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TITLE: TROWUTTA EL 19/92  
REPORT ON EXPLORATION FOR THE  
FIRST YEAR OF TENURE, 19/9/92 TO 18/8/93

AUTHOR: R. G. PARKINSON

DATE: AUGUST, 1993

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CRA REPORT NO.: 19015

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ACN 000 057 125

MINES		
FILE REF. EL19/92		
19 AUG 1993		
DOC. REF.		
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TENURE. 19/9/92 TO 18/8/93.

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FICHE No. 012931-33

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DATE: AUGUST, 1993

LICENCE HOLDER: CRA EXPLORATION PTY. LIMITED

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CRAE CANBERRA  
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CRAE REPORT NO. 19015

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## 1. SUMMARY

CRA Exploration Pty. Limited (CRAE) is exploring Trowutta EL 19/92 for sediment hosted Cu deposits in a range of lithological and structural settings. Regional studies of Cu potential in Proterozoic sequences Australia-wide by CRAE drew attention to NW Tasmania as being prospective for stratiform/stratabound Cu mineralisation within the Rocky Cape Group and the Smithton Trough. Review of CRAE and competitor stream sediment geochemistry highlighted the Kanunnah Sub-group as having regionally anomalous Cu values.

Additional stream sediment and rockchip sampling showed the mafic lithic wackes of the Kanunnah Sub-group to have average background levels of Cu and Zn of approximately 200 ppm, indicating the potential for this package to be a Cu source bed should any mineralising processes be active in the Smithton Trough.

At present, only one indication of mineralisation has been detected, a chloritic sheared rock from a quarry on the Roger River Fault that contained 4.35% Cu. The significance of this lone sample is not known.

Research studies of sediment-hosted Cu deposits throughout the world has led to a number of conceptual models relevant to the Smithton Trough being proposed for further investigation. These include:-

- Sulphidic facies within the Black River Dolomite or Smithton Dolomite for replacement-style Cu mineralisation where the favourable stratigraphic unit is cut by the Roger River Fault
- Stratiform sandstone-hosted Cu in Forest quartzite
- Cu (-Pb-Zn) deposits in pipe-like collapse/dewatering structures in Black River Dolomite

From a historical perspective, metallic mineral deposits are rare in the Smithton Trough and there are no recorded mineral occurrences within the Trowutta EL. Very little detailed exploration has been completed over the Smithton Trough.

## 2. INTRODUCTION

Trowutta EL 19/92 was granted to CRA Exploration Pty. Limited (CRAE) on 19th September 1992. The EL covers 240 sqkm located at Trowutta, S of Smithton in the far NW of Tasmania (Plan Tv 447). During the first two years of tenure, CRAE has a statutory obligation to expend \$96000.

CRAE's principal commodity of interest in the area is Cu. Regional studies of Cu potential in Proterozoic sequences Australia-wide by CRAE drew attention to NW Tasmania as being prospective for stratiform/stratabound Cu mineralisation in a variety of lithological and structural settings within the Rocky Cape Group and the Smithton Trough. Review of all CRAE and competitor stream sediment geochemistry highlighted the Kanunnah Sub-group as having strongly elevated Cu values. CRAE subsequently applied for and was granted the tenement.

Work completed during the first year of tenure included open-file data review, stream sediment and rockchip geochemistry, and an airborne magnetometer survey. This report details all exploration activities conducted within EL 19/92 by CRAE during 1992/93.

### 3. CONCLUSIONS

Open-file data review, stream sediment and rockchip geochemistry completed in the first year of tenure show the Kanunnah Sub-group to be regionally elevated in Cu, and as such may be a potential source bed for any Cu mineralising processes that may be active.

Research studies of sediment-hosted Cu deposits throughout the world has led to a number of conceptual models relevant to the Smithton Trough being proposed for further investigation. These include:-

- Sulphidic facies within the Black River Dolomite or Smithton Dolomite for replacement-style Cu mineralisation where the favourable stratigraphic unit is cut by the Roger River Fault
- Stratiform sandstone-hosted Cu in Forest quartzite
- Cu-Pb-Zn deposits in pipe-like collapse/dewatering structures in Black River Dolomite or Smithton Dolomite similar to MVT deposits or Tsumeb mine in Africa.

At present, only one indication of mineralisation has been detected, a chloritic sheared rock from a quarry on the Roger River Fault that contained 4.35% Cu. The significance of this lone sample is not known.

### 4. RECOMMENDATIONS

Three general targets are proposed for further work in the coming year.

Sulphidic facies within the Black River Dolomite or Smithton Dolomite for replacement-style Cu mineralisation where the favourable stratigraphic unit is cut by the Roger River Fault should be pursued. Partly this will involve follow-up of the 4% Cu result. In addition, the Black River Dolomite will need to be mapped and sampled in detail where it is juxtaposed against the fault at the junction of the Roger River and Trowutta Roads. If present, the black shale unit at the top of the Black River Dolomite may be of particular interest. Exploration of the Smithton Dolomite is hampered by its total lack of outcrop against the fault. A stratigraphic hole is likely to be required to determine if units suitable for replacement by Cu are present.

Stratiform sandstone-hosted Cu in Forest quartzite is a conceptual target based on sediment-hosted Cu deposits of Zambia, Ziare, Belt Supergroup, White Pine etc. Detailed mapping and rockchip sampling traverses from the base of the Black River Dolomite into the Rocky Cape Group are required to determine if any sign of mineralisation occurs. Most of the Forest quartzite lies outside the tenement.

Cu-Pb-Zn deposits in collapse structures in Black River Dolomite similar to Tsumeb mine in Africa, or breccias in MVT deposits should also be considered. The target may be pipe-like or linear, with the sulphides occurring as open-space filling between breccia blocks of limestone. At surface, these deposits may manifest themselves as circular or elongate depressions. The area of Black River Dolomite pockmarked by sinkholes near Lake Chisholm should be initially targeted. Photo interpretation will be used to delineate any possible collapse features, followed by ground recovery.

## 5. REGIONAL GEOLOGY

The most comprehensive published description of the regional geology relevant to the Trowutta EL is found in Brown (1989a). The Tas. Dept of Mines has recently mapped the Trowutta 1:50000 sheet but as yet this work is unpublished. Turner (1989) and Brown (1989b) present wider discussions of Proterozoic and early Cambrian geology, and Corbett (1989) gives a summary of possible tectonic models to account for the early palaeozoic geology of NW Tasmania. Some interesting new concepts regarding regional correlations of the Smithton Trough sequences are summarised informally in Turner (1992). Plan Tv 575 shows the main geological elements, compiled principally from the Tas. Dept of Mines mapping.

The Rocky Cape Association forms basement in NW Tasmania. To the E of the Smithton Trough four units are recognised; Cowrie Siltstone (lowermost), Detention Quartzite, Irby Siltstone and Jacob Quartzite, which together are formally known as the Rocky Cape Group. Within the EL area only the Cowrie Siltstone is present. To the W and S of the Smithton Trough the Proterozoic succession is less well defined. From base to top the stratigraphy is; Pedder River Siltstone, Lagoon River Quartzite, Interview Siltstone (includes Balfour Slates), and an upper unnamed quartzite unit. At the present level of understanding it is not possible to correlate these units across the Balfour Transform and Smithton Trough to the Rocky Cape Group.

In the late Precambrian, around 700Ma, shallow basins were forming in the stretched intracratonic area between the Rocky Cape and Tyennan Regions and within the Rocky Cape region itself. Coarse clastic sediments (conglomerates and sandstones) of the Forest Conglomerate, Donaldson Fm and base of the Timbs Gp were deposited. In the Smithton area, the Forest Conglomerate and quartzite is best observed where the Bass Hwy crosses the Black River. Here the basal angular unconformity with the Cowrie siltstone is exposed, and the overlying Black River Dolomite is visible. The Forest Conglomerate is preserved on the W side of the basin at Marrawah and to the S on Mount Frankland.

Turbidite sequences of interbedded sands and silts of upper Donaldson Fm, Timbs Gp (and Oonah Fm?) were laid down as the intracratonic basin deepened. The Smithton Trough was a shallow shelf environment at this time and so did not receive any of this phase of deeper basin sedimentation.

As the rift phase drew to a close, sag phase Black River Dolomite, Savage Dolomite, ?Timbs Gp magnesite horizons, and Success Creek Gp limestones were deposited. Black River Dolomite is extensively exposed on the E side of the Smithton Trough from Forest SSW to beyond the Arthur River. It is most commonly seen as a laminated chert, although it is unclear whether the chert is a primary sediment or recent silicification. Stratigraphic hole Forest No. 1 intersected 295m of Black River Dolomite comprised of carbonate and black mudstone units, locally pyritic (Brown, 1989a). Algal laminated units are present, indicating shallow water conditions. Within the EL a black laminated siltstone marks the boundary between the dolomite and overlying basalt and lithic wacke sequences.

Rift tholeiites and associated mafic-derived sediments of the Smithton Volcanics, Bernafai Volcanics, Timbs Gp and Crimson Creek Fm erupted over the now filled basins. On the Trowutta 1:50000 sheet, the Smithton Volcanics and associated sediments have been named the Kanunnah Sub-group, comprising the Keppel Creek Siltstone, essentially a mafic-derived lithic wacke, and Spinks Creek Basalt, a massive tholeiite (John Everard, pers. comm.). Within the Trowutta EL, the mafic lithic wacke is clearly exposed on the Roger River fault escarpment on the E side of the Roger River road. Basalt appears lesser in extent, although it is glassy, massive and resistant to weathering. Where exposed on the Gun road near the Trowutta Caves State Reserve, flecks of native Cu are common.

Airborne magnetic images clearly show the distribution of the Kanunnah Sub-group. It is important to note that the magnetic stratigraphy is absent from the W side of the Roger River fault, indicating this structure had a major control on the extent of early Cambrian sedimentation and volcanism.

Overlying the Kanunnah Sub-group is the Smithton Dolomite. This unit is a poorly exposed dolomitic limestone present in the drainages of the Duck and Montague Rivers. It is believed to be conformable with the Kanunnah Sub-group. It is proposed to formally name the stratigraphy from the Forest Conglomerate to the Smithton Dolomite the Togari Group (John Everard, pers. comm.).

During the early to middle Cambrian, a postulated arc-continent collision caused overthrusting of ultramafic-mafic rocks and related sediments, from a subduction complex whose location is unknown but may lie buried within the Dundas Trough. No ultramafics are known in the area of the Smithton Trough, although it is worth noting that significant alluvial chromite occurs near Britton's Swamp (Kosseris, 1988).

Post-collision extension tectonics then produced troughs into which the Dundas Gp sediments and Mount Read Volcanics were deposited. In the Smithton Trough, a middle to late Cambrian correlate of the Dundas Group, the Scopus Formation, overlies the Smithton Dolomite with probable disconformity (John Everard, pers. comm.). This formation is dominated by fossiliferous siltstones. The Scopus Formation forms the core of the presently preserved Smithton Trough and is best seen in the Christmas Hills area.

No units are preserved from between Cambrian and Tertiary times. Flat-lying Tertiary basalts and sediments and Quaternary deposits partially obscure the older geology.

## 6. MINERALISATION

Metallic mineral deposits are rare in the Smithton Trough and there are no recorded mineral occurrences within the Trowutta EL. In the general vicinity, Cu, Sn and Cr are reported.

Copper mineralisation is sporadically developed at Balfour as quartz-carbonate-chalcopyrite veins within Rocky Cape Association siltstones over a strike length of 30km, from The Clump to Mount Norfolk. Murray's Reward is the largest known deposit, approximately 0.5MT @ 0.8% Cu. Small parcels of ore have been mined occasionally since the turn of the century to the present day.

Malachite and Chrysocolla are visible in pyritic Cowrie Siltstone in the Tayatea Road quarry. Flecks of native Cu are locally common within the Spinks Creek Basalt. Native Cu has also been reported from a quartzite breccia SW of Mawbanna and siderite-pyrite rock from 5km NW of Mawbanna assayed 1.5% Cu (Anon, 1983). Disseminated chalcopyrite has been observed in Black River Dolomite near Nabageena (Brown, 1989a).

Cassiterite-quartz veins occur within pyrrhotitic siltstone at Specimen Hill near Balfour.

Alluvial chromite is present in Tertiary alluvials near Brittons's Swamp. BHP determined estimated resources up to 13350T of contained chromite within 6.4MT of unconsolidated and silicified alluvials (Kosseris, 1988).

## 7. PREVIOUS EXPLORATION

Compared with the Dundas Trough, the Smithton Trough has received very little attention by explorers. CRAE and BHP have returned to the area several times, reflecting an understated belief in the prospectivity of the Rocky Cape Group and Smithton Trough. A large portion of this summary is taken from Virgoe and Mathison (1990a).

### EL 12/65 Pieman Project - Pickands Mather

During the mid 1960's Pickands Mather & Co International held EL 12/65 over a large part of NW Tasmania. An extensive regional stream geochemical survey was conducted and a number of geochemical anomalies were detected. Although some resampling occurred later, no further work was undertaken (Anon, 1966).

### EL 6/72 Northwest Tasmania - Anzeco

Australian and New Zealand Exploration Company was granted EL 6/72 in January, 1972. This EL covered an area of the Smithton Trough to the Arthur River. It was considered by ANZECO to be prospective for tungsten due to the similarity of the dolomites to those hosting the King Island Scheelite ore body. A panned concentrate and stream sediment sampling programme was completed over the EL with 94 samples taken and analysed for W, Cu, Pb, Zn, Mo, Sn and Cr. ANZECO received a number of anomalous assays for all the elements tested but found it difficult to interpret the results. Though some follow up was recommended, no further exploration was attempted. (Kinnane, 1972).

### EL 2/73 ESSO

Following a study of the mineral potential of Australia during 1971, ESSO took out EL 2/73 in the northwest of Tasmania and conducted an airborne geophysical survey (INPUT) over the licence area. Sixty two anomalies were detected, however, dense vegetation restricted examination of thirty six targets and only thirteen had outcrop. Most of the anomalies were attributed to black slates and lithological contacts. ESSO considered that no further exploration was warranted and the EL was relinquished in 1974. (Neale, 1973).

### EL 1/77 Rocky Cape - CRAE

EL 1/77 was initially taken up by CRAE to investigate the possible tin potential of the area. Following a joint venture with Geopeko in 1979 and recommendations that the Rocky Cape rocks showed similarities to the Selwyn Basin, Canada, the target was extended to shale hosted lead zinc deposits.

Statistical evaluation of regional drainage data indicated that the Trowutta - Dempster Plains district showed elevated values of Cu, Pb, Zn and Co. (Weir, 1982). Follow up included stream sediment sampling, geological mapping and rock chip sampling. A photogeological interpretation (by Carey, 1981) covered the whole EL. The stream sediment sampling revealed lead anomalies from the Julius River, the Meryanna area, Wents Creek and Stephens Rivulet and an arsenic anomaly from Sumac Rivulet.

Follow up in the Julius River and Meryanna area included detailed stream sampling, gridding, soil sampling and ground geophysics. It was concluded that the Julius River anomaly was derived from a disseminated source or shears within the dolomite and that the Meryanna anomaly was the results of erosional basaltic remnants on topographic highs.

Resampling of the other 3 anomalous areas failed to repeat the initial high values. CRA Exploration relinquished the northern part of the EL 1/77 in 1983 concluding that the black shale sequences exposed at the eastern margin of the trough were too thin to have produced economic mineralisation from brines (Weir, 1983).

EL 12/80 Leigh River - CRAE

EL 12/80 was granted to CRAE in order to investigate two tin stream sediment anomalies located during previous reconnaissance by CRAE in 1977. The EL was also considered for shale hosted lead zinc and gold mineralisation and this was supported by the presence of a number of INPUT anomalies obtained by ESSO in 1973. Work carried out included a computer study of all previous stream sediment geochemistry, infill stream sediment sampling, regional scale mapping, follow up of nine aeromagnetic anomalies defined by the Mines Department, West Coast survey and investigations into the gold potential of altered Cambrian basalts. The EL was relinquished in 1985 (Dickson, 1985).

EL 18/80 Arthur River - BHP

EL 18/80 was thought by BHP to be prospective for a skarn or massive sulphide hosted tin tungsten deposit of the Renison/Cleveland style. Carlin style gold, diamonds, Mississippi Valley lead-zinc and sedimentary copper deposits were secondary targets. Work completed included stream sediment and pan concentrate sampling, rock chip sampling, petrology, a photogeological and Landsat image study, geological mapping, and evaluation and follow up of existing INPUT and aeromagnetic data. In view of the disappointing results and difficult access, the EL was relinquished in 1983 (Anon, 1984). Not followed up was a quartz-siderite-pyrite rock that assayed 1.5% Cu from Pine Corner Road NW of Mawbanna.

