Sub-microscopic phases in the Bon Accord Ni ore body, Barberton, South Africa

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The Ni enrichment (>30% whole rock NiO) of the Bon Accord oxide-silicate body has been ascribed variously to extraterrestrial[1] or deep mantle[2] sources. Bon Accord is also enriched in the PGE, and particularly so in the chalcogenides As and Sb: the concentration of Sb reaches levels $>10^4$ times chondrite in the central part of the body.

Ten new minerals, mostly the Ni end-members of common silicates or oxides, were identified by de Waal[1], but the host minerals for the enriched trace elements are unknown. We conducted a high resolution EMP investigation in order to gain a better understanding of the trace element enrichment. The major minerals in the sections studied were trevorite ($NiFe_2O_4$, i.e. the Ni equivalent of magnetite) and the Ni end-member olivine, liebenbergite (Ni_2SiO_4), extensively altered to its serpentine, nepouite.

Our research revealed that many trevorite crystals contain melt inclusions varying between <1–10 μm in size. They have sharp negative crystallographic outlines and appear to be primary inclusions. Their morphology is compatible with formation as a result of phase separation caused by decompression heating. The major elements in the inclusions are Fe, Ni and O, with Fe/Ni = 10, as opposed to the host rock for which Fe/Ni ~1.

The liebenbergite contain a myriad of Ni-As-Sb phases with size generally <30 μm. Ni concentrations vary between 15–74%, Sb between 10–80% and As between <1–20%; Fe and S are sometimes present in minor (<1%) amounts. In 2 cases <1μm nuggets of a Ru-Ir phase were found either at the crystal boundaries or enclosed within the crystal.

The most common composition is Ni = 71.00±0.94%, As = 17.29±1.06% and Sb = 10.88±0.72% (ave. of 40 analyses). Sb and As vary inversely, indicating that they enter into the same lattice position. The chemical formula of this mineral is thus suggested to be $\mathbf{Ni_7(As,Sb)_3}$. This does not correspond to any known Ni, Sb or As minerals, nor is it a pseudomorph after any Fe or S minerals. We suggest that this Ni-arseno-antimunide is a new mineral species.

References

[1]De Waal S. (1979) *Trans Geol Soc SA* **82**, 335-342.
[2]Tredoux M., de Wit M.J., Hart R.J., Armstrong R.A., Lindsay N.M. and Sellschop J.P.F. (1989) *J Geophys Res,* **94 (B1),**795-813.