

The occurrence of platinum-group element and gold minerals in the Bon Accord Ni-oxide body, South Africa

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ABSTRACT

Two samples from the enigmatic Ni-oxide body of Bon Accord (Barberton greenstone belt, South Africa) have been investigated with the hydros separation technique to obtain heavy mineral concentrates. The concentrates contain abundant Pt, Pd, and gold minerals never reported before from the Bon Accord Ni-oxide body. The grains occur as: (1) minute inclusions (<3 μm) in trevorite (ideally $\text{NiFe}^{3+}\text{O}_4$) and (2) larger (5–70 μm) free aggregates liberated from the host phase. The first group comprises several PGM compounds of Pd-Sb, Pd-Sb-As, Pd-Cu-Sb, Pt-Sb, Pt-As-S, Ru-As-S, Ru-S, along with free grains of Ni-Fe-As. The second consists of sperrylite (PtAs_2), members of the sobolevskite-kotulskite series, and electrum. These results are in good agreement with previous analyses of PGE-Au in bulk rock. Paragenetic relationships indicate that the PGM and electrum are of secondary origin, probably generated during low-temperature metamorphism of the Ni-rich mineralization. They have a terrestrial origin and are related with a low-sulfidation regime that usually accompanies hydrothermally driven serpentinization of mafic-ultramafic bodies. The ligands in the newly formed PGM (As, Sb, Bi, Te, and O) probably proceed from the same source of the hydrothermal solutions. In this model, the metals Ni-PGE-Au were original components of the primary mineral assemblage of the Bon Accord precursor, whereas As, Sb, Bi, Te, and O might have been contributed by the metasomatizing fluids, during near-surface evolution of the ore body. The data on the high-grade heavy mineral concentrates, obtained by hydros separation, have provided new knowledge about the mineral department of Pd, Pt, and Au.

Keywords: Platinum-group minerals, gold minerals, Bon Accord Ni-oxide body, hydros separation, heavy mineral concentrate, Barberton greenstone, South Africa