Light noble gases from the mass extinction layer in Hungary

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The Permian-Triassic (P-T) boundary event was the biggest mass extinction for the past 540 million years. For the cause of this extinction, various opinions; bolide impact (Becker et al., 2001), massive volcanism (Wignall, 2001), rapid change of sea-level, and oceanic superanoxia (Isozaki, 1997), have been suggested. However, it has never been yet clear which mechanism are probable vision. For the Triassic-Jurassic (T-J) boundary, the late Triassic five impact craters (Spray et al., 1998) were found, and a impact ejecta layer too.

We have measured the light noble gas concentrations and isotopic ratios for the sedimentary rocks from the four Hungary sections that recorded mass extinction events at the P-T and T-J boundaries. The noble gas analyses have been performed by a sector type mass spectrometer VG5400 in Osaka University. All samples were treated with 1N-HCl to remove $CaCO_3$. The noble gases were extracted at 1600ºC by using the Ta furnace in the vacuum line. Our aim of this study was to detect the evidence of bolide impact in these mass extinction events.

All the $^3He/^4He$ ratios were far lower than the atmospheric value ($1.39x10^{-6}$) because ^4He contained in the terrestrial rocks increases with radioactive decay of U and Th. Moreover, no ^3He anomalies were observed at the P-T boundary as compared with those above and below the boundary and at the T-J boundary. We could not obtain the evidence of the extraterrestrial helium. For argon, the $^{38}Ar/^{36}Ar$ ratios were atmospheric values within the errors. The $^{40}Ar/^{36}Ar$ ratios were very high because of the radiogenic K. Therefore, it is excluded that the mass extinction was caused by a bolide impact in the P-T boundary. We have obtained slightly high ^3He concentrations in samples for the T-J boundary, but further study is necessary to confirm the meteorite origin.

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Geochemistry of Mo in the Chao Phraya estuary, Thailand.

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Dissolved Mo concentration has been measured in the Chao Phraya estuary, Thailand to examine its sources and behavior in the mixing environment of freshwater–seawater. Water samples, collected during three different periods and having the salinity range of ~0 to 25, define linear Mo–S trends. However, at salinity >5, Mo concentrations are much higher than that is expected from conservative mixing of river water and seawater.

Estimates of Mo contributions from riverine particulates and estuarine bottom sediments are significantly less than "excess" Mo in the estuary. Re-mobilization of Mo to the sediment porewaters (Emerson and Huested, 1991; Zheng et al., 2000) and its release to the estuary via diffusion is suggested to be the dominant process that contributes to "excess" Mo. This inference is drawn from higher "excess" Mo in the deep water of the Gulf of Thailand and is supported by a strong correlation between dissolved Mo and ^{228}Ra in the estuary. Diffusion of Mo from porewater to the estuary is likely to be enhanced by tidal currents, sediment re-working and bottom water upwelling, which are documented in the northern Gulf of Thailand. Precipitation of Mo from the bottom water and porewater is limited by prevailing oxic condition in the bottom water and lack of extreme reducing condition in the sediment column as inferred from available results on dissolved REEs in the estuary/gulf (Nozaki et al., 2000) and on sediment chemistry of the Gulf of Thailand.

The finding of this study, coupled with the knowledge on Mo geochemistry, suggests that its diffusion from porewater to the estuary may be an ongoing process in many of the estuaries. Such a process would enhance input Mo flux to oceans and hence its marine residence time at steady-state would be shorter than that estimated using only the riverine Mo flux (Collier, 1985; Morford and Emerson, 1999).

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