10-1986

Paleoindians at the Auburn-Lewiston Airport : Michaud and Lamoreau Sites

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CHAPTER1
DISC ART #15A

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October, 1986

Occasional Publications in
Maine Archaeology

CHAPTER I: PROJECT BACKGROUND

During the fall of 1984 an archaeological survey was undertaken by Maine Historic Preservation Commission personnel (Spiess, Hedden) the along low-slope portions of a proposed right-of-way for a new connector road from the Maine Turnpike to the Auburn-Lewiston Industrial Park (Figure 1). The incomplete survey results at that time were negative. Early the following spring, however, several stone tools and a number of flakes were recovered from the unsurveyed right-of-way area in sandy "blow-outs" by four materials geologists from the Department of Transportation (George Eaton, Sylvia Michaud, Ray Woodman, and Rebecca Hewitt. These artifacts were brought to the attention of Spiess, who identified them as Paleoindian, especially by the presence of a fluted point base and channel flake. All four of the D.O.T. materials geologists were able to locate most of the finds they had made, either on 1"-100' scale aerial photographs, or in the field. An extensive survey of the find area described by the D.O.T. personnel, as well as the surrounding vicinity, was undertaken on May 30, 1985.

The site is reached by a gravel work road which converges with the southerly end of the North-South Runway (Runway 4-22) at the Auburn-Lewiston Airport (Figure 1-2). Standing at the end of the Runway facing south (220° magnetic), one looks downslope across an irregular, undulating surface alternately covered with grasses, weeds, and exposed patches of sand, best described as dune fields. Looking to the west, this patchy vegetational cover extends for about 200 meters, where it is bordered by a mature pine forest. Railroad tracks run perpendicular to the Runway across the view to the southward. To the far south, across the tracks, a bedrock-

controlled outcrop known locally as Christian Hill dominates the landscape. Below Christian Hill, and slightly to the west of the runway approach centerline, is a modest bog which is fed and drained by Moose Brook. A small stream runs along the southern border of the nearest dune field perpendicular to the runway center line, meandering in a generally east to west direction before finally turning south across the valley to join Moose Brook below Christian Hill. Looking in a northeasterly direction, the land rises to form a low, till-covered hill.

The dune fields were built of a fine sand base in which rocks or cobbles larger than 1 cm. in diameter are extremely rare. This sandy base appears to be the terminal depositional unit of the marine transgression in the area. Selective logging circa 1968 apparently exposed substantial areas of soil for the first time since original vegetation, though it was probably not until after 1970 that the dune field was reactivated. In 1970, according to Mr. Fernand Giguere, long-time maintenance foreman at the Airport, a variety of ground disturbing activities took place in order to clear and level the ground at the end of the runway for an expanded clearzone. As part of this activity, an intermittent drainage that ran diagonally (NE to SW) across the runway clearzone was filled by pushing in adjacent sand, soil and vegetation; and a new north-south drainage trench was dug parallel with the runway centerline, to the east. Coincident levelling of low dune tops to increase the ease of mowing low vegetation added to the disturbance which reactivated dune movement. Discussions with Mr. Giguere were invaluable in reconstructing patterns of soil disturbance. Though the dune fields had been active for more than 15 years, soils analyses, initially by Spiess and subsequently by Balogh and Gordon (Appendix), showed that much of the area still had intact older forest soil below aeolian deposits of the last

decade. These intact soils consisted of an A/E horizon overlying a deeply orange horizon, where it was predicted that most Paleoindian artifacts would be recovered. A slightly less orange B_2 horizon and C horizon respectively underlay the B_1 horizon.

All of the artifacts recovered by the D.O.T. personnel had been collected in the devegetated, deflated areas southeast of the end of the runway. The survey by Spiess and Hedden at the end of May, 1985, included both an extensive surface collection over much of the area south of the runway, and the digging of several test squares in the vicinity of the original finds. Some cultural remains were recovered by Spiess and Hedden, and total site area was predicted based on perceived limits of the artifact scatter. Based on the scanty artifactual remains located to that date, but with high hopes due to the presence of generally intact soils, it was decided that preliminary excavations would take place as other commitments allowed throughout June. Based on the results of the June excavations, a complete mitigation proposal was submitted to the Maine Department of Transportation.

On May 30, 1985, Hedden and Spiess laid out a north-south base-line with a handheld compass which was within one or two degrees of true north. A transit and 100 meter tape were used to control straight lines and horizontal distance, and red plastic flags attached to wire stakes were set along major north-side and east-west base-lines every ten meters. The D.O.T. surveyed centerline marker No. 47.00 was arbitrarily designated North 50, East 50 on the metric grid for the archaeological site (Figure 1-2). The east-west base-line was extended eastward across the drainage ditch which had its western edge at approximately North 50, East 100, and this was considered the probable eastern margin of the site.

For all subsequent work the site was considered divided into two-by-two meter squares which were each named by the coordinates of the southwest corner of the square. Each two-by-two meter unit was considered to be subdivided into four one-meter square quadrants which were named Northeast (NEq), Southeast (SEq), etc. More precise horizontal control was had by considering each quadrant divided into one-quarter quads of 50x50 centimeters each on a side, named Northeast one-quarter quad (NE$\frac{1}{4}$), of the Se quad, etc., or by taking provenience information which was exact to the centimeter. Generally, detailed trowelling by quarter-quad was employed in those areas possessing both intact soils and two or more flakes per quad, allowing exact provenience for flakes and artifacts discovered in situ, and a resolution of quarter-quad for materials found in the screened back dirt.

Gramly (personal communication) had suggested the use of 1/8" screens to aid in the recovery of concentrations of small flakes which might indicate activity areas. We developed a plan, based on the idea that we would be excavating much "sterile" ground in order to clear the construction area, to excavate using 1/4" mesh until we exceeded a count of one flake or artifact in any given square per square meter, after which a switch to 1/8" screen would take place for that square and adjacent ones.

In mid-June, with advice from Steven Cox and Bruce Bourque of the Maine State Museum, the following strategy decisions were made. (1) We would maintain a 2 m. grid divided into 1 m. quads over the whole site no matter how large it got, to enable us to record point provenience of material as found <u>in situ</u>, or to get a minimum resolution of 1 m^2 provenience on material recovered from screening. (2) We would conceptualize exploration of the site within the right-of-way in linear groups of excavation squares called "trenches" that would be 4 m. wide from east to west, and would extend across the whole width of the right-of-way

from north to south. (3) We would excavate alternate 4 m. wide trenches completely across the entire width of the right-of-way. Then excavate adjacent units to fill in areas where artifacts or flakes were found. Thus, the maximum distance between excavated points would be 4 meters. (4) We would dig some deeper testpits, of up to 2 m. depth, to test the hypothesis that Paleoindian cultural material was associated with B horizon orange soils, and that no buried soils existed.

As excavation progressed through June, ongoing area survey during lunch hours revealed a second Paleoindian site closer to Moose Brook, but well outside of the impact area. Surface collection on small patches of exposed sand suggested that the site, which we designated the Lamoreau site (Maine Archaeological Survey Site #23.13), covered an area of at least 60 meters in length. The Paleoindian artifacts and flakes recovered from the Lamoreau site are of the same range of raw materials as those we found at the Michaud site. Like the Michaud site, the Lamoreau site has an excellent view of the Moose Brook Valley. With concentrations of Paleoindian artifacts located in separate site locations within close proximity to the Moose Brook Valley, it seemed likely that the Valley was a primary focus of Paleoindian attention, perhaps for game animals sought by Paleoindian hunters. Though time and funds were not available for excavation of the Lamoreau site at that time, it has been nominated to the National Register of Historic Places and is now protected by the Maine Antiquities Law.

The information recovered from the Michaud site through June 21, 1985 was used to predict rates of excavation and an estimate of site integrity, which resulted in the development of a plan of work for mitigation and a budget. Approximately seven weeks passed while the paperwork establishing

permission for the excavation and transfer of funds was finalized, and transferring ownership of the artifactual material to the State of Maine.

Excavation began on August 15, 1985, and continued until October 23, 1985, generally with a crew of between 10 and 15 people (Plates 1-1 through 1-3). David Skinas, a graduate student from the University of Maine acted as fieldcrew chief.

Over 100 flaked stone artifacts, over 2,000 flakes and several fragments of calcined bone were recovered during the excavations at the Michaud site. Perhaps most important, however, was the fact that a great many of the artifacts were found in intact soils. With such a thin scatter of artifacts, specific activity areas could be delineated, and artifact associations are clearly defined.

Figure 1-1. Location of the Michaud site at Auburn, Maine, in relation to some other Paleoindian sites in New England.

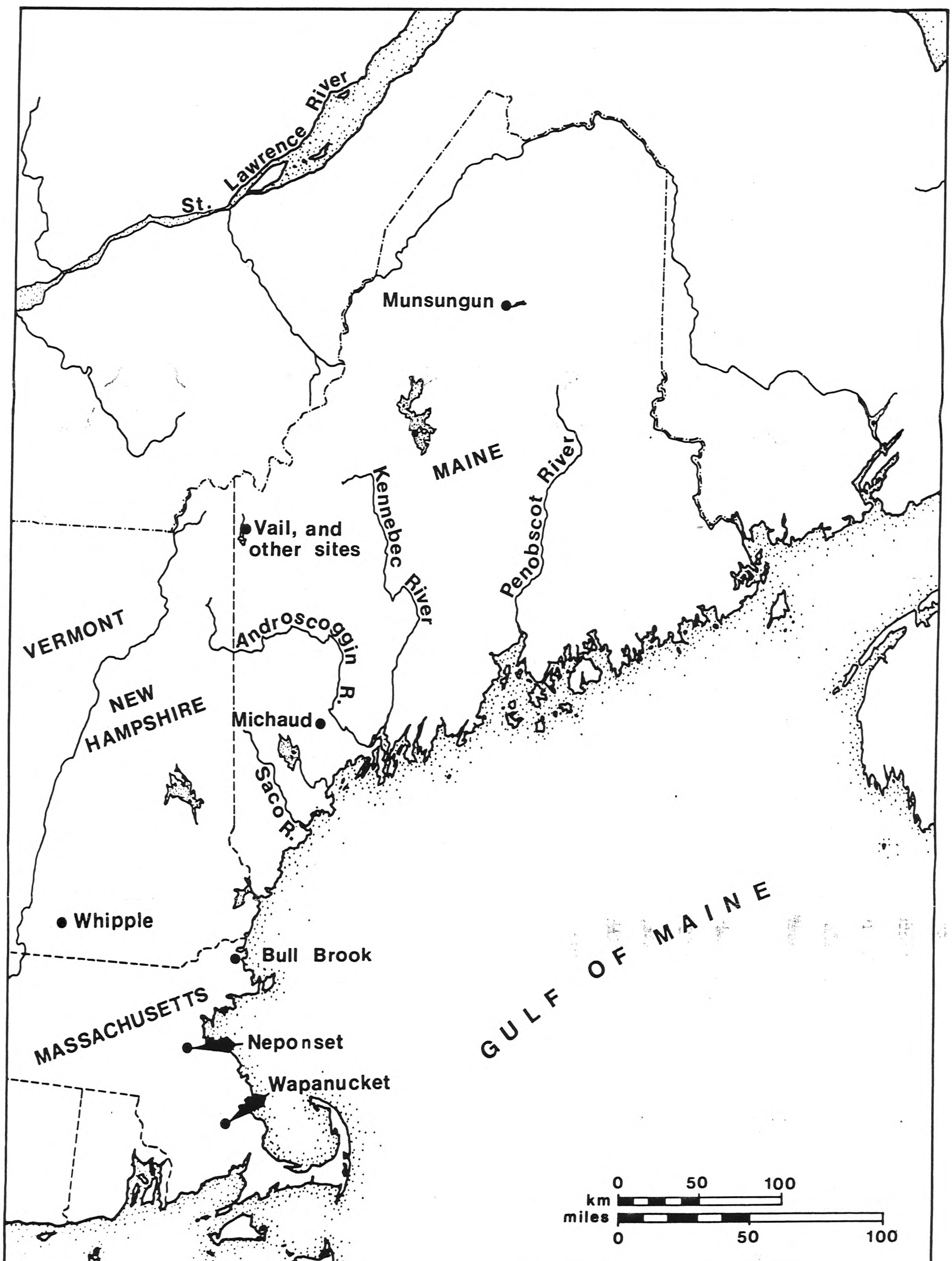

Figure 1-2. Topography of the Moose Brook Valley and Michaud site area south of Runway 4-22, and the excavated area of the Michaud site.

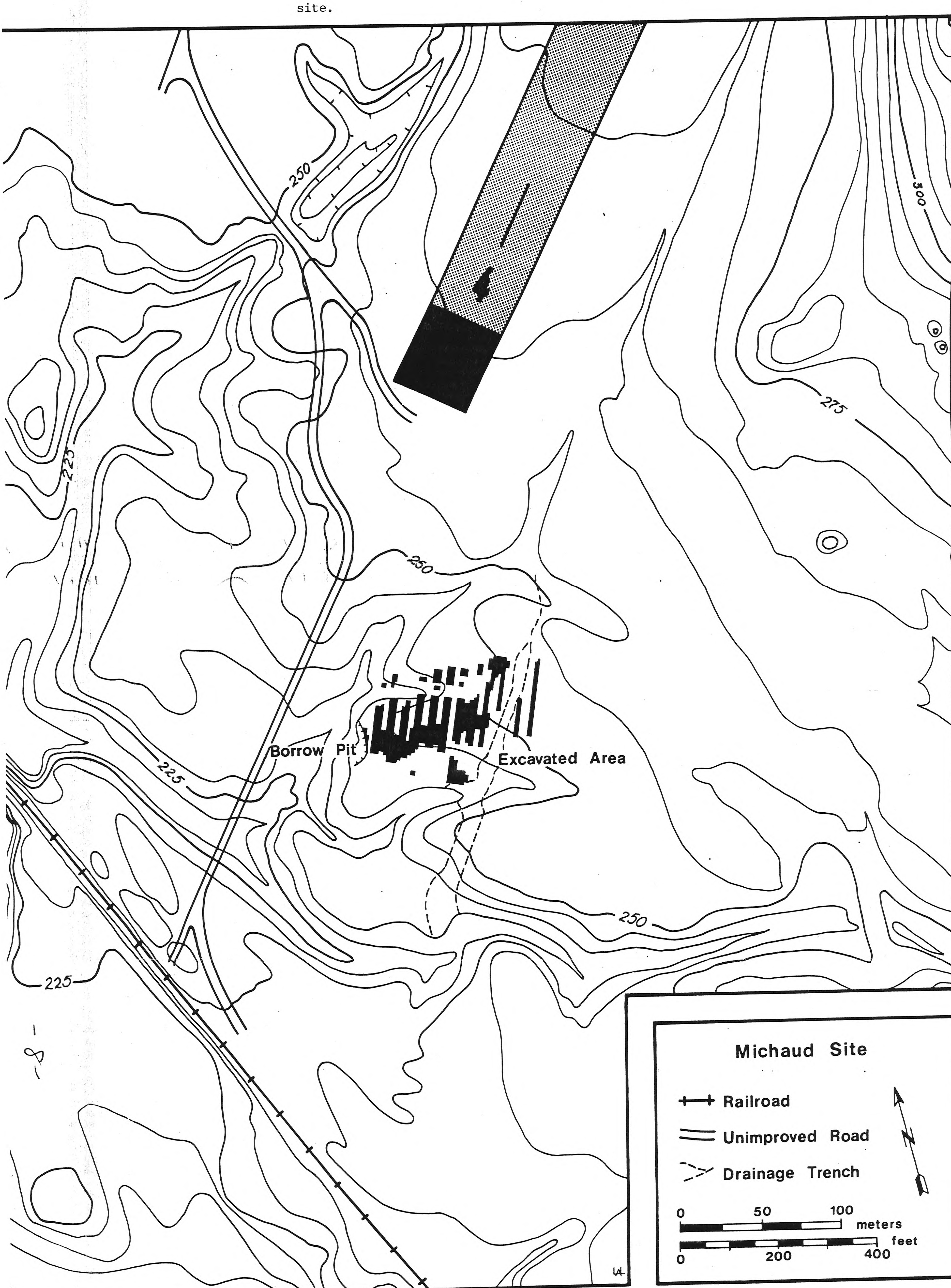

Figure 1-3. Metric grid and final limits of archaeological excavation imposed on plan for road construction and pre-existing drainage trench and borrow pit.

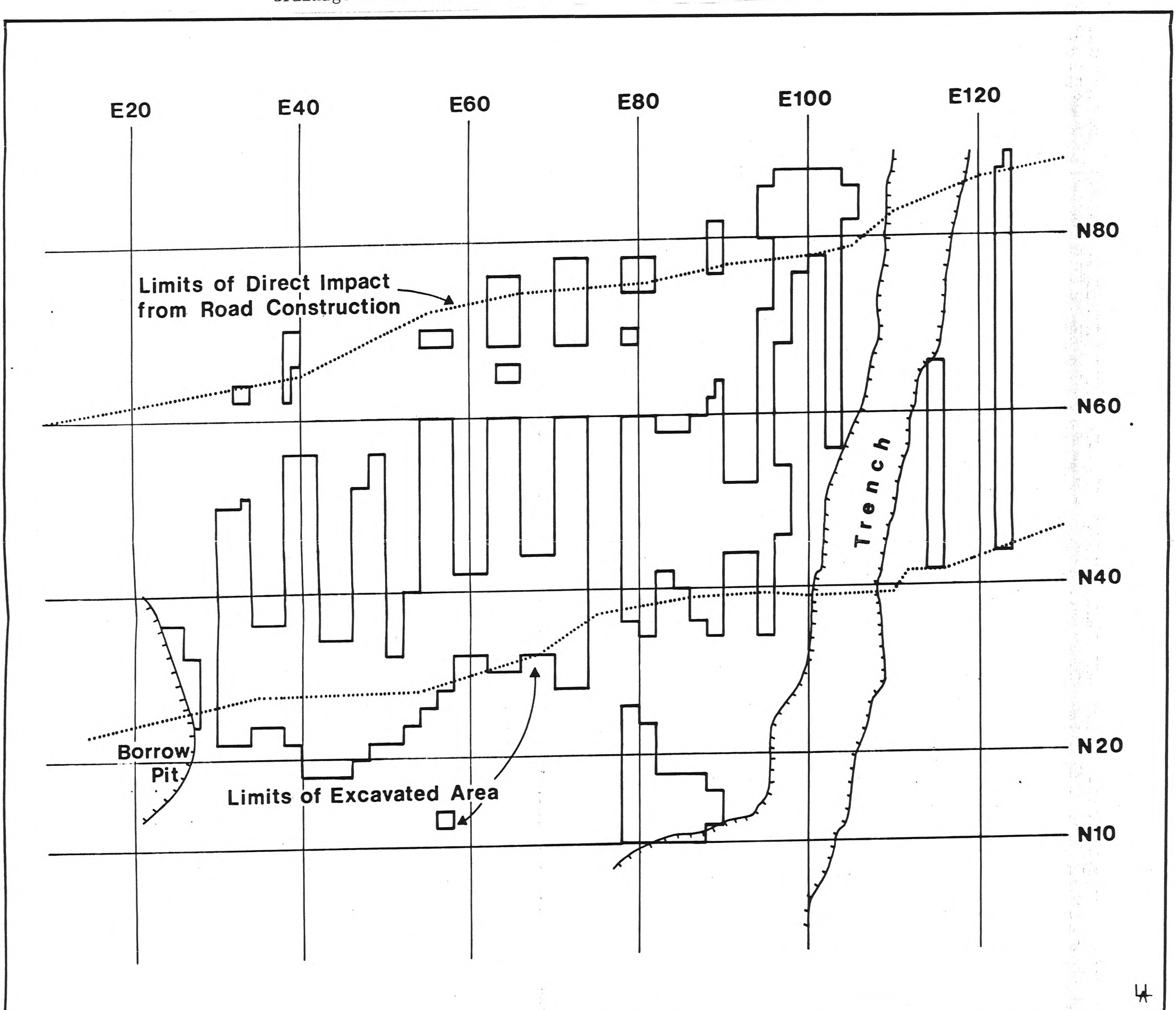

Plate 1-1. Foreground: Excavation in the N30E60 vicinity; left to right: Spiess, C. D. Cox, Skinas. Background: view south to Moose Brook; Hedden left, L. Collette right. Photo courtesy of Gregory Hart.

Plate 1-2. Excavation inside a lithic concentration. Foreground: A. Morss. Background left and right: L. LaBar-Kidd, E. Cowie. photo courtesy of Gregory Hart.

Plate 1-3. View southwest from N40E60 area, field office and lunch area. Counter-clockwise from foreground: A. Morss, H. Lamoreau, E. Cowie, D. Skinas, M. Hedden, A. Spiess, C. D. Cox, L. Collette, D. Brush, L. LaBar-Kidd (hidden).

Plate 1-4. General view of Michaud site area, behind truck in sand, center of photo. Looking southeast. Runway at left. Photo: elevation 500 feet, Spiess.

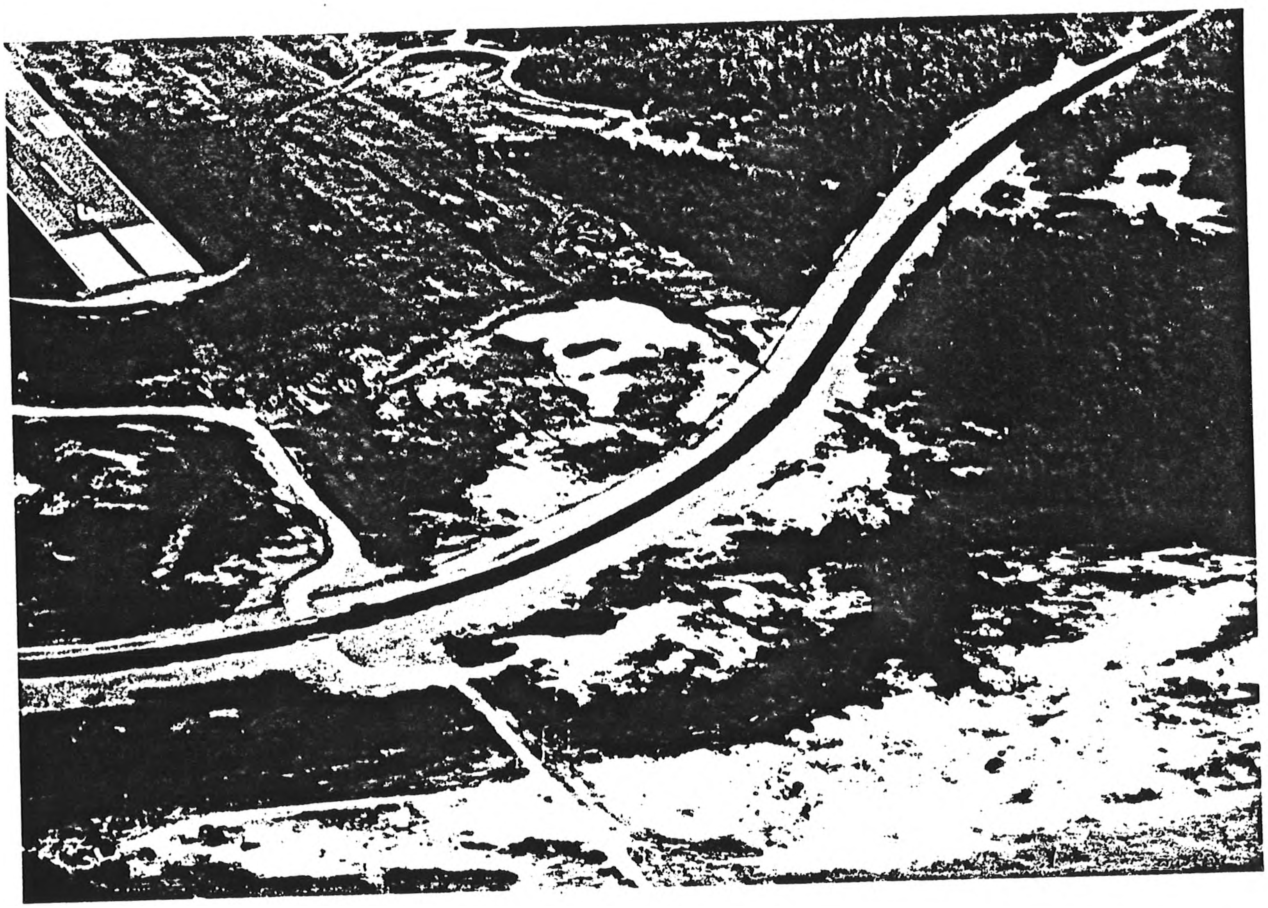

Plate 1-5. The Michaud site vicinity following road construction, August 1986. Photo: Spiess, elevation 800 feet.

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CHAPTER II: GEOLOGICAL CONSIDERATIONS

A. Landforms

The Michaud site is located at about 245 feet elevation just south of the Androscoggin River drainage and slightly southwest of Lewiston, Maine (Figure 2-1). The site is separated from the Little Androscoggin River, one kilometer northward, by a divide which reaches a height of approximately 280 feet elevation (Figure 2-2). Principally, however, the site lies just to the north of, and within sight of Moose Brook, which is a northwest-southeast flowing minor tributary of the Royal River. For approximately 20 km. west of the Moose Brook Valley, the topography consists of a mixed sand and gravel "penplain" of about 250 feet elevation. Moose Brook has its origins in small streams and channels which dissect this terrain, and which finally join to form Moose Brook, about 2 km. west of the airport.

At present, Moose Brook within the Moose Brook Valley contains extensive beaver bog. Sediment cores (see Chapter 5) may indicate the presence of long term bog conditions. Moose Brook flows southeastward to join the Royal River 1½ km. from the Moose Brook Valley. The confluence delineates the beginning of a gorge formation which is particularly pronounced at this early phase of the descent of the Royal River towards the coastal plane. The contemporary Royal River is an underfit stream meandering across the flat bottom of a broad, steep-walled valley. The steepness of the valley walls is particularly pronounced for some miles south of the Moose Brook-Royal River junction.

The Royal River flows nearly due south from its confluence with Moose Brook to the present coast at Casco Bay (Figure 2-1). During Paleoindian occupancy, when the Gulf of Maine was in relative regression compared with its present shoreline (Oldale, 1985), the Royal River would have continued its flow across what is now Casco Bay to the ancient coastline.

On a New England regional scale, the present shores of Casco Bay between Portland and Freeport represent the northernmost terminus of the New England coastal plain. The Royal River Valley is a north-trending, low elevation access to the interior from the coastal plain between two areas of near-coastal highland which extend between Portland and Gray, and Freeport and Lewiston. We suspect that even with the sea-level lower circa 10,500 B.P., the Royal River would still have been the northernmost interior access from the New England coastal plane. The north-south trending bedrock ridges that create the topographic highs east of Casco Bay currently extend seaward under water, or visibly as peninsular and island chains. Thus, we hypothesize that the Paleoindian sites in Auburn were purposefully placed within a major topographic corridor from the coastal lowlands into the interior.

B. Surfacial Geological Reconstructions

Geologists Thomas Lowell, Robert Oldale and Woodward Thompson each visited the site vicinity independently in an effort to decipher the sequence of events that placed the glacial till, clay and sand in the area of the Auburn Airport, and later reworked these deposits into the current landforms. Our reconstruction of the landform features in the vicinity of the Michaud site is as follows (Figure 2-3), based on the geologists comments, and the known glacial history of Maine (Borns et. al., 1985B).

Landform features linked solely to glacial advance and subsequent

retreat are evident in abundance. Two sets of glacial striations, scratches on bedrock created by the passage of the rock encrusted ice sheet, were noted by Lowell, trending in a south-southeasterly direction. A possible meltwater channel was recorded by Lowell flowing across the top of Christian Hill, dividing it into NW and SE peaks. Such a meltwater channel could have flowed at any time during ice retreat, when the hill was covered with ice, for example.

Two superimposed till units have been recognized for some time in southern New England, and more recently in northern New England (Koteff and Pessl, 1985). Diamicton is the generic term for an unsorted deposit of material often containing a wide particle size range. Lowell noted that the drumlin in the southeast corner of the Airport, just northwest of the Michaud site, was composed of two units of diamicton. The lower unit contains more clay and rocks whose well-rounded surfasces suggest that they may have been carried for substantial distances. In contrast, the upper unit contains less clay and more angular rocks of apparent local origin. A fist-sized cobble of dark red Munsungun-like chert was recovered from the lower diamicton unit on the south side of the drumlin. However, extensive walk-over of the lower unit and visual inspection of thousands of cobbles and boulders failed to reveal any more colored cherts. Moreover, the Michaud site does not contain any cobble cortex flakes, making it extremely unlikely that the till was used as a cobble chert source by Michaud site inhabitants. This lower till unit was probably emplaced by ice advance from a northwesterly direction (Tom Lowell, personal communication). It is not likely that a Munsungun chert cobble arrived from the northeast without multiple generations of glacial movement.

The marine transgression subsequent to glacial retreat (Smith, 1985) was responsible for other major depositional events in the area of the

Michaud site, at times in conjunction with sediments emplaced by glacial melt. A surficial examination of soils in the Airport vicinity revealed a sand-based planar topography, thought to be marine deltaic in origin, which is characterized by a relatively flat or gently sloped sandy surface. Sand ridge/mound topography, or wind-generated dunes (Lowell, personal communication), occur in certain areas of the sand plain.

Examinations of the dunes were conducted with the various geologists who visited the site. It was important to understand the temporal context of their formation in order to assess the possibility that portions of the site were obscured in hidden soil horizons or disturbed by recent soil deflation and re-deposition. One such examination was conducted by Spiess and Lowell, who measured several dune features in undisturbed pine woodland approximately 600 meters east-southeast of the Michaud site (Figure 2-3). Cross-sections seemed typical of low dune forms with shallow troughs between them. The dune center shown in cross-section at the left of Figure 2-4 trended northwest-southeast (145° true -325° true), probably perpendicular to the wind that formed it (McKeon 1972). From its northwest rise to its southeast terminous it is 77 meters in length. Soil development within the dune included a strong orange B_1 horizon of 36 cm. in depth, above a lighter orange B_2 horizon which graded into a yellow C horizon at about 53 cm. This intense soil development is of very similar intensity to that observed at the Michaud site, suggesting that the age of the soil development is similar. Realizing that the deep orange B horizon soils of the vicinity could form in as little as 1,000 years (Oldale, personal communication, 1985), more evidence was sought to determine temporality for the dune forms. A sand dune located near a gravel pit 2 kilometers west of the site, just inside the head waters valley of Moose

Brook, and lying on glacial till, provided an opportunity to test dating possibilities. The till-dune contact at the base of the dune exhibited no sign of soil formation on the till, while the top of the sand dune had the common, well-developed rich, orange B_1 horizon soil. Thus, not much time had passed between emplacement of the till (or its exposure to the air circa 12,000 years ago), and the formation of the dune on top of it (Oldale, personal communication).

Interestingly, areas of somewhat greater slope at slightly lower elevations, such as the Michaud site, appeared to be more susceptible to dune formation than areas which were more level and at a higher elevation on the delatic sandt plain. Lowell provides the following opinions on the origins and reworking of the sand in the Michaud site vicinity (personal communication, October 4, 1985):

> A preliminary examination of the sediments suggests that the sands have a bimodal origin. The sands rest upon silts commonly described as marine clay. The contact between these units appears to be gradational over an interval of some 50 cm. (Presumpscot Formation), with the upper portion of the marine unit containing couplets of sand and silt. The lower portion of the sand displays extensive horizontal bedding that most likely formed in a sub-aquious environment. The simplest model would be for deposition of the sands during the final stages of marine submergence. At some time subsequent to the withdrawal of water, wind activity appears to have remobilized the upper-most portions of the sand. Locally this sediment forms long, low linear ridges and irregular mounds.

Regression of the water is thought to have occurred at approximately 11,800 years B.P. (Smith, 1985: 38). This is the

same time frame that McKeon (1972) suggested for the formation of wind deposits in the Anson area of the Kennebec Valley. Here McKeon suggested that wind transport acted for a period of time less than 500 years.

No evidence observed during the field visit suggested that the wind deposits have become re-activated between the original deposition and historic times. McKeon (1972) found the same situation true for the Anson deposits. However, the possibility that small areas have at some time been re-activated cannot be ruled out.

Thus, it appears that primary dune formation occurred subsequent to the marine transgression but prior to vegetational cover, probably during a period of less than 1,000 years.

Concurrent with depositional events, it appears (Lowell, personal communication, 1985) that the broader Moose River watershed valley may have been cut either sub-aerially or sub-aquiously by run off from the sand plane west of the Airport either just before, during, or just after the sea was retreating southward (as the land rose) about 12,000 years ago. During the last 10,000 years, headwall erosion of the gullies along Moose Brook have steepened the valley walls, dumped sand and silts into the bottom of Moose Brook valley and possibly eroded some of the original dune edges perched along the right bank (southwest side) of the Moose Brook Valley.

Evidence from deep testing at the Michaud site failed to reveal any deeply buried Paleoindian artifacts (beside those disturbed by recent machinery), nor did we find any buried soils. Thus, apparently the dune surfaces in the vicinity, with possibly localized exceptions, have been stabilized by vegetation since before the Paleoindian occupation.

Thus, we can reconstruct the following chronological background for the Michaud site land forms:

1) Around 15,000 to 14,000 years ago, the glacial till deposits reached their final thicknesses, and local ice began to stagnate (Smith 1985).
2) Between 13,000 and 12,800 years ago, the glacial ice edge retreated inland past the locality, to be replaced immediately by the ocean, flooding the depressed land surface.
3) Between 12,800 and 11,800 years ago, the locality was submerged, a series of marine sediments were deposited, which became coarser and coarser as the land rose, the sea retreated, and the water shallowed as the coastline approached from further "inland". The last unit in this sedimentary sequence was a thick layer of fine sand.
4) At about 11,800 years ago, the sand deposits were left exposed by retreating ocean. Being unvegetated, they began to move before the wind into dune forms. Perhaps at the same time, or just before in shallow water, a broad channel was cut by water run-off from higher elevation that would later become the headwaters of Moose Brook.
5) Soon, the sand dunes acquired a vegetational cover and stopped moving. Perhaps initially a grassland, the dunes were later covered with trees, although the presence of a closed forest of pine probably post-dates the Paleoindian occupation.
6) Around 10,500 years, give-or-take a few hundred years, a Paleoindian band camped once or a few times on the vegetated

surface of the dunes.

7) With the exception of tree falls and perhaps localized forest-fire denudation, the sand dune surfaces were not disturbed until woodcutting and Airport maintenance activities in the late 1960s and early 1970s A.D. (The land was never farmed.)

8) Subsequent to that disturbance, very minor sand movements and dune formation began.

C. Soils in the Michaud Site Vicinity.

An initial assessment of the soils in the Michaud site vicinity was made on May 30, 1985, by Arthur Spiess, as part of the overall site definition following discovery by the MDOT materials geologists. The site is located on a relatively flat dune top, with large bowl-shaped "blow-outs" and dune ridges scattered among areas vegetated by grasses and occasional associated scrubby bushes. Spiess made an initial soil description based on a stratigraphic cut in the side of the 1970 drainage ditch at S10E70 at this time.

A more formal soils analysis was undertaken by James Balog and Geoffrey Gordon of the Resource Assessment Service, Orono, Maine. Their work included an examination of several deep testpits within the confines of the site, and excavation of two off-site testpits (off-site North and off-site West, see Figure 2-5). The soil sequence observed by Balog and Gordon is as follows. (See Appendix 1 for details, see Figure 2-6 and Table 2-1). The site surface is a mosaic composed of "blown-out" areas with exposed lower horizon soils, small raised dunes in the form of ridges, and areas covered by low vegetation.

Table 2-1.

S10E70 Soil Profiles, with Munsell Colors. All Developed on Fine Sand.

	Depth	Description
Layer 1	Above 0 cm.	Grass and loose, dry wind-blown sand (10YR6/6, brownish yellow).
Layer 2	0-41 cm.	Light wind-blown sand with grass roots, minor textured bedding evident. Recent wind-blown material, 10 YR6/6.
Layer 3	41-46 cm.	A1 and A2 soil horizons of original forest podsol. Black and dark brown with lump charcoal from forest burning. 10YR3/3 and 10YR2.
Layer 4	46 cm. ±	Discontinuous, 0-2 cm. thick E horizon (10YR7/1, light grey).
Layer 5	46-61 cm.	B1 horizon. Deep orange, with some sand particles lightly cemented into large chunks by iron oxide. 7.5YR6/8, reddish yellow and 7.5 YR5/8, strong brown.
Layer 6	61-75 cm.	B2 horizon. Gradual transition from above B1 horizon to a very light "orange" (10YR6/8, brownish yellow).
Layer 7	75-134 cm.	C1 horizon. Tan sand, gradual transition from B2 level (2.5YR7/8, yellow).
Layer 8	134-165 cm.	Grey soil. Abrupt upper and lower boundaries. Contains some small, hard iron (?) concretions in localized bands (5YR6/1, grey and 7.5YR5/8, strong brown).
Layer 9	165-182+ cm.	C2 horizon (bottom of section). Buff sand (2.5 YR7/8).

The sand which forms this surface, hereinafter described as a dune field, is a very recently redeposited wind-blown sand. Prior to the destabilizing affects of land clearing circa 1970, the upper-most unit was an A horizon of brownish-black humus which is currently preserved in rare patches on the site. Immediately underlying the A horizon soil is an E horizon gray, thin podsol. This podsol layer was apparently discontinuous in the pre-1970 forest soil; after that, podsol lenses deflated into raised areas surrounded by deflated sand, because they are slightly resistant to the recent wind erosion. Immediately underlying the podsol was a B_1 horizon orange subsoil containing an occasional concentration of iron concretions. Iron concretions as seen at the Michaud site were generally lumps of sand which were lightly cemented with iron oxide. The B_1 horizon graded downward into a lighter orange layer, designated the B_2 horizon. this layer in turn graded into a yellow to olive-brown C horizon sand. The A horizon, when present, ranged from 1-5 cm. in depth, and the E horizon, again when present, ranged from 9-10 cm. in depth. The combined depth range for the B_1 and B_2 horizons was from 14 to 51 cm. The C horizon averaged approximately 125± cm. in depth before mixing with gray particles of silt or clay. Underlying the C horizon sand was a gray layer, almost gley-like, which had a high clay content and often included many light orange, small, and tightly cemented sand concretions. Where it was exposed in the wall of the drainage trench, this gray layer was approximately 20 cm. thick; it was exposed on the surface of the site in the bases of the deepest "blow-outs". Gordon and Balog postulated that the gray layer underlying the C horizon may have been a gley or reduction soil layer associated with a standing water table at some time in the past, contrary to the current drainage patterns in the valley and the fact that the sand on the site itself appeared to be extremely well drained.

Dr. Woodward Thompson, quarternary geologist for the State of Maine, identified the gray layer underlying the C horizon as the uppermost clay rich layer in a stratified series which alternates between depositional units composed of predominantly clay or predominantly sand. This depositional sequence apparently formed during the Presumpscot Marine Transgression, and both the clay-rich and sandy units appear to have marine origins. This sequence is best exposed at the south end of the site in the artificial drainage trench.

Throughout the first three weeks of the dig we encountered frequent and puzzling soil stains in areas where the rich orange B_1 soil horizon was intact. Characteristically, these "features" exhibited a much thicker white E soil horizon from which soil chemicals had been leached, and a very deep orange-red, intensified B_1 horizon soil halo or chemical reprecipitation. Many of these "features" were lobate or elliptical in shape (Figure 2-7), about the correct size to have been Indian fireplaces. The vast majority, however, were round and about 20 cm. in diameter in horizontal plan, thinning to a blunt or pointed end some 15 to 25 centimeters deeper in the sandy soil. These soil discoloration features seemed most likely to be the chemical "shadows" of some wooden or organic objects that had rotted in place, changed the local soil pH, and intensified soil chemical movements. The 20 cm. diameter, blunt or tapered base objects mimic exactly the shape student archaeologists are taught to recognize as the "shadow" of a former structural post (a "post-mold" or "post-hole"). Consequently, we were faced with the dilemma that those myriad soil features were remnants of Paleoindian structures; yet the soil chemicals seemed to be so mobile that we were not sure that such a chemical shadow could survive 10,000 years in the sandy soil. Approximately 3 weeks

into the excavation an excavator found a perfect "post-hole" shaped soil discoloration in square N30E26, with slightly less intense than normal soil colors associated. Importantly, the circumference of the elluviated soil horizon still retained partially rotted fragments of poplar root bark. Double-checking the root form on some of the small poplar trees growing adjacent to the site showed that, indeed, their main root extended a short distance into the soil before breaking up into much finer roots with much thinner bark. Evidently, rotting of the main tap root produces enough organic acid to cause the local, post-hole shaped soil discoloration.

Drs. Balogh and Gordon, while digging off-site soil testpits, located 3 more of these post-hole like features in a poplar-wooded area. Evidently, such features were common in the normal soil, and not associated with the Paleoindian occupation in any way. The larger, irregular soil discolorations were associated in a few cases with rotting root structures of larger trees.

E. Modern Disturbances and Artifact Context.

The land in the area of the Michaud site had never been farmed. Local long-time residents could remember the early 20th century could not recall a farm in the area. Pine trees in the vicinity of the site, outside the clear zone, are in excess of 100 years old, indicating that they would have germinated at about the time of the Civil War, long before Maine's agricultural decline would have made abandoned fields commonly available for re-growth.

And, finally, the soils on the Michaud site itself, when not disturbed by a bulldozer or the wind, were intact and unplowed. Thus, apparently, the land use history of the site itself can be associated solely with the Airport development.

An airphoto dated April 29, 1951 clearly shows the site area covered with a bushy woods, probably pine and poplar (Plate 2-1). A close-up of the site area (Plate 2-2) has been retouched to emphasize the intermittent stream drainage pattern in the site area. It also shows the presence of a wood road, which cuts across the area northwest to southeast, passing south of the Michaud site. An airphoto dated 1969 shows that the site area had been cut (logged), though visible soil disturbance was limited to short, narrow skidder-blade scrapes at random angles, widely scattered across the site.

A 1979 airphoto clearly shows the extent of disturbance of recent activity in the clear zone (Plate 2-3). The new north-south drainage ditch has been built paralleling the runway. The intermittent streams that had run northeast to southwest across the end of the runway have been cut off by the new drainage ditch, and their channels filled with sand scraped off the surface by a bulldozer. Much of the Michaud site area remains vegetated and undamaged in the dark "hourglass" shape just west of the new drainage ditch. The "waist" area of the dark shape corresponds with the N60 to N70 grid area, where the intermittent stream bed was filled. The area west of what would eventually be designated E20 on our grid has been heavily graded.

A photograph taken on November 19, 1983 clearly shows the mowing pattern in the grassy field areas of the clear zone (Plate 2-4). Any sand-covered areas appear as light areas (due to a thin snow cover?). The southern (downstream) end of the new drainage ditch has begun to form a semi-circular erosion feature. The northern edge of this feature cut into our N10E80 site area. Due west of it is visible the semi-circular borrow pit at the western limit of the site (N20E30). The ground between seems to be mostly sand, but we found in fact that much of it retained intact soil

buried by dune deposits.

The record of soil presence recovered from excavation, or coring along transects during elevation surveys, has been used to produce a map of the site area showing areas where wind erosion has deflated the surface down into the C horizon sand or, further, to grey horizon sand (Figure 2-8). These areas should have yielded surface exposed artifacts or flakes, had any been present in the soil layers above the C horizon. Also shown in the same figure is the presence of wind-blown sand cover before excavation, in most cases protecting nearly intact soil sequences underneath.

Much of the excavated area contained nearly intact or intact forest soils (Figure 2-9). A small proportion of the soils protected under the dunes retained an intact A horizon. The deep color of the B_1 horizon was common, while B2 horizon, or "indeterminent B" (Basal B_1, transitional to B_2, usually), covers the majority of the excavated area. Wherever B horizon soils are intact, either by themselves or under A and E soil layers, we would expect to have found Paleoindian flaked stone material had any been dropped on the spot by the sites inhabitants. Thus, "negative" evidence in these areas is considered solid. Figure 2-10 reconstructs the pre-1960s tophgraphy.

The extent of bulldozer disturbance, and correspondingly of soils left intact, can be seen on the profiles that follow. Figure 2-11 shows the truncation of the original soil surface as it rises to the northward in a sterile portion of the site (N44 to N50, E124). The effect of the bulldozer scrapes in piling up the A horizon soil can be seen at N48, and the former natural depression was covered with wind-blown and bulldozed soil.

Figure 2-12 reveals the slope of the south side and center of the

natural drainage ditch that formerly ran across the N60 area of the site. An intense soil anomaly from a rotting/burned tree stump can be seen in the depth of the E horizon soils at about N55. The approximate depths of three flakes and one artifact (23.12.00308, sidescraper) from adjacent squares have been "projected" onto this profile. In the deep part of the drainage trench, apparently the flake and sidescraper were in the first fill to be pushed into the ditch, because they ended up near the bottom just above the intact A horizon. No Paleoindian cultural material was found in any of the intact soils on the sloping sides of the drainage trench.

Figure 2-13, along the E81 line from N10 to N14 reveals the slumping and surface erosion on the lip of the 1970s north-south drainage ditch. Flakes and microflakes were commonly found on the surface or in wind-blown sand, or in the top 5 cm. of C horizon sand in the N10 to N13 area. In square N12E80, we recovered twenty-seven flakes or microflakes and one artifact (23.12.01463), in the B2 horizon sand. Two microflakes had worked their way down into the top of what we considered "C" horizon sand.

Figure 2-14 comes from one of the most intact areas of the site: N24 to N28 along E52. The area is characterized by thick B1 horizon with remnant A and E horizon soil patches that escaped bulldozing. At the northern end of the profile is a thin layer of disturbed soil composed of a mixture of A and B horizon soils. The whole sequence has been capped by a wind-blown dune deposit, thickening toward the northward. There were 219 pieces of flaked stone and fire-cracked rock recovered from squares N24E50, N26E50 and N26E52 adjacent to this profile. Their proveniences are presented in Table 2-2. The vast majority of the cultural material in these squares comes from the B1 and B2 soil horizons. Where present, the patchy A and E soil horizons yielded a few pieces, while the wind-blown and disturbed soil layers yielded nothing. Indeed, all of the material culture

from these squares was "in situ" in intact soil levels, of which approximately 2/3 was found in the B2 soil level. In one localized area in the NE and SE quads of N26E50, a few flakes (n = 7) and microflakes (n = 11) were found down into the C horizon. Perhaps these represented a long vanished pit feature, or a particularly deeply biologically disturbed piece of soil (via fauna or flora action). Most of the materials in the N24-28 E50-54 area were chert fragments.

In the N34-38 E58-62 area Figure 2-15, many more of the materials were made of rhyolite (rfnp), larger flakes were more common compared with microflakes, and the B_1 soil level had been disturbed to a greater extent than in the N24-28 E50-54 area. The wind-blown sand only yielded one flake. The disturbed soil in this area, however, consists of A and B horizon soils that had been churned by bulldozer passage (left-hand edge of profile). In N34E58 they yielded four artifacts, but artifacts that we feel are near their original provenience due to churning rather than a scraping and moving nature of the disturbance. The B1 and B2 soils again yielded the vast majority of cultural material, with a very few pieces found down into the C horizon. In this area, however, more of the material appears to come from the B1 horizon than from the B2 horizon.

This pattern of cultural material being found overwhelmingly in B_1 or B_2 horizon soils, or in disturbed soils derived from B horizon soils, repeated itself wherever we found cultural material on the site.

Thus, we feel justified in having made our original assumption that the artifactual material was associated with one shallow soil development series on a surface that had been stable from the time of deposition (circa 10,500 B.P.) until it was disturbed during the 1970s.

Table 2-2.

Provenience of Cultural Material from the N24-28E50-54 Area
Number of Artifacts (A), flakes (f), and microflakes (mf)

Square and Quadrangle

	N24E50	N26E50				N26E52			
Soil Layer	NEq	NE	SE	SW	NW	NE	SE	SW	NW
wind-blown		0 0 0							
distrubed		0							
A		0							1 A
E		0							2 f
disturbed/ B1 interface		2 f 5 mf				1 mf			
B1	1 mf	5 f 17 mf	1 A 10 f 14 mf		6 mf	1 f 2 mf	2 f 2 mf	1 f 17 mf	1 A 2 f 43 mf
B1/B2 interface		10 f 8 mf							
B2		1 A 25 mf 30 mf	10 f 8 f			2 A 3 f 3 mf		2 A 17 f 76 mf	5 A 8 f 93 mf
B2/C interface									1 f
C		3 f 10 mf	4 f 1 mf			1 mf			

Table 2-3.

Provenience of Flakes and Artifacts from the N34-38E58-62 Area

Artifacts (A), flakes (f), microflakes (f)

	N34 E58				N36 E58				N34 E60				N36 E60			
Soil Layer	NE	SE	SW	NW	NE	SE	SW	NW	NE	SE	SW	NW	NE	SE	SW	NW
wind-blown(wb)							1f	3f								
disturbed	1A	2A		1A	2f 3mf											1f
wb/B1 interface															1f	
B1	6f 1mf		1A 2f 7mf	3A 2f 7mf	2A 18f 67mf	6A 15f 12mf	1A	32f 41mf				1A 16f 6mf	1f	3A 5f	28f 23mf	1A 2f
B1/B2 interface				2A										1f		
B2	1f 7mf			1A 0f 6mf	3A 65f 111mf	1A 15f 31mf	1mf	7f 19mf							9f 6mf	1mf
B2/C interface					1f 5mf											
C					4mf			1mf								

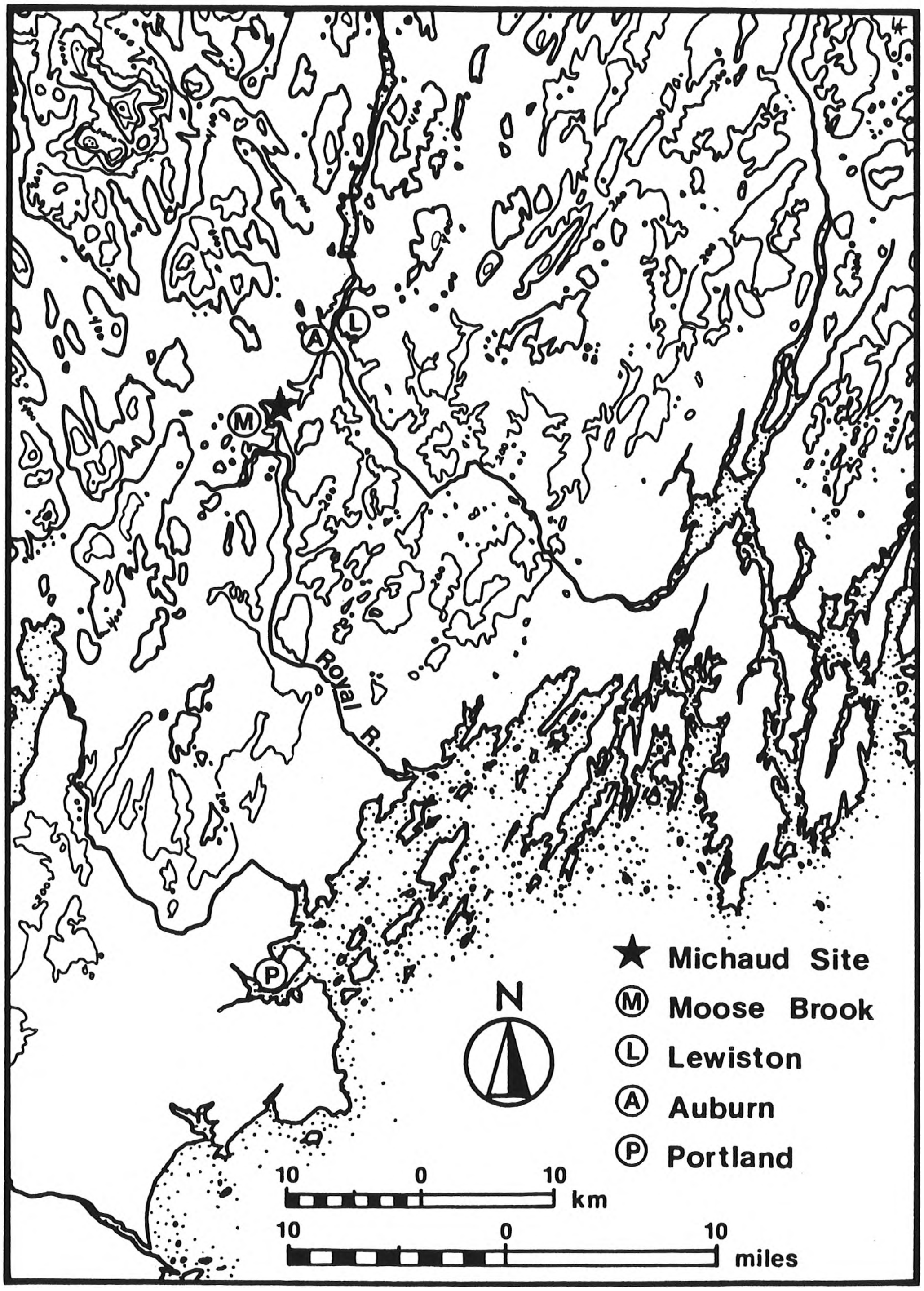


Figure 2-1. Location of the Michaud site relative to major tophgraphic trends in central Maine.

Figure 2-2. Topography around the Auburn-Lewiston Airport, and location of the Michaud site. The large hill reaching 400 feet elevation across the railroad tracks from the site is Christian Hill.

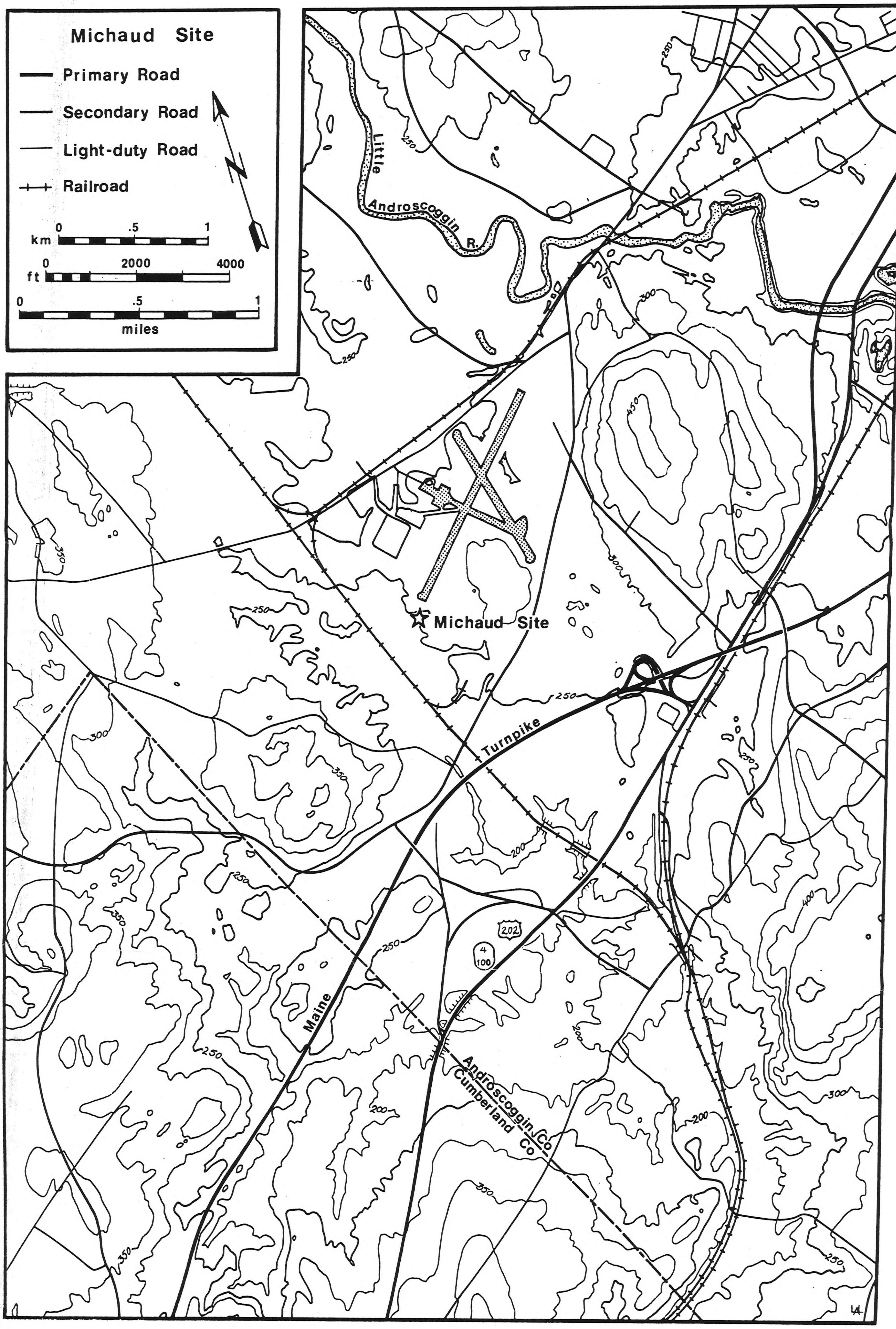


Figure 2-3. Surfacial geological observations in the Michaud site vicinity, made by Thomas Lowell.

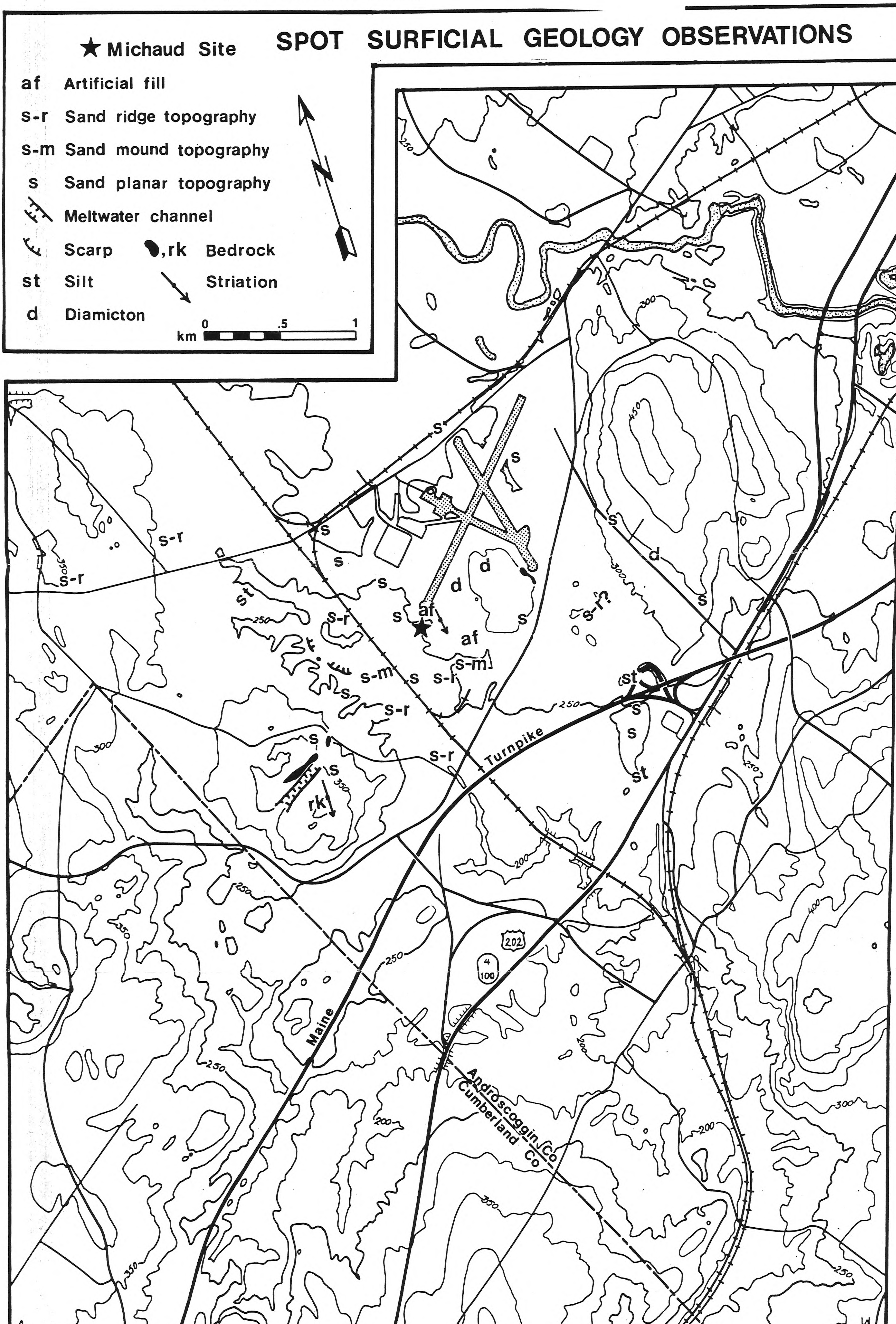


Figure 2-4. Sand dune topography 600 meters east-southeast of the Michaud site, upper view with vertically exaggerated scale.

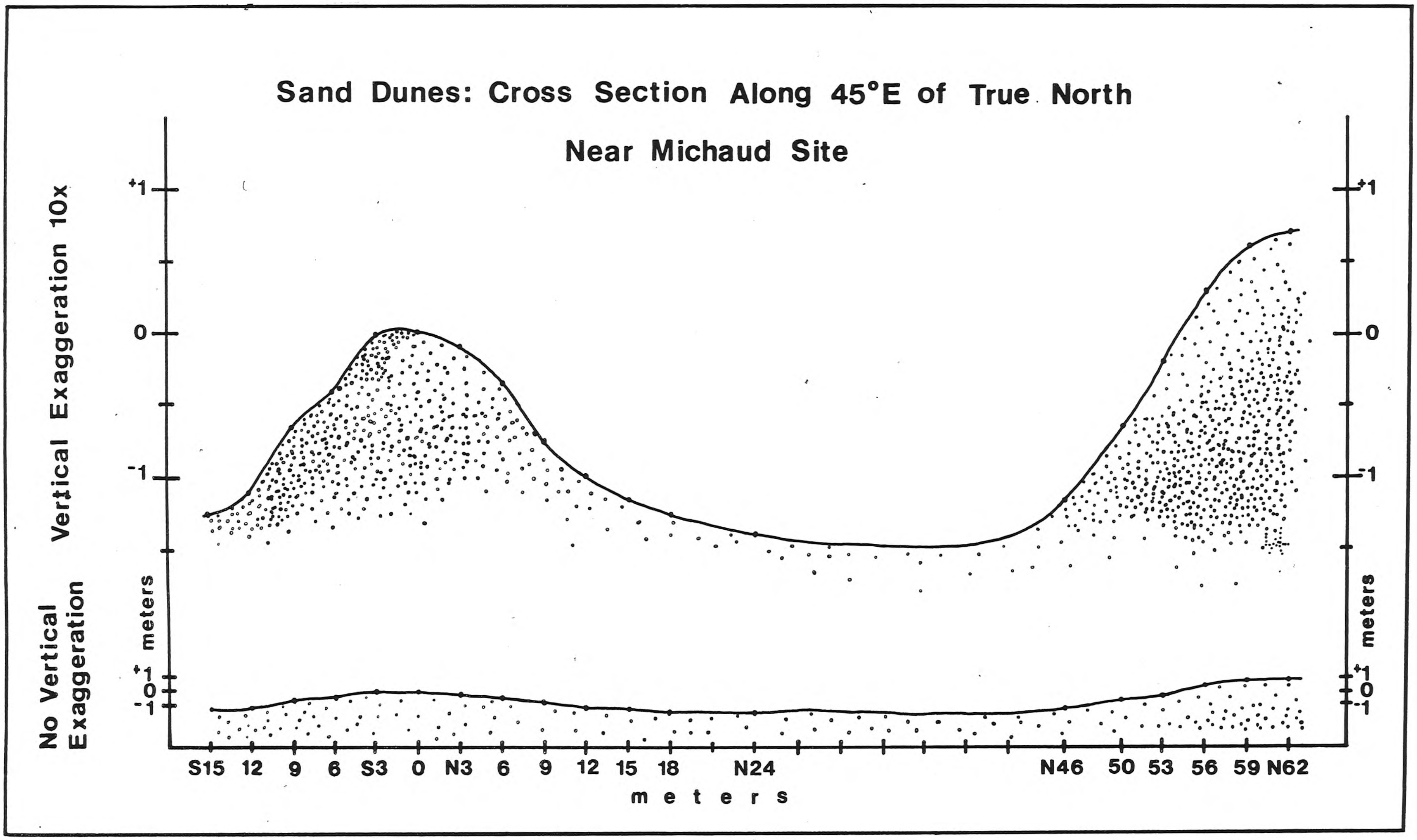


Figure 2-5. The location of off-site north and off-site west soil testpits.

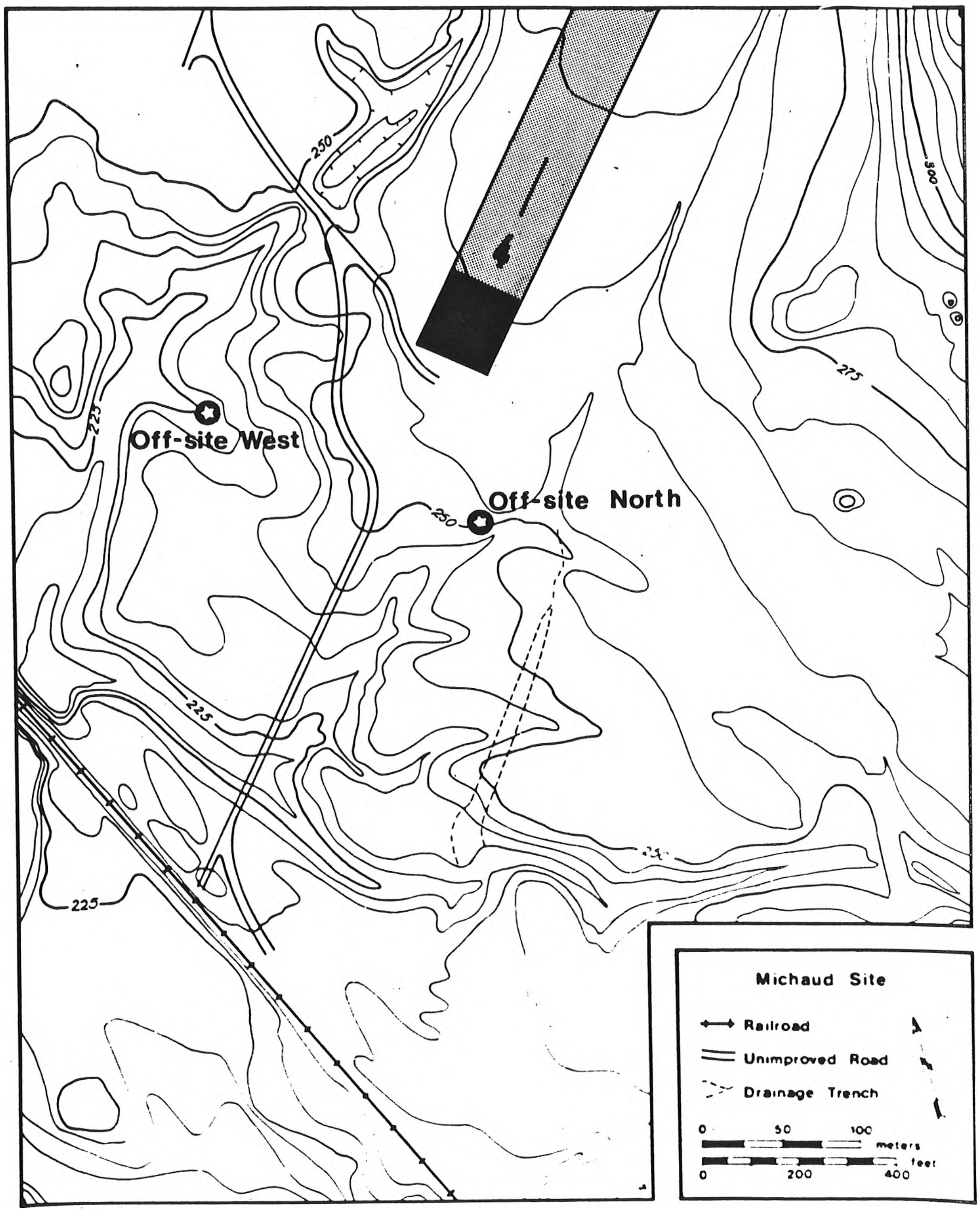


Figure 2-6. Generalized soil sequence in the S10E70 area. See description in Table 2-1.

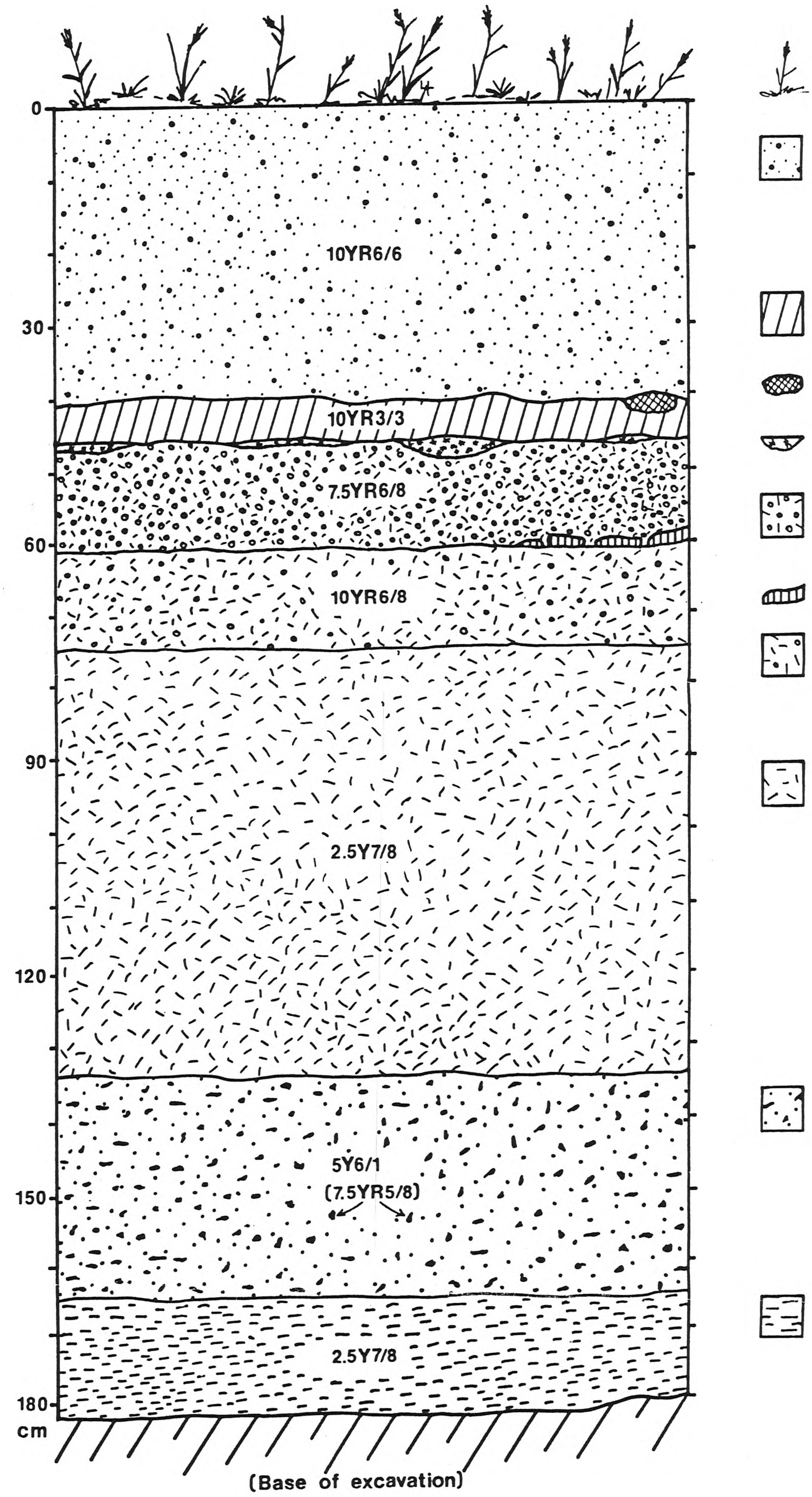


Figure 2-7. A "false feature" caused by localized ~~channel~~ chemical movement associated with tree root decomposition, designated Feature 12, in plan and section view.

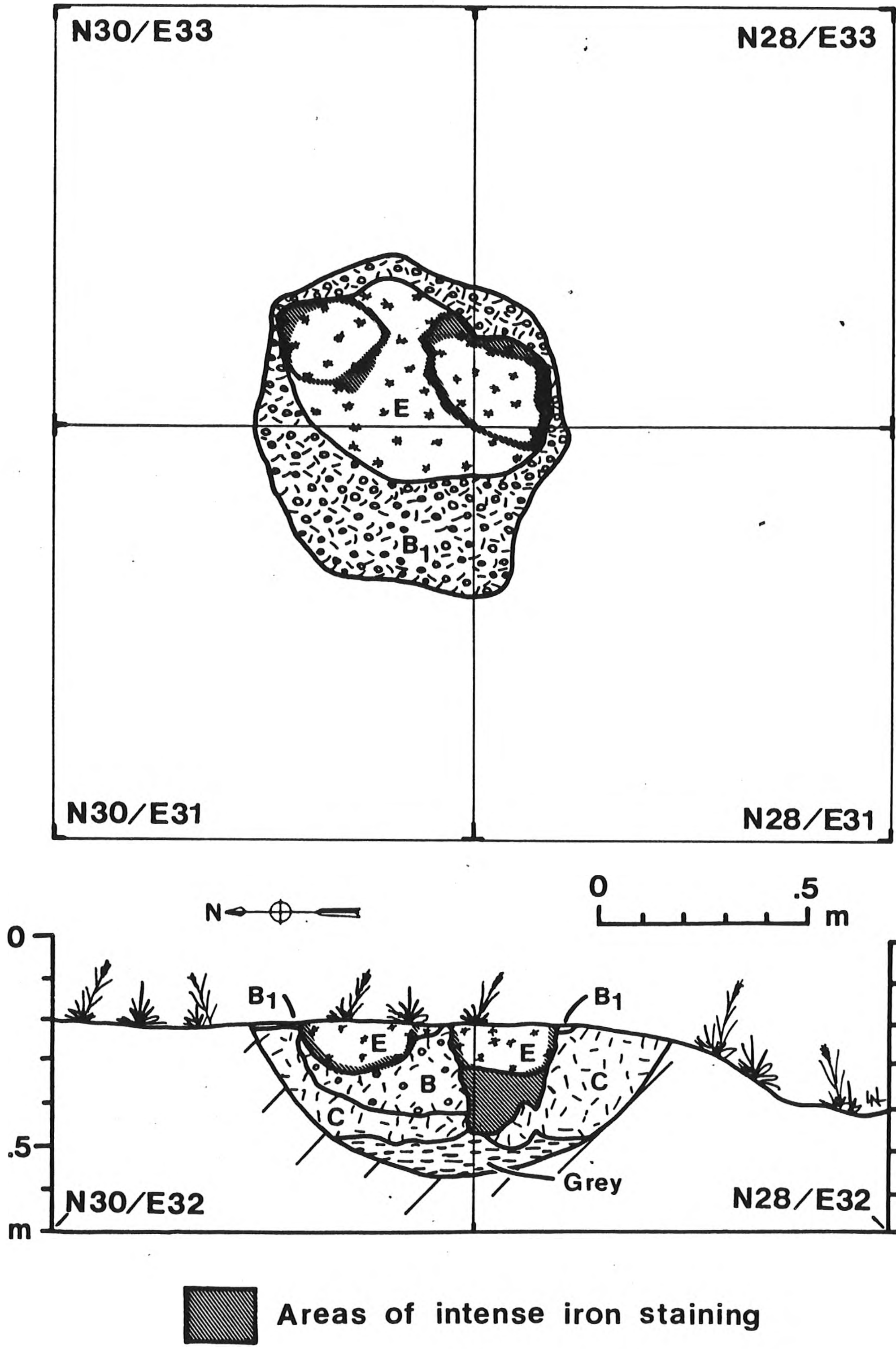


Figure 2-8. Fall, 1986 topography at the Michaud site (20 cm. contour intervals) showing areas of deflation (C horizon or grey soil) and deposition (wind-blown sand).

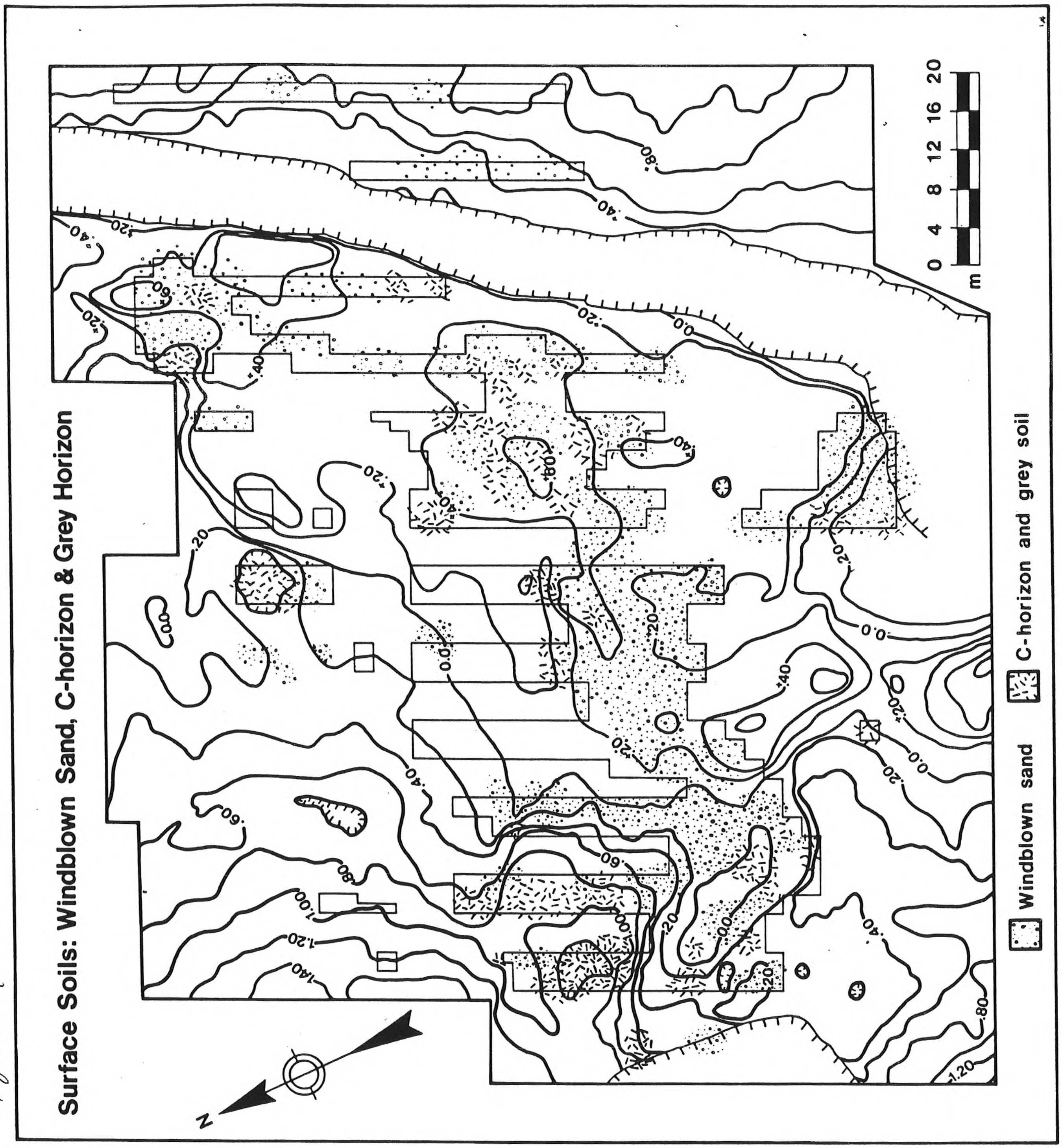


Figure 2-9. Upper-most intact soil layers on the Michaud site. Only the bank areas within the limits of excavation were totally deflated.

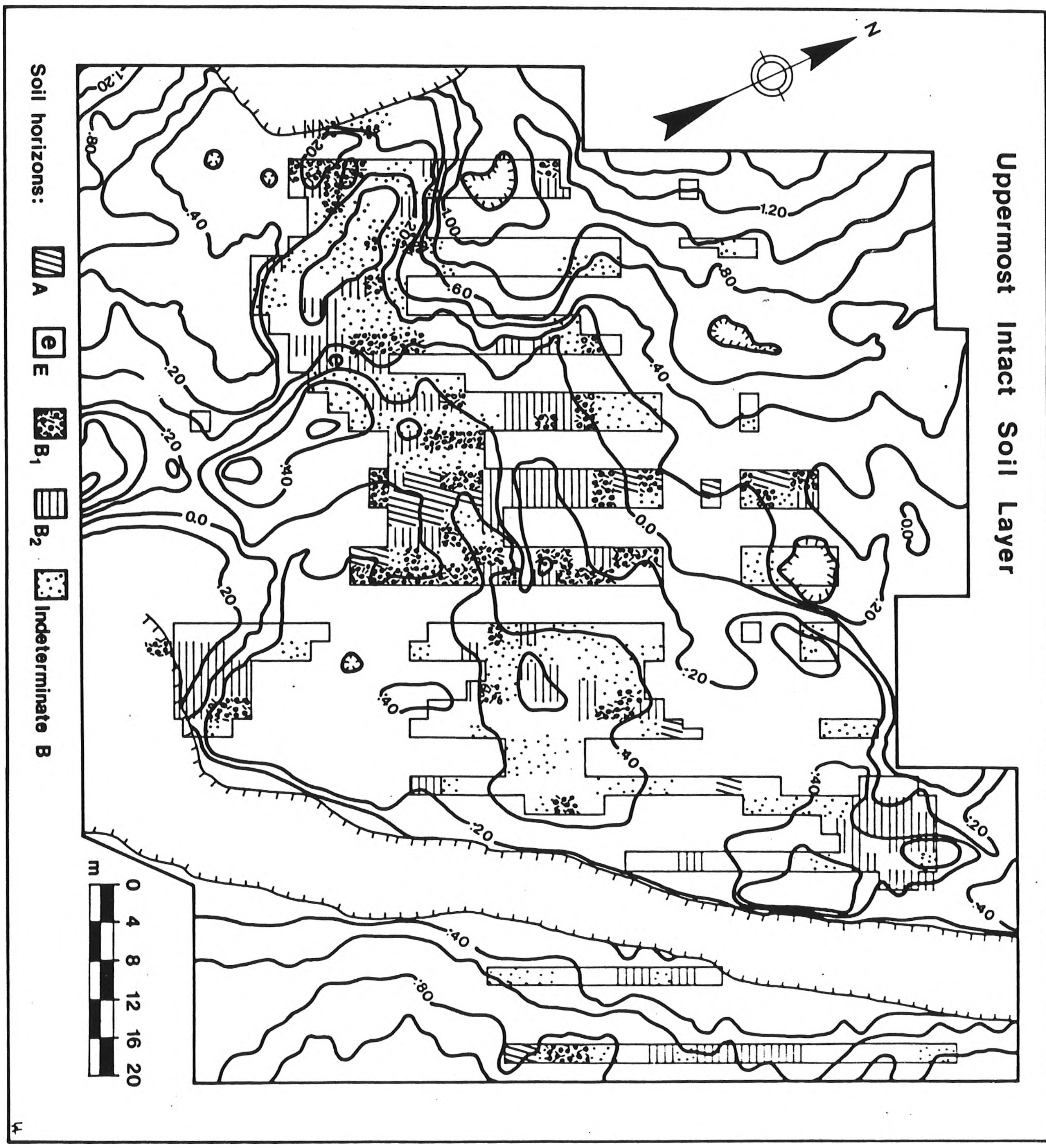


Fig 2-9

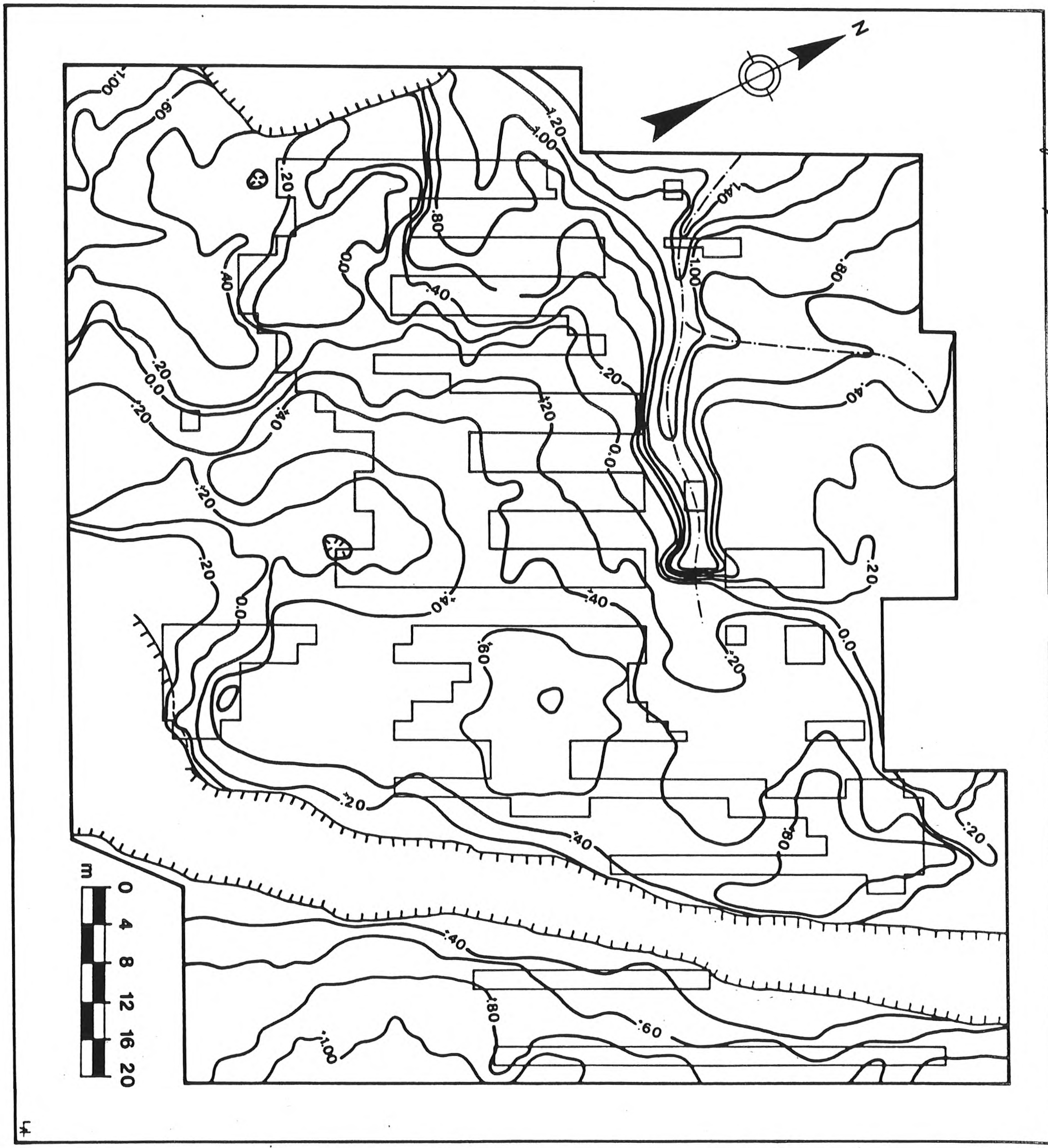


Figure 2-10. A reconstruction of site surfact topography before disturbance began circa 1969 based on pre-dig topography, intact soils and average soil depths. Note the drainage ditch with head-wall erosion in upper left.

