# Little Pond: A Microblade and Burin Site in Northeastern Alberta

**Angela M. Younie, Raymond J. Le Blanc, and Robin J. Woywitka**

*Abstract.* Until recently sites with microblades were rarely found in Alberta, Canada; however, evidence of microblade production has now been observed in a number of archaeological sites excavated in the boreal forest in the northern portion of the province. This study examines the sequence of microblade production at Little Pond (HiOv-89), a prehistoric lithic workshop in northeastern Alberta, through technological analysis and artifact refitting. This paper argues that the microcores from Little Pond and other sites in northeastern Alberta may be considered a far southeastern extension of the Denali complex of the far northwest.

## Introduction

Microblade technology is a widespread and varied approach to stone tool production developed and used across many continents and over tens of thousands of years of prehistory (cf., Elston and Kuhn 2002). The numerous variations in production techniques used to create a similar end result — the microblade — have been studied in a variety of contexts in attempts to understand how and why people discovered, learned, and chose between them. The answers to these questions, it is hoped, will lead to further understanding of the prehistoric cultural relationships and lifeways that influenced the people who made these discoveries and decisions. In North America, most evidence of microblade production is found in the far northwest, where numerous traditions of microblade production have been defined in Alaska, the Yukon and western Northwest Territories, and British Columbia (Clark and Gotthardt 1999).

The presence of some form of microblade technology in Alberta has been known since the publication of the High River microblade assemblage in southern Alberta in 1968 (Sanger 1968), and the Bezya microblade assemblage in northern Alberta in 1986 (Le Blanc and Ives 1986). While artifacts such as microcores, ridge flakes, and core tablets indicate methods of production possibly related to the Denali complex, it has thus far been difficult, without further evidence, to place these two sites within a regional context. Isolated finds of blade-like flakes and microcores, such as the Fort Vermillion microcore (Pyszczyk 1991), have also been sporadically reported in Alberta since the late 1980s, although most of these finds have remained in the unpublished grey literature of government mandated archaeological consulting reports.

Recent investigations within the Athabasca Oilsands region of northern Alberta have generated a number of reports of sites yielding

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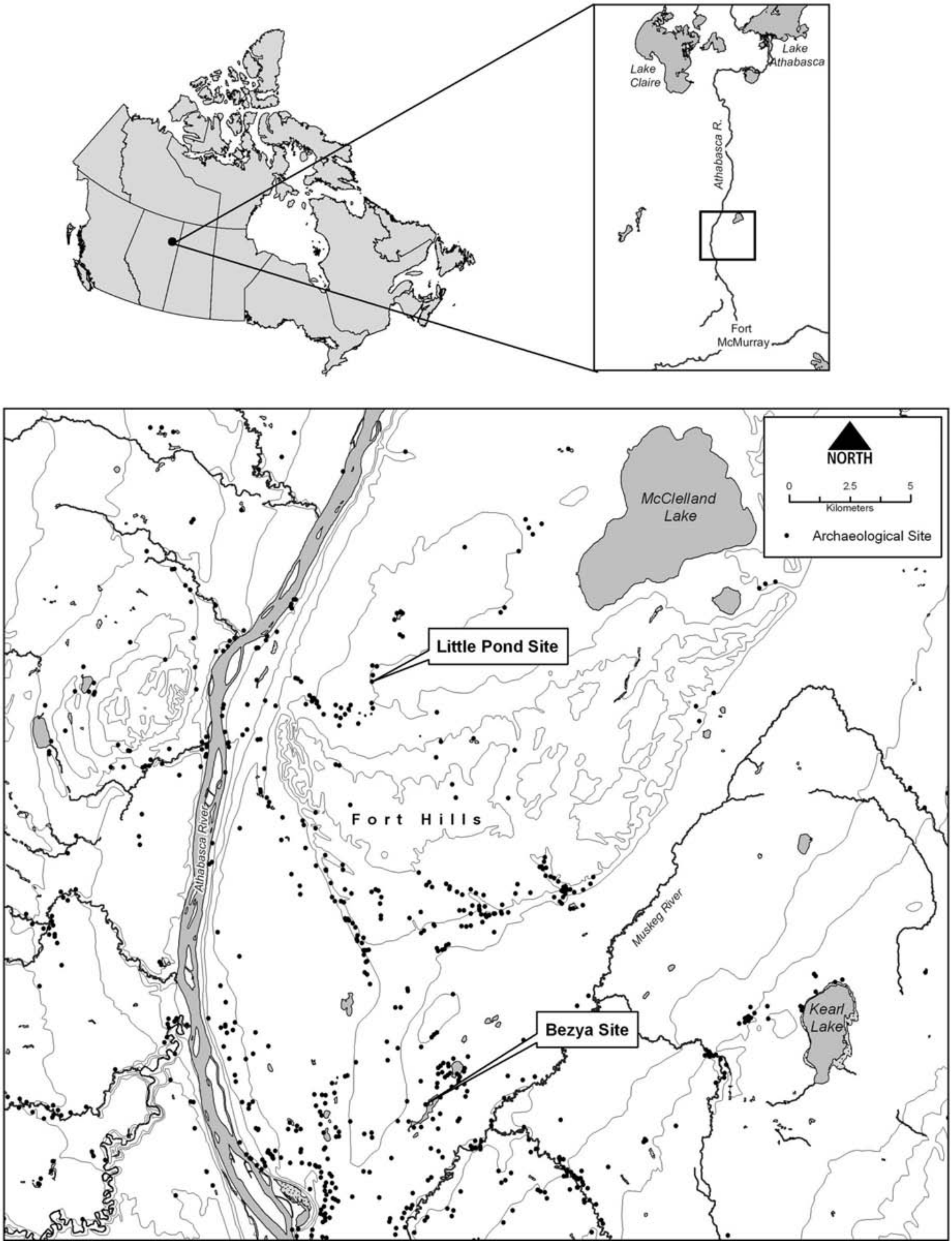


**Figure 1. Little Pond site location.**

microcores. Like Bezya, these sites have been discovered during archaeological survey and mitigation projects contracted by oil industry developers. These sites have the potential to expand the currently accepted range of microblade technology under which the Bezya, Fort Vermilion, and High River microblades and cores are considered something of an anomaly, representing possible southeastern extensions of northern traditions of wedge-shaped microcore production (Le Blanc and Ives 1986; Magne and Fedje 2007). Few of the Oilsands region sites have been thoroughly investigated, however, and it remains to be seen how they fit into the wider picture of microblade production in northwestern North America.

The main body of this paper is a technological analysis of the artifact assemblage from the Little Pond site (HiOv-89), a prehistoric lithic workshop located approximately 80 km north of Fort McMurray in northeastern Alberta (Fig. 1). The site produced an assemblage of 935 lithic specimens, 80 of which were found to be related to microblade production, and has great potential to contribute to our knowledge of microblade technology within Alberta, and its relationship to the established microblade traditions in the far northwest.

## The Denali Complex and Wedge-Shaped Microcores

Microblade technology in the early to mid-Holocene western Arctic and Subarctic is most strongly associated with the wedge-shaped core, typified by microcores found at the Campus site in Alaska (Mobley 1991; Rainey 1939). The most common form is created from a pebble or thick flake, bifacially or unifacially modified to create a wedge-shaped preform. Further flaking creates a ridge to guide the removal of a series of flakes, creating a fluted face from which microblades are removed. A flat platform is created on the upper surface of the core by the removal of a single spall, usually from the front, and rejuvenation proceeds through further similar spall removals. The ridge flakes and platform tablets created during this process may be used as evidence of the characteristic "Campus-type" core. Cores unifacially modified from naturally wedge-shaped flakes, and those with platforms prepared by transverse flaking of the platform rather than spall removal, are usually included in this group.

Throughout the northwestern Arctic this technique of microblade production and its associated wedge-shaped microcores date from just over 13,500 B.P. to less than 3000 B.P. (Clark 2001:73; Holmes 2001:162). These cores have been included within a number of overlapping lithic traditions, including the American Palaeo-Arctic tradition (Anderson 1968, 1988), the Northwest Microblade tradition (MacNeish 1954), and the Denali complex (Hadleigh-West 1967). Sites related to these traditions contain combinations of wedge-shaped Campus cores, Donnelly burins, core-burins, scrapers, bifacial tools, and lanceolate and notched points. We agree with Clark and Gotthardt (1999) in preferring to assign such sites to the Denali complex, as one of the most familiar, commonly used traditions, and one that is most strongly associated with microblade technology specifically. Unlike the Northwest Microblade tradition, the Denali complex also poses no danger of being confused with the Northwest Coast Microblade tradition. Although originally defined as a complex, the Denali category has grown to encompass the role of a tradition, and is here considered as such.

## Site Background

The Little Pond site was discovered in northeastern Alberta, near the northern edge of the Fort Hills Uplands in 2001 during a survey by FMA Heritage Resources Consultants (FMA) for the Fort Hills Oil Sands Project (Unfreed, Fedirchuk, and Gryba 2001; Fig. 1). The site is situated on the south bank of a small dry sinkhole lake approximately 90 km north of Fort McMurray and 6 km east of the Athabasca River, on the southern edge of the Late Pleistocene Athabasca Braid Delta (Rhine and Smith 1988). Local topography of the southern portion of the braid delta is composed of stabilized sand dunes, with a local relief less than 5 m, and vegetation dominated by open jack pine forest. The McClelland Lake Wetland complex to the east of the site is composed of patterned and unpatterned wooded fens, shrubby open fens, and swamps. The margins of the wetlands are interspersed with patches of dry land, sinkhole lakes, and forested peat plateaus (TrueNorth Energy Corporation 2001).

