Analysis of Platinum Group Elements and Gold in high grade mafic gneisses of Sri Lanka: Implications for mineralizations

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Gold (Au), copper (Cu) and Platinum Group Elements (PGE: Re, Pd, Pt, Rh, Ru and Ir) strongly partition into sulfide melts, if a magma become sulfide saturated during its evolution. Hence separation of an immiscible sulfide melt can control the subsequent chemical evolution of these elements in the host magma. As a result, escape of a sulfide-saturated melt may form a mineralized zone hidden within the rock unit, which could be detected geochemically by abrupt depletions of chalcophile elements. Therefore, such geochemical anomalies should be treated as indications of 'hidden' mineral occurrences. Thus in this study, mafic meta-igneous rocks of Sri Lanka are analysed geochemically using Au, Cu and PGEs in order to explore calcophile element bearing mineral deposits within the basement of the Highland Complex.

The whole-rock PGE concentrations were measured using an ICP-MS. The Ni-sulfide fire assay-isotope dilution method used 2–5 g of sample powder mixed with Ni, S, and sodium borax powder in a porcelain crucible. A mixed spike solution of PGE (^{105}Pd, ^{185}Re, ^{191}Ir, and ^{195}Pt) was added to the mixture and fused in a preheated furnace at 1,100 ºC for 30 min. After quenching, the Ni-sulfide beads were collected and dissolved in HCl. The solution was filtered and dried down to approximately 100 µl, then diluted with 2 % HNO_3 for analysis.

The ratio of Au/Pd is regarded as an indicator of sulfide saturation in evolving magmas since Pd partitions preferentially into sulfide melt relative to Au. Therefore, if silicates melt becomes sulfide-saturated, a rapid increase of the Au/Pd ratio will result. In the analyzed samples, Au/Pd gradually increases with decreasing MgO content. This feature implies that the variation of PGE and Cu in the studied samples is controlled by the progressive segregation of an immiscible sulfide melt. Further, our results show a bi-modal distribution of PGE in the studied rocks. Accordingly, sulfide saturation in parental magmas of the studied samples is inferred and probably this may indicate a segregation of an immiscible sulfide melt. Therefore, a calcophile-element mineralized zone may exist hidden within the Highland Complex of Sri Lanka. Further studies are underway to understand the detailed characteristics and extent of the mineralized zone.

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