Fig 2-12

Profile 2
N57E56 → N54E56 E wall
(A. Jackson pg: 3-625)
Art: "Trench E. Side"
(No other rels)

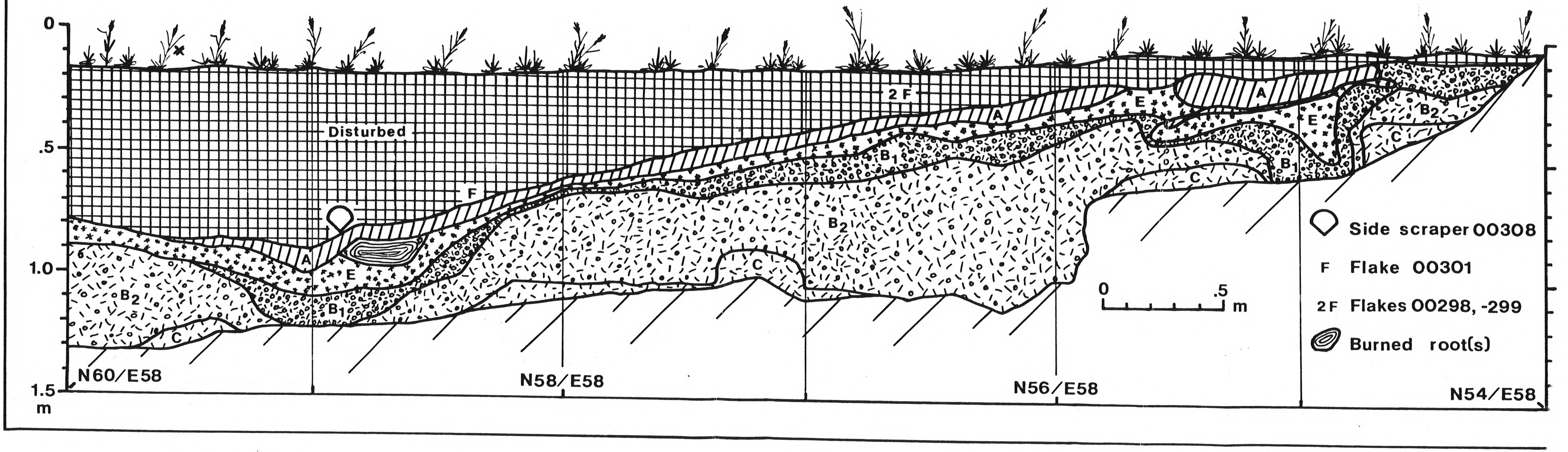


Figure 2-12. Slope of natural drainage ditch at E58.

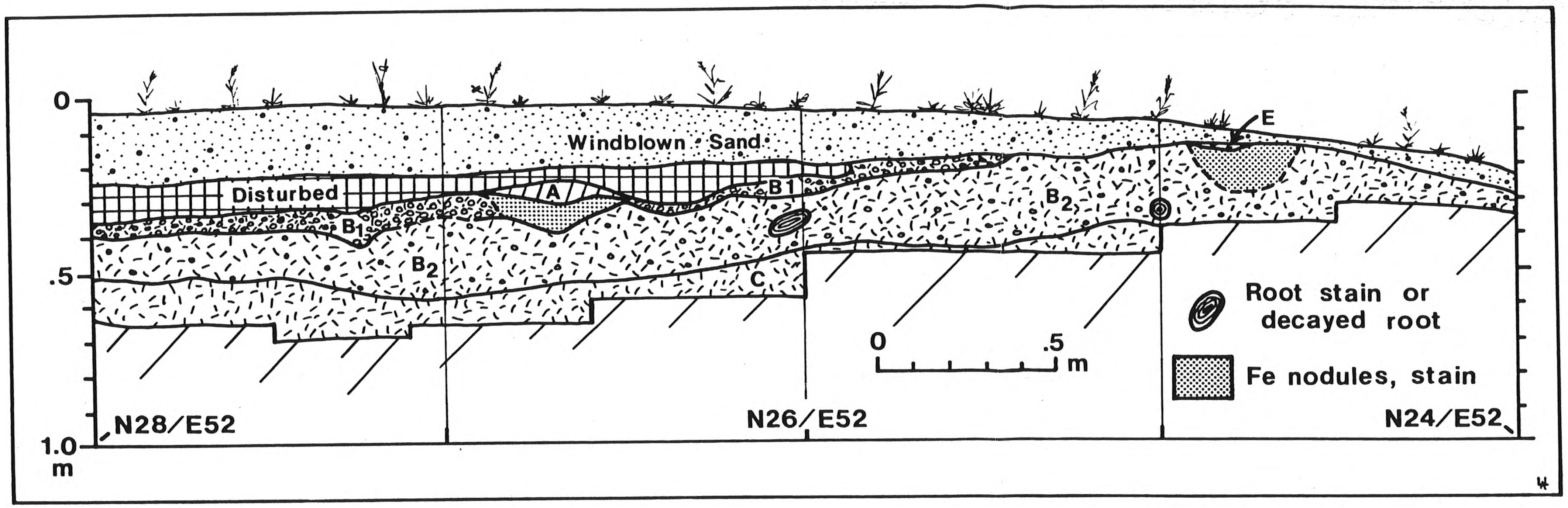


Fig 2-14

Figure 2-14. Relatively intact soils to left. Disturbed area has been mixed by bulldozer treads, with minor horizontal movement.

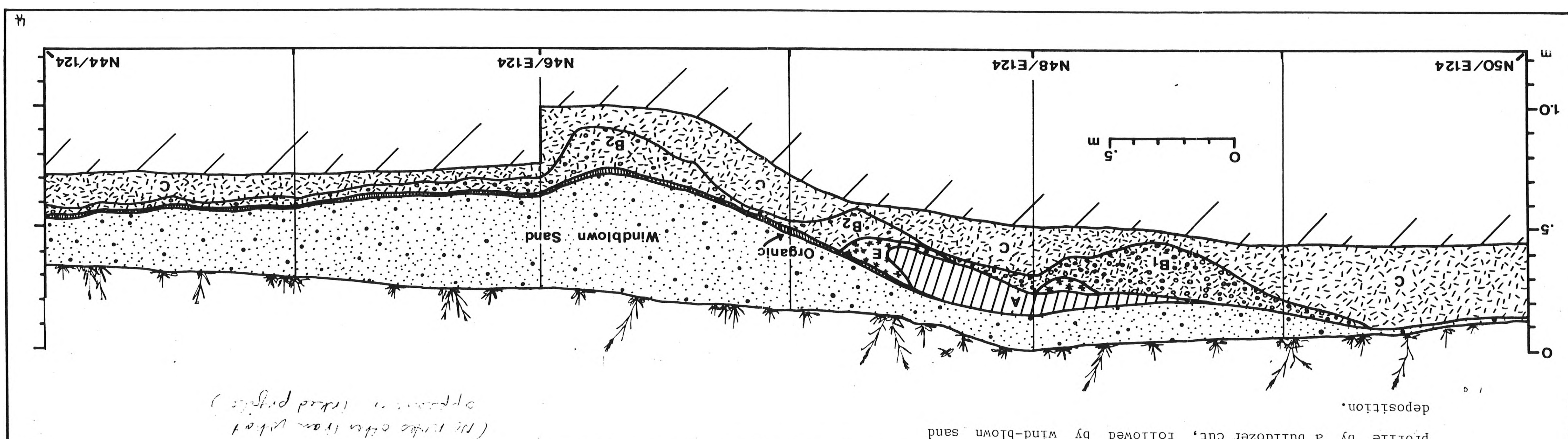


Figure 2-11. Soil profile along E124 shows truncation of original soil profile by a bulldozer cut, followed by wind-blown sand deposition.

Fig 2-15

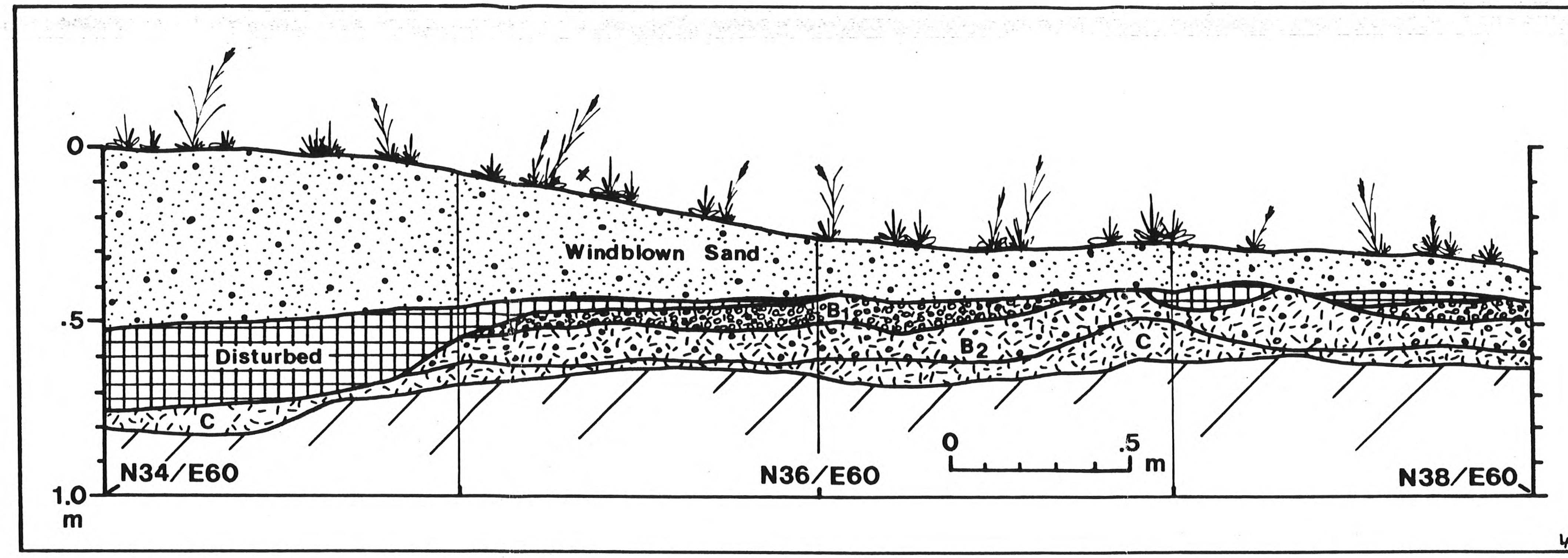
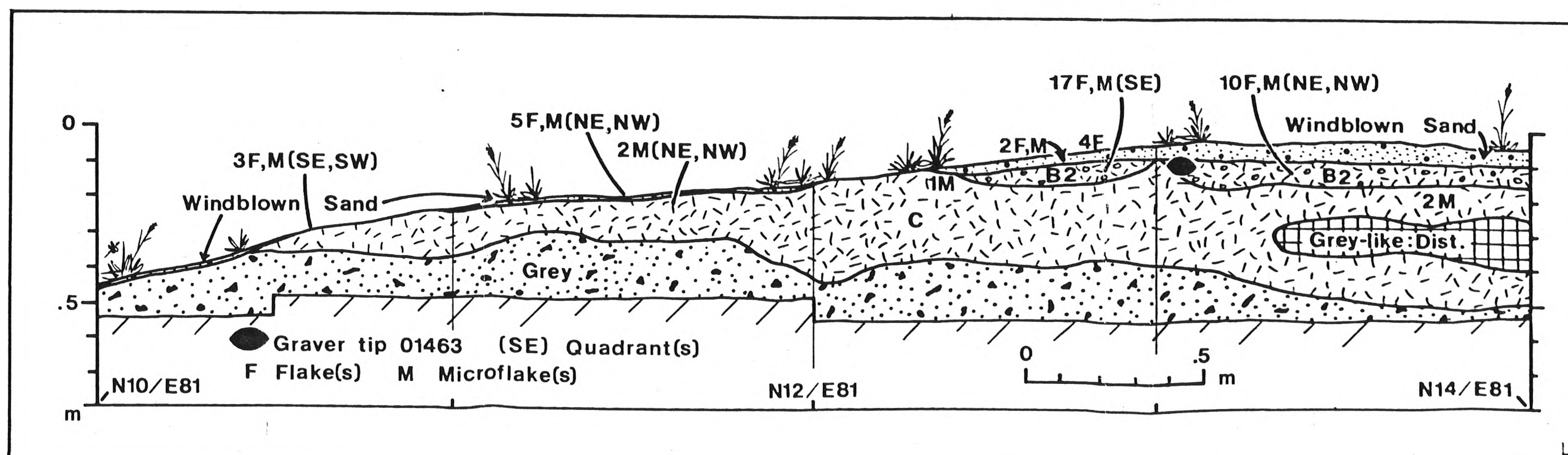


Figure 2-13. Slumping and deflation at lip of 1970s drainage ditch.

Figure 2-15. Profile of E60 area with greater bulldozer disturbance (tread marks and mixed soil) to the south.

Fig 2-13



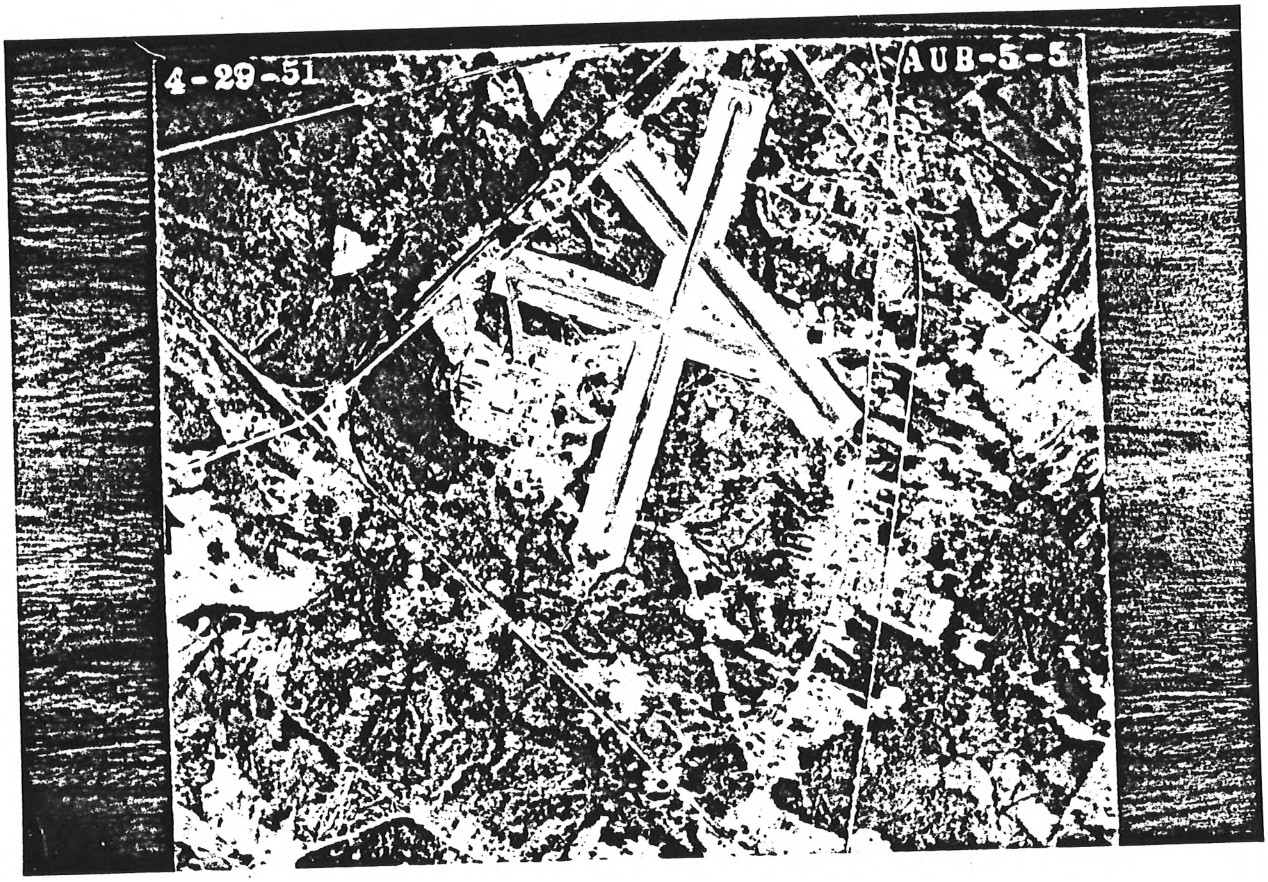


Plate 2-1. Airphoto of the Airport vicinity taken April 29, 1951.

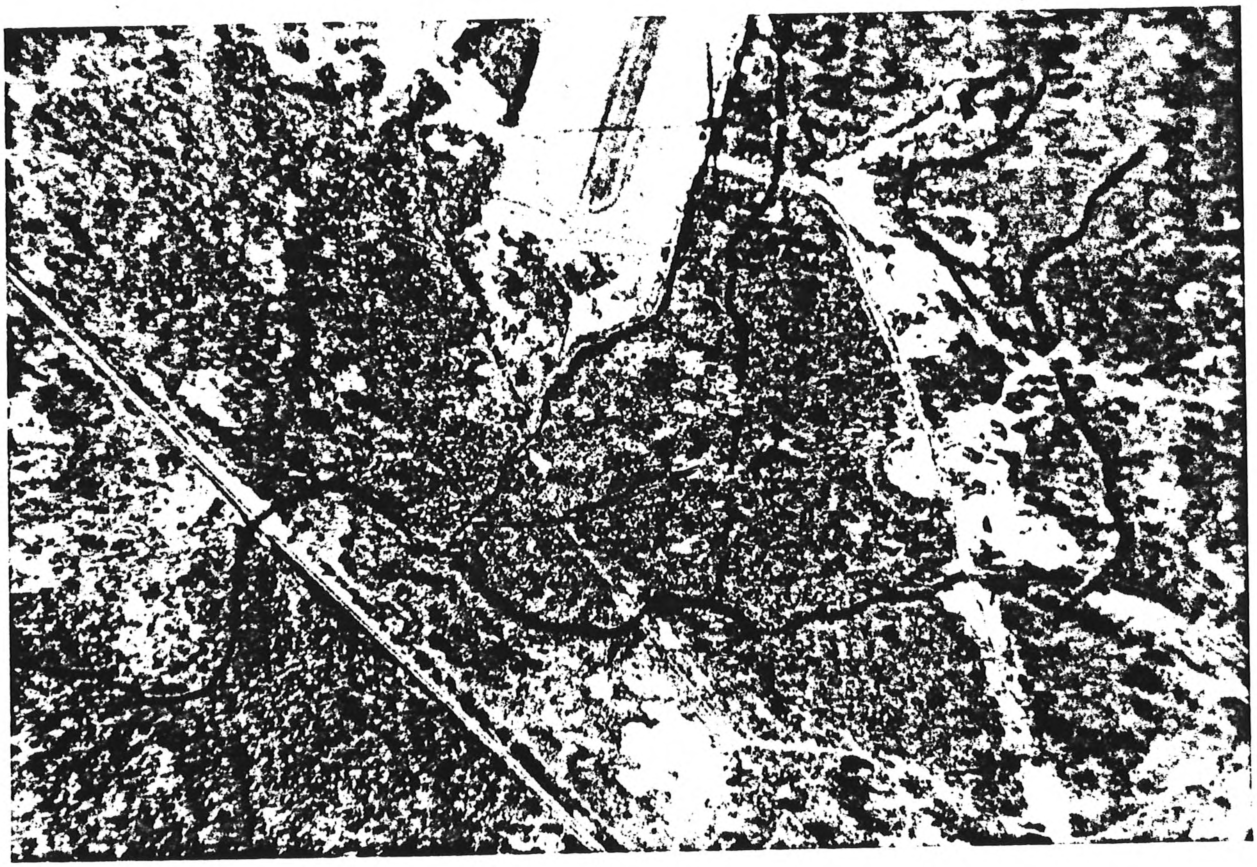


Plate 2-2. Close-up of site area in Plate 2-1, with drainage patterns highlighted. Courtesy of Ray Woodman, Maine Department of Transportation.

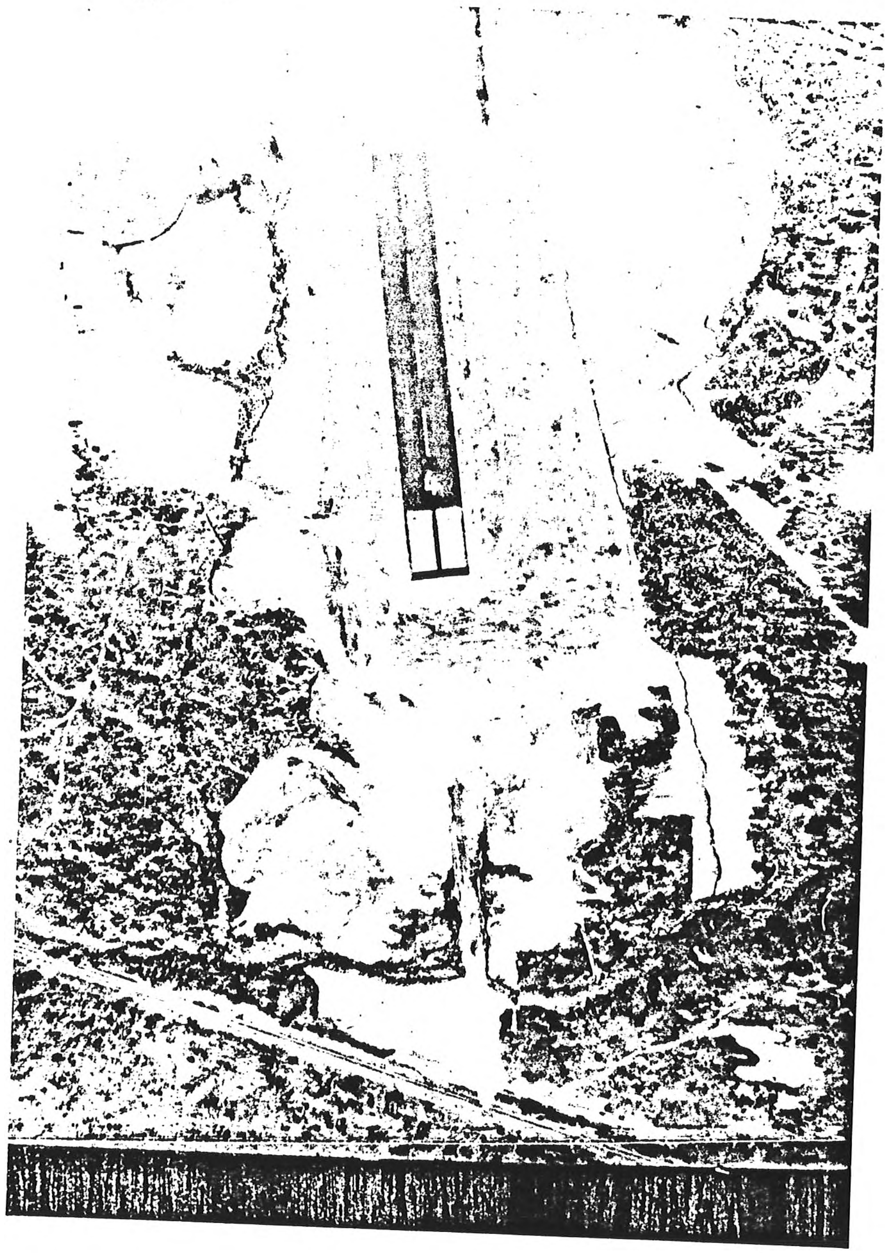


Plate 2-3. Clearzone improvement activities and soil disturbance evident in a 1979 airphoto.

Plate 2-4. Airphoto taken November 19, 1983.

CHAPTER III

ARTIFACTS AND DEBITAGE: DESCRIPTION, ATTRIBUTES AND TYPOLOGY

Excavation and surface collection at the Michaud site resulted in a collection of approximately 150 artifacts and 2,300 flakes and microflakes. A few artifacts and flakes have been surface collected from the Lamoreau site. Represented in the collection are all of the tool types generally characteristic of northeastern Paleoindian assemblages (Table 3-1), with the exception of drills, pieces esquilles, and the snapped and multi-spurred gravers or cutters seen at the Vail (Gramly 1982) and Debert (MacDonald: 1985) sites. Overall artifact to flake ratio was 1:16, though proportions varied considerably by material (see Table 3-2). The diagnostic flaked stone objects from the sites are made on cherts or a glassy rhyolite whose sources lie at great distance from these sites. There is also a large "flake and core" component made on rough diabase of local origin. This chapter presents descriptive data dealing with the stone tool assemblage from the Michaud site integrated with a literature review of the lithic industries of comparable Paleoindian sites.

ANALYSIS METHODOLOGY

Once the excavated material had been returned to the laboratory, field provenience data were checked, and the collection was catalogued by artifact type. We created separate categories for flakes and microflakes: "microflakes" were defined as chert or glassy rhyolite flakes of less than 6 mm. maximum dimension and less than 0.1 gr. in weight, i.e., those objects which would pass through a 1/4" screen. "Flakes" was a category including unmodified specimens of any dimension larger than microflakes. All objects except microflakes but including flakes received a catalogue number,

Table 3-1 Tool Counts and Percentages

TYPE	N	%
Fluted Points	9	6.5
Biface Preforms	6	4.3
Channel Flakes	17	12.2
Sidescrapers	16	11.5
Endscrapers	9	6.5
Concave Scrapers	5	3.6
Limaces	2	1.4
Gravers/Perforators	5	3.6
Utilized Flakes	70	50.4
Totals	139	100.0

Table 3-2 Artifact to Flake Ratios by Raw Material

MATERIAL	# ARTIFACTS	#FLAKES	MATERIAL
Cr1	34	219	1:6.5
Cr05	23	76	1:3.3
Cb01	10	49	1:5
Ceg1	15	356	1:24
Ct01	4	29	1:7
Rfnp	43	733	1:17

which was written on the object in india ink. Groups of microflakes from each provenience unit (1/4 quad and depth level) were sorted visually into raw material groups, and each of these groups was assigned a catalogue number.

As catalogue numbers were assigned, all objects were passed to a person doing computer data entry. A preliminary description (i.e. flake, microflake, fluted point) was assigned, a weight was taken on an electronic digital balance, and data were entered into a KNOWLEDGEMAN database file on a Corona microcomputer.

A preliminary visual catalogue of about 200 pieces was made using a Mita photocopier. Resolution of the flaking patterns and other details was good enough for laboratory notation. Spiess then proceeded with a preliminary microscopic examination of these pieces, using a binocular dissecting scope with magnifications from about 5X to 40X. Notes were taken on flaking and possible use-wear patterns along tool edges, and a search was made for blood stains or other organic residues on the artifacts. In fact, perhaps a half-dozen orange-brown stains were discovered on the artifact surfaces, but subsequent testing for hemoglobin (Downs written communication) proved negative. These stains did indeed look like iron or manganese oxide, very common on the site in the B horizon soils.

Coincidentally with the collection examination, a literature search was conducted by Spiess and Brush for appropriate tool typologies and attribute measuring systems in the North American Paleoindian literature. Throughout this process Steven L. Cox, who was coincidentally working in the same laboratory space provided by the Maine State Museum, provided many helpful suggestions and comments (see Cox 1972). Further, Spiess and Brush made several visits to the Peabody Museum of Salem, courtesy of John Grimes, to

view the Bull Brook collection. Through Grimes, we made contact with Fred Carty, who is currently analyzing the Neponset Paleoindian collection and who graciously allowed us a morning to examine that collection. James Payne, University of Maine at Orono, also was most helpful during this and other stages of our investigation. Through him, we observed some of the Munsungun Lake Paleoindian materials and also his extensive Ohio Paleoindian collections. We wish to thank these individuals for their thoughtful comments.

RAW MATERIALS

Two distinct lithic industries were noted in the Michaud collection(Table 3-3); the major industry, including approximately 2500 specimens, was comprised of a variety of cherts and a glassy rhyolite. A smaller component (221 specimens), and one which might easily have been overlooked had the sandy soil matrix contained any indigenous rocks, included a number of cores and flakes of what we termed "Christian Hill diabase" as well as a green volcanic river cobble and several pieces of granitic rock.

Inevitably in northeast Paleoindian research the question of the ultimate origin of the lithics arises, as we use their transportation patterns to help elucidate Paleoindian settlement patterns (e.g. Storck 1982) Despite groundwork on lithic characterization (Lavin and Brothers 1981; Pollock 1982) much more laboratory work remains to be accomplished. Such work has only begun with the Michaud collection. We will thus make source suggestions for the raw materials from the Michaud site based both on extensive visual examination of quarry specimens and on artifacts of known lithic sources from other Paleoindian assemblages. We are in the process of initiating thin-sectioning and characterization of the Michaud site lithics

Table 3-3

LITHIC RAW MATERIALS USED AT THE MICHAUD SITE:
HAND SPECIMEN DESCRIPTIONS

CHERT, RED 01. (Cr1 computer code)

Ground mass: Dusky red 5R3/4. This is a brick deep red/crimson chert with minor lateral shade variation in background mass color. Lustre varies from waxy toward waxy/matte. Some pieces display parallel bedding/banding on the 1 to 20 mm. scale. Bands appear to contain larger grained granular material which patinates either yellow-red, with slightly darker purple on either side of a yellow-red band. Variable frequency of small yellow (patinated) vesicles (0.1 mm. diameter approximately), possibly microfossils. Mineral inclusions include dark flecks (iron mineral?) and silvery flecks (?mica) of similar scale.

CHERT, RED 02. (Cr02)

10R4/2 grayish-red ground mass, solid color, no inclusions or visible bedding. Very dull lustre.

CHERT, RED 03. (Cr03)

Color of ground mass is intermediate between 10R4/2 (grayish-red) and 5YR3/2 (grayish-brown). No visible evidence of inclusions or bedding. Lustre very dull, and ground mass particle size apparently larger than the other cherts. Fine clay particles from the soil appear to adhere tenaciously to the surface, in contrast with more lustrous materials from the site.

CHERT, RED 04. (Cr04)

10R3/4. Dark reddish-brown ground mass, dull lustre. A marbled red chert in overall appearance, with nearly 50% inclusion of translucent brown silica inclusions in 1 centimeter diameter blobs and swirls. When patinated, the inclusions appear white and opaque.

CHERT, RED 05. (Cr05)

Ground mass color 5R3/4. Waxy lustre dark red groundmass with linear banded or cobweb geometry (bifurcating and joining at random) inclusions of 1-5 mm. thickness. Unpatinated, the bands are either translucent dark grey or dark brownish or greenish-grey silica, but they patinate to a dark tan.

NOTE:

The red cherts may all come from geographically close sources. They all appear to be geologically related Ordovician cherts.

CHERT, TAN 01. (Ct01)

Ground mass is 5Y7/2 yellowish-grey. This rock is characterized by a very light colored or cream colored ground mass with widely spaced (5-10 mm. spacing) small (0.1-1 mm.) inclusions that appear to be rust colored.

CHERT, GREY-GREEN 01. (Ceg1)

Ground mass is 5Y5/2 light olive-grey, with a patina of slight waxy lustre. This is a chert without visible bedding, but it exhibits bleach mottling lighter and darker greenish-tan diffusely bordered discolorations. Some pieces with an iron (?) derived from the soil, or with more patina (?) vary to 5Y6/4 dusky-yellow. Inclusions of both quartz (?) (light) and feldspar (dark) subspheroidal particles, about 0.1 mm. diameter. Occasional oxydized iron diffuse mineral

inclusions 1-3 mm. diameter scale.

CHERT, BLACK 01. (Cb01)

This designation is used to describe a chert which displays rapid color, texture and inclusion variation over distances on the order of centimeters. Most notably, 3 facies of this chert appear on one fluted point: 23.120.000800112.

One facies is a bluish-black with semi-waxy to very waxy lustre. Ground mass color is near 5B2/1. Some of this facies is opaque, some is marginally translucent, appearing slightly more blue in color.

A second facies is a dark grey-green color, with black silica fracture filling.

A third facies is a black opaque chert with a high proportion of vesicles on the 0.1-0.3 mm. diameter size range. These may be gas bubbles or dissolved inclusions.

The latter two facies contain rare oxydized iron stains identical to the iron stains in Ceg1.

RHYOLITE, FINE-GRAINED, NEPONSET (RfNp)

This is a visually heterogeneous group of speckled glassy rhyolites with a light grey ground mass. All but one piece are heavily patinated. In patinated specimens the light grey ground mass contains many nearly regularly spaced, darker grey, tubular discolorations that appear as speckles or as pencil-like lines depending on the angle of fracture. There is some variability in iron content or in iron oxide staining of the patina, which adds an orange tinge to some pieces. Ground mass is N7 light grey, patinated discolorations are medium grey. Fragments still exhibiting heavily patinated joint fracture surfaces of the original bedrock quarry blanks are present for this material only.

There is one piece (23.12.00029) which seems to be an unpatinated example of the same or related material. It is a very glassy, very finely flow-banded rhyolite of dark grey ground mass (5Y2/1). The flowbanding is barely discernable, but is of the same scale as the pencil-line discolorations in the patinated material.

Mineral inclusions consist of frequent small, dark octahedral crystals, possibly magnetite or garnet (Fred Carty, personal communication).

CHERT, BROWN 1. (Cbr1)

Ground mass color 5YR5/2. This is a banded chert or fine glassy flow-banded rhyolite with 1-2 mm. thick banding. Material is represented by a single utilized flake (23.12.1992).

QUARTZITE 1. (Qtz1)

This is a fine grained, lightly silicified quartzite (?) with 10R3/4 dark reddish-brown ground mass. It is represented by a single utilized flake, 23.12.00321.

CHERT, GREY, BLACK SPOTS (Cbst)

Ground mass 5YR3/1 dark brownish-grey with 1-2 mm. diameter black flecks exhibiting indistinct edges with weak foliation parallel to groundmass banding direction. This material is represented by a single specimen, 23.12.01804, a channel flake which has been reworked into a perforator or graver.

Table 3-3; continued...

SILICIFIED SILTSTONE (Sslt)

One piece may be a silicified siltstone or mudstone that has patinated deeply to a very chalky surface. It is doubtful whether any of the original material remains within the piece, which is unique, a fluted point mid-section (23.12.). Silt-sized mica and silica particles can be seen as the major matrix constituent under 25X magnification.

CHERT, BANDED TAN BLUE (Cbtb)

This is a "tan" ground mass waxy lustre chert with blue silica fracture filling. Ground mass color is 5Y5/2 "light olive-grey". It is represented by a single uniface fragment (23.12.02186).

FELSITE, MAINE (Fme)

A Kineo-Traveler-like felsite, which dominates Archaic and Woodland Period collections from Maine, is represented by only two flakes, one exhibiting a flat quarry blank (NOT rounded river cobble) cortex (23.12.00095 and 23.12.00298).

CHERT, GREY (Ce)

A light grey, dull lustre ground mass chert or silicified mudstone represented by two flakes too small for further characterization (23.12. 00653 and 23.12.00525).

QUARTZ CRYSTAL (Qch)

This material is represented only by two microflakes (23.12.01468).

CHERT, BLUE-GREEN

This chert is a light greenish-tan-grey of dull lustre, nearly translucent around the thin edges. This material is a visual match with many pieces in the Vail site collection, which Gramly attributes to a nearby source. This material visually matches hand specimens from both Ledge Ridge near the Vail site and outcrops near Munsungun Lake. The material is represented only by two microflakes (23.12.0734).

DIA BASE(RcO1)

This material is a tough, mafic material that patinates to a rusty-brown, coarse-textured surface with small vesicles or mineral crystals that appear to be high in iron content. Patinated material matching exactly the site specimens was discovered in bedrock dykes on the top of Christian Hill. Newly flaked surfaces of the Christian Hill material are a dark grey, of granular appearance. Fracture is subconcoidal.

RHYOLITE, FINE, GREEN (Rfg)

This material appears to be a fine-grained military-green rhyolite with small phenocrysts. It exhibits very poor flaking qualities (much poorer than RcO1). Flakes of this material have been refited to artifact 23.12.0225, a battered river cobble.

with geologist Steven Pollock of the University of Southern Maine.

Though cobble cherts were used extensively at several mid-Atlantic sites (Moeller 1980, Meltzer 1984), this pattern has not been generally observed in northeastern Paleoindian assemblages (Grimes et.al. 1984, Gramly 1982; Curran 1984, MacDonald 1985). Cobble cortex was not observed on any of the cherts or on the glassy rhyolite from the Michaud site. However, numerous examples of bedding plane surfaces, characteristic of blanks obtained from outcrop formations, were noted on rhyolite specimens showing that it was obtained from bedrock outcrops. Having concluded that none of the microcrystalline rocks utilized by inhabitants of the Michaud site were obtained locally, comparable samples were sought for the major raw materials components.

The cherts in the Michaud assemblage were first sorted visually by color and surface marking (striations, intergrades with other colors,etc.). Visually similar specimens believed to belong to a single source area were sorted together. A finer resolution was subsequently sought since the details of patterning and coloration on groups of pieces indicated they may have been from the same quarry blank. Most of the artifacts and flakes conveniently grouped into three rock groups. Several items remained unique.

A range of red and red and green cherts make up 30% of the tools and debitage from the Michaud site (Table 3-4). Most of these varieties fall within the range of known examples from the Munsungan Lake region chert outcrops. Robert Doyle (personnal communication) characterizes Munsungun chert as having a sub-vitreous luster, frequently showing very fine healed fractures, often showing a small percentage of small silica filled vesicles, and having a highly conchoidal fracture. Further, we have observed that microfossil vesicles may often be seen under microscopic examination. Pollack (1982: 5) states that Munsungun Lake formation stratigraphy is

complex and exhibits relatively rapid changes in character both horizontally and vertically. The cherts exhibit a range of colors of which the series of reds is only one, including red with green and sometimes tan mottling, black, green, and gray. All color types show well-defined laminae due to hue or chroma differences and color recognition in the field is easy.

Another 30% of the Michaud stone assemblage consists of an often heavily patinated black, grading to olive green, chert. In fact, the patinated olive green variation (our computer code: Ceg1) was initially separated from the black variety (Cb01). John Grimes (personnal communication) has located within the Bull Brook collection a group of about twenty fluted points and fluted point preforms (to say nothing of flake tools) that each exhibit two or more color grades of this chert. He can seriate them to demonstrate a continuous grade from the patinated olive green to black color variants. Visual comparison of this seriation and other Bull Brook collection pieces by Grimes, Spiess and Brush convinced us that the Michaud pieces in fact match portions of that series. A number of specimens in the Michaud assemblage (e.g. fluted point .0088/.0112, graver .1818) grade from black to green, while other specimens are wholly black or alternatively, completely patinated olive green. The Bull Brook and Bull Brook II collections are dominated by the same chert (80-90% Grimes et.al. 1984).

Recent inspection of the Vail site collection (by Spiess, Brush and Grimes) has revealed a raw materials match of up to 40% of the Vail pieces with the chert series just described. Gramly (1985:76-77) sources the raw materials from the Vail site in the following description (translated from the French): "the cherts of Vail can be separated into three categories: the yellow or caramel colored cherts (jaspers), the cherts of a pure blue-grey

with often a lustrous appearance, and the cherts of Ledge Ridge." Our visual inpection of hand specimens from Ledge Ridge concurrs with Gramly's suggestion that some of the Vail site materials come from that source. However, the samples from Ledge Ridge do not include the lustrous blue-grey chert, nor do they conclusively include the range of olive gray-green patinated cherts dominant in the Bull Brook collection and frequent in the Vail collection. Moreover, the pure blue-grey lustrous chert is one of the variants of Bull Brook chert present in the Bull Brook collection.

Gramly's x-ray flourescence data (1985:Figure 8) show extreme variability in the amount of various trace elements among three Ledge Ridge quarry samples, and within the archaeological samples from Vail (including one of the blue-grey lustrous pieces). Two pairs of samples cut from individual Vail site flakes (ibid: items a and b; h and i) show real variance within the same flake in trace chemical content. These cherts, then are chemically variable on a very small scale (millimeters), sugesting that criteria other than those derived form x-ray flourescence should be employed to identify the source of the Vail lithics.

Grimes had suggested (personnal communication) that the bedrock source for the materials that dominate the Bull Brook collection ("Bull Brook chert") might be found in the chert quarries near Burlington, Vermont, based on hand specimen samples from the area (vide Hawley: 1967). Grimes, Spiess, and Brush travelled to Vermont to examine quarry samples and lithic assemblages from both the Reagan site and from later sites whose inhabitants had used the limestone bedded Ordovician cherts from the Mt. Independence, St. Albans or related quarries in northwestern Vermont. Several Vermont archaeologists (Giovanna Peebles,

Vermont Historic Preservation Commission; Peter Thomas, University of Vermont), on viewing artifact samples of these materials from the Michaud site, the Bull Brook site, and the Vail site, independently suggested that we were carrying Mt. Independence or related-quarry materials. Exact matches for all color variants within the suspected range were accounted for by specimens from quarries on the Lake Champlain shore, especially near St. Albans, north of Burlington. A complete analysis of these lithics must still be undertaken, with exact outcrops pinpointed, but these authors are convinced that the source of the black and green cherts from the Michaud site is in northwestern Vermont.

A third major raw material at the Michaud site is the glassy rhyolite which we designated Rfnp (36%),after "rhyolite,fine,Neponset". All but one specimen were heavily patinated, but all specimens retained a distinctive dot and dash pattern which we had not previously observed in other prehistoric assemblages in Maine. Several Maine geologists could not recognize the material as native to Maine. John Grimes recognized it as a minority component in the Bull Brook collection. The Neponset site, a substantial, as yet unpublished Paleoindian site located southwest of Boston has an assemblage dominated by this material. The collection was made available for inspection by Frederick Carty, whom we gratefully acknowledge. The distinctive dot-and-dash patterning of the Michaud site samples was matched unquestionably with numerous samples within the Neponset collection. The quarry has yet to be located, thus the name "Neponset rhyolite" refers to the fact that it is the dominant material at the Neponset site rather than to a source.

Exact sources of the minority materials present in the Michaud collection have not as yet been identified. Most are represented by only a

few flakes or a single tool. A tan chert, however, makes up over 3% of the sample and includes over 60 flakes and two endscrapers. Brush and Spiess identified this material as a minority component in the Vail site collection, too, but again no source has been located.

Most of the rough stone component at the Michaud site, including cores, large flakes and chopper-like implements, are made of a coarse aphanitic volcanic material (our computer code: RcO1), probably a diabase, which is visually identical with weathered surfaces observed in bedrock dykes on the top of Christian Hill, immediately south of the Lewiston-Auburn Airport. Lamoreau and Spiess have both recovered specimens from the hilltop which visually match Michaud site specimens. Casual flaking of a piece recovered from Christian Hill produced large flakes with irregular edges. Flaked coarse granitic rock, as well as a dense green volcanic river cobble, are also included within this rough stone category.

Table 3-4 Raw Materials by Tool Class, Cryptocrystalline Industry

TYPE	MATERIAL Cr1	Cr05	Ceg1	Cbo1	Ct01	Rfnp	Slt	Qtz1
Fluted Point	3	1		2		2	1	
Biface Preform			4	2				
Channel Flake	6	3	4			4		
Endscraper	1	3			2	3		
Sidescraper	8	3	2		1	2		
Concave Scraper	1	2				1		1
Limace		1		1				
Graver/Perforator	1		2	1		3		
Utilized Flakes	17	9	3	4	1	29		
Total	37	22	15	10	4	44	1	1

note: Two tools, 23.12.1534 and 23.12.1843, are counted both with sidescrapers and graver/perforators. The utilized flake category includes utilized flakes, retouched flakes and small uniface fragments of unknown type.

ARTIFACTS

The uniqueness of fluted points as a marker of early human presence in North America was first recognized in 1926 or 1927, with the discovery of the bones of extinct Bison in association with fluted points near Folsom, New Mexico. By 1934 the distribution of fluted points all across the United States to the East Coast had been acknowledged. In 1936, excavations at Clovis, New Mexico associated a dozen fluted point specimens with mammoth remains and with two bone implements thought to be foreshafts. In 1934, Frank H. H. Roberts began seven seasons of excavation at the Lindenmeier site, a major Paleoindian habitation site in Texas. All preceeding excavations had been at kill sites, so that the range of stone tools associated with fluted points was poorly known. Lindenmeier. however, produced a major assemblage with a large range of tool types.

The Shoop site in Pennsylvania produced the second reported Paleoindian habitation site assemblage (Witthoft, 1952), followed by the Reagan site in Vermont (Ritchie, 1953) and Bull Brook (Byers, 1954; Jordan, 1960).

As late as 1970, Paleoindian assemblages were being analyzed and compared by quantifying the number of tools in rather arbitrarily defined artifact types (Irwin and Wormington, 1970). Their article closely follows (without citation) the typological approach to French Middle and Upper Paleolithic assemblages pioneered by Francois Bordes and Denise de Sonneville Bordes, complete with cumulative frequency graphs.

As a reaction to the Bordian school of typological assemblage quantification, American paleolithic archaeologists had been exploring the use of artifact attributes well before the Irwin and Wormington article (e.g. Movius et.al., 1968). Attribute analysis seems to have represented the "wave of the future" in Paleoindian assemblage study, although with a

less exclusive reliance on metric attributes than had been suggested by the Movius' pioneering study. Jordan (1960) is the first of the latter, with Cox's (1972) restudy of the Shoop material being a notably cogent example. The Michaud site artifact analysis presented below mostly follows in the tradition of the latter.

The Michaud site assemblage was initially divided into bifacial and unifacial specimens. Further sorting involved identifying specimens with known Paleoindian analogues. Measurement and attribute systems were adopted or devised on a tool by tool basis, generally after Cox (1972), though we also extensively reviewed MacDonald (1985), Gramly (1982), Moeller (1980), and Fitting, Devisscher, and Wahla (1966). Specific attributes and measurements were incorporated to facilitate intra-assemblage comparisons as well as to provide information on the Michaud artifacts which would be most comparable with other northeastern Paleoindian assemblages.

Throughout the artifact descriptions, an orientation standard was applied which is illustrated in Figure 3-1. For fluted points, the dorsal side was considered to be that side displaying the longest flute scar. In contrast to fluted points, designations of obverse and reverse sides for bifaces were usually assigned on an arbitrary basis, following an unsuccessful attempt to discern the ventral side as that side having been connected to the core and therefore often less convex than the dorsal side. Unifaces were always oriented with the dorsal side up and the proximal end (that end displaying a striking platform and/or a bulb of percussion) held toward the observer.

Bifaces

Judged strictly by the number of stone tools recovered archaeologically from Paleoindian sites, the Paleoindian lithic industry could be

characterized as uniface-dominated. The minority bifacial industry seems to have been focused on a production pathway leading from trimmed quarry blanks to the diagnostic weapon tip, the fluted point. To be sure, sharp-edged final stage preforms might have been hafted and used as multi-purpose knives, and a large proportion of fluted points ended up being used for work other than as weapons: being reworked, broken or not, into some other tool class (40% or more in one sample, Lepper, 1984).

Most descriptive effort dealing with the Paleoindian biface industry has concentrated on the final stages of production and the final steps of fluted point manufacture. However, Fitting has described a biface reduction sequence for the Holcombe site (Fitting, Devisscher, and Wahla 1966: 39-42) by dividing the unfinished bifaces into Types A and B and comparing their attributes. The Type A preforms are described as larger and cruder than other bifacial artifacts, with heavy edge grinding, mean thickness of 11.3 mm. and large, expanding flake removals. The type B preforms are smaller and lighter, more standardized in form, and their edges lack grinding. Mean medial thickness is 8.1 mm. Fitting implies that the Type B preforms are worked-down Type A preforms, and states that the edges are not reground before the final pressure retouch.

MacDonald (1985: 73) describes preform reduction, noting that two markedly different types of preforms were used for reduction at Debert: some starting as "bifacial core nuclei" and some as very large flakes. He observed that flake-originated preforms were the most common, some especially long. Whatever their origin, preforms were "trimmed by soft hammer percussion to the desired point outline before preparation was made for fluting".

McGary (1975: 57) notes that bifacial cores at the Williamson site

were reduced to rough preforms by both transverse and longitudinal flaking. Longitudinal flake scars often resemble flutes. They most often originate at the proximal end, although sometimes at the distal end. Similar longitudinal flake removal, designated as "medial thinning", has been observed on the Munsungun Lake area Paleoindian bifaces which are being investigated by James Payne (personal communication).

By far the most detailed biface reduction sequence description is Callahan's (1979), which is modelled after Eastern fluted point production. It is a nine part sequence of fluted point production including four stages therein called preform reduction. Stage five involves preparation for the first flute, while stages six through nine finish the fluted point. Callahan's stage three or four involves longitudinal flaking to thin if necessary (Payne's medial thinning), otherwise stage four involves secondary thinning (1979: 116). Attributes of stage four bifaces include a width/thickness ratio of 4.0 to 5.0 or more, and aligned, centered edge-angles of between 25 and 45 degrees. After stage three, the biface should be without humps, irregularities, hinge terminations, or step-fractures. The edges are ground for platform preparation as stage four begins. Stages one through three have been accomplished at the quarry, while stage four may have been "dressed out later". Stage five involves retouching the final point outline and making preparations for the first fluting attempt.

A total of six biface fragments was recovered at the Michaud site. Three specimens (23.12.0082, 23.12.1330, 23.12.660/.661; Plates 3-1 and 3-2) display attributes which are consistent with expected characteristics for fluted points in various stages of production. Three other fragments are present, all of which are too small to assign to a particular phase in the manufacturing sequence. All, however, exibit large, irregular flake removals and lack secondary retouch. Microscopic examination of the edges

Figure 3-1. Biface and uniface measurements and orientation landmarks.

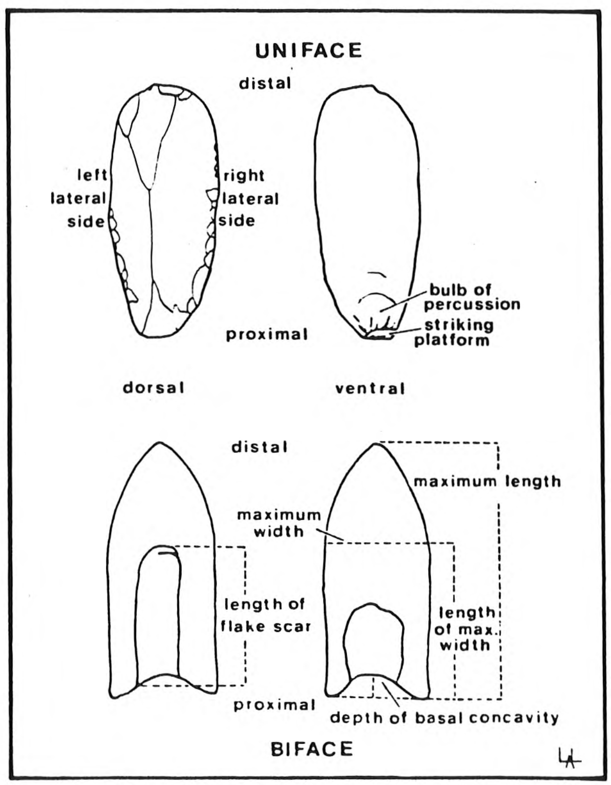


Table 3-5

Definition of Biface Measurements

Catalogue #: The site number, 23.12, and the individual artifact number are recorded. All artifact numbers are given when proken pieces are conjoined.

Category: The portion of the artifact is recorded here. Categories included distal fragment, proximal fragment, whole, tip missing, etc.

Material: See the lithic material descriptions in Table 3-3.

Type: The stage of manufacture is noted here: fluted point, preform, or simply "biface", when no diagnostic characteristics are evident.

Maximum Length: This is a measurement of the maximum length of an artifact, regardless of orientation. Lengths of broken artifacts are given in parenthesis.

Maximum Width: The point of maximum width is measured. Where an artifact is broken and it is assumed that maximum width would have occurred on the portion not present, the width measurement obtained is assumed to be less than that of the complete piece, so the measurement is enclosed in parenthesis.

Length of Maximum Width: The distance from the proximal end to the place of maximum width was measured.

Length/Width Ratio: A ratio of maximum width to maximum length was obtained.

Thickness: This is a measurement of the maximum thickness of the artifact, whereever it occurs.

Basal Width: This measurement is taken from the outside edge of one basal ear to the other for fluted points. On preforms the basal width is measured only if there is a nearly complete proximal end approaching the form of a finished fluted point.

Table 3-5

Definition of Biface Measurements (continued....)

<u>Flute Width</u>: A maximum and minimum width are given. Measurements are given for both dorsal and ventral sides where applicable.

<u>Flute Length</u>: Flute length is measured from the top of the basal concavity to the distal end of the flute scar. A length is given for both dorsal and ventral flutes as they occur. The dorsal side has been defined as that side having the longest flute scar.

<u>Ratio Flute Width/Length</u>: The ratio of flute length to width was calculated for both dorsal and ventral sides.

<u>Number of Flutes</u>: The number of flutes removed from each side was noted, whether they were removed in the manufacturing process as a thinning technique prior to final fluting, as guides for the final channel flake removal, or as a new flute removal in conjunction with resharpening.

<u>Depth of Basal Concavity</u>: Depth is measured by orienting the point on its longitudinal axis and measuring from a line perpendicular to the longitudinal axis at the tip of the longest ear. This method is also used by McDonald (1985: 71), though Gramly (1982: 27) measured maximum depth from a line connecting basal ears, regardless of point orientation.

<u>Basal Grinding</u>: Grinding on the inside edge of the basal concavity is noted as 1= absent, 2= light, 3= heavy.

<u>Lateral Grinding</u>: Presence or absence of lateral grinding is noted. When present, length of grinding from the base toward the tip is taken for both right and left sides.

<u>Edge Angle (Right)</u>: Two measurements were taken, one at ¼ of the distance from the tip back toward the base, and the other ¼ of the distance from the base towards the tip.

Table 3-5

Definition of Biface Measurements (continued....)

Edge Angle (Left): Same definition as right.

Basal Retouch: Presence or absence of basal retouch is noted. This may be described as the removal of thinning flakes from the basal concavity after the removal of the channel flakes.

Wear Type: This is a verbal description of use-wear seen on the artifact other than purposeful grinding of an edge. Tip damage is noted, as well as wear associated with functions other than use as a projectile point.

Outline Form: General outline shape is noted, which in this collection took the form of "triangular" or "lanceolate" for fluted points.

Table 3-6

Michaud Site: Biface Measurements

CAT #	109	88/112	321/433	643	1974	1568	377	330	660/661	82
CATEGORY	WHOLE	WHOLE	WHOLE	PROX. TIP MISSING	DIST.	MID-S	DIST.	PROX.	DIST.	PROX.
TYPE	FL. PT.	FL. PT.	FL. PT.	FL. PT.	FL. PT.	FL. PT.	BIFACE	PREFORM	PREFORM	PREFORM
MATERIAL	Cb01	Cb01	Cr1a	Cr1a	Rfnp	Ow	Cr05	Ceg1	Ceg1	Ceg1
LENGTH	44.4	65.5	61.9	[47.6]	[33.5]	[23.2]	[35.0]	[63.1]	[63.7]	[59.6]
WIDTH	21.5	23.1	26.04	26.2	[11.9]	[18.5]	[26.0]	[54.2]	[44.3]	[36.0]
LMW	1.5	3.3	22.9	27.5	----	----	----	----	----	----
L/W R	2:1	2.8:1	----	----	----	----	----	----	----	----
THICK	5.6	5.8	5.5	5.2	5.5	4.1	5.5	9.9	8.3	7.0
BASAL W	21.5	[23.1]	24.7	[27.5]	----	----	----	----	----	31.0
FL. W-D	6.7- 12.3	7.2- 15.0	21.0 14-	12.6 18.5	8.6	10.0 7.5	---- ----	---- ----	---- ----	13.0-25.0 ----
FL. W-V	8.7- 13.5	4.5- 19.8	19.0 28.2	[30.9]	----	----	----	----	----	
FL. LENGTH D- V	34.0 19.0	48.0 38.0	21.0 30.4	[40.0] 28.0	----	----	----	----	----	[58.8]
FL. W/L-D	2.6:1	3:1	3		----	----	----	----	----	----
FL. W/L-V	1.4:1	1.8:1	1:1	1.4:1	----	----	----	----	----	----
# FLUTES-D	1	1	1	1	1	1	----	----	----	1
# FLUTES-V	1	2	2?	1	----	1	----	----	----	----
DEPTH BC	3.4	4.0	5.0	7.0	----	----	----	----	----	----
B. GRIND	YES	YES	YES	YES	----	----	----	----	----	----
L. GRIND-L	23.0	50.0	28.2	26.0	----	----	----	----	----	----
L. GRIND-R	28.0	43.0	24.1	21.2	----	----	----	----	----	----
EDGE A.-R	55°- 57°	39°- 45°	50° 45°	43°- 40°	36°	47°	43°	----	----	----
EDGE A.-L	57°- 55°	44°- 46°	55°- 47°	46°- 38°	38°	42°	42°	----	----	----
BASAL RET.	YES	NO	YES	YES	----	----	----	----	----	----

Separate Preform and Fluted Point Measurements

*Parenthesis: A measure of the extant portion only, may not be a complete measurement.

shows occasional grinding for platform preparation, but no evidence of utilization was noted on these specimens.

The preforms whole enough to assess are all very symmetrical in outline and display a fairly uniform thickness, despite the fact that at least one specimen (23.12.0330) represents a very early stage in the manufacturing sequence. Individual descriptions of these preforms follow, with special emphasis on their place in the manufacturing sequence as outlined by Callahan (1979).

First to be described is a proximal portion of a biface (23.12.0330), which is roughly equivalent to Callahan's stage 2-3 preform (Callahan 1979: 9). The ventral face is original flake surface with retouch confined to the lateral sides. Edge angle for both left and right lateral sides averaged 62 degrees. Callahan states that the optimum edge angle for bifaces at stage three in the reduction sequence is 50 degrees, though the acceptable range is from 40 to 60 degrees. The edge angle for platform preparation thus should have been barely within acceptable limits for this stage of production. The dorsal face shows an irregular pattern of flake removals, all probably removed prior to the flake's detachment from the core. On the ventral side, edge retouch extends along the length of the right lateral side, but only 50% of the left lateral side has been flaked. The preform appears to have been snapped at mid-section.

Second, a distal biface fragment (23.12.0660/.0661) was recovered in two pieces split horizontally along the plane of the artifact, a feature obviously due to a material flaw. Lateral thinning has occurred on both faces of the artifact. Edge angle average for both sides is 37 degrees. Edge angle, (within the 25 to 45 degree range which Callahan equates with a stage four biface), regular outline, and shallow and more even flake scar

removal would indicate that this biface had reached stage four in his reduction sequence (Callahan 1979: 9). Intentional bevelling of the tip on this specimen may have been intended to provide a broader surface to dissipate force when the flutes were removed. Light grinding is noted on the flake ridges on both lateral sides, apparently to provide an improved striking platform for subsequent flaking (Plates 4-10 and 4-11).

The third specimen (23.12.0082) provides an example of a stage six preform (Callahan 1979:36). It is a proximal portion, complete with a basal fluting nipple. A transverse break (outre passe fracture, e.g. Bradley 1982: 189) occurred at an estimated one-third of the length of the completed point during the fluting process. The channel flake must have been mis-struck. With the fortunate recovery and subsequent refit of two portions of the channel flake, one including the basal portion with the tip of the fluting nipple, fluting preparation may be assessed (Plates 3-3 and 3-4). The point is nearly plano-convex in cross-section at this stage; the ventral surface shows large, moderately irregular flake removals creating a nearly flat surface, upon which retouch is limited to the outer margins of the lateral edges. An accentuated convexity has been created on the dorsal face by the regular (average spacing 5.2mm.) removal of thinning flakes from the lateral sides which terminate before reaching the longitudinal axis of the artifact. The fluting nipple on the basal end has been sharply bevelled from the ventral side and extends 5 mm. below slight concavities which have been flaked on either side of the striking nipple, again from the ventral side. The end of the striking nipple is heavily ground at the top of the bevel to provide a striking platform.

At this point it seems appropriate to describe a preform (23.13.0008) from the Lamoreau site which "hinged-out" during the removal of the second flute, in order to complete the production sequence as probably practiced

by the inhabitants of the Michaud site (see Chapter 7). The removal of the second channel flake brings the point to stage 8 in Callahan's reduction sequence (Callahan 1979:36). Having successfully removed the first channel flake, the ventral side was then prepared for fluting. The lateral edges on the ventral side were regularly flaked to create a convexity along the longitudinal axis. The striking nipple was then reworked and bevelled toward the ventral face, again bordered by slight concavities. The basal nipple on this specimen entirely disappeared with the removal of the second channel flake, leaving a straight base. As in the preceeding specimen, the channel flake must have been mis-struck, causing the flute to expand to the point margins and to "hinge out" at approximately one-half of the length of the point.

We suggest that on an unbroken specimen, the lateral sides would have been finely retouched following the removal of the second channel flake. Such retouch may have extended far enough to obscure the lateral margins of the flute scar. A basal concavity would then have been created, either by basal retouch and/or secondary fluting. Finishing touches appear to include the grinding of the lateral sides, generally for the length of the longest flute scar, and occasional light basal grinding.

Our measurements (see table 3-5 and Figure 3-1 for a description of the measurements taken and table 3-6 and 3-6A for the measurement values) add an interesting dimension to the biface reduction sequence and consequently to the projected size range for finished, unretouched fluted points. The four biface preform fragments just discussed provide an opportunity to assess decreasing dimensions as preforms were worked into finished points. Though length would be difficult to project for an accurate comparison as all specimens are medially broken, both maximum width and maximum thickness are

Table 3-6A

Summary Statistics for Fluted Points

	Number	Average	Minimum	Maximum
Length	3	57.27	44.4	65.5
Width	4	24.2	26.2	21.5
Thickness	6	5.24	4.1	5.8
Depth of Basal Concavity	4	4.85	3.4	7.0
Length Flute Scar		31.2	19.0	48.0

Material		Portion	
Crl	4	Whole	3
CbOl	2	Distal	1
Sst	1	Proximal	1
Rfnp	2	Ear	2
		Mid-Section	2

* In general, the flute scar on the dorsal side exceeds half of the length of the point and often extends nearly the full length. (Measurements were taken from inside the basal concavity.) On the ventral side however, flute scars are shorter, but still generally reach one half of the point length.

available for all specimens. Table 3-7 presents selected dimensions for biface preforms from the Michaud and Lamoreau sites and their suggested stage in Callahan's manufacturing sequence.

Table 3-5 Dimensions of Biface Preforms from the Michaud and Lamoreau Sites

Specimen #	23.12.0330	23.12.0660/.0661	23.12.0082	23.13.0008
Stage	2-3	4	6	8
Max. Thick.	9.9	8.3	7.0	5.7
Max. Width	54.2	44.3	36.0	32.5
Thick/Width ratio	1:5	1:5	1:5	1:5
Average Lateral Edge Angle	62°	37°	37°	32°

Though we are not suggesting that all of the preforms had the same initial size and shape, there is a surprising consistency in the relationship of thickness to width and of overall proportions as stone was removed in the metamorphosis from rough preform to finished point.

Interestingly, three of these preforms (23.12.0330, 23.12.0660/.0661, 23.13.0082) are associated with Concentration I (see Chapter 6). The two whole fluted points (23.12.0643, 23.12.0321/.0433) from this concentration also have a 1:5 thickness to width ratio, while the two whole fluted points from other areas of the site have a 1:4 thickness to width ratio. Based on a comparison with the measurements of the former, we suggest that a freshly finished fluted point made on one of the previously mentioned preforms would have had a length in the vicinity of 90mm.

Chronology and Typology of Fluted Points

The Michaud site contributes little information relevant to the fine scale chronology of the fluted point making Paleoindian period in the Northeast. However, it appears more closely related to some assemblages in the Northeast than to others. The literature on Northeast (in a broad geographical sense-including the Great Lakes and the mid-Atlantic states) Paleoindian, as we interpret it, supports at least a five part chronological sequence of fluted point forms as part of a Pre-Archaic sequence proposed for the Great Lakes area. That this sequence may be region wide in its broadest outlines is suggested by the occurrence of cognate forms in the Mid-Atlantic states and New England and the Maritimes provinces. The latter three divisons of this sequence are characterized by points related to Crowfield-site points, Holcombe site points, and Hi-Lo points. In turn, this Paleoindian sequence is followed by Late Paleoindian or Early Archiac manifestations characterized by a variety of point types of unknown relative chronology.

The first phases of this Pre-Archaic sequence are characterized by fluted points with a variety of outline and basal attributes which do not clearly fall in one of the later groups. Importantly, there is no independently supported evidence of chronological sequence within the first two parts of this sequence, which we designate together as the "Classic" group of fluted points. In fact there is no concensus on the meaning of the variability within this group. Thus, initially we attempt simply to place the Michaud site in context within the varibility evident in Northeast fluted points.

Witthoft (1952) was the first to propose a chronological sequence for Eastern fluted points (as reviewed by Cox 1972:5-7). Witthoft noted similarities between the Shoop material and material from the Williamson and

Hardaway sites. He grouped them into what he termed the Enterline Chert Industry, the fluted points of which were characterized by multiple fluting involving the removal of two preliminary lateral channel flakes from a blunted base. These two lateral channel flakes served to isolate the striking platform and guide the main channel flake. In his re-analysis of the Shoop site, Cox (1972: 25-27) observed that a number of the Shoop biface preforms appeared to be basally or longitudinally thinned ("medial thinning", as previosly noted), the occurrance of which directly correlated to the thickness of the original flake base. Further, several instances of lateral flute scars overlying, and subsequent to, the central flute scar were noted. Besides the Enterline fluting process, Witthoft based his thesis that the Shoop site was the earliest fluted point site in the East on the apparent presence of a core-and-blade technology, "which seemed closest to possible Old World Paleolithic ancestral cultures (Cox 1972: 2)", and on the limited number of tool types represented at the site. He proposed that it was followed by the Parrish Industry (including the Parrish, Wilhelm, and Reagan sites) which was, he said, roughly equivalent to Clovis in the West. He proposed that the Parrish Industry was followed by an equivalent of western Folsom in the area east of the Mississippi.

At the time of Cox's 1972 review, Witthoft's own views on this chronological scheme had been modified only by dropping the Hardaway site from the Enterline complex, as work at the site had continued and had produced a later (Early Archaic) collection. Cox comments that few archaeologists accepted the Enterline Industry and the chronological scheme of which it was originally part as of 1972, and the literature since continues to reflect that view. However, the concept of the "Enterline" fluting technique based on multiple channel flake removals still affects

current thought, despite the apparent discontent with the chronological framework that Whitthoft has proposed.

More relevant than Witthoft's currently unacceptable sequence is a Paleoindian chronological sequence that is currently being developed for the eastern Great Lakes states based on Roosa's (1965) idea's. Archaeologists working in the Great Lakes have taken the opportunity to use the association of Paleoindian sites with strandlines of glacial lakes dating roughly between 12,000 and 10,000 B.P. to produce a convincing chronological sequence for the latter portion of the Paleoindian sequence. Earlier Paleoindian assemblages are seriated on the basis of internally consistent changes in several categories of attributes. Recent relevant references to this work include Storck (1982,1983), Roberts (1985), Deller and Ellis (1984, 1986a,1986b). Gainey points, and associated assemblages, are postulated to be first in the chronological sequence. The second fluted point manifestation is characterized by Barnes points, as at the Fisher, Parkhill , and Barnes sites. Points like those of the Crowfield site are third, while points like those from the Holcombe site are fourth chronologically. The beach strandline series follows with sites containing Hi-Lo points, which some authors consider to be transitional to the Early Archaic.

The assemblage from the Gainey site, Michigan (Simons et al 1984, Payne 1982, Payne pers. comm. 1986), and similar fluted points from Michigan, Ohio, and southwestern Ontario is separated from the Barnes-Parkhill complex. "Because is has a simpler assemblage and simpler fluting techniques, Gainey is thought to antedate these [latter] sites, placing its occupation at some point before 10,500 B.P. (Simons et al 1984:266)." The relevant attributes of Gainey fluted points are as follows (Simons et al 1984:268-9; Deller and Ellis 1986b): 1) a basal striking platform beveled

for the production of guide flakes followed by further retouch to produce a central nipple to produce a striking platform, 2) parallel sides, the face angle which is "formed by the juncture of the lateral edges of a tool with its base" having a modal value of 91 degrees. Points from the Parkhill and Barnes assemblages display modes of 94 and 98 degrees (more convex than parallel sided). Gainey points are rarely or never "fish-tailed," while Parkhill-Barnes points often exhibit this trait. Interestingly, the Gainey site assemblage is dominated by cherts from central Ohio, a fact used to hypothesize a northward immigration (Payne 1982).

Storck states that Barnes points are characterized by preparation of a basal nipple during the final fluting stage, followed occasionally by removal of thinning flakes from the margins of the point. Barnes points are smaller, on average, than Gainey points, and their lateral edges expand moderately from a narrow point above the base, which is often fishtailed. They tend to be fully fluted on at least one face (Deller and Ellis 1986b). Succeeding Crowfield points are characterized as "pumpkin seed" in form (noticably widest at mid-point), very thin and wide, often with multiple flutes originating from basal preparation not involving a nipple. Some Holcombe points may resemble Crowfield points, but they are usually characterized by less convex sides, and with shorter and less prominent fluting or with basal thinning in place of fluting. Holcombe points are usually much smaller than Crowfield points, but seem to be logically derived from them. Differentiation of the distinctive Crowfield-like, Holcombe-like, and Hi-Lo points appears relativley easy when compared with the Gainey and the Parkhill complex groups.

As part of the history of development of a Great Lakes Paleoindian sequence, Roosa(1965) produced a discussion of the parallels between Great

Lakes fluted point manufacture techniques and the western Folsom and Clovis techniques. He suggests that points from the Bull Brook, Barnes and Parrish sites seem to form their own typological cluster, and that there were at the time several Bull Brook style points from the research area . He characterizes Bull Brook points as having a deep basal concavity removing the prepared channel-flake striking platform (nipple) after it was used. He also states that their fluting scars often terminate in hinge fractures. Thus, Roosa established a geographically-bounded point style characterized by a group of shared attributes that covered the Northeast. He later (Roosa 1977:353) added the Parkhill (Ontario) site to the Bull Brook Group, and proposed that the group be called the Parkhill Complex, with analogies in the Folsom style of point manufacture.

Roosa's statement that the Parkhill complex fluting technique is "Folsom-like" is, in his view, based both on the presence of a "well-prepared, centrally-located basal nipple" as the platform for fluting, and on the tendency to remove a single flute from each face. In Storck's opinion(1982:82-88), there are many differences between Folsom and Parkhill points, notably the extensive use of broken points for further retouch and finishing in the Folsom assemblages, and the extensive use of tip bevelling before fluting in Folsom. The Parkhill complex point exhibits neither trait. "The frequent reference to the basal nipple as Folsom-like seems to be used in a descriptive sense only and, although no one has proposed that it is the result of direct cultural influences from the Folsom complex, there has also been little other consideration given to its possible origin(s) (Storck 1983:86)."

Deller and Ellis (1986b) suggest associations based upon stylistic similarity between Gainey points and points at Shawnee-Minisink, Bull Brook, and Whipple. They suggest that isolated Barnes points (Parkhill Complex

points) exist in New England, but that no sites or assemblages have yet been identified. There were no analogues known to them from the Great Lakes for the distinctive Vail and Debert assemblages, which suggests to Deller and Ellis the possibility of contemporaneity and allopatry between the Parkhill Complex and Vail-Debert like material. The recent discovery of the Lamb site in western New York (Gramly 1986), with deeply indented point bases very reminiscent of the Vail site, may complicate this neat geographic subdivision. Additionally, the points from the Neponset site (Massachusetts) exhibit many of the same attributes as Barnes (Parkhill Complex) points: long flutes, narrow waist above fish-tailed base. Thus, extension of Deller and Ellis' sequence into New England may be complicated.

In the Mid-Atlantic states, Gardner (1983, Gardner and Verrey 1979) has proposed a chronological sequence of "Clovis, Mid-Paleo, and Dalton". In the stratified Thunderbird site , the earliest (lowest) points are "virtually identical" to western Clovis points according to Gardner, a sharp contrast with statements of Midwestern workers reviewed above that Clovis points are absent from their area. The subdivison into Clovis and Mid-Paleo as proposed by Gardner and Verrey (1979) is based upon a sample of 14 "Clovis" points, of which three are middle-stage preforms judging by the published illustrations (ibid:22-23). The Mid-Paleo stage is based on 12 points, of which two are mid-stage preforms, three are heavily resharpened to some specialized pointed (drill?) form, and all the rest are broken basal fragments (ibid:26). The metric comparison between these two types is unconvincing to us because the preform and heavily resharpened pieces are included in most of the meterics, including some multivariate analyses (ibid: 33-39). The Mid-Paleo PREFORMS are definitely shorter than the "Clovis" complete POINTS and the basal fragments of finished Mid-Paleo

points are narrower than the basal fragments of "Clovis" points. Thus, there is hard evidence in Gardner's data that his "Mid-Paleo" points are smaller than his "Clovis" points, but we question his reliance on the length/width and other ratios for differentiation, because of the nature of the sample which includes preforms and broken pieces. Subjectively, based solely on the illustrations of Gardner and Verrey (1979:26), the Mid-Paleo material seems often to be multiply basally thinned, at least on the dorsal face. This attribute, plus the general delicacy of the point bases, seems reminiscent of the Crowfield point in the Great Lakes sequence. Based mostly on a metric comparison, Gardner and Verrey state that Shoop site points (Witthoft's old Enterline point) fall in their "Clovis " category. Gardner considers the Shawnee-Minisink and Debert Paleoindian material to be a cognate with his "Mid-Paleo" (1983:49). However, based on the illustraed Shawnee-Minisink point (McNett et al 1977: 294: Fig 5r) and the illustration of points from Debert (MacDonald 1985: Plates III-Vii) we strongly disagree. Again, we suggest that the closest parallels for Gardner's "Mid-Paleo", and any similar materials from the Mid-Atlantic states, is with Crowfield-like material from the Great Lakes. This statement has appropriate implications for a region-wide chronology of Paleoindian. In Gardner's use of the term "Clovis", therefore, we have a generic term for early northeastern fluted point that subsumes the Parkhill Complex, Bull Brook and related sites, Vail and Debert. The immediate implication of (unproven) contemporaneity with Western Clovis makes use of the term "Clovis" unwise.

In New England and the Maritime Provinces, at present, there are no serious contenders for a western Clovis cognate differentiable from, and therefore supposedly earlier than, material similar to Gainey and Bull Brook material. Thus, the Gainey and Bull Brook-like fluted point, with a centrally located nipple for striking off the flutes, parallel sides and

generally lacking fish tailed basal ears, may be the earliest fluted point "type" in the area.

The Shoop site fluted points, however, seem to lack the centrally located basal nipple as part of the fluting sequence (Cox, pers. comm), as has been noted for western Clovis, and often show multiple fluting. Multiple flute removals can occur thoughout the chronological sequence of northeast fluted points, eg. occasionally on Parkhill complex points, on Gainey-like and Bull Brook-like points, and usually on Crowfield-like points. Multiple fluting is also seen on Vail site points and those from the Michaud site. It is apparent that a distinction must be made between lateral guide flutes (if this technique was indeed employed to isolate a striking platform and longitudinal ridge), medial thinning flake removals as part of preform reduction, multiple flute scars superimposed during the resharpening process or during the removal of the basal nipple and creation of the concave basal concavity, and as a basal thinning technique in its own right. Thus, attributes other than the presence of multiple flute scars must be considered when determining whether a site is "early". It is possible that the Shoop site, with its "simpler" assemblage and "core-and blade" component, ~~date~~ may place early in the chronological sequence. Further analysis of this assemblage in light of the many northeastern Paleoindian sites recorded subsequent to its examination by Witthoft (1952) and Cox (1972) will help place it within a greater context for comparison.

Loring (1980:25) reports on isolated fluted points and small finds from sites in Vermont. He divides the fluted points (N=33) into two types; one type has "straight parallel-sides and a single deep fluting spall on each face." The second group is shorter, exhibiting at their base a "slightly concave lateral edge which turns to form a broad convex blade edge." The

second type may exhibit multiple sequential flutes. It is unclear whether Loring means to imply any chronological significance to this typology, for which there is no independent evidence similar to the beach ridge series in the Great Lakes or Gardner's stratigraphic series. However, Loring's second type may be a northern New England parallel with the "Mid-Paleo" and Crowfield material in the mid-Atlantic and Great Lakes.

Ritchie (1980:6) recognizes six types among Northeast fluted points. "There exist some regional typological differences in all the traits [of fluted points]", which he suggests have chronolgoical significance. In the context of his discussion (ibid) he clearly implies that the variant forms of fluted point have chronological significance; however, the only site assemblage which Ritchie clearly designates as "late" in the Paleoindian sequence from the New England area is the Reagan site. Our recent (July 1986) examination of the extant Reagan site collection in the Bixby Library, Vergennes, Vt. and the University of Vermont collections indicates that the Reagan material may be most closely comparable with the Holcombe site in the Great Lakes sequence. There are, however, other point styles from the collection, notably Crowfield-like points (Ritchie 1953) and at least one point base (Ritchie 1953) similar to the parallel-flaked lanceolate point bases from site 154.7 at Munsungun Lake (Bonnichsen et.al. 1982). Thus, the Reagan site appears to be a multi-component Paleoindian site later in date than the Gainey, Bull Brook-like, Parkhill complex, Debert and Vail groups of "classic" fluted point assembalges.

Place of the Michaud and Lamoreau sites

The Michaud and Lamoreau sites are clearly more closely related to an undifferentiated construct of "classic" fluted point assemblages that might include the Parkhill complex ,Gainey-like points, Bull Brook, Vail and Debert points than they are to Crowfield, Holcombe, and Hi-Lo point styles.

The Michaud collection is also clearly differentiable from manifestations including Gardner's Mid-Paleo material. There are no stratigraphic or other independent means of controlling chronological separation or sequence within the group of "classic" Paleoindian assemblages from the Great Lakes, New England and the Maritime Provinces. Radiocarbon dates do not seem to have enough resolution at this time to help resolve the situation (Byers 1959: 628, Stuckenrath 1966: 77, Gramly 1982, Haynes et.al. 1984, McNett et.al. 1977, Moeller 1980: 31). The only date of great precision is the average date of 10,585 from Debert, which can be accepted as an average only if we assume that the Debert site was occupied for few years, an assumption which some might accept (eg Spiess 1983), but which others reject.

Seriation of the "classic" northeastern fluted point assemblages is indeed difficult. We have above reviewed the Great Lakes scheme which separates Gainey material from Parkhill Complex material. Grimes et.al. (1984:172) propose the "Bull Brook Phase" to include the Bull Brook I and Bull Brook II sites, Wapanucket 8 and the Whipple site, because of a similarity in lithic raw material usage at these four sites, and because of perceived typological correspondences. For example, "finished projectile points and fragments display virtually identical basal configurations, finishing and fluting, particularly between the Bull Brook localities and Whipple (ibid: 169-170)."

Gramly (1982:70-72) focuses on the depth of the basal concavity on fluted points from the Vail and Debert sites, and proposes a developmental sequence from less-deeply indented points, such as the Bull Brook point, to Vail and Debert. Gramly (ibid:71) cites a number of fluted points with deep basal concavities from across the Northeast in implying that this attribute is a style with chronological or "developmental" significance, a position

strengthened by his work at the Lamb site (Gramly 1986). Gramly (1984:111) also states that he had once thought the deep concavity "might be considered cultural, ie. an expression of style by the stone knapper" possibly indicating ethnic relationship between Vail and Debert. However, the distribution of such points across the countryside "cautions us against accepting the explanation of style or cultural whim (Gramly 1984: 111)"; alternatively, Gramly proposes that the deeply indented bases may be an adaptive trait that would tend to increase over time.

We think it instructive to contemplate the variability in fluted point form among eight fluted points associated with the kill of one mammoth at Naco in Arizona (Haury 1953). We may assume that these eight points existed in the armament supply of several to many hunters alive contemporaneously. It is probable that they came from one "band", however defined, but not a certainty. In any case, whatever variability exists in the Naco assemblage cannot be chronological in nature. The points vary in length from moderate to long, in outline from parallel sided to convex sided. The basal corners vary from no ears to moderate ears, and the depth of basal concavity varies from near nil to moderate compared with northeast fluted point. Interestingly, six of the points come in three pairs, with both examples in each pair made of the same material as its counterpart. At a visual level only, based on Haury's published figures, the basal concavity depth and ear form appear to be more similar between members of a pair than they do among the group as a whole. We might assume that paired points made of the same material, with similar basal treament, might have come from the same hunter's production. In any case, the Naco assembalge indicates that much of the variability we see in fluted point assemblages may be ascribed to individual preference without overriding chronological or social group meaning.

Table 3-8 Selected Attributes of Fluted Points from Paleoindian Sites in the Northeast

Site		Bull Brook	Bull Brook II	Vail	Debert	Michaud
Depth Basal Conc.						
	min.		3.75	5.5	2.0	3.4
	max.		6.8	12.6	15.0	7.0
	ave.	shallow	5.2	8.6	9.4	4.8
Ave. Length Flute Scar		>1/2 sometimes full length	>1/2	<1/3	<1/2	>1/2
Flaring Basal Ears		present	absent	absent	absent	present

note: Average length of the flute scar is given in relation to the distance from the proximal end of the basal ears to the point mid-section.

At this state in our analysis and inspection of "classic" Northeast fluted points, we think that certain fluted point attributes (where data are available) cluster within a site and between certain sites (Table 3-8). However, close examination of these assemblages indicates that there is certainly an overlapping attribute range. For instance, although flaring basal ears were not a majority attribute at any of these sites. they were most common at Bull Brook and the Michaud site. Several examples of slightly flaring basal ears were present at both Debert and Vail, though it was such an uncommon attribute as to be considered absent for the present purpose. Although the average depth of the basal concavity is greater at Vail and Debert, the minimum depth overlaps with specimens from Bull Brook, Bull Brook II, and the Michaud site. Clearly there are reflections of both localized afiliations and individual maker's differences in fluted point form attributes within this "classic" group of material. Much more work is necessary before this variation can be said to be stylistic marking for

ethnic or band groups or to be surely temporally indicative.

We can, however, begin to place the Michaud site specimens within the variability of Northeast fluted points. First, there appear to be two stylistic clusters of points at the Michaud Site (see below). In all, however, the Michaud points are closer to Grimes' Bull Brook Phase than to the Vail or Debert sites (although not identical with the Bull Brook Phase). There are enough differences between the Michaud site assemblage and the Vail site assemblage to demonstrate the lack of a close stylistic similarity. When compared with the Great Lakes sequence, Michaud site points tend to be closer to Gainey-like material than to the Parkhill complex, but some Michaud specimens do exhibit traits (fishtail base) that place them intermediate between these two constructs.

<u>Michaud Site Fluted Points</u>

Nine fluted points and fragments were recovered at the Michaud site (Plates 3-5 and 3-6). Of these, only four specimens were complete enough to examine a range of diagnostic details including depth of basal concavity, shape of the basal ears, and flute scar characteristics. Interestingly, the points clustered into two categories based not only on provenience data and raw material but on stylistic characteristics.

