GLASS and ICE

The Archaeology of Mt. Edziza

Knut R. Fladmark

Department of Archaeology Simon Fraser University
Publication Number 14 Burnaby, B.C. 1985

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GLASS AND ICE

INTRODUCTION

This report summarizes the methods and results of archaeological investigations conducted in the Mt. Edziza region of northwestern interior British Columbia in the summer of 1981. Mt. Edziza, situated within the Stikine River drainage near the small community of Telegraph Creek, has long been known as the source of at least 4 chemically distinct varieties of obsidian identified in archaeological sites throughout northern British Columbia and adjacent areas (Nelson *et al.* 1975). Archaeological work conducted in the Telegraph Creek area in 1969 and 1970 indicated the local presence of a microblade technology (the "Ice Mountain Microblade Industry") which, however, was not then reliably dated or culturally associated (Smith 1970, 1971, 1974a,b). Our 1981 research had several preliminary goals, including understanding the nature of aboriginal utilization of alpine-subalpine zones in general, and the Edziza obsidian sources in particular; as well as clarification of the age and relationships of the Ice Mountain Microblade Industry (Ice Mountain is one of the variant translations of the word "Edziza" -- see "Ethnography" section below). In addition we hoped to begin development of a regional cultural-historical and paleoenvironmental sequence for a part of British Columbia which was still essentially archaeologically unknown. I believe that we were successful, to varying degrees, in all these areas and that data now available from the Edziza region may begin to shed some initial light on the nature, age, and relationships of local prehistoric cultures spanning the last ca. 5000+ years.

ENVIRONMENT

The study region encompasses the Mt. Edziza and Spectrum Ranges, between 57°10' and 58°N, and 130°25' to 131°W, in the northwestern corner of British Columbia. The Mt. Edziza and Spectrum Ranges are nearly completely enclosed, often in abrupt escarpments, by valleys containing drainage elements of the Stikine River system, including the Grand Canyon of the Stikine itself in the north, the Klastline and Iskut Rivers on the east, More Creek and the Iskut River on the south, and Mess Creek on the west. While the main valley floors lie between 600 and 150m a.s.l., the peaks of the Edziza-Spectrum Range reach average elevations around 2000-2150 m, with Mt. Edziza itself the highest at 2813 m (9143') (Fig. 1). The average topographic aspect is very rugged, with deep sheer-walled canyons and escarpments, barren glacier-draped peaks and innumerable unnamed valleys, streams and mountains. This landscape reflects a complex environmental history including major recent volcanic upheavals and intense Pleistocene and Holocene

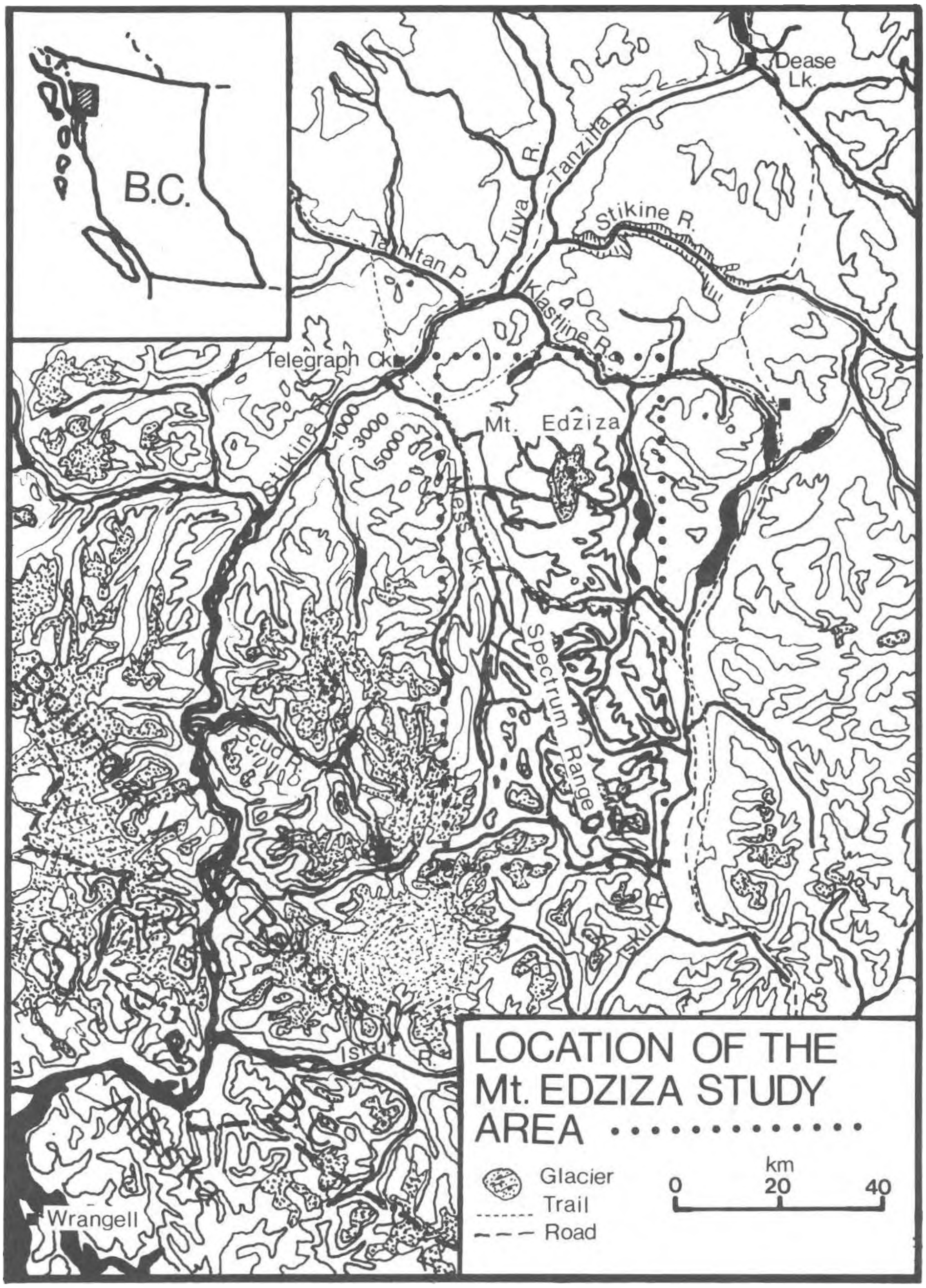

Fig. 1. Location of the Mt. Edziza Study Area.

glaciation, all of which undoubtedly had an effect on past inhabitants.

Local Environment

From the air, the mountains rise above the dark green blanket of boreal forest, like islands from a sea. The beginning of the alpine zone at about 1400m stands out as a markedly abrupt terminator of the forest-sea, above which roll much lighter coloured grassy and herbaceous tundra slopes broken by complexly patterned snow-fields. Over 70% of the ca. 2000 km^2 study area as defined above, lies at or above present tree-line, and the story of human occupation of this area must be very much a story of prehistoric interaction with a dynamic interface of forest and tundra.

The significance of the alpine zone in the study area is amplified by regional geomorphological characteristics which include extensive high elevation plateaus. Mt. Edziza peak itself possesses over 300 km^2 of flat to gently sloping plateau surface along its northern and western flanks, between 1400 and 1800 m elevation (the "Main" Plateau*). Lesser alpine plateaus occur in the Spectrum range ("Central" Plateau* of ca. 40 km^2, and "Southern" Plateau* of ca. 100 km^2), providing vast, open, low relief tundra-grassland surfaces high above the forest (Figs. 2 and 3). Many other high altitude plateaus of this sort occur in north-western B.C. (e.g.: the Klastline and Spatzisi Plateaus), and their presence lends a distinctive flavour to the local environment. The open plateaus provide extensive grazing areas for ungulates, particularly caribou (*Rangifer tarandus osborni*), Mountain Goat (*Oreamnos americanus columbiae*) and Mountain Sheep (*Ovis dalli stonei*), as well as prime habitats for smaller but often highly numerous mammals such as marmot (*Marota caligata*) and ground squirrel (*Spermophilus undulatus plesius*). Upland game birds also exist in considerable numbers in this environment, particularly ptarmigan, whose broody aggressive behaviour in early summer when chicks are hatching can deter even the most determined archaeologist from his intended path.

At tree-line, forest and tundra intergrade through a few hundred feet of elevation, forming a subalpine parkland ecotone. From here, trees progressively increase in size, diversity (Fig. 4), and density with decreasing altitude. If one accepts absolute tree-line to be the elevation of the highest arboreal specimen, no matter how

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* indicates informal name used in this report.

Fig. 2. Locations at Mt. Edziza referred to in the text.

Fig. 3. View of a portion of the Main Plateau, Mt. Edziza, looking west towards the Boundary Range.

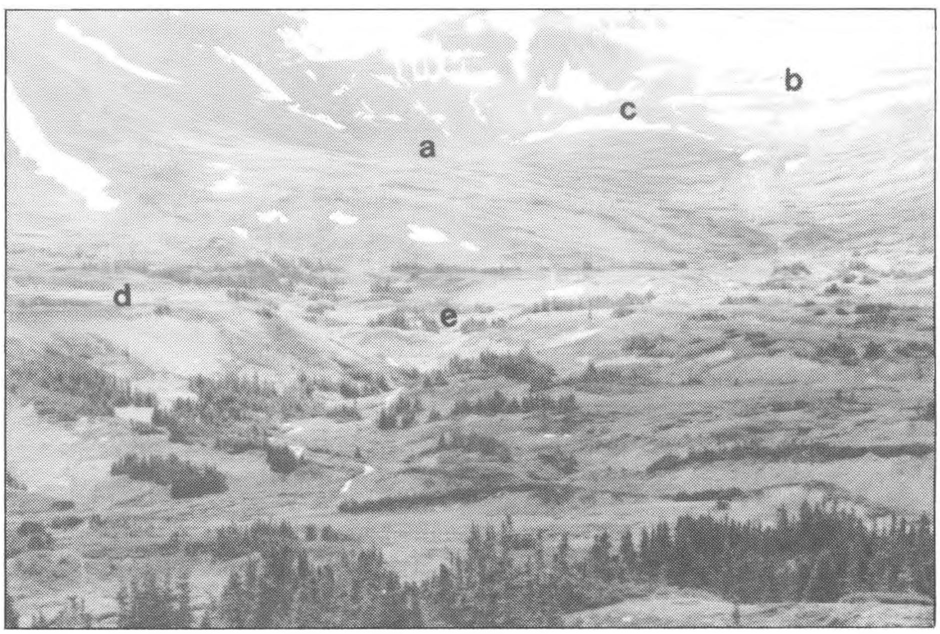


Fig. 4. View of Point Creek Valley (Upper Bourgeaux Valley) looking south. Example of open subalpine fir ecotone. a,b. Lower and upper cirques, Point Valley, c. Point Valley Neoglacial moraine and obsidian source, d. Point Creek fan-delta and EP 67, e. Raspberry Bog.

stunted and dwarfed, then there is considerable altitudinal variation, depending on exposure. The south facing slope of a valley usually carries arboreal species considerably higher than the north facing opposite valley wall. Tree-growth is obviously also dependent on edaphic factors such as slope stability and drainage, as demonstrated by small copses of alpine fir on raised well-drained sandy ridges far up in alpine valleys, while surrounding marshy ground or unstable braided flood-plains and alluvial fans remain bare. On the average, arboreal species are rare to non-existant much above ca. 1400 m, although the local exception can always be found. Tree-line arboreal species are primarily alpine fir (*Abies lasiocarpa*), white spruce (*Picea glauca*), and much rarer examples of lodgepole pine (*Pinus contorta*) (one pine may exist at treeline for every several hundred fir). Less prominent shrubby species include several varieties of willow, scrub birch (a knee-high dense shrub), and juniper. Valley vegetation communities at tree-line are usually semi-open parkland, consisting of discrete clusters or "islands" of fir, interspersed among open herbaceous or shrubby meadows. The subalpine parkland ecotone is a pleasant zone, in which travel is relatively easy and access to firewood and other plant resources is direct. Aboriginally the subalpine ecotone was probably a rich animal habitat, where hunters were able to intercept both the alpine fauna listed above and species more common to forested lowlands, such as moose (while we did not observe moose near the alpine zone, several antler racks indicate that they penetrate at least to tree-line at present), black-bear, and various fur-bearers. Also, some species such as grizzly bear, wolf, and caribou aboriginally would have moved between alpine and forest zones as part of their seasonal round, probably using major valley systems to pass from alpine to lowland areas.

Below ca. 1200 m elevation the trees close in with all the tenacity and totality typical of the boreal forest. Individual specimens increase in height with lowering altitude and open spaces dwindle and disappear, except for muskeg. Travel and visibility in the boreal forest is greatly reduced and hampered in comparison to that at or above tree-line, and game availability was also probably considerably less. In comparison to the subalpine parkland and alpine zones there would seem little to commend the lowland forested regions in summer, except increased shelter and access to freshwater and anadromous fish resources in the major lakes and rivers -- resources not available at all in the torrential mountain streams. During the historic period, at least, increased access to fur-bearers in the forest and muskeg of the lowland valleys and plateaus also must have been a factor in determining native settlement patterns.

Physiographically the Mt. Edziza-Spectrum Ranges lie on the western edge of the Stikine-Yukon Plateau (Farley 1979) with the Boundary (Coast) Ranges immediately to the west, and the Stikine-Cassiar Mountains to the east. Within the Stikine Plateau, relief is variable, with dissected uplands between 2000 and 600 m, interspersed with higher peaks. Holland (1964) ascribes the Edziza-Spectrum Ranges to a "Tahltan Highland" ("Klastine Plateau" for Bostock 1948) subdivision of the Stikine Plateau, and notes that it is physiographically a transition zone between lower plateaus and the high Boundary Ranges, which form the border between Southeast Alaska and British Columbia in this region. The Stikine Plateau is part of a "great belt of plateau country" which joins the Yukon Plateau and continues on into central Alaska (Bostock 1948: 47), and which grades into the Skeena Mountains and Nechako Plateau to the South (Holland 1964).

According to Farley (1979) the Edziza area encompasses Alpine tundra (AT), spruce-birch-willow (SW) (subalpine forest) and Boreal white and black spruce (BSpr) biogeoclimatic zones. No exact climatic records exist for the study area, but generalized summaries of British Columbian climatic conditions (e.g., Farley 1979) indicate that the Mt. Edziza-Spectrum Ranges fall along the edge of the rainshadow created by the Boundary Range. Therefore, precipitation is likely to vary considerably east to west across Mt. Edziza, from a possible maximum of 250 cm (100") to a minimum of 100 cm (20") for the same region. If our own experience on Mt. Edziza in the summer of 1981 is at all representative of general precipitation patterns, the east facing slopes and valleys are relatively dry, certainly much closer to 20-40" than 60-100". There is a slightly greater monthly average of precipitation in January (14-17 days with measurable amounts) than in July (10-13 days) (Farley 1979). Temperatures are generally low (Jan. mean of -10-15°C; July mean of less than 14°C) and the average period of frost-free days, at tree-line, is probably less than 50 (in 1981 there were only about 40 frost-free days, in July and August) (Farley 1979).

Mt. Edziza and the Spectrum Range are portions of a large volcanic complex which has undergone many eruptive and erosional events in a long and complicated geological history (Souther 1970). Eruptions probably began during the Miocene and continued into the late Holocene, interspersed by episodes of glacial and fluvial erosion which carved valleys into the flanks of the original sheild volcano, leaving multi-hued lavas standing out in sheer escarpments, peaks, and valley walls. The central peak of Mt. Edziza still possesses a recognizable volcanic form, although it is mainly buried under an extensive ice-field. At lower elevations a multitude of small recent cinder cones, some relatively eroded, others ominously fresh, are scattered around the flanks of the main mountain. Spread out from the cinder cones in a vast gently sloping apron to the west and north, are the extensive lava plateaus noted earlier, totaling over 300 km^2 of flat tundra terrain. The plateaus end abruptly in sheer escarpments up to 300 m high along the valley of Mess Creek (Fig. 5), which forms the western boundary of the study region. In the far distance, on the other side of Mess Creek, rise the jagged sawtoothed battlements of the Boundary Range, which, in their highly rugged and glaciated character, appear distinctly less hospitable to human intrusion than the relatively gentle upland terrain around Mt. Edziza.

At the southern end of the Edziza Range, and forming the somewhat arbitrary boundary between it and the Spectrum Range to the south, lies Raspberry Pass, a narrow V-shaped col, providing a relatively low and easily traversed route eastwest through the mountains (Fig. 6). Raspberry Pass is drained to the west by Raspberry Creek, a tributary of Mess Creek, which itself enters the Stikine River near the small community of Telegraph Creek. Bourgeaux Creek flows eastward from the pass, eventually joining the Iskut River. The historic "Telegraph Trail" followed the Iskut Valley from the south, then swung northwestwards, eventually reaching Bourgeaux Valley*. From there it crossed through Raspberry Pass, and followed Mess Creek northwards to the Stikine River and beyond to the Yukon and Klondike. There is little doubt that this route represents the easiest overland passage into the Edziza-spectrum Ranges and probably figured prominently in aboriginal obsidian distribution.

Immediately south of Raspberry Pass, the Central Plateau* juts northwestwards from a prominent pyramidal or matterhorn-shaped peak. This peak, 2100 m high, informally referred to as "Goat Mountain"*, carries extremely rich obsidian outcrops which were probably the most important aboriginal raw material sources in the area (Fig. 7). Goat Mountain, in turn, overlooks another major east-trending valley, which parallels Bourgeaux Valley, separated by a single mountain ridge. This valley has been informally christened "Artifact Valley"* (Fig. 9). Goat Mountain and Artifact valley are part of the Spectrum Range, which in general has a more broken and rugged aspect than the area around the main Edziza peak, and numerous unnamed valleys penetrate the Spectrum Range from east, west, and south. About 20 km south of Goat Mt., a small lake occupies an alpine valley on the east side of the Spectrum Range, providing the source for the Little Iskut River. This lake, about 1 km in length, would be suitable for fixed wing aircraft operation, and is informally named "Floatplane Lake"* (Fig. 8). A large

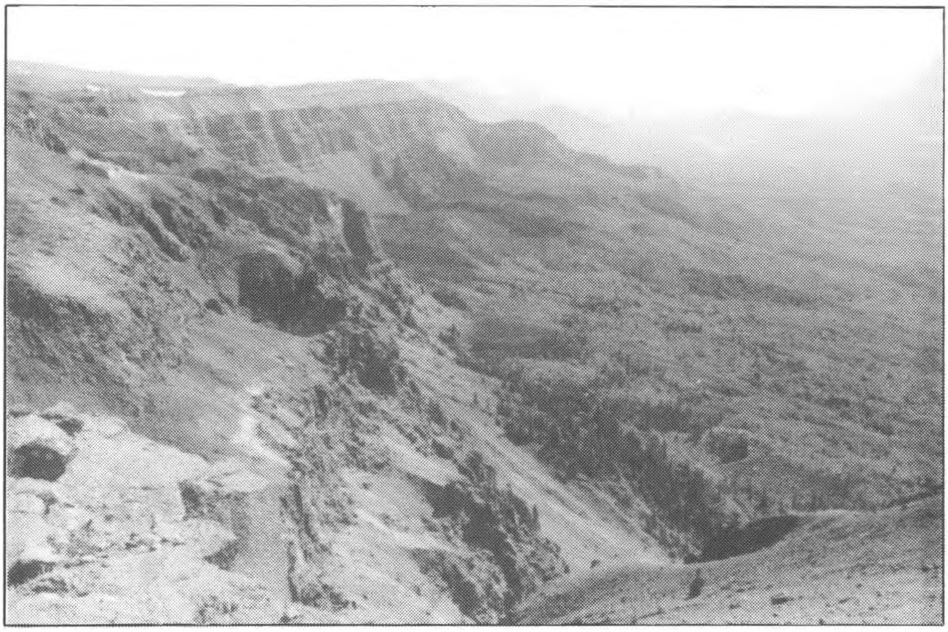


Fig. 5. View of west escarpment of Main Plateau, Mt. Edziza, looking south up Mess Creek.

Fig. 6. View of Raspberry Pass looking east across confluence of Caribou Creek in foreground.

Fig. 7. Goat Mountain from EP 1.

Fig. 8. View of Floatplane Lake area looking west from EP 33. a. Little Iskut R., b. Ball Ck. Valley, c. Pass to South Plateau, d. Rock glacier, slope of Mordor Mt.

Fig. 9. Aerial photograph of Artifact and Bourgeaux Valleys. a. Point Valley, b. Raspberry Bog, c. Point Creek fan-delta, d. Meltwater channels, e. Rocky Creek fan-delta, f. Bourgeaux Creek telegraph line-cabin, g. Telegraph trail, h. Rocky Pass, i. Goat Mt. cirque, j. Goat Mt., k. Wet Creek, l. EP 1, m. Braided River, n. Artifact Valley moraine, o. Fan Creek, p. Artifact Valley "Slide" area.

glacier northwest of Floatplane Lake provides a source for Ball Creek which flows southwards out of the Spectrum Range, eventually joining the Iskut River. Across Ball Creek, the extension of Floatplane Lake Valley* leads through a high pass in the crest of the Spectrum Range, out on to another broad expanse of alpine plateau. Termed the "South Plateau"*, this snow-mottled arctic-alpine plain provides the final southern and western limits to the study area (Fig. 2).

Our work in the Edziza region in 1981 focussed on two main study areas: (1) The Artifact Valley -- Raspberry Pass Area, and (2) The Floatplane Lake Area (Fig. 2). These regions are in sum broadly representative of much of the range of local environments, and they also probably intersect the areas of highest aboriginal utilization.

GENERAL HISTORY

Mt. Edziza and the Spectrum Range are a relatively isolated area of British Columbia today, as yet unpenetrated by any roads, and little known to most modern residents of the province. Existing (provisional) topographic maps are somewhat imprecise, and the vast majority of topographic features are unnamed, including major valleys, peaks and drainage elements. As noted above, in the course of our work it was necessary to assign a number of provisional names for descriptive purposes. In the past, Mt. Edziza undoubtedly figured more prominently in the lives of peoples of the northwest because, throughout most of prehistory, it was a source of high quality obsidian, widely distributed throughout northern British Columbia and adjacent regions, and valued for its tool-making potential. Later, during the 19th and early 20th Centuries A.D., a telegraph line was strung through Raspberry Pass at the junction of the Edziza and Spectrum Ranges, connecting the Klondike with southern civilization. For decades the "Telegraph Trail" was the only well defined overland route into and through northern interior British Columbia. However, it is highly probable that the wire and historic trail simply followed a well-worn and ancient native path along this route, over which Edziza obsidian had been moved long before the Morse Code was invented. The Telegraph Line was abandoned finally in 1935, but the trail, weathered poles, the wire itself, a deserted line cabin, and other vestiges still mark the first highway into the far northwest.

The Mount Edziza area can be conceived of as a very strategic location vis-a-vis the aboriginal natural geography of northwestern North America. Situated less than 150 km straightline distance inland from the nearest body of salt water (Endicott Arm), enclosed within the two major elements of the Stikine River (Stikine and Iskut), the main peak of Mt. Edziza also lies less than 80 km southwest of headwaters of the Liard River (Dease Lake), which flows into the Mackenzie system and the Arctic Ocean; less than 80 km north of headwaters of the Nass; less than 130 km northwest of headwaters of the Skeena River; less than 70 km south of headwaters of the Taku River, which are all major Pacific drainages, and less than 150 km south of headwaters of the Yukon River (Teslin River), which flows into Bering Strait (Fig. 1). While these are air distances, the actual ground travel distances are probably not in most cases greatly different, due to major valleys and secondary drainage elements which provide relatively direct communication avenues. Thus the mountain lies at or near a communications cross-roads, in terms of access to major river systems of the Northwest, which, in turn, flow into three different seas (Arctic Ocean, Pacific Ocean, and Bering Strait). These river valleys undoubtedly did function as regional axes of communication and trade, even though local travel might have occasionally crosscut the physiographic grain of the country, and the location of a major obsidian souce at such a strategic "node" may have been an important factor in how the area was occupied through time.

Although the latest history of Raspberry Pass and adjacent mountains and valleys is fairly well known, the subject of the first humans in the area has seen little or no investigation. It is likely that the earliest Europeans to set foot in the Edziza-Spectrum Range were surveyors for the original Collins Overland Telegraph in 1867; however the Native history of the region goes back vastly further. Obsidian chemically related to Edziza types has been identified in a ca. 9000-10,000 year old artifact assemblage from Groundhog Bay, on the coast of Southeastern Alaska, about 300 km northwest of the mountain source (Nelson pers. comm. 1981). Artifacts from other dated sites throughout northern B.C. indicate that Edziza obsidian continued to be widely distributed into the last few hundred years of prehistory and protohistory (Carlson, pers. comm. 1981; MacDonald 1979).

QUATERNARY ENVIRONMENTS

There have been no Quaternary environmental studies previously reported for the Edziza area. Fundamental data concerning the history of late Quaternary volcanism, glaciation and deglaciation, and paleoclimatic sequences are lacking, and can only be partially and inferentially reconstructed from work in nearby regions, and a scattering of observations made in the study area during the 1981 field season.

Research by Miller (1976) and Miller and Anderson (1974) in the Juneau and Atlin regions about 150-200 km to the northwest provide some pertinent data on regional Quaternary glacial sequences and paleoclimatic trends. Souther (1970, and pers. comm. 1981) has information pertaining to Quaternary volcanism in the Edziza area, while Alley and Young (1978) describe a number of Quaternary land forming processes in and adjacent to the Edziza area. A number of other Quaternary geological studies in northwestern British Columbia may be applicable to the Edziza area; the bulk of these are summarized and synthesized in Clague (1980, 1981). Other work in adjacent portions of the southwest Yukon and Southeastern Alaska (e.g., Rampton 1971) may also provide parallels for the Edziza and Spectrum Ranges. In addition to limited previously published data, we made observations of glacial limits, late Quaternary landforms and sediments in the course of our archaeological surveying in 1981. However, in total, available data permit only tentative and preliminary reconstruction of some major events in the late Quaternary history of the Edziza area.

Late Pleistocene Glaciation

Miller (1976) outlines an 8-stage model of increasingly weak late Quaternary glacial events in the Alaska-Canada Boundary Range. In this model only an undated pre-Wisconsinan glaciation achieved an "Intermontane Ice Cap" stage, overriding most peaks in the region and forming a sub-continental ice-sheet confluent with other major ice sheets to the east. All later events -- that is all Wisconsinan glacial pulses -- were progressively less intense, leaving increasingly larger amounts of upland terrain ice-free. Although most of his inferred glacial stages are not dated, it seems that the Late Wisconsinan glaciation achieved what he terms "Lesser Mountain Ice-Sheet" and (in the latest event) "Extended Icefield" conditions. The Lesser Mountain Ice-Sheet stage apparently consisted of a "confluent mass of mountain and lowland piedmont and valley-filling glaciers" with ice surfaces at intermediate elevations along present valleys. The "Extended Icefield" condition was apparently an intense alpine glaciation, with glaciers primarily restricted to mountain valleys. Thus, according to Miller (1976), upland ridges and peaks remained above regional ice surfaces during the latest Wisconsinan glaciations, with remnant periglacial features on surfaces above 900 - 1500 m elevation reflecting severe conditions prevailing in alpine nunatuks during the late Pleistocene.

Our own observations in the Edziza-Spectrum Ranges would tend to generally fit Miller's model. Direct evidence to indicate glacial over-riding of peaks above ca. 1500 m elevation is scarce. However, there is widespread evidence of intensive valley and plateau glaciation throughout the Edziza and Spectrum Ranges. This intense valley-glacier stage, apparently coinciding with piedmont coalescence on some plateau surfaces, is far more visible than any presumably earlier more intense ice-sheet stage in this area. The evidence includes kame terraces and ice lateral drainage complexes in most of the major valleys.

On the east flank of Goat Mountain, one or possibly two small kame terraces lie at about 1600 m elevation, corresponding to the probable bedrock floor elevation of Rocky Pass*, a prominent V-shaped col, and old melt-water channel, linking Artifact and Bourgeaux Valleys (Fig. 10). In Bourgeaux Valley, a complex flight of ice lateral melt-water channels debouches from the northern entrance of Rocky Pass and carries westwards along the south side of the valley, terminating in a large composite proglacial fan-delta near the mount of Point Valley* (Figs. 11, 12 and 13). The highest melt-water channels at the north end of Rocky Pass lie at about 1600 m but have a relatively steep gradient towards the west along Bourgeaux Valley, showing a drainage trend exactly the reverse of the modern pattern. The floor level of Raspberry Pass at about 1500 m is close to the surface elevation of the prominent Point Valley fan-delta, suggesting that ice-lateral streams running westward along the flanks of Bourgeaux Valley, at one stage probably drained through Raspberry Pass, across the divide of the Edziza-Spectrum Range. The sequence of deglaciation implied by these features and others will be discussed in more detail below. Similar ice-lateral melt-water features also occur on the north side of Bourgeaux Valley, including a major hanging fan-delta nearly directly opposite the entrance of Rocky Pass at about 1570 m.

Artifact Valley is dominated by a 3 km broad gently sloping area of hummocky unconsolidated sediments, partially enclosed by a nearly sheer 300 m high arcuate headwall escarpment in the northern flank of the valley, centred about 4 km east (down-valley) from the southern end of Rocky Pass (Figs. 10, 14 and 15). At first glance this feature has many of the classic landform characteristics of a major slide or slump, including a horseshoe shaped headwall scarp; hummocky rippled surface; a possible slump block fault along the base of the headwall, now occupied by a creek drainage; and an overall arcuate shape, apparently thinning towards the toe. However, there are also some significant features not compatible with an origin entirely as a major slump from the north wall of the valley. First is the fact that the headwall scarp is a near sheer

Fig. 10. Rocky Pass, looking North

Fig. 11. Main Meltwater channel south side of Bourgeaux Valley, between Point Creek and Rocky Pass. EP 80 (Grizzly Run Site) in left foreground.

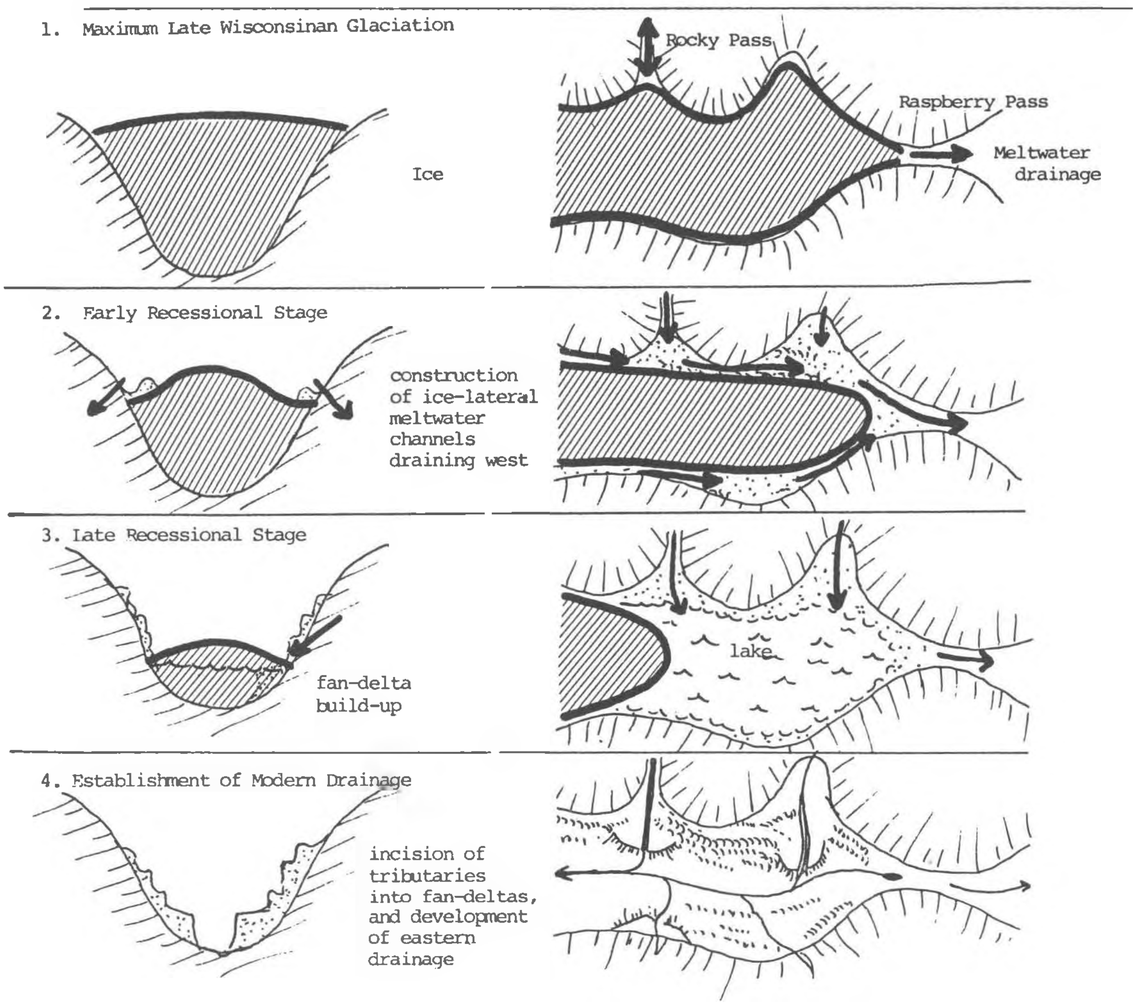


Fig. 12. Schematic Model of Deglaciation for Bourgeaux Valley.

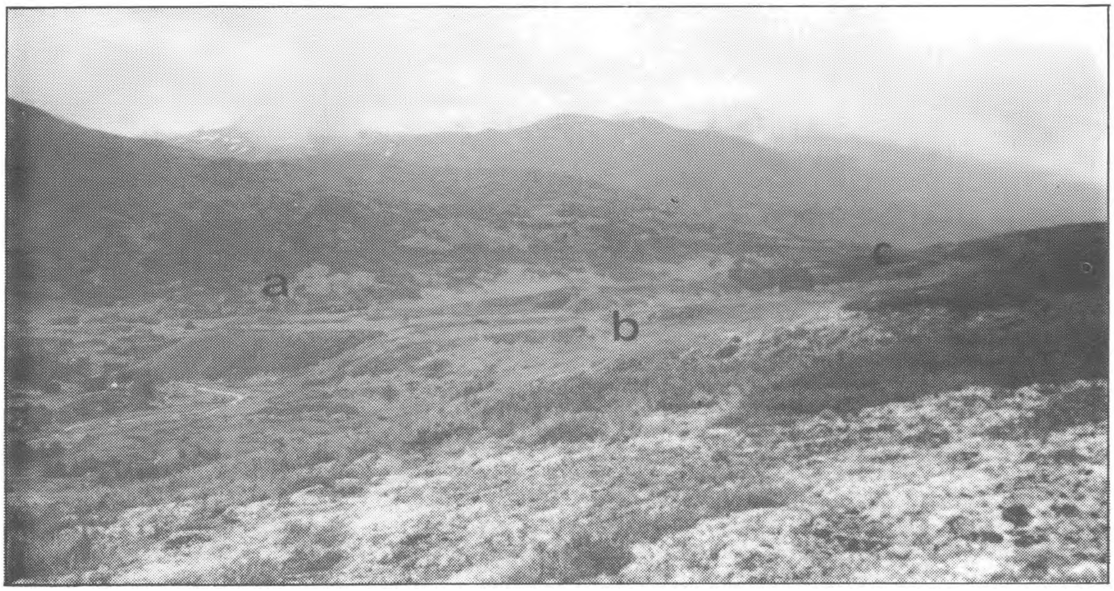


Fig. 13. Looking north from EP 63 over Point Creek fan-delta (a), and meltwater channel complex (b), Bourgeaux Valley. EP 80 (Grizzly Run Site) is "c".

Fig. 14. View east over Wet Creek and Artifact Valley. "Slide" area in left middle distance. See also Fig. 32. Site EP 17 in foreground.

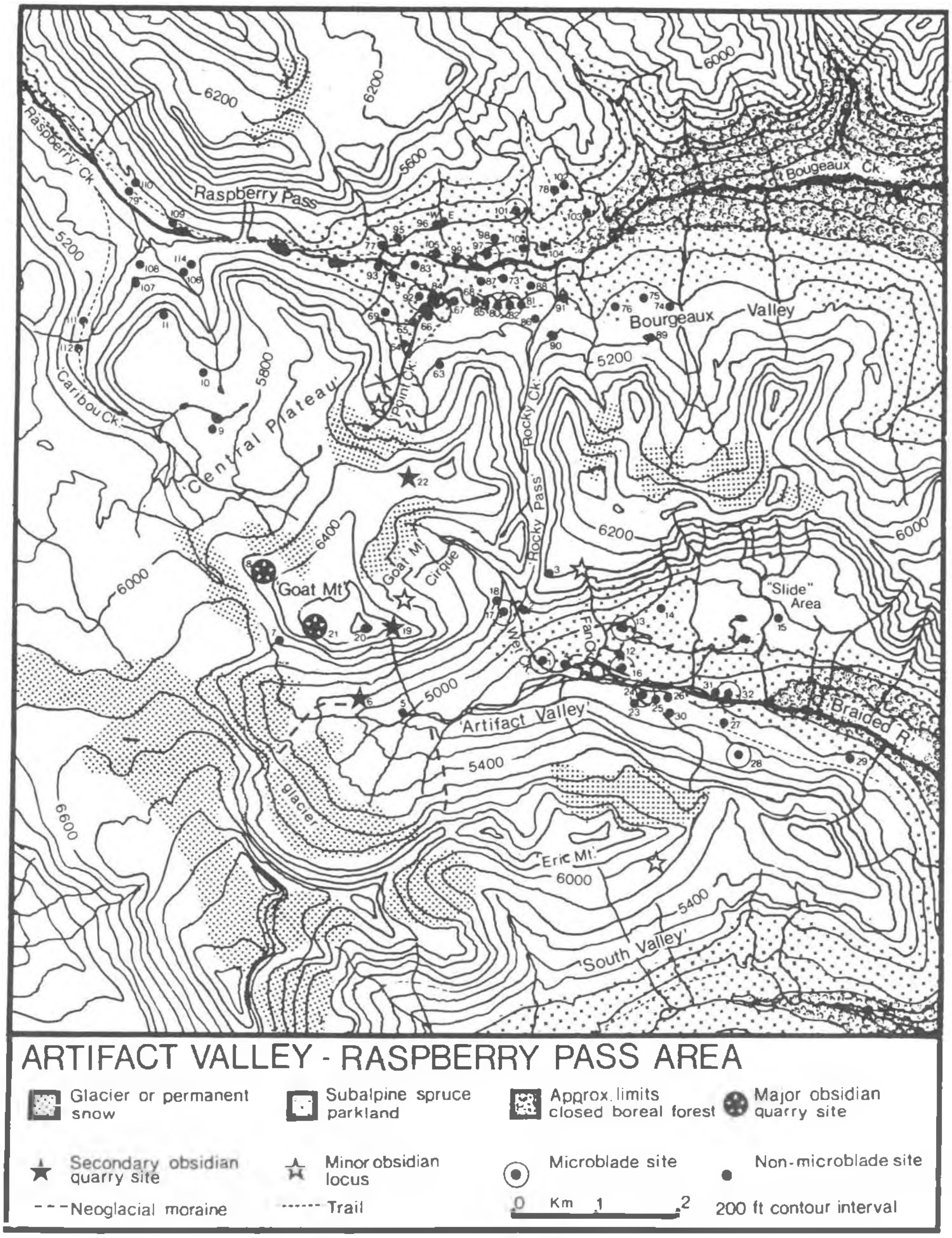


Fig. 15. Artifact Valley - Raspberry Pass Area.

face of volcanic bedrock, yet deposits in the "slide area" itself, at any distance from the headwall, even in relatively deep eroding stream banks, never contain any major blocks or boulders of bedrock. Instead, all sediments in the "slide area" consist of poorly sorted and variably rounded cobbles, pebbles, sand and silt, with only rare relatively small boulders. This sediment type is consistent with a glacial or glacio-fluvial origin, but could not be easily explained as a direct slump from adjacent bedrock cliffs. Second, is the presence of a narrow bench surface on the opposite side of the valley, at about the same elevation as the highest portion of the "slide." While it is probable that any true slide as large as the one suggested would have crossed the valley from north-to-south climbing to some height on the opposite side, it is less likely that the highest final stabilized surface would be nearly exactly horizontal across the valley. Another bench, at the same elevation about 2 km east of the main "slide," is even harder to explain this way, given the much lower valley floor. Even more problematical is the fact that the surfaces of the main "slide" and of the other benches, are either nearly on a true horizontal plane along the valley or dip *up*-valley, *against* the gradient trend of the current valley floor. It would seem that this could only have occurred if the "slide" was butressed against some no longer existing obstacle down-valley. Finally, there is a puzzling lack of evidence for major high-level damming of the Braided River*, and subsequent deeply incised outflow channel through the "slide." Except for some small currently active slumps on the south side of the valley, which may have sporadically dammed the river to a maximum depth of 20-30 m, and which are currently cut through by a short length of sheer-sided channel, the Braided River generally occupies a rather wide and undramatic U-shaped sub-valley through the "slide" area.

I presently interpret the Artifact Valley "slide" and related features as primarily consisting of kame terrace and other ice-contact deposits laid down along the sides and possibly the terminus, of a tongue of ice with a main surface elevation at or near 1500 m, which protruded into Artifact Valley from the east. This accounts for the fairly consistent surface elevation of all these bench-like features, the nature of the sediments, and other aspects not easily explained by mass wastage alone. The hummocky surface of the "slide" area is explained as a combination of kame and kettle terrain and a complex of westward trending melt-water channels. This would also be consistent with the evidence for ice-lateral melt-water features in Bourgeaux Valley produced by a tongue of ice at about 1500 m elevation penetrating up into the valley from the east. Likewise South Valley* (Fig. 15) (named because it is the next valley penetrating into the Spectrum Range, south of Artifact Valley) also possesses kame terrace and ice-lateral features near the same location and elevation. However, it is possible that portions of the original ice contact deposits in all these locations slumped to some degree after deglaciation left the sediments over-steepened along valley flanks. Thus the *lowermost* segment of the Artifact Valley "slide" may indeed be partially an earth-flow, helping to account for the limited constriction of the Braided River sub-valley in this area. If this is the case the slumping probably occurred in the early Holocene. With the exception of the limited areas of active faulting and slumping on the south side of Artifact Valley, already noted, there is no evidence of on-going major earth movement in the "slide" area; such as tilted trees, faults, or minor slumps; and archaeological sites indicate that people have lived on the area, undisturbed, for at least 4-5000 years.

Throughout the Edziza-Spectrum Ranges, segments of hanging melt-water channels, proglacial fans and kame terraces all indicate major valley glacier surfaces at or near 1500-1600 m. For instance, in the Floatplane Lake region, a complex system of abandoned channels at about 1500 m suggests that the Little Iskut River and Ball Creek may have exchanged headwater drainage elements at some time in the past, probably due to ice-damming of lower portions of one or both valleys. Major tributary valleys of Ball Creek leading westwards up onto the South Plateau (such as "Eastone"* and "Eastwo"* Valleys, Fig. 16) terminate in narrow V-shaped cols at about 1500 m elevation, which, in at least one case, is continuous with a major esker complex on the Plateau itself.

This esker complex (Fig. 36) consists of an anatomosing series of ridges which appear to originate near the summit of Eastone Valley and flow northwestwards toward the upper reaches of the More Creek drainage (Fig. 16). One branch, not shown in Fig. 16, follows the west flank of the mountains at about 1500 m elevation, and another branch trends more westerly out on to the South Plateau, where it can be traced on air photographs for at least 1.5 km. Air photos indicate evidence of extensive glaciation over much of the South Plateau; however, it is likely that the main ice surface was not much higher than ca. 1600 m. Further to the west, well defined north trending streamlined ground features shown on air photos indicate a major flow of ice following Mess Creek Valley, which possibly received some contribution from ice originating on and near the South Plateau of the Spectrum Range.

The Boundary Range and Mount Edziza itself today all possess extensive alpine valley glaciers and alpine ice-fields, while the peaks of the Spectrum Range also carry numerous smaller cirque and valley glaciers. Nevertheless, it is possible that much of the existing ice is not a surviving remnant of Pleistocene glaciation,

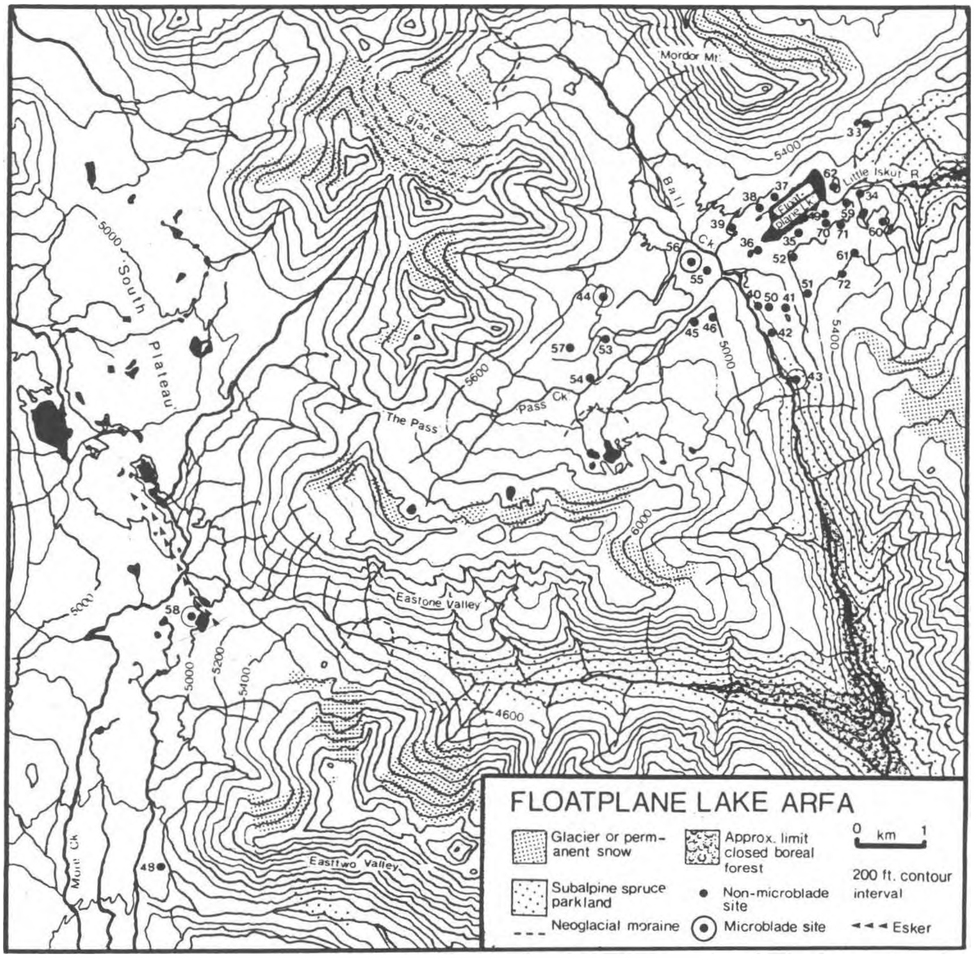


Fig. 16. Floatplane Lake Area.

but is instead the result of an increasing trend to reglacierization during the late Holocene. (cf. Miller 1976). Part of the argument for this rests in the apparent character of late Pleistocene deglaciation in this region.

Most evidence from the Edziza area suggests that Late Wisconsinan ice mainly stagnated and vertically downwasted as major masses, rather than undergoing regular terminal retreat into alpine source areas (cf. Alley and Young 1978). In Bourgeaux and Artifact Valleys it appears that the last major Late Wiconsinan ice surface lay at about 1500 m elevation with glacial lobes filling all major valleys. There is no clear evidence of terminal moraines outside Neoglacial limits, and it appears that deglaciation proceeded mainly through vertical downwasting of the ice surface, and resulting progressive emergence of upland areas.

In Bourgeaux Valley ice lateral melt-water channels sloping westward from Rocky Pass to Point Valley and Raspberry Pass suggest drainage controlled by an ice surface gradient rising towards the east (Fig. 12). At first the melt-water probably flowed directly westwards through Raspberry Pass, then as the ice surface continued to lower, a short-lived pondage in Upper Bourgeaux Valley led to the development of the proglacial delta near the mouth of Point Creek and the construction of a flight of melt-water channels down the south side of the main valley. Continued downwasting led to the construction of a similar proglacial delta at the mouth of Rocky Creek, which was probably followed shortly (?) after by the opening of eastward drainage through Bourgeaux Valley, signalling the effective completion of deglaciation. This permitted incision of the channels of Rocky and Point Creeks through the old hanging deltas, and the establishment of the existing drainage pattern (Fig. 12). In Artifact Valley, initial melt-water drainage appears to have been northward through Rocky Pass (Fig. 10) into Bourgeaux Valley. With the lowering of the ice surface to ca 1480 m, northward flow through Rocky Pass ended, and was replaced by short segments and complexes of melt-water channels along both north and south sides of Artifact Valley, which suggest a drainage gradient from east to west. Assuming ice filling of the valley below this elevation, upper Artifact Valley would have formed a closed basin pondage into which these short melt-water systems drained. There is a short section of laminated silts over till exposed in an eroded face of a fossil hydrolaccolith on the floor of Artifact Valley just upstream from the "slide" area, which may relate to a brief period of low level ponding. Establishment of the normal eastward drainage followed lowering of the ice surface below ca. 1415 m.

Dating of this deglaciation process is not clear. Large scale melting of Late Wisconsinan ice was under way in most parts of North America by ca. 14,000 B.P., including Alaska and the St. Elias Range (e.g., Hopkins 1979, Rampton 1971). Miller (1976) and Miller and Anderson (1974) suggest that deglaciation had begun in the Atlin area by at least 10,000 B.P. There seems no reason why similar dates would not be applicable to the Edziza area. As possible confirmation Souther (pers. comm. 1981) reports apparently post-glacial lava flows on the lower Iskut drainage dated 11,000-14,000 B.P. The earliest radio-carbon date so far available for our Edziza-Spectrum Range study area is 8470 ± 120 B.P. (SFU 146) obtained on the base of an excavated peat bog section (Raspberry Bog) (EP 84) at the mouth of Point Valley near Raspberry Pass at ca. 1462 m elevation (Fig. 15). The bog is developed on a fluvial terrace surface eroded by Point Creek in the process of developing and incising its channel through the old proglacial fan-delta, and therefore the date cannot be taken as a direct limiting age for deglaciation. However it is an indication that the modern drainage system was essentially fully established by 8500 B.P.

Holocene Climate and Glaciation

A 1.6 m deep section of peat was removed from Raspberry Bog and is currently undergoing palynological analysis by Dr. R. Mathewes (S.F.U.). This should provide a useful picture of the Holocene vegetational sequence within the subalpine parkland ecotone. However, until completion of this study, there are few direct data pertaining to Holocene paleoenvironmental-conditions in the Edziza-Spectrum Ranges. Miller and Anderson (1974) outline a paleoclimatic sequence derived from studies of peat sections near Atlin. They infer cool-dry conditions prior to 8000 B.P., leading into the relatively warmer and wetter "Thermal Maximum" period between ca. 8000 and 3000 B.P. This was followed by the Neoglacial with increased storminess and cooler drier conditions, persisting into the present. Miller and Anderson (1974) suggest that post-"Thermal Maximum" climatic deterioration began in the Atlin about 3250 B.P., leading to "full" Neoglacial conditions by about 2500 B.P. This process resulted in significant readvances and reappearance of alpine-valley glaciers, culminating with the most extensive Neoglacial events of the "Little Ice Age," within the last 200-350 years. Miller (1976) states 3000 B.P. to be the effective beginning of Neoglacial time in the Boundary Range, a date which is a little more recent than a similar resurgence of glacial activity throughout the more southern Cordillera (e.g., Clague 1981). Miller describes the Neoglacial as a two-phase event in the Boundary Range, with a brief warm "interstadial" punctuating generally cooler conditions about 900-1300 B.P. Between 3000 and 900 years ago temperatures are estimated to have been 3°C cooler than present, intensifying glacial activity. Following the short, warm interstade, conditions again became significantly cooler and wetter, promoting relatively extensive glaciation. Miller and Anderson (1974) also argue that existing extensive ice-fields in the Boundary Range are Neoglacial in origin, and not remnant Pleistocene ice-masses.

There seems no doubt that the Neoglacial was a significant climatic event in northwestern North America, particularly in the Boundary and St. Elias Ranges of Southeast Alaska, southwest Yukon, and northwest British Columbia. Here, the largest existing glaciers on the North American continent bring us visually closer to the reality of Pleistocene conditions that in any other non-polar contexts (Fig. 17). Yet, these glaciers are to a large degree the product of the last ca. 3000 years of time. Certainly very extensive glacial advances locally occurred in this period, filling major coastal inlets and interior valleys, and reducing the amount of unglaciated terrain everywhere (e.g., McKenzie and Goldthwait 1971). On the coast of Southeast Alaska, the Tlingit Indians retain numerous oral traditions describing their interaction through time with the coming and going of the ice, including accounts of glaciers over-running villages and blocking river communication routes inland (e.g., de Laguna *et al* 1964). For people dependent on interior alpine resources, the neoglaciation must have been even more severe.

Throughout the Edziza-Spectrum Range, there is widespread evidence of one or more recent glacial advances which caused cirque and valley glaciers to expand up to 1-2 km beyond their present termini. Prominent Neoglacial moraines were directly examined in 1981 in Artifact, Point, Ball Creek and Eastone Valleys (Figs. 15 & 16). These usually consist of sharply defined steep-sided arcuate terminal moraine ridges built of fresh unweathered rock debris, lacking extensive lichen cover, with most observed thalli less than 5-10 cm. in maximum diameter (Fig. 18). These features probably result from the latest, and in many areas, most extensive glaciations of the Little Ice Age, probably dating ca. 1700-1800 A.D. Aerial photographs indicate that similar moraines exist in front of most existing valley and cirque glaciers, representing their most extended, recognizable terminal positions. Even minor cirques which today do not possess existing glacial ice, sometimes show the same prominent Neoglacial maximum moraine. In at least one case, a tributary glacier at the head of Eastone Valley in the southern Spectrum Range, the Neoglacial moraine indicates that late Holocene ice advanced sufficiently to block the main trunk valley, obstructing local drainages, and undoubtedly seriously impeding access to the South Plateau, for anyone trying to climb up from the lower Ball

Fig. 17. Ablating till-covered glacier, head of Ball Creek.

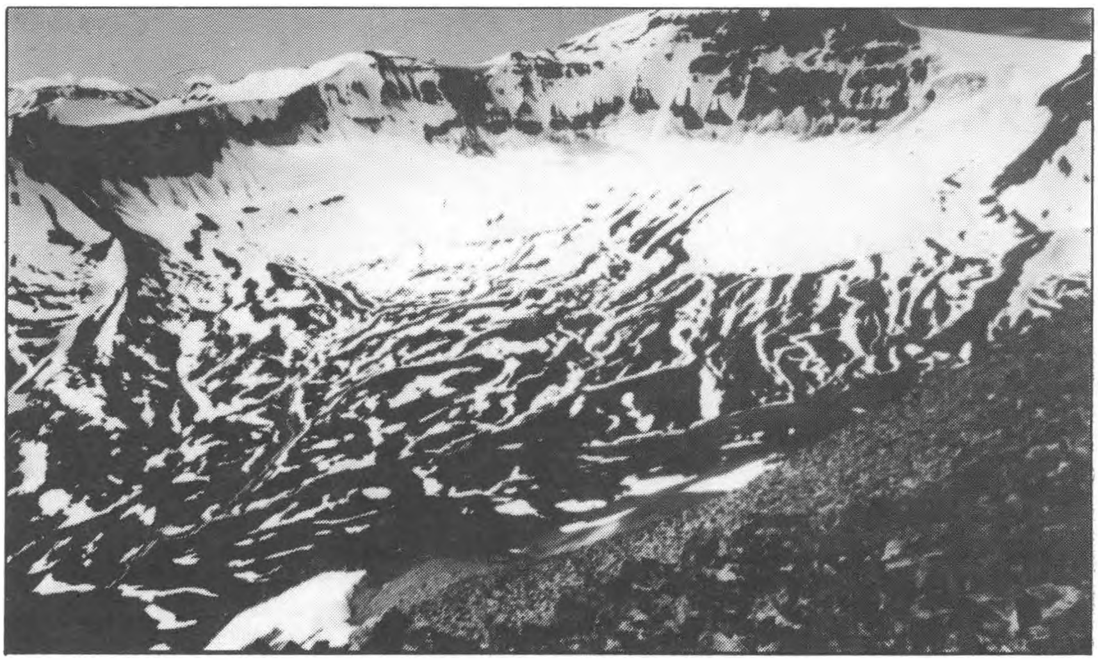


Fig. 18. Artifact Valley cirque and glacial remnant. Note portion of arcuate Neoglacial moraine on left. View southwest from EP 21.

Creek valley. Everywhere else, the Neoglacial maximum must have made travel in the mountains significantly more difficult than at present, extending permanent snow-fields, and reducing seasonal melt-off. For cultures adapted to Hypsithermal conditions, when glaciers may have been largely absent or much reduced in the Edziza-Spectrum Range, the transition to the Neoglacial must have been a difficult time.

The nature of Hypsithermal climatic conditions has been the subject of some debate (cf. Clague 1981 for a summary review), although Miller and Anderson (1974) seem confident in describing it as a time of warmer and wetter conditions, near Atlin, with mean July temperatures about 2° warmer than present.

In the Raspberry Bog peat section, to be described in the next section, the period between 8470 and 4900 B.P. (3570 years long) saw about 1 m of peat develop, while the remaining 4900 years up to the present, is represented by only about 50 cm thickness of deposit, much of which is tephra. This suggests decreased rates of peat formation during the Neoglacial compared to the Hypsithermal. If Miller and Anderson's (1974) model is correct, Hypsithermal snowlines were probably higher, and the extent of permanent alpine snow significantly reduced, improving ease of travel and general living conditions in the mountains. It is also conceivable that reduced snow may have restricted the numbers and size of alpine melt-water streams and ponds, which today provide high quality drinking water virtually everywhere in the Edziza-Spectrum Ranges, perhaps making site location near permanent sources of water more important at that time. All these factors generally suggest that alpine regions were more habitable and alpine resources, including lithic exposures, more feasibly exploited prior to the Neoglacial, and that the latter period may have seen diminished human interaction with high elevation terrain.

Periglacial Phenomena

There is widespread evidence of periglacial activity of varied age throughout the Edziza-Spectrum Ranges. This includes felsenmeer, earth hummocks, and patterned ground on high plateau surfaces; extensive colluvial or solifluction terracing, particularly on northeast facing slopes; and extensive nivation hollows, exposures and "mudflow" streams (Fig. 19) (e.g., Alley and Young 1978). More rare are rock glaciers (a large rock glacier extends from the southeast flank of "Mordor Mountain,"* overlooking Floatplane Lk., Fig. 8) and hydrolaccoliths or small pingos (one, apparently no longer active, carries site EP 4 on the floor of Artifact Valley, at about 1400 m elevation). Most periglacial features in the alpine zone appear to be currently active. One active and many inactive turf-banked solifluction lobes were observed in the Artifact Valley "slide area," within the subalpine parkland ecotone, at about 1500 m. However, solifluction does not appear to be a major current factor within the forest or parkland ecotone zones. Nivation hollows and associated cryoturbation flows of mud and rock debris occur wherever snow-banks persist into the summer. These occasionally serve as important exposures for surface collection of lithic cultural items, although any such materials are certainly significantly displaced from their original depositional contexts. As indicated by Benedict and Olson (1978) and others, periglacial phenomena may have critical effects on the vertical and horizontal displacement of artifacts in buried and surface contexts, sometimes tending to differentially sort items by mass or size. We were aware of these potential problems at the outset of the Edziza project, and tried to detect the presence of cryoturbation or solifluction effects in all sites where major collections were obtained, particularly excavated contexts. However, even non-cryoturbated surface assemblages are arguably mixed anyway, and the presence of active or relict periglacial processes would not seem to greatly alter their general "quality." However, in excavated contexts, particularly multi-component sites, the unrecognized effects of periglacial processes might profoundly affect the nature of resulting archaeological interpretations. This problem will be discussed further in relation to individual sites.

Holocene Volcanism

People living on and near the flanks of Mt. Edziza must have had to cope not just with ice and climatic changes, but also, from time to time, with the fiery activities of an active volcano. Volcanic vents began construction of the Edziza and Spectrum Ranges during the Miocene, and lava extrusion, cindercone construction, and tephra discharges have continued up to the late Holocene (Souther 1970). There are at least 10 recent-looking cinder cones around the flanks of the main peak (Fig. 20), each of which could well have contributed significant pyroclastic and tephra deposits to the surrounding areas. Unfortunately, there are no reported studies of local Quaternary volcanism and, before our work this summer, there was apparently only one radiocarbon sample directly pertaining to post-glacial volcanic events on Mt. Edziza. This yielded a date of 1340 ± 130 B.P. (GSC-566) on charred wood found in basaltic tephra (Clague 1981) which Souther (pers. comm. 1981) interprets as also dating the eruption and discharge of a major blocky basaltic lava flow from Eve Crater, a very prominent and classically shaped cinder cone at the north end of the main plateau. This lava flow caused the damming of Buckley Lake at the northern end of the massif (Fig.

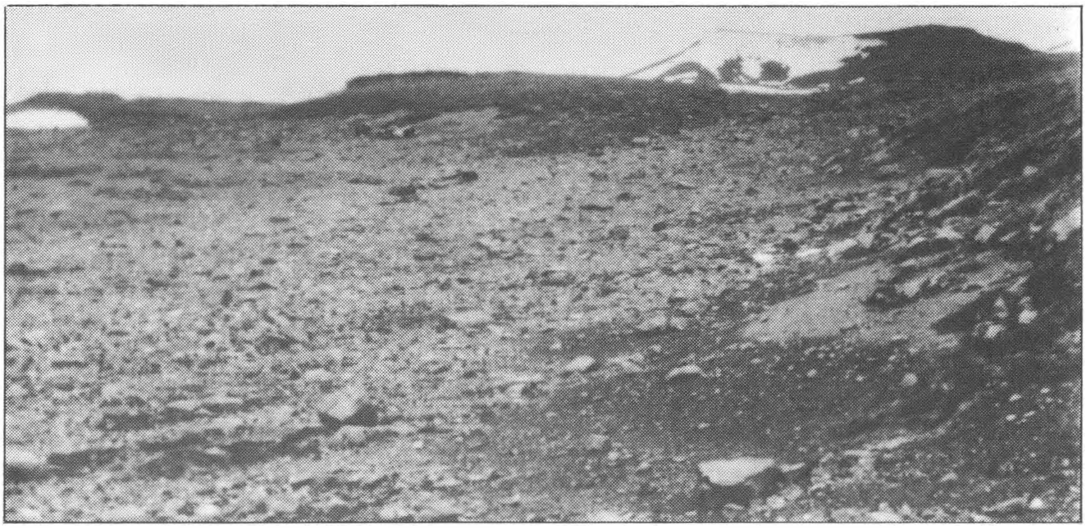


Fig. 19. Nivation flow, EP 56, Ball Creek Valley.

