Geology and Oral History—Complementary Views of a Former Glacier Bay Landscape

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Abstract. We collected data that link the geologic record with ethno-historical accounts, which chronicle the history of the Huna people in Glacier Bay. Radiocarbon dates on organic materials in sediments from lower Glacier Bay yield ages ranging from about 4,900 to 240 years ago, dating the formation of landforms pre-dating the advance of Neoglacial ice. Concurrently, the Huna people have place names and narratives that describe this pre-Little Ice Age landscape. Geological evidence collected from Neoglacial lacustrine, fluvial and marine sediments provides a temporal framework and environmental context for the landscapes available for human occupation. This inter-disciplinary study provides a more lucid understanding of past environments than the fields of geology or ethnography might achieve independently.

Introduction

For the people of Hoonah, Glacier Bay is *At.oow*—an owned place of abundant resources, clan origins, and territory. The Glacier Bay of former times is described by Hoonah Tlingits through their oral narratives, songs, place names, personal names, and clan and house crests. All of these things, including the land itself, are thought of in Tlingit culture as property which links the people to Glacier Bay historically, legally, and spiritually.

Glacier Bay also is a place where geologic research provides a basic understanding of ice age history. This study combines geologic research on the Little Ice Age (Neoglacial) history of Glacier Bay with Tlingit oral history to provide an environmental context for Tlingit occupation prior to the Little Ice Age. In our view, geologic data and ethnography, taken together, provide a vivid environmental sketch of a former time.

Methodology

This study was conducted in two phases by an interdisciplinary team of geologists and ethnographers. The geologic team utilized data from prior geologic research, both published and unpublished, to recreate a depositional and environmental history of Glacier Bay for the past 5,000+ years, concentrating on the period during which the landforms of lower Glacier Bay were being constructed. The ethnographic team compiled Tlingit oral histories and place names for lower Glacier Bay, both published and unpublished, that portray a 'remembered' landscape from a time before the Neoglacial advance. With these data in hand the combined team then conducted field research throughout lower Glacier Bay during May/June of 2003 and 2004, observing depositional packages and collecting organic remains for radio-carbon dating, adopting a strategy to fill in gaps in our combined understanding. Further, we compare our findings with the modern topography and bathymetry of Glacier Bay, and with analogs from other glacially dynamic landscapes, to corroborate our conclusions. Dates used in this paper are calibrated radiocarbon ages adjusted to a calendric scale (table 1), and presented in the narrative as years ago (Ya). Radiocarbon dates in the narrative are rounded to the nearest decade, but represented in calibrated radiocarbon years in table 1.

Results

The story of the Neoglacial begins in Reid Inlet and John Hopkins Inlet where wood fragments in glacial till date to 5,850 Ya and 5,540 Ya, respectively (table 1), indicating that ice and associated outwash probably extended a short distance down Glacier Bay's West Arm. In Muir Inlet, forested outwash extended mid-inlet by 5,490 Ya (Goldthwait, 1963). It is probable that all of Glacier Bay south of middle Muir Inlet and the uppermost West Arm was marine at this time. The lower Bay mouth, unencumbered by later sedimentation, was a broad sound that probably extended from Excursion Ridge to Point Carolus. We have no definite ethnographic or archaeological data to indicate human occupation of Glacier Bay during this time, although the archaeological record from nearby Groundhog Bay (Ackerman, 1996) indicates human occupation of the Icy Strait region 10,180±800 BP, and a human presence in Glacier Bay was possible given the similarity to today's environment.

By 5,120 Ya and 4,682 Ya, coarse outwash was killing trees on Francis and Sturgess Islands, respectively, indicating a large outwash plain extending from the West Arm and spanning the mid-bay. There is no evidence at this time of a Muir ice advance (Goldthwait, 1963). From uplifted sediments in the central Beardslee Islands and upper Berg

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Table 1. Radiocarbon dates (in chronological descending order).