Two specimens (23.12.0109, 23.12.0088/.0112) were made of black chert. Though these points differ in length, their form is surprisingly alike. Both display a shallow basal concavity bounded by thick, squared basal ears. The single flute scar showing on the dorsal side of each specimen extends nearly to the distal end of the point. The ventral side displays a single flute scar on specimen 23.12.0109 which extends for half of the length of the specimen, and a double flute scar on specimen 23.12.0088/.0112 which extends just beyond the mid-section of the point. The thickness to width

ratio for both specimens is 1:4. Both specimens show a convex longitudinal ridge beyond the flute scars defined by regular collateral flaking. Though retouch may have accentuated this characteristic on specimen 23.12.0109, it is apparent that a thick longitudinal ridge near the tip was an original feature of both of these points.

Two fluted points, one with the distal end missing and the other with the tip missing were recovered from Concentration I. Further, a tip section and a basal ear (which do not fit with the preceeding specimens) were also recovered from this concentration (making a minimum of four points). All of these specimens are made from a red Munsungun chert. The two fragments (23.12.0377. 23.12.0451) which are not whole enough to contain many diagnostic characteristics nonetheless support the stylistic configurations which will now be examined in the other two specimens (23.12.0643, 23.12.0321/.0433). Both of these specimens have relatively shallow basal concavities, though both are somewhat deeper than those of the previously described black chert specimens (see table 3-9). The basal concavities are symmetrically arcuate and are bounded by finely pointed, heavily ground "fish-tailed" basal ears. The points are lanceolate in outline, with the length of maximum width occurring just proximal to the mid-section of the point, in contrast to the preceeding specimens, whose length of maximum width occurred near the base. The thickness to width ratio for specimens 23.12.0643 and 23.12.0321/.0451 is 1 to 5, in keeping with the same ratio for the preforms from Concentration I. Flute scars in general are not as long as on the preceeding specimens, although the terminus for the dorsal flute scar on specimen 23.12.0643 is indeterminable as the proximal portion of the tool is missing.

Three other fluted point fragments were recovered from elsewhere on the site during our excavations. One (23.12.1974) is an asymmetric, very narrow

tip fragment displaying the remnant of a flute scar to just beyond a transverse break. It is made from Neponset rhyolite. A very thin, narrow biface mid-section (23.12.1568) showing a flute scar is also present. Finally, a very small fragment of a basal ear of Neponset rhyolite was recovered. The fragments just described were not whole enough to contribute any information to the above discussion. In fact, the mid-section (23.12.1568) and tip (23.12.1974) fragments appear to come from points which would have been considerably smaller than the whole fluted points described above.

Channel Flakes

Twenty-one channel flakes and fragments were recovered at the Michaud site. They appear to vary in size and shape as a function of both raw material (Table 3-10; Plate 3-7) and preparation techniques. Channel flakes made from Neponset rhyolite tend generally to be narrow and less well defined than those made of chert. The width of these Neponset rhyolite channel flakes is similar to the small width of the flute scar of the one extant fluted point of Neponset rhyolite (23.12.1974). In the cherts, there appears to be an equation between the extent of symmetrical convexity achieved by lateral flake removals and the production of the desired parallel-sided long channel flakes. Two red chert channel flakes (23.12.0087, 23.12.1398) are excellent examples: they are narrow--13 mm. and 15 mm average widths, parallel-sided, and, though both are broken, their extant lengths are 55 mm. and 47 mm., respectively. Both are plano-convex in cross-section with a well-defined longitudinal ridge on the dorsal side. Specimens that do not display this well-defined convex longitudinal ridge are asymmetric and tend to detach as dictated by the irregular pattern of lateral flake scars. The fluted points in this collection (and many of those observed in the Vail collection) tend to have one long flute removal on what we call the dorsal side, and one or more shorter and less well-defined flute scars on the ventral side. This effect may be due to the careful production of a medial longitudinal ridge by lateral flaking on the dorsal surface of the preform. Although this pattern may be constrained by the original flake from which the point was manufactured (i.e. if the flake was curved more surface need be removed from the dorsal side to "straighten out " the flake, and less from the ventral side), it would be expected that much of this straightening process would have been accomplished prior to the final fluting. Alternatively, it may simply have been standard procedure

Table 3-10

Raw Materials Distributions for Channel Flakes

Material	Number	Percent
Cr1	5	30.0
Cr105	3	17.0
Ceg1	5	30.0
Rfnp	4	23.0
	17	100.0

to work the dorsal and ventral faces in slightly different ways.

Of the twenty-one channel flakes and fragments present, nine have been utilized. Two of these have been worked into gravers or perforators, and are discussed below. Three channel flake fragments (23.12.1139. 23.12.0932, 23.12.0817) are present which preserve the top of the fluting nipple and the ground striking platform.

Sidescrapers

Sidescrapers are perhaps the most morphologically diverse Paleoindian tool type. As the name implies, the primary working surface generally occurs on the lateral side(s), though the distal end may be utilized as well. Quite often sidescrapers take the general shape of the flake on which they were made, and we suspect that large, primary flakes of several standard types were employed in their manufacture. Interestingly, sidescrapers are a tool form confined almost exclusively in the northeast to the Paleoindian time period (Steven Cox personnal communication), and therefore they represent a diagnostic form paralleling that of fluted points.

Various authors (Cox 1972, MacDonald 1985, Gramly 1982, Irwin and Wormington 1970) have suggested a number of sub-types for the sidescraper class, as well as recognized the relationship of these forms to other tool classes. Funk, for instance, suggests a relationship between sidescrapers, flake knives, and retouched flakes. "These artifacts are here grouped in one category, partly because of a fundamental morphological similarity: all are based on flakes retouched on one or more long edges...(1976: 215)." Funk's distinction between knives and sidescrapers is arbitrary, as it is based on the steepness or shallowness of the bevel on the retouched edge(s). There is even less of a distinction from a functional viewpoint: Funk

records the same pattern of wear consisting of "edge-crushing, or the removal of tiny hinge-flakes from the working edge" (Funk 1976: 215) on both knives and scrapers.

The Holcombe Beach site uniface collection was divided into three categories: standardized scrapers, gravers, and unique or irregular tools (Fitting, et.al. 1966: 48-51). This approach seems to have been conceived as a typological exercise, but summary attributes for each type are discussed. Most recent eastern Paleoindian assemblage discussions have followed a similar approach, except for Eisenberg (1978), who has attempted a purely attribute-based approach to subdividing unifacial tools. MacDonald says the typology of the sidescraper class is difficult because "variations in form are myriad. A major technological difference occurs between those that are true unifacials -- that is, trimmed over the entire face of one side--and those that are retouched only marginally (MacDonald 1985)." Actually, MacDonald (1985: 395-98) subdivides the sidescraper group into eight types, such as "sidescrapers on expanding flake with unilateral retouch, sidescrapers with steep retouch opposite the bulb of percussion". Most of the types seem to be based on flake shape, but one type is the "sidescraper with graver spur".

"At first glance sidescrapers appear to be a variable lot defying classification. Actually, the tool class is easily analyzed (Gramly 1982:36)." Gramly divides the sidescraper tool class into two types: those that converge distally and those that expand distally. Gramly further comments that sidescrapers are the largest tools in the assemblage, and that their function is unknown. He favors the idea that sidescrapers were used on wood.

Alexander (1973) presents an extreme case of the typological

Table 3-11

Unifaces Attributes Used in the Michaud Site Analysis

1. Cat. #
2. Category (whole or fragment).
3. Type (sidescraper, endscraper).
4. Material
5. Length: Maximun on the longitudinal axis.
6. Width: maximum.
7. Length or Maximum Width: always taken from the proximal end forward.
8. Length/Width Ratio
9. Thickness: maximum, independent of where it occurs.
10. Length/Thickness Ratio
11. Description: a description of the outline of the tool.
12. Edge Angle: Distal: an average of several when variation occurs.
13. Edge Angle: Right Lateral: same comments as for distal edge angel.
14. Edge Angle: Left Lateral: same comments as for distal edge angel.
15. Platform Angle: an angle of the striking platform in relation to the ventral side of the artifact.
16. Platform Preparation: choices are 1) flat, 2) retouched, 3) grinding or crushing.
17. Concavity(ies): number and position.
18. Spurs: number and position.
19. Wear Position
20. Wear Type
21. Cutting Edge Contour: (for endscrapers only) a description, choices are 1) pointed, 2) irregular, 3) flat, 4) assymetric.

subdivision of this artifact class, creating fifteen scraper types. Likewise, Irwin and Wormington (1970 28-29) devise approximately twelve sidescraper types.

Jordan (1960:85, 102-103) perceptively comments that the largest pieces of raw material in the Bull Brook assemblage seem to have been used to make sidescrapers or retouched flakes. The largest in the Bull Brook collection is a retouched flake weighing 94.5 gr., and measuring 107x74x15 mm. "It is also my belief that slabs of raw material were transported from their sources (whereever they were) in the form of these sidescrapers." "Being carried as a large tool instead of merely as dead weight would help 'pay the freight' of the material."

It is possible that sidescrapers were indeed a handy carrying form for raw materials, though evidence thus far is only suggestive. However, the substantial number of relatively large sidescrapers found discarded in archaeological contexts would seem to place limits on such a probability, since they would tend to be re-utilized for other tools if they were intended as primary raw materials sources.

Just as other authors have been faced with making typological decisions about the sidescraper class, so the Michaud site's small sidescraper collection includes a diversity of forms suggesting a number of types. Whether these be functional types, or simply original flake morphological variation, remains an unanswered question at this time.

Sidescrapers, as well as other standard form unifacial tools (e.g. endscrapers, concave scrapers, but not utilized/retouched flakes) were measured and described using a common series of measurements (Table 3-11). Summary statistics for the sidescraper class are presented in Table 3-12.

We use the term "backing" frequently throughout this section, and a definition should precede its use. Intentional "backing", or providing a

Table 3-12

Sidescrapers: Summary Statistics

N = 9	N = 9	N = 9
length ave. 66.91	width ave. 37.7	length max. width ave. 38.01
sdv. 15.59	sdv. 15.7	sdv. 18.07
min. 44.9	min. 20.3	min. 6.0
max. 85.0	max. 74.3	max. 61.0

N = 10	N = 8	N = 8	
thickness ave. 8.64	length max. thickness	ave. 28.9	edge angle/dist. ave. 54.5
sdv. 2.78		sdv. 12.58	sdv. 13.13
min. 5.0		min. 10.2	min. 26.0
max. 13.5		max. 44.0	max. 65.0

N = 10	N = 10
edge angle: r. lat.	edge angle: l. lat.
ave. 48.9	ave. 55.3
sdv. 9.13	sdv. 7.98
min. 41.0	min. 41.0
max. 65.0	max. 69.0

rounded or smoothed surface to prevent abrasion either to the hands or to a haft, has been noted in two forms. One, in the form of intentional medial snapping, has been noted elsewhere (MacDonald 1985: 97, Cox 1972: 44). The second form of "backing" is seen either on a distal end or a lateral side which has not been regularly retouched. These often ragged margins have been either lightly and irregularly retouched, "nibbled", or ground, or a combination of these features. Approximately half of the sidescrapers in the Michaud collection display at least one of these varieties of "backing".

The most numerous type of sidescraper recovered at the Michaud site is parallel-sided or expanding. Five specimens are represented, three of which have hinge fractures or are snapped at one end (Plate 3-8). Two of these are retouched on all other margins (23.12.1700, 23.12.2301), while one (23.12.2323) is "backed" by slight retouch and edge "nibbling" on the left lateral side.

Two other specimens (23.12.2293, 23.12.2053) have been created on large, expanding flakes (Plate 3-9). The left lateral side on each of these specimens has been steeply retouched, while the right lateral sides show "nibbling" and light retouch. The distal end of specimen 23.12.2053 is a jagged edge which displays light retouch and possible grinding as "backing".

A second type, represented by three specimens, may be described as distally convergent. Two specimens (23.12.1477, 23.12.0308) are relatively small, with regular retouch confined to the right lateral sides and irregular retouch and edge "nibbling" on the left lateral sides (Plate 3-8). The third specimen (23.12.0289) appears to be a preform. The left lateral side is crescentic in outline and has been bifacially flaked, while the right lateral side is straight and steeply retouched.

Three specimens (23.12.2218, 23.12.0090, 23.12. 0488) represent a

smaller variety in the sidescraper class (see Plate 3-10 lower left for 23.12.0090, Plate 3-16 upper right for .0488). They are made on thin, small flakes which have an average thickness of 4.6 mm., compared to the average thickness of 9.1mm. for the remaining sidescrapers in the collection. Moderately steep retouch is seen on both lateral edges. The distal end of specimen 23.12.0090 is convex in outline, and may have served an endscraper function. A second specimen (23.12.0488) is unmodified on the distal end.

Numerous specimens which are too fragmentary to be assigned to a particular type have simply been catalogued as uniface fragments.

Endscrapers

The form "endscraper" as generally observed in Paleoindian site reviews refers to uniface tools whose primary working surface occurs opposite from the bulb of percussion e.g. on the distal end. Endscraper "bits" are usually mildly to strongly convex with edge angles which vary greatly, though they most often fall within the 55-75 degree range. It has been suggested that edge angle may have functional significance (Wilmsen 1970) in that certain edge angles are more effective for some tasks than for others. It seems likely that the measured edge angle of an endscraper which has been retrieved from an archaeological context may reflect not only the edge angle purposefully knapped to an appropriate angle, but also both the effect on edge angle of resharpening and of use.

Besides exhibiting a usual flake orientation and distal end form, Paleoindian endscrapers may vary considerably in size and in the number and type of additional features which each specimen may display. Other authors describing Paleoindian assemblages have found it useful to define a number of types for this class, based both on morphological characteristics and presumably functional attributes.

The extreme typological approach to this class is exemplified by Irwin and Wormington (1970 28-29) who identify eleven types of endscraper on the basis of overlapping and not mutually exclusive attributes. One group is distinguished by the shape of the bit, another by the presence of a graving spur or angle where the retouched edge intersects the side of the flake, another by ventral as opposed to dorsal retouch, and so forth.

MacDonald (1985: 90-92) defines six types of endscraper in a sample of 1,587 specimens from the Debert site. Of these, 425 were too fragmentary to assign to type, leaving a typeable sample of 1,162. Over 50% of the sample were "characterized by a tapering stem, by extensive retouch often tending to diminish the lateral margins, and by a steeply chipped working edge.""Their most striking feature is the presence of hook-like projections or 'spurs' at the corners of the bit." Another 30% of the intact endscrapers, called rounded bit endscrapers by MacDonald, are identical to the spurred endscraper in size, material, and manufacturing details, but lack the spurs. The remaining types described exhibit variation in flake shape, preform-to-tool orientation, and the amount of retouch occurring on the tool.

In contrast to the typological approach exemplified above, the Holcombe site yielded eight tools which were simply classified as endscrapers and described as follows (Fitting et al. 1966: 48): "They are marked by a convex working edge, a series of parallel flakes forming a steep retouch and a series of small flakes, ending in hinge fractures, directly on the working edge. The entire series is marked by a slight constriction back of the working edge. In several examples an actual 'spur' is present. "Funk (1976: 214-15) also simply describes the type "endscraper" without further subdivision. He states that they were

invariably made on preforms which were "oval or expanding, flat to ridge-backed flakes, retouched at the broad end opposite the striking platform".

Of particular interest, Gramly (1982: 34) has noted that at the Vail site endscrapers are but one stage in the useful life of the stone on which they are made. "The usual transformation for a trianguloid endscraper was first to become a cutter with a spur flaked at the corner of its working edge or proximal end. Next, the former scraper was tipped on edge and beaten with a hammer, perhaps one made of stone. This use as a wedge (piece esquillee) resulted in heavy crushing and stepflakes on the piece." Gramly here presents the hypothesis that endscrapers would not have had graving spurs flaked on their lateral margins until after they had ended their useful life as endscrapers, having been finally resharpened and used to a dulled edge.

Only nine endscrapers were recovered at the Michaud site (Plate 3-10) and they do not sort easily into well-defined types. Flake size and other flake "preform" characteristics, raw material selection (Table 3-13) and extent of resharpening appear to be the attributes responsible for most of the variation. Individual "stylistic" variation must also be considered, particularly in a small site like the Michaud site where a low artifact density coupled with well-defined concentrations of tools suggest the possibility of tools left by a single artisan in each concentration.

For instance, three endscrapers (23.12.0151, 23.12.2193, 23.12.2214) recovered from two adjacent tool concentrations (Concentration I and Concentration III) and a forth specimen (23.12.0022), which was surface collected, are all small and made from red chert (Cr05 and Cr1b). Further, each has been made on a flake which appears to have been chosen and worked so that the dorsal surface centers between flake ridges, leaving a medial dorsal facet. Two of these specimens have been bilaterally notched.

Table 3-13

Endscrapers, Raw Materials

Cr1	1	11.1
Cr05	3	33.3
Ct01	2	22.2
Rfnp	3	33.3
	9	99.9

Table 3-14

Summary Statistics: Endscrapers

Variable	N	ave.	sdv.	min.	max.
Length	10	30.31	8.09	22.8	48.2
Width	10	22.5	4.33	16.5	28.3
Thickness	11	5.8	1.6	4.6	9.2
Length Max Width	10	22.5	7.0	14.6	35.0
Length Max Thickness	10	21.72	8.88	13.0	45.0
Distal Edge Angle	11	56.0	8.97	41.0	68.0
Rt. Lat. Edge Angle	11	51.36	14.15	39.0	78.0
Left Lat. Edge Angle	11	51.18	14.28	27.0	73.0
Platform Angle	4	112.5	18.69	98.0	138.0

presumably for hafting. It is here suggested that other specimens in the collection may have been hafted in an open-socketed haft, as are similar specimens in Neo-eskimo collections (Fitzhugh and Kaplan ----). When resharpening brought the scraper bit too close to the haft, the endscraper would then have reached the end of its useful life and would have been discarded. Thus, some spurs or sharp angles at the intersection of a lateral side with the scraper bit were created during resharpening. Particularly as the scraper bit receded toward the haft, it would have been increasingly difficult to round the distal lateral corner. This situation would have been accentuated in the cases where hafting concavities had been flaked into the lateral sides.

Two endscrapers of Neponset Rhyolite (23.12.2396, 23.12.2109) exhibit both trianguloid outlines and slightly convex bits; both were recovered within several meters of eachother. Hafting modification is suggested on these specmiens as flakes, not unlike small, rough channel flakes have been removed from the proximal dorsal ends of the tools. In contrast to the specimens described of red chert, the dorsal surfaces of these endscrapers exhibit a random distribution of flake scars with the exception of the medial thinning flakes.

Two specimens (23.12.1528, 23.12.0586) made from tan chert (Ct01) were recovered from different tool concentrations. Both, however, have a greater length to width ratio than other endscrapers in the Michaud collection, and both display a central dorsal ridge. It is not suggested necessarily that the two specimens were made by one toolmaker but rather that raw material may have played a substantial role in determining scraper shape in this case.

Thus, though the dominant endscraper form at the Michaud site is

parallel-sided to trianguloid in outline with a convex bit, and all are lacking intact spurs, very definite stylistic similarities exist among endscrapers of the same material and particularly among those recovered in close association with one another. Summary statistics for the endscraper class are presented in Table 3-14.

Limaces

The tool form named "flakeshaver" in a recent functional/morphological study (Grimes and Grimes 1985) has a long history of poor recognition in Paleoindian studies. Jordan (1960: 104-5) calls them "groovers", stating that they are between 30 and 50 mm. in length and up to 10 mm. in width. According to Jordan, Byers called the specimens from Bull Brook "keeled scrapers", while the Beverly group of avocational archaeologists who excavated at Bull Brook called them "rowboats or canoes". Witthoft called this tool form "flint bars", and was apparently the first to differentiate it from the mass of other Paleoindian tools. MacDonald (1985) classified tools of this form as "stone awls" under "perforating tools". Gramly (1982: 37-8) calls these tools "limaces" based on an Old World (French, Upper Paleolithic) analogue.

Just as the form has had a poor history of recognition, so has their function been open to much speculation. Though he does not ascribe direct function, MacDonald (1985: 98-99) notes of the "stone awls" at Debert,

ventral side of the tip and occasionally from the tip itself indicates that considerable pressure was exerted on this point through the length of the tool. These awls show superficial resemblance to drill bits but are completely unifacial and show no signs of rotary use"

Cox (1972 48-49) describes six specimens in the Shoop collection as "perforators" which may, instead, belong in the "limace" category. Several

of the Shoop specimens have been made on blades or blade-like flakes. The tips in half of the specimens are bifacially flaked and sharp, while the remaining specimens have a fairly blunt tip. Cox notes of this difference: "In view of the near identity otherwise in tool shape and execution, I doubt that this is a significant difference-in all cases the tip has been carefully shaped and probably represents the main working portion of the tool."

By far the most detailed analysis has been prepared by Grimes and Grimes (1985), who derive several lines of evidence strongly suggesting that these objects were hafted in more-or-less standard depth sockets, and sequentially re-set and re-used if they snapped. At each snap the proximal fragment was extracted from the haft and discarded, and the distal portion re-hafted until it got too short. The distal end was used as a push-plane and scraper, leaving use-wear as scalar flake removals from the ventral side of the distal end or from the distal end of the lateral sides. Grimes and Grimes (1985) suggest that a "flakeshaver" is a .."hafted whittling or shaving tool applied to hard materials such as bone, ivory, wood, or antler."

Two limaces were recovered from the Michaud site excavation, while a third was found by George Eaton while surveying for the Maine Department of Transportation airport road and subsequently lost. The latter specimen was described as being whole, long and fairly narrow, and made from gray-green chert (Ceg1).

A single whole specimen (23.12.1342) of red and green mottled chert (Cr05) was recovered by our excavation (Plates 3-11 and 3-12). It is long and narrow, measuring 61.8 x 9.8 x 4.0 mm. and appears to have been made on a blade, although the striking platform is absent. The lateral sides have been steeply retouched, though it is not clear whether the sides were used

for a scraping function or were only reouched to strengthen the tool and shape it for hafting. Both the distal and proximal ends have use microflakes removed from the ventral side. Microflakes have also been removed by force from the dorsal side along the dorsal arris at the top of the retouched left lateral distal end. The tip was either pushed into a hard substance and/or inserted into a hole in a semi-hard substance.

The second specimen (23.12.0634) is made from black chert and is a proximal or distal fragment. It also was made on a blade-like flake. The specimen, though broken, is narrow (9.5 mm.) and relatively thin (5.0 mm.). Flaking from both lateral sides meets on the longitudinal axis of the tool to form a central ridge. Again, slight microflaking is seen at the tip on the ventral side.

The two extant limaces and the one described by George Eaton are more long and narrow than those generally found in Paleoindian assemblages in the northeast. At present we hesitate to ascribe a temporal or functional significance to this difference. As all three are finely formed and come from the same tool concentration (Concentration I) it is possible that we are again viewing an individual's stylistic preferences, parallel with other tool forms in this concentratioon (see Chapter 6).

Pieces Esquilles and Drills

The Michaud and Lamoreau site assemblages lack piece esquilles and bifacial drills. However, as their absence may be significant in a seasonal/functional sense, we hereby discuss each tool as it is described in the literature.

Jordan (1960: 95-96) was apparently the first to report the tool type that has come to be called a "wedge" or "piece esquilles" (translation: scaled piece). He calls them lozenges: rectangular, or diamond-shaped

bifacial implements, coarsely and crudely chipped, with flake scars reminiscent of bipolar flaking. They have a vague similarity to cores "but the flaking is too irregular, and a small number of definite cores have been found at the site which are quite different. I feel that these do constitute a new tool type, but can offer no suggestion as to their function." "P.E.L. Smith has recently called my attention to a somewhat similar artifact from the Upper Paleolithic in France, interpreted there as a wedge (Jordan 1960: 95-96)."

At Debert pieces esquilles account for up tp 20% of the total tool sample (MacDonald 1985: 85-86). "In form they are generally rectangular and exhibit bipolar flaking from paired, crushed and battered surfaces. Primary flakes driven from both faces by direct hard percussion exhibit extreme concentric ripples emanating from the point of percussion." "Several paired edges are observed on many specimens which have been rotated one or more times during use (MacDonald 1985: 85-86)." He surmises that these tools were used as wedges on unstated substances and as slotting tools when removing a sliver of antler from its parent piece.

Wedges or pieces esquilles are present in the Shoop assemblage, for which Cox (1972: 51-52) generally follows MacDonald's description and functional interpretation. MacDonald (1985:) states that pieces esquilles are present in the Holcombe assemblage, although Fitting, et al. (1966) do not describe them.

Pieces esquilles constitute the third most common tool at the Vail site, where Gramly (1982: 41-42) and Lothrop and Gramly (1982) clearly feel they were used as wedges. None of the thus produced hard-hammer flakes at the Vail site seem to have been utilized. Importantly, however, up to 20% of these tools show clear evidence that they had been other tool types prior

to being used as pieces esquilles.

Basally fluted twist drills are first described by MacDonald (1985: 81-85) who identified four specimens in the Debert collection, where there is considerable variety of form in the tip. The Vail site assemblage contains 56 drills (Gramly 1982: 30-31) of which 35% are unfluted, 24% are fluted on one face only, and the rest are bifacially fluted. Gramly also notes variability in distal end form. Although neither author states so, the implication of such a high percentage of fluting on the drills is that they were often thinned for hafting, perhaps in conjunction with a bow drill.

Byers (unpublished: 21-24), in his preliminary analysis of the Bull Brook assemblage, suggests that the bit ends of Debert drills (and under this definition Vail drills-Brush and Spiess personnal observation) do not qualify as "twist drills" in the sense that the form from Bull Brook does in terms of tip morphology. A number of Bull Brook drills examined by Byers exhibited flake removals which had been removed from opposing sides of a flat, broad bit end, thereby creating an end analogous to a modern twist drill. Despite the variability of distal end form noted by both MacDonald and Gramly, neither site produced a drill bit with this particular twist bit configuration.

Concave Scrapers/Spokeshaves

Concavities of varying size and of probable functional diversity are found on tools in most Paleoindian assemblages. Two distinct categories seem to emerge: those small concavities found generally in association with another tool form (e.g. endscraper), and most often assumed to be a hafting modification, and larger concavities (over 2 cm. in width) which occur singly or on opposing sides of a modified flake. Concave scrapers, as defined here, refer to the latter description.

Functionally these tools, as the oft used term "spokeshave" describes, are thought to be woodworking tools (Funk 1976: 216; MacDonald 1985:102) McDonald suggests that the concavities on the spokeshave "were probably used to remove material from wooden shafts by cutting as well as scraping with the concave edge. Concave scrapers make up 11% of the formal tools (formal tools including all types except utilized/retouched flakes and minute unifacial tool fragments) at the Michaud site. This is a significant proportion when compared to their frequency in other Paleoindian assemblages. Fifty concave scrapers were present at Debert, representing 1.5% of the formal tools. Gramly does not mention either concave scrapers or spokeshaves at the Vail site, though marked concavities occur on some endscrapers at Vail (Brush and Spiess personnal observation). These were often unilateral rather than bilateral, and occurred proximal to a graver spur that was on the distal lateral corner. One specimen was designated as a "spokeshave" at 6LF21 (Moeller 1980: 68-69), because of the presence of a semi-circular concavity on the distal end of a flake tool. The concavity, however, was not intentionally created, and the tool has spurs (three) which were isolated as the primary working portion of the tool. Spokeshaves were not noted in the Bull Brook or Bull Brook II assemblages, though this may be a function of the incomplete data available from these large collections to date. Only one "spokeshave" was noted for the Potts site (Gramly and Lothrop 1984: 137), though concavities occur on other tools.

So, the type concave scraper or "spokeshave" appears to be another Paleoindian tool type which varies in distribution both spatially and perhaps temporally, along with drills, pieces esquilles, and limaces. Another possibility, however, is the option that many of the concave scrapers are flake tools and consequently were not given a formal description by other authors.

Five concave scrapers were recovered at the Michaud site (see. Table 3-15 for individual measurements; Plate 3-13). Three are made on chert (1-Cr1, 2-CrO5), one is made on Neponset rhyolite, and one on a quartzite. Four are made from thin flakes on which only the concavity significantly alters the basic outline of the flake. Minimal retouch or edge "nibbling", perhaps to provide backing for these probably hand-held tools, occurs on most flake margins. The concavities are all located adjacent to the bulb of percussion.

One specimen (23.12.0086) is unique and deserves individual description. Its proximal end has been bifacially retouched, on the ventral side to remove the bulb of percussion. The left lateral side diverges from the base for 13 mm. and is retouched on the ventral side. A concavity of 21.7 mm. in length and 4 mm. in depth extends along the mid-portion of the left lateral side which is dorsally flaked. Distal to the concavity, the edge converges slightly, still retouched on the dorsal margin. The distal end is snapped. The right lateral side of the tool is slightly convex. The proximal half is retouched from the dorsal side, a large concnoidal flake was removed from the ventral side at mid-section, and the remaining length of the right lateral side is ventrally retouched. This opposing pattern of edge retouch, both laterally and transversely, is a functional enigma.

Gravers and Perforators

This is a loosely defined class at the Michaud site. There are multiple examples of tools with utilized tips, as at many other Paleoindian sites. However, the tipped specimens do not appear to be a functionally cohesive group. Gramly has chosen to include any specimen with a tip, whether snapped, flaked, or naturally occurring, multiply or singly spurred or associated with another tool (e.g. endscraper, generally) under the

Table 3-15

Individual Concave Scraper Measurements

Cat. #	Length	Width	Thickness	Length of Concavity	Depth of Concavity	Edge Angle of Concavity
23.12.1319	37.5	43.2	7.3	28.2	7.7	52°
23.12.0335	49.0	36.4	6.2	30.8	4.1	52°
23.12.1591	41.2	23.6	6.5	22.4	2.2	65°
23.12.0032	[36.4]	[18.7]	4.4	[20.3]	[1.8]	45°
23.12.0086	51.8	27.0	6.2	21.7	4.0	57°

functional rubric of "cutter."

Tipped specimens at the Michaud site do not appear to have preformed cutting tasks. Some may have served to puncture or perforate a soft material, presumably hide. It has been suggested (personnal communication to C.D. Cox from C.Vance Haynes) that the finely tipped specimens may have been used for tatooing or for splitting sinew. Other specimens appear to have been utilized on harder substances, possibly wood, bone or antler. "The suggestion that (fine tips) were used to cut the eyes in bone needles is plausible in light of the fact that eyed needles have been reported from the Lindenmeier site (Roberts 1941: 71)." "They are much too delicate to have been used for extensive work for bone or antler other than for scratching surface designs (MacDonald 1985: 100)."

As in other Paleoindian assemblages, these are flake tools, generally made on irregularly shaped flakes with little retouch except occasionally for tip definition. Backing, however, in the form of edge "nibbling" or irregular, light retouch is seen on the margins of many specimens.

Three specimens (23.12. 1843, 23.12.1534, 23.12.1592) from the Michaud site have expanding tips centered on a dorsal flake ridge (Plate 3-14). Of these, two (23.12.1534, 23.12.1843) have a steeply retouched lateral edge identical to a sidescraper edge, suggesting that these were multi-purpose tools.

A single specimen (23.12.1818) , made on a strongly concavo-convex flake displaying edge "nibbling" for backing on the lateral sides, has a sharp, fine, slighly expanding tip on the distal end which has been created by fine retouch. A small flake has been removed from the tip from the ventral side, probably for resharpening the tip.

Two specimens are made on channel flakes (23.12.0215, 23.12.1804). The former has a spur on the left lateral side defined by a transverse break and a concavity on the left lateral side which isolated the tip. The latter specimen has a tip which has been finely flaked on the distal end of the channel flake on the longitudinal axis of the tool. Both lateral edges of this specimen have been nibbled, and a concavity has been flaked on the left lateral proximal end from the ventral side of the flake. The tip has a flake removed from the ventral side, as does specimen 23.12.1818, presumably for resharpening the tip.

Utilized/Retouched Flakes

Retouched flakes will be discussed with utilized flakes because, in all cases, modification has not significantly altered the basic outline of the flake. Usually light retouch and/or wear in the form of edge damage occurs on one or more margins of the flake. Functional shapes such as concavities are often accentuated naturally occuring characteristics of the original flake. Whole specimens are generally of moderate size; the range for length is from 28.5 mm. to 69.2 mm, the range for width is from 20.9 mm. to 36.5 mm, and the range for thickness is from 2.7 mm. to 17.5 mm. Their distribution by raw material is presented in Table 3-17. See Plate 3-16 for examples.

The form in which the raw material arrived at the site and the purpose for which the flake was removed from its parent rock influenced the size and retouch/utilization characteristics observed on the retrieved specimen. For example, the utilized flakes of black chert are all thin, fairly large, biface thinning flakes whose distribution (see chapter 6) suggests that they were generated on the site from one episode of biface reduction. The finely feathered edges on these specimens show edge damage from use rather than

Table 3-16

Utilized/Retouched Flakes, Uniface Fragments

Material	Number	Percent
Cr1	17	24.3
Cr02	1	1.4
Cr03	2	2.8
Cr04	1	1.4
Cr05	10	14.3
Ceg1	3	5.7
Cb01	4	5.7
Ct01	1	1.4
Rfnp	30	42.9
Rc01	1	1.4
TOTAL	70	100 %

intentional retouch, indicating that they were expedient tools which were utilized and discarded probably close to where they had been originally removed. The same pattern of edge use-wear rather than retouch holds true for the utilized/retouched flakes of Neponset rhyolite (Rfnp) The high frequency of these forms in close association with large amounts of Rfnp debitage again suggests that they were an expedient tool, perhaps a handy-sized or shaped flake which was picked up from among a number of flakes and utilized in the vicinity for any number of tasks before being discarded.

The utilized/retouched flakes of the various red cherts, on the other hand, exhibit a high proportion of retouch. With the exception of several examples (23.12.0150, 23.12.2322, 23.12.1158), all are fragmentary. It seems possible to suggest that some retouched flakes were "curated" or carried for some time before being discarded.

Rough Stone

A rough stone industry, including hammerstones, anvils, a variety of abrading stones, chopping and crushing tools, and perhaps large, coarse scraping planes (MacDonald 1985: 105) has now been noted for many Paleoindian sites. There does not, however, appear to be a universal inclusion of these tools in Paleoindian site reports. A variety of factors may account for this non-uniform reportage, as well as for the identification of only limited types of rough stone tools in specific sites. In contexts where other stones are present within the soil matrix, the entire range of large, coarse stone may be missed, especially in sites already disturbed. Additionally, these rough stone tools do not often look convincing as tool types and may thus be ignored, unless the context indicates human importation of all large, rough stone. Alternatively, lack of reportage may reflect a functional difference from site to site.

Almost all rough stone tools found at Paleoindian sites are made from locally available material, most often in cobble form, but occasionally from a bedrock source. At larger sites, such as Lindenmeier (Wilmsen and Roberts 1984), Agate Basin (Frison and Stanford 1982, Debert (MacDonald 1985), and Bull Brook I (Grimes personal communication), greater numbers and varieties of rough stone tools are found. At smaller sites including Bull Brook II (Grimes personal communication), 6LF21 (Moeller 1980), and the Whipple site (Curran 1984), as would be expected, the few rough stone tools present often seem specific to a single task. For example, a single hammerstone completes the coarse tool inventory at both Bull Brook II (Grimes personal communication) and 6LF21 (Moeller 1980).

It has been suggested by Funk (1973: 31) that rough stone tools such as "abrading stones, anvil stones and other rough stone tools, because such traits are extremely rare in Paleoindian contexts, (are) rather (more) characteristic of archaic complexes." Since a range of rough stone tools is present at many Paleoindian sites, it seems more likely that a rough stone component has always had some place in the Paleoindian manufacturing kit.

As previously noted, rough stone tools appear in a number of categories. For instance, several types of abrading stones have been identified, which are most often made from sandstone. One type which has a flat surface and was possibly used to smooth bone or wood (Wilmsen and Roberts 1984) was found at Lindenmeier, Debert (MacDonald 1985), and West Athens Hill (Funk 1973). Another type, seen at both Debert and West Athens Hill had one or more grooves worn into the surface; this pattern of wear suggests use for the smoothing and rounding of bone and/or wood, as in the shaping of hafts or manufacture of bone needles.

Abrading stones with shallow concavities are associated with pigment

grinding at the Lindenmeier site (Wilmsen and Roberts 1984). Though no analogous association has been confirmed for the northeast, the presence of pigments at Debert (MacDonald 1985), Bull Brook I, Bull Brook II (Grimes personal communication), and the Michaud site as well as abrading stones at Debert, Bull Brook I and possibly the Michaud site suggest a possible similar association.

Choppers are defined (MacDonald 1985, Goodyear 1974) as cobble tools. Generally the surface is removed from one side of the cobble, though occasional bifacial flaking is seen on the chopping edge. When wear is evident, it is generally in the form of crushing on the working edge (MacDonald 1985) or rounding and polish as at the Brand site (Goodyear 1974).

In the Folsom level at the Agate Basin site, granite and quartzite choppers were found in good context with well preserved skeletal remains of several bison (Frison and Stanford 1982: 60). One "was recovered in direct context with several disarticulated and butchered skeletal parts of a bison calf.... (The general appearance of working edge damage suggests that these specimens have been used for breaking or crushing [bone] rather than for chopping [meat or softer materials].)"

Hammerstones show characteristic patterns of battering and crushing in all Paleoindian assemblages, and are most often made from "hard" stones such as quartzite and granite. Anvil stones as well are generally made from "hard" stones and often show wear patterns of indented lines, such as might be expected from contact with the base of a piece esquilles. Indeed, a significant spatial correlation was noted between pieces esquilles and anvil stones at Debert (MacDonald 1985).

A significant proportion of the cultural material retrieved from the

Michaud site (about 400 pieces or 8.4%) was rough stone, either in the form of debitage or as possible tools. The majority (55%) of the rough stone from the Michaud site was Christian Hill diabase. Another 17.5% was a somewhat finer grained and harder volcanic, represented by one utilized river cobble and a sizeable amount of debitage, demonstrably from the same cobble. A final 27.5% of the rough stone was classified as "other", and included a variety of coarse-grained, relatively hard, purposefully broken cobbles.

Eighteen cobble chunks were present which weighed over 300 grams each. Another 37 flakes ranged in size from 25 grams to 300 grams, while 345 pieces were in flake or "shatter" form, weighing less than 25 grams each. Virtually all of the large specimens (those weighing more than 300 grams) exhibit flake removals or appear to have been modified by being broken in some way (Plates 3-17 through 3-19). In this sense they may be considered "cores". However, it is not apparent by macroscopic or microscopic examination if these large "cores" were utilized. For example, they show no consistent pattern of shaping to suggest particular functions. Additionally, obvious wear patterns on all but one specimen are totally lacking. This may in part be due to the heavily weathered surfaces of all of the diabase specimens, on which the great degree of weathering would obscure all but the most deeply inscribed patterns of wear. The coarser-grained specimens, belonging to the "other" category, seem unlikely to show wear patterns except for perhaps heavy crushing. A small number of the medium-sized flakes (approximately 25 gr.) show some evidence of grinding or smoothing, indicating an abrading function of some sort. Most likely, however, is that a combination of weathering and short use-life (an assumption based on the apparent brief occupation of the site and local origin of these tools), as well as type of use, have rendered these

cobbles and flakes "unreadable".

None of the rough stone at the Michaud site shows wear patterns characteristic of hammer or anvil stones, nor edge crushing as would be expected from chopping onto an anvil stone. It seems most likely, based on the relative hardness of most of the rocks in the rough stone category, and the lack of deeply inscribed wear patterns, that tasks of an abrading or smoothing nature were carried out with these stones, or that chopping or breaking of bone was accomplished without use of a stone anvil underneath the bone.

One specimen (23.12.0225) deserves an individual description (Plate 3-20). It is a cobble of green felsite probably related to the Kineo Traveler series but lighter in color and displaying fewer phenocrysts. Flakes have been removed from both ends and two sides. Deeply inscribed lines as would, for example, be expected from grinding a biface edge to prepare a striking platform are evident along a ridge between the original cobble surface and the rough area where a flake has been removed. Polish is evident on the "high spots" along the length of this roughened area. Two shallow, highly polished grooves are evident on one end of the cobble, while another slight depression on the surface on the side above the incised lines also shows high polish. It is evident that this piece was used for a variety of abrading tasks.

A range of grit sizes is available among the different abrading stone specimens (Plate 3-21), suitable for a sequence of abrading tasks from rough to fine or, alternatively for tasks requiring different rates of abrasion.

Pigment

Mineral substances which are assumed to have been used as pigment have been recovered from a number of Paleoindian sites, notably the Lindenmeier

site (Wilmsen and Roberts 1978), Agate Basin (Frison and Stamford 1982), the Debert site (MacDonald 1985), Bull Brook and Bull Brook II (Grimes et. al. 1984).

A total of 61 pieces of hematite and 8 pieces of ochre were recovered at Lindenmeier. Though the ochre was in a "crumbly state" (Wilmsen and Roberts 1978: 126), all of the pieces of hematite showed evidence of grinding. Of particular interest, coarse grinding stones of sandstone were recovered in association with these minerals, with pigment residues retained on many specimens.

The Debert site yielded 690 grams of pyrolusite, a soft gray-black mineral commonly found in the Minas Basin area (MacDonald 1985). The occurrance of this substance in one isolated locus supports the assumption that its presence is cultural. None of the nodules showed evidence of abrasion; however, MacDonald notes (1985: 107) that the mineral has a tendency to decompose in acidic soils like those in the Debert site vicinity.

Nodules of graphite, a mineral similar to pyrolusite (MacDonald 1985: 107) were present at both Bull Brook and Bull Brook II (Grimes et.al. 1984). Grimes notes that although the nodules from Bull Brook II were "somewhat eroded, several bear indication of direct abrasion against another substance". In the same reference Grimes mentions that a number of the graphite nodules at Bull Brook are clearly faceted.

A total of 4.9 grams of small (0.1 grams to 1.6 grams) nodules of red ochre were collected at the Michaud site. As most were recovered in situ from one locus, it seems plausible that these nodules were used as a source of pigment.

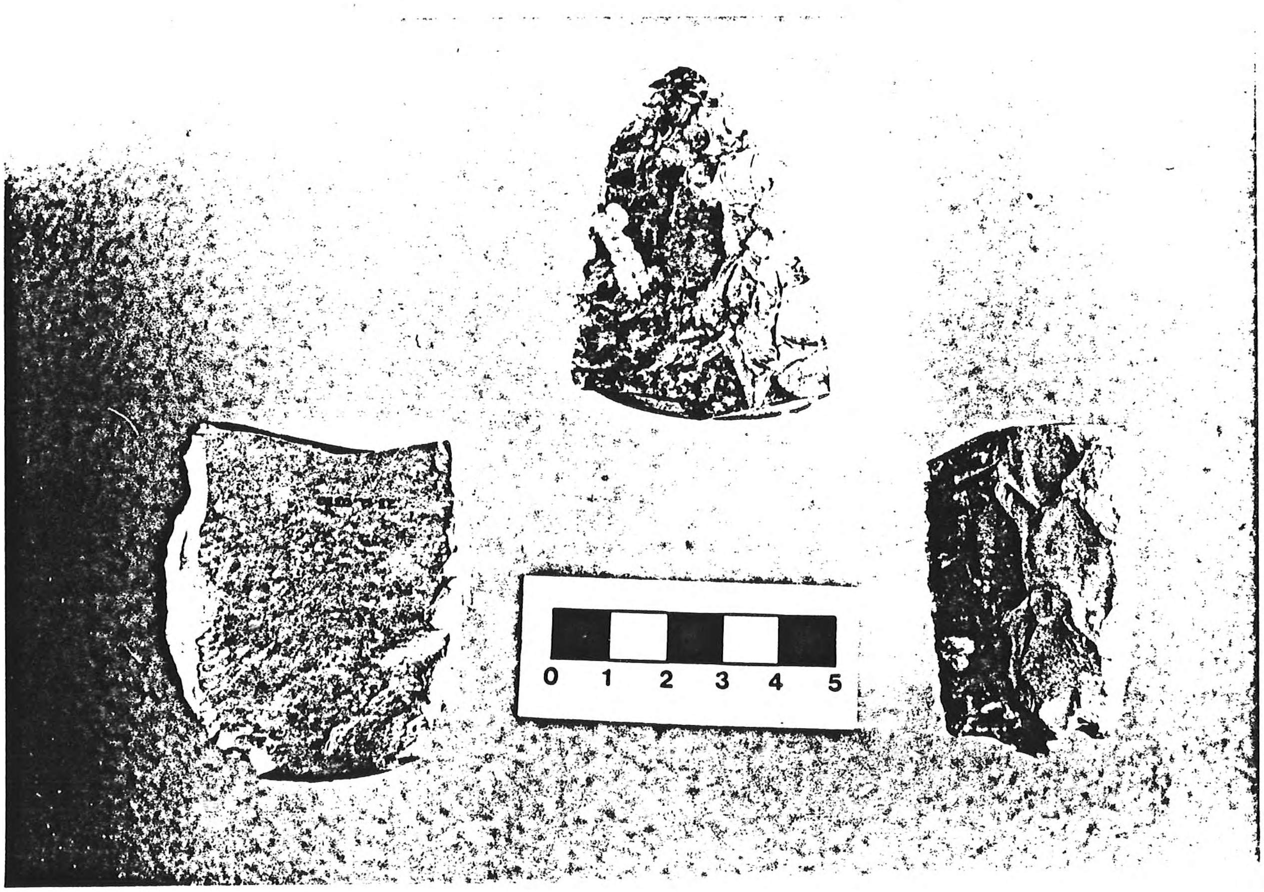


Plate 3-1. Biface specimens from left to right illustrating biface preform production sequence (l. to r. 23,12,0330, .0660/.0661, .0082).

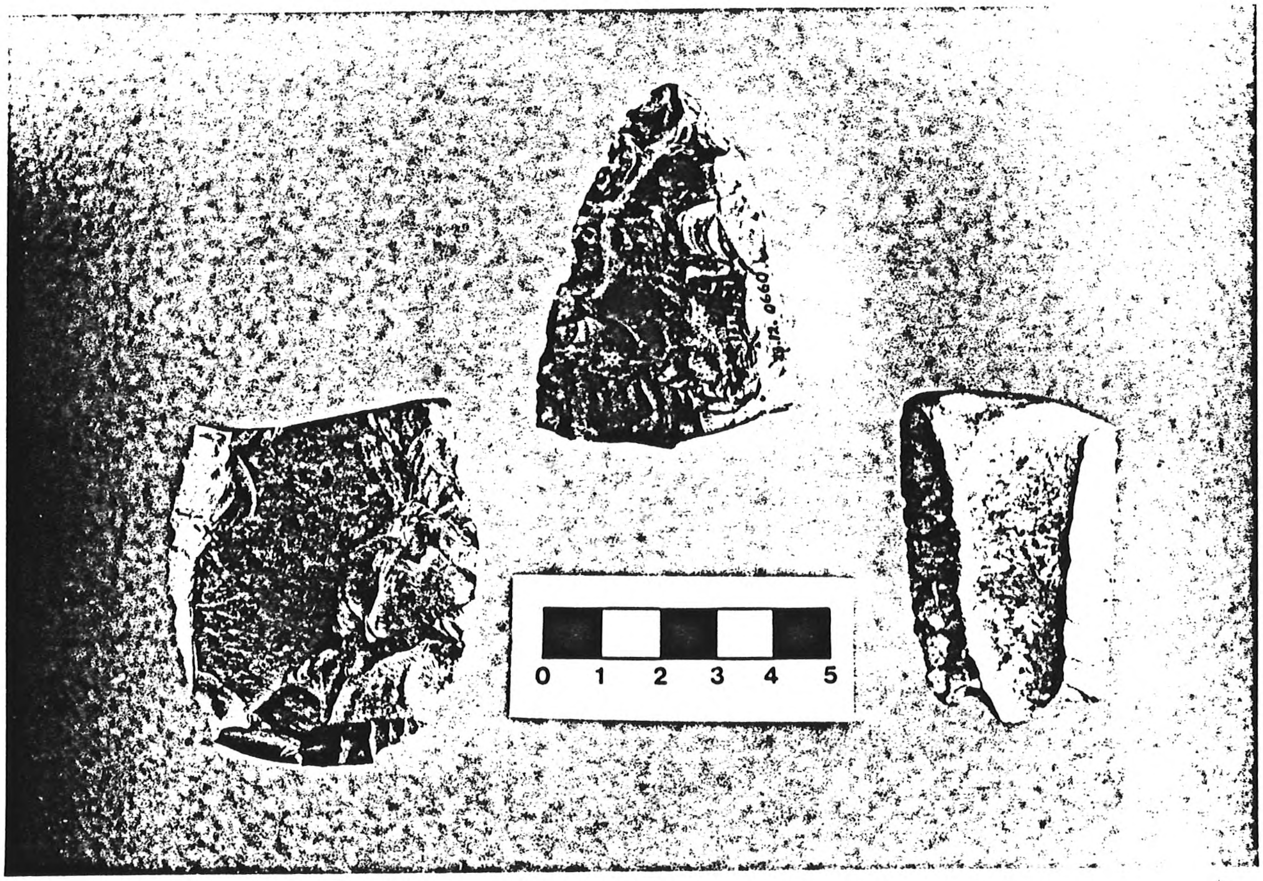


Plate 3-2. Reverse of specimens in Plate 3.1. Note the outre passe termination of the channel flake removal attempt on .0082, right.

Plate 3-3. Biface preform 23.12.0082 with two pieces of the channel flake shown adjacent.

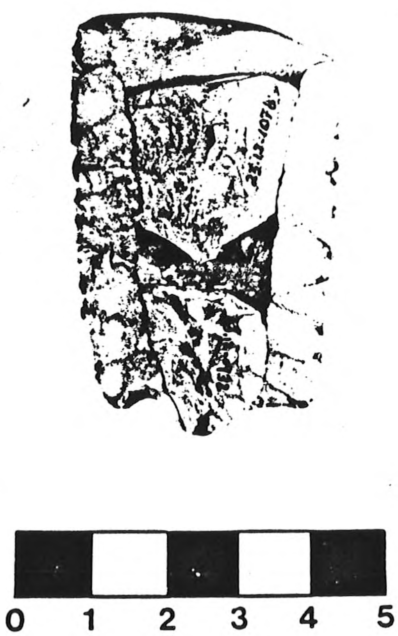


Plate 3-4. Biface preform 23.12.0082 with channel flake fragments refit in place.

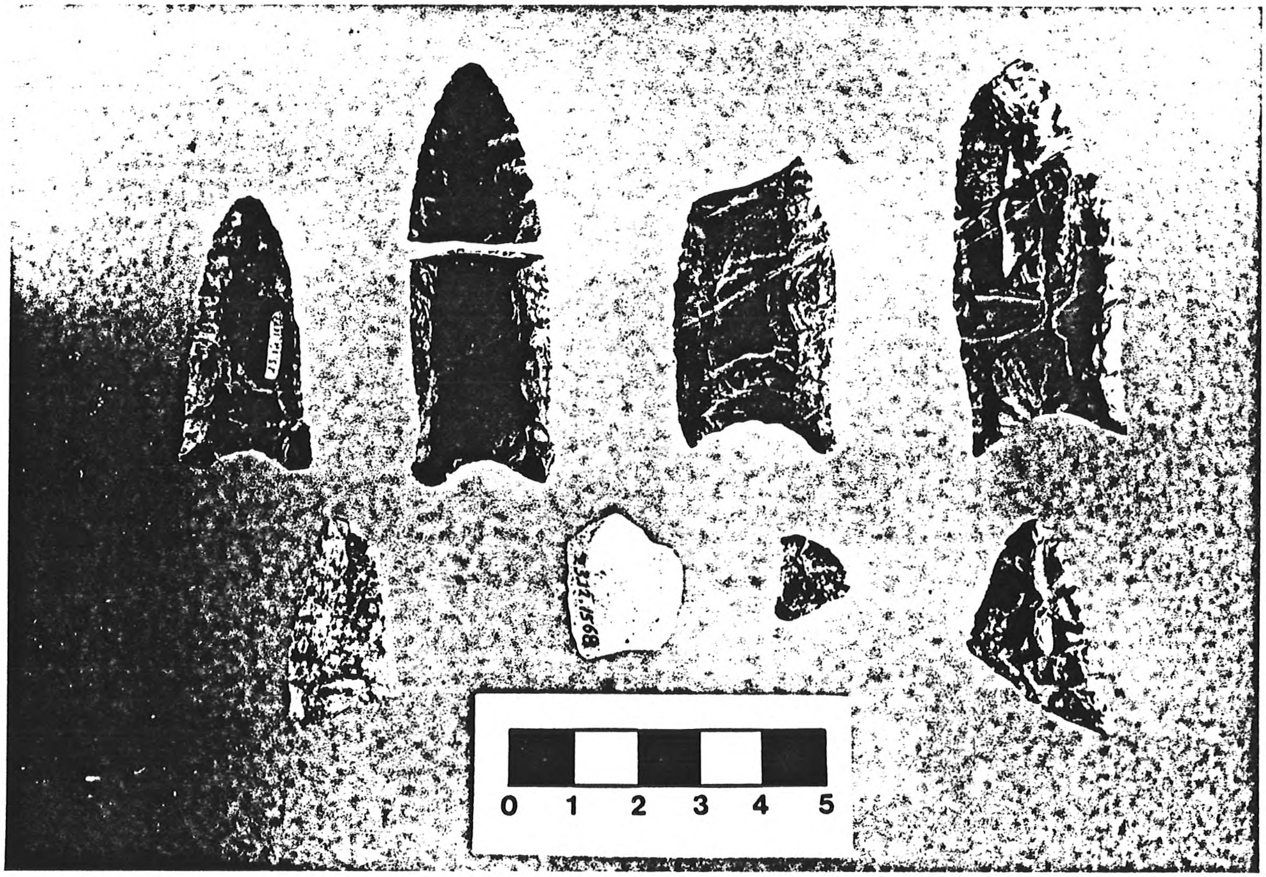


Plate 3-5. Fluted point fragments from the Michaud site. Upper row, left to right: 23.12.0109, .0088/.0112, .0643, .0321/.0451.

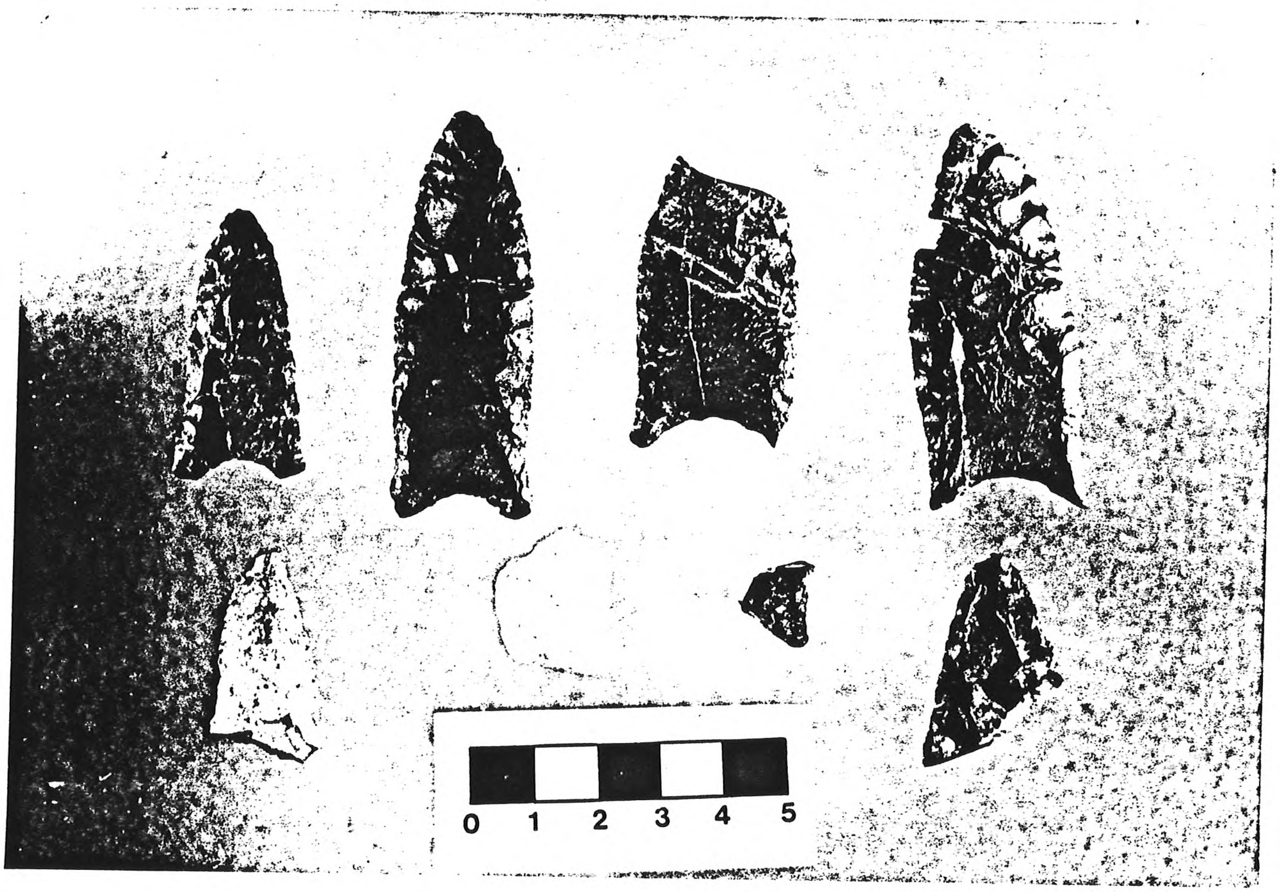


Plate 3-6. Reverse side of points shown in Plate 3-5.

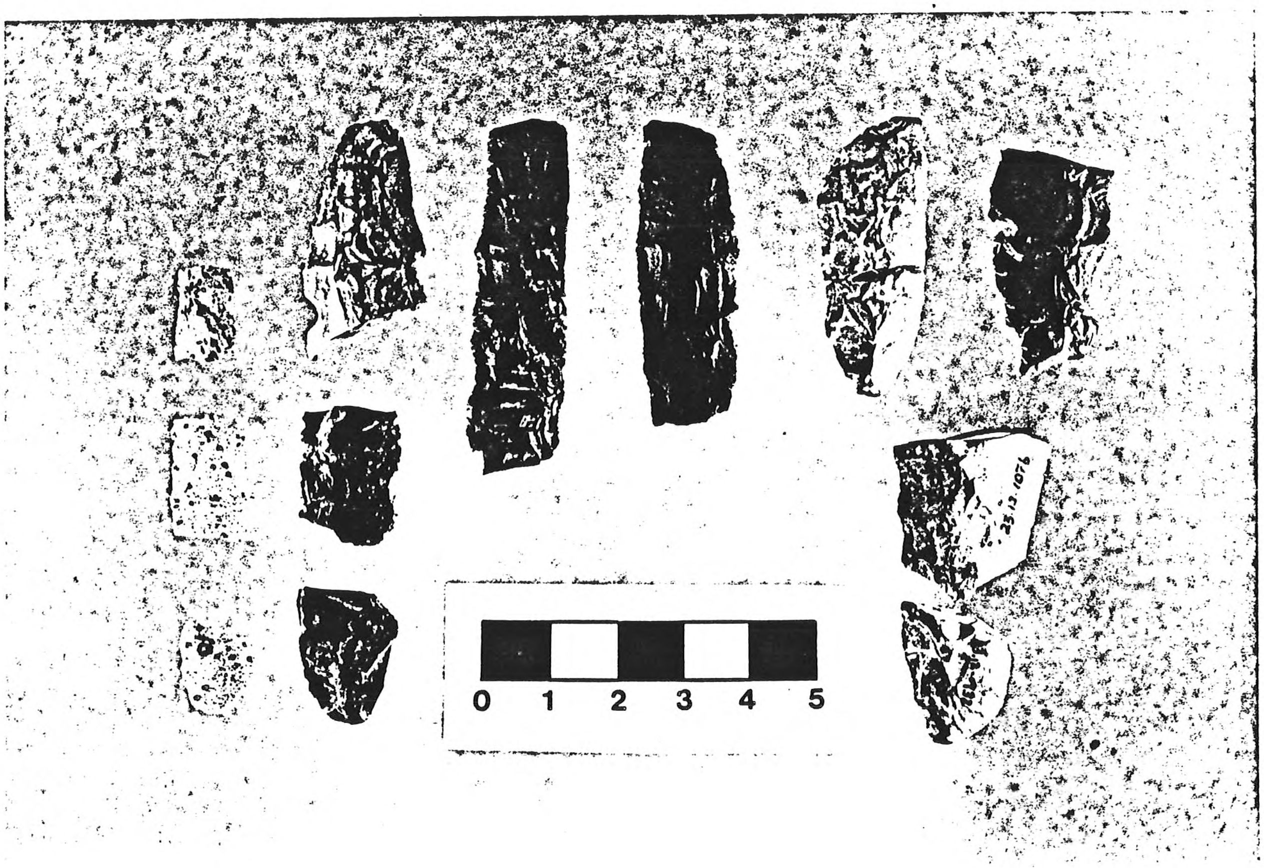


Plate 3-7. Channel flakes form the Michaud site.

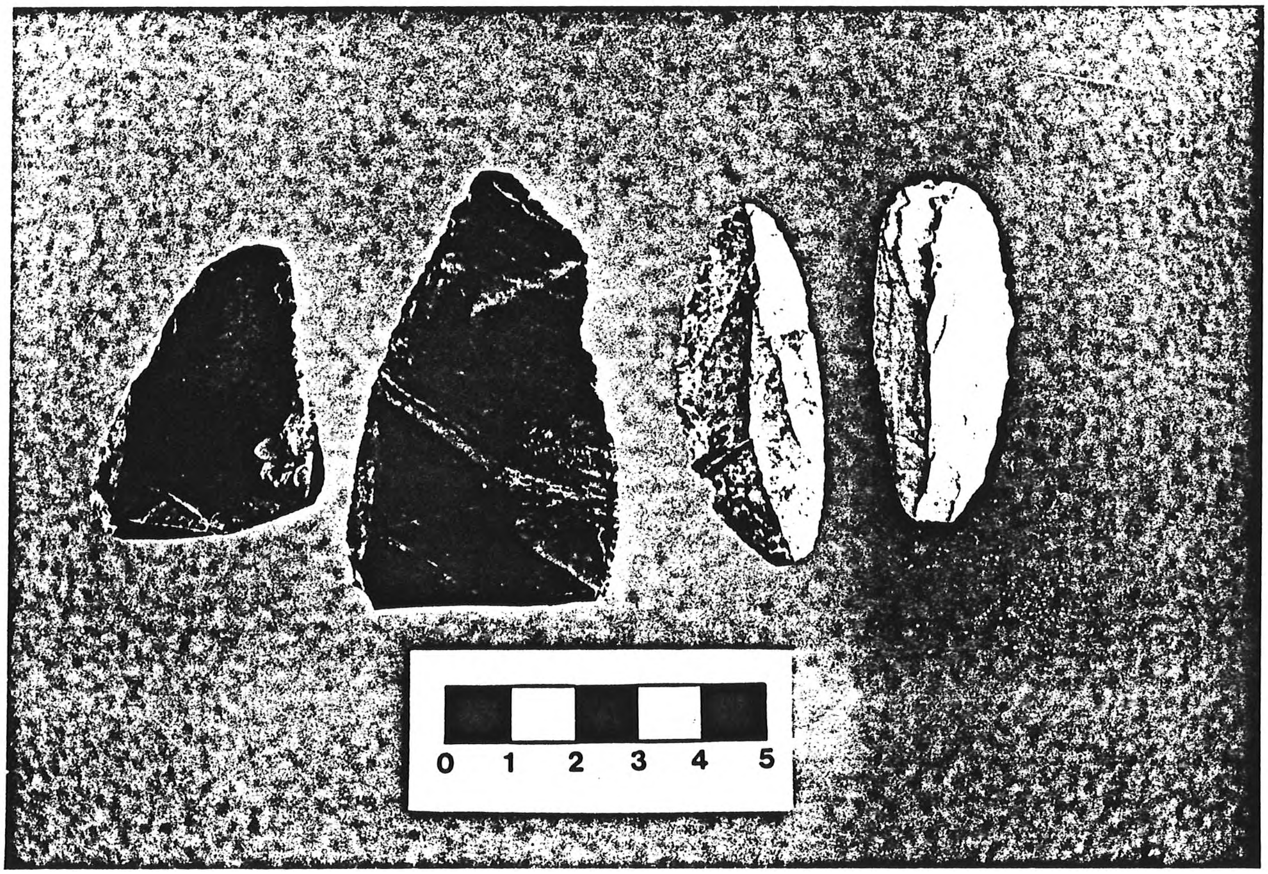


Plate 3-8. sidescrapers. l. to r. 23.12.1700, .2323, .0308, .1477.

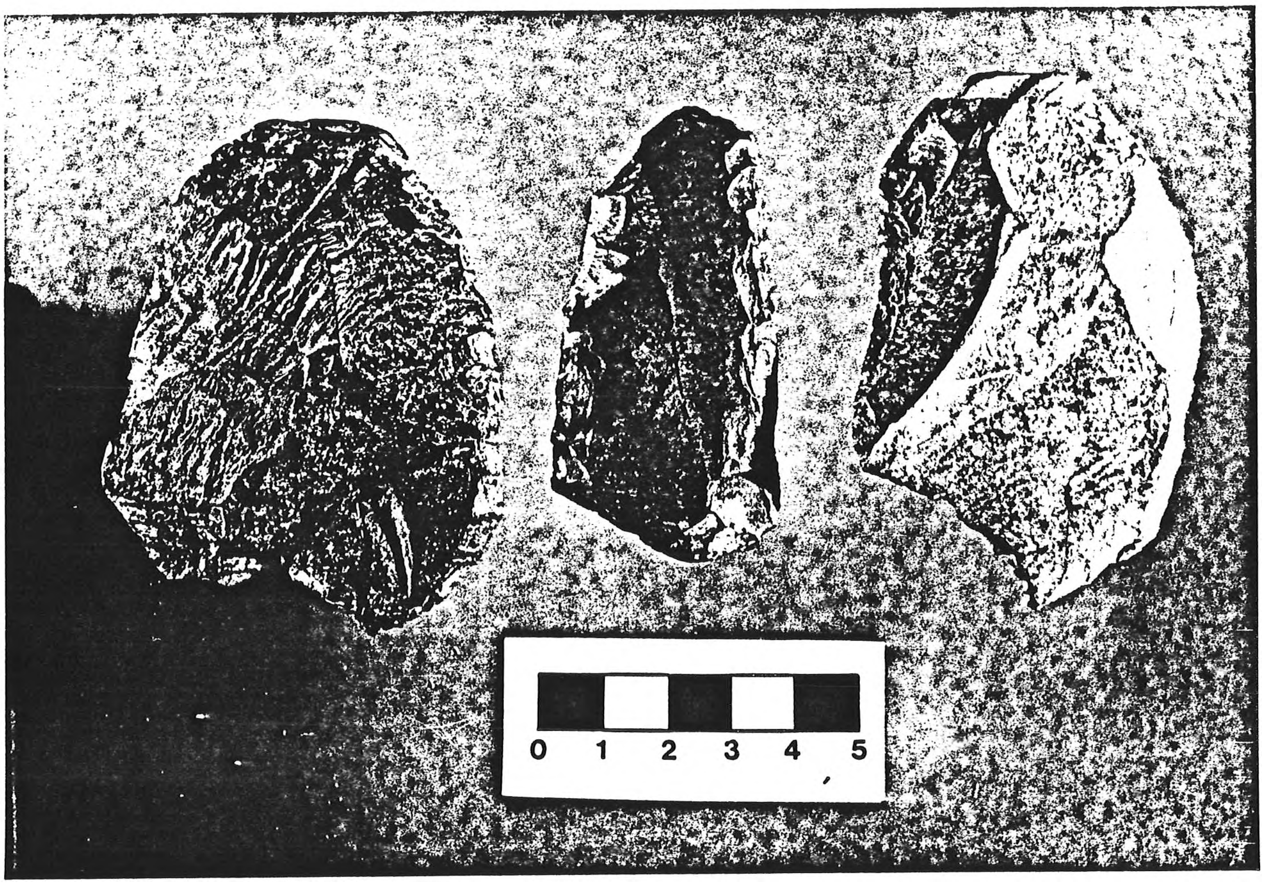


Plate 3-9. Large sidescrapers. l. to r. 23.12.2293, .2361,.2053/.2051.

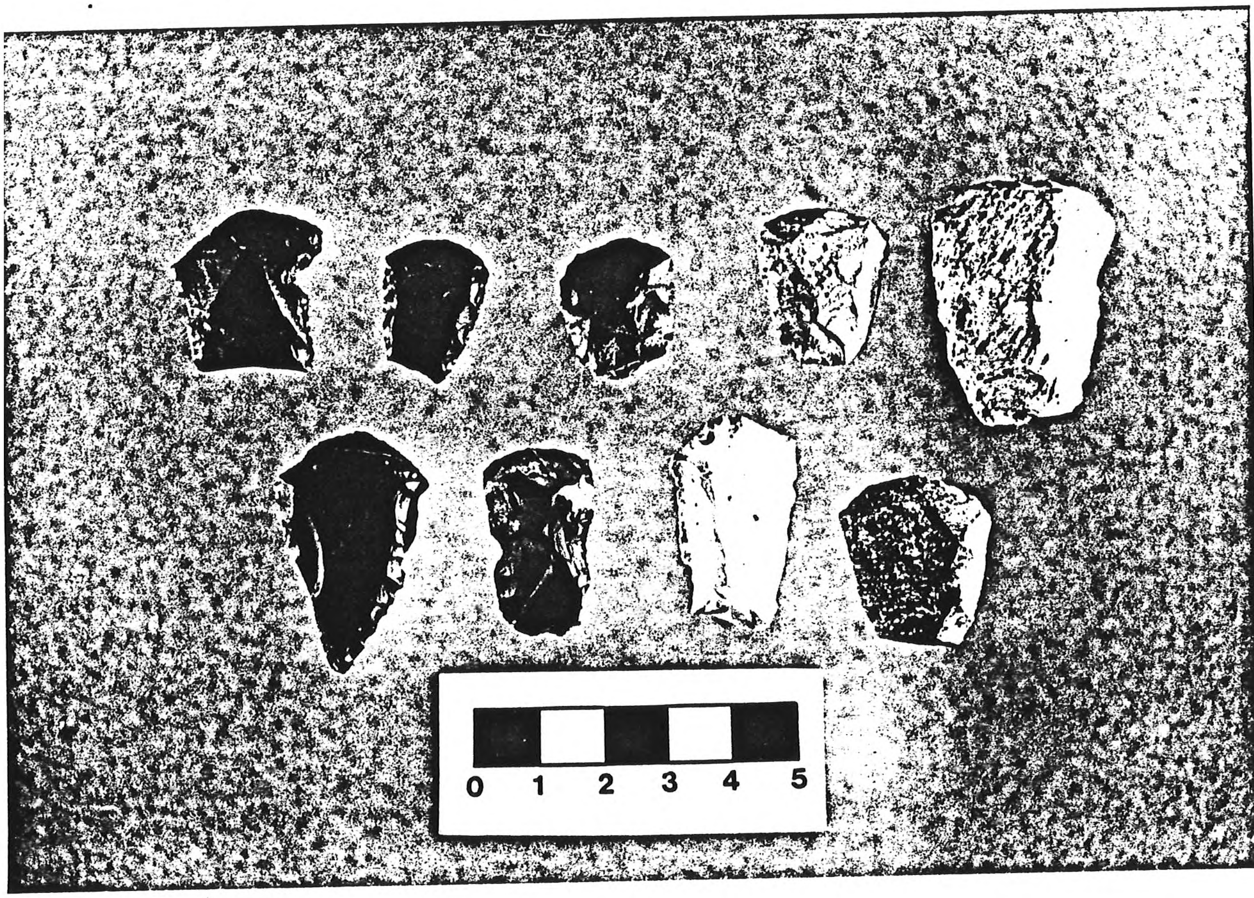


Plate 3-10. Endscrapers from the Michaud site. Upper row, l. to r.: 23.12.2193, .oo22, .2214, .2109, .2396. Lower row, l. to r.: 23.12.0090, Endscraper .1528 is not shown.

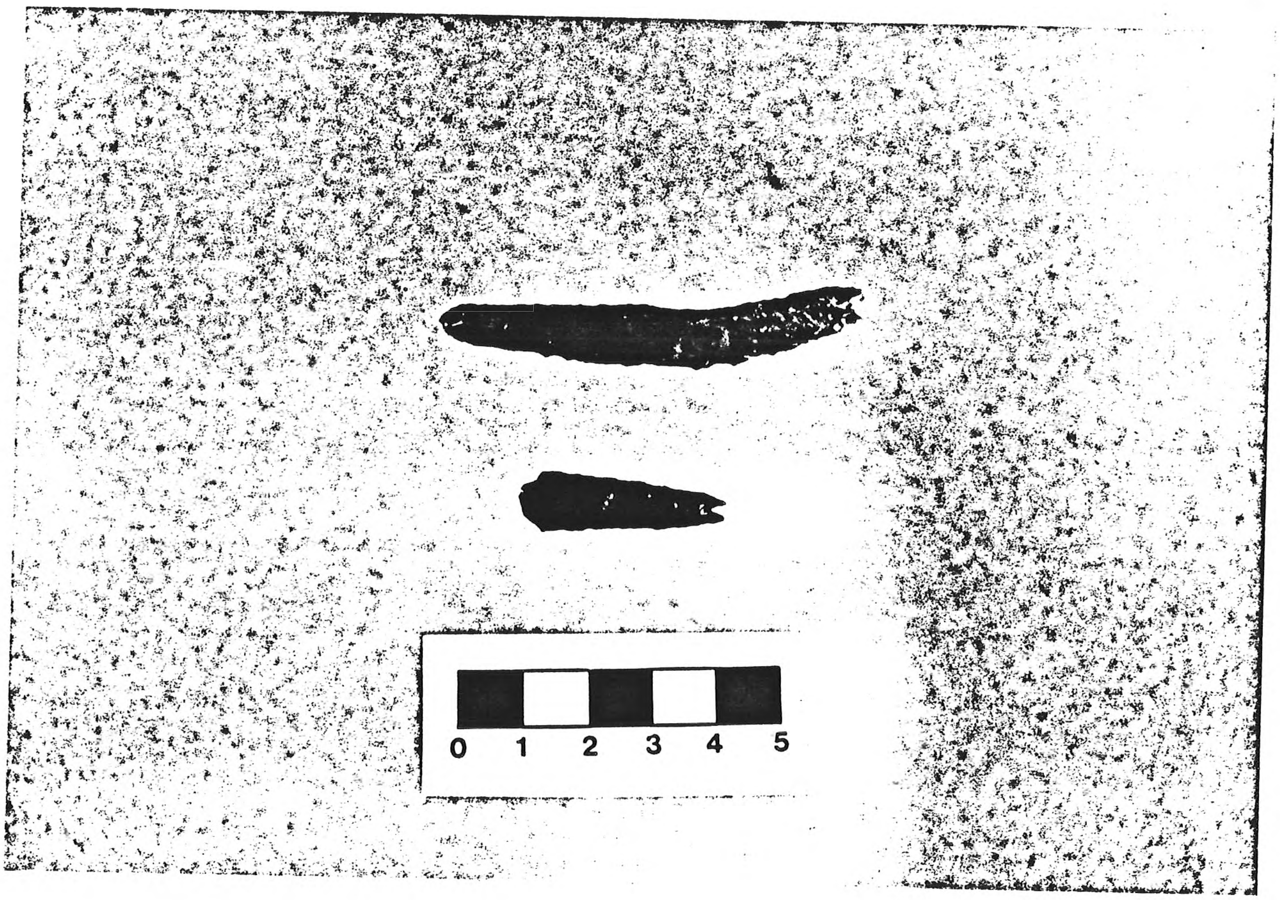


Plate 3-11. Limaces, dorsal view. 23.12.1342 above, .0634 below.

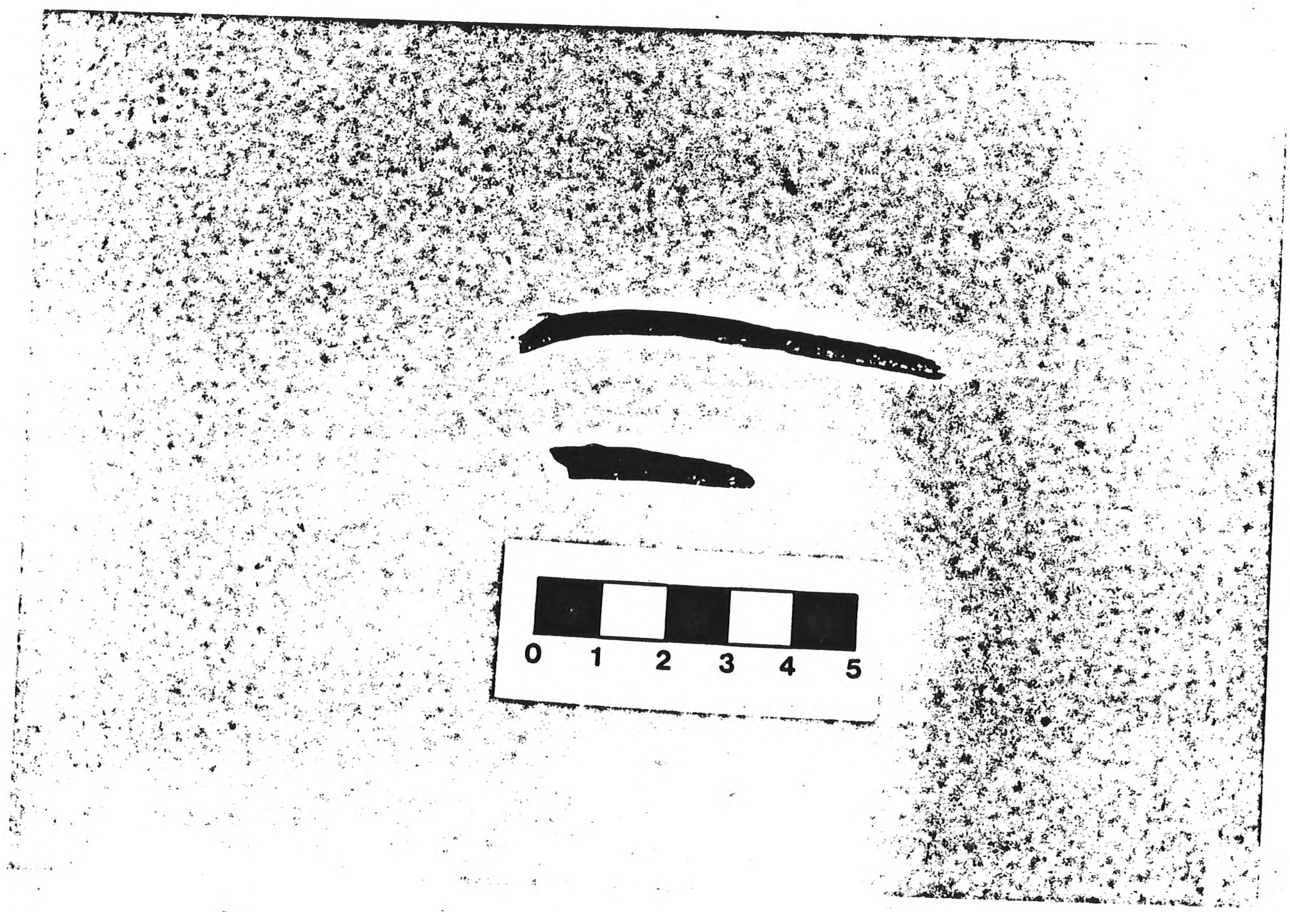


Plate 3-12. Lateral view of licamces in Plate 3-11, exhibiting longitudinal blade curvature.

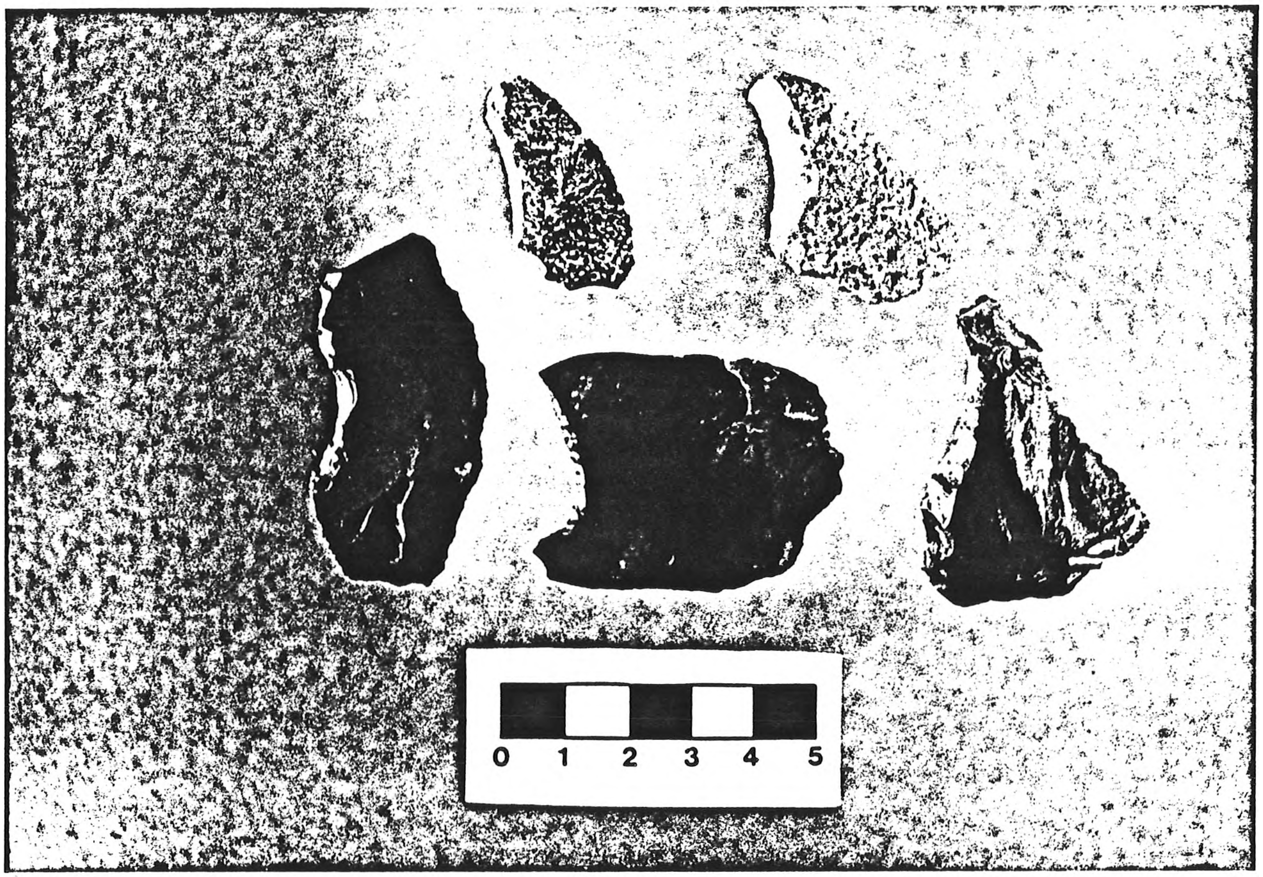


Plate 3-13. Concave scrapers. Upper row, l. to r.: 23.12. 0032, .1591; lower row, l. to r.: 23.12.0086, .1314, .0335.

Plate 3-14. Graver 23.12.1534 at left.

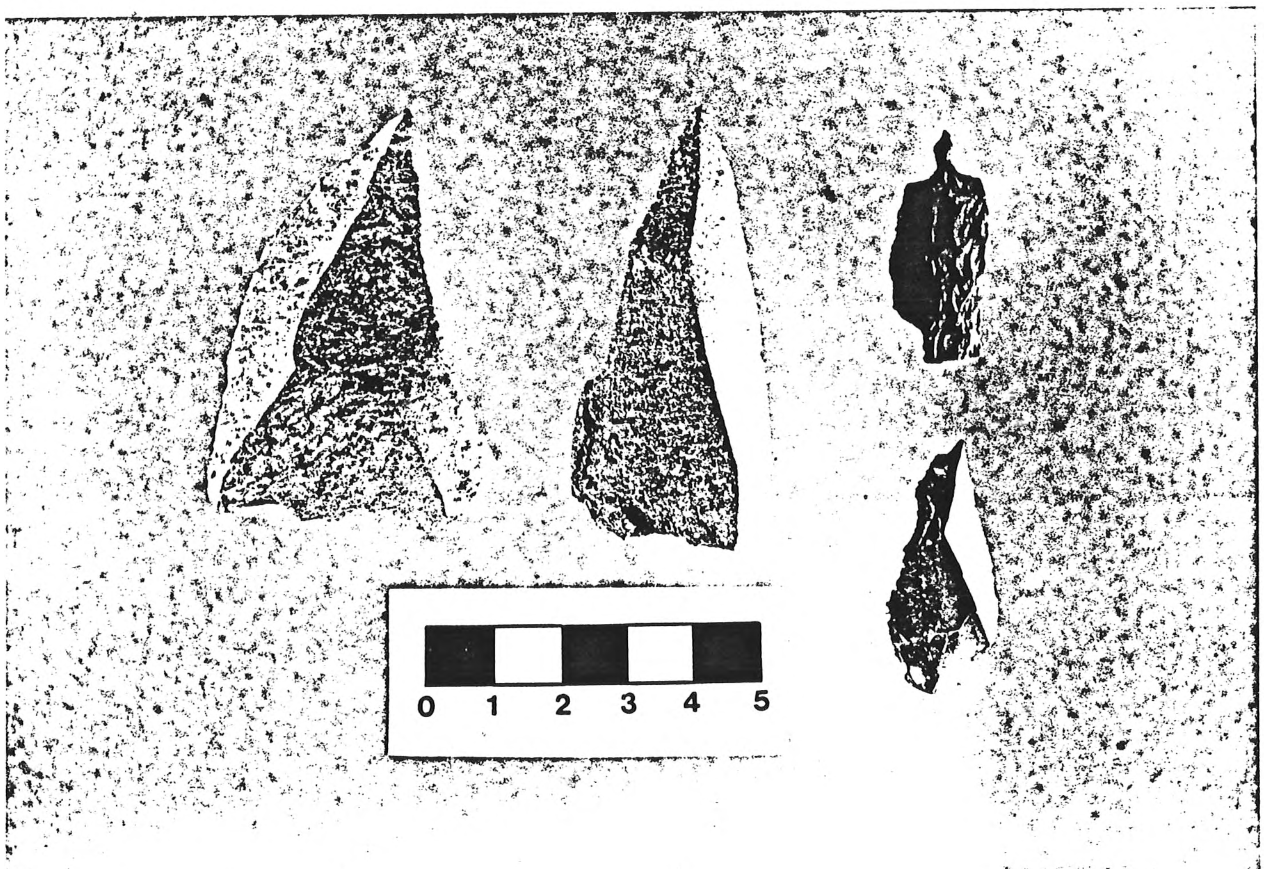


Plate 3-15. Gravers and perforators. Left: 23.12.1843. Center:23.12.1592. Right, upper: .1804; right, lower: .1818.

