GEOPEKO LIMITED

KING ISLAND

REPORT No. KI/78/1

BLACK BLUFF AREA - TASMANIA,

PROGRESS REPORT EXPLORATION LICENCE 10/74.

JOINT VENTURE

GEOPEKO LIMITED - UNION OIL DEVELOPMENT CORPORATION.

Volume 1

by

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and

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DEVONPORT, TASMANIA. APRIL, 1978.

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SUMMARY

Exploration Licence 10/74 is jointly held by Geopeko Limited and Union Oil Development Corporation. The area of 150 square kilometers covers portions of the Mt. Read type volcanic suite exposed on Bond Range and its southeastern flanks, two inliers in Black Bluff Range and in the Cattley Creek northwestern region of the Exploration Licence.

This report details the nature and results of Phase 1 of the exploration program, which involved the following methods:

1. Regional:
   - geological mapping at 1:10,000 scale.
   - 266 stream sediment samples for geochemistry from the Bond and Black Bluff Range area.

2. Mariner 1 prospect:
   - 10,600 metres of gridding.
   - 32 poweraugered holes at 25 metre spacings for a total depth of 90.7 metres for orientation soil geochemistry.
   - 127 handaugered and 188 power augered holes for grid soil geochemistry.
   - 1 auger-core hole located at 10,000N, 9,700E, for bedrock geochemistry.
   - geological rock chip logging, float and surface outcrop mapping at 1:5,000 scale.
   - ground geophysics involving magnetics, S.P., gradient array configuration I.P. and V.L.F. (EM) techniques.

3. Mariner 2 prospect:
   - 6,400 metres of gridding.
   - 17 poweraugered and 5 handaugered holes at 25 metre spacings for orientation soil geochemistry.

- 3 handaugered and 111 poweraugered holes for grid soil geochemistry.
- geological rock chip logging, float and surface outcrop mapping at 1:5,000 scale.

Phase 1 of the exploration program has indicated that:

- The Mariner 1-2 region is considered a prime prospect area for Cu, Pb, Zn sulphide mineralisation.
  Soil and rock geochemical anomalies are co-incident with S.P. and I.P. geophysical anomalies over areas of intense chloritic and argillic alteration in acid volcanic rocks.

- There is potential for further prospects to emerge:

  An area of intense silicification with pyrite, chalcopyrite and bornite mineralisation in vicinity of the 'Copper adit', north-eastern Bond Range.

  An area reporting high stream sediment response and anomalous rock geochemistry in northern Bond Range.

  A fine grained volcaniclastic sediment horizon having disseminated pyrite and anomalous Pb rock geochemistry is present in central Bond Range.

Recommendations for Phase 2 of the onward program are given in this report.

INTRODUCTION

Exploration Licence 10/74 termed Black Bluff is held jointly by Geopeko Limited and Union Oil Development Corporation.

An area of 143 square kilometers, subsequently designated E.L. 10/74, was pegged by Union Oil Development Corporation (here on referred to as Union) in May 1974.

A joint venture agreement between the parties was sealed in February 1977 whereby Geopeko would manage exploration at Black Bluff.

During September 1977 the E.L. was formerly transferred to Geopeko's name and later that month an E.L. of 7 square kilometers which abuts the southern boundary of E.L. 10/74 was pegged by Geopeko. This land was incorporated within E.L. 10/74 in November 1977 giving a combined area of 150 square kilometers.

Previous exploration conducted by Union had delineated areas of anomalous stream sediment, soil and rock chip geochemistry. I.P. and resistivity anomalies were also located along intervals of regional grid lines. Regional geological mapping had verified the presence of acid volcanic and pyroclastic rock types which have a potential to host massive lead-zinc and copper sulphide orebodies.

An exploration program constituting the first phase of fieldwork conducted by Geopeko was prepared, being designed to further assess the anomalous areas.

This report reviews field exploration progress at Black Bluff until February 1977.

Phase 1 of the exploration program consisted of:

(a) base map preparation.

(b) gridding at the Mariner 1 and Mariner 2 prospects.

(c) orientation and grid soil geochemical sampling over the prospects.

(d) geochemical stream sediment sampling.

(e) regional 1:10,000 scale and prospect 1:5,000 scale geological mapping.

(f) ground geophysics on the Mariner 1 prospect involving I.P., S.P., V.L.F. (EM) and magnetometer surveys. (Deakin, 1977)

(g) reporting.

CONCLUSIONS

MARINER 1 - 2 AREA

The Mariner 1-2 region is considered a prime prospect for significant Cu-Pb-Zn sulphide mineralisation.

- the geological environment is highly prospective.
- highly anomalous stream sediment, soil and rock geochemistry values are evident.
- coincident geophysical S.P., I.P. and V.L.F. (EM) anoamlies are present.

1. Geological mapping using surface outcrop, float and auger hole rock chip cuttings data has indicated that the geological environment in the Mariner 1-2 region is considered highly favourable for the presence of massive Cu-Pb-Zn sulphide mineralisation.
   Favourable factors are:
   - The presence of a biotite feldspar quartz porphyry in contact with a lithic quartz crystal tuff of gross andesitic composition. The contact which appears unconformable runs northwest - southeast across the grid and may represent a transition from a period of felsic to one of more mafic volcanism.
   - The biotite feldspar quartz porphyry is interpreted as probably being at the top of a rhyolitic - dacitic volcanic pile and appears to be unconformably overlain by a sequence of andesitic lithic quartz crystal tuff. This stratigraphic position is favourable to the occurrence of massive sulphides e.g. Mt. Lyell and Rosebery.

- The presence of intense argillic and chloritic alteration within the porphyry and volcanic breccia? zones in proximity to the contact with the overlying? pyroclastic unit.
- The volcanic breccia? has been silicified and invaded by epithemal quartz veins containing visible pyrite. Spherulitic chlorite is associated with the quartz veins. The rock is anomalous in Cu, Pb, Zn, Ag, As, Cd and Sn.

  This type of enviroment suggests that the mineralisation here may be of a 'stockwork' nature similar perhaps to that of Kuroko types elsewhere.

2. (a) Stream sediment samples from streams draining the Mariner 1 grid area are anomalous in Cu, Pb, Zn, Sn, Cd and Mn.
Peak values recorded are 100ppm Cu, 1680ppm Pb, 740ppm Zn, 1770ppm Sn, 10ppm Cd and > 10,000ppm Mn.
These values compare to visually estimated background values of the order of 20ppm Cu, 100ppm Pb, 80ppm Zn, 50ppm Sn, < 2ppm Cd and 500ppm Mn.
The anomalous stream sediment values in the Mariner 1 region are located to the south and east of the grid and fall into three zones - Zones A, B and C.
Mineralogical zoning in this region is a possibility.

(b) Soil geochemical results indicate the presence of three coincident strongly anomalous areas in Pb, Zn, Cu and Mn, which appear en echelon and approximately follow the interpreted geological contact. Spot anomalous values for Sn, As and Ag occur.
Peak values are 440ppm Cu, > 10,000ppm Pb, 1400ppm Zn, 240 (XRF)ppm Sn, > 10,000ppm Mn, 15ppm Ag and a spot high of 0.71% As.
These values compare to visually estimated background values of the order of 30ppm Cu, 120ppm Pb, 130ppm Zn, 5ppm Sn, 500ppm Mn, < 2ppm Ag, and < 5ppm As.

(c) Rock geochemistry analyses on float samples from the altered zones at Mariner 1 are highly anomalous with peak values being:
390 ppm Cu, 2950 ppm Pb, 1050 ppm Zn, 12 ppm Ag, 10,000 ppm Mn, 60 ppm As, 730 ppm Sn and 10 ppm Cd.

3. Geophysical results at Mariner 1 are most encouraging with a significant self potential anomaly (peak -50 millivolts below background) coincident with a gradient array configuration induced polarisation anomaly (peak approximately 3.5% chargeability at M1) and another apparantly linear gradient array I.P. anomaly (peak approximately 3% chargeability at M1 over 3 grid lines) which correlates with the interpreted geological contact and a V.L.F. (EM) anomaly. This verifies the I.P. anomaly located by Union on Line C. The I.P. anomaly located by Union on line D, and approx 1.2 kilometres east of the anomaly on line C has not been followed up as yet. These anomalies are coincident with soil geochemical anomalies.

4. From the results of the orientation soil sampling, augering to 3 metres depth (or bedrock, which-ever was the lesser) was considered adequate for sampling the C horizon at Mariner 1, but was not so definitive at Mariner 2.

5. In places the thickness of Quaternary scree over the Mariner 2 grid was such that bedrock was not always sampled. Resampling at a greater depth than 3 metres is warranted.

REGIONAL

6. The Lower-Middle Cambrian rocks of the Bond and Black Bluff ranges consist of:
   - acid porphyries of rhyolitic and rhyodacitic composition.
   - pyroclastics of lithic, quartz crystal and vitric tuff composition.

- tuff-lavas of coarse quartz, altered plagioclase, and a distinctive altered vitric matrix composition displaying a fluidal texture.
- volcaniclastic sediments gradational to tuffs.

The rocks are correlatives of the Mount Read type volcanic suite.

7. The structural trend of the rocks on Bond and Black Bluff Range is probably northeasterly. This direction is in sympathy with the probable anticlinal crests developed along these ranges. No facing have been observed.

8. The exposed Cambrian inlier on Black Bluff Range centring on 5,403,300N, 406,200E does not appear to have significant potential for massive sulphide mineralisation. The rocks consist of rhyolitic lavas, tuff-lavas and crystal-lithic tuffs but no obvious alteration zones were mapped.
The stream sediment geochemistry results were low, with peak values being: 10ppm Cu, 40ppm Pb, 50ppm Zn and 100ppm Sn.
Visually estimated background values are in the order of $<$2ppm Cu, 20ppm Pb, 30ppm Zn and 30ppm Sn.

9. Reconnaissance geological mapping on Bond Range in the vicinity of 5,402,000N, 410,400E has located the position of a fine grained volcaniclastic sediment horizon. At one locality anomalous Pb rock geochemistry (KR 2700, 570ppm Pb) was recorded, and framboidal pyrite is present. This horizon has potential to host massive Pb-Zn ore of the Rosebery type.

10. Union mapped an area of intense silicification in the north-east of Bond Range in the region of the 'Copper adit'. Hematite, pyrite, chalcopyrite and bornite have been observed around lenses of intensely silicified tuffs.

This area was not covered in the Phase 1 program reported on here, but appears to be a favourable environment for massive sulphide mineralisation.

11. Streams draining an area at the northeastern end of Bond Range approximately centring on 5,404,500N, 413,100E have several anomalous stream sediment samples.
Peak spot values are 15ppm Cu, 440ppm Pb, 190ppm Zn and $>$ 10,000ppm Mn.
These values compare to visually estimated background values of the order of 5ppm Cu, 80ppm Pb, 30ppm Zn and 70ppm Mn.
Geological mapping in this region is incomplete but has indicated the presence of acid porphyry and tuff-lava rock types.

12. The stream sediment geochemical results of the Black Bluff and Bond Range areas show that:
- The Black Bluff inlier, (centring 5,403,300N 406,200E) has lower background metal distributions compared to Bond Range.
- The 'highland' results at Bond Range have generally lower metal distributions than the 'lowlands'. The 'lowland' environment is commonly swampy and Fe and Mn can be precipitated (low pH and Eh conditions) and co-precipitation of base metals can also occur.

13. Away from the Mariner 1 - Mariner 2 region anomalies have been located using reconnaissance geology and stream sediment sampling in areas of outcropping Cambrian volcanics and pyroclastics.
Deeper seated anomalies or anomalies obscured by thin scree or conglomerate overburden, which have no surface geochemical or geological expression have not been located.

RECOMMENDATIONS

The Mariner 1 - Mariner 2 region is considered a prime prospect for significant massive sulphide mineralisation.

Phase 2 of the exploration is aimed at completing necessary gridding, soil sampling for geochemistry, geological mapping and ground geophysics in the Mariner 1 - Mariner 2 region so that the best targets for subsequent diamond drilling testing are chosen.

Other regional follow up work is also planned.

Phase 2 of the exploration should involve the following steps:

MARINER 1-2 REGION:

Gridding

Extend the grid to cover anomalous areas detected by stream sediment, soil sampling and geological mapping (Zones A,B and C).

1. Extend the Mariner 1 baseline east to 11,700E. At the positions of the crosslines, establish and continue the grid by 200 metres north to 10,200N and by 600 metres south to 9,400N.

2. Extend existing crosslines by 200 metres south between 9,200E and 10,200E.

3. Extend northward crosslines 9,800E, 10,000E and 10,200E by 1880 metres to 11,200N.

4. Amalgamate the existing Mariner 1 and Mariner 2 grids between 9,200E and 9,600E by extending the crosslines north from Mariner 1 to join Mariner 2.

5. Short intermediate grid lines and short extensions to existing grid lines may be required for geophysical purposes to enable further work aimed at better anomaly definition.

Soil geochemistry

1. Complete soil sampling at 25 metre spacings using the powerauger rig where access permits and a handauger elsewhere.

2. Reauger several lines at Mariner 2 where Phase 1 augering did not penetrate scree.

3. Investigate the economics of using a rig which is capable of penetrating through thin basalt to reach the underlying Cambrian rock types.

4. To more accurately determine the presence of basalt contamination in soil samples from acid volcanic rocks, assay for Ni or Cr.

Geology.

1. Complete geological rock chip logging, surface and float mapping at 1:5,000 scale.

2. At several strategic locations, drill an auger-core hole to provide bedrock Cambrian geochemistry and to substantiate the interpreted geology.
This work will facilitate optimum locations for drilling of targets.

Geophysics.

1. Continue the ground geophysical program on the Mariner 1

grid extensions using the magnetometer, S.P. and V.L.F. (EM) techniques over the entire grid and conduct I.P. and T.E.M. surveys over selected anomalous regions detected by the former techniques.

2. Conduct detailed I.P. (and T.E.M.) surveys over the Union Oil I.P. anomaly (line D).

REGIONAL PROGRAM:

1. Complete reconnaissance geology and stream sediment sampling in the area surrounding the 'Copper adit' at the northeastern end of Bond Range.
   This area will probably require follow - up gridding and soil sampling if the geological reconnaissance work proves encouraging.

2. Accurately map and sample along strike the fine grained volcaniclastic sediment horizon which reports anomalous lead geochemistry.
   This horizon has a potential to host massive Pb-Zn sulphide mineralisation. The work is aimed at locating such mineralisation.

3. Complete regional mapping to the south of the Mariner 1 grid including the extended E.L. area.

4. Conduct detailed geological follow-up of the anomalous stream sediment results reporting from two streams draining the area centred approximately 5,404,500N, 413,100E.

5. Conduct reconnaissance geology and stream sediment sampling over the Cambrian inlier on Black Bluff Range approximately centring on 5,401,900N 405,500E.

6. Conduct reconnaissance geology and stream sediment sampling in the Cattley Creek, northwestern portion of the Exploration Licence.

7. Consideration be given to conducting reconnaissance ground geophysics along wide spaced grid lines over the potential Mt. Read type rocks along Bond Range.

ACTION SHEET

1st May, 1978

1. Additional gridding in the Mariner 1-2 region as recommended under points 1 to 4 has been completed.

2. Reconnaissance stream sediment sampling in the Cattley Creek region has been completed.

PREVIOUS WORK

During 1968 Pickands Mather conducted regional and detailed stream sediment sampling over the area concluding that values reported were not anomalous and therefore no follow up work was warranted.

Tasminex N.L. held the ground until May 1974 under Exploration Licence 14/73. An area of anomalous radioactivity in uranium and thorium from stream water samples taken from a tributary flowing into the Lea River at the north east end of Bond Range was detected. A rock sample which was reported as silicified rock after limestone from this area assayed 250 ppm U and 9500 ppm Th. A scintillometer reconnaissance survey over the area surrounding this rock sample revealed a small anomalous area extending approximately 15 metres radially.

Subsequently a Mines Department Geologist (Collins, P.L.K, 1973) inspected the region and concluded that the anomalous area was located within Cambrian quartz and quartz feldspar porphyries and tuffaceous units. Secondary surface enrichment of uranium bearing minerals resulting from the weathering and leaching of tuffaceous units within the volcanic sequence originally containing very low concentrations of uranium were the mechanisms and source of the anomalous uranium.

The only other apparent evidence of activity by Tasminex N.L. is the existence of a diamond drill hole collar pipe adjacent to the Mariner 2 grid. Drilling data was apparently not reported to the Mines Department.

Exploration Licence 10/74 termed Black Bluff was pegged by Union in May 1974.

Wrote to 22/5/78

Fieldwork conducted by and on behalf of Union between December 1974 and February 1975 (McGregor-Dawson, J.L. 1975) consisted of:

(a) gridding - five regional grid lines totalling 15.8 km. orientated N.W. - S.E, at 1600 and 800m spacings across Bond Range and the basalt plain to the S.E.

stream sediment sampling - at 134 sample locations on Bond Range and over the two windows of Cambrian volcanics in the Black Bluff Range, two samples were taken; a fine sediment sample and a sample of humic rich bank material from below water level.

soil sampling - 74 humic rich Al horizon samples taken along selected intervals of 3 grid lines.

rock chip sampling - 27 samples from throughout the area.

(b) ground geophysics - 14 line kilometers of pole - dipole I.P. surveys along the grid lines. (Sailsbury, B.K, 1975)

(c) geological mapping - of areas of Cambrian acid lavas and pyroclastics along Bond Range and smaller outcrops occuring in the Black Bluff Range and near the Iris River bridge. (Corbett, E.B: 1975.) A brief geological inspection was conducted in the Cattley Creek portion of the E.L.

As a result of this work Union ascertained the following:-

(a) there was no significant variation in assay values reported for sediment and bank humic rich material.

(b) four significant anomalous zones were identified.

- five Pb and Zn anomalous stream sediment samples delineated a zone approximately 800 metres in length. (Mariner 1 and 2 region)

- a coincident I.P./ resistivity and Pb soil anomaly on an interval of a grid line, together with a Pb stream sediment anomaly from an adjacent creek draining the area. (Mariner 1, eastern).

- on the N.W. slopes of Bond Range, two streams 400m apart yielded anomalous Pb and Zn stream sediment values.

- at the N.E. end of Bond Range, an area produced anomalous stream sediment samples (Cu and Pb), soil (Pb, Cu, minor coincident Zn) and rock chip samples (Zn).

(c) the Bond Range tuffs which are host rocks to a major porphyry intrusion are potential economic targets with hematite, pyrite, chalcopyrite and bornite mineralisation having been observed around lenses of intensely silicified tuffs at the northern end of the range.

LOCATION AND ACCESS

Exploration Licence 10/74 covers Lower-Middle Cambrian volcanics and volcaniclastic sediments of potential economic interest exposed in the Bond Range, Black Bluff Range, and Cattley Creek inliers. The Cambrian sequence forms part of the Mt. Read Volcanic belt which to the west and south-west contains the Que River, Rosebery, Hercules and Mt. Lyell mineral deposits.

The northern boundary of Exploration Licence 10/74 is situated 43 kilometers south of the Burnie township. (see Figure 1) Access to the southeast part of the Exploration Licence (Bond Range and Black Bluff Range) is via the road to Cradle Mountain, access to the northwest (Cattley Creek area) is via the logging roads south of Hampshire. The majority of the Cambrian suite, in Exploration Licence 10/74 occurs in open button grass plains, and access to working areas can be obtained by Bombardier. Parts of Bond Range, Black Bluff Range, and Cattley Creek region, have rugged terrain, with areas of dense rain forest. The elevation is between 600 and 1300 meters. Streams are generally open and present no access problems.

The location and general access to and within Exploration Licence 10/74 can be summed up as good. The area, for exploration, must rank as one of the highest in Australia in regards to closeness to a pool of labour (Burnie and Devonport), good roads, and sea ports (Burnie and Devonport).

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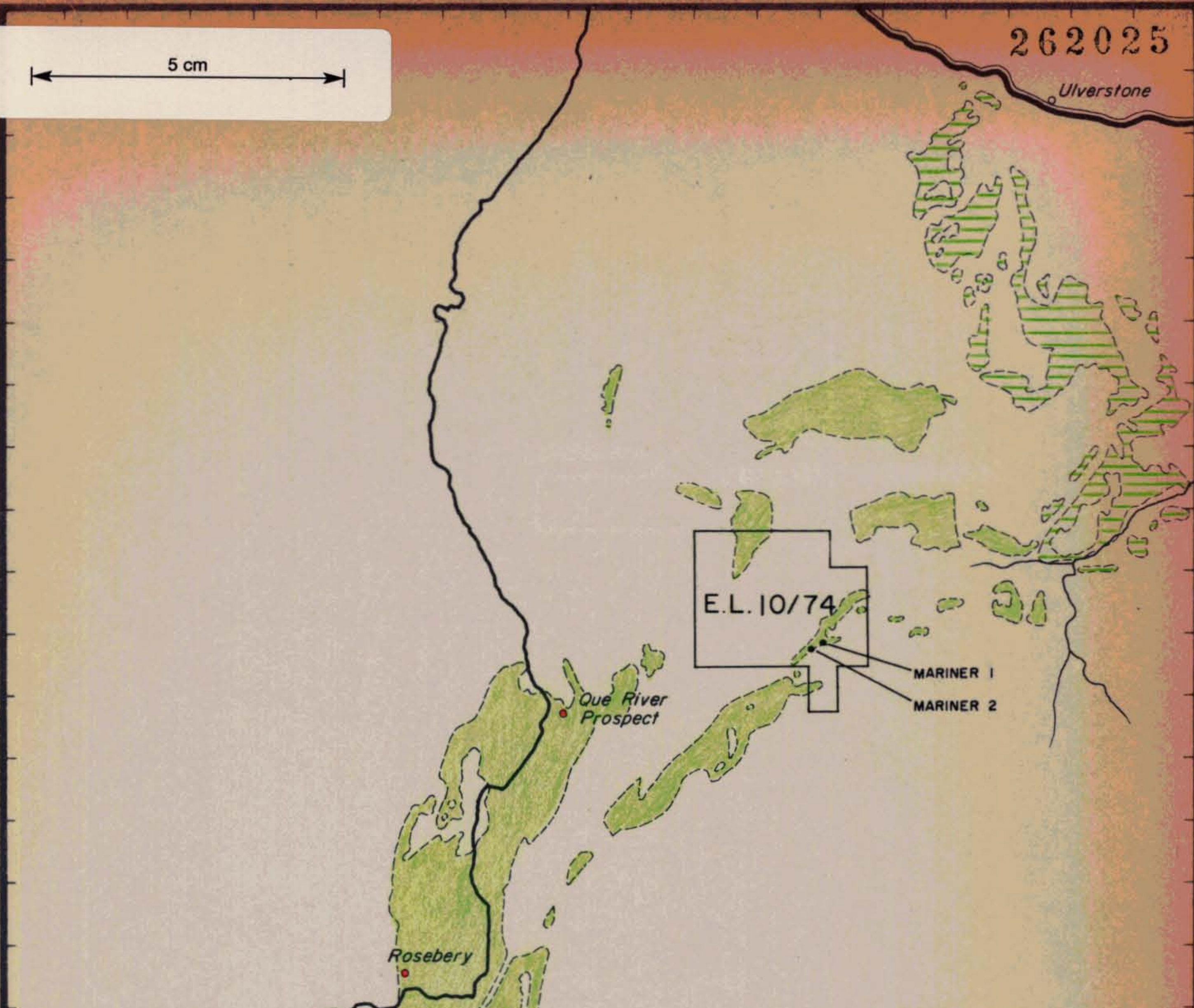


LEGEND

- Significant Basemetal Mineralization
- Mt. Read Acid Volcanics
- Mt. Read Volcanics / Sediments

DATE Mar'78	GEOPEKO LIMITED KING ISLAND	
GEOL G.L.B.	Scale: 1:500 000	Fig. No. 1
DWN J.P.M.	Location Map E.L. 10/74	
CHKD M.C.R.		

EXPLORATION PROGRAM - PHASE 1

Phase 1 of the exploration program conducted by Geopeko Limited consisted of the following exploration steps.

- Aerial photographs at an approximate scale of 1:40000 and 9"x9" size, were obtained giving stereo coverage of the area. Enlargements to 1:10000 scale of every second photo were also obtained for field mapping.

- Positive transparencies of the machine plots at 1:10,000 scale of the Sophia 1:100,000 topographical map prepared by the Lands Department, were obtained for the area. These maps were not suitable for base maps due to the fact that they were enlargements, each one compiled from two maps (a)'topographical' and (b) 'detail'. As it was difficult to differentiate between tracks, contours and streams, the machine plots were re-draughted to give three base maps on B1 size sheets covering most of the Exploration Licence. A base map at a scale of 1:5000 was redraughted from the enlarged machine plots on a A1 size sheet to cover the Mariner 1 and Mariner2 prospects.

- A detailed budget work program was prepared for the area, and forwarded to Sydney Office, Union Oil Development Corporation and the Mines Department in Hobart.

- Follow up work based on a recommendation in the Union Oil Development Corporation 1974/75 field season report, lead to the establishment of two grids over prospects here named, Mariner 1 and Mariner 2 prospects.

A total of 17,000 metres of gridding (including base lines) was completed during the 1976-77 field season. The Mariner 1 prospect has a base line 2000 metres long between 9200E and 11,200E with offsets every 100 metres, for the establishment of cross lines. The cross lines between 9200E and 10,100E are 700 metres long, the cross lines between 10,200E and 11,200E are 600 metres long. A total of 10,600 metres of gridding was completed on the Mariner 1 grid, and 5200 metres remains to complete phase 1. The Mariner 2 prospect has a base line 1200 metres long between 8400E and 9800E. Cross lines 400 metres long were established every 100 metres along the base line. A total of 6400 metres of gridding was completed to finalize phase 1 on the Mariner 2 prospect.

- Orientation soil sampling on the Mariner 1 and Mariner 2 prospects using a Bombardier mounted Jacro 200 commenced in early December 1976. On the Mariner 1 prospect 32 holes at 25 metre spacings, were completed for 90.7 metres. On the Mariner 2 prospect 17 powerauger holes and 5 handauger holes at 25 metres spacings were completed for 78.2 metres. The samples were largely taken at 1 metre intervals down the hole, however, this was not always desirable due to contamination or soil contacts. A sample depth of 3 metres or rock bottom was decided, after the orientation soil sample results were obtained. Geochemical profile overlays for Cu, Pb, Zn, Mn and Fe for Mariner 1 and Mariner 2 prospects are included in the folder at the end of this report.

- 472 soil samples (including 44 duplicates) were collected from 429 holes on the Mariner 1 and Mariner 2 prospects. The nature of sample, location number depth taken, and assay values were recorded in sample books, which are kept at the Devonport Office.

- The samples were dried, rebagged if required, and forwarded to A.C.S. Laboratories in Adelaide. The -80 mesh fraction was separated and analysed for Cu, Pb, Zn, Ag, Fe, Mn, Cd, Ba, As and Sn by A.A.S. 11 soil samples which assayed 100 ppm Sn or more, were reassayed using the X.R.F. method of analysis. The geochemical result sheets in the folder of the report, record the sample book number, depth drilled, and assay results for Cu, Pb, Zn, Mn, and Sn. The analytical report of A.C.S. Laboratories occurs as appendix at the back of this report.

- Geophysical work was carried out on Mariner 1 prospect using IP, SP, V.L.F. (EM) and magnetometer surveys. The magnetics appears to have outlined the basalt coverage. Anomalies were detected on all lines investigated using IP, SP, and V.L.F. The geophysicial anomalies appear to coincide with geochemical anomalies. Details of the geophysical program and results are provided in a report by Deakin (1977).

- Field work, consisted of geological mapping along tracks, streams, ridges of the Bond and Black Bluff ranges and the Mariner 1 and Mariner 2 grids. Geochemical drainage sampling was carried out in an intensive manner in order to complete the work before the field season in south-west Tasmania. Field work was curtailed on February 17th and by the 19th July plotting and draft map preparation was all but complete. Geological fact and interpretation maps for the regional and prospect work occur in the folder at the end of this report.

- During geological mapping representative rock samples were collected to aid in later correlation for map preparation. 265 samples were collected, the location of which are recorded on maps in the folder of this report. The samples are kept at the Geopeko Office in Devonport. 39 of the samples, selected from throughout the area, were thin sectioned and briefly reported on by I.R. Pontifex and Associates, Adelaide. The samples were of representative rock types, altered rock types, and rocks where the field determination was vague. The location of the thin sectioned rocks are recorded on maps in the folder of this report, and Mr. Pontifex's report is enclosed as appendix. 66 of the samples were selected for rock geochemistry and sent to A.C.S. Laboratories in Adelaide. The samples were of representative rock types, altered rock types and rocks containing mineralization (mainly hematite and/or pyrite). The location of the rocks analysed and the results are recorded on maps in the folder of this report and the analytical results are enclosed as appendix.

- 266 drainage samples were collected from the streams draining the prospective areas. At every tenth location a second sample was taken. The area sampled is approximately 24 square kilometers, and the overall sample density over the prospective area was approximately 11 samples per square kilometre. The sample location points were measured off from a known starting point and all locations were marked with flagging tape and numbered aluminium tags. The nature of the sample, location number and assay values were recorded in sample books which are kept at the Devonport Office.

The samples were dried, rebagged if required, and forwarded to A.C.S. Laboratories in Adelaide. The - 80 mesh fraction was separated and analysed for Cu, Pb, Zn, Ag, Fe, Mn, Cd, Ba and Sn by A.A.S. 27 stream drainage sample which assayed 100ppm Sn or more were reassayed using the XRF method of analysis. The geochemical result sheets in the folder of this report record the sample book number and assay results for Cu, Pb, Zn and Sn. The analytical report sent by A.C.S. Laboratories occurs as appendix at the back of this report.

The expenditure incurred by Geopeko up until the end of the financial year 1976/77 is shown as follows.

		$
1.	Base diamond drilling	8.00
2.	Base other drilling	3843.10
3.	Geology	12632.64
4.	Drafting	388.76
5.	Leasing	1049.21
6.	Gridding	6231.13
7.	Geochemical base	16501.10
8.	Geophysical base	815.05
9.	General Field Expenses	1227.00
10.	Administration	4089.00
11.	Geochemical Division (Sydney)	2545.00
12.	Geophysical Division (Sydney)	6897.00
		$56226.99

GEOLOGY

REGIONAL AND TECTONIC SETTING

This section has been compiled from several sources, reference to which is made at the end of this report.

PRE-CAMBRIAN:

The oldest rocks in Tasmania are of the late Pre-Cambrian, and occur in the Tyennan - Rocky Cape Province. The rocks are divided into two groups on the basis of metamorphism, the 'Older' and 'Younger' Proterozoic sequences.

The 'Older' Proterozoic rocks of the Tyennan Nucleus outcrop south of Exploration Licence 10/74. Rocks belonging to the Tyennan Nucleus sequence, extend from the south - west coast of Tasmania. The rocks of this sequence have been grouped into quartzite - phyllite and quartzite - schist assemblages associated with amphibolites (Gee, R.D. et al, 1970). The metamorphic rocks were derived from successions of interbedded siltsones and orthoquartzites (Williams and Turner), and have suffered two periods of regional metamorphism (maximium grade in the upper greenschist facies) and two widespread phases of deformation, attributed to the Frenchman Orogeny of Upper Proterozoic age (Spry, A.H.).

Overlying the metamorphic sequence, are the unmetamorphosed 'Younger' Proterozoic rocks. (at Devonport). The 'Younger' Proterozoic, is a turbidite sequence of interbedded mudstones and poorly sorted but graded sandstones. Metamorphism and tectonic activity in the 'Younger' Proterozoic sequence are attributed to the Penguin Orogeny of Upper Proterozoic age, which is believed to be younger than the Frenchman Orogeny responsible for the deformation of the rocks of the Tyennan Nucleus.

The relationship of the unmetamorphosed and metamorphosed rocks in the central and south-west Tasmania is still uncertain, however, where the metamorphosed rocks occur adjacent to the unmetamorphosed, they are usually structurally lower, therefore thought to be older. Near Burnie, however, the two appear transitional. (McNeil 1961.)

The distribution of unmetamorphic Proterozoic indicates that during their deposition, the metamorphic Proterozoic rocks formed a geanticline (Tyennan Geanticline) in the Central Highlands. The surrounding basin formed part of a large miogeosyncline . (Spry 1962, Solomon 1965.)

Gee (1967) suggested that the emergence of the Rocky Cape Geanticline began immediately prior to the Oonah Formation sedimentation (Mid Younger Proterozoic) and that the major axis of subsidence moved toward the Tyennan Geanticline with accumulation of Oonah Formation in the new basin. The Oonah Formation consists of unfossiliferous and comparatively unmetamorphosed sequences of quartzites and to a lesser extent dolomite.

CAMBRIAN:

In early Cambrian, the Dundas Trough, situated to the west of the Tyennan Nucleus, and the Barrington - Dial Range Trough to the north, were initiated in the Tasmanian area of the Lachlan Province of the Tasman Geosyncline. The trough filling reflects marked changes in the depositional environment from that of earlier rocks.

The Cambrian rocks are generally of fossiliferous turbidite-greywacke sequences (Crimson Creek Formation and the fossiliferous Dundas Group) associated with probably submarine volcanism. The Cambrian sedimentation involved a deepening of the sedimentaty basin, the Dundas Trough, where great thicknesses of sediments and volcanic rocks accumulated.

A thick pile of acid volcanics accompanied the sedimentation, this pile is now represented by the arcuate zone known as the Mt. Read Volcanic Arc. The acid volcanic rocks and associated volcaniclastic sediments appear to be Cambrian and possibly Upper Proterozoic in age. (Loftus - Hill 1967.).

Within Exploration Licence 10/74 the Lower - Middle Cambrian rocks of the Mt. Read Volcanic suite consist of massive acid volcanics, with lesser amounts of pyroclastics and volcaniclastic sediments. Most effort during the 1976-77 field season has been concentrated on the Cambrian rocks of Bond and Black Bluff Ranges.

Sedimentation was terminated over most of West Tasmania in the Upper Cambrian by the Jukesian Orogeny which produced folding of the Cambrian and older rocks on trends sub-parallel to the margin of the Tyennan Geanticline. Solomon(1965)suggested that the major feature was faulting on a similar trend which uplifted the Tyennan and Rocky Cape Geanticlines and produced an intervening basin divided by an axial ridge of Cambrian rocks. The Owen Conglomerate was deposited in these basins, with lateral transgression of the younger sandstones and limestones over the initial highland areas.

ORDOVICIAN

The oldest beds of the Ordovician are usually derived from the Cambrian rocks and accumulated when the margins of the earlier Cambrian trough rose with steep tilting locally resulting in the rapid accumulation of wedge shaped beds of conglomerate. Basal breccias and conglomerates containing Cambrain fragments possibly equivalent to the 'Jukes Breccia', has been reported on Bond and Black Bluff Range by E.B. Corbett.(1975)

Conformably resting on those beds and overlapping them is the Lower Ordovician Owen Conglomerate and its correlates which appear to have accumulated as continental alluvial piedmont fans against Pre-Cambrian highlands. Massive pink and white sandstones and siltstones predominate throughout Bond Range. Basal conglomerates outcrop on the north western limb of the Bond Range anticline along the northern half of the range. On the Black Bluff Range west of Lake Lea, the basal conglomerates reach 25m in thickness.

In Middle and Upper Ordovician times the areas of deposition in the Tasmanian area of the Lachlan Province were greatly enlarged by shallow extensive seas in which accumulated fossiliferous silts and sands of the Gordon Limestone. Gordon Limestones outcrop in the area of the Lea Syncline forming the Vale of Belvoir.

SILURIAN - DEVONIAN

Minor uplift of the source area, which appears to have been in the north, at the end of the Gordon Limestone sedimentation is suggested by the occurrence of coarse sandstones (Grotty Quartzite) which conformably overlie the Gordon Limestone. The whole Silurian - Devonian sedimentary sequence (the Eldon Group) represents a tectonically quiescent period. Silurian - Devonian rocks do not outcrop in the vicinty of Exploration Licence 10/74.

DEVONIAN

The Tabberabberan Orogeny followed the close of sedimentation in the Middle Devonian.

West of the Pre-Cambrian nucleus, Tabberabberan anticlinoria and synclinoria within the Cambro - Lower Devonian rocks, trend approximately north-south extending from the Gordon River of the south-west to Devonport in the north.

At the northern margin of the central Pre-Cambrian area of the State, Tabberabberan folds trend approximately east-west which interfere with the northerly structures. There appears then, to be two stage of Tabberabberan folding.

Structures of the second kind extend from Zeehan, through Lake Lea, to Sheffield. The dominating structural elements of Exploration Licence 10/74, are the Lea Syncline, forming the Vale of Belvoir, and the flanking anticlinal structures of Bond Range and Black Bluff Range. These north-east - trending structures are terminated against the Kauri Fault, north of which Lower Ordovician quartzites extend from Black Bluff almost to the Iris River, with the N.N.W. - trending fault apparently controlling the structure. (Corbett E.B. 1975.)

Cambrian rocks are exposed along anticlinal crests, and in the Bond and Black Bluff ranges are covered by a thin skin of Ordovician Owen type sandstone and conglomerates. Current mapping in Tasmania suggests the whole Tabberabberan structure is influenced by the shape of the Pre-Ordovician terrian. It seems likely that the Bond, and Black Bluff Ranges may have represented topographical highs at the time of the Ordovician sedimentation.

Many granite masses were emplaced after the Tabberabberan Orogery. These are, the Heemskirk Granite, the Meredith Granite, the House Top Granite, Three Hummock Island, the Granite Tor, the Dolcoath Granite, and the eastern granites of King Island. All these have given age of 335-360 m.y. indicating Upper Devonian - Lower Carboniferous. Carey (1953) has suggested that these were intruded along large scale anticlinal structures which were the first phase folds of the Tabberabberan.

Deposits of Sn, W with minor Mo, Bi and Ag-Pb occur near the granite margins in fissure, stockwork and replacement deposits. e.g. Moina, and around the Dove and Forth Rivers.

LATE DEVONIAN - RECENT

Prolonged erosion of the rocks followed the intrusion of Upper Devonian granites and continued until Late Carboniferous. Extensive glaciation of the region followed and thousands of feet of deposits accumulated overlying the older rocks. The Late Carboniferous - Permian deposits consist of fresh water sequences separated by marine. Extensive Carboniferous -Permian deposits occur in the Barn Bluff area south of Exploration Licence 10/74.

A thick mass of dolerite underlies the central plateau and caps most of the highest mountains in Tasmania (e.g. Cradle Mountain south of Exploration Licence 10/74). The dolerite has intruded through older rocks and appears to be of the one period of igneous activity. It is dated at 165 m.y. - Middle Jurassic.

Extensive basalt out-pouring occurred at a number of times during the Tertiary. Tertiary basalt covers most of the area east and south of Bond Range.

Extensive Pleistocene glacial and fluvioglacial deposits occur south of Exploration Licence 10/74 especially in the Cradle Mountain district. Numerous glacial erratics consisting of quartzite and dolerite occur in the valley of the Fall River and at the Mariner 1 and Mariner 2 prospects.

Recent deposits of gravel and sand occur in the present streams and along higher alluvial terraces. They consist largely of reworked Ordovician, Tertiary or Pleistocene deposits.

LOCAL GEOLOGY

For this section refer to the geological map sheets KT 10/74 - M -3A to 3D, KT 10/74 - 2A and 3A, and to the Mineralogical Report by I.R. Pontifex and Associates, Appendix Nol.

The geological maps (above) have been divided into two sections.

(1) Grid Geology on the Mariner 1 and Mariner2 prospects, and

(2) Regional Geology. Both 'fact maps' and 'interpretation maps' have been presented.

OLDER PROTEROZOIC

Unconformably underlying the Cambrian rocks south of Exploration Licence 10/74 are the 'Older' Proterozoic of the Tyennan Nucleus. The 'Older' Proterozoic of the Tyennan nucleus extends from the south-west coast of Tasmania. The rocks of this region have been grouped into quartzite - phyllite and quartzite - schist assemblages (Gee. R.D. et al., 1970). The purity of the quartzite layers and the occasionally preserved sedimentary features indicate that the metamorphic rocks were derived from successions of interbedded siltstones and orthoquartzites. Regional metamorphism reached a maximum grade in the upper greenschist facies (Williams and Turner). The Older Proterozoic occurs south of Exploration Licence 10/74 and has not been studied for this report.

CAMBRIAN

Cambrian acid volcanic rocks of potential economic interest are exposed in the Bond and Black Bluff Ranges.

The Bond and Black Bluff Ranges apparently represent a series of Cambrian cones consisting of lavas, tuff-lavas, tuffs and to a lesser degree volcaniclastic sediments.

The gross composition of the entire suite is 'acid' varying from rhyolite to rhyodacite. Rarely some contain anomalously high hornblende or secondary chlorite content which superficially indicate 'andesitic' affinities. It must be emphasized that no single field group (except the volcaniclastic sediments) is composed of a facies which is exclusive to that group.

The suggested Cambrian sequence on Bond Range is as follows. (no facings have been determined)

Top?

(1) fine quartzose volcaniclastic sediment

(2) a coarser volcaniclastic sediments
 b lithic plagioclase-quartz crystal tuff

(3) a biotite feldspar quartz vitric tuff-lava
 b sheared biotite feldspar quartz vitric tuff-lava

(4) a quartz crystal vitric tuff-lava
 b lithic quartz crystal vitric tuff

(5) a biotite feldspar quartz porphyritic lavas
 b argillic altered biotite feldspar quartz prophyritic lava

(5) appears to have intruded (2), (3) and (4) above.

