

Neogene history of Mediterranean hydrology based on sedimentary osmium isotopic records

Junichiro Kuroda^{1*}, JIMENEZ-ESPEJO, Francisco J.², Tatsuo Nozaki¹, Katsuhiko Suzuki¹

¹Japan Agency for Marine-Earth Science and Technology (JAMSTEC), ²Nagoya University

The Mediterranean Sea has experienced an extreme event called Messinian Salinity Crisis (MSC) that represents a formation of gigantic evaporite deposits in deep basins. In this study we report an osmium (Os) isotopic record of marine sediment cores from four deep-sea drilling (DSDP) sites in the Mediterranean; DSDP Site 372 in the western Mediterranean, DSDP Site 374 in the central Mediterranean, and DSDP Sites 375 and 376 in the eastern Mediterranean. The Os isotopic ratios of the pre-MSC sediments (Burdigalian to Serravallian) in the western Mediterranean are identical to that of the coeval global seawater. In contrast, the pre-MSC sediments (Langhian to early Messinian) in the eastern Mediterranean have significantly low $^{187}\text{Os}/^{188}\text{Os}$ values than those of the global Middle-Late Miocene seawater. Our data suggest that Os in the eastern Mediterranean was not fully mixed with that of other seas such as western Mediterranean and North Atlantic, and that the basin isolation has already started before the MSC, probably as early as Middle Miocene. The unradiogenic Os would have been supplied to the eastern Mediterranean by selective weathering of ultramafic rocks in the surrounding ophiolite bodies, which contains high amount of non-radiogenic Os. The isotopic compositions of Os in gypsum samples from all sites are significantly lower than the end-Miocene ocean water values, suggesting isolation of all Messinian basins. Sediments from the Pliocene show Os isotopic ratios more radiogenic, and close to the global seawater values of the Pliocene, indicating that Os started mixing with global seawater again.

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