

Gold deposition in the Pine Creek Orogen – New wine, old bottles

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“It doesn’t take many observations to think you’ve spotted a trend, and it’s probably not a trend at all.”

Dan Kahneman, 2002 Nobel Laureate

Introduction

PNX Metals Ltd is a multi-commodity explorer and aspiring producer with a large landholding (5512 ha Mining Leases, 1528 km² Exploration Leases; **Figure 1**) in the Central Domain of the Pine Creek Orogen (PCO).

The PCO comprises two Palaeoproterozoic (2020–1863 Ma) volcanic-sedimentary rock successions separated by an unconformity. These successions were intruded by thick dolerite sills (Zamu Dolerite) and the combined package underwent complex deformation and metamorphism (ca 1855 Ma Litchfield Event) prior to intrusion by voluminous granite (1835–1820 Ma Cullen Supersuite; Ahmad and Hollis 2013). The PCO has been subdivided into three domains based on metamorphic grade, structural style, and composition of their dominant magmatic phases: the Litchfield, Central and Nimbuwah domains (**Figure 1**). The Central Domain is well exposed and known for a range of commodities including gold, uranium, tin and lithium. The known gold endowment exceeds 20 Moz. The PCO is a significant component of the North Australia Craton (NAC) and despite numerous more recent sedimentary basins covering and encapsulating the PCO, geological events in the exposed PCO can be broadly correlated to other NAC entities such as the Tanami and Tennant regions.

Gold in the PCO

Gold in the PCO is hosted within various units of the folded Palaeoproterozoic successions and is commonly associated with anticlinal axes formed during the ca 1855 Ma Litchfield Event. Historic exploration has successfully followed these anticlinal hinges along from exposed gold occurrences. Detailed airborne magnetic imagery shows that there are many unexposed anticlinal axes that have not been adequately followed and explored.

In detail, gold is either in or near quartz veins or along sedimentary rock beds within these fold axes. Gold-bearing quartz veins and associated sericite–chlorite–pyrite alteration overprint both the peak metamorphic minerals that define axial planar cleavages and the metamorphic minerals formed in the contact aureole around large granite bodies. Quartz vein-related gold mineralisation appears to post-date granite intrusion; however, gold mineralisation is concentrated in fold hinges that formed prior to granite intrusion. Şener *et al* (2005) obtained a SHRIMP U–Pb monazite age from quartz veins at the Goodall gold deposit that post-dates granite intrusion by ~100 million years (1727 ± 13 Ma). Gold has yet to be discovered within PCO granites despite their presence during the mineralisation event.

The Fountain Head Gold deposit was mined sporadically from 1883 with alluvial workings and minor hard-rock mining to less than 20 m depth. In 1995, Dominion Mining completed a trial pit; in 2006, GBS Gold started open-cut mining based on an initial Mineral Resource estimate of 750 000 tonnes at 2.29 g/t Au for 55 000 oz of gold, which was defined along the axis of the Fountain Head anticline (Harris *et al* 2004). During sterilisation drilling in 2006, gold-rich quartz veins were identified oblique to the axial plane, and further testing intersected the Tally-Ho gold lodes (900 000 tonnes at 2.61 g/t Au for 75 500 oz of gold; Ahmad and Hollis 2013).

At the Glencoe Gold deposit, ~2.5 km north of Fountain Head, the main gold mineralisation follows the axis of the Glencoe anticline, which is grossly parallel to the Fountain Head anticline. Two trial pits exposed the axial planar mineralisation, with two other trial pits targeting parallel structures. Recent work at Glencoe has identified gold-rich quartz veins oblique to the Glencoe anticline and thus is similar to those at Tally-Ho. It is likely that the oblique Tally-Ho-style gold-rich quartz veins at Fountain Head and Glencoe have a similar genesis and may represent a discrete style of mineralisation in the PCO worth exploring. A structural model involving reactivation of positive and negative flower structures formed during basin inversion is proposed to explain the relationship between anticlinal and Tally-Ho-style gold lodes.

PNX activities

PNX started work in the PCO in 2014 when it acquired a substantial land package from Crocodile Gold. Initially, PNX’s emphasis was on the high-grade gold–silver–zinc VHMS deposits at Iron Blow and Mount Bonnie. At these deposits, PNX has greatly expanded the size and confidence of the gold–silver–zinc resources. In conjunction with upgrading these resources, PNX began exploring its extensive landholding for additional VHMS and gold resources, now a continuing work programme.

As part of its development strategy, PNX expanded its resource base with the acquisition of historical gold mines at Fountain Head in 2018 and Glencoe in 2021. PNX has since upgraded the gold resources at both deposits. Currently, PNX is working hard to expand its current resources, find new resources, and start staged development operations by commencing with construction of a gold plant at Fountain Head.

