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Chronology and environment of the Palaeolithic and Neolithic cultures on the southern Russian Far East

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ABSTRACT

The results of geoarchaeological studies of the prehistoric cultural complexes on the Russian Far East (Primorye, or Maritime Province; the Amur River basin; and Sakhalin Island) are presented. Upper Palaeolithic sites are dated to ca. 40,000-10,500 B.P. They existed during the mild climate of the Chernoruchie interstadial (ca. 40,000-21,000 B.P.); during harsh climate at the Last Glacial Maximum, ca. 20,000-18,000 B.P., in several places on the Russian Far East (Primorye, Amur River basin, and Sakhalin); and during climatic amelioration in the Late Glacial time, ca. 16,000-10,500 B.P. The earliest Neolithic sites, represented by Osipovka and Gromatukha cultures, existed at ca. 13,000-10,000 B.P. in the environment of coniferous forests with admixture of broadleaved taxa. Since ca. 8000 B.P., Neolithic cultures appeared in all of the Russian Far East. They existed until ca. 3000 B.P., first during the Holocene Climatic Optimum, ca. 8000-5000 B.P., in the environment of coniferous-broadleaved forests; and later, at ca. 5000-3000 B.P., in the environment of birch-oak and coniferous forests.

Introduction

The aim of this paper is to present the updated summary of the results of geoarchaeological studies of the territory of Russian Far East, which is close to neighbouring Korea, Northeastern China, and Japan. It is based mainly on author's own data collected in 1986-2002, as well as on results of the Russian Far East paleogeographical investigations conducted in the 1960s-1990s. Because of intensive contacts between archaeologists of the Russian Far East and adjacent countries in the 1990s and until now, this review will be useful to scholars who study the Palaeolithic and Neolithic archaeology and environment in Northeast Asia.

Geographic characteristic

In modern Russian physical geography, the definition of the term "Russian Far East" is "territory belonging to the Pacific Ocean drainage basin"; the Arctic-Pacific watershed line separates the Russian Far East from Siberia (Suslov 1961; Gvozdetsky and Mikhailov 1978). The most distinctive geographic peculiarities of the Russian Far East, compared with Siberia, are modern volcanic activity, a monsoon climate, mixed coniferous-broadleaved vegetation, and fauna with a mixture of Siberian and East Asian elements.

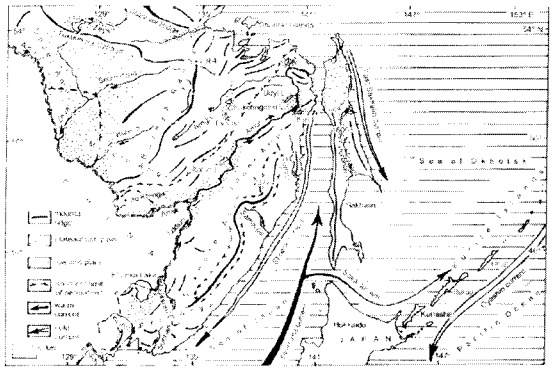

Fig. 1. Main physiographic features of the Russian Far East.

Southern part of the Russian Far East covers ca. 900,000 ㎢ of territory. It includes the Primorye (Maritime) District; the Amur River basin within Russian Federation borders; Sakhalin Island; and the southern Kurile Islands including Kunashir, Iturup, Urup, and Shikotan. Geographically, Primorye includes the whole Sikhote-Alin Ridge system up to right side of the Amur River valley, the lower mountains southwest of Khanka Lake, and the Ussuri-Khanka Plain. The left bank of the Amur River basin may be subdivided into three parts: the Upper Amur (from the headwaters to the Zeya River confluence), the Middle Amur (from the Zeya to the Ussuri River confluence), and the Lower Amur (from the Ussuri confluence to the mouth) (Fig. 1).

The main geomorphic feature of the Russian Far East is a combination of mountains and wide intermountain plains and lowlands (Fig. 1). The main mountain systems include the Sikhote-Alin Ridge (highest point 2077 m above sea level), the Stanovoi Ridge (1463 m), the Xiao Khingan Range (1270 m), the Bureya Ridge (2384 m), the Tukuringra-Dzhagdy Ridge (1694 m), the Eastern Sakhalin Range (1609 m), and the Western Sakhalin Range (1330 m). Principal plains include the Middle Amur Lowland, the Khanka-Ussuri Plain, the Zeya-Bureya Plair., the Amur-Zeya Plateau, the Northern Sakhalin Plain, and the Tym-Poronay Plain.

The Russian Far East coast touches two seas, the Sea of Japan and the Okhotsk Sea. In the Sea of Japan, several warm and cold currents occur (Fig. 1). The most important are warm currents such as the Tsushima and the Soya, and cold currents such as the Shrenk (Primorskoye) and the North Korean (Yurasov and Yarichin 1991). In the western part of the Okhotsk Sea, the most important currents are the cold East Sakhalin and the warm Soya (Komsomolsky and Siryk 1967). In the open Pacific Ocean close to the southern Kurile Islands, the Oyashio cold current strongly affects the regional climate (Gorshkov 1974).

