11 THE SPREAD OF MICROBLADE TECHNOLOGY IN NORTHWESTERN NORTH AMERICA

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INTRODUCTION

In 1983 Roy Carlson wrote: "Someday the archaeologist will be able to plug in his retroscope, punch in his hypothesis, and obtain probability readings and simulated models based on all relevant data." (Carlson 1983:96). In this paper we use a kind of retroscope, contour-mapping technology, to examine the geographic and temporal distribution of early microblade technology in the North American "Far West". We also examine the long-standing proposal of Borden (1968) and Dumond (1969; see also Carlson 1983, 1998) that microblades in northwestern North America are the signature of Early Holocene movement of proto-Na-Dene or early Athapaskan speakers from the Beringian region. Carlson appears to support the Athapaskan linkage as well when he writes "The distribution of the microblade tradition correlates best with the distribution of Tlingit, Haida and Athapaskan, and this distribution likely represents the ancestors of people speaking these languages, although it is not all unlikely that the ancestors of the Eskimo and Aleut were also the bearers of microblade technology" (Carlson 1983:93).

We tend to side with Carlson's approach to lump together the various terms for Early Holocene microblade and core occurrences in the far western areas of North America. Starting with his view that the technological distinctions arise as a function of time and space, we use modern mapping technology to plot microblade and microblade core assemblages, and remark on the principal patterns that are revealed.

EARLY HOLOCENE MICROBLADE DISTRIBUTION

The oldest North American microblade assemblages are to be found in central Alaska, in the form of the Denali complex, which is fairly widespread in Alaska at c. 10,500 BP[1] (West 1967, 1996a, 1996b, 1998). Its earliest manifestation may be the 11,600 BP assemblage at Swan Point (Holmes *et al.* 1996). Outside of central Alaska the majority of early (>8000 BP) microblade assemblages in North America (Figure 11.1) are found at coastal sites along the southern Alaska Panhandle and northern Canadian Pacific coast. In interior North America, south of Alaska, evidence of early microblade technology is limited to a few sites on the east side of the Canadian Rocky Mountains (Fladmark *et al.* 1988; Fedje *et al.* 1995; Sanger 1968b). After c. 8000 BP microblade technology is more broadly distributed in the "Far West". The cores produced by microblade manufacturing technology are usually immediately recognizable, but there are definite variants. In Alaska, Yukon, and the Subarctic, the most common form is that which we call Denali or Campus. These are narrow-platformed, have bifacially retouched bases, and most characteristically exhibit platform preparation produced by a blow perpendicular to the flute face. Often these are also called "wedge-shaped", a term we prefer to avoid, since in fact most microblade cores of all forms are "wedge-shaped" in some way. The second most common form is what we call the Northwest Coast variant, which are mostly pro-

[1] All dates are in uncorrected radiocarbon years before present unless otherwise noted.

duced from large flakes or pebbles, have wide platforms that are not retouched or rejuvenated (or only very occasionally), but do exhibit flute face rejuvenation (as seen in facial rejuvenation flakes), and can ultimately result in "circular" or even "conical" shaped core forms at the end of their manufacturing trajectories (Magne 2004). The Northwest Coast variant often takes the "boat-shaped" or "tongue-shaped" form. The third but less common type we refer to as "tabular", although in many respects such as platform rejuvenation, this type is most similar to the Campus form. Interestingly, this tabular form is that which we see in the two dated sites of Vermilion Lakes and Charlie Lake Cave (although each only has a single microblade core), in the Canadian Rocky Mountains. Another important but undated Canadian locality, on the Plains at High River in southern Alberta, exhibits more typical Campus type bifacial body manufacturing in its three known cores, discussed below. A key distinction among these microblade core-bearing assem-

Figure 11.1: Early Holocene Northwest Coast microblade sites.

blages is that only those containing Denali-like cores have true burins, whether they be Donnelly burins with prepared notches to facilitate burin removal (see, for example, West 1967; LeBlanc and Ives 1986), or simple burin-on-flakes. We observed these fairly frequently when we examined the Campus and Dry Creek assemblages, among others. Ackerman (1996c:127) shows a Donnelly burin-scraper from Ground Hog Bay 2, but the associated microblade cores are clearly what we would call Northwest Coast variants. Very occasionally burin-like artifacts are found in the coastal British Columbia sites, but they appear to be accidental. Among the Northwest Coast variants we include the Ice Mountain Microblade Industry (IMMI; Smith 1971; Fladmark 1985) found in the vicinity of Mount Edziza, a primary obsidian source in northwestern British Columbia. Although Smith (1971) claimed these were mostly like Asian Shirataki cores, Fladmark (1985) clearly demonstrates that they are different from those and quite variable, and that the key distinctions are very acute (30 to 60 degrees) platform angles, a thin core (which is comparable to Denali types), and occasionally bases shaped almost like stems. Most of the IMMI cores, however, are not manufactured from split bifacial blanks. At Mount Edziza the microblade industry dates from 4900 BP to 1140 BP (Fladmark 1985:177).

NORTHWEST COAST VARIANT DISPERSION

As we move out of interior Alaska down the Pacific coast the incidence of true Denali or Campus-like microblade cores declines rapidly. On the Alaska Panhandle microblade cores and microblades appear in archipelago environments at about 9500 BP at Ground Hog Bay and Hidden Falls where Ackerman (1996c, 1996d) considers both Denali and Northwest Coast variants to be present (Figure 11.1).

Moving southerly and forward in time on the northern Northwest Coast, microblade technology is well represented at a 9200 BP to 8500 BP component in On Your Knees Cave (PET–408) where location and stable isotope analyses of human bone indicate a maritime adaptation (Dixon 1999, 2001, 2002; Figure 11.1). The Northwest Coast forms continue to the Haida Gwaii (8900–7000 BP) set of sites – Richardson Island, Arrow Creek, Lyell Bay, Lawn Point, and Kasta (Fedje and Christensen 1999; Fladmark 1986; Figure 11.1). These contain a large number of microblade cores and blades in well-dated contexts (Figure 11.2). They post-date an earlier, apparently non-microblade, archaeological record now firmly dated from 10,500 BP to 9000 BP (Fedje *et al.* 2004). The Namu sample (Figure 11.3; Carlson 1983, 1996) on the central coast of British Columbia dates to shortly after 9000 BP (Figure 11.1). Microblade technology endures in this northern coastal area through to c. 5000 BP. On the Kodiak Archipelago, the Ocean Bay tradition sites have abundant microblades and cores, and are of the Northwest Coast variant. Microblades appear at about 7500 BP in Ocean Bay I and are no longer present by 4500 BP in Ocean Bay II (Steffian *et al.* 2002).

The Northwest Coast variant-type microblade technology also disperses southerly along the coast and up river valleys into the interior of British Columbia and the U.S. Northwest. Microblade components on Vancouver Island and in the Strait of Georgia area (Mitchell 1968; McMillan 1996; Wright 1996; J. Maxwell personal communication 2004; Figure 11.3) are mostly undated, especially early ones, but they appear to be Early to Middle Holocene in age based on geological context and associated lithic technology. This is substantiated by the recently discovered Saltery Bay site on the east side of the central Strait of Georgia that dates from 6750 BP to 6050 BP (A. Mason personal communication 2005; Figure 11.1). This technology reached the British Columbia interior by 8500 BP at the Landals and Drynoch Slide sites and somewhat later (7500 BP) the Lochnore-Nesikep sites (Sanger 1968a; Figure 11.1). It is also present in southern Oregon and in the Columbia River region by c. 8000 BP at such sites as Cascadia Cave and Layser Cave (Sanger 1970a; Newman 1966; Daugherty *et al.* 1987a, 1987b). Recent reporting of 7500 BP Northwest Coast type cores from Eel Point on San Clemente Island, California (Cassidy *et al.* 2004), hint at an even more extensive coastal dispersal.

