Geochemical Characteristics of Orogenic Nickel Sulphide deposits

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Orogenic nickel sulphide (NiS) deposits are becoming recognized increasingly as a sub-class of orthomagmatic mineralisation; with Aguablanca (Spain), Giant Mascot (Canada), Moxie (U.S.A.), the Jilin Province (China) and the Riwaka Complex (New Zealand) all examples. Through comparison of the geochemical data available, common processes between Aguablanca, the Jilin Province and the Riwaka Complex have been identified that may have driven mineralisation in these deposits.

These deposits are all low tonnage with the sulphides occurring as high-grade enigmatic horizons and magmatic pipes. The common sulphide minerals observed are pentlandite, pyrrhotite and chalcopyrite with minor platinum group minerals. The mineralisation is associated with primitive lithologies such as pyroxenites and melagabbros with no clear link to crustal sulphur addition.

Comparison the of the rare earth elements indicates melting in the three deposits was initiated in the garnet stability field with all rare earth element patterns having light rare earth element enrichment relative to the heavy rare earth elements.

The available Nd isotopes for Aguablanca, The Jilin Province and the Riwaka Complex indicate a common parental magma source, with variable degrees of contamination. The Aguablanca samples indicate a stronger influence from crustal contamination than the Riwaka Complex and the Jilin Province.

Melting models based on the REE's of pyroxenites suggest significant melting in the spinel bearing fields for the Jilin Province and Aguablanca. The Riwaka Complex displays melting sources both from spinel and garnet bearing fields, with mineralised samples containing greater spinel melting components. The primary magma for the Riwaka Complex reflects a higher degree of partial melting (>10%) with the Jilin Province and Aguablanca both being comparably lower (5-1% partial melt).

The differences in mineralisation grade between these deposits may be a reflection of the different source components, melting and crustal contamination.