Nylon-11 itself is not a carrier-transporting material. The observed ability of BiI_3–nylon-11 nanocomposites to transport both electrons and holes is the result of the presence of BiI_3. The ability to sustain high field and the low dark conductivity (Fig. 3) show that the composite is not an ionic solid. The conduction mechanism is electronic rather than ionic. At a 50% by weight loading level (~14% by volume), the conduction pathway can be established upon the percolation of BiI_3 domains. Electrons and holes can then hop along the BiI_3 domains. The transport mechanism should be very similar to the disorder transport model established for amine-doped polymers (*19*).

The leveling-off of the discharge rate with large fields (Figs. 3 and 4) results from the limited amount of x-ray–absorbing BiI_3 present in the composites. This can limit not only the number of x-ray absorption centers per unit volume but also the charge generation efficiency. After x-ray absorption by BiI_3, the electron-hole pairs are generated mostly in the polymer matrix (~86% by volume), which has a large band gap and which may have lower charge generation efficiency [it has been shown that the electron-hole generation efficiency is inversely proportional to E_g (*20*)]. Clearly, a more efficient x-ray photoconductor will result if the BiI_3 concentration in the composite can be increased while its fine dispersion is maintained. As pointed out in Fig. 1B, simple cooling of a melt with 75% by weight BiI_3 results in micrometer-sized BiI_3 crystallites. We have verified that the charge generation efficiency of the 75% sample is reduced as compared to that of the 50% sample. Therefore, techniques need to be developed to limit the growth of BiI_3 crystallites to the nanosize regime. Many such techniques have been demonstrated in solution phase (*1–8*) and could be extended to this problem.

Other inorganic-polymer combinations could also be explored. Our search has led us to several additional x-ray photoconductive nanocomposites with inorganic compounds such as PbI_2 and HgI_2 and polymers such as *N*-polyvinylcarbazole and polystyrene. The threshold concentrations for the formation of large inorganic crystallites are lower for these composites than for BiI_3, because of the weaker interaction between the inorganic compounds and the polymer. Maximal interaction between the inorganic compounds and polymers therefore seems to be an important design element. Alternatively, one could synthetically attach strong x-ray–absorbing inorganic nanoclusters directly to the polymers.

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21. We thank J. B. Jensen and S. Harvey for technical assistance and R. Li for electron microscopy. This is Du Pont Co. contribution 7355.

4 March 1996; accepted 10 June 1996

A Fluted Point from the Uptar Site, Northeastern Siberia

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Lanceolate bifacial points, including one fluted specimen, have been collected from beneath an early Holocene tephra at the Uptar site, northeastern Siberia. Thus, the technology associated with the well-known Paleoindian tradition was not confined to the Americas. The Uptar collection does not compare readily with other Beringian complexes and demonstrates that there is greater diversity in the archaeological record of northeastern Siberia than traditional colonization models imply.

During the Pleistocene epoch far northwestern North America was the eastern part of a vast subcontinent, named Beringia, that connected the Old and New Worlds. The Bering Land Bridge provided a major pathway for the exchange of plants and animals as well as a corridor for the entry of early peoples to North America (*1*). By about 11,000 to 10,000 radiocarbon years before the present (years B.P.), the land bridge was submerged and the western and eastern remnants of Beringia again became two separate geographic regions (*2*). Presuming an overland entry for early colonizers of the Americas, the western remnant of Beringia (northeastern Siberia) was the point of departure.

The earliest firmly documented tradition in the New World, the Paleoindian tradition (11,200 to 8500 years B.P.), begins with a distinctive series of fluted lanceolate bifacial points. Data from northeastern Siberia are too few to indicate much about the colonization of Beringia (*3*); however, the earliest firmly documented tradition in eastern Siberia (the Upper Paleolithic Diuktai culture from the Aldan basin, 35,000 to 10,000 years B.P.) (*4*) is thought (*5–7*) to bear little resemblance to Paleoindian traditions. The origin of fluting has been controversial and involves a debate not only about the source of a distinctive technology, but also about the peopling of the Americas (*8*).