Fig. 20. Cocoa Crater, recent cinder-cone, southwest flank of Mt. Edziza.

2), and turned much of the northern portion of the main plateau into a barren moonscape of twisted rock. Other major lava flows were discharged from the vicinity of Coffee Crater at the southern end of the main peak, travelling both east and west. One of these in-filled a valley now occupied by the south branch of Taweh Ck., flowing as far west as Mess Creek (Fig. 21). Another may have originated under Neoglacial ice of the main peak of Mt. Edziza (Souther pers. comm. 1981). Unfortunately none of these events are directly dated.

In the course of archaeological investigations we were interested from the outset in identifying and dating tephra layers in the Edziza region as a means of establishing chronological marker horizons. Highly visible light rhyolitic ash was noted in several contexts, but the most important development was the discovery of 4 stratigraphically distinct ash layers in the Raspberry Bog* peat section (Figs. 4, 15 and 22).

The Raspberry Bog section consists of a ca. 1.5 x 3 m cut, a maximum of ca. 2 m deep, excavated in from the edge of a small stream gully on site EP 84. The bog itself occupies a low sloping sandy terrace surface a minimum of 4-5 m above Point Creek (ca. 1462 m). Because of the sloping surface of the bog, and its relatively high elevation, the cut was extended well back into the bog in order to determine if there was any evidence of solifluction which might have disturbed the stratigraphic relationship of the ash layers. The only indication of such disturbance consisted of an apparent solifluction fold in the highest ash layer (Ash 4), exposed in the east wall of the cut. All other ashes maintained their vertical relationships as consistent unbroken horizontal layers throughout the length and width of the cut. Two sets of samples were collected from the bog section. One consisted of a complete ca. 12 cm square monolith removed intact from the north wall, 20 cm west of the section shown in Fig. 22. This ca. 1.6 m long column has been stored for future analyses, following removal of small samples for palynological studies now being conducted by Dr. R. Mathewes. A further set of peat and tephra samples was removed from the northern end of the east wall for petrographic studies, and radiocarbon dates. Six radiocarbon peat samples have now been processed from the east wall bog section and although the dates are not as perfectly consistent as one would like, they are still useful contributions to understanding the sequence of late Holocene ash eruptions from Mt. Edziza.

Ash 1 is the lowest visually recognizable tephra layer in the section; about 2 cm thick, it occurs about 50 cm below the surface. One peat sample yielded a date of 4560 ± 170 B.P. (SFU-166) just

Fig. 21. Lava flow in Taweh Creek valley, Main Plateau. View northeast towards Edziza peak.

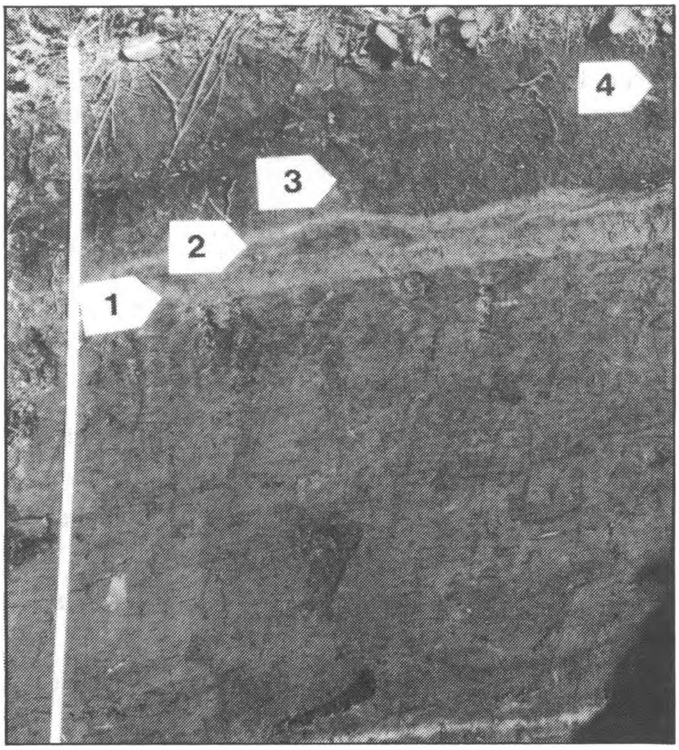


Fig. 22. Raspberry Bog section showing numbered tephra layers. Thin light bed near base is a discontinuous lens of basal glacio-fluvial sediments.

beneath this ash, while a date of 4990 ± 130 B.P. (SFU-163) was received from directly above the ash. About 5 cm above the latter date, and directly beneath Ash 2, a third peat sample yielded an age of 4630 ± 100 B.P. (SFU-164). Ash 2 is directly overlaid by a visually very distinctive tephra layer (Ash 3) which we referred to as "the cinder layer" in the field. It is characterized by coarse granule to small pebble-sized lumps of red-brown iron-rich pumice-like lava, although the actual grain size distribution is highly bimodal, including a substantial proportion of particles less than .125 mm in size. The bimodal size range suggests two different methods of transport; the coarse fraction, which is too large for normal aeolian transport, being distributed through pyroclastic explosion, while the fine fraction was wind-carried. This "cinder layer" was also recognized by its distinctive texture in a number of archeological sites in Bourgeaux Valley. A sample directly above Ash 3 produced a modern date (SFU-167), indicating that solifluction disturbance or modern root growth had affected this area. Another sample about 15 cm higher, just below the surface, and just above the highest ash (Ash 4) also produced a "modern" result (SFU-165).

Although the radiocarbon dates bracketing Ash 1 are not perfectly consistent with their stratigraphic position, they overlap at 2 standard deviations. Considering that all three samples are separated vertically by less than 20 cm of peat and tephra, a relatively short period of overall time may be represented. A problem in dating peat is that normal pre-treatment in hot NaOH to remove recent organic contaminants cannot be carried out. Therefore, all or some of the peat samples may be too recent by variable amounts due to the presence of recent roots and other contaminants. However, the three dates in question may be brought into stratigraphic alignment by adjusting the two lowest samples by one or two standard deviations. The highest age determination (4630 ± 100 B.P.) does not need to be adjusted, regardless of the final fixing of the two lowest dates, which seem to involve the most glaring inconsistencies. The following correlations are suggested:

Correlation 1			Correlation 2
Original Date	Adjustment		Adjustment
		Ash 2	
4630±100	no change		no change
4990±130	no change		4860 (-1*s*)
		Ash 1	
4560±170	4900 (+2*s*)		4900 (+2*s*)

While either correlation is possible, with or without adjustment of the 4630 date, I believe that correlation 2 is most probable, because an age of 4860 B.P. immediately above Ash 1 is supported by a charcoal date of 4870+120 B.P. (SFU 129) obtained on Component 2 immediately above the lowest ash in excavated site EP 80, about 1 km east of Raspberry Bog. This site is discussed in detail in a later section. Another radiocarbon determination from EP 80 of 3910±120 B.P. (SFU 147) probably dates a post-"cinder" occupation and provides the only upper limit currently available for ashfalls 2 and 3, given the apparent "modern" date of the two highest samples in the Raspberry Bog sequence. The same general sequence of tephra deposition, undated, is also duplicated at site EP 96, directly across Bourgeaux Valley from Raspberry Bog.

Thus, evidence from Raspberry Bog and adjacent sites in Bourgeaux Valley indicate multiple tephra deposition events in the last 5000 years. There were apparently no significant ashfalls between about 5000 and 8500 B.P., which may indicate that volcanic activity was quiescent during this period, or that ash distributions did not reach the sampling site. The oldest ashfall dates between 4860 and 4900 B.P., according to the suggested correlation of 14C samples; this was followed by Ash 2, and directly thereafter by the "cinder" layer (Ash 3). These last two layers are not separated by any interval of peat formation at Raspberry Bog, and in EP 80 (the only other dated locality) they may be mixed as a single deposit. Ash 2 and Ash 3 were probably deposited between 4630+100 and 3910±120 B.P., although the upper limit is uncertain (see the discussion of EP 80 stratigraphy and dates). Ash 3 included a major fall of coarse ejecta, mixed with fine airborne ash. If Ashes 2 and 3 are considered part of the same eruptive event, it was a multistaged process, probably beginning with a fine ashfall less than 1 cm thick (Ash 2), leading into a combined explosive ejection of coarse ash and lapilli, mixed with and perhaps immediately followed by a final fine ashfall. In Bourgeaux Valley the "cinder" layer is of variable thickness in different exposures, probably due to redepositional processes, but in places was observed over 30 cm thick. In Raspberry Bog it possesses a uniform thickness of about 16 cm, which in this context, is probably indicative of the true magnitude of the original airfall. As noted previously, this deposit has a very characteristic dark red-brown colour (10R 2.5/1) and coarse granular texture which makes it an easily recognized marker horizon, at least in Bourgeaux Valley. A final ashfall visible near the surface of the Raspberry Bog section is not yet well dated, due to apparent recent contamination or solifluction folding noted earlier. It probably post-dates 3910±120 B.P. and, if any reliance can be placed on a direct correlation between thickness of peat deposit and age, may date to approximately 1000 B.P. The fact that it was deposited prior to a cold episode may be indicated by the later solifluction disturbance, and a date of ca. 1000 B.P. would place this thin and weakly visible ashfall a few centuries before the peak Neoglacial events of the "Little Ice Age." It should be noted that no existing permafrost was encountered in any portion of the Raspberry Bog section, which may imply that the Neoglacial peak was locally significantly cooler than present, if the presumed solifluction fold is, in fact, evidence of past periglacial conditions.

The Raspberry Bog section is located about 25 km SSW of the main peak of Mt. Edziza (Fig. 23), and about 15 km SSW of the nearest cinder cones around the south flank of the main peak, including Coffee Crater. One or more cinder cones around the main peak are probably the most likely sources of the tephra observed in the peat bog, although this question must await lithological and trace element "fingerprinting." Souther (1970) also notes at least one Recent (?) cinder cone in the northern Spectrum Range about 7 km SW of Raspberry Bog (Fig. 2). We did not observe this feature ourselves, but it may also be a source candidate for one or more of the Bourgeaux Valley ashes. Another possibility, less likely than any of the above, is that one or more of the ashfalls derives from a source entirely distinct from the Edziza-Spectrum Range vents, maybe in Alaska. There is perhaps some chance that the highest, less well dated Ash 4, may represent a previously unrecognized southern plume of the Whiteriver ash (ca. 1200-1400 B.P.), although presently I view this as distinctly improbable. It does not appear that any of the rhyolitic Raspberry Bog tephras correlate with the previously reported northern Edziza basaltic ash dated 1240 B.P. (Souther 1970).

The regional and even local distribution of any of these tephras is largely unknown. No visually obvious and definite ash layers were noted in Artifact Valley, even though excavations at EP 1 spanned at least 3000 years and a variety of sediment types. However, even in about the last 3900 years, the only tephra which should definitely be present, assuming that Artifact Valley lay within the plume area, is the latest and most weakly defined Ash 4. The scale and distribution of this event may have been inadequate to produce a clearly visible bed at EP 1, which is about 6 km southeast of Raspberry Bog, particularly since this ash was also not observed at EP 80.

One difficulty and caution for future research in ash identification in the region are the often relatively thick and well defined light grey elluviated (Ae) horizons formed in ferro-humic podzols. This soil type is directly associated with forested zones of the region (Young and Alley 1978) and was observed throughout treed portions of EP 1, but not in any areas lacking arboreal vegetation. A sample from an elluviated pedogenic horizon, formed in tephra-rich parent material, might not be readily distinguishable from an ash, even under optical microscopy. It is possible, therefore, that true ashes and Ae horizons may sometimes be mutually confused in this volcanic terrain, during cursory surficial surveys. However, this is definitely not a problem with any of the tephras in Raspberry Bog or EP 80, discussed above.

Since our work in Artifact Valley was prior to our first clear recognition of distinct tephra layers in Bourgeaux Valley, it is possible that we may not have recognized them in the earlier study area. However I consider this unlikely, particularly for the coarse cinder layer (Ash 3), since the location of tephra marker beds was a clearly stated goal from the outset of the project. It is most likely that the absence of clearly defined ash layers in Artifact Valley is due to: (1) that most archaeological sites examined in that area were surface localities, or; (2) were too recent to possess any tephra except possibly Ash 4, or, (3) fell outside of main plume areas. The same might be said for the Floatplane Lake area where also no tephra layers were observed, although we conducted no excavations in that region. Despite the fact that our time on the Main Plateau of Mt. Edziza was limited, we did observe a thick buried rhyolitic ash layer along the edge of the escarpment overlooking Mess Creek in one location.

The prevailing winds in the Edziza region are generally westerly, so it is likely that local ashfalls are much more widely distributed east of the mountain range than in any other direction. So far no Edziza tephra layers have been recognized or reported beyond the Edziza Range; however, they probably will eventually be found. To date it seems to have been general practice to equate any late Holocene volcanic ash horizons found in the Yukon or Northwest Territories with the Whiteriver Ashfall. However, some caution may now be in order, given the demonstrated presence of several Mt. Edziza tephra events in this period, and any ash deposits should be identified to source before using them for archaeological correlations.

The general environmental effects of volcanic ashfalls have been subjects of considerable discussion (eg. Workman 1979; Dumond 1979; Thorarinsson 1979). No direct evidence exists in the Edziza region for any ecological disturbances induced by the tephra events, although some vegetational responses may eventually be revealed by palynological studies. The macroscopic characteristics of peat formed above and below the various ashes in Raspberry Bog appear identical and there is no evidence of any significant hiatus in organic deposition other than the ashes themselves. Nevertheless, it seems very probable that the Ash 2 and 3 events, representing as they apparently do a continuous violent eruptive sequence spanning perhaps several decades or more, culminating with a rain of coarse scorious ejecta burying the landscape 16 cm deep in the vicinity of Raspberry Bog, had a profound negative effect on the local environment. The coarse ejecta, in particular, was likely distinctly unpleasant to experience in the open, being probably akin to a rain of hot heavy hail. After this event the land surface must have taken some time to restabilize, as thick sediment loads were discharged in streams and washed down slopes (assuming a summer season deposition; the immediate effects of a winter deposition are less clear, see Workman 1979). A sediment which seems texturally very similar to the coarse ejecta of Ash 3 still currently mantles considerable areas of the ground around the mouth of Caribou Valley* and the west entrance to Raspberry Pass, where it forms unstable surface exposures and active flows on slopes. It seems very probable that human occupation of at least the Raspberry Valley - Bourgeaux Valley area must have been severely curtailed during these events and for some years after.

Finally, it is worth noting and commenting briefly on the fact that all dated tephra events so far known in the Edziza region appear to just pre-date the Hypsithermal-Neoglacial climatic transition, or are Neoglacial in age. I will leave it for others to argue whether repeated late Holocene dust eruptions in this general region of North America, including the massive Whiteriver ashfall, might have had something to do with a scale and severity of local Neoglacial events possibly surpassing those of other regions. More pertinent to the present study is the fact that possibly serious volcanic disruption of local alpine environments began in the Edziza-Spectrum Ranges at about the same time that a trend towards cooling temperatures may also have been setting in. The total effect of the major Ash 2 -- Ash 3 event and the onset of the Neoglacial may have been very serious for aboriginal occupants and/or users of the mountain ranges and their resources.

ETHNOGRAPHY

The Mt. Edziza and Spectrum Ranges now generally lie within the traditional territory of the Tahltan Indians. This Athapaskan group shares close linguistic ties with their nearest neighbours to the east, the Kaska of the upper Liard, who in turn form part of a linguistic continuum with the Sekani and Beaver of the upper Peace River drainage (Krause and Golla 1981). North of the Tahltan lie the Tagish, a Tlingitized Athapaskan tribe on Taku River and Atlin

Lake, while to the west along the coast of Southeast Alaska live various Tlingit subtribes. Historically the Tlingit controlled the lower course of the Stikine River upstream to about the vicinity of Telegraph Creek, where they came to fish for salmon, dry it in the warm winds of the Stikine Canyon, and trade with the Tahltan. South of the Stikine, tribal boundaries and territories were apparently in a state of flux in late prehistory and it is not directly obvious who originally controlled much of this interior territory. The Tsetsaut, a little known Athapaskan group at the head of Portland Canal, who were in the process of being assimilated by the Niska when observed by Boas at the turn of the century (Duff 1981), had earlier probably competed with the Niska for control of the upper Nass drainage and Meziadin Lake area. The Tsetsaut may at one time have claimed all or part of the Edziza-Spectrum Range, although there is no direct proof of this. The Niska-Tsimshian themselves may have also, at least occasionally, travelled into the Iskut drainage. By the time of the first significant European occupations of the Stikine basin, the Tahltan appear to have been in firm control of the uplands, plateaus and river valleys upstream from Telegraph Creek, while the Tlingit controlled the lower course of the river and adjacent floodplain (Emmons 1911, MacLachlan 1981). However, there may be some question as to the age of this pattern. Several ethnographers, including Emmons (1911), suggest that originally a series of small bands or families moved down the Stikine and Tahltan rivers from homelands in the north and east and, together with interchange with the Tlingit, formed the present Tahltan tribe. The implication is that these events occurred in the relatively recent past, although direct data to support this assumption are not given. It seems likely that there has been a slow and constant movement and interchange among Athapaskan speakers and neighbouring non-Athapaskans for a long time in this area. The very productive salmon habitat of the middle Stikine, coupled with the resources of the extensive alpine plateaus, including obsidian, would suggest that people have probably occupied the region continuously since the late Pleistocene. Indeed its relative richness may have always made it a zone of contact and potential competition or fusion between groups, as implied by the historical Tahltan-Tlingit interface. However, this situation also means that for any given time the ancestors of any or all of the historic tribes of the region (as well as groups with perhaps no direct historical or local descendants) might have been responsible for observed archaeological remains, and that prehistoric ethno-linguistic identification will always be problematical.

While there may be some evidence to indicate that the Tahltan are relatively recent arrivals in the middle Stikine drainages, they are the only group ethnographically known to have utilized the

Edziza-Spectrum Ranges. Unfortunately, published data pertaining to traditional subsistence and settlement patterns are rare and incomplete, and only a few scattered references appear to make specific mention of the mountains. The most complete published ethnographic descriptions of the Tahltan are those by Emmons (1911) and Teit (1956), recently summarized by MacLachlan (1981). Ongoing research by Albright (1981) shows promise of improving the data base. In brief, it seems that the Tahltan spent summer along the main drainages fishing and processing salmon, and spent varied portions of the spring, fall and winter hunting and trapping in the mountains and plateaus. However, a pattern of winter trapping for furbearers might be partly a post-contact fur-trade phenomenon. Nevertheless, springtime hunting and trapping of both large and small game in mountain regions seems to be a pattern well recorded in Tahltan folk-tales, while Albright (1981) suggests that mountain marmot-hunting was mainly done in the fall. Teit (1919, 1921a and b) recorded a number of Tahltan oral traditions collected in the early 1900's. These provide some interesting glimpses of traditional use of alpine areas.

Most of the traditional tales recorded by Teit (1919, 1921a and b) mention one or more animals as food, enemies, or supernatural elements. Of those 15 different species mentioned as game or in some way associated with food, caribou is by far the most frequent (10 references). Next are salmon, marmots, mountain sheep, and bear, each mentioned 3 times. It is interesting that of these 5 possibly most important game species, only 1 (salmon) is found only in the valleys. Caribou and mountain sheep are today mostly restricted to alpine and subalpine areas, although aboriginally the former species at least, probably had a much wider distribution. Marmots are mainly subalpine-alpine, while bears occur in all zones. Thus, if the evidence of folk-tales can be treated in this way, and it is possible that they more accurately reflect precontact aboriginal culture than can any post-contact ethnographic observations, many of the most important game species were available mainly or solely in the alpine-subalpine zones. The importance of caribou to the native way of life seems certain. One story recounts how in the beginning of time contents of a caribou stomach became the moss and brush; the stomach and intestines became the canyons; caribou bones became rough rocky ground, and the meat became the marsh and lakes (Teit 1921a).

The territory of the Tahltan Indians is rugged country, even near the river valleys, and several stories indicate the importance of physical strength and endurance in hunting and survival. Youths trained by running and climbing steep slopes, and one story describes how Tahltans were able to escape from some angry Tlingits by being able to run uphill faster than the "less fit" coastal dwellers (Teit 1921a). Several stories describe natural, and supernatural, hazards encountered in hunting in the high mountains, such as snowslides. One man survived an area where snowslides had already killed several hunters by becoming "something" so small the snow could not hurt him. A relatively recurrent theme is the existence in the mountains of semi-human, semi-supernatural people who would attack and eat people, and who behaved in other strange ways. Teit (1921b) uses the term "Duciné" to describe cannabalistic wild people who inhabited mountains to the east of the Tahltan, who possessed strong shamanistic powers and "travelled in clouds of down." They used their magic to try to entrap and kill solitary hunters in the mountains, and are frequently mentioned as shooting arrows in great numbers. One story, which pertains to the origin of "Duciné" is worth paraphrasing in some detail:

> (The Duciné originated from) an evil boy who killed people. His mother was Indian and his father unknown. When just a tiny boy he made arrows; as he grew up he made them larger and put stone heads on them...One day he was playing a shooting game with other boys and shot one of them. The people were angry...The boy ran away and his mother chased him...He shot her through the breasts...He became completely wild now, and never returned to the people. He went to the mountains where obsidian is abundant and made many arrow-heads. Whenever he made one which did not suit him he threw it away. He spent all his spare time making arrow and spear heads. All the unfinished arrows and spear heads found here and there scattered over the country were made by him. They were discarded in his travels around the country and when hunting. He used no flakers of any kind. He flaked the arrowheads with the palms of his hands which were of bone.
>
> (Teit 1921b: 353)

This story suggests several interesting inferences concerning the archaeology of local obsidian sources. First is the indication that large numbers of obsidian preforms (i.e., partly finished spearheads and arrowheads which did not "suit" their maker) were already scattered throughout the area, and sufficiently obvious to require some explanation by at least late prehistoric-protohistoric times. Second is the important inference that the Tahltan story-teller did not accept those pieces as the products of Tahltan workmanship -- instead, they had to have been made by strange semi-Indian people who did not flake stone in the same way as the Tahltan (did not use bone flakers). This may lend some further credance to the notion that the present Tahltan are relatively recent arrivals in the area, who encountered and had to try to explain the obvious and abundant remains of previous, "different," lithic technologies around the obsidian sources. One other story, this one Tsetsaut, also links the semi-human mountain people with flakeable stone, albeit in a rather different manner. As recorded by Boas (1897), the Tsetsaut cannablistic mountain-dwellers were called "xudelê," and like the "duciné" (probably the same word) of the Tahltan legends, hunted and set traps for men. However, one day, some xudelê who came to a Tsetsaut village for dinner (apparently thinking they would not be recognized) were killed by the Tsetsaut who mixed, pounded, powdered "flint" (possibly obsidian? -- i.e., ground glass) into their dog-meat soup. Considering that *any* references to flakeable rock are rare in the oral traditons of the Northwest Coast region, these two stories would seem to imply some rather firm connection between lithic raw materials and non-human -- i.e., "different" -- peoples, in the minds of some historic tribes.

Besides the reference to the obsidian sources described above, the published Tahltan legends make few recognizable specific references to Mt. Edziza itself. One story, however, describes early spring marmot hunting "south or southwest of the head of Raspberry Creek." This is probably the "Central Plateau" area, immediately south of Raspberry Pass (Fig. 2), which would mean that the marmot hunting ground was very close to the major obsidian source of the area (Goat Mountain, to be described in a following section). A Tahltan visitor to our project in 1981 stated that people would come to the Raspberry Pass area in the fall for marmot and ground squirrels, and that this area was known as an obsidian source. Marmots were considered important, both for skins and meat, and successful marmot hunting involved a number of winter taboos and restrictions (Teit 1921b). These fat "whistling sentries" of the mountains, sitting upright in front of immense burrows, were apparently considered partially human in character and thought to dwell in large communal houses deep in the mountain, with closing doors. The Tahltan considered marmots to be more plentiful south of the Stikine than to the north (Teit 1921a). Our own observations suggest that these animals, and ground squirrels, would provide plentiful and relatively easily captured meat for small groups of people, at least until they were hunted out in a given area.

There is no specific recorded reference to volcanic activity in the published Tahltan legends; however, there are some indirect references which might pertain to such events, suggesting that any eruptions of Mt. Edziza are sufficiently far removed in time to cloud them in supernatural symbolism. However, Albright (pers.

comm. 1981) reports a recently collected story that rather explicitly describes volcanic activity in the area. Several of Teit's stories describe giant supernatural toads which lived in the hinterland of Tahltan territory. The name for at least one of these toads is transcribed by Teit (1919) as "E'dista." The toads were believed to live partly underground and partly underwater and their breath would come out "through holes and cracks in the mountains." One toad's breathing hole was legendarily at the top of an (unnamed) mountain. The toads were also legendarily associated with "fire running over water" and fire consuming a man (Teit 1921b). While this can only be left as an undemonstrated hypothesis, it is interesting that giant supernatural subterranean forces, associated with mountain "breathing holes" and deadly fire, would have a name which seems phonologically similar to "Edziza."

The original origin and meaning of the name "Edziza" seems somewhat unclear, although there is no shortage of modern interpretations. Teit (1919) refers to a mountain on the Stikine River called "Atixza," "*also* known as Glacier and Sand Mountain." Some present local residents of the Telegraph Creek area still call Mt. Edziza "Ice Mountain." I was told by a young Tahltan visitor to our project in 1981 (J. Frank) that "Edziza" means "ashes in the sand." Thus, while there may be some agreement that the word refers to sand (i.e., tephra?) and ice, the exact etymology and meaning of the name "Edziza" seems unresolved. Finally, there may be some slight chance that the "edz" prefix is a derivation of the widespread Athapaskan word "batz" or "atz" for black flakeable rock (i.e., obsidian) which is associated with major lithic quarry sites from Alaska (e.g., Batza Tena) to central British Columbia (e.g., Batzaeko).

In sum, traditional Tahltan culture was orientated to both river and mountains, with major subsistence derived from both spheres. Caribou and marmot hunting were probably major activities in the uplands, which may have been synchronized with obsidian exploitation. Some Tahltan stories suggest that they associated widespread cultural remains around the obsidian sources with "strange" non-Tahltan peoples, who worked the material differently than did the Tahltans. Many minor references indicate that the Tahltan were familiar with the obsidian sources, which they used for various implements and weapons, but there is very little detail preserved in the published record, and none pertaining to the actual process and mechanism of obsidian extraction.

GENERAL RESEARCH DESIGN

Objectives

Archaeological investigations conducted in the Edziza area between July 8 and August 20, 1981, had four primary goals. As stated in the original research proposal these were the following:

1. *To develop an understanding of the nature and scope of aboriginal utilization of northern alpine and subalpine areas.* Considering the generally mountainous character of British Columbia, very little archaeological research has been conducted outside of low-lying valleys and coastlines. We were therefore interested in locating and mapping site distributions, searching for specialized hunting complexes (e.g., for caribou), and in determining the relationship of the aboriginal settlement pattern with natural avenues of communication into and through the mountains.

2. *To develop a preliminary cultural chronology for northwestern British Columbia, including clarification of the previously defined "Ice Mountain Microblade Industry"* (hereafter referred to as the "IMMI;" Smith 1974a, b, Smith and Calder 1972), and to develop some understanding of the nature of the transition between microblade and later non-microblade cultures in the area.

3. *To study obsidian quarrying and distribution patterns, to determine spatial and temporal variations* in the distribution of both "phenotypic" colour variants and chemical types of obsidian, in and around the quarry sources.

4. *To make preliminary studies of paleoenvironmental and volcanic events which might be significant to understanding and correlating human occupation in this area.*

We were fortunate in being able to obtain field data bearing on all these goals, as will be described below.

General Field Procedures

General field procedures involved establishment of sucessive base tent camps in 3 locations, initially brought into the mountains by helicopter from the nearest road point at Edentenanjon Lake. Camp was first set up in Artifact Valley (July 8 to July 26); moved to Floatplane Lake (July 26 to August 4); and finally shifted to

Raspberry Pass (August 4 to August 20). Each camp served as a base of operations, including surveying and sometimes limited excavations in the surrounding area. The 1-3 weeks spent at each base camp permitted thorough surveying within one day's hike of the camp, and preliminary excursions into areas up to 2 day's hike distant. The main crew consisted of myself and two graduate students (Eric Damkjar and Gary Warrick) augmented by two high-school students from Telegraph Creek (Bob Frank and Dale Day) who worked with us for the first 2 weeks in Artifact Valley, and by a high-school teacher and former S.F.U. archaeology student from Prince George (Richard Gilbert), who ably assisted us between July 20 and August 4. We were also visited and assisted by Sylvia Albright, who was conducting ethnographic research at Telegraph Creek, and 3 of her Tahltan assistants, between July 23rd and 26th. Work was fairly continuous, aided by relatively long hours of light, and days off were taken only as weather or exhaustion demanded -- no more frequently than once every 7 days. Most of our time in Artifact Valley was devoted to excavation of EP 1, originally located in 1977, and limited surveying around Goat Mountain and the Central Plateau. No excavations were conducted in the Floatplane Lake area, our efforts being concentrated on site surveying of Floatplane Lake, Ball Creek and Pass Creek* Valleys, with a single 3-day excursion onto the South Plateau. The Raspberry Pass camp provided a base for surveying of upper Bourgeaux and Raspberry Creek Valleys, and for excavations at EP 80. In addition, extended helicopter surveys were conducted from this camp, onto the main peak and plateau, and other areas not reached on foot. Unfortunately, helicopter availability was much reduced by an extremely severe forest fire season in the lowlands and plateaus to the east of the Edziza Range. Most machines were pre-empted for fire fighting and we were unable to get the extended blocks of helicopter time needed to conduct intensive surveys in the more remote areas. Besides this minor problem, we encountered no significant obstacles to our work, finding the subalpine ecotone a very pleasant area to occupy in comparison to the forested lowlands. Weather was generally clear and often warm, although the last snowfall on July 8 and the first on August 18 did not add up to a very long summer. In the following sections, survey and excavation methodology will be described in greater detail.

Analytical Perspectives

Archaeological analytical methods employed in this report are probably best described as "traditional." I have tried to utilize all the data we obtained to what I hope is an optimum degree, in the formulation of primarily cultural-historical interpretations and hypotheses. As pointed out in the appropriate sections, much of the data, such as surface collections, is subject to varied interpretations. Hopefully, when one interpretation is preferred over others in this report, the reasons for this selection are made clear.

Dating of a varied range of materials, both surface and sub-surface, is always a problematical aspect of archaeological analysis. While we were fortunate in obtaining a relatively large number of radiocarbon determinations (12) bearing directly or indirectly on the archaeology of the Edziza region, many questions of chronology are still left uncertain. Considering that the bulk of the artifacts found in the area are of obsidian, hydration analysis might have been employed as a dating method. However, no hydration studies have yet been conducted, for the following reasons: (1) There is still considerable lack of confidence in the technique, related to the markedly different hydration rates that result from variations in even minor factors, such as length or position of surface exposure vs. burial; paleoclimatic (and paleo-volcanic) effects; unpredictable forest fires and cultural heating; and the general uncertainty of a chemical process when "standard temperature and pressure" cannot be assumed (E. Nelson, pers. comm. 1981). (2) Even if all of these problems are ever resolved, and a standard hydration rate developed for the Edziza area, it could never be used in the same way as radiocarbon to obtain absolute dates on individual specimens. If the technique has any future potential validity and utility, it will be as a means of obtaining averaged relative age estimates of large sample populations, collected from identical passive contexts (cf. Tite 1972). For these reasons, the obsidian hydration "dates" obtained earlier by Smith (e.g., 1971) for his Stikine River materials are essentially meaningless, and there can be no advantage in continuing to employ a technique whose results cannot be treated much differently than age "guesses." Of course, if in the future new developments in hydration dating suggest that it may be relevant, the specimens collected in 1981 can still be tested.

In addition to "traditional" archaeological procedures, X-ray fluorescence and palynology will also play a role in some aspects of analysis of the Edziza collections. XRF studies, to chemically characterize and identify obsidian types, will be applied to archaeological collections to attempt to trace spatial and temporal trends in obsidian use. Palynological and plant macrofossil analysis of the ca. 8500 year long Raspberry bog section, to be completed within about one year by Dr. R. Mathewes of Simon Fraser University, will provide an invaluable paleoenvironmental record with which to compare and align the archaeological sequence.

Previous Investigations

The only other reported archaeological investigation in the Edziza-Spectrum Ranges was a preliminary 6 day reconnaissance of a portion of Artifact and Bourgeaux valleys undertaken in 1977 by Fladmark and Nelson. This served to indicate the presence of relatively dense cultural remains, including microblades and a core of the Ice Mountain Microblade Industry, and several minor obsidian outcroppings. During this initial survey we first located several of the sites reported in this paper, including EP 1 (called "Site-Locality 3" in 1977); EP 16 ("S-L 4"); and EP 17 ("S-L 1") (Fladmark and Nelson 1977). The 1977 survey was largely prompted by J. Souther, a volcanologist with the Geological Survey of Canada, who has spent many years conducting research in the Edziza area. Souther reported observing archaeological remains in the mountains, and has long been interested in seeing archaeological research conducted in the region (e.g., Souther 1970).

Most of northern interior British Columbia has seen little archaeological research. However, in 1969 and 1970 Smith (1970, 1971, 1974 a, b; Smith and Calder 1972; Smith and Harrison 1978) conducted some excavations along the Stikine River upstream from Telegraph Creek. This work demonstrated that there were rich archaeological resources in the area, and that some of them were of a rather distinctive character (e.g., the "Ice Mountain Microblade Industry"). However, no informative descriptions of the sites, their contents, or age were ever published, and on the basis of Smith's work all that can be said is that certain distinctive core forms were found; meaningful cultural associations and dating being unknown. In 1978, an archaeological survey was directed by Diana French and myself along the Stikine River between the confluences of the Tanzilla and Chutine Rivers, including the Telegraph Creek area. This served to confirm the presence of large numbers of sites, and to relocate some of Smith's earlier excavations (French 1979). Surface collections from this project also verified the presence of the IMMI; however, no further excavations were conducted. Since 1978, several archaeological surveys have been carried out in the middle and upper Stikine River (e.g., Magne 1982; Friesen 1982) in association with the proposed "Site Z" Stikine Canyon hydro-electric dam. However, relatively few prehistoric sites have been located in this rugged and forested portion of the river valley, and none apparently indicate any significant time-depth.

SITE SURVEYING IN THE EDZIZA AREA

Survey Methods

Archaeological surveying had the primary goal of locating sites and assemblages which might yield cultural-historical data, and information about the nature of prehistoric alpine-subalpine occupations in space and time. Efforts were designed to optimize actual site verification by judgmentally concentrating on those areas which, through increasing experience, demonstrated greatest site densities. Surveying was not specifically orientated to cultural resource management goals, although hopefully the data obtained will be of some use for those purposes. For these reasons, and because we were effectively limited in survey coverage to areas accessible by 1-2 days hiking around the base camps (Fig. 24) with occasional much more extensive helicopter overviews, survey data are concentrated or focussed in 3 main regions: (1) Floatplane Lake; (2) Artifact Valley and (3) Bourgeaux-Raspberry Valley (Figs. 2, 14, and 16). The first region is relatively distant from known obsidian sources and almost entirely above tree-line; the second and third areas are major valleys which penetrate deep into the Edziza-Spectrum Range close to the most important sources, and possess extensive areas of subalpine parkland and forest. As noted earlier, base camps were established by helicopter in each of these three areas, and maintained for 1-3 weeks, while survey and/or excavation was conducted in the vicinity.

Site surveying consisted of intensive ground traverses by small crews of up to 5 members, although more frequently only 1-3 individuals surveyed while the other(s) remained at or near camp carrying out other functions. Ground coverage was maximized by walking in line abreast or as multiple parties when possible, separated at times to the limit of visibility, and an effort was made to systematically examine as much ground as possible around each base camp. By this means all major inhabitable surfaces (i.e., those not steeply sloping) were surficially examined within a 1-day return hike of each base camp, and more extensive but less complete reconnaisance to a considerable distance beyond that. Given the time required for note-taking, mapping, surface collection, and other activities as each site was discovered, 25-30 km was the maximum distance we were able to travel in a single long day. I am confident that most major surface clusters of lithic materials within these limits were located.

Site Definition

Definition of discrete "sites" and site boundaries is a traditionally thorny problem in archaeological surveying, particularly

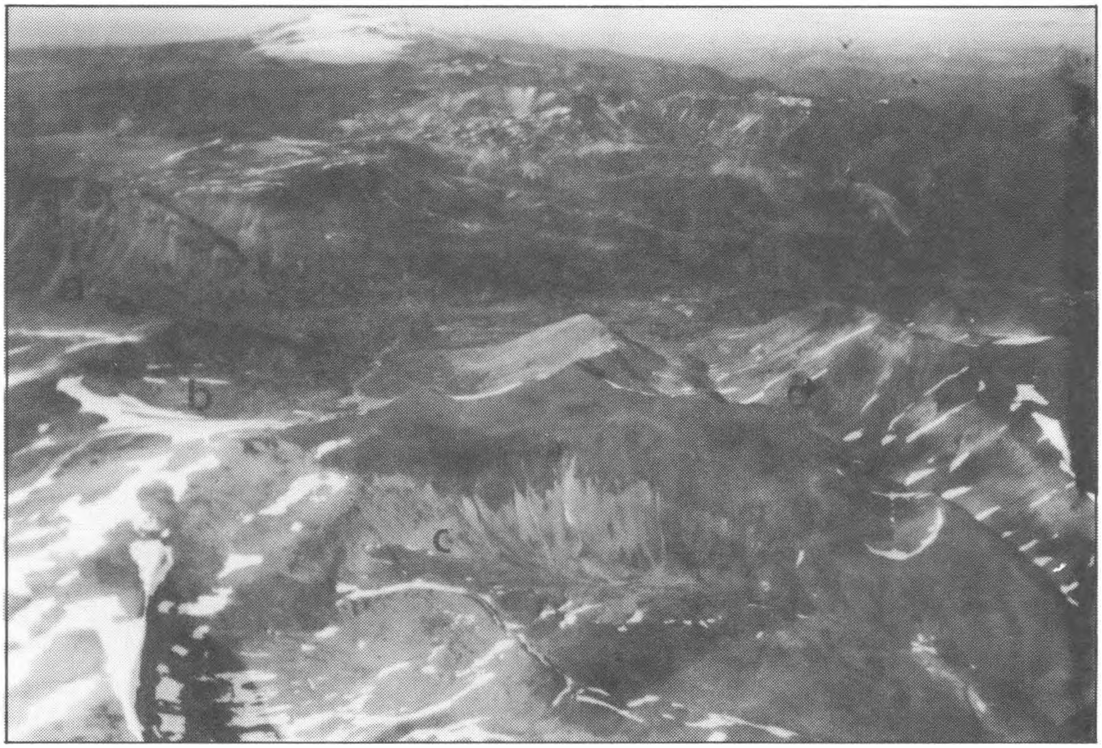


Fig. 23. Aerial view over Bourgeaux Valley towards Mt. Edziza peak. a. Raspberry Pass, b. Point Valley, c. Goat Mt. cirque, d. Rocky Pass.

Fig. 24. Hiking pass between Floatplane Lake - Ball Creek valleys and South Plateau. View southwest from near summit, South Plateau in distance.

where differential ground exposure may obscure cultural distributions. In and around major lithic quarry-sources this problem becomes greatly amplified by a general abundance and ubiquitous distribution of surface lithics. Also, in most portions of the Artifact Valley -- Raspberry Pass study area, obsidian pebbles are relatively frequent constituents of stream beds and alluvial fans, so that at least small amounts of obsidian were available to prehistoric lithic craftsmen virtually everywhere. Thus, it is not an overstatement to say that most ground exposures larger than a few square meters, in the parkland area of Bourgeaux Valley particularly, were found to contain one or more obsidian flakes. Obsidian detritus is really everywhere, and definition of any specific "sites" becomes a task of defining a particular concentration or clustering of cultural materials in what generally is a relatively rich, widespread, "background" density. This problem is particularly true for the Central Plateau region between Raspberry Pass and Artifact Valley, including Goat Mountain. Here, every non-vertical area not covered by snow seems to possess some scatter of obsidian. For instance, obsidian flakes were observed essentially continuously in the course of a 4-5 km walk across the Central Plateau, northwest from the main Goat Mountain quarry-sources, to the escarpment overlooking Raspberry Pass (Fig. 15). Thus, "sites" located by our survey in the Artifact Valley-Raspberry Pass area are best perceived as "hotspots" or peaks in a blanket general distribution of lithic cultural materials -- in a real sense they are "features" scattered across a very large and complex macro-site, formed by the Goat Mountain quarry-sources and their ancillary occupations, which covers all reasonably habitable ground in the Upper Artifact and Bourgeaux valleys. The Floatplane Lake area, on the other hand, represents a different and perhaps more "normal" site distribution, situated as it is relatively distant from major obsidian sources.

In the Artifact Valley-Raspberry Pass area, sites were defined by clusters of obsidian debitage markedly exceeding the general background density. In practice this was operationally defined as a surface concentration of 50 or more flakes in a 50 m^2 area, or less; separated from any similar cluster by at least 100 m. The separation could be formed by ground cover obscuring observation of intervening cultural occurrences, or by a reduced density of lithic material on exposed ground. In most lower valley situations (below 1500m) ground cover (grass, moss, shrubs or small trees) was the primary factor in defining site boundaries, with the "sites" themselves confined to surface exposures formed by stream banks, nivation hollows and blowouts. In some cases lithic concentrations exceeding the limits of natural exposures were traced by probing through the turf with a knife, or by creating limited artificial surface exposures. However, in general, "site boundaries" are the limits of local exposed surface areas, and must be considered potentially arbitrary. It is quite possible that several site clusters along the valley sides (e.g., sites 67, 68, 85, 80, 82 and 81 along the south side of Bourgeaux Valley, and sites 16, 12, 13 and 14 on the north side of Artifact Valley) would be found members of a continuous site area if the connecting ground surface could be observed. It was not practicable to attempt the type of systematic test-pitting program needed to verify this possibility, nor desirable at this stage of investigation, given its environmental impact.

While it is sometimes possible to infer the original cultural functions carried on at a given "site," these must be recognized as possibly incomplete segments of a much larger cultural fabric whose present day manifestations essentially link all of the Artifact Valley-Raspberry Pass area into a single "super-site."

Site Recording

Previous experience in the Mt. Edziza region (Fladmark and Nelson 1977) had indicated that determining precise map locations of individual sites was going to be difficult due to a combination of terrain ruggedness and complexity, and the relatively poor resolution (contour intervals of 100') of the best available topographic maps. We therefore took particular care in trying to define site locations by multiple compass bearings, altimeter readings, and study of air photos.

Compass and pace maps were made of the general topographic characteristics of each site; number of surface flakes estimated, along with average size and obsidian colour variants present; all modified artifacts mapped with precise surface provenience (methods used included compass and pace; surface grids; chain trilateration, and compass triangulation) and collected. Surface vegetation was also recorded along with overlook and shelter-exposure potential; access to permanent water; access to trails and hunting potential; and other environmental data. In some cases a small test pit was excavated by trowel or knife to get some information about subsurface sediments and stratigraphy, if no natural sections existed. Aboriginal sites were numbered in a provisional series as they were discovered -- EP 1 to EP 115 (EP = "Edziza Prehistoric"). Only one noteworthy historical "site" was recorded (EH-1, in Bourgeaux Valley). These numbers do not relate directly to the Borden System designations, which are noted in Table 1. The provisional field numbers are shorter and easier to use in the text and illustrations, and will be retained throughout this report. Landforms, deposits, glacial limits and drainage features pertinent to understanding the

TABLE 1. List of Sites

Temporary Site No.	Permanent Borden No.	General Location	Approximate Elevation	Site Type
EP 1 ("Wet Ck")	HiTp 1	Artifact Valley	1460 m	multi-component, multi-function
2	HiTp 2	" "	1570	flaking station
3	HiTp 3	" "	1780	" "
4	HiTp 4	" "	1400	" "
5	HiTp 5	" "	1530	" "
6	HiTp 6	" "	1780	quarry-workshop
7	HiTq 1	" "	1850	flaking station
8	HiTq 2	Goat Mountain	1950	quarry-workshop
9	HiTq 3	Central Plateau	1750	flaking station
10	HiTq 4	" "	1720	flaking stat.& cairn
11	HiTq 5	" "	1720	flaking station
12	HiTp 7	Artifact Valley	1450	" "
13	HiTp 8	" "	1480	" "
14	HiTp 9	" "	1500	multi-function
15	HiTp 10	" "	1720	flaking station
16	HiTp 11	" "	1400	" "
17	HiTp 12	" "	1600	camp
18	HiTp 13	" "	1630	"
19	HiTp 14	Goat Mountain	2000	quarry-workshop
20	HiTp 15	" "	2090	flaking station
21	HiTq 6	" "	2030	quarry-workshop
22	HiTp 16	" "	1940	" "
23	HiTp 17	Artifact Valley	1430	flaking station
24	HiTp 18	" "	1420	multi-function
25	HiTp 19	" "	1450	camp ?
26	HiTp 20	" "	1420	multi-function
27	HiTp 21	" "	1450	flaking station
28	HiTp 22	" "	1500	" "
29	HiTp 23	" "	1420	" "
30	HiTp 24	" "	1460	" "
31	HiTp 25	" "	1380	" "
32	HiTp 26	" "	1380	" "
33	HiTp 27	Floatplane Lake	1600	camp ?
34	HiTp 28	" "	1490	flaking station
35	HiTp 29	" "	1500	" "
36	HiTp 30	" "	1480	" "
37	HiTp 31	" "	1510	" "
38	HiTp 32	" "	1510	" "
39	HiTp 33	" "	1510	" "
40	HiTp 34	" "	1480	" "
41	HiTp 35	" "	1510	" "
42	HhTp 1	" "	1450	" "
43	HhTp 2	" "	1420	" "
44	HiTp 36	" "	1600	" "
45	HiTp 37	" "	1540	" "
46	HiTp 38	" "	1540	camp ?
47	--			
48(115)	HhTq 2	South Plateau	1450	camp ?
49	HiTp 39	Floatplane Lake	1510	multi-function
50	HiTp 40	" "	1500	camp
51	HiTp 41	" "	1570	flaking station
52	HiTp 42	" "	1540	" "
53	HhTp 3	" "	1570	" "
54	HhTp 4	" "	1600	camp ?
55	HiTp 43	" "	1510	camp ?
56	HiTp 44	" "	1510	camp ?
57	HhTp 5	" "	1630	camp ?
58	HhTq 1	South Plateau	1540	multi-function
59	HiTp 45	Floatplane Lake	1510	camp ?
60	HiTp 46	" "	1540	flaking station
61	HiTp 47	" "	1600	" "
62	HiTp 48	" "	1510	camp
63	HiTp 49	Bourgeaux Valley	1570	multi-function
64	HiTp 50	" "	1550	flaking station
65	HiTp 51	" "	1510	flaking station
66	HiTp 52	" "	1450	isolated point
67	HiTp 53	" "	1450	multi-function

TABLE 1 (Contd.) List of Sites

Temporary Site No.	Permanent Borden No.	General Location	Approximate Elevation	Site Type
68	HiTp 54	" "	1450	flaking station
69	HiTp 55	" "	1540	camp
70	HiTp 56	" "	1510	multi-function
71	HiTp 57	" "	1540	flaking station
72	HiTp 58	" "	1600	" "
73	HiTp 59	" "	1450	" "
74	HiTp 60	" "	1480	" "
75	HiTp 61	" "	1490	" "
76	HiTp 62	" "	1490	" "
77	HjTp 1	" "	1480	" "
78	HjTp 2	" "	1510	" "
79	HjTq 1	Raspberry Valley	1450	camp
80("Grizzly Run")	HiTp 63	Bourgeaux Valley	1480	multi-component, multi-function
81	HiTp 64	" "	1480	flaking station
82	HiTp 65	" "	1480	" "
83	HiTp 66	" "	1420	camp
84	HiTp 67	" "	1480	flaking station
85	HiTp 68	" "	1480	multi-function
86	HiTp 69	" "	1490	flaking station
87	HiTp 70	" "	1450	" "
88	HiTp 71	" "	1480	" "
89	HiTp 72	" "	1540	" "
90	HiTp 73	" "	1540	" "
91	HiTp 74	" "	1480	" "
92	HiTp 75	" "	1480	" "
93	HiTp 76	" "	1480	" "
94	HiTp 77	" "	1480	" "
95	HjTp 3	" "	1480	" "
96	HjTp 4	" "	1480	multi-component, multi-function multi-component?
97	HjTp 5	Bourgeaux Valley	1410	multi-function
98	HjTp 6	" "	1420	flaking station
99	HjTp 7	" "	1420	" "
100	HjTp 8	" "	1420	" "
101	HjTp 9	" "	1480	camp
102	HjTp 10	" "	1510	flaking station
103	HjTp 11	" "	1420	" "
104	HjTp 12	" "	1420	multi-function
105	HjTp 13	" "	1420	flaking station
106	HiTq 11	Raspberry Valley	1510	" "
107	HiTq 7	" "	1540	multi-function
108	HiTq 8	" "	1510	flaking station
109	HjTq 2	" "	1480	" "
110	HjTq 3	" "	1480	" "
111	HiTq 9	" "	1570	" "
112	HiTq 10	" "	1570	" "
113	--			
114	HjTq 4	" "	1450	" "
EH-1	HjTp 14	Bourgeaux Valley	1350	historic cabin

late Quaternary history of the region were also recorded as a secondary aspect of survey data collection.

Site Classification

Individual sites consisted of numbers of obsidian and, rarely, other lithic items scattered over ground exposures, forming cultural clusters of varied configuration. Organic remains clearly associated with prehistoric occupations were non-existent in all surface sites, with one possible exception (EP 12 in Artifact Valley, where some small fragments of calcined small mammal bone were exposed by a ground squirrel burrow). Features other than apparently clustered or patterned distributions of lithics were likewise non-existent in aboriginal contexts, with three exceptions (EP 1, a possible "house" depression described later; EP 10, a possible rock cairn, on the escarpment of the Central Plateau overlooking Raspberry Pass; and EP 93, where a scattered nondescript stone-ring hearth might be prehistoric in age). Therefore, it was not possible to determine site function (e.g., hunting kill-sites vs. lithic workshops) on the basis of faunal remains, or by the presence of specialized structures (hunting blinds or drive features). As well, trampling and cryoturbation has caused natural edge-damage of virtually all obsidian items, so identification of tools, let alone their function, by use wear or retouch, is difficult and uncertain.

Ethnographic data indicate that a fairly wide range of activities probably took place in alpine and subalpine regions of Mt. Edziza, including hunting of caribou, ground-squirrels and marmots; obsidian exploitation and tool manufacture; and associated camping-maintenance tasks. These activities, and perhaps others, have gone on for at least 5000 years in the areas studied, and probably substantially longer. Therefore not only do individual sites represent incomplete segments of the total "macro-site," but also may be "multi-component." Most surface assemblages cannot be conclusively stated to entirely result from a single occupation, although occasionally a good case can be made for this likelihood (e.g., EP 58). For this reason, no claim is made in the following pages that surface collections necessarily represent sets of coherent, synchronic activities. However, it can be argued that "*in sum*," assemblages from some sites appear to emphasize one particular set of activities, while assemblages at other sites do not. Thus site "A" can be said to be dominated by tools suggestive of multi-purpose domestic activities -- processing and maintenance tasks associated with band or family encampments -- while site "B" is dominated by lithic items indicating primary reduction of quarried cores and blanks, with little or no evidence of other activities, and "C" shows an equal or intermediate weighting. These patterns could result from:

1. an actual single-component single function occupation;
2. the net depositional outcome of a series of occupations of varying or same function through time;
3. the result of selective natural and artificial processes (e.g., cryoturbation, past collecting activity, different sampling, exposure) acting on original assemblages;
4. any combination of the above.

It is conceivable that all of these factors could result in apparently similar surface assemblages, in terms of numbers of different artifacts and artifact classes, and the amount of debitage and its surface distribution. In some cases it is possible to argue that one factor is dominant, but for most site assemblages our surface data do not permit ready identification of which is responsible for its diagnostic properties. Nevertheless, some assemblages are distinctly different from others, as noted above, in "emphasis" on different functional artifact classes. Furthermore, barring major effects from factor 3, the presence of such different assemblages is probably significant in understanding overall or net interaction of "men and mountains" through time, regardless of which of the other factors is actually responsible. Thus, if the assemblage from a site or site segment reflects a numerically dominant influence of "campsite"-type activities, it is probably due to an overriding and/or recurrant cultural selection of that area for that purpose, barring major effects of factor 3. For these reasons, we have classified all aboriginal sites found in the Edziza area under one of four generalized functional headings: (a) "Obsidian quarry-sources"; (b) "Lithic Workshops"; (c) "Camps"; and (d) "Intermediate or mixed."

Assignment of sites to one of these 4 categories was based on the following factors: (1) Local presence or absence of natural flakeable obsidian; (2) Overall assemblage diversity; (3) Ratio of biface preforms and cores, to retouched tools; and (4) the relative proportion of debitage vs. modified artifacts. A fifth aspect, the degree of workmanship or index of reduction achieved in bifaces, may eventually also prove useful, but this analysis is not yet complete. In the absence of faunal remains or features and with uncertainty concerning site size, these would seem the only indicators available of general site function.

Local availability of flakeable obsidian is the prime criterion in the identification of obsidian outcrops or sources. The additional presence of quantities of clearly cultural debitage indicates a utilized quarry workshop site; only the latter were designated and numbered as archaeological sites in the course of our survey.

Overall assemblage variability was defined as the ratio of number of artifact classes to numbers of specimens collected. We attempted to collect all secondarily modified surface artifacts from all non-quarry sites, including the larger flake core fragments and preforms; only debitage was left uncollected. No serious collecting was attempted on the major quarry workshop sites (EP 8 and 21), which require an entirely different scale of research attention. Artifact collections can thus be considered at least representative, if not inclusive, of the total range of modified artifacts on each exposed site surface. In most cases, collections were small -- an average of 8 artifacts for each of 79 sites which yielded any surface collection, while an additional 33 sites possessed only flakes. There were 22 different artifact classes represented in the total Edziza surface collection of 606 artifacts. These include 5 subtypes of projectile points; 2 of generalized bifaces and 2 of flake cores (Table 2). In determining assemblage diversity, only surface sites yielding 5 artifacts or more were considered, reducing the total to 32; adding the 5 excavated components from EP 1 and 80, brings the final sample to 37. These assemblages were plotted in Fig. 25 with number of specimens on the vertical axis, and number of classes on the horizontal axis. The resulting distribution was used as a measure of relative assemblage diversity, with those sites left of the mean trend having lower diversity, and those to the right having higher diversity.

A ratio of primary lithic reduction indicators to hunting and processing tools was calculated by plotting numbers of cores and biface preforms vs. retouched implements (projectile points, scrapers, retouched flakes and unifaces) (Fig. 26). This produces a distribution comparable to that of Fig. 25 -- which can be used to verify the general site functions indicated by assemblage diversity.

At all sites, a rough estimate was maintained of the number of flakes visible on the surface. This was used in conjunction with number of observed modified artifacts as an additional measure of relative importance of lithic raw material processing vs. other tasks.

Obsidian Quarry-Sources

Previous X-ray fluorescence analyses of obsidian from the Mt. Edziza area had indicated at least 5 distinct chemical variants (Nelson pers. comm. 1981), and original reconnaissance by J. Souther had located a number of loci where obsidian was readily available in outcrops and fluvial deposits. One goal of our work in 1981 was to relocate as many of Souther's obsidian sources as possible, and to

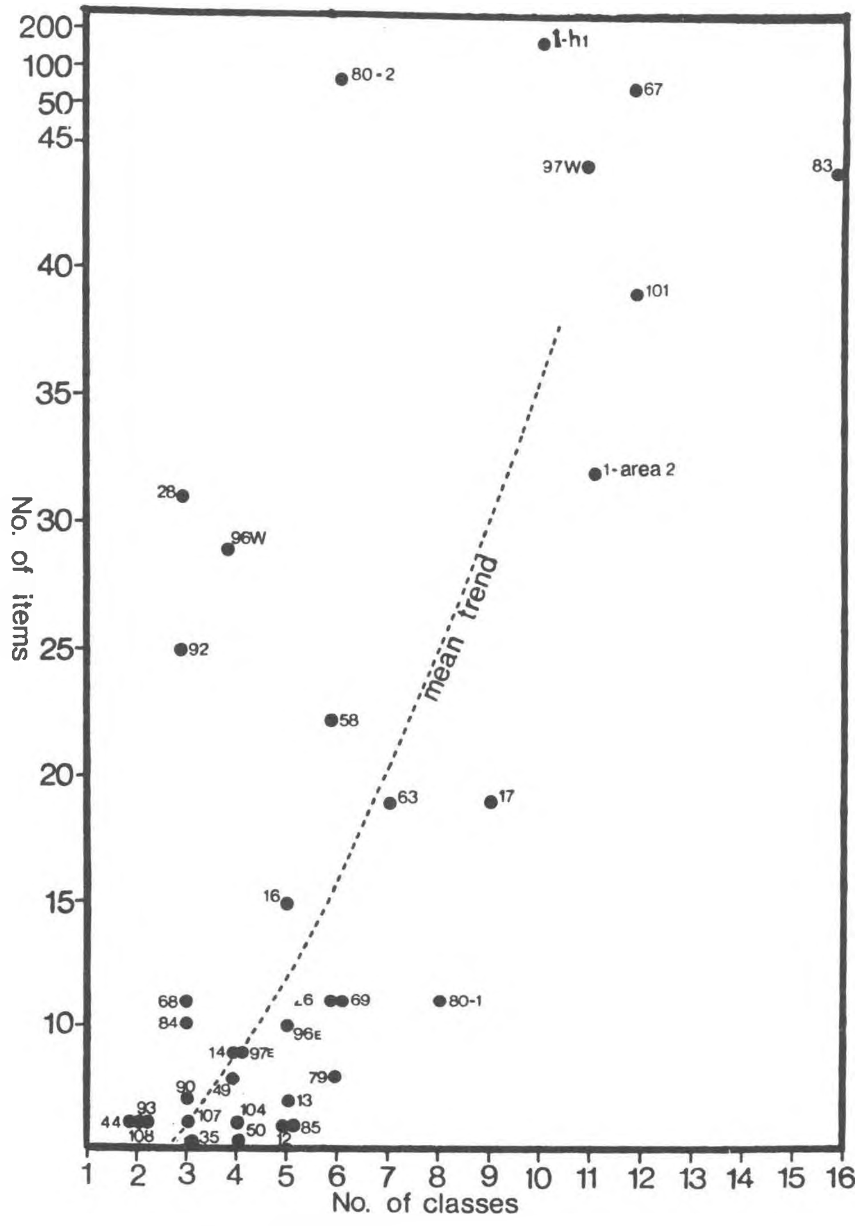


Fig. 25. ASSEMBLAGE DIVERSITY CHART.

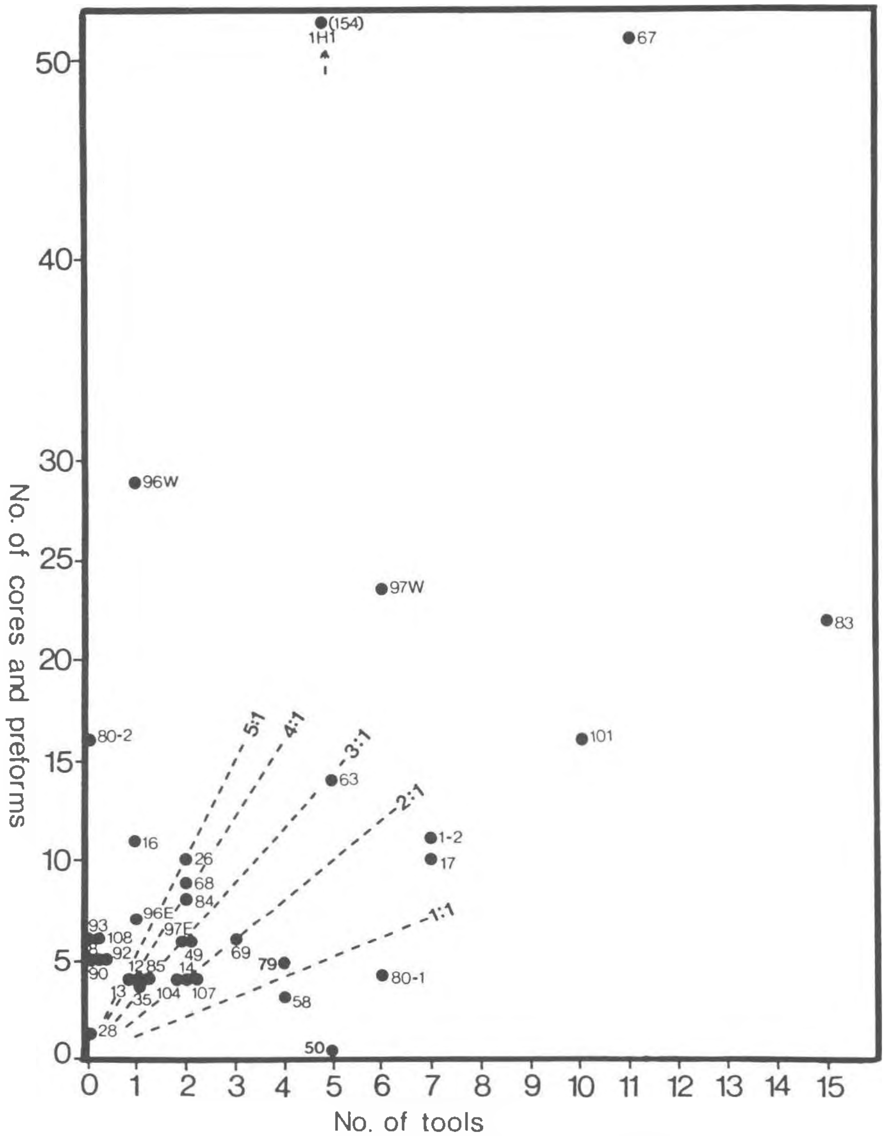


Fig. 26 PLOTTED RATIO OF TOOLS TO PREFORMS AND CORES

collect samples from them for later XRF analysis, in an attempt to geographically localize the 5 chemical variants. Additionally, we hoped to estimate the degree of aboriginal utilization of each source, and evaluate the significance of a wide range of colour-texture variants in Edziza obsidian, as a means of determining exact quarry sources for obsidian artifacts, and hence tracing their distribution in relation to precise points or origin on the mountain. The latter aspect was of interest since it seemed likely that the chemical variants would cross-cut a number of different obsidian outcrops, while it was possible that specific colour variants might be limited to single localized outcrops. Edziza glass occurs in a tremendous range of colours, translucency, and purity. Most appears to be nearly black, but in thin areas usually possesses a slight greenish-brown hue. Many rarer obsidian varieties are highly coloured, including brown, red, mauve, all shades of blue, green and grey, often highly mottled and variegated, and sometimes possessing subsurface sheen, but very often nearly totally opaque even in thin sections.