The site sits on a sandy knoll in undulating terrain, forested by open jack pine with sparse underbrush of alder and blueberry bushes, and ground cover of reindeer lichen and club moss. The banks of the lake, including the northern portion of the site, are covered in thick underbrush of alder, willow, and young aspen, while the bottom of the lake is overgrown with muskeg, grass, and shrubs. The soil is massive, unstratified sand with a leached grey Ae horizon 0–10 cm below surface, lying over an orange iron-oxide stained Bm horizon extending to 40 cm below surface (Fig. 2). This is underlain by a light brown C horizon. Near the edge of the lake, thick alder root mats have caused significant bioturbation, as have a number of jack pine scattered throughout the site.

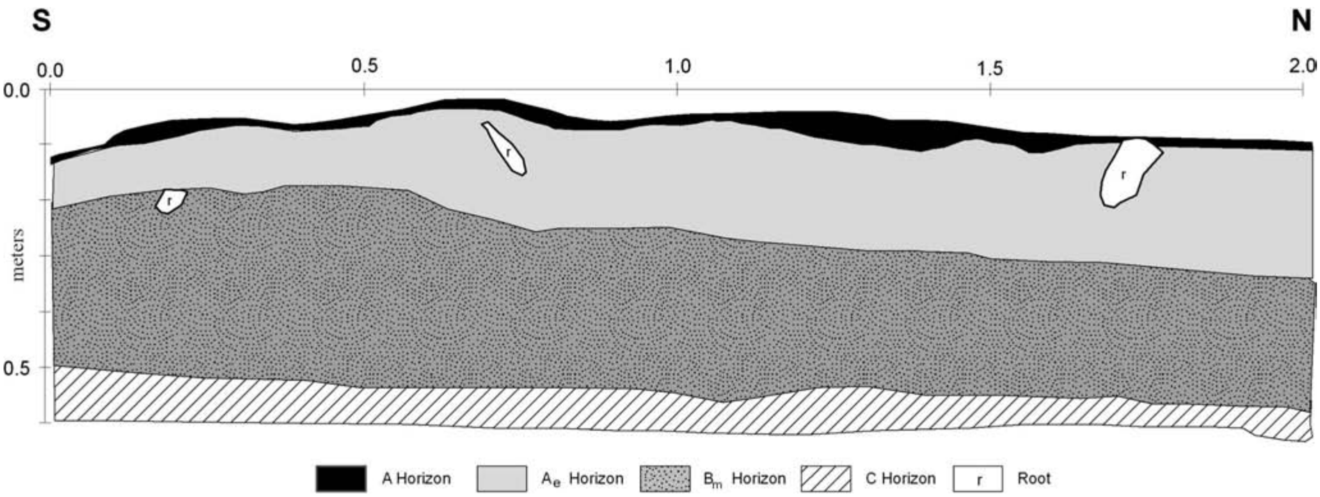


**Figure 2. Soil profile from main excavation block of Little Pond (51N599E and 52N599E, west wall).**

Ten artifacts were recovered during survey shovel testing, including two rare items: a proximal microblade fragment and a microcore fragment, both made of a white, chert-like material. FMA returned to perform mitigative excavation in 2005, as the site area was slated for forestry clearing and full-scale Oilsands development within the next 10 years (Woywitka and Younie 2008). Following mitigative methods standard to the region (Alberta Community Development 1989), excavation was performed by shovel shaving, with all sediment screened through ¼ inch mesh, and minimum location data recorded to 1 × 1 m excavation unit and 10 cm arbitrary levels. Depth was measured from the ground surface at each corner of the unit.

Excavation units were placed over the 2001 shovel tests, with further units expanding outward in the directions of highest concentrations of material. The placing of these units resulted in three main blocks of excavation (Fig. 3). Block A consists of two adjacent concentrations near the bank of the lake on a large level section of land on the eastern slope of the knoll. Block B is a few meters southwest, farther from the lake but on the same level section of land, while Block C is located on the highest point of the knoll, 10 m to the west of Block B. In total, 43 units were excavated in Block A, 11 units in Block B, and six units in Block C (Woywitka and Younie 2008).

## Study Methods

The most probable sequence of microcore reduction used at the Little Pond site was interpreted through a combination of methods, including the measurement and description of artifacts related to microblade production, as well as the attempted refitting of these artifacts. This sequence was then compared to those proposed for previously established traditions of microblade production in North America.

### Orientation and Measurement

Tools and flakes were oriented in the conventional method (Banning 2002:280), with the working edge oriented away from the observer (distal), and the dorsal surface facing upward. Flakes were oriented with the platform facing the observer (proximal), and the dorsal surface, the outside core surface prior to flake removal, facing upwards. Microcores were oriented and described following Morlan (1970, 1976) and Le Blanc and Ives (1986). Microblades were oriented with the platform facing proximally, reflecting the identity of the microblade as a specialized flake (Banning 2002:280). Ridge flakes and burin spalls, having no working edge, were also oriented as flakes.

All tools and specialized debitage (ridge flakes, microcores, and burin spalls) were measured in at least three dimensions. Microcore measurements and orientation are shown in Figure 4. All measurements represent the maximum value of the artifact after refitting, and are given in millimeters. A catalogue of the full measurements of the microblade and core assemblage may be found in the appendix of Younie (2008). Flakes and tools were also examined under 15X magnification for retouch and use wear.

### Refitting

The small number of artifacts present at the site, as well as the distinct material type used for microblade production, made the assemblage an ideal

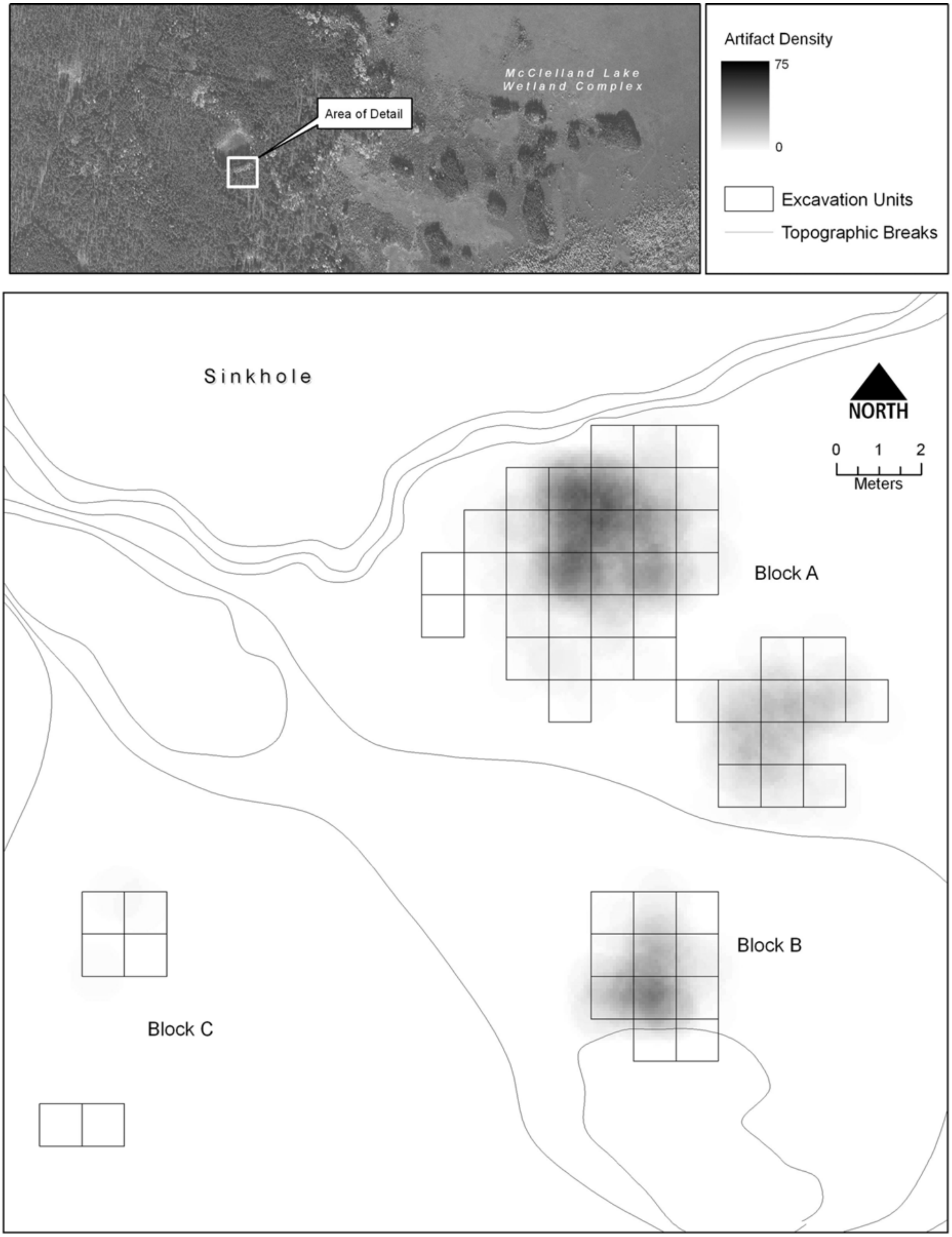


**Figure 3. Little Pond site map and excavation layout.**

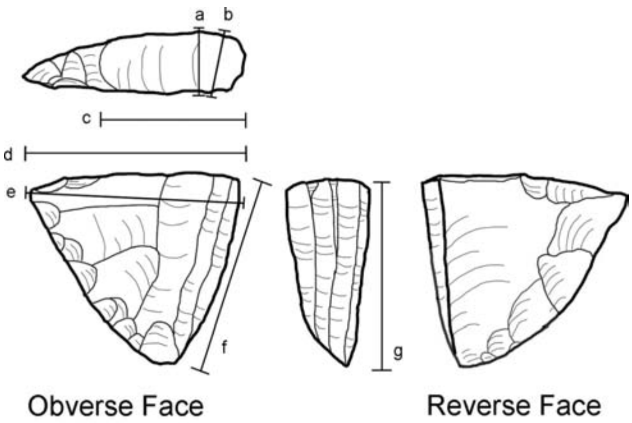


**Figure 4. Microcore measurements.**

candidate for refitting analysis. The refitting analysis was carried out with the goal of reconstructing the microblade component of the site. Forty-two hours were devoted to refitting over an interval of two weeks, resulting in the discovery of 82 refitted pairs, 16 of which represented conjoined artifacts in a reduction sequence. The remaining refitted pairs represented broken and pot-lidded artifacts.