EL 18/83 Lake Chisholm - BHP

EL 18/83 lies adjacent to EL 18/80 and was taken up by BHP to cover a broadly coincident INPUT/Aeromagnetic anomaly. An extensive grid was cut over the main zone of interest at Lake Chisholm and soil sampling, geophysical surveys and geological mapping were carried out. Pan concentrate sampling was used to follow up anomalous tin geochemistry reported from earlier work. The INPUT/Aeromagnetic anomaly was attributed to a small amphibolite body and magnetically susceptible basalts. No indications of potentially economic mineralisation were encountered (Anon, 1984).

EL 12/86 Montague - BHP

EL 12/86 was taken up by BHP to investigate potential for alluvial chromite in Tertiary alluvials S of Britton's Swamp. BHP estimated resources up to 13350T of contained chromite within 6.4MT of both unconsolidated and silicified alluvials (Kosseris, 1988).

EL 22/87 Trowutta - Aureole Resources

Aureole Resources took up EL 22/87 to explore for platinum group metals, gold and base metals, hosted mainly by receptive rocks along the eastern and southern margins of the Smithton Trough. Work concluded a regional geophysical evaluation by D.E. Leaman and rock chip sampling for assay and petrological purposes. Despite upgrading the prospectivity of parts of the EL 22/87 was relinquished (Cromer, 1988).

#### EL 46/89 Julius River and EL 52/89 Balfour - Geopeko

Geopeko held these tenements impinging on the area of EL19/92 as part of a considerable holding over the Rocky Cape Group. Potential deposit types of interest to Geopeko included shale-hosted Pb-Zn-Ag, Besshi-type Cu-Zn and shear-hosted Au in the Rocky Cape Group, and carbonate-hosted Pb-Zn-Ag and Carlin-style Au in the Smithton Trough.

Geopeko covered the ELs with a regional "Huminex" stream sampling survey. In the method, humic matter within stream waters is extracted and analysed for Au and base-metals. Anomalies were detected however it was subsequently shown that some component of the sample (probably carbon) was interfering with the analysis, producing spurious results. The project was abandoned and the tenements relinquished (Virgoe and Mathison, 1990a and 1990b).

#### EL 29/90 Trowutta - Newcrest

This tenement was acquired by BHP Gold to explore the Smithton Trough carbonates for Carlin-style Au. The merger with Newmont saw the EL pass to the newly created company, Newcrest. A cursory bulk cyanide leach sampling program detected weak Au anomalies up to 9ppb draining the area of the Roger River Fault in the catchments tested. Three possible causes for the anomalies were put forward; the fault itself, the Smithton Dolomite adjacent to the fault, or high background in the mafic volcanoclastics. High Cu and Zn values led to the conclusion that the cause was mafic volcanoclastics. Exploration was not taken further and the EL was surrendered (McEwen, 1992).

### 8. EXPLORATION ACTIVITIES FOR THE PERIOD 19/9/92 TO 18/8/93

#### 8.1 Exploration Philosophy

CRAE's principal commodity of interest in the Trowutta area is Cu. Regional studies of Cu potential in Proterozoic sequences Australia-wide by CRAE drew attention to NW Tasmania as being prospective for stratiform/stratabound Cu mineralisation in a variety of lithological and structural settings within the Rocky Cape Group and the Smithton Trough.

Three general areas conceptually may be prospective for sediment-hosted Cu targets; the Balfour trend, Arthur Lineament, and Smithton Trough.

Sulphidic facies within the Black River Dolomite or Smithton Dolomite could be suitable target areas for replacement-style Cu mineralisation. Native Cu-bearing Spinks Creek Basalt was suggested as a possible Cu source, and pyritic dolomite breccias have been intersected in previous exploration. Such a replacement-style Cu deposit could possibly develop where a favourable stratigraphic unit is cut by a major structure.

Review of CRAE and competitor stream sediment geochemistry highlighted the Kanunnah Sub-group as having strongly elevated Cu values. This anomaly is regionally pronounced, emphasising the potential of the Kanunnah Sub-group to act as a Cu source bed.

Other targets and commodities relevant to the Trowutta EL include:-

- sandstone-hosted Cu (or Zn-Pb) in Forest quartzite
- carbonate-hosted Zn-Pb in Black River Dolomite or Smithton Dolomite
- MVT or Tsumeb style Cu-Pb-Zn deposits in breccia and collapse structures in Black River Dolomite or Smithton Dolomite

## 8.2 Literature Review and Data Compilation

Key open-file and CRAE reports have been reviewed as part of the research into the Cu potential of NW Tasmania. This review is summarised in the relevant section above.

All available CRAE and competitor stream sediment geochemistry was reassessed. Within the Trowutta EL, areas draining the Kanunnah Sub-group are clearly elevated in Cu above local and regional background. The extent of the anomaly indicates the cause to be lithochemical rather than mineralisation-related, suggesting the Kanunnah Sub-group has potential to be a source for Cu should any mineralising processes be active in the area.

Approximately 200 to 300 -80# samples are recorded from the Trowutta EL and immediate periphery. Copper values for anomalous -80# samples ranged up to 660ppm, with 40 samples exceeding 100ppm. Unfortunately several of these samples contain spurious results. Some high Cu samples have been shown by detailed repeat sampling to be incorrect. Samples taken from the Arthur River are also unusable as they are contaminated by tailings from Mount Bischoff. These samples are usually distinguished by their very high (>1000ppm) Zn. One sample with elevated Cu taken near the Arthur River, from the same batch as the other spurious high Cu samples has not been resampled to prove whether the result is real.

Of reliable assays, anomalous Cu values fall in the range 120ppm to 200ppm. Zinc results for these samples commonly average 200ppm. Arsenic anomalies up to 30ppm were detected in Joiner and Fahey's Creeks, draining the Kanunnah Sub-group - Black River Dolomite contact.

## 8.3 Stream Sediment Geochemistry

A limited stream sediment sampling program was carried out in selected catchments of EL19/92 to confirm whether the highest Cu results from previous surveys were indeed lithochemical. Arsenic anomalies in Joiner and Fahey's Creeks were also resampled. Sample locations are plotted on Plan Tv 574, Cu, Zn, As and Au anomalies for this program are presented on Plans Tv 567 to Tv 570, and full results and ledgers are found in Appendix 1.

Initially a total of 61 -80# stream sediment samples over selected targets were collected, with a further six subsequently taken. Samples were collected from active depositional sites in creeks, taking care where possible to avoid bank contamination. Sediment was wet-sieved in the field with 50g to 100g of -80# material collected. Samples were despatched to ALS in Brisbane for multi-element analysis. Trace elements Ag-As-Bi-Cu-Hg-Mo-Pb-Sb-Zn were subjected to single acid, mild oxidant digestion, with organic solvent extraction, then assayed by ICP-OES. This solvent extraction method allows ultra-low detection limits to be attained. Major and other elements Ca-Co-Cr-Fe-Mg-Mn-Na-Ni-P-V were determined by total acid digest ICP-OES. Gold was analysed by aqua-regia AAS.

As suspected, previously identified Cu anomalies coincided with Kanunna Sub-group lithologies. Repeat sampling returned similar, high-background Cu values ranging between 120ppm and 320ppm from the Kanunna Sub-group (Plan Tv 567). Two samples from tributaries of Coronation Creek returned Cu values of 320ppm and 290ppm in an area of basalt and mafic lithic wacke. Follow-up stream sediment and rock chip sampling returned up to 240ppm Cu. Float samples peaked at 350 ppm Cu in mafic lithic wacke. As the stream sediment Cu values do not increase with decreasing catchment size, the cause of the anomaly can be concluded as widespread high background Cu values in this lithology.

Zinc values range to 250ppm in the mafic lithic wacke (Plan Tv 568). Values for Fe-Mn-Co-Cr-Ni-V also reflect the distribution of mafic lithologies.

Two samples draining basalt and mafic lithic wacke adjacent to the Roger River Fault contained 61ppb and 26ppb Au (Plan Tv 569). As the sites mark an abrupt change in gradient, there may be a component of alluvial concentration in the samples.

Three samples returned high Pb, up to 2200ppm. The samples were the start of the batch, do not define an anomaly train and occur in a creek where earlier sampling had shown background Pb levels. Laboratory contamination was suspected, and the samples were repeated for confirmation. Repeat samples were below 32ppm Pb, confirming the anomalies were due to laboratory contamination.

Follow-up of archive As anomalies showed that the Black River Dolomite contains weak As levels in the range 4ppm to 8ppm, against less than 2ppm in the Kanunna Sub-group (Plan Tv 570). These values are not significant. Molybdenum is also weakly elevated in the Black River Dolomite, showing 2ppm to 4ppm against less than 2ppm in the Kanunna Sub-group. Curiously, Ca and Mg appear ineffective in delineating carbonate and mafic lithologies. Phosphorous values peaked at 23%, almost definitely due to fertilizer in the catchments draining cultivated properties.

#### 8.4 Rockchip Geochemistry

A small number of float and outcrop samples have been collected during the year from various localities. Samples were submitted to Analabs, Burnie for aqua regia - perchloric acid digest for Ag-As-Cu-Fe-Mn-Pb-Zn. A small batch were analysed by the same method for Bi-Mo. Samples were also analysed for Au by fire assay. Ledgers and assay results are listed in Appendix 2 and sample locations are plotted on plan Tv 574.

A sample of chloritic sheared rock from a quarry on the Roger River Fault contained 4.35% Cu. Other elements were not anomalous except for weak Ag and Au enrichment, 7ppm Ag and 12ppb Au. The quarry is flooded and the sides covered by scree so the extent of mineralisation is unknown.

A sample of massive basalt with flecks of native Cu throughout from Gun road near the Trowutta Caves State Reserve assayed 180ppm Cu.

Mafic lithic wacke from several localities was sampled. Copper values over 200ppm were common, up to a maximum of 330ppm in Coronation Creek. Zinc values were also enriched, up to 325ppm. These results reflect the high Cu-Zn geochemical background within the Kanunnah Sub-group and do not indicate mineralising processes.

Laminated locally pyritic black shale was identified in Joiner Creek, Reid's Road, and Cannon Creek, marking the contact between Black River Dolomite and Kanunnah Sub-group wacke. Best assay was 97ppm Cu and 200ppm Zn from Joiner Creek.

Outcrops of carbonate breccia with haematite matrix were discovered in Joiner Creek and near Fahey's Creek. It is unknown whether the breccia is tectonic, or derived from weathering. Base-metal and Au analyses were not anomalous.

A vuggy, pyritic chert/limestone from the Sumac quarry was barren of base-metals and Au.

Pyritic Cowrie Siltstone from the Tayatea quarry (outside EL19/92) contains 175ppm Cu and 150ppm As. Malachite staining was visible in some samples in the quarry but was not resampled. A gossanous fragment from the same location returned 655ppm Cu, 250ppm As and 13ppb Au. Another pyritic Cowrie Siltstone sample from the Tayatea Bridge over the Arthur River contained 150ppm As indicating the Cowrie Siltstone, at least in this locality, is regionally anomalous in As.

#### 8.5 Airborne Magnetometer Survey

Specifications were drawn up for a detailed, low level aeromagnetic and radiometric survey covering the SW portion of EL 18/92 (Plan Tv 577). The contract was awarded to Kevron Geophysics and the survey was flown in March 1993.

The digital located data and final plans for the survey were delivered in July 1993. The flight path plan, aeromagnetic stacked profiles and contours have been produced for the NE portion of the survey over the Trowutta EL (Plans Tv 571-73). The operations/logistical report for the survey has not been delivered to date. The survey details are documented in Appendix III.

Preliminary interpretation based on 35 mm slide sets of image processed magnetic and radiometric data in a geological context of published mapping was produced (Plan Tv 576). The main elements of the Cambrian Smithton Trough, with portions of the underlying correlatives of the Proterozoic Rocky Cape association are evident in the airborne data. The character of the interpreted units are described below in chronological/lithological order.

A bland magnetic unit associated with a high radiometric (K, U & Th) background, on the south western margin of the EL is thought to be correlatives of the Interview Siltstone, part of the Rocky Cape Association. Magnetic anomalies located near 234000E 5438300N are interpreted due to intrusive bodies, possibly dipping to the NE.

An intermittent magnetic linear (~ 25 nT) with little radiometric response immediately to the east of the Rocky Cape sediments is interpreted to mark the western margin of the Smithton Trough. Geological mapping Brown, 1989a has indicated that there is an angular unconformity between the Rocky Cape Association and the Smithton Trough, of which the Forest Conglomerate is the basal unit. Although there is no documented evidence to suggest that the Forest Conglomerate has a magnetic response, the position of the magnetic linear between the Rocky Cape and overlying sequence suggests that the Forest Conglomerate may be the cause of the observed anomaly. This magnetic anomaly coincides with a topographic ridge (suggestive of a resistive unit) which may warrant geological mapping.

Overlying the magnetic unit is a distinctive sequence with a very low radiometric response. In the south of the EL, this unit correlates to the Black River Dolomite where it occurs within an inlier. Surrounding the Black River Dolomite Inlier is weak to moderately magnetic complex unit that is associated in part with elevated K and Th. This unit may correlate to the basal part of the Keppel Creek Siltstone, a mafic derived sediment contemporaneous with the Smithton Basalt.

The overlying Smithton Basalt appears as a slightly west dipping, strongly magnetic complex zone on the eastern limb of the Smithton Trough. Modelling has indicated that a majority of the variability in the magnetic response may be attributed to topographic irregularity over the basalt. On the western limb of the trough, the Smithton Basalt appears as a strongly magnetic (~800 nT) linear. Preliminary modelling has suggested that the basalt dips to the east at a moderate to steep angle and has a susceptibility of ~  $10,000 \times 10^{-5}$  SI.

The radiometric data suggests that a strongly potassic unit occurs between the Smithton Basalt and Smithton Dolomite in the north of the survey area. This K rich unit may be related to the pyritic black shale exposed in a quarry, (326900E 5400800N), which also has a strong associated K anomaly. The quarry occurs at the intersection of two inferred faults.

The Smithton Dolomite appears as a bland magnetic unit with distinct depressed radiometric response similar to that of the Black River Dolomite.

Two dextral faults cross cutting the Smithton Trough and extending into the Rocky Cape Association were identified from the aeromagnetic data. The most prominent of these faults is the *Roger River Fault*, which clearly limits the flat lying Smithton Basalt on the eastern limb of the trough and displaces the basalt over 1.5 km on the western limb. Additionally, a number of mainly NE oriented faults are seen to disrupt the basalt on the eastern limb of the Smithton Trough. In particular, the Black River Dolomite Inlier is thought to have resulted from fault controlled uplift and subsequent erosion, possibly related to a deep seated intrusive.

#### 8.6 Proposed Exploration During 1993-94

Excepting the chortic sheared rock from a quarry on the Roger River Fault that contained 4.35% Cu, no indications of mineralisation have yet been detected. Target selection within the EL is still very much conceptual. Work completed during the first year of tenure aimed primarily to compile all available information to help refine the concepts. At the present level of knowledge, three general targets are considered for further work in the coming year.

Sulphidic facies within the Black River Dolomite or Smithton Dolomite for replacement-style Cu mineralisation where the favourable stratigraphic unit is cut by the Roger River Fault should be pursued. Partly this will involve follow-up of the 4% Cu result. In addition, the Black River Dolomite will need to be mapped and sampled in detail where it is juxtaposed against the fault at the junction of the Roger River and Trowutta Roads. Of particular interest is the black shale unit at the top of the Black River Dolomite (if present) where it may intersect the fault. Exploration of the Smithton Dolomite is hampered by it's total lack of outcrop against the fault. A stratigraphic hole is likely to be required to determine if units suitable for replacement by Cu are present.

Stratiform sandstone-hosted Cu in Forest quartzite is a conceptual target based on sediment-hosted Cu deposits of Zambia, Zaire, Belt Supergroup, White Pine etc. Case histories of the discoveries of these deposits indicate this style of mineralisation may be quite subtle since as little as 2% chalcocite may be sufficient for an orebody. Detailed traverses from the base of the Black River Dolomite into the Rocky Cape Group are required to determine if any sign of mineralisation occurs. If the Forest quartzite is developed over the whole of the Smithton Trough (which may not be so), possible surface strike length available for exploration could be up to 90km, from Forest SSW to Mount Frankland, then NW to Marrawah. Most of the Forest quartzite lies outside the tenement.

Cu-Pb-Zn deposits in collapse structures in Black River Dolomite or Smithton Dolomite similar to Tsumeb mine in Africa or MVT deposits should also be considered. The target could be pipe-like or linear, with the sulphides occurring as open-space filling between breccia blocks of limestone. At surface, these deposits may manifest themselves as circular or elongate depressions. The area of Black River Dolomite pockmarked by sinkholes near Lake Chisholm should be initially targeted. Photo interpretation will hopefully delineate any possible collapse features, to be followed by ground recovery.

