TANAMI JOINT VENTURE

ZAPOPAN NL
KUMAGAI GUMI CO LTD
KINTARO METALS PTY LTD

EXPLORATION LICENCE 5411

TANAMI REGION
NORTHERN TERRITORY

FIRST ANNUAL REPORT - 1990

TANAMI 1:250,000 SHEET SE52-15

MAY 1990
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The western zone forms part of a sequence of interbedded mafic rocks and volcanioclastic sediments (Lower Proterozoic) which occur around the periphery of a large granitic intrusion known as the "Frankenia Dome". The eastern zone of magnetics comprises a series of arcuate magnetic highs also interpreted to be of Lower Proterozoic age.

An extensive cover of aeolian sand has precluded any detailed geochemical sampling. Shallow auger or RAB drilling is recommended in order to test the magnetic zones beneath the sand cover.
2. INTRODUCTION

Exploration Licence 5411 was granted on the 3 May 1989 to Harlock Pty Ltd and subsequently a 50% interest was transferred to Zapopan NL. Harlock holds its interest in trust on behalf of Kumagai Gumi Co Ltd (30%) and Kintaro Metals Pty Ltd (20%). Zapopan, Kumagai and Kintaro comprise the Tanami Joint Venture (TJV).

The EL covers an area of 950sq km (295 blocks) and is located 20km-60km NNE of Rabbit Flat (Figure 1).

No roads or tracks occur within the EL and access to date has been via helicopter.

The EL lies on totally on Aboriginal land within the Central Desert Land Trust area.

This report details exploration carried out in the first year of the licence.
EL 5411
295 blocks
950 sq kms

Figure 2

TANAMI JOINT VENTURE

Scale: 1:280,000
Compiled:
Drawn:
Date:
3. **PREVIOUS WORK**

No modern exploration has been carried out within EL5411.

A summary of previous geological and geophysical work follows:-

1900 A gold prospecting expedition led by Davidson (1905) discovered gold at Tanami and The Granites, and named several topographic features.

1909 Brown (1909) visited the mines at Tanami and made geological notes of the country to the north and north-east.

1910 Gee (1911) visited the Tanami goldfield. He noted the prospecting being carried out south and east of Tanami especially at The Granites.

1914 Jensen (1915) travelled from Pine Creek to Tanami and described the geology in the vicinity of the gold workings and along his route between Hooker Creek and Tanami. He named the metamorphic rocks at Tanami the 'Tanami Metamorphic Series'.

1928 Terry (1930, 1931) led a prospecting expedition from Halls Creek to Tanami via the Gardner Range, and explored the country to the south and southeast as far as The Granites (then also known as Bugagee).

1937-38 The Aerial Geological and Geophysical Survey of Northern Australia (AGGSNA) carried out geological investigations in the Tanami and The Granites goldfields. The results were reported by Hossfeld (1940a, 1940b) who later suggested an Early Proterozoic age for the low-grade metamorphic rocks at the two localities (Hossfeld, 1954).


1962 BMR carried out an airborne magnetic and
radiometric survey of Tanami and The Granites Sheet areas (Spence, 1964; BMR, 1965a, 1965b).

1967
BMR carried out a reconnaissance gravity survey of The Granites Sheet area (Whitworth, 1970)

1970
Geopeko carried limited exploration in the Tanami-The Granites region primarily targeting magnetic anomalies (Twigg, 1970).

1972
BMR geologically mapped the area as part of a larger mapping programme covering The Granite-Tanami block (Blake et al 1973 and 1975; Hodgson, 1975; Hodgson, 1976; Blake et al 1979). At the same time as the geological mapping, a programme of shallow stratigraphic drilling was carried out by BMR drilling crews (Blake, 1974) (See Appendix I).

Since 1972, several papers of a general nature concerning The Granites-Tanami region have appeared in the literature. These include:- Blake, 1975; Blake, 1978; Blake and Hodgson, 1976; and Page et al, 1976.
4. GEOLOGY

EL5411 is almost completely covered by aeolian sand with areas of colluvium and alluvium. The following brief description derives from assessment of gravity, airborne magnetic and radiometric maps, and from 10 shallow stratigraphic drillholes completed by the BMR in 1971 (see Appendix I).

