Kinex

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GEOLOGICAL REPORT

WHITE HILL DAM PROSPECT

EL 4528 and EL 4463

HARTS RANGE, NORTHERN TERRITORY

SEPTEMBER 1986

Report by
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TABLE OF CONTENTS

INTRODUCTION

Work presented in this report was carried out under instruction from I.R.F. MacCulloch of Kinex Pty Limited. Eleven days were spent in the field in the Harts Range, mainly in a regional appraisal involving major revision of then-current company mapping, reconaissance structural investigations, appraisal of areas of known mineralization and hard rock (mainly quartz vein) and alluvial sampling for anomalous gold values. approximately 500 in situ magnetic susceptibility measurements were made in order to aid interpretation of aeromagnetic data.

This report presents only field data: rock determinations are based only on hard specimen examination. However a representative set of lithologies were collected and are at present being prepared for microscopic study. They may form the basis for a later report.

LOCATION, ACCESS AND TENURE

These aspects were dealt with in detail in the Kinex report of July 1984 by MacCulloch and Nielsen. The material below is an updated version of that report. I have no direct knowledge of the present tenure of the exploration licences.

EL 4463 and EL 4528 informally referred to as the White Hill Dam Prospect, are situated in the Harts Range district in the south-eastern part of the Northern Territory. The centre of the licence area is 102 km on a bearing of 52 degrees from Alice Springs. From Alice Springs the area is reached by driving north 68 km on the Stuart Highway and then east for 96 km on the Plenty Highway to the Blackfellow's Bones Bore track turn off (immediately east of the Highway crossing of Ongeva Creek). The blackfellow's Bones Bore track is followed southeast for about 20 km to the western limit of EL 4528. The track runs approximately west to east across the White Hill Dam Prospect area and continues further east to Oonagalabi. The Blackfellow's Bones Bore track is dirt and best negotiated in a four-wheel drive vehicle. The route from Alice Springs to Ongeva Creek is bitumen.

Exploration Licences 4463 and 4528 were granted to Kinex Pty Ltd on the 31st May 1981 for a term of six years. The licences together comprise 36 EL Blocks, where a block is one minute square. El 4463 encompasses 24 blocks and EL 4528 12 blocks. The total area of the licences is 116 square kilometres.

GEOLOGY

Except for areas of Quaternary alluvium, rocks exposed in the White Hill Dam Prospect comprise high-grade regional metamorphic lithologies of Early Proterozoic age and small associated intrusions. Descriptions of the geology of the prospect are included in a number of regional accounts of the rocks of the Harts Range. Joklik (1955) described the geology of about 2,000 square miles of the central Harts Range in a monograph that covered the regional geology, petrology and mica deposits. More recently Shaw adm Wells (1983) and Shaw, Stewart and Rickard (1984) have produced regional maps and brief summaries. Warren (19800 gave a short description of some mineral deposits on the Alice Springs 1:250,000 sheet, and Stewart and Warren (1977) mention some White Rock Dam prospect locations in their review of the mineral potential of the Arunta Block. MacCulloch and Nielsen (1984) reported on aspects of the area for Kinex, as also did leitch in a preliminary account of the present work for Kinex (Leitch, July 1986).

ROCK UNITS

Various divisions of the metamorphic rocks of the Harts Range have been proposed by previous workers (eg Joklik, 1955; Shaw and Wells, 1983; Shaw, Stewart and Richard, 1984). In this report five major groups of these rocks are distinguished, defined mainly on the range of rocks types found associated and their relative abundances While some of these groupings may be stratigraphically significant they are not based on any inferred stratigraphic principles, the application of which would require much more detailed study than that of the present study. Within the groups, areas in which a single rock type or closly related rock types predominate can often be reconized. These, as well as the primary divisions are shown on the accompanying geological map. Boundaries on the map are the result of the present field observations, colour air photograph interpretation and the interpretation of earlier maps.

ONGEVA CREEK GRANULITE

Granulite facies rocks in the southeast corner of EL 4528 surround the Mount Schaeber Granite and are collectively referred to as Ongeva Creek Granulite. This grouping encompasses closely associated mafic, felsic and silicic granulites that are veined by aplite and pegmatite. Fluidal structures and intrusive relationships indicate a migmatitic character for some of these rocks. Prominent well foliated metaquartizite occurs close to the Mount Schaeber Granite. No calc-silicate rocks were recognized in this unit, which may originally have been a pile of diverse volcanic flows. The presence of cordierite in some rocks suggests high temperature but relatively low pressure metamorphism. Although air photo interpretation suggests that the rocks are cut by several sets of faults no evidence of retrogression was noted. The Ongeva Creek Granulite is bounded to the northeast by the southern zone of Gough Dam Schists with an inferred faulted contact.
Shaw, Stewart and Richard (1985) mapped out distinct zones of mafic and felsic granulite within the Granulite but this did not prove possible during the present survey.

