OS ISOTOPES REQUIRE CRUSTAL SOURCE FOR SULFIDE ENRICHMENT IN PROTEROZOIC ANORTHOSITE COMPLEXES

HANNAH, Judith L. and STEIN, Holly J., AIRIE, Colorado State University, Fort Collins, CO 80523-1482 USA

Economic or potentially economic concentrations of sulfide ores have been described in at least four Proterozoic anorthosite complexes (PACs): (1) the Okiep district, Koperberg anorthosite suite, Namaqualand, South Africa, (2) the Voisey's Bay deposit, Nain plutonic suite, Labrador, Canada, (3) the Babbitt deposit, Duluth complex, Minnesota, USA, and (4) several deposits in the Suwalki anorthosite suite, northeastern Poland. Sulfide concentrations are also described in the Rogaland suite, southwest Norway. Re-Os data are now available for three of these, and in each case document significant input of crustal material as reflected in high gamma Os values, from about +400 to over +1000. In each case, the crustal Os signature is corroborated by Nd and Sr isotopic data. Major sulfide accumulations have not been identified in most well-studied PACs; while these apparently sulfide-poor systems may also show evidence of crustal assimilation, the isotopic shifts are less extreme. Sulfur isotopic data, available for three sulfide-bearing systems, are variable and reflect mixing of primitive and crustal sulfur sources. We propose that sulfide ores associated with PACs may form in one of two ways: (1) direct melting of sulfides in a mafic, crustal source for the anorthositic magma, or (2) assimilation of crustal sulfide accumulations during ascent of a mantle-derived anorthositic magma. The relative rarity of sulfide deposits in PACs reflects the requirement of fortuitous overlap (#1) or intersection (#2) of the anorthositic magmatic system with pre-existing crustal sulfide accumulations. Os isotopic data offer a potential exploration tool for fingerprinting sulfide-enriched PACs.