DRIFTWOOD IN THE NORTH PACIFIC

REPORT OF A DRIFTWOOD SAMPLING PROJECT UNDERTAKEN ON THE HARRIMAN EXPEDITION RETRACED AUGUST 2001

Claire Alix
Alaska Quaternary Center,
University of Alaska Museum,
UMR 8096 Archéologie des Amériques (CNRS, University of Paris 1)

David Koester
Department of Anthropology,
University of Alaska Fairbanks

February 2002

DRIFTWOOD IN THE NORTH PACIFIC

REPORT OF A DRIFTWOOD SAMPLING PROJECT
UNDERTAKEN ON THE HARRIMAN EXPEDITION RETRACED
AUGUST 2001

CLAIRE ALIX, ALASKA QUATERNARY CENTER, UNIVERSITY OF ALASKA MUSEUM, UMR 8096 **ARCHÉOLOGIE DES AMÉRIQUES** (CNRS, UNIVERSITY OF PARIS 1)
DAVID KOESTER, DEPT. OF ANTHROPOLOGY, UNIVERSITY OF ALASKA FAIRBANKS

Abstract:

Wood is and has been an important resource in the far North beyond the latitudes where trees grow. Driftwood is the major source of the wood used by northern coastal peoples but relatively little is known about the nature of the driftwood resource (Alix 2001). This report outlines results from the sampling of driftwood accumulations in the North Pacific, from the Alaska Peninsula to the northern Bering Sea. This extensive sampling was made possible by the Harriman Expedition 2001, a retracing of the 1899 Harriman Expedition to Alaska. In the course of the expedition, maps of driftwood accumulations were sketched, samples were taken at several stopping points and limited observations made at others. The largest accumulations were at uninhabited locations, Kukak Bay, on the Alaska Peninsula and on St. Matthew Island. A total of 9 different genera were identified by microscopic analyses from a total of 61 samples. Considerable variety of species occurred at all sampled locations, especially considering the small sample sizes at some. The samples indicate a general, if not surprising tendency: the further north, the more spruce predominates in the accumulations. Nevertheless, in comparison with accumulations sampled at more northerly locations (and wood that appears in archeological sites in the far North), significant diversity was found at all sites until St. Matthew Island.

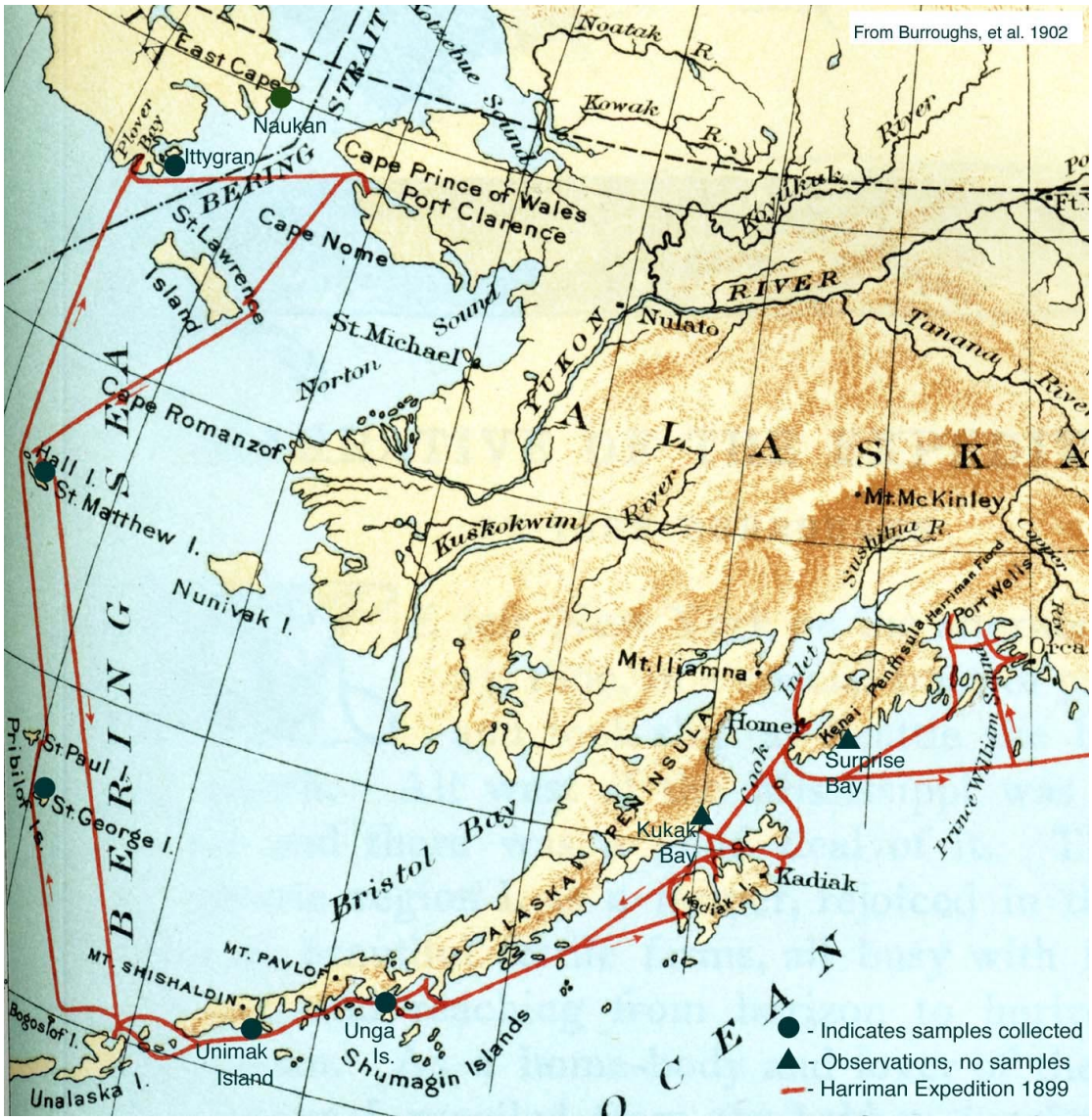


Figure 1 Map Showing Harriman Expedition Route 1899 and Data Gathering Locations 2001

DRIFTWOOD IN THE NORTH PACIFIC

Introduction:

From August 4 to August 19, the Harriman Expedition 2001 went from Kodiak Island, along the Alaska peninsula, out the Aleutians to Unalaska then north to the Pribilofs, St. Matthew and St. Lawrence and across Bering Strait to Chukotka before returning to Nome, Alaska. Expedition participant, David Koester, assistant professor of Anthropology at the University of Alaska Fairbanks, with archaeologist Claire Alix, postdoctoral researcher at UAF, planned a small project to record and sample driftwood accumulations at planned stopping points. This *driftwood sampling* is part of Alix's larger postdoctoral project entitled « The *Economic status of wood and its social significance in Neo-eskimo society of Bering Strait* », financed by the French foundation Fyssen. Alix's study of traditional uses of wood by Eskimo cultures in Bering strait and on the North Slope, raised the question of what wood resources are available to coast dwellers both near and beyond latitudinal tree line and of how wood users chose wood for the manufacture of tools, utensils and other artifacts that are now found in archaeological sites. To understand the driftwood resource base, Alix began an inventory of modern driftwood abundance and composition along the coasts of Alaska. Information on the composition of driftwood accumulations, such as number of driftlines, abundance of logs (as opposed to branches and roots), state of preservation, dimensions, type of grain, color and other characteristics of specific samples were recorded on prepared data sheets in the field and wood characteristics were analyzed in the laboratory to determine genera.[1]

