THE NORTHWEST COAST DURING THE PLEISTOCENE/HOLOCENE TRANSITION: HIGH ROAD OR HINDRANCE?

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ABSTRACT

This paper examines the results of recent paleogeographical and archaeological investigations bearing on the question of whether the Northwest Coast was a route by which late Pleistocene peoples moving from Beringia could have reached points south of the glacial margins. There is as yet no radiocarbon-dated archaeological evidence on the Northwest Coast earlier than about 11,000 ^{14}C yrs BP, even though it can be inferred from paleoenvironmental indicators that transit down the coast was possible between 14,000 and 12,000 ^{14}C yrs BP. Interior migration routes, however, were also feasible during the latter part of this time interval.

KEYWORDS: migration routes, Beringia, British Columbia

INTRODUCTION

In spite of speculative claims to the contrary, Beringia is still the most logical late Pleistocene homeland for New World aborigines. Given this assumption, the question then arises as to the route or routes Beringians took when the glaciers that barred them from North American regions to the south began to melt during the terminal Pleistocene, and what enticed these arctic-adapted people to spread into unfamiliar regions. It is known from archaeological evidence that microblade-using people were present north of the glaciers at the Swan Point site in central Alaska by at least 12,250 ^{14}C yrs BP (Holmes 2007), that human coprolites dating to 12,300 ^{14}C yrs BP were deposited in Paisley Cave in eastern Oregon south of the glaciated regions (Gilbert et al. 2008), and that Clovis people were spread throughout most of the United States south of the glaciers by 11,050–10,800 ^{14}C yrs BP (Waters and Stafford 2007) and in parts of western Canada (Driver 1998), if not earlier. Many scholars favor an interior corridor either east or west of the Rocky Mountains as the primary route of entry, although a coastal route has come to be preferred by some investigators. There has been speculation about migration by nunatak hopping and ice floe cruising during periods of peak glaciation, but the less controversial migration models depend on at least partial deglaciation of the respective routes during the late Pleistocene. Considerable glaciological research has been undertaken in the last decade, and needs to be considered in assessing the relative likelihood of alternative migration scenarios from Beringia south. Fig. 1 shows locations of proposed corridors and relevant sites or localities.

THE COASTAL ROUTE

A model of migration south along the Northwest Coast was brought into prominence by Fladmark (1979, 1983), who suggested travel via unglaciated coastal refugia during peak glaciation. At that time there was some suggestion of mid-Pleistocene human occupation south of the glacial margins that has since been debunked (Dincauze 1984, Owen 1984). More recently, the Monte Verde site in southern Chile, with its pre-Clovis radiocarbon dates, has sometimes been cited (Ames and Maschner 1999, Dixon 1999, Gruhn 1994) as evidence of an early Pacific coastal migration, although the confusions in the published reports on this site (cf. Fiedel 1999b) now make this evidence equivocal. We will never know whether Monte Verde is pre-Clovis or not without confirmation from other excavations at sites in the area. In a recent analysis of colonization routes, Anderson and Gillam (2000) rule out the Northwest Coast as the "least-cost" route for Clovis ancestors because of the indented nature of the coastline, but do not seem to take into account the ease of movement on a treeless coastal plain such as existed during the terminal Pleistocene when the outer continental shelf was exposed during a short interval.

Glaciologists consider the outer fringes of the north Pacific coast to have been deglaciated earlier than elsewhere. Mann and Peteet (1994:136) date the last glacial maximum in that region at 23,000 to 14,700 ^{14}C yrs BP and note that coastal ice masses terminated offshore during this period and extended onto the outer continental shelf approximated by the 200 m bathymetric contour. They further infer that the Alaska Peninsula Glacier Complex "would have precluded coastal migration by humans during its maximum extent" even though some places such as Cook Inlet were glacier free by 16,000 ^{14}C yrs BP. In the Queen Charlotte Islands ice had also retreated by 16,000–15,000 ^{14}C yrs BP and bears had reached the outer coast of the Queen Charlotte Islands by 14,500 ^{14}C yrs BP (Fedje 2003:30). Further south on the coast in southwest British Columbia and Washington State, the last glacial maximum was a thousand or more years later and ice covered a 400 km stretch of the continental shelf west of Vancouver Island until 14,500–14,000 BP (Blaise et al. 1990). In the interval following deglaciation of the outer coast and before melting of the continental glacial mass caused sea level rise, a strip of shrub-tundra along the outer coast could have permitted passage by 14,000 ^{14}C yrs BP of peoples with a culture already adapted to survival in the Arctic, including use of skin-covered watercraft for crossing rivers, inlets, and estuaries, although such a passage would not have been easy. Today this coastal strip lies far beneath the sea. A full maritime adaptation such as is known by almost ten thousand years ago on the northern Northwest Coast (Carlson 1998) would not have been necessary for such a passage. The extant Beringian hunting, fishing, and hide-working technology would have worked well in this newly deglaciated shrub-tundra coastal environment, providing that resources were available.

