Lithological and structural controls of gold mineralization of the MEM2 deposit in the Murchison Greenstone Belt, South Africa

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The major gold and antimony deposits of the Murchison Greenstone Belt (MGB) in South Africa are aligned along the Antimony Line, a subvertical, brittle-ductile shear-zone corridor that can be traced for some 13 km along its easterly strike in the central parts of the MGB. Mafic and ultramafic lavas and minor intercalated metasediments dissected by the Antimony Line have been locally overprinted by a pervasive silicification, carbonatization and sericitization, which is associated with the gold and antimony mineralization.

This study reports the results of detailed mapping, sampling and 3D modelling of the MEM2 deposit along the eastern extents of the Antimony Line. The study further integrates detailed petrographic work aimed at identifying the paragenesis of disseminated gold mineralization revealed by deposit-scale structural and lithological 3D modelling. Present results suggest gold mineralization to be controlled by subtle lithological variations. Disseminated gold mineralization is primarily associated with pyrite and arsenopyrite that is mainly concentrated in quartz-carbonate schists (former metasediments) that are enveloped by talc-chlorite schists (former mafic volcanics) and spatially closely associated late-tectonic mafic dykes. The relative rheological contrasts between weaker talc-chlorite schists (ductile) enveloping more rigid quartz-carbonate schists (brittle-ductile) resulted in a pronounced strain partitioning within the layered sequence. Gold-sulphide mineralization largely confined to the brittle-ductile quartz-carbonate schists suggests that fracture permeabilities in the more rigid domains preferentially controlled fluid flow and mineralization.

On a broader scale, the MEM2 deposit spatially coincides with the deflection of the regional and deposit-hosting ENE-WSW trending schistosity along a massively-developed fuchsite-quartz-carbonate plug to the immediate north. The kinematics and 3D geometry of this structural setting is the subject of further field mapping and 3D modelling.

Overall, the MEM2 deposit serves as a case study into the styles and controls of gold mineralization along the Antimony Line, integrating relevant observations from a regional-, mine- and microscopic-scale, to effectively guide exploration.