## The Assemblage

A total of 935 lithic artifacts were recovered during shovel testing and excavation at Little Pond (Table 1). The majority of artifacts, including all of the 80 items related to microblade production, are composed of white, grey, and red silicified mudstone. The silicified mudstone was recovered from Block A, while Block B was dominated by black silicified siltstone, and contained no evidence of microblade production. Only five artifacts were recovered from Block C, none of which are related to microblade production. Chert, quartzite, and Beaver River Sandstone were also recovered in small quantities in all areas (Table 2). The vast majority of artifacts were found in exca-

Table 1. Artifacts recovered during testing and excavation.

| | Excavation Block | | | | |
|---|---|---|---|---|---|
| **Artifact Type** | **A** | **B** | **C** | **Shovel Tests** | **Total** |
| Microblade | 38 | | | 1 | 39 |
| Microcore | 9 | | | | 9 |
| Microcore Fragment | 12 | | | 1 | 13 |
| Microcore Preform | 1 | | | | 1 |
| Platform Tablet | 1 | | | | 1 |
| Platform Ridge Flake | 3 | | | | 3 |
| Primary Ridge Flake | 5 | | | | 5 |
| Secondary Ridge Flake | 9 | | | | 9 |
| Burin | 8 | | | | 8 |
| Burin Spall | 28 | | | | 28 |
| Multi-Tool | 8 | | | | 8 |
| Scraper | 8 | | 1 | | 9 |
| Extensively Retouched Flake | 4 | 1 | | 1 | 6 |
| Core Fragment | 2 | | | | 2 |
| Edge Modified Debitage | 153 | 5 | | 1 | 159 |
| Unmodified Debitage | 456 | 169 | 4 | 6 | 635 |
| **Total** | **745** | **175** | **5** | **10** | **935** |

Table 2. Distribution of raw material types.

| | Excavation Block | | | | |
|---|---|---|---|---|---|
| **Artifact Type** | **A** | **B** | **C** | **Shovel Tests** | **Total** |
| Silicified Mudstone | 471 | | | 2 | 473 |
| Silicified Siltstone | 152 | 161 | 1 | 3 | 317 |
| Chert | 63 | | | | 63 |
| Quartzite | 32 | 1 | 1 | 1 | 35 |
| Beaver River Sandstone | 14 | 13 | 3 | 3 | 33 |
| Gneiss | 13 | | | 1 | 14 |
| **Total** | **745** | **175** | **5** | **10** | **935** |

vation levels 2 and 3, between 10 and 30 cm below ground surface, although artifacts were found near the surface and occasionally at depths of up to 60 cm. The silicified siltstone materials in Block B were found at slightly greater depths than the majority of materials in Block A, but no distinct occupation levels were evident, and the materials were analyzed as a single unit.

## Microblade Component

### *Microcores*

The 24 microcores and fragments found at Little Pond were refitted to create ten full microcores, four microcore fragments, a large microcore preform, and a large rejuvenation tablet (Table 3). Overall, the microcores are small and wedge-shaped, weighing an average of 6.0 g with an average height of 24.25 mm, length of 28.27 mm, and thickness of 9.14 mm (Table 4). Most cores are roughly unifacially shaped, exhibiting various types of platform preparation, but consistently having either two or three flute scars, and showing intensive use-wear on one or more surfaces, including the edges of the platforms, fluted faces, and wedge elements. Nine of the ten microcores in the assemblage were created from thick flakes, three of which exhibit substantial amounts of remnant cortex on the dorsal surface (Figs. 5B, 6B, 7C). With the exception of one informally shaped core (Fig. 6D), the remainder are wedge-shaped in cross-section, exhibiting marginal unifacial flake scars and occasional unifacial thinning scars originating from the wedge element and base.

While platform rejuvenation techniques often result in the removal of much of the platform, obscuring the original preparation methods, it appears that most cores in the assemblage were created by spall removal. Platform rejuvenation is evident in the form of both spall removal (Figs. 6D, 6F) and side-blow flaking (Figs. 6B, 7A). While spall removal is slightly more common, only two cores exhibit a single platform scar that would indicate the removal of a long spall similar to the traditional Denali platform tablet (Figs. 5A and 6F). Instead, many cores appear to have been rejuvenated through the removal of short, hinged spalls from the front of the platform (Figs. 5B, 6D, 7B).

A few of the microcores exhibit variations to this general pattern. One of the microcores, a tiny core created from dark brown silicified mudstone (Fig. 6B), exhibits two parallel fluted faces and no wedge element. One fluted face exhibits two flute scars, the other three. The platform has been extensively rejuvenated through side-blow flaking, and exhibits scraper-like use-wear. Another of the cores appears to have been converted into a scraper (Fig. 7C), with the platform completely removed by steep unifacial retouch and use-wear. Two of the larger cores in the collection exhibit step-fractures on the fluted face that appear to have been caused by irregularities in the raw material, and that may have led to abandonment of the cores for microblade production. A third step-fractured microcore exhibiting irregularities in the raw material was refitted from a number of frost-spalled fragments, and was further refitted to a short sequence of ridge flake and microblade removals (Fig. 8A).

Another unique artifact recovered from the site is a microcore on a biface, exhibiting initial shaping into a rough oval outline through short, irregularly placed bifacial thinning flakes (Fig. 6G). More regular bifacial and unifacial marginal retouch are present along most of the edges, as well as moderate use-wear. The core platform was prepared by the removal of a short spall ending in a hinge, and there is no evidence of further rejuvenation of the platform. Two flute scars remain on the wedge-shaped fluted face, which exhibits mod-

Table 3. Microcore characteristics.

| Figure Reference | Portion | Base | Flute Shape | Platform Scars | Preparation | Platform Rejuvenation | Shaping Methods |
|---|---|---|---|---|---|---|---|
| 5A | Core | Flake | Wedge | 3 | Full spall | Unknown | Unifacial, some thinning |
| 5B | Core | Flake | Wedge | 2 | Full spall | Partial spall | Rough, some thinning |
| 6G | Core | Biface Tool | Wedge | 2 | Partial spall | None | Bifacial flaking |
| 6B: Face A | Core | Unknown | Wedge | 3 | Unknown | Side flaking | Unknown |
| 6B: Face B | – | – | – | 2 | – | – | – |
| 6F | Core | Thick flake | Wedge | 3 | Full spall | Full spall | Rough |
| 6D | Core | Flake | Informal | 2 | Unknown | Partial spall | Rough, some thinning |
| 7A | Core | Flake | Wedge | 2 | Side flaking | Side flaking | Unifacial thinning |
| 7B | Core | Flake | Wedge | 4.5 | Unknown | Partial spall | Rough |
| 7C | Core | Flake | Wedge | 2 | Unknown | Unknown | Unifacial flaking |
| 8A | Refitted Core | N/A | Wedge | 1 | N/A | N/A | N/A |
| 6E | Core Fragment | N/A | N/A | 2.5 | N/A | N/A | Fluted face rejuvenation |
| 6C | Core Fragment | N/A | N/A | 2 | Spall | N/A | N/A |
| N/A | Core Fragment | N/A | Wedge | 3 | Side flaking | Partial spall | N/A |
| N/A | Core Fragment | N/A | Wedge | 3 | N/A | Partial spall | N/A |
| 5L | Core Preform | Core | Wedge | N/A | Spall | N/A | Bifacial flaking |
| 6A | Platform Tablet | N/A | N/A | 6 | Full spall | Full tablet | Bifacial flaking |

erate use wear on both its obverse and reverse edges.

The smallest of the microcore fragments identified within the assemblage is a small flake exhibiting thin, parallel scars on the dorsal surface, strongly suggestive of flute scars (Fig. 6E). Use-wear is visible along a ridge between the scars, while a thin line running across the scars may represent an inclusion or irregularity in the material. If these dorsal scars are indeed fluted face scars, the flake may represent an attempt to rejuvenate the fluted face. The remaining microcore fragments at the site are incomplete due to breakage and frost-spalling, but show characteristics similar to those seen on the complete cores, such as narrow fluted faces exhibiting use-wear on their lateral margins, and partially rejuvenated platforms.

