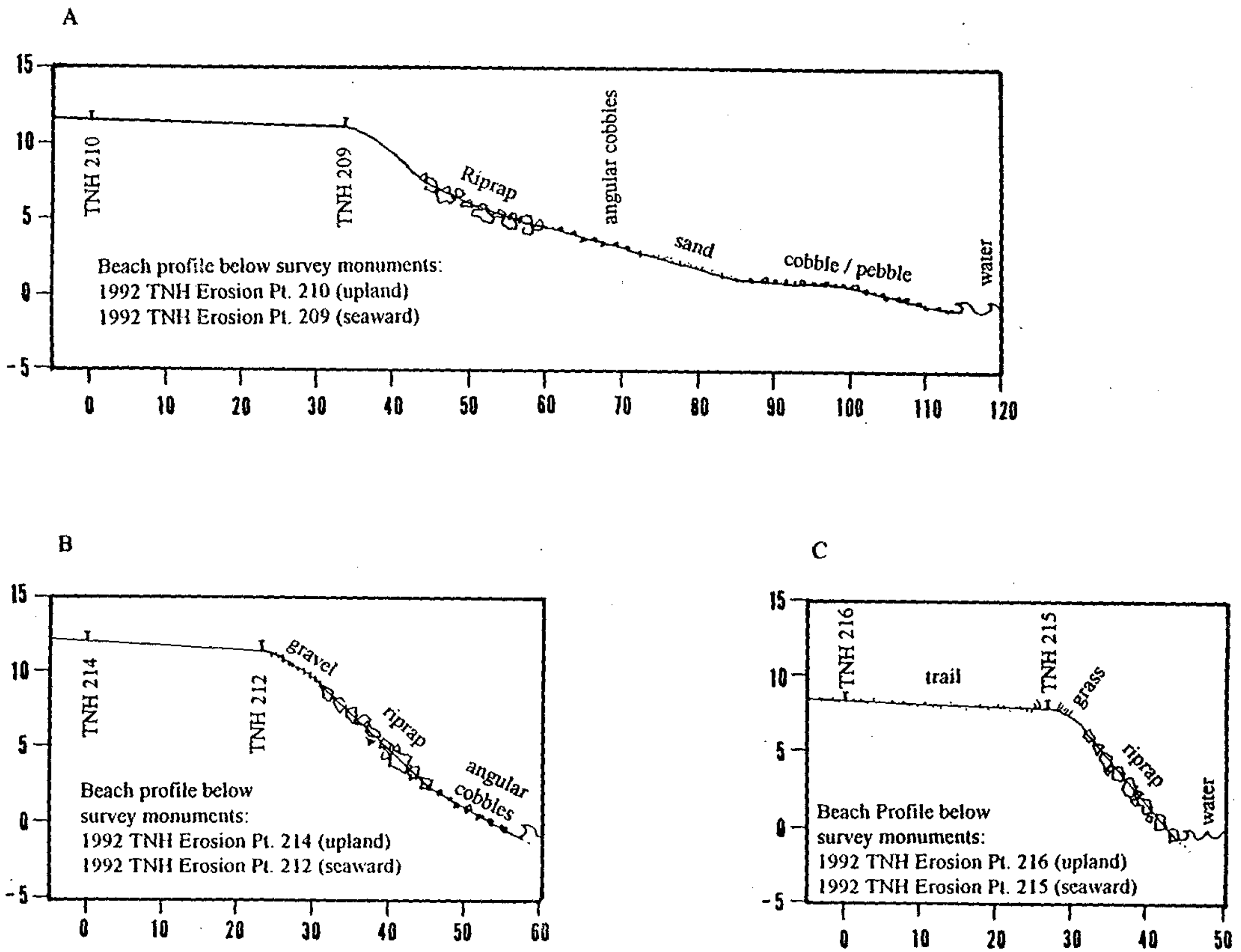


Figure 5.3. Profiles of beaches below erosion control survey monuments. Oct. 24, 1994.

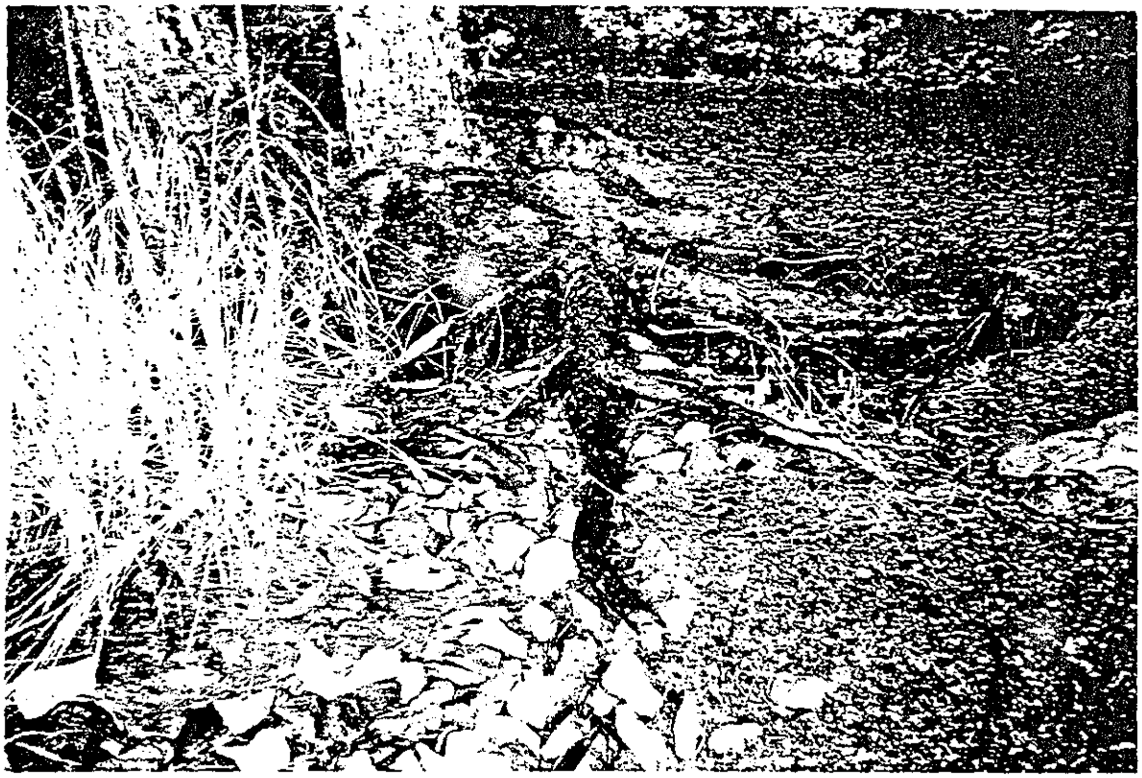


Figure 5.4 Tree roots 22 feet north of TNH Erosion Pt. 203. Roots exposed by wave erosion. Angular cobbles probably installed during erosion control program.

Figure 5.5 Tree roots exposed by wave driven erosion just north of TNH Erosion Pt. 206.

Figure 5.6 Photo taken from TNH Erosion Pt. 209. Trees are leaning seaward due to erosion of their roots but roots were covered during erosion control project.

5.2. UPLIFTED BEACHES

5.2.1. Field Methodology

Locating, documenting, and collecting datable organics and tephra were the highest priorities of the sampling strategy employed areas of uplifted beaches. Documenting the context of these finds was vital to construction of a coherent landform morphogenesis. Considering that long term regional uplift had been suspected but poorly documented, it was necessary to establish the elevation of each sampling site as accurately as possible. The Park west of Indian River had been mapped to a one foot contour interval therefore deriving elevation of sampling sites merely required establishing accurately where the sample location was on the SNHP contour map. This was done by use of a hand held compass and tape measure to take bearings and distances from known locations. The accuracy of this method was excellent but less accurate in the brush and fallen trees. Many of the sampling locations were checked using bearings and distances to more than one known point. Based on this experience, the actual sampling locations are within 10 feet of where they are represented on Map 1. Future researchers should be able to relocate these sampling locations using the same field methodology.

Sampling locations were selected before going into the field from terraces of relatively uniform elevation identified on the SNHP topographic map. It was hoped that data from these individual locations could be extrapolated to encompass the terraces they occupied. Determining representative sampling locations east of Indian River was far more difficult. This portion of the

Park had not been mapped at the time of 1994 field study. Only the general property boundaries had been established with certainty. Elevations of sampling locations on the east side of Indian River were obtained in the field in 1994 by comparing elevations of sampling locations with those of nearby survey monuments. These elevations may be slightly different than those ultimately plotted on the 1995 SNHP topographic map.

Fluvial processes dominated the formation of landforms east of Indian River. The dynamic nature of fluvial erosion and deposition processes made formulation of an efficient sampling strategy on this side of the river more difficult. The combination of these factors resulted in a more random distribution of sampling locations east of Indian River. As the final draft of this report was being compiled in March of 1995, a rough draft of a topographic map of the east side of the Park was made available. Information provided by the draft map was incorporated into this report but since this map was in draft form and not field checked during this study, all conclusions derived from this map should be considered preliminary.

Sampling locations were assigned a letter of the alphabet: "A" through "L" on the west side of the Park (Map 1). In addition a sample location was established at the cut bank behind the maintenance shed and was designated "Shed". Sample locations "M" through "V" were located on the east side of Indian River. Once the predetermined position of a sampling site was located on the ground, the actual position of a sampling pit often had to be shifted slightly to avoid trees, logs, large roots or wind thrown root wads. The actual site of a sampling pit was designated with a number. For example a single pit excavated at "B" would be designated "B-1". If a second pit was dug on the same terrace, it was designated "B-2". In many cases two pits were excavated on a terrace to establish the consistency of observations. If a sample was collected from a pit, it was designated by its pit number and was given a number in case more than one sample was collected from a single pit. For example: If a tephra sample was collected from "D-2" it would be designated "Tephra Sample D-2-1". This strategy allowed more than one sample to be collected from an individual pit. After samples were collected and stratigraphic information recorded, pits were filled in and returned to as natural as state as possible. A short strip of orange or striped flagging was usually left at the bottom of each pit to warn future researchers that the stratigraphy had been disturbed.

As indicated earlier in the report, the primary goal of this portion of the investigation was to establish when representative landforms were lifted above the surf zone. In an attempt to establish this date, datable carbon was sought as close to the clast bearing marine soils as possible. The ideal material was charcoal lying in direct contact with marine deposited cobbles and pebbles. Charcoal is very resistant to decay and larger particles do not dissolve and leach out of context. Quite fortunately, charcoal lenses are fairly common in the park and many lie in direct contact with the marine cobble/pebble layer. All carbon samples were wrapped in aluminum foil, dried, rootlets removed and sent to Beta Analytic Inc. for analysis. Tephra was also collected when observed in sampling pits. Due to budgetary constraints only two representative tephra samples, one from each side of Indian River, were submitted for analysis.

All stratigraphic profiles presented contain "Undifferentiated clast-free organic loam". This broad description includes soils exhibiting many combinations of color, texture and root density. The micro stratigraphy within these soils was often subtle, complex and disturbed by root growth. Any further classification of this layer would have required considerable site specific evaluation and was not deemed necessary for the purposes of this investigation. The use of this general classification is not intended to imply a high degree of uniformity of this soil type within the study area. Future site specific projects might benefit from further analysis of this portion of the soil profile.

5.2.2. Sampling Location "SHED-1" (Figure 5.7)

This sampling location was observed behind the maintenance shed along a bank cut by heavy equipment. This profile was the largest expanse of stratigraphy exposed above the banks of Indian River. The magnitude of variation exhibited by all soil layers should be noted. This was one of the only profiles available where lateral extent of individual layers was observed. If this sampling location had been restricted to a narrow portion of this exposure, erroneous conclusions may have been drawn regarding thickness of individual layers. Throughout the uplands of the Park stratigraphic variability is often extreme and extrapolation from individual sampling locations should be undertaken with caution.

It was here that the possibility of tephra presence in the Park was first reported (Griffin 1985). Several interesting features are evident at this location. Of primary importance was the continuous layer of tephra ~30 cm below the surface. Tephra sample "Shed-1-1" was collected from the area indicated on the sketch (tephra analysis and overall distribution is discussed at the end of this section). A well defined layer of charcoal was located directly above the tephra layer. Some of this charcoal was embedded in the uppermost portion of the tephra layer. It seems probable, based on this close association, that the charcoal was deposited very soon after the ash fall event. Radiocarbon sample "Shed-1-1" was collected from this location which yielded a radiocarbon date of 4,000 ±70 yr B.P. (cal. 2,485 BC) [Beta 78713]. This may represent the approximate date of Mount Edgecumbe's last eruption.

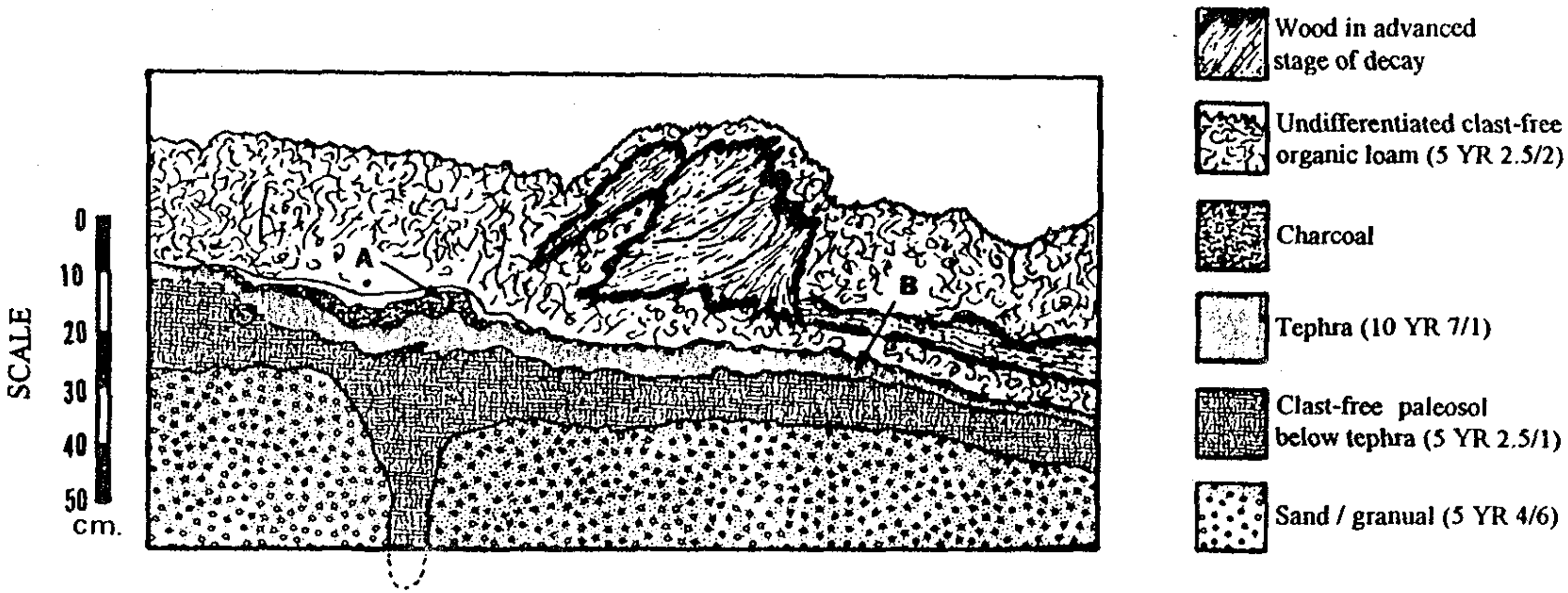
The tephra layer was deposited on top of a clast-free paleosol which averaged ~10 cm thick. If a local rate of soil accumulation could be derived, then the approximate amount of time this soil took to develop could be estimated. The paleosol rests on marine sand and granule deposits. An accumulation of ~30 cm of undifferentiated clast-free organic loam was observed above the charcoal layer. Remnants of a decayed stump were observed in this layer.

5.2.3. Sample Locations "A-1", "D-1", "D-2", "E-1", and "O-1" (Figure 5.8)

This collection of sampling locations all yielded clear evidence of well defined tephra layers. Sample location "A-1" provides another perspective of the stratigraphy on the knoll near the maintenance shed. Located on the 38 foot elevation contour this was the highest point sampled within the park. The tephra horizon observed here exhibited the same characteristics as observed at "Shed-1". Charcoal flecks were noticed in association with the upper surface of the tephra layer. Tephra sample "A-1-1" was collected and analyzed under a binocular microscope. Under magnification it appeared very similar in composition and morphology to tephra sample "Shed-1-1". A paleosol was found below the tephra layer which appeared very similar to the paleosol recorded at "Shed-1". C14 sample "A-1-1" was collected from this paleosol. This sample yielded a radiocarbon date of 4,290 ±70 yr B.P.(cal. 2,900 BC) [Beta 78714]. This provides a maximum date for the ash fall event as well as a minimum date for emergence of this location from storm waves.

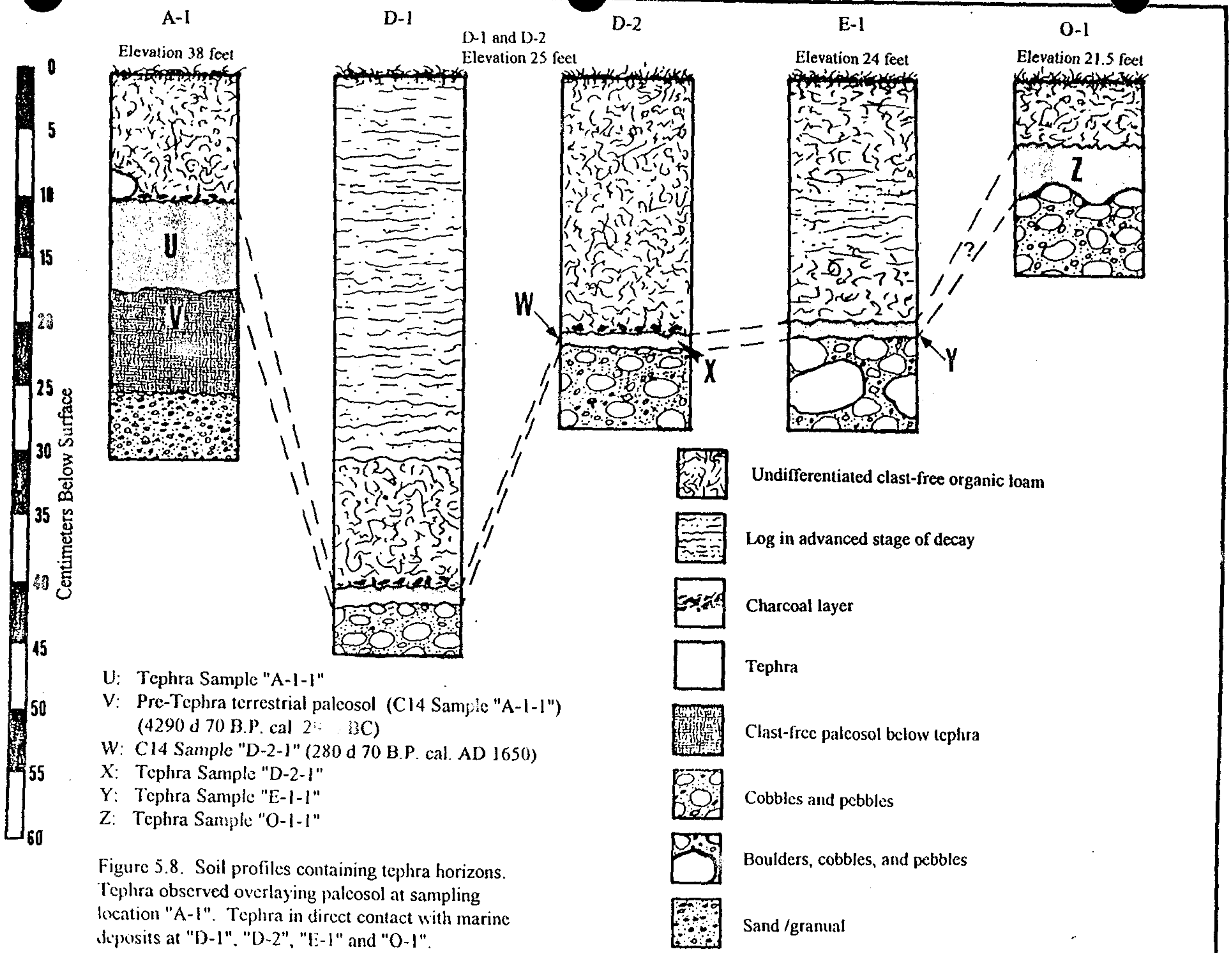
A tephra horizon with discontinuous flecks of charcoal along its upper contact was observed at sample locations "D-1" and "D-2". A similar horizon was documented at "E-1" however charcoal flecks were not apparent at this site. In all three locations the tephra observed was ~2 cm thick.

Figure 5.7 Soil profile sampling location "Shed-1". Elevation ~36' above mean sea level. Observed along the cut bank eight feet from the maintenance sheds northeast corner.



A: Collection location for C14 sample "Shed-1-1" (4000 +/- 70 B.P. cal. 2485 BC)
(Thin yellow (2.5 Y 7/6) soil layer observed above charcoal concentration)

B: Collection location for Tephra sample "Shed-1-1"



U: Tephra Sample "A-1-1"
V: Pre-Tephra terrestrial paleosol (C14 Sample "A-1-1") (4290 d 70 B.P. cal 2[illegible] BC)
W: C14 Sample "D-2-1" (280 d 70 B.P. cal. AD 1650)
X: Tephra Sample "D-2-1"
Y: Tephra Sample "E-1-1"
Z: Tephra Sample "O-1-1"

Figure 5.8. Soil profiles containing tephra horizons. Tephra observed overlaying paleosol at sampling location "A-1". Tephra in direct contact with marine deposits at "D-1", "D-2", "E-1" and "O-1".

These three sites were located along the 24 to 25 foot elevation contours and the tephra layer here was thinner than that observed higher on the knoll. The tephra here was also in direct contact with marine sediments. Terrestrial paleosols were not observed under tephra at any of the sampling locations at elevations of 24 to 25 feet. This provides strong evidence that this elevation had emerged from storm wave influence immediately prior to the ash fall. In addition, little if any wave action could have reached this elevation after the ash fall event or the fragile tephra layer would have been destroyed. Tephra was also observed on the east side of the Park near the Russian Memorial at an elevation of 21½ feet. This was designated Sample Location "O-1". Tephra in this region was discontinuous and occurred in pockets. It is important to note that "O-1" was located in one of these concentrations. Tephra sample "O-1-1" was collected from this location and submitted for micro-probe analysis. It proved to be a match with tephra sample "Shed-1-1". This indicates that the tephra observed at these locations were deposited during the same eruption. It is worthy to note that tephra sample "O-1-1" was compared under a binocular microscope with other tephra samples. All samples exhibited similar characteristics. Samples from "Shed-1-1" and "A-1-1" contained a few small ribbed glass shards while these features were not observed from samples collected from locations "D-2-1","E-1-1" and "O-1-1". This may provide evidence of reworking after deposition.

C14 Sample "D-2-1" was collected from charcoal flecks observed in direct contact with tephra. This charcoal yielded an anomalously young radiocarbon date of 280 ±70 yr B.P. (cal. AD 1650) [Beta 78807]. Field notes indicate that this was a "dirty" sample. Considering that sample location "D-2" was adjacent to a wind thrown root wad, it is possible some soil mixing had occurred (Figure 3.5). Alternatively, a root from a tree may have grown down to this level and later burned in a forest fire. The possibility exists that the sample was contaminated at some point after collection. What ever the case, this young date is probably not representative of the age of this soil profile.

5.2.4. Sample Locations "B-1", "B-2", and "C-1" (Figure 5.9)

The stratigraphy in these locations was very difficult to observe due to the high water table which resulted in rapid test pit flooding. Tephra was not observed in these locations. This may have been due to the extremely poor viewing conditions. Alternatively, tephra may have been eroded away by ephemeral surface flow or ground water movement. Further research is recommended in this region during a relatively dry period when the water table would be at its lowest level.

The primary point of interest to note from these locations is soil depth. "B-2" and "C-1" had soil depths of +100 cm. Due to pit flooding, these soil depths were derived using a soil probe. C14 sample "C-1-1" yielded a radiocarbon date 2,220 ±60 yr B.P. (cal. 185 to 375 BC) [Beta 78812]. This date was obtained from a fragment of a log which was preserved ~55 cm below the surface. Considering this location had a clast-free soil depth of ~125 cm, it was probably removed from the influence of wave action considerably earlier than this time. A resistant layer ~100 cm from the surface may represent still water silt deposits.

5.2.5. Sample Locations "E-1" and "E-2" (Figure 5.10)

The stratigraphy observed at sampling location "E-1" was reviewed above in comparison with other tephra bearing soils, however conditions in this locality warrant an expanded discussion. In

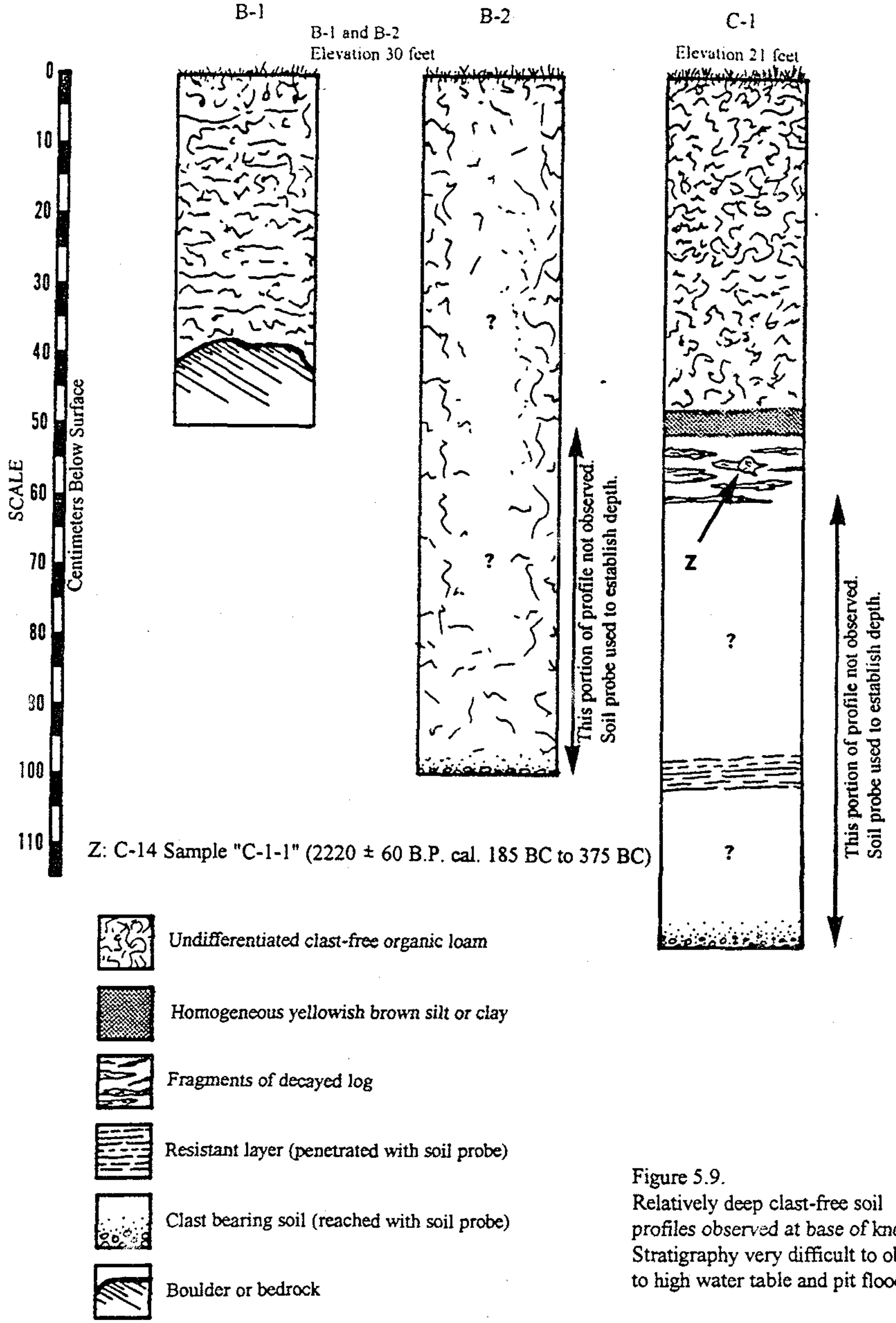


Figure 5.9.
Relatively deep clast-free soil profiles observed at base of knoll. Stratigraphy very difficult to observe due to high water table and pit flooding.

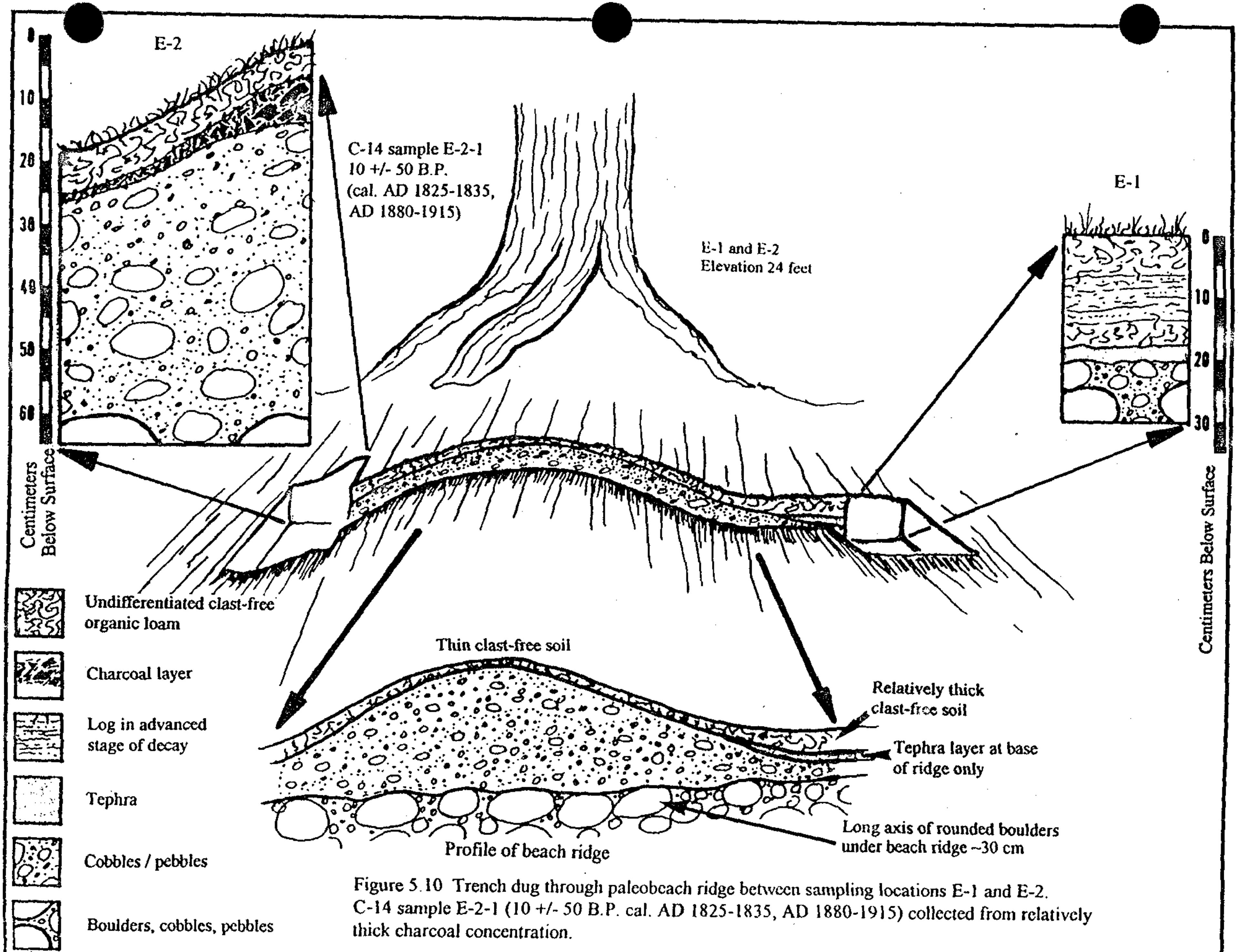


Figure 5.10 Trench dug through paleobeach ridge between sampling locations E-1 and E-2. C-14 sample E-2-1 (10 +/- 50 B.P. cal. AD 1825-1835, AD 1880-1915) collected from relatively thick charcoal concentration.

the course of excavating "E-1" a low ridge was noticed nearby. Exploratory sampling of this ridge revealed that it was constructed of cobbles and pebbles. Another sampling pit was excavated at "E-2" and the two pits were connected by a ~30 cm wide trench through the ridge. The cobbles and pebbles which composed the ridge rested on a layer which contained rounded boulders with an long axis of ~30 cm. This was the only location in the Park where a concentration of boulders of this size were observed.

This area provides a good example of the lack of continuity between soil horizons over a relatively short distance common in the Park uplands. In this case the ridge appears to have been built by waves and abandoned as a result of uplift. Although tephra was not observed on top of the paleo-beach ridge, it was found at its base. This may have been due to accelerated erosion of tephra commonly observed in areas of relatively high relief.

Clast-free soil depth at the top of the paleo-beach ridge was relatively thin. A discrete lens of charcoal was observed in sample location "E-2". A sample of this charcoal was collected and yielded a very recent radiocarbon date of 10 ±50 yr B.P. (cal. AD 1,825 to AD 1,915) [Beta 78715]. The charcoal concentration may have been from a fire which burned sometime after the turn of the century which incorporated wood which grew in the 1800s. The localized distribution of this charcoal concentration implies that it may have been a hearth feature. Considering the proximity of this area to the privies dug in 1940 (see Figure 7.7), it would not be surprising if some surficial soil disturbance had taken place in this vicinity.

5.2.6. Sample Locations "G-1", "G-2", "H-1", and "H-2" (Figure 5.11)

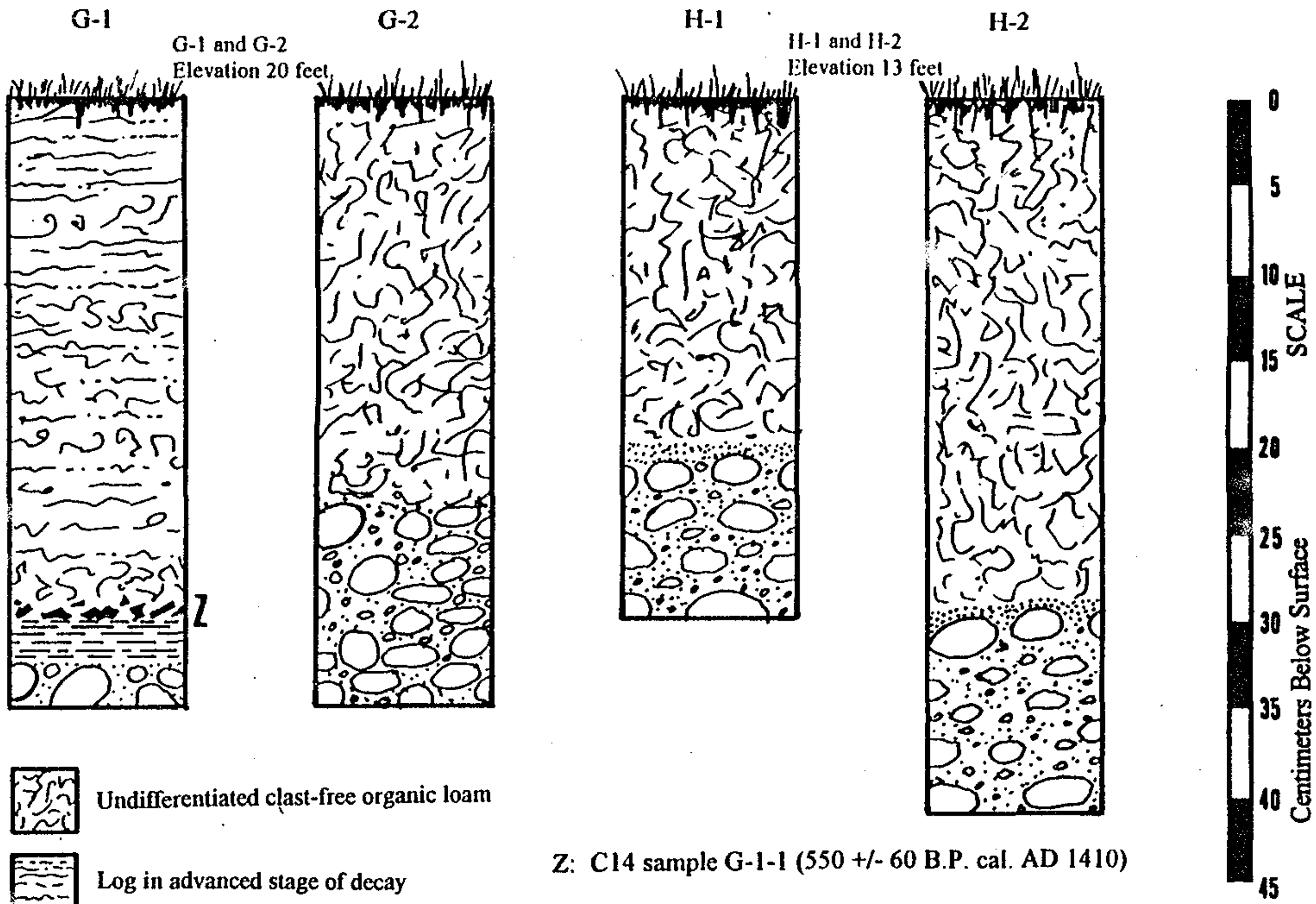
Tephra was not observed in these locations. This factor implies that storm waves reached above the 20 foot elevation contour during the last ash fall. Further research is recommended along the 20 to 24 foot elevation range to explore the nature of the tephra boundary.

A thin but distinct charcoal layer was observed in sample location "G-1" ~2 cm above the clast-based marine sediments. C14 sample "G-1-1" yielded a relatively young radiocarbon date of 550 ±60 yr B.P. (cal. AD 1,410) [Beta 78716]. Since this sample was not collected from the contact between marine and terrestrial soils, it provides an artificially young minimum age for this landform. It should be noted that the 30 cm deep clast-free soil observed at "D-1" is composed primarily of a rotten log. The clast-free soil depth observed at "G-2" appears to more accurately reflect the undisturbed soil development at this elevation.

Soil development recorded at sample locations "H-1" and "H-2" implies similar age to that observed at "G-2". This is particularly interesting because "H-1" and "H-2" were located at 13 feet elevation while "G-2" was at the 20 foot elevation. "H-1" and "H-2" were located in an enclosed depression which appears from stratigraphic evidence to have been protected from wave energy at a similar point in the past.

5.2.7. Sample Locations "I-1", "I-2", "J-1", "J-2-1", "J-2-2", "K-1", and "L-1" (Figure 5.12):

These sampling locations yielded several datable charcoal concentrations lying directly on marine sediments. Furthermore the ages of these charcoal layers decreased with decreasing altitude. This implies a long term trend of gradual uplift.



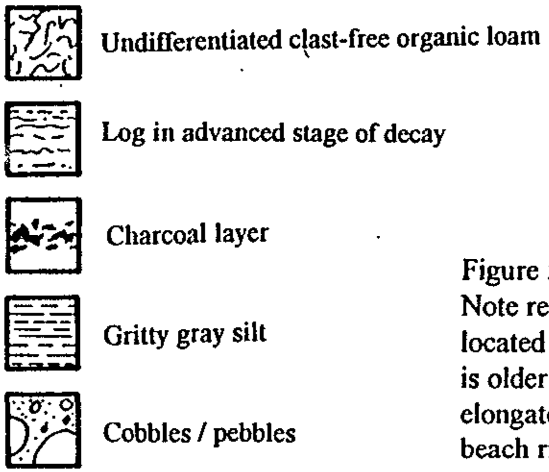


Figure 5.11. Soil profiles from sampling locations "G-1", "G-2", "H-1", and "H-2". Note relatively deep clast-free soil profile at "H-1" and "H-2" even though they were located at 13' elevation. This indicates that the swale where these profiles were collected is older than other features at this elevation elsewhere in the Park. The morphology of the elongated depression containing "H-1" and "H-2" implies it is a swale between two relic beach ridges.

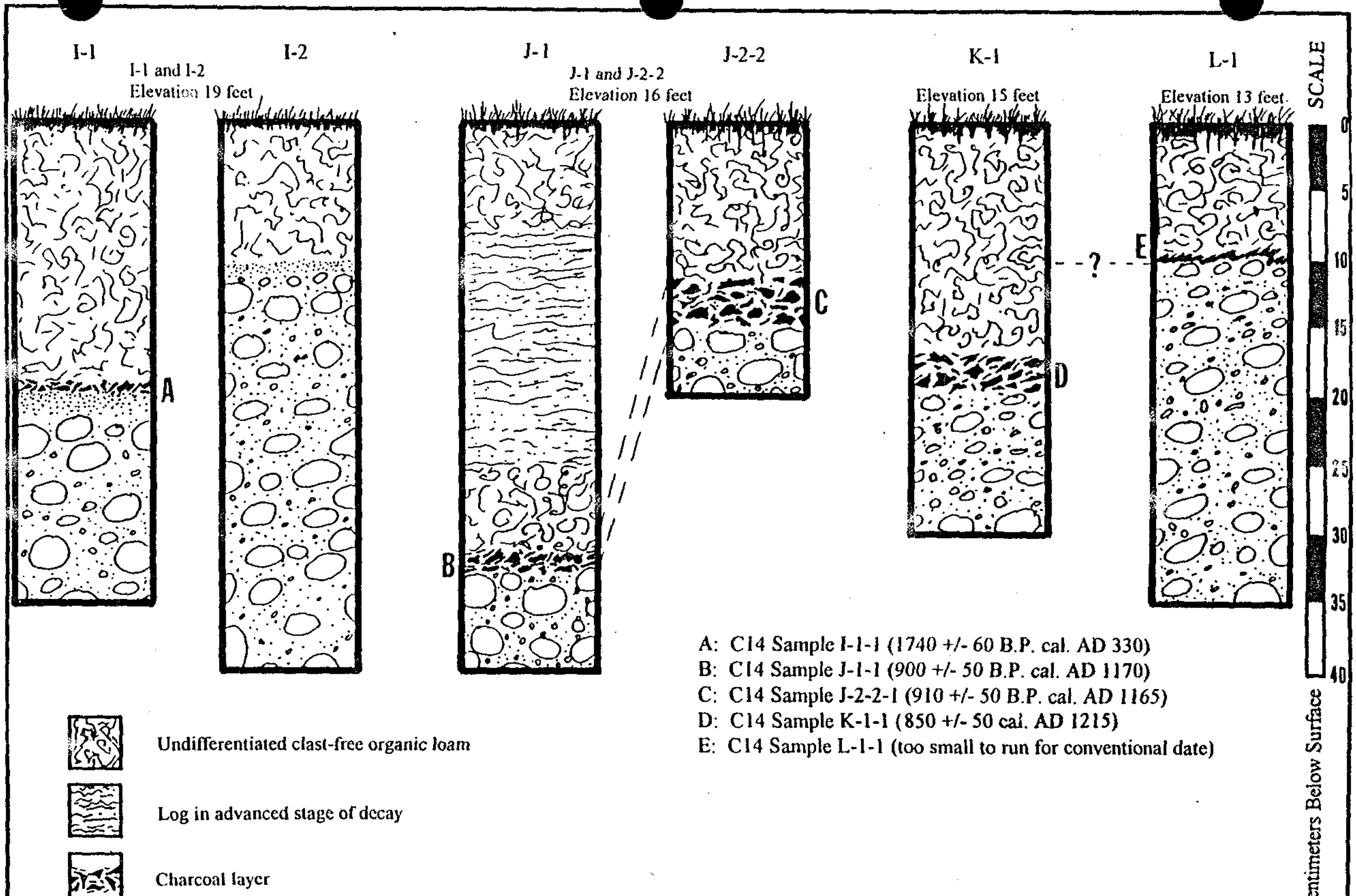


Figure 5.12 Soil Profiles for sampling locations in areas of uplifted beaches.

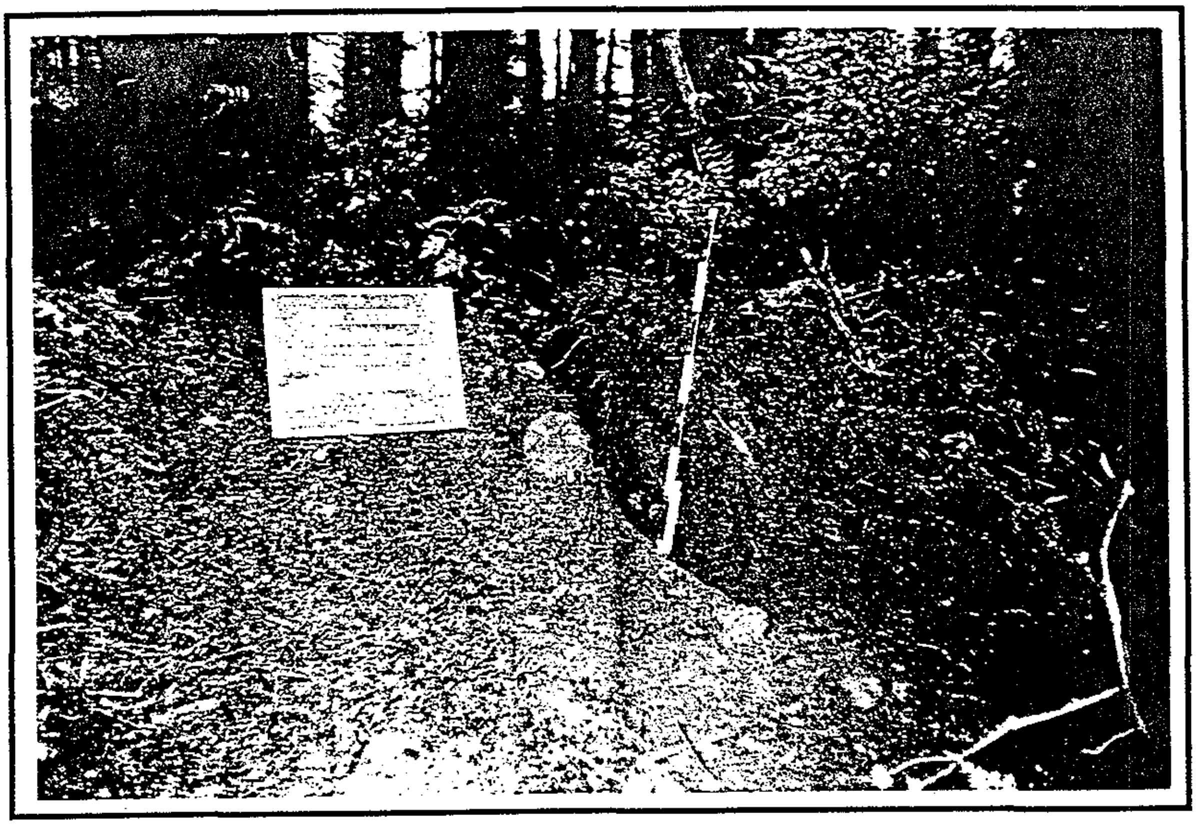
Sample locations "I-1" and "I-2" were located on a terrace at the 19 foot elevation. C14 sample "I-1-1" provided a radiocarbon date of 1,740 ±60 yr B.P. (cal. AD 330) [Beta 78717]. This sample was collected from a thin dispersed layer of small fragments and flecks of charcoal lying on a thin bed of sand over cobbles and pebbles. This date provides a good approximation of when this terrace was lifted beyond the reach of storm waves. The relatively thin soil observed at nearby "I-2" may represent the crater of an old wind thrown tree root wad.

C14 samples "J-1-1" and "J-2-2-1" were both collected from a terrace at the 16 foot elevation but the sampling locations were 90 feet apart. These yielded nearly identical radiocarbon dates of 900 ±50 yr B.P. (cal. AD 1,170) [Beta 78811] and 910 ±50 yr B.P.(cal. AD 1,165) [Beta 78718] respectively. Both of these distinct charcoal bearing horizons yielded pieces of charcoal +1 centimeter in diameter. The close agreement of the dates between these two samples provides an excellent approximation of when this terrace was lifted above storm waves.

Another distinct charcoal layer was observed in contact with marine deposited cobbles and pebbles at sample location "K-1". This sample location was at the 15 foot elevation contour and was also seaward of sampling location "J-2-2" This charcoal layer was quite distinct and consisted of charcoal pieces +1 cm in diameter. C14 sample "K-1-1" yielded a calibrated date of 850 ±50 yr B.P. (cal. AD 1,215) [Beta 78808]. This provides a good indication of when this terrace was uplifted above the reach of storm waves.

A small ridge exhibiting similar morphology to that observed between "E-1" and "E-2" was selected for sample location "J-2-1". A shallow trench excavated through this feature revealed that it was constructed of cobbles, pebbles and sand. Comparison of photographs taken of these two paleo-beach ridges reveals the extreme similarity in morphology between these two features (Figure 5.13). Paleo-beach ridges such as these were noticed at several locations on the side of the Park facing Sitka Sound. Mounds were also observed which turned out to be cored with extremely decayed logs. It was impossible to distinguish between these two very different types of ridges without digging through the overlying soil. It should be noted that these beach ridges were not always packed tightly together in parallel rows as is often the case elsewhere. This may have resulted from the fact that these ridges were derived from sediments which were deposited subtidally and were briefly reworked by wave action as the delta deposits were lifted beyond the reach of the surf zone. Detailed mapping of the extent and orientation of these features might yield further insights into this issue.

Sample location L-1 was located at the 13 foot elevation. Clast-free loam in the region was noticeably thinner than had been observed at earlier sampling sites. A thin black layer was observed at the contact between the clast bearing marine sediments and terrestrial soil. This black layer appeared as if it consisted of burned grass because no flecks or chunks of charcoal were discovered. C14 sample "L-1-1" was not run because too little datable carbon remained after pretreatment for the C14 dating process. Therefore the only clue to the age of this terrace is average clast-free soil depth of ~11 cm. If the rate of terrestrial soil development at nearby "K-1" can be used as an indication, a local rate of ~40 years/centimeter of terrestrial soil accumulation would be indicated. If this rate is applied to the 11 cm of soil observed at "L-1" an age of 440 years would be indicated. Therefore it appears that sample location "L-1" was uplifted from storm waves ~AD 1550.



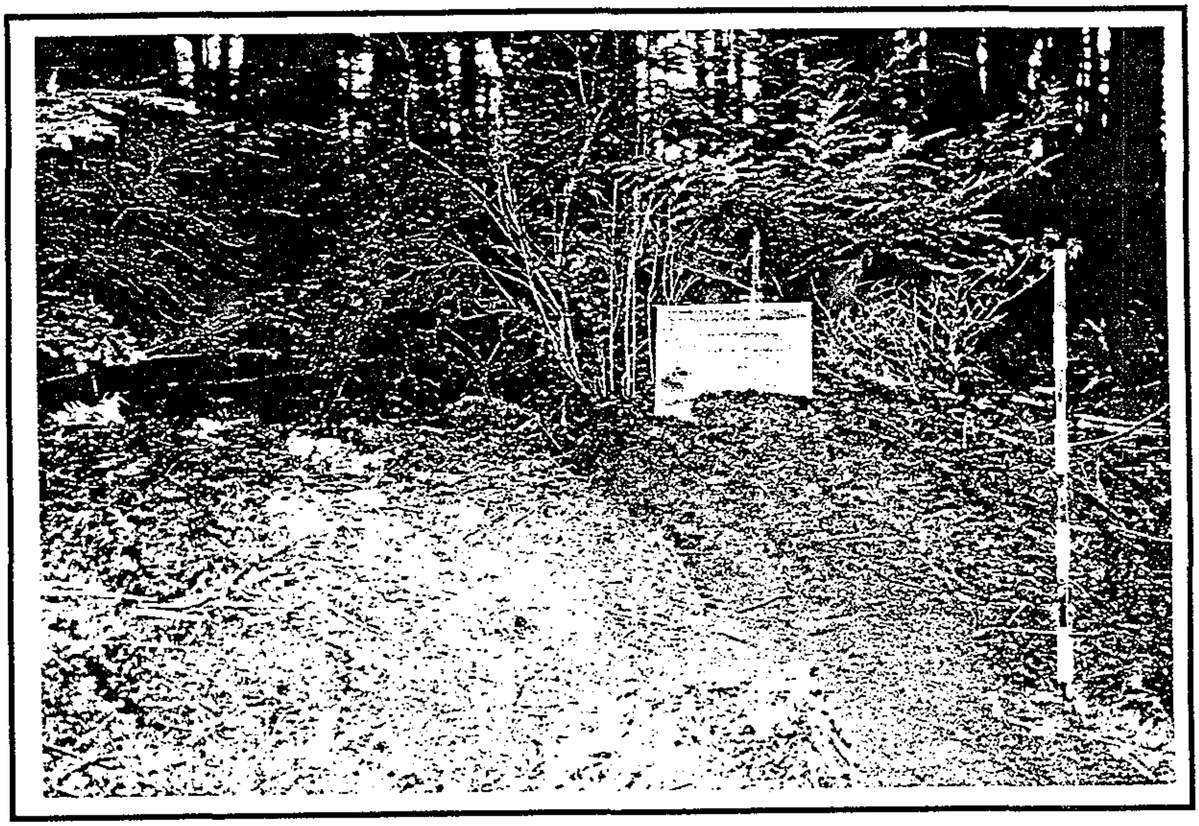


Figure 5.13 Comparison of morphology of relic beach ridges observed at Sampling Locations "E-2" and "J-2-1".

5.2.8. Sample Locations "Q-1", "N-1", "S-1", "P-1", "O-1" (Figure 5.14)

Sampling locations placed on the east side of the Park did not have the aid of a topographic map to determine representative terraces. Therefore the distribution of sampling locations north of the Russian Memorial were clustered around a region where tephra had been observed in a wind thrown tree's root wad. In hindsight this area turned out to be near the crest of a low rise. It seems likely that this feature was an uplifted river mouth bar. It was probably built by waves pushing river born sediment into a linear mound along the delta. Alternatively, it is possible that this feature is morainely cored as has been suggested in the past (Figure 3.1)(USFS 1993) but no clear evidence of glacially deposited sediments were observed in this area.

Of all the areas visited in the Park, this region exhibited the most graphic evidence of stratigraphic disturbance. Removal of forest around the perimeter of the park for road construction, trailer court construction and river bank erosion has left the trees in this area subject to high wind loading. This has resulted in the widespread blow down of many large trees. Craters from wind thrown tree root wads are common, giving the area the appearance of having been bombed. Sorting out stratigraphy in this environment is extremely challenging and further research is highly recommended before any archeological excavations are conducted in this area.

Tephra was preserved in pockets in this area with best preservation at the highest elevations. Tephra sample "O-1-1" was collected and submitted to for microprobe analysis. The results of this analysis provide conclusive evidence that tephra observed on the east side of Indian River dates from the same ash fall event as tephra observed on the west side of the Park. It is worthwhile to note that "O-1" was located at an elevation of 21½ feet which is within the elevation band where tephra tapered out on the west side of the park. Tephra preservation at sample locations "P-1" and "S-1" was localized and these pockets of tephra may have been reworked. Of particular interest is the appearance of tephra at the 15 foot elevation of "S-1". This tephra was observed in the middle of clast-free loam. This anomalous positioning of tephra in the middle of a soil column at a relatively low elevation can probably be attributed to localized stratigraphic mixing which is common in this area. A distinct charcoal layer ~1 cm thick was observed in the middle of a terrestrial soil at sample location "N-1". C14 sample "N-1-1" yielded a radiocarbon date of 230 ±50 yr B.P. (cal. AD 1,665) [78810]. It is interesting to note that this charcoal layer was ~12 cm above the marine sediments, indicating that this location was uplifted from the erosional effects of storm waves considerably earlier than AD 1,665.

Sample location "Q-1" was located at an elevation of 11 feet and demonstrates the lack of soil development observed at lower elevations on the east side of the park. This sampling location may have been located in an old ephemeral runoff channel and could have been subjected to scouring during periods of high runoff in the past. In addition, a decayed fragment of wood containing an extremely corroded spike and nail were found ~1 cm below the surface. The exact depth of this artifact is unknown because it was so decayed and covered with mud that it was not identified as an artifact until after the first few cm of soil had been removed. A subsequent metal detector sweep of the area revealed more metal is scattered in the immediate vicinity. The thin soil observed at "Q-1" may be due in part to early historical cultural use of the locality. See Section Seven of this report for further discussion.