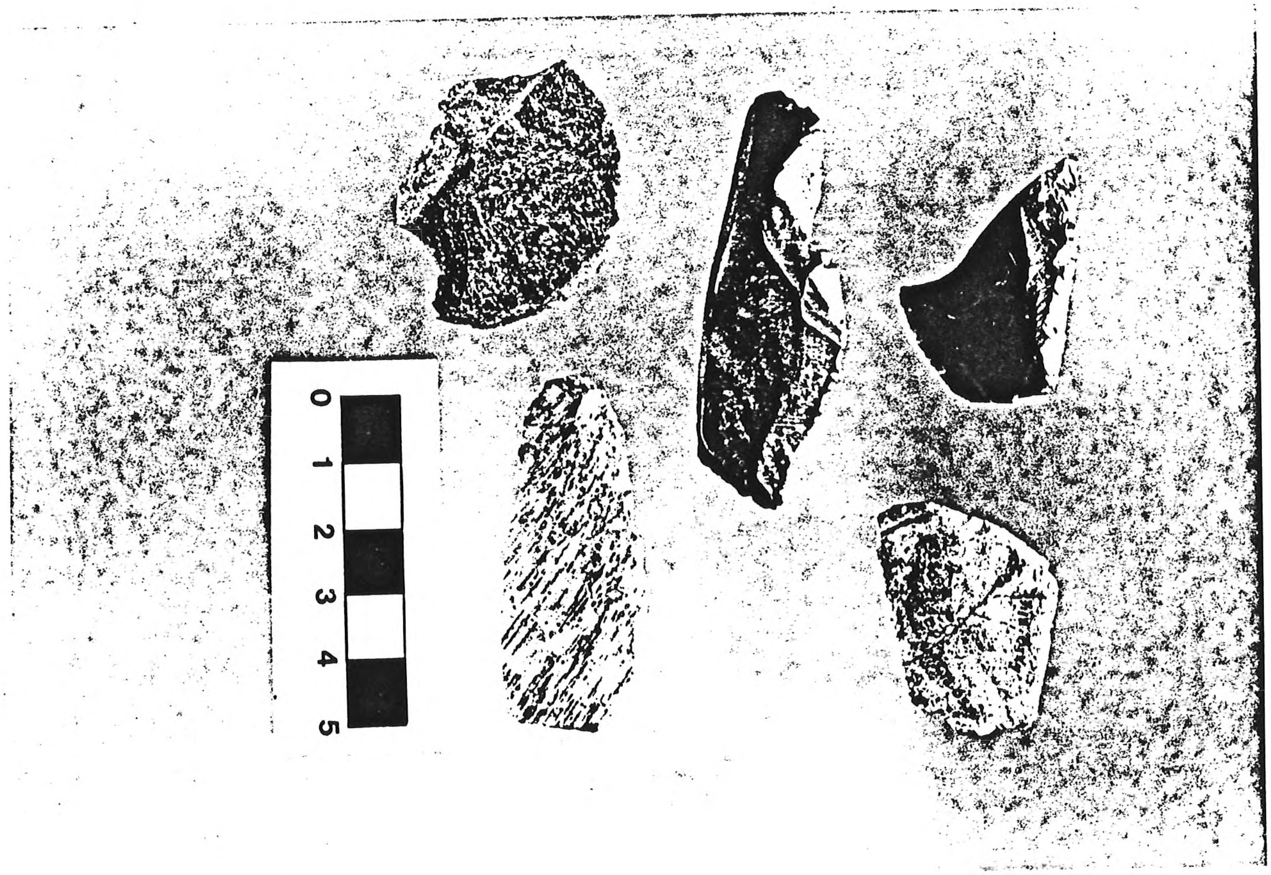


Plate 3-16. Four utilized flakes, with sidescraper fragment (23.12.0488) in upper right.

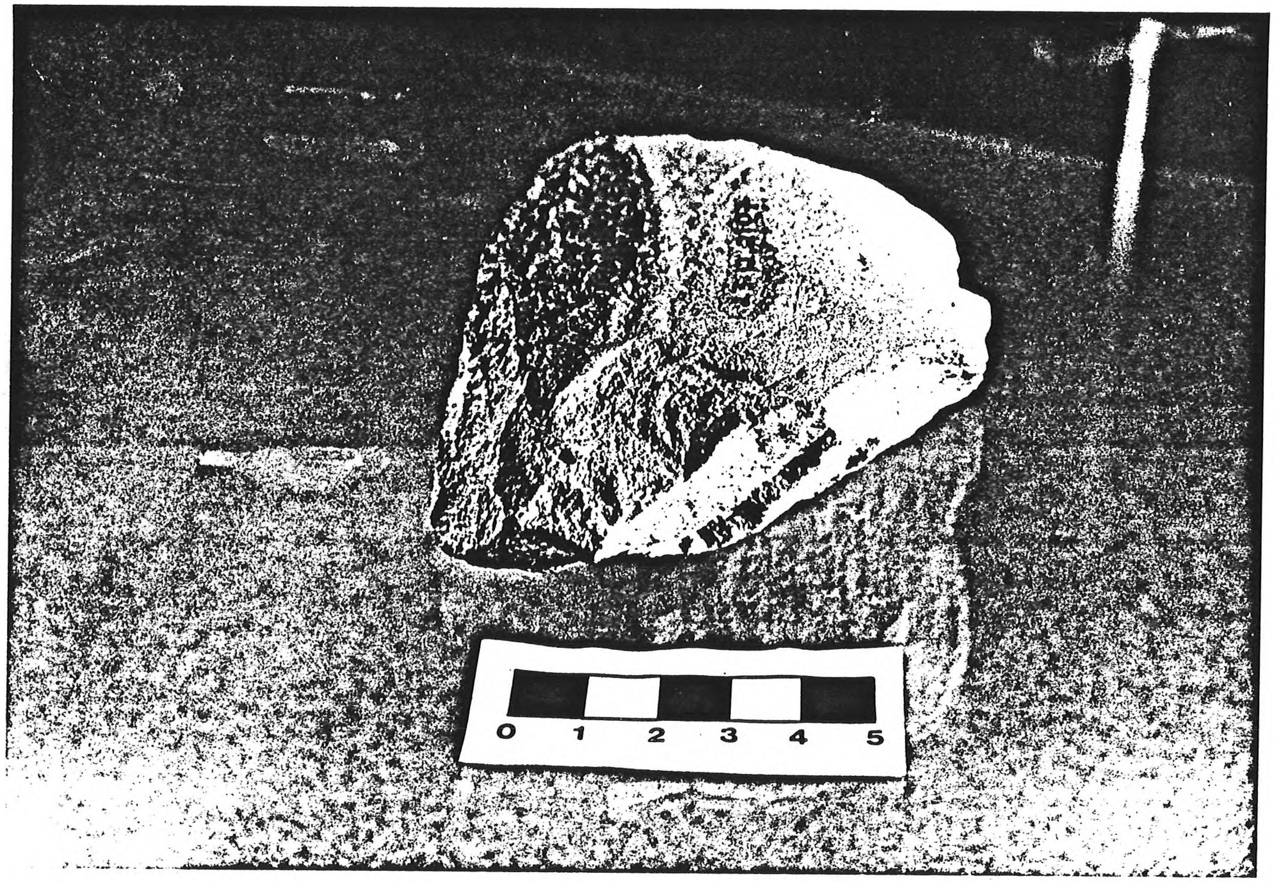


Plate 3-17. Christian Hill diabase "core" tool.

Plate 3-18. Christian Hill diabase "core" tool with blunt, sinuous edge.

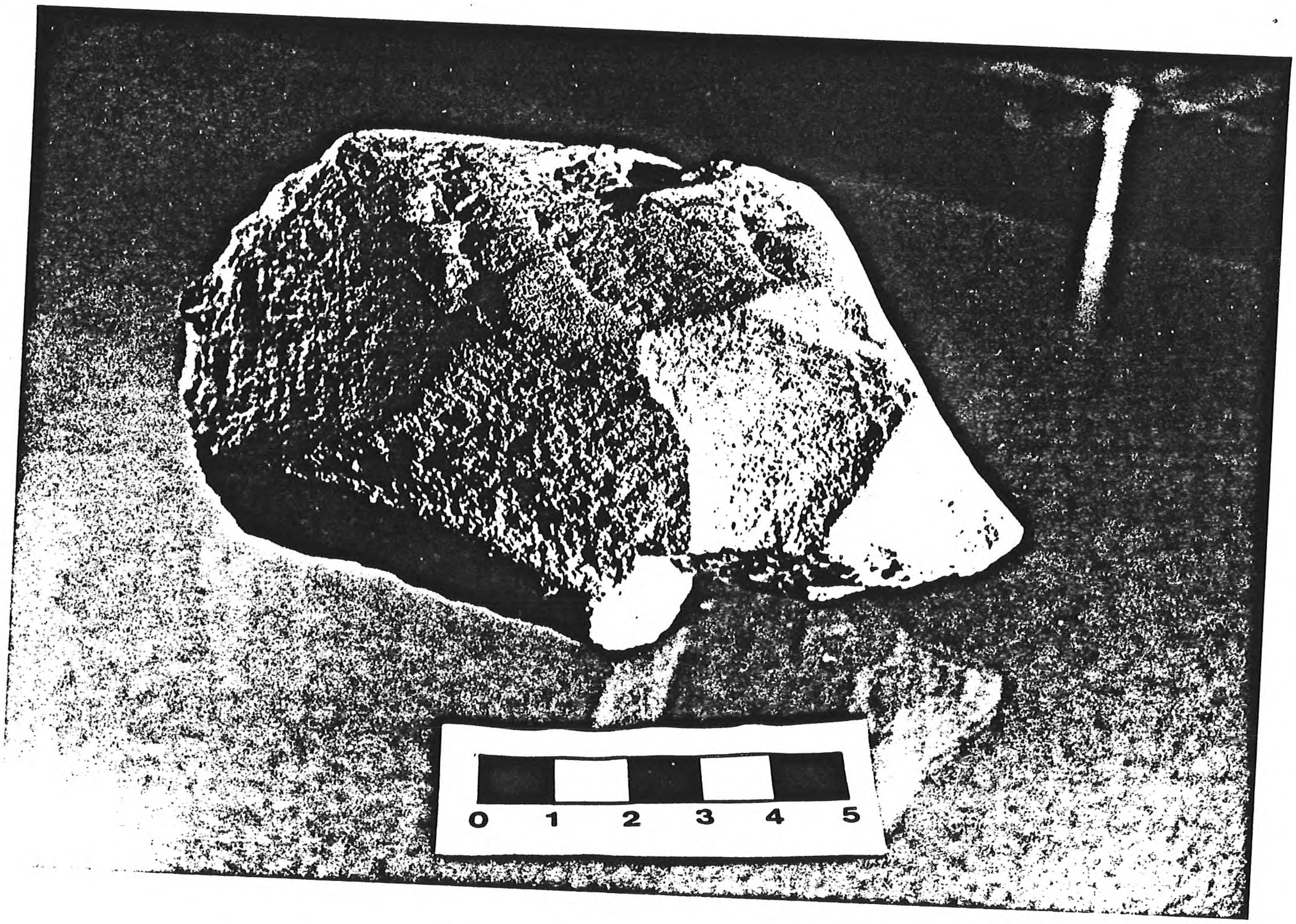


Plate 3-19. Christian Hill diabase "core" tool.

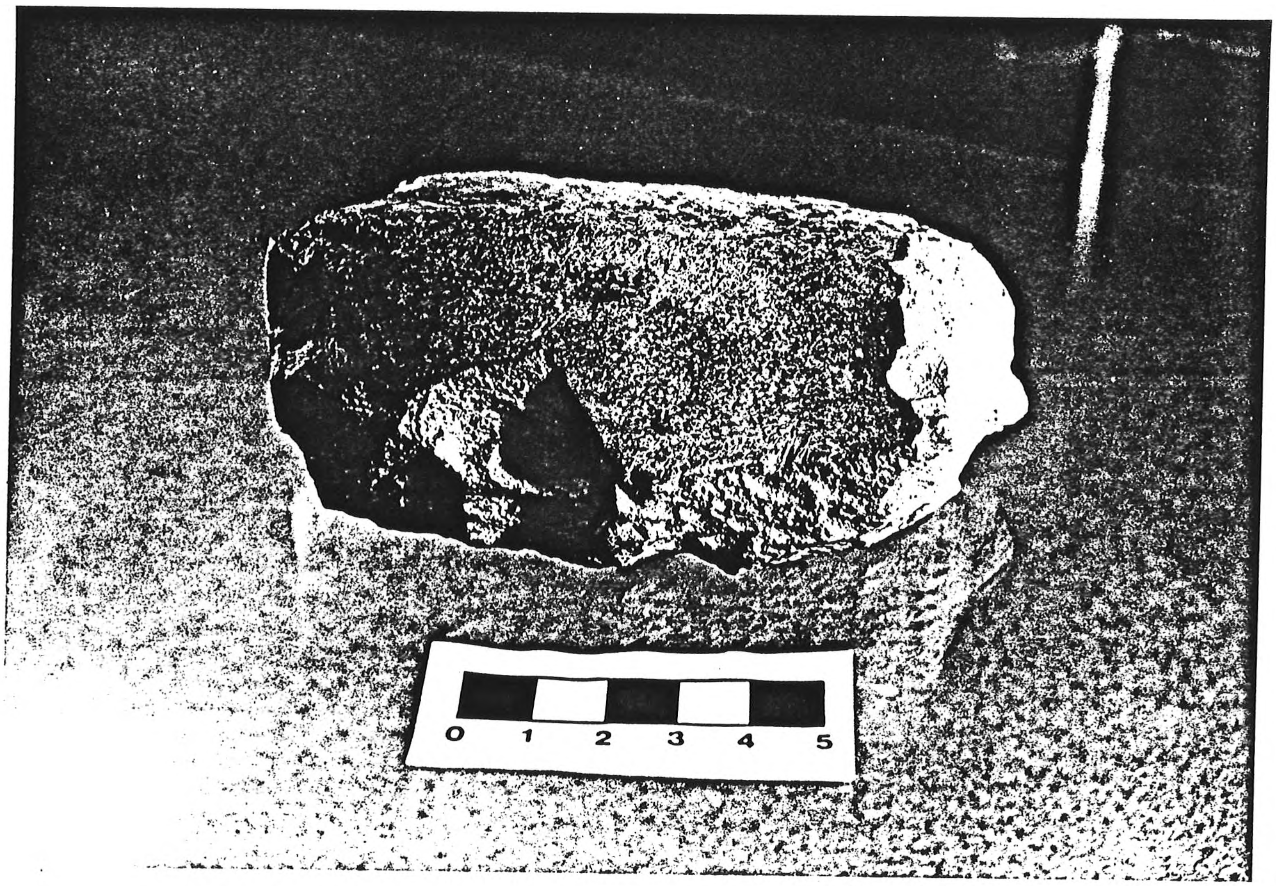


Plate 3-20. Green felsite "core" tool. Abrasion marks are visible along lower right hand edge of cobble cortex at intersection with flaked surface.

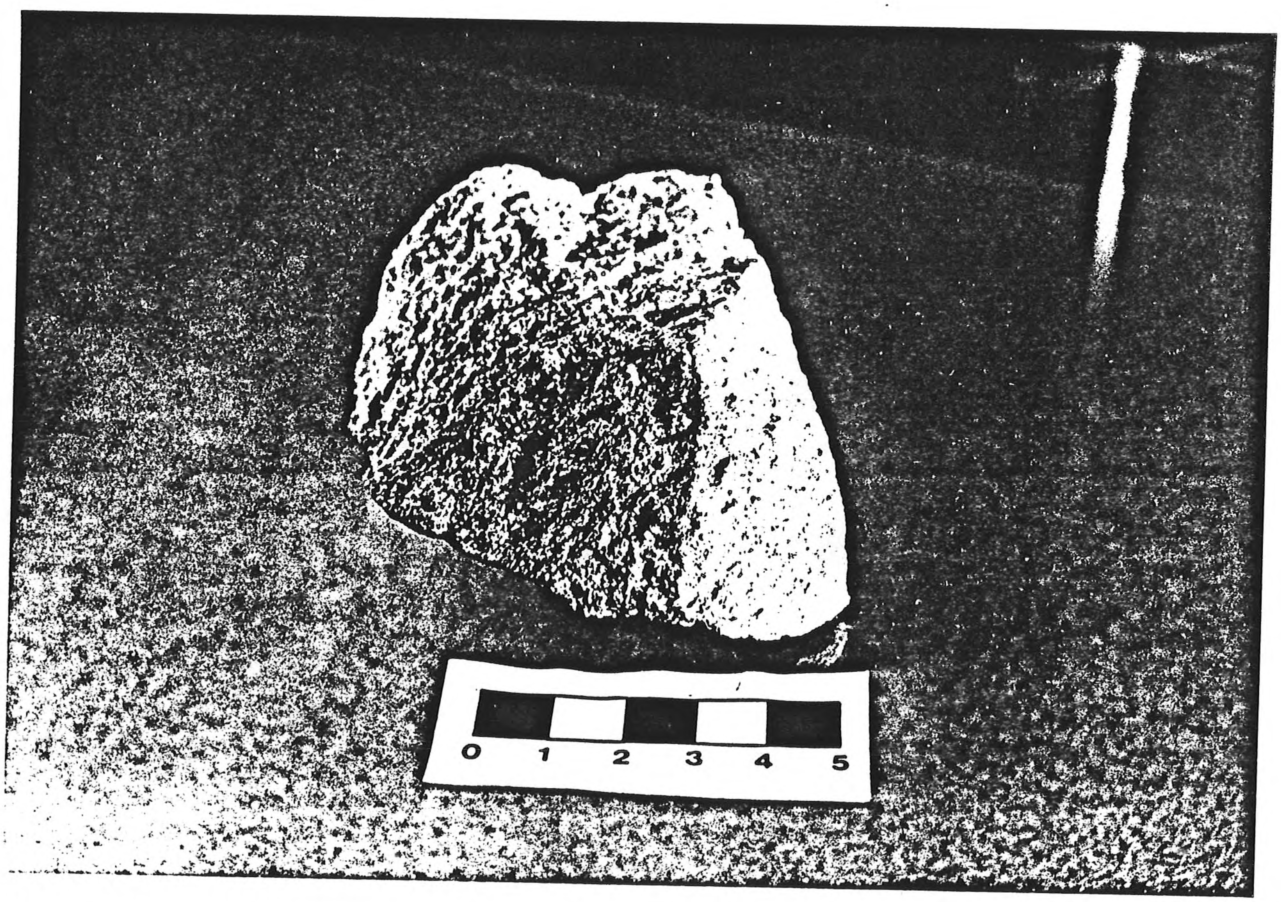


Plate 3-21. Medium-coarse grit probable abrading stone, with evidence of flake removal.

CHAPTER 4: ARTIFACT USE WEAR STUDIES AND FUNCTIONAL ANALYSIS

The Michaud site appears to have some of the best preserved horizontal patterning yet recovered over a large area at a northeast Paleoindian site. The limited size of the collection also implies that the site might have been occupied only once, or a limited number of times. These two considerations indicated that an in-depth functional analysis of the assemblage might be worthwhile, especially coupled with a limited use-wear study. Our hope is to produce a detailed understanding of the activity patterns at this short-term occupation.

USE WEAR STUDY METHODS

A visual record of the major pieces of the collection was produced by placing them on a photocopy machine, covered with a white cloth background. Subsequently the collection was examined at 10-40X magnification under a binocular dissecting microscope for such signs of use wear as are visible on cherts and glassy rhyolites at that magnification, and notations were made on the photocopy record.

Our initial assumption was that the cherts that comprise the majority of the collection would show use wear similarly to the flint used by Tringham, et al (1974). Notations were made describing the micro-flaking and/or abrasion rounding/polish seen on our materials that followed the use wear attributes described in that study. Principally these attributes include the form (scalar or step) of flake removals, their shape and size, their distribution (along the edge, and unifacial or bifacial), and the presence, intensity and distribution of any polish, gloss, abrasion or

scratching noted. We also attempted to record information relevant to Ahler's (1979) use wear attributes.

Intially we discovered that our archaeological bifaces exhibited varying amounts and intensity of edge abrasion, interpretable as grinding, depending on whether they were unfinished preforms or finished fluted points. This "wear" has been interpreted by many investigators as either platform preparation in Paleoindian biface preforms or dulling of basal and proximal lateral edges for hafting in fluted points. We will not discuss this apparently well understood phenomenon further.

It was rare to find a wear pattern on an unretouched flake edge in the collection, such a situation being confined mostly to the use of the sharp edges of fluting channel flakes, and the few utilized utility flakes. More commonly, what appeared to be a step-microflaking wear pattern occurred along the edges of pieces that had been retouched unifacially. This "use wear" appeared to be superimposed over the pre-existing retouched edge, and it came in two basic forms: arris polish or lustre (rare) and step flaking of varying intensity. Laterally retouched unifaces (side-scrapers) often exhibited a retouched edge with subsequent crushing or step flaking. Moreover, both limace fragments had been laterally retouched to a steep angle and subsequently the edges had been heavily step-flaked, invasively undercutting the edge.

Tringham et al. (1974: 181) discuss use wear on retouched edges <u>briefly</u> and <u>inconclusively</u>. Spiess began to wonder whether or not both the the step-flaking along some edges wasn't intentionally produced during tool manufacture. Thus, we were facing a major variable not considered by Tringham et al. since we were mostly dealing with retouched edges, not fresh flake edges.

Thus, we conceived and executed a few simple experiements to test the null hypothesis that the use wear patterns visible on our retouched chert tool edges were produced by actions on materials similar to those reported in the Tringham et al. experiments.

The experimentation began after Charles Cox, one of our crewmembers who had recently completed a summer flintknapping fieldschool, used Munsungun cherts to produce a limace, a sidescraper, a retouched flake, and a perforator/graver. These tools were examined visually, macroscopically and microscopically, and photographed. The working edges of these tools were then cast in Dow Corning L-RTV casting rubber, and epoxy casts made. Subsequently, these tools were utilized for a number of tasks, beginning with ones thought to produce relatively little edge wear. The mode of action and number of stokes were recorded, each tool was examined, and rephotographed to provide a permanent, sequential record. Doubts about the form of the original retouched edge were checked against the epoxy casts.

USE WEAR EXPERIMENTS

When absolutely fresh and unutilized, both the limace and the sidescraper exhibited a very thin band of step-flaking confined to the edge of the dorsal (retouched) surface. The steeper retouched angle on the sides of the limace were accompanied by lightly invasive or undercutting step-flaking. In both cases perhaps 80% of the retouched edge exhibited this step-flaking. Cox indicated that this step-flaking was a normal result of the practice of "evening up" a retouched edge to remove the very small projections caused by the intersection of the flake arisses with the edge by rubbing it lightly from the ventral side with the hammerstone or an abrading stone..

Tringham et al. (1974: 180) reports that the micromorphology (flaking,

polish, etc.) or scarring of the unretouched flint edge is task specific, but that the degree of edge damage correlates with edge angle. A thinner flake of the use-wear patterns vary in part with the hardness of the worked material (Tringham et al, 1984: 183), with antler and bone being hardest, woods of various densities intermediate, and skin and flesh softest.

Whether the worked material was hard or soft, the first microflakes produced wear comprising scalar-shaped scars. The harder the material, the more rapidly did the flakes detach, and the larger and deeper were the scars than produced (Tringham et al. 1984: 188-191). However, they were always smaller, and easily differentiable from, scars produced by deliberate retouch. With "hard" materials, very rapid removal of scalar scars weakens the flake edge such that small flakes terminating in hinge fractures (step flakes) are removed. Work on soft materials (skin and flesh) produces only scalar shaped scars. Effects of abrasion (polish, etc.) from soft materials are hardly visible below 100X magnification, if then. No matter what species of tree, use on wood produced scalar scars "including semicircualr and triangular scars, but also including trapezoidal scars not observed on working any other materials". Hard wood may eventually give rise to setp-flaking, but on a much smaller scale than use on "hard" materials such as bone or antler. Wood working scars consistently present a "fuzzy" appearance due to abrasion and fine polish of the scar edge and interscar arrises. Work on hard materials produces step scarring that obliterates any scalan flaking.

A distinction is made (1984:188-89) between longitudinal action of the flake (cutting or sawing) and transverse action (scraping or shaving). In the former, use wear flakes occur on both surfaces of an edge (bifacially), while they occur unifacially with transverse action.

Thus, we believe that edges at a gross morphological level we could

distinguish between use on soft material (edge "nibbling"), use on medium materials (common scalar flaking with arris polish and obscured flake scar edges) and hard materials (step flaking), and that differentiation can be made between a scraping (transverse) action and cutting (longitudinal) action.

"Exp-1" was a grey Munsungun chert limace, chipped to conform to the shape reported by Grimes and Grimes (1985). In its unused state this piece exhibited retouched edge angles of 60° to 69° along the lateral sides, and scalar retouch was 3.75 to 5.0 mm. wide (perpendicuar to the edge), but the immediate edge was characterized by step-flaking (or crushing with hinge-terminations) that were 0.5 to 1.5 mm. wide. There was of course, no evidence of rounding or sheen on the edges of the fresh step flakes, which were produced simply by grinding the hammerstone along the edge to "even" it up. Use-wear experiments with this tool consisted solely of pushing it along a piece of deer antler cortex (in the push-plane manner suggested by Grimes and Grimes, 1985), several hundred times. The tool efficiently scraped away a narrow patch of antler, but exhibited no evident wear. Had we used the tool on soft material (skin or hide) we suspect that no wear would have been evident. Use on wood may have only produced polish on the highpoints and inter-flake arrises along the edge.

"Exp-4" was a long, triangular flake/blade of grey Munsungun chert that terminated in an unretouched point, similar in scale to many Paleoindian "gravers". This point was used to attempt scribing a deep line on a piece of dry hardwood. The tip shattered on the first attempt, making it likely in our view that these objects were used to pierce softer materials, perhaps softer wood or hides.

Most of the use wear experimentation was done with Exp-2 and Exp-3.

"Exp-2" was a large, thick flake of red Munsungun chert retouched to a steep edge angle (between 60° and 78°) on the edge that we utilized. The retouch was mostly scalar, up to 6.4 to 8 mm. wide (perpendicular to the edge), and step-flake terminations were few and widely spaced. "Exp-3" was a thinner, lighter, grey Munsungun chert flake retouched to a 45°-47° edge angle in the region that we utilized. The deliberate retouch was mostly scalar, 2.6 mm. (±0.5 mm.) wide perpendicular to the edge. Step-flake terminations were rare and intermittent, averaging 0.5 to 0.2 mm. wide.

The first experiment with Exp-2 and Exp-3 (Plates 4-1 and 4-2) involved scraping 500 strokes on dry deer hide with each experimental object, attempting to keep all force on the same portion of the retouched edge. The ventral side of each retouched flake was held away from the experimenter, and the action was to push away. We anticipated that dry hide would produce the most wear, if any, of any possible "soft" substance. No new flakes had been removed, and only very slight rounding or dulling of aris ridges or anything else near the edge was bisible up to 40X magnification.

Subsequently, we did 500 strokes scraping dry hardwood with Exp-2 (same action as above). Afterwards, the edge itself no longer appear fresh: it showed definite but light rounding, and noticeable gloss. Arrises and chert projections, especially, showed noticeable rounding and gloss. No new step-flakes or scalar flakes had been removed from the edge, however.

Thus, for Exp-2 with its steeply retouched edge, use wear produced by skin scraping and wood scraping differs markedly in degree, but not in kind. No new flakes were removed from the retouched edge.

Five-hundred strokes scraping hardwood with Exp-3 (thin flake, lower retouched edge angle) proceeded with the same motion as reported above. We

then compared the edge microscopically with an epoxy cast made of the fresh edge. The utilized portion of the edge had worn away physically into a shallow concavity, by the repeated removal of very shallow step-flakes of 0.5 mm. to 0.8 mm. width perpendiculat to the edge. (Compare step-flake widths with the 2.0 to 3.0 mm. widths for the retouch flake scars.) The edge of the flake itself was not polished and rounded, but appeared fresh; as the step-flakes came off, any polish was removd from the ventral flake surface. Thus, the resistence of a retouched edge to step-flaking is determined in part by its edge angle. Low retouched angles will exhibit step-flaking on wood, while high retouched angles will preserve arrise and flake margin polish.

We then did 500 strokes scraping dry antler with Exp-2. There was a visible effect: small undercutting step-flakes of less than 0.5 mm. width perpendicular to the edge were common along the edge. However, the wood-scraping polish from the previous experiment was still present on arrises and projections not removed by the step-flaking.

One-hundred strokes scraping dry antler with Exp-3 destroyed the edge. A deep concavity was worked in the side of the flake, and the retouched edge was nearly obliterated by step-flaking.

In sum, it appears that use of a retouched edge on soft materials will leave a little polish, or perhaps no trace of wear at all. Use on medium or hard materials will produce step-flakes at some threshold value determined by edge angle. If the material is of medium hardness, it will either cause polish or step-flaking depending on the retouched edge angle of the artifact. No scalar flakes are produced, in diameter contrast to use wear of unretouched flake edges on medium hardness materials. Hard materials appear to produce step-flaking no matter what, but the intensity

of step-flaking varies with the edge angle. Such step-flaking can normally be differentiated from intentional retouch by its lesser width perpendicular to the edge than the intentional retouch, even if the intentional retouch also terminates in step-flaking. However, even intensive use wear on hard substances may be "lost" in the heavy narrow step-flaking retouch such as appears on the limace (Exp-1) when its retouched edge is abraded deliverately by a stone in the hand of the artisan. Essentially the artisan wears the edge against the hardest object to be found in the local environment; the hammerstone is his tool kit. Subsequent step-flaking edge wear does not occur or is undetectable, although arris and projection polish would be visible with use on wood.

The evidence produced by these few experiments contrasts strongly with interpretations of use-wear patterns on Paleoindian archaeological specimens being made by some workers (e.g., Davis et al., 1985).

One variable that we have not investigated is the effect of heat treatment on the production of use wear on chert tools. one of the effects of heat treatment on some cherts is an increased lustre on facets flaked after the heat treatment (Rich and Chappell, 1983). Since much of the chert in the Michaud assemblage exhibits a fairly high lustre, we wish to suggest, notably without any other current evidence, that some of the pieces may have been heat treated. (Certainly some were discarded into the fire, and fractured or acquired pit-lid fractures.)

Olansson (1983) has demonstrated that heat treatment, among other things, decreases the tnesile strength of flint. While this conveys an advantage in manufacturing implements, it increases the rate at which edges wear because microflaking initiates at lower forces. All of Olansson's substantive results were on unretouched flake edges, however.

We think that heat treating would tend to lower the fire threashhold

at which step-flaking occurs on a retouched edge of a given angle, logically it would tend to increase the edge angle at which step flaking occurs for a given force used on a given material. The magnitude of these effects, however, remain uninvestigated on the cherts used by the Michaud site inhabitants. If anything, heat treating would tend to reduce the amount of wood polish accumulating on a retouched edge, and convert it to step-fracturing. Thus, a heat treated, retouched edge without polish and without step flaking is even more likely to have been used lightly on soft materials (hides?).

RESULTS OF EXAMINATION OF MICHAUD COLLECTION

Channel Flakes

Sixteen channel flakes and flake fragments were examined for use wear, which was found on six along the lateral edges. These pieces are mostly not retouched, and are characterized by a low, edge angle. Use wear on all six was similar (Plate 4-3). It can be characterized by the extensive presence along the lateral edges of small scalar flakes ($<$ 0.1 mm. width), plus noticeable polish on the flake edge itself, heavy polish on chert promontories, and polished or obscured flake margins. The wear is essentially unifacial, with the number of flake scars on one face being at least an order of magnitude less than on the opposite face. However, opposite edges of the channel flake may or may not have been used on opposite faces, i.e., most of the flake scars may be ventral on one edge and dorsal on the other, or not.

Only one of the twelve edges on these six channel flakes has been retouched (low angle), and it too exhibits edge and promontory polish.

Step flakes along all edges are small and very rare, but present. The channel flakes involved are items 00087, 01813, 01387, 02314, and a single

channel flake refitted from three pieces (01398, 01399, 01401).

We interpret these objects to be curated, light-duty unidirectional cutting or whittling implements. Most or all of the action was transverse, producing unifaced wear. Sawing motion wear used but minimal There is no consistent pattern in whether the ventral or dorsal flake side was "up" relative to the object being worked. The extent of polish and presence of occasional step-flakes indicates that the hardest material on which these objects were consistently used was of "medium" hardness, probably a wood. We hypothesize, then, that these objects were used for whittling or light scraping of wood, or light cutting of bark.

Utilized Flakes

All flakes with retouch on less than 50% of their edges, or showing signs of wear without retouch, were classified as "utilized and/or retouched flakes". For the purposes of use wear analysis this category was further subdivided into "utilized flakes", showing utilization on a fresh flake edge, and "retouched flakes" with use signs, if any on the retouched edge.

Results of the "utilized flake" wear examination are presented in Table 4-2. The vast majority of chert utilized flakes exhibit wear in two patterns. The most common pattern is intense unifacial scalar microflaking with arris polish and obscured flake margins. We interpret this wear pattern to indicate scraping a medium hardness material, possibly wood. The intensity of these indications varies, either reflecting the intensity of use of the flake, or the nature of the medium-hardness substrait (wood, bark, roots, etc.). The second, less common pattern, includes bifacial edge nibbling and scattered microflake removal. This pattern is interpreted as cutting of soft material, possibly either flesh or hide.

Table 4-1

Channel Flakes

0087. Medium hardness material scraping or whittling with light cutting/sawing. N10E80

1398, 99, 1401. Medium hardness material scraping or whittling with light cutting/sawing. N14E82

1816. One edge retouched. Both scraping/whittling. N35E58

1803. Medium-hardness material scraping?? N35E58

1387. Cutting medium-hardness material. N20E42

2314. Cutting medium-hardness material. Scraping and light whittling or sawing.

Table 4-2

Utilized Flakes

Black Chert

.00089 Very low edge angles. Lateral edges. Edge nibbling with occasional scalar microflakes, on both dorsal and ventral. Cutting soft or medium material - probably soft.

.00091 Edge nibbling and minor scalar microflaking, random and bifacial. Little edge rounding of arrises or flake scars. Bifacial cutting soft or medium, probably soft.

.00153 Utilized edge is covered with scalar microflakes and a few step flakes, small. Unifacial. Edge of flake and arrises are heavily obscured and polished. Scraping medium material.

.01748 Edge (1): Edge nibbling and a few scalar microflakes, bifacial, polish minimal. Cutting soft.

Edge (2): Edge covered with scalar microflakes, no step-flakes. Edge of flake scars and arrises obscured/polished. Unifacial - scraping medium.

Red Cherts, various.

.01397 Large biface thinning flake with ground striking platform. This is a "snapped cutter" by Gramly definition.

(1) "cutter" edge - 3 sharp points showing extensive polish on tips. Edge connecting these sharp peaks (90° sides) exhibit edge nibbling - very small scalar microflakes about 0.05 mm. width. Used for graving or cutting a medium hardness substance.

(2) 2 cm. long edge, covered with scalar microflaking, and a few step flakes. Flake scar edges and arrises obscured by polish. Unifacial. Scraping medium.

(3) Heavy step-flaking. Deliberately blunted.

.01158 (1) Edge nibbling and bifacial, well spaced scalar microflakes. Arris and flake edge polish minimal. Cutting soft or medium material, probably soft.

(2) Unifacial extensive scalar microflaking a few step-flakes. Arrises and flake margins obscured by polish and wear. Scraping medium.

.02322 All edges exhibit unifacial, extensive small scalar microflakes with rare step-flakes. Flake margins and arrises exhibit light polish and some obscuration. Scraping soft or medium, likely medium material.

.01749 (1) Unifacial extensive coverage by small microflakes, arrises and flake margins obscured , rare small step -flakes. Scraping medium.

(2) Bifacial edge nibbling and some microflaking. Arrises and flake margins exhibit some polish. Probably cutting or sawing medium hardness material.

.00092 .00093 .00123 Unifacial scalan microflaking covering the edge. Occasional step- flaking. Flake edges and arrises lightly obscured by polish. Light scraping of medium hardness substance, or possibly scraping soft substance.

.1801 Broken flake. Very short segment with bifacial scalar microflakes. Not enough present to be diagnostic.

.00209 Short segment of broken flake. One edge exhibits 1 cm. long segment of utilized edge characterized by unifacial step-flaking. Possibly indicating scraping hard substance, but not enough of edge present to view which pattern.

.02286 One short edge segment on this broken flake exhibits unifacial scalar microflaking with arris and flake edge polish and obscuration. Light scraping of medium substnce.

.01814 Extensive unifacial scalar microflaking with flake margin obscurred. Scraping medium.

.02302 Very light edge nibbling. Possibly cutting soft material.

.00130 Very short (1 cm.) edge lightly retouched. Rest of edge utilized unretouched. Bifacial edge polish, very light edge nibbling. No step flakes removed from retouched edge. Cutting soft material.

<u>Tan Chert</u>

.02204 Mostly unifacial edge nibbling and small scalar flakes, but one segment of curvature at base of utilized flake edge has scalar flakes on ventral side. A few larger scalar flakes. Probably cutting soft material.

<u>Neponset Rhyolite</u>

.00029 (unpatinated) Unifacial scalar microflaking with edge obscuration and polish on projections and arrises. Light scraping of medium hardness substance.

.01590 Unifacial scalar microflaking with flake edges obscurred and
(3) Heavy step-flaking. Deliberately blunted.

.01158 (1) Edge nibbling and bifacial, well spaced scalar microflpatinated for characterization.

.01392 .01394 .01393 Unifacial scalar microflakes with arris polish and flake edge obscuration. Scraping medium.

Table 4-2; Utilized Flakes; continued...

.02350	Patinated. Wear appears to be bifacial edge nibbling and occasional scalar microflaking. Cutting soft (?).
.00033	Bifacial edge nibbling and widely spaced scalar microflaking. Cutting soft.
.00006	Unifacial scalar microflaking along the inside of a concavity, flake edges obscurred. Scraping medium.
.01820	Possibly very light edge nibbling and polish on flake high points near edge. Possible, but not conclusive, evidence for cutting soft material.
.01447	Heavily patinated. Unifacial scattered rather large scalar microflakes present. No possibility of use assignation.
.00814	Flake edge exhibits bifacial edge nibbling and slight polish. Probably cutting soft. Note: Promixal end of this flake-blade has been retouched with a pair of side notches, possibly for suspension on a string.

Table 4-3

Retouched Flakes

<u>Cherts</u>

.00150 Edge angle 55°. Retouch width 2 mm. Intensive step-flaking 1 mm. wide and less. No evidence of arris polish or projection polish. Scraping hard substance.

.02215 Edge angle 50°. Retouch width 1.5 mm. Step-flaking .05 mm. wide, plus arris and projection polish. Scraping medium substance.

.01121 A small fragment of a retouched flake with retouched edge 1.1 cm. long. Recovered portion has been bifacially retouched with pressure retouch flakes to an edge angle 40°. Use wear on the piece, if any, is arris polish only. (This curious little piece is not a fragment of a biface point or preform.)

.00024 Edge angle 41°. Retouch width 2mm. Use wear consists of small scalar microflakes, edge polish, and arris polish and a few step-flakes. Scraping medium material.

.00896 Edge angle 45°. Retouch width 3 mm. This is a small fragment of a larger piece, only 1 cm. of retouched edge is preserved. Use wear along the flake edge. Scraping medium.

<u>Neponset Rhyolite</u>

.00070 Edge angle, both edges 55°. Retouch width 2 mm. Use wear: occasional step-flakes. Probably scraping medium.

.01848 Edge angle 31°. Retouch width 2½ mm. Use wear: a few wide (up to 1 mm.) step-flakes. Probably scraping medium.

.01828 Edge angle 45°. Retouch width 2 mm. Use wear: a few step flakes about 0.5 mm. wide. Probably scraping medium.

.00333
.00336
.00334 Edge angle 30°. Retouch 4 mm. wide. Use wear: Possible edge nibbling. Probable use, scraping soft material or light scraping of medium material.

.02329 Edge angle 50°. Retouch width 2 mm. Only about ½ cm. of retouched edge preserved on this fragment. No use-wear indications seen.

.02474
.02553 Edge angle 60°. Retouched width 2.5 mm. No use wear seen except for polish on a short graver-like spur at one end. Possibly a graver or cutting tool.

.02657 Retouched edge angle 60° approximately. Small fragment, no use wear seen.

The intensity of edge polish and scalar microflakes associated with this pattern varies. Probably a variety of activities are involved: some, such as butchery of meat, may involve encounters with harder materials (bone, cartilage) producing more or less polish or flaking. Use wear on the Neponset rhyolite specimens was less easily discussed due to heavy patination on some pieces. However, when the use wear was unequivocally visible, it fell into the above two categories.

Thus apparently casually used flakes, those selected for use without retouch, were utilized for two types of activities: scraping medium hardness materials (possibly wood) and cutting soft materials (possibly meat or hide).

For retouched flakes and all subsequent retouched tool classes, interpretation of edge wear must take into account the retouched edge angle. The steeper the angle (near or exceeding 60°) the harder the substance needed to produce extensive step-flaking.

Retouched Flakes

Of five retouched chert flakes, use-wear indications are clear on four, of which one exhibits use wear interpreted as scraping on a hard substance, while three suggest scraping on a medium hardness substance (wood?). Four Neponset rhyolite retouched flakes exhibit use wear interpreted as scraping on a medium (or soft in one case) substance. Indications of extensive step-flaking, as seen below in the Neponset rhyolite endscrapers, was absent. In general, apparently retouched chert and Neponset rhyolite flakes were casually made for light scraping of medium hardness substances.

Endscrapers

The endscraper sample (Table 4-4) also shows a range of scraping use

wear. Scraping on medium-hardness substances was a common function, but there is more evidence of scraping hard substances. There are seven chert endscrapers and three of Neponset rhyolite. The three Neponset rhyolite endscrapers and the largest of the chert endscrapers (.01528) account for the four highest edge angles in the series (57° to 68°).Three of these four exhibit step-flaking sufficient to indicate dominant use on hard substances (Plate 4-4), whether or not there was use on medium substances as well. Artifact number .00110, a Neponset rhyolite endscraper with edge angle 60° has such light use wear that it must have been predominantly used on medium hardness substances, or resharpened shortly before discard.

Of the six chert endscrapers, with edge angles of 54° to 41°, four show evidence of dominant use scraping medium hardness substances (Plate 4-5). Use wear on one (.02214) is so extreme that it must have been nearly useless and demanded replacement or reshaping. The other two endscrapers in this low-edge angle category exhibit one case of dominant use on a hard substance and one equivocal case of use on perhaps both medium and hard substances. None of these tools were used exclusively for scraping soft substances, which we interpret as leaving little or no wear on retouched edges. The universal accumulation of wear from harder substances suggests that they were especially designed for such work.

In general, more polish accumulates on the scrapers of lower edge angle, supporting the hypothesis that they tended to be used more on medium hardness than on hard hardness substances. The high edge angle (>55°) pieces tended to be used more on hard hardness substances. However, the data indicate that this is a general tendency to differential task use, and not an exclusive behavioral practice.

Table 4-4

Endscrapers

Chert

.00151 Distal edge angle 45°. There is a small "graver spur" on the right-hand margin of the distal edge, which has been broken and heavily polished. Use wear on the main portion of the distal scraping edge consists of multiple small step-flakes of 1 mm. or less width. Their margins have been heavily polished and obscurred. The last use of this edge was for scraping a medium hardness substance (wood?). Both lateral margins have been heavily ground, producing abrasion and extensive heavy step-flaking. The grinding is interrupted by retouched side notches.

.00214 Distal edge angle 52°. Intensive step-flaking along the edge, with very heavy abrasion of flake margins. The distal edge itself is heavily rounded by abrasion. Very heavy use scraping a medium hardness substance. The lateral margins have been heavily ground.

.00090 Distal edge angle 49°. Extreme step-flaking to a maximum width of 2 mm. Flake scar edges and projections only lightly polished or obscurred. Probably scraping a hard substance, or mostly scraping hard substances.

.02193 Distal edge angle 54°. Distal edge wear is heavy step-flaking, to a width of 4 mm. Light to medium polish on arrises and projections. Largest step-flake margins not obscurred or polished. Probably scraping both medium and hard substances although exact sequence and proportion of use equivocal. Lateral edges heavily abraded, purposefully ground.

.00022 Distal edge angle 41°. Moderate width step-flaking, up to 1½ mm. with heavy polish of arrises and projections, and some obscurring of flake margins. Working edge itself shows beginnings of rounding due to abrasion. Used to scrape medium hardness substance.

.01528 Distal edge angle 67°. Extreme invasive and undercutting step-flaking with heavy polish on chert projections and obscuration of flake margins. Working edge itself has been rounded slightly by abrasion. Heavy use scraping medium-hardness substances at least possibly had substances as well. This edge has been "used up", in need of resharpening before re-use.

.00586 Edge angle 47°. Light step-flaking with arris polish and flake scar obscuration. Scraping medium hardness substances.

Neponset Rhyolite

.02396 Edge angle 68°. Invasive, undercutting step-flaking up to 2 mm. wide on left half of working edge. Amount of polish difficult to

judge because of patination, but appears to be moderate. Scraped hard substances and possible medium substances. Lateral edge intentionally dulled, producing large step-flakes indicating no use polish.

.00110 Distal edge angle 60°. Light step-flaking <1 mm. wide with noticeable rounding of edge angle. Probably scraping medium substance.

.02109 Edge angle 57°. Undercutting step-flaking up to 2 mm. wide. Light or no polish or abrasion of flake scars in place. Edge used most often or most recently, mostly or exclusively to scrape hard substances.

Sidescrapers

Wear patterns on the sidescrapers seem to be consistent. The carefully retouched edge, or one of the two if two have been carefully retouched, exhibits light unifacial polish on chert arrises and orojections, and in some cases exhibits enough polish to obscure the retouch flake scars (Plate 4-6). On several specimens this wear is barely noticeable. No step-flakes or scalar flakes such as might be produced by scraping medium or hard substances are evident. We hypothesize that these edges were all used to scrape soft materials, possibly skins. This hypothesis is reinforced by the impression that extra care was taken to retouch the edge to be utilized into an even edge with no sharp projections. The side opposite the most heavily utilized edges has either been retouched and utilized little if at all, or has been "backed" or dulled with a combination of casual retouch and edge nibbling, plus abrasion or grinding of a thicker edge similar to that seen in platform preparation on biface preforms.

Perforators and Gravers

Two Neponset rhyolite flakes have naturally occurring tips of triangular cross-section on one corner that look as if they could withstand considerable force (.01592; .01843). Both tips seem to have been rotated inside a hole in a medium or hard substance, because scalar microflaking wear extends approximately ½ cm. from the tip along the flake ridges (Plate 4-7). On one piece the microflaking appears to indicate dominant counter-clockwise rotation. The other piece seems to indicate equal wear on both sides of the tip arrises.

Two chert perforator/gravers show light use wear in the form of minute, uncommon scalar step flaking, polish and edge abrasion. Apparently they were not used on a hard substance, but whether their use was confined

Table 4-5

Perforators and Gravers

Neponset Rhyolite

.01592 Distinct scalar flake removals from flake edges within ½ cm. of tip indicated predominant but no exclusive counter-clockwise action. Tip definitely w;orn by scalar flaking on all sides. One of flake edges appears to have microflaking wear extending 2½ cm. proximal to the tip.

.01843 One margin exhibits convex retouched edge along 4 cm., with noticeable polish and arris wear on the 1 mm. closest to the edge. This edge has been used to scrape a medium hardness material. Opposite flake edge, concave, exhibits the same type of wear. The tip exhibits more intensive scalar flaking along flake margin within 1 cm. of the perforator point. The point seems to have been rotated in both a clockwise and counter-clockwise direction.

Chert

.01818 Flake edges show edge nibbling that produced occasional scalar flakes bifacially, plus abrasion. Tip formed by retouch. Tip itself exhibits abrasion and polish and minute step-flaking along retouched edge within 3 mm. of tip. Flake edges used to cut a soft or medium substance. A possible interpretation is that the tip was used to pierce and the flake edges were used to cut away from the puncture.

.01534 Two retouched flake margins proximally. One exhibiting light arris polish similar to the sidescraper use pattern which apparently antidates the snap used for one side of the perforator point. Point itself shows minute flake removals on the very tip.

.00215 Tip damaged by minute flake removals and polished.

.01804 This piece appears to have been abraded or "sandblasted" after discard, making it impossible to specify whether or not abrasion was caused by use wear. Tip appears to have lost several flakes ventrally to force applied during piecing or graving. Lateral margins of the tip do <u>not</u> exhibit microflaking that would be indicative of rotary or boring motion in a medium or hard substance. proximally two separate segments of the edge of this channel flake have been retouched to a low edge angle. One segment exhibits little wear beyond very small scalar flakes. The second retouched segment exhibits step-flaking from scraping a hard or medium substance. This is a "multi-purpose" tool.

to medium or soft substances is difficult to determine. The one formally flaked perforator in the collection has been too heavily "sand-blasted" to detect all but the grossest use wear, which is absent.

Concave Scrapers

The use wear indications along all retouched edges on the concave scrapers indicated dominant or exclusive use on a medium hardness substance, possibly wood.

There is heavy step microflaking along some edges, but it is accompanied by use polish (Plate 4-9). None of the edges exhibit the fresh, unpolished extreme step microflaking which we associate with scraping on a hard substance.

Bifaces and Fluted Points

There is no evidence of use of any of the bifaces or fluted points for any function other than as piercing implements. All edge "wear" indications (were present) are consistent with edge grinding as platform preparation during bifacial flaking (Plate 4-10, 4-11), or basal edge grinding (dulling for hafting). The flakes removed from the broken edge of .00112 appear to be indications of an attempt to remove the chert "lip" overhang from the break.

Limaces

The lateral edges of our two specimens exhibit regular retouch, upon which has been superimposed invasive step-flaking along the junction between the retouched edge and the ventral surface. We interpret this step flaking as a deliberate attempt to "even up" and strenghten the edge by the knapper because: (1) the step-flaking is nearly uniform in intensity along the whole of the extant lateral margins, and (2) identical "wear" was produced on the experimental limace made for us simply by running the

Table 4-6

Sidescrapers

23.12.02301 Edge preparation accounts for most of the visual relief along the edge of this tool, including scalar and step-flake removals up to 10 mm. wide, followed by light pressure retouch to produce straight retouched edge. Scalar or step-flakes produced by use wear are absent from both the dorsal and ventral surfaces. Along some portions of the edge, the angle is low enough (40°) to show step-flaking if it had been used on medium hardness materials. The only indication of wear is a light polish on projections and flakes scar edges on the right-hand side of the tool, and a medium such polish and edge rounding on the left-hand edge. Definitely used, exclusively for scraping soft substances (?skin).

23.12.02051 Same as .02301: light polish and flake scar obscuration on both .02053 edges, but more prominant on left (larger, convex) tool edge. No definite scalar or step flakes postdating the initial stages of edge retouch. Scraping soft, or no use at all.

23.12.02323 Left edge is retouched. Right edge has been dulled by slight retouch, grinding, and edge crushing similar to biface preform edge preparation. Only sign of use wear is light polish on chert projections along the left (retouched) edge. The amount of polish is only one, two, or three times the amount we produced with 500 strokes scraping dry deer hide on Exp-2. Conclusion: light use scraping soft material.

.02293 A backed edge opposite a retouched convex edge. Very light
.02209 polish on projections along retouched edge furthest away from striking platform. Scraping soft material.

.00289 One side definitely "dulled" on purpose: bifacially flaked segment of edge has grinding on high points identical to biface preforms. Other edge a definite uniface with carefully prepared straight edge. Almost no polish on arrises on projections visible at all: used less than or equal to our 500 stroke experiment scraping soft material.

.01582 Backed (ground) edge opposite retouched edge. Retouched edge shows moderate polish on flake arrises and chert projections, noticeable edge rounding, but no scalar or step-flake. Scraping soft material.

.01700 A barked (lightly retouched and ground) edge opposite the carefully retouched working edge. Light but definite polish on chert projections along immediate working edge. Scraping soft material, with light use.

.01477 Edge rounding and polish, plus obscuration of flake margins and chert projections on both edges. One edge is retouched,

	the other was a fresh flake edge before it was "barked" by microflake removal. The polish on the "backed" edge may be deliberate grinding. Scraping medium.
.00488	Both edges of this piece are retouched. The broadly retouched (4-5 mm.) edge exhibits little or no wear, while the narrowed retouched edge (2-3 mm.) exhibits moderate polish on chert projections and flake arrises. Light use scraping soft material.
.00308	Edge wear includes some abrasion and no scalar or step-flakes on this Neponset rhyolite piece. Patination is too advanced for definitive statements.
.02216 .02218 .02282	Low angle retouched edges, with heavy arris and projection polish and flake scar obscuration. Scraping soft.

hammerstone lightly along the edge. On both specimens the major evidence of use, therefore, consists of scalar flakes removed from the ends on the ventral face (Plate 4-12).

The dorsal surface on the complete specimen exhibits small scalar flakes removed at random from the distal $\frac{1}{2}$ of one of the dorsal blade arrises, yet the edges show no evidence of twisting or rotating wear. We suggest that these tools were used to shave out or whittle inside a long concavity, such as the scraping of the sides of a deep, narrow socket. The dorsal arris acquired its use marks while rubbing in and out on the edge of the concavity.

The mode of use of the flake-shavers proposed by Grimes and Grimes seems consistent with this wear pattern, although the fact that the complete specimen exhibits use wear on both ends (albeit one end much more intensely) might mean that not all limaces were hafted in the manner proposed by Grimes and Grimes.

Additional use wear experiments would have to be undertaken to decide which range of hardness of raw materials would produce the use wear scalar flakes seen on these specimens; we suspect that at least a medium or a hard substance would be involved.

Table 4-7

Concave Scrapers (Retouched Edges)

Neponset Rhyolite

.01591 No step-flaking visible along retouched edge. Nature of the material precludes discerning arris wear or polish. Used on medium or soft hardness materials.

Quartzite

.00032 Very minor step-flaking. Heavy edge polish and rounding. No experimental evidence for this material, but it it acts like chert, then use wear indicates scraping medium hardness material.

Chert

.00335 Invasive and undercutting multiple step-flaking, on a low angle retouched edge. Heavy flake margin polish and rounding. Scraping medium hardness substance, fairly intensively.

.01319 Unifacial scalar and uncommon step-flaking, accompanied with heavy edge rounding, arris polish and flake margin obscuration. Scraping medium hardness material.

.00086 Both the convex and concave edges on this piece exhibit the same signs of use wear: intense multiple step-flaking up to 1 mm. wide, accompanied by heavy polish and wear on arrises and projections and obscuration of flake scars. The polish on these edges indicates use on medium hardness materials. The intensity of the step-flaking indicates heavy use. Note that the convex edge has been retouched on alternate sides of the flake for each approximately half the length of the side of the flake, making this piece a very versatile scraping tool.

Table 4-8

Bifaces and Fluted Points

.00330 Biface preform. Some of bifacially flaked edge had been lightly ground as platform preparation, producing localized, bifacial step-flaking alternating with intense abrasion and dulling of some edges. No other signs of use wear present.

.00660
.00661 Biface preform. Edge grinding for platform preparation visible around whole bifacially flaked edge; eg. breakage of artifact occurred after platforms preparation but before extensive flaking of the prepared edge. Possible use wear confined to a 1 cm. long stretch of one edge of the freshly broken surface, where there are a series of small scalar microflakes. Fresh edge may have been "tried" as a scraping edge on some object but not utilized further.

.00082 Fluted point preform, broken on first flute attempt. Traces of bifacial edge preparation (grinding) visible between flake scar (e.g., grinding predates the existing regular flaking, and the fluting attempt). Use wear absent on distal edge (the flute carry-over fracture), which contrasts sharply with a similar specimen from 23.13 which was heavily utilized along the freshly broken edge.

.00037 Biface tip, red chert. Edges have been ground in preparation for bifacial resharpening, which never took place. No other signs of use wear.

.00451 Fluted point ear, red chert. Bifacially flaked edge has been heavily ground.

.01355 Biface preform tip. Before edge has been heavily ground as platform preparation, thus subsequently flaked.

.01974 Biface tip, Neponset rhyolite. No use wear indications.

.00109 Fluted point, black chert. Base heavily ground. A few traces of bifacial edge platform preparation antedating last resharpening incident visible on distal portion. No other use wear indications.

.00643 Red chert, fluted point, tip missing. Same comments as .00109.

.00321
.00433 Fluted point, broken tip refitted. May have been undergoing resharpening when break occurred because both of the lateral edges distally show <u>unifacial</u> removal of large flakes that postdate the edge grinding platform preparation. No other indications of use wear, except grinding of the proximal portion of the point.

.00088 Black chert fluted point. Tip broken, tip utilized. No use wear visible on fluted point edges, which are clean and sharp except for remnants of platform preparation antedating last resharpening plus basal grinding.

The broken edge of the tip is another matter. A serious attempt was made to remove the "overhang" of chert on the break by retouch, a procedure which ended in failure as the edge crushed after a few scalar flake removals. There is no evidence of use of this edge subsequent to the flaking attempt.

Table 4-9

Limaces

.00634 All flake arrises and projections on whole object have been lightly "sandblasted", probably by the wind. lateral, retouched edges are marked by intrusive, invasive multiple step flakes removals up to 1 mm. wide. We believe that this step-flaking represents intentional edge "evening"; it is nearly universal along one edge but only occurs on projection portions of the edge on the other margin. Use wear indications are confined to two large scalar flake scars on the ventral surface originating from a lateral edge with ½ cm. of the tip, and a series of several generations of scalar microflake removals from one side of the distal tip.

.01342 Almost universal and uniform step-flaking of both lateral edges, again interpreted as intentional edge evening/grinding. Use wear indications are confined to scalar flake scars on the ventral surface which originate from, in the case of this complete object, both ends of the tool. Only one scar originated at the proximal (striking platform) end of the implement. Distal end has multiple generations of scalar scar removals.

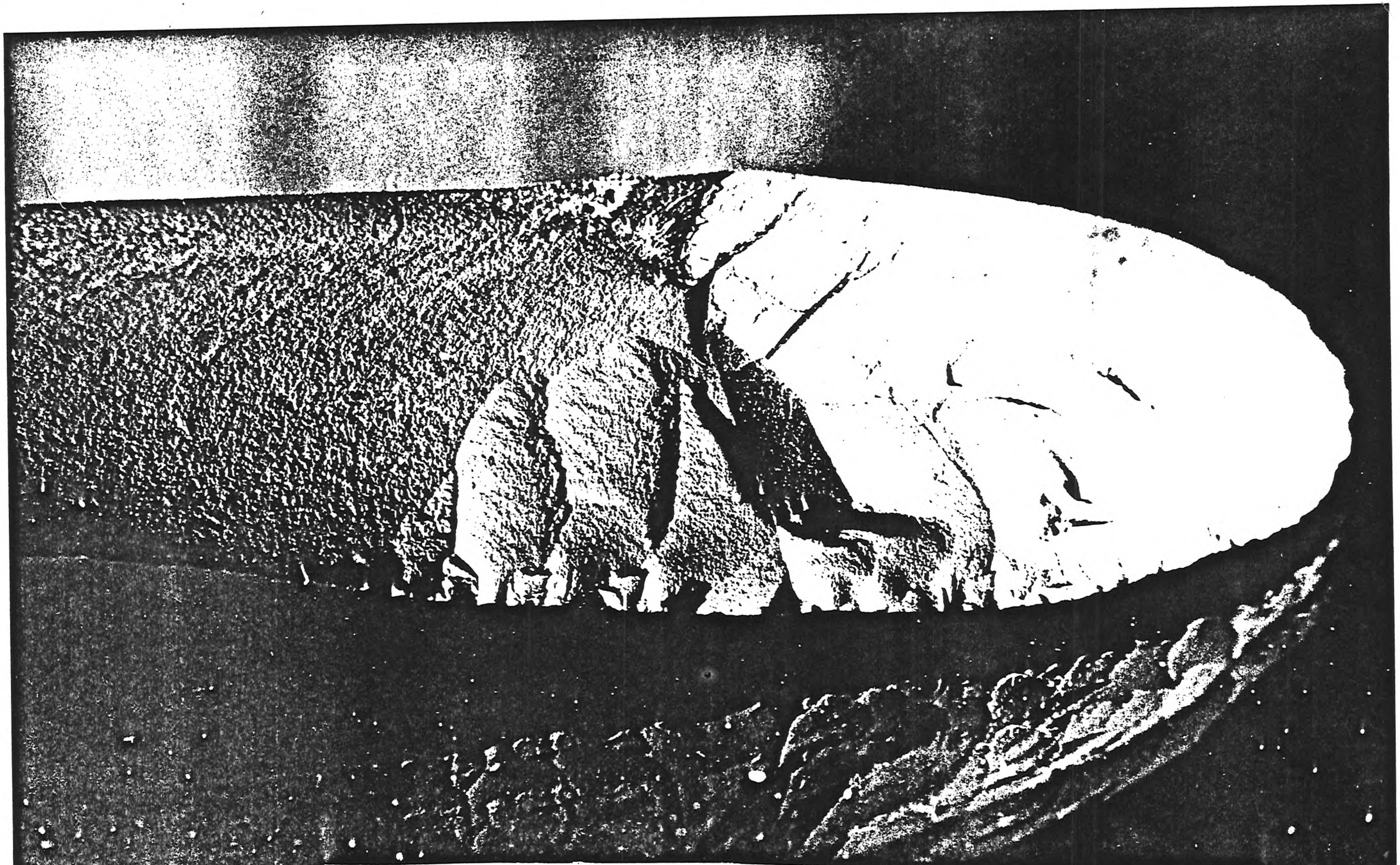


Plate 4-1. Fresh, unused, steeply retouched edge of Exp-2, an experimentally used red Munsungun chert side scraper. This photograph, coupled with an epoxy cast of the unused edge, were used for comparative purposes during use wear experiements.

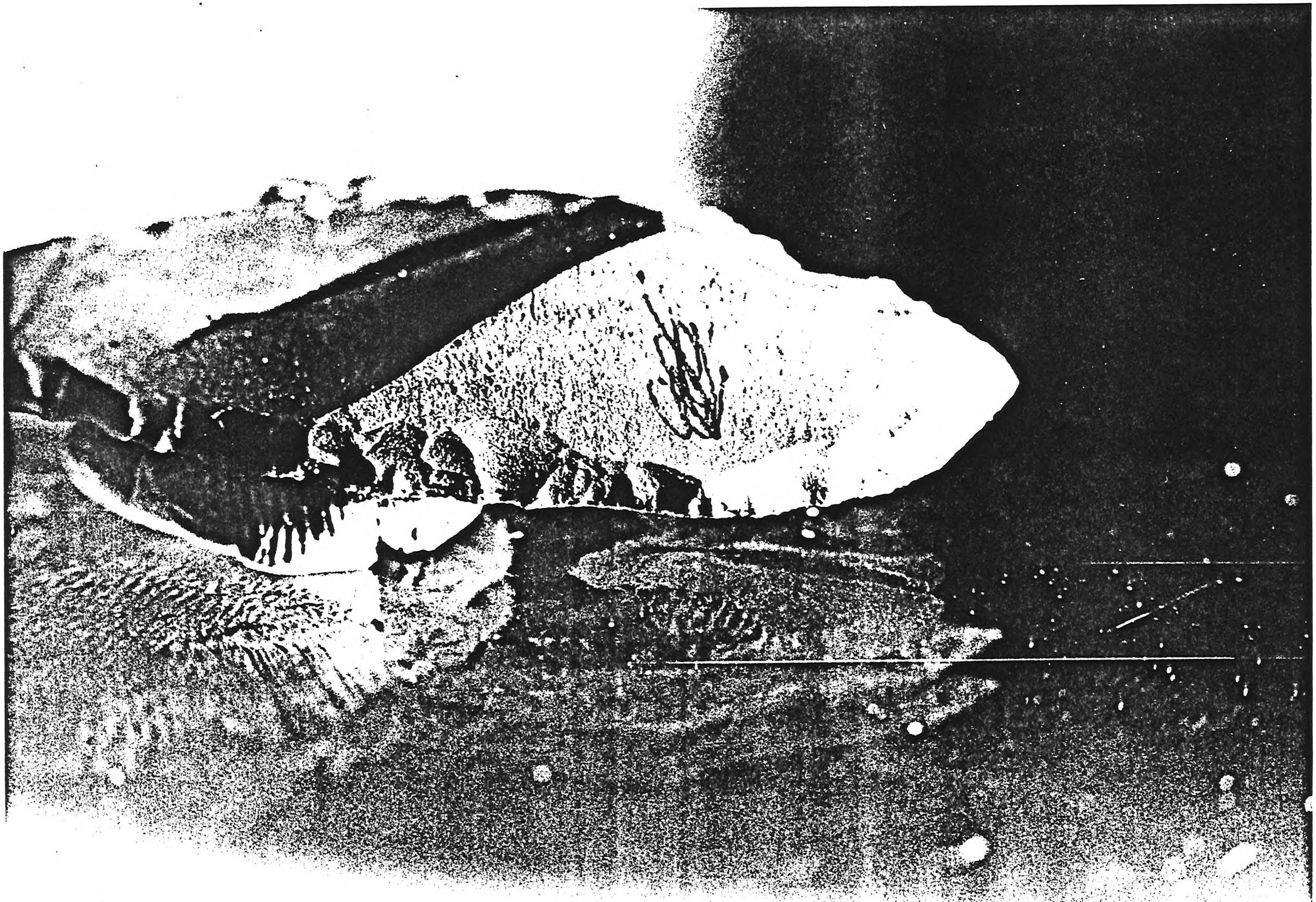


Plate 4-2. Fresh, unused, low-angle retouched edge of Exp-3, an experimentally used grey Munsungun chert retouched flake.

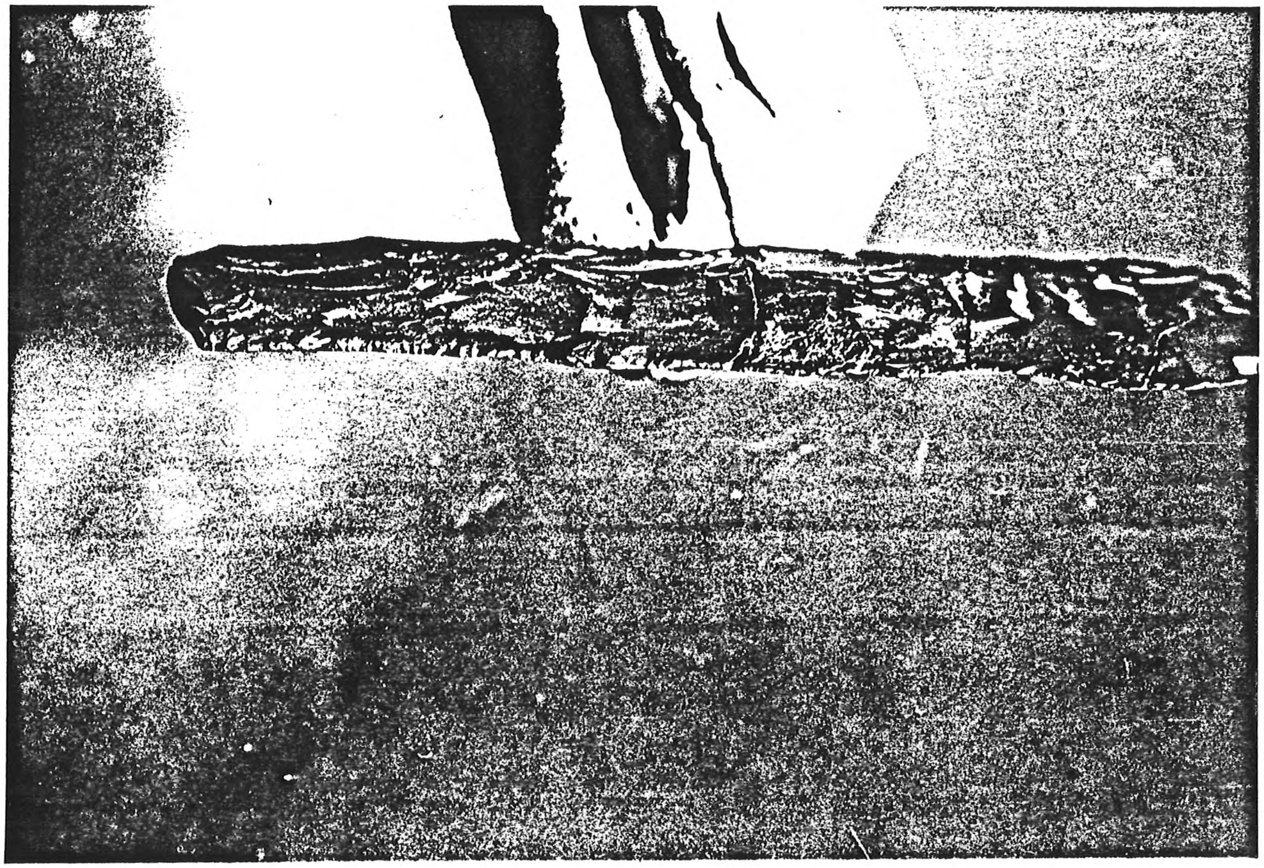


Plate 4-3. Channel flake (23.12.01398, .01399 and .01401) exhibiting use wear along unretouched edge. Use wear consists of extensive scalar flaking coupled with polish or arrises and promontories along the edge.

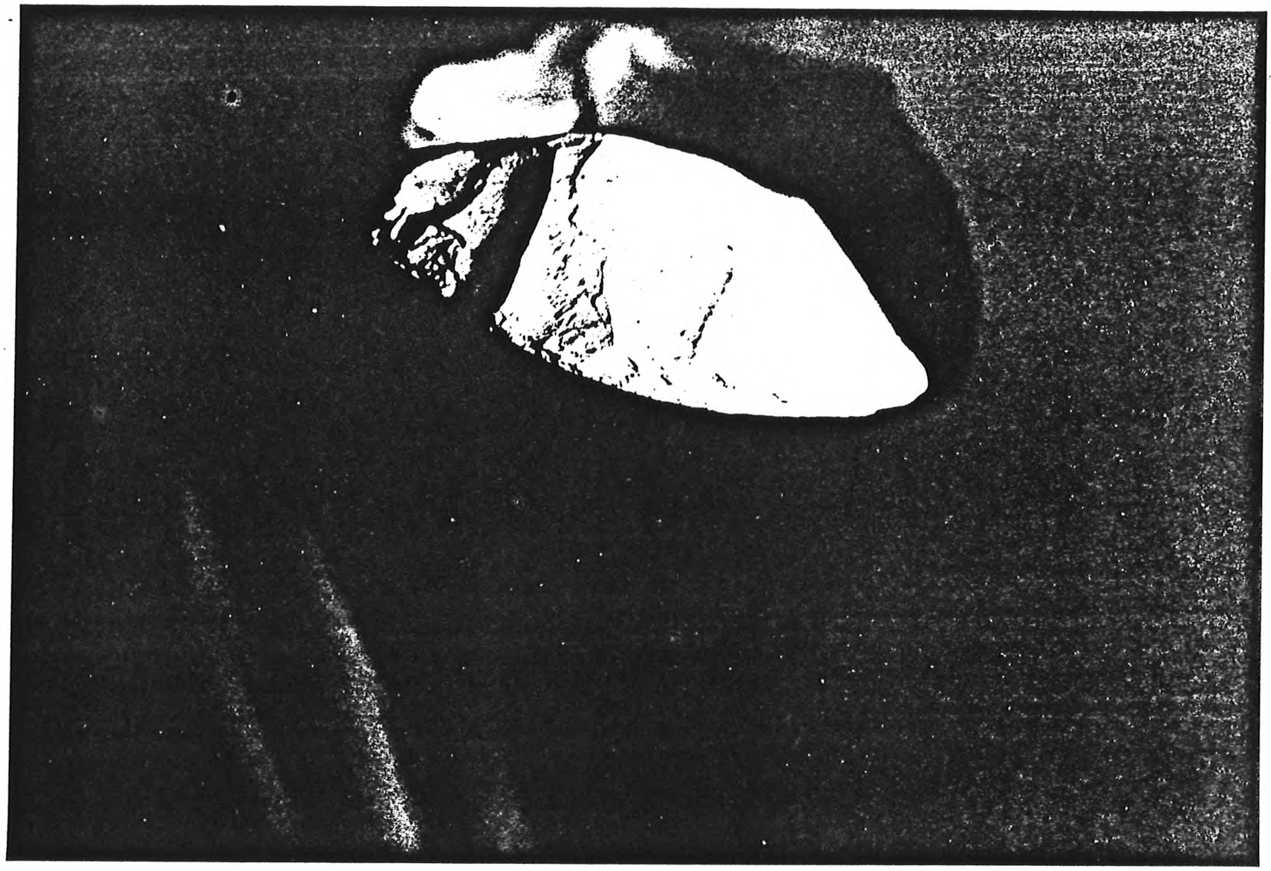


Plate 4-4. Use wear on distal end of endscraper (23.12.01528), showing invasive step-flaking, plus obscuration of flake margins, polish on projections, and slight rounding of the working edge itself.

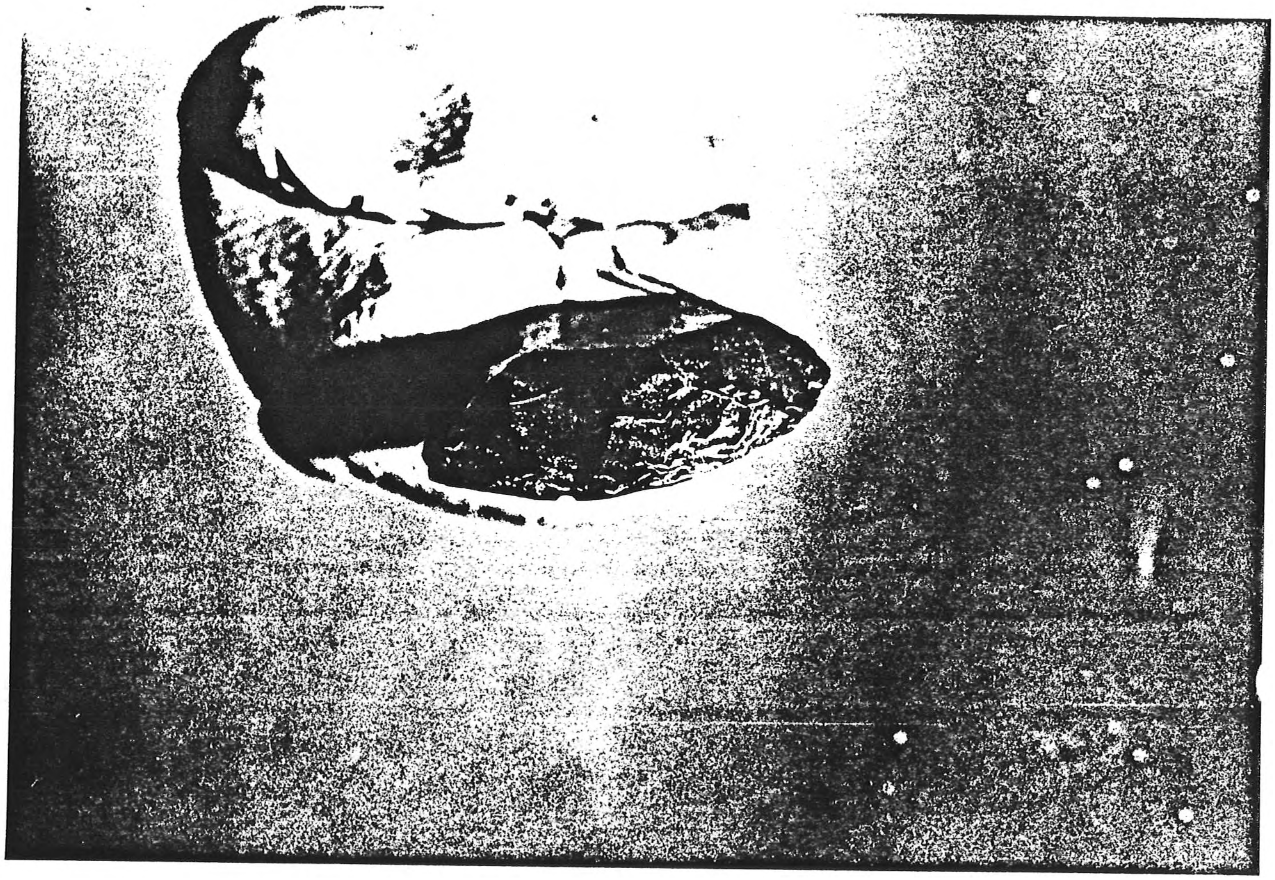


Plate 4-5. Distal end of endscraper (23.12.00151) showing multiple step flakes with heavy polish and obscurred flake margins.

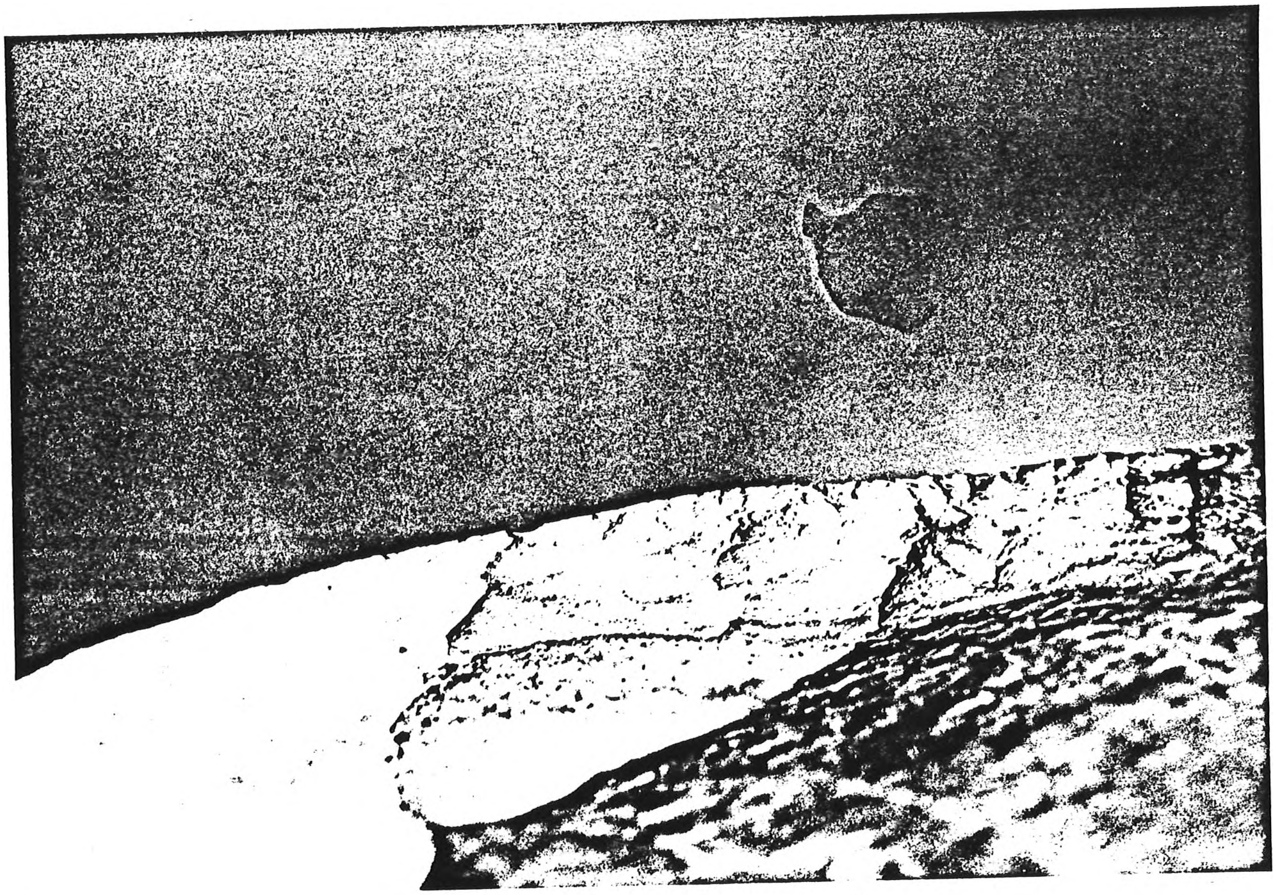


Plate 4-6. Sidescraper (23.12.02051/.02053) working edge showing light polish on retouch flake scars and arrises.

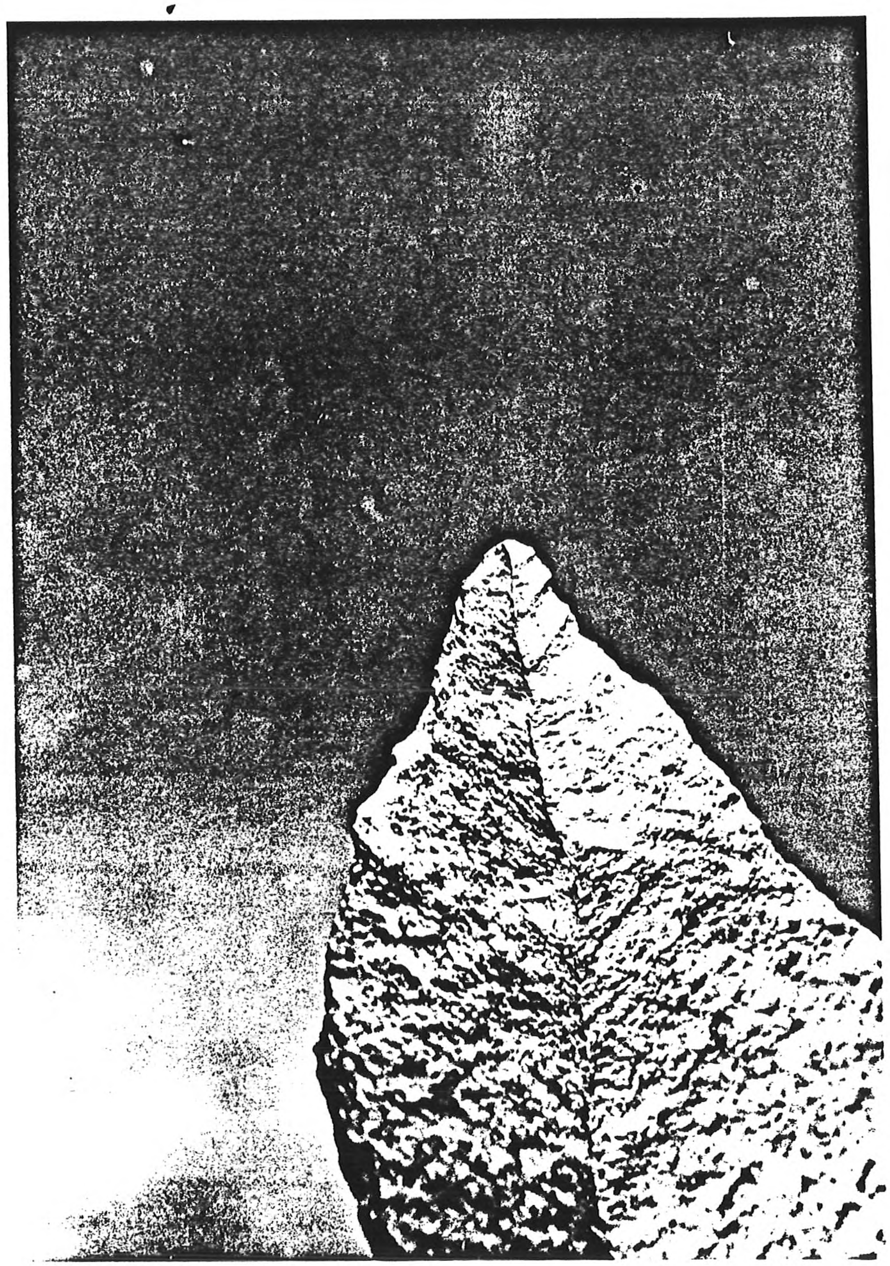


Plate 4-7. Perforator/graver tip (23.12.01843) exhibiting scalar microflaking extending approximately ½ cm. from the tip.

