

# ARCHAEOLOGICAL REMAINS OF PRECONTACT WATERCRAFT ON THE NORTHWEST COAST

**Kathryn Bernick**

Research Associate in Archaeology, Royal British Columbia Museum, 675 Belleville Street, Victoria, BC, V8W 9W2;  
kbernick@seanet.com

## ABSTRACT

Archaeological site locations on small offshore islands indicate that people on the Northwest Coast had watercraft beginning in the early Holocene, but direct evidence is no more than 2000 years old. The only boat remains confirmed to be of precontact age are pieces of dugout canoe sides recycled as house-wall planks at Ozette (45CA24). Precontact-age bailers suitable for dugouts, numerous paddles, and two cordage-bound anchor stones were recovered from the Ozette, Little Qualicum River (DiSc-1), and Lachane sites (GbTo-33). Ethnographic analogues suggest a range of boat types that might have been made and used on the coast in antiquity: dugouts, bark boats, skin boats, frameless plank boats, reed boats, and possibly also log rafts. Remains of any of these types might be preserved in waterlogged deposits (wet sites) in the region.

Boats of great antiquity have been recovered from water-saturated sediments in many other parts of the world. Northwest Coast specimens likely exist, but apparently not in the locations being excavated. Finding them will probably require digging deeper than is our custom, in wetlands and in peat. In addition, reanalyzing existing collections may identify boat fragments that have gone unrecognized. Knowing watercraft size, capacity, speed, and seaworthiness would contribute an important dimension to our reconstructions of the past. Knowing whether people had boats when they first arrived in North America, and what types of boat, would add significant information to current theories about the route they followed.

People who lived on the Northwest Coast made and used boats long before European ships arrived on their shores. Oral histories, as well as written accounts by explorers and anthropologists, testify to the accomplished seafaring skills of the indigenous people, their habitual use of watercraft, and the ubiquity of dugout canoes (Suttles 1990 and references therein). Such traditions imply long-standing familiarity. The presence of archaeological sites on small offshore islands indicates access by boat for the past 10,000 years or more (Fedje et al. 1996; Letham et al. 2015), though it does not provide clues about the type of boat or whether boat types changed through time.

Proponents of the hypothesis for initial peopling of the Americas via the coastal migration route and the kelp

highway observe that watercraft would have been necessary (Dixon 1999:31–34; Erlandson et al. 2007), which suggests that the earliest watercraft on the coast may have had parallels in Asia. Moss (2011:60) points out that the first migrants to the Northwest Coast are unlikely to have made dugouts resembling those in the postcontact era since forests that might supply the requisite logs did not develop until later. She suggests skin boats or driftwood rafts as more plausible than dugouts. However, there is no direct archaeological evidence of any kind of watercraft until relatively recent times. Unsurprisingly, research into the origins of the Northwest Coast dugout canoe and its variants tends to be conjectural (e.g., Duff 1981) or limited to the past few centuries (e.g., Holm 1987, 1991; Olson 1927).

It is tempting to dismiss the data gap by noting that boats, being made of perishable materials, would not survive in the archaeological record. But that rationale for the absence of evidence is unsatisfying when one considers that (1) numerous examples of ancient watercraft have been found in many other regions of the world, (2) dozens of wet sites with preserved ancient wooden artifacts are known on the Northwest Coast, (3) archaeological excavations at coastal sites on the Northwest Coast have taken place for more than fifty years, and (4) perishable wooden artifacts from Northwest Coast wet sites have been dated to various eras—from 9400 BP to the recent past, although they are more common from the past four millennia (Coles et al. 1993; Croes 2013). It would seem that evidence of watercraft should be present in waterlogged conditions despite the vulnerability of organic material to rapid decay.

Some of the reasons for our failure to discover ancient boats on the Northwest Coast no doubt reflect research design, logistics, and funding, which also apply to other types of archaeological finds. Certainly, most excavation projects are too limited in scope. However, it is quite possible that we are not excavating in the right locations, that is, not the locations where we might expect to find boats. It is also quite possible that boat parts have been recovered but not recognized.

This article considers the issues of recognition and location. I begin with descriptions of existing archaeological evidence. Next, I discuss watercraft types documented in the ethnographic literature for the Northwest Coast and neighboring regions and what these might look like in archaeological context. The third section gives examples showing how and where wooden watercraft of great antiquity have been found in other culture areas. The article concludes with a discussion of implications for Northwest Coast archaeology. The overall aim is to promote future discoveries of watercraft.

My review of watercraft is based on published archaeological and ethnographic literature supplemented by unpublished information about archaeological specimens with which I am personally familiar. I provide details of Northwest Coast archaeological specimens, since much of the information is buried in reports on other topics. In the case of the Ozette site (which accounts for more items and more categories of watercraft-related artifacts than other assemblages), I found descriptive details in dissertations completed midway through the eleven-year excavation project (Friedman 2005; Mauger 1991) but no studies

centered on watercraft. Research for this review did not extend to examining excavation and analysis records or viewing collections.<sup>1</sup>

The Northwest Coast culture area spans two countries with different systems for enumerating archaeological sites. In the United States, when a site is officially registered it is assigned an alphanumeric identification code that indicates the state and county in which it is located, followed by a number corresponding to the order in which it is registered. For example, 45CA24 is the 24th site registered in Clallam County (CA), Washington State (45). In Canada, archaeological site codes indicate their locations on a map grid that is based on latitudes and longitudes and the numerical order in which they are registered. Thus, DiSc-1 is the first site to be registered in the grid unit DiSc. Artifact catalog numbers are usually prefaced by the site code. Many sites also have other names, but site codes, which are unique, are used for inventories and data management. Here, I mainly refer to sites by their English names. I note the code the first time I describe a site.

## THE EXISTING ARCHAEOLOGICAL ARTIFACTS

Objects made of normally perishable plant material, such as wood and bark, can survive for thousands of years in waterlogged anaerobic (low oxygen) conditions. Archaeologists refer to terrestrial waterlogged sites as “wet sites,” distinct from underwater or submerged sites. On the Northwest Coast, archaeologists have excavated watercraft-related artifacts from wet sites, and divers have found and occasionally recovered boats from lakes. Some of these items are of precontact age. In addition to waterlogged objects, partially made dugouts have been found in the forest in various locations on the Northwest Coast. Those recorded by archaeologists are classified as culturally modified tree (CMT) features.

### BOATS AND BOAT PIECES

Throughout the Northwest Coast, there are numerous CMT canoe logs and associated logging debris that comprise the initial stages of dugout manufacture. However, they do not provide appreciable time depth for watercraft (Mobley and Eldridge 1992). For example, the partially made CMT dugouts that I documented on Haida Gwaii date from the late nineteenth century AD (Bernick 1984). Others may be older, perhaps by as much as 200 years

(i.e., the age of the canoes—the trees would be older). Some archaeologists refer to these types of features as canoe blanks. They are felled logs, in some cases roughly shaped on the outside but abandoned in the forest due to breakage or for another reason (Mobley and Eldridge 1992; Stryd and Eldridge 1993). My Haida Gwaii sample of five canoe logs had an average diameter of about 1.50 m (range, 1.25–1.70 m) and an average length of 12.30 m (Bernick 1984:55). For Meares Island, off the west coast of Vancouver Island, Stryd and Eldridge (1993:201) report seven canoe blanks, 4.90–9.50 m long. Associated stumps indicated that they were cut from trees about 1.40 m in diameter (diameter at breast height). At both Haida Gwaii and Meares Island, the canoe logs had been cut with metal tools from mature stands of western red cedars (*Thuja plicata*) deep in the forest.

A number of complete or nearly complete waterlogged wooden boats have been found on the Northwest Coast, but none are confirmed to date from precontact times. In 2010, archaeologists excavated a waterlogged partial dugout and paddle fragments from a creek bank at a shell midden site, Hopetown (EfSq-2), on British Columbia's central coast. Details are not yet reported, but preliminary analysis indicated a postcontact age (Odwak 2014). Divers have raised a few dugouts from lake bottoms, but there is little documentation of these discoveries and, to my knowledge, none has been radiocarbon dated. For example, in 2009, the curator of the Campbell River Museum on the east coast of Vancouver Island consulted me regarding options for preserving a waterlogged dugout that local residents had raised from a nearby lake. When she apprised the finders of what they would need to do, they put it back in the lake.