(6) quartzo-feldspathic lava

(7) volcanic breccia

(6) or (7) appears to have intruded the biotite feldspar quartz porphyritic lavas above.

(8) hornblende rhyolite

(9) andesitic? lithic crystal tuff

The suggested Cambrian sequence on Black Bluff range is:-

Top?

(1)	a	Lithic vitric tuff-lava
	b	Porphyritic plagioclase lava
(2)		Quartz crystal lithic tuff
(3)		Porphyritic plagioclase-quartz rhyolite

The silica-clay-sericite alteration in the lava-groundmass, and in the tuff-matrix, the pseudo-porphyritic appearance of the coarser tuff crystals and the super-imposed cleavage, generally prohibits the distinction between tuffs, lavas and tuff lavas in hand specimen. The very close genetic inter-relationship and gradational nature of these lavas, tuffs and tuff-lavas, has led to problems in individual rock identification and hence the definition of units.

A large number of rocks have been thin sectioned in this region to clarify interpretation. Mr.Pontifex has examined some 'problem' rocks, and also a representative suite of the rock type within the Cambrian suite. His report occurs as an appendix at the end of the report.

BLACK BLUFF RANGE

Lithic Vitric Tuff-Lava.

This rock type outcrops in the Cambrian inlier exposed on the Black Bluff Range approximately 2 kilometers west of Lake Lea.

The lithic vitric tuff lava overlies (?) the porphyritic plagioclase - quartz rhyolite described below. The unit is brecciated in parts, and is intercalated with rhyodacitic porphyritic plagioclase lava.

The rock is generally dark green in colour, the only recognisable macroscopic mineral is quartz. The rock consists of minor quite discrete fragments of sericite (and/or pyrophyllite) and minor discrete fragments of devitrified glass are scattered. The rock has a groundmass of complex, streaky to contorted, turbid and extremely fine quartz-sericite, with subordinate chlorite including abundant oxidised chloritized biotite and attenuated lenses of altered glass are scattered.

The rock is distinguished from almost all other rock type described, by the almost complete absence of single quartz crystal grains, of either phenocryst or tuff origin. Also its biotite - chlorite content is higher than normal.

Thin section example of this rock type is KR 2664.

Porphyritic Plagioclase Lava.

This rock type outcrops in the Cambrian inlier exposed on the Black Bluff Range, approximately 2 kilometers west of Lake Lea.

The porphyritic plagioclase lava interfingers the lithic vitric tuff-lava unit described above. The porphyritic plagioclase lava appears to be transitional to the lithic vitric tuff-lava described above.

Essentially the lava consists of euhedral phenocrysts of plagioclase (up to 3 mm) which are evenly disposed, locally in clumps, through a homogeneous microcrystalline groundmass. These plagioclase phenocrysts are stressed and show minor sericite-limonite alteration. Accessory small rounded and embayed quartz phenocrysts are also present. The groundmass consists of fine quartz mosaic, with an intimately intergrown, shredded, extremely fine network of sericite and minor chlorite. The rock has been moderately sheared.

This is a lava with gross rhyo-dacitic composition, but differs from other types described by being abnormally deficient in quartz phenocrysts.

Thin section example of this rock type is KR 2672.

Quartz Crystal Lithic Tuff.

This rock type outcrops in the western portion of the Cambrian inlier exposed on the Black Bluff Range, approximately 3.5 kilometers west of Lake Lea.

The quartz crystal lithic tuff contains large (up to 10 cm) lithic particles apparentely a silicified equivalent of the coarser fraction. The silicified lithic particles probably represent a broken up crystal lithic sequence.

The quartz crystal lithic tuff consists largely of a loosely packed aggregate of quartz crystals, variably euhedral, subrounded, embayed broken and angular, fragments of sericitised rhyolite, also of quartz micro mosaic representing devitrified glass and/or groundmass, and irregular patches of sericite. These occur in a heterogeneous matrix of sericitic and siliceous glass alteration products.

The lithic particles consist of a mass of cryptocrystalline quartz, densely clouded by clays and ultrafine sericite, with minor disseminated extremely fine tuff quartz fragments. The lithic particles may be classified as a siliceous "tuffite" (i.e. tuffaceous shale particle sized material.)

The rock is sheared, with weak discontinuous foliae cutting through the coarser tuff and finer tuffite. Quartz veins of related volcanogenic origin are continuous through the coarser tuff and finer tuffite.

Thin section examples of the rock type are KR 2646 and 2648.

Porphyritic Plagioclase - Quartz Rhyolite

These lavas outcrop in the Cambrian inlier exposed on Black Bluff Range approximately, 2 kilometers west of Lake Lea.

The lavas are pale yellow or greenish when fresh, with quartz and feldspar phenocrysts being the only macroscopic minerals. Some varieties show well developed primary fluidal texture and rare perlitic cracking textures.

The rock consists of phenocrysts of euhedral plagioclase rounded and embayed quartz phenocrysts which are randomly disposed through a homogeneous, diffuse microcrystalline groundmass. The plagioclase are extensively sericitised, and are generally surrounded by reaction rims. The groundmass consists predominantly of quartz, with minor to subordinate ultra-fine clay-sericite, and extremely fine granular carbonate dispersed throughout. There is no evidence of shearing.

The rhyolite appears to have no affinities with any of the varieties previously described.

Thin section examplesof this rock type are KR 2684 and 2659.

BOND RANGE

Fine Quartzose Volcaniclastic Sediment

This thin (?) unit outcrops approximately 500m northwest of Bond Peak, where it can be consistently mapped for about one kilometer.

This rock is dark grey and has a very fine grained texture. It consists of a non bedded, rather poorly sorted and variably loosely to lightly packed aggregate of quartz grains within extremely fine quartz - clay - sericite matrix probably representing glass alteration products. Accessory coarse flakes of chlorite, grains of tourmaline, zircon and titaniferous grains are scattered. The rock contains 3 - 5% disseminated pyrite.

The fine quartzose volcaniclastic sediment shows a moderate penetrative cleavage, with shiny sericite developed on the schistosity surfaces.

This unit has been reported by Corbett and was described by her as a volcaniclastic siltstone. Corbett reported that this unit outcrops consistently at the north - east end of Bond Range up to 4 kilometers west of the Kauri Fault. Confirmation by more detailed mapping is required here.

Some confusion as to the extent of this unit exists. In outcrop this unit closely parallels the overlying Owen conglomerate and the contact appears to be disconformable rather than unconformable. A "shaly" unit underlying Bond Peak may infact be a fine quartzose volcaniclastic sediment, this needs to be confirmed.

Thin section example of this rock type is KR 2697.

The fine quartzose volcaniclastic sediment contains disseminated pyrite (3-5%). The pyrite occurs as fine (0.02m) euhedral crystals fairly commonly in clusters to form framboids. An important fact to note, is that these microspherical bodies (particularly pyrite) are often found in stratiform lead-zinc ores and in the associated pyritic zones. Framboidal pyrite often contains zones of galena and/or sphalerite, the galena in particular often forming distinctly spongy intergrowth with the pyrite. (p 526 Stanton - Ore Petrology) Preliminary rock geochemistry revealed that KR 2700 contained 570 ppm Pb and 10 ppm As. however KR 2697 was not anomalous.

Volcaniclastic Sediments

Only minor outcrops occur on the northern flank of Bond Range. This rock has a light to dark grey colour, and has a medium grained texture. Quartz and feldspar fragments are the only recognisable macroscopic minerals. The rock consists of a heterogeneous,fairly loosely packed and poorly sorted aggregate of single crystals and volcanic debris, all in an ultrafine chloritic clay matrix of apparent volcanic derivation. Minor muscovite fragments are characteristic indicating a minor contribution from a metamorphic terrain. Discontinuous streaks of sericite through the matrix define an incipient cleavage.

This unit is somewhat complicated in that it is closely related or interfingers a lithic crystal tuff unit described below.

Thin section example of this rock type is KR 2596. KR 2594 is transitional to lithic crystal tuff.

Lithic Plagioclase - Quartz Crystal Tuff.

Only minor outcrops occur on the northern flank of Bond Range, and are closely related to the volcaniclastic sediments and tuff lavas.

This rock has a grey colour and may show a vague layering. Layering is in the order of 20mm. The finer layers are composed essentially of small (0.02 to 1mm) subrounded and broken, volcanic quartz crystals, lesser plagioclase crystals, accessory flakes of chloritised biotite and rock fragments. The coarser grained layer consists of subrounded to euhedral and embayed single quartz crystals (up to 2-3mm), also subrounded grains of similar size, composed of microcrystalline quartz mosaic with minor sericitised feldspar and chloritised biotie, minor single subhedral to euhedral feldspar crystal and trace altered hornblende. All of these components are randomly scattered but vaguely layered within a homogeneous, compact mass of cryptocrystalline silica mixed with clays, extremely fine sericite and chlorite and silt-sire quartz ash. Most of this fine material appears to be derived from altered volcanic glass. The rock has been sheared to produce a weak schistosity. This schistosity is oblique to the layering.

The lithic crystal tuff is somewhat complex in that:

(1) The unit has many affinities with the tuff lava described below. The lithic crystal tuffs occur in close proximity to, and may be intercalated with the tuff-lavas.

(2) The unit is transitional to the volcaniclastic sediments described above, as represented by KR 2594.
(3) It is intercalated with a tuffaceous shale, and may be related to the fine quartzose volcaniclastic sediment described above.

Thin section examples of this rock type is represented by KR 2536, 2539 and 2590.

Biotite Feldspar Quartz Vitric Tuff - Lava.

This unit outcrops on the northern flank of Bond Range. The full extent of this unit is unknown, as the survey is not complete in this region. The rock unit is generally grey in colour, and has a medium grained texture. Quartz and feldspars are the only recognisable macroscopic minerals. The unit is transitional to the lithic crystal tuff described above. The unit has been weakly or moderately sheared, with extensive shearing the unit grades into the sheared biotite feldspar quartz vitric tuff - lava described below. Some types show minor brecciation.

The rocks generally contain quite large, subrounded and embayed quartz phenocrysts, smaller angular and broken single quartz grains, and fragments of diffuse microcrystalline, quartz mosaic, which represents devitrified glass. Patches of clay-sericite are fairly widespread. Some of these are pseudomorphous after plagioclase crystals, some are completely altered fragments of glass. Minor biotite replaced by chlorite and/or quartz is scattered. All of those components occur in a matrix of turbid cryptocrystalline quartz, clouded by ultrafine chlorite and sericite, which are the alteration products of glass.

Some biotite feldspar quartz vitric tuff-lavas contain disseminated hematite and to a lesser extent pyrite. Peak values of 640 ppm Pb and 120 ppm Zn have been recorded from 2 separate samples in close proximity to elevated stream drainage values, and will require follow up work.

Thin section examples of this rock type are KR 2551, 2576, 2577, and 2588. This unit is transitional to lithic crystal tuff described above. Thin section examples representing a gradation to lithic crystal tuff are represented by KR 2590, 2593, 2594 and 2602.

Sheared Biotite Feldspar Quartz Vitric Tuff-Lava.

This unit outcrops consistently for approximately one kilometer on the northern flank of Bond Range. The full extent of this unit is unknown, as the survey is not complete in this region. The rock unit is distinctive in that it is vitreous, extensively sheared and is dark grey or red in colour (due to disseminated hematite grains). The rock typically contains large (up to 6mm) rounded and embayed quartz phenocrysts. However, most quartz crystals, have a maximum size of 1 mm, and although some are characteristically rounded and embayed, most are more or less angular and broken (more typical of the lithic crystal tuffs). These quartz crystals are lenticular to warped clumps of chloritized biotite, rare muscovite and vague sericite pseudomorphs after plagioclase. Rare chloritic patches appear to replace hornblende. All these components are randomly disposed through a rather heterogeneous, very fine, cryptocrystalline clay and silica groundmass.

Fine crenulated and scale - like textures are primary fluidal textures, modified by fairly extensive shearing. With less extensive shearing they grade into the biotite feldspar quartz vitric tuff - lavas described above.

Thin section examplesof this rock type are KR 2546 and KR 2560.

Quartz Crystal Vitric Tuff-Lava.

This rock unit outcrops in the Cambrian inlier exposed approximately one kilometer west of Bond Peak.

The quartz crystal vitric tuff-lava occurs in conjunction with lithic crystal tuffs and agglomerates. The rock has a medium grained texture and fresh specimens are a pale green colour. Quartz is the only macroscopically recognisable mineral.

The rock consists of subrounded and embayed quartz phenocrysts (up to 3mm) which are evenly distributed, but roughly layered in a texturally very heterogeneous altered glassy matrix. Abundant, small angular broken quartz-crystal fragments are also roughly layered through the matrix. The matrix consists of cryptocrystalline silica mixed with ultrafine clay-sericite. The clay-sericite define a variety of confused, compacted fluidal textures, including shards. There is no evidence of shearing.

This rock type shows many affinities with the lithic quartz crystal vitric tuff described above.

The quartz crystal vitric tuff-lava varies from the other varieties described in that it is of gross rhyolitic composition as compared to rhyodacitic and dacitic composition.

Thin section example of this rock type is KR 2692.

Lithic, Quartz Crystal Vitic Tuff.

This rock unit outcrops in the Cambrian inlier exposed approximately one kilometer west of Bond Peak.

The lithic quartz crystal vitric tuff occurs in conjunction with agglomerates and tuff-lavas. No rhyolite lavas have been recoginized. The rock varies from fine to coarse grained, more detailed mapping may reveal lapilli and agglomerate units. The rock is generally a pale green colour when fresh, weathered specimens are reddish in colour.

The rock unit consists essentially of small quartz phenocrysts and fractured volcanic quartz crystals of various sizes and commonly aligned, and roughly layered through an altered glassy matrix. This matrix consists of cryptocrystalline quartz with patchy clay-sericite patches which define confused compacted flow textures including vague shards. This unit is transitional to the quartz crystal vitric tuff-lavas described below.

The lithic quartz crystal vitric tuff varies from the other varieties described in that it is of gross rhyolitic composition as compared to rhyodacitic and dacitic composition.

Thin section example of this rock type is KR 2702.

Biotite Feldspar Quartz Prophyritic Lava.

This is by far the most dominant Cambrian rock type exposed in Exploration Licence 10/74. This rock outcrops consistently for approximately 5 kilometers, on the southern flank of Bond Range. Numerous smaller outcrops occur east of Bond Peak, and west of the Kauri Fault. This unit has been arbitrarily subdivided into 2 groups.

(1) Biotite feldspar quartz porphyritic lavas, and
(2) Argillic altered biotite feldspar quartz porphyritic lavas.

(1) Biotite Feldspar Quartz Porphyritic Lavas.

Relatively "unaltered" biotite feldspar quartz porphyritic lava is the dominant unit, and forms massive rounded pink outcrops in the Bond Range.

Textural variations within the biotite feldspar quartz porphyritic lavas are slight over the entire six kilometer outcrop. Rare flow textures and range in composition from rhyolitic to rhydacitic suggest that this sequence is extrusive. The biotite feldspar quartz porphyritic lavas may have a superimposed cleavage due to shearing. Generally, however, shearing is only moderate. Some quartz phenocrysts may be moderately stressed, but generally not fractured or recrystallized.

The lava has a homogeneous composition. Phenocrysts consist of variably subrounded and embayed, often with radial cracks, quartz crystals up to 12mm, euhedral potash and plagioclase feldspar crystals, biotite and rare hornblende. The groundmass consists of a microcrystalline mosaic of quartz, plagioclase and potash feldspar, with minor chloritized biotite and/or hornblende. Moderately sheared varieties contain irregular patchy, flame-like streaks of clay-sericite through the groundmass, and through fractured phenocrysts define an incipient cleavage.

The feldspar crystals characteristically show a concentration of alteration of clay-sericite and fine epidote from the centre outwards. Biotite and hornblende are completely chloritized with + - accessory epidote and secondary iron oxides.

Thin section examples of this rock type are KR 2507, 2511, 2522, 2527, 2541, 2560, 2621 and 2622.

(2) Argillic Altered Biotite Feldspar Quartz Porphyritic Lava.

Argillic altered biotite feldspar quartz porphyritic lava occur as a minor outcrop near the Mariner 2 prospect, approximately 50 metres west of the Tasminex N.L. diamond drill hole. Float and auger rock chip mapping on the Mariner 1 and Mariner 2 prospects indicate a consistent narrow belt (?) having a strike length of approximately 3 kilometers. The full extent of this sequence has not been mapped.

This rock has a homogeneous texture. Composition is variable, and is characterized by selective argillic alteration. Less extensive varieties are pink in colour, and are characterized by 'waxy' dark green feldspars and abundant six-sided crystals of micaceous chlorite. Extensively altered varieties are dark green in colour. Both varieties contain phenocrysts of rounded and embayed quartz up to 8 mm, plagioclase completely replaced by sericite and clays, and biotite almost completely chloritized. The phenocrysts are randomly disposed through a microcrystalline groundmass of essential quartz, subordinate clay-sericite replacing plagioclase, and minor chlorite replacing biotite.

The argillic altered biotite feldspar quartz porphyritic lavas differs essentially from the biotite feldspar quartz porphyritic lava described above in being more potassic in composition, and is characterized by extensive pervasive clay-sericite and chlorite alteration, rather than selective epidote - chlorite (deuteric) alteration.

Thin section examples of this rock type is KR 2502, and a portion of KR 2764.

The pervasive clay-sericite and chlorite alteration appears to form a halo around a possible (?) intrusion in the biotite feldspar quartz porphyritic lavas by a volcanic breccia. The high Pb-Zn anomaly on the Mariner 1 and Mariner 2 prospects appear to be directly related to the volcanic breccia (?) and argillic altered biotite feldspar quartz porphyritic lavas described above. Five float samples from the Mariner 1 prospect where sent to A.C.S. Laboratories for rock analysis. The results occur in the table below:-

KR NO'S	Cu (ppm)	Pb (ppm)	Zn (ppm)
2732	100	90	320
2734	90	60	310
2756	5	160	90
2758	10	40	110
2762	15	80	150

Quartzo Feldspathic Lava

Quartzo feldspathic lava occur in two minor outcrops near the Iris Bridge south of Exploration Licence 10/74 southern boundary.

The outcrops occur on either side of the access road to the Mariner 1 prospect. The outcrop on the western side of the access road is being quarried for road aggregate.

The rock is very finely grained, and appears to have no characteriztic macroscopic texturual features except small quartz phenocrysts and accessory limonite spots after pyrite. The quartzo feldspathic lava is pale grey when fresh, but weathers to a red or yellow colour.

The quartzo feldspathic lava consists of small subrounded and embayed quartz phenocrysts with minor patches of relatively concentrated clay-sericite which appear to replace original plagioclase phenocrysts. The groundmass consists of primary microcrystalline quartz mosaic, with intergranular and rather diffuse patches of clay-sericite which has formed from primary groundmass feldspars originally intergrown with the quartz mosaic. There is no evidence of primary flow or of superimposed shearing. Some contortion was noted during the survey. Contortion of this scale often leads to autobrecciation of the unit along strike and this unit may be related to the volcanic breccia on the Mariner 1 prospect. More detailed mapping is required in this area.

Thin section example of this rock type is KR 2765.

Rock analysis revealed that the quartzo feldspathic lava contained 25 ppm Cu, 260 ppm Pb, 110 ppm Zn, 2 ppm Ag, (2 ppm Cd and 30 ppm As.

Volcanic Breccia (?)

The volcanic breccia occurs as a minor outcrop near the Mariner 2 prospect, approximately 50 metres east of the Tasminex N.L. diamond drill hole. Here it occurs in conjunction with argillic altered biotite feldspar quartz porphyritic lavas which probably forms a halo around it.

The rock is fine grained, dark green in colour and is easily confused with extensively argillic altered varieties of biotite feldspar quartz porphyritic lavas. A possible criterion for recognition of this rock type, is the complete absence of the characteristic large rounded potash feldspar phenocrysts which typify the biotite feldspar quartz porphyritic lavas. The extent of this rock type is unknown, but detailed float mapping will probably reveal a strike length similar to the argillic altered biotite feldspar quartz porphyritic lava sequence. i.e., greater than 3 kilometers.

The volcanic breccia appears to be a pyroclastic fragmental rock. The rock consists essentially of loosely packed angular fragments of glassy rhyolite, variably tuffaceous, vesicular and finely porphyritic. The fragments are also silicified, and to a lesser extent chloritized. The areas between fragments consist of similar material with abundant veins of epithermal quartz with associated quite coarse spherulitic chlorite. Large quartz phenocrysts are extensively stressed, and fractured, indicating tectonic disruption, superimposed on the primary, pyroclastic fragmental fabric.

It is possible that the volcanic breccia may be an intrusion into the biotite feldspar quartz porphyritic lavas, which is suggestive of the thin section description of KR 2764 which occurs adjacent to the volcanic breccia outcrop.

This area needs more detailed investigation.

The volcanic breccia and associated quartz veins (containing pyrite) are invariably anomalous in Cu, Pb, Zn, and to a minor extent Cd, Ag and As. Eight float samples from the Mariner 1 prospect where sent to A.C.S. Laboratories for rock analysis. The results occur in the table below:-

KR NO	Cu	Pb	Zn	Ag	Cd	As. (all ppm)
2744	40	750	430	(2	(2	30
2746	30	1880	520	5	2	200
2747	390	420	70	12	(2	400
2748	20	2950	160	(2	10	60
2749	45	910	1050	(2	2	10
2751	80	960	890	(2	(2	30
2759	120	370	170	7	(2	100
2761	100	870	370	(2	5	(5

It is interesting to note that many Kuroko type mineralization have formed in a silicified andesitic - dacitic breccia in which occur a stockwork of quartz veins containing pyrite with minor quantities of Cu, Zn, and Pb sulphides. These appear to be the feeder complex to the more typical stratiform Kuroko-type orebodies. Stratiform Kuroko-type orebodies overlie or occur in close proximity to the feeder complex.

Thin section example of this rock type is KR 2739.

Porphyritic Hornblende Rhyolite

This distinctive rock type outcrops west of the quarry near the Iris Bridge approximately 400 metres south of Exploration Licence 10/74 southern boundary.

The porphyritic hornblende rhyolite underlies the basalt in the vicinity of the Mariner 1 prospect. In hand specimen the rock looks very similar and has been confused with the lithic crystal tuffs described above. The rhyolite can easily be distinguish from the lithic crystal tuff because of its characteristic primary fluidal texture.

The rock consists essentially of hornblende, quartz and feldspar. The quartz and hornblende phenocrysts are evenly distributed and are commonly flow aligned, together with crystals of potash feldspar, lesser plagioclase and biotite, through a matrix of cryptocrystalline quartz potash feldspar and very fine chlorite. Accessory quite coarse apatite and finely disseminated pyrite crystals are also present.

Thin section example of this rock type is KR 2740.

<u>Lithic Crystal Tuff</u>

This distinctive rock type is known only from rubble and float. The lithic crystal tuff may outcrop west of the quarry, near the Iris Bridge approximately 400 metres south of the Exploration Licence 10/74 boundary. More detailed mapping is required in this region. The lithic crystal tuff, underlies the basalt in the vicinity of Mariner 1 prospect, and the approximate extent of rubble and float has been mapped in detail (see KT 10/74 - M - 3C). Only minor amounts of lithic crystal tuff have been recorded on the Mariner 2 prospect.

Fresh specimens are pale grey. Macroscopic minerals include large quartz and feldspar phenocrysts, cloudy feldspar patches, black needles of hornblende, minor lithic particles of quartzite and porphyritic hornblende rhyolite and scattered pyrite crystals in a crystalline groundmass.

The lithic crystal tuff has many affinities with the porphyritic hornblende rhyolite described below, and is probably derived from it by explosive volcanism.

Thin section examples of the above rock rype is KR 2721.

MIDDLE TO UPPER CAMBRIAN

A 2 to 3 metre unit of breccia probably equivalent to the Jukes Breccia is developed on an uneven surface of Cambrian lavas in the vicinity of Prospect Mountain. Minor outcrops of conglomerates? containing fragments of Cambrian volcanics occur on Bond Range. The conglomerates? are generally well cleaved, disorientation of these boulders show their cleavage to be pre-Lower Ordovician (Corbett K.D. 1975.) . The conglomerates? are probably equivalents to the Jukes Breccia.

This unit was not observed during the survey.

GEOCHEMISTRY

DRAINAGE SAMPLING

Stream sediment sampling was selected as an appropriate exploration technique for the Black Bluff area. The sample spacing of 200 metres and the size fraction for analysis, -80 mesh, were selected based on experience gained in the Loongana area, during the 1975-76 field season. In addition to samples being taken every 200 metres, one in ten were resampled to serve as checks.

A total of 266 (including duplicates) were collected from Bond and Black Bluff Ranges, an area of approximately 24 square kilometers. The overall sample density was approximately 11 samples per square kilometer.

As it was impossible to accurately locate the sample points on aerial photographs, film copies of the base maps were used to record the locations, each point being measured off, by using a graduated poly tape from a known starting point such as a tributary junction. All the sample locations were marked by flagging tape and numbered aluminium tags. Details of location, stream dimensions and sediment type were recorded on KD series cards. The samples were dried, rebagged if required, prior to despatch to A.C.S. Laboratories in Adelaide.

All samples were seived to -80 mesh, and were analysed for Cu, Pb, Zn, Fe, Mn, Ag, Cd, Ba, As and Sn. The sediment samples were digested in hot concentrated perchloric acid ($HClO_4$) for one hour of 0.25g sample, then diluted with water and determined by A.A.S. Sn and Ba were determined by Emission Spectrography, and As by modified Gutzeit method. Drainage sample location map and geochemical results for Cu, Pb, Zn and Sn occur in the folder at the end of the report

The analytical report from A.C.S. Laboratories occurs as appendix at the back of this report and includes results for As, Ag, Cd, Ba, and Fe.

STATISTICAL TREATMENT

Persual of the results of the survey plotted on sheets KT 10/74 - 3B - (1-4) and KT 10/74 - 2B (1-5) show that three main divisions are apparent within the data. Generally the two main divisions occur within the Cambrian acid volcanics, Cambrian acid volcanics from Black Bluff Range have lower backgrounds than the Cambrian acid volcanics from Bond Range. A third not so obvious division, occurs between the 'lowlands' organic rich button grass plains sediments, where metal values are higher compared to the 'highlands' sediments, which in general, contain less organic content. Some apparent anomalous values around the Fall Plains area have been attributed to metal concentration in organic rich sediments, and require minimal or no follow up work.

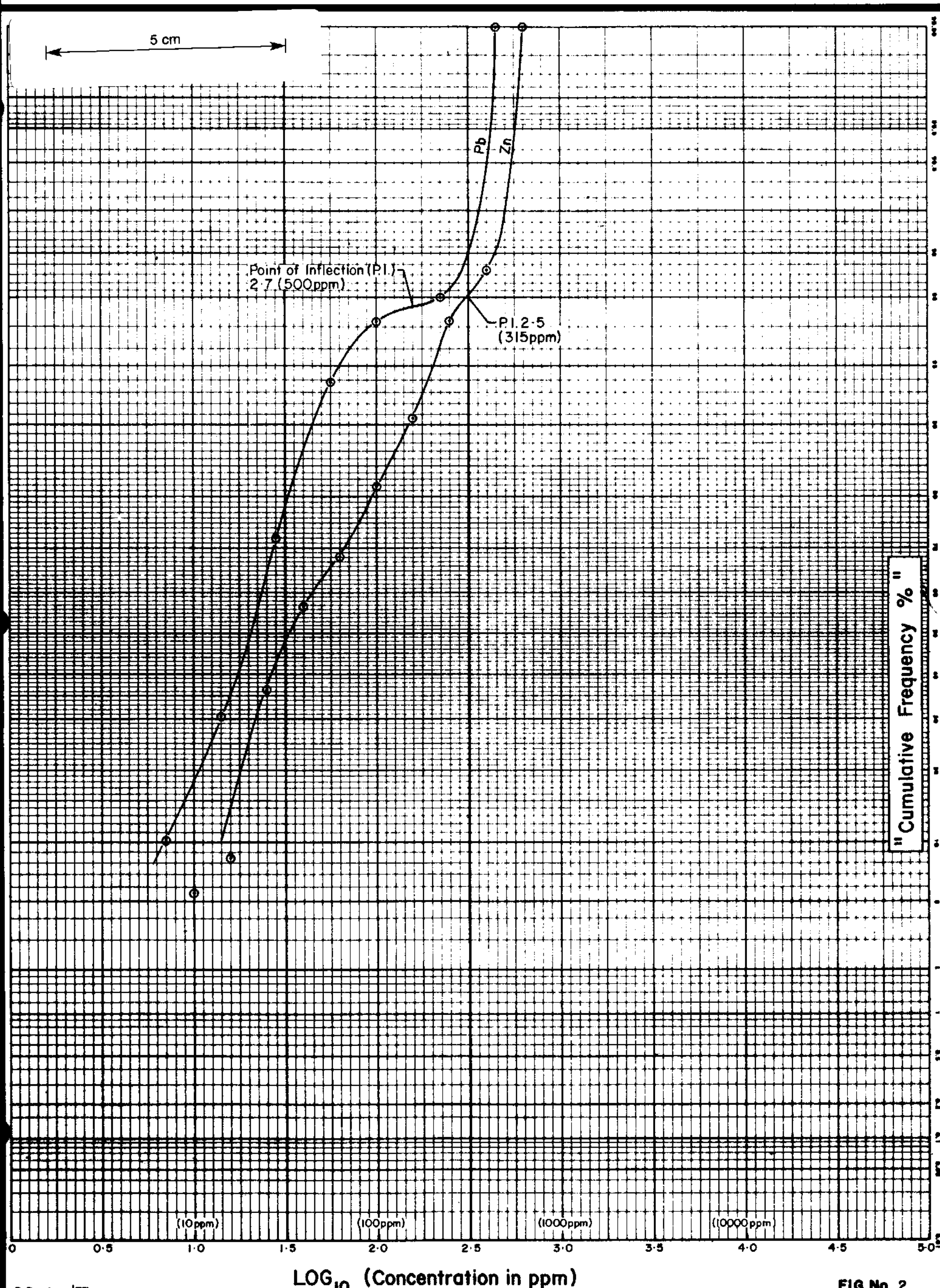
The Cu, Pb, Zn and Sn results of the samples within the Cambrian volcanics of Bluff Range and Bond Range have been treated separately for the purpose of determining 'threshold' approximations for the various populations.

Cumulative frequency plots of the Log_{10} concentrations of Cu, Pb, Zn and Sn were made in order to see whether local minimums in the probability density functions were present. These minimums represent 'threshold' values or approximate dividing points between overlapping log normal distributions. The results are shown by figures 2 and 3.

The method of selection of local minimums or thresholds is subjective, the most important assumption being that the accuracy of assaying is a good as the reported figures imply.

Cumulative Frequency Plots - Stream Sediment Geochemistry - Pb and Zn
Lower - Middle Cambrian Area, Bond Range

262060

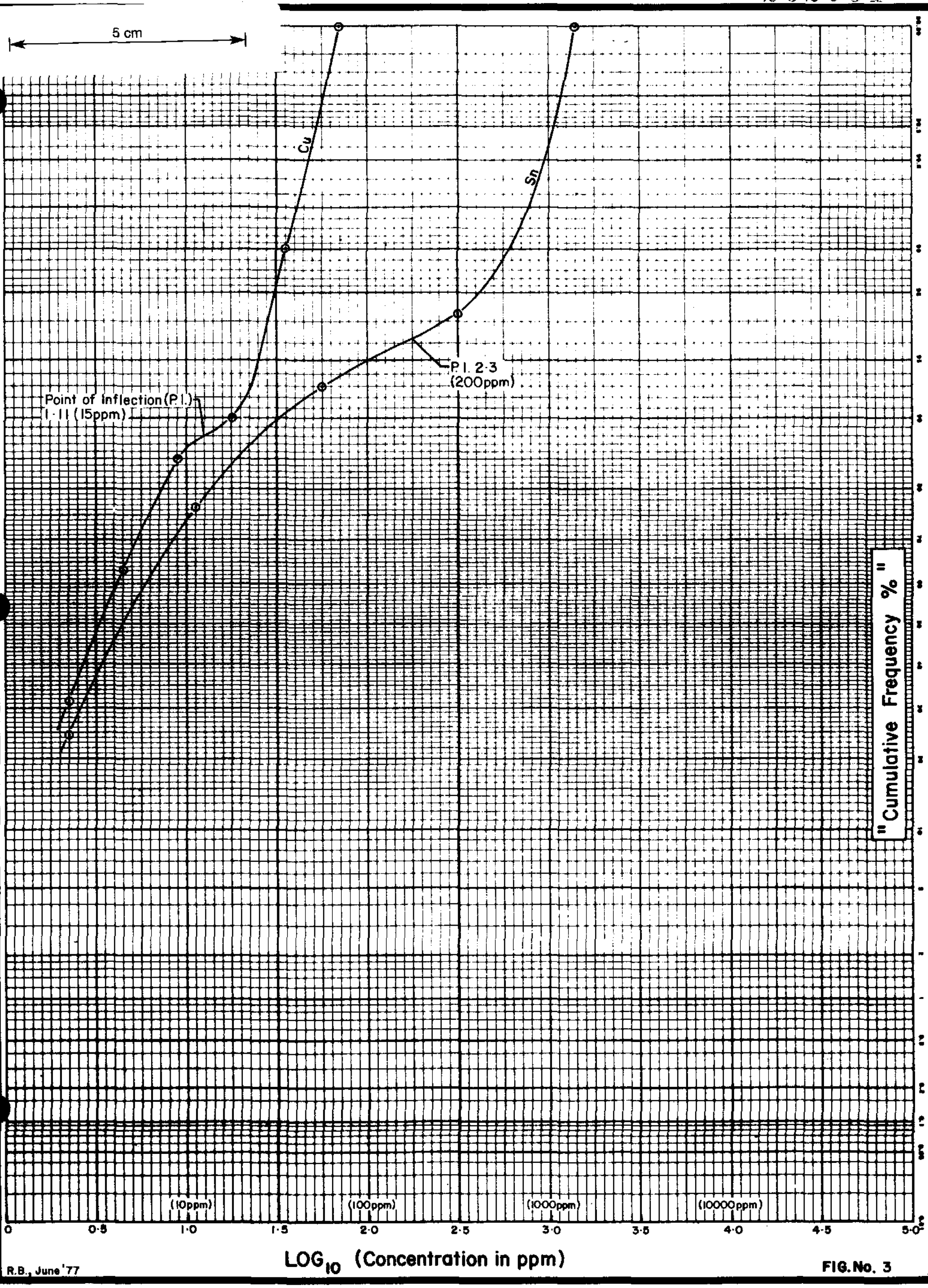


R.B., June '77

FIG. No. 2

Cumulative Frequency Plots - Stream Sediment Geochemistry - Cu and Sn
Lower-Middle Cambrian Area, Bond Range

262061



R.B., June '77

FIG. No. 3

The higher threshold values selected from the cumulative frequency plots were used to define anomalous values for Cu, Pb, Zn and Sn as shown on sheets KT 10/74 - 3B- (1-5) and sheet KT 10/74 - 2B- (1-4). In summary, the anomalous areas were selected using the 'eyeball' method aided by statistical treatment of data to select approximate threshold values.

The following are the threshold approximations, above which the values can be considered anomalous. The number of values above the threshold is expressed as a percentage of the total (in brackets). Threshold approximations could not be obtained for Cu, Pb and Zn from the Cambrian Volcanics in the Black Bluff Range area, and only approximate background values are quoted.

Black Bluff Range (Approx. Background Values)

Cu	Pb	Zn
<2ppm	20ppm	30ppm

Black Bluff Range (Threshold Value)

Sn
50ppm (13.5%)

Bond Range (Threshold Values)

Cu	Pb	Zn	Sn
15ppm	500ppm	300ppm	200ppm
(13.0%)	(2.8%)	(2.8%)	(6.51%)

DISCUSSION OF RESULTS

Black Bluff Range

Perusal and statistical treatment of the geochemical drainage survey in one of the Cambrian "windows " revealed no anomalous values in Pb, Cu and Zn. Sn is the only metal with some character, peak values obtained were 100ppm, however, no real support from the other base metals was observed.

Sample localities with single (one element) anomalous values as observed in the Black Bluff Range are not considered significant and no follow up work is recommended.

Bond Range

Four main anomalous areas were outlined by the drainage geochemical survey in the Bond Range area. Most anomalous values are combined with weakly anomalous or anomalous values of either Pb, Zn, Cu, Sn, Mn and to a minor extent Cd.

All the anomalous areas mentioned above, occur in the vicinity of the Fall and Iris Rivers, and follow up work should be achieved by extensions of the already established Mariner 1 and Mariner 2 prospect grids. One of the anomalous area outlined in the drainage geochemical survey is on the Mariner2 prospect grid. The other three anomalous areas have here been termed Mariner 1 ZONE A, ZONE B and ZONE C respectively due to an apparent mineral zonation within the Mariner 1 prospect to be discussed later. It will be recommended in discussions to follow that Mariner 1, Mariner 1 Zone A, B and C and Mariner 2 prospects be combined to form one large intergrated grid system.

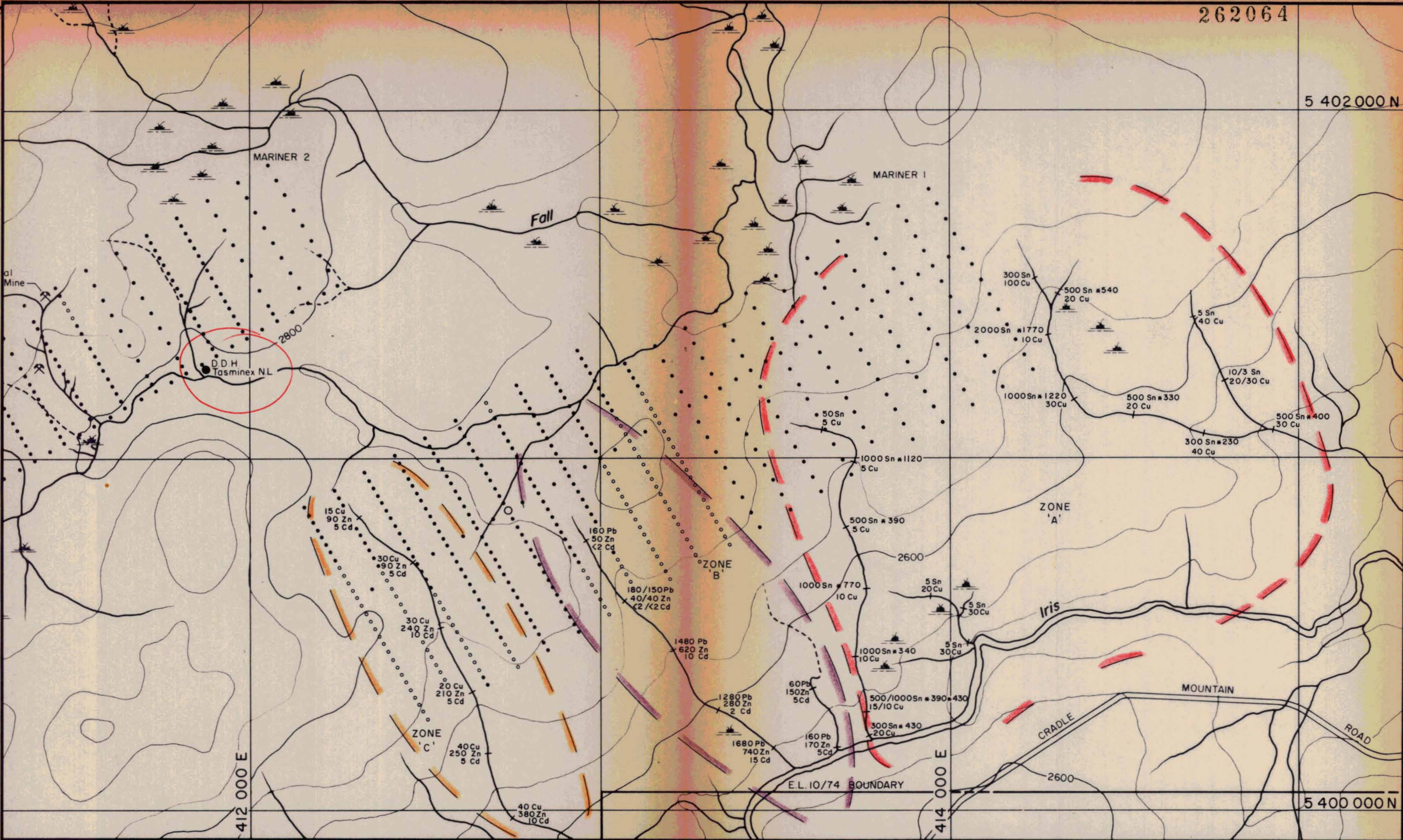
In addition several interesting, but lower priority areas possibly requiring follow up work have been outlined.

Mariner 1 Zone A

See Figure 4

The drainage geochemical samples from this prospect area are anomalous in Sn, and Cu. Peak values for Sn and Cu are 2000ppm, and 100ppm. The average values of the background distribution are in the order of 10ppm and 5 ppm.

262064



LEGEND:

ANALYTICAL METHODS:– Stream sediment samples Cu, Pb, Zn, Cd by AAS following HCl leach and HCl/HNO_3 leach in latter stages of 0·25g sample.

Sn determined by – Emission Spectrography
– * X.R.F.

Results in ppm

5 cm

GEOPEKO LIMITED
KING ISLAND GROUP

SCALE: 1 : 10 000

FIG. 4

DATE: APRIL '78
GEOLOGIST: G.L.B.
DRAWN: J.P.M.
CHECKED: M.C.R.

