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Human biogeography and climate change in Siberia and Arctic North America in the fourth and fifth millennia BP

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This paper explores the relation between the geographic shifts in prehistoric hunting populations and changes in climate between 4500 and 3000 before present (BP) within the polar regions from the Yenisei River in Siberia to Greenland. We have chosen this time period because major human geographic changes occurred over much of northeastern Asia and northern North America, and because these changes appear to be linked, at least in part, to a palaeoclimatic fluctuations. The cultures under consideration have been termed the Early and Middle Neolithic (Syalakh and Bel'kachi) in Siberia and the Arctic Small Tool Tradition (with such local variants as Denbigh, Independence I, Pre-Dorset, and Sarqaq) in North America. Despite these terminological differences, these groups shared such a close similarity in their technology and adaptive patterns that they must have once shared a direct historical relation.

Introduction

The assumption underlying this paper is that there are linkages between palaeoclimatic fluctuations and such changes in the natural environment as sea-ice conditions, snowfall régimes and terrestrial spring icing conditions that directly affected the distribution and abundance of critical mammalian resources. These, in turn, affected the distribution and abundance of ancient hunting groups especially in the most extreme northern latitudes. On one hand, the northernmost distribution of all mammals, including humans, should be very sensitive to climatic and environmental fluctuations. On the other, humans adapt primarily through learned, patterned, symbolically transmitted informational and behavioural systems that anthropologists term culture. As such, the ability of humans to adapt to changing natural conditions is much enhanced, and more rapid and flexible than other animal species. Interspecifically, humans are probably the least sensitive species to climatic and environmental fluctuations, particularly if there are exploitable resource alternatives. Intraspecifically, however, human populations inhabiting the northernmost margins of the globe should, and probably were, among the most susceptible to such changes.

Palaeoclimatic conditions

Palaeoclimatic data are best derived from a number of North American sources. Oxygen isotope data from Camp Century and Dye 3 in Greenland and the Devon Ice Sheet in Canada all indicate a mid-Holocene warming that peaked about 5000 before present (BP)† (Dansgaard *et al.* 1969; Dansgaard *et al.* 1982; Paterson *et al.* 1977). Average temperature

† All dates in this paper are presented in calendric time to provide a consistent and comparable chronolological framework. Radiocarbon dates have been recalibrated according to Pearson *et al.* (1986).

conditions declined thereafter but must have been above present average conditions through the first half of the fifth millennium BP. For example archaeological sites from north Greenland, dating between 4000 and 4500 BP, contain driftwood and seal bones, both unavailable regionally under current conditions given permanently frozen seas. Contemporaneous sites from Devon Island, High Arctic Canada, have also produced faunal evidence for warmer conditions (McGhee 1979, p. 37).

Data from the fourth millennium BP, however, register a period of increasingly colder conditions. Evidence for these conditions is registered by the oxygen isotope ratios in the Greenland and Canadian ice cores, and a 300 km southerly shift of the forest–tundra border west of Hudson Bay (Sorenson *et al.* 1971; Sorenson & Knox 1973). They are further corroborated by tree-ring data from western North America (La Marche 1974), palynological data from the Labrador–Ungava Peninsula (Short 1978) and Keewatin (Nichols 1975 with references), and global expansions of glaciers after 3300 BP (Denton & Karlen 1973).

Human biogeography

About 5500 BP the Middle Neolithic Bel'kachi culture developed from the Early Neolithic Syalakh culture in the Lena Basin (Mochanov 1969). It spread westward to the Taimyr Peninsula and eastward to the Bering Sea. In general, the Bel'kachi culture is very similar to the preceding Syalakh culture. Camps were situated in the areas where the maximum return in game resources could be obtained: near the confluences of smaller and larger streams and on the shores of lakes with rich fish and migratory waterfowl resources. People lived in round skin tents warmed by small interior hearths. Sites on higher terraces also have bark-lined storage pits in which the bones of moose and large fish have been recovered (Mochanov 1969).