In 1989–1990, a scuba diver found two waterlogged dugouts buried in mud at the bottom of Angle Lake near SeaTac Airport in Washington. The finds attracted attention from the local press, which described them as Salish-style dugouts, 4 m long and 3.5 m long, respectively. Apparently the diver first saw the bow of a boat sticking up about 50 cm from the lake-bottom mud. Both boats were raised, treated with polyethylene glycol by the Washington State Archives, and given to a local tribe (Brown 1990; Long 1990; Scattarella 1991). There does not appear to be a report about these boats, though the two find locations, which are about 45 m apart, are recorded as submerged archaeological historical resources (CH2M HILL 1997; Stilson et al. 2003:46). Press coverage at the time of the discovery noted that the Angle Lake dugouts may be as

much as 500 years old, but the basis for that estimate is not mentioned (Long 1990).

Canoe fragments from Ozette are the only Northwest Coast boat remains confirmed to be of precontact age. The Ozette site (45CA24) is on the northwestern tip of the Olympic Peninsula in Washington and produced 500-year-old waterlogged artifacts and collapsed wooden houses that had been buried by a mudslide. Mauger (1991:65–68) reports wood pieces that were salvaged from broken or worn-out canoes and reused as house planks. He describes them as cross-grain planks with characteristics that match methods of carving and finishing dugouts as described in the ethnographic literature. Several are canoe side fragments with gunwale strips sewn onto one edge using withes and also perforations with remains of withes that had secured thwarts (see Mauger 1991:fig. 34). Mauger notes that some of the gunwales show scrapes from paddles. He remarks that most of the cross-grain planks (recycled dugout sides) are small broken pieces but does not indicate their sizes, the number of specimens, or the number of original canoes represented. According to Daugherty (1988:22), fourteen canoe fragments were recovered from Ozette. Whether these are the recycled cross-grain planks or another type of canoe remnant is not clear.

## BOAT EQUIPMENT

Watercraft accessories are more numerous than boat remains in Northwest Coast precontact assemblages. They provide direct evidence of watercraft use and, in some cases, indicate boat type. Bailers suitable for dugouts are reported for two archaeological sites, Ozette and Little Qualicum River. Each assemblage has a different style of bailer, though both styles correspond exactly to their respective ethnographic expectations. The Ozette bailers, about 500 years old, are each carved from a single piece of wood and shaped like a hollow pyramid, which is the bailer style used in postcontact times by the Makah and Nuuchah-nulth (Arima 2000:314; Waterman [1920] 1967:27–29). Figure 1 shows an ethnographic specimen. Daugherty (1988:22) lists fourteen canoe bailers for Ozette. Friedman (2005:178–179) sampled three of these and identified two as red alder (*Alnus rubra*) and one as big-leaf maple (*Acer macrophyllum*). This type of bailer functioned by scooping or pushing water up and out against the curve of the boat, which is efficient in a dugout (Arima 2000:314).



Figure 1. Pyramid-style canoe bailer, 21x13x6 cm. Ethnology catalog no. 7153, Royal British Columbia Museum. Photograph by G. Hill, 2016, courtesy Royal British Columbia Museum.

The bailer from the Little Qualicum River site (DiSc-1), on the east coast of Vancouver Island, was recovered from ca. 1000-year-old water-saturated anaerobic deposits in the intertidal zone. It is an incomplete cedar-bark bailer made by creasing a rectangular sheet of western red cedar (*Thuja plicata*) bark and bending each end at a right angle to form a scoop with two open sides (Figs. 2 and 3). The central portion of the bark sheet, that is, the bottom of the bailer, is 250 mm long and 5 mm thick; it appears to be broken lengthwise and probably was nearly square. The side edge was stiffened by inserting two wood splints into the middle of the bark sheet (indicated by arrows in Fig. 2); one of the splints was identified as ocean spray, also known as ironwood (*Holodiscus discolor*). The ends of the bark sheet are 110 mm and 140 mm long, respectively, and were slit at their outer edges and bunched up, perpendicular to the central portion of the bailer. The handle, which is missing, would have been a stick of wood and was probably attached with cherry bark (Bernick 1983:336–338). The folded-bark bailer, which was the usual Coast Salish bailer type, functioned as a scoop rather than a dipper (Barnett 1955:116).

Several other wet sites have yielded fragmentary scoop-like cedar-bark artifacts that might have been bailers, though different from the Little Qualicum bailer as well as from other ethnographic types. They include “creased bark with handles” artifacts from the 3000-year-old Musqueam Northeast site (DhRt-4) and the 1700-year-old Water Hazard site (DgRs-30), both in the lower

Fraser River region. However, their handles seem inconsistent with use as a bailer suggesting another, indeterminate function (Archer and Bernick 1990:38–41; Bernick 1989:42–47).

Paddles are the most numerous watercraft accessory recovered from precontact archaeological contexts on the Northwest Coast. The 500-year-old Ozette site yielded 361 canoe paddles (Daugherty 1988:22). Friedman (2005:182–186) describes more than half of these, eleven complete specimens and 190 paddle pieces. Some of the paddles are carved from a single piece of wood; others have a separate crutch handle attached to the proximal end of the shaft. The paddle blades are 10–12 cm wide, and two tip shapes are represented, rounded and pointed. The complete paddles average about 1.5 m long.

Friedman identified six of the Ozette complete paddles as Pacific yew (*Taxus brevifolia*), three as big-leaf maple (*Acer macrophyllum*), and two as red alder (*Alnus rubra*). The incomplete paddles are made from these same three species, in roughly equal numbers. Paddles with pointed tips are predominately Pacific yew, whereas those with rounded tips are mainly red alder. However, for the two types of handles represented, statistical tests showed no correlation with particular wood species. Friedman notes that the strength properties of the three species—yew, maple, and alder—are particularly suited for paddles. In contrast, ten separate-piece crutch handles that Friedman also analyzed are made from a variety of other woods, including huckleberry (*Vaccinium* sp.), fool’s huckleberry (*Menziesia ferruginea*), big-leaf maple (*Acer macrophyllum*), Sitka spruce (*Picea sitchensis*), and willow (*Salix* sp.) (Friedman 2005:182–186).

The oldest reported Northwest Coast canoe paddles are from the 2000-year-old Lachane site (GbTo-33) in Prince Rupert Harbour (Fig. 4). There are two blade fragments, one with a portion of the shaft; three handles with shaft; and one handle fragment (Inglis 1976:177). Wood identifications by E. Perm, of the Eastern Forest Products Laboratory in Ottawa (in Inglis 1976:182), determined that three specimens are made from western red cedar (*Thuja plicata*); two from yellow cedar, also known as Alaska cedar (*Chamaecyparis nootkatensis*); and one from Pacific yew (*Taxus brevifolia*).