[**Corrected age:** t conversion to clendric dates according to CALIB 14C, Stuiver, and others, 2004, CalPal, Weiniger and others, 2004. All Beta dates from the present study except Halibut Cove date]

Sample No.	Location	Provenance	Measured 14C age	Corrected age[t]
UW 597[1]	Mouth of Reid Inlet	wood in till	4,980±90	5,852±105 Ya
UW 598[1]	Near Topeka Glacier	wood in till	4,655±75	5,544±99
I 58-5[2]	Goose Cove	stump in outwash	4,775±250	5,494±320
UW 596[1]	Francis Island	stump killed by outwash	4,385±60	5,116±116
Beta 194100	Head of Berg Bay	shells in marine silt	4,380±50	4,898±50
Beta 194096	Kidney Island	shells in marine silt	4,310±40	4,758±40
UW 671[1]	Sturgess Island	stump killed by outwash	4,165±80	4,692±111
---------[3]	Muir Inlet	general date for formation of	2,500	2,630±112
Beta 194103	Lars Island	stick in organic debris	2,300±40	2,398±40
Beta 194102	Lars Island	woody debris	2,120±40	2,208±40
---------[3]	Muir Inlet	general date for end of	2,000	2,013±62
Beta 194104	N of Rush Pt.	organics	1,860±40	1,920±40
Beta 194101	Head of Berg Bay	allochthonous peat	1,910±60	1,870±60
---------[3]	Adams Inlet	general date for formation of	1,700	1,671±66
Beta 194099	North. Fox Farm Is.	*ex situ* stump	1,630±60	1,650±60
Beta 194098	Kidney Island	spruce rooted in peat	1,300±50	1,300±50
--------[3]	Adams Inlet	general date for end of	900	878±67
UW-672[1]	Kidney Island	*in situ* spruce	750±65	696±42
DIC-939[1]	Upper Beartrack	stump killed by lake	380±40	416±70
Beta 194097	Kidney island	shrub rooted in peat	430±60	410±60
Beta 194095	Lester Point	root fragment near stump	370±50	390±50
Beta 86378[4]	Halibut Cove	*in situ* stump	240±60	275±126
Beta 86328[4]	North of Pt. Gustavus	*in situ* stump	233±40	235±77
Beta 86379[4]	Lester Point	*in situ* devil's club root	150±60	145±108

[1]Unpublished dates obtained by Austin Post from samples collected by Post and Streveler..

[2]Dates from Goldthwait (1963).

[3]Dates given by Goodwin (1988) bracketing glacial lakes in Muir Inlet, corrected as if they were radiocarbon dates.

[4]Unpublished dates obtained by Dan Mann from sample collected by Mann and Streveler.

Bay we recovered shallow-water marine bivalves *Macoma balthica* and obtained two dates (4,760 Ya) and (4,900 Ya). These demonstrate that at least part of the lower Bay remained marine around this time.

From about 2,580 Ya to 1,960 Ya, a glacial lake formed in Muir Inlet (Goodwin, 1988), indicating extension of West Arm ice sufficiently far south to form a dam. A considerable outwash plain grew south from the ice front, reaching to the latitude of Berg Bay by about 2,400 Ya. Retreat of West Arm ice drained this lake, to be replaced by a second advance and lake about 1,620 Ya. This second lake apparently was extinguished about 820 Ya by river infilling and then overriding ice moving out of Muir Inlet.

The modern bathymetry of Glacier Bay shows a pair of deep marine basins that terminate just north of the Beardslee Islands. We can imagine two ways to explain this abrupt change in bathymetry; bedrock control, and sedimentation. Based on Goldthwait's (1963) sedimentation observations for Wachusett Inlet, we favor the sedimentation model as the most likely explanation for the Bay's bathymetry. This explanation requires holding the glacier terminus in the deep basins for millennia, during which time the construction of the Beardslee Island complex was occurring. We interpret the modern Beardslee Island complex to be the glacially deformed and eroded remnants of a large outwash plain whose source was this glacier. This outwash plain formed from about 2,400 to 300 Ya, and provided the Tlingit habitation surface (fig. 1).

