Resource model update for the Fountain Head Gold Project, Pine Creek Orogen, Northern Territory

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Fountain Head and Tally Ho are structurally-controlled orogenic gold deposits situated southeast of the Burnside Granite in the Pine Creek Orogen, Northern Territory. These two deposits comprise the Fountain Head Gold Project. The Project area consists of Mining Licences Northern (MLN) 4, 1020 and 1034, and Mining Lease (ML) 31124, all 100% owned by PNX Metals Ltd (PNX, **Figure 1**). The licences are located near the Stuart Highway between Adelaide River and Pine Creek, 150 km south of Darwin.

Mineral resources

PNX released its maiden mineral resource estimate (prepared in accordance with the JORC code 2012) on Fountain Head and Tally Ho deposits in July 2019, reporting total inferred and indicated resources of 2.58 Mt at 1.7 g/t Au for 138 000 oz of contained gold (Meakin 2019). The resource estimation was based on a new geological model including 2018 drilling results and historical drillhole information. PNX then followed with drilling in late 2019 to early 2020, resulting in an updated mineral resource estimate in May 2020 with a total of 2.94 Mt at 1.7 g/t for 156 000 oz of contained gold (Meakin 2020), promoting parts of the resource to indicated category and adding newly discovered inferred category resources.

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History

The discovery of a gold-bearing quartz reef at Fountain Head in 1883 was followed by a brief phase of eluvial mining. From 1886 to 1936, small-scale mining of eluvial material and individual quartz reefs produced around 9980 oz of gold. This included underground mining around the Potter's Shaft (~30 m deep) in the area currently known as Fountain Head East. From 1985 to 1989, further alluvial and eluvial mining by Zapopan Mining NL produced 10 104 oz of gold. In 1995, Dominion Mining Limited conducted trial pit open mining around 'Potter's Zone' to determine bulk performance at the nearby Cosmo Mill. Following discovery of the Tally Ho lodes in late 2006, the deposit was quickly expanded and brought into production, with mining by GBS Gold Australia in 2007 and 2008. The present-day adjoined pits are the result of this mining activity. GBS Gold was liquidated in 2009 and the project was purchased by Crocodile Gold Australia (subsequently merged to form Kirkland Lake Gold). The deposits were acquired by PNX in early 2018 from Kirkland Lake Gold.