Plate 4-8. Perforator/graver (23.12.01818), close-up of tip and distal edges.

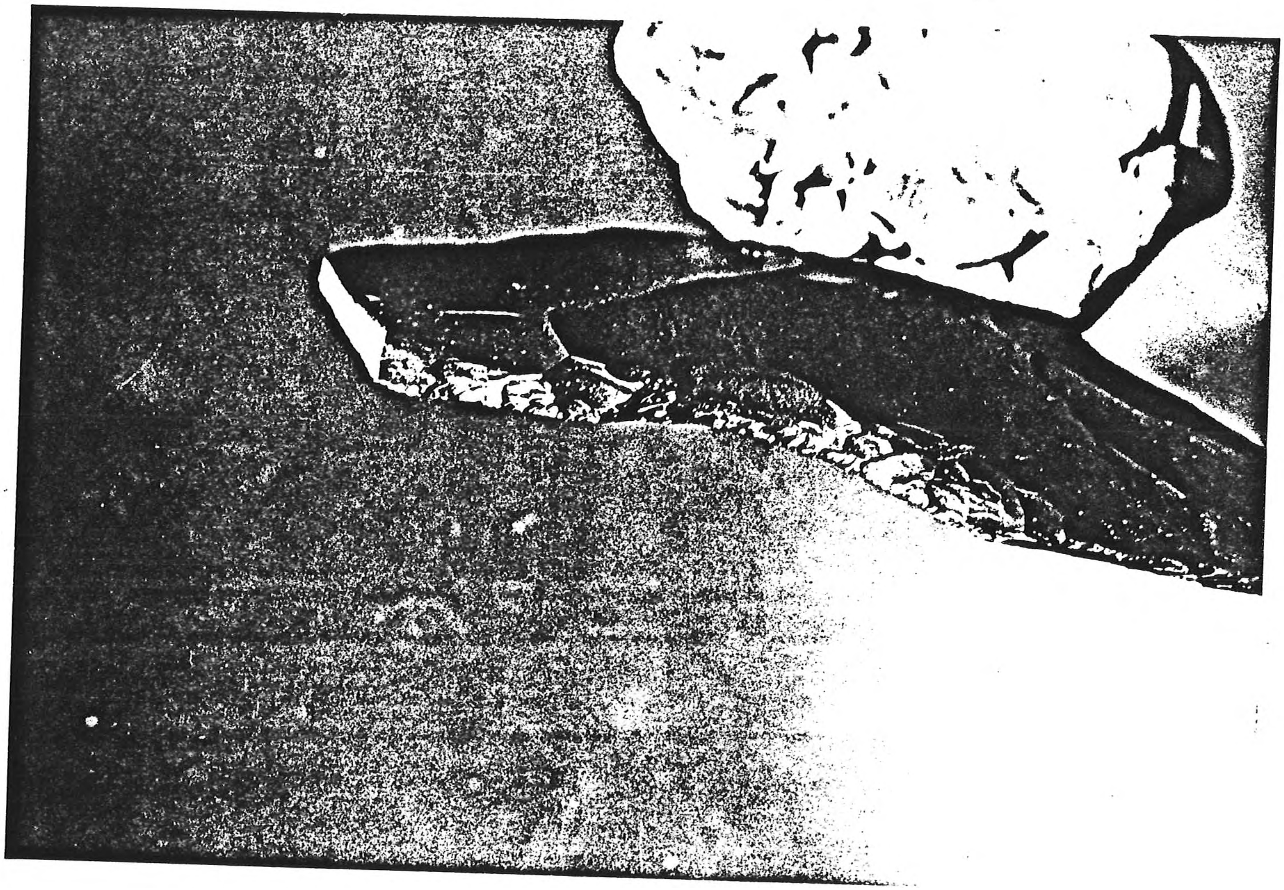


Plate 4-9. Use wear in the concavity of concave scraper (23.12.00086), including step flaking and use polish on arris margins.

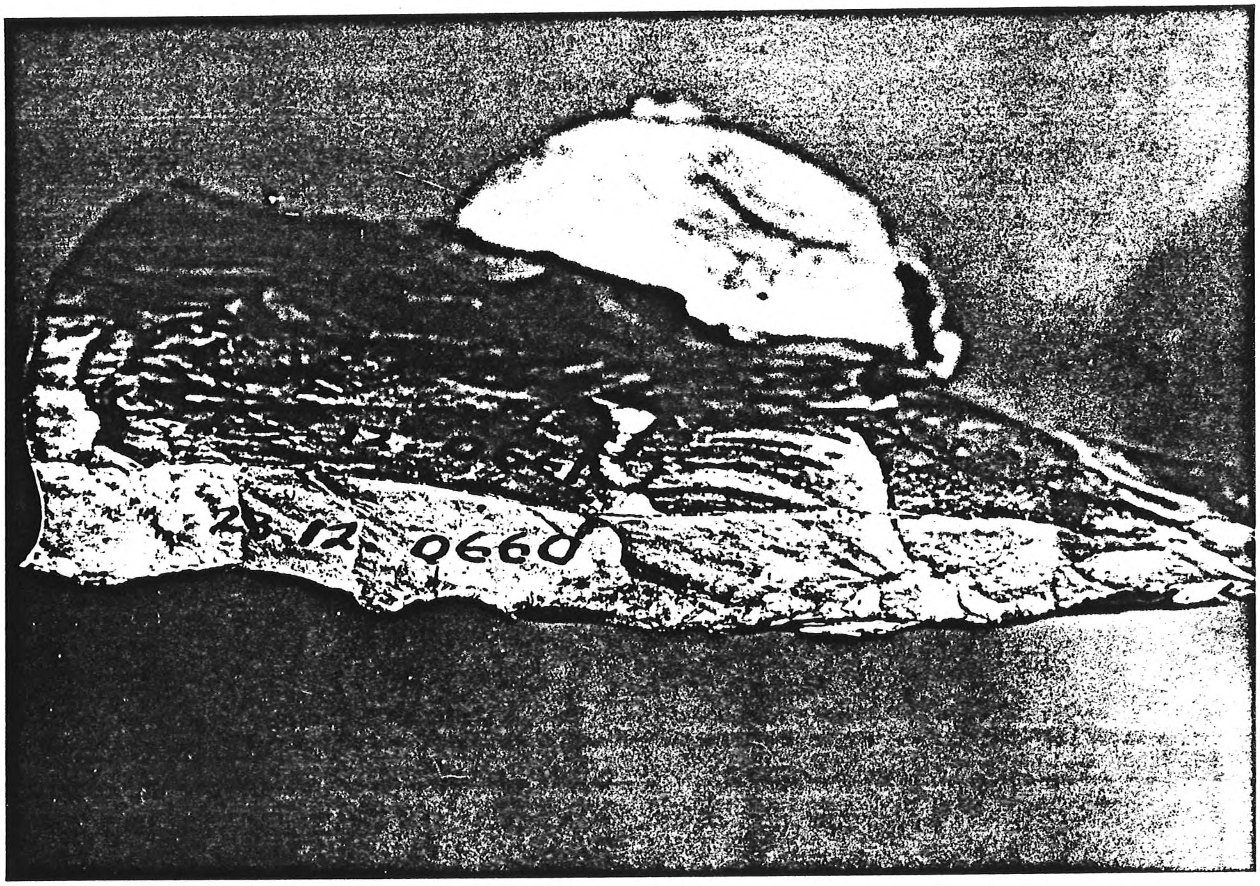


Plate 4-10. Oblique view of margin of biface preform (23.12.00660/.00661) showing edge dulling as platform preparation.

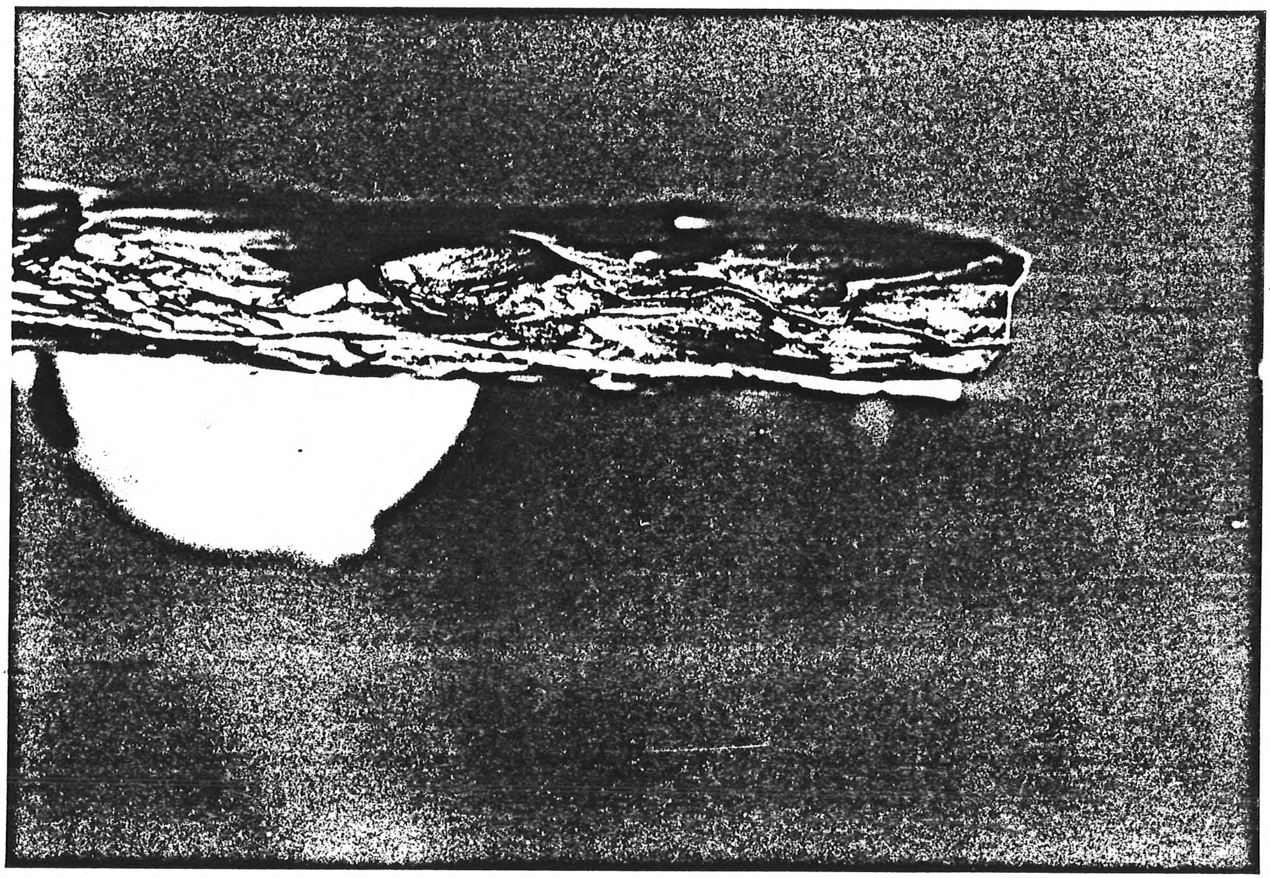


Plate 4-11. Edge on view of biface shown in Plate 4-10. Grinding along sinuous edge visible.

Plate 4-12. Ventral view of end of limace (23.12.01342) with scalar flaking renewals visible at tip.

CHAPTER5
DISC ART #15A

CHAPTER V:

ECOFACTS: FEATURES, CHARCOAL, RADIOCARBON DATES, BONE, AND THE BOG CORE

This chapter is designed to present data on non-lithic material recovered from the site. It includes the only "architectural" information from the site: descriptions of three features that are likely to be Paleoindian in age.

A. PALEOINDIAN FEATURES

We had recorded forty soil discoloration features before realing that those associated with bright soil colors were relatively recent in date, being associated with burned or rotten tree roots (see Chapter 1). Thirty-seven such features were discarded from consideration as not Paleoindian in age, leaving three (Features 7, 8 and 21) as possible Paleoindian features (Figure 5-1). Two, Features 8 and 21, fall inside the largest flake and artifact concentration on the site. Feature 7, the best preserved candidate for a Paleoindian hearth feature lay between two flake/artifact concentrations, but adjacent to one.

Feature 7 was recognized early in the excavation as a darker charcoal-flecked stain in the B2 soil horizon of N22E48 and N24E48 along the border between the squares. Subdivision designations were assigned to each part of the bilobate stain (Figure 5-2). Feature 7a was originally noticed in the NW $\frac{1}{4}$ of the NE quadrant of N22E48 at about 9 cm. below the soil surface, which was a B1 soil. Feature 7b was recognized in the SE $\frac{1}{2}$ of the SE quadrant of N24E48. At 9 cm. depth each feature was recognizable as a dark-stained (grey) core surrounded by a halo of lighter grey tinging the

soil. The "halos" of both the 7a and 7b darker cores joined at the 9 cm. level. Excavation proceeded in vertical and horizontal section, hoping for the less soil movement and less possibility of contamination by later charcoal through soil turbation with greater depth. The darker feature centers were then excavated, and all the dark grey (10YR5/3) soil was retained for future laboratory processing (approximately 20 quarts). Charcoal lumps and flecks were noted in the sand, the largest being 1x1x3 mm. Average size was about 1 mm^3. At depths of 14-18 cm. a few larger (4 mm. length) lumps were encountered. NO calcined bone was recovered from the feature fill. The charcoal was noticed to be a mixture of wood charcoal and a bubbly, or resinous, charred material.

The margins of the dark grey stain were marked by earthworm holes: visible mottling of the 10YR5/4 and surrounding "yellow" B2 or C soil horizons as the earthworms had moved soil particles horizontally. This bioturbation had created a boundary zone several centimeters thick, rather than a sharply defined pit edge. The pit base was encountered approximately 27 cm. below the soil surface datum (18 cm. below the elevation at which the feature had been recognized). It is very important to note that there was NO CHARCOAL present in the surrounding B2 and C soil horizons outside the light grey (10YR5/4) halo. Thus, the charcoal was in excellent association with the pit-shaped feature, whatever its age.

The pit turned out to be roughly bi-lobate, or dumbell-shaped along its centerline long axis running NE-SW. We excavated a profile NW-SE across the center of Feature 7a (Figure 3), revealing a very steep, almost undercut eastern wall to the feature. Feature 7a was a steep-sided, elliptical basin. The depths of the feature exhibited two deep conical pit bases connected by a shallower shelf.

We interpret Feature 7a and 7b as a pit hearth, dug in the sand by hand or with a small scoop-like tool resembling a hand, probably from the western side, creating a steep southeastern wall and a shallower western wall.

Feature 8 was located in the NW¼ of the NE quad and the NE¼ of the NW quad of N28E40. It appeared as a greyish tinge to the B2 and C soil horizon sand, associated with a visibly increased charcoal incidence compared with the surrounding sand. It was an elongated (possibly bilobate) ellipse, very similar in shape to Feature 7a and 7b. Unfortunately, the margins were not as clearly defined.

Feature 21 occured on the square border in the eastern halves of N28E40 and N30E40. It appeared as a darker charcoal-containing stain in the B2 horizon soils. A small amount (1 pint) of in situ fire-cracked rock was located just inside the southern end of this oblong, basin-shaped feature. The feature was about 70 cm. maximum diameter NE to SW, with maximum width 30-40 cm. The north end of the feature had been cut by a definite rodent burrow (of chipmunk diameter).

These three features are clearly similar in dimension and in construction, all being elliptical or bilobate shallow basins. Only one was associated with small amount of fire-cracked rock. Where orientation and margins were most certain, a NE to SW long axis of each feature is recorded.

The variable association of these three features with flake and artifact concentrations (inside and outside of such concentrations) and the presence of Feature 8 and 21 so close together makes it seem unlikely that there is a one-to-one correspondence between hearth location and the interior of a structure. The oblong shape of the pits is consistent, but whether that shape represents an accomodation to the size of the fuel

supply, or an attempt to control draft (perpendicular or parallel with prevailing wind?), or some other factor, is unknown.

No similar features were noticed anywhere else on the site. With the exception of a few areas of disturbed soil, if such features had been present they would have been detected, especially since Feature 7a-b was recorded early in the dig and we were subsequently watching for such features. It may also be significant that the three features come from the western margin of the site where certain kinds of raw material are dominant in the activity areas near the hearths. Other materials are dominant in activity areas elsewhere on the site. We will explore this topic further in the horizontal patterning section.

B. CHARCOAL

Bulk feature fill samples from Features 7, 8 and 21 were processed in the laboratory for charred plant material by placing the feature fill on a window screen (1 mm mesh) and washing gently with running water. By far the vast majority of the sample bulk was silty fine sand. Also passing through the mesh was a very small volume of powdered charcoal, some pieces with maximum dimension greater than 1 mm. but with minimum dimension less than 1 mm. that fit through the screen by chance. All the material passing through the screen was collected in a childrens' plastic swimming pool (3 foot diameter), and rescreened several times to recover charcoal bits with maximum dimension greater than 1 mm. One attempt was made to float a sample in supersaturated salt (NaCl) brine. More charcoal was recovered than during the first washing of soil through the window screen, but recovery in the brine did not seem to be substantially improved over the multiple washing through window screen.

Subsequently, charcoal samples were examined under a dissecting

microscope (to 20x magnification), remaining pieces of mineral (sand or mica) and uncharred plant matter were removed by hand. Table 5-1 presents the sample volumes and weights for charcoal extraction from several feature fill samples.

The charcoal content of Feature 7 soils was approximately 5% by volume, but there is evidence from the radiocarbon dates that not all of that volume dates to the Paleoindian period.

Feature 8 yielded a much higher proportion of charcoal, but its contents obviously do not all date to the Paleoindian occupation. About 40% of Feature 8 fill that remained on the window screen was a charred frothy substance interpreted as burned conifer pitch. One-fifth of the residue was unoxydized plant root fragments. Importantly, a few percent of the wood charcoal pieces in the sample exhibited adhering patches of light brown, softer material that appeared to be incompletely oxydized (and rotting) wood. Based on the experience with Feature 7 radiocarbon dates (below), we assume that the Feature 8 burned frothy substance (pitch) will date anomalously. Moreover, finding partially charred wood fragments with rotting wood still adhering to the charcoal, visually identifiable under the microscope at 10x to 20x magnification, we assume that any attempt to date the charcoal from this feature will produce a date not representative of the Paleoindian occupation. In fact, the only way to confirm our observation that the charcoal in the feature is likely in part of Paleoindian age, would be to run a series of accelerator dates on individual lumps of charcoal and hope to hit several of the appropriate date (about 10,500 B.P.). Such an approach, however, would be prohibitively expensive.

TABLE 5-1

FEATURE/ PROVINCE	SOIL SAMPLE NUMBER	CHARCOAL SAMPLE NUMBER	TOTAL SOIL VOLUME	CHARCOAL VOLUME	RADIOCARBON DATE	OTHER
7a lighter grey	90281	---	2,200 ml	11 ml	----	charred pitch and wood charcoal
7a center of feature	90258	80045(coarse) 80046(fine)	800 ml	4 ml	Beta-15,660	all wood charcoal
7b center of feature	90280	80047(coarse) 80048(fine)	1,750 ml	10 ml(3.2 gr) 2 ml(0.8 gr)		wood charcoal, charred pitch, or fat
7a lighter grey margin	-----	23.12 Fea 7(1)	2,000 ml	? (3.0 gr)	Beta-13,833	wood charcoal and burned pitch
8	90278		3,000 ml(°)	90 ml	----	See Table 5-2
7a light or grey	90282	----	3,500 ml	12 ml		
7a + b (between)	90283	----	2,300	5 m.		

TABLE 5-2

Feature 8 Contents, Soil Sample 90278.

Volume	
40%	Charred pitch (?) frothy
20%	unoxydized plant root and root bark
20%	Charred wood charcoal
Trace	Wood, charred, with partially oxydized patches lighter brown color.
Trace	Small round specimens (?) fungal fruiting bodies, of seeds of a vascular plant, some only partially charred.
5%	Chert microflakes, red cherts and Ceglchert.
Trace	Partially charred seed (? coniferous nut)
10%	Remaining mineral

The charred plant material from Feature 7 was examined, but attempts at identification were only partially successful due to the small size of the particles (Dosia Laeyendecher, Smithsonian Institution, pers. comm.; samples 23.12.80045, 80047, 90283, 90282). The frothy, non-charcoal material was detected, without positive identification. (We assume that it is either burned confier pitch or burned fat.) Several charcoal fragments were identifiable only as coniferous, of which several were identifiable only as hardwood. Some of the conifer fragments were identifiable as Pinus species. Several samples yielded charred berry stems identifiable to the Ericaceae (partridge berry and blueberry family) or Empetraceae (crowberry family).

As a cautionary note, the identification of charred berry stems need not indicate full use of a ripe berry resource as human food by the Paleoindians. Berry fragments can over-winter when covered with snow in a low, thick vegetation net, and be incorporated into brush fuel at any season of the year. Moreover, many over-wintered arctic berries are desirable to eat as they begin to germent in early summer (Spiess, personal observation, Labrador).

In sum, the Feature 7 charcoal preserves evidence of a wooded and brushy environment on or near the site. Features 8 and 21 appear to be contaminated by later rodent disturbance and root growth, followed by episodes of partial burning.

RADIOCARBON DATES

Charcoal sample 23.12 Fea. 7 (1) consisted of 3.0 grams of wood charcoal and some burned, frothy material described by Spiess as "pitch" on the radiocarbon submission form. The sample came from the lighter grey margin around Feature 7a. The sample was received at Beta Analytic on

September 11, 1985. Pretreatment consisted of handpicking uncharred grass rootlets, then sequential boiling in acid-alkali-acid solutions. The synthesis and radiocarbon counting that followed went normally (Murray Tamers, pers. comm. 9/18/85). The reported radiocarbon date was 9010 ± 210 B.P. (Beta-13,833), received while we were still in the field.

Sample 23.12.80046, submitted after the field season, consisted of 0.8 grams of wood charcoal with minor rootlet penetration by modern grass rootlets. This sample came from soil excavated from the very darkest, central portion of Feature 7a at a depth of 14 to 18 cm. below the surface. Microscopic examination of the sample by Spiess revealed that the sample submitted to Beta Analytic was clean of any of the frothy, burned material (?pitch) that was suspected of causing contamination of the first radiocarbon sample. This sample was pretreated exactly the same way as the previous sample, with manual rootlet removal and standard acid-alkali-acid boiling. Only 0.4 gr charcoal had survived pre-treatment, yielding 0.1 gram carbon, an absolute minimum for a standard radiocarbon date. The sample produced a date of 10,200 ± 620 B.P. (Beta-15,660). The sample had been counted for four times the normal counting time to reduce what would have been a huge standard error.

The 10,200 date is acceptable for what "should" be a mid-11th millenium Northeast fluted point site. The large standard error means that the true age of the carbon in the sample could be as old as 11,440 B.P. or as young as 8,960 B.P. with 96% confidence. It should be noted that this date overlaps Beta-13,833 (9,010 B.P.) in the time range <u>before 9,500 B.P.</u>. The probability of these two dates being drawn from the same population of caribou by chance is less than 17%. There is about one chance in five (17%) that these dates have samples the same carbon population, with an

average age of less than 9500 years. There are four chances in five (83%) that the carbon samples are different in age. The frothy, burned pitch-like substance is the only visually identifiable candidate to produce that contamination.

CALCINED BONE

The Michaud site excavation yielded 26 fragments of calcined bone weighing a total of 1.5 grams (Table 5-3). All pieces are more heavily eroded and fragmented, and therefore less likely to be identifiable, than the calcined bone from the Bull Brook site and Whipple site that has been identified (Spiess, Curran and Grimes 1985). Some of the factors controlling calcined bone identification are discussed in that reference. Essentially, calcination occurs in the heat of a wood fire above about 600 degrees centigrade, and results in the bone shrinking and fracturing as it turns white. Calcined bone is much less resistant to stress fracture than is fresh bone, so that it breaks into small pieces with human passage or soil movement. It is, however, more resistant to acid groundwater and bacterial action than is fresh bone, and tends to survive when fresh bone does not.

The Michaud site calcined bone comes from only two areas of the site. Twenty-two pieces were found in the N10E80 vicinity, all lying on a localized deflated ground surface with a large number of flakes, microflakes and a few artifacts. The coincidence of this bone concentration and the flaked stone concentration lends some credence to the hypothesis that the bone is of Paleoindian age. The second group of calcined bones comes from the activity area about 40 meters north of the first group. One piece was found in situ in B2 horizon soils in N46E90. Three more pieces were found in bulldozed soils pushed in to fill a drainage ditch in N58E64. This fill may have originated in the N50E90

TABLE 5-3

Calcined Bone from the Michaud Site

Sample	Provenience	Weight	Number	Identification
70052	N10E80 SEq, Surface	0.2 gr.	6	Mammal bone cortex, one may be an antler fragment based on bone structure: small parallel trabeculae.
70052	N10E80 over bank edge	0.4 gr.	2	Mammal bone cortex, one may be antler based on bone structure.
70048	N10E80 NEq, Surface	0.1 gr.	3	Mammal bone cortex.
70046	N10-12E82-84, Surface	0.1 gr.	7	Mammal bone cortex, two may be antler fragments based on trabecular structure.
70049	N10E80 NEq, Surface	0.2 gr.	4	Mammal bone cortex.
70053	N58E64 SEq, Disturbed Soil	0.3 gr.	2	Mammal bone cortex, one is a large or medium-sized mammal with minimum bone cortex thickness ± cm.
70051	N58E64 SWq, Disturbed	0.1 gr.	1	Large or medium mammal bone cortex fragment, 0.4 cm. thick in its highly eroded state.
70045	N46E90 NEq, B2 Soil	0.1 gr.	1	Mammal bone cortex fragment.

area, or further west around N50E70. The distribution of the calcined bone in the second area is congruent, again, with a light scatter of flaked stone material, including flakes and artifacts pushed into the drainage ditch fill.

There was no calcined bone recovered from the densest areas of lithic recovery on the southwestern portion of the site, and no calcined bone from any of the three possible Paleoindian hearths (Features 7, 8 and 21). We suspect that this absence of bone in the most concentrated lithic working area may be due to some factor of preservation, since the calcined bone that was recovered on the site, was rare, highly fragmented, and extremely heavily eroded.

The calcined bone can only be positively identified as mammal bone, based on the structure of the bone cortex and the trabeculae occasionally preserved on its interior surface. Two pieces are definitely from large or medium-sized mammals (beaver, wolf, or larger) based on bone cortical thickness. Four of the pieces exhibit a fine-grained, parallel trabecular structure that Spiess has come to associate with cervid antler. Since there may be other possibilities for such structure in small or medium-sized mammals, however, the identification as cervid antler on these very small fragments cannot be conclusive.

BEAVER BOG CORE

On February 14, 1986, we succeeded in obtaining a series of core samples to a depth of nearly 7 meters under the frozen beaver bog in Moose Brook, south of the Michaud site, useing a 1" diameter piston core head attached to a series of steel rod sections. The piston core could be tripped by pulling sharply up on the steel rod, followed by driving the piston down about 20 cm., in theory obtaining a 10 to 20 cm. long core. The sediments under the frozen surface of the beaver bog were water-logged, rock free, and either sandy or silty in general particle size, making it possible to drive the core with a 6 lb. maul.

Two different bore holes were used, 15 cm. apart. From the first we obtained core sample 1 at 2.30 meters below surface, and core sample 2 at 3.44 meters below surface. From the second we obtained core sample 3 at 1.59 meters below surface, core sample 4 at 6.30 meters and core sample 5 at 6.76 meters. The horizontal location of the core was controlled by setting a transit at the foot of (just north, adjacent to) the first approach light standard on the center-line of Runway 4-22 located just south of Moose Brook. The center-line of Runway 4-22 was used as the 0 degree radial for surveying. Azimuth to the core location was 64°15' west, and the hypotenuse distance measured by tape was 96 m. Transit height above bore hole surface was 6.8 meters. Thus, the bore hole location is 76 meters left of the center-line and 57 meters toward the runway from the approach light.

Core samples were extruded from the sampler onto household plastic wrap sheets. We expected the air temperature to be below freezing, and it was our original intent that the cores hold their shape until they froze. However, the sun was quite bright, and the samples all too water-logged to retain their shape. So, instead of visually inspecting the details of the stratigraphy in the bog, we obtained 5 bulk samples each for a vertical depth covering 15 to 20 cm. However, each such core only represents 3% of the total depth of sediment that post-dates the Presumpscot Transgression clay at the base. Samples were returned to a warm indoors environment where they were placed in clean containers, covered with a cloth to keep dust out, and allowed to air dry. Charred and non-oxydized plant macrofossils were hand-picked for later examination, a soil sub-sample was set aside for inspection for the presence of pollen, and the rest of each sample was run through a graded series of soil screens.

Visual descriptions of the samples when wet are presented in Table 5-4. It should be noted that charcoal and plant macrofossils are present in

Table 5.4

Sample 1. 2.30 m.	Medium-dark grey, silty, fine sand with abundant wood fragments, and fragments of partially oxydized or oxydized plant parts, plus plant rootlets. Abundant mica flecks.
Sample 2. 3.44 m.	Dark grey, silty fine sand with high content of small mica flecks. Organic content lower than Sample 3. Apparently dark charcoal-like color caused in part by many fine flecks of black mica.
Sample 3. 1.59 m.	A dark charcoal grey, clayey, silty, very fine sand with high content of small mica flecks. Oxydized organic flecks (plant parts?) present. Possibly some are unoxydized macrofossils.
Sample 4. 6.30 m.	When wet, a dark greyish green, silty, clayey, very fine sand with a high proportion of particulate organic matter, including wood fragments, and a few pieces of what look like shell fragments.
Sample 5. 6.75 m.	Greenish-blue, very fine sandy, silty clay, with very fine mica flecks and occasional organic debris, including some unoxydized or poorly oxydized wood.

Table 5-5

23.12/13 Soil Core, February 14, 1986

Soil GRANULOMETRY

SCREEN SIZE AND CONTENTS
% OF INORGANIC

SAMPLE#/DEPTH	#18/1,000 U.	#60/250 U. FINE SAND	#140/105 U. VERY FINE SAND	#270/53 U. SILT	LESS THAN 53 U. CLAY
1. 2.30 meters (63.1 gr. mineral)	0.2 gr. organics 0%	0.2 gr. organics 28.2 gr. 44.7%	27.8 gr. 44.1%	5.5 gr. 8.7%	1.6 gr. 2.5%
2. 3.44 meters (46.7 gr. mineral)	0.1 gr. organics 0%	<0.1 gr. organics 6.5 gr. 13.9%	34.8 gr. 74.5%	4.6 gr. 9.9%	0.8 gr. 1.7%
3. 1.59 meters (32.7 gr. mineral)	0.1 gr. organics 0%	<0.1 gr. organics 9.2 gr. 28.1%	18.6 gr. 56.9%	4.0 gr. 12.2%	0.9 gr. 2.8%
4. 6.30 meters (18.5 gr. mineral)	0.1 gr. organics 0%	0.2 gr. organics 1.7 gr. 9.2%	6.4 gr. 34.6%	7.4 gr. 40%	3.0 gr. 16.2%
5. 6.75 meters (35.8 gr. mineral)	<0.1 gr. organics 0%	0.1 gr. mica 0%	5.2 gr. 14.5%	21.8 gr. 60.9%	8.8 gr. 24.6%

set aside for inspection for the presence of pollen, and the rest of each sample was run through a graded series of soil screens.

Visual descriptions of the samples when wet are presented in Table 5-4. It should be noted that charcoal and plant macrofossils are present in all the samples. Sample 5, the deepest, is clearly Presumpscot Formation clay, a Terminal Pleistocene member unit in central Maine. Forty centimeters above it (Sample 4) there is a high proportion of organic matter, and a few shell fragments as might be expected on the surface of a marine, inshore clay. Granulometry data (Table 5-5) demonstrate that the silt and clay-sized particles are by far most common in Sample 5 at 6.75 meters (85% by weight), the Presumpscot clay, and that they are less frequent (56%) in Sample 4. The upper three samples are dominated by sand. Charcoal derived from Sample 4 returned a date of 9630 ± 140 B.P. (Beta-16122). This date indicates that the sediment approximately ½ meter above the Terminal Pleistocene clay was collecting charcoal wood during the Pleistocene-Holocene boundary, or within the first few centuries of the Holocene.

The charcoal and plant macrofossils were sent to Dosia Laeyendecker at the Smithsonian Institution for identification. All of the pieces were too small for specific identification. All five samples contained wood from one or more coniferous species not further identifiable. Samples 3 (3.44 m.) and 4 (6.30 m.) contained wood that might be from a hardwood species as well.

Samples have been sent off for pollen presence/absence inspection and identification, if possible. Preliminary inspection has indicated well-preserved pollen in all samples from the core.

The Moose Brook bog may or may not ultimately provide plant

macrofossil and pollen samples dating from the expected age of the Paleoindian occupation adjacent to Moose Brook (circa 10,500 B.P.). At present the information does indicate a different hydrologic regime and valley-bottom configuration, in that the stream bottom valley was at least 6.5 meters deeper and therefore that much steeper-sided. Valley side erosion of firm sand, and failure of the stream to carry off those particles, allowing 6.5 meters of accumulation, are events that post-dated the Paleoindian occupation.

Only subsequent investigations can determine whether or not the deeply incised nature of the stream was immediately relevant to the Paleoindian occupants, either as an impediment to their travel, or an aid on hunting one or more species of herbivore, or as an environment growing plant species not found elsewhere.

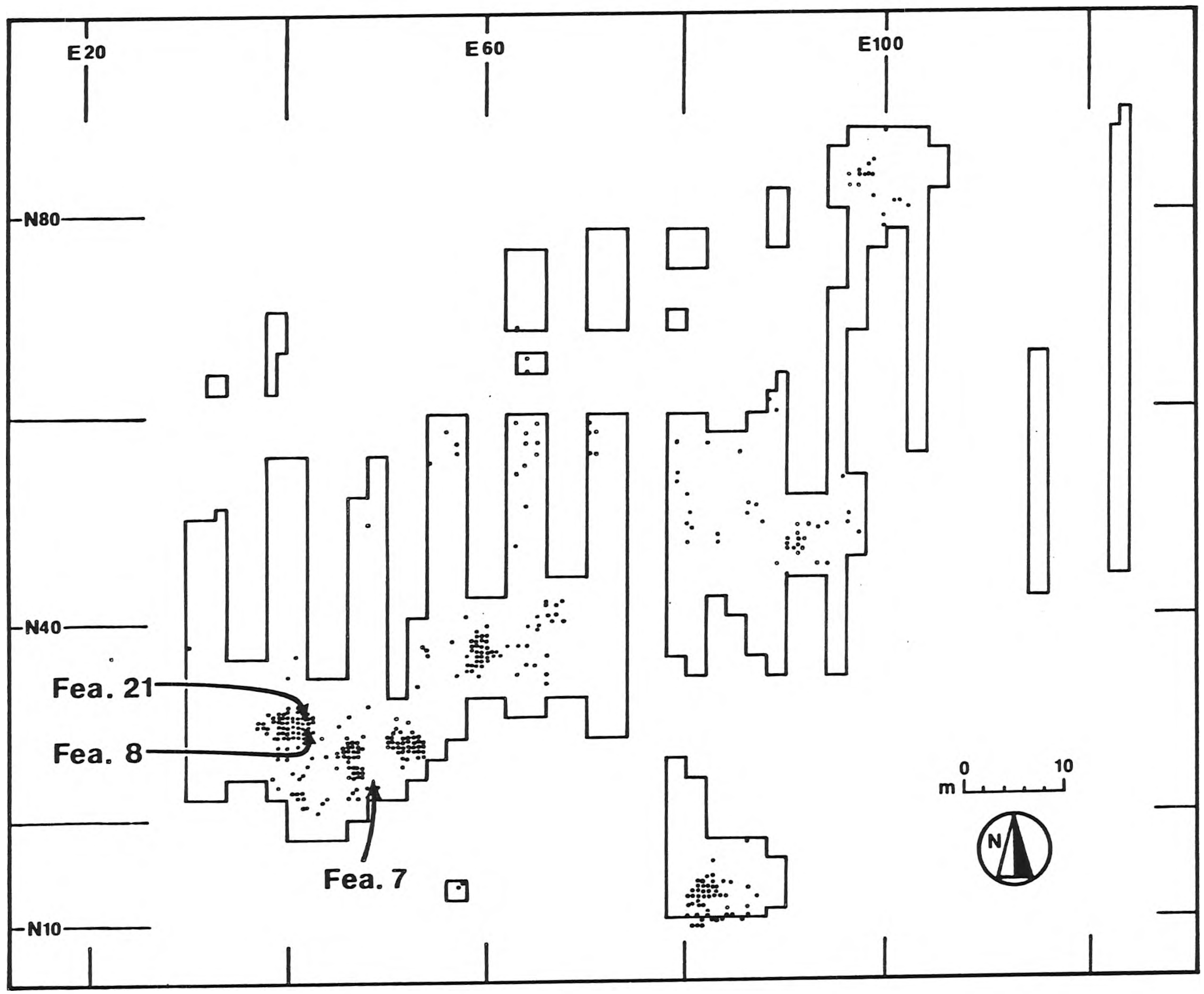


Figure 5-1. Locations of probable Paleoindian hearth features relative to artifact and flake concentrations. Each dot represents an excavation unit (quadrangles) with one or more artifacts or flakes.

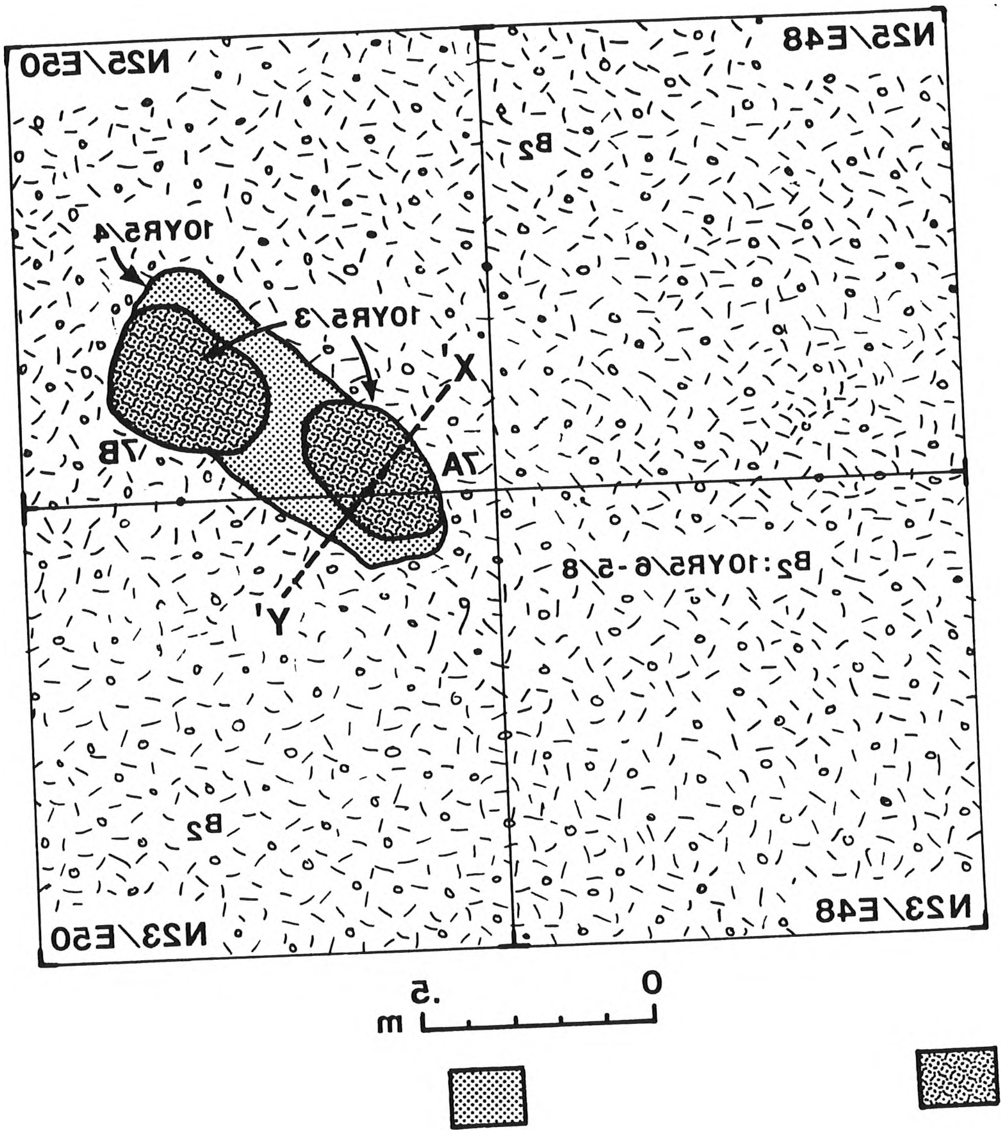


Figure 5-2. Plan view of Feature 7 at top of B_2 horizon sands.

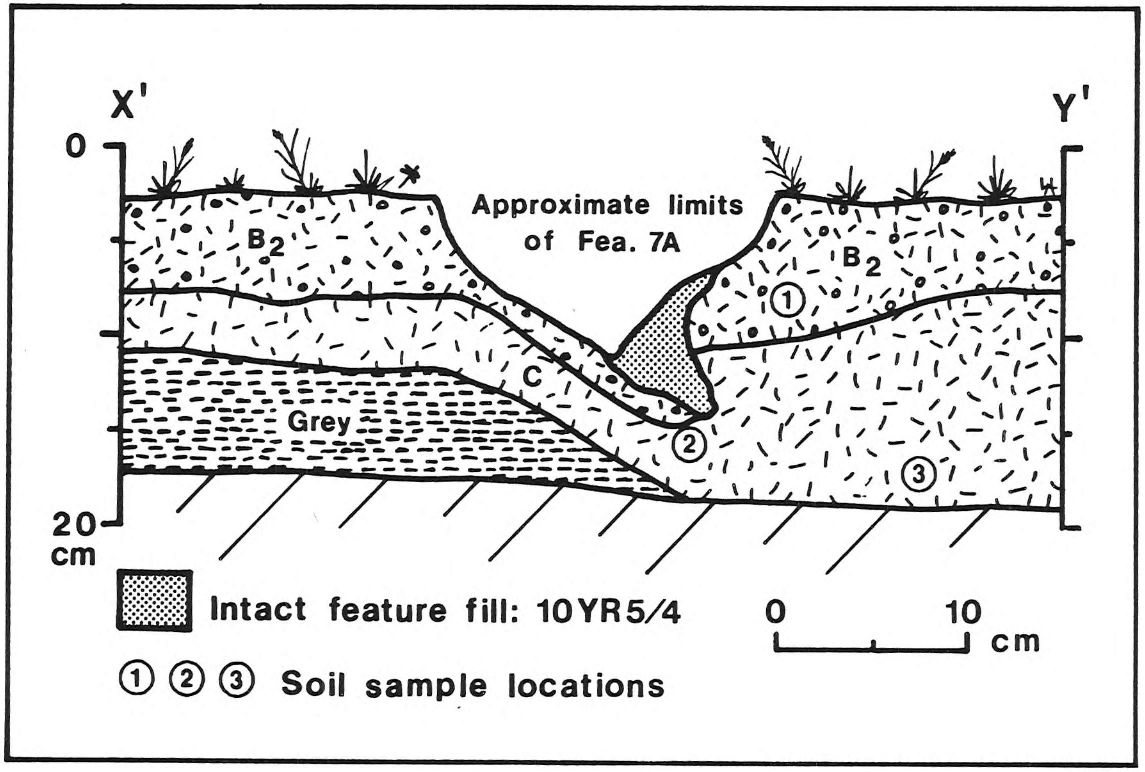


Figure 5-3. Cross section of Feature 7A (X-Y on Figure 5-2), taken after partial excavation of the fill of Feature 7A. Note the steep eastern pit margin and sloping western margin.

CHAPTER 6

SPATIAL DISTRIBUTIONS

The Michaud Site is a single component site in which minimal vertical sorting occurred through frost action, tree throws, animal burrowing, and bioturbation. Horizontal disturbance is limited, with small portions of the site displaced by bulldozing and deflated by blow-out of the devegetated sandy surface. As a small number of tools and flakes were recovered, with a large percentage in situ, we felt that we had an oppurtunity to assess a Paleoindian site to a fine scale of resolution.

Nine identifiable material culture concentrations are visible in the distribution of all flakes and microflakes of chert and Neponset rhyolite plus coarse rhyolite flakes and shatter mapped on Figure 6-1. Artifacts in situ (Figure 6-2) and from disturbed context or surface collection (Figure 6-3) group well within the concentrations defined in Figure 6-1. Examination of the distribution data presented below shows that there is significant variability among the concentrations in raw materials used, flake to microflake ratio within some materials, and functional types of stone tools present from concentration to concentration. We here present a concentration by concentration examination, followed by a discussion of inter-concentration relationships.

CONCENTRATION I

Concentration I is located between E36-E44 and N20-N32, covering an area approximately 8 x 12 meters (Figure 6-4). The northern portion of this area is characterized by a very high concentration of artifacts, flakes, and microflakes and a number of pieces of coarse stone. The southern section of Concentration I contains a light scattering of material blown out or otherwise displaced from the northern area. Feature 8/21, an oblong, bilobal gray-brown lens containing a large amount of charcoal, is located at about the center of the northern portion of the concentration (in squares

N28E40 and N30E40).

Artifacts recovered from this concentration include five fluted points and fragments and four fluted point preform fragments (see Tables 6-1 and 6-2). Interestingly, all of the spent fluted points were made from red Munsungan chert, while the broken preforms were all made from gray-green patinated Bull Brook chert. A total of 10 channel flakes were recovered in Concentration I, nine of which were unutilized and one of which had a graver spur worked on a lateral corner of a medial break. All three limaces present at the site were located in this concentration, along with two endscrapers, one concave scraper, and a number of retouched and utilized flakes.

A number of impressions resulted from visual inspection of the artifacts as they were laid out in correct provenience on a large scale plan. It was obvious that we were looking at an area where tool replacement had been carried out, as evidenced by the discarded broken fluted points and broken biface preforms, and that much of this activity had centered around the hearth feature previously mentioned. Several of the apparently spent artifacts (fluted points 23.12.321/.433, 23.12.377 and endscraper 23.12.151), all made from Munsungan chert, diplayed linear fractures often filled with a black, oxidized mineral, surface discoloration, and pot-lid fractures, indicating that these artifacts had been subjected to high heat. The endscraper is long, narrow, and exhibits bilateral notching, probably indicative of hafting. We here hypothesize that these artifacts were removed from their hafts near the fire of feature 8/21, and that possibly heat from the fire was utilized to help soften or remove some sort of mastic that had held them in their hafts.

Flakes and cores of coarse stone were recovered in abundance from

Concentration I (see Table 6-3). As previously mentioned, it is unclear from the specimens recovered from the Michaud Site what was the actual use of these stones, due to their lack of "readable" edges and surfaces. We suggest, on the basis of the green felsitic core recovered just south of Concentration II, which showed abrasion striations and several highly polished surfaces, that some of these specimens were used for an abrading function, including grinding biface edges for platform preparation. Grinding and polishing bone implements may also have been a function of these tools, as well as chopping and/or splitting bone.

Our use-wear studies suggest that many of the tools recovered from Concentration I may have been used in the replacement of armature. The limaces, for example, show wear at the tip and on the dorsal flake ridges, possibly indicating their use in a confined space such as a socket. The concave scraper and flake utilized on a concavity exhibit curvatures of 3 to 5 cm. diameter, indicating that portions of the object being scraped had a diameter less than 3 to 5 cm. We surmize that a wooden spear shaft would fit these dimensions. Further, both endscrapers from Concentration I show wear patterns suggesting use on a medium hard substance, with edge damage correlating well with the experimental tool edges which had been used on wood. Making or modifying a haft for any stone tool may have been carried out with these scrapers, or they may simply have been removed from their hafts in an area where tool replacement was being carried out.

The debitage from Concentration I adds additional insight into the activities occurring in the vicinity of the concentration. Flakes and microflakes were sorted by material type. The microflakes, being of extremely small size (less than 7 mm. in length), were not examined in detail. The flakes, however, were analyzed for type (uniface or biface), general size (see Table 6-5), and any other distinguishing characteristics.

Debitage from the heavily patinated Bull Brook chert (Ceg1) dominated Concentration I. Of the 227 flakes recovered, only two were identified as uniface sharpening flakes. The rest were identified as biface thinning flakes, as evidenced by their ground, low angle (35-50 degree) striking platforms. Ceg1 flakes are of moderate size, about 16 x 10.5 x 1.6 mm average, although they range in size from tiny microflakes to a fairly large specimen (28.8 x 19.2 x 2.8 mm). Most flakes have fairly well-developed bulbs of percussion, indicating that they were probably struck by soft-hammer percussion. Because no primary debitage such as quarry fragments, angular pieces, or chunky pieces were recovered, it is suggested that this material was brought to the Michaud site as partially worked biface preforms. Since five channel flakes were recovered from this Concentration, and since two channel flake fragments belong to a single broken fluted preform, it is likely that at least one finished fluted point of Bull Brook chert was carried off the site. Approximately eight of these biface thinning flakes display heavily ground dorsal surfaces, with striations occurring on several. The apparent grinding use of this surface is unusual, and the use may parallel that of the coarse diabase.

Only a small number (33) of black chert (Cb01) flakes were recovered. They do not display a well-developed bulb of percussion , but rather appear to be early reductions from a large early stage biface core. Extreme arris polish was noted on all old flake surfaces, suggesting that the "core" may have been carried for some distance in a pouch of some sort, perhaps being reduced in stages as time allowed.

A moderate number (43) of biface thinning flakes of brown chert (Cr03) was recovered from both sides and the middle of the feature in Concentration I. All are large and extremely thin with ground striking

platforms and small bulbs of percussion indicating soft-hammer removal. As no primary, chunky flakes, microflakes or channel flakes were recovered, it seems likely that here again we have an instance of a stage of reduction being accomplished without an end product being produced. Two of these flakes were utilized, but so many were not that it seems unlikely that the purpose of the removals was to create useable flakes.

The Munsungun chert debitage also supports the thesis that fluted point manufacture may have been a several step process. Two red and green Munsungan chert (Cr05) channel flakes were recovered from Concentration I, accompanied by only a small amount of debitage, with a numerically large proportion of this in microflakes from final finishing or resharpening. The general size of the red chert (Cr1) flakes was small, and a single red chert channel flake was recovered. Fine details on the chert (including an occasional mottle, stripe, mineral pit, texture or luster variation) suggest that some of these flakes are resharpening flakes, because the details of the debitage match variations in the tools present in the Concentration. Some, on the other hand, may be the result of fluted point finishing. In other words, it appears that here was there was no requirement to finish a fluted point in one sitting. It may have been general practice to "pick up" working on a point at any convenient time, and points in various stages of manufacture may have been carried in a tool replacement kit. It would, of course, be possible to suggest that tools were finished in other parts of the site, but rigorous attempts at refitting artifacts and flakes between concentrations has not been productive (see also discussion on refits and conclusion, this chapter). Further, debitage clusters by material type, although overlapping in the areas of densest discard, suggest single episodes of reduction and resharpening. In fact, discard patterns are in several cases such that it seems as if a tool maker sat in one spot while

debitage scattered around a central "seat".

The tools from Concentration I consistently display characteristics which suggest that they were created by a single maker. Both of the nearly complete fluted points (23.12.321/.433, 23.12.643) are remarkably similar in total form (see description Chapter 3). The biface preforms from the same concentration are extremely well formed even in the early stages of reduction, and attain a shape early in the sequence suggestive of the forms of the finished fluted points from Concentration I. Both extant limaces from this concentration are extremely long and thin, and though apparently functionally the same as limaces recovered from other Northeastern Paleoindian sites (same tip wear), they appear to be a distinctive stylistic form. The possibility exists, of course, that these tools were created for a special function, and may represent the modification of a standard tool form. That this exact form remains unique in the known northeastern Paleoindian assemblages suggests that it is the product of an individual toolmaker. One endscaper from this concentration, two from Concentration III, and one with only site provenience, appear also to belong to this toolmaker. These tools, unlike others in the collection, are particularly small and either have medial thinning flakes removed from the dorsal surface or were created on flakes whose original shape had a dorsal surface centered between flake ridges (see Chapter 3 descriptions). Symmetrical shape, fine, regular flaking, replicated forms within a tool type, similarity in form from preform to fluted points in the biface category, and provenience data support the suggestion of a single toolmaker having created at least the formal tools in Concentration I. In fact, only one specimen, endscraper 23.12.00586 from Concentration I, does not appear to be a tool manufactured by this maker.

In sum, Concentration I provides an interesting association of tools with the one activity that we can clearly define: the production of a few (3 to 6?) fluted points and the replacement of several, for which we find the discards. Associated are a variety of tools for scraping a medium hardness substance (such as wood), including "spokeshaves" and limaces, which we propose were used in the production of hafts. Associated with these activities is the production and possible use of a rough stone industry, probably for use of an abrading nature in this concentration.

CONCENTRATION II

Concentration II (Figure 6-5) covers an area from E44-E48 and N20-N30, just east of but adjacent to Concentration I. Features 7a and 7b, together forming an elliptical hearth similar in form to Feature 8/21 in Concentration I, are found in the southeast corner of this concentration, actually on the border between Concentrations II and III. Although charcoal which was dated at 10,200 BP was removed from this feature, no cultural debris was immediately associated. In fact, the few artifacts and the majority of the debitage recovered from Concentration II were centered on an area several meters north of the hearth but several meters south of the dense cultural debris in Concentration I.

Two chunky fragments of an early biface preform of black chert (Cb01) with well worn flake arrisses were recovered from Concentration II, along with several flakes of large size and several of small size. The on-site reduction of this preform must have been limited to the removal of only a few flakes and fragments. Perhaps work on this particular preform was presenting difficulties and further reduction was postponed until a later time. On the other hand, this preform may have been a practice piece for a child or a chunk whose use was limited to extracting sharp-edged flakes.

It's crude form suggests that it did not belong to the toolmaker in Concentration I. One large flake of this material was found utilized in Concentration II, while several others were recovered during MDOT survey and have only site provenience. One small sidescraper (23.12.488), which appeared to have been used to scrape soft material, and a very small uniface fragment were the only other tools recovered from this concentration.

The flakes from Concentration II were few in number and were mostly uniface sharpening flakes or flakes of unknown type. Very few (5-7) biface thinning flakes were recovered. The largest grouping of flakes involved 17 specimens of a deeply olive green patinated piece of Bull Brook chert. All of these are uniface sharpening flakes and appear to have been removed from the same sidescraper.(Fewer removals with steeper edge angles would have been expected from an endscraper). Several have been refit to show the heavily used sidescraper edge, although the tool from which the flakes were removed must have been carried off the site.

It is the coarse stone industry which is dominant in Concentration II (Table 6-6). A large number of small flakes (<25 gm) as well as several medium sized flakes and three large cores were recovered. The core of green felsite showing polish and striations which is described in Chapter 3 was retrieved from a sandy blow-out to the south of this concentration. but much of the debitage which refits the cobble comes from this concentration.

Interestingly, the distribution of Cegl flakes and microflakes within Concentration II was located a meter or two further east than the scatter of coarse diabase (RcO1) and coarse green felsite shatter. The black chert flakes, including the biface preform fragments, were found just to the north of both the Cegl flakes and the rough stone shatter, again suggesting a slight separation of activites involving these materials.

Thirty-six small nodules of red ochre were found in the middle of this

concentration, all in square N24E46. Also located in this square were a small number of red chert flakes and a small red chert uniface fragment, the uniface resharpening flakes of Cegl, and some bits of diabase shatter. The majority of the coarse stone flakes and shatter, however, were recovered from the northern portion of Concentration II, rather than the area around the red ochre. If there were an association between rough stone for grinding and pigment, there is no obvious, substantiatable connection within Concentration II.

In sum, the light scatter of artifacts and flakes in Concentration II diplays none of the specialized activity focus suggested for the debris from Concentration I. The dominant form of debitage is coarse stone shatter, much of which had been removed from the green felsite core found ex-situ to the south of this concentration. An area in the middle of the concentration contained a number of fragments of red ochre; no clear association with either components of the rough stone industry or with any other tools was observed.

CONCENTRATION III

Concentration III covers an area from E48-E54 and N24-N30. Although no features were associated with this Concentration, it is distinguished by the high incidence of sidescrapers and the lack of biface or fluted point fragments. It is separated from Concentration II by several meters of sterile, undisturbed soil, though it is adjacent to it. In fact, Concentrations I, II, and III form a line along an east-west axis, with all located at about the same degee of northing.

The Concentration III assemblage is dominated by sidescrapers (N = 5), with a small number of endscrapers (N = 2), scraper fragments (N = 3), and retouched and utilized flakes (N = 3). The use-wear patterns on the

sidescrapers all suggest the scraping of a soft substance, presumably hide. The utilized flakes include one piece used to cut a soft material, one used to scrape a soft to medium hardness substance, and one of unknown function. In all, the artifacts from this concentration represent a very different functional suite of tools than we see in Concentration I. We hypothesize that this area was one in which the processing of hides took place.

The debitage from Concentration III confuses our hypothesis somewhat, however. We expected to find little debitage associated where tool replacement was not the primary focus, and what debitage we did find were expected to be uniface resharpening flakes. This hypothesis held for the majority of raw material types, but many biface thinning flakes and microflakes of Ceg1 were found in this concentration. A glance at the intra-concentration lithic distribution (Figure 6-6) shows several discrete clusters, and it is from this perspective that a possible explanation emerges.

The sidescrapers, endscrapers, and utilized flakes from concentration III were discarded in the eastern portion of the concentration, with the exception of one sidescraper which was located on the west side. The biface flaking episode which produced a number of Ceg1 flakes and microflakes occurs south and slightly west of the tool cluster. In fact, there were no flakes occurring in the area of densest tool discard. Coarse stone is distributed in seemingly random fashion throughout the concentration; no bias in distribution towards either the area of biface thinning flakes or sidescraper discard was noted.

The biface thinning flakes associated with this concentration lead to an interesting possibility. It was suggested in the discussion of Concentration I that fluted points may be made in a number of stages. and not completed from early preform to finished point in one sitting. Evidence

in that concentration implied that complete production did occur, but that only particular stages in the manufacturing sequence were represented for some materials. We may draw the conclusion from the presence of the biface thinning flakes in Concentration III that fluted point manufacture again did not involve rigid behavioral patterning; the presence of an area seemingly devoted entirely to tool manufacture, and particularly biface reduction did not preclude the practice of this behavior in an area of the site which was primarily focussed on another activity, in Concentration III, III, probably the scraping of hides.

Interesting, also, is the association of the six large core/cobble fragments of rough stone with this concentration, and the near absence of rough stone shatter. Either the cobble/core objects were flaked at this location and the debris was cleaned up and moved elsewhere, or the cobble/core objects were flaked elsewhere and moved into Concentration III. As so much shatter of this material was recovered from both Concentrations I and II, the latter seems the most likely explanation. If this deduction is correct, then the cobble/core objects themselves were the desired objects for use, at least in Concentration III.

In sum, we suggest that concentration III represents a specialized activity area, one which our use-wear studies indicate involved the scraping and cutting of soft materials. Although the dominant and probably most time consumir activity in this area may have been hide-working, there is a modest scattering of biface thinning flakes in the western portion of the concentration that represent the partial reduction of a biface of the same material that was being used in Concentration I. It is here proposed that biface reduction may not have been a rigid practice limited to certain work space and production constraints; rather, it may have been expedient to remove mastic and haft

lashing in a fire, and to have gathered togther the necessary materials for the refurbishment of a tool kit all in one place. But once in production, it was possible to move around.

CONCENTRATION IV

Concentration IV covers an area from E54-E62 and from N34-N40, all of which is in situ. Concentration IV is characterized by the densest grouping of Neponset rhyolite flakes and microflakes on the whole site, a moderate concentration of coarse rock flakes and shatter, and the near absence of chert. The small collection of artifacts from Concentration IV is diverse in terms of artifact type and contains artifacts of a variety of raw materials.

Concentration IV can be divided on the basis of horizontal clustering into three sub-groups of tools, with a number of other tools scattered outside of the clustered tools (Figure 6-7). One cluster, centered on N34.5 E58.5, of nine tool fragments, is found in the southwest corner of the concentration. Interestingly, all of the tools and tool fragments in this cluster are made from chert, which is the minority material in the rest of the concentration. One tool is a graver made on a channel flake of a unique chert which is not represented elsewhere on the site, even by a flake. Several of the other tools in this cluster are channel flakes whose edges have been utilized. As there is no debitage associated with this cluster of tools, and only minor amounts of chert debitage elsewhere in this concentration, it seems likely that these channel flakes are "curated" tools, specifically retained for their fine cutting edge. They may have been moved around as part of a larger tool kit. In fact, this cluster of tools, aside from the tools just discussed, is made up of small scraper fragments and small utilized flakes. The entire grouping may be the pieces

lost from a functionally specific toolkit-perhaps a child's kit or a woman's sewing kit made up of tool fragments scavenged from manufacturing debris. The graver shows wear patterns suggesting that the tip had been used and resharpened. It is a unique cluster on the Michaud Site.

The other two clusters of tools, centered on N35.5 E59.5 and N35.5 E60.5, are dominated by Neponset rhyolite artifacts, with localized concentrations of rhyolite debitage. Each of these two sub-groups contains one Neponset rhyolite graver/perforator, each of which has a thicker, more expanding tip than the graver/perforator of chert. It seems likely that on this basis there is a functional difference between the tipped specimens made on rhyolite and that made on chert. Each of these clusters also contains a utilized flake and a scraper, one a concave scraper and the other a sidescraper.

Debitage occurs in two main clusters in Concentration IV. Most intense is the area in the northwest corner of the concentration which is associated with one of the tool clusters. Large amounts of Neponset rhyolite are found in this area as well as large amounts of diabase and other coarse rock shatter. The Neponset rhyolite debris contained both large (over 5 grams) fragments suggesting early phases of reduction, and well-developed biface thinning flakes. The larger fragments displaying bedding plane surfaces and few previous flake removals are a sharp contrast to the chert debitage of Concentrations I, II, and III, which is of generally small size and displays ground striking platforms with low angles suggesting, that those preforms came onto the site in an already shaped and reduced state.

The second concentration of debitage is located in the middle of the Concentration IV, just west of the second rhyolite tool cluster and south of the debitage and tool cluster just described. Again, the debitage is of both Neponset rhyolite and coarse stone shatter of various type stones. A

very small fluted point mid-section of a heavily patinated silicified siltstone (?) was found in this debitage cluster, perhaps representing a point which was being replaced with a Neponset rhyolite point.

Our use-wear studies of the discarded tools in all three of these sub-groups suggests that a primary activity in Concentration IV was scraping a medium hardness substance, but there is also substantial evidence of cutting material of medium hardness and scraping soft substances. The combination of a graver/perforator in each cluster, plus tools showing wear from cutting and scraping of medium-hardness substances, suggests the manufacture of wooden objects, perhaps in conjunction with working softer materials such as skins. The horizontal distribution suggests that this suite of activities was performed two or three different times, or in two or three different sitting locations. The total lack of chert in two of the clusters, and the lack of Neponset rhyolite in the third, plus the physical spacing of about one-two meters apart, seems strong evidence that three individuals were involved or that the incidents resulting in the lithic debris occurred on several different occasions.

In sum, Concentration IV contains three clusters of tools and two areas of intense flaking debris. Neponset rhyolite is the dominant cryptocrystalline material, dominating two of the tool clusters and all of the debitage in this concentration. Coarse rock shatter of various grades is found in association with the rhyolite debitage. Biface reduction is suggested by the presence of many biface thinning flakes, but large, angular fragments of Neponset rhyolite suggest that the inhabitants of Concentration IV had either just come from the rhyolite quarry and/or they did not carry well-reduced preforms as did the occupants of Concentrations I, II, and III. The activities performed probably include cutting and scraping hide and

wood, and perforating holes in one or both substances. With the discard of a broken fluted point fragment in Concentration IV, we can state that the range of activities performed there approaches the range of activities performed at Concentrations I, II, and III together, but the spatial organization of those activities is radically different. Moreover, while apparently one individual in Concentration IV had access to a chert tool kit, the rest produced theirs from Neponset rhyolite. This situation contrasts with the presence of only two artifacts of Neponset rhyolite in Concentrations I, II, and III, both possibly highly curated before discard: the ear of a fluted point and the proximal end of blade-like flake notched on two sides for suspension on a thread or cord.

CONCENTRATION V

Concentration V covers an area from N34-N42 and ~~E54-E62~~ E62-E68, all of which is in situ except for the northeast corner, which is a blow-out and the northern margin which was bulldozed. Several tools were recovered from this concentration, including a fluted point tip, several scraper fragments, and a utilized flake. The fluted point tip had been retouched along the break for reasons which are unclear. The utilized flake and scraper fragment appear to have been used to scrape a soft material. Debitage is represented by a dispersed scatter of flakes of a variety of cherts and Neponset rhyolite. These flakes represent at most the resharpening or retouch of a few tools; no single episode of manufacture from a large piece of chert is indicated. Interpretation of Concentration V is hampered by the disturbnce that may have truncated its northern margins and contributed to the dispersed tool scatter in Concentration VIII.

CONCENTRATION VI

Concentration VI extends from E86-E98 and N44-N52; about half of the

area is in situ, while the other half has been "blown out". A central area is defined by a light concentration of flakes and one artifact in situ, which is surrounded by a dispersed halo of chert and Neponset rhyolite flakes and artifacts. A broken fluted point tip of Neponset rhyolite, evidently heavily resharpened, coupled with a channel flake of Neponset rhyolite and plenty (91 grams) of Neponset rhyolite flakes, indicate fluted point replacement in this concentration. Also present are two Neponset rhyolite endscrapers which our use-wear studies suggest were used to scrape hard substances, and a graver/perforator of black chert. Three utilized flakes were used for a variety of activities, including cutting soft, scraping medium, and cutting or sawing medium hardness substance materials.

Like Concentration IV, the Concentration VI assemblage is dominated by the production of perhaps one Neponset rhyolite tool, while the chert debitage present is enough to indicate local retouch of chert tools that had been imported to the activitiy area from elsewhere. Fluted point replacement may have been limited to the final thinning of a preform and fluting, as had several specimens in Concentration I. Although the uniface tool kit is small, the range of activities suggested by the use-wear studies is large. In fact, there are enough general similarities between Concentrations IV and VI to postulate a functional parallel between these two: Neponset rhyolite dominated flaking, with imported chert artifacts, one fluted point fragment, presence of graving/perforating tools, and a variety of other cutting and scraping functions repesented by the other tools. The major difference between these two concentrations is the lack of a rough stone component in Concentration VI, and its high incidence in the form of shatter and flakes in Concentration IV.

CONCENTRATION VII

Concentration VII extends from N10-N16 and E80-E88. The southern boundary and the southwestern corner of this concentration are disturbed by drainage ditch construction and blow-out. The Concentration VII tool assemblage again represents a range of activities similar to those observed in Concentrations IV and VI. The assemblage is dominated by utilized flakes (N=5) and channel flakes (N=6), of which two were definitely utilized. Also represented are one retouched flake, one perforator made on a broken scraper, one endscraper, and one sidescraper. Our use-wear studies indicate that most of the utilized flakes and the utilized channel flakes were used to scrape or cut materials of medium hardness. Although no wear patterns were observed on the retouched flake, both the sidescraper and endscraper exibit wear patterns suggesting the scraping of a medium hardness substance, possibly wood.

As in Concentrations IV, V, and VI, the discarded tools made on chert appear to be at the end of their use-life, while the Neponset rhyolite appears to be the dominant manufacturing material. Both channel flakes of red chert are long, parallel sided, and heavily utilized. The debitage of red chert is of such insignificant proportion (2 flakes and 3 microflakes) that it is unlikely that even final fluting and finish retouch were accomplished with this material. As previously discussed, channel flakes of the proportions represented by these specimens would make ideal cutting or scraping tools, in the same manner as microblades, and their curation as tools thus seems logical. Their is insufficient debitage from any of the other cherts represented as discarded tools to indicate manufacture from these materials. That Neponset rhyolite is the incoming material is supported by the fact that only utilized flakes, presumably not curated tools, and un-utilized channel flakes are represented in Concentration VII. The debitage further supports this thesis: the majority

of the debitage is Neponset rhyolite, including both biface thinning flakes and larger, more irregular flakes suggesting reduction from angular, unformed cores. Although there are no fragments of fluted points in Concentration VII, the evidence of fluted point manufacture is inescapable: (1) about 120 grams of Neponset rhyolite flakes and microflakes are present, many of them biface thinning flakes, indicating substantial reduction of Neponset rhyolite preforms or bifaces, and (2) the presence of Neponset rhyolite channel flakes, including a basal portion with a characteristic nipple remnant for striking the flute. As in Concentration VI, however, there is no rough stone associated with Concentration VII.

Thus, Concentration VII exibits several parallels with other concentrations. Like Concentrations IV and VI, the dominant material available for local flaking was Neponset rhyolite. Again, like Concentrations IV and VI, chert tools must have been imported to the area substantially as they were found, for there is little evidence of their retouch and none for manufacture from any of the cherts. The principal activity accomplished by stone tools at Concentration VII appears to have been working wood. Like Concentrations IV and VI, a single graver/perforator is present, on a "one per tool kit" basis, but the range of activity (cutting and scraping soft and medium hardness materials) is not present at Concentration VII. Like the other areas, however, there is local evidence of fluted point production and/or replacement.

CONCENTRATION VIII

Concentration VIII is a label applied to a diffuse, disturbed area affected by the bulldozing of soil to fill the east-west drainage trench that stretched along the northern border of the site. It covers an extensive area from N46-N70 and E54-E84. It seems likely that the few flakes and

artifacts pushed into the ditch fill originated in Concentration VIII. All artifacts from the area are from surface or disturbed contexts, except for one Neponset rhyolite endscraper (23.12.00110). The artifact assemblage includes the black chert fluted point base that joins the tip portion recovered from Concentration V, two sidescrapers, an endscraper, and five utilized flakes. Seven of the twelve artifacts are made of Neponset rhyolite, while the rest are made of a variety of cherts. Though few flakes were recovered from this area, the dominant material represented is Neponset rhyolite. We suggest, based on the observed direction of several bulldozer tread impressions, that Concentration VIII represents redeposited soil containing tools mostly derived from the periphery of Concentrations IV, V, and VI. Cutting soft and scraping medium are activities indicated by the use-wear on utilized flakes and the endscraper from Concentration VIII. If some or all of these tools originated in Concentration V, the addition of these forms would augment the somewhat limited range of activities indicated for the in situ collection.

CONCENTRATION IX

Concentration IX covers the area from N80-N88 and E96-E104. Little can be said about the assemblage from this area; three red chert artifacts are assigned to the concentration, only one of which was recovered in situ. The other two were attributed to the area by the MDOT personnel who initially surface collected the site. Very little debitage was collected during excavation, but there was enough to indicate that some sort of ephemeral activity area had once been intact on the spot.

DISCUSSION

The distribution patterns at the Michaud Site, therefore, suggest that at least eight and perhaps nine non-overlapping areas were utilized by the

Paleoindian inhabitants. Much of the site is in situ, although disturbance by light bulldozing and sand blow-out occurs to some extent in nearly all of the concentrations. The southern portion of Concentrations I, II, and III show slight disturbance, as does the northwest corner of Concentration V. Concentration IV is entirely in situ, while up to one half of Concentrations VI and VII are disturbed. Most of Concentrations VIII and IX are disturbed, by bulldozing in the former and blow-out in the latter. We will, thus, limit our discussion of spatial distributions to Concentrations I-VII.

It became evident upon examination of the distribution patterns, both with regard to the intra-site distribution of raw materials (Figures 6-8 through 6-14) and to the spatial/functional patterning (Figure 6-15), that there are two clusters of concentrations. Concentrations I, II, and III, henceforth collectively called Area A, in many ways form a cohesive unit, as do Concentrations IV-VII (henceforth designated Area B). While Concentrations VIII and IX appear to belong with latter group, we will not include them due to their disturbed condition. As refits of broken artifacts between concentrations may indicate relatedness (Gramly 1984), we shall first examine the results of our conjoining efforts.

REFITS

Attempts to conjoin broken flakes and artifacts resulted in 28 successful refits. In most instances, refits were between two fragments, but nine cases resulted in the refitting of three or more pieces. One chunk of diabase was refitted from eight flakes of shatter. Twelve of the cases were refits of broken flakes, while the rest involved utilized flakes and formal artifacts (Table 6-6).

Three of the refits occurred between pieces with only site provenience, thereby contributing no information on internal site structure. Several other small, refitted flake fragments were recovered from windblown sand,

again adding little information about internal site structure. Of the remaining 22 cases, 14 involved refits between pieces displaced horizontally by less than a meter, suggesting that the items fell where they broke. Six other cases were refit pairs involving pieces refit within a concentration but which were displaced more than one meter.

Of particular interest within the latter group was the refitting of two channel flake fragments from the center of Concentration I with the basal portion of a fluted point preform from the southern limit of the concentration. These pieces show clearly the configuration of the basal nipple created for the removal of the channel flake. The distribution of these pieces within the concentration, however, does not suggest any definitive behavioral patterns. None of the other intra-concentration refits were distributed in such a way as to suggest that their movement was functionally intended.

Items 23.12.02108 and 23.12.01567 are broken pieces of a substantial Neponset rhyolite flake (weights 5.7 grams and 12.1 grams, respectively). Neither shows detectable evidence of use or retouch; likewise, neither falls within the boundaries of a defined concentration. One was recovered from just west of Concentration IV while the other was found to the southeast of the same concentration. These flakes are large enough to have been utilized, and we suspect that their breakage occurred within the Neponset rhyolite work area of Concentration IV, but we cannot present a serious hypothesis as to why they were ejected from the concentration.

The final refit case involves the broken tip of a black chert fluted point retouched for use as a scraper (in situ, 23.12.00112), and the base of the fluted point. The tip was recovered from the northeastern margin of Concentration IV, while the point was surface collected by George Eaton from

the margin of a sand blow-out near N70E70. Eaton was definitive in his attribution of the point to that area (plus or minus 5 meters). The point tip, then, may thus be associated with the diffuse scatter of material from Concentration VIII, which was in part disturbed by bull-dozing, thus providing no basis for a possible original provenance for this item.

In sum, none of the refits definitively associated activities occurring in more than one concentration. For various reasons (time contraints, patination), we did not attempt extensive refitting of flakes to artifacts: refitting attempts were principally confined to broken items. These data confirm that there was not a great deal of movement of broken pieces between concentrations after breakage occurred. The lack of refit items contrasts sharply with the Vail site (internally) and the Vail "killing ground" (Gramly 1984), and suggests not only non-overlapping activity areas at the Michaud site, but may also point to the short duration of site occupation. In fact, the refit pieces present a strong case for the integrity of the concentrations and for the relative unimportance of the post-depositional disturbance of the site.

RAW MATERIALS DISTRIBUTIONS

Aside from minority components of a number of unprovenanced raw materials, three major cryptocrystalline lithic materials were utilized at the Michaud Site (see Chapter 3). Utilized throughout the site are the red and red and green varieties of Munsungun chert. Although artifacts of this material are present in all concentrations, only in Concentrations I,II, and III is there sufficient debitage to suggest that tool manufacture with this material occurred on the site. In all other concentrations, the scarcity of red chert flakes suggests that only minor resharpening of existing tools took place at the Michaud site.

We have suggested that the heavily patinated olive green chert (Bull

Brook chert) and the black chert (Cb01) may be examples of Champlain Lowlands cherts from western Vermont. This material dominates the manufacturing debris in Area A. Interestingly, though the source for this chert may be 350 km from the Michaud Site, there are no tools either of the black or green variety in this concentration which exibit morphological features suggestive of long use-life. Rather, all of the material in this category appears to be freshly flaked. But if the tools all appear to have been manufactured on the site, the flake scars on some of these pieces display extreme arris polish, suggesting that they had been carried for some distance in preform or core form. Only one black chert fluted point and minimal amounts of debitage were recovered from Area B.

Neponset rhyolite, on the other hand, was the only manufacturing material present in Area B. The extreme minority presence of chert debitage we interpret as the by-product of minimal resharpening episodes. Although no Neponset rhyolite debitage was recovered from Area A, one fluted point ear fragment was recovered from Concentration III, while a side-notched blade-like utilized flake fragment was recovered from Concentration I.

Based on the foregoing discussion, we suggest that we have two different groups at the Michaud Site, one responsible for Area A and the other for Area B. The presence in some quantity of the same raw materials suggests that, even if Areas A and B were not occupied contemporaneously, the groups were most likely related.

SPATIAL/FUNCTIONAL PATTERNING

Areas A and B display a marked contrast in the functional use of space. Area A is composed of three discrete, non-overlapping tool concentrations, each of which appears to be functionally different: together they span a linear distance of 16-18 meters. We suggest that the

activities represented in the three concentrations together include many of the activities necessary for short term (weeks to months) maintenance of a small group of Paleoindians. Concentration I, as previously mentioned, appears to be a center of tool manufacture, particularly fluted point replacement. Concentration III is dominated by scraping tools, particularly sidescrapers, which our use-wear studies suggest were used to scrape a soft material such as hide. Concentration II lacks concentrated discarded tools and debitage suggestive of a single, focussed activity as do Concentrations I and III. However, of particular interest in Concentration II is the large amount of coarse stone shatter and the presence of pigment fragments.

It is possible that the pigment fragments were associated more with domestic activity than with tool manufacture or hide processing. If there was a structure associated with Concentrations I, II, and III, it is unlikely to have been inclusive of all three. It is equally unlikely that Concentrations I and III were covered with "separate but equal" structures for such disparate activities. Thus, it is most likely that, if there were a single structure, it was focussed on Concentration II. Following this reasoning, it is logical that Concentrations I and III were open-air activity area satellites to Concentration II. One hypothesis, therefore, for the seeming restraint on activities in Concentration II is that it represents "interior, perhaps domestic, space.

Area B, in sharp contrast to Area A, is organized into at least four non-overlapping tool concentrations that are more-or-less functionally repetitious. Significantly, none of these were associated with hearths that were large enough or deep enough to have survived to modern recognition. Activities suggested by the use-wear patterns on the discarded tools from this area include both cutting and scraping functions on soft and medium

hardness substances, probably including but not limited to work on wood and hide. Broken fluted point fragments were recovered from four of the tool concentrations in Area B, while bifacial thinning flakes of Neponset rhyolite occur in all Area B concentrations to greater or lesser degree. Channel flake fragments of Neponset rhyolite were also recovered from most of the Area B assemblages, notably excluding Concentration IV. Thus, in Area B fluted points of a variety of materials, including black chert, silicified siltstone, and Neponset rhyolite, were being replaced by weaponry of Neponset rhyolite. Coarse stone tools, cores, and shatter are absent from Area B except for the high incidence of coarse stone shatter in Concentration IV.

We may speculate that the seemingly repititious activity patterns of Area B represent assemblages discarded or dropped by small groups of hunters or by a number of small family groups over a short span of time. Their non-overlapping placement in seemingly random fashion over a large area argues for contemporaneous use , or for sequential use where the evidence of previous settlement was obvious and positive efforts at avoidance were made.

SUMMARY

We have defined two areas of tool concentrations which display significant differences in incoming/outgoing lithic raw material. The mode of transporting the raw material also appears to be different. Bifacial preforms and large, shaped flakes appear to be the form used for transport into Area A, while the presence of some angular, unformed fragments of Neponset rhyolite displaying bedding plane surfaces from Area B suggests that the inhabitants of Area B carried in raw material in a less reduced state.

Although the same tools forms are represented in Area A and Area B, with the exception of the limaces found only in Area A, stylistic

differences, particularly of fluted points, suggest that we are not looking at the artifacts of a single toolmaker with an associated group of people occupying the Michaud Site during opposing phases of a seasonal round. Further, the highly patterned spatial division in area A contrasts sharply with the non-patterned, activity inclusive assemblages from Area B. It is possible that two groups of different social composition, possibly a family group in Area A and a small, specialized hunting party in Area B, were responsible for the different forms of assemblage as seen between these two areas. With respect to the latter, the concept of exploitation camp (Cox 1972) may be applicable. If there were a major encampment at some reasonable distance from the Michaud Site, it is possible that hunting parties left for days at a time, making camp and repairing and/or replacing equipment as necessary. Small camp sites including limited tool types, as seen in Area B, would be the expected remains of such short term forays. On the other hand, a campsite such as is seen in Area A may represent the occupational debris of a family group, with task specific division of labor.

The distribution patterns at the Michaud Site, then, have important implications for Paleoindian settlement pattern as a whole. The Michaud Site appears to include the remains of two distinct groups, who either occupied the site contemporaneously, or who were groups of different social composition and different task orientation occupying the site at different times. As Paleoindian sites of much greater size and tool density occur (Vail, Debert, Bull Brook) in the northeast, we suggest that large groups came together periodically, possibly to cooperate in the seasonal procurement of large or migratory game species. The population must also, however, have divided into smaller segments, in family or small group units to exploit seasonally diverse resources, as small hunting parties, or possibly as task groups to

procure quantities of fine quality lithic material.

We here and in Tables 6-3 and 6-4 give the figures for the Michaud Site. Microflakes were not included in the average flake weights in Table 6-4, as their inconsistent recovery at Paleoindian sites might make our figures difficult to use for comparative purposes.

The total mass of all the cherts and glassy rhyolite discarded and lost on the Michaud Site is quite small. There were only 274 grams of Ceg1, 237 grams of Cr1, 146 grams of Cr05, and 610 grams of Neponset rhyolite, plus much smaller amounts of other cherts. The total amount of these "non-local" rocks lost, flaked, or discarded on the site falls just short of 1.5 kilograms. Whatever the length of stay at the site, and we assume that it was fairly short in both areas based on the non-overlapping, confined tool concentrations with limited lithic debris, the stone tool kits were only 1.5 kilograms lighter when the inhabitants left than when they arrived.

Table 6-1

Artifact Types, Counts for Each Concentration

CONCENTRATION

Artifact Type	I	II	III	IV	V	VI	VII	VIII	IX
Fluted Point/ # Fragments	4	0	1	1	1	1	0	1	0
Biface Preform	4	1	0	0	0	0	0	0	0
Channel Flakes	10 (1 used)	0	0	4 (3 used)	1	3	4 (2 used)	0	0
Sidescraper	0	1	5	1	1	0	1	2	0
Endscraper	2	0	2	0	0	2	1	1	0
Concave Scraper	1	0	0	1	0	0	0	0	1
Scraper Fragment/ Uniface Fragment	1	1	3	2	0	1	0	1	0
Limace	3	0	0	0	0	0	0	0	0
Retouched Flake	3	0	1	4	0	1	1	0	0
Utilized Flake	6	0	2	1	0	4	4	6	0
Perforator/Graver	1	0	0	1	0	1	1	0	0
Combination Perforator/Graver	0	0	0	2	0	0	0	0	0
Rough Stone Core Cobble Tools	4	3	6	0	1	0	0	0	0
Rough Stone Large Flakes	9	4	1	7	2	0	0	4	0
Rough Stone Shatter	109	108	13	118	3	11	0	16	0
Pieces Pigment	0	0	48	0	0	0	3	0	0

Table 6-2

Artifacts Listed by Concentration

Artifacts of Concentration I

Catalogue Number	Description	Material-Weight		Inferred Use
.00321	Fluted Point	Cr05	7.8 gr.	?undergoing resharpening
.00377	Fluted Point Tip	Cr05	3.1 gr.	not utilized except as projectile
.00433	Fluted Point Tip Frag.	Cr05	2.0 gr.	joins .00321
.00451	Fluted Point Ear	Cr1a	0.6 gr.	not utilized except as projectile
.00643	Fluted Point	Cr1a	7.3 gr.	not utilized except as projectile
.01127	Channel Flake Base	Cegl	0.4 gr.	not utilized
.01137	Channel Flake	Cr1a	0.8 gr.	joins .00895
.00597	Channel Flake	Cr05	0.4 gr.	not utilized
.00610	Channel Flake	Cegl	1.9 gr.	not utilized
.00817	Channel Flake	Cegl	1.0 gr.	not utilized
.00895	Channel Flake	Cegl	1.2 gr.	not utilized, joins .01137
.00932	Channel Flake	Cegl	1.1 gr.	not utilized
.01076	Channel Flake	Cegl	2.5 gr.	not utilized
.01387	Channel Flake Frag.	Cr05	1.5 gr.	not utilized
.00330	Biface Preform	Cegl	48.1 gr.	not utilized
.00660	Biface Preform	Cegl	13.7 gr.	not utilized
.00661	Biface Preform	Cegl	13.0 gr.	not utilized
.01355	Biface Preform Frag.	Cegl	2.8 gr.	not utilized
.00215	1 Channel Flake/Graver	Cegl	2.4 gr.	grave medium or soft material
.00634	Limace	Cb01	1.4 gr.	production, socket?
.01342	Limace	Cr05	3.8 gr.	production, socket?
No Numbers	Limace	Cegl	?	production, socket?
.00586	Endscraper	Ct01	3.8 gr.	scraping medium
.00151	Endscraper	Cr05	8.9 gr.	scraping medium
.00335	Concave Scraper	Cr05	7.2 gr.	scraping medium
.00814	Retouched Flake	Rfnp	0.4 gr.	cutting soft
.00896	Retouched Flake Frag.	Cegl	0.4 gr.	scraping medium
.00150	Retouched Flake	Cr05	28.1 gr.	scraping medium
.01121	Utilized Flake	Cegl	0.8 gr.	function unknown
.01158	Utilized Flake	Cr05	8.9 gr.	scraping medium
.00209	Utilized Flake	Cr1b	0.7 gr.	scraping?
.00440	Utilized Flake	Cr1a	0.2 gr.	joins .00462
.00462	Utilized Flake	Cr1a	1.8 gr.	function unknown
.00471	Utilized Flake	Cr1a	0.1 gr.	function unknown

Table 6-2, continued...

