9 MICROBLADE TECHNOLOGY IN SIBERIA AND NEIGHBOURING REGIONS: AN OVERVIEW

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INTRODUCTION

One of the purposes of this paper is to present the evidence for the earliest microblade assemblages from Siberia. The Siberian evidence for this technology has emerged in the last decade or so and is not well known outside of Russia. The place of origin of microblade technology is still being debated and is placed in various parts of northern or eastern Asia, with most opinions favouring either China (e.g., Jia *et al.* 1972; Gai 1985) or Siberia (e.g., Teilhard and Pei 1944; Derevianko 2001). It is also pertinent to provide definitions of microblade cores and microblades. A microblade is defined as "A type of flake whose length is greater than twice its width and whose width is less than 1.2 cm.", while microblade cores have a single striking platform and from this a series of small flakes are detached (Akazawa *et al.* 1980:74). Microliths are defined as "a group of stone tool industries based on the production of microblades from special cores that appears at around 18,000 BP and covers an area stretching from the Near East across Central Asia through China, Japan and into North America." (Sinclair 1996:553). According to another definition, microlithic technology is Mode V technology, and in Africa associated with the Later Stone Age. This technology produced geometric microliths (triangles, crescents, and other shapes) and formed part of composite tools [in the European Mesolithic] (Toth and Schick 1988). Microblades in Siberia were produced from a variety of small cores, including wedge-shaped and conical cores. Microcores also include those on which microblades were detached from the butt, known as *tortsovyi* cores (Abramova 1979). Apart from the "classic" microblades, in Siberia, microblades also include "small flake-blades" (with length more than twice the width); these have a curved shape and non-parallel dorsal arris (S.A. Vasil'ev personal communication 2005). In China, microliths are very small sized cores, microblades and microblade tools (An 1978 in Gai 1985:227). A microlithic industry is characterised by microcores (such as wedge-shaped, conical, and cylindrical types), microblades (c. 2 mm thick), and also scrapers and points, the latter including "projectile points." "Typical microblades" are distinguished by parallel sides, 20–60 mm length and a width of up to 10 mm (Gai 1985:227).

The sites described in this paper belong to the earliest microblade production sites. The evidence for this is presented with information on the stratigraphic and chronological contexts and on the archaeological materials found associated with microblades and/or microblade cores.

SIBERIA AND THE RUSSIAN FAR EAST

The Gorny Altai

The Gorny (Mountainous) Altai sites are located in southern Siberia (Russia). In this region, where Mousterian and Upper Palaeolithic industries coexisted (e.g., Derevianko 2001; Derevianko and Rybin 2003), a gradual transition from the Middle Palaeolithic to the Upper Palaeolithic has been identified (e.g., Derevianko *et al.* 2003; Derevianko and Shunkov 2004). Two open-air

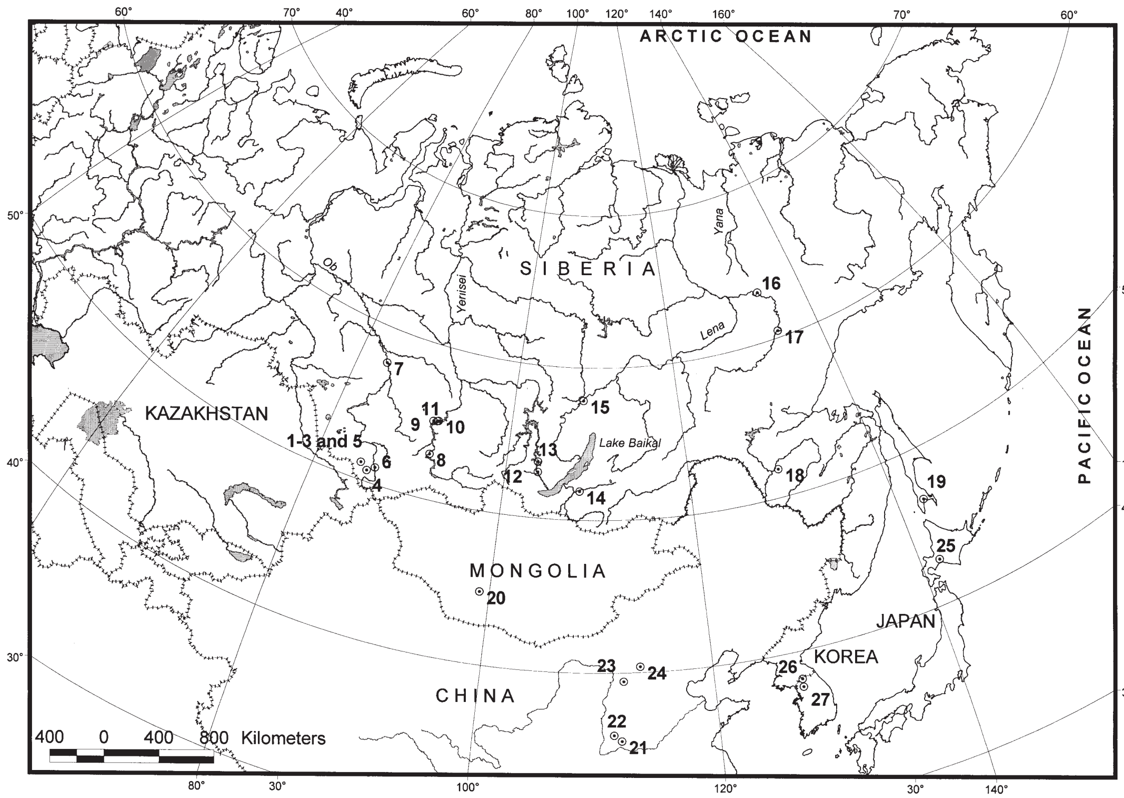

Figure 9.1: Russian, Mongolian, Chinese, Korean, and Japanese sites mentioned in the text. 1. Ust-Karakol 1; 2. Anui 2; 3. Denisova Cave; 4. Kara-Bom; 5. Anui 3; 6. Kara-Tenesh; 7. Mogochino I; 8. Ui 1; 9. Novoselovo 13; 10. Kurtak 4; 11. Kashtanka 1; 12. Mal'ta; 13. Krasny Yar; 14. Kamenka B; 15. Alekseevsk 1; 16. Ikhine 2; 17. Verkhne-Troitskaya; 18. Ust-Ul'ma 1; 19. Ogonki 5; 20. Chikhen Agui; 21. Xiachuan; 22. Dingcun locality 77:01; 23. Shiyu; 24. Xujiayao; 25. Kashiwadai I; 26. Janghungri; 27. Hopyung.

sites in the Altai, Ust-Karakol 1 and Anui 2, and one cave site, Denisova, have yielded evidence of incipient, at Ust-Karakol 1 and Denisova, or true microblade, at Anui 2, technology. These sites constitute some of the most significant sites in the Palaeolithic of the Altai, in terms of the large quantity of archaeological discoveries made there, including fauna and plant remains, and their chronological sequences (see Derevianko *et al.* 2003). Denisova Cave, discovered in 1977, and a large site still under excavation, is one of the best known Palaeolithic sites in the Altai.

Ust-Karakol 1

The earliest evidence of microlithic technology in the Altai has been recorded at Ust-Karakol 1 in stratum 11 (Derevianko 2001; Figure 9.1). Discovered in 1984, this site is located on the slope of a terrace, with the excavation trench nine metres above the Karakol River (Derev'anko and Markin 1998:97). This partially excavated site is situated close to the Anui River on a slope of the Karakol River valley (personal observation 2002). The archaeological deposit is about 6.5 m thick containing 20 layers (e.g., Derevianko 2001). The strata 11 and 10 (A, B, C) sediments are loam, and stratum 9 (A, B, C) contains sandy loessic loams and palaeosols; the thickness of layers is approximately 0.5 m for stratum 11; 0.2–0.3 m for stratum 10; and 0.6 m for stratum 9 (Derevianko *et al.* 2003:242–244). The fauna from strata 7–12 (individual frequencies for strata are not given) comprises *Equus przewalskii* (Przewalskii's horse), *Bison priscus* (bison), *Capra sibirica* (Siberian goat), and *Ovis* *ammon* (mountain sheep) (Derevianko *et al.* 2003:253, Table 57). Stratum 11 is undated (Derevianko 2001), and the upper part of stratum 10, directly bordering on stratum 9 C, is radiocarbon dated to 35,100 ± 2850 BP (SOAN–3259) (Derevianko *et al.* 1998b; Derevianko 2001). Stratum 9 C (stratigraphically below 9 A and 9 B) has four ^{14}C dates ranging from 33,400 ± 1285 BP (SOAN–3257) to 29,720 ± 360 BP (SOAN–3359) (Derevianko *et al.* 1998b*,* 2005; and see Kuzmin, this volume).

Early Upper Palaeolithic artifacts have been identified *in situ* in strata 11 to 8, and these include some Levallois artifacts (Derevianko and Shunkov 2004:26, Fig. 20.4). The Initial Upper Palaeolithic at Ust-Karakol 1 occurs in layers 11–9 and derives from Levallois technology (Derevianko 2001; Derevianko *et al.* 2003). The assemblages include Levallois cores and blades as well as flakes and debitage. Most of the artifacts were manufactured in local raw materials, mainly igneous and sedimentary rocks, including sandstone (Postnov *et al.* 2000).

The lithic artifacts in stratum 11 (with a total of 385 specimens), comprise cores (n. 11), amorphous core-like specimens (n. 3), a broken pebble [worked?], flakes (n. 68), blades (n. 43), fragments and spalls (n. 200), and tools (n. 59, including, among others, retouched flakes and blades, scrapers, borers, and points) (Derevianko *et al.* 2003). Derevianko (2001:82) mentions that the microblade specimens from Ust-Karakol 1 include wedge-shaped and conical cores, carinated end scrapers with microblade removals, and "classical microblades." Seventeen microblades (Derevianko *et al.* 1998b; Derevianko 2001; Derevianko *et al.* 2003) and a wedge-shaped microblade core (see Derevianko *et al.* 2003: Fig. 153.1; Derevianko 2001, Plate 2) were identified. A more recent source refers to small conical and wedge-shaped microblade cores and microblades (Derevianko and Shunkov 2004:26, Fig. 20.4; see also Derevianko and Volkov 2004). The cores include eight monofrontal single platform cores (Derevianko *et al.* 2003, Fig. 153, 1 and 3), two circumfrontal double platform cores and one bifrontal core (Derevianko *et al.* 2003, Fig. 154, 1 and 2). The microblade cores are wedge-shaped and pyramidal (Derevianko and Shunkov 2004, Fig. 20, 1–4;). A carinated end scraper shows three scars of microblade dimensions, and another carinated endscraper has a cruder appearance (Derevianko and Shunkov 2004, Fig. 21, 12 and 8, respectively). Two monofrontal cores with one striking platform were used to manufacture microblades (Derevianko *et al.* 2003, Fig. 158, 1 and 3; Figure 9.2: 1 and 2). It has been suggested that microblade technology in the Altai, including the Ust-Karakol 1 site, developed from the "… repetitive detachment of elongated blanks from prismatic, conical, and narrow-face cores, including wedge-shaped varieties." (Derevianko and Shunkov 2004:38; see also Derevianko and Volkov 2004).

The stratum 10 assemblage with a total of 679 lithic artifacts [(Derevianko *et al.* 1998b); total n. 677 according to Derevianko (2001) and Derevianko *et al.* (2003)], comprises cores (n. 6), broken pebbles (n. 9 [worked?]), flakes (n. 116), blades (n. 64), fragments and spalls (n. 378), tools for chipping stone (n. 3 [presumably hammerstones]), and tools (n. 101 or 15.4%, including, among others, 26 retouched flakes, 11 retouched blades, 10 skreblos, seven scrapers, nine burins, and five borers. (Note: Skreblo is the Russian term for large side scrapers.) The cores include a single platform monofrontal type (Derevianko *et al.* 2003, Fig. 155, 4–5) and 16 microblades were found (Derevianko *et al.* 2003, Fig. 157, 4–10; Figure 9.3:1–6). Both of the monofrontal cores have flake scars, and one of these has a flat striking platform (see Derevianko *et al.* 2003, Fig. 155, 5), and neither of these is a microblade or microblade-like core. Apart from prismatic blade cores, a similar proportion of microblade cores have also been identified (Derevianko *et al.* 1998b). Seven microblades from stratum 10 are illustrated (Derevianko *et al.* 2003, Fig. 157, 4–10). Of the four specimens described as backed microblades (Derevianko *et al.* 2003), two (Derevianko and Shunkov 2004, Fig. 21, 1 and 2) have the appearance of flakes. Zenin (2002:41) refers to micro-tools, i.e., micro-points, borers, and backed blades.

