SOME ASPECTS ON THE DISTRIBUTION OF RADIOCARBON DATES FROM THE MESOLITHIC AND NEOLITHIC OF EUROPEAN RUSSIA

G.I. Zaitseva,* V.I. Timofeev,* V.A. Dergachev,** and A.A. Sementsov

* *The Institute of the History of Material Culture, Russian Academy of Sciences, Dvortsovaya noberezhnaya 18, 191186 St.Petersburg, Russia*

** *The Ioffe Physico-Technical Institute, Russian Academy of Sciences, Politeknicheskaya St. 26, 194021 St.Petersburg, Russia*

Abstract

The Stone age chronology for the main regions of European Russia based on radiocarbon dating is presented. The source of information is a database consisting of all available radiocarbon dates created in the ^{14}C Laboratory at the Institute of the History of Material Culture. Special attention is paid to the correlation of radiocarbon chronology with climatic data obtained by different isotopic methods.

Archaeological investigations made in European Russia for more than 100 years have led to the discovery of thousands of archaeological sites belonging to different archaeological epochs from the Palaeolithic to the Medieval. The completeness of the investigations differs from site to site. The information concerning many of them consists of the finds, their position inside the sites and their description with special attention to materials, which are important for the determination of cultural attribution. Research, where archaeological and scientific methods have been combined has been carried out only at a few sites. The percentage of objects investigated in such a way is larger for the Palaeolithic sites and decreases significantly for sites from later periods. The most common scientific method used in archaeological investigations is radiocarbon dating. The importance of this method in archaeological research has increased since the 1960s, and today a rather large amount of dates have been obtained. These dates form the foundation for the constructed chronology for a number of areas, and give a possibility to discuss the chronological problems from a new point of view. This paper presents a survey of the established chronologies for those areas of European Russia, which are best covered with radiocarbon dates.

About 1500 radiocarbon dates are obtained for archaeological sites in the European Russia spending in time from the Palaeolithic to the Medieval. 70% of them were obtained by the ^{14}C Laboratory at the Institute of the History of Material Culture. For the systematising of this material a database has been created using the computer program PARADOX. The main structure of the database has been presented by Michzynski (1994). In this paper we will focus on the distribution of the radiocarbon dates of the Mesolithic and the Neolithic in the main regions of European Russia. The regions under consideration are Far North (Kola Peninsula), North-West (Karelia and Leningrad oblast), West (Pskov, Novgorod and Smolensk oblasts) and Central part (Moscow, Yaroslavl, Ivanovo, Ryazan, Kursk, Voronezh, Bryansk).

As mentioned above, the dated sites forming the base for our chronological comparison comprises only of a small part of all known sites (in common about 2–5%). It is therefore reasonable to ask if the conclusions can be regarded reliable. In this re-

spect it should be noted that there are radiocarbon dates for many key sites, which form the foundation for studies of the different archaeological cultures in the regions. The total amount of radiocarbon dates for the Palaeolithic, Mesolithic and Neolithic sites of the area outlined above is about 600 and the number of sites is 128. The locations of the sites are shown in Fig. 1, groups of sites in the same area are marked by one point, as for instance Kostenki 1–21 or Ivanovskoye I–VII. The dated Palaeolithic sites in the area under consideration are situated only in the Central region. The age distribution of the dates is shown in Fig. 2 as samples per a time interval of 200 years. According to the figure, the main part of the dates fall in the interval 10000–4000 BP corresponding to Mesolithic and Neolithic time. Special attention should be paid to the fact that there are almost no dates in the interval 10500–11500 BP. Taking into account that the area under consideration is rather large this fact can not be accidental. The lack of dates can probably be explained by change in climate and other natural factors during this time interval.