**9. ENVIRONMENT AND REHABILITATION**

During the year no exploration having an environmental impact was undertaken, consequently no rehabilitation is required.



**R.G. PARKINSON**

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- |                           |       |  |
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#### KEYWORDS

Tasmania, Proterozoic, Cambrian, Literature Review, Stream Sediment Sampling, Rockchip Sampling, Airborne Magnetic Survey, Copper.

#### LOCATION

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Arthur River	1:100,000	7915

Sandy Cape	1:100,000	7815
Trowutta	1:50,000	7915N
Bluff Point	1:50,000	7815N
Roger	1:25000	3245
Sumac	1:25000	3244
Dempster	1:25000	3443
Tayatea	1:25000	3445

LIST OF DPO'S

71511, 71517, 71518, 71521, 71522, 71538.

LIST OF PLANS

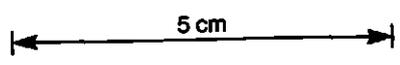
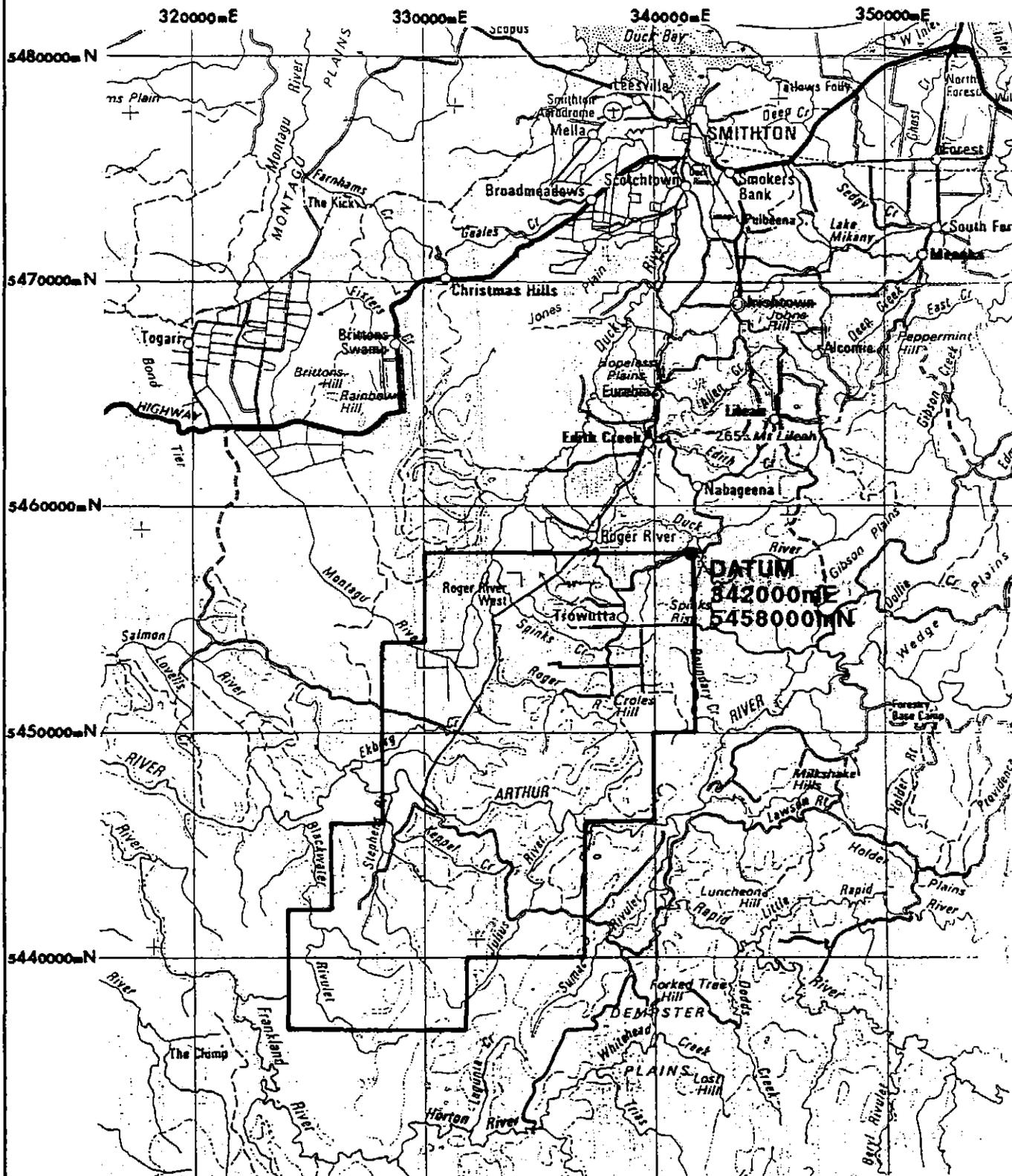
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Tv 574	Trowutta EL 19/92 Stream Sediment Sample Location Plan	1:25,000
Tv 567	Trowutta EL 19/92 Stream Sediment Geochem - Cu	1:100,000
Tv 568	Trowutta EL 19/92 Stream Sediment Geochem - Zn	1:100,000
Tv 569	Trowutta EL 19/92 Stream Sediment Geochem - Au	1:100,000
Tv 570	Trowutta EL 19/92 Stream Sediment Geochem - As	1:100,000
Tv 577	Trowutta EL 18/92 Mt. Frankland Survey Location Plan	1:250,000
Tv 572	Trowutta EL 18/92 Mt. Frankland Survey Flight Path Map	1:25,000

Tv 573	Trowutta EL 18/92 Mt. Frankland Survey Aeromagnetic Stacked Profiles	1:25,000
Tv 571	Trowutta EL 18/92 Mt. Frankland Survey Aeromagnetic Contours	1:25,000
Tv 576	Trowutta EL 18/92 Mt. Frankland Survey Interpretation Plan	1:25,000

### LIST OF APPENDICES

- APPENDIX 1: CRAE stream sediment sampling ledgers and geochemistry
- APPENDIX 2: Rockchip lithological codes, sampling ledgers and geochemistry
- APPENDIX 3: Mt. Frankland Airborne Survey - Flight Specifications

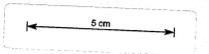
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93-3483.



CRA EXPLORATION PTY. LIMITED	
APPLICATION FOR EXPLORATION LICENCE	
"TROWUTTA"	
246km <sup>2</sup>	
Ref.: SK55-3	Scale: 1: 250 000
Author: T.W. Dickson	Report No.: 19015
Drawn: A. Jelen Apr. '92	Plan No.: Tv 447



**93-3483.**

990023  
CRA EXPLORATION PTY. LIMITED

**TROWUTTA EL 19/92  
STREAM SEDIMENT  
SAMPLE LOCATION PLAN**  
S<sub>MAC</sub>

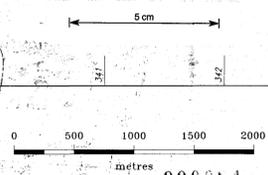
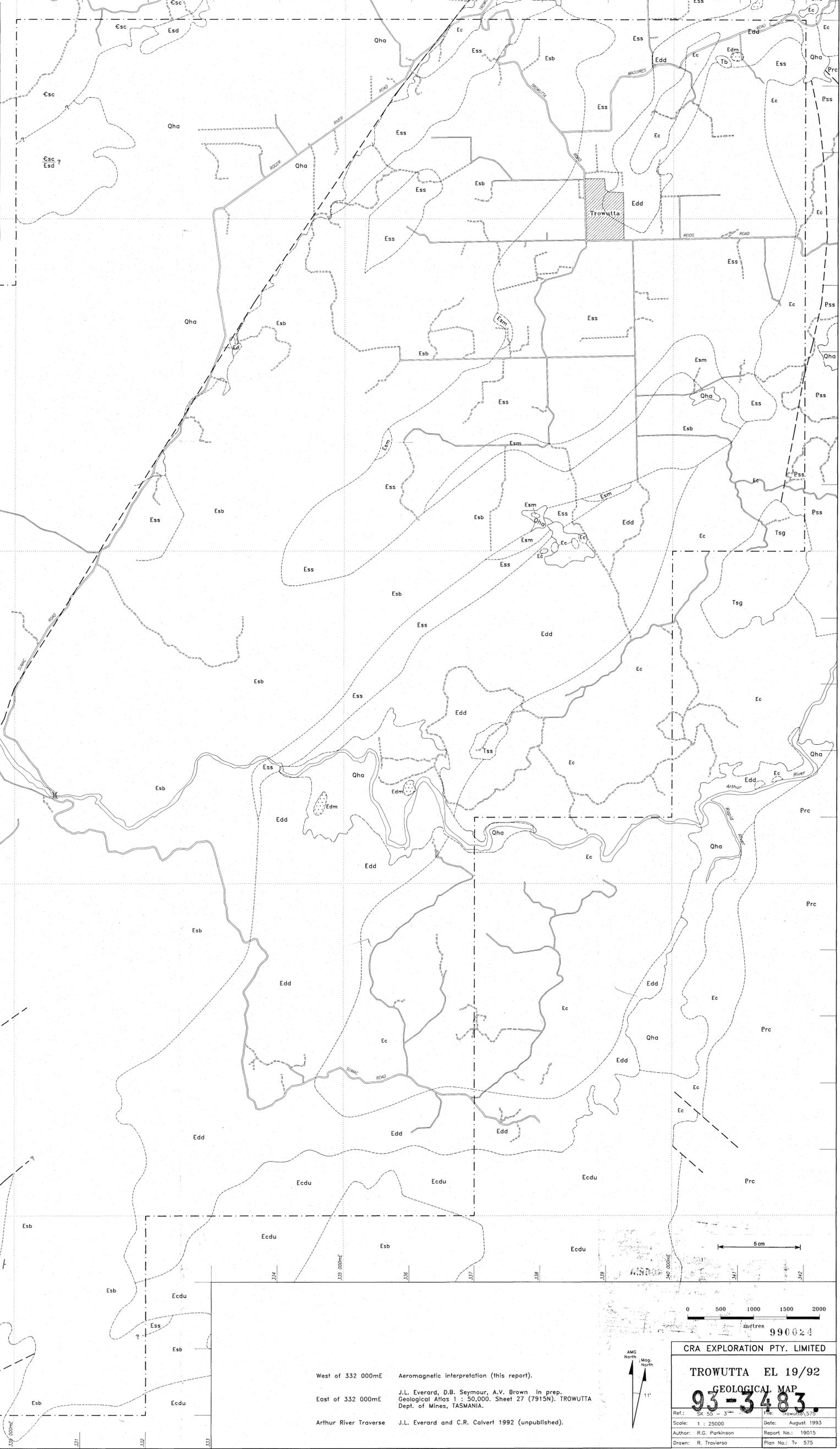
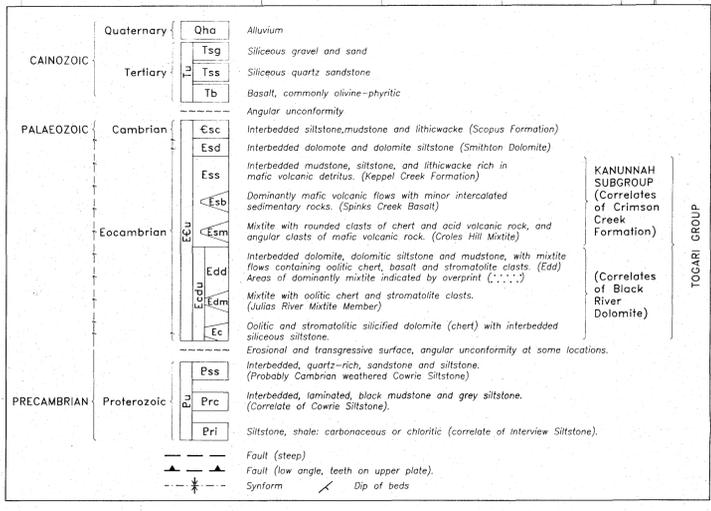
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Author: R.G. Parkinson	Report No.: 19015
Drawn: R. Traverso	Plan No.: Tv 574

735 • Stream sediment sample location and number (Prefix 3313...)  
042(oc),049(F) \* Rock sample (Prefix 3308...)  
(oc)Outcrop grab sample, (F)Flot sample



458  
457  
456  
5 455 000mN  
454  
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452  
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447  
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5 440 000mN  
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324 325 326 327 328 329 330 331 332



CRA EXPLORATION PTY. LIMITED

**TROWUTTA EL 19/92**

**GEOLOGICAL MAP**

**93-3483**

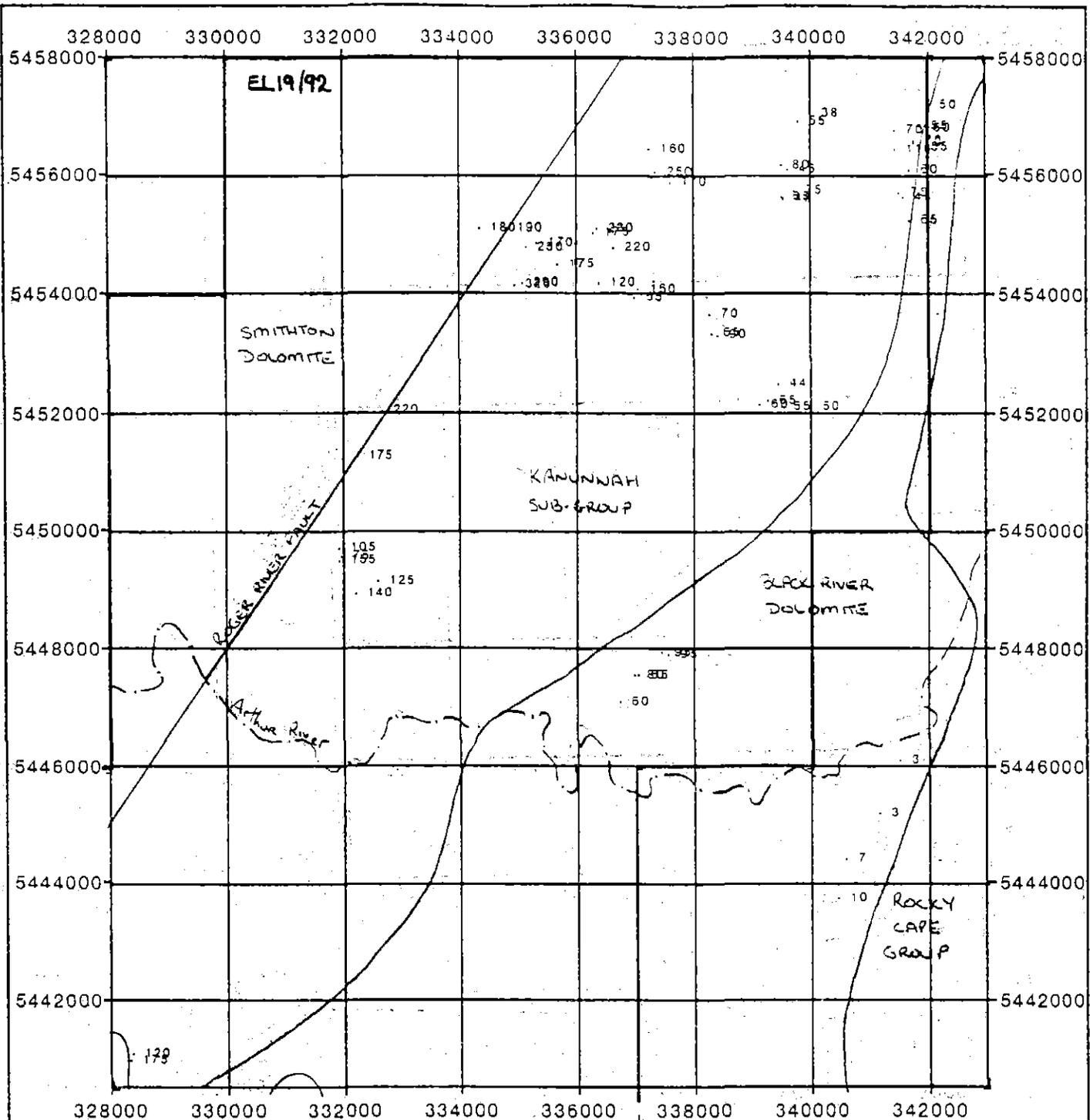
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Drawn: R. Traverso	Plan No.: Tv 575

