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X-RAY DIFFRACTION AND IR-SPECTROSCOPY OF BOTTOM SEDIMENTS IN LAKE HOVSGOL FOR PALEOCLIMATIC RECONSTRUCTIONS

Zhdanova, A.N.

United Institute of Geology, Geophysics and Mineralogy, SB RAS, Kopyug pr., 3, 630090, Novosibirsk, Russia
e-mail: zhdanova@uiggm.nsc.ru

Lake Hovsgol, on the territory of Mongolia, lies in a region critical for understanding global climate change in central Asia during the late Cenozoic. Biogenic silica is known to serve as a useful climate proxy. Biogenic silica tends to increase in the sediments as a result of elevated diatom productivity in the lake, which is responding to warmer water temperatures, but it does not provide any information about paleoclimatic changes in catchment basin. Clay minerals, in particular, would therefore be more likely to preserve the conditions of hydrolysis that generated them in the weathering profile. We focus on determining whether patterns in the mineralogical composition of the sediments can also be used as a supporting tool for paleoclimatic interpretation.

The series of short cores (up to 1.15 m depth) have been obtained from different parts of this lake during 2001-2002 as a part of the Russian Academy of Sciences' expeditions. The cores show two distinct sedimentary divisions. The upper part of core is dominated by fine-grained silts and the lower part is generally sandier with numerous intervals of graded bedding. The mineral composition of the original samples and their fine granulometric fractions were analysed by X-ray powder diffraction and IR spectroscopy. For X-ray the oriented mounts were prepared by transferring the suspension of bulk sample in distilled water onto a glass slide and drying at room temperature. Then they were solvating for about 24 hours with ethylene-glycol vapor in an evacuated exicator. The measurements were conducted on a DRON-4 automated powder diffractometer system with CuKα radiation, graphite monochromator. Scans were performed from 2° to 35° 2θ with speed of 0.05° 2θ/s. A new method was proposed for modeling X-ray diffraction profiles in order to identify correctly clay minerals and evaluate the amount of each clay mineral. The method is based on the calculation of the interference function of the one-dimensional disordered crystals with finite thickness and using a specially developed optimization procedure. Quantitative estimations of the composition of minerals such as quartz, plagioclase, carbonate and biogenic silica were made by IR. Samples were prepared using the KBr pellet method. The measurements were conducted on a Specord-75 IR spectrometer.

A consistent clay mineral assemblage containing illite, illite-smectite, chlorite, chlorite-smectite, muscovite and kaolinite, characterizes much of the studied sediments. Dominating illite and smectite layers in illite-smectite indicate chemical weathering condition under a warm and humid climate in an interglacial period. Prevalence of muscovite and illite layers in illite-smectite shows the influence of physical weathering in the glacial period. The clay-mineral-based fluctuations are correlated well with the abundance of biogenic silica and provide an independent tool for gaining insight into the paleoclimate of interior continental site.

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