The Bel'kachi culture is characterized by the following: small bifacial triangular points; bifacial diagonally retouched willow-leaf points; microblades and cores; chipped burins and spalls; flaked and polished adzes; small, bifacial chisels; unifacial and bifacial, single- and double-ended endscrapers; concave sidescrapers; flake knives and scrapers; multifaceted burin-drills; bifacial knives; microblade insets with one longitudinal worked edge; perforators or gravers; and net sinkers. Bone tools comprise polished tips, awls, needles, and slotted arrows. The pottery is cord marked (Mochanov 1967, pp. 167–172, 1969, pp. 235–247)†.

About 4500 BP an aceramic variant of Bel'kachi spread east across north Alaska and entered the Canadian High Arctic and Greenland, a completely uninhabited area (figure 1). The strong similarities in the lithic technology and typology of the tool kits are grounds for calling the entire cultural phenomenon, from the Taimyr to Greenland, the Arctic Small Tool Tradition. We are, in effect, subsuming the Siberian data into a long-recognized North American tradition. In addition, we see the North American Arctic Small Tool Tradition originating in northeast Siberia as a complex, which was derived from Bel'kachi (cf. McGhee 1976). The ultimate origins of this development lie even deeper in the preceding Neolithic (Syalakh) and pre-Neolithic (Sumnagin) cultures of the Siberian North.

The only minor differences among early assemblages are the presence of pottery, and the distinctive multifaceted burin-drills in Bel'kachi that have not been reported in North America. An emphasis on delicately chipped, bifacial insets is distinctly Alaskan, whereas Eastern Arctic

† Russian and American terminology differs considerably for some tools of identical form and probable function. We have chosen the American terminology in this paper.