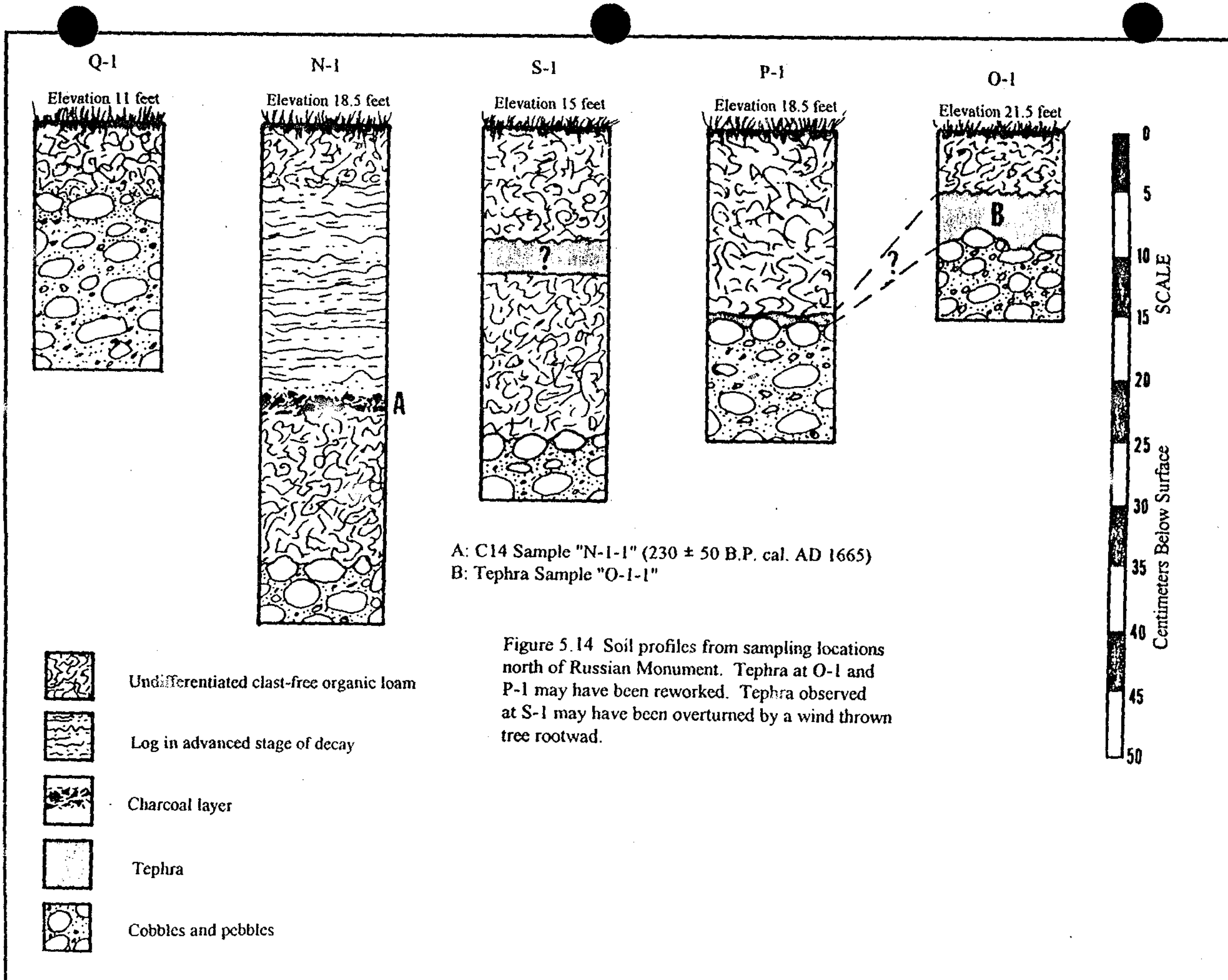


Figure 5.14 Soil profiles from sampling locations north of Russian Monument. Tephra at O-1 and P-1 may have been reworked. Tephra observed at S-1 may have been overturned by a wind thrown tree rootwad.

5.3 RIVER CHANNEL

The banks of Indian River provide a rare opportunity to observe long sections of stratigraphy in the Park. Unfortunately, as has been discussed earlier, erosion control projects have significantly altered much of the river bank stratigraphy within the Park. Since the extent and location of all former erosion control projects was not known to us during the 1994 field season, time spent along the river channel was minimal. In addition, lower elevations within the Park were known to have only recently been uplifted beyond the reach of waves and river erosion, so the probability of observing in situ archeological artifacts along eroding riverbanks was relatively low. In spite of the above limitations, two sites were examined on the east bank of the river which did not exhibit evidence of former erosion control measures.

5.3.1. Sampling Location "M-1" (Figure 5.15)

A log was observed projecting at a 90 degree angle to the river channel at sampling location "M-1". Closer examination revealed that this log was in the process of being eroded out of the surrounding sediments by the river (Figure 5.16). The top of the log was buried below 216 cm (~7 feet) of fluvial deposits. C14 sample "M-1-1" taken from the outer growth rings of this log yielded a radiocarbon date of 1,020 ±50 yr B.P. (cal. AD 1,015) [Beta 78809]. This date reveals that the 216 centimeter (~7 foot) stratigraphic sequence which covered this log took less than 1,000 years to develop. This sedimentation rate was the most rapid observed in the entire park and illustrates

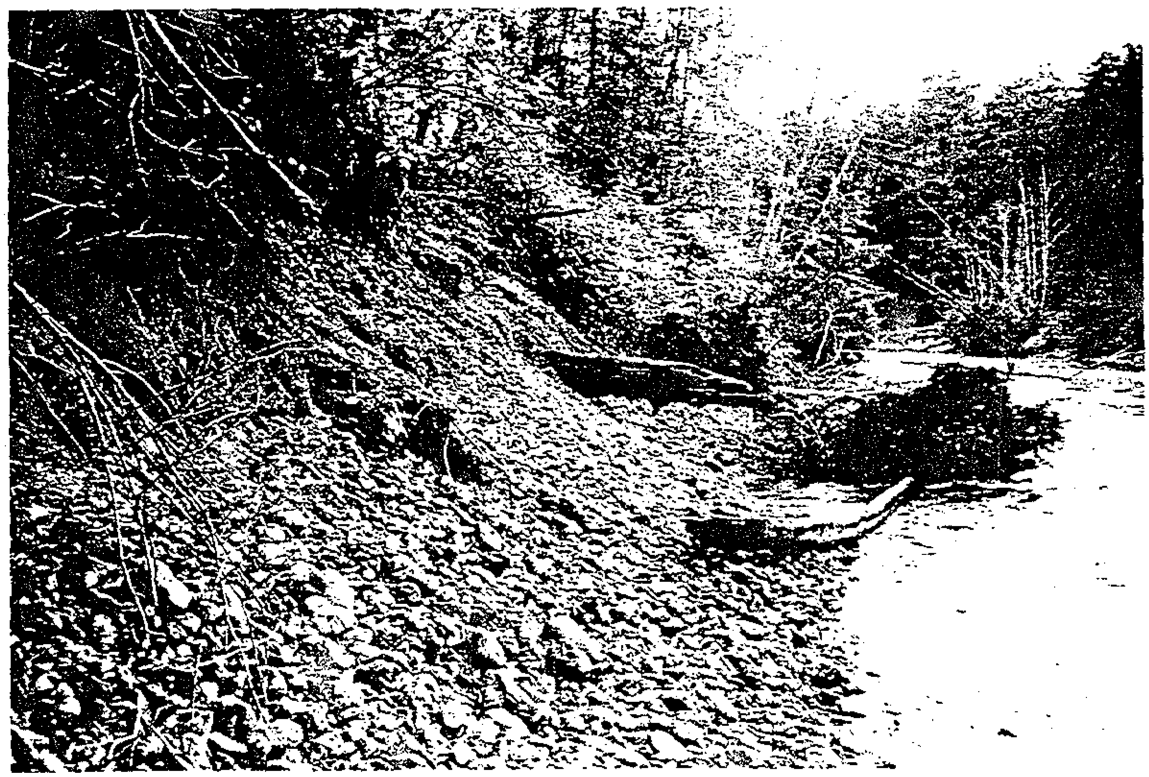


Figure 5.16. Sample location "M-1". Log projecting from eroding east bank of Indian River.

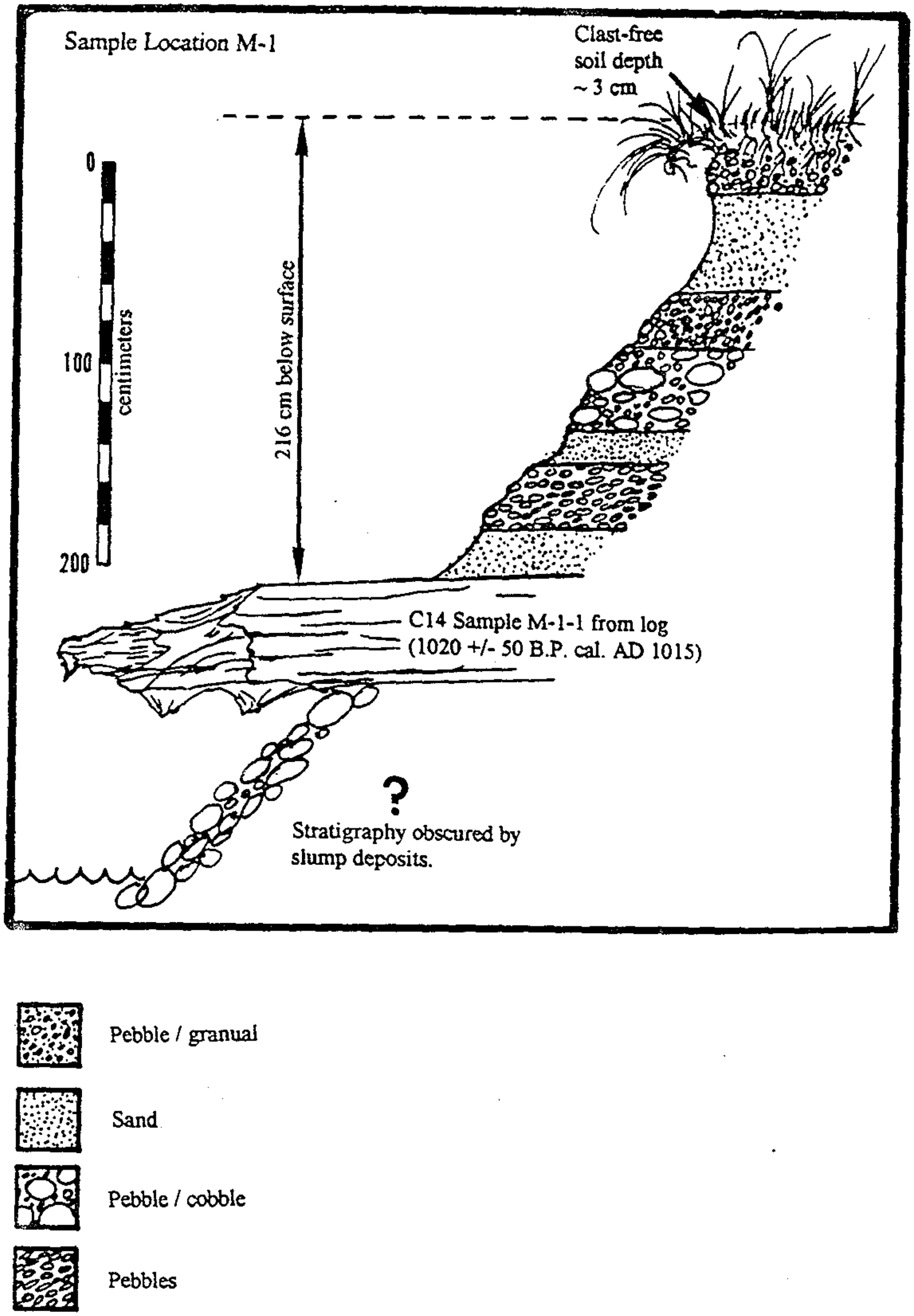


Figure 5.15. River bank stratigraphy at Sample Location "M-1". Yellow cedar (*Chamaecyparis nootkatensis*) log was found projecting from eroding river bank deposits. This stratigraphic sequence took less than 1,000 years to develop. This log was associated with a thin bed of decayed wood debris.

the dynamic nature of a fluvial deposition regime. Areas directly influenced by Indian River have been subjected to very different rates of change than other portions of the Park.

Considering that rivers may actively engage in eroding one section of their channels while depositing material in other sections at the same time, individual beds of river channel deposits rarely extend laterally very far. In this case, the log observed at "M-1" seemed to be associated with a thin layer of decayed wood debris, however this layer could not be traced laterally with any certainty.

It seems most probable that this log floated into position and was deposited on the broad braided river delta. If this is the case, the land surface in this area may have been 7 feet lower ~1,000 years ago. The lateral extent of this lower land surface would be difficult to determine without intensive deep sampling east of the river. This surface would have been subject to fluvial and tidal influences and would not have supported terrestrial soil development. Alternatively it is possible that this log was a tree growing along an adjacent river bank. This tree was then undermined by the river, fell in and was quickly buried. If this was the case, the roots of this tree may still be embedded in the former bank. Careful monitoring of this log as it is exposed may yield further insights into the nature of the former river channel. It is also possible that this log may represent a former lower stand of sea level. If it were in growth position 1,020 ±50 yr B.P (cal. AD 1,015) at its current elevation of ~12½ above mean sea level, a significant revision of paleo land level changes would be required. Too little information is available at this time to evaluate this possibility.

5.3.2. Sampling Location "R-1" (Figure 5.17)

In 1992 SNHP personnel observed what appeared to be hearth feature exposed by river bank erosion. Although it was documented and a charcoal sample was collected, the charcoal has not been submitted for C14 dating. In an effort to evaluate this site, the river bank was examined during the 1994 field season in the vicinity of the suspected hearth feature. No clear evidence of the hearth was discovered, however a small lens of charcoal was observed at sample location "R-1". This may have been the last remaining traces of the hearth which was observed eroding from the river bank in 1992. All recoverable charcoal observed was collected and submitted as C14 sample "R-1-1". This sample weighed 5.4 grams and was the smallest collection of carbon submitted during this project which was datable. This sample yielded a radiocarbon date of 60 ±80 yr B.P. (cal. AD 1,690-1735 or AD 1,815-1,925) [Beta 78814]. This result implies that the sample was too young to be effectively dated using radiometric techniques. If the original carbon sample collected by SNHP personnel can be located and submitted for dating, the larger sample size may yield a more accurate date. The young date obtained from this sample demonstrates the dynamic nature of river deposition and erosion. This charcoal was deposited at the surface and buried by river born gravels less than 300 years ago (perhaps only 100 years ago). Since that time the river has cut a channel adjacent to this site over 10 feet deep and undermined the deposit.

5.4. RIVER TERRACES

5.4.1 Sample Locations "T-1", "U-1", "V-1", and "F-1" (Figure 5.18)

Evidence of fluvial erosion and terracing is most predominate in the portion of the Park east of Indian River. Small terraces are found parallel to the current river channel but a broad terrace is

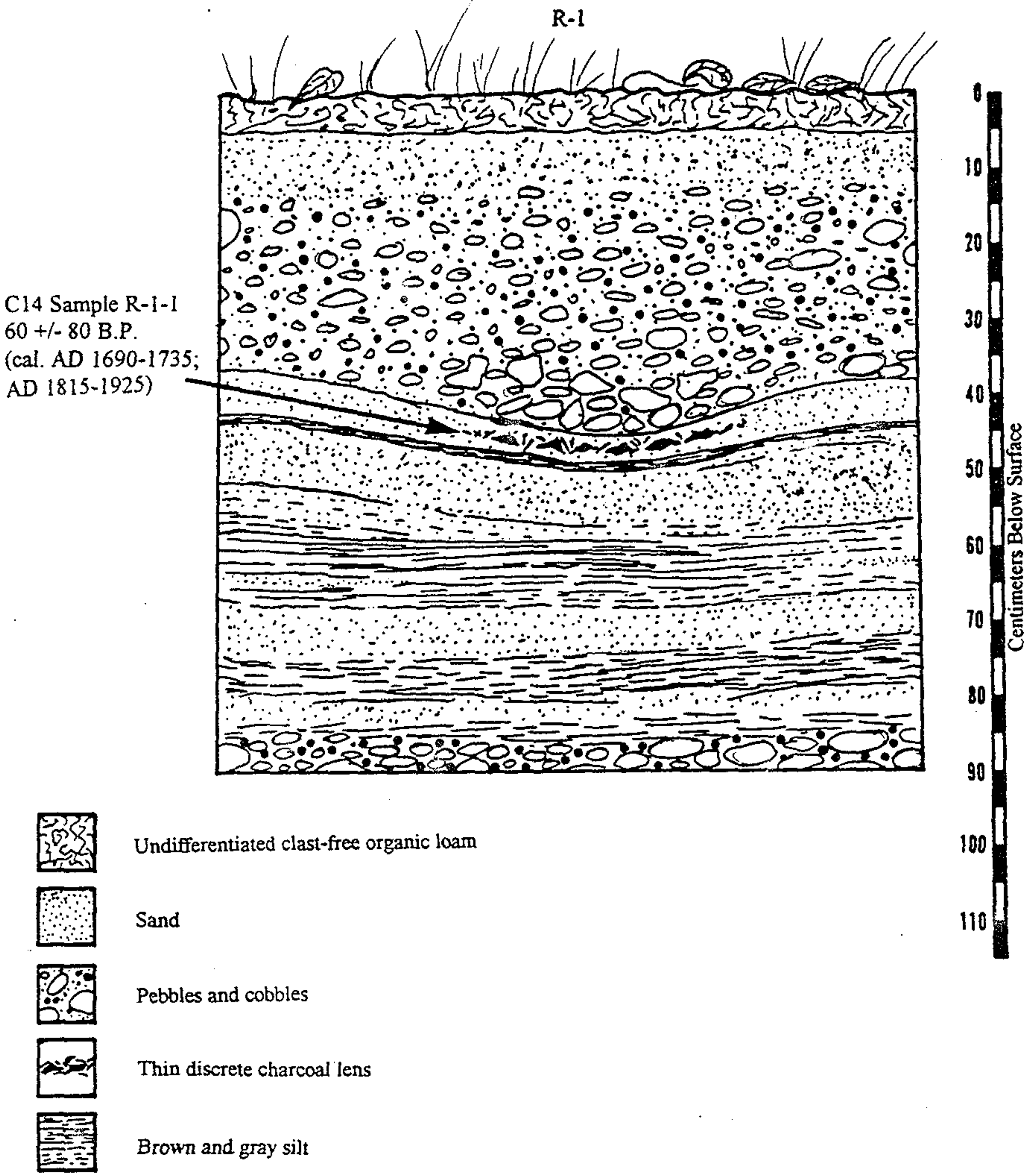


Figure 5.17 Sketch of stratigraphy observed along river cut bank in the vicinity of where Sue Thorsen indicated a hearth feature had been. Charcoal collected from this sampling location may have been from the same hearth. If this is the case, then the majority of the hearth had been lost to erosion by Oct. 25, 1994.

located east of the picnic shelter (Map 1). Topography in this region seems to have been sculpted by three different sources. These include the paleo Indian River course, seasonal runoff from adjacent uplands, and road/trail construction.

It seems probable that in the past, Indian River meandered over this area. The actual channel shifted from time to time but during the course of centuries a broad platform of alluvium was deposited. This area slopes from a high point at the 25 foot elevation at the extreme northern edge of the Park, to the ~15 foot elevation south east of the picnic shelter. The gradient of this slope is ~1 foot of drop per 100 feet of run which is similar to the current river channel gradient below the foot bridge. It should be noted that since the river has undergone so many historical modifications, such comparisons are made with caution. As is common in old meander belts, local topographic relief is not level. Fragments of abandoned channels and river banks are widespread. Unfortunately, deciphering the course of these abandoned channels is complicated by the scouring effects of more recent seasonal runoff from uplands east of the Park. The construction of Sawmill Creek Road and buildings east of the Park in the modern era have combined to radically change the course of these minor ephemeral drainages. The scouring effects of these runoff streams probably ran at a ~45 degree angle to the old river's course. This has resulted a palimpsest drainage pattern with the appearance of a skewed checkerboard.

Beyond the natural system's inherent complexity is the complicating factor of road construction which has taken place in this area. Although a wagon road is shown on early maps of the Park (see Figure 7.7), the exact path followed by the road which ran through here is uncertain. Several generations of Park paths are also present. Considering the swampy nature of some of the soils in this area, the old road beds which occupied this area may have been somewhat elevated. Remnants of these constructions would be difficult to discern from natural ridges in the area without thorough site specific evaluation. Several small depressions were also observed in the region which may have been "borrow" pits mined for fill used in road construction. An additional complexity is the presence of wind thrown trees and accompanying soil disturbance.

In spite of this regional complexity, a time specific stratigraphic horizon was observed at sample locations "T-1", "U-1" and "V-1". The extent of this layer was also noted during soil probe transects looking for tephra. This homogeneous silt layer was readily identifiable and appeared to have been deposited as an over bank flood deposit. No datable carbon material was observed directly in contact with the deposit so it's age can only be estimated. Given the soil depth above this layer averaged ~9 cm and a soil development rate of ~39 years per centimeter was measured at "K-1" this deposit may date from 350 years B.P. (AD ~1650). Admittedly this is a crude approximation and the actual time frame could easily be ±100 years. Considering the broad area covered by this readily identifiable time specific stratigraphic horizon, further research should be conducted to more closely determine the age of this deposit. This silt horizon may prove to be the most valuable time specific stratigraphic horizon on the east side of the park.

This silt deposit may have resulted from a flood caused by a major landslide which blocked Indian River at some point upstream. The slide debris may have created a large unconsolidated dam. When this dam broke, the lower reaches of Indian River may have been inundated by a mud laden flash flood. The silt saturated waters may have flooded lowlands adjacent to the river channel and deposited the homogeneous silt layer observed in soil pits in the eastern half of the Park.

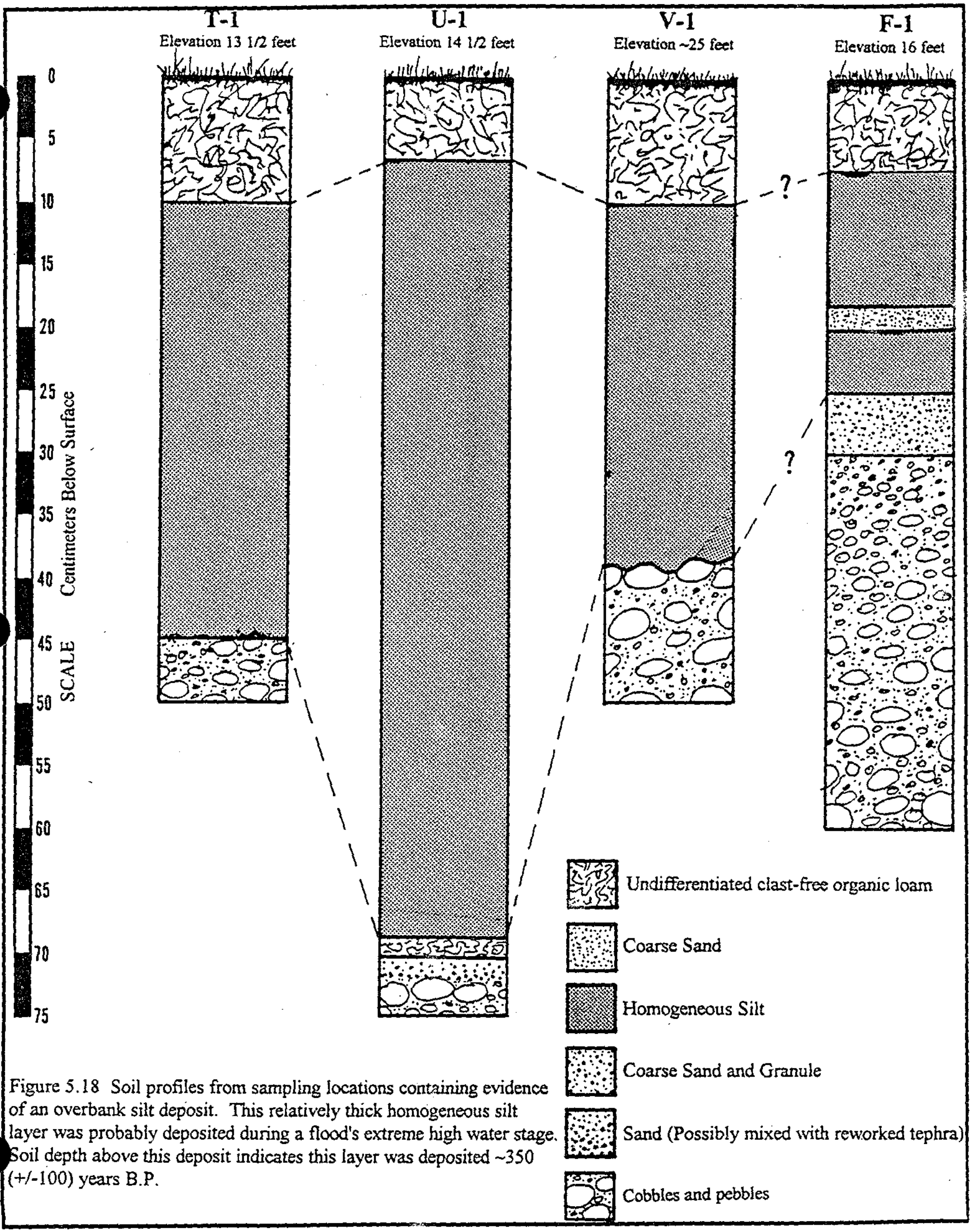


Figure 5.18 Soil profiles from sampling locations containing evidence of an overbank silt deposit. This relatively thick homogeneous silt layer was probably deposited during a flood's extreme high water stage. Soil depth above this deposit indicates this layer was deposited ~350 (+/-100) years B.P.

A similar silt deposit was observed at sample location "F-1" (Figure 5.19). Given the similar appearance of the silt and the same magnitude of soil development above the silt layer, the deposit may date from the same flood event. There was a thin bed of coarse sand in the silt observed at "F-1". This may indicate that "F-1" was closer to the active stream channel during the flood and a brief interval of fast moving water was experienced here. Further research is recommended before this stratigraphic sequence is definitively linked to the homogeneous silt observed on the east side of Indian River.

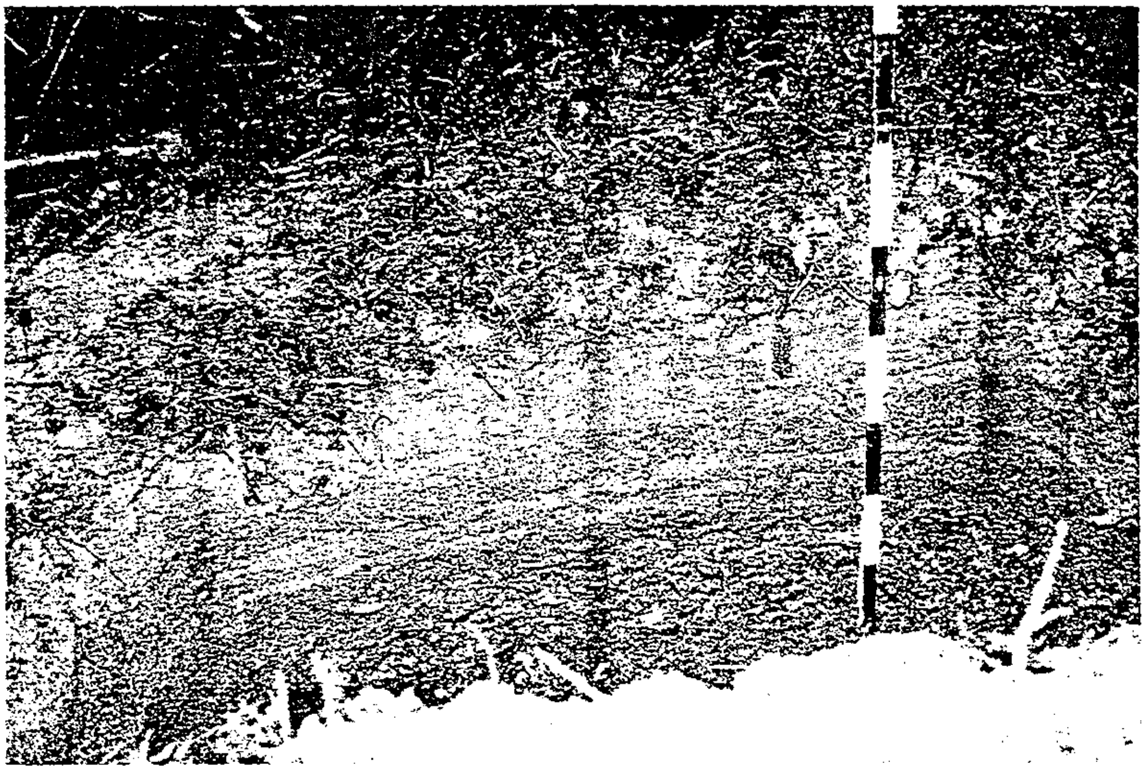


Figure 5.19. Silt deposit observed at sample location "F-1".

5.5. BEDROCK OUTCROPS

The distribution of bedrock outcrops in the Park is quite limited. The course of Indian River is controlled by bedrock from the point where it enters the park to just north of the Park's footbridge. This linear portion of the river channel provides evidence that bedrock along its course is weaker than is found in immediately adjacent areas. This lineament may represent a minor fault.

Another bedrock outcrop is located in the intertidal zone near the Visitor Center. This outcrop appears to have predated dredging and was probably exposed by wave driven erosion. This provides evidence that net littoral sediment movement was toward the southeast. If deltaic deposits had been evenly distributed along the shoreline, all bedrock would have been buried to some degree.

5.6. MORAINE QUESTION

The degree to which Park landforms were sculpted by ice remains uncertain. Considering that moraines have been previously mapped within the Park (Figure 3.1), special care was taken not to overlook evidence suggesting their presence in the Park. While it is highly probable that some of the sediments located in the park were incorporated into glacial ice at some point, no clear evidence was observed of structures built by glacial ice. All of the boulders observed could have been transported and deposited by fluvial or littoral mechanisms. A possible exception to this were large boulders observed adjacent to where Indian River enters the Park. These boulders appear to rest on bedrock and may be glacial erratics. No striated boulders were observed but this may have been due to moss mantling, poor light and limited time devoted to the search for these features. A concentration of small rounded boulders was observed at the base of soil profiles "E-1" and "E-2". These boulders had a long axis diameter of ~30 cm and may represent the surface of a moraine which was reworked by wave energy. Beaches in other locations along the Alaskan Gulf coast are primarily composed of wave transported boulders of this size (Chaney 1987:84,105 Figure 4.4). Another possible explanation for the presence of some large boulders in the Park is that they may have rafted into position as "drift log erratics" (Figure 5.1). However, these sediments could have also been transported and deposited by ice rafting, littoral, or fluvial processes. Evidence for the presence of glacial moraines within the park remains inconclusive.

5.7. TEPHRA

The presence of volcanic ash of known age provides an important time stratigraphic marker horizon for both geomorphicalogical and archaeological investigations in Sitka National Historical Park. Bracketing radiocarbon dates and the results of chemical analysis on Park tephra make this tephra horizon a valuable geological timeline wherever it can be identified in the stratigraphy.

Prior to the present investigation tephra had been recognized by Park Service archaeologist Gene Griffin (NPS 1985) in a soil profile exposed along the southeast side of the Park maintenance shed and in the root wads of tree throws near the Russian Memorial on the east side of Indian River. One of the goals of the current research was to identify other locations where tephra was present and to map the distribution of volcanic ash deposits within the Park. Tephra distribution was determined through recording its presence or absence in test pits and soil probes. Random examination of exposed soil in the root wads of tree throws also helped define the approximate boundaries of tephra distribution in the Park. On the west side of Indian River, where more test pits were dug, soil probes were extended outward from test pits to better define the extent of tephra identified during testing, or confirm the absence of tephra where it was not identified in test pit stratigraphy. On the east side of the river where fewer test pits were dug, soil probe testing was the principal means of determining the distribution of tephra. On this side of the river systematic soil probe transects following a compass course of 45 degrees true north from 1992 survey monuments or other mapped locations were employed to help identify areas where tephra was present or absent.

A relatively thin horizon of light gray (10 YR 7/1) tephra was recognized in test pit stratigraphy and in soil probes at higher elevations on both sides of Indian River (Table 5.6). On the west side of Indian River tephra was not present at sample locations at or below the 20 foot elevation contour. East of Indian River, in the vicinity of the Russian Memorial, tephra was present at Sample Location "O-1" at an elevation of 21 feet and at "S-1" at an elevation of 15 feet where it appears to have been reworked downslope. Test pits and soil probes on the east side of the river did not reveal the present of tephra below 15 foot elevation.

A radiocarbon date of 4,000 +/- 70 B.P. (cal. 2,485 BC) on charcoal at the upper contact of the tephra at Sample Locale "Shed-1" provides a minimum limiting date on this ash fall. The calibrated date indicates the tephra was deposited at or slightly before about 4,500 years ago. A radiocarbon date on wood from a soil unit below the tephra lens at nearby Sample Locale "A-1" provides a maximum limiting date on this ash fall of 4,290 +/- 70 (cal. 2,900 BC) or about 4,900 years ago.

5.7.1. Tephra Distribution

The estimated extent of tephra distribution within Park boundaries is presented on Map 2. Tephra is present within the areas indicated on Map 2, however it is discontinuous within these areas due to the fact that tephra is easily reworked downslope and has consequently been selectively preserved in the soil profile. At the time of the ash fall ~ 4,500 years ago most of the land presently forming the Park was still subject to storm waves and tephra from this eruption of Mt. Edgecumbe was preserved only on land that was already emergent. Consequently it is the higher elevations within the Park where tephra can be identified in the stratigraphy.

West of Indian River tephra is present in two areas separated by intervening lower terrain (Map 2). The northernmost area is above 30' elevation on the knoll located in the vicinity of the Park maintenance shed. Testing in this area encountered a 2-8 cm thick tephra lens ranging in depth from 10 to 30 cm below the ground surface (Table 5.6). Testing and soil probes below 24' elevation on the poorly-drained terrace south of the knoll did not encounter tephra but the tephra

Table 5.6
Tephra Present in Subsurface Tests

Sample Location	Soil Probe	Side of Indian River	Depth of Tephra Lens	Thickness of Tephra Lens
Shed-1		West	30-35 cm	5 cm
A-1		West	10-18 cm	8 cm
D-1		West	40-42 cm	2 cm
D-2		West	20-22 cm	2 cm
E-1		West	18-20 cm	2 cm
	Transect 1: Probe 1	East	15 cm	Not determined
	Transect 1: Probe 2	East	15 cm	Not determined
	Transect 1: Probe 4	East	15 cm	1 cm
O-1		East	5-10 cm	5 cm
	Transect 1:Probe 6	East	15 cm	Not determined
	Transect 1:Probe 7	East	15 cm	Not determined
P-1	(Expanded Probe)	East	15-17 cm	1-2 cm
	Transect 2:Probe 1	East	30 cm	Not determined
	Transect 2:Probe 2	East	10 cm	Not determined
S-1	(Expanded Probe)	East	9-12 cm	3 cm

horizon again became apparent on the southeast trending ridge line above an elevation of about 24 ft where it was encountered at Sample Locations "D-1", "D-2", and "D-3". Here the tephra lens was thinner (only 2 cm thick) and was encountered directly above the pebble/cobble deposits at a depth ranging between 18 and 40 cm.

East of Indian River apparently *in situ* tephra was located only above about 21 ft. elevation in the area immediately northwest of the Russian Monument (Map 2). Tephra identified in test pits "O-1" and "P-1" and in a number of soil probes varied in thickness between 1-5 cm and in depth from 5-30 cm below the surface although most soil probes encountered the tephra at a depth of about 15 cm directly above the pebble/cobble deposits. At one location (Sample Locale S-1) at an elevation of 15 ft. a 3 cm thick tephra lens was encountered at a depth of 9-12 cm below the surface but it is likely that this tephra has been redeposited from upslope. It is possible that tephra is present at the northeastern corner of the Park where the terrain rises to about 25 ft. in elevation although no tephra was observed in this area in 1994. Lack of field time allowed only one Sample Location ("V-1") to be investigated in this area but two soil probe transects between Indian River and the Park boundary at Sawmill Road failed to identify tephra in the soil profile in this area of the park.

5.7.2. *Microprobe Analysis*

Volcanic ash was collected at five Sample Locations in the Park ("Shed-1", "A-1", "D-2", "E-1", and "O-1") and tephra samples "Shed-1-1" and "O-1-1" were submitted to Dr. Jim Beget at the University of Alaska - Fairbanks for electron microprobe analysis. The laboratory results of this analysis are presented in Appendix C. Tephra collected at "Shed-1" (ACT Lab # 1371) on the west side of Indian River and at "O-1" east of the river (ACT Lab # 1372) are geochemically very similar. Dr. Beget reports that all major oxides (SiO_2, Na_2O, K_2O, CaO, and Fe_2O_3) overlap at a one sigma standard deviation and are essentially identical. These two tephra samples are geochemically identical with two other Holocene Mt. Edgecumbe tephras collected from peats in the Sitka area in 1994 and are geochemically distinct from Pleistocene-aged Mt. Edgecumbe volcano complex which are more mafic than the Holocene tephras. Dr. Beget (Appendix C) reports:

> Nine analyses have been completed of samples of Pleistocene pumice and ash found at sites near Sitka, as well as on Kruzoff Island, and at one site near Icy Straits to the north. All of these Pleistocene samples are geochemically distinct from the Holocene samples, as they are all lower in SiO_2 and more mafic. There is no possibility that samples found in Holocene peats are simply reworked or remobilized components of the thick Pleistocene ash deposits, as they are geochemically quite different.

The previously published data set includes only one sample of a Holocene ash deposit, identified near Mt. Edgecumbe on Kruzoff Island, and insufficient data was presented to compare this analysis with the Sitka area data therefore this deposit cannot be proven to be correlative with the Holocene distal ash deposits found around Sitka (Jim Beget, personal comm.).

The two tephra samples submitted from Sitka National Historical Park are correlative with one-another, and with Holocene ash deposits from Mt. Edgecumbe found elsewhere in the Sitka vicinity. These samples are geochemically distinct from older, Pleistocene tephras erupted from Mt. Edgecumbe, and so cannot be reworked material, but record a Holocene eruption.

NOTES:
The Vertical datum is Mean Sea Level.
The Horizontal datum is Alaska State Plane, Zone 1.
Mapped by AEROMAP U.S., Inc. from photography dated 8-10-1989 for Tryck, Nyman, Hayes, Inc.
This map conforms to National Map *Accuracy Standards as related* to the project photo control for scales of 1"=100' or smaller.
The vertical accuracy is approximately one half of the contour interval shown in any given area on the map. Contours in vegetated areas may be less accurate. Dashed contours indicate approximate lines due to very dense trees.
The portion of the Park lying north of Indian River surveyed in 1995 by Stragier Engineering Services, Inc. and not based on aerial photography.

MAP 2
TEPHRA DISTRIBUTION
SITKA NATIONAL HISTORICAL PARK

SITKA, ALASKA

Tephra samples "A-1-1","D-2-1", and "E-1-1" which were not submitted for geochemical analysis were compared with tephra samples "Shed-1-1" and "O-1-1" under a binocular microscope at the USDA Forest Service Forest Sciences Laboratory in Juneau. All five tephra samples collected in Sitka National Historical Park appeared indistinguishable under magnification and it appears that only one ash fall event is recorded in the Park stratigraphy. The tephra horizon present in the Park constitutes a synchronous geochronological marker horizon which can be used for future archaeological, geological, and oceanographic studies.

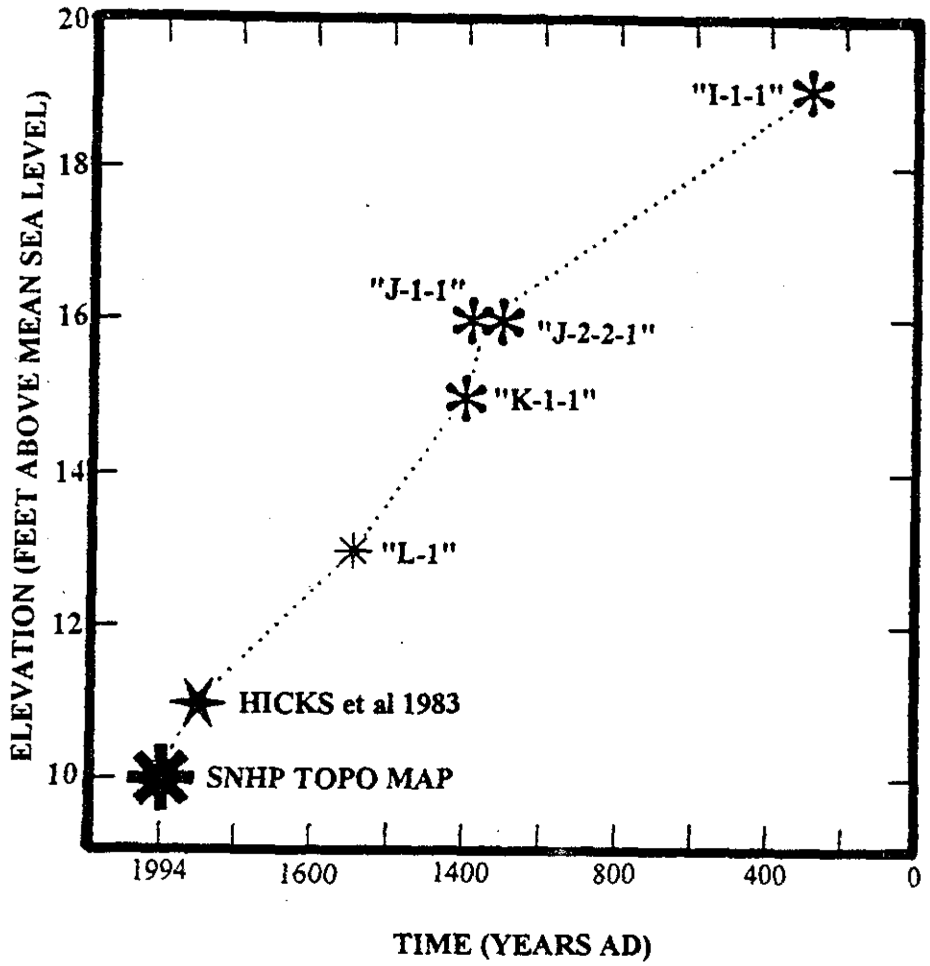


Figure 6.1 Local trend of land emergence from the influence of storm waves - AD 1994 to AD 300.

It is also assumed that major storms have been of similar magnitudes for the last ~1,700 years. It is possible that the storm which built the ridge containing sampling locations "I-1" and "I-2" was the most severe storm in the last ~1,700 years. Alternatively the ridge containing Sampling Locations "I-1" and "I-2" could have been built in response to episodic uplift or sudden increase in littoral sediment supply. After the 1964 earthquake in Southcentral Alaska new storm berms were built seaward of the pre-quake beach ridges. Trenches were observed separating the new storm berms (Chaney 1987).

Beyond 1,700 years ago the data becomes quite sparse. Tephra preserved in direct contact with marine sediments provides a "snapshot" from 2500 BC. The tephra observed at elevations of 25 feet clearly indicate that this ash fell on recently emergent marine sediments. Tephra observed at sample location "O-1" indicates that the storm water line may have been as low as 21 feet. Traces of possible ash at "P-1" suggest that elevations below 20 feet may have provided poor preservation environments such as would be expected along extreme high water. The preservation of tephra over at least five feet of elevation without any terrestrial soil present between the tephra and the clast-based marine sediments suggests episodic uplift of at least five feet. The magnitude of episodic uplift may have been much greater than the 5 feet but more field data is required to clarify this issue.

Interestingly enough this leaves a data gap of at least 2,000 years. One interpretation is that the period following the eruption and episodic uplift was one of relative stability with little local land level change. Another possibility is that subsidence may have followed the uplift event during the 2,000 years after the eruption. The only evidence observed which suggest that uplift may have been greater than the five feet implied by field data is the very deep soil observed at the 21 foot elevation sample location "C-1". After the uplift event, the region may have slowly subsided until uplift resumed sometime before 1,700 years ago. Unfortunately, due to an extremely high water table, the lower portion of "C-1" profile was not observed. It is possible that the sediment observed below the ancient log which provided a radiocarbon date of 2,220 ±60 yr B.P. (cal. 215-350 BC) might have been marine soil over terrestrial soils. This could be an indication of subsidence in the interim period however too little data is available at this time to say for sure. One hundred miles north of Sitka there is evidence for dramatic uplift followed by subsidence at Dundas Bay in the form of stumps which were radiocarbon dated 1,960 ±65 yr B.P. These stumps have been observed emerging from the intertidal zone along the north shore of Cross Sound (Derksen 1976:43,91). If they represent a land level trend for northern Southeast Alaska, then relative sea level may have been near present levels in the Sitka region at that time. Such a correlation is highly questionable considering modern rates of emergence are 10 times greater near Cross Sound than in the Sitka area. On the other hand, both areas are currently emerging, indicating a possible geophysical link between the two areas. Although direct evidence is lacking to support submergence following uplift in the Park, it is possible that at some point between 2500 BC and AD 300 shoreline was lower than the 19 foot elevation contour. Then sea level rose to 20 feet and then began dropping again. Data to support this reconstruction is weak but includes the following:

- Possible traces of tephra below 20 foot elevation were observed which may have been reworked by rare high storm waves.

- The deep organic clast-free soil profile at 21 foot elevation sample location "C-1" indicates an extended period of terrestrial soil development. Over half of this soil accumulation was below C14 sample "C-1-1" which yielded radiocarbon date of 2,220 ±60 (cal. 215-350 BC).

- ~2,000 years ago shoreline was <u>below</u> current levels in Dundas Bay 100 miles to the north (Derksen 1976:43,91).

- A lack of dates from 2,600 BC to AD 300 indicates the possibility that these deposits were washed away by rising sea level. This process could have eroded away evidence of a lower stand of sea level.

If this trend did take place, then further detailed excavation at locations protected from storm energy may reveal terrestrial paleosols dating from +1,700 years B.P. below the 19 foot elevation contour. The lateral extent of such deposits will probably be quite limited because high energy marine and river environments provide poor preservation environments for such fragile deposits.

The exact date when the knoll emerged from above the highest storm waves is difficult to determine from evidence gathered during this study. Bracketing dates for this period are provided by radiocarbon sample "A-1-1" which established a minimum date of emergence at 4,290 ±70 years B.P.(cal. 2,900 BC). The absence of 9,000 year old mafic tephra provides a maximum date. Soil depth observed at sample location "Shed-1" below the tephra lens averaged 10 cm thick. Radiocarbon sample "Shed-1-1" collected in contact with the tephra layer yielded a radiocarbon date of 4,000 ±70 years B.P.(cal. 2,485 BC). A terrestrial soil accumulation rate of ~80 years per centimeter was calculated at sampling location "I-1". If the rate of soil development at "I-1" was comparable to "Shed-1", emergence may have occurred 800 years prior to the tephra fall. The soil profile at "Shed-1" may represent closer to 1,000 years if compaction is taken into account. This line of reasoning suggests that the knoll may have emerged from the influences of storm waves ~3,500 BC. It is stressed that rates of soil development are quite variable in the park and past rates of soil development may have been different that modern rates.

Although large gaps in the data set are present, a storm tidal emergence graph has been compiled for the Park (Figure 6.2). Due to the numerous site specific factors which might have caused local sea level variations, this curve should only be extrapolated beyond the limits of the Park with due caution.

One point of interest. If current rates of uplift continue and dredging remains suspended, a new meadow area will probably be formed about 600 years from now along the current tide flats southwest of erosion survey monuments 210 and 209 (Map 1).

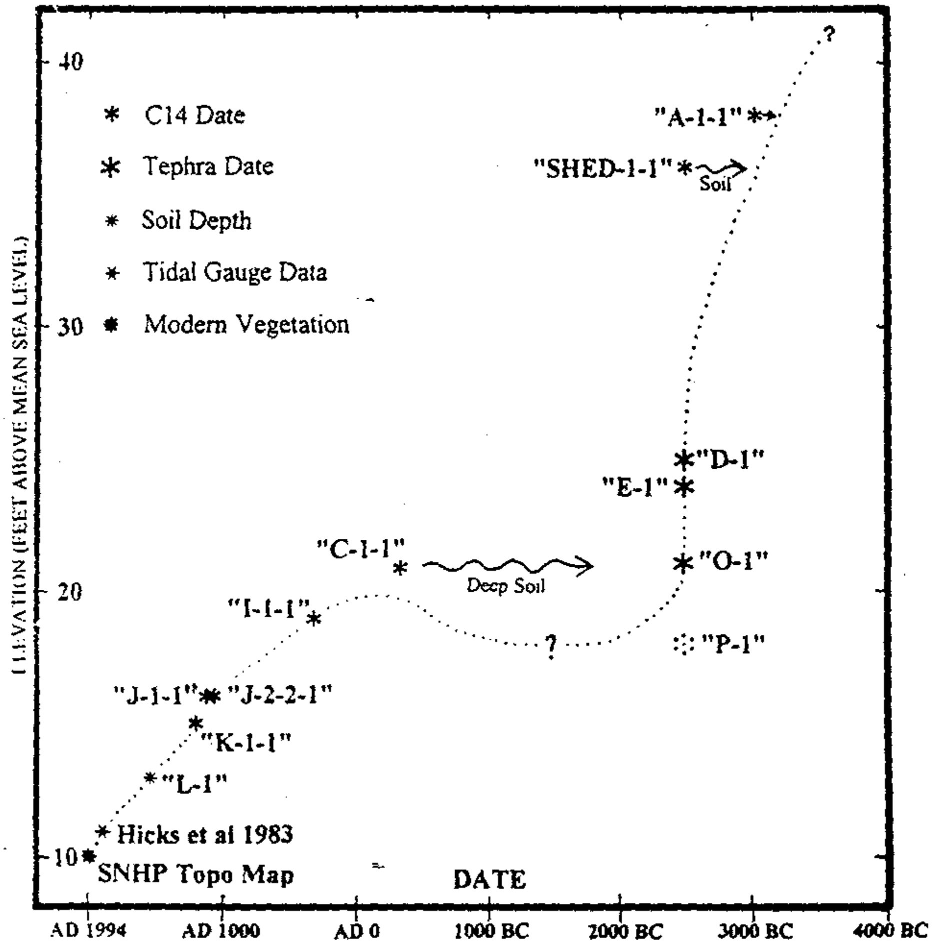


Figure 6.2 Storm tidal emergence graph for Sitka National Historical Park.

6.2 EVOLUTION OF LANDFORMS

To facilitate the discussion of landform evolution, a series of maps has been drafted depicting shorelines and landforms at various times in the past. These particular times were selected based on dates derived from this investigation. Some of these shorelines are highly conjectural and may be subject to major revisions in the future when more information comes to light.

The reader is guided through the map series by captions which accompany the figures. Due to scale constraints imposed by the format of this report, the orientation and boundaries encompassed by each map in this series are slightly different in order to concentrate on the areas of greatest landform development for each period. Areas which are not contained within any given map in the sequence may have also experienced landform development. The reader is advised to use the sampling locations as constant geographic reference points. The positions of these sampling locations are provided on Map 1 in relation to current landmarks in the Park.

6.2.1. Landform Development Prior to 2600 BC

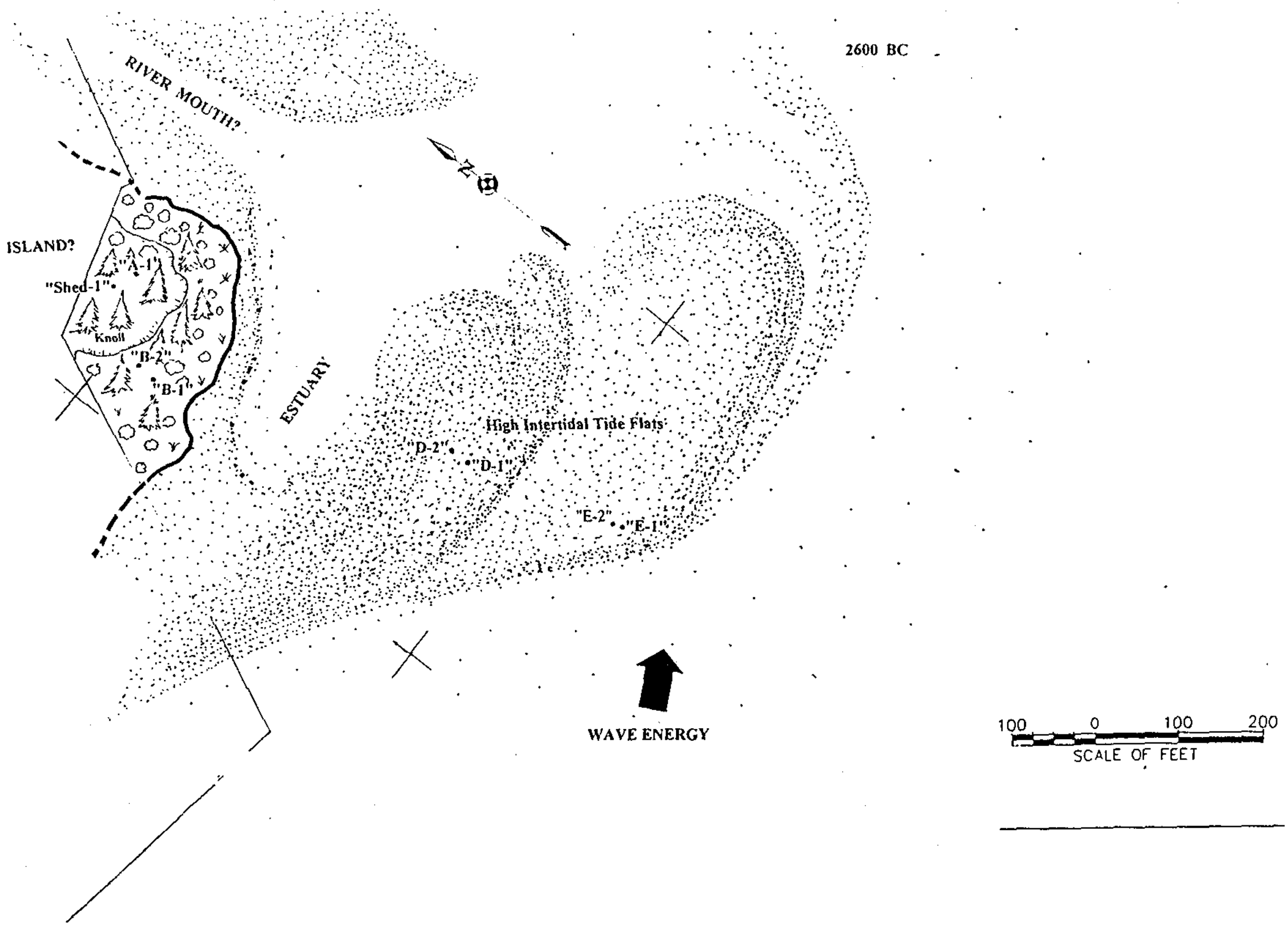
Uplifted beaches observed below the Sitka Observatory indicate a former high tide line above the present 40 foot elevation contour (Yehle 1974:Figure 4). Other landforms and the general topographic pattern around Sitka suggest a land emergence of at least 50-65 feet (Yehle 1974:14) At this higher stand of sea level, all landforms within the Park would have been intertidal or sub tidal. Pebbles and granules observed at the base of sampling location "Shed-1" were probably deposited on the outer reaches of the developing Indian River delta during this period.

Prior to 3600 BC, the Indian River delta was probably north of the Sheldon Jackson Museum's current location. Wave energy which reached this shore would have been much greater than Crescent Bay experiences today because most of the islands in Sitka Sound would have been underwater at high tide. As the land emerged, the Indian River delta's sediment wedge built outward. During this period, the knoll adjacent to sampling location "Shed-1" would have been a bedrock cored island near shore projecting from the building Indian River delta. The setting would have been similar to Cannon Island today. Considering that the clast-free soil thickness between marine sediments and the 2500 BC tephra layer is estimated to have taken about 1,000 years to develop, the knoll probably emerged from tide water about 3500 BC. Without further research outside of the Park's boundaries, it is difficult to say where the mouth of Indian River was at that time.

The small terrace containing sampling locations "B-1" and "B-2" was a beach for some time. This terrace is estimated to have been uplifted above the reach of storm waves between 2600 and 3500 BC. More research is needed to clarify this time frame. As emergence continued, a bar extended from this point toward the south. Wave energy deflected the end of the bar eastward. As the bar was swept eastward, an estuary was formed at the base of the knoll around sampling location "C-1".

6.2.2 Ca. 2600 BC PRIOR TO MOUNT EDGECUMBE ERUPTION AND UPLIFT (Figure 6.3).

The knoll was the outer point of what may have been an island in the Indian River delta. It is not certain if the mouth of Indian River had reached the Park boundaries by this time. A bar extended offshore and was submerged at high tide. An estuary occupied the area around sampling location "C-1". A beach was at the base of the terrace containing sampling locations "B-1" and "B-2". Since the bar was built out from the island by waves, its offshore gradient may have been very steep and was probably near its angle of repose. This underwater slope would have been very susceptible to seismically induced subaqueous slides.



2600 BC
RIVER MOUTH?
ISLAND?
"A-1"
"Shed-1"
Knoll
"B-2"
"B-1"
ESTUARY
N
High Intertidal Tide Flats
"D-2"
"D-1"
"E-2"
"E-1"
WAVE ENERGY
100 0 100 200
SCALE OF FEET

Figure 6.3

6.2.3 Ca. 2485 BC - AFTER MOUNT EDGECUMBE ERUPTION AND UPLIFT (Figure 6.4)

After episodic uplift associated with the eruption Mt. Edgecumbe that occurred ~2485 BC, former tidal flats were lifted above the reach of storm waves. The knoll was connected to the mainland and the river mouth would have been in this vicinity. Offshore gradient may have been relatively steep. It is possible subaqueous slides may have occurred along the new beach front. Waves began attacking oversteepened beach. Tephra that was observed at sampling locations "D-1", "D-2" and "E-1" was preserved on recently uplifted former tidal flats. It is possible that large wildfires were caused by the eruption or followed soon after because most tephra observed on the west side of the river had small amounts of charcoal imbedded on it's upper surface. Pioneer forest began to develop on the newly emerged lands. The former estuary surrounding "C-1" became a developing meadow. A low bar was uplifted in the vicinity of sampling locations "S-1", "N-1" and "O-1" but the extent and morphology of this location is difficult to define due to erosion and other disturbances. It is possible that subsidence followed this uplift event but no clear evidence of this was observed during this investigation.