BLACKFELLOWS BONES GRANULITE

The Blackfellow's Bones Granulite consists of two major lithologies that can usually be readily separated even during reconaissance mapping. Mafic granulites are mostly rather equigranular aggregates of plagioclose and pyroxene often with accompanying garnet and/or hornblende. These granulites form dark coloured outcrops, usually of lensoidal or ovoid shape. They are mostly massive, but in a few outcrops show a layered structure, resulting from variations in plagioclase content, or a foliation defined by the alignment of prominent crystallographic directions. By contrast felsic granulites comprise aggregates of quartz, feldspar and biotite with the accessory phases cordierite and garnet. The most quartzose of the rocks are appropriately termed biotite quartzites which grade, with increasing feldspar content, into quartzose gneiss and quartzofeldspathic gneiss. Felsic granulites have a similar range of fabric types to the mafic granulites but typically form yellow or orange weathering outcrops, resistant to erosion and with little vegetation. Felsic granulites are more common than those of mafic character in the Blackfellow's Bones granulite.

In the east-central part of EL 4528 the granulite has a migmatitic structure and is host for a number of small granitic bodies. Pegmatites occur widely throughout the unit. As with the Ongeva Granulite mineral assemblages indicate high temperature/low pressure regional metamorphism. The shape of many of the mafic granulite bodies suggests they were once small basic intrusions, perhaps into a sequence of fairly mature sedimentary rocks, the latter now represented by the felsic granulites.

The Blackfellow's Bones Granulite is separated from the Ongeva Granulite by the southern zone of Gough Dam Schist, and its relationship to this Granulite is unknown. Both contain a similar range of rock types but felsic granulites are more common in the

Blackfellow's Bones Unit. A zone of Gough Dam Schist also separates the latter unit from the Irindina Gneiss. The lower metamorphic grade of the Gneiss suggests the Blackfellow's Bones Granulite may have been uplifted along this northern zone. In the east the Granulite is in contact with the Cadney Gneiss. This contact appears conformable and the amphibolite facies of the Cadney Gneiss suggests it lay structually above the Granulite during regional metamorphism.

CADNEY GNEISS

Calcsilicate rocks are the most characteristic lithology of the Cadney Gneiss. They comprise rocks consisting of varying proportions of brown (grossular) garnet, epidote, diopside, amphibole and calcite that are commonly thinly banded but show little foliation. Locally the rocks have recrystallized, seemingly under hydrostatic conditions, with the production of coarse quartz-epidote- (garnet) - (ilmenite) rocks.

With increase in carbonate content the calc-silicates pass into coarse equigrannular marble, which forms elongate lenses in the Copper Queen area. Increase in amphibole leads to the production of dark coloured amphibolites that outcrop in irregular masses within the Cadney Gneiss. Biotite gneiss is a significant member of the Cadney in the area around Pannikin Dam and further east. These rocks are generally well foliated types which while dominated by biotite, quartz and geldspar also contain pink (almandine) garnet garnet and sillimanite. Lenses of quartzofeldspathic and quartzose gneiss occur throughout the Cadney Gneiss. They are readily recognized by their orange coloured outcrops that are often more resistant to erosion than surrounding lithologies. These rocks, the principal variation in which are the result of differing quartz to feldspar ratios, are often well foliated with layering defined by aligned biotite flakes.

Most of the Cadney Gneiss occurs between the southern Gough Dam Schist zone and the eastern extension of the northern Gough Dam Schist zone. However, an area predominantly of calcsilicate rocks in the northeast of EL 4463 previously mapped as Irindina Gneiss (Shaw, Stewart and Richard, 1984) is also included in this unit. This occupies an antiformal culmination which if the interpretation is correct, shows that the Cadney lies structurally below the Irindina Gneiss. Although this contact has been previously interpreted as an unconformity no convincing evidence for such a relationship was noted during this survey.

The Cadney Gneiss comprises a lithologically diverse sequence, probably of relatively shallow-water limestone, calcareous sandstone, sandstone and shale, that has been highly deformed and metamorphosed under amphibolite facies conditions. Pegmatites are widespread throughout the Cadney Gneiss but no migmatitic structures have been recognised nor any minor silicic intrusive bodies.