The radiocarbon concentration in the atmosphere in the past is known to be connected with the production rate of this isotope and with variations in climatic conditions. Fluctuations in the ^{14}C concentration with a period of about 2000 years have been connected with change in solar activity and climate (Dergachev and Vecksler, 1991). Fluctuations in solar activity with periods of 200 and 200 years can be traced in carbon isotope records from tree-rings (Dergachev and Vecksler, 1991; Dergachev and Chistyakov, 1992). According to these investigators corresponding periods of change in climate can be observed at 400, 2700, 5000, 7200 and 9500 years BP. These data are in good concordance with paleoclimatic reconstructions reached by other methods. Oxygen isotope records from Greenland ice-cores have revealed that the climate of the Northern Hemisphere was exposed to reiterated great and sharp changes in the Late Pleistocene (Dansgaard et al. 1993). Rapid climatic variations connected with sharp fall of temperature and formation of massive icebergs were revealed. Cold episodes called Heinrich events took place in the time-intervals: 10500 BP, 14300 BP, 21000 BP, 27000 BP and 35000 BP. These periods were characterised by dramatic decrease in the productivity of foraminifers in the upper layers of the ocean. According to these data the Younger Dryas climatic period occurs at about 10500 BP. Heinrich events correspond to transitions from Glacial to Interglacial or the reverse.

Very interesting data have been obtained from investigation of the $^{13}C/^{12}C$ ratio in sedges and mosses from a stratified peat-bog (White et al. 1994). This method allowed reconstruction of the CO_2 content in the atmosphere during the last 13000 years. According to this investigation the atmospheric CO_2 concentration changed at certain periods as rapidly as during industrialised time. Three episodes with sharp increase in CO_2 content could be observed in intervals around 4000 BP, 7000 BP and 10000 BP and these are in coincidence with the decrease of ^{14}C concentration in the atmosphere and corresponds to epochs of warmer climate. About 11000–12000 BP there are periods with significant decrease in CO_2 content. This interval with practically no ^{14}C dates from archaeological sites occurs during a period of strong climatic changes and coincides with the transition from Palaeolithic to Mesolithic time.

A discussion on this phenomenon in more detail requires special attention. Most of the Mesolithic sites dated by ^{14}C are located in north-western Russia mainly in Karelia (42 dates) and in the Central region (56 dates). Their distribution is presented in Fig. 3. There is a small amount of dates for the Early stage of the Mesolithic (from 10200 to 9000–8500 BP) for both areas. For later periods regional differences can, however, be recognised. Almost all ^{14}C dates for the sites of the North-West lie in the interval 7000–8000 BP, and a more Early group of dates (8000–9000 BP) is distinguished in the dates from the sites of Central Russia only. The difference can be a