Here, we describe excavations at the Uptar site in Magadan Oblast, northeastern Siberia (Fig. 1), including a stone tool assemblage with lanceolate bifaces and a fluted point. The Uptar site is 40 km north of Magadan in a tectonic basin bordered to the north by the Kolyma Upland and to the south by the Okhotsk Sea. At ~160 m above sea level, the site is on a fluvial terrace 4 to 5 m above the modern floodplain of the Uptar River, a tributary of the Arman River. The site was discovered in 1984, and subsequent surface collection and excavation have taken place over an area of 32 m^2 (*9*).

A 2- to 10-cm-thick deposit of the

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Elikchan tephra, a regional chronostratigraphic horizon dated to 8300 years B.P. (*10*), lies beneath the surface organic soil. A radiocarbon date of 8260 ± 330 years B.P. (*11*) was obtained from scattered charcoal in the tephra and at the interface between the tephra and underlying sediments. During excavation, artifacts were found under the tephra on the surface of a poorly sorted, fine- to medium-grained sand. These deposits, in turn, were underlain by massive alluvial deposits. The tephra thus provides a minimum date for the Uptar collection. However, patination, the formation of cortex on preexisting flake scars, and polishing (wind abrasion) suggest that the materials were exposed for some time at the surface. Most of the artifacts are of a clastic sedimentary rock (*12*). The origin of the debitage, or the by-products of manufacture, is likely the nearby cobble-strewn riverbed. Whereas marine sedimentary rocks are common in the region, the bedrock sources for the materials are unknown.

Except for two artifacts formed by abrasion (described as a pendant and a pendant preform), the artifacts collected during surface collection and excavation are chipped stone. About 3100 pieces of debitage were collected (~33% of the debitage falls in a size grade larger than 12.5 mm). Most of the shaped artifacts are bifaces or biface fragments (n = 36). The assemblage also includes four cores, seven flake tools, and ten blades or blade fragments (one of the blades has evidence of wear on the distal end, and at least two of the artifacts are microblade fragments). No distinct blade cores have been found, although one of the biface fragments served subsequently as a core and includes a blade facet. The dominant strategy for stone tool production was bifacial. The initial stages of the reduction sequence were carried out at the site, but continuous reduction from cobbles to finished bifacial points does not appear to be represented.

Bifaces from the Uptar collection fall into two size classes. The larger bifaces are variable in morphology, but their thickness, patterns of flake removal, and marginal sinuosity all suggest that many of the larger