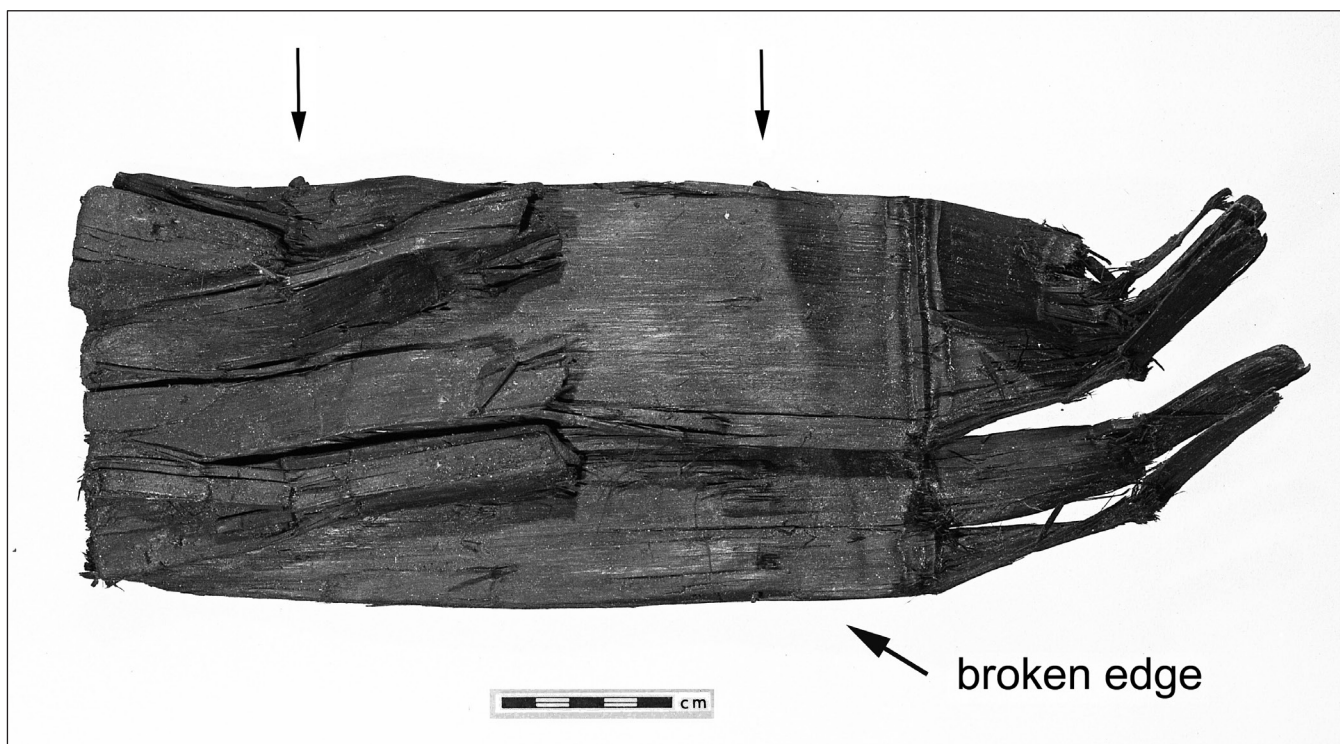


Figure 2. *Folded cedar-bark canoe bailer from the Little Qualicum River site, about 1000 years old. Arrows at top point to sticks inserted into edge of the bark sheet. Handle missing. DiSc-1:218, Archaeology Collections, Royal British Columbia Museum. Photograph by K. Bernick, 1979. Scale in cm.*



Figure 3. *Folded-bark style canoe bailer, 30x20x19 cm. Ethnology catalog no. 1187, Royal British Columbia Museum. Photograph by G. Hill, 2016, courtesy Royal British Columbia Museum.*

Photographs in the online catalog of the Canadian Museum of History, which is the repository for the Lachane collection, show complete proximal ends of two handle fragments with shaft portions (artifact numbers GbTo-33:C456 and GbTo-33:C523) and a third handle with a shaft that is broken longitudinally (GbTo-33:C627). The scales in the photographs indicate that each of the three is 30–35 cm long and that the handle fragment without a shaft (GbTo-33:C237) measures about 5 cm in its largest dimension. The repository's digital database does not have images or descriptions of the blade pieces (GbTo-33:C134 and GbTo-33:C624). Judging by the photographs, the Lachane paddle handles resemble the Ozette single-piece carved paddles (as described by Friedman 2005 and illustrated in Daugherty 1988:fig.4).

A waterlogged, 1.58-m-long paddle was found in 1992 by a construction worker in the Fraser River delta but not in archaeological context (Fig. 5). He brought it to an artifact identification clinic at the University of British



*Figure 4. Paddle handle with portion of shaft from the Lachane site in Prince Rupert Harbour, about 2000 years old. Length of fragment, 30 cm. Image credit: Canoe paddle, Canadian Museum of History, GbTo-33:C-523, S94-36600.*



*Figure 5. Paddle found buried in alluvium in the Fraser River delta. Age unknown; about 1.6 m long. Private collection. Photograph by K. Bernick, 1992.*

Columbia, where I had an opportunity to examine and photograph it. The paddle blade is lenticular in cross-section, 99x10 mm at its widest point, and the handle shaft is circular, 23x23 mm. The object remains in private hands and has not been previously reported. It was found about 1.4 m below the surface lying on silt underlain by blue-gray clay. These sediments are typical of the Fraser estuary. The find location is on the delta floodplain and not near the riverbank or a raised landform. The age of the paddle is not known.

In addition to paddles and bailers, watercraft equipment mentioned in the Northwest Coast ethnographic literature includes sails, mats for various purposes, and anchors. No precontact sails are reported from the Northwest Coast. However, one postcontact mat sail woven from cedar-bark strips was recovered from a site in Hesquiat Harbour on the west coast of Vancouver Island. It is about 150 years old and came from a burial cave that also contained parts of a canoe (there is no description of the canoe) (Bernick 1998).<sup>2</sup> That particular mat sail may never have propelled a boat. However, it is stylistically distinctive and identical to sails described in ethnographic accounts (e.g., Waterman 1967:23–26). Basketry mats of various sizes and types were commonly used inside boats to

kneel on and to cover beached dugouts as protection from the sun. Since these kinds of mats were ubiquitous and often multipurpose, it is impossible to associate archaeological specimens with watercraft unless they are found together.

Stone artifacts related to boats are difficult to identify with confidence. Two objects from the 1000-year-old Little Qualicum River site intertidal waterlogged deposits are interpreted to be anchors, but perhaps for seal nets rather than canoes (Fig. 6). They are unmodified, amorphous rocks bound with stout, 15-mm-diameter cedar-withe cordage and weigh 22.2 kg and 14.2 kg, respectively (Bernick 1983:238–240).

Smaller cordage-bound stones, as well as perforated stones and grooved and notched specimens of various sizes, are reported in several other assemblages, but they are usually interpreted to be net weights or fishing line weights in consideration of the particular find locations and the weights of the stones (e.g., de Bruijn 1990). Easton (1985, 1990) reports piles of reef-net anchor stones on the sea bottom off the southeast coast of Vancouver Island and concludes that they represent a boat-dependent fishing method that began 500 years ago. Canoe runways where boulders have been cleared in front of residential sites show that boats were being landed but not what type of boat (Boas 1909:446).

## POSSIBLE WATERCRAFT TYPES

Identifying precontact boats and boat parts requires visualization of the kinds of boats that might be present. The near absence of archaeological specimens from the Northwest Coast heightens the significance of ethnographic analogues. The ethnographic literature describes several types of watercraft made by Northwest Coast peoples and their neighbors. These types varied in material, structure, and function. The following descriptions consider water-





*Figure 6. Anchor. Unmodified stone bound with cedar with the cordage, in situ, Little Qualicum River site. About 1000 years old, 30x22x15 cm, 14.2 kg. DiSc-1:216, Archaeology Collections, Royal British Columbia Museum. Photograph by B. Simonsen, 1976, courtesy Royal British Columbia Museum.*

craft from the perspective of what their remains might look like in archaeological sites. All these types except rafts are containers (boats) designed to traverse bodies of water while keeping passengers and cargo dry. Technically, rafts are floats (Durham 1974; McGrail 2001).

## DUGOUTS

The Northwest Coast ethnographic literature, which draws on museum collections, traditional knowledge, and experimentation, documents considerable variation in sizes and styles of dugouts, reflecting particular functions, cultural traditions, and aesthetic qualities. There is also evidence of changes in dugout styles during postcontact times, apparently at an accelerating pace (Arima 2000; Boas 1909; Duff 1981; Durham 1974; Holm 1987, 1991; Waterman 1967). Boas (1909) gives a detailed account of traditional dugout construction. The recent sources are mainly forward-looking, providing inspiration and direction for the current resurgence of dugout manufacture (e.g., Arima 1975; Lincoln 1991).

Dugouts are the type of boat most archaeologists working on the Northwest Coast would anticipate. Examples dating from the nineteenth and twentieth centuries can be seen in museums throughout the region. The ethnographic Northwest Coast dugouts, or “canoes” as they are locally called, are hollowed-out logs with shaped exteriors. Some styles are enhanced with additional pieces of wood sewed or pegged onto the head and stern and separate-piece gunwales (Swan [1869] 1972:36–37; Waterman 1967:15–19). Archaeological specimens should be readily recognizable, though they may be rough versions of the sleek ethnographic and contemporary canoes.