As for the rivers on the mainland, the Amur and its tributaries (the Zeya, Bureya, Ussuri, and Amgun) constitute the biggest water system. Among other major rivers are the Razdolnaya (Suifun), Partizanskaya (Suchan), Samarga, and Tumnin. On the insular part of area, the Tym and Poronay are the longest rivers. Khanka Lake is the largest; other important freshwater lakes include Evoron, Chukchagirski, Bolon, Udyl, and Kizi.

The main climatic feature of the Russian Far East is monsoon atmospheric circulation. As a part of the East Asian non-tropical monsoon area, the territory under consideration is exposed to cold and dry air from inner Siberia during the winter, and to warm and humid air from subtropical and tropical belts of the Northern Pacific during the summer. Continuous permafrost covers most of the Russian Far East mainland, except the Zeya-Bureya Plain, the Amur-Zeya Plateau, the Middle Amur Lowland, and most of Primorye (Fig. 1).

Chronology of the prehistoric cultures

Material and methods

Radiocarbon (^{14}C) dating is the most widely accepted technique for studying the chronological relationships of archaeological complexes (cf. Taylor 1987). Radiocarbon dating of the prehistoric cultures from the Russian Far East started in the late 1950s and early 1960s (Okladnikov 1964; Butomo 1965). Significant progress in chronology construction was achieved in the 1980s and 1990s (Kuzmin 1998; Kuzmin et al. 1994, 1998a). At present we have more than 190 indisputable ^{14}C dates from about 60 sites, and the most updated lists of ^{14}C dates may be found in several publications (Kuzmin 1998, 2002; Kuzmin et al. 1998a).

For ^{14}C dating of the prehistoric sites from the Russian Far East, both liquid scintillation counting (LSC) and accelerator mass spectrometry (AMS) equipment are used. About 20% of the ^{14}C dates were made by AMS technique. The dated material includes charcoal and burnt food (87% of dates), bones (8%), organic temper in pottery (2.5%), marine mollusk shells (1.5%), and humates (1%).

For calibration of the ^{14}C dates younger than 10,000 ^{14}C years ago (B.P.), both the Groningen calibration computer program (van der Plicht 1993) and calibration curves extending up to 10,000 B.P. that are based on a German and Irish oaks sequence (Pearson et al. 1993; Kromer and Becker 1993) were used. When using the Groningen program, we combined all the possible time intervals. Calibrated dates refer in the text as "cal B.C." and "cal A.D.".

General periodization of prehistoric cultures

The Stone Age of the Russian Far East may be subdivided into two main epochs, the Palaeolithic and Neolithic. The concept of the Mesolithic as a separate epoch was in use into the 1980s (Krushanov 1989) but almost disappeared in the 1990s (Derevianko 1998). Thus, the drawing of the boundary between the Palaeolithic and Neolithic should be based on the appearance of pottery. In this case, pottery refers to well developed vessels for food preparation. The sites without pottery should be categorized as Palaeolithic and the sites with pottery should be associated with the Neolithic.

Two archaeological cultures have been established within the Upper Palaeolithic: Ustinovka in Primorye (Vasilievsky and Gladyshev 1989) and Selemdzha in the Middle Amur River basin (Derevianko and Zenin 1995; Derevianko 1998).

The Neolithic of the southern Russian Far East may be subdivided into three stages: Initial, Early, and Late (Derevianko and Petrin 1995; Medvedev 1995). The Initial stage comprises three cultures, Osipovka in the Lower Amur River basin (Medvedev 1995), and Gromatukha and Novopetrovka in the Middle Amur River basin (Derevianko 1970; Derevianko and Petrin 1995).

Several cultures may be associated with the Early Neolithic: Malyshevo in the Lower Amur River basin (Okladnikov 1965; Medvedev 1995); Rudnaya and Boisman in Primorye (Tatarnikov 1983; Andreeva 1991; Djakov 1992; Popov et al. 1997); and Yuzhno-Sakhalinsk on the southern Sakhalin (Vasilevsky 1992, 1995).

Six cultures are identified with the Late Neolithic: Zaisanovka in Primorye (Brodiansky 1987); Voznesenovka (Okladnikov 1970) in the Lower Amur River basin; Osinoozerskaya in the Middle Amur River basin (Okladnikov et al. 1971); Imchin on northern Sakhalin (Vasilievsky

and Golubev 1976; Shubina 1990; Vasilevsky 1995); Aniva on southern Sakhalin (Vasilevsky 1992, 1995); and Yuzhno-Kurilsk on Kunashir, Iturup, and Urup Islands (Golubev 1972, 1986).

The cultural epoch that follows the Neolithic in the Russian Far East is the Early Iron Age and/or Bronze Age (Krushanov 1989); both are combined by some investigators under the single term "Paleometal" (Brodiansky 1987).

Palaeolithic ^{14}C chronology

The single ^{14}C-dated early Upper Palaeolithic site in the Russian Far East with macroblade complex, Geographical Society Cave, gives a ^{14}C values between > 40,000 B.P. and ca. 32,600 B.P. (Kuzmin et al. 2001). The earliest evidence of microblade manufacture in the Russian Far East, which may be used to establish the boundary between the early and late stages of the Upper Palaeolithic in Northern Asia (Abramova 1989: 241), is from the Ust-Ulma 1 site with a ^{14}C value of ca. 19,300 B.P. (Derevianko 1996, 1998; Derevianko and Zenin 1995). Since this time, we have a continuous sequence of ^{14}C dates from the late Upper Palaeolithic sites in both Primorye and the Amur River basin. The latest Palaeolithic sites with microblades are dated in the Amur River basin to ca. 10,500 B.P., and in Primorye to ca. 11,500 B.P., and possibly to ca. 7800 B.P. (ca. 6700 cal B.C.) (see General comments).