A large microcore preform was partially refitted from four pot-lidded fragments (Fig. 5L). Clearly it is an unexhausted core of some type, and its shape suggests that it might have been a microcore preform. It contains a bifacially shaped keel, and a smooth flat platform apparently created by the removal of a large, wide spall. The fluted element is relatively flat, with a number of small flake scars running transversely and longitudinally across the surface, none reaching far past the center. A portion of the bottom of this face was not refitted, but the remainder exhibits a wedge-shaped outline. Why this core would have been abandoned at this stage in reduction is not known, although it could be that these fragments spalled from the core during reduction rather than post-depositionally, and that the artifact was abandoned as flawed material. The core is distinctive

Table 4. Microcore measurements.

| Figure Reference | Portion | Weight | Height | Length | Thickness | Platform Element Length | Platform Scar/ Rejuvenation Length | Chord Length | Flute Length |
|---|---|---|---|---|---|---|---|---|---|
| 4A | Core | 3.7 | 21.86 | 23.02 | 7.45 | 21.70 | 21.70 | 5.45 | 21.81 |
| 4B | Core | 4.6 | 19.85 | 26.40 | 9.29 | 26.34 | 6.23 | 4.41 | 20.63 |
| 5D | Core | 11.3 | 26.56 | 43.81 | 12.24 | 43.74 | 12.25 | 5.57 | 22.18 |
| 5E: Face A | Core | 3.0 | 19.73 | 17.93 | 7.00 | 17.93 | 17.93 | 6.89 | 18.96 |
| 5E: Face B | Core | – | – | – | – | – | – | 6.22 | 19.89 |
| 5F | Core | 11.4 | 28.55 | 41.10 | 10.56 | 41.10 | 26.57 | 10.79 | 27.91 |
| 5G | Core | 5.9 | 23.98 | 27.52 | 8.35 | 26.74 | 7.96 | 5.48 | 19.56 |
| 6A | Core | 4.4 | 21.74 | 26.53 | 9.83 | 25.81 | 7.17 | 5.39 | 22.15 |
| 6B | Core | 5.7 | 28.22 | 21.55 | 9.46 | 21.82 | 6.35 | 7.37 | 24.70 |
| 6C | Core | 4.5 | 22.53 | 24.28 | 8.68 | 19.16 | N/A | 6.31 | 18.12 |
| 7A | Refitted Core | 5.2 | 29.52 | 30.56 | 8.57 | 21.50 | N/A | 6.67 | 29.05 |
| **Average Full Core Measurement** | | *6.0* | *24.25* | *28.27* | *9.14* | *26.58* | *13.27* | *6.41* | *22.27* |
| **Minimum Full Core Measurement** | | *3.0* | *19.73* | *17.93* | *7.00* | *17.93* | *6.23* | *4.41* | *18.12* |
| **Maximum Full Core Measurement** | | *11.4* | *29.52* | *43.81* | *12.24* | *43.74* | *26.57* | *10.79* | *29.05* |
| 5A | Core Fragment | 0.3 | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 5B | Core Fragment | 1.6 | N/A | N/A | N/A | N/A | N/A | 5.08 | N/A |
| N/A | Core Fragments | 3.4 | 31.89 | 24.34 | 6.97 | 20.63 | 9.59 | 8.27 | 30.51 |
| N/A | Core Fragment | 2.6 | 25.65 | N/A | 7.58 | N/A | N/A | 6.01 | 24.61 |
| 4L | Core Preform | 56.9 | 47.25 | 45.00 | 25.03 | 45.00 | N/A | 23.45 | N/A |
| 5C | Platform Tablet | 5.0 | 15.25 | 36.12 | 13.22 | 36.12 | N/A | 13.22 | N/A |

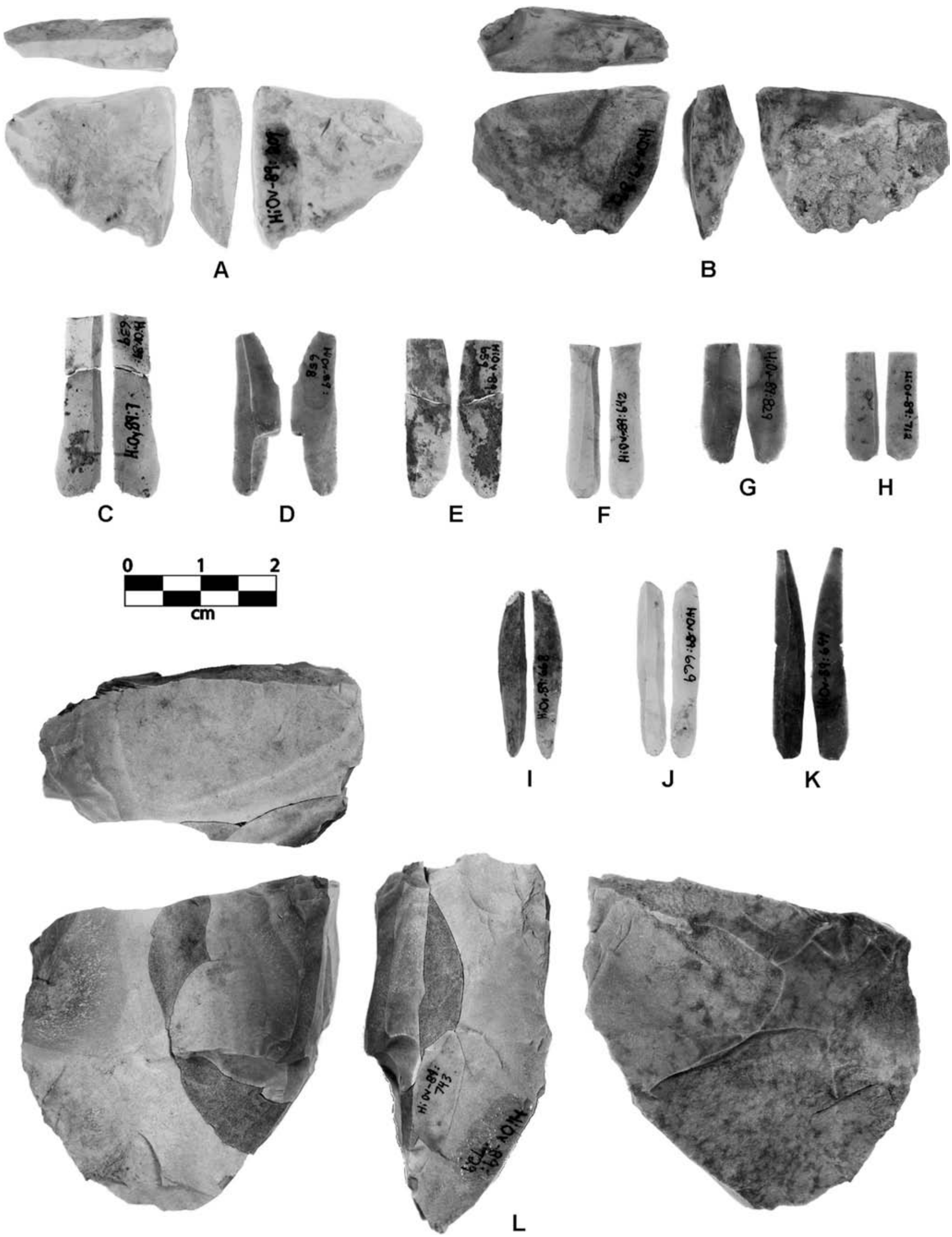


**Figure 5. Microcores and microblades. *A–B*, microcores with platforms created through spall removal; *C–K*, microblades; *L*, refitted microcore preform.**

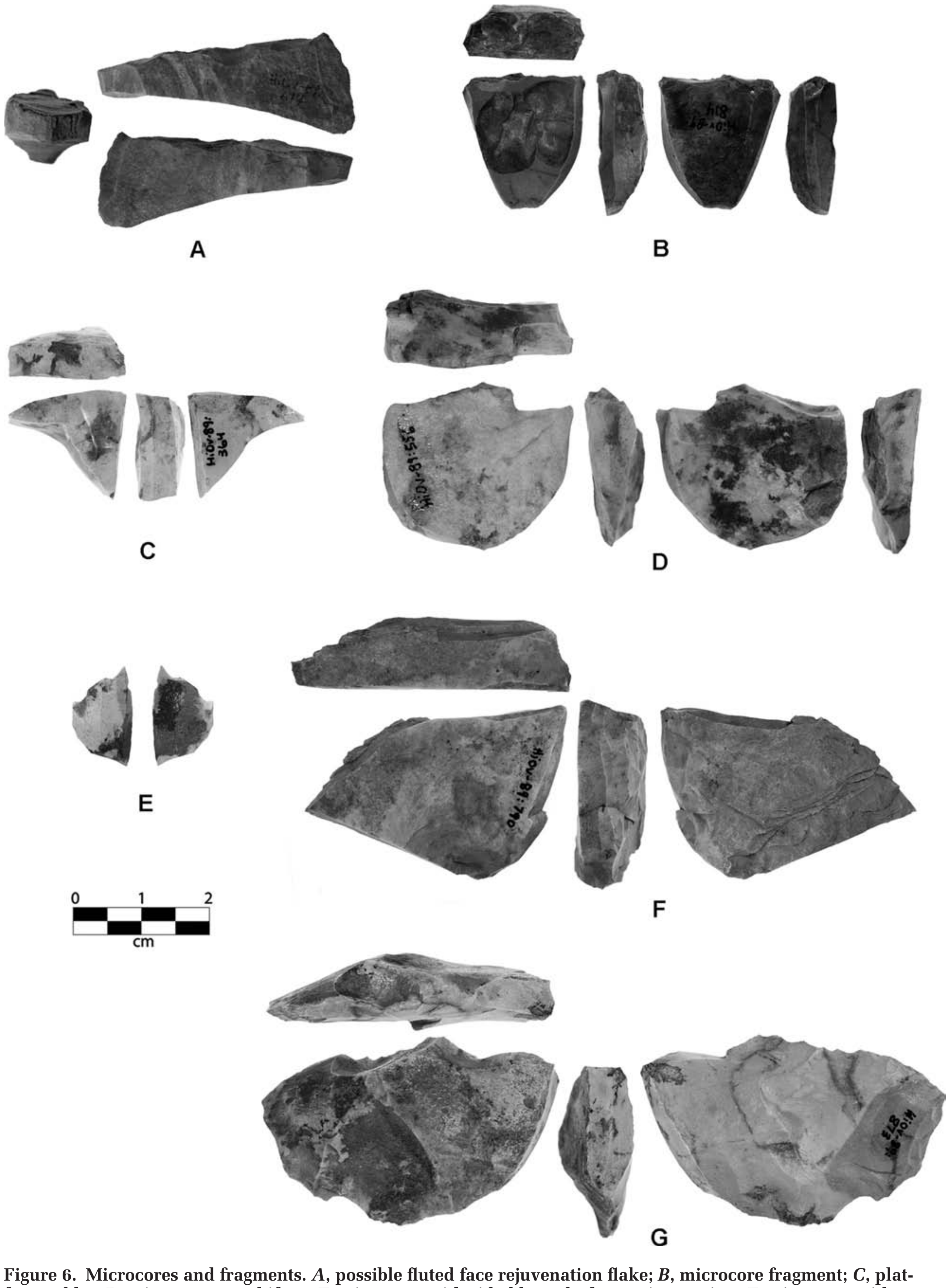


**Figure 6. Microcores and fragments. *A*, possible fluted face rejuvenation flake; *B*, microcore fragment; *C*, platform tablet; *D*, microcore on a biface; *E*, microcore with side-blow platform rejuvenation; *F*, microcore with step-fractured fluted face; *G*, microcore with partial platform rejuvenation.**

