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FRANCIS CREEK AREA, NORTHERN TERRITORY

1:250,000 SHEET SD52-8 PINE CREEK
1:100,000 SHEET 5270 PINE CREEK

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Sourcing of weak BLEG stream anomalies by MMI geochemistry and rock chip sampling has located a number of new gold veins, breccias and shears. Most of the new gold occurrences show a spatial relationship with deep magnetics anomalies (?) which are adjacent to the Allamber Springs Granite. Drill testing is required.

**KEYWORDS**

Gold Quartz. Reefs, High grade gold.  
Tourmaline Breccias  
Mt Partridge Group  
Hematitic Breccias
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SUMMARY

AN389 and EL8313 lie approximately 25km north of Pine Creek township and are easily accessed by a well formed gravel road. The road, built to service the Francis Creek Iron mines is serviceable all year except when it is “closed” following heavy rainfalls. Away from the main access road motorised access is extremely difficult due to the steep topography and deeply incised creeks.

During the 1997 field season (March to November), a comprehensive second pass exploration program has been applied to most of the licensed area and some follow up work completed. The activities concluded include various forms of geochemical sampling.

The geochemical sampling work (MMI and Stream Sediment BLEG) and ground recovery work has discovered a series of outcropping, narrow, high grade gold reefs (The Golden Honcho and Golden Slips) a series of low anomalous-tourmaline matrix breccias, and gold anomalous shear zones in several of the historical hematitic “iron-ore” pits.

Work is proceeding toward testing the potential of the area to host a deeper, causative intrusive stock for this mineralisation and thus a larger mineralised body.
1. **INTRODUCTION**

1.1 Access and Physiography

EL8313 and AN389 lie approximately 25km by road north of Pine Creek township. Pine Creek is situated 230km south of Darwin along the Stuart Highway (Figure 1). From Pine Creek travelling 3km along the Kakadu Highway then turning north onto the well made Francis Creek road and covering 25km leads directly to the project area. All roads in the area are subject to closure or become impassable due to heavy seasonal rains between November and March.

Within the project area vehicle access is heavily restricted by steep sided hills and deeply incised creeks. Following the wet season long grass, 1m to 2m high restricts both vehicle and pedestrian traffic away from the main road. One poorly formed and unmaintained track leads from the Francis Creek road to an abandoned airstrip in the south-central portion of EL8313. This track when visible, after burn-off, provides limited access to the south-central and the eastern edge of the project area.

1.2 Tenure

EL8313 was granted to Norman Sydney McCleary on December 31, 1993 for a period of 5 years. The original licence covered almost 9 graticule blocks (a small area of freehold land in the abandoned township of Francis Creek was excluded) bounded by latitudes 13° 37"S and 13° 40"S and longitudes 131° 50"E and 131° 53"E (Figure 2).

Background land tenure under EL8313 is Mary River West Pastoral Lease (PL815). An area of freehold land (Francis Creek township) straddles the boundary between the EL8313 and AN389 which abuts the licence on its northern boundary.

2. **PREVIOUS EXPLORATION AND MINING**

Within AN389 and EL8313 previous mining activity has been restricted to the iron deposits to the east and northeast of Francis Creek. According to Ahmad et al (1993) these were discovered in 1962 and mined by the Francis Creek Iron Mining Corporation Pty Ltd between 1966-1974. A total of 8 million tonnes grading 59% Fe were produced, the bulk (6.1 million tonnes) from the Helene No.6 and 7 lodes within AN389. The iron ore occurred as a series of massive hematite lodes conformable within tight to open folded pyritic, carbonaceous shales near the base of the Wildman Siltstone. The ore consists of massive and micaceous hematite with included shale and quartz grains in varying proportions. Ahmad et al (1993) postulate that the ore developed by
oxidation of a pyritic horizon though no drillholes have penetrated this unit in the primary zone to confirm this interpretation.

After the cessation of mining activity and surrender of the original titles, the area was held within a Mining Reserve because of the extent of surface disturbance caused by the operations. Consequently, up until the grant of the current titles, the area was not available for systematic exploration and hence escaped the detailed investigations for gold conducted throughout the surrounding region over the past decade.

