Platinum Group Element (PGE) Resources in Ocean Sediments

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Cobalt-rich iron-manganese crusts occur throughout the global ocean on seamounts, ridges and plateaus where currents have kept the rocks, swept clean of sediments for millions of years. Crusts precipitate from cold ambient seawater onto rock substrates, forming pavements up to 250 mm thick. Crusts are important as a potential resource primarily not only for cobalt, but also for titanium, cerium, nickel, platinum, manganese, thallium, tellurium, tungsten, bismuth, zirconium and other metals (Banakar et al 2007). Though considerable work has been done on the Fe-Mn crusts of the world oceans, the studies on Indian Ocean Fe-Mn crusts are limited. Studies have been initiated to understand the cobalt-platinum enrichment processes in the ferromanganese crusts on the Afanasy-Nikitin Seamount (ANS) in the Eastern Equatorial Indian Ocean. Ferromanganese crusts are hydrogenous colloidal precipitates, which are known to record oceanographic conditions contemporaneous to their growth period. Ferromanganese encrustations (Fe-Mn Crust) from Indian Ocean were found to contain on an average >1% of cobalt metal can be designated as Co-rich crust. The Co-rich crusts accrete at shallow water depth (generally <2500m) as slabs capping the seamounts. They are 3-6 times more enriched in Co metal than the abyssal polymetallic nodules and deep-water crusts. After Co, Ni, Cu, V, Pb, Zn, etc., the second group of elements that is enriched is the REE and followed by ultra-trace metals such as platinum group elements (PGE). Geochemical studies of platinum and iridium have indicated that both these elements are relatively enriched in manganese nodule and crust samples (Balaram 1999; Balaram et al 2006), compared to the concentrations of these elements in Earth's upper continental crust (~4 ng/g). There is a growing recognition that cobalt-rich crusts are an important potential resources for platinum group elements. Accordingly, it is necessary to fill the information gap concerning various aspects of geochemical characterization and crust mining through research, exploration and technology development.

References

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