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990025

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TROWUTTA EL19/92

**STREAM SEDIMENT GEOCHEM - Cu**

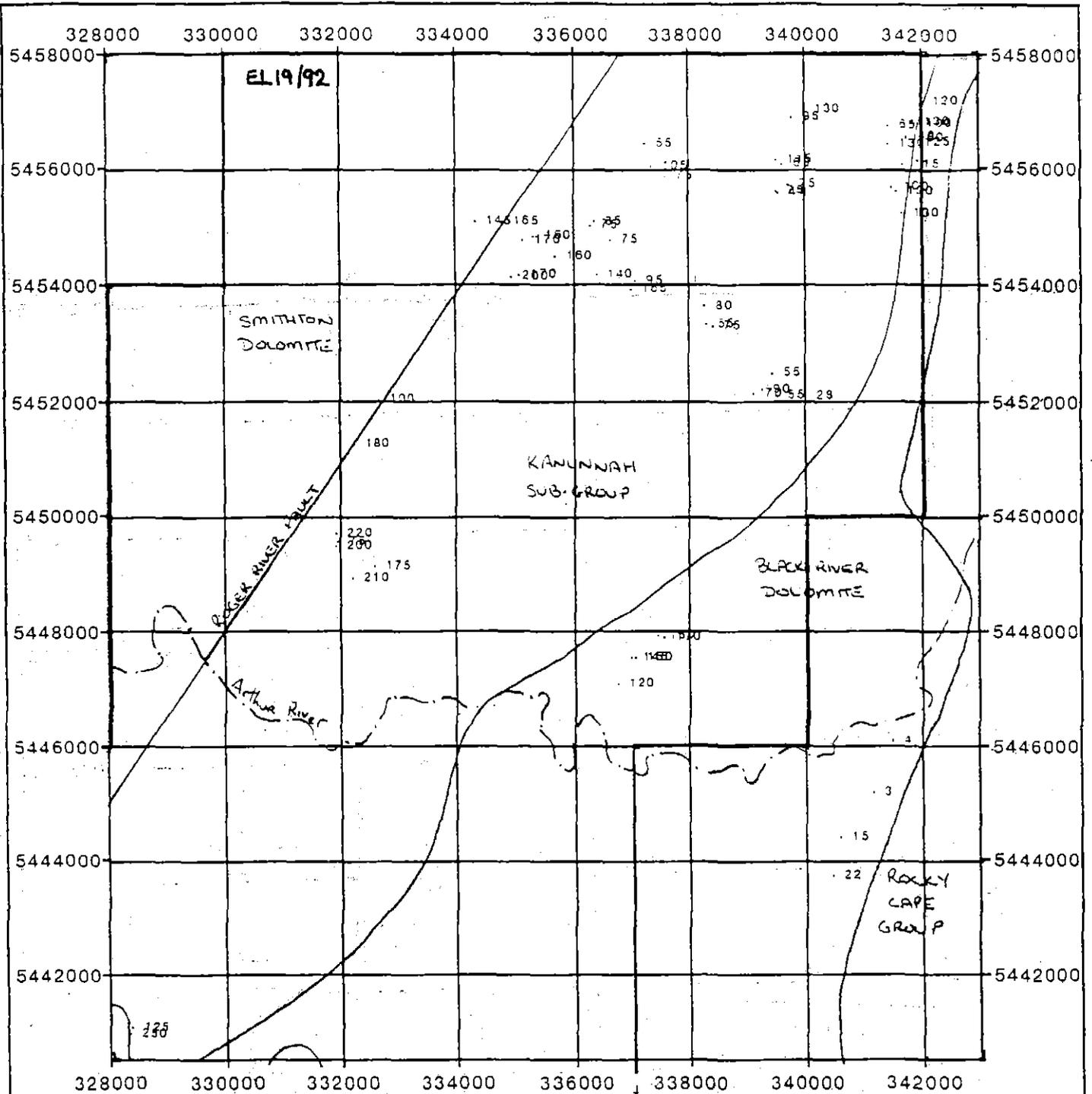
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# 93-3483.

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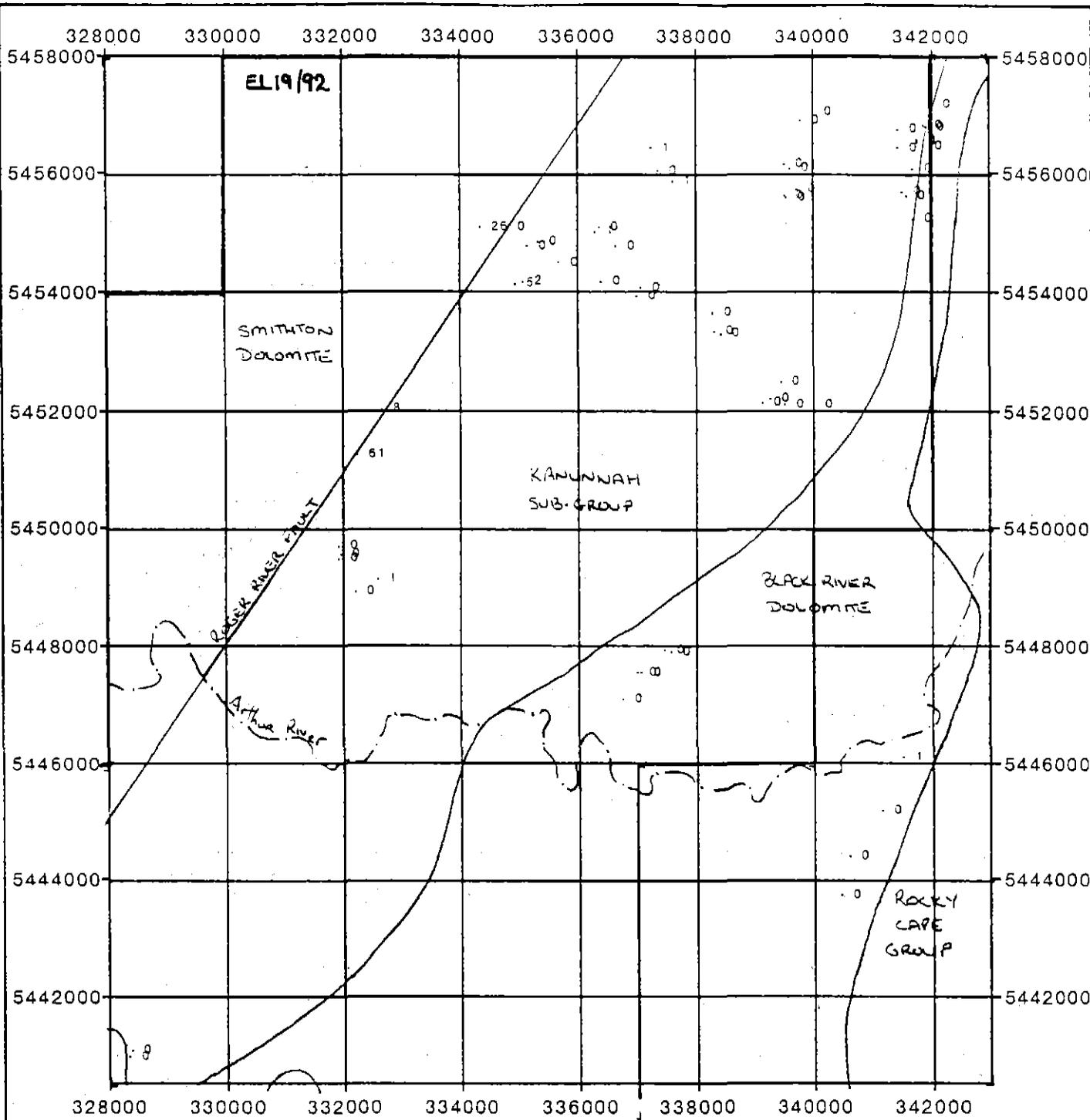
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1000m

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CRA Exploration Pty Limited		
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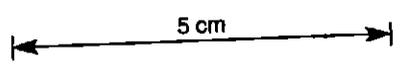
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CRA Exploration Pty Limited

TROWUTTA EL19/92

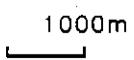
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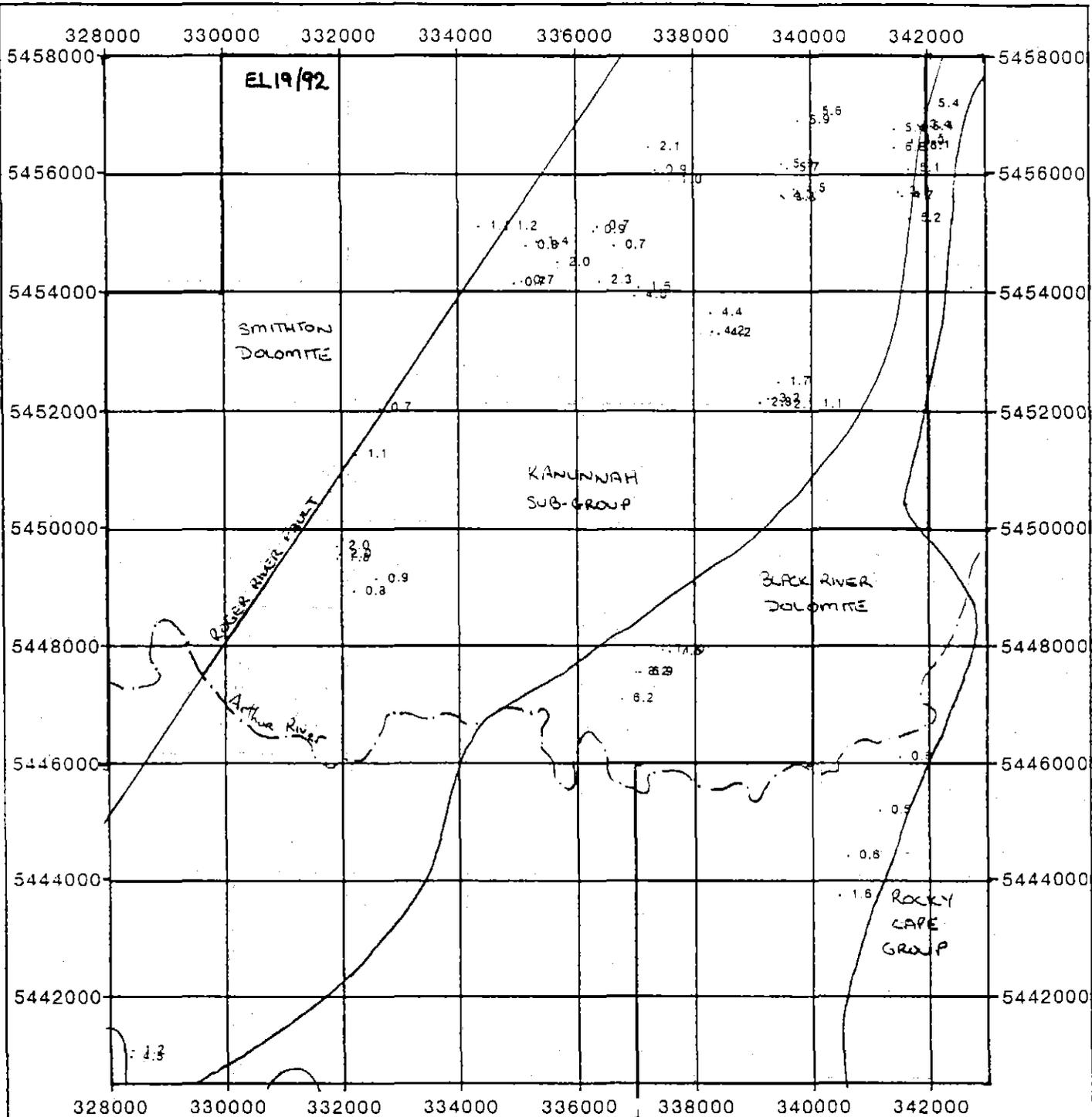
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CRA Exploration Pty Limited

TROWUTTA EL19/92

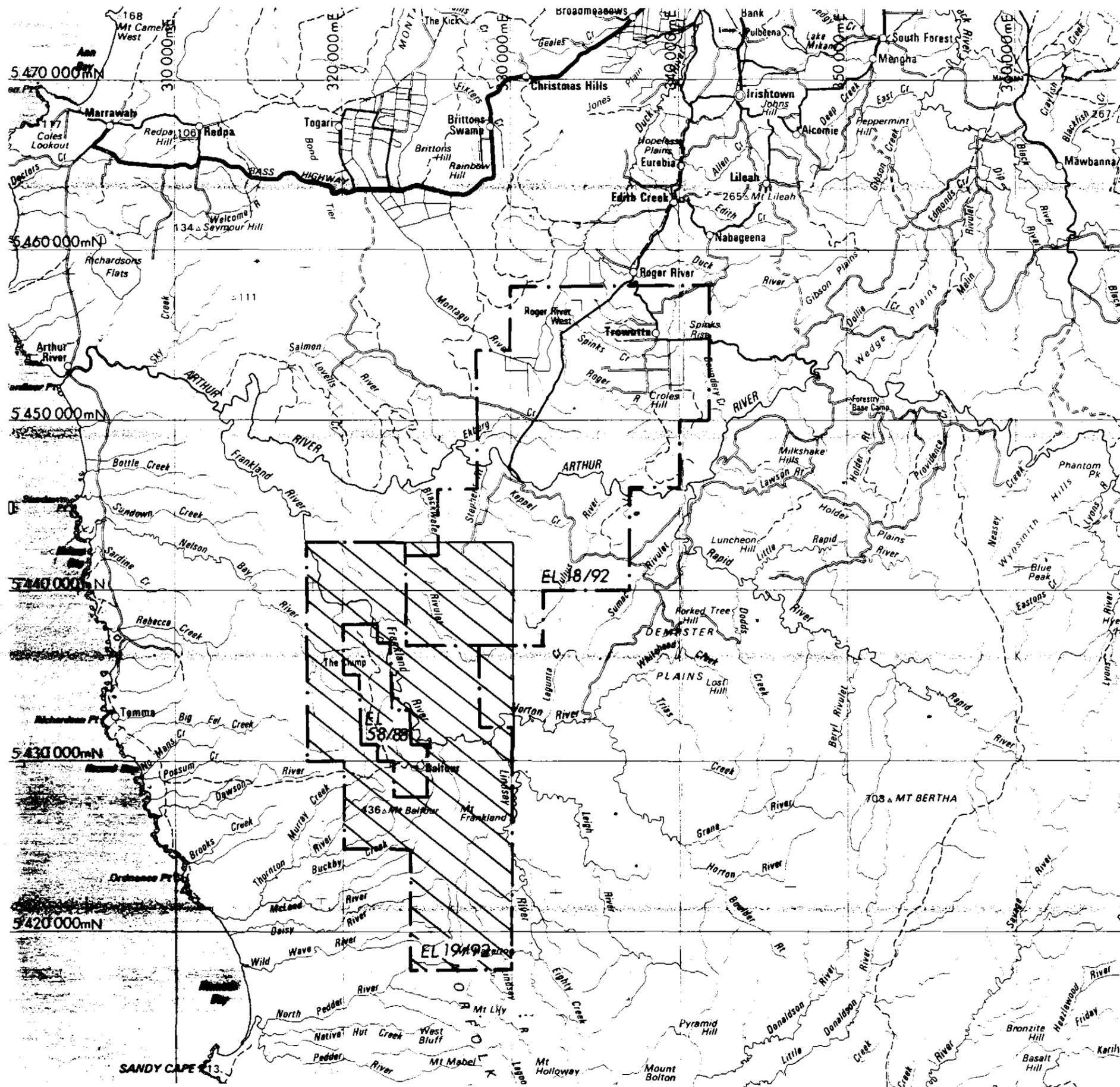
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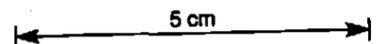
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SURVEY AREA