## BARK BOATS

Folded cedar-bark canoes were common on the Northwest Coast. Easy and quick to make, they were used for crossing rivers and lakes, freshwater fishing, and emergencies. They were also commonly used by escaping slaves (Durham 1974:46). Boas (1909:449) describes the process of constructing a folded bark canoe used by the Kwakwaka'wakw for beaver hunting, and Barnett (1939:284) illustrates Coast Salish specimens that were used on inland waters. These boats were made from a tube or sheet of cedar bark folded lengthwise with the ends clamped shut between wood strips.

The folded cedar-bark canoe might be considered a low-tech or temporary version of the birch-bark canoe, which was common in the Subarctic and Eastern Woodlands culture areas and also on the Canadian Plateau. Both are made from a sheet of bark folded or curved to form the sides and with the ends closed up. The birch-bark canoe had elaborately stitched ends, gored construction, a bentwood gunwale structure that was inserted into the shaped bark, and various crosspieces and longitudinal planks also inserted into the shaped bark. Where birch was scarce or of poor quality, spruce bark and pine bark were used instead (Adney and Chapelle 1964; Osgood 1940:359–373; Ray 1939:142–144). Bark canoes were not as durable as dugouts, though they were equally seaworthy (Teit 1906:228–229). In her discussion of southern Yukon spruce-bark canoes, McClellan (1975:267–268) observes that they tended to snag on rocky streambeds and break, and that they would crack if left out in the sun. Apparently people would sink them in the river when they stopped for a day. A major advantage of bark canoes over dugouts is their light weight, a

characteristic that must have been greatly appreciated on journeys requiring portages.

Remains of bark canoes might occur in wet sites on the Northwest Coast, especially in sloughs and ponds and, perhaps, along the banks of small streams. Such remains would likely consist of pieces of thick bark (cedar or another species), perhaps creased, or perhaps with holes where something had been attached, or with remnants of the wood strips that closed the ends. I can testify that wet sites often contain broken pieces of cedar bark, some with those very attributes. Determining whether they represent watercraft is challenging because people also made other kinds of objects from slabs of cedar bark (e.g., roof planks, temporary shelters, and containers [see illustrations in Stewart 1984:119]). There is also the potential of culturally modified tree evidence: trees with large, broad scars where slabs of bark had been removed could signify harvesting material for bark boats.

#### SKIN BOATS

People to the north and northeast had skin-covered boats. There were three types: (1) the kayak, a relatively small decked boat (that is, with a closed top—except for a hole in which the paddler sat), was used mainly for hunting and when speed was paramount; (2) the umiak, an open boat that was made in large sizes for transport and migrations and smaller ones for hunting and other daily uses; and (3) the moose-hide boat, a rough version of the umiak used for transport on inland rivers. The kayak and umiak were used throughout the Arctic regions of Greenland, Canada, Alaska, and Siberia, and ethnographic studies document functional variability and stylistic differences corresponding to cultural groups and subgroups. The moose-hide boat was a temporary craft, mainly used in the western Subarctic culture area (Adney and Chapelle 1964; Anichtchenko 2012; Arima 1987; Arima et al. 1991; Dyson 1986; Heath 1987; Osgood 1940; Waskey 2012:49n13; Zimmerly 2000).

Structurally, skin boats are the opposite of the bark canoe. The entire frame was built first, with all the pieces lashed together to form a rigid skeleton for the boat. The frame was then covered with a large prepared skin and the edge of the skin tightly secured to the gunwale—the skin was not attached to any other part of the frame. For kayaks and umiaks, walrus skin was desirable because it is durable and large, but smaller sea mammal skins sewn together were also used. One advantage of kayaks and umi-

aks is that when they bump up against ice, the skin gives and the boat is neither punctured nor broken. The skins, however, need to be dried out thoroughly every few days. That means taking the boat out of the water and leaving it upside down to dry, a task that would be best accomplished in dry weather (Durham 1974:11–25).

The temporary moose-hide boats were constructed like umiaks but with simpler frames and with unprocessed skins of land mammals, especially moose and caribou. They were used for transporting heavy loads downstream on inland rivers; for example, to take game from a hunting camp to the village or to bring goods for trade to the coast. Moose-hide boats tended to soak up water, and after a single journey they were dismantled and the components were recycled (the skins were cut up for making cordage and other items; the framework became firewood). Unlike bark boats, they were not at risk of breaking on rocky streambeds. If treated with care and dried out after being in the river for a few hours, they could last for a several-day journey and on occasion for more than a year (de Laguna and McClellan 1981:650; Durham 1974:32; Kari 2003:102; McClellan 1975:269; Osgood 1940:378–380).

The oldest Arctic-style skin-boat specimen I know of is a 2000-year-old piece of a sealskin kayak from the Seward Peninsula in Alaska. There are small ivory figurine-like kayak-umiak models from graves of that same age in Siberia (Arutiunov and Fitzhugh 1988:fig.135; Zimmerly 2000:3). Some archaeologists, notably Charles Borden (1968:18), have suggested that skin boats were used on the Northwest Coast prior to the development of dugouts. Duff (1981) proposes that the West Coast whaling canoe is a derivative of the umiak—based on similarity of shape, proportions, various specialized components, use, and associated rituals.

The skins and sinew or hide cords used to make kayaks and umiaks might be preserved in frozen conditions, but animal tissue does not survive in Northwest Coast wet sites. The wooden frame might be expected in waterlogged anaerobic sediments, and an articulated skin-boat frame or a part of one should be readily identifiable even if the pieces are no longer lashed together. Distinguishing between stray, nonarticulated boat parts and pieces of worked wood from other constructions would require familiarity with skin-boat frames. However, inland-style moose-hide boats are highly unlikely to be preserved in the archaeological record since they were dismantled at the end of each journey.



The kayaks and umiaks described in the ethnographic literature often had assorted bone or ivory fittings, and specimens have been recovered in archaeological contexts. A site in the Aleutian Islands yielded ivory kayak fittings dating to 1700 BC (Lubischer 1991; Zimmerly 2000:3). These kinds of items would survive in coastal sites, especially in sediments containing shell. If any have been recovered on the Northwest Coast, archaeologists likely have classified them as “whatsits.”

#### FRAMELESS PLANK BOATS

People to the south made boats of multiple pieces of wood sewed together. Several groups in southern California made these, but they are best known by their Chumash name, *tomol* (Durham 1974; Meroz 2013). The bottom of the *tomol* consists of a shallow log hull and the sides are built up with planks—that is, slats of wood—that are sewn together and waterproofed with asphalt caulking. The planks are fitted edge to edge (not an overlapping clincker build). According to one estimate, it took 144 planks to make a *tomol*, and each plank had ten holes drilled into it for the sewing (Gamble 2002:309). The Chumash *tomol* has attracted considerable attention from archaeologists who are trying to link the technology to the development of social complexity. The link concerns access to a wealth of resources on offshore islands and the prestige and power that would accrue to those who had seaworthy watercraft (J. Arnold 1995; Arnold and Bernard 2005; Fagan 2004; Gamble 2002; Heizer 1940; Jobson and Hildebrandt 1980).

One piece of a *tomol* plank has been dated to about AD 650, and some possible plank fragments are about 2000 years old. Archaeologists have recovered numerous lumps and plugs of asphalt, some of which may have been used on boats. More interesting, they have found many specimens of a type of chipped chert drill that corresponds in size and use-wear to the holes on *tomol* planks where they were sewn together, and which occur only in the part of California where the *tomol* was used. Some of these drills may be 4500 years old, but that is not confirmed. An age of at least 2000 years for the *tomol* is implied by the presence of deep-sea fish in faunal assemblages (Gamble 2002). Fagan (2004) argues “on purely theoretical grounds” that the Chumash planked canoe is 8500 years old. In my opinion, that is entirely possible. Moreover, sewn plank boats may have been made on the Northwest Coast. They are not unique to California; ethnographers and historians

have documented similar boats in the Aleutian Islands, Siberia, and many other parts of the world (Meroz 2013). The idea of making a large object by “sewing” together numerous small pieces seems straightforward, especially for people whose technological repertoire included sewing clothes, weaving baskets, and making nets.

Remains of *tomol*-style plank boats would preserve in Northwest Coast wet sites. However, it might be challenging to distinguish stray, fragmentary planks from pieces that had been attached to dugout canoes. Both would feature drilled holes and, perhaps, remnants of sewing cord. It is also possible that the “planks” could be pieces of thick bark rather than wood. I further note that chipped-stone drills would not have been necessary since people on the Northwest Coast drilled holes in wood using hafted bone points (Boas 1909:321), and instead of asphalt they used conifer pitch for caulking (Turner 2007).