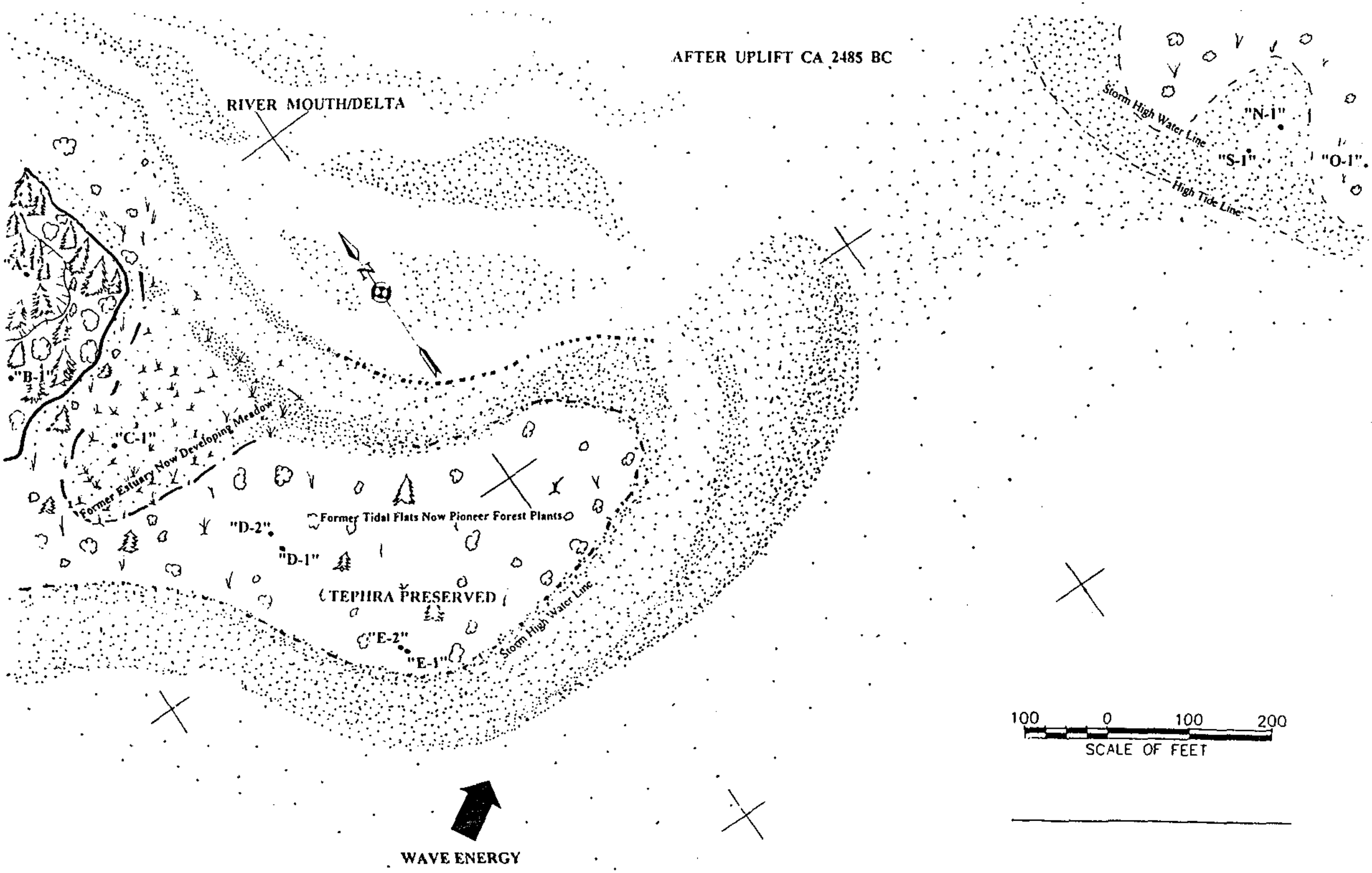

AFTER UPLIFT CA 2485 BC
RIVER MOUTH/DELTA
Storm High Water Line
"N-1"
"S-1"
"O-1"
High Tide Line
"A-1"
"B-1"
"C-1"
Former Estuary Now Developing Meadow
Former Tidal Flats Now Pioneer Forest Plants
"D-2"
"D-1"
TEPHRA PRESERVED
"E-2"
"E-1"
Storm High Water Line
100 0 100 200
SCALE OF FEET
WAVE ENERGY

Figure 6.4

6.2.4. Ca. AD 0 (Figure 6.5)

Uplift resumed after the long period of elevational stability (or perhaps subsidence). The uplifted bar (area of sampling locations "D-1", "D-2" and "E-1", "E-2") was eroded on the west side by wave attack and on the east side by the meandering river. Relatively steep banks surrounded the remnant bar. Former meadow at "C-1" became forested. Accretion began on southern tip of bar. Young forest hugged the base of the slope. Young forest shown along beach followed approximately the modern 19 and 20 foot elevation contours. Date of map derived from radiocarbon sample "C-1-1" collected from a buried tree trunk fragment and uplift curve Figure 6.2. Admittedly the dating of this map is blurry.

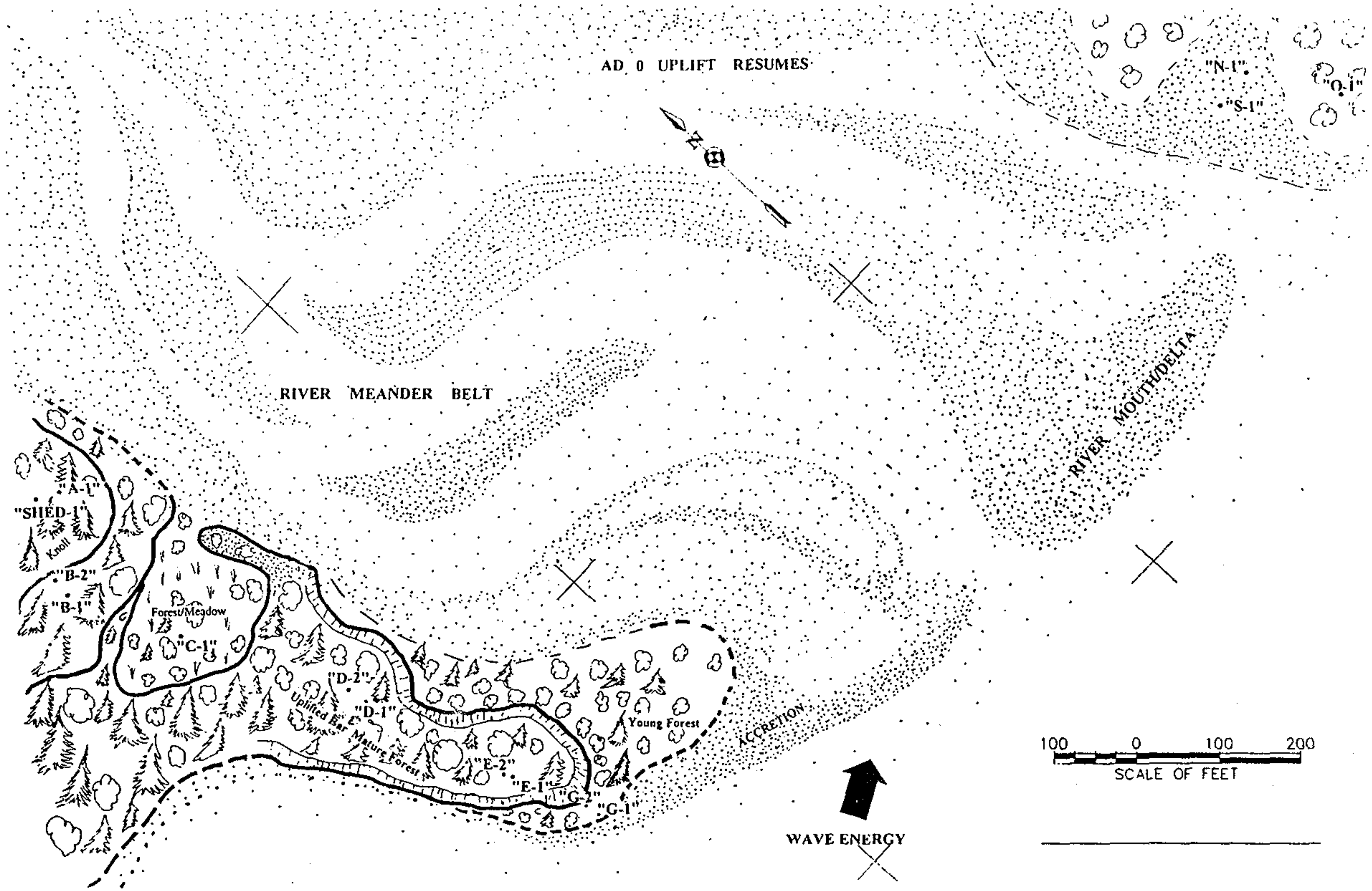
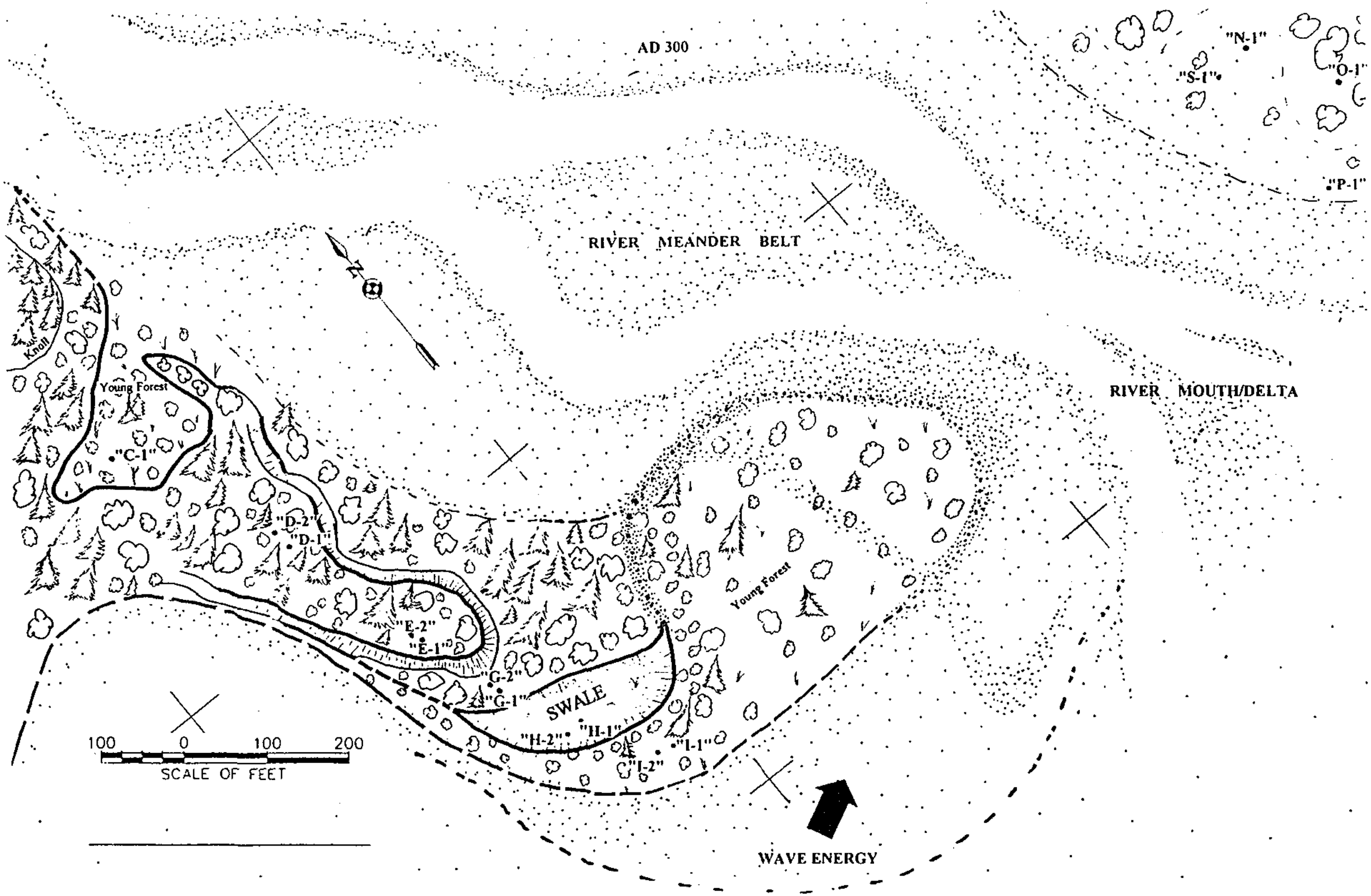

AD 0 UPLIFT RESUMES
"N-1"
"O-1"
"S-1"
N
RIVER MEANDER BELT
RIVER MOUTH/DELTA
"A-1"
"SHED-1"
Knoll
"B-2"
"B-1"
Forest/Meadow
"C-1"
"D-2"
"D-1"
Uplifted Bar Mature Forest
"E-2"
"E-1"
"G"
"G-1"
Young Forest
ACCRETION
WAVE ENERGY
100 0 100 200
SCALE OF FEET

Figure 6.5

6.2.5. Ca. AD 300 (Figure 6.6)

In response to massive storm, episodic uplift or sudden increase in sediment supply, a large beach ridge formed in front of the old bar. Date of bar formation derived from radiocarbon dating of charcoal lying on clast-based marine deposits "I-1-1". A deep swale was left behind the new bar. A meadow or pond was established in the enclosed depression. Note that the tip of the previous bar was removed by the meandering river. Young forest along beach followed approximately the modern 18 foot elevation contour.



AD 300
"N-1"
"S-1"
"O-1"
"P-1"
RIVER MEANDER BELT
N
Knoll
Young Forest
"C-1"
"D-2"
"D-1"
"E-2"
"E-1"
"G-2"
"G-1"
SWALE
"H-2"
"H-1"
"I-1"
"I-2"
Young Forest
RIVER MOUTH/DELTA
100 0 100 200
SCALE OF FEET
WAVE ENERGY

Figure 6.6

6.2.6. Ca. AD 1150 (Figure 6.7)

Uplift continued. Magnitude of uplift derived from radiocarbon dating of charcoal lying on clast-based marine deposits "J-1-1" and "J-2-2-1". Large bar which formed during last map period was forested but the tip has eroded by the meandering river. Several small beach ridges were formed as area was uplifted and accreted seaward. Young forest colonized this new land. Shoreline followed approximately the modern 16 foot elevation contour. Notice the immature bar which began to project from the extreme southwest point.

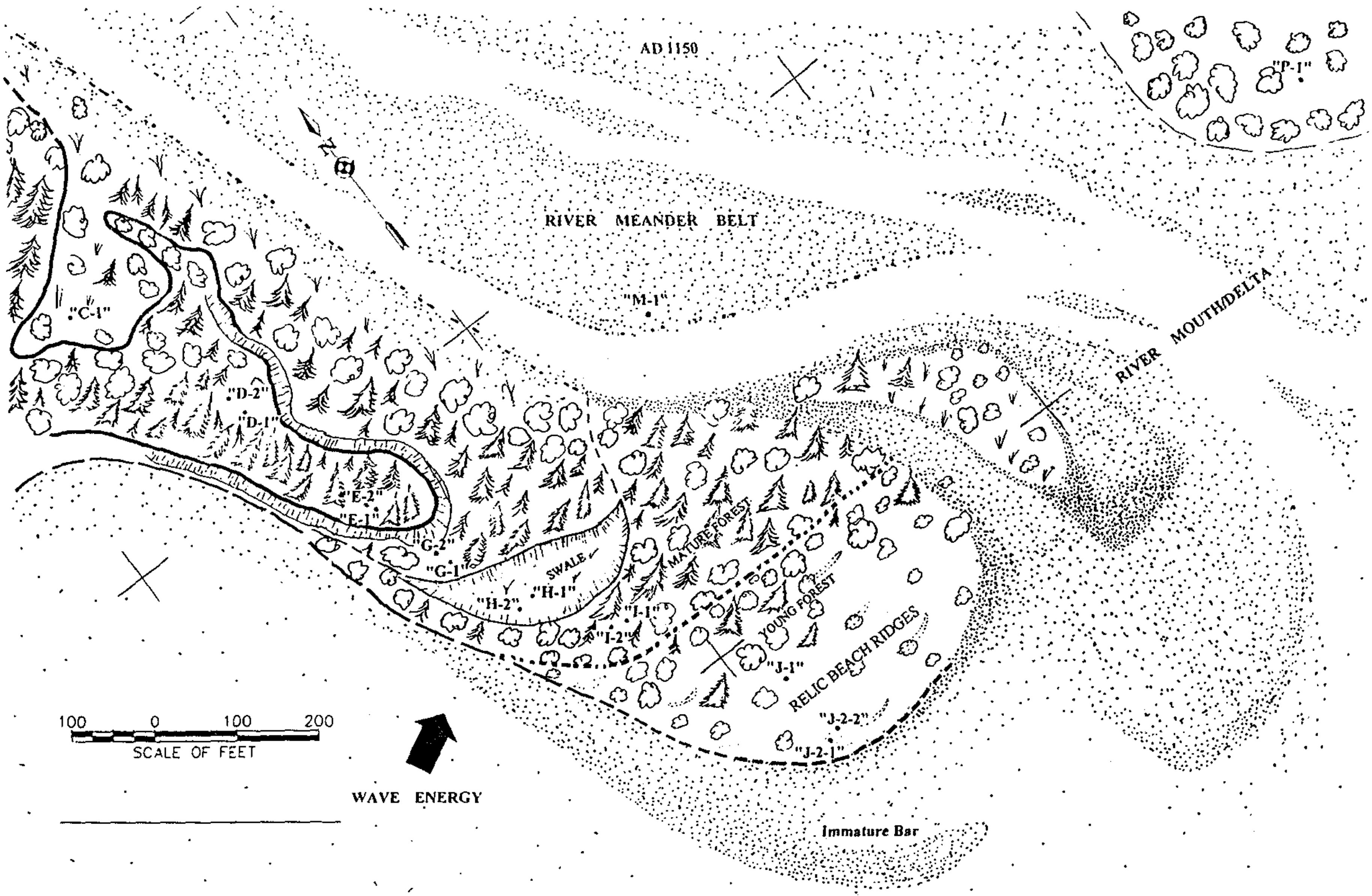

AD 1150
"P-1"
N
RIVER MEANDER BELT
"M-1"
RIVER MOUTH/DELTA
"C-1"
"D-2"
"D-1"
"E-2"
"E-1"
"G-2"
"G-1"
SWALE
"H-2"
"H-1"
MATURE FOREST
YOUNG FOREST
"I-1"
"I-2"
"J-1"
RELIC BEACH RIDGES
"J-2-2"
"J-2-1"
100 0 100 200
SCALE OF FEET
WAVE ENERGY
Immature Bar

Figure 6.7

6.2.7. Ca. AD 1250 (Figure 6.8)

Uplift continued. The east end of former bar was eroded by the meandering river. Magnitude of uplift derived from radiocarbon dating of charcoal "K-1-1" lying on clast-based marine deposits. Young forest line followed modern 14 foot elevation contour. Note bar that began to extend from the southwest point and formed a partially protected estuary.

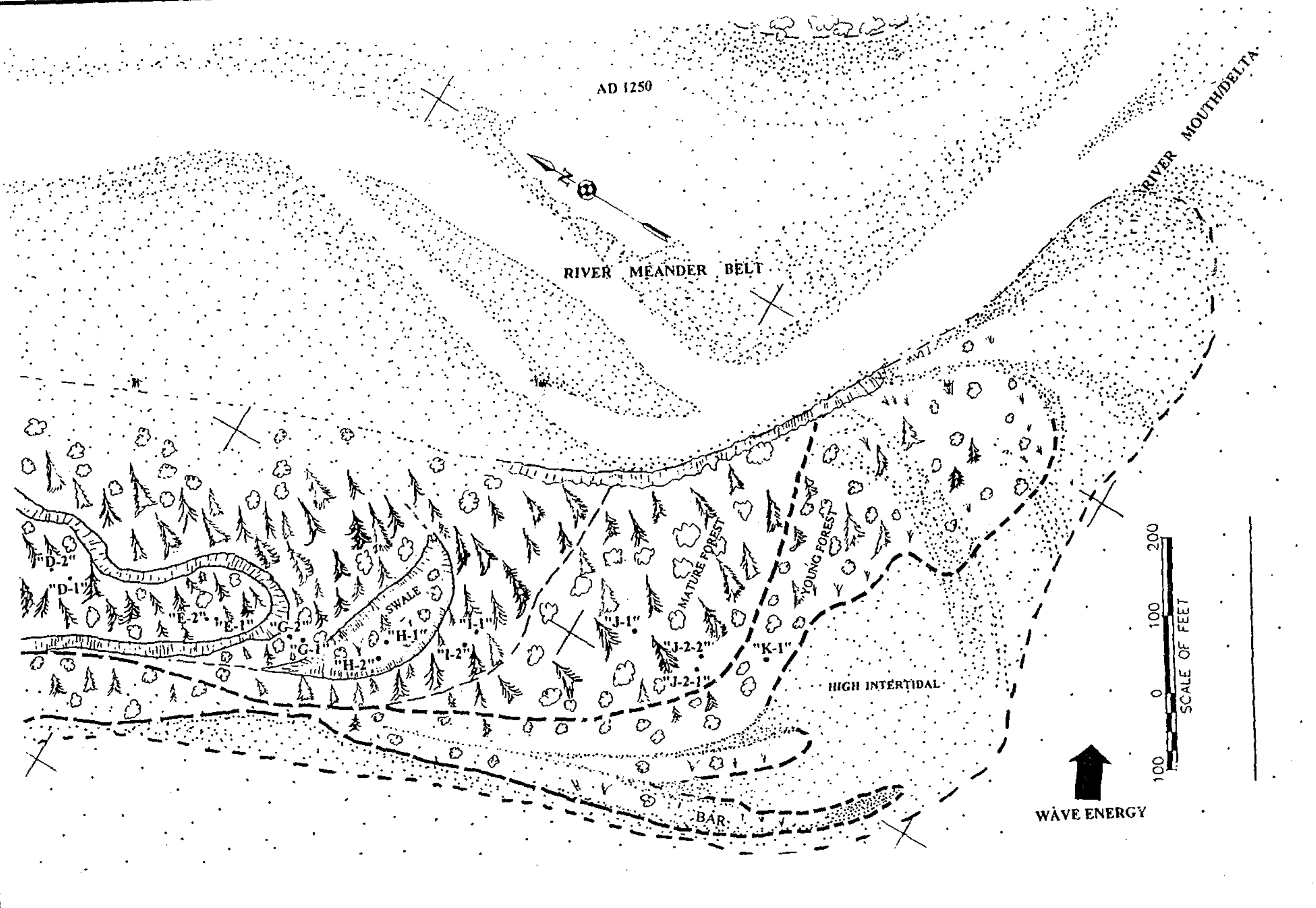
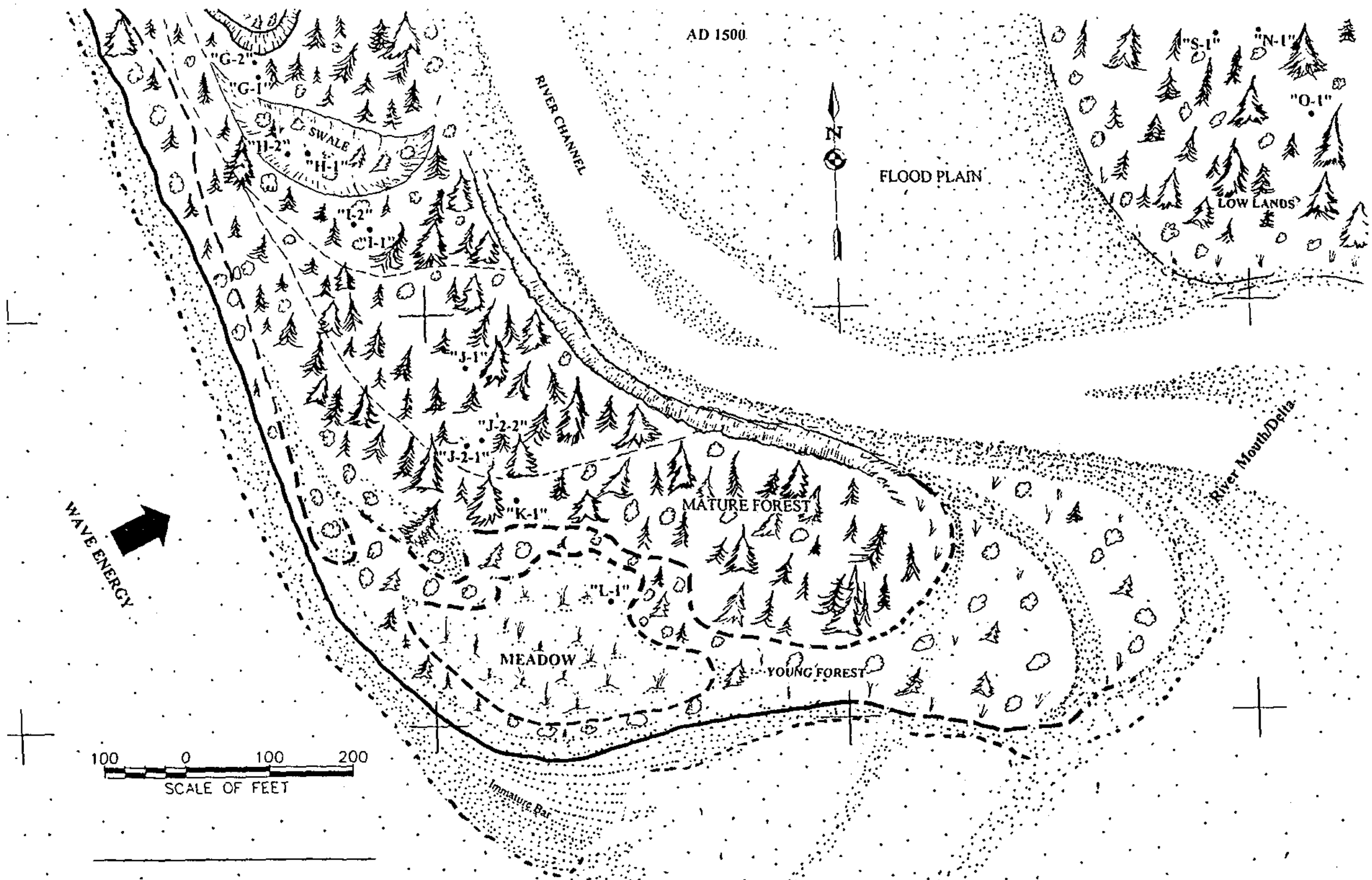

AD 1250
N
RIVER MEANDER BELT
RIVER MOUTH/DELTA
"D-2"
"D-1"
"E-2"
"E-1"
"G-2"
"G-1"
SWALE
"H-1"
"H-2"
"I-1"
"I-2"
MATURE FOREST
"J-1"
"J-2-2"
"J-2-1"
YOUNG FOREST
"K-1"
HIGH INTERTIDAL
BAR
200
100
0
100
SCALE OF FEET
WAVE ENERGY

Figure 6.8

6.2.8. Ca. AD 1500 (Figure 6.9)

Magnitude of uplift estimated from soil depth at sampling location "L-1". Forest line followed the modern 12 foot elevation contour. The combination of uplift and wave action extended the bar around the southwest point and created a new meadow, very similar in extent and morphology to the modern meadow in the "Battlefield Trail" area. A new immature bar extending from the southeast point began to form.



AD 1500
RIVER CHANNEL
FLOOD PLAIN
N
"S-1"
"N-1"
"O-1"
LOW LANDS
"G-2"
"G-1"
SWALE
"H-2"
"H-1"
"I-2"
"I-1"
"J-1"
"J-2-2"
"J-2-1"
"K-1"
MATURE FOREST
"L-1"
MEADOW
YOUNG FOREST
River Mouth/Delta
WAVE ENERGY
100 0 100 200
SCALE OF FEET
Immature Bar

Figure 6.9

6.2.9. Ca. AD 1804 (Figure 6.10)

This date was selected because it corresponds to the *Kiksadi*-Russian battle. Uplift had continued but no specific evidence was collected from this study for local land level during 1804. Uplift rate was calculated using modern rates and projecting them into the past for an uplift of approximately 1½ feet. The forest edge is shown following the modern 11 foot contour interval. In fact portions of the area had been cleared for construction of the *Kiksadi* fort. The AD 1500 meadow containing sampling location "L-1" supported a young forest. A new bar was forming off of the southwest point. Extent of low tide derived from 1929 aerial photography and Tebnekov's 1850 chart 38. (Extensive off shore shoal is shown for reference but had developed before this date.) River bank interpreted from 1850 map as well. Position of the fort site is discussed in Section Seven of this report.

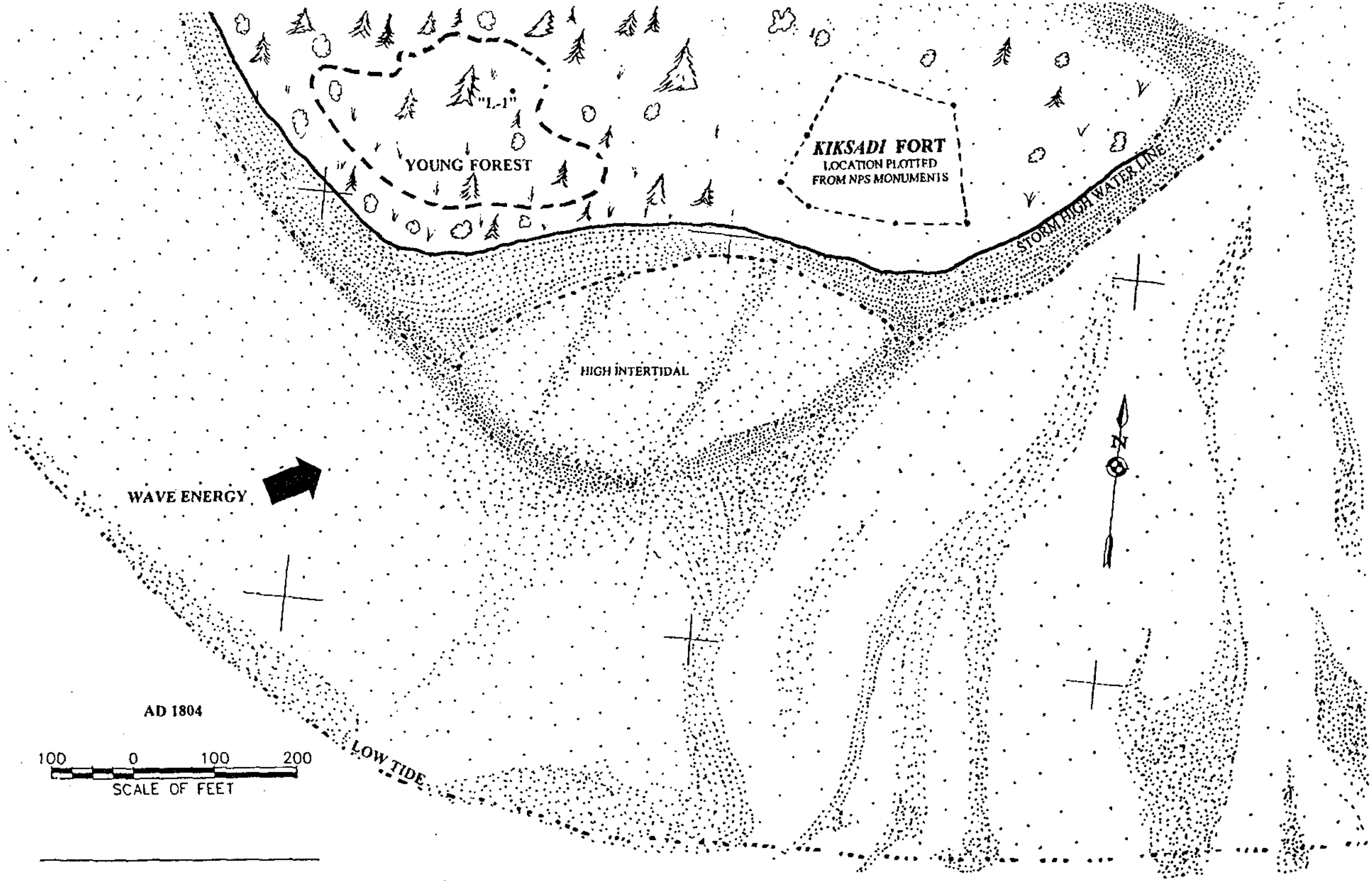

YOUNG FOREST
"L-1"
KIKSADI FORT
LOCATION PLOTTED
FROM NPS MONUMENTS
STORM HIGH WATER LINE
HIGH INTERTIDAL
WAVE ENERGY
N
AD 1804
LOW TIDE
100 0 100 200
SCALE OF FEET

Figure 6.10

6.3 AGE OF PARK LANDFORMS (Map 1)

This map represents a synthesis of the landform development map series. The dates shown represent when landforms were first able to support terrestrial vegetation. In many cases they were actually formed by waves or water before these dates but the dates shown represent when they could have supported permanent habitations for plants. The edges of these units are not well defined. Any interpretation of landform age which takes place near the edge of a mapped polygon should be undertaken with caution. As distance from mapped sampling locations increases, the dependability of interpretations decreases.

Near shore landforms have undergone dramatic change since 1804. Most of these changes have been the result of the major dredging and subsequent erosion control measures discussed earlier in this report. Further modifications have resulted from construction of trails, bridges, roads and buildings in the Park. Erection of totems and landscaping of the fort site have caused further disturbances to local stratigraphy.

6.4 EROSION OF PARK LANDFORMS

The effect of erosion due to ocean waves was observed along long sections of the beach along the seaward shoreline of the Park. These areas are experiencing retrogradation as a result of the extensive dredging which took place near shore adjacent to these areas in World War II. Storm waves can now break with full force on shore while prior to dredging much of their energy would have been dissipated on off shore shoals. The rate of beach erosion should slow with time because as material is eroded from the high intertidal zone it will be placed lower in the intertidal zone. This relocated sediment will then "trip" waves farther from shore. Eventually an equilibrium state will be reached. Aiding this process is the regional uplift taking place in the Sitka region. If this continues it will also have the effect of moving breaking waves further from shore and lift the offshore islands ever higher to create a more effective wave barrier. Construction of the airport runway which began in 1964 has also established an artificial breakwater which serves to protect the Park from some of the wave energy it was once subjected to. In addition, an undetermined length of this beach has been reinforced with riprap and angular cobbles as part of the erosion control program. In spite of all of this, areas adjacent to the large "borrow" pits dredged near shore will continue to experience erosion during major storms into the foreseeable future.

River bank erosion is quite a different matter. The forces driving river bank erosion are not projected to subside in the near future. If regional uplift continues, the base level of Indian River will continue to drop. Dams upstream are collecting coarse sediment which would have buffered the stream's tendency to erode. River banks in the vicinity of sample locations "M-1" and "R-1" are unconsolidated and will continue to experience erosion during floods. It is strongly recommended that erosion control survey monuments be established in these locations so the magnitude of future erosion can be evaluated. Sections of the bank which have been protected by large riprap will probably remain stable for some time. It should be noted that as the river's base level is lowered, the river could undermine the riprap and compromise some of its protective value.

The site of the buried hot asphalt plant is currently experiencing retrogradation primarily because it is composed of unconsolidated fill and is out of equilibrium with the local erosional regime. If this artificial terrace is to be protected, installation of riprap or other erosion control measures will have to be under taken.

SECTION 7

7.0 CULTURAL LANDSCAPE

We are not among those who believe that a distant view of a cape or mountain - or dropping the first anchor in a bay or harbor - nay, we carry our incredulity so far as to doubt, if the magical ceremony of landing on a coast, hoisting a piece of bunting, cutting an inscription, or even that last great act of empire, burying a bottle, can invest the nation, whose flag the navigator happens to bear, with the right of sovereignty over a country, inhabited by a brave and independent people, whose right to the soil which they possess, and the freedom they enjoy, is coeval with time itself.

William Sturgis 1822

7.1 INTRODUCTION

The original intention of this section of the report was to focus only on the results of the geomorphology fieldwork to identify areas of high site potential based on the age and characteristics of Park landforms. Delineation of areas of natural and human disturbance which have reduced or destroyed the possibility of identifying prehistoric or historic features, or of recovering *in situ* artifacts from undisturbed cultural deposits was also an initial objective of this part of the report. In the course of reviewing early Russian charts of Sitka Sound and researching Russian and Native accounts of the battle of 1804 for evidence of landform changes since 1804, significant new information concerning the location of the *Kiksadi* fort site and other information relevant to events which have shaped the "cultural" landscape of Sitka National Historical Park were uncovered. Research into the Battle of 1804 and the early history of the Park led to further cartographic research, oral history interviews, and a search for alternate English translations of Lisianskii's 1812 Russian language account of the battle, as well as in other directions not initially foreseen. In the course of research into the geomorphology and history of the Park the magnitude of human impacts which have, in recent times, dramatically altered the natural processes which have formed the physical landscape of the Park became apparent.

What follows then goes well beyond restricting this section of the report only to a discussion of archaeological potential in relation to a geoarchaeological evaluation of landform age and morphogenesis. An effort has been made to incorporate all relevant cultural information into the following discussion of archaeological site potential within Sitka National Historical Park. After a brief overview of Southeast Alaska prehistory, a summary of historical events that have shaped the cultural landscape of the Park is presented. Following this, previous archaeological investigations that have taken place in the Park are reviewed and archaeological discoveries made during the 1994 geomorphology fieldwork are discussed. Finally the results of both the literature review and analysis of geomorphological field data collected in 1994 are used to discuss the archaeological potential of various landforms identified within Sitka National Historical Park.

7.2 CULTURAL OVERVIEW

7.2.1. Southeast Alaska Prehsitory

Southeast Alaska has been occupied by maritime hunting and gathering people for at least the last 10,000 years. The earliest known evidence of human occupation in Southeast Alaska includes a group of sites characterized by the presence of a microblade and core technology, defined by Moss (1993) as the Early Period and by Davis (1990a,1990 b) as the Paleomarine Tradition. The Paleomarine Tradition endured for several millennia from the early to mid-Holocene when, around 6,500 years ago, microblade technology began to be replaced by artifact assemblages with ground stone tools, polished slate, and an apparent emphasis on bone tools (Davis 1990b).

A Middle Period (Moss 1993) or Transitional Stage (Davis 1990a; 1990b) of Southeast Alaska prehistory appears to have begun between 6,500 and 5,000 years ago marking the change between microlithic technology and the ground stone industries associated with the succeeding Late Period (Moss 1993) or Developmental Northwest Coast Stage (Davis 1990a, 1990b). The Developmental Northwest Coast Stage in Southeast Alaska is associated with the Tlingit and Haida people who occupied the region at the time of historic contact. Large shell middens, house features and burials, as well as a wide range of artifacts, including barbed harpoons, labrets, and ground stone tools, are characteristic of this most recent cultural stage. Davis (1990a, 1990b) has subdivided the Developmental Northwest Coast Stage into three phases: the Early Phase dating from 5,000 to 3,000 B.P., the Middle Phase dating from 3,000 to 1,000 B.P. and the Late Phase dating from 1,000 B.P. to European contact. Moss (1993) has cautioned that the cultural chronology of the northern Northwest Coast is too poorly known at present to warrant this breakdown.

Early Period

Since de Laguna's pioneering work at late-prehistoric sites at Angoon in 1949 and 1950 (de Laguna 1960) first began to shed light on Southeast prehistory, a number of important early sites have been discovered in Southeast Alaska. Of these sites, only one, Ground Hog Bay 2 (GHB 2), has yielded a radiocarbon date older than 10,000 B.P. and only a few other Southeast sites have been dated to the early Holocene. The GHB 2 site in Icy Strait is located on a raised marine terrace 46-49 ft above present sea level. The lowest cultural level (Component III) at GHB 2 produced a radiocarbon date of 10,180 +/- 800 B.P. on charcoal associated with a depression containing clay discolored by fire (Ackerman 1968:60). The small artifact assemblage recovered from Component III included bifacial tools, pebble choppers, and end-and-side scrapers but no microblades (Ackerman 1968:62). This artifact assemblage, dominated by heavy bifacial tools, pebble choppers, and end-and-side scrapers, suggests affinities with the Pebble Tool Tradition from the Queen Charlottes and Namu to the south (Moss 1993:5). Ackerman (1993:6) suggests that "these heavy choppers and large flake tools appear to be an addition to the Denali-like tool kit of early sites in Southeastern Alaska and are apparently a cultural response to large amounts of available wood." The middle component (Component II) at GHB 2, dates to 8,880 +/- 125 B.P., and contains extensive evidence of microblade production. Similarities in several attributes between microblade cores at GHB 2 and those recovered at sites in interior Alaska are suggested by Ackerman (1980:193) to indicate that people utilizing microblade technology dispersed out of central Alaska into the Alexander Archipelago 9,000 to 10,000 years ago.

The Hidden Falls site on Baranof Island is the most intensively tested Southeast Alaska early Holocene site to date (Davis 1990a). Hidden Falls is a multi-component coastal site with the earliest level (Component I) dating from about 8,600 to 9,500 years B.P. This earliest component, associated with a microblade technology characterized by wedge-shaped cores, split pebble cores, cobble tools, gravers, scrapers, burinated flakes, and utilized flakes, appears to have been terminated by a Holocene glacial advance around 8,600 years ago. The Component I microblade assemblage at Hidden Falls compares closely with the core and blade technology associated with the middle component at GHB 2.

Another important early Holocene microblade site was discovered in 1985 near Chuck Lake on Heceta Island (Ackerman et al. 1985b). The earliest component of the Chuck Lake site dates from 8,200 to 7,300 years B.P. and provides the first evidence for early Holocene occupation of the southern portions of Southeast Alaska. This site, which consists of six localities, is located on the south side of Chuck Lake at an elevation of 40-70 ft above present sea level (Arndt et al. 1987:58). Microblade cores recovered from the Chuck Lake site were similar to those from Component II at the GHB 2 site and from the earliest component at Hidden Falls (Ackerman et al. 1985b:6). Other artifacts found with microblades at Chuck Lake Locality 1 include cobble cores, hammerstones, an anvil stone, a scraper, a whetstone, and a fragment of a fixed, unilaterally barbed, bone point (Ackerman et al. 1985b:5). The 8,200 year old midden at Chuck Lake provides one of the best examples of subsistence data for the early Holocene on the Northwest Coast. Faunal material recovered at Chuck Lake indicates that maritime people were fully adapted to the exploitation of marine and intertidal resources in the early Holocene. The lower component faunal assemblage of the Chuck Lake site, dominated by shellfish but also containing seal and sea lion remains, provides the first evidence in Southeast Alaska that people utilizing a microblade technology were following a maritime hunting and gathering subsistence strategy (Ackerman et al. 1985a:110-146).

Artifacts from a single component firmly dated to 7,600 years B.P. at the Thorne River site on Prince of Wales Island also provide early evidence of the utilization of a core and blade lithic technology in Southeast Alaska (Ackerman et al. 1987). Obsidian is the dominant lithic material at the Thorne River site, reflecting the proximity of the site to a major obsidian source at nearby Suemez Island. Moss (1993:6) points out that the consistent presence of obsidian from both Suemez Island and Mt. Edzina at early Holocene sites in Southeast Alaska is clear evidence of long-distance marine travel and trade networks although we have no direct evidence of the early use of water craft.

Middle Period

Mid to Late-Holocene sites are represented by the upper components at GHB 2, Hidden Falls, and Chuck Lake. This time period is also represented by the lowest component at the Lake Eva site on Baranov Island, dated to approximately 5,780 B.P. (Davis 1990b), the Coffman Cove site, a coastal midden on Prince of Wales Island dating to between 4,100 and 1,400 B.P. (Clark 1979), and Rosie's Rockshelter on Heceta Island, dating from 3,800 to 4,500 years B.P. to the historic present (Ackerman et al. 1985a). Artifact assemblages from this period generally show a decrease in the use of chipped stone tools and increasing utilization of ground stone tools. It now appears that use of microblade technology in Southeast Alaska continued into the Late-Holocene. At the North Point Site at Port Houghton on the mainland coast microblades and cores appear to be associated with intertidal deposits dated to between 2000 and 2600 B.P. (Bowers et al. 1994:45) suggesting either that microblade technology continued much longer than previously thought or was reintroduced in the Late-Holocene, possibly from the south.

A major mid to Late-Holocene technological development is the appearance of wood stake fish weirs which have been dated as early as about 4500 B.P. on the Fraser river in British Columbia (Moss 1993:8). A date of 3635 +/- 65 yr. B.P. (cal.) from the Cosmos Cove fish weir on Baranof Island (Moss et al. 1990:151) as well as other early dates on wooden stakes from fish weirs provide evidence that the harvest of large quantities of salmon has been an important subsistence activity in Southeast Alaska for more than 3,000 years. The corresponding development of efficient fish processing and storage capabilities would likely have been established by 3600 years ago making settled villages and larger populations possible by that time.

Late Period

The Late Period on the northern Northwest Coast defined by Moss (1993:8) as post-dating 1500 B.P. is generally characterized by evidence of cultural continuity with the preceding Middle Period and the historic period. There does appear to be evidence for increasing warfare in the Late Period since fortified defensive sites, one of the characteristic site types of the Late Period, do not seem to be widespread in Southeast Alaska until after about AD 1000 (Erlandson et al. 1990:2). Many Late Period sites are associated with Tlingit place names and are known through oral history (Moss 1993:8). Late Period artifact assemblages recovered by de Laguna from excavations at Angoon (de Laguna 1960) and Yakutat (de Laguna et al. 1964) and by Ackerman at Grouse Fort on Icy Strait (Ackerman 1968) are characterized by proportionately fewer chipped stone tools compared with Middle and Early Period Assemblages. At *Daax Haat Kanadaa* near Angoon de Laguna recovered an artifact assemblage including abraders, whetstones and double-pointed bone pins. Ground stone tools recovered at this site included ulus, knives, and blades along with heavy splitting adzes, stone lamps, shale "pencils", morters, and pestles. A variety of unbarbed and barbed bone points, bone awls, bipoints, and large barbs for gaff hooks were also recovered along with items of European manufacture (Moss 1993:9). Ornaments from *Daax Haat Kanadaa* include stone labrets, beads, and pendants of stone, bone, teeth, shell, and ivory (Moss 1993:9). Incised stone tablets were recovered by de Laguna at *Daax Haat Kanadaa* and also by Ackerman at Grouse Fort where abraders, whetstones and ground stone knives were common but bone tools and ornaments were rare (Moss 1993:9). The ground stone and bone artifacts at Old Town near Yakutat resemble those from other late prehistoric sites with the addition of a notched stone, bone fish lures and a bone harpoon socket, and anthropomorphic ground stone mauls. A variety of ornaments and other items manufactured of native copper, including arrowheads, knife and ulu blades, were also recovered at Old Town.

It is now evident that the prehistoric record spans the greater part of Holocene time throughout much of the Alexander Archipelago, and there is accumulating evidence to support the hypothesis advanced more than a decade ago that a major break in the chronological sequence would be found separating two quite distinct cultural traditions on the Northwest Coast (Borden 1975:19). The break is presently believed to lie somewhere in the time range of 5,500 to 4,500 years ago (Ackerman et al. 1985:155; Fladmark 1982:106-110). A critical period between 6,500 and 5,000 years ago is poorly known archaeologically and remains a major gap in the cultural chronology of Southeast Alaska. Evidence for cultural continuity linking the Early and Late Prehistoric periods in Southeast Alaska and culminating in a stage of cultural development comparable to that known for the historic Tlingit has not yet been established, however, the developmental trend from the broader perspective of northern Northwest Coast prehistory is clearly of increasing cultural complexity.

Although the ethnographically known Tlingit in Southeast Alaska were previously thought to have a time depth of only a few hundred years prior to European contact (de Laguna 1960:206), recent work on Admiralty Island now suggests that the Tlingit settlement pattern is probably at least 1,600 years old (Moss et al. 1989). It is not known how long the Tlingit of the *She-tika Kwan* "people from outer edge of Baranof Island" (Emmons 1991:439) had occupied Sitka Sound prior to the arrival of the first Europeans in the late 18th century. Evidence that Native occupation of Sitka Sound extends back at least six to eight hundred years has been presented by Erlandson et al. (1990:6) who date a shell midden associated with a fort site (SIT-228) on the north shore of Jamestown Bay to between AD 1200 and AD 1400.

7.2.2. Historical Overview of Sitka National Historical Park

Early Explorers

When Alexander Baranov, Chief Manager of the Russian American Company (RAC), arrived in Sitka Sound in July of 1799 to establish the first Russian settlement south of Yakutat, he was not the first European to visit the Sound or make contact with the Sitka Tlingit. In 1741 Chirikov's ship the *St. Paul* had passed Sitka Sound going north, after having made landfall near the southern end of the Alaska panhandle (Frost 1994:44). The loss of both of the *St. Paul's* boats and disappearance of fifteen of Chirikov's sailors somewhere north of Sitka Sound remains unexplained. Whether the Tlingit were responsible for the disappearance remains as speculation but two canoes seen in the area after the loss of the boats refused to approach the *St. Paul*. This was probably the first encounter between Europeans and what may have been Sitka Tlingit. It was not until 1775 that the latitude of Sitka Sound would again be reached by a European ship.

In August of 1775 the Spanish schooner *Sonora* out of San Blas in Baja California, scarcely thirty-six feet long, arrived in the vicinity of Sitka Sound. The *Sonora,* commanded by Juan Francisco de la Bodega y Quadra, was under orders to explore north to 65 degrees of latitude (Cook 1973:79-81). Making landfall on August 15th at 57 degrees north latitude, Bodega named a prominent 3,201 foot snow-capped volcano that dominated the coastline sixteen miles west of Sitka "San Jacinto" (renamed Mount Edgecumbe in 1778 by Cook). Bodega sighted but didn't enter present day Sitka Sound, naming it "*Ensenada del Susto*" or "Bay of Terror". Three days after sighting Mount Edgecumbe, Bodega anchored at the northern end of Kruzof Island in a sheltered bay [Sea Lion Cove] which he named "*Puerto de Nuestra Senora de los Remedios*" (Port of Our Lady of the Remedies). Here Mourelle, one of Bodega's officers, saw "on the bank of the river, a high house, and a parapet of timber supported by stakes drove into the ground" (Mourelle 1987:43-44). The ten men and several women and children seen were extremely wary, either remaining in hiding or as Mourelle (1987:45) remarks "threatened us with long and large lances pointed with flint...." Bodega's landing parties were heavily armed and remained within reach of the schooner's swivel gun. Although a clash was avoided, little direct contact or trade was possible under these circumstances.

Between 1775 and 1784 only four Spanish and two British ships visited the Northwest Coast (Cook 1973: Appendix E) and the Sitka Tlingit had little or no direct access to European trade items or contact with Europeans. In 1778 Captain James Cook's ships, the *Discovery* and *Resolution,* passed Sitka Sound but did not enter the sound or make contact with the Sitka Tlingit. After 1784 the number of ships reaching the Northwest Coast began to increase dramatically and European trade goods including firearms and ammunition became increasingly available to the Sitka Tlingit. Cook (1973: Appendix E) lists by nationality 176 vessels that visited the Northwest

Coast between 1785 and 1798. The majority of these ships were English (69) and, after 1788, American (47) vessels engaged in the fur trade. In 1787 Capt. George Dixon entered Sitka sound naming it Norfolk Sound, a name adopted by Capt. George Vancouver in 1794 (Orth 1967:881). Much to the later dismay of the Russians, the principal early source of firearms and ammunition obtained by the Tlingit were the English and American trading vessels which began to frequent the northern Northwest Coast after 1785 (Khlebnikov 1973:28-29).

Russian American Company

In 1795 Alexandr Baranov explored southward from Kodiak taking the *Olga* as far as present day Sitka Sound where he expected to meet one of his ships on its return northward from the Queen Charlotte Islands (Chevigny 1971:131). The rendezvous failed to occur but while there Baranov came to appreciate the many advantages of the sound for a Russian Settlement. Before departing, Baranov erected a wooden cross and buried a copper crest at what he named Krestov Bay (Chevigny 1971:135-136; Andrews 1922:17-18). Four years later, in 1799, alarmed by the incursion of British and American trading vessels in Russian territory, Baranov returned to Sitka Sound to establish a Russian American Company post. Gaining control of the lucrative fur trade and establishing Russian dominance in Southeast Alaska were major considerations in the decision to establish a permanent Russian settlement in Sitka Sound. Baranov received permission from the Sitka Tlingit to establish the settlement he named Archangel Saint Michael's Redoubt at Starrigavan Bay near present day Sitka. After Baranov's return to Kodiak in 1780 relations between the Russians and their Aleut hunters, left under the command of Vasili Medvednikov, and the *Kolosh* (Tlingit), worsened. In June 1802 the Russian settlement was attacked and destroyed (Dauenhauer and Dauenhauer 1990:8). The few defenders who escaped with their lives were rescued by an English trading vessel under the command of Captain Barber who transported the survivors to Kodiak where he ransomed three Russians, five Aleuts, 18 women and six children back to Baranov (de Laguna 1972:170).

1804 Battle of Sitka

In October 1804 Baranov and his Russian *promyshlennikii* arrived in Sitka Sound leading 350 *baidarkas* and about 800 native hunters including "Kodiak natives, Alaskans [Aleuts], Kenaits and Chugach" (Dmytryshyn et al. 1989). It is with the return of Baranov to Sitka Sound to avenge the Tlingit attack on Archangel Saint Michael's Redoubt that historical events pertaining directly to Sitka National Historical Park come into focus. The best historical source (and only detailed eyewitness account) for events relating to the 1804 battle is the log of the *Neva* published in Russian by Lisianskii in 1812 (Lisianskii 1947) and in English in 1814 (Lisianskii 1968). Iurii Lisianskii, commanding the ship *Neva* on the first Russian voyage around the world voyage had, upon arriving at Kodiak, received a request from Baranov to meet him at Sitka Sound to provide naval support for the re-establishment of the Russian post destroyed in 1802. The *Neva*, without question, proved to be the pivotal factor that allowed the Russians to reestablish their presence in Sitka Sound. Without the timely appearance and support of Lisianskii the subsequent history of Southeast Alaska may have been quite different. Baranov's forces would probably have been no match for the Sitka Tlingit. Lisianskii states:

> The same day I arrived I went aboard both Company vessels and found they had serious shortages. Each had two six-pound cannon and two four-pound cannon. They had no gunpowder, however, nor rigging enough to accomplish their plan. I was amazed at how these two ferry boats (for they could not be

> called ships) in such sorry condition could have set out against natives who, once they had committed their crime, used every possible means to defend themselves and had accumulated a sizable collection of firearms. For this reason I entered into a practical arrangement with these vessels and told their leader to request everything he needed. I meanwhile gave each vessel two more cannon and a goodly number of ball (Dmytryshyn et al. 1989:77).

The appearance of the *Neva* made the Tlingit fortified village on the *Kekur* [Castle Hill] indefensible. Abandoning Castle Hill to the Russians, the Tlingit moved to a newly constructed log fort at a seasonal fishing site at the mouth of Indian River (Antonson and Hanable 1987:12). An extensive offshore shoal at this location prevented the *Neva* and other Russian ships from bombarding their fortified defense at close range.

The historical events of the 1804 battle which occurred between the Russian forces and the Tlingit *Kiksadi* clan in early October, are recounted in detail by Lisianskii (1968 [1814]) and others (Khlebnikov 1973; Krause 1956; Dmytryshyn et al. 1989) and oral history accounts are available that present the battle from the viewpoint of the Tlingit (Dauenhauer and Dauenhauer 1987; NPS 1992, Andrews 1987; Hope 1992a, 1992b; Hopkins 1987). Of primary concern here is the physical description of the Tlingit fort and details of the battle that may provide information as to the nature of the physical remains of the fort that may still be archaeologically discernible.

European Accounts of the 1804 Battle

As the primary historical source for the 1804 battle and the source for the only drawing of the Tlingit fort site at Indian River, Lisianskii's contemporary description of the fort is of major significance. After days of sporadic bombardment by the *Neva* and out of gunpowder for their own two cannons which Lisianskii (1968 [1814]:159) admits had caused considerable damage to the rigging of the *Neva*, the Tlingit abandoned their fort during the night and retreated unseen overland. Upon entering the fort prior to its destruction, Lisianskii (1968 [1814]:163) describes it as:

> .....an irregular square, its longest side looking towards the sea. It was constructed of wood, so thick and strong, that the shot from my guns could not penetrate it at the short distance of a cable's length [1/10 nautical mile or 608 ft.] As represented in Plate II [see Figure 7.1], it had a door, *a*, and two holes, *b*, for cannons the side facing the sea, and two large gates, *c*, in the sides towards the wood. Within were fourteen houses, or barabaras, *d*, as they are called by the natives. Judging from the quantity of dried fish and other sorts of provision, and the numerous empty boxes and domestic implements which we found, it must have contained at least eight hundred male inhabitants.