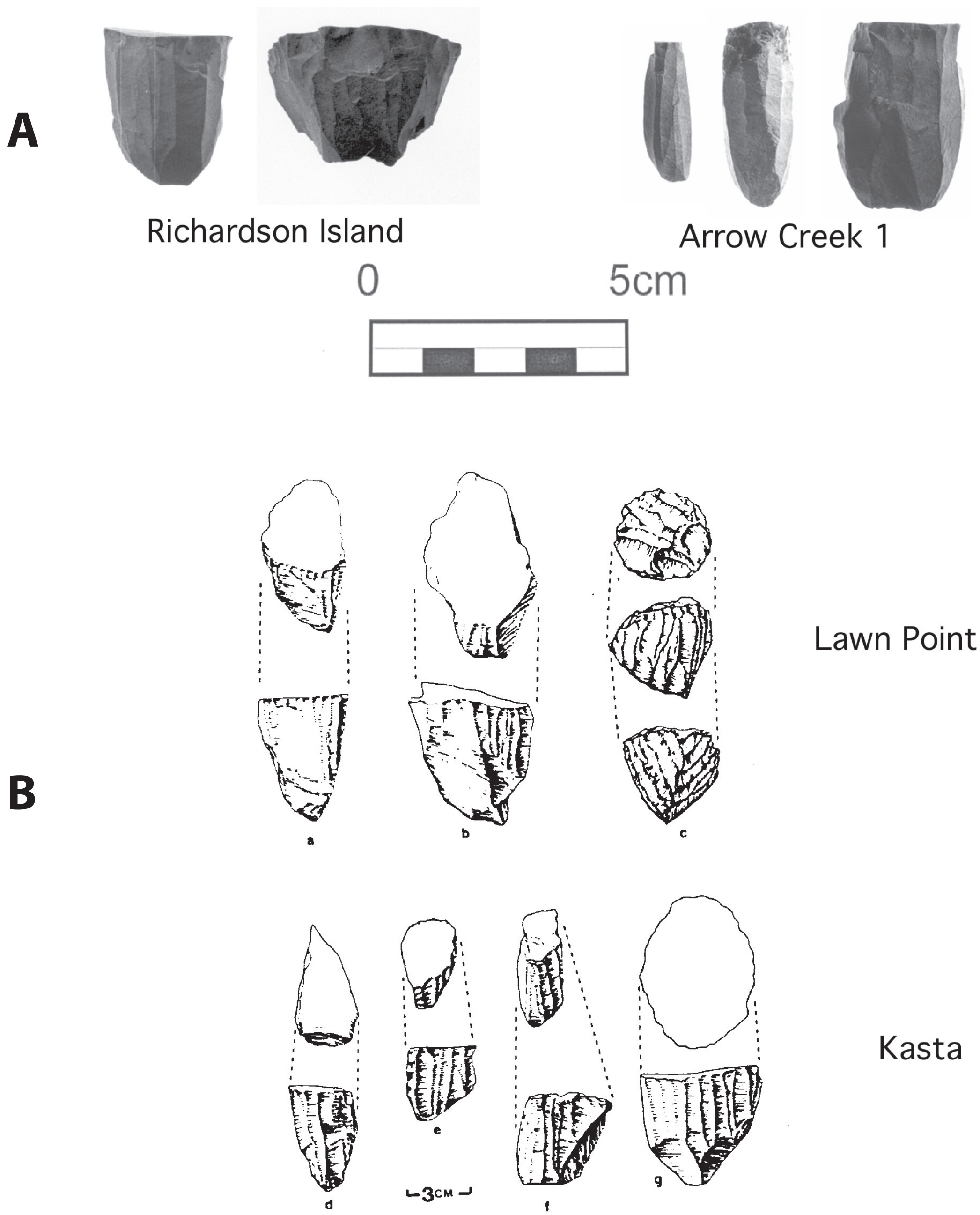

Figure 11.2: Early Holocene microblade cores from Haida Gwaii.
A: Richardson Island and Arrow Creek 1 (photos by J. McSporran);
B: Lawn Point and Kasta (drawings courtesy of Knut Fladmark).

EASTERN SLOPES DENALI-TYPE DISPERSION

In the Canadian Rocky Mountains area (Figure 11.4), early tabular-type microblade cores were found by Fladmark (1996:11) at Charlie Lake Cave dating to c. 9500 BP, and by Fedje (Fedje *et al.* 1995) at Vermilion Lakes dated to c. 9600 BP. One Denali type core has been found in an undated surface context east of the Rockies at Fort Vermilion in northern Alberta (Pyszczyk 1991; Figure 11.4) and three more are known from High River in southern Alberta (Sanger 1968b; Wilson and Visser 1990; Figure 11.4). One of the High River cores is made of Knife River flint, which is quarried in

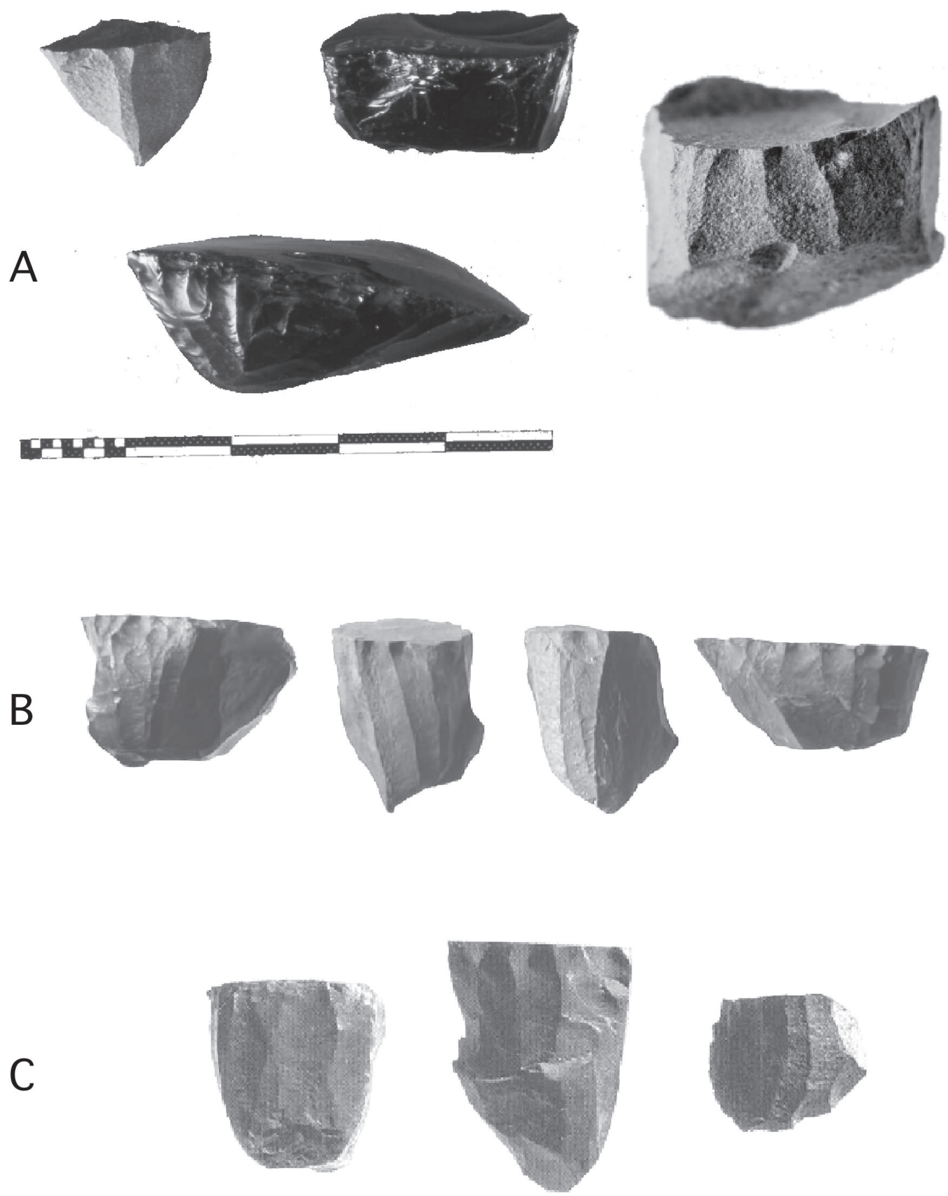

Figure 11.3: Microblade cores from the British Columbia central coast and Vancouver Island. A: Namu (photo courtesy of Roy Carlson); B: Elsie Lake (photo courtesy of Joanne McSporran); C: Somass River (from McMillan 1996).