In stratum 9 (total of 1099 lithic artifacts), microblade cores and microblades have been recognised (Derevianko *et al.* 1998b, 2003). The stratum 9 artifacts comprise mostly fragments

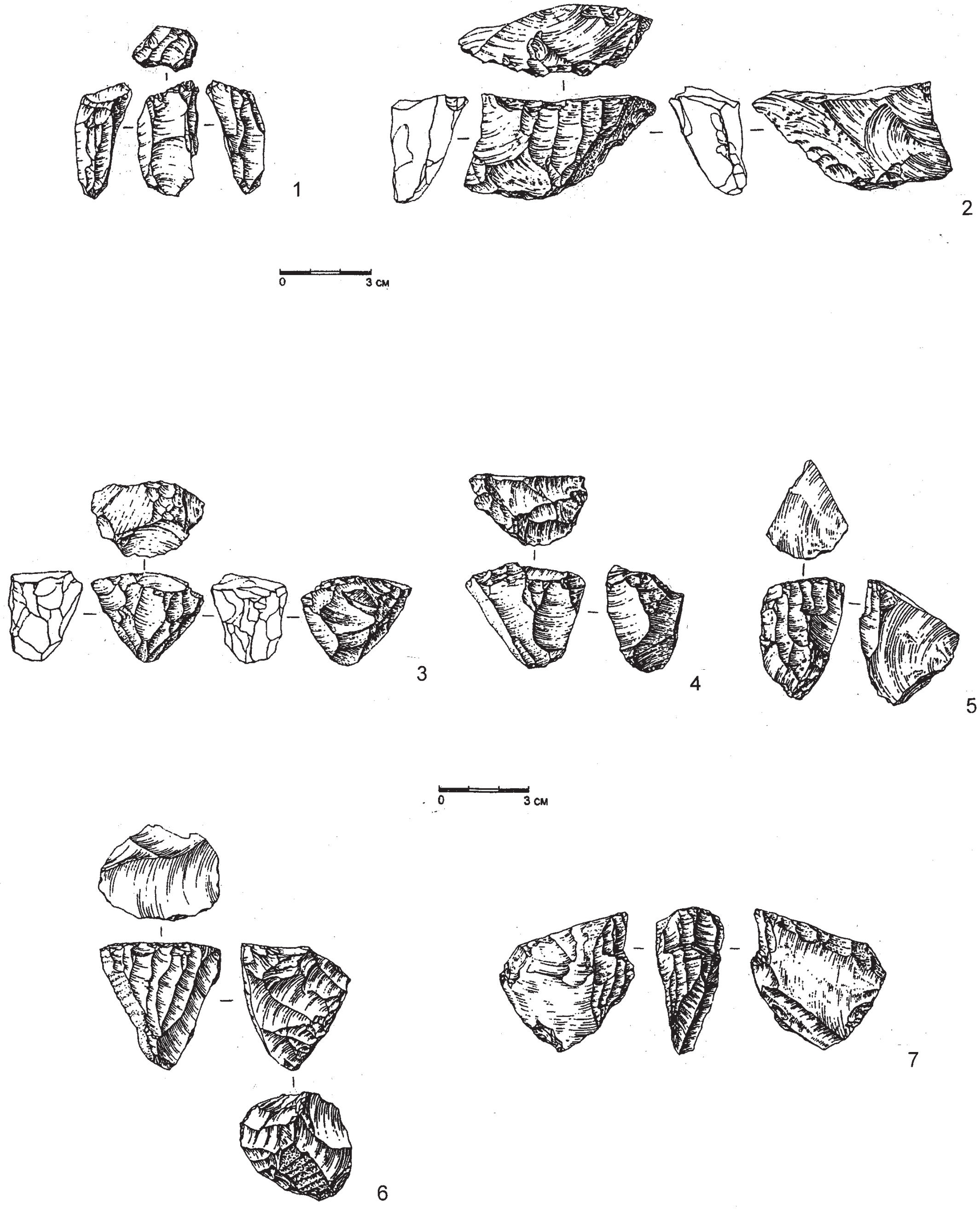

Figure 9.2: Cores from Ust-Karakol 1.
1 and 2. Monofrontal cores with one striking platform, stratum 11; 3 and 6. Conical shaped cores, stratum 9; 4, 5, and 7. Wedge-shaped cores, stratum 9 (after Derevianko *et al.* 2003, Fig. 158).

and spalls (n. 464) and flakes (n. 229). Other artifacts are cores, blades, tools, and hammerstones; tools include borers, skreblos, scrapers, and burins (Derevianko *et al.* 2003). Two conical shaped cores (Figure 9.2: 3 and 6) and three wedge-shaped cores (Figure 9.2: 4, 5, and 7) were found in stratum 9 [(Derevianko *et al.* 2003, Fig. 158, 4 and 3 (conical cores); and Fig. 158, 2, 1, and 6 (wedge-shaped cores)] as well as 29 microblades (Derevianko *et al.* 2003).

Denisova Cave

The Denisova Cave site is located about 3 km away from Ust-Karakol 1 (Figure 9.1). In the main chamber, the Pleistocene sequence contains 13 cultural layers, beginning with layer 22 as the basal layer. The Denisova cave fauna is quite fragmentary and includes *Equus* sp. (horse), *Bison priscus*, *Poephagus mutus* (yak), *Cervus elaphus* (red deer), *Capra sibirica*, and *Ovis ammon* as well as carnivores (Derevianko *et al.* 2003:188). In stratum 11, approximately 1.50 m thick (see Derevianko 2001, Plate 1), the total number of lithic artifacts is 2611. There are also 50 bone tools and five flint ornaments (Derevianko 2001; Derevianko and Shunkov 2004). The lithic artifacts comprise Mousterian, Levallois and, most frequently, Upper Palaeolithic tools; the latter

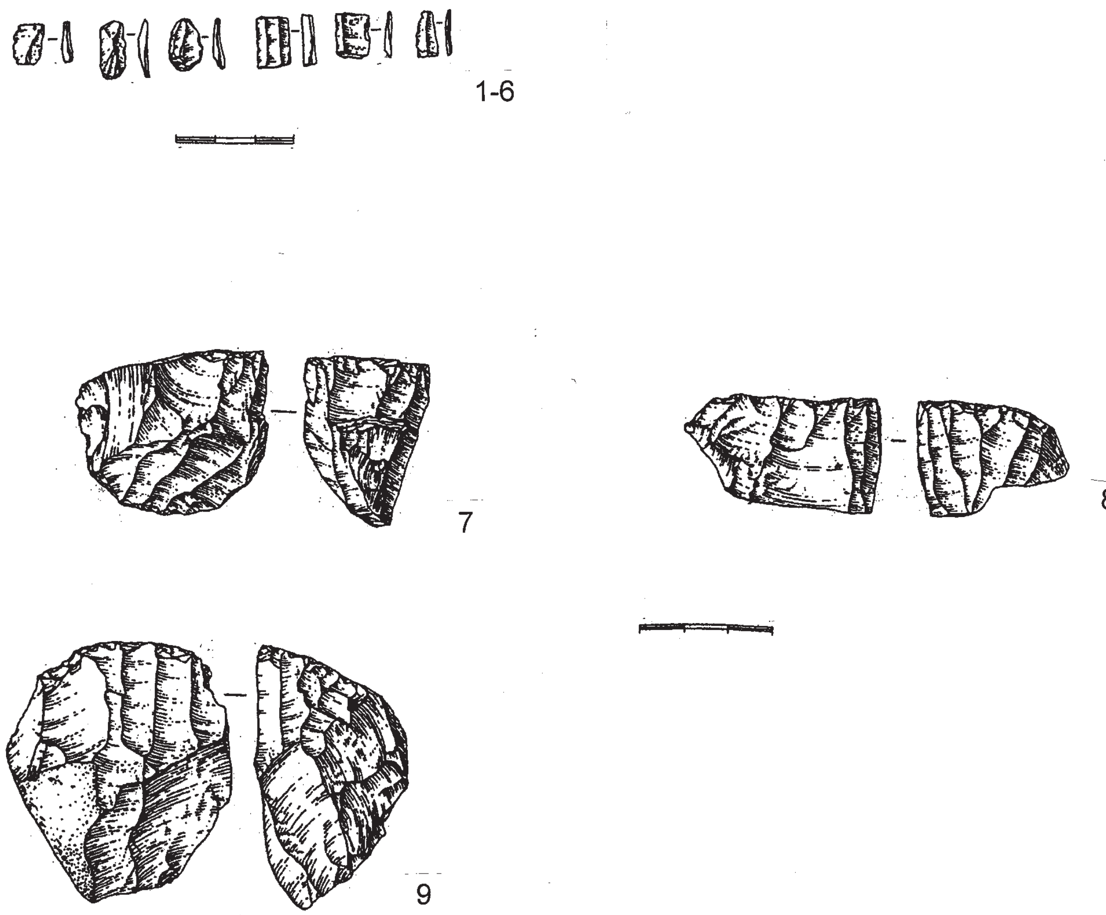

Figure 9.3: Microblades from Ust-Karakol 1 and cores from Anui 2.
1-6. Microblades from Ust-Karakol 1, stratum 10 (after Derevianko *et al.* 2003, Fig. 157); 7. Wedge-shaped core from Anui 2, horizon 8; 8. Prismatic core from Anui 2, horizon 9; 9. Prismatic core from Anui 2, horizon 8 (after Derevianko *et al.* 2003, Fig. 178). Scale represents 3 cm.

include backed blades, *grattoirs*, burins, borers, and foliate bifaces. Fifteen microblades, including backed specimens, were identified (Derevianko *et al.* 2003:132). The stratum 11 assemblage from the main chamber is classified as the initial Upper Palaeolithic or early Upper Palaeolithic (Derevianko 2001), and ^{14}C dated to > 37,235 BP (SOAN–2504; Orlova 1995). Derevianko and Volkov (2004) mention microblades from layer 12 of Denisova Cave, though without illustrations, and that wedge-shaped cores, besides narrow-faced cores, are the most numerous cores beginning in layer 11.

A larger number of microblades (all or some of which are backed) were found in the relatively thick stratum 9 (see Derevianko 2001, Plate 1). This is a late Upper Palaeolithic assemblage (Derevianko *et al.* 2003). Horizons B and C of stratum 9 yielded 49 lithic artifacts including 10 microblades (Derev'anko and Markin 1998:93). In horizon D, 417 lithic artifacts were recorded, including six backed bladelets (Derev'anko and Markin 1998:93). One prismatic core for the manufacture of microblades and 67 microblades, including backed specimens, were identified (Derevianko *et al.* 2003:132). Stratum 9 also includes a unique discovery in the Altai, that is, a geometric microlith (Derev'anko and Markin 1998:93; Derevianko *et al.* 2003:365). No dates are available for stratum 9.