E.L. 10/74 BLACK BLUFF, TASMANIA

MARINER 1 ZONES A, B and C

The area is also weakly anomalous is Mn.

Anomalous drainage values for Sn and Cu report in 2 streams spaced approximately one kilometer apart. Both streams drain into the Iris River and some anomalous values are near the southern boundary of Exploration Licence 10/74. The extent of the anomalous area is approximately 2 square kilometers.

Mariner 1 Zone B

See Figure 4

The drainage geochemical samples from this prospect area are anomalous in Pb, Zn, Cd, Mn and to a minor extent Cu. Peak values for Pb, Zn, Cd, Mn and Cu are 1680ppm, 740ppm, 15ppm, > 10000ppm and 50ppm. The average values of the background distributions for Pb, Zn and Cd are of the order 100ppm, 50ppm, 5ppm respectively.

Anomalous drainage values for Pb, Zn Cd, Mn and Cu report in one major stream and to a minor extent in another. The two streams are approximately 100 metres apart and drain into the Iris River near the southern boundary of Exploration Licence 10/74.

Mariner 1 Zone C

See Figure 4

The drainage geochemical samples from this prospect area are anomalous in Cu, Zn, Cd and Mn. Peak values for Cu, Zn, Cd and Mn are 40ppm, 380ppm, 10ppm, and >10000ppm. The average values of the background distributions for Cu, Zn and Cd are of the order of 5ppm, 50ppm, 5ppm respectively.

Anomalous drainage values for Cu, Zn, Cd and Mn report in one major stream, the anomalous area bounds the Mariner 1 grid to the north and the Mariner 1 ZONE B are to the east.

The anomalous Zn values are south of the Exploration Licence 10/74 boundary.

A large portion of the Mariner 1 Zone A, Zone B and Zone C is covered by thin olivine basalt flows. No Cambrian rock outcrop was recorded during the survey, Float mapping along the stream banks within the region revealed biotite feldspar quartz porphyry, some areas showing extensive argillic-sericitic - chloritic alteration probably along strike to the present Mariner 1 and Mariner 2 prospect alteration zone. Lithic crystal tuffs underlie the basalt in the Mariner 1 Zone C area.

From the preliminary geological work carried out on the streams draining into the Fall and Iris Rivers suggest that the region is mineralogically zoned. The alteration of the biotite - feldspar quartz porphyry appears to follow the sequence below, in decreasing intensity.

(a) Silicification of part of the argillic - sericitic-chloritic alteration zone.

(b) Intensive argillic-sericitic-chloritic alteration.

(c) Intermediate to minor argillic-sericitic-chloritic alteration.

(d) Sericitic-chloritic alteration.

The drainage geochemical survey of stream systems draining into the Fall and Iris River also suggests that the area is chemically (mineralogically) zoned. The zoning from east to west appears to follow the sequence below.

Mariner 1	ZONE A	Sn-Cu-Mn
Mariner 1	ZONE B	Pb-Zn-Cd-Cu-Mn
Mariner 1	ZONE C	Cu-Zn-Cd-Mn

Significance of drainage geochemical anomalies.

A problem arising from the recent geochemical drainage survey, was to distinquish between 'significant' and 'non - significant' anomalies. A characteristic feature of anomalous, weakly anomalous or elevated base metal values, were that the locality samples are generally anomalous in Fe and Mn, and obtained from organic rich sediments occurring on the button grass plains.

The edges of organic swamps are known to be especially favourable sites for the development of anomalies. This distribution results from the fact that the organic matter of swamps tend to precipitate many of the ore metals out of groundwater solutions at the points where they first encounter the swamp environment (change in pH and Eh conditions).

Similarly hydrous Fe and Mn oxides are commonly precipitated from groundwaters in swamp and spring environments (change in pH and Eh conditions). If groundwaters are rich in ore metals, these metals may be scavenged from the groundwaters by co - precipitation as a minor constituent of the precipitated Fe and Mn minerals.

Careful attention should be directed to possible relationships between metal content, pH, Eh, organic matter and possible precipitated hydrous Fe and Mn oxide in future soil and drainage geochemical surveys. It is recommended the pH and Eh readings should be taken with soil and drainage geochemicial surveys in future Tasmanian geochemical exploration.

'Significant' anomalies have been distinguished from 'nonsignificant' anomalies by the following criteria.

(1) Most anomalous values are combined with weakly anomalous or anomalous values of either Pb, Zn, Cu, Sn, Mn and Cd. It is these sample localities that are classed as significant and warrant further investigation.

(2) Where several nearby samples are also classed as significant, it is strongly recommended that further definitive work be done to ascertain the source of the anomalies.

(3) With the exception of the anomalous Sn areas (Mariner 1 Zone A), anomalous Cd (10-15ppm) is a characteristic feature of the areas classed as significant. The following are features of interest.

(a) Cd show an almost univeral association with Zn.

(b) Cd in stream sediments has been reported as a possible path finder for Zn deposits (Hawkes and Webb).

(c) Cd follows Zn in weathering except during the oxidation of Zn sulphide. Here, the secondary Cd sulphide tends to remain behind after the Zn sulphide has been solubilized by oxidation. It would appear that Zn has been leached out due to oxidation of the biotite feldspar quartz porphyry in the Mariner 1 area.

(4) Sample localities with single (one element) anomalous values are not considered significant and no follow up work is recommended.

(5) Slightly anomalous or elevated values in Pb and/or Zn, and also anomalous Fe and Mn occuring in organic rich sediments are not considered significant, and are designated as low priority warranting no follow up work at this stage, unless

in the vicinity of anomalous soil and drainage samples. Category (3) and (4) are discussed below under nonsignificant anomalies.

Perusal of the results of the geochemical drainage survey has revealed four 'nonsignificant' anomalies, areas high in Pb-Zn when compared to average background values.

(1) An anomalous Pb and Mn geochemical drainage sample centring on 5,400,880N, 410,500E occurs on the edge of the Fall River Plains, approximately 500 metres due south of Bond Peak. The sample is not anomalous in any other base metal, although elevated values are recorded for Zn and Sn. The sample locality is not considered significant, and is designated as low priority warranting no follow up work at this stage.

(2) An elevated Pb geochemical drainage sample centring on 5403,900N, 413,650E is not considered significant, and no follow up work is recommended.

(3) Elevated base metal values (Pb, Zn and Mn) trending east centring between 5,402,020N to 5,401,670N, 413,000E to 412,000E occur in a tributary of the Fall River. The geochemistry samples themselves do not warrant any follow up work, however, the 'anomalous' area is north of the present extent of the eastern half of the Mariner 2 prospect. If hand augering of the eastern half of the Mariner 2 grid is encouraging, then it is recommended that the grid be extended to include the above elevated values.

(4) Elevated Pb and Zn values centring on 5,404,240N, 412,670E. This stream drains biotite feldspar quartz porphyry and crystal vitric tuff lavas warranting restricted follow-up work at present.

DISCUSSION

Mineralogical and compositional zoning may have important practical exploration implications.

Compositional zoning (?) within the Mariner region appears to be on a scale in excess of 4 kilometers. In most cases compositional zoning appears to be largely the effect of differential depletion of certain constituents of the ore-forming fluids with increasing distance from the source. These variations, where they can be correlated with the direction of flow of the ore solutions (?) may be a direct guide in locating the possible orebody.

Argillic-sericitic-chloritic alteration on the Mariner 1 grid appears to be confined to the anomalous Pb-Zn areas. This alteration is suggested to have important exploration implications and requires further investigation.

The exploration implications are where the alteration patterns have been deposited contemporaneously with the ore, and at no other time, their distribution may be a direct guide in locating ore deposits. Furthermore, the solutions responsible for the alteration, may follow a pattern of channel-ways that differs more or less from that followed by the ore-forming solutions themselves. Alteration patterns, therefore may indicate only general areas of mineralogical activity and not the exact channel-ways through which ore - stage solutions passed.

Favourable factors for the occurrence of significant mineralization in the Mariner 1 area include.

(a) The presence of biotite-feldspar-quartz porphyry, a correlate of the Mt. Read Volcanics.

(b) Acid volcanic mineralization is often situated immediately adjacent to rhyolite domes. Bond Range appears to be a rhyodacitic or dacitic Cambrian high or dome?

(c) The presence of intermediate (andesitic) pyroclastics and volcanics (?) are very favourable associates with acid volcanic mineralization. This represents a transition from a period of felsic volcanism to one of more mafic volcanism.

(d) The biotite-feldspar-quartz porphyry is the top(?) of a sequence of rhyodacitic or dacitic volcanics. The Mt. Lyell and Rosebery orebodies are formed near and at the top of a sequence of acid volcanics. At Rosebery the overlying volcanics are andesitic in composition - but at Mt. Lyell they are rhyolites and tuff.

(e) The proximity to an unconformably overlying volcanic sequence, which may include quartz bearing volcanics, volcanoclastic rocks or pyroclastics. On the Mariner 1 prospect the biotite feldspar-quartz porphyry (high level intrusion?) is overlain unconformably (?) by a sequence of andesitic lithic crystal tuffs.

(f) Sericite and chlorite appear to be genetically related to the ore at Rosebery and Mt. Lyell. The Kuroko type deposits have an argillic alteration zone associated with the mineralization. It should be noted that induced polarization method used on the Japanese deposit were complicated by the intense argillic alteration zone.

07

Argillic-sericitic-chloritic alteration appears to be related to the higher geochemistry values on the Mariner 1 prospect and with the surrounding streams.

(g) Volcanogenic chert appears to be a favourable factor often associated with Cu-Pb-Zn ore deposits. On the Mariner 1 prospect part of the alteration zone has been silicified? Corbett describes silicification of tuff on Bond Range associated with pyrite-bornite-chalcopyrite and hematite mineralization.

(h) The association of brecciated host rocks with many Kuroko type deposits. The fracturing allows easy access to later volcanic emanations and mineralizing fluids. A silicified volcanic breccia or brecciated tuff has been described from the Mariner 1 prospect e.g. KR 2739. Associated quartz veins with pyrite mineralization has been noted.

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G.L. BUCKLAND,
GEOLOGIST.

APPROVED: M.C. ROGERS,
SUPERVISING GEOLOGIST.

ACKNOWLEDGEMENTS

R. Van den Bogaart completed all geological mapping, plotting and interpretation of results and also the written draft of report sections discussing Location and Access, Exploration Program, Geology, Geochemistry and Discussion of Results before his transfer to Jabiru base on 23rd August, 1977.

G.L. Buckland finalised map legends, wrote the remaining text sections and supervised report draughting and compilation.

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8th February, 1977.

Mr. I. Pontifex,
26 Kensington Road,
ROSE PARK.
South Australia.....5067

Dear Ian,

Enclosed are 12 rock samples from one of our northern Tasmanian areas. We have not previously submitted rocks from this area to you.

From field evidence there appears to be 3 main groups of rocks which are very similar in hand-specimen.

1. Porphyry - quartz, feldspar, represented by No's 63, 2, 113?

2. Cleaved porphyry - quartz, feldspar or crystal tuff, represented by No's 30, 71, 93?, 114.

3. Crystal tuff - quartz, feldspar or porphyry represented by No's 144, 100, 104? and 106?

4. There is another distinctive rock type, Porphyry - feldspar, quartz - No 116.

Please:

- give brief thin section description of each rock.
- compare the four groups. Could 1 be an alteration of group 4? Could group 2 be just a cleaved group 1?
- compare No. 63 with No. 2 - for alteration. (No.2 green in colour)
- compare type No. 63 with type No. 71.
- discuss results.

We would appreciate if you could undertake this work soonest please.

Regards,

Bob van den Bogaart
Geologist.

Ian R. Pontifex & Associates Pty. Ltd.

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A.H. 31 3816

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SOUTH AUSTRALIA

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MINERALOGICAL REPORT NO. 2104

28th February 1977

TO:

Mr. M. C. Rogers,
GeoPeko Ltd. - King Island,
P.O. Box 120,
Grassy, KING ISLAND
TASMANIA 7256

Attention: Bob van den Bogaart

YOUR REFERENCE: Letter from Bob van den Bogaart dated 8/2/77 Order No. KP1400

MATERIAL: Rock samples from northern Tasmanian exploration areas

IDENTIFICATION: Nos. 2 to 116F (various intermediate nos.)

WORK REQUESTED: Petrographic examination and comments as detailed

SAMPLES & SECTIONS: Returned to you

PONTIFEX & ASSOCIATES PTY. LTD.

COMMENTS

Each section offcut was stained with sodium cobaltinitrite to detect potash felspar, but this mineral only reports in samples 14A, 30, 63 and 116F.

Each thin section is given an essential, fairly objective description with specific comments re your covering letter, and comparisons between samples are made where appropriate.

The following groupings are made in the general terms of the hand specimen groupings reported in your letter but are determined by the petrological evidence (mineral names generally listed in order of increasing abundance):

1. Biotite felspar quartz porphyry, negligible cleavage, represented by:-

   no. 2 - ?dacitic composition, extensive clay-sericite alteration and chloritisation of biotite

   no.63 - dellenitic, extensive epidote alteration of biotite, negligible clay-sericite alteration

   no.113- ?dacitic, extensive clay-sericite alteration; less biotite and felspar than in 2 and 63 but none the less it fits this group better than any other in the suite

These rocks are distinguished (from the tuffs) by relatively homogeneous composition and texture, notably of their uniform microcrystalline quartzo-felspathic mosaic groundmass. Biotite (albeit altered) is fairly clear in hand specimen at least in nos. 2 and 63, and could well be included in a macroscopic rock name.

2. Biotite felspar quartz porphyry, sheared with resultant moderate development of cleavage (or weak schistosity) obvious in hand specimen, and manifest in thin section as shredded streaks of sericite through the groundmass. Otherwise these rocks are relatively homogeneous as in group 1, and almost certainly are sheared equivalents.

no. 30 - rhyodacitic, extensive clay-sericite alteration of plagioclase, chloritisation of biotite, minor potash felspar determines

no. 114 - ?dacitic no evidence of biotite and less felspar than other porphyries but none the less a porphyry rather than tuff

There is no positive evidence whether these porphyries of groups 1 and 2 are high-level intrusive or extrusive, however the latter seems most likely. As noted, they are decidedly acid but variation in potassic content indicates a range in composition from dacite to dellenite (adamellite equivalent). There do not appear to be any genuine rhyolites.

3. Lithic, quartz-crystal tuffs, mainly dacitic to minor rhyodacitic composition; clay sericite alteration is extensive with some chloritic alteration; generally moderate cleavage:-

no. 14A - vague primary layering, with oblique incipient schistosity

no. 71 - quartz crystal ash flow tuff, devitrified glass-shards in matrix

no. 93

no. 100

no. 104

no. 106

Nos. 100, 104, and 106, represent a similar facies, however as noted in the individual descriptions no.106 may not be a genuine pyroclastic; it has some characteristics of a volcanoiclastic sediment of erosional derivation, conceivably a highly tuffaceous ?wacke.

The petrography confirms the field observations that no. 14A is very similar to the 100, 104, 106 group (the sedimentary layering reported in 14A, possibly relates to the comments applied to no. 106.)

Samples nos. 71 and 93 contain less coarser components than the other tuffs. They are identified as tuffs only on subtle petrological evidence and indeed in hand specimen may well be considered as (sheared) felspar quartz porphyry.

4. Sample 116F is a lithic crystal tuff, and is distinctive in that it contains essential unaltered hornblende, and to a large extent appears to have an intermediate (potassic-andesite) source. Quartz crystals however indicate a subsidiary probable dacitic contribution.

- -

262081

No. 2: biotite felspar quartz porphyry: of dacitic composition; extensive argillic alteration of felspars, and chloritisation of biotite

2502

Field comment: quartz felspar porphyry

This is indeed a porphyry. Phenocrysts up to 8 mm in maximum dimension are randomly disposed through a microcrystalline groundmass of essential quartz, subordinate clay-sericite replacing plagioclase, and minor chlorite replacing biotite. The phenocrysts are:-

rounded and embayed (some euhedral) quartz crystals	20%
generally smaller subhedral to euhedral felspar, completely replaced by sericite and clays	15-20%
biotite flakes, almost completely chloritised with relicts of intergrown muscovite, + Fe/Ti granules	15-20%

The composition of the original felspar is difficult to ascertain, but it seems likely that the phenocrysts were predominantly plagioclase, thus the porphyry had a dacitic composition.

This rock seems likely to be a (high-level) intrusive, but it may be an extrusive, but without any distinctive flow characteristics.

No. 14A: lithic crystal tuff of rhyodacitic composition;
2536 roughly layered and moderately schistose

Field comment: quartz felspar crystal tuff or porphyry

This rock has been sheared to produce a weak schistosity, but a vague layering is manifest (within the limited size of the sample), by average grain-size and compositional variation within bands about 20 mm thick. This schistosity is oblique to the layering.

The coarser grained layer consists of subrounded to euhedral and embayed single quartz crystals (up to 2.3mm), also subrounded grains of similar size, composed of microcrystalline quartz mosaic with minor sericitised felspar and chloritised biotite, and rarely small phenocrysts of the same. These fragments are derived from quartz felspar porphyry similar to sample no. 2. Minor single subhedral to euhedral felspar crystals and trace altered hornblende are also present. Most felspars are plagioclase but minor potash felspar occurs singly or intergrown with plagioclase.

All of these components are randomly disposed through a sheared matrix of ultrafine clays chlorite and sericite.

The finer grained domain has a similar gross composition. Single subrounded but rarely embayed, and abundant angular quartz grains; also fragments of microcrystalline quartz mosaic ± felspars, and minor single felspar crystals are randomly distributed through a weakly schistose matrix of ultrafine clays, sericite and chlorite.

The coarser grained area could conceivably be a brecciated sheared and altered porphyry equivalent to no. 2. However the decidedly tuffaceous nature of the finer grained area and the overall textures indicates that the rock is a lithic crystal tuff of rhyodacitic composition.

No. 30: biotite felspar quartz porphyry: of rhyodacitic composition, extensive argillic alteration of felspars with attendant shear to form moderate cleavage: biotite extensively oxidised

2522

Field comment: cleaved quartz felspar porphyry or crystal tuff

The general textural and compositional homogeneity of this rock, including a fairly uniform, albeit altered microcrystalline groundmass indicates that this is an (intrusive) porphyry rather than a tuff.

Phenocrysts consist of: rounded and embayed to euhedral quartz crystals (20%) up to 6 mm; rare single large potash felspar crystals; several plagioclase crystals (10%) completely replaced by clay-sericite; single quite coarse flakes of biotite (15%) $\pm$ rare hornblende, almost completely oxidised to chlorite $\pm$ secondary iron oxides.

The groundmass consists of microcrystalline quartz and felspar (?plagioclase), with the felspar completely replaced by sericite $\pm$ clays. Irregular patchy, flame-like streaks of clay-sericite through the groundmass, and through fractured phenocrysts, appear to be essentially metamorphic, but conceivably coincidental with late magmatic (deuteric) argillic alteration. These define a moderate cleavage.

No. 63: (hornblende) biotite felspar quartz porphyry of dellenitic composition; extensive but selective epidote-chlorite alteration, very minor clay-sericite alteration

2507

Field comment: quartz felspar porphyry

This rock has a homogeneous composition and texture. Phenocrysts consist of variably subrounded (subhedral) and embayed, quartz crystals (20-25%), several euhedral potash felspar (5-7%), and plagioclase crystals (10-15%), biotite (10-15%), and hornblende (10%).

The felspar crystals are vaguely clouded and flecked by clay-sericite and fine epidote, but generally far less altered than in the samples above. Biotite however is completely pseudomorphically replaced by epidote $\pm$ chlorite and titaniferous granules. Hornblende is completely chloritised $\pm$ accessory epidote.

The groundmass consists of microcrystalline mosaic of a similar abundance of quartz plagioclase and potash felspar, with minor chloritised biotite and/or hornblende.

This is a (hornblende) biotite felspar porphyry, somewhat more potassic than those above and characterised by selective epidote-chlorite (deuteric) alteration, rather than more pervasive clay-sericite (and chlorite) alteration above. Thus re the comment in your letter, the alteration is substantially different than in no. 2, except for (partial) chloritic alteration of biotite and hornblende.

Also, no. 63 differs from 71 in that it is an intrusive potassic porphyry; 71 is an (acid) quartz-crystal tuff, but less potassic than 63 and dominated by clay-sericite rather than chlorite-epidote alteration.

No. 71: quartz-crystal (ash-flow) tuff; extensive
2602 clay-sericite alteration including streaks of sericite defining a cleavage

Field comment: cleaved quartz felspar porphyry or crystal tuff

This is a fairly homogeneous rock with large quartz crystals, macroscopically similar to (sheared) porphyries in the suite, however microscopic characteristics, notably of the matrix classify it as a tuff rather than an intrusive.

Variably subrounded, embayed, euhedral, and broken coarse single quartz crystals (20%), and somewhat irregular but roughly tabular sericite pseudomorphs after felspar crystals (10-15%), are randomly disposed but with similar orientation through a cleaved ultrafine matrix. Minor chlorite ± epidote pseudomorphs after biotite (5-7%) are largely leached out to form voids.

The matrix consists of ultrafine clays ± cryptocrystalline quartz, with irregular patches of microcrystalline quartz and streaky, variably continuous layers of sericite defining a vague cleavage. Extremely fine fragments of quartz and minor devitrified glass shards are scattered through the matrix, the gross characteristics of which are interpreted to represent ash-flow material.

The rock has a gross leuco-dacite composition.

No. 93: quartz crystal lithic tuff of dacitic
2583 composition, sheared and as a result sericitised and cleaved

Field comment: cleaved quartz felspar porphyry or crystal tuff

Irregularly rounded and embayed single quartz crystals up to 7 mm across, also minor much finer fragments of these are randomly scattered. They are commonly fractured, rarely some are contained within a cryptocrystalline groundmass foreign to the enclosing matrix of the whole rock, i.e. they form part of acid volcanic rock fragments.

Small lenticular patches (or fragments) of diffuse microcrystalline quartz mosaic, variably sericitised, form a loosely packed aggregate constituting an essential part of this rock. These also appear to be exotic acid volcanic groundmass material; they can only be identified as specific fragments in thin section.

Closely spaced, wavy, but fairly continuous streaky foliae of sericite throughout the matrix tend to weave around these fragments, and single quartz crystals. Minor oxidised biotite is randomly scattered variably as part of the fragments and matrix.

No. 100: lithic crystal tuff of dacitic composition
2590 moderate, variable clay-sericite alteration, incipient cleavage

Field comment: quartz felspar crystal tuff or porphyry

This is a volcaniclastic rock consisting of a fairly tightly packed aggregate of the following listed components These are slightly better-sorted than the tuffs described above which are texturally, relatively more heterogeneous.

subrounded and embayed single quartz crystals	25-30%
more or less independent, angular fragments of quartz crystals	7-10%
angular plagioclase which may be crystals or fragments	10-15%
fragments of glassy acid volcanic groundmass, variably devitrified argillised-sericitised, some porphyritic	?30%
composite flakes of oxidised muscovite and some biotite	7-10%
oxidised magnetite and/or titaniferous grains	3-5%

Petrography and staining of the slide offcut indicates that potash felspar is essentially absent. It is difficult to differnetiate between the altered fragments of volcanic rock, composed of clays, sericite and ultrafine silica, since these components also constitutue the whole rock matrix. This matrix however appears to form about 25% of the rock. Some plagioclase is also fairly extensively argillised and/or sericitised, thus also confused with the matrix.

Discontinuous streaks of sericite through the matrix define an incipient cleavage.

No. 104: lithic crystal tuff of gross dacitic composition
2594 possibly transitional to erosional volcaniclastic sediment; extensive clay-sericite alteration; streaky sericite foliae define a weak cleavage

Field comment: quartz felspar crystal tuff or porphyry

This rock consists of a heterogeneous, fairly loosely packed and poorly sorted aggregate of single crystals and fragments of acid volcanic groundmass, all in an ultrafine matrix of apparently largely volcanic derivation, and including chloritic clays. The coarser components are:-

single quartz crystals, subrounded and embayed	25-30%
angular quartz crystal fragments	5-7%
fragments of (glassy) acid volcanic groundmass variably devitrified, argillised and sericitised	30%
felspar (?plagioclase) crystals, completely replaced by clays and/or sericite	10-15%
composite flakes of oxidised muscovite and minor biotite	5-7%
oxidised hornblende crystals	5-7%

The matrix consists of ultrafine quartz mixed with chloritic clays and sericite, including similarly oriented streaks of sericite which define an incipient cleavage. These matrix materials are confused with altered rock fragments and felspars, however they appear to constitute about 25% of the rock.

This is a sediment composed essentially of volcanic detritus. It may be classified as a volcaniclastic, but rather than completely derived directly from a volcanic centre it seems to be partly of erosional origin, with the muscovite indicating minor contribution from a metamorphic terrane.

No. 106: a largely volcaniclastic sediment, possibly
2596 a genuine pyroclastic (lithic crystal tuff); possibly a highly tuffaceous wacke

Field comment: quartz felspar crystal tuff or porphyry

This rock consists of a fairly heterogeneous aggregate essentially of volcanic debris, loosely packed and unsorted, with an ultrafine matrix of largely chloritic clays. The components are as follows:-

single quartz crystals, subrounded and embayed	20%
angular and some composite grains of indeterminate origin	10-12%
highly irregular fragments composed essentially of clays streaked with sericite (apparently altered acid glass)	25-30%
clay-sericite pseudomorphs after felspar	10-12%
composite muscovite (schist?) fragments	10-12%
grains of titania ± iron oxide	7-10%
fragments of sericitic ?quartz siltstone	1-2%

The matrix constitutes about 25% of the rock. The coarser quartz crystals, most altered fragments and most altered felspar crystals have a virtually undoubted volcanic origin. However the smaller angular (and some composite) quartz grains, much of the matrix, have an indeterminate origin, while most muscovite fragments appear to derive from a metamorphic terrane. Thus while the rock may be classified essentially as a volcaniclastic, it is not clearly a pyroclastic sediment, indeed it seems likely to be transitional to a tuffaceous wacke.

No. 113: (biotite) felspar quartz porphyry;
2621 advanced pervasive sericitic alteration

Field comment: quartz felspar porphyry

Large subrounded and extensively corroded (embayed) quartz phenocrysts (25%); slightly smaller, completely sericitised euhedral plagioclase crystals (20%); amd completely altered, composite mica (?biotite) flakes (7-10%) are randomly scattered. Several corroded euhedral magnetite crystals are also present.

These components occur in a homogeneous, rather diffuse micromosaic of quartz, intimately mixed with a similar abundance of ultrafine sericite which completely replaces felspar.

There is no significant cleavage.

This rock is a quartz felspar porphyry; there is no distinctive evidence to say if it is a high-level intrusive or extrusive but it seems to have a gross dacitic composition. The pervasive sericitic alteration is probably indigenous (deuteric).

No. 114: cleaved (felspar) quartz porphyry of
2622 almost certain extrusive origin; extensive pervasive argillic-sericitic alteration

Field comment: cleaved quartz felspar crystal tuff or porphyry

In thin section, microscopic textures mainly in the groundmass indicate that this is an extrusive porphyry.

Phenocrysts consist mainly of single quartz crystals (20%) up to 3 mm; these are randomly scattered, stressed, fractured and rarely recrystallised. Rather irregular but otherwise quite concentrated patches of sericite appear to replace deformed plagioclase phenocrysts. Certainly however there is less evidence of felspar in this rock than in most others in the suite.

The groundmass is quite homogeneous, composed of a diffuse mosaic of ultrafine clays and/or silica intimately mixed with ubiquitous fine shredded streaks of sericite. To a large extent these reflect cleavage, but they also appear to represent primary fluidal textures characteristic of volcanic glass, which are over-printed by this cleavage.

The pervasive argillic-sericitic alteration is probably very largely deuteric, however the streaky sericite along cleavages is caused by shearing relatively later than the initial rock crystallisation.

No. 116F: (lithic) crystal tuff of potassic (hornblende) andesite composition, 'but with quartz crystals indicating a probable dacitic component; fairly extensive saussuritic alteration of the felspars and matrix; hornblende unaltered

2721

Field comment: distinctive felspar quartz porphyry

This is a pyroclastic rock, its most distinctive property, particularly within this suite of rocks, is the presence of essential hornblende crystals, and to a lesser extent its potash-felspar-rich groundmass (largely indicated by staining) which occurs in one other rock (no. 30). The coarse components consist of:-

single quartz crystal grains variably subrounded, embayed and broken	15-20%
single plagioclase grains variably euhedral and broken, clouded with argillic alteration ± sericite and epidote	15-20%
potash felspar grains ± intergrown plagioclase, clouded with argillic alteration	15%
single brownish green hornblende crystals, virtually unaltered	15%
single biotite flakes, largely replaced by epidote	10-12%
rock fragments composed of the above components except quartz (i.e. potassic andesite)	3-5%

Matrix forms about 25% of the rock and is composed largely of saussuritic material, locally with ultrafine quartz, rarely including glass shards.

..../

No. 116F contd. :

This lithic crystal tuff thus appears to derive largely from a potassic andesite source, i.e. a predominantly intermediate rather than the acid facies which dominate the suite. However the essential quartz phenocrysts do indicate a contribution from an acid, probably dacitic source.

It is not certain however, that this is precisely, genetically related to the equally abundant plagioclase, hornblende and potash felspar.

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18-7-77

Mr. C. Pontifex
26 Kensington Road,
ROSE PARK... .5067
South Australia.

Dear Sir,

Enclosed are 28 rock samples from one of our northern Tasmanian areas. Twelve (12) rock samples have been studied by you earlier this year, refer to Mineralogical Report No 2104. These rock samples have now been given rock sample card numbers, and the original field No's for the samples studied by you occur in brackets behind the new rock sample card number e.g. No 2721 (116F). The 12 thin sections have been resubmitted to you for your comment to the following problems.

From field evidence there appears to be 10 main groups. These are discussed below:-

GROUP 1

Biotite feldspar quartz porphyry. The porphyries range from uncleaved to cleaved.

(a) Uncleaved biotite feldspar quartz porphyry represented by No's 2507 (63), and 2621 (113).

(b) Moderately cleaved biotite feldspar quartz porphyry, represented by No 2522 (30).

(c) Cleaved biotite feldspar quartz porphyry represented by No 2622 (114).

Please comment on rock samples 2583 (93) and 2602 (71) and discuss whether rocks are fragmented biotite feldspar quartz porphyry due to shearing, rather than crystal and lithic crystal tuffs. Also refer to group 2.

GROUP 2

Biotite feldspar quartz porphyry with various degrees of shearing, alteration and silicification?

(a) Biotite feldspar quartz porphyry with minor alteration and shearing, represented by No 2507 (63).

(b) Sheared biotite feldspar quartz porphyry represented by samples No's 2527, 2551, 2541, 2576, 2577, 2527, 2511, 2585, 2546, 2560. Some samples appear to show flow, and may represent a lava e.g. No's 2527, 2541 and 2511. Other samples appear to show silicification or flow e.g. No's 2546 and 2560. Many samples appear to be fragmented by shearing, rather than representing a lithic crystal tuff. Please give a brief thin section description of each sample, and discuss the comments given above. Compare with group 1 and discuss any differences.

GROUP 3

Biotite feldspar quartz porphyry with various degrees of argillic alteration. In hand specimen, these rocks are dark coloured, and the feldspars have a dark green waxy appearence.

(a) Biotite feldspar quartz porphyry with minor argillic alteration represented by No 2507 (63).

(b) Biotite feldspar quartz porphyry with extensive argillic alteration represented by No's 2502 (2), 2764 and 2739. Sample No 2764 shows selective alteration, and sample No 2739 appears to be silicified. Please give a brief thin section description of each sample and discuss the comments given above.

GROUP 4

A group of lithic crystal tuffs represented by No 2536 (14A). After considering group 1 and 2 please comment on the differences of No's 2583 (93), 2602 (71) and any possible lithic crystal tuff of group 2.

GROUP 5

A group of volcaniclastic sediments represented by No's 2590 (100), 2594 (104) and 2596 (106). Please give a brief thin section description of samples No's 2539 and 2597 and comment of the following:-

(a) Do samples No's 2539 and 2597 appear to be related? i.e. do the rocks belong to the same suite of rocks?

(b) Are samples No's 2539 and 2597 finer grained eqivalents of 2590 (100), 2594 (104) and 2596 (106).

(c) Confirm sample No 2597 contains ultra fine sulphides in its matrix.

Give a brief thin section description of samples No's 2588 and 2593 and comment on whether this group of rocks belongs in group 1,2, or 3.

GROUP 6

A group of lithic crystal tuffs of andesitic composition represented by No's 2721 (116F) and 2740. Please give a thin section description of No 2740 and discuss differences between No's 2721 (116F) and 2740.

GROUP 7

A fine grained lava, possibly of rhyodacitic composition. This rock contains small quartz phenocrysts and minor pyrite. It is found close to group 6 type rocks. Please give a thin section description and discuss differences with group 6.

GROUP 8

A fine grained lava, possibly of rhyolitic composition represented by No's 2684, 2659 and 2702. Please give a thin section description and discuss difference between 2684, 2659 and 2702 and group 7.

GROUP 9

A fine grained lava, possibly of dacitic or rhyodacitic composition. Please give a thin section description and discuss difference with group 8 and group 9.

GROUP 10

A group of lithic crystal tuffs represented by No's 2646, 2657 and 2692? (may be lava related to 2702?). Sample No 2648 is a lithic particle which may be a chert or a fine grained rhyolite. Please give a thin section description and discuss differences.

We would appreciate if you could undertake this work soonest please as field geologist is being transferred to Northern Territory next month.

Regards,

R. Van Den Bogaart.
GEOLOGIST.

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MINERALOGICAL REPORT NO. 2184

3rd August, 1977.

TO:

Mr. M.C. Rogers
Geopeko Ltd.,
P.O. Box 598,
DEVONPORT. Tasmania 7310

Attention: Bob vanden Bogaart

YOUR REFERENCE: Letter from Bob vandenBogaart dated 18/7/77.
Order No. KP 1227

MATERIAL: Rock samples from Northern Tasmanian exploration areas

IDENTIFICATION: No. 2511 to 2765

WORK REQUESTED: Brief descriptions, and detailed comments, (including correlation with samples in previous report 2104), as raised in your covering letter.

SAMPLES & SECTIONS: Returned to you at above address

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COMMENTS

Your covering letter allocates most samples in this suite to 10 Field Groups, and requests detailed comments regarding comparisons variable within and between these groups, and with samples described in report 2104. Unfortunately I am not in all cases quite clear as to exactly which samples precisely represent a given field group, thus some of the suggested comparisons of individual samples, may not prove meaningful in field group terms.

Therefore I have objectively grouped the rocks in this suite according to their petrological characteristics with the hope that these petrological groupings may have some meaning in terms of the field representation of the samples.

Following this I attempt to answer your specific questions relating to Group 1 through to Group 10, according to the order laid out in your letter.

PETROLOGICAL GROUPINGS

The following groupings are essentially a distinction between tuffs, lavas, and tuff-lavas. There are also several representatives of pyroclastic sediments in the suite. These rock types may be briefly defined as follows:

Tuffs are volcaniclastic rocks composed of an accumulation of primary volcanic material including volcanic rock fragments; volcanic glass (as fragments or as a compacted and variably flow textured matrix); crystal fragments (angular and broken), or whole crystals of volcanic origin. In this suite, the matrix generally consists of cryptocrystalline silica-clay-sericite ± chlorite glass alteration products, with relict textures after the various forms of glass.

The coarse components generally have essentially the same, predominantly quartz-crystal and altered glassy composition, and are generally fairly well sorted.
To a large extent these components have been produced by explosive ejection from a volcanic vent. They are commonly vaguely layered.

Lavas are effusive rocks, with a relatively more homogeneous composition, and with relatively more ordered flow features and cooling history than is characteristic of pyroclastics. In this suite they generally contain (whole) subhedral, euhedral to subrounded and embayed quartz phenocrysts, euhedral felspar phenocrysts ± coarse biotite and rarely hornblende crystals. These are generally more randomly, but evenly distributed, and generally less abundant than the crystals, or crystal fragments in the tuffs. The groundmass is more homogeneous than the tuff matrix and generally microcrystalline. The ubiquitous felspar component in the groundmass is generally argillised and sericitised, and evenly intergrown with the microcrystalline quartz mosaic. Rare flow textures may be retained.

Tuff-lavas, have the petrological characteristics of both tuffs and lavas, and may be considered synonymous with the term pyroclastic-flows. These may be defined as a turbulent mixture of gas and pyroclastic materials, of high temperature, ejected explosively from a crater or fissure, that then flows swiftly down the slopes of a volcano and along adjacent ground surfaces.

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In this suite they consist of minor coarse (whole) quartz and felspar phenocrysts and flow textured microcrystalline groundmass, (as in lavas), but with a relatively greater abundance of finer broken tuff crystal fragments, and a texturally confused, altered glassy matrix including shards (as in tuffs). Small discrete fragments of diffuse cryptocrystalline quartz mosaic (devitrified glass), and/or sericitised glass fragments, are also fairly common as inherent lithic components.

Pyroclastic sediments, are characterised by inter-bedded, coarser and relatively finer volcaniclastic detritus and may be reworked tuffs. Beds of shale-size tuffaceous material are called tuffite.

SUMMARY COMMENTS ON NOMENCLATURE AND ROCK IDENTIFICATION

All of the facies defined above may have a superimposed cleavage due to shearing. Generally however shearing is only moderate, causing similar orientations of sericite alteration products through the groundmass, or matrix. The coarser components (e.g. quartz tuff crystals and/or phenocrysts) may be moderately stressed but they are not fractured or recrystallised.

This shearing is most apparent in the lavas and tuff-lavas in field group 2b, but it appears to be divorced from primary rock composition.

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It is emphasised that distinction between these rock groups is almost exclusively only possible by thin section examination. It is also emphasised that no single field group (except perhaps the 'pyroclastic sediments'), is composed of a facies which is exclusive to that group.

The universal (silica) clay-sericite alteration in the lava-groundmass, and in the tuff-matrix, the pseudo-porphyritic appearance of the coarser tuff crystals and the superimposed cleavage (unrelated to primary facies), generally prohibits the distinction between tuffs, lavas and tuff-lavas in hand specimen.

The gross composition of the entire suite is "acid", varying from rhyolite to rhyodacite. Rarely some contain anomalously high hornblende or secondary chlorite content which superficially indicates "andesitic" affinities. Essential quartz phenocrysts in these samples however tends to make them dacitic. Since primary felspar is almost completely altered, the relative abundance of K-felspar to plagioclase cannot be ascertained, thus precise subdivisions between rhyolite and rhyodacite is generally not possible on the basis of felspar content.

The overwhelming conclusion from the above comments, considered together with the predictably very close genetic inter-relationship and gradational nature of these lavas, tuffs and tuff-lavas, is that there are likely to be enormous problems in individual rock identification, field mapping and definitions of units. Conceivably the volcaniclastic sediments however, are easier to distinguish, and may be expected relatively more distal from the volcanic centres.

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INDIVIDUAL PETROLOGICAL GROUPINGS (according to the above definitions)

Lavas (generally microporphyritic in quartz and plagioclase ± biotite).

2511	minor coarse biotite, weakly sheared
2527	rare coarse biotite, weakly sheared
2541	minor coarse biotite, moderately sheared
2560	highly glassy, groundmass, weakly sheared
2585	dacitic glassy lava, selectively silicified biotite and plagioclase, minor carbonate alteration.
2659	flow textured porphyritic rhyolite, not sheared.
2672	plagioclase porphyry lava, moderately sheared
2684	porphyritic rhyolite not sheared
2740	hornblende rhyolite lava (unaltered)
2764	biotite rhyolitic lava
2765	quartzo-felspathic lava
(2) 2502	biotite dacitic lava
(30) 2522	minor biotite, moderately sheared
(63) 2507	minor chloritised biotite (unaltered)
(93) 2583	minor biotite, dacitic, moderately sheared gradational to glassy tuff-lava
(113) 2621	minor biotite, not sheared
(114) 2622	moderately sheared equivalent of 2560

<u>Tuff-lavas</u> (generally coarse quartz, lesser altered plagioclase minor biotite, with a distinctive altered, vitric matrix)

2546	chloritised biotite extensively sheared
2551	altered biotite, weakly sheared
2576	weakly sheared, includes lithic fragments
2577	chloritised biotite, includes lithic fragments
2588	moderately sheared
2664	(lithic) vitric with chloritised biotite dacitic matrix
2692	vaguely layered, not sheared
(14A) 2536	lithic crystal vitric tuff-lava, weakly sheared
(100) 2590	gradational to crystal vitric tuff
(104) 2594	as for (100) 2590

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Tuffs (generally lithic, quartz-crystal, vitric tuffs).

2593	quartz crystal vitric tuff or tuff-lava, contains shards
2657	vitric tuff breccia
2702	lithic quartz crystal vitric tuff
2739	coarse tuff or volcanic breccia of silicified rhyolite, epithermal quartz-chlorite veins
(71) 2602	crystal vitric tuff or tuff-lava with shards
(100) 2590	dacitic lithic crystal tuff, gradational to tuff-lava
(104) 2594	as for (100) 2590
(116F)2721	crystal vitric tuff with exact same mineralogical composition as 2740

Volcaniclastic sediment (gradational to tuff)

2539	tuffite in contact with acid volcaniclastic sand
2646	tuffite in contact with lithic quartz crystal tuff or volcaniclastic sand
2648	quartz crystal vitric tuff in contact with ? silicified tuffite
2697	? reworked tuff, accessory fine dispersed pyrite
(106)2596	coarse volcaniclastic sediment (?gradational to crystal tuff of (100) and (104) type).