#### REED BOATS

Reed boats do not merit much attention in the literature. The technology is relatively simple and common worldwide where people needed to traverse marshes and reeds were plentiful (Durham 1974:96–101). In California, they were made from several tightly bound bundles of tule (reeds), with a narrow bottom, raised sides, and up-turned closed ends. However, reeds tend to soak up water, and the craft are not as seaworthy as wooden boats. The Chumash waterproofed them with asphalt to prolong the time they could be in the water before needing to be dried out (Meroz 2013). My observations indicate that reeds, rushes, and similar monocot material preserve poorly in Northwest Coast wet sites, and I am uncertain whether watercraft made of these materials would retain sufficient integrity to be identifiable. Monocot preservation in waterlogged conditions may vary according to soil chemistry and other factors, but that has not been explored.

#### LOG RAFTS

I did not find any ethnographic references for use of rafts by people of the Northwest Coast. Inland, in the Plateau and Subarctic areas, log rafts were used for fishing on lakes, to cross small streams, and for downstream travel on wide, slow-flowing rivers. One function of rafts was to transport firewood; that is, the logs comprising the rafts were firewood. The rafts could travel downstream only; they drifted on the river currents with directional

assistance from poles and paddles. If the fishing village was upstream from the winter village, then dried fish would be transported on the firewood raft. Rafts varied in shape and size within and between groups, in part correlated with characteristics of available materials and the time invested in construction tasks. They were made of logs lashed together with cords of sinew, babiche, bark, or withes. The more substantial types had a deck constructed of smaller logs and on that a layer of earth on which a fire burned. The essential characteristic was that the logs comprising the raft had to be very dry—presumably so that they would float high in the water (Durham 1974:33–34; McClellan 1975:271; Osgood 1940:381–382; Teit 1906:228).

For directional stability, a raft needs to be rectangular (McGrail 1998:44). That corresponds to McClellan's (1975:271) description of rafts in southern Yukon as four logs lashed together with babiche. On the other hand, Osgood (1940:381–382) identifies Ingalik rafts as square, constructed by lashing together several logs and, on top of them, a log platform. The Dene had an A-shaped raft (Durham 1974:33–34), which would provide better directionality and greater speed (McGrail 1998:45).

Log rafts were used in many other regions of the world on inland waterways. In his extensive review of watercraft, McGrail (1998:44–53) found that, although rafts are seaworthy, they are used on the ocean only in latitudes within 40° of the equator. Johnstone (1980:230) reasons that since rafts are a wash-through construction, and the people and cargo on them are exposed to the water, rafts are unlikely to have been used in the cold waters of the North Pacific Ocean. Whether a raft would survive in archaeological context in a configuration that would render it recognizable probably depends on the sturdiness of the construction and the nature of modifications to the logs.

## POTENTIAL LOCATIONS

Finding and recovering watercraft from archaeological deposits on the Northwest Coast seems entirely possible. The archaeological record in other parts of the world provides clues for identifying potential sites and an indication of what exactly might be present. This section briefly relates several examples, beginning with dugouts in Florida, which are truly impressive in terms of quantity, density of occurrence, and time span represented. Many were found in lakes. In part, that reflects a common practice of submerging canoes in lakes before people went away for an

extended period (Purdy 1991). I assume that doing this protected the very wet wood of the dugouts from cracking if left out in the Florida sun, a concern that would not be as critical on the Northwest Coast.

At Newnans Lake in Florida, archaeologists recovered ninety-five complete and fragmentary dugouts over the course of a twelve-month season in 2000–2001. These craft were found by pedestrian survey during a drought year, when the water level in the lake was unusually low, by looking for bits of the ends or sides of boats that projected slightly above the lake-bottom sediments. Some were found next to or on top of one another, their disposition apparently influenced by wind and sedimentation. All were in oxidized quartz sands that comprise the lake bottom and overlain by a 20-cm-thick layer of gyttja. The insides of the canoes, and often also the outsides, were covered with a 2-cm-thick woody peat-like muck. The Newnans Lake canoes are all technologically the same. They fall into two age ranges: 5000–2300 BP ( $n = 41$ ) and 1300–500 BP ( $n = 13$ ). They are very like two other canoes, from DeLeon Springs, Florida, which date to ca. 7000 BP (Ruhl and Purdy 2005; Wheeler et al. 2003).

Ten years before the Newnans Lake fieldwork that recovered ninety-five specimens, there were already 185 known dugout canoes from Florida dating from 5100 BP to the nineteenth century AD. They are from various locations, mainly in the north-central part of the state that formerly had a network of interconnected lakes and streams. Many were found in peat. Four precontact and two post-contact styles are represented, with the crudest being the oldest (Purdy 1991).

There are also large numbers of recovered ancient dugouts (and other types of boats) from Europe, mainly from bogs, shallow lakes, and floodplains. The published reports tend to focus on descriptions of the boats. Information about the deposits in which they were found is harder to come by, but I did find some.

In Lithuania, while draining a bog along the Baltic coast in 1966, numerous Neolithic sites were found, and ten were excavated. One produced a 1-m-long model canoe. At another site, archaeologists found the bottom portion of a 3.6-m-long dugout as well as stakes that were used to push dugouts off from the shore, three types of paddles, and a dock constructed of posts and boards. At the time of occupation, the area was a shallow coastal lake (sea lagoon), with alders, reeds, and other water plants along the shores. At the end of the Neolithic, the lake became a bog. It is now separated from the sea by an 800-m-wide sand

spit (Rimantiené 1992). Logboats (dugouts) from Latvia, Russia, and Ukraine include specimens found in peat or alluvium, in some cases 10 m below the surface. Generally they are 5 to 8 m long; one is reported to be 11 m long. They range in age from the fifth century BC to the fifteenth century AD (Burov 1997).

Numerous ancient dugouts have been recovered in Switzerland, Germany, France, the British Isles, Scandinavia, and other countries in western Europe. Their ages span many thousands of years. The oldest date from the Mesolithic and are 6000–8000 years old (B. Arnold 1993; Christensen 1999; Henriksen and Sylvester 2007; Waterbolk 1981). The Danish logboat finds are particularly interesting. Until 1979, all the known logboats in Denmark were from inland bogs and lakes and were of Neolithic age. In the 1980s and 1990s, archaeologists found twenty-one older boats, all Mesolithic and all but one at coastal sites. The oldest was more than 7 m long and was recovered from gyttja deposits in a small creek. Others were in sandy layers in the foreshore. The Mesolithic and Neolithic craft are technologically similar, and they differ from later Bronze Age and Iron Age watercraft. Altogether, there are about 250 boats and boat parts from Denmark (Christensen 1999).

One of the oldest reported dugouts is from China. Archaeological excavations in 1990 at Kuahuqiao, in the lower Yangtze River area, discovered an 8000-year-old early Neolithic dugout canoe. They recovered the bottom, parts of the sides, and the prow, as well as paddles and miscellaneous associated pieces of wood in the immediate vicinity. The settlement site where the dugout was found is on a riverbank facing a bay and about 1 m below sea level. It was abandoned about 7000 cal BP. Littoral sediments overlying the settlement deposits are 3–4 m thick, which, the investigators infer, indicates that the site was abandoned due to rising sea levels (Jiang and Liu 2005).

In addition to discoveries in situ, unrecognized boat remains may be present in existing collections. For example, thirty fragments, all from the same umiak, were found recently in an assemblage that had been excavated about eighty years ago from the Birnirk archaeological site near Point Barrow, Alaska. Radiocarbon dates of about 1000 BP document these finds as the oldest known umiak remains in Alaska (Anichenko 2013). In other cases, a precontact boat may be “sitting in plain sight.” A recent maritime heritage project documented a dugout canoe that had been recovered in 1934 from a Minnesota

lake and displayed in various local venues. A radiocarbon date found it to be 1000 years old, which was unexpected since other dated dugouts from Minnesota are postcontact (Merriman and Olson 2014:9–12).