In the terrace (or entrance) section of Denisova Cave, "Elements of microblade flaking" have been observed in stratum 7 (Derevianko *et al.* 2003:368). Levallois-Mousterian artifacts and ornaments also occur in this layer, which is assigned to the early Upper Palaeolithic (Derevianko *et al.* 2003:368). In stratum 7, a core of small dimensions has "negative scars of repeated microblade removals" and was manufactured on jasper; the source of this stone lies at about 30–50 km distance from the cave (Derevianko and Shunkov 2004, Fig. 17.6). Microblades were found in layer 6, which also yielded bone tools and flat beads (or rings) manufactured on ostrich eggshell. Radiometric dates are not available for layers 6 and 7 (Derevianko *et al.* 2003:368). The terrace section fauna includes *Equus ferus* (Pleistocene horse), *Bison* sp./*Poephagus* sp., *O. ammon*, and carnivores (Derevianko *et al.* 2003:197). The single radiocarbon date for the terrace section [the other dates are based on the radiothermoluminescence method (RTL)] is for stratum 9, with a date of 46,000 ± 2300 BP (GX–17602) (Goebel *et al.* 1993). According to palynological data, stratum 6 of the terrace corresponds to the lower part of stratum 9 of the main chamber, and stratum 7 is assumed to be of Karginian age, Oxygen Isotope Stage 3 (Derevianko *et al.* 2003:150–153, 155), with an estimated age of 40,000 to 30,000 years. In the southern gallery section of Denisova Cave, a flat-faced core derives from layer 11 (Figure 9.4) and two microblades were found in layer 9 (Derev'anko and Markin 1998, Figure on page 96, specimens 8: 1 and 2). Layer 11 in the southern gallery is radiocarbon dated to 29,200 ± 360 BP (AA–35321) (Derevianko *et al.* 2000a). The flat-faced core has similarities to a wedge-shape form; an illustration showing all sides of this specimen is clearly necessary for a more informed evaluation. Chen Shen, with reference to the published drawing, argues that the flat-faced core, although manufactured to a form similar to a wedge-shaped core, is different from the latter, with one important difference being that wedge-shaped cores have microblade detachments on the end only, not the sides (Chen Shen personal communication 2005). Nevertheless, cores like the flat-faced example from the Denisova Cave gallery could be

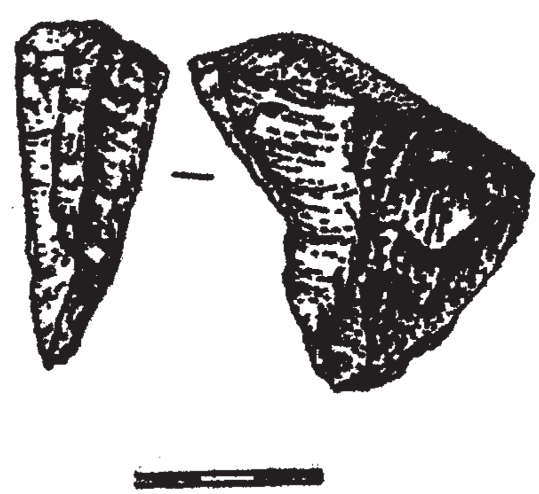

Figure 9.4: Core from Denisova Cave. Flat-faced core, southern gallery, layer 11 (after Derevianko *et al.* 2000a). Scale represents 3 cm.

representative of another, though rare, variety of wedge-shaped core.

Anui 2

The open-air deposit of Anui 2 (Figure 9.1) is situated below Denisova Cave and closer to the Anui River; it is 5–6 m above the Anui River level and has a terrace-like surface. The deposit consists mainly of colluvium; alluvial sediments are in the lower part. There are 15 lithological strata or layers and 12 archaeological horizons at the site; lithological strata 8–13 contain 12 archaeological horizons (Derevianko *et al.* 2003:311, 372). Lithological stratum 6 is 0.5 m thick loam with rock debris and scree; stratum 7 is 0.4 m thick loam with debris; stratum 8 is 0.4 m thick debris and scree with loams; stratum 9 is 0.2.–0.3 m thick loam; stratum 10 is 0.8 m thick debris and scree with loams; stratum 11 is 0.3–0.4 m thick loam; and stratum 12 is 0.3–0.4 m thick debris and scree with loams. The artifacts of Anui 2, horizons 6–12, belong to the middle Upper Palaeolithic (Derevianko *et al.* 2003:355–356). *Bison* sp. was found associated with the artifacts in layer 11, corresponding to horizons 6 and 7 (Derevianko *et al.* 2003:304). In the English translation, no mention is made of an archaeological horizon 7 (see Derevianko *et al.* 2003:372).

The assemblages from Anui 2 date to after 30,000 BP: horizon 12 (at the bottom of geological stratum 13.2 and the contact zone of geological stratum 14; Derevianko *et al.* 2003:311) is radiocarbon dated to 27,930 ± 1590 BP (IGAN–1425) and 26,810 ± 290 BP (SOAN–3005) (Vasil'ev *et al.* 2002). Horizon 11 (at the top of geological stratum 13.2) and horizon 10 (at the bottom of geological stratum 13.1) have no radiometric dates (Derevianko *et al.* 2003:311). Horizon 9 (at the top of geological stratum 13.1) is ^{14}C dated to 27,125 ± 580 BP (SOAN–2868). Horizon 8 (stratum 12) has a ^{14}C range of 24,205 ± 420 BP (SOAN–3006) to 20,350 ± 290 BP (SOAN–2863) (Derevianko *et al.* 2003, Fig. 178).

Raw materials used at Anui 2 are sandstone and mainly effusive rocks (Derevianko *et al.* 2003:311). Of the 761 artifacts from horizon 12, the majority are flakes and blades (63.5%), fragments and spalls (27.2%), and tools (5.9%), with the latter including mostly retouched flakes; other tools are, for example, scrapers, skreblos, and small points. A few cores (n. 6) and one hammerstone have also been found. Cores include a single platform core, two double platform cores, a bifrontal double platform core, and two flat-faced microform cores. (Note: Flat-faced cores are cores with a flattened working surface.) Four backed microblades were also found (Derevianko *et al.* 2003:311–329), and two are illustrated in Derevianko *et al.* (2003, Fig. 187, 4 and 12).

The 3501 artifacts from horizon 11 are for the most part flakes and blades (47.3%) and fragments and spalls (43.1%); the other artifacts are core-like forms and cores (2.9%), broken [worked?] pebbles (2.4%), anvils and hammerstones, and tools (4.2%). The majority of cores are single platform cores; there are also two double-platform cores and an “orthogonal core”, five flat-faced cores, and a wedge-shaped microform core (Derevianko *et al.* 2003:311–329). Two retouched microblades, one microblade with a dull edge, and two micropoints, were also identified (Derevianko *et al.* 2003:372, Fig. 178, 5). The illustrated wedge-shaped core shows small scars, of which a few may be interpreted as microblade scars.

Horizon 10 yielded 6509 artifacts. This assemblage contains mostly flakes and blades (49.3%) and fragments and spalls (42.6%); other artifacts are cores and “core-like tools” (2.1%), broken pebbles (2.6%), stone working tools (3.3%), and tools (3.3.%); the tools include, for example, retouched flakes, skreblos, notched tools, and small points. Among the microtools are three micro-scrapers, two micropoints, and backed microblades. Most of the cores are “single platform parallel cores”; other cores are, among others, a prismatic core and eight flat-faced cores (Derevianko *et al.* 2003:311–329).

The majority of the 2666 artifacts from horizon 9 are fragments and spalls (58.4%), followed by flakes and blades (29.2%), tools (6.8%, mostly retouched flakes, notched tools, and skreblos), core-like forms and cores (2.8%), broken pebbles (2.7%), and a hammerstone. Cores include double platform cores, flat-faced cores, and a prismatic microcore, for example. One of the tools is a backed microblade and another is a micropoint (Derevianko *et al.* 2003:311–329). A prismatic core from horizon 9 has several microblade negatives on two faces (Derevianko *et al.* 2003, Fig. 178, 6; Figure 9.3:8). A wedge-shaped core (Figure 9.3: 7) and a prismatic core (Figure 9.3:9) derive from horizon 8 (Derevianko *et al.* 2003, Fig. 178, 7 and 4). Of the more than 15,000 artifacts from Anui 2 (including rare ornaments), there are seven flat-faced microcores (Derevianko *et al.* 2003:372, Fig. 178, 1 and 2). All of the cores used to produce microblades have a flat base, a slanted striking platform, and platform preparation with evidence of pressure flaking (Derevianko *et al.* 1998b; Derevianko *et al.* 2003:319).

Kara-Bom

Microblades and suggested precursors of wedge-shaped cores have been discovered at the open-air and stratified site of Kara-Bom, situated in the central Altai Mountains, approximately 100 km from Denisova Cave (Figure 9.1). The Kara-Bom deposit is about 5 m thick, and includes six cultural horizons, of which two are Middle Palaeolithic (layers 1 and 2) and two are early Upper Palaeolithic (layers 6 and 5) (e.g., Derevianko 2001). The fauna from cultural layer 6 is *Equus* cf. *hydruntinus*, *C. sibirica*, and *Crocuta spelaea* (hyena). *Bison* sp. was documented in layer 5, and *C. sibirica*, *Bison* sp., and *Equus* sp. in layers 4–1 (Derevianko *et al.* 2000b). Cultural layer 6 is radiocarbon dated to 43,200 ± 1500 BP (GX–17597), layer 5 to 43,300 ± 1600 BP (GX–17596), and layer 4 to 34,180 ± 640 BP (GX–17595) (Goebel *et al.* 1993; Vasil'ev *et al.* 2002). Levallois cores and large blades are characteristic of the Upper Palaeolithic at Kara-Bom (Derevianko and Rybin 2003), and effusive rocks were most often used at this site (Derevianko *et al.* 2000b). Microblades and butt-ended cores thought to be "related to" the microblades were found in cultural layer 6, the earliest Upper Palaeolithic layer at Kara-Bom (Derev'anko and Markin 1998:104). Microblades were also recovered from layer 4, a loam layer with some "fine rubble and scree" and slate fragments (Derev'anko and Markin 1998:103; Derevianko 2001, Plate 3). According to Derevianko *et al.* (1999:180), in the Upper Palaeolithic of Kara-Bom, "the flaking front was moved to the butt end of the core resulting in the production of blanks with characteristic features showing removals of previous flakes. The origin of the wedge-shaped core seems to be associated with this process".

Other sites in Gorny Altai

Microblades and backed microblades were found in strata 12 and 11 of the Anui 3 site (Figure 9.1), located about 1.3 km away from Denisova Cave. This stratified site has 21 layers, and strata 12–10 are loam sediments with rare debris. The only radiometric date is a RTL date for stratum 12 of 54,000 ± 13,000 years (Derevianko and Shunkov 2004). The assemblages from strata 12 and 11 comprise a low frequency of artifacts and these are classified as early Upper Palaeolithic, occurring together with a small number of Middle Palaeolithic artifacts. Artifacts include a prismatic core with parallel working, flake and blade tools, and carinated end scrapers. A microblade and several backed microblades have been identified in these strata (Derevianko and Shunkov 2004, Fig. 23: 6, 1–5 and 7); the microblade may be a fragment of a microblade.

At Kara-Tenesh, in the central Altai Mountains, microblades have been found with "irregular outlines". The four radiocarbon dates for this site range from 42,165 ± 4170 BP (SOAN–2485) to 25,600 ± 430 BP (SOAN–3646) (Vasil'ev *et al.* 2002).

West Siberian Plain

At several open-air localities in the southeastern lowlands of West Siberia, artifacts have been excavated which have similarities to microlithic artifacts. Of the 1348 flint artifacts from Mogochino 1, found on the right bank of the Ob River (Figure 9.1), most are unretouched fragments (73.8%), followed by tools (17.8%; microtools, retouched blades, burins, wedges, end scrapers, side scrapers, and other tools) and nuclei (8.4%) (Derev'anko and Markin 1998). The associated fauna is primarily composed of *M. primigenius,* horse, and *Rangifer tarandus* (reindeer), and, to a lesser extent, *Coelodonta antiquitatis* (woolly rhinoceros) (Derev'anko and Markin 1998). The cultural layer has a single ^{14}C date of 20,150 ± 240 BP (SOAN–1513) (Zenin 2002:29). S.A. Vasil'ev (personal communication 2005), however, argues that the age of Mogochino needs to be confirmed by additional data; he also mentions that the artifacts are "typical for the Afontova-like culture … younger than 18,000–16,000 years ago". Some of the microcores can be compared to wedge-shaped cores (Zenin 2002:29). There are 50 wedge-shaped cores, and one appears to be illustrated in Fig. 44: 4 by Derev'anko and Markin (1998). Three faces of this core are shown, two of which have microblade scars, although this core is not a standardised example of wedge-shaped core technology.

Based on the presently available evidence, microlithic technology was not common in the lowlands of West Siberia, but at the same time research is at a relatively early stage in this vast region and the number of Palaeolithic sites found so far is small (Zenin 2002). Authors have noted "… a clear tendency towards tool dimunition at early Sartan sites." (see Zenin 2002:40). The environment of the West Siberian Plain in the Early Sartan [age] was open tundra, and human mobility in the cold and arid climate may have been instrumental in the size reduction of tools (Zenin 2002).