North Dakota. Although the cores are surface finds, Cody complex artifacts made of Knife River flint with similar degrees of patination are found in direct association with the microblade cores, so a date of c. 9000–10,000 BP is possible. There is no direct evidence for Denali or tabular microblade technology in the western Canadian Plains and Rocky Mountains after c. 9500 BP.

LATE HOLOCENE MICROBLADE DISTRIBUTION

Sanger's (1970a) Plateau Microblade tradition was at its maximum c. 7000–3500 BP, but he recognized that microblades "continue up to the Christian era" (Sanger 1970a:123). Investigating the Late Holocene movement of Athapaskan speakers in the interior of British Columbia and

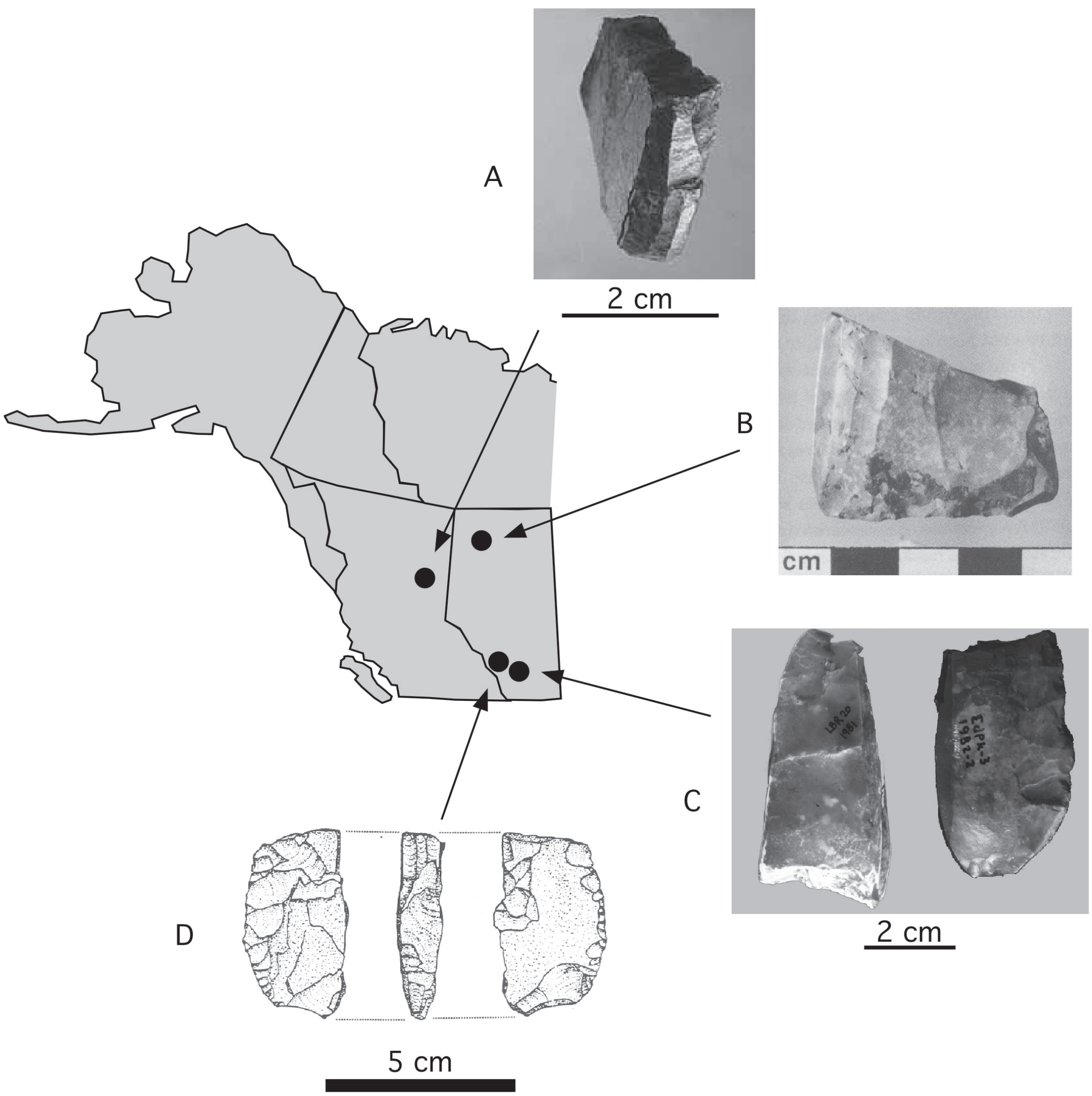

Figure 11.4: Microblade sites from the eastern slopes of the Rocky Mountains.
A: Charlie Lake Cave (photo courtesy of Knut Fladmark); B: Fort Vermilion (after Pyszczyk 1991); C: High River; D: Vermilion Lakes drawing by J. McSporran).

the Plains regions of North America, Magne and Matson (Magne 2001; Magne and Matson 1987; Matson and Magne 2007) have shown that there are a number of sites in the west where microblades are directly associated with late prehistoric and ethnohistoric Athapaskan occupations in Alaska, the Yukon, the British Columbia plateau, and in southwestern Oregon at AD 1000 to AD 1500 and possibly later.

Microblade cores are also present in late prehistoric contexts in northern Alberta and in the Northwest Territories including Peace Point (Stevenson 1986) in two components (dated to 2200 BP and ethnohistoric times) and at Bezya in northeastern Alberta (composite date of 3900 BP; LeBlanc and Ives 1986). At the northeast end of Great Bear Lake, Clark (1982) mentions microblades occurring around the hearth of a surface rectangular structure at site MdPs 5, but dismisses their late association, stating that these are "not likely to be associated with historic structures." (Clark 1982:116). Several late prehistoric sites at Anahim Lake contain microblades in association with house features and Wilmeth (1977) considered those to be mixed. In fact, he proposed his principle of housepit-construction-causing-assemblage-mixing (Wilmeth 1977) to account for microblades in those houses even though they are quite shallow and were not constructed like classic earth covered pithouses. Dismissal of late microblades is a common theme in western North American archaeology (see also West's (1975) defense of early dates for the Denali complex), although that practice was challenged nearly 30 years ago (Helmer 1977). Alaskan researchers inform us that late prehistoric microblade components are a fairly common occurrence there as well (P. Bowers personal communication 1999; J. P. Cook personal communication 1999). While we focus here on Early Holocene occurrences, we show later that late prehistoric microblade assemblages are actually very common.