Photo 1 Sampling a spruce log at St. George Island

During the expedition, D. Koester, with the help of Harriman Expedition Young Explorer Natashia Dallin, was able to sample wood at six locations, and record information from others as well (Table 1 & fig. 1). The sampling procedure varied according to the time spent at each location. The samples were brought back to Fairbanks where Alix identified them by genus using a transmitted light microscope (maximum magnification usually x400, sometimes x1000). Though the results presented below are informative, the sample sizes were not large enough to be considered fully representative of the accumulations at the various locations. The results from Unimak Island were the most reliably representative because Unimak was the only location where the sampling was systematically carried out over a measured space. Wood samples were collected along a two-meter wide transect across the beach, from the hightide line to the highest driftline.

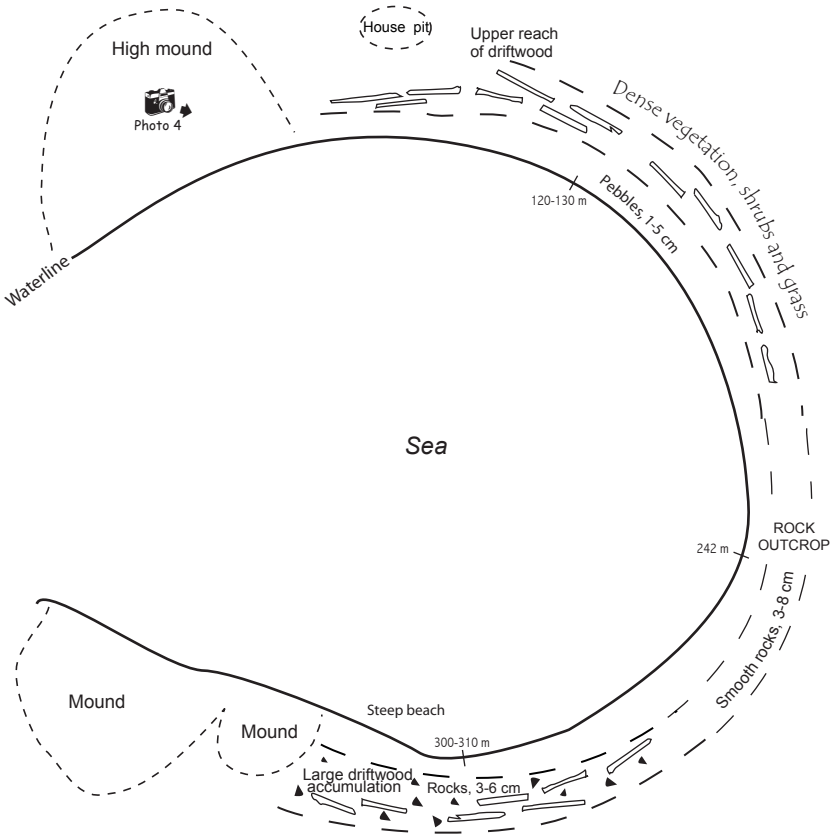
Location	Coordinates	Recorded samples	Identified samples	Number of photographs	Abundance of accumumation
Kenai Pen. Surprise Bay,	59°31.57'N – 150°28.55'W	-	-	2	-
Alaska Pen. Kukak Bay	58°15'N – 154°10'W	-	-	9	++++
Unga Is.	55°23.5'N – 160°45.7'W	5		7	++
Unimak Is., Otter Cove	54°44.65'N – 160°19.5'W	28	25	5	++
St George Is. Starya Artil	56°38'N – 169°40'W	11	11	11	++
St Matthew Is. North side	60°20'/60°35'N – 172°30'/173°W	13	12	12	++++
Chukotka, Naukan	66°N – 169°40' W	3	3	1	+
Chukotka, Ittygran	64°38.7'N – 172°32.15W	6	5	none	+
Total		**66**	**61**	**49**	

Table 1: Locations and data obtained

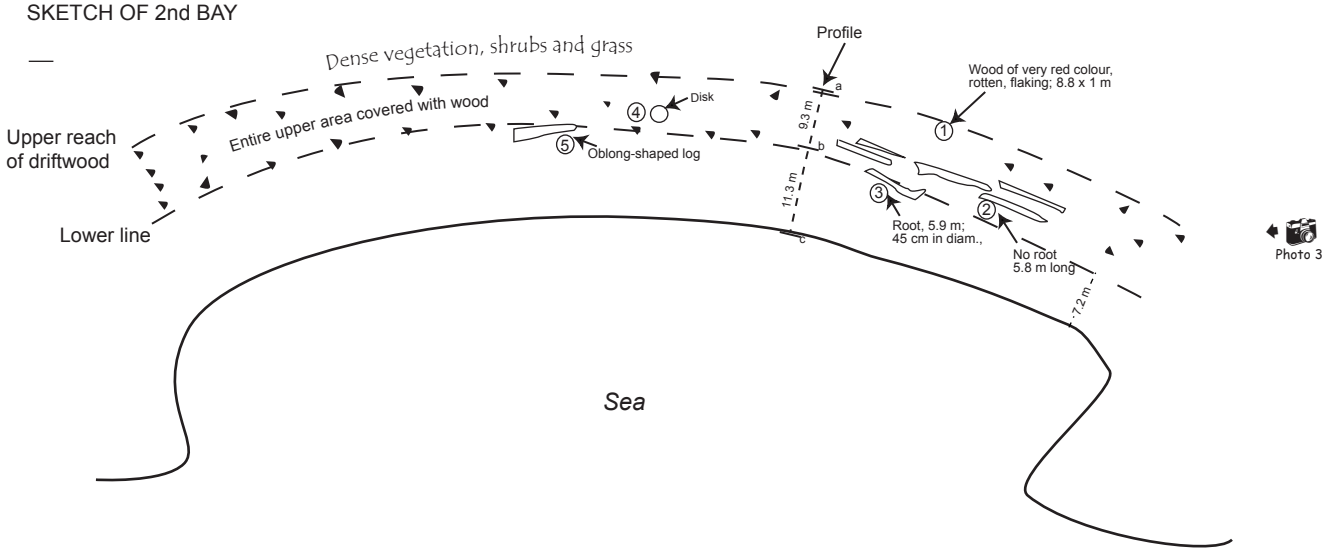
[1] Anatomical observation allows one to identify wood at the level of genus but not at the level of species. Species in this report are proposed according to what seem be the most likely species given the proximity of known forests of North America and Northeast Asia. This is the reason for the designations given in the following form: *Picea cf. P. sitchensis.* Some species identifications are based on the color or dimensions of the tree as well as the empirical knowledge of the species growing in the nearest forests of North America and Siberia.