Lisianskii's statement that he was firing at the fort from about 600 ft provides a valuable piece of information as to the fort location. Unfortunately the exact location of the anchorage of the *Neva* during the battle is not identified by Lisianskii (1968 [1814]:157) who states only "we carried this menace to execution, by forming a line with four of our ships before the settlement." However, Langsdorff (1968 [1814]:34) visiting Sitka in 1806, only two years after the battle, reports "The *Neva* was posted at the mouth of the river, with her artillery directed partly on the side towards the cape and fortress, and partly to the opposite bank of the river." Why the *Neva* would be firing at the east bank of Indian River may be explained by the fact that there was a fish camp on that side of the river in 1804 (Herb Hope personal comm.).

In order for the *Neva* to fire (to the northwest) at both banks of Indian River with different cannons the ship would clearly have had to be anchored off the river mouth rather than to the west of the Indian River peninsula. Certainly Lisianskii would have brought his cannon as close to the fort as the shoal at the mouth of Indian River would allow. Tlingit Point House oral tradition relates that all the Russian ships were anchored in a line broadside to the Kiksadi fort, right at the drop-off to deeper water at the edge of the shoal formed by the Indian River delta (Herb Hope, personal comm.). Even with the extensive dredging activity which has taken place at the mouth of Indian River since 1939, it is still possible to estimate the approximate position of the pre-1939 extent of the shoal off which the *Neva* would have anchored. This can be done by using an aerial photograph taken in 1929 (see Figure 4.2) and the results of recent topographic mapping of the shoal at the mouth of Indian River based on 1989 aerial photography (Map 1). It appears that in 1804 Lisianskii would have been able to anchor no closer than about 600 feet from the location currently landscaped as the fort location. This agrees exactly with Lisianskii's estimation of the distance he was firing as a "cable's length." Based on Lisianskii's estimation of the distance from the *Neva* to the fort, the *Kiksadi* fortress had to be at or very close to the end of the Indian River peninsula (as shown on Golovnin's 1818 chart of Sitka Sound to be discussed shortly).

The drawing of the *Kiksadi* fort that Lisianskii includes in the 1814 English version of his journal shows an irregular log palisade surrounding fourteen rectangular Native houses (Figure 7.1). Lisianskii's drawing appears to show a palisade constructed of vertical posts sandwiched between larger horizontal logs three rounds high which support the base of the posts. The profile of the longest side of the fort shows exterior poles supporting the upper section of the palisade posts. A narrow entrance set at an angle in this wall and two openings for cannons make it obvious that this longer side of the fort was the south or southwest wall which faced the sea. A section of Indian River is represented in the drawing to the northeast of the fort and two openings in the rear or northern wall of the fort agree with Native accounts of the existence of rear gates. A scale labeled "fathoms" accompanies the drawing included with the English translation of Lisianskii's journal published in 1814. However, an identical scale used with an earlier version of the fort drawing contained in an Atlas of Maps and Drawings that accompanied the 1812 Russian edition is in sazhens (1 sazhen = 7 ft.). In recopying the drawing for the 1814 English language edition sazhen was translated as "fathom" but the scale was not modified (Khlebnikov 1985:43, Figure 7.2). Using sazhens as the unit of measurement the south wall of the fort would have been about 231 feet in length and the dimensions of the fort appear to be about 154 ft by 231 feet The ground area covered by the *Kiksadi* fort would have been approximate 35,574 sq. feet or slightly less than an acre (43,560 sq. ft).

There are subtle differences between the 1812 and 1814 versions of Lisianskii's drawing of the *Kiksadi* fort. The number and relationship of the houses inside the walls of the fort are the same but the size and spacing of some of the houses is different. The plan of the log palisade and number and position of the gates and embrasures [gun openings] are the same in both drawings but other minor differences are apparent. For example, in the 1812 drawing there is no gap in the horizontal pole that runs just below the top of the vertical palisade logs at the entrance whereas in the 1814 drawing there is a break at the entrance. Other small differences between the two drawings are also evident.

Construction details of the fourteen b*arabaras* [houses] which appear inside the walls of the fort are not described in detail by Lisianskii at the time of the battle but they were probably similar to Tlingit houses which Lisianskii (1968 [1814]:239) describes on his 1805 return visit to Sitka.

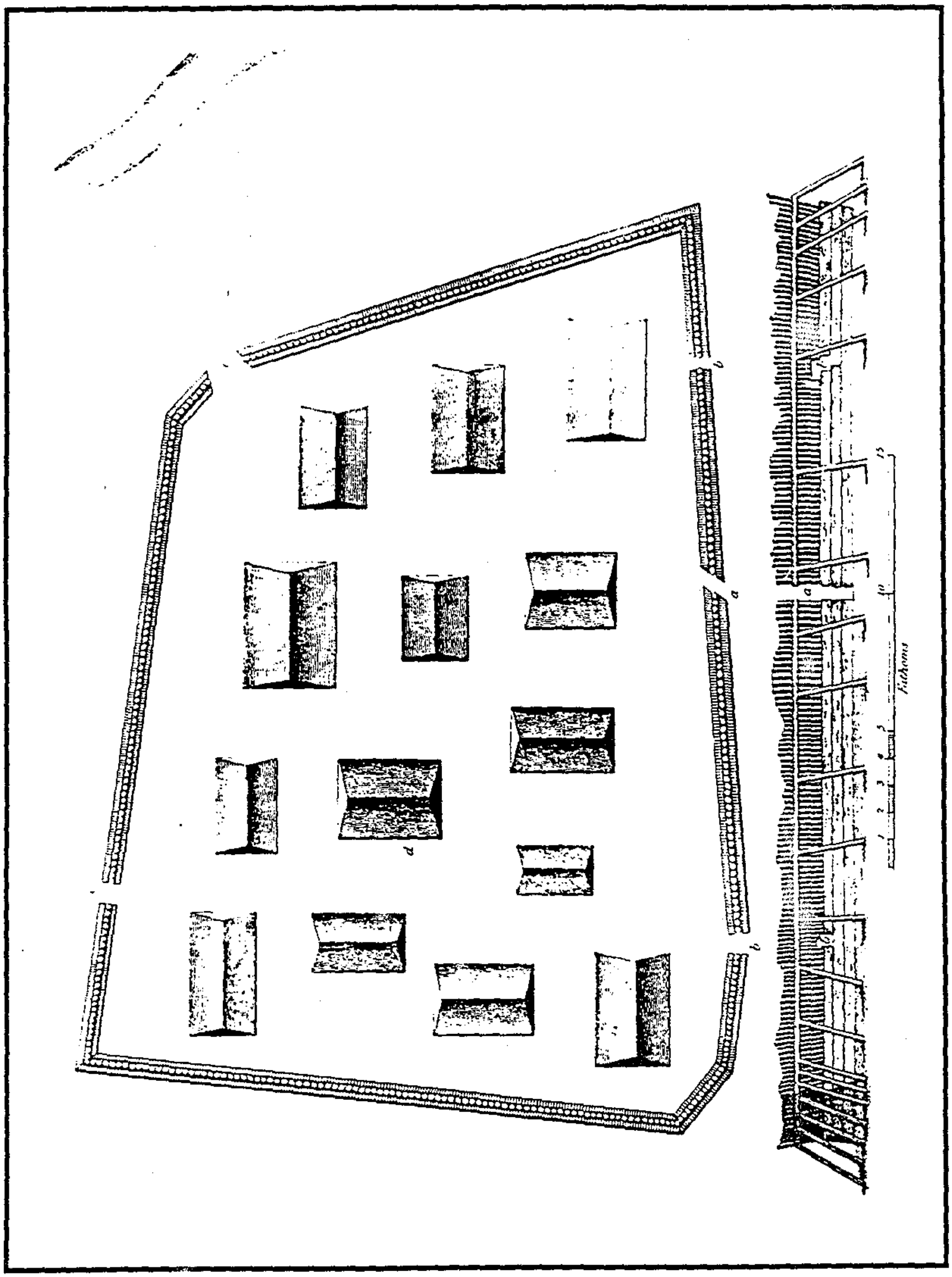


Figure 7.1. Lisianskii's (1968 [1814]: Plate II) drawing of the *Kiksadi* fort at Indian River. The scale should be in "sazhens", a Russian unit of measure equal to seven feet.

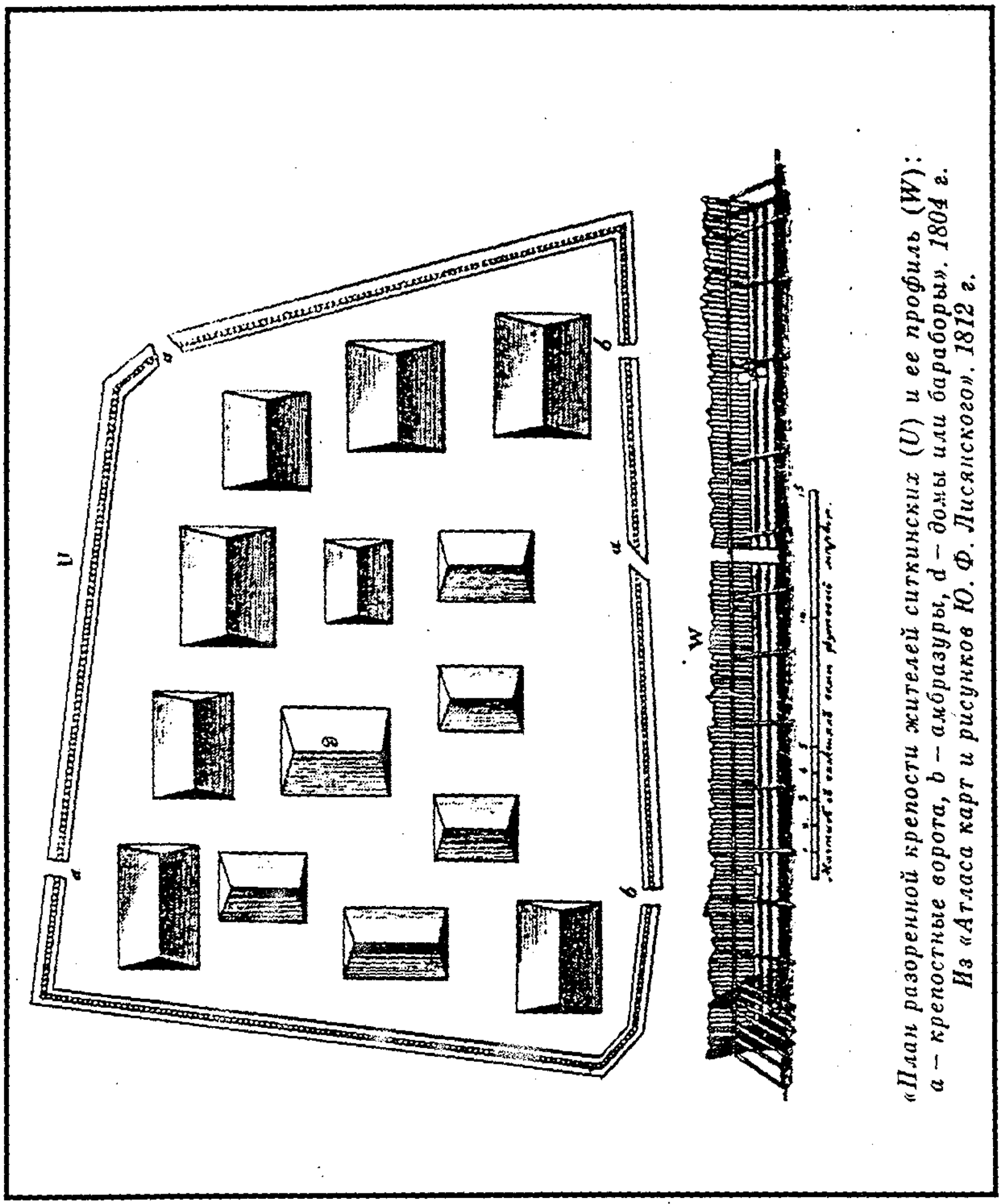


Figure 7.2. Lisianskii's 1812 "Plan Drawing of the [Destroyed] Fortress of the Sitka Residents." Reproduced from Khlebnikov (1985). The scale is in *Sazhens*.

The barabaras of the Sitcan people are of a square [Black n.d.:49 "rectangular"] form, and spacious. The sides are of planks; and the roof resembles that of a Russian house, except that it has an opening all along the top, of the breadth of about two feet, to let out the smoke. They have no windows; and the doors are so small, that a person must stoop very low to enter. In the middle of the building is a large square hole [Black n.d.:49 "rectangular pit"], in which fire is made. In the houses of the wealthy, this fire-place is fenced round with boards; and the space between the fire-place and the walls partitioned by curtains for the different families of relations, who live together in the same house. Broad shelves are likewise fixed to the sides of the room, for domestic purposes.

After abandoning their fort at Indian River, the Sitkans constructed another fortress at the eastern end of Peril Strait. The exact location of this fort is uncertain but it was in the immediate vicinity of Point Craven (Herb Hope, personal comm.). In 1806 Langsdorff (1968 [1814]) visited the Sitka Tlingit at their new fortress in Peril Strait. The suggestion by de Laguna (1960:147-148) that the fort visited by Langsdorff may have been at Lindenberg Head is probably not correct since Herb Hope (personal comm.) states that Lindenberg Head was not used as a fort site until much later. Langsdorff, taken for an American, was permitted to enter the fort which was situated at the top of a high rock. Although the setting of the new fort was quite different from that of the one constructed at Indian River, the houses inside the fort described by Langsdorff (1968 [1814]:128-129) were probably similar to the houses which had been constructed inside the Indian River fort.

Expelled from Norfolk Sound, they [the Tlingit] have fortified themselves here, upon a rock that rises perpendicularly to the height of some hundred feet above the water. The only possible access to it is on the north-west side, and they have rendered this extremely difficult by strewing it all over with very large trunks of trees which they have cut down. The rock itself is secured against the attack of an enemy by a double palisade of large trunks of trees stuck close together, measuring from twelve to fifteen feet in height, and from three to four feet in thickness. A high natural wall of earth beyond the palisading on the side toward the sea, conceals the habitations effectively, so that they cannot be discerned by any ship.

The houses within the fortress are in the form of parallellograms, of various sizes, placed in regular rows some *toises* [a *toise* is about 6 ft] distance from each other. The roof which consists of several layers of bark, rest upon ten or twelve thick posts driven into the ground, and the side of the houses are composed of broad thick planks fastened to the same posts. The entrance is at the gable-end and is often painted with different colored earths (Langsdorff 1968:128-129).

Lisianskii's 1814 English translation (De Capo Press 1968) of his journal originally published in 1812 departs significantly from the original Russian text (Dauenhauer and Dauenhauer 1990:13). Because of this, it is of considerable importance to review other English translations for information concerning the 1804 battle. Two additional English translations of Lisianskii's journal were reviewed for details of the 1804 battle and descriptions of the Tlingit fort. These are a recent translation of a portion of Lisianskii's 1814 journal reproduced in the Oregon Historical Society Press (Dmytryshyn et al. 1989) and a 1987 unpublished translation of portions of a later Russian edition of Lisianskii's journal (Lisianskii 1947) by Lydia Black (Black n.d.), generously made available for this research by Richard Dauenhauer. These translations add considerable detail to Lisianskii's description of the Tlingit fort. Dmytryshyn et al (1983:88) translate Lisianskii's description of the fort as follows:

> The form of the Sitkan fortress was an irregular triangle, with the longest side extending about 35 *sazhens* toward the sea. It was made of heavy logs in a form similar to a palisade. There were two inside rows of spars below, and three rows outside. Between these were heavy timbers about ten feet long which were braced against the exterior. At the top they were joined with similar heavy timbers and below they were held up by supports. One gate and two embrasures faced the sea and two gates faced the woods. Within this broad enclosure were fourteen baraboras [dwellings], all crowded together. The palisade was so stout that not many of our cannon balls had pierced it. Therefore we attributed the flight of the Sitkans to their having an inadequate supply of powder and shot. In the fortress we found about a hundred of our cannon balls. I ordered these to be taken out to the ship. In addition to these we fell heir to two small cannon left by the enemy. We found a certain amount of dried fish in the baraboras as well as salted roe and other foodstuffs, and also a quantity of empty boxes and *some plates* [italics added]. All of this led us to conclude that there had been at least 800 men in the fortress.

At the time of his 1806 visit to the Sitka Tlingit at Pt. Craven Von Langsdorff (1968 [1814]:130) estimated the new fort to contain between thirteen and fourteen hundred people. Based on this information, Lisianskii's estimate of 800 men at the Indian River fort appears reasonable. Additional information on the construction of the Indian River fort is provided by Lydia Black (n.d: 26-27) who translates Lisianskii's physical description of the fort as:

> .....an irregular rectangle shape, the large side extending toward the sea for about 35 *sazhen*. It was constructed of thick logs resembling a palisade. At the bottom were placed mast timbers on the inside in two and on the outside in three rows. Between them were thick logs about 10 feet long *inclined from the outside* [italics added]. At the top they were linked by other thick log supports. One gate and two embrasures were on the seaside and two gates opened toward the forest.

Lisianskii's remark that the palisade wall was inclined inward is not included in the 1814 English translation of his journal but Black's translation of Lisianskii's description of the fort construction is consistent with a drawing of the fort wall made by Herb Hope showing the palisade angled inward to deflect cannonballs (Andrew Hope, personal comm.).

It is of some interest that the Russians found "plates" in the Tlingit fort. On Lisianskii's return to Sitka in 1805 he discusses the domestic life of the Sitka Tlingit and reports that "Food is prepared in cast iron, tin, and copper European kettles....the well-to-do Islanders have a lot of European dishes" (Black n.d.:49).

During the unsuccessful ground attack on the fort in which Baranov himself was wounded in the right arm, Lisianskii reports "the artillery was carried [Black n.d.:21 says "dragged across"] over a small river" and that "the cannons were already right at the gates and a few shots would have given us victory. But the cowardice on the part of the Kodiaks ruined everything" (Dmytryshyn et al. 1989:85). In a letter to Demid Il'ich Kulikalov, dated April 29, 1805 Baranov (1979:141-142) provides additional first hand information concerning the Tlingit fort.

> Gathering together we decided to take decisive action against our enemies, the barbarians who were in a fine fortress built in an inaccessible place....We went there on the 19th and after a short parley with the arrogant villains we attacked on the 20th. The water was so shallow that our ships could not approach closely and our bombs and grape shots were almost harmless. Not only was the fortress protected by spruce logs so heavy that a man and in some cases even two men could not encompass them, placed both in horizontal and vertical positions *beside the creek* [italics added] but inside, where the huts were, the natives also *had dugouts* [italics added] where they could hide from the artillery fire...."

In his biography of Baranov, published in 1835, Khlebnikov (1973 [1835]:47) gives further information about the Tlingit fort to the effect that "....the *Kolosh* fort was made of very thick tree trunks laid two or more together, then dugouts were set in a shallow depression in the ground. Because of this, and the distance involved, our gunfire did the enemy no harm."

The only Tlingit structure outside the fort mentioned by Lisianskii was a "a large barn, not far from the shore" (Lisiansky 1968 [1814]:157) which Lt. Arbuzov was sent to set fire to, precipitating the subsequent ground attack on the fort itself. Black (n.d.:20) translates "I sent the longboat with several sailors to shore and also a yawl with a 4 pound copper *kartaun* [cannon] commanded by Lt. Arbuzov who was to make every effort to destroy the enemy boats and then to burn a storage structure [Dmytryshyn et al (1989: 85) translates structure as "warehouse"] which was not too far away from the boats." There is no further mention of this structure and it can only be assumed it was subsequently razed and burned along with the fort. The Tlingit defenders had concealed numerous caches of food and supplies in the forest around the fort and on offshore islands which were searched for and plundered by the Russian forces (Lisianskii 1968 [1814]:160). Black (n.d.: 24) translates:

> Since the vessels have arrived at this locality, members of our party freely moved along the small islands and looted whatever came to hand, as the Sitkans do not keep much at home, but in caches in the woods. Yesterday the Kodiak men found woolen cloths and yukla (dried fish which is put up for winter provisions) in such great quantities that they loaded 150 bidarkas with it.

During the siege of the *Kiksadi* fort Lisianskii states "I advised Baranov to order a raft to be made so that at high tide the cannon could be placed on it and taken in right under their walls. (Dmytryshyn et al. 1989:87). Black (n.d.:25) translates this passage "I counseled Baranov to make rafts, on which we could transport the cannon at high tide to the very wall of the fortress." This statement by Lisianskii clearly indicates the fort was situated very close to the high tide line and combined with Baranov's statement (1979:141-142) that the fort was "beside the creek" provides further evidence that the fort had to have been constructed at or very close to the location presently identified as the fort site at the end of the peninsula on the west side of Indian River.

Native Accounts of the 1804 Battle

Native oral history accounts of the 1804 battle indicate only *Kiksadi* clan warriors took part in the 1804 battle (Jacobs 1990:3). The fort the Tlingit called *Shisk Kee Nu (*or *Shiksi Noow),* translated variously as "Sapling", "Green Wood", or Second Growth Fort (Jacobs 1990:4; Hopkins 1987:10; Hope n.d.:131), was constructed in the fall of 1803 and spring of 1804 (Hope 1992a:3;

Jacobs 1990:4) by six *Kiksadi* clan house groups (Hope 1992b:4). In a traditional account of the 1804 battle recorded in 1960 Tlingit elder Alex Andrews (1987) provides a fascinating account of the battle from the Tlingit perspective but details of the fort construction are sketchy: Andrews (1987:23) relates only that "the *Kiksadi* built their fort at Indian River. On the beach side logs were piled high. Ten houses stood inside and a huge pit was dug inside it...."

In 1992 Herb Hope (1992b), a descendent of the Point House warriors who took part in the 1804 battle, related to National Park Service interviewers that Tlingit accounts passed down orally to him by his father and uncle indicate the fort construction consisted of a wall constructed of a framework of smaller logs supported by larger base logs and that the support poles and logs were bound with "rope of animal or plant material". Point House tradition indicates the vertical poles of the palisade were angled inward and supported by three rounds of horizontal base logs on the outside and a single horizontal base log on the inside (Herb Hope, personal comm.). The inclined palisade wall was designed to deflect cannonballs, especially those which fell short and bounced along the ground (no exploding cannonballs were fired by the Russians). Hope (personal comm.) also relates that the women gathered kelp which they used to cover the front wall of the fort to create a "slippery" surface to further aid in the deflection of cannonballs. No Point House oral information has been passed down concerning the framework of diagonal poles shown in the Lisianskii drawing as supporting the front wall of the fort. In fact, such a series of exterior supporting poles makes little structural sense if the front wall was angled inward. The narratives of Lisianskii and Baranov do not mention supporting diagonal poles and this aspect of the fort's construction remains puzzling.

A second detailed Tlingit account of the events surrounding the 1804 battle is provided by Sally Hopkins, born in 1865 only 60 years after the events she describes (Dauenhauer and Dauenhauer 1990:11). Sally Hopkins (1987:11) states that "Greenwood Fort" was built at the *point* of Indian River. Hopkins (1987:15) also says that in preparation for the counter attack against the Russian forces advancing on the fort "They [children and aged] were already *put into the pit* these many people that were alive." It is interesting to note that both Native accounts of the battle and Baranov's description of the fort include mention of pits or depressions in which the defenders sought protection from Russian cannon fire.

7.2.3. EARLY RUSSIAN CHARTS OF SITKA SOUND

1805 Lisianskii Chart

The earliest Russian charts of Sitka Sound have proven to be an invaluable resource in the effort to pinpoint the actual site of the Tlingit fort at Indian River and identify other areas of historic Russian activity within the boundaries of Sitka National Historical Park. Translation of Russian terms on these maps was provided by Richard Dauenhauer of Sealaska Heritage Foundation. The earliest map of Sitka Sound is an 1805 chart produced by Iuri Lisianskii (1812; Figure 7.3). Separate versions of the 1805 map were published in 1812 and 1814. Indian River is not identified on Lisianskii's 1805 map although what appears to be a river delta is shown at the approximate location of the mouth of Indian River. A single structure labeled in old style Russian

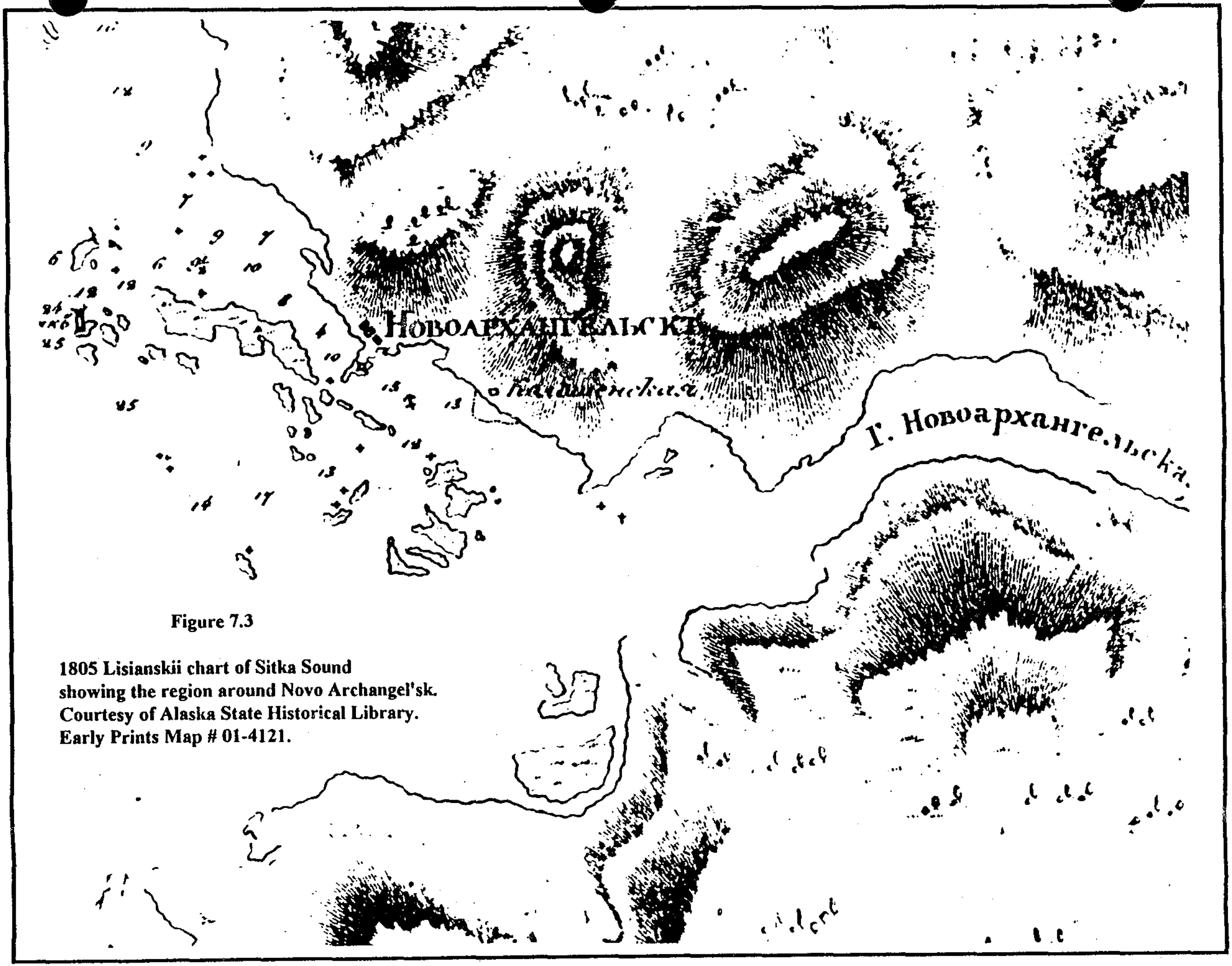


Figure 7.3

1805 Lisianskii chart of Sitka Sound showing the region around Novo Archangel'sk. Courtesy of Alaska State Historical Library. Early Prints Map # 01-4121.

as "*Koloshenskaya*" is indicated on the coastline at this location. Dauenhauer translates *Koloshenskaya* as "*Kolosh*" (Tlingit) with an adjective ending. This would seem to indicate that the structure at this location was of Native rather than Russian origin although it cannot be certain that it represents the Tlingit fort site. Of particular interest is the "star" symbol used to depict Baranov's fortifications on Castle Hill. This symbol, clearly representing a fort, is also used by Lisianskii in 1805 to identify the location of Archangel Saint Michael's Redoubt at Old Sitka which had been destroyed by the Tlingit in 1802. This symbol is of particular interest because it is the same symbol used in 1818 by Golovnin to identify the site of the Tlingit fort at the mouth of Indian River.

1818 Golovnin Chart

In 1817 Vasilii Mikhailovich Golovnin began a voyage around the world on the war sloop *Kamchatka*. One of the objectives of this 1817-1819 voyage was to visit outposts of the Russian-American Company to "inquire into the treatment of the native population by the employees of the Company" (Golovnin 1979:xxvii). The *Kamchatka* arrived at *Novo Arkhangel'sk* (New Archangel) in Sitka Sound on July 25, 1818.

Golovnin's chart of Sitka Sound, incorporating survey data from as early as 1809 was drawn in 1818 and published in 1822 (Golovnin 1822). This chart, compiled only a few years after the 1804 battle, provides important cartographic evidence pinpointing the location of the Tlingit fort at the mouth of Indian River (Figure 7.4). Indian River, labeled in Russian as *R. Kaloshenka* (*Kolosh* [Tlingit or Indian] River) is clearly identified on Golovnin's chart. At the end of the peninsula of land on the southwest side of Indian River Golovnin places a "star" symbol identical to the "star" symbols used by Lisianskii in 1805 to identify the sites of Russian "fort" locations at Castle Hill and Old Sitka. If there were any question whether this symbol represented the site of the Tlingit fort at the mouth of Indian River it is dispelled by the Russian text *"Staraya Kaloshen Krepost"* identifying the location as the "old *Kolosh* [Tlingit] Fortress" (Richard Dauenhauer, personal comm.). The 1818 Golovnin chart should once and for all lay to rest the question of whether the Tlingit fort site is within the boundaries of Sitka National Historical Park. The site of the Tlingit fort is clearly indicated to be close to the end of the peninsula and inland some distance from the seaward side of the peninsula. This agrees closely with the area excavated by Hadleigh-West in 1958 (NPS 1987: Appendix C, 1958 Excavation Map).

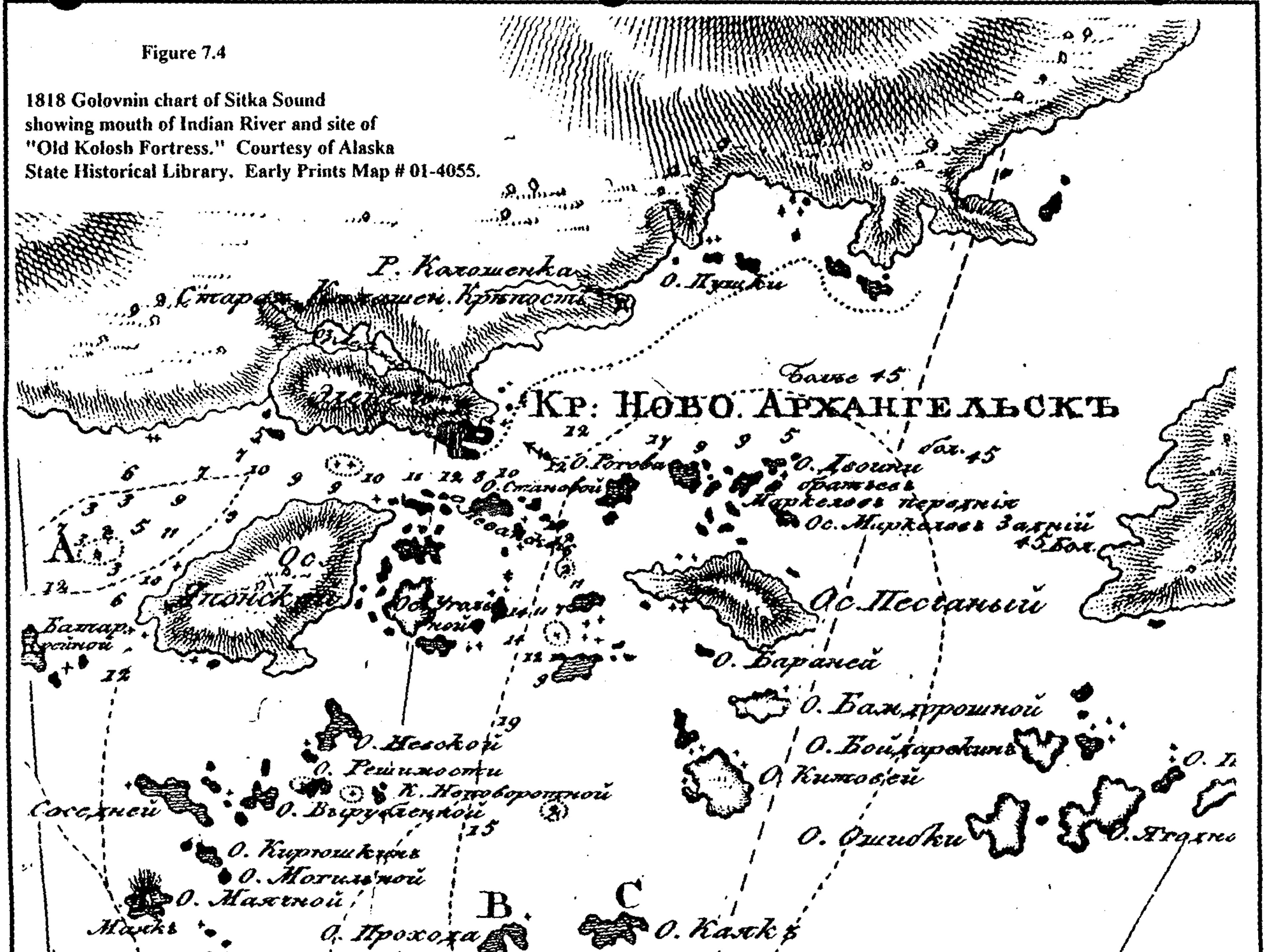
7.2.4. Destruction of the *Kiksadi* Fort

Lisianskii (1968 [1814]:162) reports that the day following abandonment of the Indian River fort by the Tlingit, Baranov sent three hundred men ashore to completely destroy the *Kiksadi* fort and that "after every thing in it that could be of use was removed out of it, it was burned to the ground." Herb Hope (1992:a:3) disputes the account that the Russian burned the fort believing that it is more likely they salvaged the logs for their first buildings in Sitka. Khlebnikov (1973:49) reports that "the spoils for the victors were three cast iron falconets and several rifles, and on the beach, 30 large boats [Black n.d.:26 "20 canoes."]. Lisianskii (1968 [1814]:163 remarks that "By this fortunate termination of the contest we added two small cannon to our artillery, and we picked up about a hundred of our exhausted shot."

The disposal of the bodies of five children found inside the fort and of 30 Tlingit defenders found outside the walls (Khlebnikov 1973:49) is not addressed by Lisianskii although Native oral tradition indicates that a rear guard of Tlingit defenders "stayed behind and took the bodies of the

Figure 7.4

1818 Golovnin chart of Sitka Sound showing mouth of Indian River and site of "Old Kolosh Fortress." Courtesy of Alaska State Historical Library. Early Prints Map # 01-4055.



individuals that had been killed in the battle effort, as well as a number of infants and children killed by the Russian bombardment, and buried them "in shallow graves to the east of the fort" (Hope1992b:4). Herb Hope (1992b:4), a descendant of the Point House people who lost around 20 warriors in the 1804 battle, relates that the Tlingit intended to return and exhume the bodies so that they could be cremated in accordance with the custom for those who lost their lives in war (Lisianskii 1968 [1814]:241). According to Point House oral history these bodies were exhumed by the Russians and the *Kiksadi* were not able to recover and cremate the bodies (Hope 1992b:4).

7.2.5. The Russian Memorial or "Grave Site"

Details regarding the 1804 battle casualties on the Russian side vary but Khlebnikov (1973:48) lists the casualties of the 1804 battle on the Russian side as "....three sailors, three *promyshlenniks* and four Aleuts were killed and two sailors, nine *promyshlenniks* and six Aleuts wounded: in all there were 10 dead and 24 wounded, amongst the latter the two officers [Baranov and Lieutenant Povalishin]." The primary sources make no reference to burial of the bodies of the Russians and the basis for a statement by the Arctic Brotherhood in a 1908 petition to the President of the United States to the effect that the Russian casualties were "buried where they fell" is unclear (Antonson and Hanable 1987:13). Another unreferenced statement in the same petition states that Baranov "caused a wooden monument to be erected over their graves..." The earliest cartographic evidence for the location of a monument to the Russian casualties appears to be the 1852 Teben'kov Atlas chart of Sitka Sound to be discussed shortly.

7.2.6. New Archangel

Following the battle at Indian River, Baranov immediately began fortification of Castle Hill and construction of *Novo Archangel'sk* at the present site of Sitka. Antonson and Hanable (1987:32) state "almost a thousand trees were cut for the stockade" and it is not unlikely that Hope (1992a:3) is correct in believing that many of the logs from the Tlingit fort at Indian River were reused by the Russians at *Novo Archangel'sk*. Following the 1804 battle relations remained hostile between the Russians and their allies and the *Kiksadi* Tlingit. The situation was so dangerous for the Russians that upon visiting the new settlement in 1818 Golovnin (1979[1822]:125) remarked "They [the Tlingit] never miss a chance to kill a Russian whenever they can do so without exposing themselves to danger; consequently when the local *promyshlenniks* must leave the fort to work outside in the vegetable gardens, they carry arms and always go as a group." In order to keep a closer eye on the Tlingit, the Russians permitted them to return in 1821 to settle outside the walls of *Novo Archangel'sk*. By 1825 the threat from the Tlingit appears to diminished since Sitka residents felt able to go on "walks and picnics to the deep woods near Indian River" (Antonson and Hanable 1987:35).

Continued use of Indian River by the Tlingit for fishing activities in the late 1820s and early 1830s is evident from a report made by Khlebnikov to Deputy Governor Etolin in 1831. Khlebnikov (cited in Dean 1993:195) writes:

> Please do not allow the Tlingits to camp on [Indian River] as far as possible as our gardens *and additions* will be vulnerable to their unacceptable incidents leading to unpleasant quarrels....If they do not heed our instructions not to settle on that creek, then it will be necessary dissuade them permanently by force of that design. [Chief] Naushketl' is excluded from this prohibition, whom I gave permission to reside there during the fishing season on the

> condition that he be responsible for any Tlingit disorder....Do not allow the Tlingits to stroll or loaf about on the holidays near our boundaries, so as to avoid quarrels and fights with our people.

Russian American Company records researched by David Nordlander for the National Park Service provide additional information on activities that took place or may have taken place at the mouth of Indian River. By 1831 the Russians had established a "spinner's shop" and had planted a "kitchen garden" near the mouth of Indian River. A "rope spinner" is listed among the craftsmen to be found in *Novo Arkhangel'sk* in 1821 and a "spinning shop for rope making" is one of the enterprises still present at Sitka in 1861 (Fedorova (1973:194,199). The spinner's shop was probably a "rope walk", commonly a shed or long, narrow building in which ropes were made from fiber. The importance of garden plots to the inhabitants of *Novo Arkhangel'sk* is reflected in the observation of an English sailor visiting Sitka in 1813 or 1814 who commented "every Russian has cleared a piece of ground, where they sow potatoes, turnips, carrots, radishes, sallad (sic), etc., by which means they live very comfortably" (P.C. Corney cited in Fedorova 1973:234). Because he felt that these activities would be disturbed by the Indians, Von Wrangell urged that the Tlingit should not be allowed settle on Indian River (RAC 1831).

In 1845 and 1846, RAC records show that Mikhail Teben'kov, the new Chief Manager, issued orders for the construction of "retirement homes" for employees near Indian River stating that the company would provide tools and supplies but that employees "like Ovchinnikov [Avchinnikov] must provide labor."(RAC 1845,1846). Also, in 1845, RAC archives indicate a proposal was made to build a fish drying and processing shed near Indian River but there is no indication at such a structure was actually build (RAC 1845)

1850 Teben'kov Chart of Sitka Sound

Mikhail Dmitrievich Teben'kov was a cartographer and eighth Chief Manager of the Russian American Company from 1844 to 1850 during which time he supervised the preparation of an Atlas of the Pacific Coast (Pierce 1986:27-31). Teben'kov's Atlas, combining the results of years of exploration and coastal surveys by Russian navigators, was published in 1852 and includes a chart of Sitka Sound dated 1850 (Figure 7.5). Indian River, identified as "*R. Koloshanka*" is clearly marked on this 1850 chart which shows extensive shoal development at the mouth of the river. Of particular interest are three structures shown in close proximity to the location indicated as having been the Tlingit Fort site on the 1818 Golovnin chart. It is not surprising to find that an area already cleared of trees for a fort by the Tlingit would offer an attractive location to place later Russian residences or structures and in all likelihood the three structures represented on the 1850 chart were constructed on the site previously occupied by the Tlingit fort.

The 1850 chart indicates a trail leading from the bank of Indian River westward toward a large garden area and a feature indicated on a 1838 town plat of Sitka as a memorial stone to Baranov (Longenbaugh 1986) but which is labled on the 1850 chart "K. Khlebnikov." Kiril Khlebnikov, an official of the RAC, arrived in New Archangel in 1817 and remained in Sitka until 1832 (Khlebnikov 1973ix-x). The Baranov memorial stone is well outside the present National Park boundary. Of more relevance to the Park is a garden area and three unlabled features on the northeast side of the mouth on Indian River. These (and the structures across the river in the fort area) may be "the additions" mentioned in Khlebnikov's 1831 letter to Etolin cited above. One of the earliest illustrations of Indian River is a pencil sketch done by I.G. Voznesenskii between 1843 and 1845 (Blomkvist 1972:138,148). The sketch shows a narrow log footbridge with railings on

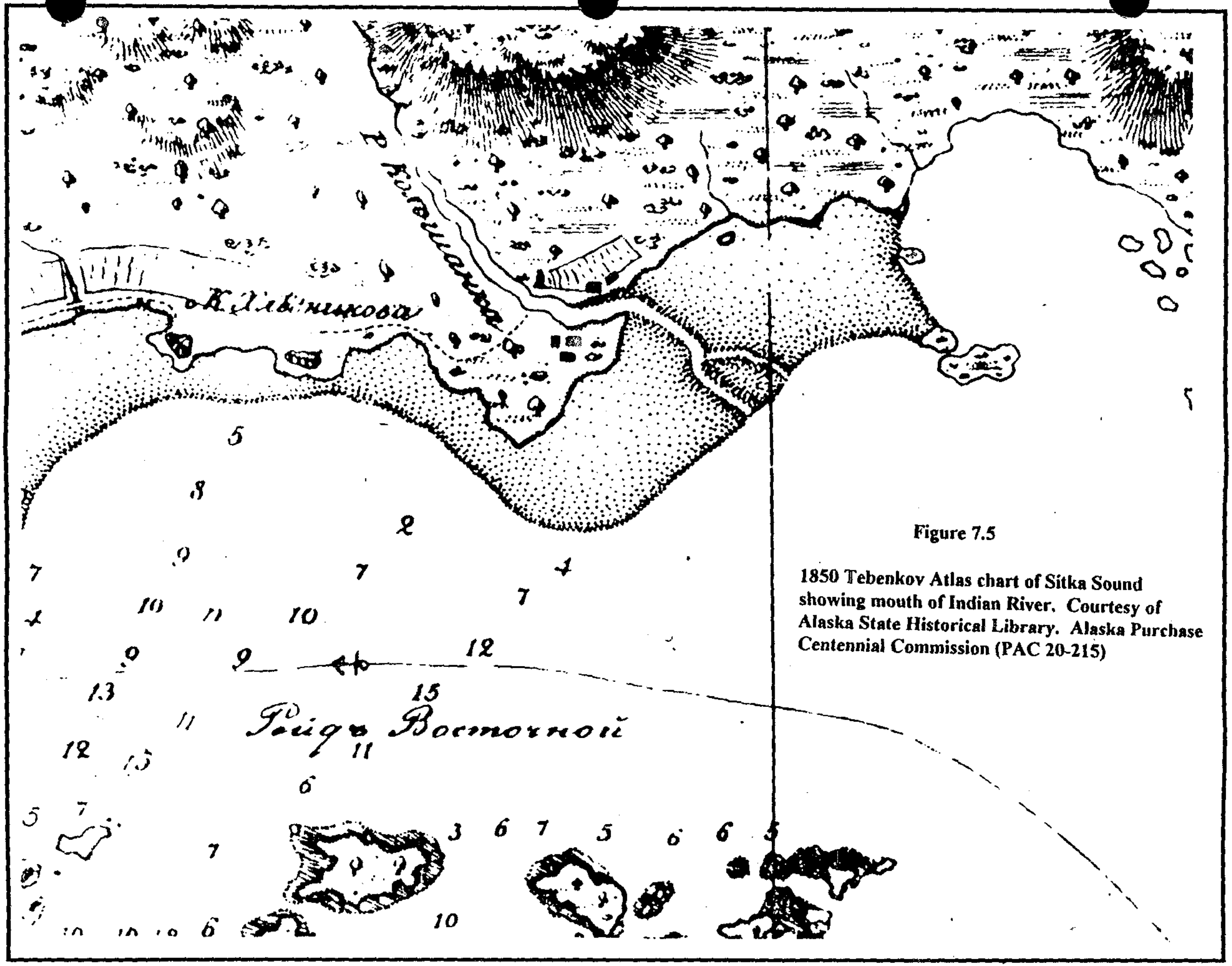


Figure 7.5

1850 Tebenkov Atlas chart of Sitka Sound showing mouth of Indian River. Courtesy of Alaska State Historical Library. Alaska Purchase Centennial Commission (PAC 20-215)

both sides spanning the river. The bridge rests on cribbing of split logs. The direction of view, downstream towards Silver Bay is clearly established by Sugarloaf Mt., the rounded mountain in the background of the drawing. On the bank of the river in the far distance is a house with a double gabled roof and a chimney around which is a picket fence with a gate. This structure would have been on the east bank of Indian River, probably near the mouth. It would have predated the Haley homestead in this same vicinity since Nicholas Haley, a American Civil War veteran, did not file a homestead application until 1882. It is not presently clear whether any of the structures represented in the vicinity of Indian river on the 1850 Teben'kov map can to attributed to the various activities referred to in the RAC archives between 1831 and 1846, however by April 1850 Peter Avchinnikov [also spelled Ovchinnikov], the retired company employee mentioned in RAC records as early as 1845 was living in a small house on the fort site "during part or all of the period from 10 April 1850 - 17 December 1851 inclusive" (Dilliplane 1993:8, Holmberg 1855:91).

1855 Tlingit Uprising

Relations between the *Kiksadi* and the Russians at Sitka remained tense throughout the first half of the 1800s and in 1855 warfare again erupted after a sailor shot and wounded a Tlingit man caught stealing firewood on Japonskii Island (Dean 1994:11-12). Following this incident approximately 800 Tlingit assaulted *Novo Arckhangel'sk.* Two Russians were killed and 18 wounded and fifty Tlingit were killed and wounded in the two hour attack. In a letter written from *Novo Arckhangel'sk* in February 1861, Golovin (1983:118) remarks that the *Kolosh* destroyed "a small Russian settlement" during the 1855 uprising. The cluster of three buildings represented on the 1850 Teben'kov chart at or near the *Kiksadi* fort site may have also been among the structures burned by the *Kolosh* in 1855. Herman Kitka, a Tlingit elder, reports the Tlingit burned structures made from milled lumber in the vicinity of the fort site shortly before the transfer of Sitka to the Americans (Herman Kitka, personal comm, February 26, 1995). When he was a small boy in the early 1900s Mr. Kitka remembers seeing milled boards with rusted square nails in the vicinity of the fort site.

As late as 1858 the *Kolosh* sporadically attacked the Russian settlement and groups caught away from the post. By the 1860s hostilities had decreased to the point where Russians were again using a trail through the woods to Indian River for recreational walks where they sometimes collected wood and made fires to prepare tea (Antonson and Hanable 1987). During a visit to Sitka in February 1861 Golovin (1983:118) describes the walk along the trail to Indian River:

> It used to be too dangerous to go into the forest, for fear of being attacked by the *Kolosh*, but now everyone goes to this stream, and in fact they go unarmed. The forest is really magnificent! If you go off the path it is almost impossible to move through the dense thicket, and you can only go a short distance. The backwoods area is beyond description. Centuries-old trees, felled by the wind, lie one atop another. Some have already rotted and turned into loam; others disintegrate at a touch, and new trees grow on top of these fallen giants, not infrequently as much as 90 feet in height. It is a truly picturesque place, especially in summer, when raspberries grow all over these stumps, with immense but watery berries, and flowers blossom so that their nectar and pollen attract thousands of hummingbirds.

7.2.7. Americans in Sitka

After the formal transfer of Alaska to the United States at Sitka on October 18, 1867, the Tlingit came under American laws administered by the U.S. Army (Antonson and Hanable 1987:36). By 1870 Sitka residents were making increasing use of the Indian River trail for recreational walks. Sophia Cracroft (1981:3-4), in a journal kept while she was visiting Sitka in 1870, writes:

> ....[we] were following the shore....by a well made road leading to the "Indian River". It was a very long walk - too much for my Aunt - but our friends had to return to the ship, & we cd. sit down to rest from time to time. The river was a small rapid stream issuing from the heavy forest - a tree had been felled and thrown across as a bridge, & a little clearing of the tangled forest had been affected. This is the only road in any direction, so it is the universal walk for the whole community. The military carts too come this way for wood and often for water also, as the river water is very fine. The half cleared margin gives a good deal of variety in vegetation, old stumps, fallen trees & bits of rock which was very pleasant to newcomers fresh from the confinement of a ship.

In the 1880 Alaska census Petroff (Orth 1967:454) reports a population of 43 Tlingits at "Indian River" indicating that seasonal Native fishing activities were probably still taking place at the mouth of the river as late at the 1880s. Goldschmidt and Haas (1946:108) comment that:

> Indian river is called *kahsdahin* by the natives and aboriginally belonged to the *Kiks'adi* clan. In the old days there were many smokehouses at the mouth of this river, and the native village of Sitka extended from the mouth of the river to Jamestown Bay. The native name for the village was *casayeon*. Sitka river was a source of humpies, cohoes, and dog salmon. Native people still go up the river to hunt brown bear and deer and to gather wild currants and blueberries. Some of them also trap up the river.

Herb Hope (1992a:3) indicated to the National Park Service that Native use of the lands that are now included in the Park included "the Cameron house and smoke house [that] were on the site of today's visitor center. Hope (1992b:5) also reported that in May and June the Point House people traditionally gathered a variety of plants from the present Park area. Plants collected including wild celery, salmonberry sprouts, seaweed, and another leafy green plant that grows along the beach line.

The herring run in Sitka Sound was of major importance to the Tlingit. Andrews (1922:46) states that in 1807 "there were over 2,000 hostile natives gathered in the harbor at the herring season and they threatened an attack on the settlement." It is of interest to note that in 1844 salmon were reported to be so thick at the mouth of a little stream within a mile of the fort [Indian River] that "a canoe could not be forced through" but that by the turn of the century trout predominated and salmon could be caught only occasionally (Antonson and Hanable 1987:9) Tlingit fishing activities in 1880 apparently did not conflict with non-Native recreation use of what was popularly known as "Lover's Lane", an improved and extended Russian trail along the beach and through the woods to Indian River (Antonson and Hannable 1987:7-8).

7.3 SITKA NATIONAL MONUMENT AND PARK

In 1890 President Benjamin A. Harrison established a 50 acre public park at the mouth of Indian River, an area that President Taft made into Sitka National Monument in 1910. Then, in October 1972, Sitka National Monument was redesignated a National Historical Park at which time control of state tidelands adjacent to the Park was leased to the National Park Service from the City of Sitka under a 55 year lease. The *Kiksadi* Fort site had previously been placed on the National Register of Historic Places on October 15, 1966. With increased government and public attention, activity at the mouth of Indian River began to intensify.

7.3.1. Trail Improvements, Road Development, and Bridge Construction

In 1869 the Army had constructed a one and a half mile long corduroy wagon road between Sitka and Indian River to facilitate transport of water and wood (Antonson and Hanable 1987:37). Further road construction at the mouth of Indian River was undertaken about 1881 by Nicholas Haley, a Civil War veteran who filed for a homestead claim on the north bank of Indian River in 1882 and was still occupying the land without a title as late as 1910 (Antonson and Hanable 1987:4,65,68). The "wood road" and Haley house (east of the present Park boundary) is evident on a 1910 Department of the Interior map showing the boundary of Sitka National Monument (Antonson and Hanable 1987: Appendix C). A 1953 map of the Monument also shows the Haley homestead to have been located outside the eastern Monument boundary in the area currently occupied by a trailer park.

Efforts to improve trails at Indian River continued in 1884 when a party of U.S. Marines and Indians cleared a new path from the beach to the river and constructed additional paths along both river banks and into the woods. The Marines also constructed two bridges across the river and bridged two small ravines on the river bank (Antonson and Hanable 1987:8). In 1888 a suspension bridge was built over "the lower portion of Indian River" by I.B. Hammond to improve access for miners to the upper Indian River valley where gold had been discovered in 1870. This footbridge remained in good condition through 1916 but underwent repair work in 1921 (Antonson and Hanable 1987:38,51,58,65). This bridge (see Figure 4.4) is illustrated by Antonson and Hanable (1987, Appendix B) and appears on a 1910 Park Service map of the Monument with the handwritten notation "suspension bridge" added sometime later (SNHP Archives RG45 SITK14588a).

In 1895, a new trail was cut from "the Point to the Bridge" along Indian River. (Antonson and Hanable 1987:9). A huge hemlock near the mouth of the river, known at the "Witch Tree" was reported in the early 1900s to have been the site of important Native councils and supposedly of a witch trial and execution (Antonson and Hanable 1987:16). This tree must have been very close to the bank of Indian River because in 1927 the river was reportedly undermining the tree and the Witch Tree was finally washed away by a flood during World War II.

By 1904 the Sitka Wharf and Power Company was filling a water-wagon at Indian River to serve outlying areas. In 1916 mention is made of the use of the wagon road along Indian River by visitors in horse-drawn vehicles and the recently graveled road was reported to be in good condition after repair work by the Alaska Road Commission (Antonson and Hanable 1987:51). Andrews (1922:97-98) description of the trail through the Monument provides an enticing picture of the Monument in the 1920s:

Beyond the Mission is the famous Indian River Road, a continuation of the Governor's Walk of the Russians, and often called the Lover's Lane. It winds along the shore of the sea, through the Park, with here and there an opening in the forest where there are splendid examples of Hydah [sic] carvings in the tall totems placed in well chosen spots....From the rustic bridge on the Indian River there are enticing paths leading along the stream and toward Mt. Verstovia, which towers above the bay to the height of 3,216 feet. Along the river, known as the *Kolosh Ryeka*, by the Russians, the winding paths are bordered with huge Sitka spruces and giant cedars, with the space thickly filled with a dense growth of shrubbery, among which is prominent the Devil's Club (panax horridus), with its beautifully palmated leaves and its cruel spines concealed underneath.....in the depths of the forest the earth is covered with a carpet of ferns and mosses, and the trunks of fallen trees of former years may be seen with other trees of from two to three feet in diameter growing on their prostrate bodies."

