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ANNUAL PROGRESS REPORT

MACKINTOSH RIVER

Exploration Licence 2/70.
(licence holder Aberfoyle Tin N.L.)
for 12 months ended June 30, 1976

24/6/76

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1. INTRODUCTION

1.1 Summary

Surface exploration in the Mackintosh licence, (West Block), exclusive of the Que River Leases 2M-4M/75, is described, but because of the intimate relationship between the development of geological understanding at Que River and exploration in the surrounding licence some inclusion of Que River data was inevitable.

The work described was undertaken in the period November 1975 to May 1976 with interpretation still proceeding.

A programme of detailed geological mapping, soil geochemical sampling, IP and HEM was implemented and will proceed further as weather permits.

The Que River pyritic host rock suite was reconnoitred beyond the northern lease boundary, and the contact between the surrounding andesites and overlying Que River slates defined, indicating a significant anticlinal fold.

No drill targets were distinguished during the field season. The severe terrain and the remoteness of some areas of interest in the licence inhibited progress.

One particularly attractive area of stream and soil geochemical anomalies was found and several lesser soil anomalies also located.

1.2 History

Adequate reports of history and previous exploration appear in Webster (1975), Skey, Young and Webster (1975), CEPL Staff (1974), and Skey (1974).

1.3 Tenure

The licence is held by Aberfoyle Tin N.L. a subsidiary of Aberfoyle Ltd. Work is managed by Cominco Exploration Pty. Ltd. The property is the subject of a joint venture between Paringa Mining and Exploration Co. Ltd. and Abex (comprising members of the Aberfoyle Group).

Current equities are:	Paringa	20.0%
	Cominco Exploration	24.0%
	Cleveland Tin	22.4%
	Ardlethan Tin	22.4%
	Aberfoyle Tin	11.2%

Licence expiry date is 30/6/76 and it may be renewed at 6 monthly intervals.

1.4 Topography, Services, etc.

The topography of the West Block, subject of this report, is dominated by a northeasterly trending hillside which descends from the Que River watershed to the Southwell River valley. The fall is in the range 400 to 600m over 2.5 to 3 km. The slope and adjacent plateau and valley areas are densely forested. Rainfall is approximately 250 cms annually.

Vehicular access is possible only in the Que River area, where camp facilities are now available.

1.5 Objectives

The fundamental intention is to progressively explore the licence, and to gain understanding of the geology away from the Que River prospect, where detailed information is being continually acquired.

The aim of the past seasons work was to define the strike extent of the Que River pyritic suite and to make a preliminary examination of this prospective horizon. Attention was also given to seeking other stratigraphy with potential base metal interest.

2. WORK PROGRAMME

2.1 Survey

Reconnaissance and detailed gridding extends from 1900N to 10550N (8.65 km strike) within this licence and the adjacent EL 15/73.

Compass and chain survey with clinometer control for slope corrections was used throughout to extend earlier stadia gridding.

Cutting for the six months from November 1975 totalled 19.9 kms. Line spacing varied from 200m reconnaissance to 100m first stage follow-up.

2.2 Geological Mapping

Field mapping was conducted at 1 to 2500 scale. Virtually all data were plotted at this scale (Plates QR 81 A,D,F,G,H,K,L) and abbreviated information at 1 to 10,000 scale (Plates QR 61 A,B,D). The eastern extremities of some long reconnaissance lines were plotted at the latter scale only. Approximately 22 line kilometres of grid was mapped this season.

Additional creek sampling has not made a substantial contribution to date but is expected to increase in future programmes.

42 rock samples were thin sectioned and described by consulting petrologists with check examinations by CEPL staff. Reports are appended (II). Five samples (collected 1973/74) were subjected to silicate analysis. This topic is not discussed in this report, having been covered by Yates (1975) and Joyce, Batchelor and Skey (1974).

2.3 Geochemistry

2.3.1 Soils

1680 C horizon soil samples were collected during the 1975/6 season, by screw augering to depths of 150 cms, at 10m or 20m intervals on grid lines. After drying and sieving to minus 80 mesh, 5 gram samples were digested in perchloric acid and analysed by AAS.

Results of these and all previous analyses are shown on Plates Mac 45-47, A,D,E,F,G,H,K,L.

Contour levels for all data were selected by inspection. A statistical approach has since been initiated. This approach does not affect reporting of results to date but is significant in formulating future programme proposals.

2.3.2 Two different stream surveys were conducted for separate

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purposes. Overlap is not adequate to permit a thorough comparative assessment, however some preliminary conclusions can be made (ref. section 3.). An attempt will be made to control future work so that comparisons are possible.

- a) Silt: Revised plans (DT 65 A,B,D; DT 60 A,B,D and DT 64) submitted with this report record analytical results. After drying and sieving of minus 40 mesh active silt, 5 gram samples were digested in perchloric acid and analysed by AAS for copper, lead and zinc. 78 samples were collected during the season from the Southwell River catchment, and a further 4 from a small tributary of the Mackintosh River.
- b) Humus: As part of a preliminary environment impact study related to the Que River Project, mobile humus samples were collected from 20 sites by Chemlabs (Hobart) on behalf of Technical Services Tas Pty. Ltd. consultants to Aberfoyle Management. Those analytical results considered to have exploration significance are plotted on Plate DT 66. The remaining data are included in Appendix I. 10 locations are within this licence or the Que River leases.
- c) Water: Samples collected by Chemlabs were divided by filtration and residue and filtrate analysed separately by AAS.

2.4 Geophysics

The airborne geophysical survey of 1975 (Webster, 1975), indicated EM anomalies within EL 2/70 which warranted follow-up. Two attempts were made to locate these anomalies, both of which failed due to equipment malfunction and adverse conditions. A survey grid or traverse line has been established in the inferred anomaly position and will be geophysically evaluated when weather conditions are favourable.

The ground geophysical programme in EL 2/70 has been restricted to the IP technique, both in reconnaissance and detail work, after surveys with numerous techniques at Que River. It was illustrated in this work that IP was the only technique that could detect and delineate the Que River orebodies.

The reconnaissance programme comprised traversing with 100m dipols along lines spaced 1,000m apart. This work was complemented by a coincident geochemical soil sampling survey to define anomalous zones for detailed follow-up.

A total of 9 km of reconnaissance (100m dipole) traversing was undertaken, plus 2 km of 25m dipole detail traversing as indicated on accompanying Plates QR88, A, B.

IP survey in the Southwell River catchment (8400N to 9000N) was deferred due to wet weather and the problem of drying wet equipment in this remote area of steep terrain.

3. DISCUSSION OF RESULTS

3.1 Geology

Relevant fact plans were detailed in 2.2. An interpretation of the 1 to 10,000 fact geology is given on Plates DT 62 A,B,D.

Lithologies

- 1) Upper sediment and acid volcanic group: Black shales outcropping to the northwest, north and north east of the Que River leases are identical with slates outcropping along the Murchison Highway. In the Southwell River catchment, grits with sub-angular detritus to 3mm comprising, quartz grains, quartzite, grey chert, black shale, muscovite and occasional biotite occur. Micaceous siltstones have also been noted.

Interbedded with these sediments are fine to coarse grained quartz feldspar porphyries, some of which are massive lavas and others regarded as crystal tuffs. Rare black shale xenoliths occur in these volcanics.

The similarity with the sequence straddling the Murchison Highway within EL 15/73 is marked.

- 2) Andesitic Pyroclastics (formerly called Dacitic Pyroclastics): Members of this group are predominant in the mapped area.

Most common are feldspar porphyry agglomerates or lithic tuffs commonly interpreted to be lava flow breccias, with frequent glass, chalcedony and carbonate amygdales. Also present are massive andesite to basalt feldspar pyroxene and/or hornblende porphyry lavas, and feldspar crystal tuffs. Colour is generally green due to weak chlorite after ferromagnesian minerals. Weathered skins are typically cream to white.

Coarse amygdaloidal carbonated andesitic (to dacitic?) lavas appear more common near the contact with the shales. This phenomenon was also observed in the adjacent Hatfield property.

Deformed grey chert layers occur within the andesites, again most commonly adjacent to the sediment-acid volcanic group.