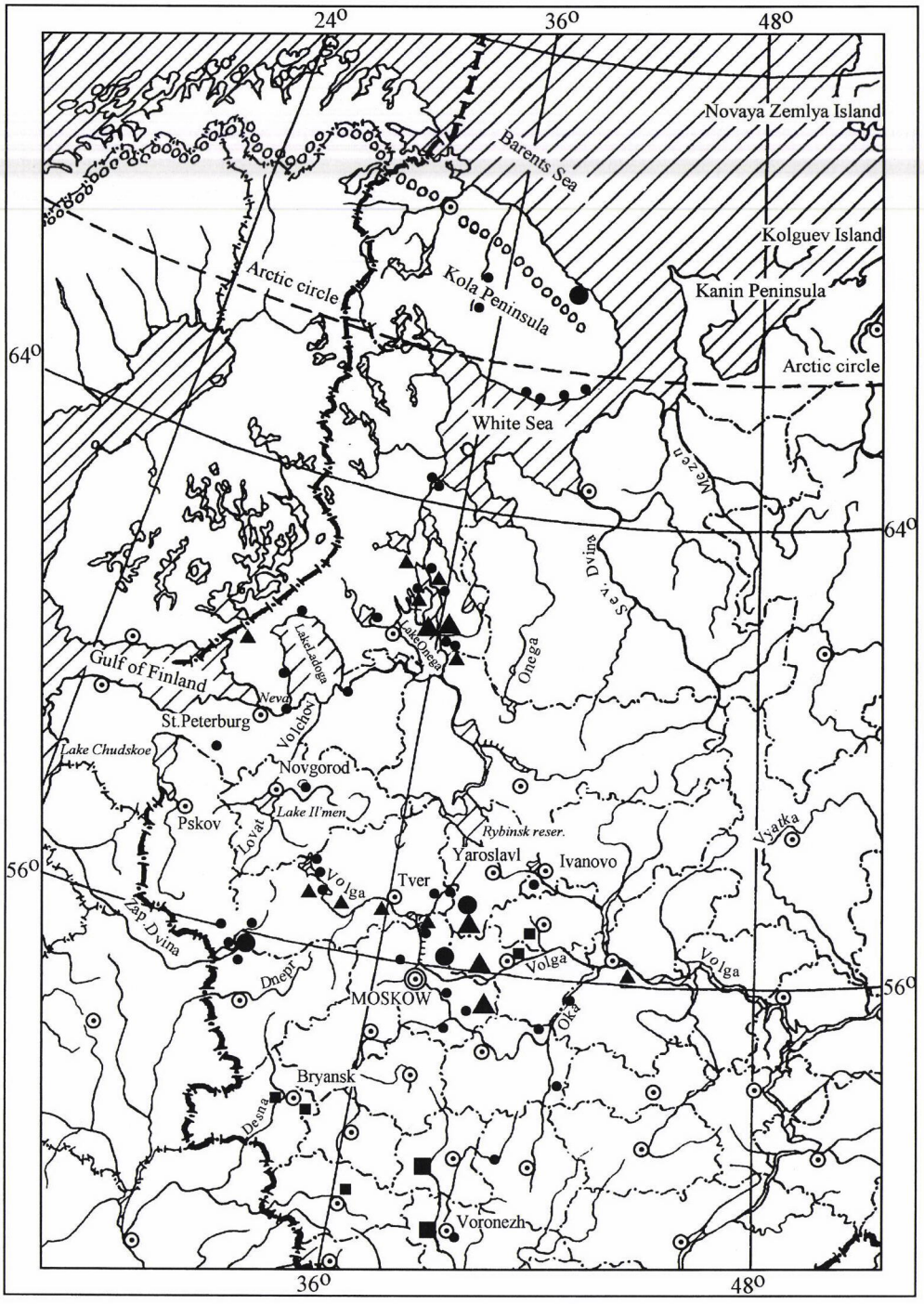

Fig. 1. Location of archaeological sites in European Russia: the Far North, North-West, West and Central regions. ● – Neolithic sites, ▲ – Mesolithic sites, ⊙ – Palaeolithic sites.