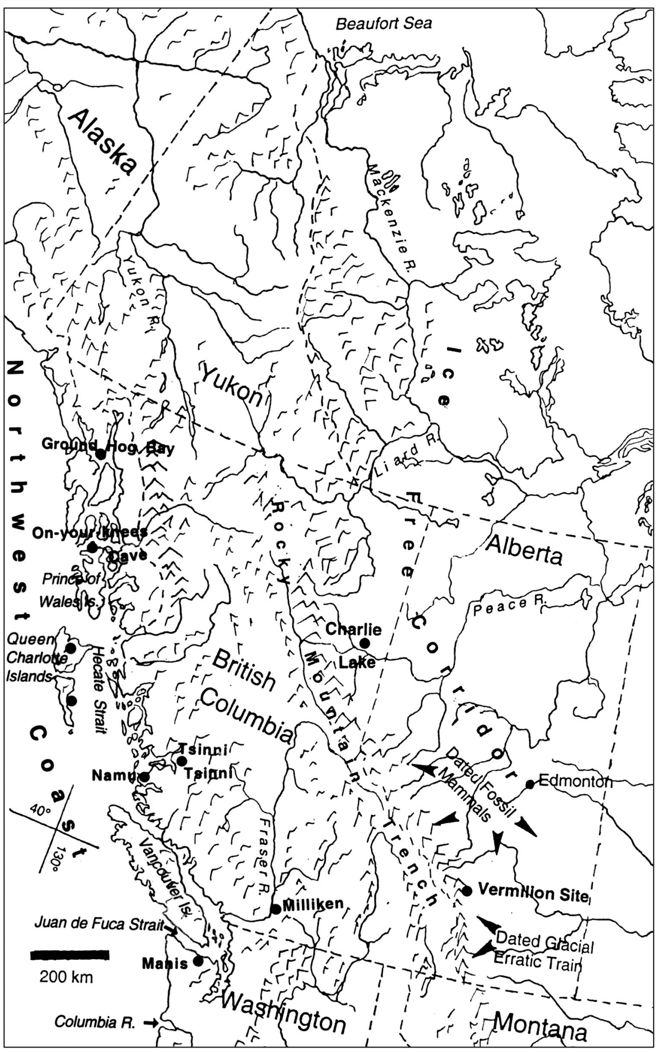

Fig. 1. Map showing Northwest Coast and Interior corridors with selected sites and localities mentioned in the text.

The inner coast, the inside passage that today permits travel by small boat in protected waters from Skagway in Alaska to Olympia in Washington State with few exposures to the open ocean, with the possible exception of an already ice-free refugium underlying what is now Hecate Strait (Byun 1999), appears to have become ice free later than the outer coast. Heaton et al. (1996) obtained twenty dates on land mammal bones from Prince of Wales Island that yielded four dates between 44,500 and 35,365 ^{14}C yrs BP, followed by an interval with no land mammal dates, and then ten dates between 12,295 and 9,995 ^{14}C yrs BP, and six dates younger than 6,415 ^{14}C yrs BP. There was also one date of 17,565 ^{14}C yrs BP on bones of ringed seal, a sea mammal adapted to pack ice, and some dates on fish bones. These dates suggest that the inner coast was uninhabitable by land mammals between 35,365 and

12,295 ^{14}C yrs BP because of glacial cover, but that by the younger date the region was occupied by bears and could have been occupied by other land mammals. Further south on northern Vancouver Island the earliest bears have been dated at 9,830±140 ^{14}C yrs BP; mountain goats are known even earlier at 12,200±190 ^{14}C yrs BP (Nagorsen et al. 1995, Nagorsen and Keddie 2000). Unlike bears, people don't hibernate during the winter, and unlike both bears and mountain goats, people do not have thick fur. However, Beringians did have both clothing and fire, and should have been able to survive as well on the Northwest Coast twelve thousand years ago as they did in Beringia. So far the archaeological record provides no solid evidence for humans that early on the coast itself, although there is solid evidence dating a little over ^{14}C yrs BP both to the north at the Swan Point site in central Alaska (Holmes 2007) and to the south at Paisley Caves in eastern Oregon (Gilbert et al. 2008).