## IMPLICATIONS AND CONCLUSIONS

Archaeological evidence of precontact watercraft on the Northwest Coast is remarkably scarce for a culture area that for thousands of years has been characterized by human occupation of indented shorelines and offshore islands, long-standing use of intertidal and near-shore resources, intervillage contacts and settlement patterns requiring movement across bodies of water, and skilled use of forest products that are ultimate boat-building material. Other than a few recycled pieces of dugouts and bailer types that imply dugouts, there is no information about the watercraft itself. Boat-related objects of known age are no more than 2000 years old, the large majority dating from the past 1000 years. The archaeological remains provide virtually no indication of craft size, shape, draw, capacity, speed, or seaworthiness of the vessels during more than 90 percent of the time in which people must have used watercraft on the Northwest Coast.

Equally remarkable is the variety of watercraft documented in the ethnographic literature for the Northwest Coast and neighboring regions. These boats include all of the types, worldwide, that nautical historians document as being made entirely from organic materials without metal nails and without metal tools: dugouts, bark boats, skin boats, sewn-plank boats, reed boats, and log rafts (e.g., Johnstone 1980; McGrail 2001). Remains of any of these types of boats might be present in archaeological contexts on the Northwest Coast, though probably not all were made at the same time everywhere. Any of them could have been made on the coast if appropriate materials were available.

The notion that during the early Holocene people would have had simple and expedient watercraft appears to be rooted in conjectural evolutionary models of boat technology. Some nautical historians aim to reconstruct the evolution of modern (European) ships from a perspective of increasing technological complexity (e.g., McGrail 1998). However, the effort bogs down when confronting the range of small, simple types that do not line up in an obvious developmental sequence. Much like the Northwest Coast watercraft conundrum, it is not clear, for example, whether skin boats came before, after, or



separate from dugouts, or where *tomol*-style plank boats fit into the sequence. Gould (2000:95–96) notes that other scholars have taken an adaptational approach, emphasizing that people built boats in different ways depending on geographic constraints, available materials, craft traditions, and purpose. This view has the potential to accommodate multiple boat types at the same place and time in history, but without archaeological evidence it is no closer to elucidating the past than a conjectural evolutionary scheme (Gould 2000).

It is possible that most wooden boats were recycled as firewood, mortuary furniture, or construction materials and that lake and marsh boats and temporary-use watercraft along the coast were mainly bark or reed and have preserved poorly. I further note that ethnographic and ethnohistoric studies of Northwest Coast seagoing dugout canoes mention that their thin hulls rendered them susceptible to splitting in half lengthwise, and that many a canoe, as well as the people and whatever else it carried, went down (Boas 1909:446; Waterman 1967:26). Although any or all of these factors may have reduced the number of boats entombed in wet-site deposits awaiting discovery by future archaeologists, it seems unlikely that this would have happened only on the Northwest Coast.

Boats of great antiquity can and do survive in archaeological contexts in many other parts of the world, notably when they are buried in peat or anaerobic muck. That seems to be particularly true of dugouts, though dugouts are likely overrepresented due to preservation and recognition factors. Gould (2000) considers all non-wood boats to be ephemeral and archaeologically nearly invisible. Although I agree with Gould's observation that the key point is the scarcity of direct archaeological evidence, I suggest that referring to them as "ephemeral" is unwarranted. The remains of bark boats and the frames of skin boats, and possibly also reed boats and rafts, should survive in anaerobic waterlogged sediments, though they may be in pieces. Archaeologists working on the Northwest Coast might encounter remains of various types of boats, not only dugouts. Moreover, even if remains of boats have not survived, there should be bailers, paddles, and other boat equipment that is more than 2000 years old.

It is clear that dugouts were used over a long period, by many people, in many parts of the world. Whether the first people who arrived on the Northwest Coast traveled in dugouts, we don't know—if they had access to logs of any size they could have. If they did not travel in dugouts,

then they must have begun to make and use them after settling on the coast, and we should be able to confirm when that occurred. The kind of watercraft people used had a bearing on their economic pursuits and social relations. Watercraft were a key component of the culture, and the types and styles of boats people made would have reflected a combination of available materials, cultural traditions, and intended purpose of the craft.

Northwest Coast archaeologists assume that people in this region had watercraft from time immemorial, meaning forever. That conviction often goes unstated, but it is embedded in reconstructions of the past. Research directed at finding material remains of those boats has been minimal. Wet sites on the Northwest Coast that contain ancient wood and bark artifacts might yield boats, though to find them we probably need to dig deep, in peat and gyttja deposits, in wetlands, and along protected paleo-shorelines as well as the modern coastlines. Boat accessories have been recovered from waterlogged deposits in shell middens, intertidal sites, and, at Ozette, amid collapsed houses. These kinds of settings likely contain older specimens. We might also find evidence of boats by reanalyzing existing collections. The type of boats we find will contribute new information for reconstructing the past. Daily activities, seasonal rounds, resource procurement, intergroup relations, ceremonial gatherings, trade, warfare, and migrations all involved travel over water. It seems strange that such a significant item of material culture has not attracted more attention.

## NOTES

1. The sources for the artifact descriptions that I present are cited in the text. The repositories housing those artifacts are (1) Makah Cultural and Research Center, Neah Bay, WA: Ozette material; (2) Royal British Columbia Museum, Victoria, BC: Little Qualicum River site material and collections from Hesquiat Harbour; (3) Canadian Museum of History, Gatineau, Quebec: Lachane site material; (4) Muckleshoot Indian Tribe, Auburn, WA: Angle Lake canoes; (5) University of British Columbia Laboratory of Archaeology, Vancouver, BC: Musqueam Northeast and Water Hazard collections; (6) private collection in BC (Fraser Delta paddle); (7) repository not yet designated: Hopetown site material excavated by Sources Archaeological and Heritage Research Inc., Vancouver, BC.

2. Artifacts from the surfaces of several burial caves were collected in 1971 at the request of the Hesquiaht First Nation, in whose traditional territory they are located. The sites were being vandalized, and the Hesquiaht Cultural Committee surveyed the damage and concluded that the contents of the caves were at risk of complete destruction. Rather than seal the caves, the committee chose to remove the cultural materials to a place where they would be preserved and studied, and in 1970 they approached the Royal BC Museum to join them in that endeavor. The resulting multiyear, multidisciplinary heritage recovery project was regulated by the Hesquiaht Cultural Committee. The recovered cultural materials were taken for safekeeping to the museum in Victoria, BC, where they are held in trust for the Hesquiaht people. Human skeletal remains that were collected from the cave surface deposits were analyzed in the field and placed in a crypt at Hesquiat Harbour (Hoover 1998; Sneed 1972). Artifact analysis has proceeded in stages. In the mid-1980s, I had the privilege of analyzing the basketry and cordage and writing a descriptive report (Bernick 1998).

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## REFERENCES

- Adney, Edwin Tappan, and Howard I. Chapelle  
1964 *The Bark Canoes and Skin Boats of North America*. Smithsonian Institution, Washington, DC.
- Anichenko, Jenya [Anichtchenko, Evguenia]  
2013 The Birnirk Umiak: A Glance at Prehistoric Arctic Boat Technology. *Arctic Studies Center Newsletter* 20:24–25.
- Anichtchenko, Evguenia  
2012 Open Skin Boats of the Aleutians, Kodiak Island, and Prince William Sound. *Études/Inuit/Studies* 36(1):157–181.
- Archer, David J. W., and Kathryn Bernick  
1990 Perishable Artifacts from the Musqueam Northeast Site. Manuscript on file, British Columbia Archaeology Branch, Victoria, BC.
- Arima, Eugene Y.  
1975 *A Report on a West Coast Whaling Canoe Reconstructed at Port Renfrew, BC*. History and Archaeology no. 3, National Historic Parks and Sites Branch, Parks Canada, Department of Indian and Northern Affairs, Ottawa.  
1987 *Inuit Kayaks in Canada: A Review of Historical Records and Construction, Based Mainly on the Canadian Museum of Civilization's Collection*. Canadian Ethnology Service Mercury Series, no. 110, National Museums of Canada, Ottawa.  
2000 Thoughts on the Nuu-chah-nulth Canoe. In *Nuu-chah-nulth Voices, Histories, Objects, and Journeys*, edited by Alan L. Hoover, pp. 306–329. Royal BC Museum, Victoria, BC.
- Arima, Eugene Y., John D. Heath, Guy Mary-Rousseliere, et al., editors  
1991 *Contributions to Kayak Studies*. Canadian Ethnology Service Mercury Series, no. 122, National Museums of Canada, Hull, QC.
- Arnold, Béat  
1993 Logboats of the 6th Millennium BC Discovered in Switzerland. In *A Spirit of Enquiry: Essays for Ted Wright*, edited by John Coles, Valerie Fenwick, and Gillian Hutchinson, pp. 5–8. Wetland Archaeology Research Project, Nautical Archaeology Society, and National Maritime Museum, Exeter, UK.
- Arnold, Jeanne E.  
1995 Transportation, Innovation and Social Complexity among Maritime Hunter-Gatherer Societies. *American Anthropologist* 97(4):733–747.
- Arnold, Jeanne E., and Julianne Bernard  
2005 Negotiating the Coasts: Status and the Evolution of Boat Technology in California. *World Archaeology* 37(1):109–131.
- Arutiunov, S. A., and William W. Fitzhugh  
1988 Prehistory of Siberia and the Bering Sea. In *Crossroads of Continents: Cultures of Siberia and Alaska*, edited by William W. Fitzhugh and Aron Crowell, pp. 117–129. Smithsonian Institution Press, Washington, DC.