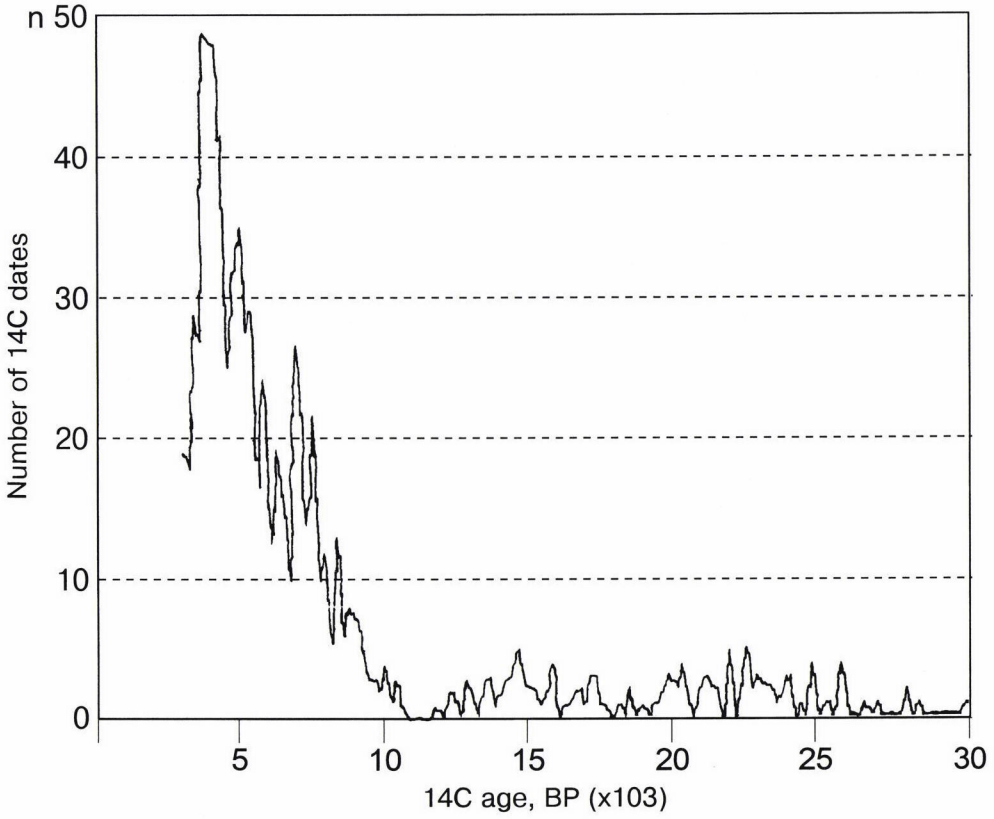

Fig. 2. Distribution of radiocarbon dates from the Palaeolithic to the Neolithic for the Far North, North-West, West and Central regions of Russia. n = 450 dates for 108 sites.

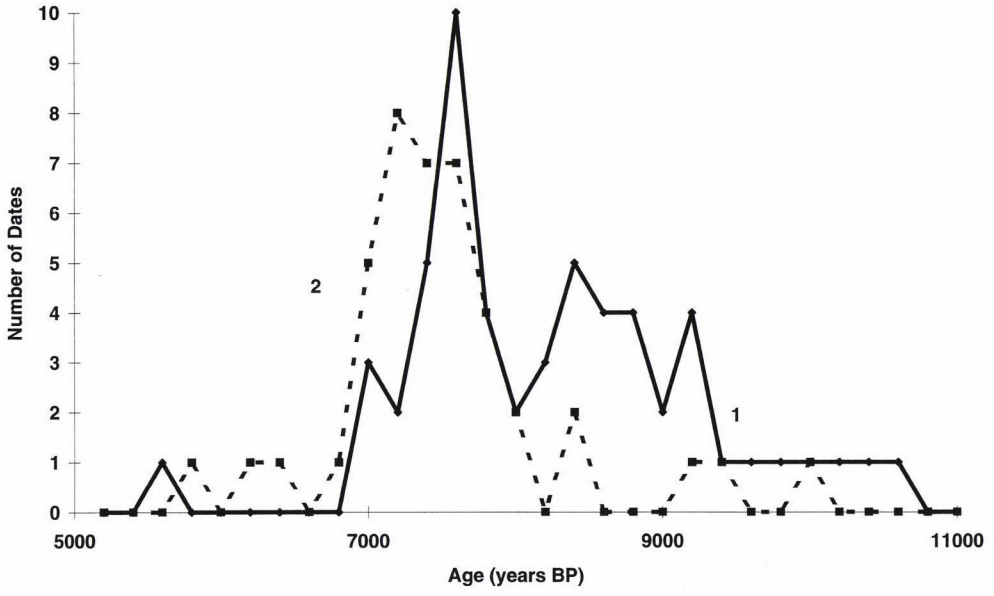

Fig. 3. Distribution of radiocarbon dates for the Mesolithic. 1 – Central Russia, n = 56, 2 – North-West Russia, n = 42.

result of uneven distribution of the dated sites. From Karelia ten sites have been dated, but a large part of the dates has been done for the Oleneostrovsky burial ground, and from Central Russia twenty sites. The Neolithic sites are represented widely in Far North, North-West, West and Central Russia. The distributions of the Neolithic radiocarbon dates of these regions are shown in Fig. 4. The distributions for the sites from West and North-West (curves 2, 3) are very similar. The regional differences are more obvious for the initial stages of the Neolithic. The earliest group (about 7000 BP) is represented in the Central region only and the Early Neolithic dates from the Far North are later in comparison with the dates of this period for the other regions. The character of the distributions of the radiocarbon dates for the interval 5500–4000 BP is similar for all four regions. The main part of the Neolithic dates are in the interval 6000–4000 BP. It is just the period when the appreciable increase of CO_2 content in the atmosphere has been observed, which indicates a warmer climate. Further research will probably provide more detailed correlation between climatic and archaeological data. The analysis of the latitudinal distribution of the ^{14}C dates, now in preparation, may give useful information . The rather significant amount of material in the created database provides a good opportunity for chronological reconstruction.