Upper Yenisei River Basin

Ui 1

Three open-air sites on the banks of the Upper Yenisei River basin have artifactual evidence interpreted as microblade technology. At Ui 1 (Figure 9.1), situated on a terrace of the Ui River at a height of 23–25 m (close to the confluence of the Yenisei and Ui rivers), lithic artifacts were recovered from two horizons in layer 2 of the third terrace in alluvial sands with gravel and pebbles. Three horizons within layer 2 have been recognised (Vasil'ev 1996). The majority of archaeological specimens occur *in situ* and were found in horizons 2 and 3. Microblades derive from the 0.20 m thick cultural layer 2, horizon 2; horizon 2 is in the lower part of geological layer 7. Horizon 3 occurs below horizon 2 and lies at the base of geological layer 7; layer 7 is 0.42 m thick (Vasil'ev 1996:147). There is evidence of permafrost in horizon 3 in the form of ice-wedges, with cracks up to 5 cm wide (Vasil'ev 1996:164, Fig. 139: 10, 11). Artificial stone formations were identified in horizon 2 and hearths in horizon 3. The state of preservation of archaeological materials appears to be good (see Vasil'ev 1996:145–170). The fauna (bones and teeth) from layer 2, horizon 2, is predominantly *Capra* sp. or *Ovis* sp., *Bison priscus*, and *Equus hemionus* (Asiatic wild ass); other species are *Capra sibirica* and *Cervus elaphus* (Vasil'ev 2003, Table 4). Layer 2 has four ^{14}C dates ranging from 22,830 ± 530 BP (LE–4189) to 16,760 ± 120 BP (LE–3358) (Vasil'ev 1996). These dates show a very wide range, i.e., about 6000 years within one layer.

Raw materials used were quartzite and "micro-quartzite" (more than 90%), and, to a far lesser extent, green flint, schist, a gneiss-like stone, a marble-like stone, liparite, and quartz. Most artifacts found in layer 2 were manufactured on quartzite and "micro-quartzite", while schist, flint, and gneiss were more rarely used (Vasil'ev 1996).

The total frequency of stone artifacts in layer 2, horizon 2, is 851, including debitage and tools, and 60 bladelets and microbladelets (Vasil'ev 1996:170, Fig. 142). In layer 2 (horizon 2) 32 cores have been identified of which five are prismatic cores (Vasil'ev 1996:203, Table 13), and "one atypical wedge-shaped core with bifacial retouch of the lower edge" (Vasil'ev 1996:161). Artifacts with secondary retouch number 35 blades, points, chisel-like tools, skreblos, retouched flakes, denticulate tools, notched tools, and scrapers. A retouched bone and a bone point were also found (Vasil'ev 1996).

In layer 2, horizon 3, a total of 4416 lithic artifacts were recorded, including debitage and tools, and 324 bladelets and microbladelets (Vasil'ev 1996:170, Fig. 142). In this layer, 68 cores were identified. Of these, two are classified as wedge-shaped core blanks, one with an elongated oval platform, the other a boat-shaped blank (with "spalls" on the perimeter, and part of the platform used for small flake detachment) (Vasil'ev 1996:164, Fig. 139:10 and 11). One of these cores is interpreted as a preform for a wedge-shaped core. However, this small specimen is a core from which flakes, not microblades, were detached (see Vasil'ev 1996: Fig. 139:11). Conical-like cores and six flat-faced cores were also found (Vasil'ev 1996, Fig. 139:17). According to Vasil'ev (1996:170), some of the Ui 1 cores show the technique of detaching microblades from flat-faced cores. For a more concise independent evaluation, clearer illustrations are needed. There are several microblades, though no specific frequency is given (see Vasil'ev 1996). Whole microblades are rare, and have a length range of 17–19 mm and a width range of 4–7 mm. Of the 125 modified artifacts, 11 are micropoints, three are microchisels, and four are microscrapers (Vasil'ev 1996, Fig. 140, 18). Other specimens are points, chisel-like tools (including *piéces escalieés),* scrapers, skreblos, denticulate tools, notched tools, and multi-functional cores. A bone borer and a fox tooth pendant were also recovered (Vasil'ev 1996). Lithic artifacts from layer 2 are generally small (Vasil'ev 1996).

Novoselovo 13

The site of Novoselovo 13 (Figure 9.1) is on a terrace-like surface of the Yenisei River with a 49 m^2 large square excavated in 1974. Layer 3, an 0.50 cm thick loam, is the lowest cultural layer (Lisitsyn 2000:34–37), and has yielded microcores and microblades (Abramova *et al.* 1991), with a ^{14}C date of 22,000 ± 700 BP (LE–3739) (Vasil'ev *et al.* 2002). *Rangifer tarandus* was found with the artifacts (Lisitsyn 2000:35; Vasil'ev 2003, Table 4). The 26,488 lithic artifacts are mostly small flakes (15,256 or 57.6%) and flakes (9710 or 36.6%); two unworked pebbles are not included in the total count of artifacts here. The assemblage also contains spalls (n. 622), cores and core fragments (n. 92), blades (n. 58), pebbles with flake scars (n. 62), tools (n. 395), and four broken pebbles. There are 51 microcores and 67 bladelets (Abramova *et al.* 1991). Associated with the artifacts is a bead of green "soft stone". The raw materials used at Novoselovo 13 are clayey schist-argillite, chert, flint, and quartzite (Lisitsyn 2000:35). Of the three microcores illustrated by Abramova *et al.* (1991, Fig. 44:1, 6, and 7), one is relatively large (with a length of c. 9.5 cm and a width of c. 4 cm) showing regular negatives approaching blade-size (see Abramova *et al.* 1991, Fig. 44:6). Two of the microcores show microblade scars, and one of these cores is more irregular in morphology than the other (Figure 9.5:1). The second microcore has clear microblade scars on its narrow end (Figure 9.5:2). According to Lisitsyn (2000), microcores are single-platform, double-platform with bidirectional removal on the same side, and single platform with flake removal on three sides (see Lisitsyn 2000, Figs. 30:5, 7, 8). The bladelets (Lisitsyn 2000, Fig. 30:6, 9, 11, 14, 15, 19) include small and larger specimens, some more regular in form than others (Figure 9.5:3–5). Of the three microcores illustrated by Lisitsyn (2000), there is only one specimen with microblade scars, a core which approaches a wedge-shape form (Figure 9.5:6).

Kurtak 4

Kurtak 4 is located on a slope 70–90 m above the Yenisei River (Figure 9.1). The upper cultural layer is in geological layer 11, which occurs 5 m below the ground surface in a loam deposit. The excavation yielded 1763 lithic artifacts and fauna (Lisitsyn 2000). The fauna includes *Mammuthus primigenius* (woolly mammoth), ?*Ursus arctos* (brown bear), *Panthera* sp. (cave lion), *B. priscus, C. elaphus*, *E. hemionus*, and *O. ammon*. The age of the archaeological materials is in the range of 24,890 ± 670 BP (LE–3357) to 23,470 ± 200 BP (LE–2833) based on five ^{14}C dates (Vasil'ev *et al.* 2002). The artifacts include 20 cores, 28 tools, and debitage; none of the tools are standardised. Chert, quartzite, and rarely jasper, marble-like limestone, granite and argillite, were selected for artifact manufacture. One core is described as a proto-type of a prismatic core (Lisitsyn 2000:21, Fig. 8:9), and is a small core with a flat platform and flake scars. Two other cores have radial spalls (Lisitsyn 2000:21, Fig. 8:4 and 6) of which one shows some smaller percussion scars. Lisitsyn (2000:89) suggests that before the origin of microblade technology, humans tried out new ways for stone flaking, with the first such development at Kurtak 4, and which eventually culminated in the development of wedge-shaped cores.

Kashtanka 1

Kashtanka 1 is an open-air site with loess-like deposits where lithic artifacts and fauna were found associated (Derevianko *et al.* 1992; Figure 9.1). The main layer is layer 2 and has ^{14}C dates of 21,800 ± 200 BP (IGAN–1049) and 20,800 ± 600 BP (GIN–6968) (Derevianko *et al.* 1992; Vasil'ev *et al.* 2002). *R. tarandus* predominates in the faunal assemblage; other taxa are *E. hemionus*, *Equus* sp., *B. priscus*, *C. elaphus*, and *Vulpes vulpes* (fox) (Vasil'ev 2003, Table 4). The layer 2 assemblage, with more than 5400 lithic artifacts, contains 11 so-called microcores which are pyramid-like microcores, 86 microblades and 124 pieces of microdebitage. Only a preliminary report has been published (Drozdov *et al.* 1990).

Angara River Basin

Mal'ta

At the Mal'ta site, located in the southern Angara region (Figure 9.1), archaeological materials were recovered from the so-called "cover loams" of the second terrace of the Belaya River, a tributary of the Angara (Lipnina *et al.* 2001).

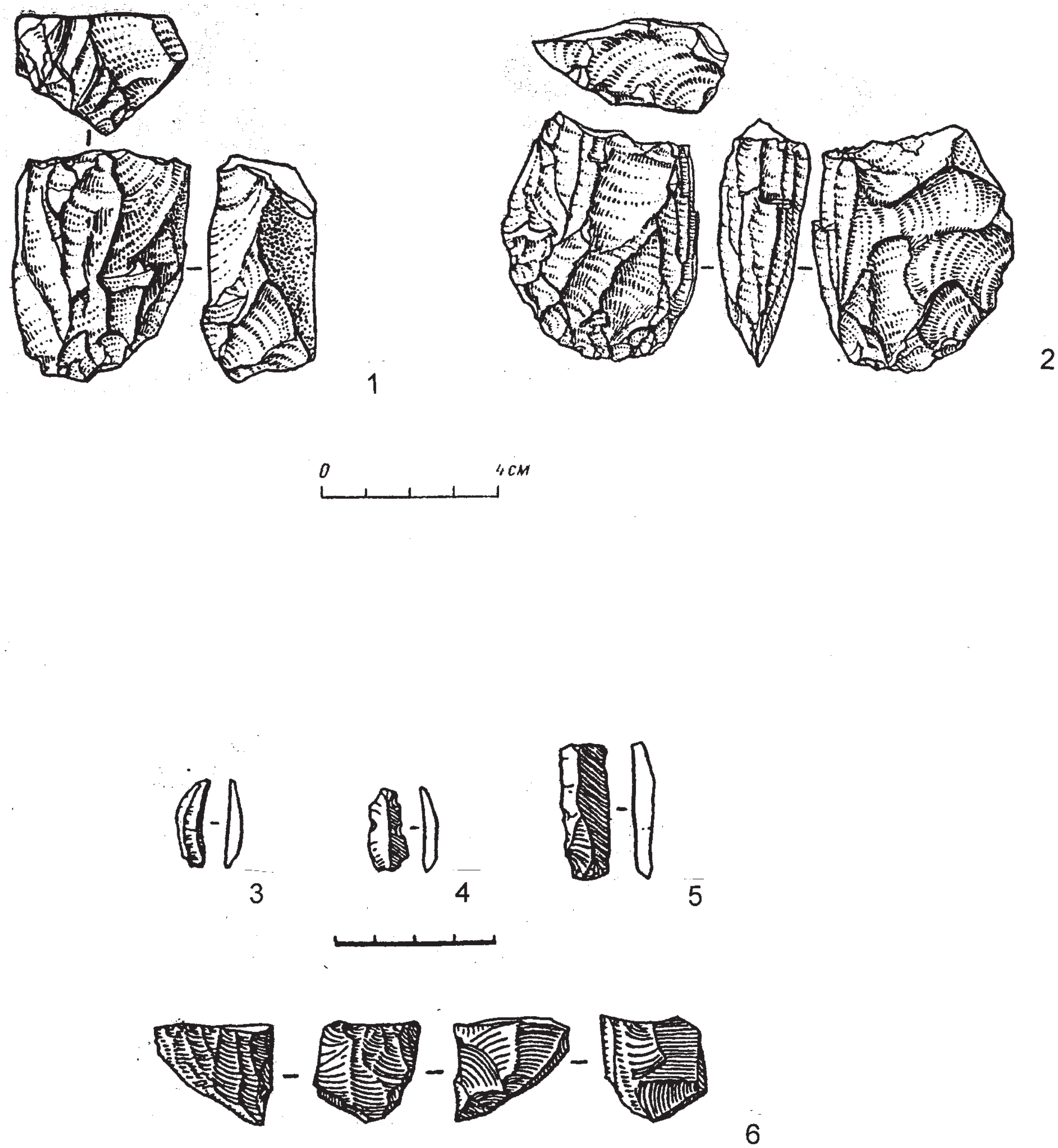

Figure 9.5: Artifacts from Novoselovo 13.
1 and 2. Microcores (after Abramova *et al.* 1991, Fig. 44);
3-5. Bladelets; 6. Microcore (after Lisitsyn 2000, Fig. 30).