Prior to 1921 wheeled traffic had forded Indian River downstream from the footbridge but in that year the Alaska Road Commission constructed a new bridge for vehicles outside the present park boundaries. The following year (1922) wheeled traffic was banned in the Monument. Prior to 1925 two additional footpaths were constructed and an ornamental gateway consisting of two

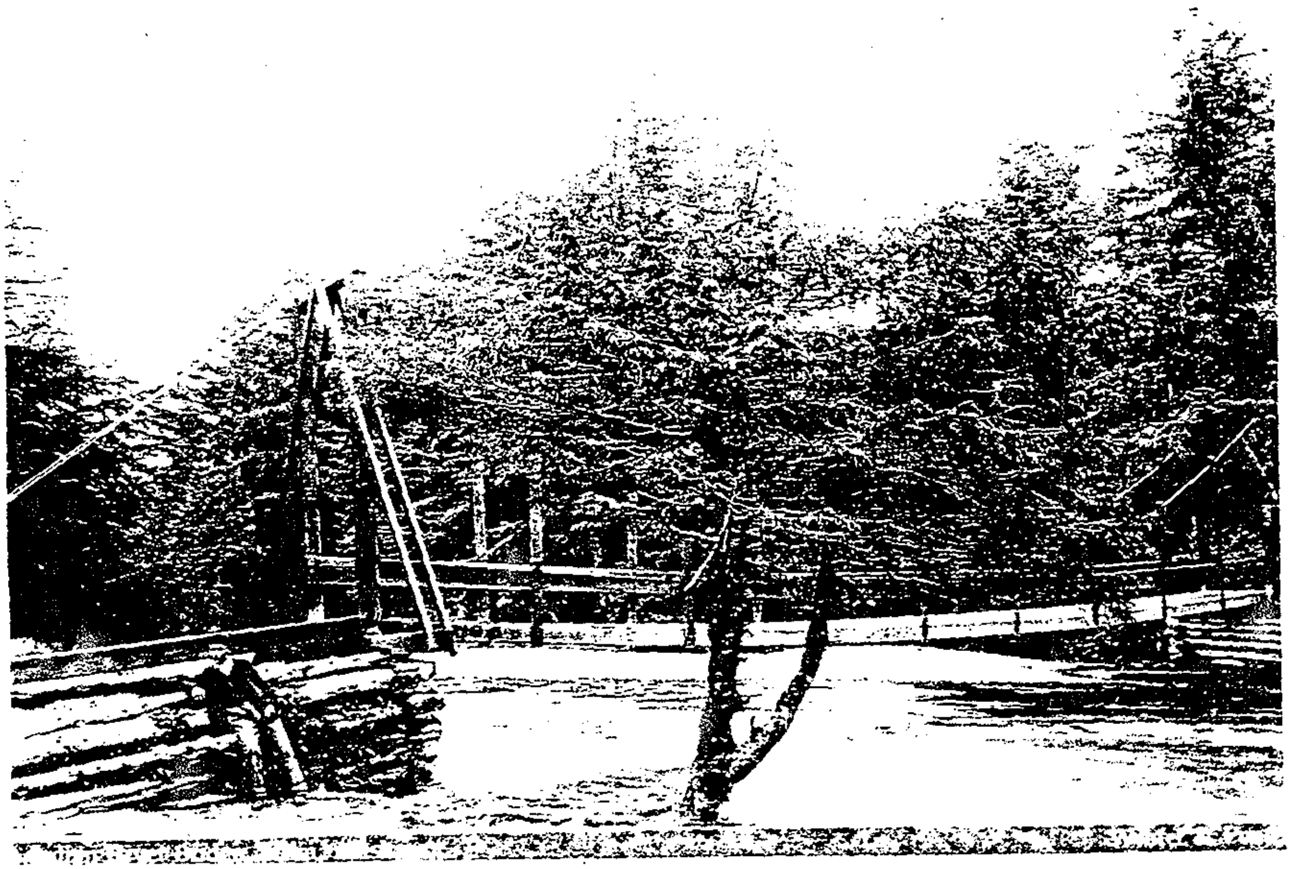


Figure 7.6. Winter and Pond photograph taken in the 1890s of the Indian River suspension bridge. Courtesy of Alaska State Historical Library (PCA 87-2969).

totem poles and two heavy concrete pillars was erected (Antonson and Hanable 1987:69). In March 1940 a Park Service master plan had recommended placement of toilet facilities in the Monument and by April two pit toilets were under construction, the first sanitary facilities in Sitka National Monument (Antonson and Hanable 1987:104; Figure 7.7).

Erosion along the bank of Indian River in 1927 required 100 feet of road to be reconstructed and in September of 1942 a flood washed away a footbridge, totem pole, and water pipeline (Antonson and Hanable 1987:70, 109-110). A new section of road to replace that destroyed by flooding was completed in the winter of 1942. Dredging of gravel from the mouth of Indian River beginning in 1939 increased river erosion and along with flood events destroyed a wooden footbridge over Indian River in 1961. Flooding again in 1966 destroyed a new footbridge which had been constructed only ten days earlier (see Figure 4.9)(Antonson and Hanable 1987:134). The wood and concrete footbridge that presently spans the river was constructed in 1968 and the most recent trail, called the "Battleground Trail" was added to the park in 1980 as was a "Fitness Trail" on the east side of the river (Antonson and Hanable 1987:22,135).

A power transmission line had been constructed along the beach on the seaward boundary of the Monument and across the mouth of Indian River sometime prior to 1919 (US Survey Map 1258). In 1923 the removal of this "unsightly" power line became an issue but the removal was not accomplished until 1954 when the Sitka Utilities Board funded relocation of the transmission line to follow Sawmill Creek Road. (Antonson and Hanable 1987:66,97). A 1953 map of the Monument shows the location of this power line which followed the edge of the vegetation along the seaward coast of the Monument and then turned eastward and continued further out in the intertidal zone across the mouth of Indian River (Figure 7.7).

7.3.2. Totem Poles

All of the present and past totem poles at Sitka National Historical Park have been transported to the park from elsewhere or are replicas of original poles brought to the Park (Antonson and Hanable 1987:15). The first carved items to be relocated to the park were a totem pole, four house posts and a war canoe brought to the park from Kassan by the U.S. Revenue Cutter *Rush* in 1901. In 1903 Alaska governor John G. Brady had 20 totem poles transported to the park from Tlingit and Haida villages on Prince of Wales Island. These poles and the carved items brought to the park in 1901 were shipped to St. Louis for the 1904 Louisiana Purchase Exposition. Not more than 14 of these poles were eventually returned to the park and a 1908 map shows only 13 poles erected. In the summer of 1911 these poles were reset in concrete after having been originally set in gravel (Antonson and Hanable 1987:46). On the site of the "Native stockade of 1802" [sic 1804] four small totems "were set as corner posts in anticipation of a reconstruction of a traditional community house and a giant totem had been located before the prospective door" (Antonson and Hanable 1987:47).

By 1939 weathering and deterioration of totem poles required that the poles be taken down and treated with preservative. By February 1940 "sixteen" poles had been treated and reset in their former locations (Antonson and Hanable 1987:105). Weathering and deterioration of the park poles continued to be a problem and a project to recarve the original poles was undertaken by the Civilian Conservation Corps. By 1947 most of the original poles had been destroyed or transported out of the Monument. The majority of the original poles removed to the Mount

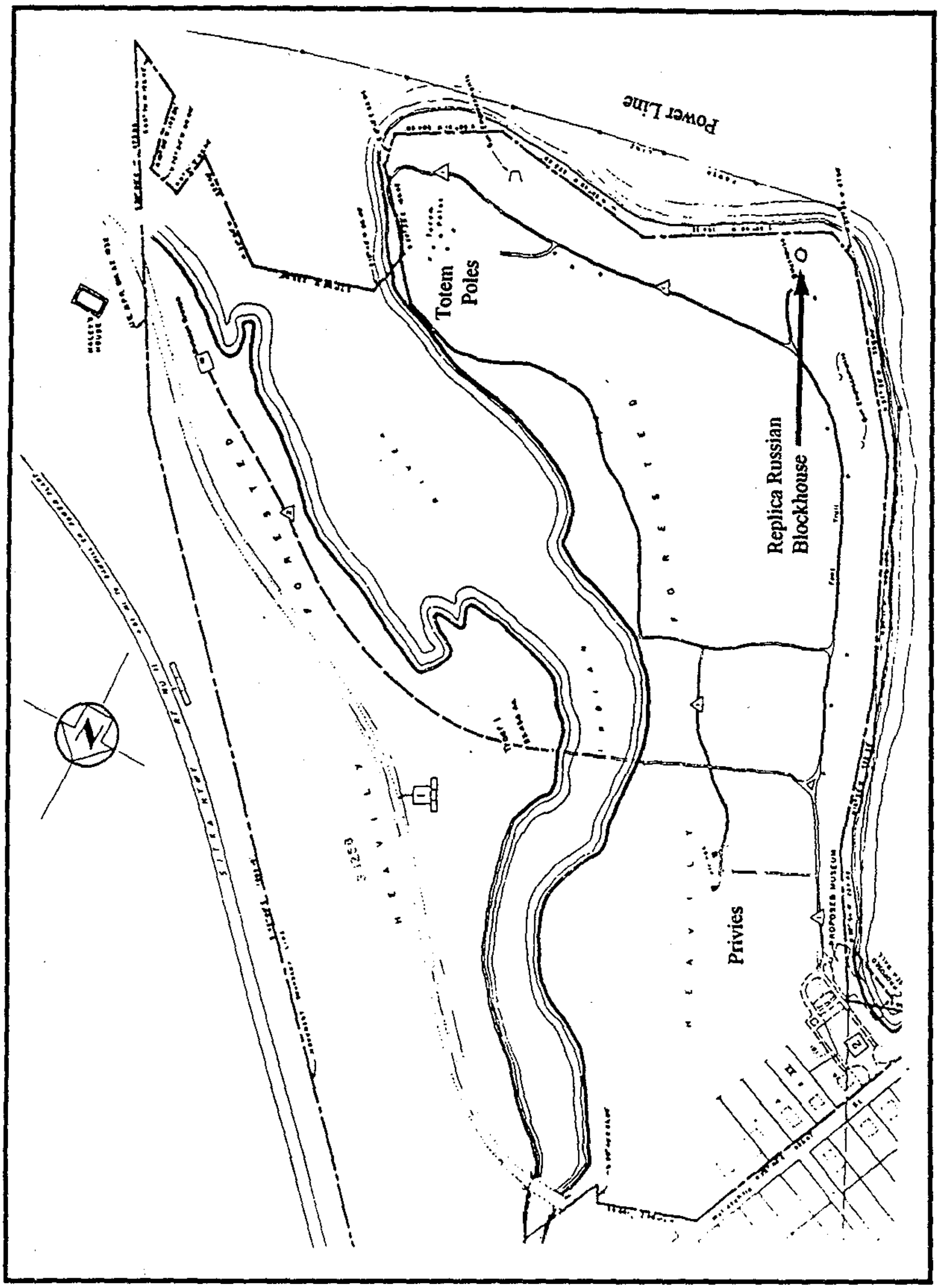


Figure 7.7. 1953 Park Service map of Sitka National Monument showing the transmission line removed in 1954 and the Haley homestead, wood road, Russian "graves", replica Russian blockhouse, 1940 privies, and trail system.

Edgecumbe boarding school on Japonski Island were eventually lost. By 1971 the duplicate poles were beginning to weather badly and another major totem pole restoration project was initiated.

7.3.3. Blockhouse Replica

In 1926 Stephen T. Mather, director of the National Park Service, approved construction of a replica Russian blockhouse in the Monument. By July 1927 the replica, constructed of heavy cedar logs *and hardware from the original Blockhouse No. 2* (Blockhouse D) which had formed part of the palisade separating the Russian and Native settlements at Sitka (Antonson and Hanable 1987:71). The original Blockhouse D had been demolished in 1921 by a United States Observatory crew because its metal interfered with their instruments.

The 1953 Park Service map of the Monument (Figure 7.7) shows the replica blockhouse was placed on a point of the seaward coastline, southwest of the fort clearing. The blockhouse can also be identified on a 1929 US Navy aerial photograph of the mouth of Indian River (see Figure 4.2). By 1959 the replica blockhouse had deteriorated and become a target for vandalism. In July of 1959 the National Park Service demolished and then bulldozed the blockhouse remains onto the beach where the timbers were burned (Antonson and Hanable 1987:115.

7.3.4. World War II Activity

In May of 1942 Sitka National Historic Monument was essentially taken over by U.S. military forces anticipating a possible Japanese attack on Sitka. Ground-disturbing military activity between 1942 and 1945 (other than dredging activity) was largely confined to the west side of Indian River south of the "second cross footpath" (Antonson and Hanable 1987:89). In 1942 two pyramid tents were erected by the Army and two aircraft observation posts that had been established near the blockhouse immediately following the December 1941 attack on Pearl Harbor were dismantled. Sometime during this period at least eight "machine gun pits" were dug along the seaward side of the "Lover's Lane" footpath (Antonson and Hanable 1987:19). Several larger pits located northwest of the *Kaksadi* fort site appear to have been excavated as military bunkers at this time (Hadleigh-West 1959:44). A water pipe line from Indian River used by the Navy and the city of Sitka that appears to have been constructed by the military was destroyed by flooding in September 1942 (Antonson and Hanable 1987:109-110).

Gravel Dredging

Gravel dredging began at the mouth of Indian River in 1939 and did not end until 1979. Facilities to store gravel were constructed on Monument land east of Indian River in 1940. These gravel bunkers were destroyed by a fire in November 1942. By 1941 erosion along the banks of Indian River, intensified by gravel dredging activities, was becoming a serious problem but dredging activity continued. In October 1941 the Navy dredged a pit 30 to 200 feet wide and four to 30 feet deep at the river mouth (Antonson and Hanable 1987:108-109). A Navy Seabee battalion took over operation of the Indian River gravel plant from private operators in 1943. The need for gravel diminished in 1944 when military construction on Japonski Island was nearing completion and in April 1945 the Navy razed its gravel bunkers and all but one of the shacks used in dredging operations (Antonson and Hanable 1987:111). Gravel dredging increased dramatically between 1954 and 1960 when at least 320,000 cubic yards of gravel were removed from the vicinity of the mouth of Indian River creating further serious erosion problems.

Asphalt Plant

Sometime prior to 1958 the Morrison-Knudsen Company had received a special use permit to operate an asphalt plant on the east bank of Indian River within the Monument. In 1958 plant operations were terminated but "surplus asphalt and debris from the plant were buried on the site, which was later reforested" (Antonson and Hanable 1987:99).

Kiksadi Fort Site

There have been a number of unmonitored ground-disturbing impacts at the *Kiksadi* fort site since the establishment of Sitka National Monument in 1910, beginning with the erection of several totems poles at the site in 1911. Trail construction and improvement activities beginning in the 1920s and placement of gun pits by the military in the vicinity of the fort site in the 1940 have been discussed earlier.

Prior to and following archaeological testing and excavation at the fort site by Hadleigh-West in 1958 (to be discussed), ground-disturbing activities have dramatically disturbed the integrity of the site. Hadleigh-West (1959:42) indicates that there is evidence from his excavations and Park Service photographs that the excavation site had been leveled and landscaped prior to his excavations, and possibly bulldozed either at or just prior to the time the initial totem poles were erected in 1911 (NPS 1982:2). It is interesting to consider the potential for the displacement and transport of artifacts contained in the root wads of bulldozed trees. NPS records indicate these trees were burned on the beach which could have easily resulted in the secondary deposition of cultural material in the intertidal zone or beach area.

Another major impact to the fort site were trenches were dug in 1970 to allow totem poles to be laid horizontally for treatment with preservatives (Antonson and Hanable 1987:140). These trenches, placed *"near the center"* of the clearing where the 1958 excavation was conducted, are described by Davis (NPS 1983:2) as "deep backhoe trenches." The number of trenches and their location in relation to the 1958 excavations was apparently not recorded at the time and evidently there was no archaeological monitoring of the trench digging. In 1980 a new trail around the "1804 battle site" was added to the park and further landscaping of the fort site and "battle site" was undertaken. As part of this landscaping, the totem pole trenches dug in 1970 were filled in. It is of some importance to note the nature of the backdirt used to fill the trenches. Davis (NPS 1982:2) reports:

> More recent disturbance at the Ft. site occurred in the 1970s when deep trenches were dug by back hoe near the center of [the] site to soak totem poles in preservative. Until recently, the depressions for the trenches, and the depressions marking the locations of the totem poles erected on the site, were discernible. These depressions were filled in 1982, for landscaping purposes, *with fill from the grounds of the Russian Bishop's House*. The fill locations were mapped by park staff using tape and compass (memorandum of 6/17/82, Gary Candelaria, Sitka Park Ranger, to Craig Davis, Regional Archeologist). *The fill from the Russian Bishop's House contained fragments of glass, brick, pottery and metal, further contaminating the site.*

Other prior impacts to the area of the fort site noted by Davis (NPS 1982:3) were evidence of a chain link fence around the boundary of the site clearing (indicated by regularly spaced depressions between the stone monuments marking the corners) and "four or five metal posts placed at the suspected corners of the Ft. Site, to give the visitor an appreciation of the Fort boundaries." At the time of his investigation Davis (NPS 1982:1) reports that "a large clearing exists where the Fort site is believed to have been. This area has been filled and graded and now is a manicured/mowed lawn. An approx. 10 ft. wide path passes around the Ft. site and through it."

7.4. PREVIOUS ARCHAEOLOGICAL INVESTIGATIONS

7.4.1. 1958 Hadleigh-West Excavations

Archaeological verification of the location of the *Kiksadi* fort site became of paramount importance in 1958 because Park Service officials had come to the conclusion that "retention of Sitka National Monument in the National Park System would not be justified" unless it was determined that the fort was clearly within the park boundaries (Antonson and Hanable 1987:114). The Park Service contracted Frederick Hadleigh-West, an archaeologist from the University of Alaska in Fairbanks, to conduct excavations with the objectives of identifying the fort site location and determining whether or not the marked Russian "gravesite" was actually the burial site of the six Russians killed in the 1804 battle (Hadleigh-West 1959:1,34). In 1958 Hadleigh-West and several local students (who apparently had no prior archaeological training) spent the latter part of July and all of August conducting excavations at the Monument.

Excavations at the Russian "Grave Site"

The location of what had been considered to be the burial site of the Russians on the east side of Indian River had been marked for an unknown length of time prior to 1958 with a fence and a Russian cross. A memorial at or near this location appears to be represented on the 1850 Teben'kov chart (Figure 7.5). Excavation at the location marked as the Russian grave site in 1958 encountered "badly rotted timbers" just below the ground surface. This 6 x 7.2 foot rectangular feature consisted of heavy cribbed planks partly overlain by compact gravel from road fill (Hadleigh-West 1959:35). Three iron spikes and some historic artifacts were found directly associated with the planks. Excavation was continued to a depth of about eight feet through sterile undisturbed alluvium below the planks without finding human remains or evidence that the location of the monument was actually a burial site (Hadleigh-West 1959:36). All artifacts recovered were of European manufacture and were found in the first 20 cm below the ground surface. Hadleigh-West (1959:36) states unequivocally "There were no Russians buried at this point. Neither was there any other sort of excavatory activity which would have disturbed the soil." The iron spikes found in the excavation showed similarity in form with spikes found at the 1802 Russian settlement at Old Sitka and the weathered condition of the plank feature suggested to Hadleigh-West that the feature could have dated to 1804.

Hadleigh-West (1959:38) suggests that the memorial placed by the Russians may have been only a commemorative marker and that the Russians who died may have been buried at sea. Fear of mutilation of the Russian bodies by the Tlingit, some of whom remained behind after the abandonment of the fort to watch and harass the Russian forces (Hope 1992a:3), may have made burial at sea a preferred alternative to interment on land. It should also be remembered that the six Russians were killed during the first day of Battle (Oct.1st by Lisianskii's reckoning) but the fort was not taken until October 6th, five days later. It would seem unlikely that the bodies of the six Russians would have been kept aboard ship for five days before the Russians were able to land and dig a mass grave for the men killed on October 1st.

The 1850 Teben'kov chart of Sitka Sound (Figure 7.5) may provide a clue to the location and nature of the Russian memorial. This map represents the westernmost of three structures on the northeast side of Indian River differently from the box-like symbol used for other structures represented in this vicinity. The westernmost location is marked with a distinct vertical symbol which suggests this map feature may represent either the actual Russian grave site or a monument to the Russian sailors killed in 1804. Indication that this symbol represents only a monument and not an actual grave site is suggested by the 1818 Golovnin chart of Sitka Sound which shows a vertical symbol labeled "*Pamyatnki*" [monument or memorial] at the site of the 1802 battle at Old Sitka. Although some of the Russian victims were reportedly buried by Captain Barber a few days after the 1805 massacre (Tikhmenev 1979:136) there is no indication that the gravesite at Old Sitka was marked at the time of the burial and it is unlikely that the actual location of the interment would have been known to the returning Russians in 1804. The monument symbol used on the 1818 chart is identical to the symbol shown on the east bank of Indian River on the 1850 Teben'kov chart. It appears that monuments commemorating the loss of Russian lives at both the 1802 and 1804 battle sites were placed at the locations of these battles sometime between 1804 and 1850. It is almost certain that the monument at Old Sitka did not mark an actual burial site and probably the one at the mouth of Indian River did not mark an actual grave site either. In any event, the location indicated as the Russian "gravesite" in 1958 was shown by excavation to be a memorial and not a burial site and the disposition of the bodies of the Russians who died in the 1804 battle remains historically undocumented.

Excavations at the *Kiksadi* Fort Site

In 1958 what was thought to be the location of the *Kiksadi* Fort on the west side of Indian River (near the end of the peninsula) was identified by a Park Service marker. Hadleigh-West (1959:34.40) reports that this marker had been placed on the basis of "hearsay and traditional statement" and "the exact location of the fort was unknown; in theory it could have been anywhere on the peninsular portion of the Monument, or, worse still, as suggested by some local Tlingit informants, it could have been totally destroyed by bank or beach erosion."

Preliminary testing in depressions and at other undocumented locations along the length of the peninsula (other than at the "lower end of the park") failed to locate cultural material and all the depressions investigated appeared to have been the results of tree fall. Initial examination of what appeared to be moss-covered ridges also proved to be natural alignments of deadfalls which in some cases gave the appearance of linear features of possible cultural origin. In the vicinity of the area marked as the fort location "artifact material was found in some abundance" however it "consisted entirely of items of European and American manufacture, many of them obviously quite recent" (Hadleigh-West 1959:40-41). Initially test pits and trenches in this area produced no evidence of surface or subsurface features suggestive of the *Kiksadi* fort. Finally, after an appeal to the local Native community, Alex Andrews, a Tlingit elder, visited the site of the excavations and pointed out a low ridge which his father had told him was part of the fort wall (Hadleigh-West 1959:42).

Whether all structural evidence of the Tlingit fort was completely destroyed following the 1804 battle is uncertain. Two popular books published in the early 1900s mention surviving surface remains of the *Kiksadi* fort. C.L. Andrews (1922:24-25), visiting the fort site in the 1920s remarks "There was enough remaining of the structure that some of the remains of the foundation may yet be seen in the forest which has sprung up around it in the Indian River Park, although more than a century has since elapsed." A few years later Barrett Willoughby (1930:201) also observed "grass-grown ridges that mark the site of the great fort which was the Thlingets stronghold." It is possible, of course, that Andrews and Willoughby mistook natural tree fall or the remains of later Russian structures for the structural remains of the Tlingit fort. It is impossible to know whether the grass-grown ridges observed by Andrews and Willoughby were the same features pointed out to Hadleigh-West by Alex Andrews in 1958.

In the limited time remaining to Hadleigh-West, excavation efforts focused on following the linear feature indicated by Mr. Andrews as having been part of the fort and of testing within the apparent fort walls (Figure 7.8). The results of this excavation are discussed in detail by Hadleigh-West (1959). Although Hadleigh-West (1959;57,79) felt he had, without doubt, identified the *Kiksadi* fort, there have remained nagging questions about the excavation technique used, the features identified, and the artifacts recovered. According to Hadleigh-West (1959:52) the "excavation" procedure consisted largely of "stripping the sod down to the logs, stripping an area to either side to be sure no mistake was made, either in missing other wall logs there or in inadvertently following a deadfall." No exposed logs were moved during the excavation.

The badly weathered condition of the features exposed in the 1958 excavations made it difficult to be certain that what was being exposed was a cultural rather than a natural alignment of logs. Hadleigh-West (1959:42) himself admits "In view of the nature of the wall at that point [where Andrews indicated the wall of the fort was] [we] could quite conceivably have gone through it without there being any realization that it was anything but deadfall or rotten stump wood...." Hadleigh-West (1959:43,45) goes on to say "....it was necessary to uncover the wall logs continuously in order to be certain that the wall had not actually turned and one was not dealing with a deadfall fortuitously disposed in the correct seeming alignment" and that "it was not until the corners were turned that any real assurance was felt about the first wall." No indications of cutting or chopping were observed on any of the logs uncovered and only one post hole, discernible only as a surface feature, was discovered (in a wood stain on the east wall). Furthermore, "no remains that could definitely be attributed to any of the fourteen dwellings were found" (Hadleigh-West 1959:56). Furthermore, the artifacts recovered, with few exceptions, were of European manufacture post-dating 1840 (Dilliplane 1993). A three pound cannon ball found among wall timbers at Feature 3 and the recovery of a .40 caliber musket ball by Hadleigh-West do not necessarily mean the log features he exposed were part of the 1804 fort since the battle went on for several days and hundreds of cannon balls and musket shots were fired at the Tlingit defenders, many of which surely went astray. At one point during the 1804 battle Lisianskii (Dmytryshyn et al. 1989:89) reports that "we had to fire on the fortress repeatedly because many people were coming out of it onto the shore in order to pick up our cannon balls."

Nevertheless, there is other evidence from the 1958 excavation that Hadleigh-West was indeed digging in the right location. The fact that signs of burning (mostly superficial charring) were evident on many of the logs exposed along what were considered to be the south and west walls of the fort is certainly consistent with Russian accounts that the fort was burned following the 1804 battle. As Hadleigh-West (1959:59) points out it would not be surprising for the bottom-most logs to have survived the fire relatively intact. It seems unlikely that such extensive evidence of burning could be the result of a natural fire although intentional fires lit by either the Tlingit or the Russians to get rid of the dense brush at the mouth of Indian River might be a possible explanation. No mention of the use of fire for this purpose was found in historical records. Unfortunately, there is no mention by Hadleigh-West of whether or not burned or charred logs were found outside the area thought to be the fort site. The 1958 excavations did encounter three possible hearths located within the walls of the fort (Hadleigh-West 1959:54,57-58). A charcoal concentration (possibly a hearth of which the upper portions had been bladed off) was discovered inside the suspected southeast corner of the fort, twenty-five feet west of the east wall. Another location inside the northern part of the suspected fort contained two irregular burned areas that were associated with a variety of artifacts of European manufacture.

The question of whether or not the excavators were exposing chance alignments of natural deadfall seems to be dispelled by the discovery along the south wall of "a clear abutment of one log upon another" accompanied by several rocks positioned so as to suggest their employment as wall supports (Hadleigh-West 1959:47). On the west wall, as well, Hadleigh-West (1959:52) indicates "there were several very clear cases of one log abutting against another." This evidence, and the tracing out of what corresponds fairly closely to the southwest corner of the fort, as represented in Lisianskii's 1804 drawing, seems to substantiate Hadleigh-West's claims that the southern and western alignments of logs he uncovered were indeed the walls of the fort. In addition, the exposure of two artificial arrangements of stones inside the apparent south wall of the fort at approximately the location Lisianskii's drawing indicates openings for cannons suggests these may have been platforms for the two cannons used by the Tlingit defenders. The piles of stones formed a small oval heap with the long axis lying at a right angle to the axis of the south wall (Hadleigh-West 1958:49).

Possible Native Artifacts

Many of the artifacts recovered by Hadleigh-West in 1958 are clearly associated with later Russian and American activities that postdate the destruction of the Tlingit fort. There were some artifacts recovered, however, that may have been associated with the *Kiksadi* fort (Table 7.1). Lisianskii reports he saw "plates" inside the fort (Black n.d.:47) making it clear that the Sitka Tlingit had obtained items of European manufacture prior to the 1804 battle, probably both through trade contacts with the English and Americans and as a result of overrunning the Russian redoubt at Old Sitka in 1802. Hadleigh-West had access to Russian artifacts recovered from the site of Archangel Saint Michael's Redoubt and was able to make comparisons between those artifacts and artifacts of European manufacture he excavated in 1958. In addition to the items listed in Table 7.1 some of the other ceramic china, glass, and metal artifacts of European manufacture recovered in 1958 may have been in the possession of the Tlingit defenders at the time of the 1804 battle.

Lisianskii's Drawing of the *Kiksadi* Fort

It is known now, through research conducted as part of the present project, that the unit of scale used in the 1804 Lisianskii drawing of the *Kiksadi* fort is the Russian *sazhen* rather than fathoms as indicated on the drawing included with the 1814 English translation of Lisianskii's journal. Hadleigh-West (1959:59) was correct when he assumed this to be the case and used seven feet rather than six feet as the unit of measure in Lisianskii's scale. The size of the *Kiksadi* Fort, as indicated by Lisianskii, and evidence from the 1958 excavation are in close agreement. Retaining the term "fathom" but using seven feet as the unit of measurement, Hadleigh-West (1958:59-60) points out:

> .....where Lisiansky counts approximately 34 1/2 fathoms (241 feet) for the entire south wall and diagonal corner section, the corresponding distance disclosed by excavation is about 250 ft. The comparative distances of the west wall proper are closer: On Lisiansky's map, 22 fathoms or 154 feet as compared with 157 measured in excavation.....the distance across Lisianksy's fort is about

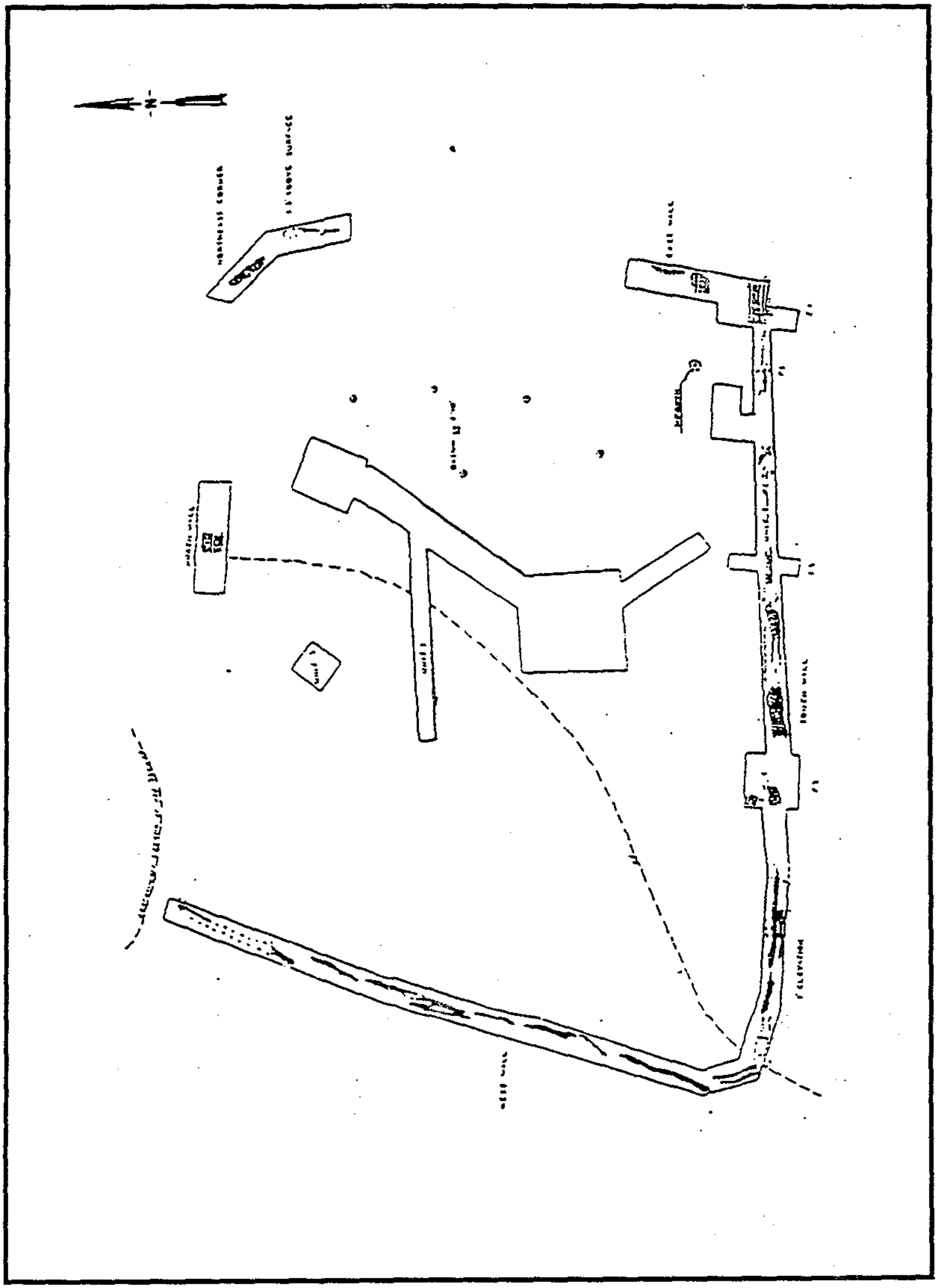


Figure 7.8. Plan view of 1958 fort site excavation from Hadleigh-West (1959).

Table 7.1
Artifacts Possibly Predating the 1840s Excavated at the *Kiksadi* Fort Site in 1958[1]

Provenience	Number	Description	Hadleigh-West Remarks
South Wall	1	Lead shot, ball. Perhaps of about .40 caliber	Found partially embedded in log in middle section of wall. Deformed.
South Wall	1	Glass bead, round. 0.8 cm dia. Moderate Blue (5 B 5/6)	Resembles early trade beads in the western Arctic, where they are presumed Russian via the Chukchi.
South Wall	3	Worked wood. Originally one incomplete piece. Total length 45 cm. 3.5 cm wide. Slightly concave one surface; high rib on opposite.	Superficially resembles section of bow. One of few items of possible Indian manufacture.
South Wall	1	Wooden ball. 3.2 cm dia.	A. Andrews suggested this could be a rattler from a shaman's rattle.
South Wall	1	Spoon. 13.8 cm. Copper alloy; zinc over 10%. Nickel 1-1.5%. Probably nickel plated. Illegible hallmark under handle.	Style of spoon, plus placement of hallmark indicate possibility of contemporanity with the fort.
South Wall	1	Piece of iron kettle with handle	Closely resembles specimen from Old Sitka.
South Wall	1	Cannonball. 7.3 cm. dia. 3 lbs.	Found among timbers of wall. Undoubtedly one the Russians missed in their salvage of their spent shot.
North Wall	1	Small glass bead. Cylindrical. 0.3 x 0.2 cm. Light blue (5 B 7/6)	Appears old. Could be trade bead.
East Wall	2	Iron spikes. Square heads. (1) 22 cm. long; head, 2.5 cm. (2) 18.5 cm.; head, 2 cm.	These resemble spikes from Old Sitka.
Feature 2	4	Sheet copper fragments. Very small	
Feature 2	1	Sheet copper ornament. 5.9 x 1.3 cm. Ends rounded. Slits at either end for attachment.	Many have been worn as part of clothing. Probably Tlingit.
Feature 4	1	Glass bead. Cylindrical. Core white china; glass moderate red (5 R 4/6). 0.5 x 0.4 dia.	Resembles trade beads from western Arctic.
Unit 1	1	Iron tine for fish spear. Edged single barbed point 4.9 cm. long; width at barb 0.9 cm.	
Unit 1	11	Small fragments sheet copper. Some has been folded; 1 fragment has portion nail shaft in it.	Spectroanalysis was inconclusive on whether or not this is native copper.
Unit 1	1	Copper wire. 0.45 cm. dia.	Bent to form hook

1 From Hadleigh-West (1958: 62-75)

> 30 1/2 fathoms or, roughly, 213 feet. That dimension as measured in excavation is closer to 250 feet. A measurement north-south from the sea wall [south wall] to the small area interpreted as part of the north wall gives a figure of approximately 148 feet for the excavated fort; for Lisiansky's fort measurement in a corresponding location yields a figure of a little over 20 1/2 fathoms or about 144 feet.

Although it is not absolutely clear that the linear surface features exposed by Hadleigh-West were the fort walls, any doubt that the Kiksadi fort was not located in the immediate vicinity of the Hadleigh-West excavation has been dispelled by the discovery that the 1958 excavation was conducted in the same location as that indicated as the fort site on the 1818 Golovnin Chart of Sitka Sound as discussed earlier in this report (Figure 7.4). Golovnin's chart was compiled only a few years after the 1804 battle while Baranov and other participants in the battle were still at Sitka. When enlarged, the detail of the mouth of Indian River is sufficient to show that the *Kiksadi* fort was in the immediate vicinity of the 1958 excavation. The low number of possible Native artifacts and limited evidence for structural remains of the fort probably relates to the short time span that the fort was actually occupied (probably only a few weeks) and Russian efforts immediately after the battle to remove anything usable and destroy the fort. Subsequent Russian construction and gardening activity at the fort location in the 1840s and later Park Service landscaping had very likely obscured or destroyed most remaining surface or subsurface evidence of the fort prior to the 1958 excavations.

7.4.2. Recent Cultural Resource Investigations

Archaeological Clearance Surveys in the 1980s

With the notable exception of the 1958 excavations, archaeological work in Sitka National Historical Park has until very recently been limited to clearance surveys and monitoring of specific ground disturbing activities with the potential to impact cultural resources. Archaeological clearance surveys in the park have preceded erosion control work (NPS 1982; NPS 1985) and construction of maintenance buildings and an underground electrical cable route (NPS 1985).

These clearance surveys have not identified or documented archaeological or historical remains other than in the immediate vicinity of the *Kiksadi* fort. Testing by Davis and Staley (NPS 1982:2) at the fort site in 1982 recovered a variety of historic artifacts and cultural debris from disturbed and mixed secondary deposits. In 1985 Griffin (NPS 1985:5), also testing at the fort site, recovered historic materials to a depth of 22 cm below the ground surface "dating no earlier than the 1850s." Griffin (1985) found no other cultural resources elsewhere in the park during his clearance survey.

Indian River Fire Pit

In 1992 Dan Thorington, a Park maintenance employee, noticed a concentration of charcoal exposed in the east bank of Indian River a short distance downstream from two cement bridge foundation blocks in the middle of the river channel (Figure 7.9). The location of the discovery was along a segment of Indian River that had not been previously disturbed by erosion control activities. The exposure was investigated by Sue Thorsen who documented an apparent hearth feature eroding from the river bank. The feature consisted of a discrete concentration of charcoal and fire-cracked rock 40 to 60 cm below the ground surface. No artifacts or faunal material were

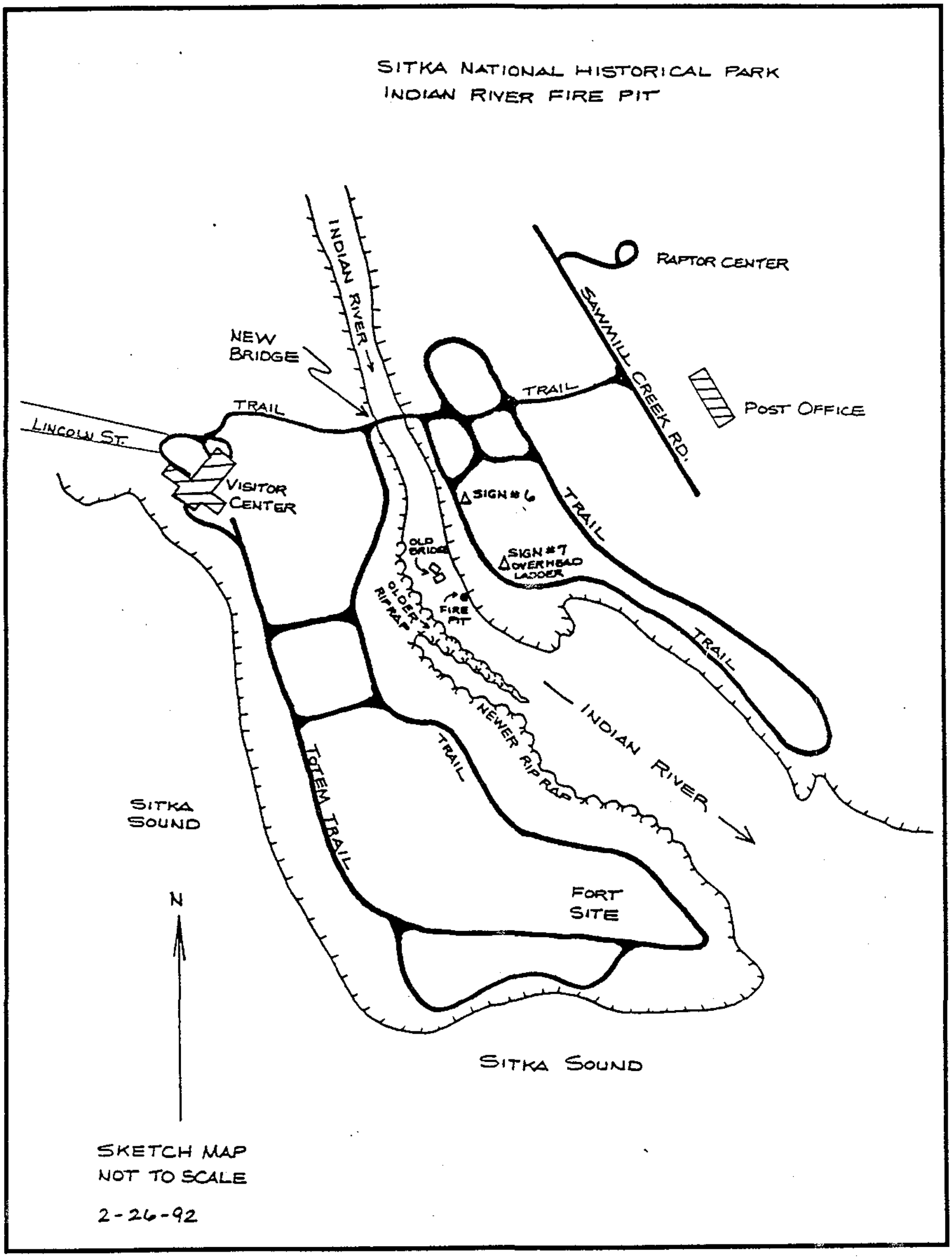


Figure 7.9. Sue Thorson's sketch map of the location of the hearth feature discovered in 1992 eroding from the east bank of Indian River.

found associated with this feature. The hearth was overlain stratigraphically by a very compact stratum consisting of gravel mixed with fine gray silt which Thorsen interpreted as a possible road bed (Thorsen and Thorington n.d.). A charcoal sample was collected by the Park Service but was not submitted for radiocarbon dating (Sue Thorsen, personal comm.).

NPS Mapping Project

A topographic mapping project was initiated by the Park Service in 1992 when Aeromap U.S., Inc. was contracted to undertake the surveying and mapping of the park. The west side of Indian River within the park boundaries was mapped by Tryck, Nyman, and Hayes during the first phase of the project in 1992 based on their own ground survey and 1989 aerial photography taken by Aeromap U.S., Inc. (SNHP Topographic Map). The completion of the topographic mapping project on the east side of the river by Stragier Engineering Services, Inc. in 1995 will result in a one foot contour map of the entire park at a scale of 1" = 100 feet. In addition to natural topography all cultural surface features encountered are being mapped. Examples of the cultural features being mapped as part of this survey effort include the clearing at the *Kiksadi* fort, park totem poles, World War II gun pits and bunkers, World War II privies, culturally modified trees, and the existing park trail system.

Reanalysis of the 1958 Hadleigh-West Artifacts

A new analysis of artifacts from the 1958 excavations at the fort site was undertaken in 1993 by Ty Dilliplane (1993), an historic archaeologist employed by the National Park Service. Preliminary results indicate that identifiable historic artifacts of European manufacture recovered by Hadleigh-West appear to be mostly associated with later Russian dwellings located in the vicinity of the fort area and most post date 1840, however a final report on the artifact analysis is not yet available.(Gene Griffin, personal comm.). A statistical analysis of the fort site artifacts conducted for the National Park Service by Charles Utermohle in 1995 indicates that as many as 353 items (33.1%) recovered from the fort site in 1958 could potentially be contemporary with the Indian River fort. However, most of these artifacts (94.9%) are ceramic items which continued to be in use long after the 1804 battle. In the opinion of Dr. Utermohle only 18 items (1.7% of the artifact assemblage) can be reasonably dated to the period prior to the destruction of the fort site based upon an upper limiting date. These items include one ceramic fragement and 17 iron spikes.

Geoscan Remote Sensing Survey

In 1994 Geoscan Research, under contract to the National Park Service, completed an analysis of remote sensing surveys undertaken at the fort site and at the location of the Russian Memorial. Two separate geophysical surveys were performed by Geoscan. A magnetic field gradient survey was designed to map magnetic anomalies typically associated with metal, brick, and fired soils. A soil resistance survey, conducted at the same time, mapped subsurface variations in soil composition to identify subsurface pits, ditches, and architectural features. Discussion of the technical results of these surveys as presented to the National Park Service (Geoscan 1994) is beyond the scope of the present review and only an abbreviated summary of the results is presented here.

The magnetic field gradient survey at the fort site primarily targeted subsurface iron and metal objects located 25 cm to 75 cm below the ground surface. The results of this survey indicated that iron objects were scattered non-uniformly throughout the site area with a few major clusters. The report (Geoscan 1994:6) states "the major clusters appear to be assemblages of iron objects, as if thrown into a pit." The Geoscan report (1994:7) goes on to say: "The density and magnitude of the magnetic dipoles (iron/steel objects) within these features suggests a modern origin. If these objects were placed in the ground during "back-fill" operations in the modern period, the archaeological record in this area is at best disturbed and may be lost."

The soil resistance survey identified a number of "more or less circular" areas of low resistance features that were interpreted as humus-rich filled pits that "may be the result of human activity or they may be caused by root-ball removal associated with fallen trees" (Geoscan 1994:11). Of particular interest is the failure of the soil resistance survey to identify subsurface features that might be expected to be associated with the construction of the *Kiksadi* fort. The Geoscan report (1994:17) states: "In other surveys performed by the author at a number of contact period settlements associated with the Russian expansion, it is common to detect and map walls and hearth[s]. These surveys of the Tlingit fort are an exception." Three possible explanations for the apparent absence of anticipated subsurface evidence for walls and hearth features are given in the report. These include 1) the subsurface structures have not survived in a form suitable for generating a magnetic or resistance contrast, 2) these structures may have never been substantial enough to generate a magnetic or resistance contrast, and 3) the fort may have been built ON the ground rather than IN the ground (Geoscan 1994:17). Given the historical and ethnohistorical evidence for defensive pits dug at the fort by the Tlingit and the strong probability that central hearth pits were present in the dwellings inside the fort, the failure of the remote sensing survey to identify these types of features can probably be attributed to later ground disturbance to the site area than to the other reasons presented.

Soil resistance and magnetic field gradient surveys at the Russian Memorial site covered only the immediate vicinity of the memorial as presently marked (Geoscan 1994:16). The resistance survey, partly obstructed by ground cover, targeted a depth of 50 cm. No evidence of any interments were identified by the resistance survey. The magnetic survey indicated a number of near surface "midsized" iron objects scattered throughout the 20 x 20 m grid that was investigated. The report (Geoscan 1994:16) states "Graves and likely grave goods, if present are obscured by the scattered iron and steel." It was not possible for the investigators to delineate areas of high or low archaeological potential in the vicinity of the Monument.

Unconfirmed Cultural Resources

Although Golovnin's 1818 chart of Sitka Sound definitively places the *Kiksadi* fort site at the end of the peninsula on the west side of Indian River, there are Tlingit elders presently living at Sitka who believe the fort was located elsewhere. One elder who believes the fort was not at the location currently identified by the National Park Service is Mark Jacobs Jr. (1990:4) who writes: "....the cleared area at the far end of the park was not the site of the fort. That clearing was for placing the totem poles that were borrowed for display at the world fair. The *Kiksadi* fort site is about half way through the park."

Herman Kitka is another Tlingit elder who believes the fort site is actually "further toward town" from where it is presently marked by the Park Service (Herman Kitka, personal comm. February 26, 1995). Mr. Kitka believes the fort site was near the "Battlefield Trail" sign at the intersection where the Battlefield Trail leaves the main footpath and leads down to the beach. According to Mr. Kitka it was near this intersection that offshore dredging activity in 1939 or 1940 encountered "a line of cannonballs" which Mr. Kitka believes would have been in the vicinity of the fort. This area, according to Mr. Kitka, was the only area in which cannon balls were found during gravel dredging activities along the seaward shore of the park peninsula. Mr. Kitka doesn't know what happened to the cannonballs found during the gravel dredging activity.

In spite of the doubts put forth by Mark Jacobs and Herman Kitka, the weight of the evidence is clearly that the *Kiksadi* fort was located very close to the end of the peninsula on the west side of Indian River. Significantly, the Point House people do not dispute that the fort was at the location presently marked as the fort site by the National Park Service (Herb Hope, personal comm.). Several aspects of Point House oral tradition concerning the 1804 battle as related by Herb Hope (personal comm.) suggest that the fort site could not have been on the seaward (western) side of the park peninsula. Point House tradition is clear that the fort was constructed very close to the high tide line and historical accounts of the battle support Native oral history on this point. During construction of the fort in 1803, Point House tradition indicates trees were cleared to the west of the fort to provide a better view in that direction. The Point House oral tradition also indicates that during the second day of the bombardment from the *Neva* most of the Tlingit defenders left the fort and concealed themselves in the woods "slightly" to the west of the fort, leaving only a few young men in the fort to make the Russians believe the fort was still occupied. Both of these events, as handed down orally by the Point House people, are inconsistent with the fort having been located close to the high tide line anywhere along the western side of the peninsula. They are consistent with the fort having been constructed at the location presently landscaped as the fort site.

Oral information from the Native community in Sitka indicates that a Native fish camp was located on the west bank of Indian River downstream from the present park bridge (Gene Griffin, personal comm, October 25, 1994). In an interview with the Park Service Herb Hope (1992b:2) related Tlingit oral history information that indicated Indian River was primarily used as a source for "fresh fish" in the "winter season" and that a fish camp at Indian River would have been rather small by Tlingit standards as opposed to a large summer camp for putting up dried fish.

Over the years visitors to the park have occasionally turned in stone tools or other artifacts allegedly found within the park boundaries. Unfortunately, information concerning the provenience of these artifacts was either not obtained or has been lost. No historic or prehistoric sites other than the *Kiksadi* Fort Site, the Russian Memorial, and the hearth feature discovered eroding from the east bank of Indian River in 1992 had been documented archaeologically within the park boundaries prior to 1994.

7.5 CULTURAL RESOURCES IDENTIFIED IN 1994

7.5.1. Monitoring of Geomorphology Testing

Archaeological monitoring of the 1994 geomorphology fieldwork resulted in the documentation of the first stone tools located within the park for which provenience is known. Several other possible site areas were identified on the basis of charcoal concentrations that appeared to be of cultural origin. While the purpose of the present field study was not to document cultural resources or conduct an archaeological survey, the nature of the fieldwork and presence of an archaeological monitor provided an opportunity to record cultural resources encountered to the degree possible considering the scope of work. Under the terms of the Park Service work order subsurface testing was stopped upon encountering cultural material and the Park archaeologist notified. Because of this constraint and because the purpose of the fieldwork was not to record cultural resources, none of the sites or potential sites discovered in 1994 were fully investigated.

Isolated Stone Artifacts

Two large unifacially worked cobble choppers were found associated with separate tree throw depressions on the peninsula to the west of Indian River (Map 3, Figure 7.10). The larger of the two chopping tools (94-Sitka-1) was encountered in a subsurface test placed at the edge of an extensive root wad depression (see Figure 3.5). In the course of facing the edge of the depression a massive basalt cobble with unifacial retouch was encountered lying horizontally 10 cm below the surface in the organic horizon. The organic horizon overlay a thin discontinuous tephra lens at 20-22 cmbs which was present at the contact with the underlying cobble/gravel sediments which formed the basal unit in most of the 1994 test pits. A radiocarbon date of 280 +/- 70 B.P. (cal. AD 1650) was obtained on charcoal associated with the tephra lens at the contact between the organics and the cobble/gravel sediments (Appendix B, C14 sample "D-2-1"). Unfortunately this date is an anomalous date which is much younger than the estimated maximum limiting date of about 4,550 years B.P. for this location based on other radiocarbon dates obtained within the Park. The discontinuous nature of the tephra lens below the artifact and the location of test at the edge of a large tree throw depression suggests that this artifact may have been displaced from its original position in the stratigraphy at the time the tree fell. For these reasons the radiocarbon date on the underlying tephra lens cannot be considered a maximum limiting date on this artifact. This cobble chopper was initially collected by the NPS on October 20, 1994 and then, a few days later, returned to its original location by Park Service archaeologist Gene Griffin. Lack of other artifacts or evidence of cultural material in the two subsurface tests in this vicinity and failure to identify additional artifacts in the root wads of nearby tree throws suggests that artifact 94-Sitka-1 is an isolated find not associated with other cultural material.

A second unifacial cobble chopper (94-Sitka-2) was discovered next to a footpath 50 feet east of Test "I-1" (Map 3, Figure 7.10). This heavy chopping tool, made by the removal of large flakes from one side of a basalt cobble, is similar to the lithic technology exhibited by artifact 94-Sitka-1. Artifact 94-Sitka-2 was found seven feet west of the footpath during inspection of tree throws in the immediate vicinity of sampling location "I-1". The artifact was lying on the ground surface, directly below a massive wind-thrown root wad. A second possible basalt artifact, possibly a fragment of a ground stone abrader, was found lying next to this cobble chopper but it was not certain that this was unquestionably an artifact. Both the cobble chopper and possible abrader had clearly been displaced by the uprooted tree and appear to have fallen out of the root wad directly above them. No other artifacts were found in the root wad or on the ground surface below the tree throw. The Park Service was notified of this second artifact find but as of the end of the geomorphology field work on October 25, 1994 this cobble tool and the possible abrader remained uncollected.

Charcoal Concentrations of Possible Cultural Origin

Approximately 200 feet southwest of the western end of the Indian River bridge, a dense concentration of subsurface charcoal was encountered on a low bench 72 feet west of sampling location "F-1".(Map 3). The charcoal was discovered in a soil probe which was expanded into a shovel test exposing a 10 cm thick charcoal lens directly above sand. No artifacts or faunal material was observed in the initial shovel test but because this charcoal appeared to be of cultural origin shovel testing at this location was terminated. Four soil probes placed 13 feet out from the initial shovel test in different directions all hit dense charcoal concentrations and indicated that this thick charcoal lens covers an area of at least 13 x 23 feet or about 300 sq. feet. Charcoal was

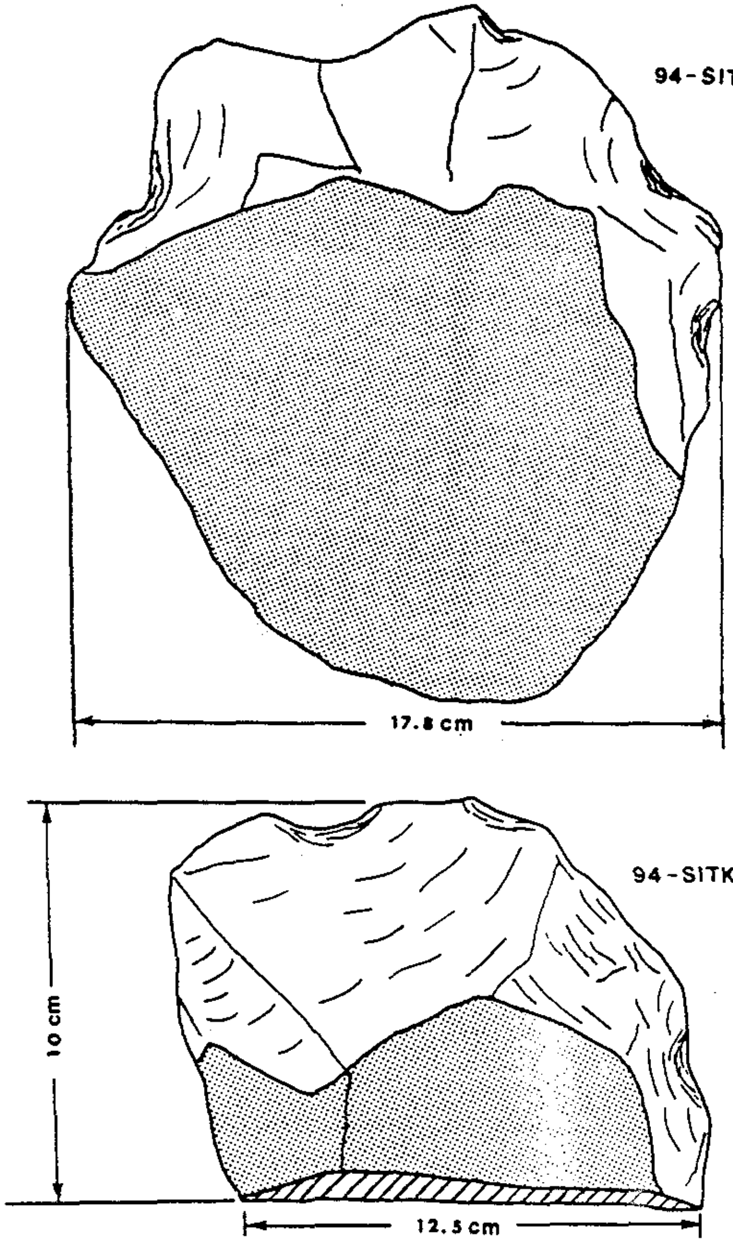


Figure 7.10. Dorsal views of two unifacial cobble choppers (94-Sitka-1,2) found on the west side of Indian River in Sitka National Historical Park during the 1994 geomorphology study.

encountered in many of the soil probes and sampling locations on the west side of Indian River but normally consisted of charcoal flecks associated with the thin tephra lens that was found directly overlying the cobble/gravel sediments. Once it was determined that the charcoal at this location was probably of cultural origin all testing was stopped and the park archaeologist notified of the possible site. Oral information previously obtained by the Park Service from Native informants indicates an undocumented Native fish camp may have been located in the vicinity of this subsurface charcoal (Gene Griffin, personal comm.).

Another charcoal concentration discovered on the west side of Indian River during subsurface testing may also be of cultural origin. This 4-8 cm thick charcoal lens was encountered 8 cm below the surface in the east wall of test "E-2" placed at the north side of an uplifted paleo-beach ridge. This charcoal lens, containing large chunks of charcoal, was located at the contact between modern organics and unconsolidated beach sediments consisting of cobbles, pebbles, and gravel. The charcoal appeared to occur in a discrete concentration (like a hearth feature) rather than as part of a continuous lens and terminated abruptly at the edge of the paleo-beach ridge (see Figure 5.10). No artifacts or faunal material was found in association with the charcoal lens and it was not certain at the time of testing that it was a cultural feature. A radiocarbon date obtained on charcoal from Test "E-2" yielded a modern date of 10 +/- 50 B.P. (Appendix B, C14 sample "E-2-1"). Calibration of this standard radiocarbon date indicates two possible calibration ranges: AD 1825-1835 and AD 1880-1915. The modern date on charcoal from Test "E-2" is a strong indication that this charcoal concentration is probably of cultural rather than natural origin. The slight depression on the eastern side of the paleo-beach ridge would have very likely provided a sheltered place to make a fire.