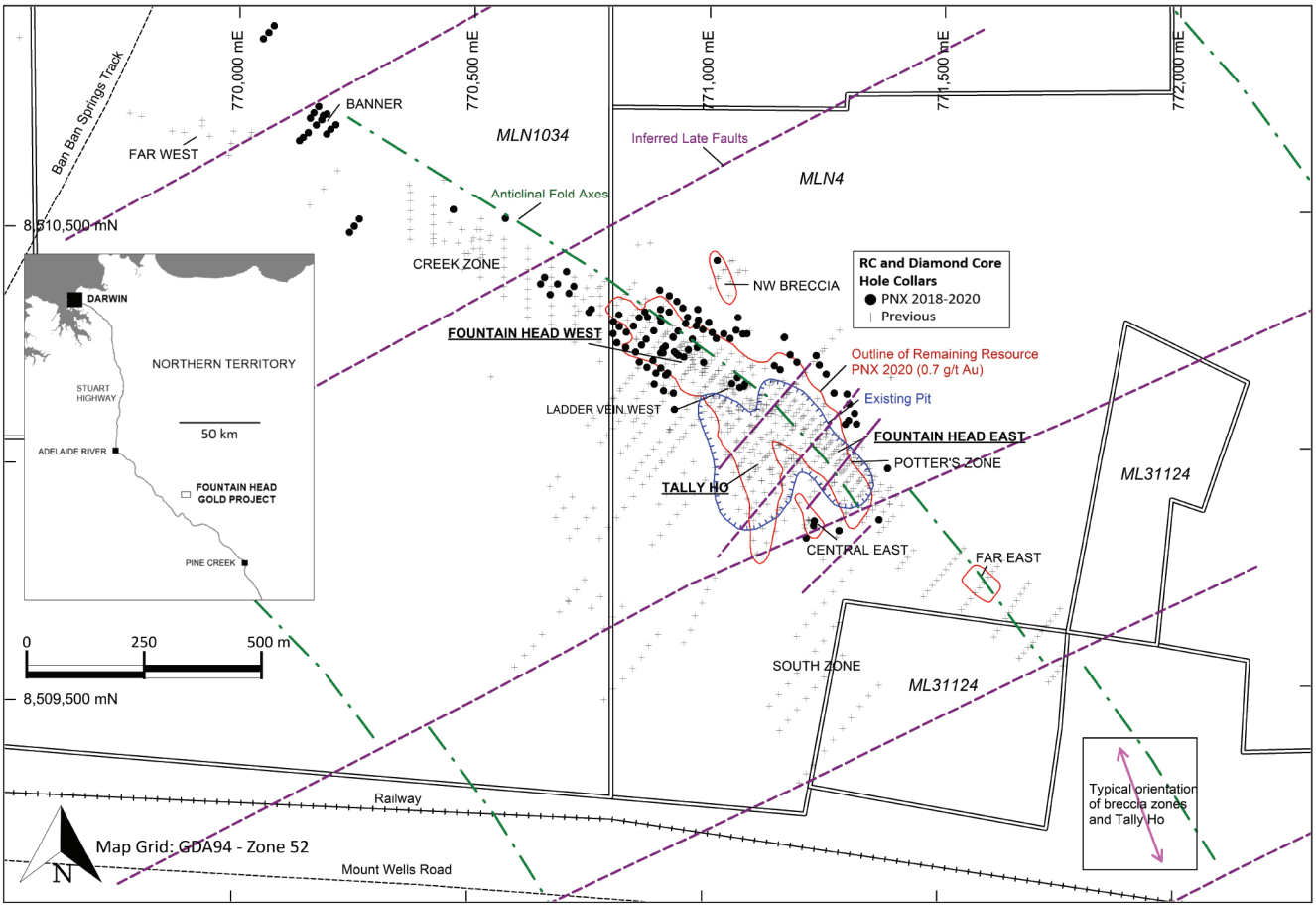

Figure 1. Location map of the Fountain Head Gold Project, including location of all drillhole collars and inferred geological features.

Geology and mineralisation

Gold mineralisation is located within and proximal to the Fountain Head Anticline. The folded units at the Fountain Head Project consist of marine sediments assigned to the Burrell Creek Formation, deposited in the Early Proterozoic at ca 1880–1870 Ma; the units were later metamorphosed to greenschist facies with the main lithologies being meta-greywackes, meta-siltstones, phyllites, carbonaceous black shales, and greenish cherty tuffs. Zamu Dolerite intruded the formation at ca 1860 Ma. The Cullen Batholith granitoids were then emplaced, including the nearby Burnside Granite. Sener (2004) states that in the Pine Creek Orogen, although most deposits are located within the contact-aureole of the ca 1835–1805 Ma granitoids, few appear synchronous with granitoid emplacement and aureole dehydration, and that analyses demonstrated gold mineralisation is typically younger (ca 1720–1710 Ma) than the youngest phase of granitoid intrusion (ca 1775 Ma).

The Fountain Head Anticline is one of several northwest–southeast-oriented folds in the area southeast of the Burnside Granite (Nimbuwah Event, ca 1870–1850 Ma) that were later gently re-folded in an east–west compression event (ca 1700s Ma?) creating doubly-plunging folds. The most important gold-bearing lodes at Fountain Head and Tally Ho deposits are oblique to the Fountain Head Anticline fold axis, following what appears to be a regional north-northwest–south-southeast fabric, roughly matching the strike and dip (~ -60 to -80 degrees) of quartz-carbonate-sulfide breccias and shears, with associated arsenopyrite abundance, and chlorite, sericite, potassium feldspar, silica, and hematite alteration. The exact timing of the mineralisation event or events is unknown.

Several small-scale, north–south-oriented faults offset parts of both deposits, while a larger-scale, northeast–southwest-oriented fault, roughly parallel with the Hayes Creek Fault and splays, appears to have offset both the Fountain Head and Tally Ho deposits on the eastern edge of the resource, leading to the possibility that the displaced mineralisation could be preserved in a downthrown block yet to be tested by drilling. Gold occurrences continue along the Fountain Head Anticline for at least 5 km, as evidenced by shallow exploration drilling, alluvial and eluvial prospects, and the Lady Josephine West prospect to the southeast.

Exploration activity and geological interpretation

Reverse circulation (RC) and core drilling within the project area prior to PNX acquisition totalled around 70 000 m. PNX drilling in 2018–2020 totalled 11 874 m, consisting of 10 171 m RC (113 holes), 945 m core (5 holes), and 758 m RC with core tails (5 holes). Drilling was focused around the Fountain Head and Tally Ho pits and westward along the anticline. RC drillholes were designed to delineate and infill the known resource (Fountain Head West; maximum spacing typically ~15–30 m), to extend mineralised trends along-strike and down-dip/down-plunge, to explore for new mineralisation based on surface geochemical anomalies (Banner prospect), and to add modern QA/QC sampling data to areas dominated by historical drilling (Fountain Head East). Core drilling included two geotechnical and two metallurgical holes.