EL5411 occurs on the northeastern flank of the Frankenia granitic dome. Airborne magnetic data suggest an almost continual stratigraphy around the dome from the Tanami Mine with the exception of a gap between the northern part of EL5411 and the Black Hills. This stratigraphy comprises Lower Proterozoic sediments (mudstones, sandstones, tuffites) and mafic rocks (pillowed basalts to gabbros) and are not known to crop out in the EL. Areas of low magnetic response are assumed to be underlain by granite (s.l.). Several of the BMR stratigraphic holes hit granite in the northern part of the EL. This granite is a pale pink medium to fine-grained porphyritic granite, partly greisenized, with microcline, sodic plagioclase, biotite, apatite, epidote, sphene, zircon and minor tourmaline.

Sedimentary rocks of possible Cambrian age, consisting of mudstone and sandstone were intersected in several stratigraphic holes (61-67). Core samples and cuttings of the rocks were examined at BMR, but no fossils were found, hence their inferred Cambrian age cannot be confirmed (Appendix I). Areas of Cambrian Antrim Plateau Volcanics crop out near the southern boundary of the EL along with possible Cambrian sediments.

A broad southwest tending palaeochannel channel is apparent, from interpreting the radiometric data, in the eastern part of the EL. This channel overlies several highly magnetic zones (Lower Proterozoic).

The following paragraphs on landforms and regolith geology relate
to The Granites-Tanami area in general rather than to EL5411 specifically.

Landforms and corresponding regolith geology characteristics in The Granites and Tanami area are complex but it is possible to understand their genesis and recognise their characteristics with careful evaluation. Broadly, the area can be described as an etched laterite peneplain typical of arid terrains throughout Australia. The residual lateritic duricrust which formed on the Tennant Creek palaeosurface (Hays, 1967) can be recognised over a wide area. It is often buried beneath aeolian sands/silts and sheet wash alluvium over the prospective geological basement sequence. Its distribution is erratic and unpredictable beneath cover because of erosion.

A significant aspect of the regolith stratigraphy is the striking similarity to the areas mapped in detail over the Archaen Yilgarn Province in WA. The broad landforms recognised have been broken up into erosional and depositional categories. (See Appendix II for full descriptions).

**Erosional Landforms:**
Unit 1: Low rises of outcrop and small rounded hills.
Unit 2: Etched laterite plateau-uplands and breakaways.
Unit 3: Outcropping area.
Unit 4: Pediplains.

**Depositional Landforms:**
Unit 5: Alluvial and aeolian covered pedimented slopes and plains.
Unit 6: Colluvial outwash plains.
Unit 7: Linear playa drainage lines.
Unit 8: Clay filled drainage sumps.
Unit 9: (a) Alluvium plain - upper tributary.
(b) Alluvium plain - lower tributary.
(c) Alluvium floor in valley tract - braided wash areas.

Within these landforms the regolith stratigraphy is variable but broad units have been recognised and are as follows:-

Aeolian Sands/Silts (depositional landforms): This unit is widespread, generally 1-2m thick (max 5m) and a reddish brown coloured sand or loam. This unit is interpreted to be dominantly windborne but has been locally affected by fluvial processes. It is interpreted to be the fine grained silica-rich component of a degraded laterite duricrust. It locally forms a hard pan.

Laterite/Quartz/Ironstone Lag (erosional landforms): This unit generally develops on the mottled zone and is interpreted to be the remnants of a degraded lateritic duricrust/mottled zone. The material does not appear to have been transported over long distances and is characterised by coarse laterite pisoliths/nodules (generally ferricrete category), quartz and formation of ironstone from the hardened mottles.

Pisolitic/Nodular Duricrust (erosional landforms): This crust is composed of coarse, packed and cemented nodular and pisolitic laterite that forms a distinctive duricrust. The iron oxides content is variable and dependant upon the bedrock lithologies.

Ferruginous Duricrust (erosional landforms): This unit preferentially develops on the cherty component of
Ferruginous Duricrust (erosional landforms): This unit preferentially develops on the cherty component of Antrim Plateau Volcanics and is characterised by a 1-3m crust comprised of angular chert and lithic fragments up to 10-20cm diameter, cemented by a ferruginous matrix.

Mottled Zone (erosional landforms): The pisolitic/nodular duricrust passes down into a mottled zone characterised by splotches of maroon red discolouration in a pale to dark brown groundmass. The mottles often become hardened with the additional of iron oxides and silica when exposed on the surface and are liberated as a distinctive ironstone lag with degradation of the laterite duricrust. It is common to observe goethite/haematite rich bands within this zone. There are no primary textures remaining from the parent rock until the mottled zones passes down into saprolite.
5. **EXPLORATION COMPLETED**

5.1 **Data acquisition and interpretation**

Open-file reports and relevant geological data from the Tanami-Granites region were obtained.