DATABASES AND DISPERSAL PATTERNS

Modern databases allow examination of the spatial and temporal distributions of microblade technology. Ideally, we would employ a sample including only sites or areas where we can date both the initial arrival and full duration of the Microblade tradition and we will continue to refine our database in this way and in others. For example, sites such as Broken Mammoth and Dry Creek in central Alaska and Richardson Island and Namu on the Northwest Coast provide clear timelines for the transition from an earlier non-microblade technology.

At present we have to work with a less than perfect database. We have gathered the oldest date, most recent date, and two intervening dates for each site, although most by far have only one date. In many cases, the "oldest date" probably does not date the arrival of microblade technology to the region. In other cases, the dates obtained are only assigned to the microblade components by the original researchers, with qualifications. This exercise is an experiment in revealing patterns that we hope we and others can refine in the future. We were able to obtain unpublished archaeological site records for microblades and microblade cores from the provinces and territories of Alberta, British Columbia, Yukon, Northwest Territories, and Nunavut. These provinces and territories provided Excel spreadsheets downloaded from their official databases. This initially gave us a list of 487 Canadian sites. Once we removed the non-Northwest Microblade tradition complexes, that is, Dorset, Pre-Dorset and Arctic Small Tool, or questionable sites, and added a few sites from published sources, we were left with a list of 196, with radiocarbon dates for 58 of those. A few of these may yet be dubious, and there are no doubt more sites not listed in the government databases.

In the United States, statewide data of this sort do not exist in database format in SHPO (State Historical Preservation Officer) offices, so we gathered an initial sample from the literature, at this time only referring to dated sites. The U.S. data sample consists of a total of 59 sites, with 34 from Alaska and 25 from Washington and Oregon states. Our entire sample now consists of 255 sites, 117 of which are dated (Table 11.1), and a total of 329 individual radiocarbon dates. We recognize that some of the microblade components' associations with microblades are subject to debate and we refer below primarily to the oldest dates

Table 11.1: List of dated microblade sites and oldest dates (years BP, uncorrected) used in the analyses.

SITE	OLDEST DATE
EdRg-1	140
EeRb-140	160
MjTp-1	210
Skagit 45WH253	580
EeRj-55	600
FcSi-1	790
KdVo-3	810
Judd Peak N.	1070
45GR88	1080
EcRg-2AA	1120
EeRj-93	1270
Daniktco	1300
KbTx-2	1340
Skagit 45WH283	1380
Skagit 45WH241	1430
45DO243	1530
DiQj-5	1660
Rogue River 35JA190	1700
KbVo-1	1790
Donnelly Ridge	1830
Potlatch	1870
JhVq-1	1890
Skagit 45WH300	1940
IaTr-2	1975
IgPc-2	2210
JlRq-1	2265
DiQw-2	2500
DiQm-4	2530
45DO211	2580
EdRk-7	2605
DjSf-13	2770
HiTp-1	2850
45DO242	2860
DcRt-13	2910
EeRk-4	2965
45DO326	2997
JgVu-3	3020
JiVr-1	3220
FhUa-1	3300
Lisburne Site	3470
JeVd-15	3480
45OK18	3512
45OK258	3605
EeRh-3	3920
45OK288	3980
Hhov-73	3990
45OK11	4010
45DO204	4030
Wells 45OK382	4040
EeRf-1	4220
Ilnuk	4390
JgVf-2	4570
HiTp-63	4870
45OK208	4950
GdTc-16	5050
EeRb-144	5170
EdQx-41	5480
35DO47	5859
JjVu-4	5870
KaVa-3	5890
Judd Peak S.	5970
Kettle Falls 45FE45F	5980
FgTw-4	6010
Rice Ridge	6080
EdQx-42	6290
Zaimka	6390
Ryegrass Coulee	6470
Tanginak Spring	6600
Long Lake	6605
Layser Cave	6650
NkTm-8	6650
EdRk-8	6650
Saltery Bay	6750
Campus	6850
FjUb-10	6980
JeVc-20	7030
JcUr-3	7160
JfVg-1	7195
DiRa-9	7400
FiTx-3	7400
Drynoch Slide	7530
Thorne River	7650
EdRi-2	7670
Broken Mammoth	7700
JdTg-2	7790
Crag Point	7790
Graveyard Point	7895
Cascadia Cave	7910
Chuck Lake	8220
1355T	8500
Anangula	8700
1354T	8800
766T	8900
1127T	8900
Ugashick Narrows	8995
ElSx-1	9000
Hidden Falls	9060
Trail Creek Caves	9070
Healy Lake	9100
Sparks Point	9200
Ground Hog Bay 2	9220
On Your Knees	9280
Owl Ridge	9325
Chugwater	9460
Charlie Lake Cave	9500
Gerstle River	9510
Lime Hills	9530
Vermilion Lakes	9600
Onion Portage	9815
Little Panguingue Ck	10,180
Panguingue Creek	10,180
Phipps	10,230
Whitmore Ridge	10,270
Gallagher Flint Stn.	10,540
Dry Creek	10,600
Moose Creek	10,640
Swan Point	11,660

available; however, for the experimental purposes of this paper the data are sufficient.

In all of the analyses to follow we refer to uncalibrated dates before present as reported. Plotting those sites yields the map shown here (Figure 11.5). The U.S. data cannot be considered representative of pure geographic distribution so we cannot speak of the entire Far West, but the most concentrated areas of microblades in Canada are in the southwestern Yukon, Haida Gwaii (Queen Charlotte Islands), southern and central British Columbia. The figure also shows the distribution of those sites for which we have radiocarbon dates. That sample is representative of the general distribution so we are fairly confident in seeing what the dates show about the spread of microblade technology. We must keep in mind, however, that these data are not representative of all dated sites, particularly from Alaska.

When we look at the statistical distribution of all dates provided (Figure 11.6a), the most striking feature of the histogram is its bimodality. In the graph of all dates (n = 329), there are peaks of dates at about 2000 BP and 8000 BP. A histogram of only the oldest dates in the sample (n = 117) changes the distribution to a more irregular one, but the overall early and late preponderance with a middle prehistoric decline is still evident (Figure 11.6b).

These patterns may truly represent the temporal spread of microblade technology in the Northwest even though this sample is incomplete. There may be several reasons why microblade sites appear to decline in frequency at about 5000 BP. For example, the pattern may simply represent sampling error; there may be many more sites with middle prehistoric dates that have not been found and dated; people may have reduced their use of microblades during this time, possibly as a result of environmental changes leading to fewer requirements for tasks associated with microblades; microblade-using cultures moved out of certain areas and concentrated themselves in other areas (again, essentially a sampling issue); or, overall population levels may have been less during those times. This appears to be the case, for example, in the Upper Columbia region of the Plateau, which demonstrates a 400 year-long hiatus in radiocarbon dates from all types of archaeological sites at 4199–3800 cal BP, attributed to environmental