Initial Neolithic ^{14}C chronology and Palaeolithic-Neolithic boundary

The earliest evidence of pottery making in the lower Amur River basin is dated to ca. 13,300-13,000 B.P. at both the Khummi and Gasya sites (Kuzmin et al. 1997; Kuzmin and Keally 2001). The Goncharka site is slightly younger, ca. 12,500-9900 B.P. All three sites belong to the Osipovka culture, and the date of the upper level of the Osipovka layer at the Khummi site is ca. 7800 B.P. (7010-6345 cal B.C.). This is probably the upper limit of the Osipovka culture; thus it existed ca. 13,300-7800 B.P. (Fig. 2).

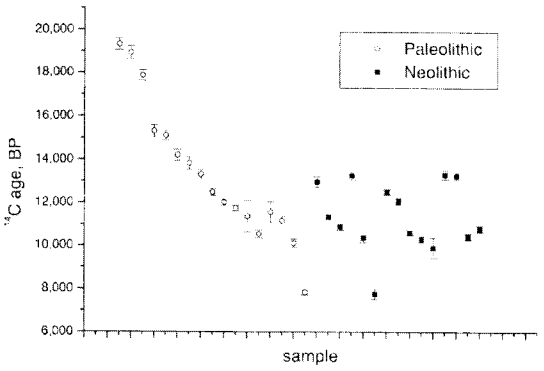

Fig. 2. Plot of the Upper Palaeolithic and Initial Neolithic ^{14}C dates.

As for the Gromatukha culture, several ^{14}C dates, based on organic temper in the pottery, reveal an age of ca. 13,300-10,400 B.P. (Jull et al. 1998; O'Malley et al. 1999; Derevianko et al. 2002). These dates should be considered as preliminary due to unsolved problems in the dating of organic-tempered pottery. However, they fit well with the latest archaeological model of Neolithic periodization in the Russian Far East (Derevianko and Petrin 1995). Recently, ^{14}C charcoal date of ca. 12,300 B.P. was obtained from the lower part of the Gromatukha cultural layer (Jul et al. 2001; Kuzmin, 2002; Kuzmin and Keally 2001; Derevianko et al. 2002), and this is generally consistent with pottery temper ^{14}C values.

In the Middle Amur River basin, the dates of the Novopetrovka culture pottery, made on clay temper, provided a ^{14}C ages of ca. 12,700-9800 B.P. (Jull et al. 1998; O'Malley et al. 1999; Derevianko et al. 2002). The single ^{14}C date

for the Novopetrovka site, obtained on carbonized food adhesion on the pottery sherd, is ca. 9700 BP (Derevianko et al. 2002; Kuzmin 2002).

In Primorye, the beginning of the Neolithic may be placed at ca. 8400 B.P., though it may be even earlier, at ca. 10,700 B.P., as indicated by the ^{14}C age of organic temper in the pottery from the Chernigovka site (Jull et al. 1998; O'Malley et al. 1999). On Sakhalin, the Puzi 2 site was ^{14}C-dated to ca. 8800 B.P. (8080-7550 cal B.C.) (Kuzmin and Orlova 2000); the majority of the earliest Neolithic sites have ^{14}C dates of ca. 6500-6700 B.P. (Fig. 3). In the southern Kurile Islands, the earliest Neolithic site is ^{14}C-dated to ca. 7000 B.P.

Thus, after ca. 8000 B.P. Neolithic cultures appeared throughout the Russian Far East. We can draw the Palaeolithic-Neolithic boundary in the lower and middle parts of the Amur River basin at ca. 13,300-10,500 B.P. and in Primorye at ca. 8400-7800 B.P. The lack of ^{14}C-dated Palaeolithic sites on both Sakhalin and in the Kurile Islands prevents determination of the Palaeolithic-Neolithic chronological boundary in these territories.

Early Neolithic ^{14}C chronology

In the Lower Amur River basin, the Malyshevo culture is 14C-dated to ca. 7000 4400 B.P. (5970-2920 cal B.C.) (Fig. 3). Medvedev (1995) suggested that the Malyshevo culture might be even older, up to ca. 9000 B.P. In Primorye, the Rudnaya culture existed ca. 8400-5900 B.P. (7540-4680 cal B.C.); and the Boisman culture existed ca. 6400-5000 B.P. (5420-3520 cal B.C.) (Fig. 3). The Almazinka site, which is not affiliated with either culture, is dated to ca. 7550-7400 B.P. (6450-6050 cal B.C.).

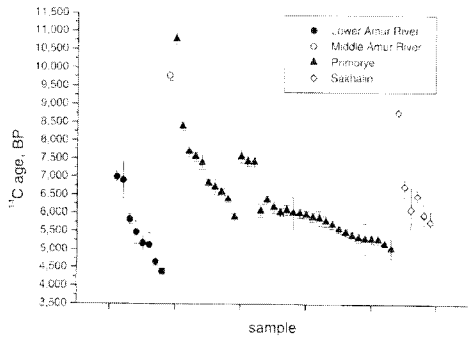

Fig. 3. Plot of the Early Neolithic 14C dates.