The TJV contracted Geoterrex Pty Ltd to fly an airborne magnetic survey over selected areas including the whole of EL5411.

Colour aerial photography at 1:50,000 scale was flown by AiResearch Mapping on behalf of the TJV over all their exploration licences. Relevant landforms, outcrop extent, geology, drainage, structure etc were interpreted from the photography.

Landsat images at 1:250,000 scale covering the Tanami-Granites region were purchased and again relevant geological and structural features interpreted.

All the available data have been utilized to build up a broad geological and structural picture of the area.

In an attempt to quantify the prospectivity of the TJV’s exploration licences, initial area selection for exploration was based on four parameters: aeromagnetics, geology, landform and structure. Each parameter was assigned a numerical ranking value of 0-5 for a given area. The values were then added to give a prospectivity index.

Areas with a prospectivity index in the range 15-20 are considered to be of a high priority, 9-14 a moderate priority and less than 9 a low priority. This does not mean that areas with a prospectivity index of 8 or less are not prospective, however they will be more difficult to explore due to overlying regolith geology or younger sediments.
5.2 Aboriginal Sacred Site Clearance

Prior to reconnaissance exploration commencing a sacred site clearance was conducted by an anthropologist and Traditional Owners.

Sites identified during this programme have been given a 1km exclusion zone around them and subsequent exploration will not encroach on these areas.

5.3 Geochemical sampling

Due to extensive aeolian sand cover and lack of suitable lateritic material over target zones, geochemical sampling was restricted. Totals of four laterite samples and 1 rock-chip sample were collected.

Sample locations are plotted on Figure 3 and results are appended (Appendix III).

The laterite samples were prepared by splitting out approximately 200 grams by hand, jaw crushing, and then 100 grams fine pulverised in a zirconia mill in the low level geochemistry section of Genalysis in Perth.
The elements analysed and techniques used are as follows:-

**LATERITE ANALYTICAL TECHNIQUES**

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<td>As</td>
<td>5 ppm</td>
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<td>Se</td>
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<td>Sn</td>
<td>5 ppm</td>
<td>D/MS</td>
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The results obtained from check samples clearly indicated that As and Sb levels were too low. Check sampling by the TJV using Neutron Activation Analysis (NAA) at Becquerel Laboratories in Sydney indicates that the As values obtained by Genalysis using AAS could be as much as 500% too low. Due to the small number of samples collected in EL5411 no geochemical anomalies could be outlined. However, the 25ppm As value (53151) if assayed correctly could well be anomalous, ie greater than 70ppm As. This figure is considered anomalous in orientation surveys at the Tanami Mine.

5.4 Geophysics

Airborne magnetic data for EL5411 was flown on behalf of the TJV by Geoterrrex as part of a survey covering most of TJV's exploration areas.

The specifications for the survey are as follows:-
AIRBORNE SURVEY SPECIFICATIONS

MAGNETOMETER: Cesium Vapour optical absorption. Sensitivity : 0.04 nT

READING INTERVAL: 0.2 sec (approx 13m sampling) at mean ground speed of 220km/hour

SPECTROMETER: Nuclear Data 256 channel ADC Volume : 33.5 litres

TOTAL COUNT WINDOW: 0.8 - 3.00 MeV
POTASSIUM WINDOW: 1.36 - 1.56 MeV
URANIUM WINDOW: 1.66 - 1.86 MeV
THORIUM WINDOW: 2.42 - 2.82 MeV

RECORDING INTERVAL: 1.0 sec (approx 60m sampling) at mean ground speed of 220km/hour

DATA RECORDING: Geoterrex MADACS acquisition system. Digital to magnetic tape.

NOMINAL TERRAIN CLEARANCE: Both detectors in aircraft at 90m

NOMINAL LINE SPACING: Traverse lines at 500 metres Tie lines 5km

FLIGHT PATH NAVIGATION: SYLEDIS STR4 radio navigation system

FLIGHT PATH RECORD: Real time calculation of AMG co-ordinates from the SYLEDIS STR4 navigation system.