The site was discovered by M.M. Gerasimov in 1928 and was excavated in five seasons beginning in 1928 and ending in 1958 (e.g., Medvedev *et al.* 1996). Smaller scale excavations were conducted from 1995 to 1998 under the direction of G.I. Medvedev. Artifacts were found in alluvium of the third terrace (Medvedev 1998:126) in the approximately 0.30–0.50 m thick layer 8 (see Lipnina *et al.* 2001, Fig. 18). Human activity at Mal'ta occurred during a period of "active formation of the solifluction layer" (Medvedev 1998:126). Mammalian fossils and fish bones occurred associated with the artifacts. *R. tarandus* is the most numerous species (Vasil'ev 2003, Table 4). The other mammal species are *M. primigenius, C. antiquitatis, E. caballus* (Pleistocene horse)*, B. priscus, Ovis* sp., *?O. nivicola* (snow sheep), and five or six carnivore species (Vasil'ev 2003, Table 4). Thirteen radiocarbon dates were determined for layer 8 ranging from 21,700 ± 160 BP (OxA–6191) to 19,900 ± 800 BP (GIN–7705) (Vasil'ev *et al.* 2002).

A total of 12,263 flaked lithic specimens were found (Medvedev 1998:126) previous to the 1991 to 1999 excavations, when 2350 artifacts were recovered. The stone artifacts were manufactured on hornblendite, quartzite, and jasper-like rock, and mostly flint (Medvedev 1998:126). Among the cores, there is a "flat" blade core of "medium size" (Lipnina *et al.* 2001, Fig. 19:3) and six "microliths", of which the largest is 1.5 cm long, and manufactured by "micro" retouch (Lipnina *et al.* 2001:74). Retouched and truncated bladelets have been identified (Vasil'ev 1993). Medvedev (1998:126, Fig. 109: 5) refers to some cores as "pseudo-wedge-shaped, core-like artifacts", illustrating one specimen wholly flaked on one face and with two irregular microblade scars on the obverse. Other cores with microblade scars are referred to as (1) "single-platform, with multiple fronts of removal" (Medvedev 1998:126, Fig. 109:1; Figure 9.6: 1); (2) "single-platform microcore" (Medvedev 1998:126, Fig. 109:3; Figure 9.6:2); (3) "single-platform with removal fronts on all sides" (Medvedev 1998:126, Fig. 109: 2; Figure 9.6: 3); (4) "single-platform with a 'fan-shaped front'" (Medvedev 1998:126, Fig. 109:6 and 7; Figure 9.6:4 and 5); and (5) "single-platform core '(wedge-shaped)'" (Medvedev 1998:126, Fig. 109: 4; Figure 9.6: 6). S.A. Vasil'ev (personal communication 2005) mentions the occurrence of true wedge-shaped cores at Mal'ta.

Krasny Yar (Krasnyi Iar)

The stratified site of Krasny Yar (Krasny Yar 1 in Vasil'ev *et al.* 2002), situated on the right bank of the Angara River in central Siberia (Figure 9.1), preserves deep and unconsolidated deposits of a complex subaerial origin. The site is located on a 16–20 m thick terrace-like bench. Geological horizon 7 (0.20–0.30 m thick) contains cultural layers V, VI, and VII (Medvedev 1969:31; hereafter referred to as layers). These layers are a lower component of the site and form one cultural stratum (Medvedev 1998:129, 131 and Fig. 117). Layers V, VI, and VII are situated 4.60-6.20 m below the ground surface in light loam, and thin sandy layers separate these layers (Medvedev 1998). The very thin layer VI lies 0.05–0.10 m above the base of geological horizon 7 (Medvedev 1969:31). Layer VI is a loam horizon and layer VII is in sandy deposits (Medvedev 1998). Layer VI is ^{14}C dated to 19,100 ± 100 BP (GIN–5330) (Vasil'ev *et al.* 2002). *C. antiquitatis, R. tarandus* and *B. priscus* were recorded in layer VI, and *R. tarandus*, and ?*B. priscus* in layer VII (Vasil'ev 2003, Table 4).

Of the archaeological materials recovered from layer VI, these "...in part, also came from layer VII.", and hearths occur in both of these layers (Medvedev 1998:129). The majority of the 369 artifacts from layer VII are flakes and small chips (87%), many on chalcedony. Artifacts from this layer also include, for example, flakes on flint and quartzite, ostrich eggshell bead blanks, and whetstones. Layer VII yielded six prismatic microblades (Figure 9.7: 1–8) and a "ridge spall struck from the front of a boat-shaped core" (Medvedev 1998, Fig. 118: 4–11, 14; Figure 9.7: 9). More than 2000 artifacts were excavated from layer VI, of which 683 are derived from flaking and 10 are reindeer incisor ornaments. There are also animal bones (n. 595), which Medvedev (1998:130) links to human subsistence. The stone artifacts include amorphous cores, flake fragments, blades, the latter manufactured from quartzite boulders and showing no evidence of preparation, as well as burins and choppers. The raw materials also include argillite. The 17 wedge-shaped cores, with five categories distinguished, were manufactured on flint, chalcedony, and jasper (Medvedev 1998, Fig. 122: 1, 2, 5–8; Figure 9.7: 10–15). Note that in the caption of Figure 122, Medvedev (1998:233) refers to specimens numbered "1, 2, 5, 8" as wedge-shaped cores, and does not list specimens numbered 6 and 7 in the same caption. Specimens 6 and 7 appear to be wedge-shaped cores, too, and are therefore included in Figure 9.7 as specimens numbered 10 and 13. Abramova (1965:125) states that the wedge-shaped core dimensions have a range of 2.3 x 1.9 cm to 4.0 x 3.3 cm.

Transbaikal

Kamenka, complex B

The open-air site of Kamenka is a piedmont slope deposit located on Kamenka hill (Figure 9.1). Eight layers have been identified in this up to

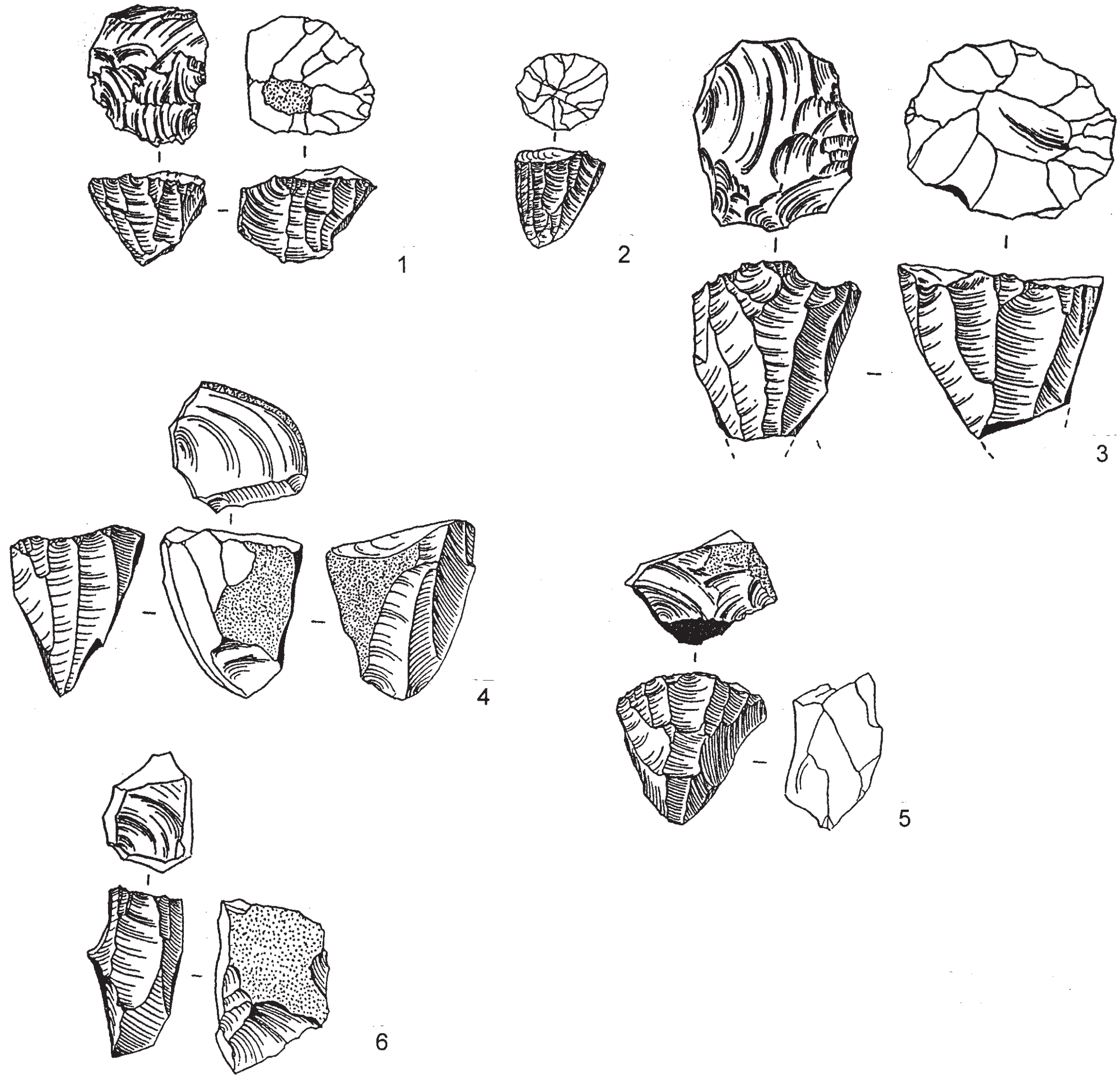

Figure 9.6: Cores from the Mal'ta site.
1. Single-platform, with multiple fronts of removal; 2. Single-platform microcore; 3. Single-platform core with removal fronts on all sides; 4 and 5. Single-platform cores with a "fan-shaped front"; 6. Single-platform core (wedge-shaped) (after Medvedev 1998, Fig. 109). No scale given.