IRINDINA GNEISS

Layered gneisses that outcrop boldly in the northern part of EL 4463 consist mainly of amphibolite, biotite gneiss and quartzofeldspathic gneiss. These rocks comprise the Irindina Gneiss. Amphibolite is the major rock type and consists of plagioclose - hornblende aggregates most of which contain smaller amounts of garnet or pyroxene. Many of the amphibolites are layered and foliated. Biotite gneiss shows the assemblage quartz-feldspar-biotite-(garnet)-(sillimanite) and is also strongly foliated and lineated, the latter structure being especially prominent in sillimanite - bearing rocks. With increase in the abundance of quartz and feldspar biotite gneiss passes into rock type in typically more massive than other members of the Irindina Gneiss.

Interlayering of the main lithologies in the Gneiss occurs on a range of scales. Some amphibolite layers are in excess of 200 m thick but more often layers are 0.5 to 10 m thick with mapped units being characterised by the abundance of a particular rock type rather than its exclusive occurrence.

Locally quartzite, garnet quartzite, marble and calc-silicate rocks occur within the Irindina Gneiss.

Metamorphism of the Gneiss occurred under amphibolite conditions. The nature of the protolith is uncertain. The strongly layered character of the unit indicates the rocks were stratified but it is unclear if the rocks are all of sedimentary parentage or whether at least the amphibolites had igneous progenitors. As indicated previously the Irindina Gneiss probably lies structurally above the Cadney Gneiss. Shaw, Stewart and Richard (1985) considered there was a difference in structural complexity between these two units and certainly the Irindina Gneiss forms more planarmore continuous layers. However, on a mesoscopic scale the two units show a comprable structural history.

Pegmatites occur widely within the Irindina Gneiss.

GOUGH DAM SCHIST

Rock units that have suffered significant amounts of retrograde metamorphism are collectively grouped in the Gough Dam Schist. The most characteristic rock is a micaceous schist, notably more finely foliated than the gneisses of the White Hill Dam prospect, and containing notably amounts of muscovite. Associated with the schists are amphibolites, some epidote bearing, as well as epidote - rich calc-silicate rocks, marble, biotite schist and quartzo-feldspathic rocks.

Gough Dam Schist outcrops in two zones, one trending east and then southeast from the northwestern corner of EL 4528, and the other running eastsoutheast across the southern part of this EL and along the southern edge of EL 4463. The northern zone separates Blackfellow's Bones Granulite from Irindina Gneiss. It includes many calc-silicate rocks and marble lenses suggesting correlation with the rocks of the Cadney Gneiss. The wider and more continuous southern zone reveals a variety of lithologies outcropping in blocks that are interpreted as fault-bounded. Individual blocks are dominated by calc-silicate, quartzofeldspathic and micaceous rocks suggesting they collectively comprise slices of retrogressed Blackfellow's Bones Granulite and Cadney Gneiss.

Like the surrounding units, the Gough Dam Schist contains abundant pegmatites. However quartz - veining is no more common than in other rocks and despite the mineralogical evidence for retrogression the rocks are nor more structurally complex than unaltered gneiss and granulite. Overall Gough Schist appears to be the product of crystallization under conditions of relatively high water pressures of rocks similar to those found elsewhere in the White Hill Dam prospect.

MOUNT SCHAEBER GRANITE

A small elliptical granite pluton has been emplaced within the Ongeva Granulite in the southwest corner of EL 4528. this on is termed the Mount Schaeber Granite. It ranges in composition from at least tonalite to granodiorite, consisting mainly of quartz plagiioclose, alkali feldspar and biotite. The rocks are stained and show a weak foliation. An amphibolite dyke 1 m wide was noted on the northern edge of the pluton but neither pegmatite nor aplite dykes were observed in the body or in immediately surrounding rocks Evidence of the thermal metamorphism in the surrounding rocks is also absent, and there is no sign of hydrothermal alteration associated with the emplacement of the body. Collectively these observations suggest granite emplacement during regional meta -morphism. Rare mafic schlieren occur within the pluton.

QUATERNARY ALLUVIUM

Sandy and gravelly alluvium is associated with the more prominent west-flowing creeks in EL 4528. Alluvium mantles valley floors for up to 500 m from present day creek courses but drilling indicates such material rarely attains a thickness greater than 4 metres.

STRUCTURAL GEOLOGY

All of the metamorphic units show the same deformation history on outcrop scale. The earliest recognised structural event produced tight to isoclinal folds in lithological layering, folds that now plunge at widely varing angles to the west, north or east. A later event refolded these structures and lithological layering, into open to close ctructures the axial surfaces of which strike east-west. Folds of this generation plunge at low to moderate angles east or west. Even folds of the later generation from the same outcrop show a wide range of orientations, suggesting rather unconstrained fluidal flow, probably near the peak of metamorphic temperatures. Axial - surface structures are rare, indicating an absence of a highly anisotropic stress field.