Although it has long been known that there were sea level changes, it is only recently that the magnitude of these changes along the Northwest Coast at the close of the Pleistocene has become apparent. It is necessary to look for former shorelines both underwater and at higher elevations far back in the forest. Whereas south of the glaciated regions sea level rise is the most significant factor in hiding the coastal archaeological record, within the glaciated region not only sea level rise but postglacial isostatic change—the rebound of areas depressed by the load of glacial ice as well as forebulge, tilting, and nonsynchronous changes in ice loading and unloading—significantly complicate discovery of early sites. At present, early coastal sites are known to range in elevation from 55 m below sea level for a flake from an ancient shoreline in the Queen Charlotte Islands (Fedje and Josenhans 2000), to sites at and below sea level exposed in the intertidal zone, to sites 300 m above sea level such as Tsini Tsini, now far inland above the Bella Coola valley (Hobler 1995). The evidence for sea level change and related archaeology is summarized in the following paragraphs from north to south on the coast.

There is evidence for sea level change on the northern Northwest Coast in Alaska, the Queen Charlotte Islands (Haida Gwaii), and the northern mainland coast of British Columbia (B.C.). The earliest component at Ground Hog Bay in southeast Alaska dating 10,000–9,000 ^{14}C yrs BP is some 10–15 m above present sea level (Ackerman, Hamilton, and Stuckenrath 1979). In the southern Queen Charlotte Islands, Hobler (1978) found intertidal lithic scatters like those found earlier on the central B.C. coast, and more recent work at the Richardson Island intertidal site (Fedje and Christiansen 1999, Fedje and Josenhans 2000) has resulted in the discovery of an underlying bifacial component without microblades dating to 9,300 ^{14}C yrs BP succeeded by one with microblades at 8,900 ^{14}C yrs BP. In addition, sonar was used to map the bottom of Hecate Strait and develop predictive models of where sites would be when this was dry land. Testing the model by dredging resulted in the discovery of two artifacts: a flake at 53 m depth on a 10,000 ^{14}C yrs BP shoreline, and a crude undiagnostic notched stone anchor at 110 m depth. Evidence that a drowned pine forest, dating to 12,200 ^{14}C yrs BP at a depth of 143 m, had replaced the earlier herb-shrub tundra present since about 14,000 ^{14}C yrs BP (Mathewes 1989) was also discovered. Cave sites in the Queen Charlotte Islands have yielded fragments of spear points directly associated with bear bones dated between 10,950 and 10,400 ^{14}C yrs BP (Fedje 2003, Fedje et al. 2008). Working in the Queen Charlotte Islands, Fladmark discovered pebble tools and microblade industries in various sites at high elevations (Fladmark 1970, 1990). The first site excavated, Skoglund's Landing, is an ancient raised beach containing some badly rolled pebble tools high above Massett Inlet. Microblade industries at other sites were found to date back to 7,000 ^{14}C yrs BP, and have since been found to date back to 9,000–8,500 ^{14}C yrs BP (Fedje 2003, Magne and Fedje 2007). On the northern B.C. mainland Archer (1998) recently examined large exposures of a raised beach 50 m above modern sea level at Port Simpson that contained a variety of clamshells but no evidence of human occupation. The shells provided two close radiocarbon dates which gave a marine reservoir corrected average of 12,400 ^{14}C yrs BP.

On the central British Columbia coast, the 1969–70 excavations at Namu (Hester and Nelson 1978) revealed a microblade component dating to 9,000 ^{14}C yrs BP. Later excavations (Carlson 1979, 1996) in a different part of the site uncovered an earlier premicroblade component in the bottom 30 cm of nonshell deposits with a beginning date of 9,700 ^{14}C yrs BP. This occupation was probably at a time of lower sea levels, when the site was a considerable distance from the intertidal shellfish beds. Cannon (2000) has since undertaken an augering program at Namu and other central coast sites and has postulated a gradual decline in relative sea level on the central coast for the last ten thousand years, although my reading of his figures suggests a short-term sea level rise about 5,000 ^{14}C yrs BP. At the Bear Cove site on northern Vancouver Island the oldest component is in a nonshell deposit like that at Namu, 7 to 10 m above present sea level (C. Carlson 1979). In 1970 when doing surveys on the central B.C. coast we started finding the opposite of higher elevation sites. These were beach assemblages of flaked stone tools interpreted as lag deposits from sites eroded by early Holocene rising sea levels (Apland 1982, Carlson 1972).