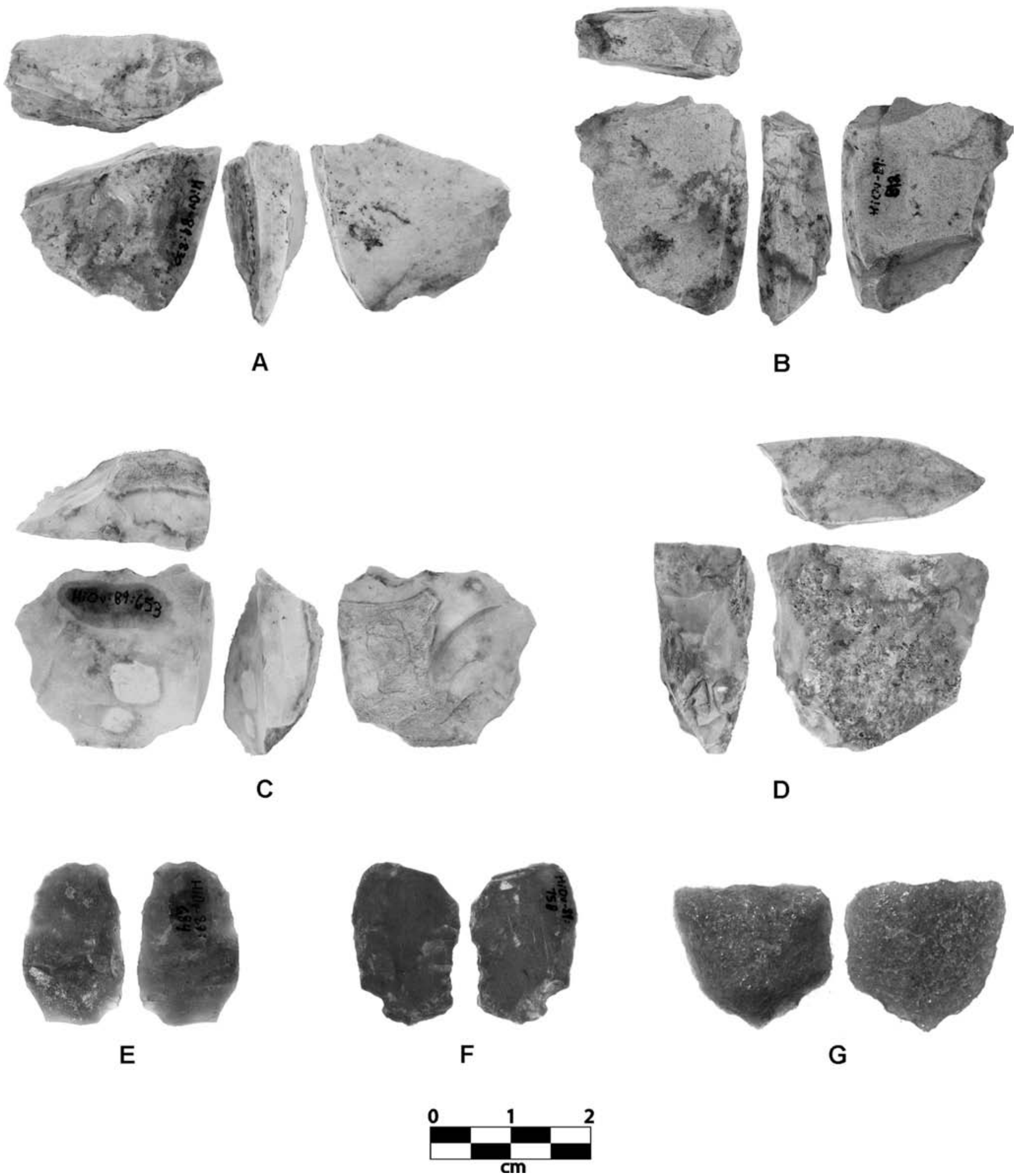


**Figure 7. Microcores and scrapers. *A–B*, microcores; *C*, microcore converted into a scraper; *D*, core-like scraper, *E–G*, scrapers.**

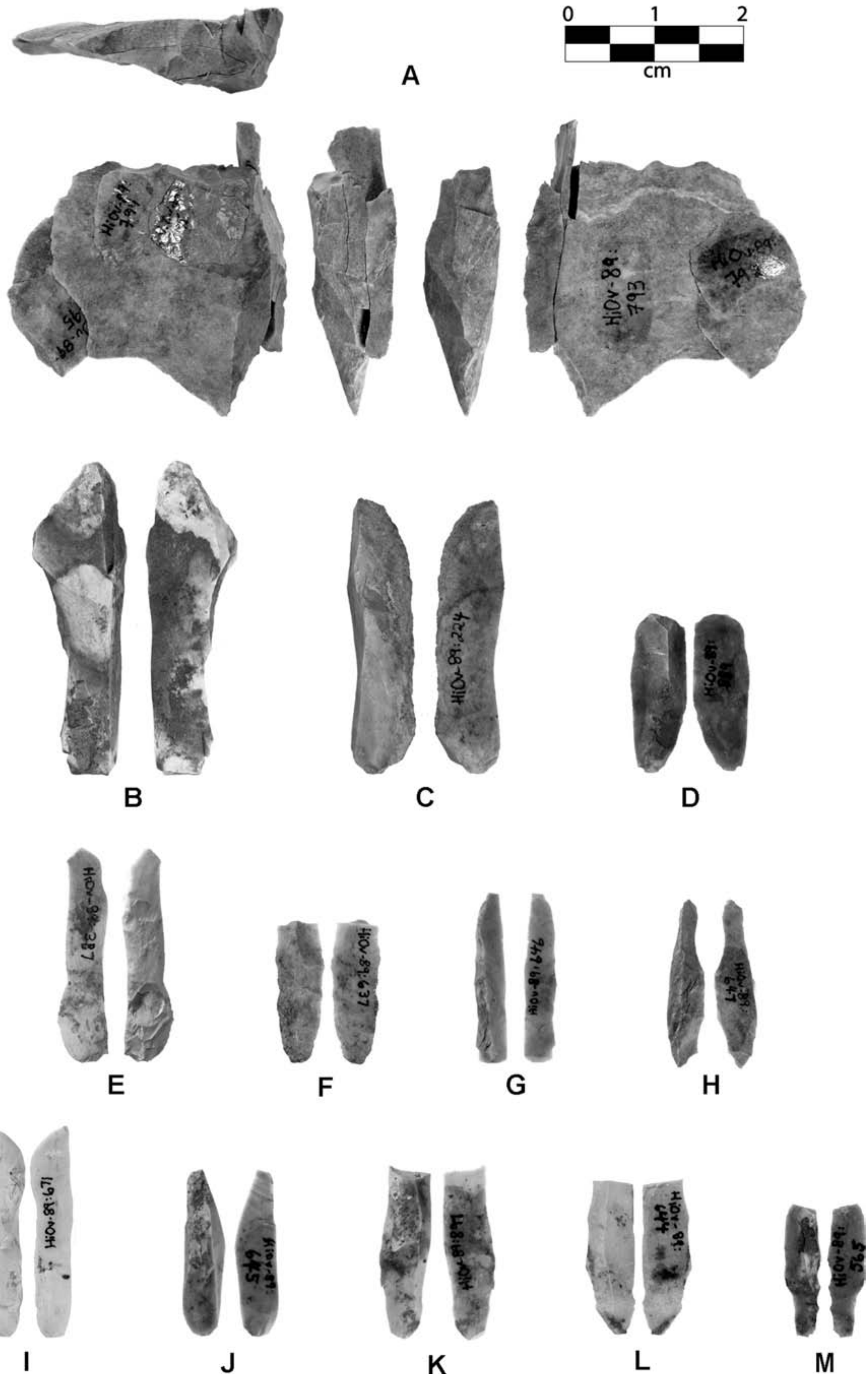


**Figure 8. Ridge flakes. *A*, refitted ridge flakes and post depositionally pot-lidded microcore; *B,–D*, platform ridge flakes; *E–H*, primary ridge flakes; *I–M*, secondary ridge flakes.**

within the assemblage for its size, method of production, and the abandonment of such a large piece of material with no evidence of attempted reworking.

The only core tablet found in the assemblage (Fig. 6A) is an excellent example of a Campus-type core rejuvenation tablet. Like the core preform, the platform tablet is unusual for its size and production method; it is, however, too small to refit to the core preform. A remnant bifacially shaped keel is present, as well as the remnant of the original platform, containing six flute scars with platform grinding at their proximal ends. The inferior surface of the tablet exhibits a strong bulb of percussion at the front, indicating rejuvenation by a transverse burin blow.

### *Ridge Flakes*

Of the 17 ridge flakes present at the site (Fig. 8), three are platform ridge flakes similar to the striking platform preparation flakes found at the Bezya microblade site HhOv-73 (Le Blanc and Ives 1986:72). These ridge flakes are wider and thicker than standard fluted-face ridge flakes, with hinge terminations reflecting partial platform preparation or rejuvenation. The platform ridge flakes also seem to be less carefully shaped than other ridge flakes at the site, with a central ridge extending only part way down the length of the flake. Two of these flakes exhibit a single large flake scar on the dorsal surface, originating from the proximal end, indicating a previous partial ridge flake removal. These secondary platform ridge flakes are likely the result of platform rejuvenation, similar in function to the Denali platform tablet.