Artifacts Listed by Concentration

Artifacts of Concentration II

Catalogue Number	Description	Material-Weight		Inferred Use
.01167	Uniface Frag	Cr1b	0.5 gr.	function unknown
.00488	Sidescraper	Cr05	3.9 gr.	scraping soft (?)
.00152	Biface Preform Base	Cb01	3.6 gr.	
.00153	Utilized Flake	Cb01	2.7 gr.	scraping medium
.02798	Biface Preform Frag.	Cb01	4.3 gr.	

Table 6-2, continued...

Artifacts Listed by Concentration

Artifacts of Concentration III

Catalogue Number	Description	Material-Weight		Inferred Use
.02053	Sidescraper	Cegl	42.2 gr.	scraping soft
.02193	Endscraper	Cr05	3.6 gr.	scraping medium and ? hard
.02209	Sidescraper	Cr1a	5.4 gr.	joins. 02293, scraping soft
.02214	Endscraper	Cr05	2.8 gr.	?
.02215	Retouched Flake	Cr1a	0.9 gr.	?
.02216	Scraper Fragment	Cr05	0.5 gr.	scraping soft, joins .02218, .02282
.02218	Sidescraper Frag.	Cr05	2.1 gr.	joins .02216, .02282
.02264	Utilized Flake Frag.	Cr05	0.1 gr.	?, joins .02322
.02282	Scraper Frag.	Cr05	1.9 gr.	joins .02216, .02218
.02293	Sidescraper	Cr1a	52.7 gr.	scraping soft, joins .02209
.02302	Utilized Flake	Cr02	0.4 gr.	? cutting soft
.02322	Utilized Flake	Cr05	4.3 gr.	scraping soft or medium
.02323	Sidescraper	Cr1a	22.2 gr.	scraping soft
.02159	Fluted Point Ear	Rfnp	0.2 gr.	

Table 6-2, continued...

Artifacts Listed by Concentration

Artifacts of Concentration IV

Catalogue Number	Description	Material-Weight		Inferred Use
.01568	Fluted Point Frag.	Sslt	1.5 gr.	? broken point
.01590	Retouched Flake	Rfnp	13.1 gr.	scraping medium
.01591	Concave Scraper	Rfnp	4.6 gr.	scraping medium or soft
.01592	Perforator	Rfnp	13.8 gr.	perforating
.01700	Sidescraper	Cr05	12.0 gr.	scraping soft
.01801	Retouched Flake	Crlb	1.0 gr.	?
.01803	Channel Flake	Crlb	1.3 gr.	?
.01804	Perforator, Scraper	Cbst	1.7 gr.	perforating, scraping medium and ?
.01809	Uniface Frag.	Crla	0.2 gr.	?
.01814	Retouched Flake	Crla	0.3 gr.	scraping medium
.01816	Channel Flake Frag.	Crlb	0.7 gr.	scraping and cutting medium
.01820	Utilized Flake	Rfnp	0.9 gr.	? cutting soft
.01828	Retouched Flake	Rfnp	2.7 gr.	scraping medium
.01843	Perforator, Scraper	Rfnp	14.5 gr.	perforating, scraping medium
.02314	Channel Flake	Cr05	0.6 gr.	scraping and cutting medium ?
.02319	Scraper Frag.	Cr05	1.7 gr.	?

Table 6-2, continued...

Artifacts Listed by Concentration

Artifacts of Concentration V

Catalogue Number	Description	Material-Weight		Inferred Use
.00333	Scraper Frag.	Rfnp	3.4 gr.	scraping, soft?
.00336	Scraper Frag.	Rfnp	0.9 gr.	use medium
.00112	Fluted Point Tip	Cb01	3.7 gr.	broken point
.00130	Utilized Flake	Cr05	3.2 gr.	cutting soft

Table 6-2, continued...

Artifacts Listed by Concentration

Artifacts of Concentration VI

Catalogue Number	Description	Material-Weight		Inferred Use
.01748	Utilized Flake	Cb01	1.4 gr.	?
.01749	Utilized Flake	Cr1b	6.8 gr.	edge 1: cutting soft edge 2: cutting medium
.02109	Endscraper	Rfnp	3.4 gr.	edge 1: scraping medium edge 2: cutting or sawing medium
.02329	Retouched Flake	Rfnp	2.0 gr.	scraping hard
.02350	Utilized Flake	Rfnp	4.7 gr.	no use wear visible
.02396	Endscraper	Rfnp	10.8 gr.	cutting soft /
.02401	Scraper Frag.	Rfnp	0.8 gr.	scraping hard, probably also scraping medium
.01974	Fluted Point Tip	Rfnp	2.6 gr.	?
.01818	Graver/Perforator	Cb01	2.4 gr.	not utilized? perforating?
.02367	Channel Flake	Rfnp	0.3 gr.	?

Table 6-2, continued...

Artifacts Listed by Concentration

Artifacts of Concentration VII

Catalogue Number	Description	Material-Weight		Inferred Use
.01396	Utilized Flake	Crla	0.2 gr.	
.01397	Utilized Flake	Cr05	2.2 gr.	scraping or cutting medium
.01398	Channel Flake	Crlb	1.5 gr. ---	
.01399	Channel Flake	Crlb	0.7 gr. ---	one piece, scraping medium
.01401	Channel Flake	Crlb	0.5 gr. ---	
.00006	Utilized Flake	Rfnp	1.7 gr.	scraping medium
.02439	Channel Flake	Rfnp	0.6 gr. ---	
.02454	Channel Flake	Rfnp	0.3 gr. ---	?
.02498	Channel Flake	Rfnp	0.3 gr. ---	
.02657	Retouched Flake	Rfnp	0.6 gr.	no use wear seen
.00087	Channel Flake	Crlb	3.1 gr.	scraping medium and cutting medi
.01534	Perforator/Scraper	Crlb	7.7 gr.	perforator
.01528	Endscraper	Ct01	11.6 gr.	scraping medium, possibly scraping hard
.01477	Sidescraper	Ct01	7.2 gr.	scraping medium
.01392			1.7 gr. ---	
.01393	Utilized Flake	Rfnp	0.5 gr. ---	scraping medium
.01394			0.3 gr. ---	
.02448	Channel Flake Frag.	Rfnp	0.7 gr. ---	function unknown
.1580	Utilized Flake	Rfnp	5.6 gr.	scraping medium

Table 6-2, continued...

Artifacts Listed by Concentration

Artifacts of Concentration VIII

Catalogue Number	Description	Material-Weight		Inferred Use
.00308	Sidescraper	Rfnp	8.4 gr.	heavily patinated
.00632	Utilized Flake	Rfnp	11.7 gr.	unifacial wear, patinated scrapi
.01447	Utilized Flake	Rfnp	3.4 gr.	unifacial wear, patinated scrapi
.00126	Uniface Frag.	Rfnp	1.9 gr.	?
.02325	Utilized Flake	Rfnp	2.8 gr.	?
.00289	Sidescraper	Crla	42.1 gr.	light use, scraping soft
.00088	Fluted Point Base	Cb01	7.1 gr.	
.01319	Concave Scraper	Cr05	10.8 gr.	scraping medium
.00089	Utilized Flake	Cb01	4.5 gr.	cutting soft or medium
.02204	Utilized Flake	Ct01	5.3 gr.	cutting soft (?)
.00110	Endscraper	Rfnp	3.8 gr.	scraping medium
.00070	Utilized Flake	Rfnp	5.0 gr.	use unknown

Table 6-2, continued...

Artifacts Listed by Concentration

Artifacts of Concentration IX

Catalogue Number	Description	Material-Weight		Inferred Use
.00086	Concave Scraper	Crlb	9.4 gr.	scraping medium
.01582	Sidescraper	Crla	20.6 gr.	scraping soft
.00090	Endscraper	Crlb	4.6 gr.	scraping hard

TABLE 6-3

Coarse Rock Distribution by Weight

	Small (<25 gm)	Medium 25-300 gm	Large >300 gm
Conc. I	102	9	4
Conc. II	108	4	3
Conc. III	13	3	6
Conc. IV	118	7	
Conc. V	3	2	1
Conc. VI	11	0	
Conc. VII			
Conc. VIII	16	4	
Conc. IX			
	371	29	14

Table 6-4

here

Table 6-4

Numbers/Weights of Raw Materials Recovered in Each Concentration

Concentration		Other	Ceg1	Cb01	Cr1	Cr02	Cr03	Cr04	Cr05	Ct01	Rfnp
						Material					
I	Artifacts	2/0.2	11/88.2	1/1.4	3/10.3				10/70.4	1/3.8	1/0.4
	Flakes		250/43.1	33/7.5	173/26.7	7/2.4	43/35.3	8/2.0	58/8.9	14/1.2	
	Microflakes		1167/30.4	143/3.82	979/31.9		1/0.1	3/0.6	203/6.66	54/1.4	
II	Artifacts			31/10.5	1/0.5				1/3.9		
	Flakes		86/15.2	26/6.1	34/4.4		2/0.2	3/1.0		2/1.1	
	Microflakes		203/6.09	30/0.59	187/3.41				25/0.45	2/0.6	
III	Artifacts		2/65.8		4/81.3	1/0.4			7/15.2		1/0.2
	Flakes		94/27.7	4/0.5	12/2.1		4/0.4			3/0.7	
	Microflakes		273/4.61	11/0.55	130.2.34				27/.51	20/0.53	
IV	Artifacts	2/3.2			5/3.8			1/1.7	2/12.6		6/49.6
	Flakes			1/0.1	5/3.6		1/0.3		5/2.1		205/108.0
	Microflakes			7/0.3	20/0.40					1/0.05	433/19,7
V	Artifacts			1/3.7					1/3.2		3/4.0
	Flakes			1/0.1	9/10.5		1/1.5	1/0.6	10/4.0		3/1.5
	Microflakes				2/0.1						
VI	Artifacts			2/3.8	1/6.8						7/24.7
	Flakes				2/1.4				1/0.3	1/0.3	72/75.8
	Microflakes				3/0.1					2/0.1	54/0.82
VII	Artifacts				5/21.9				1/2.2	2/18.8	5/5.5
	Flakes				2/2.4						368/115.2
	Microflakes			3/0.1	3/0.1					7/0.15	181/3.5
VIII	Artifacts			2/11.6	1/42.1				1/10.8	1/5.3	7/79.1
	Flakes			1/0.3	4/2.9				1/0.3	1/0.2	32/46.9
	Microflakes										
IX	Artifacts	1/2.1			3/34.6						
	Flakes				6/04						2/0.2
	Microflakes			8/0.25							24/2.5
Not in Concentrations		1/2.1	1/2.9	3/9.9	1/2.4					1/2.5	2/17.8
Total Artifacts		4/3.5	13/154.0	12/40.9	24/203.7	1/0.4	0	1/1.7	24/120.8	5/30.4	32/181.3
Total Flakes			430/86.0	66/14.6	247/54.4	7/2.4	51/37.7	12/3.6	75/21.0	21/3.5	704/347.6
Total Microflakes			1643/41.14	202/5.6	1321/38.35		1/0.1	3/0.6	255/7.6	86.2.8	692/17.62
Total Weight/ Material		4/3.4	273.6	61.1	296.35	2.8	37.8	6.5	149.4	36.7	546.52

Table 6-5

Average Weight of Chert and Neponset Rhyolite Flakes in Different Concentrations

* = Small Sample Size ($n \leq 3$)

	Material									
Concentration	Cegl	Cb01	Cr1a	Cr1b	Cr02	Cr03	Cr04	Cr05	Ct01	Rfnp
I	0.17	0.23	0.16		0.34	0.82	0.25	0.25	0.1	
II	0.18	0.23	0.14	0.09		0.1*	0.33*		0.6	
III	0.30	0.13	0.18			0.1			0.2*	
IV	0.1*	0.1	0.72			0.3*				0.53
V	0.1*	0.1*	1.0	1.75*		1.5*	0.6*	0.42		.5*
VI	0.25		0.7					0.3*	1/0.3	1.1
VII										.31
VIII	0.1*	0.3*	0.6*	1.2*				0.3*		1.46
IX										0.1

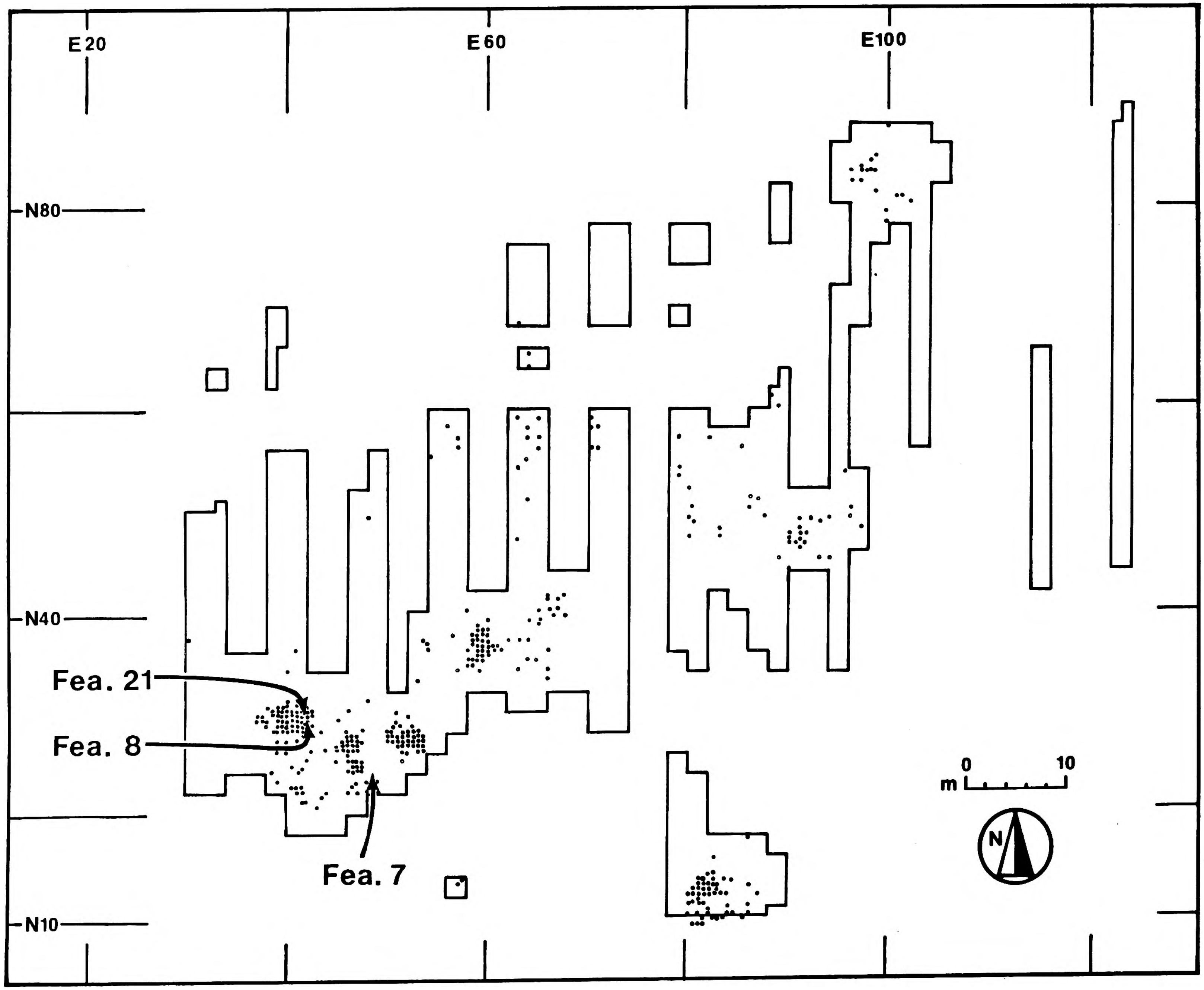


Figure 6-1. Quadrangles with flake(s), microflake(s), and/or artifact(s)

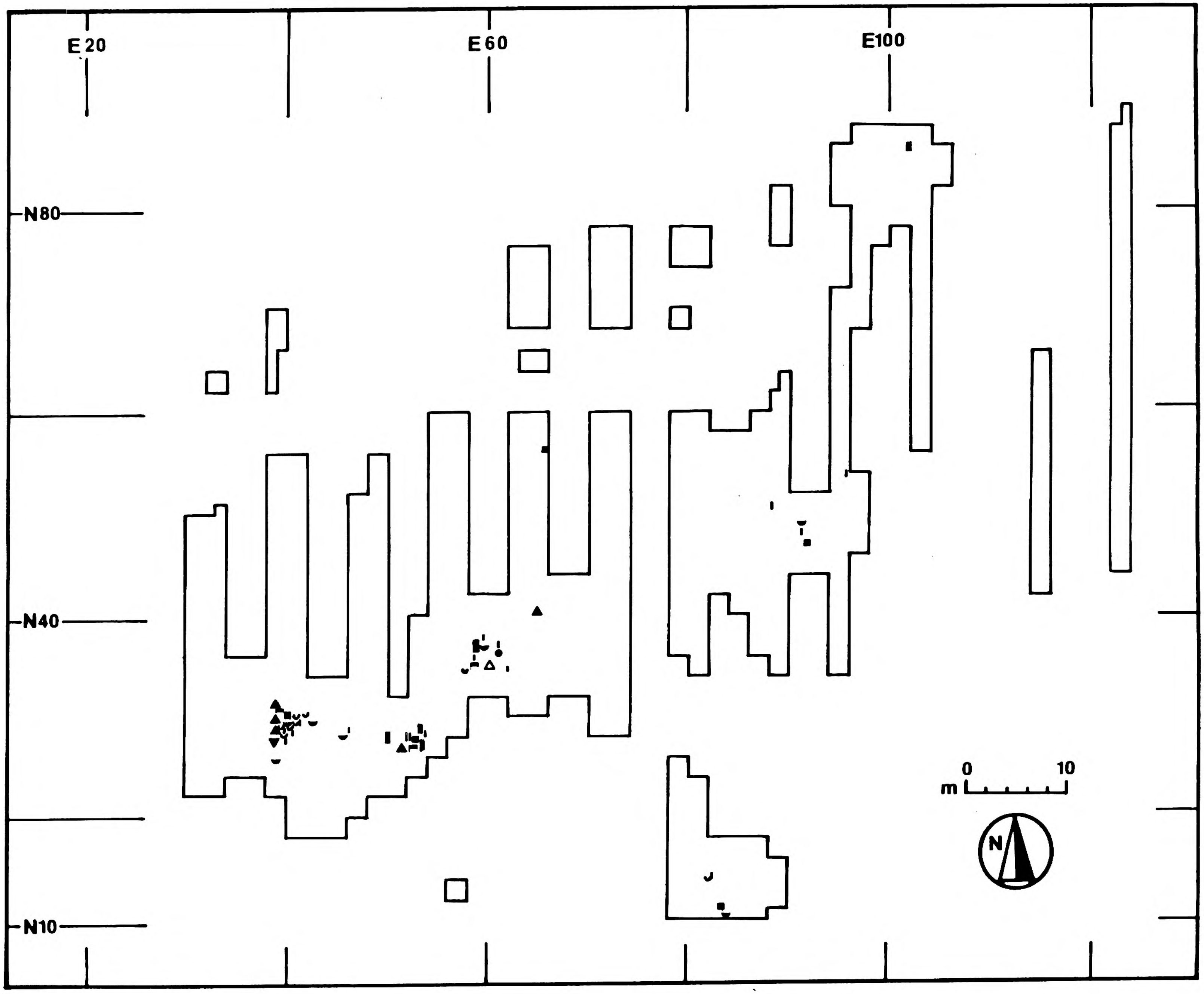


Figure 6-2. Locations of in-site artifacts. Symbols as in Figure 6-4.

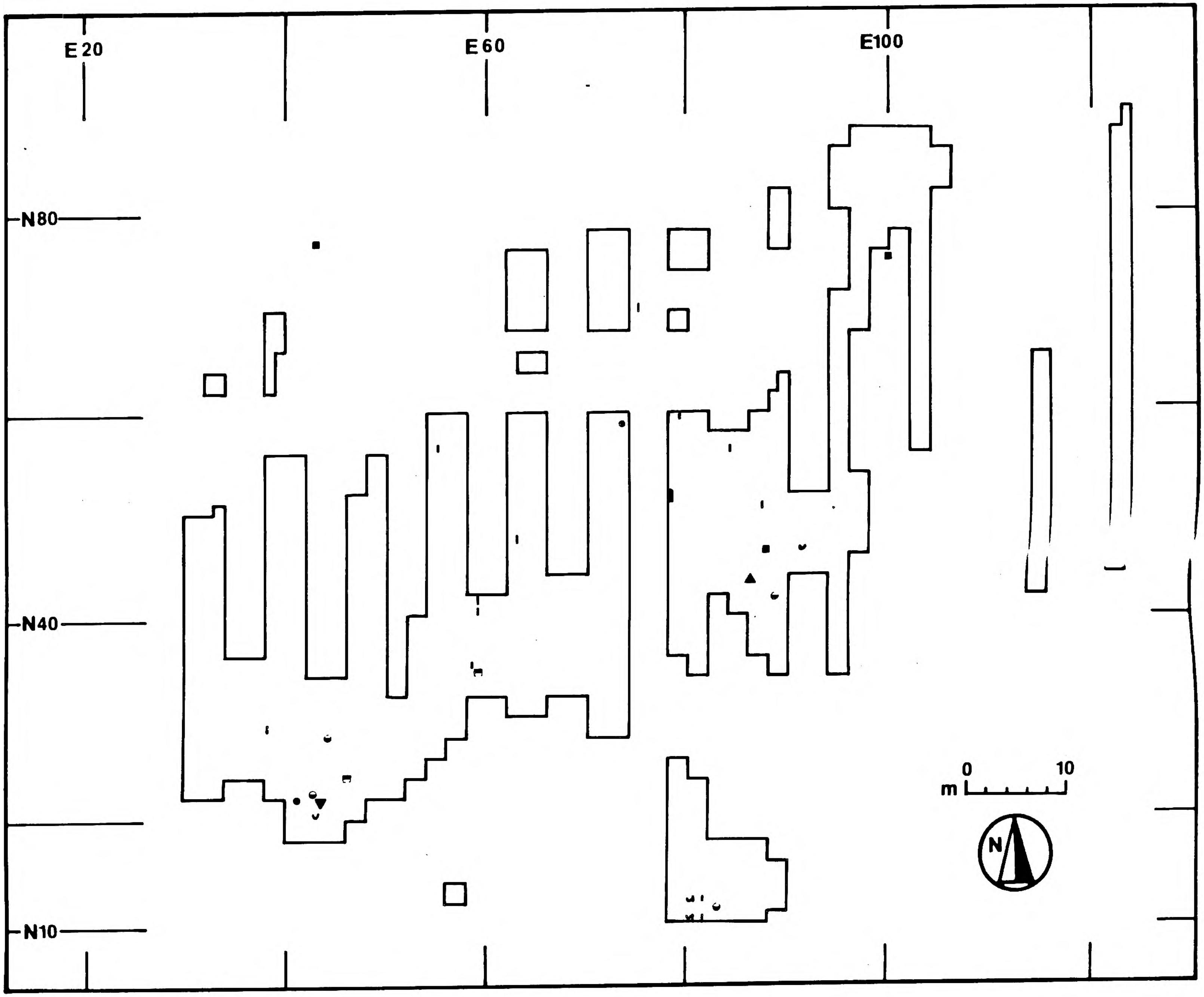


Figure 6-3. Ex-situ artifacts.

Figure 6-3

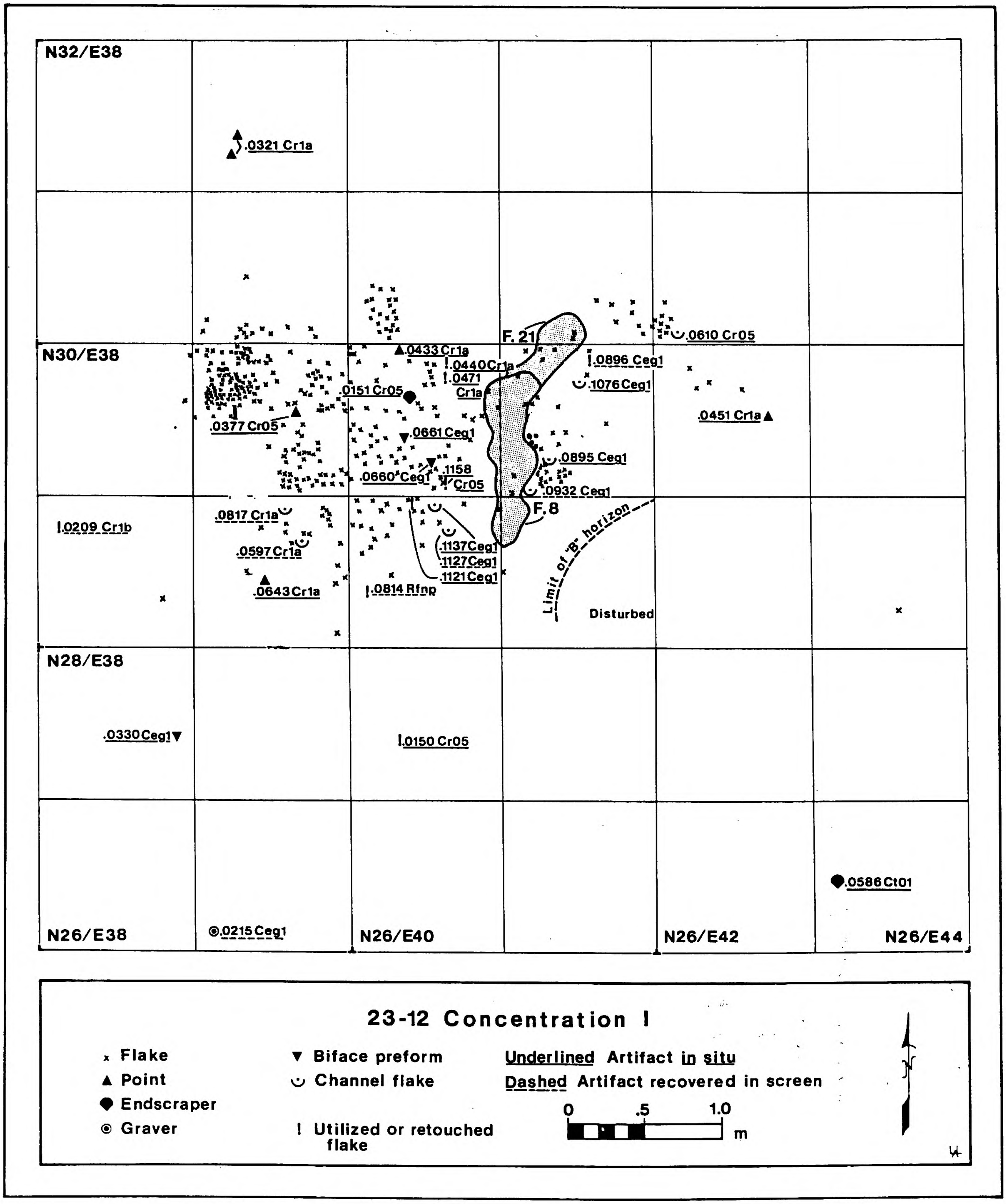
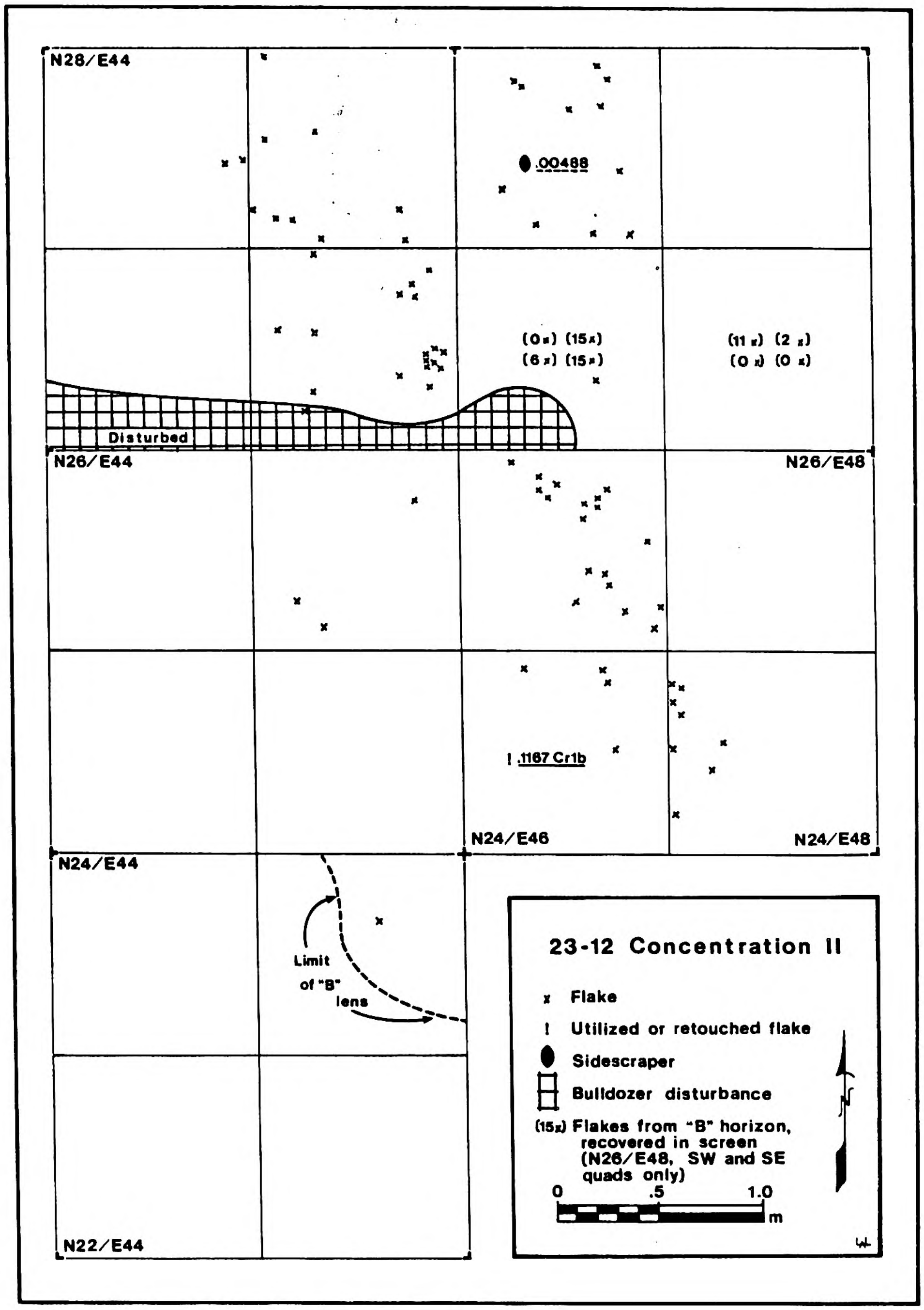


Figure 6-4. Artifacts and flakes with point provenience in Concentration I.

Figure 6-5. Artifacts and flakes with point provenience in Concentration II.



6-5

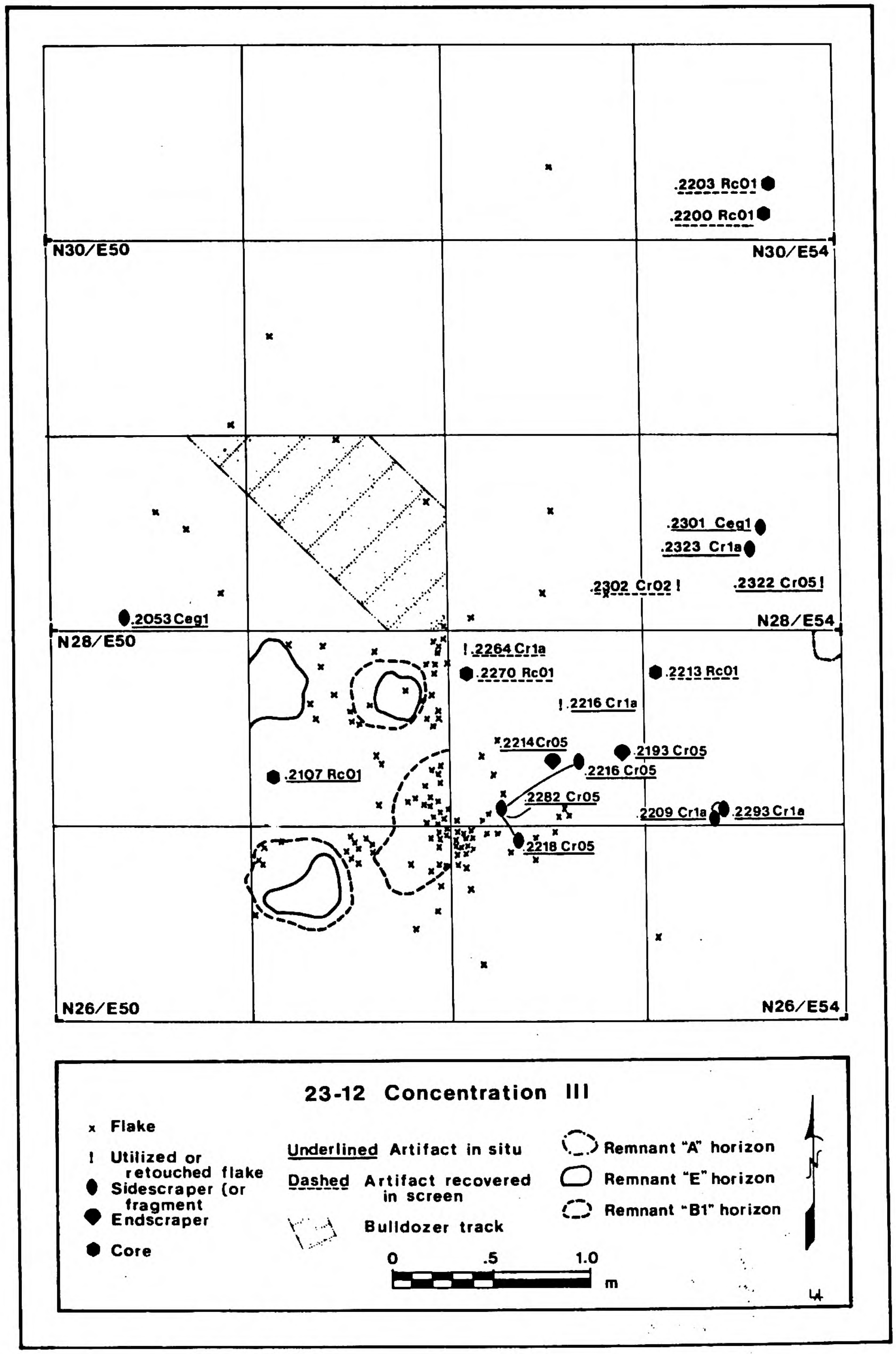


Figure 6–6. Artifacts and flakes with point provenience in Concentration III.

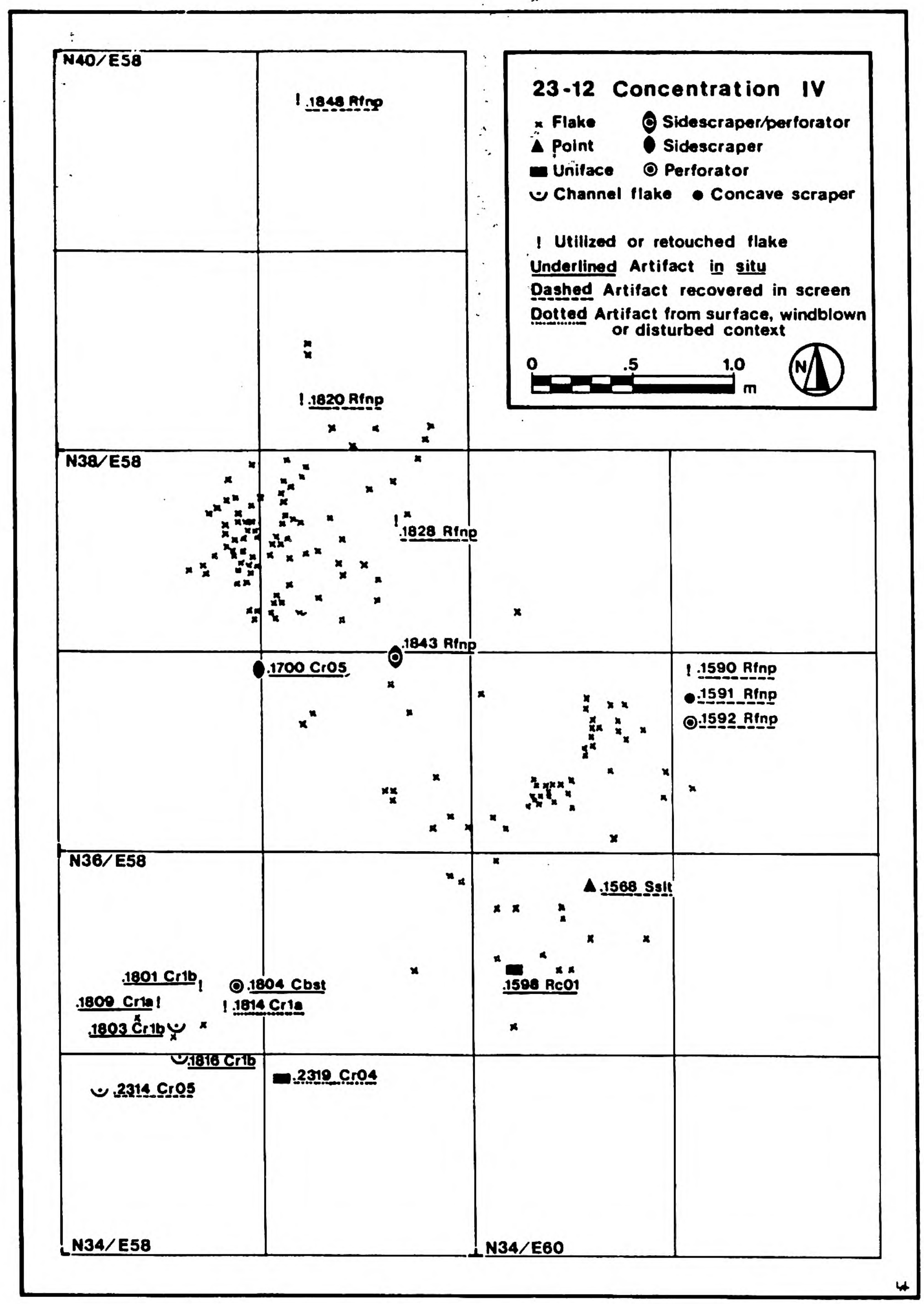


Figure 6-7. Artifacts and flakes with point provenience in Concentration IV.

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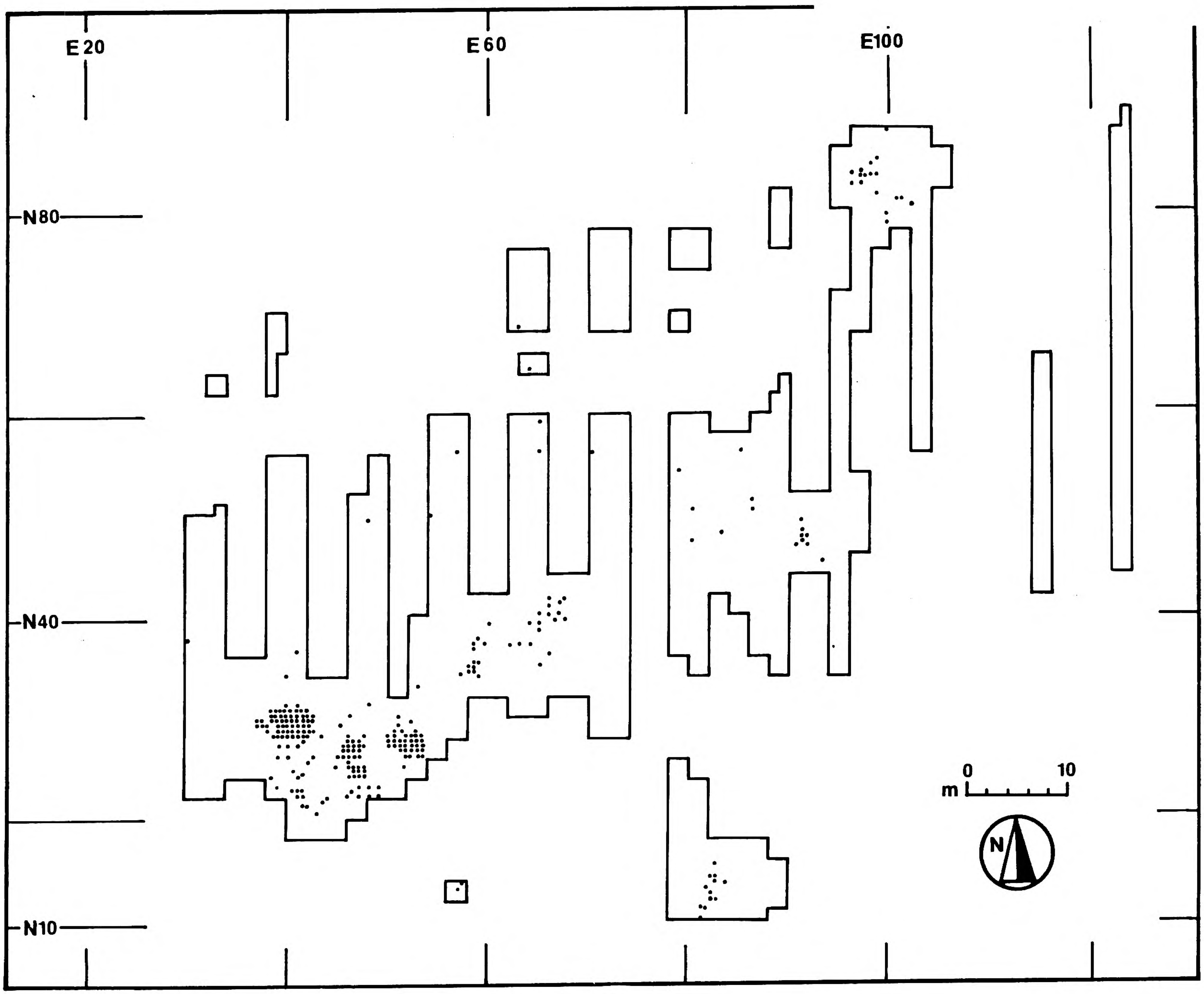

Figure 6-8. Quadrangles with chert debitage or artifacts.

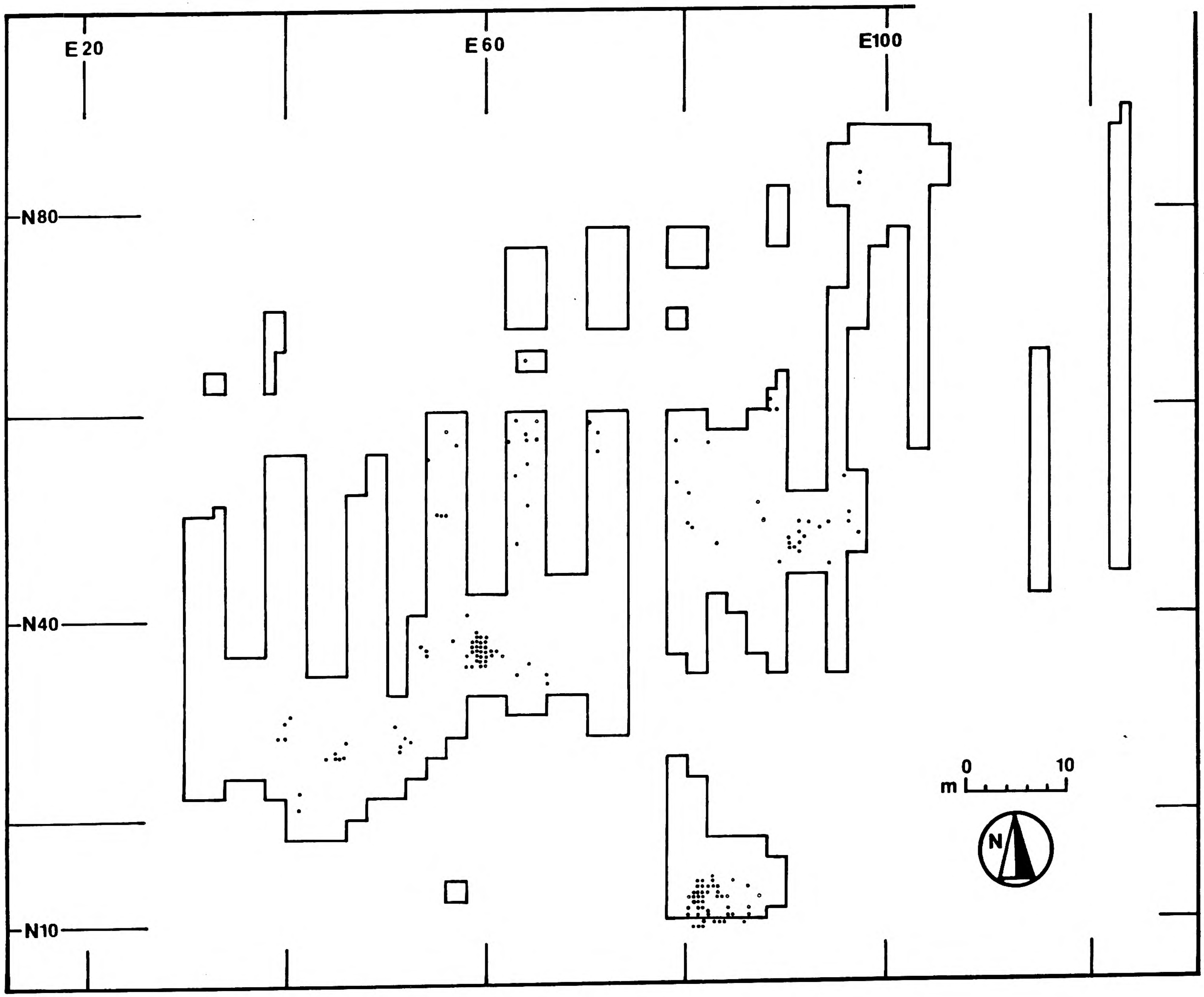

Figure 6-9. Quadrangles with Neponset rh lite debitage or artifacts.

Fig 6.21

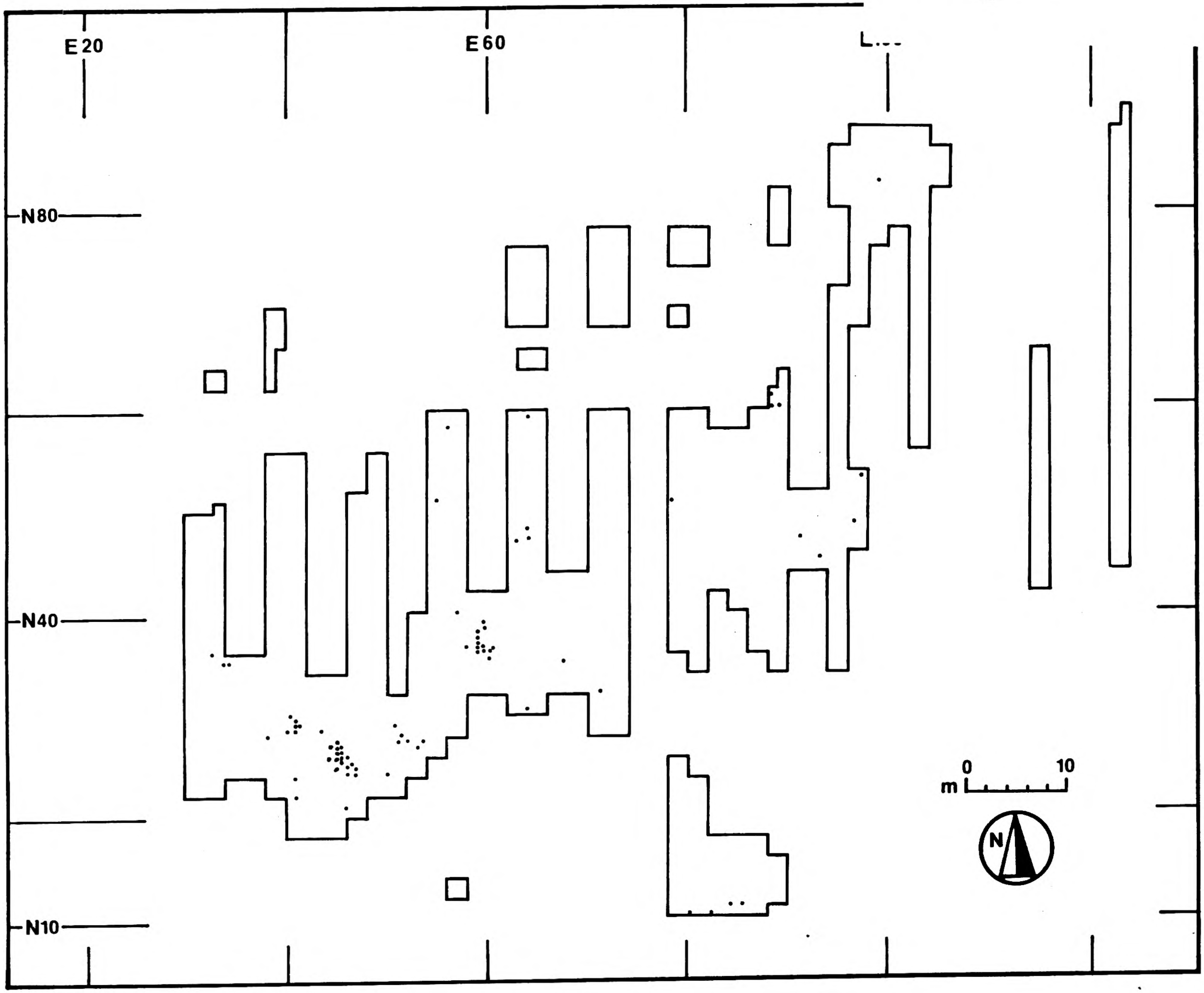

Figure 6-10. Quadrangles with diabase shatter, flakes, or modified pieces.

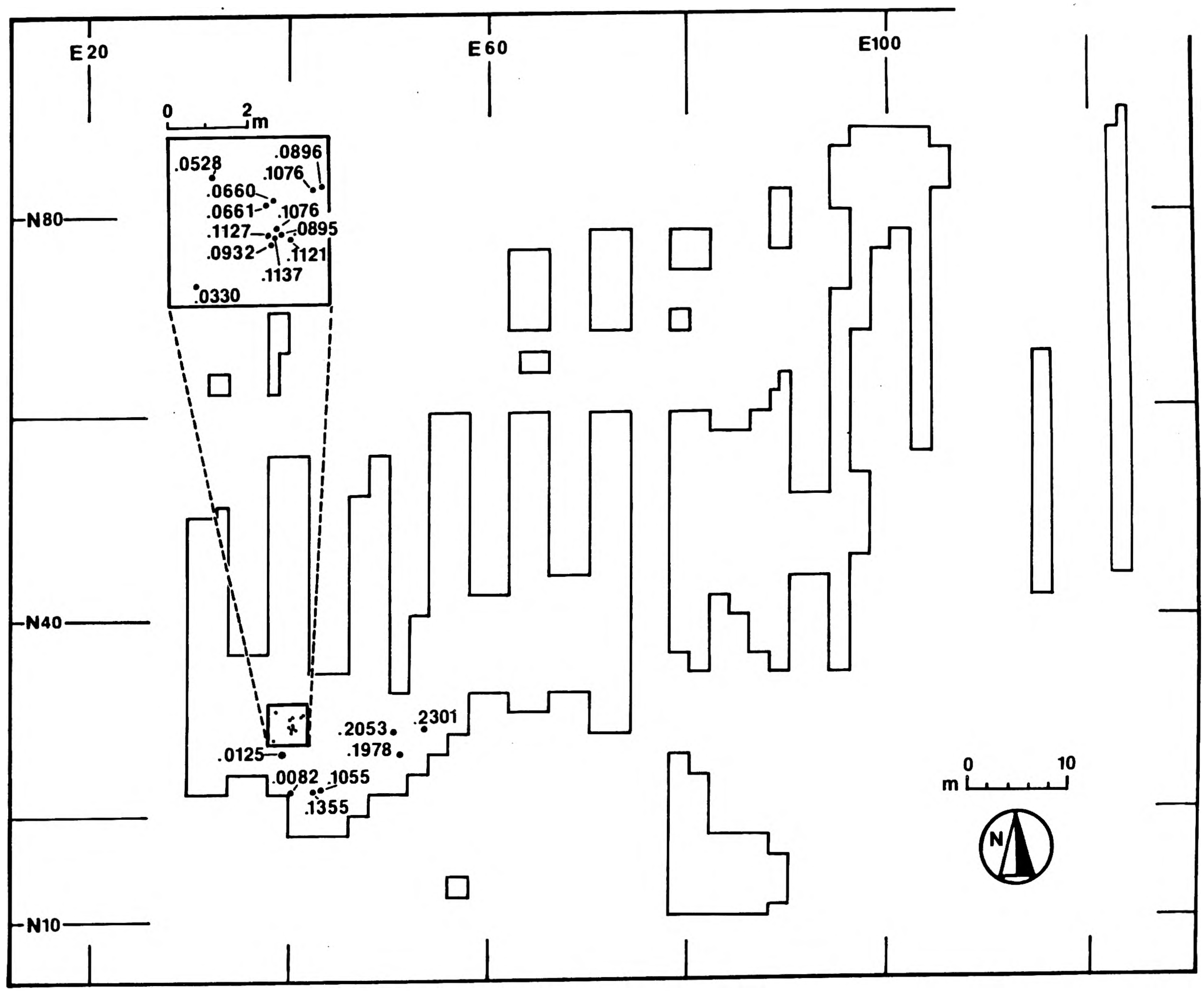

Figure 6-11. Bull ɔok chert (Cegl) artifacts.

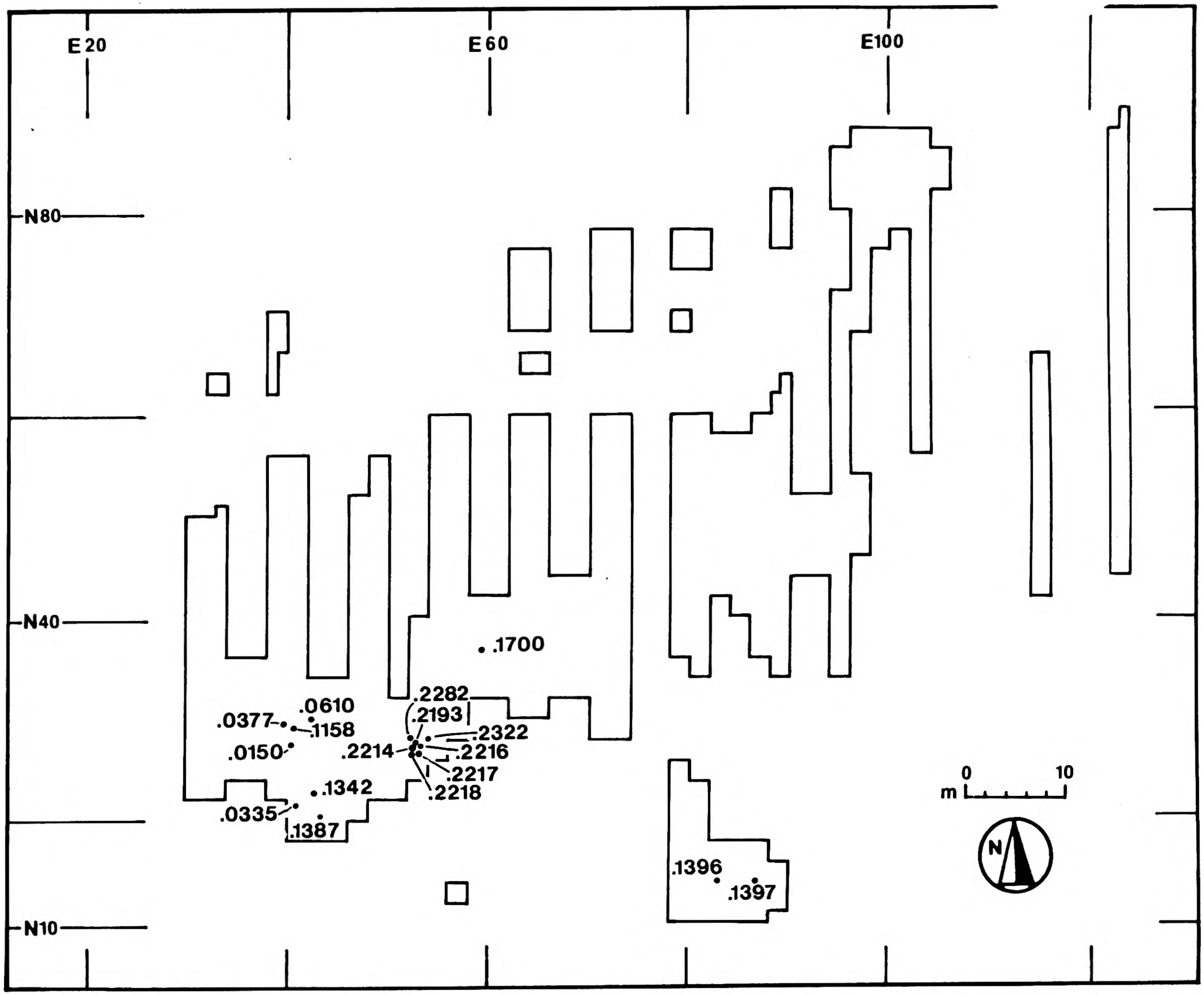

Figure 6-12. Red and green chert (Cr05) artifacts.

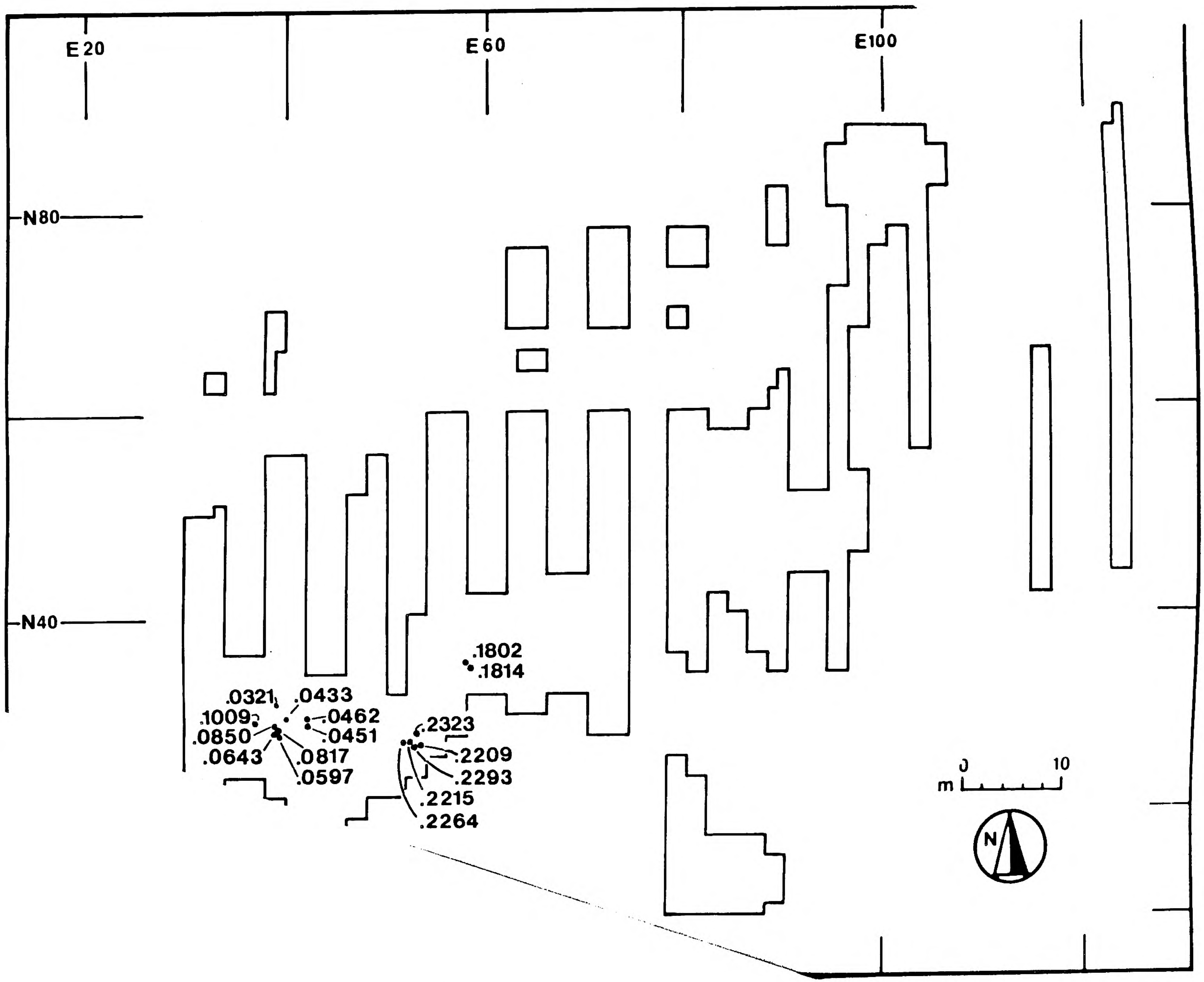

Figure 6-13. Red chert (C artifacts.

6-13

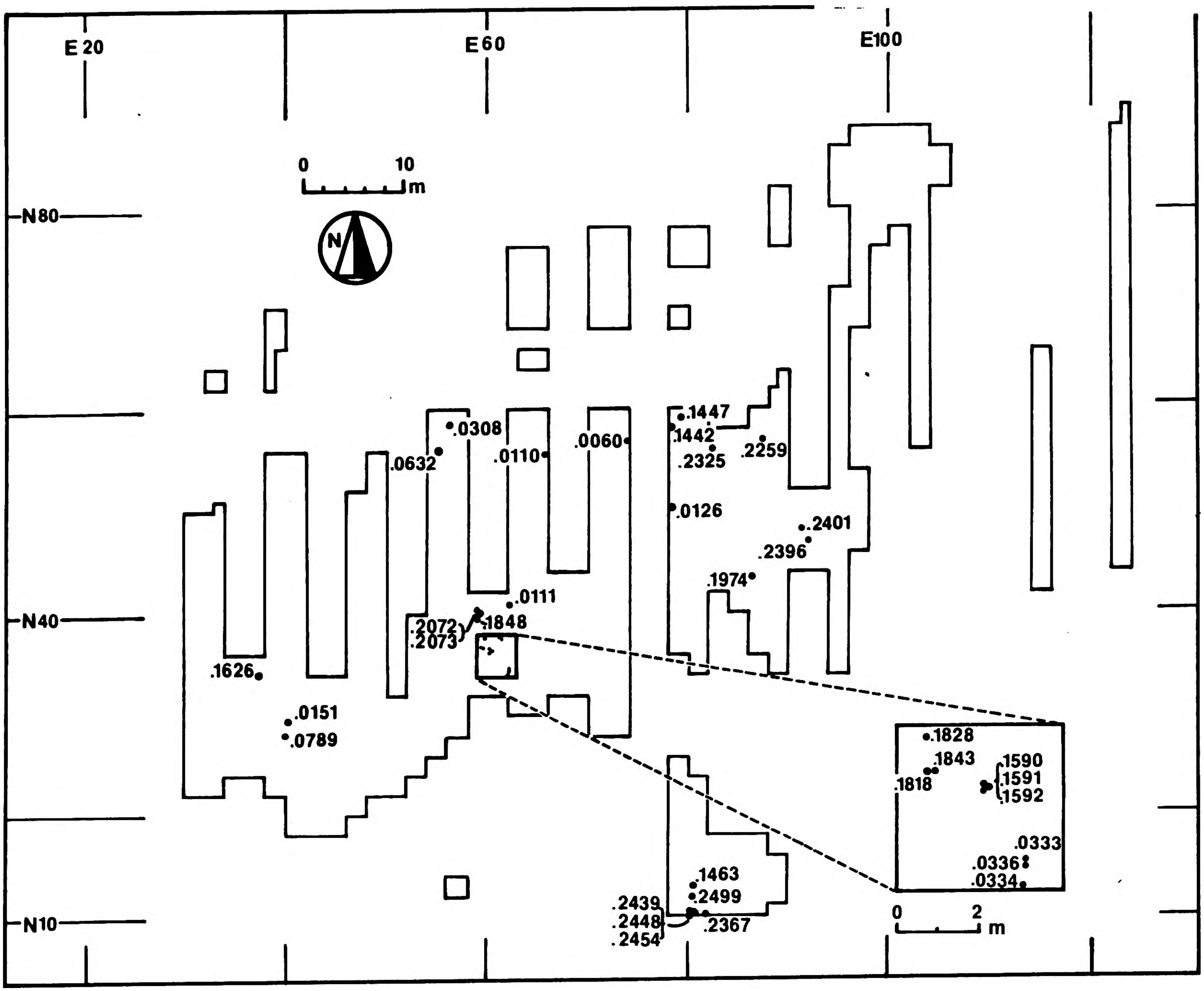

Figure 6-14. Neponset rhyolite artifacts.

CHAPTER VII

The Lamoreau Site (23.13)

The Lamoreau site (Maine Archaeological Survey Number 23.13) is a fluted point Paleoindian site discovered during the Michaud site project. It is located near the Michaud site, and has yielded to surface collection a small assemblage that clearly relates the two sites. We here present what is known about the Lamoreau site, and the relationship between the Lamoreau and Michaud sites at the time of preparation of this report (summer, 1986).

LAMOREAU SITE DESCRIPTION

The Lamoreau site is located approximately 400 meters from the Michaud site. In an unforested environment, it would be possible to see directly from one site to the other, and on a calm day it is possible to signal from one site to the other with a loud shout. Both sites are located on the outer margin of the Moose Brook Valley, on a sandy substrait that was apparently reworked by aeolian action during the Terminal Pleistocene and stabilized by vegetation before Paleoindian occupation. In a treeless or semi-forested environment, both sites together or sequentially could provide surveillance for a substantial portion of the Moose Brook Valley, perhaps depending on prevailing wind conditions or other factors. These geographic factors, plus a similarity in suite of raw materials and artifact styles, indicates that there probably exists a close relationship between the two.

To date the Lamoreau site is known only from surface collection. There was no knowledge of it in the local community previous to its discovery by Henry Lamoreau, so that it likely will yield a complete assemblage with future work.

The site occupies at least 63 meters of the crest of a fossil dune

feature along the margin of the Moose Brook Valley. Soils have been minimally disturbed, in some ways perhaps less disturbed than portions of the Michaud site. A portion of the soil may be intact, well developed podsol similar to the original soil on the Michaud site.

The interior margin of the Lamoreau site is partially bounded by a parabolic dune with its concavity pointing southeasterly. The age of the parabolic dune is unknown, but the podsol on it is well developed. Thus, it is older than the last few hundred years.

The preliminary indications from surface collection are of at least three concentrations of material placed linearly along the 63 meters of dune top, with a maximum dimension perpendicular to the long axis of 10 to 15 meters.

THE ARTIFACT ASSEMBLAGE AND RAW MATERIALS

Three artifacts were recovered during surface collections of the Lamoreau site (Plates 7-1, 7-2). One is a miniature fluted point of (Cr05) red and green Munsungun chert, similar to those described from 6LF21 (Moeller 1980) in Connecticut and Debert (MacDonald 198_: Plate Vi: g). It is made on a flake, whose proximal end has become the tip or distal end of the point. Ventral flake surface nipple marks indicate it may have been made on a charcoal flake. Retouch occurs along both lateral margins on the dorsal side, and along the right lateral margin and the distal half of the left lateral maring on the ventral side. Also, a slight concavity has been partially worked into the base by retouch along the ventral side of the base. No attempts at fluting are seen, and the ventral flake surface is unmarred save for retouch on the outer margins. Two moderate sized flake scars intrude on the interior dorsal face, though they appear to have been removed prior to the shaping of the lateral sides. The point measures

32.7x16.5x3.2 mm. It exhibits a transverse break which occured one quarter of the distance from the base towards the distal end. Both pieces were found at the same location, and it is unclear whether it is an old or new break.

A second specimen is a red and green (Cr05) chert biface preform fragment, which apparently "hinged out" during the removal of the second channel flake. It measures 48.5 mm. in length. A more detailed description of this preform may be found in Chapter 3.

The final artifact that was surface collected is a red chert (Cr1) endscraper, which measures 28.5x22.2x7.7 mm. The striking platform is intact on the proximal end; both lateral sides are retouched, the right more steeply than the left side. The distal end is angled rather than arcuate in outline and steeply retouched. Rounding and polish is quite noticeable on distal and lateral edges, and it extends up to 4.5 mm. onto the retouched surface on the dorsal side on the distal end and the left lateral side.

Fourteen flakes were also surface collected. Six of these are Neponset rhyolite (Rfnp), three are of patinated blackish-green chert (Cegl), two are red
Munsungun chert (Cr1). Two flakes are of a
whiteish-tan chert which was not present in the Michaud raw materials, as is one of a multi-colored red and blue chert. Additionally, three small chunks of Christian Hill rhyolite, ranging in weight from 17.7 grams to 63.2 grams were collected from the Lamoreau site.

Further work at the site is planned.

Table 6-6

Refit Artifacts or Flakes

Table contains a listing of refits of material found in situ, where pieces are further apart than one meter.

Item	Material	Catalogue Numbers and Proveniences
Fluted Point Channel Flakes	Cegl	00082 N22E40vic, 01076 N29.73E41.49 00932 N28E40 neq SW¼
Fluted Point	Crla	00321 (Conc. I) N31.34E39.30 00433 N29.99E40.38
Fluted Point, Tip Broken and Reflaked	Cb01	00088 N70E70 vicnity (surface coll.) point base 00112 N40.40E62.16 tip, endscraper
Utilized Flake	Crla	00440 N28E40 NWq NE¼ 00462 N29.63E42.75
Flake	Rfnp	01567 N34E66 SWq SW¼ 02108 N37.10E53.65
Flake	Rfnp	02328 N48E92 NW 02354 N46E90 NWq Nw¼

Plate 7-1. Artifacts from the Lamoreau site - flake-point at left, endscraper in middle, broken fluted preform at right.

Plate 7-2. Reverse side of points shown in Plate 7-1.

CHAPTER 8

SYNTHESIS AND DISCUSSION

New England-Maritimes Paleoindian Region

In this section we turn our attention from patterning on the intra-site scale to patterning on the regional geographic scale. We propose a New England-Maritimes Paleoindian region, within which fluted point Paleoindian sites share similarities in site location attributes, site size relationships and/or content attributes, and whose inhabitants shared access to a limited number of preferred lithic sources (Table 8-1). We are not suggesting that a single population or populations (with time-transgressive change in specific tool attributes) continuously occupied this region during the entire Paleoindian time period, nor are we rejecting this hypothesis. Rather we are suggesting a loosely defined region which provided the necessary economic base to support one or quite possibly more populations at any time during the Paleoindian time period. Just as we recognize a defined region, however, so also do we recognize the permeability of its boundaries. Regionally exotic lithics in small quantity are present in a number of the assemblages from New England-Maritimes Paleoindian sites, suggesting possible remnants from immigration and contact on an inter-regional level.

The concept of a Paleoindian region is not a new one. Gramly (1986) has proposed that what is now New York state may be part of three Paleoindian regions. The westernmost, dependent upon Flint Ridge and other central Ohio cherts, extends from central Ohio, up the Allegheny River watershed to westernmost New York southwest of Lake Erie. The central region, dependent primarily on Onandaga cherts, comprises central New York and extends south to the Shoop site in central Pennsylvania (see also Lantz 1984). The eastern region occupies the eastern third of New York, along the

west bank of the Hudson and its tributaries. Site assemblages in this latter region are dominated by Normanskill and other Hudson Valley cherts.

Other possible Paleoindian regions in the east seem to have internally consistent settlement patterns of their own. Sites located in the eastern Great Lakes region are found on strandlines of glacial lakes, which were probably occupied subsequent to the lakes presence. (Deller and Ellis, various; Storck, various; James Payne, pers. comm.) Lantz (1984) proposes a coherent settlement pattern for the area of western Pennsylvania, with observed occupational differences between glaciated and unglaciated terrain. Settlement in the mid-Atlantic states seems focussed on river floodplains and swampy areas, as at the Thunderbird site (Custer 1986:53).

On the basis of the criteria stated above, we define the New England-Maritimes Paleoindian region with a western boundary along the then eastern shore of the receeding Champlain Sea (Davis and Jacobson 1984: 20) and its southern tributary valley as far south as 43 degrees 30 minutes north. South of 43 degrees north, the boundary appears to be the western margin of the Connecticut River valley drainage basin. (The western boundary between 43 degrees and 43 degrees 30 minutes north is archaeological terra incognita.) The northern boundary of this region is the border between Quebec and Maine, New Hampshire, Vermont or New Brunswick. This political boundary conveniently follows, for the most part, the height of land between the St. Lawrence watershed and more rugged terrain to the south. No fluted points have been found northward of this boundary, suggesting that it was not inhabited until after fluted points had become obsolete. To the east, the New England-Maritimes Paleoindian region extends, on the basis of isolated point finds, to include the St. John River valley. Eastern New Brunswick, Nova Scotia including the Debert site, and perhaps Prince Edward Island are provisionally included in the region based on similarities in tool form

between major sites, principally the Vail site and Debert. We have not personally examined the lithics utilized at the Debert site; although most appear to be indigenous materials, the lack of description for minority lithics does not preclude the inclusion of more westerly lithics which dominate the assemblages in the rest of the New England-Maritimes Paleoindian region. The southern limits extend across Massachusetts to include within the region the DEDIC, Wapanucket, and Bull Brook sites. The eastern regional margins include the now submerged coastal plain.

In concurrence with Bonnichsen et. al. (1985: 155), we suggest that access into this region would have been limited to penetration from the south along the coastal lowlands and/or from the west along the receding Champlain Sea. Access from the north would have been precluded by the presence of the Champlain Sea and inhibited by the Boundary Mountains. Since the dominant "exotic" lithic raw material in New England-Maritimes Paleoindian assemblages appears to be "Pennsylvania Jasper", we suggest that the most frequent direction of immigration and probably inter-regional contact was from the south.

Intra-Regional Lithic Distributions

We have suggested that a limited number of high quality lithic materials, whose sources appear to be distributed throughout the New-England-Maritimes Paleoindian region, occur in variable combinations and proportions in site asemblages within the region (see Table 8-1 and Appendix II). This pattern of lithic distribution indicates a high degree of mobility of some sort within the region. There appears to be no "cost" for travel in terms of decrease in proportion of stone with distance from the source, until an abrupt frequency fall-off is reached near the borders of the region. The mobility that created this pattern need not have been mobility of large

Table 8-1. Lithic raw materials in New England-Maritimes Paleoindian Region sites. (Percentages noted where possible, plus sign indicates presence).

	Munsungun Red cherts	Bull Brook chert	Neponset rhyolite	Cheshire quartzite	crystal quartz	Pennsylvania jasper
Wapanucket		95%				+
Neponset	1%	+	95%			+
Bull Brook I	+	85%				+
Bull Brook II		86.4%				1.4%
DEDIC		82%	14%			
Turners Falls						>70%
Dam	+	+		+	+	+
Michaud	30%	30%	40%			
Lamoreau	+	+	+			
Whipple		90%		9%		+
Vail	+	40%				+
Morss	95%					
Adkins	+	40%				20%

population segments, nor need it have been tied to a seasonal cycle of subsistence activities (discussion below).

We suggest that the movement of lithic material within a Paleoindian "region" was different in quality than the less frequent movement of pieces from far away into a particular region. Lantz (1984:213) uses the term "migration" to characterize Paleoindian behavior that transported lithic material from great distances. He states that Paleoindian knowledge of high quality lithic materials "seems more likely due to personal encounters with

various deposits, rather than a trade system being established at such an early date." We suggest that movement of lithics within a region was a result not only of the high mobility of at least a portion of the population, but also resulted from "trade" or "exchange", perhaps very informally, between people who interacted frequently. Movement of pieces inter-regionally over longer distances might have been a less frequent, although not unique, event rather than a reciprocal trade connection.

Except for the possibility of initial immigration into a region, it is difficult to analyze change over time within one Paleoindian region. The eastern Great Lakes sequence, from Gainey to Parkhill, does hint at settlement pattern changes over time that are reflected in shifts in lithic procurement patterns and site relationships (Storck various, Deller and Ellis various). However, when focussing on sites containing "classic" fluted points, there are few independent temporal indicators. At present we can only suggest the temporary nature of the Paleoindian regions as outlined herein, and suggest that time transgressive change in environment would cause part of the variability in lithic content that is recorded in the archaeological record.

Site Location Attributes

Many sites within the New England-New Brunswick Paleoindian region share a similar set of site location attributes. With currently only one exception, regional fluted-point sites (ignoring isolated fluted point findspots) are located on sandy soils. Near the coast, these sands generally derive from proglacial runoff deltas built into waters of the marine transgression that inundated coastal margins of northern New England circa 13,000 B.P. As the transgression ebbed, deltas were built at lower and lower elevations. Further away from the coast the deltas were built

into proglacial or meltwater lakes (e.g. Curran and Dincauze 1977). Often, these sandy deposits were blown into dune forms and stabilized by vegetation before Paleoindian occupation. The only sites in the New England-Maritimes Paleoindian region that are exceptions are the Munsungun chert quarry-related sites at the Munsungun-Chase Lake Thoroughfare, which are located on a landform interpreted as a kame terrace (Bonnichsen et.al. 1981,1982).

Approximately 5% or less of the land surface of the state of Maine is composed of sandy soils. The rest are till or clay-derived soils, Holocene alluvium or bedrock (visual inspection, Maine Geological Survey surficial map). A similar percentage of sandy soils is expected in the rest of the New England-Maritimes region. The location of more than 90% of the regional Paleoindian sites on a sandy substrait is, therefore, significantly non-random. These sandy soils are extremely well drained, which must have had an effect on their vegetation cover circa 10,500 B.P. In terms of their attractiveness to Paleoindians, we suggest two alternative hypotheses: (1) The sandy areas maintained more open vegetation associations as the rest of the northeast slowly overgrew with brush and forest cover, or (2) the sandy areas attracted pioneer or soil specific plant species not available elsewhere. At present, the pollen and plant macrofossil data are not sufficient to refine these hypotheses further. Sites on this type of terrain include the Michaud and Lamoreau sites, Dam, Bull Brook I and II, Wapanucket, DEDIC (Ullrick 1978), Whipple, Neponset, Turners Falls and Debert. The Vail site and several nearby smaller sites are located on valley side, lacustrine sandy soils.

It is seemingly significant that most of the sites, with the exception of the Vail site and possibly Debert, are located on sandy soils adjacent to a wet or boggy landform. It is not at present possible to reconstruct the conditon of any of these wet places at the time of Paleoindian occupation.

Similar associations have been noted for several other places where Paleoindian settlement pattterns have been examined (Judge and Dawson 1972, Storck 1982,1984, Lantz 1984). We currently feel that some plant or animal resource associated with these wetlands made it very desirable to camp nearby when a sandy campsite could be located. Such possible wetlands associated resources could be as mundane as cat-tail reeds (Gramly 1986) or as exciting as mammoth and mastodon (Fisher 1984a,1984b).

Judge and Dawson (1972) published the first systematic Paleoindian site location attribute study. All the Paleoindian sites in Judge's southwestern study area combine the attributes of an overview, a hunting area, and water source. Moreover, Judge detected subtle changes in settlement pattern between Folsom and later Paleoindian time periods. "The distinctiveness of the Folsom pattern, however, lies in the close proximity (vertically and horizontally) of the sites to water and in the key role of the playas as sources of water." This association of camping locality with special attributes (elevation) in conjunction with a water source attractive to game might be expected in the dry southwest.

Lantz (1984:210-211) reports similar attributes in a portion of his western Pennsylvania study area. On the glaciated plateau section of western Pennsylvania, Paleoindian sites and finds spots both are closely tied horizontally and vertically to lakes, marshes and abandoned river channels. Lantz suggests (1984: 216 with references) that this settlement pattern was influenced by mammoth and mastodon use of the swampy lowlands. In the unglaciated southern portion of Lantz's study area, there is less of a concentration of sites on elevations near water, suggesting to Lantz use of a more diverse fauna. Lantz also recognized a strong association between Paleoindian findspots and sites and low-order (small, upland) streams, with

proportionately less use of the major river valleys.

Sites in the New England-Maritimes region do indeed exhibit similarities among themselves in site location attributes. The Bull Brook and Bull Brook II sites occupy a sandy high spit, probably a delta remnant. Low ground around the site, which is currently being encroached by the Muddy Run and Egypt River, was probably the location of extensive wetlands during Paleoindian occupation of the sites. The Neponset site occupies a sandy soil area, probably a delta remnant. It is situated at the base of a hill, adjacent to a huge area of wetlands. The Wapanucket site occupies a sandy dune adjacent to a low area, which is now filled with water raised by a dam in a former lake basin. The DEDIC site lies on the foreset beds of a sandy delta built into glacial Lake Hitchcock, on sands blown into a dune form before Paleoindian occupation. Its association with lower, wetter ground is unclear on the USGS map of the area because of development. The Whipple site occupies a valley side sandy delta surface near a bog and low-lying marsh with small pond.

The newly discovered Dam site (Wayne, west of Augusta, Maine) is located on the sandy surface of a small lobe of a terminal Pleistocene delta, probably reworked by aeolian action into dunes before the Paleoindian occupation. Immediately adjacent to the east and south is a small stream and large bog. The Michaud and Lamoreau sites are on valley side sand dunes, originally formed by aeolian reworking of a sandy upper fascies of the Presumpscot Formation. Adjacent to these sites is a deep valley currently occupied by a beaver bog resting on top of 7 meters of saturated stratified fine sand and silty fine sand.

The Vail site is located on sandy, lacustrine soils which have been reworked to some degree by manmade Lake Aziscohos. In front of the Vail site lies the flat-bottomed Magalloway River valley (at low lake level).

The habitiation site, and killing ground #1 (Gramly1985) may be associated with a fossil river channel, or a stream channel connecting a kettle hole to the main channel.

The Debert site is located on a sandy outwash delta high above the existing Minas Basin. There does not appear to be any bog, pond, river or other freshwater source naturally occurring immediately adjacent to the main portion of the site (Spiess, personal visit to the site 1975). Section One, however, does have a possible bog association: "The area of the artifact concentration occurred on a low sand ridge higher in elevation by some six feet than the southern sections. Toward the southwest of Section One, this elevation falls off at a rate of six feet per hundred feet and enters a swampy area of willows and alders" (MacDonald 1968: 50). Although the spruce growth now obscures one's line of sight, in a less tree-covered environment the site's inhabitants might have had an excellent view southward and westward for many miles.

In sum, extant Paleoindian sites in the New England-Maritimes region, with the exception of quarry-related sites, are all located on sandy deposits of marine deltaic or lacustrine origin which have generally been reworked into dune formations, probably prior to vegetative cover and hence, Paleoindian occupation. The Vail Site remains the only exception to the phenomena of bog and wetland association with these sand-based site. Its location in a steep-walled river valley may indicate, per Gramly's interpretation, that this was a strategic area from which to intercept species such as caribou during their spring or fall migration. It is possible, then, that sites located on a sandy surface adjacent to a bog were desirable locations for exploiting non-migratory game or migratory game in a sedentary portion of their annual cycle.

Site Size and Content Attributes

However measured, the Bull Brook site is the largest site in the New England-Maritimes Paleoindian region. The Bull Brook site is composed of approximately 42 loci or "hotspots", which yielded roughly 8000 flaked stone tools. The 42 loci are arrayed in a rough semicircle of large diameter.

The Vail site was dug and analyzed as 8 loci (Gramly various), although the artifact plots of Locus E suggest the presence of two nearly equally-sized elliptical concentrations of tools. Moreover, Locus E contains nearly twice the number of tools as the next-largest locus. Thus, Locus E might be considered as two adjacent loci (or tool concentrations). The total tool count for the Vail site is very near 4000 (3935 as last published).

Debert contained 11 loci, with eight in a closely spaced array. Two Debert loci (D and E) were located 200 to 400 feet westward of the main array, and Locus One was located 800 feet northeastward. Like Locus E at Vail, MacDonald's plots of artifact locations for Locus F seem to show a northern and southern tool concentration, so the main section of the Debert site may include 9 loci as well. The total tool count at Debert is roughly 4000 artifacts.

Bull Brook II contained 6 loci and 487 artifacts; Grimes et al. state that the 6 loci were more closely spaced (less sterile space between) than the 42 loci at Bull Brook. The Whipple site has 3 loci and 136 artifacts; the Michaud site 8 loci (concentration VIII being considered disturbed soil from concentrations V and VI) with approximately 130 artifacts; the Neponset site has at least 3 loci and 200 artifacts. The Wapanucket 8 site provides incomplete data due to limited excavation and prior disturbance.

The DEDIC site was only partially surveyed (Ullrich 1978) but yielded evidence of 6 loci. A testpitting program recovered only a very small percentage of artifacts from the site.