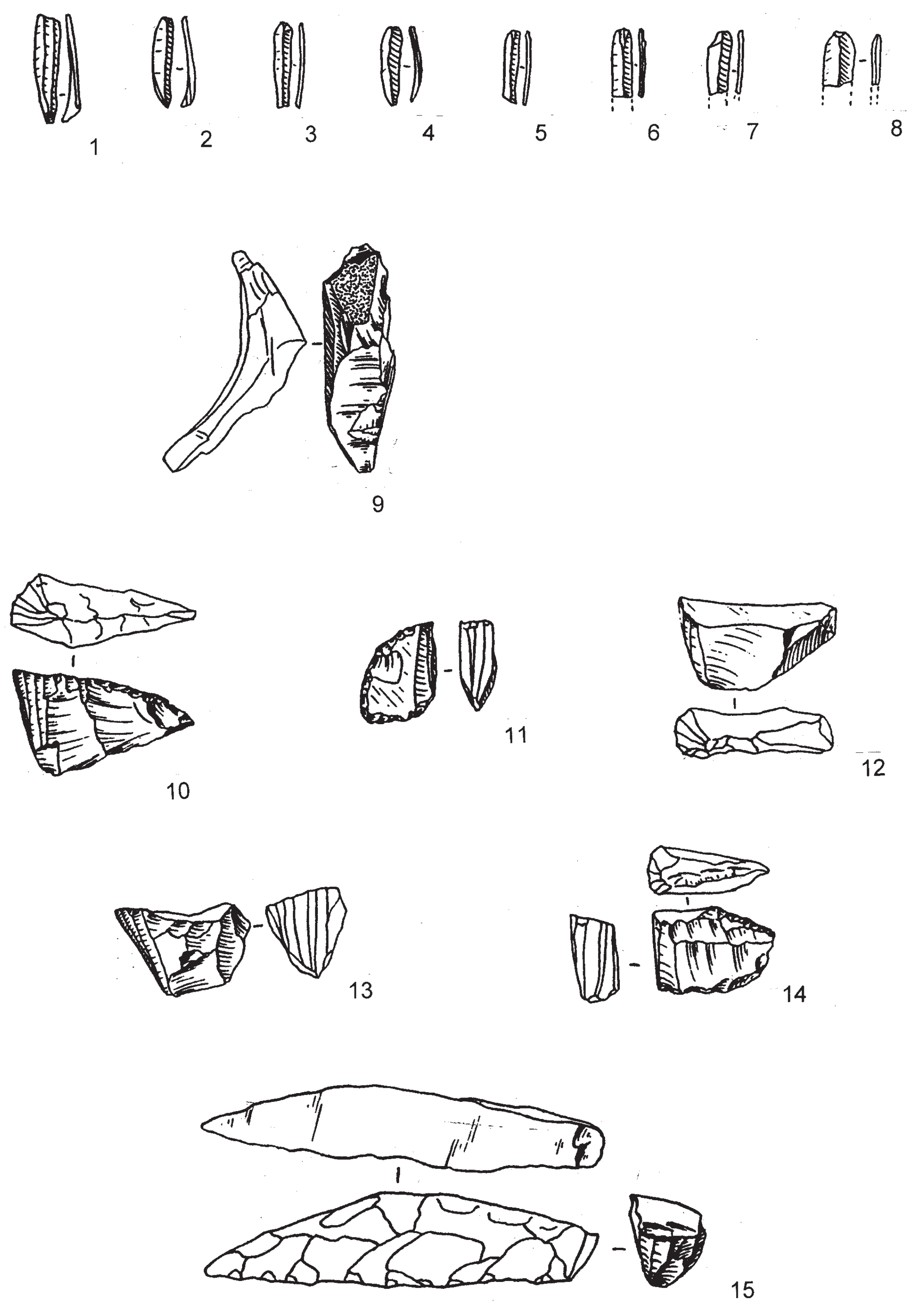

Figure 9.7: Artifacts from Krasny Yar.
1-8. Microblades, layer VII; 9. Ridge spall from boat-shaped core, layer VII; 10-15. Wedge-shaped cores, layer VI (after Medvedev 1998, Figs. 118 and 122). No scale given.

25 m thick slope deposit (Lbova 2000:163). The sediments are colluvial sands intercalated with clays. Slight disturbance of the deposit is possible because of the colluvial nature of the sediments. No information is available on the state of faunal or artifact preservation (see Lbova 2000:42–61; Lbova *et al.* 2003). Artifacts and associated fauna occur in the upper part of layer 6 in complex B of Kamenka; the upper part of layer 6 is about 1 to 1.5 m thick (Lbova 2000:163, Fig. 11). The fauna found is *C. antiquitatis*, *M. primigenius*, *B. priscus*, and *Gazella (Procapra) gutturosa* (Mongolian gazelle) (Lbova 2000:163). The four radiocarbon dates of complex B range from 28,815 ± 150 BP (SOAN–3032) to 24,625 ± 190 BP (SOAN–3031). The Kamenka B lithic technology is classified as early Upper Palaeolithic (Lbova 2002:52).

The assemblage from layer 6 comprises 653 artifacts of which 68 are stone tools, four are bone tools and one is an antler tool (Lbova 2000:47, 52), while Lbova *et al.* (2003:129) refer to 70 lithic tools and five bone tools. Raw materials used were basalt, porphyry, silicified tuff, jasper-like rock, microquartzite, and chalcedony (Lbova 2000). A total of 23 cores were found, including a Levallois core for flake production (Lbova 2000:122). Tools are described as scrapers (including two microscrapers), borers, notched tools, skreblos, knives, chisel-like tools, combined tools, Levallois points, drills, a biface, and a burin. The lithic artifacts include eight microcores in different stages of reduction (Lbova 2000:47, Fig. 13), referred to as residual microcores, and 13 microblades (Lbova *et al.* 2003:129; Lbova 2000, Fig. 13: 1–4). The artifacts also include 15 cores (2.2% of the total assemblage), two of which are classified as proto-wedge-shaped single and double faced cores (Lbova *et al.* 2003). Among the cores are six flat-faced cores. Of these, four have a prismatic monofront and two are described as proto-wedge-shaped cores, single and double faced with amorphous platforms (Lbova 2000, Fig. 13:7, 9; Lbova *et al.* 2003). Two small cores illustrated in Lbova *et al.* (2003, Fig. 46: 3 and 5), show microblade scars. Two proto-wedge-shaped cores are shown in Lbova (2000:48, 165, Fig. 13: 7 and 9). One of these has microblade scars on two faces (Figure 9.8: 1), while the other core, less regular in shape, has microblade scars on one face (Figure 9.8: 2).

Lena River Basin

Alekseevsk 1

The Alekseevsk site 1 is a river terrace locality north of Lake Baikal, where layer 3 (Figure 9.1), of about 0.45 m thickness, yielded several microblade cores and microblades (see Zadonin 1996, Fig. 1). The single radiocarbon date is 22,410 ± 480 BP (LE–3931) (Zadonin 1996). The fauna is *M. primigenius*, ?*C. elaphus*, *Capreolus capreolus* (roe deer), and *R. tarandus* (Vasil'ev

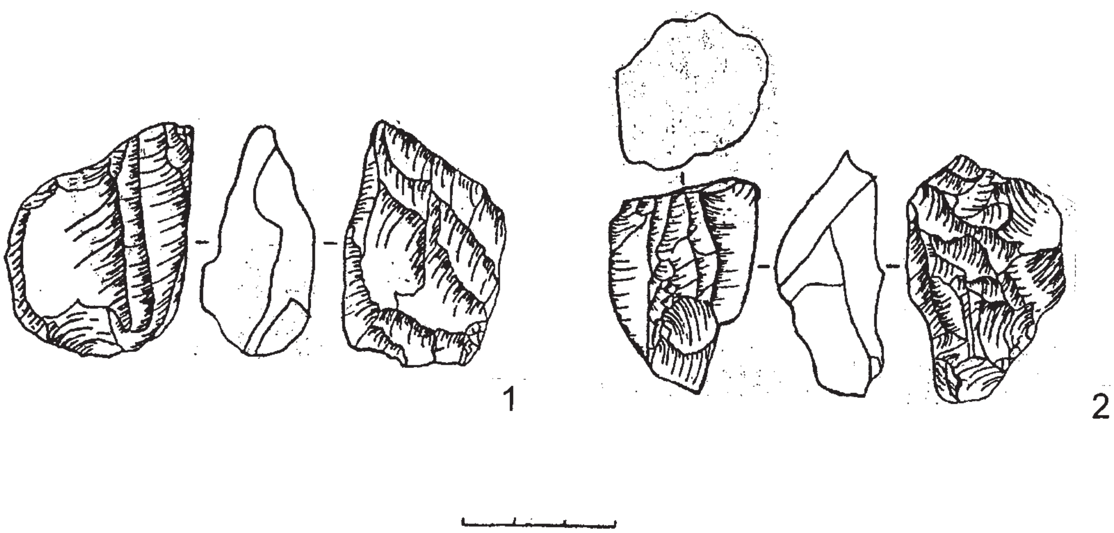

Figure 9.8: Cores from Kamenka B.
1 and 2. "Proto-wedge-shaped cores", layer 6 (after Lbova 2000, Fig. 13).

2003, Table 4). All of the microblade cores show microblade negatives, some more regular than others; none of the cores are of the wedge-shaped or other “true” microblade core type (see Figure 9.9), and S.A. Vasil'ev's examination of the artifacts from this site identified no wedge-shaped cores. Vasil'ev characterizes the artifacts as a “typical Middle Upper Paleolithic industry of Siberia”, comparable to that found in the Yenisei region (S.A. Vasil'ev personal commnication 2005). One of the cores from Alekseevsk site 1, based on the published drawing, is interpreted by Chen Shen as a preform core for a microblade core; it appears that this specimen was worked before microblade production. Furthermore, in Chen Shen’s opinion, these microblade cores are similar to those known from the Levant and the style of retouch on blades and microblades is very similar to that found in Western Asia (Chen Shen personal communication 2005).

Ikhine 2

The site of Ikhine 2 is located on the third terrace of the Aldan River within a 15–16 m thick deposit (Mochanov and Fedoseeva 1996; Figure 9.1). Palaeolithic stratum IIa/Cultural horizon IIa and the underlying Palaeolithic Stratum IIb are in loams with sporadic sand and gravel, and of 0.25–0.30 m and 0.35–0.40 m thickness, respectively. The age of Stratum IIa is estimated to be 25,000–23,000/22,000 years old with reference to ^{14}C dates from deposits below this stratum and the stratigraphic context (Mochanov and Fedoseeva 1996). The ^{14}C age of Palaeolithic

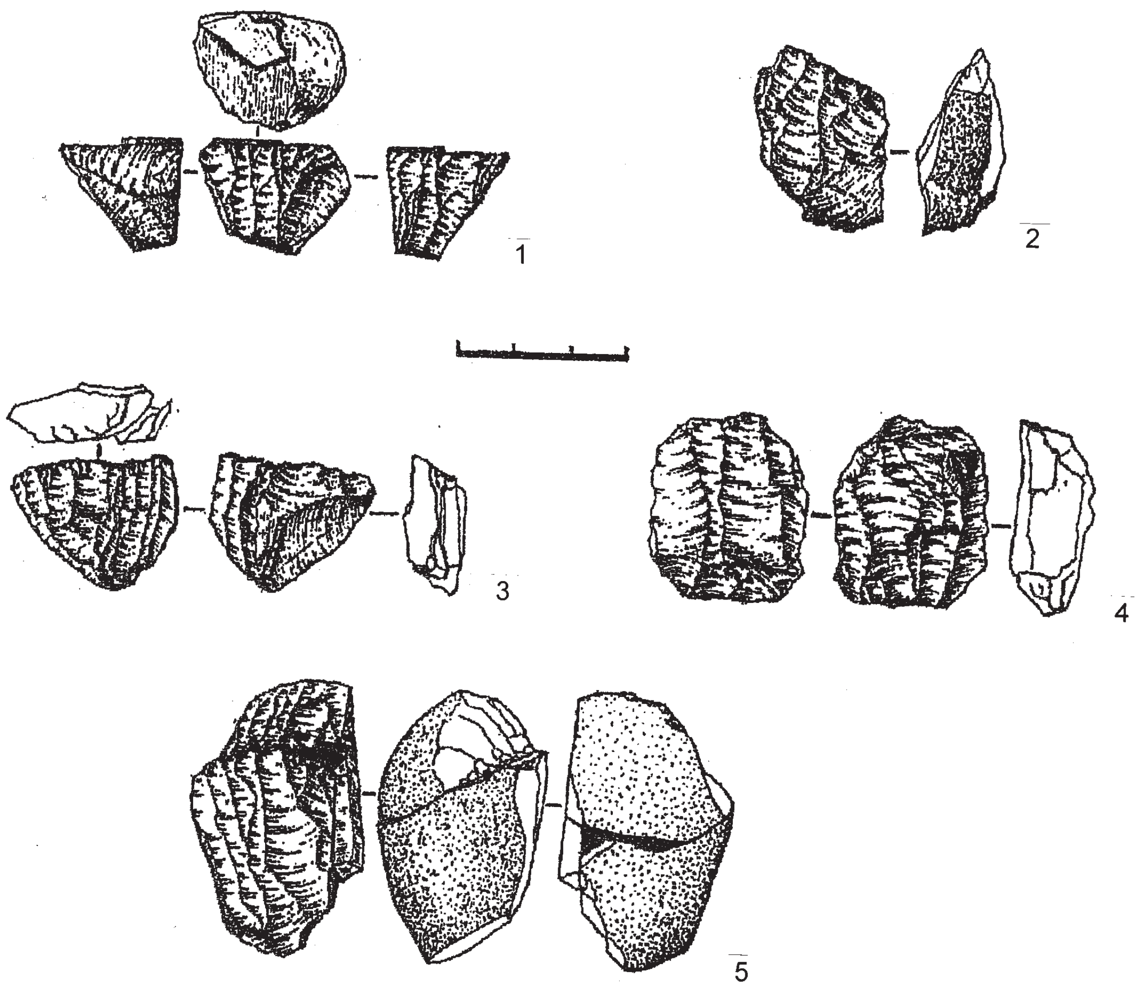

Figure 9.9: Cores from Alekseevsk 1.
1–5. Microblade cores, layer 3 (after Zadonin 1996, Fig. 1). Scale represents 3 cm.

stratum IIb is based on five dates with a range of 30,200 ± 300 BP (GIN–1019) to 24,330 ± 200 BP (LE–1131) (Mochanov and Fedoseeva 1996). Possible re-deposition from permafrost deposits of the dated wood samples has, however, introduced some doubt about the association between the dated wood and the artifacts (e.g., Yi and Clark 1985). The strata IIa and IIb fauna is *E. cabalus*, *B. priscus*, and *R. tarandus* (Vasil'ev 2003, Table 4), with 254 bone fragments from stratum IIa and 202 animal bones from stratum IIb (Mochanov and Fedoseeva 1996).