- 3) Intermediate (dacitic) fine grained lavas: These typically pink to buff fine lavas to tuff lavas were first observed in drill core at Que River and eventually termed the Dacitic Tuff-Lava group (DTL). They constitute a major rock type in the 'mine' sequence and similar lithologies outcrop to the north east of the leases. A variant, or possibly an unaltered form of these lavas, are the magnetite bearing lavas (MTL group of Que River). Colour is typically dark brown and texture is fine grained with barely visible feldspar phenocrysts generally, though one specimen found was a green coarse andesite feldspar porphyry. Magnetite content ranges up to 5%, partly converted to hematite-limonite. Distribution is widespread, in addition to locations mentioned, these volcanics occur east of the leases and south of Mt. Charter.
- 4) Intermediate to acid pyritic volcanics (PyP mine group): Because of the intense carbonatisation and sericitisation characteristic of these feldspar porphyry lavas and fragmentals, they are poorly exposed. Definition of boundaries is on the basis of sparse rubble and resistivity or frequency effect features, (Skey, Young and Webster 1975). Colour is pale cream (weathered) to blue grey (fresh). Pyrite content varies from 2% to massive, as disseminated grains, veins, lithic fragments and beds (?). Detailed lithological knowledge is from diamond drilling within the Que River leases; this work is described in reports cited in the bibliography.

- 5) The volcanics and sediments are masked in the north west corner of the licence by Tertiary flood basalts. These weather brown and occasionally exhibit crude columnar jointing.

Cambrian Stratigraphy

Mapping of the central and eastern parts of the west block are insufficiently advanced for a definitive statement.

It is concluded however, that the similar sedimentary and acid volcanic lithologies surrounding the andesitic fragmentals to the north represent one continuous formation. This formation exhibits interfingering of shales, grits, mica sandstones and acid volcanics.

The chert debris within the grits is similar to chert layers within the adjacent andesites, possibly indicating local unconformity. The sediments are concluded to overlie the andesites on the basis of continuity with the Que River slates (exposed in cuttings on the Murchison Highway) which show gentle west dips, west facing sedimentary features coupled with acceptance of simple open folding, based on regional studies.

Stratigraphic subdivision within the andesites is non-existent. The pyritic suite has been termed a sequence of distinctive intermediate to acid volcanics within a dominantly andesitic basalt pile and tentative lithologic and metal zoning evidence (Skey, Young and Webster 1975) indicates west facing. However, drilling at Mt. Charter (EL 15/73) and deep holes at Que River (ML 2M/75) indicate that part of the pyritic pyroclastics are probable alteration variants of the andesites.

Reconnaissance mapping has revealed mica sandstones and greywackes extending over 4 km from 3400N to 7400N in the centre of the concession area. On 7400N associated volcanics include andesites, pyritic fragmentals and magnetite bearing lavas. The two most obvious alternatives, correlation with the base of the shale-acid volcanic group, or with the Que River mineralisation horizon as a complementary east facing fold limb require resolution by mapping. The occurrence of mica sandstone favours the former, whilst the presence of magnetite bearing lavas favours the latter. Pyritic pyroclastics are known in both situations elsewhere.

Structure

Plates DT 62 A,B, and DT 63 show an interpretation whereby the steep north easterly to vertical dips in the sediments and acid volcanics represent the east limb of a north plunging asymmetric anticline. Structural data on the west limb is described in the report on the Hatfield Licence (EL 15/73).

This simple structure is complicated by a possible east-south-easterly trending cross fold indicated by strikes in shales outcropping in the Que River (Hatfield Report).

Major fault trends, indicated by photo, geophysical and geochemical lineations in both EL 15/73 (Hatfield) and EL 2/70 (Mackintosh West), may be resolved into two groups, viz. 045 to 065 (A) and 315 to 335 (B) degrees magnetic. The absence of sediments at the eastern limit of the line 8400N may be explained by movement on faults in set (B).

Alteration

Weak chlorite development which is ubiquitous in the andesites and basalts, is ascribed to low grade regional metamorphism of pyroxenes and amphiboles.

Carbonation and deuteric silicification of the andesites culminates in the intense alteration to carbonate and sericite, with patchy siliceous and chloritic zones, of the pyritic suite. This intense alteration is considered to be a close association of the mineralisation process. The alteration results in poor exposure and most knowledge is thus gained from drill core from within the leases.

Mineralisation

Observed mineralisation is limited.

Traces of galena and pyrite occur in pyritic fragmentals north of the leases indicating continuity of the Que River host rocks.

Disseminated chalcopyrite (1400 ppm Cu by AAS) was found in a fine grained grey tuffite within the andesite sequence adjacent to the sediments and acid volcanics of the Southwell River catchment. A substantial copper soil anomaly occurs 600m to the south east.

3.2 Geochemistry

3.2.1 Soils

Contour levels for all data determined by inspection of values plotted on 1 to 2500 scale plans, are as follows:

Copper	100 ppm	200 ppm		
Lead	250 ppm	500 ppm	1000 ppm	2000 ppm
Zinc	200 ppm	400 ppm		

The statistical study referred to in 2.3.1 served at this stage only as a check on the selection of contours by inspection. This study indicated the need for computer processing of data to enable a greater variety of techniques to be applied and for human errors in data handling to be eliminated. At this time selection of threshold values from cumulative frequency curves did not represent a significant advance over contouring based on inspection of plans.

Specific Soil Anomalies

Five anomalies or zones of interest, warrant mention.

Sampling was of a reconnaissance nature on 200m spaced lines, compared with 50m or 100m lines in the mineral leases, so that spot values or small groupings assume greater potential.

- 1) A south easterly trending zone of 100-200 ppm lead values between 8400N and 9000N, vicinity 6500E to 7100E, with spot values of 2320 ppm and 750 ppm enhances the marked copper anomaly on 8400N. Copper values of up to 700 ppm are the best observed in either Hatfield, Mackintosh or Que River properties. Anomalous zinc in soils, known disseminated chalcopyrite mineralisation and anomalous stream sediment responses combine to make this zone the most interesting in the Mackintosh licence. As reported above, geophysical follow-up was deferred due to bad weather.

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- 2) A small copper-zinc anomaly straddling the northern boundary of ML 2M/75 has associated spot values of anomalous lead. A linear trend apparent in the copper anomaly is on strike with a major anomaly of all three metals at the Kimber trench, 8750N. The latter, having been drilled, is known to occur over andesitic pyroclastics. However the dimensions and tenor of that anomaly remain problematical and this adjacent anomaly requires further examination possibly by trenching or limited IP.
 - 3) Spot high values of copper (1400 ppm), lead (2700 ppm, 600 ppm) and zinc (300 ppm) occur within the pyritic pyroclastics north of the leases. General sulphide level does not appear high, as indicated by IP, but additional limited sampling will be carried out to confirm this.
 - 4) Three single line lead-zinc anomalies occur immediately east of the mineral leases on lines 8000N, 8400N and 8800N. All appear to be in intermediate to basic volcanics. The latter two localities failed to respond to 100m IP, therefore major sulphide occurrences may be discounted. Detailed mapping may assist on 8400N as the terrain is steep; 8800N would be amenable to trenching. The 8000N anomaly requires sampling of new adjacent lines, and detailed mapping.
 - 5) Broad, weak copper and lead anomalies between ML 2M/75 and EL 15/73 constitute part of an anomaly complex whose better values are within that adjacent licence. The anomaly is discussed in the report on EL 15/73.
 - 6) Negative results were achieved from the two locations gridded to permit testing of AEM anomalies. These locations were 1055N 7300E and 4800N-5400N, 7000E.

3.2.2 Streams

One markedly anomalous zinc value (1000 ppm) was identified in a small tributary of the Southwell River

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(Plate DT 60B), with a diminished dispersion train due to dilution by main creek detritus. Copper values in the vicinity 60 ppm are equivalent to values achieved from previous programmes immediately east of the mineral leases. The distinction lies in the absence of lead in the Southwell drainage. Soil sampling in this area is reconnaissance style only and the area requires future follow-up, even though the geology does not appear to be of the most prospective pyritic pyroclastic group.

In the three creeks between 9400N and 8400N, several sites anomalous in individual or a combination of metals occur, with maximum values 100 ppm copper, 200 ppm lead and 350 ppm zinc (the latter two coincidental). These values compare very favourably with metal levels in streams draining the central mineral leases, and lend support to the soil values described previously.

Examination of Chemlabs analyses of stream-borne humus, indicate that copper, lead, zinc, iron and manganese reflect values obtained from mineral sediment material. Both sets of results appear to derive from the footwall volcanics rather than from the ore itself. The strongest metal values in both humus and sediment occur in east draining creeks. However, the one stream which traverses known ore (the central stream) has, in general, lowest relative values. It is concluded that for practical purposes, methods other than stream geochemistry are essential for defining potential ore grade as against halo mineralisation.

Metal values in both stream humus and silt are of equivalent order so that selection of method depends on convenience of collection, processing and analysis. There appears to be no justification for discontinuing minus 40 mesh mineral sediment sampling for geochemical reconnaissance in favour of humus sampling. Mineral sediments are more readily collected, dried and analysed and a substantial volume of data is already available.

