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VMS exploration in Oman

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Abstract

Copper and gold were critical metals that helped build Middle Eastern civilizations during the Bronze Age and the Magan area in modern Oman was one of the important sources. Ancient mining was limited to oxide and supergene enriched zones of mainly Cyprus-type VMS deposits derived from basalt-hosted obducted Tethyan seafloor crust emplaced during the Cretaceous over the Arabian Palaeozoic-Mesozoic oil-rich carbonate platform.

Modern multinational exploration from 1970-2000 discovered 44Mt at 1-2% Cu in the Sohar region including the Lasail, Yanqul and Ghuzayn deposit groups, but only 15Mt of Cu ore in the Lasail district was mined by government entity OMCO to 1994, and then about 0.5Mt gold ore at 5g/t was open cut mined from two of the Yanqul deposits. However due to the small size and low grade of these individual deposits the Government and major international miners considered the local industry had a limited future.

Since 2000, mainly local companies (Mawarid) and junior expat JV partners (Gentor) discovered about 25Mt of 1.5% Cu in twelve new ophiolitic deposits, of which Mawarid from 2007- 2013 have mined out 6.6Mt at 2.5%Cu in the Hatta, Shinas and Safwa deposits. Ongoing mining is being conducted at Mandoos and the Ghuzayn UG deposits are scheduled for development.

Due to the excellent mountainous exposure of the Semail Ophiolite all the usual exploration techniques have been successful except drainage geochemistry due to the alkaline groundwater. Airborne geophysics–VTEM and magnetics have been the main discriminators in shallow cover, whilst footwall alteration mapping and gossan recognition are most effective in outcropping areas.

Recent petrochemical research has led to revision of the mineralised pillow basalt stratigraphy and recognition that apart from the primary VMS ore position at the top of the MORB V1 volcanics, the off-axis more evolved and possibly subduction related V2 volcanics contain a range of positions that host gold enriched deposits. This improves the potential for further discoveries because relatively little exploration has been focussed on the V2 sequences.

Key exploration criteria include recognition of geochemically anomalous exhalative seafloor sediment positions related to local volcanic centres, and mineralisation structural controls such as synvolcanic growth faults in hydrothermal upflow zones that typically have an IP and magnetic expression.

VTEM appears to recognise MS deposits down to 150m depth in resistive terrain but much less under conductive cover, so discovery of new blind deposits at depths >200m and under shallow cover needs to be achieved by more focussed ground and downhole geophysical surveys and targeted stratigraphic drilling.