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Mantle derived economic sulfide mineralization?

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Sulfide ores of the unique Pt-Cu-Ni Noril'sk deposits are characterized by heavy sulfur isotopic composition (d34S = 6-18 ‰ ; Grinenko, 1985). These data are traditionally explained by the crustal contamination of the mantle melts by Devonian sedimentary rocks with anhydrites at certain depths or in a chamber of crystallization (Naldrett, 1992; Li et al., 2009). However, data on the distribution of major and trace elements and isotopic composition (their eNd, 87Sr/86Sr, d34S) in the contact zones of the intrusions with the host rocks are at variance with any significant in-situ contamination. Moreover , the mechanism of the "digestion" of this high-temperature material (Tm = 1430ºC) by the lower temperature magma (1250ºC) has never been analyzed and questioned. Our pioneering data on the sulfur radiogenic isotopes in the anhydrite are in conflict with the hypothesis that this mineral could serve as a sulfur source for the Noril'sk ores. The fact that the average composition of the intrusions is independent on the stratigraphic setting of these intrusions, which can be hosted by limestone, sandstone, and/or basalt, provides further support for the idea that no assimilation took place at the depths of the chambers in which the melts crystallized.The reason for the heavy sulfur isotopic composition of ores in the Noril'sk district is still uncertain.

Last data obtained on the sulfur isotopic composition of basalts and ores from some intrusions in the Taimyr Peninsula likely provide a clue to this problem. The highest d34S values in rocks of all of the trap formations were detected in the Gudchikhinsky picrites (d34S = +8,7; Ripley et al., 2003) formed from a primitive mantle magma. They are geochemically similar to the rocks from the Dyumtaleysky Massif (d34S = 12.2; Krivolutskaya and Gongalsky, 2013) which crystallized from a primitive mantle-derived magma (with no Ta-Nb and Pb anomalies and high Gd/Yb ratio) too. This intrusion comprises economic important sulfide ores with geochemical and mineralogical characteristics similar to unique Noril'sk deposits – Talnakh, Okty'abr sky and Norilsk 1. The features of the Dyumtaleysky massif can be explained by its origin from an unusual sulfide-bearing mantle source that had sulfides through earlier crustal-mantle interaction.

These data support that the mantle source of magmas in the Noril'sk district was enriched in the heavy sulfur isotope. It is the age difference that could be responsible for the unusual composition of the Noril'sk ores, because the mantle source in the Early Mesozoic was remarkably different from that in the Proterozoic one, when practically all Cu-Ni deposits worldwide were produced.