

A LA-ICP-MS study of the massive sulfides from the Noril'sk-Talnakh mining district: Implications for the behaviour of Te, As, Bi, Sb and Sn during sulfide liquid evolution

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Platinum-group elements (PGE) can occur within base-metal sulfides (BMS), or as platinum-group minerals (PGM) [1]. Typically, PGM consist of PGE and one or more of the elements: Te, As, Bi, Sb or Sn (TABS). Despite the common presence of TABS in PGM, little is known about the potential role of TABS in collecting PGE. In order to assess their role, we have carried out a LA-ICP-MS study of the distribution of TABS in BMS from Noril'sk-Talnakh massive ores [2]. These BMS were chosen because they record the crystallization history of sulfide liquid from Cu-poor ores, which represent the first sulfides to crystallize, to Cu-rich ores, which represent the last sulfides to crystallize. The BMS from Cu-poor ores have low concentrations of TABS, whereas BMS from Cu-rich ores are richer, reflecting the increase of the TABS in the fractionated liquid. Mass balance calculations show that most of the Te, Bi and Sn are within the BMS in the Cu-poor ores, whereas only 50% of these elements are found in BMS in the Cu-rich ores. In both ore types, discrete PGM account for the balance of Pd, Pt and TABS. We propose that the Cu-poor ore consists of early formed BMS accumulates, with sufficiently low concentrations of TABS to be accommodated in the BMS, and a small amount of primitive liquid component, not yet enriched in TABS. In contrast, the Cu-rich ore contains more of the TABS-rich fractionated liquid component. Therefore, PGM crystallize from this fractionated TABS-rich liquid in Cu-rich ores.

[1] Barnes and Ripley (2016) Reviews in Mineralogy and Geochemistry 81, 725-774. [2] Duran et al. (2017) Ore Geology Reviews 90, 326-351.