Small-scale structures are most common in the thinnly layered rocks of the Cadney Gneiss but are also widespread in the Irindina Gneiss and the Gough Dam Schist. Although the same pattern occurs in the granulites their massive character commonly masks their structure, while migmatitic rocks mostly yield a confused structural geometry.

On the macroscopic scale the White Hill Dam Prospect can be divided into 4 structural domains. Domain 1 comprises the rocks north of the northern zone of the Gough Dam Schist and the inferred fault that continues east from the tapering end of this zone. The domain is occupied mainly by the Irindina Gneiss that has an overall east-west trend, well defined by mapped lithological layers despite numerous small-scale folds. A major synform occurs in the south-east of this domain, with east-west axial trace and steeply inclined axial plane. A similarly oriented antiform is responsible for the emergence of an elongate inlier of the Cadney Gneiss about a kilometre north of the synformal trace, and a further synformal fold is probably marked by the hinge in a disrupted layer of quartzofeldspathic gneiss close to the northern boundary of EL 4463.

Domain 2 encompasses the northern zone of the Gough Dam Schist.This is a region of widespread small-scale folding in which the foliation strikes approximately parallel to the overall trend of the zone.

Domain 3 encompasses the outcrop area of Blackfellow's Bones Granulite and Cadney Gneiss lying between the northern and southern Gough Dam Schist zones (and their eastward extension). A major synformal structure is postulated within the Blackfellow's Bones Granulite, the axial trace of which is slightly sinuous but trends approximately eastsoutheast from the unnamed dam on the western boundary of EL 4528. This structure has also affected the contact of the Granulite with the Cadney Gneiss but has not been traced into the latter unit.

An antiformal structure is believed to fold the Cadney Gneiss further south, with an axial trace directed about eastnortheast and lying a little to the north of the North Copper Queen. The existence of this fold is inferred from both structural data and from the aeromagnetic pattern in this area, and causes rocks along strike from the western end of the Copper Queen mineralization to be bent north and disappear beneath the extensive area of alluvium northwest of the Copper Queen. The combined affect of these structures may be to fold the cupriferous gneiss horizon of the North Copper Queen such that it links with the similar gneisses exposed in the costean just south of the Copper Queen track junction with the Blackfellow's Bones Bore - Oonagalabi track.

Further east in the Cadney Gneiss large-scale folds are indicated by the outcrop pattern of quartzofeldspathic gneiss south and southeast of Pannikin Dam. The seemingly abrupt termination of these layers against biotite gneiss in the Pannikin Dam area has been interpreted as indicating a fault (Shaw, Stewart and Richard 1985) but little evidence for this structure can be seen in the field. Large mesoscopic folds mark the boundary where it is cut the Cadney Creek.

Domain 4 comprises the southern Gough Dam Schist Zone and the area of granulite and granite in the southwest corner of EL 4528. The structure of this domain is of fault-bounded blocks and slivers that show an overall west north west - east south east elongation. Rocks that occur within the domain are similar to those further north in lithology. No zones of brecciation or slickensiding have been recognised, and it is inferred that the movements which produced the distinctive structure of the domain occurred under elevated temperatures, probably just below those which stabilise muscovite rather than sillimanite plus potash feldspar.

The rocks of the White Hill Dam Prospect are noteworthy for the absence of signs of post-metamorphic faulting. No breccia zones have been recognized, nor prominent fracture systems, nor zones of intense jointing. The relatively young pegmatites and associated veins probably lie along fractures, possibly the products of tensile stresses operating late in the history of the region.

MINERALIZATION

Two styles of mineralization have been recognised in the White Hill Dam Prospect: copper mineralization in biotite gneiss and copper-gold mineralization associated with calc-silicate rocks and marble. These are discussed in turn below, followed by a discussion of various quartz vein types which were sampled in an attempt to establish whether gold was introduced in a separate event from that responsible for the copper in the area of copper-gold mineralization.

Cupriferous Gneiss

The most extenxive area of cupriferous gneiss is that of the Copper Queen North (MacCulloch and Nielsen, 1984). Here small malachite-stained lenses of biotite-sillimanite-(garnet) gneiss are concentrated in discontinuous zone up to about 1.5 m thick and several hundred metres long. Individual lenses, and the zone they collectively define, trend parallel to the foliation in the rocks. Apart from the presence of malachitie, seldom in other than minor concentrations, the rocks in the lenses are similar to adjacent unmineralized gneiss. No sulphides were observed in fresh gneiss from this area and it is possible that the malachite has been produced by the breakdown during weathering of a copper-bearing silicate mineral. The North Copper Queen mineralization occurs within the Cadney Gneiss, the unit in which this style of mineralization is most common. Cuprifereous biotite-sillimanite-garnet gneiss of the Cadney Gneiss exposed in a costean at the intersection of the Copper Queen track with the Blackfellow's Bones Bore - Oonagalabi track are of very similar characters to those of the North Copper Queen, and the possibility that these two areas are linked has already been discussed. Other occurences of malachite stained gneiss are about 0.75 km south of Pannikin Dam (Cadney Gneiss), within the southern Gough Dam Schist Zone (in rocks believed derived from Cadney Gneiss) and in a discontinuous zone west from the Virginia Prospect which is located immediately east of EL 4463 adjacent to the Oonagalabi track. The last zone is developed within rocks mapped as Irindina Gneiss lying just north of the anticlinal inlier of Cadney Gneiss. Again the host-rock is biotite-sillimanite-garnet gneiss, the mineralization is restricted to small lenses concentrated in a strike-parallel zone, and only secondary copper minerals have been identified.