In 1994 Hobler (1995) began excavations at Tsini Tsini at an elevation of 300 m above the Talchako River in the upper Bella Coola drainage. This site is undated by radiocarbon, but on the upper, older terrace the assemblage, which lacks microblades, is like that at Namu I with its oldest date of 9,720±140 ^{14}C yrs BP (Carlson 1996). There are marine diatoms in the deposit. Further down the valley, but still some 50 km from saltwater, shells from an elevated layer of marine clay gave a radiocarbon date of 10,570±85 ^{14}C yrs BP (Hobler 1995). A marine reservoir correction of six hundred years (Josenhans et al. 1995) on shell makes this date about 10,000 ^{14}C yrs BP. The younger terrace at Tsini Tsini contained a microblade assemblage that at dated sites on the central coast appears just before 8,500 ^{14}C yrs BP and persists to about 5,000 ^{14}C yrs BP. The Sallompt site, also on a raised terrace above the Bella Coola River, produced an assemblage with microblades similar to that from the lower terrace at Tsini Tsini further upriver (Hobler 2004). The artifact assemblages at both Tsini Tsini and Sallompt contain Chindadn points and resemble Nenana assemblages in Alaska and the Yukon (Carlson 2008:68–70). The Bella Coola valley with its tributaries was apparently an estuary filled with saltwater when Tsini Tsini was occupied, with uplift taking place more recently than 10,000 ^{14}C yrs BP (Hall 2003).

Borden's (1960) work in the Fraser Canyon at the Milliken and South Yale sites resulted in the discovery of early sites at higher elevations in the southern B.C. coastal zone. The earliest occupation level at Milliken, dated about 8,000–9,000 ^{14}C yrs BP, is in sands deposited by the Fraser River when it was running some 20 m above its present high water level (Mitchell and Pokotylo 1996). At South Yale thousands of pebble tools found in terraces above the Fraser River led Borden (1969) to hypothesize a pre-Wisconsin or late Pleistocene occupation that we now know is only four thousand to six thousand years old at this site (Haley 1996). Such pebble tools do occur in early sites dating back nearly ten thousand years, and are found in undated surface assemblages on high terraces above the major rivers in British Columbia, but they are only part of the lithic assemblages of that period. The South Yale assemblages, consisting mostly of pebble tools, are found on a series of kame terraces well above the Fraser River. Borden originally thought they were early, but later work (Haley 1996) has shown that these particular assemblages date to the Hypsithermal period and occur in eolian sand covering the terraces, rather than in the terraces themselves. Recent work in reservoirs on tributaries of the lower Fraser River during draw-down periods has exposed many early lithic assemblages at elevations well above the present shoreline (McLaren and Steffen 2008, Wright 1996), whereas at the Fraser delta itself and offshore islands, early sites are probably below current sea level as a result of rapid sea level rise between 5,800 and 4,500 ^{14}C yrs BP (Williams and Roberts 1988).

Enticements for movements from Beringia into newly deglaciated territory on the northern Northwest Coast by hunter-gatherers would be the presence of resources, whether they be the clams, sea mammals, fish, bears, or mountain goats for which there is direct evidence cited above. These resources predate the earliest evidence for the presence of humans. With the earliest humans there is evidence for additional faunal resources. The earliest dated archaeological evidence on the coast is at the Manis Mastodon site (Gustafson et al. 1979) on the south side of the Strait of Juan de Fuca in Washington State. The dates range 11,000–12,000 ^{14}C yrs BP with the earliest date of 12,000±310 ^{14}C yrs BP on willow from the bottom of the bog in which the remains were found (Petersen, Mehringer, and Gustafson 1983). No culturally diagnostic artifacts were recovered. A piece of pointed bone embedded in a rib of the mastodon and several pieces of grooved and polished ivory were associated with the faunal remains. Of more interest than the artifacts are the faunal remains themselves, which in addition to the mastodon include both bison and caribou (Peterson et al. 1983). While both bison and mastodon could have spread from the south, the presence of caribou raises the question of how this species reached this previously glaciated coastal region. Caribou are known both prehistorically and historically from the Queen Charlotte Islands off the northern B.C. coast and are very common in the paleontological record north of the glaciated regions in Beringia, where caribou bones have been directly dated at 13,130 and 15,190 ^{14}C yrs BP (Ackerman 1996:473), in the Yukon at Bluefish Cave at 12,830±60 and 12,210±210 ^{14}C yrs BP (Cinq-Mars 1979), and at the Little John site at 9530±40 ^{14}C yrs BP (Easton and MacKay 2008:338). They appear on the coast in the

Alexander Archipelago by 12,000 ^{14}C yrs BP (Heaton and Grady 2003). Bones from the Queen Charlottes dating 6,000–4,000 ^{14}C yrs BP are more similar to those of the large barren-ground caribou rather than to those of the historic Dawson caribou (Byun et al. 2002, Severs 1974), and DNA studies suggest they are a late-glacial or post-glacial import rather than a relic from a preglacial population. If caribou followed a shrub-tundra environment out of the Yukon on to the northern coast and down the exposed coastal plain during glacial retreat, this would have been a major enticement for human predators to follow (Carlson 2007).