On Sakhalin, the Yuzhno-Sakhalinsk culture existed ca. 6700-5800 B.P. (5940-4340 cal B.C.) (Fig. 3). In the southern Kiriles, the single Yankito site was dated to ca. 7000 B.P. (5950-5710 cal B.C.) (Fig. 3). However, the uncertainty over the presence of pottery at this site makes this ^{14}C date questionable (Zaitseva et al. 1993).

Late Neolithic ^{14}C chronology and Neolithic-"Paleometal" boundary

In the Lower Amur River basin, the Voznesenovka culture existed ca. 4900-3300 B.P. (3700-1430 cal B.C.) (Fig. 4). In the Middle Amur River basin, a few ^{14}C dates from the Mikhailovka-Kluch site, ca. 4300 B.P. (3340-2490 cal B.C.), and from the Osinovoe Ozero site, ca. 3700 B.P. (2200 cal B.C.), may be associated with the Osinoozerskaya culture. In Primorye, the Zaisanovka culture is ^{14}C-dated to ca. 5800-3100 B.P. (4780 1270 cal B.C.) (Fig. 4). On Sakhalin, the Aniva culture is ^{14}C-dated to ca. 3000-2300 B.P. (1250-40 cal B.C.). The Imchin culture existed for a long time, from ca. 5900 B.P. to ca. 3100 B.P. (5050-1270 cal B.C.) (Fig. 4). In the southern Kuriles, the Yuzhno-Kurilsk culture is ^{14}C-dated to ca. 4200- 1800 B.P. (3340 cal B.C.-420 cal A.D.) (Fig. 4).

The Neolithic-"Paleometal" boundary in the mainland Russian Far East may be placed at ca. 3000-2800 B.P. (1300-1000 cal B.C.). For

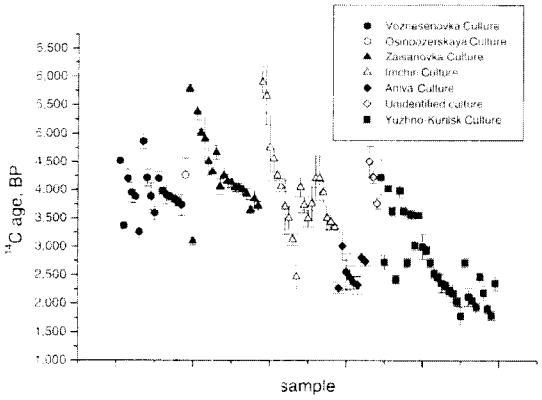

Fig. 4. Plot of the Late Neolithic ^{14}C dates.

the insular territories such as Sakhalin and the southern Kuriles, this boundary may be drawn at ca. 2300-1800 B.P. (390 cal B.C.-230 cal A.D.).

Paleoenvironment of the Palaeolithic and Neolithic cultures

Natural paleoenvironmental background for the past 40,000 ^{14}C years

A brief description of the paleoenvironment of the Russian Far East is based on previously published summaries (Alekseev 1978; Markov 1978; Pushkar 1979; Aleksandrova 1982; Korotkii 1985, 1993; Korotkii et al. 1980, 1988, 1997a, 1997b; Pletnev 1985; Grebennikova et al. 1995; Mikishin and Gvozdeva 1996). In general, three stages of natural environment development may be established for the past 40,000 ^{14}C years (Kuzmin and Orlova 1998: 26-29): 1) the Chernoruchie interstadial, ca. 50,000-21,000 B.P. (corresponding to the Karginian interstadial in Siberia or to Oxygen Isotope Stage 3, OIS 3); 2) the Partizansk Glaciation, ca. 21,000-10,000 B.P. (corresponding to the Sartan Glaciation in Siberia, or OIS 2); and 3) the Holocene, the past 10,000 ^{14}C years.

During the Chernoruchie time period, the

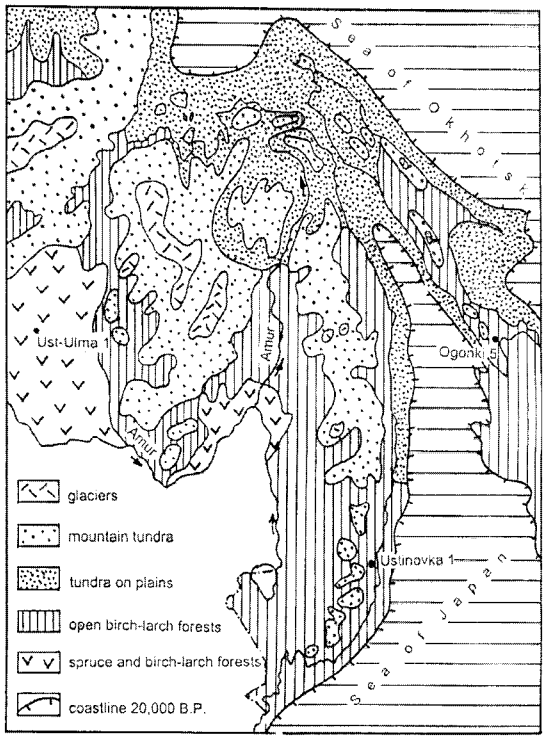

Fig. 5. Paleoenvironmental scheme of the Russian Far East for ca. 20,000 B.P. (with Upper Palaeolithic sites).

main vegetation in the entire Russian Far East consisted of dark coniferous and mixed coniferous-broadleaved forests during the optimal phase, ca. 40,000-24,000 B.P.; and by coniferous forests at the end of the interstadial, ca. 24,000-21,000 B.P. The mean annual surface temperature of the water in the Sea of Japan was 2-3℃ lower than it is today. In general, the climate during the Chernoruchie stage was cooler than in modern times.