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Future environmental control programmes testing water and humus could be expanded to permit assessment of down stream dispersion and apparently abnormally high sulphur and low pH values in the adjacent Hatfield licence.

Water samples are not considered useful for exploration purposes because of the highly variable dilution related to the heavy fluctuating rainfall.

3.3 Geophysics

The reconnaissance IP traversing in EL 2/70 has assisted in mapping the extent of the pyritic Que River horizon north from the mineral leases. Detail IP traversing (25m dipoles) has been used to trace this horizon to the south of the mineral leases, until poor weather prevented further work.

It will be recommended, for next spring, that detailed IP traversing be undertaken to trace the mineralised horizon to the south and to examine the geochemically anomalous zone to the north east of Que River. Further attempts will be made to examine airborne EM indications within EL 2/70.

4. TECHNICAL CONCLUSIONS AND RECOMMENDATIONS

Reconnaissance mapping, geochemistry and induced polarisation satisfactorily outlined the extent of the Que River pyritic volcanics north of the mineral leases. This mineralised suite appears to merge with the andesitic pyroclastics. The andesitic pyroclastics are surrounded to the north by black shales and acid volcanics. An asymmetric north plunging antiform is inferred.

Continued mapping is highly desirable to define the stratigraphy of the central part of the licence where pyritic and magnetite bearing volcanics similar to those at the Que River Prospect were found.

The most attractive exploration area located during the summer is located north east of the Que River prospect in an area of difficult access. Soil and stream geochemical anomalies are enhanced by adjacent observations of disseminated chalcopyrite in acid volcanics within the andesite suite. Stream sediment geochemistry continues to be a useful

indicator of areas requiring detailed soil sampling programmes. Extremely wet weather forced suspension of an IP programme until next spring.

Adequate testing of AEM anomalies was not completed due to equipment problems. However geological and geochemical examination of the northern anomaly (10550N) indicates no further interest as the area is one of massive quartz porphyry.

Sufficient funds are available to permit exploration to resume as soon as the weather allows. Reconnaissance mapping will be emphasised since extended geological knowledge is essential to planning of further gridding.

In parallel with the field programme, improved methods of geochemical data assessment are recommended. It is proposed to store analytical data in a manner suitable for computer processing.

5. FINANCE

Expenditure on Exploration Licence 2/70 for the 12 months ending June 30, 1976 is as follows:

Geology	\$13,584
Survey	16,620
Geophysics	15,954
Geochemistry	11,610
Sundries	1,346
Tenure*	<u>4,456</u>
	<u>\$63,570</u>

*Tenure cost includes cost of survey for boundary definition of Que River leases and Mackintosh - Hatfield licences.

6. ATTACHMENTS

Plates QR 81 A,D,F,G,H,K,L. 1:2500 Scale. Mackintosh-Hatfield Area,
Surface Outcrop Geology.

Plates DT 61 A,B,D. 1:10,000 Scale. Mackintosh-Hatfield Area,
Surface Outcrop Geology.

Plates Mac 45-47 A,D,E,F,G,H,K,L. 1:2500 Scale. Mackintosh-Hatfield
Area, C Horizon Geochemistry.

Plates DT 65 A,B,D. 1:10,000 Scale Mackintosh-Hatfield Area, Stream
Sediment Locations.

Plates DT 60 A,B,D. 1:10,000 Scale. Mackintosh-Hatfield Area, Stream
Sediment Geochemistry (Results - Cu, Pb, Zn).

Plates DT 66 A,B. 1:10,000 Scale. Mackintosh-Hatfield Area, Stream
Humus.

Plates DT 62 A,B,D. 1:10,000 Scale. Mackintosh-Hatfield Area,
Preliminary Interpretive Geology.

Plate DT 63 1:10,000 Scale. Mackintosh-Hatfield Area, Interpretive
Cross Section, 5395000N (AMG Coordinate).

Plate QR 88 1:10,000 Scale. IP Coverage Mackintosh-Hatfield Area.
A,B.

Plate QR 47 1:500 Scale. Cross Section 7600N

Plate QR 84 Geological Legend.

Appendix I Chemlabs Report: Analysis of Stream Water and Stream
Transported Humus.

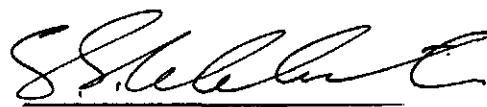
Appendix II Petrological Reports by I.R. Pontifex and Associates;
Central Mineralogical Services Pty. Ltd. (H.W. Fander,
D. Cowan) and A.S. Joyce.

7. REFERENCES

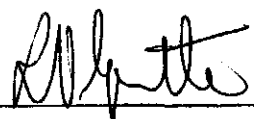
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Signed


for E.H. Skey
Project Geologist


S.S. Webster
Geophysicist.

Endorsed


L.V. Gentle
Chief Geologist

APPENDIX IANALYSIS OF STREAM WATER AND STREAM TRANSPORTED HUMUS

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Hatfield.

THE ANALYSIS OF WATER SAMPLES

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	Site No.		3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
	1	2																		
pH	7.7	5.9	4.9	5.1	5.0	6.5	7.5	5.3	4.4	4.3	6.1	7.0	7.2	6.3	7.2	6.2	4.6	6.8	6.8	6.9
Dissolved Oxygen (% saturation)	98	96	96	98	92	98	98	99	92	95	90	97	90	92	98	96	98	97	97	98
Turbidity (Jackson Units)	13	73	80	13	20	15	7	12	17	23	40	400	57	87	37	42	250	95	17	20
total	13	73	80	13	20	15	7	12	17	23	40	400	57	87	37	42	250	95	17	20
filtrate	13	42	55	13	15	5	3	2	8	6	3	60	2	5	12	11	35	22	4	0
Total residue (mg/l)	52	107	89	16	72	56	88	71	51	60	60	186	128	118	50	48	269	45	94	66
non-filtrable residue	11	18	26	14	14	18	23	15	10	18	23	74	107	88	27	6	202	22	20	14
filtrable residue	41	89	63	2	58	38	65	56	41	42	37	112	21	30	23	42	67	23	74	52
Total sulphur (mg/l)	2.4	1.2	1.9	0.9	0.5	0.3	1.6	1.2	0.9	0.8	1.7	0.5	2.5	0.8	0.7	0.8	1.5	1.9	0.3	0.7
Fluoride (mg/l)	(all <0.01)																			
Cadmium (µg/l)	(all <0.5)																			
soluble	(all <0.5)																			
insoluble	nd	nd	nd	0.2	0.3	nd	nd	0.4	0.2	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Cobalt (µg/l)	(all <5)																			
soluble	(all <5)																			
insoluble	nd	nd	nd	nd	nd	0.1	0.4	nd	nd	0.1	0.1	0.8	0.5	0.2	0.5	0.5	0.3	0.4	nd	0.1
Copper (µg/l)	22	29	29	9	27	13	13	49	73	22	9	16	7	2	6	11	8	13	12	4
soluble	21	27	26	7	25	12	11	48	69	19	7	4	4	2	3	8	2	7	9	3
insoluble	1.4	1.5	2.7	1.7	2.3	1.4	2.3	1.2	3.7	3.4	2.0	12	3.3	1.6	3.4	3.3	7.6	5.7	2.9	0.9
Iron (µg/l)	804	2,260	3,070	824	849	379	367	881	2,520	2,300	3,120	11,360	2,060	3,130	1,420	1,870	3,060	3,610	396	184
soluble	410	1,220	2,080	578	667	167	56	733	2,320	1,940	1,940	4,400	211	956	911	1,000	2,180	1,300	189	100
insoluble	394	1,040	990	246	182	212	311	148	200	363	1,180	6,920	1,850	2,170	511	870	882	2,310	207	84
Lead (µg/l)	21	15	13	12	<5	5	~4	<5	8	22	24	<5	~14	~10	19	~10	~23	<5	<5	<5
soluble	8	8	13	8	5	<5	<5	<5	8	15	15	<5	<5	<5	5	<5	<5	<5	<5	<5
insoluble	13	7	nd	4	nd	nd	4	nd	nd	7	9	nd	14	10	14	10	23	nd	nd	nd
Mercury (µg/l)	0.1	0.1	nd	0.2	0.3	0.1	0.2	0.1	0.2	0.2	0.2	0.7	0.1	0.2	0.3	0.2	0.5	0.2	0.1	0.2
soluble	0.1	0.1	nd	0.1	0.2	0.1	0.2	nd	0.2	0.1	0.2	0.7	0.1	0.2	0.3	0.2	0.2	nd	0.1	0.2
insoluble	nd	nd	nd	0.1	0.1	nd	nd	0.1	0.1	0.1	nd	nd	<0.1	nd	nd	nd	0.3	0.2	nd	<0.1
Nickel	(all <5)																			
soluble	(all <5)																			
insoluble	(not detected)																			

