PRELIMINARY GEOLOGICAL REPORT

WHITE HILL DAM GOLD PROSPECT

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NORTHERN TERRITORY GEOLOGICAL SURVEY
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(1) INTRODUCTION
Except for areas of Quaternary alluvium, rocks exposed in EL's 4463 and 4528 (White Hill Dam area) comprise high-grade regional metamorphic rocks of Early Proterozoic age and small associated intrusions.

Various divisions of the metamorphic rocks of the Barts Range have been proposed by previous workers (e.g. Joklik, 1955; Shaw, Stewart and Rickard, 1984; MacCulloch and Nielsen, 1984). In terms of the White Hill Dam area 4 major lithological units can be identified the Cadney Gneiss, the Irindina Gneiss, the Blackfellows Bore Granulite and the Gough Dam unit. The Mount Schaeber Granite is the only named igneous rock but at least two suites of pegmatite dykes and several minor finer-grained intrusive bodies are also present.

(2) LITHOLOGICAL UNITS

(2) 1. CADNEY GNEISS

The Cadney Gneiss is typified by the widespread occurrence of garnet - epidote - diopside - (amphibole) - (calcite) rock frequently referred to as 'calc-silicate'. Less common but still widespread lithologies are amphibolite, biotite - (sillimanite) - (garnet) gneiss, marble, quartzite and quartzofeldspathic gneiss. The calc-silicate rocks are finely layered and intimately associated with the other rock types. However it is possible to map areas composed largely of one of the latter and such areas appear as
elagant lenses within the 'calc-silicate' dominated unit.

(2) 2. BLACKFELLOWS BORES GRANULITE

Mafic and felsic rocks of granulite metamorphic grade are the characteristic lithologies of the Blackfells Bore Granulite. The mafic rocks are dark plagioclase - pyroxene - (hornblende) - (garnet) types which typically form elongate lenses 10's of metres to hundreds of metres wide, usually of massive character but in a few places layered or foliated internal structure. The felsic granulites are dominated by quartzofeldspathic gneiss, biotite gneiss and biotite quartzite. Some rocks are migmatitic showing irregular fluidal structures and are net-veined by aplite. Garnetiferous gneiss, biotite-sillimanite gneiss and cordierite gneiss are less common rock types. The felsic granulites form both massive lenses and units of relatively thinly layered character which contain narrow mafic granulite bodies.

(2) 3. IRINDIMA GNEISS

The Irindina Gneiss is characterised by interlayered amphibolite and biotite - sillimanite - (garnet) gneiss and quartzofeldspathic gneiss. Interlayering occurs on a wide range of scales, with amphibolite layers up to 200m thick and intervening gneissic rocks of similar thickness being readily mapped from air photographs. In detail however, many such layers are composite and composed of much thinner mafic and felsic units with the mapped lithology being the dominant one.

Locally quartzite, garnet quartzite, marble and epidote - garnet - diopside - amphibole ('calc-silicate) rocks are important lithologies.
(2) 4. GOUGH DAM UNIT

The name Gough Dam Unit is applied to thinly foliated rocks, and associated highly lensoidal masses of the common rock types in the other metamorphic units, that occupy two belts in the White Hill Dam area. Many of the schists are highly micaceous and include both biotite-rich and biotite-muscovite varieties. At least the latter are of lower metamorphic grade than the surrounding rocks and the material in the lenses. Despite this the schistose rocks are not obviously any more structurally complex than the other rocks.

(2) 5.1 MOUNT SCHAEBER GRANITE

A small elliptical granite pluton within and south of EL4528 is termed the Mount Schaebter Granite. Within the EL it comprises lightly foliated biotite granodiorite. The pluton is emplaced within rocks of the Blackfellows Bore Granulite and while it has a sharp contact with this unit there is no obvious sign of contact metamorphism. There is no evidence of pegmatite or aplite dykes within the body, nor in the immediately surrounding country rocks, nor any indication of closely associated hydrothermal activity. Rare mafic schlieren occur in the granite and a single amphibolite dyke 1m wide was observed cutting the pluton.

