

## REE enrichment in manganese deposits: Potential for HREE resources

# Takeru Moriyama[1]; Yasushi Watanabe[2]

[1] AIST; [2] IGR, AIST

Geochemical re-examination, especially trace and rare earth elements, of Phanerozoic stratabound manganese deposits within accretionary complexes in Japan and Late Archean stratabound manganese deposits in the Iron Ore Group (IOG) in Orissa, east India, were carried out for the study to clarify genetic environment of these ores and HREE (heavy rare earth element) potential of manganese deposits. The Phanerozoic Japanese deposits subdivided into manganese ores within chert or basalt-chert horizon and ferromanganese ores within basalt-chert horizon. Total REE content of the manganese ores has 61 ppm on average, and those of the ferromanganese ores range from 1512 to 2678 ppm with HREE-enriched patterns and negative Ce anomalies. REE patterns of the manganese and the ferromanganese ores in Japan are similar to modern submarine hydrothermal manganese deposits and modern ferromanganese sediments near mid-oceanic ridges, respectively. The REE geochemical signatures suggest that the Phanerozoic manganese and ferromanganese ores formed in submarine hydrothermal system.

The Late Archean stratabound manganese, ferromanganese and iron ores occur within shale horizon in the IOG. Total REE contents of the IOG manganese and ferromanganese ores are up to 975 ppm, and HREE-enriched REE patterns, negative Ce anomalies and positive Eu anomalies are found in the IOG ores. These characteristics with positive Eu anomalies in the IOG ores suggest that the Late Archean manganese and ferromanganese ores in the IOG were precipitated from seawater enriched with REE through submarine hydrothermal supply.

HREE abundances of the Japanese ferromanganese ores and the Late Archean manganese and ferromanganese ores are up to 20 times of those of the continental upper crust. Although REE concentration technique from manganese and ferromanganese ores has not been established yet, those ores could be a future producer of HREE.