....Continued

The Analysis of Water Samples

(Page 2)

Belenium (µg/l)	(all <1)																			
Silver (g/l)	(all <1)																			
soluble	(all <1)																			
insoluble	(not detected)																			
Zinc (µg/l)	12	124	20	11	14	8	58	56	38	26	48	67	25	26	13	6	60	11	18	13
soluble	10	123	19	10	13	7	54	56	38	25	46	63	13	8	10	4	42	8	17	10
insoluble	2.0	1.4	1.0	0.7	0.6	1.1	3.6	nd	nd	1.2	2.1	4.6	12	18	2.7	2.0	18	3.3	0.9	2.9
nd : not detected																				

THE ANALYSIS OF HUMUS SAMPLES (Expressed On Dry Weight Basis)

	Site No.		3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
	1	2																		
Fluoride (µg/g)	(All <0.1)																			
Total Sulphur (µg/g)	824	107	183	142	76	36	286	143	81	77	161	39	293	35	68	65	138	182	142	63
Arsenic "	0.7	0.6	3.3	0.3	0.9	0.4	0.2	0.6	0.8	0.9	1.8	0.1	0.6	0.2	2.5	2.8	0.6	3.3	1.4	1.1
Cadmium "	0.2	0.4	0.4	0.5	0.3	1.1	0.5	0.3	0.6	0.3	0.2	0.9	0.9	0.4	nd	nd	nd	nd	0.5	0.3
Chromium "	20	4.7	2.2	7.6	4.4	18	28	36	35	6.6	5.0	4.2	16	5.9	4.3	1.9	4.1	26	14	32
Cobalt "	12	2.9	1.9	2.9	2.7	7.3	26	27	7.6	1.2	1.1	1.1	185	16	1.5	1.7	1.6	6.7	7.0	15
Copper "	9.5	12	5.0	9.5	9.1	10	17	24	33	19	69	29	25	16	10	6.8	4.1	16	13	15
Iron (%)	2.86	1.34	0.83	1.01	1.16	1.79	1.53	3.49	4.35	0.91	6.92	3.41	3.64	3.42	1.67	0.61	0.34	1.61	2.20	3.03
Lead "	52	21	16	17	30	39	19	343	121	263	484	249	250	113	227	93	6	127	46	89
Manganese "	326	63	28	44	37	286	543	1,530	164	26	86	99	10,900	1,340	90	21	15	293	448	786
Mercury "	0.04	0.06	0.04	0.11	0.10	0.07	0.06	0.12	0.09	0.19	0.50	0.30	0.09	0.15	0.06	0.06	0.06	0.07	0.05	0.04
Nickel "	15	11	4.8	2.4	4.1	9.3	19	10	8.4	1.1	nd	2.8	11	3.3	2.2	0.3	nd	8.3	7.2	15
Selenium "	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	<0.1	0.1	<0.1	0.1	0.2	0.1	0.2	0.1	0.1
Silver "	0.2	0.5	0.5	1.0	0.7	0.7	0.3	0.7	0.8	0.7	0.9	0.4	0.9	nd	0.2	nd	0.2	nd	0.3	nd
Zinc "	37	13	5.6	23	11	68	83	160	128	21	19	123	167	46	64	5.8	4.5	39	70	181

nd: not detected

APPENDIX II

Petrological Reports by I.R. Pontifex and Associates

Sample Nos. 179602

166599

155055

94522

94524

94526

94528

94530

94532

94516

94518

87507

87508

87509

87510

147140

147144

147146

147147

147148

147149

157538

155413

155423

155429

155430

155433

183170

183187

9330N 6960E

179602: recrystallised and otherwise altered,
very siliceous volcanic glass

Field comment: rhyolite or tuff-lava; or derived
sediment; occurs in sequence of black shales,
polymict grits, quartz and quartz felspar
porphyries and crystal tuffs

This is a massive homogeneous rock with a
roughly polygonal to microgranuloblastic texture, on a
scale of about 0.3 mm. Each "grain" forming the aggregate
has a rather diffuse mottled appearance with a vague,
relict spherulitic to fibrous radiating texture shown by
stress patterns and the distribution of extremely fine
clay-sericite.

Margins between "grains" are commonly gradational,
although ultra fine clay-sericite mixed with cryptocrystalline
silica occurs around most such margins and in poorly defined
intergranular areas. Rare single quartz crystal phenocrysts
up to 2 mm across have very corroded and slightly embayed
margins.

Within a local limonite-stained area, limonite
occurs along intergranular boundaries. Trace minute,
cubic form limonite pseudomorphs after pyrite occur as
inclusions in quartz throughout the rock.

.../

024

179602 contd:

The rock is interpreted to be an altered volcanic glass, originally composed largely of spherulitic to perlitic textured siliceous material, admixed with minor aluminous, ?potassic and hydroxyl radicles. It appears to have formed an independent igneous rock such as obsidian, or perlite.

(Objectively the rock may be called an argillaceous sericitic quartzite. Its glass origin is based almost entirely on the diffuse internal texture in most "grains", and the presence of primarily corroded phenocrysts.)

7300E 9900N

166599: micaceous and quartzose, lithic
fine grained (argillaceous) sandstone;
leached and fairly extensively ferruginised

This is a fine grained quartzose sandstone, slightly more leached and ferruginised than the sediments 166567 and 166568, thus modifying its original composition. The grains range in size from 0.05 to 0.3 mm; they are subangular to subrounded, and form a random quite loosely packed aggregate. They consist of -

single quartz crystal grains	25-30%
detrital muscovite	15-20%
fragments of cryptocrystalline quartz (chert)	10%
fragments of fine metaquartzite	5-7%
fragments of siliceous siltstone	5-7%
fragments of ferruginised argillite	7-10%
plagioclase and tourmaline	accessory
limonitised void ?after matrix	20%

Many components in this rock are also common to 166567 and 166568, with the detrital muscovite being the most diagnostic common component in all three samples.

The quartzose lithic fragments are similar to those in 166568 although the chert is more distinctive (these are virtually absent from 166567.)

...../

166599 contd.

The abundant widespread limonite along intergranular boundaries, and filling leached matrix areas, prevents positive recognition of the ?graphitic and ferruginous argillite clasts as seen in 166567 and 166568. It seems highly likely however that such material occurred in this rock.

Petrologically this sample is not the exact equivalent of 166567 or 166568, however its composition lies somewhere between that of these two samples. It seems highly likely therefore that the major proportion of each of these three sediments derived from the same provenance.

9850N 4500E

027
155055: hornblende micro dolerite (? dyke);
plagioclase commonly altered to
sericite, quartz micro mosaic replaces ?
hornblende and occurs through interstices
(c.f. 99401).

The homogeneous, fine sub-ophitic texture in this rock indicates that it is an intrusive (possibly a dyke-rock) rather than extrusive.

It consists of aggregate of randomly interlocking labradorite plagioclase, with subordinate evenly distributed crystals of clinopyroxene (augite). Average grain size is about 0.2 mm, although minor slightly larger crystals of augite are scattered.

Irregular interstitial areas through this aggregate consist of clouded chlorite and/or urallite (15%), possibly after hornblende or after interstitial residual basic glass. The augite crystals are essentially unaltered, but the plagioclase is commonly partly replaced by sericite, rarely by carbonate. Patches of microcrystalline to cryptocrystalline quartz mosaic (15 - 20%) rarely with carbonate, appear to selectively replace much of the chlorite noted above; less commonly it partly replaces plagioclase. This quartz also occurs in interstices. Accessory fine Fe and/or Ti oxides are disseminated.

This rock is a silicified equivalent of 99401.

028

94522 : lithic tuff (or possible tuff-lava);
extensively silicified, with scattered
patches of ferruginised carbonate

This rock consists essentially of an extremely fine, rather patchy mass of siliceous material, admixed with minor clays, and containing minor, highly irregular and somewhat cellular ferruginous patches.

The essential mass consists of diffuse microcrystalline to cryptocrystalline quartz, intimately mixed with plagioclase laths which are virtually completely replaced by quartz and/or clays. Locally, extremely fine ?lava flow textures are evident. Vaguely rounded patches of microcrystalline quartz mosaic up to 2 mm (25-30%), extremely fine rounded quartz crystals (10%), single and groups of plagioclase crystals (7-10%), all less than 1 mm are randomly scattered. Quartz mosaic replicas after plagioclase crystals (20%) are also present.

The irregular limonite patches consist of fairly poorly preserved limonite replicas and boxwork after aggregates and single crystals of a rhombic mineral, almost certainly carbonate. These are randomly scattered and form about 15% of the rock.