Palaeolithic stratum IIa yielded 11 lithic artifacts, including blades, flakes, and modified pebbles, on hornfels, diabase, chert, and granite. A wedge-shaped core, also described as a wedge-shaped core blank, and manufactured on a hornfels pebble, was recorded in this stratum. Based on the drawing (see Mochanov and Fedoseeva 1996, Fig. 3–21:c), the classification as a wedge-shaped core or blank cannot be confirmed. Six artifacts were recorded in stratum IIb. A wedge-shaped core, pebble scraper, and flakes were produced on hornfels, chert, argillite, and diabase. The specimen described as a wedge-shaped core/ wedge-shaped core blank is not convincing (see Mochanov and Fedoseeva 1996, Fig. 3–21:e), and may rather be described as a (retouched?) flake. According to Kashin's (2003, by personal communication S.A. Vasil'ev 2005) examination of the Ikhine 2 collection, he has profound doubts about the wedge-shaped core from stratum IIb. S.A. Vasil'ev (personal communication 2005) points out that the stratum IIa "wedge-shaped core" is a "crude pebble" with a few scars, which Y.A. Mochanov diagnosed as a questionable core blank. Goebel (2002) has also expressed doubts about a microblade industry at this site. Considering the small number of artifacts found in these layers [and Palaeolithic strata IIc and IId with a total of four artifacts, see Mochanov and Fedoseeva (1996)] and the composition of the assemblages, the evidence for *in situ* evidence of lithic tool manufacture needs to be confirmed.

Verkhne-Troitskaya

The Verkhne-Troitskaya site is situated on the second terrace of the Aldan River (Figure 9.1). Most of the site appears to have been destroyed by lateral erosion and ice wedges. Three cultural units are recognised at the site. Lithic artifacts were found in the c. 0.80 m thick geological layer 6 (see Mochanov and Fedoseeva 1996, Fig. 3–11), which contains the Palaeolithic cultural stratum III. The artifacts were excavated 5 cm from above the place where a sample for radiocarbon dating was collected; the ^{14}C age is 18,300 ± 180 BP (LE–905). A total of 52 lithic artifacts, an ivory needle, and 49 split animal bones were found [bison, horse, *M. primigenius*, *C. antiquitatis, R. tarandus* and *Canis lupus* (wolf)]. Flakes, blades, tools, and other artifacts, were predominantly manufactured on chert; diabase was used to make one artifact (see Mochanov and Fedoseeva 1996:181). Two wedge-shaped cores show several microblade scars at one end (see Mochanov and Fedoseeva 1996, Fig. 3–12:a, b). A blade inset is also shown (Mochanov and Fedoseeva 1996, Fig. 3–12:c). The collection of 87 artifacts eroded from the river terrace includes 10 wedge-shaped cores (Mochanov and Fedoseeva 1996).

The Russian Far East

Ust-Ul'ma 1

In the Amur River basin, the Ust-Ul'ma 1 site has yielded typical microcores and microblades, with the earliest recorded in layer 2b (Derevianko 1996; Figure 9.1). Ust-Ul'ma 1 is situated in colluvial loam on the terrace-like surface of the Ul'ma River about 25 m above the river level (Derevianko and Zenin 1995, Fig. 2). The archaeological materials occur within a thin layer, and four cultural layers (1, 2a, 2b, and 3) were identified. Fauna was not found. There was no evidence of redeposition, and artifact preservation is very good (Derevianko and Zenin 1995). The ^{14}C determination for Ust-Ul'ma 1 dates layer 2b to 19,350 ± 65 BP (SOAN–2619) (Derevianko and Zenin 1995). Layer 2b is located at the base of dark-brown "mild" clay. Here, a total of 9249 lithic artifacts were found (cores, flakes, blades, and tools), and raw materials are liparite pebbles, jasper and flint. Most artifacts are described as waste materials (95.9%), and these occurred in the pit of a hearth (Derevianko and Zenin 1995:87). Of the 180 cores, 18 wedge-shaped cores were identified; other cores include, amongst others, “simple” single platform cores and seven Levallois cores (Derevianko and Zenin 1995:88, Fig. 37:1–3, 5–7, 39:5–9; and see Derevianko 1998, Fig. 179). Layer 3, which lies below layer 2b, also contains microcores and microblades (Derevianko 1996). This layer is a “thick stratum” composed of red-brown “mild” clay and includes lamination and 209 lithic artifacts, including two cores, as well as flakes and tools. Artifacts were manufactured on liparite pebbles as well as sandstone. Cores include two wedge-shaped cores and a “simple” single platform core (Derevianko and Zenin 1995:88, Fig. 52:3).

Ogonki 5

In southern Sakhalin, the river terrace locality of Ogonki 5, locality 1 (horizon 3), in a loam deposit on the left bank of the Lyutoga River (Figure 9.1), has yielded microcores and microblades from stratum 3 (a clay “layer”), and from substratum 2B (loamy soil) (Vasilevski 2003), with three ^{14}C dates ranging from 19,320 ± 145 BP (AA–20864) to 17,860 ± 120 BP (AA–23137) (Vasil'ev *et al.* 2002; see also Kuzmin, this volume). Fauna was not found (Vasilevski 2003). Horizon 3 is strata 2B and 3 with a thickness of 0.4–0.7 m (Vasilevski 2003), and both strata are treated as one, that is, the lower assemblage. The 11,450 lithic artifacts include 66 wedge-shaped cores, 8390 flakes, spalls, chips, and burin microspalls, and 339 “standard” microblades as well as microchips and “needle-like” microblades; there are also amorphous cores, a few refits, blades and blade tools, rare retouched tools, and an incompletely polished adze. Flint, obsidian, basalt, and chert are mentioned as raw materials (Vasilevski 2003:60, Figs. 10–12). Charcoal and hematite were found associated (Vasilevski 2003).

MONGOLIA

Chikhen Agui

Microlithic artifacts in Mongolia have a wide distribution and usually occur as surface finds in desert and steppe environments (e.g., Maringer 1950; and see Chen and Wang 1989:147–148 for a review). The only radiometrically dated site with microblade technology in Mongolia is Chikhen Agui (Figure 9.1). This cave site is located in the northern Gobi Desert, where 1385 stone artifacts were excavated from cultural horizon 3. The assemblage includes cores, debitage [(the majority of which are flakes (n. 395) and scalar debitage (n. 584)], and tools, thus representing evidence of on site tool manufacturing activity. Cores are mainly “Levallois-like”; the 35 tools are for the main part points and scrapers, with “specific tools”, burins, and knives in lower frequency (Derevianko *et al.* 2001:30). One of the cores is described as a microblade core, exhibiting “Levallois-like and prismatic techniques”, and the first of its kind known from a Late Pleistocene context in Mongolia (Derevianko *et al.* 2001). One face shows a few long and narrow scars, and one end was flaked (Derevianko *et al.* 2001), in cross-section giving the appearance of a wedge-shaped core (Figure 9.10). This core and the 24 microblades from this site are thought to represent an incipient microblade technique; microblade width is less than 70 mm (Derevianko *et al.* 2001). Charcoal from a hearth in the Pleistocene horizon was used to determine the radiocarbon chronology of the assemblage to 27,432 ± 872 BP (AA–26580; Derevianko *et al.* 2001:33, Fig. 6).

CHINA, JAPAN AND KOREA

In neighbouring regions of Siberia, microlithic technology, when it appears, is standardised. Here I will present the Chinese evidence in more detail. The earliest localities in China include Xiachuan (e.g., Wang *et al.* 1994; see below; and see Chun Chen, this volume). All Chinese radiocarbon dates are cited with the Libby half-life of 5568 years.

China

In China, microblades are known from more than 200 assemblages and findspots (Lu 1998; and see Chun Chen, this volume). At localities in the Xiachuan Basin (east of the Fen River in Qinshui County, southern Shanxi Province; Figure 9.1), excavations between 1972 and 1973 recovered Late Palaeolithic artifacts (Wang *et al.* 1978; see also Jia and Huang 1985). Lithic artifacts, animal bones, charcoal, and ash were found associated in layer 2 (Lu 1998), that is, layer 5 (the upper cultural layer) of Wang *et al.* (1978:262). This layer reaches a thickness of 1.0–1.5 m (Wang *et al.* 1978). Of the 1800 lithic artifacts, most are microlithic and others are large tools, such as grinding stones and adzes (Wang *et al.* 1978). The radiocarbon dates for layer 2 range from 23,220 ± 1000 BP (ZK–0417; The Institute of Archaeology 1991:40) to 15,940 ± 900 BP (ZK–0385; The Institute of Archaeology 1991:40). However, samples were collected from four localities, and were not taken in a sequence from the depositional profiles, raising some doubt about the ^{14}C chronology of Xiachuan (Chen and Wang 1989:135, 156; and see Wu and Wang 1985). The microlithic artifacts, including microcores and microblades, were manufactured on flakes and blades of black flint (Wang *et al.* 1978) and Lu (1998; and see Keates 2003) also mentions chert. Wedge-shaped cores are characteristic of this assemblage, while conical and boat-shaped cores were also identified, and manufactured by indirect percussion (Wang *et al.* 1978; Chen 1983). Tools were produced using pressure flaking, and the majority of tools are backed knives, burins, awls, bifacial foliate points, small triangular points, borers, and end scrapers. Tang (2000) suggests that most core scrapers from Xiachuan could be microblade cores (see Fig. 10 in Wang *et al.* 1978). Microcores and microblades comprise approximately 22.6% of the Xiachuan artifacts (Lu 1998). Most of the microblades were truncated at the ends and not retouched (Lu 1998), and comparison to truncated microblades hafted into bones at some Neolithic sites in China could indicate a similar use for the Xiachuan microblades (Jia 1978 in Lu 1998).

At 25,650 ± 800 BP (ZK–0635; on freshwater mollusc shell sampled from the Pleistocene sand gravel layer, but with no further contextual information given; The Institute of Archaeology 1991:33; Wang *et al.* 1994), the Chaisi site, also known as Dingcun locality 77:01, in the Fen River valley, Xiangfen County, southern Shanxi Province (Figure 9.1), is known as one of the earliest microblade sites in China (e.g., Wang *et al.* 1994; Huang and Hou 1998). It should, however, be pointed out that the excavators of locality 77:01, Wang *et al.* (1994) speculate that this locality may be a secondary deposit. The microblade cores and microblades are of a highly standardised microblade technology, and manufactured in black flint (Wang *et al.* 1994, Plate 10; personal observation 1994).