RESIDUAL MAGNETIC CONTOURS
Grid notation refers to Australian Map Grid Zone 51
Magnetics : Tie line levelled
IGRF (1985) : Removed, Datum 2000 nT added
Grid mesh size : 100 x 100 metres
Grid filter : None
Contour interval : 2, 20 and 100 nT

The airborne magnetic contours for EL5411 at 1:50,000 scale are
The airborne magnetic contours for EL5411 at 1:50,000 scale are attached (Figure 4). TJV's airborne magnetic data plus the NTGS open-file data were merged and image processed by Geoimage Pty Ltd of Brisbane. A report by Geoimage is appended (Appendix IV).
### 6. EXPENDITURE

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7. **FORWARD PROGRAMME**

The proposed programme for 1990/91 is as follows:-

- **Geochemistry** $16000
- **Access preparation** $3000
- **Salaries/Wages** $6000
- **Other, including administration costs, messing, drafting, vehicles etc.** $5000

$30000

The programme involves first pass geochemical sampling over selected targets using shallow auger drilling.

A commitment of $30,000 for 1990/91 is requested.
REFERENCES


PAGE, R.W., BLAKE, D.H. and MAHON, M.W., 1976 - Geochronology and related aspects of acid volcanics, associated granites, and


APPENDIX I

BMR STRATIGRAPHIC DRILLINGS - EL5411
Fifteen holes, nos 53 to 67, were drilled along an east-west line crossing the extensive sand plain between the Black Hills in the west and the most westerly outcrops of possibly Cambrian sedimentary rocks of the Wiso Basin succession in the east. As well as getting information on both the thickness of the Cainozoic cover and the type of bedrock present, it was also hoped to collect samples of sedimentary rocks suitable for palaeontological examination.

Along the line east of the Black Hills, the Cainozoic sediments intersected consist mainly of sand, with some lateritic ironstone. They are 2 to 6m thick except in hole 66, where 3m of sand overlies 8m of clay. Sedimentary rocks of probably Cambrian age, consisting of limestone, dolomite, mudstone and clayey sandstone, were intersected in holes 61 to 67 and possibly also in hole 60, in which the limestone present may be Cambrian or Tertiary. Three of the holes, nos 60 and 61 bottomed in weathered granite and hole 64 bottomed in hornblende gabbro. Hole 62 bottomed in breccia consisting predominantly of the clay mineral palygorskite; the breccia may be part of the Wiso Basin succession or part of a Precambrian weathering profile developed on granite or other basement rocks. Core samples and cuttings of the sedimentary rocks have been examined by palaeontologists at BMR, but no fossils have been found, hence their inferred Cambrian age cannot be confirmed.
BMR Tanami 59

Location: lat. 19°50'30"S, long. 130°02'18"E; alt., 390 m; E of the Black Hills, 38 km ENE of Tanami.

Drilling data: commenced and completed, 28 September 1971; depth, 4.6 m; drilled with air.

Cuttings: 0-3 m, reddish-brown sand and lateritic ironstone; Cainozoic.
3-4.3 m, weathered granite; Lower Proterozoic unnamed granite.

Core: 4.3-4.6 m, 100% recovery; medium-grained biotite granite containing feldspar phenocrysts up to 1 cm across; biotite is altered to chlorite; unnamed granite.

BMR Tanami 60

Location: lat. 19°50'30"S, long. 130°04'06"E; alt., 390 m; E of the Black Hills, 41 km ENE of Tanami.

Drilling data: commenced and completed, 28 September 1971; depth, 20.4 m; drilled with air.

Cuttings: 0-3 m, reddish-brown sand; Cainozoic.
3-5 m, white limestone; probably Cainozoic calcrete but possibly Cambrian.
5-20.1 m, weathered granite; Lower Proterozoic unnamed granite.

Core: 20.1-20.4 m, 100% recovery; pale pink porphyritic medium to fine-grained granite, thin section - phenocrysts about 5 mm across of microcline and sodic plagioclase in groundmass of quartz, microcline, brown biotite and accessory apatite, epidote, sphene and zircon; unnamed granite.

BMR Tanami 61

Location: lat. 19°50'30"S, long. 130°05'54"E; alt., 380 m; W side Wiso Basin, 44 km ENE of Tanami.

Drilling data: commenced and completed, 28 September 1971; depth, 39.7 m; drilled with air and water.
BMR Tanami 61 (cont.)

Cuttings: 0-4 m, reddish-brown sand; Cainozoic.  
4-6 m, pale brown sand; Cainozoic.  
6-15 m, chocolate brown mudstone; Cambrian?  
15-16 m, chert; Cambrian?  
16-39.6 m, disaggregated granite; Lower Proterozoic 
unnamed granite.  

