Metal stable isotopes and the evolution of Lake Baikal

DER-CHUEN LEE[1], HSIN-TING LIU[2] AND SHUN-CHUNG YANG[3]

[1]Institute of Earth Sciences, Academia Sinica, Taipei, Taiwan
[2]Dept. of Earth Sciences, Nat. Normal Univ., Taipei, Taiwan
[3]Research Center for Environmental Changes, Academia Sinica, Taipei, Taiwan

Metal isotopes of Fe, Zn, Mo, and Cd, have been studied for the authigenic portion of a gravity core from Lake Baikal, in order to study the sources and sinks for these trace metals in the Lake Baikal, the largest fresh water lake in the world, and as potential proxies for the past climate changes in the region. A gravity core (GC-99; 52°05'23"N, 105°15'24"E; ~ 3m) sampled near the bore hole of BDP-99 in Lake Baikal is used in this study. The core was sampled continuously every cm, and one sample was analyzed for every 10 cm for the entire core in this study. A series of leaching procedures were used to remove the carbonates, and to collect the authigenic fractions for study. Double spike technique is used for all four metal stable isotopic measurements.

Significant variations are observed, yet no correlation is found among these four metal stable isotopes, and their respective elemental contents. New ^{14}C-dating results indicate that the 3m GC-99 core seems to have reorded the past ~ 30 ka of sedimentation history for Lake Baikal, with the Holocene/Pleistocene boundary at around 80-85 cm depth, marking the Younger Dryas Event at ~ 12 ka. The similar depth also marks the gradual shift of $\delta^{97}Mo/^{94}Mo$ for GC-99, from -0.5 ‰ in the deeper depth to ~ -2.2 ‰ in the upper 80-90 cm. Simlar shifts from relatively constant at -0.7 ‰ in the deeper depth to more variable, 0 to -1.5 ‰, in the upper 100 cm is also observed for $\delta^{56}Fe/^{54}Fe$. Less pronounced but nonetheless similar shfts also observed for Cd and Zn isotopes. While the vairations of Cd, Zn, and Fe (to some degrees) isotopes are mostly likely reflect the biological activities, booming of diatoms, the isotopic vairations of Mo and Fe (to a lesser degree) can be explained by the changing of the redox states, towards more oxic from YD event to the present, in Lake Baikal. This study marks the first time the metal stable isotopes can be used to study the connections between the local climate events and Lake Baikal using the sedment records. More data, in particular, the detailed chemical and mineralogical compoisitions of the sediment cores are needed in order to better constrain the relationship between the Lake Baikal and regional climate changes in the past.