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COMMENTS ON QUESTIONS RAISED IN YOUR LETTER OF 18/7/77

(1) Sample 2583 (93) was re examined in the light of the larger suite of rocks, and classified as a (biotite) quartz porphyry, or glassy rhyolitic lava, strongly porphyritic in quartz, and with a moderately sheared groundmass; rather than the initial interpretation of crystal tuff given in report 2104. (This is essentially the only rock reclassified in report 2104).
Sample 2602 (71) remains a crystal vitric tuff, with an altered, highly vitreous groundmass, including shards. It has only a weakly sheared (cleaved) groundmass.
Both rocks have equivalents in field group 2.
Several large quartz phenocrysts in 2583 (93) are fractured and silicified in-situ, but apart from this minor tectonism there are no significant fragmental characteristics, and certainly none which may be due to shearing.
Both samples 2602 and 2583 contain less biotite than appears to be implied in the naming of field groups 1 and 2.

(2) Sample 2507 (63) which is listed in field group 1, 2a and 3 is a (hornblende) biotite felspar quartz porphyry, with a microcrystalline quartzo felspathic groundmass. The mafic components show selective chlorite-epidote alteration, the felsic components are essentially unaltered and unsheared. The rock is a lava of rhyodacitic composition, and appears to have several equivalents in group 2(b), but in that group the felspars are largely replaced by clay-sericite, compared to the "fresh" felspars in this sample.

...9

(3) The large field group 2b includes mainly lavas, with minor tuff-lavas, all of rhyolitic to rhyo-dacitic composition. They are variably sheared with no correlation between the development of cleavage and primary rock type. Both facies may show evidence of flow as described in their definitions above. None show significant fragmentation, either primary, or due to superimposed shearing. Silicification is negligible, except perhaps for devitrification of primary glassy matrix plus sericite ± chlorite glass alteration. There are no lithic tuffs in field group 2.

Similarities between individual samples as listed in your letter in group 2, with group 1 rocks may be found in the petrological rock groupings outlined above. The following more detailed petrological groupings apply.

(a) porphyritic, rhyolitic lavas (± biotite):
2511, 2527, 2541, (63) 2507

(b) porphyritic rhyolitic lavas with finer, generally more sheared groundmass:
2560, (30) 2522, (113) 2621, (114) 2622

(c) quartz crystal vitric tuff-lavas:
2576, 2577, 2588, 2593

(d) quartz crystal vitric tuff-lavas, (? transitional to lavas):
2546, 2551, 2585.

(4) Sample (2) 2502 has more affinities with the (biotite) porphyritic rhyolite facies in group 2b than with the other samples listed in your field goup 3.
Sample 2764 is of similar composition, but more felsic and more finely porphyritic. Sample 2739 is a tuff or volcanic breccia and not a lava, it is indeed partly silicified by epithermal quartz veins, ± chlorite.

(5) Sample 14A has many affinities with the tuff-lava group 2576, 2577, 2588 and 2593 listed under field group 2b. Sample (93) 2583 is different, in that it is a coarse porphyritic lava (albeit with in-situ fractured quartz (phenocrysts). Sample (71) 2602 is classified as a quartz crystal vitric tuff, largely by virtue of devitrified glass shards in the matrix.

(6) Samples 2539 and 2697 are related in that they may be confidently included in the same "volcaniclastic-sediment" petrological group defined above. There is no diagnostic evidence that they are fine-grained equivalents of (100) 2590, (104) 2594 and (106) 2596, (however samples (100), (104) and (106) are very similar and probably very closely related). Conversely, there is no evidence that the fine tuffs 2539 and 2697 are not, fine equivalents of (100), (104), (106).

(7) Sample 2588 and 2593 are similar (albeit allocated to separate petrological groups above). Certainly they have numerous affinities with the large field group 2b, but also they are similar to samples in groups 1 and 3. As explained above the various field groups are simply not made up of facies which are mutually exclusive from other groups.

(8) Samples (116F) 2721 and 2740 have the same highly characteristic composition within the suite in that they contain essential hornblende. Sample (116F) 2721 however is a tuff, and 2740 is a lava.

...11

(9) Sample 2765, representing field group 7, is a quartz-felspathic lava, objectively it has no petrological affinities at all with field group 6 rocks 2721 and 2740. This sample also has no detailed textural or compositional affinities with group 8 samples 2684, 2659 and 2702.

(10) Samples 2672 and 2664 which represent field group 8, (sample 2668 is missing), are similar in that coarse single crystal quartz grains are absent, even though the former is a plagioclase porphyritic lava, and the latter a dacitic tuff-lava. These differ substantially from the distinctively quartz porphyry, rhyolitic lavas 2684, 2659 and the quartz crystal lithic tuff 2702.

(11) The fine tuff detritus forming part of 2646, and most of 2648 has essentially the same composition and is identified as tuffite. Sample 2648 is silicified. The coarser pyroclastic sand in 2646 is quite distinctive and similar to the coarser component in 2539. The quartz crystal tuff 2692 has no detailed affinity with the other samples you list as representing field group 10.

2511: biotite felspar quartz porphyry (lava), weakly sheared, with clay sericite alteration of felspar

Group 2b. phenocrysts and through groundmass

Large phenocrysts of quartz (30%), felspar (plagioclase) (35%) and quite coarse flakes of oxidised biotite (10%), are randomly disposed through a fairly homogeneous, microcrystalline groundmass. Accessory relict orthoclase phenocrysts are also present.

The quartz crystals are stressed and rarely fractured but not recrystallised or dislocated. The plagioclase phenocrysts are completely replaced by (potassic) clay-sericite pseudomorphs, which are vaguely attenuated in a common plane due to moderate shear.

The groundmass consists predominantly of fine quartz mosaic which appears to be a primary component. Subordinate sericite is evenly dispersed through intergranular areas, also in variably continuous streaks representing incipient shear planes. This sericite appears to replace primary groundmass felspar, in the same manner in which the phenocrysts are replaced. Minor relich fine potash felspar is also dispersed.

Small euhedral, oxidised, magnetite crystals (5%) are randomly scattered.

This porphyry has a gross granodioritic (rhyodacitic) composition, almost certainly it is a lava.

2527: biotite felspar quartz porphyry (lava) of rhyodacitic composition, very weakly sheared, but fairly extensive clay-sericite replacement

Group 2b. of felspars

Large subrounded and embayed quartz phenocrysts (25-30%), felspar (plagioclase) phenocrysts (30-35%), and quite coarse flakes of biotite (7-10%) are scattered with vague, primary (flow) alignment, through a homogeneous microcrystalline groundmass. Accessory relict potash felspar phenocrysts are present.

The quartz phenocrysts are stressed, but generally not fractured, and certainly not recrystallised. Plagioclase phenocrysts are completely replaced by clay-sericite, which is locally slightly sheared, out. Trace fine secondary biotite accompanies some clay-sericite. The coarse primary biotite is weakly chloritised, argillised and oxidised.

The groundmass consists predominantly of microcrystalline quartz mosaic, minor sericitised-argillised (plagioclase) felspar, and minor relict potash felspar. The sericite locally forms streaky lenses indicating incipient shearing.

Accessory, small oxidised magnetite is scattered.

This is a rhyodacitic lava.

2539: (lithic) plagioclase-quartz crystal tuff, intercalated with highly tuffaceous shale, or "tuffite".

Group 5.

Within the limiting size of this sample, this rock is seen to be layered on a scale of about 20mm. The most distinctive layer is characterised by small (0.02 to 1mm), subrounded and broken, volcanic quartz crystals, lesser plagioclase crystals, accessory discrete flakes of chloritised biotite and rock fragments. These are scattered but vaguely layered within a homogeneous, compact mass of cryptocrystalline. silica mixed with clays, extremely fine sericite and chlorite and silt-size quartz ash.

One layered part of this matrix is enriched in cryptocrystalline potash felspar.

This layer grades into the majority of the rock which has essentially the same composition as the matrix material described above. Layering in this domain is manifest as parallel, variably continuous trains of fine quartz ash, and braided foliae of ultrafine chlorite sericite. Most of this fine material appears to be derived from altered volcanic glass, and is essentially a highly tuffaceous shale, or "tuffite". The coarser intercalated layers are (lithic) plagioclase-quartz crystal tuff.

2541: biotite felspar quartz porphyry (lava), moderately sheared, advanced clay-sericite alteration of plagioclase phenocrysts; groundmass enriched in potash felspar, but also sericitised

Group 2b.

This is similar to 2511 and 2527 above, with the notable exception that the groundmass is more sheared and is distinctly potassic.

Large subrounded and deeply embayed phenocrysts (35%) are stressed and rarely fractured but not recrystallised. Coarse oxidised biotite phenocrysts (10%) are randomly scattered, some with similar orientation, but they are not deformed. Former plagioclase crystals (30%) are represented by sheared out, lenses and concentrated shredded streaks of clay-sericite.

All of these components occur in a groundmass composed of a loosely packed aggregate of fine, quartz mosaic, within a matrix of clouded, cryptocrystalline potash felspar, and fine shredded sericite along shear foliae. This potash felspar appears to be primary.

Accessory oxidised magnetite crystals are disseminated, rare veinlets of quartz-albite, carrying trace oxidised pyrite are present.

2546: biotite (felspar) quartz glassy tuff lava;
quite extensively sheared with a foliated sericitic and lesser chloritic groundmass

Group 2b.

There are two large quartz rounded and embayed phenocrysts in this slide, as in the porphyries above. Most quartz crystals however, have a maximum size of 1mm, and although some are characteristically rounded and embayed, most are more or less angular, and broken, which is characteristic of tuff-crystal quartz rather than genuine primary effusive components.

These quartz crystals (20-25%), also lenticular to warped clumps of partly oxidised and chloritised biotite (10-15%) ± rare muscovite, and vague sericite pseudomorphs after plagioclase (10%), are all randomly disposed through a rather heterogeneous, very fine groundmass. Rare chloritic patches appear to replace hornblende.

The basis of this groundmass is clouded cryptocrystalline silica and clays. Fairly dense shredded streaks and braided networks of sericite and chlorite throughout are largely alteration after glass. Peculiar fine crenulated and scale-like textures are deformed, primary fluidal textures.

It is difficult to identify this rock as a tuff or a lava, indeed it has characteristics of both. Certainly the quartz crystals appear to be more tuffaceous than the phenocrysts in the porphyries 2511 and 2527.

There is no positive evidence of primary flow, since the planar structures are modified by fairly extensive shearing. However the rock fabric does appear to be due to a combination of flow in a groundmass, which was far more glassy than in most porphyrites above, and of shearing.

2551: biotite felspar quartz,(vitric) tuff-lava; weakly sheared, extensive clay sericite alteration of felspars and through the groundmass

Group 2b.

This is similar to most porphyries above but with slightly more patches of sericite constituting a texturally far more heterogoneous groundmass. It contains quite large, subrounded to embayed quartz phenocrysts, single quartz crystal grains as in 2546, which are probably of tuffaceous origin.

Irregular lenticular to flame-like patches of clays sericite (35-40%) scattered through the groundmass are vaguely commonly aligned. The more compact patches are after plagroclase. The thinner, streaky ones appear to represent completely altered domains in the original glassy "groundmass", and/or incorporated altered glass fragments.

Lesser single, quite coarse muscovite is "spotted" with titaniferous granules, and these represent former biotite (10%).

These components occur in a groundmass of diffuse microcrystalline to cryptocrystalline quartz mosaic, with intimately mixed, extremely fine sericite. Minor patches of fine secondary biotite are scattered.

The rock is interpreted as a glassy tuff-lava, by virtue of the tuff-crystal nature of some finer quartz and the confused composition of the matrix. It is weakly sheared, with extensive, clay-sericite-muscovite alteration; and may be considered as a weakly sheared equivalent of 2546.

2560: (felspar) quartz,porphyritic, highly glassy lava, extensive clay-sericite alteration; weakly sheared. Group 2b.

Subrounded and embayed quartz phenocrysts (20%), and minor, generally smaller, clay-sericite pseudomorphs after plagioclase, are scattered through a groundmass of cryptocrystalline silica with intimately intergrown sericite, and dispersed ultra fine chlorite.

The shredded, lenticular, streaky nature of the sericite through the groundmass, including fairly distinct fiamme structures indicates an original, highly fluidal glassy composition. The silica is essentially devitrified glass.

In this respect it is very similar to 2546, but it is less sheared, contains apparently less plagioclase, and no biotite.

Accessory fine magnetite is disseminated.

2576: moderately sheared, quartz crystal (vitric) tuff lava, with clay-sericite alteration widespread through the groundmass,

Group 2b.

This rock has a somewhat more heterogeneous composition and texture than the porphyries above. Coarse quartzose grains (up to 3mm) consist of subrounded and embayed phenocrysts, (5-7%); smaller angular single crystal grains (15%); and discrete fragments of diffuse microcrystalline quartz mosaic (15%), which represent devitrified glass, (rhyolitic groundmass).

Patches of clay-sericite are fairly wide-spread. Some of these are pseudomorphous after plagioclase crystals, some are completely altered fragments of glass, also, shredded lenticular patches replace fiamme-like domains in an original vitreous and probably flow matrix. Moderate shearing contributed to the alteration and attenuation of these domains. Minor biotite replaced by chlorite and/or quartz is scattered.

All of these components occur in a matrix of turbid cryptocrystalline quartz, clouded by ultrafine chlorite and sericite, which are the alteration and products of glass.

The rock has a gross rhyodacitic composition, and confused textural characteristics of both tuff and lava.

2577: moderately sheared, biotite felspar quartz crystal, (vitric) tuff-lava, with an argillised - sericitised glassy groundmass

Group 2b.

This rock is rather similar to 2576, but it is characterised by felspar crystals remaining partly preserved, Coarse components consist of:

subrounded and embayed quartz phenocrysts	10 - 15%
generally finer and more angular single crystal quartz grains	15%
single plagioclase crystals, corroded, sericitised argillised and selectively limonite stained	12 - 15%
coarse biotite crystals, chloritised $\pm$ clays,quartz and Fe-Ti granules	10%
fragments of sericitic microcrystalline quartz mosaic (as in 2576)	5 - 7%

These are all randomly disposed, to vaguely bedded, through a groundmass of cryptocrystalline quartz, crowded with streaky, braided and shredded lenses of fine sericite $\pm$ minor chlorite. This very largely reflects a flowed, primary glassy groundmass, and partly a superimposed shearing.

Some discrete ?breccia areas in the altered glass selectively enclose coarser components. Thus the rock has incipient volcanic breccia characteristics, but it cannot be ascertained if these are of flow or pyroclastic origin.

262118

2585: Porphyritic dacitic glassy lava; biotite and minor hornblende replaced by quartz, chlorite, carbonate, plagioclase phenocrysts by quartz, clay-sericite ± carbonate; altered glassy groundmass largely as in rocks above.

Goup 2b

This rock may be given the general primary name as most other porphyritic rocks in the suite, but in petrographic detail it is somewhat different, due largely to the presence of hornblende, carbonate alteration, and selective silicification of coarse biotite. It is a glassy lava; phenocrysts consist of:

subhedral - subrounded and embayed quartz	10 - 15%
coarse biotite flakes replaced by chlorite and quartz, carbonate,	15 - 20%
euhedral plagioclase crystals, replaced by quartz, ± clay-sericite and carbonate, rarely with residual relicts,	10 - 15%
hornblende crystals, replaced by chlorite ± carbonate ± quartz.	7 - 10%

These components are fairly evenly distributed through a groundmass of diffuse, microcrystalline quartz mosaic crowded with fine dispersed and abundant shredded streaks of sericite and minor chlorite. It is an altered glassy groundmass.

The plagioclase laths and biotite flakes have a very definite common alignment due to flow.

2588: moderately sheared, quartz crystal (vitric) tuff-lava, with clay-sericite alteration widespread through the groundmass

Group 5?

This rock is so similar in composition and texture, to 2576, that a separate description is not warranted. It is primarily a felspar quartz porphyritic lava, with abundant, finer, broken quartz crystals of tuffaceous origin, in a moderately sheared, heterogeneous matrix of altered, siliceous (rhyodacitic) glass. It contains numerous (15%) fairly discrete "patches" of fine quartz mosaic ± sericite, which are interpreted as devitrified glass or volcanic groundmass fragments.

2593: mica quartz crystal tuff, or tuff-lava, with a weakly sheared and moderately altered glassy matrix, and minor fragments of devitrified glass.

Group 75

This is a fine porphyritic rock which like numerous samples above has a weakly sheared, highly glassy matrix. Single crystal quartz grains (15-20%) up to 1.5mm are variably subrounded and embayed, with more abundant, smaller grains generally angular (broken).

Minor fragments of diffuse, microcrystalline quartz mosaic (devitrified glass), and accessory quite coarse crystals of muscovite, (? after biotite) are also scattered throughout.

The glassy matrix shows patchy domains of devitrified silica, including apparently deformed groups of shards and vitric fragments. These are contained within a hetrogeneous mass of cryptocrystalline silica crowded with streaky-shredded sericite and minor ultra fine chlorite.

This is an acid tuff or tuff-lava of gross rhyodacitic composition.

2646: layered quartz crystal, lithic tuff, in contact with "tuffite" composed of a compact mass of glass alteration products

Group 10

This rock shows two volcaniclastic facies of distinctly different grain size in contact. The limited size of the sample doesn't allow the smaller area of finer facies to be positively identified as a bed, or incorporated fragment, however the former seems most likely. The coarser facies is similar to some of the fine tuff-lavas described above, but its mode of occurrence in this sample confirms its predominantly pyroclastic origin, however some lava characteristics are also retained.

The coarser facies consists largely of a loosely packed aggregate of quartz crystals, variably euhedral, subrounded, embayed broken, and angular, fragments of sericitised rhyolite, also of quartz micro mosaic representing devitrified glass and/or groundmass, and irregular patches of sericite. These occur in a heterogeneous matrix of sericitic and siliceous glass alteration products.

It is this matrix of altered glass which continues to form the finer facies, which contains in addition, very fine broken (angular) fragments of quartz.

The rock is sheared, with weak discontinuous foliae cutting across the contact at right angles.

<u>2648</u>: quartz-crystal vitric tuff, in contact with siliceous "tuffite"

Group 10

This is similar to 2646 in that two volcaniclastic facies are represented. A small part of the rock consists of a quartz crystal vitric tuff. This is adjacent to and closely, genetically related to a mass of cryptocrystalline quartz, densely clouded by clays and ultrafine sericite, with minor disseminated extremely fine tuff quartz fragments.

By comparison with domains of similar composition in 2646 and to a lesser extent in 2539, the major portion of this rock may be classified as a siliceous "tuffite". It is not a rhyolite, "chert", or the typical micro-mosaic of volcanic exhalative silica.

Quartz veins of related volcanogenic origin are continuous through the coarser tuff and finer tuffite.

<u>2657</u>: altered vitric tuff-breccia
Group 10

This rock consists of a mass of glass alteration products, with relict textures of individual blocks of the same vitric composition fused together in the one mass.

Basically the various ghost-like "breccia" domains, are individually flow textured, and consist of diffuse microcrystalline to cryptocrystalline quartz mosaic, crowded with shredded, streaky braided networks of clay-sericite.

Accessory small tuff quartz crystals are randomly scattered. Irregular veinlets of epithermal quartz meander through the rock.

2659: fine (quartz-plagioclase) porphyritic rhyolite, advanced, selective sericitic alteration of plagioclase phenocrysts

Group 8

This is a homogeneous finely porphyritic lava.

Subrounded to subhedral and embayed quartz phenocrysts (20%) and euhedral plagioclase crystals (15-20%) are evenly disposed through a variably microcrystalline to cryptocrystalline groundmass.

The plagioclase crystals are extensively microfissured and sericitised. Minor shredded flakes of chloritised biotite are present.

The groundmass consists essentially of quartz and potash felspar (highlighted by staining). It shows well formed fluidal (flow) textures, relatively undeformed by superimposed tectonic modification.

2664: (lithic) vitric tuff-lava composed predominantly of flow-textured, biotite-rich dacitic glassy matrix

Group 9

This rock has a matrix (or groundmass) of complex, streaky to contorted, turbid and extremely fine quartz-sericite with subordinate chlorite, including quite abundant oxidised chloritised biotite and attenuated lenses of altered glass.

Minor quite discrete fragments of sericite (and/or pyrophyllite), and minor discrete fragments of devitrified glass are scattered.

The rock is distinguished from almost all others in the suite by the almost complete absence of single quartz crystal grains, of either phenocryst or tuff origin. Also its biotite-chlorite content is higher than normal.

NOTE: Sample 2668 reported by telegram to be in group 9 was not included in the samples received.

2672: moderately sheared, fine plagioclase porphyry (lava)

Group 9

This is a homogeneous fine porphyritic lava. Euhedral phenocrysts of plagioclase (10-15%), up to 3mm are evenly disposed, locally in clumps, through a homogeneous microcrystalline groundmass. These plagioclase phenocrysts are stressed and show minor sericite-limonite alteration. Accessory (<5%), small rounded and embayed quartz phenocrysts are also present but substantially less than in other rocks in the suite.

The groundmass consists of fine quartz mosaic, with an intimately intergrown, shredded, extremely fine network of sericite and minor chlorite, apparently largely sheared and retrograded groundmass felspar.

This is a lava with a gross rhyodacitic composition, but abnormally deficient in quartz phenocrysts.

<u>2684</u>: plagioclase-quartz porphyry, rhyolite lava; widespread clay-sericite-carbonate alteration through the groundmass

Group 8

Phenocrysts of euhedral plagioclase (10%), rounded and embayed quartz crystals (15-20%) are randomly disposed through a homogeneous, diffuse microcrystalline groundmass. The plagioclase crystals are extensively sericitised, and are generally surrounded by reaction xims.

The groundmass consists predominantly of quartz, with minor to subordinate ultra fine clay-sericite, and extremely fine granular carbonate dispersed throughout. There is no evidence of shearing.

2692: quartz crystal, vitric, tuff-lava of gross rhyolitic composition

Group 10

This is a pyroclastic flow rock, with characteristics of both tuff and lava. Subrounded and deeply embayed quartz phenocrysts (20-25%) about 3mm across, are evenly distributed, but roughly layered in a texturally very heterogeneous altered glassy matrix.

Most of this matrix consists of cryptocrystalline silica intimately mixed with ultrafine clay-sericite, which define a variety of confused, compacted fluidal textures, including shards.

Abundant (20-25%), small angular broken quartz-crystal fragments are also roughly layered through this groundmass.

There is no clear evidence of shearing.

2697: fine, quartzose volcaniclastic sediment (? reworked tuff), fine matrix of glass alteration materials contains accessory disseminated pyrite

Group 5

This is indeed a volcaniclastic sediment as noted in your covering letter. It consists of a non bedded, rather poorly sorted and variably loosely to tightly packed aggregate of quartz grains (35-40%) within irregular domains of variable concentrations of extremely fine quartz-clay-sericite.

The coarser quartz grains are almost certainly fragments of the (volcanic) phenocrysts and tuff quartz common to many samples through the suite. The matrix is composed of glass alteration products, also common to many samples through this suite.

Accessory coarse flakes of chlorite, grains of tourmaline zircon and titaniferous grains are scattered.

An examination of a polished slab indicates that fine (0.02mm) pyrite (3-5%) is also dispersed. This occurs mainly as minute euhedral crystals fairly commonly in clusters to form framboids.

2702: lithic, quartz-crystal vitric tuff, of gross rhyolitic composition

Group 8

This is a pyroclastic rock fragments of altered glassy groundmass material enclosing small quartz phenocrysts (30-35%), and abundant fractured volcanic quartz crystals (30%) of various size are commonly aligned, and roughly layered through an altered glass matrix.

This rock matrix consists of cryptocrystalline quartz with patchy domains of clay-sericite which define confused compacted-flox textures including vague shards.

In view of the abundance of lithic fragments and of fractured tuff-quartz crystals, and negligible 'genuine' phenocrysts this rock is classified as a tuff rather than tuff lava, however the vitric matrix is essentially the same as in the tuff-lavas in this suite and thus the whole rock is also closely related to them.

2739: stressed and brecciated, quite coarse tuff or volcanic breccia of gross silicified rhyolite composition, invaded by epithermal quartz and chlorite through interfragmental areas

Group 3

This is a pyroclastic fragmental rock.

Loosely packed angular fragments of glassy rhyolite, variably tuffaceous, vesicular and finely porphyritic form the essential rock fabric. These fragments are also silicified, and to a lesser extent chloritised.

The areas between these fragments consist of similar material, also abundant veins of epithermal quartz with associated quite coarse spherulitic chlorite. Patches of this same quartz and chlorite are randomly scattered.

Several rather isolated large quartz crystals are quite extensively stressed, and fractured indicating tectonic disruption, superimposed on the primary, pyroclastic fragmental fabric.

2740: hornblende rhyolite lava, essentially unaltered
Group 6

The abundance of hornblende crystals in this rock (30%) and the resultant darkish colour does suggest andesitic affinities as suggested in your covering letter, however the essential quartz phenocrysts (20%) indicate a relatively more acid rock.

These quartz and hornblende phenocrysts are evenly distributed, and commonly flow aligned, together with crystals of potash felspar (10%), lesser plagioclase and biotite, through a matrix of cryptocrystalline (glassy), quartz, potash felspar and very fine chlorite. Accessory quite coarse apatite crystals are also present.

The rock is a porphyritic lava with the composition of a hornblende rhyolite. It is essentially unaltered.

2764: biotite quartz-felspar (rhyolitic) lava, with porphyritic domains (? possibly a resorbed xenolith); extensive clay-sericite alteration of felspars (phenocrysts and groundmass), extensive chloritic alteration of biotite

Group 3

Most of this rock consists of "porphyry" with phenocrysts of subrounded and embayed quartz (10%), of euhedral plagioclase (20-25%) and randomly disposed through a microcrystalline quartzo-felspathic groundmass. The plagioclase crystals are completely pseudomorphically replaced by sericite. The biotite is virtually completely replaced by chlorite ± muscovite and titaniferous granules. Groundmass plagioclase is also virtually completely replaced by turbid clay-sericite.

This major porphyritic domain grades into lesser non-porphyritic areas of rock composed essentially of biotite quartzo-felspathic, microcrystalline groundmass. In these the biotite is chloritised and/or argillised. The felspar is argillised-sericitised.

It is difficult to confirm the genetic relationship between these two phases in such a small sample, but it seems that the porphyry may be a largely resorbed xenolith in a finer lava.

2765: quartzo felspathic lava, weakly micro porphyritic in quartz and sericitised felspar; with extensive clay-sericite attenuation of groundmass felspar

Group 7

The limited abundance of small subrounded and embayed quartz phenocrysts (10%), and the general homogeneity of the groundmass in this sample, indicates that it is a lava. Minor patches of relatively concentrated clay-sericite (10%) appear to replace original plagioclase phenocrysts.

The groundmass consists of primary microcrystalline quartz mosaic, with intergranular and rather diffuse patches of clay-sericite which has formed from primary groundmass felspars originally intergrown with the quartz mosaic.

There are no common orientation, streaky or attenuated structures, and thus no evidence diagnostic of primary flow, or of superimposed shearing.

Accessory small limonite spots appear to be after pyrite.

Note: Outcrop sample taken from a road aggregate quarry just south of E.L. 10/74 boundary. Position not plotted on base map.

GEOPEKO LIMITED
(Incorporated in New South Wales)
Phone: (02) 498 4566

INTER-OFFICE MEMO

Gordon, 22nd July, 1977

Our Ref.:

Your Ref.:

cc K. WRIGHT
R.L. RICHARDSON

From: G.H. SHERRINGTON AND S. GATEHOUSE

To: M.C. ROGERS

GEOCHEMISTRY, MARINER 1, EL 10/74
INTERIM REPORT ON 21.7.77

This memo is written from data given on grid maps for Cu, Pb, Zn, Mn and depth of sample; from stream sediment results; and from preliminary geological maps.

1. Stream sediment results

Attention is drawn to the creek which joins the Iris River at AMG 413550 E and 5400 200 N. The lead values from source to junction are 160, 180, 1480, 1280 and 1680 ppm respectively. Zinc shows a similar increase. The gradient of the stream is fairly constant. We wonder why the values show a progressive increase. The grid work to date shows a soil anomaly at the top of the creek, up to about 2000 ppm Pb and 300 ppm Zn. Regional mapping puts the creek in olivine basalt for the first half and colluvium for the second half.

A valid inference is that the stream drains a mineralised area, not on the current grid, about half way down its course.

Next, the west arm of the stream which joins the Iris River at 414 750 E and 5,400,400 N has high tin values (to 2000 ppm) and elevated base metal values. This drains an area east of the proposed grid extension.

2. Soil Grid Results

A problem of interpretation arises because of the thin basalt cover over some of the grid, mainly to the West.

We attacked this problem by plotting iron results. Unfortunately we did not have all of the values and so these comments are preliminary. The basalt itself would seem to have an iron content of 10% or more, up to 17%. The QFP would seem to run from 1% to 4% Fe. However, some of the samples analyse between 4% and 10% Fe. Two major ways for this to happen are:

1. These samples represent weathered basalt, depleted in iron.
2. They are a physical admixture, part basalt and part other rock of low iron.

...../2

To test possibility 1, we looked at manganese results. We supposed that if iron was being weathered from the basalt, so was manganese. This is not a foolproof method by any means. The results showed that there was a general increase in Mn in the area mapped as thin basalt and where Fe was 4-10%. Also, when one considers that all the basalt should be about equally weathered at the depth of sampling, one wonders how the lowered iron occurs. We are of the opinion that possibility 2, an admixture, is the case. You will know more of this by having examined the cuttings.

If the admixture theory is correct, there are two further possibilities. The first is that the admixture is colluvium or till above the basalt; the second is that the admixture occured through augering just through the basalt. We cannot tell from here which is most likely. The implications of the latter being correct are most interesting, because those areas mapped as basalt which have 4-10% iron do not sit over mineralisation. The main area is just west of one of the main lead anomalies.

The correspondence of magnetic expression with mapped basalt cover is not good. In the vicinity of the first ACH there is a good match. To the NW of the grid there is a mismatch of 100 m or so, which could be attributed to weathering of the basalt. But then, why should its weathering change so much over such a short distance?

3. Summary

We see many puzzles in the response so far. We are worried about the association of the lead anomalies with the mapped edge of the basalt and wonder about artificial concentrations along the unconformity. We have expressed doubts before about the match of the northern lead anomaly with deeper weathering and bogs.

The doubts expressed are not to be taken as an attempt to downgrade this prospect. Our feelings, in summary, are that we could do harm to the development of the prospect by starting testing too soon. It should be a general aim to test the best part of the prospect and there is reason to believe that we have not yet found the best part.

Our recommendations for future work are:

1. Plot the iron results and define those areas of above 4% iron as possible admixture and those above 10% iron as thick basalt.

2. Enter available geochemistry on paper tape and send to Gordon.

3. Proceed with sampling and geophysics on the grid extension as it appears on the current maps.

4. Extend the grid 300 m further east to test the high stream sediment results.

..../3

5. Establish a rough grid between 9700 E and 10,100 E, moving south from the present grid for 400 m. Read this grid with magnetics. Define those areas with assumption of thick basalt. Sample the rest.

6. In future sampling, investigate the economics of a rig which will penetrate several meters of basalt.

7. Review the geology, geophysics and geochemistry of the completed grid and plan a testing program.

It is to be understood that these recommendations are made from the isolation of Sydney office and may gloss over some local considerations. We are, as always, happy to discuss alternative programs, noting that such discussion should consider reasons for not proceeding to the above plan.

GHS:ps

G.H. SHERRINGTON

S. GATEHOUSE

APPENDIX NO. 4

ANALYTICAL RESULTS

SAMPLE NUMBER		Cu ppm	Pb ppm	Zn ppm	Ag ppm	Mn ppm	Cd ppm	Fe %
KR	2505	30	40	100	(2	910	(2	2.3
	18	20	50	100	(2	330	(2	3.1
	32	5	30	50	(2	220	5	1.15
	37	5	50	190	(2	490	(2	1.8
	44	10	30	80	(2	620	(2	2.8
	49	5	40	20	(2	40	(2	4.9
	59	10	60	150	(2	80	2	25.0
	60	5	50	40	2	110	(2	4.4
	61	5	30	20	2	40	2	3.4
	62	5	30	10	(2	30	2	3.0
	62**	5	30	10	(2	30	2	3.1
	72	15	30	120	(2	370	(2	3.0
	74	10	130	120	(2	740	5	4.5
	75	10	60	65	(2	230	(2	1.4
	78	10	640	20	(2	40	2	1.05
KR	2598	10	50	90	(2	840	2	2.2
KR	2604	10	30	10	(2	30	(2	6.5
	09	15	120	320	2	2700	10	35.0
	16	5	100	40	(2	1400	2	3.1
	45	2	20	10	(2	30	(2	1.02
	62	10	30	15	(2	40	(2	1.1
	66	2	30	10	(2	20	(2	0.38
	77	2	50	30	(2	80	(2	2.0
	80	10	30	60	(2	220	(2	1.45
	86	10	40	40	(2	120	(2	1.5
KR	2697	2	60	10	(2	30	(2	1.05
KR	2697**	2	50	10	(2	30	(2	1.10
KR	2700	10	570	15	(2	20	(2	1.1
	04	10	40	10	(2	30	(2	6.1
	22	20	40	45	(2	380	5	2.2
	28	10	40	30	(2	260	(2	1.7
	29	10	90	110	(2	740	2	2.1
	30	15	290	190	(2	840	(2	2.6
	31	10	60	150	(2	1300	(2	2.6
	32	100	90	320	(2	1220	5	2.0
	33	25	140	50	(2	430	(2	2.2
	34	90	60	310	(2	1850	(2	3.1
	35	120	940	140	(2	620	2	4.1
	36	15	80	60	(2	420	(2	1.9
	37	15	120	120	(2	500	(2	2.5
	38	5	60	100	(2	510	5	2.2
	39	10	400	190	(2	3900	5	7.9
	40	5	50	80	(2	580	2	1.85
	40**	5	50	85	(2	600	2	1.9
	41	15	40	90	(2	560	5	2.4
KR	2742	5	50	60	(2	580	5	1.9

* Denotes duplicate of previous sample.

** Denotes repeat and check

(Denotes less than

SAMPLE NUMBER	Cu ppm	Pb ppm	Zn ppm	Ag ppm	Mn ppm	Cd ppm	Fe %
KR 2743	30	60	85	(2	740	(2	2.0
44	40	750	430	(2	820	(2	6.4
45	2	50	90	(2	1350	(2	2.4
46	30	1880	520	5	4200	2	7.4
47	390	420	70	12	180	(2	3.3
48	20	2950	160	(2	10000	10	1.28
49	45	910	1050	(2	1950	2	6.6
50	5	70	150	(2	770	2	3.1
51	80	960	890	(2	1600	(2	4.8
52	10	240	160	(2	870	2	2.4
53	15	260	240	(2	730	(2	2.6
54	20	230	210	(2	690	(2	2.5
55	10	80	200	(2	3100	5	7.7
56	5	160	90	(2	660	(2	2.5
57	10	100	110	(2	390	2	2.2
58	10	40	110	(2	1350	(2	2.5
59	120	370	170	7	1400	(2	10.5
60	10	70	80	(2	780	2	2.6
61	100	870	370	(2	3300	5	10.0
62	15	80	150	(2	2300	2	6.3
KR 2763	25	260	110	2	540	(2	3.6

ANALYTICAL METHODS: Cu, Pb, Zn, Ag, Cd, Fe by AAS following HCl and HCl/HNO_3 leach in latter stages of 0.25g sample.

* Denotes duplicate of previous sample.

** Denotes repeat and check.

(Denotes less than.

SAMPLE NUMBER	Ba ppm	As ppm				
KR 2505	3000	(5				
18	3000	(5				
32	3000	(5				
37	1000	(5				
44	3000	(5				
49	2000	(5				
59	300	10				
60	3000	(5				
61	3000	(5				
62	2000	(5				
62**		(5				
72	3000	10				
74	3000	(5				
75	2000	(5				
78	3000	(5				
KR 2598	3000	(5				
KR 2604	2000	(5				
09	500	(5				
16	2000	20				
45	1000	(5				
62	1000	(5				
66	2000	(5				
77	2000	(5				
80	3000	(5				
86	3000	(5				
KR 2697	1000	(5				
KR 2697**		(5				
KR 2700	1000	10				
04	1000	(5				
22	2000	(5				
28	2000	(5				
29	2000	(5				
30	2000	(5				
31	2000	(5				
32	2000	(5				
33	2000	(5				
34	1000	(5				
35	500	(5				
36	2000	(5				
37	3000	(5				
38	3000	(5				
39	100	(5				
40	3000	(5				
40**		(5				
41	3000	(5				
42	3000	(5				
43	2000	(5				
44	500	30				
45	3000	(5				
46	300	200				
47	500	400				
48	100	60				
KR 2749	1000	10				

* Denotes duplicate of previous sample.

** Denotes repeat and check.

(Denotes less than.

SAMPLE NUMBER	Ba ppm	As ppm
KR 2750	2000	(5
51	2000	30
52	3000	(5
53	3000	(5
54	2000	(5
55	500	(5
56	2000	10
57	2000	(5
58	500	10
59	2000	100
60	2000	(5
61	300	(5
62	500	(5
KR 2763	1000	30

ANALYTICAL METHODS: Ba determined by Emission Spectrography-Scheme ES 3. As by modified Gutzeit method following Potassium Pyrosulphate fusion of 0.25g sample.

● Denotes duplicate of previous sample.

●● Denotes repeat and check.

(Denotes less than.

APPENDIX NO. 4

ANALYTICAL RESULTS

SAMPLE NUMBER	Au ppb					
KR 2559	(20					
2572	(20					
2700	(20					
2744	(20					
2746	20					
2747	(20					
2748	(20					
2751	(20					
2756	(20					
2759	95					
KR 2763	(20					

ANALYTICAL METHODS: Au determined by special low level CRA/AAS.

● Denotes duplicate of previous sample.

●● Denotes repeat and check.

(Denotes less than.

APPENDIX NO. 4

ANALYTICAL RESULTS

SAMPLE NUMBER		Sn ppm	
KR	2505	(20	
	2518	(20	
	2532	(20	
	2539	20	
	2544	(20	
	2549	(20	
	2559	60	
	2560	(20	
	2561	(20	
	2562	(20	
	2562**	(20	
	2572	(20	
	2574	(20	
	2575	26	
	2578	(20	
	2598	(20	
	2604	(20	
	2609	(20	
	2616	(20	
	2645	26	
	2662	22	
	2666	(20	
	2677	(20	
	2680	48	
	2686	(20	
	2686**	(20	
	2697	33	
	2700	38	
	2704	(20	
	2722	(20	
	2728	24	
	2729	(20	
	2730	(20	
	2731	(20	
	2732	(20	
	2733	(20	
	2734	(20	
	2735	43	
	2736	(20	
	2737	(20	
	2738	(20	
	2739	230	
	2740	(20	
	2740**	(20	
	2741	(20	
	2742	(20	
	2743	(20	
	2744	47	
KR	2745	(20	
KR	2746	54	
	2747	62	
	2748	(20	
	2749	730	
	2750	(20	
	2751	31	
	2752	(20	
	2753	(20	
	2754	(20	
	2755	960	
	2756	(20	
	2757	(20	
	2758	(20	
	2759	(20	
	2760	(20	
	2761	430	
	2762	170	
KR	2763	(20	

ANALYTICAL METHODS: Sn determined by XRF.

* Denotes duplicate of previous sample.

** Denotes repeat and check.

(Denotes less than.

SAMPLE NUMBER	Cu ppm	Pb ppm	Zn ppm	Ag ppm	Cd ppm	Mn ppm	Fe %
KR 2717	210	1760	520	10	5	520	4.0
8	160	7800	290	55	5	7600	2.9
8**	170	7900	300	60	5	7650	3.0
9	10	310	1010	2	2	1680	3.6
KR 2720	5	110	360	(2	5	630	1.8

ANALYTICAL METHODS: Cu, Pb, Zn, Ag, Cd., Mn, Fe by AAS following HCl leach and HCl/HNO_3 leach in latter stages of 0.25g sample.

* Denotes duplicate of previous sample.

** Denotes repeat and check.

(Denotes less than.

SAMPLE NUMBER	Ba ppm	Sn ppm	SAMPLE NUMBER	Ba ppm	Sn ppm
KR 2717	500	100			
8	1000	100			
9	500	50			
KR 2720	1000	50			

ANALYTICAL METHODS: Sn, Ba by Emission Spectrography.

* Denotes duplicate of previous sample.

** Denotes repeat and check.

(Denotes less than.

