Umbers in the Japanese accretionary complex as recorders of Os isotopic composition of Phanerozoic seawater

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The Os isotopic composition of seawater reflects the relative intensity of two dominant influxes into the ocean; radiogenic continental crustal detritus and unradiogenic mantle-like materials derived from oceanic crust and meteorites. The difference in $^{187}Os/^{188}Os$ ratios between these two sources is very striking (1.0˜1.4 for continental crust vs. ˜0.1 for mantle-like materials), which makes the Os isotopic system an excellent tracer for mantle and continental input into the marine environment. Hence, the marine Os isotope record has been increasingly used as a reliable proxy for continental weathering caused by global-scale geological processes (e.g., orogenesis and glaciation), emplacement of large igneous provinces on seafloor or land, and extraterrestrial impact events.

The secular change of Os isotopic composition of Cenozoic seawater has been well reconstructed by the Os isotopes of marine sediments including pelagic carbonates and hydrothermal metalliferous sediments. Specifically, the metalliferous sediments deposited on flanks of mid-ocean ridge (MOR) are one of the most suitable lithologies that accurately record the marine Os isotope composition because the metalliferous sediments dominantly scavenge Os from ambient seawater and are not severely contaminated by detrital materials due to a relatively high sedimentation rate. However, because the oldest available in-situ submarine sediment is ˜180 Ma in depositional age, we can only reconstruct the secular change of Os isotopic composition of ancient seawater since ˜180 Ma by using metalliferous sediments (carbonates) on seafloor.

Umbers that are ancient hydrothermal metalliferous sediments originally deposited on oceanic crust and subsequently accreted onto continent or island arcs due to subduction are a potential proxy for the Os isotopic composition of seawater older than ˜180 Ma. There are many umber deposits in the Phanerozoic accretionary complexes in Japan. These umber deposits are closely associated with N-MORB-type greenstones without exception. We report the marine Os isotope record since ˜350 Ma, which is reconstructed by umber deposits in the Phanerozoic accretionary complexes.