Kukak Bay, August 7, 2001

SKETCH OF 1st BAY



SKETCH OF 2nd BAY



BEACH PROFILE

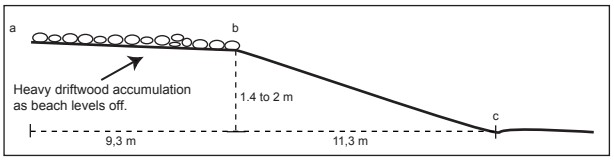


Figure 2

RESULTS

As a rule, driftwood accumulations are composed of logs, branches and root deprived of bark. Most often trunks are branchless and if bark is too be found, it is usually near the root. Though some logs have a root system, most of them are broken at both ends. This makes it difficult to ascertain whether their fate as driftwood was naturally or culturally determined. Root parts are also found separately from trunks. Bark, and particularly birch bark or cottonwood bark, is often found separated from its wood. Finally, most of the wood has a weathered surface while some show growth of moss and traces of decay caused by insects.

KENAI PENINSULA, Surprise Bay, near miner's camp (no samples, photographs, 1 sketch)
Date: August 5, 2001
Coordinates (from GPS): 59°31.57'N – 150°28.55'W
Beach description: the bay is surrounded by huge Sitka spruce with heavy moss growth on the spruce; thick brush of devil's club, willow thicket and blueberries and raspberries growing on the hillside. The rear of the bay is a floodplain covered by dead spruce logs, probably a result of the 1964 earthquake. However the tidal flat has almost no wood.
Because of the very close origin of the wood lying on the ground, most of the logs still have bark, branches and even needles (Photo 2).


Photo 2 Surprise Bay - Log with root system

ALASKA PENINSULA, Kukak Bay, (no samples [Katmai National Park], photographs, 2 sketches)
Date: August 7, 2001
Coordinates (from map): 58°15'N – 154°10'W


Photo 3 Kukak Bay (1st bay)

Beach description: Two bays flank the sides of a promontory. Driftwood was plentiful on both bays (Fig. 2). There was human occupation between the two bays and a fortified site on the hill at the end of the promontory, overlooking the entire area. No samples were taken, though some logs were measured and described. Some are deep red and could be the so-called "redwood," often mentioned by coastal inhabitants. This red wood could correspond either to redcedar (*Thuja plicata*) or Douglas fir (*Pseudotsuga menziesii*), which, as will be seen, is regularly found as driftwood in the area. A "redwood" log on the beach is 8.8 m long and 1 m in diameter. Most of the logs are of large size.


Photo 4 Kukak Bay (2nd bay)

One specimen, a disk, is worth mentioning. About 50 cm in diameter, the disk appears to have very wide rings (see Photo 5) and has been deliberately cut as a disk. A similar but larger disk (with narrower rings) was found by Alix in the lowest driftline of a beach of south Chukotka, near Ittygran Island. This disk, 112 cm in diameter, was identified as Douglas fir, *Pseudotsuga cf. P. menziesii*. The peculiarity of the two disks could suggest a similarity of origin. We would be glad to receive any information related to the production of such disks.

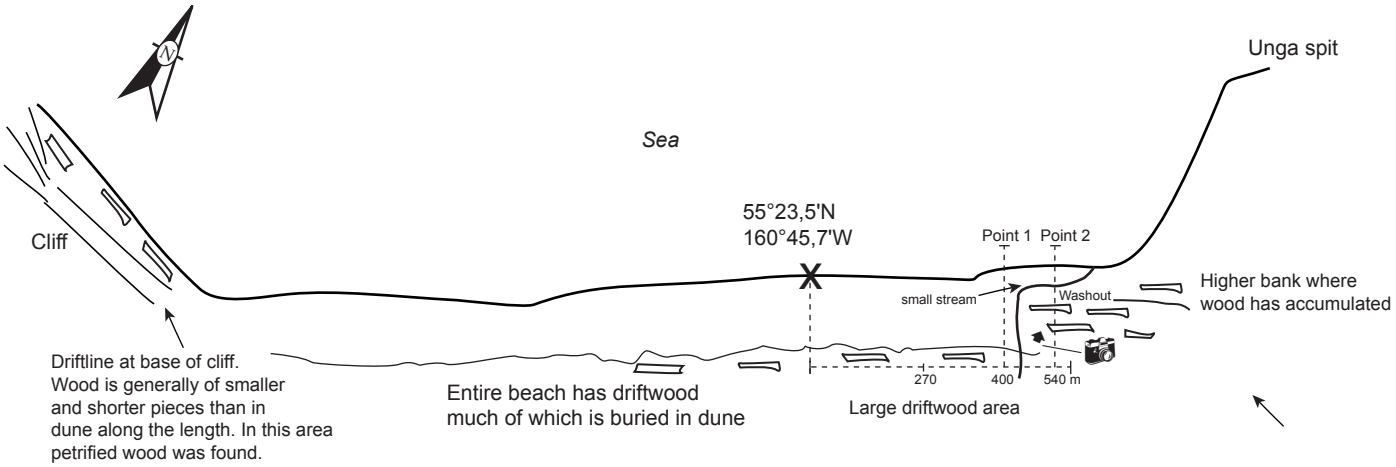

Photo 5 Disk found at Kukak Bay


Photo 6 Douglas fir disk found in Chukotka

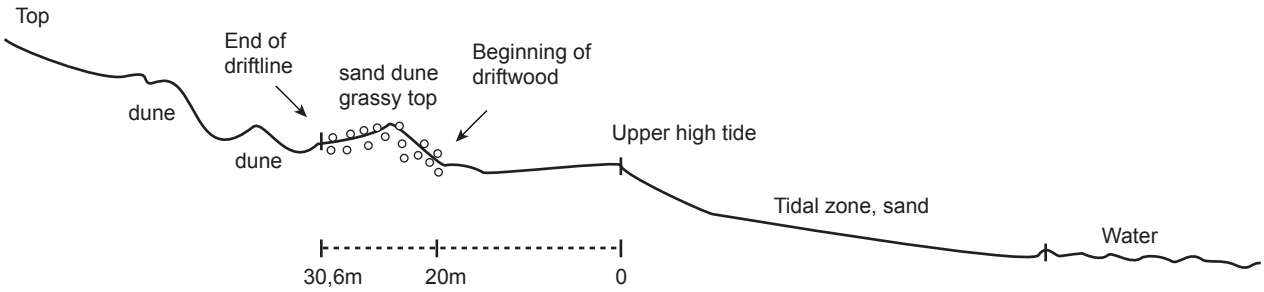
North coast of Unga Island, August 9, 2001

(All dimensions are approximations)

SKETCH OF THE BEACH



SKETCH OF BEACH PROFILE AT POINT 1



SKETCH OF BEACH PROFILE AT POINT 2

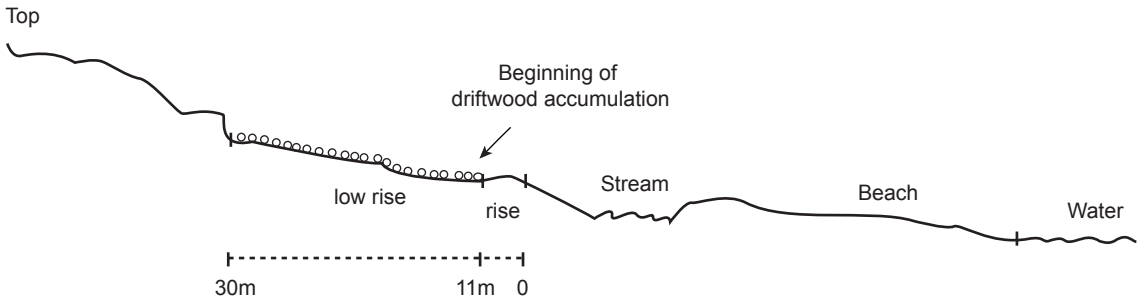


Figure 3

UNGA ISLAND, North side, west of Unga spit (5 samples, 7 photographs, two sketches)
Date: August 9, 2001
Coordinates (from GPS): 55°23.5' N; 160°45.7'W
Beach description: very fine and sticky gray sand; rain area but good drainage allowing wood to be fairly dry. The major accumulation is parallel to the beach (Fig. 3).
Sampling procedure: wood sampled where the accumulation is more dense, near the stream (see Fig. 3).