Prior to leaving for the field, I consulted with Souther to determine the map location of major obsidian outcrops. Throughout the summer, we were able to visit most of these locales at least briefly. As indicated by Souther, most "bed-rock" obsidian occurs at relatively high elevation, ca. 1800-1900 m throughout the Edziza Range and the northernmost portion of the Spectrum Range; southern parts of the Spectrum Range appear to be relatively devoid of significant obsidian sources, although other useful raw material types ("jasper," chert, chalcedony, quartz) do occur. It seems that the obsidian was originally associated with beds of rhyolitic lava which spread over the upper slopes of the formerly massive shield volcano, and later erosion left it as a series of discontinuous occurrences on isolated peaks and ridges surpassing ca. 1800 m.

Our own observations suggest that obsidian of flakeable quality does not commonly surface outcrop as consolidated beds or flows, although such features probably exist below the surface. Low quality glass was occasionally seen as thin distorted laminae in rhyolitic matrices, but all culturally significant sources which we saw showed as concentrated surface occurrences of obsidian pebbles, cobbles and occasional boulders (e.g., Goat Mountain), or angular felsenmeer-like surface carpets (Coffee Crater). In addition, as noted earlier, obsidian is a relatively frequent natural clastic constituent of most plateau surfaces, streambeds, flood-plains, alluvial fans, and moraines in the Artifact Valley-Raspberry Pass area. For purposes of discussion, 4 types of obsidian occurrences are defined below: (1) High Elevation Sources; (2) General Plateau Scatters; (3) Moraines; and (4) Alluvial Deposits.

High Elevation Sources

This class, occurring at or above 1800 m a.s.l., encompasses all the richest and most concentrated obsidian quarry-sources which we observed. Two principal areas were located, with several lesser occurrences. The two major areas are (1) Coffee Crater, and (2) Goat Mountain.

Coffee Crater Quarry

This source was visited once in the course of a quick helicopter survey of a portion of the main Mt. Edziza peak. It is located 2.5 km southeast of Coffee Crater, a prominent Holocene cinder cone named for its dark brown "coffee" colour, on the south flank of the main mountain (Fig. 2). Obsidian surface scatters were traced over an area of at least 1 km^2, without reaching definite limits. However, the distribution density is spotty, varying from relatively limited area-carpets of pure obsidian, to lesser concentrations of glass mixed with shattered lava; time did not permit any precise quantitative observations in this regard. Obsidian colour variants were mainly opaque pitchy "black" and "black" with a light sheen. The material was occasionally banded in black and grey and contained crystal inclusions.

The environment of the Coffee Crater source is barren alpine snow and rock, completely devoid of vegetation except lichen; and somewhat threateningly dominated by recent volcanic cones and lava flows in the near distance and the ice-clad main peak of Mt. Edziza in the background (Fig. 27). Access to this source from the lowlands would not be as easy or direct as would be access to Goat Mountain, particularly from the west. The easternmost limit of the Coffee Crater source overlooks a steep slope into the head of an unnamed valley which penetrates into the Mt. Edziza massif from the vicinity of Kakiddi Lake, near the headwaters of Klappan Creek (Fig. 2). A stiff climb up the headwall slope of this valley would provide the most direct access from eastern lowlands to the Coffee Crater source, but this would be a considerably more energetic route than any normally needed to reach the Goat Mountain sources. Perhaps a more significant factor in possibly limiting aboriginal utilization of this source, is its proximity to centres of recent volcanism. The history of eruption of Coffee Crater or any of the several other recent cinder cones at the south end of Edziza peak is uncertain. However, a major lava flow originating near Coffee Crater filled the upper valley of the south arm of Taweh Creek and travelled over 15 km westward to end near the confluence of Taweh and Mess Creeks (Fig. 21). An additional basaltic flow apparently originated under

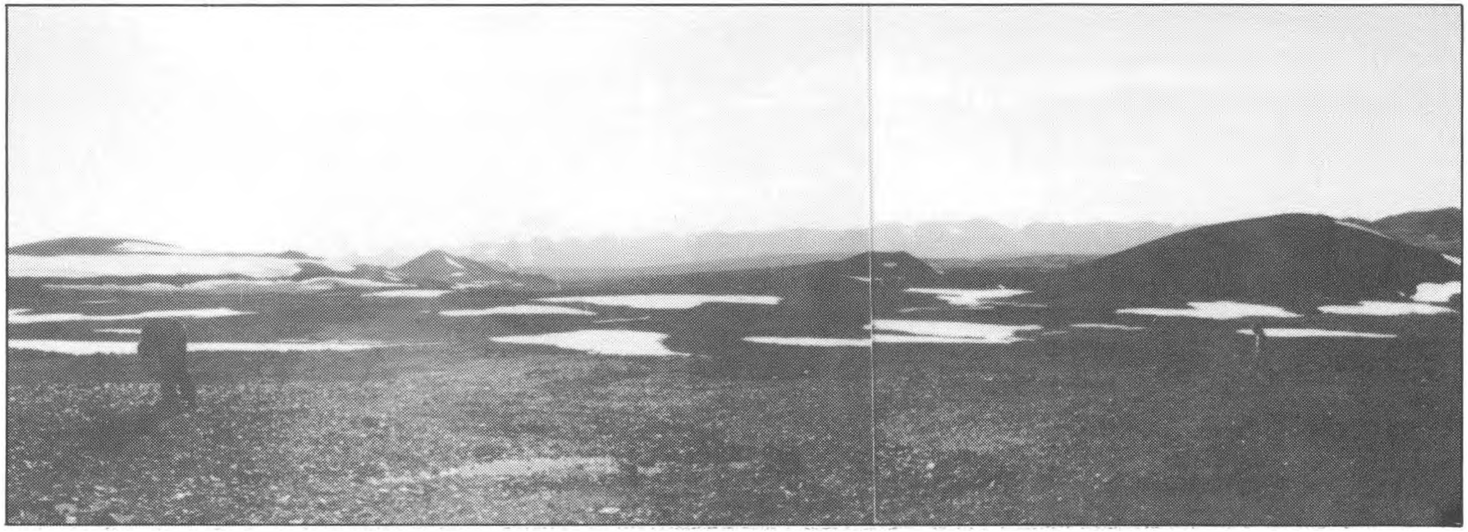


Fig. 27. Portion of the Coffee Crater obsidian quarry-source. All sparkling material is obsidian. View west over the Main Plateau towards Boundary Range in far distance; Coffee Crater cinder cone on the right.

the main Mt. Edziza glacier near Coffee Crater and cascaded eastwards over the headwall slope, into the valley described above. These lava extrusions and undoubtedly multiple pyroclastic events, have all occurred near the Coffee Crater obsidian source since the beginning of the Holocene. While each event was active, access to the source was probably physically difficult if not dangerous, and for some time afterwards people may have been reluctant to travel near the area. Additionally, secondary reasons to penetrate into alpine regions, such as large and small game, may have been less common on the barren volcanic slopes of the main peak, than in other parts of the range.

All of these factors suggest that the Coffee Crater source, while large in extent, may not have been as frequently utilized by aboriginal craftsmen as were other obsidian outcrops in the Edziza-Spectrum Ranges, at least since the volcanism described above. This is supported by our brief observations of the nature of obsidian scatters at this site. While it is clear that some portions of this outcrop were aboriginally exploited, the density of clearly humanly fractured pieces, cores and preforms, appeared much lower here than at the Goat Mountain quarries, and most of the surface litter of obsidian seemed to consist mainly of natural angular fragments. Of course, it is not always easy to distinguish between human and natural modification of obsidian, particularly on rocky slopes where natural high energy impact fracturing might occur. Our criteria for assuming cultural intervention included dense accumulations of flakes vs. just angular nuclei; apparent directed flaking (e.g., unidirectional cores); and clearly modified artifacts, such as biface preforms. No artifact collection was attempted at this site, although samples of different obsidian colour variants were obtained.

Goat Mountain Quarries

About 4 km south of Raspberry Pass, a prominent pyramidal mountain rises to about 2093 m elevation, overlooking the head of Artifact Valley from the north. This peak, informally designated "Goat Mountain" during our 1977 reconnaissance, is probably the focus of aboriginal Mt. Edziza obsidian exploitation (Fig. 7). During the 1977 survey we located some small obsidian outcrops in an east-facing cirque on the flank of Goat Mountain (Fladmark and Nelson 1977), but in 1981 we discovered that these were merely peripheral outliers of a huge quarry-workshop complex on the west side of the mountain.

Two single-day foot traverses completely around Goat Mountain, and out onto the "Central Plateau," which slopes gently away from its northwest flank, and 2 additional helicopter visits, revealed 2 very large obsidian quarry-workshop surface scatters and a nearly continuous set of smaller surface occurrences. Together, these sites represent a substantial aboriginal energy investment in the exploitation of obsidian. Although the two largest sites (EP 8 and 21) were recorded separately, and do carry significantly greater obsidian concentrations than intervening regions, they, and other sites on the northwest side of Goat Mountain extending down to the Central Plateau, are part of a continuous scatter of obsidian items that rarely diminishes to a density of less than 1 piece per 4 m^2 over the entire observed area of the Central Plateau. In the actual EP 8 and 21 site areas, however, the surface is basically pure obsidian, with densities of 1000-4000 obsidian items per m^2.

EP 8 is located at about 1950 m along the lip of a bench overlooking a col running northwest from the head of Artifact Valley, on the northwest flank of Goat Mountain (Fig. 28). The area is relatively barren alpine terrain, with only moss and lichens as vegetation in sheltered spots. On July 14, extensive snowfields existed around the site areas and in the col, with overhanging snow cornices preventing access directly across the col to its southern rim. However, foot travel northwestwards onto the "Central Plateau" was relatively easy, although it involved some long climbs down gradual snow-clad slopes. Nevertheless, to anybody in reasonable physical shape, access to EP 8 and the rest of Goat Mountain would present no barriers, and could be directly accomplished in less than 2-3 hours from subalpine areas of Raspberry Valley, via "Caribou Creek," which has its source close to the Goat Mountain Sites; or from the head of Artifact Valley, either directly over Goat Mountain, from the valley, or via the col high on the upper end of Artifact Valley (Fig. 14). In fact, travel to and from the Goat Mountain source is practicable in virtually any direction except directly southwards, where a nearly sheer escarpment drops over 300 m into Artifact Valley; however, the easiest route is undoubtedly northwestwards down Caribou Creek to Raspberry Valley, where access northwards to the Stikine River or southwards to the Iskut Valley and beyond would probably have been facilitated by the aboriginal equivalent of the Telegraph Trail. Also, travel along the crest of the Goat Mountain cirque north of the main quarry site area, and down the east spur of Point Creek valley, would have provided direct if somewhat steep access to Bourgeaux Valley, and again to the Telegraph Trail.

Site EP 21 is upslope from EP 8 along the same escarpment separating Goat Mountain from Artifact Valley and the col (Fig. 29). As noted earlier, the two sites could be considered continuous, although flake densities fall off between the two principal areas of concentration. EP 21 lies directly along the steep ca. 300 m escarpment into Artifact Valley mentioned above, and travel to or

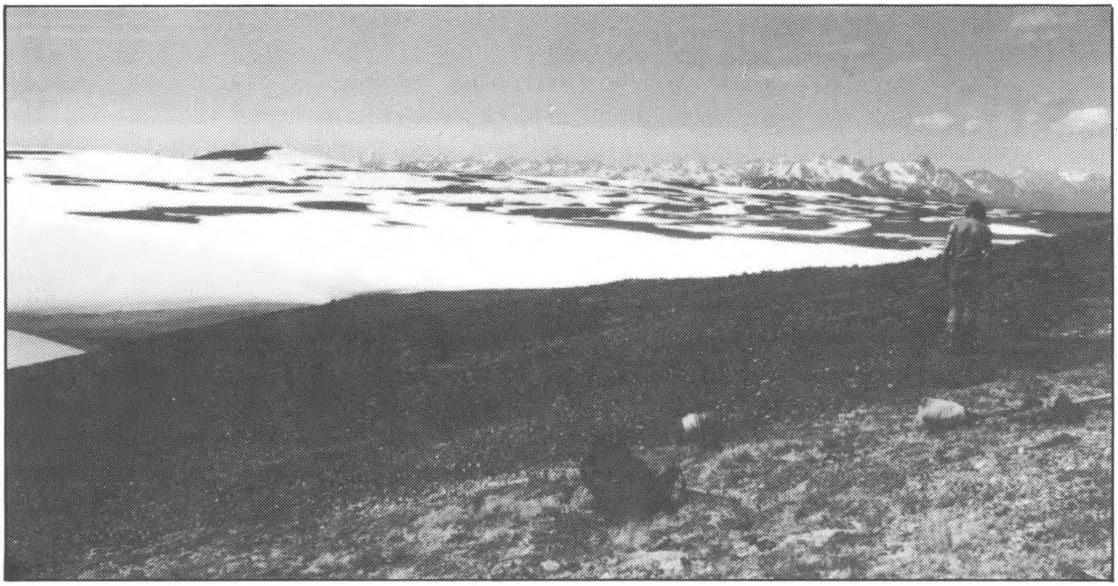


Fig. 28. View of a portion of EP 8 looking west towards the Boundary Range.

Fig. 29. View of EP 21 looking west. Dark surface colouration is obsidian. Site continues over ridge crest in middle distance.

from the site in this direction would be exceedingly difficult; otherwise, similar access conditions pertain at both sites. EP 21 is about 100 - 150 m higher in elevation, and about 500 m upslope from EP 8, and is backed by larger snowfields on the sheltered northwest slope of Goat Mountain.

The general nature of surface obsidian occurrences at both Goat Mountain sites appears similar, although at about 27,000 m^2, the area of concentrated surface obsidian at EP 21 is considerably larger than that of EP 8 which is only about 5600 m^2. Through most of these areas, the ground surface is basically pure obsidian, and it is impossible to walk without stepping on large numbers of obsidian pieces with each footstep (Figs. 28 and 39). However, the size, fragmentation, and degree of cultural modification varies widely across each site. Thus, while some areas carried mainly small glass pebbles with relatively little modification, others were completely saturated with large flakes, core fragments and biface preform fragments. Four 50 x 50 cm quadrats were randomly placed in each site, and the numbers of obsidian items of different sizes counted. At EP 8 an average of 462 items were recorded in each quadrat (max. 780, min. 138) within 10 cm of the surface, between 15 cm and 1 cm in maximum dimension. Densities and size distributions were similar at EP 21, with an average of 350 items per 50 x 50 cm. Extrapolating these averages to the total site areas, produces an estimate of ca. 10,348,800 lithic items on the surface of EP 8, and c. 37,660,000 items at EP 21. However, these estimates are bound to be conservative, given the fact that they refer to only the areas of peak concentration, and do not include extensive regions of lesser surface densities surrounding the main clusters.

The surface condition of obsidian items in these sites varies from completely clean and fresh, to heavily lichen encrusted and weathered (Fig. 30). Lichen coverage is distinctly variable and localized, with some areas of obsidian detritus and core fragments completely overgrown, and others fresh and clean. It would be tempting to correlate this with differences in age of portions of these sites, and any future studies should probably experiment with systematic lichenometry. However, such studies require a large sample of measured lichen thalli of known species, and we had neither the time to make the necessary collection or the expertise to speciate the lichen. Also, since the detritus fragments are usually much smaller than the large rock surfaces normally used to measure lichen diameters, there may be definite methodological limitations to using lichenometry on archaeological sites. At the moment, it is my opinion that areas of variable lichen growth and other surface "weathering" differences across these sites probably more closely reflect varying degrees of surface stability than any direct function of time since original deposition. It is clear that objects on sloping portions of these sites are subject to significant ongoing down-slope displacement, sorting, and heaving by frost action. Marked linear alignments of flakes, some standing vertically, were observed at EP 8 (Fig. 31), and pronounced stripes of obsidian drape the upper slopes of the Artifact Valley escarpment at EP 21. Thus weathered lichen-covered surfaces may indicate flakes which have remained relatively undisturbed in terms of surface exposure for some length of time, while fresh, unweathered materials may simply be the result of continual cryoturbation or displacement. Periglacial processes may also be responsible for differential size-weight sorting of materials across these sites; and for crushing and microflaking on most pieces.

The obsidian raw material exploited at EP 8 and EP 21 appears to be eroding as rounded pebbles, blocks and boulders from a soft tufaceous matrix exposed along the northwest flank of Goat Mountain, between about 2060 and 1907 m a.s.l. Most unworked pieces are in the softball size range, or smaller, with the largest boulder observed measuring 66 x 50 x 25+cm, on the periphery of EP 8. Pieces of intermediate size were also seen, with greatest concentrations of flakeable nodules apparently occurring along the slope escarpments. Most of the obsidian is high quality pure glass, black to dark bottle green, and translucent in thin portions. However, numerous colour variants were also observed, including opaque light green, grey, blue, mauve, and rarely, opaque brownish-red, often complexly mottled. Green and other variants appear to increase in frequency towards the northwest end of EP 21, although "pure" occurrences of these types were also observed on the northeast-facing flank of the cirque on the opposite side of Goat Mountain.

Degree of flaking at these sites is variable across each area. However, bifaces are not particularly common, and it seems that the lithic reduction going on here was generally of a very primary sort. Nevertheless, a few large biface fragments were observed at both sites, indicating that more advanced work was occasionally conducted. Most cores and core fragments appeared relatively unsystematic, although occasional large polyhedral single-platform cores were seen. A number of large blade-like flakes were noted at EP 8, but no micro-blades or clearly functional tools were seen at either locality. Also, somewhat surprisingly, no hammerstones were seen. Coherent clusters of lithic items indicative of a single person's flaking activity were not obvious in the ubiquitous background of detritus. However, it seems that the aboriginal craftsmen preferred working on south and west sloping areas, rather than hollows and swales, and were not adverse to carrying on these activities in locations more comfortable for mountain goats, than flatland archaeologists. This

Fig. 30. Small portion of surface obsidian scatter at EP 21.

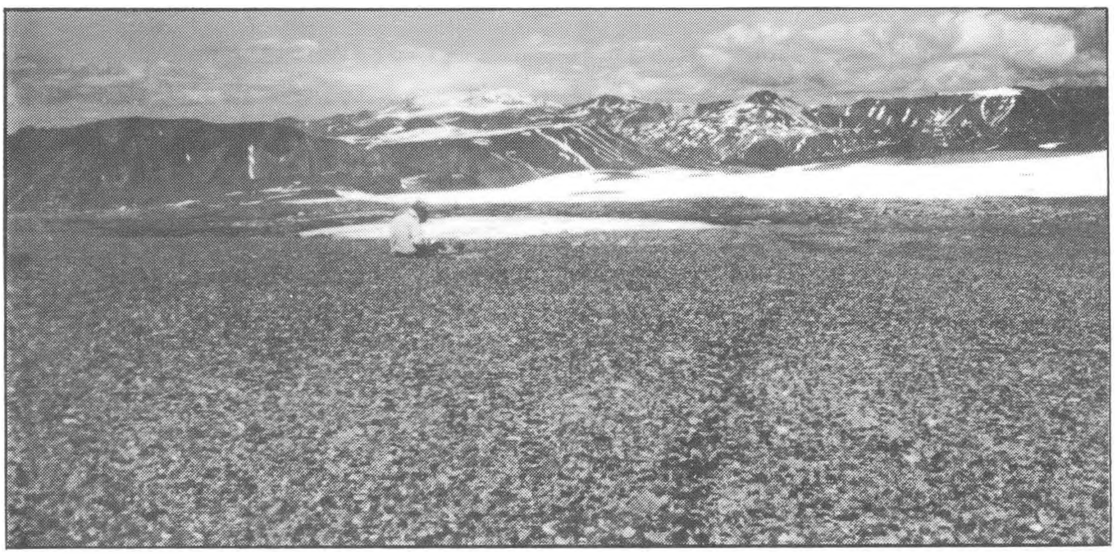


Fig. 31. Frost induced alignment of obsidian flakes, EP 8. View looking north towards the main peak of Mt. Edziza in the far distance.

includes dense flaking scatters smeared down the steep loose lower slopes of EP 21, which end in near sheer precipices of over 300 m, and up onto erosional remnant spires and abutments which project out from this slope. Although part of the obsidian concentrations draped over the edge of this escarpment may be of natural origin, including frost-induced ground patterning and colluviation, man was also directly involved in at least some cases.

Very large and rich surface sites such as these impose a unique set of problems on the field investigator, particularly when time on-site and available manpower is limited. It is possible, for instance, to stand in the middle of EP 21 with low evening lighting and face a solid surface of glittering obsidian in all directions as far as the eye can see; each site is readily visible from low air elevations as a large dark "stain" over the light green-grey landscape. This perspective tends to promote a certain feeling of futility on the part of the archaeologist who is all too aware of the helicopter waiting in the background, or of the need to return to a base camp at lower elevations before nightfall. Because any systematic collecting or surface mapping program to do justice to these sites would have required far more man-hours than we had available, we elected to leave them basically unimpacted, with the exception of the four 50 x 50 cm sampling quadrats in each. No collecting was carried out, other than obtaining a few random samples of surface material for XRF analysis, and no attempt was made to plot surface artifact occurrences or densities. The sites were compass-and-pace mapped and a number of qualitative surface observations made; any full-scale study would require a major commitment in time and labour by a large crew.

Although the Goat Mountain sources are in high alpine areas, their environment is different, and seemingly more pleasant, than that of the Coffee Crater quarry. People walking or sitting on the surface of EP 21 or 8 have clear and unimpeded views west and northwest over the Central Plateau, and beyond to the sawtoothed rim of the Boundary Range in the far distance. Thus game could easily be spotted from this location at a sufficient distance to permit interception. Several mountain sheep were observed along the south-facing escarpment at the edge of these sites in our brief visits, and a large rack of caribou antlers provides a prominent marker near the north boundary of EP 8. Although vegetation on and near these sites is restricted to lichen, moss and grass, 1-2 hours travel downhill would reach the subalpine ecotone in several directions. Water is available in snow packs and surface run-off immediately adjacent to the main obsidian scatters, and major creeks can be reached in virtually all directions in a half-hour walk or less. Portions of both EP 21 and EP 8 are relatively flat surfaced, and would provide reasonable short-term campsites. However, given the ease and speed by which these sites can be reached on foot from nearby valleys, there was probably little requirement that people camp for any duration at this elevation. Instead it seems more likely that obsidian was exploited by persons moving up into the alpine area from camps situated in the much more hospitable open subalpine forest, perhaps in the course of short-term combined hunting-lithic exploitation excursions in the mountains. That hunting was a constant concern of the Goat Mountain obsidian knappers may be evidenced by the widespread distribution of lithic workshop detritus in situations where a dominating overlook seems the main objective. Thus site 20 on the very summit of Goat Mountain provided the lithic craftsmen with an impressive panorama of Artifact Valley and adjacent areas (Fig. 32). Hunting, defense and perhaps aesthetics would seem the only reasons that such a flaking station would be chosen, and of these three, only hunting seems supported by any secondary data -- i.e. the demonstrable presence of game in the areas overlooked by this site.

There is no evidence of any recent primary volcanic events originating on or near Goat Mountain, although the region has probably been affected by several tephra falls since man was first present. Volcanism is probably not a major factor in restricting access or usage of these sites in the past, except insofar as events on the main peak of Mt. Edziza may have imposed restrictions on general travel into the mountain range (eg. lava flows into Mess and Kakkidi Creeks). However, given their elevation, it is possible that past climate induced glacier and snow-field expansion may have hampered travel to the Goat Mountain sites from some directions, and/or restricted the extent of usable obsidian exposures on the sites themselves.

Besides the two very large quarry-workshops, several lesser sites occur on and around Goat Mountain. These include EP 22, overlooking Point Valley from the crest of the arrête separating Goat Mountain cirque from the Point Valley headwall; EP 19, just below the summit of Goat Mountain on an east-facing ridge, and an un-numbered and diffuse scatter of material within the Goat Mountain cirque itself. EP 22 is a small version of 8 and 21, consisting of a dense carpet of obsidian fragments covering an irregular area of rough sloping terrain. The lithic carpet is estimated at approximately 900 m^2, containing about 378,000 items; however, the vast majority of these pieces are not conclusively modified by man. The obsidian itself is a black-blocky glass of lower flaking quality than seen at EP 8 and 21. This site would be readily accessible by a steep scramble up the headwall slope of Point Valley, itself tributary to Raspberry Pass, or via Wet Creek* valley from the southeast. EP 19 consists of a scatter of lithic detritus along the crest of a steep-sided ridge which juts eastward, just below the summit of Goat

Mountain. This ridge continues for about 200 m, falling in elevation towards the east, until it reaches a near-sheer escarpment looking east over Artifact Valley (Fig. 32). For most of this distance the ridge is narrow and in places knife-edged, falling on the south ca. 300 m into Artifact Valley, and on the north down a steep snow-slope into Goat Mountain cirque. Given its narrowness, therefore, site 19 really consists of 2 sub-areas, separated by a steep hog-back where lithic detritus is scarce. The densest lithic concentration occurs in the most western and highest sub-area (ca. 2030 m), directly beneath a ca. 6-8 m high bedrock cliff which rims the Goat Mountain summit. Here a dark blocky glass appears to be weathering onto the surface, and there is a concentrated scatter of debitage. However, the density is much lower than any of the sites discussed so far, and the variety of obsidian colour types observed suggests that people were carrying raw materials into this location from other parts of Goat Mountain. Relatively flat terrain is limited to about 2400 m^2, with most of the cultural materials concentrated on the south-facing slope overlooking the 300 m drop into Artifact Valley. Mountain goats and sheep could traverse this steep talus slope around to EP 21 on the opposite side of Goat Mountain however, this would be a hazardous journey for less surefooted travellers. It is possible that most access to this site was gained via the Goat Mountain cirque, or perhaps over the top of Goat Mountain, involving a short vertical climb over the bedrock escarpment.

On the first reconnaissance of the Mt. Edziza area in 1977, Nelson and I located a small concentrated exposure of mottled opaque light-green obsidian on the north-facing slope of Goat Mountain cirque, in a spot providing a good overlook down Artifact Valley (Fig. 33). At the time, this lithic exposure consisted of about a 2 m^2 area melted bare in the middle of an extensive snow-field, and it was not possible to estimate the actual size and density of the source. We tried to relocate this same spot in 1981, but without definite success. We did locate a similar type of obsidian in the same general area, but the size and location of exposed ground had changed. Nevertheless, Goat Mountain cirque does contain a diffuse scattering of obsidian which is recorded in Fig. 13 as an un-numbered "minor" obsidian locus. Extensive snow cover within the cirque prevents a clear estimate of the cultural importance of this area, but it was probably less than the sources on the west side of the mountain. Nevertheless, colour variants in the cirque are distinctive, including the mottled green noted above, and a brownish-red obsidian found as small rounded pebbles on till ridges well towards the western cirque headwall. None of these types have been clearly extensively exploited by man within the cirque, and all are found at other sites, including EP 8 and 21.

Fig. 32. View from EP 20, summit of Goat Mountain, looking East over EP 19 and Artifact Valley.

Fig. 33. View of Goat Mountain cirque from east side of Rocky Pass (looking west). a. EP 20, b. EP 19, c. approximate location of small outcrop of mottled green obsidian, d. till ridges containing reddish brown obsidian pebbles.

South Valley Source

This obsidian surface exposure occurs at about 1840 m elevation on the south facing flank of "Eric Mountain," which forms part of the ridge separating Artifact Valley from South Valley (Fig. 14). Obsidian occurs as angular fragments scattered down the slope formed by a col which crosses the ridge between South and Artifact Valleys, and which isolates Eric Mountain from the eastward continuation of that ridge. Density of obsidian pieces was relatively low, never achieving the blanket-like aspect of the Goat mountain sites, and all observed pieces were under about 30 cm in maximum dimension, scattered among the loose angular scree sloping down from Eric Mountain. Most observed obsidian at this location consisted of the complexly mottled light-green opaque variety previously noted in the Goat Mountain cirque, and at other Goat Mountain sites. There was little if any definite evidence of human modification of this obsidian; however, the steepness of the slope may continually recycle surface clasts, scattering and obscuring cultural features. It is possible that more of this site occurs higher on Eric Mountain, but we were unable to extend our search beyond the immediate area marked on Fig. 14. The observed area covers about 100 x 200 m of slope surface, with an average density of less than 1 flakeable obsidian item per m^2. Lack of direct evidence of aboriginal utilization of this source prevented it being formally recorded as a site. However, the obsidian found here is of high flakeable quality and relatively easily accessible. Access would be possible from Artifact Valley, over the steep crest of the intervening ridge and along the col, but this would be much more difficult than climbing directly up from South Valley.

Our only contact with sites within South Valley this season consisted of two short helicopter stops in the open subalpine forest area of the valley. These were sufficient to indicate that this valley was generally similar to Artifact Valley in environment, and a similar density of cultural occupation may be indicated by the fact that several small lithic scatters were observed within 2-300 m of each helicopter stop. Several flakes of green mottled obsidian were noted in the South Valley sites, which may indicate utilization of the closest available lithic source.

Plateau Scatters

This type of obsidian source encompasses several high elevation areas which possess general diffuse scatters of obsidian, both worked and unworked, with few if any dominant quarry-workshop foci. All plateau areas observed in the Artifact Valley-Raspberry Pass region possessed this characteristic and our limited observations of the Main Plateau west of Edziza Peak suggests that it may also hold true for much of this area, to a lesser degree. In a foot traverse over the Central Plateau directly northwest of Goat Mountain, obsidian was observed as a continuous scatter wherever adequate ground exposures existed. Sites 9, 10 and 11, recorded in the course of this trek, represent flake concentrations or other cultural manifestations (EP 10 is a collapsed cairn or rock cache), in this ubiquitous background of obsidian. It seems that aboriginal users of the plateau, which is itself probably prime hunting terrain, could depend upon finding flakeable pieces of obsidian within a few meters of any position they happened to occupy. The long term result appears to be a widespread distribution of unworked pieces and small workshop scatters, over the entire plateau. Definition of specific site areas and quarry foci is not feasible, nor would it be an accurate reflection of the actual cultural data.

A similar general distribution of obsidian occurs along the rim of the plateau overlooking Artifact Valley and Wet Creek from the northeast, and a less dense scatter was observed on portions of the Main Plateau. However, the escarpment overlooking the Little Iskut River from the northern gateway of Artifact Valley lacked any evidence of obsidian occurrences. Although the plateau lithic scatters do not possess the neatness and coherence of traditionally defined lithic quarry sites, they probably represent a significant pattern of aboriginal obsidian exploitation in the study area. If one estimates an average density of only 1 obsidian item per 4 m^2 (probably a conservative average), then the ca. 8 km^2 surface of the Central Plateau directly northwest of EP 8 contains approximately 2,000,000 lithic pieces; if a similar average is extended to the rest of the Central Plateau further to the southwest (29 km^2), which was not examined in 1981, and the portion of the Main Plateau between the Taweh Creek lava flow and the Raspberry Valley escarpment (ca. 24 km^2 +), even excluding the western and northern portions of the Main Plateau (another ca. 280 km^2 +), there is a possible ca. 15.25 million obsidian items on the surface of these areas -- a total significantly exceeding that of EP 8. This type of obsidian exploitation suggests a less focussed or specialized process than that represented by the densely concentrated quarry-workshop sites like EP 8 and 21. The plateau scatters imply an *ad hoc* utilization of available lithic materials as they were encountered, perhaps in the course of hunting trips or other excursions into the alpine plateaus. The big Goat Mountain sites, on the other hand, seem to indicate repeated more purposeful returns to specific locations in order to specifically exploit the obsidian at those places. The diffuse "plateau" pattern suggests less concern with specific characteristics of the lithic source (rock quality, or abundance), relative to other factors such as game availability, environment, access, or distance travelled; while the Goat Mountain obsidian sites suggest that, to their users, some aspects of these sites were sufficiently important to justify intensely focussed lithic exploitation at just those locations. While it would be tempting to suggest that these seemingly different approaches to obsidian exploitation reflect temporal or tribal differences, there would be little justification for such an inference at the moment -- i.e. peoples of all ethnic identities through all time periods may have carried out both "focussed" and "diffuse" obsidian utilization. Nevertheless, it is possible that sites at highest elevation (such as EP 21) may not have been as continually or equally favoured obsidian sources throughout the course of post-glacial time; more will be said about this later.

Moraines

Prominent moraine complexes lie up to 1 km in front of remnant glaciers and abandoned cirques throughout the Edziza and Spectrum Ranges. In at least two cases, they contain significant quantities of flakeable obsidian, providing useful raw material sources.

Artifact Valley Moraine

A small remnant glacier currently occupies a large cirque complex at the western terminus of Artifact Valley. A prominent arcuate moraine parallels the flanks of the ice remnant, defining classic lateral-terminal boundaries for a glacier once approximately 3 times greater in area (Fig. 18). This moraine is steep-sided and formed of fresh angular-tabular rhyolitic rock debris. Vegetation is limited to occasional small thalli of dark lichen (usually no more than 5 cm in diameter) and the rock rubble is itself loose and unstable. At its downstream end, the Braided River cuts through the moraine in a series of deep rock-strewn channels, some now abandoned. Three hundred meters northwest (up-slope towards Goat Mountain) from the point where Braided River debouches from the till ridges, the latest lateral moraine lies along the slope of Goat Mountain at about 1630 m elevation. Here it overlies what appears to be an older moraine or hummocky kame surface, which possesses considerable quantities of flakeable obsidian pebbles. The fresh moraine is directly superimposed on a mature soil surface formed on the older "moraine," which carries moss, grass and low shrubs. Excavation at the foot of the fresh moraine reveals that the soil surface extends under the recent rock rubble for at least 50 cm and it is very probable that more extensive excavation would have revealed lithic detritus actually buried by the latest moraine (Fig. 34). Scattered obsidian pebbles in the older "moraine" are of the same general colour types as the Goat Mountain material and, indeed, some may have been deposited by mass wastage from these sources, which are nearly directly up-slope. In ground exposures, including sandy blowouts along crests of hummocks in the older moraine, cultural flaking scatters occur, but never approach the density of the Goat Mountain quarries.

For a variety of reasons discussed previously, the fresh moraine is considered to represent a Neoglacial maximum which peaked sometime within the last few hundred years. The older surface is probably late Pleistocene or early Holocene in age, judging from the degree of weathering and plant growth. This site indicates that people were utilizing secondary obsidian sources in moraines and till accumulations, at a time when glacier remnants were probably no more extensive than present, prior to the Neoglacial maximum. The Neoglacial maximum, in turn, directly lowered the productivity of this quarry site by depositing fresh non-obsidian-bearing moraine on top of portions of it. How much of the original site was destroyed by this process is not known. While this deposition was occuring, the immediate environment of the site must have been substantially degraded by the direct presence of ice and melt-water, but apparently not to the extent that vegetation on all older surfaces was totally destroyed.

Point Valley Moraine

Point Valley penetrates directly south towards Goat Mountain from the eastern entrance of Raspberry Pass, culminating in multiple cirques, with the highest cirque floor at about 1780 m, containing today a small remnant glacier (Fig. 4). Approximately 6-700 m downslope from the present ice terminus lies a prominent steep sided moraine formed of loose angular rhyolitic fragments and occasional obsidian cobbles. This moraine is difficult to climb due to its steepness (ca. 60°) and very loose rubbly surface, although access is aided by occasional melt-water gullies and snowbanks. At its crest, one has a superb view down Point Valley to Bourgeaux Creek to the north, and a grim perspective of snow, melt-water, and grey rock rubble piles in the opposite direction across the cirque (Fig. 35). A strong wind seems to drain constantly down this valley off the cirque and plateau, and the only shelter is provided by occasional large erratic boulders. Despite its barren location, the Point Valley moraine is a good source of obsidian today, with football-sized flakeable cobbles of high quality black to green glass occurring relatively frequently. Experimental flaking indicates that these cobbles are in good condition and not altered noticeably

Fig. 34. Artifact Valley Neoglacial moraine (center foreground) overlying older moraine of kame (right). Obsidian found in older surface only. View looking west, Goat Mountain in upper right.

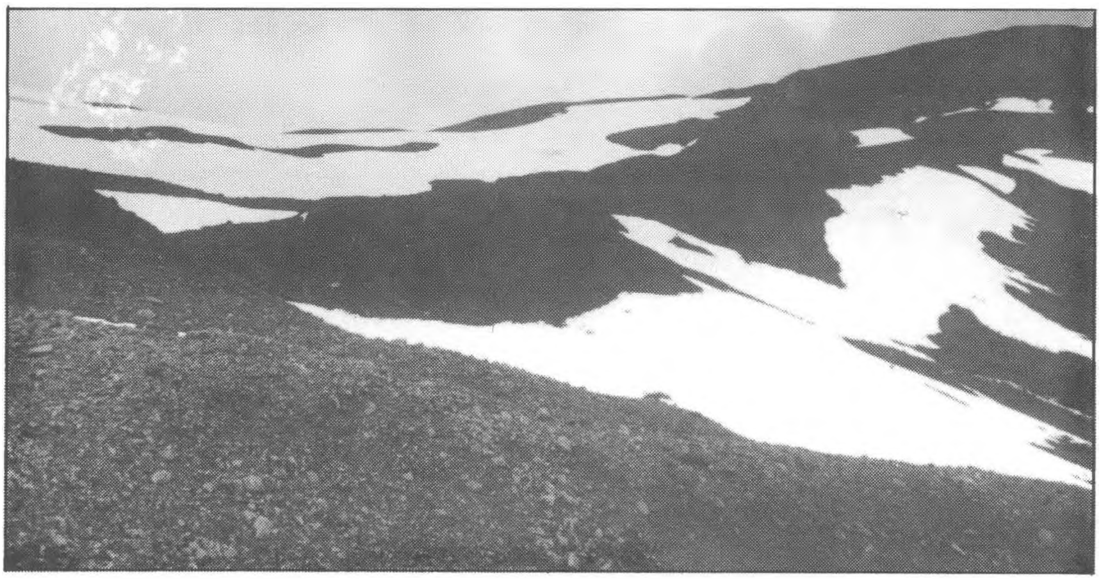


Fig. 35. Point Valley, upper cirque and moraine. Obsidian found throughout till in foreground.

by incipient fracturing. Nevertheless, there is no evidence on the moraine itself that aboriginal flaking took place, all observed obsidian consisting of relatively "whole" cobbles and pebbles.

The Point Valley moraine is extremely fresh, with unstable surfaces and no vegetation except for occasional lichens up to ca. 5-10 cm in diameter. It probably represents the same recent Neoglacial maximum responsible for the latest Artifact Valley moraine; thus absence of direct evidence of aboriginal utilization of the moraine obsidian would be a function of its recent age. Nevertheless, it is probable that any morainal deposits in this area, of any date, would have provided significant quantities of lithic raw material, and that such older sources did exist, but were overridden and destroyed by this latest Neoglacial maximum. It is possible, therefore, that people in Point Valley and Upper Bourgeaux Valley may not have always needed to travel all the way up onto the plateau or Goat Mountain to find dependable quantities of good quality obsidian, instead, simply obtaining it on the edges of whatever ice mass, if any, happened to exist at the head of the valley at the time. However, it is also possible that, at certain times, much reduced glaciation limited the availability of fresh morainal deposits at relatively low elevations, making it more economic to search into higher elevations for the diminishing lithic resource.

It is possible that other Neoglacial moraines around the Central Plateau and Goat Mountain, as well as Edziza peak, may also contain usable obsidian; only the Artifact Valley and Point Valley moraines were directly confirmed as sources this season.

Alluvial Deposits

Many of the stream beds and alluvial deposits throughout Artifact and Bourgeaux Valleys contain obsidian clasts as natural constituents. Three such contexts stand out as more abundant sources of obsidian, although it must be remembered that some natural obsidian pebbles can be found virtually anywhere in upper Artifact Valley and associated uplands.

Braided River

"Braided River" is an informal name applied to a broad gravel flood-plain and its anastomosing outwash stream, which occupies the floor of Upper Artifact Valley (Fig. 14). Obsidian cobbles and pebbles occur over the entire Braided River flood-plain upstream from the "Slide," at a rate of about 1 softball-sized or smaller pebble for every 3-5 m of linear transect. Colour types are diverse but consist mainly of dark green to black varieties, occurring as well-rounded pebbles and cobbles. Density of obsidian seems to increase upstream, at least as far as Wet Creek, with locally greater concentration around the confluence of Fan Creek* (Fig. 15). There is no evidence of flaking debris, but obviously this would have been removed or buried by recent stream action.

While the Braided River would initially seem a good local source of obsidian in Artifact Valley, the quality of the raw material available in this active fluvial environment seems low. Experimental flaking of large pebbles indicates the presence of numerous incipient fractures which make controlled workmanship difficult. It seems that these pebbles have been subjected to repeated impacts in the course of alluvial transport and deposition, resulting in mechanical weakening. Although some flakeable pieces could probably be salvaged from this context by trial and error reduction, the nearby presence of high quality materials on Goat Mountain would seem to argue against the Braided River as a major aboriginal lithic source.

Fan Creek

"Fan Creek" enters Braided River on the north side of Artifact Valley, about 700 m down-valley (east) from Wet Creek (Fig. 15). One arm of Fan Creek drains the northwest slope of the Artifact Valley "Slide," while a second arm falls precipitiously down the steep north escarpment of the valley, originating in snow-fields on the adjacent plateau. This latter branch has constructed a somewhat chaotic alluvial fan of large jumbled bedrock fragments at the foot of the valley escarpment. This debris cone contains frequent fragments of a relatively coarse "pitchy" dark green to black obsidian, which often displays a slight gold sheen or sub-surface reflectance when held at an angle to the light. Pieces of obsidian found in this context are of a larger mean size than those in the Braided River flood-plain, and appear to be far less affected by incipient fractures, possibly due to a decreased number of impact events in their shorter transport history. Although the obsidian appears coarser or more crystalline than the pure glass of Goat Mountain, it still seems to be perfectly usable lithic material, at least for generalized flaking tasks. Again, the alluvial context would not permit long-term survival of any aboriginal flaking detritus. Similar obsidian varieties were noted on the plateau surface at the head of Fan Creek.

Point Creek

"Point Creek" originates in a series of tributaries draining the Point Creek cirque complex. One main branch has its source in a cirque floor about 60 m lower than that containing the existing glacial remnant, while the second branch flows out of the Neoglacial moraine and higher cirque. At all points along this stream, down to nearly its confluence with Bourgeaux Creek, obsidian occurs as relatively frequent pebbles and cobbles in the fluvial channel gravels. Colour varieties include dark green to black high quality glass; no red-brown variants were observed anywhere in Point Valley, and it is possible that this type is restricted solely to Goat Mountain. Limited flaking tests suggest that the Point Creek obsidian is more coherent and unaffected by incipient fractures than Braided River float pebbles, possibly because of a shorter distance of transport. Thus, aboriginal occupants of Bourgeaux Valley may have had access to a relatively constant source of usable obsidian at low elevation in the bed of Point Creek. It is worth noting, however, that the fairly low density of flakeable pebbles in this context, and the probably slow rate at which new pieces would be exposed, might have restricted the significance of this source during periods of intense cultural exploitation.

Miscellaneous Lesser Sources

Besides the source areas already described, obsidian of lesser quality and density was also observed in several other contexts. None of these loci are demonstrably significant to the history of aboriginal exploitation of natural glass in this region, but might be of some importance in attempts at understanding the full range of obsidian chemical variability and distribution. Such "sites" include a limited area at the summit of Raspberry Pass, where numerous small fragments of a poor quality black banded obsidian occurs as scree or talus derived from a ca. 2060 m high mountain which forms the northern escarpement of the Pass. None of this material appears of useful flakeable quality, and there is no evidence of its aboriginal exploitation. Nevertheless it does occur in a very central and strategic location, where obsidian otherwise is not a common sedimentary constituent. Another similar occurrence is a localized scatter of dark glass on the west wall of Rocky Pass between Artifact and Bourgeaux Valleys observed in 1977 (Fladmark and Nelson 1977). In comparison to sources located in 1981, this "site" possesses little to indicate that it was an important feature in the aboriginal lithic geography of the region. On the other hand, its focal position, accessibility, and localized nature suggests that it should be considered in any attempts at tracing the detailed distribution and variability of obsidian chemical types.

The Floatplane Lake study area possessed little or no evidence of natural obsidian occurrences, although cherts, chalcedonies and quartz were observed. However, a very small and restricted occurrence of what appeared to be poor quality glass, in thin contorted laminae in a rhyolitic matrix, was noted at the crest of the pass separating Floatplane Lake and Pass Creek Valley from the South Plateau. Further north in the Spectrum Range, this occurrence would have been quantitatively and qualitatively completely insignificant, and is only notable here in the absence of any other indications of natural obsidian. There is no evidence of aboriginal usage and, indeed, the observed occurrence could not have been practicably utilized for stone-tool manufacture in any way.

Obsidian Sources -- Discussion

Thanks to the assistance of J. Souther, the task of locating and identifying obsidian outcrops in the Mt. Edziza region was much simplified. His thorough knowledge of local lithology allowed us to focus our efforts more efficiently and in 1981 permitted ready identification of the Goat Mountain area as the most intensely utilized obsidian source in the Edziza-Spectrum Range. Certainly, no other source observed came close to the overwhelming density and concentration of culturally modified obsidian found at the Goat Mountain sites, and distributed around those sites in secondary or more diffuse occurrences. Although other sources were undoubtedly exploited, Goat Mountain seems to be *the* dominant feature of aboriginal obsidian exploitation in the Mt. Edziza region. This raises some significant questions about the nature of aboriginal use of this area, and the correct modern management of such a significant prehistoric native landmark.

One of the initial questions which concerned us at the outset of the 1981 field season was whether any patterns would be discernible in the spatial and temporal distribution of obsidian colour variants which would permit reconstruction of vectors of prehistoric movement of obsidian both on and off the mountain, in relation to "point" quarry sources. Initially, such colour variants were hypothesized to be possibly more specific indicators of localized sources than chemical types, which would probably prove to cross-cut large areas covered by the original obsidian flows. To test this hypothesis, it was first necessary to demonstrate that the obsidian colour variants were consistently and discretely recognizable and specific to individual quarry sites. A second preliminary fact, not considered prior to our field work, was also the necessity to demonstrate some kind of quantitative comparability between different colour variants (i.e. which was most common, which was least common), in terms of densities at the source in order to assess the relative significance of widely scattered occurrences. Our experience in 1981 indicates that questions raised by the demonstrable occurrence of markedly different colour variants will probably not be easily answered.

First, it cannot be proven that any distinctive colour variant is restricted to a *single* highly localized point source. However, Goat Mountain obsidian, in general, may bear some distinctive colour characteristics in relation to the Coffee Crater source. Thus, little of the Goat Mountain material is notably banded, while little if any coffee Crater material ranges into colour shades other than dark green-pitchy-black. Any light opaque mottled green obsidian probably comes from Goat Mountain, or the South Valley sources; and red-brown, mauve, pink, steel-blue and other rare variants are seen only on Goat Mountain, and nearby cultural sites. Unfortunately, these distinctive colour variants appear to occur at all Goat Mountain sites, and cannot be isolated to a small discrete source. The apparent overwhelming dominance of Goat Mountain as an obsidian source suggests that most Edziza obsidian was probably aboriginally obtained from that general locale, thus reducing the potential significance of distributional studies of the sort originally proposed. Indeed, preliminary XRF studies indicate that Edziza type 3 is the most commonly distributed and is equivalent to materials found in Artifact Valley. Secondly, while there certainly are distinctive -- one could even say highly unusual -- obsidian colour types originating in the Mt. Edziza (Goat Mountain) area, most of these are so rare relative to the ubiquitous black to dark-green glass, even in sites directly adjacent to the source, that they will probably never be observed in significant numbers any distance from the mountain. Thus, these exotic colour variants will probably not be of much use in distributional studies, even if they should eventually prove localized to specific sources. In the end, detailed studies of chemical variants may prove more useful in tracing general trends of exploitation and distribution through time.

A second question of interest was whether significant obsidian sources, and site "trains" associated with them, would show any correlation with primary routes of access and communication onto and through the mountains. We wondered, specifically, whether certain sources might have proven more accessible from the east (interior) or west (coast) and whether access could have affected the nature of their aborigninal utilization. As it turned out, this question would have been of greater significance if it had been shown that the bulk of original obsidian utilization was spread between a number of widely separated, equally significant quarries; this was not the case. Goat Mountain is apparently the dominant source and seems readily accessible from all directions. Goat Mountain is located immediately south of Raspberry Pass, which is the only low valley through the north-south axis of the Edziza-Spectrum Range, and a major route of communication from both east and west. As demonstrated by the historic Telegraph Trail, Artifact and Bourgeaux Valleys provided natural routes to the east, towards the Iskut-Kakkidi Valleys; while Raspberry Valley (via Caribou and Point Valleys) provides an equally easy avenue to the west, connecting with Mess Creek, and the Stikine River. These primary east-west channels to the mountain lead directly into extended secondary axes of communication in all directions, defined by major river and lake systems and the Pacific Coast. For instance, obsidian could have been readily transported down the Stikine to its mouth, where it could have been distributed north or south along the coast. In the opposite direction, obsidian being moved up the Stikine and Tanzilla Rivers to Dease Lake could have been easily transported eastwards via the Laird or Finlay Rivers, and into the MacKenzie drainage. Similarly, obsidian carried directly northwards, via the Tahltan or Tuya Rivers, would have shortly entered the headwaters of the Yukon system, with virtually unlimited potential movement from there. Southwards, communication would have been almost equally direct via the Iskut and Bell-Irving Rivers to the headwaters of the Nass and Skeena systems. Thus, natural communication routes tend to place the Goat Mountain source in a highly strategic location, where its lithic produce could be readily distributed in all directions without obviously favouring any particular distributional vector over another. In fact, Edziza "Type 3" obsidian occurs from the Peace River in northwest Alberta, to Punchaw Lake in the Central Interior of B.C., to the Queen Charlotte Islands on the northern Northwest Coast (R. Carlson, pers. comm. 1982). The Coffee Crater area, on the other hand, is in a less favourable position, although its materials could still have been moved both east and west, with greater effort.

With the exception of some alluvial and morainal sources, all major obsidian quarry sites located to date occur in relatively high alpine zones, raising the question of their continual accessibility and degree of exploitation through time. As noted earlier, it is possible that many of the peaks of the Edziza-Spectrum Range, including Goat Mountain, remained above any general Late Wisconsinan ice surface in this area, although access would probably have been extremely difficult, if not impossible, during that time. Following the major valley glaciation stage, ice apparently withdrew mainly by vertical downwasting of glacial masses in the major valleys, rather than by horizontal recession of valley tongues up into the mountains, encouraging utilization of upland areas by any existing peoples.

Some time prior to 8500 B.P., deglaciation had advanced sufficiently to allow establishment of the present drainage patterns, and any remaining mountain ice was presumably no more extensive than at present. There is no evidence of well-defined terminal morains lying outside of the Neoglacial maximum position in any of the areas examined, and it is possible that local Hypsithermal glaciers were significantly more withdrawn than now, if not absent. On this basis, it is probable that alpine regions were more accessible, and alpine environments better for human exploitation, prior to the Neoglacial. During the thermal maximum, which Miller and Anderson (1974) date to between ca. 8000 and 3000 BP. in the Atlin region, alpine glaciers may have been much more reduced than present, if not entirely absent in many areas, and permanent snowfields were probably much reduced in area, improving ease of travel through alpine areas, and exposing larger surfaces for obsidian collection. Conversely, a trend to renewed glaciation, snowfield expansion, and a lowered treeline associated with developing Neoglacial conditions can only be seen as restricting use of alpine areas and lithic quarries. The extent of permanent snowfields could be critical to obsidian extraction and, even today, the largest Goat Mountain sites are closely bounded by major snowfields, while the Goat Mountain cirque sources exist only as small ground exposures in the middle of an extensive snow pack. It is probable that even minor increases in the extent of the permanent snow cover in the Goat Mountain area would significantly degrade the utility of the alpine obsidian quarry-sites. As well, at the same time as Neoglaciation began to degrade high alpine environments, re-expansion of cirque and valley glaciers may have begun to rejuvenate the amount and quality of obsidian available at lower elevations, such as in the Point Valley moraine.

In addition to climatic factors, increased volcanism in the last 5,000 years may also have acted to discourage use of portions of the Mt. Edziza complex. The Raspberry Bog and EP 80 sections reveal 4 significant tephra eruptions affecting the Raspberry Pass area since about 4,900 B.P., including a fall of heavy pyroclastic ejecta ca. 4,500 B.P., which must have been exceedingly unpleasant to experience, and which probably significantly and permanently buried a considerable portion of the original surface.

Thus, several environmental factors may have reduced the desirablility of alpine terrain and obsidian sources over the last ca. 4,500 years. The result, in terms of decreased cultural involvement, was probably more a matter of degree than any dramatic cessation of use of high elevation areas. However, it is conceivable that individual volcanic events may have prevented significant occupation of large portions of the Mt. Edziza Range for a few years or decades at a time. On this basis, I am willing to hypothesize that the major Goat Mountain quarry sites probably represent mainly, but not necessarily solely, pre-Neoglacial occupations, and that reduced accessibility to these primary sites shifted the pattern of obsidian exploitation towards lower elevation plateau (?) and valley sources in the last few thousand years. This hypothesis may eventually be tested by application of more precise obsidian dating methods than presently available, or through technological-stylistic studies of the flaking industries in the area. Additionally, discovery of significant obsidian quarry workshop sites beneath existing Neoglacial snow and ice cover would confirm the presence of more expansive Hypsithermal use of the area.

Whether a trend towards diminished use of high elevation sources would have affected the nature and type of obsidian redistribution beyond Mt. Edziza is not certain. However, the large Goat Mountain sites are collectively quantitatively the richest foci of obsidian so far known in the area, and essentially represent concentrated surpluses of this raw material. While the diffuse "plateau" surface scatters may include, in total, more surface items than any individual quarry site, such sources may also lend themselves much more to *ad hoc* use as needed, than as sources of obsidian surplus for trade or redistribution. Even if people did collect widely scattered surface items in order to accumulate surpluses, the possible Neoglacial "loss" of the concentrated raw material bulk represented by the main Goat Mountain sites, might suggest that the amount of obsidian aboriginally distributed outwards from Mt. Edziza diminished during the last 2-3 thousand years, in comparison to that of earlier periods. At the moment, there are not enough source-identified obsidian items reported from date site contexts to verify this hypothesis; however, it does appear that a considerable number of known items of Edziza obsidian in distant dated sites are as old, or older, than 3-4000 B.P. This includes finds from Groundhog Bay, the Queen Charlotte Islands, and Punchaw Lake.

The obsidian sites on and around Goat Mountain present unique management problems and opportunities. Goat Mountain must be considered a major Native and historical landmark in northern British Columbia, since the extent and density of cultural material in this locality is probably not equalled by any other known lithic site context in the province. When Goat Mountain is coupled with the extremely rich site concentrations in Artifact and Bourgeaux Valleys, the amount of surface material is truly staggering. It makes sense to view this area as a unit -- rather than as a cluster of individual sites -- since the intensity and visibility of aboriginal occupation is clearly mainly due to the presence of the Goat Mountain quarries. In my own experience in the archaeology of Northwestern North America, which includes contact with one other large recorded obsidian quarry locale in the western Subarctic (Batza Tena in Alaska), I have seen no other site complex which achieves the density of surface cultural materials of EP 8 and 21. EP 8 and 21 are both readily visible from the air as broad "black" patches smeared across the alpine landscape. I doubt that any other lithic site in the province could be so identified.

Non-Quarry Sites

Non-quarry sites include all localities lacking significant quantities of naturally available obsidian raw material, and include lithic workshops, where secondary lithic reduction was the principle archaeologically visible activity; "camps," where normal domestic processing and maintenance tasks dominate the artifact assemblage, and "intermediate" or multi-purpose sites where both domestic activities and lithic reduction are represented.

Selected Surface Site Descriptions

In this section, some of the more important non-quarry surface sites and assemblages will be briefly described, in order to facilitate interpretative discussions to follow.

EP 17:

This site is situated on a complex of small kame terraces on the east flank of Goat Mountain, at about 1630 m elevation, directly opposite the south portal of Rocky Pass (Fig. 14). Cultural materials are distributed in 4 principle concentrations about 20-30 m apart along the crest of the ridge. The back of the ridge is separated from the main slope of Goat Mountain by a deep swale, or old melt-water channel segment, now infilled with snow and melt-water, providing a useful water source immediately at hand. Wet Creek is also directly accessible down-slope. A low twisted mat of stunted fir shrubs occupies the southern end of the ridge, providing some firewood, and the overlook potential of the site is virtually unlimited to the east. The site also possesses good insolation and is sufficiently high and exposed to be nearly insect-free. Finally, a short steep scramble up the mountain slope immediately behind the site brings one directly into the Goat Mountain cirque, and its obsidian.

Artifacts include a single wide-edged end-scraper, one side-scraper of light grey rhyolite, 3 relatively thick, unifacial core-scrapers, one retouched flake, one probable "Ice Mountain" type microblade core, based on a relatively flat, tabular retouched flake, (Figs. 75, 76i and 77f) one macroblade, 7 nondescript obsidian biface preforms, one short wide and thick biface of grey rhyolite, and one flake core remnant. Flakes and artifacts are clearly subjected to frost sorting and movement down the sloping ground exposures.

EP 28 (Miranda Site):

This site occupies a low sandy ridge on the south side of Artifact Valley, at about 1530 m elevation, opposite and at the same level as the large "slide area" described in the section on "Quaternary Environment." The ridge, which runs parallel to the trend of the valley, rises about 3 m above the surrounding surface on the north, and ca. 6 m on the south, where it overlooks a small melt-water pond and stream. A thick scattering of flakes was observed in an open exposure near the west end of the ridge, as well as a surface concentration of microblades and single large complete leaf-shaped biface. This specimen measures 121 x 38.8 x 16.8 mm and has a pronouncedly plano-convex lateral cross-section (Fig. 80a). Flaking on the end of the convex dorsal surface is relatively refined, including small-scale retouching, while the flat ventral surface carries a small number of broad soft-hammer thinning scars. This is clearly a preform, but of a rather advanced stage, and one apparently intended to produce a thick, leaf-shaped end-product. At least 5 microblades were within a few centimeters of this piece, and a total of 29 microblades and one primary spall were found at this site. We trowelled off surface moss over an "L-shaped" area 6 m long x 1-2 m wide to expand the natural exposure, but most artifacts were found in the area of the original discovery. There was no indication of a buried component, or of any stratigraphic associations for the artifacts.

The location of EP 28 is a little unusual since a clear overview of Artifact Valley is not possible from this site, which is situated a considerable distance back from the main valley edge, on the surface of what is probably a kame terrace. In some ways the setting is reminiscent of EP 80, (discussed in a later section) since the terrace surface is an animal travel route east and south from Artifact Valley. The site is interpreted as a short-term flaking station dedicated to microblade manufacture, with little or no evidence of prolonged or functionally varied activities.

EP 50

This site is located on the crest of a round-topped rocky knoll, which rises about 30 m above the main terrace surface on the east side of Ball Creek, about 1 km south of Floatplane Lake, at an elevation of ca. 1500 m. The site location completely dominates the

Ball Creek Valley, which is a principal route up into the alpine zone from the south. Although the site possesses a superb overlook capacity in all directions, the steep sides of the knoll would also make this a naturally defensible position. There is a broad shallow natural depression on the summit, which shelters a carpet of shrub birch, and a snow patch protected behind the northeast flank of the knoll provides a local source of water, if necessary. Obsidian detritus was scattered over the mainly rocky exposed surface of the knoll. Most flakes were small biface trimming detritus and a fairly high frequency of mauve and blue coloured obsidian (probably Goat Mountain) was observed. Artifacts include a single expanding stem projectile point (Fig. 72i), 2 well-made biface fragments which are probably pieces of other projectile points, a wide pointed unifacial "knife" of basalt (Fig. 82 b) and one retouched flake.

EP 58:

This is one of the most isolated and unusual site assemblages observed in the Edziza area. It was located among a complex of esker ridges at an elevation of about 1500 m, on the South Plateau at the upper end of More Creek (Fig. 16). At this spot, "Eastone" Valley cuts through the backbone of the Spectrum Range and falls eastwards towards Ball Creek. The esker complex represents a late Pleistocene sub-glacial drainage system which was continuous westwards from the head of Eastone Valley over the South Plateau, crossing the trend of the present More Creek drainage. A ramifying complex of ridges at the head of Eastone Valley merges into a single ridge which can be traced on air-photos for almost 2 km out onto the plateau. Unfortunately, we did not have time to walk the length of this ridge ourselves. EP 58 was discovered as a scatter of obsidian flakes and artifacts in a broad gravelly exposure, occupying a swale between eskers, in the area of branching ridges (Fig. 38). Immediately on the opposite side of the esker forming the east boundary of the site lies a relatively large pond dammed within the esker complex (Fig. 36). A single small fir tree growing on a southwest-facing slope of the esker beside this pond is the only specimen of arboreal vegetation for several kilometers in any direction. Otherwise the plateau surface consists of bare nivation exposures, snow patches, and scattered grass, moss and lichen vegetation. The vista across the vast, barren, rolling surface of the South Plateau, broken by fresh-looking glacial ridges and hummocks, and a complex colour pattern of snow and gravel dwindling into the jagged backdrop of the Boundary Range in the far distance, is more akin to a polar landscape than to any usual image of British Columbia (Fig. 38).