The gross patchy, heterogeneous texture of this rock, the nature and mode of occurrence of scattered crystals, indicates that the rock is a pyroclastic (lithic tuff), or possibly a tuff-lava. Most quartz appears to be essentially secondary, probable deuteric enrichment (as in other rocks in this suite); certainly there are no definite quartz phenocrysts which may indicate an original acid composition. The rock seems therefore to be of essential intermediate composition, but very extensively silicified.

The scattered patches of ferruginised carbonate are conceivably after siderite, and indicate moderate carbonatisation, and tends to support an original intermediate (to possibly basic) composition.

8400N 5760E

94524 : extremely fine tuff or possible tuff-lava,
extensive siliceous carbonate and sericite
alteration

This rock consists predominantly of a vaguely bedded mass of ultra fine quartz sericite carbonate and minor chlorite. Relatively coarser components are scattered through this "matrix", more or less in the sense of the bedding, and they consist of:-

fine (0.1 mm) single, angular to corroded-looking
quartz grains (10-15%)

single plagioclase crystals (5-7%), rarely up to
1 mm, extensively replaced by sericite and/or carbonate

clumps of mainly plagioclase + mafic minerals, i.e.
volcanic rock fragments (7-10%) largely replaced
by chlorite

independent very fine chlorite (5-7%)

The composition and mode of occurrence of the coarser components strongly suggests that they are of direct volcanic (tuffaceous) derivation. The fine size and recrystallised nature of the matrix prevents an accurate assessment of its genesis.

It may be a sediment of mixed argillaceous, siliceous, carbonate detritus largely of volcanic origin. However there is a vague evidence of extremely fine micro-crystalline textures expected in a glassy lava.

8400N 5850E

94526 : irregularly layered crystal lithic, tuff-lava, of glassy basalt composition; fairly extensive silicic and lesser chloritic alteration, mainly of the matrix

This is a dark green, rather indurated, bedded rock, composed largely of fine (1 mm) basic volcanic detritus. Minor, more or less continuous, albeit irregular "bands" of flow textured basic glass material within the limited size of the thin section, appear to be intercalated lava, although they may be part of coarser volcanic rock fragments or ash.

The detritus consists of abundant crystals of augite and fragments of glassy basalt - rarely with vesicles filled with glass; and lesser crystals of plagioclase extensively replaced by sericite and/or carbonate and quartz.

These occur in an ultra fine matrix, the composition of which is largely indeterminate. Locally however it is seen to have a relict flow-oriented microlite texture, and to consist of clouded chlorite-quartz ?saussurite mixture.

As noted above, relatively continuous domains of glassy basalt occur throughout the layered tuff, and suggest that the term tuff-lava (or possibly ash flow) is more appropriate than tuff for this rock.

8400N 5950E

94528 : vesicular andesitic lava, enriched in
deuteric quartz; extensively chloritised

This rock is dominated by a groundmass made up of flow aligned plagioclase microlites with an essentially equal abundance of interstitial chlorite. It is clouded by fine clay-sericite alteration material.

Subhedral to euhedral crystals of plagioclase (10-15%) up to 1 mm, and some clumps of these; lesser crystals of hornblende (5-7%) which have been extensively chloritised, and fine (0.2 mm) rounded to bleb-like grains of quartz and quartz mosaic (10%) are randomly disposed through this groundmass, apparently localised in interstices in the primary rock.

Also the rock contains irregular vesicles up to several mm across, these generally have a lining of ragged chlorite which appears to be relicts of a filling removed by leaching. Minor quartz of the type occurring as "bleb-like" grains above line some of these cavities, and indicate a deuteric origin of this quartz and the localisation of it, and of chlorite in primary vesicles within the lava.

The rock has an essential vesicular andesitic lava composition, enriched in deuteric quartz, and with primary mafic components extensively chloritised.

8400N 6300E

94530 : layered tuff-lava of glassy, basic composition; the glass is variably devitrified and altered; minor carbonate chlorite and saussurite alteration appears to be deuteric

A band of quite homogeneous basic lava, some 25 mm wide, occurs between domains (either end of the rock and section) of relatively heterogeneous basic lava, which contains some fragmental characteristics indicative of a tuff component, i.e. a tuff-lava. Within the limited size of the sample and considering the nature of the contact between the different facies, this relationship is interpreted to represent a layered basic tuff-lava sequence; (however it is possible that the central band is a xenolith within an enclosing lava).

The central band consists of minor small phenocrysts of augite and lesser saussuritised plagioclase through a homogeneous groundmass composed of a diffuse cryptocrystalline siliceous material densely clouded with chlorite, brownish glass alteration products and ultra fine iron oxides. The rock is a devitrified glassy basalt.

The enclosing facies contains abundant euhedral augite crystals and some clumps of these, fairly abundant plagioclase crystals extensively altered by saussurite, carbonate, clay and sericite, minor irregular patches of carbonate and devitrified glass.

Minor "patches" of basic pumice composition with vesicles filled by quartz, are present. These components are all randomly disposed through a basaltic groundmass showing minute flow textured microlites clouded by chlorite and glass alteration products. As noted above, the patchy heterogeneous texture indicates that this facies is partly tuffaceous.

8000N 4830E

94532 : volcanic breccia largely of glassy, vesicular pyroxene basalt composition; fairly extensively silicified and chloritised, mainly through matrix areas

This rock has a clearly defined fragmental texture, with subangular blocks of mainly glassy, flow textured basalt, up to 20 mm, form a loosely packed aggregate in a matrix of similar composition but extensively silicified and chloritised.

The fragments have a groundmass of felted plagioclase microlites within clouded altered glass, which contains generally flow aligned small augite and plagioclase phenocrysts, and elongated vesicles filled with chlorite. This chlorite is a primary deuteric component, certainly the pyroxene crystals (as in most rocks in this suite) are virtually unaltered. Vesicles in some fragments are lined by microcrystalline quartz. The augite phenocrysts are quite unaltered (as in most other rocks in the suite.)

The matrix between fragments consists largely of basic volcanic groundmass, i.e. essential plagioclase and original interstitial mafic minerals, but this has been fairly extensively replaced by chlorite and quartz, and spotted by secondary titania minerals.

5075E 6900N

94516

Basalt (flow) breccia with a (potassic) siliceous matrix contaminated with uraltic alteration products -- essentially of deuteritic origin.

Highly irregular fragments of basaltic composition (35%), measuring up to 15mm across, are randomly disposed through a heterogeneous, rather patchy microcrystalline matrix composed largely of deuteritic quartz.

The fragments consist of a glassy, extremely fine, flow textured basaltic groundmass containing minor euhedral phenocrysts of clinopyroxene (augite) and a similar number of calcic plagioclase. The phenocrysts commonly occur in clumps, they are unaltered. Minor fragments of variolitic basaltic glass (? pillow lava) are also present. These basaltic domains contain several vesicles filled with deuteritic quartz.

The matrix between the fragments consists of a rather diffuse microcrystalline mosaic of quartz crowded by irregular patches of chlorite, fine amphibole, minor ultra fine potash feldspar, accessory secondary titanite minerals and epidote. This matrix fairly extensively invades the fragments along their margins and internal fissures and fractures. Minor quartz veinlets ⁺ chlorite cut the rock. Trace sulphides are seen in hand specimen where they appear to be in the interfragmental areas.

The rock is a basalt breccia, probably a flow breccia rather than a pyroclastic. The interfragmental matrix is interpreted to be inherent to the lava, but of late magmatic (deuteritic) origin; contaminated by uraltic alteration products derived from the fragments during its emplacement.

4700E 7260N

94518

Clinopyroxene basalt, essentially unaltered although quartz of deuteric origin fills vesicles and replaces minor plagioclase phenocrysts.

This rock has a homogeneous composition and texture. Equant, euhedral crystals of clinopyroxene (augite) (30%), average size 0.8mm and far lesser similar size crystals of calcicplagioclase (5%) are randomly, but evenly disposed through a basaltic ground mass. The pyroxene crystals are unaltered, the plagioclase is clouded by clay-sericite, and/or replaced by quartz.

The ground mass has a uniform, extremely fine basaltic texture, it is fairly intensely clouded, but apparently composed of intricately interlocking plagioclase and pyroxene microlites with interstitial glass.

Minor (7-10%) spheroidal vesicles are randomly scattered, and filled by deuteric quartz generally with a margin of chlorite.

The rock is a clinopyroxene (glassy) basalt essentially unaltered but minor vesicles and plagioclase crystals replaced by deuteric quartz. This basalt is virtually identical to the fragments in 94516, giving support to the interpretation that 94516 is a primary breccia, probably a flow top breccia.