(2) 5.2 PEGMATITE

Two distinct generations of pegmatite dykes can be recognised, an early highly deformed group and a younger, little strained group. The former form lenses and irregular patches, often elongate parallel to the foliation in the surrounding rocks; they are frequently mylonitic, contain little other than quartz and
feldspar, but are often cut by later quartz veins. The younger pegmatites are members of the well-known Harts Range mica pegmatites. They are little deformed, cross cut all mesoscopic structures in the surrounding rocks, are up to several tens of metres wide, and although of irregular form in detail they approximate planar bodies, the larger of which are continuous over several hundred metres. These bodies often pass at their extremities into quartz veins and most of the larger ones are distinctly zoned.

(2) 5.3 OTHER MINOR INTRUSIONS

Rare dykes of granite, aplite and slightly more mafic rocks are found in all the metamorphic units. They show no sign of having altered the immediately surrounding rocks. Some appear to be relatively late bodies, cutting across structures in the country rocks whereas others have been affected by deformation.

(3) STRUCTURAL GEOLOGY

All of the metamorphic units show the same deformation history. In outcrop an early set of tight to isoclinal folds are refolded about generally gently – moderately plunging open structures the axial surfaces of which strike east-west. These structures are most common in the thinly layered rocks of the Cadney Gneiss but are also readily observed in the Irindina Gneiss and the Gough Dam Unit. Although the same pattern occurs in the Blackfellows Bore Granulite the massive character of some of these rocks masks their total structural pattern, and the migmatitic structure of some of the other rocks yields a confused structural pattern.

Large-scale fold patterns, as revealed by the form of mapped lithologies vary amongst the units. Marked, but rather irregular large folds are clearly present in the Cadney Gneiss and produce
the zone of approximately north-south trends in the area south of Pannikan Dam. The strike of rock types in the Blackfellows Bore Granulite defines a tight, probably, north plunging reclined fold. Judging from the concentration of mafic granulites on the northern limb of this structure and felsic rocks on its southern limb this is a late-stage structure. This fold has deformed the contact between the Blackfellows Bore Granulite and the Cadney Gneiss but it is not clear yet whether it is of the same generation as the large folds in the latter unit. (Work on this problem is proceeding.)

The Irindina Gneiss shows a relatively simple megascopic structure within the White Hill Dam area. Strikes of major lithological divisions are straight and parallel over considerable distances and mostly curve only gently. A prominent synform of these rocks is readily recognised in the east-central part of EL4463, separated from the main mass of Irindina Gneiss to the north by a tight antiform. The hinge of the latter contains quite a high concentration of quartz veins and pegmatites and may be in part faulted. 'Calc-silicate' rocks in the core of the antiform are mapped by Shaw, Stewart and Rickard (1984) as part of the Irindina Gneiss but they could well belong to the Cadney Gneiss and be exposed in domal culminations along the structure.

The Gough Dam Unit schists have generally been interpreted as zones of retrograde metamorphism, formed during late-stage movements which also isolated the lenses of surrounding lithologies found within the Unit. This would imply that the two zones of Gough Dam rocks, one stretching west from south of White Hill Dam to Old Station Well, and the other extending along the southern edge of EL4463 and swinging to the northwest to separate the Mount Schaebel Granite and associated granulites from the Cadney Gneiss and the main area of Blackfellows Bore Granulite, are faults or ductile shear zones. My preliminary analysis suggests the schists in these zones while perhaps more intensely deformed have
not suffered any deformational episodes additional to those in the adjacent rocks. This tends to discount the fault/shear zone hypothesis. It is conceivable that the zones mark areas of fluid-flow during metamorphism, and that high water pressures, and possible associated potassium metasomatism, account for the widespread development of mica, especially muscovite.