Since the current titles were granted, reconnaissance soil sampling was completed in 1994 by the title holder over the rocks of the South Alligator Group (Hardy, 1995). These crop out in a band about 0.5-0.8 kilometres wide along the western margin of AN389 and in the northwest corner of EL8313. A total of 135 samples were collected at 25 metre intervals and composited to 100 metre samples along 15 lines spaced 400 metres apart. Samples were analysed for gold (BLEG) and arsenic. Two weak but distinct linear gold-arsenic anomalies, each 2 to 2.5 kilometres long and with values to 30ppb Au and 120ppm As, were defined. These coincided with westerly dipping Koolpin Formation metasediments which form the hanging-wall of a metadolerite sill at the base of the unit. Further detailed soil sampling, rockchip sampling and mapping were recommended.

In November 1995, Homestake Gold of Australia Limited (HGAL) commissioned a soil sampling program (550 samples) over the western portion of the licences. The survey was situated to test the extent of the Koolpin Formation. The grids referred to as the northern and southern were pegged at 50m on lines 100m apart.

Exploration work in 1996 included RC-percussion drilling, ground EM sampling, first pass stream sediment sampling, and limited geological line mapping. No targets or explanations for the weak gold anomalism in streams or large aeromagnetics anomalies was found.

The 1997 exploration program is discussed below.

3. GEOLOGICAL SETTING

AN389 and EL8313 straddle the contact between metasediments and metadolerites of the early Proterozoic Pine Creek Geosyncline succession and the later, though still early Proterozoic, intrusive Allamber Springs Granite, part of the Cullen Batholith (Figure 3).

The metasediments within the titles under review largely belong to Wildman Siltstone and Mundogie Sandstone of the Mount Partridge Group. These unconformably overlie the Masson Formation of the Namoona Group in the
south east corner of AN389 and are unconformably (?) weak warping) overlain by the Koolpin Formation and Gerowie Tuff of the South Alligator Group along the western margin of AN389 and the northwestern corner of EL8313. Metadolerite sill of the syn-sedimentary Zamu Dolerite intrude the Koolpin Formation and the contact between the Koolpin Formation and underlying Wildman Siltstone.

According to the published 1:100,000 geological map of the area (Pine Creek) the Masson Formation consists mainly of carbonaceous phyllite, slate, silty phyllite and sandy siltstone with minor quartzite and massive ironstone and rate tremolite marble. The Mundogie Sandstone is comprised of coarse pebbly feldspathic quartzite, arkose and micaceous quartzite with minor chert and pebble conglomerate. The Wildman Siltstone is divisible into two units. The upper part consists dominantly of siltstone, phyllite, carbonaceous phyllite and minor laminated coarse sandstone whereas the lower part includes mainly pyritic carbonaceous phyllite, siltstone and pyritic carbonaceous shale breccia (massive hematite ironstone lenses on the surface). In the South Alligator Group, the Koolpin Formation consists mainly of ferruginous (pyritic and pyrrhotite) and carbonaceous phyllite with horizons of laminated, lensoidal and nodular chert along with minor dolomite and marl. The Gerowie Tuff is comprised of grey siltstone interlayered with crystal tuff, lithic tuff and black cherty tuff as well as minor laminated chert.

The Zamu Dolerite sills are composed of chloritised quartz dolerite and amphibolite.

Adjacent to the contact with the sediments and dolerites, the Allamber Springs Granite is composed mostly of pink, coarse, equigranular and porphyritic, biotite granite while further from the contact, in the southern half of EL8313, pink-green coarse porphyritic hornblende-biotite granite and pink-grey fine to medium equigranular leucogranite and alkali feldspar granite sequentially dominate. Greisen stockwork is extensively developed within a kilometre or two of the contact.

The metasediments and metadolerite sills are folded about upright folds which plunge at a shallow angle to the north-northwest. Folding was accompanied by lower greenschist regional metamorphism. The folding and the regional metamorphism are overprinted by the effects of granite intrusion. The granite contact truncates the folded sequence in a passive fashion and albite-epidote hornfels and hornblende hornfels facies contact metamorphism overprints the regional metamorphic assemblages progressively closer to the contact. A distinctive feature of the contact metamorphism is the development of fine white andalusite (chiastolite) needles in the more aluminous black carbonaceous meta-mudstones of the Masson Formation, Wildman Siltstone and Koolpin Formation.
Flat-lying Mesozoic sandstone, siltstone and conglomerate unconformably overlie all of the early Proterozoic rocks in the area. Several remnant outliers of these rocks are present in the Francis Creek area and one of these is within the eastern part of AN389. They form flat topped mesa-like landforms above an elevation of 240 metres ASL. According to Ahmad et al (1993) these sediments were originally mapped by Skwarko (1966) as Mullaman Beds, but were interpreted by Hughes (1978) as belonging to the Petrel Formation of Jurassic to Lower Cretaceous age and the Darwin Member of the Bathurst Island Formation of Lower to Upper Cretaceous age.

