SEG 2017 Conference

Primary silver mineralisation from the Manuka MVT deposit, Cobar Basin, central New South Wales, Australia

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The Manuka Ag-Pb-Zn deposit is a low-grade carbonate-hosted deposit similar to Mississippi Valley Type (MVT) mineralisation. The deposits (Manuka, Boundary and Boundary South) are located ~ 85 km southwest of Cobar, central New South Wales, Australia. Current estimated resources are 59.9 Moz Ag @ 45 g/t Ag and 0.5% Pb. The deposits are located on the western Winduck Shelf of the Cobar Basin, an intra-cratonic basin located within the Palaeozoic Lachlan Orogen. The Winduck Group (U/Pb age of 412±6 Ma) which hosts the Manuka deposits, outcrops along the Winduck Shelf, varies in thickness from 500m to 1500m and comprises 3 main lithostratigraphic units, the Buckambool Sandstone, Sawmill Tank Siltstone, and Gundaroo Sandstone. The Booth Limestone Member, the main host of mineralisation, forms part of the Gundaroo Sandstone, represents a period of distal marine sedimentation, and unconformably overlies the Thule Granite (U/Pb age of 427 ± 3.1 Ma). The Manuka deposits represent one of only two sediment-hosted Pb-Zn-Ag deposits (the other being Endeavor, previously called Elura) within the Cobar Basin, an area better known for high-sulfide base metal (Cobar-type) and volcanic associated massive sulfide deposits.

Silver is associated with most mineralisation styles in the Cobar Basin. Primary sulphide mineralisation occurs in two assemblages within the Booth Limestone Member at Manuka: 1) Pyrite-dominant mineralisation hosted by black calcareous shales immediately above the carbonate sequence; 2) Galena and sphalerite hosted by fossiliferous dolomitic limestone.

The only primary silver mineral found at Manuka is acanthite, typically associated with or forming rims around galena and always last in the paragenesis of the sulfides hosted by the fossiliferous dolomitic limestone. The Ag-Pb-Zn with rare Cu mineralisation is typically expressed through one main continuous epigenetic hydrothermal assemblage of fine-grained galena (I), chalcopyrite, low-Fe sphalerite, massive galena (II), acanthite, anglesite, and covellite. Early diagenetic framboidal pyrite (I) in both host rocks (calcareous shale and fossiliferous dolomitic limestone) recrystallised to form pyrite (II) and marcasite. The abundance of framboidal pyrite (I) is more prominent at the Boundary pit where it occurs in distinct framboidal pyrite-rich bands, while at Manuka and Boundary South Pits, framboidal pyrite (I) is typically disseminated irregularly throughout the host.

Acanthite at Manuka contains considerable Pb (up to 2.76%), Hg (up to 0.13%), In (up to 0.11%) and Cu (up to 1.68%). Galena has a Ag content of 750ppm to 1625ppm while Sb ranges from 884ppm to 5884ppm. No As, Bi and Hg were detected. Sphalerite is characterised by a low Fe content (up to 1.03%), and minor amounts of Ag (up to 197ppm), Pb (up to 0.14%), In (up to 0.16%) and Cu (up to 938ppm). Pyrite (II) contains minor Ag (500ppm), Pb (up to 0.3%), As (up to 2.5%), Cu (up to 295 ppm), Sb (up to 0.3%), and Zn (up 0.12%). Pyrite (II) also has variable

Co/Ni ratios from 0.6 to 2.7 consistent with pyrite of sedimentary (average Co/Ni ratio of 0.63) or hydrothermal (average Co/Ni ratio < 5) origin. Due to its extremely fine-grained nature, Pyrite (I) could not be quantitatively analysed.