During the severest cold episode of the Partizansk time period, ca. 20,000-16,000 B.P., the majority of the Russian Far East was covered by tundra and open birch-larch forests (Fig. 5). The coastal plains of the Sea of Japan and the Okhotsk Sea, occupying the continental shelf at depths up to 120-130 m below modern sea level, were covered by tundra

and forest-tundra. In the highest mountain ridges, small cirque glaciers existed on the Sikhote-Alin Ridge and in both the Western and Eastern Sakhalin Ranges. In the Bureya Range system with elevations above 1500-1800 m, mountain-and-valley glaciers developed (Fig. 5). In general, the mean annual temperature ca. 20,000-18,000 B.P. was at least 8-9 ℃ lower than it is today. In the second part of the Partizansk stage, ca. 16,000-10,000 B.P., the climate gradually became milder, and as a result dark coniferous and mixed coniferous-broadleaved forests expanded. Birch-larch forests at ca. 15,000-10,000 B.P. replaced tundra and forest-tundra in Primorye. At the end of the Late Glacial, ca. 13,000-11,000 B.P., broadleaved species such as oak, elm, and hornbeam appeared in the southern Primorye and Sakhalin territories.

The Holocene period in the Russian Far East is characterized in general by a warming of the climate and a rise in annual mean temperature. According to Khotinsky (1987), there were three episodes in the Holocene with temperatures higher than today's: 1) the Boreal period, ca. 8900-8300 B.P.; 2) the Atlantic period, ca. 8000-4900 B.P.; and 3) the Subboreal period, ca. 4200-3000 B.P. These episodes were separated from each other by two colder events: 1) at the end of Boreal period, ca. 8300-8000 B.P.; and 2) at the end of the Atlantic and the beginning of the Subboreal period, ca. 4900- 4200 B.P.

In the Early Holocene (Preboreal and Boreal period, ca. 10,000-8000 B.P., vegetation of the Russian Far East consisted mainly of birch-larch forests in the northern part and of mixed coniferous-broadleaved forests with thermophilous species (such as elm, hazel, and hornbeam) in southern Primorye and Sakhalin. The warmest and most humid climatic conditions for the

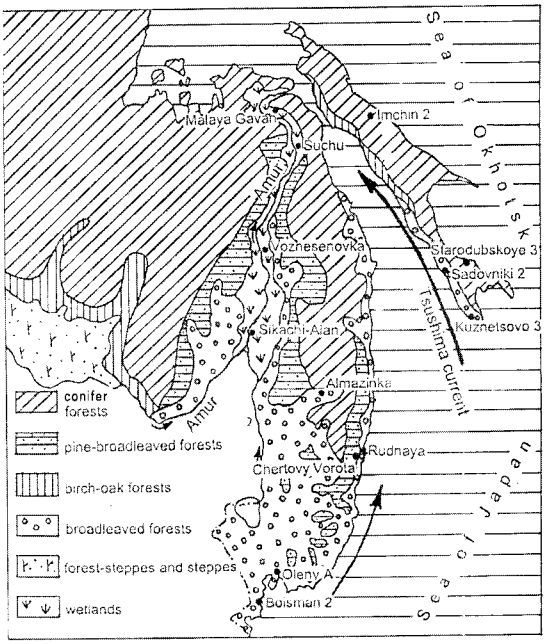

Fig. 6. Paleoenvironmental scheme of the Russian Far East for ca. 6000 B.P. (with Early Neolithic sites).

past 10,000 years existed in the Russian Far East during the Atlantic period, ca. 6000-4900 B.P. The vegetation was represented in the northern part of the territory by dark coniferous forests and mixed coniferous-broadleaved forests in Primorye, the Amur River valley, and on the western coast of Sakhalin (Fig. 6). On the Zeya-Bureya Plain, forest-steppe and even steppe formations existed. The annual mean temperature was 2-3 ℃ higher than it is today. The levels of the Sea of Japan and the Okhotsk Sea during this time exceeded the modern ones; the elevations were estimated to be 1.5-2 m to 3-4 m higher.

In the Subboreal period, ca. 4900-2500 B.P., the main type of vegetation in the Russian Far East consisted of mixed coniferous-broadleaved forests in Primorye and on southern Sakhalin. Dark coniferous forests covered the remaining territory.