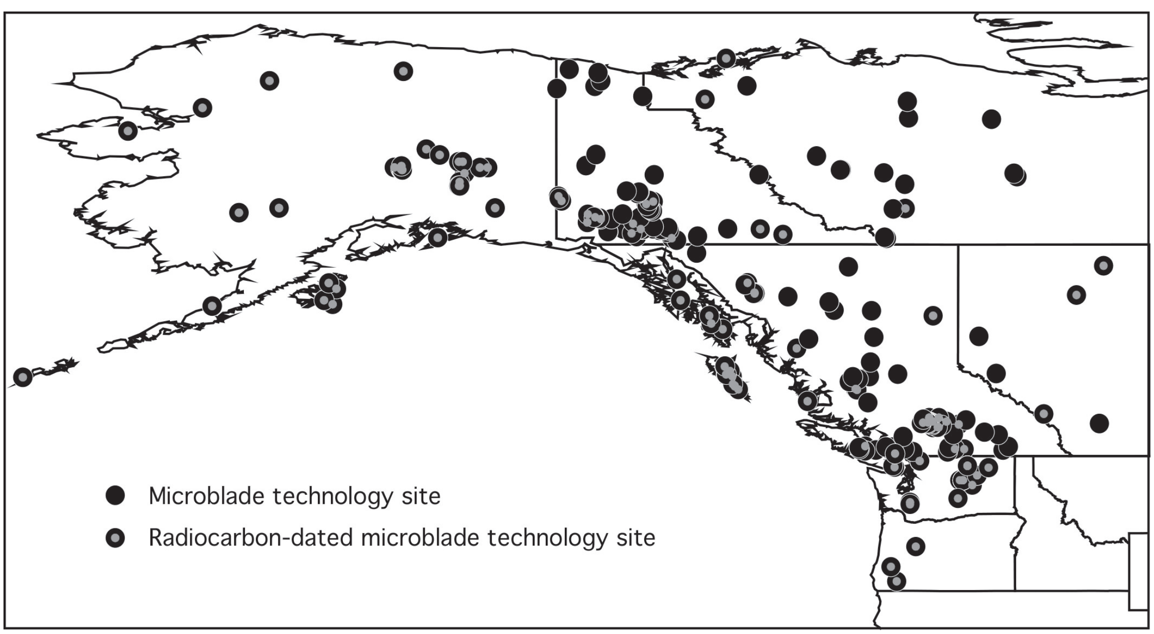

Figure 11.5: Distribution of a sample of microblade technology sites. Note that some sites overlap at this scale.

degradation (Goodale *et al.* 2004). Nonetheless, the many late microblade component occurrences cannot be simply the result of dating errors or sampling bias. Some late dates may have resulted from mixing of shallow sites but, we believe it unlikely that this is true of all cases, or even most. Note also that several assemblages in protohistoric contexts have no radiocarbon dates so they are not part of the database and therefore do not influence this graph.

Surface contour plots (using Surfer; Golden Software 1997) of the radiocarbon dates show patterns that pose some challenging questions about the spread of microblade technology in the Northwest. Here we work with the oldest dates available for the sites or microblade components, the ratio-

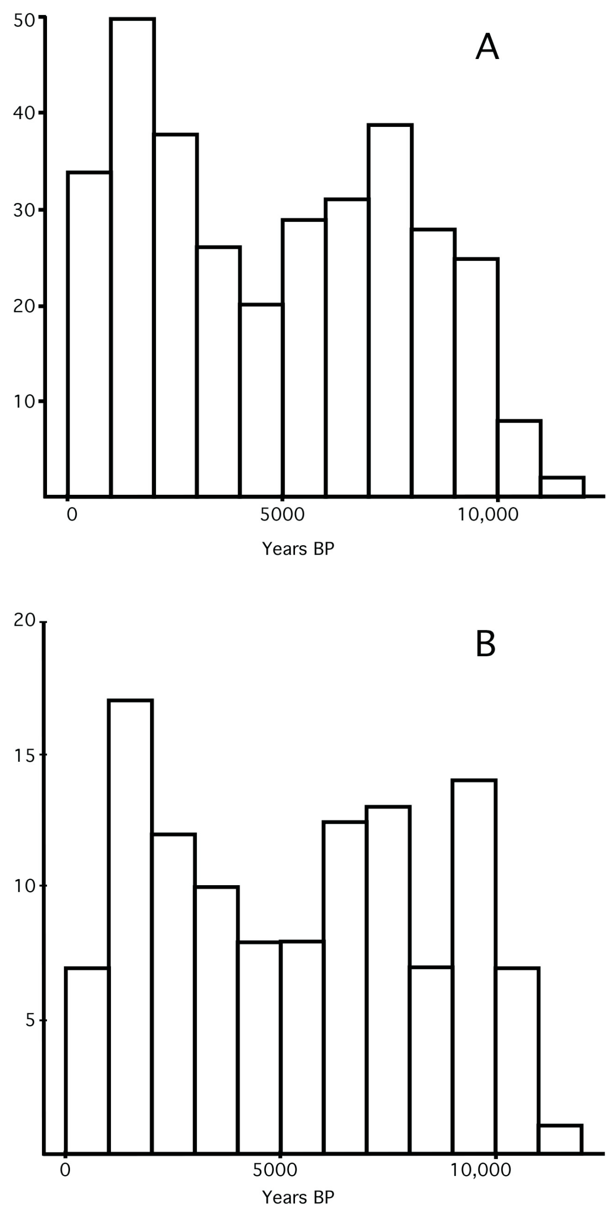

Figure 11.6: Histograms of dates for microblade sites and components, 1000 year intervals.
a. All dates, n = 329; b. Oldest dates only, n = 117.

nale being that if we are interested in the spread of microblade technology, then the most relevant dates are those of first arrival. At the same time, since many components have only single dates, the perseverance of microblade technology across the Northwest is not neglected. We first apply a Kriging contour method, a normal default for this kind of contouring, to interpolate between data points. We later change the programme settings to explore the effects of various "smoothing" options. When we contour the oldest (or only) dates for each site (Figure 11.7) the main initial dispersal nodes are firstly central Alaska, secondly the Rocky Mountains and the Alaska Panhandle, and thirdly Queen Charlotte Sound and northern Oregon. In other words, microblades first arrive from the west into interior Alaska. They then appear to occur independently on the northern Northwest Coast and in the southern Canadian Rockies. On the west coast this technology disperses south to Namu and eventually to Oregon and California (not shown). The apparently independent rise at several locations along the coast and inland may simply reflect data gaps where we only have undated assemblages (such as the Vancouver Island area), and the drowning of Early Holocene shorelines by rising sea levels. Interpretation of the early microblade occurrences at sites such as Charlie Lake Cave and Vermilion Lakes on the eastern flanks of the Rocky Mountains is constrained by an absence of any dated Early Holocene microblade cores in the area between these sites and the Denali "heartland" of central Alaska.

Contour mapping options can allow different levels of confidence in the data to be expressed, slightly changing the patterns. For example, using an "Inverse Distance to a Power" method, rather than the "Kriging" method used above (that is more faithful to the individual data point grid), the "bullseye effect" can be controlled. What this means is that a strong "bullseye" or "power" effect is acceptable when we know our data to be evenly distributed and we are less interested in interpolating between points. Furthermore, the data can be "smoothed" to greater or lesser degrees, to reduce the influence of individual points