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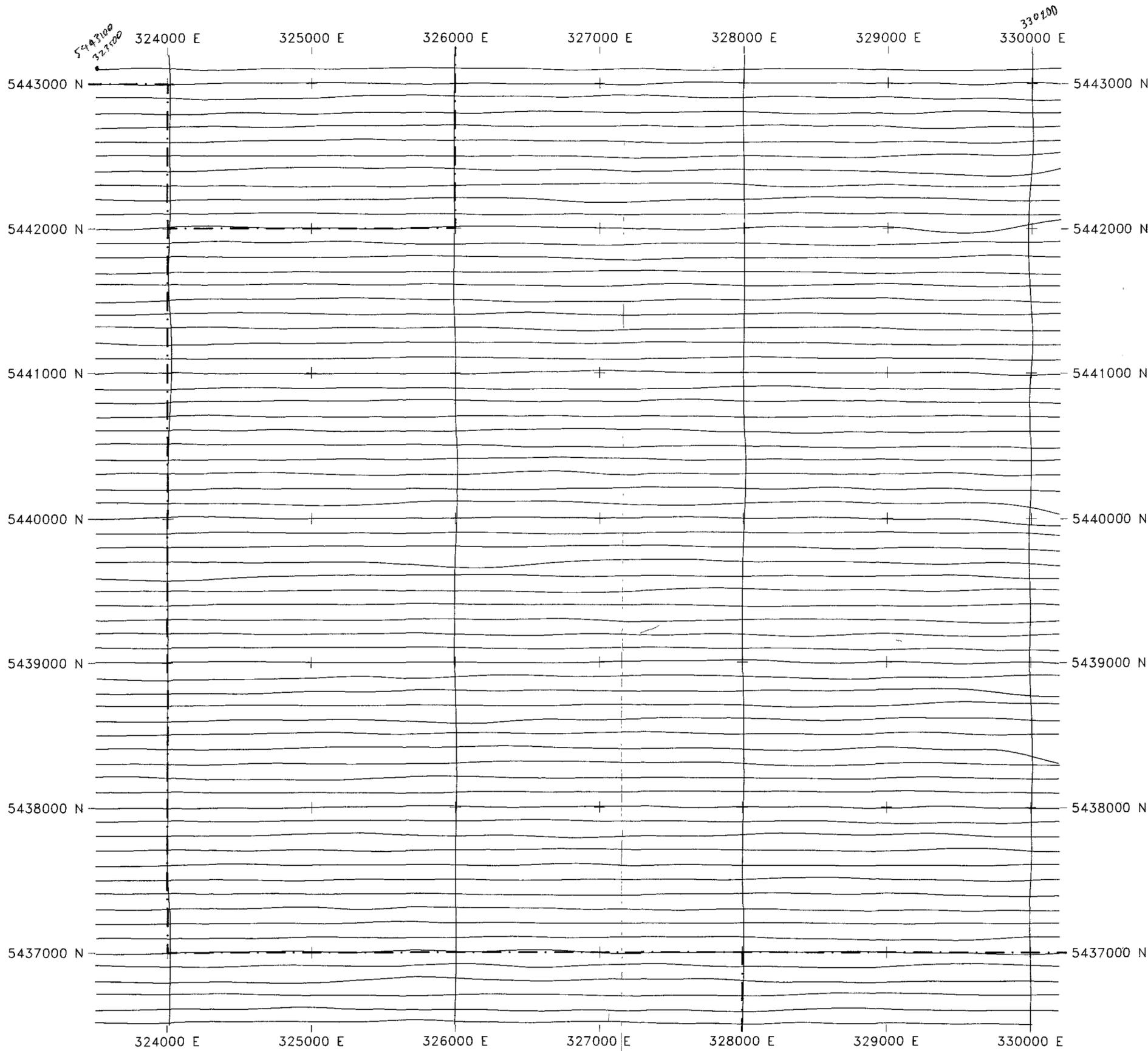
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CRA EXPLORATION PTY. LIMITED

**MT. FRANKLAND  
AIRBORNE SURVEY  
LOCATION PLAN**

Ref.: Burnie SK55-03	Scale: 1:250 000
Author: T. Aravanis	Report No.: 19015
Drawn: S. Brook	Plan No.: Tv 577

Aug. 1993



**AIRBORNE SURVEY EQUIPMENT**

*Aircraft:* ROCKWELL AEROCOMMANDER 500S VH-KAC  
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*Magnetometer sample interval:* 0.10 s (7 m approx.)  
*Data acquisition:* RMS DAS-8  
*Data recording:* DC300 data cartridges  
*Spectrometer:* Geometrics GR800D  
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*Spectrometer sample interval:* 1.0 s (35 m approx.)  
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*GPS Navigation system:* Ashtech XII GPS receiver

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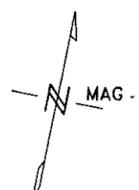
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*Tie line separation:* 2000 m  
*Mean terrain clearance:* 60 m

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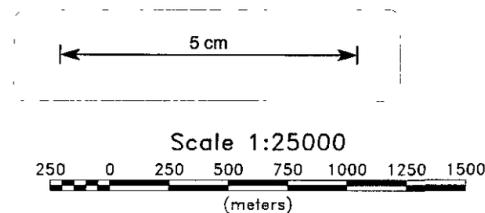
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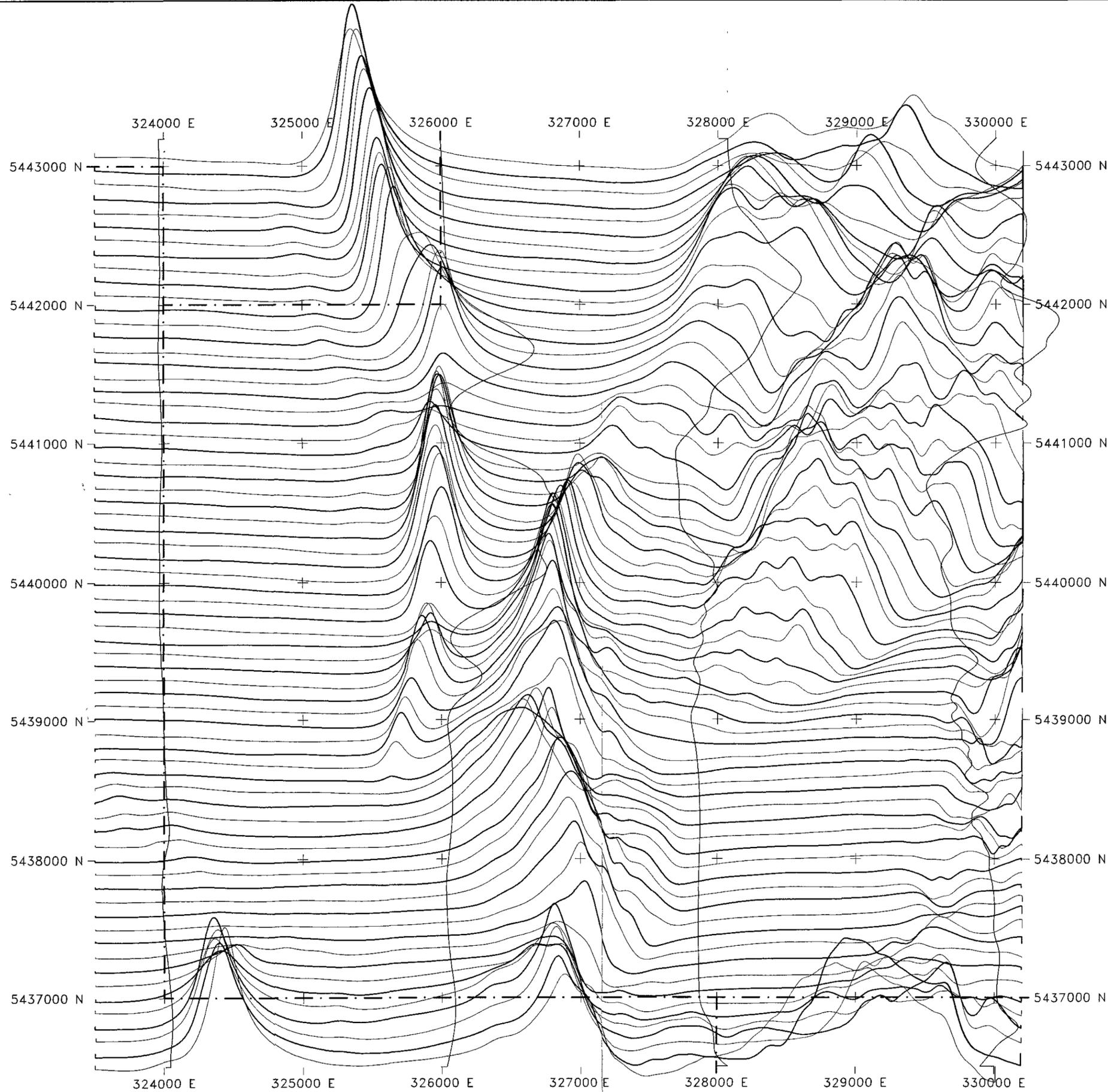
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Magnetic north bearing 11° AMG



CRA EXPLORATION PTY. LIMITED		
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<b>MT. FRANKLAND SURVEY</b>		
FLIGHT PATH PLAN		
BURNIE SK55-03		
GEO:	TA	SCALE: 1:25000
REPORT:	19015	
DRAWN:	TA	DATE: 09/08/93
PLAN:	Tv 572	



**AIRBORNE SURVEY EQUIPMENT**

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*Data recording:* DC300 data cartridges  
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*Spectrometer sample interval:* 1.0 s (35 m approx.)  
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**AIRBORNE SURVEY SPECIFICATIONS**

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*Survey date:* March 1993  
  
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*Tie line separation:* 2000 m  
*Mean terrain clearance:* 60 m

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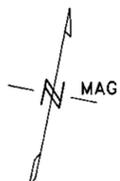
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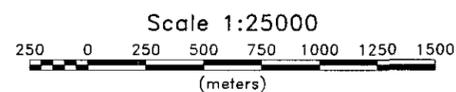
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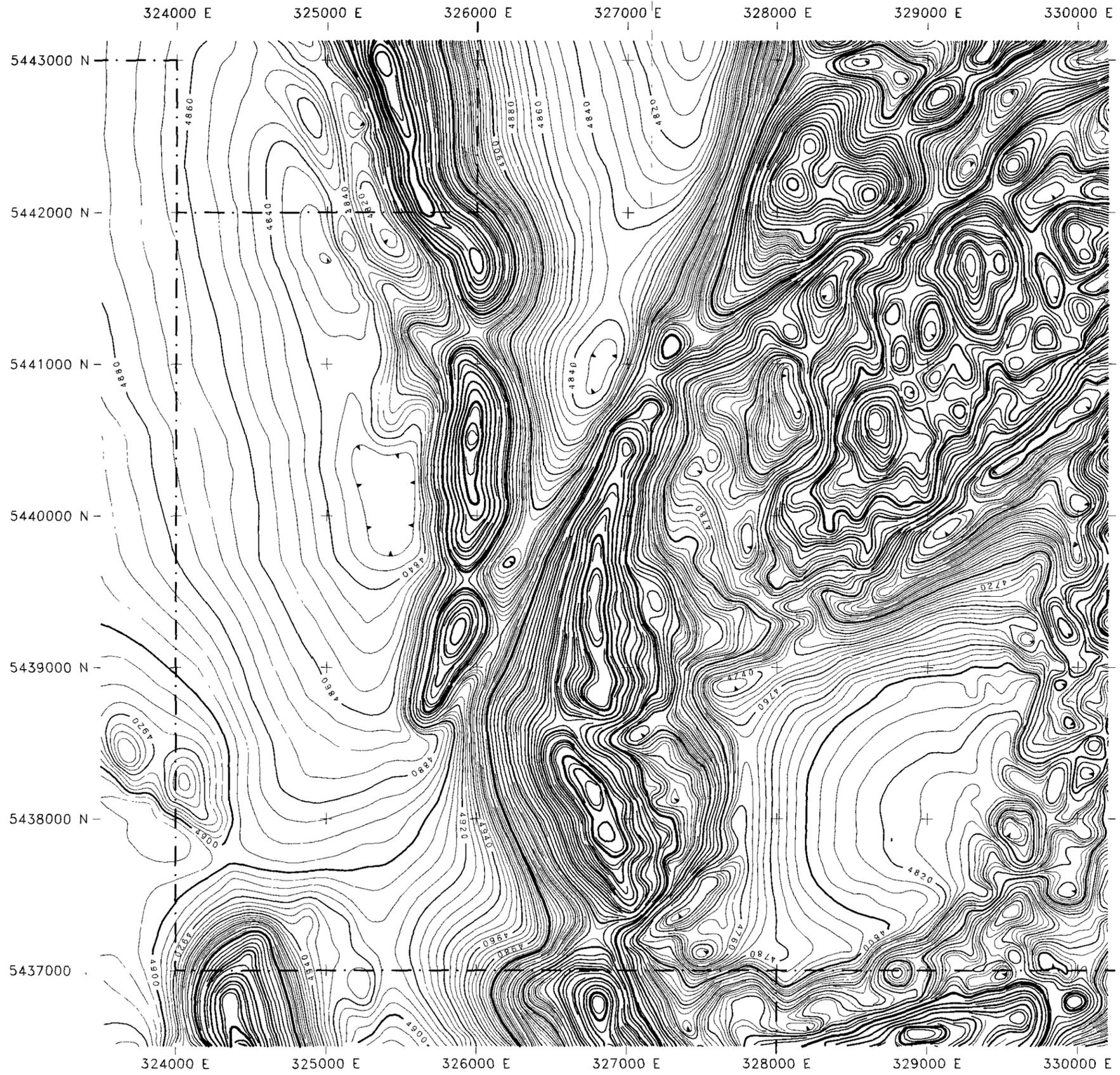
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Magnetic north bearing 11° AMG



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MT. FRANKLAND SURVEY		
AEROMAGNETIC STACKED PROFILES		
BURNIE SK55-03		
GEO:	TA	SCALE: 1:25000
REPORT:	19015	
DRAWN:	TA	DATE: 09/08/93
PLAN:	Tv 573	



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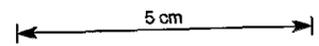
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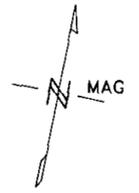
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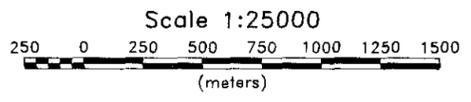
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**93-3483.**

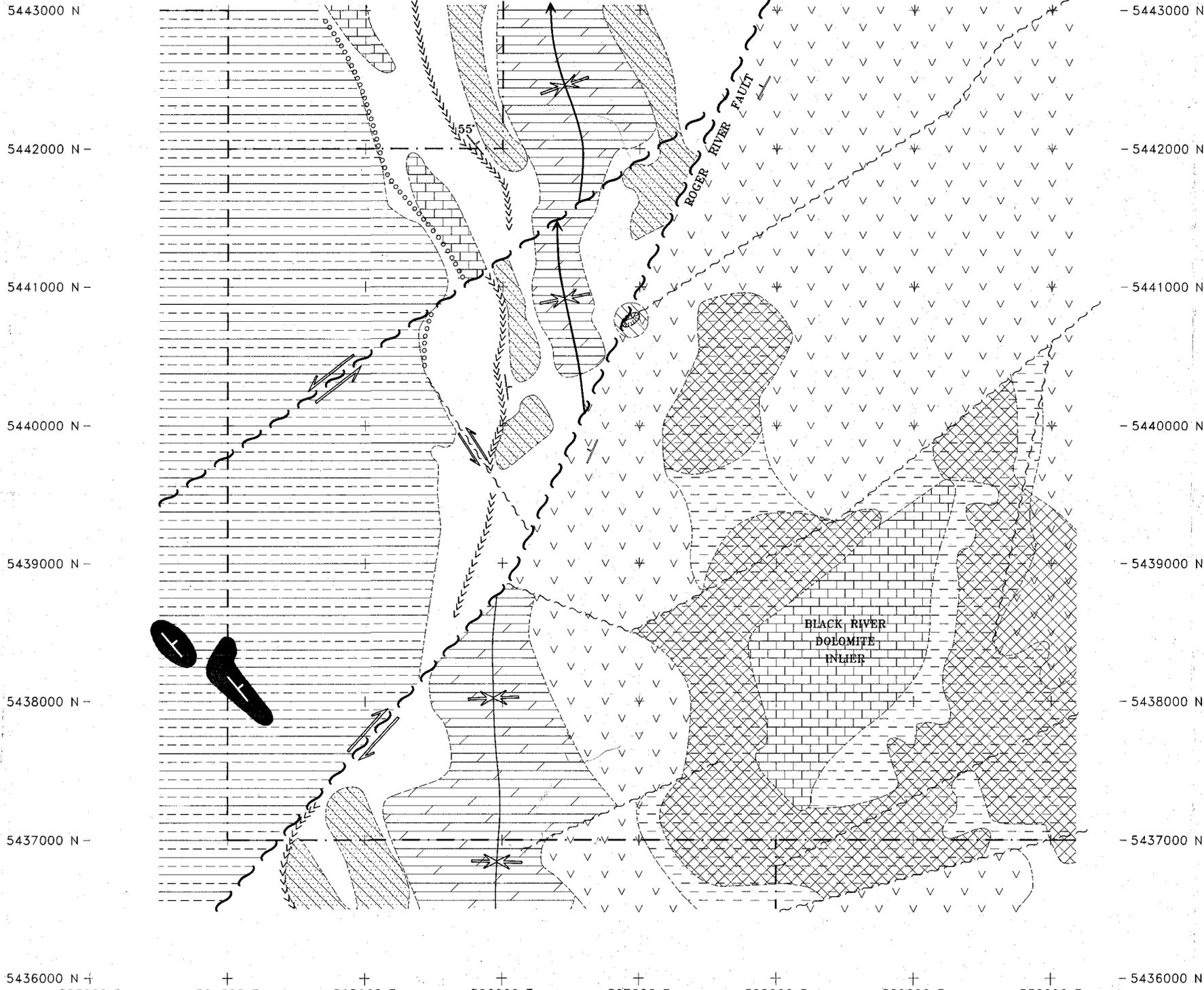


Magnetic north bearing 11° AMG



CRA EXPLORATION PTY. LIMITED		
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BURNIE SK55-03		
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PLAN:	Tv 571	

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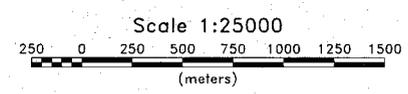
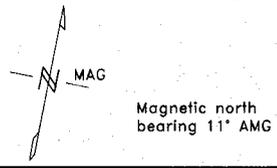
- 5443000 N  
- 5442000 N  
- 5441000 N  
- 5440000 N  
- 5439000 N  
- 5438000 N  
- 5437000 N  
- 5436000 N

LEGEND			
AGE	Magnetic/Radiometric Character	Possible Geological Unit	
CAMBRIAN SMITHTON TROUGH		Bland Magnetics V. Low Radiometrics	Smithton Dolerite Dolomite?
		Bland Magnetics K Anomaly	Unnamed Sedimentary Unit
		Strongly Magnetic Linear Unit	Smithton Basalt
		Complex Magnetic Unit	
		Weak Radiometric Anomaly	Possible Keppel Creek Siltstone Equivalent
		Bland Magnetics V. Low Radiometrics	Black River Dolomite
		Weakly Magnetic Linear Unit	Possible Forest Conglomerate Equivalent
?		Moderate Magnetic Anomaly	Possible Intrusive
PROTEROZOIC		Bland Magnetics High Background Radiometrics	Possible Correlatives of the Rocky Cape Association

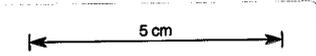
- Elevated K
- Elevated Th
- Quarry
- Plunging Syncline
- Modelled Dip and Strike
- Major Inferred Fault With Movement Sense
- Minor Inferred Fault

93-3483.