At the time we found EP 58, we had been walking for a good many hours without encountering any cultural material, and we were

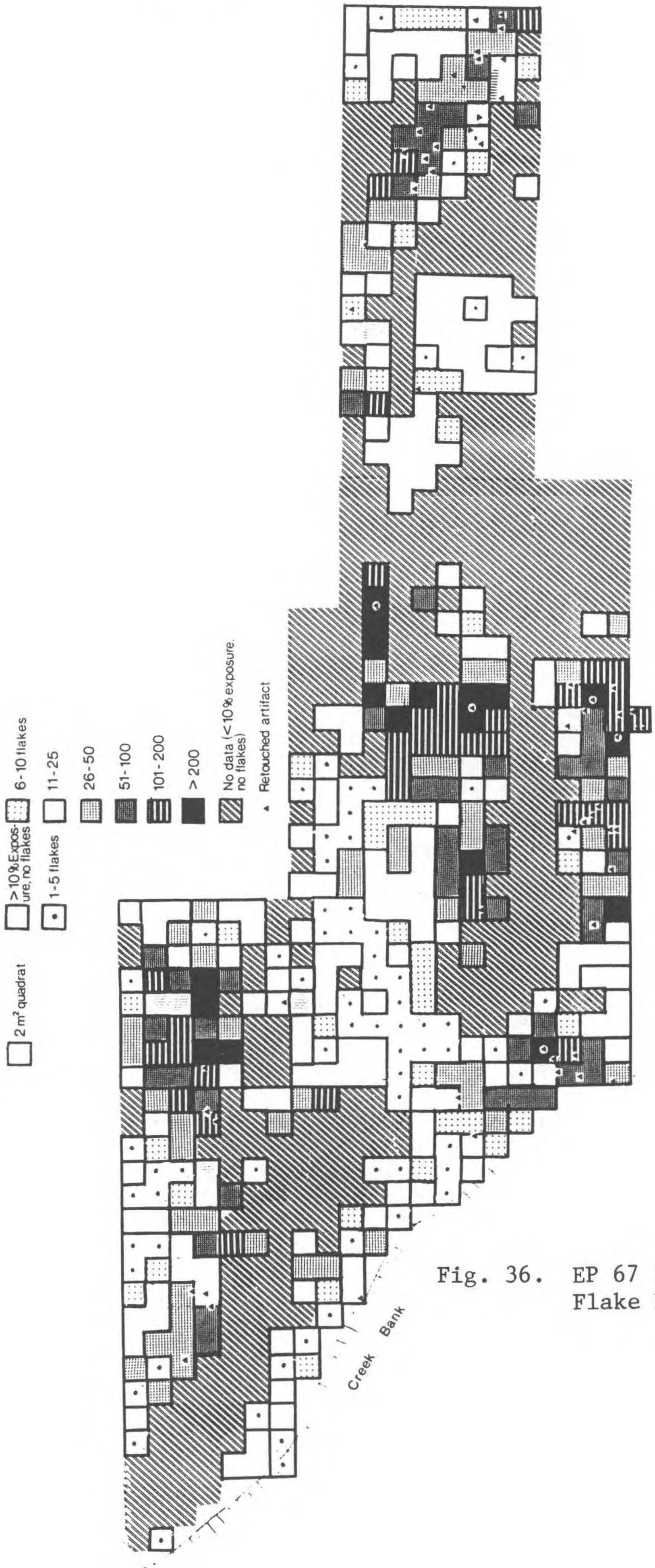


Fig. 36. EP 67 Surface Flake Density.

contemplating the possibility that the South Plateau would prove barren of sites. Although a few widely scattered flakes were noticed further south, down More Creek Valley, the isolated nature of EP 58, and the closely concentrated artifact distribution within EP 58 (Fig. 36) makes it nearly certain that all objects found here result from a single, brief occupation. This is significant, since the assemblage itself is somewhat unusual. It includes a large oblique collaterally flaked, leaf-shaped projectile point (Fig. 72a), deliberately burinated; 2 side-scrapers; 2 retouched flakes; 2 expired remnants of non-"Ice Mountain" type microblade cores (Figs. 75a,k, 76g,k and 78d,e); 14 microblades, including several medial fragments possessing lateral use-retouch; 2 nondescript biface fragments, and a single flake core fragment, all of obsidian. Unfortunately, no buried component or dateable material was found, and the age of this assemblage must remain uncertain.

I interpret this site as the remains of a single short-term hunting camp, deliberately situated to intercept game, probably caribou, using the esker as a travel route. The seeming present inhospitality of the site location as a camp, even on a mild July day, leads to speculation that environmental conditions may have been different at the time of the original occupation. A rise in tree-line over the crest of Eastone Valley of only 30-60 m would probably have been sufficient to allow forest to expand over the site area, and the presence of a single stunted fir tree in the area today both proves the inherent feasibility of this notion, and possibly represents a remnant of an earlier population. Such an upward shift in tree-line may well have occurred during peak warm periods of the "thermal maximum" or Hypsithermal, some time prior to ca. 4000 B.P.

EP 67:

This site occupies the broad flat surface of the old proglacial fan-delta on the east side of Point Creek near its confluence with Bourgeaux Creek, on the south side of Bourgeaux Valley, at an elevation of ca. 1450 m (Figs. 13 and 15). Obsidian scatters were observed across the delta surface, which forms a pronounced terrace promontory overlooking the low floodplain of Bourgeaux Valley and lying at the terminus of a long melt-water channel, which slopes gently upwards towards the east and the north portal of Rocky Pass. As will be noted in the description of EP 80, this outwash channel serves as a major animal travel route along the valley. EP 67 possessed some of the largest continuous ground exposures in the Artifact Valley-Raspberry Pass area, so it was decided to systematically plot surface flake frequencies across this site. This involved establishment of a 2 x 2 m grid over the central western portion of the site, and counting flakes within 746 2 x 2 m units, representing approximately 2-5% of the total site area. Because many sampling quadrats possessed some proportion of vegetation obscuring the site surface, an estimated percentage of exposure was also determined for each 2 x 2 m unit. Dividing number of flakes into exposed ground area produced an estimate of flake density per 20 cm^2 (1% of the area of a 2 x 2 m unit), which could then be extrapolated to predict theoretical total flake density in each unit. Only 2 x 2 m quadrats possessing more than 10% exposed ground were treated in this way. The resulting plot is shown in Fig. 38, where flake densities are coded by shading. Although vegetation patches (mainly shrub birch) hinder interpretation, it seems that two main flaking concentrations are represented, one covering a roughly oval area about 40 x 20 m in size, and the other, also somewhat ovate, about 20 x 12 m. These flake concentrations are also associated with artifact occurrences, mainly biface preform framents, but also occasional tools. Each area of concentration appears to have its long axis orientated at right angles to the steep escarpment dropping into Point Creek which forms the west side of the mapped zone, and the two areas are separated by about 12-14 m of very low flake occurrence. A final third area of high artifact and flake frequency at the east end of this site (Fig. 37) marks the head of a long nivation mudflow, and cultural materials in this area are undoubtedly displaced by cryoturbation processes.

The pattern of flake distribution at EP 67 is open to several interpretations: (1) The apparently discrete surface concentrations may represent activity areas separated in space and/or time. However, artifacts reveal no significant differences between the areas. (2) The areas of flake and artifact concentration may be perceived as defining a single coherent, roughly circular "encampment" (although unknown extensions beyond the mapped area may exist), approximately 50 m in diameter, with cultural materials localized around its periphery. No evidence of structures or hearths was identified.

The surface artifact assemblage from EP 67 was the largest recovered in the Edziza area (63 items) (Table 2). Most (50) were broken biface preforms or flake core fragments, including the bulk of items from the site-portion shown in Fig. 37. Other artifacts include a single relatively small expanding stem point from the central area of concentration (Fig. 72h); 1 wide-edged and 2 narrow-edged end-scrapers (2 of which came from the nivation flow, east of the plotted zone); 1 tip of a green rhyolite-formed uniface "point," perhaps a drill; 5 retouched flakes, 1 "macroblade" and 1 "battered piece." No vestige of a microblade industry was seen at this site.

Fig. 37

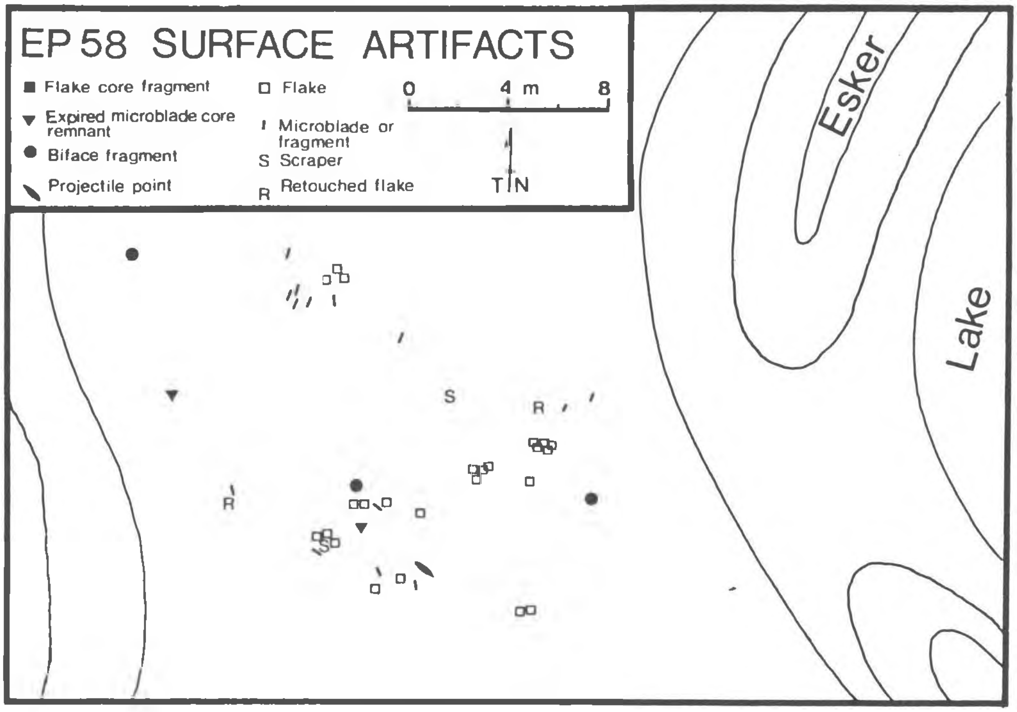


Fig. 37. EP 58 Surface Artifact Distribution.

EP 83:

This site is located on the opposite side of Point Creek from EP 67, on a low gravel knoll near the confluence of Point and Bourgeaux creeks, facing the eastern entrance to Raspberry Pass at about 1430 m a.s.l. (Fig. 15). A dense litter of artifacts and flakes was concentrated over the exposed gravelly surface of the knoll, in an area approximately 50 m in diameter. The gravel surface is an active nivation exposure, nearly completely surrounded and hidden from view by a natural hedge and mat of stunted fir trees and shrub birch. Most artifacts and flakes were found concentrated at the lower sloping edge of the exposure, indicating that they have probably been displaced from original locations towards the crest of the knoll. The site assemblage is highly diverse (42 items, 15 classes), although it totally lacks any evidence of a microblade technology (Table 2). It includes 21 flake core fragments and broken and unfinished biface preforms; 4 end-scrapers, equally of wide and narrow types (to be described later) (1 of rhyolite); 1 side-scraper; 1 formed uniface (a broadly pointed asymmetrically unifacially retouched flake); and 7 retouched flakes. The only projectile point from this site is a Type 1(a) leaf-shaped form, of heavily weathered basalt(?) (Fig. 72d). Other rarer artifacts include a single small battered-pebble hammerstone, and an incised pebble. The latter is a small elongated rounded pebble of a fine-grained grey-green medium hard rock (tuff ?), covered with parallel striae, sometimes in criss-crossed patterns, as well as two deeper V-shaped grooves worn in one end (Fig. 86d). The striae are definitely artificial in origin, and probably result from use as an abrasive stone in grinding biface preform edges during the flaking process.

Strong evidence for cryoturbation and horizontal displacement of artifacts at this site makes its interpretation difficult. The location is a prime campsite, overlooking and controlling travel into the eastern entrance of Raspberry Pass, and could have been repeatedly occupied. The extremely weathered nature of the projectile point might lead to the suggestion that it belongs to an earlier component than the bulk of materials at this site but, since those are mainly obsidian, weathering rates are obviously non-comparable.

EP 96:

EP 96 includes a series of low hummocky ridges, at ca. 1480 m along the north side of Bourgeaux Valley, opposite Point Valley (Fig. 39). It was arbitrarily divided in the field into two collecting areas (E and W), separated by a small unnamed stream. The western portion occupies a single sloping nivation exposure along the edge of the creek gully. It contained large quantities of flakes and

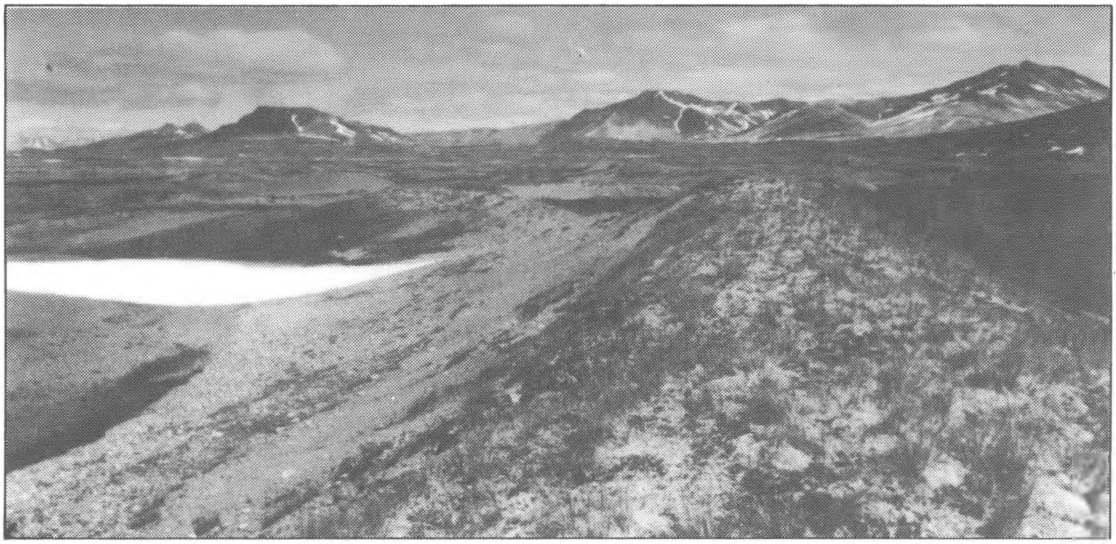


Fig. 38. View of a portion of the South Plateau, looking north up More Creek. Figures in left distance are on EP 58; note esker and pond (middle right).

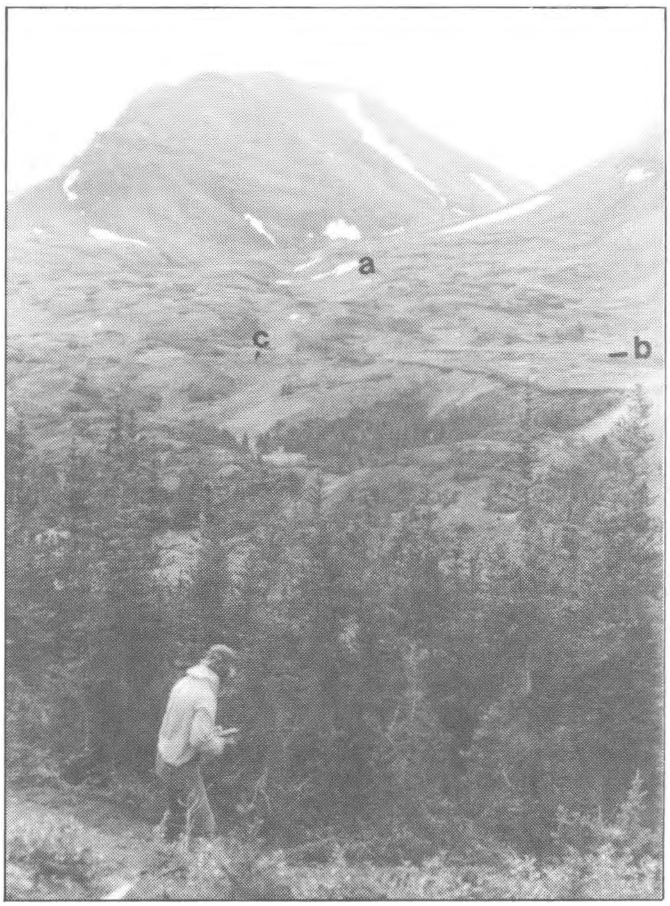


Fig. 39. View from EP 96 looking south across Bourgeaux Valley to the northern mouth of Rocky Pass. Note multiple meltwater channels (a), surface of Point Creek proglacial fan-delta (b), and location of the Grizzly Run site (EP 80) (c).

biface preform fragments, and 1 wide-edged end-scraper. This is clearly basically a flaking station devoted to biface manufacture, of a character rather similar to the excavated EP 1 "House 1," to be described in a later section. East of the creek, cultural materials are scattered over a complex series of small undulating ridges and knolls, interspersed by "islands" of low stunted fir. Crests and south-facing slopes of the ridges are often bare, and these yielded considerable evidence of cultural activity. Biface fragments were again the most common artifact, but those from 96E tended to be better flaked and apparently more finished than those from 96W. This included one base fragment of a large leaf-shaped biface, finely retouched, with a symmetrical lenticular cross-section, and lightly ground edges. A single long straight microblade was also found about 10 m from the biface fragment in a blow-out on the crest of a knoll. A small knife-excavated test-probe revealed the presence of a buried cultural component about 30 cm deep. This consisted of a thin band of flat-lying biface-thinning flakes apparently within a volcanic ash bed, resting directly on fluvial sand and gravel. The cultural ash layer is overlaid by 4 cm of a dark gray-green silt; 3 cm of light yellow-brown silt (probably another ash); a 6 cm thick bed of coarse reddish-brown tephra (almost certainly the Ash 3 "cinder" layer of Raspberry Bog and EP 80, both of which lie directly across the valley from EP 96), capped by 10 cm of yellow-brown silt and the modern sod. This sedimentary sequence is nearly an exact parallel of that in the nearby Grizzly Run Site (EP 80), where a lower cultural component was found just above the basal tephra member. Dating of EP 80 and the Raspberry Bog peat section would suggest that the buried cultural horizon at EP 96E is probably about 5000 years old and is probably the source of the microblade found in the nearby blowout. The fact that the lower ash seems to directly overlie basal glacio-fluvial (?) sediments at EP 96E may indicate very little net sedimentary accumulation on this site during the pre-5000 B.P. portion of the Holocene, or may simply reflect the interpretative inadequacies of such a small study section.

EP 97:

EP 97 was found about 500 m southeast of EP 96, on an exposed sandy ridge which rises about 10 m above the marshy floodplain of Bourgeaux Creek, on the north side of the valley (Fig. 15). The surface of the ridge lies at about 1410 m a.s.l., and is crossed by an old unused segment of the Telegraph Trail complex, while the modern horse trail and old telegraph wire follows the edge of the boggy Bourgeaux Creek floodplain around the base of the ridge. EP 97 was also divided into eastern (E) and western (W) collection areas due to a major constriction of the ridge, which seemed to break it into two physiographically distinct sub-areas. The northern, or up-slope edge of the ridge holds back a hanging bog between it and the main wall of Bourgeaux Valley, so that there is essentially flat boggy meadow both behind (N) and in front (S) of the site.

EP 97W was primarily a microblade and biface flaking station, and yielded the bulk of artifacts from the site (43 out of 52). These included 25 biface preform fragments; 8 microblades (and 1 primary spall); 3 retouched flakes; 1 core-scraper; 1 wide-edged end-scraper; 1 flake core fragment; 1 pebble hammerstone; 1 macroblade; and 1 small mid-fragment of a thin obliquely collaterally flaked projectile point. All of these artifacts were clustered within an exposure approximately 30 x 20 m (Fig. 40). Across the constriction dividing the site into two collecting areas, were a further 4 biface preform fragments and 2 flake cores, as well as a broken corner-notched projectile point. Also, at a considerable distance further east from the area shown in Fig. 40, came a single, long, bifacial edge-spall, or possible microblade "primary spall" of an IMMI-type core.

Whether site 97 should actually be treated as a single collection unit cannot be resolved. As discussed in the sections on "projectile points" and "cultural chronology," this site is one of the few examples of a possible association between large notched points and microblades in the Edziza area. The site itself is a prime campsite, bare and well-drained, with good perspectives up and down the valley. It may well have been occupied repeatedly in the prehistoric past, given its proximity to what is probably a long-standing trail system. The discovery of a "cache" of 3 glass insulators for the historic telegraph line, in the bog just behind the site, suggests that the area was also utilized into the contact period.

<u>EP 101</u>:

This site was located on a bare ridge high on the north side of Bourgeaux Valley (ca. 1480 m) directly opposite the north entrance to Rocky Pass (Fig. 15). A small creek flows past the ridge on the west, draining a pond and bog directly behind it, while a much larger stream (unnamed) flows to the east. The overview potential of this site is superb in all directions, including into the V-shaped col of Rocky Pass to the south. The suitability of this location as a hunting lookout is probably confirmed by the presence of two modern brass cartridge cases and a small piece of brass snare-wire. These were the only such artifacts that we noted in the region.

The aboriginal artifact assemblage from EP 101 (n=39) includes 14 biface preform fragments and broken flake cores; 10 microblades and 1 primary spall (including one blade medial segment with lateral use-retouch); 3 side-scrapers (which are thick, with heavily crushed

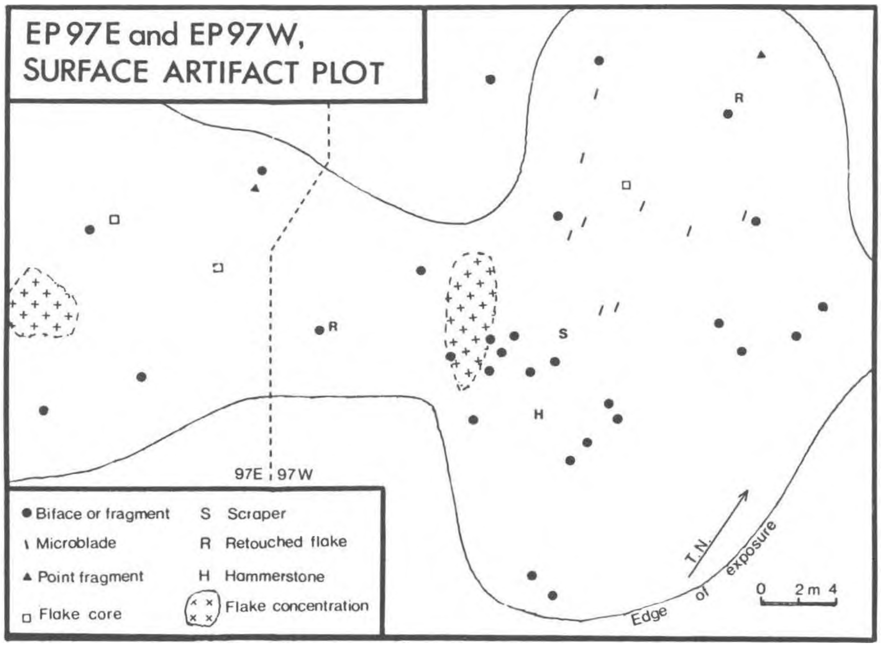


Fig. 40. EP 97E and EP 97W, Surface Artifact Plot.

near right-angled edges, including 1 possible spokeshave); 1 each, wide and narrow edged end-scrapers; 2 "battered pieces"; 2 hammer-stones (1 of which is a small, flattened discoid pebble, heavily use-battered around its entire edge); and a single tip-broken, green chert, lanceolate, concave-based projectile point, found a considerable distance away from the rest of the surface assemblage (Figs. 72g and 73f).

EP 101 is a very strategic situation, both as a hunting overlook and general lookout, and as a prime campsite, vis-a-vis drainage, exposure, water access, and access to game trails and travel routes. Regarding the latter factor, a modern horse-trail towards the Main Plateau ascends the north flank of Bourgeaux Valley on the opposite bank of the eastern creek, and its prehistoric equivalent may well have passed directly by this site. The site has probably been repeatedly re-occupied, and, as discussed in later sections, the original cultural association of lanceolate point and micro-blades is considered dubious.

EH-1 (and related historic features):

EH-1 ("Edziza Historic 1") is the only purely non-aboriginal, non-prehistoric site recorded in 1981. It consists of the partially collapsed remains of a small log "line-cabin," probably built as a part of the Dominion Telegraph system, to serve as residence for a lineman who maintained the telegraph through the Raspberry Pass area. The cabin is located on the south side of Bourgeaux Creek, at the point where the telegraph line crosses the creek, about 1 km downstream (east) of the confluence of Bourgeaux and Rocky Creeks (c. 1380 m a.s.l.). The area is well within the limits of dense subalpine forest, and is best reached by following the modern horse-trail. The remains of the cabin are illustrated in Figs. 41 and 42.

The original structure was small (ca. 3 x 3 x 1.4 m) and primitive, with low log-walls, doubled and insulated with earth around the base; an overhanging roof at one gable end to form a porch overlooking Bourgeaux Creek; a pole bunk across the end wall opposite the door; a sheet metal stove, and some shelves and cupboards made of old packing cases. The door itself hung on leather hinges and was pieced together from short packing case boards. The roof was formed of logs, overlaid by canvas or oilcloth, and there were no windows. The slope leading down to the creek from the door of the house is littered with rusted tin cans and broken bottles, and scattered in the forest around the house are various vestiges of the telegraph line, such as coils of wire and broken insulators. The telegraph wire apparently originally entered the house, where the occupant probably possessed a key. The main line must have originally crossed Bourgeaux Creek

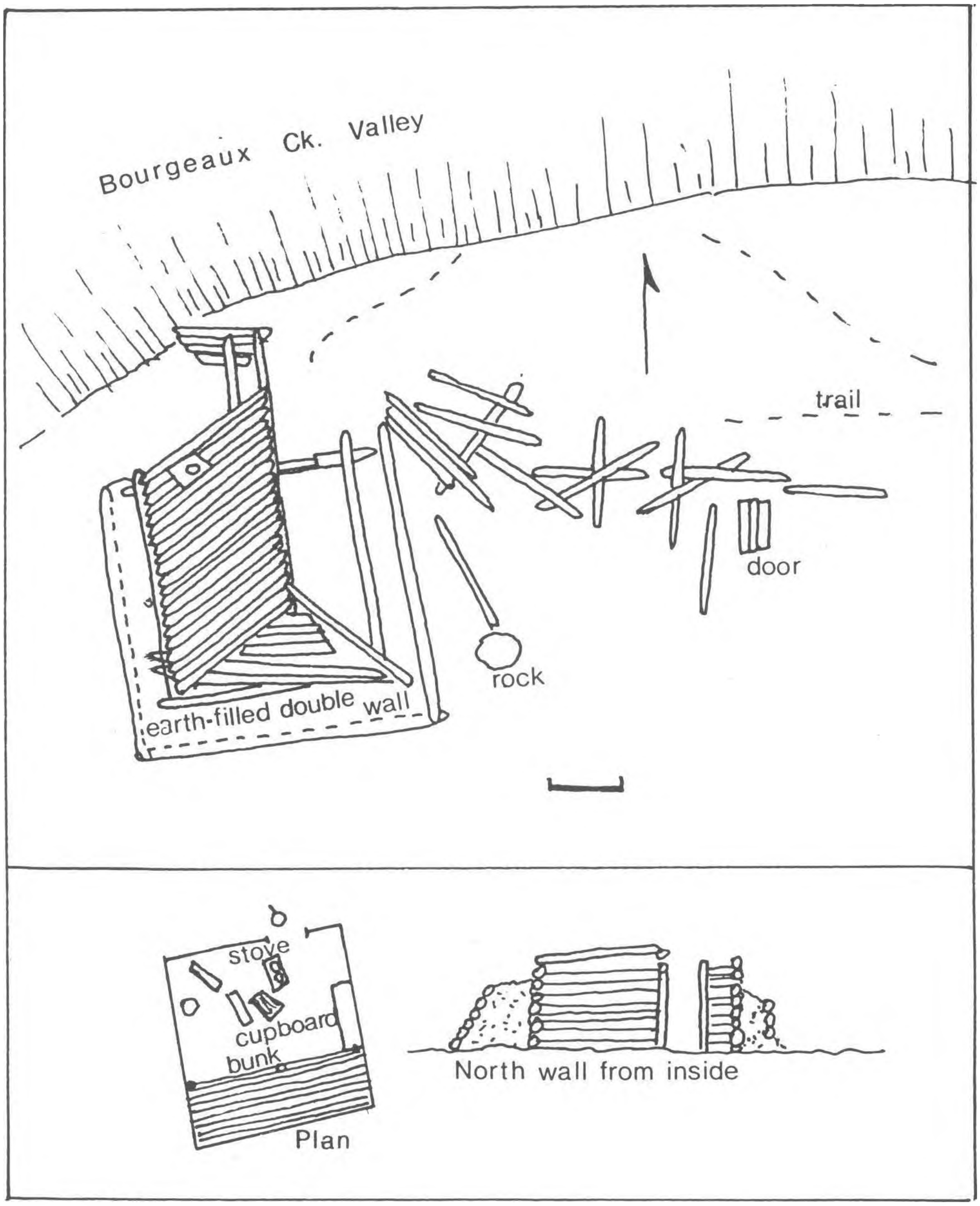


Fig. 41. EH 1: Bourgeaux Creek Telegraph Line Cabin.

in a single span hung from now-collapsed towers, while a bridge probably also existed for the trail. Although the original blazed clearing for the line can be detected, and the telegraph trail itself is still well-defined for several kilometers on each side of the cabin, there is no remaining trace of a bridge.

Besides the line cabin and the telegraph trail itself, many other vestiges of the old Telegraph line are still visible. Through most of upper Bourgeaux and Raspberry Valleys the wire can still be followed more or less continuously, and occasionally is still strung on the original poles (Fig. 43). However, in most cases the poles are fallen and insulators stolen. At one point, about 1 km upstream (west) from the cabin at Bourgeaux Crossing, at site EP 104 (Fig. 15), relatively strong vestiges of the historic Telegraph line are superimposed on earlier prehistoric remains. This situation is not unusual in Raspberry and Bourgeaux Valleys where the steel wire is often found stretched across flaking scatters, but the EP 104 occurrence is particularly evocative of a little-known segment of recent Canadian history. Here, an old blaze, on the underside of an overhanging fir tree which stood directly beside an older portion of the Telegraph Trail complex than the one currently used, records the names and thoughts of some men who passed through this area in 1928 and 1929. The old blaze is largely overgrown, now obscuring much of the original writing in indelible pencil, but enough remains to be tantalizing (Fig. 44). Brief segments of messages such as "... none ... returned soon ..." or "never been ... never through ... more on ..." by men named "Dick Jackson" and possibly "River Breaker," dated 1926, 1928 and 1929, make it hard to resist trying to peel back the re-grown scar in an effort to learn the full story. Perhaps the most appropriate message from the beginning of one Depression to another is: "You got some change ..." These scribblings record the fact that throughout the first half of the 20th Century, and earlier, the Telegraph Trail was the *only* direct overland route from southern British Columbia into the Cassiar area and beyond to the Yukon. Perhaps Dick Jackson and his colleagues were refugees from the deteriorating economic situation of the Great Depression, on their way northwards in search of opportunities? Elsewhere on the Telegraph Trail other remains, such as a collapsed bridge abutment on upper Raspberry Creek, and the scattered frame members of at least 4 pairs of old snowshoes in the heart of Raspberry Pass, also serve to mark the historical importance of this route.

Lithic Workshops and Flaking Stations

All sites possessing low assemblage diversity, and a high ratio of flake cores, preforms and debitage, to modified functional tools

Fig. 42. Bourgeaux Creek telegraph line-cabin (EH-1), Bourgeaux Valley. View of east wall looking northwest.

Fig. 43. Telegraph wire still strung on pole. About 1.5 km east of the Bourgeaux Creek line-cabin, Bourgeaux Valley, looking north.

or weapons, are considered "lithic workshops" (cf. Figs. 25 and 26). This class includes the surface assemblages at sites 96W and 92, and the excavated components of "House 1" at EP 1, and Component 2 at EP 80. Smaller surface assemblages from sites 12, 13, 16, 28, 44, 68, 84, 91, 93, 96E and 108 also result from mainly secondary lithic reduction functions. In addition, many small surface assemblages with 5 or fewer artifacts can probably be assigned to this site class, particularly where relatively large quantities of debitage stand in contrast to few functional tools (eg. sites: 2-5, 7, 9-11, 15, 20, 23, 27, 29, 30-32, 34-45, 51-53, 60, 61, 64, 65, 70-78, 81, 82, 86-90, 94, 95, 98-100, 102, 103, 105, 109-114). In total, 65.5% of all assemblages are probably best described as flaking stations. As noted earlier, many of the surface sites may in fact be portions of larger multi-function site complexes, and/or be poorly represented by available exposed surfaces and assemblages. Nevertheless, it is not unreasonable to expect that lithic reduction was an important and widespread aboriginal activity in all areas adjacent to major obsidian outcrops. In addition, it is an activity which is far more visible by standard archaeological techniques than most other aboriginal behaviour.

Flaking stations are widely distributed through the study areas in the Edziza-Spectrum Ranges. They occur at an average elevation of 1,518 m, with a few sites as low as 1,380 m (about the lower limit of survey coverage) and as high as 2,090 m; exposure orientation is nearly evenly split between generally northerly, and generally southerly, reflecting the nearly equal site densities on opposite sides of E-W trending valleys. All sites are close to drinkable water; on the other hand, it would be difficult to ever get very far away from melt-water streams and ponds today in the areas examined. Virtually all flaking stations (the only real exception is EP 28) possess excellent overviews of surrounding terrain, and occupy ridges, knolls, terraced higher slopes, or in one case (EP 20) the very peak of a major mountain (Goat Mountain). All sites are primarily obsidian workshops; however, EP 34 and 70 include substantial additions of other local lithics, mainly an opaque ochrous-yellow fine-grained silicate, possibly a yellow "jasper." In most cases, precise site boundaries cannot be stated with confidence due to obscuring vegetation. However, judging from a few large exposures, and from the size of topographic features (knolls, ridges, etc.), individual lithic concentrations are generally small, usually ca. 10-50 m in diameter, or longest linear dimension. However, such lithic scatters are sometimes joined in groups or "strings" in longer sites, spanning hundreds of meters.

Observed lithic debitage averaged 100-200 items per site, with occasionally much richer concentrations. However, with the exception of the major quarry sites, most localities classified as "pure" flaking stations are relatively small, and not particularly densely littered with debitage, compared with some of the multi-purpose sites. Most detritus appeared to be biface thinning flakes, averaging 3 cm in maximum dimension or smaller, although larger primary detritus up to 10 cm or more in maximum dimension was relatively common in sites in Artifact and Bourgeaux Valleys. Sites in the Floatplane Lake area possessed consistently smaller detritus, less dense surface scatters, fewer biface preforms and cores, and less colour variety of obsidian, than did sites to the north, probably reflecting the ca. 20 km air-distance separating Floatplane Lake from the Goat Mountain quarries.

Several flaking stations (EP 28, 44, 80-Component 2, and 92) are dominated by microblade manufacture, including relatively dense clusters of blades themselves and core preparation flakes. At EP 80, component 2, and EP 92, the microblades can be partly refitted, indicating that they are early-stage products of single blade-core reduction sequences, and were probably judged unsuitable for use and abandoned as they fell from the core. Interestingly, none of these sites produced a microblade core or remnant itself, while several locales which did yield one or more microblade cores produced few if any blades. The Edziza microblade industry will be discussed further in a separate section; at the moment it is sufficient to note that microblade production is an important element of some flaking stations. However, in general, the bulk of flaking activity carried out at these sites appears to have been biface manufacture, judging from the nature of the detritus, and the nearly ubiquitous presence of fragmentary bifacial preforms. This artifact class is the most common surface cultural occurrence throughout the Edziza area, with the exception of unmodified flakes.

Three hundred biface preform fragments were found in surface assemblages, and another 144 were excavated. Most of these artifacts are heavy, unthinned early stages in biface reduction. Only a few generalized (non-projectile-point) bifaces found in the area are sufficiently thinned and secondarily trimmed to suggest that they might have been "finished" given the overwhelming local evidence for large scale aboriginal biface preform manufacturing. However, not even these pieces can be always confidently treated as "tools" rather than preforms. The second most common artifact type in flaking stations is flake cores (and fragments). These are usually relatively unsystematic multiple platform core remnants, although occasional single platform "polyhedral" flake or macroblade-like-flake cores occur. It is possible that the latter type of core occurs more frequently on the major quarry sites, but this must await confirmation by detailed studies of those localities.

Camps

All sites possessing high assemblage diversity and relatively low ratios of cores, preforms and debitage to modified tools are classed as "camps." These include some of the large surface artifact collections and, in the absence of detailed regional obsidian technological studies, are of the most interest for spatial and temporal comparisons. It is obvious that the category "camp" encompasses a wide potential range in site functions and associations (short-term, long-term; large group; small group; big-game hunting vs. small game, varied seasonality; diverse cultural-temporal associations etc.). Unfortunately, in most cases these variables cannot be more closely defined with the available data.

Major camp assemblages include surface sites EP 17, 69, 79, 83, and 101, and excavated collections from EP 1, Area 2, and EP 80, Component 1. A number of smaller collections containing solely or mainly retouched implements possibly also represent campsites. These include EP 18, 25, 33, 46, 48, 50, 54-57, 59, and 62. Thus, there are 19 possible campsite assemblages out of a project total of 116 (or 16.4%). Of these, the largest assemblages occur in Raspberry and Bourgeaux Valleys (sites 69, 79, 83, 101, and excavated Component 1 at EP 80) with an average of 28 artifacts each; the second largest assemblages occur in Artifact Valley (sites 17, 18, 25, and 33; and excavated component from EP 1, Area 2) with an average of 12 artifacts; and the smallest assemblages are found in the Floatplane Lake area (sites 46, 48, 50, 54, 55, 57, 59, and 62) with an average of only about 2 artifacts each. Therefore, while the Floatplane Lake region has a greater concentration of apparent camps, these tend to be much smaller and less rich in artifacts than the other study areas.

As with other site classes, many of the surface concentrations designated here as camps may eventually prove to be simply portions of larger multi-function site complexes. However, normal domestic activities must have been associated with all but the shortest-term aboriginal visits to this region. Hunting and trapping of large and small game, processing of animal and plant products, manufacture and maintenance of shelter, clothing, tools and weapons, food preparation and possibly preservation, care of children, and a host of other day-to-day tasks were probably all carried out by any families and bands camping in the alpine and subalpine areas for more than just a few days at a time. While it is conceivable that individuals or all-male task-groups occasionally made forays into the Edziza region solely to obtain obsidian or to hunt, ethnographic data seem to suggest that a sojourn in the mountains was frequently carried out as a multi-function portion of the normal seasonal round of whole bands or families. Although a lack of preserved organic remains prevents direct recognition of many normal campsite activites, some of the attributes of lithic assemblages from the Edziza area indicate the presence of women, in contexts strongly suggesting small band-sized encampments. Such indicators include a relatively high frequency of end-scrapers, usually assumed to be women's tools, as well as other less functionally definitive "side- scrapers," formed unifaces and retouched flakes, which are often found as frequent co-occurrences. Of 36 end-scrapers collected, only 4 come from sites designated as "flaking stations" on the basis of assemblage diversity and tool: core-preform ratios (1 from 96W, one from EP 1, "House 1," and 2 from EP 68); all others are associated with camps or multifunction sites. A similar although less strong correlation of "side-scrapers" and retouched flakes with camps is also indicated.

Campsites are less numerous than flaking stations in the areas examined, and give an impression of more selective positioning. Thus, the "purest" and largest camp assemblages (sites 1, 17, 50, 69, 79, 80, 83, and 101), all seem to occur in notably strategic or commanding locations in relation to natural avenues of communication. Thus EP 1 sits near the head of Artifact Valley astride the junction of a main route onto Goat Mountain from the east (Artifact Valley itself) and a major north-south communication route with Bourgeaux Valley (Rocky Pass and Wet Creek). People occupying this site are within 2 hours hike or less of the main Goat Mountain obsidian sources, and essentially control the most practicable routes to those resources from the east. Site 17 on the east flank of Goat Mountain above EP 1 has all the same attributes, but, being higher, looks directly into the mouth of Rocky Pass and is directly juxtaposed between that "gate-way" to Goat Mountain, and the obsidian sources themselves. it is also on the highest and closest flat surface presently possessing any firewood, adjacent to the Goat Mountain obsidian outcrops. EP 50, in the Floatplane Lake area, is located on the top of a prominent steep-sided bedrock knoll which completely commands Ball Creek Valley. This valley provides one of the most direct routes up into the Spectrum Range alpine plateaus from the south, and further travel northwards past Floatplane Lake and through South Valley to Artifact Valley would be relatively simple in the alpine zone. EP 69 is one of the highest recorded sites in Bourgeaux Valley, overlooking the mouth of Point Valley and the east entrance of Raspberry Pass from the upper limit of tree growth (Fig. 14). People travelling through Raspberry Pass from the west, with the intention of climbing directely into the Point Valley cirques, or beyond to Goat Mountain, would naturally pass this location. Sites 79 and 83 are close to the "Telegraph Trail," one on each side of Raspberry Pass, and command this very important communication route through the Edziza-Spectrum Ranges. EP 80 is situated near the western outlet of a prominent ice lateral channel along the south side of Bourgeaux Valley between Rocky Pass and Point Valley, which provides a natural "highway" through this area. Its location also distantly commands Point Valley and the eastern entrance of Raspberry Pass. EP 101 occupies a high ridge on the north side of Bourgeaux Valley, looking into the northern entrance of Rocky Pass. The overview potential of this site is as unlimited to the east, south and west, as the confines of a mountain valley system permit, and it also is situated close to a trail northwards onto the Main Plateau.

While it might be argued that virtually any location within Artifact or Raspberry Valleys could be considered "strategic" in terms of having some proximity to important local communication routes, the site locations just described are exceptionally well-chosen to visually command major junctions or confluences between valleys and nodal points of trails. A concern with locations on, and overlooking, major travel routes through the mountains implies an interest in observing and being able to intercept movement on those routes. This interest most likely derives from hunting strategies and the need to be able to watch game movements from situations which also permit reasonable probability of successful interception. However, it is also possible that such very strategic campsite locations imply an interest in being able to detect and interact advantageously with other human groups moving through the region. The nature of any such interaction is speculative and unresolved by existing ethnographic data, although a major lithic resource area such as this may have acted as a focus and common meeting ground for different groups drawn to the obsidian. As well, it is not completely inconceivable that control of Edziza obsidian was occasionally an issue of aggressive competition between different groups at some time(s) in the past. Many of these camp locations would be quite defensible, particularly EP 50. Nevertheless there is no real evidence, either archaeological or ethnographic, for significant warfare in the Edziza area, and the same attributes which make these sites easily defended also make them prime hunting overlooks.

Other than commanding locations, campsites do not seem to share many notable environmental characteristics, except that all those in Artifact and Bourgeaux Valleys occurred within the subalpine parkland ecotone where shelter and firewood are readily available. All sites of any type found in the Floatplane Lake region were above present tree-line, but it is possible that this was different at times in the past. Campsites have about the same average elevation as flaking stations (ca. 1,525 m) and exhibit a variety of exposure orientations, although most face generally south and/or east. All sites are within a few 10's of meters of streams or melt-water ponds, but then it would be hard to find any low relief locations in these valleys today in summer which are not. Site areas tend to be small (50-100 m or less in diameter, or longest dimension) and, where definable with any confidence, roughly circular or elongated, apparently depending on the shape of the topographic feature (knoll, ridge, or terrace) which they occupy. Many camp sites were probably repeatedly occupied because of their location, and their assemblages, while reflecting a generally similar function through time, may well be culturally multi-component. No true structural features or definite house platforms or pits were observed, with the exception of a possible collapsed rock cairn or meat cache at EP 10. This last feature, measuring about 2 m in diameter and made up of at least 14 large cobbles, at the rim of the Central Plateau overlooking Raspberry Pass, is similar to several presumed collapsed meat caches observed in the Stikine Valley.

Multi-function or Mixed Sites

Multifunction sites are those whose characteristics of assemblage diversity and ratio of core-preforms to tools are near the mean tendency for each distribution (Figs. 25 and 26). These are sites 14, 24, 26, 35, 49, 58, 63, 67, 85, 97E, 97W, 104, and 107, relatively equally spread between the Floatplane Lake and Artifact Valley-Raspberry Pass study areas.

Multi-function sites inlude some of the largest surface collections (eg. EP 67) and therefore some of the most "diverse" assemblages in terms of simple number of artifact classes present. However, usually these assemblages are also numerically dominated by biface preforms and/or flake core remnants and/or microblades which lower the ratio of numbers of items to numbers of classes, and ratios of tools to preforms/cores. In one case (EP 58), a relatively large number of microblades has the effect of sharply lowering apparent assemblage diversity, even though the ratio of tools to preforms/cores strongly indicates that this site should be considered a camp.

With the exception of EP 58, which is undoubtedly single-component and to be discussed further in the section on culture history, many of the multi-function sites are possibly culturally multi-component -- the result of functionally varied occupations through time. Others may simply reflect a near-synchronous juxtaposition and overlap of intensive lithic reduction activities and normal domestic tasks. In terms of surface assemblages at least, the results are indistinguishable.

Multi-function sites generally occupy locations nearly as "strategic" as those of camps, with the same general environmental associations. These sites are sometimes much larger in area than either camps or flaking stations and this is in part a function, and problem, of difficulties inherent in defining site boundaries in an area of general ubiquitous lithic distributions. Thus lumping several of the smaller adjacent sites defined as camps and lithic workshops into larger more inclusive groupings might also result in assemblages with intermediate "multi-function" characteristics.

General Survey Results and Conclusions

Intensive foot surveying of the Artifact Valley-Raspberry Pass and Floatplane Lake areas resulted in identification and recording of 112 separate aboriginal sites, as defined above. These included 23 sites in Artifact Valley, 39 in Bourgeaux Valley; 9 in Raspberry and Caribou Vallesy; 10 on the Central Plateau, and Goat Mountain; 31 in the Floatplane Lake area; and 2 on the South Plateau. Treating the sites as point locations (and ignoring the possibility of continuous cultural distributions connecting some of them), this results in the following approximate site densities: $2.4/km^2$ in Artifact Valley; $7.8/km^2$ in Bourgeaux Valley; $2.2/km^2$ in upper Raspberry and Caribou Valleys; and $1.5/km^2$ in the Floatplane Lake area. There is no point in calculating similar density values for the Central Plateau where, as indicated earlier, surficial obsidian seems essentially continuous. The density of surficial cultural remains in upper Bourgeaux Valley is exceptional, and may in fact be unparalleled in British Columbia.

Site locations do not seem to strongly favour one side of a valley over another, although it must be noted that these valleys are generally sufficiently wide to permit some significant summer insolation of even north-facing flanks. However, snow does linger much later into the summer on the south slopes, particularly in Artifact Valley, and the presence of numbers of sites on this side of the valley may indicate that there were more important site selection criteria being employed aboriginally than simply "exposure" orientation (such as, perhaps, access to trails and obsidian sources). Most of the sites in the Artifact Valley-Raspberry Pass area were found within the limits of the existing subalpine forest-tundra ecotone, where open grassy areas are intermixed with "islands" of stunted fir. Here pleasant living conditions include a relative lack of insects compared to lower altitude closed forests, and well-drained open ground for camping. In addition, firewood and materials for shelter are readily available. No aboriginal sites were found within the lower elevation closed forest, although we did not penetrate that zone very extensively, where all the usual problems of site location in a dense forest are applicable. Sites other than quarry workshops and flaking stations are apparently infrequent in the true alpine zone of the Artifact Valley-Raspberry Pass area, probably reflecting the lack of firewood and shelter materials. However, virtually all sites found in the Floatplane Lake area are now within the alpine tundra zone. It is possible, however, that the subalpine ecotone extended further up the Floatplane Lake and Ball Creek Valleys some time in the past. At present a few stands of shrub alpine fir occur on a south-facing slope at the west end of Floatplane Lake, while the main treeline itself comes almost up to the crest of a bedrock sill which dams Floatplane Lake high at the head of the Little Iskut River valley. It would seem to require little climatic warming to permit the treeline to climb over this sill and invade the slightly lower valleys to the west. The site distribution in the Floatplane Lake area is primarily limited to elevations below 1600 m a.s.l., even though the local environment does not seem to exhibit any significant change through this elevation today (Figs. 8 and 16). Perhaps this may reflect the altitude of an earlier alpine fir limit. If this is the case, it could probably be inferred that most of the sites in this area predate the Neoglacial, although this must remain very tenuous in the absence of supporting data. A similar treeline shift in the past was also suggested for the EP 58 location on the South Plateau. Hopefully, palynological analysis of the Raspberry Bog peat section will help verify this hypothesis.

Besides correlation with the subalpine parkland ecotone, sharply increased site densities in the vicinity of the Goat Mountain quarries, and an association of campsites with natural avenues of communication, there do not appear to be other obvious environmental associations with site distribution. Availability of water is not a significant limiting factor in this area, at least at present, since melt-water streams and ponds are virtually everywhere. Indeed the former, at least, can sometimes be more of a barrier and hindrance for human use of the area today, than an inducement.

No clearly defined caribou hunting complexes or kill sites were identified, although EP 58 is possibly associated with caribou travel routes along an esker. Lack of preserved faunal remains would make positive identification of any such sites difficult. It is also possible that such sites more likely occur in the high alpine plateaus, than in the lower valleys and subalpine zones. Since the high plateaus were not as extensively investigated in 1981 as some of the valleys, lack of evidence for aboriginal caribou hunting may also be partially a problem of regional survey representivity.

Site surveying was only one of several research methods employed in the 1981 Edziza project, and there was no intention of producing a comprehensive "resource inventory" for the entire region. However, foot and helicopter coverage did result in the definition and recording of 112 separate prehistoric sites, mainly concentrated in the Artifact Valley-Raspberry Pass and Floatplane Lake study areas. Most of these are classifiable into four generalized site-types on the basis of the diversity of assemblages, and relative ratio of tools vs. cores and preforms. The site classes include: (1) Obsidian outcrops - quarry-sites; (2) Flaking stations; (3) Camps; and (4) Multi-function sites. Aboriginally utilized obsidian quarries are concentrated on and around Goat Mountain, and apparently represent some of the densest surface lithic concentrations in the province. All other sites in the adjacent valleys and plateaus can be considered a "train" of aboriginal activities (camping and lithic reduction) associated with the Goat Mountain obsidian outcrops, linking the entire region into a single large and remarkably rich macro-site. The exceptional density of cultural materials, and the "unified" nature of the site distribution in the Artifact Valley-Raspberry Pass area, must be considered in any future management plans for this portion of Mt. Edziza Provincial Park.

SITE EXCAVATIONS

The original research design for the Mt. Edziza project called for one or more small-scale site excavations, primarily to address basic questions of cultural chronology and artifact typology. The small size of the crew, limited resources and time, and the exploratory nature of the 1981 project, mitigated against any large scale excavations. In the end, two sites were excavated, EP 1 (The Wet Creek Site) in Artifact Valley, and EP 80 (The Grizzly Run Site) in Bourgeaux Valley. In the following sections, EP 1 and 80 will be described in terms of general environment, geology and stratigraphy, excavation methodology, and cultural remains. Artifacts will not be specifically described here, except where necessary to discuss other characteristics of the sites, since they are incorporated into a general classification and description of all Edziza cultural items in the chapter titled "Artifacts." A final section in each site report will offer interpretations of function and chronology.

EP-1, The Wet Creek Site

Location

EP 1 (HiTp 1) is located on the north side of Artifact Valley (57°27'10"N, 130°37'12"W), extending from the confluence of Wet Creek and Braided River, upstream along the creek, to the base of a major waterfall at about 1500 m elevation (Fig. 45). Cultural materials have a general distribution along the creek and up to 50 m east of the stream channel for this entire distance of ca. 400 m. A further lesser cultural concentration also occurs on a low sandy ridge on the west side of Wet Creek, at its confluence with the Braided River floodplain.

EP 1 can be divided into at least four distinct subareas, based on sediment type and vegetation. Area 1 (Fig. 46) consists of the southern and western margins of a large patch of dense shrubby matted fir which covers the upper north wall of Artifact Valley. The western margin of the forest is formed by the steep channel bank of Wet Creek, while on its southern and southwestern borders the forest breaks into a series of ragged partially interconnecting grassy openings surrounding scattered "peninsulas" and "islands" of trees. The ultimate southern boundary of Area 1 is formed by the bouldery Fan A deposits, and the wide bare floodplain of the Braided River. Cultural materials are most obvious in Area 1 along the eroding bank of Wet Creek, and in the mossy littermat among the trees and clearings immediately east and north of the creek. Surface finds consist of scatters of obsidian flakes and core

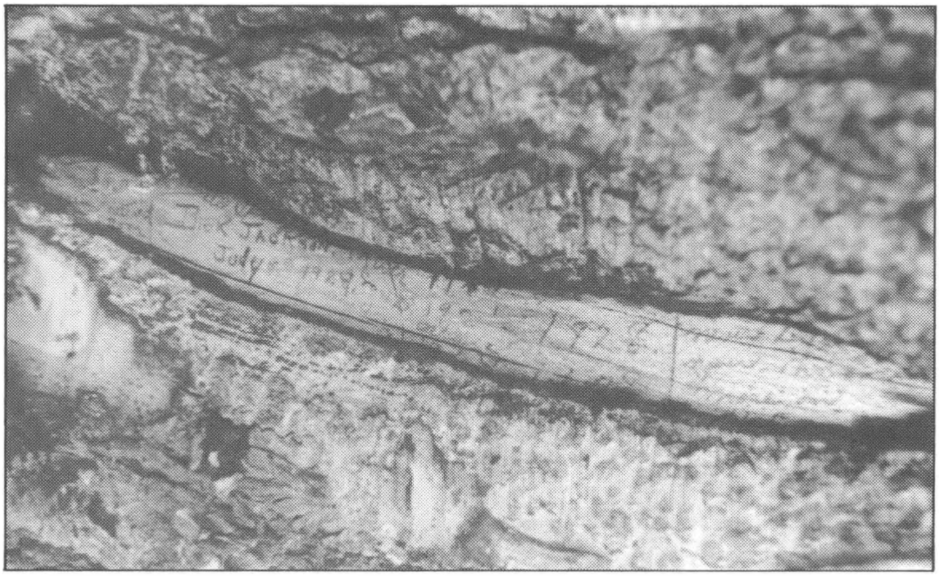


Fig. 44. "Message Tree", EP 104, Bourgeaux Valley. Pencil messages from 1928 and 1929 on old blaze beside the Telegraph Trail.

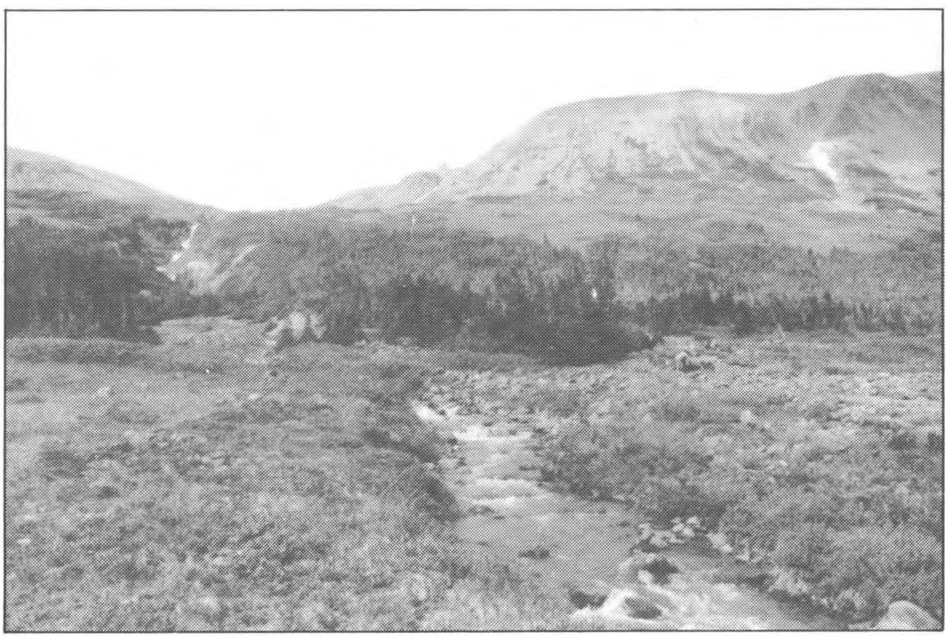


Fig. 45. General view of the Wet Creek Site (EP 1, HiTp 1), looking north up Wet Creek towards Rocky Pass. Area 2 being excavated, "House 1" behind trees in middle distance.

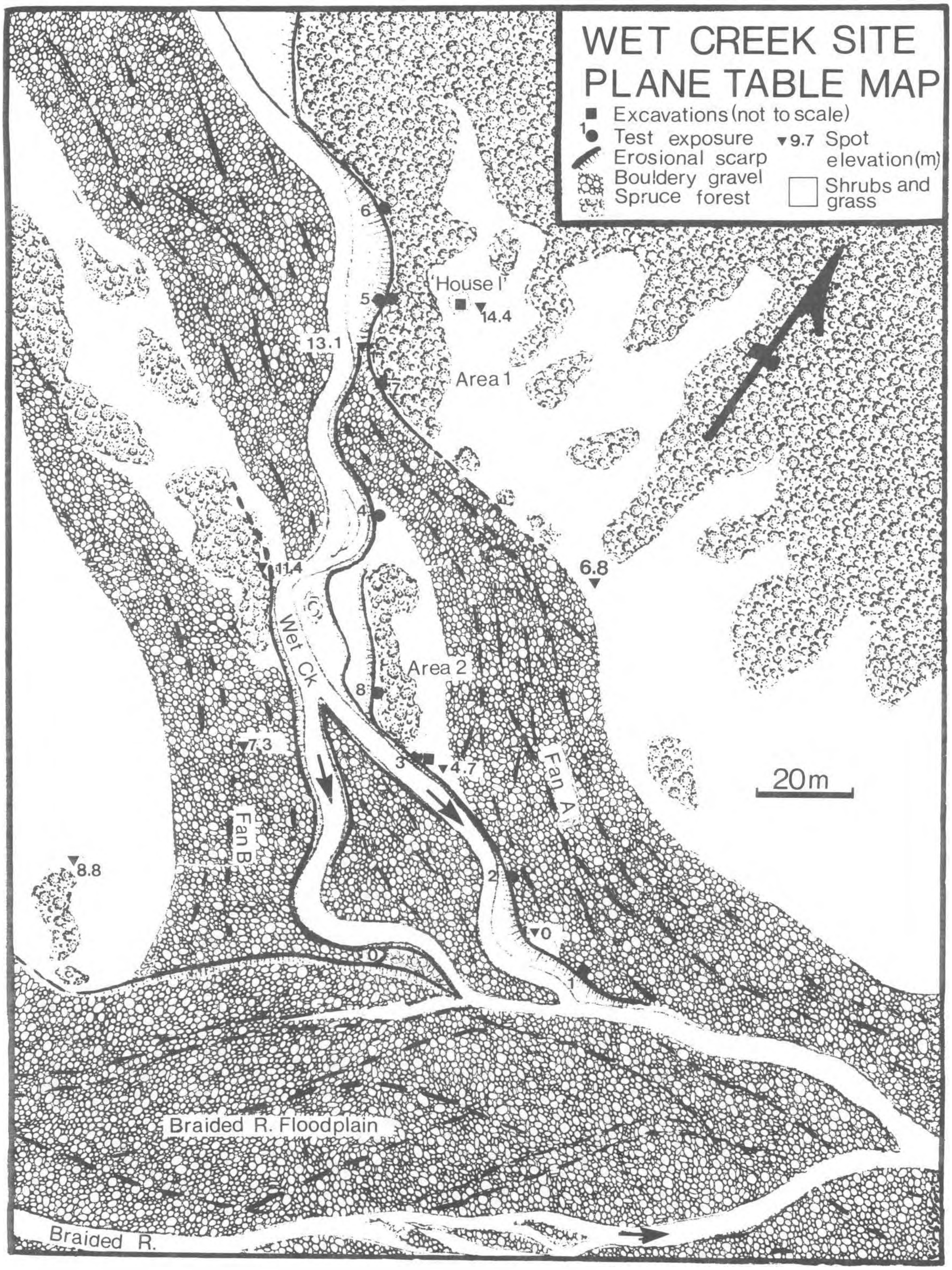


Fig. 46. Wet Creek Site Plane Table Map.

fragments, with the density of obsidian debitage through this area being very high, averaging ca. 100 items per m^2. Small test probing anywhere among the trees or scattered clearings consistently reveals large quantities of flakes, cores and biface fragments, mainly within the top ca. 10 cm of deposits. Also, directly east of the creek, in one of the open areas, is a small subrectangular topographic depression, labelled "House 1" in the field. This is discussed in detail below. Area 1 consists generally of pleasant, relatively high, south-facing and well-drained ground. Its surface is older and more stable than the portion of this site immediately to the south, which is covered by recent coarse fan gravels (Fan A in Fig. 46).

Area 2, as defined operationally in the field, consists of a small (ca. 50 x 30 m) interfluve remnant formed of sediments similar to those in Area 1, between the recent gravels of Fan A on the east and north, and the even more recent current channel of Wet Creek on the west and south. However, it is likely that this interfluve is simply an erosionally isolated portion of a larger low ridge of similar sediments, also mainly forest-covered, extending northwestwards on the opposite side of the present creek (Fig. 46). Cultural materials are most concentrated in the downstream "tail" of the Area 2 interfluvial remnant, and are currently being eroded by Wet Creek. Flakes can also be found in limited test exposures throughout much of the forest portion of the interfluve. Area 2 is about 10 m lower in elevation than "House 1," and separated from Area 1 at the narrow upstream end of Fan A by about 20 m of mainly bare coarse fan gravels and boulders.

Other possibly geologically distinct portions of the site, but not formally designated as separate areas in the field, includes Fan B west of Area 2, another large expanse of relatively recent coarse boulders and cobbles. Also, forming the extreme western limit of all Wet Creek site deposits, is a low gently mounded sandy ridge (marked with a relative elevation of 8.8 m in Fig. 46). Mainly grass-covered, but also bearing limited stunted forest, this landform could be considered another distinct site area, probably roughly geologically comparable to the older more stable surfaces of Areas 1 and 2. It bears widely scattered flakes over the downstream portion of the ridge, but this portion of the site was not intensively examined in 1981.