THE INTERIOR ROUTES

Routes south from Beringia both east and west of the Rocky Mountains have been proposed by various researchers. The western route through the Rocky Mountain Trench in British Columbia was favored by Borden (1969), whereas most other researchers have considered the eastern route between the margins of the retreating ice sheets—usually referred to as the "Ice-Free Corridor"—as more feasible. Glacial retreat in the Interior was later than on the Northwest Coast. Some researchers consider the Ice-Free Corridor as opening too late to permit access by Clovis or proto-Clovis migrants from the north.

The Yukon was the gateway to the Rocky Mountain Trench. Catto (1996) indicates that overland migration was feasible through the Richardson Mountains–Peel Plateau along the Yukon–Northwest Territories border and then south along the foothills west of the glacier-filled Mackenzie Mountains. This area was deglaciated no later than 13,000–12,000 ^{14}C yrs BP with a minimum date for deglaciation at 12,400±120 ^{14}C yrs BP on a sample of herbaceous vegetation. Further south numerous isolated areas along the western foothills of the northern Rockies were never glaciated (Catto et al. 1996).

The Rocky Mountain Trench is a 1,400-km-long valley that stretches from the Liard Plain near the Yukon–British Columbia border south to Flathead Lake in Montana. The trench varies from 3 to 16 km in width and is flanked by the Rocky Mountains on the east and the Cassiar-Columbia Mountains on the west. Several reservoirs now occupy much of this feature. Montane glaciers from the west covered much of the trench during the late Pleistocene (Rutter 1977, Ryder and Maynard 1991). The dating of glacial events seems to be limited to deposits in the Finlay, Parsnip, and Peace River valleys, where the last glacial advance was apparently gone by 13,970±170 ^{14}C yrs BP, which is the earliest postglacial date in the western Peace River–Grand Prairie region of Alberta and British Columbia (Catto et al. 1996). Additional dates are 11,600±1,000 ^{14}C yrs BP on a mammoth tusk from an end moraine in the Peace River Valley, and dates of 10,400±170 to 9,280±200 ^{14}C yrs BP for the same event on shells and a bighorn sheep skull (Rutter 1977). Further to the west on the Fraser Plateau mammoth is dated at 20,190±190 ^{14}C yrs BP (Carlson and Carlson 1998), but this occurrence predates the last glacial maximum. With the opening of the Richardson Mountain–Peel Plateau pass in the Yukon to the north by 12,400 ^{14}C yrs BP (Catto 1996), the data at hand tend to indicate that the Rocky Mountain Trench was a passable route at this time. So far the few archaeological surveys in this region have failed to discover remains earlier than the type of fluted point found at Charlie Lake Cave dated at 10,500 ^{14}C yrs BP (Howe and Brolly 2008).

The Ice-Free Corridor, the proposed corridor area east of the Rocky Mountains, has been subjected to a considerable amount of glaciological research in continuing attempts to determine whether this route was blocked during glaciation, and if so, when it opened after the last glacial maximum. Dyke and Prest (1987) published a map and date estimates indicating that glacial retreat began between 14,000 and 12,000 ^{14}C yrs BP. More recent research has focused on the radiocarbon dating of faunal remains found in and near the central and southern parts of the corridor (Burns 1996). Burns obtained twenty-nine dates on fossil mammal bones (mammoth, horse, caribou, prairie dog, and unidentified) from sites in the Edmonton area of Alberta. The absence of any dates in the interval between 21,330 and 11,620 ^{14}C yrs BP tends to indicate both that the region was covered with glacial ice during this period and that it was open and repopulated by fauna by 11,620 ^{14}C yrs BP (based on dates on bison, mammoth, and horse after 11,620 ^{14}C yrs BP). Palynological work by MacDonald and McLeod (1996) indicates that during the period between 12,000 and 10,000 ^{14}C yrs BP, the area between the waning ice sheets supported an herb and shrub vegetation, creating a biogeographic corridor with warm and dry summers.

The most recent dating in the proposed corridor is that of Jackson et al. (1997) using the cosmogenic Chlorine 36 method on eight glacial erratics in the foothills erratic train in Alberta. This method measures elapsed time since the erratics were reexposed to cosmic rays when the glacier carrying them melted. Seven of the eight dates ranged in age from 17,600 to 12,000 BP and average 14,900 ^{14}C yrs BP representing the last time the erratics were exposed to sunlight.

Lemmon et al. (1994) present a series of maps showing positions of Laurentide ice in the northern part of the corridor area between 25–30,000 and 8,550 ^{14}C yrs BP that indicate more recent ice retreat there than to the south. These maps tend to indicate a maze of glaciers and meltwater lakes that would have been a significant obstacle to passage until at least 10,500 ^{14}C yrs BP. Part of this difference from the above-referenced estimates of Dyke and Prest (1987) is based on a more conservative evaluation of the radiocarbon dates for deglaciation. In addition, Mandryk (1996:84) points out that, because of the nature of the process of deglaciation, the "ice-free" corridor did not actually have to be ice free in order to support human populations, and that the corridor environment was capable of such support by 12,000 ^{14}C yrs BP. Detailed calibration of particular radiocarbon dates (cf. Fiedel 1999a) may eventually help resolve some of these dating problems. Classic Clovis fluted points are found at the East Wenatchee site (Mehringer and Foit 1991) on the upper Columbia River, but it is not in the corridor, and probably represents a northward extension of classic Clovis from a point of origin to the south.