Photo 7 Driftwood on Unga Island

To the west of the bay, at the base of the cliff, driftwood is less abundant and consists mostly of smaller shorter pieces than to the east where the wood is buried into the dune. Most of the wood has accumulated to the east, close to the stream. The southeast part of the beach received the densest accumulation (Fig. 3). The profile at Point 1 (see Fig. 3) shows that the accumulation starts about 20 meters above the upper high tide line and covers a dune with a green grassy top for about 10.6 m. In the washout area (Point 2), the accumulation is more spread out. Most of the logs are quite deeply embedded in the gray sand and are lying in the green vegetation. This indicates that the accumulation could be relatively old. The modern sandy beach has almost no driftwood. These facts suggest that the deposition of the wood was, as is usually the case, the result of a major storm event.

The few logs sampled present a relatively wide variety of genera (Table 2).

Genus or species	Main accumulation
Thuja cf. T. plicata Donn (Western redcedar)	2
Chamaecyparis cf. C. nootkatensis (D. Don) Spach (Alaska-cedar)	1
Pseudotsuga menziesii (Mirb.) Franco (Douglas fir)	1
Picea sp. cf P. sitchensis (Bong.) Carr. (Sikta spruce)	1
TOTAL	**5**

Table 2: Wood identification results from Unga Island.

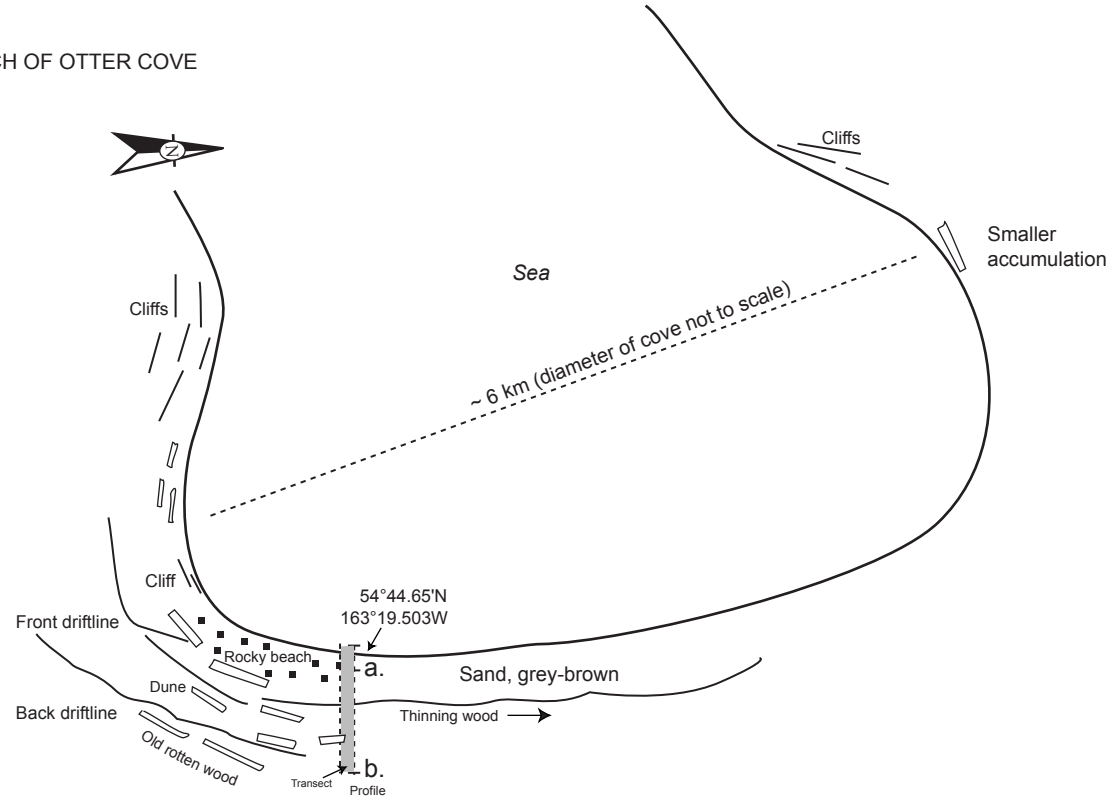
The logs sampled are relatively large, the largest sampled being 80 cm in diameter. It was identified as spruce (*Picea*), most probably *Picea sitchensis* judging from its large diameter. Only Sikta spruce frequently reaches such dimensions. The average length of the logs is, on the other hand, surprisingly short if one consider the height reached by most of the species identified (more than 50 m for some of them); the longest drift log in the sample is only about 8 m long.

Three of the genera identified (*Picea, Chamaecyparis and Thuja*) are commonly found in the Coastal Spruce-Hemlock forests of Southeast Alaska (Viereck and Little, 1972:13-14). However, *Pseudotsuga menziessi* is not native to Alaska and must have come from further south on the west coast of North America where it is a common tree (Arno 1977:67-74 & 117-123).

UNIMAK ISLAND, Otter Cove (28 samples; 5 photographs, 2 sketches)
Date: August 10, 2001
Coordinates (from GPS): Two points along the 2-meter transect where measured (*Cf.* Fig. 4),
a: 54°44.65'N; 163°19.503'W
b: 54°44.65N; 163°19.47'W
Beach description: ground rocky in the Southwest corner of the beach, the rest consists of fine sand. The Southeast part of the beach has received the largest amount of wood. Most of the wood was lying on a sandy gentle slope of 13° angle. There are at least two driftlines, the oldest lying above the dune and consisting of old and rotten wood (Fig. 3). The driftwood is moderately abundant.