Copper Queen Mineralization

The Copper Queen mineralization has been discussed in detail by MacCulloch and Nielsen (1984). Copper mineralization here is concentrated in a discontinuous layer of garnet-clinopyroxene-epitote rock closely associated with other calc-silicate lithologies and marble. The mineralized zone is generally less than a metre thick, parallels layering in adjacent metamorphic rocks, and becomes increasingly discontinuous westward. To the east the zone terminates in a series of small late-stage mesoscopic folds. Only secondary copper minerals, mainly malachite have been recognized at the Copper Queen and the primary phase carrying the copper is not known. The abundance of copper minerals is highly variable along the zone with concomittant variation in copper grades.

Although the host-rock mineralogy is that expected in a skarn, the geological setting is inappropriaite for skarn-type mineralization. There is no nearby evidence for an adjacent unexposed pluton; the rocks show regional rather than contact metamorphic charaters and there is no need to postulate metasomatism to account for their composition.

Of particular note in some assayed Copper Queen samples described by MacCulloch and Nielsen are anomalously high gold values. Not all Copper Queen samples show high values and there is no close relationship between gold and copper abundance so the relationship between the introduction of the two metals into the rocks is unclear.

Quartz Veins

As indicated in the preceeding section the origin of the gold ed from some Copper Queen samples is obscure. Although there are no cross-cutting veins at the Copper Queen, the sporadic distribution of high gold values raises the possibility that this metal was introduced separately from the copper. Elsewhere in the Arunta Block, gold mineralization is associated with quartz veins. In the White Hill Dam Prospect quartz veins of a range of structural settings and implied ages have been sampled in an attempt to determine if gold was mobilised at any stage during the formation of the veins.

Sampled veins include:

Cadney Gneiss

(a) veins associated with mylonitic pegmatites - HR 4, HR5

(b) late-stage quartz-epidote segregation veins - HR 3

(c) late-stage cross-cutting quartz veins - HR2, HR 21

(d) veins associated with copper-stained gneiss - HR 19

Ongeva Granulite

(e) Concordant quartz veins - HR 34

Blackfellow's Bones Bore Granulite

(f) Broadly concordant, commonly pegmatite associated veins - HR 23 HR 25, HR 36, HR 37.

Irindina Gneiss

(g) Quartz veins associated with cupriferous gneiss - HR 9, HR 10, HR 11, HR 13

(h) Early metamorphic segregation veins - HR 15, HR 42

(i) Pegmatite - associated veins HR 17

(j) Late-stage discordant veins HR 14

Gough Dam Schist (northern zone)

(k) Concordant veins - HR 24, HR 39, HR 41

(l) Pegmatite related veins - HR 32

Gough Dam Schist (southern zone)

(m) Concordant veins, some pegmatite related - HR 6, HR 7, HR 8, HR 27, HR 28, HR 29, HR 30, HR 31, HR 33.

The interpretation of assay values, not available at time of writing, will be discussed separately.

CONCLUSIONS

New geological mapping, allied with assay results should allow the refining of exploration targets substantially. The present survey suggests:

(1) The copper mineralization is of itself of no economic significance but the metal may serve as an indicator to anomalous gold values. Assay results should help to determine whether this is indeed the case.

(2) The Cadney Gneiss appears to be the most promising of the units mapped for mineralization.

(3) Exploration might be concentrated (a) in the area north from the Copper Queen to the Blackfellow's Bones Bore - Oonagalabi Track and (b) in the little known region between this area and west of a line joining Pannikin Dam and the White Lady Mica Mine.

(4) As the Gough Dam Schist Zones are propably areas of

metasomatism involving the introduction of water and the introduction or remobilization of potassium. Assays from these rocks should be carefully assessed.

(5) Preliminary analysis of in situ magnetic susceptibilitiy indicates high values are associated with some of the Copper Queen rocks. Ground magnetic traverses would probably allow more precise definition of any continuation of this zone to the north as suggested by structural and aeromagnetic data.

