Lantern Project update – Evolution of the understanding of the mineralisation

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Overview

Kirkland Lake Gold Limited (KL) is a growing gold company operating in Australia and Canada that has produced 974 615 oz of gold in 2019, and is targeting 1 470 000–1 540 000 oz in 2020. Our production profile is anchored by two of the world's highest-grade, lowest-cost, gold mining operations: the Macassa Mine, located in Northern Ontario, Canada; and the Fosterville Mine, located in Victoria, Australia (Kirkland Lake Gold 2020). Added to these two high-grade underground projects was the acquisition in early 2020 of the Detour Lake mine, a large scale, open pit mine located in northern Ontario, Canada. A key driver of our success continues to be a commitment to exploration as shown by our solid track record for growing reserves and actively pursuing further value creation by investing in new projects where our growing capital base and expertise can be deployed to support the development and operation of new, economically attractive gold mines. The recent acquisition of the Detour Lake gold mine provides a third anchor operation by adding 600 000 oz of annual gold production, as well as adding substantial growth potential. The property has around 20 years of mine life and 15.4 Moz of ore reserves according to the latest Mineral Reserve statement.

KL has been actively exploring in the Northern Territory since the acquisition of Newmarket Gold in mid-2016. Exploration results for the Cosmo and Lantern Deposits, and more recently at Union Reefs and Pine Creek, were detailed in the 18 December 2019 press release (Kirkland Lake Gold 2019). The results highlight the exploration potential across the Pine Creek region, with significant intersections of 530 g/t Au over 0.4 m and 53.4 g/t Au over 2.0m at Union Reefs, and 16.1 g/t Au over 3.0 m and 9.7 g/t Au over 4.1 m at Pine Creek.

Lantern gold deposit update

The Lantern deposit is situated in the Howley Anticline, between two dolerite sills, and hosted in rocks of the Lower Koolpin stratigraphy, part of the South Alligator Group. The host rocks include variably metamorphosed metapelites, banded ironstones, carbonate rocks, and breccias, all of which broadly correlate through the Lantern Deposit. These are regionally metamorphosed to greenschist facies and further to amphibolite facies through subsequent contact metamorphism. Retrograde metamorphic mineral assemblages are also observed broadly, which are thought to be coincident with the hydrothermal events that generated the gold system across the moderately north-plunging anticline.

The Howley anticline runs north-northwest between the Mt Shoebridge fault on the west and the Burnside granitic emplacement to the east. Regional east-west compression regime and the uplift during the granitic intrusion have created the regional folded structural architecture with near upright folds for most of the Howley anticline except at its far northern Mt Paquilin area and far southern Cosmo mine area. Northwest-trending sub-vertical, strike-slip faulting is also present within the Lantern deposit with several faults showing small-scale dextral movements recorded in the order of 10s of metres.

What we have learnt

The understanding of the Lantern deposit has developed considerably since its discovery in 2016 as presented at AGES 2018 (Greenberger and Edwards 2018). The basics of the deposit were understood: structurally-controlled, bedding-parallel shears formed due to the competency contrast between the dolerite sills and metasedimentary package, with an observed correlation between cross-cutting structures and higher gold grades. Additional drilling during 2018–2019 has shown that mineralisation is also present over a vast area. The presence of the highly altered sericitic (green) and Fe-oxidised (bright red) host rock suggests late stage localized overprint, focused at higher elevations in the hinge zone. Mineralisation deeper in the mine is concentrated around a dolomitic siltstone unit, which provides a chemical mechanism for deposition, with late-stage pegmatite veins cross cutting mineralisation.

During 2019, underground development accessed the Lantern deposit, creating exposures over multiple levels for mapping, Maptek I-Site scanning, and sampling. With ongoing development, our understanding improved through the use of back to basics data collection combined with the latest technology, as discussed at AGES last year (Lower 2019). The extra information has helped subset the deposit into three similar but distinct mineralisation zones:

- stratigraphically controlled limb mineralisation
- stratigraphically controlled hinge mineralisation
- hinge related cross-cutting vein-style mineralisation.

Development and bulk sampling has focused attention on the hinge zone and has highlighted the existence of increased grades and widths due to the additional structural complexity. We found that, while mineralisation was continuous down the limb of the Anticline, the stratigraphically controlled veins were pinching and swelling within the host rocks, with variable levels of gold mineralisation at very local scales. Underground mapping was unable to identify a consistent vein structure across multiple faces; however, when digitized and scanned into 3D, the controlling structure was present and parallel with bedding as expected. Diamond drilling on a 50 m × 50 m and even 25 m × 25 m drill spacing identified the structures and allowed the construction of a 3D block model with a good quality statistical estimation; however, the drill spacing was not sufficient to provide a full picture of the variability of the stratigraphically-controlled limb mineralisation.

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Development towards the hinge has highlighted the importance of the structural complexity in elevating the gold mineralisation in the Lantern system. Very high grades were observed in fractures within quartz-carbonate-sulfide veins cross cutting stratigraphy in close proximity to the northwest-trending shears. Mapping of the development drives shows a direct correlation between areas of high grades, cross-cutting veins, large shear structures and parasitic fold geometries.

An academic study completed in 2019 (James 2019) has highlighted that several phases of mineralisation are present at the Lantern deposit; cross-cutting and overprinting relationships can identify discrete higher grade mineralisation events. Minor amounts of gold mineralisation occur in the early quartz and quartz-carbonate veins, with higher grade gold mineralisation intimately associated with native bismuth. Overprinting relationships show these veins post-date granite emplacement by cross cutting peak-metamorphic textures. There is a third, late stage, very high-grade mineralising event that is characterised by native gold within fractures in quartz veins proximal to shears.

Trial mining and underground development have highlighted the importance of understanding the geological controls on mineralisation in areas of structural complexity. Drilling and resource estimation can produce good quality statistical models; however, they run the risk of not being representative of the actual mineraliation extents where strong local controls have effect. Trial mining and batch processing continues at Lantern. It is an ongoing challenge for everyone involved to be better geologists, and highlights the fact that mapping, scanning, and structural interpretation are still required skills for successful mining in structurally complex environments.

References

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