APPENDIX NO. 5

ANALYTICAL RESULTS

SAMPLE NUMBER	Cu ppm	Pb ppm	Zn ppm	Ag ppm	Mn ppm	Fe %
KS0029	50	90	130	2	1300	8.4
30	50	80	100	2	810	7.0
1	40	140	110	(2	1200	7.2
2	50	80	95	(2	680	5.6
3	60	90	110	(2	500	7.6
4	20	60	80	(2	690	4.7
5	55	100	130	(2	380	9.6
6	70	110	160	(2	1300	8.2
7	35	110	100	2	1700	8.9
8	45	100	100	2	1100	9.6
8**	45	100	100	2	1100	9.8
9	65	120	130	2	820	9.6
40	80	120	120	5	1500	12.6
1	50	110	150	2	830	10.8
2	50	90	130	2	740	9.8
3	45	80	110	(2	1600	6.2
4	50	90	120	(2	1000	8.8
5	30	80	95	2	830	6.2
6	40	100	110	2	560	9.0
7	30	100	80	2	220	7.6
8	20	480	50	2	60	1.4
9	55	190	140	2	1100	11.8
50	45	580	130	2	1200	10.4
1	60	800	340	(2	110	3.2
2	45	2400	340	2	200	4.0
3	45	2000	330	2	200	2.6
4	90	2600	460	2	640	4.4
5	75	2700	760	2	1000	5.8
6	50	2300	410	2	430	2.4
6**	60	2300	420	2	440	2.5
7	60	1500	390	2	330	2.2
8	60	1600	400	2	370	2.6
9	70	2200	400	2	310	2.3
60	60	2000	260	5	200	2.2
1	40	1100	180	2	540	2.4
2	50	1400	170	2	2100	13.2
3	60	940	140	2	1100	1.2
4	90	2400	190	2	2100	2.8
4**	95	2500	200	2	2200	2.8
5	110	1600	210	2	1500	2.0
6	35	1600	230	2	1000	1.3
7	25	1500	360	2	1100	1.2
8	20	840	480	2	1600	2.5
9	10	440	530	2	1700	2.6
KS0070	20	980	410	2	1200	2.0

* Denotes duplicate of previous sample.

** Denotes repeat and check.

(Denotes less than.

SAMPLE NUMBER	Cu ppm	Pb ppm	Zn ppm	Ag ppm	Cd ppm	Mn ppm	Fe %
KS0071	10	420	80	(2	5	1000	2.6
2	15	520	80	(2	10	1200	3.0
3	10	420	80	(2	5	1100	2.8
4	10	250	90	(2	5	700	2.2
5	10	290	150	(2	(5	1300	2.7
6	10	300	260	(2	5	1600	2.3
7	20	310	240	(2	10	1200	2.6
8	20	350	250	(2	5	1200	2.8
9	15	280	270	(2	(5	1600	2.8
80	10	280	240	(2	10	960	3.3
1	15	290	230	(2	10	1100	2.8
2	20	280	200	(2	10	790	2.9
2**	25	280	190	(2	10	780	3.0
3	20	510	200	(2	(5	620	3.7
4	10	150	60	(2	5	280	1.6
5	10	120	180	(2	(5	500	2.0
6	10	490	50	(2	(5	150	0.6
7	15	160	170	(2	(5	430	4.8
8	60	300	90	(2	5	100	4.6
9	60	520	150	(2	(5	90	2.0
90	20	160	90	(2	(5	120	0.9
1	20	160	110	(2	5	120	0.8
2	15	120	80	(2	(5	630	2.4
3	10	70	170	(2	(5	5000	3.6
4	10	100	210	(2	5	2100	3.1
4**	10	100	200	(2	5	2100	2.9
5	10	160	260	(2	10	1600	2.8
6	10	150	140	(2	5	830	2.8
7	10	360	440	(2	5	1600	3.0
8	10	190	310	2	(5	1100	3.5
9	40	1400	330	2	5	2500	4.6
100	40	1500	320	2	(5	2700	4.6
1	40	1300	400	(2	5	2900	3.8
2	35	1000	440	(2	5	1600	2.8
3	40	1200	530	(2	10	1800	2.7
4	45	1200	510	(2	5	1400	2.8
5	55	940	380	(2	5	1000	3.4
6	30	1300	340	(2	5	4200	1.8
7	30	1400	390	2	(5	2500	2.0
7**	25	1400	380	2	(5	2500	1.9
8	40	2000	350	2	5	2600	2.1
9	35	1300	380	2	(5	2500	2.2
KS0110	40	1300	500	(2	(5	2300	2.4
KS0111	20	70	45	(2	2	170	4.2
2	20	70	50	(2	5	190	4.4
3	15	110	60	(2	2	600	2.5
4	10	100	65	(2	5	190	2.6
5	25	100	80	(2	2	200	2.7
6	10	60	200	(2	2	480	2.7
7	10	90	110	(2	2	340	2.7
8	20	60	260	(2	2	1100	2.4
9	20	140	240	(2	2	450	2.8
20	50	210	220	(2	2	480	2.9
1	60	150	380	(2	2	630	3.1
KS0122	20	90	380	(2	(2	630	3.5

* Denotes duplicate of previous sample.

** Denotes repeat and check.

(Denotes less than.

SAMPLE NUMBER	Cu ppm	Pb ppm	Zn ppm	Ag ppm	Cd ppm	Mn ppm	Fe %
KS0123	60	260	380	(2	2	770	2.7
4	40	280	320	(2	2	1200	3.4
4(a)	35	210	300	(2	2	870	3.4
5	20	120	280	(2	5	2300	3.0
6	5	60	370	(2	5	2800	3.2
7	5	150	30	(2	2	50	0.70
8	10	1200	95	(2	2	160	2.8
9	15	320	80	(2	2	170	3.9
30	15	250	80	(2	2	160	3.1
1	30	280	90	(2	2	140	3.3
2	15	220	85	(2	(2	270	2.9
3	15	240	130	(2	(2	710	2.5
4	Not Received						
5	5	50	290	(2	2	1100	2.5
6	10	140	80	(2	2	75	2.4
7	10	160	85	(2	(2	80	2.8
8	15	180	230	(2	(2	1400	3.0
9	15	250	190	(2	(2	2200	2.5
40	20	360	140	(2	2	1400	2.6
1	10	420	230	(2	2	960	3.4
2	15	180	80	(2	2	90	2.6
3	20	230	75	(2	(2	70	2.5
4	15	220	75	(2	2	90	2.5
5	15	550	190	(2	2	250	3.6
6	30	1800	220	2	5	4500	6.6
7	25	360	130	(2	5	90	2.9
8	15	300	110	(2	2	60	1.9
9	15	340	170	(2	2	190	2.6
150	20	400	240	(2	2	310	2.7
1	10	100	90	(2	5	150	1.34
2	10	120	60	(2	2	330	1.58
3	10	140	100	(2	5	280	3.2
4	20	120	100	(2	5	290	3.4
5	20	110	90	(2	2	490	2.8
6	10	80	100	(2	2	290	3.0
7	5	60	110	(2	2	1300	2.6
8	10	70	130	(2	5	330	1.44
9	20	100	70	(2	5	260	4.4
60	10	140	40	(2	2	170	1.00
60**	10	150	50	(2	2	180	1.00
1	10	140	50	(2	2	220	1.44
2	10	150	90	(2	5	200	1.16
3	10	70	130	(2	2	1100	3.4
4	5	80	80	(2	2	430	3.0
5	10	60	130	(2	5	790	2.9
6	20	100	210	(2	5	760	2.6
7	15	120	90	(2	2	140	0.74
8	20	120	160	(2	2	280	1.44
9	10	130	110	(2	5	150	4.3
70	60	460	120	2	5	190	5.0
1	60	440	130	3	5	220	5.3
2	60	160	200	2	5	1500	7.2
3	50	200	180	3	5	1200	8.1
4	15	280	50	(2	(2	140	1.10
KS0175	60	220	190	2	5	1400	8.0

* Denotes duplicate of previous sample.

** Denotes repeat and check.

(Denotes less than.

SAMPLE NUMBER	Cu ppm	Pb ppm	Zn ppm	Ag ppm	Cd ppm	Mn ppm	Fe %
KS0176	70	180	190	2	5	740	7.7
7	60	160	220	(2	5	1060	6.7
8	70	160	170	2	5	1900	8.6
9	40	220	120	(2	5	1060	6.7
80	40	180	130	2	5	520	7.4
1	50	180	150	2	5	650	8.6
2	50	170	160	2	5	580	7.4
3	40	220	120	(2	2	960	6.1
4	60	140	180	2	5	2450	8.6
5	60	140	170	(2	5	2400	7.8
6	60	180	200	(2	5	1040	7.2
6**	60	170	190	(2	5	1020	7.2
7	20	500	610	(2	5	480	2.9
8	20	660	90	(2	5	80	1.5
9	40	940	140	(2	5	420	3.2
90	40	620	100	(2	5	120	3.6
1	40	600	90	(2	5	80	3.7
2	50	840	120	(2	5	160	4.6
3	20	260	70	2	5	260	3.0
4	20	300	70	(2	5	260	4.5
5	80	140	140	2	5	120	4.2
6	70	200	200	2	5	520	11.4
7	60	140	250	(2	2	100	2.7
8	50	160	120	(2	5	140	4.7
9	60	140	160	(2	5	360	7.1
200	50	160	140	(2	5	180	5.1
1	60	120	160	(2	5	160	4.6
2	50	180	160	(2	5	200	6.3
3	50	100	120	(2	2	140	4.7
4	50	180	140	(2	5	440	5.1
5	40	1080	100	(2	5	380	3.0
6	30	180	50	2	5	60	3.2
7	40	1060	160	(2	5	980	3.3
7**	40	1080	150	2	5	1000	3.5
8	90	140	250	2	5	760	10.8
9	70	150	170	2	5	400	7.4
10	50	120	150	(2	2	140	3.2
1	60	130	160	(2	5	160	4.7
2	110	140	90	(2	5	100	5.2
3	60	120	170	(2	5	200	5.8
4	70	180	150	(2	2	380	8.0
5	50	100	120	(2	5	620	4.7
6	70	140	140	(2	2	200	5.6
7	15	120	130	(2	2	140	1.7
8	15	120	120	(2	2	120	1.9
9	20	120	70	(2	5	100	4.1
20	40	160	80	(2	5	80	2.4
1	30	140	80	(2	5	80	2.3
2	15	80	90	(2	5	120	3.5
3	50	160	140	(2	5	160	4.2
4	30	160	120	(2	5	220	2.9
5	80	130	220	(2	5	220	1.6
6	20	80	200	(2	5	200	3.7
7	20	160	120	(2	2	140	2.8
KS0228	20	180	100	(2	5	100	2.8

* Denotes duplicate of previous sample.

** Denotes repeat and check.

(Denotes less than.

SAMPLE NUMBER	Cu ppm	Pb ppm	Zn ppm	Ag ppm	Cd ppm	Mn ppm	Fe %
KS0229	70	140	150	2	5	90	2.3
30	70	160	130	(2	5	60	1.6
1	70	160	130	2	5	60	1.7
2	70	180	120	2	5	80	1.5
3	10	100	220	(2	2	30	0.8
4	140	120	130	(2	5	360	3.4
5	5	120	160	(2	5	1750	3.9
6	20	140	140	(2	2	220	1.7
37	15	80	60	(2	5	80	2.3
39 (a)	15	140	200	(2	5	220	1.7
39 (b)	15	120	60	(2	2	60	1.5
40	10	160	90	(2	2	110	1.7
40**	10	150	100	(2	2	120	1.5
1	15	120	90	(2	2	140	2.6
2	20	120	90	(2	5	140	2.1
3	10	80	70	(2	5	110	2.7
4	10	100	120	(2	5	100	1.6
5	20	160	150	(2	5	260	3.9
6	30	120	130	(2	5	840	4.2
7	10	100	70	(2	5	180	2.8
8	30	130	140	(2	5	320	2.8
9	15	100	230	2	5	720	3.9
250	10	100	150	(2	5	280	3.4
1	80	460	370	(2	2	600	2.8
2	95	500	400	(2	2	680	2.9
3	120	390	390	(2	5	670	2.8
4	85	520	380	(2	2	2300	3.2
5	20	180	200	(2	2	440	2.7
6	20	90	180	(2	2	590	2.8
7	30	120	160	(2	2	240	2.4
KS 258	40	500	230	(2	2	360	3.1
KS0262	30	340	500	5	5	1400	4.5
3	Sample not received						
4	30	160	150	5	5	380	2.6
5	30	100	100	2	5	280	0.88
6	10	140	100	(2	480	5	2.9
7	20	220	120	2	5	260	4.7
8	Sample not received						
9	Sample not received						
80	30	1000	620	2	5	2000	2.9
80**	30	1000	620	2	5	2100	3.0
1	30	1100	630	2	5	2800	2.9
2							
3							
4	10	190	380	2	5	1600	4.3
5							
6							
7	30	100	370	(2	5	1300	3.9
8							
9							
90	30	190	200	(2	5	240	4.1
KS0291	30	190	200	(2	5	230	4.1

* Denotes duplicate of previous sample.

** Denotes repeat and check.

(Denotes less than.

SAMPLE NUMBER	Cu ppm	Pb ppm	Zn ppm	Ag ppm	Cd ppm	Mn ppm	Fe %
KS0292							
3							
4	30	160	160	(2	5	180	4.4
5	10	140	50	(2	5	800	3.2
6	25	80	110	(2	5	380	3.9
7	25	200	110	(2	5	450	3.2
8	20	200	140	(2	5	630	6.8
9	10	120	120	(2	5	1100	1.34
300	65	200	150	2	5	760	14.5
1	60	200	150	2	5	800	15.0
2	65	160	150	2	5	3100	15.0
3	20	750	90	(2	5	410	4.0
4	80	1400	210	2	5	1000	14.5
5	55	280	110	2	5	1500	13.0
6	60	220	110	2	5	480	15.0
7	30	1200	250	(2	5	2300	3.5
8	40	2200	140	(2	5	1300	4.1
9	10	180	80	(2	5	5700	4.3
310	20	180	200	(2	5	410	3.2
1	20	180	180	(2	5	370	3.1
2	30	160	140	(2	5	400	3.9
3	10	100	180	(2	5	420	1.38
4	30	280	240	(2	5	1500	4.0
5	60	1400	250	2	5	410	7.5
6	20	740	170	(2	5	460	1.40
7	30	1600	180	(2	5	1800	2.3
8	30	1200	260	(2	5	580	3.3
9	50	3300	730	(2	5	1300	4.1
20	45	360	280	(2	5	290	5.6
1	40	340	260	(2	5	280	5.7
2	10	200	100	(2	5	90	5.2
3	10	90	150	(2	5	290	4.0
4	10	100	310	(2	5	210	3.6
5	10	440	250	(2	5	410	4.4
6	10	190	180	(2	5	370	3.2
7	300	)10000	260	15	10	460	5.3
8	170	3400	160	5	5	2500	3.1
9	30	820	400	(2	5	1300	3.1
30	15	680	140	(2	5	1100	3.0
1	20	700	170	(2	5	1100	2.9
2	20	80	120	(2	5	130	3.1
3	20	660	280	(2	5	430	4.3
3**	20	650	290	(2	5	450	4.3
4	20	390	150	(2	5	110	4.0
5	20	2400	200	(2	5	80	5.2
6	20	4900	320	5	5	)10000	3.1
7	30	410	130	(2	5	90	3.2
8	440	8500	1400	2	5	690	5.2
9	10	1100	340	2	5	1900	3.3
40	10	640	800	5	5	5200	3.3
1	5	610	750	5	5	5100	3.3
2	25	260	440	(2	5	2300	3.4
3	10	150	95	(2	5	220	3.5
4	20	130	160	(2	5	670	2.7
KS0345	20	100	240	(2	5	760	3.5

* Denotes duplicate of previous sample.

** Denotes repeat and check.

(Denotes less than.

) Denotes greater than

SAMPLE NUMBER	Cu ppm	Pb ppm	Zn ppm	Ag ppm	Cd ppm	Mn ppm	Fe %
KS0346	20	120	250	(2	5	620	3.2
7	20	310	270	(2	5	280	4.1
8	25	200	240	(2	5	400	4.1
9	25	200	240	(2	5	420	3.3
KS 0350	15	130	100	(2	5	170	1.9
KS0551	10	100	160	2	5	260	3.2
2	20	100	170	2	2	260	2.9
3	110	120	170	2	2	580	3.7
4	20	280	410	(2	2	440	2.4
5	20	100	80	(2	2	320	2.2
6	20	100	90	(2	5	140	2.1
7	50	180	80	(2	5	120	3.1
8	20	80	70	(2	5	100	3.0
9	20	180	90	(2	5	200	3.8
60	20	100	110	(2	5	180	2.6
1	20	60	110	(2	5	180	2.9
2	60	80	120	(2	5	160	2.2
3	10	60	90	(2	2	80	1.8
4	10	120	80	(2	5	120	1.7
5	10	120	240	(2	5	2050	3.4
6	25	180	150	(2	5	500	3.1
7	20	190	230	(2	5	5400	3.2
8	30	140	140	(2	5	240	3.9
9	50	560	150	(2	5	680	4.7
70	10	200	110	(2	5	940	3.2
1	15	220	110	(2	5	760	3.0
2	20	130	130	(2	5	160	2.9
3	20	160	140	(2	2	380	3.1
4	20	160	110	(2	2	140	3.0
5	20	1060	150	(2	5	580	3.2
6	10	80	200	(2	5	760	2.8
7	20	140	100	(2	5	960	5.7
7**	20	140	100	(2	5	940	5.6
8	20	120	70	(2	2	480	4.4
9	10	80	60	(2	5	120	3.3
80	20	200	280	(2	5	840	2.7
1	20	340	290	(2	5	1060	2.9
2	10	100	60	(2	5	100	2.9
3	40	180	170	(2	2	1550	2.8
4	40	560	220	2	5	880	3.1
5	60	620	460	(2	5	880	3.5
6	40	730	280	(2	5	2500	3.1
7	10	280	360	2	5	4100	2.6
8	20	200	170	2	5	340	2.2
9	20	240	210	2	5	680	3.7
90	10	240	120	2	5	1400	3.9
1	10	220	140	2	5	1550	4.2
2	40	300	450	2	5	2050	3.2
3	20	200	250	2	5	620	3.1
KS0594	40	460	270	2	5	940	4.4

* Denotes duplicate of previous sample.

** Denotes repeat and check.

(Denotes less than.

SAMPLE NUMBER	Cu ppm	Pb ppm	Zn ppm	Ag ppm	Cd ppm	Mn ppm	Fe %
KS0595	50	320	230	2	5	320	3.4
6	40	280	130	(2	5	280	3.0
6**	40	280	120	(2	5	280	3.2
7	10	160	150	2	5	580	3.1
8	20	140	160	(2	5	920	2.9
9	10	150	120	2	5	230	1.7
600	20	160	220	2	2	520	3.3
1	15	160	220	2	5	860	3.2
KS0602	15	160	150	2	5	340	2.2
KS0603	20	140	310	(2		300	2.1
4	20	160	150	(2		260	1.6
5	30	110	150	(2		180	1.8
6	10	120	240	(2		310	3.6
7	30	110	100	(2		60	2.8
8	20	140	210	(2		460	2.9
9	30	1450	350	(2		420	2.7
10	50	460	270	(2		660	2.8
10**	50	480	270	(2		680	2.8
1	60	460	280	(2		640	2.8
2	10	90	200	(2		580	2.8
3	30	280	390	(2		820	2.4
4	5	200	270	(2		220	3.3
5	30	240	140	(2		60	3.5
6	20	580	310	(2		280	3.5
7	10	140	260	(2		400	2.8
8	20	180	310	(2		540	2.6
9	40	940	200	(2		800	3.6
20	30	160	120	(2		520	8.0
1	40	190	120	(2		520	7.8
2	10	160	90	(2		140	3.2
3	10	120	140	(2		200	3.0
4	10	160	140	(2		260	3.2
5	50	80	140	(2	10	640	7.0
6	80	100	230	(2	5	3900	10.6
7	50	90	150	(2	10	2300	8.6
8	90	120	260	(2	5	1500	13.4
9	80	100	270	(2	10	1800	12.8
30	10	100	30	(2	5	80	1.5
30**	10	100	30	(2	5	80	1.6
1	10	70	30	(2	5	80	1.4
2	40	140	160	(2	15	8300	11.2
3	50	100	130	(2	10	2400	10.0
4	50	140	140	(2	10	980	10.2
5	50	120	160	(2	5	1000	11.0
6	30	720	230	(2	5	240	3.3
7	70	120	170	(2	10	520	10.8
8	50	60	140	(2	5	1450	8.8
9	60	70	220	(2	5	740	4.8
40	60	80	150	(2	10	1150	10.8
1	60	110	160	(2	10	1150	10.4
2	50	130	150	(2	5	1050	11.2
3	40	100	130	(2	5	940	7.2
4	40	120	170	(2	5	2100	11.2
KS0645	30	100	120	(2	5	1500	8.8

* Denotes duplicate of previous sample.

** Denotes repeat and check.

(Denotes less than.

SAMPLE NUMBER	Cu ppm	Pb ppm	Zn ppm	Ag ppm	Cd ppm	Mn ppm	Fe %
KS0646	30	60	110	(2	5	1100	6.2
7	40	70	140	(2	2	3800	9.4
8	60	100	110	(2	5	1150	8.6
8**	60	100	110	(2	5	1150	8.8
9	70	120	130	(2	10	1050	12.0
50	60	120	160	(2	5	980	11.4
1	60	80	170	(2	5	1100	12.4
2	70	140	130	(2	10	1200	11.4
3	70	80	130	(2	5	640	11.8
4	80	60	190	(2	5	1500	13.2
5	40	120	140	(2	5	700	12.8
6	50	140	210	(2	5	3400	14.4
7	60	420	170	(2	10	5800	9.2
8	10	280	50	(2	5	1150	3.8
9	30	720	80	(2	2	1100	3.0
60	70	140	440	(2	5	1950	13.0
60**	80	140	450	(2	5	1950	12.8
1	70	140	400	(2	10	1800	12.6
2	70	160	360	(2	5	750	13.8
3	90	100	300	(2	5	5200	14.4
4	100	120	190	(2	10	1150	14.2
5	10	160	70	(2	2	140	1.6
6	20	640	180	(2	2	240	3.6
7	30	780	110	(2	5	1200	6.0
8	30	2150	150	(2	2	1950	2.9
9	30	1200	320	(2	5	2400	3.2
70	30	1350	60	(2	2	1300	1.5
1	20	980	60	(2	5	450	4.2
2	20	760	60	(2	5	380	4.0
3	70	80	140	(2	5	1200	10.4
4	50	140	120	(2	10	460	8.0
5	(2	60	240	(2	2	2000	3.2
6	20	360	290	(2	5	)10000	2.8
7	30	660	290	(2	5	1150	5.4
8	5	220	280	(2	5	5000	3.0
9	70	2400	270	10	5	290	1.8
80	10	1850	120	5	10	80	0.80
1	20	340	140	(2	5	280	3.6
2	20	360	140	(2	5	160	3.8
3	20	320	130	(2	5	220	3.4
4	5	80	40	(2	2	120	2.6
4**	5	80	40	(2	2	110	2.6
5	20	120	90	(2	5	480	2.9
6	20	180	70	(2	5	1100	2.6
7	5	160	160	(2	5	650	2.7
8	50	180	170	(2	5	1000	10.6
9	60	160	120	(2	10	900	10.4
90	50	200	150	(2	5	800	7.8
1	50	180	160	(2	10	520	9.0
2	40	2350	200	(2	5	6600	4.2
3	10	260	120	(2	5	360	2.9
4	5	320	110	(2	5	380	3.2
5	50	920	160	(2	10	260	7.2
6	5	280	200	(2	5	1900	3.4
KS0696**	5	280	200	(2	5	1900	3.4

* Denotes duplicate of previous sample.

** Denotes repeat and check.

(Denotes less than.

SAMPLE NUMBER	Cu ppm	Pb ppm	Zn ppm	Ag ppm	Cd ppm	Mn ppm	Fe %
KS0697	40	3000	180	5	5	1050	6.4
8	20	820	170	2	5	6400	8.6
9	60	140	160	(2	5	1300	11.2
KS 700	40	160	130	(2	5	300	10.6
KS4851	60	110	190	(2	15	480	12.5
2	40	100	140	(2	10	340	8.4
3	20	100	170	(2	(2	240	7.2
4	60	90	190	(2	5	1250	9.4
5	60	90	190	(2	10	1200	9.0
6	30	80	120	(2	5	500	10.2
7	50	80	120	(2	5	560	9.8
8	40	80	170	2	10	680	9.6
9	40	100	110	(2	10	980	9.4
9**	40	100	110	(2	10	940	9.6
60	20	70	70	(2	10	80	6.8
1	30	120	100	(2	10	860	11.4
2	40	80	150	2	10	280	14.5
3	40	120	190	(2	10	420	11.5
4	70	100	250	2	10	720	12.0
5	40	80	220	2	5	520	11.0
6	40	110	220	(2	5	560	11.2
7	60	100	230	2	10	380	11.9
8	60	100	200	(2	5	440	12.0
9	70	120	190	(2	10	580	11.5
70	120	110	180	2	10	1100	16.5
1	40	90	110	(2	5	410	9.8
2	40	80	160	2	5	600	11.5
3	50	100	140	(2	10	490	11.5
4	50	70	180	(2	10	2000	10.3
5	50	120	130	(2	10	1550	11.5
5**	40	110	130	(2	10	1600	11.6
6	50	90	170	2	10	680	10.5
7	50	90	140	(2	5	820	12.5
8	30	100	120	(2	10	2050	11.8
9	50	150	130	(2	5	380	11.3
80	30	100	90	(2	10	280	9.0
1	70	110	170	2	10	220	13.0
2	70	140	130	2	5	1700	11.0
3	70	120	150	2	10	440	16.0
4	50	100	130	(2	10	800	12.3
5	60	80	90	(2	5	210	6.5
6	20	140	80	(2	10	240	6.3
7	40	50	130	(2	5	340	12.5
8	40	80	120	2	10	380	11.8
9	50	120	180	(2	10	440	10.8
90	40	80	110	(2	10	1300	10.8
1	60	80	100	(2	5	880	12.0
2	40	60	100	2	15	740	7.0
3	30	80	110	(2	5	4100	10.8
KS4894	60	60	110	(2	5	280	9.3

* Denotes duplicate of previous sample.

** Denotes repeat and check.

(Denotes less than.

SAMPLE NUMBER		As ppm	Ba ppm	Sn ppm			
KS	0111	(5	50	(1			
	2	(5	50	3			
	3	(5	100	3			
	4	(5	500	5			
	5	(5	300	5			
	6	(5	500	5			
	7	(5	300	5			
	8	(5	500	5			
	9	(5	500	5			
	20	(5	500	5			
	1	(5	500	5			
	2	(5	500	10			
	3	(5	500	5			
	4	(5	300	5			
	4(a)	(5	300	5			
	5	(5	300	5			
	6	(5	300	5			
	7	(5	500	5			
	8	(5	300	10			
	9	(5	300	5			
	30	(5	300	10			
	1	(5	500	5			
	2	(5	500	5			
	3	(5	500	5			
	4	(5	500	5			
	5	(5	300	10			
	6	(5	500	5			
	7	(5	500	10			
	8	(5	500	5			
	9	(5	500	5			
	40	(5	300	20			
	1	(5	500	10			
	2	(5	200	5			
	3	(5	300	5			
	4	(5	300	3			
	5	(5	300	5			
	6	10	200	30			
	7	(5	300	10			
	8	(5	200	5			
	9	(5	500	5			
KS	0150	(5	300	5			
KS	0151	(5	500	50			
	2	(5	300	5			
	3	(5	300	5			
	4	(5	500	100			
	5	(5	300	10			
	6	(5	300	5			
	7	(5	1000	10			
	8	(5	300	10			
	9	(5	300	10			
	60	(5	300	5			
	60**	(5					
	1	(5	300	5			
	0162	(5	300	10			

● Denotes duplicate of previous sample.

● ● Denotes repeat and check.

(Denotes less than.

SAMPLE NUMBER		As ppm	Ba ppm	Sn ppm			
KS	0163	(5	300	10			
	4	(5	300	10			
	5	(5	500	5			
	6	(5	300	5			
	7	(5	500	5			
	8	(5	300	5			
KS	0169	(5	300	5			
KS	0170	(5	500	10			
	1	(5	500	3			
	2	(5	500	10			
	3	(5	300	10			
	4	(5	1000	10			
	5	(5	500	10			
	6	(5	500	5			
	7	(5	1000	5			
	8	(5	200	3			
	9	(5	200	10			
	80	(5	300	5			
	1	(5	300	10			
	2	(5	50	10			
	3	(5	100	10			
	4	(5	500	10			
	5	(5	500	10			
	6	(5	500	10			
	7	60	1000	20			
	8	(5	1000	10			
	9	(5	1000	20			
	90	(5	500	100			
	1	(5	500	100			
	2	10	500	10			
	3	(5	500	10			
	4	60	300	10			
	5	(5	300	3			
	6	(5	50	3			
	7	(5	300	3			
	8	(5	300	3			
	9	(5	500	5			
	200	(5	100	5			
	1	(5	300	3			
	2	(5	300	3			
	3	(5	300	5			
	4	(5	500	5			
	5	(5	1000	3			
	6	(5	500	5			
	7	10	1000	10			
	8	(5	100	10			
	9	(5	300	10			
	10	(5	500	10			
	1	(5	500	20			
	2	(5	300	5			
	3	(5	500	30			
	4	(5	500	20			
	5	(5	200	10			
	6	(5	100	30			
KS	0217	(5	1000	20			

● Denotes duplicate of previous sample. ● ● Denotes repeat and check.

(Denotes less than.

SAMPLE NUMBER	As ppm	Ba ppm	Sn ppm			
KS 0218	(5	1000	50			
9	(5	1000	50			
20	(5	1000	50			
1	(5	1000	50			
2	(5	1000	50			
3	(5	1000	30			
4	(5	1000	50			
5	(5	1000	10			
6	(5	1000	50			
7	(5	500	20			
8	(5	500	30			
9	(5	500	30			
30	(5	500	10			
1	(5	500	30			
2	(5	500	50			
3	(5	1000	20			
4	(5	1000	20			
5	(5	1000	50			
6	(5	1000	50			
37	(5	1000	50			
8	Sample not received					
39(a)	(5	1000	10			
39(b)	(5	1000	10			
40	(5	500	10			
1	(5	1000	30			
2	(5	500	20			
3	(5	300	20			
4	(5	1000	20			
5	(5	500	5			
6	(5	1000	50			
7	(5	1000	50			
8	(5	1000	3			
9	(5	500	5			
KS 0250	(5	1000	30			
KS 0251	(5	500	5			
2	(5	500	3			
3	(5	500	3			
4	(5	500	3			
5	(5	500	3			
6	(5	300	3			
7	(5	300	3			
KS 0258	(5	200	3			
KS 0262	(5	300	300			
3						
4	(5	1000	10			
5	(5	500	5			
6	(5	500	10			
7	(5	500	10			
8						
9						
70	(5	1000	10			
1	(5	500	5			
KS 0272						

● Denotes duplicate of previous sample.

● ● Denotes repeat and check.

(Denotes less than.

SAMPLE NUMBER	As ppm	Ba ppm	Sn ppm			
KS 0273						
4	20	500	10			
5						
6						
7	20	1000	5			
8						
9						
80	(5	500	20			
80**	(5					
1	(5	500	80			
2						
3						
4	(5	300	10			
5						
6						
7	(5	500	10			
8						
9						
90	(5	500	10			
1	20	500	10			
2						
3						
4	(5	500	10			
5	(5	300	10			
6	(5	1000	10			
7	(5	500	5			
8	(5	1000	3			
9	(5	1000	5			
300	10	50	10			
1	20	300	10			
2	(5	200	10			
3	(5	300	10			
4	60	100	10			
5	(5	50	10			
6	10	100	5			
7	(5	1000	20			
8	80	1000	20			
9	(5	1000	10			
10	(5	1000	20			
1	(5	1000	10			
2	20	500	20			
3	(5	500	3			
4	20	500	30			
5	30	500	30			
6	10	500	20			
7	(5	500	10			
8	(5	500	5			
9	(5	500	20			
20	20	500	30			
1	20	300	10			
2	20	300	10			
3	(5	300	10			
4	10	300	10			
5	10	300	5			
KS 0326	(5	300	10			

* Denotes duplicate of previous sample.

** Denotes repeat and check.

(Denotes less than.

SAMPLE NUMBER	As ppm	Ba ppm	Sn ppm	As%		
KS 0327	)1000	200	300	0.71%		
8	100	300	300			
9	100	500	10			
30	20	500	5			
1	20	500	5			
2	(5	300	5			
3	(5	300	10			
3**	(5					
4	30	500	3			
5	100	500	5			
6	20	300	3			
7	60	300	3			
8	200	300	10			
9	60	500	5			
40	20	500	5			
1	20	500	10			
2	20	500	10			
3	(5	500	10			
4	(5	500	5			
5	(5	500	5			
6	(5	500	5			
7	(5	300	5			
8	(5	300	5			
9	(5	300	5			
KS 0350						
KS 0551	(5	1000	30			
2	(5	1000	50			
3	(5	1000	20			
4	(5	1000	50			
5	80	1000	50			
6	(5	1000	5			
7	(5	1000	5			
8	20	1000	30			
9	(5	1000	30			
60	(5	1000	20			
1	(5	500	20			
2	(5	500	5			
3	(5	1000	5			
4	(5	1000	5			
5	(5	1000	30			
6	(5	500	30			
7	10	1000	50			
8	(5	500	30			
9	(5	500	10			
70	(5	500	30			
1	(5	500	30			
2	(5	500	30			
3	10	1000	20			
4	(5	500	30			
5	20	500	30			
6	(5	1000	30			
7	(5	200	5			
8	20	100	5			
KS 0579	(5	1000	20			

* Denotes duplicate of previous sample.

** Denotes repeat and check.

(Denotes less than.

SAMPLE NUMBER	As ppm	Ba ppm	Sn ppm			
KS 0580	(5	1000	10			
1	(5	1000	30			
2	(5	500	10			
3	(5	1000	5			
4	(5	1000	10			
5	(5	500	30			
6	(5	500	30			
7	(5	1000	5			
8	(5	500	5			
9	(5	500	30			
90	(5	1000	5			
1	10	1000	5			
2	(5	2000	10			
3	(5	500	10			
4	(5	1000	50			
5	(5	1000	30			
6	(5	500	20			
7	(5	2000	10			
8	(5	1000	30			
9	(5	1000	10			
600	(5	1000	10			
1	(5	1000	30			
KS 0602	(5	500	10			

● Denotes duplicate of previous sample.

● ● Denotes repeat and check.

(Denotes less than.

SAMPLE NUMBER	As ppm	Sn ppm	Ba ppm			
KS 0625	(5	20	300			
6	(5	5	200			
7	(5	10	200			
8	10	10	300			
9	(5	10	300			
30	(5	30	500			
1	(5	10	500			
2	(5	5	500			
3	(5	30	300			
4	(5	10	100			
5	(5	10	300			
6	(5	20	500			
7	5	20	300			
8	(5	20	(30			
9	10	20	100			
40	5	20	100			
1	(5	10	200			
2	(5	10	300			
3	5	10	300			
4	10	10	100			
5	60	10	300			
6	5	10	300			
7	(5	10	100			
8	(5	10	(30			
9	(5	5	30			
50	(5	10	(30			
1	(5	(1	30			
2	(5	3	30			
3	(5	10	200			
4	(5	10	200			
5	(5	10	50			
6	(5	10	300			
7	(5	3	100			
8	(5	5	300			
9	(5	10	500			
60	(5	5	300			
1	(5	5	300			
2	(5	3	200			
3	(5	3	100			
4	(5	5	30			
5	(5	(1	500			
6	(5	3	500			
7	10	10	200			
8	5	10	500			
9	5	5	300			
70	5	3	300			
1	40	3	100			
2	30	3	100			
3	10	5	100			
4	(5	5	100			
5	100	10	300			
6	30	10	500			
7	200	3	300			
8	60	10	300			
KS 0679	60	10	300			

● Denotes duplicate of previous sample.

●● Denotes repeat and check.

(Denotes less than.

SAMPLE NUMBER		As ppm	Sn ppm	Ba ppm			
KS	0680	(5	5	300			
	1	(5	5	300			
	2	(5	(1	200			
	3	(5	(1	300			
	4	(5	(1	300			
	5	(5	3	500			
	6	5	10	300			
	7	(5	5	500			
	8	(5	5	50			
	9	(5	5	100			
	90	5	3	100			
	1	(5	(1	50			
	2	60	3	300			
	3	100	5	300			
	4	200	10	300			
	5	800	10	300			
	6	30	3	200			
	7	200	30	300			
	8	40	30	300			
	9	(5	3	300			
KS	0700	(5	5	30			
KS	4851	(5	20	500			
	2	(5	100	500			
	3	60	30	300			
	4	(5	500	500			
	5	(5	3	500			
	6	5	5	300			
	7	(5	5	50			
	8	(5	10	500			
	9	(5	10	30			
	60	(5	5	50			
	1	(5	10	300			
	2	(5	10	500			
	3	(5	10	100			
	4	(5	10	300			
	5	(5	10	50			
	6	(5	5	30			
	7	(5	10	30			
	8	(5	10	300			
	9	5	3	500			
	70	(5	10	300			
	1	(5	10	50			
	2	(5	10	300			
	3	(5	10	300			
	4	(5	10	300			
	5	(5	10	30			
	6	(5	10	300			
	7	(5	3	500			
	8	(5	(1	30			
	9	(5	50	300			
	80	(5	5	100			
	1	(5	10	500			
	2	(5	5	300			
KS	4883	(5	10	300			

* Denotes duplicate of previous sample.

** Denotes repeat and check.

(Denotes less than.

SAMPLE NUMBER	Cu ppm	Pb ppm	Zn ppm	Ag ppm	Cd ppm	Mn ppm	Fe %
KS4895	50	60	120	(2	10	590	11.8
6	60	80	130	(2	5	560	11.0
7	60	60	130	(2	10	440	12.3
7**	50	70	130	(2	10	420	12.0
8	30	70	100	5	5	2900	9.8
9	30	80	100	2	5	4000	9.5
900	40	110	90	(2	10	780	11.0
1	30	100	80	(2	10	490	8.3
2	40	60	100	(2	5	1050	10.0
3	50	100	130	(2	10	520	10.3
4	30	110	130	(2	10	640	11.3
5	30	60	90	(2	10	1800	10.3
6	50	100	140	(2	10	1300	11.5
7	70	90	220	(2	5	1250	11.5
8	40	880	140	2	5	640	6.8
9	50	760	130	(2	5	560	7.5
10	20	3600	70	(2	5	40	2.8
1	20	4200	60	(2	10	30	2.5
2	20	220	70	(2	5	200	3.0
3	40	340	120	2	10	360	4.8
4	10	160	60	2	5	40	2.0
5	5	180	90	2	5	30	3.8
6	15	380	110	(2	10	80	4.3
7	30	540	60	2	10	140	2.0
8	30	400	80	(2	5	80	4.8
9	40	720	80	2	5	220	6.8
20	60	1060	140	2	5	80	6.0
1	15	240	100	2	10	120	4.3
2	10	260	80	2	5	80	4.0
3	20	200	140	(2	10	280	2.0
4	10	80	90	(2	10	110	3.0
5	10	50	90	2	10	240	3.0
6	10	90	70	(2	5	140	3.5
7	5	60	50	(2	5	160	3.0
8	10	100	70	2	5	240	3.5
9	30	100	170	2	10	450	3.3
30	10	220	60	2	5	120	4.0
1	10	160	50	(2	5	60	3.0
2	20	210	140	(2	5	760	2.5
3	10	280	80	(2	10	460	2.8
4	20	220	180	2	10	280	3.0
5	10	130	60	(2	5	540	2.8
5**	10	140	60	(2	5	520	3.0
6	15	60	80	(2	5	440	3.4
7	20	40	80	(2	10	520	2.8
8	80	4100	60	(2	10	100	3.4
9	20	190	110	(2	5	1900	4.5
40	10	110	100	2	10	420	4.2
1	10	80	50	(2	10	30	1.0
2	20	80	50	(2	2	90	3.0
3	10	220	30	(2	5	(5	0.5
4	40	1450	90	(2	5	60	2.5
5	30	80	90	(2	5	80	6.8
6	30	90	90	(2	10	140	5.3
KS4947	60	40	200	(2	2	400	9.3

* Denotes duplicate of previous sample.

** Denotes repeat and check.

(Denotes less than.

SAMPLE NUMBER	Cu ppm	Pb ppm	Zn ppm	Ag ppm	Cd ppm	Mn ppm	Fe %
KS4948	50	60	210	(2	5	360	8.8
9	30	100	140	(2	5	2000	6.8
9**	40	100	140	(2	5	2050	7.0
50	30	100	150	(2	5	620	6.8
1	30	100	170	(2	10	3000	7.0
2	30	80	110	2	5	1500	6.3
KS4953	20	70	100	(2	5	1350	7.8

Analytical Methods:

Cu, Pb, Zn, Ag, Mn, Cd by A.A.S. following HCl leach and HCl/HNO_3 leach in latter stages of 0.25g sample.

* Denotes duplicate of previous sample.

** Denotes repeat and check.

(Denotes less than.

SAMPLE NUMBER	As ppm	Sn ppm	Ba ppm			
KS 4884	(5	10	(30			
5	20	10	300			
6	5	10	100			
7	(5	20	50			
8	5	10	(30			
9	(5	10	30			
90	(5	5	30			
1	(5	5	50			
2	(5	10	50			
3	(5	10	30			
4	(5	10	200			
5	(5	10	30			
6	(5	10	30			
7	(5	10	30			
8	(5	5	30			
9	60	10	300			
4900	(5	10	50			
1	(5	20	30			
2	(5	10	100			
3	(5	5	30			
4	(5	10	50			
5	(5	10	30			
6	(5	3	50			
7	(5	10	30			
8	20	10	500			
9	(5	10	500			
10	(5	20	500			
1	(5	30	500			
2	(5	10	200			
3	10	30	500			
4	(5	20	500			
5	(5	20	1000			
6	10	10	1000			
7	80	10	500			
8	5	20	1000			
9	(5	10	300			
20	10	50	300			
1	(5	20	1000			
2	(5	10	300			
3	(5	10	300			
4	(5	10	500			
5	(5	10	500			
6	(5	10	500			
7	(5	10	500			
8	(5	10	500			
9	(5	10	1000			
30	(5	5	300			
1	(5	3	300			
2	(5	10	200			
3	(5	5	500			
4	(5	5	500			
5	(5	10	500			
6	(5	10	500			
7	(5	10	500			
KS 4938	(5	20	500			

● Denotes duplicate of previous sample. ●● Denotes repeat and check.