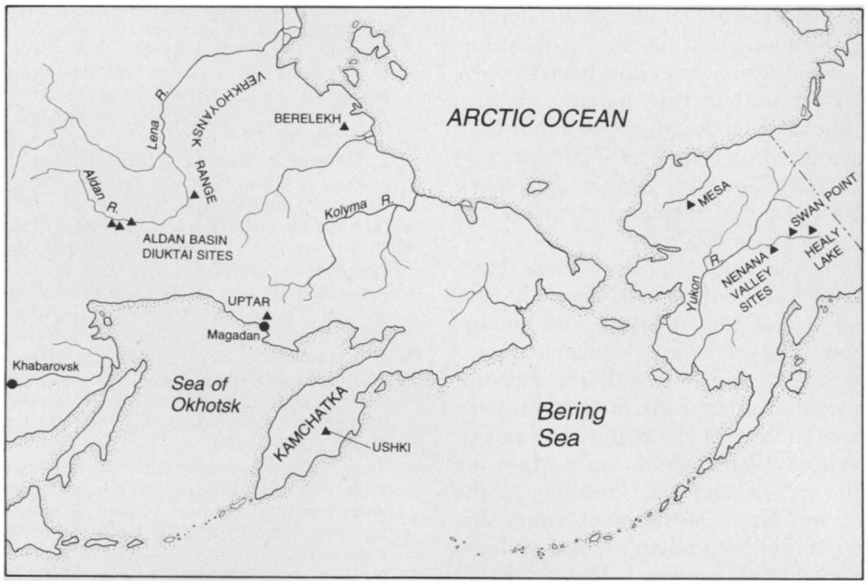
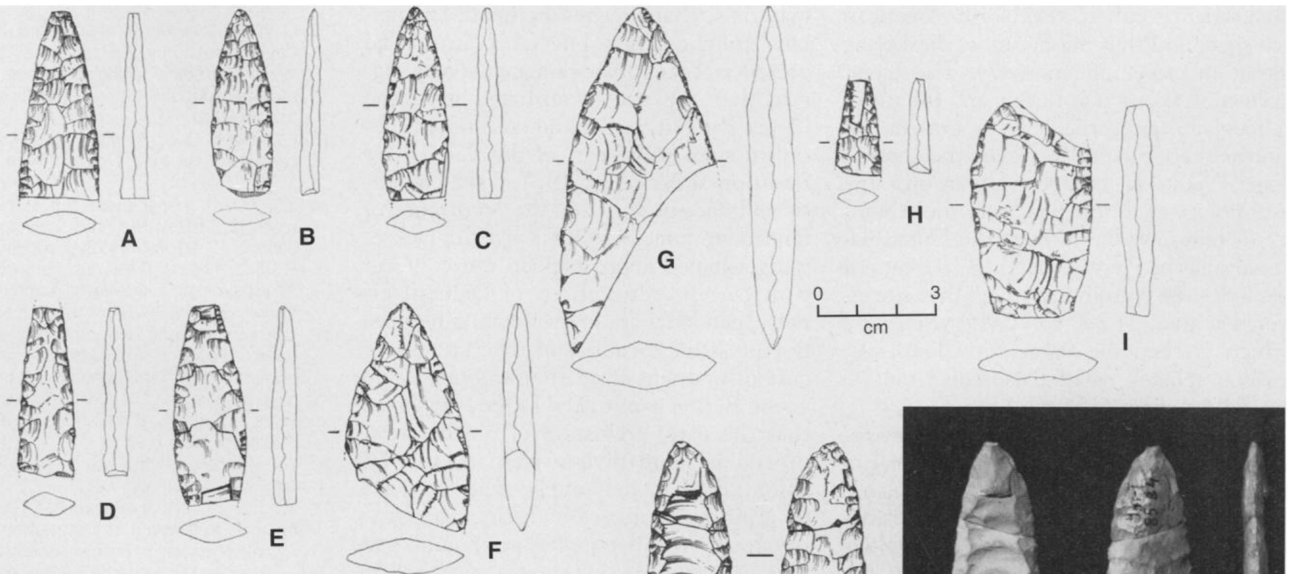


Fig. 1. Map of Beringia illustrating archaeological sites mentioned in the text. The Uptar site is located about 1920 km (1193 miles) from the Bering Strait.



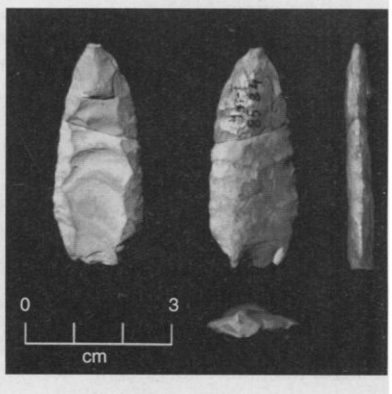


Fig. 2 (**upper left and upper right**). Bifaces from the Uptar Site: bifacial points (**A** to **D**), bifacial points with impact fractures (**E** and **H**), and bifaces (**F**, **G**, and **I**). **Fig. 3** (**left**). Fluted point from the Uptar Site. **Fig. 4** (**right**). Digital images of the fluted point from the Uptar site. Much of the base of the point has been broken off, although it retains a portion of the original platform, which indicates that the flute was removed from a broad platform, not from a beveled base. The remaining platform is 3.90 mm wide. The width of the platform at the base before the flute was detached would have been ~9 mm.

forms are finished implements rather than preforms for the smaller bifaces (Fig. 2). We have identified 13 bifacial points and point fragments, of which 6 are complete or nearly so. They are lanceolate in outline and lenticular in cross section; flaking of the faces is dominantly collateral with finely controlled percussion and pressure flaking. Two artifacts have impact fractures at the tip, which suggests that at least some of the bifacial points functioned as projectiles (Fig. 2, E and H). One of these artifacts also has the remnant of a basal thinning flake. Snap fractures are common and represent either manufacturing breaks or finished tools with broken bases.