At least two features of the general environment of the Wet Creek site warrant further consideration, from the standpoint of trying to interpret its archaeological remains. These are: (1) its location relative to communication routes and resource areas; and (2) its forest cover. As noted in the previous discussion of campsites, EP 1 appears to be in a highly strategic location. Artifact Valley and the Braided River are ultimately tributaries of the Iskut River, which flows southwards along the eastern flank of the Edziza-Spectrum Ranges, eventually turning west, and joining the Stikine River near the Alaska-B.C. border. The Iskut "corridor" is a natural communication route northwards and southwards, as shown by its modern use by telegraph line and road (via the Bell-Irving River to the upper Nass and Skeena systems), or westwards directly to the coast, via the lower Stikine. Thus EP 1 sits astride the head of a major access route to the obsidian sources from the north, south and west. It occupies what is essentially the last relatively extensive area of favourable camping terrain in Artifact Valley, prior to ascending Goat Mountain to the obsidian quarries. In addition, it is located just below Rocky Pass which is another communication channel northwards to Bourgeaux Valley and Raspberry Pass. From Raspberry Pass travel is relatively simple into Mess Creek valley, and from there to the Stikine or eastwards once again to the Iskut River. The Wet Creek site therefore controls all easy routes onto Goat Mountain, with the exception of direct access from the northwest (e.g. up Raspberry Valley to Caribou or Point Valleys, and from there directly onto the Central Plateau). Thus, for people interested in exploiting or controlling the Goat Mountain obsidian sources, the Wet Creek site has probably always been an important location.

The dense alpine fir forest is another interesting characteristic of the EP 1 area. Although there is scattered arboreal vegetation throughout Artifact Valley on stable south-facing slopes below about 1500 m elevation, the ragged blanket of dense short shrubby fir trees around Wet Creek is probably the largest continuous forest patch in the local subalpine parkland ecotone. The trees grow in two distinct habits -- a normal upright trunk reaching a maximum height of ca. 4-5 m, and low ground-hugging shrubs with tangled trunks growing parallel to the ground. Nowhere is there much, if any, evidence of young trees or seedlings expanding significantly beyond the existing limits of the mature forest "islands," and these patches of forest may reproduce primarily vegetatively, with adventitious roots from horizontal trunks, and new growth developing from old stumps. Although temperature probably controls the upper limits of tree growth, locally, within forested areas, soil drainage conditions seem to be the principle factor defining the shape and extent of the individual stands or "islands." Most patches of trees occupy relatively well-drained ridges, slopes and knolls, while intervening swales are left open with moss, grass or herbaceous ground cover. Such swales retain snow late into the summer, sometimes contain nivation exposures, and are nearly always damp and poorly drained.

Some of the oldest trees in the Wet Creek area are reminiscent of bristlecone pines in appearance, with short, squat lower trunks, branching into a multitude of twisted living and dead secondary stocks. We removed a tree-ring section from the largest such tree growing in Area 1. It was 26 cm in diameter, bark surface to bark surface, and contained over 240 rings. Most trees average 6-10 cm in diameter; one 6 cm in diameter possessed 35 rings.

The presence of these trees was undoubtedly an important factor for aboriginal occupants of the mountains. In a region where snow stays late into the summer, and no month is guaranteed free of new snowfall; where night-time temperatures even in the middle of summer can be very cool; and where constant winds drain down valleys from surrounding glaciers and snowfields, adequate supplies of wood for fire and shelter were probably essential for all but the shortest encampments. Thus it is important to know how long this forest has been growing in this area, and whether there have been any recent changes in the distribution or abundance of trees.

Unfortunately, this question cannot be answered with any certainty at the moment. Five charcoal dates currently available from the Wet Creek site indicate that there has been some wood available for fuel for at least the last 3000 years, i.e. throughout the Neoglacial. However, the occurrence of obsidian flake concentrations, as well as a hearth, within the boundaries of what is now dense forest, suggests that the distribution and/or density of trees may have changed over that time. While it may be possible that people occasionally squeezed amongst such forest growth to obtain rudimentary shelter; carrying out any activities, including sleeping, would be at best very uncomfortable in such a situation. The possibility that such flaking scatters represent winter occupations, on top of snow overlying all or some of the trees may also have to be considered, although currently I consider regular winter encampments in sub-alpine or alpine regions during the Neoglacial to be unlikely. Instead, it seems to me more probable that there was less extensive tree cover during at least parts of the Neoglacial, permitting cultural activities in areas which are today nearly impenetrable thickets. All charcoal samples obtained for dating were from small diameter sticks or branches. This possibly indicates a cultural preference for drier or more easily harvested small wood. However, it might also suggest a paucity of large firewood in the area at the time. Finally, the fact that the oldest tree growing today probably began life shortly after the peak Little Ice Age glaciation, may suggest that much of the present extensive forest cover began to spread about 250 years ago. EP 1 is about 2 km down-valley from the Artifact Valley Neoglacial moraines, but glaciation may still have indirectly degraded the quality of environment in the Wet Creek area. Finally, past forest fires, perhaps caused adcidentally or purposely by man, may also have affected the openness of the forest at various times, although the importance of this factor cannot be addressed more fully at the moment. All 14C samples were found with cultural materials, but this does not completly exclude the possiblity that one or more result from natural fires.

Geological History

Two basic sets of geological deposits are represented in natural and artificial exposures across EP 1. The first occurs in Areas 1 and 2. It consists of an unknown total depth of bouldery clay diamicton (at least 2.0 m in Area 1), topped by 20-50 cm of fine grained sediment, containing at its surface the modern soil, and cultural materials. The diamicton, which appears to be a widespread substrate throughout the area, consists of 20-40% silty-clay and the remainder sand, rounded-to-subangular pebbles, cobbles and boulders of volcanic lithology. This unit is relatively compact and resistant to penetration, and probably is basically till, although it might also involve ice-contact, glacio-fluvial, or debris flow sediments. The capping of fine grained yellow-brown sediments consists mainly of well-sorted, structureless sandy silty-clay, with the proportion of fine fractions increasing towards the surface. This sediment is probably mainly aeolian in origin, since there is little evidence of a direct lacustrine or low energy fluviatile contribution. The fine clays and silts may be loess from the nearby braided flood-plain, or from other exposed alpine or glacial land surfaces, and may also contain some tephra component. The surface soil is a ferro-humic podzol in forested areas, with a well-defined light-grey elluviated Ae horizon, and a thin littermat; elsewhere it is a weakly developed brunisol, or regosol.

The second distinctive set of geological deposits consists of the coarse bouldery gravels of alluvial fans A and B, and the modern channel deposits of Wet Creek and the Braided River. At the present time Wet Creek is incised as much as 1.5 m below the surface of Fan A north of Area 2, and 0.8-1.0 m near the confluence with the Braided River flood-plain. Its present channel is thus relatively well-defined, with an apparent current trend towards incision rather than aggradation. Since the surfaces of the A and B fan gravels are now hanging about 1 m above the present stream level, they must represent a different alluvial depositional regime than that of present.

These sediments in total and their vertical and horizontal relationships suggest the following tentative reconstruction for the geological history of EP 1: (1) During deglaciation the diamicton was laid down directly by retreating ice and/or as ice-contact and mass wasteage. (2) This was followed by a period of unknown duration of much diminished depositional energy, in which mainly fine grained aeolian sediments were laid down. This process may not necessarily have been of long duration, nor interrupted by periods of surface stability or erosion, given the apparent total absence of paleosols or unconformities. (3) A pedogenic profile then developed in the surface of the aeolian sediments, which in forested areas includes a well-defined podzol with L-H and Ae horizons occupying the top 10-20 cm. This weathering zone may represent the bulk of post-glacial time in some areas, and shorter intervals in others. It is possible that it also contains unrecognized tephra. The reasons for the general absence of distinct tephra layers in this area were discussed previously. (4) Some time during this sequence, Wet Creek incised a channel in the region presently occupied by Fan A. The bed of this channel was lower than the present bed of Wet Creek as shown in the section infilled by Fan gravels upstream from Area 2, and lateral walls of the old channel are nearly completely buried by the more recent fan deposits. (5) This was followed by a period of fan gravel deposition infilling and overflowing the original channel (Fan A). A branch overflowing the original channel further upstream also deposited coarse gravels in the Fan B area. Gravels were probably also deposited through the areas now occupied by the present channel, by another ephemeral branch of the shifting fan system. At the same time, the Braided River floodplain was probably aggrading to its present level. (6) The episode of fan deposition and aggradation was followed most recently by renewed channel formation and incision by Wet Creek.

Dating of the earlier portions of this sequence is not easy. However, I am inferring that the first episode of channel incision is probably pre-Neoglacial and perhaps Hypsithermal in age. This process must have occurred when Wet Creek possessed a relatively low sediment load (i.e. little or no input from ice at its source in the Goat Mountain cirque), and when the Braided River itself was flowing at a lower level. This being true, the deposition of Fans A and B logically represent Neoglacial events of the last 3000 years, with sharply renewed coarse sediment input from Goat Mountain cirque causing Wet Creek to infill and overflow its old channel. Finally, decreasing glacial activity and reduced sediment input has most recently allowed Wet Creek to renew channel incision in its present bed.

General Research Methodology

Investigations at the Wet Creek Site proceeded through three general phases. The first involved mapping of the site with alidade and plane table (Fig. 46), and the clearing of 8, 2 m long profile "test-cuts" at intervals along the east bank of Wet Creek. These provided a discontinuous stratigraphic transect along much of the length of the site, and were used to select areas for later more extensive excavation. The second phase consisted of a relatively intensive period of excavation in Area 1, in "House 1," while the final phase consisted of expansion of original test cuts 5 and 3 with a series of small excavation units. At completion, all excavation units were back-filled. The last two phases will be described in detail below.

Average crew size throughout our stay at EP 1 consisted of a total of 5 persons, although visitors raised that number as high as 8 for about 3 days.

"House 1" -- Description and Excavation Methods

The feature referred to as "House 1" was first observed in 1977 (Fladmark and Nelson 1977) when it was thought to be a possible aboriginal housepit or house depression. However, even during the preliminary survey we were cautious of this interpretation, given the overall hummocky nature of the ground surface in this area, and the possible effects of cryoturbation processes. During 1981, we returned to the Wet Creek Site with the intention of test-excavating this feature to determine whether it was of cultural origin and if so, what its age and cultural associations were. The result of this work indicates that the depression itself is primarily natural, but that it was intensively occupied prehistorically. For descriptive purposes I will continue to refer to it as "House 1," since some kind of light aboriginal shelter may have been built in the natural depression.

"House 1" lies about 10 m east of Wet Creek and about 25 m due north of the northern limit of the Fan A deposits, in an irregular natural grassy opening in the surrounding forest (Fig. 46). It consists of an irregular to sub-rectangular centrally depressed bench, approximately 6 x 4 m in size, with long axis orientated nearly true north, in the gentle southeast-facing slope (Figs. 47 and 48). Immediately to the east, another larger and less well-defined sub-rectangular area initially suggested the possibility of other "structures" existing in the area. "House 1" is protected from the steep open and eroding bank of Wet Creek by a tongue-like stand of stunted fir, and is similarly enclosed to the east and north, although in the latter direction a meandering series of small interconnected clearings permits relatively easy walking a considerable distance upslope. On the south, "House 1" possesses a view down Fan A and over the Braided River floodplain. The elevation of the "house" feature is approximately 1446 m a.s.l.

Shovel probing of the adjacent rectangular feature turned up nothing but water-saturated moss and clay within the top 50 cm. However, delicate penetration of the surface moss and sod of "House 1" with a knife blade, everywhere revealed dense quantities of obsidian just below the surface. "House 1" is clearly now much better drained than its neighbour, and therefore a more desirable human activity area at least in summer. This is confirmed by the well-preserved traces of a modern guide-outfitter's camp, including dismantled poles of a wall-tent frame and the remains of spruce bough mattresses scattered over the surface. Other evidence of modern camping activity includes at least one other tent-floor further upslope, and occasional rusted tin cans.

Excavation was initiated and completed in 11 1 x 1 m units, distributed in an alternate or "checkerboard" fashion across the central and up-slope portion of the feature (Figs. 47 and 49), representing about 50% of its area. Excavation was by trowel, with all matrix screened through either 6 mm or 3 mm mesh. Full 3-dimensional provenience was maintained on modified artifacts, and flakes were collected by 50 x 50 cm quadrats per excavation level. A single 50 x 50 cm unit near the centre of the feature was entirely removed as a bulk sample, for later flotation and sorting. Excavation generally proceeded by 5 cm levels contoured parallel to the ground surface, except where well-defined natural stratigraphic boundaries could be followed. About 40 mandays in total were spent in excavating "House 1," between July 12 and July 25.

"House 1" -- Stratigraphy

Cultural deposits in "House 1" are of variable though generally shallow depth (average 15-20 cm), ranging from a maximum of ca. 40 cm over some subsoil depressions, to a minimum of less than 10 cm on the southern rim of the feature. Obsidian flaking debris was found from just below the modern sod, to the bottom of the cultural deposits and the lower limit of our excavations, defined by the diamicton "subsoil." The cultural sediments themselves were primarily clay-rich, moist, dark brown in colour and highly organic, with very little internal differentiation, and no obvious cultural stratification (Fig. 50). There was a tendency for deposits within

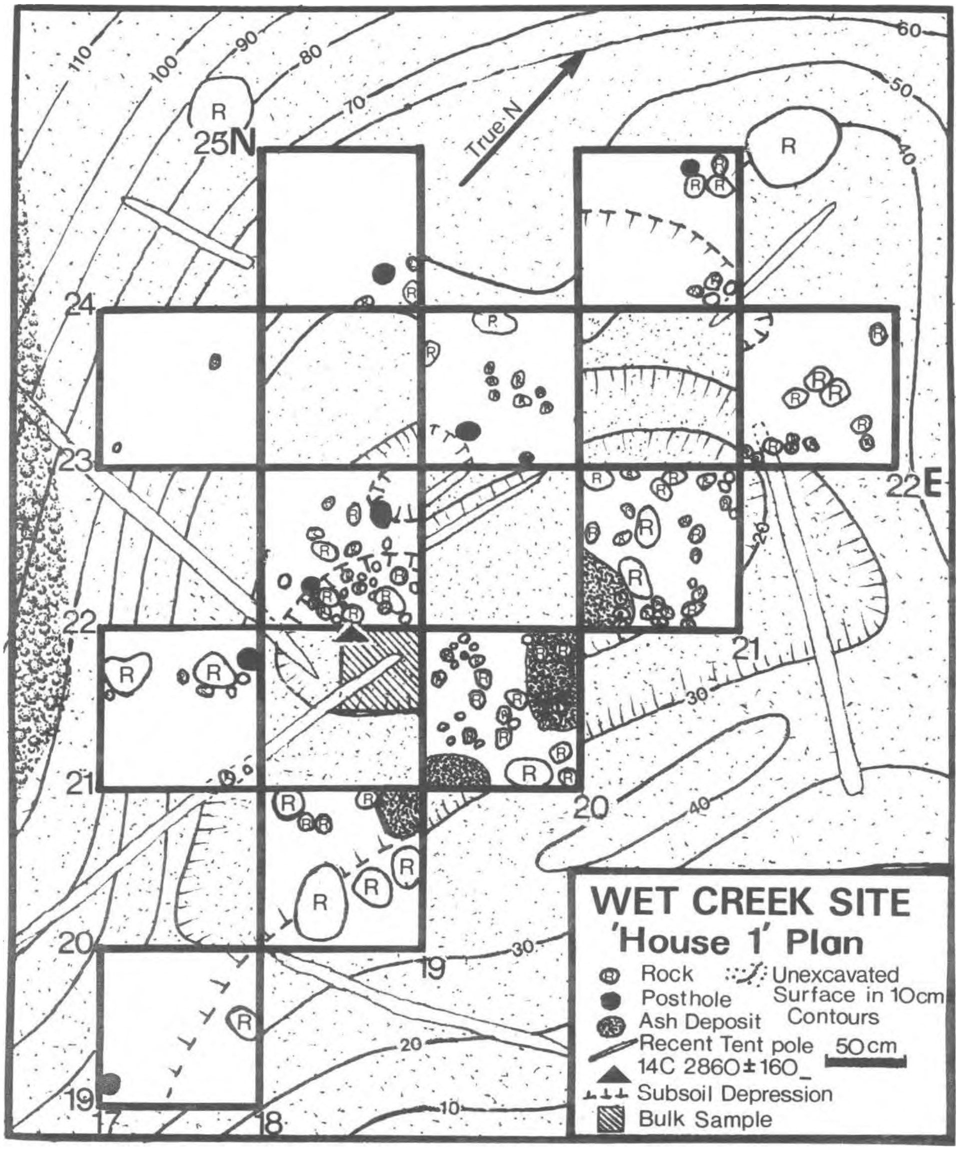


Fig. 47. Wet Creek Site 'House 1" Plan.

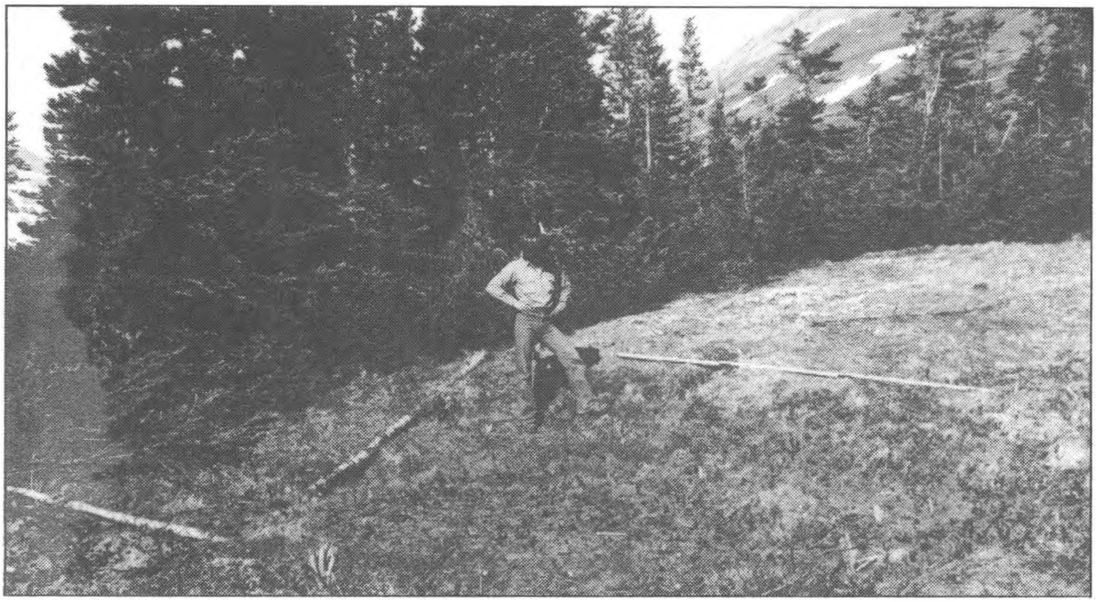


Fig. 48. General view of "House 1" before excavation, looking west. Note remains of recent tent-frame.

Fig. 49. Excavations in "House 1" nearing completion. View looking south, Braided River in background.

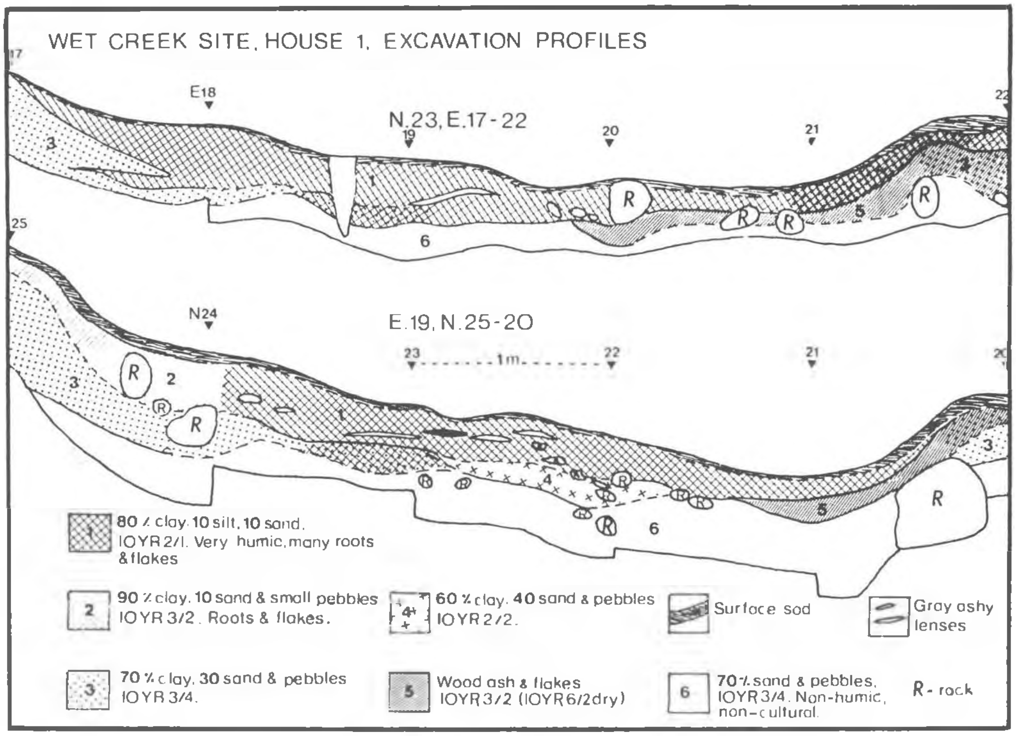


Fig. 50

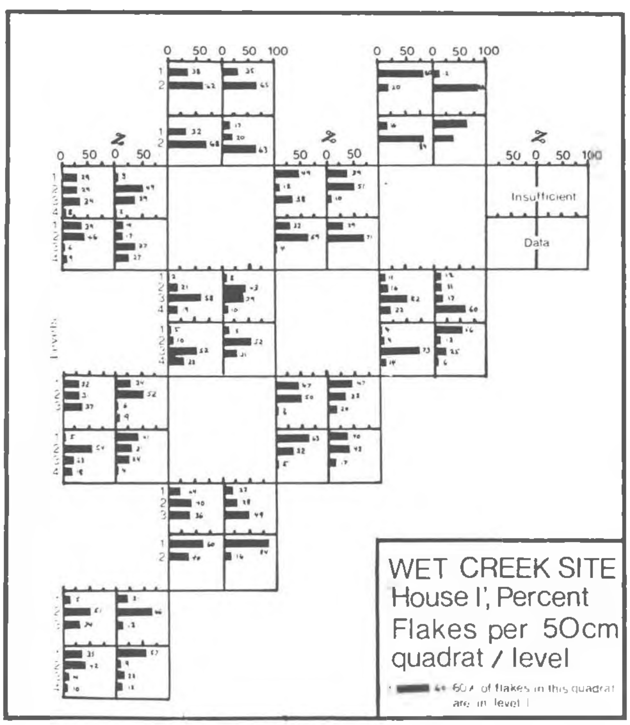
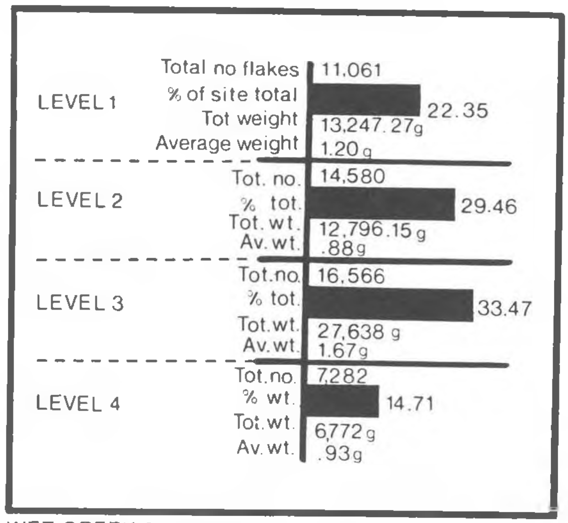


Fig. 51



WET CREEK SITE, HOUSE 1, FLAKE NUMBERS AND WEIGHTS BY LEVEL

Fig. 52

the central basin of the feature to be darker than those of the edges and lip, while extended areas of light-grey wood-ash and charcoal flecks lay just inside the southeastern (downslope) rim of the depression (Fig. 47). Some additional thin discontinuous lenses of ash and charcoal also occurred sporadically throughout the dark cultural matrix. Rocks, fire-cracked or otherwise were not common in the dark sediments themselves, although they protruded in profusion from the surface of the sterile subsoil. The upper surface of the culturally sterile diamicton was very irregular, including 3 basin-shaped depressions. These are probably cultural, although their function is unclear. None was totally excavated, but the largest probably measured about 1.0 x 0.5 m, extending no more than 15-20 cm into the diamicton. Thin lenses of yellow-brown sediment, overlying and mixed with dark cultural matrix, suggest spoil from aboriginal excavations in these areas, and obsidian flakes were frequently found within the depressions, orientated parallel to the basin contours.

Features and Organic Remains

Few definitely aboriginal features were identified within "House 1," other than the subsoil depressions noted above. Eight post-holes, 10-20 cm in diameter, and up to 30 cm deep (Fig. 47) are probably entirely the result of the recent tent camp on the site. The post-holes extended to the surface, or to just beneath the recent surface littermat, and were either void or loosely filled with matted root hairs and humic material. At least one short pole, pointed on the lower end, was still stuck into the surface of "House 1." This pole and most of the other post-holes probably represent the supports of internal structures or furniture within the floorless modern wall-tent. No clearly defined hearths were identified, but two irregular to oval areas possessing a 2-5 cm thick layer of grey wood ash and charcoal flecks were noted just inside the southeast (downslope) rim of the depression. These also contained occasional burned and partially melted obsidian flakes and artifacts and, in one location, a few scattered fragments of calcined bones of one or more small animals. The bone fragments are not specifically identifiable, but their size would seem compatible with ground squirrel. These few small bits of bone are the only organic cultural remains other than charcoal from "House 1." Few positively fire-cracked rocks were identified near the hearths or elsewhere, but it should be noted that some of the attributes normally used to identify recent heating of sedimentary or metamorphic rocks are not of much use in an area of purely igneous extrusive lithology.

The overall topographic depression defined as "House 1" is probably due to natural causes, most likely periglacial processes which occurred prior to the cultural occupation. This judgement is based on the following:

(1) The plan form of the depression lacks a clearly defined shape, but instead, is a segment of a somewhat undulating and irregular depressed bench stretching across the slope, interrupted by tongue-like flows which form the "end-walls" of the enclosed "depression." There are at least three such flows helping to shape "House 1" and the adjacent feature.

(2) There is no evidence of major aboriginal excavation, including the large amount of spoil that would have to be removed; and there is no evidence of collapsed earth or sod-covered walls and/or roof.

(3) The yellow-brown diamicton underlying the cultural deposits and defining the basic shape of the depression is very rocky and compact. It is difficult to penetrate with even steel implements, and it seems highly improbable that people would have gone to the immense effort and difficulty involved in excavating a house depression in this location, with aboriginal tools.

While it can safely be concluded that the "House 1" depression was not originally constructed by man, there is no doubt that it was intensely occupied and there is some likelihood that people did modify some of its internal characteristics for their own purposes. Evidence for "subfloor" excavations was cited earlier; an additional possibility is raised by a tendency for larger rocks to be found concentrated around the rim of the depressed feature (Fig. 47). This is particularly true along the down-slope rim, but large cobbles occurred wherever excavation units reached the outer limits of the surface feature, while even in unexcavated rim areas a few boulders protrude through the surface sod. Although it is possible that this rock distribution may also result from periglacial processes, it seems equally probable that many of these large cobbles and boulders were moved out of the way by human occupants. As well, rocks placed around the rim of the depression, enclosing the areas of peak cultural concentrations, may have served some structural function, perhaps as braces or anchors for a light wood-frame dwelling or shelter. It is worth noting that at least one contemporary but traditionally constructed Tahltan gable-roof pole smokehouse in the Stikine Canyon has a well-braced main framework resting entirely on surface boulders and cobbles. This substantial structure uses no posts-in-ground, as an adaptation to rocky soil conditions, and its archaeological manifestation would consist of only a loose rectangular pattern of rocks, perhaps somewhat similar to that in "House 1." While it is not possible to confirm by existing data that any aboriginal dwelling stood in the natural "House 1" depression, the intensity of occupational debris; its concentration in a relatively limited area, possibly divided into different activity zones; and the presence of cooking hearths and subfloor depressions may indicate that this was more than just an open air flaking station.

Vertical Distribution of Cultural Material

The homogenous, dark organic, clayey matrix containing the bulk of cultural items found in "House 1" exhibits little or no stratification, and there is no positive evidence of multiple prehistoric occupations of this part of EP 1. Plotting of flake distributions by level, and artifacts by precise vertical provenience does not reveal any strong vertical patterning. Instead, there seems to be a random variation in percentage of flakes found per quadrat/level, across "House 1" (Fig. 51), with adjacent 50 cm^2 quadrats sometimes having inverse vertical density peaks. Taken together the vertical spread of flakes appears to approximate a normal distribution through the average 15-20 cm of cultural deposits, with a peak density occurring in Level 3 (usually 10-15 cm below surface) (Fig. 52). Plotting of artifact vertical proveniences in relation to depth below surface (Fig. 53a), or depth above sterile subsoil (Fig. 53b), again does not seem to indicate any strong polymodality, although in the latter case there is a slight fall-off in artifact occurrence 5 cm above the basal sediments. However, since relatively few artifacts were found beneath this level, and even the addition of 2 or 3 items in this 1 cm depth range would cause the apparent "gap" to be far less visible, I tend to discount its significance. Indeed, plotting the artifact depths by 2 cm increments, perhaps a more realistic exercise given the possible range of error in field measurements, causes the "gap" to disappear entirely. Thus, artifact proveniences also suggest a peak vertical occurrence just beneath the mid-range of depth, with the tails of an approximation of a normal distribution curve above and below that point.

A vertical patterning of cultural materials following a normal distribution through ca. 20 cm of undifferentiated sediments may be due to at least two different processes, operating alone or in concert: (1) The intensity of cultural deposition relative to general sedimentation rates grew slowly to a peak period, then declined through the time span represented by these deposits; and/or (2) Various processes of bio- and/or cryoturbation have acted to mix and homogenize the cultural matrix, "scattering" artifacts and flakes above and/or below (an) original depositional horizon(s). At

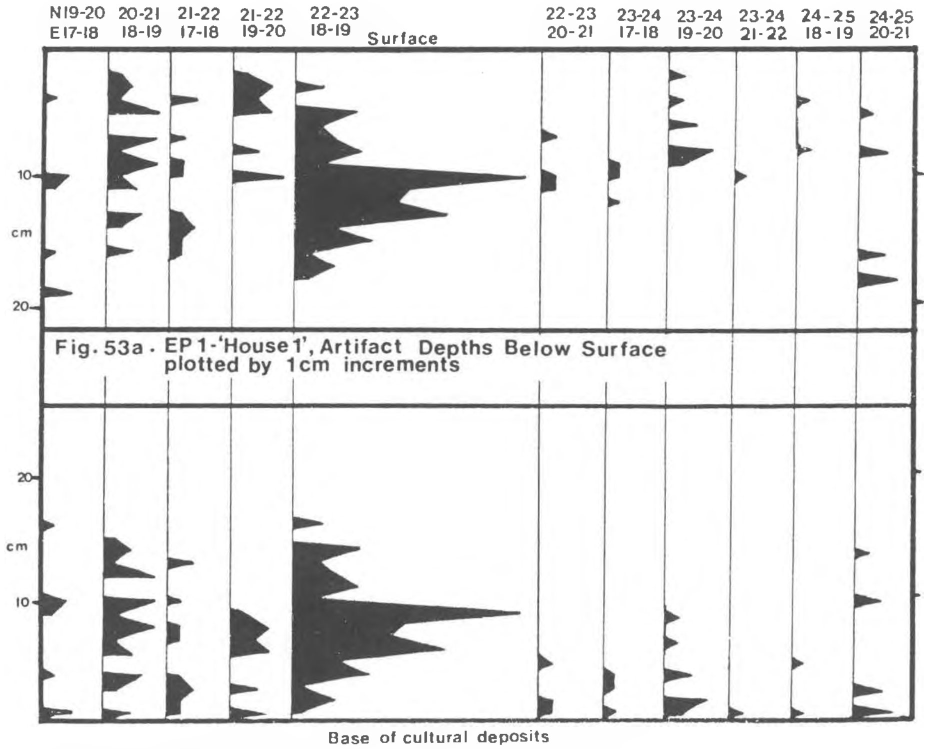


Fig. 53a. EP 1-'House 1', Artifact Depths Below Surface plotted by 1cm increments

Fig. 53b. Artifact Elevations Above Sterile Subsoil

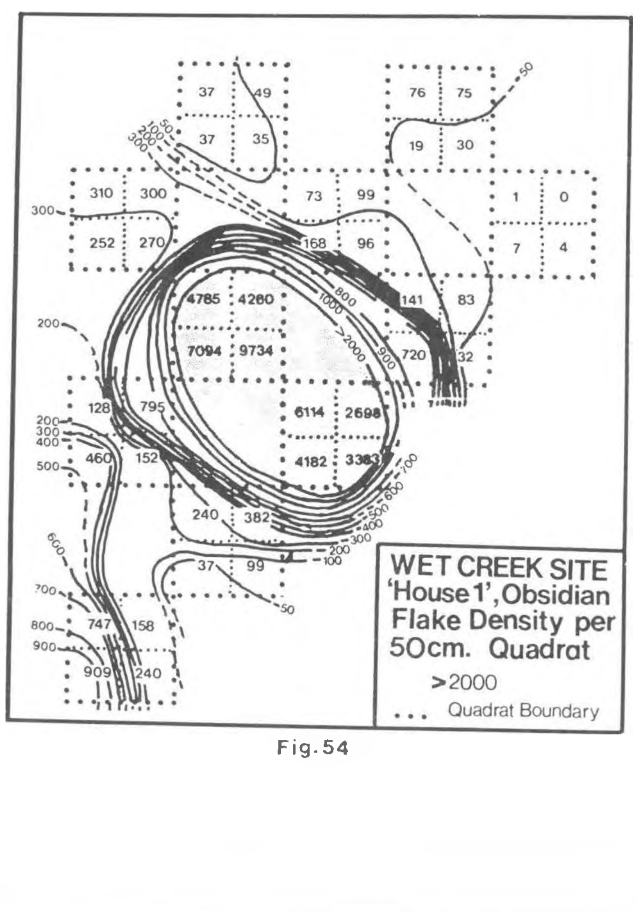


Fig.54

the moment empirical data do not seem to strongly favour either possibility. Given the site location in a high subalpine setting, with abundant surrounding evidence of past and present periglacial processes, it would seem possible that some form of cryoturbation has been operative in these cultural sediments. Such disturbance processes have been noted in numerous other alpine and Arctic sites. For instance, in high altitude sites of the Colorado Front Range, Benedict and Olson (1978) demonstrate the differential effects of cryoturbation phenomena on artifact vertical proveniences, in which, depending on the situation, heavier and larger objects are displaced and sorted vertically. However, a simple test for similar processes in "House 1," involving plotting of average flake weight per level (Fig. 52), does not seem to reveal any such trend. Heaviest flakes coincide with the peak numerical concentration (Level 3), while the second heaviest average flake occurrence is in level 1, 0-5 cm beneath the surface littermat and sod. Also, there is no clear evidence of horizontal clusters of flakes or rocks solely induced by cryoturbation phenomena such as frost cracks or boils, and all but a few flakes and artifacts were found lying flat or parallel to the subsoil surface. Bioturbation, particularly by ground squirrel burrowing may also have been a factor in "House 1." Although no burrows were identified in the excavations, extensive animal digging might conceivably have led to total mixing and homogenization of cultural sediments. However, no ground squirrels were observed at EP 1 during our stay, and in general they seem to prefer slightly more open and sandy meadow areas. Finally, mixing of underlying cultural materials may have occurred through human trampling or other activities. This, however, is likely a constant in most archaeological contexts and probably cannot be used by itself to account for the vertical distribution of artifacts and flakes at "House 1."

In summary, there is no definitive evidence of multiple major occupations of the "House 1" area through time. Instead, there may either have been: (1) A single main occupation, with relatively minor later bio- and/or cryoturbation scattering and mixing of its deposits; or (2) There were continuous minor occupations, building to a peak episode, and then dwindling into later minor occupations over an unknown time interval. At the moment, I consider the second alternative least probable, but direct confirmation is lacking.

Horizontal Distribution of Cultural Material

Artifact and flake distributions, plotted horizontally across "House 1" seem to show patterning which may be related to aboriginal activities carried on in the area. The lack of strong evidence for large scale cryoturbation of these deposits, as noted above, and the occurrence of some preserved primary cultural associations (e.g. heat-altered flakes and artifacts in hearth areas; refitted biface fragments found within a few centimeters of each other), suggests that this is a valid assumption. Although a proportion of all objects may have been vertically displaced by various disturbances, given case 1 above; or a minor proportion of all flakes and artifacts may result from occupations later or earlier than the main episode, given case 2, it is still likely that the bulk of cultural materials in this area result from a relatively coherent set of cultural events. I am hypothesizing, therefore, that, while relatively small vertical and horizontal displacements probably have occurred, the positions of general clusters and concentrations of cultural items approximate their original locations, and that these clusters and concentrations were laid down in the course of inter-related activities.

A very large number of flakes were found in the 11 excavation units of "House 1" (a total of 49,489 larger than 1 cm in maximum dimension), although their density varied markedly across the feature. Fig. 54 shows numerical flake and core "shatter" distribution by 50 x 50 cm quadrats, regardless of depth, with density isopleths plotted in 100 flake per quadrat increments around a central high density zone containing over 1000 items per quadrat. Although it might be possible to debate the exact position of some of the isopleths, the overall message seems clear. There is a central or core area within "House 1," approximately 3 x 2 m in size, dominated by the residue of very intensive lithic reduction activity. The two 1 x 1 m excavation units within this zone never possess less than 2698 flakes per quadrat, and one single 50 x 50 cm area yielded almost 10,000 flakes (Fig. 55). Almost all appear to be biface thinning flakes, with an average weight (i.e. size) of items generally smaller than for the rest of "House 1" (Fig. 56). All of these flakes are probably the result of direct percussion, by hard or soft hammers, with little or no pressure flaking going on anywhere in the immediate area. This region also possessed nearly 70% of all the artifacts (Fig. 57). Most are nondescript biface preform fragments (Table 2) with about 80% of this class of artifacts found in the central two excavation units (Fig. 58). Thus, this "core" zone appears to be a lithic workshop dedicated to biface preform manufacture. While flake and artifact densities are high, the total accumulation of material need not represent much more than a few day's flaking activities by a single person. Over 70 biface preform fragments occur within the central zone, and it is likely that many more were originally removed from the flaking station as successful completions. Given an average (skilled) time of ca. 20 minutes for manufacture of each biface preform, then these 70 pieces represent about 26 man-hours of labour; this estimate can then be multiplied

Table 2. Artifact Distribution by Site.

	Projectile points						End scrapers		Side scrapers	Unifaces	Core-scrapers	Retouched flakes	Microblade cores	Microblades	Primary spalls	Macroblades	Bifaces		Cores		Battered pieces	Hammerstones	Incised pebble	Ground stone point	Site Total
	1	2	3	4	5	6	1	2									1	2	1	2					
1-A1				1			1	1	1					1				5		2					12
1-A2							3		1	1		2	2	7	3		4	7		2					32
1-H1							1			1	2	1					8	105	2	35	5			1	160
7																		2							2
8																	2	2							4
9																	1								1
12									1					1			1		1	2					6
13											1			2			1	2	1						7
14							2									3	1	3							9
16											1		3				3	7		1					15
17							1	1	1		3	1	1			1	5	3		2					19
18								2																	2
19																		2							2
20																	2								2
21																	1	2							3
24								1	2				1					2							6
25							1																		1
26		1					1										1	5		3	1				12
27																	1								1
28														29	1		1								31
29																		1							1
32														3											3
33							1	1									1								3
35									1									3			1				5
37																	1								1
38																	1								1
39																					1				1
43													1												1
44														5	1										6
46									1																1
48							1																		1
49				1				1									2	4							8
50					1	2				1		1													5
52																		1							1
54									1																1
55												2						1							3
56	1													1						1					3
57									1																1
58	1								2			2	2	14				2		1					24
59									1																1
62									2																2
63	1				1			1				2					5	8		1					19
64																	1	1							2
66		1																							1
67					1		1	2	1	1		5				1	5	37	2	6	1				63
68							2										5	4							11
69				1								2				2	2	3	1						11
70							1		1									2							4
71									1								2			1					4
74																	1								1
76								1										3							4
77																		1							1
78																		1							1
79			1						2	1							2	2	1						9
80-1			1					2	1			2					2	1		1	1				11
80-2														55	5		2	10		4					76
82										1			1				1	1							4
83	1						2	2	1	1	1	7				3	2	9	2	8	1	1	1		42
84												2					5	3							10
85								1						1			1	2		1					6
86																1		1		1					3
87																	1	3							4
91																	1	4				2			7
92														20			3	2							25
93																	1	5							6
95																	2	2							4
96 E									1					1			6	1							9
96W							1										3	18		7					29
97 E				1					1						1			4		2					9
97W						1	1				1	3		8	1	1	4	21		1		1			43
98																	1								1
99																	1								1
100																	2								2
101			1				1	1	3			4		10	1		2	10		2	2	2			39
102																	2	2							4
103																		1			1				2
104				1					1									3			1				6
106												1						1							2
107												2					1	3							6
108																	2	4							6
110											1														1
111																	1	1	1						3
113											1							2							3
114																	2								2
Total	4	2	3	5	3	3	21	17	28	7	11	39	11	158	13	12	108	335	11	83	15	6	1	1	(897)

Fig. 55. Dense concentration of obsidian flakes in situ, N. 22-23, E.18-19, EP 1, "House 1". Pit is 1 m square, knife points north.

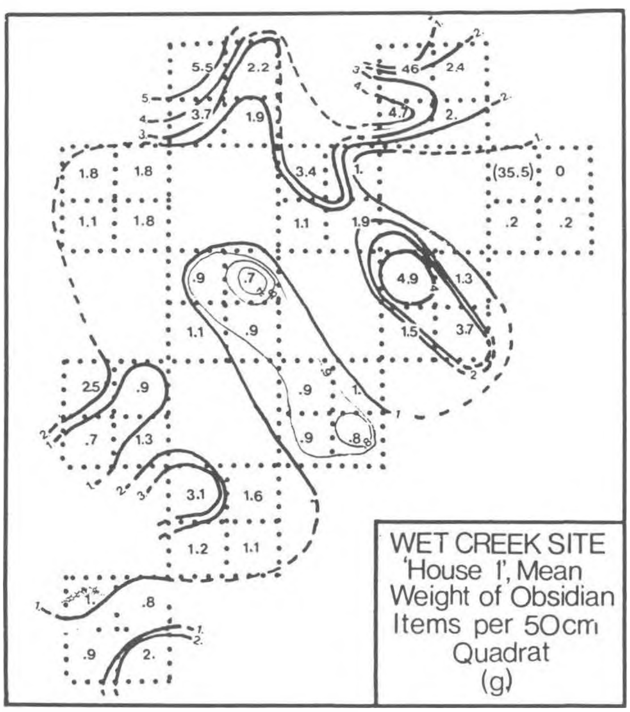


Fig. 56

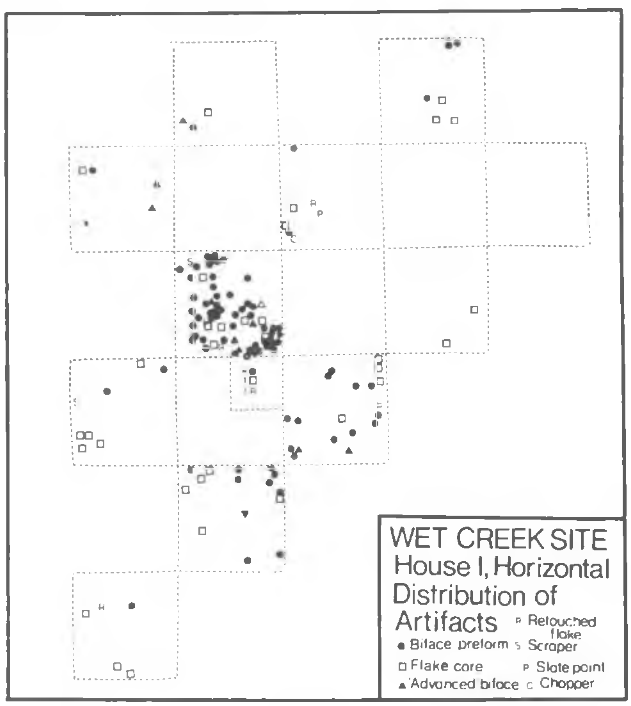


Fig. 57

Table 3: Metric Attributes of Selected "House 1" Biface Preforms

Artifact No.	General form	Length	Width	Thickness	Cross-section	Longitudinal Section
1: 28	leaf-shaped	91.4	24.7	12.1	irregular	irregular
1: 49	convex-edged end frag.	52.5*	37.3	11.1	lenticular	irregular
1: 93	leaf-shaped	64.4	23.5	11.0	plano-convex	plano-convex
1: 97	leaf-shaped	64.7	27.7	14.2	plano-convex	plano-convex
1: 119a&b	ovate	89.5	34.1	10.0	lenticular	thin lenticular
1: 122	leaf-shaped	78.8	27.8	15.4	plano-convex	plano-convex
1: 162	convex-edged end frag.	41.5*	36.3	8.6	lenticular	lenticular
1: 164	square base fragment	33.0*	26.2	10.4	lenticular	lenticular

*indicates incomplete axis of measurement.

All measurements in mm.

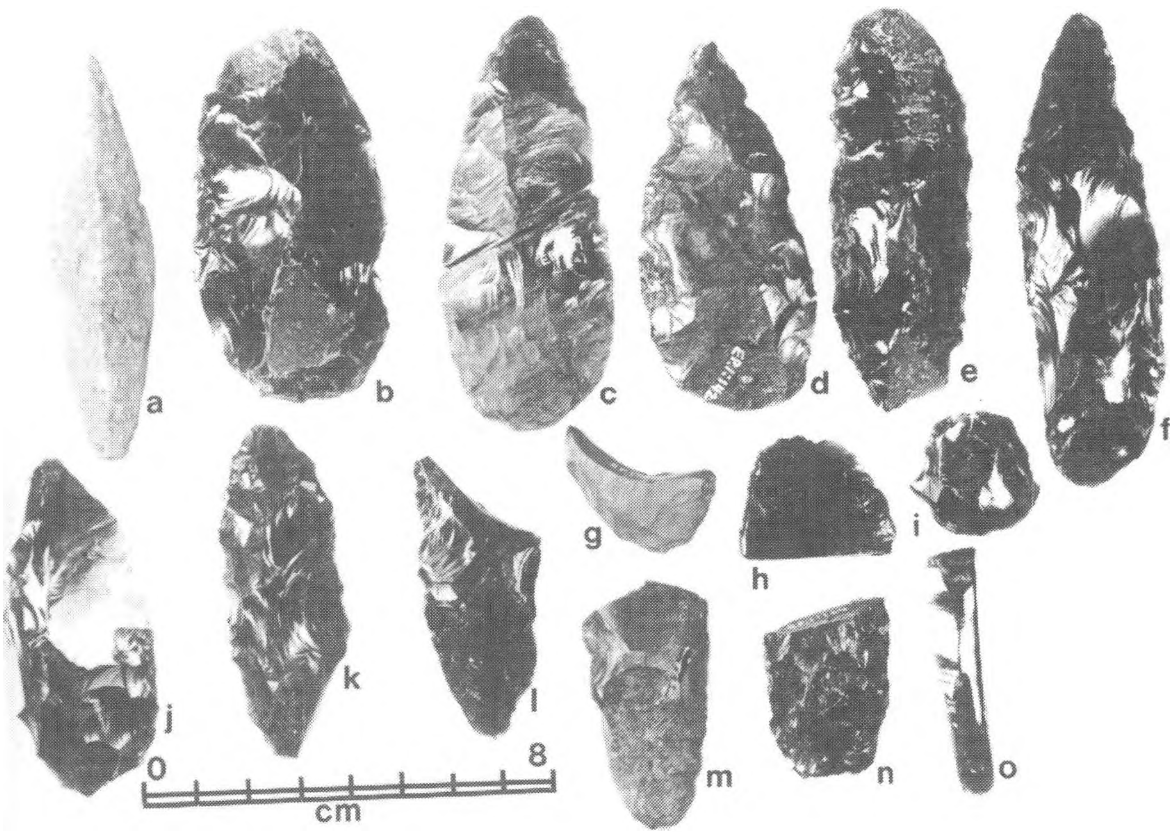


Fig. 58. Artifacts from FP1-"House 1" excavations: a. ground slate or siltstone point; b-g,j-n. biface preforms and fragments; h. possible retouched flake; i. possible end-scraper; o. blade-like flake.

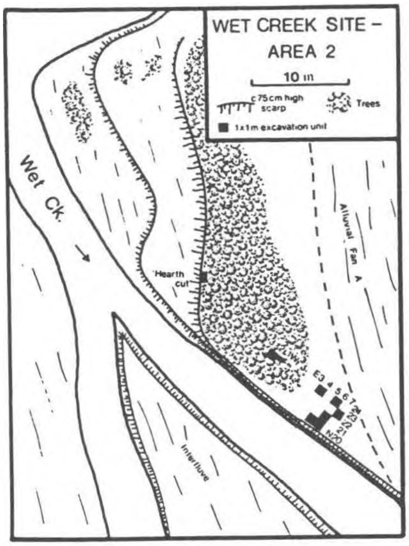


Fig. 59. Wet Creek Site.

Fig. 61. View of excavation underway at EP 1-Area 2. Crew is excavating units adjacent to Test Cut 3. Goat Mountain in background.

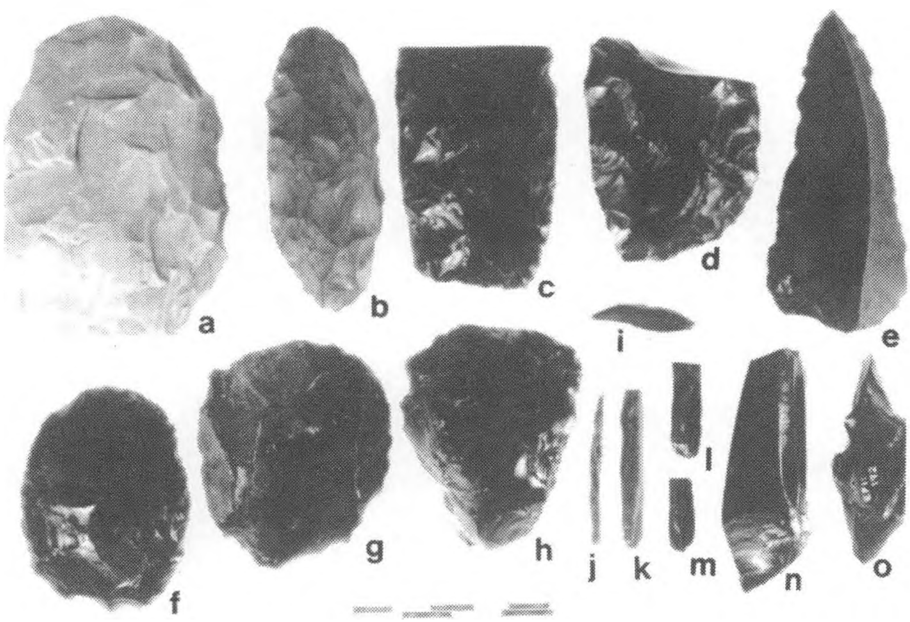


Fig. 60. Artifact assemblage from EP 1-Area 2, main excavation. a. rhyolite biface; b-d. obsidian biface fragments; e. pointed uniface; f-h. end-scrapers; i. retouched flake; j. lame a crete, or microblade "primary spall"; k-m. microblades; n,o. microblade cores.

depending on one's prediction of the original success rate, and the proportion of "finished" items originally removed from the site.

There is a marked fall-off in flake density around the biface-flaking station, with the concentration declining from 2000+, to less than 100 flakes per quadrat in about 1.0 m distance to the north. South of the main concentration, peripheral flake densities remain somewhat higher (ca. 100-500) climbing again to what may be the edge of another major concentration outside the southern boundary of the excavations (Fig. 54). The sharp gradient in flake concentration around the biface workshop may simply represent the normal limits to the spread of flaking debris around a person or persons sitting in a single location; however, it seems somewhat abrupt for that. Biface preforms and other artifacts also show a similar sharp break in distribution, particularly notable as a near absence of artifacts across the northeast quadrat of the unit possessing the densest flake and artifact occurrences (N.22-3; E.18-19). I am inclined to suggest that some kind of artificial barrier to flake or artifact distribution may have existed in this area, perhaps the wall of a sub-enclosure or shelter, although periglacial processes might also be wholly or partly responsible.

Flakes and artifacts found north of the main concentration tend to be somewhat different than those in the rest of "House 1." These include a faceted ground-slate or siltstone point, an artifact type quite unexpected in the area. Flakes were often larger than the site mean, and notably larger than the biface thinning flakes in the main concentration. A group of large flat flakes found together in N.24-25, E.20-21 appears deliberately placed there as perhaps a cache of cutting tools or potential blanks for later reduction; the absence of quantities of smaller flaking debris indicates that these flakes were not removed from a core in this location. It is conceivable then that the area north of the flaking station was a living or sleeping zone, deliberately kept relatively clear of detritus, and perhaps enclosed by some kind of wall or barrier. In the area south of the main concentration, primary core reduction appears to have been a frequent activity, as indicated by the relative abundance of flake cores, and a mean flake size again larger than that of the central zone (Fig. 56).

House 1: Artifacts

All artifacts from the Edziza area will be described in a later chapter. This section will simply serve to indicate some of the more distinctive aspects of the "House 1" assemblage. The numerical distribution of artifacts by class is summarized in Table 2.

The "House 1" assemblage is overwhelmingly dominated by biface preform fragments (70%) and flake core fragments (23%). These are primary stages of lithic reduction, and are morphologically incomparable to assemblages composed of "finished" tools. The "House 1" bifaces mainly represent unsuccessful early stages of biface manufacture, and exhibit a considerable range of size and shape. Of these, 8 appear sufficiently "advanced" to offer some suggestion of the form of the desired end-product. Table 3 lists the basic metric attributes of these pieces, which are illustrated in Fig. 58.

The "advanced" bifaces appear to represent two somewhat different forms; one long, narrow and thick leaf-shaped type, and another relatively thin and broad-based ovate type. EP 1: 119 a and b, found as two closely spaced fragments, broken during manufacture, appears to be the most "finished" of all the preforms and is representative of the broad-ovate form. This type of preform could be finally reduced into a wide range of possible projectile point shapes, if that was its original purpose, but would seem particularly suited to relatively large and broad notched points, such as provisional "Type 4," described later. The leaf-shaped perform variant would seem only useful for thick, narrow leaf-shaped or lanceolate points.

Other artifacts from "House 1" are characterized by a lack of careful workmanship and clearly defined form. Thus the unifacially retouched tools from this assemblage, including the one end-scraper, are very rudimentary and haphazardly worked. There is a possiblity that all of these are merely fortuitous by-products of intensive core and biface reduction, which frequently involves unifacial retouch of platform edges. If these presumed tools are in fact only "accidents," then the character of this assemblage would become thoroughly and totally dedicated to primary lithic workmanship. The sole exception to this, and an entirely anomalous find in all regards, is the one faceted ground stone point. Otherwise, the assemblage from "House 1" is best described in negatives: no definite evidence of a microblade industry; no finished projectile points; no well formed tools of any type. While this is a less than satisfying situation for essaying cultural historical relationships, the assemblage still presents a number of interesting implications, to be discussed below.

Chronology of "House 1"

Two radiocarbon determinations pertain to the "House 1" deposits. The first is a date of 260±80 B.P. (SFU 143) obtained on wood charcoal 7 cm below the surface of the bulk-sample removed from

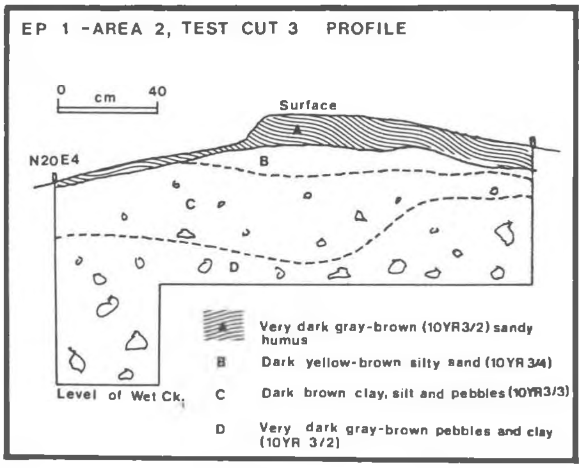


Fig. 62. EP 1-Area 2. Test Cut Profile.

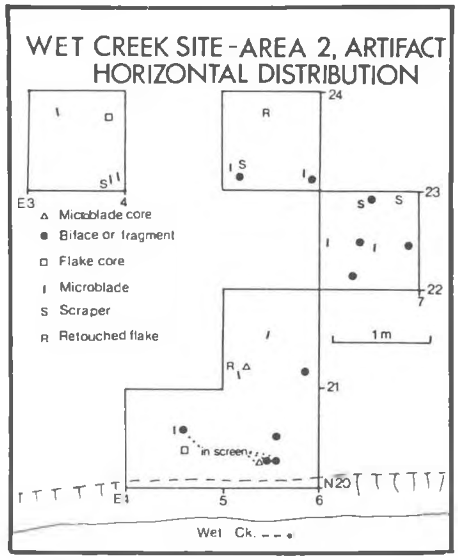


Fig. 63. Wet Creek Site-Area 2, Artifact Horizontal Distribution.

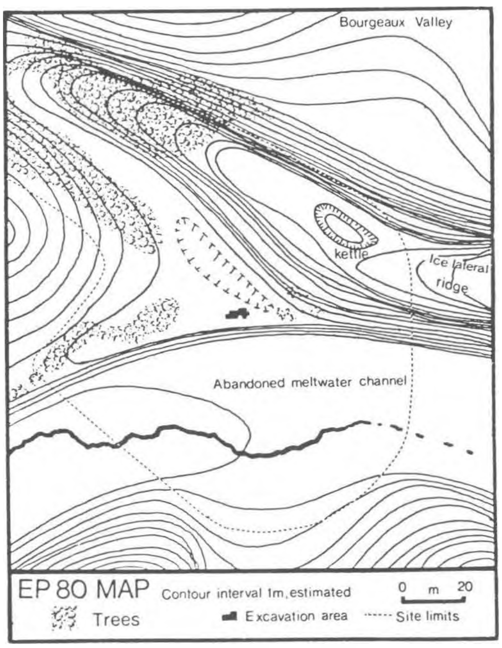


Fig. 64. EP 80 Map.

N.21.5-22; E.18.5-19. This overlay the main cultural level, and is interpreted as simply a minimum age limit on the main "House 1" occupation. The second date, of 2850±160 B.P., also on wood charcoal (SFU 141), was obtained about 10 cm below the first sample. It was directly associated with numerous flakes and a large biface fragment, and is considered an accurate estimate of the age of the main cultural occupation in this area.

Only the ground slate/siltstone point recovered from "House 1" is considered sufficiently time-diagnostic to be useful in dating. It is fully ground, and well-made, with a thick diamond-shaped cross-section, and nearly bi-pointed outline (79.5 x 20.2 x 7.5 mm) (Fig. 58a). It is clearly of coastal origin, where it would most probably date about 2000-3000 B.P., tending to confirm the single radiocarbon estimate for the main cultural horizon. The later 14C date of 260 B.P. may indicate that there was some continuing cultural occupation of "House 1" through the climax of the "Little Ice Age," or it may be the result of a natural forest-fire.

Cultural Reconstruction and Relationships

Evidence from assemblage diversity, tabulated in Table 2 and illustrated in Figs. 24 and 25, indicate that "House 1" is overwhelmingly a lithic workshop, in terms of its main functional classification. This is also obvious from the flake concentrations and artifact distributions discussed above. However, a small number of items from this "feature" have been classified as scrapers and retouched flakes (a total of 5 out of an overall assemblage of 160). These may suggest that some domestic activities were carried out, possibly to provide support and sustenance to the obsidian-knappers, although, as noted earlier, these "tools" are not well-formed. All cultural material from "House 1" is of obsidian, except for the ground stone point. Obsidian used in "House 1" is primarily dark black to green in colour, but includes rarer examples of all the myriad colour variants of the Goat Mountain quarry sources. There seems little doubt that this is the origin of most of the materials being worked at this site.

The fact that most of the artifacts found in "House 1" result from primary reduction and preform preparation means that there are virtually no "diagnostic" items in this assemblage of much direct or certain use for tracing areal or temporal relationships. One large side-notched atlatl point was found in Test Cut 5 about 10 m west of "House 1" on the bank of Wet Creek, associated with a small assemblage of scrapers, biface fragments, flake cores, and one microblade; however, the association of this "Area 1" ("A-1" in Table 2) assemblage with "House 1" is not demonstrable. The fragmentary bifacial preforms left in the "House 1" area are presumably those which were discarded as completely unsuitable for further reduction by the original manufacturer. Most are too fragmentary, or at too early a stage of reduction, to permit much inference about the desired end-product. However, as noted above, some of the ovate bifaces could presumably have been preforms for large wide-based notched points ("Type 4"). Other narrow, round-based, thick biface preforms, with irregular edges whose intransigence was probably responsible for their discard, were probably only usable for making equally long, narrow, and thick leaf-shaped, lanceolate or perhaps stemmed points. The biface preforms from "House 1" do not include the very large size extremes of this class sometimes found in local surface assemblages. The goal of lithic reduction at this site seems to have been solely middle-sized bifaces, ca. 10 cm in length.

No definite evidence of a microblade industry was observed in the "House 1" collection, although a few small blade-like flakes were found. However, these are undoubtedly only normal fortuitous by-products of sustained biface and flake core reduction, and lack clear evidence of successive prior blade removal. Although it is possible that blades were simply not being manufactured or used in a context primarily devoted to biface preform production, I think it is likely that if we were dealing with a microblade-using culture, there would have been some definite traces of it in this relatively large assemblage. In the Edziza collections overall, elements of the microblade industry occur at an average of almost 1 for every 2 biface preforms.

The significance of a distinctively coastal type of artifact -- the faceted ground stone point -- being found in a remote mountain valley over 200 km ground travel from the nearest salt water is not clear. As previously indicated, there are several routes by which travellers from the coast could have reached the Wet Creek Site, either from the south (e.g. the Tsimshian or Tsetsaut areas) or from the west (the Tlingit). We know that Edziza obsidian was reaching both Tsimshian and Tlingit areas throughout prehistory, and the ground stone point is not sufficiently distinctive to permit its positive association with only one or the other sub-area. However, it is interesting to note that coastal weapons (and therefore possibly other materials) were moving inland as early as almost 3000 years ago, at the same time as interior products (obsidian) were moving coastward. There is no firm basis for suggesting that "House 1" was necessarily occupied or owned by a Tlingit or Tsimshian chief, but the point suggests that their influences may have been felt in the area at this time.