Unimak Island, Otter Cove, August 10, 2001

SKETCH OF OTTER COVE



SKETCH OF PROFILE (From point a to b)

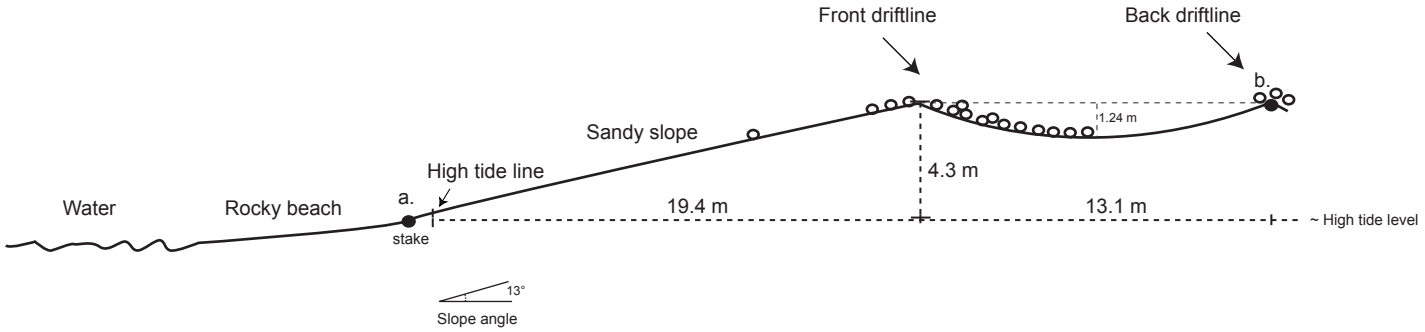


Figure 4

Sampling procedures: a 2-meter transect was run across the beach from the hightide line to the back driftline, where all logs were sampled. A profile of the transect was drawn and 5 pictures were taken. Three samples belong to the back driftline, above the dune; the rest comes from the more recent front driftline.

Photo 8 Natashia Dallin measuring at Otter Cove

The sample presents a relatively high variety of wood with 6 different genera, 5 being coniferous and 1 deciduous (Table 3). Hemlock (*Tsuga sp.*; n=8) is as abundant as spruce (*Picea sp.*; n=8), but appears only in the lower drift. One of the spruce logs, which belongs to the higher driftline, seems to be *Picea sitchensis* (Sikta spruce), because of its large diameter (> 60 cm). No Alaska-cedar (*Chamaecyparis sp.*) was identified.

The logs include sizeable specimens, the largest diameter being 65 cm and averaging 28.9 cm and the longest 905 cm, averaging 318 cm. Branches are not included here. Only one specimen had a preserved root system and some bark; all the other logs had broken ends and no bark. The logs sampled from the back driftline had moss growing on their surface suggesting that the back line is significantly older than the front line.

Genus or species	Front driftline	Back driftline
Tsuga sp. cf. T. heterophylla (Raf.) Sarg. or *cf. T. Mertensiana* (Bong.) Carr. (Western or moutain hemlock)	8	
Picea sp. (spruce)	7	
Picea sp. Cf P. sitchensis (Sikta spruce)		1
Pseudotsuga menziesii (Douglas fir)	2	2
Thuja cf. T. Plicata (Western redcedar)	2	
Abies cf. A. amabilis (Dougl.) Forbes or *A. lasiocarpa* (Hook.) Nutt. Or even *A. grandis* (Pacific silver fir or subalpine fir or grand fir)	1	
Coniferous, undetermined	1	
Populus sp. cf. P. balsamifera L. (cottowood) or *P. Tricocarpa* Torr & Gray (black cottonwood) or *P. tremuloides* Michx. (aspen)	1	
TOTAL	**22**	**3**

Table 3: Wood identification from Otter Cove, Unimak Island.

As for Unga Island, some genera are characteristic of the species of the Coastal Spruce-Hemlock forest of SE Alaska. The abundance of Hemlock (most probably western hemlock as opposed to mountain hemlock), and spruce suggest that most of the wood could come from this area. However, *Pseudotsuga* (Douglas fir), typically growing in more southern forests, appears once again in this sample. One "rare" genus was identified in the samples, *Abies* (fir), the various species of which grow in Alaska, but are relatively rare. *Populus* is also present, probably cottonwood (*Populus balsamifera*), black cottonwood (*P. trichocarpa*) or even aspen (*P. tremuloides*)[2] though the latter is less common on flood plains and prefers well-drained soil; cottonwood is very often found in driftwood accumulations further North.

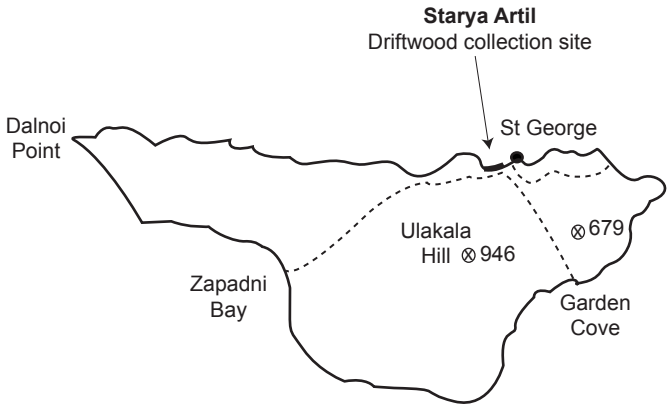
ST. GEORGE ISLAND, Starya Artil
(11 samples; 11 photographs)
Date: August 12, 2001
Coordinates (from map): 56°38'N – 169°40'W
Beach description: rocky with red, grey and dark rocks ranging from 4 to 60 cm; large amount of plastics mixed with sea mammal bones (a protected fur seal rookery is only a few hundred meters away). Koester estimated that 1 out of 6 pieces of the driftwood had been milled. Wood is not exceptionally abundant on the beach; logs and pieces of

Photo 9 Starya Artil at St. George Island – sampled logs in the foreground; northern fur seal rookery in the distance

[2] Though cottonwood and aspen are very distinct as trees, their anatomies are too similar to distinguish through microscopic observations.

St George Island, August 12, 2001

SKETCH OF ST GEORGE IS.



