Platinum –group Element Abundances in Deccan Volcanic Rocks: Inferences on Differentiation and Mineralization.

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Abundances of PGE in Large Igneous Provinces are not well known excepting the Siberian Traps of Russia, which hosts the Noril'sk – Talnakh Ni-Cu-PGE deposits. In a survey of the PGE abundances in the Deccan Volcanic Province (DVP), Crocket and Paul (2004, 2008) identified a high- and a low-Ir group with average Ir value of 0.21 ppb and 0.024 ppb respectively in a suite tholeiitic flows and dolerite dykes from Maharashtra. The Ir-rich group has lower REE, higher transition group elements (Ni, Cr) and S contents, large Nb-Ta anomalies in mantle-normalized plots, radiogenic ⁸⁷Sr/⁸⁶Sr and large negative ε Nd values. This group is also modified by crustal and/or lithospheric mantle assimilation. On the other hand, fractional crystallization seems to increase Pd. Au and Cu contents of the Ir-depleted group relative to the Ir-rich group.

The PGE abundances and ratios can thus be used as indicators of differentiation of Flood basalts.

Some of the oldest flows of the Deccan Volcanic Province are exposed in Kutch, Gujarat. These tholeiitic flows are characterized by Ni-Cu-PGE mantle –normalized plots similar to those of the Western Ghats described earlier. Both suites have very high proportion (99%) of Pt, Pd and Rh relative to Ir and Ru, and have been interpreted as highly evolved parental mantle melts. The alkaline intrusives in Kutch, Gujarat, however, have much lower PGE abundances than the tholeiite of the region. The Ni-Cu-Pd-Ir metal ratios in these alkaline intrusives compare well with the Hawai'i Ocean Island basalt. The average Pt/Pd ratio of the Kutch alkaline basalts is higher than that of Western Ghats tholeiite (0.79 vs. 0.47). In the Nir Wandh igneous complex of northern Kutch where the main ideologies are gabbro, pyroxenite and syenite, the pyroxenite is relatively PGE- rich unfractionated compared to the tholeiite.

Based on the geochemical features of the sulfide-bearing Noril'sk deposit, Keays and Lightfoot (2009) have suggested that assimilation of crustal sulfur is essential for economic mineralisation in Flood basalts. Although some the basal flows of the Deccan e.g. Bushe Formation, are known to be crustally contaminated, no economic mineral deposits have been found. The Deccan flows are believed to have erupted at about 65 Ma (Baksi, 1988) over a short span of 1 million years. Such a high rate of lava extrusion might have prevented significant crustal sulphur assimilation.

References:

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