Discovery and exploration of the Oberon gold deposit

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Introduction

The Oberon orogenic gold deposit, ~28 km north of the Dead Bullock Soak Goldfield, previously known as the Titania prospect, represents a significant new gold resource in the Palaeoproterozoic Tanami Region (**Figure 1**). As of February 2024, Oberon has a measured, indicated and inferred resource totalling 2.7 Moz of gold and is the focus of ongoing exploration and resource development. The delineation of this deposit represents the culmination of over three decades of exploration by multiple exploration teams, developing the deposit from a low-order, single-point geochemical anomaly to a multi-million ounce gold resource, demonstrating the value of persistence of exploration of undercover but highly prospective domain.

Phases of exploration

Gibbons and Webb (1997) provide an account of the initial exploration and discovery of the Oberon prospect, which is summarized below. North Flinders Mines Ltd (NFM) identified the potential for economic gold deposits in the Tanami Region and commenced negotiations for exploration permits in 1979. The process was slow moving, allowing the exploration team to develop their target selection criteria and detailed exploration programs. This resulted in the NFM team developing a two-pronged exploration strategy. The first part of the strategy was designed to test highly prospective targets that had similar geophysical and geochemical attributes to other deposits in the region. The second part of the strategy was designed to test in a systematic fashion as much of the sand-covered terrain as possible, regardless of perceived prospectivity. This important second part of the strategy paid homage to the simple and pragmatic view that 'you don't necessarily know what you don't know'.

By early 1988, NFM received permission to explore their newly granted tenure and swiftly moved from planning to execution of a reconnaissance vacuum drill program across parts of the tenure entirely covered by aeolian, alluvial and lacustrine sediments. A 2 km × 1 km-spaced triangular drilling program over the Oberon exploration lease resulted in a single point, low order geochemical anomaly (bottom-of-hole 28 ppb Au, sub-aeolian soil BLEG 1.99 ppb Au). However, follow-up vacuum drilling was unable to penetrate through the paleochannel sediments and was adversely affected by water ingress. The project was then paused for the next five years whilst the team progressed the exploration of the recently discovered Callie deposit at Dead Bullock Soak (DBS).

In 1993, a RAB drill program, which was able to intersect bedrock at Oberon, defined an extensive (15 km^2) gold anomaly. The discovery RAB hole was drilled at the prospect in June 1994, intersecting 12 m at 2.5 g/t gold. Follow up aircore, reverse circulation and diamond drill programs targeted near-surface oxide mineralisation. By 1996, a modest gold resource of 344 000 oz was identified, with mineralisation primarily hosted in the South and North zones (**Figure 2**). In the late 1990s, the company turned their focus back towards developing the Callie Underground resource and the Oberon project stalled.

In 2002, Newmont purchased Normandy (formerly NFM), and the Oberon resource estimate was reduced by

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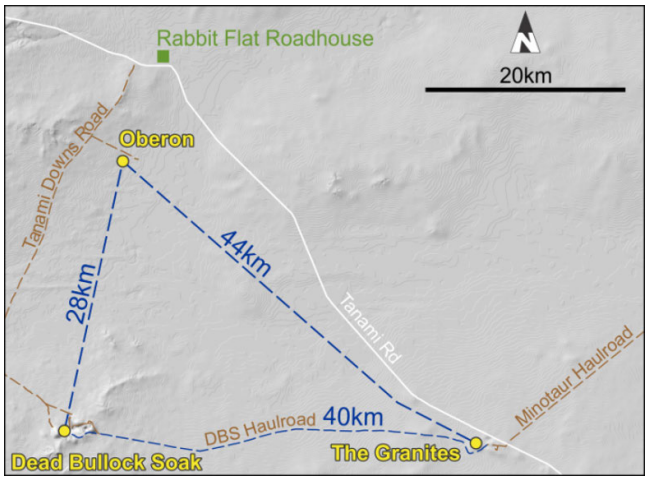

Figure 1. Location map showing the Oberon project relative to the Newmont Tanami Dead Bullock Soak underground operations and historic Granites open pit and underground operations.