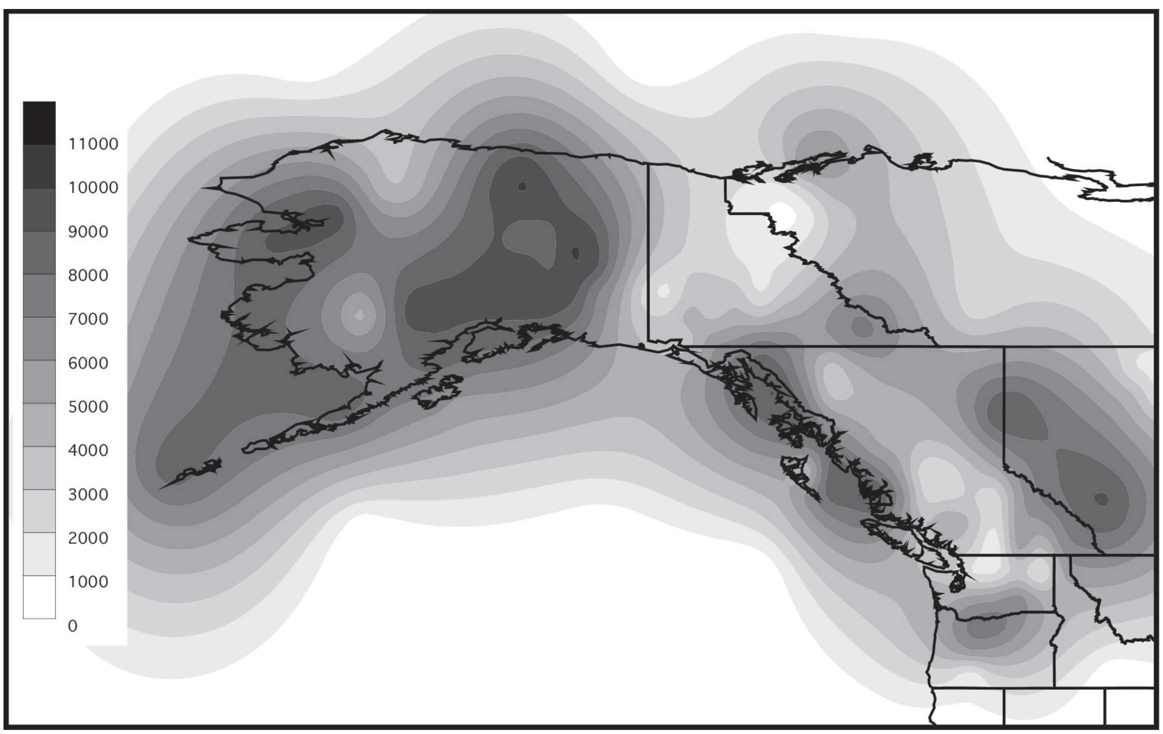

Figure 11.7: Surface contour plot of microblade sites, oldest dates only, 1000 year interval, Kriging method.

in predicting neighbouring nodes of the output grid. Thus, when the "Power" and "Smoothing" parameters are altered to recognize that, indeed, our data are not evenly distributed across space, and that individual points may strongly influence neighbouring areas, we arrive at what may be a more accurate depiction of microblade distribution through time (Figure 11.8a). In this case, the earliest distributions appear strongly tied to mountain environments in Alaska, the coast, and the Rocky Mountains. When the data are smoothed even further (Figure 11.8b), the Rocky Mountains effects drop out and the pattern of early dispersal is from central Alaska to the Northwest Coast and then fairly evenly from those centres. Still, the spread into the Rocky Mountains appears to be from northern British Columbia.

Clearly, core Alaska remains a central area of microblade use from the Late Pleistocene through the mid-Holocene, but in the Late Holocene microblade use in Alaska appears to shift westward. During the Early Holocene new centres arise in the Panhandle-Haida Gwaii region, and also in southeastern Yukon and the Canadian Rockies, as well as in northwestern Oregon. The northern Rockies appear linked via east-west river systems in northern British Columbia and southern Yukon. A spread to the southern British Columbia interior appears to take place about 8500 BP, and although one would think that the Fraser River system would be the logical connection, the Rockies appear more closely connected to the southern British Columbia interior. Meanwhile, mid-Holocene microblade sites in the Gulf of Georgia appear more closely connected to the coastal manifestations. From the Middle to Late Holocene a general spread northward and eastward is apparent. Furthermore, nodes appear at about 5000 BP in the Terrace area east of Haida Gwaii, in southwestern Yukon, and in south-central British Columbia. Finally, late prehistoric microblade occurrences appear most prevalent on the British Columbia interior plateau and the extreme northwest area of the Northwest Territories.

These plots support a coastal north to south dispersal of the Northwest Microblade tradition, with eastward spreads up major river valleys to the interior areas. The derivation of Denali type cores recovered from the east slope of the Rockies is unclear, and only more complete and more precise data should refine these patterns. Early microblade dispersal patterns have the appearance here of a leap-frog series of events, jumping southwesterly from interior Alaska to the coast and southeasterly to the Rocky Mountains, then easterly via the Bella Coola, Fraser and/or Columbia valleys into the interior of British Columbia and the U.S. "Far West". The leapfrogging is likely an artifact of sampling and the geological history of the coastal margin, especially with regard to the sea level history for that area south of the central Northwest Coast (Clague *et al.* 1982). Not surprisingly, this early technology is abundantly evident on those parts of the Northwest Coast (Alaska Panhandle to Namu) where c. 9000–5000 BP shorelines are stranded inland due to isostatically-driven sea level history and very sparse where eustatically-driven sea level history has drowned all c. 9000–5000 BP shorelines (south of Namu).

While gaps in the distribution of Northwest Coast microblade technology may be an artifact of sampling, the possibility of true geographic gaps should be considered. For example, the ethnographies and archaeologies of historic and protohistoric period Athapaskans demonstrate rapid long distance movements and their historic distribution shows that small nodes of them existed within the territories of other ethnolinguistic groups.

Microblades remain in use in interior Alaska throughout the Holocene and probably spread down from there through Yukon to the Rocky Mountains, although pre-9000 BP assemblages are not recorded in the central to southern Yukon. The microblades at Bluefish Caves, in northern Yukon, though probably older than 10,000 BP, are not well dated. Outside of Alaska, during the Middle to Late Holocene microblades appear to settle in the southern Yukon, western Mackenzie District, and on the southern British Columbia-northern Washington state plateau, and enter the Gulf of Georgia region. Microblade technology then spreads northeastward, mainly in the central Northwest Territories and northern Alberta.

WHYS AND WHEREFORES

Why microblade technology replaced a pre-existing adaptation is unclear. The Early Holocene