One additional charcoal sample collected from the cut bank on the east side of Indian River may be of cultural origin. This sample was collected from Test "R-1" located in the vicinity of the hearth feature recorded in 1992 by Sue Thorsen (Figure 7.9). A careful inspection of the cut bank of Indian River at this location failed to locate fire-cracked rocks or other cultural material clearly associated with the hearth previously identified by Sue Thorsen but did identify a small concentration of charcoal 46 cm below the top of the cut bank (approximately the depth as the hearth feature recorded in 1992). A modern radiocarbon date of 60 +/- 80 B.P. was obtained on charcoal collected at this location (Appendix B, sample R-1-1). Calibration of this date yielded two calibration ranges: AD 1690-1735 and AD 1815-1925. Whether this charcoal is associated with the hearth feature recorded in 1992 is uncertain but the documentation of a hearth feature in this vicinity at approximately the same stratigraphic position in the cut bank suggests that the charcoal recovered from the cut bank at Sampling Location "R-1" is also of cultural origin.

Culturally Modified Trees

During the course of the geomorphology fieldwork seven culturally modified trees (CMTs) were observed and recorded (Table 7.2). Two CMTs were observed on the east side of Indian River and five on the west side (Map 3). Of the six trees that could be identified as to species, all were Sitka spruce. Langsdorff (1968 [1814]:131) observed in 1806 that the Sitka Tlingit "....eat besides muscles....a sort of square cake made of the bark of the spruce-fir, pounded and mixed with roots, berries, and train-oil." Cultural modification of trees by the Tlingit and other Native groups on the Northwest Coast has been discussed in detail by McCallum et al. (1991) and by Mobley and Eldridge (1992). It is likely that additional CMTs are present in the park since only those fortuitously encountered in the course of the geomorphology investigations were recorded.

TABLE 7.2

Culturally Modified Trees Identified in Sitka National Historical Park

CMT #	TREE SPECIES	SCAR DESCRIPTION	LOCATION	COMMENTS
1	Spruce	Irregular Oval	West side of Indian River. On south side of path, 26 m (85 ft) west of signpost at Indian River bridge.	60 x 75 cm north facing scar exhibits heavy hacking (metal ax cuts).
2	Spruce	Narrow Oval	West Site of Indian River, 16 m (53 ft) west of path along east side of peninsula (see map)	North facing scar exhibits hack marks (metal ax cuts).
3	Spruce	Oval Alcove	West side of Indian River. 41 m (135 ft) south of highest elevation in park near SE corner of maintenance shed.	50 x 120 cm scar faces north (uphill) and exhibits hack marks (metal ax cuts). Tree is at break in slope where 45 degree slope does down to wet marsh.
4	Spruce	Blaze	East side of Indian River. Very close to park boundary near Sawmill Creek Rd. turnout.	101 in diameter tree (largest dia. tree mapped in park). Hacking marks (metal ax cuts).
5	Spruce	Triangular	East side of Indian River. 6 m (20 ft) SE of Russian Memorial	Basal scar measures 43 x 135 cm tapering up from ground level.
6	Unknown (Snag)	Blaze	West side of Indian River ca. 30 m (100 ft) south of path from visitor's Center to Indian River bridge. 8 m (26 ft) @ 320 degrees from Test D-2 where cobble chopper (94-Sitka-1) was recovered.	Scar is 15 x 50 cm with hacking marks (metal ax cuts).
7	Spruce Snag	Blaze	West side of Indian River. Close to CMT #6. 12.8 m (42 ft) @ 320 degrees from Test D-2.	Scar measures 8 x 46 cm.

Other Cultural Resources

The recent topographic survey of Sitka National Historical Park has mapped many cultural features including modern totem poles as well as World War II gun emplacements, bunkers and privies. Since the primary purpose of the present field research was not the documentation of cultural resources, no effort was made to further investigate previously mapped cultural features. During the course of the geomorphology field work two cement bridge foundations were noted in the channel of Indian River approximately 400 ft downstream from the present bridge location (Figure 3.6). Also noted was a deep depression, apparently of cultural origin, and a heavy timber located on the east bank of Indian River approximately 350 ft upstream from the present bridge location. The timber may be part of the remains of a wagon bridge shown at at this location (at the park boundary) on a 1919 map of the Monument (U.S. Survey No. 1258) (see Figure 4.4). Boards and other non-historic cultural material was also observed eroding out of the east bank of Indian River 200 feet south of the Russian Memorial where debris from a demolished hot asphalt plant had been buried in 1958 (see Figure 3.7).

7.5.2. Metal Detector Survey Results

The availability of a metal detector (used primarily for locating survey monuments) made a trial metal detector survey of the peninsula on the west side of Indian River possible. The survey involved only about an hour and consisted of four transects between the eastern and western footpaths along the margins of the peninsula (Map 3). The metal detector survey was not a complete systematic survey. It was simply a test of the metal detector intended to provide some indication as to the effectiveness of a metal detector in locating buried artifacts, and to access the potential for the presence of subsurface historic artifacts in the area immediately west of the *Kiksadi* fort.

In Juneau, prior to the start of fieldwork, a controlled metal detector test had been conducted using modern round .50 caliber lead musket balls buried at known depths in unconsolidated gravel and sand fill. The metal detector used was a Coinmaster Classic III manufactured by White's Electronics, Inc. The detector was used in the GEB mode which detects all types of metals. It was found that a single musket ball gave a strong magnetic signal up to 13 cmbs and that this signal became progressively weaker until at 18 cmbs it could no longer be detected. The shallowness of the soil at the southeastern end of the park peninsula (8-14 cm deep at Test "L-1") should have allowed metal objects as small as a musket ball to be detected in the area of the test transects. In his testing at the fort site location Griffin (1985:5) recovered historic material to a depth of 22 cmbs, below which he encountered only "culturally sterile alluvial deposits." Based on information from our own testing and prior Park Service testing in the vicinity of the fort site, it appeared that most metal artifacts in the test area should be close enough to the ground surface to be easily detected.

The metal detector survey was conducted following compass transects from known points identifiable on the park topographic map. Coverage along these transects was discontinuous due to dense vegetation, fallen trees, or irregular terrain which in some areas made "sweeping" the ground with the metal detector loop impossible. The metal "hits" that did occur were physically marked with a pin flag and the approximate location marked on the topographic map. After all four transects were completed, each pin flag was revisited and a shovel test dug to identify the object responsible for the magnetic signal. All objects located were left in place, shovel tests backfilled, and pin flags removed. The items located were all of relatively recent age (Table 7.3).

Table 7.3

Results of Trial Metal Detector Survey Northwest of Fort Site

Transect #	Hit #	Depth	Object	Comments
1	1	~ 4 cm	Rusted "church key" type can opener	In deep depression near footpath. Recovered from organic horizon. Modern.
1	2	< 8 cm	Brass center fire cartridge case	Located 15 ft. SW of footpath along river. Found in sandy soil below 4 cm thick organic horizon. Cartridge is 0.8 cm dia. at neck, 1.0 cm rim dia., 2.5 cm long. Base says "WRA CO MAUSER 7-63".
3	3	~ 12 cm	Brass center fire cartridge case	Approx. midway between foot paths. Cartridge is 1.7 cm dia. at neck, 1.2 cm rim dia., 6.3 cm long. Base has "S", "L", "4", "5" around circumference; neck has a cupped crimp - possibly a blank. Possible WW II military cartridge.
3	4	< 2 cm	Coin, 1975 Liberty head dime. Denver Mint.	Approx. midway between foot paths. In forest duff.
4	5a-c	~ 5 cm	a: tin foil b: Beer can c: > 1 m long length of telegraph wire.	Approx. 30 ft. west of edge of fort site clearing - between the clearing and two deep pits (WW II bunkers?) this area had a high concentration of "hits", only three were investigated.
4	6	10-15 cm	Round wire nail with flat head.	Same vicinity as hits 5a-c. In organic horizon. 9 cm long.

Subsurface metal was detected on three of the four test transects. In addition to five isolated "hits" and a concentration of more than eight "hits" occurred in a five meter diameter area to the northwest of the fort site clearing, between the clearing and two or three deep pits which are probably WW II bunkers. Limited time only permitted three of the "hits" in the area of concentrated metal to be investigated (transect 4; 5a-c). The discovery of buried telegraph wire at this location and what appear to be World War II bunkers nearby suggests that much of the metal in this area may be related to World War II activity. The variety of metal detected at depths ranging from 2 cm to as much as 15 cm below the surface suggests a systematic metal detector survey would be able to locate objects as small as a musket ball if they were present. Certainly if any cannon balls remain in the area from the 1804 battle they should easily be located by a metal detector survey utilizing closely spaced transects.

One other concentrated area of subsurface metal was fortuitously discovered on the east side of Indian River. A random metal detector check in the vicinity of Sampling Location "Q-1" (Map 1) was conducted after a decomposed fragment of wood with a large rusted iron spike was encountered in Test "Q-1". Approximately a dozen metal "hits" were concentrated in a 20 ft diameter area around Test "Q-1". None of these "hits" were investigated by subsurface testing and the wood fragment with the spike was replaced during the backfilling of Test "Q-1" after notifying the Park Service of the find. The number of magentic "hits" in this area suggests the possibility that a structure of some sort may have once existed at this location.

Cast Iron Stove

The remains of a cast iron stove was discovered, after dark, in the final minutes of the 1994 field work, thus allowing no opportunity to record the artifact or investigate the immediate site area. The stove, all but a corner of which is concealed by moss and forest duff, is located just within the tree line near the northeast corner of the "upper" Visitor Center parking lot. The visible corner sticks up 28 cm from the ground surface. At the time of discovery it was located 15 feet northeast of a portable Park Service outhouse placed at the northeast corner of the upper parking lot. It was not determined whether the stove was an isolated find, an artifact associated with a historic structure, or was part of an historic trash dump.

7.6 Archaeological Potential of Park Landforms

7.6.1. Introduction

As discussed previously in this report the landforms found within the boundaries of Sitka National Historical Park can be broadly categorized as 1) active beach, 2) uplifted beaches, 3) active river channel, 4) abandoned river channels and floodplains, and 5) bedrock outcrops. The major geomorphic processes that have produced the present Park landscape and which have influenced past human activity in the study area include the emergence of the land (possibly resulting from both isostatic and tectonic forces) and the interplay between coastal wave action and the erosional and depositional action of Indian River. In terms of evaluating the archaeological site potential of SNHP landforms there are several important factors to consider. The landforms found on the western and eastern sides of Indian River have been formed as the result of drastically different geomorphic processes. The peninsula west of the river which rises to a maximum elevation of 41 feet is formed by uplifted beach deposits while the lower elevation terrain east of the river is largely a product of fluvial erosion and deposition which has created a complex "cut and fill" topography. In the evaluation of archaeological site potential within the

Park it is of utmost importance to recognize that Park landforms were quite different in the past than they are today. Because of regional uplift most of the land within the park has only been available for human use in the late Holocene and the entire park area was probably below the reach of storm waves until just prior to about 5,500 years ago. Shorelines have changed over time as a result of land emergence and the dynamic interplay between Indian River and coastal geomorphic processes as discussed previously in this report. The extent of *present* shorelines and terraces do not represent the extent of *former* shorelines and terraces. Because of these factors it is essential to evaluate prehistoric artifact finds and archaeological features or site locations in terms of past environments.

There are a number of geomorphological and historical factors that complicate the determination of the archaeological site potential for landforms within the Park. While terrestrial soil horizons and volcanic tephra do provide some stratigraphic lateral continuity, the dominant geomorphic processes that have shaped the Park landscape have not generally resulted in lateral continuity of landforms. In fact, on the east side of Indian River lateral continuity of landforms is essentially non-existent. Well-defined continuous river terraces are not discernible on this side of the river because they have been constantly reworked by a meandering river. Instead of floodplain terraces the Park land east of Indian River is largely characterized by discontinuous "pockets" of fluvial sediment truncated by old river channels. The uplifted beach deposits which form much of the land on the peninsula west of Indian River originate from wave deposited sediments which also lack original lateral continuity so that stratigraphic correlation between even nearby locations can be difficult or impossible. On both sides of Indian River centuries of tree fall have churned and mixed the soils which have developed on beach and river deposits. This bioturbation has subdued and even destroyed surficial landform characteristics often effectively masking boundaries between landforms. This type of bioturbation has been a major factor in destroying much of the natural near-surface stratigraphy. In addition to these natural processes, ground disturbance by humans since the 1804 battle has further confused or destroyed the natural landscape and stratigraphy at many locations in the Park. These human impacts which include early Russian activities and later homesteading, military, and Park Service activities have already been discussed in detail. It is obvious that landscaping, totem pole restoration activities, World War II gun emplacements and other types of land disturbance in the vicinity of the *Kiksadi* fort site have left little potential for finding undisturbed stratigraphy or intact archaeological features in this location. Road and trail construction, totem pole excavations, building and parking lot construction, gravel dredging and erosion control activities, an asphalt plant, and a landscaped picnic shelter are only some of the more recent ground disturbing human impacts which have masked the natural landscape and confused the natural stratigraphy elsewhere in the Park. The impact of earlier and less well documented road building, homesteading, and gardening activities in the 19th century are even more difficult to access in terms of potential impact to prehistoric sites.

In spite of the difficulties outlined above, some general statements can be made concerning the archaeological potential of various park landforms as defined by the present geomorphology study. Of the five primary geomorphological landforms identified within the Park in this study, the active beach and river channel have little or no potential of containing *in situ* cultural material simply because they consist of sediments which are being reworked in modern times. Redeposited artifacts may be present in these locations but the potential for recovering artifacts in cultural context is minimal. Cultural sites associated with bedrock outcrops are unlikely to be present within the Park boundaries. Exposed bedrock was identified only along the west bank of Indian River at the Park boundary, upstream from the footbridge. While bedrock outcrops have the potential for the formation of caves or rock shelters which may contain evidence of past human activity and rock art is occasionally associated with exposed bedrock near the mouths of anadromous streams in Southeast Alaska, there appears to be little potential for these site types to be present in the Park. Given the amount of Russian and American activity along Indian River dating back to the early 1800s and the heavy recreational use of the area in the 1900s it is highly unlikely undiscovered cultural resources are associated with the small amount of bedrock exposed in the Park.

The two geomorphological zones within the Park that have the greatest site potential are uplifted beaches and river floodplains. These were the areas that were most intensively investigated during the geomorphology study. The landform dates presented on Map #1 and in the discussion that follows represent when the land was first able to support terrestrial vegetation although it should be recognized that in many cases the land may have actually been formed by waves or water prior to these dates. The dates obtained from radiocarbon analysis of organic material represent when the land could have supported permanent habitation for plants or humans. It is conceivable that artifacts older than these dates could have been deposited on these landforms from temporary activity sites below high tide line, redeposited below high tide line by stream or wave action, or have been dropped overboard from watercraft. The occurrence of isolated artifacts deposited in these ways would seem to be relatively rare and such artifacts would not be expected to be found in primary context. It also should be recognized that the date of land emergence provides only a maximum limiting date for that locality, since once land is emergent more recent sites of any age can be present. Except for intertidal areas and recently emerged tidelands below about 10 feet in elevation, historic sites and artifacts dating as early as 1804 can potentially occur in primary depositional context anywhere within the Park boundaries.

7.6.2. Indian River Peninsula

The highest elevation on the peninsula west of Indian River is found near the northern Park boundary where a Park Service maintenance shed has been constructed. The land, rising to an elevation of 41 feet above mean sea level at this location, forms a small knoll. This knoll, initially a small island, was the first land in the Park to emerge from the ocean and consequently the date of emergence provides a maximum limiting date on archaeological sites that can potentially be present within the park boundaries. This knoll is estimated to have emerged around 5,500 years ago and any archaeological sites within the Park are not expected to date earlier than this. Moving southward and decreasing in elevation the land becomes progressively younger as does the maximum potential age of archaeological sites (Map #1). The full extent of the low ridge on which test pits "D-1", "D-2", "E-1", and E-2" were placed -- which extents south from the knoll -- was probably emergent by 4,500 years ago. This date could be considered as the probable maximum limiting date for any artifacts or sites occurring on this ridge. Land below approximately 20 feet in elevation on the peninsula was below the influence of storm waves until approximately 2,000 years ago. Thus it appears that any archaeological sites or artifacts occurring west of Indian River below the elevation of the base of the ridge (an area which includes the entire southern end of the peninsula) could not be more than about 2,000 years old. The maximum potential age of sites decreases with decreasing elevation towards the southeastern tip of the peninsula. The majority of the land in the immediate vicinity of the *Kiksadi* fort site emerged from the sea only about 500 years ago (ca. AD 1,500). Land below about 10 feet in elevation at the extreme end of the peninsula where the battlefield trail has been constructed was still largely intertidal in 1804 and consequently has very little, if any, prehistoric site potential.

Based on the geomorphology reconstruction, the area which appears to have the highest potential for the oldest evidence of human activity in the Park is a small terrace south of the Park Service maintenance shed in the vicinity of Sample Locations "B-1" and "B-2". This terrace is estimated to have emerged some time between 4,600 and 5,500 years B.P. During this time the terrace would have been a beach situated at the base of a knoll fronting on a small estuary formed behind a gravel bar extending to the southeast (Figure 6.3). This location, offering a sheltered canoe landing with nearby high ground, near the mouth of Indian River would probably have been an attractive camp location during this time period.

The former estuary area at an elevation of 21 feet is presently poorly drained and the deep clast-free deposits encountered at Sample Locale "C-1" suggest an extended period of terrestrial soil development which began sometime after about 4,500 yr B.P. The water-saturated soil in the vicinity of Sample Locale "C-1" could be expected to have preserved any organic artifacts associated with an archaeological site which might have existed in this area. A radiocarbon date of 2220 +/- 60 yr B.P. (cal. 215-350 BC) was obtained on a well preserved piece of wood excavated from 55 cmbs at Sample Locale "C-1". Archaeological testing of this area would be complicated by ground water and a large amount of undecomposed subsurface organic material however this is one of the few locations in the park with deep stratigraphy and the possibility for the preservation of organic artifacts dating to the mid-Holocene.

The potential for sites dating as early as 4,500 years B.P. would seem to be fairly good along the ridge line south of the knoll where Sample Locations "D-1", "D-2", "E-1", and "E-2" were located at about 24 feet elevation. This landform would have formed a low projecting peninsula between Indian River and the coast between about 4,500 and 2,000 (or possibly 1,700) yr B.P.

7.6.3. East Side of Indian River

The lower elevation terrain on the east side of Indian River is much more complex geomorphologically than the land on the west side of the river. Here the terrain consists of a mosaic of old floodplains and abandoned river channels. The meandering of Indian River has constantly reworked this area alternatively eroding and depositing sediments. Prior to the construction of Sawmill Creek Road it appears that a number of small drainage channels crossed the floodplain and emptied into Indian River from the northeast. Sawmill Creek Road seems to have blocked this former drainage pattern. The placement of fill along the route of the old wagon road paralleling the east side of Indian River adds to the complexity of sorting out the natural geomorphologic processes that have shaped the landscape on this side of the river. The overall picture of the present landscape here is that of portions of relic river channels that have been modified by cross-cutting minor drainage channels and modern road fill. When the masking effect of bioturbation from tree fall is added it is not surprising that the topography on the east site of the river defies a simple geomorphological reconstruction of its morphogenesis.

For these reasons few generalizations concerning archaeological site potential can be made with the limited level of field data it was possible to collect on the east side of the river. It is apparent that the maximum land elevation of approximately 26 ft on the east side of Indian River means that the terrain on this side of the river is more recently emergent and the maximum potential age of sites east of the river could not be greater than about 4,500 years B.P. (the age of the park tephra). The absence of evidence for a tephra horizon below about 20 feet in elevation and the irregular ground suggest both more recent emergence and continual reworking of the floodplain by Indian River. A radiocarbon date of 1020 +/- 50 years B.P. (cal. AD 1015) obtained on wood from a log overlain by more than seven feet of fluvial sediments demonstrates that a maximum limiting date on any artifacts or archaeological sites below an elevation of about 15 feet on the east side of Indian River could not be more than a few hundred years old. The potential for older sites east of Indian River is restricted to elevations above about 15 feet at the southeast corner of the Park in the vicinity of the Russian Memorial where tephra is present, or at the extreme northeast corner of the Park, an area only briefly field investigated but where topographic mapping shows land between 15 and 26 feet in elevation.

7.6.4. Disturbed Areas

As has been apparent from the literature review much of the intertidal zone along the Park coastline has been drastically altered by large scale dredging activity along the seaward shore of the peninsula and at the mouth of Indian River. Most of the western bank of Indian River at the end of the peninsula consists of artificially placed riprap and rock fill appears to also have been placed along much of the coastal side of the peninsula as well. Dredging, wave and river erosion, and human efforts at erosion control have altered the coastline of the peninsula and the western bank of Indian River to the extent that there is almost no potential for undisturbed archaeological sites to exist anywhere along the extreme margin of the peninsula. Recent human impacts to the inland portion of the peninsula have been so extensive that any archaeological finds, especially in the vicinity of the *Kiksadi* fort site, need to be carefully documented in terms of their stratigraphic position to determine whether or not associated artifacts are in primary or secondary context.

Areas of little or no archaeological potential on the east side of Indian River include a large area of recently formed tideland at the mouth of Indian River immediately west of the Russian Memorial (see Figure 4.8 b). Aerial photos show this erosion of the east bank of Indian River to have occurred since 1929. This area of recent erosion is immediately upstream from the abandoned asphalt plant and the area of recent trailer park fill. The east bank of Indian River from the trailer park to Sample Location "R-1" is either very recently eroded or a result of artificial landscaping. Upstream from the asphalt plant location erosion control activity has not artificially altered the river margin and the rapid erosion of the cut bank between the asphalt plant and the present footbridge makes the potential for future discovery of cultural features or artifacts eroding out of the east bank of Indian River fairly high. An undated hearth with associated fire-cracked rock discovered in this area in 1992 has been discussed previously.

7.6.5. Specific Areas of High Site Potential

The intent of the present study was not to identify or document specific cultural resources, however, in the course of the geomorphology fieldwork artifacts and several possible cultural features were identified in the Park. Specific cultural resources encountered during the course of the geomorphology field work have already been discussed but the implications of such finds remain to be briefly addressed.

Isolated Artifact Finds

The two unifacial cobble choppers identified in the park were both located on the west side of Indian River on terrain of different maximum age. Artifact 94-Sitka-1, found at Sample Location "D-2", was located at an elevation between 24 and 25 feet on a north-south trending ridge line thought to have emerged above the reach of storm waves about 4,500 years ago, an approximate maximum limiting date for this artifact. Artifact 94-Sitka-2, observed under a root wad, was located on the ground surface about midway down the peninsula at an elevation between 18 and 19 feet. The land surface where this second cobble chopper was found emerged above the reach of storm waves approximately 2,000 years ago, and this would be the approximate maximum limiting date on this artifact. Since both artifacts are morphologically quite similar and the artifact found on the ridge could have been deposited anytime after 4,500 years ago it is likely that both tools are probably less than 2,000 years old.

While heavy unifacial pebble and cobble flake tools are commonly found associated with early Holocene archaeological sites in Southeast Alaska this generalized tool type provides little chronological information since it occurs over a wide time span on the Northwest Coast from the early Holocene to historic period sites (Borden 1975:59, Griffin 1984:54). Unifacial pebble flake cores are associated with Moresby tradition sites dating between about five and eight thousands years ago in the Queen Charlotte Islands (Borden 1975:22). Cobble tools are also found at Ground Hog Bay in Icy Strait (Ackerman 1968) and at the Hidden Falls site on Baranof Island (Davis 1990a) where they are associated with artifact assemblages that date between approximately 8,000 and 9,500 years old. The cobble tools documented in Sitka National Historical Park are clearly of much more recent age since the locations at which the artifacts were found were under water in the early Holocene. No evidence of associated sites or archaeological features were identified at the locations where the stone tools were found and it is most likely that the two artifacts were expedient tools possibly used in plant procurement activities and discarded after use (Griffin 1984:27). The importance of the discovery of these two cobble choppers is that for the first time in the history of Sitka National Historical Park the provenience of stone tools has been documented within the park boundary, demonstrating a clear potential for other stone tools and prehistoric sites to exist in the Park.

Subsurface Charcoal Concentrations

An extensive concentration of subsurface charcoal encountered on a low bench west of Sampling Locale "F-1" (Map #3) is very likely of cultural origin. The elevation of the small bench at this location is between 16 and 18 feet suggesting a maximum age of this charcoal of about 350 years B.P., although it is probably more recent and could easily be historic. The potential for the presence of sites elsewhere on this river terrace would seem to be relatively high. At about this time this bench formed a narrow river terrace between the western margin of Indian River and the higher terrain to the west which would have provided a relatively level sheltered area along the river margin.

A charcoal concentration dated to 10 +/- 50 years B.P. (cal. between AD 1825 and AD 1915) encountered at Sample Locale "E-2", adjacent to the north side of a paleo-beach ridge is also probably cultural in origin and suggests the potential for finding other hearth or campsites may be fairly high on the sheltered north or northeast (lee) sides of uplifted paleo-beach ridges on the peninsula west of Indian River. Paleo-beach ridges were identified between 16 and 24 feet in elevation along the mid-line of the peninsula at Sample Locations "E-1", "E-2", and "J-2-1" but may exist at other locations and elevations as well.

Kiksadi Fort Site

The literature and map review conducted as part of the present study leaves little doubt that the site of the Tlingit fort attacked by the Russians in 1804 was at or in the immediate vicinity of the 1958 excavations conducted by Hadleigh-West. In a sense this is somewhat disappointing because the extensive landscaping and other ground disturbance at this location greatly reduces the potential for recovering archaeologically meaningful data from the fort site. It does appear that efforts to locate an alternative location for the fort site within the Park can be discontinued. This does not mean that the features excavated in 1958 were necessarily portions of the fort and, in fact, Dilliplane's (1993) analysis of the artifacts recovered indicates most of the cultural material recovered by Hadleigh-West postdates the 1804 battle and is very likely associated with Russian dwellings present at this location in the 1840s and 1850s. The fort site area remains a very high potential area for both prehistoric and historic artifacts although there is little chance of recovering artifacts in primary context. The possibility of features associated with the *Kiksadi* fort or later Russian dwellings having survived undisturbed in the shallow stratigraphy at the fort site is low.

Other Sites

Metal detector test transects across the peninsula northwest of the fort site have demonstrated the potential for historic metal artifacts to occur just about anywhere on the peninsula regardless of elevation. Artifacts associated with the World War II occupation of the Park by the military are likely to be concentrated in the vicinity of the bunkers and gun emplacements mapped by the NPS near the end of the peninsula. It is also possible that metal hardware from one of the original Russian blockhouses, incorporated in the construction of the 1927 replica blockhouse, is mixed with the beach gravels where the block house was bulldozed onto the beach and burned in 1959 (Map 3).

The report of a Native fish camp on the east side of Indian River (H. Hope, personal comm.) at the time of the 1804 battle is the only specific indication at present for prehistoric use of the east side of the river. It is highly unlikely that any evidence of an early 19th century Native fish camp on the east bank of the river has survived the river bank erosion and human impacts that have occurred over the last two hundred years. It was demonstrated by excavation in 1958 that the location previously though to be a Russian grave site on the east side of Indian River was a Memorial site rather than an actual burial site. It is remotely possible that one or more actual grave sites exist somewhere on the east side of the river, containing either the bodies of Russians who fell during the 1804 battle or the 30 or so Tlingit bodies found outside the fort following the battle. There are few historic leads to indicate whether there were actually any burials at all and there is no solid evidence at present, either historical or archaeological, indicating human remains are buried within the Park boundary.

Although the Haley homestead, occupied between 1882 and 1910, was located outside the Park boundaries it is possible that artifacts or features associated with 19th century or early 20th century Russian or American structures are present on Park property. It appears possible that the cultural features and much or all of the garden area indicated on the east side of the river mouth by the 1850 Teben'kov chart could have been lost to erosion. The proximity of these features to the eastern bank of Indian River in 1850 and the extensive erosion along this side of the river in the 1900s suggests there is little chance they could still be archaeologically discernible. However, the rusted spike encountered at Sampling Location "Q-1" and numerous subsurface metallic objects in the immediate vicinity of this test suggest that this area at about 10 feet in elevation has a high potential for producing historic artifacts and may have been the site of a structure of some sort.

SECTION EIGHT

8.0 RECOMMENDATIONS FOR FURTHER RESEARCH

The eye sleeps until the mind awakens it with a question.

Arabian Proverb

All research projects inevitably generate additional questions beyond the scope of the study at hand. This investigation has resolved some questions which have puzzled many people involved with Sitka National Historical Park over the decades, however more remains to be done.

Perhaps the most overwhelming factor encountered during this investigation was the vast amount of information currently residing in the Park's archives. Access to these archives was quite limited but future researchers should be aware of the volume of information available. Future projects should budget ample time to review this data base.

A tremendous quantity of information about the Sitka region (including Indian River) is scattered in various libraries and archives throughout the world. This location has been visited and documented by many people since the arrival of European explorers in the 1700s. Perhaps more long term documentation exists concerning this area than any other location along the Pacific northwest coast. Consolidating this information could be a lifetime pursuit. Recently improved access to historic Russian documents will undoubtedly shed more light on the Park's early history.

8.1. GEOMORPHOLOGY

Historic charts, maps and aerial photographs can provide an amazing wealth of information. Many of the maps which were consulted for this project had been published but the original survey notes were unavailable and might provide additional insights. Many of these original surveys are probably housed in Russian archives and should be consulted if possible because published charts often delete details from original surveys in order to keep the final product legible. Although several cartographic products were consulted for this project, more are known to exist. Survey notes for US Survey 1258 should be reviewed. US hydrographic surveys H-1439 and H-2174 should also be obtained.

TABLE 8.1

Early Hydrographic Surveys
in the Vicinity of Indian River

Year of Survey	Survey Number	Scale
1879	H-1439	1:15,000
1893	H-2174	1:10,000

All 1929 aerial photography which includes land within the Park's boundaries should be copied and placed in the Park's archives. World War II era aerial photography could provide additional documentation concerning the rate, timing and extent of Park landform erosion. If this imagery is located, it should be obtained.

Even if additional maps and aerial photographs are not obtained, photogrammetric mapping of Park landforms from the available photography could provide detailed quantitative data concerning landform erosion in the Park. Additional data might be obtained from old photographs taken of Indian River and the Park's shoreline. By relocating the original photographer's vantage point, current photographs could be obtained which could be compared with historic images.

Field time available for this study was limited. It became obvious during this project's early planning stages that only a few locations could be investigated intensively and the results would have to be extrapolated to other areas exhibiting similar characteristics. Future geomorphology investigations should be aware of the limitations of this technique and plan additional sampling for areas of specific interest. Of particular concern is the unanswered question about the presence of glacial moraines within the Park. The large boulders near the Park boundary above the banks of Indian River should be examined for evidence of glacial transportation and deposition. Any future deep excavations (including construction projects) should be monitored for evidence of glacially deposited sediments.

It is clear that erosion in several locations in the Park is still active. At a minimum, the beach profiles presented in Section Five should be resurveyed after large storms to quantitatively measure the extent of beach erosion in those locations. Additional erosion control survey monuments could be established at other locations within the Park to monitor erosion rates in places where erosion is currently active.

8.2. ARCHAEOLOGY

The fieldwork and literature review conducted as part of the present geomorphological research has identified areas of known historic and prehistoric activity within Sitka National Historical Park and shown that there is potential for isolated artifacts or archaeological sites dating as early as approximately 5,500 years ago to be present in the Park. The results of this research have provided some indication as to the probable age of Park landforms where artifacts or archaeological features may be found in the future and has shown that, because of extensive ground disturbance from a variety of natural and human causes, artifacts and archaeological features discovered in the course of future cultural resource investigations must be carefully documented as to their stratigraphic provenience in order to determine whether they are actually *in situ*. A more extensive review of Park Service, military, and other documents and historical records would undoubtedly provide additional information on specific high probability site areas within the park. In particular, an attempt should be made to locate the log of the *Neva* in Russian archives. If this document could be located and translated it is likely that more detailed information on *Neva's* involvement in the 1804 Battle of Sitka would be obtained.

If the beach area where the trees cleared from the fort site were burned could be identified through photographs or other Park Service records it is likely that archaeological testing at that location would encounter artifacts transported in root wads and redeposited in secondary context. While the information obtainable from redeposited artifacts would be limited to the typology of the artifacts themselves, it would be interesting to try to document the extent of the impact of past landscaping activities at the fort site.

Further ethnographic research and oral history interviews with the Native community has the potential to provide significant additional information concerning the history and prehistory of the Park. One source of untapped ethnographic information are unpublished Goldschmidt and Haas interview records in the Curry-Weisbrodt papers at the Alaska State Historical Library in Juneau. These interview notes are not included with the rest of the Goldschmidt and Haas (1946) material and provide additional ethnographic information on the Sitka Tlingit (Marty Betts, ADF&G Subsistence Division, personal comm.). The small effort undertaken as part of the present project in contacting Natives knowledgeable about the Indian River area and the 1804 battle has demonstrated that a more extensive effort at compiling past oral history work and conducting additional interviews would be extremely productive.

Any future intensive survey of Sitka National Historical Park would be incomplete without including a systematic metal detector survey as part of the research design. A sampling strategy of shovel testing at least five or ten percent of metal detector "hits" to determine the nature and stratigraphic provenience of subsurface metallic objects should be an integral part of the survey. The heavy ground cover and dense vegetation in the Park require that any intensive archaeological survey be conducted in the early spring or winter (provided there is no snow cover) when the leaves are down. While soil probe testing should be included as part of any survey strategy, the greatest potential for identifying artifacts or archaeological features is through inspection of the exposed soil in and around tree throws. The large number of uprooted trees in the Park provide almost the only available natural soil exposures other than those found along the river banks. Both stone tools discovered in the course of this survey were found in the immediate vicinity of root wad depressions. Soil exposed by any new tree falls in the Park should be periodically examined for artifacts or other evidence of past human activity. The undated hearth discovered eroding out of the east cut bank of Indian River in 1992 by Park Service personnel (Thorsen 1992) suggest other archaeological features may be present along the eastern margin of the river and periodic inspection of the cut bank on this side of the river should also be made from time to time.

REFERENCES CITED

Ackerman, Robert E.

1968 Archaeology of the Glacier Bay Region, Southeastern Alaska. *Final Report of the Archaeological Survey of the Glacier Bay National Monument*. Laboratory of Anthropology Report of Investigations No. 44. Washington State University, Pullman. 123 pp.

1980 Microblades and Prehistory: Technological and Cultural Considerations for the North Pacific Coast. pp. 89-197. In: *Early Native Americans: Prehistoric Demography, Economy, and Technology*. Edited by David Browman. Mouton publishers. The Hague.

1994 The Early Prehistory of Southwestern and Southeastern Alaska. Paper prepared for the 45th Arctic Science Conference. Anchorage.

Ackerman, R.E., K.C. Reid, J.D. Gallison, M.E. Roe.

1985a *Archaeology of Heceta Island: A Survey of 16 Timber Harvest Units in the Tongass National Forest, Southeast Alaska*. Center of Northwest Anthropology Project Report No. 3. Washington State University. Pullman, Washington.

Ackerman, R.E., K.C. Reid, J.D. Gallison, M.E. Roe, C. Rabich Campbell

1985b The Prehistoric Occupation of Heceta Island, Southeast Alaska. Paper Presented at the 12th annual meetings of the Alaska Anthropological Association. Anchorage.

Anderson, D.D.

1968 A Stone Age Campsite at the Gateway to America. *Scientific American* 218(6):24-33.

Anderson, Peter D., Goldthwait, Richard P., McKenzie, Garry D.

1978 Observed Processes of Glacial Deposition in Glacier Bay, Alaska: guidebook for INQUA Commission II field conference, 7-16 June 1986, Glacier Bay National Park and Preserve, Alaska. Byrd Polar Research Center, Ohio State University

Andrews, Alex.

1987 The Battle of Sitka. Audio tape recording, collected by the National Park Service, Sitka National Historic Park, July 20, 1960. Transcribed in Tlingit and translated by Nora Marks Dauenhauer, 1987. Unpublished ms. on file at Sitka National Historic Park. Sitka

Andrews, C. L.

1922 *The Story of Sitka:* The Historic Outpost of the Northwest Coast; The Chief Factory of the Russian American Company. Lowman and Hanford Co. Seattle.

Antonson, Joan M. and William S. Hanable
1987 *Administrative History of Sitka National Historic Park*. Report prepared by IPH/JMA-Alaska for the National Park Service, Alaska Region. Published by the National Park Service. Anchorage.

Arndt, K.L., R.H. Sackett, and J.A. Ketz
1987 A Cultural Resource Overview of the Tongass National Forest, Alaska. Parts 1, 2a, 2b, Atlas. Contract No. 53-0109-6-00203. Final Report Submitted to the USDA Forest Service, Tongass National Forest, Region 10. Juneau, Alaska.

Baranov, Alexandr
1979 Letter to Demid Il'ich Kulikalov, Commander of the Andreianov, Rat and Near Islands Detachment, April 29, 1805. In: *A History of the Russian American Company*. Vol. II. Translated and Edited by R.A. Pierce and A.S. Donnelly. Limestone Press. pp 141-142.

Barns, David F.
1990 Gravity, Gravity-change, and Other Geophysical Measurements in Glacier Bay National Park and Preserve. In: Milner, A.M. and J.D. Wood, Jr. (eds.) Proceedings of the Second Glacier Bay Science Symposium. Glacier Bay National Park and Preserve. Gustavus, Alaska. U.S. National Park Service, Alaska Regional Office. September 19-22, 1988. pp. 12-18.

Becker, G.F.
1898 Reconnaissance of the Gold Fields of Southern Alaska, with Some Notes on General Geology. U.S. Geological Survey 18th Annual Report. Part 3. p. 1-86.

Black, Lydia
n.d. Iurii Lisianskii: Account of the Battle of Sitka. Unpublished translation from 1947 Russian language edition of Lisianski's journal. Draft No. 9. March 1987. On file at Sealaska Heritage Foundation. Juneau.

Blomkvist, E.E.
1972 A Russian Scientific Expedition to California and Alaska, 1839-1849: The Drawings of I.G. Voznesenskii. Translated by Basil Dmytryshyn and E.A. P. Crownhart-Vaughan. *Oregon Historical Quarterly*. Vol. 73 (2). June 1972.

Bloom, Arthur L.
1978 *Geomorphology: A Systematic Analysis of Late Cenozoic Landforms*. Prentice-Hall, Inc. New Jersey.

Borden, Charles E.
1975 Origin and Development of Early Northwest Coast Culture to about 3000 B.C. *National Museum of Man Mercury Series*. Archaeological Survey of Canada. Paper No. 45. Ottawa.

Bowers, Peter M., Robert C. Betts, Catherine M. Williams

1994 Port Houghton / Cape Fanshaw Environmental Impact Statement: Cultural Resources Inventory Report. Contract Number 53-0109-4-00390. Report prepared for the USDA Forest Service. Stikine Area Supervisor's Office. Tongass National Forest. Petersburg, Alaska.

Brew, David A.

1990 Plate-tectonic Setting of Glacier Bay National Park and Preserve and of Admiralty Island National Monument, Southeastern Alaska. In: Proceedings of the Second Glacier Bay Science Symposium. Edited by A. M. Milner and J. D. Wood, Jr. Glacier Bay National Park and Preserve. Gustavus, Alaska. September 19-22, 1988.

Buddington, A.F.

1927 Abandoned Marine Benches in Southeastern Alaska. *The American Journal of Science*. Vol. 13.

Chaney, Greg P.

1987 Coastal Geomorphology of Puget Bay, Alaska. M.A. Thesis. University of Idaho. Moscow.

Clark, G.H.

1979 Archaeological Testing at the Coffman Cove Site, Southeast Alaska. Paper presented at the 32nd Annual Northwest Anthropological Conference, Eugene, and the 6th Annual Conference of the Alaska Anthropological Association, Fairbanks.

Cook, Warren L.

1973 *Flood Tide of Empire: Spain and the Pacific Northwest 1543-1819*. Yale University Press. New Haven and London.

Cracroft, Sophia

1981 *Lady Franklin Visits Sitka, Alaska 1870*: the Journal of Sophia Cracroft Sir John Franklin's Niece. Edited by R.N. DeArmond. Alaska Historical Society. Anchorage.

Cross, Aureal T.

1968 Mendenhall Glacier Buried Forest, Alaska. Paper presented at the 19th Alaska Science Conference. Whitehorse, Yukon Territory, Canada. August 26-30, 1968.

Davis, S.D.

1990a *The Hidden Falls Site, Baranof Island, Alaska*. Aurora. Alaska Anthropological Association Monograph Series. Department of Anthropology, SUNY Brockport. Brockport, NY.

1990b Prehistory of Southeastern Alaska. In: *Handbook of North American Indians*., Vol. 7. edited by Wayne Suttles. Smithsonian Institution, Washington.

Dauenhauer, Nora M. and Richard Dauenhauer
1990 The Battles of Sitka, 1802 and 1804, From Tlingit, Russian, and Other Points of View. In: *Russia in North America*. Proceedings of the 2nd International Conference on Russian America. Alaska History No. 35. Edited by Richard A. Pierce. The Limestone Press. Fairbanks, Alaska.

Dean, Jonathan R.
1993 'Rich Men, 'Big Powers' and Wastelands - The Tlingit-Tsimshan Border of the Northern Pacific Littoral, 1799 to 1867. Vol. I. Ph. D. Dissertation. University of Chicago. Chicago.

1994 "Their Nature and Qualities Remain Unchanged": Russian Occupation and Tlingit Resistance, 1802-1867, *Alaska History*. Vol 9 (1). Spring 1994.

Dilliplane, Timothy
1993 Analysis and Recommendations Concerning the Site of Shisk-Kee-Nu, Sitka National Historical Park. Draft report on file at Sitka National Historic Park. Sitka.

Derksen, Stephen J.
1976 Glacial Geology of the Brady Glacier Region, Alaska. Report No. 60. Institute of Polar Studies. Ohio State University. Columbus, Ohio.

Dmytryshyn, Basil, E.A.P. Crownhart-Vaughan, and Thomas Vaughan (Editors)
1989 July 13 - November 2, 1804. From the Journal of Captain Iurii Fedorovich Lisianskii, aboard the ship Neva during his 1803-1806 circumnavigation. In: *The Russian American Colonies: Three Centuries of Russian Eastward Expansion 1798-1867.* Vol. 3. Oregon Historical Society Press.

Dumond, D.E.
1978 Alaska and the Northwest Coast. In *Ancient Native Americans*. Edited by J.D. Jennings. W.H. Freeman and Co., San Francisco.

Emmons, George Thornton
1991 *The Tlingit Indians*. Edited by Frederica de Laguna. University of Washington Press. Seattle and London.

Erlandson, Jon, Madonna Moss and Robert Stuckenrath
1990 Radiocarbon Dates from a Tlingit Fort in Sitka Sound, Southeast Alaska. Draft Report for publication in the proceeding of the 1990 Alaska Anthropological Meetings.

Fladmark, K.R.
1982 An Introduction to the Prehistory of British Columbia. *Canadian Journal of Archaeology* 6:95-156.

Fedorova, Svetlana G.
1973 *The Russian Population in Alaska and California: Late 18th Century - 1867.* Translated and edited by R. A. Pierce and A.S. Donnelly. Material for the Study of Alaska History, No. 4. Limestone Press. Ontario.

Gehrels, George and Henry C. Berg
1992 Geological Map of Southeast Alaska. Map I-1867. Miscellaneous Investigations Series. U.S. Geological Survey.

Geoscan Research
1994 Geophysical Remote Sensing Surveys within Sitka National Historic Park. Report submitted to Sitka National Historic Park. Vol. 1.

Goldschmidt, W.R. and T.H. Haas
1946 Possessory Rights of the Natives of Southeastern Alaska. Report to the Commissioner of Indian Affairs. United States Department of Interior. Washington D.C.

Golovin, Pavel N.
1983 *Civil and Savage Encounters: The Worldly Travel Letters of An Imperial Russian Navy Officer 1860-1861*. Translated by Basil Dmytryshyn and E.A.P. Crownhart-Vaughan. Oregon Historical Society Press. Portland. [1861].

Golovnin, V.M.
1822 *Voyage Around the World by Order of His Majesty the Emperor Made in a War-Sloop Kamtchatka, by Navy Captain Golovnin in the Years 1817, 1818, and 1819.* Vol. II. St. Petersburg. Two charts in end pocket. Alaska Historical Library. Juneau.

1979 *Around the World on the Kamchatka 1817-1819*. Translated by Ella Lury Wiswell. Hawaiian Historical Society and University Press of Hawaii. [1822].

Griffin, Gene
1984 Archaeological Evidence for Plant Procurement in the Northwest Coast. Masters thesis. Western Washington University. Bellingham.

n.d. National Park Service archaeologist, Sitka National Historic Park. Personal Communication, October 24, 1994.

Hadleigh-West, Frederick
1959 Exploratory Excavations at Sitka National Monument, a cooperative enterprise conducted under an agreement between the University of Alaska and the National Park Service. Contract # 14-10434-210. Manuscript on file, Alaska Regional Office. National Park Service. Anchorage.

Heusser, Calvin J.
1960 *Late-Pleistocene Environments of North Pacific North America*. Special Publication No. 35. American Geographical Society. New York.

Hewlett, John D.
1982 *Principles of Forest Hydrology*. University of Georgia Press. Athens, Georgia

Hicks, Steacy D. and W. Shofnos.
1965 Determination of Land Emergence from Sea Level Observations in Southeast Alaska. *Journal of Geophysical Research* 70 (14):3315-3320.

Hicks, Steacy D., Henry A. Debaugh, Jr., Leonard E. Hickman, Jr.
1983 Sea Level Variations for the United States 1855-1980. U.S. Department of Commerce. National Oceanic and Atmospheric Administration. National Ocean Service. Rockville, Maryland.

Holmberg, Heinrich Johan
1985 *Holmberg's Ethnographic Sketches*. Edited by Marin Falk. Translated by Fritz Jaensch. Rasmuson Library Historical Translation Series. Vol. I. University of Alaska Press. Fairbanks. [Originally published 1855 through 1863].

Hope, Herb
1992a National Park Service Conservation Record. Interview with Micki Hellickson. August 14, 1992. Sitka National Historic Park. Sitka.

1992b National Park Service Conservation Record. Interview with Bonnie Houston and Tim Cochrane. September 28, 1992. Alaska Regional Office. Anchorage.

n.d. The Kiks.adi Survival March of 1804. Draft manuscript.

n.d. Personal communication. Telephone interview with Bob Betts, March 13, 1995.

Hopkins, Sally
1987 Audio tape recording, collected by Peter Nielson, Sitka, 1958. Transcribed in Tlingit and translated into English by Nora Marks Dauenhauer, 1987. Unpublished ms. on file at Sitka National Historic Park. Sitka.

Horner, Robert
1960 Seismicity in the Glacier Bay Region of Southeast Alaska and Adjacent Areas of British Columbia. In: Milner, A.M. and J.D. Wood, Jr. (eds.) Proceedings of the Second Glacier Bay Science Symposium. Glacier Bay National Park and Preserve. Gustavus, Alaska. U.S. National Park Service, Alaska Regional Office. September 19-22, 1988. pp. 6-11.

Jacobs, Mark, Jr.
1990 Early Encounters Between the Tlingit and the Russians. In. *Russia in North America*. Alaska History No. 35. Edited by Richard A. Pierce. Proceedings of the 2nd International Conference on Russian America. Sitka, Alaska. August 19-22, 1987. The Limestone Press. Fairbanks.

Komar, P. D.
1976 *Beach processes and sedimentation*. Prentice-Hall Inc. Englewood Cliffs, New Jersey.

Khlebnikov, Kyrill T.
1973 *Baranov: Chief Manager of the Russian Colonies in America*. Edited by Richard A. Pierce. Translated by Colin Bearne. Materials for the Study of Alaska History, No. 3. Limestone Press. Kingston, Ontario. [1835].

1985 *Russkaya amerika v zapiskakh Kirila Khlebnikova, Novo Arkhangel'sk* [Russian America in the Notes of Kyrill Khlevnikov] Edited by V.A. Aleksandrov, complied by S.G. Fedorova. Akademiia Nauk, Institut Etnografii. Nauka. Moscow.

Kitka, Herman
n.d. Personal communication. Telephone interview with Bob Betts. February 26, 1995.

Krause, Aurel
1956 *The Tlingit Indians*: Results of a Trip to the Northwest Coast of America and the Bering Straits. Translated by Erna Gunther. University of Washington Press. Seattle and London. [1885].

de Laguna, F.
1960 *The Story of a Tlingit Community*: A Problem in the Relationship Between Archaeological, Ethnological, and Historical Methods. Smithsonian Institution. Bureau of American Ethnology. Bulletin 172. U.S. Government Printing Office. Washington D.C. 254 pp.

de Laguna, F., F. Riddle, D.F. McGeein, K.S. Lane, J.A. Freed
1964 *Archaeology of the Yakutat Bay Area, Alaska*. Bureau of American Ethnology Bulletin 192. U.S. Government Printing Office. Washington D.C.

Langsdorff, George H. Von
1968 *Voyages and Travels in Various Parts of the World*. Vol. 2. Bibliotheca Australiana # 41. Da Capo Press. New York. [1814].

Lisianskii, Iurii
1812 1805 Chart of Sitka Sound. Michael Z. Vinokouroff Collection. Folder 5: Alaska Maps - Sitka. Alaska State Historical Library. Juneau.

1947 *Puteshestvia vokrug sveta na korable ""Neva" v 1803-1806 godakh.* [Voyage Round World on the Ship Neva, 1803-1806] Moscow: Gosudarstvennoe Izdatel'stvo Geograficheskoi Literatury. [1812].

1968 *Voyage Round the World in the Years 1803, 1804, 1805, and 1806*. Biliotheca Australiana No. 42. Da Capo Press. New York. [1814].

Lisowski, M., J.C. Savage, and R.O. Burford
1987 Strain Accumulation Across the Fairweather and Totschunda Faults, Alaska. *Journal of Geophysical Research* 92:11552-11560.

Longenbaugh, Dee
1968 A View of Sitka in 1838: The Plat of the Capital of Russian America. *The Alaska Journal.* Edited by Terrence Cole. Vol. 16. Alaska Northwest Publishing Company. Anchorage.

Mann, Daniel H.
1986 Wisconsin and Holocene Glaciation of Southeast Alaska. In: *Glaciation in Alaska: The Geologic Record.* Edited by Thomas D. Hamilton, Katherine M. Reed, and Robert M. Thorson. Occasional Paper No. 2. Alaska Geological Society. University of Alaska Museum. Fairbanks.

1983 Paleogeography of the Lituya Refugium. In: Proceedings of the First Glacier Bay Science Symposium. Glacier Bay National Park and Preserve. September 23-26, 1983.

McCallum, W.M., E. Hardin, and M. Jesmain
1991 Cultural Resource Inventory of the Frosty Bay Timber Sale, Southeast Alaska. Wrangell Ranger District. Project 91-02-15-A. Report on file with USDA Forest Service, Tongass National Forest, Stikine Area Supervisor's Office. Petersburg, Alaska. 54 pp.

Mobley, C. M. and Morley Eldridge
1992 Culturally Modified Trees in the Pacific Northwest. *Arctic Anthropology* Vol 29 (2).

Molnia, Bruce F.
1986 Glacial History of the Northeastern Gulf of Alaska -- A Synthesis. In: Glaciation in Alaska: The Geologic Record. Edited by Thomas D. Hamilton, Katherine M. Reed, and Robert M. Thorson. Occasional Paper No. 2. Alaska Geological Society. University of Alaska Museum. Fairbanks.

Molnia, Bruce F. and Denree Smith
1980 Erosion by the Indian River at Sitka National Historic Park. Report prepared for the U.S. National Park Service. Mss. on file at Sitka National Historic Park.

Moss, Madonna L.
1993 Northern Northwest Coast Regional Overview. Paper prepared for the International Seminar on the Origins, Development, and Spread of the Prehistoric Pacific-Bering Sea Maritime Cultures. Tokai University. Honolulu, Hawaii. June 3-7, 1993.

Moss, M.L., J.M. Erlandson, and R. Stuckenrath
1989 The Antiquity of Tlingit Settlement on Admiralty Island, Southeast Alaska. *American Antiquity.* 54(3):534-542.

1990 Wood Stake Weirs and Salmon Fishing on the Northwest Coast: Evidence from Southeast Alaska. *Canadian Journal of Archaeology,* vol. 14:143-157.

Mourelle, Don Francisco Antonio
1987 *Voyage of the Sonora from the 1775 Journal. Translated by Daines Barrington. Reprint of the 1920 English translation. Ye Galleon Press. Fairfield, Washington.*

National Oceanic and Atmospheric Administration
1992 1894-1917 Gulf of Alaska Hydrographic Surveys. Hydrographic Index No. 111B. National Ocean Service. Washington, D.C.

National Park Service
1982 Archaeological Clearance Survey Form. Indian River Bank Erosion Control, Sitka National Historic Park. Report by Graig Davis and David Staley.

1985 Archaeological Clearance Survey Form. Indian river Erosion Control; Underground Electrical Cable Route; and Additional Maintenance Building Construction. Report by Gene Griffin. Form on file at Sitka National Historic Park. Sitka.

Pierce, Richard A.
1986 *Builders of Alaska: The Russian Governors 1818-1867.* Alaska History, No. 28. The Limestone Press. Ontario.

1990 *Russian America: A Biographical Dictionary.* The Limestone Press. Kingston, Ontario.

Press, Frank and Raymond Siever
1982 *Earth.* W.H. Freman and Company. San Francisco.

Putnam, D.E., T.W. Greiser, and G. Walter
1994 Tectonic Stream Piracy and Prehistoric Stone Fish Weir Abandonment on Prince of Wales Island, Southeast Alaska. Paper presented at the 21st Annual Meeting of the Alaska Anthropological Association, Juneau, Alaska.

Rathje, William L.
1982 *Archaeology.* Harcourt Brace Jovanovich Inc. New York

Reed, J.C.
1958 Southeastern Alaska. In: *Landscapes of Alaska: Their Geologic Evolution.* University of California Press. p 9-18.

Ricks, Melvin B.
1970 *The Earliest History of Alaska.* Cook Inlet Historical Society. Anchorage.

Riehle, James R., Daniel H. Mann, Dorothy M. Peteet, Daniel R. Engstrom, David A. Brew, and Charles E. Meyer
1992 The Mount Edgecumbe Tephra Deposts, a Marker Horizon in Southeast Alaska near the Pleistocene-Holocene Boundary. *Quaternary Research* Vol. 37. p183-202.

Riehle, James R. and David A. Brew
1984 Explosive Latest Pleistocene (?) and Holocene Activity of the Mount Edgecumbe Volcanic Field, Alaska. In: *The United States Geological Survey in Alaska: Accomplishments During 1982*. Edited by Katherine M. Reed and Susan Bartsch-Winkler. U.S. Geological Survey Circular 939.

Russian American Company
1831 Archival Records. Reel #33, No. 337; folio 262v. 26 May 1831. Translation notes on file at Sitka National Park. Sitka

1845a Archival Records. Reel #50, No 216; folio 343. 12 Oct. 1845. Translation notes on file at Sitka National Park. Sitka

1845b Archival Records. Reel #49, No. 17; folio 161. 1 Sept. 1845. Translation notes on file at Sitka National Park. Sitka

1846 Archival Records. Reel # 51, No. 299; folio 229v. 5 May 1846. Translation notes on file at Sitka National Park. Sitka

Sharman, Lewis
1990 Marine Intertidal Community Development following Glacial Recession in Glacier Bay, Alaska. In: Milner, A.M. and J.D. Wood, Jr. (eds.) Proceedings of the Second Glacier Bay Science Symposium. Glacier Bay National Park and Preserve. Gustavus, Alaska. U.S. National Park Service, Alaska Regional Office. September 19-22, 1988. pp. 108-115.

Shepard and Wanless
1971 *Our Changing Coastlines*. McGraw-Hill. New York. pp 395-453

Stanley, K.W.
1968 Efects of the Alaska Earthquake of March 27, 1964 on Shore Processes and Beach Morphology. USGS Professional Paper 543-J.

Steffian, Amy F., Owen K. Mason, and Stacie J. McIntosh
1994 Archaeological Survey on the West Coast of Lynn Canal: William Henry Bay to Pyramid Island. Report Prepared for FPE/Roen Engineers, Inc. by Northern Land Use Research, Inc. Fairbanks, Alaska.

Streveler, Greg
1969 Memorandum to Dan Kuehn, Park Historian, Sitka National Historic Park. August 21, 1969. On file at Sitka National Historic Park.

Streveler, Greg, Richard Carstensen and Gretchen Bishop
1993 A Naturalist's Look at Southeast Alaska. Discovery Foundation. Juneau, Alaska.

Sturgis, William
1822 Message from the President of the United States, Transmitting the Information Required by a Resolution of the House of Representatives of the 16th of February Last, in Relation to Claims set up by Foreign Governments, to the territory of the United States upon the Pacific Ocean, North of the Forty-Second Degree of Latitude &c." *The North American Review* n.s. vol. 6 (2) (1822), p. 388

Sundberg, Kimbal A.
1981 Sitka Coastal Habitat Evaluation: Final Project Summary with Management Recommendations. Habitat Protection Section. Alaska Department of Fish and Game. Anchorage.