Location - eastern boundary of MLA 3M/75 at 8500N

87507

Porphyritic andesite lava; complete pervasive chlorite - clay possible supergene alteration of ground mass, plagioclase phenocrysts extensively altered to sericite, hornblende to chlorite.

Euhedral phenocrysts of plagioclase (20%), average size 1mm, several groups of these, also chloritic pseudomorphs after hornblende (5-7%) and rare chloritised deformed ? vesicles, are all randomly dispersed through a flow textured ground mass.

The plagioclase phenocrysts are extensively altered to fine sericite minor clays, and cut by abundant chloritic microfissures.

The original ground mass consisted of a flow textured, felted aggregate of plagioclase microlites, with a similar abundance of more-or-less interstitial mafic component and possible minor glass. This is now completely altered to a clouded patchy mass of chloritic clays and minor dispersed, ultra fine titaniferous material. The patchy ? silicious characteristic suggests original glass. Accessory oxidised magnetite, trace pyrite, and several small patches of carbonate are scattered.

This is a homogeneous andesite lava, the sample represents outcrop (rather than core in the above samples) and this fact, together with the nature of the alteration suggests that it may be due to weathering rather than hydrothermal.

Location - eastern boundary of MDA 3M/75 at 8500N.

87508

Porphyritic andesite flow breccia; extensive chlorite-clay ? silica alteration of ground mass moderate sericitic alteration of plagioclase phenocrysts.

Euhedral phenocrysts of plagioclase, average size 0.5mm (20-25%) and much lesser chlorite pseudomorphs after hornblende (7-10%) are randomly disposed through an altered, flow textured, felted ground mass consisting largely of plagioclase microlites. Although the mineralogical composition, and relationship of phenocrysts to ground mass is continuous throughout the section abrupt discontinuities in the ground mass and to a lesser extent the stressed, bent, fissured nature of the phenocrysts, indicate primary flow brecciation.

The plagioclase phenocrysts are replaced to a moderate degree by sericite and minor clay, and rare carbonate, also they are cut by chloritic fissures. The ground mass shows similar alteration features to 87507, and is largely replaced by a clouded mass of chloritic clays ? silicious glass alteration products, clouded by ultra fine titaniferous material. It is not certain if this alteration of hypogene or supergene.

Location - Vicinity 8400N 5980E (Geochem Pb, Zn)

87509

Coarse lithic tuff (agglomerate or volcanic breccia) of essential andesitic composition; advanced irregular argillic carbonate silicic alteration.

This volcanic rock has a heterogeneous texture and composition indicating a coarse lithic pyroclastic. Most domains have an essentially altered andesite composition, with quite fresh plagioclase crystals, and a similar abundance of apparent carbonate replicas after plagioclase, and patches of carbonate of no specific configuration. The carbonate has particularly high relief and is almost certainly highly magnesian.

These crystals occur in a felsic, generally flow textured ground mass which has been recrystallised, sericitised and partly silicified.

Irregular patches of ? interfragmental carbonate (7-10%) and quartz mosaic (10-15%) are randomly scattered as separate or combined entities. The quartz is variably microcrystalline to cryptocrystalline.

A limonitised domain consists of a confused aggregate of fine argillised plagioclase and secondary quartz (? some after glass), with abundant random vesicles variably filled by carbonate, quartz, minor zoölite, with rims and/or concentric zones of limonite. This is fairly continuous and within the scope of this section and rock size it is not possible to determine if it is part of a large fragment or a flow band.

A fragment of apparent sericitised argillite is also present.

Location - Vicinity 7400N 4400E

87510

Volcanic breccia of glassy vesicular basalt composition; vesicles and interfragmental areas filled variably by quartz chlorite epidote of deuteritic origin; pyroxene and rare plagioclase phenocrysts are unaltered.

This is a coarse lithic tuff (or volcanic breccia), composed of a loose random aggregate of fragments of glassy, vesicular basalt which measure up to 20mm across. The fragments consist of abundant rounded vesicles filled variably by pale, near-isotropic chlorite, quartz, prehnite and ? pumpellyite; also of clino-pyroxene phenocrysts and clusters of these, all randomly disposed through a fine clouded ground mass. Plagioclase phenocrysts are rare.

The ground mass consists of streaky drawn-out plagioclase commonly aligned by flow in a densely clouded matrix of poorly defined, chloritic glass alteration products. Eutaxitic textures outlined in brownish altered glass are abundant in some fragments.

Interfragmental areas are occupied by irregular fine aggregates of quartz chlorite and minor epidote - and no doubt have the same deuteritic origin as the minerals filling vesicles.

8420N 5180E

147140: volcanic breccia of glassy rhyolite composition, extensive argillic and minor sericitic alteration, scattered patches of epithermal quartz-pyrite

This rock responded strongly to potash feldspar stain, and apart from 145938 and a small area in 147147 is the only rock which does respond.

Macroscopically it is seen to have a breccia texture with angular light colored fragments of fine volcanic rock to 30 mm across, loosely packed with a darker colored, fine grained volcanic matrix. Petrologically the ground-mass in all domains of the rock is seen to consist of a cryptocrystalline mosaic of potash feldspar, intimately mixed with minor, ultra fine clays and sericite, and highly irregular patches of microcrystalline ?epithermal quartz.

The fragments contain scattered clay replicas after small feldspar phenocrysts.

Fine groups of pyrite (5-7%) are scattered, generally associated with quartz.

7760N 5390E

147144: volcanic breccia of glassy rhyolite composition, virtually complete argillic and subordinate sericitic alteration; accessory disseminated pyrite

This rock has a pyroclastic texture. Minor angular fragments of very fine volcanic rock to 25 mm across are randomly disposed through a slightly darker colored matrix of essentially the same composition.

The groundmass in all domains consists of clay, patchy devitrified glass, with subordinate, shredded streaks of sericite. Pinkish, small feldspar phenocrysts extensively replaced by clays, and clay pseudomorphs after feldspar crystals occur in all areas of the rock. Accessory spheroidal clusters of quartz, and of ?pseudobrookite appear to represent vesicles.

This is a completely altered rhyolitic glassy lava, containing breccia blocks of essentially the same rock type.

Extremely fine irregular grains of pyrite are randomly disposed in all areas of the rock.

7780N 5420E

147146: Vesicular basalt, completely replaced by carbonate, minor sericite, chlorite and secondary cryptocrystalline quartz

This is a basic volcanic lava, differing from those above largely in that it shows a relict microcrystalline essentially basaltic texture of clouded, flow oriented plagioclase microlites in the groundmass. These microlites and possibly original mafic crystals between them, are completely replaced by carbonate, mixed with subordinate sericite and with minor chlorite and interstitial secondary cryptocrystalline quartz. Accessory plagioclase phenocrysts are also completely replaced by carbonate and quartz.

Minor (10-12%) vesicles are drawn out in the direction of flow in one layer, and remain spheroidal in another. These are filled by carbonate and cryptocrystalline quartz.

Accessory, partly oxidised, euhedral pyrite crystals are randomly scattered.

The absence of primary quartz and potash feldspar (or alteration products thereof) and the general texture suggests that the primary rock was an original basic lava, i.e. a vesicular basalt.

7840N 5520E

147147: glassy, vesicular basalt breccia, late
magmatic quartz epidote and chlorite
alteration products

This is a basic volcanic fragmental rock,
with the size of the fragments commonly up to 6 mm
it may be considered a volcanic breccia.

Fragments have a flow oriented groundmass of
plagioclase microlites set in near-isotropic, altered
(chloritised) basic glass. Minor vesicles filled with
chlorite, less commonly quartz and epidote, and minor
plagioclase phenocrysts, partly epidotised occur in all
fragments. Interfragmental areas are occupied by
late magmatic quartz, chlorite and epidote.

A single potassic (acid) fragment may be a
xenolith. Opaques are absent.

7840N 5580E

147148: tuff or breccia of vesicular intermediate volcanic, abundant late magmatic quartz, carbonate and lesser jarosite, and pyrite in vesicles and interfragmental areas

This rock consists of a confused aggregate of fine volcanic fragments containing abundant relict vesicles, and late magmatic (hydrothermal) quartz, carbonate, and related clay-sericite alteration products.

The rock is classified essentially as a tuff or volcanic breccia, in the absence of potash feldspar (or alteration derivatives) and in the absence of basaltic features seen in 147146 and 147, and considering the nature of some relict plagioclase phenocrysts, the primary rock type appears to be andesitic.

The general groundmass of clay mixed with cryptocrystalline quartz is crowded with abundant fragments of feldspar and spheroidal bodies of quartz and carbonate, some zoned with a quartz rim and a core of carbonate and/or jarosite. Irregular patches and discontinuous veins of quartz and carbonate $\pm$ chlorite, and accessory extremely fine pyrite are all randomly disposed.