Finally Cainozoic alluvial and colluvial sand, silt clay and gravel are deposited across the area and as pointed out by Ahmad et al (1993) these are separated from the basement rocks by residual laterite in many areas.

Four main styles of gold mineralisation are known to occur through the region. These occur exclusively within the metasediments and metadolerites of the Pine Creek Geosyncline sequence and almost without exception above the stratigraphic level of the middle of the Koolpin Formation in the South Alligator Group.

Of prime interest is gold mineralisation of the Cosmo-Howley/Golden Dyke style which is hosted by silicate-sulphide facies, cherty iron formations in the middle and upper levels of the Koolpin Formation. At the Golden Dyke Mine (and adjacent smaller deposits), 35 kilometres west of Francis Creek, the mineralisation occurs as a stratiform lens on the western side of the Golden Dyke Dome. At the Cosmo-Howley Mine, 50km west of Francis Creek, similar stratiform mineralisation occurs on the limbs and the crest of the Cosmo Anticline where it has been complicated by, and possibly remobilised and upgraded by, strong axial plane faulting and nearby granite intrusion. To date, no mineralisation of this type has been discovered below the iron formations in the Middle Koolpin Formation. Similar mineralisation occurs at Mount Porter, 2.5km west of the Francis Creek titles.

Of lesser importance in the Francis Creek titles, but of major importance elsewhere in the region, is gold mineralisation in sheeted and stockwork and saddle quartz-pyrite vein systems. This type of mineralisation is generally developed along the crest and limbs of major regional anticlines and is almost exclusively hosted by tuffaceous greywacke-siltstone sequences above the Koolpin Formation. Significant examples of stockwork-type gold mineralisation (as this type is collectively described) in the region include the Enterprise Mine at Pine Creek (1.3 million ounces of production and resources) the Batman deposit at Mount Todd further to the south (2-3 million ounces of reserves and resources) and the Union Reef, Brocks Creek, Rustlers Roost, Goodall and Woolwonga deposits. Lesser deposits include Chinese Howley, Big Howley, Spring Hill, Yam Creek, Fountain Head and Western Arm. Stratiform gold mineralisation hosted by pyritic chert and banded iron
formation in the Gerowie Tuff is known at the Zapopan mine and this may also be part of this group.

Stratiform poly-metallic base metal mineralisation (with associated gold) occurs at Mount Bonnie and Iron Blow, 30km west of Francis Creek and at Fenton (unpublished). In both cases it is hosted by the lower Mount Bonnie Formation.

Because of the stratigraphic position of the Francis Creek titles, they are prospective for mineralisation of the Cosmo-Howley/Golden Dyke-type, especially in the Middle and Upper Koolpin Formation. However, work by Homestake has now shown that the Mt Partridge Group below the Koolpin Formation may host brittle, sandstone hosted, quartz-veins/breccias with both high grade gold, arsenopyrite, and accessory tourmaline. It is now postulated that these may represent hydrothermal leakage from blind, specialised intrusive stocks. This implies a potential for larger breccia bodies in the sandstones and distal, pyrrhotite-subfacies, skarn or replacement bodies in the underlying limestones.

4. WORK COMPLETED

During the 1997 field season work continued with endeavouring to explain the low order stream BLEG anomalies encountered during 1996; with the assistance of Auserian and Exploremin Geological Consultants. In order to test these anomalies as possibly representing geochemical leakage from a deeper mineralised source (eg. specialised intrusive or distal metasomatic “skarn”) 5 lines of Mobile Metal Ion (MMI) samples were taken across the perceived shallowest portion of the magnetic anomalies (the lines are shown on Figures 3 & 4). Figure 4 shows the location of strongest gold anomalies on line 93,600N (the northern-most line) and Appendix I contains the geochemical data. On line 93,600N (8493600 AMG N) the peak gold anomaly of 81.65ppb corresponds with 1960ppb Pb was ground checked and found to be located adjacent to a sulphidic, brecciated quartz-reef hosted by sandstone. The reef returned initial assays of 11.2 to 26.1g/t Au over a 1 metre true width. Follow up systematic sampling gave 18.5g/t Au average over a length of up to 360 metres. Figure 3 shows the location of this vein (Golden Honcho) in relation to the MMI sample line, Figure 4 shows relationship with RTP aeromagnetics and Figure 5 shows the relationship to the first-pass stream sediment BLEG anomalies.