REFERENCES

JOKLIK, G.F., 1955: The geology and mica fields of the Harts Range, Central Australia. B.M.R. Bulletin 26.

LEITCH, E.C., 1986: Preliminary report on EL 4463 and EL 4528 Harts Range, Northern Territory. Report to Kinex Pty Ltd July 1986.

MACCULLOCH I.R.P., NIELSEN, K.I., 1984: White Hill Dam Prospect, Alice Springs, Northern Territory, Kinex Report July 1984.

SHAW, R.D., STEWART, A.J., RICKARD, M.J., 1984: Artlunga - Harts Range Region, Northern Territory, B.M.R. 1:100,000 Map and Commentary.

SHAW, R.D., WELLS, A.T., 1983: Alice Spring, Northern Territory (second edition) - 1:250,000 Geological Series B.M.R.

STEWART, A.J., WARREN, R.G., 1977: The mineral potential of the Arunta Block, Central Australia. B.M.R. Journal 2, 21-34

WARREN, R.G., 1980: Summary descriptions of mineral deposits by commodities in the Alice Springs 1:250,000 Sheet area. Northern Territory, B.M.R. Record 1980/44

19

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Client: KINEX PROPRIETARY LIMITED
Address: P.O. BOX 167
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Batch Number: G168-1

Contact: MR. I. MacCULLOCH

No. of Samples: 30
Date Received: 18/07/86
Date Completed: 07/08/86

Order No. LETTER (FAX)

Sample Type: BULK SAMPLE

SAMPLE NUMBER	Element Unit Method	Au ppt PM216	S.Wt Kg			
1/1		300	5.10			
2/1		350	5.46			
3/1		<50	5.97			
4/1		300	4.60			
5/1		400	6.06			
6/1		400	5.40			
7/1		50	5.07			
1/5		150	6.27			
2/5		300	6.65			
1/2		50	4.63			
2/2		250	4.25			
3/2		350	6.12			
4/2		400	5.90			
5/2		100	5.24			
6/2		250	4.79			
7/2		300	5.19			
8/2		650	5.04			
9/2		150	5.41			
1/4		850	7.13			
2/4		950	7.31			
3/4		1450	5.30			
4/4		650	5.41			
5/4		750	5.51			
6/4		1750	5.56			
7/4		650	5.49			
8/4		850	4.89			
9/4		1050	4.43			
10/4		1150	5.99			
11/4		500	4.65			
12/4		1900	6.25			
Detection Limit:		50				

Comments:

Signatory: G J Kehnster

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ddress: P.O. BOX 167
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N.S.W 2072

Batch Number: 6168

ontact: MR. I. MacCULLOCH

No. of Samples: 33
Date Received: 18/07/86
rder No. LETTER (FAX) Sample Type: ROCK CHIP
Date Completed: 07/08/86

SAMPLE NUMBER	Element Unit Method	Au ppm PM210				
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HR 3		0.01				
HR 4		0.01				
HR 5		0.02				
HR 6		0.01				
HR 7		0.02				
HR 8		0.01				
HR 9		0.01				
HR 10		0.01				
HR 11		0.01				
HR 13		<0.01				
HR 14		0.01				
HR 15		0.08				
HR 17		0.01				
HR 19		0.04				
HR 21		<0.01				
HR 23		<0.01				
HR 24		0.04				
HR 25		0.03				
HR 27		0.04				
HR 28		0.08				
HR 29		<0.01				
HR 30		0.03				
HR 31		0.04				
HR 32		0.03				
HR 33		0.03				
HR 34		0.02				
HR 36		0.03				
HR 37		0.03				
HR 38		0.01				
etection Limit:		0.01				

omments:

NLESS NOTIFIED PULPS WILL BE DUMPED ON 18/01/87 AND SPLITS (IF ANY) ON 18/10/86

Signatory: G J Kilmister

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Batch Number: G168

ontact: MR. I. MacCULLOCH

No. of Samples: 33
Date Received: 18/07/86
der No. LETTER (FAX) Sample Type: ROCK CHIP
Date Completed: 07/08/86

SAMPLE NUMBER	Element Unit Method	Au ppm PM210				
HR 39		0.01				
HR 41		<0.01				
HR 42		<0.01				
etection Limit:		0.01				

omments:

NLESS NOTIFIED PULPS WILL BE DUMPED ON 18/01/87 AND SPLITS (IF ANY) ON 18/10/86

Signatory:

Harts Range Drilling.

Four areas were drilled (see air photos).

Area 1 - Line £1 - Bearing of 345T on map. (Holes=7).
Area 2 - Line £2 - Bearing of 225T on map.
Area 3 - Line £4 - Bearing of 165T then 175T on map.
Area 4 - Line £5 - Two holes on a bearing of 170T on map.