The remaining ridge flakes in the assemblage consist of five primary and nine secondary fluted-face ridge flakes, with an average length of 21.7 mm, width of 5.3 mm, and thickness of 2.9 mm. Their ridges have generally been unifacially shaped, with retouch originating equally often from the right and left sides of the ridge, representing the obverse and reverse faces of a microcore, respectively. The only exceptions are two flakes exhibiting bifacial shaping, and two secondary flakes whose ridges have been obscured by previous ridge flake removals. All of the primary ridge flakes are triangular in cross-section, while the secondary flakes are evenly divided between triangular and trapezoidal.

### *Microblades*

After refitting, the 36 resulting microblades and fragments were sorted into 10 whole microblades and 20 proximal, 3 medial, and 3 distal fragments. The microblades are very small, weighing on average only 0.12 g (Fig. 5C-K). Whole microblades range from 13.66 mm to 28.24 mm in length, measuring an average of 20.95 mm. Average mid-point width and thickness measurements are 4.58 mm and 1.46 mm, respectively, creating a width/thickness ratio of 0.333 for the collection. Maximum width and thickness measurements for the microblades are on average only 0.3 mm to 0.4 mm larger than those taken at the midpoint.

Of the 30 microblades with observable platforms, 70.0% (n=21) exhibit evidence of platform grinding in the form of small, clearly visible flake scars on the dorsal surface of the platform. Close to half (n=16) exhibit a single platform scar, while the other half (n=14) exhibit two or more scars. Equal numbers of triangular and trapezoidal microblades were examined, while ten of the artifacts are trapezoidal near the platform but triangular near the distal end where the arrises of overlapping flake scars merge together. The microblades also range widely in thickness; some are flat and thin, and tend to increase in width near the platform, while others are thicker, curved, and more consistent in width. The majority of microblades, however, show slight or no curvature. Use-wear and retouch are both rare, seen on 30.6% (n=11) and 8.3% (n=3) of the microblades, respectively.

### *Refitted Ridge Flake and Microcore Sequences*

**Sequence 1: Ridge Flake to Microcore.** The secondary ridge flake in this sequence is a thin, triangular proximal fragment with remnant shaping scars along its left edge (Fig. 8L). Although the two artifacts do not directly refit, the microcore shows remnants of corresponding ridge-shaping scars on its reverse face adjacent to the fluted element (Fig. 7C). The indirect conjoining of the two artifacts is further supported by a thin purple line of discoloration seen directly below the remnant cortex on the reverse face of the microcore. This purple line has also been exposed by shaping scars on the ridge flake, and matches the pattern seen on the microcore. Although indirect, this refitting is not without useful information. Most notably, it can be seen that the core has not been intensively reduced since the removal of this ridge flake; there is little evidence that further shaping has occurred, while only a few hypothetical microblades separate the ridge flake from the core.

The platform of the core appears to have been reused as a scraper, and is obscured by steep, intensive retouch. Assuming that this core would only be recycled after its usefulness for blade removal was exhausted, this indicates that the core was significantly depleted after limited use for microblade production. While this assumption is not necessarily certain, it is supported by the small size of the core. It is also an assumption that the ridge flake represents the original shaping of the fluted face rather than a method of rejuvenation;

however, the authors are unaware of any reported cases of such a method of fluted face rejuvenation. Taking all assumptions into consideration, it seems that the artifact was limited in its use as a microcore; after the completion of the shaping process it was quickly reduced, and then reshaped into a new tool rather than being rejuvenated for the further removal of microblades. This conclusion is supported by the presence of remnant cortex and by the irregular shape of the core, indicating that careful, continual shaping of the core was not conducted.

**Sequence 2: Ridge Flakes to Microblades.** This sequence of two ridge flakes and two microblades, when refitted, provides a picture of the hypothetical prepared fluted face of the microcore from which they were struck (Fig. 9). A medial primary ridge flake fragment, unifacially flaked, overlies a small but whole secondary ridge flake containing remnant unifacial scars. A third ridge flake would fit between these two ridge flakes in a reduction sequence, but was not found. A misshapen and unused proximal microblade fragment lies directly below the ridge flakes. Midway along the length of the dorsal surface of this microblade, a scar from the removal of the missing ridge flake ends in a step fracture, leaving the surface of the hypothetical fluted face irregular and lacking a consistent ridge to guide microblade removal. The secondary ridge flake was refitted into a flake scar directly distal to the step fracture on the microblade; the step fracture had been used as a platform for ridge flake removal. It appears that the secondary ridge flake was struck in an attempt to correct the step fracture. The final flake in this sequence is a short, triangular distal microblade fragment lying below the first microblade. This refitted sequence provides a representation of the shaping sequence for the fluted element of a core that has not been found to refit to these flakes. Measurements of the refitted artifacts together provide a fluted face length of approximately 27.7 mm, and a hypothetical core thickness of approximately 7.5 mm, placing this core well within the quantitative range of the other cores found at the site.

**Sequence 3: Ridge Flakes to Abandoned Flawed Microcore.** This short core reduction sequence (Fig. 8A) seems to have been interrupted by flaws in the raw material, preventing the removal of useable microblades. It consists of a primary ridge flake fragment refitted to a secondary ridge flake, which then refits to a microcore that has been refitted from numerous pot-lidded fragments. The triangular primary ridge flake fragment has been shaped by unifacial flaking, and the secondary flake was removed from directly beneath the primary ridge flake, resulting in a trapezoidal cross-section. The proximal end of this flake extends above the current platform element of the microcore; however, subsequent spalling of the platform makes platform rejuvenation impossible to diagnose. There is evidence of only one further flake removal, which ends in a step fracture on the fluted surface of the microcore just below the platform. It appears that the fluted face of the microcore has not yet been fully shaped.


**Figure 9. Refitted ridge flake sequence.**

**Sequence 4: Ridge Flake and Microblade Pair.** A secondary ridge flake (Fig. 8I) was refitted to a dorsal flute scar on a microblade (Fig. 5J). Both artifacts are whole, with their platforms lining up almost exactly along a single horizontal plane, indicating that the platform from which they were removed was not rejuvenated or modified by any methods other than grinding between ridge flake and microblade removal. This refitted pair constitutes the only direct evidence in the collection regarding the sequence of microcore shaping, indicating that the platform production occurred before the removal of ridge flakes to shape the fluted face.

### *Burins and Burin Spalls*

Burins in the assemblage display a wide range of characteristics and methods of production. As with microblade artifacts, burin tools and spalls were found exclusively in Block A. Burination was most commonly performed on silicified mudstone flakes, but a few items of chert and Beaver River sandstone were also found among the burin artifacts. Both transverse and longitudinal burins are present, with platforms located on notches, breaks, and sometimes simply on opportunistically selected edges (Fig. 10G–H). Both single and dihedral facets are present, as well as those occurring adjacently along the same flake edge. Burins in the collection also vary widely in width and in

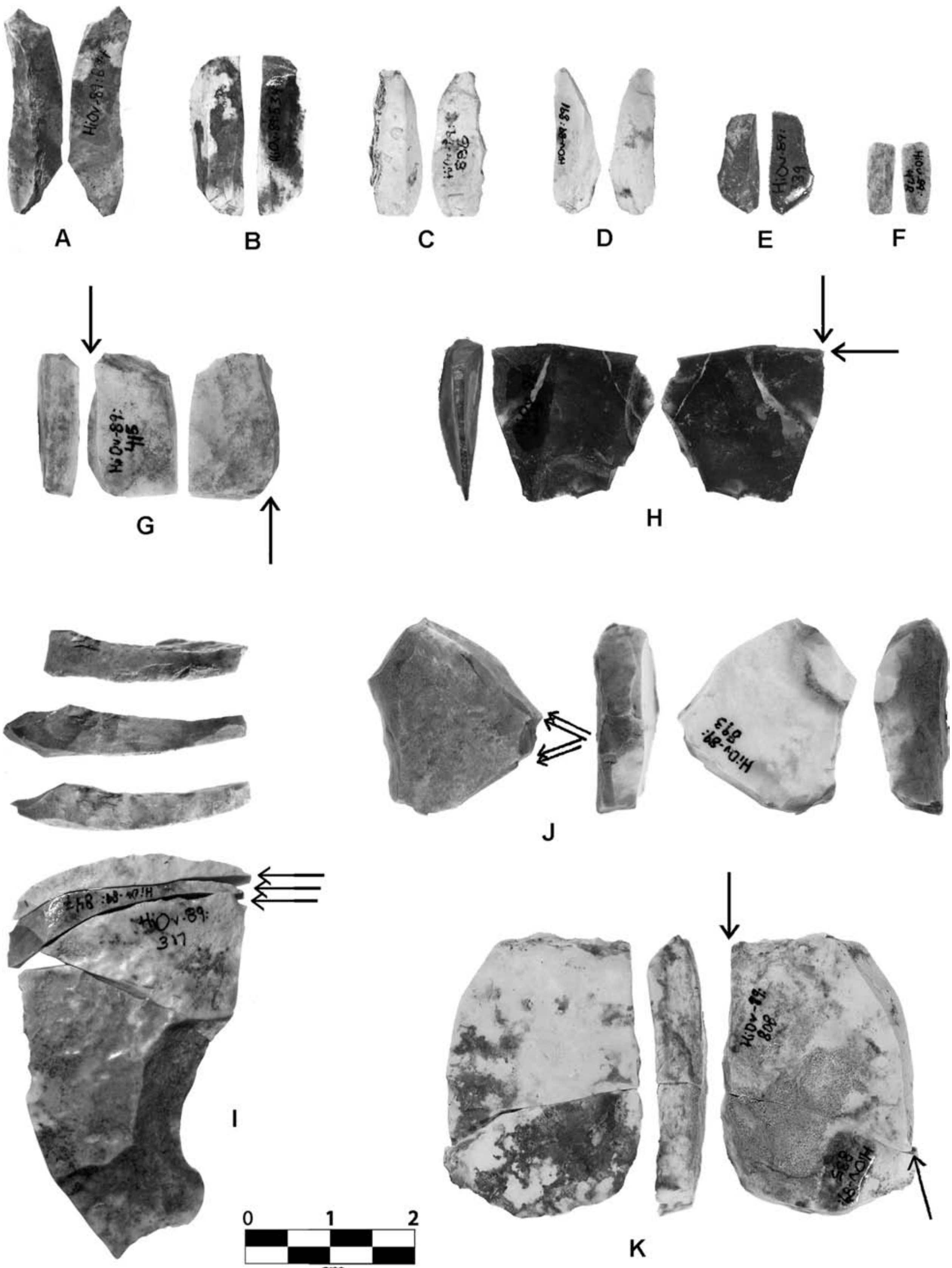


**Figure 10. Burins and burin spalls. *A–F*, burin spalls; *G–H*, burins; *I*, multi-tool and refitted burin spalls; *J–K*, multi-tools.**

overall size. The great variety in burin styles and production methods indicates a flexible, expedient approach to burination. Although notching is present, it is not specifically combined with longitudinal burination, nor is it as pronounced as that seen in the Donnelly burins associated with many Denali microblade sites.