Tarr, L.S. and L. Martin
1912 Earthquake at Yakutat Bay, Alaska in September 1899. U.S. Geological Survey Professional Paper 69.

Teben'kov, M.D.
1852 *Atlas of the Northwest Coasts of America: From Bering Strait to Cape Corrientes and the Aleutian Islands with Several Sheets on the Northeast Coast of Asia*. Map of Sitka Bay: Port Novo-Arkhangel'sk Channel to Port Novo-Arkhangel'sk. [1981 reprint translated and edited by R.A. Pierce as Alaska History, No. 21: Maps of Russian America. Limestone Press. Ontario.]

Thomas, Lewis
1984 *Lives of a Cell*. Bantom Books. New York.

Thorsen, Sue and Dan Thorington
n.d. Unpublished field notes and photographs taken at the location on the northeast bank of Indian River from which a charcoal sample was collected in 1992. Records on file at Sitka National Historic Park. Sitka.

Tikhmenov, P.A.
1863 *Supplement of Some Historical Documents to the Historical Review of the Formation of the Russian-Amercian Company*. Vol. II. St. Petersburg. [1938 Translation by Dimitri Krenov. Works Progress Administration, Project No. 5668. Seattle. pp 261-265]

1979 *A History of the Russian American Company*. Edited by Richard A. Pierce and Alton S. Donnelly. Translated by Dmitri Krenov. Vol. 2. Documents. Materials for the Study of Alaska History, No. 13. The Limestone Press. Kingston, Ontario.

Tocher, D.
1960 The Alaska Earthquake of July 10, 1958: Movement on the Fairweather Fault and Field Investigation of Southern Epicentral Region. *Bulletin of the Seismological Society of America* 50 (2):267-292.

Ugolini, Fiorenzo C.
1983 Soil Studies in Glacier Bay National Park and Preserve. In: Proceedings of the First Glacier Bay Science Symposium. Glacier Bay National Park and Preserve. September 23-26, 1983.

USDA Forest Service
1993 Ecological Inventory: Sitka National Historic Park. Report Prepared under Interagency Agreement No. IA 97070-2-9017. Tongass National Forest. Chatham Area.

Willoughby, Barrett
1930 *Sitka: Portal to Romance*. Houghton Miffliln Company. Boston and New York.

Yehle, Lynn A.
1974 Reconnaissance Engineering Geology of Sitka and Vicinity, Alaska, with Emphasis on Evaluation of Earthquake and Other Geologic Hazards. U.S. Department of Interior. Geological Survey. Open-File report 74-53.

APPENDICES

APPENDIX A

SIGNIFICANT EVENTS
AT
SITKA NATIONAL
HISTORICAL PARK
(1775-1982)

SIGNIFICANT EVENTS AT SITKA NATIONAL HISTORICAL PARK (1775-1982)

Summarized from

An Administrative History of Sitka National Historical Park (Antonson and Hanable 1987)

Date	Event	Page Reference
1775 August	Bodega y Quadra sailed into Krestof Bay and sighted Mt. Edgecumbe which he called "San Jacinto."	28
1778	Capt. James Cook sighted and named Mt. Edgecumbe.	29
1795	Alexander Baranov visits Sitka Sound for the first time.	29
1799 July	Alexander Baranov establishes Archangel Saint Michael's Redoubt at Starigavan Creek.	29
1802	Tlingits attack and burn Archangel Saint Michael's Redoubt.	30
prior to 1804	Mouth of Indian River is a Native summer fishing camp.	12
1804 spring	Tlingits construct a log fort at the mouth of Indian River.	13
1804 fall	The Indian River fort is the scene of the decisive battle ground of the Russian conquest over the *Kiksadi* Tlingit. Russians bombarded the fort with 16 guns for several days.	12, 31
1804 fall	After the Tlingits abandoned the fort, the Russians burned it. Russian sailors were "buried where they fell." Baranov erected a wooden monument over their grave.	13
1805 Summer	Russians cut a thousand trees for the stockade at Castle Hill. Source of trees not given.	32
1821	*Kiksadi* Tlingit return to Sitka and settle outside the Stockade.	34
1825	For outdoor recreation Sitka residents went on walks and picnics in the deep woods near Indian River.	35
1852	Tebenkov Atlas published. Map of Sitka Sound shows five buildings and cultivated ground at the mouth of Indian River.	12
1855	Indians destroyed a small Russian settlement in the vicinity of Indian River and attack Novo Archangel'sk	12
1858	Tlingit warriors sporadically attacked the town and groups who were away from the post.	32
1860s	Russians used trail through the woods to Indian River for recreational walks.	7
1867	Map showing Sitka properties transferred from Russia to the United States.	103
1867 October	Formal transfer ceremony of Russian America to the United States.	35
1867-68	At least 537 people leave Alaska on Russian American vessels.	36
1869	U.S. Army constructs a one and a half mile corduroy road form the town to Indian River to enable wagons to haul water and wood.	37
1870	Gold is found at Silver Bay and for many years miners worked a mine on the upper Indian River.	38
1880	Petroff's census reported 43 Tlingits at "Indian River."	12
1880's early	"Lover's Lane" was an extension and improvement of a Russian-constructed walk along the beach and through the woods.	8
ca. 1881	Nicholas Haley built a road that was within what later became the monuments boundary.	68
1882 June	The Nicholas Haley family occupied the west side of the Indian River delta.	4, 65

Date	Event	Page Reference
1883 February	Nicholas Haley filed homestead claim "on Indian River N. bank, all above high tide." Haley never perfected his title.	65
1884	2nd Lt. Howard H. Gilman, USMC, used a party of Marines and Indians to clear a new pathway from the beach to the river. His crews constructed additional paths on either side of the stream and bridged it twice. He had two other bridges built over ravines on the river bank. Leaving the river banks, the Marine-build paths also explored the woods themselves.	8
1888	To reach some of the mining sites upstream, a bridge was built over the lower portion of Indian River. I.B. Hammond built the bridge at a cost of $142.50.	38
1890s	Visitor's could follow the boardwalk from the wharf through town to the 1804 battle site and the Indian River.	40
1890	President Benjamin A. Harrison set aside approximately 50 acres for a public park at the mouth of Indian River.	3
1892	U.S. Coast and Geodetic Survey nautical Chart No. 8245 shows the vicinity of Indian River.	Appendix C (Map)
1895	A new trail was cut from "the Point to the Bridge" along Indian River.	9
1900s early	Photo's of the "Witch Tree" could be purchased at the "Photo Shop" in Sitka. This huge hemlock was the site of important tribal councils. Supposed to have been the site of a witch trial and execution.	16
1901	U.S. Revenue Cutter *Rush* relocated a tall totem pole, four house posts and a war canoe from Kassan to the park.	15
1903	Alaska governor John G. Brady collected 20 totem poles from Tlingit and Haida villages on Prince of Wales Island. These in addition to the ones at the park (and the canoe) were shipped to St. Louis for the 1904 Louisiana Purchase Exposition. Only 14 were returned to the park. Only 13 of these were documented.	15
1904	Photo taken of the Indian River bridge.	43-44
1904	Sitka Wharf and Power Company tapped the Indian River for a water-distribution system that served the center of town. A water-wagon, filled at Indian River, served outlying areas.	41
1905	Elbridge Warren Merrill opened his photography store in downtown Sitka in the Mill's building. His studio was on Jamestown Bay and was accessible only by a footpath that wound along the beach and through the Indian River Park.	54
1906	Capital of the Territory of Alaska is moved from Sitka to Juneau	39
1908	William A. Langille (head of Tongass National Forest) offered to prepare a sketch map of the park and see that the petition photographs (by Merrill) and map went to the President of the United States. [sketch maps shows the location of the Russian Memorial (a photo is included), 13 totem poles and location of Haley's house, and second growth forest.	10-11, 13, 15, 54, Appendix C (Map)
1910	Enhanced map of Sitka National Monument published. Based on 1908 sketch map.	Appendix C
1910 March	President Taft declared Sitka National Monument.	10
1911	Totems were in good repair, set in concrete after having originally been set in gravel.	46

Date	Event	Page Reference
1911	On the site of the "Native stockade of 1802" four small totems had been set as corner posts in anticipation of a reconstruction of a traditional community house and a giant totem had been located before the perspective door.	47
1912	W.J. Lewis, Special Agent of the General Land Office, filed an eye witness report of the monument. Reference to a plat. Photos by Merrill.	45-6, 54
1916	Some visitors were traveling through the monument in two-horse drawn vehicles. There was no objection to this traffic. The vehicles were light and no damage was being done to the road. The road was in good condition as the Alaska Road Commission has spent about $1,500 making repairs and graveling it. The Indian River bridge was also in good condition, but trails on both sides of the river needed work.	51
1917 January	Arthur Shoup stated that nothing had been done about brush in the park since Federal prisoners had been removed from Sitka about 1905.	52
1918	Elbridge Warren Merrill recommended to act as official custodian of the monument. The appointment did not seem to last.	54
1919	Arrangements were made for a surveyor from the General Land Office at Juneau to resurvey the monument boundaries.	55
1920 summer	The Alaska Road Commission repaired the footbridge across the Indian River and strengthened the bulkheads along the river's bank.	65, 58
1921 summer	The road commission put up a new bridge for vehicles outside the monument's boundaries. Prior to this wheeled traffic had crossed the river at a ford below the foot bridge.	9, 58
1920s	Two footpaths were constructed in the monument and an ornamental gateway consisting of two totem poles and two heavy concrete pillars connected by a heavy chain.	69
1922 January	Wheeled traffic is banned in the monument. Sign is posted at Corner No. 2.	59
1923 September	A power line running across the seaward boundary of the monument was objected to on aesthetic grounds. Time of power line installation not given.	66
1925 May	James G. Steese sent six photograph of the power line to his Washington superiors.	68
1926	Stephen T. Mather, director of the National Park Service, approved efforts of the Alaskan Historical Society and the Sitka Commercial Club to construct a replica of a Russian blockhouse in the monument.	18
1927	Indian River was undermining the Witch Tree so the stream was cleared of obstructions above the tree's location. A bulwark was constructed along the bank in the tree's location. 100 ft. of road was reconstructed.	70
1927 July	The blockhouse replica had been completed. Constructed of heavy cedar logs and hardware from the original Blockhouse No. 2 (Blockhouse D). Photographs were included in the report to Washington.	71
1933	Letters document the wandering and flooding of Indian River and discuss the condition of the monument.	61

Date	Event	Page Reference
1939	Sitka's Service Transfer Company began dredging gravel from the mouth of Indian River. Recommendation is made to keep cattle from grazing in the monument.	81
1940 February	Sitka totem poles had been restored, treated with preservative and reset in their former locations.	105
1940 March	First master plan for the monument recommends controlling Indian River erosion and toilet facilities within the monument.	86
1940 March (?)	Gravel dredging at the mouth of Indian River continues with the construction of facilities to store gravel on monument land east of the Indian River. Gravel bunkers were put on monument lands because the boundaries were not clearly defined.	87, 108
1940 April	Construction begins on two pit toilets in the monument.	104
1940	Navy extracts gravel from the mouth of Indian River and cuts trees in the monument. Indian River is tapped to provide water for the residents of Japonski Island.	19, 78, 81
1941	Miller documents gravel dredging with photographs.	111
1941 May	Several photographs taken of the monument including pictures of the sea shore.	88
1941 June	Ben Miller stopped Navy contractors from cutting trees near the mouth of Indian River.	108
1941	Several trees were removed from the shoulders of the monument's road. A large rustic sign was erected at the entrance and the road was widened.	88
1941 October	Significant flood and erosion along the banks of Indian River. Strip of river bank about 600 feet long and six to 40 ft. wide washed away. The Navy had dredged a pit 30 to 200 ft. wide and four to 30 ft. deep at the river mouth.	108, 109
1942 May	Large portions of Sitka National Historical Monument are taken over by the U.S. Army and Navy.	78, 89
1942 September	Gravel operations continue. Major flood destroys 200 feet of road and 250 feet of trail - land eroded 10 to 50 feet wide on either side of the bank. The footbridge washed away and two army guards were drowned. The flood washed a totem pole away that stood near the bridge and destroyed a pipeline that took water from Indian River for the Navy and the city water supply.	109, 110
1942 November	The office building and a repair shop at the gravel bunkers burned. A new road to replace the one destroyed by the flood was almost completed.	110
1943	A Navy Seabee battalion took over operation of the Indian River gravel plant. Entrance to the monument is widened to provide space for turning around and parking.	110
WWII	Machine gun pits are dug in the monument along "Lovers' Lane."	19
WWII	The Witch Tree is washed away in a major flood.	16
1944	Military dredging of Indian River diminished because the construction on Japonski Island was almost complete. Army agrees to restore the monument to as natural a state as possible.	110
1945 February	Miller writes a letter to document gravel dredging and changes in river channel.	111
1945 April	Navy razed its gravel bunkers and all but one of the shacks used in dredging operations. Work was also begun on erosion-control cribbing along the banks of Indian River.	111 Appendix C (Map)

Date	Event	Page Reference
1945 August	More than 600 ft. of log cribbing installed along the river banks.	111
1945 September	600 ft. of log cribbing was washed out in a flood.	111
1947 November	Original totem poles were removed from Sitka National Monument to Mount Edgecumbe on japonski Island. All but one were eventually lost.	107
1951	Unknown amount of gravel was removed from the mouth of Indian River.	112 Appendix C (Map)
1954	Sitka Utilities Board funded relocation of the transmission lines along the beach, new lines followed the Sawmill Creek Road.	97
1957	20,000 cubic yards of gravel dredged from mouth of Indian River.	112
1958	Frederick Hadleigh-West conducted excavations at the fort site and the Russian "gravesite" and tested elsewhere in the monument.	114-115 Appendix C (Map)
1958	Morrison-Knudsen Company hot asphalt plant removed from east bank of Indian River. Surplus asphalt and debris from the plant were buried on the site which was later reforested.	99
1958	40,000 cubic yards of gravel was dredged from the mouth of Indian River.	112
1959 July	Russian blockhouse is bulldozed to the beach and burned. It is currently unclear what happened to the original hardware.	20, 115-116
1959	120,000 cubic yards of gravel was removed from the mouth of Indian River.	112
1960	Permits for dredging 140,000 cubic yards of gravel from the mouth of Indian River were issued by State Officials.	113
1960	Major flooding of Indian River as violent as the one in the early 1940s.	134
1961	The wooden footbridge over Indian River destroyed by river erosion.	134
1961 July	Plan to dig an 800 ft. long channel from the mouth of Indian River is implemented. The new channel is lined with rock rip-rap.	114 Appendix C (Map)
1961 August	Major flood event. Mostly contained in the new channel but several feet of rip-rap fell into the river along its lower stretch.	114
1964 June	Littlefield house near the entrance which had been acquired by the monument was burned by the Sitka Fire Department.	101
1964 July	City of Sitka granted the monument a 55 year lease to tidelands adjacent to the monument.	127
1965	Visitor Center was dedicated.	20, 43, 102
1966 August	A new foot bridge which was constructed 10 days earlier was destroyed by flooding.	134
1967	Cadastrak survey of the tidelands adjacent to the monument is requested (Alaska Tidelands Survey 649).	127
1968	Present footbridge that spans Indian River was constructed of wood and concrete.	135
1970	Trenches were dug at the fort site for the totem pole treatment program.	140
1972	Map of general layout of Sitka National Monument	Appendix C (Map)
1972 October	Sitka National Historical Monument redesignated a National Historical Park. Control of state tidelands adjacent to the park are given to the National Park Service.	43, 119, 122, 127
1973 March	NPS applies to build a breakwater along the beach.	128

Date	Event	Page Reference
1978	A maintenance building and storage shed are constructed behind the Visitor's Center.	134
1978	Offshore gravel-dredging operations in Sitka Sound finally ended.	135
1979	Owner of the trailer court just north of park boundary illegally puts fill into Indian River to enlarge the size of his property.	135
1980	A new trail, called the "Battleground Trail," is added to the park. This trail goes around the edge of the 1804 battle site. The fort site and battle site are landscaped. State Historic Preservation Officer approves this work. Totem pole treatment trenches are filled in.	135
1980	A "Fitness Trail" is constructed on the east side of Indian River.	22, 135
1982	Denver Service Center staff conduct an erosion control study.	136
1985 June	Contractors install 4,600 cubic yards of rip-rap along the bank of Indian River.	137
1986	1,300 cubic yards of stones are scattered along the river bank for stabilization	137

APPENDIX B

RADIOCARBON DATA

SITKA NATIONAL HISTORICAL PARK
RADIOCARBON DATES

Sample # (Test)	Beta Analytic Lab #	Sampling Location Elevation (Feet a.s.l.)	Conventional C14 Date (yrs B.P.)	Calibration Intercept Date(s)	Material	Sample Depth (cm)	Stratigraphic Context	COMMENTS
NPS-94-1 (SHED-1-1)	Beta-78713	~ 36.0	4000 +/- 70	cal BC 2485	Charcoal	~ 30	At upper contact of 5 cm thick tephra lens at 30-35 cmbs (tephra sample Shed-1-1 taken)	Collected from cut bank behind NPS storage shed. Tephra sample Shed-1-1 submitted for lab analysis
NPS-94-3b (A-1-1)	Beta-78714	~ 38.0	4290 +/- 70	cal BC 2900	Wood from bulk soil sample	18-25	Brown/Black soil directly below tephra lens and overlying sand granual layer.	Several wood fragments present in bulk soil sample
NPS-94-4 (E-2-1)	Beta-78715	24.0	10 +/- 50	No intercepts Calibrated results: AD 1825-1835 and AD 1880-1915	Charcoal	~ 4-8	East wall of Test E-2 adjacent to lee side of paleo-beach ridge. Ground surface uneven and sloped. Sample collected below 8 cm of organics at contact with unconsolidated beach deposits.	Dense concentration of charcoal with large chunks - charcoal lens appeared to be very concentrated and did not continue into beach ridge. Possibly of cultural origin but no associated FCR or artifacts.
NPS-94-5 (G-1-1)	Beta-78716	20.0	550 +/- 60	cal AD 1410	Charcoal	~ 30	From above cobble (pebble/cobble) strata and 2 cm organic loam (overlying pebble/cobble strata).	
NPS-94-6 (I-1-1)	Beta-78717	19.0	1740 +/- 60	cal AD 330	Charcoal	~ 20	At upper contact with pebble/cobble strata	
NPS-94-7 (J-2-2-1)	Beta-78718	~ 16.5	910 +/- 50	cal AD 1165	Charcoal	10 - 15	From contact between organic-rich dark red-brown loam and pebble/cobble/sand strata	
NPS-94-8 (D-2-1)	Beta-78807	25.0	280 +/- 70	cal AD 1650	Charcoal	20-22	Upper contact with gravel/pebble/cobble strata	Directly associated with tephra lens 20-22 cmbs

SITKA NATIONAL HISTORICAL PARK
RADIOCARBON DATES
(CONT.)

Sample # (Test)	Beta Analytic Lab #	Sampling Location Elevation (Feet a.s.l.)	Conventional C14 Date (yrs B.P.)	Calibration Intercept Date(s)	Material	Sample Depth (cm)	Stratigraphic Context	COMMENTS
NPS-94-9 (K-1-1)	Beta-78808	*15.0*	*850 +/- 50*	*cal AD 1215*	*Charcoal*	*15-25*	*At upper contact with pebble/cobble* strata	*Soil depth is uneven,* charcoal layer is discrete
NPS-94-10 (M-1-1)	Beta-78809	?	1020 +/- 50	cal AD 1015	Wood	277-327	Wood from 50 cm diameter log embedded in river bank on northeast side of Indian River (at right angle to river channel)	Sample taken from outer wood (~5 growth rings)
NPS-94-11 (N-1-1)	Beta-78810	18.5	230 +/- 50	cal AD 1665	Charcoal	22	1 cm thick charcoal lens 12 cm above contact with pebble/cobble strata (in brown organic loam)	
NPS-94-12 (J-1-1)	Beta-78811	16.5	900 +/- 50	cal AD 1170	Charcoal	30-35	At upper contact with pebble/cobble strata	
NPS-94-13 (C-1-1)	Beta-78812	21.0	2220 +/- 60	cal BC 350 cal BC 300 cal BC 215	Wood	55	Contact between active live rootlets and dryer loam	Possibly degraded log; Collected from wet bog sediments.
NPS-94-14 (L-1-1)	sample not run	13.0			Charcoal "Powder"	~ 8-14	From upper contact with pebble / gravel / cobble strata	Charcoal lens did not contain chunks - only "crushed" black powder. Very dirty sample w/ rootlets.
NPS-94-15 (R-1-1)	Beta-78814	14.0	60 +/- 80	No Intercepts calibrated results: cal AD 1690-1735 and cal AD 1815-1925	Charcoal	~ 46	Indian River cut bank - Northeast Side of Indian River. Discontinuous charcoal pocket in fluvial deposits.	Very small sample collected in vicinity of hearth w/ FCR reported by Sue Thorsen in 1992

BETA ANALYTIC INC.

RADIOCARBON DATING SERVICES

Dr. JERRY J. STIPP
Dr. MURRY A. TAMERS
CO-CHAIRMEN

DARDEN G. HOOD, P.G.
General Manager

RONALD E. HATFIELD
Laboratory Manager

CHRISTOPHER PATRICK
TERESA A. ZILKO-MILLER
Associate Managers

Dear Colleague:

Enclosed are the radiocarbon dating results on material recently authorized/submitted for analysis. Please recall any correspondences or communications we may have had regarding sample integrity, size, special considerations or conversions from one analytical technique to another. If we have your fax or E-mail number in our records, we have sent the report by electronic mail in addition to the originals being sent by normal first class mail.

Results are obtained on the portion of suitable carbon remaining after necessary chemical and mechanical pretreatments of the submitted material. These pretreatments were applied to isolate ^{14}C which may best represent the time event of interest. Along with each sample result, the individual analysis method, delivery basis, material, and chemical pretreatment is also reported. Pretreatments are defined in the glossary enclosed along with the mailed report copy.

Materials measured by the radiometric technique are analyzed by synthesizing sample carbon to benzene (92% C), measuring for ^{14}C content in one of our 68 liquid scintillation spectrometers, and then calculating for radiocarbon age. AMS results are derived from reduction of sample carbon to graphite (100 %C), along with standards and backgrounds, followed by ^{14}C measurement and calculation in an accelerator-mass-spectrometer located at one of three collaborating laboratories; Lawrence Livermore National Laboratory (CAMS) in California, Eidgenössische Technische Hochschule University (ETH) in Zürich, or Oxford University (Ox) in Oxford, England.

The "Conventional C14 Age (*)" is the result after applying C13/C12 corrections to the measured age and is the most appropriate radiocarbon age (the "*" is discussed at the bottom of the report sheet). Applicable calendar calibration (results 0 to 10,000 BP for organic material, 0 to 8,300 BP for marine carbonates, suitable materials) is reported separately with the original report copy. It is important to read the calibration explanation sheet before interpreting the results.

As always, if you have any specific questions regarding these analyses, please do not hesitate to contact us. We thank you for allowing us to participate in your research and appreciate your prompt attention to payment.

Sincerely,

The directors and professional staff

4985 S.W. 74 COURT, MIAMI, FL, 33155 U.S.A.
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PRETREATMENT GLOSSARY

Pretreatment of submitted materials is required to eliminate secondary carbon components. These components, if not eliminated, could result in a radiocarbon date which is too young or too old. Pretreatment does not ensure that the radiocarbon date will represent the time event of interest. This is determined by the sample integrity. The old wood effect, burned intrusive roots, bioturbation, secondary deposition, secondary biogenic activity incorporating recent carbon (bacteria) and the analysis of multiple components of differing age are just some examples of potential problems. The pretreatment philosophy is to reduce the sample to a single component, where possible, to minimize the added subjectivity associated with these types of problems.

"acid/alkali/acid"

The sample was first gently crushed/dispersed in deionized water. It was then given hot HCl acid washes to eliminate carbonates and alkali washes (NaOH) to remove secondary organic acids. The alkali washes were followed by a final acid rinse to neutralize the solution prior to drying. Chemical concentrations, temperatures, exposure times, and number of repetitions, were applied accordingly with the uniqueness of the sample. Each chemical solution was neutralized prior to application of the next. During these serial rinses, mechanical contaminants such as associated sediments and rootlets were eliminated. This type of pretreatment is considered a "full pretreatment".

Typically applied to: charcoal, wood, some peats, some sediments, textiles

"acid washes"

Surface area was increased as much a possible. Solid chunks were crushed, fibrous materials were shredded, and sediments were dispersed. Acid (HCl) was applied repeatedly to ensure the absence of carbonates. Chemical concentrations, temperatures, exposure times, and number of repetitions, were applied accordingly with the uniqueness of each sample. The sample, for a number of reasons, could not be subjected to alkali washes to ensure the absence of secondary organic acids. The most common reason is that the primary carbon is soluble in the alkali. Dating results reflect the total organic content of the analyzed material. Their accuracy depends on the researcher's ability to subjectively eliminate potential contaminants based on contextual facts.

Typically applied to: *organic sediments, some peats, small wood or charcoal, special cases* "collagen extraction"

The material was first tested for friability ("softness"). Very soft bone material is an indication of the potential absence of the collagen fraction (basal bone protein acting as a "reinforcing agent" within the crystalline apatite structure). It was then washed in de-ionized water and gently crushed. Dilute, cold HCl acid was repeatedly applied and replenished until the mineral fraction (bone apatite) was eliminated. The collagen was then dissected and inspected for rootlets. Any rootlets present were also removed when replenishing the acid solutions. Where possible, usually dependant on the amount of collagen available, alkali (NaOH) was also applied to ensure the absence of secondary organic acids.

Typically applied to: bones

"acid etch"

The calcareous material was first washed in de-ionized water, removing associated organic sediments and debris (where present). The material was then crushed/dispersed and repeatedly subjected to HCl etches to eliminate secondary carbonate components. In the case of thick shells, the surfaces were physically abraded prior to etching down to a hard, primary core remained. In the case of porous carbonate nodules and caliche, very long exposure times were applied to allow infiltration of the acid. Acid exposure times, concentrations, and number of repetitions, were applied accordingly with the uniqueness of the sample.

Typically applied to: shells, caliche, calcareous nodules

"neutralized"

Carbonates precipitated from ground water are usually submitted in an alkaline condition (ammonium hydroxide or sodium hydroxide solution). Typically this solution is neutralized in the original sample container, using deionized water. If larger volume dilution was required, the precipitate and solution were transferred to a sealed separatory flask and rinsed to neutrality. Exposure to atmosphere was minimal.

Typically applied to: Strontium carbonate, Barium carbonate
(i.e. precipitated ground water samples)

"none"

No laboratory pretreatments were applied. Special requests and pre-laboratory pretreatment usually accounts for this. This would never be the circumstance without the knowledge of the submitter.

BETA ANALYTIC INC.
RADIOCARBON DATING LABORATORY
CALIBRATED C-14 DATING RESULTS

Calibrations of radiocarbon age determinations are applied to convert BP results to calendar years. The short term difference between the two is caused by fluctuations in the heliomagnetic modulation of the galactic cosmic radiation and, recently, large scale burning of fossil fuels and nuclear devices testing. Geomagnetic variations are the probable cause of longer term differences.

The parameters used for the corrections have been obtained through precise analyses of hundreds of samples taken from known-age tree rings of oak, sequoia, and fir up to 7,200 BP. The parameters for older samples, up to 22,000 BP, as well as for all marine samples, have been inferred from other evidence. Calibrations are presently provided for terrestrial samples to about 10,000 BP and marine samples to about 8,300 BP.

The Pretoria Calibration Procedure program has been chosen for these dendrocalibrations. It uses splines through the tree-ring data as calibration curves, which eliminates a large part of the statistical scatter of the actual data points. The spline calibration allows adjustment of the average curve by a quantified closeness-of-fit parameter to the measured data points. On the following calibration curves, the solid bars represent one sigma statistics (68% probability) and the hollow bars represent two sigma statistics (95% probability). Marine carbonate samples that have been corrected for $\delta\ ^{13/12}C$, have also been corrected for both global and local geographic reservoir effects (as published in Radiocarbon, Volume 35, Number 1, 1993) prior to the calibration. Marine carbonates that have not been corrected for $\delta\ ^{13/12}C$, have been adjusted by an assumed value of 0 ‰ in addition to the reservoir corrections. Reservoir corrections for fresh water carbonates are usually unknown and are generally not accounted for in those calibrations. In the absence of measured $\delta\ ^{13/12}C$ ratios, a typical value of -5 ‰ was assumed for freshwater carbonates. There are separate calibration data for the Northern and Southern Hemisphere. Variables used in each calibration are listed below the title of each calibration page.

(Caveat: the calibrations assume that the material dated was living for exactly ten or twenty years (e.g. a collection of 10 or 20 individual tree rings taken from the outer portion of a tree that was cut down to produce the sample in the feature dated). For other materials, the maximum and minimum calibrated age ranges given by the computer program are uncertain. The possibility of an "old wood effect" must also be considered, as well as the potential inclusion of some younger material in the total sample. Since the vast majority of samples dated probably will not fulfill the ten/twenty-year-criterium and, in addition, an old wood effect or young carbon inclusion might not be excludable, these dendrocalibration results should be used only for illustrative purposes. In the case of carbonates, reservoir correction is theoretical and the local variations are real, highly variable and dependant on provenience. The age ranges and, especially, the intercept ages generated by the program must be considered as approximations.)

BETA ANALYTIC INC.

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REPORT OF RADIOCARBON DATING ANALYSES

FOR: Dr. Robert C. Betts
Vanguard Research

DATE RECEIVED: December 12, 1994
DATE REPORTED: January 18, 1995

Sample Data	Measured C14 Age	C13/C12 Ratio	Conventional C14 Age (*)
Beta-78713	4000 +/- 70 BP	-25.0* o/oo	4000 +/- 70* BP
SAMPLE #: NPS-94-1 ANALYSIS: radiometric-standard MATERIAL/PRETREATMENT:(charred material): acid/alkali/acid			
Beta-78714	4290 +/- 70 BP	-25.0* o/oo	4290 +/- 70* BP
SAMPLE #: NPS-94-3b ANALYSIS: radiometric-standard MATERIAL/PRETREATMENT:(wood): acid/alkali/acid			
Beta-78715	10 +/- 50 BP	-25.0* o/oo	10 +/- 50* BP
SAMPLE #: NPS-94-4 ANALYSIS: radiometric-standard MATERIAL/PRETREATMENT:(charred material): acid/alkali/acid			
Beta-78716	550 +/- 60 BP	-25.0* o/oo	550 +/- 60* BP
SAMPLE #: NPS-94-5 ANALYSIS: radiometric-standard MATERIAL/PRETREATMENT:(charred material): acid/alkali/acid			
Beta-78717	1740 +/- 60 BP	-25.0* o/oo	1740 +/- 60* BP
SAMPLE #: NPS-94-6 ANALYSIS: radiometric-standard MATERIAL/PRETREATMENT:(charred material): acid/alkali/acid			

Dates are reported as RCYBP (radiocarbon years before present, "present" = 1950A.D.). By International convention, the modern reference standard was 95% of the C14 content of the National Bureau of Standards' Oxalic Acid & calculated using the Libby C14 half life (5568 years). Quoted errors represent 1 standard deviation statistics (68% probability) & are based on combined measurements of the sample, background, and modern reference standards.

Measured C13/C12 ratios were calculated relative to the PDB-1 international standard and the RCYBP ages were normalized to -25 per mil. If the ratio and age are accompanied by an (*), then the C13/C12 value was estimated, based on values typical of the material type. The quoted results are NOT calibrated to calendar years. Calibration to calendar years should be calculated using the Conventional C14 age.

BETA ANALYTIC INC.

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REPORT OF RADIOCARBON DATING ANALYSES

FOR: Dr. Robert C. Betts

Sample Data	Measured C14 Age	C13/C12 Ratio	Conventional C14 Age (*)
Beta-78718	910 +/- 50 BP	-25.0* o/oo	910 +/- 50* BP

SAMPLE #: NPS-94-7
ANALYSIS: radiometric-standard
MATERIAL/PRETREATMENT:(charred material): acid/alkali/acid

Dates are reported as RCYBP (radiocarbon years before present, "present" = 1950A.D.). By international convention, the modern reference standard was 95% of the C14 content of the National Bureau of Standards' Oxalic Acid & calculated using the Libby C14 half life (5568 years). Quoted errors represent 1 standard deviation statistics (68% probability) & are based on combined measurements of the sample, background, and modern reference standards.

Measured C13/C12 ratios were calculated relative to the PDB-1 international standard and the RCYBP ages were normalized to -25 per mil. If the ratio and age are accompanied by an (*), then the C13/C12 value was estimated, based on values typical of the material type. The quoted results are NOT calibrated to calendar years. Calibration to calendar years should be calculated using the Conventional C14 age.

BETA ANALYTIC INC.

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REPORT OF RADIOCARBON DATING ANALYSES

FOR: Dr. Robert C. Betts
Vanguard Research

DATE RECEIVED: December 13, 1994
DATE REPORTED: January 25, 1995

Sample Data	Measured C14 Age	C13/C12 Ratio	Conventional C14 Age (*)
Beta-78807	280 +/- 70 BP	-25.0* o/oo	280 +/- 70* BP

SAMPLE #: NPS-94-8
ANALYSIS: radiometric-standard
MATERIAL/PRETREATMENT:(Partially charred wood): acid/alkali/acid

Beta-78808	850 +/- 50 BP	-25.0* o/oo	850 +/- 50* BP

SAMPLE #: NPS-94-9
ANALYSIS: radiometric-standard
MATERIAL/PRETREATMENT:(charred material): acid/alkali/acid

Beta-78809	1020 +/- 50 BP	-25.0* o/oo	1020 +/- 50* BP

SAMPLE #: NPS-94-10
ANALYSIS: radiometric-standard
MATERIAL/PRETREATMENT:(wood): acid/alkali/acid

Beta-78810	230 +/- 50 BP	-25.0* o/oo	230 +/- 50* BP

SAMPLE #: NPS-94-11
ANALYSIS: radiometric-standard
MATERIAL/PRETREATMENT:(charred material): acid/alkali/acid

Beta-78811	900 +/- 50 BP	-25.0* o/oo	900 +/- 50* BP

SAMPLE #: NPS-94-12
ANALYSIS: radiometric-standard
MATERIAL/PRETREATMENT:(charred material): acid/alkali/acid

Dates are reported as RCYBP (radiocarbon years before present, "present" = 1950A.D.). By International convention, the modern reference standard was 95% of the C14 content of the National Bureau of Standards' Oxalic Acid & calculated using the Libby C14 half life (5568 years). Quoted errors represent 1 standard deviation statistics (68% probability) & are based on combined measurements of the sample, background, and modern reference standards.

Measured C13/C12 ratios were calculated relative to the PDB-1 international standard and the RCYBP ages were normalized to -25 per mil. If the ratio and age are accompanied by an (*), then the C13/C12 value was estimated, based on values typical of the material type. The quoted results are NOT calibrated to calendar years. Calibration to calendar years should be calculated using the Conventional C14 age.

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REPORT OF RADIOCARBON DATING ANALYSES

FOR: Dr. Robert C. Betts

Sample Data	Measured C14 Age	C13/C12 Ratio	Conventional C14 Age (*)
Beta-73812	2220 +/- 60 BP	-25.0* o/oo	2220 +/- 60* BP

SAMPLE #: NPS-94-13
ANALYSIS: radiometric-standard
MATERIAL/PRETREATMENT:(wood): acid/alkali/acid

Beta-78814	60 +/- 80 BP	-25.0* o/oo	60 +/- 80* BP

SAMPLE #: NPS-94-15
ANALYSIS: radiometric-standard
MATERIAL/PRETREATMENT:(charred material): acid/alkali/acid
COMMENT: small sample resulting in low precision (< 1 gm C)

Note: One additional sample, NPS-94-14, was submitted but not analyzed (as instructed).

Dates are reported as RCYBP (radiocarbon years before present, "present" = 1950A.D.). By international convention, the modern reference standard was 95% of the C14 content of the National Bureau of Standards' Oxalic Acid & calculated using the Libby C14 half life (5568 years). Quoted errors represent 1 standard deviation statistics (68% probability) & are based on combined measurements of the sample, background, and modern reference standards.

Measured C13/C12 ratios were calculated relative to the PDB-1 international standard and the RCYBP ages were normalized to -25 per mil. If the ratio and age are accompanied by an (*), then the C13/C12 value was estimated, based on values typical of the material type. The quoted results are NOT calibrated to calendar years. Calibration to calendar years should be calculated using the Conventional C14 age.

EXPLANATION OF THE PRETORIA/BETA ANALYTIC DENDRO-CALIBRATION PRINTOUT

CALIBRATION OF RADICARBON AGE TO CALENDAR YEARS

(Variables:C13/C12=-24.8:lab mult. =1) ← Variables used in the calculation

Laboratory Number: Beta-12345

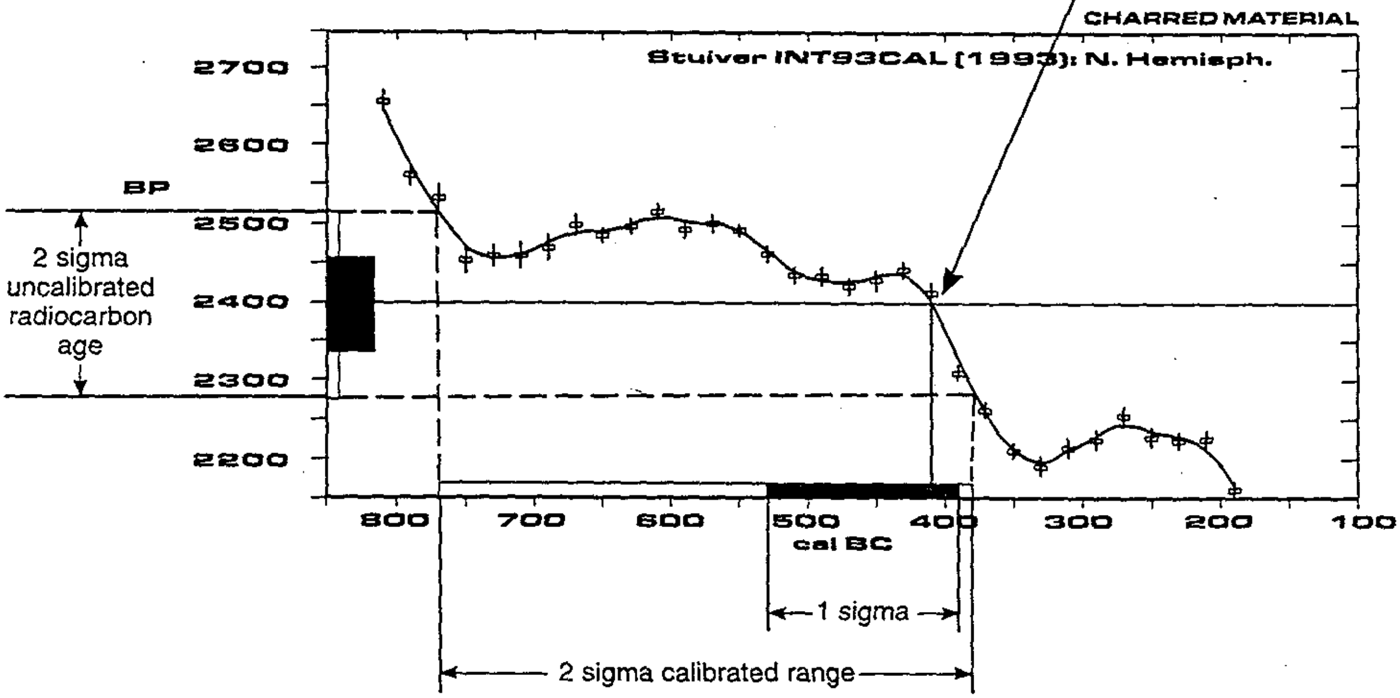
Conventional radiocarbon age: **2400 +/- 60 BP** ← The uncalibrated radiocarbon age (± 1 sigma)

The recommended calibration age range to be used for interpretation → **Calibrated result: (2 sigma, 95% probability)** **cal BC 770 to 380**

Intercept data:

Intercept of radiocarbon age with calibration curve: cal BC 410 ← The intercept between the radiocarbon age & the calibrated calendar time scale curve

The calibration result of the radiocarbon age ± 1 sigma → 1 sigma calibrated result: (68% probability) cal BC 530 to 390



References:

Vogel, J. C., Fuls, A., Visser, E. and Becker, B., 1993, Radiocarbon 33(1), p73-86
Talma, A. S. and Vogel, J. C., 1993, Radiocarbon 35(2), p317-322
Stuiver, M., Long, A., Kra, R. S. and Devine, J. M., 1993, Radiocarbon 35(1)

Results prepared by:

Beta Analytic, Inc., 4985 S.W. 74th Court, Miami, Florida 33155

Reporting results (recommended):
1. List the radiocarbon age with its associated 1 sigma standard deviation in a table and designate it as such.
2. Discussion of ages in the text should focus on the 2 sigma calibrated range.

CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables:estimated C13/C12=-25:lab mult.=1)

Laboratory Number: Beta-78713

Conventional radiocarbon age*: 4000 +/- 70 BP

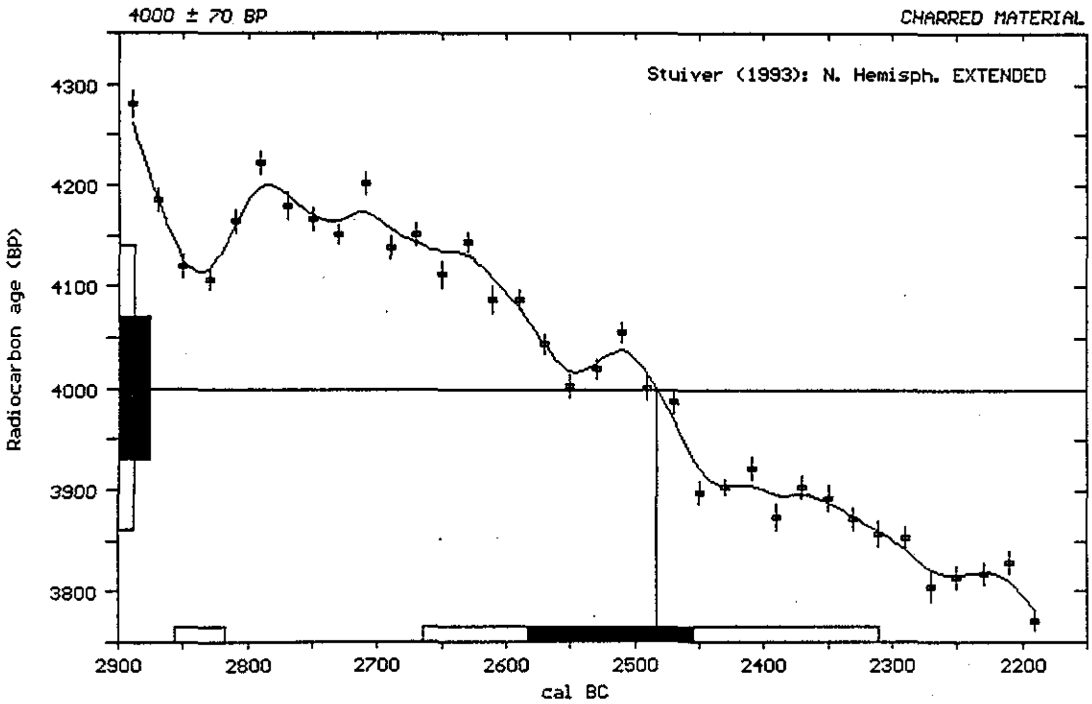
Calibrated results: (2 sigma, 95% probability) **cal BC 2855 to 2820 and cal BC 2665 to 2310**

* C13/C12 ratio estimated

Intercept data:

Intercept of radiocarbon age with calibration curve: cal BC 2485

1 sigma calibrated results: (68% probability) cal BC 2585 to 2455



References:

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Stuiver, M., Long, A., Kra, R. S. and Devine, J. M., Radiocarbon 35(1)

Results prepared by:

Beta Analytic, Inc. 4985 S.W. 74th Court, Miami, Florida 33155

CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables:estimated C13/C12=-25:lab mult.=1)

Laboratory Number: Beta-78714

Conventional radiocarbon age*: 4290 +/- 70 BP

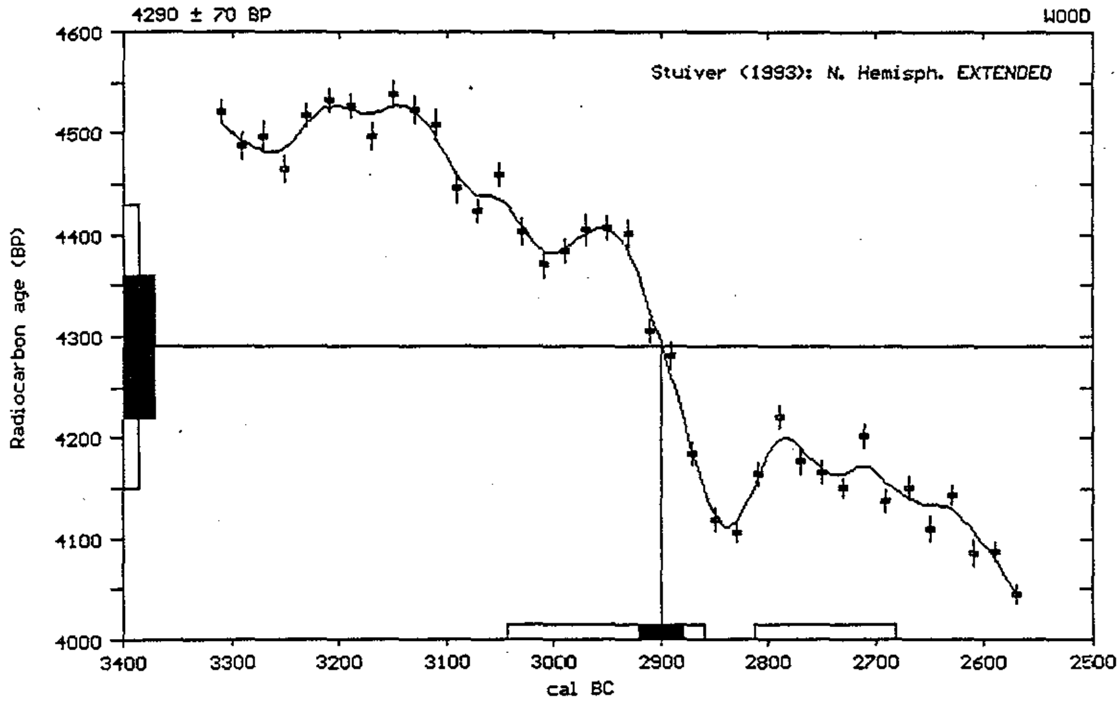
Calibrated results: (2 sigma, 95% probability) **cal BC 3045 to 2860 and cal BC 2815 to 2680**

* C13/C12 ratio estimated

Intercept data:

Intercept of radiocarbon age with calibration curve: cal BC 2900

1 sigma calibrated results: (68% probability) cal BC 2920 to 2880



References:

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Talma, A. S. and Vogel, J. C., 1993, Radiocarbon 35(2), p317-322
Stuiver, M., Long, A., Kra, R. S. and Devine, J. M., Radiocarbon 35(1)

Results prepared by:

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CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables:estimated C13/C12=-25:lab mult.=1)

Laboratory Number: Beta-78715

Conventional radiocarbon age*: 10 +/- 50 BP

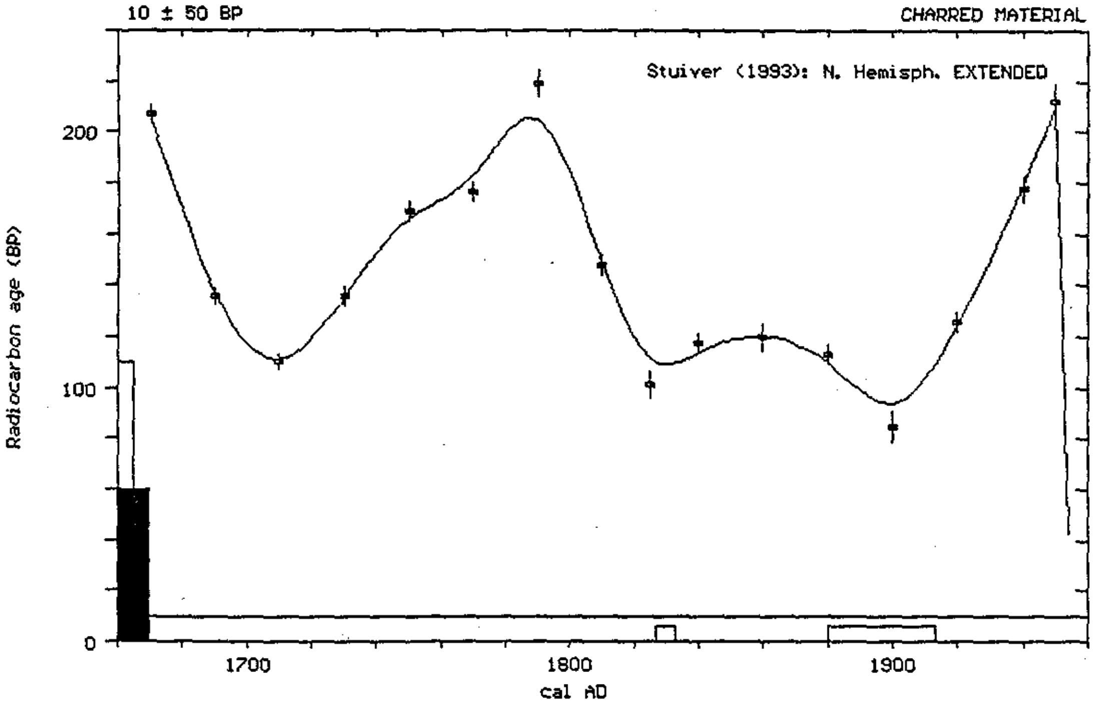
Calibrated results: cal AD 1825 to 1835 and
(2 sigma, 95% probability) cal AD 1880 to 1915

* C13/C12 ratio estimated

Intercept data:

Intercepts of radiocarbon age with calibration curve: NO INTERCEPTS

1 sigma calibrated result: NO INTERCEPTS



References:
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Talma, A. S. and Vogel, J. C., 1993, Radiocarbon 35(2), p317-322
Stuiver, M., Long, A., Kra, R. S. and Devine, J. M., Radiocarbon 35(1)

Results prepared by:
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CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables:estimated C13/C12=-25:lab mult.=1)

Laboratory Number: Beta-78716

Conventional radiocarbon age*: **550 +/- 60 BP**

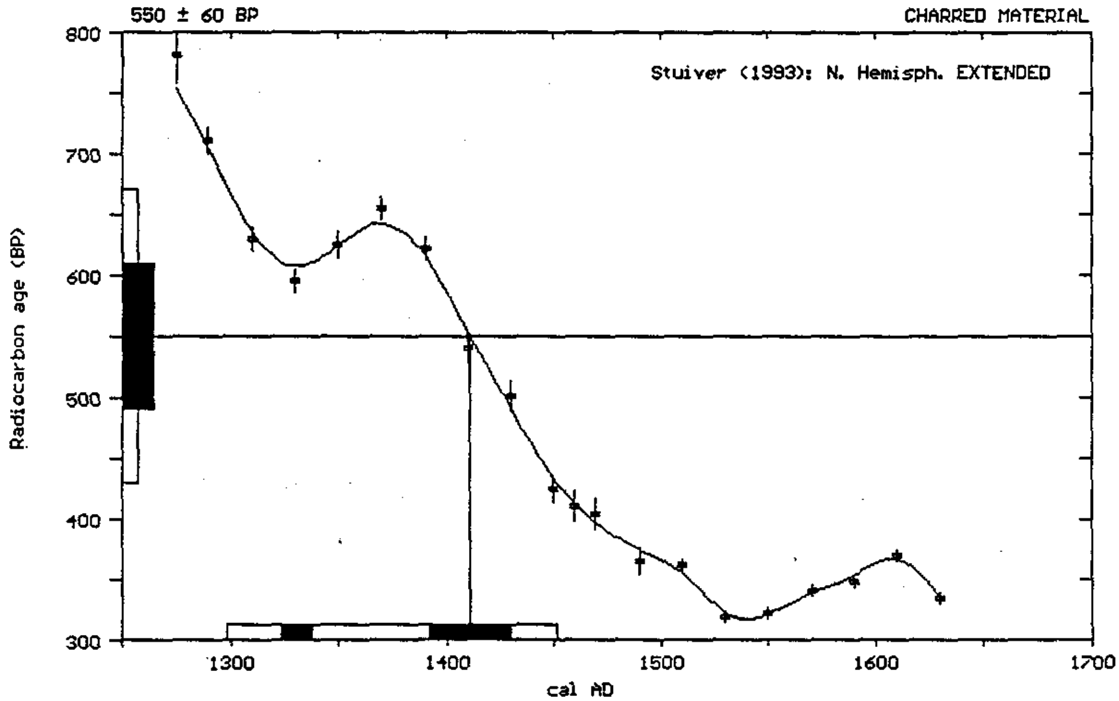
Calibrated results: (2 sigma, 95% probability) **cal AD 1300 to 1450**

* C13/C12 ratio estimated

Intercept data:

Intercept of radiocarbon age with calibration curve: cal AD 1410

1 sigma calibrated results: (68% probability) cal AD 1325 to 1340 and cal AD 1390 to 1430



References:

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Talma, A. S. and Vogel, J. C., 1993, Radiocarbon 35(2), p317-322
Stuiver, M., Long, A., Kra, R. S. and Devine, J. M., Radiocarbon 35(1)

Results prepared by:

Beta Analytic, Inc. 4985 S.W. 74th Court, Miami, Florida 33155

CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

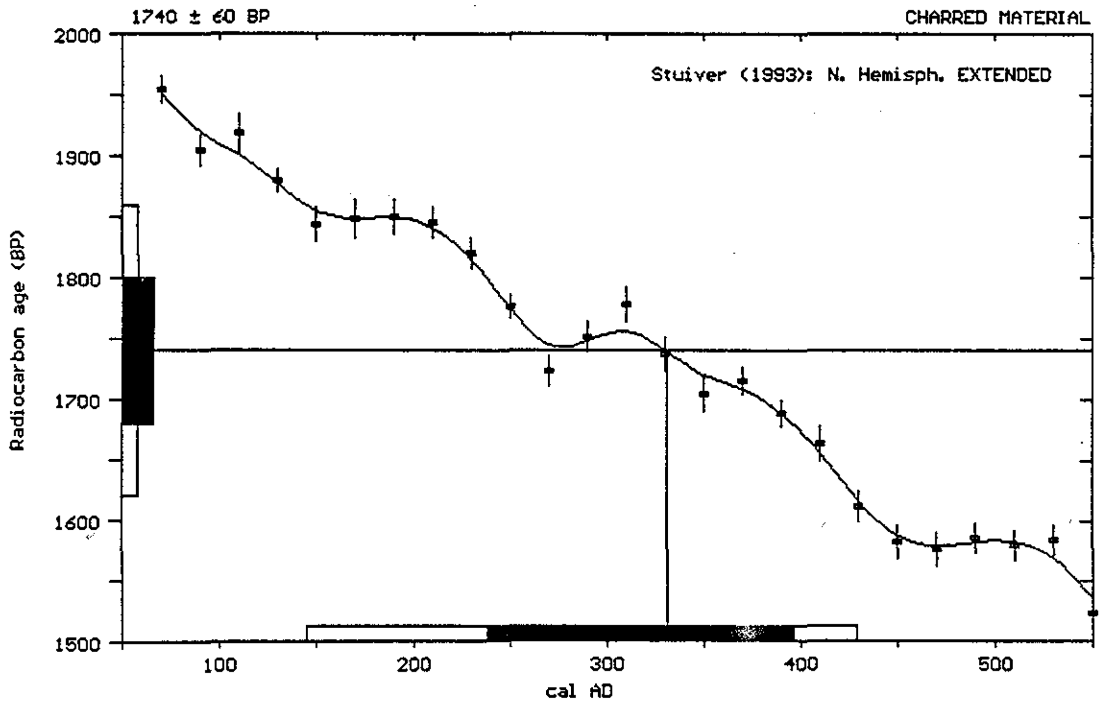
(Variables:estimated C13/C12=-25:lab mult.=1)

Laboratory Number:	Beta-78717
Conventional radiocarbon age*:	**1740 +/- 60 BP**
Calibrated results: (2 sigma, 95% probability)	**cal AD 145 to 430**

* C13/C12 ratio estimated

Intercept data:

Intercept of radiocarbon age with calibration curve:	cal AD 330
1 sigma calibrated results: (68% probability)	cal AD 240 to 395



References:

Vogel, J. C.,Fuls, A., Visser, E. and Becker, B., 1993, Radiocarbon 35(1), p73-86
Talma, A. S. and Vogel, J. C., 1993, Radiocarbon 35(2), p317-322
Stuiver, M., Long, A., Kra, R. S. and Devine, J. M., Radiocarbon 35(1)

Results prepared by:

Beta Analytic, Inc. 4985 S.W. 74th Court, Miami, Florida 33155

CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables:estimated C13/C12=-25:lab mult.=1)