DRILLING - HARTS RANGE.

LINE £1. 50m hole intervals (paced).

Hole 1. Sample 1/1. 30m from tree on bearing 345T. Top of calcrete = 1.7m. Lithologies: quartz/biotote schist. Sample from 1m below top of calcrete.

Hole 2. Sample 2/1. Top of calcrete at 1.8m. Lithologies: quartz and biotite metamorphics and feldspar fragments. Sample from 1m below top of calcrete.

Hole 3. Sample 3/1. Gravel encountered at 1m (drilling aborted) - sample at this stage (3/1). Noticeable amphibolite chips.

Hole 4. Sample 4/1. Bedrock (? or large rock) at 1.4m - micaceous schist. Lot of mica in sand (also a lot of outcrop nearby). Sample taken at this level.

Hole 5. Sample 5/1. Located between two stream courses - gravel encountered at 2.3m, with chips of quartz-biotite schist.

Hole 6. Sample 6/1. Gravel encountered at 2m (chips of amphibolite and quartz, biotite, feldspar). Cut through, and encountered gravelly sand (muscovite flakes and quartz chips) -

some calcrete and mica schist). Definite calcrete encountered at 2.8m, and sample taken at 3.8m (ie 1m below top of calcrete).

Hole 7. Sample 7/1. Last on this line. Gravel at 2.3m (chips of quartz, mica schist, amphibolite). Calcrete at 2.8m - sample taken at 1m below this in a buff coloured gravelly sand.

Two odd holes were drilled, labelled 1/5 and 2/5 respectively.
Hole 1. located 30m from blazed tree in direction 170T. Sample 1/5. Gravel at 3.2m comprising chips of quartz, feldspar micaeous metamorphics, and amphibolite. Quartz and feldspar chips resemble pegmatites. Possible calc-silicate fragments. Chips up to 2.5cm long. subangular and occasionally fractured. More chips here than previous holes, including large mica flakes. Sample taken at 3.8m.

Hole 2. Sample 2/5 located 150m on beariong 170T from Hole 1. Gravel at 3.7m - chips of quartz, feldspar, mica flakes. Is a coarse sand - pebbly sand. Occasional micaceous schist chips. Sample taken at 4.4m.

Line £2. 50m hole spacings.
Hole 1. Sample 1/2. Gravel at 2m - drill stopped. Sample here.

Hole 2. Sample 2/2. 50m from hole 1 on bearing 225T. Calcrete at 1.2m. Material is a fine-grained grey-brown silty sand with mica schist chips, and rare calcrete chips. Sample at 1.9m as drilling aborted.

Hole 3. Sample 3/2. Poor penetration, as o/c approximately 10m away. Max penetration only 0.5m (sample taken) comprising friable sand with rare (?amphibolite) chips.

Hole 4. Sample 4/2. Lot of o/c nearby. 1m - minor calcrete (and rare chips of amphibolite + 1 piece of calc-silicate) in a grey-brown sandy silt. Maximum penetration is 1m (sample taken).

Hole 5. Sample 5/2. No visible o/c. At 1.5m, bottomed on mica schist (sand has noticeable mica flakes) - sample at this level.

Hole 6. Sample 6/2. No visible outcrop nearby. At 0.8m, penetrated a weathered brown rock, with cemented grains of quartz and mica. Determined as a ferricrete. Sample taken at this level.

Hole 7. Sample 7/2. No visible outcrop. Ferricrete at 0.5m, penetrated at 0.8m (ie 30cm thick). Weathered mica schist encountered at 1.8m - sample at this level.

Hole 8. Sample 8/2. No visible outcrop. Mica schist and amphibolite fragments at 2.8m - drilling easier here. Drill stops at 3.2m (too hard) - some fragments of quartzite, mica schist and amphibolite. Sample taken at 3.2m.

Hole 9. Sample 9/2. Last of this line located approximately 20m from blazed tree. Ferricrete at 0.7m - drilled through it. Very few rock fragments - alluvium seems thick here. Some ferricrete fragments. Drill stopped at 3m (sample).

Line £4 (Line towards Copper Queen).

The first two holes were drilled on Friday 27th June. 100m spacings on a line bearing 165T from track junction to a blazed tree (approx 500m) then a bearing of 175T to the end.

Hole 1. Sample 1/4. Calcrete at 2m. Sample taken approx. 0.2m below this.

Hole 2. Sample 2/4. Calcrete at 2.75m. Sample taken approximately 0.2m below this (??).

Hole 3. Sample 3/4. Conspicuous amphibolite and quartz schist fragments at 1.6m. Color change to lighter sand here (calcrete). Sample taken 1m below this at 2.6m.