SKETCH OF DRIFTWOOD COLLECTION SITE

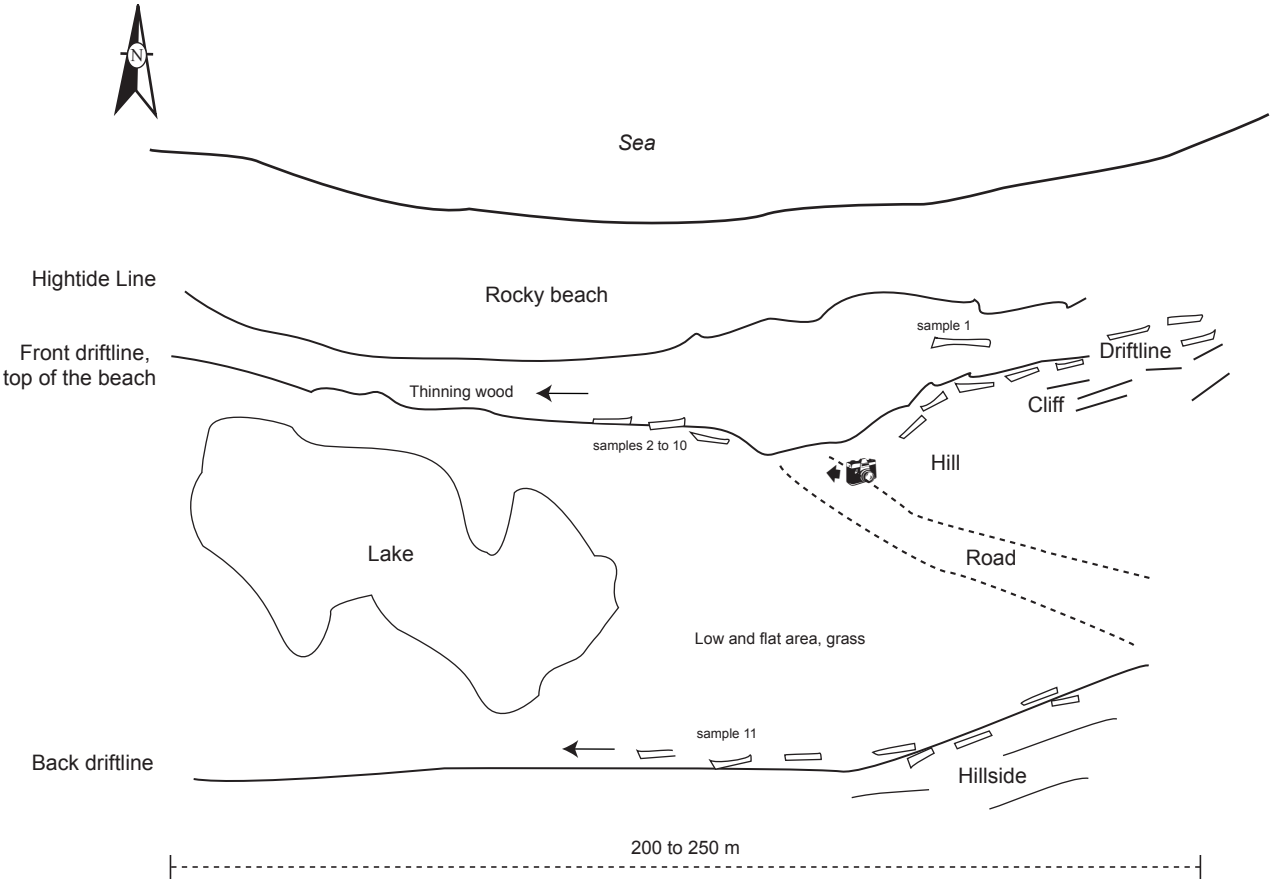


Figure 5

driftwood are rather loosely scattered (see Fig. 5). Most of the logs seem relatively short and deprived of their root systems, their surface is often highly weathered or eroded.
Sampling procedure: random sampling while walking along the driftline, mostly west of the road just above the lake.
The main driftline lies above the actual high tide line, whereas the back driftline lies even further from the rocky beach, past the road against the hillside (Fig. 5).

Ten samples were collected from the front driftline and one sample from the back driftline which, again, seems older judging from the moss growing on the sampled log. Once more, the few samples collected show a relatively high diversity with 4 coniferous genera and one deciduous (Table 4).
Samples of spruce or undifferentiated spruce/larch[3] are the most numerous. This increasing relative presence of spruce is consistent with St George's more northerly location. However, as before, the genera hemlock, yellow cedar and Douglas fir were found. The deciduous tree is a large trunk of red alder (*Alnus rubra*). This species, especially of this size (48cm x 30 cm, oblong), has not yet appeared in sample sets taken further North.[4] The wood sampled from the back line is a big trunk of Douglas fir. The logs of the back driftline appeared to have been deposited in one major storm event; roughly of the same size, they could be all of the same age, and possibly of the same species, but this would need further verification.
It is noteworthy that the larger trunks, that is, >20 cm, are genera other than *Picea*. The biggest log sampled is an Alaska cedar trunk of 55 cm in diameter. The logs sampled present an average length of 4.25 m; the longest comes from the back line and measured more than 10 meters; the shortest is 138 cm.

The species found in the driftwood from St. George still show characteristics of the coastal spruce-hemlock forest. The presence of Douglas fir indicates that wood from more southern forests does reach the islands of the Bering Sea, at least as far as St. George. However the increased percentage of spruce suggests the proximity of the boreal forest and the Kuskokwim River as a possible source.

Genus or species	**Front driftline**	**Back driftline**
Tsuga sp. cf. T. heterophylla or *cf.* T. *Mertensiana* (Western or moutain Hemlock)	1	
Picea sp./Larix sp. (Spruce or Larch)	2	
Picea (spruce)	3	
Pseudotsuga menziesii (Douglas fir)	2	1
Chamaecyparis cf. C. nootkatensis (Alaska-cedar)	1	
Alnus cf. A. rubra (Red alder)	1	
TOTAL	**10**	**1**

Table 4: Results from St. George Island.

ST. MATTHEW ISLAND (13 samples; 12 photographs)
Date: August 14, 2001
Beach description: grey sand beach rising very gradually. The accumulation was abundant and covered most of the higher part of the beach (Fig. 5). Some logs were partly embedded in sand.
Coordinates (from map): In between 60°20' & 60°35'N – in between 172°30' & 173°W.
Sampling procedure: random sampling from the front (water side) toward the back of the accumulation.

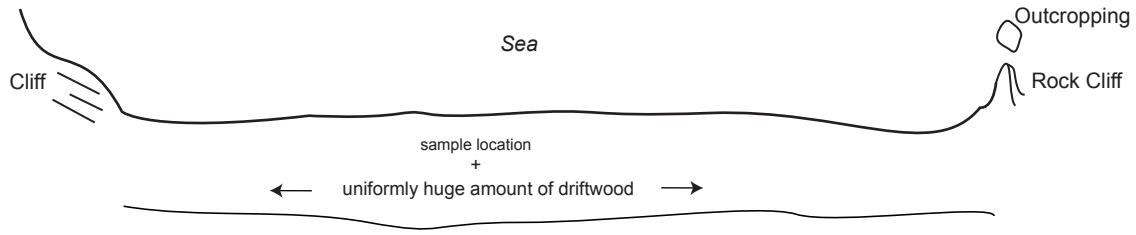
Photo 10 St. Matthew Island - endless driftwood

St. Matthew Island is uninhabited and there was a tremendous amount of driftwood along its shores. In the Harriman expedition publications from 1902, this was the only place that driftwood was noted. John

[3] *Picea* and *Larix* have very close anatomical characteristics. Only when a number of characteristics are present together and seen repeatedly is it possible to distinguish the two genera with confidence (Bartholin 1979; Anagnost & *al.*, 1994).
[4] In the summer, 2001, Alix sampled several driftwood accumulations in the area of Barrow, Wainwright and Nome.

St Matthew Island, August 14, 2001

SKETCH OF THE BEACH



GENERAL PROFILE OF BEACH

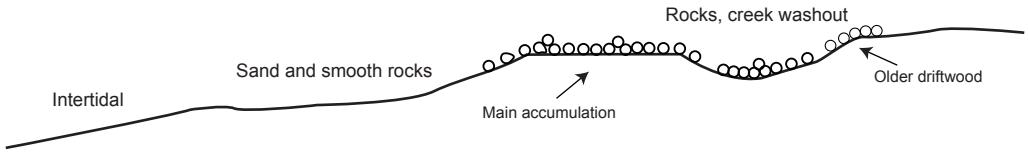


Figure 6

Burroughs wrote: "There were snowbanks on the beach by the sea, and piles of driftwood, most of the large tree trunks doubtless brought down by the Yukon, and many hewn and sawed timbers from wrecked vessels" (Burroughs, Muir, et al. 1902). Although other sources are possible, the Yukon does make sense. The wood sampled at St. Matthew is, in fact, unlike the other locations, mostly spruce (Table 5) or perhaps larch. It is also noticeable that the average trunk diameter is lower than before: from 35 to 9.5 cm (against 55 to 11 cm at St. George and 65 to 16 cm at Unimak Is.). On the other hand the logs seem to be of good length with an average of 5.9 m, the longest being over 13 m. The number of samples taken was too small to be conclusive in assessing size differences, however.