There is a range of mearly 2 1/2 orders of magnitude (50-8000) in number of stone tools, but only 1 1/2 orders of magnitude (1 - 40) in number of loci among these sites. Thus, the range in number of tools per locus varies over roughly one order of magnitude, yet even the largest sites maintain the discrete spatial patterning with tols deposited in bounded concentrations. We feel (Spiess 1984) that internal site patterning such as exhibited by the non-overlapping concentrations of loci at Bull Brook, Vail and Debert could not be accounted for by 10 to 20 repetitive occupations of the "size" of the Bull Brook II site, or even more of smaller site size. A much more random distribution pattern should have resulted from many repeated small occupations as domestic structures were rebuilt, added or moved. Even the largest sites must have been occupied one or a very few times. Thus, there must have been some social or economic (food or non-food) factor causing either periodic or random larger population gatherings (eg. 40+ loci at Bull Brook) and/or longer residence within one pattern of campsites and activity areas (8-12 loci at Vail and Debert).

In terms of intensity of occupation, and considering that Locus F at Debert and Locus E at Vail actually consist of two tool concentrations, the number of tools per intact concentration ranges from roughly 100 to 648 at Debert, roughly 60 to 230 at Vail, and roughly 70 to 270 in a sample of 6 loci at Bull Brook (Grimes et al 1984). Bull Brook II yielded 50 to 120 tools per locus, and therefore was roughly similar in intensity to the Neponset and Whipple sites. The Michaud site yielded between 1 and 20 tools per locus.

To date, there does not appear to be a regular pattern of site size or intensity of use correlating with geographic location. The largest sites (Vail, Bull Brook, Debert) appear widely separated. We also note that there is NOT a continuum of site size: there are approximately 8000 tools at Bull Brook (I) and 4000 tools each at Debert and Vail. The next largest site, Bull Brook II, contains about 500 tools, a drop in total occupation (as measured in tools finding their way into archaeological context) of an order of magnitude.

One subtle geographic pattern emerges from these data. Many of the sites in the New England-Maritimes study area occur as site clusters or site pairs. The Michaud and Lamoreau sites are an example which share a common suite of lithics. Another association includes the Bull Brook I and Bull Brook II sites, which share a common suite of lithics. The Vail site has at least 5, possibly more, smaller Paleoindian sites in geographic proximity. We argue that Section One at Debert, separated as it is from the other loci by 800 feet and with a significantly different suite of lithics, represents an analagous associated but geographically displaced site. The presence of the mineral pigment pyrolusite in Section One and in none of the other sections supports this suggestion, as does its slightly different topographic location. The presence of tools and debitage of significantly different raw materials composition than that recorded for the rest of the site also segregates the locus from the main portion of the site.

In all these cases the small-site:larger-site association may represent a smaller occupation followed (shortly, perhaps seasonally or within a few years) by a larger occupation in the same vicinity, or vice versa. We shall call this concept the "satellite site" phenomenon. At least Paleoindians did not use the very largest sites (Vail, Debert, Bull Brook) without precedent or without followup (or both). It is perhaps logical that the

satellite site may be precedent to the larger site of the pair. Transmission of information concerning a successful kill from this initial settlement, or only about the availaibility of game locally, to the regional population may then have resulted in a major gathering. An alternative to this economic hypothesis is that the larger gatherings were planned primarily for social reasons, without economic constraint.

The Michaud and Lamoreau sites, apparently, prove that not all multiple reuses of a small geographic area resulted in, or followed, a major gathering. Perhaps the Michaud and Lamoreau occupations reflect (seasonally?) different short term occupations. We suggest that the inhabitants either (1) were a family(s) or small group(s) who were moving during a time of the year when the population segmented for the acquisition of widely dispersed resources, or (2) were task groups sent out from a major encampment for the purpose of observing or procuring game, obtaining lithics or some other resource which need not involve the participation of the entire population. We have suggested that the location of the Michaud and Lamoreau sites directly above the headwaters of the Royal River (Chapter 1) may be indicative of the area's position on a travel corridor from the coastal plain into the interior. Small groups may have met at the Michaud and Lamoreau sites on this known route or have occupied the site at different times because the physical characteristics (sandy soil and associated bog) were desired locational attributes.

Stone Tool Kits

In this section we consider some of the processes responsible for the appearance of stone tools in archaeological context. The goal is to explain considerable variability in stone tool assembalge content between loci within each site and between sites. We do not assume a 1:1 tool use and

task performance relationship with tool recovery in the region's Paleoindian sites. We suggest that there are three main processes by which material in these assemblages gets deposited. First, material may have been discarded during the manufacture or resharpening of stone tools, resulting in the production of flakes, microflakes, preforms broken during manufacture, and the discard of spent tools whose replacement was imminent. For example, broken or heavily resharpened fluted points could have been discarded from a haft as a replacement for them was made. Secondly, tools for which a duplicate or a replacement already existed may have been discarded in a work area as their size was reduced below the threshold of usefulness and/or their working edge became dulled and steepened beyond the point where resharpening could reinstate a useful edge. Some of the endscrapers with advanced step-flaking may fall into this category. Thirdly, there is simple loss (misplacement, with unsuccessful attempt to recover) or abandonment (including caching with intent to retrieve later) of tools that had not been broken and had much use left in their existing edges, or much potential for resharpening or reworking into other tools. Seemingly, many of the large sidescrapers fall into this last category, as they would certainly at least represent a reservoir of raw material that could have been used if the need were there.

The use of a stone tool, its breakage, end of useful life, discard or simple laying aside, may or may not occur congruently with the manufacture of a replacement piece (see discussion of Gramly 1980, below). To some degree, however, the coincidence of such activities within each locus at a Paleoindian site should be testable. The killing ground at the Vail site (Gramly 1984), for instance, reveals the use of fluted points at one locality, the curation of broken hafted proximal ends, and their return

to a second locality for replacement.

We do not assume that there was a one-to-one correspondence between use of a single stone tool and a single task. For example, production of a set of snowshoes (if present in the technological repertoire) must have required the use of at least 3 or 4 stone tools or tool edges: one for splitting wood, one for whittling (scraping), one for making holes and one for cutting rawhide line. Thus, there was often a suite of tools habitually used for a task.

Based on Osgood's (1940) ethnohistoric data, it can be demonstrated that different types of tools have different lifetimes of usefulness. Some simply wear out more quickly and must be replaced more often. All other things being equal, we would expect to find tools with short use lives more often in archaeological context than we would tools with longer useful lifetimes. Thus, the tool prportions recovered by the archaeologist will reflect not only the frequency of the tool in the original kit and its frequency of use, but its shorter or longer use life as well. Thus, a given task repeated many times over with associated tol maintenance and replacement, will yield an average signature of tool proportions diagnostic of that task. The statistics of sampling, however, will create some variabiltiy in the tool assemblage deposited into archaeological context, especially among short-term deposits originating from the same activity. (Additional sampling problems occur during archaeological recovery, of course.) Thus, we cannot expect a characteristic signature from any given task performed during short-term occupation, but can hope for an assemblage that is interpretable. We believe that the "toolkit" from Concentration I at the Michaud site is, for example, a signature for fluted point replacement and some sort of associated activity (possibly hafting, making foreshafts or shafts). There are discarded broken fluted points, mis-made

fluted preforms, unutilized channel flakes, numerous biface thinning flakes, endscrapers used to scrape (?) wood, concave scrapers, limaces, and rough stone tools.

Consideration must also be given to the context of discard as well as to the content of discard. Keeley (1982: 800) suggests that hand-held tools are most often discarded at the location of their use and are generally not curated. Hafted tools, because dislodging the stone implement from the haft often requires some special effort and more time, are more often found discarded in a location other than where the tool was last used. Interestingly, he states (1982: 800) that "because the handle or shaft is usually more 'expensive' than the tool that arms it, it follows that the former would be regarded as especially valuable, and therefore highly curated and carefully conserved, while the hafted tool would be replaced several times during the use-life of the haft". Thus, careful examination of the tool associations within a site locus should yield information on the context of discard or loss.

Following the logic presented above, we may be able to decipher some of the tasks performed at shrot-term activity areas on one site. Those tasks, of course, would have varied from site to site for a variety of reasons. We suggest that variability in the performance of tasks within a Paleoindian region over a short time resulted from : (1) seasonally variant activities, (2) geographically variant activities, (3) scheduling of activities relative to lithic supply replacement, (4) seasonally and geographically random activity, associated with "windfall" resource procurement for example, and/or (5) duration of occupation. Seasonally focussed activity in arctic culture includes the production of winter clothing in fall, production of transportation equipment (kayak, sled, toboggan, snowshoe) at appropriate

season, repair of skin tents with the approach of summer or winter (with appropriate cover), and manufacture of many items seasonally when some raw material (root, wood, bark, bone) is available or "best" in quality, and/or when certian working conditions (use of small outdoor fires for charring wood, for example) are available (e.g. Osgood 1940). There is no guarantee that Paleoindians in the New England-Maritimes region were operating on a seasonal schedule, but it seems probable , as all ethnographically known arctic, subarctic, or north temperate hunter-gatherers seem to have done so to greater or lesser degree.

Geographically focussed activity may have included the preparation of boats when near large bodies of water, or the harvesting of plant resources (wood, bark, roots for lashing, reeds for weaving, or food resources) when near or in certain "patch types" in the environment, wherever located. It is probable that the harvesting of certain faunal resources was also geographically focussed. An example is the postulated focus on boggy or marshy localities in a portion of our study region, possibly for trapping and killing proboscidians or other fauna.

It is only when geographic variability and seasonal variability covary in parallel over spans of time longer than a few years that a true "seasonal round" can be established. At present there is little or no evidence (discussion below) that we can detect such a construct during classic fluted point Paleoindian in our study area. Perhaps the decoupling of geographic and seasonal variability is an apt characterization of the "free wandering" mode of life postulated for Paleoindian so long ago (Beardsley et al 1956).

Gramly (1980) postulates an effect which may be a third source of variability in the stone tool record. He hypothesizes that curated tools (sensu Binford 1976) are pushed to their limits of resharpening and usefulness, to be replaced at annual visits to chert (or other

cryptocrystalline lithic) quarries. There the archaeologist finds these discarded "class III" tools, often of exotic raw materials , where they were replaced by newly made objects. Gramly's example is the Mount Jasper rhyolite source in Berlin, New Hampshire, a quarry used beginning in Middle Archaic time. When writing about West Athens Hill (1980:829), a Paleoindian quarry-workshop-(?)habitation in eastern New York, Gramly notes the much lower proportion of Class III tools made of exotic cherts there than at Mt. Jasper. He postulates either frequent Paleoindian visits to quarry sources, or that "journeys to other provinces and lithic sources may have lasted a shorter time than it took for the complete tool kit to become worn and in need of replacement." Gramly's Mt. Jasper work immediately preceeded his Vail site work, thus he naturally transferred the view of hunters arriving at a quarry with an exhausted tool kit to his Vail site analysis (Gramly 1982). The Vail site is situated less than thirty miles from a chert source. Our reexamination of the Vail collection, however, has produced several lines of evidence that lead us to question this hypothesis in regard to the tool assemblage present at the Vail site. In any case, nearness to a quarry source, or a sudden infusion of new raw material into the "economy", could have caused extensive tool replacment activities which would influence the Paleoindian archaeological record.

Our model of New England-Maritimes Paleoindian transhumance (below) tends to support Gramly's (1980) hypothesis of several to multiple Paleoindian visits to chert sources every year. Moreover, only roughly 2 kg. of cryptocrystalline rock was "used up" by the occupations at the Michaud site. Assuming that the occupations lasted a few weeks by several families, and assuming that the Michaud site is "average" for lithic loss rates, then total annual lithic use per family of cryptocrystalline rock may

have been on the order of magnitude of 10 kg. Obtained several times a year, and carried as biface blanks or large quarry flakes, this rate of expenditure of cryptocrystalline rock would not have been a tremendous burden to maintain.

Length of occupation at a site would also have necessarily been a factor influencing certain activities and thus the stone tools deposited therein. The production of items requiring a substantial amount of time, such as the construction of a toboggan or boat, may have been carried out at campsites which were occupied for longer duration. The presence of drills at the larger regional sites such as Bull Brook, Vail, and Debert, and their absence at many of the smaller sites, may be an indication of their use in "long term" tasks. Their absence or limited presence in smaller sites may also indicate that they were a minority tool which did not as often find its way into the archaeological record. However, they are present in less than expected frequency, or are absent altogether, at sites other than the largest ones. Certain tasks, such as fluted point replacement, appear to have been frequent activites which were not related to length of occcupation.

Finally, tool kit content and use might have changed slowly over time, as tool forms were modified or new ones invented. Such change could be a gradual response to environmental change, in the sense that some activites were no longer as frequent and new ones were invented. Thus, chronological change may be a source of variation in the record as well.

As an effort at intersite comparison, in an attempt to "crack" the Paleoindian adaptation pattern puzzle in the study area using lithic analysis, we examined any available data on stone tool type counts and frequencies, and tool status (fragmentation, etc.). Data were collected for each locus on a site where possible, because of the recognized inter-locus variability in each site. It became immediately apparent that a

comprehensive, detailed description of each stone tool assemblage, including raw material, fragmentation, pot-lidding, and use-wear had not been inclusively published for any of the larger assemblages available for comparison. There is a general lack of such information as: which portion of a fluted point was present when counted as a fluted point; whether it had been broken during manufacture or during action, or simply mislaid; what was made on retouched flakes; whether or not channel flakes were utilized, etc. Even more limiting, we found a non-congruence in classification of stone tools into named tool types. Gramly's "cutter" category, for example, contains objects designated in other reports as endscrapers with spurs, gravers, and (his new identification) snapped pieces. Often channel flakes were not counted and limaces were not consistently reported. We are limited by these factors to comparing data on fluted points (undifferentiated), endscrapers, sidescrapers, drills, piece esquillee, and occasionally, flake:tool ratios.

Even with these severe limitations, some interesting patterns emerge. Tables 8-1 through 8-5 present locus-by-locus tabulations for Michaud, Bull Brook I and II, Debert, Whipple and Vail. Table 8-6 presents range (among loci) and mean frequency data for these five tool types only. The small samples from Michaud (Table 8-1) make standard errors on the proportions large (not calculated). However, the contrast between Concentration I, interpreted as biface manufacturing, and Concentration III, dominated by sidescrapers, is apparent. The homogeneity apparent in Concentrations IV through IX is masked by missing tool types and small numbers, but it is apparent in the summation.

We have previously discussed the variation evident in site size in the New England-Maritimes Paleoindian region. Here we will examine assemblage

variability in relation to site size, first among sites of roughly similar proportions and then between sites dissimilar in size.

Bull Brook remains the largest Paleoindian site in the region. However, since Vail and Debert are an order of magnitude larger than any other regional Paleoindian site, we will compare these three as one group of "large" sites. Among the tool classes chosen for comparison, both endscraper and fluted point percentages are roughly equivalent in each of these sites. Endscraper proportions range from 43-55% and fluted point densities (unknown stages) average from 5-8% of the comparable assemblages. Drills are present at all three of these sites in low frequency. (Stylistic variability in drill bit form has already been discussed in Chapter 3). Locus C at the Vail site displays an uncharacteristically high proportion of drills, several of which were found in proximity to fluted points, biface thinning flakes, an endscraper, cutter, and in one instance, a limace. It would be hard to draw any conclusions about the associated tool types without a much greater familiarity with the entire assemblage and the methods used in generating the presented information. The high proportion of drills in a single locus does, however, suggest focussed activity. The explanation may be as simple as a particularly proficient drillmaker who periodically replaced the drills of a number of inhabitants or, on the other hand, may involve the production of specialized gear which required the use of many drilled holes.

It is when examining the proportions of piece esquillee and sidescrapers, however, where major differences between sites become apparent. The mean frequency of pieces esquillees at Bull Brook is 9.16%, with the largest proportion per locus measuring 21.43%. At Vail and Debert, mean piece esquillee incidence was 36.84% and 26.20%, respectively, while the the greatest proportion of this tool in a single locus is well over 50% in

both cases. Sidescrapers as well show significant variation in frequency between Bull Brook and Vail and Debert. Bull Brook shows an average incidence of 40% at the sample loci, while the averages for Debert and Vail are between 7% and 8%.

In sum, while some tool types are present in approximately the same frequencies among the largest Paleoindian sites in the New-England-Maritimes Paleoindian region, the incidence of both pieces esquillee and sidescrapers are disproportionate between Vail and Debert (as a pair) and Bull Brook.

We will next consider sites in the medium size range together with satellite sites of the larger sites, because in most cases these satellite sites are either an order of magnitude smaller than their larger relatives in terms of the number of loci present or in the density of artifacts per concentration. Bull Brook II falls into this category, as does Locus One at Debert, and the Vail related sites in the Magalloway Valley. Unfortunately, we have only limited information about the Vail satellite sites, but such as it is, we present it here. Sites located in close proximity to the Vail site include the Adkins site, Morss site, Wight site, Site A, and Site B; all are composed of one locus each, with a tool density per site of several tools to approximately one hundred tools (Gramly personal communication). Relatively high percentages of both endscrapers and pieces esquillees are found in all of these sites, in parallel with the Vail Site. Drills are absent from all of these sites. Fluted points are present in various but always relatively low proportion. Although the average depth of the basal concavity varies somewhat between sites, it generally attains a depth similar to that for the mean for Vail points. Coupled with a definite similarity in other fluted point attributes, it can be reasonably stated that all of these sites are "related". Of particular interest is the stone-

lined cache pit recorded and recovered from the Adkins Site. It suggests that the inhabitants left the area with the intent to return, and that they left during a season when they expected stored meat to remain edible.

Bull Brook II represents an assemblage dominated by endscapers, with a mean per locus presence of 79%. A small number of sidescrapers were recovered from each locus, as were a small number of pieces esquillees. A total of six fluted points were recovered from three of the six loci; seventeen biface preforms and fragments as well as a substantial number of biface thinning flakes attest to the significance of fluted point manufacture at the site (Grimes et al 1984: 163-165). Drills are completely absent from the site assemblage. Interestingly, only a single hammerstone completes the rough stone component at Bull Brook II, providing a possible example of the exclusion of activity related to abrading and/or chopping functions.

Locus One at Debert is rather small in comparison to the Bull Brook II site, but is actually roughly proportionate in the total number of tools recovered in comparison to the number of tools recovered from the main site (136 in Section One, 4,000 total for the Debert Site; 335 at Bull Brook II, 8,000 at Bull Brook). "In the artifact assemblage (for Section One) pieces esquillees hit their peak at over 27%, while bifacial artifacts including points was a low 1.5%. In general, it can be said that tool manufacture and maintenance was almost negligible on this floor (MacDonald 1985: 52)." Endscrapers are also present in considerable proportion, although certainly not in the dramatically high percentages present at Bull Brook II.

In sum, a potential correlation exists between the satellite site phenomena at the Debert Site (Section One) and at the Vail site (Atkins Site, etc.). Dramatic similarities in tool attributes and proportions of specific tool types at the main sites, coupled with the similar number of

loci in each site (assuming that Sections D and E at Debert are tool manufacturing areas), suggest that the groups who occupied the Debert and Vail sites may either have been related or were actually the same group temporally displaced. Bull Brook II seems to represent the same phenomena of satellite site, but rather in relation to Bull Brook.

The Upper and Lower Wheeler Dam sites reported by Gramly are located in a river valley north of Lake Aziscohos where the Vail and its related satellite sites are located. Although these sites have been tested but not thoroughly excavated, a pattern of site use similar to that at the Vail site may be emerging. The Lower Wheeler Dam Site (Gramly personal communication) has yielded to date an assemblage from multiple loci which includes over 600 pieces. The Upper Wheeler Dam Site, on the other hand, appears to be the smaller, possibly a satellite of the Lower Wheeler Dam Site. Anticipated analysis of the existing collections by Gramly should prove most interesting as the information generated is compared with other regional sites.

Other sites of apparently "medium" size but without known satellite sites include the Neponset Site just west of Boston, the DEDIC site in Deerfield, Massachusetts and possibly the Turner's Falls site in western Massachusetts. Unfortunately, thorough analyses of these sites are not available.

Sites of small magnitude which are apparently unrelated to larger sites have now been noted for a number of locations in the New England-Maritimes Paleoindian region. Included under this heading are the Michaud and Lamoreau Sites, the Dam Site, the Whipple site, and possibly the Windy City and Fluted Point sites in the Munsungan Lake region.

As mentioned in Chapter 6, the Michaud site contains two distinct

areas. Area A was comprised of three tool concentrations, one which was dominated by fluted point manufacture and one which contained mostly sidescrapers, separated by a concentration containing few formal tools but a small amount of red ochre and a significant proportion of debitage. Section B, on the other hand, contained five small tool concentrations which were composed of roughly similar assemblages including generally a fluted point fragment, some bifacial debitage, a graver/perforator, a sidescraper and endscraper and a number of utilized flakes.

The Lamoreau Site remains unexcavated, although testing done in the fall of 1986 suggests that the site is of approximately the same magnitude as the Michaud Site i.e. very small with several dense concentrations of tools and debitage separated by sterile soil. An insufficient number of tools have thus far been recovered to reveal significant tool percentage relationships.

The Dam Site was thoroughly excavated in the spring of 1986. Although distributional data are not exact due to deflation of the sandy soil and because of soil displacement by sheet runoff movement though portions of the blown-out sandy area, an interesting, small assemblage was recovered. A single fluted point and a second fluted point base were present, along with several endscrapers and sidescrapers, several gravers and "snapped pieces", and a number of utilized flakes. A complete analysis has not yet been undertaken, but subjectively determined tool proportions are presented here. One complete fluted point which had been broken at mid-section, and a fluted point base, complete the biface inventory. No preforms and very few biface thinning flakes were recovered, suggesting that fluted point replacement was not a primary occupation at the Dam Site. Endscrapers and sidescrapers were present in nearly equal proportions. Drills and pieces esquillees were absent. The raw materials from the site are diverse, and are

from seemingly such widely separated localities as eastern New York state, the Champlain Lowlands, Central Vermont, Pennsylvania, Nova Scotia and northern Maine.

The Whipple Site produced approximately 136 artifacts in three loci. Interestingly, considerable amounts of debitage were recovered, suggesting large scale reduction of lithics suspected to come from western Vermont. The formal tool inventory includes most of the known Northeastern regional Paleoindian tool forms; particularly notable in this small collection are a single fluted drill and several pieces esquillees, which are usually absent in sites of comparable size. Distribution of tool forms among loci is uneven, as are the percentages of raw material types. These internal inconsistencies have led the author (Curran 1984: 14-15) to speculate on functional and perhaps temporal differences between loci. It is also possible in a small site of this nature for the inhabitants in different loci to have had different functional requirements and/or tools in various states of their use-life which would not have all been discarded during the performance of the same short-term activity. It is difficult without examining the collection and distributions to assess whether or not the composition and size of discarded lithics is of significance.

Discussion

Site size, coupled with the distribution of specific intrasite assemblage attributes over the New England-Maritimes region, suggest the possibility that at least two bands of fluted point using Paleoindians, which were either temporally displaced or entirely different populations, inhabited the area. We here cluster the Vail and Debert sites as one group, including the satellites of Vail from the Magalloway Valley area, based not only on consistent congruence of fluted point form and similarity of other

tool forms, but on the basis of major site-satellite site size relationships. The main sites at Vail and Debert (excluding Section One at Debert and considering it as a separate occupation, and considering Sections D and E as tool replacement areas rather than habitation loci) are quite similar both in the number of loci occupied and in the number of tools discarded overall. The consistent relationship of a single locus satellite a number of times in the Vail Site locality and seemingly once at Debert provides another interesting analogy. The absence of sites displaying the distinctively deep based fluted points in the New England-Maritimes Paleoindian region south of the Magalloway Valley, and their occurance to the northeast at the head of the Bay of Fundy, may in time provide some temporal-economic clues to be used in conjunction with more detailed micro-environmental data in reconstructing the particular adaptive pattern of these people in the regional Paleoindian picture.

In the same way that the former sites appear to cluster, so also do Bull Brook, Bull Brook II, and probably Whipple, DEDIC, the Turner's Falls site and possibly a number of others. The fluted points from these sites fall within an overlapping range which is distinctly different from the range of attributes displayed by the Vail-Debert group. A proportionately higher incidence of sidescraper use for the Bull Brook group, coupled with the proportionately lower frequency of pieces esquillees further segragates the two groups.

Site locational attributes also display some subtle differences: all of the sites of the Bull Brook group are located on duned sandy deposits associated with wetlands of varying magnitude. Section One at Debert shows this association, but the main site, although located on duned sand, is not significantly juxtaposed with a bog or other wetland. The Magalloway Valley sites are located adjacent to the early Holocene course of the Magalloway

river which Gramly (1982) has postulated to have aided early hunters in directing game movements. The Magalloway River and associated valley, however, might not have supported the same faunal and floral communities as would a bog or wetland.

Site size associations provide another possible pattern relevant to this discussion. Bull Brook II is comprised of six loci. While other sites postulated to belong to the Bull Brook group are probably not this large, none are limited to single locus. As Bull Brook represents the largest Paleoindian site in the New England-Maritimes Paleoindian region, so also do its apparently related sites contain multiple rather than single loci.

It is difficult to postulate seasonal or otherwise repetitive patterns of movement for the Debert-Vail group. However, the Bull Brook group appears to have utilized a corridor west from the Massachusetts coast, up the Connecticut River Valley and into the Champlain Lowlands of western Vermont. It is possible that this was an ephemeral part of a "seasonal round" based on a relatively short period of resource stability. Alternatively, the sites distributed to the west and north of the Bull Brook Site may represent parts of a much more complex pattern of land use, group mobility and social segmenting, as well as resource procurement.

The Michaud Site does not belong with the Vail-Debert group, nor does it fit comfortably into the northwest-southeast "seasonal round" model presented above for the Bull Brook group. Fluted point style and composition of the tool kit, however, suggests that the Michaud Site is more closely related to some phase of the regional occupancy by the Bull Brook group. An alternate or expanded north-south route utilizing the coastal plain may also have been a part of the patterns of movement of at least portions of this

band. As we shall now suggest, Paleoindian regional movements may have been highly influenced by rapidly changing post-Pleistocene environmental conditions.

The Larger Picture

The New England-Maritimes Paleoindian region vegetational and climatic paleoenvironment has received several extensive reviews (Curran 1986, Davis and Jacobson 1985, Curran and Dincauze 1977, Parent et al 1985, Jacobson and Grimm 1986, Gaudreau 1986, Webb 1986). Regional climate was influenced by atmospheric circulation around the Laurentide ice sheet into the terminal Pleistocene (circa 10,000 B.P.). Following 12,000 B.P., vegetational change over the region, and colonization of deglaciated terrain, was rapid. Relative stability was achieved after the Pleistocene-Holocene boundary. For the period circa 11,000 to 10,500 B.P., not only was the vegetation cover changing rapidly, but it was very "patchy": diverse on an appropriate geographic scale. For the study area during "classic" fluted point maker occupation, there would have been dense coniferous forest with more hardwood inclusions further south, less dense forest (parkland) or more open terrain (tundra?) further north and at higher altitude. There is no concensus concerning which environmental subtype(s) the Paleoindian adaptation favored. Curran and Dincauze (1977) postulate they favored more closed forest over more open parkland or tundra.

Faunal resources available to Paleoindians included at least caribou, beaver, mastodon and mammoth circa 11,000 B.P. Caribou and beaver have been specifically identified from Paleoindian context (Spiess, Curran and Grimes 1985). Mammoth and mastodon of appropriate age are known for the study area (Grimes, pers. comm.). We decline at this time to reconstruct the type and range of caribou behavior in this diverse and rapidly changing

environment.

The question of timing and extent of human use of proboscidians (mammoth and mastodon) in eastern North America has been debated for nearly 150 years. Bonnichsen et al (1985) and McNett (1986) present the most recent restatements of the view that fluted-point using populations in the northeast were not adapted to hunting these "megafauna" that went extinct during the terminal Pleistocene. Bonnichsen et al. (1985) hypothesize that fluted points were an invention that postdates the megafauna extinction, were designed to hunt caribou or other herd animals (1985:156-7), and that they were the product of intensified craft specialization. Apparently Bonnichsen et al (ibid 156) rely on dates of between 12,000 and 11,000 years for the extinction of the diverse terminal Pleistocene fauna in Appalachia, and state that the "final extinction of Pleistocene mammals of northern New England coincided with the demise of the ice cap, although the two events are probably not directly related." They (1985:156) then state that the post-extinction economy in northern New England focussed on caribou hunting. "It seems likely that caribou represented the greatest food resources available to human hunters and gatherers in post-extinction times. A switch to an economy of caribou procurement would have caused the least disruption in life styles.... Humans probably responded to the new opportunities presented by the larger herds [of caribou] by restructuring their social organization and by adjusting their tool-making repertoires." "On a seasonal basis, large bands of people may have formed for communal hunts of a single prey species." (See also Spiess 1984,1979). One implication of the hypothesis that fluted point introduction or invention in the northeast postdates the demise of mammoth and mastodon is that fluted points will not be found in association with these beasts and that the latest chronological date on them will predate the earliest fluted points. There is some evidence

that fluted points have been associated with mastodon, at least, and that mastodon were one major focus of Paleoindian economic effort for at least part of the time of fluted point manufacture in the northeast.

The Kimmswick site (Graham et al 1981) in Missourri establishes fluted-point mastodon association in the mid-west. A team of paleontologists and archaeologists working for the Buffalo Museum of Science has recovered a fluted point in association with a level containing mastodons and other extinct Pleistocene fauna at the Hiscock site in western New York (Laub 1986). As more circumstantial evidence, Fisher (1984) reports human butchery on a Michigan mastodon. Elsewhere he (Fisher and Koch 1983) reports seasonal differences in death between a large sample of unutilized (natural death) and butchered (?killed) mastodon, with the butchered mastodon being mostly fall kills and the natural deaths being mostly spring deaths.

There is, moreoever, an unpublished partial recovery of a mastodon specimen from a farm pond about four miles from the Bull Brook site, including a talus and ulna (?). Spiess has inspected the specimen, and feels that one clear mark on the dorsal articular surface of the talus was made by impact from a sharp instrument before mineralizaiton of the bone. Grimes (pers. comm.) has recently obtained radiometric evidence of the probable contemporaneity of mastodon, mammoth and fluted points in the New England-New Brunswick Paleoindian region.

Thus, circumstantial evidence appears to falsify the hypothesis, and we here present an alternative: mastodon hunting (at least, if not mammoth as well) was indeed economically important in the northeast, including northern New England, during at least some of the time during which fluted points were manufactured. We hypothesize that the site location attributes of Paleoindian sites in the southern portion of the region, specifically the

combination of a well-drained camp location on sandy soil and a nearby bog or wetland, was focussed on either the expectation of, or the successful completion of, mastodon hunts.

It is axiomatic in hunter-gatherer studies that the larger the prey body size, the more likely it is that a camp will be moved to the kill location, than vice versa. Thus, mastodon need not have been frequent prey, or even the dominant prey year round, to have had a major effect on settlement pattern. It should be noted that the Debert and Vail sites, while located on sandy soil, do not share this pattern of association with boggy terrain. Gramly (1984) has already discussed the location of the killing ground associated wtih the Vail site, adjacent to what appears to be a shallow fossil stream or river channel, as a herd herbivore ambush location. MacDonald has opined that the Debert site location also makes sense in terms of intercepting caribou.

Caribou have been identified from the Bull Brook and Whipple sites (Spiess, Curran and Grimes 1985). Beaver bone has also been identified in the Bull Brook sample. However, the Bonnichsen et al. statement that "the remains from the three largest Paleo-Indian sites in the northeast support the hypothesis of a post-extinction readaptation to caribou hunting (1985:158)" is overstatement. Caribou have been identified in two faunal collections from the southern end of the study area. This fact says nothing about the extent of the adaptation to caribou hunting, since unfortunately the faunal samples were meagre. Nor does it eliminate the possibility that caribou were a short-term focus in an economy using several other faunal resources (as well as floral resources). We do, however, agree with Bonnichsen et. al. that the environment of the study region underwent rapid change during the time that fluted points were made. But the details of behavior of mastodon, caribou and other possible faunal focal points of the

Paleoindian adaptation, and their change seasonally, chronologically and geographically, are very poorly known.

The largest Paleoindian sites (Vail, Bull Brook and Debert) must have been supported by either a concentration of food or a surplus gathered and stored in anticipation. The latter option seems unlikekly. Thus, we assume that the largest sites were supported by a successfull communal hunt of medium-sized herbivores (caribou probably, muskoxen, or possibly horse), or succcessful killing of very large packages of meat and fat (probocideans), or both. Whether such events were attempted regularly on a seasonal or geographic basis is unknown. The alternative is that such events were opportunistic, or were rare events during one season of the year, occurring perhaps once in many years.

In any case, the extreme size range of Paleoindian sites in our study area, coupled with the regularity of site location attributes (sandy soil, often near bog) is evidence against the hypothesis of fluted point Paleoindians as generalists (Dincauze and Curran 1983). We would expect to find generalist's sites in a wider variety of location types, and we would not ordinarily expect them to have a "focal" economic component necessary to supply a large residence group.

As stated above, there is no obvious regularity to the regional pattern of site size and lithic raw material content. We have spent some time considering hypotheses related to the idea (John Grimes, pers. comm.) that the lithic raw materials recovered from sites, coupled with a consideration of "used up" tools versus plentiful raw material, would inform us of some sort of cyclical pattern of movement within the study area. However, we do not perceive any sort of cyclical pattern in the data. The lithic raw material associations are not dependent upon nearness to quarry source,

northerness or southerness within the sutdy area, or any regularity with respect to dominant tool type. Consider the Bull Brook I site and the Turners Falls site, the former dominated by a Champlain Valley chert and the latter by Pennsylvania Jasper. While it may seem logical to explain the Michaud Area A assemblage as southbound folk who had just visited the Munsungun and (?!) Champlain Valley sources, and Area B as northbound folk who had stocked up on Neponset rhyolite, there is no logical way to explain the long distance transport of chert over more than 500 km. northbound to Turner's Falls from Pennsylvania, or southeast bound to the Bull Brook site from northern Vermont, as part of a regular seasonal pattern.

However, the lithics must be informing us of human movment at some level. We are left with the following hypotheses: (1) movement of the entire Pleoindian population within a region was or was not part of a regular seasonal cycle of subsistence activity (a repeated, coupled geographic and seasonal movement pattern). MOreoever, either the whole population made journies to lithic sources, or some smaller segment of the population made such journies. In either case, there was a portion of the population which did have the resources and reason to travel very long distances specifically to transport masses of cryptocrystalline rock. Thus, large amounts of lithic were "injected" into the tool production, wear and discard cycle based on the travels of this segment of the population. This hypothesis essentially states that lithic procurement was "decoupled" from subsistence activity to a great degree, and possibly was decoupled from the movements of the mass of the population. There must, or course, have been some adaptive reason for this behavior, be it a strictly functional, economic, or social one, but the reason for procurement was not based upon cyclic proximity to one or more lithic sources.

Finally, we would comment on the possiblity of time-transgressive change

in lithic tool form and use, coupled with environmental change. Bonnichsen et al (1985) suggest that mastodon and mammoth did not survive to see fluted points used in the study area. We disagree that extinction occurred before fluted-production in the Northeast, but maybe it occurred during the time of fluted point production. The general outlines of vegetational change during the time period are also known: northward transgression of the forest. In the eastern Great Lakes, Deller and Ellis and others have commented on the supposed northward shift with passage of time between Gainey-point lithic procurement focus and Parkhill Phase lithic procurement. In the New England-Maritimes Paleoindian region, we may be seeing a similar phenomenon in a northward shift from the Bull Brook Phase to something like the Vail (and Debert) sites. Neither of these latter fully fit the dominant regional site location model of sand dune adjacent to bog or water, although there are similarities. Moreover, their tool kits are distinctive, not just in the basal form of fluted points, but in the reduced percentage of sidescrapers and presence of pieces esquillees in great quantity. We are suggesting that some of the variability in site location and lithic assemblage style and content dimly percieved <u>within</u> the New England-Maritimes Paleoindian region may be chronological, and may be recording adaptive shifts to the changing environment, in particular to megafauna extinction.

Table 8-1

Michaud	FP	Ends	Sides	Drill	PE	Total
Concentration 1	4 66.6%	2 33.3%	0	-	-	6
Concentration 2	0		1	-	-	1
Concentration 3	1 12.5%	2 25.0%	5 62.5%	-	-	8
Concentration 4	1 50.0%	-	1 50.0%	-	-	2
Concentration 5	2 40.0%	-	3 60.0%	-	-	5
Concentration 6	1 33.3%	2 66.6%	-	-	-	3
Concentration 7	0	1 50.0%	1 50.0%	-	-	2
Concentration 8	(Added to 5)		___	___	___	___
Sum 4-8	4 33.3%	3 25%	5 42.0%	-	-	12

Table 8-2

	Fluted Points	Ends	Sides	Drill	PE	Total
Bull Brook I						
Locus 6	0	14	20	0	1	35
	0.0	40%	57.14%	0.0	2.85%	
Locus 10	0	33	25	1	3	62
	0.0	53.22%	40.32%	1.61%	4.83%	
Locus 36	1	10	11	0	6	28
	3.57%	35.71%	39.28%	0.0	21.43%	
Locus 18	2	50	24	0	7	83
	2.41%	60.24%	28.91%	0.0	8.43%	
Locus 2	2	5	12	1	2	22
	9.09%	22.73%	54.54%	4.54%	0.09%	
Locus 32	3	38	23	0	2	66
	4.54%	57.57%	34.85%	0.0	3.03%	
Locus 27	5	55	37	2	18	117
	4.27%	47.0%	31.62%	1.7%	15.38%	
Locus 11	5	29	16	0	3	53
	9.43%	54.71%	30.18%	0.0	5.66	
Locus 9	6	42	40	0	10	98
	6.12%	42.85%	40.81%	0.0	10.20%	
Locus 41	5	26	33	0	9	73
	6.85%	35.62%	45.20%	0.0	12.33%	
Locus 19	7	59	50	1	11	128
	5.47%	46.09%	39.06%	.78%	8.59%	
Locus 15	12	46	39	4	9	110
	10.91%	41.82%	35.45%	3.63%	8.18%	
Total: 8,000 Tools						875
Bull Brook II						
Locus A	3	15	6	0	3	27
334/61 1:5.5	11.11%	55.55%	22.22%	0.0	11.11%	
Locus B	2	37	1	0	1	41
257/51 1:3	4.89%	90.24%	2.43%	0.0	2.43%	
Locus C	0	19	1	0	2	22
794/76 1:10	0.0	86.36%	4.54%	0.0	9.09%	
Locus D	-	-	-	0	-	0
Locus E	0	25	1	0	1	27
51/49 1:1	0.0	92.59%	3.7%	0.0	3.7%	
Locus F	0	24	2	0	6	32
	0.0	75.0%	6.25%	0.0	18.75%	
Locus G	1	43	4	0	8	56
	1.78%	76.78%	7.14%	0	14.28%	

These figures are based on the sample size figures used by Grimes (1984:174) to compare tool frequencies between the Bull Brook and Bull Brook II assemblages. Some discrepancy has been encountered between total tool counts (Grimes 1984:164-165) and those extrapolated from the data presented in the comparative table previously mentioned.

Table 8-3

	Fluted Points	Ends	Sides	Drill	PE	Total
Debert						
Locus A	3	121	11	1	41	177
Flake/Tool 6:1	1.69%	68.36%	6.21%	.56%	23.16%	
Locus B	2	62	5	0	34	103
4:1	1.94%	60.19%	4.85%	0.0	33.0%	
Locus C	17	224	22	0	77	340
5:1	5.0%	65.88%	6.47%	0.0	22.64%	
Locus D	19	28	6	2	13	69
35:1	27.53%	40.57%	8.69%	2.89%	18.84%	
Locus E	2	3	0	0	0	5
22:1	.40%	.60%	0.0	0.0	0.0	
Locus F	25	363	47	9	95	539
5:1	4.63%	67.34%	8.71%	1.66%	17.62%	
Locus G	11	216	43	0	144	414
4:1	2.65%	52.17%	10.83%	0.0	34.78%	
Locus H	0	40	2	0	22	64
6:1	0.0	62.5%	3.125%	0.0	34.37%	
Locus I	5	44	1	0	19	69
7:1	6.25%	63.76%	1.44%	0.0	27.53%	
Locus J	27	233	61	2	103	426
4:1	6.33%	54.69%	14.32%	.05%	24.17%	
Locus One	0	31	3	0	37	71
1.2:1	0.0	43.66%	4.23%	0.0	52.11%	

Total From Site:
3,935 Art./23,636 Flakes

These data have been extrapolated from Table 3 (MCD 29) of the Debert site report. Percentages of tool types were given by locus, with a total # of specimens listed below tool frequency percentages. The number of specimens in the selected tool classes were obtained by multiplying the percent given by the total number of artifacts for the given locus.

Table 8-4

	Fluted Points	Ends	Sides	Drill	PE	Total
Whipple						
Locus A	12	4	5	1	0	22
55/30,000±1:545	54.54%	18.18%	22.72%	4.54%	0.0	
Locus B	3	17	1	-	-	21
34/2,000 1:65	14.28%	80.95%	4.26%			
Locus C	3	19	6(Small)	-	2	30
47/6,000 1:120	3.33%	63.33%	20.0%		6.66%	

The figures used in the above table were derived from the text describing the Whipple site in the locus by locus discussions (Curran 1984:10-12).

Table 8-5

	Fluted Points	Ends	Sides	Drill	PE	Total
Vail						
Locus A	8 8.33%	49 51.0%	8 8.33%	1 1.04%	30 31.25%	96
Locus B	8 10.81%	42 56.75%	9 12.16%	-	15 20.27	74
Locus C	8 8.60%	40 43.01%	8 8.60%	20 21.50	17 18.28%	93
Locus D	9 7.43%	43 35.53%	7 5.78%	3 2.47%	59 48.76%	121
Locus E	19 6.29%	109 36.09%	23 7.6%	8 2.64%	143 47.35%	302
Locus F	3 13.63%	17 77.27%	-	-	2 9.09%	22
Locus G	1 2.70%	6 16.21%	6 16.21%	-	22 59.45%	37
Locus H	4 9.09%	13 29.54%	3 6.825%	1 2.27%	23 52.27%	44

The tool frequencies per locus sited above have been taken from the updated version of the Vail site report (Gramly 1985:66,93).

Table 8-6

	Range	Mean	N
Endscrapers			
Bullbrook	22% -60%	45%	407
Debert	40% -68%	55%	1,365
Vail	16% -77%	43%	319
Whipple	18% -81%	54%	40
Bull Brook II	55% -92%	79%	163
Michaud	25% -66%	43%	7
Sidescrapers			
Bull Brook	30% -57%	40%	
Debert	1.5% -14%	7.2%	
Vail	6% -16%	8.18%	
Whipple	4.76%-22.72%	15.82%	
Bull Brook II	2% -22%	7.71%	
Michaud	50% -62%	24.6%	
	0% - 4.54%		
Drills			
Bullbrook	0% - 4.54%	1.02%	9
Debert	0% - 2.89%	.46%	14
Vail	0% -21.50%	3.74%	33
Whipple	0% - 4.54%	1.51%	1
Bull Brook II	0	0	0
Michaud	0	0	0
PE			
Bullbrook	2.85%-21.43%	9.16%	81
Debert	17.62%-52.11%	26.20%	585
Vail	9.09%-59.45%	36.84%	311
Whipple	0.0% - 6.68%	2.2%	2
Bull Brook II	Figures Inaccurate		
Michaud	0	0	0
Fluted Points			
Bullbrook	0.0% -10.91%	5.22%	48
Debert	0.0% -27.53%	5.12%	111
Vail	2.70%-13.63%	8.36%	60
Whipple	3.33%-54.54%	24.05%	18
Bull Brook II	0.0% -11.11%	2.96%	6
Michaud	0.05 -66.6%	28.91%	9

APPEND/1
DISC ART #15C

APPENDIX 1: SOIL CLASSIFICATION, GENSIS AND MORPHOLOGY AT THE MICHAUD ARCHAEOLOGICAL SITE

This appendix contains the detailed soils information prepared for the Michaud site by Resource Assessment Service, Orono, Maine, acting under contract to the Maine Historic Preservation Commission (Balogh and Gordon 1986). It has been edited by Spiess to insure format and site location consistence with the rest of the monograph. All the substantive contributions of this chapter were generated by Balogh and Gordon.

INTRODUCTION

Deposition of glacial outwash sand and eolian movement of these outwash deposits have created common geomorphic features in southern Maine (Bloom 1960; Borns and Hagar 1965; McKeon 1972; Soil Conservation Service 1970). Wind action under cold or periglacial conditions is responsible for late-Quaternary and post-glacial eolian depositional activity (Embleton and King 1968). McKeon (1972) provides an excellent review of research on eolian deposits associated with outwash sands in southern Maine. An overview of late-Quaternary events and glacial retreat in Southern Maine and New England has been presented by Borns et al. (1981).

Formation of both longitudinal and transverse dunes in outwash sand deposits has been observed in the vicinity of both the Androscoggin and Kennebec River valleys. The post-glacial sand dunes in this region were formed primarily by prevailing west-northwest winds, approximately 12,900 to 12,200 BP while outwash was actively accumulating. The Embden and Presumpscot formations are the sources for the sand dunes and outwash deltas (Bloom 1960, Bloom 1963, Borns and Hagar 1965, McKeon 1972). The outwash and eolian deposits were stabilized with rapid re-vegetation of the exposed surfaces (Bloom 1960, McKeon 1972).

If soil horizons develop in the surface outwash sand or other glacial deposits, subsequent eolian deposition will cover these horizons (Grigal et al. 1976; Macoun 1968; Ruhe 1968 ,1969). The buried soil horizons, or paleosols, will retain in part the genetic characteristics developed during their residence as surface soils (Crawford et al. 1983; Muhs 1985; Ruhe 1969, Simonson 1941; Soil Survey Staff 1975). A series of soils buried by a succession of periglacial dune formation events in an outwash plain has been observed in northern Minnesota (Grigal et al. 1976). These buried soils have the spodic characteristics developed during their genesis in a forested environment. The pattern of development for paleosols is analogous to genesis of current surface soils (Ruhe 1969). Buried soil horizons are easily identified in outwash and eolian dune sand by the occurrence of discontinuity, changes in color, texture, chemical, and bedding characteristics (Grigal et al. 1976; Muhs 1985). The extensive buried soil horizons have not been reported in outwash sands and eolian deposits of southwestern Maine (Epstein et al. 1962; McKeon 1972; Rourke and Beek 1968; Soil Conservation Service 1970, 1974).

Bloom (1960) speculated that the majority of the coastal eolian sand movement occurred in the 17th century with agricultural settlement of Maine, rather than as a result of periglacial wind conditions. Pollen profiles indicate that

emerging marine sand was covered by forest vegetation as fast as the uplifted surfaces were exposed. However, most other investigations have attributed post-glacial movement of outwash sands to periglacial wind action (Borns and Hagar 1965, McKeon 1972, Borns et al. 1981).

Recent reworking of outwash and dune sand has occurred in Maine as a result of agricultural activity, construction, over-grazing with subsequent loss of stabilizing surface vegetation (McKeon 1972). Dune 'blow-outs' are bowl shaped surface deflations produced by wind excavation of previously stabilized sand surfaces (Schwab et al. 1981). Shifting sand from the dune blow-out is deposited downwind in dune form. Current soil horizons buried by over 30 cm of eolian overburden would be classified as buried soils (Soil Survey Staff 1975).

Description and analysis of soils formed in sandy outwash and eolian deposits were conducted in cooperation with Dr. Arthur Spiess of the Maine Historic Preservation Commission at the Michaud archaeological site (Spiess 1985). The Michaud site has been proposed as an important New England fluted point Paleoindian site (Spiess 1985). The study site is located at the Auburn-Lewiston Municipal Airport in Southwestern Maine. The study site is located on sand dune features at the headwaters of the Royal River. The dunes located on a marine outwash delta have experienced recent wind erosion with surficial de-stabilization and de-vegetation (Spiess 1985, Balogh and Gordon 1985). Paleoindian artifacts have been identified in the exposed surface soil horizons. Archaeological and soil investigation of the Michaud site was initiated in response to a mitigation plan associated with proposed construction work by the Maine Department of Transportation (Spiess 1985).

The objectives of this cooperative research project were 1) to evaluate the site landform; 2) to describe the morphology of soil profiles on the archaeological site 3) to determine selected physiochemical characteristics of sampled soil horizons; and 4) to briefly evaluate the genesis of the soil sequence on the Michaud research site. During initial site reconnaissance a potentially buried soil horizon, a subsurface fine sand 'gray' horizon, was identified in the stratigraphy of the sandy parent material. Another surface feature noted during site reconnaissance blow-out area of the archaeological site were exposed concentrated tongues of podzolization penetrating the subsurface sand. The origin of these two soil features will also be briefly discussed in this report.

METHODS

Site Reconnaissance and Site Location

Initial field reconnaissance of the Michaud archaeological site was conducted on June 18, 1985. A brief evaluation of the soil on the research site was developed on an exposed section of a drainage ditch. A sequence of soil horizons was observed to have field characteristics similar to typical sandy Haplorthods. A mottled gray subsurface horizon was observed at a depth of approximately 90 to 150 cm. Surface wind eroded features were identified as recent dune blow-outs during initial site inspection with Dr. Arthur Spiess and personnel of the Maine Department of Transportation (Spiess 1985, Balogh and Gordon 1985).

The Michaud archaeological site is located in Androscoggin County, Maine (44°02'N, 70°20'W). The research area is east of the centerline of the southern end of Runway 4 of the Auburn-Lewiston Municipal Airport. A complete description of site location and history of recent site disturbance is provided by Spiess (1985). Overstory vegetation on the site was harvested in the late 1960's and early 1970's. Approximately 20 - 25% of the area was disturbed by mechanical grading and drainage ditch filling. The area is now partially vegetated by remnant forest forbes and field herbs. Following loss of overstory cover and mechanical surface disturbance, 20 to 30% of the site has been subjected to wind erosion, surface sand movement, and dune deflation. Drifted sand was observed to cover 20% of the study site in the form of overburden on older dune and inter-dune surfaces. The overburden has formed new, unstable dune surfaces.

During initial field reconnaissance of the Michaud site, the general locations for soil pit excavations were identified. Two soil pits were to be located off the actual area of archaeological activity: one profile to be located in an area of undisturbed forest vegetation, and another profile to be described in a representative dune blow-out. Within the archaeological site six profiles were located for description of both undisturbed and wind eroded profiles. Soil pits were located on September 6, 1985, the first day of intensive field investigation.

Soil Profile Morphology and Soil Sampling

Soil pits were excavated and soil profiles were described on September 7-8, 1985. Exact locations of soil profiles were ~~noted and~~ identified using the ~~site excavation code~~ developed by the Maine Historic Preservation Commission. Description of soil profiles on the Michaud site followed standard methods and terminology (Soil Survey Staff 1951; Soil Survey Staff 1981). Soil taxa were identified using current USDA Soil Conservation Service taxonomic criteria (Soil Survey Staff 1975; USDA Soil Management Support Services 1985). Soil was sampled from each profile horizon at the Michaud site. All soil samples were labeled to identify site location, sampling date, site profile code, depth, and horizon designation. Soil samples are being stored in the facilities of Resource Assessment Service.

Laboratory Analyses

Soil samples were air-dried and sieved to pass a 2 mm sieve. Particle size distribution was determined by a hydrometer method (Day 1965) as modified by Grigal (1973). Particle size distribution of the sand fraction was determined by dry sieving (Day 1965) after wet sieving the sand fraction. Organic carbon was analyzed by dry combustion (Allison 1965; Nelson and Sommers 1982). Iron (Fe) and Aluminum (Al) were extracted from soil samples using both a dithionite-citrate extract (Olson and Ellis 1982) and a pyrophosphate extract (Bascomb 1968). Pyrophosphate extraction is associated with amorphous Al and Fe associated with organic translocation and illuviation (Mokma 1983). Free oxides of Fe and Al are associated with the dithionite-citrate extraction (Olson and Ellis 1982; Soil Survey Staff 1975). All physical and chemical variables are reported on an oven-dried (105^{o} C) basis.

Morphological/chemical criteria and rationale for verification of spodic horizons has been presented and reviewed by the Soil Survey Staff (1975), Mokma (1983), and Holmgren and Yeck (1984). These criteria were applied to field identified spodic B horizons to differentiate spodic Bs horizons from cambic Bw horizons. These criteria are based on color, observed morphology in the field, and a combination of clay, organic carbon, and extractable Fe and Al. The relationship of organic carbon, Fe, and Al content in the sequence of horizons was used to identify 1) spodic horizons, 2) cambic horizons with spodic characteristics, and 3) potentially buried sequences of horizons. Reddish-brown spodic horizons and cambic horizons subject to podzolization (translocation of amorphous carbon, Al, and Fe) will have combined elevated levels of carbon, Al, and Fe relative

to the surface horizons. Elevated levels of carbon and Al in subsurface B horizons in relation to E or Ap horizons (eluviated horizons) is critical for diagnosis of soil development under moist climatic conditions with forest vegetation (Buol et al. 1973, Mokma 1983, Soil Survey Staff 1975).

Statistical Analyses

Differences ~~between~~ among physiochemical characteristics of soil horizons sampled at the Michaud archaeological site were tested using ~~both~~ oneway analysis of variance (ANOVA) (Snedecor and Cochran 1967; SAS 1982). Separation of mean values of soil horizons was tested by Bayes least significant difference (BLSD) at the 0.05 level, when the ANOVA demonstrated significant differences at the 0.05 level (Smith, 1978; Waller and Kemp, 1975). Simultaneous comparison of differences between physiochemical properties were tested using oneway multiple analysis of variance (MANOVA) using the 0.05 level of significance from the Wilks' criterion and Hotelling-Lawley Trace statistics (Morrison 1976; SAS 1982). Separation of multiple mean values of soil horizons was tested by Hotelling T^2 at the 0.05 level, when the MANOVA demonstrated significant differences at the 0.05 level (Dixon 1983; Morrison 1976). To facilitate the statistical comparison of soil properties, soil horizons were grouped for mean comparison based on aggregation of E horizons; spodic B horizons; non-spodic B horizons (Bw, Bh, Bm); oxidized C horizons above the gray C horizon; the gray colored C horizons; and oxidized sandy C horizons observed beneath the gray C layer.

Multivariate analysis of variance and Hotelling T^2 statistics are multivariate generalizations of univariate analysis of variance and mean separation techniques. MANOVA allows simultaneous comparison of p variables in p-dimensional space. MANOVA is analogous to a discriminant classification and provides a test statistic. The MANOVA test statistic is based on a linear combination of the p-variates to evaluate p-dimensional differences among classified groups (soil horizons) based on the all selected variables. Multiple analysis of variance was used primarily to elucidate multidimensional differences of chemical characteristics between horizons. Multivariate comparison was directed to elucidate similarities or differences between the surface soil and potentially buried subsurface horizons.

8. RESULTS

Dune Field Landform

The surficial features and stratigraphy of the parent material observed at the Michaud archaeological site are characteristic of sand dunes formed by eolian movement of glacial outwash sands (Embleton and King 1968; Smith 1968; Mckeon 1972). The original outwash sand was deposited over fine textured marine sediments. The marine sediments were observed at the base of the drainage ditch exposure (N0 E72) and at the base of the undisturbed soil profile (West Offsite) (~~Appendix 1~~). Stratigraphic characteristics related to depositional processes of the sandy parent material were observed during soil profile description. Horizontal bedding of the parent material was observed at a depth ranging from 28 to 94 cm. Horizontal bedding within the parent material stratum of the soil profiles (C horizons) provides evidence that the sandy parent material was deposited as glacial outwash over the marine sediments. Cross-bedding within the dune remnants was not observed and has been lost with freeze/thaw pedoturbation of the shallow dune matrix.

With recent loss of vegetative cover and surface disturbance, these dunes are being subjected to wind erosion and deflation. Formation of the bowl shaped dune blow-outs is common on the site (Schwab et al. 1981). An undisturbed dune was observed ~~on a site~~ across Moose Creek, on a line south~~east~~ from the Michaud site.

Within many of the dune blow-outs remnant soil horizons have been exposed. These remnant features are described in detail at site location (North Offsite, N78 W10, N30 E38) (~~Appendix 1~~). These remnant horizons are more resistant to wind erosion than the surrounding soil matrix. These features have high concentrations of carbon, iron, and aluminum ~~and are~~ bound in place by the amorphous organic-sesquioxide complex. These features are also cemented in part with nodules of particles cemented with iron and organic matter (orstein). Soil genesis of these features will be discussed in Soil Classification and Genesis section.

Soil Morphology at the Michaud Archaeological Site

Soils observed on the Michaud research site all have similar morphology, horizon development, and physiochemical properties (Table 1; Table 2; Table 3; ~~Appendix 1~~). The observed profiles are similar to descriptions of other sand texture soils in this

section of Maine (Epstein et al. 1962; Rourke and Beek 1968; Soil Conservation Service 1970, 1974). Soil morphology of the soils observed at the Michaud site is characteristic of soils developed under humid climatic conditions with coniferous overstory vegetation (Buol et al. 1973; Pritchett 1979; Soil Survey Staff 1975).

The soil horizons and parent materials at the Michaud site have formed in glacial outwash sands. These outwash sands range in texture from sand to loamy sand (Table 1, Table 2). Some of the surface horizons have a finer texture, sandy loam, which may have derived in part from low flow periods or by post-glacial/Holocene incorporation of eolian dust. The outwash sediments were deposited on silt loam marine sediments, the Presumpscot formation. The marine sediments have been characterized by Bloom (1963) and Goldthwaite (1951).

The West Offsite soil profile is the site control profile having no recent disturbance or loss of vegetation. Soil profiles described at N0 E72 (drainage ditch exposure), N36 E66, and N34 E62 are intact profiles covered with sandy overburden from recent dune blow-outs. Soil profiles described at N78 W10, North Offsite, and N18 E68 are the morphology of remnant soil horizons within dune blow-outs. The morphology at N30 E38 provides a detailed description of a concentrated tongue of podzolized horizons within the archaeological site.

The surface layers of the soils on the Michaud site are sandy dark brown A and bleached E horizons (Table 1) (Appendix 1). Both the A and E horizons are eluviated horizons, although the A layer retains a higher percentage of organic matter giving it a darker color than the highly weathered albic E horizons (Table 3). Surface A horizons are very thin ranging in depth from 3 to 5 cm (Table 1). The albic horizons (E) are also relatively thin ranging in depth from 1.5 to 7 cm.

All the observed profiles at the Michaud site have horizons with morphological (color, depth, organic coatings) and chemical (Table 1, Table 3) characteristics demonstrating spodic development. The illuviated near-spodic Bh and Bm and spodic Bs horizons occur in sequence beneath the eluviated surface A and E horizons. Soil profiles observed at N36 E66 and N18 E68 within the archaeological excavation area did not have B horizons meeting the defined chemical characteristics for spodic designation under taxonomic criteria (Soil Survey Staff 1975; USDA Soil Management Support Services 1985). Although the cambic Bw horizons in these profiles do not meet the arbitrary limits for spodic classification, the color and elevated carbon content (Table 1, Table 3) of the Bw1 horizon in both sites indicates active spodic (podzolization) has occurred. Bh horizons indicate illuvial accumulations of organic matter and the Bm horizon is a horizon indurated with illuviated iron. (Soil Survey Staff 1981).

The spodic horizons have a range of texture from sand to loamy sand and vary in depth from 5 to 14 cm (Table 1).

The central concept of spodic horizon development includes the subsurface illuviation (accumulation) of organic carbon and Al, with or without Fe. The dominant characteristic of Bs horizons is the reddish brown color imparted by illuvial organic carbon and to some extent by iron oxide. Sandy soils with relatively low surface areas for absorption, show much stronger color for a given level of accumulation than finer textured soils (Holmgren and Yeck 1984). Therefore, even the cambic horizons in profiles N36 E66 and N18 E68 have colors characteristic of spodic development. The accumulated amorphous materials are translocated (eluviated) from the surface A and/or E horizons. The Al and Fe are transported as organic complexes and the spodic horizons are the zone of organic Al and Fe precipitation (Holmgren and Holzhey 1984: Mokma 1983; Soil Survey Staff 1975). Spodic horizons should have greater cumulative accumulations of organic carbon and associated (pyrophosphate extracted) Fe and Al (Table 3) (Mokma 1983). Genesis of spodic (Bs) and near-spodic (Bh and reddish Bw) horizons is associated with acidic leaching conditions under humid coniferous and deciduous forest vegetation in Northeastern United States (McFee and Stone 1965; Soil Survey Staff 1975).

In profiles N0 E72, West Offsite, North Offsite and N30 E38 one or two cambic (Bw) horizons occur (Table 1; ~~Appendix 1~~). The first cambic horizon (Bw1) intergrades into the spodic horizon. The second cambic horizon (Bw2) or single Bw horizon are horizons with limited color development (Table 1) and organic carbon accumulation (Table 3). The lower cambic horizons have limited accumulation of translocated organic amorphous materials (Table 3) and intergrade into the unweathered parent material or C horizons. The cambic horizons range in texture from sand to loamy sand (Table 1). However, the particle distribution (texture) is closer to the unweathered C1 layers than the horizons associated with surface activity (Table 2).

The C horizons observed in all soil profiles are the unweathered parent material derived from glacial outwash sands (~~Table 1; Appendix 1~~). Except for the gray colored C2 horizon in profiles N0 E72, (C horizon) West Offsite, N34 E62, and N18 E68, all the C horizons have well oxidized colors (Table 1) and very low accumulations of organic complexes (Table 3; ~~Appendix 1~~). The C horizons have a wide range of depths and have a predominantly sandy texture (Table 1). The texture and color of the C horizons reflect the original properties of the relatively unweathered original parent material.

It is unlikely that the gray C horizon is a gleyed layer, as this horizon is bounded by well oxidized horizons (~~Table 1, Appendix 1~~). A gleyed subsurface horizon requires chemical (Fe) reducing conditions associated with chronic waterlogging and lack

of oxygen (Buol et al 1973; Bohn et al. 1979). The predominantly oxidized matrix of sandy outwash beneath the gray C horizon eliminates this horizon as a gleyed layer. The potential of this horizon as a buried albic (E) horizon will be discussed in the analysis of horizon chemical and physical properties. It should be noted that horizontal bedding was observed in all the gray C horizons (Appendix 2). This indicates that the gray C horizon is part of the original matrix of outwash sand. In profile N0 E72 bedding of the oxidized C1 horizon was observed above the gray C2 layer (Appendix 1, N0 E72 Comments). In the C3 horizon directly beneath the gray C2 layer in profile N0 E72 and N18 E68 bands of the C2 matrix were embedded in the otherwise well oxidized matrix (Appendix 2). This morphology suggests the possibility of the gray C2 horizon resulting from deposition of sand with a light gray color in relation to other sand deposits. Analysis of texture in the next section will further illuminate this possibility.

Many of the subsurface horizons exhibit mottling varying in intensity from weak to prominent with progression in horizon depth (Table 1). Mottles and iron banding are indications of periodic soil soil wetness associated with localized changes in soil redox potential (Buol et al. 1973; Soil Survey Staff 1981). Mottles in the observed profiles may reflect current soil moisture regimes associated with periodically poor drainage conditions. The fine sand of the gray 2C horizon and the silty marine deposits beneath the outwash sand will periodically inhibit drainage as a result of textural discontinuity (Hillel 1971). The faintly developed mottles generally observed in the surface horizons and a few of the B horizons may be relic features associated with older moisture regimes. As the headwaters of the Royal River (Moose Creek) were down cutting through the freshly exposed outwash, the local water table would have been according close to the surface. Under these conditions of fluctuating redox conditions, mottles in the surface horizons will develop (Buol et al. 1973). Mottles are accumulations of iron oxide or centers of iron oxide deposition on ped and grain surfaces. Formation of orstein, iron concretions, observed in several Bs horizons may have been initiated as mottles during previous moisture regimes. Mottles and iron concretions are very stable and will remain as relic features in the soil for considerable periods after the original conditions have changed (Buol et al. 1973; Kubiena 1970; Soil Survey Staff 1975).

Silt loam marine sediments beneath the outwash sand were observed in the bottom of the site drainage ditch and at the base of the West Offsite profile (Appendix 1). The marine sediment is a lithologic discontinuity and designated as a 2C horizon. These marine sediments were deposited during the post-glacial marine submergence of the Maine coast between 13,000 BP and 12,000 BP (Stuvier and Borns 1975). These sediments have been designated as the Presumpscot Formation and this site is within the limits for

deposition of this formation (Bloom 1963; Goldthwaite 1949; Stuvier and Borns 1975). Most likely the outwash sands sediments were deposited over the marine silty sediments as a marine delta.

Comparison of Soil Physical and Chemical Properties

The particle size distribution and selected chemical characteristics of the soils sampled at the Michaud archaeological site ~~(Table 2; Table 3)~~ have a range of values similar to other soils developed in outwash sands in southwestern Maine (Epstein et al. 1962; Rourke and Beek 1968; Soil Conservation Service 1968, 1970). The particle size distribution or texture of all horizons is dominated by sand, especially in the fine-very fine sand fraction ~~(Table 2)~~. Significant differences in particle size distributions were observed for the aggregated horizons (Table 3A 4). There is a trend of an increasing coarse fraction (sand) and decreasing fine fraction (silt/clay) with depth ~~(Table 4)~~. The surface horizons are exposed to the forces of physical and chemical weathering as well as incorporation of atmospheric dust. These factors are associated with formation and accumulation of fine particles. The gray C horizons also have a significantly higher fraction of fine-very fine sand and silt as compared to the deeper oxidized C horizons ~~(Table 2; Table 4)~~. The gray C layer has a particle size distribution similar to the transformed and weathered surface horizons. The range in total depth of the eluviated surface horizons (A and E) varies from 1.5 to 10 cm, whereas the gray C horizon varies in depth from 16 to 39 cm ~~(Table 1)~~. Considerable weathering and translocation of chemical constituents would be required to create eluviated horizons with depths of 16 to 39 cm.

The distribution of organic carbon, Al, and Fe in the soil horizons is characteristic of soils developed in acidic leaching environments with forest vegetation (Pritchett 1979; Soil Survey Staff 1975). The surface A horizons, where they exist, have high concentrations of organic carbon associated with litter decomposition (Table 3). The A horizon also has high levels of Al and Fe resulting from element cycling and litter decomposition. The E horizon exhibits the loss of organic matter and organic translocation of Al and Fe with reduced levels of organic carbon, Al, and Fe (Table 3A 3). The precipitation of organic Al and Fe complexes are observed in both the Bs and non-spodic horizons with elevated levels of carbon, Al, and Fe. The spodic horizons have significantly higher levels of organic carbon and aluminum as compared to both the E and non-spodic horizons (Table 3A 4). This condition is critical for identification of a spodic horizon (Mokma 1983). All the surface horizons, E, Bs, and non-spodic B, have significantly greater accumulations of organic matter and Al as compared to all the sand subsurface C horizons ~~(Table 3; Table 4)~~. The Fe distribution follows a similar pattern, but does not

exhibit as clear a statistical differentiation (Table 4). Accumulation of organic carbon and Al content are the critical factors in identification of Bs and spodic-like Bw horizons. The oxidized C horizons are not statistically nor numerically different from the gray C horizon in relation to the content of organic carbon, Al, and Fe ~~(Table 4)~~. The oxidized C horizons beneath the gray C horizon exhibit no chemical evidence of illuviation of organic amorphous materials ~~(Table 3; Table 4)~~. This suggests that the development of a sequence of a buried E horizon over even a remnant B horizon has not occurred on this site. Buried soil horizons should retain in part the genetic characteristics developed during their residence as surface soils (Crawford et al. 1983; Muhs 1985; Ruhe 1969, Simonson 1941; Soil Survey Staff 1975).

The simultaneous and multidimensional comparison of chemical characteristics of the surface and subsurface horizons confirms the univariate analyses of the genetic relationships of the soil horizons (Table 5). There is an overall difference among the horizons based on simultaneous (linearized) comparison of the chemical variables used to identify spodic development. Comparison of multidimensional group means confirms the conclusions that 1) the illuviated B horizons differ significantly from all the sandy C horizons; 2) the oxidized C layers are not significantly different from the gray C layer; 3) the horizons beneath the gray C horizon (hypothesized buried E horizon) do not demonstrate a simultaneous accumulation of organic carbon, Al, and Fe; 4) the oxidized C horizons beneath the gray C layers are not similar to the Bs horizons nor the non-spodic B horizons; 5) the highly leached E horizons have lost significant amounts of amorphous material to the Bs and non-spodic B horizons; 6) with translocation of amorphous material out of the E horizon, the E horizons have a multidimensional composition of organic carbon, Fe, and Al similar to the unweathered C horizons.

DISCUSSION

Soil Classification

The soil profiles observed at the Michaud archaeological site have been identified as Typic Haplorthods and Typic Dystrochrepts (~~Appendix 1~~) (Soil Survey Staff 1975; USDA Soil Management Support Services 1985). These two soil taxa are differentiated primarily on the basis of the presence of the diagnostic spodic horizon. Haplorthods are more or less freely drained Spodosols that have accumulations of organic carbon and aluminum with or without iron in a subsurface spodic horizon. Spodosols are usually found in coarse, acidic, Pleistocene or Holocene deposits under forest vegetation (Soil Survey Staff 1975). In the Northeastern United States conifer forests are usual associated with spodosol development.

The Typic subgroup taxa of Haplorthods is the modal designation or central concept of the great group classification. Mottles do occur in several spodic horizons (Table 3A-1), however these faint mottles do not have the intensity required for an aquic designation. The Haplorthods on this site are an intergrade between the aquic and typic subgroup designation. The mottles are associated with periodic moisture saturation, iron reducing conditions, and subsequent segregation of precipitated iron oxides (Buol et al. 1973). The textural discontinuity of the C2 layer and the lithologic discontinuity at the contact with the silt loam marine sediments is responsible for the subsurface mottling. Previous moisture regimes during downcutting of the Royal River headwaters through the newly exposed outwash delta may be responsible for the faint relic mottles in the spodic (Bs) and cambic (Bw) horizons.

Dystrochrepts are relatively undeveloped brownish colored Inceptisols, more or less freely drained. Dystrochrepts form on acidic Pleistocene or Holocene deposits. Vegetation is usually deciduous forests with genetic processes of eluviation/illuviation occurring with less intensity than under coniferous vegetation. Dystrochrepts are associated with spodosols as local variations in the intensity of podzolization (Soil Survey Staff 1975). Development of cambic (Bw) subsurface horizons and the observed distribution of organic carbon are diagnostic features of dystrochrepts (Soil Survey Staff 1975). At the Michaud site the cambic horizons lack sufficient deposition of illuvial amorphous materials to be designated as a spodic horizon. However, color morphology and soil chemistry (Table 3A-1; Table 3A-3) does indicate podzolization is currently operating in these soils. High variability in the magnitude of soil genetic

processes will account for localized variation in soil classification in a single site. Considering both the spodosols and inceptisols on the Michaud site, podzolization has been the dominant soil genesis process.

Selected Profile Morphological Features

Throughout the Michaud archaeological site, intense tongues of podzolization were observed by the principal investigator, Dr. Arthur Spiess. Profile N30 E38 provides and example of this relic feature in a dune blow-out. At the time of site reconnaissance and soil profile location, there was a question whether these particular features were of natural or of anthropogenic origin. In the control soil profile, West Offsite, located in an undisturbed area of the outwash deposit with overstory cover, several intense podzolized tongues were observed (Appendix 1). Tonguing of the albic/spodic horizon sequence into the parent material of a soil has been associated with local intensification the spodic development (podzolization). This phenomena has been attributed to increased leaching with water concentration from stemflow (Buol et al. 1973; Pritchett 1979). Stemflow is the water that runs down tree trunks during rainfall events. Stemflow funnels a portion of the precipitation intercepted by the forest canopy into the soil at the base of individual trees. This often results in higher levels of soil moisture and leaching environment directly beneath the tree. This may result in increased podzolization and formation of albic/spodic tongues. These tongues with deep spodic development were observed on the Michaud site and should be attributed to natural genetic processes.

During initial site reconnaissance on June 18, 1985, the gray C horizon was observed in profile N0 E72. It was hypothesized that this horizon could be a buried E horizon. The color, morphology, and strong mottling suggested during the initial observation that this horizon was the E layer of a buried Aquod or Aqept ~~(Balogh and Gordon 1985)~~. Subsequent analysis of 1) bedding morphology, 2) color characteristics relative to the other oxidized horizons, and particularly 3) the distribution of organic carbon, Al, and Fe (Table 3; Table 4) demonstrates this horizon is not a buried albic horizon nor a gleyed horizon. The color of this fine sand textured horizon reflects the originally deposited outwash sand. Layers of light gray to olive brown sand have been frequently observed in soil profiles developed in glacial outwash sand throughout southwestern Maine (Epstein et al. 1962; Rourke and Beek 1968; Soil Conservation Service 1968, 1970).

Sequence of Glacial Outwash Deposition and Dune Formation

The stratigraphy of soil and geologic parent material on the Michaud site provides evidence of deposition of glacial outwash sands over marine silt sediments. Marine sediments are part of the Presumpscot formation deposited during the post-glacial marine invasion of the Maine coast. The glacial outwash sands were deposited over the marine sediments. The finer textured layers of sand may have been deposited during low flow events. The outwash sands were exposed to wind erosion and dune formation after isostatic rebound of the Maine coastal area (ca. 12,200 BP). Development of forest vegetation in a cool humid climate created the acidic leaching conditions necessary for genesis of the spodosols observed on the Michaud site.

Some investigators have suggested that coastal dune formation is related to agricultural activity in the 17th century (Bloom 1960). Considering the well developed spodic horizons, horizons with orstein (mineral particles cemented with iron) ~~(Appendix 1)~~, and proximity to verified post-glacial dune fields in the Androscoggin and Kennebec River valleys (Borns and Hagar 1965, McKeon 1972); the shallow dunes on this archaeological site were most likely formed and rapidly stabilized immediately after isostatic emergence. Recent site disturbance and loss of vegetative surface has resulted in the renewed eolian activity on the site. The lack of well defined buried horizons with evidence of surficial organic accumulation (formation of A horizons) indicates there has been limited eolian activity on this site between the original dune stabilization and the current dune deflation.

~~Recommendations for Future Work~~

Absolute dating of the sand dune surfaces will establish the time of dune formation at the Michaud archaeological site. Soil genesis, morphology, and chemical characteristics will only provide semi-quantitative evidence of stratigraphic chronology. The amount of subsurface amorphous accumulation provides a relative indication of the duration of soil development. Determination of the chemical composition of the mineral fraction in combination with residual elemental fractions and rates of mineral weathering would be a quantitative index of the time of original surface deposition. A detailed search of the soils genesis literature may provide information concerning the time required for development and length of stability of spodic features.

Carbon-14 dating of subsurface organic carbon and paleoindian artifacts will substantiate the sequence of dune formation outlined in this report. Pollen diagrams of post-glacial peat deposits or lake bed sediments will substantiate periods of outwash plain exposure and history of vegetative cover. A glacial geologist with experience in sedimentology and geomorphology would provide additional supporting evidence. Investigation of the undisturbed dune feature observed on the southwest side of Moose Creek will enhance the soil genesis, geomorphic, and geological record of the local pattern of outwash deposition and dune formation.

CONCLUSIONS

Glacial outwash sand was deposited over marine sediments at the Michaud archaeological site. Concurrent with post-glacial rebound of southwestern Maine, eolian movement of the emerging sand plain resulted in dune formation. Rapid revegetation of the site is associated with development of soils with spodic horizons. Soils formed in the sandy parent material are Haplorthods and Dystrochrepts. Natural tonguing of intense and at times weakly cemented spodic horizons was observed throughout the disturbed and undisturbed portions of the Michaud site. The gray subsurface C horizon reflects its original color and physical characteristics. The gray C horizon is not a gleyed horizon nor a buried albic horizon.

A1-1

Table V. Summary of morphological properties of soil profiles at the Michaud archaeological site.

Profile Code	Horizon	Depth (cm)	Color (Munsell)	Texture	Mottles (Munsell)
NO E72	A	0 - 3.5	10YR 3/3	sand	-------
	Bs1	3.5 - 13	7.5YR 4/4	sand	-------
	Bs2	13 - 24	5YR 4/6	sand	-------
	Bw	24 - 30	7.5YR 5/6	sand	-------
	C1	30 - 98	10YR 5/6	sand	-------
	C2	98 - 128	2.5Y 5/1	sand	common, medium, prominant (7.5YR 5/4)
	C3	128 - 162	10YR 6/4	sand	few, fine, distinct (7.5YR 5/6)
	C4	162+	10YR 6/4	sand	few, fine, distinct (7.5YR 3/4)
N78 W10	E1	0 - 3	10YR 6/2	sand	-------
	E2	3 - 6	10YR 5/2	sand	few, fine, distinct (7.5YR 4/6)
	Bh	6 - 13	5YR 3/2	sand	-------
	Bm	13 - 15	5YR 4/4	sand	-------
	Bs1	15 - 22	7.5YR 4/4	sand	-------
	Bs2	22 - 28	7.5YR 4/4	sand	few, fine, faint linear (7.5YR 4/6)
	C1	28 - 33	10YR 4/6	sand	-------
	C2	33 - 70	10YR 5/6	sand	few, fine, distinct (5YR 4/6)
	C3	70 - 140+	10YR 6/3	sand	few, fine, distinct (7.5YR 4/6)
					few,coarse, prominant (5YR 4/6)

Table 1. Continued. Summary of morphological properties of soil profiles at the Michaud archaeological site.

Profile Code	Horizon	Depth (cm)	Color (Munsell)	Texture	Mottles (Munsell)
West Offsite	E1	0 - 3	10YR 4/2	sand	-------
	E2	3 - 10	10YR 5/2	fine sand	-------
	E/B	10 - 16	10YR 5/2 5YR 4/6	loamy sand	-------
	Bs	16 - 19	5YR 4/6	loamy sand	-------
	Bw1	19 - 29	7.5YR 4/6	loamy sand	-------
	Bw2	29 - 53	10YR 4/6	loamy sand	-------
	C	53 - 114	2.5Y 6/2	fine sand	few, fine prominant (10YR 4/6 & 10YR 5/8)
	2C	114+	10YR 5/3	silt loam	few, fine prominant (7.5YR 4/6)
North Offsite	A	0 - 3	7.5YR 3/3	sand	-------
	Bs1	3 - 13	5YR 4/4	sand	-------
	Bs2	13 - 27	7.5YR 4/6	sand	-------
	Bw	27 - 47	10YR 4/4	sand	-------
	C1	47 - 109	10YR 6/6	sand	few, fine, faint (10YR 4/4)
	C2	109 - 135	10YR 5/4	sand	few, fine, distinct (7.5YR 5/6)
	C3	135 - 153	10YR 5/4	sand	-------
	C4	153 - 233+	10YR 4/6	sand	few, fine, distinct (10YR 5/6)

Table 1. Continued. Summary of morphological properties of soil profiles at the Michaud archaeological site.

Profile Code	Horizon	Depth (cm)	Color (Munsell)	Texture	Mottles (Munsell)
N36 E66	A	0 - 3	7.5YR 4/4	fine sand	few, fine, faint (7.5YR 4/6)
	Bw1	3 - 18	7.5YR 5/6	sand	--------
	Bw2	18 - 54	10YR 5/4	sand	few, fine prominant (5YR 4/6)
	C1	54 - 63	10YR 5/5 10YR 4/4	sand	few, fine prominant (5YR 3/6)
	C2	63 - 94	10YR 5/3	sand	few, fine, distinct (5YR 5/3)
	C3	94 - 148+	10YR 5/4	sand	few, medium, distinct (7.5YR 5/6)
N34 E62	A	0 - 3	10YR 3/2	loamy sand	--------
	E	3 - 4.5	10YR 6/2	sand	________
	Bs1	3 - 8	5YR 4/4	loamy sand	few, fine; faint (7.5YR 4/6)
	Bs2	8 - 21	7.5YR 5/6	sand	few, fine, faint (7.5YR 4/6)
	C1	21 - 68	10YR 5/6	loamy sand	few, fine, faint (7.5YR 5/6)
	C2	68 - 84	2.5Y 5/2	sand	few, fine prominant (5YR 3/6)
	C3	84 - 128	10YR 6/4	sand	few, coarse prominant (5YR 4/6)
	C4	128 - 150+	10YR 6/4	sand	--------

A1

Table 1. Continued. Summary of morphological properties of soil profiles at the Michaud archaeological site.

Profile Code	Horizon	Depth (cm)	Color (Munsell)	Texture	Mottles (Munsell)
N18 E68	A	0 - 5	7.5YR 3/2	sandy loam	--------
	Bw1	5 - 7	7.5YR 4/4	sand	--------
	Bw2	7 - 19	7.5YR 5/6	sand	few, fine, faint (7.5YR 4/6)
	C1	19 - 56	10YR 5/6	sand	few, fine, faint (7.5YR 5/6)
	C2	56 - 77	10YR 5/2	loamy fine sand	________
	C3	77 - 100+	10YR 5/6	sand	few, fine, distinct (5YR 4/6)
N30 E38	A	0 - 3	7.5YR 3/2	fine sand	--------
	E	3 - 8	7.5YR 5/2	fine sand	--------
	Bh	8 - 13	7.5YR 3/4	loamy fine sand	--------
	Bhs	13 - 17	5YR 3/6	loamy fine sand	--------
	Bs	17 - 22	7.5YR 4/6	loamy fine sand	--------
	Bw	22 - 32	7.5YR 5/6	fine sand	--------
	C1	32 - 74	10YR 5/4	fine sand	few, fine, faint (7.5YR 4/4 & 7.5YR 4/6)
	C2	74 - 101	10YR 5/3	sand	common, medium, distinct (5YR 4/6)
	C3	101 - 121+	10YR 4/3	sand	common, medium, distinct (5YR 4/6)

Table 2. Particle size distribution (mm) of soil horizons at the Michaud archaeological site.

Profile	Horizon	Total (mm): Sand (2–0.05) (percent)	Total (mm): Silt (0.05–0.002) (percent)	Total (mm): Clay (<0.002) (percent)	Sand Particle Distribution (mm)[1]: Very Coarse (2–1), Sieve Mesh 18 (percent)	Coarse (1–.5), Sieve Mesh 40	Medium (.5–.25), Sieve Mesh 60	Fine (.25–.18), Sieve Mesh 80	Fine (.18–.15), Sieve Mesh 100	Very Fine (.15–.05), Sieve Mesh 300
N0 E72	A	88.76	8.32	2.92	0.02	0.48	12.16	20.30	21.19	34.03
	Bs1	87.43	8.85	3.72	0.00	0.53	11.38	21.11	20.98	32.88
	Bs2	88.29	9.06	2.65	0.02	0.58	11.67	21.17	20.99	33.72
	Bw	90.19	6.96	2.15	0.02	0.51	11.77	21.21	23.16	33.85
	C1	97.60	1.77	0.63	0.02	0.80	13.20	21.32	24.38	37.49
	C2	88.70	10.18	1.12	0.00	0.08	3.30	5.58	6.43	73.04
	C3	98.05	1.23	0.72	0.04	0.88	16.73	25.90	23.74	29.96
	C4	97.90	1.93	0.17	0.02	1.35	17.61	23.47	23.89	31.56
N78 W10	E1	91.24	7.94	0.82	0.12	1.11	10.64	14.06	17.02	47.78
	E2	88.57	7.89	3.54	0.10	1.23	12.02	16.56	18.53	40.17
	Bh	89.32	7.53	3.15	0.13	2.08	16.47	18.08	17.45	34.68
	Bm	91.61	6.09	2.30	0.31	1.83	15.50	18.38	18.36	36.56
	Bs1	88.52	8.47	3.01	0.17	1.52	15.56	17.27	17.00	36.55
	Bs2	96.63	1.69	1.98	0.01	0.81	13.06	19.67	22.96	39.52
	C1	97.41	1.98	0.61	0.01	1.22	12.00	15.87	17.49	50.52
	C2	97.78	1.71	0.51	0.02	1.22	15.36	22.72	23.45	35.27
	C3	98.16	1.14	0.70	0.01	0.45	10.40	18.21	31.37	37.28
West Offsite	E1	82.20	13.25	4.55	0.08	0.29	2.20	4.19	10.40	64.98
	E2	85.45	11.04	3.51	0.06	0.22	1.44	4.03	9.97	68.94
	E/B	81.55	13.24	5.21	0.13	0.37	2.16	5.53	12.11	60.41
	Bs	81.90	12.71	5.39	0.14	0.30	1.89	5.31	12.66	61.01
	Bw1	89.95	7.77	2.28	0.03	0.16	1.55	5.68	13.15	69.05
	Bw2	81.86	15.82	2.32	0.13	0.34	3.07	5.78	11.35	60.89
	C	97.23	1.97	0.80	0.01	0.08	1.94	9.64	26.87	58.23
	2C	18.05	69.81	12.14	0.00	0.02	0.25	1.09	2.83	13.64

[1] Mechanical loss of sand during dry sieving results in cumulative sand particle distributions less than the total percentage of sand.

A1-2 cont'd

Table 2. Particle size distribution (mm) of soil horizons at the Michaud archaeological site.