The discovery of new gold deposits in the PCO, such as the Tally-Ho-style gold lodes, will require an exploration strategy beyond the standard anticlinal model applied for so long. Tally-Ho can be viewed as a new style of gold deposit and should be considered as a novel exploration model. In addition, exploration models from other similarly folded and intruded regions, such as the Tanami region, should

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also be considered and applied to the PCO. PNX Metals Ltd has a very strong landholding in the PCO and is applying these new concepts to its exploration strategy.

References

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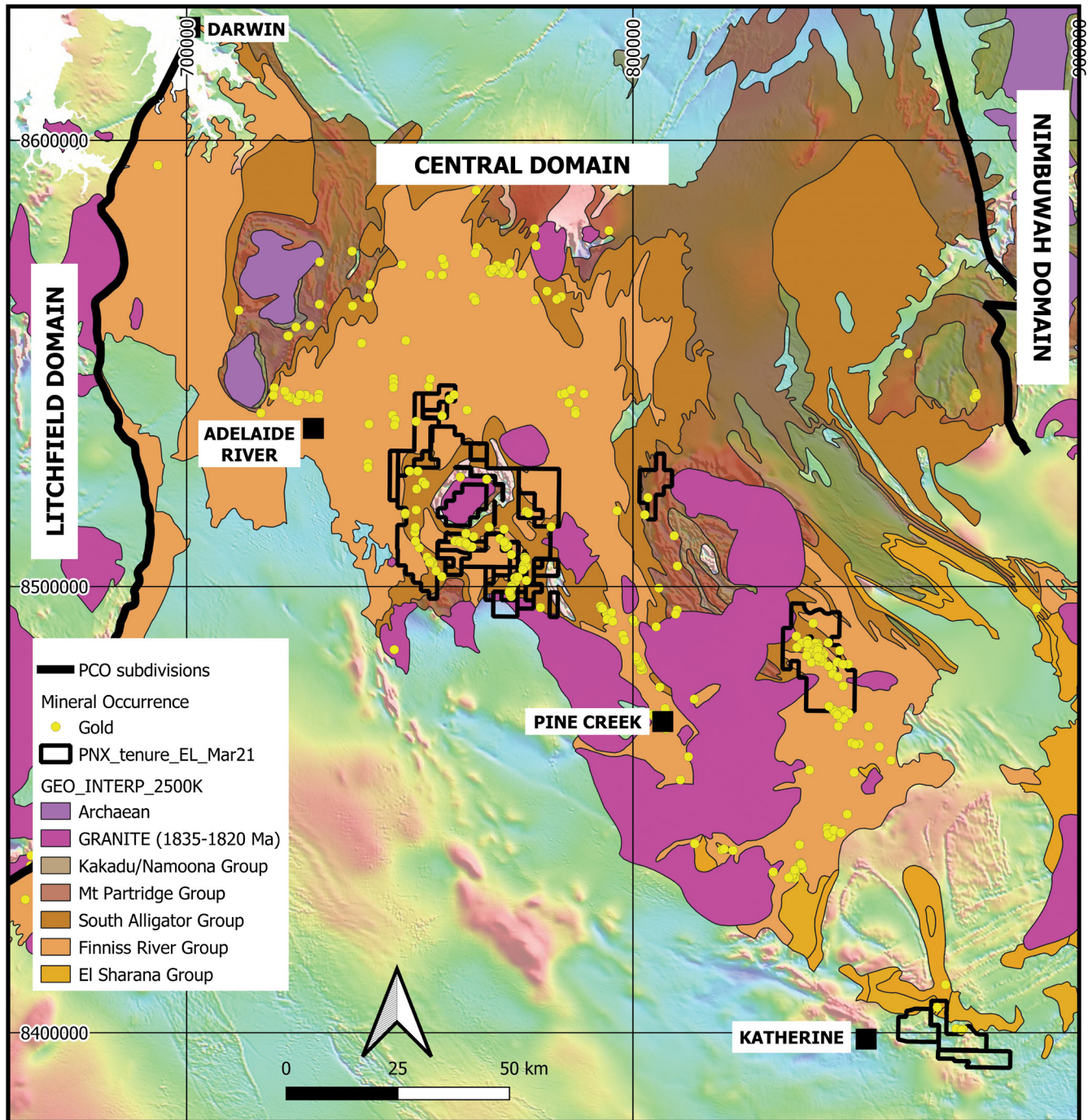


Figure 1. Regional map showing the Central Domain of the Pine Creek Orogen, gold occurrences (taken from STRIKE³), Archaean to Palaeoproterozoic geology and PNX tenure. Background: NT-wide total magnetic intensity. GDA94, Zone 52.

³ <https://strike.nt.gov.au/wss.html>