The earliest dated archaeological remains so far discovered in either interior corridor area are at Charlie Lake Cave at 10,500 ^{14}C yrs BP (Fladmark 1996) and at Vermilion Lakes dated at 10,770 ^{14}C yrs BP (Fedje et al. 1996) east of the Rockies. The indications at Charlie Lake are that the inhabitants were bison hunters moving northward, although strains of both genetically distinct northern and southern bison are found there at this time (Shapiro 2004), which does indicate contact between the northern and southern ends of the corridor at 10,500 ^{14}C yrs BP.

Direct evidence of enticements into either of the interior corridors is difficult to come by, probably because of the obstacles to both habitation and discovery (Mandryk 1996). Fiedel (2000) suggests observation of the flights of migrating birds could have been a factor, and some plants and small animals are found throughout the ice-free corridor between 12,000 and 10,000 ^{14}C yrs BP (MacDonald and McLeod 1996). Larger game animals are so far unknown from the corridor until 11,620 ^{14}C yrs BP. Catto et al. (1996) conclude that the corridor was a laterally fluctuating zone adequate for some plants and small animals, but unfavorable for humans. The overall impression is that the corridor would have been an unpleasant and difficult place in which to survive. However, it should be kept in mind that aboriginal peoples do cross glaciers while moving into unknown territory judging from eighteenth-century accounts of Athabascan movements (Cruikshank 2005:33–40), indicating that a corridor need not be ice free.

DISCUSSION

The major problem with current discussions of the routes for the peopling of the Americas is the absence of hard archaeological evidence in the most promising places at the right period of time. First, the paleogeographical evidence suggests that glacial ice had receded from the far outer coast by 14,000 ^{14}C yrs BP and from the Yukon gateway to the interior routes by 12,400 ^{14}C yrs BP. Second, there is no hard archaeological evidence from either of these potential corridors that is either that early or falls within the time period of the oldest known cultures in the Arctic—the microblade industry at Swan Point I at 12,250 ^{14}C yrs BP (Holmes 2007)—and the earliest fully accepted Paleoindian culture—Clovis beginning at either 11,500 or 11,050 ^{14}C yrs BP, depending on which dates are selected for America to the south. An additional problem is whether to make use of averages of radiocarbon dates or the range of radiocarbon dates on particular cultures. In view of these problems and others, the alternative to hard evidence and an inconclusive range of dates is to make comparisons between the earliest archaeological remains found and the remains from adjacent regions in order to assess similarities and differences and infer relationships. Because of the specific nature of fluted points this comparison is relatively easy for the two interior corridors.

The earliest known archaeological remains from the Rocky Mountain Trench is one undated projectile point, similar to the Peace River fluted type, found by Arcas Associates in recent surveys (Howe and Brolly 2008). From the potential corridor east of the Rockies, the "Ice-Free Corridor," the earliest known remains include the Peace River fluted type, a late derivative dated at only one site, Charlie Lake Cave at 10,500 ^{14}C yrs BP, where the type and dates suggest that the points belong to belated cultures of the Fluted Point Tradition moving northward following the retreating glacial environment. Arctic fluted points closely resemble the Peace River fluted points and probably represent the culmination of this northward movement. The direct ancestry of the bison hunters using these late types of fluted points is traceable to earlier fluted point makers such as classic Clovis to the south (Carlson 1991, Carlson and Magne 2008). If the ancestors of classic Clovis came through either of the interior corridors moving south, their remains are yet to be found. The recent discovery of human coprolites, but no diagnostic artifacts, dating 12,300 BP at Paisley Caves in eastern Oregon (Gilbert et al. 2008) indicate the presence of humans well before classic Clovis, but do not help with determining a route of entry.