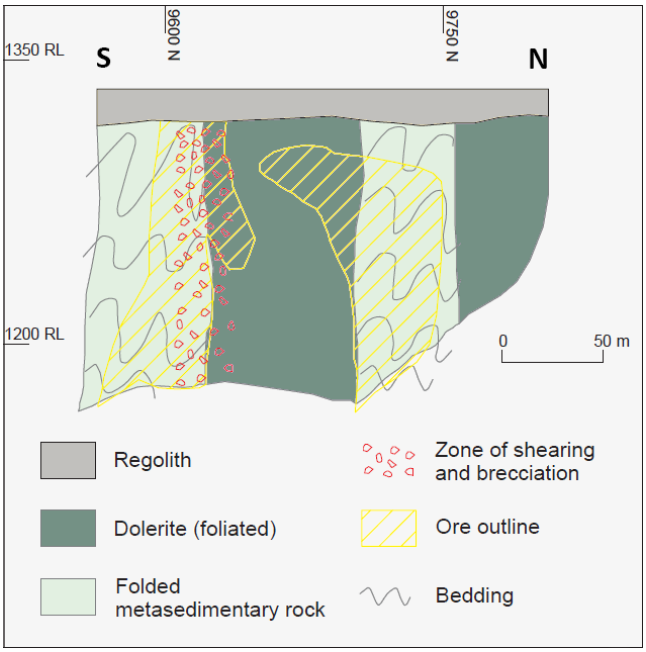

Figure 2. Cross-section from Wygralak *et al* (2005), after Gibbons and Webb (1997). 21250 mE section with southern and northern lodes modelled. Note mineralisation was interpreted to focus on the contact between the folded sedimentary rocks and dolerites.

59 000 oz resulting in a combined indicated and inferred resource of 285 000 ounces for the project. Newmont restarted drill programs in 2003 and over the course of two years, 24 shallow holes were drilled. These included a second series of reverse circulation holes that successfully tested the bedrock. The program tested only a small extent of the geochemical anomaly identified during the earlier RAB drilling, and there was no geological interpretation to support the large surficial gold and arsenic anomalies. The team wanted to answer the question originally posed by Gibbons and Webb (1997) as to how one interprets results of surface vs bedrock geochemistry samples. The decision was made to analyse the surface and bedrock samples against the regolith profile to better understand the gold and arsenic dispersion signatures. The final interpretation supported the location and extent of the Northern and Southern lodes and identified a stand-alone anomaly to the east and west of the east–west trending Oberon dome.

No significant further work was completed until 2009, when the first deep diamond holes targeted potential mineralisation below the defined open pit resource. From 2009 through 2012, a total of 25 holes (22.4 km of drilling) tested the underground potential. These holes confirmed that mineralisation continued to depth and defined three new lodes. The North and South lodes were also refined and shown to be sub-parallel to the steeply dipping north and south limbs of the Oberon dome, rather than subvertical. The newly defined central axis lode was modelled as near vertical and oriented along the axial plane of the dome. In addition, two new cross-lodes, striking from the southeast to the northwest, defined a new orientation to target with the exploration program. Unfortunately, like many projects, the global economics of 2012 to 2013 forced the team to tighten up their exploration efforts and focus on supporting the Callie Underground mine once again. Besides the shift in exploration focus, Oberon's 285 000 oz were also written off in 2013.

No exploration drilling was completed at the project between 2012 and 2017. During this time, newly developed surface sampling techniques paired with detailed ground geophysical surveys lent credence to the potential scale of the Oberon deposit. The exploration team reinterpreted the deposit model, and the result was a highly prospective target over more than 2 km of strike length. The cover sequence over the Tanami project area was causing difficulties with generating new targets. The team completed soil sampling using Newmont's proprietary deep sensing geochemistry (DSG) technique in 2015 to identify new targets below the cover sequence. This work defined a >3 km × 0.5 km zone of gold anomalism beneath transported cover, which extends from the Lamaque prospect in the western part of the area to the main Oberon deposit in the east. Arsenic anomalism was defined over a shorter strike length (~2 km) and more tightly focused above the Oberon deposit, following the axial trace of the mineralised anticline, which locally contains abundant arsenopyrite.

The focus of resource development activities at Newmont Tanami transitioned from the Callie Underground mine toward open pit opportunities at DBS and Oberon due to the ramp up of shaft construction activities at DBS. This change of focus supported Newmont restarting exploration at Oberon in 2019 with the objective of defining a broader open pit resource below the original oxide resource. Drilling targeted open pit mineable material in the partial oxide and fresh rock portions of the deposit from 2019 through 2022 and successfully defined a near-surface resource of 1.7 Moz of gold, with mineralisation open at depth. New drilling facilitated further development of the geological model and demonstrated that mineralisation is hosted within an approximately east–west-trending, doubly plunging antiformal culmination, localized in favorable stratigraphic units and along the margins of semi-conformable dolerite sills (eg Crawford *et al* 2024, Crawford *et al* in review). Mineralisation has been identified on both limbs and in the hinge of the anticline, but the bulk of known mineralisation is hosted in the southern limb position (previously termed the South Zone; **Figure 3**).