Profile	Horizon	Total (mm): Sand (2-0.05)	Silt (0.05-0.002)	Clay (<0.002)	Very Coarse (2-1) 18	Coarse (1-.5) 40	Medium (.5-.25) 60	Fine (.25-.18) 80	Very Fine (.18-.15) 100	Very Fine (.15-.05) 300
		(percent)			(percent)					
North Offsite	A	86.64	10.32	3.04	0.04	0.39	11.57	21.71	21.75	30.64
	Bs1	88.77	7.80	3.43	0.03	0.34	12.50	23.36	23.86	28.37
	Bs2	93.54	4.81	1.64	0.02	0.43	13.31	24.37	24.99	28.99
	Bw	97.09	1.96	0.95	0.13	0.67	18.78	27.31	25.06	24.69
	C1	98.84	0.28	0.88	0.02	0.18	16.38	32.69	28.14	21.19
	C2	95.97	3.03	0.99	0.41	1.04	11.28	17.37	21.72	44.04
	C3	97.21	1.80	0.99	0.03	0.92	12.31	19.32	22.93	42.00
	C4	97.54	1.16	1.30	0.06	2.17	18.51	22.71	20.99	32.44
N36 E66	A	87.78	8.30	3.92	0.07	0.51	6.11	11.17	15.02	54.48
	Bw1	87.43	10.08	2.49	0.05	0.31	4.22	8.33	10.90	63.30
	Bw2	86.03	13.10	0.87	0.02	0.16	3.57	6.65	7.63	67.99
	C1	92.66	6.59	0.75	0.02	0.60	10.67	15.24	20.57	45.15
	C2	98.10	1.72	0.18	0.10	1.30	13.95	20.36	21.99	40.09
	C3	98.34	1.48	1.18	0.01	0.62	12.83	21.20	24.23	39.23
N34 E62	A	82.32	13.50	4.18	0.07	0.44	4.80	9.28	12.55	54.99
	E	—	—	—	—	—	—	—	—	—
	Bs1	83.10	13.32	3.58	0.04	0.32	4.80	9.00	11.70	57.11
	Bs2	88.54	9.34	2.12	0.05	0.37	5.77	10.03	13.34	58.87
	C1	84.40	14.34	1.26	0.01	0.23	5.85	9.10	9.45	59.27
	C2	98.39	0.92	0.69	0.03	1.06	14.50	20.78	23.79	37.76
	C3	98.26	1.57	0.17	0.03	1.28	19.77	25.11	23.80	28.07
	C4	98.79	1.04	0.17	0.02	0.78	13.65	22.56	24.38	37.14

Sand Particle Distribution (mm); Sieve Mesh numbers 18, 40, 60, 80, 100, 300.

A1-2 cont

Table 2. Particle size distribution (mm) of soil horizons at the Michaud archaeological site.

		Total (mm)			Sand Particle Distribution (mm)					
					Very Coarse (2-1)	Coarse (1-.5)	Medium (.5-.25)	Fine (.25-.18)	Very Fine (.18-.15)	Very Fine (.15-.05)
		Sand (2-0.05)	Silt (0.05-0.002)	Clay (<0.002)	Sieve Mesh 18	40	60	80	100	300
Profile	Horizon	(percent)			(percent)					
N18 E68	A	74.13	19.25	6.62	0.11	0.80	7.27	11.01	12.51	42.14
	Bw1	89.35	5.31	5.34	0.04	0.46	8.69	17.09	18.23	44.07
	Bw2	88.40	9.45	2.15	0.01	0.36	8.21	13.85	18.94	46.61
	C1	87.03	10.94	2.02	0.06	0.30	6.01	11.22	15.15	55.03
	C2	76.15	21.84	2.01	0.01	0.07	1.81	3.61	4.65	66.01
	C3	97.30	1.75	0.95	0.12	1.79	18.59	21.35	21.43	33.51
N30 E38	A	81.13	15.45	3.42	0.05	0.26	5.02	10.67	14.73	49.87
	E	83.70	14.16	2.14	0.09	0.23	4.21	8.82	11.61	58.00
	Bh	76.68	15.71	7.61	0.01	0.17	3.33	7.38	11.57	54.06
	Bhs	84.26	12.89	2.85	0.02	0.25	4.64	9.13	12.48	57.30
	Bs	84.59	12.41	3.00	0.01	0.25	4.34	8.55	11.84	59.00
	Bw	86.16	12.00	1.84	0.02	0.25	3.66	7.45	9.87	64.26
	C1	82.34	16.58	1.08	0.02	0.19	4.89	7.95	7.73	61.05
	C2	97.60	2.04	0.36	0.03	0.78	14.16	21.27	22.83	38.11
	C3	98.22	1.59	0.19	0.02	1.08	13.40	17.06	21.92	44.81

Table 3. Selected chemical properties of soil horizons at the Michaud archaeological site.

Profile	Horizon	Organic Carbon (%)	Pyrophosphate Extractable Fe (ppm)	Pyrophosphate Extractable Al (ppm)	Dithionite Extractable Fe (ppm)	Dithionite Extractable Al (ppm)
N0 E72	A	2.17	456	1130	837	380
	Bs1	1.72	761	1902	1041	688
	Bs2	2.64	292	1183	1985	893
	Bw	1.53	24	403	1174	345
	C1	0.40	0	135	363	1
	C2	0.41	8	185	548	63
	C3	0.19	3	110	297	<1
	C4	0.19	0	50	151	1
N78 W10	E1	0.30	84	116	244	29
	E2	1.29	1848	1762	309	691
	Bh	2.82	1672	2182	1943	1464
	Bm	2.19	1400	2073	2630	1356
	Bs1	4.21	1287	4441	3378	1547
	Bs2	0.97	494	2052	2088	293
	C1	0.42	26	204	381	80
	C2	0.22	22	195	244	20
	C3	0.16	4	79	356	<1
West Offsite	E1	2.45	851	990	1337	628
	E2	0.84	377	508	603	238
	E/B	2.35	1012	1824	2560	1268
	Bs	2.88	908	2632	2445	1254
	Bw1	1.47	79	492	1016	287
	Bw2	0.58	7	170	628	91
	C	0.22	0	45	192	1
	2C	1.32	1662	2321	2741	272

Table 3. Continued. Selected chemical properties of soil horizons at the Michaud archaeological site.

Profile	Horizon	Organic Carbon (%)	Pyrophosphate Extractable Fe (ppm)	Pyrophosphate Extractable Al (ppm)	Dithionite Extractable Fe (ppm)	Dithionite Extractable Al (ppm)
North Offsite	A	2.99	2516	3851	2713	1124
	Bs1	3.38	869	2888	1915	1516
	Bs2	1.97	163	928	935	468
	Bw	0.86	44	372	610	157
	C1	0.28	12	117	372	33
	C2	0.40	29	136	363	24
	C3	0.26	11	116	206	<1
	C4	0.25	20	97	231	<1
N36 E66	A	2.72	704	1740	1609	782
	Bw1	1.30	75	587	1811	333
	Bw2	0.73	50	352	1137	172
	C1	0.34	15	135	892	25
	C2	0.22	0	57	488	1
	C3	0.19	0	55	263	<1
N34 E62	A	2.38	3363	3713	481	665
	E	----	----	----	----	----
	Bs1	3.80	340	689	1933	1001
	Bs2	1.50	63	563	900	371
	C1	0.66	42	296	904	279
	C2	0.18	7	127	395	16
	C3	0.16	3	55	495	23
	C4	0.17	0	38	406	<1

Table 3. Continued. Selected chemical properties of soil horizons at the Michaud archaeological site.

Profile	Horizon	Organic Carbon (%)	Pyrophosphate Extractable Fe (ppm)	Pyrophosphate Extractable Al (ppm)	Dithionite Extractable Fe (ppm)	Dithionite Extractable Al (ppm)
N18 E68	A	5.37	1452	1763	2583	1347
	Bw1	1.33	161	593	921	245
	Bw2	0.99	12	286	817	165
	C1	0.65	17	210	914	143
	C2	0.67	36	250	707	143
	C3	0.28	14	85	516	<1
N30 E38	A	3.60	988	966	284	587
	E	0.86	712	549	1244	234
	Bh	2.98	3224	4623	997	964
	Bhs	4.57	1696	3871	1957	1761
	Bs	2.61	397	1947	2703	758
	Bw	1.84	109	786	1527	462
	C1	0.77	11	226	1174	149
	C2	0.21	0	114	622	17
	C3	0.21	0	55	315	18

A1.4

Table 4. Univariate analysis of variance of physical and chemical characteristics by soil horizons and group separation of horizon means.

Soil variable	Designation for Horizon Means						Anova F-probability (df among, df within)
	E (n=6)*	Spodic B (n=11)	Non-Spodic Bh, Bm, Bw (n=12)	Non-gray C above (n=16)	Gray C (n=4)	Non-gray C below (n=5)	
Sand (percent)	85.45a**	87.78a	87.90a	94.95bc	90.12ab	98.06bc	<0.001 (5,48)
Silt (percent)	11.25a	9.21ab	9.31ab	4.26bc	8.72ab	1.51c	0.002 (5,48)
Clay (percent)	3.3a	3.01a	2.79a	0.79b	1.15b	0.44b	<0.001 (5,48)
Sand-Size Distribution by Mesh Size							
Mesh 18 (percent)	0.10	0.05	0.08	0.05	0.01	0.05	0.519 (5,48)
Mesh 40 (percent)	0.58	0.52	0.61	0.82	0.32	1.22	0.091 (5,48)
Mesh 60 (percent)	5.45a	8.99ab	8.24ab	11.95b	5.39a	17.27c	<0.001 (5,48)
Mesh 80 (percent)	8.87a	15.36ab	13.10ab	18.35bc	9.90a	23.68c	0.002 (5,48)
Mesh 100 (percent)	13.21a	17.53abc	15.47ab	20.90bc	15.43ab	23.45c	0.017 (5,48)
Mesh 300 (percent)	56.71ab	44.85bc	50.00ab	42.68ab	58.76a	32.05c	0.008 (5,48)

*Sample size.

**Means with the same letter in a row do not differ significantly at the 0.05 level by Bayes L.S.D.

Table 4. Continued. Univariate analysis of variance of physical and chemical characteristics by soil horizons and group separation of horizon means.

Soil variable	Designation for Horizon Means: E	Spodic B	Non-Spodic Bh, Bm, Bw	Non-gray C above	Gray C	Non-gray C below	Anova F-probability (df among, df within)
Organic Carbon (percent)	1.34b	2.75a	1.55b	0.35c	0.37c	0.20c	<0.001 (5,48)
Pyrophospate Extractable:							
Fe (ppm)	814a	661ab	571abc	13bc	13bc	4bc	0.008 (5,48)
Al (ppm)	958bc	2100a	1077b	139c	152c	67c	<0.001 (5,48)
Dithionite Extractable:							
Fe (ppm)	1050bc	1935a	1268b	506cd	460d	373d	<0.001 (5,48)
Al (ppm)	515b	959a	503b	49c	56c	5c	<0.001 (5,48)

Table 5. Multivariate analysis of variance (MANOVA) and multivariate mean separation (Hotelling mean separation) for soil horizons presented as the F-probabilites (overall MANOVA) and T^2-probabilities. The multivariate combination of variable is for organic carbon, pyrophosphate extractable Al, and pyrophosphate extractable Fe.

MANOVA Overall Separation

F-probabilities:

Wilks' Criterion $F(15, 144) = 7.43$
Probability > F = 0.0001

Hotelling-Lawley Trace $F(15, 134) = 9.94$
Probability > F = 0.0001

Hotelling T^2 Multiple Mean Separation

Matrix of Probabilities > T^2

Horizon	Spodic B	Non-Spodic Bh, Bm, Bw	Non-gray C above	Gray C	Non-gray C below
E	0.002	0.047	<0.001	NS*	NS
Spodic B	-----	0.001	<0.001	0.013	0.002
Non-Spodic Bh, Bm, Bw	-----	-----	<0.001	0.014	0.001
Non-gray C above	-----	-----	------	NS	NS
Gray C	-----	-----	------	-----	NS

*Not Significant

Table A1-6a.

NO E72

Soil Profile Description: ~~Site Characteristics~~

Date: September 7, 1985 Name: Balogh and Kosian

Location

County: Androscoggin Site Name: Michaud

Map Coordinates: 44°02'N, 70°20'W Site Code: NO E72

Landform

Type: Sand Dune Field; Dune blowout overburden area (Drainage ditch exposure)

Slope: Percent; 0 - 5% Shape; Convex

Aspect; 120° Site Class; Gently Undulating

Rock Outcrop Class: 0

Parent Material: Sand dunes from marine outwash delta sands deposited over fine marine sediments

Vegetation: Abandoned field, weeds and grasses, mixed hardwoods with pine present on the field edge

Erosion Class: Water 1 Wind 4 Hazard 4

Water Status:

Soil Water Status at Time of Description: Moist

Drainage; Well drained

Depth to Water Table; Below 3 m Depth to Mottles; 98 cm

Depth to Restricting Layer; ---

Effective Rooting Depth: 120 cm

Comments: Horizontal to slightly sloping bedding of sand becomes evident at 90 cm. Thin bands of C2 horizon bounded by iron bands present in the C3 horizon. Water may be perched in the surface horizons by the finer texture sands in the C2 horizon. Overburden (30 to 0 cm) from recent dune blowout has characteristics similar to the C1 horizon.

Classification: Sand, mixed, frigid Typic Haplorthod

NOE72 Horizon Morphology

Soil Profile Description: Horizon Morphology Site Code: NO E72

A - 0 to 3.5 cm, dark brown (10YR 3/3) sand; weak, medium subangular blocky structure; very friable; common, very fine animal burrows; many, fine roots and many medium roots; approximately 30 cm of overburden from recent dune blowout covers this horizon clear, wavy boundary.

Bs1 - 3.5 to 13 cm, dark brown (7.5YR 4/4) sand; moderate, medium angular blocky sturcture parting to weak, fine angular blocky structure; friable; common, faint (7.5 YR 3/4) iron coatings on grain surfaces; few, fine ant burrows and macropores; few, medium roots and common, fine roots, clear, wavy boundary.

Bs2 - 13 to 24 cm, yellowish red (5 YR 4/6) sand; weak, medium angular blocky structure; friable; few, distinct organic coatings on surface of old root channels; few, distinct, (5YR 3/4) iron coatings on sand grain and ped surfaces concetrated in a single lens, lens is weakly cemented with strong, medium angular structure; few, fine, rounded and irregular iron concretions (orstein) in iron lens area; directly above the iron lens between the A - Bs1 horizon is evidence of eluvial activity (E) with a very thin (<2 mm) weak, light gray (10YR 7/2) sand lens; few, fine roots; clear, wavy boundary.

Bw - 24 to 30 cm, strong brown (7.5YR 5/6) sand; weak, medium angular blocky structure; friable; few, distinct organic coatings on surface of old root channels; few, faint (7.5YR 4/4) bands of iron coatings on grain surfaces; few, fine roots; clear, wavy boundary.

C1 - 30 to 98 cm, yellowish brown (10YR 5/6) sand; weak, coarse angular blocky structure; very friable; few, distinct organic coatings on surface of old root channels; <4 percent small platy coarse fragments (mica) concentrated in thin bands with moderate, medium structure, friable sand; very few, fine roots; abrupt, smooth boundary.

C2 - 98 to 128 cm, grayish brown (2.5Y 5/1) fine sand; weak, moderate angular blocky structure parting to weak, fine, angular blocky structure; friable; common, medium, prominant (7.5YR 5/4) mottles; common, medium (7.5YR 5/6) bands of iron coatings on grain surfaces; few, fine bands of C3 material distributed throughout horizon; <1 percent small platy coarse fragments (mica); very few, fine roots; strong horizontal to slightly downward sloping bedding present throughout horizon; abrupt, smooth boundary.

C3 - 128 to 162 cm, light yellowish brown (10YR 6/4) sand; weak, medium angular blocky structure parting to weak, fine angular blocky structure; friable; few, fine, distinct (7.5YR 5/6) mottles; many, fine (7.5YR 5/6) bands of iron coatings on grain surfaces; one, fine band of C2 material at 131 cm bounded by iron bands; <1 percent small platy coarse fragments (mica); strong horizontal bedding throughout horizon; abrupt, smooth boundary.

C4 - 162+ cm, light yellowish brown (10YR 6/4) sand; weak, medium angular blocky structure parting to weak, fine angular blocky structure; friable; few, fine, distinct (7.5YR 3/4) mottles; <1 percent small platy coarse fragments (mica); strong horizontal bedding throughout horizon.

Title A1-66

N78W10

Soil Profile Description: ~~Site Characteristics~~

Date: September 7, 1985 Name: Balogh and Kosian

Location

County: Androscoggin Site Name: Michaud

Map Coordinates: 44°02'N, 70°20'W Site Code: N78 W10

Landform

Type: Sand Dune Field, Dune remnant from dune blowout

Slope: Percent; 0 - 5% Shape; Convex, mid-slope

Aspect; 210° Site Class; Gently Sloping

Rock Outcrop Class: 0

Parent Material: Sand dunes from marine outwash delta sands deposited over fine marine sediments

Vegetation: Abandoned field, bare surface, weeds and grasses, mixed hardwoods with pine present on the field edge

Erosion Class: Water 1 Wind 4 Hazard 4

Water Status:

Soil Water Status at Time of Description: Moist

Drainage; Well drained

Depth to Water Table; Below 3 m Depth to Mottles; 6 cm

Depth to Restricting Layer; 11 cm

Effective Rooting Depth: 11 cm

Comments: Horizontal bedding of sand becomes evident at 28 cm. Manganese coatings in C2 horizon verified with 30 percent H_2O_2.

Classification: Sand, mixed, frigid Typic Haplorthod

N78 W10 Horizon Morphology

~~Soil Profile Description: Horizon Morphology Site Code: N78 W10~~

E1 - 0 to 3 cm, light brownish gray (10YR 6/2) sand; weak, medium subangular blocky structure; friable; few, fine roots; clear, wavy boundary.

E2 - 3 to 6 cm, grayish brown (10YR 5/2) sand; weak, fine subangular blocky structure; very friable; few, fine distinct (7.5YR 4/6) mottles; few, fine roots; abrupt, wavy boundary.

Bh - 6 to 13 cm, dark reddish brown (5YR 3/2) sand; strong, medium angular blocky structure; firm; few, fine iron coatings on ped and grain surfaces; few, fine roots; clear, wavy boundary.

Bm - 13 to 15 cm, reddish brown (5YR 4/4) sand; very strong, medium angular blocky structure; very firm; common, fine iron and organic (5YR 2/2) coatings on ped and grain surfaces; few, fine rounded iron concretions (orstein); abrupt wavy boundary.

Bs1 - 15 to 22 cm, dark brown (7.5YR 4/4) sand; moderate, medium angular blocky structure; friable; few, fine iron and organic (5YR 3/3) coatings on ped surfaces; very few, fine roots; abrupt, wavy booundary.

Bs2 - 22 to 28 cm, dark brown (7.5YR 4/4) sand; moderate, medium angular blocky structure; friable; few, fine, faint linear (7.5YR 4/6) mottles; clear, wavy boundary.

C1 - 28 to 33 cm, dark yellowish brown (10YR 4/6) sand; weak, coarse angular blocky structure parting to weak, medium angular blocky structure; very friable; two thin bands of iron coatings on grain surfaces; <1 percent small platy coarse fragments (mica); strong horizontal bedding present throughout horizon; clear, smooth boundary.

C2 - 33 to 70 cm, yellowish brown (10YR 5/6) sand; weak, medium subangular blocky structure; very friable; few, fine distinct (5YR 4/6) mottles; common, fine bands of iron coatings on grain surfaces; few, medium lens of manganese coatings on grain surfaces; <1 percent small platy coarse fragments (mica); strong horizontal bedding present throughout horizon; gradual, smooth boundary.

C3 - 70 to 140+ cm, pale brown (10YR 6/3) sand; weak, coarse angular blocky structure; very friable; few, fine distinct (7.5YR 4/4) mottles; few, coarse prominant (5YR 4/4) mottles; common, fine bands of iron coatings on grain surfaces; <1 percent small platy coarse fragments (mica); strong horizontal bedding present throughout horizon.

Table A1-6c

west offsite

Soil Profile Description; ~~Site Characteristics~~

Date: September 7, 1985 Name: Balogh and Kosian

Location

County: Androscoggin Site Name: Michaud

Map Coordinates: 44°02'N, 70°20'W Site Code: West Offsite

Landform

Type: Sand Dune Field, Undisturbed Marine Outwash Sands

Slope: Percent; 0 - 5% Shape; Level

Aspect; 334° Site Class; Gently Sloping

Rock Outcrop Class: 0

Parent Material: Sand dunes from marine outwash delta sands deposited over fine marine sediments

Vegetation: Cut-over hardwoods (esp. Populus tremuloides Michx.) with pine and fir present

Erosion Class: Water 1 Wind 1 Hazard 1

Water Status:

Soil Water Status at Time of Description: Moist

Drainage; Well drained

Depth to Water Table; Below 3 m Depth to Mottles; 53 cm

Depth to Restricting Layer; 114 cm

Effective Rooting Depth: 120 cm

Comments: Horizontal to slightly sloping bedding of sand becomes evident at 53 cm. A vertical column of 2C material has been pulled up into the C horizon by an old tree throw. Irregular tonguing of E-Bs1-Bs2 horizons into B3 and C horizons is evidence of localized concentrations of podzolization possibly associated with stemflow from previous forest vegetation. 2C horizon is marine sediment deposited as the Presumpscot Formation.

Classification: Sand, mixed, frigid Typic Haplorthod

~~Soil Profile Description:~~ **Horizon Morphology** ~~Site Code:~~ **West Offsite**

Oi - 3 to 0 cm, hardwood leaves and twigs.

E1 - 0 to 3 cm, dark grayish brown (10YR 4/2) loamy sand; weak, fine granular structure; friable; common, tonguing of organic matter coatings (10YR 3/2) on grain surfaces from surface; <1 percent very fine, platy coarse fragments (mica); many, fine roots, common, medium roots, few, coarse roots; clear, wavy boundary.

E2 - 3 to 10 cm, grayish brown (10YR 5/2) fine sand; weak, fine subangular blocky structure; friable; <1 percent very fine, platy coarse fragments (mica); few, fine roots and few, medium roots; clear, irregular boundary (tonguing of E horizons into B horizons with tongue widths ranging from 1 to 17 cm).

E/B - 10 to 16 cm, grayish brown (10YR 5/2) and yellowish red (5YR 4/6) loamy sand; weak, medium granular structure; friable; few, fine (5YR 4/4) iron coatings on ped surfaces in B portion of horizon; very few, fine, rounded, iron concretions (orstein) in B portion of horizon; <1 percent very fine, platy coarse fragments (mica); few, fine roots and common, medium roots; clear, broken boundary.

Bs - 16 to 19 cm, yellowish red (5YR 4/6) loamy sand; strong, medium subangular blocky structure parting to weak, fine subangular blocky structure; firm; few, fine (5YR 4/6) iron coatings on ped and grain surfaces; many, fine, weakly cemented iron concretions; common, fine roots and common, medium roots; clear, wavy boundary (few tongues into lower horizons).

Bw1 - 19 to 29 cm, dark brown (7.5YR 4/6) loamy sand; weak, fine subangular blocky structure; very friable; few, fine (5YR 4/6) iron coatings in root channels; few, fine iron concretions (orstein); common, fine roots; gradual, wavy boundary.

Bw2 - 29 to 53 cm, dark yellowish brown (10YR 4/6) loamy sand; weak, medium subangular blocky structure; very friable; few, fine (7.5YR 4/6) iron coatings in root channels; few, coarse (5YR 3/6) iron concretions (orstein) concentrated directly beneath tonguing from E-Bs horizons; few, fine roots; clear, wavy boundary.

C - 53 to 114 cm, light brownish gray (2.5Y 6/2) fine sand; weak, medium angular blocky structure; friable; few, fine, prominant (10YR 4/6) mottles; few, fine (7.5YR 5/6) bands of iron coatings on grain surfaces; 20 percent of C horizon has a vertical inclusion: fine sandy loam, brown (10YR 5/3); moderate, medium angular blocky structure parting to moderate, fine angular blocky structure; friable; few, fine prominant (10YR 5/8) mottles, very few, medium lens of 2C material distributed evenly throughout inclusion; <2 percent fine, platy coarse fragments (mica); very few, fine roots; strong horizontal to slightly downward sloping bedding present throughout horizon; abrupt, wavy boundary.

2C - 114+ cm, brown (10YR 5/3) silt loam; strong, coarse subangular blocky structure parting to strong, medium subangular blocky structure; firm; common, medium prominant (7.5YR 4/6) mottles; few, fine iron coatings in root channels and on ped surfaces; few, fine roots and very few, medium roots.

Table A1-6d

North Offsite

Soil Profile Description: ~~Site Characteristics~~

Date: September 7, 1985 Name: Balogh and Kosian

Location

County: Androscoggin Site Name: Michaud

Map Coordinates: 44°02'N, 70°20'W Site Code: North Offsite

Landform

Type: Sand Dune Field, Dune remnant from dune blowout

Slope: Percent; 0 - 5% Shape; Convex

Aspect; 210° Site Class; Gently Undulating

Rock Outcrop Class: 0

Parent Material: Sand dunes from marine outwash delta sands deposited over fine marine sediments

Vegetation: Abandoned field, bare surface, weeds and grasses, mixed hardwoods with pine present on the field edge

Erosion Class: Water 1 Wind 4 Hazard 4

Water Status:

Soil Water Status at Time of Description: Moist

Drainage; Well drained

Depth to Water Table; Below 3 m Depth to Mottles; 47 cm

Depth to Restricting Layer; ---

Effective Rooting Depth: 140 cm

Comments: Horizontal to slightly sloping bedding of sand becomes evident at 47 cm. Beneath a concentrated zone of organic coatings (stain) from a concentration of small roots in C1 to C3 horizon a small lens of eluviated material and iron band (C3) has developed as evidence of localized accelerated podzolization from a concentration of decomposing organic material.

Classification: Sand, mixed, frigid Typic Haplorthod

~~Soil Profile Description:~~ Horizon Morphology ~~Site Code:~~ North Offsite

A - 0 to 3 cm, dark brown (7.5YR 3/3) sand, moderate, medium angular blocky structure parting to weak, fine angular blocky structure; friable; few, fine organic coatings (10YR 3/2) on particle and grain surfaces; many, fine charcoals; few, fine roots; clear, wavy boundary with fine tonguing into next horizon.

Bs1 - 3 to 13 cm, reddish brown (5YR 4/4) sand; weak, medium angular blocky structure parting to weak, fine angular blocky structure; friable; common, fine iron coatings on particly and ped surfaces; common, coarse, rounded, weakly cemented, iron concretions; few, fine roots, gradual, wavy boundary.

Bs2 - 13 to 27 cm, dark brown (7.5YR 4/6) sand; weak, medium subangular blocky structure; friable; few, fine organic coatings in root channels; few, fine roots, few, medium roots; gradual, wavy boundary.

Bw - 27 to 47 cm, dark brown (10YR 4/4) sand; weak, coarse angular blocky structure parting to weak, fine subangular blocky structure; friable; few, fine organic coatings in root channels; few, fine roots; gradual, wavy boundary.

C1 - 47 to 109 cm, brownish yellow (10YR 6/6) sand; moderate, medium angular blocky structure; friable; very few, fine, faint (10YR 4/4) mottles; single, fine, large organic stain (10YR 5/6 and 10YR 4/3) in area of concentrated fine roots; <1 percent small platy coarse fragments (mica) sorted in thin layers; strong horizontal bedding present throughout horizon; few, fine roots; clear, smooth boundary.

C2 - 109 to 135 cm, yellowish brown (10YR 5/4) sand; moderate, medium angular blocky structure; friable; few, fine, distinct (7.5YR 5/6) mottles; single, fine, large organic stain (10YR 5/6 and 10YR 4/3) in area of concentrated fine roots; <1 percent small platy coarse fragments (mica) sorted in thin layers; strong horizontal bedding present throughout horizon; few, fine roots; clear, smooth boundary.

Soil Profile Description: Horizon Morphology Site Code: North Offsite

C3 - 135 to 153 cm, yellowish brown (10YR 5/4) sand; moderate, medium angular blocky structure; friable; single, fine, large organic stain (10YR 5/6 and 10YR 4/3) in area of concentrated fine roots, beneath organic stain is a small lens of eluviated material (10YR 5/2) and over two fine (7.5YR 5/6) iron lens; <1 percent small platy coarse fragments (mica) sorted in thin layers; strong horizontal bedding present throughout horizon; few, fine roots; clear, smooth boundary.

C4 - 153 to 233+ cm, dark yellowish brown (10YR 4/6) sand; moderate, medium angular blocky structure; friable; very few, fine, distinct (5YR 4/6) mottles; few, fine bands of iron coatings (7.5YR 5/6), few, fine bands of light colored bedded sand (10YR 4/2); <1 percent small platy coarse fragments (mica) sorted; strong horizontal bedding present throughout horizon; very few, fine roots.

Table A1-62

N36 E66

Soil Profile Description: ~~Site Characteristics~~

Date: September 7, 1985 Name: Balogh and Kosian

Location

County: Androscoggin Site Name: Michaud

Map Coordinates: 44°02'N, 70°20'W Site Code: N36 E66

Landform

Type: Sand Dune Field; Dune blowout overburden area within archaeological site

Slope: Percent; 2 - 5% Shape; Level

Aspect; 184° Site Class; Gently Sloping

Rock Outcrop Class: 0

Parent Material: Sand dunes from marine outwash delta sands deposited over fine marine sediments

Vegetation: Abandoned field, weeds and grasses, mixed hardwoods with pine present on the field edge

Erosion Class: Water 1 Wind 4 Hazard 4

Water Status:

Soil Water Status at Time of Description: Moist

Drainage; Well drained

Depth to Water Table; Below 3 m DepthtoMottles;Surface

Depth to Restricting Layer; ---

Effective Rooting Depth: 54 cm

Comments: Horizontalbedding of sand becomes evident at 94 cm. Overburden (17 to 0 cm) from recent dune blowout has characteristics similar to the B horizons.

Classification: Sand, mixed, frigid Typic Dystrochrept

~~Soil Profile Description:~~ Horizon Morphology ~~Site Code:~~ N36 E66

A - 0 to 3 cm, dark brown (7.5YR 4/4) fine sand; weak, fine subangular blocky structure; very friable; few, fine faint (7.5YR 4/6) mottles; few, fine charcoals; common, fine roots; abrupt, wavy boundary.

Bw1 - 3 to 18 cm, strong brown (7.5YR 5/6) sand; weak, medium angular blocky structure parting to weak, fine angular blocky structure; friable; few, fine organic coatings on root channels; very few, fine charcoals; few, fine roots; gradual, wavy boundary.

Bw2 - 18 to 54 cm, yellowish brown (10YR 5/4) sand; weak, coarse angular blocky structure parting to weak, medium angular blocky structure; friable; few, fine, prominant (5YR 4/6) mottles; few, fine organic coatings on root channels; very few, fine roots; clear, wavy boundary.

C1 - 54 to 63 cm, yellowish brown (10YR 5/5) and dark yellowish brown (10YR 4/4) sand; weak, medium angular blocky structure; friable; few, fine prominant (5YR 3/6) mottles; few, medium bands of iron coatings (10YR 5/3) on grain surfaces; <1 percent, small platy coarse fragments (mica); clear, smooth boundary.

C2 - 63 to 94 cm, brown (10YR 5/3) sand; weak, medium angular blocky structure parting to weak, fine angular blocky structure; friable; few, medium distinct (5YR 5/3) mottles; common, coarse bands of iron coatings (7.5YR 4/3) on grain surfaces; few, medium lens of C1 matrix evenly distributed throughout horizon; <1 percent, small platy coarse fragments (mica); clear, smooth boundary.

C3 - 94 to 148+ cm, yellowish brown (10YR 5/4) sand; weak, coarse angular blocky structure parting to weak, fine angular blocky structure; friable; few, medium distinct (7.5YR 5/6) mottles; few, fine, faint bands of iron coatins on grain surfaces; <1 percent, small platy coarse fragments (mica); strong horizontal bedding present throughout horizon.

Table A1-6f

Soil Profile Description; N34E62 ~~Site Characteristics~~

Date: September 8, 1985 Name: Balogh and Kosian

Location

County: Androscoggin Site Name: Michaud

Map Coordinates: $44^{o}02'N$, $70^{o}20'W$ Site Code: N34 E62

Landform

Type: Sand Dune Field; Dune blowout overburden area within archaeological site

Slope: Percent; 4 - 8% Shape; Convex

Aspect; 184^{o} Site Class; Gently Sloping

Rock Outcrop Class: 0

Parent Material: Sand dunes from marine outwash delta sands deposited over fine marine sediments

Vegetation: Abandoned field, weeds and grasses, mixed hardwoods with pine present on the field edge

Erosion Class: Water 1 Wind 4 Hazard 4

Water Status:

Soil Water Status at Time of Description: Moist

Drainage; Well drained

Depth to Water Table; Below 3 m DepthtoMottles;Surface

Depth to Restricting Layer; ---

Effective Rooting Depth: 54 cm

Comments: Horizontalbedding of sand becomes evident at 68 cm. Overburden (29 to 0 cm) from recent dune blowout has characteristics similar to the C1 horizon.

Classification: Sand, mixed, frigid Typic Haplorthod

~~Soil Profile Description:~~ **Horizon Morphology** ~~Site Code:~~ N34 E62

A - 0 to 3 cm, very dark grayish brown (10YR 3/2) loamy sand; weak, fine angular blocky structure; very friable; few, fine macropores; common, medium roots and many, fine roots; abrupt, smooth boundary.

E - 3 to 4.5 cm, light brownish gray (10YR 6/2) sand; weak, fine angular blocky structure; friable; common, fine roots; abrupt, broken boundary.

Bs1 - 3 to 8 cm, reddish brown (5YR 4/4) loamy sand; moderate, medium angular blocky structure parting to weak, fine angular blocky structure; friable; few, fine faint (7.5YR 4/6) mottles; common, fine iron coatings on grain and ped surfaces; very few, very fine, rounded iron concretions (orstein); common, fine roots, few, medium roots; clear, wavy boundary.

Bs2 - 8 to 21 cm, strong brown (7.5YR 5/6) sand; weak, coarse platy structure; friable; few, fine, faint (7.5YR 4/6) mottles; few, fine organic coatings on grains of root channels; common, fine roots, few, medium roots; diffuse, wavy boundary.

C1 - 21 to 68 cm, yellowish brown (10YR 5/6)loamy sand; weak, coarse angular blocky structure parting to weak, fine angular blocky structure; friable; very few, faint (7.5YR 5/6) mottles; few, fine organic coatings on grains of root channels; few, fine roots, few, medium roots; clear, wavy boundary.

C2 - 68 to 84 cm, grayish brown (2.5Y 5/2) sand; weak, coarse angular blocky structure; very friable; few, fine prominant (5YR 3/6) mottles; many, medium to coarse bands of iron coatings (7.5YR 6/4) on grain surfaces; <1 percent small platy coarse fragments (mica); very few, fine roots; strong horizontal bedding present throughout horizon; diffuse, smooth boundary.

C3 - 84 to 128 cm, light yellowish brown (10YR 6/4) sand; weak, medium angular blocky structure; very friable; few, coarse, linear/vertical, prominant (5YR 4/6) mottles; few, fine bands of iron coatings on grain surfaces; common, coarse lens of C2 matrix; <1 percent small platy coarse fragments (mica); strong horizontal bedding present throughout horizon; diffuse, smooth boundary.

Soil Profile Description: Horizon Morphology Site Code: N34 E62

C4 - 128 to 150+ cm, light yellowish brown (10YR 6/4) sand; moderate, coarse angular blocky structure parting to weak, medium angualr blocky structure; friable; <1 percent small platy coarse fragments (mica); strong horizontal bedding present throughout horizon.

Tab. A1-Eg

N18E68

Soil Profile Description/ ~~Site Characteristics~~

Date: September 8, 1985 Name: Balogh and Kosian

Location

County: Androscoggin Site Name: Michaud

Map Coordinates: 44°02'N, 70°20'W Site Code: N18 E68

Landform

Type: Sand DuneField; Duneblowout

Slope: Percent; 0 - 10% Shape; Level, footslope

Aspect; 168° Site Class; Gently Sloping

Rock Outcrop Class: 0

Parent Material: Sand dunes from marine outwash delta sands deposited over fine marine sediments

Vegetation: Abandoned field, bare surface, weeds and grasses, mixed hardwoods with pine present on the field edge

Erosion Class: Water 1 Wind 4 Hazard 4

Water Status:

Soil Water Status at Time of Description: Moist

Drainage; Well drained

Depth to Water Table; Below 3 m DepthtoMottles;7 cm

Depth to Restricting Layer; ---

Effective Rooting Depth: 19 cm

Comments: Horizontalbedding of sand becomes evident at 77 cm. This profile was described within the archaeological site.

Classification: Sandy, mixed, frigid Typic Dystrochrept

Soil Profile Description: Horizon Morphology Site Code: N18 E68

A - 0 to 5 cm, dark brown (7.5YR 3/2) sandy loam; moderate, fine subangular blocky structure; very friable; few, fine charcoals; many, fine roots; abrupt, wavy boundary.

Bw1 - 5 to 7 cm, dark brown (7.5YR 4/4) sand; moderate, fine subangular blocky structure; friable; common, fine iron coatings (5YR 4/4) on ped surfaces; abrupt, wavy boundary.

Bw2 - 7 to 19 cm, strong brown (7.5YR 5/6) sand; weak, medium angular blocky structure; friable; few, fine faint (7.5YR 4/6) mottles; few, fine organic coatings on grains of root channels; few, fine roots; diffuse, wavy boundary.

C1 - 19 to 56 cm, yellowish brown (10YR 5/6) sand; weak, medium angular blocky structure parting to medium, fine angular blocky structure; friable; few, fine faint (7.5YR 5/6) mottles; very few, fine organic coatings on grains of root channels; diffuse, smooth boundary.

C2 - 56 to 77 cm, grayish brown (10YR 5/2) loamy fine sand; weak, coarse angular blocky structure parting to weak, medium angular blocky structure; friable; few, fine prominant (5YR 4/6) mottles; smooth, diffuse boundary.

C3 - 77 to 100+ cm, yellowish brown (10YR 5/6) sand; weak, medium angular blocky structure; very friable; few, fine distinct (5YR 4/6) mottles; many, coarse bands of iron coatings on grain surfaces; <1 percent small platy coarse fragments (mica); two coarse bands of C2 matrix; strong horizontal bedding present throughout horizon.

Table A1-6h

Soil Profile Description; N30 E38 ~~Site Characteristics~~

Date: September 8, 1985 Name: Balogh and Kosian

Location

County: Androscoggin Site Name: Michaud

Map Coordinates: 44°02'N, 70°20'W Site Code: N30 E38

Landform

Type: SandDuneField; Duneblowout

Slope: Percent; 0 - 10% Shape; Convex, dune crest

Aspect; 2° Site Class; Gently Sloping

Rock Outcrop Class: 0

Parent Material: Sand dunes from marine outwash delta sands deposited over fine marine sediments

Vegetation: Abandoned field, bare surface, weeds and grasses, mixed hardwoods with pine present on the field edge

Erosion Class: Water 1 Wind 4 Hazard 4

Water Status:

Soil Water Status at Time of Description: Moist

Drainage; Well drained

Depth to Water Table; Below 3 m DepthtoMottles;32 cm

Depth to Restricting Layer; ---

Effective Rooting Depth: 74 cm

Comments: Horizontal bedding of sand becomes evident at 74 cm. This profile was described within the archaeological site and the morphological description is focused on an example of a deep podzolized tongue, as seen throughout the dune field and the archaeological site. A thin (<1 cm) band of Bs2 was observed between the broken A and E horizon. This morphological feature may be remnant overburden from a past tree throw event or an indication of the beginning of bisequel development in the soil profile.

Classification: Sand, mixed, frigid Typic Haplorthod

~~Soil Profile Description:~~ Horizon Morphology ~~Site Code:~~ N30 E38

A - 0 to 3 cm, dark brown (7.5YR 3/2) fine sand; weak, medium platy structure; very friable; common, fine roots; abrupt, irregular boundary.

E - 3 to 8 cm, dark brown (7.5YR 5/2) fine sand; weak, fine subangular blocky structure; very friable; few, fine organic coatings on ped surfaces; few, fine roots; clear, broken boundary.

Bh - 8 to 13 cm, dark brown (7.5YR 3/4) loamy fine sand; weak, fine angular blocky structure; very friable; common, fine organic coatings (7.5YR 3/3) on ped and grain surfaces; few, fine iron coatings (5YR 3/4) on ped surfaces; few, fine roots; clear, broken boundary.

Bhs - 13 to 17 cm, dark reddish brown (5YR 3/6) loamy fine sand; strong, fine subangular blocky structure; firm; few, coarse iron coatings (5YR 4/3) on ped surfaces; common, fine, rounded iron concretions (orstein); few, fine roots; abrupt, irregular boundary.

Bs - 17 to 22 cm, dark brown (7.5YR 4/6) loamy fine sand; moderate, medium subangular blocky structure; friable; few, fine organic coatings on grains of root channels; few, fine iron coatings (5YR 3/4) on ped surfaces; few, fine roots; clear, wavy boundary.

Bw - 22 to 32 cm, strong brown (7.5YR 5/6) fine sand; weak, medium angular blocky structure parting to weak, fine angular blocky structure; friable; few, fine iron coatings (5YR 3/4) on surface of root channels; very few, fine charcoals; few, fine roots and few, medium roots; diffuse, wavy boundary.

C1 - 32 to 74 cm, yellowish brown (10YR 5/4) fine sand; weak, coarse angular blocky structure; friable; few, fine, faint (7.5YR 4/4) mottles; few, fine, faint (7.5YR 4/6) mottles; <1 percent small platy coarse fragments; few, fine roots; very few, medium roots; gradual, wavy boundary.

C2 - 74 to 101 cm, brown (10YR 5/3) sand; weak, coarse angular blocky structure; friable; common, medium, vertical/linear distinct (5YR 4/6) mottles; few, fine, faint bands of iron coatings on grain surfaces; <1 percent small platy coarse fragments (mica); horizontal bedding present throughout horizon; clear, smooth boundary.

C3 - 101 to 121+ cm, brown (10YR 4/3) sand; weak, coarse angular blocky structure parting to weak, medium angular blocky structure; friable; common, medium, vertical/linear distinct (5YR 4/6) mottles; many, fine, distinct bands of iron coatings on grain surfaces; <1 percent small platy coarse fragments (mica); horizontal bedding present throughout horizon.

APPEND/2
DISC ART #15C

APPENDIX 2

A SURVEY OF MAINE AND NEARBY FLUTED POINTS

The purpose of Appendix 2 is to provide a current review of existing data on isolated fluted point finds that may be important in formulating a model of Paleoindian economics and movements across the landscape of the New England-Maritimes Paleoindian region. All of the isolated Paleoindian finds mentioned in previous compilations (Brennan 1982:27-46; Ritchie 1980:5), with one exception, are discussed below, and new information is added. The exception is a fluted point indicated on Ritchie's map by a dot in the Farmington-Wilton area, for which no known specimen exists. The discussion of isolated Maine point finds proceeds generally from those at the southern and western end of the state toward the northern and eastern end. At the end of the section we discuss a few finds from New Hampshire, New Brunswick and Vermont. The data presented here is as complete as is currently professionally known for Maine only. Comprehensive literature reviews were conducted to obtain information on isolated finds in other parts of the region.

ISOLATED PALEOINDIAN POINT FINDS FROM MAINE

We now review the record of isolated fluted points from our research area with respect to both raw materials and various morphological attributes. The purpose is to augment the data from sites in an attempt to detect geographic patterning in either category.

Desert of Maine Point

The Desert of Maine point is mentioned in print by Sargent (Brennan 1982:43). It was known to Douglas Jordan who provided a sketch in a personal communication to Bruce Bourque, October 22, 1974, and it has been studied recently by Spiess, courtesy of Howard Sargent. This point is delicately made (Figure A2-1), with slightly concave sides flaring to distinct moderately pointed ears. The basal concavity is approximately 3 mm. deep, length 71 mm.,

width 19 mm., thickness 7 mm. The point exists in 3 pieces: a distal and medial piece that have been refitted, the latter having a single point of contact with a basal piece. The dorsal fluting scar is 21 mm. in length, ventral fluting scar 12 mm. The lateral retouch on this piece and retouch producing the sharp tip are identical in spacing, sequence and style to point 23.12.0088/0112 from Michaud. The raw material is an olive-green chert with vesicles similar to Cegl from the Michaud site. It could be the same material as the majority material at the Bull Brook site. The point is from the "L. M. Crosbie" collection, from the Desert of Maine, Freeport (near Portland). The Desert of Maine is currently a partially vegetated and partially reactivated sand dune field; several archaeologists including Spiess have surface searched it without success in the last two decades.

McAllister Point

During the time of writing of this manuscript, a new fluted point was reported to Bruce Bourque by M. B. McCallister of Lebanon, Maine (Bourque, personal communication). The point was found underwater near the shore of Northeast Pond, Berwick USGS quadrangle. The point consists of perhaps four-fifths of the total length of a fluted point with the tip and basal ears missing. It is made on a light and medium grey mottled dull lustre chert which looks like it could be part of the Ordovician chert series from northern Maine, New Hampshire, or Vermont. The nearest analogue in terms of material is the Earl Flanders point (below). The McCallister point was originally 5 cm. approximately long.

Clarke and Lake Site Point

The Clarke and Lake Site (Baker 1985) is located on the Sasanoa River on Arrowsic Island, Georgetown, Maine. The Sasanoa, along with the Back River form a "back channel" connecting the tidal Kennebec River with the tidal Sheepscot River.

The principal component at the Clarke and Lake Site is a mid-17th century European trading establishment with extensive structural features. The site has been partially excavated by several amateur and professional archaeologists during the 1970s, notably from Bates College and the Maine State Museum. During the course of the excavations, several score lithic and ceramic artifacts of prehistoric age were recovered from contexts indicating disturbance of a prehistoric site by the builders of the 17th century settlement. Thus, there is no chance for subdividing the prehistoric assemblage into components on any basis other than style. Except for the fluted point in question, the prehistoric assemblage from the site contains a series of points, end scrapers, ground/pecked stone and ceramics that document habitation at the site from Middle Archaic through Late Ceramic times.

Although the site seems to be yielding a multi-component collection not unusual on some Maine sites, we were surprised to notice the presence of a slightly atypical fluted point in the collection (Plate A2-1). This point is made on a black phenocrystic felsite, and its tip has been broken. As it exists now, it is 3.7 cm. long, 2.4 cm. wide and .55 cm. thick. The base is concave, and one side (only one) is clearly fluted (flute length, 2.0 cm.). The basal corners of this specimen exhibit pronounced ears. One can feel the heavy grinding of the basal concavity, and of the sides as far as 18 mm. along the lateral edges. Immediately distal to the termination of the grinding the sides of the point converge sharply and asymmetrically, possibly indicative of heavy resharpening of the unhafted portion of the blade.

The point tip had been broken away with some force, which produced two long flake scars ending in hinges. The hinges coincide with the distal limits of grinding, indicating that the flake propagation may have stopped non-coincidentally at the lashing.

We attribute this point to the Paleoindian fluted-point tradition on the basis of a long flute on one face, coupled with a concave base and heavy grinding on the base and lateral margins. Heavy resharpening of fluted points distal to the termination of the grinding also seems to be a common Paleoindian cultural trait, in the Northeast at least.

The point is atypical with the slight ears at its basal corners and the unifacial nature of the fluting. Felsite is an uncommon raw material for Maine fluted points, but other examples exist.

Sagadahoc Island Fluted Preform

The Sagadahoc Island site (15.117 in Maine's prehistoric archaeological survey) is located near the Clarke and Lake site in the lower Kennebec. It is currently under investigation by Robert Bradley and Emerson Baker. The circumstances of recovery of the aboriginal collection are similar to that at Clarke and Lake: a range of aboriginal occupation, including Middle Archaic, disturbed by 17th century Euro-American building.

The probable Paleoindian artifact is the base of what appears to be a large, medially-thinned preform (see Plate A2-2). There is a channel flake running up from the base on both sides of this object. Subsequently the base has been retouched and lightly ground. The large size of this biface and lack of basal concavity suggest that it may have been a preform awaiting further fluting and retouch. The specimen is "fresh", not having been rolled on the beach. The material is a dark, grey rock with slightly sugary texture.

Earle Flanders' Point

This point was donated to the Maine State Museum by Mr. Earle Flanders from the collection of a small museum in Monmouth, just west of Augusta. The point was acquired by the Monmouth Museum without a more exact provenience than that it came from somewhere in the Monmouth area. Several years ago a young Augusta area collector mentioned to Spiess that he knew of a very old, large grey

spearpoint collected some time ago by an older relative or friend from a hill overlooking Cochnewagon Lake in Monmouth. This may be the point's provenience. This fluted point is very long, with converging straight sides and short fluting scars. The point is made on dull-lustre chert that has patinated to a mottled light and medium grey. The lustre is slightly duller than Cegl material from the Michaud site, which patinates a yellow-greenish mottled rather than grey mottled.

Whitefield Point

In 1985 the Maine State Museum was given a short, resharpened fluted point found in the yard of a house in Augusta. Bourque (personal communication) tested the yard extensively without finding any more flakes or artifacts. According to the owner, the yard had recently been covered with several loads of loam, which Bourque managed to trace to an origin in Whitefield (a community in hilly country east of Augusta). This point has been heavily resharpened. It exhibits thin, pointed ears similar to the red chert fluted points from Concentration I at the Michaud site. The material is a grey groundmass rhyolite that visually fits in the Neponset rhyolite series (Spiess, Brush and Grimes, personal observation).

Boothbay Point

An examination of an amateur collection in the Boothbay region conducted located a fluted point in the collection of C. Haggett (Plate A2-3). Haggett had found the point below the high tide mark in front of a Late Archaic and Ceramic Period shell midden (site 16-37). Our model of Maine coastal paleoenvironment indicates that this location may have been on a slope beside a small freshwater stream when sea level was much lower during the Paleoindian Period. The point is approximately 7½ cm. long, with nearly parallel sides, a moderately deeply indented base, and a fluting channel flake that extends nearly

the whole length on one side. The point is made of a red chert visually identical with the Crl series that we attribute to bedrock sources near Munsungun Lake.

Rumford Center Point

Before 1980 the late Leo Bartlett of Rumford Point on the upper Androscoggin River discovered a fluted point in the garden behind his house (Gramly 1981). The findspot was on a remnant valleyside kame or river terrace near the mouth of a tributary valley, over-looking the Androscoggin Valley from a level significantly above the modern floodplain. Subsequent intensive investigation of this seemingly prime spot for a habitation site by the Maine State Museum failed to recover flakes, other artifacts, or any evidence that this was more than a single fluted point findspot. The point (Plate A2-4) is complete, moderately long, with markedly convex sides, pointed ears on a base that does not "fishtail", and has a deeply indented basal concavity. The point is made on a blotchy yellowish-brown dull-lustre chert with black swirls and rills. This chert is one of the varients of Bull Brook chert found in the Bull Brook collection (Grimes, Spiess, Brush, personal observation).

Mount Desert Island Point

Ritchie (1980:7) mentions a fluted point from Mount Desert Island without further details. Douglas Jordan (personal communication to Bruce Bourque 1974) refers to two fluted point specimens which were "reportedly surface finds" from Mount Desert Island, Maine. These points from the R. S. Estee collection, were first reported by Fowler (1954). Both Bourque and Gramly are aware of these pieces and discount them as being neither from Maine originally nor authentic (personal communication). We will not use these data in further analyses.

Graham Lake Point

A fluted point collected by Mickey Chandler from the shores of Graham Lake is currently in the Department of Anthropology, University of Maine (Orono),

collection (catalogue #74/158.15.056). The specimen (Figure A2-2) is the distal 2/3 of a thick, very large biface. I suspect that it is a biface preform having undergone at least one round of medial thinning (removal of a longitudinal thinning flake). The material is a swirled, finely flow-banded red and purple rhyolite.

Second Graham Lake Point

According to Maine Archaeological Survey Site Form 58-21, a fluted point was found along the east shore of Graham Lake circa 1970. The spot was checked by Harold Borns, Jr., Douglas Beyers, and Robert G. MacKay, who considered that there was no site in association (i.e., just an isolated point find). Slides of this point, which is about 5.6 cm. long, exist in the Department of Anthropology University of Maine collection (70/001 to 70/004). The point is made of a red chert visually identical to the Crl series from the Michaud site, which we are attributing to a bedrock source origin near Munsungun Lake.

Layman Point

Eric Lahti (personal communication, February 24, 1986) reports a fluted point (Plate A2-5) owned by John Layman of South Solon. Mr. Layman is a Maine antique dealer who found the point in an attic box with other Maine prehistoric lithic material (non-Paleoindian). Unfortunately, there is no way to trace the provenance of this piece beyond knowing that it certainly came from Maine and likely came from central Maine. The point is approximately 7 cm. long, with a 0.4 cm. basal indentation, and definite (asymmetrical) ears providing a fish-tailed appearance. The piece is made on a red and green chert visually identical to the Cr05 material from the Michaud site, of which one bedrock outcrop is the Willard Brook Quarry near Munsungun Lake. In form and flaking style it is hard to imagine a closer match to the large black point from the Michaud site.

Eddie Brown's Point

A large collection of prehistoric material made over many years by Eddie Brown in the Grand Lake area, St. Croix drainage, has been recently analyzed by Diane Kopec (1985). One of the points in the collection (catalogue #95.3.1021) is a complete fluted point. The point is relatively short, with near parallel sides. One face exhibits a long fluting scar, the other a much shorter one. This point is made of a breciated or variegated banded agate, with a deep pink ground mass and purple-grey and white bands. Beveling of the basal concavity is uncharacteristic of northeastern fluted points. Several professional archaeologists in Maine have seen points made of identical material which are known fakes. This material apparently outcrops in the American southwest. We will not use the data from this point in future analyses.

Flagstaff Point

The Bryce Clayton collection, made in the Flagstaff Lake area, includes a fluted point found below the high water level on this man-made lake. The point (Plate A2-6 is approximately 7.7 cm. long, 2.7 cm. wide at its widest, with a deeply indented (1.0 cm.) basal concavity. The base is very reminiscent of Vail collection fluted points. Gramly (1985:52) states that it is made on a "dark grey argillite, and was found in company with several flakes of the same material". It may be the same material as the Earle Flanders point and the McAllister point, based on the photograph and verbal descriptions.

Brassua Lake Point

There is a short fluted point in the University of Maine (Orono), Department of Anthropology collection with a provenance of somewhere around Brassua Lake. The point (Figure A2-2) has been marked with several catalogue numbers: "74/1", and "4815" and it may have come from the M. Chandler collection. This is a short point (approximately 5 cm.), made on a fairly thick preform, with marked basal ears. The flutes did not travel far on this point;

it is fluted and basally ground for only approximately 25% of its short length. The point is made on white-patinated Kineo-Traveler porphyritic felsite, a material that outcrops at Mount Kineo and on ridges between Moosehead and Brassua Lakes. This material is widely distributed southward as cobbles in glacial drifts. Thus, this point was probably, but not certainly, locally manufactured and lost in the Moosehead-Brassua Lake basin.

Schoodic Lake Point

Jordan (personal communication to Bourque, October 22, 1974) reports a "point about 3 inches long, both sides fluted, especially thick, of a dark yellow material (Figure A2-3), which came from Schoodic Lake. The specimen was in the hands of its finder, one Bernard Flynn of Dover-Foxcrift in 1954 when I recorded the data." Mr. Flynn returned to Danvers, Massachusetts, and his collection has been sold without possibility of recovery (Bourque, personal communication). This material is likely to be the same as a mustard-colored yellow chert found rarely in the Vail collection, Dam collection and other New England collections. If so, its bedrock source may be somewhere in the "Pennsylvania jasper" series from eastern-most Pennsylvania. The point, as illustrated by a Jordan sketch, is another eared or "fish-tailed" specimen.

Hall Point

Milton Hall, father of Dr. Brad Hall who is a faculty member and administrator at the University of Maine (Orono), found a large fluted point (Figure A2-2) in the vicinity of Munsungun Lake about the time of World War II. Both the existence of this point and knowledge of potential chert outcrops were principal factors in the development of Bonnichsen's Munsungun Lake Project. The point is exceedingly long and made on grey chert. Its sides are nearly straight and converging, and the fluting channel length is very short compared with the length of the point.

MOOSEHORN ARTIFACTS

The Moosehorn "site" has been reported by Bonnichsen, Bourque and Young (1983). The circumstances of the discovery, and how it became known to Bourque are presented therein (ibid:37). We add our comments here. In the winter of 1980/81, Bourque was shown one or more black and white photograph(s) of the purported assemblage. Subsequent conversations with Earle Meyers (Spiess, field notes) indicated that the assemblage originally consisted of four whole fluted points, two broken proximal fluted points, two (side?)scrapers, a large bifacial "knife" made on a large flake, one large flat flake, and a large biface with a broken tip.

Thus, Myers' recollection of the assemblage does not completely coincide with the photograph-based assemblage published by Bonnichsen and Bourque. Bourque, Gramly and Spiess visited Mr. Meyers in 1981, and Meyers gave us vague directions to a hillside in the Moosehorn Wildlife Refuge where he understood the material might have been found. Meyers indicated that the collection was probably found on the ground surface or in sparse vegetation under the lip of a large boulder or at the entrance to a small cave. We made as detailed a check of the hillside as three energetic men could do in a day, indeed finding a group of house-sized boulders with many places underneath into which a man could crawl. No sign of disturbed soil or vegetation cover was found to confirm recovery of anything from the soil. On October 26, 1981 we returned to Mr. Meyers residence and were met by his wife. Mr. Meyers was to return home from work shortly; his wife had no knowledge of the artifacts after which we enquired. Returning later, we were informed by Mr. Meyers that his wife had cleaned out the basement and taken a cigar box with two whole points and all the other pieces to the Machias dump about two weeks previously. Thus, the Moosehorn specimens, except for the two at the State Museum, are currently lost. The lack of correspondence between Mr. Meyers' recollection of the collection

(broken point bases) and the photograph, plus the inability to confirm who found them and where they were found, is puzzling. Most importantly, the material from which the two extant points are made is unique in the New England Maritimes region in our experience. Not even a flake of this material is found in the Bull Brook, Vail, Michaud, or Dam site assemblages, nor does it match any other fluted points so far found in this area.

The Moosehorn Point material has been described (Young and Bonnichsen 1985:113) as a silicified limestone containing crinoid stem fragments, a brachiopod shell fragment and other fossils. Young and Bonnichsen (ibid.) produce an elegant description of the differences in final manufacturing steps between the two Moosehorn points available for study, and two unquestionably genuine Clovis points from the Anzich site. Indeed there are radical differences in technology, but we would caution against using the Moosehorn points for any far reaching hypothesis (i.e., ibid.:125) about Paleoindian origins or behavior.

Discussion

Isolated Maine fluted points are found in a wide variety of circumstances. They are certainly not confined to the sandy soils that characterize the New England Paleoindian region habitation sites. The majority of these points were found (or probably found) on landforms associated with an existing lake basin, but at an elevation substantially above (a meter to a score of meters) the pre-Euro-American lake/river levels. The construction of dams and flooding of land during the 19th century is the factor most responsible for revealing the majority of these points. However, at least two points come from river terrace features in the lower Kennebec River valley that would have been several miles upstream from estuarine water when the points were lost. Thus, they are definitely "riverine" locations.

The isolated points from Maine are made of lithics both recognized from extant sources or Paleoindian sites, and lithics that are "unique". The majority of these materials are probably Ordovician cherts from bedrock sources in northern Maine, New Hampshire and Vermont. Only a couple can be said to be "likely" Munsungun-area lithics. The presence of Neponset rhyolite, and a possible Pennsylvania-jasper-like material is noteworthy, as are points made of felsite which might be strictly sub-local.

ISOLATED FLUTED POINTS FROM ADJACENT TERRITORY

Neville Site

The Neville site, Amoskeag Falls, Manchester, New Hampshire has yielded the "tip of a fluted point made of jasper" from the interface between Stratum 1 and 2 (Dincauze 1976:118-119). The material of the fluted point is not described further. Dincauze also assigns four flake tools to the Neville Paleoindian component because they are distinctive in raw material and manufacturing technique from the Middle Archaic component. She hypothesizes that these pieces, plus several Early Archaic pieces, were picked up nearby as curios, and brought to the Neville site by the Middle Archaic inhabitants. The sand-dunes formed along the higher margins of the river valley are implied as the probable provenance of these early materials.

Smyth Site

The Smyth site, twin to the Neville site, has yielded two fluted points (Winter 1975:6), one apparently complete and one a basal section. No Paleoindian "campsite", as distinguished by other tools has been recognized on this location. A slide of one of these points provided by Victoria Kenyon discloses a long point made of lustrous red chert, another probable Munsungun (Crl) piece.

Intervale

A fluted point from Intervale, New Hampshire, near North Conway in the

Upper Androscoggin River valley, is currently on display at the Smithsonian Institution. It is made of a red chert with streaks of a darker color, another possible Munsungun chert (?Cr05 equivalent).

Ossipee Lake

Spiess has examined a fluted point of red Saugus rhyolite from the outlet of Ossipee Lake, New Hampshire, through the courtesy of Howard Sargent. (The same reddish-pink rhyolite occurs as a minority component in the Bull Brook collection and the Neponset collection.) The Ossipee point exhibits slightly flaring ears, and is thick and heavily made (length 79 mm., width 28 mm., thickness 8.5 mm.). The flutes, a single on each face, are short (29 and 23 mm.).

Howard Sargent (1982, personal communication 1986) has also reported two Paleoindian sites near Lake Sunapee. Both sites have yielded uniface and biface fragment forms which are consistent with Paleoindian technological practices, but no diagnostic forms to date. A retouched flake from one site is made of Neponset rhyolite (Spiess, personal observation).

Vermont

Loring (1980), has illustrated several fluted points from Vermont. Spiess, Grimes and Brush examined two of these points (ibid.: Plate I) in the University of Vermont collections, courtesy of Peter Thomas. Both are broken short points with substantially flaring basal ears. One specimen is identical in form, thickness, retouch style, and basal ear form to Michaud specimen 23.12.00643. Both points are made of a patinated speckled rhyolite visually similar to Neponset rhyolite in the Neponset, Michaud, Bull Brook, and DEDIC sites collections. Microscopic examination revealed a basic similarity, but a higher incidence of very small, dark mineral inclusions (?garnets) in the Vermont specimens then in the other Neponset rhyolite specimens. At present it appears

likely that the Vermont points are made of Neponset rhyolite, or a lithologically related material.

Other fluted points in Vermont are made of local material (Ordovician cherts, Cheshire quartzite) (Loring 1980), and reddish-brown or red cherts (Giovanna Peebles, personal communication concerning Mr. Crandall collection).

Maritime Provinces

Fluted points from the Maritimes provinces have recently been reviewed by Keenlyside (1985:79-80). At present seven are known, outside the major Debert collection (Keenlyside, personal communication to Spiess, April 1986). There is a point from Kingsclear, New Brunswick, well described by Turnbull (1974). It is 66 mm. long, 25 mm. wide, and 9 mm., thick with a moderate basal concavity (4 mm.). One side is multi-fluted, the other singly fluted. The basal ears are well defined by retouch along the base, but do not extend laterally (no fish-tail). The material (Keenlyside, personal communication) is a red and blue-green chert similar to Munsungun chert (possibly our Cr05).

There are two fluted points from Qwaco Head, New Brunswick. One has a deeply indented base like the Debert or Vail points. The larger point is made on a dull brick red chert and the smaller point (5-6 cm. length) is made of the red and green Munsungun chert (Keenlyside, personal communication), possibly our Cr05. There is a fluted point from North Tryon, Prince Edward Island made on a translucent chalcedony, a material common in the Debert site. A fluted point point from Gaspereau River, Nova Scotia, is made of an unknown material (Kennlyside, personal communication). This point is lanceolate in outline with slightly excurvate sides tapering toward the tip and slightly toward the base. Both faces are shortly fluted (maximum 23 mm.), and the base is moderately concave. It is 8.2 mm. long, 3.2 mm. wide and 0.9 mm. thick.

The fluted point from the Hogan-Mullen site is lanceolate, with nearly parallel sides, and an almost straight base (Turnbull and Allen, op. cit.), 4.2

mm. long, 2.0 mm. wide and 6.9 mm. thick. It is fluted on one face only, It is made on "massive" white quartz, a locally available material. Turnbull and Allen (1978:152) are uncertain whether the unifacial fluting of this point is due to the poor flaking qualities of the raw material. There is no evident geographic sorting in fluted point style attributes, or raw material types within this geographic region.

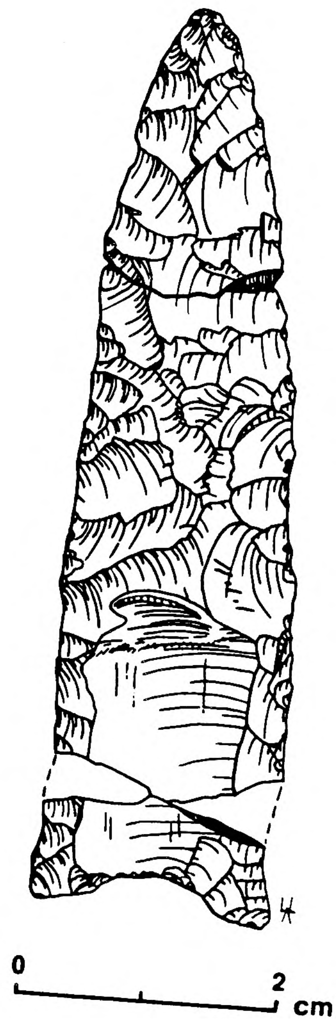

Figure A2-1. Desert of Maine point, redrawn after Jordan, and Spiess.

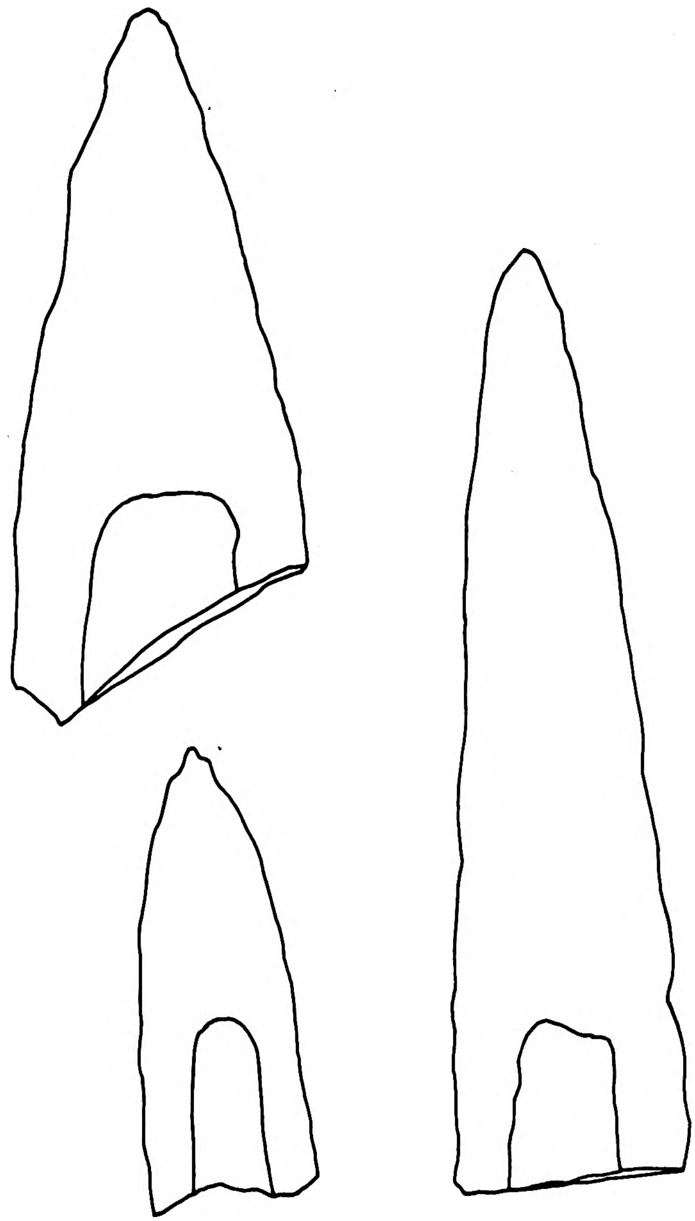

Figure A2-2. Upper left, Graham Lake point outline. Lower left, Brassua Lake point outlining. Right, Hall point from Munsungun Lake.

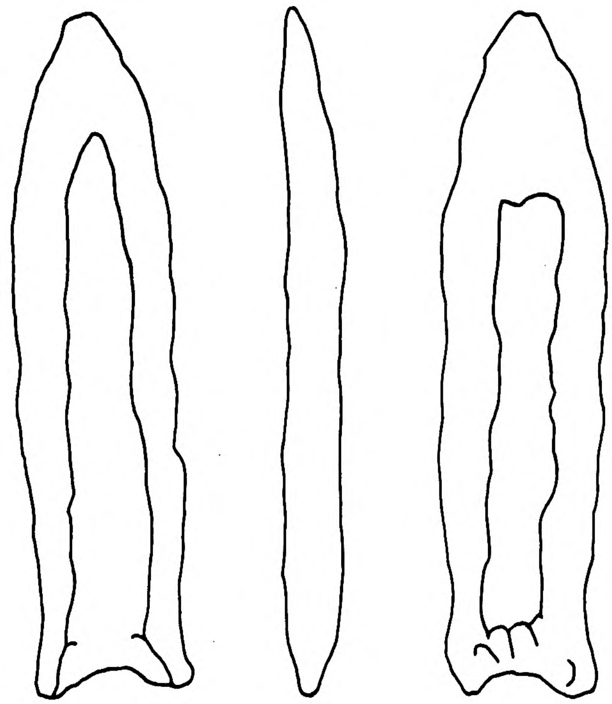

Figure A2-3. Outline drawing of the Schoodic Lake point, after Jordan.

Figure A2-4. Locations of Isolated Fluted Points in Maine and Adjacent Areas.

Maine

1. Desert of Maine point
2. McAllister point
3. Clarke and Lake, Sagadahoc Island points
4. Whitefield point
5. Boothbay point
6. Rumford Center point
7. Graham Lake points
8. Flagstaff Lake point
9. Brassua Lake point
10. Schoodic Lake point
11. Hall point

New Hampshire

12. Neville and Smyth points
13. Intervale point
14. Ossipee Lake point

New Brunswick

15. Kingsclear
16. Qwaco Head

Figure A2-4

Here

Plate A2-1. Dorsal and ventral views of the Clarke and Lake fluted point.

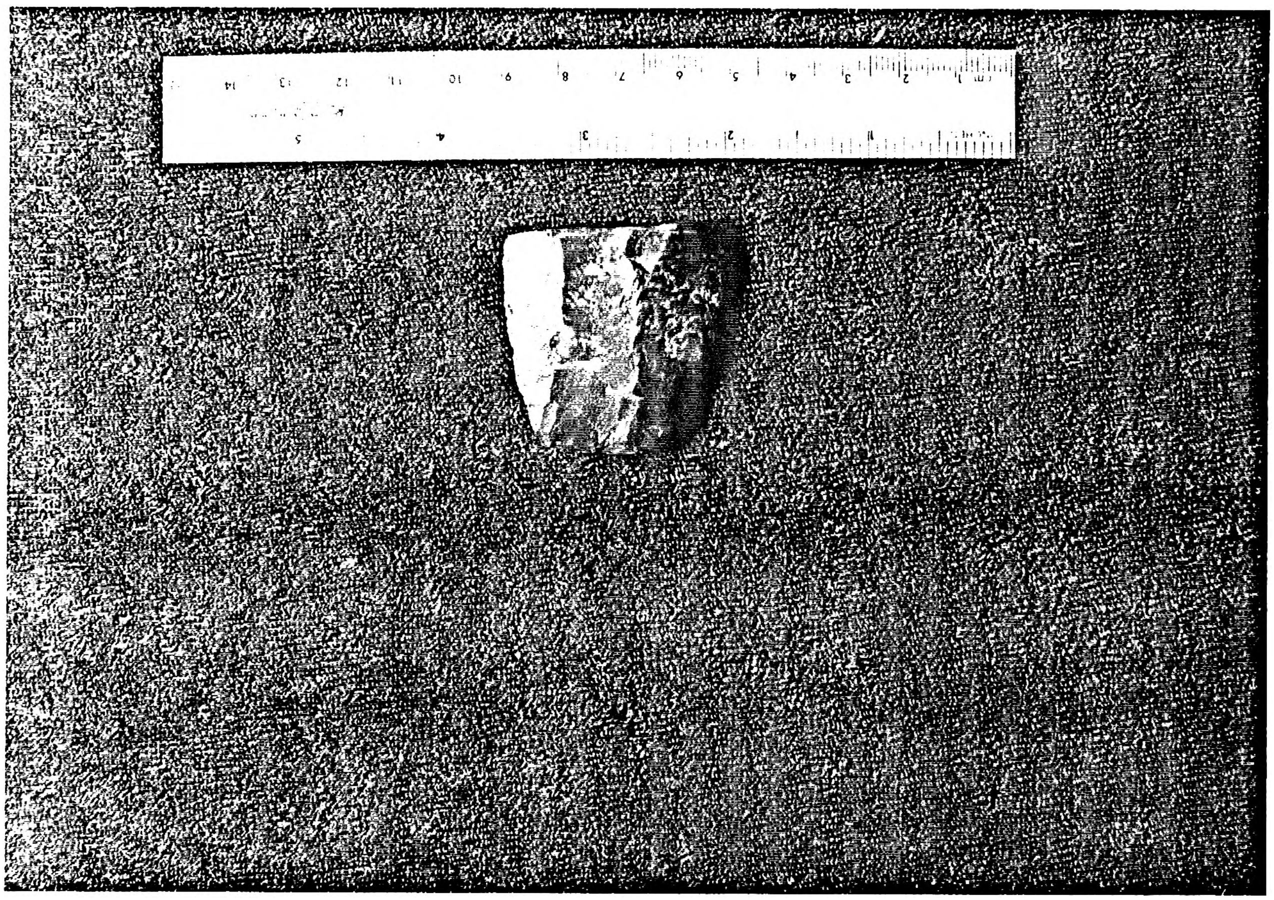

Plate A2-2. The Sagadahoc Island medially thinned biface preform.

PLATE A

15,117

Sagadahoc Island, 4

379

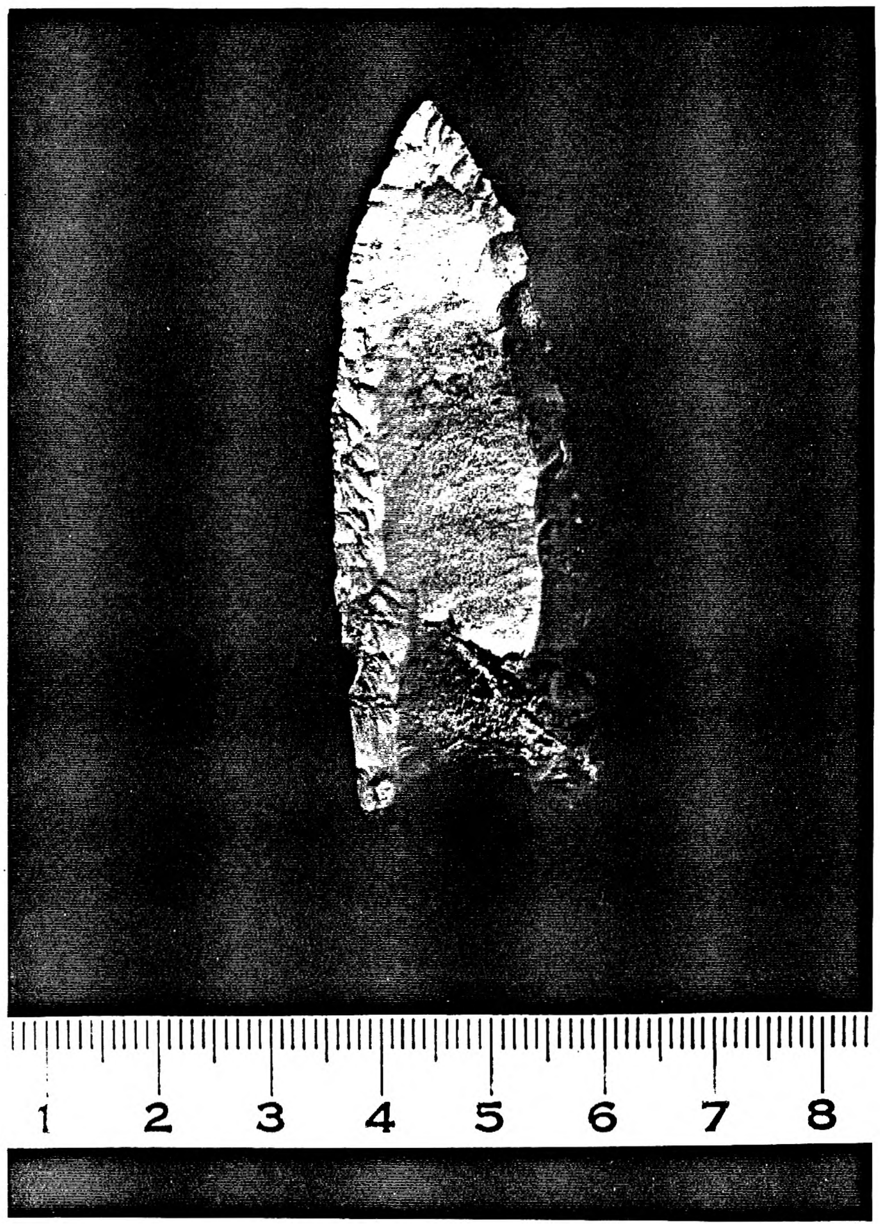

Plate A2-3. The Haggett point from Boothbay. Photo: Steven Bicknell, University of Maine.

Plate A2-4. Leo Bartlett's point from Rumford Point. Photo: R. M. Gramly.

Projectile point from the
Leo Bartlett farm residence,
Rumford Center, Oxford Co.,
Maine

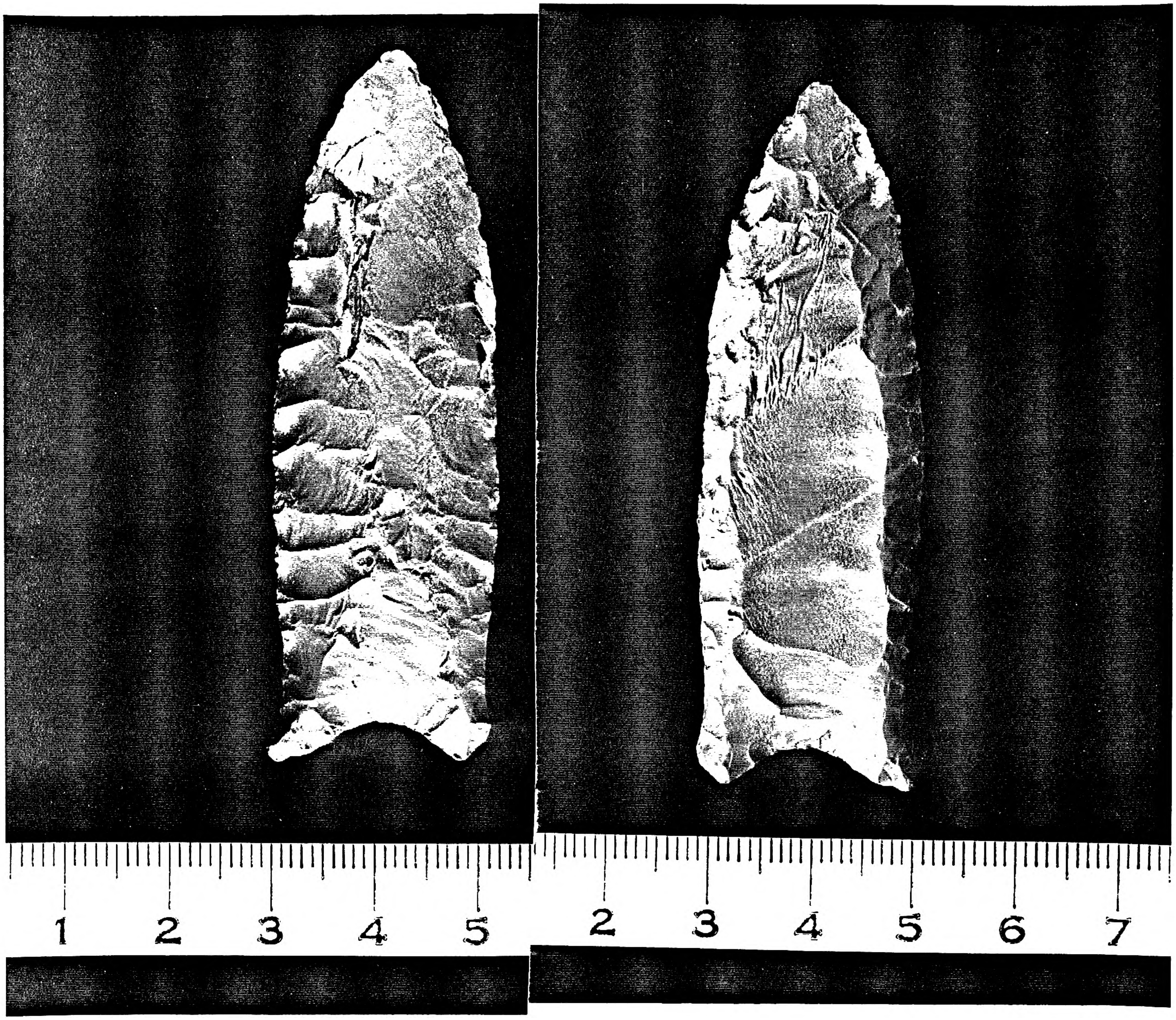

Plate A2-5. The Layman point, dorsal and ventral views. Photo courtesy of Eric Lahti and Steven Bicknell, University of Maine.

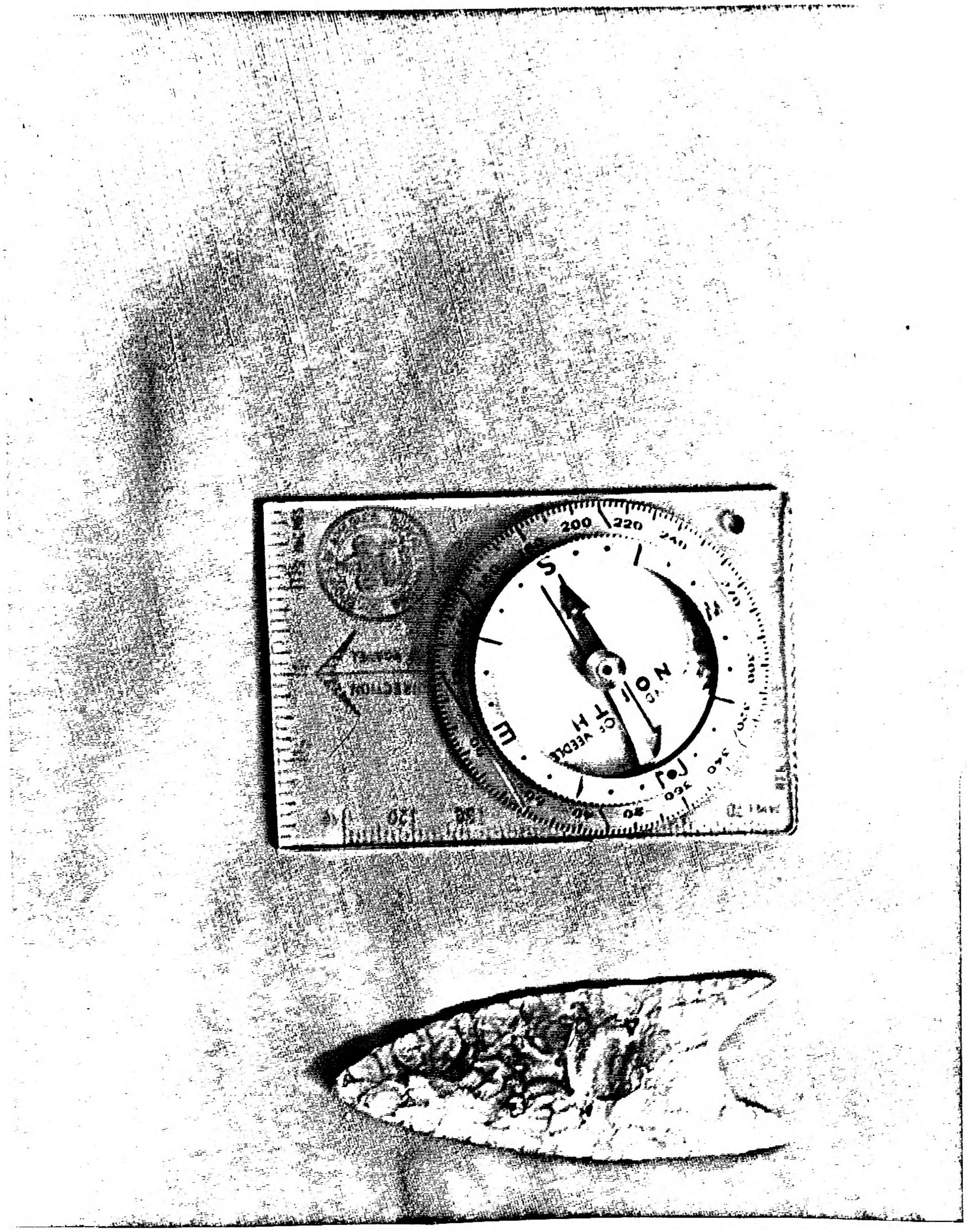

Plate A2-6. The Clayton point, Flagstaff Lake. Photo: R. M. Gramly.

PHOTO K, BRY AYTON COLLECTION

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