The earliest materials from the Northwest Coast corridor indicate a somewhat more complicated scenario than that found in the interior. Four lithic technologies are present in Northwest Coast sites that date between 11,000 and 8,000 ^{14}C yrs BP (Carlson 1990, 1996). To the south of the Strait of Juan de Fuca in the coastal environmental zone there is a scattering of Clovis fluted points (Croes et al. 2008), which although not directly dated mark the presence of the earliest identifiable inhabitants at about eleven thousand years ago. In part of this coastal area, at least in the lower Columbia River region, fluted points are succeeded first by points belonging to the Intermontane Stemmed Point Tradition—a possible Clovis derivative spreading down the Columbia River from the interior (Carlson 1988, 1996; Carlson and Magne 2008), and later by foliate biface and pebble tool assemblages found along the coast into southern Oregon (Moss and Erlandson 1995; Pettigrew 1990) that are found earlier to the north. Microblade technologies are the last early lithic tradition to appear and are also earlier in the north and appear later as far south as the lower Columbia River (Carlson 1996, Magne and Fedje 2007). The earliest known microblade industry in North America is in the Swan Point I component in central Alaska dating 12,250 ^{14}C yrs BP where the Ubetsu and Diuktai techniques were used to produce microblades (Holmes 2007). The Northwest Coast microblade technique is different, but is probably derived from those found further north.

A single fluted point of local graywacke is known from Whidbey Island in Puget Sound, which is not far from the Manis Mastodon site, so it is likely that hunters using fluted points were in the area at the same time as the mastodon, although this occurrence has little bearing on whether the Northwest Coast was a route of entry into subglaciated North America. No fluted points have been found on the coast north of Whidbey Island, and the occurrence there probably represents a northward extension of the fluted point tradition that originated from blade and biface prototypes elsewhere in the United States (Carlson 1991). A site similar to Manis, the Woodburn Bog in the Willamette Valley, Oregon, dating between 12,760 and 9800 ^{14}C yrs BP and containing bones of extinct mammals and birds and reported flakes, is under investigation by Hibbs (2000) and Stenger (2000). Foliate bifaces and pebble spalls are found in younger post-mastodon components at Manis (Gustafson et al. 1979).

On the Northwest Coast north of Whidbey Island the earliest known assemblages contain neither fluted points nor microblades. These components constitute a pre-microblade horizon and are found in the earliest components at the Milliken (Mitchell and Pokotylo 1996), Bear Cove (C. Carlson 1979), Namu (R. Carlson 1996), Tsini Tsini (Hobler 1995), and Queen Charlotte Island sites (Fedje et al. 2008), and probably at Skoglund's Landing (Fladmark 1979), Ground Hog Bay (Ackerman 1979), and On-your-knees Cave (Dixon 2008), although the assemblage size of the last three components is very small and difficult to separate from succeeding components that do contain both bifaces and microblades. At On-your-knees Cave the only artifact from what could be a pre-microblade component is a bone point dated at 10,300 ^{14}C yrs BP. At Skoglund's Landing the depositional environment—an ancient raised beach—could preclude the discovery of microblades. One flake from Milliken has been classified as a microblade (Mitchell and Pokotylo 1996) but since there is no other evidence of microblade technology in this fairly large assemblage it is probably a fortuitous occurrence. This pre-microblade horizon consists of assemblages (Fig. 2) containing foliate bifaces in particular, and smaller numbers of scraper-planes, blades, side-scrapers, bifacial knives, tear-drop bifaces ("Chindadn points"), and perforators in components that range in age from 10,000 to 8,000 ^{14}C yrs BP and overlap with the earliest microblades at 9,000–8,500 ^{14}C yrs BP. These assemblages are more similar to the Nenana Complex of central Alaska (Goebel et al. 1991, Pearson 1999, West 1996), which predates them, than to other North American assemblages, and were probably derived from that source via a migration route to the coast through the Yukon (Carlson 2007, 2008) where Nenana Complex–related remains have also been found (Easton and MacKay 2008). The incentive for this move could well have been the caribou that are found at this time in the steppe-tundra regions of both the Yukon and the northern Northwest Coast coastal plain.