Many of the burinated tools exhibit retouch, and are referred to here as multi-tools, as they have multiple, often seemingly unrelated, working edges. In general, the multi-tools are created from larger and thicker flakes than the simple burins, and exhibit steep, scraper-like retouch on or adjacent to the burin facets (Fig. 10I–K). In cases where the retouch occurs on the burin facet itself, the working edge is extremely steep, often right-angled, reflecting the original shape of the burin facet. The prevalence of multi-tools in the assemblage, combined with evidence that burination may have occurred both before and after retouch, is consistent with the flexible approach to burination seen throughout the burin tools in the assemblage.

It is possible that the burin spalls found at Little Pond represent a biased sample, as there is potential for small, thin artifacts of this type to be lost during screening. The spalls in this collection are relatively large and thick (Fig. 10A–F); however this is consistent with the size and thickness of the burins and multi-tools also present in the assemblage. Strong to moderate curvature is common, as are overshot flake terminations, rather than the typical hinge termination associated with burination. This observation may be related to the thickness of the burin spalls; the greater force necessary to remove burin spalls from a thick flake, compared to burins on thin flakes, may prevent the early termination of the spall in a hinge. Spalls are equally seen with triangular and trapezoidal cross-sections. Remnant use-wear is common, and is often intense and steep. Modification of burin spalls themselves through retouch is rare, seen in only a few of the artifacts.

### *Scrapers and Retouched Flakes*

Nine scrapers and six extensively retouched flakes were found throughout the site, concentrated in Block A. All of these artifacts have been rather informally created from flakes, while bifacial core tools are distinctly lacking from the site. The retouched flakes at the site show a greater variation in size and shape than the scrapers, without the characteristic steep-angled scraping edge, and do not show intentional overall shaping of the artifact as seen in more elaborate bifacial tools common to Oilsands archaeological sites. These artifacts do, however, show at least some unifacial or bifacial shaping or thinning, and scraper-like use-wear on their working edges. Scrapers and retouched flakes together show some of the greatest variety in material type of any other artifact category at the site, with no one material type dominating the collection, which includes silicified mudstone, black silicified siltstone, quartzite, northern quartzite, Beaver River Sandstone, and two types of chert.

While most of the retouched flakes and scrapers are unremarkable in their shape and overall appearance, one wedge-like specimen displays a shaping method very similar to that displayed by microcores at the site (Fig. 7D). The artifact has been created from a thick decortification flake. The scraping edge strongly resembles the unifacially shaped fluted face ridges seen in refitted ridge flake sequences, while the opposite edge has been partially shaped through small, parallel flake scars and resembles a keel. The distal end of the flake appears to have been removed by a burin blow. The burin scar terminates in a slight hinge just before the retouched keel, and strongly resembles a prepared microcore platform. However, there is no obvious reason why such a core might have been abandoned at this stage in reduction.

### *Debitage*

**Debitage Characteristics.** Debitage of all material types generally represents the intermediate stages of core reduction, with low numbers of bifacial flakes, cortical flakes, or shatter present, as well as low numbers of small finishing or retouch flakes. Moderate platform and dorsal scar counts predominate the assemblage, with both values averaging between counts of one and two. The majority of flakes and debitage are fragmentary, with complete flakes representing only 23.9% of the entire debitage assemblage. Debitage artifacts have an average weight of 0.6 g and an average size between 1.5 to 2.0 cm.

There are 159 pieces of debitage in the assemblage showing evidence of edge modification. This includes 50 artifacts with evidence of retouch, 53 with apparent use-wear, and 56 exhibiting both. Twenty-five complete flakes were found among the modified debitage, with the remaining 134 retouched artifacts including distal, medial, and proximal flake fragments, as well as two pieces of retouched shatter. The complete flakes represent only 16.2% of the retouched debitage, a much smaller proportion than for the entire assemblage, indicating either that broken flakes were more commonly selected for edge modification, or that flakes were intentionally snapped before utilization. Refitting of broken flakes showed that edge retouch occurred both before and after snapping or breaking of the artifact, so it could also be that often larger flakes were selected for utilization, which were then more susceptible to post-depositional breakage. This is supported by the observation that edge-modified artifacts are larger than average for the general debitage, having an average weight of 1.1 g and an average size between 2.0 and 2.5 cm.

## Site Conclusions

### *Microcore Reduction Sequence*

The microcores, ridge flakes, and microblades combine to provide evidence of a consistent method of microblade production at Little Pond. Although the artifacts themselves are not always consistent in shape and size, they share many distinct features indicating that they were created using a formal production sequence. One important characteristic that must be noted throughout the process is a flexible approach to microcore creation and reduction, using similar techniques to create the desired result despite an apparent limitation in the availability and size of the raw materials being used.

The most common starting point in the microcore creation process of this assemblage is the selection of a thick flake. There is little evidence for the reduction and shaping of pebbles or cobbles into microcores, although one large preform indicates that the tool makers at the site may have been aware of this possibility. Flakes seem to have been selected for a wedge-like cross section, allowing for minimal reduction to create the desired shape. Such an approach would allow for the efficient use of both time and material. Microcores are most consistent in measurements of thickness and height, with overall length and platform rejuvenation lengths being the least consistent. Given that the latter measurements may vary with the extent of core exhaustion, these differences are not surprising; however, the former measurements also indicate that flakes are most strongly selected for a desired thickness, around 9.0 mm, and height, around 24.0 mm. Given that core height influences flute length, which in turn determines the length of microblades produced from that core, this selection process would allow for the creation of microblades of a standardized length with minimal initial effort.

After flakes were selected, cores were informally shaped through unifacial flaking, equally common on the reverse and obverse faces. Flaking was usually marginal, shaping only the outer edges of the artifact, with the exception of occasional thinning flakes running horizontally across the upper obverse or reverse face of the core. The fluted face was formed through more intensive unifacial shaping of ridges, to be removed as ridge flakes. Platforms were less consistently created; platform ridge flakes, informal spall removals, and side-blow flaking were all used. Although platform preparation methods themselves varied, they generally resulted in similar platforms, extending only partially across the top of the core from the fluted face, with spall removals, when present, typically ending in a hinge termination. It may be inferred that the most likely core reduction sequence was core shaping, then platform production, and finally creation of the fluted face. This is supported by refit Sequence 4 in which the ridge flake and microblade platforms are at an equal height on a hypothetical core, indicating a previously prepared platform. The core-like scraper, if indeed a partially finished core, also supports this argument; it exhibits a fully prepared platform, but only partially prepared fluted face. Indirect evidence for this sequence of reduction can also be observed in that the ridge flake method of shaping the fluted face would tend to require a suitable platform for ridge flake removal.

There is evidence that both platform and fluted face rejuvenation occurred during microblade production. Platforms were typically rejuvenated through a spall removal beginning at the juncture of the platform and fluted face, commonly extending only about 30% of the way into the platform element, at which point the spall terminated in a hinge. Fluted face rejuvenation also occurred, as seen in the sequence of correction for the step-fractured microblade in Sequence 2, and in the presence of a possible side-blow fluted face rejuvenation flake. However, a number of cores in the collection also appear to have been abandoned due to irregularities and flaws in the material of the fluted face, and so fluted face rejuvenation was not consistent throughout the collection. Many of the microcores at this site do not seem to have undergone long and complicated reduction sequences, but rather were casually shaped and quickly abandoned when they became difficult to work.

Despite this apparently casual approach to core reduction and disposal, many other microcores at Little Pond seem to have been used, and reused, to the point of exhaustion. Cores with remaining lengths significantly larger than average, are also those that seem to have been abandoned due to flaws in the material affecting microblade removal. The relatively large microcore on a biface is the only exception to this rule; however, this artifact is unique in a number of ways, and seems to represent an exception to most of the processes described here. It must be taken into account that the extremely small, apparently exhausted nature of the microcores may also be a factor of the selection process for working materials; if large flakes were not available for the creation of cores, then cores would naturally be small before microblade removal even began, and would quickly have become exhausted. After exhaustion or abandonment as cores, many of these artifacts were further used as scrapers and burins, with use-wear clearly visible over the flute scars on many of the microcores. Use-wear is also found on the edges of the platforms and keels, and is commonly heavy. Extremely heavy wear is present on the bases of many cores, and moderate wear at the front of the platforms at the margin of the fluted face; however, some of these forms of wear may be from use, or simply the result of basal crushing and platform grinding during microblade removal. Heavy wear on the ridges of core preparation flakes may be due to the core shaping process, but could also indicate use-wear deposited prior to microblade removal.

