Phase relationships in the system PtS-PdS-NiS: Summary of previous results and new X-ray diffraction data

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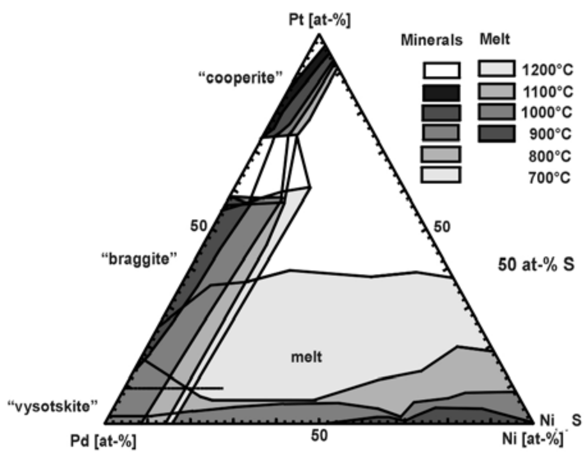
Data and Sample Sources

Phase relationships in the dry system PtS-PdS-NiS (i.e. at metal:sulphur ratio of 1) at 700°C, 800°C, 900°C, 1000°C, 1100°C, and 1200°C have been shown by Verryn & Merkle [1] in an experimental investigation (Fig. 1). In natural examples as in the platinum-group element ores of the Bushveld Complex [2-5], of the Stillwater Complex [6, 7] and of Noril'sk [8], cooperite, braggite, and vysotskite display a distinct compositional variation in which the Pt/Pd ratio and the Ni content can vary significantly and will be shown.



Results

Comparative results of analytical techniques such as Raman spectroscopy, electron microprobe analysis as well as new X-ray diffraction data will be presented.

[1]Verryn & Merkle (2002) *Can. Mineral* **40**, 571–584. [2] Kingston & El-Dosuky (1982) *Econ. Geol.* **77**, 1367–1384 [3] Mostert *et al.* (1982) *Econ. Geol* **77,** 1385–1394 [4] Kinloch (1982) *Econ. Geol* **77**, 1328–1347 [5] McLaren & De Villiers (1982) *Econ. Geo.l* **77,** 1348–1366 [6] *Todd et al.* (1982) *Econ. Geol* **77**, 1454–1480 [7] Volborth *et al.* (1986) *Can. Mineral* **24,** 329–346 [8] Genkin & Evstigneeva (1986) *Econ. Geol* **81,** 1203–1212.

Fluid-rock interaction in hydrothermal system at Kärdla impact structure, Estonia

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Meteorite impact induced hydrothermal (IHT) alteration is a specific type of hydrothermal process that has been recognized at numerous terrestrial impact craters varying in size and composition [1]. Kärdla impact structure (D=4km; 58º58´40´´N, 22º46´45´´E), one of the best-preserved and well-investigated impact structures of its size [2], serves as a type model for IHT activity [3,4] in small-to-medium sized complex impact craters at marine targets. The mineralogical, geochemical and stable isotope studies of the structure suggest three stages in the IHT evolution, characterized by different fluid-state conditions, temperature, alteration type and mineral phases [5].

Mineralogical characteristics of the IHT alteration in Kärdla correspond to the K-series during the initial stages, which then evolves into Ca-Mg-series in last stage of the cooling. Rapid precipitation of K-feldspar during the first stage suggests rather high pH (>8) of the circulating fluid. At the later stages the pH of the initial fluid was lowered, but remained high enough (>7) to promote the II type of K-feldspar and carbonate mineral precipitation. Due to interactions with aluminosilicate minerals the fluid became gradually enriched in respect to Ca-Mg. Precipitation of calcite/dolomite was controlled by the availability of Ca- and Mg-ions in the convecting fluids. The calcite I precipitated from a supersaturated solution, which resulted in an efficient removal of Ca, thus, allowing the precipitation of dolomite. Calcite II precipitation was initiated after removal of Mg by dolomite formation. At the final stage, precipitation of sulfides, Fe-oxyhydrates and calcite III occured likely at temperatures close to the ambient conditions.

Compared to volcanic hydrotherms, IHT mineralization in Kärdla was apparently richer in dissolved oxygen, but not necessarily oxidative, and low in reduced compounds.

[1] Naumov (2005) *Geofluids* **5**, 165-184. [2] Puura *et al.* (2004) *MAPS* **39**, 425-451. [3] Jõeleht *et al.* (2005) *MAPS* **40(1)** 20-32. [4] Versh *et al.* (2006) *PSS* **54**, 1567-1574. [5] Versh *et al.* (2005) *MAPS* **40(1)** 3-19.