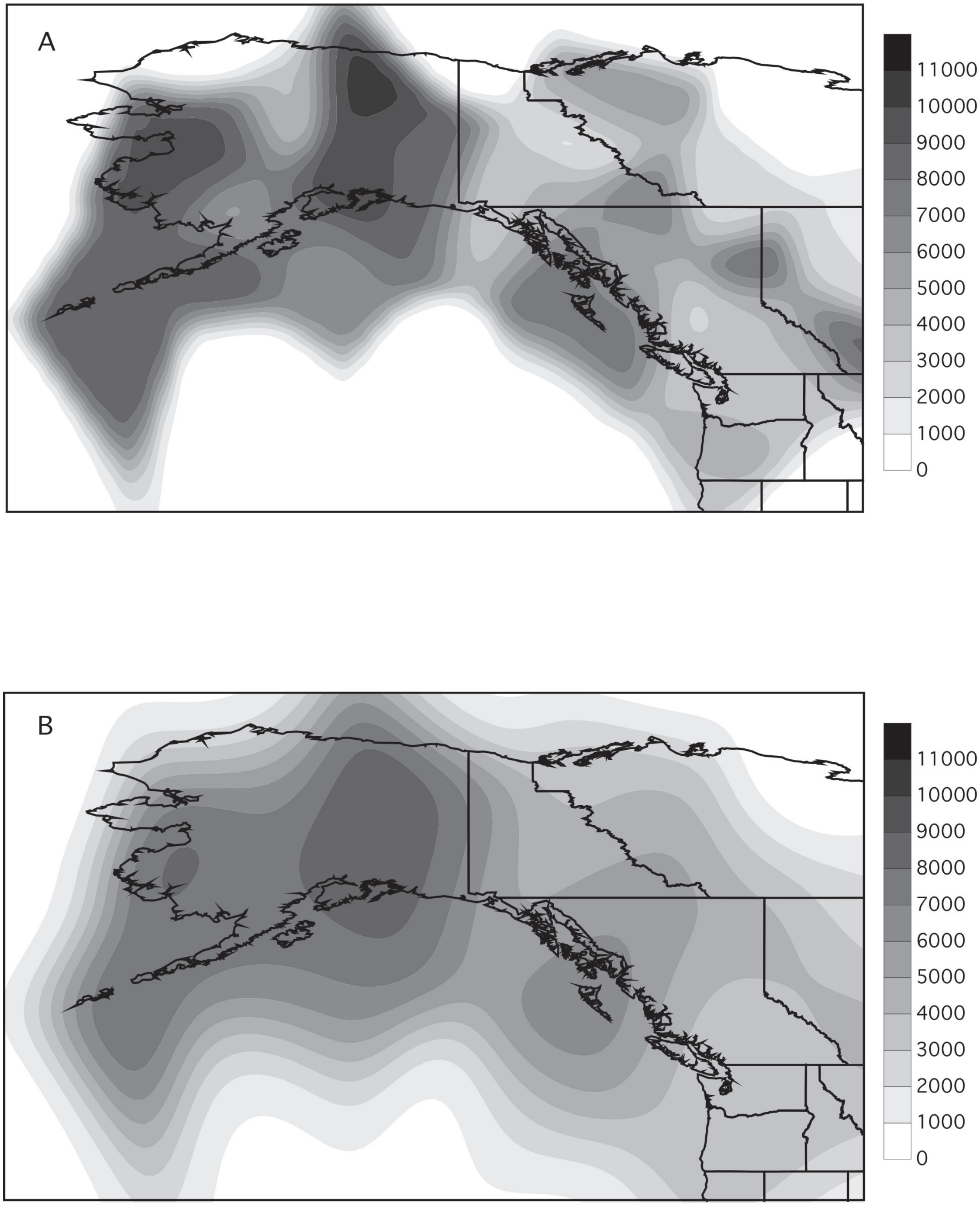

Figure 11.8: Surface contour plot of microblade sites, oldest dates only, 1000 year interval, inverse distance to power method, varying degrees of smoothing. A. Power = 25, Smoothing = 10; B. Power = 25, Smoothing = 20.

dispersal patterns seen in the contour plots seem to point to mountain adaptations being a key to microblade manufacture. Possibly it was simply a technological development that proved advantageous. Potentially it was a sufficiently specialized adaptation to allow exploitation of heretofore-unused environmental niches (effectively filling in the human landscape).

Alternatively, it was always there if needed, spurred on by gradual or abrupt change. Whether its arrival was simply through diffusion or a combination of ethnic assimilation or replacement is also not clear, although a number of researchers suggest microblade technology may have arrived in the Americas shortly after 11,000 BP with the Na-Dene antecedents of the Athapaskans (Scott and Turner 1997; Greenberg *et al.* 1986; Lell *et al.* 2002; Yesner 1996; Goebel 2002).

But why was the door open in the first place? What happened at c. 10,500 BP in central Alaska, c. 9500 BP on the Northwest Coast, and c. 8500 BP in the British Columbia interior? In Alaska researchers have raised the possibility that Younger Dryas cooling may have necessitated a shift to a highly mobile technology for more marginal resources (Mason *et al.* 2001; Goebel 2002; Elston and Brantingham 2002; Yesner 1996). Possibly, environmental change may have stressed the existing population and provided an opening for a more mobile and flexible microlithic adaptation. On the northern Northwest Coast the period c. 10,000–9000 BP was a time of significant environmental change. Sea level changes and climate change may be worked together to affect availability, distribution, and abundance of a variety of terrestrial, intertidal, and anadromous resources (Fedje *et al.* 2001, 2004). In Haida Gwaii, for example, sea levels rose sharply from over 100 m below modern to 15 m above modern levels, drowning large areas of the formerly exposed continental shelf. At the same time there was a rapid and significant rise in atmospheric and oceanic temperatures. This warming accelerated the development and altitudinal migration of closed forests to positions significantly higher than those of today (Walker and Pellatt 2004; Pellatt and Mathewes 1994).

The consequences of these changes are just starting to be examined, but must have included huge shifts in the distribution of animal and plant species. In Haida Gwaii, for example, several animals became locally extinct at this time including brown bear, caribou, deer, and possibly fox. There is also evidence for smaller populations of black bear and salmon after c. 9500 BP (Fedje *et al.* 2004). These changes may have necessitated an adaptive response from the local population that could be mediated through the introduction or resurrection of microblade technology. Alternatively, they may have provided a window of opportunity for immigration of a people with a highly mobile Denali type adaptation. The specific advantage of microblade technology is unclear, but heightened mobility would be a distinct advantage with fewer predictable intertidal and interior resources. A similar environmentally triggered shift might be considered for the c. 8500 BP arrival of microblade technology to the interior of the Northwest (Stryd and Rousseau 1996). This is the time of the xerothermic maximum (Walker and Pellatt 2004) that has been suggested to have made parts of the Northwest interior and Plains more marginal to human occupation. Perhaps this could be mitigated in part with a high mobility, ”Athapaskan type” adaptation.

ATHAPASKAN AND PROTO-NA-DENE CORRELATES

When the distribution of Athapaskan speakers is laid over our site sample (Figure 11.9), the map reveals a good, though not perfect, correspondence of microblades with the distribution of Athapaskan and Na-Dene languages, even extending into the states of Washington and Oregon. Several areas are of particular note. The strong concentration of microblades in southwestern Yukon would likely be matched by a full sample from Alaska, both areas of the Athapaskan homeland. Secondly, the central British Columbia concentration fits well with the largest group of southern Subarctic Athapaskans, the Carrier. Thirdly, the southern British Columbia concentration focuses on the location that was known for the Nicola, a small band that was a possible offshoot of Chilcotin. The dribble of sites through Washington and Oregon is interesting in light of small Athapaskan groups' locations there. Additionally, if we include Na-

Dene-related people such as the Eyak, Tlingit, and Haida, an even stronger correspondence can be seen (Dumond 1969; Greenberg 1987; Yesner and Pearson 2002). Whether or not Tlingit and Haida are related to Na-Dene languages continues to be debated among linguists, although Tlingit would appear to be more closely connected. This connection, proposed by Sapir (1915), was dismissed subsequently by Goddard (1920), Krauss (1973, 1979) and others, but recent research supports Sapir's hypothesis (Ramer 1996; Renner 1995). An enlightening review of the Na-Dene controversy by Dürr and Renner (1995) does much to clarify the inconsistent methodologies and misun-

Figure 11.9: Distribution of Northwest Microblade tradition sites and Athapaskan groups at contact. The 196 sites are from the Alberta, British Columbia, Yukon Territory, Northwest Territories, and Nunavut Territory databases, >1 microblade. Alaska and Pacific Northwest US data are incomplete.

derstandings that have characterized this debate. Ruhlen (1998) proposes that Na-Dene has a central Siberian origin, as shown by relationships of Ket (the sole remaining Yeniseian language) to the Na-Dene family. Since microblade-using cultures of northwestern North America likely originated in Northeast Asia, this proposal deserves additional examination, although it is beyond the scope of this paper.

Vancouver Island, Strait of Georgia, and northern Washington State exhibit two other concentrations of microblade sites. These sites are well outside of known Athapaskan territory and thus throw a wrench in the hypothesis although prehistoric persistence of a number of pockets of Athapaskans, comparable to the extinct southeast Alaskan coastal Athapaskans, remains a possibility (traders-specialists at outposts along the coast). Finally, although the Apachean area shows no microblades, we have recently heard from J. Torres (personal communication 2003) that he has microblades in 16th century Navajo sites.