323000 E 324000 E 325000 E 326000 E 327000 E 328000 E 329000 E 330000 E



990033



CRA EXPLORATION PTY. LIMITED		
TROWUTTA EL 19/92		
MT. FRANKLAND SURVEY		
INTERPRETATION PLAN		
BURNIE SK55-03		
GEO: TA	SCALE: 1:25000	REPORT: 19015
DRAWN: TA	DATE: 09/08/93	PLAN: Tv 576

APPENDIX 1

CRAE STREAM SEDIMENT SAMPLING LEDGERS AND GEOCHEMISTRY

APPENDIX 1: STREAM SEDIMENT GEOCHEMISTRY

APPENDIX 1: -80# STREAM SEDIMENT LOCATIONS AND ASSAY RESULTS

Results in ppm unless stated otherwise

SAMPNO	EAST	NORTH	Ag	Cu	Pb	Zn	As	Fe%	Mn	Bi	Mo	Au ppb	Sb	Hg	Co	Cr	Ni	P	V	Ce%	Mg%	Na%
3313701	342001	5457200	-0.1	50	2200	120	5.4	6.94	1300	1.2	3.3	-1	2.4	-0.5	35	260	95	1300	180	0.17	0.16	0.2
3313702	341851	5456850	-0.1	55	230	130	3.4	5.56	100	0.3	1.3	-1	1.2	-0.5	80	200	95	1750	140	0.29	0.42	0.26
3313703	341900	5456800	-0.1	60	145	100	5.4	9.25	1850	0.5	2.9	-1	1.2	-0.5	45	280	105	1800	250	0.14	0.18	0.25
3313704	341751	5456600	-0.1	70	70	80	4.5	11.5	2600	0.5	3.1	-1	1.4	-0.5	45	320	110	2200	320	0.11	0.15	0.42
3313705	341450	5456750	-0.1	70	32	65	5.4	11.4	2000	0.6	3.2	-1	1.2	-0.5	35	400	85	2000	300	0.09	0.14	0.38
3313706	341450	5456450	-0.1	110	110	130	6.8	14	2500	0.6	3.3	-1	1.4	-0.5	55	320	180	193000	300	0.1	0.22	0.48
3313707	341751	5456550	-0.1	70	95	160	6	9.93	2550	0.4	2.7	-1	1.8	-0.5	80	280	170	1300	210	0.12	0.23	0.39
3313708	341849	5456500	-0.1	55	30	125	8.1	8.1	1200	0.4	2.7	-1	1.4	-0.5	50	220	105	232000	210	0.16	0.18	0.3
3313709	341700	5456100	-0.1	60	18	115	5.1	8.33	1000	0.4	2.5	-1	1.2	-0.5	45	220	115	33300	210	0.12	0.2	0.38
3313710	341700	5455250	-0.1	65	65	130	5.2	7.24	840	0.5	2.6	-1	1.1	-0.5	50	250	85	11100	200	0.04	0.12	0.33
3313711	341599	5455650	-0.1	48	38	120	4.7	5.98	520	0.3	2.8	-1	1.0	-0.5	45	230	90	8800	180	0.05	0.18	0.27
3313712	341501	5455700	-0.1	75	50	100	3.9	7.04	530	0.4	2.7	-1	1.2	-0.5	30	230	110	4500	220	0.11	0.19	0.46
3313713	339499	5456150	-0.1	80	24	115	5.9	10.5	1300	0.5	3.0	-1	1.7	-0.5	45	300	130	3650	250	0.13	0.18	0.52
3313714	339599	5456100	-0.1	48	28	60	5.7	9.42	930	0.6	3.4	-1	1.9	-0.5	30	200	70	2100	220	0.08	0.19	0.35
3313715	339699	5455750	-0.1	75	15	75	4.5	8.82	570	0.4	4.3	-1	1.4	-0.5	25	200	75	2300	260	0.07	0.14	0.3
3313716	339550	5455600	-0.1	48	42	44	3.8	9.78	550	0.5	2.6	-1	1.1	-0.5	15	150	60	2000	230	0.18	0.23	0.43
3313717	339500	5455650	-0.1	65	26	75	4.3	9.16	520	0.4	2.6	-1	1.2	-0.5	25	200	95	3150	230	0.14	0.19	0.6
3313718	339999	5457050	-0.1	38	17	130	5.6	8.84	900	0.3	2.8	-1	1.3	-0.5	30	330	85	2250	160	0.1	0.15	0.26
3313719	339800	5456900	-0.1	55	32	95	5.9	10.2	1250	0.5	3.4	-1	1.5	-0.5	40	230	85	1650	22	0.1	0.18	0.42
3313720	337250	5456450	-0.1	160	16	55	2.1	11.3	1600	0.5	1.2	1	1.0	-0.5	50	340	85	3100	340	0.09	0.2	0.5
3313721	337350	5456050	-0.1	250	11	105	0.9	9.16	1450	0.4	1.1	-1	1.2	-0.5	45	140	60	1500	310	0.15	0.15	0.5
3313722	337600	5455900	-0.1	170	11	75	1	10.8	1150	0.4	1.1	1	0.8	-0.5	45	180	85	1450	340	0.11	0.14	0.52
3313723	336650	5454800	-0.1	220	7	75	0.7	8.68	650	0.3	0.9	-1	0.9	-0.5	40	200	65	1900	370	0.07	0.13	0.33
3313724	336301	5455050	-0.1	175	16	75	0.9	9.11	1300	0.4	0.9	1	0.9	-0.5	50	180	70	2350	320	0.09	0.14	0.5
3313725	336350	5455100	-0.1	230	20	85	0.7	7.54	2550	0.5	0.8	-1	0.9	-0.5	55	110	60	1100	300	0.08	0.14	0.43
3313726	335701	5454500	-0.1	175	18	160	2	8.77	1400	0.7	1.2	-1	1.1	-0.5	45	230	155	1350	300	0.27	0.36	0.76
3313727	336399	5454200	-0.1	120	22	140	2.3	9.22	1650	0.2	1.4	-1	0.9	-0.5	45	250	145	1350	270	0.14	0.28	0.58
3313728	337050	5454100	-0.1	160	15	95	1.6	9.93	780	0.4	1.5	-1	0.8	-0.5	30	250	110	990	350	0.05	0.11	0.42
3313729	337000	5453950	-0.1	65	17	165	4	9.89	1250	0.4	1.9	-1	0.9	-0.5	35	430	175	1500	250	0.07	0.17	0.53
3313730	338301	5453350	-0.1	65	22	55	4.2	6.55	300	0.3	3.0	-1	1.2	-0.5	15	230	75	1250	250	0.05	0.17	0.32
3313731	338400	5453300	-0.1	90	14	75	4.2	9.82	370	0.3	2.4	-1	1.1	-0.5	20	210	90	1600	280	0.08	0.18	0.37
3313732	338250	5453650	-0.1	70	20	80	4.4	7.81	1200	0.5	2.9	-1	1.2	-0.5	25	150	70	1350	230	0.06	0.21	0.36
3313733	340000	5452100	-0.1	50	13	28	1.1	4.7	150	<0.2	0.7	-1	0.3	-0.5	10	120	40	810	270	0.02	0.09	0.22
3313734	339249	5452200	-0.1	65	18	90	3.2	11.7	2150	0.4	2.0	-1	1.0	-0.5	70	330	110	1750	320	0.05	0.11	0.54
3313735	339099	5452150	-0.1	60	15	70	2.8	10	730	0.6	1.8	-1	0.8	-0.5	25	330	90	1800	310	0.05	0.11	0.32
3313736	339501	5452100	-0.1	65	16	55	2.1	7.03	390	1.0	0.8	-1	0.8	-0.5	20	170	60	1000	250	0.03	0.1	0.28
3313737	339449	5452500	-0.1	44	15	55	1.7	6.77	260	0.5	1.2	-1	0.6	-0.5	25	290	95	1400	240	0.03	0.11	0.27
3313738	336750	5447100	-0.1	60	22	120	6.2	6.54	1150	0.4	2.5	-1	1.1	-0.5	35	120	90	1200	180	0.13	0.44	0.37
3313739	336999	5447550	-0.1	80	28	145	8.2	8.06	1200	0.5	4.2	-1	1.5	-0.5	40	140	120	1400	220	0.11	0.4	0.56
3313740	337050	5447550	-0.1	65	20	150	6.9	7.49	1150	0.3	2.7	-1	1.0	-0.5	45	130	105	1300	190	0.14	0.49	0.41
3313741	337550	5447900	-0.1	95	17	170	7.5	7.91	1400	0.4	3.0	-1	1.1	-0.5	45	150	125	1550	240	0.16	0.44	0.46
3313742	337449	5447950	-0.1	95	17	180	11	8.52	850	0.4	3.6	-1	1.4	-0.5	45	140	110	1400	220	0.14	0.45	0.38
3313743	328350	5441000	-0.1	175	9	250	4.5	8.93	1150	0.2	0.5	-1	0.8	-0.5	50	190	140	690	350	0.28	0.35	0.72
3313744	328400	5441100	-0.1	120	9	125	1.2	6.55	670	0.2	0.6	-1	0.7	-0.5	35	200	80	530	260	0.25	0.27	0.6
3313745	332249	5451250	-0.1	175	9	180	1.1	9.74	1100	0.5	0.6	61	0.8	-0.5	55	210	150	740	360	0.51	0.47	1.17
3313746	332650	5452050	-0.1	220	6	100	0.7	9.16	1450	0.3	0.7	8	0.7	-0.5	35	110	70	620	3890	0.18	0.17	0.8
3313747	335351	5454850	-0.1	170	34	160	1.4	9.59	1500	0.6	1.2	-1	0.9	-0.5	50	230	150	840	340	0.41	0.22	0.7
3313748	335150	5454800	-0.1	250	16	170	0.8	9.96	1700	0.3	0.7	-1	0.9	-0.5	45	120	90	730	400	0.48	0.35	1
3313749	334801	5455100	-0.1	190	13	165	1.2	10.9	1550	0.5	1.0	-1	0.8	-0.5	50	200	140	840	440	0.39	0.37	1.01
3313750	334349	5455100	-0.1	180	7	145	1.1	9.3	880	0.3	1.0	26	0.8	-0.5	35	210	120	730	400	0.4	0.27	0.84

990035

APPENDIX 1: STREAM SEDIMENT GEOCHEMISTRY

SAMPNO	EAST	NORTH	Ag	Cu	Pb	Zn	As	Fe%	Mn	Bi	Mo	Au ppb	Sb	Hg	Co	Cr	Ni	P	V	Ce%	Mg%	Na%
3313751	334951	5454150	0.1	320	8	200	0.7	9.99	1400	0.4	0.7	5	1.0	-0.5	45	120	90	750	480	0.41	0.36	0.95
3313752	335100	5454200	-0.1	290	9	170	0.7	8.98	970	0.3	0.8	2	0.9	-0.5	35	100	65	540	420	0.32	0.26	0.71
3313753	331900	5449700	-0.1	105	14	220	2	7.06	870	0.4	0.7	-1	0.7	-0.5	35	300	145	690	220	0.07	0.33	0.32
3313754	331900	5449500	-0.1	155	10	200	1.8	8.81	1250	0.4	0.6	-1	0.8	-0.5	40	170	120	710	310	0.2	0.31	0.74
3313755	331951	5449550	-0.1	75	15	75	2	8.02	920	0.4	0.6	-1	0.5	-0.5	20	250	95	540	200	0.09	0.32	0.35
3313756	332600	5449150	-0.1	125	8	175	0.9	8.21	1000	0.4	0.6	1	0.7	-0.5	35	220	110	520	310	0.34	0.28	0.91
3313757	332199	5448950	-0.1	140	8	210	0.8	8.75	1350	0.3	0.7	-1	0.6	-0.5	40	120	105	580	340	0.24	0.24	0.77
3313758	340450	5443750	-0.1	10	18	22	1.8	0.99	90	0.3	0.7	-1	1.0	-0.5	-5	40	10	250	30	0.1	0.27	0.15
3313759	340600	5444400	-0.1	7	11	15	0.6	0.81	250	0.3	0.5	-1	<0.2	-0.5	-5	30	10	390	30	0.16	0.43	0.19
3313760	341151	5445200	-0.1	3	5	3	0.5	0.56	30	<0.2	0.6	-1	<0.2	-0.5	-5	20	-5	120	20	-0.01	0.28	0.19
3313761	341501	5446101	-0.1	3	7	4	0.6	0.53	110	<0.2	0.9	1	<0.2	-0.5	-5	30	-5	140	20	-0.01	0.2	0.24
3313762	342000	5457200	-0.1	44	17	130	5.3	7.23	1550	<0.2	2.5	-1	2.8	-0.5	45	200	100	1100	180	0.25	0.25	0.16
3313763	341850	5456850	-0.1	46	12	140	4	6.18	1100	<0.2	1.2	-1	1.3	-0.5	80	240	95	1450	155	0.21	0.43	0.07
3313764	341900	5456800	-0.1	60	32	115	5.2	9.16	1850	0.3	3.2	-1	1	-0.5	50	280	110	1850	240	0.42	0.37	0.17
3313765	335100	5353850	-0.1	240	13	230	0.7	10	1750	<0.2	0.7	2	0.8	-0.5	50	150	110	650	510	0.56	0.32	0.85
3313766	335500	5354150	-0.1	210	19	150	0.9	12.8	1500	<0.2	0.8	-1	0.8	-0.5	55	135	85	590	510	0.29	0.29	0.35
3313767	335800	5353850	-0.1	65	7	70	1.3	5.55	270	<0.2	1.2	-1	0.3	-0.5	20	130	45	260	270	0.29	0.3	0.7

## KEY TO GEOCHEMICAL DRAINAGE SAMPLING LEDGER

HEADER DATA - Self Explanatory

SAMPLE No. CRAE 7 figure number.

LOCATION

Co-ords.: AMG or grid co-ordinates

- remember if grid co-ordinates used at least 2 points should have AMG co-ords. (for metrication of grid sample numbers.)

SAMPLE TYPE

1. Stream Sediment Sample.
  2. Panned Concentrate Sample.
  3. Bulk Sediment Sample.
  4. Clay Sample (suspended silt.)
  5. Loam Sample.
  6. Magnetic Fraction.
  7. Water Sample.
  8. Miscellaneous Sample.
- .1 Sized by mesh sieves.
  - .2 Sized by millimetre sieves.
  - .3 Not sized.
  - 3.2 Bulk sample sized by millimetre sieves.