- Barnett, Homer G.  
1939 *Culture Element Distributions: IX, Gulf of Georgia Salish*. Anthropological Records, vol. 1, no. 5, University of California Press, Berkeley.  
1955 *The Coast Salish of British Columbia*. University of Oregon Press, Eugene.
- Bernick, Kathryn  
1983 *A Site Catchment Analysis of the Little Qualicum River Site, DiSc 1: A Wet Site on the East Coast of Vancouver Island, BC*. Archaeological Survey of Canada Mercury Series, no. 118, National Museums of Canada, Ottawa.  
1984 Haida Trees: Remains of Canoe Manufacture in the Forests of Southern Masset Inlet. HCA permit 1984-5. Unpublished report on file, British Columbia Archaeology Branch, Victoria, BC.  
1989 Water Hazard (DgRs 30) Artifact Recovery Project Report. HCA permit 1988-55. Unpublished report on file, British Columbia Archaeology Branch, Victoria, BC.  
1998 *Basketry and Cordage from Hesquiat Harbour, British Columbia*. Royal BC Museum, Victoria, BC.
- Boas, Franz  
1909 The Kwakiutl of Vancouver Island. *Publications of the Jesup North Pacific Expedition* 5(2):301-522, and *Memoirs of the American Museum of Natural History* 8(2), New York.
- Borden, Charles E.  
1968 Prehistory of the Lower Mainland. In *Lower Fraser Valley: Evolution of a Cultural Landscape*, edited by Alfred H. Siemens, pp. 9-26. BC Geographical Series 9, Tantalus Research, Vancouver, BC.
- Brown, Charles E.  
1990 Who Owns Ancient Dugout Canoe?—Angle Lake Relic to Get Preservative Treatment. *Seattle Times*, October 7, 1990.
- Burov, Grigory M.  
1997 Ancient Dugouts of Eastern Europe. *NewsWARP* (Wetland Archaeology Research Project, UK), no. 22:17-21.
- CH2M HILL  
1997 Technical Appendix 6.0: Environmental Implications. In City of SeaTac PRT Feasibility Project 1, Historical and Archaeological Preservation Discipline Report, prepared in 2000 by CH2M HILL for Washington State Department of Transportation. Electronic document pdf.
- Christensen, Charlie  
1999 Mesolithic Boats from around the Great Belt, Denmark. In *Bog Bodies, Sacred Sites and Wetland Archaeology*, edited by Bryony Coles, John Coles, and Mogen Schou Jørgensen, pp. 47-50. WARP (Wetland Archaeology Research Project), Exeter, UK.
- Coles, John, Valerie Fenwick, and Gillian Hutchinson, editors  
1993 *A Spirit of Enquiry: Essays for Ted Wright*. Wetland Archaeology Research Project, Nautical Archaeology Society, and National Maritime Museum, Exeter, UK.
- Croes, Dale R.  
2013 Wet-site Archaeology on the Northwest Coast of North America and the Native Communities' Involvement in Managing Their Wetland Heritage Sites. In *The Oxford Handbook of Wetland Archaeology*, edited by Francesco Menotti and Aidan O'Sullivan, pp. 703-716. Oxford University Press, Oxford, UK.
- Daugherty, Richard D.  
1988 Problems and Responsibilities in the Excavation of Wet Sites. In *Wet Site Archaeology*, edited by Barbara A. Purdy, pp. 15-29. Telford Press, Caldwell, NJ.
- de Bruijn, Erik  
1990 Evidence for Aboriginal Fishing in Porlier Pass. *The Midden* 22(3):6-10.
- de Laguna, Frederica, and Catharine McClellan  
1981 Ahtna. In *Handbook of North American Indians*, vol. 6, *Subarctic*, edited by June Helm, pp. 641-663. Smithsonian Institution Press, Washington, DC.
- Dixon, E. James  
1999 *Bones, Boats, and Bison: Archeology and the First Colonization of Western North America*. University of New Mexico Press, Albuquerque.
- Duff, Wilson  
1981 Thoughts on the Nootka Canoe. In *The World Is as Sharp as a Knife: An Anthology in Honour of Wilson Duff*, edited by Donald N. Abbott, pp. 201-206. British Columbia Provincial Museum, Victoria, BC.
- Durham, Bill  
1974 *Canoes and Kayaks of Western America*. Facsimile reproduction, Shorey Book Store, Seattle. Originally published 1960, Copper Canoe Press, Seattle.



- Dyson, George  
1986 *Baidarka*. Alaska Northwest Publishing, Edmonds, WA.
- Easton, N. Alexander  
1985 The Underwater Archaeology of Straits Salish Reef Netting. Master's thesis, Department of Anthropology, University of Victoria, BC.  
1990 The Archaeology of Straits Salish Reef Netting: Past and Future Research Strategies. *Northwest Anthropological Research Notes* 24(2):161–177.
- Erlandson, Jon M., Michael H. Graham, Bruce J. Bourque, Debra Corbett, James A. Estes, and Robert S. Steneck  
2007 The Kelp Highway Hypothesis: Marine Ecology, the Coastal Migration Theory, and the Peopling of the Americas. *Journal of Island and Coastal Archaeology* 2(2):161–174, doi:10.1080/15564890701628612.
- Fagan, Brian  
2004 The House of the Sea: An Essay on the Antiquity of Planked Canoes in Southern California. *American Antiquity* 69:7–16.
- Fedje, D.W., A.P. Mackie, J.B. McSporran, and B. Wilson  
1996 Early Period Archaeology in Gwaii Haanas: Results of the 1993 Field Program. In *Early Human Occupation in British Columbia*, edited by Roy L. Carlson and Luke Dalla Bona, pp. 133–150. UBC Press, Vancouver, BC.
- Friedman, Janet P.  
2005 The Prehistoric Uses of Wood at the Ozette Archaeological Site. In *Ozette Archaeological Project Research Reports*, vol. 3, edited by David L. Whelchel, pp. 99–218. Reports of Investigations, no. 68, Department of Anthropology, Washington State University, Pullman, WA and Pacific Northwest Regional Office, U.S. National Park Service, Seattle.
- Gamble, Lynn H.  
2002 Archaeological Evidence for the Origin of the Plank Canoe in North America. *American Antiquity* 67(2):301–315.
- Gould, Richard A.  
2000 *Archaeology and the Social History of Ships*. Cambridge University Press, Cambridge, UK.
- Heath, John D.  
1987 Baidarka Bow Variations. In *Faces, Voices and Dreams: A Celebration of the Centennial of the Sheldon Jackson Museum, Sitka, Alaska 1888–1988*, edited by Peter L. Corey, pp. 93–96. Division of Alaska State Museums and Friends of the Alaska State Museum, Sitka.
- Heizer, Robert F.  
1940 The Frameless Plank Canoe of the California Coast. *Primitive Man* 13(3/4):80–89, doi:10.2307/3316181.
- Henriksen, Merete Moe, and Morten Sylvester  
2007 Boat and Human Remains from Bogs in Central Norway. In *Archaeology from the Wetlands: Recent Perspectives*, edited by John Barber et al., pp. 343–347. Society of Antiquaries of Scotland, Edinburgh.
- Holm, Bill  
1987 The Head Canoe. In *Faces, Voices and Dreams: A Celebration of the Centennial of the Sheldon Jackson Museum, Sitka, Alaska 1888–1988*, edited by Peter L. Corey, pp. 143–155. Division of Alaska State Museums and Friends of the Alaska State Museum, Sitka.
- 1991 Historical Salish Canoes. In *A Time of Gathering: Native Heritage in Washington State*, edited by Robin K. Wright, pp. 238–247. University of Washington Press, Seattle.
- Hoover, Alan  
1998 Foreword. In *Basketry and Cordage from Hesquiat Harbour, British Columbia*, by Kathryn Bernick, pp. 1–2. Royal BC Museum, Victoria, BC.
- Inglis, Richard  
1976 'Wet' Site Distribution—The Northern Case: GbTo 33—The Lachane Site. In *The Excavation of Water-Saturated Archaeological Sites (Wet Sites) on the Northwest Coast of North America*, edited by Dale R. Croes, pp. 158–185. Archaeological Survey of Canada Mercury Series, no. 50, National Museums of Canada, Ottawa.
- Jiang, Leping, and Li Liu  
2005 The Discovery of an 8000-year-old Dugout Canoe at Kuahuqiao in the Lower Yangtze River, China. Project Gallery 305. *Antiquity* 79, Project Gallery online at <http://antiquity.ac.uk/projgall/liu/>.
- Jobson, Robert W., and William R. Hildebrandt  
1980 The Distributions of Oceangoing Canoes in the North Coast of California. *Journal of California and Great Basin Anthropology* 2(2):165–171.
- Johnstone, Paul  
1980 *The Sea-Craft of Prehistory*. Routledge and Kegan Paul, London.