We acknowledge the discussion by Yesner and Pearson (2002) that while a linguistic correspondence to microblades may exist, archaeologists have yet to determine confidently whether this is a coincidence, whether microblades had a seasonal-subsistence function that was widely spread, or what the patterns mean. Historical linguistics and archaeology both deal with far-from-complete data, so both disciplines should make use of insights provided by each other and allow for continuing research into areas that may not be so well illuminated. In light of the late prehistoric and ethnohistoric microblade occurrences in Athapaskan assemblages and in what must be early Na-Dene assemblages, our view is that the correlation is strong evidence that proto-Athapaskan and Athapaskan speakers were the primary makers of microblades in northwestern North America.

CONCLUSIONS

We have attempted here to synthesize what is known of the spread of microblades in northern and western North America, supplementing previous impressions with surface contour plots of microblade site ages. Additional data from Alaska, and refinement of the radiocarbon dates will undoubtedly improve the patterns seen here. The evidence is consistent with an initial entry of microblades with proto-Na-Dene people sometime around 11,000 BP, becoming well placed in central Alaska by c. 10,500 BP. This technology becomes entrenched on the north coast after c. 9500 BP where it remains until c. 5000 BP. Also at c. 9500 BP it is weakly represented along the Canadian Rocky Mountains. By c. 9000 BP the technology is present both in marine and inland mountain environments. Microblade technology spreads from the coast into the interior areas of Yukon, southern British Columbia, and the U.S. Northwest by c. 8000 BP where it remains well represented until about 3000 BP. Following c. 3000 BP, microblades continue to spread east and north, especially in southern British Columbia, Yukon, and the western Northwest Territories. Finally, in the Late Holocene, microblade technology is represented in identifiable Athapaskan assemblages in British Columbia, Yukon, Northwest Territories, and northern Alberta. As a graphic way of illustrating our preliminary conclusions, we present Figure 11.10, which shows a model of microblade technology movements through the Late Pleistocene to Middle Holocene periods. Overall we believe there is continuing evidence that proto-Na-Dene, Na-Dene, and Athapaskan people were the primary users of microblade technology in North America. The strong microblade presence in Haida Gwaii may provide support for the hypothesis that Haida are descendent from proto-Na-Dene.

Certainly there are many avenues yet to explore. The distribution of Denali cores versus Northwest Coast cores could be a way of looking at age distributions in the absence of radiocarbon dates. This would depend on obtaining firm dates for Denali techniques in Canada or firmer core typologies. Magne (1996) has shown, for example, that for Haida Gwaii, simple measurements across various core types may distinguish the general ages of microblade cores. Analyses that would incorporate broader technological elements such as biface types and raw materials such as obsidian sources, along with microblade technology, would likely help sort out techno-cultural succession patterns in more definite ways than we have

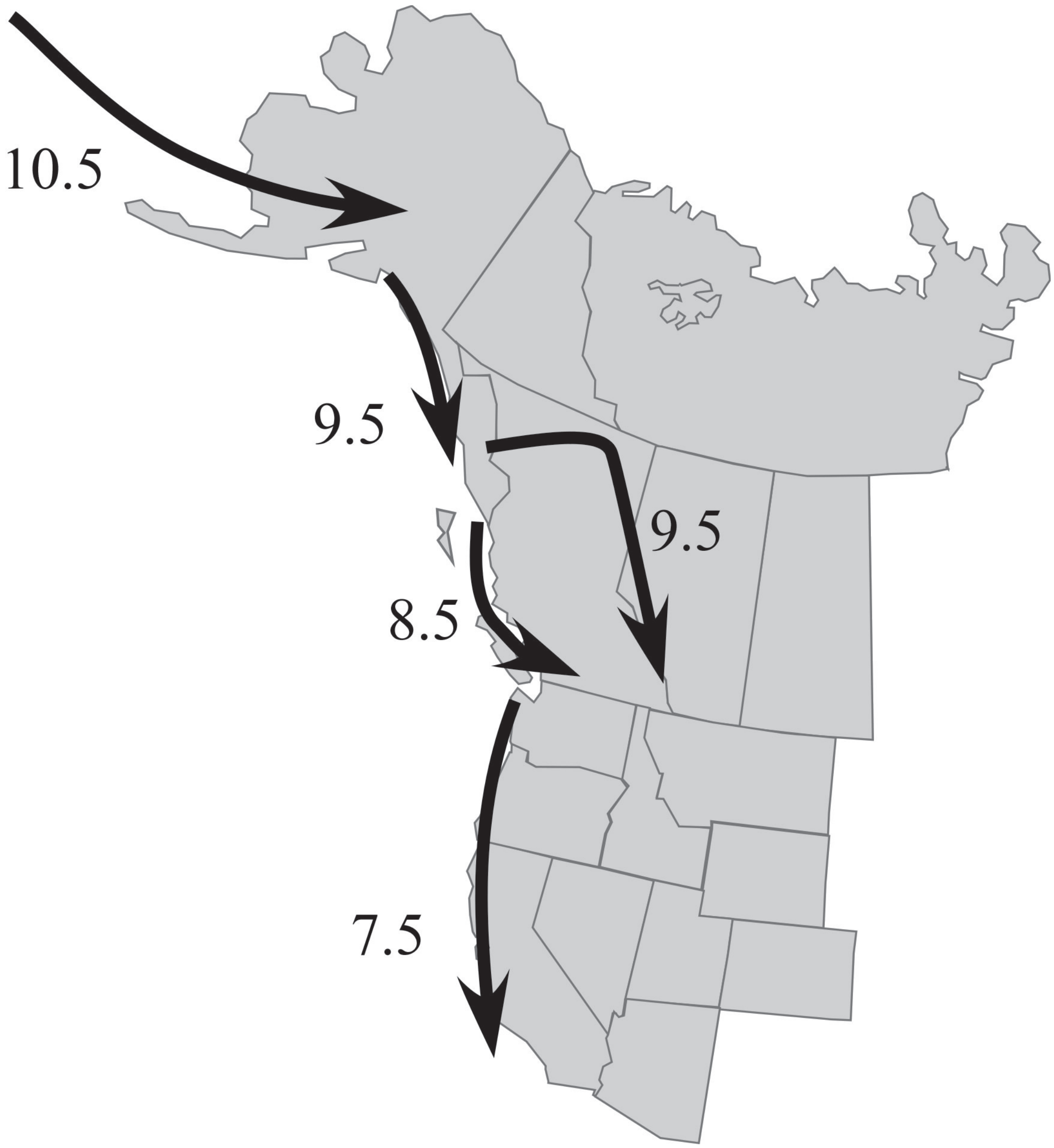

Figure 11.10: Model of the spread of Early Holocene microblade technology in western North America, thousands of radiocarbon years before present.

shown here. We do not understand much about why different core forms were manufactured, although we believe that raw material morphology at source (cobble sources, quarry extractions of varying thicknesses, incipient cleavages, etc.) is a key factor. As for major routes of dispersal, microblade technology could very well have spread rapidly via pre-existing trade routes along the main inlets and river valleys feeding the coast and along the coast itself. Ethnographic connections include Tanaina Athapaskans, Eyak-Athapaskans, and Tlingit to interior Alaska; Dry Bay Athapaskans and Tlingit into Yukon Territory; and Tsetsaut Athapaskans into interior British Columbia. In early historic times, for example, the coastal

Tlingit chiefs each had their own inland Athapaskan trading partners.

The linkages we propose among linguistic groups and ancient movements are captured in the following quote:

"There is an old story that says how some strange people came from the western ocean. Among them were two sisters. They landed on Dall Island in southeastern Alaska. There the sisters met and married men whose people were coming down the rivers from interior North America. One sister went with her family to the Queen Charlotte Islands. Her children grew and multiplied into the Haida Nation. The other sister went with her family to Prince of Wales Island. She became the ancestress or Mother of the Tlingit Nation." (Larson and Larson 1977).

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