

Mafic-ultramafic intrusions and related Ni-Cu-PGE deposits in the northern part of the Fennoscandian Shield

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In the northern part of the Fennoscandian Shield, magmatic Ni-Cu-PGE deposits are associated with ultramafic-mafic magmatism generated at four stages, ca. 2.82 Ga, 2.45-2.50 Ga, 2.06 Ga, and 1.98 Ga, with all of them thought to be related to mantle plume events. The parental magmas of the ore-bearing intrusions or lava flows vary from komatiites to high-siliceous magnesian basalts and ferropicrites.

In this presentation, most peculiar features of the Ni-Cu-PGE deposits are discussed. For example, their base and precious metal tenors and Pd/Pt show a very wide variation. At the other end, ultrahigh Ni of more than 40 wt% in the sulfide phase has been recognized, which is reflected in the presence of a mineral paragenesis containing pyrite, millerite, and pentlandite. In some deposits, this seems to be the result of post-magmatic oxidation of sulfides and related sulfur loss whereas in some others, it is more likely a primary feature linked to an exceptional high Ni content of the magma.

Recently, multiple sulfur isotope analyses have provided a useful tool for detecting evidence for assimilation of external sulfur during ore formation. Consistent with the occurrence of mass-independent sulfur isotope fractionation (MIF-S) exclusively in pre-GOE (Great Oxygenation Event) sedimentary rocks, Archean komatiite-hosted Ni-Cu deposits in the Kuhmo greenstone belt show various levels of MIF-S, whereas no signs of MIF-S have so far been observed in Paleoproterozoic Ni-Cu deposits, such as Pechenga or Lomalampi, though it does not rule out contamination with Paleoproterozoic sedimentary sulfur.