Landing at St. Matthew Is., 15 July 1899, from Harriman Alaska Expedition Vol. I (p. 112)

The only deciduous sample was identified as willow. The general composition of the accumulation is closer to what is found further North on the Alaskan side of Bering Strait. The wood seems to be coming more directly from the Alaskan boreal forest, and if the larch identification can be confirmed, possibly from the Russian taiga. No wood with a distinctly southern origin was found.

Genus or species	Front driftline	Back driftline
Picea (Spruce)	7	1
Picea sp./Larix (Spruce or Larch)	1	
Picea sp./Larix cf. Larix	2	
Salix sp. (Willow)	1	
TOTAL	**11**	**1**

Table 5: Samples from St. Matthew Island

LITTLE DIOMEDE, (no samples collected).

There were no significant driftwood accumulations evident near the landing site at the village on the west side of the island. Residents recounted that when a huge storm hit a few years ago, the quantity and size of driftwood that accumulated was so great that traffic to the helicopter port was delayed.

NAUKAN, Chukotka (3 samples collected, photographs)
Coordinates (from map): 66˚N – 169˚40' W

The beach at Naukan was a narrow strip of sand at the base of a steeply rising hillside. Naukan is located in Northern Chukotka near East Cape, close to the famed archaeological sites of Ekven and Uelen (*Cf*. fig. 1). It was an important and large village—the home of the Naukan Siberian Yupik language. It was closed by the Soviet government in 1952 and the site is uninhabited at this time. The house remains still contain wood poles and rafters, some of which appear to have been driftwood. Little driftwood was lying on the narrow beach, but some larger logs were present.

Photo 11 Base of wall with standing posts at Naukan

Of the 3 pieces sampled, one is a tiny fragment of a standing post from a house pit on the hillside. The post is identified as larch (*Larix sp*.). The two other pieces have been identified as spruce (*Picea sp*.) and pine, strobus section (*Pinus sp*. section *strobus*). This piece of pine comes from a big log and could correspond to the following species (which can not be distinguished on the basis of wood anatomy): *Pinus cembra* L. (cembro pine) also found under the name *P. sibirica* Mayr Rgl; *P. pumilla* (Pall.) Rgl. (Siberian dwarf pine) or *P. monticola,,* a North American species. According to species distribution in Siberia, *P. pumilla,* which is a krummholz shrub often present at tree line, would be the most likely. However, the sample identified came from a large log, and it could correspond to either of

the two mentioned species. Pinus monticola is the most unlikely given the distance which separates Naukan from the growth area of this species.

Photo 12 Naukan from Ingegrak hill – the dark shapes are house and cache pits

ITTYGRAN North shore of the Island (5 samples)
Date: August 19, 2001
Beach description: pebble beach with some whale bone structure remnants near by.
Coordinates (from GPS): 64°38.7'N – 172°32.15'W
Sampling procedure: random sampling near landing point.

Six driftwood fragments were recorded and only five were sampled. One is a birch like bark roll. Among the 4 remnants, three were small branches of *Salix sp*. (willow) and one, a narrow but quite long branch (300 cm) identified as pine: *Pinus sp*. section *strobus*. As the above post from Naukan, the pine could be one of the following species: *Pinus sibirica; P. monticola* or *P. pumilla*. However, considering its dimensions and shape, it is likely to be dwarf Siberian pine, *P. pumilla.*

CONCLUSION

On beaches from just off the Alaska Peninsula to as far as St. George Island, samples taken from large pieces of driftwood show considerable diversity. The samples correspond well to the wood of the coastal and interior forests of Alaska. More sampling would be necessary to determine definitively whether the decreased diversity found in samples taken from St. Matthew Island represent a real decline or an artifact of the sampling. Below the Aleutian chain, 7 different genera were identified. On St George Island 4 of the 6 gymnospermous genera found earlier on the trip remain and a "new" deciduous genus is added, *Alnus*. On the other hand, only one genus *Picea sp*. remains at St. Matthew together with one deciduous *Salix* (willow). In most cases, the wood accumulations were found pushed to the top of beaches. Sometimes a higher and older driftline was observed where the wood was well embedded in grass or sand and showed an advanced stage of decay. Microscopic observations confirmed the advanced degraded stage of cell walls for those samples. This driftline pattern was also found on beaches described and sampled by Alix further north (Barrow, Wainwright and Nome areas). Although at those locations Alix was able to relate the driftlines to known storm events, we do not yet have this information for the places visited by the Harriman expedition.

For all of these accumulations, the question of origin remains. What is the proportion of wood due to human activities versus river-fallen trees and other naturally occurring wood deposition? One way to distinguish the two categories is to look for the presence of root systems. This decisive criterion can often not be used, however, because many "natural" drift logs go to sea without their root systems. Broken ends could be caused by other events in the drift cycle. In fact, relatively few logs had their root systems preserved and many were broken at both ends (see data & photographs). Yet at the same time, the ends are often worn out and it is difficult to establish that the logs have been sawn. On St. George Island, Koester estimated that one out of six pieces of wood had been milled, though of the samples collected, only the red alder log had its root system still attached. On Unimak Island, only two logs had root systems out of the 28 pieces recorded within the 2 meter transect. Earlier studies on large logs and smaller wooden debris carried by Californian and Oregon rivers (Gonor & *al.*, 1988) have shown that natural sources of driftwood "have been greatly reduced since the 1850's and the opportunities for wood to be retained in the lower estuary have also been reduced through diking, marsh filling and channelization" (*Ibid*.: 101).This is partly compensated by human related drift logs lost to sea from increased lumber and forestry activities. It is

interesting to note, though, that the only mention of driftwood by the original Harriman Expedition already alluded to milled pieces of wood in the huge accumulation on St. Matthew (Burroughs, Muir, et al. 1902). It would be interesting to gather information for Alaska on river-related activities that could have affected the amount of wood reaching the sea.

As mentioned above, the densest accumulations were found at uninhabited locations, Kukak Bay (Katmai National Park) and St Matthew Is. To the North, in the Bering Strait, there seems to be a striking difference between the amounts of driftwood found on the coasts of Alaska and Chukotka and more precisely on the coasts of Seward Peninsula, St. Lawrence Island, Little Diomede on the one hand and the coast from Naukan to Provideniya bay on the Chukotkan side of the strait. However the lack of driftwood in the near Naukan area could be due to the characteristics of the beach visited. Driftwood has been reported as greatly abundant along the coast near Ekven and south of Ekven, where an archaeology party made endless use of it for camp fire during their fieldwork of the mid-1990's (Csonka, 1998, personal communication; Holzlehner 2002, personal communication).

