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The Late Pleistocene environment and conditions of human existence in Western Siberia: A Regional Geographic Information System (GIS)

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Abstract: This paper is devoted to a study of the interrelationships between the natural environment and early people on the territory of Siberia and the Russian Far East during the time interval from 10 to 40 ka ago. Western Siberia is a key area in terms of both Quaternary geology and Palaeolithic archaeology. The GIS (Regional Geographic Information System) technology is being used to provide a complex analysis of environmental changes and human setting. The reference points (objects with palaeoenvironmental and archaeological characteristics) are characterized by spatial evidence, chronological components, and by multiple palaeoenvironmental proxy data such as modern geomorphic features, sediments, biotic features, palaeoclimatic data and palaeolandscape type. Archaeological sites are additionally characterized by traces of human activity and cultural affiliation. The regional GIS Atlas supports palaeoecology reconstruction by several software products (GIS "ARC/INFO-ARC/VIEW, GIS "SOCRAT-GEO" and "PARADOX" Database Management System). As an example of our approach maps of palaeovegetation and ancient sites for the Late Karginsk (32 000–24 000 yr. BP) and Sartan (24 000–14 000 yr. BP) intervals were generated.

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INTRODUCTION

The aim of the paper is to study the interrelationships between the environment and ancient people on the territory of Siberia and of the Russian Far East over the time interval from 10 to 40 ka BP when rapid and sharp environmental changes took place. Because the human subsistence in the Late Pleistocene and the Early Holocene was of a hunting-and-gathering type, the environmental conditions very strongly affected the early people's lifestyle, economy and cultural development. The landscape and climatic changes in the Late Pleistocene influenced also the peopling process of different parts of Northern Asia.

West Siberia (southern part of the West Siberian Lowland, and the Altai and Sayan Mountains) is one of the most promising areas for both Quaternary geology and archaeology. The GIS technology for palaeoecological proxy data processing and generalization is being used in order to promote a new progressive approach for geoarchaeological investigations over the large Siberian territory.

MATERIALS

As a source of information, we use our own data and the results published by other investigators as well (TSEITLIN 1979, FIRSOV et al. 1985, Archaeology and Palaeoecology 1990, ABRAMOVA et al. 1991, DEREVIANKO - MARKIN 1992, ORLOVA 1995). The database contains information about the reference points (i.e. the objects with environmental and archaeological information) and consists of two main parts: 1 – environmental characteristics and 2 – early site characteristics. All the points are related to geographic coordinates and the radiocarbon chronological scale. We use the points within the time interval of 10–40 radiocarbon years BP that encompasses the Karginsk and Sartan stages (ARKHIPOV - VOLKOVA 1994).

Each reference point is spatially determined (latitude, longitude, altitude and a depth below the surface in the section) and characterized by chronological components (radiocarbon dates), and by palaeoenvironmental data such as modern geomorphic features (relief type, form and microfeatures), sediments (lithology, stratigraphy and genesis of deposits), biotic features (vegetation type and faunal ecotype), palaeoclimatic data (humidity, temperature) and palaeolandscape type. For archaeological sites we add the traces of a past human activity (dwell-

Fig. 1. Distribution of the reference points in Western Siberia and captions for Figs. 1–4.
1 – reference points. Archaeology: 2 – Early Karginsk (42 000–55 000 yr. BP) sites; 3 – Middle Karginsk (32 000–42 000 yr. BP) sites; 4 – Late Karginsk (24 000–32 000 yr. BP) sites; 5 – Sartan (14 000–24 000 yr. BP) sites; 6 – Late Glacial (10 000–14 000 yr. BP) sites. Palaeovegetation: 7 – cold steppe; 8 – steppe; 9 – forest-steppe; 10 – taiga; 11 – forest-tundra; 12 – tundra; 13 – tundra-steppe (a periglacial vegetation); 14 – forest-tundra-steppe (a periglacial mixed vegetation).

ings, fireplaces, etc.) and cultural affiliation (epoch and culture). All archaeological sites are subdivided into five groups in terms of climatostratigraphy: the Early Karginsk correlated with the late Mousterian culture, the Middle and Late Karginsk, Sartan and Late Glacial (different stages of the Late Palaeolithic – Fig. 2).

It should be emphasized that we use only sites with radiocarbon dates as reference points. Thus, the real number of Palaeolithic sites in Western Siberia is much larger than is included into GIS; undated sites or sites where age is poorly known are, at the moment, not considered in the analysis.

METHOD

To analyse the Late Pleistocene biotic and abiotic environmental components and their influence on the spatial-temporal distribution of ancient occupation sites, the Regional GIS Atlas was compiled. It is supported by