SAMPLE SIZE Minisize, maxisize - data from sieve sizes used.

SAMPLE DESCRIPTION Percentage of gravel, sand, silt/clay and organic matter at the sample size.

SITE DESCRIPTION

Catchment: Size in square kilometres.

Contamination:

1. No apparent contamination.
2. Urban e.g. Houses, rubbish, etc.
3. Roads, tracks, railways, dams, stone quarries, etc.
4. Metalliferous Mine, workings or tailings in catchment area.
5. Rubbish (man made) if separate from 2.
6. Agricultural e.g. Fertilisers, cattle yards, heavy cultivation, animal faeces or remains.
7. Natural dilution from banks of creek.

Site Rating:

- |             |                   |
|-------------|-------------------|
| 1. Good     | 3. Poor           |
| 2. Moderate | 4. Unsatisfactory |

Banks:

- |              |                       |
|--------------|-----------------------|
| 1. Alluvial  | 3. Alluvial/Colluvial |
| 2. Colluvial | 4. No defined channel |

Flow:

- |          |         |
|----------|---------|
| 1. Dry   | 3. Slow |
| 2. Pools | 4. Fast |

Width: Width of channel in metres.

990037

## ROCKCHIP AND DRILLING CODES

17/2/93

## BMRLITH

Rock code as per published geological map  
For time designation use:-

Q Quaternary	M Permian	P Proterozoic
T Tertiary	C Carboniferous	A Archaean
	S Silurian	
K Cretaceous	D Devonian	
R Triassic	O Ordovician	
J Jurassic	E Cambrian	

## FIELD ID

Field term for rock type  
Broad groupings are:-

S Sedimentary	I Intrusive	C Surficial
M Metamorphic	E Extrusive	O Others

## SEDIMENTARY

Scg Conglomerate	Sls Limestone
Sas Sandstone	Sch Chert
Ssi Siltstone	Slf BIF
Ssh Shale	
Sbs Black shale	Sbx Breccia

## METAMORPHIC

Msl Slate	Mq Quartzite	Mmg Migmatite
Mph Phyllite	Mm Marble	
Msc Schist	Ma Amphibolite	Msk Skarn
Mbs Graphitic schist	Mcs Calcisilicate	
Mgn Gneiss	Mh Hornfels	

## INTRUSIVE IGNEOUS

lf Felsic undiff.	li Intermed undiff.	lu Ultramafic
lfp Felsic porphyry	lip Intermed porph	lus Serpentinite
lap Aolite	lm Mafic undiff.	
lgr Granite	ldo Dolerite	lpg Pegmatite
lgd Granodiorite	lgb Gabbro	

## EXTRUSIVE IGNEOUS

Ery Rhyolite	Ean Andesite	Et Tuff undiff
Edc Dacite	Eb Basalt	Eft Felsic tuff
		Emt Mafic tuff

## SURFICIAL (COVER) MATERIAL

Ca Alluvium	Clt Laterite	Csg Gossan
Col Colluvium	Csp Placettes	
Cs Sand	Csf Ironstone	Ccy Clay
Cbs Black soil	Csi Silcrete	
Cg Gravel	Ccl Calcrete	Cv Vegetation/peat

## OTHERS

Ovq Vein quartz	Omy Mylonite	Oms Massive sulphide
Ovc Vein carbonate	Obx Breccia	
Ovs Vein sulphide	Of Fault gouge	Ox Unknown

## TEXTURAL CODES

## WEATHERING/SURFICIAL FEATURES

We Weathered	Fe Ferruginous
Bl Bleached	Fo Fe ox in tract
La Leached	

## MINERALISATION/ALTERATION FEATURES

Gs Gossanous	Vs Vein sulphide	Al Altered
Vn Veined	Ds Dissem sulph	Sl Silicified
Di Disseminated	Fs Fracture sulph	
	Bs Banded sulph	

## GEOLOGICAL FEATURES

Bd Bedded	Fr Fractured	Pa Porphyritic
Bn Banded	lb Interbedded	Sc Schistose
Bx Brecciated	Lm Laminated	Sh Sheared
Fi Fissile (slaty)	Ma Massive	Vu Vuggy

## DIAGNOSTIC MINERALOGY

## PRIMARY MINERALISATION

Ga Galena	Py Pyrite	Ni Ni sulphides
Sp Sphalerite	Po Pyrrhoite	
Cp Chalcopyrite	Su Unknown sulph	

## SECONDARY MINERALISATION

Ls Lead secondaries	Cs Copper sec.	Ni Ni secondaries
Zs Zinc	Us Uranium	

## ALTERATION/DIAGNOSTIC MINERALS

Cy Clay	He Haematite	Gt Garnet
Ep Epidote	Mt Magnetite	Ky Kyanite
Cc Carbonate	Js Jarosite	To Tourmaline
Sd Siderite	Mh Manganese mins	

## COLOUR CODES

L Light	A Banded	M Mottled
D Dark		
N Black	P Purple	V Green
G Grey	R Red	K Pink
B Brown	O Orange	E Blue
W White	Y Yellow	S Silver



# CRA EXPLORATION PTY. LIMITED

FILE NAME: \_\_\_\_\_ D

SAMPLE No.	LOCATION		SAMPLE DESCRIPTION				SITE DESCRIPTION						ROCK TYPE				METAL CONTENT IN p.p.m.						GEOLOGICAL OBSERVATION					
	CO. ORDS.		SAMPLE TYPE	SIZE		GRAVEL	SAND	SILT/CLAY	ORGANIC	CATCH-MENT	CONTAM	SITE RATING	BANKS	FLOW	WIDTH	FLOAT			OUTCROP	Pb	Zn	Cu		Mn	Ag	Au		
	AMG E	AMG N		MIN.	MAX.											MAJ.	MIN.	MIN.										
3313710	341700	5455250	SS			10	70	10	10	0.2	7	2	2	3	2		Sls	Sw										Joiner CK.
3313711	341600	5455650	SS			10	70	10	10	0.7	1	2	3	3	1	Sw	Sls	Sw										Joiner CK
3308037			F																									Strange clay-filled pebbles concretionary rock.
3308037																												TLHS trib. Dam upstream.
3308038	341800	5454750	GS			10	70	15	5	0.2	6?	1	2	3	0.5	Sw		Sw										Laminated black shale.
3308039	339650	5456250	GS																									Ferruginous 1st breccia
3313713	339500	5456150	SS			30	50	10	10	0.2	6	1	2	3-4	1.5	Sw	Sls											TLHS trib of FAHEY'S CREEK
3313714	339600	5456100	SS			60	30	5	5	1.5	7	3	2	4	2	Sls	Sw	Csf	Sls									Fahay's CK.
3313715	339700	5455750	SS			10	70	10	10	0.2	7	3	2	3	1	Sw												TRHS trib of Fahay's CK.
3313716	339550	5455600	SS			10	20	50	20	0.2	7	3	2	3	1				Sw									" " " "
3313717	339500	5456650	SS			-	20	60	20	0.4	7	3	2	3	2				Sw									Fahay's CK.
3313718	340000	5457050	SS			30	40	20	10	0.5	7	3	2	4	1	Sls	Sw											TRHS trib Fahay's CK.
3313719	339800	5456900	SS			45	40	10	5	2	7?	3	2	4	1	Sw	Sls	Eb	Sw									Fahay's CK.

GEOCHEMICAL DRAINAGE SAMPLING LEDGER	DETECTION LIMITED ANALYTICAL METHOD	
SAMPLED BY: <u>RGP</u> DATE: <u>10/9/92</u>	LABORATORY USED: _____	PROJECT: _____
D.P.O. No.s: _____	SCALE, PLAN No.s, ZONE: _____	TENEMENT NAME: <u>TROWITA</u>
MAP OR PHOTO REF.: <u>ARTHUR RIVER</u>	APPENDIX No. _____ PAGE: <u>2</u> OF: <u>8</u>	AREA OR PROSPECT: <u>JOINER CK / FAHEY'S CK</u>

090010

# CRA EXPLORATION PTY. LIMITED

FILE NAME: \_\_\_\_\_ D

SAMPLE No.	LOCATION		SAMPLE DESCRIPTION				SITE DESCRIPTION							ROCK TYPE				METAL CONTENT IN p.p.m.							GEOLOGICAL OBSERVATION				
	CO-ORDS.		SIZE		GRAVEL	SAND	SILT/CLAY	ORGANIC	CATCH-MENT	CONTAM	SITE RATING	BANKS	FLOW	WIDTH	FLOAT			OUTCROP	Pb	Zn	Cu	Mn	Ag	Au					
	AMG E	AMG N	SAMPLE TYPE	MIN											MAX	MAJ.	MIN.												
3308040	339800	5456850	GS																										Interbedded 1st - volcanoclasti
3313720	337250	5456450	SS	-80#	20	60	15	5	1.5	1	2	2	4	3	Sw														Williamson's ck
3313721	337350	5456050	SS		35	50	10	5	0.8	1	1	3	4	3	Sw														-"-
3313722	337600	5455900	SS		35	50	10	5	0.5	1	1	3	4	3	Sw														-"-
3308041			GS																										Volcanoclastic (mafic lithic wacke?)
3313723	336650	5454800	SS		10	50	30	10	0.2	3?	2	3	4	1.5	Sw														McDonald CK TRHS
3313724	336300	5455050	SS		-	30	50	20	0.4	3?	2	2	3	1.5	Sw														-"- -"-
3313725	336350	5455100	SS		30	40	20	10	0.3	1	1	2	4	1	Sw														-"- TRHS
3313726	335700	5454500	SS		80	15	5	-	6	1	2	3	4	3	Eb														Spinks Creek

GEOCHEMICAL DRAINAGE SAMPLING LEDGER

DETECTION LIMITED  
ANALYTICAL METHOD

SAMPLED BY: RGF DATE: 11/9/92  
 D.P.O. No s : \_\_\_\_\_  
 MAP OR PHOTO REF.: ARTHUR RIVER

LABORATORY USED: \_\_\_\_\_  
 SCALE, PLAN No.s, ZONE: \_\_\_\_\_  
 APPENDIX No. \_\_\_\_\_ PAGE: 3 OF: 8

PROJECT: \_\_\_\_\_  
 TENEMENT NAME: TROWUTTA  
 AREA OR PROSPECT: WILLIAMSON'S CK / McDONALD CK

140001

# CRA EXPLORATION PTY. LIMITED

FILE NAME: \_\_\_\_\_ D

SAMPLE No.	LOCATION		SAMPLE DESCRIPTION				SITE DESCRIPTION						ROCK TYPE				METAL CONTENT IN p.p.m.							GEOLOGICAL OBSERVATION				
	CO. ORDS.		SAMPLE TYPE	SIZE		GRAVEL	SAND	SILT/CLAY	ORGANIC	CATCH-MENT	CONTAM	SITE RATING	BANKS	FLOW	WIDTH	FLOAT			OUTCROP	Pb	Zn	Cu	Mn		Ag	Au		
	AMG E	AMG N		MIN	MAX											MAJ.	MIN.	MIN.										
3313727	336400	545200	SS			-	30	50	20	SS	1	2	3	4	5	EB	SW											Spinks CK (Cu)
3313728	337050	5454100	SS				30	45	20	5	2	1	1	3	4	2	SW	EB	SW									Spinks CK (Cu) TRHS trib
3313729	3371000	5453950	SS				30	50	15	5	3	1	1	1	4	4	SW		SW									Spinks CK (Cu) TLHS trib
3313730	338300	5453350	SS				-	60	30	10	0.2	1	1	2	3	0.3	SW	Ssh3	SW									Spinks CK (As) TLHS trib
3313731	338400	5453300	SS				-	30	50	20	0.2	1	2	1	3	5	SW		SW									Spinks CK (As) TRHS trib (Swampy)
3313732	338250	5453650	SS				-	30	50	20	0.6	7	3	2	3	3			SW									Spinks CK (As) TLHS trib
3313733	340000	5452100	SS				-	-	60	40	1	1	3	3	3	1.5												Dobson CK
3313734	339250	5452200	SS					20	60	20	-	0.2	6	1	2	4	0.5	SW		SW								Dobson CK TRHS trib
3313735	339100	5452150	SS					10	40	30	20	0.2	1	3	3	3	1	SW										Dobson CK TRHS trib (Swampy)
3313736	339500	5452100	SS					-	10	50	40	1.5	6	4	4	3	2											Dobson CK Swampy
3313737	339450	5452500	SS					-	20	70	10	0.1	7	4	4	3	8	SW										Dobson CK TRHS trib Swampy
3308042	339650	5452350	GS																									Basaltic agglomerate.

**GEOCHEMICAL DRAINAGE SAMPLING LEDGER**

DETECTION LIMITED  
ANALYTICAL METHOD

SAMPLED BY: RGP DATE: 12/9/92  
 D.P.O. No.s : \_\_\_\_\_  
 MAP OR PHOTO REF.: ARTHUR RIVER

LABORATORY USED: \_\_\_\_\_  
 SCALE, PLAN No.s, ZONE: \_\_\_\_\_  
 APPENDIX No. \_\_\_\_\_ PAGE: 4 OF: 8

PROJECT: \_\_\_\_\_  
 TENEMENT NAME: TROWUTTA EL19/92  
 AREA OR PROSPECT: SPINKS CK/DOBSON CK.

990042



# CRA EXPLORATION PTY. LIMITED

FILE NAME: \_\_\_\_\_ ID

SAMPLE No.	LOCATION		SAMPLE DESCRIPTION					SITE DESCRIPTION						ROCK TYPE				METAL CONTENT IN p.p.m.							GEOLOGICAL OBSERVATION			
	CO. ORDS.		SAMPLE TYPE	SIZE		GRAVEL	SAND	SILT/CLAY	ORGANIC	CATCH-MENT	CONTAM	SITE RATING	BANKS	FLOW	WIDTH	FLOAT			OUTCROP	Pb	Zn	Cu	Mn	Ag		Au		
	AMG E	AMG N		MIN.	MAX.											MAJ.	MIN.	MIN.										
3313743	3282350	5441000	SS			50	35	10	5	0.5	1	1	3	4	3	Sw			Sw									Stephen's Rivulet TRHS till
3313744	3284400	5441100	SS			75	25	5	-	2	1	2	3	4	4	Eb Sw			Sw									-11- TRHS
3313745	332250	5451250	SS			60	30	10	-	3	1	1	1	4	3	Eb											Montague River	
3313746	332650	5452050	SS			10	60	25	5	0.2	1	1	2	4	0.5	Sw Eb											Unamed ch near Roger R Reser	

GEOCHEMICAL DRAINAGE SAMPLING LEDGER

DETECTION LIMITED  
ANALYTICAL METHOD

SAMPLED BY: RGF DATE: 14/9/92

LABORATORY USED: \_\_\_\_\_

D.P.O. No.s: 71518

SCALE, PLAN No.s, ZONE: \_\_\_\_\_

MAP OR PHOTO REF.: SUMAC 1:25000/ROGER 1:25000

APPENDIX No. \_\_\_\_\_ PAGE: 6 OF: 8

PROJECT: \_\_\_\_\_  
TENEMENT NAME: TROWITA EL 19/92  
AREA OR PROSPECT: STEPHEN'S RIV/MONTAGUE R.