7840N 5580E

147149: vesicular and flow oriented andesitic
lava, advanced argillic and
carbonate alteration

This rock has a very similar gross composition to 147148 but its texture is more ordered and can be identified as a flow textured, porphyritic lava with minor vesicles. Its primary composition is almost certainly andesitic.

Relict plagioclase (andesine) phenocrysts (25-30%) and some groups of these occur in an extremely fine streaky groundmass of clays and minor chlorite which completely replace primary plagioclase microlites and interstitial mafic minerals. Small spots of carbonate are crowded through the groundmass and these also invade and replace the phenocrysts. Total carbonate content is about 25%.

Rounded (spheroidal) and ovoid vesicles (5-7%), measuring up to 1.5 mm are filled variably by quartz and carbonate showing relict spheroidal-colloform texture. They are generally lined by a thin shell of quartz. All of these components are inherent to the host rock, localised by processes of deuteritic mineralisation.

7870N 5780E

157538: basaltic andesite, abundant vesicles
variably filled by chlorite, quartz and
primary chalcedony; incipient
epidote alteration

This is a relatively unaltered strongly vesicular lava of primary basaltic-andesite composition, but later silicified. It has a homogeneous groundmass of locally flow oriented plagioclase and pyroxene microlites with minor interstitial ultra fine quartz and/or albite. The mafic crystals are clouded by epidote alteration products.

Small euhedral phenocrysts of plagioclase (10-12%) and augite (7-10%) and some groups of these, are randomly disposed; the plagioclase shows minor, patchy alteration to epidote, chlorite and trace sericite. Rare augite crystals are replaced by serpentiferous-biotite.

A prominent feature in the rock is the presence of ovoid to irregularly extended lensoid vesicles, filled by deuteritic minerals. Darker colored vesicles (7-10%) up to 1 x 5 mm obvious on the sawn surface, are lined by quartz and filled by chlorite. Larger (12 mm), lighter colored vesicles (7-10%) are more irregular, they are lined by quartz and filled by fibrous radiating groups of primary chalcedonic silica, and/or quartz mosaic.

047

457048

8060N 5380E

155413: slightly porphyritic (augite)
basalt; minor orthopyroxene and
weakly potassic, essentially unaltered

This rock consists of a homogeneous, crystalline aggregate made up of randomly interlocking plagioclase laths of labradorite composition and of pyroxene each in about equal abundance. Plagioclase is generally finer grained (0.3 mm) than the pyroxene (1.2 mm) producing a weak porphyritic texture. Most pyroxene is a clino variety (augite), however parallel extinction of many grains indicates subordinate orthopyroxene. Augite forms rims around some orthopyroxene crystals.

Accessory (5-7%), clouded felspar filling some interstices in the aggregate is at least in part potassic. Accessory (2-3%) fine primary magnetite is dispersed.

The rock is essentially unaltered.

8105N 5105E

155423: (lithic) crystal tuff, completely altered
by clay sericite and lesser chlorite
alteration, minor disseminated pyrite

This is a tuff in which the coarser components ranging in size from 0.2 to 3 mm have a fairly ordered layered distribution, in a fairly homogeneous extremely fine matrix. The coarse components consist mainly of plagioclase crystals (20%), completely replaced by clay-sericite, and chlorite pseudomorphs after mafic crystals (15%) of similar size and distribution. Minor patches of ultra fine quartz-sericite-clay appear to be altered volcanic groundmass, i.e. lithic fragments. Minor (5-7%) fine euhedral pyrite crystals are randomly scattered, but commonly clustered in the vicinity of chlorite.

The groundmass consists of an ultra fine intimate mixture of clay, rather spotty quartz, shredded sericite and chlorite. These minerals, and the alteration components in the fragments, are of hydrothermal origin.

There is no quartzose coarse components and no evidence of potash feldspar, which negates an acid volcanic source of this tuff. The gross composition suggests an intermediate composition.

8205N 5495E

155429: microporphyritic and very weakly vesicular lava of intermediate composition; extensive sericitic, minor chlorite and clay alteration; enrichment in deuteric quartz

Euhedral phenocrysts of plagioclase and groups of these (25%), rarely up to 2 mm across, are evenly disposed through a microcrystalline groundmass composed largely of plagioclase microlites.

The plagioclase is fairly extensively replaced by patches of sericite, minor clay and trace epidote. The plagioclase microlites in the groundmass are intimately mixed with clouded, chloritic-clay alteration products.

Cryptocrystalline quartz (7-10%) also occurs in short streaks and patches relatively more concentrated in some layers than in others. These may have formed from original glass incorporated in the lava or deuteric quartz permeating and filling elongated pore space in the mobile felsic groundmass.

Accessory small patches of chlorite and rare epidote are scattered. Trace quartz-epidote filled vesicles are present.

8035N 5300E

155430: altered microporphyrritic andesitic
lava, abundant vesicles filled by
quartz and chlorite

Altered euhedral plagioclase crystals (20%)
to 1.5 mm rounded and variably deformed vesicles (30-35%)
ranging in size from 0.1 to 3 mm are randomly disposed
through an ultra fine groundmass. The plagioclase is
fairly extensively sericitised $\pm$ minor clays and
chlorite.

The smaller vesicles are filled by quartz
(devitrified glass) the larger ones have a variably
continuous quartz shell and are filled by chlorite.
These components are of deuteric origin. The groundmass
consists of an intimate mixture of clays, quartz and
chlorite, which appear to be the hydrothermal alteration
products after an original andesitic, possibly basaltic-
andesite groundmass.

8300N 5020E

155433: altered basalt breccia

This rock has a fragmental texture, with subangular fragments of microporphyritic basaltic rock to 15 mm across, and crystals randomly disposed through a matrix of basic composition but enriched in quartz.

The fragments consist of altered plagioclase crystals, virtually unaltered pyroxene crystals, and rare vesicles, in a groundmass of largely basaltic glass completely altered to a chlorite-quartz admixture. (These may be compared to the rock type of sample 147538.)

These fragments, also crystals of similarly altered plagioclase and pyroxene occur in a matrix of "spotted" microcrystalline quartz intimately mixed with chlorite, and clays and minor secondary titania minerals.

7550N 6750E

183170: "felsic andesitic lava", with coarse
(oxidised) magnetite crystals; complete
pervasive argillic lesser silicic alteration

Field comment: ?intermediate lava, associated with
dacite felspar porphyry lava bearing
up to 5% magnetite

This is an intermediate lava which has been
completely, pervasively altered. Original euhedral
phenocrysts (15-20%), up to 1 x 2 mm, have a fairly uniform
distribution with common orientation through the groundmass.
These appear to be mainly plagioclase, but probably include
minor hornblende; they are completely replaced by clays
+ shredded sericite.

The groundmass has a relict, more or less felted
texture of flow aligned plagioclase microlites with
subordinate interstitial chlorite. It is completely
replaced by a mottled, intimate mixture of clays, ultra
fine silica and finely dispersed iron oxide dust.

An irregular network of streaky lenses of clay
alteration products cut the rock.

Minor quite coarse euhedral crystals of magnetite
(3-5%) are scattered, and completely oxidised to hematite-
limonite. Several coarse euhedral crystals of apatite
and trace quartz are present.

1950N 5300E

183187: hornblende basalt; phenocrysts of
lamprobolite (hornblende) in extensively
saussurised and uralitised basaltic groundmass

Field comment: intermediate lava with black, vitreous
platy inclusions. Rubble associated with
Cambrian (?) diorite dyke. Overlain by
mica sandstone

This rock has a homogeneous, massive, extremely
fine crystalline groundmass of fairly typical basaltic
characteristics. It consists of intimately interlocking
randomly oriented laths of plagioclase with a similar
abundance of more or less interstitial chlorite. The
plagioclase is very extensively replaced by fine saussuritic
alteration products. The chlorite appears to be
secondary after primary mafic minerals.

Minor clouded grains of secondary titanite minerals
(10-12%), and accessory small granules of epidote are wide-
spread. Accessory hornblende phenocrysts are replaced by
chlorite-carbonate-epidote and sphene granules. Veins of
chlorite-epidote-tremolite cut the rock.

The main phenocrysts, referred to as vitreous
inclusions above are peculiarly rounded to subhedral crystals
of strongly pleochroic, brown hornblende. These have an
average size of about 1.5 mm and form 5-7% of the rock.
They are identified as the basaltic hornblende, variety
lamprobolite. Unlike the groundmass they are unaltered.

An inclusion (xenolith) of chlorite schist, and
trace grains of pyrite are seen in the hand specimen
(but not in the thin section).