(Denotes less than.

SAMPLE NUMBER		As ppm	Sn ppm	Ba ppm			
KS	4939	(5	20	500			
	40	30	10	300			
	1	(5	5	300			
	2	(5	10	500			
	3	5	50	300			
	4	(5	200	200			
	5	(5	5	50			
	6	(5	5	100			
	7	20	5	100			
	8	(5	10	100			
	9	10	10	200			
KS	4950	5	10	500			
	1	5	100	300			
	2	(5	5	300			
KS	4953	(5	5	30			

● Denotes duplicate of previous sample.

●● Denotes repeat and check.

(Denotes less than.

SAMPLE NUMBER	Cd ppm	Sn ppm	Ba ppm	As ppm		
KS 0047	5	(20	150	(5		
8	10	25	500	10		
9	10	(20	450	20		
50	10	(20	440	60		
50**		(20	420	60		
1	10	(20	980	20		
2	5	(20	1100	10		
3	5	(20	1040	20		
4	10	(20	1060	30		
5	5	(20	1150	20		
6	5	(20	930	10		
6**	5					
7	10	40	940	10		
8	10	45	1050	10		
9	5	(20	1050	20		
60	5	20	950	(5		
60**		(20	910	(5		
1	10	40	610	30		
2	10	(20	890	40		
3	5	(20	850	30		
4	10	(20	1130	40		
4**	10					
5	10	35	810	40		
6	10	25	780	30		
7	5	(20	700	30		
8	10	(20	680	40		
9	5	(20	500	30		
70	10	(20	750	30		
1	5	30	540	(5		
2	10	(20	890	(5		
3	5	(20	820	(5		
4	5	30	440	(5		
5	5	30	800	(5		
6	5	(20	890	(5		
7	5	(20	840	(5		
8	10	(20	740	(5		
9	5	(20	710	(5		
80	10	(20	510	(5		
1	10	(20	450	(5		
2	10	(20	660	(5		
2**	10					
3	5	25	590	(5		
4	5	(20	640	(5		
5	5	(20	660	(5		
6	10	30	800	(5		
7	5	(20	120	(5		
8	2	(20	520	20		
9	5	(20	700	10		
90	2	(20	280	(5		
1	5	(20	620	(5		
2	2	(20	790	(5		
2**		(20	780	(5		
3	5	(20	950	(5		
4	5	(20	950	20		
KS 0094**	5					

* Denotes duplicate of previous sample. ** Denotes repeat and check.

(Denotes less than.

SAMPLE NUMBER	Cd ppm	Sn ppm	Ba ppm	As ppm		
KS 0095	5	(20	720	20		
6	2	(20	560	(5		
7	5	(20	630	20		
8	2	(20	580	20		
9	2	(20	830	(5		
100	5	40	920	(5		
1	10	(20	840	(5		
2	5	(20	680	(5		
3	10	(20	950	20		
4	5	(20	940	30		
4**		(20	920	20		
5	2	(20	400	20		
6	2	(20	420	20		
7	2	30	1120	30		
7**	2					
8	5	(20	960	40		
9	2	(20	1050	30		
KS 0110	2	(20	900	20		

* Denotes duplicate of previous sample.
** Denotes repeat and check.
(Denotes less than.

APPENDIX NO. 5

ANALYTICAL RESULTS

SAMPLE NUMBER	Sn ppm	
KS 0031	(20	
1*	(20	
2	(20	
3	(20	
4	(20	
5	(20	
6	(20	
7	(20	
8	(20	
9	(20	
40	(20	
1	(20	
2	(20	
3	(20	
4	(20	
5	(20	
KS 0046	(20	
KS 0603	(20	
4	(20	
5	(20	
6	(20	
7	(20	
8	(20	
9	(20	
9*	(20	
10	(20	
1	(20	
2	(20	
3	(20	
4	(20	
5	(20	
6	(20	
7	(20	
8	(20	
9	(20	
20	25	
1	(20	
2	(20	
3	(20	
KS 0624	(20	
KS 0154	(20	
0190	(20	
0191	(20	
KS 0262	60	

SAMPLE NUMBER	Sn ppm	
KS 0262*	66	
0327	240	
0328	180	
4852	(20	
4854	(20	
4855	(20	
4944	33	
KS 4951	(20	

The Sn (XRF) values are in most cases in agreement with the Emission Spec. values reported in earlier batches. In some cases there was insufficient sample to give a pressing of infinite thickness for XRF work and this probably accounts for Sn being undetected in some samples, contrasting with positive values by Emission Spec.

ANALYTICAL METHODS: Sn determined by XRF.

* Denotes duplicate of previous sample.

** Denotes repeat and check.

(Denotes less than.

GEOCHEMICAL RESULTS

SEMI-QUANTITATIVE EMISSION SPECTROSCOPY

All values in ppm

GROUP		SAMPLE NUMBER KS							
		0052	0054	0055	0064				
ES 1	Be	5	3	10	3				
	Co	5	5	(5	5				
	Cr	100	200	100	200				
	Ir	(2	(2	(2	(2				
	Mn	300	600	1000	2000				
	Mo	(3	(3	10	(3				
	Nb	(20	(20	(20	(20				
	Ni	50	50	30	50				
	Os	(10	(10	(10	(10				
	Pd	(10	(10	(10	(10				
	Pt	(10	(10	(10	(10				
	Re	(10	(10	(10	(10				
	V	100	100	50	50				
	W	(50	(50	(50	(50				
	Ta	100	100	100	100				
	Th	(100	(100	(100	(100				
ES 2	Ag	3	2	2	2				
	As	(50	(50	(50	(50				
	Au	(3	(3	(3	(3				
	Bi	100	100	100	100				
	Cd	(3	(3	(3	(3				
	Cu	50	100	60	100				
	Ge	(1	(1	(1	(1				
	In	(5	(5	(5	(5				
	Pb	2000	3000	3000	2000				
	Sb	(30	(30	(30	(30				
	Sn	10	10	10	10				
	Tl	(1	(1	(1	(1				
	Zn	300	500	600	200				
ES 3	Ba	2000	2000	2000	2000				
	Ca	10000	10000	)10000	5000				
	Ce	(300	(300	(300	(300				
	La	(100	(100	(100	(100				
	Sc	(50	(50	(50	(50				
	Sr	30	50	50	30				
	Ti	10000	5000	5000	5000				
	Y	20	30	50	20				
	Zr	(100	(100	(100	(100				
ES 4	Hg	(30	(30	(30	(30				
	P	2000	2000	3000	1000				
	Te	(20	(20	(20	(20				
ES 6	B	(10	(10	(10	(10				

(Denotes less than

) Denotes greater than

APPENDIX NO. 6

ANALYTICAL RESULTS

SAMPLE NUMBER	Cu ppm	Pb ppm	Zn ppm	Ag ppm	Cd ppm	Mn ppm	Fe %
KD 0651	15	290	320	2	10	)10000	3.6
2	10	210	170	35	5	500	2.7
3	10	120	90	(2	5	390	8.0
4	10	180	150	(2	5	)10000	5.3
5	5	120	160	(2	5	)10000	5.8
6	10	190	200	(2	5	7000	4.7
7	10	160	100	(2	2	4700	2.7
8	10	730	270	2	15	)10000	12.0
9	10	460	110	(2	5	700	3.6
60	2	180	50	(2	5	340	4.2
1	(2	100	40	(2	2	4200	1.8
2	(2	40	30	(2	2	180	0.65
3	(2	30	40	(2	2	230	0.70
4	(2	60	50	(2	2	470	2.4
5	10	170	80	(2	2	140	2.4
6	10	220	120	(2	5	)10000	5.8
7	10	300	410	2	10	)10000	5.3
8	5	80	50	(2	5	5700	6.3
9	(2	20	15	(2	2	70	0.25
70	10	130	60	(2	5	2400	4.1
1	10	100	70	(2	2	2000	3.8
2	10	150	80	(2	5	830	4.8
2**	10	170	90	(2	5	850	5.1
3	5	100	50	(2	2	4100	3.9
4	5	90	50	(2	2	6400	2.3
5	5	50	60	(2	2	1000	3.2
6	2	80	35	(2	2	830	1.7
7	2	20	25	(2	5	80	0.60
8	5	60	40	(2	2	470	2.2
9	2	40	30	(2	2	90	0.95
80	2	70	40	(2	5	500	1.7
1	5	90	50	(2	2	440	3.5
2	5	120	65	(2	5	810	3.6
3	5	140	60	(2	2	900	3.7
4	5	60	65	(2	2	150	1.8
5	5	100	40	(2	5	730	2.3
6	5	100	60	(2	2	540	2.2
7	5	80	50	(2	2	780	2.6
8	2	50	30	(2	5	590	1.0
9	5	120	60	(2	5	1700	3.1
90	5	100	60	(2	5	1500	3.1
1	5	80	60	(2	5	1100	2.6
2	2	80	40	(2	5	520	3.2
3	5	30	25	(2	2	40	0.25
3**	5	30	25	(2	2	35	0.25
4	5	70	30	(2	5	80	1.1
5	5	80	30	(2	2	30	0.50
6	5	50	50	(2	2	340	2.3
KD 0697	10	60	60	(2	2	110	3.2

* Denotes duplicate of previous sample.

** Denotes repeat and check.

(Denotes less than.

SAMPLE NUMBER		Cu ppm	Pb ppm	Zn ppm	Ag ppm	Cd ppm	Mn ppm	Fe %
KD	0698	10	80	80	(2	2	320	4.3
	9	10	80	75	(2	5	200	4.6
	700	10	40	100	(2	2	150	4.1
	1	10	50	100	(2	5	190	1.6
	2	2	50	40	(2	5	1300	1.3
	2**	30	100	200	2	5	2000	6.4
	3	(2	20	30	(2	2	10	0.15
	4	5	60	50	(2	2	420	1.1
	5	.2	40	30	(2	2	100	0.85
	6	2	80	40	(2	5	2000	3.2
	7	2	40	25	(2	2	1200	0.75
	8	10	60	25	(2	2	20	0.35
	9	10	60	90	(2	5	250	1.8
	10	5	60	40	(2	5	140	1.4
	1	5	50	40	(2	2	150	1.4
	2	30	100	200	2	5	2100	6.3
	3	30	110	140	2	5	740	8.6
	4	20	90	160	(2	5	)10000	6.1
	5	10	180	90	(2	5	590	1.9
	6	5	160	50	(2	5	310	0.80
	7	5	180	80	(2	5	310	1.00
	8	5	180	70	2	5	1700	1.5
	9	10	140	90	(2	5	830	2.4
	20	15	220	160	(2	5	2100	6.1
	1	10	160	130	(2	5	1600	5.7
	2	20	150	180	(2	5	2100	4.5
	3	50	160	170	2	5	580	7.0
KD	0724	50	60	150	2	5	600	7.0
KD	0725	30	80	110	(2	5	190	6.3
	6	5	100	40	(2	(2	50	1.16
	7	10	130	50	(2	2	50	2.00
	8	(2	80	20	(2	5	30	0.60
	9	(2	80	30	(2	2	60	0.96
	30	5	80	30	(2	2	60	1.32
	1	5	80	40	(2	5	60	1.36
	2	(2	100	30	(2	2	80	2.15
	3	(2	90	20	(2	5	60	0.76
	4	(2	70	20	(2	2	10	0.16
	5	(2	80	50	(2	(2	10	0.20
	6	(2	70	10	(2	2	10	0.20
	7	(2	80	20	(2	2	70	0.68
	8	5	90	15	(2	2	20	0.48
	9	5	130	20	(2	2	20	0.50
	9**	5	110	20	(2	2	20	0.44
	40	(2	120	30	(2	2	1800	2.55
	1	5	100	40	(2	2	1100	2.05
	2	10	100	20	(2	2	10	0.86
	3	(2	100	20	(2	2	10	0.64
	4	(2	90	15	(2	5	(5	0.08
	5	(2	60	60	(2	2	10	0.10
	6	(2	440	20	(2	2	15	0.38
	7	5	70	30	(2	2	80	2.40
	8	(2	80	20	(2	2	70	0.62
KD	0749	10	70	20	(2	2	30	0.48

* Denotes duplicate of previous sample.

** Denotes repeat and check.

(Denotes less than.

SAMPLE NUMBER		Cu ppm	Pb ppm	Zn ppm	Ag ppm	Cd ppm	Mn ppm	Fe %
KD	0750	15	60	35	(2	(2	5800	4.4
	1	10	110	40	(2	5	2300	2.65
	2	5	140	30	(2	2	210	0.86
	3	10	100	60	(2	2	500	2.5
	4	15	120	100	(2	2	1100	3.1
	5	10	130	130	(2	5	1500	4.4
	6	10	160	100	(2	5	610	6.3
	7	5	100	25	(2	2	270	0.46
	8	5	60	50	(2	5	640	2.15
	9	35	90	170	(2	5	1500	6.1
	60	5	80	40	(2	5	310	3.1
	1	5	200	40	(2	5	9400	2.1
	2	10	170	50	(2	5	5800	4.25
	2**	10	180	60	(2	5	5600	4.1
	3	10	300	80	(2	5	)10000	7.1
	4	5	120	100	(2	5	)10000	5.7
	5	10	220	200	(2	5	)10000	6.7
	6	5	180	120	(2	5	)10000	5.8
	7	(2	210	140	(2	5	)10000	6.1
	8	5	200	100	(2	5	)10000	6.3
	9	(2	340	150	(2	5	)10000	6.7
	70	(2	60	30	(2	2	290	0.72
	1	(2	40	40	(2	2	230	0.82
	2	5	220	70	2	5	)10000	6.6
	3	5	160	70	2	5	7000	6.2
	4	5	140	70	(2	5	2650	5.8
	5	5	180	50	(2	5	5600	7.1
	6	5	70	30	(2	5	90	1.1
	7	(2	40	20	(2	2	30	0.18
	8	(2	100	40	(2	2	1300	3.9
	9	(2	120	40	(2	5	4900	5.6
	80	(2	70	30	(2	2	4700	1.44
	1	(2	140	30	(2	5	2300	2.5
	2	(2	60	20	(2	2	1500	0.96
	3	(2	40	15	(2	5	2500	0.32
	4	(2	40	30	(2	2	520	0.34
	5	10	90	60	(2	(2	240	2.9
	6	Sample not received						
	7	10	340	190	2	5	)10000	8.4
	8	(2	80	40	(2	2	170	1.22
	8**	5	90	40	(2	2	160	1.3
	9	10	60	25	(2	2	60	0.64
	90	5	70	20	(2	2	140	0.34
	1	(2	60	20	2	2	10	0.08
	2	5	80	30	(2	2	1700	1.16
	3	(2	100	30	(2	2	4100	3.8
	4	5	80	20	(2	5	240	0.76
	5	10	80	10	(2	2	30	0.22
	6	5	150	15	(2	2	30	0.28
	7	5	120	20	(2	5	40	0.40
KD	0798	(2	100	20	(2	2	20	0.24

* Denotes duplicate of previous sample.

** Denotes repeat and check.

(Denotes less than.

SAMPLE NUMBER	Cu ppm	Pb ppm	Zn ppm	Ag ppm	Cd ppm	Mn ppm	Fe %
KD 0801	5	30	20	(2	2	60	0.64
2	(2	40	20	(2	(2	180	0.20
3	(2	30	10	(2	(2	20	0.10
4	5	60	10	(2	(2	2000	0.44
5	(2	20	10	(2	(2	80	0.14
6	(2	30	10	(2	2	60	0.08
7	(2	250	90	(2	5	)10000	5.4
8	(2	140	40	(2	2	5800	0.78
KD 0809	2	640	260	(2	5	)10000	5.0
KD 0810	(2	90	30	(2	(2	280	0.16
1	(2	90	30	(2	(2	680	0.18
2	(2	30	30	(2	(2	180	0.08
3	(2	60	40	(2	2	300	0.21
4	(2	40	20	(2	(2	100	0.16
5	(2	20	20	(2	(2	(5	0.08
6	(2	40	40	(2	(2	200	0.30
7	(2	50	20	(2	(2	(5	0.18
8	(2	30	50	(2	5	440	3.4
9	(2	20	20	(2	(2	(5	0.46
20	(2	30	20	(2	2	780	1.65
1	(2	40	40	(2	(2	600	4.4
2	(2	20	20	(2	(2	140	0.53
3	(2	20	20	(2	2	20	0.06
3**	(2	20	30	(2	2	20	0.06
4	(2	30	30	(2	(2	80	0.60
5	(2	30	30	(2	(2	60	0.40
6	(2	20	30	(2	(2	60	0.42
7	(2	20	20	(2	(2	40	0.20
8	(2	20	30	(2	2	40	0.34
9	(2	20	20	(2	(2	20	0.04
30	2	20	30	(2	(2	20	0.08
1	(2	20	20	(2	2	30	0.08
2	(2	20	20	(2	(2	20	0.19
3	2	20	30	(2	(2	10	0.12
4	(2	20	30	(2	(2	(5	0.04
5	(2	20	30	(2	(2	(5	0.02
6	(2	20	40	(2	(2	(5	0.05
7	(2	20	30	(2	(2	(5	0.04
8	(2	20	20	(2	(2	(5	0.02
9	(2	20	15	(2	(2	(5	0.04
40	(2	20	20	(2	(2	(5	0.05
40**	(2	20	30	(2	(2	10	0.06
1	(2	20	15	(2	(2	(5	0.08
2	10	20	20	(2	(2	40	1.28
3	(2	30	20	(2	(2	60	0.80
4	10	30	30	(2	(2	380	1.92
5	5	30	30	(2	(2	60	1.04
6	5	30	20	(2	2	250	0.80
7	(2	40	20	(2	2	540	1.80
8	5	30	30	(2	2	60	1.00
9	5	20	15	(2	(2	60	0.82
KD 0850	10	40	20	(2	(2	480	2.20

* Denotes duplicate of previous sample.

** Denotes repeat and check.

(Denotes less than.

SAMPLE NUMBER		Cu ppm	Pb ppm	Zn ppm	Ag ppm	Cd ppm	Mn ppm	Fe %
KD	0851	(2	90	20	(2	5	130	0.92
	2	5	90	20	(2	5	140	0.88
	3	(2	70	20	(2	5	10	0.38
	3**	(2	60	20	(2	5	10	0.42
	4	(2	60	20	(2	5	10	0.22
	5	10	140	110	(2	5	4000	2.7
	6	(2	150	50	(2	5	1700	0.90
	7	10	150	60	(2	5	4400	1.21
KD	0858	10	80	40	(2	2	70	1.14
KD	0859	30	40	130	(2	2	900	3.6
	60	20	40	100	(2	2	1260	3.5
	1	30	40	110	(2	(2	860	3.6
	2	40	40	220	(2	2	860	8.2
	3	40	120	230	(2	2	9600	6.6
	4	20	100	150	(2	2	3400	4.7
	5	30	140	200	(2	2	5400	4.4
	6	10	110	80	(2	(2	420	0.72
	7	100	120	110	2	2	1240	1.6
	8	20	120	50	(2	(2	140	0.84
	9	5	160	50	2	(2	120	0.42
	70	5	180	40	(2	(2	300	0.86
	1	5	150	40	(2	(2	300	0.82
	2	10	1480	620	2	10	)10000	7.0
	2**	10	1440	600	2	10	)10000	6.9
	3	10	1280	280	(2	2	4700	4.1
	4	40	1680	740	(2	15	)10000	9.0
	5	40	70	280	2	10	5200	36.0
	6	20	20	180	2	10	2800	23.0
	7	50	70	210	(2	5	6000	22.0
	8	15	120	170	(2	10	)10000	19.0
	9	15	130	140	2	5	)10000	18.0
	80	15	120	130	2	10	)10000	27.0
	1	20	130	120	2	5	5000	21.0
	2	10	80	130	2	5	8000	18.0
	3	20	120	90	(2	5	2200	10.2
	4	15	90	90	(2	5	680	7.8
	5	30	120	90	(2	5	600	8.6
	6	30	120	240	2	10	)10000	10.4
	7	20	80	210	(2	5	5400	17.0
	8	40	40	250	(2	5	1800	13.0
	9	40	90	380	(2	10	)10000	18.0
	90	40	30	280	(2	5	6400	18.0
	1	40	90	340	(2	10	6000	18.0
	2	30	70	190	(2	5	5200	16.0
	3	5	30	10	(2	(2	60	0.52
	3**	5	30	15	(2	(2	50	0.50
	4	5	20	10	(2	(2	60	0.20
	5	5	20	10	(2	(2	20	0.26
	6	5	30	20	(2	(2	40	0.22
	7	5	20	10	(2	(2	30	0.07
	8	(2	20	10	(2	(2	30	0.10
KD	0899	5	20	30	(2	(2	40	0.64

* Denotes duplicate of previous sample.

** Denotes repeat and check.

(Denotes less than.

SAMPLE NUMBER	Cu ppm	Pb ppm	Zn ppm	Ag ppm	Cd ppm	Mn ppm	Fe %
KD 0901	(2	40	20	(2	2	2200	2.64
2	5	40	15	(2	(2	400	1.40
3	(2	30	15	(2	2	440	0.92
4	(2	40	50	2	(2	2400	3.0
5	(2	20	30	(2	(2	70	0.19
6	(2	40	30	(2	(2	3800	1.70
7	(2	20	40	(2	(2	(5	0.28
8	(2	20	20	(2	(2	20	0.34
9	(2	20	20	(2	2	20	0.10
10	(2	20	20	(2	(2	1220	0.76
1	(2	20	30	(2	2	900	0.74
1**	(2	20	30	(2	2	880	0.72
2	(2	20	30	(2	(2	80	0.18
3	(2	20	30	(2	(2	(5	0.09
4	(2	20	30	(2	(2	20	0.09
5	(2	20	30	(2	(2	380	0.88
6	(2	20	40	(2	5	400	1.70
KD 0917	(2	20	40	(2	(2	20	0.15

ANALYTICAL METHODS: Cu, Pb, Zn, Ag, Cd, Mn, Fe by AAS following HCl leach and HCl/HNO_3 leach in latter stages of 0.25g sample.

* Denotes duplicate of previous sample.

** Denotes repeat and check.

(Denotes less than.

SAMPLE NUMBER	As ppm	Ba ppm	Sn ppm			
KD 0651	(5	500	50			
2	(5	300	5			
3	(5	300	5			
4	(5	300	10			
5	(5	300	10			
6	(5	300	10			
7	(5	500	10			
8	30	100	5			
9	(5	500	10			
60	(5	500	5			
1	(5	500	20			
2	(5	500	20			
3	(5	300	10			
4	(5	500	10			
5	(5	50	10			
6	30	300	10			
7	(5	300	30			
8	10	300	30			
9	(5	500	10			
70	(5	300	20			
1	(5	300	10			
2	(5	500	10			
3	(5	500	10			
4	(5	500	20			
5	(5	300	10			
6	(5	300	10			
7	(5	300	10			
8	(5	300	10			
9	(5	500	10			
80	(5	500	10			
1	(5	500	5			
2	(5	300	20			
3	(5	500	20			
4	(5	500	5			
5	(5	300	10			
6	(5	500	30			
7	(5	400	30			
8	(5	300	10			
9	20	500	10			
90	(5	300	10			
1	(5	500	10			
2	(5	1000	20			
3	(5	1000	10			
4	(5	500	5			
5	(5	1000	5			
6	(5	500	30			
7	(5	500	20			
8	(5	500	50			
9	(5	300	10			
700	(5	500	30			
1	(5	300	5			
2	(5	500	3			
3	(5	100	20			
4	(5	500	10			
KD 0705	(5	500	20			

● Denotes duplicate of previous sample.

● ● Denotes repeat and check.

(Denotes less than.

SAMPLE NUMBER	As ppm	Ba ppm	Sn ppm			
KD 0706	(5	500	30			
7	(5	300	10			
8	(5	100	3			
9	(5	500	10			
10	20	500	20			
1	(5	500	20			
2	(5	100	5			
3	(5	200	5			
4	(5	(30	5			
5	(5	300	1000			
6	(5	300	500			
7	(5	300	1000			
8	(5	300	50			
9	(5	300	1000			
20	(5	300	500			
1	(5	200	1000			
2	(5	300	300			
3	(5	100	3			
KD 0724	(5	200	3			
KD 0725	(5	500	5			
6	Insufficient Sample					
7	(5	1000	10			
8	(5	500	10			
9	(5	300	10			
30	(5	300	10			
1	(5	300	20			
2	(5	300	10			
3	(5	300	(1			
4	(5	300	(1			
5	(5	300	10			
6	(5	1000	10			
7	(5	1000	10			
8	(5	300	10			
9	(5	1000	10			
40	20	300	20			
1	10	500	10			
2	10	300	5			
3	10	300	3			
4	(5	200	(1			
5	(5	300	(1			
6	10	500	3			
7	10	300	10			
8	(5	500	10			
9	(5	200	5			
50	10	500	10			
1	(5	500	5			
2	(5	500	5			
3	(5	300	10			
4	(5	200	10			
5	10	300	10			
6	60	300	3			
7	(5	300	10			
8	(5	500	10			
KD 0759	(5	300	5			

● Denotes duplicate of previous sample.

●● Denotes repeat and check.

(Denotes less than.

SAMPLE NUMBER	As ppm	Ba ppm	Sn ppm			
KD 0760	(5	500	10			
1	10	500	10			
2	(5	500	10			
3	(5	500	10			
4	10	1000	20			
5	(5	500	30			
6	10	500	30			
7	(5	500	50			
8	(5	500	20			
9	(5	500	30			
70	(5	500	20			
1	(5	500	20			
2	10	500	20			
3	(5	500	20			
4	10	500	10			
5	(5	500	10			
6	(5	500	5			
7	(5	500	5			
8	(5	300	20			
9	10	500	5			
80	(5	500	10			
1	(5	300	10			
2	(5	300	10			
3	(5	100	3			
4	(5	300	5			
5	(5	500	3			
6	Sample not received.					
7	20	500	30			
8	(5	500	20			
9	(5	500	10			
90	(5	500	10			
1	(5	200	5			
2	(5	300	20			
3	(5	500	30			
4	(5	500	10			
5	(5	500	10			
6	(5	500	20			
7	(5	500	10			
KD 0798	(5	300	5			
KD 0851	10	300	10			
2	(5	300	5			
3	(5	500	10			
4	(5	100	5			
5	(5	500	3			
6	(5	300	10			
7	(5	500	10			
KD 0858	(5	500	5			

ANALYTICAL METHODS: As by modified Gutzeit method following Potassium Pyrosulphate fusion of 0.25g sample. Ba, Sn determined by Emission Spectrography

* Denotes duplicate of previous sample.

** Denotes repeat and check.

(Denotes less than.

SAMPLE NUMBER	Ba ppm	Sn ppm	SAMPLE NUMBER	Ba ppm	Sn ppm
KD 0801	300	10	KD 0863	1000	300
2	300	10	4	500	500
3	500	10	5	500	1000
4	300	100	6	500	2000
5	500	5	7	1000	300
6	500	10	8	300	500
7	500	10	9	500	50
8	300	100	70	500	50
9	500	100	1	300	20
10	500	50	2	1000	50
1	500	30	3	1000	50
2	300	50	4	1000	5
3	500	20	5	300	10
4	1000	10	6	300	10
5	500	5	7	300	10
6	1000	10	8	300	20
7	1000	1000	9	200	5
8	1000	500	80	300	10
9	300	30	1	300	5
20	300	100	2	300	5
1	300	50	3	300	3
2	500	20	4	300	5
3	100	20	5	300	5
4	300	100	6	300	5
5	500	100	7	300	30
6	500	50	8	200	10
7	300	100	9	500	10
8	500	30	90	300	10
9	50	5	1	300	10
30	100	5	2	300	3
1	200	10	3	1000	30
2	300	100	4	500	10
3	500	10	5	500	5
4	50	20	6	500	30
5	50	10	7	300	50
6	100	50	8	300	10
7	500	10	KD 0899	300	30
8	100	30			
9	100	10			
40	100	30			
1	100	30	KD 0901	300	20
2	300	50	2	500	30
3	500	30	3	500	30
4	300	100	4	300	30
5	500	20	5	500	5
6	300	30	6	300	100
7	1000	30	7	300	20
8	500	10	8	300	10
9	500	10	9	300	30
KD 0850	500	30	10	500	50
			1	300	50
KD 0859	500	500	2	300	30
60	300	3	3	300	30
1	300	10	4	100	50
KD 0862	100	5	KD 0915	500	30

• Denotes duplicate of previous sample.

•• Denotes repeat and check.

(Denotes less than.

SAMPLE NUMBER	Ba ppm	Sn ppm	SAMPLE NUMBER	Ba ppm	Sn ppm
KD 0916	500	50			
0917	500	10			

ANALYTICAL METHODS: Ba, Sn determined by Emission Spectrography.

● Denotes duplicate of previous sample.

● ● Denotes repeat and check.

(Denotes less than.

APPENDIX NO. 6

ANALYTICAL RESULTS

SAMPLE NUMBER	Sn ppm		SAMPLE NUMBER	Sn ppm	
KD 0715	770				
0716	390				
0717	1120				
0719	340				
0720	390				
0721	430				
0722	140				
0804	Insufficient sample				
0808	(20				
0809	Insufficient sample				
0817	(20				
0818	350				
0820	(20				
0821	55				
0824	55				
0825	46				
0827	29				
0832	20				
0844	26				
0859	400				
0863	230				
0864	330				
0865	1220				
0866	1770				
0867	Insufficient sample				
0868	540				
KD 0906	(20				

The Sn (XRF) values are in most cases in agreement with the Emission Spec. values reported in earlier batches. In some cases there was insufficient sample to give a pressing of infinite thickness for XRF work and this probably accounts for Sn being undetected in some samples, contrasting with positive values by Emission Spec.

ANALYTICAL METHODS: Sn determined by XRF.

* Denotes duplicate of previous sample.

** Denotes repeat and check.

(Denotes less than.

GEOCHEMICAL RESULTS

SEMI-QUANTITATIVE EMISSION SPECTROSCOPY

All values in ppm

GROUP		SAMPLE NUMBER KD 0809	0872	0873	0874	0878	0880	0881	0889
ES 1	Be	3	3	3	5	3	3	5	10
	Co	30	10	10	10	30	50	10	10
	Cr	300	300	1000	300	300	200	200	300
	Ir	(2	(2	(2	(2	(2	(2	(2	(2
	Mn	)10000	)10000	5000	)10000	)10000	)10000	5000	)10000
	Mo	30	5	5	5	5	20	(3	5
	Nb	(20	(20	(20	(20	(20	(20	(20	(20
	Ni	100	50	100	100	50	50	50	100
	Os	(10	(10	(10	(10	(10	(10	(10	(10
	Pd	(10	(10	(10	(10	(10	(10	(10	(10
	Pt	(10	(10	(10	(10	(10	(10	(10	(10
	Re	(10	(10	(10	(10	(10	(10	(10	(10
	V	50	30	100	100	100	100	100	300
	W	(50	(50	(50	(50	(50	(50	(50	(50
	Ta	(100	(100	(100	(100	(100	(100	(100	(100
	Th	(100	(100	(100	(100	(100	(100	(100	(100
ES 2	Ag	1	2	1	0.5	1	2	2	0.5
	As	(50	(50	(50	(50	50	(50	(50	(50
	Au	(3	(3	(3	(3	(3	(3	(3	(3
	Bi	50	100	100	50	100	100	50	50
	Cd	3	10	(3	10	10	10	3	5
	Cu	3	10	10	30	20	20	20	30
	Ge	(1	(1	(1	(1	(1	(1	(1	(1
	In	(5	(5	(5	(5	(5	(5	(5	(5
	Pb	500	1000	1000	2000	100	100	100	100
	Sb	(30	(30	(30	(30	(30	(30	(30	(30
	Sn	AS REPORTED ON PAGES (1) AND (2)							
	Tl	(1	(1	(1	(1	(1	(1	(1	(1
	Zn	300	500	300	500	200	100	100	300
ES 3	Ba	AS REPORTED ON PAGES (1) AND (2)							
	Ca	3000	)10000	3000	)10000	5000	5000	3000	5000
	Ce	(300	(300	(300	(300	(300	(300	(300	(300
	La	(100	(100	(100	(100	(100	(100	(100	(100
	Sc	(50	(50	(50	(50	(50	(50	(50	(50
	Sr	(30	30	50	50	50	100	100	50
	Ti	1000	3000	3000	5000	3000	3000	3000	3000
	Y	(10	10	(10	(10	(10	(10	10	(10
	Zr	300	100	100	100	(100	300	200	300
ES 4	Hg	(30	(30	(30	(30	(30	(30	(30	(30
	P	500	500	500	300	1000	1000	500	500
	Te	(20	(20	(20	(20	(20	(20	(20	(20
ES 6	B	10	10	(10	(10	30	50	30	30

(Denotes less than

) Denotes greater than

GEOCHEMICAL RESULTS

SEMI-QUANTITATIVE EMISSION SPECTROSCOPY

All values in ppm

GROUP		SAMPLE NUMBER KD 0890	0891							
ES 1	Be	5	10							
	Co	10	10							
	Cr	200	300							
	Ir	(2	(2							
	Mn	5000	5000							
	Mo	5	5							
	Nb	(20	(20							
	Ni	50	100							
	Os	(10	(10							
	Pd	(10	(10							
	Pt	(10	(10							
	Re	(10	(10							
	V	50	100							
	W	(50	(50							
	Ta	(100	(100							
	Th	(100	(100							
ES 2	Ag	1	1							
	As	(50	(50							
	Au	(3	(3							
	Bi	50	100							
	Cd	3	10							
	Cu	30	30							
	Ge	(1	(1							
	In	(5	(5							
	Pb	30	100							
	Sb	(30	(30							
	Sn	AS REPORTED ON PAGES (1) AND (2)								
	Tl	(1	(1							
	Zn	300	300							
ES 3	Ba	AS REPORTED ON PAGES (1) AND (2)								
	Ca	3000	3000							
	Ce	(300	(300							
	La	(100	(100							
	Sc	(50	(50							
	Sr	50	100							
	Ti	3000	3000							
	Y	(10	(10							
	Zr	200	100							
ES 4	Hg	(30	(30							
	P	1000	1000							
	Te	(20	(20							
ES 6	B	50	50							

(Denotes less than

) Denotes greater than

262186

Geopeko Limited
Geological Legend – E.L. 10/74

OPERATION OF LEGEND:

1. Capital letter – indicates primary classification e.g. S - sedimentary rock, A – acid rock, M - basic rock
2. Lower case letters – indicate the following:
   (i) Colours - e.g. pk/grn A = pink fragments in an acid igneous rock with a green matrix.
   (ii) Textural or structural features - e.g. xt A = crystal tuff of acid composition, e.g. pA = porphyric acid rock, e.g. oxA = oxidised acid rock

   b. As suffixes in progresive order,
   (i) Categorised – e.g. pAr = rhyolite, e.g Ia = intermediate rock of andesitic composition.
   (ii) Mineralogy – e.g. pArf = porphyritic (rhyolite) with feldspar phenocrysts, e.g. lxt f/b = lithic crystal tuff with feldspar (phenocryst component) and biotite (prominent matrix component), e.g. lxt f q = lithic crystal tuff with (major) feldspar crystals and (minor) quartz crystals, e.g. fb lvt - lava Idb = flow banded lithic vitric tuff - lava of intermediate dacitic composition with a biotite rich groundmass.

SYMBOLS

IGNEOUS:

A	acid igneous unclassified
Ar	rhyolite
Ard	rhyodacite
I	intermediate igneous unclassified
Ia	andesite
Id	dacite
M	basic igneous unclassified
Mv	basalt
Md	dolerite

STRUCTURAL and TEXTURAL:

t	tuff unclassified
lt	lithic tuff
xt	crystal tuff
vt	vitric tuff
fb	flow banding
p	porphyritic
vns	veins
ox	oxidised
sid	silicified
argd	argillitised

GRAIN SIZE

fg	fine grained	(< 1mm)
mg	medium grained	(5mm - 1mm)
cg	coarse grained	(5mm - 5cm)

SEDIMENTARY

Ssst	Sandstone
Scongl	conglomerate
S	volcaniclastic sediment
Sqtz	quartzite

STRUCTURAL:

	outcrop limit
	rubble boundary
	approximate contact
	bedding
	joint

COLOURS

pk	pink
grn	green
brn	brown
ple	pale
dk	dark

SILICATE MINERALOGY

q	quartz
f	K feldspar
p	plagioclase
b	biotite
c	chlorite
s	sericite
maf	mafics
e	epidote
hb	hornblende

SULPHIDE MINERALOGY

s"	sulphides
py	pyrite
hm	hematite

MISCELLANEOUS

TS 2502 Thin Section and rock No

GEOLOGICAL INTERPRETATION:

Pencil No.		
19 - 43	HOLOCENE	Alluvium, glacial debris (Md), swamp soils
19 - 47	TERT	Olivine basalt (flows, Mv)
19 - 38	L. ORDO	Limestone (Gordon type)
19 - 71	u Є ?	Talus - sandstone, conglomerate
19 - 70	u Є ?	Sandstone, conglomerate (Owen type, Ssst, Scongl)
19 - 22	Є	Undifferentiated cambrian
19 - 63	Є	Crystal lithic tuff (xlt Ar qf; gradational to tuff - lava)
19 - 28	Є	Lithic vitric tuff - lava (fb lvt - lava Idb; intercalated with pArdpq)
19 - 21	Є	Porphyritic plagioclase - quartz rhyolite (fb pAr qp)
19 - 3	Є	Fine grained quartzose volcaniclastic sediment (fg S volcaniclastic sed. q s")
19 - 57	Є	Lithic quartz crystal vitric tuff (lxt Arqf)
19 - 55	Є	Lithic quartz crystal tuff (lxtIa qf maf s")
19 - 23	Є	Quartz crystal vitric tuff - lava (xvt - lava Arq)
19 - 19	Є	Biotite feldspar quartz porphyritic lava (pArd bfq, pAr bfq)

G.L.B., April 1978

OPERATION OF LEGEND:

1. Capital letter – indicates primary classification e.g. S – sedimentary rock, A – acid rock, M – basic rock
2. Lower case letters – indicate the following:
   (i) Colours – e.g. pk/grn A = pink fragments in an acid igneous rock with a green matrix.
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   b. As suffixes in progresive order,
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   (ii) Mineralogy – e.g. pArf = porphyritic (rhyolite) with feldspar phenocrysts, e.g. lxt f/b = lithic crystal tuff with feldspar (phenocryst component) and biotite (prominent matrix component), e.g. lxt f q = lithic crystal tuff with (major) feldspar crystals and (minor) quartz crystals, e.g. fb lvt - lava Idb = flow banded lithic vitric tuff - lava of intermediate dacitic composition with a biotite rich groundmass.

NOTE:
This map has been compiled from enlargements of the Tasmanian Lands Department's 1:15 840 scale topographic machine plots.

SYMBOLS:

IGNEOUS:

A	acid igneous unclassified
Ar	rhyolite
Ard	rhyodacite
I	intermediate igneous unclassified
Ia	andesite
Id	dacite
M	basic igneous unclassified
Mv	basalt
Md	dolerite

SEDIMENTARY:

Ssst	Sandstone
Scongl	conglomerate
S	volcaniclastic sediment
Sqtz	quartzite

STRUCTURAL and TEXTURAL:

t	tuff unclassified.
lt	lithic tuff
xt	crystal tuff
vt	vitric tuff
fb	flow banding
p	porphyritic
vns	veins
ox	oxidised
sid	silicified
argd	argillitised

STRUCTURAL:

- outcrop limit
- rubble boundary
- approximate contact
- bedding
- joint

GRAIN SIZE:

fg	fine grained (< 1mm)
mg	medium grained (5mm - 1mm)
cg	coarse grained (5mm - 5cm)

COLOURS:

pk	pink
grn	green
brn	brown
ple	pale
dk	dark

SILICATE MINERALOGY:

q	quartz
f	K feldspar
p	plagioclase
b	biotite
c	chlorite
s	sericite
maf	mafics
e	epidote
hb	hornblende

SULPHIDE MINERALOGY:

s"	sulphides
py	pyrite
hm	hematite

MISCELLANEOUS:

TS 2502 Thin Section and rock No.

GEOLOGICAL INTERPRETATION:

Pencil No.	Age	Description
19-43	HOLOCENE	Alluvium, glacial debris (Md), swamp soils
19-47	TERT.	Olivine basalt (flows, Mv)
19-38	L.ORDO.	Limestone (Gordon type)
19-71	u Є ?	Talus - sandstone, conglomerate
19-70	u Є ?	Sandstone, conglomerate (Owen type, Ssst, Scongl.)
19-22	Є	Undifferentiated cambrian
19-63	Є	Crystal lithic tuff (xlt Ar qf; gradational to tuff - lava)
19-28	Є	Lithic vitric tuff - lava (fb lvt - lava Idb; intercalated with pArdpq)
19-21	Є	Porphyritic plagioclase - quartz rhyolite (fb pAr qp)
19-3	Є	Fine grained quartzose volcaniclastic sediment (fg S volcaniclastic sed. q s")
19-57	Є	Lithic quartz crystal vitric tuff (lxt Arqf)
19-55	Є	Lithic quartz crystal tuff (lxtIa qf maf s")
19-23	Є	Quartz crystal vitric tuff - lava (xvt - lava Arq)
19-19	Є	Biotite feldspar quartz porphyritic lava (pArd bfq, pAr bfq)

5 cm

GN MN 11·7°

GEOPEKO LIMITED
KING ISLAND GROUP

262187

SCALE: 1:10,000

No. KT10/74-2A

DATE: APRIL '78
GEOLOGIST: R.B.
DRAWN: L.G. & J.M.
CHECKED: M.C.R.