990044



990046

CRA EXPLORATION PTY. LIMITED

FILE NAME: \_\_\_\_\_ D

SAMPLE No.	LOCATION		SAMPLE DESCRIPTION				SITE DESCRIPTION							ROCK TYPE				METAL CONTENT IN p.p.m.						GEOLOGICAL OBSERVATION			
	CO-ORDS.		SAMPLE TYPE	SIZE		GRAVEL	SAND	SILT/CLAY	ORGANIC	CATCH-MENT	CONTAM	SITE RATING	BANKS	FLOW	WIDTH	FLOAT			OUTCROP	Pb	Zn	Cu	Mn		Ag	Au	
	AMG E	AMG N		MIN.	MAX.											MAJ.	MIN.	MIN.									
3308050	333400	5458150	GS																								OLD QUARRY green sheared chlorite rock. Fav Red haematitic clay after 050
051	"	"	GS																								
052	"	"	GS																								Silicified rock with minor malachite
053	"	"	GS																								Brecciated limestone
054	"	"	GS																								Silicified rock with q-hc veins
3308055	348350	5459500	RC	2m																							Black siltstone with q-py veins (Tayatea Bridge)
3308056	348800	5445200	GS																								TAYATEA QUARRY. Gossanous qtz vein
3308057	"	"	GS																								Gossanous sheared black siltstone
058	"	"	GS																								Black siltstone with 10% bedded py
059	"	"	GS																								Dolomite dyke? weath to chlorite
3313758	340450	5443150	SS	-80#	70	25	45	-	1.5	1	1	1	3	1.5	Sss	Sch											Red Hat Hill. Rapid R Rd.
3313759	340600	5444400	SS		70	25	45	-	1.5	1	1	1	3	3	Sch		Sch										Coleman's Hill. Rapid R Rd. Hard to tell if schist is after lst or is mtn sst?
3313760	341150	5445200	SS		70	25	5	-	1	1	1	1	3	1.5	Sss	Sks	Sch										Coleman's Hill. Rapid R Rd.
3308060			F																								Sst with 10% dissemin he.
3308061			F																								Sst with 5% dk green spots
3313761	344500	5446100	SS		70	25	45	-	2	1	1	1	3	1	Sss		Sss										Joy Ck. Rapid R. Rd. Geopacko SWS 20450

GEOCHEMICAL DRAINAGE SAMPLING LEDGER

DETECTION LIMITED  
ANALYTICAL METHOD

SAMPLED BY: RGP DATE: 20/9/92  
D.P.O No: 71518  
MAP OR PHOTO REF: HOLDER/1:25000  
ROGER

LABORATORY USED: \_\_\_\_\_  
SCALE, PLAN No.s, ZONE: \_\_\_\_\_  
APPENDIX No. \_\_\_\_\_ PAGE: 8 OF. 8

PROJECT: \_\_\_\_\_  
TENEMENT NAME: TROWITA EL19/92  
AREA OR PROSPECT: ROGER R QUARRY / COLEMAN'S HILL  
TAYATEA



APPENDIX 2

ROCKCHIP LITHOLOGICAL CODES, SAMPLING LEDGERS AND GEOCHEMISTRY

090049

## ROCKCHIP AND DRILLING CODES

17/2/93

## BMRLITH

Rock code as per published geological map  
For time designation use:-

Q	Quaternary	M	Permian	P	Proterozoic
T	Tertiary	C	Carboniferous	A	Archaean
		S	Silurian		
K	Cretaceous	D	Devonian		
R	Triassic	O	Ordovician		
J	Jurassic	E	Cambrian		

## FIELD ID

Field term for rock type  
Broad groupings are:-

S	Sedimentary	I	Intrusive	C	Surficial
M	Metamorphic	E	Extrusive	O	Others

## SEDIMENTARY

Scg	Conglomerate	Sls	Limestone	Sw	Wacke
Sss	Sandstone	Sch	Chert	Sag	Agglomerate/mixtite
Ssi	Siltstone	Slt	BIF		
Ssh	Shale				
Sbs	Black shale	Sbx	Breccia		

## METAMORPHIC

Msi	Slate	Mq	Quartzite	Mmg	Migmatite
Mph	Phyllite	Mm	Marble		
Msc	Schist	Ma	Amphibolite	Msk	Skarn
Mbs	Graphitic schist	Mcs	Calcsiticate		
Mgn	Gneiss	Mh	Hornfels		

## INTRUSIVE IGNEOUS

If	Felsic undiff.	ii	Intermed undiff.	Iu	Ultramafic
Ifp	Felsic porphyry	Iip	Intermed porph	Ius	Serpentinite
Iap	Aplite	Iim	Mafic undiff.	Ipg	Pegmatite
Igr	Granite	Ido	Dolerite		
Igd	Granodiorite	Igb	Gabbro		

## EXTRUSIVE IGNEOUS

Ery	Rhyolite	Ean	Andesite	Et	Tuff undiff
Edc	Dacite	Eb	Basalt	Eft	Felsic tuff
				Emt	Mafic tuff

## SURFICIAL (COVER) MATERIAL

Ca	Alluvium	Clt	Laterite	Csg	Gossan
Coo	Colluvium	Csp	Pisolites	Ccy	Clay
Cs	Sand	Cst	Ironstone	Cv	Vegetation/peat
Cbs	Black soil	Csi	Silcrete		
Cg	Gravel	Ccl	Calcrete		

## OTHERS

Ovq	Vein quartz	Omy	Mylonite	Oms	Massive sulphide
Ovc	Vein carbonate	Obx	Breccia	Ox	Unknown
Ovs	Vein sulphide	Of	Fault gouge		

## TEXTURAL CODES

## WEATHERING/SURFICIAL FEATURES

We	Weathered	Fe	Ferruginous
Bl	Bleached	Fo	Fe ox in fract
Le	Leached		

## MINERALISATION/ALTERATION FEATURES

Gs	Gossanous	Vs	Vein sulphide	Al	Altered
Vn	Veined	Ds	Dissem sulph	Sl	Silicified
Di	Disseminated	Fs	Fracture sulph		
		Bs	Banded sulph		

## GEOLOGICAL FEATURES

Bd	Bedded	Fr	Fractured	Po	Porphyritic
Bn	Banded	Ib	Interbedded	Sc	Schistose
Bx	Brecciated	Lm	Laminated	Sh	Sheared
Fl	Fissile (slaty)	Ma	Massive	Vu	Vuggy

## DIAGNOSTIC MINERALOGY

## PRIMARY MINERALISATION

Ga	Galena	Fy	Pyrite	Ni	Ni sulphides
Sp	Sphalerite	Po	Pyrrhotite		
Cp	Chalcopyrite	Su	Unknown sulph		

## SECONDARY MINERALISATION

Ls	Lead secondaries	Cs	Copper sec.	Ni	Ni secondaries
Zs	Zinc	Us	Uranium		

## ALTERATION/DIAGNOSTIC MINERALS

Cy	Clay	He	Haematite	Gt	Garnet
Ep	Epidote	Mt	Magnetite	Ky	Kyanite
Cc	Carbonate	Js	Jarosite	To	Tourmaline
Sd	Siderite	Mn	Manganese mins		

## COLOUR CODES

L	Light	A	Banded	M	Mottled
D	Dark				
N	Black	P	Purple	V	Green
G	Grey	R	Red	K	Pink
B	Brown	O	Orange	E	Blue
W	White	Y	Yellow	S	Silver

APPENDIX 2- ROCKCHIP GEOCHEMISTRY

APPENDIX 3 - TROWUTTA EL19/92 ROCKCHIP DATABASE.											
All results in ppm.											
Database last updated on 6/7/93											
SAMPNO.	DPO	EAST	NORTH	PROSPECT	BMRLITH	FIELD ID	TEXTURE	ALT/MIN	COLOUR	COMMENTS	
3307849	71511	340750	5451750	TROWUTTA	Esp	Eb	Ds	Qu	DV	Native Cu 0.1%	
3307850	71511	332600	5452200	TROWUTTA	Ess	Sw	We	Mn	MYWBN	Mafic sediment (c.f. Crimson Ck Fm)	
3307851	71511	332600	5452200	TROWUTTA	Ess	Sw	We	Mn	MRON	Mafic sediment (c.f. Crimson Ck Fm)	
3307852	71511	326900	5440800	TROWUTTA	P?	Msl	Ds	Py	N	Trace Py.	
3307853	71511	326900	5440800	TROWUTTA	P?	Msl	Fe		MRON		
3307854	71511	326900	5440800	TROWUTTA	P?	Msl	Ds	Py	VN	Trace Py. Green surface stain.	
3308034	71517	341750	5456600	JOINER CK	Ec	Sbs	Lm		DG		
3308035	71517	341550	5456750	JOINER CK	Ec	SlsSbx	Vu		MYRN		
3308036	71517	341450	5456450	JOINER CK	Ec	Sbs	Lm		ANG		
3308037	71517	341600	5455650	JOINER CK		Ox	Fe		CEG	Float. Clay concretion with Fe crust.	
3308038	71517	341800	5454750	REID'S RD	Ec	Sbs	Lm		N		
3308039	71517	339650	5456250	FAHEY'S CK	Ec	SlsSbx	VuFo		MRYW		
3308040	71517	339800	5456550	FAHEY'S CK	Ec	SchSls	Bd		WGOR	Mixed bedded chert, lst, mudstone.	
3308041	71517	337600	5455900	WILLIAMSON'S CK	Esb	Sw?	Ma		LP		
3308042	71517	339650	5452350	ODGER'S RD	Esm	Sag			DVP	Basaltic agglomerate/mixtite	
3308043	71517	336750	5447100	W of CANNON CK	Edd?	Sss	Fe		R	Float	
3308044	71517	336750	5447100	W of CANNON CK	Edd?	SwSsh	LmFo		MYBN	Float	
3308045	71517	337550	5447900	W of CANNON CK	Edd	Sbs	MaDs	Py	N	Float	
3308046	71517	337550	5447900	W of CANNON CK	Edd?	Ccy			G	Float. Clay rock.	
3308047	71517	337450	5447950	W of CANNON CK	Edd?	Ssh	Fe		G	Float. Fe Ox spots.	
3308048	71517	337450	5447950	W of CANNON CK	Edd	Sbs	Ma	Gf	N	Float	
3308049	71517	335150	5454800	CORONATION CK	Ess?	Ovg	AlVn	Ep	VB	Float. Ep vn in qtz, wacke and basalt	
3308050	71517	333400	5453150	ROGER R QUARRY	Ec?	Of?	Sh		V	Chlorite rock. in fault?	
3308051	71517	333400	5453150	ROGER R QUARRY	Ec?	Of?	We	He	R	Weathered after chlorite?	
3308052	71517	333400	5453150	ROGER R QUARRY	Ec?	Of?	Sl	Os	MRV	Chl-he-Qz rock with minor malach	
3308053	71517	333400	5453150	ROGER R QUARRY	Ec?	SlsSbx	Bx		LYG		
3308054	71517	333400	5453150	ROGER R QUARRY	Ec?	Of?	Sl		V	Totally silicified rock.	
3308055	71517	348350	5452500	TAYATEA BRIDGE	Prc	Ssi	VsDsSh	Py	DGN		
3308056	71517	348800	5445200	TAYATEA QUARRY	Prc	Ovg	Gs		MOBY		
3308057	71517	348800	5445200	TAYATEA QUARRY	Prc	Csg	Gs		MWBN	Gossanous nodule in siltstone	
3308058	71517	348800	5445200	TAYATEA QUARRY	Prc	Ssi	BsDs	Py	N		

APPENDIX 2- ROCKCHIP GEOCHEMISTRY

SAMPNO.	DPO	EAST	NORTH	PROSPECT	BMRLITH	FIELD ID	TEXTURE	ALT/MIN	COLOUR	COMMENTS
3308059	71517	348800	5445200	TAYATEA QUARRY	Pd	Ido	We		V	Dolerite dyke
3308060	71517	341150	5445200	COLEMAN HILL	Pss?	Sss	Di	He	LRV	Float
3308061	71517	341150	5445200	COLEMAN HILL	Pss?	Sss			LV	Float. Spotted sst.
3308081	71521	334950	5454150	CORONATION CK	Ess	Sw	We		PVG	Float.
3308082	71521	334950	5454150	CORONATION CK	Ess	Sw	We		PB	Float.
3308083	71521	334950	5454150	CORONATION CK	Ess	Sw	We		MWRN	Float.
3308084	71521	334900	5454000	CORONATION CK	Ess	Sw	We		R	Float.
3308085	71521	335000	5453900	CORONATION CK	Ess	Sw	WeFr	Mn	R	Float. Mn on fractures.
3308086	71521	335050	5453550	CORONATION CK	Ess	Sw	WeFr	Mn	MRV	Dam spillway. Mn on fractures.
3308087	71521	335500	5454150	CORONATION CK	Ess	Sag	VuBx	Mn	MYBN	Float. Mixtite.
3308088	71521	335500	5454150	CORONATION CK	Ess	Sw	We		MYGV	Float.
3308089	71521	335500	5454150	CORONATION CK	Esb	Eb	Ma		DV	Float.
3308090	71521	335700	5453950	CORONATION CK	Esb	Eb	Al?	He	MRDV	Subcrop, altered basalt?
3308091	71521	335800	5453850	CORONATION CK	Esb?	EbSag	Di	Cs?	DGVLP	Agglom? 2-5% green Cu? min.
3529839	71538	336150	5442100	SUMAC QUARRY	Edd	SchSls	VuGs	Py		

APPENDIX 2- ROCKCHIP GEOCHEMISTRY

SAMPNO.	Ag	As	Au	Bi	Co	Cu	Fe%	Mn	Mo	Pb	V	Zn
3307849	-1	2	-0.005	-10	52	180	7.34	1500	-5	11	180	125
3307850	-1	-1	-0.005	-10	170	210	9.94	2100	-5	11	225	105
3307851	-1	-1	-0.005	-10	140	105	12.4	1900	-5	14	365	215
3307852	-1	10	-0.005	-10	8	19	2.31	170	-5	31	66	130
3307853	-1	22	-0.005	-10	-3	21	4.21	170	-5	33	68	83
3307854	-1	24	-0.005	-10	10	33	3.15	225	-5	26	69	87
3308034	-1	3	0.005	-10		8	0.69	52	15	19		53
3308035	-1	14	-0.005	-10		5	20.50	225	15	-3		75
3308036	-1	14	-0.005	-10		97	6.90	325	10	12		200
3308037	-1	12	-0.005	-10		18	48.00	10000	5	4		105
3308038	-1	14	-0.005	-10		47	1.70	43	5	15		22
3308039	-1	4	-0.005	-10		22	25.00	175	-5	5		77
3308040	-1	11	-0.005	-10		11	2.50	23	5	14		22
3308041	-1	-1	-0.005	-10		62	5.10	1300	-5	16		85
3308042	-1	1	-0.005	-10		57	6.90	1000	-5	7		98
3308043	-1	6	-0.005	-10		9	6.60	79	10	-3		22
3308044	-1	200	0.005	-10		140	13.50	310	45	7		52
3308045	-1	8	-0.005	-10		18	1.35	225	20	26		31
3308046	-1	5	-0.005	-10		56	1.10	22	5	24		15
3308047	-1	2	-0.005	-10		65	7.30	740	-5	6		160
3308048	-1	30	0.012	-10		11	2.05	565	70	30		245
3308049	-1	2	0.014	-10		215	7.90	1300	-5	-3		93
3308050	-1	6	-0.005	-10		305	9.20	895	-5	-3		165
3308051	-1	3	-0.005	-10		65	11.50	510	-5	-3		58
3308052	7	1	0.012	-10		43500	11.50	1350	5	3		130
3308053	-1	-1	-0.005	-10		16	0.13	120	-5	8		-3
3308054	-1	2	-0.005	-10		28	7.10	1400	5	5		86
3308055	-1	150	0.008	-10		27	7.00	26	35	37		17
3308056	-1	150	0.007	-10		270	5.40	31	55	13		5
3308057	-1	250	0.013	20		655	6.90	32	30	42		21
3308058	-1	150	0.01	-10		175	6.00	25	55	62		51

APPENDIX 2- ROCKCHIP GEOCHEMISTRY

SAMPNO.	Ag	As	Au	Bi	Co	Cu	Fe%	Mn	Mo	Pb	V	Zn
3308059	-1	24	-0.005	-10		110	5.80	335	15	21		63
3308060	-1	3	-0.005	-10		5	1.40	21	5	14		4
3308061	-1	5	-0.005	-10		6	0.39	24	5	3		-3
3308081	-1	5	-0.005			200	7.59	2950		-3		205
3308082	-1	7	-0.005			130	11.5	7800		5		325
3308083	-1	4	-0.005			350	10.5	4250		-3		200
3308084	-1	2	-0.005			165	9.76	750		-3		81
3308085	-1	1	0.005			330	10.2	6300		-3		96
3308086	-1	1	0.01			285	13.7	1800		-3		36
3308087	1	1	0.006			265	9.41	2900		-3		82
3308088	-1	1	0.008			280	13.7	6000		3		120
3308089	-1	1	0.011			69	8.42	950		4		140
3308090	-1	-1	0.007			42	4.6	285		5		24
3308091	-1	-1	-0.005			17	4.84	850		5		100
3529839	-1	5	-0.005			22	1.41	79		-3		5

APPENDIX 3

MT. FRANKLAND AIRBORNE SURVEY  
FLIGHT SPECIFICATIONS

**General**

Survey name: Mt. Frankland  
Survey date: 23 - 26 March 1993  
Survey size: 2704 line km  
Contractor: Kevron Geophysics Pty. Ltd.  
Job number: 1188

Flight line direction: 090 - 270° AMG  
Flight line spacing: 100 m  
Tie line direction: 000 - 180° AMG  
Tie line spacing: 2000 m  
Altitude: 60 m mean terrain clearance  
Navigation: Differential GPS

**Magnetometer**

Type: Scintrex V2321 Cesium Vapour  
Resolution: 0.001 nT  
Sample interval: 0.1 s (~ 7 m)

**Spectrometer**

Type: Geometrics GR-800D Differential Gamma Ray  
Crystal size: 33.6 l downwards; 4.2 l upwards  
Sample interval: 1.0 s (~ 70 m)