As a result of the initial sampling program at the Golden Honcho vein, the following work programs have been completed;

Stream Sediment Sampling:
All initial gold results of plus 1ppb Au in streams have been infill sampled and sourced.
Figure 6 shows the total BLEG coverage and results. Gulf Exploration and Kovaco Pty Ltd Consultants collected 2kg, minus 2mm samples which were assayed by the Givens technique at AssayCorp, Pine Creek. Samples represent active stream components. An additional 68 samples were taken during 1997.

Figure 7 compiles the catchment area for all values over 3ppb Au. Note the 4km long "ridge" of anomalism along the eastern side of AN389.

Surprisingly, the dispersion train from Golden Honcho, which crops out at 18g/t in the creek, is about 3.5-3.7ppb to 700 metres down-stream. Values are mostly in the 2.4 to 4ppb range up-stream and <2.8ppb down-stream. This suggests either a poor total endowment in the vein area, a current exposure not far below the true top of the vein, and/or a very aggressive stream flow (removing fine components far from the source).

The stream sediment survey also shows a strong gold background in the area of the iron ore pits. BLEG anomalies of up to 122ppb located 2 to 3km SE and SW of Golden Honcho have been resolved to be sourcing from small greisen zones within the Allammer Springs Granite.

Rock Chip and Soil Sampling:
A total, additional, number of rock chip samples taken on the project is 487. Most of this work centred on the Honcho-Amigo ridge (including Golden Gulf and Golden Slips), and the "Iron-Ore" pits.

Figure 8 shows the relationship between areas of sampling.

Figures 9 & 10 show the mapping and sampling results for the Golden Slips and Golden Gulf Prospects.

Figures 11 & 12 show the rock chip and soil sampling results for the Golden Gulf prospect, which is along strike from Golden Slips. Note that -10mesh soil gold values of over 30ppb (up to 950ppb) and arsenic values of 100 to 305ppm occur over a zone of 300 metres long by 20 to 50 metres width. Rock chip samples in tourmalinised breccia grade up to 2.7g/t Au.

In sourcing the BLEG anomalies along the Western Anomalous Zone all of the iron ore pits were sampled, within the safety limits possible at the time.

Figures 16 to 25 compile the results of this work.

Of note were anomalous Au, Zn and As results in Helene 11 & 6. In Helene 11N gold values of up to 1.68g/t and As to 1200ppm occur in sheared shale near hematitic ironstone.
From the analytical data and geological logging, it was difficult to derive a clear drill target for follow up; yet it is clear that there is an association between gold and hematitic matrix breccias.

5. RESULTS AND DISCUSSION

During the 1997 field season, Homestake’s field crews resolved many of the large, low order (2ppb Au-CN) stream BLEG anomalies into narrow, high grade gold reefs. The reefs vary from 1 to 2 metres in width and 200 to 400 metres in length. They are often boudinaged? (Golden Slips) and show syn-mineralisation brecciation (Golden Honcho). They assay between 6 and 18g/t at surface at what is suspected to be the near base of supergene/sulphide interface. Being only 500 metres or so east of the iron ore pits and in prospectable terrain it is surprising to find absolutely no evidence of previous prospecting, mining or pitting. If found by the historical gold booms, these reefs would have constituted a gold CAMP.

Interestingly, along the same NNW-trending ridge a 300 to 600 metre long anomalous zone (30 to 100ppb Au, 100 to 300ppm As) of sporadic quartz and tourmalinised sandstone breccias supports the idea of a major zone of hydrothermal activity. Figure 26 illustrates the schematic shape of the deeper magnetic anomaly. If the anomaly is related to an I-type/magnetite series intrusive centre or a distal-pyrrhotitic replacement body, then there is a geometrical relationship with the iron ore mines (hematitic breccias) and the newly discovered gold mineralisation. The magnetic anomaly has a, NNW trending, eastern corridor which is fault bound. The gold reefs appear to have a geometrical relationship with this eastern zone.

The iron ore pits are symmetrically distributed about the anomaly core and the eastern axis. Future work will be aimed at exploring the larger structures for breccia and replacement bodies of medium grade mineralisation.


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7. 1998 WORK PROGRAM

Exploration activity will centre on geology, structural assessment and sampling to determine possible drill target positions for larger gold bearing bodies.

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8. REFERENCES