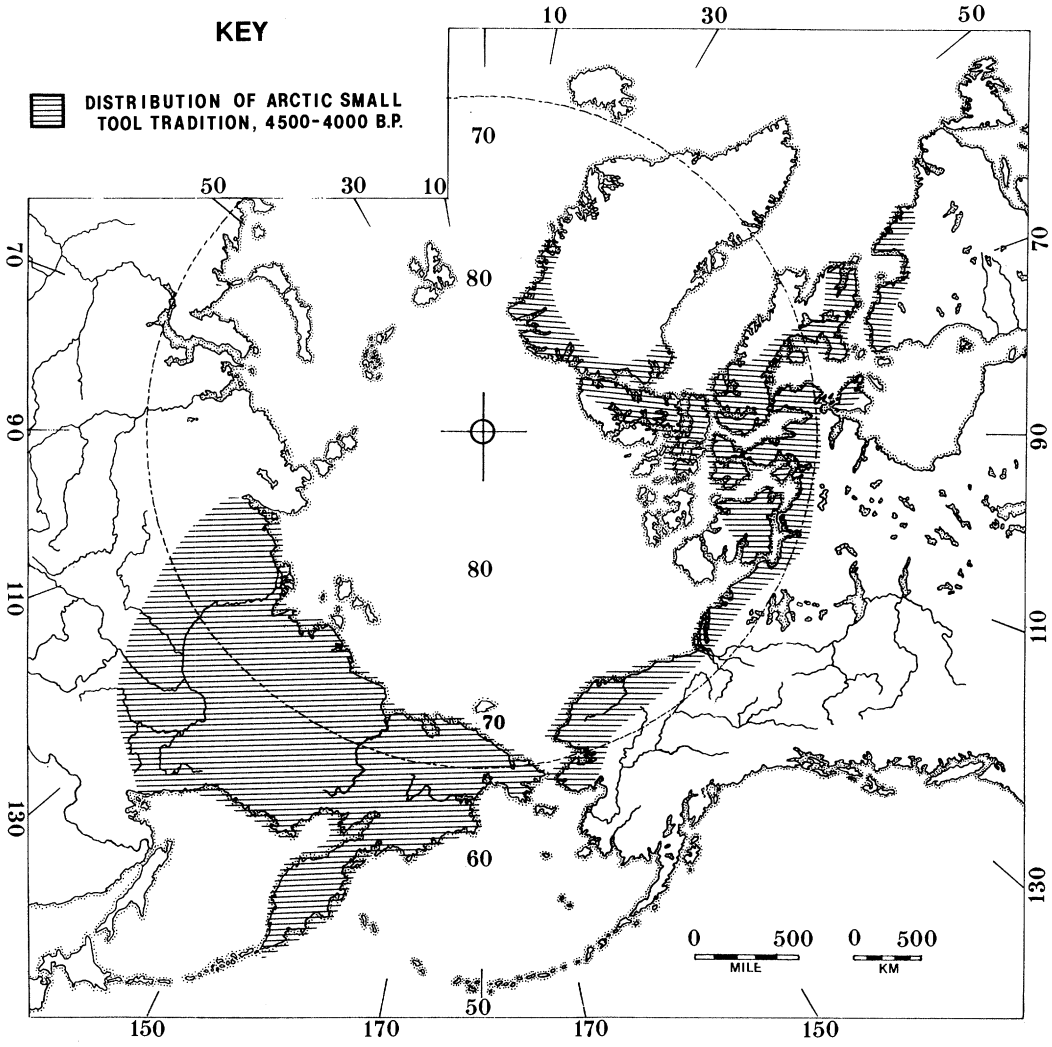

FIGURE 1. Distribution of Arctic Small Tool Tradition, 4500–4000 BP.

assemblages evidence a stronger emphasis on the stemming of bifaces. Yet the similarities far outweigh these differences. This has lead us to the conclusion that this tradition could not have evolved independently on both sides of the Bering Strait from such different antecedents as Syalakh and American Palaeoarctic.

In North America, the earliest manifestations are found in north Alaska and the High Arctic regions of Canada and Greenland. Soon after, they appear in such comparatively southern regions as Labrador and south Baffin (Anderson 1988; Cox 1978; Knuth 1967; Maxwell 1973, 1985; McGhee 1979). The nearly synchronous dates from the Eastern Arctic with those in Alaska and Siberia suggest an extremely rapid population spread. In the Eastern Arctic, where organic preservation is better, the data indicate that the subsistence economy was based on such terrestrial mammals as caribou and musk-oxen. Marine mammal hunting, particularly for ringed and bearded seals, also played an important role (Knuth 1967; McGhee 1979). Evidence for fishing has been recovered from early sites in Alaska and Greenland (Anderson 1988; Knuth 1967). Despite this broad subsistence base, sites generally consist of thin deposits

and a variety of tent structures and occasional cache pits, indicating a seasonally nomadic existence.

The termination of the mid-Holocene warming had severe effects on the distribution of this tradition, particularly in northern Canada and Greenland where a southern extension of permanent pack ice must have occurred. Both these regions were abandoned during the fourth millennium BP (figure 2). Populations expanded south along the shores of East and West

