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Discovery of PGE in the Neoproterozoic sediment-hosted stratabound Cu-Ag deposit in the Kalahari Copperbelt, NW Botswana

Piestrzyński, A.¹, Wendorff, M.¹, Letsholo, M.^{1,2}, Mackay, W.²

¹AGH University of Science and Technology, Faculty of Geology, Geophysics and Environmental Protection, Mickiewicza Ave. 30, 30-059, Krakow, Poland, piestrz@geol.agh.edu.pl

²Discovery Metals Botswana; PO Box AB156, ABC, Gaborone, Botswana

This paper presents the first results on the PGE-bearing mineral occurrences in the Ghanzi Group strata recorded in the Boseto Exploration Area near the Ngami Lake, at the SE margin of the Damara Belt in Botswana. The discovered mineralisation of platinum group minerals (PGM) is hosted in the lowest part of the D'kar Formation, a part of the rift-related Neoproterozoic-Lower Palaeozoic Ghanzi Group metasedimentary succession hosting copper-silver mineralisation [1]. The mineralisation occurs at a redox boundary between reddish meta-arenites (the Ngwako Pan Fm.) and the overlying grey to greenish meta-pelites containing subordinate calcareous interbeds (the D'kar Fm.). The maximum age of the mineralisation is estimated at ca. 780-800 Ma, but the upper age bracket remains unknown [2]. Our investigations were inspired by the discovery of economic concentrations of Au and PGE in the Polish Kupferschiefer, especially as it is considered that the Permian Kupferschiefer and the Neoproterozoic deposits of the Kalahari Copperbelt show remarkable similarities [2, 3].

The PGM in the D'kar Formation (identified in one borehole) are associated mainly with molybdenite, bismuth-bearing minerals and copper sulphides. The combination of reflected light microscopy and SEM-EDAX analyses revealed a presence of Pd-Hg tellurides occurring together with molybdenite and Bi-bearing minerals forming a veinlet cross-cutting a larger quartz-calcite vein. The BSE image shows two mineral phases of diversified chemical composition with concentrations of Pd and Hg reaching maxima of 45.82 wt. % and 21.41 wt. %, respectively. The metalliferous mineralisation in the Ghanzi Group strata includes two generations: older Cu-sulfates; and younger Pd-Bi-Te mineralisation. Their relative age is documented by younger chalcocite cross-cutting an older molybdenite grain that was identified next to Pd-Hg tellurides. This age relation reflects two successive episodes of hydrothermal mineralisation, the younger of which introduced PGMs. Pd-Hg tellurides occur together with molybdenite, bismuth-bearing minerals and copper sulphides in veinlets rich in organic matter. The identification of this association reveals the potential of the Ghanzi Group for vein-hosted occurrences of precious metals. Together with copper sulphide mineralization, silver mineralization (stromeyerite) was identified. This observation confirms similarities between the Boseto area and the world-class copper-silver deposit in the Polish Permian/Kupferschiefer strata of the Fore-Sudetic Monocline [4]. PGM in the Ghanzi Group are represented by kotulskite, potarite and temagamite and hosted by a veinlet cross-cutting a larger quartz and calcite vein containing organic-rich matter [3]. A similar position of precious metals in relation to the redox boundary was described from the Permian copper deposits in Poland. A noble metals association found in the oxidised part of the Kupferschiefer and in the underlying oxidized sandstone strata is hosted by Pd-arsenides, diarsenides, Bi-Pd alloys and M-Te-Se minerals [4]. In both deposits, the copper mineralisation was influenced by change in the oxidation state within the sedimentary sequence. Sulfur isotope values in the samples from the Boseto area in Botswana are more or less similar to those

recorded in most of the samples from the Polish Kupferschiefer, which display a wide range of values from -26 to -40 ‰ indicating precipitation of the majority of sulphides from a solution containing metals, with simultaneous reduction on the contact with a geochemical barrier containing sulfur derived from organic matter.

References:

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