

Paleoenvironmental changes during the last 10 million years around Lake Baikal based on the density measurement of sediments

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In this study, environmental changes during the past 10 million years are discussed based on the particle density variation of the BDP98 (total length 674m) sediments drilled in Lake Baikal. Density of BDP98 sediment varies between 2.36 and 2.98 g/cm³, the average is 2.59 g/cm³ and some high density spikes exist in the core depth about 200-600m.

In Lake Baikal, diatom is the major primary producer, and many diatom valves are observed in BDP98 sediments. Diatom valves are chiefly composed of Opal-A which has low density (about 2.0 g/cm³). That is, when many diatom valves are included in sediments, the density becomes lower. In addition, XRD analysis shows that mineral composition seldom changes in the whole BDP98 sediments. These facts imply that density of the sediment can be one of the main proxies that show primary production in Lake Baikal. Productivity of diatom is depended on climate in Lake Baikal. Therefore, density of BDP98 sediment may be a proxy which shows climatic changes over the upper 200m (about 5-0Ma) that have not changed drastically the depositional environment. Some of the high density layers mentioned above contain siderite of which density is 3.9 g/cm³.

Environmental history shown in BDP98 core can be roughly classified into five phases based on the variation of particle density: Phase5 (12-8.7 Ma) shows a little higher density, Phase4 (8.7-5.7Ma) shows slow shift into lower density, Phase3 (5.7-3.2 Ma) shows stable lower density, Phase2 (3.2-1.8Ma) shows abrupt shift to higher density, Phase1 (1.8 Ma - to present) shows high amplitude of density changes, and overall higher density. Climatic changes shown in the density profile of Phase 3 to 1 have the same tendency as that of marine oxygen isotope ratio. Primary production in the lake expected from the density profile of Phase 5-4 contradicts the result of the other proxies, such as pollen records. This result might be related to the depositional environmental change at BDP98 drilling site that changed dramatically in this period. Quaternary climatic changes around Lake Baikal expected from the density profile are concordant with the global climatic changes. However, as for the cooling for MIS 21 and change of periodicity from about 0.3 Ma, mode of the climatic changes around Lake Baikal differs from that of the global climatic changes. These climatic events coincide with the timing of strength changes of the Asian monsoon, and it suggest that the Asian monsoon was related to the climate around Lake Baikal.