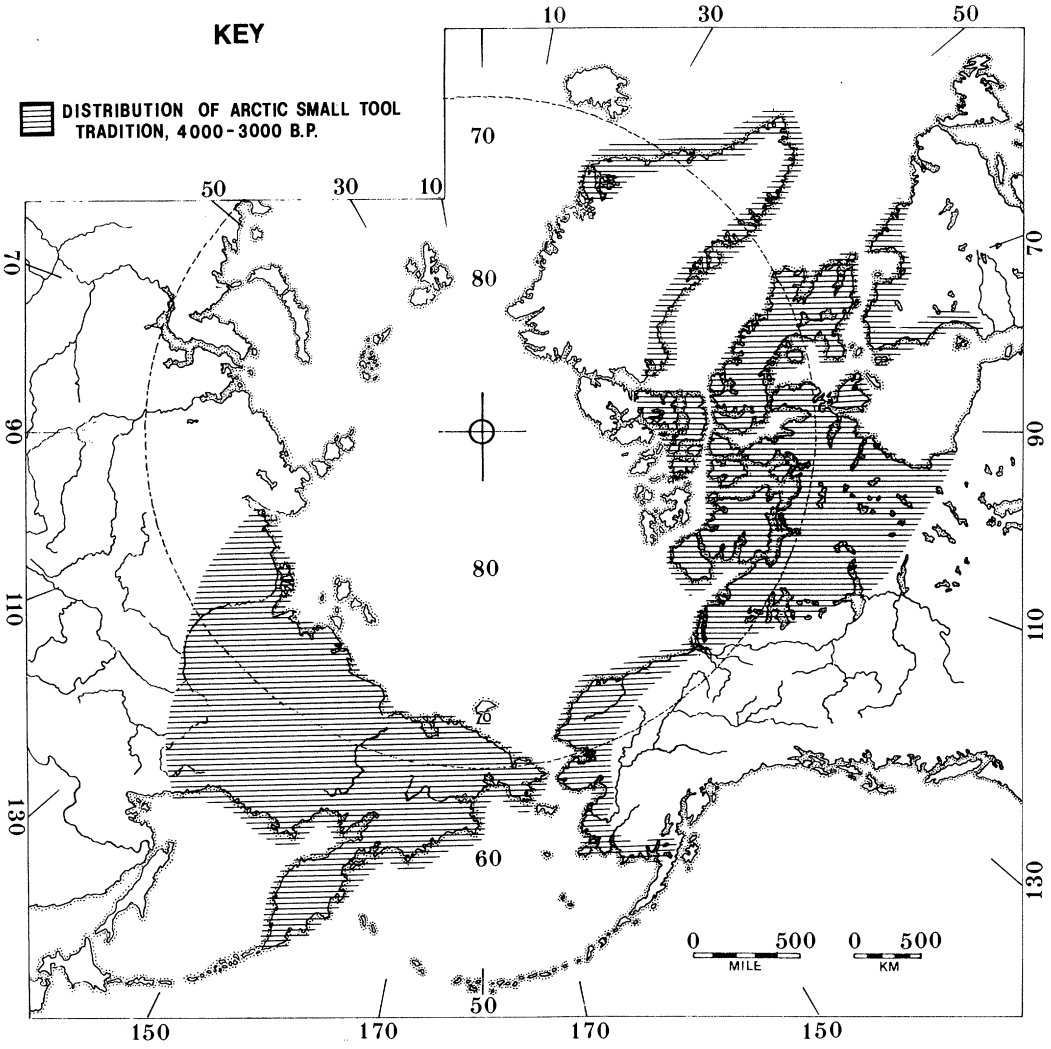

FIGURE 2. Distribution of Arctic Small Tool Tradition, 4000–3000 BP.

Greenland, along both shores of Hudson Bay and the broad expanses of the Barren Grounds as far south as Churchill, Manitoba and Lake Athabasca in northern Saskatchewan (Gordon 1975; Maxwell 1985; Moberg 1986; Nash 1969; Plumet 1976). Another southern geographic expansion as far south as the Alaska Peninsula apparently occurred during between 3500 and 3000 BP as well (cf. Dumond 1981; Giddings 1964).

Discussion

About 4500 BP the Arctic Small Tool Tradition spread into Alaska and the Eastern Arctic from Siberia. Although this was a period of generally warmer climatic conditions, this major population expansion cannot be correlated with changing climatic conditions. The archaeological data suggest that the most significant alterations may have been in the subsistence economy. The addition of seasonal marine mammal hunting in Arctic waters to an existing base of terrestrial hunting and fishing seems to have been central to this adaptive success. Geographic shifts in the fourth millennium BP, however, seem to be clearly linked to climatic cooling as the Canadian and Greenlandic High Arctic was abandoned and populations expanded their ranges south.

In addition to the reconstruction of human history, this paper suggests that northern archaeology has important applications to the historically oriented branches of the physical and biological sciences. For example, the changing geographic distributions of prehistoric hunting cultures can be used, albeit with caution, as proxy palaeoclimatic data if economic adaptations can be accurately evaluated. Moreover, well-preserved archaeological sites, commonly found throughout the north, are repositories of large quantities of environmental data that can provide new insights into changes in the Earth's climate and ecology.

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