Hole 4. Sample 4/4. Amphibolite and quartz schsit chips at 1.7m, with minor calcrete. Rare feldspar fragments (?pegmatite). Sample at 2.7m.

Hole 5. Sample 5/4. Gravel at 1.8m (?calcrete). Rock hit at 2.4m. Sample taken here.

Hole 6. Sample 6/4. First hole after change in bearing to 175T. Calcrete-cemented gravel at 3m. - drill impeded and sample taken at this level.

Hole 7. Sample 7/4. Calcrete (grey with amphibolite and quartz schist chips) at 1m then 2m of poorly-cemented calcrete - sample taken at 3m.

Hole 8. Sample 8/4. Calcrete gravel (slight colour change) at 1.6m. Sample taken at 2.6m.

Hole 9. Sample 9/4. Pebbly sand for first 1m. Calcrete chips at 0.8m, which are finer grained than before. Sample at 1.8m.

Hole 10. Sample 10/4. Calcrete at 1.8m. Large rock at 2.4m - sample taken at this level.

Hole 11. Sample 11/4. Great thickness of stream alluvium here as only 2m from stream bed. At 4.3m, hit rock - sample at this level.

Hole 12. Sample 12/4. Calcrete cemented gravel at 0.8m - drill impeded at 1.2m - sample taken here.

7. 7. '86

LEGEND

———	Fault
—?—	Inferred Fault
	Syncline
	Overturned anticline
	Anticline
	Geological boundary
	Main road, track, stream, fence
⚒	Mine
•35	Thin section locations
•HR 23	Geochemical rockchip sample point
⊙	Spot drill holes
1 — 9	Drill lines with hole numbers

QUATERNARY		Qa	Alluvium
TERTIARY	THE GARDENS FORMATION	T	Conglomerates, sandstones, siltstones, Fe oxide rich
DEVONIAN	MT. BRASSY FORMATION	Pzb	Na-Ca feldspar – hornblende amphibolites
	MT. RIDDOCK FORMATION	Pzr	Na-Ca feldspar – hornblende & garnet amphibolites (shows distinct, felsic – mafic layering
PROTEROZOIC	MT. SCHAEBER HORNBLENDE GRANITE	P€g	Quartz K-feldspar – hornblende, minor biotite granite
	BRADY FORMATION	P€b	Quartz feldspar biotite muscovite gneiss
	IRINDINA FORMATION	P€i	Quartz feldspar biotite garnet, often porphyroblastic & calcsilicates
	SPRIGGS CREEK MEMBER	$P€i_1$	Predominantly marbles with minor garnets epidote magnetite & pyroxene
	NARINGA MEMBER	$P€i_2$	Calc. silicates
	PANNIKIN MEMBER	$P€i_3$	Diopside quartzite
	OCHRE BAR MEMBER	$P€i_4$	Feldspar quartz porphyroblastic gneiss
	CLARAVILLE MEMBER	$P€i_5$	Biotite with minor quartz feldspar gneiss
	BRUMBY BORE MEMBER	$P€i_6$	Quartzite
PROTEROZOIC	BLACKFELLOW BONES FORMATION	P€af	Mainly quartzo – feldspathic with, minor biotite, garnet & magnetite gneiss
	FLORENCE CREEK MEMBER	$P€af_1$	Porphyroblastic K-feldspar in biotite, quartz feldspar gneiss
	OONAGALABI MEMBER	$P€af_2$	Mineralised para – amphibolites with calcsilicates
	MT. JOHNSTONE MEMBER	$P€af_3$	Large K-feldspar gneiss in felsic, ground mass with garnet
	CADNEY CREEK FORMATION	P€c	Interbedded calcsilicates & quartz, feldspar biotite gneisses with magnetite
	WHITE LADY MEMBER	$P€c_1$	Marbles
	BULLOCKY BORE MEMBER	$P€c_2$	Quartz feldspar biotite garnet & magnetite gneiss
	TUG CREEK MEMBER	$P€c_3$	Porphyroblastic K-feldspar, in quartz feldspar biotite gneiss
	ONGEVA CREEK FORMATION	P€z	Granulites hypersthene quartz phlogopite, diopside Ca-feldspar magnetite

KINEX PTY LIMITED

WHITE HILL DAM AREA – HARTS RANGE, N.T.

PRELIMINARY REGIONAL GEOLOGY & GEOCHEMICAL SAMPLE LOCATIONS

SCALE 1:23,500
(APPROX.)

DATE: JUNE 1986	GEOL.	TRACE No 115	REF. SF 53-14

NORTHERN TERRITORY GEOLOGICAL SURVEY **CR86/271**