In summary, this portion of the Wet Creek Site seems to represent a short-term flaking station dedicated primarily to biface preform production. It was occupied for perhaps no more than 2-3 days, approximately 2800 years ago, by members of a culture whose sphere of relationships included coastal contacts. These people utilized the Goat Mountain obsidian sources for the production of medium-sized ovate and leaf-shaped biface preforms, which were removed from this particular area for use, redistribution, or further reduction elsewhere. If the central flake concentration is, as thought, the result of a single episode of obsidian-knapping, it must have been a sustained and energetic bout of activity. Great quantities of flakes, and core fragments, many of a size and quality which would be highly valued as tools or blanks in their own right in obsidian-poor regions, here were discarded apparently without thought. This illustrates that conservation of raw material was of little concern.

As an obsidian-knapper of mediocre skill, and one who has watched many talented and novice lithic craftsmen at work, I am struck by what might be described as a rather uninspired quality to the lithic workmanship in this assemblage. Granted that it is almost totally concerned with preliminary stages of biface manufacture, and that most of the secondarily modified pieces still remaining are undesired discards, there still seems to have been little planning of stages of biface thinning, and a tendency to be "stumped" by relatively insignificant flaking problems, such as minor areas of overthickening, or assymetrical outlines. In such cases, usable pieces often were apparently discarded through lack of interest or skill in coping with such problems. Perhaps this perspective simply points out differences between avocational flint-knappers who strive for detailed technological "niceties" for pedagogical or aesthetic reasons, and the pragmatic concerns of hunter-gatherers who needed sharp edges and points with a minimum of effort. Certainly, there was little time wasted on the manufacture of bifaces at this site.

It is not possible to say much about how these people lived, or make any inferences about their ethno-linguistic identity. We know they built wood fires and, at one time, threw into the flames the remains of what was probably a ground-squirrel dinner. There is no evidence of any larger game, but a general lack of organic preservation prevents any useful statement about their diet. While they may have occupied a light wood-frame dwelling, perhaps brush or skin-covered, there is no strong evidence of this, except for a possible rock alignment, and hint of possible artificial boundaries to flake distributions. By 2800 B.P., they had already apparently abandoned use of microblades, although the general lack of cultural-chronological diagnostics in this assemblage makes statements about any cultural relationships or comparisons difficult.

EP 1 - Area 2

Description and Methodology

In 1977 a microblade was observed eroding from the bank of Wet Creek in the portion of the site since termed Area 2. During preliminary work at the Wet Creek Site in 1981, a profile exposure (Test Cut 3) was made in the bank at that location (Figs. 46 and 59). This did not immediately produce any more microblades, but did yield a basal fragment of a large, well-flaked square-based biface (Fig. 60c). Following completion of work in "House 1" we shifted efforts towards expanding test excavations around Test Cut 3 and Test Cut 5, with the former being designated "Area 2." This did confirm the presence of a microblade industry and the following sections will describe these investigations and their results.

As noted earlier, Area 2 is a streamlined interfluvial remnant, built of sediments similar to those in Area 1, caught between modern Wet Creek on the west, and an old creek channel, later infilled with the Fan A bouldery gravels on the east (Fig. 46). A small "island" of fir with trunks of up to 20 cm in diameter occupies the slightly elevated central zone, while the rest of the area has a thin ground cover of moss and grass. Fan A deposits overlap onto interfluve sediments along the eastern flank, while low (1-0.5 m high) active or abandoned erosional escarpments attest to the recent destructive activities of Wet Creek along the western side. Except for these scarps, the ground is gently hummocky, sloping upwards to the northwest.

Our total time in Area 2 was limited to about 12 man-days due to a scheduled helicopter move to the next base camp, and the sampling coverage and level of data recovery was accordingly somewhat lower than in "House 1." We laid out a 1 x 1 m excavation grid orientated true north-south, based on the original Test Cut 3 exposure (Fig. 59), at the extreme downstream end of Area 2. This grid was later expanded westwards, to include a single 1 x 1 m unit and a 50 x 50 cm extension excavated within the spruce forest about 8 m northwest of the test cut. Pits were trowelled using 5 cm contoured levels, and all flakes collected by unit/level. Modified artifacts were given full provenience. All matrix was screened through 6 mm mesh. Seven 1 x 1 units (and 1, 50 x 50 cm extension) were started and completed between July 24 and 26 (Fig. 61).

Area 2 -- Stratigraphy

Stratigraphy in Area 2 is relatively simple and well-defined. In the Wet Creek channel exposure (Fig. 62), the basal sediments consist of the same yellow-brown stoney clay diamicton noted earlier. With decreasing depth, the proportion of coarse clasts diminishes, so that by 10-20 cm below surface the deposits consist of approximately 70% clay and 30% sand-silt. A weakly developed brunisolic soil profile in open areas, and a well defined podzol under the forest are developed in the top ca. 20 cm of the section. In the main excavation outside the trees, the soil includes a surface humic layer (Ah) ca. 8 cm thick, overlying a ferro-humic (Bfh) horizon of variable thickness. All cultural materials occurred in the top 10-20 cm of deposit, primarily associated with the B horizon, and sometimes lying on the surface of the coarser parent materials. In unit N.23-24, E.5-6, at the eastern edge of the interfluve, a flake concentration was overlain by coarse fluvial gravels associated with Fan A; nearby a microblade and scraper were found underneath a large rounded cobble, also probably laid down by the development of Fan A. Therefore, at the time of site occupation, Wet Creek probably flowed in the old channel to the east of the cultural area, *since* buried by Fan A.

Area 2 -- Cultural Materials and Distribution

No cultural features were identified in the main (eastern) excavation block of Area 2. Two hearths were located in areas further west, however, these cannot be associated with the eastern excavation area and will be discussed separately. Thirty-two modified artifacts were found in the main excavation area (Table 2) and their horizontal distribution is shown in Fig. 63. They include a well-defined microblade industry with 2 IMMI-type microblade cores and 10 microblades; several fragments of large well-made bifaces which may be functional implements rather than preforms, 5 scrapers and retouched flakes, as well as biface preforms and flake cores (Fig. 60). Flake detritus is not yet fully counted and tabulated, but will in total amount to another several thousand items. There is no evidence of any vertical patterning in artifact occurrence, and the assemblage is most probably single component. However, artifacts are distributed through as much as 15 cm of culture-bearing sediments, and I suspect, but cannot prove, the past action of cryoturbation processes. It is also possible that some of this area was briefly swept by floodwater during peak phases of aggradation of the Wet Creek alluvial fan complex, since the highest portion of the cultural horizon is no more than 40-50 cm higher than the surface of the Fan A boulder deposits overall and, along its eastern edge, the

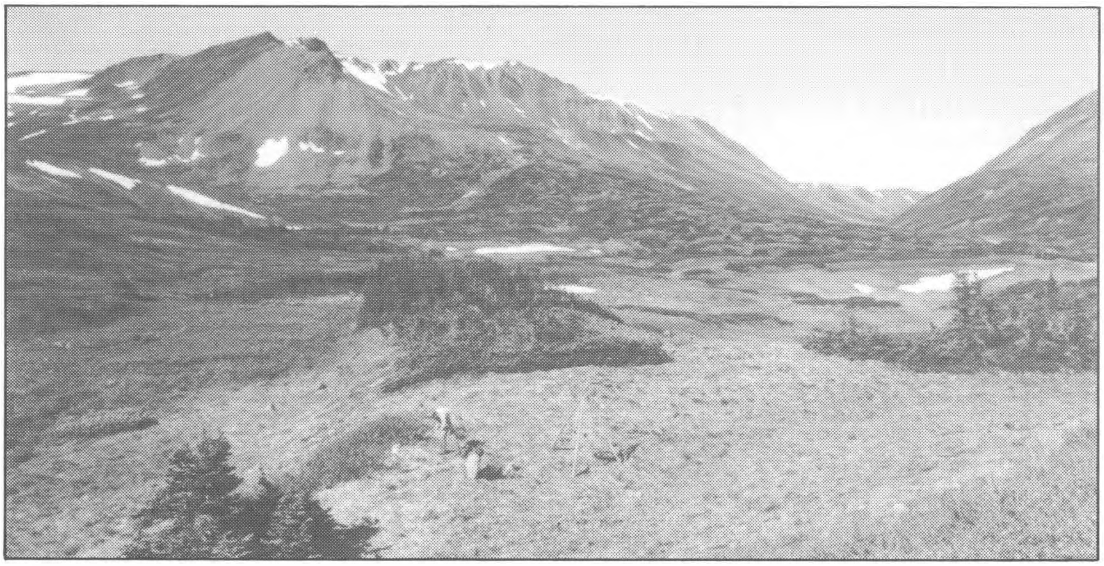


Fig. 65. General view of the Grizzly Run Site (EP 80 - HiTp 63) looking west. Point Creek Valley in left distance, and Raspberry Pass in right distance.

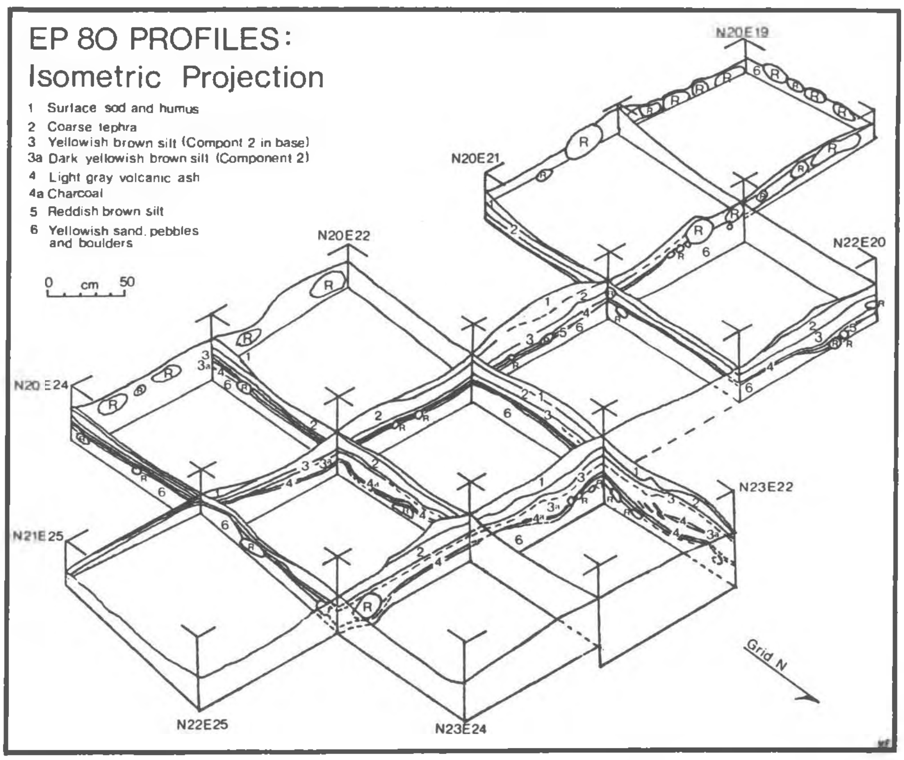


Fig. 66. EP 80 Profiles: Isometric Projection.

Fig. 67. Microblades in situ, N.20-21, E.20-21, EP 80-Component 2. Knife points north.

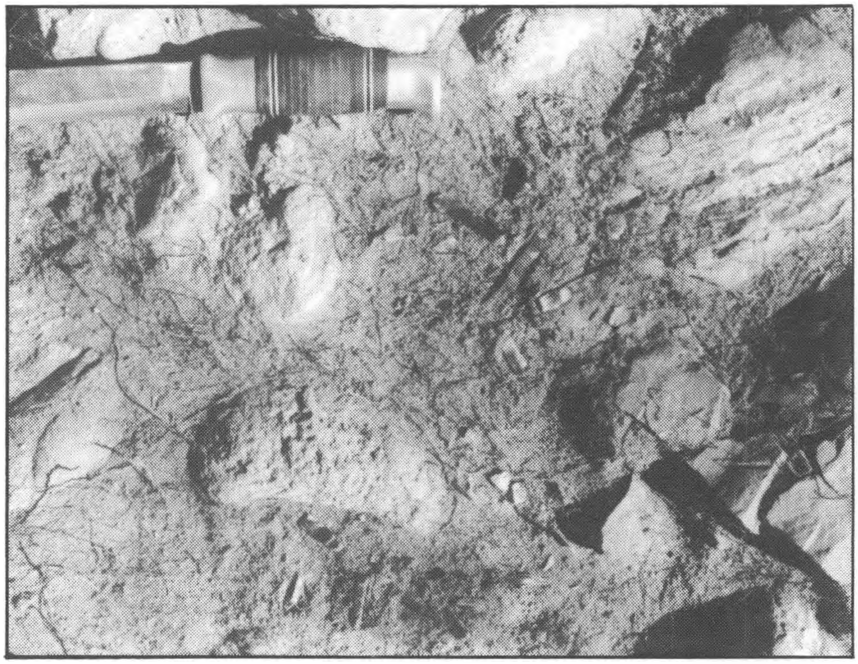


Fig. 68. Reconstructed microblade core segment, EP 80-Component 2. a. frontal view of fluted surface, b. lateral view, showing facial retouch, c. striking platform. (8 cm scale)

Area 2 interfluve and cultural materials are partly buried by the fan. Water sorting or some other post-depositional disturbance may also account for the apparently scattered horizontal distribution of microblades, in a situation where one would expect tight manufacturing clusters to occur, such as those in several other sites (e.g. EP 80, Component 2; EP 28, 58, and 92). Also, active slumping into the present channel of Wet Creek is occurring at present, and cracks parallel the creek bank about 1 m back. All these processes may have acted in the past to vertically separate and horizontally scatter cultural materials in this area, perhaps partly accounting for what seems to be rather "loose" and random distributions of artifacts, and problematical 14C dates.

The artifact assemblage from Area 2 (Fig. 60) is distinct from that of "House 1" in several ways: (1) It includes a strong microblade industry; (2) It possesses much greater diversity, measured as ratio of numbers of items to numbers of classes, or as ratio of numbers of cores and preforms to numbers of functional tools (Figs. 25 and 26). These measures place the EP 1-A 2 assemblage clearly within the "camp" class, as described in the section on survey data; (3) As implied in statement 2, there are more functional tools in the Area 2 collection, including well-formed end and side-scrapers, a formed uniface, retouched flakes, and probably functional bifaces (knives?). While a few roughly similar tools were found in "House 1," none of those are as well made and clearly defined as those from Area 2; (4) Finally, one of the possibly "functional" biface fragments from Area 2 is flaked from a fine grained grey rhyolite. Use of a non-obsidian rock type for flaked stone artifacts in this area implies that people were importing some curated items of their tool kit and not depending entirely upon *ad hoc* manufacture of obsidian implements. While non-obsidian tools are generally rare in Mt. Edziza area collections, they do occur, and are relatively most frequent in classes of functional tools and weapons (e.g. projectiles and scrapers, particularly) characteristic of campsites. Several of the Area 2 tools show very visible use polish, and one green obsidian biface is highly worn over all its flake scar ridges. Thus, all characteristics of the main Area 2 assemblage indicate a small multifunction campsite, in which tool preparation (microblade production, biface manufacture) and maintenance activities (possibly replacement of broken knives or lance heads) were balanced by hide preparation and other routine domestic tasks of a mixed-sex group.

Chronology

Two samples from the main eastern excavation block of Area 2 were submitted for radiocarbon dating. These were the only organic remains found in that area. Field observations concerning the first sample, a single large clean-looking, well-preserved lump of wood charcoal found at the base of the cultural horizon, note that it is "possibly intrusive" by slump or frost cracking. It produced a date of 1430±160 B.P. (SFU 142). The second sample consisted of a small cluster of charcoal flecks 8 cm below ground surface, near the top of the cultural horizon, at the northern end of the excavation. It was collected with the express intention of providing only a minimum limiting date for the assemblage. It produced an age of 1140±80 B.P. (SFU 162).

I am presently inclined to treat both dates as only minimum "older than" estimates for the Area 2 assemblage, for the following reasons: (1) Direct association of either sample with the cultural occupation which deposited the artifacts in this location is not definitely demonstrated. The first sample was the largest piece of coherent charcoal found in any of our excavations in the Edziza region. Its size, solidity and solitary cleanliness made it immediately remarkable and suspect in a context which otherwise completely lacked any organic remains, or else possessed only scatterings of the smallest carbon flakes; (2) The second sample was simply too close to the surface for any reliance on its cultural associations and, as noted above, was never considered suitable for anything more than a minimum limiting date; (3) Although precise dating of the upper age limit of microblade technology is still somewhat uncertain in the Northwest, most data indicate that true microblades were generally out of fashion by 3-4000 B.P. in all areas adjacent to the Mt. Edziza research area (e.g. central-northern B.C.; northern Northwest Coast, and the southwest Yukon). In addition, other sites and assemblages in the Edziza region, such as "House 1" and EP 80, Component 1, suggest that microblades had ceased to be used in that area by at least 3000 B.P.; (4) More tentatively, if the Fan A gravels were deposited during the Neoglacial, as argued previously, then the fact that they overlap Area 2 cultural deposits indicates that this site portion pre-dates all or part of the Noeglacial. For the moment, therefore, I consider Area 2 to date near 4000 B.P., on the basis of the presence of the microblade industry, and the absence of any distinctive tephra layers which presumably should have been present if it was much older than 4500 years in age. However, it is possible that a locally thin ashfall might be invisibly incorporated into the soil horizons, or have been removed from this portion of the site by slopewash or other redepositional processes. The two radiocarbon dates do overlap at two standard deviations and it is possible that they reflect a single recent natural event, such as a forest-fire, or a flood from Fan A, washing organics over and into the site. Of course, should other "Ice Mountain" microblade components consistently produce similar dates, the arguments presented above may have to be revised.

Area 2 -- Cultural Relationship and "Reconstruction"

The most obvious cultural tie of EP 1-Area 2 is with other microblade components of the region. The technological characteristics of the IMMI are described in the section on "Artifacts," and its overall dating is discussed in the final chapter on "Cultural History." Very little can be said with confidence about the way of life of the original Area 2 occupants. They were apparently engaged in more diversified activities than the people of "House 1," and were not so committed to intensive biface manufacture, although they were conducting some primary lithic reduction. Nothing certain can be said about their diet, settlement or subsistence pattern, or cultural ties external to the mountain area, on the basis of this one site-area alone.

Other EP 1 Excavations

Besides relatively extensive excavations in "House 1" and Area 2, we conducted some small tests in other portions of the Wet Creek Site. This included clearing of the profile of a shallowly buried charcoal-lens hearth exposed in the creek channel within Area 2, 8 m due west of excavation unit N.23-24, W.2-3 (Fig. 59). This "hearthcut" produced a large number of biface thinning flakes, one heavily worn sub-triangular dark grey basalt biface, a wide-edged end-scraper, some small fragments of small calcined bones (possibly ground squirrel), and a radiocarbon date of 600 ± 80 B.P. (SFU 145). The area immediately behind the hearth-cut is heavily vegetated in a tangle of stunted alpine fir today, but at the time of occupation must have been more open. The small assemblage of modified artifacts from this location is undiagnostic, but does demonstrate the presence of some native occupation at EP 1 during the latter cool phase of the Neoglacial.

The westernmost excavation unit of Area 2 is considered here as a separate case because of its spatial separation from the main excavation block, and because of its somewhat different stratigraphic situation. This unit (N.23-24; W.2-3, Fig. 59) was excavated in the middle of the coniferous thicket which crowns the highest portions of Area 2. This 1 x 1 m pit was the last excavation opened at EP 1 and it was not possible to follow up what appeared to be a buried cultural layer which lay at a depth of 30-40 cm below surface, beneath a near-surface cultural component. In this area, fine grained silty sands extend 40-50 cm deep in places, before encountering the more rocky substrate. The buried "component" consists of a thin layer of obsidian flakes, lying flat, but not associated with any visually obvious soil horizon or stratigraphic unconformity, within the fine grained sand. No modified artifacts or dateable sample was recovered from the one small exposure, although charcoal associated with the current surface podzolic soil development, and lying just above flakes of the highest cultural component, yielded a "modern" age determination (SFU 144). Although time did not permit serious exploration, this small test suggests that stratigraphically discrete, well-buried cultural horizons may await future investigations at the Wet Creek Site.

Finally, two other 1 x 1 m test-pits were shovel-screened through 6 mm mesh by 10 cm levels, as an extension of Test Cut 5, 10 m west of House 1, on top of the high bank of Wet Creek. This area also possessed the by now familiar stratigraphic sequence of basal coarse diamicton, grading into fine grained silty-sand, topped by contemporary podzol. Cultural materials were confined to the top 10-20 cm, within the soil profile. Flakes were, as usual, extremely abundant, including large fragments of core "shatter" and the usual massive quantities of biface thinning flakes. Artifacts included one large complete side-notched obsidian projectile point, found in the original Test Cut 5 (Fig. 72o); two end-scrapers (1 wide-edged and 1 narrow-edged), a side-scraper, 5 rough biface preform fragments, 2 flake cores, and 1 possible microblade. No organic material was found in this excavation, and it is not directly datable. However, as will be discussed later, other surface assemblages from the Edziza area which include "Type 4" large notched points, usually lack microblades. The Test Cut 5 area is also another portion of the Wet Creek Site, now densely forested, which must have been more open at the time of original occupation.

The Wet Creek Site: Summary and Synthesis

Wet Creek is one of the largest and richest cultural sites encountered in the Edziza area. This probably reflects its highly strategic location vis-a-vis the Goat Mountain obsidian outcrops and major routes of travel off the mountain in all directions. Its environmental setting is also favourable, being the last large camping area, with adequate firewood supplies on the direct route to the lithic quarries. Relatively intensive excavations in "House 1," and exploratory test-excavations in other portions of the site, suggest that it has been occupied for more than ca. 3000 years. During this time, some significant cultural-technological changes seem to have occurred, particularly the final waning of the microblade industry, and its replacement by non-blade complexes. By 2800 B.P., at least one group of occupants at Wet Creek were engaged in a vigorous, but technologically unsophisticated biface manufacturing industry, at the same time possessing some cultural contact with the Pacific Coast. People were still returning to the Wet Creek locality 600 years ago, and perhaps even as late as about 260 B.P., if the upper date in "House 1" can be related to cultural activities.

EP 80 -- The Grizzly Run Site

Location and Description

The Grizzly Run Site is located on the south side of Bourgeaux Valley, at an elevation of 1480 m, nearly half way between the northern entrance to Rocky Pass, and Point Creek (57°29'54"N., 130°37'48"W; Fig. 15). This site occupies a small glacio-fluvial terrace associated with the complex of ice-lateral outwash channels and lateral moraines which slope along the side of Bourgeaux Valley from the outlet of Rocky Pass towards the west, where they terminate in a large pro-glacial fan-delta now incised by Point Creek (see section on "Quaternary Environments," Figs. 11, 12 and 13). A very prominent ice lateral channel forms a broad, smooth-bottomed, easily travelled trough along the valley side, from a kettle lake just east of the Point Creek fan-delta, to Rocky Pass (Fig. 11). This is by far the fastest walking route along Bourgeaux Valley (the valley bottom itself is often marshy or heavily vegetated), from Point Creek to Rocky Pass and beyond. Several game trails, and a modern guide-outfitter's horse-path can be traced through portions of this old channel, and animals obviously use it as a natural highway (hence the site name). EP 80 was discovered in the course of using the old channel as a "highway" ourselves, and it is probably the importance of this location in relation to travel routes through the valley which led to its repeated aboriginal occupation.

The main site area of EP 80 consists of a roughly triangular terrace formed along the north side of the best defined meltwater channel described above (Figs. 64 and 65). The terrace surface stands about 4 m above the present floor of the abandoned channel, and is situated at a point where that channel runs into and around a complex of large kettle depressions, the lowest of which now contains a small lake. Upslope from the site area is a flight of smaller less well-defined channels, forming a ramifying complex sloping northwest from the mouth of Rocky Pass. Directly opposite the site-terrace one of these upper gullies drops nearly vertically to join the main channel, forming a series of sills and steps representing an ancient waterfall. Travel directly up this steep col is difficult but feasible, leading one finally on to high terraces above the present floor of Rocky Pass. Directly north of the site-terrace rises a prominent steep-sided ridge, which winds sinuously westwards from the Rocky Creek fan-delta, and forms the north wall of the main melt-water channel along most of its length. The surface of this ridge is hummocky and kettled, and occasionally large boulders protrude from its crest or sides. This is probably a lateral moraine or kame ridge once formed between valley-filling ice and an ice lateral stream flowing in the now abandoned channel. Many lithic scatters were found in exposures along this ridge, and surface materials also extend over the ridge directly adjacent to the main EP 80 site on the lower terrace. Immediately north of the main moraine ridge the slope drops steeply down into Bourgeaux Valley, with the modern valley floor about 160 m below the site elevation. This slope is not a smooth gradient, but is interrupted by a complex succession of discontinuous ridges, hummocks and depressions, which probably represent a flight of moraine and ablation till features reworked by meltwater from successively lower and later stages of glacial recession. Thus the main site area occupies a flat, pleasant, well-drained bench, sheltered and hidden immediately to the north by the 9-10 m high "lateral moraine," but with a reasonably good view northwards down the abandoned meltwater channel and over the large kettles and Point Creek Valley to the eastern portal of Raspberry Pass in the distance. At the same time, any persons stationed on the "moraine" would have an unimpeded view in all directions over Bourgeaux Valley.

Vegetation in the site area consists of discontinuous and irregular patches of scrubby fir, thickening and increasing in vigour and size downslope to the north. The abandoned meltwater channel shelters a number of forest "islands" along its course, but these, and the trees growing around the site itself, are at the upper limit of significant tree growth on this side of the valley. Other plant species noted within 1 km of the site include scattered juniper shrubs (*Juniperus commonis*), very rare individual pine trees (*Pinus cntorta*), shrub birch (*Betula glandulosa*), (often in very extensive patches, including the crest of the moraine), several varieties of willow shrubs (*salix sp.*), crowberry (*Empetrum nigrum*), heather, moss and a great variety of herbaceous species (the latter including, interestingly, several poisonous varieties, e.g. Mountain hellebore [*Veratrum eshochltzii*] and monkshood [*Aconitum columbianum*]). There seem to be very few species of significant edible plants, including berries, in these alpine-subalpine valleys. Water is immediately accessible to the site in a small underfit creek which meanders along the floor of the old channel from seep springs along its southern wall; other water sources could include Point Creek about 1 km to the west, and Rocky Creek about the same distance to the east.

Geological History

The prominent "moraine" ridge, meltwater channels and other distinctive topographic features of the EP 80 area clearly indicate that its recent geological history begins with the ultimate Wisconsinan deglaciation of this valley. This process was reconstructed as extensively as available data permit in the chapter on Quaternary Environments, and will not be repeated here. It seems likely that the "moraine" and associated features result from an ice surface close to the maximum late Pleistocene ice surface in this area, so they need not necessarily date to only the latest stages of deglaciation. Certainly these features were formed significantly before the beginning of organic deposition in the Raspberry Bog peat section, about 1 km to the west, and ca. 30-60 m lower, dated at 8500 B.P. It seems reasonable to suggest that the terrace surface was dry and potentially inhabitable by at least 10,000 B.P., although there is no direct confirmation for this as yet. The channel must also have been abandoned by any significant drainage well before 8500 B.P., and available as a "highway" above the glacial rubble and bog in the valley bottom for any human or animal travellers.

Geological deposits in the site area consist of coarse rubbly till, with unsorted angular rock fragments forming the basic substrate and outcropping along much of the moraine ridge. The small terrace containing the main site area appears based on finer, better-rounded and better-sorted glacio-fluvial gravels, containing occasional large clasts up to boulder size. In sheltered low gradient areas these deposits are capped by up to 50 cm of fine aeolian silt and tephra, forming a hummocky, discontinuously moss-covered surface over much of the main site area. Aeolian deflation of exposed sediments seems to have been a constant and ongoing factor in this area, with parts of the "moraine" crest, and even the outer slightly raised edge of the small glacio-fluvial site-terrace, basically stripped of fine grained post-glacial sediments in open blow-outs. The same process has also undoubtedly contributed to a relatively deep accumulation of silts in protected areas. The post-glacial depositional sequence will be described in more detail below, under "Stratigraphy."

Research Methodology

Our attention was originally drawn to the Grizzly Run Site when, during the course of surveying, we located a finely flaked lanceolate point on the surface of the glacio-fluvial terrace, surficially apparently associated with a number of obsidian microblades. Since test-probing indicated what appeared to be buried cultural levels with charcoal and, in the first flush of discovery, the projectile point looked to be a potentially early form (Figs. 69, 72 and 73), it was decided to spend some time excavating the site in order to try to determine the chronological relationships of point and blades. As seen below, this question was to prove more complex than originally thought.

We began by laying out a 1 x 1 m excavation grid orientated true north-south, over the areas containing the surface items of interest. Eleven 1 m^2 units were excavated (Figs. 64 and 65), approximately 5-8 m back from the terrace edge. Vertical control was maintained by 5 cm contoured excavation levels, and all matrix screened through 3 mm mesh. Modified artifacts received full provenience recording, while flakes were collected by unit-levels. A total of 12 man-days were spent in excavation at this site, between August 8 and August 11. All units were back-filled upon completion.

Stratigraphy

Excavations spanned the total depth of fine grained post-glacial sediments at this site, with the lower boundary of excavation formed by the surface of the glacio-fluvial gravels. Depth of deposits varied considerably, in relation to locally hummocky and unconformable substrate and modern surfaces, and the relative effects of aeolian deflation and aggradation in different parts of the excavated area. The hummocky character of the modern surface is at least partly due to horizontal alternation between relatively thick turf and sod layers, and exposed blow-outs lacking any surface organics. In several areas of the site a combination of wind deflation from the surface, and an upsloping substrate surface, has resulted in the removal of virtually all fine fractions, leaving a surficial lag of pebbles and cobbles from the glacio-fluvial sediments, mixed with artifacts, which may have been dropped from originally superior strata, or deposited directly on the coarse lag. Such conditions particularly characterize the extreme western end of the excavated area and, to a lesser degree, the eastern end. Deposits are thickest, and reveal the most complete stratigraphic sequence in the central excavation units, such as N.21-22, E.22-23 (Fig. 66). The following description of these sediments is based on sections exposed in these relatively deep central excavation units; other pits on the periphery of the excavated area often lack some or all of these strata.

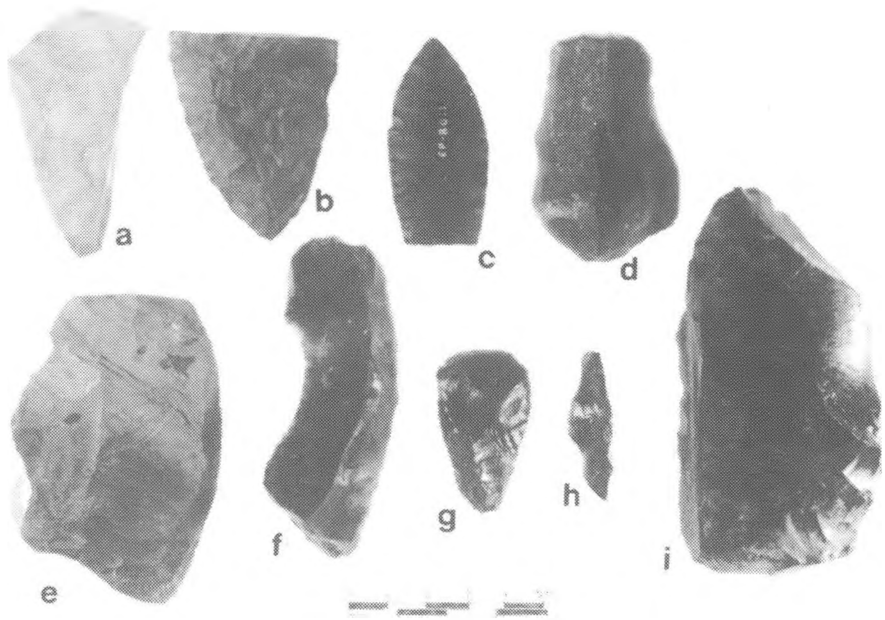


Fig. 69. Artifact assemblage from EP 80-Component 1. a. rhyolite biface fragment; b. basalt biface fragment; c. basalt projectile point; d. obsidian end-scraper; e. andesite side-scraper; f. obsidian retouched flake; g. obsidian end-scraper; h. obsidian biface edge fragment; i. "battered piece".

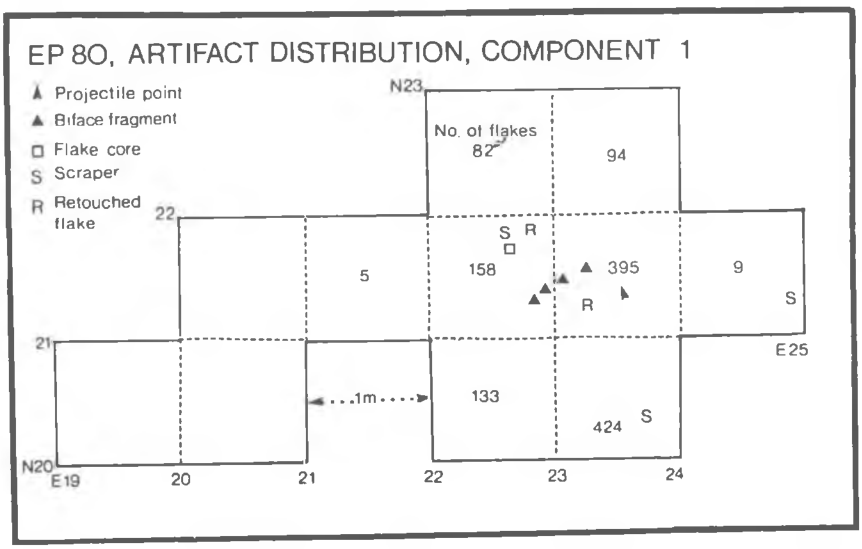


Fig. 70. EP 80, Artifact Distribution, Component 1.

Although there are some minor variations, all relatively deep exposures showed a generally similar sequence of natural strata, characterized by distinctive colour and texture. Directly underneath the surface sod and zone of root matted silt which, as noted above, was of variable thickness and which probably incorporates Ash 4 of the Raspberry Bog tephra sequence, there was a texturally distinctive, coarsely granular, dark reddish-brown layer of soft vesicular lava particles. This undoubtedly is the Ash 3 "cinder" layer noted in the Raspberry Bog section, which was deposited shortly after ca. 4630 B.P., and which has identical colour, texture and macroscopic lithology at EP 80. This layer could be traced as a well-defined marker horizon through virtually all of the excavation units at the Grizzly Run Site, except for deflated portions at the extreme eastern and western ends. The thickness of the Ash 3 deposit (Unit 2 in Fig. 66) varied considerably across the excavation area, probably due to the variable effects of different redepositional mechanisms. However, except at the eastern and western peripheries where this bed and others thinned out and vanished, the culturally sterile Ash 3 layer was generally unbroken and continuous, rather definitely precluding the possibility that any items could have been vertically displayed through this layer in those areas. This is important, because a definite discrete cultural horizon (Component 1) is associated with the surface of the Ash 3 deposit, and the base of the surface silt and sod, while a discrete lower cultural zone (Component 2) underlies Ash 3, in those areas where vertical separation of artifacts and strata is most clear.

Underlying the "cinder" bed is a relatively complex set of strata which, despite minor local variations, display remarkable overall consistency and continuity throughout all portions of the site deep enough to have ensured their preservation. The uppermost and thickest of these is a layer of brown silt, well-sorted and structureless, which is almost certainly of aeolian origin. In many areas this silt can be separated into upper and lower horizons on the basis of colour, which tends to darken with depth. The upper "yellow-brown" sub-unit (3) probably has less organic material, and may also contain the reworked light-coloured tephra of Ash 2, which directly underlies the cinder bed in the Raspberry Bog section. The lower "dark yellowish-brown" sub-unit (3a) may contain relatively increased organic constituents and less tephra (Fig. 66). It does certainly contain a discrete buried cultural component (Component 2), marked by flakes and artifacts scattered through the darker silt sub-unit, from the base of the lighter silt, to the top of the underlying tephra bed. The base of the 3-3a silt unit is marked in several units by a thin band of charred vegetal material, which in turn rests directly on top of a thin, but continuous, light grey rhyolitic tephra. The tephra forms a markedly undulating surface, with several pronounced basin-like depressions, following the contours of the closely underlying glacio-fluvial substrate. The band of charred material seems to consist mainly of small twigs, grass and (so far) unidentified seeds, sometimes matted and compressed, which tends to be concentrated in the basin-shaped depressions defined by the underlying tephra. This organic zone gives the impression of a burned natural sod or littermat, rather than formally organized hearths. However, flakes and artifacts were commonly directly imbedded in this layer, and I am assuming that the burning was contemporary with Component 2. In many areas the tephra directly overlay coarse glacio-fluvial sands and gravels. However, in a few of the deepest units, a thin lower silt unit was spaced between the tephra and substrate, probably representing an early interval of aeolian deposition. This unit (5, in Fig. 66) has a pronouncedly reddish-brown oxidized colour, which may either represent the B horizon of a paleosol, or the effects of the overlying fire. The underlying glacio-fluvial gravels are clean and culturally sterile, but do contain considerable numbers of well-rounded sand and granule-sized clasts of obsidian, perhaps indicating a mountain (i.e. higher elevation) origin for this sediment. This stratigraphic sequence is nearly exactly duplicated in a small test-exposure at EP 96E, immediately across Bourgeaux Valley from the Grizzly Run Site, suggesting that it may have some strength as a representative section of late Holocene sediments for the region.

Despite its location near tree-line on the north-facing flank of a valley, the deposits of the Grizzly Run Site seem to reveal no convincing evidence of or cryoturbation within the time-span represented by the post glacio-fluvial sedimentary sequence. Where depth permits their preservation, the multiple, relatively thin parallel beds generally persist continuously without evidence of major faults, involutions or stratigraphic inversions. There is likewise no evidence of ground-squirrel burrowing, now or in the past. The only obvious post-depositional disturbance has been deflation of more exposed surfaces through wind and perhaps melt-water run-off.

Within the deeper sections of EP 80, there is a clearly defined separation of upper and lower cultural components, the latter occupation overlying the very distinctive and uninterrupted "cinder" bed, which serves to seal off the earliest component, contained within the aeolian silt layer. The relatively thick "cinder" bed is itself culturally sterile, except for Component 1 materials in its upper surface. Unfortunately, however, these ideal stratigraphic relationships only occur where deep sections are preserved and, as these thin out towards the peripheries of the excavation areas, vertical separation of the two components is lost. In those areas where no fine grained sediments are preserved and artifacts rest as a lag on the glacio-fluvial sediments, we are left with solely surface associations, and all their concomitant problems and uncertainties.

Grizzly Run site -- Cultural Associations and Distributions

A total of 87 artifacts were found in the EP 80 excavations or on the surface of the excavation units (Table 2). By far the single largest category was microblades and "primary spalls," with 60 complete or fragmentary pieces, while the next largest class was biface preforms (15), followed by flake cores (5), retouched flakes (2), endscrapers (2), and one each side-scraper, "battered piece," and projectile point. The point which had originally excited our interest as a surface find was unfortunately the only example found in the site. At the time of its original discovery, the presence of a number of microblades a few meters to the west, also on the surface, was taken as an indication that lanceolate projectile points and microblade industry would probably prove to be culturally associated. However, while this question still cannot be answered with absolute certainty, our excavation data strongly indicate that surface point and nearby surface microblades belong to different cultural components, separated by perhaps as much as 1000 years of time.

The best stratigraphic separation between Component 1 and Component 2 occurs in excavation units N.21-23, E.22-23; N.21-22, E.23-24, and the north half of N.20-21, E.23-24 (Fig. 66). Virtually everywhere else diagnostic strata are either lost or too thin to be useful. Unfortunately, almost all of the microblades were found clustered at the western end of the excavation area, where most occur near or on the surface, among large rocks protruding from the substrate, in unit N.20-21, E.20-21 (Fig. 67). However, several factors still make it possible to infer that *all* of these blades are associated with the *older* cultural component: (1) A large number of the blades in the main cluster area can be refitted to partially recreate the core from which they were removed (see "Microblade Industry," in the Artifact chapter, Fig. 68). Those remaining blades that cannot be directly joined to the reconstructed core are clearly still part of the same reduction sequence, based on attributes of raw material (only one visual type of obsidian is represented); metric ranges; and general characteristics, such as curvature, and platform remnants. (2) Several blade fragments found in nearby excavation units, in stratigraphic context in the lower component, can be joined to the refitted core sequence, or with blade fragments from the main distributional cluster which are clearly part of that same core. These include one large, definitive

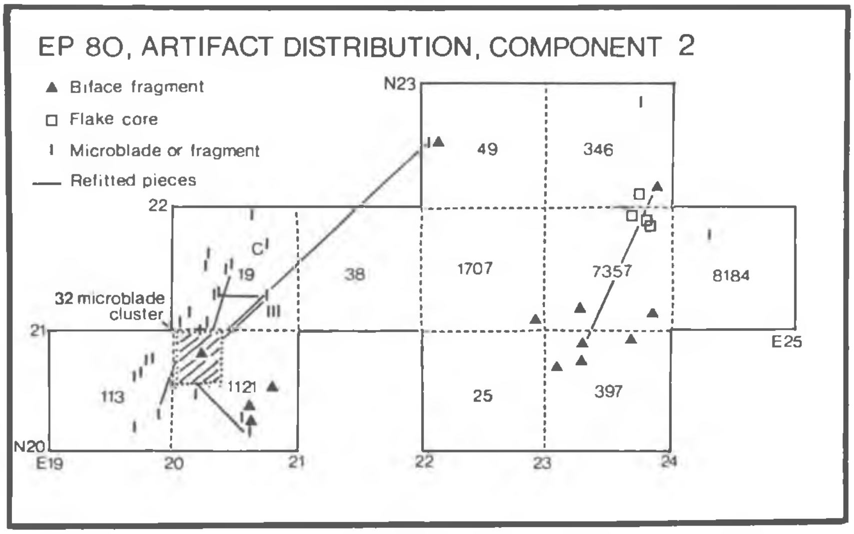


Fig. 71. EP 80, Artifact Distribution, Component 2.

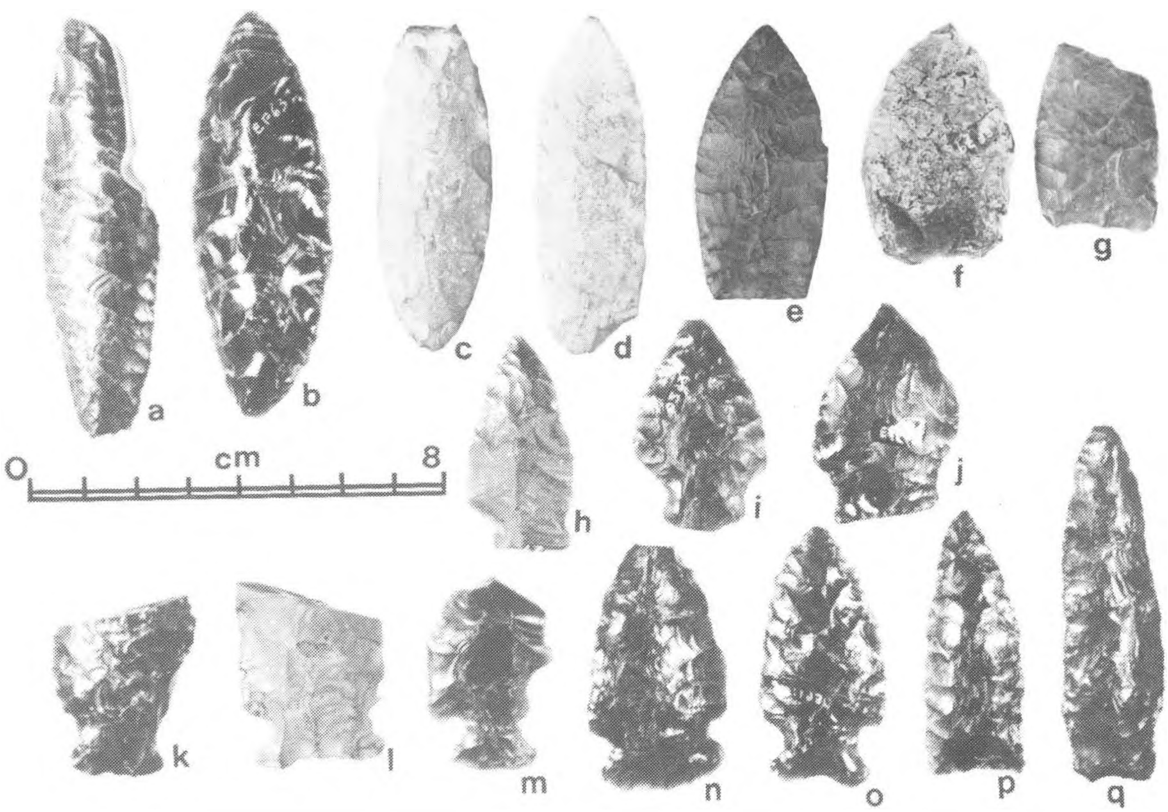


Fig. 72. Projectile points: a. EP 58, b. EP 63, c. EP 56, d. EP 83, e. EP 80-Comp. 1, f. EP 79, g. EP 101, h. EP 67, i. EP 50, j. EP 63, k. EP 69, l. EP 97E, m. EP 49, n. EP 104, o. EP 1-TC 5:206, p. EP 26, q. EP 66.

microblade segment found low in one of the deepest portions of the site (N.22-23; E.22-23), beneath the "cinder layer," directly associated with a large biface fragment and horizontally within 70 cm of the single radiocarbon date so far obtained on the lower component (4870±120 B.P., SFU 129). Thus, since all the blades found in the western portion of the excavations (i.e. all but 2 of the total) are products of a single core and a single reduction episode, and since several of these (3 can be positively refitted) *are* in situ in Component 2 in deeper portions of the site, it is safe to state that *all* of these microblades belong to Component 2, even though many were found on or near the present site surface. However, the two blades or blade-like flakes found in the eastern-most portion of the site are also in areas locally lacking the complete sedimentary sequence, and neither can be positively refitted to the core reconstruction. These are still assigned to Component 2 because: (1) Their raw material and technological features suggest them to be part of that same core reduction series; and (2) 96% of the other microblades in the site can be positively associated with Component 2, while none can be positively associated with Component 1. Thus, it appears that the lower occupation in EP 80 possesses a strong microblade industry, while the latest component lacks definite evidence of this trait.

Besides microblades, most of the other artifacts at the site were found in situations permitting some degree of stratigraphic interpretation. Thus, the lanceolate projectile point, while found on the surface, can be shown to belong within a small tight cluster of 9 Component 1 tools which were found in situ on the upper surface of the "cinder" bed, just beneath the modern sod (Figs. 69 and 70). This is a strong association, with little room for doubt. However, the final 2 artifacts assigned to Component 1 (the 2 end-scrapers) were found on the southwestern periphery of the excavation, again in areas lacking clear-cut stratigraphy. These are very tentatively assigned to Component 1, because the only other functional domestic implements belong to that occupation. This is obviously an unsatisfactory criterion, but no better are available. The internal association of the main Component 1 artifact cluster is supported by its close spacing (all 9 artifacts within 1 m, horizontally, and either on the surface or in immediately subsurface vertical contexts); the absence of artifacts in the Ash 3 bed immediately beneath them; the lack of any refits joining this cluster with any of the artifacts assigned to Component 2, despite the fact that Component 2 refit vectors cross this space at a lower stratigraphic level (Fig. 71); and the presence of a relatively high frequency of distinctive raw materials in this cluster, not represented in Component 2. These materials include fine grained light-to-dark rhyolite, and andesite/basalt. The four pieces made of this range of materials include the projectile point (a dark grey basalt), two biface fragments (dark grey basalt and light grey rhyolite) and a large side-scraper (dark and light grey banded material, possibly andesite). Non-obsidian lithic materials are rare anywhere in the Edziza area sites, and this represents the highest proportion (36%) of such materials in any assemblage. No flaking detritus from these materials were observed, indicating that they are curated items transported to the site from elsewhere.

Component 2 artifacts consist of microblades (75% of the assemblage if counted as individual non-refitted items, or one core segment -1.3%- if counted as a rejoined entity); twelve biface fragments, and four flake cores. The latter items are associated with the microblades with varying degrees of strength, although the "loss" of any of them would not change the character of this assemblage in any significant manner. It appears to consist of nearly pure lithic workshop flaking residue, reflecting biface and microblade preparation, and lacking any positive evidence of multi-function or domestic activities. The only definite modified tools from this site which might belong to the older component are the two uncertainly associated end-scrapers. However, even their addition to the Component 2 assemblage would not quantitatively affect its predominantly single-function character. Besides the microblades, only 2 other artifacts from this lower level seem of interest from a cultural comparative or historical perspective. These are elongated lateral edge and tip segments of what were originally unusually large bifaces (the largest segment is 15 cm long, and it need not represent any more than half the length of the original complete item (Fig. 80b). Since these artifacts were probably preforms, they spark some speculation as to what kind of finished tool or weapon required such large primary forms. These bifaces appear to have been generally leaf-shaped or ovate, although one end is missing in both cases.

Grizzly Run Site -- Chronology

Two radiocarbon dates have been processed for the Grizzly Run Site. The first, noted previously, is a determination of 4870±120 B.P. (SFU 129) received on charred vegetal material associated with Component 2, just above the lowest tephra layer. This is currently accepted as a reasonable estimate of the age of the oldest cultural occupation at EP 80, and is the oldest culturally associated date from the Edziza region. Another sample submitted from Component 2 proved too small for dating, so no direct confirmation is possible, however, the general age sequence of the ashfalls recognized in Raspberry Bog supports a date in this range for an occupation beneath Ash 3 and above Ash 1. The second 14C sample consisted of a large volume of wood charcoal collected from a cavity between several large rocks, which extended from the glacio-fluvial substrate to within a few centimetres of the modern surface. This was directly associated with a number of obsidian flakes but it could not, in the field, be given a positive stratigraphic relationship. It produced a date of 3910±120 B.P. (SFU 147). Although its cultural associations are uncertain, I tend to accept it as a reasonable age estimate for Component 1, and probably a direct result of that occupation, for the following reasons: (1) The dated material (large wood fragments) is significantly different from the only organic material positively associated with Component 2 -- i.e. the "mat" of fine charred grass and twigs; (2) It was not overlaid by the "cinder" layer; and (3) It was found close to the southeast boundary of the main Component 1 artifact cluster. Possibly it represents material blown into the rock cavity from a nearby hearth, or charring of some natural organic deposits caused by the Component 1 occupation. It is likely that Component 1 dates no later than about 4000 B.P., since it occurs directly in the surface of the Ash 3 "cinder" layer which was deposited shortly after 4600 B.P., according to the Raspberry Bog section.

Grizzly Run Site -- Summary and Cultural Reconstruction

Accepting that these relatively small samples of material are representative of coherent cultural activity sets conducted at this site prehistorically, and that there has been no significant natural post-depositional disturbance, the Grizzly Run assemblages may provide some significant glimpses of aboriginal cultural use of the Edziza region. The earliest (Component 2) occupation was apparently devoted nearly entirely to lithic manufacturing, including microblade and biface preparation, as well as some primary flake core reduction. Large quantities of unmodified detritus (19,318 pieces), biface preform fragments, and flake core fragments suggest a picture not much different from that of EP 1 "House 1," except in scale. However, major differences between the ca. 5000 year old Grizzly Run flaking station, and the ca. 3000 year old occupation of "House 1" include the presence of a strong microblade industry, and very large biface preforms in the former site. Like "House 1" the Component 2 flaking episode need not represent more than a few hours of activity, at most, on the part of one obsidian-knapper. The absence of any positive evidence for multi-sex, multi-function, camp-type activities, suggests that Component 2 represents nothing more than a short maintenance and repair stop on the part of a mobile hunting and/or lithic resource party.

Component 1, on the other hand, appears to be nearly the opposite. Probably dating to about 4000 B.P., it consists of a small closely associated, yet remarkably diversified collection of retouched tools and weapons and, only secondarily, some evidence of standard lithic reduction residues. This assemblage includes a single complete broad-based lanceolate basalt projectile point, characterized by high quality flaking. Other functional implements include two biface fragments of non-obsidian raw materials. Both of these exhibit extensive macroscopically visible smoothing (presumably wear polish) over both faces. Both their raw material and evidence of use-wear indicates that these were not preforms, but were instead functional tools, perhaps knives. Retouched flakes, one of which was also made of non-obsidian material, and at least one scraper, also point to a range of domestic and processing activities quite possibly conducted by women. The small areal extent of the Component 1 lithic scatter, absence of clearly defined hearths or features, and the small numbers of items in each functional class, all suggest that this occupation need not represent anything more than a brief camp (perhaps a few days duration at most) by a small group of people (perhaps a single family). Additionally, the tightly clustered nature of this small assemblage, consisting of generally unbroken and functionally diversified tools, might even indicate a cache of implements deliberately left behind at this location for a planned return which never materialized. Caching behaviour would make perfect sense for people engaged in seasonal transhumance between mountains and lowlands.

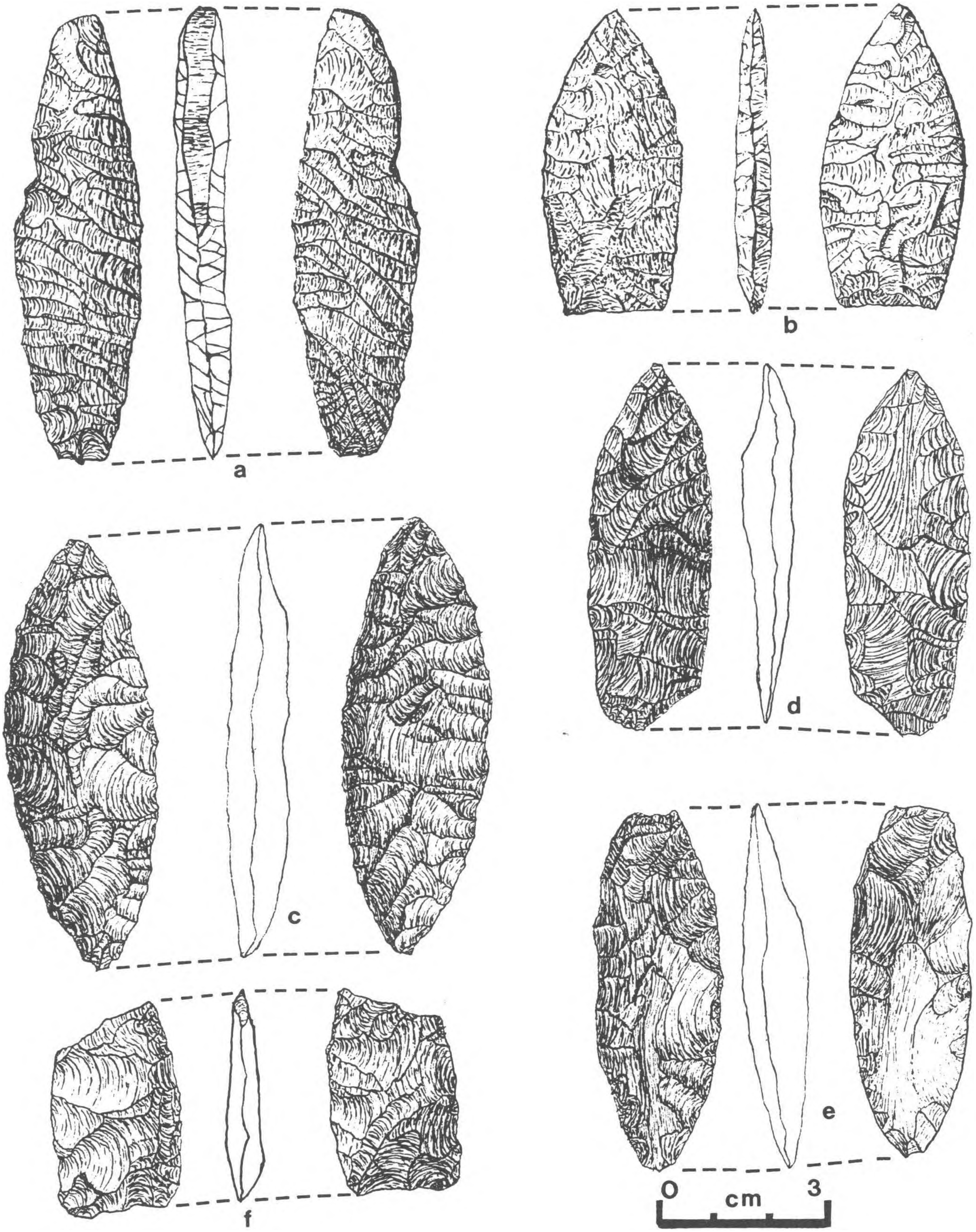


Fig. 73. Leaf-shaped and lanceolate projectile points. Type 1, leaf-shape: a. EP 58, c. EP 63, d. EP 83, e. EP 56; Type 3, lanceolate: b. EP 80-Component 1, f. EP 101.

MOUNT EDZIZA AREA, ARTIFACT DESCRIPTIONS

The following sections will describe artifacts collected from both surface and excavated sites in 1981. This description is organized according to a traditional functionally orientated morphotaxonomy of 24 separate classes and types. Class descriptions will emphasize average or general trends, although exceptions will be indicated when they are considered significant. Brief comparative statements and functional interpretations will be included for each class. Functional identification is based entirely on form -- admittedly a hazardous procedure -- but necessitated here by the inapplicability of microscopic use-wear studies on materials that are almost universally edge damaged and striated by natural processes, such as cryoturbation, wind action, and trampling. Where possible some observations about patterns of co-occurrence and association will also be offered.

Projectile Points

The projectile point assemblage recovered from the Edziza area is small (17 relatively complete; 3 fragments), and characterized by a diversity of form, size and flaking characteristics. Unfortunately, all were found on the surface, and generally only single projectile points were found in any site assemblage (only one site, EP 63 yielded two relatively complete specimens). This does not facilitate chronological discussions; however, since this is the only assemblage of points from a rather large region lacking any previously reported finds, it is probably useful to describe it in some detail.

For descriptive and analytical purposes the collection of relatively complete points was sorted into five provisional "types" based on general outline form: (1) leaf-shaped; (2) incipient stem; (3) lanceolate; (4) notched; and (5) expanding stem. A sixth category consists only of unclassifiable fragments. Like all subjective taxonomies there is some degree of arbitrary judgement involved in decisions to "lump" or "split," and there is considerable internal variability within each provisional type. Considering this problem and the small collection involved, many of the points will be described individually, as well as in terms of general class attributes. Basic metric data are summarized in Table 4, and the points are illustrated in Figs. 72, 73 and 74.

Type 1: Leaf-Shaped Points: (n=4)

This provisional type is characterized by generally excurvate

TABLE 4: Projectile Point Measurements

Site/ Artifact Number	Provisional Type	Material	Max. Length	Max. Width	Max. Thickness	Stem Length	Base of edge or Neck Width
58:1	1	Obsidian	80.0*	23.3	9.5	N/A	N/A
83:1	1	Basalt?	64.6	21.5	11.0	N/A	N/A
56:1	1	Rhyolite?	62.4*	22.3	8.0	N/A	N/A
63:1	1	Obsidian	77.6	27.9	12.2	N/A	N/A
26:1	2	Obsidian	50.8	19.3	9.0	14.7	18.7
66:1	2	Obsidian	69.3	20.0	7.3	12.6	16.3
79:1	3	Obsidian	47.3	29.1	8.9	N/A	23.5
80:1	3	Basalt	53.1	26.1	6.8	N/A	18.9
101:1	3	Chert	36.4*	23.7	6.8	N/A	20.9
1:206	4	Obsidian	50.0	24.9	7.6	11.9	14.4
49:1	4	Obsidian	37.6*	24.9*	6.3	9.8	11.2
69:1	4	Obsidian	34.1*	27.7	7.1	11.5	14.4
97E:1	4	Obsidian	36.3*	28.3	8.0	11.5	19.2
104:1	4	Obsidian	47.1*	28.2	9.2	12.7	20.0
50:1	5	Obsidian	41.7	26.5	7.4	10.9	14.9
63:2	5	Obsidian	41.4	29.1	7.7	11.5	19.8
67:1	5	Obsidian	42.7	21.8	7.6	9.2	13.9

*axis of measurement incomplete. All measurements in mm.

