Characterisation of gold mineralisation, Oberon prospect, Tanami region, N.T.

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ABSTRACT

Oberon is a relatively recently discovered gold prospect in the Tanami district approximately 600 km NW of Alice Springs, N.T. Petrographic, mineralogical and mineral chemical analysis of the gold-bearing horizons in drillhole TID0065 has characterised the mineralisation with particular emphasis on gold distribution.

Two mineralised horizons are identified. The 'Upper' zone contains semi-massive pyrite within a characteristic 'Boudin Chert' lithology and adjacent graphite schists. The 'main' mineralisation, towards the bottom of the drillhole, occurs within relatively low-sulphide calcareous turbidites of the 'Puck' sequence. The mineralogy of the gold mineralisation is simple. Arsenopyrite, pyrite and pyrrhotite are the dominant sulphides and occur both within multiple generations of quartz-carbonate veins and as disseminations in adjacent wallrock. There is widespread evidence for late sulphide recrystallization. Gold occurs as native gold. A population of fine-grained gold (1-10 microns) is seen within arsenopyrite, and more rarely in pyrite. 'Exotic' Au-bearing minerals such as Au-(Ag)-tellurides are not present.

Laser-Ablation ICP-MS analysis has established that invisible gold in sulphides plays a negligible role in terms of overall gold balance. 'Residual' gold concentrations in the central parts of arsenopyrite grains are no more than a few ppm; Au concentrations in pyrite are an order of magnitude lower still. There is, however, a marked enrichment in Au concentrations around the margins of arsenopyrite and in areas of intense fracturing and brecciation, with individual LA-ICP-MS spot analyses giving up to several thousand ppm. This enrichment can be readily linked to grain-scale gold remobilisation and reconcentration of lattice-bound gold during sulphide recrystallization. Using high-resolution Focussed Ion Beam – SEM imaging, this gold is revealed to occur as microfracture fillings and as fine particles and nanoparticles. This study is the first to demonstrate the presence of gold nanoparticles in an orogenic gold deposit.

The Oberon deposit is metamorphosed at middle greenschist facies and displays both lithological and structural control. Mineralisation at Oberon shows broad similarities with that at Callie, but also a number of differences. Pyrite chemistry in the 'Upper' mineralisation is subtly different to that in the "Main' mineralised level, leading to the conclusion that the former may represent authigenic (bacterially-mediated?) pyrite that formed in a euxenic or oxygen-starved environment. Such carbon- and iron-rich horizons provide a ready mechanism for gold precipitation from fluid via redox reaction. This contrasts with the clearly hydrothermal sulphide assemblage and associated chlorite alteration in the 'main' mineralised zone.