- Kari, James  
2003 Notes on Dena'ina Watercraft. In *Shem Pete's Alaska: The Territory of the Upper Cook Inlet Dena'ina*, edited by James Kari and James A. Fall, pp. 102–105. University of Alaska Press, Fairbanks.
- Letham, Bryn L., Andrew Martindale, Duncan McLaren, Thomas Brown, Kenneth Ames, David J. W. Archer, and Susan Marsden  
2015 Holocene Settlement History of the Dundas Islands Archipelago, Northern British Columbia. *BC Studies* 187:51–85.
- Lincoln, Leslie  
1991 *Coast Salish Canoes*. Center for Wooden Boats, Seattle.
- Long, Katherine  
1990 Centuries-Old Indian Dugout May Be Lost to History. *Seattle Times*, August 6, 1990.
- Lubischer, Joseph  
1991 The Baidarka as a Living Vessel: The “Bones” in the Joints. In *Contributions to Kayak Studies*, Canadian Ethnology Service Mercury Series, no. 122, edited by E. Y. Arima, John D. Heath, Guy Mary-Rousseliere, et al., pp. 221–258. National Museums of Canada, Hull, QC.
- Mauger, Jeffrey E.  
1991 Shed-Roof Houses at Ozette and in a Regional Perspective. In *House Structure and Floor Midden*, edited by Stephan R. Samuels, pp. 29–173. Ozette Archaeological Project Research Reports, vol. 1. Reports of Investigations 63. Department of Anthropology, Washington State University, Pullman, WA and Pacific Northwest Regional Office, U.S. National Park Service, Seattle.
- McGrail, Sean  
1998 *Ancient Boats in North-West Europe: The Archaeology of Water Transport to AD 1500*. Longman, New York.  
2001 *Boats of the World: From the Stone Age to Medieval Times*. Oxford University Press, Oxford, UK.
- McClellan, Catharine  
1975 *My Old People Say: An Ethnographic Survey of Southern Yukon Territory*. National Museum of Man Publications in Ethnology no. 6, pt. 1. National Museums of Canada, Ottawa.
- Meroz, Yoram  
2013 The Plank Canoe of Southern California: Not a Polynesian Import, but a Local Innovation. In *Structure and Contact in Languages of the Americas*, edited by John Sylak-Glassman and Justin Spence. Reports of the Survey of California and Other Indian Languages 15:103–188. Electronic document, pdf.
- Merriman, Ann, and Christopher Olson  
2014 *Minnesota Dugout Canoe Project Report*. Maritime Heritage Minnesota, St. Paul.
- Mobley, Charles M., and Morley Eldridge  
1992 Culturally Modified Trees in the Pacific Northwest. *Arctic Anthropology* 29(2):91–110.
- Moss, Madonna L.  
2011 *Northwest Coast Archaeology as Deep History*. SAA Press, Washington, DC.
- Odwak, Hartley  
2014 The Hopetown Archaeological Project—Wet Site Challenges and Outcomes. Paper presented at the 67th annual Northwest Anthropological Conference, Bellingham, WA, March 26–29.
- Olson, Ronald L.  
1927 *Adze, Canoe, and House Types of the Northwest Coast*. University of Washington Publications in Anthropology, vol. 2, no. 1. University of Washington Press, Seattle.
- Osgood, Cornelius  
1940 *Ingalik Material Culture*. Yale University Publications in Anthropology, no. 22. Yale University Press, New Haven, CT.
- Purdy, Barbara  
1991 *The Art and Archaeology of Florida's Wetlands*. CRC Press, Boca Raton, FL.
- Ray, Verne F.  
1939 *Cultural Relations in the Plateau of Northwestern America*. The Southwest Museum, Los Angeles.
- Rimantienė, Rimutė  
1992 Neolithic Hunter-Gatherers at Šventoji in Lithuania. *Antiquity* 66:367–376.
- Ruhl, Donna L., and Barbara A. Purdy  
2005 One Hundred-one Canoes on the Shore—3–5,000 Year Old Canoes from Newnans Lake, Florida. *Journal of Wetland Archaeology* 5:111–127.
- Scattarella, Christy  
1991 Monster of Angle Lake Glides Again. *Seattle Times*, June 28, 1991.
- Stilson, M. Leland, Dan Meatte, and Robert G. Whitlam  
2003 *A Field Guide to Washington Archaeology*. Washington State Parks and Recreation Commission, Olympia, WA, and Office of Archaeology and Historic Preservation, Olympia, WA.

- Sneed, Paul G.  
1972 A Report of Archaeological Research Activity in Hesquiat Harbour, Vancouver Island, British Columbia: Summer 1971. HCA permit 1971-29. Unpublished report on file, British Columbia Archaeology Branch, Victoria, BC.
- Stewart, Hilary  
1984 *Cedar: Tree of Life to the Northwest Coast Indians*. Douglas and McIntyre, Vancouver, BC.
- Stryd, Arnoud H., and Morley Eldridge  
1993 CMT Archaeology in British Columbia: The Meares Island Studies. *BC Studies* 99:184–234.
- Suttles, Wayne, editor  
1990 *Handbook of North American Indians*, vol. 7, *Northwest Coast*. Smithsonian Institution Press, Washington, DC.
- Swan, James G.  
[1869] 1972 *The Indians of Cape Flattery*. Shorey Book Store, Seattle.
- Teit, James A.  
1906 *The Lillooet Indians*. Memoir, American Museum of Natural History, vol. 4, pt. 5 (Jesup North Pacific Expedition, vol. 2, pt. 5), pp. 193–300. American Museum of Natural History, New York.
- Turner, Nancy J.  
2007 *Plant Technology of First Peoples in British Columbia*. Royal BC Museum, Victoria, BC.
- Waskey, Frank H.  
2012 Tribal Divisions of the Eskimo of Western Alaska. Edited and annotated by Kenneth L. Pratt. *Alaska Journal of Anthropology* 10(1&2):42–52.
- Waterbolk, H. T.  
1981 Archaeology in the Netherlands: Delta Archaeology. *World Archaeology* 13(2):240–254.
- Waterman, T. T.  
[1920] 1967 *The Whaling Equipment of the Makah Indians*. University of Washington Press, Seattle.
- Wheeler, Ryan J., James T. Miller, Ray M. McGee, Donna Ruhl, Brenda Swann, and Melissa Memory  
2003 Archaic Period Canoes from Newnans Lake, Florida. *American Antiquity* 68(3):533–551.
- Zimmerly, David W.  
2000 *Qayaq: Kayaks of Alaska and Siberia*. University of Alaska Press, Fairbanks.