The first 3D geological model for Fountain Head was created in 2019 with Datamine StudioRM software utilising all downhole data, georeferenced surface geology maps, and costean sections. Previous geological section interpretations had not been not linked along strike. No pit mapping exists, nor exact information for the volumes extracted during underground mining. Lithology codes and interpretations have varied over the long history of exploration at Fountain Head, so a certain degree of data filtering was required in order to bring uniformity to the dataset. Even the host formation itself has had different interpretations: the Burrell Creek Formation (Scriven and Orridge 1989, Partington 1997) or the underlying Mount Bonnie Formation (Shaw 2003). Details of the local sequence, particularly with the presence of cherty tuffs and thick meta-argillites near Potters Shaft, suggest Mt. Bonnie Formation or transitional Mt. Bonnie/Burrell Creek (Scriven and Orridge 1989).

The contact surfaces of at least six regularly alternating greywacke-mudstone sequences were modelled, with ~20 m thickness for each greywacke or mudstone unit, and interbeds of siltstone, chert and tuff. Despite much of the existing Tally Ho drilling being subparallel with bedding on the southern limb, there was enough data to model surfaces with high confidence. Chert and tuff were found to share the same bedding horizons (the chert perhaps being silicified tuff) and were the first to be drawn because of their excellent continuity (tuff is isochronous but can be approximate to lithostratigraphic surfaces at the prospect scale). There are isolated occurrences of dolerite sills within the downhole lithology data, assumed to be the Zamu Dolerite. Several carbonaceous black shale 'marker' horizons were interpreted; these may have been relatively overlooked by past geologists. Interpretation of bedding surfaces was further assisted by high-resolution aerial drone survey photography since bedding contacts could be clearly seen along the pit walls, as well as by data from handheld XRF performed on all PNX drill samples.

Mineralisation is described here by Shaw (2003). Fountain Head mineralisation is hosted by subvertical shear-related stockworks and fracture zones in greywackes and saddle reefs at lithological contacts. Most of the resource is in the hinge zone of the anticline, with gold grade rapidly tapering off along the limbs. Fracture zones within the hinge zone lie parallel to the axis of the fold and have acted as a locus for fluid channelling. Broadly stratabound lode zones are the result of two styles of mineralisation. Quartz stockworks have formed only in competent greywacke units where folding of the hinge zone and adjacent limbs has increased fracture permeability. Saddle reefs have commonly formed at the contact between greywacke and mudstone units, and are thickest in the hinge zone, tapering rapidly down the limbs. The gold mineralisation is part of a quartz-pyrite-arsenopyrite mesothermal system.

At least three phases of quartz veining are evident in drill core: a first stage of massive blue/white quartz, a second stage of quartz-carbonate veining, and a third phase

of small quartz-hematite stringers (Scriven and Orridge 1989). Pyrite and arsenopyrite are found in quartz veins; arsenopyrite occurs also in disseminations in the country rocks bordering quartz veins.

In some areas, higher gold values are associated with areas of broken core or where quartz veins have been sheared, while elsewhere unsheared, bedding-parallel quartz veins have elevated gold values. It is possible that multiple generations of gold mineralisation have occurred (Longridge 2019). Although gold appears to be loosely associated with quartz veining, it often appears at contacts with quartz veins, suggesting that vein contacts may have served as zones of weakness reactivated during younger deformation (Longridge 2019). This can be seen in several blue-grey quartz veins, typically subvertical and subparallel to the anticline fold axis, which have been modelled by PNX. These veins sometimes display high-grade gold mineralisation, and yet some are unmineralised.

Several influences for gold mineralisation are interpreted within the deposit and are overlapping in nature, some being more dominant than others. Greywacke units and the greywacke contacts with siltstone, chert or carbonaceous black shale are the dominant vectors for mineralisation within Fountain Head West, and to a lesser degree, at Fountain Head East. The mudstones/phyllites are strikingly low grade or barren in comparison. Mineralisation within the greywacke units may be attributed to mineralised quartz stockworks and stringers, saddle reef quartz (particularly at Fountain Head East), or the highly continuous and often grey-coloured bedding-parallel quartz veins. A zone of particularly high-grade mineralisation, historically known as 'ladder vein west', is interpreted to be a bedding-parallel, subvertical zone on the southern limb of the anticline.