The Stone Age environment of the Russian Far East

The study of Stone Age geoarchaeology in the Russian Far East started in the 1950s (Petrun 1956; Ganeshin and Oklandikov 1956; Chemekov 1964). The review of results obtained in Primorye from the 1950s to the1970s may be found in Derevianko (1983) and in Vasilievsky and Gladyshev (1989). In the Middle Amur basin, paleoenvironmental data were obtained for a few Palaeolithic sites from the 1960s to the 1990s (Tseitlin 1979; Derevianko 1983, 1998; Derevianko and Zenin 1995; Kuzmin 1996; Jull et al. 1999). The results of the Sakhalin Stone Age geoarchaeological studies are presented in several monographs (Vasilievsky and Golubev 1976; Vasilievsky et al. 1982; Derevianko 1983; Golubev and Lavrov 1988). The data obtained for the whole Russian Far East in the 1980s- 1990s are summarized by Kuzmin (1992, 1994, 1996, 1997). In this section, only Stone Age sites with cultural layers in situ are being considered. The Early and Middle Palaeolithic sites, all in secondary contexts, are characterized by Derevianko (1998).

Today we have paleoenvironmental characteristics for all main cultural complexes, both Palaeolithic and Neolithic. Several geoarchaeological methods, such as geomorphologic, stratigraphical, lithological, palynological, and radiocarbon, are being used to study the human paleoenvironment. In order to reconstruct the natural vegetation, climate, and chronology of the key sites and cultures, both palynological and radiocarbon methods are the most widely used.

A. Palaeolithic

In Primorye, the majority of geoarchaeologically studied Palaeolithic sites - Ustinovka 1, 5, and 6; Suvorovo 3, 4, and 6; Ilistaya 1; Gorbatka 3; and Timofeevka 1 - correspond to the late Upper Palaeolithic and are dated after ca. 20,000 B.P. Only two sites, Geographical Society Cave and Osinovka, correspond to the early Upper Palaeolithic and are dated to ca. 35,000-30,000 B.P. These sites existed in the favorable environment of coniferous-broadleaved forests during the Chernoruchie interstadial (Kuzmin 1996).

The best-studied area in Primorye is the Zerkalnaya River basin. Here sites exist from the Last Glacial Maximum, ca. 20,000-18,000 B.P., for example, the Ustinovka 1 (Kuzmin 1992). The Suvorovo 4 site existed at ca. 16,000-15,000 B.P. during a climatic amelioration, in an environment of birch-hazel forests (Kuzmin 1994). The Ustinovka 6 site corresponds to the Late Glacial period, ca. 11,750-11,550 B.P.; around the site at this time light birch forests with an admixture of broadleaved species developed (Verkhovskaya and Kundyshev 1996). Both the Suvorovo 3 and Suvorovo 6 sites may be associated with the Pleistocene-Holocene boundary and the Early Holocene, ca. 10,000-8000 B.P.; the environment contained birch-hazel forests (Kuzmin 1994; Verkhovskaya 1996).

In the Ilistaya and Razdolnaya River basins, the Gorbatka 3, Ilistaya 1, and Timofeevka 1 sites existed in an environment of birch-hazel forests with an admixture of broadleaved species (Kuzmin 1994; Verkhovskaya 1996), and corresponds to the Late Glacial, ca. 13,000-10,000 B.P.

In the Middle Amur River basin, only a few Palaeolithic sites have been sufficiently studied. In the Selemdzha River valley, the presence of ice-wedge traces at the Ust-Ulma 1 site shows clearly that it existed in the cold and dry environment of the Last Glacial Maximum. For the Malyie Kuruktachi site in the Bureya River

basin, pollen and radiocarbon data were obtained (Jull et al. 1999). The vegetation around the site has changed from forest tundra and light birch forests to birch-larch forests with an admixture of broadleaved species, such as oak, elm, and linden. Taking into account 14C dates (ca. 14,200-10,500 B.P.), one can assume that the Malyie Kuruktachi site existed during one of the ameliorations within the Late Glacial, most likely at ca. 13,000-12,200 B.P. or ca. 13,800-13,300 B.P.

On Sakhalin Island, Ogonki 5 is the key site for the Palaeolithic epoch. Geoarchaeological data show that it existed ca. 19,300-17,800 B.P. in an environment of light fir-spruce forests. There are no solid geoarchaeological data for the remaining Palaeolithic sites; using general chronological boundaries (Kuzmin 1998; Kuzmin and Orlova 2000) one can place the Palaeolithic of Sakhalin between ca. 20,000 B.P. and ca. 9000 B.P.

Based on data obtained, we can conclude that Palaeolithic sites in southern Primorye continued to exist from the middle of the Chernoruchie interstadial, ca. 35,000 B.P., to the Pleistocene-Holocene boundary, ca. 10,000 B.P. Starting at ca. 20,000 B.P., permanent occupation of the Primorye territory can be traced in the Zerkalnaya River basin. In the Late Glacial, ca. 13,000-10,000 B.P., Upper Palaeolithic sites existed also in the Ilistaya and Razdolnaya River basins. In the Middle and Lower Amur River basin, Palaeolithic sites existed from ca. 20,000 B.P. The upper chronological limit for the Palaeolithic epoch in the Amur River basin may be placed at ca. 12,000 B.P. (Kuzmin et al. 1998a) (Fig. 7). On Sakhalin Island one can now establish the permanent occupation from ca. 19,000-20,000 B.P (Kuzmin et al. 1998b).