The outwash plain surface appears to have been quite barren, probably due to active glacial river processes and a severe glacier-margin climate. Short-lived wetlands, and by about 1,600 Ya, groves of young spruce, occurred in places temporarily escaping river action. Large lakes may have been present at times. Developed forest vegetation eventually existed in a band from the present-day Beartrack Cove through

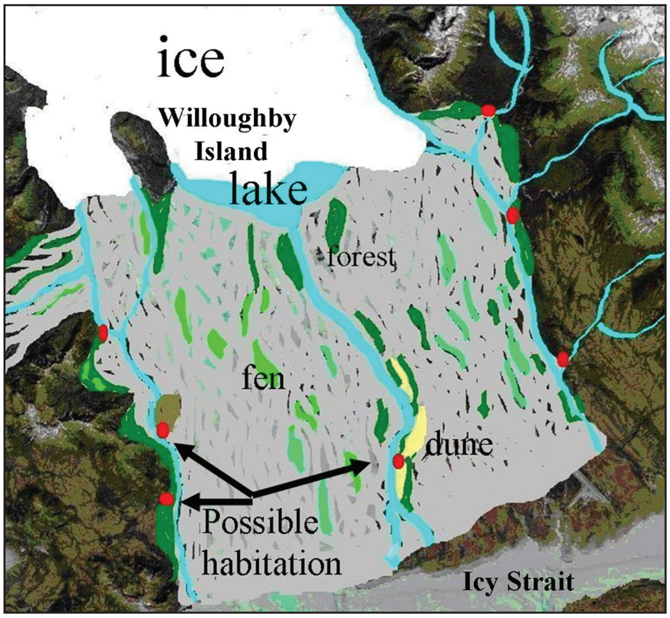

Figure 1. A plausible lower bay landscape for ca. 300 Ya.

Bartlett River to Point Gustavus, which may argue for pre-existing sheltering landforms in the area. Forests may have existed in the Berg Bay area as well, judging by the relative abundance of woody debris incorporated in the surface till. It is very likely that the plain extended to the bay mouth, given a date of 230 Ya for an in-place stump just north of Point Gustavus (table 1). The large extent of fine-grained river deposits throughout the Beardslee Islands and Gustavus suggests a distant source for the sediments, and that the glacier had not yet advanced significantly south of Beartrack Cove. We consider it likely that the plain extended east-west from shore to shore of the Bay, given the similarity of sediments in the Berg Bay islands and Beardslee Islands, and the lack of constraining bedrock features except for the Bay margins.

The original name for the ancient valley in what is now lower Glacier Bay is S'é Shuyee (Area at the End of the Glacial Silt), an apt name for the environment we have observed geologically. Up valley was a glacier, sometimes described as being visible in the far distance. Tlingit oral history (see Dauenhauer and Dauenhauer, 1987; Swanton, 1909) can be interpreted as referring to several inhabited areas. Narratives describe a broad valley with a meadow-lined river flowing through it, Chookanhéeni (Grassy River) from which the Chookaneidi Clan derives its name. Since the early historic period, Huna Tlingits have considered the stream entering the northwest corner of Berg Bay as the modern manifestation of Chookanheeni, and it is regarded as the Clan's place of origin. The Chookaneidi Clan also remembers a name for a prominent cliff that stood near their main village—T'ooch' Ghí'l'I (Black Cliff). The bedrock geology of Glacier Bay provides limited options for a prominent black cliff—the most plausible being argillaceous hornstone outcrops (Rossman, 1963) on the southern shore of Berg Bay and at Rush Point, both situated on the western shore of Glacier Bay. The proximity of these two named features—Chookanhéeni and T'ooch' Ghí'l'I—argue for the ancestral Chookanheeni along what is now the western shore of Glacier Bay.

A second named river occupyies S'e' Shuyee—Gattheeni (see Dauenhauer and Dauenhauer, 1987, p. 245). This name currently is associated with two river systems on the eastern side of the bay, the Bartlett River (Ghathéeni, or Sockeye River) and the Beartrack River (Ghathéeni Tlein, or Big Sockeye River). By analogy to modern outwash plains, the headwaters of the Bartlett and Beartrack rivers likely would have been gathered into a single stream held against the eastern valley wall by the actively aggrading glacial valley. We imagine that the same would apply to Chookanheeni on the west margin of the outwash plain.

