The Pilbara's conglomerate gold

BY DR MICHAEL CUNNINGHAM, PRINCIPAL CONSULTANT (GEOLOGY), AND DR STUART MUNROE, PRINCIPAL CONSULTANT (GEOLOGY), SRK CONSULTING

Conglomerate-hosted gold has recently been discovered in the Pilbara region of Western Australia. These conglomerate-hosted discoveries represent a different style of gold mineralisation to deposits in other parts of the country and have been found over an extensive area, opening up an expanse of potentially prospective ground.

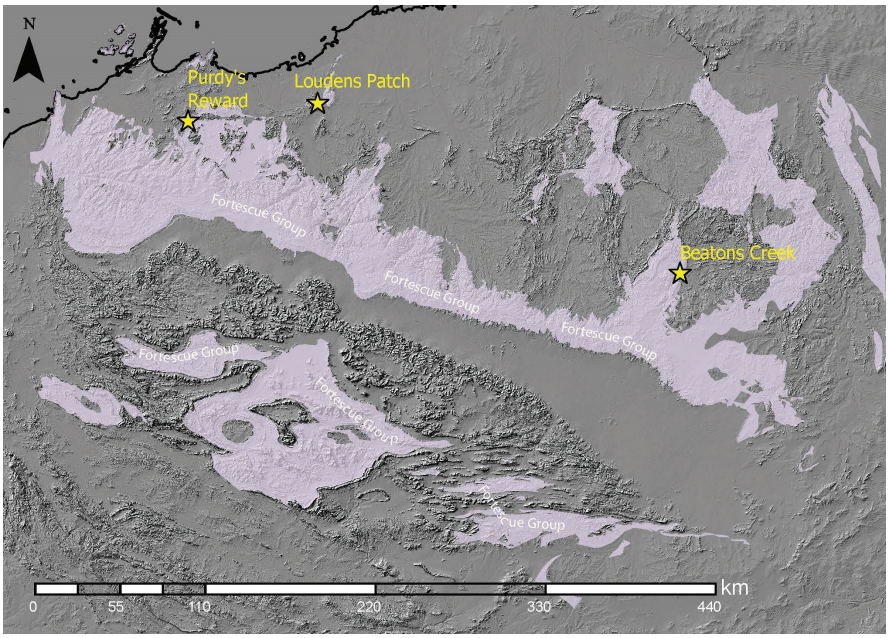
Some of the interest in this discovery is based on comparisons made between the Fortescue Group of the Pilbara and South Africa's well-known Witwatersrand (Wits) Basin.

Most of the conglomerate-hosted gold in the Pilbara has been recognised in the conglomerates of the Hardey Formation, which is at the base of the Mount Roe Basalt in the lower part of the Fortescue Group. This formation is of an equivalent age to the Ventersdorp Supergroup of the Wits in South Africa. The Ventersdorp Supergroup overlies and is slightly younger than the Central Rand Group and Western Rand Group, which host most of the gold in the Wits. Some conglomerate-hosted gold in rocks of similar age to the Central Rand Group has been discovered in the Pilbara, in the Lalla Rookh Basin, for example, but volumes are comparatively small.

The Pilbara and the Wits both contain conglomerate in similar age rock, which was deposited prior to the Great Oxygenation Event. The low levels of oxygen in the atmosphere at the time allowed detrital gold to be co-deposited with pyrite, graphitic carbon and uraninite.

The Wits is one of the most exposed and studied mineral districts in the world, owing to its very large historic gold endowment, and its lengthy exploration and mining history. For much of this history, the origin of the Wits gold deposits has been strongly debated. The debate is primarily divided between those in favour of a sedimentary gold deposition model – otherwise known as the placer theory – and those favouring a model of hydrothermal emplacement of the gold mineralisation at some time after the formation of the sedimentary succession; this is known as the hydrothermal theory.

Evidence from the Wits suggests that gold may have been affected by very localised remobilisation, which destroyed primary sedimentary gold grain features in some cases, leading to theories of hydrothermal rather than placer gold deposition. Understanding



Map of known distribution of the Fortescue Group, Western Australia


Conglomerate rock within the Hardey Formation

Lalla Rookh Sandstone Basin (age equivalent to the top of the Ventersdorp Contact Reef)

sedimentary features and controls on gold distribution have been the best tools for exploration. Numerous researchers and explorers have suggested a paleoplacer deposition model for the Wits and Pilbara conglomerate-hosted gold deposits. To date, no hydrothermal overprinting has been documented for any of the Pilbara conglomerate-hosted gold deposits.

The clasts in the reef conglomerates of the Central Rand Group mainly comprise siliceous material, and the succession is overall coarsening upwards due to uplift of the eroding Kaapvaal Craton (generally acknowledged as the source of the conglomerate), with continuous new sediment input rather than reworking of previously deposited material. At the level of the main mineralisation, the Wits conglomerates are regarded as mature, having been well sorted and rounded. By contrast, clasts in the Hardey Formation in the Pilbara are mostly mafic in character, and the sequence is interpreted to be comparatively immature. Mafic clasts are also dominant in the Pardo conglomerate-hosted gold deposits in Ontario, Canada. Another important distinction is the abnormally high background levels of gold in the Kaapvaal Craton compared to other source cratons.

Although these differences are relatively subtle, they have potential implications for gold deposition within the conglomerates under the placer model. The Wits deposits have a relatively 'high nugget', which is also expected to be the case for the Pilbara deposits. High nugget refers to the large statistical differences between closely spaced samples of the same material in the mineral system. The gold grade continuity in the Wits is reasonable, allowing variography and kriging to be used in developing mineral resource estimates of the Wits deposits. The same technique is now widely used in resource estimation of gold and other mineral deposits.

High nugget is a common problem in gold deposits and may be exacerbated in the case of the Pilbara deposits by the relative immaturity of the host conglomerates, but this has not been extensively tested. Early indications are that the Pilbara gold is coarse, producing the 'watermelon seed' gold grains that have recently been discovered. How these gold nuggets are formed remains a contentious topic, and a lot more work is needed to fully understand this phenomenon and the implications for sample assay statistics.

Because high-nugget mineralisation requires customised sampling approaches to address the statistical variance, work on the Pilbara conglomerate-hosted gold discoveries is still at the stage of solving these sampling issues to provide the data required for resource delineation. More work is required to determine the extent to which the nugget effect will influence the accuracy of resource estimation of Pilbara conglomerate-hosted gold deposits.

At the Pardo deposit in Ontario, a recent 985-tonne (dry) bulk sample of exposed pyritic conglomerate-hosted gold returned a head grade of 4.2 grams per tonne gold in a pilot plant program. The volume of rock excavated had an estimated average grade of 1.3 grams per tonne gold from 11 diamond drillholes[1], highlighting the variability with respect to sample grade in this style of mineralisation.

In conclusion, while there is no doubt that conglomerate-hosted gold is present in the Pilbara, the collective understanding of the mineralisation styles in the region remains incomplete, and any comprehensive comparisons with the Wits are relatively premature at this stage.

1 Inventus Mining Corp News Release, 3 January 2018