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Middle Holocene abrupt water-level drop of Lake Balkhash revealed by mineralogical analysis of the lake sediments

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Lake Balkhash located in Kazakhstan in the dry area is a terminal lake of the maximum waters area in Central Asia. It is important to evaluate climatic change and the human activity to restore the environment of old Lake Balkhash.

The paleoenvironment of Lake Balkhash of about 10000 years is being restored because through core analysis and acoustic profiling analysis in the Lake Balkhash (Endo et al.,2010).

However, there is only limited study related to mineralogy. In the restoration of the paleoenvironment around the lake, it is important to understand the mineral deposit in Lake Balkhash. In addition, it will be able to supplement the place without microfossils such as pollens and diatoms in mineral analysis.

Powdery diffractometry was used in the present study. Up to now, the mineral analysis has been done to 80 samples (0901 core 40 samples and 0902 core 40 samples) in total for the crushed sample.

Present result showed the presence of quartz, feldspars, calcites, aragonites, dolomites, micas, and chlorites were contained in 0901 cores. It was also confirmed that 0902 cores contained hydro-magnesite, magnesite, and gypsum present in addition to all minerals of 0901 cores. In the present study, attention is paid to quartz, feldspars in 0901 cores, and magnesite and gypsums in 0902 cores.

Magnesite is generated from the environment with an extremely high Mg/Ca ratio in water (Last,1992). That is, the maximum peak of the magnesite confirmed by 0902 cores suggests the decrease under the evaporation environment in the lake level. In addition, the gypsum confirmed by the same depth is one of the typical evaporites generated with the evaporation environment. It provides an evidence to support the drawdown. 0901 cores also have the coarse-grained sediment. It was confirmed that a lot of quartz and feldspars existed from the mineral analysis in the same depth. In a word, it is suggested that this coarse-grained sediment be a land source material. Moreover, there are white silt in upper and lower 0901 cores and 0902 cores. When this sedimentary facies is compared, the gypsum horizon in 0902 cores is corresponding to the coarse-grained sedimentary facies of 0901 cores. Concerning that the AMS-14C ages of the shell and plant material within the coarse sedimentary unit of 0901 show around 5.5 ka (Sugai et al., 2010), We conclude that the water level of Lake Balkhash markedly decreased in the middle Holocene.

Keywords: Lake Balkhash, X-ray Diffraction, sediments mineralogy, Holocene, lake level fluctuation