One of the bifaces is a fluted point (Figs. 3 and 4). The point is finished, although there is a lateral fracture across the blade. This break occurred sometime after the flute was removed. The two fragments were found directly beneath the tephra and were ~4 m apart. A longitudinal channel flake scar on one face of the point extends from the base to just below the tip where it terminates in a step fracture. The channel flake appears to have been removed with sufficient force to cause most of the platform to collapse and to detach a small flake on the reverse face. Additional damage is evident at the tip, but this is recent.

Fluted points have not previously been reported from Siberia (*13, 14*). The technology of fluting bifaces is thought to be a New World invention that first occurred somewhere south of the North American ice sheet and thus did not cross the Bering Strait in either direction (*7*). The Uptar collection shows that fluting and the use of lanceolate projectiles were present in northeastern Siberia. However, the chronological relation between Uptar and the technology of fluting bifaces in the Americas is unresolved. Although the Uptar materials may be Pleistocene in age, we cannot exclude the possibility that the site is younger than 11,200 to 10,900 years B.P., which is the time frame for Clovis, the earliest reliably dated Paleoindian culture in the Americas (*15*).

The Uptar collection includes microblade and blade fragments (*16*). The use of osseous points armed with stone blades has been considered to be so markedly distinct from a stone projectile point technology that there can be no close relation between the two (*17*). This presumption is evident in one colonization model for Beringia in which two successive overland migrations were associated with these distinct technological strategies (*6*). By 11,300 years B.P., people entered Alaska with a "Paleoindian"-like technology, lacking lanceolate projectile points and fluting, such as that from the Nenana complex in interior Alaska. This complex was later replaced by the Denali complex, a regional variant of the Paleoarctic tradition characterized by wedge-shaped microcores and microblades, by 10,700 years B.P.

Other archaeological data from central Alaska (Healy Lake and Swan Point in interior Alaska) indicate that microblades date to the time of the Nenana complex (*18*), which suggests that the link between the Nenana complex and Clovis is implausible (*8*). Complicating the situation further, recent discoveries have provided evidence of a second "Paleoindian" complex, best known from the Mesa site in northern Alaska dated to 11,700 to 9700 years B.P. (*19*). Here, basally ground lanceolate points and point fragments dominate the tool assemblage.

Although the Uptar collection shares some affinities with early Beringian complexes, it does not fit squarely within any of them. The presence of lanceolate points offers a tempting link with the Paleoindian tradition in the Americas. However, the morphology of the points does not fit the classic Paleoindian form: they are smaller in size and lack grinding on the edges and base. Furthermore, other elements of the Paleoindian tool kit are lacking (for example, gravers). This collection is dissimilar to the materials from Ushki I level 7 in central Kamchatka, where stemmed point forms dominate. Nor does the collection resemble Nenana complex materials, characterized by small, triangular, straight based bifacial points. The presence of microblade fragments may suggest that the site is affiliated with the Upper Paleolithic Diuktai culture of Siberia, thought to be part of the Paleoarctic tradition of Beringia (*20*). Yet, the emphasis on biface production, the occurrence of lanceolate bifacial points, and the lack of wedge-shaped microcores do not conform with current conceptions of Diuktai. Finally, pendants are known from a number of Paleolithic localities in Siberia, but are curiously absent from the American side of the Bering Strait. The Uptar site shows that the early prehistory of northeastern Siberia is more diverse than traditional colonization models imply. The focus on defining technologically distinct migratory groups (for example, pre-microblade versus microblade complexes) may neglect important aspects of assemblage variability, especially as they pertain to issues of the peopling of Beringia.

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21. We thank P. M. Anderson, P. E. Buck, D. E. Dumond, D. K. Grayson, D. M. Greenlee, and D. Rhode for critical reading of the manuscript; A. E. Close, M. L. Kunz, and D. Meltzer for valuable discussions of the Uptar material; F. Nials for petrographic work; S. Edwards for advice about artifact drawings; D. Melton for assistance with Fig. 3; and H. Herpolsheimer for the digital images of the fluted point. The support of G. Eddy, the University of Washington Royalty Research Fund, and the University of Washington Alice L. and Genevieve B. Niles Fellowship is gratefully acknowledged.

21 March 1996; accepted 30 May 1996