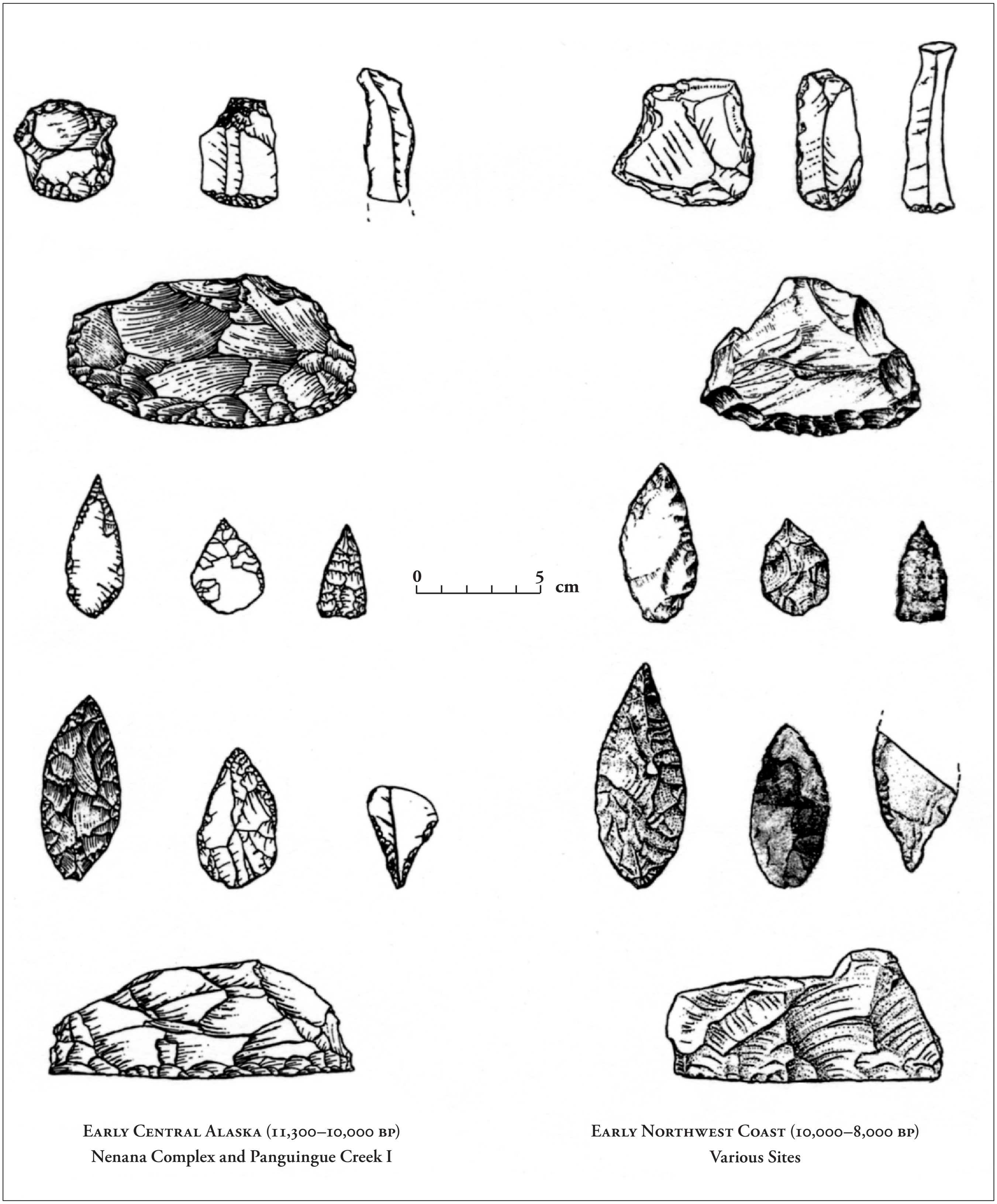

Fig. 2. Types of lithics found in both Nenana Complex sites in central Alaska and in early sites on the Northwest Coast of British Columbia. Top two rows: scrapers. Third row: triangular and Chindadn bifaces. Fourth row: foliate and Chindadn bifaces and drills. Bottom row: scraper planes. Artifacts re-drawn from Carlson (1996), Fedje (2003), Pearson (1999), West (1996).

CONCLUSIONS

There is no hard archaeological data from projected migration routes either on the coast or in the interior that is early enough to indicate passage of the ancestors of Clovis or proto-Clovis peoples to regions south of the glacial margins, even though most paleogeography indicates that both the outer coast and interior deglaciation corridors became potentially passable by Arctic-adapted peoples sometime between 14,000 and 12,000 ^{14}C yrs BP, with the coastal route opening about two thousand years earlier than the interior routes. In view of the changing environments of that period such evidence may never be found. In the proposed interior corridors the earliest known culture is a derivative of the Fluted Point Tradition probably spreading from the south, where fluted points may have originated from a proto-Clovis blade and biface industry such as that found at the Cactus Hill site in Virginia (McAvoy and McAvoy 1997) and the Meadowcroft Rockshelter in Pennsylvania (Adavasio 1993). In contrast, on the Northwest Coast the earliest known culture north of the Strait of Juan de Fuca is probably derived at least in part via the Yukon from the Nenana Complex of central Alaska to the north.

We don't know if either or both the projected coastal and interior corridors were high roads for early migrants, but such migrants did somehow get to subglaciated regions of the Americas by 12,300 ^{14}C yrs BP in spite of hindrances to travel. The evidence for more abundant faunal resources and the earlier retreat of glaciers on the coast than in the interior favor the coast as the initial route, but the archaeological record in both regions is still silent. Both routes remain more plausible than trans-Atlantic crossings proposed on the basis of similarities in European and American lithics (Stanford 1999) that can be explained more economically as the results of parallel evolution from a common Old World Upper Paleolithic technological base than by migrants floating the Atlantic on icebergs (Greenman 1963) or on any other type of primitive watercraft.

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