Core: 39.6-39.7 m, 50% recovery; medium-grained weathered 
granite; unnamed granite.  

BMR Tanami 62  

Location: lat. 19°50'30"S, long. 130°07'47"E; alt., 370 m;  
W side Wiso Basin, 46 km ENE of Tanami.  

Drilling data: commenced and completed, 29 September 1971; depth,  
36.7 m; drilled with air 0-21 m, water 21-36.7 m.  

Cuttings: 0-5 m, reddish-brown sand and lateritic ironstone;  
Cainozoic.  
5-21.3 m, pale yellowish-brown mudstone; Cambrian?  

Core: 21.3-21.6 m; 100% recovery; pale brown cellular clayey 
sandstone; Cambrian?  

Cuttings: 21.6-36.6 m, pale reddish-brown mudstone and sandstone;  
Cambrian?  

Core: 36.6-36.7 m, 100% recovery; diamond bit; breccia of 
angular brown fragments in hard pinkish matrix, 5/3 x 
background radioactive anomaly, thin section - rounded 
to angular grains up to 4 mm across of quartz, opaque 
minerals, and minor tourmaline, zircon, quartzite and 
microcline in abundant matrix of palygorskite (confirmed 
by X.R.D. determination); Cambrian or altered Lower 
Proterozoic unnamed granite.  

BMR Tanami 63  

Location: lat. 19°50'30"S, long. 130°09'42"E; alt., 360 m; W side 
Wiso Basin, 50 km ENE of Tanami.  

Drilling data: commenced, 29 September 1971; completed, 30 September 
1971; depth, 62.8 m; drilled with air 0-34 m, water 
34-62.8 m.
BMR Tanami 63 (cont.)

Cuttings: 0-5 m, reddish-brown sand and lateritic ironstone; Cainozoic. 5-26 m, pale brown mudstone; Cambrian? 26-62.5 m, brown weathered greisenized granite; Lower Proterozoic unnamed granite.

Core: 62.5-62.8 m, 100% recovery; pink medium to fine-grained greisenized granite, thin section - mosaic of quartz, muscovite, sericitic aggregates (after feldspar), and accessory biotite, iron oxide, apatite, and tourmaline: unnamed granite.

BMR Tanami 64

Location: lat. 19°50'24"S, long. 130°11'18"E; alt., 350 m; W side Wiso Basin 53 km ENE of Tanami.

Drilling data: commenced, 30 September 1971; completed, 1 October 1971; depth, 53.9 m; drilled with air 0-26 m, water 26-53.9 m.

Cuttings: 0 - 3 m, reddish-brown sand; Cainozoic. 3 - 24 m, pale buff limestone; Cambrian? 24-53.3 m, maroon weathered gabbro; Lower Proterozoic unnamed granite.

Core: 53.3-53.9, 100% recovery; medium grained hornblende gabbro, thin section - plagioclase largely altered to sericite and clay, brown hornblende partly replaced by pale green amphibole, and accessory brown biotite, apatite, opaque minerals and interstitial quartz: may be basic dyke cutting unnamed granite.

BMR Tanami 65

Location: lat. 19°50'24"S, long. 130°13'12"E; alt., 330 m; W side Wiso Basin, 56 km ENE of Tanami.

Drilling data: commenced and completed, 6 October 1971; depth, 67.4 m; drilled with water.

Cuttings: 0 - 2 m, reddish-brown sand; Cainozoic. 2 - 21 m, maroon limestone: Cainozoic calcrite or Cambrian? 21 - 67.1 m, pale buff clayey mudstone; Cambrian?

Core: 67.1 - 67.4 m, 100% recovery; white to iron-stained friable sandy dolomite; Cambrian?
BMR Tanami 66

Location:  lat. 19°50'24"S, long. 130°15'00"E; alt., 315 m; W side Wiso Basin, 59 km ENE of Tanami.

Drilling data: commenced and completed, 7 October 1971; depth, 31.1 m; drilled with mud.

Cuttings:  0 - 3 m, reddish-brown sand; Cainozoic.
           3 - 11 m, pale grey clay; Cainozoic.
           11 - 12 m, maroon mudstone; Cambrian?
           12 - 30.8 m, pale grey clayey mudstone; Cambrian?

Core:  30.8 - 31.1 m, 100% recovery; white to brown mottled friable clayey sandstone (X.R.D. determination); Cambrian?