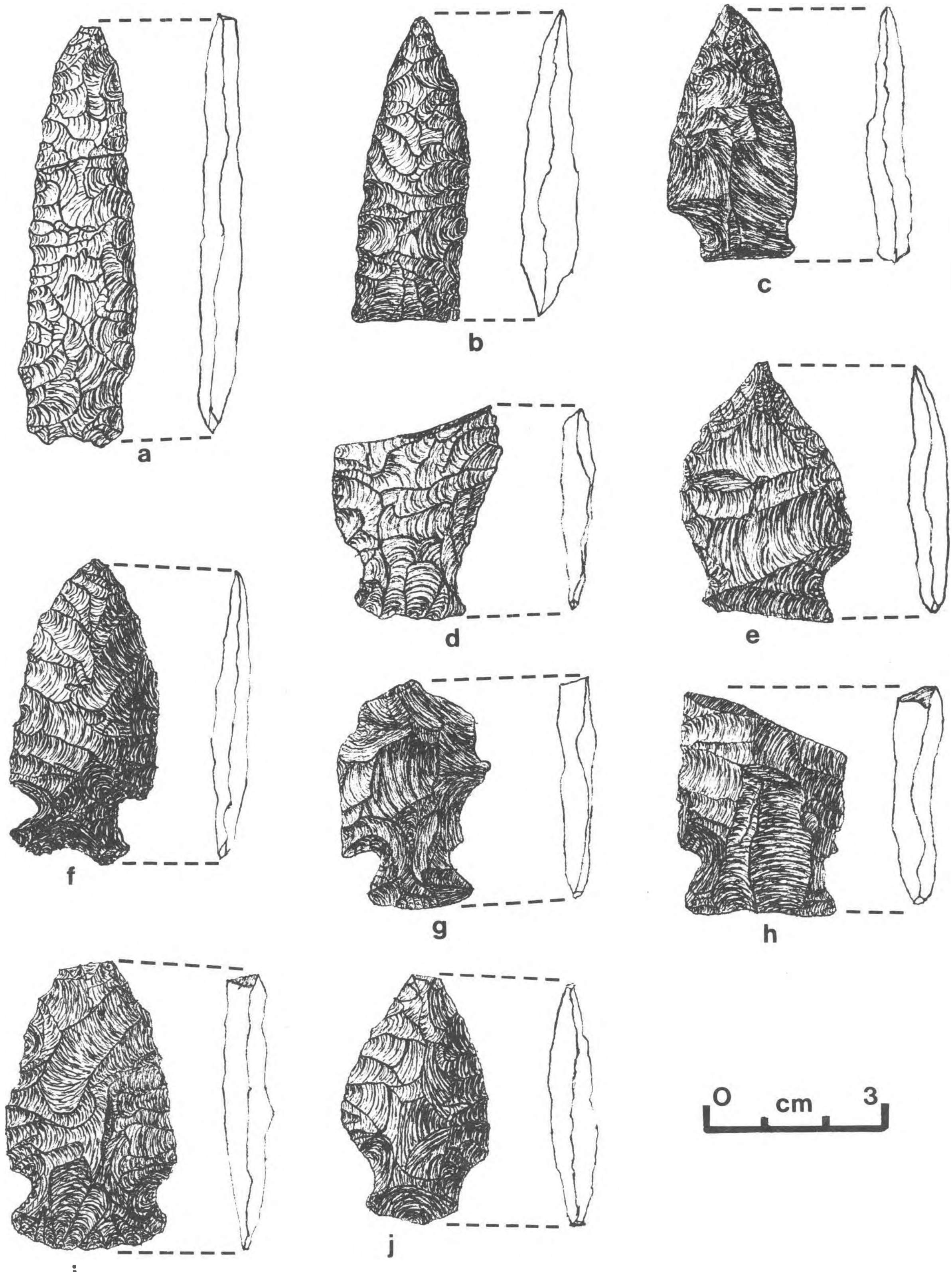


Fig. 74. Stemmed and notched projectile points. Type 2, incipient stem: a. EP 66, b. EP 26; Type 5, expanding stem: c. EP 67, e. EP 63. j. EP 50; Type 4, notched: d. EP 69, f. EP 1-TC 5:206, g. EP 49, h. EP 97E, i. EP 104.

lateral edges terminating in bipointed or round-based forms, and long, relatively narrow proportions. The four specimens suggest at least three relatively distinct sub-types.

(a) Points 83:1 and 56:1 are both made of non-obsidian materials, and both possess a generalized leaf-shaped form with length to width proportions of about 3:1, and width to thickness ratios of 2-3:1. The proximal or basal edge of 83:1 is partially missing but appears to have been gently rounded, while that of 56:1 is bluntly pointed. The latter specimen has lateral edge-grinding 2/3 of its length from the base, and its extreme tip is broken by flexure, although a single short (9 mm long) burin spall is removed proximally from that break along one edge. Point 83:1 is intensely weathered, which has altered the surface of the original very dark grey basalt (?) to a soft light grey colour, obscuring details of workmanship. For this reason it is not certain whether edge grinding was originally present, however a single burin spall has been removed distally from about 15 to 34 mm above the base along one edge. The central portion of this point is over-thickened, probably unintentionally, and the burin spall may have been an attempt at preparing a platform to remove this bulge. Flaking quality of both points is "average" with variably sized shallow expanding flake scars, centrally directed from all edges.

(b) EP 63:1 is a thick bipointed biface of obsidian, quite different in form and proportion from the 1(a) sub-types. Plan form and longitudinal profiles are symmetrically bi-convex, and it is not feasible to clearly distinguish functional tip and basal ends. Indeed, it is possible that this specimen is not a functional implement, but simply an advanced preform. However its flaking is more extensive and refined than that of most of the large class of objects defined as biface preforms, including secondary pressure retouch on both faces. The "point" is unbroken and lacks any evidence of deliberate edge-grinding.

(c) The single projectile from EP 58 is the most distinctive point observed in the Edziza area. It is principally distinguished by fine, highly controlled, oblique collateral "ripple" flaking, meeting evenly along a medial line of the entire length of both faces. Both extremities are broken, however, the base is only slighly damaged and suggests an originally narrow, nearly straight basal edge. The distal end has been eradicated by removal of at least two large burin spalls, forming a curving scar extending across the point from side to side, and along more than half of its estimated reconstructed original total length (ca. 101.5 mm). A secondary small burin spall was then removed from the juncture of the main spall and the longest remaining lateral edge. This secondary spall, and extensive crushing and micro-flaking in its vicinity, are interpreted as definite use-wear, and there seems little reason to doubt that this point was deliberately altered into a burin and used in a chiselling or gouging function. The longest surviving lateral edge of the point is relatively strongly ground, increasing towards the burin tip; the opposite lateral edge is only lightly ground, if at all. The asymmetrical distribution of edge-grinding may suggest that it is, in fact, some kind of use-wear, perhaps associated with its secondary function as a burin.

Type 2: Incipient Stem Points: (n=2)

These two specimens are characterized by concave-based lanceolate outlines, broken by slight indentations of the lateral edges a short distance above the base, which form weakly defined stems (Figs. 72 and 74). Both points have slightly uneven asymmetric lateral edges and flaking is relatively random, with shallow flake scars of irregular dimensions. There is no evidence of edge-grinding. EP 66:1 was found as two fragments a short distance apart, and EP 26:1 is complete. Ths short, relatively thick proportions of the latter specimen may suggest that it was originally broken and reworked.

Type 3: Lanceolate Points: (n=3)

These points have relatively short-wide proportions, uninterrupted excurvate lateral edges and straight to concave bases (Figs. 72 and 73). The three specimens exhibit a considerable range of flaking quality, from the well-controlled sub-parallel workmanship of EP 80:1 to the relatively rudimentary and irregular flaking of EP 79:1. The latter point, which is the only one of this type of obsidian, may be unfinished. EP 80:1 has a straight base and symmetrical lateral edges expanding to a maximum width at about the mid-point. Thinning flakes extend in from the base a short distance, although one basal thinning flake, located asymmetrically, carries about a third of the length on one face. There is no edge-grinding or burination of any of these points. EP 101:1 is the smallest of the three and, manufactured of a pale speckled grey-green chert (?), is one of the very few flaked stone items from the Mt. Edziza area of probably non-volcanic material. Its base is slightly concave and, although its tip is missing, it possesses a slightly asymmetric outline form. Flaking of this specimen is relatively random and irregular.

Type 4: Notched Points (n=5)

These are relatively large, broad side-notched (2) and corner-notched(3) forms, all of obsidian. They exhibit a much higher proportion of major breakage than do the previous classes, with four of the specimens lacking various portions of their distal (tip) ends (Figs. 72 & 74). One of these (EP 69:1) is too fragmentary to allow positive reconstruction of its original form, but was probably corner notched, with acute blade-stem juncture angles, since broken off. The two better preserved corner-notched forms (EP 1:206 & EP 49:1) have slightly trailing or "barbed" blade-stem junctures, relatively narrow stem neck-widths and indented and excurvate basal edges respectively. The later point is the only example in this series to possess notable edge-grinding, which in this case carries around the basal edge and along the entire remining lateral edge of the point blade (ca. 18.5 mm), distally from the notch. The large side-notched forms (EP 104:1 & 97E:1) display respectively, convex and concave basal edges, although both have relatively wide inter-notch necks. The latter specimen has two prominent basal thinning flakes on one face over 22 mm in length. Flaking of all the notched points is again of "average" quality, with relatively irregular and unpatterned pressure retouch forming fairly thick lenticular lateral cross-sections, and somewhat asymmetrical longitudinal sections.

Type 5: Expanding Stem Points: (n=3)

This provisional type may simply represent variation of the large side-notched forms described above, but is treated separately here on a trial basis. Some of the metric attributes of these points, such as thickness (Table 4) seem sufficiently distinct and consistent to warrant this perspective. All three specimens are somewhat asymmetric in outline form, particularly 63:2 and 67:1, with short expanding stems possessing straight basal edges orientated slightly diagonally to the long-axis of the point (Figs. 72 and 74). Points 63:2 and 67:1 have basal edges formed by single thick right-angled flake scar remnants which exhibit only ineffectual attempts at thinning and both these specimens also display only rudimentary flaking of one or both faces, with 2-4 large flake scars modified by minimal edge retouch. EP 50:1 is more finely worked than the others, but also possesses a small remnant of an unthinned right-angled scar along the basal edge. No edge-grinding can be observed on these points, although one face of 63:2 shows smoothing of the flake scar ridges.

Unclassifiable Fragments (n=3)

These are fragments of thin well-flaked bifaces which are probably mid-sections of projectile points. Two come from EP 50 and one from EP 97W. None are sufficiently complete to allow any confident reconstruction, although the fragment from 97W was apparently a distal mid-section of a relatively thin-narrow point, with suggestions of oblique collateral flaking on one face. On Table 2 these fragments are shown as "Type 6."

Projectile Points: Comparisons and Discussion

Although it is not my intention to attempt to outline all other sites and areas in which points similar to these Edziza specimens occur, some general comparative comments are in order.

As aptly summarized by Workman (1978) the cultural-historical associations of leaf-shaped projectile points are still far from clear. Relatively specific and detailed morpho-technological traits may eventually prove much more useful as discrete dating indicators than generalized form descriptions in regard to this class of artifact. Although leaf-shaped bifaces are often cited as a diagnostic trait of southern Northwest Coast and Interior Plateau "Old-Cordilleran" (etc.) complexes, points of similar generalized leaf-shaped outline continue commonly as late as 2000 B.P. on the southern Northwest Coast and, more rarely on the northern coast, at Prince Rupert (e.g. Carlson 1970; MacDonald and Inglis 1981). In the central Interior of British Columbia, occasional large leaf-shaped points date more recently than 4000 B.P., at Punchaw Lake (Fladmark 1976) and Tezli (Donahue 1975), while such points also occur in the Lower Zone III assemblage at Gitaus, near Terrace on the Skeena River (Allaire 1979), dated about 3500-4000 B.P. In the Yukon, Alaska, and Northwest Territories "leaf-shaped" points, as a generalized form also occur in a variety of widely dated contexts (e.g. Workman 1978; Millar 1968; Clark 1981). Thus, as attempted by Workman (1978), it seems clear that this general class of point must be sub-divided and compared and contrasted on the basis of more specific formal attributes than simply its outline form.

Of the four "Type 1" points from the Edziza area, none appear to match Workman's (1978) description of broad-thin round-based points from the early Little Arm component at the Canyon Site. However, the two "Type 1a" points may equate with his "P2" "Crude Ground Convex-Based" point type, reported from the pre-Whiteriver ash, presumably Little Arm levels of the Gladstone Site. Here they were associated with microblades and heavy unifaces (Workman 1978). One of the Edziza points (EP 56:1) was found on the surface of a nivation flow, which some 10 m away yielded one other artifact -- a microblade. However the EP 83:1 point was found with an extensive surface assemblage entirely lacking evidence of microblade manufacture.

The diagonally flaked point from EP 58 has few precedents in the published literature from adjacent areas. To my knowledge no similar point has ever been reported from British Columbia, and I have encountered no published references to such a point style from the Yukon. In the Plains generally similar flaking patterns sometimes characterize late Paleoindian complexes, but, again, the outline form and thickness of those points would differ considerably from the EP 58 specimen. The closest published parallel that I have found are fragmentary burinated points from the "middle layers" of the Trail Creek Cave sequence in northwestern Alaska (Larsen 1968), and to a lesser degree points of the Choris Complex, of the Bering Sea coast of Alaska (e.g. Giddings 1967; Dumond 1977). Other parallels may exist in the undated Bedwell Complex of the Alaskan north-slope (Alexander 1974) and points from Lake Minchumina in Central Alaska (Holmes 1977). The Trail Creek Cave deposits were somewhat mixed and dating of the large diagonally flaked and burinated points from this context is possibly uncertain. They were considered to be related to the Choris Complex by Larsen (1968) which would date them approximately 3000 B.P. Illustrated Choris points, however, seem generally wider and thinner than the EP 58 specimen, and tend to have incipient stems; as well, Choris lacks a microblade industry. At the Trail Creek Caves, a well defined microblade complex, including slotted antler points to mount microblade arming elements, was considered to predate the levels containing the bifacial points (Larsen 1968). However, if these elements were in fact originally associated in this apparently somewhat "mixed" context, the result would be a very close fit with the EP 58 lithic assemblage. Large oblique collaterally flaked and partially edge-ground points from the Lake Minchumina area of east-central Alaska, are dated between ca. 3000 and 1000 B.P. These are associated with an apparently late-persisting microblade industry (Holmes 1974, 1977). However the Lake Minchumina points are also apparently broader and thinner than the EP 58 specimen. The EP 58 assemblage should be older than ca. 3-4000 B.P. if most evidence concerning the dating of the microblade industry in this area is correct.

The "Type 2" incipient stemmed points from the Edziza area are also representative of a widely distributed but poorly dated general form. Approximately similar kinds of points occur rarely in northern and southern Interior Plateau sites of British Columbia dated within the last 4000 years (e.g. Punchaw Lake), but this style never seems to be particularly numerous. In terms of general technological traits, the two incipient stemmed points from the Edziza area are basically the same as the "lanceolate" variety, with slight lateral indentations. Whether this may suggest that the two forms are related cannot be verified at the moment. Both Edziza points were not surface associated with microblades, although the EP 66 point was the only artifact from that site.

The lanceolate "Type 3" points are similar in outline form to some Paleoindian straight-to-concave-based lanceolates of the central and eastern continental area, and have occasionally been initially related to such early complexes by researchers encountering them in areas of the Northwest lacking previous well-controlled cultural chronologies. I admit that this was my first reaction to the EP 80:1 point which, not only in outline form, but quality of flaking, resembled a Milnesand or Browns Valley style. However, as indicated in the previous discussion of the Grizzly Run Site, this point probably dates about 4000 B.P., and *must* be younger than 4600 B.P., associated with an apparently non-microblade occupation. The similar lanceolate point from EP 101 was found on the surface over 20 m distant from the main microblade bearing assemblage at this site, which, considering the EP 80 experience, is certainly no demonstration of cultural association. The EP 79 lanceolate was associated with an otherwise relatively diverse, but non-microblade surface assemblage. Thus, although the data from the Edziza area are not completely positive, they suggest that points of this lanceolate style are usually not associated with microblades.

Similar kinds of lanceolate projectiles have been observed up in surrounding areas for a number of years, always with non-microblade complexes and dates falling within the last ca. 5000 years. These include Workman's (1978) P3 and P4 types (concave based and square based lanceolate points, the former termed "Whitehorse Points"), which help to characterize his Taye Lake Phase, 4500/5000-1300 B.P. Similar points occur in Gitaus on the Skeena River Lower Zone III and Zone II (Allaire 1979) dated ca. 3500-2500 B.P. Other examples occur at Hagwilget, at the Skeena-Bulkley confluence, dated ca. 4000 B.P. (Ames 1979) and a few similar lanceolates (apparently traded in) occur in Prince Rupert Period III, ca. 5000-3500 B.P. (MacDonald pers. comm.). The only complete flaked stone projectile point from the Queen Charlotte Islands, found in a context which must post-date 4500 B.P., is also of this type (Fladmark 1970). Generalized lanceolates of this form also occur in the upper Peace River area of both British Columbia and Alberta (e.g. Bryan and Conaty 1975) where, however, they overlap in distribution with genuinely Paleoindian forms (e.g. Fladmark 1981). Finally a few similar specimens turn up in middle to late Taltheilie or similar complexes of the Northwest Territories, dated within the last 2000 years (Gordon 1977).

Thus, evidence seems to be accumulating for what appears to be a relatively abrupt occurrence of lanceolate projectiles through northern British Columbia and adjacent areas beginning about 4000 years ago in the west, and perhaps later in the east. In some areas the appearance of the lanceolate point complex may be relatively closely synchronized with the demise of previous microblade industries, although a positive answer to this intriguing question requires many more dated sequences transecting the microblade to non-microblade transition.

The "Type 5" notched projectile points from the Edziza area include a general range of forms very widely distributed throughout northwestern North America, and elsewhere. In British Columbia middle to large sized corner-notched and side-notched points are thought to characterize much of the "Late" and "Middle" prehistoric periods of the southern Fraser Plateau and north-central regions, some forms apparently dating as early as 7000 B.P. (Sanger 1970). Most assemblages dated prior to 1300 B.P. have one or more varieties of such points, but the confused stratigraphy of the pit-house sites which have been the most common subjects of excavation so far in the interior of the province, seriously hinders definitive statements about specific artifact-trait chronologies. At Punchaw Lake, and at Tezli, various forms of large notched and stemmed points occur in mainly non-microblade contexts post-dating 4000 B.P., (Fladmark 1976; Donahue 1975) while Oxbow-like points and other large notched forms occur in the upper Peace River Valley in the same time range, also apparently non-associated with microblades (Valentine, Fladmark and Spurling 1981). At Gitaus, one incomplete notched obsidian point was found at the interface of Zones II and III, possibly later than 2500 B.P., (Allaire 1979) in a non-microblade assemblage, while generally similar points occur throughout the non-microblade Taye Lake Phase of the Southwest Yukon (Workman 1978). However, in other areas both to the north and south, large notched points may occur with both microblade and non-microblade industries (e.g. Sanger 1970; Shinkwin 1979).

In the Edziza area, there are no strong or convincing associations between notched points and microblades. At EP 1, one small blade-like flake was sorted from level bag material excavated from the Test Cut 5 extension, which also yielded a single large side-notched point, in undated context. Unfortunately, it is not certain if point and blade came from the same stratum and even if this were demonstrated, a single blade-like flake is uncertain proof of a whole microblade industry in a site where intensive biface thinning activity was going on. One fragmentary corner-notched point was found at EP 97, but this large surface locality was split into eastern (E) and western (W) collecting areas to reflect what appeared to be a significant distributional break in surface materials, and the point was found in the eastern portion, while all the blades were in the western. All other surface occurrences of notched points were with non-microblade assemblages. Finally, I tentatively suggested in a previous section that some of the biface preforms being produced at EP 1 "House 1" -- a 3000 year old non- microblade component -- were possibly intended for production of large broad-bladed notched points.

At the moment, the Edziza evidence does not preclude the eventual confirmation of a notched point-microblade association in this area, but it seems to make it less likely than the eventual demonstration that notched points are primarily characteristic of non-blade, and probably post-blade complexes, as is apparently the case in the southwest Yukon.

The Microblade Industry

Evidence of a prehistoric microblade industry is relatively abundant in the Edziza region, with 21 assemblages or about 19% of the total, yielding 11 microblade cores or fragments, (counting one found in 1977), 158 microblades, and at least 13 "primary spalls" (including "lames a crêtes" and ski-spalls) (Figs. 75-79). Previous work in the Stikine River area, enabled Smith (1971) to define the "Ice Mountain Microblade Industry," distinguished by distinctive bifacial core preforms and a sequence of reduction reminiscent of certain Asian microblade complexes (e.g. Smith 1974 a and b). One of our goals in 1981 was to locate similar materials, in observable and dateable contexts, and to try to determine their chronology and cultural relationships. In addition we hoped to shed some light on the nature of the microblade to non-microblade cultural transition which occurred throughout the entire Northwest over the last ca. 5000 years. Our research was successful to some degree in all these areas. Questions of cultural chronology and relationships are discussed in the section on "Culture History." Crucial to these questions is a more precise definition and description of the "Ice Mountain Microblade Industry" as originally formulated by Smith (1971).

Smith (1971) describes the most unique core-types of the IMMI as being similar to the Japanese paleolithic "Shiritaki" microblade complex, and in later publications (e.g. Smith 1974 a and b), presumed technological relationships to Asian industries were emphasized. As I interpret Smith (1971) the principle characteristics of the most distinctive IMMI are:

(1) A leaf-shaped bifacial preform, split or broken by a lateral blow;

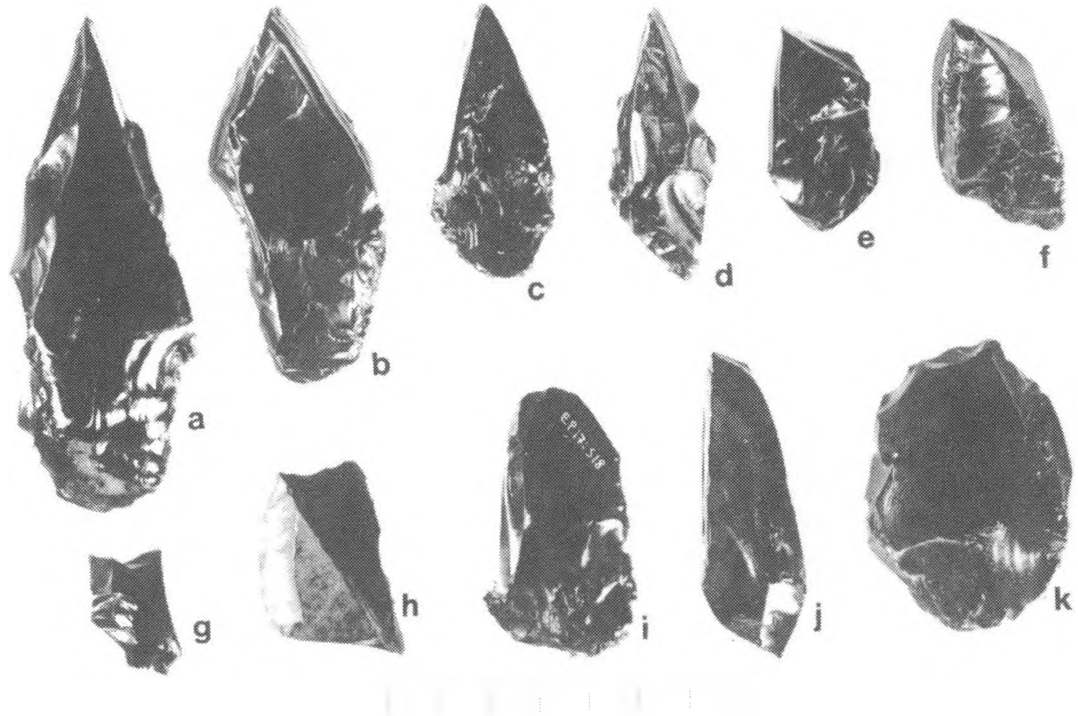


Fig. 75. Microblade cores, lateral view.

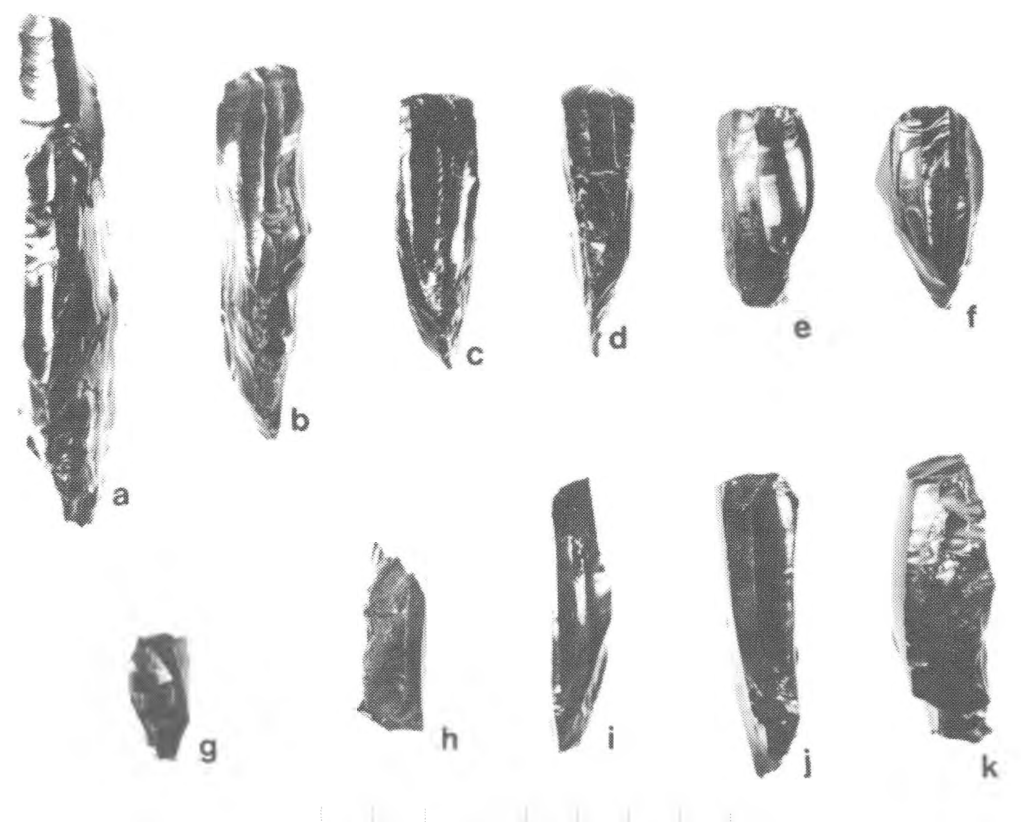


Fig. 76. Microblade cores, view of one fluted surface; a. EP 16:2, b. EP 24:1, c. EP 43:1, d. EP 1-A2:192, e. EP 82:1, f. EP 16:1, g. EP 58:2, h. EP 16:3, i. EP 17:18, j. EP 1-A2:198, k. EP 58:1.

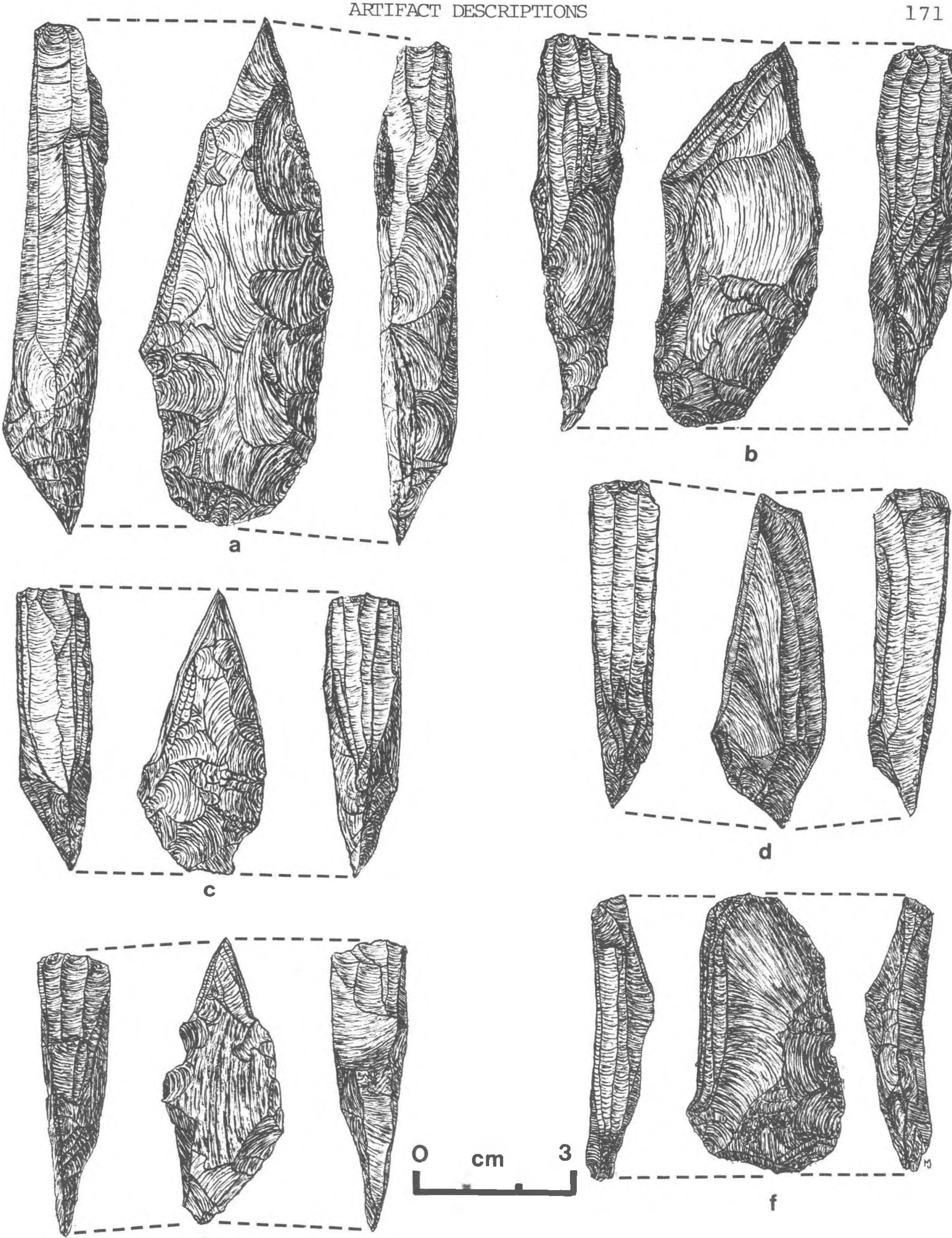


Fig. 77. Ice Mountain-type microblade cores. a. EP 16:2, b. EP 24:1, c. EP 43:1, d. EP 1-A2: 198, e. EP 1-A2: 192, EP 17:18. Fluted surfaces and lateral views

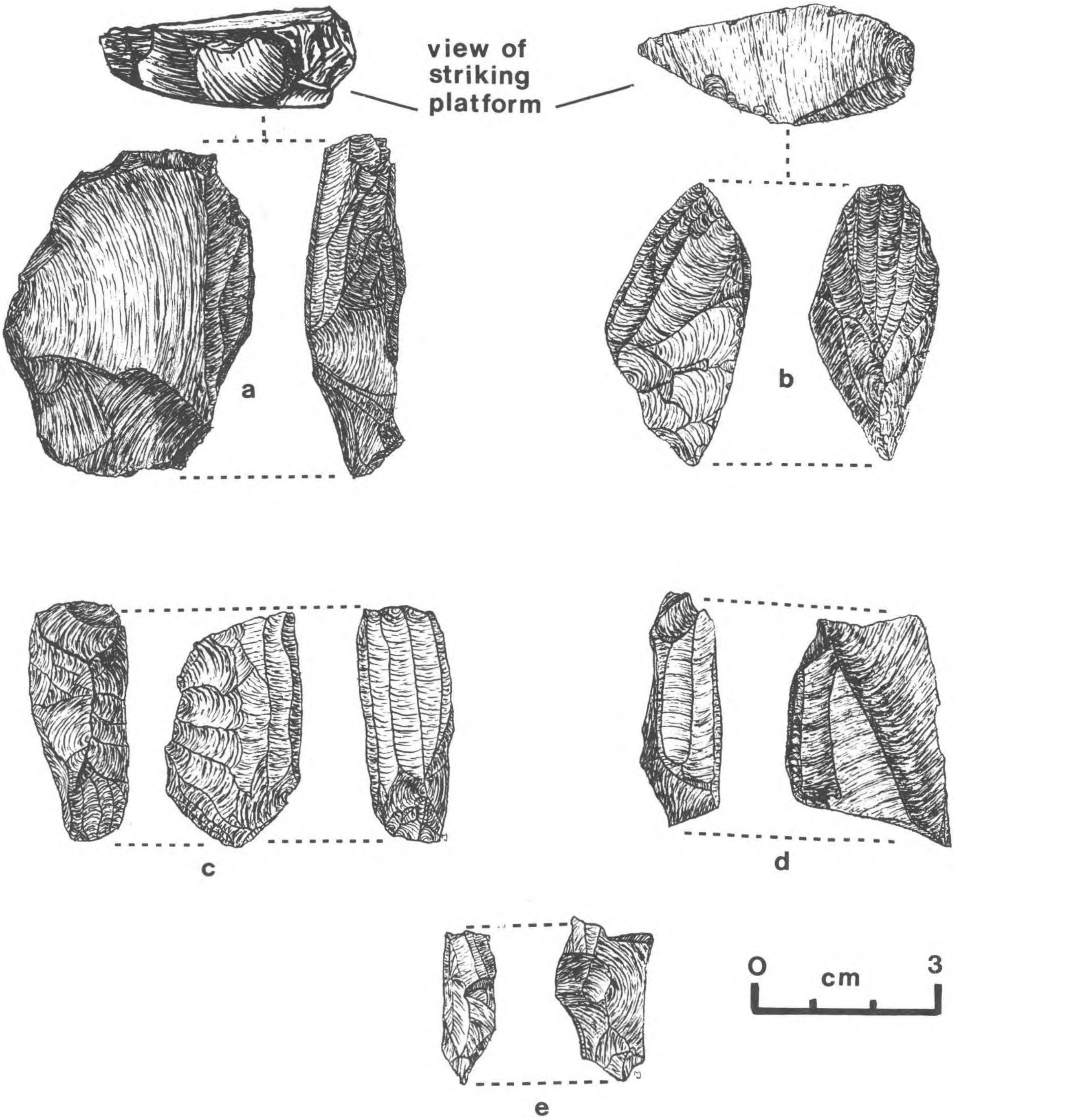


Fig. 78. Non-IMMI microblade cores: a. EP 58:1 striking platform, lateral, and remnant fluted surface views; b. EP 16:1 striking platform, lateral and fluted surface-keel views; c. EP 82:1 fluted surface A, lateral, and fluted surface B views; d. EP 16:3 fluted surface and lateral views; e. EP 58:2 fluted surface and lateral views.

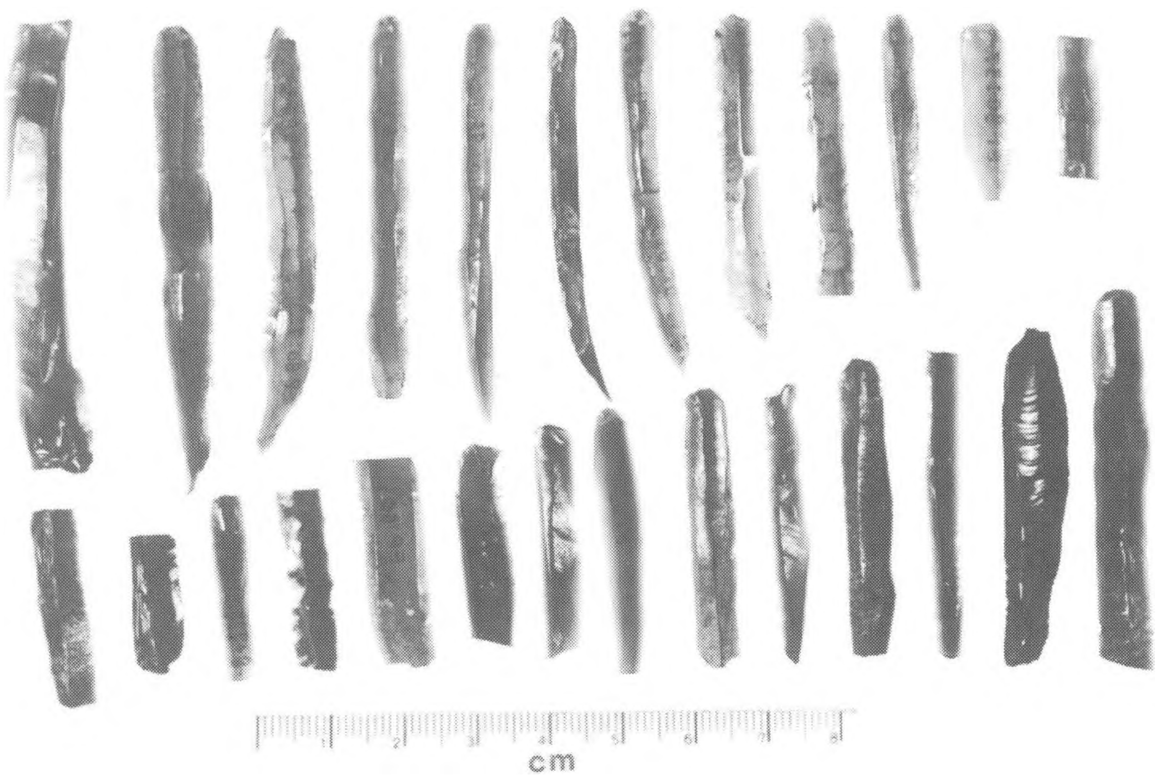


Fig. 79. Microblades: Top row EP 80 Component 2; bottom row, left to right: EP 1 - A2, EP 1-A2, EP 1-A2, EP 1-TC 5, EP 101, EP 56, EP 58, EP 28, EP 97W, EP 28, EP 1-A2, EP 58,EP 16, EP 96E

(2) Removal of a primary spall ("ski-spall" or "false ski-spall") down one lateral edge of the biface fragment from the fracture surface;
(3) Removal of additional "burin-spalls" to widen and flatten the surface formed by the ski-spall scar; and,
(4) Removal of microblades down the original fracture surface, using the burinated edge as striking platform.

The resulting core form (hereafter referred to as the IMMI type) had a very acute angle between striking platform and fluted surface, and approached a multiple dihedral burin (on a biface) in general appearance. It should be noted that Smith's (1971) description of this complex is very unclear, a problem not alleviated in later works. For instance, although the core-type described above is apparently the most distinctive aspect of the microblade industry reported by Smith (1970, 1971, 1974a and b) he, in fact, considered the Stikine assemblages to represent a wide range of microblade technological variation, at one point describing it as "one of the most representative collections of microblades and core types in North America" (Smith 1974b:349). However, of the eight "cores" described by Smith (1971) only five are clearly real cores or core remnants on the basis of the published descriptions and illustrations (only two or three of which are distinctive IMMI types). Analysis of the new and larger assemblage recovered from the Edziza area suggests that Smith misintrepreted some aspects of the technological sequence. This may be due to the fact that the Stikine Valley cores were possibly more extensively reduced or expired than cores found closer to the obsidian raw material source.

The microblade cores from the Edziza area can be divided into several general types on the basis of preform variations (i.e. flake vs. biface), and the number and relationships of striking platform-fluted surface pairs. At least six of the cores seem generally to comply with the IMMI type described above (Figs. 75 and 77); one may belong to the IMMI but has an extra fluted surface-striking platform pair; one seems to be an approximation, though not an exact copy, of generalized wedge-shaped cores common further to the northwest, while three highly expired fragments may represent another distinct variant (Figs. 75, 76 and 78).

Some selected metric and non-metric attributes of all eleven cores are summarized in Table 5. IMMI cores from the Edziza assemblage show the following general characteristics: (1) Production based on a well-flaked symmetrical biface fragment (n=1); *or* crudely flaked biface preform segments, with pronouncedly plano-convex cross-sections (n=3); *or* slightly bifacially retouched flakes (n=2); (2) Use of an existing acute fracture angle, or bifacial preparation of

TABLE 5

MICROBLADE CORES FROM THE EDZIZA AREA: SELECTED METRIC AND NON-METRIC ATTRIBUTES

1. Site/artifact No.	16:2	24:1	1:192	1:198	43:1	17:18	82:1	16:1	16:3	58:1	58:2
2. Core type	IMt.	IMt.	IMt.	IMt.	IMt.	IMt.?	?	Wedge	?	?	?
3. Condition	Comp.	Comp.	Exp.	Frag.[6]	Comp.	Frag.[6]	Comp.	Comp.	Frag.	Exp.	Frag.
4. Preform type	Bif.	Bif.	Bif.	Flake	Bif.	Flake	Bif.	Bif.?	Flake	Flake	Flake
5. Overall max. length (mm)	95.2	73.0	53.3	62.2	53.2	53.5	41.1	44.5	43.2	52.1[7]	26.3[7]
6. Overall max. width (mm)	35.0	31.0	22.1	20.0+[7]	26.1	30.7	21.2	23.1	25.7	39.2	16.0[7]
7. Overall max. thickness (mm)	16.6	16.5	14.0	13.9	15.8	11.3	15.9	20.0	12.8	16.7	10.0
8. Length, fluted surface A (mm)	49.4	41.0	27.6	? (7)	32.0	16.9[7]	19.1[10]	35.0	31.7[7]	34.1[7]	12.9[7]
9. Length, fluted surface B (mm)	71.9	47.3	28.2	56.1	42.0	43.0	30.8[10]	–	–	–	–
10. Width, fluted surface A (mm)	10.9	15.9	13.9	11.8	14.2	7.7	11.3	21.1	12.0	15.6	9.7
11. Width, fluted surface B (mm)	11.2	16.1	13.9	14.2	15.0	11.3	15.1	–	–	–	–
12. No. of blade scars, A (1)	3	4/4	3/1	2+	5/2	5/3[9/9]	5/1[9/9]	5/3	?/2	1/8+	3
13. No. of blade scars, B (1)	2/3	4/2	4/3	3/3	4/2	3[9]/4	4/0	–	–	–	–
14. Platform edge angle (2)	36/40	62/64	30/33	64/74	37/48	47/77	91/101 / 67/60	50/82	?	89/93	?
15. Platform edge width (3)(mm)	9.9	10.38	13.9	10.4	13.7	10.7	11.5 / 12.9 (10)	6.3	?	12.0	?
16. Max. width, last blade scar (4)(mm)	7.3	6.0	5.0	4.9	6.5	5.0[8]	4.3 / 6.0 (10)	5.5	7.1[8]	5.0	5.0[8]
17. Max. length, last blade scar (mm)	25.0	36.7	16.6	41.2	42.0	37.6[8]	15.7 / 29.8 (10)	31.9	25.0[7]	23.1[7]	?
18. Max. length, platform (5)(mm)	–	–	–	–	–	–	10.8 / 19.5 (10)	16.1	?	29.1	?
19. Max. width, platform (5)(mm)	–	–	–	–	–	–	10.6 / 14.7 (10)	20.0	?	12.1	?

(1) eg.4/2: 4 is no. of flake scars extending to the remaining platform; 2 is no. of distal remnants.

(2) eg. 35/40: 30 (deg.) is angle of main trend of intersecting platform and fluted surfaces (or of 2 fluted surfaces with IMt. cores); 40 (deg.) is the immediate angle within 5mm of platform.

(3) Measured as "chord length", from side to side.

(4) This is the only remaining blade scar likely to accurately reflect the width of the blade.

(5) Pertains only to non-IMt. cores.

(6) Fluted surface A almost entirely lost.

(7) This measurement axis incomplete.

(8) Sequence of blade removal not determinable; This is widest remaining blade scar.

(9) Very short narrow scars.

(10) Two non-intersecting platform-fluted surface pairs.

TABLE 6: Average Microblade Measurements by Site*

Site	Average Length	Sample measurable for length	Average Width	Average Thickness	Measure Sample	Average No. Ridges
EP 80	52.7	22	6.1	2.14	39	1.82
EP 92	48.4	2	7.86	1.98	5	1.6
EP 1/A2	37.7	1	6.53	2.3	9	1.3
EP 97W	–	–	5.98	2.52	8	1.87
EP 58	33.5	1	5.58	1.74	11	1.63
EP 101	49.6	1	5.87	1.63	8	2.0
EP 44	–	–	4.32	2.02	4	1.5
EP 28	37.0	1	5.73	1.72	19	1.78
Total Av.	43.15		5.99	2.01		1.68

*Only sites with 4+ measurable blades included an acute angle of intersection between lateral edges of the biface or flake blank as a potential platform for blade removal; (3) Where previously existing random fractures formed a suitable intersection of acutely angled edges, probably no further preparation was necessary. Where the intersection was formed by bifacially retouched lateral edges, one or more primary spalls might be removed from one or both edges, to form an acute intersection of flat striking surfaces; (4) Blade removal began by striking or pressing-off blades along one of the intersecting surfaces, using the other as platform; (5) Blade removal continued on that surface, until platform conditions (e.g. angle, width, or length) or hinge fracturing along the fluted surface, prohibited further easy blade removal in that direction; (6) The core was then rotated so that the previously fluted surface could serve as a striking platform for a series of blades removed down the original striking platform surface; and (7) Rotation of the core and alternation of fluted surface-striking platforms could conceivably occur several times, until the core remnant became too small, or the platform angle too steep for further effective reduction.

It is clear that a wide range of blanks were judged suitable for blade-core production, not just well flaked "laurel-leaf" bifaces (e.g. Smith 1971). It seems that the critical factor was the existence of an acute angle of intersection between two lateral edges; this could exist fortuitously in detritus or "shatter" produced by lateral snapping or burination of flakes or bifaces, or might exist in the tip intersection of biface preforms. The possibility that people simply "found" fortuitously appropriate core blanks is not at all unlikely in an area where the ground is littered by obsidian fragments produced by both natural and cultural processes. However, it seems that the most common procedure was the deliberate production or use of a crudely flaked plano-convex cross-section biface preform. If the same result could be accomplished by minor bifacial retouch of a tabular flake, this was also apparently satisfactory. Once people "found" or produced a preform with suitable edge-angle characteristics (apparently ca. 30-60° was considered best), blade removal could begin immediately, if the intersecting edges were already relatively flat. If not, removal of one or more primary spalls (ski-spalls or lames à crêpes) would produce flat dihedral surfaces. Blade removal could then proceed in one or the other direction, until the first striking platform and angle were no longer effective. With rotation, and alternate use of fluted surfaces as striking platforms, the end result was an expired core remnant with one fluted surface (i.e. the one last used as a platform) shorter than the other. In some cases the fluted surface last used as a platform may be so diminished in length as to appear only as short distal blade-scar remnants along one edge. This appears to be the case where Smith (1971) identified short "burin-scars" as a prepared striking platform for what he thought to be a unidirectional core -- in fact the "burin-scars" were merely distal remnants of an original opposed fluted surface on a rotated bi-directional core.

Despite seemingly liberal tastes as to specific core preform types, some core attributes apparently were not permitted to vary widely by users of the IMMI. These were: (1) the acute angle of intersection (30-60°), which was maintained if possible through the life of the core; (2) the general thickness of the preform (kept close to 15 mm); and less frequently, (3) some effort to shape the distal end of the core (furthest from the striking platform edge) into a form approximating a stem or tang. Edge angles of course, are difficult to measure consistently. The angle referred to here is the angle of the main trend of the intersecting surfaces, not the immediate and local angle of conjunction; it is not clear what angle Smith was measuring. The core thickness referred to is maximum thickness, which may relate to both the specific mechanics of blade removal as well as methods of mounting or holding the core during reduction. Unfortunately, these measurements apparently cannot be easily compared to those of Smith (1971), which are sometimes inconsistent -- for instance, his core 248 is stated to have a maximum thickness of 0.5 cm (although an illustration at "3/4 size" shows a thickness of 0.8 cm) while the maximum width of one striking platform is stated to be 0.7 cm.

The modification of the distal portion of the Edziza cores probably relates to methods of holding and mounting the core during reduction. In several cases these basal areas are heavily crushed on opposed edges and there may have been some effort to continually modify these edges in relation to progress of blade removal and possibly changing angular and leverage relationships with the working face. As well, deliberate indentation of the basal portions of the core would stop blades from carrying right to the distal extremity, perhaps to reduce distal curvature (J. Lukes pers. comm. 1981). The same purpose may have been served by buildup of hinge residues, after core reduction was well advanced.

Another prominent characteristic of these cores, besides edge-angle, thickness and distal "hafting" modifications, is the straightness of the remaining fluted surfaces. Very little if any longitudinal curvature is apparent in the remaining blade scars on these artifacts. The intersection of the two fluted surfaces is wedge-like and sharp, exhibiting no evidence of extensive grinding or crushing. Indeed the EP 16:2 core is so acutely pointed that it could conceivably serve a number of functions other than just blade-core, including projectile point! However, there is no convincing evidence of secondary use (e.g. as burins) for any of these cores. The fluted surfaces are also very flat in lateral cross-section, not commonly exhibiting a significant curvature to the platform. This suggests blades were removed from an originally flat surface, and that blade removal tended to be equal across the fluted surface. We also see no evidence of localized crushing from heavy flaking tool impacts as reported by Smith (1971). This may again suggest that the Stikine River cores, at a greater distance from the raw material sources, experienced more total and forceful reduction than did the Edziza sample.

The question of why people in this area were carrying on a rather unique and specialized microblade industry is not clear, but I suspect that it more likely relates to the local abundance of high quality lithic material than to any direct prehistoric ties between the Stikine-Edziza area and Japan. The only other northwest North American core that I have seen in the published literature which is markedly similar to the IMMI types, was also found in another obsidian source area -- Batza Tena in Alaska (Clark 1972). Both Batza Tena and the Edziza area produced large quantities of nondescript biface preforms as their most common surface artifacts. In the Artifact Valley-Raspberry Pass region such bifaces are second in abundance only to unmodified detritus, and are widely visible to even untrained eyes. As noted in the "Ethnography" chapter, the Tahltan Indians themselves clearly noted and wondered at the quantities of "unfinished points" scattered around this mountain area. It is then perhaps not unreasonable to suggest that later secondary reduction systems would eventually develop to take advantage of this local surface abundance of ready-made preforms, using bifacial blanks for microblade reduction and other purposes. Perhaps some other reasons related to the mechanics of blade production may also have favoured the development of this core-type, however, at the moment, in the absence of any serious replicative experiments, these can only be guessed at. For instance, it is possible that use of opposed striking-platforms-cum-fluted surfaces may tend to favour retention of an acute striking platform angle and hence promote core life and increase blade production. However, if this is the case, why did not similar systems come into widespread use in other regions? Perhaps, there was a desire for longer, straighter blades here than elsewhere, and certainly many of the Edziza microblades are very long. Perhaps as well, this type of core reduction system (i.e. utilizing bifacially retouched preforms) was simply more compatible than others with people who spent a great deal of their time in the production of generalized biface quarry-blanks. Replicative experiments will eventually, hopefully, aid in answering some of these questions; for the moment the cultural-functional significance of the localization of this specific core-type in a rather remote corner of northwestern North America is uncertain. However, it does seem clear that any resemblances between the IMMI cores and those of the Hokkaido paleolithic are not as obvious as they may have seemed originally, and that the actual sequence of core preparation and reduction is significantly different from that first proposed by Smith (1971).

While the basic outline of the sequence of IMMI core evolution seems preserved relatively well in the Edziza assemblage, many specific details of the IMMI technology are less certain. For instance, while several layers of blades could be removed from a given fluted surface before core-rotation, it is not clear if core rotation was automatically carried out at a certain stage to maintain geometric symmetry and angular relationships, or if rotation only occurred when specific blade-removal problems were encountered. Most fluted surfaces seem to display a sequence of blade removal from left-to-right or right-to-left, rather than removal of two lateral blades, to set up a central area for removal of a wide well-formed prismatic blade. Thus multi-ridged blades tend to have their arretes skewed towards one lateral edge. It seems that the early blades in the core reduction sequence were much more curved in longitudinal section and thicker and more triangular in cross-section than later products. This is demonstrated in the core partially reconstructed from a concentrated blade scatter at the Grizzly Run Site (EP 80, Component 2, Fig. 67). In this assemblage virtually all blades appear to belong to a single core, and probably only a single fluted surface of that core. Twenty-two blades and fragments were rejoined and diminishing longitudinal curvature and thinning and widening of individual blades is evident through this refitted sequence. It is likely that this scatter of blades left at EP 80 consists of mainly undesired rejects of an early phase of core reduction, and that the reconstructed core segment represents only the waste trimming necessary to shape a core to the point where optimum quality blades could be consistently produced. These were either produced at another site, or were all removed from the manufacturing locale at EP 80 for use elsewhere. It seems clear that wide, thin, straight blades were the desired ideal, and that considerable material wastage occurred as a result. Striking platform remnants on the reconstructed core have alternating lateral angles, suggesting that they were removed from another fluted surface.

It is very probable that IMMI cores were fastened or held firmly in some kind of device while force was applied to them during blade removal. The modified distal elements of these cores suggests that they may have been "hafted" in a way analogous to the hafting of other bifaces as knives or points. It is possible that such hafting fixed the core in a nearly vertical position (with the intersection edge pointing upwards) so as to permit an efficient application of force against that relatively thin sharp chisel "tip." Also, such a hafting mechanism may have readily allowed the occasional rotation of the core in order to work the alternate surfaces.

Other Edziza microblade cores exhibit considerable differences from the IMMI types, but at least some of this variation may be due to more advanced stages of reduction represented by these often highly exhausted remnants. Core 16:1 is the only example of a microblade core which approximates the standard wedge-shaped "Denali" form most frequently found in the interior of Alaska and the Yukon (e.g. West 1981; Dumond 1977). However, even it is not a precise parallel. This core consists of a small thick biface edge segment, or bifacially retouched flake, roughly "lozenge-shaped" in side-view, and triangular or "wedge-shaped" in end-view, with a single fluted surface at one narrow end, and a striking platform based on a single broad curving flake scar struck from the chord-end prior to blade removal. The platform has been minimally retouched by crushing along the chord edge but there is no real secondary flaking of the platform. All flake scar ridges are heavily worn and abraded, suggesting water-tumbling or aeolian weathering. While it is barely possible that this small core represents the accidental result of the splitting of an IMMI type and the complete removal of one fluted surface, this seems improbable. Core 82:1 is another variant which may be related to the IMMI form, but, instead of two intersecting fluted surfaces, possesses three such faces, two intersecting, and one from a platform made by a single broad flake scar at the opposite end of the core. The original core preform appears to have been a thick, narrow, well-flaked biface segment. The final three non-IMMI cores possess only single fluted surfaces, and are based on thick tabular flakes possessing some unifacial retouch, but no evidence of bifacial workmanship. Unfortunately all three are expired or very fragmentary exhausted remnants, and many characteristics of the original core are now probably obscured. The largest example, 58:1 has a rough multiply hinged fluted surface below an extensively laterally retouched striking platform remnant, and appears to have been strongly battered prior to abandonment. The original preform was a thick tabular flake, rectangular in end-view, with some unifacial retouch on one face (Fig. 78). The other two core remnants may have been similar, but are too fragmentary to permit any detailed statements as to original morphology.

It is perhaps significant that the four cores which seem most clearly non-aligned with the more common IMMI type, come from only two sites (EP 58 and 16), one of which arguably possesses considerable age or unique cultural associations. More will be said about the dating of microblade industries in the Edziza region in the final chapter on cultural chronology.

Edziza microblades (Fig. 79) exhibit a considerable range of metric variation (Table 6) with the average blade fragment being 6.0 mm wide and 2.01 mm thick, with 1.68 ridges (two ridges being most common) and with little if any longitudinal curvature. Except for the assemblage from EP 80, Component 2, which can be refitted, most blades are incomplete fragments so it is not possible to comment on average length in general. At EP 80, the average blade length is 52.7 mm, but these are from mainly early stages of core reduction. The most common fragments are medial or proximal (i.e. with striking platform remnant); tip fragments are not usually found in surface assemblages, probably as a result of their small size and less certain resemblance to classic blade form. There is very little definite evidence of retouching or use-wear of the blades. On most cases, slight random edge breakage or microflaking can be much more probably attributed to depositional and post-depositional attrition than to deliberate modification and I have little faith in the reality of micro-retouched "small tools" as described by Smith and Calder (1972). However, two sites (EP 80 and 101) yielded a total of four short (14.6-23.5 mm) medial blade fragments, which appear to have been definitely use-retouched along one lateral edge. The retouch consists of continuous uneven pronounced micro-flaking onto the ventral surface of the blade. The association of three of these retouched medial fragments with the EP 58 assemblage is intriguing since, as noted above, it also possesses two of the non-IMMI cores. In addition, the metric attributes of the blades from this site show them to be generally narrower than the overall blade assemblage, at 5.58 mm.

There are few close comparisons to the IMMI in the published literature pertaining to northwestern North America. As noted earlier, the most similar previously reported core is one from an undated surface site in the Batza Tena obsidian quarry of north-central Alaska (Clark 1972). Elsewhere in the northern interior, microblade core types are generally of the Campus-Denali wedge-shaped type, with uni-directional blade removal from a usually narrow retouched and rejuvenated platform. The EP 16:1 and EP 58 cores come closest of any of the Edziza assemblage to this form, but even here exact parallels are lacking. Around the Gulf of Alaska and the northern Northwest Coast several early microblade assemblages also display no close parallels with the Edziza cores, being frequently based on large split pebble nuclei, or of generalized wedge-shaped form (e.g. Ackerman 1974). The cores of the Plateau microblade tradition are also seemingly unrelated to the IMMI type, as are the less common Tuktu tabular core forms of the Alaska-Yukon area.

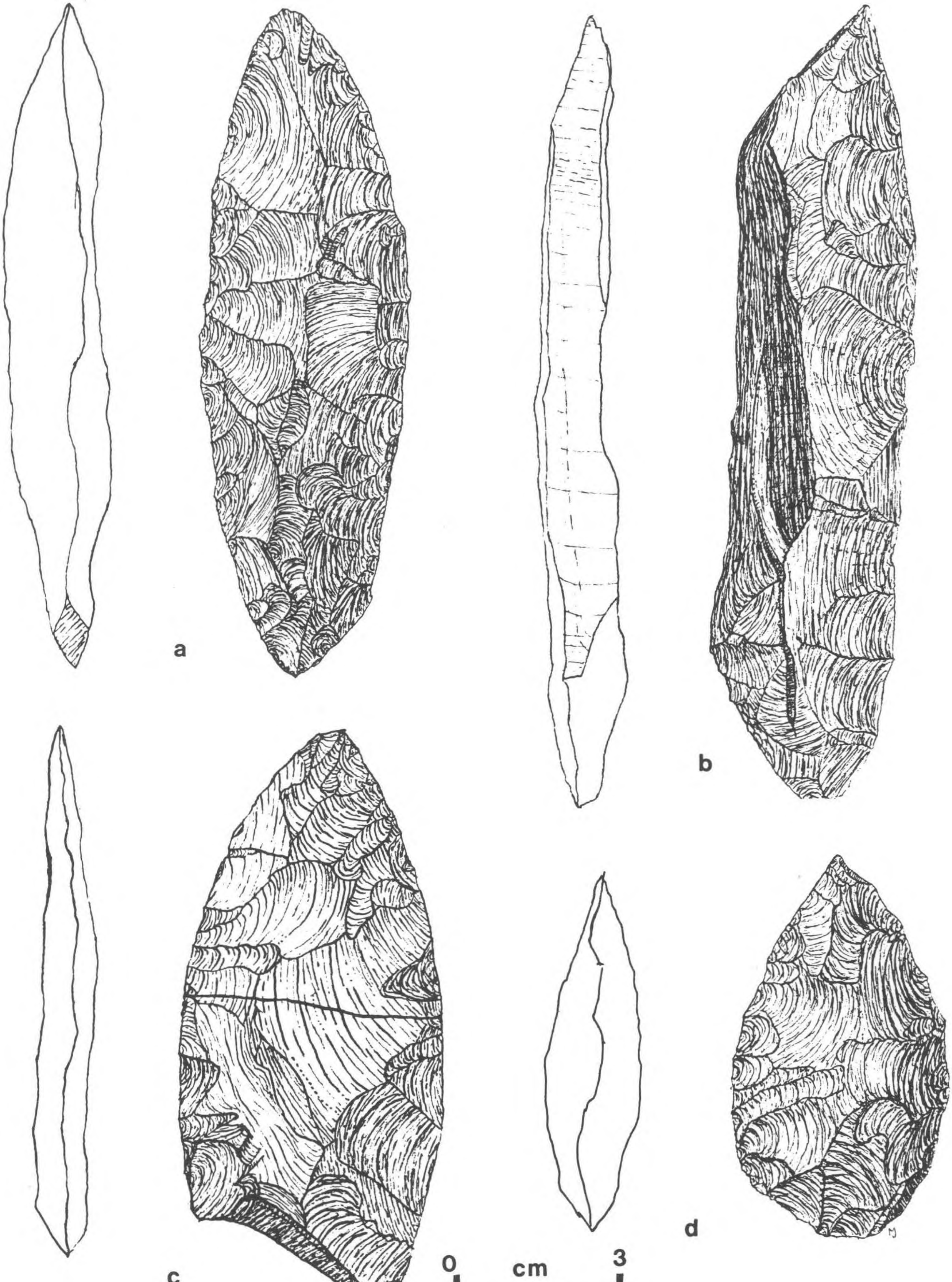


Fig. 80. Advanced bifaces: a. EP 28, b. EP 80, Component 2, c. EP 80, surface of lateral moraine, d. FP 97W.

Biface Preforms

All bifaces or fragments which are not projectile points, or which do not display clear macroscopic evidence of use, are here classed as biface preforms. While it is possible that a few of the more finely retouched and better formed pieces were finished tools (knives, lance-points, etc.), in a context overwhelmingly dominated by early stages of biface manufacture, and relatively few traces of other activities, it is difficult to demonstrate that such possible "tools" are not simply advanced preforms. This is particularly so when it is nearly impossible to place much faith in microflaking or striation of edges -- which might normally be an indication of functional use -- in an area where all surface artifacts and most buried artifacts have been possibly subjected to cryoturbation. However, to recognize the fact that some bifaces are much more "finished" than others, the provisional artifact classification used in this report splits the biface preforms into two sub-types: (1) "Advanced"; and (2) "Early stage." This is a rather crude segregation, to apply only until a more sophisticated taxonomy of preform-stages can be tested. The initial data collection for the latter task is complete, including the tabulation of 18 metric and non-metric attributes for each of the 300 surface-collected bifaces. A further 144 from excavations at EP 1 and EP 80 still await analysis.

All "advanced" bifaces have an ovate or leaf-shaped form, with relatively elongated proportions predominating (Fig. 80). The largest complete specimen measures 120 x 38.5 x 17.2 mm (from EP 28), while the smallest complete biface measures 68.5 x 49.2 x 14 mm (EP 97W). Base forms are usually pronouncedly convex to pointed, although one basal fragment in the excavated assemblage from micro- blade-bearing Area 2 of the Wet Creek Site has a straight base and nearly parallel lateral edges. It measures 41 mm wide x 15 mm thick, and has crushed and lightly ground lateral and basal edges. Most "advanced" bifaces possess relatively thick symmetrical lenticular cross-sections, and somewhat sinuous or irregular longitudinal sections.