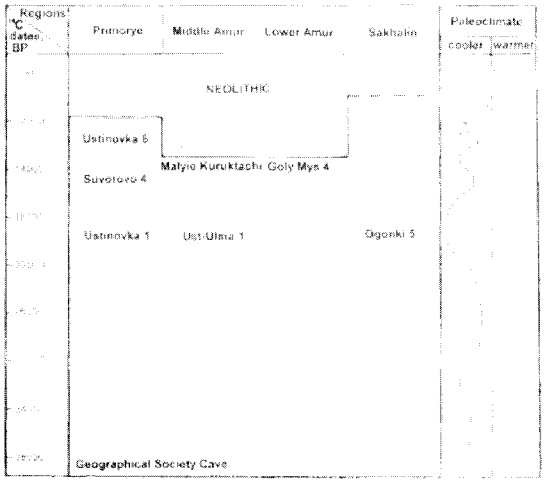

Fig. 7. Paleoenvironment and chronology of the Palaeolithic of the Russian Far East.

B. Neolithic

In central Primorye, the Rudnaya culture (ca. 8400-5900 B.P.) existed during the Atlantic period of the Holocene in an environment of birch-hazel and birch-broadleaved forests. In northern Primorye, the Almazinka site, dated to ca. 7550-7400 B.P., was located in birch-pine forests with an admixture of broadleaved species. In southern Primorye, the Boisman culture existed during the warmest phase of the Atlantic period, ca. 6400-5000 B.P., in an environment of hornbeam-oak forests with an admixture of linden, elm, and ash (Verkhovskaya and Kundyshev 1993; Jull et al. 1994) (Fig. 6). The Zaisanovka culture sites correspond in general to the Late Atlantic and Subboreal periods (ca. 5800-3100 B.P.). Climatic deterioration at the Atlantic-Subboreal boundary, ca. 5000-4500 B.P., caused vegetation changes in southern Primorye to forest-steppe with birch and hazel forests (Fig. 8).

In the Lower Amur River basin, the Osipovka culture existed amid environmental changes, and four phases may be distinguished. The early phase (ca. 13,000-12,000 B.P.) corresponds

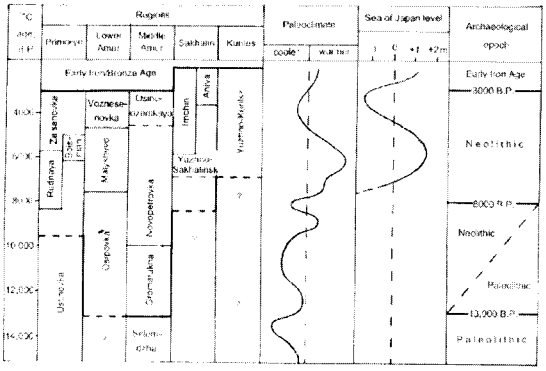

Fig. 8. Paleoenvironment and chronology of the Neolithic of the Russian Far East.

to rare pine-larch forests, indicating the cold climate of the Late Glacial. The middle phase (ca. 12,000-11,000 B.P.) may be correlated with Bølling and Allerød stadials, with a vegetation of coniferous and coniferous-broadleaved forests containing mari (larch forests on bogs). The late phase (ca. 11,000-10,300 B.P.) corresponds to the Younger Dryas cold event with a vegetation of light larch-pine forests. The final stage (ca. 10,300-10,000 B.P.) correlates with climatic amelioration of the Pleistocene-Holocene boundary with an environment of coniferous forests and an admixture of broadleaved species (Fig. 8).

The Malyshevo culture existed during the end of the Boreal, the entire Atlantic, and the beginning of the Subboreal periods. At the beginning, ca. 8000 B.P., the vegetation consisted of light birch-larch forests. During the Atlantic period, ca. 8000-5000 B.P., the climate was warm and wet. The vegetation was coniferous-broadleaved forests with an admixture of hornbeam, ash, and nut-tree at the beginning; and birch and coniferous forests at the end (Fig. 6). At the beginning of the Subboreal period, ca. 5000-4500 B.P., the vegetation was birch-oak and coniferous forests.

The Voznesenovka culture existed ca. 4900-3500 B.P. At the Atlantic-Subboreal boundary, ca. 4900-4500 B.P., birch-broadleaved forests with bogs constituted the vegetation, and the climate was dry and cool. In the early Subboreal, ca. 4500-3500 B.P., the coniferous-broadleaved forests with larch prevailed, indicating climatic amelioration (Fig. 8).

On southern Sakhalin, several sites corresponding to Early and Late Neolithic were geoarchaeologically studied (Golubev et al. 1991; Vasilevsky 1992). The Early Neolithic Yuzhno-Sakhalinsk culture existed under mid-Holocene warm and wet climatic conditions ca. 6700-5800 B.P., in an environment of dark coniferous and broadleaved forests. The key sites of the Late Neolithic Aniva culture, Yuzhnaya 2 and Predreflyanka, correspond to the Subboreal period, ca. 3100-2700 B.P., with cool climate and dark coniferous forests.