BMR Tanami 67

Location:  lat. 19°50'24"S, long. 130°16'48"E; alt., 315 m; W side of Wiso Basin, 62 km ENE of Tanami.

Drilling data: commenced and completed, 7 October 1971; depth, 47 m; drilled with air 0 - 4.6 m, water 4.6 - 4.7 m.

Cuttings:  0 - 4.6 m, reddish-brown sand; Cainozoic.

Core:  4.6 - 4.7 m, 100% recovery; diamond bit: white cellular very fine-grained dolomite with some quartz (confirmed by X.R.D. determination); Cambrian?
APPENDIX II

TANAMI-GRANITES REGION LANDFORMS
TANAMI - GRANITES AREA LANDFORMS

EROSIONAL LANDFORM

Unit 1. Low rises of outcrop and small rounded hills.
Low rises above the sand covered pediplain that are generally mottled zone or saprolite with a thin veneer of pisolithic/nodular laterite and/or quartz and ironstone lag after the degradation of lateritic duricrust.

Unit 2. Etched laterite plateau/uplands and breakaways.
Discontinuous pisolithic/nodular duricrust on mottled zone exposed by erosion. The duricrust can be cemented or loose. Surficial silification is common. Commonly locally obscured by soil or aeolian sand.

Unit 3. Outcropping areas.
Areas where there is a >70% exposure of recognizable bedrock. Occurs as ranges of dissected hills with a well developed drainage pattern. Rare lateritic duricrust preserved. Local areas with a semi residual soil development.

Unit 4. Pediplains
Pediplains with semi residual red earthy soils and belts of thick vegetation. Sheet washed in places.

DEPOSITIONAL LANDFORMS

Unit 5. Alluvial and aeolian covered pedimented slopes and plains.
Gently sloping and flat plains covered by brown red aeolian sand and alluvial sandy soils with a lateritic debris lag. Abundant spinifex and low scrub vegetation. Cover generally attains a maximum thickness of 5m. Often overlays a residual laterite duricrust.
Unit 6. Colluvial outwash plains
Slopes away from outcrop with a sandy soil and often a well developed lag that decreases in size away from outcrop. Can cover a laterite duricrust.

Unit 7 Linear playa drainage lines
Linear areas commonly with playa lakes that are calcrete, silcrete, sand and sediment filled depressions that formed in paleodrainage channels. Often thick vegetation.

Unit 8 Clay filled drainage sumps
Grey brown cracking clays of the montmorillonite family and claypans.

Unit 9. (a) Alluvium plain - upper tributary
(b) Alluvium plain - lower tributary
(c) Alluvium floor in valley tract - braided wash areas
APPENDIX III

LATERITE AND ROCK-CHIP RESULTS
GENALYSIS LABORATORY SERVICES PTY. LTD.

LABORATORY REPORT

17 DAVISON ST. MADDINGTON, W.A. 6109. P.O. BOX 144 GOSNELLS W.A. 6110
TELEPHONE (09) 459 9011, 459 2272. TELEX: GLS 96166.
FAX: (09) 459 5343.

KALGOORLIE SAMPLE PREPARATION DIVISION 12 KEOGH WAY KALGOORLIE W.A. 6430
P.O. BOX 388 KALGOORLIE W.A. 6430 TELEPHONE (090) 21 2881.
FAX: (090) 21 3476.

JOB INFORMATION
JOB CODE: 498.0/893259
NO. SAMPLES: 359
ELEMENTS: 15
CLIENT O/N: DN50105
DATE RECEIVED: 28/07/89
DATE COMPLETED: 23/08/89

LEGEND
'X' = LESS THAN DETECTION LIMIT
'N/L' = SAMPLE NOT RECEIVED
'*' = RESULTS CHECKED
'(' ')'= RESULTS STILL TO COME
'I/S'= INSUFFICIENT SAMPLE FOR ANALYSIS
'E6' = RESULT x 1,000,000

COMMENTS: ATTENTION: S MILNER, I BUTLER, I BUTLER....
COMMENTS: LATER....