Acknowledgements

Many thanks are due to V. Bessonov who helped to create the computer database of the radiocarbon dates of archaeological sites. This research was supported by the Russian Foundation of Humanitarian Research Grant Nr 96-01-00003.

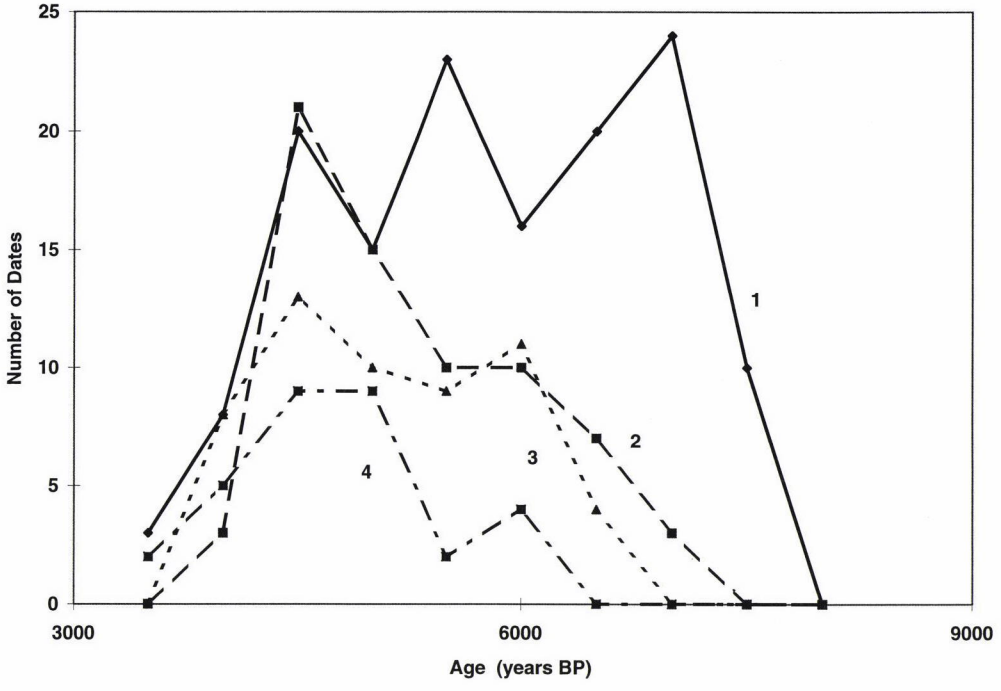

Fig. 4. Distribution of radiocarbon dates for the Neolithic. 1 – Central Russia, n = 140, 2 – North-West Russia, n = 69, 3 – West Russia, n = 55, 4 – Far North, n = 31.

References

Dansgaard, W., Johnsen, S.J., Clausen, H.B., Dahl-Jensen, D., Gundestrup, N.S., Hammer, C.U., Hvidberg, C.S., Steffensen, J.P., Sveinbjörnsdottir, A.E., Jouzel, J. and Bond, G. 1993. Evidence for general instability of past climate from a 250-kyr ice-core record. Nature 364, 218–220.

Dergachev, V.A. and Vecksler, V.S. 1991. The use of the radiocarbon method for the study of natural environment in the past. Ioffe Physical-Technical Institute Press. Leningrad. 258 p. (in Russian).

Dergachev, V.A. and Chistyakov, V.F. 1992. About solar activity and climate on the boundary of Pleistocene and Holocene. Ioffe Physical-Technical Institute Press. No. 1585. 27 p. (in Russian).

Dergachev, V.A., 1995. Large-scale cyclical fluctuation of cosmogenic ^{14}C concentration. Reports of Academy of Sciences. Physical series. V.59, No. 4. P. 91–96. (in Russian).

Michczynski A., Krzanowski A., Pazdur, M. and Ziolkowski, M. 1995. A computer-based database for radiocarbon dates of Central Andean archaeology. Proceeding of the 15th International ^{14}C Conference. Radiocarbon, Vol. 37, No. 2, P. 337–343.

White, J.W.C., Clais, P., Figge, R.A., Kenny, R. and Markgraf, V. 1994. A high-resolution record of atmospheric CO_2 content from carbon isotope in peat. Nature 367, 153–156.