The Neolithic environment may be represented as follows (Fig. 8). The Neolithic of Primorye corresponds to the Early and Middle Holocene, and existed amid a changing natural environment. The clearest changes, such as cooling and drying, started ca. 5500-5000 B.P. and continued up to ca. 3500-3000 B.P. (Verkhovskaya and Kundyshev 1993; Verkhovskaya 1996; Verkhovskaya et al. 1996). The Neolithic of the Lower Amur River basin existed for a long time - in the Late Glacial, ca. 13,000-10,000 B.P. and in Early - Middle Holocene, ca. 10,000-4000 B.P. During this time span, climatic conditions changed several times. The warmest and wettest climate is observed for the Malyshevo culture. The Neolithic of the Middle Amur River basin is still poorly studied geoarchaeologically; however, general peculiarities of this region are close to those of the Lower Amur River basin. On Sakhalin Island, Neolithic cultures existed between ca. 9000 B.P. and 2300

B.P. No reliable paleoenvironmental information was obtained from the southern Kurile Island Neolithic sites. In general, they existed during the Late Holocene, ca. 4200- 1800 B.P.

General comments

One of the most important chronological peculiarities of the Stone Age complexes in the Russian Far East is the co-existence of different cultures or even epochs. Since in many cases there is no stratigraphic control, only radiocarbon dating allows us to correlate Stone Age cultures within this vast territory. The data obtained show clearly that late and final Upper Palaeolithic cultural complexes in the Amur River basin coexisted with Initial Neolithic cultures, the Osipovka and the Gromatukha, ca. 13,300-10,100 B.P. (Kuzmin and Jull 1997; Kuzmin and Orlova 1998) (Figs. 2, 7-8).

The Late Neolithic cultures of the insular regions of the Sakhalin and the southern Kuriles ca. 3000-2000 B.P. coexisted with "Paleometal" complexes on the mainland, such as the Lidovka and Sinegaiskaya cultures of the Bronze Age and the Yankovskaya culture of the Early Iron Age (Kuzmin et al. 1994). For the insular territories, we have a definite chronological lag - up to 1400 calendar years - between the mainland and the islands for the beginning of the Paleometal stage.

The degree of study of pre-Upper Palaeolithic cultures in the Russian Far East is still not satisfactory (cf., Kuzmin 1996: 138; Kuzmin 2000). On the other hand, no sites represent cultural layers in situ. In the Middle Amur River basin, some sites, such as Filimoshki and Ust-Tu, were redeposited and some, such as Kumary and Bogorodskoye, were completely destroyed (Derevianko 1998). Today it is impossible to ascertain when humans first arrived in the territory of the modern Russian Far East.

In the Upper Palaeolithic geoarchaeology of Primorye, the problem with age determination of some Ustinovka culture sites still remains. Verkhovskaya (1996), based on pollen spectra from the Ustinovka 5 and 6 and Suvorovo 4 and 6 sites, assumed that they correspond to the Holocene optimum, ca. 8000-6000 B.P. However, ^{14}C dates from Suvorovo 4 (ca. 15,900-15,100 B.P.) and Ustinovka 6 (ca. 11,750-11,550 B.P.), contradict this conclusion. Unfortunately, we still do not have enough ^{14}C dates for the Palaeolithic of Primorye, and the contradiction between pollen and ^{14}C data cannot currently be solved.

Geoarchaeological data also does not allow to date the Upper Paleolithic Ustinovka culture as the Early Holocene, less than 10,000 B.P., as it was suggested by Djakov (2000). Two Holocene ^{14}C dates from the Ustinovka culture sites, Ustinovka 1 [7800±500 B.P. (GIN-2503)] and Ilistaya 1 [7840±60 B.P. (Ki-3163)], seems to be less reliable and need additional confirmation. The Ustinovka 1 date was obtained for pooled sample, and on very small amount of charcoal. The Ilistaya 1 date might respresent the Early Neolithic component. In the Early Holocene, ca. 9300 B.P. (and maybe even earlier, ca. 10,800 B.P.), the Early Neolithic sites with pottery already have been existed in Primorye (Ustinovka 3 and Chernigovka).

The degree of human adaptation to the harsh Last Glacial environment in the Late Palaeolithic in the Russian Far East was quite high. Several sites such as Ustinovka 1, Ust-Ulma, and Ogonki 5, existed during the Last Glacial Maximum, ca. 20,000-18,000 B.P. (Fig. 5). Because the level of the Sea of Japan was

about 120-130 m below the modern one, vast coastal plains appeared. This made human migrations from the Amur River basin toward the Japanese Islands via Sakhalin, as well as from mainland Northeast Asia to the Japanese Islands via the Korean Peninsula, easier than before or after this time period.

Several Early Neolithic cultures in the Russian Far East, such as Malyshevo, Rudnaya, Boisman, and Yuzhno-Sakhalinsk, existed during the Holocene Climatic Optimum, ca. 7000-5000 B.P. At this time, two branches of Tsushima warm current penetrated further north, and reached the northern coast of the Tatar Strait, and the Primorye coast (Fig. 6). The other branch of Tsushima current, Soya, penetrated deeper into the Sea of Okhotsk, and reached the southern Kurile Islands.

Conclusion and Acknowledgments

The data presented above create a background for more precise geoarchaeological knowledge of the southern Russian Far East. Ongoing excavations, especially in Primorye, the lower Amur River basin, and Sakhalin, will bring new information about Palaeolithic and Neolithic chronology and environment in this part of Northeast Asia.

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