Laboratory Number: Beta-78718

Conventional radiocarbon age*: **910 +/- 50 BP**

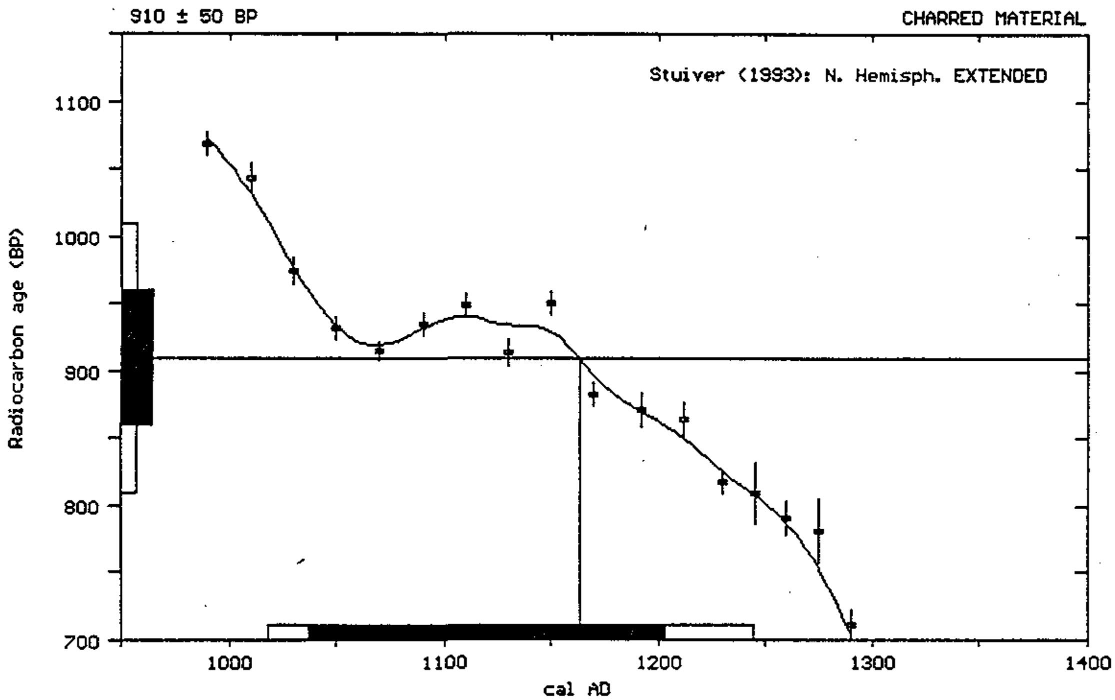
Calibrated results: **cal AD 1020 to 1245**
(2 sigma, 95% probability)

* C13/C12 ratio estimated

Intercept data:

Intercept of radiocarbon age with calibration curve: cal AD 1165

1 sigma calibrated results: cal AD 1035 to 1205
(68% probability)



References:

Vogel, J. C.,Fuls, A., Visser, E. and Becker, B., 1993, Radiocarbon 35(1), p73-86
Talma, A. S. and Vogel, J. C., 1993, Radiocarbon 35(2), p317-322
Stuiver, M., Long, A., Kra, R. S. and Devine, J. M., Radiocarbon 35(1)

Results prepared by:
Beta Analytic, Inc. 4985 S.W. 74th Court, Miami, Florida 33155

CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

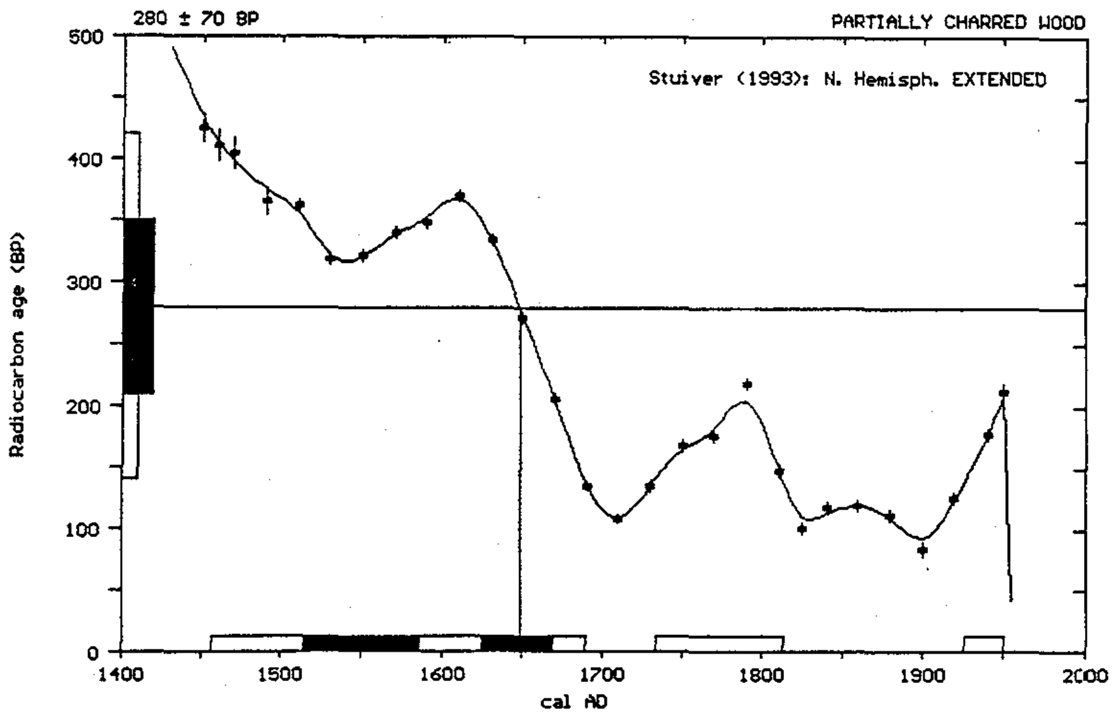
(Variables:estimated C13/C12=-25:lab mult.=1)

Laboratory Number:	Beta-78807
Conventional radiocarbon age*:	**280 +/- 70 BP**
Calibrated results: **(2 sigma, 95% probability)**	**cal AD 1455 to 1690 and** **cal AD 1735 to 1815 and** **cal AD 1925 to 1950**

* C13/C12 ratio estimated

Intercept data:

Intercept of radiocarbon age with calibration curve:	cal AD 1650
1 sigma calibrated results: (68% probability)	cal AD 1515 to 1585 and cal AD 1625 to 1670



References:

Vogel, J. C.,Fuls, A., Visser, E. and Becker,.B., 1993, Radiocarbon 35(1), p73-86

Talma, A. S. and Vogel, J. C., 1993, Radiocarbon 35(2), p317-322

Stuiver, M., Long, A., Kra, R. S. and Devine, J. M., Radiocarbon 35(1)

Results prepared by:

Beta Analytic, Inc. 4985 S.W. 74th Court, Miami, Florida 33155

CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables:estimated C13/C12=-25:lab mult.=1)

Laboratory Number: Beta-78808

Conventional radiocarbon age*: 850 +/- 50 BP

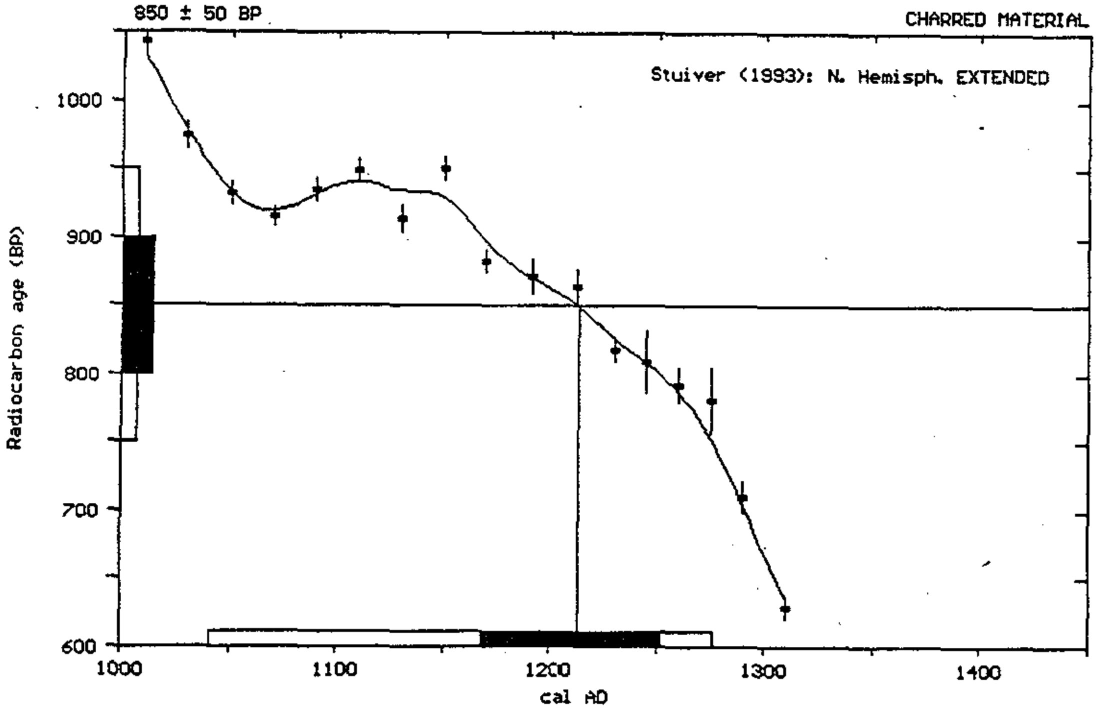
Calibrated results: (2 sigma, 95% probability) cal AD 1040 to 1275

** C13/C12 ratio estimated*

Intercept data:

Intercept of radiocarbon age with calibration curve: cal AD 1215

1 sigma calibrated results: (68% probability) cal AD 1170 to 1250



References:

Vogel, J. C.,Fuls, A., Visser, E. and Becker, B., 1993, Radiocarbon 35(1), p73-86
Talma, A. S. and Vogel, J. C., 1993, Radiocarbon 35(2), p317-322
Stuiver, M., Long, A., Kra, R. S. and Devine, J. M., Radiocarbon 35(1)

Results prepared by:
Beta Analytic, Inc. 4985 S.W. 74th Court, Miami, Florida 33155

CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables:estimated C13/C12=-25:lab mult.=1)

Laboratory Number: Beta-78809

Conventional radiocarbon age*: **1020 +/- 50 BP**

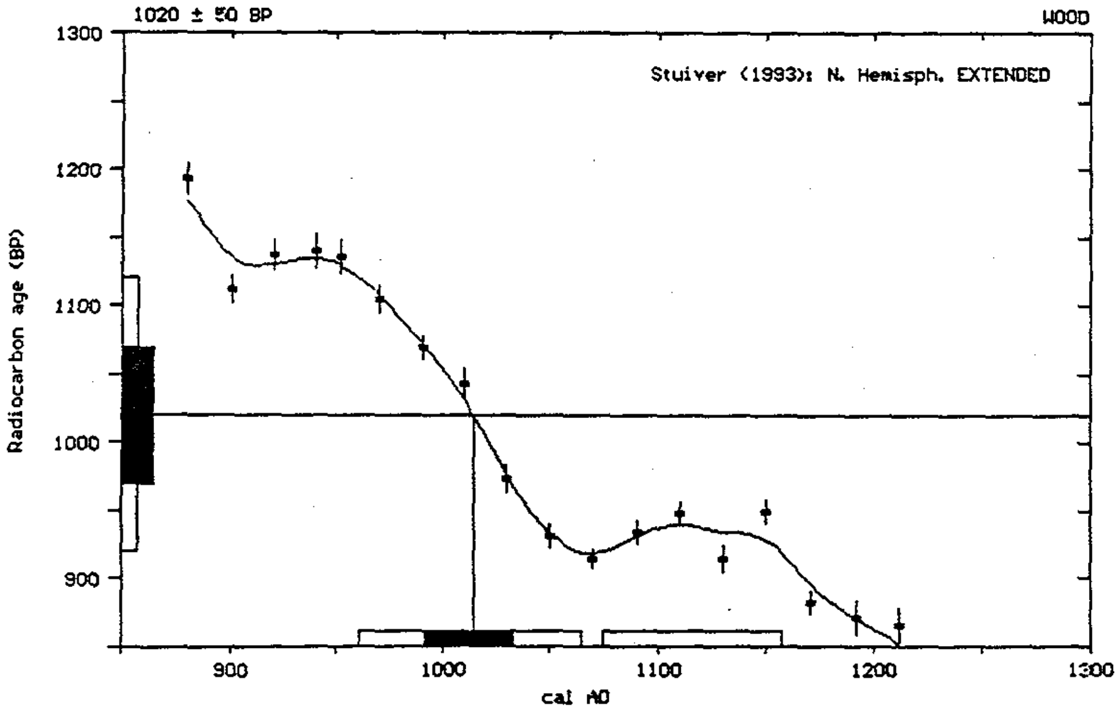
Calibrated results: (2 sigma, 95% probability) **cal AD 960 to 1065 and cal AD 1075 to 1155**

* *C13/C12 ratio estimated*

Intercept data:

Intercept of radiocarbon age with calibration curve: cal AD 1015

1 sigma calibrated results: (68% probability) cal AD 990 to 1035



References:

Vogel, J. C.,Fuls, A., Visser, E. and Becker, B., 1993, Radiocarbon 35(1), p73-86
Talma, A. S. and Vogel, J. C., 1993, Radiocarbon 35(2), p317-322
Stuiver, M., Long, A., Kra, R. S. and Devine, J. M., Radiocarbon 35(1)

Results prepared by:

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CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

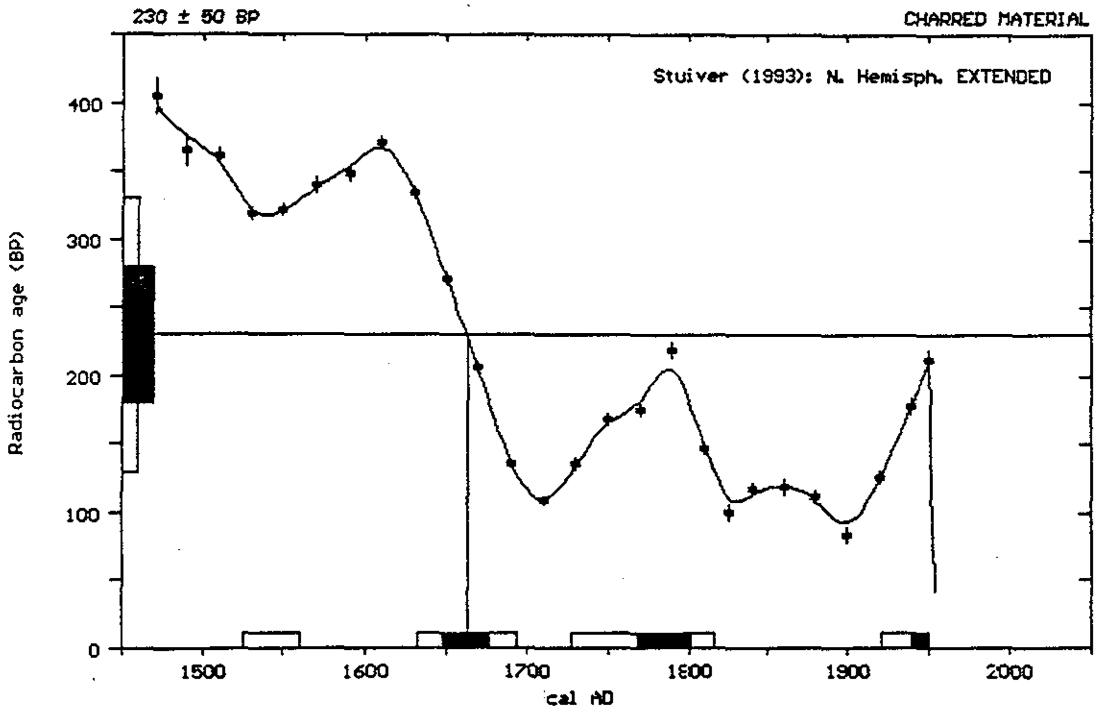
(Variables:estimated C13/C12=-25:lab mult.=1)

Laboratory Number:	Beta-78810
Conventional radiocarbon age*:	**230 +/- 50 BP**
Calibrated results: **(2 sigma, 95% probability)**	**cal AD 1525 to 1560 and** **cal AD 1630 to 1695 and** **cal AD 1725 to 1815 and** **cal AD 1920 to 1950**

* C13/C12 ratio estimated

Intercept data:

Intercept of radiocarbon age with calibration curve:	cal AD 1665
1 sigma calibrated results: (68% probability)	cal AD 1650 to 1675 and cal AD 1770 to 1800 and cal AD 1940 to 1950



References:

Vogel, J. C.,Fuls, A., Visser, E. and Becker, B., 1993, Radiocarbon 35(1), p73-86

Talma, A. S. and Vogel, J. C., 1993, Radiocarbon 35(2), p317-322

Stuiver, M., Long, A., Kra, R. S. and Devine, J. M., Radiocarbon 35(1)

Results prepared by:

Beta Analytic, Inc. 4985 S.W. 74th Court, Miami, Florida 33155

CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables:estimated C13/C12=-25:lab mult.=1)

Laboratory Number: Beta-78811

Conventional radiocarbon age*: 900 +/- 50 BP

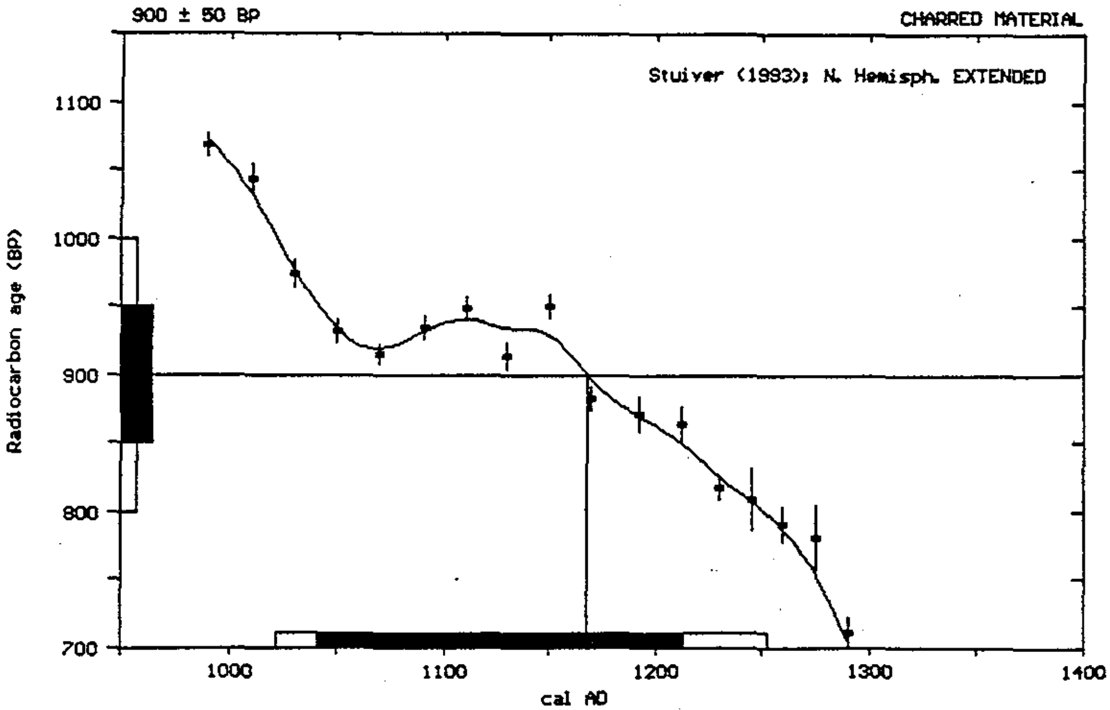
Calibrated results: (2 sigma, 95% probability) cal AD 1020 to 1250

* C13/C12 ratio estimated

Intercept data:

Intercept of radiocarbon age with calibration curve: cal AD 1170

1 sigma calibrated results: (68% probability) cal AD 1040 to 1215



References:

Vogel, J. C.,Fuls, A., Visser, E. and Becker, B., 1993, Radiocarbon 35(1), p73-86

Talma, A. S. and Vogel, J. C., 1993, Radiocarbon 35(2), p317-322

Stuiver, M., Long, A., Kra, R. S. and Devine, J. M., Radiocarbon 35(1)

Results prepared by:

Beta Analytic, Inc. 4985 S.W. 74th Court, Miami, Florida 33155

CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables:estimated C13/C12=-25:lab mult.=1)

Laboratory Number: Beta-78812

Conventional radiocarbon age*: 2220 +/- 60 BP

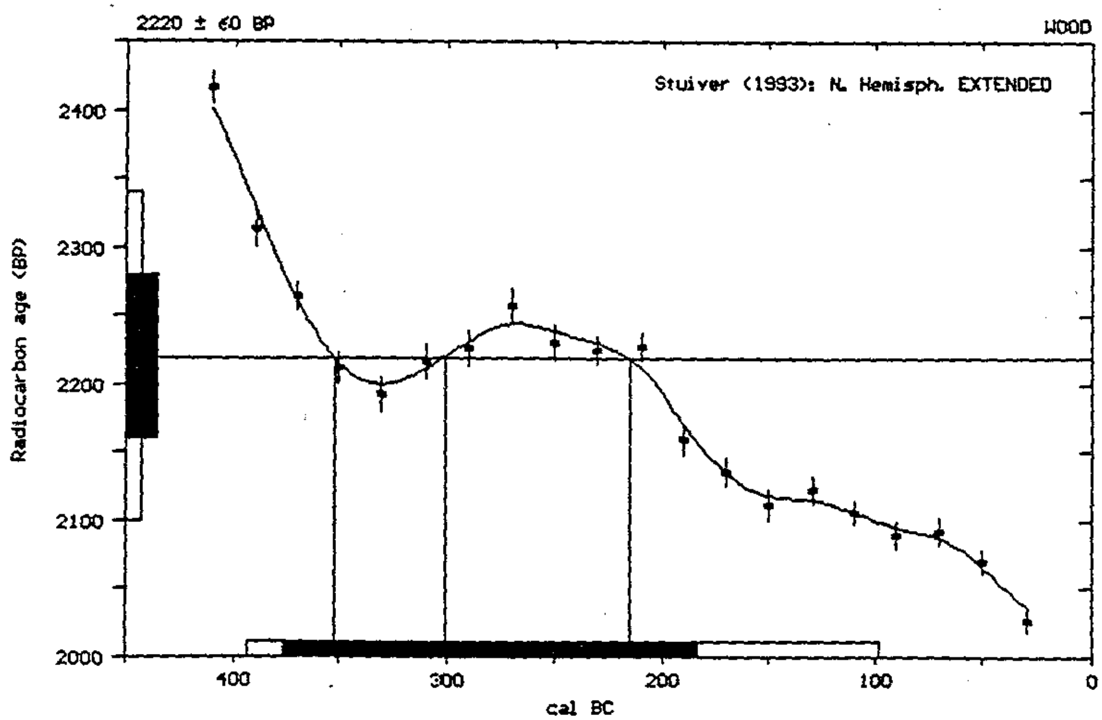
Calibrated results: cal BC 395 to 100
(2 sigma, 95% probability)

* C13/C12 ratio estimated

Intercept data:

Intercepts of radiocarbon age with calibration curve: cal BC 350 and cal BC 300 and cal BC 215

1 sigma calibrated results: cal BC 375 to 185
(68% probability)



References:
Vogel, J. C.,Fuls, A., Visser, E. and Becker, B., 1993, Radiocarbon 35(1), p73-86
Talma, A. S. and Vogel, J. C., 1993, Radiocarbon 35(2), p317-322
Stuiver, M., Long, A., Kra, R. S. and Devine, J. M., Radiocarbon 35(1)

Results prepared by:
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CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

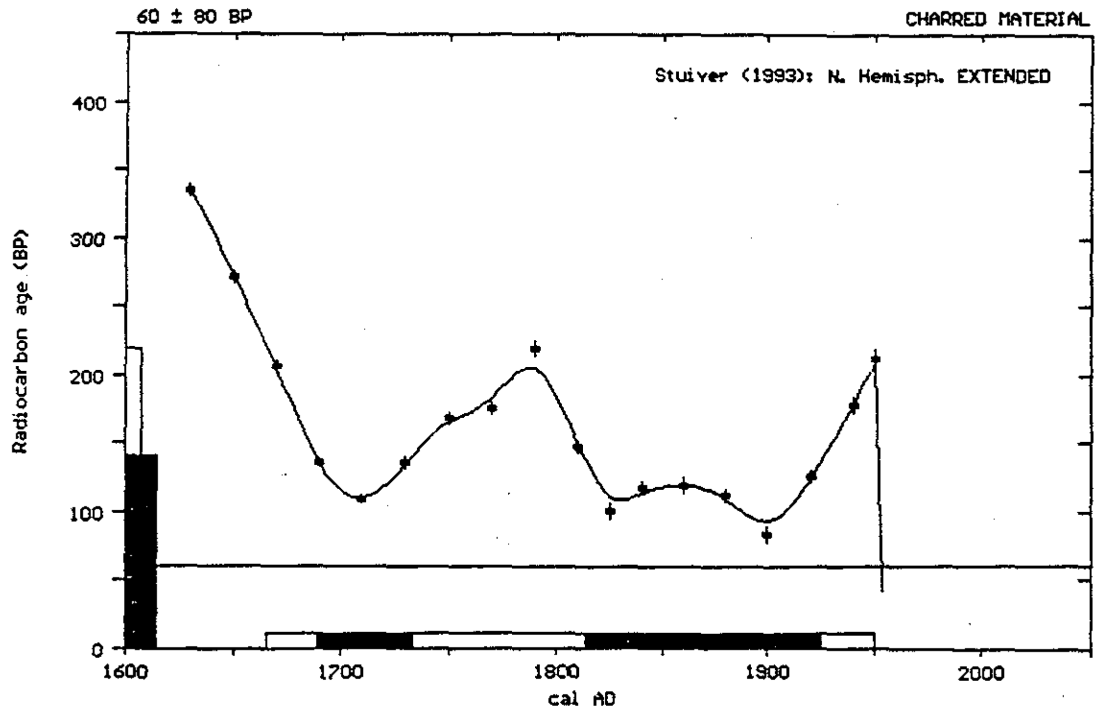
(Variables:estimated C13/C12=-25:lab mult.=1)

Laboratory Number:	Beta-78814
Conventional radiocarbon age*:	**60 +/- 80 BP**
Calibrated results: (2 sigma, 95% probability)	**cal AD 1665 to 1950**

* C13/C12 ratio estimated

Intercept data:

Intercepts of radiocarbon age with calibration curve:	NO INTERCEPTS
1 sigma calibrated results: (68% probability)	cal AD 1690 to 1735 and cal AD 1815 to 1925



References:

Vogel, J. C.,Fuls, A., Visser, E. and Becker, B., 1993, Radiocarbon 35(1), p73-86

Talma, A. S. and Vogel, J. C., 1993, Radiocarbon 35(2), p317-322

Stuiver, M., Long, A., Kra, R. S. and Devine, J. M., Radiocarbon 35(1)

Results prepared by:

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APPENDIX C

TEPHRA DATA

SITKA NPS TEPHRA SAMPLES

SITKA NATIONAL HISTORIC PARK

ACT SAMPLE #	FIELD ID # (Lab #)	SAMPLE TYPE	DATE COLLECTED	SAMPLE DEPTH (CMBS)	COLLECTED BY	DATE SENT TO UAF LAB	COMMENTS
ACT 1371	SHED-1-1 (NPS-94-T1)	TEPHRA	10-19-94	30-35	R. Betts	11-23-94	Collected from faced cutbank directly below charcoal sample SHED-1-1 at cut bank behind NPS workshed.
	A-1-1 (NPS-94-T2)	TEPHRA	10-19-94	10	G. Chaney	not submitted	Collected from Test A near NPS workshed: large sample
	D-2-1 (NPS-94-T3)	TEPHRA	10-20-94	20-22	R. Betts	not submitted	Collected from Test D-2 at edge of tree throw root wad depression - below cobble chopper Artifact # 94-SITKA-1
	E-1-1 (NPS-94-T4)	TEPHRA	10-21-94	18-20	R. Betts	not submitted	Collected from N.E. wall of Test E-1 at contact with gravel unit.
ACT 1372	O-1-1 (NPS-94-T5)	TEPHRA	10-25-94	5-10	R. Betts	11-23-94	Collected from Test 0 on N.E. side of Indian River near Russian Memorial (036 degrees @ 33 ft from TNH #90). From directly above gravel and pebble unit.

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Robert C. Betts
Project Archeologist
Vanguard Research
POB 2406365
Douglas, Alaska 99824

Dear Robert: April 6, 1995

Enclosed please find several documents concerning the tephras you found near Sitka, Alaska. These documents include (Page 1) the results of analyses I made of Holocene tephras from the Sitka area using the electron microprobe (EMP) at the University of Alaska; (Page 2) the results of analyses I made of Pleistocene tephras found in Sitka, on Kruzoff Island, and north to Icy Strait; and (Page 3) all previously published EMP data on Edgecumbe tephras. Also please find (Pages 4, 5) two spreadsheets showing the raw data obtained on the two samples you submitted.

Please note that each analysis is an average of multiple EMP analyses of individual, discrete glass shards; typically the area analyzed on each shard is 10 microns in diameter. The glass shards are assumed to be geochemically homogenous at this scale. Please also note that the standard deviations (one sigma) are low. This is a sign of good data quality. I discuss this data and interpret it below:

HOLOCENE TEPHRAS: The EMP data shows that the two tephras you found and submitted are geochemically very similar to one-another, and also to two other samples of Holocene tephras I collected from peats during field work in Sitka in 1994. I followed my usual procedures with your samples, giving them an ACT number upon arrival in my laboratory. I then analyzed the samples using the geochemical standards and EMP analytical routines described in Begét et al. (1992).

There is very good agreement between the four Holocene samples, as all of the oxide compositions overlap at a one sigma standard deviation. In particular, the major oxides (SiO2, Na2O, K2O, CaO, and Fe2O3) are all essentially identical.

The identity of one Holocene tephra (ACT 1334 collected by Begét north of Sitka) is complicated by the existence of a second population of very high silica glass found only in this sample at this site. The populations are distinct (i.e. no overlap on SiO2) at one standard deviation from their means. This glass may record a second, minor ash fall, near in time to the first, which was preserved at one locality and not the others. A sample of pumice found by Robert Sattler in a seacave during an archeological survey south of Sitka is similar (though not identical) in composition to the high silica glass.

The correlations between the four Holocene tephras should be considered extremely reliable, as all the Pleistocene tephras from the Edgecumbe volcanic complex are apparently somewhat more mafic than the Holocene tephras (see below).

PLEISTOCENE TEPHRAS

Nine analyses have been completed of samples of Pleistocene pumice and ash found at sites near Sitka, as well as on Kruzoff Island, and at one site near Icy Straits to the north. All of these Pleistocene samples are geochemically distinct from the Holocene samples, as they are all lower in SiO2 and more mafic. There is no possibility that samples found in Holocene peats are simply reworked or remobilized components of the thick Pleistocene ash deposits, as they are geochemically quite different.

PREVIOUSLY PUBLISHED DATA ON EDGECUMBE TEPHRAS

I've tabulated all previously published analyses of Edgecumbe tephras (Riehle, 1992). Where possible, I've normalized this data and calculated the precision of the data at one standard deviation. Two of these samples are based on only 4 and 7 analyses, while at least 10 EMP analyses are usually needed to adequately describe a sample, so the data accuracy precision may be unreliable. However, the compositions of Pleistocene tephras on Kruzoff Island appear quite similar to those I've obtained and discussed above.

Unfortunately, the previously published data set includes only one sample of a Holocene ash deposit, identified near Mt. Edgecumbe on Kruzoff Island, and insufficient data was presented to compare this analysis with the Sitka area data. No standard deviation was reported for this data, and the number of analyses was not given. This deposit appears to be roughly midway in compostion between the two glass types found in ACT 1334. However, based on the available data it cannot be proven to be correlative with the Holocene distal ash deposits found around Sitka.

RAW DATA

I include the raw data sheets for samples ACT 1371 and ACT 1372 (i.e. your two samples). In all cases I attempt to analyze 40 particles on polished grain mount slides. Fewer paticles were analyzed on your samples because I couldn't find enough good analytical sites. However, enough good analyses were obtained to provide some confidence in the data quality. This confidence is enhanced because the analyses are so similar to those at other Holocene sites.

SUMMARY AND CONCLUSIONS:

The two ash samples submitted by Robert Betts from sites near Sitka are correlative with one-another, and with Holocene ash deposits from Mt. Edgecumbe found elsewhere in the Sitka vicinity. These samples are geochemically distinct from older, Pleistocene tephras erupted from Mt. Edgecumbe, and so cannot be reworked material, but instead record a Holocene eruption.

The Holocene ash deposits identified by Robert Betts consitute a synchronous geochronologic marker horizon in the Sitka area, which should be useful for future archeologic, geologic, and oceanographic studies.

ELECTRON MICROPROBE ANALYSES OF TEPHRAS FROM MT. EDGECUMBE FOUND NEAR SITKA, ALASKA

						James Begét Dept. Geology and Geophysics Univeristy of Alaska Fairbanks, AK. 99775-5780 (907) 474-7565							
HOLOCENE TEPHRAS													
Holocene ash from Sikta (Robert Betts sample #NPS-94-T1)													
Label		Na2O	MgO	Al2O3	SiO2	Cl	K2O	CaO	TiO2	Fe2O3	Total	Hydration	Diddle
act 1371	ave	4.35	0.30	14.20	73.71	0.07	2.54	1.73	0.28	2.83	100.00	3.52	1.04
n=15	std dev	0.25	0.03	0.23	0.15	0.02	0.07	0.08	0.12	0.19	0.00	0.70	0.01
Holocene ash from Sitka (Robert Betts sample #NPS-94-T5)													
Label		Na2O	MgO	Al2O3	SiO2	Cl	K2O	CaO	TiO2	Fe2O3	Total	Hydration	Diddle
act 1372	ave	4.13	0.30	14.55	73.56	0.07	2.48	1.73	0.27	2.91	100.00	4.52	1.05
n=11	std dev	0.12	0.06	0.29	0.28	0.02	0.10	0.07	0.11	0.12	0.00	1.50	0.02
Begét postglacial ash sample (94SIT-18) from Sitka peats													
act 1342	ave	4.34	0.29	14.35	73.55	0.07	2.49	1.80	0.30	2.81	100.00	3.87	1.04
n=25	std dev	0.26	0.04	0.35	0.46	0.02	0.13	0.16	0.11	0.20	0.00	1.56	0.02
94SIT18 (Holocene ash)													
Begét postglacial ash sample (94SIT-17) from Sitka peats													
Label		Na2O	MgO	Al2O3	SiO2	Cl	K2O	CaO	TiO2	Fe2O3	Total	Hydration	Diddle
act 1334	ave	4.11	0.29	14.51	73.70	0.07	2.49	1.69	0.30	2.85	100.00	4.98	1.05
n=15 (p1)	std dev	0.23	0.05	0.30	0.45	0.03	0.10	0.11	0.12	0.15	0.00	1.83	0.02
Label		Na2O	MgO	Al2O3	SiO2	Cl	K2O	CaO	TiO2	Fe2O3	Total	Hydration	Diddle
ACT 1334	ave	4.00	0.30	12.48	77.52	0.12	2.34	1.70	0.31	1.23	100.00	4.92	1.05
n=10 (p2)	std dev	0.26	0.07	0.23	0.38	0.07	0.20	0.20	0.11	0.48	0.00	1.20	0.01
Robert Sattler sample from tectonically uplifted sea-cave south of Sitka (water-washed pumice)													
Label		Na2O	MgO	Al2O3	SiO2	Cl	K2O	CaO	TiO2	Fe2O3	Total	Hydration	Diddle
act 1340	ave	3.66	0.31	12.69	78.12	0.16	1.68	1.50	0.26	1.38	100.00	4.59	1.05
n=17 (p2)	std dev	0.22	0.10	0.49	0.75	0.03	0.39	0.42	0.10	0.17	0.00	1.21	0.01

PLEISTOCENE TEPHRA		Na2O	MgO	Al2O3	SiO2	Cl	K2O	CaO	TiO2	Fe2O3	Total	Hydration	Diddle
	ave	4.22	0.27	13.79	74.50	0.06	2.67	1.57	0.23	2.69	100.00	3.39	1.04
act 1290	std dev	0.29	0.11	0.37	0.53	0.02	0.11	0.13	0.13	0.41	0.00	1.40	0.01
n=24													
		Na2O	MgO	Al2O3	SiO2	Cl	K2O	CaO	TiO2	Fe2O3	Total	Hydration	Diddle
	ave	4.62	0.30	14.68	73.05	0.10	2.53	1.72	0.28	2.70	100.00	7.29	1.08
act 1264	std dev	0.25	0.06	0.38	0.49	0.05	0.13	0.13	0.10	0.15	0.00	6.45	0.09
n=13													
		Na2O	MgO	Al2O3	SiO2	Cl	K2O	CaO	TiO2	Fe2O3	Total	Hydration	Diddle
	ave	4.25	0.25	14.62	73.63	0.07	2.69	1.63	0.25	2.62	100.00	5.06	1.05
act 1305	std dev	0.26	0.04	0.23	0.46	0.02	0.12	0.13	0.10	0.22	0.00	1.69	0.02
n=31													
		Na2O	MgO	Al2O3	SiO2	Cl	K2O	CaO	TiO2	Fe2O3	Total	Hydration	Diddle
	ave	4.43	0.71	16.06	69.74	0.08	2.04	2.72	0.47	3.75	100.00	3.55	1.04
act 1306	std dev	0.29	0.09	0.41	0.57	0.02	0.10	0.23	0.14	0.29	0.00	1.98	0.02
n=17													
		Na2O	MgO	Al2O3	SiO2	Cl	K2O	CaO	TiO2	Fe2O3	Total	Hydration	Diddle
	ave	4.43	0.71	16.02	69.78	0.08	2.04	2.72	0.47	3.74	100.00	3.27	1.03
act 1306.1	std dev	0.30	0.09	0.40	0.56	0.02	0.10	0.24	0.14	0.29	0.00	1.65	0.02
n=16													
		Na2O	MgO	Al2O3	SiO2	Cl	K2O	CaO	TiO2	Fe2O3	Total	Hydration	Diddle
	ave	4.45	0.71	16.08	69.69	0.08	2.05	2.71	0.46	3.78	100.00	3.65	1.04
act 1306.2	std dev	0.29	0.09	0.41	0.55	0.02	0.10	0.23	0.14	0.26	0.00	2.00	0.02
n=15													
		Na2O	MgO	Al2O3	SiO2	Cl	K2O	CaO	TiO2	Fe2O3	Total	Hydration	Diddle
	ave	4.36	0.69	16.01	69.89	0.10	2.13	2.77	0.39	3.66	100.00	3.79	1.04
act 1307	std dev	0.39	0.15	0.22	0.37	0.02	0.19	0.19	0.11	0.36	0.00	1.18	0.01
n=9													
		Na2O	MgO	Al2O3	SiO2	Cl	K2O	CaO	TiO2	Fe2O3	Total	Hydration	Diddle
	ave	4.43	2.35	16.09	58.74	0.04	1.08	6.41	1.59	9.27	100.00	3.39	1.04
act 1310	std dev	0.86	1.13	2.95	0.49	0.02	0.22	0.60	0.44	2.52	0.00	0.71	0.01
n=11													
		Na2O	MgO	Al2O3	SiO2	Cl	K2O	CaO	TiO2	Fe2O3	Total	Hydration	Diddle
	ave	0.42	0.02	17.81	64.97	0.02	16.65	0.03	0.04	0.04	100.00	3.28	1.03
act 1333	std dev	0.09	0.02	0.22	0.22	0.01	0.24	0.04	0.07	0.05	0.00	0.66	0.01
n=12													

TEPHRA SAMPLE SHED-1-1
(West of Indian River)

ACT SAMPLE # 1371

	0.00	4.35	0.12	34.56	46.11	0.04	0.23	13.60	0.02	0.97	100.00	7.70	1.08
	0.00	0.34	14.80	1.39	52.03	0.00	0.03	20.89	0.24	10.28	100.00	1.28	1.01
	0.00	6.31	0.00	27.61	55.75	0.01	0.13	9.63	0.08	0.48	100.00	2.73	1.03
	0.00	5.00	0.20	23.96	59.87	0.03	0.64	9.24	0.17	0.89	100.00	2.71	1.03
	0.00	2.64	7.94	8.83	62.46	0.00	1.38	11.04	0.30	5.41	100.00	11.76	1.13
	0.00	3.17	3.79	10.22	71.34	0.00	2.38	6.50	0.08	2.52	100.00	3.27	1.03
	0.00	3.62	0.17	16.29	72.37	0.00	3.76	3.45	0.04	0.30	100.00	3.91	1.04
	0.00	4.70	0.33	13.92	73.41	0.07	2.53	1.74	0.09	3.22	100.00	4.49	1.05
	0.00	4.30	0.32	14.22	73.53	0.07	2.62	1.83	0.35	2.76	100.00	3.33	1.03
	0.00	4.34	0.27	14.23	73.54	0.07	2.46	1.76	0.20	3.13	100.00	2.32	1.02
	0.00	4.40	0.33	14.20	73.58	0.07	2.50	1.66	0.37	2.88	100.00	3.47	1.04
	0.00	3.79	0.29	14.65	73.62	0.06	2.54	1.70	0.40	2.96	100.00	3.75	1.04
	0.00	4.29	0.34	14.25	73.65	0.05	2.52	1.65	0.54	2.72	100.00	2.13	1.02
	0.00	4.46	0.33	14.14	73.69	0.10	2.51	1.78	0.37	2.62	100.00	3.68	1.04
	0.00	4.31	0.32	14.40	73.72	0.07	2.55	1.82	0.28	2.52	100.00	2.81	1.03
	0.00	4.49	0.26	14.32	73.72	0.08	2.63	1.62	0.11	2.77	100.00	3.91	1.04
	0.00	4.26	0.24	14.21	73.73	0.05	2.36	1.72	0.37	3.06	100.00	3.41	1.04
	0.00	4.33	0.31	14.03	73.81	0.08	2.60	1.87	0.20	2.77	100.00	3.32	1.03
	0.00	4.85	0.28	13.69	73.85	0.04	2.55	1.78	0.20	2.75	100.00	4.35	1.05
	0.00	4.27	0.26	14.31	73.86	0.06	2.64	1.62	0.31	2.68	100.00	3.51	1.04
	0.00	4.05	0.32	14.42	73.89	0.06	2.52	1.68	0.20	2.86	100.00	3.82	1.04
	0.00	4.47	0.29	14.01	73.98	0.10	2.55	1.69	0.22	2.68	100.00	4.45	1.05
		Na2O	MgO	Al2O3	SiO2	Cl	K2O	CaO	TiO2	Fe2O3	Total	Hydration	Diddle
act 1371	ave	4.35347	0.299663	14.19983	73.7053	0.068705	2.539224	1.727456	0.281034	2.825315	100	3.515901	1.036491
n=15	std dev	0.245608	0.031901	0.22779	0.1547	0.015888	0.071088	0.078378	0.122561	0.194413	0	0.69792	0.007472

TEPHRA SAMPLE O-1-1
(East of Indian River)

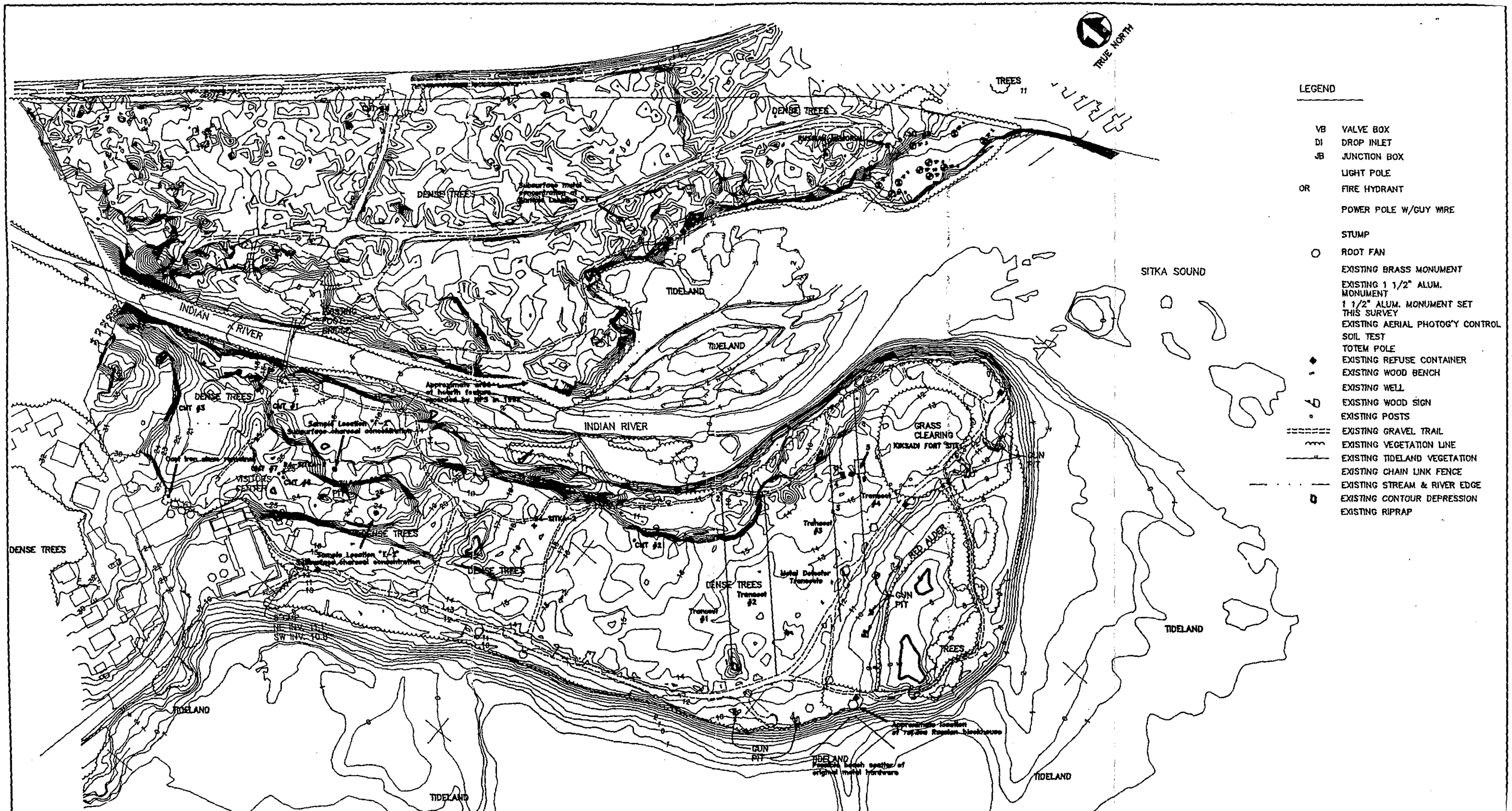
ACT SAMPLE # 1372

0.00		4.35	0.12	34.56	46.11	0.04	0.23	13.60	0.02	0.97	100.00	7.70	1.08
0.00		0.34	14.80	1.39	52.03	0.00	0.03	20.89	0.24	10.28	100.00	1.28	1.01
0.00		6.31	0.00	27.61	55.75	0.01	0.13	9.63	0.08	0.48	100.00	2.73	1.03
0.00		5.00	0.20	23.96	59.87	0.03	0.64	9.24	0.17	0.89	100.00	2.71	1.03
0.00		2.64	7.94	8.83	62.46	0.00	1.38	11.04	0.30	5.41	100.00	11.76	1.13
0.00		3.17	3.79	10.22	71.34	0.00	2.36	6.50	0.06	2.52	100.00	3.27	1.03
0.00		3.62	0.17	16.29	72.37	0.00	3.76	3.45	0.04	0.30	100.00	3.91	1.04
0.00		4.06	0.36	14.64	73.20	0.10	2.34	1.85	0.47	2.98	100.00	2.70	1.03
0.00		4.25	0.27	15.04	73.24	0.08	2.47	1.73	0.22	2.71	100.00	4.01	1.04
0.00		4.13	0.28	14.81	73.33	0.07	2.43	1.65	0.35	2.93	100.00	5.49	1.06
0.00		4.27	0.22	14.37	73.39	0.08	2.62	1.72	0.39	2.94	100.00	4.14	1.04
0.00		4.19	0.32	14.73	73.43	0.07	2.50	1.69	0.18	2.90	100.00	7.14	1.08
0.00		4.15	0.28	14.70	73.54	0.10	2.61	1.69	0.19	2.76	100.00	3.12	1.03
0.00		4.20	0.32	14.26	73.60	0.08	2.58	1.75	0.11	3.09	100.00	4.64	1.05
0.00		4.25	0.43	13.99	73.62	0.05	2.51	1.87	0.33	2.94	100.00	6.49	1.07
0.00		3.97	0.31	14.54	73.82	0.02	2.33	1.71	0.35	2.95	100.00	4.57	1.05
0.00		4.01	0.26	14.42	73.92	0.07	2.49	1.66	0.15	3.03	100.00	2.30	1.02
0.00		3.92	0.29	14.56	74.05	0.05	2.43	1.70	0.24	2.75	100.00	5.09	1.05
		Na2O	MgO	Al2O3	SiO2	Cl	K2O	CaO	TiO2	Fe2O3	Total	Hydration	Diddle
act 1372	ave	4.13	0.30	14.55	73.56	0.07	2.48	1.73	0.27	2.91	100.00	4.52	1.05
n=11	std dev	0.12	0.06	0.29	0.28	0.02	0.10	0.07	0.11	0.12	0.00	1.50	0.02

APPENDIX D

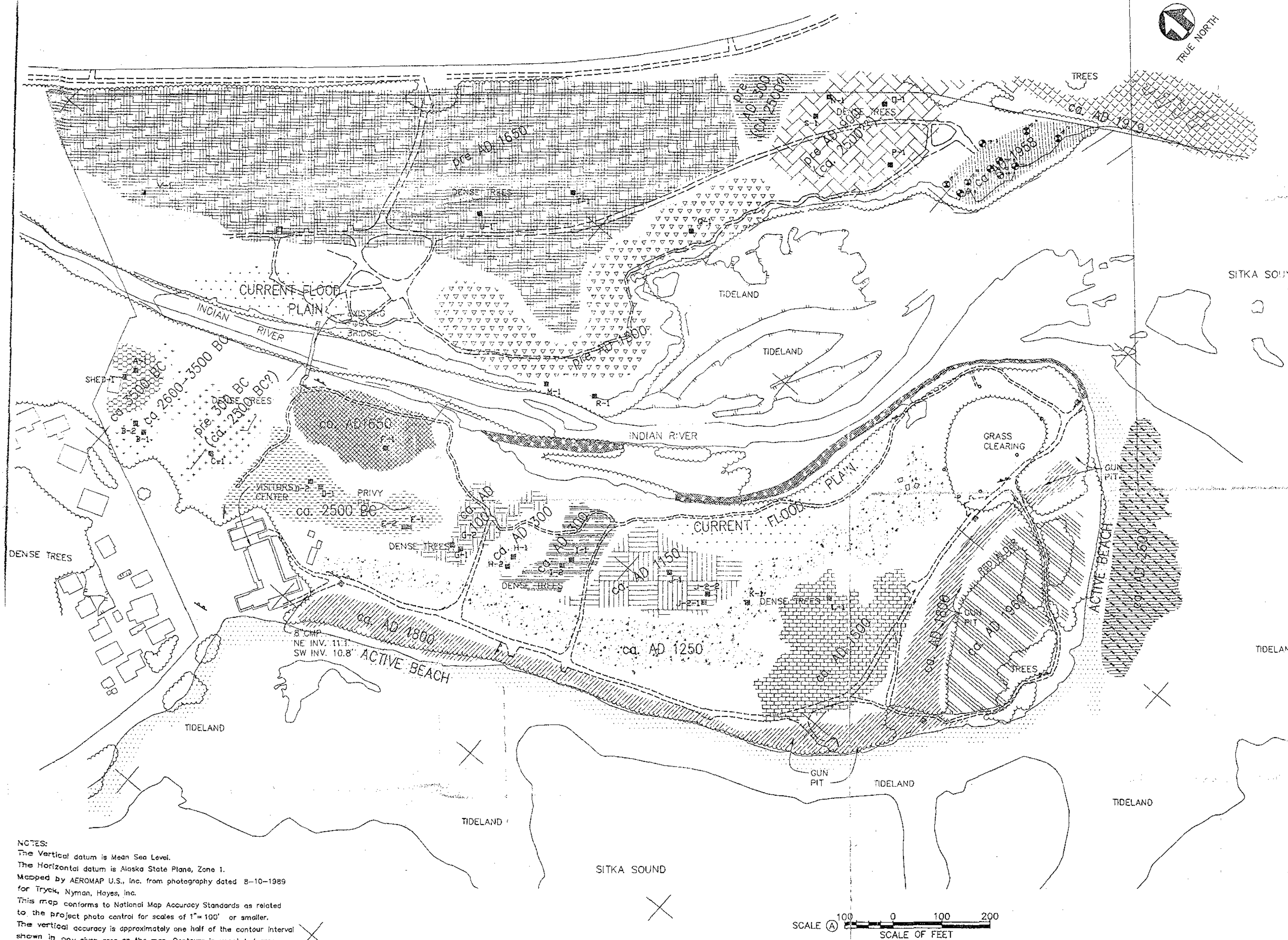
MAP 3

CULTURAL RESOURCES



NOTES:
The Vertical datum is Mean Sea Level.
The Horizontal datum is Alaska State Plane, Zone 1.
Mapped by AEROMAP U.S., Inc. from photography dated 8-10-1989 for Tryck, Nyman, Hayes, Inc.
This map conforms to National Map Accuracy Standards as related to the project photo control for scales of 1"=100' or smaller.
The vertical accuracy is approximately one half of the contour interval shown in any given area on the map. Contours in vegetated areas may be less accurate. Dashed contours indicate approximate lines due to very dense trees.
The portion of the Park lying north of Indian River surveyed in 1995 by Stragler Engineering Services, Inc. and not based on aerial photography.

MAP 3
CULTURAL FEATURES
SITKA NATIONAL HISTORICAL PARK
SITKA, ALASKA



MAP LEGEND

Dates reflect when landforms emerged from wave zone and could support forest vegetation and clast free soil development.

- ca. AD 2600 FUTURE BEACH MEADOW (development delayed due to dredging, Indian River dams & airport blocking wave energy)
- CURRENT FLOOD PLAIN (Periodically occupied during floods at extreme high water)
- CURRENT ACTIVE BEACH (Storm waves reach ~9 ft above mean sea level)
- ca. AD 1979 ARROWHEAD TRAILER COURT RIPRAP AND FILL
- ca. AD 1958 HOT ASPHALT PLANT BURIAL SITE
- ca. AD 1960 "BATTLE FIELD" BEACH MEADOW
- ca. AD 1800 BEACH (high intertidal zone during 1804)
- pre AD 1800 EPHEMERAL DRAINAGES (occasional modern scouring)
- ca. AD 1650 FLOOD PLAIN – RIVER TERRACE (age from soil depth over silt deposits)
- pre AD 1650 RIVER CHANNEL ALLUVIUM (age estimated from soil depth over silt deposits)
- ca. AD 1500 UPLIFTED BEACH MEADOW (age estimated from clast free soil depth)
- pre AD 1250 BEACH (calibrated C14 date)
- pre AD 1150 BEACH (calibrated C14 date)
- pre AD 900 REMNANT BAR (age interpolated from uplift curve possibly storm tidal ca. 2500 BC tephra date)
- pre AD 300 BEACH RIDGE (calibrated C14 date)
- pre AD 300 BEACH TROUGH (formation date. periodically flooded)
- pre AD 300 REMNANT BAR (possibly storm tidal ca. 2500 BC tephra date)
- pre AD 100 BEACH (interpolated from uplift rate)
- pre 300 BC BEACH MEADOW (possibly formed ~2500 BC)
- ca. 2500 BC REMNANT TERRACE (tephra horizon date)
- ca. 2600 BC – 3500 BC(?) BEACH (estimated age, need further data)
- ca. 3500 BC KNOLL (Island at that time. Age estimated from clast free soil depth below tephra horizon)

- EXISTING REFUSE CONTAINER
- EXISTING WOOD BENCH
- EXISTING WELL
- EXISTING WOOD SIGN
- EXISTING POSTS
- EXISTING GRAVEL TRAIL
- EXISTING VEGETATION LINE
- EXISTING TIDELAND VEGETATION
- EXISTING CHAIN LINK FENCE
- EXISTING STREAM & RIVER EDGE
- EXISTING CONTOUR DEPRESSION
- EXISTING RIPRAP

NOTES:
The Vertical datum is Mean Sea Level.
The Horizontal datum is Alaska State Plane, Zone 1.
Mapped by AEROMAP U.S., Inc. from photography dated 8-10-1989 for Tryck, Nyman, Hayes, Inc.
This map conforms to National Map Accuracy Standards as related to the project photo control for scales of 1"=100' or smaller.
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The portion of the Park lying north of Indian River surveyed in 1995 by Stragier Engineering Services, Inc. and not based on aerial photography.

MAP 1
LANDFORM CHRONOLOGY
SITKA NATIONAL HISTORICAL PARK

SITKA, ALASKA