EVOLUTION OF THE SEVERNAYA ZEMLYA GLACIATION IN HOLOCENE

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The location of the Severnaya Zemlya archipelago in the centre of Eurasian Arctic makes its ice cover a particularly interesting target area both in terms of its present condition and its history. A complex analysis of the ice cores, including determination of δD and $\delta^{18}O$, geophysical investigations of several deep boreholes in the ice caps along with mathematical modeling of ice dynamics were carried out by research teams from the Institute of Geography, Arctic and Antarctic Research Institute, Laboratoire de Modelisation du Climat et de l'Environnement (Saclay, France), St. Petersburg Mining Institute, Kazan and St. Petersburg universities.

The results of oxygen isotope investigations of the ice core from the deepest borehole in the Severnaya Zemlya archipelago are given in Fig. 1.

The age of basal ice from the Academy of Sciences and Vavilov ice caps is 12–13 thousand years (Fig. 1). Based on the stable isotope study, only an ice layer covered by a block of frozen deposits under the Vavilov ice cap is of Pleistocene age (Fig. 2). Ice from the underlying unlithified sediments consists of segregated ice and ice-cement. Interpretation of the isotope data allows us to suggest that the January temperatures during permafrost formation were about 10 °C higher than at present (Last Interglaciation). The Holocene thermal optimum dates by its beginning in this region.

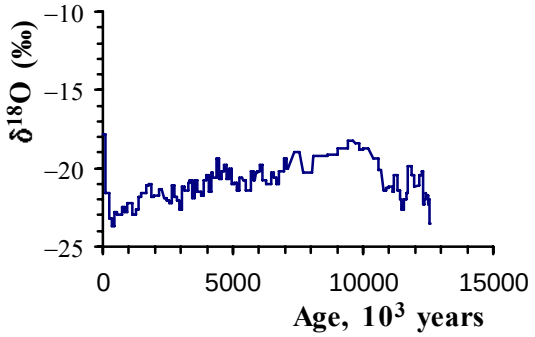

Fig. 1. Variations of $\delta^{18}O$ in the ice core from Academy of Sciences Ice Cap in Holocene

A mathematical model has been applied to interpret our direct measurements of ice core density and thickness of annual ice layers versus depth in the Vavilov and Academy of Sciences ice domes. For both glaciers the mean positive annual mass balance in Holocene was about 140–150 % compared with the balance in recent years. Ice domes grew in Middle Holocene and were in a quasi-steady state in Late Holocene. All our simulations agree with the results of independent palaeogeographical investigations.

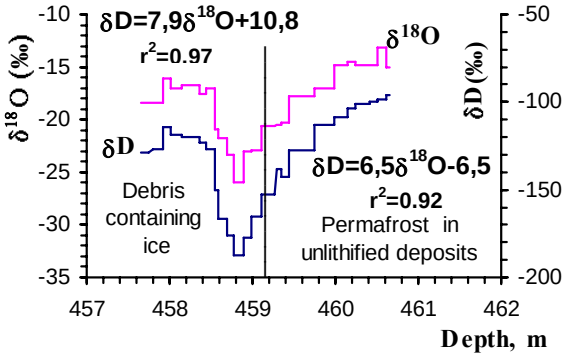

Fig. 2. Results of isotope studies (δD, $\delta^{18}O$) of ice from the contact zone ice/underlying sediments under the Vavilov Ice Cap

So far, we have not been able to find any significant layer of Pleistocene ice anywhere on the archipelago. Numerous palaeogeographical data suggest small dimensions of the Severnaya Zemlya Glaciers at the Pleistocene/Holocene boundary. All these facts indicate that there was no great glaciation of Severnaya Zemlya in Late Pleistocene and that glaciers dried during the Last Glacial maximum (18,000 BP) or, alternatively, that the glaciation represented a thin (several tens to few hundred metres) but laterally extensive ice sheet.

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