"Early stage" bifaces primarily consist of fragments of large, thick, irregular bifaces or bifacially retouched flakes of highly varied proportions and sizes, which lack closely spaced fine retouched scars and, in most cases, a clearly defined shape. This class of artifacts is by far the most common in the Edziza area, occurring in 65% of the assemblages. It also appears to be of the least immediate use for cultural-historical interpretations, although this impression may change after completion of study of their technological attributes. These pieces are all the result of primary biface manufacturing activities, involving percussion

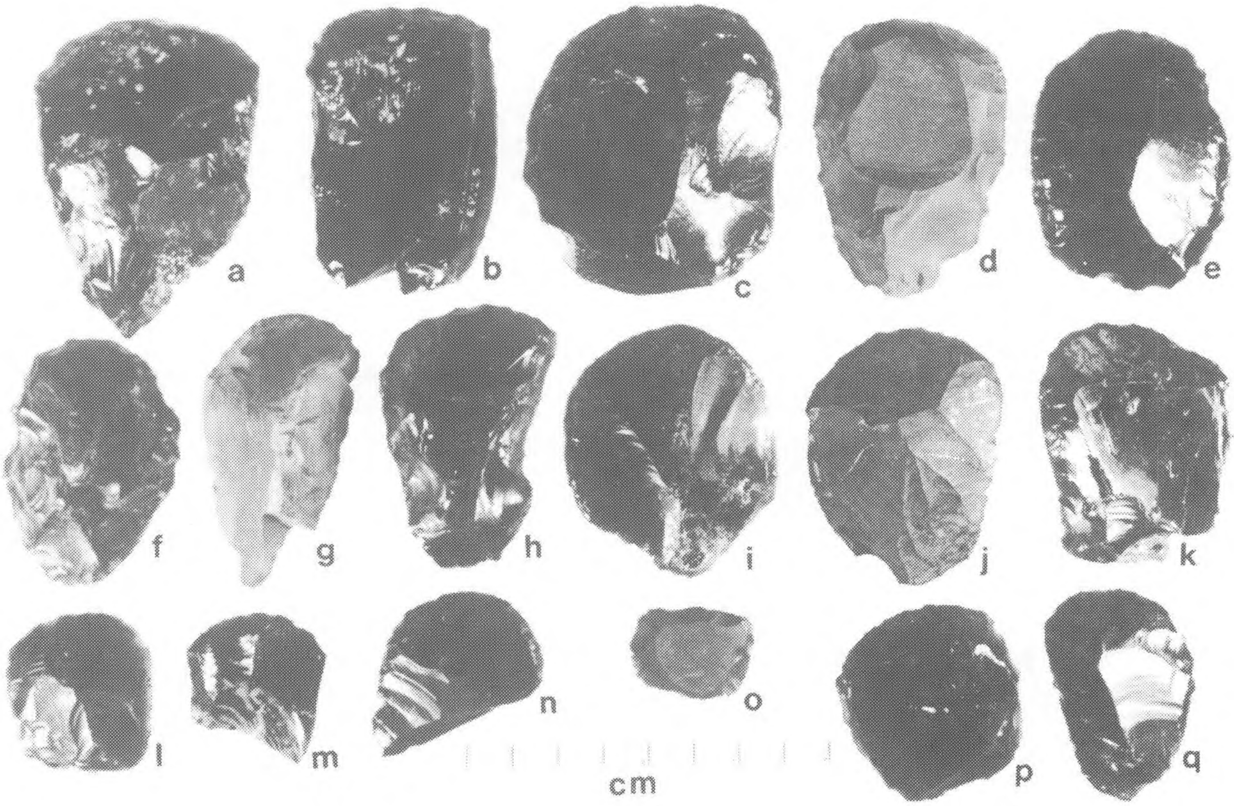


Fig. 81. End-scrapers: a. EP 26, b. EP 25, c. EP 14, d. EP 68, e. EP 1-A2, f. EP 24, g. EP 85, h. EP 83, i. EP 67, j. EP 48, k. EP 70, l. EP 18, m. EP 18, n. EP 33, o. EP 76, p. EP 83, q. EP 67.

flaking of large obsidian flakes. They were mostly discarded as a result of breakage or the presence of some irresolvable flaw such as excessive asymmetry or over-thickening. Most of these artifacts are too fragmentary to permit generalization about dimensions, although a width greater than about 60 mm is relative rare; however, a few exceptionally large fragments stand out in this assemblage, suggesting that some of the bifaces being manufactured were of a considerable size. For instance, one relatively well-formed convex-edged basal fragment from EP 12 measures 98 mm wide x 32 mm thick. Extrapolating the curve of the remaining lateral edges would suggest a "complete" wide leaf-shaped biface over 250 mm in length. Another basal fragment from EP 84 is 77 mm wide and 17 mm thick.

As noted in the site descriptions, biface reduction is archaeologically the single most visible prehistoric activity within the Artifact Valley-Raspberry Pass area, not counting the actual obsidian quarry sites. Virtually every site displays some evidence of this process, regardless of its definition as "camp" or "flaking station," or its artifact-tool assemblages -- e.g. "microblade," or "non-microblade." Even if actual biface fragments are not observed, quantities of biface thinning flakes are by far the most prevalent deteirus on most sites, often occurring, as in EP 1, "House 1," in tremendous quantities. The goal of most of this activity appears to have been the production of relatively large, thick, leaf-shaped to ovate bifaces, by hard and soft-hammer percussion, with little concern for final "finishing" retouch in the local area. Presumably, despite the large numbers of bifaces found, the bulk of such products were removed from the mountains for use or finishing elsewhere. Many such pieces may have been further reduced into projectile points of varied forms, although the generally large size of the preforms might suggest that a particularly large finished biface was being sought. There may be some tendency for the largest bifaces to be associated with microblade assemblages. For example, very large biface edge fragments were found in EP 80, Component 2; while the more finished preforms from EP 1 "House 1," post-dating microblades, are relatively smaller, lighter, and more suitable for the making of projectile points. However, the existing sample is insufficient to demonstrate this trend conclusively.

Some of the larger, thicker, and seemingly less well-organized early stage bifaces may possibly have functioned, at least secondarily, as bifacial flake cores. However, there is no convincing evidence from the mountain sites that the wide, thin flakes normally resulting from such activity were particularly desired or used as blanks or tools. Perhaps large bifaces, thinned elsewhere at a distance from the quarry sources, did function as cores, but not in direct proximity to an abundant obsidian supply.

One inference that does seem justified is that relatively large bifaces were the primary form in which obsidian was being transported away from the source. "Quarry-blank" bifaces of this general type are widely known from other lithic resource sites across North America, and they may have been a particularly efficient and flexible initial form, permitting a wide range of final modification and use, without involving excessive weight. It is worth noting that large "crude" bifaces of this type are not common in Stikine River assemblages that I have seen, suggesting that they were ultimately reduced into unrecognizable end-products. At sites a significant distance from the quarry sources, broad sharp biface thinning flakes may also have been desirable cutting tools in their own right, implying that all portions of an original biface preform might in the end be usable.

End-Scrapers

End-scrapers are defined as flakes possessing one or more steeply retouched edges orientated at approximate right angles to the long axis of the flake (Fig. 81). Such artifacts represent one of the most common secondarily modified tool classes observed in the Edziza area, and, after projectile points, one of the few artifact classes which displayed patterned recurrent forms and dimensional attributes which could be considered definitely related to functions other than primary lithic reduction. A total of 38 end-scrapers were collected, 30 of them from surface contexts. Because Workman (1978) suggests that there may be some association of end-scraper size with chronology, the assemblage from the Edziza area was divided into two sub-types (1) "Large" and (2) "Small" for the purpose of inter-assemblage comparisons. The dividing boundary between these two sub-classes was arbitrarily set at an edge chord width of 30 mm (Table 7). Although these two sub-types occur together in the same assemblage about as often as they occur separately, there may be a slight tendency for wide-edged end-scrapers to be more commonly associated with microblade assemblages. Table 7 summarizes some metric attributes for most of the end-scrapers. Edge angles are rather consistently in the 45-55° range. General tool shape varies from scrapers made on irregular flakes, to scrapers on the ends of elongated ridge flakes, to fully edge-retouched ovate and discoid forms. Again there do not appear to be significant association differences between these forms. Macroscopically visible use-wear or edge-rounding is absent in any of these specimens, suggesting that they were used relatively infrequently. This class of objects also possesses a relatively high frequency of non-obsidian raw materials, particularly a grey-white rhyolite. This implies curated tools transported into the obsidian quarry area, perhaps because obsidian was not as suitable a raw material for the "scraping"

TABLE 7 Metric Attributes of End-Scrapers

Site/ Artifact No.	Shape	Raw Material	Length (normal to main edge)	Max. Width	Edge Angle	Max. Thickness	Thickness of edge	Chord Width of edge	Chord Radius of edge
EP 14:1	(ovate)	obsidian	62	56	50	21	9	48 L	12
17:11	(rect)	"	44	27	55	7	4	38 L	4
17:22	(frag)	"	21*	40	45	5	4	34 L	8
18:1	(rect)	"	35	31	55	7	4	28 S	8
18:2	(irreg)	"	28	30	55	8	7	28 S	4
24:1	(ovate)	"	54	37	60	12	7	27 S	8
25:1	(rect)	"	62	40	45	10	8	38 L	9
26:1	(ovate)	"	70	47	55	14	7	42 L	8
33:1	(irreg)	"	31	34	55	6	4	22 S	5
33:2	(ovate)	"	42	28	45	8	4	33 L	10
48:1	(ovate)		56	43	50	11	6	38 L	8
49:1	(irreg)	"	49	33	60	12	7	29 S	6
63:1	(sub. rect)	"	30	32	60	12	8	28 S	4
67:1	(disc)	"	54	46	55	10	3	47 L	11
67:2	(rough file)	"	65	36	60	7	7	21 S	4
67:3	(ovate)	"	44	33	35	11	4	30 S	7
68:1	(broken)	rhyolite	33*	48	55	11	10	45 L	6
68:2	(ovate)	"	61	42	65	13	11	38 L	7
70:1	(irreg)	obsidian	54	41	55	12	5	33 L	9
76:1	(rect)	"	27	20	55	8	6	22 S	3
83:1	(elong)	"	56	36	55	13	5	46 L	4
83:2	(irreg)	"	32	24	55	10	8	24 S	5
83:3	(irreg)	"	23	35	50	4	4	22 S	3
83:4	(disc)	"	44	42	55	10	9	32 L	3
85:1	(elong)	rhyolite	60	32	35	13	5	25 S	5
96W:1	(TN)	obsidian	38	33	45	9	9	33 L	6
101:1	(irreg)	"	42	38	50	9	4	31 L	5
101:2	(irreg flake)	"	35	28	65	8	6	26 S	4
(1,A2)EP1:177	(irreg)	"	57	46	42	16	10	45	3
(1,A2)EP1:182	(ovate)	"	57	43	55	11	6	35	11
(1,A1)EP1:160	(irreg)	"	42	42	65	8	6	40	12
EP97W:1	(elong. ridge flake)	"	71	33	65	12	9	33	5
EP1:150	(TN)	"	28	27	55	7	6	27	5
EP80:102	(elong. ridge flake)	"	60	40	75	11	9	27	5
EP80:105	(T.N)	"	42	25	55	8	5	24	5

function. Twenty-three assemblages, or about 20% of the total, yielded end-scrapers, suggesting that mixed-sex multi-function occupations were relatively common occurrences. There is a frequent association of end-scrapers with relatively diverse, multi-function camp-type assemblages. Of the 23 end-scraper assemblages, only 30% co-occur with the microblade industry, while 35% co-occur with projectile points. End-scrapers do commonly co-occur with side-scrapers and retouched flakes (Table 8), suggesting both a taxonomic and functional overlap.

Side-Scrapers

Side-scrapers include 28 flakes of varied sizes and shapes possessing one or more steeply retouched "scraper" edges. They range in size from 78 x 53 x7 mm (EP 80, Component 1) to 40 x 18 x 8 mm (EP 59). They are generally distinguished from end-scrapers by the lateral position of the worked edges in relation to the long axis of the flake. Edge angles are comparable to those of end-scrapers, although edge forms tend towards greater straightness. In some cases the worked edges are actually concave, approaching the form of a "spokeshave." Some side-scrapers have two alternately bevelled edges (EP 54 and 62). Beside the ubiquitous association with biface preforms and cores, side-scrapers are most commonly found with end-scrapers (41%) and retouched flakes (32%) (Table 8).

Core Scrapers

This class includes eleven thick heavy flakes or core-remnants possessing extensive steep unifacial edge retouch and a roughly ovate form. All are of obsidian, and average about 60 x 40 x 20 mm in size. Retouch is usually continuous around the circumference, with edge-angles in the 40-70° range. These artifacts are most commonly associated with end-scrapers and retouched flakes (not counting biface preforms and flake cores, Table 8).

Formed Unifaces

This is a heterogeneous category of seven items characterized by full unifacial flaking of all edges, forming a distinctively shaped (usually pointed) tool. These include two large unifacial "knives," one of basalt and the other of obsidian, from EP 50 and 79 (86 x 48 x 11 and 116 x 39 x 13 mm respectively). These are asymmetric pointed forms, shaped by fine unifacial pressure flaking which may extend totally across one face (Fig. 82). Two pieces, from EP 67 and 82 respectively, are probably flaked awls or drills. The former, of a speckled grey-green chert, is thick, ridged and sharply pointed (51 x 13 x 7 mm), and the latter is, a tip fragment of a thick well-formed unifacial obsidian point (? x 13 x 8 mm). One uniface from EP 83, of opaque green obsidian, is formed into a thin, relatively narrow, asymmetric "knife" (49 x 190 x 55.5 mm). A single small triangular unifacial tip fragment was excavated from EP 1 "House 1" (18.7 x 15.4 x 3.1 mm), and the EP 1 Area 2 excavations also yielded a single broadly pointed uniface of obsidian (84.2 x 37.5 x 13.3). Unifaces occur most frequently with end-scrapers (57%) and retouched flakes (71%), not counting biface preforms and flake cores (Table 8).

Retouched Flakes

This class includes 39 flakes of diverse shapes and sizes, possessing one or more lightly retouched, acute edges. All but five are unifacially flaked, the others are bifacial. Artifacts were identified as retouched flakes only where there was substantial reason to believe that they were not simply detritus from primary lithic reduction activity. Unifacial flaking, of course, is an initial stage in any manufacturing process leading to bifaces and unifacial retouch, and may be used to strengthen edge platforms of flake blanks and other preforms. Therefore, not all unifacially "retouched" flakes need be tools, and the relatively small number of artifacts so identified in the Edziza assemblages hopefully errs only on the conservative side. The largest retouched flake is a wide flat ridge-flake of obsidian, entirely unifacially retouched into a broadly pointed knife-like form (91 x 58 x 17 mm) from EP 67; the smallest is a basalt or andesite flake from EP 83 (37 x 33 x 4.5 mm) with a single lightly retouched excurvate lateral edge.

Retouched flakes were found in sixteen separate assemblages, which also contained most frequently end-scrapers and side-scrapers, following bifacial preforms and flake cores. Only five of these assemblages possessed any elements of a microblade industry (Table 8).

"Battered Pieces"

This term applies to fifteen artifacts which appear to represent a distinct and unfamiliar artifact class, although this may simply be due to a scarcity of well-described lithic quarry assemblages in the literature. All share a number of distinctive attributes including: (1) Based on thick flakes or flake core remnants, possessing one long edge formed by the intersection of a right-angled flake scar which was usually end-struck. The right-angled edge formed by this scar is usually between 10 and 20 mm thick. (2) Bifacial retouch to form a semi-lunar shape, when viewed facially, with the right-angled flake scar surface forming the chord edge, and a wedge-shaped cross-section (Fig. 83). (3) Heavy battering of the right-angled edge, and sometimes lesser battering of the opposed edge. These objects exhibit none of the typical characteristics of bi-polar cores or "pièces esquillées," despite evidence of opposed percussive forces. Battering of the thick edge was intense, resulting in heavy crushing and small flake removal, but without removal of columnar flakes, hinge-fracturing, or extensive reduction of opposed impact surfaces. Neither are these artifacts crude bifacial preforms with the battering resulting from unsuccessful attempts at thinning the right-angled edge; the objects are too small and thick to have made this effort worthwhile (90 x 39 x 22 to 72 x 28 x 14 mm), and the direction and location of the battering is not correctly designed to have resulted in significant thinning. In some ways these artifacts resemble wedge-shaped microblade core preforms, with the right-angled scar representing the potential "striking platform." However, none of the "battered pieces" display any evidence of blade removal and, indeed, the battering is so intense as to have surely microfractured the pieces, destroying their usefulness for fine flaking tasks.

I have no ready explanation for these artifacts, and other archaeologists I have shown them to are also puzzled by them. Of the nine separate assemblages in which they occur, only one has any vestige of a microblade industry (EP 101), and the largest single assemblage occurrence was in EP 1 "House 1," with five specimens. Otherwise, end-scrapers and side-scrapers are the most frequent co-occuring artifact type with battered pieces, not counting biface preforms and flake cores. I tend to think that the battering is evidence of some association with lithic manufacture, and it is perhaps not totally inconceivable that these pieces were used as flaking tools. Although the use of obsidian to flake obsidian might seem improbable, there is a possible scarcity of hard rocks in the vicinity of the Goat Mountain quarry, where most of the volcanics seem relatively soft and friable. A thick, right-angled edge of the sort that these artifacts display might be sufficiently strong to allow its use as a light-duty hammer or flaking tool. Some experimentation is needed to resolve this question.

Macroblades

One of the long-standing questions concerning microblade assemblages throughout northwestern North America is their associa-

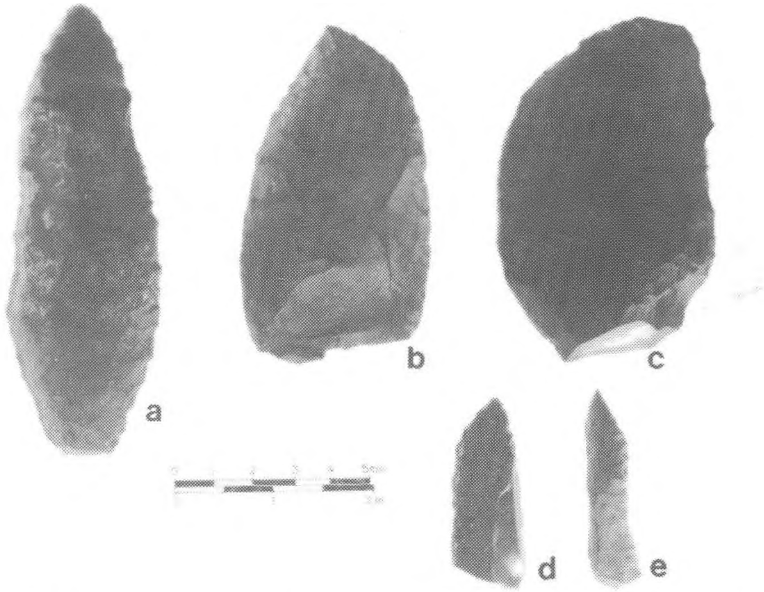


Fig. 82. Flaked unifaces: a. EP 79, b. EP 50, c. EP 67, d. EP 83, e. EP 67.

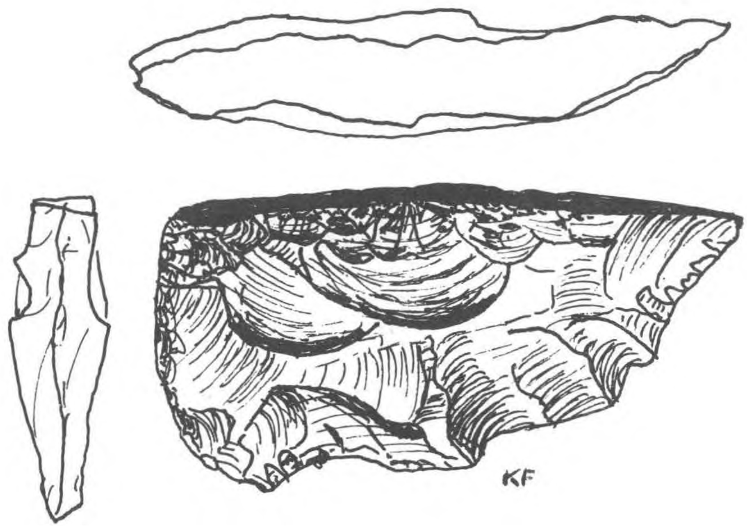


Fig. 83. Typical "battered piece" (EP 1, "House 1"). Natural size.

tion with macroblades, and whether true prepared core macroblade industries actually commonly exist in the region. Throughout the Edziza research an effort was made to identify and collect large blade-like flakes to assess the reality of possible "macroblade" industries in the area. The collection of 12 items here classed as "macroblades" represents a distillation of a much larger number of "elongated flakes" originally collected as potential macroblades. Even so, few if any of these pieces would fully match the generally accepted criteria for true blades (Fig. 84). Although these end-struck macroblade-like flakes are of the proper proportions and shape, most do not exhibit convincing evidence of previous patterned blade removals. They are probably simply fortuitous by-products of generalized core and biface reduction processes and not representative of a true macroblade industry. On the other hand, the presence f a few large well-formed polyhedral single-platform flake cores, sometimes possessing multiple macroblade-like scars (Fig. 85) may suggest that some large blades were produced at least rarely. These may have been intended for further reduction so that their original form was usually quickly eradicated.

The large blade-like flakes here retained for the time being under the designation of "macroblades" (average 50.0 x 15.0 x 8.0 mm) are all of obsidian. None show convincing evidence of deliberate retouch. They were most commonly associated with end-scrapers in the seven assemblages in which they occurred, and only two of those assemblages also produced evidence of a microblade industry.

Flake Cores

Flake cores and fragments were the second most common general artifact class in the Edziza assemblages, after biface preforms, with a total of 94 specimens. These were divided into two sub-types: (1) single platform, unidirectional cores; and (2) multi-platform, multi-directional cores and amorphous core remnants (Fig. 85). The first group includes 11 polyhedral cores, with single broad flake scar platforms from which multiple flakes were removed around the circumference. The resulting flake scars are often fairly elongated and parallel-sided. Such cores average ca. 55 x 45 x 35 mm. The second sub-type mainly includes relatively small core remnants and fragments which have been worked from multiple platforms in several directions. This was probably the final form of any flake core reduced to complete exhaustion. However, four of these cores are also true "tortoise" bifacial cores, with large flakes removed from around the edge of a thick hump-backed biface (Fig. 85). Flake cores are by far the most common artifact form on the major Goat

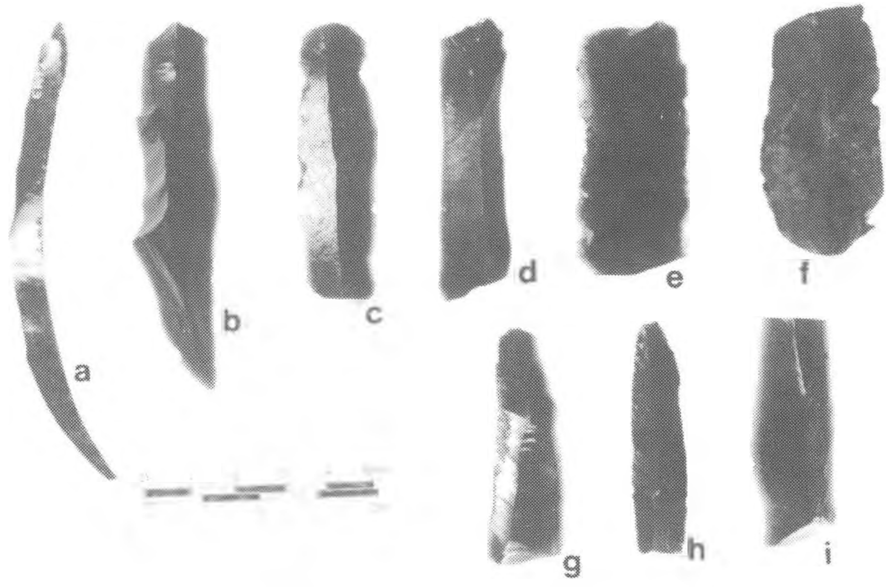


Fig. 84. Macroblades and macroblade-like flakes. a. EP 12; b. EP 14, c. EP 67, d. EP 83, e.,f. EP 13, g. EP 97W, h. EP 69, i. EP 17.

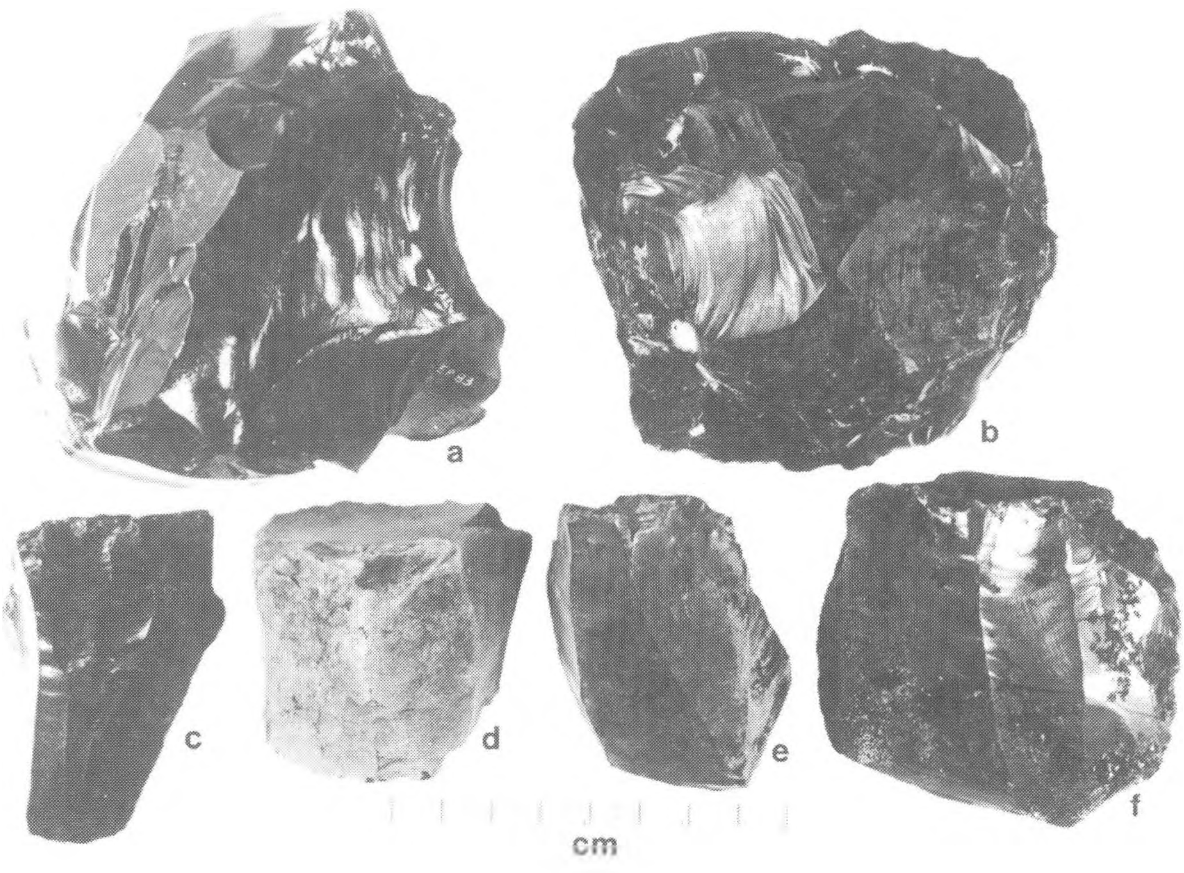


Fig. 85. Flake cores: a. EP 83, b. EP 16 ("tortoise" type); c. EP 67, d. EP 79, e. EP 13, f. EP 8 (polyhedral type).

Mountain quarry sites, and if these had been collected, this artifact class would possibly have outnumbered biface preforms overall.

Pecked and Ground Stone

This category includes the only non-flaked stone artifacts found in the Edziza area (n=8). Most (6) are hammerstones, ranging from a smooth, cylindrical end-battered pebble (152 mm long x ca. 60 mm in diameter; 887.7 g), to a discoid pebble about 65 mm in diameter x 37 mm thick (weight 215 g), entirely edge-battered, from sites 90 and 101 respectively (Fig. 86). The majority of hammerstones are merely lightly end-battered pebbles. Raw materials are generally fine grained igneous rocks. Hammerstones are actually surprisingly rare given the amount of primary lithic reduction activity represented at the Edziza sites, and it is possible that suitable hammerstones were left at favorite camps or flaking stations in the mountains to be repeatedly rediscovered and reused over many years. The final two artifacts in the pecked and ground stone category -- the ground stone point from EP 1, "House 1," and the incised pebble from EP 83 -- have already been described in the sections pertaining to those sites and will not be repeated here.

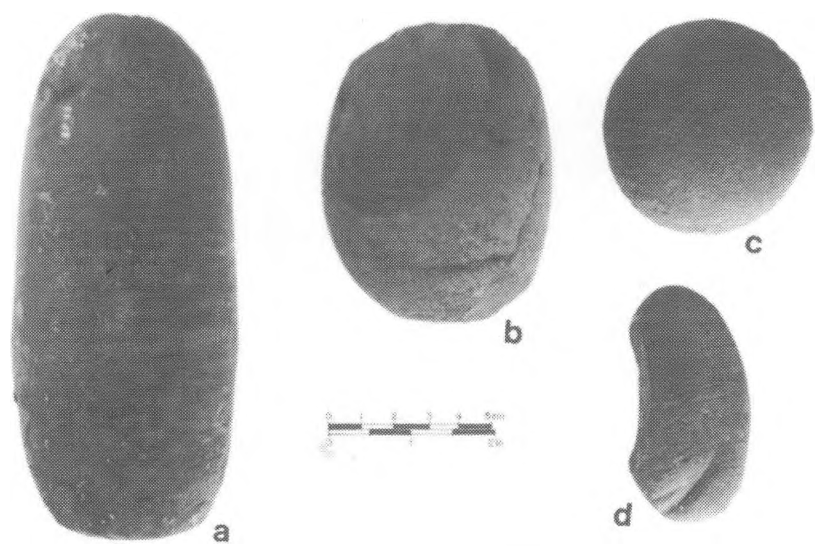


Fig. 86. Hammerstones: a. EP 90; b. EP 97; c. EP 101; d. Incised pebble, EP 83.

CORRELATIONS AND CULTURE HISTORY

Data available from the first season's archaeological investigations of the Edziza region are still inadequate to develop a firm cultural chronology for the area, but may permit some preliminary statements. The following section will outline a tentative cultural history in the form of two alternative hypotheses, either of which might be valid on the basis of the Edziza study data alone, but only one of which is strongly favoured by wider comparative analyses with adjacent and surrounding regions.

In the absence of extensive excavation data, any tentative, cultural-historical structures can only be based on a small number of apparently chronologically sensitive and relatively visible traits, particularly the presence or absence of a microblade industry, and projectile point typology. In the Edziza area, a relatively large number of assemblages possess some evidence of microblades (ca. 19%), which in itself suggests that a significant proportion of the prehistoric record represented in the Edziza sites results from microblade-using cultures. Only one microblade component is well-dated, Component 2 of the Grizzly Run Site, at about 4900 B.P. Two dates from EP 1: Area 2, of 1340 and 1140 B.P. are considered only minimum age estimates on the microblade assemblage, while other surface occurrences of microblades cannot be directly dated. Component 2 of the Grizzly Run Site, overlying and stratigraphically separated from the earlier occupation by a zone of sterile tephra, is probably associated with a 14C date of 3910 ± 120 B.P., while the relatively large assemblage from EP 1 "House 1" is radiocarbon dated to 2850 ± 160 B.P. Both of these are apparently non-microblade cultures, although there is still room for future revision of this evaluation. However, present data suggest that a microblade industry which was flourishing as late as ca. 4900 B.P., was no longer a major factor in local tool kits by 3000-4000 B.P. As represented by the EP 80, Component 2 and the EP 1, Area 2 assemblages, the Ice Mountain Microblade Industry (ca. 4-5000 B.P.) was associated with, minimally, very large biface preforms (perhaps also represented by the complete specimen from EP 28); wide-edged (Type 2) end-scrapers; side-scrapers; retouched flakes of varied form; nondescript flake cores; and a variety of medium-sized (10-15 cm) bifaces, mainly preforms at different stages of completion, but also, rarely, functional knives. The latter include one large square-based obsidian preform, and a roughly ovate, use-polished biface of rhyolite.

Besides the excavated microblade components, site EP 58 is also considered to represent a strong cultural association of microblades with a relatively diverse assemblage. Even though this is a surface assemblage, this small, horizontally tight cluster of artifacts, in a remote alpine location where cultural occurrences of any type are rare, can only be reasonably explained as resulting from a single short-term occupation. This assemblage includes a large diagonal-parallel flaked point, two of the three non-IMMI type microblade cores, two side-scrapers, two retouched flakes, fourteen relatively narrow microblades, two nondescript biface fragments, and one flake core fragment. The point and core types seem to set this assemblage apart from other microblade collections in the region. Although this may be due to a functional distinction between this site and the others, related to its high altitude, presumed big-game hunting context, this does not seem likely as the sole explanation for this assemblage, since its unique qualities could be better explained by a significant age difference between it and the other microblade collections. Given that the IMMI apparently persisted no later than 3000-4000 B.P., and that there is no strong reasons, as yet, to believe that there were locally any later recurrences of a microblade industry, the EP 58 assemblage could predate 5000 B.P. Much more tentatively, its location in a setting which would be possibly forested and hence more hospitable given a tree-line ca. 100 m higher than present, suggests the possibility that this site was occupied during a warm period of the Hypsithermal. However, confirmation of this estimate must await discovery of similar materials in dateable contexts.

Other positive or negative associations with the microblade industry can only be proposed on the basis of surface occurrences and, for obvious reasons well-demonstrated at the Grizzly Run Site, such are usually weak indications of actual cultural relationships. However, until further excavated data are available, the following hypothetical relationships can be suggested on a numerical tabulation of all co-occurrences (both surface and excavated, Table 8).

In terms of the rather coarse-grained descriptive artifact taxonomy employed in this report, the only artifact types which *never* co-occur on the same site with some vestige of a microblade industry are incipient stem (Type 2) and expanding stem (Type 5) projectile points. Barring biface preforms and Type 2 flake cores, which are associated with virtually *all* artifact forms because they are so relatively numerous, the next most common co-occurrences with the microblade industry are side-scrapers (45% of all microblade industry occurrences) and retouched flakes (24%). Counting all surface and excavated assemblages, the microblade industry occurs a little more frequently with wide-edged than narrow-edged end-scrapers (wide=24%; narrow=19%). Counting all end-scrapers as a single group, the microblade industry co-occurs with end-scrapers seven times, or 33%. Microblade elements associate with projectile points in general six times (29%), but only the EP 58 association (Type 1) has any real degree of confidence. Microblades are less certainly associated with other Type 1 points (once); Type 3 (once); and Type 4 (twice); however, both the Type 3 and Type 4 "associations" are considered very weak for reasons discussed in the section on "Projectile Points."

An interesting aspect of the Edziza microblade assemblages is the rather pronounced tendency for microblades and cores to be negatively associated. Thus, not counting the reconstructed core portion from EP 80, of the fifteen assemblages containing microblades, only two also contained microblade cores; or, conversely, out of a total of seven assemblages with microblade cores, only two also yielded blades. Primary spalls are also much more closely associated with microblades than with cores. This suggests that, while most blade assemblages result from blade manufacture rather than use in those locations (with the probable exception of EP 58 with three retouched blade segments), core remnants were usually removed from blade-making stations. This indicates that cores were only intermittently worked as sources of blades, rather than being totally reduced in a single session, with probably only the number of blades needed for an immediate purpose being made at a given time. The cores would presumably then be curated and transported from place to place, with the bulk of archaeologically recovered microblades being discarded rejects of short-term blade manufacturing episodes conducted as needed. Carrying cores instead of blades would present fewer problems in terms of damage to fragile ready-made microblades; and would permit a wider selection of most suitable forms as needed (particularly if several sizes and shapes of cores were carried). Extension of this inference would also suggest that blades were relatively easily manufactured whenever and wherever needed; i.e. major preparation and access to anything but light easily portable instruments was not needed. How blades were used in this area is not known, except that in the mountains they certainly were not fish-knives. They were probably side mounted if the use-retouch at EP 58 and 101 is representative.

The nature of the last 3000-4000 years of prehistory in the Edziza area is even less definite than earlier periods. Evidence from the upper component at the Grizzly Run Site and "House 1" at EP 1 strongly indicate that the microblade industry had disappeared by 3000-4000 B.P. At the former site, it is apparently replaced ca. 4000 B.P. by an assemblage characterized by a distinctive lanceolate projectile point, thin flat biface knives, possibly narrow-edged end-scrapers, retouched flakes, nondescript biface fragments, a flake core and a "battered piece." The origins of this non-microblade lanceolate-point complex are unknown. However, in both the Skeena Valley and on Mt. Edziza it appears to show up rather suddenly around

4000 B.P. Further definition of this complex or horizon is needed. The assemblage from "House 1" adds little to the post-microblade picture, since it was rather single-mindedly dedicated to biface preform manufacture, although some roughly flaked thick-edged core-scrapers, one small unifacial "point" tip and a ground stone point are new elements.

Although only one lanceolate projectile point is positively associated with a non-microblade component in the Edziza area, it is possible to tentatively suggest some additional projectile styles of the post-microblade period on the basis of surface occurrences. For instance, as noted above, neither incipient stem or expanding stem types were found with elements of the microblade industry. Since these points were the only definite negative associations with the microblade industry, and were sometimes found in otherwise relatively large surface assemblages (e.g. EP 67), the lack of co-occurrence of blades and stemmed points may be significant. Likewise, I think it highly likely, as noted earlier, that all the lanceolate points, including that from Ep 101, result from a non-microblade horizon related to the upper component at the Grizzly Run Site. The situation with notched points is less certain, and seems incapable of being clarified by the available local data. Three of the five notched point occurrences were not associated with microblades, while two were; however, of the latter, both were in situations where confidence in any implied cultural relationships must be low. Given the possibility that at least some of the "House 1" preforms were most suitable for production of large notched points, and that the surface association of microblades and notched points is dubious at best, I tend to think for the moment that notched points are primarily post-microblade phenomena.

One of the notable absences in the Edziza field collections is any evidence for definite arrow-sized projectile points, including the small side-notched and stemmed forms which nearly universally define the late prehistoric period (the last ca. 1300 years) in the rest of British Columbia and adjacent regions. We had expected, on the basis of prior experience in other parts of the British Columbia interior, that small notched and stemmed projectile points would be among the most common weapon tips recovered. However, this was not the case, despite extensive surface collecting, and intensive investigation of one site (EP 1) which, on the basis of radiocarbon dates, was occupied well into the time range of small notched points dated elsewhere. A number of possible explanations for this situation may be considered. First, is the standard problem of sampling coverage and representivity with a nonprobablistic research design. The reasons for choosing a judgemental survey methodology were discussed previously and it is felt that we accomplished near total recovery of surface sites within at least one day's travel of each base camp. Considering that such areas of "total coverage" completely overlap the environs of Raspberry Pass, ethnographically noted to have been used by the Tahltan, as well as overlapping the principle obsidian outcrops in the area, it is extremely improbable that the lack of diagnostically "recent" artifacts can be attributed solely to inadequate survey coverage. A second possibility may be that small side-notched and stemmed arrow-points, common in the late prehistoric period elsewhere, simply were rare or not used by the aboriginal inhabitants of this region, and that we should be looking for other cultural indices of the last one or two thousand years of native occupation. This seems unlikely for a variety of reasons, including the widespread occurrence of such points in all surrounding regions (except the adjacent Pacific coast), including north central British Columbia, the upper Peace River area, and the southwest Yukon. Indeed, small side-notched points were the most common projectiles found in a recent surface survey of the Stikine Valley near Telegraph Creek (French 1980), indicating that they were in use just 70 km away as the crow flies (and ca. 1500 m lower). The possibility that the bow-and-arrow was introduced in this region later, or perhaps took hold here less strongly than in other areas, might need to be borne further in mind, particularly given Honigmann's (1981:443) enigmatic comment that "the atlatl is thought to have been used by the Dease Lake Kaska"; however, at the moment the absence of small arrow-points in the Edziza area does not seem readily explicable on this basis alone. A third, and what seems to me the most likely possibility is simply that high elevation areas were relatively less intensely exploited in the last few thousand years, than they were earlier.

An hypothesis of diminishing aboriginal exploitation of alpine and sub-alpine zones in the last few thousand years of prehistory satisfies both the apparent relative absence of recent cultural horizon markers, and the implications of paleoenvironmental studies in the Edziza region and adjacent areas. As noted earlier, the Neoglacial period locally began about 3000 B.P., culminating in the particularly cool episodes of the "Little Ice Age" ca. 200-400 years ago. This cooling trend saw renewed and greatly expanded glaciation in alpine regions, particularly in the St. Elias and Boundary Ranges. Glaciation could have physically impeded access to some alpine areas, while the growth of permanent snow cover may have reduced the value of high altitude lithic resources and hunting areas. In the Edziza region, the terminal phases of the Hypsithermal, just preceding the trend towards an increasingly cooler climate, was additionally marked by a closely spaced series of volcanic tephra eruptions, culminating just after 4600 B.P. by a major explosive ejection of coarse tephra which could not have had anything but undesirable effects on the local alpine environment. Increased volcanism and a trend to cooling climate may have made the Edziza-Spectrum Ranges relatively undesirable places to visit and occupy, compared to what seems to have been volcanic quiescence and milder temperatures during most of the preceding Hypsithermal. Therefore, it is perhaps significant that what appears to have been a major shift in cultural inventories -- from microblade to non-microblade -- seems to have occurred by ca. 4000 B.P., and was almost certainly complete by 3000 B.P., at about the same time as climatic change begins and explosive volcanism ends. If we accept that all microblade components predate ca. 3000 B.P., then 20-21 "known" components can be clearly assigned to Hypsithermal occupations of the mountains, while, even counting *all* surface lanceolate, stemmed and notched point occurrences as post-Hypsithermal in age, plus dated occurrences at EP 1 and EP 80, that period only accounts for a "known" fifteen components, only one of which can be definitely stated to fall within the last ca. 1000 years of peak Neoglacial climatic conditions (the 670 B.P. "hearthcut" at EP 1). This age distribution of sites, tentative as it is, implies an inverse relationship in comparison to the "normal" archaeological situation, where most surface occurrences decrease in frequency with increasing age. It seems to me that this can only be explained by hypothesizing steadily decreasing aboriginal use of the mountain areas in the last ca. 3-4000 years. Whether the mountains were ever totally abanodoned for any length of time cannot be verified, but is probably unlikely given an apparently continuous flow of obsidian from the Edziza sources into surrounding areas, right up until proto-historic time (e.g. MacDonald 1979). Unfortun- ately, there are not sufficient numbers of dated samples to indicate whether there was a quantitative fall-off in the amount of Edziza obsidian being redistributed over the last few thousand years, although I would not be surprised if this was the case.

The second alternative cultural-historical hypothesis would follow the first but, by accepting the two dates from EP 1, Area 2, would suggest that there was some continuation or recurrence of the IMMI as late as ca. 1100-1400 B.P. In this case, the apparently anomalous appearance of the EP 58 assemblage might be accounted for by its relative recency, rather than relative antiquity. This would also bring it into chronological congruity with Lake Minchumina. I think that there is not much evidence to support this alternative, since it is based only on the two EP 1 - A2 dates, neither of which can be directly associated with the microblade industry, as discussed earlier. However, until there are additionally dated IMMI sites this hypothesis should probably be retained as at least a remote possibility, for reasons outlined below.

External comparisons with dated microblade complexes elsewhere generally tend to confirm the validity of the first hypothesis, in terms of an upper terminal date of about 4000 B.P. for most microblade industries in the northwest and western Subarctic. However, there are still a number of apparently anomalous occurrences of microblades considerably later than this, in some areas.

Most northern coastal microblade occurrences pre-date ca. 5000 B.P., including the Namu and Queen Charlotte sites on the British Columbia coast; Hidden Falls, Groundhog Bay and Early Ocean Bay I around the Gulf of Alaska (Hester 1978; Fladmark 1979; Davis 1979; Ackerman 1974; Clark 1979). Several other coastal sequences extend back to 5000-6000 B.P. without any evidence of a blade industry (e.g. Prince Rupert and Katmai Monument; MacDonald and Inglis 1981; Allair 1979; Dumond 1971). However, on the southwest coast of British Columbia, in the Strait of Georgia region, microblades are thought to be associated with archaeological components dated between ca. 5000 and 1500 B.P. (Mitchell 1968; Carlson 1970). This is an area which apparently possesses no definitely older microblade manifestations, and many characteristics of the later microblade industry are unusual, including use of small quartz crystal cores. It has been suggested that the quartz-crystal "microblade" industry on the southern Northwest Coast is in fact basically a bipolar industry and not representative of a true prepared-core blade technology (e.g. L. Ham pers. comm.). The subtraction of all presumed quartz-crystal "blades" from south coast sites would leave only a very small number of obsidian microblades and cores, greatly reducing the apparent importance of prepared core industry in this area, and perhaps restricting it to just the earlier portion of the sequence. In the southern interior of British Columbia, microblades appear to date as late as about 3000 B.P. in the middle Fraser region. Sanger (1970) originally proposed that microblades might persist in the area as late as ca. 2000 B.P., But Stryd (1973) argues for effective termination of the microblade industry by 3000 B.P.

One of the most anomalous series of dated microblade finds occurs close to the northwestern boundary of the Southern Plateau bioclimatic zone near Anahim Lake, in west central B.C. Here, Wilmeth (1978a) reports excavation of a number of late prehistoric-historic Chilcotin pit-houses, virtually all of which (seven separate excavation areas) contained one or more microblades in association with much later, sometimes historic assemblages and eleven radiocarbon dates between 130±80 B.P. and 1870±75 B.P. The total collection included over 75 microblades and one core fragment. While Wilmeth (1978a) was willing to accept microblade occurrences as late as 1615±80 B.P., he considered microblade associations with the later dates and artifacts to be the result of disturbance and mixture with earlier components due to processes of pit-house construction, use, and collapse (Wilmeth 1979). There is no doubt that re-used pit-house sites are extremely difficult to interpret, and the generally poorly developed state of cultural historical studies in much of the Plateau is probably directly a result of archaeological emphasis on excavation of such sites. However, the Anahim assemblages still seem to be a remarkably large and consistent sample of late microblade occurrences, awkward to entirely discount out of hand. One additional factor which may be partially involved is the co-occurrence in all these sites of a strong bi-polar industry (Wilmeth 1978a). While eight of the nine illustrated microblades (Wilmeth 1978a) look like definite blades, perhaps some of the others could be products of a late bi-polar technology. However, other anomalies occur in the same general region. Excavations in a proto-historic or historic Bella Coola House on the central Northwest Coast, less that 100 km from Anahim Lake, produced four obsidian microblades in apparent association with historic artifacts (Hobler, pers. comm.), while Borden's (1952) excavations at Natalkuz Lake, 200 km north of Anahim Lake, produced one of the first microblade industries recognized in the Northwest, dated ca. 2470 B.P. Recent dating of another charcoal sample from the hearth of the odd centrally-excavated "pit house" feature apparently represented at this site, turned out fifty years younger than the original estimate (Carlson, pers. comm.).

In 1977, Helmer discussed these late microblade occurrences, and suggested that they were "real" associations, representative of a late Athapaskan incursion into the region. He pointed out that researchers in the area had been too ready to extrapolate the early dating of microblade technology in southern British Columbia to the northern interior, and he predicted that no older microblade horizons would be recognized in the Athapaskan area of the province. This was a useful and thought-provoking paper, and while I think more recent data disprove the overall hypothesis, I do agree that rejection of all "late" microblade occurrences simply because they do not fit preconceived cultural-historical schemes is invalid. Thus, until further, well-dated, non-housepit sequences become available, I think that it is appropriate that we operate on the assumption that there *is* some kind of late persistence of a microblade industry in and around at least the Anahim Lake area. This might be extended northwards to encompass the Natalkuz Lake site, although it is not nearly as chronologically anomalous as the Anahim finds. It is also worth noting in this regard that the Anahim Lake area includes significant obsidian sources and if there are any raw-material technological factors acting to promote persistence of a microblade industry in this region, they might conceivably also apply to the Edziza area.

If a late microblade anomaly does occur in the Anahim area, it probably does not extend far to the north, with the possible exception of Natalkuz Lake. Although the densely forested northern interior regions of British Columbia are still poorly known archaeologically, the few data points available strongly indicate the absence of any significant microblade industries later than about 3-4000 B.P. Donahue (1975) reports the presence of a small sample of late-dated microblade elements at Tezli (another complex pit-house village, 100 km northeast of Anahim Lake), but convincingly indicates that the 4000 year long artifact sequence from this site is essentially microblade-free; if the few examples are truly associated, they must represent only the weak vestiges of an older tradition. At Punchaw Lake, continuing analysis by this writer of the ca. 6000 artifacts from House pit 1, spanning about 4000 years, conclusively shows that there are no definite microblades in the assemblage, despite earlier comments to the contrary (cf. Fladmark 1976; Helmer 1977). The few triangular single-ridge blade-like flakes scattered throughout the deposit cannot be used to define the presence of a prepared core technology. Two dated sequences from the Skeena River valley east of Terrace, demonstrate the apparent absence of microblades in that area, in the last ca. 4000 years (Allaire 1979; Ames 1979).

With the exception of the Mt. Edziza data, archaeological information is scarce for the rest of northern intermountain British Columbia and it is necessary to extend our survey into the Yukon Territory and Alaska. The bulk of reported archaeological information from the Yukon comes from the extreme southwestern corner, where Workman (1977, 1978) has most recently summarized the culture-history. He argues that the microblade industry ends before 4500 B.P., as a major technological shift defining the transition between the earlier Little Arm Phase and the later (Northern Archaic) Taye Lake Phase. This relatively early date for the microblade/non-microblade transition in the southwest Yukon stands in contrast to several much later microblade assemblages from east central Alaska, particularly in the Tanana River Valley. These include a date of ca. 1100 B.P. on Healey lake (Cook 1975); ca. 1000 B.P. at Lake Minchumina (Holmes 1974, 1977); and 2420 ± 60 B.P. on the lower component at Dixthada (Shinkwin 1979). In contrast, West (1981) states that the microblade industry was finished in the Tangle Lakes area of the Alaska Range by 7000 B.P. Also, microblades were no longer used at Onion Portage on the Kobuk River after about 5900 B.P. (Anderson 1968) and on the north side of the Alaska Peninsula on the Ugashik River by 4000 B.P. (Henn 1978). Thus, in the Alaska-Yukon region, non-ASTt microblade assemblages are generally early, with the exception of what appears to be a "node" of late persistence in the east central interior of Alaska, which may last until about 1000 years ago. Eastwards, in the Mackenzie District of the Northwest Territories, well-dated microblade occurrences are few, but appear to be a little later than those of the southwest Yukon (Millar 1968; Clark 1981).

To summarize this brief review of the termination dates for microblade industries across northwestern North America, the bulk of the geographic area appears to have lost any strongly developed microblade technology by about 4000 B.P. However, there is an uneven scatter of significantly later microblade persistence, particularly concentrated in two notable anomalous areas; (1) southwestern British Columbia, and (2) east central Alaska. While these distributions may be of interest in regional cultural-historical synthesis, and might have some bearing on the question of the origin and relationship of historical ethnolinguistic units, my purpose at the moment is simply to indicate that a ca. 4000 B.P. termination date for the Ice Mountain Microblade Industry is supported by the bulk of available data. However, the same data clearly indicate that caution should be used in this regard since what seem to be fairly definite exceptions to this trend can be demonstrated. Thus, the initial investigation of a large previously archaeologically unknown area might possibly encounter other unforeseen occurrences of anomalously late microblade technology, for which a "standard" termination date of ca. 4000 B.P. would be inappropriate. While I doubt that this is the case in the Edziza area, available well-dated information in the region is insufficient to *completely* rule out the possibility that some elements of the IMMI might have lasted as late as ca. 1000 B.P. Previous research by Smith is not particularly helpful in this regard, since his excavated components were not reliably dated. Smith (1970, 1971) did not report any radiocarbon dates on his microblade components, although he did obtain a date of 1975 ± 310 B.P. on IaTr2 (Wilmeth 1978b) which is apparently a non-microblade site (e.g. Smith 1971). He depended on obsidian hydration estimates on artifacts which is a demonstrably unreliable technique and one which certainly cannot be routinely employed for absolute age estimates.

SUMMARY AND CONCLUSIONS: PREHISTORIC NATIVE USE OF THE EDZIZA AREA

The 1981 archaeological project in the Edziza and Spectrum Ranges was a first-stage investigation of an area which had seen little or no previous research, but which could still be demonstrated, on the basis of wide externally distributed dated occurrences of Edziza obsidian, to have been visited by native people for about the last 9-10,000 years. Archaeological surveying and test excavations verified the presence of rich lithic surface sites concentrated around the vicinity of several major obsidian quarries on "Goat Mountain," but also scattered throughout the mountain ranges wherever ground surveying was conducted. The sheer density of surficial cultural material in the major quarry sites -- exceeding many millions of items -- is unparalledled in the experience of this investigator, and the equally impressive density of flaking stations and camp sites in the Raspberry Pass and "Artifact Valley" areas around Goat Mountain is not exceeded elsewhere in British Columbia to my knowledge. The east side of Raspberry Pass and Bourgeaux Valley, in particular, is so thoroughly saturated with lithic detritus that, with the exception of bogs and streambeds, it is difficult to walk without encountering cultural materials everywhere. To someone used to the difficulty of finding even a single flake in the confining brush of the boreal forest, or of trudging through endless wheatfields in the Peace River grass lands in search of relatively meagre and widely spread handfuls of lithic remains, the Bourgeaux Valley area does not seem to belong to the subarctic. The region is literally redolent with the physical signature of countless numbers and generations of human beings who lived and worked there in the past, and who seem to have stamped the valley with a real feeling of human familiarity and presence. In comparison to other parts of the mountain system, such as Floatplane Lake valley, this area seems "civilized," due simply to the prevailing density of prehistoric cultural "garbage"! This impression is, of course, helped by the presence of the Telegraph Trail -- both the deep straight-walled modern horse-trail, and older generations of trails, branching and joining, sometimes becoming lost in brush or marsh, but clearly signifying the longstanding importance of this valley as a communication route. The old telegraph wire itself, stretched along the valley from fallen pole to fallen pole, and crossing prehistoric lithic scatters like a ready-made baseline connecting one to the next, also helps promote the feeling of a deep human presence and familiarity. Finally, rare and very human mementoes, such as the "message tree" from 1928, provide at least a few of the past travellers through Raspberry Pass, with actual names and personalities.

Besides the surficial density of cultural remains, it can be assumed that there is also considerable prehistoric time depth for human interaction with this area. Directly dated cultural components at the Grizzly Run Site indicate that people have been living and working in Bourgeaux Valley itself for at least 5000 years. In this length of time their way of life apparently underwent some significant modifications, probably in part as a response to changing climatic conditions and episodes of violent volcanism which occurred about 5000 to 4000 B.P. However, people continued to come into the general area for obsidian at least as late as ca. 670 B.P., at a time when Neoglacial climatic conditions had probably substantially degraded the alpine-subalpine environment.

In the archaeological record of the Artifact Valley-Raspberry Pass area, the predominant importance of the adjacent Goat Mountain obsidian sources overshadows all other cultural activities. Most sites display some presence of primary core reduction or biface manufacture, and some site portions are intensely dedicated to just those functions (e.g. EP 1, "House 1"). Obsidian detritus and core shatter is often so dense that it presents a significant practical hindrance to excavation, short of simply discarding it. In other words, if any attention is to be maintained to provenience recording and full or representative recovery, the sheer bulk of materials greatly reduces the areal size of excavations. At both "House 1" and the Grizzly Run Site, screening often consisted of picking out and discarding the grains of natural sediment from among an overwhelming density of cultural flakes. These are also the only sites I have ever excavated in which screeners and excavators were routinely cut and stabbed by detritus so dense that it was sometimes difficult to place a hand anywhere in the excavations not posessing broken glass. In this context the observed settlement pattern, and intra site artifact distributions and frequencies, cannot easily be equated to more "normal" patterns of aboriginal utilization of alpine areas not possessing such rich local lithic sources. An approximation of this situation was only obtained in the Floatplane Lake study area, where site locations and distributions are presumed to be unrelated to any known local lithic sources, and instead indicative of a subalpine to alpine settlement pattern concerned primarily with subsistence persuits. Even here sites were relatively frequent and closely spaced, although site cultural inventories were far less impressive than those to the north.

We had relatively little opportunity to examine the true high altitude plateaus, with the exception of the "Central Plateau" northwest of Goat Mountain, where obsidian exploitation was again the most archaeologically visible concern. However, in a single limited reconnaissance of a portion of the "South Plateau" we found, in virtual isolation, a single small surface scatter (EP 58) which possesses some of the most distinctive artifacts found in the Edziza area, including an oblique collaterally flaked leaf-shaped projectile point, and non-Ice Mountain Microblade Industry cores. Located adjacent to a large esker complex, this is thought to represent a small hunting camp, possibly for caribou using the esker ridge for travel. This is the only site we can identify which might be associated with caribou hunting, in the absence of generally preserved faunal remains, and it also may predate most of the other finds. We observed no evidence of drive complexes or pounds, although such features, of brush, are reported to have been built and used by the Tahltan in mountain areas north of the Stikine (Albright pers. comm. 1981). Cultural features of any sort are rare, including what is probably a collapsed stone cairn or meat-cache on the southern lip of Raspberry Pass, a single scattered rock-ringed hearth near the eastern portal of Raspberry Pass (which may be historic in age), and the partially culturally modified depression forming "House 1" at the Wet Creek Site.

Little can be said about the actual way of life of prehistoric occupants of the mountains, other than some general inferences based on ethnographic analogy. These would suggest that early spring and fall were prime times for movement into the alpine area, to hunt and trap marmot and ground-squirrel. This would be done by an entire band, or family, although oral traditions suggest that occasionally single hunters or small parties of all-male hunters would enter the mountains after caribou and other game. Mountain camps were probably temporary and rudimentary, although archaeological data suggest that considerable skill and experience was probably involved in the selection of campsites which provided excellent visual command of valleys and other routes of travel.

Edziza obsidian was being widely distributed as early as ca. 9000 B.P. and continued to be carried far from its source up to the historic period. The actual redistribution or transport mechanisms involved are not known, and could have involved both planned travel to the obsidian sources by widely separated groups, or trade systems, with the source of obsidian perhaps controlled by only one "tribe." The ground stone point from "House 1" indicates that not only were quantities of Edziza obsidian reaching out to the coast and elsewhere, but that by at least ca. 3000 B.P., some coastal elements were also being brought inland as far as the obsidian source. Although this is certainly not proof of control of the obsidian source at this time by Tlingit or other coastal people, it does suggest that general coastal influences may have been felt in the area.

After 3000 B.P., the Neoglacial climatic downturn was well under way, and there is some evidence that aboriginal utilization of the alpine and subalpine zones diminished through this period. This is suggested by the complete lack of any clearly recent artifact types, particularly small notched and stemmed arrow-points, as well as adze-blades, and chi-thos, although it is unlikely that there was ever a true hiatus in occupation.

Ethnolinguistic identification of past occupants of the Edzizia region is not possible with the available data. There is some suggestion in the ethnographic literature that the Tahltan are relatively recent arrivals in the lower Stikine drainage, and it is possible that some other group, such as the now extinct Tsetsaut, may have at least moved through the Edziza area not long ago. Tahltan oral traditions suggest that they did *not* attribute the quantities of flaking residue found around the obsidian sources to people like themselves, which may suggest that they were relative newcomers, and users of a different flaking technology than that exhibited in the bulk of the Edziza surface sites. The absence of *any* archaeological component which can be dated to the last ca. 500 years of prehistory, makes use of a direct historical approach impossible, and this question, like so many others, will have to await future investigations.

TABLE 8 : Artifact Associations Expressed as Percentage of Assemblages with Co-occurrences.

	Type 1, Proj. Pts.	Type 2 [Proj. Pts.]	Type 3 [Proj. Pts.]	Type 4 [Proj. Pts.]	Type 5 [Proj. Pts.]	All proj. pts.	Type 1, End Scrs.	Type 2 [End Scrs.]	All end scrapers	Side scrapers	Formed Unifaces	Core scrapers	Retouched Flakes	Microblade cores	Microblades	Primary Spalls	All microblade ind.	Macroblades	Type 1, Bifaces	Type 2 [Bifaces]	Type 1, Cores	Type 2 [Cores]	Battered pieces	Total no. occurrences
Projectile Points, Type 1	X				25	25	25	50	50	50	25	25	75	25	50		50	25	50	75	25	75	25	4
Type 2		X				X	50												50	50		50	50	2
Type 3			X			X	66	66	66	100	33				33	33	33		100	100	33	66	33	3
Type 4				X		X	20	40	40	60			20		20	20	40	20	40	100	20	40	20	5
Type 5	33				X	X	33	66	66	33	66		100					33	66	66	33	65	33	3
All Projectile Points	X	X	X	X	X	X	29	41	47	47	24	6	41	6	24	12	29	18	53	76	24	59	35	17
End scrapers, Type 1	6	6	12	6	6	31	X	37	X	50	25	25	50	12	25	19	56	31	75	81	19	44	31	16
Type 2	17		17	17	17	58	50	X	X	50	17	8	50	17	17	8	33	17	67	83	17	58	25	12
All end scrapers	9	4	9	4	9	35	X	X	X	39	17	17	39	13	22	13	30	22	70	83	13	57	26	23
Side scrapers	9		14	14	5	41	36	27	41	X	14	9	39	18	36	14	41	14	36	68	18	45	23	22
Formed unifaces	14		14		29	57	57	39	57	43	X	29	71	29	14	14	29	29	86	86	71	43	43	7
Core scrapers	12					12	50	12	50	25	25	X	50	25	25	12	37	37	75	87	25	62	25	8
Retouched flakes	19			6	19	44	50	37	56	44	31	25	X	19	25	19	31	31	75	94	25	56	25	16
Microblade cores	14						29	29	43	57	29	29	43	X	29	14	X	14	43	86		43		7
Microblades	13		7	7		27	27	13	33	40	7	13	27	13	X	40	X	7	67	67	13	53	7	15
Microblade primary spalls			14	14		29	43	14	43	43	14	14	43	14	86	X	X	14	71	71		71	14	7
All microblade industry	10		5	10		24	19	19	33	43	10	20	24	X	X	X	X	10	62	67	10	52	10	21
Macroblades	14			14	14	43	71	29	71	43	29	43	71	14	14	14	29	X	86	100	43	71	29	7
Biface preforms, Type 1	4	2	6	4	4	18	24	16	33	16	12	12	24	8	20	10	27	12	X	71	16	33	10	49
Type 2	6	2	6	9	4	24	24	19	35	28	11	13	28	11	19	9	26	13	65	X	13	31	15	54
Flake cores, Type 1	12		12	12	12	50	37	25	37	50	62	25	50		25		25	37	100	87	X	50	37	8
Type 2	15	5	10	10	10	65	55	35	65	50	15	25	45	15	40	25	55	25	80	85	20	X	25	20
Battered pieces	11	11	11	11	11	66	55	33	66	55	33	22	44		11	11	11	22	55	88	33	55	X	9
Total number occurrences in individual assemblages	4	2	3	5	3	17	16	12	23	22	7	8	16	7	15	7	21	7	49	54	8	20	9	

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