The lower bay landscape also is described as having had a large 'Sand Mountain', L'eiwshaayí, and a village located thereon, L'eiwshaa Shakee Aan (Town on top of the Glacial Sand Dune). Sand dunes today are common at the mouths of large glacial rivers. The ancient Sand Mountain landscape is commonly described to have extended from the current Point Gustavus (S'é X'aayí Lutú—Clay Point) to the base of the Beartrack Mountains. This coincides nicely with the only zone in the lower Bay known to have abundant remains of well-developed forest, which argues for some sort of protection from river destruction. Large sedimentary features such as dunes or moraines could have provided such protection. Environmental descriptions are implicit in a number of the ancestral names. "Area at the End of the Glacial Silt" conjures a glacial river environment, which may be imagined to have looked somewhat like the broad, barren tidal flats of modern Taylor Bay. We gain a corroborative hint of the biota of this landscape from an archived letter recounting Tlingit statements about their former homeland: "The old native...[legends] where they had a large village at the east mountain side at the face of the Glacier, where there was scarcely no brush or timber" (1940 letter to Frank Been from Albert Parker, Glacier Bay National Park [GLBA] Archives). By contrast, the name "Grassy River" suggests a more benign environment such as one could find in stabilized areas protected from the ravages of braided rivers. A modern example is found today at the eastern margin of the Taylor Bay flats. In our experience, such areas are generated either by sheltering landforms such as those along valley walls, or along rivers that have been tamed by lakes that rob them of the sediment that causes rivers to braid.

The Story of the Kaagwaantaan related to ethnographer John Swanton in 1904 provides a travelogue through this ancient landscape (Swanton, 1909, p. 326). The story's protagonist, Qakēq!utê, upon returning to his homeland from the Alsek River, comes upon his clansmen at a village located along Chookanheeni. Not recognizing him, and suspicious of his odd travel mates (Athabaskans laden with heavy packs) his clansmen reject his overtures. From Chookanheeni, on the western side of the valley, the party "went directly to the place whither they had been sent, and crossing a glacier, came to Sand Hill Town" (Swanton, 1909, p. 334). There the party settled in with the people who eventually went on to become the Kaagwaantaan Clan. The story relates further that trade relations were established with the Athabaskans, and reveals something of the location of the glacier, "*The Athabaskans on their way down used to be seen when still far back from the coast. One time, as they were coming across the glacier...*" (Swanton, 1909, p. 337).

Dates varying from 390 to 150 Ya have been obtained by various investigators for forests in the Bartlett Cove area just prior to the ice advance (table 1). In 1794 AD (210 Ya.), Lt. Whidbey of the Vancouver Expedition mapped the Glacier Bay ice sheet already somewhat back from its maximum extent. The two youngest dates in table 1 from wood living prior to the advance average to 235 Ya, and their 1-sigma positive limits average to 285 Ya. This gives a very tight window (210–235/285 Ya) during which time the glacier would have over-run the Bartlett Cove area, reached its maximum in Icy Strait, and begun to retreat.

Discussion and Conclusions

This interdisciplinary study provides two independent sets of data to reconstruct a past Glacier Bay landscape. Geologic observations of landform composition and environmental conditions conform nicely with Tlingit oral narratives. Radiocarbon dates on organic materials contained within these sediment packages provides a temporal framework for correlating geologic processes with Tlingit oral narratives. Combined, these complimentary data provide a plausible description of pre-Neoglacial human occupation in Glacier Bay, and validate oral history as a viable data set, especially when corroborated with independent data. This study also takes a step toward understanding the terrestrial landscape history and bathymetry of lower Glacier Bay.

Management Implications

This study helps deepen our understanding of the human history of Glacier Bay. It provides an enhanced understanding of Glacier Bay's geologic history and bathymetry, and information with application to other fields of study such as oceanography. It helps NPS more accurately describe and draw boundaries around the cultural landscapes of lower Glacier Bay—Chookenheeni and L'eiwshaa Shakee Aan—as the agency prepares to nominate them to the National Register of Historic Places. Lastly, and most importantly, the study integrates more fully and richly the Hoonah Tlingit people into the history of their ancestral homeland.

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