In 2022, diamond drilling tested between the -200 RL to the -450 RL to evaluate the underground potential of mineralisation on the southern limb. This steeply dipping

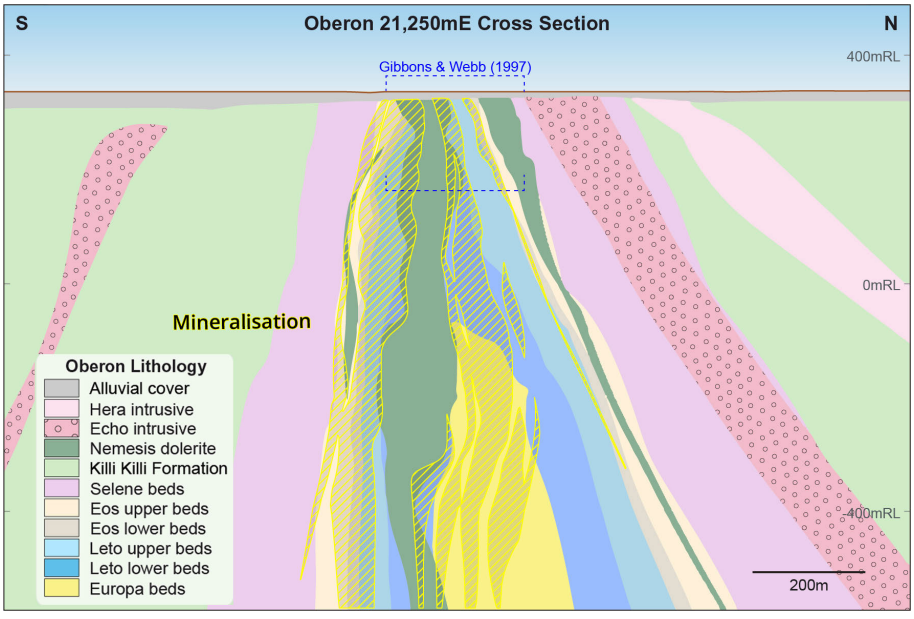

Figure 3. Cross-section from 2023, 21250 mE section with southern and northern lodes modelled. The lodes are focused along the contact between sedimentary rocks and dolerites, the central axis position of the Oberon dome and in the Lower Eos beds, which are high-iron host rocks.

mineralised zone was shown to be continuous with higher-grade intervals localised in favourable host units, such as the Lower Eos beds and Lower Leto beds. More positive results supported aggressive ongoing resource development in 2023. The deposit remains open at depth and down-plunge to the east and west. Drilling has intersected significant mineralisation up to 1000 m below surface.

At the time of writing this paper, the Oberon project is currently under study, with ongoing active exploration programs.

Unconventional exploration model

The NFM exploration team utilised a mature exploration approach that acknowledged limitations in understanding did not necessarily render an area unprospective. The Oberon deposit represented an unconventional target for the region, being hosted by non-magnetic stratigraphy lacking iron formation like that seen at Callie and The Granites. It is also notable that the prospect was initially defined by only a single point geochemical anomaly. It is a testament to the insight of the NFM explorers that they understood that the transported cover hosting hydromorphically remobilised gold might not yield the same tenor of geochemical anomalism as that seen in bedrock at other deposits. This combined approach has resulted in the identification of a significant new deposit that has opened up exploration space in the region away from the more commonly targeted magnetic stratigraphy of the Tanami Group.

Acknowledgements

The authors acknowledge the Warlpiri people, Traditional Custodians of the land on which the exploration activities were undertaken, and pay respects to their Elders, past, present and emerging. Many thanks to all the previous explorers who built the foundation of the Oberon deposit. Your passion and curiosity set the project in motion many decades ago. Great thanks to the Tanami Near Mine team; your hard work logging the +100 km of core, countless hours of interpretation and modelling is the reason Oberon exists today. Finally, thank you Tanami Core Shed team; you are truly the unsung heroes of this story with your tireless work of prepping and processing our core.

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