E.L. 10/74
BLACK BLUFF, TASMANIA
GEOLOGICAL MAP

78-1264 Vol. 1/2

1243

KT10/74-1	
KT10/74-2	KT10/74-3


GEOPEKO LIMITED
KING ISLAND GROUP
262188
No. KT10/74-3A
SCALE: 1:10,000
E.L. 10/74
BLACK BLUFF, TASMANIA
GEOLOGICAL MAP
DATE: APRIL '78
GEOLOGIST: R.B.
DRAWN: L.G. & J.M.
CHECKED: M.C.R.
KT10/74-1
KT10/74-2
KT10/74-3
1244
78-1264 Vol 1/2
OPERATION OF LEGEND:
1. Capital letter – indicates primary classification e.g. S - sedimentary rock, A - acid rock, M - basic rock
2. Lower case letters – indicate the following:
(i) Colours - e.g. pk/grn A = pink fragments in an acid igneous rock with a green matrix.
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b. As suffixes in progresive order,
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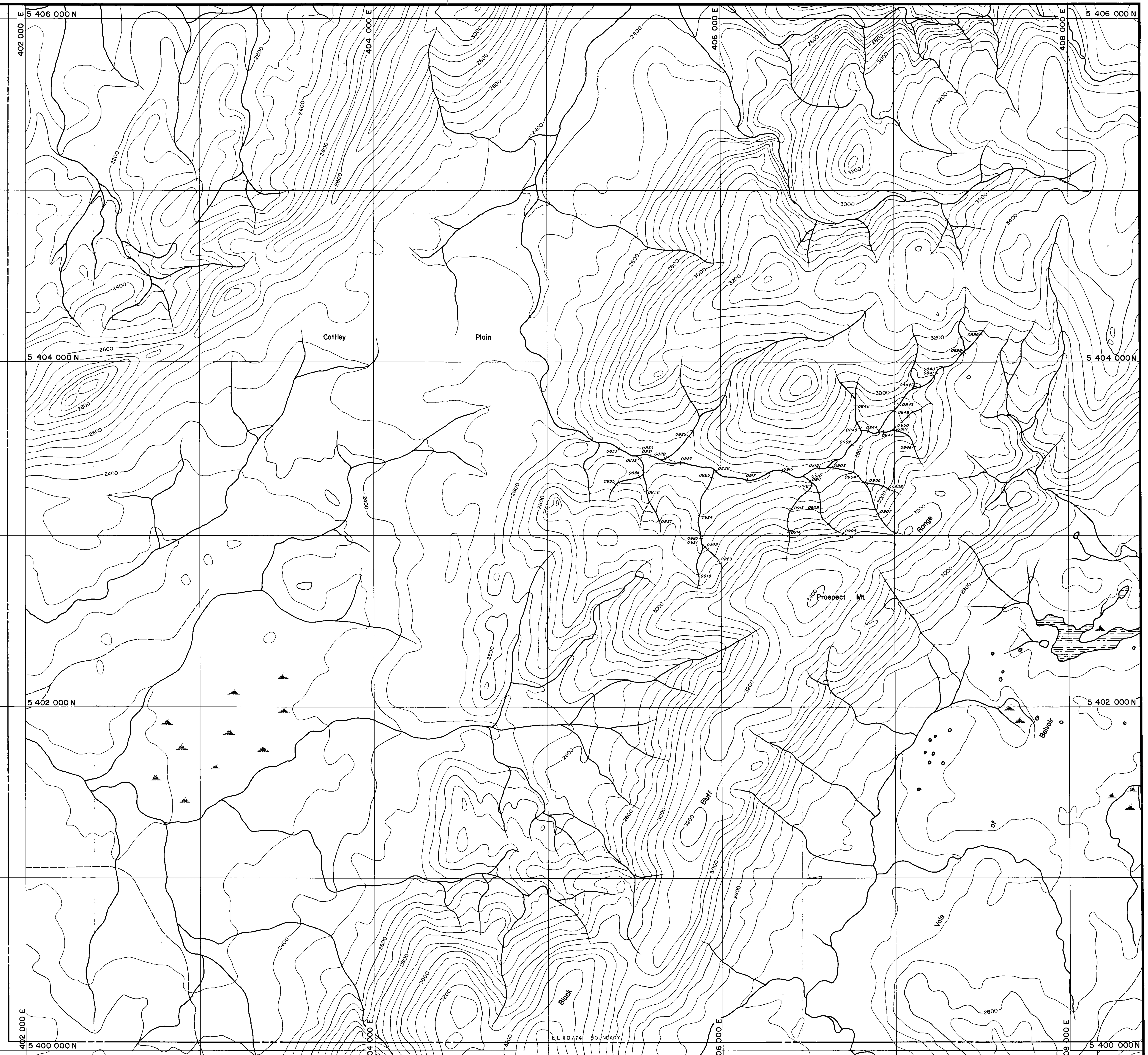
(ii) Mineralogy – e.g. pArf = porphyritic (rhyolite) with feldspar phenocrysts, e.g. lxt f/b = lithic crystal tuff with feldspar (phenocryst component) and biotite (prominent matrix component), e.g. lxt f q = lithic crystal tuff with (major) feldspar crystals and (minor) quartz crystals, e.g. fb lvt - lava Idb = flow banded lithic vitric tuff - lava of intermediate dacitic composition with a biotite rich groundmass.
NOTE:
This map has been compiled from enlargements of the Tasmanian Lands Department's 1:15840 scale topographic machine plots.
SYMBOLS:
IGNEOUS:
A acid igneous
Ar rhyolite
Ard rhyodacite
I intermediate
Ia andesite
Id dacite
M basic igneous
Mv basalt
Md dolerite
SEDIMENTARY:
Ssst Sandstone
Scongl conglomerate
S volcaniclastic
Sqtz quartzite
GEOLOGICAL INTERPRETATION:
Pencil No.
19-43 HOLOCENE Alluvium, glacial debris (Md), swamp soils
19-47 TERT. Olivine basalt (flows, Mv)
19-38 L.ORDO. Limestone (Gordon type)
19-71 U Є ? Talus - sandstone, conglomerate
19-70 U Є ? Sandstone, conglomerate (Owen type, Ssst, Scongl.)
19-22 Є Undifferentiated cambrian
19-63 Є Crystal lithic tuff (xlt Ar qf; gradational to tuff - lava)
19-28 Є Lithic vitric tuff - lava (fb lvt - lava Idb; intercalated with pArdpq
19-21 Є Porphyritic plagioclase - quartz rhyolite (fb pAr qp)
19-3 Є Fine grained quartzose volcaniclastic sediment (fg S volcaniclastic sed. q s")
19-57 Є Lithic quartz crystal vitric tuff (lxt Arqf)
19-55 Є Lithic quartz crystal tuff (lxtIa qf maf s")
19-23 Є Quartz crystal vitric tuff - lava (xvt - lava Arq)
19-19 Є Biotite feldspar quartz porphyritic lava (pArd bfq, pAr bfq)
Lake Lea
Bare Mt.
Black Bluff
Bond Peak
Fall Plain
MARINER 1
MARINER 2
CRADLE MOUNTAIN ROAD
BOUNDARY
5 406 000 N
5 404 000 N
5 402 000 N
5 400 000 N
408 000 E
410 000 E
412 000 E
414 000 E
416 000 E



LEGEND

0820 Drainage sample No KD 0820

NOTE

This map has been compiled from enlargements of the Tasmanian Lands Department's 1 15840 scale topographic machine plots

5 cm

GEOPEKO LIMITED

KING ISLAND GROUP

262189

SCALE: 1:10,000

No. KT10/74-2C

GIS Surv 246

DATE: November 1977

GEOLOGIST: R B

DRAWN: L G & J M

CHECKED: M C R

E.L. 10/74

BLACK BLUFF, TASMANIA

DRAINAGE SAMPLE LOCATION MAP

78-1264 Vol. 1/2

1245

KT10/74-1	
KT10/74-2	KT10/74-3

LEGEND

0612 Drainage sample No. KD 0612

NOTE
This map has been compiled from enlargements of the Tasmanian Lands Department's 1 15840 scale topographic machine plots

5 cm

DATE: November 1977

GEOLOGIST: R B

DRAWN: L G & J M

CHECKED: M C R

262190 GEOPEKO LIMITED
KING ISLAND GROUP

78-1264 Vol 2

SCALE: 1 10,000

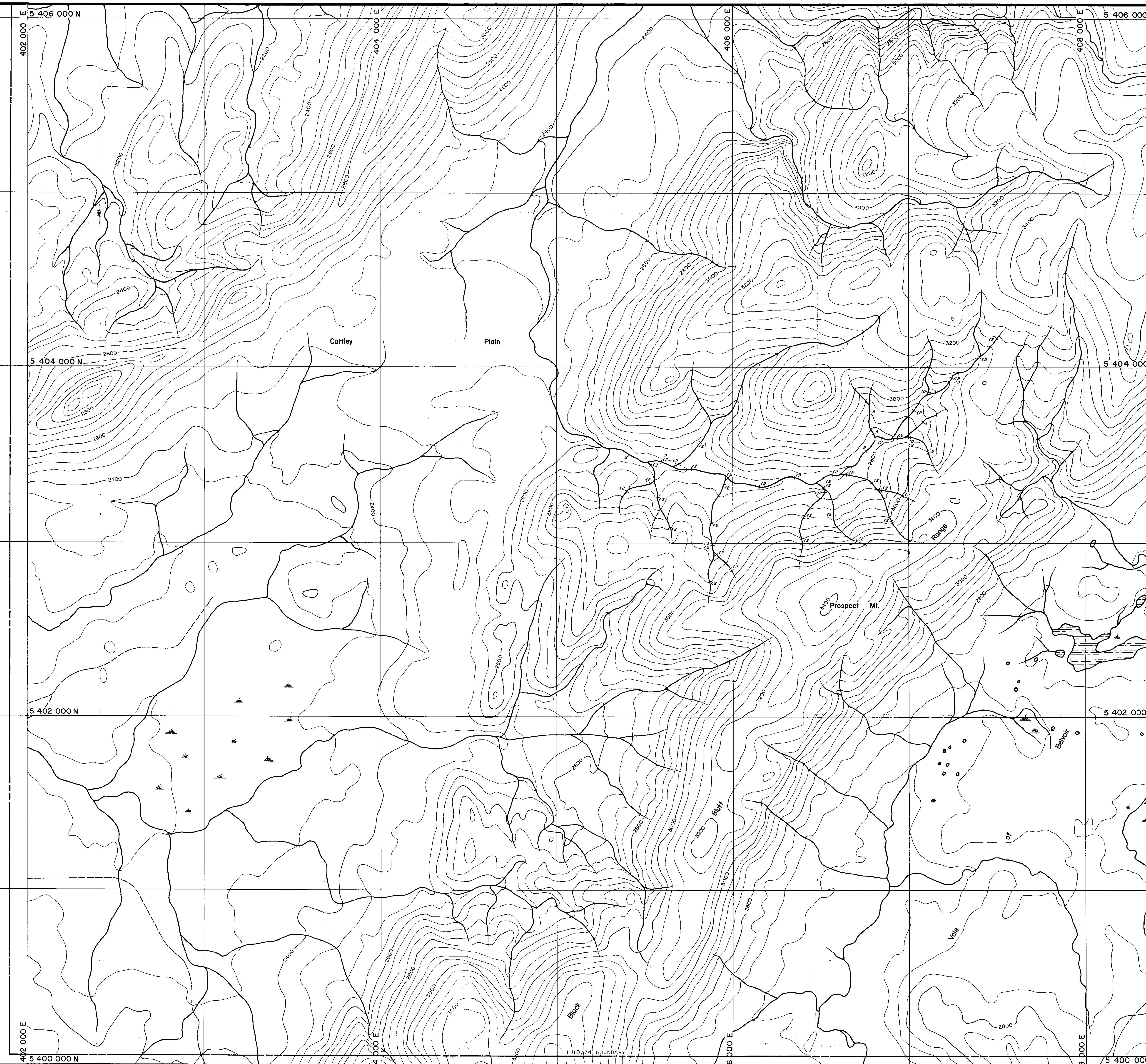
No. KT10/74-3C

1246

KT10/74-1	
KT10/74-2	KT10/74-3

E.L. 10/74
BLACK BLUFF, TASMANIA

DRAINAGE SAMPLE LOCATION MAP



LEGEND

<2 Cu ppm

ANALYTICAL METHODS Cu by AAS following conc HCL leach and HCL / HNO3 leach in latter stages for 1 hour of 0 25g sample

A C S Laboratories Pty LTD

NOTE

This map has been compiled from enlargements of the Tasmanian Lands Department's 1 15840 scale topographic machine plots

5 cm

262191 GEOPEKO LIMITED
KING ISLAND GROUP
78-1264 Vol 1/2

SCALE: 1 10,000

No. KT10/74-2B-1

DATE - November 1977

GEOLOGIST R B

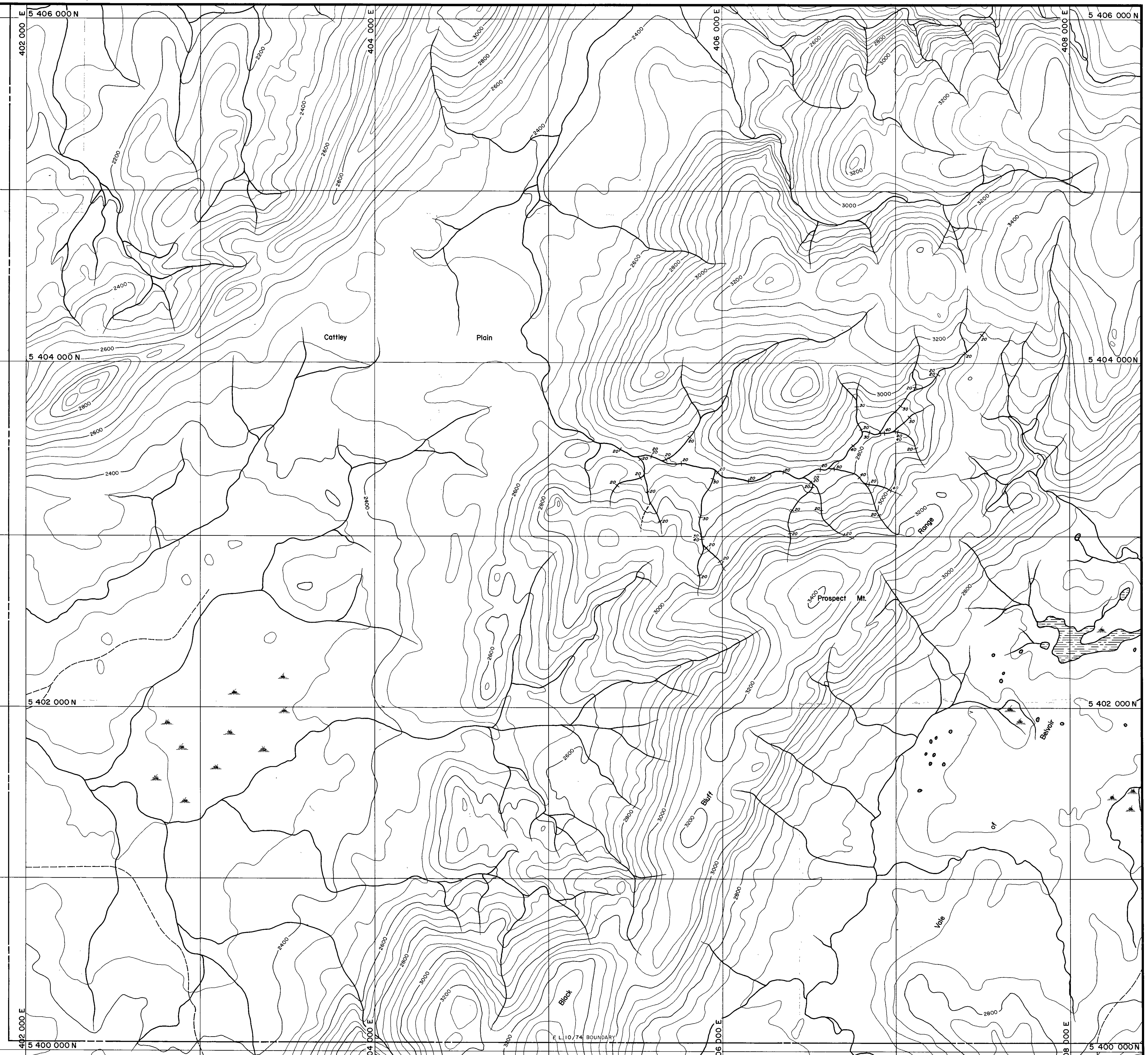
DRAWN L G B J M

CHECKED M C R

E.L. 10/74
BLACK BLUFF, TASMANIA

DRAINAGE GEOCHEMICAL RESULTS
COPPER

KT10/74-1	1247
KT10/74-2	KT10/74-3



LEGEND:

20 Pb ppm

ANALYTICAL METHODS Pb by AAS following hot conc. HCL leach and HCL/HNO3 leach in latter stages for 1 hour of 0 25g sample

A C S Laboratories Pty LTD

NOTE

This map has been compiled from enlargements of the Tasmanian Lands Department's 1 15840 scale topographic machine plots

5 cm

GEOPEKO LIMITED

KING ISLAND GROUP

262192

78-1264 Vol 1/2

SCALE: 1 10,000

No. KT10/74-2B-2

DATE: November 1977

GEOLOGIST: R B

DRAWN: L G. & J M

CHECKED: M C R

E.L. 10/74

BLACK BLUFF, TASMANIA

DRAINAGE GEOCHEMICAL RESULTS

LEAD

1248

KT10/74-1	
KT10/74-2	KT10/74-3

LEGEND
40 Zn ppm

ANALYTICAL METHODS Zn by AAS following hot conc HCL leach and HCL/HNO3 leach in latter stages for 1 hour of 0 25g sample
A C S Laboratories Pty LTD

NOTE
This map has been compiled from enlargements of the Tasmanian Lands Department's 1 15840 scale topographic machine plots

5 cm

262193 GEOPEKO LIMITED
KING ISLAND GROUP
78-1264 Vol 1/2

SCALE: 1 10,000

No. KT10/74-2B-3

DATE: November 1977
GEOLOGIST: R B
DRAWN: L G & J M
CHECKED: M C R

E.L. 10/74
BLACK BLUFF, TASMANIA
DRAINAGE GEOCHEMICAL RESULTS
ZINC

1249

KT10/74-1	
KT10/74-2	KT10/74-3

LEGEND:
100 Sn ppm
*55 Sn ppm XRF

ANALYTICAL METHODS Sn by Emission Spectrography
*Sn by XRF
A. C S Laboratories Pty LTD

NOTE
This map has been compiled from enlargements of the Tasmanian Lands Department's 1 15840 scale topographic machine plots

5 cm

DATE: November 1977
GEOLOGIST: R B.
DRAWN: L G & J M
CHECKED: M C R

262194 GEOPEKO LIMITED
KING ISLAND GROUP
78-1264 Vol. 1/2

SCALE: 1 10,000

No. KT10/74-2B-4

E.L. 10/74
BLACK BLUFF, TASMANIA
DRAINAGE GEOCHEMICAL RESULTS TIN

1250

KT10/74-1	
KT10/74-2	KT10/74-3

LEGEND
50 Cu ppm

ANALYTICAL METHODS Cu by AAS following hot conc HCL leach and HCL/HNO3 leach in latter stages for 1 hour of 0.25g sample
A C S Laboratories Pty LTD

5 cm

NOTE
This map has been compiled from enlargements of the Tasmanian Lands Department's 1:15840 scale topographic machine plots

262195
GEOPEKO LIMITED
KING ISLAND GROUP
78-1264 Vol 1/2

SCALE: 1:10,000

No. KT10/74-3B-1

DATE: November 1977
GEOLOGIST: R B
DRAWN: L G & J M
CHECKED: M C R

E.L. 10/74
BLACK BLUFF, TASMANIA

DRAINAGE GEOCHEMICAL RESULTS
COPPER

1251

KT10/74-1	
KT10/74-2	KT10/74-3

LEGEND

1680 Pb ppm

ANALYTICAL METHODS Pb by AAS following hot conc HCL leach and HCL/HNO3 leach in latter stages for 1 hour of 0 25g sample

A C S Laboratories Pty LTD

NOTE

This map has been compiled from enlargements of the Tasmanian Lands Department's 1 15840 scale topographic machine plots

5 cm

262196 GEOPEKO LIMITED

KING ISLAND GROUP

78-1264 Vol 1/2

SCALE: 1 10,000

No. KT10/74-3B-2

DATE: November 1977

GEOLOGIST: R B

DRAWN: L G & J M

CHECKED: M C R

E.L. 10/74

BLACK BLUFF, TASMANIA

DRAINAGE GEOCHEMICAL RESULTS

LEAD

1252

KT10/74-1	
KT10/74-2	KT10/74-3

LEGEND

620 Zn ppm

ANALYTICAL METHODS Zn by AAS following hot conc HCL leach and HCL/HNO3 leach in latter stages for 1 hour of 0 25g sample

A C S Laboratories Pty LTD

NOTE
This map has been compiled from enlargements of the Tasmanian Lands Department's 1 15840 scale topographic machine plots

5 cm

DATE: November 1977
GEOLOGIST: R.B.
DRAWN: L G & J M
CHECKED: M C R

262197 GEOPEKO LIMITED
KING ISLAND GROUP
78-1264 Vol. 1/2

SCALE: 1 10,000

No. KT10/74-3B-3

E.L. 10/74
BLACK BLUFF, TASMANIA

DRAINAGE GEOCHEMICAL RESULTS
ZINC

1253

KT10/74-1	
KT10/74-2	KT10/74-3

LEGEND:

1000 Sn ppm

*770 Sn ppm by XRF

ANALYTICAL METHODS Sn by Emission Spectrography
Sn by XRF

A C S Laboratories Pty LTD

NOTE:
This map has been compiled from enlargements of the Tasmanian Lands Department's 1:15840 scale topographic machine plots.

5 cm

DATE: November 1977
GEOLOGIST: R B
DRAWN: L G & J M
CHECKED: M C R

262198 **GEOPEKO LIMITED**
KING ISLAND GROUP
78-1264 Vol 1-2

SCALE: 1 10,000

No. KT10/74-3B-4

E.L. 10/74
BLACK BLUFF, TASMANIA
DRAINAGE GEOCHEMICAL RESULTS TIN

1254

KT10/74-1	
KT10/74-2	KT10/74-3

LEGEND

5800 Mn ppm

ANALYTICAL METHODS: Mn by AAS following hot conc HCL leach and HCL/HNO_3 leach in latter stages for 1 hour of 0 25g sample

A C S Laboratories Pty LTD

NOTE

This map has been compiled from enlargements of the Tasmanian Lands Departments 1 15840 scale topographic machine plots

5 cm

262199

GEOPEKO LIMITED

KING ISLAND GROUP

78-1264 Vol 1/2

SCALE: 1 10,000

No. KT10/74-3B-5

DATE: November 1977

GEOLOGIST: R B

DRAWN: L G & J M

CHECKED: M C R

E.L. 10/74

BLACK BLUFF, TASMANIA

DRAINAGE GEOCHEMICAL RESULTS

MANGANESE

1255

KT10/74-1	
KT10/74-2	KT10/74-3

LEGEND

o 2624 Outcrop sample No KR 2624

NOTE

This map has been compiled from enlargements of the Tasmanian Lands Department's 1:15840 scale topographic machine plots

5 cm

262200 GEOPEKO LIMITED

KING ISLAND GROUP

78-1264 Vol 1-2

SCALE: 1:10,000

No. KT10/74-2D

DATE: December 1976

GEOLOGIST: R B

DRAWN: J P M

CHECKED: M C R

E.L. 10/74
BLACK BLUFF, TASMANIA
ROCK SAMPLE LOCATION MAP

1256

KT10/74-1	
KT10/74-2	KT10/74-3

LEGEND
o 2710 Outcrop Sample No KR 2710

NOTE
This map has been compiled from enlargements of the Tasmanian Lands Department's 1 15840 scale topographic machine plots

5 cm

DATE: November 1977
GEOLOGIST: R B
DRAWN: L G & J M
CHECKED: M C R

262201 GEOPEKO LIMITED
KING ISLAND GROUP
78-1264 Vol 1/2

SCALE: 1 10,000

No. KT10/74-3D

E.L. 10/74
BLACK BLUFF, TASMANIA

ROCK SAMPLE LOCATION MAP

1257

KT10/74-1	
KT10/74-2	KT10/74-3

Geopeko Limited
Geological Legend – E.L. 10/74

OPERATION OF LEGEND:

1. Capital letter – indicates primary classification e.g S – sedimentary rock, A – acid rock, M - basic rock
2. Lower case letters – indicate the following:
   (i) Colours - e.g. pk/grn A = pink fragments in an acid igneous rock with a green matrix.
   (ii) Textural or structural features - e.g. xt A = crystal tuff of acid composition, e.g. pA = porphyric acid rock, e.g oxA = oxidised acid rock

   b. As suffixes in progresive order,
   (i) Categorised – e.g. pAr = rhyolite, e.g Ia = intermediate rock of andesitic composition.
   (ii) Mineralogy – e.g. pArf = porphyritic (rhyolite) with feldspar phenocrysts, e.g lxt f/b = lithic crystal tuff with feldspar (phenocryst component) and biotite (prominent matrix component), e.g. lxt fq = lithic crystal tuff with (major) feldspar crystals and (minor) quartz crystals, e.g. fb lvt - lava Idb = flow banded lithic vitric tuff - lava of intermediate dacitic composition with a biotite rich groundmass.

SYMBOLS:

IGNEOUS:

A	acid igneous unclassified
Ar	rhyolite
Ard	rhyodacite
I	intermediate igneous unclassified
Ia	andesite
Id	dacite
M	basic igneous unclassified
Mv	basalt
Md	dolerite

STRUCTURAL and TEXTURAL:

t	tuff unclassified
lt	lithic tuff
xt	crystal tuff
vt	vitric tuff
fb	flow banding
p	porphyritic
vns	veins
ox	oxidised
sid	silicified
argd	argillitised

GRAIN SIZE:

fg	fine grained (< 1mm)
mg	medium grained (5mm - 1mm)
cg	coarse grained (5mm - 5cm)

SEDIMENTARY:

Ssst	Sandstone
Scongl	conglomerate
S	volcaniclastic sediment
Sqtz	quartzite

STRUCTURAL:

	outcrop limit
	rubble boundary
	approximate contact
	bedding
	joint

COLOURS:

pk	pink
grn	green
brn	brown
ple	pale
dk	dark

SILICATE MINERALOGY

q	quartz
f	K feldspar
p	plagioclase
b	biotite
c	chlorite
s	sericite
maf	mafics
e	epidote
hb	hornblende

SULPHIDE MINERALOGY

s"	sulphides
py	pyrite
hm	hematite

MISCELLANEOUS

TS 2502 Thin Section and rock No

GEOLOGICAL INTERPRETATION:

Pencil No		
19-43	HOLOCENE	Alluvium, glacial debris (Md), swamp soils
19-47	TERT	Olivine basalt (flows, Mv)
19-38	L. ORDO	Limestone (Gordon type)
19-71	u Є ?	Talus - sandstone, conglomerate
19-70	u Є ?	Sandstone, conglomerate (Owen type, Ssst, Scongl)
19-22	Є	Undifferentiated cambrian
19-63	Є	Crystal lithic tuff (xlt Ar qf; gradational to tuff - lava)
19-28	Є	Lithic vitric tuff - lava (fb lvt - lava Idb; intercalated with pArdpq)
19-21	Є	Porphyritic plagioclase - quartz rhyolite (fb pAr qp)
19-3	Є	Fine grained quartzose volcaniclastic sediment (fg S volcaniclastic sed q s")
19-57	Є	Lithic quartz crystal vitric tuff (lxt Arqf)
19-55	Є	Lithic quartz crystal tuff (lxtIa qf maf s")
19-23	Є	Quartz crystal vitric tuff - lava (xvt - lava Arq)
19-19	Є	Biotite feldspar quartz porphyritic lava (pArd bfq, pAr bfq)

G.L.B., April 1978

NOTE:
This interpretation is based upon —
surface (KT 10/74 - M - 3B),
float (KT 10/74 - M - 3C), and
auger hole rock chip (KT10/74-M-3D)
geological data.

SYMBOLS

- TS 2739 — Thin section and rock number
- . 2742 — Rock sample for geochemical analysis, results in appendix 4.
- ——— Approximate contact.
- — — — Interpreted contact.
- ● Power auger hole.
- ∘ Hand auger hole
- ○ Auger core hole

GEOLOGICAL INTERPRETATION

Pencil			
	TERT.		Olivine basalt (thin)
19-47	TERT.		Olivine basalt (thick)
19-55		Є	Lithic quartz crystal tuff
19-19		Є	Biotite feldspar quartz porphyry
19-41		Є	Argillic- chloritic biotite feldspar quartz porphyry (minor volcanic breccia).

AUGER CORE HOLE ROCK GEOCHEMISTRY: (ppm)

KR	Depth Interval (m)	Cu	Pb	Zn	Ag	Cd	Mn	Sn	Ba	Fe %
2717	8·94 — 9·04	120	1760	520	10	5	520	100	500	4·0
2718	11·28 — 11·38	160	7800	290	55	5	7600	100	1000	2·9
2718*	11·28 — 11·38	170	7900	300	60	5	7650	—	—	3·0
2719	16·64 — 16·74	10	310	1010	2	2	1680	50	500	3·6
2720	17·87 — 17·97	5	110	360	<2	5	630	50	1000	1·8

* Denotes repeat and check analysis.

GN MN 11·7°

262203

GEOPEKO LIMITED
KING ISLAND GROUP

SCALE: 1 : 5000

No. KT10/74-M-3A

DATE: MAR '78
GEOLOGIST: R.B.
DRAWN L.G. & J.M.
CHECKED: M.C.R.

E.L.10/74 BLACK BLUFF, TASMANIA
MARINER 1 and MARINER 2
INTERPRETATION GEOLOGICAL MAP

1256

78-1264 Vol. 2/2.

LEGEND:

For details of abbreviations used for the geological interpretation refer to map number KT 10/74- 3A

GEOLOGICAL INTERPRETATION

Pencil No.			
19-43		HOLOCENE	Alluvium
19-51		HOLOCENE	Colluvium – Mv, lxt, pArd bfq, pAr q hb, glacial debris (Md; Sqtz), swamp deposits.
19-47		TERT.	Olivine basalt (flows, Mv)
19-70		U Є ?	Sandstone, Conglomerate (Owen type)
19-19		Є	Biotite feldspar quartz porphyritic lava (pArd bfq)

5 cm

GEOPEKO LIMITED
KING ISLAND GROUP

SCALE: 1 : 5000

No. KT10/74-M-3B

DATE: MAR '78
GEOLOGIST: R.B.
DRAWN L.G. & J.M.
CHECKED: M.C.R.

E.L. 10/74 BLACK BLUFF, TASMANIA
MARINER 1 and MARINER 2
SURFACE GEOLOGICAL MAP

1259

78-1264 Vol. 2/2.

LEGEND

For details of abbreviations used for the geological interpretation refer to map number KT 10/74-3A

GEOLOGICAL INTERPRETATION

△ lx* Ia fq maf, minor lxt Ia fqe maf

▲ lxt Ia fq maf s', minor lxt Ia fqe maf s''

⊘ fb pArd fq maf s''

◐ pArd bfq, minor pArd bfqe

◩ pArd bfq argd, minor pArd bfqe argd

□ Md f maf s''

☒ Mv

GEOPEKO LIMITED
KING ISLAND GROUP

SCALE 1 5000

No KT10/74-M-3C

DATE MAR '78
GEOLOGIST RB
DRAWN J.M
CHECKED MCR

E.L.10/74 BLACK BLUFF, TASMANIA
MARINER 1 and MARINER 2

GEOLOGICAL FLOAT MAP

1260

78-1264 Vol. 2/2.

LEGEND:

1. For details of abbreviations used for the geological interpretation refer to map number KT 10/74-3A
2. ? indicates rock chip identity unknown

GEOLOGICAL INTERPRETATION

- △ Ixt Ia fq maf
- ◐ pArd bfq
- ◪ pArd bfq argd (Volcanic breccia ?)
- ☐ Mv

262206

GEOPEKO LIMITED
KING ISLAND GROUP

SCALE 1 : 5000

No KT10/74-M-3D

DATE MAR '78
GEOLOGIST R B
DRAWN J M
CHECKED M C R

EL 10/74 BLACK BLUFF, TASMANIA
MARINER 1 and MARINER 2
GEOLOGICAL INTERPRETATION
AUGER HOLE ROCK CHIPS 1261

78-1264 Vol. 2/2


411 000 E
412 000 E
413 000 E
414 000 E
5 402 000 N
5 401 000 N
5 400 000 N
Fall
Plain
MARINER 2
MARINER 1
Fall
River
Bond Peak
Alluvial Gold Mine
Remnants of Water Race
D.D.H. Tasminex N.L.
Tie Line
Iris
River
CRADLE MOUNTAIN ROAD
E.L. 10/74 BOUNDARY
10/74
3400
3200
3000
2800
2600
262207
LEGEND:
75 - 150 (Cu ppm)
150 - 300 (Cu ppm)
300 +
o50........Hand augered sample 50 ppm Cu
•110........Power augered sample 110 ppm Cu
O........Auger core hole
60........Original sample
o60........Duplicate sample
ANALYTICAL NOTES:
Analytical Methods: Cu by AAS following hot conc. HCL leach and HCL/HNO3 leach in latter stages of 0·25g sample.
Size fraction analysed: -80 mesh
Analytical results in ppm.
5 cm
GEOPEKO LIMITED
KING ISLAND GROUP
SCALE: 1 : 5000
No. KT10/74-M-4
DATE Sept 1977
GEOLOGIST R.B.
DRAWN L.G. & J.M.
CHECKED M.C.R.
E.L. 10/74 BLACK BLUFF, TASMANIA
MARINER 1 and MARINER 2
GEOCHEMICAL RESULTS
COPPER
1262
78-1264 Vol 2/2


GEOPEKO LIMITED
KING ISLAND GROUP
No. KT10/74-M-5
SCALE: 1 : 5000
E.L. 10/74 BLACK BLUFF, TASMANIA
MARINER 1 and MARINER 2
GEOCHEMICAL RESULTS
LEAD
1263
78-1264 Vol 2/2
262208
DATE: Sept 1977
GEOLOGIST: R.B.
DRAWN L.G. & J.M.
CHECKED: M.C.R.
LEGEND:
500 - 1000 (Pb ppm)
1000 - 2000 (Pb ppm)
2000 - 5000 (Pb ppm)
5000 +
○60 .... Hand augered sample 60 ppm Pb
●120 .... Power augered sample 120 ppm Pb
O .... Auger core hole
80 .... Original sample
○110 .... Duplicate sample
ANALYTICAL NOTES:
Analytical Methods: Pb by AAS following hot conc. HCL leach and HCL/HNO3 leach in latter stages of 0·25g sample.
Size fraction analysed: – 80 mesh
Analytical results in ppm.
5 402 000 N
5 401 000 N
5 400 000 N
411 000 E
412 000 E
413 000 E
414 000 E
Bond Peak
Fall
Plain
Fall River
Iris River
MARINER 2
MARINER 1
Alluvial Gold Mine
Remnants of Water Race
D.D.H Tasminex N.L.
Tie Line
E.L. 10/74 BOUNDARY
CRADLE MOUNTAIN ROAD
5 cm

LEGEND:

200 - 300 (Zn ppm)	○110........Hand augered sample 110 ppm Zn
300 - 400 (Zn ppm)	●170........Power augered sample 170 ppm Zn
400 - 500 (Zn ppm)	O........Auger core hole
500 - 1000 (Zn ppm)	190......Original sample
1000 +	o190......Duplicate sample

ANALYTICAL NOTES:

Analytical Methods: Zn by AAS following hot conc. HCL leach and HCL / HNO_3 leach in latter stages of 0·25g sample.

Size fraction analysed: — 80 mesh

Analytical results in ppm.

GEOPEKO LIMITED
KING ISLAND GROUP

SCALE: 1 : 5000

No. KT10/74-M-6

DATE: Sept 1977
GEOLOGIST: R.B.
DRAWN L.G. & J.M.
CHECKED: M.C.R.

E.L. 10/74 BLACK BLUFF, TASMANIA
MARINER 1 and MARINER 2
GEOCHEMICAL RESULTS 1264
ZINC

78-1264 Vol. 2/2

262210

LEGEND:

ANALYTICAL NOTES

Analytical Methods Ag by AAS following hot conc HCL leach and HCL/HNO_3 leach in latter stages for 1 hour of 0 25g sample.

Size fraction analysed - 80 mesh

Analytical results in ppm.

- o2 ......Hand augered sample 2ppm Ag
- •2 . Power augered sample 2ppm Ag
- O . . . Auger core hole
- o2 . Original sample
- 5 ......Duplicate sample

GEOPEKO LIMITED
KING ISLAND GROUP

SCALE 1 5000

No KT10/74-M-7

DATE Sept 1977
GEOLOGIST R.B
DRAWN L G & J M
CHECKED M C R

E.L. 10/74 BLACK BLUFF, TASMANIA
MARINER 1 and MARINER 2
GEOCHEMICAL RESULTS
SILVER

1265

78-1264 Vol 2/2

LEGEND:

(yellow)	2000 - 5000 (Mn ppm)
(red)	5000 +

o760........Hand augered sample 760 ppm Mn
•1000......Power augered sample 1000 ppm Mn
O............Auger core hole
820........Original sample
o680........Duplicate sample

ANALYTICAL NOTES:

Analytical Methods: Mn by AAS following hot conc. HCL leach and HCL/HNO_3 leach in latter stages of 0·25g sample.

Size fraction analysed: −80 mesh

Analytical results in ppm.

262211

GEOPEKO LIMITED
KING ISLAND GROUP

SCALE: 1 : 5000

No. KT10/74-M-8

DATE: Sept 1977
GEOLOGIST: R.B.
DRAWN: L.G.& J.M.
CHECKED: M.C.R.

E.L. 10/74 BLACK BLUFF, TASMANIA
MARINER 1 and MARINER 2
GEOCHEMICAL RESULTS
MANGANESE

1266

78-1264 Vol 2/2

262212

LEGEND:

ANALYTICAL NOTES:

Analytical Method: As by modified Gutzeit method.

Size fraction analysed: − 80 mesh.

Analytical results in ppm.

o200 .... Hand augered sample 200 ppm As
●200 .... Power augered sample 200 ppm As
O .... Auger core hole
100 .... Original sample
o200 ...... Duplicate sample

GEOPEKO LIMITED
KING ISLAND GROUP

SCALE: 1 : 5000

No. KT10/74-M-9

E.L. 10/74 BLACK BLUFF, TASMANIA
MARINER 1 and MARINER 2
GEOCHEMICAL RESULTS 1267
ARSENIC

DATE: Sept 1977
GEOLOGIST: R.B.
DRAWN: L.G.& J.M.
CHECKED: M.C.R.

78-1264 Vol 2/2

262213

LEGEND:

ANALYTICAL NOTES:

Analytical Methods: Sn by Emission Spectrography
* Sn by XRF

Size fraction analysed :- 80 mesh

Analytical results in ppm.

o500 .... Hand augered sample 500 ppm Sn
●300 .... Power augered sample 300 ppm Sn
O .... Auger core hole
20 .... Original sample
o10 .... Duplicate sample

* <20● .... XRF result

●<20 ..... Emission Spectrography result

5 cm

GEOPEKO LIMITED
KING ISLAND GROUP

SCALE: 1 : 5000

No. KT10/74-M-10

DATE: Sept 1977
GEOLOGIST: R.B.
DRAWN: L.G. & J.M.
CHECKED: M.C.R.