PLEASE NOTE:
COARSE REJECTS AND PULPS WILL BE STORED FOR 60 DAYS WITHOUT CHARGE. AFTER
THIS TIME ALL COARSE REJECTS AND PULPS WILL BE STORED AT A RATE OF
$1.20/cubic metre/day UNTIL YOUR WRITTEN ADVICE REGARDING COLLECTION OR
DISPOSAL IS RECEIVED. EXPENSES RELATED TO THE RETURN OR DISPOSAL OF
SAMPLES WILL BE CHARGED TO YOU AT COST.
SAMPLE PREPARATION DETAILS

SAMPLE STATE(S) & SAMPLE PREPARATION(S)

MS-0.2Kg
CR
FP-0.1Kg
Zr-BOWL

Abbreviations used for Preparation codes:

CP : Course Pulverise
CUT : Diamond Saw Cut
SSMG : Single Stage Mix & Grind
N : Not Required
ZK : Two Splits
CR : Crush
FP : Fine Pulverise
MS : Mix & Split
QTZ : Quartz Clean Between
DR : Dry
HM : Hammer Mill
O : Other
COMPS : Composite

Abbreviations used for Sample States:

CONC : Concentrates
D/CHIP : Drill Chip
"MC : Heavy Mineral Concentrates
NC : Reverse Circulation
SOLOM : Solutions
V/CHIP : Vacuum Chip
COST : Costeans
D/CORE : Drill Core
PERC : Percussion Chip
R/CHIP : Rock Chip
STRESI : Stream Sediments
V/DRIL : Vacuum Drill
CRJCT : Coarse Rejects
D/CUT : Drill Cuttings
PISLIT : Pisolite
SOLM : Solutions
UNSPEC : Unspecified
XCRJCT : Ex Coarse Rejects
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| 150 53150 | X | 12 | 44 | 15 | 20 | 8 | X | X | 30 | 1 | 0.7 |
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| 150 53150 | 2 | X |
| 151 53151 | 5 | X |
EUPENE EXPLORATION ENTERPRISES P/L

Report: NO 05639

Client reference: DN 50109

Copies to:

STEVE MILNER-TANAMI JOINT VENTURE

FACS (089) 410821

IAN BUTLER-EUPENE EXP.FACS(089) 411364

SAMPLES: received 10/07/1989

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APPENDIX IV

Processing of Airborne Geophysics

of the

Granites - Tanami area

for the

Tanami Joint Venture

by

GEOIMAGE PTY LTD
PROCESSING

of

AIRBORNE GEOPHYSICS

of the

GRANITES-TANAMI AREA

for the

TANAMI JOINT VENTURE

R.N. Walker
SEPTEMBER 1989
INTRODUCTION

Under instructions from Mr P. Nicholson of Eupene Exploration Enterprises, airborne geophysical surveys over the Granites-Tanami area covering exploration areas held by the Tanami Joint Venture have been processed. The work involved -

1. reading data off a number of located data tapes
2. gridding the data at 20 metres cell size over the Tanami mine area and 50 metres cell size over the full area for the following parameters
   - magnetics
   - vertical derivative
   - vertical derivative with automatic gain (mine area only)
   - radiometrics
3. processing and photography of the above files
PROCESSING (ctd)

Tanami Regional Data

Flight line data from several surveys flown for various companies including the NT Geological Survey, BHP, North Flinders and the Tanami JV, were processed. Other than a constant flight line spacing of 500 metres, the specifications for these surveys varied. The North Flinders surveys on the Frankenja and Ptilotus 1:100 000 sheets were flown E-W whereas the remaining areas were flown N-S.

Two major problems were encountered with the gridding -

1. Individual surveys had completely different radiometric responses and this problem was overcome as much as possible by gridding the individual surveys and matching the statistics either over the overlap areas or over the full area.

2. In the case of the vertical derivative (VD), problems were encountered because the original flight lines were separated into individual 1:100 000 sheets. Because of the technique used to calculate VD's, the responses at the end of the lines differed and resulted in apparent E-W discontinuities where survey or line segments met.

The final grids for the area were

- **BLHC**: 498 000 E, 7 691 800 N
- **Samples**: 5492
- **Lines**: 3140
- **Sample size**: 50 metres

for magnetics, vertical derivative (VD) and radiometrics. The VD image file was then used to derive shade images at various sun azimuth angles.
Appendix 1 contains output from runs converting the real grid files to byte files.

The magnetics, VD and VDG data were gridded using a minimum curvature algorithm, whereas the radiometrics were gridded using a bicubic spline algorithm.