Microcores at Little Pond are excellent correlates to the core-burins described at the Dry Creek Site by Powers, Guthrie, and Hoffecker (1983), and other Denali sites in Alaska, Yukon, and the Northwest Territories (cf., Clark 2001:76). The low flute scar count, high degree of use-wear, and associated presence of burin-and-scraper multi-tools, all indicate that these cores were not used solely, or possibly even primarily, for microblade production. The presence of some use-wear and retouch on the microblades indicates they were indeed used; however, the sample is too small and fragmentary to determine the specific nature of this use. While these blades were likely hafted and used as parts of composite tools, few utilized specimens remain at the site. It could be that many microblades were produced here, then hafted, and taken away when the site was abandoned. The high proportion of proximal fragments remaining at the site could be interpreted as evidence for this idea, as the medial fragments would be most consistent in form, with a straight edge ideal for hafting (Wyatt 1970). Alternatively, proximal flakes may have been most commonly recovered simply because their greater width at the bulb of percussion increased their potential for being caught in the screen. Given the average small size of microblades and other debitage in the assemblage, it is probable that only the smallest fragments would have been lost and the sample is representative. Nevertheless, because of this possibility, the low number of microblades and medial fragments and lack of retouch cannot be considered conclusive evidence about microblade use at the site, and the interpretation of the site focuses on the larger microcores and ridge flakes.

Overall, the analysis of microblade artifacts indicates that conservation of raw material was a key aspect of lithic production at Little Pond. Continual reuse and recycling of raw materials was facilitated by a flexible approach that allowed for artifacts to be created, used, and recreated as a variety of different tool types. Despite this fluidity, standardized methods such as ridge flake preparation were also being used to create consistently wedge-shaped cores, indicating the presence of a specialized but adaptable microblade technology. The presence of bifacially and unifacially shaped cores, as well as ridge flakes, burins, and a single platform tablet, all indicate a northwestern influence. It seems that a method of microcore reduction closely related to that seen in the Denali complex was used at Little Pond, adapted to make use of small fragments of rare raw materials. Variations in the reduction sequence such as side-blow platform preparation and partial rejuvenation may have delayed the exhaustion of the microcores. Comparison of these interpretations to a wider view of microblade production in northwestern Alberta has the potential to extend the boundaries of the Denali complex much farther southeast than previously interpreted, and similarly to indicate a more extensive northern influence in the region than current interpretations of the archaeology of northern Alberta allow.

## *Site Occupation and Tool Use*

Overall, debitage at Little Pond represents the intermediate stages of lithic reduction, with a focus on core technology over bifacial technology. This is consistent with the presence of numerous microcores and flake tools, and lack of bifacially modified artifacts. The low number of finishing flakes found at the site is consistent with the focus on microblade and burin technology over the production of tools such as bifaces that often require edge sharpening. Decortification flakes are noticeably also lacking at the site, indicating that decortification of the materials used at this site occurred elsewhere, prior to site occupation. Cores other than microcores are also conspicuously absent. A high proportion of the debitage at the site is small and fragmentary. Refitting analysis has shown that average measurements of flake size and weight are unrepresentative, and that many larger flakes originally existed at the site. The larger sized flakes, and the absence of cores, allow for the interpretation that moderately sized, unexhausted cores may have been removed from the site when it was abandoned, to be reused later elsewhere.

Tool production and use at Little Pond appears to have been largely expedient in nature. Formal tools including burins, retouched flakes, and scrapers together are far outnumbered by edge-modified flakes, many of which are small and thin, and were used and reused after the flake was broken. Burins are similarly small and thin, while multi-tools and scrapers are only roughly shaped. This is not to say that the lithic technology is unsophisticated; the variation in multi-tools and burins at the site shows instead the knowledge of how to apply a few flaking methods to create a variety of working edges and tools, without resorting to intricate and time-consuming bifacial shaping.

It seems likely that tools created at this site were both used on-site and carried away for later use or reuse. The low rate of successful refitting indicates either that artifacts at the site were highly modified and reused to the point that they could not be recognized and refitted, or that many artifacts from various points in the reduction process were removed from the site. Another possibility is that the high rate of breakage and post-depositional pot-lid fractures among the artifacts reduced large parts of the assemblage to fragments too small to be recovered during screening, while those artifacts that were recovered were too fragmentary to be effectively refitted. In either case, extensive reuse and multiple reduction events for flakes and tools are evident, indicating that conservation of material may have been a priority, which seems likely given the rarity and workability of the raw materials being used.

A number of prehistoric activities are represented by the artifacts at Little Pond, particularly those involving silicified mudstone. Most notably, previously decortified pieces of lithic material were reduced in a specialized lithic workshop, producing microblades, burins, and retouched flake tools. These tools were then utilized, mostly for scraping but also possibly for engraving functions. Combined with the small size of tools and lack of bifaces and projectile points, this observation indicates the performance of domestic activities such as later-stage butchering, food processing, and possibly the working of bone, antler, and wood. It is likely that some of these materials were used for the hafting of microblades and other small lithic artifacts produced at the site. Due to the lack of organic preservation, it is unknown whether microblades at this site were hafted into wood, bone, or antler handles or shafts; all materials were likely present at the time of site occupation. It is possible, however, that the larger, thicker scrapers may have been used as wedges for splitting wood rather than for more traditionally conceived uses such as scraping of hides, while burins may have been used for engraving small notches for the hafting of microblades.

## Discussion

At this time Little Pond and Bezya remain the only two intensively studied microblade sites in the Oilsands region. Microcores have also been uncovered at a number of recently excavated sites, most notably, a wedge-shaped chert core from HhOv-449, and a bifacially flaked chert microcore preform from HhOv-468 (Wickham 2009) with a platform created by hinged spall removal. As well, possible microcores and blade-like flakes are frequently being reported throughout the region, many made of Beaver River sandstone (BRS), a ubiquitous material in the region. While not as easily workable as the less common cherts and silicified mudstones seen at microblade sites thus far, BRS can be fine-grained and have a predictable fracture (Fenton and Ives 1990). It is perhaps more commonly found in medium to coarse-grained forms with rougher fracture patterns, and is readily available in local sources that appear to have been near central occupation areas (Ives 1993; Saxberg and Reeves 2004).

Both bifacial reduction and bipolar technology are known to create blade-like flakes as a byproduct, and they are also both common to the prehistoric lithic industries currently known in the region, possibly for their advantages in the reduction of moderately workable but common materials such as BRS. A number of sites to the south of Little Pond exhibiting a high proportion of bipolar cores were also found to have blade-like flakes comparable to those from Little Pond, although larger and rougher in form (Woywitka, Younie, and Landals 2008.). Given the lack of associated microcores or other debitage related to microblade production at sites reported to contain microblades and blade-like flakes, it seems most likely that the majority, though not necessarily all, of these artifacts are simply the byproducts of more conventional types of lithic reduction, and do not represent a fluorescence of microblade production using BRS as a raw material.

Even at this level of evidence, a number of patterns may be found among the microblade assemblages in the Oilsands. Most notably, fine-grained materials such as chert and silicified mudstone seem to be selected as the raw material for microblade reduction, even when BRS is also present in the assemblage. Secondly, nearly all cores found in the region are distinctly wedge-shaped, with evidence of bifacial and unifacial core shaping. While cores at Bezya show more extensive bifacial reduction from pebble preforms, compared to the unifacial shaping of thick flake preforms typical to Little Pond, both sites contain extensive evidence of ridge flake and platform ridge flake removals. Both also show a distinct pattern of partial platform rejuvenation.

Many characteristics seen at Bezya and Little Pond are typical of the Denali complex, most notably the presence of platform tablets and ridge flakes in conjunction with bifacially and unifacially formed, wedge-shaped microcores. The sequence of reduction represented by the artifacts also strongly resembles that used in Denali microcore reduction. While the Bezya microcores resemble the more classic microcore design, those from Little Pond resemble the core-burins discussed by

Clark (2001) as a Denali artifact type found at sites in Alaska and Yukon, as well as heavily utilized microcores reported at Healy Lake in the interior Yukon (Cook 1968). Minor variations from the Denali technique may be noted, however, such as the prevalence of hinged platform spalls among Oilsands microcores. While the partial platform preparation created by these spalls is not common to the Denali complex, the core tablet and cores exhibiting rejuvenation through side-blow flaking indicate that platform rejuvenation methods typical to the Denali were also used.

While the emerging pattern of microblade production in the Oilsands indicates a definite association to the traditions of microblade production seen further northwest, the exact meanings of these associations are not as clear. It is highly unlikely that the presence of microcores at a few sites can represent the mass migration of a large group of people into the area from the north. However, the presence of not only microblades, but also the by-products of microblade production, indicate that composite artifacts with hafted microblades were not simply traded into the region, but that prehistoric people in the region possessed knowledge of the microblade reduction process. This knowledge may most likely have been transferred to northeastern Alberta through cultural diffusion. Alternatively, microblade sites may represent seasonal camps at the southern territorial extension of more northern cultural groups. The scarcity of BRS at both Little Pond and Bezya is a characteristic uncommon to Oilsands sites, and may represent habitation by migratory groups unfamiliar with the distribution of local raw material sources. Unfortunately, a lack of temporal data greatly limits this discussion, as few sites within the Oilsands have been dated. While Bezya has been tentatively dated through a composite charcoal sample to 3990 ± 170 uncalibrated rcy B.P. (Beta-7839; Le Blanc and Ives 1986), it cannot be determined if the sample is directly related to the cultural material at the site, nor can this date be used for comparison with the mainly undated sites in the region. This does not, however, limit the relative significance of Oilsands microblade sites for interpretation of prehistoric Subarctic cultural relationships, and the potential for future interpretation if dating of these sites becomes possible.

Further study in the Oilsands may help us to determine more securely the origins and relationships of the various approaches to microcore reduction discussed here. For example, it is not yet known whether the microcores from various sites are roughly contemporaneous, or whether they vary sequentially over time. If this variation were found to show similar temporal distribution as that seen in the far north, it would give even stronger evidence for incorporating the microcores from Oilsands sites into the traditions of microblade production found in the far northwest of North America.

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