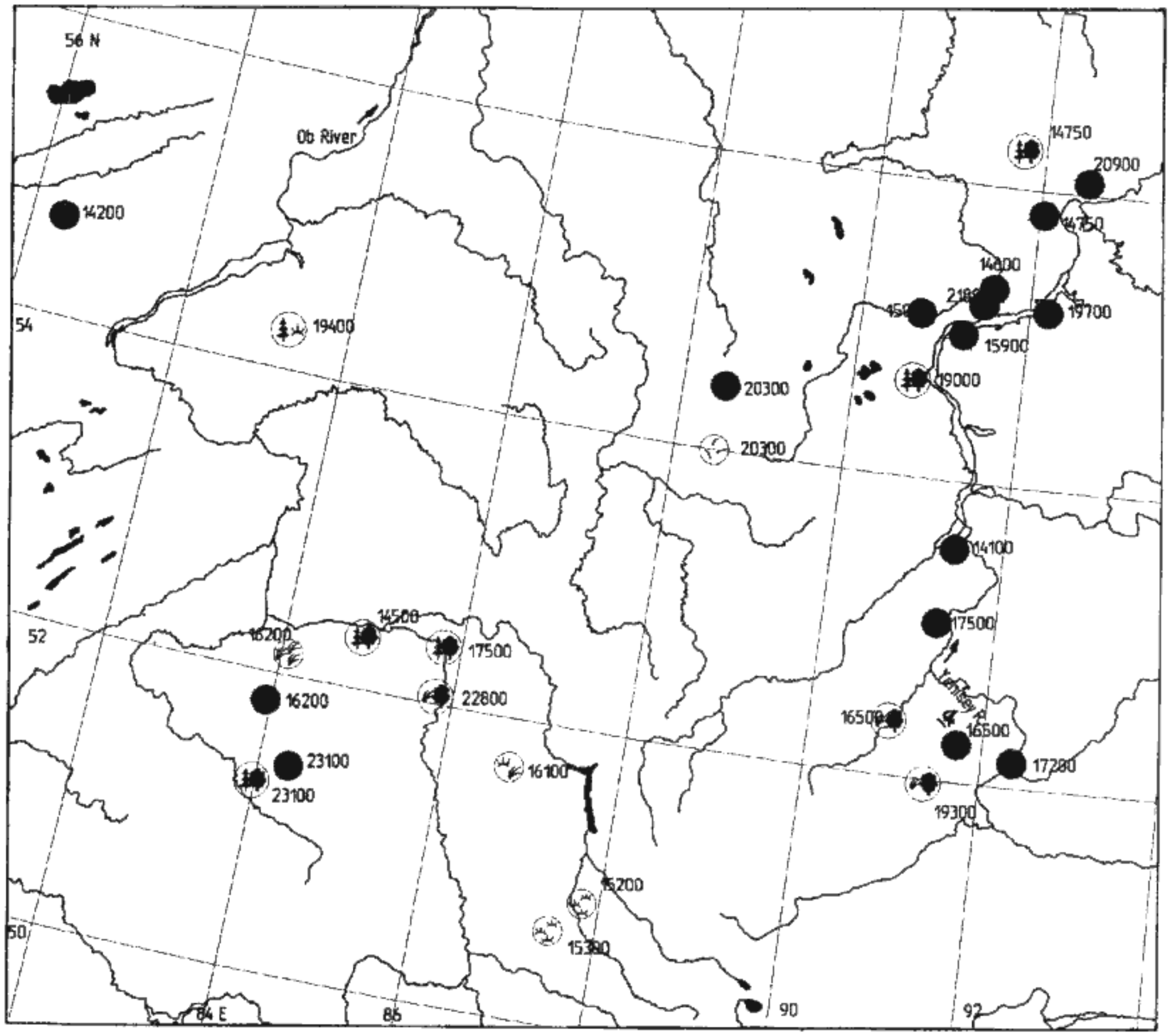

Fig. 4. Sartan (14–32 ka BP) vegetation and occupation sites.

in the Altai foothills and a taiga forest in the river valleys. In the southern part of the West Siberian lowland, where the main vegetation type during the entire late Karginsk (32 700–24 900 yr. BP) was forest-steppe and steppe, there are no well-studied sites corresponding to the interval.

As for the Sartan glacial stage, the geographical distribution of the Upper Palaeolithic sites is quite different compared with the late Karginsk interstadial (Fig. 4). There is a site concentration in the Yenisey River valley, and there are only a few sites known in the Altai foothills (Okladnikov cave and Anui 2) and on the southern margin of the West Siberian lowland (Volchya Griva). Probably, the concentration of sites in the Yenisey valley may be explained by a more favourable environment. The evidence of severe conditions with a vegetation of "cold steppes" are known only for the interval close to the last glacial (Sartan) deterioration maximum ca. 20 000 years BP. Within the interval of 19 300–14 750 yr. BP, the main vegetation types were forest-steppe in the Yenisey upstream area, and taiga in the southern part of the basin. In the Altai Mountains and the southern West Siberian lowland, the vegetation during the Sartan glacial stage was represented by forest-tundra and tundra. Taiga and forest-steppe survived as separate biotic "islands". The human occupation of the Volchya Griva ca. 14 200 yr. BP probably correlates with the general climatic amelioration after 15 000 yr. BP and the comparatively favourable environmental situation on the southern West Siberian lowland at the time.

CONCLUSION

The above examples illustrate the application of GIS technology for a joint analysis of natural environment components and early prehistoric sites. The employment of the GIS Atlas will allow the generation of maps of palaeoenvironments for different time intervals across the entire Siberia and the Russian Far East. The schemes of a spatial-temporal distribution of the Palaeolithic sites will be superimposed on the palaeoenvironmental maps, and the simultaneous analysis of both kinds of information will reveal the peculiarities of human existence within the Pleistocene natural environment. The model of human dependence on palaeoenvironment in the Palaeolithic time for Siberia and the Russian Far East will be the aim of our following research.

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