E.L. 10/74 BLACK BLUFF, TASMANIA
MARINER 1 and MARINER 2
GEOCHEMICAL RESULTS
TIN

1268

78-1264 Vol 2/2

262214

LEGEND

ANALYTICAL NOTES

Analytical Method: Cd by AAS following hot conc HCL leach and HCL/HNO$_3$ leach in latter stages for 1 hour of 0 25g sample

Size fraction analysed :– 80 mesh

Analytical results in ppm

o10	Hand augered sample 10 ppm Cd
●10	Power augered sample 10 ppm Cd
10 / o5	Original sample / Duplicate sample

GEOPEKO LIMITED
KING ISLAND GROUP

SCALE 1 5000

No KT10/74-M-11

DATE Sept 1977
GEOLOGIST RB
DRAWN L G & J M
CHECKED MCR

E.L. 10/74 BLACK BLUFF, TASMANIA
MARINER 1 and MARINER 2
GEOCHEMICAL RESULTS
CADMIUM

1269

78-1264 Vol 2/2

LEGEND

- o Hand augered sample
- • Power augered sample
- O Auger core hole

o4903 Soil sample no. KS 4903

5 cm

262215

GEOPEKO LIMITED
KING ISLAND GROUP

SCALE 1 5000

No KT10/74-M-12

E.L.10/74 BLACK BLUFF, TASMANIA
MARINER I and MARINER 2
SOIL SAMPLE LOCATION MAP

1270

78-1264 Vol 2/2

DATE Sept 1977
GEOLOGIST R.B.
DRAWN L G
CHECKED MCR

262216

LEGEND
- o 0 5 . ..Hand augered hole depth 0·5 m
- ● 3 0 Power augered hole depth 3 0 m

GEOPEKO LIMITED
KING ISLAND GROUP

SCALE 1 5000

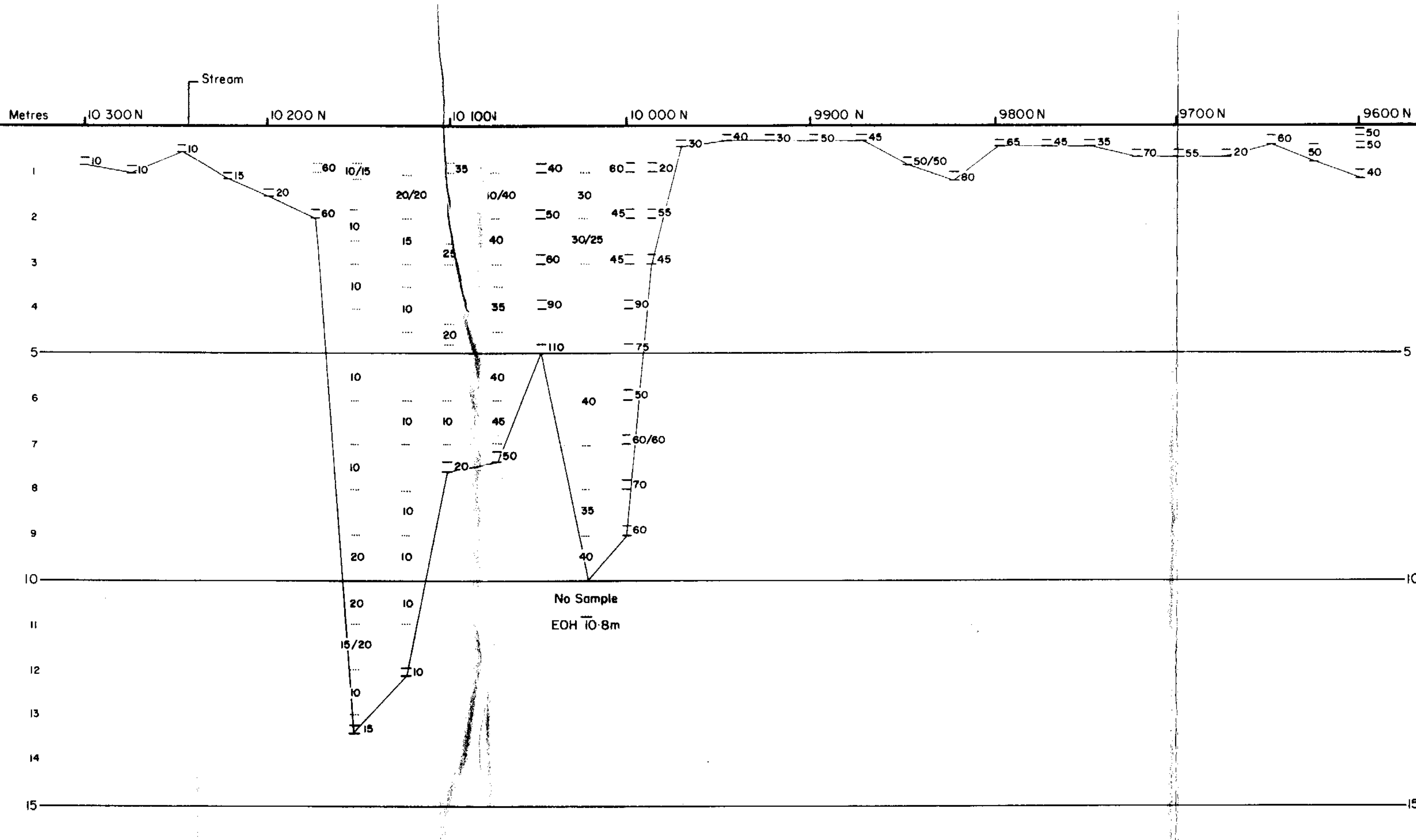
No. KT10/74-M-13

E.L. 10/74 BLACK BLUFF, TASMANIA
MARINER 1 and MARINER 2 1271

AUGER HOLE DEPTHS

78-1264 Vol 2/2

DATE	Sept 1977
GEOLOGIST	R.B
DRAWN	L G
CHECKED	M C R



262217

LEGEND

— Depth Accurate

.... Depth Approximate

Horizontal Scale 1:2500

Vertical Scale 1:100

5 cm

DATE: Oct 77
GEOL: R.B.
DWN: L.G.
CHKD: M.C.R.

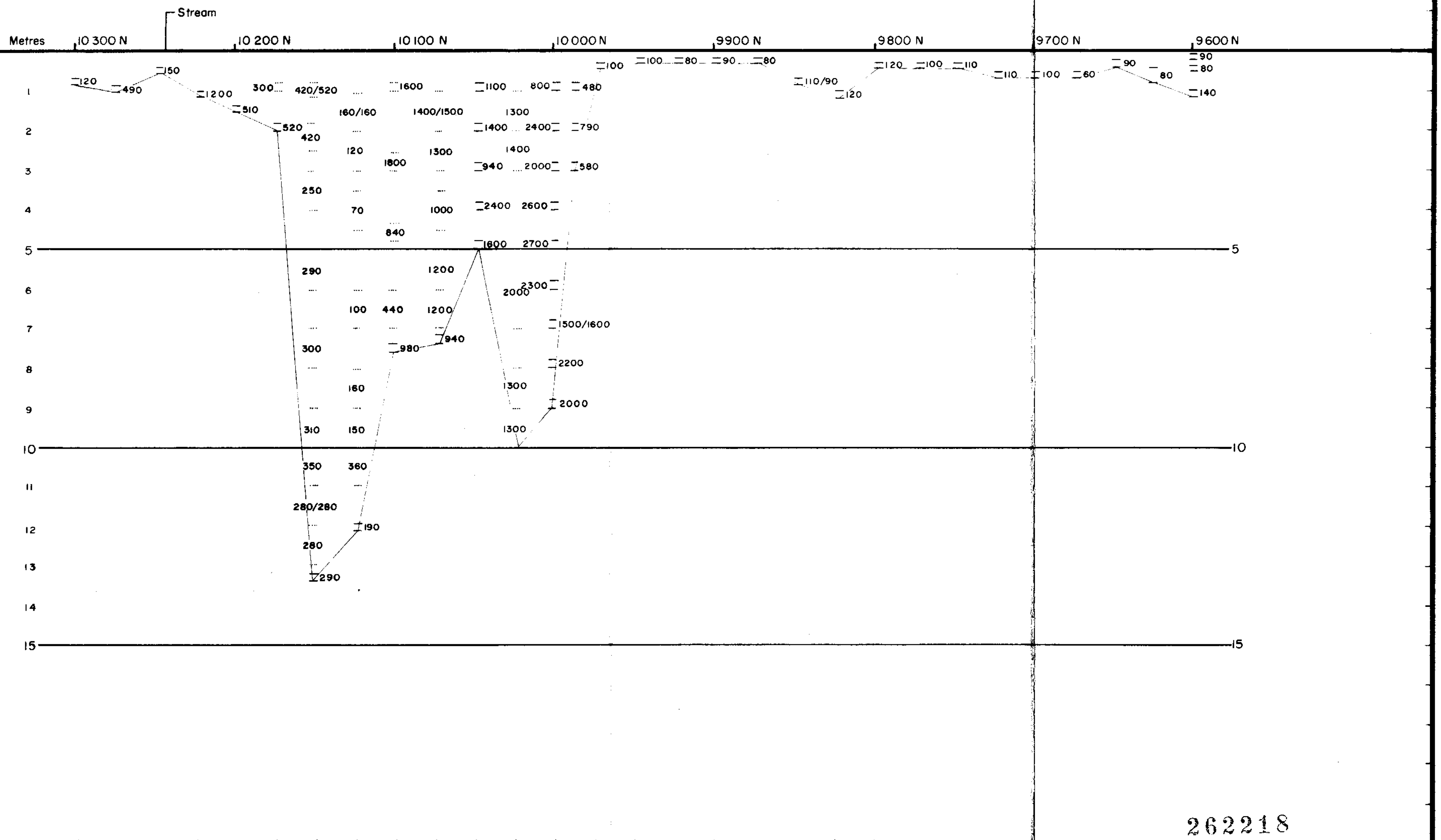
GEOPEKO LIMITED
KING ISLAND

Scale

Nº K

MARINER I 1272

C HORIZON ORIENTATION 9700 E
Cu CONCENTRATION



262218

LEGEND

... Depth Accurate

.... Depth Approximate

Horizontal Scale 1:2500

Vertical Scale 1:100

5 cm

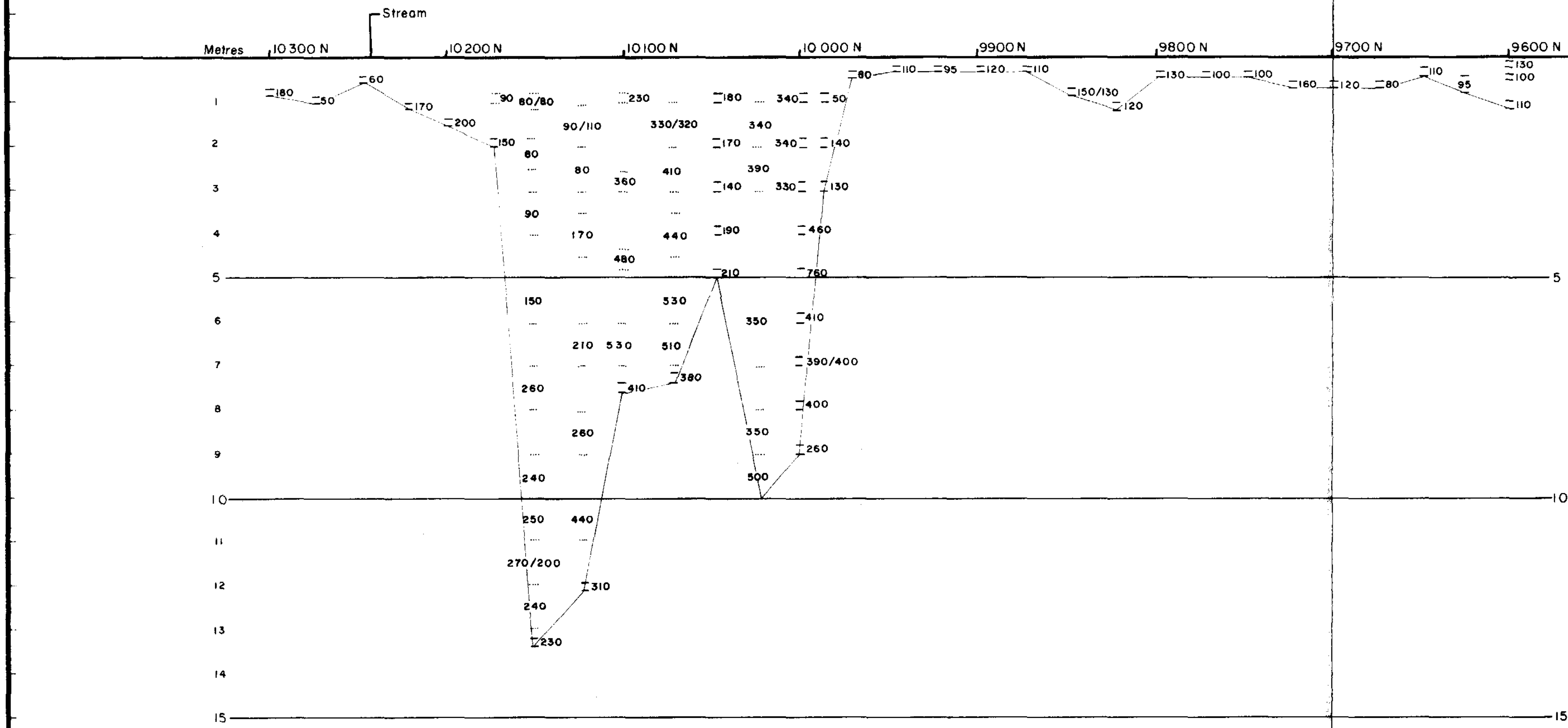
GEOPEKO LIMITED
KING ISLAND

Scale:

Nº K 1273

DATE Mar 78
GEOL. R.B.
DWN. J.P.M.
CHKD. MCR

MARINER I
C HORIZON ORIENTATION 9700 E
Pb CONCENTRATION



LEGEND.

_ DEPTH ACCURATE
... DEPTH APPROXIMATE

Horizontal scale 1:2500
Vertical scale 1:100

5 cm

262219

GEOPEKO LIMITED
KING ISLAND

Scale:

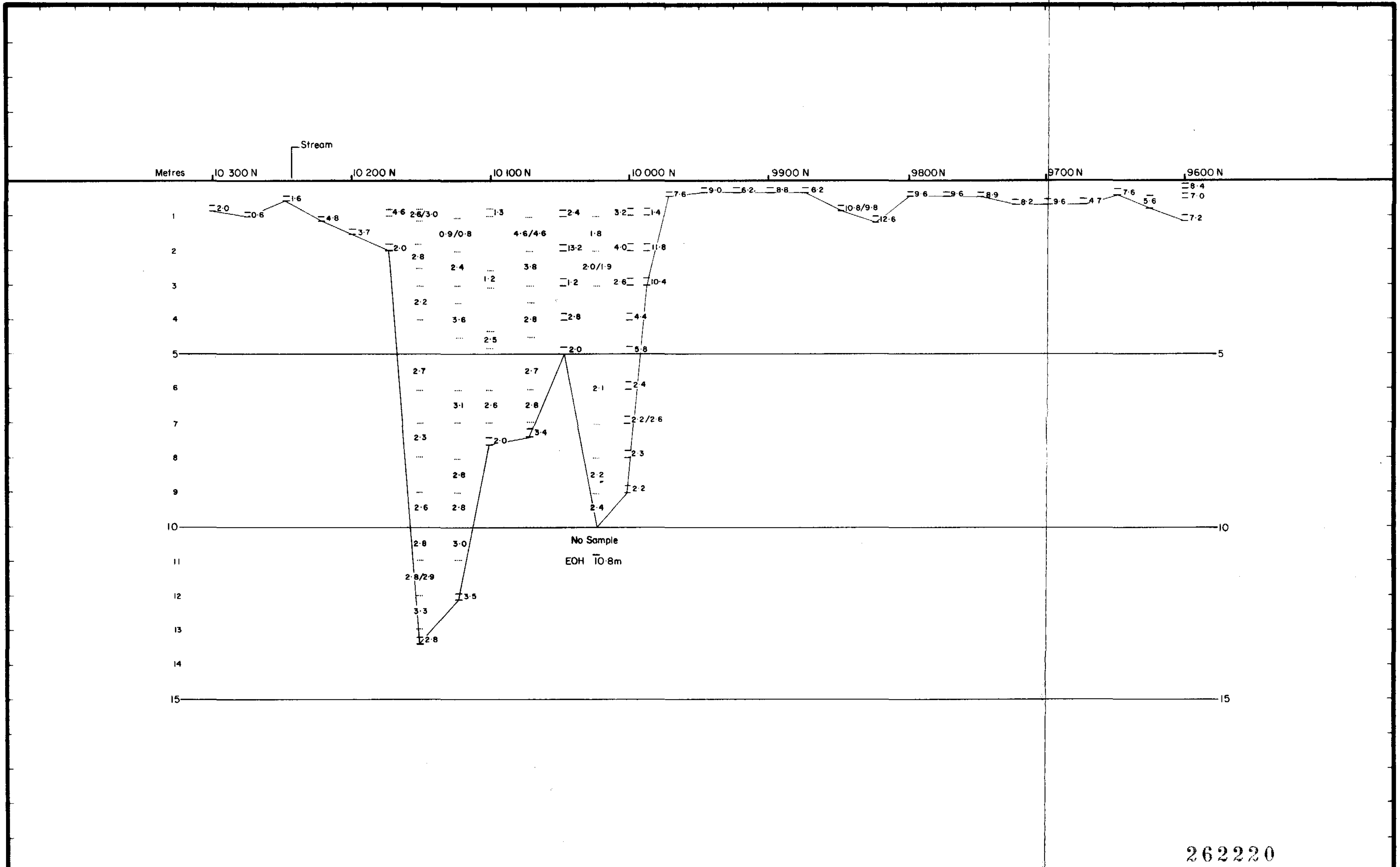
Nº K

DATE: Mar 78
GEOL: R.B.
DWN: J.P.M.
CHKD: M.C.R.

MARINER I 1274

C HORIZON ORIENTATION 9700 E
Zn CONCENTRATION

78-1264 Vol. 2/2



262220

LEGEND:

— Depth Accurate

... Depth Approximate

Horizontal Scale 1:2500

Vertical Scale 1:100

5 cm

GEOPEKO LIMITED
KING ISLAND

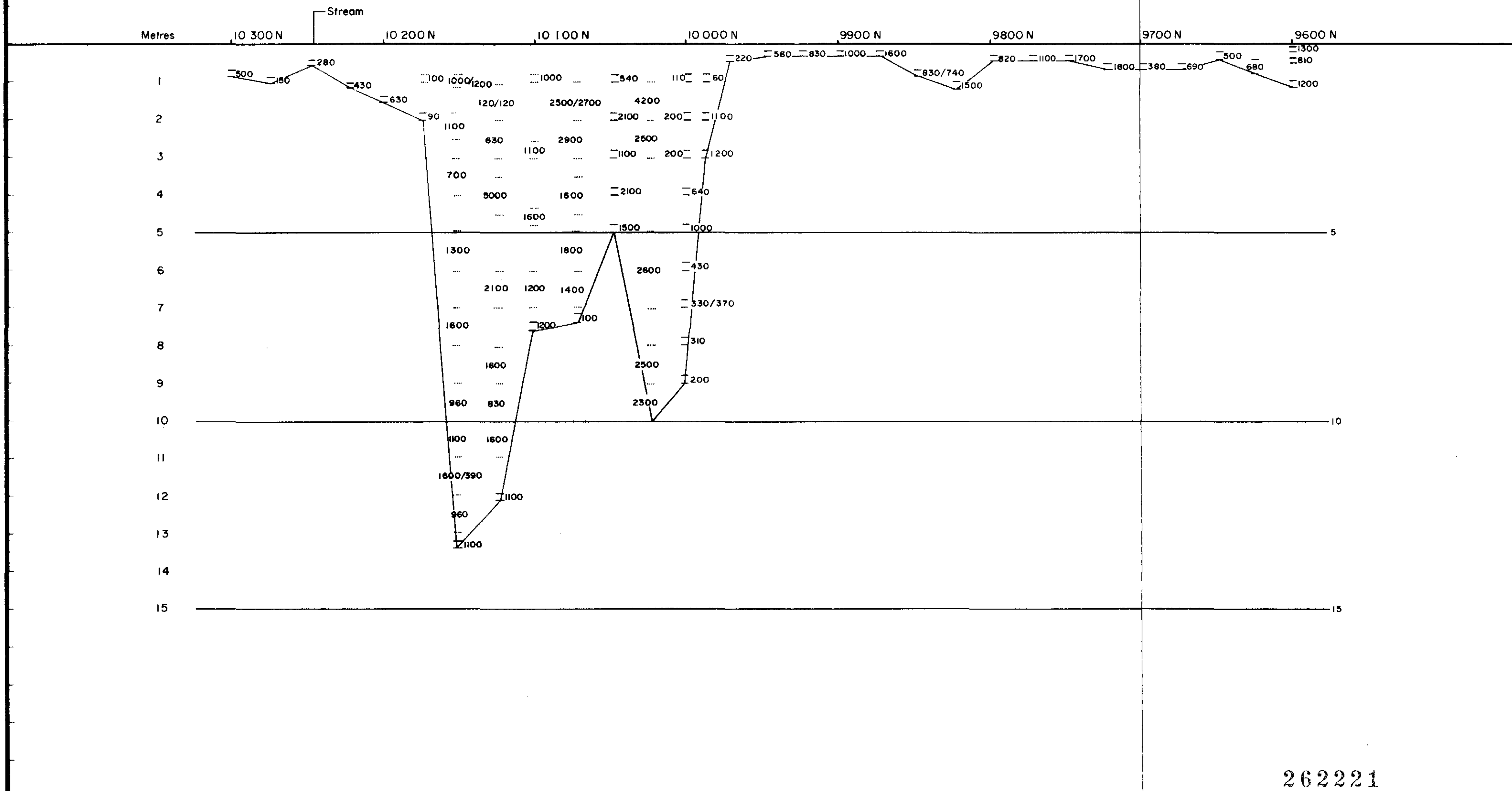
Scale

Nº K

DATE Oct 77
GEOL R.B.
DWN L.G.
CHKD M.C.R.

MARINER I 1275

C HORIZON ORIENTATION 9700 E
Fe% CONCENTRATION



262221

LEGEND:

_ DEPTH ACCURATE

_ DEPTH APPROXIMATE

Horizontal Scale 1:2500

Vertical Scale 1:100

5 cm

GEOPEKO LIMITED
KING ISLAND

Scale:

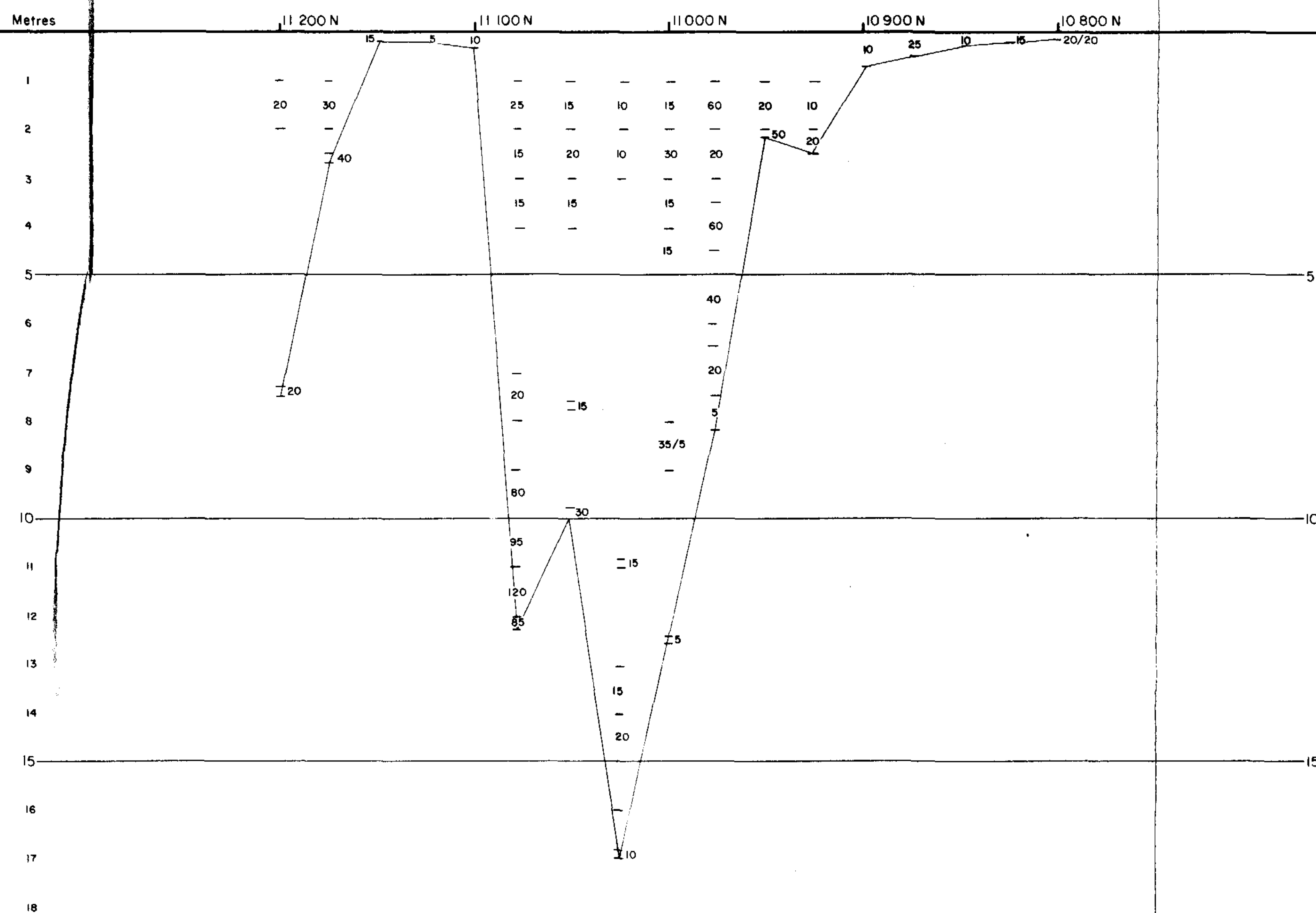
Nº K

DATE: Mar 78
GEOL: R. B.
DWN: J.P.M.
CHKD: M.C.R.

MARINER I 1276

C HORIZON ORIENTATION 9700E
Mn CONCENTRATION

78-1264 Vol 2/2



262222

LEGEND.

5 cm

GEOPEKO LIMITED
KING ISLAND

Scale

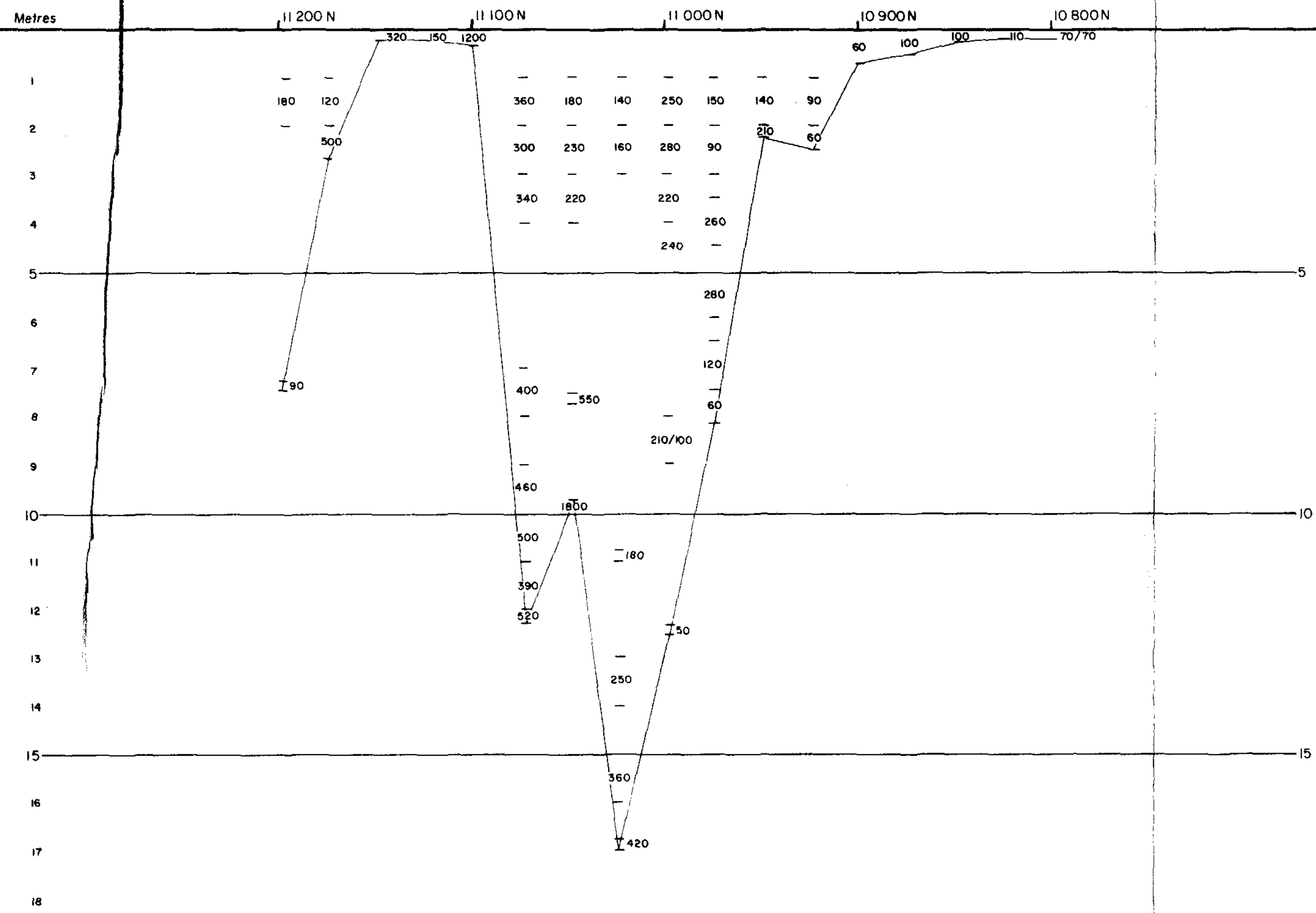
Nº K

DATE Oct 77
GEOL R.B.
DWN L.G.
CHKD M.C.R.

MARINER 2 1277

C HORIZON ORIENTATION 8900 E
Cu CONCENTRATION

79-1264 1/d 2/7



262223

LEGEND

5 cm

GEOPEKO LIMITED
KING ISLAND

Scale

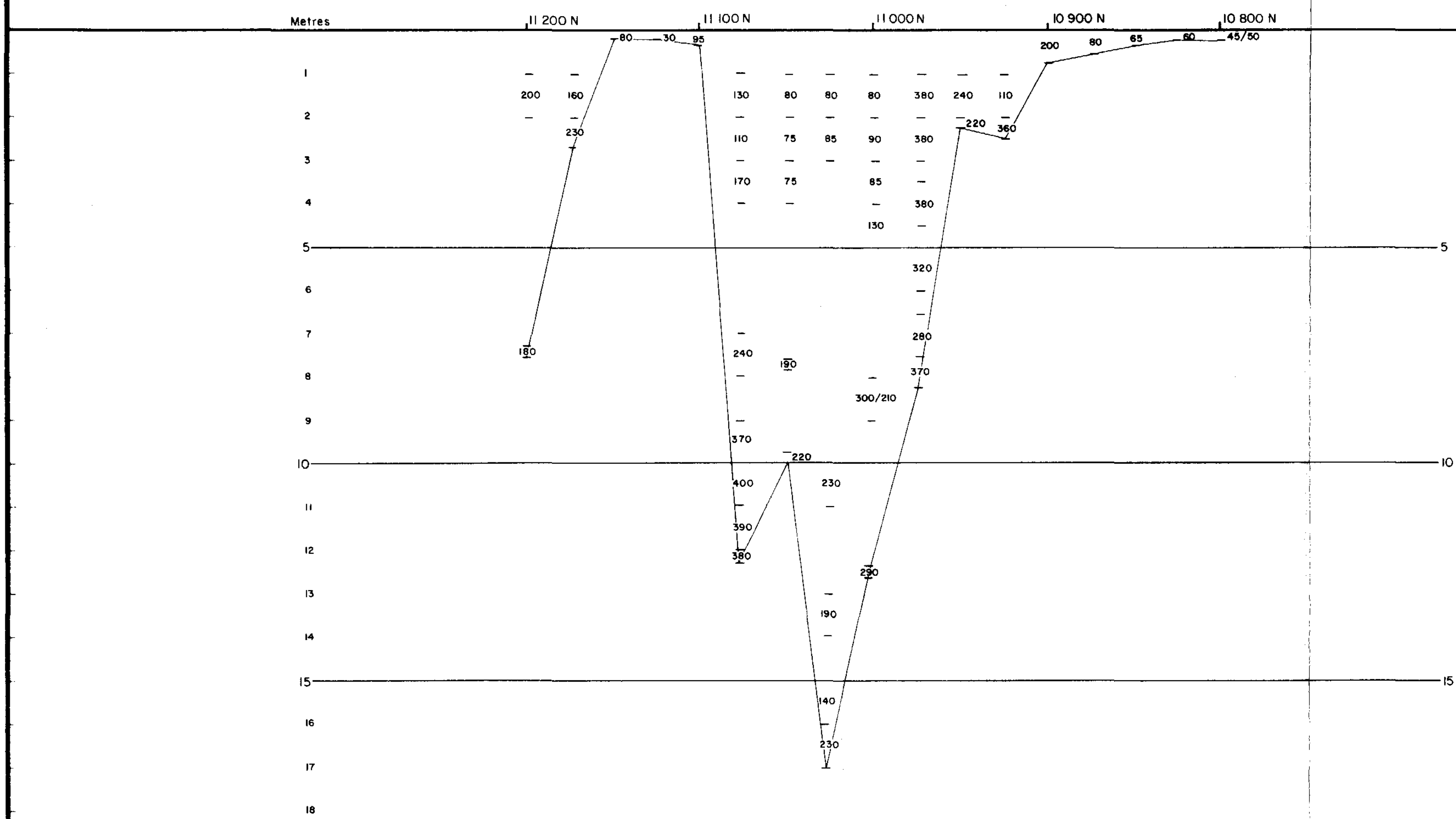
Nº K

DATE Oct 77
GEOL R.B.
DWN L.G.
CHKD M.C.R.

MARINER 2 1278

C HORIZON ORIENTATION 8900 E
Pb CONCENTRATION

78-1264-Vol 2/2



262224

LEGEND.

GEOPEKO LIMITED
KING ISLAND

Scale

Nº K

MARINER 2 1279

DATE Oct 77

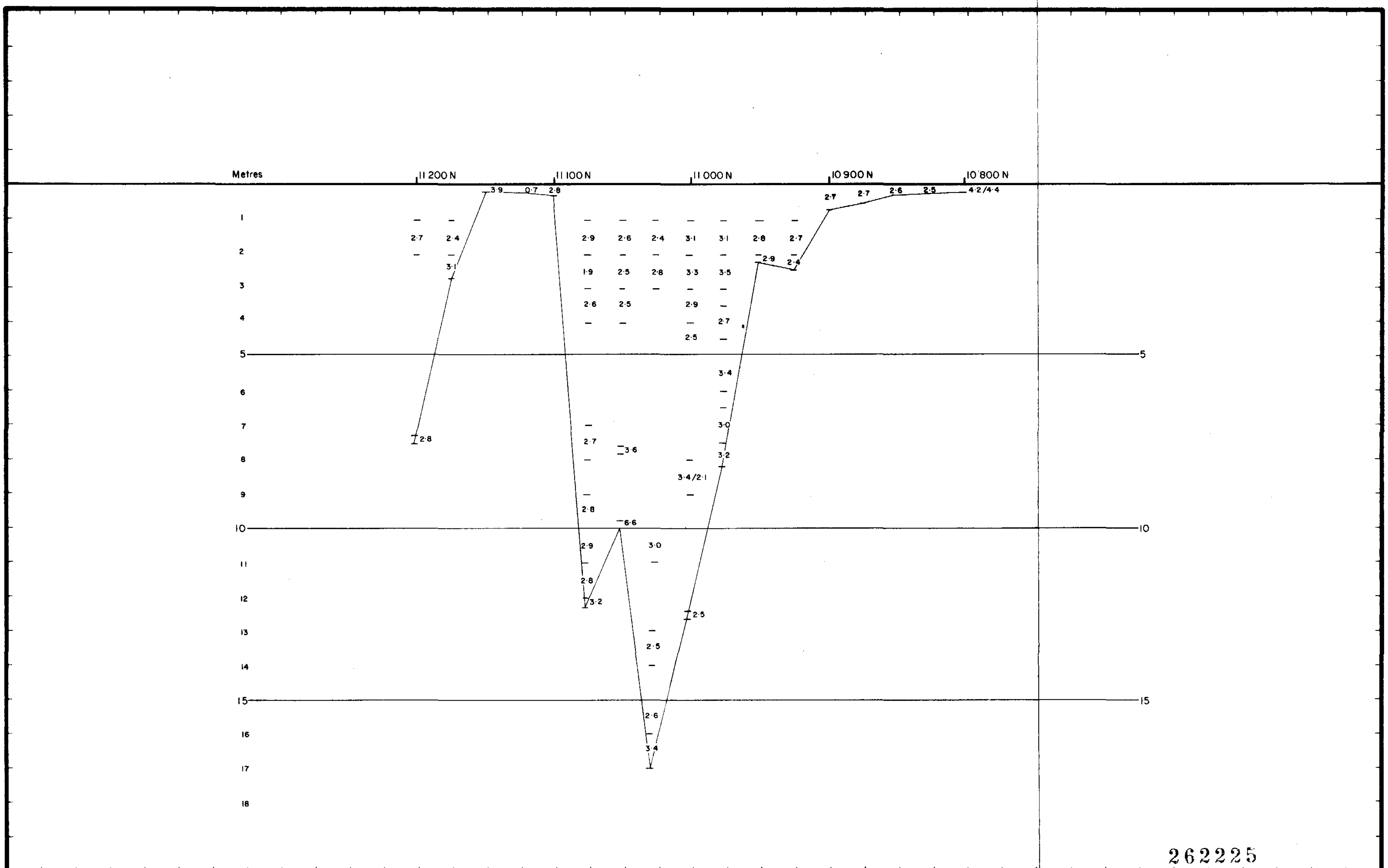
GEOL R.B.

DWN L.G.

C HORIZON ORIENTATION 8900E

Zn CONCENTRATION

5 cm



262225

LEGEND:

5 cm

GEOPEKO LIMITED
KING ISLAND

Scale:

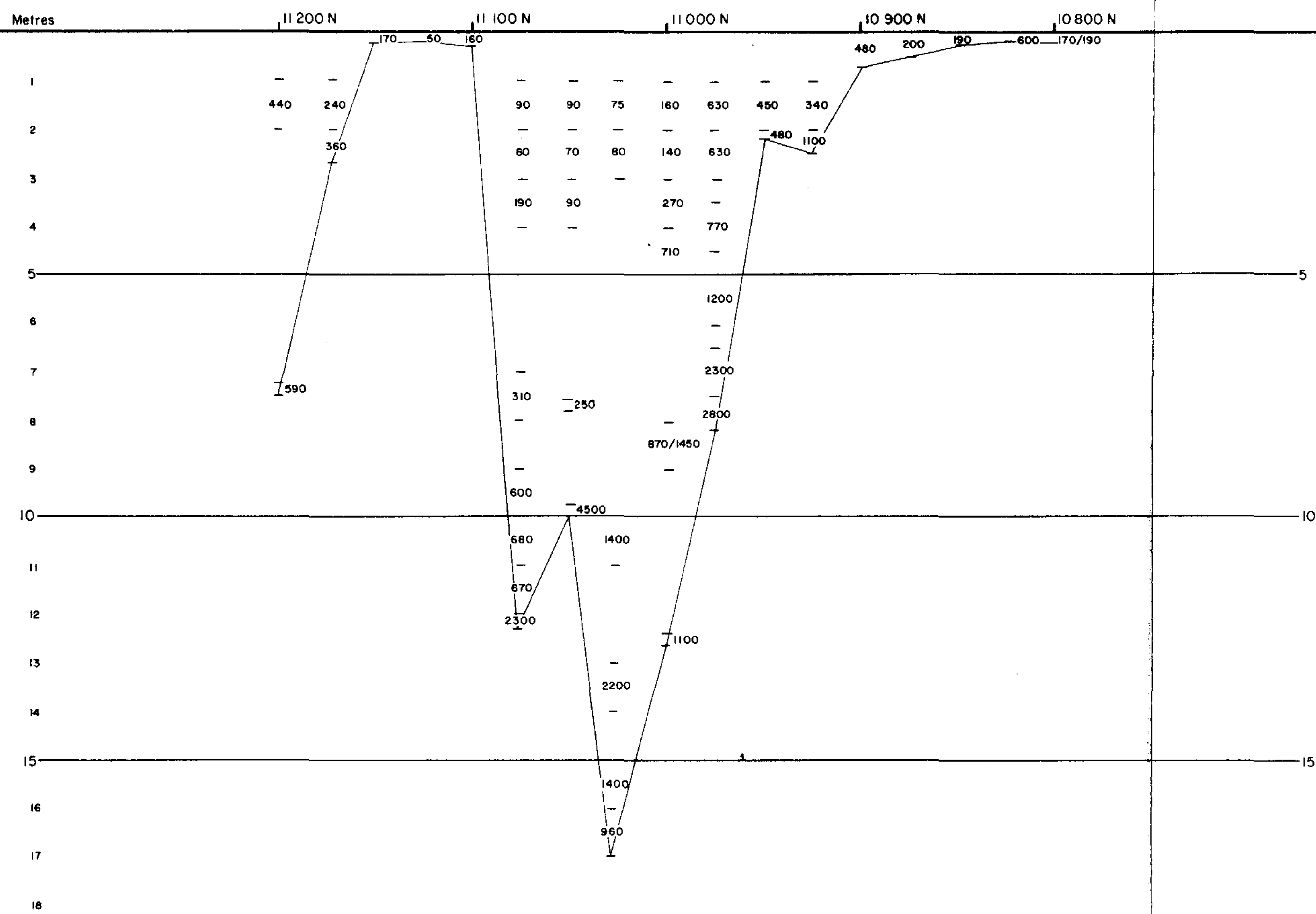
Nº K

DATE Oct 77
GEOL. R.B.
DWN. L.G.
C.. M.C.R.

MARINER 2 1280

C HORIZON ORIENTATION 8900 E
Fe % CONCENTRATION

78-1264 Vol 2/2



262226

LEGEND

5 cm

GEOPEKO LIMITED
KING ISLAND

Scale

Nº K

DATE Oct 77
GEOL R.B.
DWN L.G.
CHKD M.C.R.

MARINER 2 1281

C HORIZON ORIENTATION 8900E
Mn CONCENTRATION

78-1266 Vol 2/2