High grade gold mineralisation often occurs within zones of alteration that appear as haloes around predominantly barren quartz-carbonate filled breccias, and among stockworks, planar white quartz veins and shears. Hematite alteration is commonly logged in holes directly above these zones within the oxidised zone. These barren breccia zones flanked with high grades can be seen throughout the gold assay dataset at Tally Ho and Fountain Head East, and in relatively thin zones striking across the Fountain Head West area. Brittle fracture zones and stockwork zones are generally common around the anticline hinge zone but are less easily interpreted.

The intersection lineations between breccia planes and bedding surfaces appear to form high-grade shoots (or zones where high grades are most likely), which are too narrow to model. However, these shoots have been successfully targeted by PNX drilling along 150 m of strike at Fountain Head West and at the Northwest Breccia prospect. A drill spacing of less than around 30 m is needed to reveal such zones.

Resource modelling

The existing Fountain Head resource model depicted an isoclinal fold with overturned bedding, including a subvertical blue quartz vein subparallel to the anticline fold axis. This model was replaced by PNX following interpretation of stratigraphic surfaces and grade trends. The dominant vector for mineralisation at Fountain Head East is interpreted by PNX to be oblique to the fold axis, roughly parallel with the Tally Ho lode. Only minimal changes were made to the Tally Ho resource wireframes. The 2020 PNX resource model was sub-domained into: a) structurally-dominant Fountain Head East, consisting of 11 lodes; b) structurally-dominant Tally Ho, consisting of one main lode and a few smaller lodes; c) a more stratigraphically-influenced Fountain Head West domain, consisting of Greywacke Units D and E, and Mudstone Units C to E; and d) newly added isolated lodes Northwest Breccia, Central East Lode and Far East.

Grades were interpolated into the model using ordinary kriging and using the process of dynamic anisotropy whereby a search ellipse is defined for each block, allowing the undulating nature of the mineralisation (such as around folded units) to be reflected in the modelling. Oxidation boundaries were treated as soft boundaries as there is no apparent correlation between oxidation and gold grades.

Resource classification was made considering data quality, data distribution, and geological and grade continuity. The resource is classified as indicated category for all of Tally Ho, three of the 11 lodes at Fountain Head East, and the central parts of Fountain Head West. The rest of the resource is inferred category due to a large percentage of drill data being historic in some parts; sampling quality control data was not routine in historic drill programs (prior to 2004). These areas were also inaccessible to PNX drilling as they lie directly beneath the existing pits.

At a smaller scale than is required for resource block modelling, an attempt was made to interpret the mineralisation style for every sample having gold assays >1 ppm by assigning unique codes for every interpreted feature or vein in the ~82 000 m drillhole dataset. The lower grade (1–2 ppm) bedding-concordant veins or contacts were found to have good continuity, often extending around 100–200 m with good confidence. This continuity was also seen in targeted PNX drilling. These veins were then able to be filtered out from the crowded drillhole dataset, making other mineralisation styles and structures stand out. All core photos, historic and recent, were checked for breccias, whether mineralised or unmineralised, and each was given a unique code. This enabled detailed modelling of the breccias, highlighting some likely offsetting faults. The apparently discontinuous mineralisation often mentioned in past work at the Fountain Head Project is probably partly due to gold-bearing structures not being fully mapped, or not having a short enough drill spacing to enable confident correlation.

Evidence for a northeast-trending fault apparently truncating the Fountain Head and Tally Ho deposits on the eastern side include: a) offset of the Fountain Head Anticline fold axis interpreted by both PNX and Zapopan Mining; b) lineaments in aerial imagery, airborne magnetics, and topographic expression; c) abrupt termination in gold content, lithology and alteration;

d) core logging observations; e) water issues encountered during drilling; and f) possible fault drag suggested by 2020 lode wireframes. It is currently unclear if the northeast faults were originally a source for gold redistribution, then later reactivated and further displaced; however, no mineralisation or alteration appears coincident with these faults.

Future work

During 2021, PNX plan to continue near-mine exploration drilling with a number of targets. The Far East prospect represents the northeast fault-displaced eastern continuation of the Fountain Head Anticline; it shows signs of high-grade, bedding-concordant mineralisation and only has been sparsely tested by drilling. The Banner prospect is a tightly-folded zone of the western continuation of the anticline that displays signs of breccias and alterations similar to the rest of the Project area; high gold grades have been encountered directly beneath a chert bed in the hinge – the tight fold may be due to fault drag near a northeast-oriented fault interpreted nearby. The Northwest Breccia prospect is a sign that mineralisation can be found on the northern limb of the anticline, predictably following the modelled breccia planes – although solitary and thin, it is hoped the trend improves further north into an untested area, which was also modelled as an area containing the favourable Greywacke D unit.

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