Overall the rocks of the White Hill Dam area are noteworthy for the absence of signs of post-metamorphic faulting. No breccia zones have been recognised, nor prominent fracture systems, nor zones of the late-stage alteration. However, the younger pegmatites and associated quartz veins probably lie along fractures, perhaps the products of tensile stresses late in the history of the area.

(4) MINERALIZATION

(The preliminary nature of these comments is stressed)

(4) 1. MINERALIZATION IN CADNEY GNEISS

Known mineralization in the Cadney Gneiss includes that at the Copper Queen and Copper Queen North. At the latter prospect small malachite-stained lenses of biotite-sillimanite - (garnet) - gneiss are concentrated in a seemingly discontinuous zone up to about 1.5m thick and several hundred metres long. Both the core and the lenses parallel the foliations in the rock. Apart from the presence of malachite, seldom in other than minor concentrations, the material in the lenses appears the same as adjacent unstained gneiss. No sulphides were observed in fresh gneiss from this area and it is possible that the malachite has been produced by the breakdown of a copper-bearing silicate mineral. Similar copper-stained biotite-sillimanite-garnet gneiss occurs in the costean
adjacent to the Copper Queen track intersection with the Oonagalabi tracks, and comparable mineralizations occurs rarely in garnet gneiss about 0.75 km south of Pannikan Dam.

At the Copper Queen copper mineralization occurs in a garnet-clinopyroxene-epidote rock. Again the copper minerals are secondary ones, mainly malachite, and no primary sulphides have been identified. Although the host-rock mineralogy is that expected in a skarn, the geological setting is not. There is no nearby exposed intrusive body, nor independent evidence for an adjacent unexposed pluton; the rocks show regional rather than contact metamorphic characters and there is no need to postulate metasomations to account for their composition. The mineralised zone is a discontinuous one, which terminates to the east in a series of late-stage megascopic folds, and to the west it disappears in an area of incomplete outcrop. The magnetic susceptibility of the mineralized zone is notably higher than that of surrounding rocks, and preliminary analysis of aeromagnetic data suggests it possible continues west then curves east in a broad fold buried beneath recent alluvium.

The source of the significant gold assayed in some Copper Queen samples is unclear. Although there are no cross-cutting veins its sporadic distribution suggests that the copper and gold mineralization may not be closely coupled. Quartz veins of a range of structural settings and implied ages, that occur widely in the Cadney Gneiss, have been sampled in an attempt to determine if gold was mobilized at any of the times these formed. Assay results are not yet to hand.

(4) 2. MINERALIZATION IN BLACKFELLOWS BORE GRANULITE

MacCulloch and Nielsen (1984) report anomalous copper values in samples collected from this unit but no significant mineralization
known from it. In places the Granulite is host to concentrations of quartz veins which have been sampled for assay.

(4) 3. MINERALIZATION IN IRINDINA GNEISS

Mineralization at the Virginia Prospect, located immediately east of EL 4463 occurs in garnetiferous quartzofeldspathic gneiss. The style of mineralization is similar to that at the Copper Queen North, with malachite and azurite occurring as a stain in lenses in the rock and on adjacent joints. Some quartz veins are associated with the cupriferous rocks here and assays of these are awaited.

Copper-stained zones, all of very local occurrence occur along a belt stretching west from the Virginia, and MacCulloch and Nielsen (1984) record copper anomalies in rock from this belt. However, the occurrences are very small and no primary sulphides have been noted. The relatively common veining in the antiformal culmination in the Irindina Gneiss (see Section 3) may deserve more study if the assay of samples collected from this area prove of interest.

(4) 4. MINERALIZATION IN THE GOUGH DAM UNIT

Despite evidence for high water pressures and possibly for potassium metasomatism (section 3) the only visible signs of mineralization in Gough Dam Unit are small patches of copper staining. Veins from this unit have been collected but until assay results are available discussions of their significance is unwarranted.