The driftwood accumulations everywhere contained a high proportion of coniferous wood in comparison with deciduous wood. In a sample of 61 logs and branches, only 6 were deciduous. Three are willow twigs or small branches from Ittygran in Chukotka, while the other three are 19 to 35 cm diameter logs, from St Matthew (willow: *Salix* spp.), St George (red alder: *Alnus rubra*) and Unimak (Poplar: *Populus sp*.). Coniferous trees do predominate in coastal and interior Alaskan forests but birch, willow, aspen, cottonwood are also quite common. The shrub form of *Alnus* (alder) is relatively common throughout Alaska, while red alder (*Alnus rubra*) has a much more limited range "[t]hroughout southeast Alaska, northwest to Yakutat Bay" (Viereck and Little, 1972: 145). Fernow had already noted this short range of red alder during the Harriman Expedition, finding it "abundantly as far as the foot of La Perouse Glacier, a little south of Mt. Fairweather, but was entirely absent at Yakutat Bay and farther west" (Fernow, 1901: 247). Interestingly enough, a rooted trunk of red alder made it all the way to St George, past the Alaska Peninsula and Aleutian Islands. Resistance to decay could also explain the small amount of deciduous wood present in the accumulations. In fact, these Alaskan hardwoods are quite soft and their resistance to decay is quite low. For example, birch, which was not found in the accumulations sampled, has low buoyancy and tends to rot very quickly. It usually does not reach the coasts and is rare in any accumulation in Alaska and elsewhere. On the other hand, its bark has high buoyancy and can travel far; rolls of birch bark are often found mixed with driftwood. One such roll was collected at Ittygran.

The coniferous genera identified in the Aleutians, the Pribilofs, and on Matthew Is. indicate that the most likely origin of the driftwood is the forests of Alaska: the coastal spruce hemlock forests of the Southeast and the spruce-dominated boreal forest of the interior. In fact, Viereck and Little's description of the coastal spruce-hemlock forest fits quite perfectly the distribution of species found south of the Aleutians: "In the southern part, the coastal forests are composed primarily of western hemlock and Sitka spruce with a scattering of mountain hemlock, western redcedar, and Alaska-cedar" (Viereck and Little, 1972: 14). The driftwood samples taken at Otter Cove (where the sampling was done most systematically) match well this range of species (see Table 3). The predominance of spruce is not surprising if one considers that it is the main species in the northern and western sections of the coastal forests: "Sitka spruce remains as the important tree in the coastal forest of Cook Inlet and the lone conifer on Afognak and Kodiak Island" (*Ibid.*). It is also the dominant genus of interior boreal forests throughout Alaska and has by far the greatest buoyancy. The discrete presence of red and yellow cedar can be linked to the fact that "red-cedar is not found north of Frederick sound (just off Sitka), and Alaska-cedar drops out at Prince William Sound" (*Ibid.*). However, considering their southeastern range, their appearance in the driftwood accumulations randomly sampled is an indication of their propensity to float and resist decay. On the other hand, the presence of Douglas fir suggests a more distant origin for some of the logs for it is the only non-Alaskan species. Douglas fir grows abundantly on the west coast from California/Oregon to the northern part of British Columbia. It seems to be well known that the Davidson current, a northward winter current flowing along the west coast of North America, brings logs of Douglas fir to the north Pacific coast (Cf. Lepofski & *al.*, 2001, referring to her find of Douglas fir in charcoal from archaeological features of Cape Addington, Southeast Alaska). We do not know of other reports of Douglas fir reaching the Pribilof islands. It is especially worth noting that the Douglas fir on St. George was not only an occasional find, but identified 3 times and from both driftlines.

This sampling has helped to make a significant step in our understanding of driftwood accumulations in the North Pacific and particularly the Bering Sea. More work is needed however to confirm species distributions north of the Aleutian Islands.

AKNOWLEDGEMENTS AND THANKS

Thanks go first to Harriman Expedition Director Thomas Litwin (Smith College Science Center) for his enthusiastic support of the project, and to other expedition organizers and trip leaders, including, Lawrence Hott (Florentine Films) and Expedition Leader Mike Messick (Zegrahm Expeditions). Special thanks to Natashia Dallin, whose help in driftwood collection was invaluable. Thanks also to the other Young Explorers who helped out and to the many participants of the Harriman Expedition who made it such a wonderful trip. We are also grateful to Aron Crowell for use of his report on Kukak Bay, which helped our sketches and informed our description.

We are grateful to the communities and organizations that gave their permission for the collection of driftwood samples: the Isanotski Corporation at Unimak Island, the Traditional Council at St. George Island and others whose permissions we did not have the opportunity to use.

The wood identifications were conducted in Dr. Gary Laursen's laboratory at the University of Alaska Fairbanks and our best thanks goes to him for being so enthusiastic and supportive of the work. We also wish to acknowledge the Alaska Quaternary Center, especially Paul Matheus and Owen Mason for providing help and some of the equipment needed for the sampling and the French Fondation Fyssen which has sponsored Alix's research .

References Cited

ALIX, C.
2001 Exploitation du bois par les populations néo-eskimo entre le nord de l'Alaska et le Haut-Arctique canadien. Thèse de doctorat de l'Université de Paris I – Panthéon Sorbonne, Anthropologie, Ethnologie, Préhistoire., 2 vol.

ANAGNOST, S. E., MEYER, R. W. and C. de ZEEUW
1994 Confirmation and Significance of Bartholin's Method for the Identification of the wood of *Picea* and *Larix*. *IAWA,* vol.15 n°2: 171-184, Rijksherbarium, Leiden.

ARNO, S. F.
1977 *Northwest Trees.* The Mountaineers, Seattle, Washington.

BARTHOLIN, T. S.
1979 The *Picea-Larix* problem. *IAWA,* vol.1: 68-70, Rijksherbarium, Leiden.

BURROUGHS, J., J. MUIR, *et al*.

1902 *Alaska (Volume I) Narrative, Glaciers, Natives*. Doubleday, Page, New York.

FERNOW, B. E.
1901 F,orests of Alaska. *In: Alaska, (Volume II) History, Geography, Resources*: 235-256, Doubleday, Page & Company, New York.

GONOR, J. J., SEDELL, J.R., and P. A. BENNER
1988 What We Know About Large Trees in Estuaries, in the Sea and on Coastal Beaches. *In*: C. Maser, R. F. Tarrant, J. M. Trappe and J. F. Franklin (eds.) *From the Forest to the Sea: A Story of Fallen Trees*. pp. 83-112, General Technical Report PNW-GTR-229. Pacific Research Station US dept. of Agriculture, Forest Service, Portland, Oregon.

LEPOFSKY, D. and M. L. MOSS
2001 The Unrealized Potential of Paleoethnobotany in the Archaeology of Northwestern North America: Perspectives from Cape Addington, Alaska. *Arctic Anthropology*, vol. 38 n°1: 48-59.

VIERECK, L. A. & E. L. LITTLE
1972 *Alaska Trees and Shrubs*. Agriculture Handbook n°410, Forest Service US dept. of Agriculture, Washington D.C., 265p.