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Lithology and Magnetic Features of the Sediments in Darkhad Basin, North Mongolia: Preliminary Results

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The Darkhad basin in Northern Mongolia is represented by 110 km long and 10-40 km wide NS stretching depression that is considered to be the westernmost continuation of Baikal rift system. The elevation of the depression is 1538 m a.s.l. The previous geological work in the basin have shown that basin contains thick lacustrine and other quaternary sediments related to glacial and fluvial-glacial fan system, however the timing and maximum advancing of glaciation events are still under discussion (Ufland et al., 1969; Gillespie, 2001; Krivonogov at al., 2005). The geomorphologic and other reconnaissance work have identified repeated glaciations, one of which had dammed the Shishhid river, the exit for water from Darhad basin, creating short-lived lakes up to 190 m in depth (Selivanov,1967; Ufland et al., 1969; Gillespie, 2001). Thus, the ancient onshore lake sediments can offer clue for timing of advanced glaciations in basin and for other climatic signals. For clarifying glacial history and related paleoenvironmental changes in Darhad basin drilling campaign was undertaken by A. Gillespie and A., Bayasgalan in 2004. The about 93 m core was obtained in the central part of the basin close to the depocenter.

First of all, the drill-core was subjected to detail lithologic descriptions with photo documentations. The description is generally resulted in distinguishing two units.: upper unit covers interval from 31.4-1.5 m and conisists of mainly varved lacustrine clayey silts; lower unit exposed within intervals of 92.6-31.4 m, and consists of sandy silts and silty sands of massive or thick bedded textures containing remnants of ostracods and other shells.

After that, paleomagnetic, magnetic-susceptibility, and grain-size distribution analysis conducted on the sub-samples of the drill-core at different steps ranging from 2 cm to 5-10 cm.

The paleomagnetic measurements for 1480 cubic samples show that no stable reverse polarity exists. That means whole drilled sediments were accumulated during the Normal polarity Brunhes Chron (the last 780 Ka). Further evaluation of the paleomagnetic measurement is resulted to distinguish several excursions. If we assume that the uppermost part of lacustrine sediment partly covers Holocene, then the excursions recorded in that sequence should be of Late Pleistocene age. Thus, based on above assumption, the excursions were evaluated in following ways.: The best expressed excursion at interval of 39.5-39.0 m was ascribed to the Black excursion (114-120 Ka); two other- at intervals of 23.5-23 m and 10.5-10 m were belonging to Hajimus/Straight (60-70 Ka) and Mono (28-32 Ka) correspondingly (Krivonogov et al., 2007). Then, average rate of sedimentation based on the excursion ages was calculated as 30 cm/ Ka and time coverage of whole drill-core is about ca 300 Ka,

and of the varved lacustrine sediments is about 95 Ka correspondingly.

Natural remnant magnetizations (NRM) recorded in whole drill-core show fluctuating high (up to 100-250 ma/m) values at intervals of 38-31.5 m and 17.3-1.9 m and lower (up to 10 ma/m) value at intervals of 93-60 m.

Magnetic susceptibility (MS) values for drilled core are within intervals of $10*10^{-5}$-$100*10^{-5}$ CI. The highest value was recorded at interval of 36.8-31.5, the lowest - at interval of 91-60 m.

The NRM and MS data suggest that high and lower magnetic properties of the sediment at intervals of 38-31.5 m and 90-60 m just triggered by corresponding high and low terrigenous sediment fluxes into lake. However, the high NRM and lower MS values at intervals 17.3-1.9 m possible have other reason, and we suggest the magnetic properties of sediment at this interval mainly was originated by chemical processes.

Thus the above data suggest following preliminary conclusions:

Lithology show that the varved (not annual varv) clayey silt at intervals of 31.4-1.5 were accumulated in deep water condition, and its time coverage is about 90-95 Ka. However the silty clay, sandy silt in lower part of the core indicate shallow water environment for its formation. So far transition from low to high stand happened ca.90-95 Ka. On the basis of consideration that the damming exit of lake created deep water lake in Darhad basin, we suggest advancing of glaciations occurred early than 95-100 Ka, and possibly it was coincided with MIS5d and Ermakov cold stage in accordance with Siberian chronostratigraphy (Imbrie et al, 1984; Archipov, 1991).

References

Alen R. Gillespie 2001. Galcial History in Darhad basin. International workshop for the Baikal-Hovsgol Drilling project in Ulaanbaatar, October 4-7, p.12-13.

Archipov, S.A. Chronostratigraphy of Pleistocene-basis for palaeoclimate reconstruction and history of biota. 1989. Evolution of climate, biota , and environmentof humanbeing in late Cenozoic in Siberia. Novosibirsk, UIGGM SB RAN, 106 p (in Russian).

Imbrie, J., Hays, J.D., Martinson, D.G. et al.,The orbital theory of Pleistocene climate: support from a revised chronology of marine $\delta^{18}O$ record. 1984. Milankovitch and climate, part I, Dordrecht, Netherlands, Reidel Publishing company, p.269-305.

Krivonogov S. K., Sheinkman V. S., Mistruykov A. A. 2005. Stages in the development of the Darhad dammed lake (Northern Mongolia) during the Late Pleistocene and Holocene. Quaternary International, 136, 83-94.

Krivonogov S., Kazansky A, Matasova G., Dolgorsuren Kh., Bezrukova E., Gillespie A., ayasgalan A.' Narantsetseg Ts., Tomurhuu D. 2007. Environmental records from the 92-m core, the Darhad basin, Northern Mongolia, Abstract volume of 6 International Symposium 'Terrestrial Environmental Changes in East Eurasia and Adjacent Areas' Russia, August 24-28, p

Selivanov E. I. 1967. Neogen-quaternary giant lakes in Transbaikalia and North Mongolia. Doklady Akademii nauk USSR, 177 (1), 175-178.

Spirkin A. I. 1970. About ancient lakes of the Darhad depression (Western Prehovsgol). In: Geologiya mezozoya I kainozoya Zapadnoi Mongolii. Nauka, Moscow, pp 143-150.

Ufland, A. K., Iljin, A. V., Spirkin, A.I. 1969. The Baikal-type depressions of the North Mongolia. Bulletin of the Moscow Soc. of naturalists, Geological Series, 44 (6). 5-22.

Ufland, A. K., Iljin, A. V., Spirkin, A.I., Shilova, G.N. 1971. Main features of stratigaphy and formation of Cenozoic deposits in Prekosogol (MPR). Bulletin of the Moscow Soc. of naturalists, Geological Series, 46 (1), 54-69.