At the Shiyu site (in the Datong Basin of northern Shanxi Province; Figure 9.1), more than 15,000 lithic artifacts and many fossils (including burnt

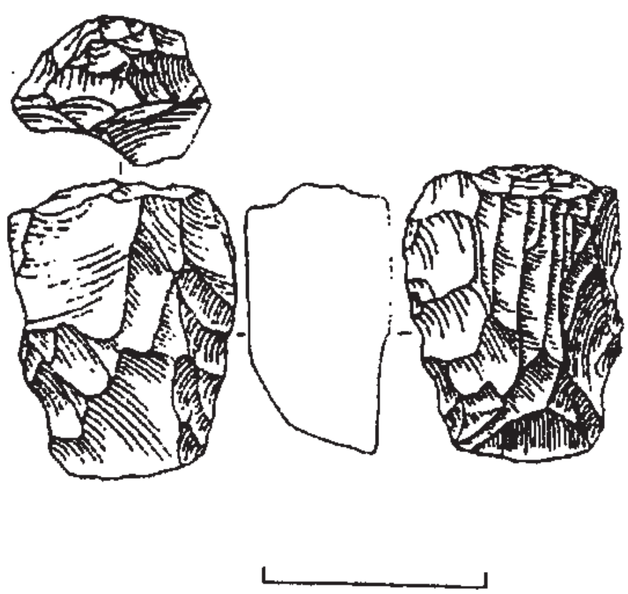

Figure 9.10: Chikhen Agui microblade core (after Derevianko *et al.* 2001, Fig. 7). Scale represents 3 cm.

bones) were found associated in fluvial sands and gravels; most artifacts are small (Jia *et al.* 1972), with some standardisation (Jia and Huang 1985). The composition of the fauna indicates a cool steppe environment (Gai 1985:231). The single radiocarbon date for Shiyu is for layer 2, with a date of 28,130±1370 BP (ZK–0109; The Institute of Archaeology 1991:41). Jia *et al.* (1972, Fig. 4.14 and Plate 1:8) refer to a "fan shaped stone core tool", while Gai (1985) mentions microlithic cores from Shiyu. As Aigner (1981:227, Fig. 77.14) argues, this core, manufactured on a retouched flake, is similar to a microcore of wedge-shape type (see also Chen and Olsen 1990:277, Fig. 15.2.1; Figure 9.11:2). There is no (other) evidence for a microblade industry (Aigner 1981:227; Chen and Wang 1989). In contrast, Chen and Wang (1989:128) interpret this core as "accidental", manufactured by bipolar percussion.

It is also worth mentioning Gai Pei's (1991:23) finding of what he describes as a "cone artifact of yellow isotopic rock which has all of the attributes of a wedge-shaped microcore. This artifact, made on a flake, with a D-shaped cross-section, has negative microblade scars on one end, demonstrating an initial effort at microblade core manufacture in China." This specimen is from the early Late Pleistocene site of Xujiayao (e.g., Wu and Wang 1985; Chen and Yuan 1988; Liu *et al.* 1992; Keates 2001) in northern Shanxi Province, northern China (Figure 9.1). However, no illustration of this artifact is provided (Gai 1991:23), although the description of this specimen may be of potential interest for studies concerning the origin of microblade technology. The predominantly small tools are argued to identify Xujiayao as an important antecedent of microlithic technology in China (e.g., Jia and Wei 1976; Qiu 1985), in-

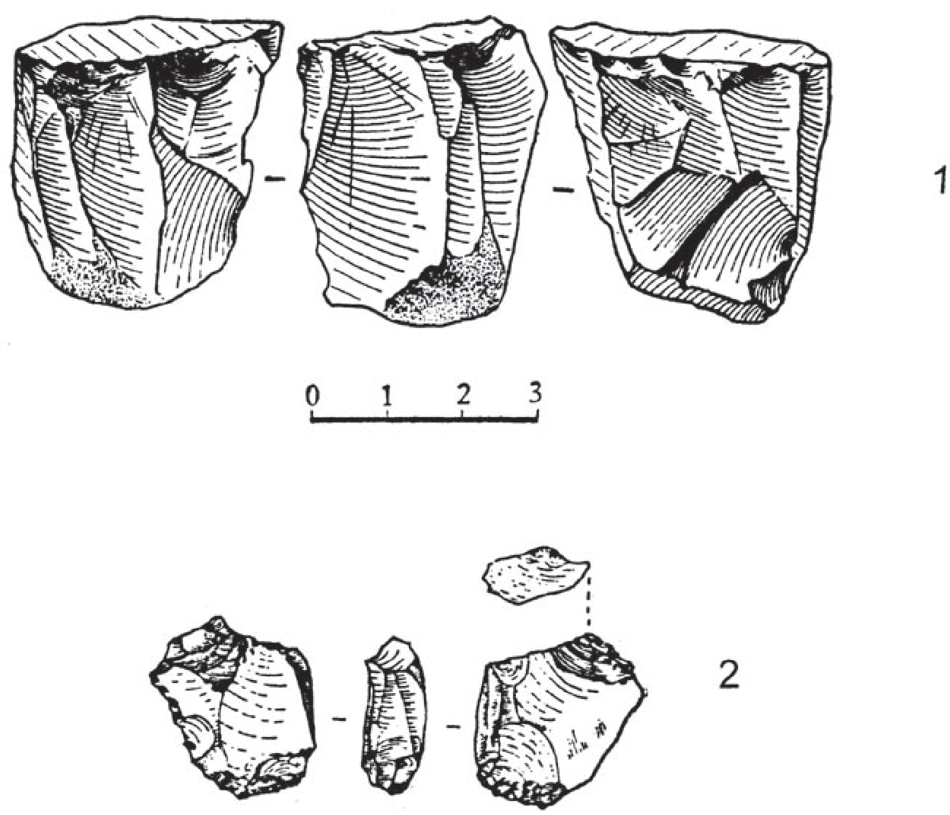

Figure 9.11: Cores from China.
1. Funnel-shaped core from Xujiayao (after Jia and Wei 1976, Fig. 5:1).
2. Shiyu fan shaped stone core tool (after Jia *et al.* 1972, Fig. 4.14), life-size.

cluding the discoidal and proto-prismatic cores from this site (Jia *et al.* 1979). Most cores at Xujiayao are small and none have prepared striking platforms (see Jia *et al.* 1979; Qiu 1985; personal observation of selected artifacts at the Institute of Vertebrate Paleontology and Paleoanthropology (Beijing) and at the Xujiayao site, 1989 and 2002). One of the illustrations of the Xujiayao artifacts includes a proto-prismatic core [classified by Jia and Wei (1976) as a "primitive ridge column shaped core"] with a flat striking platform and a few microblade-shaped negatives (see Jia and Wei 1976, Fig. 5:1, see also Fig. 5:2; Qiu 1985, Fig. 10.13; Figure 9.11: 1).

Japan and Korea

The earliest microblade locality in Japan is the Kashiwadai 1 site on Hokkaido, northern Japan. Microblade cores and microblades derive from layer 4, dated to c. 20,000 BP (Terasaki and Miyamoto 2003; see Sato and Tsutsumi, and Sano, this volume). In the central part of the Korean Peninsula, Janghungri at c. 24,000 BP (Bae and Kim 2003) and Hopyong at c. 22,000 BP (Hong *et al.* 2002; see Norton *et al.* and Seong, this volume) are the earliest microblade sites. At Kashiwadai 1, Janghungri, and Hopyong, obsidian was the main raw material used for microblade manufacture, and the microblade industries from these sites are highly standardised.

DISCUSSION AND CONCLUDING REMARKS

The microcores from the Altai do not evince the standardisation that was subsequently to become a distinctive feature of microlithic technology. Indeed, a number of these cores cannot be classified as typical microblade cores, such as the wedge-shaped type, and some are unconvincing. The frequency of suggested "precursors" of microblade cores and of specimens which are morphologically close to microcores at the earliest sites is usually small with a larger number of microblades. Atypical microblade cores occur at Ui 1 as mentioned above and also at the middle Upper Palaeolithic Tarachikha and Afanas'eva Gora sites in the Yenisei River basin (S.A. Vasil'ev personal communication 2005).

The first appearance of microblade technology is in the Siberian Altai, specifically at the Ust-Karakol 1 site (layer 11) and Denisova Cave (layer 11), with a minimum age of 37,000 years. Concerning the earliest microblades from Kara-Bom (layer 6), dated to c. 43,000 BP, more data on the cores would help to determine if these produced the microblades.

The latest known appearance of microblade cores and microblades in the Altai is at c. 26,000 BP, at Anui 2. While layer 11 of the main chamber in Denisova Cave contains microblades, there are no microblade cores. Were the microblades introduced to Denisova from elsewhere or are these in the unexcavated sections of this site? More specific information is necessary on several aspects of microblade flaking found at Denisova Cave as well as additional radiocarbon dating in order to better determine the technological and chronological evidence of this site. The suggestion that microblade technologies in Siberia make their first appearance after the Last Glacial Maximum (Goebel 2002), can, in view of the Altai evidence, now be abandoned. The chronological evidence as a whole shows a west to east pattern, that is, the earliest microblade sites are in the Altai, with later sites in Eastern Siberia, the Russian Far East, China, Korea, and Japan. S.A. Vasil'ev (personal communication 2005), sees a gradual development of microlithic technology in the Upper Palaeolithic of Siberia.

The other point that needs to be made about the significance of the early microlithic artifacts from the Altai, is that there appear to be no other microlithic localities here except for the few mentioned above, unlike regions such as the Transbaikal and the Russian Far East. It therefore appears that microblade technology was abandoned in the Altai, and was used at a later stage in regions further to the east.

Given the early radiometric dates of the Altai sites and what in some cases can be referred to as incipient "true" microblade technology, a case can be made for the origin of microblade technology in the Altai of Siberia. In Siberia, early microblade technology is associated with small and large tool assemblages and late Mousterian artifacts. In China, the specimen from Shiyu, which for some authors has similarities to a wedge-shaped core, is part of the so-called small tool technology of northern China (e.g., Zhang 1985). Gai (1978 in Aigner 1981:234) suggested a Late Pleistocene derivation of wedge-shaped microcore technology. In northern China, blade technology did not precede microblade technology (Aigner 1981:273), in contrast to Siberia (see above), with the apparent exception of large blade tools at the c. 27,000–25,000 year old Shuidonggou Locality 2 (Ordos Plateau) as well as bipolar bladelets (Madsen *et al.* 2001). The earlier dates for microblade technology in the Altai and the rare occurrence of blade tools in China, are indications that microblade technology did not originate in China. However, some technological aspects from China are intriguing, and before analyses of whole asssemblages are conducted to establish the *chaîne opératoire* and precise documentation of their chronological contexts is made, the possibility remains that microblade technology in this region is earlier than might be assumed on the evidence presently available.

In Central Asia, Coon (1957:250) proposed that the technology and morphology of carinated steep scrapers, one of the characteristics of the Aurignacian, at the Upper Palaeolithic cave site of Kara Kamar, layer III (northern Afghanistan, c. 34,000 BP), "anticipated the microlithic technique …". Although lacking radiometric dates, the Middle Palaeolithic assemblage of Teshik Tash cave in Uzbekistan, contains five prismatic cores (Movius 1953:394, Fig. 11:5). The illustrated specimen is small, has a flat striking platform, and shows several small flake scars; Davis (1978, Fig. 2.7) refers to these artifacts as "carinated endscrapers/bladelet cores". Carinated end scrapers are also known from the Altai, for example, at Ust-Karakol 1, layer 11 (see above), and one may speculate about the significance of the contemporaneity of these tools and microblade core technology.

Recent discoveries in Indonesia of microblades and a burin core at Liang Bua (Sector IV) on the island of Flores, electon spin resonance/Uranium-series (ESR/U-series) dated from c. 95,000–74,000 years ago to c. 12,000 BP radiocarbon years (Morwood *et al.* 2004), are also worth mentioning. These artifacts are associated with radial cores, flakes, blades, points, and perforators, predominantly manufactured on volcanic stones and chert, and Morwood *et al.* (2004) suggest that the micoblades could have been hafted. The burin core (see Morwood *et al.* 2004, Fig. 5), shows that the Liang Bua microblade technology is different from the "classic" microblade technology found in East and Northeast Asia. The point to be made here is that the Flores microblades and core indicate an early age for this technology.

Microlithic technology may have been invented as a risk-minimizing strategy, particularly in environments of Northeast Asia with very cold winter seasons where the need to secure large animals was a significant part of human adaptation; microliths are assumed to have been hafted and used as weapons (e.g., Elston and Brantingham 2002; see also Kuhn and Elston 2002). To examine more comprehensively the role microlithic technology played in Late Pleistocene hunter-gatherer life, far more detailed data on artifacts, environment, and resource subsistence should be collected.

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