The VD and VDG were processed on the flight line data using an along line 31 point FFT derived filter. A description of the methodology is attached as Appendix 2.
LIST OF SLIDES

TANAMI REGIONAL DATA - FULL AREA

1. Greyscale magnetics.
2. Rainbow pseudocoloured magnetics multiplied by a vertical illumination.
4. Rainbow pseudocoloured vertical derivative multiplied by a vertical illumination on the vertical derivative.
5. Greyscale 00 azimuth 26 degree altitude shade illumination on the magnetics.
6. Rainbow pseudocoloured magnetics multiplied by a 00 azimuth 26 degree altitude shade illumination on the vertical derivative.
7. Greyscale 45 azimuth 26 degree altitude shade illumination on the magnetics.
8. Rainbow pseudocoloured magnetics multiplied by a 45 azimuth 26 degree altitude shade illumination on the vertical derivative.
9. Greyscale 90 azimuth 26 degree altitude shade illumination on the magnetics.
10. Rainbow pseudocoloured magnetics multiplied by a 90 azimuth 26 degree altitude shade illumination on the vertical derivative.
11. Greyscale 135 azimuth 26 degree altitude shade illumination on the magnetics.
12. Rainbow pseudocoloured magnetics multiplied by a 135 azimuth 26 degree altitude shade illumination on the vertical derivative.
13. Radiometric colour composite.
   Potassium in red, thorium in green, uranium in blue.
LIST OF SLIDES

TANAMI REGIONAL DATA - EL 5411

Subsampled 2033 1765 800 1000 1 1 (for magnetics)
Subsamples 1021 883 400 500 1 1 (for radiometrics)
Reduced to 75m metre pixels

1. Greyscale magnetics.
2. Rainbow pseudocoloured magnetics multiplied by a vertical illumination.
4. Rainbow pseudocoloured vertical derivative multiplied by a vertical illumination on the vertical derivative.
5. Greyscale 00 azimuth 26 degree altitude shade illumination on the magnetics.
6. Rainbow pseudocoloured magnetics multiplied by a 00 azimuth 26 degree altitude shade illumination on the vertical derivative.
7. Greyscale 45 azimuth 26 degree altitude shade illumination on the magnetics.
8. Rainbow pseudocoloured magnetics multiplied by a 45 azimuth 26 degree altitude shade illumination on the vertical derivative.
9. Greyscale 90 azimuth 26 degree altitude shade illumination on the magnetics.
10. Rainbow pseudocoloured magnetics multiplied by a 90 azimuth 26 degree altitude shade illumination on the vertical derivative.
11. Greyscale 135 azimuth 26 degree altitude shade illumination on the magnetics.
12. Rainbow pseudocolour magnetics multiplied by a 135 azimuth 26 degree altitude shade illumination on the vertical derivative.
13. Radiometric colour composite.
   Potassium in red, thorium in green, uranium in blue.
APPENDIX 1 - REAL TO BYTE CONVERSION RUNS (ctd)

Tanami Regional Data - Full Area
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Tanami Regional Data - Full Area
Radiometrics (TC, K, U, Th)

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APPENDIX 1 - REAL TO BYTE CONVERSION RUNS (ctd)

Tanami Regional Data - Full Area
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APPENDIX 2 - VERTICAL DERIVATIVES

Vertical derivatives are used to improve the resolution of small scale anomalies caused by near surface magnetic sources, and to suppress the longer wavelength anomalies resulting from deeper sources. Derivatives can be calculated using a one dimensional operator and this is usually done on the original flight line data prior to gridding, or using a two dimensional operator on the grid file.

One dimensional operators tend to suppress local anomaly trends which parallel or near-parallel the flight line direction. This however can also be an advantage of the one-dimensional operator in that on poorly levelled data it will suppress or even remove artefacts caused by poor levelling.

In image products produced from vertical derivative grids, the usual distribution of data is such that the major anomalies will be very obvious however the weaker trends in the less magnetic units will tend to fall around a greyscale value of 127 and be difficult to see. This can be overcome using the technique of "Automatic Gain Control" (AGC) as suggested by S. Rajagopalan (Conference Volume, 5th ASEG Conference, 1987). In this technique, the vertical derivative is calculated along the flight line and the relative amplitude of each data point is adjusted by dividing by the gain in a window around the data point. The gain is defined as the inverse of the root mean square of the original data values in the window.

The result of the vertical derivative with AGC is to emphasise small anomalies in low gradient areas while suppressing high amplitude anomalies in high gradient areas.

Geoimage routinely carries out vertical derivative and vertical derivative with AGC operations on the original flight line data prior to gridding.