Petrological Reports by C.M.S. - W. Fander

Sample Nos. 155176
155177
155178
155179
155180
155181
155182
155183

Petrological Descriptions

Creek traverse E of 7700N (155176 - 155183) 7870N, 5600E

155176 Buff coloured altered finely porphyritic rock, K stain negative.

TS 16541 This is an argillised and somewhat weathered Fe-stained porphyritic lava of dacitic-quartz andesitic affinities. It consists of variably Fe-stained illite semi-pseudomorphs of feldspar and (minor) hornblende phenocrysts dispersed throughout an incipiently Fe-stained altered groundmass of fine kaolin-illite and microgranular-anhedral quartz with accessory traces of zircon and leucogenised opaques. There are no quartz phenocrysts and overall quartz is barely present above accessory amounts.

Limonite, pervasive in fine clots throughout the altered groundmass originates in part from fine primary opaques (probably magnetite), elsewhere it has developed from fine carbonate particularly with the "sericite" replacements of feldspar. There are sporadic sericitic fracture veinlets. Possibly a little very fine grained pyrite was present.

7970N, 5650E

155177 Grey green altered fragmental rock, K stain positive.

TS 16542 This is a fairly thoroughly altered basic-intermediate lithic crystal tuff.

Numerous angular to subangular variably sized (150-5mm) lava clasts are seen, locally closely packed and forming 80-90% of the rock elsewhere somewhat more dispersed (to 45-50%). These features are typically porphyritic or microporphyritic towards plagioclase and greenish clinopyroxene and frequently show subtrachytic fabrics. Many have altered-devitrified microlitic groundmasses, others are vesicular and some are virtually holohyaline.

Crystal fragments (feldspar, clinopyroxene) occur sporadically. The matrix consists essentially of microgranular-anhedral quartz and albite.

Plagioclase is albitised and epidotised ("saussuritised"). Fine chlorite and granular cryptocrystalline epidote are semi-pervasive throughout replacing glass, filling interfragment cavities and filling vesicles. Alteration makes the primary composition a little obscure but on the basis of fabric and the positive K stain the rock is of trachybasaltic-trachyandesitic affinities.

7860N, 5730E

155178 Pale grey brown slightly weathered ? rhyolite, K stain negative.

TS 16543 This is a devitrified, sericitised and carbonated porphyritic "rhyolite".

457057

The rock contained disseminated flow-orientated feldspar phenocrysts (mean 600 μ) now completely pseudomorphed by random sericite which is frequently Fe-stained. There are thinly dispersed recrystallised quartz phenocrysts. The groundmass consists of sericite stained semi-lineated felsite and subordinate anhedral quartz. A crude perlitic microfabric is developed locally. Groundmass quartz tends to occur in microlenticular aggregates which give the rock a "graphic" appearance on a fine scale.

Sporadic discontinuous chlorite veinlets occur with closely associated fine aggregates and disseminated rhombs of Fe-carbonate (extensively oxidised) and occasional discontinuous films and anhedral particles of pyrite (marginally to completely limonitised).

7970N 5850E

155179 Grey green altered coarse fragmental rock, K stain negative.

TS 16544 This is a fairly thoroughly altered basic-intermediate agglomerate lava.

The rock consists essentially of angular to subangular clasts of chloritised vesicular lava cemented by a similarly altered felsitic-devitrified non-vesicular lava.

The clasts (400 μ -1cm) contain frequent quartz-chlorite-sericite (-epidote) infilled vesicles (100 μ -1mm) and sporadic saussuritised-albitised plagioclase phenocrysts (200 μ -1mm) enclosed in a chloritised glassy to feldspar-microlitic groundmass. Primary composition is obscure but overall these features are of basaltic-andesitic character.

The lava matrix/cement is more felsic and consists essentially of felsitic plagioclase and (subordinate) quartz with sporadic feldspar phenocrysts and varying proportions of secondary chlorite. This material approximates to quartz andesitic-dacitic composition and locally involves vesicles in the more basic clasts.

Textural evidence suggests the "basalt" was fairly well consolidated but unaltered when intruded/cemented by the "dacite" which shows some evidence of chilling. The alteration (chloritisation, vesicle filling) is a post-dacite phenomenon.

7960N 6170E

155180 Grey green altered fine grained basic rock, K stain positive.

TS 16545 This is an altered slightly porphyritic orthoclase microgabbro not far removed from monzonitic composition.

The rock consists mainly of albite and fine grained chlorite-epidote pseudomorphous after plagioclase and ? pyroxene respectively. Fairly abundant intersertal fine grained orthoclase is present with subordinate/minor quartz.

Leucoxenised primary opaques and fine acicular apatite are additional accessory constituents. The rock was incipiently porphyritic towards pyroxene and to a lesser extent plagioclase; feldspar laths (mean 50 μ) are randomly orientated; orthoclase, quartz (and chlorite) are late magmatic to deuteric components (mesostasis).

There are sporadic chlorite veinlets and discontinuous epidote-quartz veins (400 μ -1.8mm).

7960N 6300E

155181 Pale grey green altered amygdaloidal lava, K stain weakly positive.

TS 16546 This is a moderately altered amygdaloidal porphyritic basalt.

Phenocrysts comprise up to 50% of the rock with plagioclase (saussuritised-indeterminate) and augite (partly altered to chlorite, montmorillonite) present in roughly equal proportions. These 100 μ -1mm features are frequently clustered and are essentially randomly orientated. They are contained in a very fine grained groundmass of semi-felted feldspar microlites (max. about 10 μ), clinopyroxene microlites (10-20 μ) intersertal pyroxene granules, and pervasive chlorite.

Ovoid to subspherical vesicles (0.5-2.5mm) are fairly common. These features are filled with Mg-chlorite usually with a thin selvage of microgranular quartz. There are occasional fracture veinlets (max. 100 μ) of adularia and quartz with traces of chlorite and a little epidote. These features developed more or less contemporaneous to later than the vesicle fillings.

Traces of fine grained pyrite (and $\frac{1}{2}$ chalcopyrite) are disseminated throughout partly associated with vesicle fillings but absent from the veinlets.

7860N 6550E

155182 Grey green altered ? fragmental rock, K stain weakly positive.

TS 16547 An altered vesicular porphyritic basalt, not unlike and probably related to 155181.

Phenocrysts (100-400 μ , frequently clustered) are mainly feldspar (sericitised-albitised) with subordinate pale augite. The groundmass consists of ultrafine random chlorite and tremolite-actinolite with relicts of feldspar and pyroxene microlites (sim. 155181). Chlorite amygdales (100-600 μ), with microgranular quartz selvages and a little acicular tremolite-actinolite are frequent. The fabric is locally subtrachytic with flow orientated phenocrysts, vesicles and groundmass microlites.

The rock is locally brecciated and healed with fine grained aggregates of chlorite, acicular tremolite-actinolite and (patchy) granular epidote with a little prehnite (after pyroxene). Late quartz-adularia (-epidote-chlorite) fracture veinlets (sim. 155181) are frequent.

8000N 6420E

155183 Grey green altered fragmental rock, K stain positive.

TS 16548 This is an altered hybrid tuff lava.

The rock consists essentially of corroded angular basaltic lava fragments (sim. 155181, 155182, sized 400 μ -2mm, total 30-35%) with occasional fragments of chloritised pumice cemented and marginally corroded by a relatively felsic lava matrix.

The fragments carry sporadic sericitised plagioclase and variably chloritised augite phenocrysts in a chloritised-actinolitised microlitic groundmass with sporadic chlorite-quartz infilled vesicles. Some of these features show a deformed flow fabric suggesting they were incompletely consolidated when incorporated.

The matrix contains fairly frequent augite and (sericitised) plagioclase crystals in a groundmass of microfelsitic to spherulitic quartzo-feldspathic material (partly K feldspar) which is poorly determinate due to very fine grain size and poor crystallinity. Crude perlitic microtextures occur and chloritic alteration is marked although most of the pyroxene is quite fresh.

On textural grounds the rock is reasonably termed a tuff lava. It is hybrid in the sense that the fragments ("basaltic") and matrix (trend trachytic) are of different composition.

D. Cowan, B.Sc.

Petrological Reports by S. Joyce.

Sample Nos. 141159

141160

95877

95886

95887

060

457061

141159 Basalt flow

6950N 5650E

<u>Analyses</u>		<u>Catanorms</u>	
SiO ₂	52.00	Calcite	.00
TiO ₂	.55	Apatite	.26
Al ₂ O ₃	13.70	Pyrite	.00
Tot. Fe	3.70	Ilmenite	.80
MnO	.19	Orthoclase	6.80
MgO	7.00	Albite	25.30
CaO	9.20	Anorthite	22.57
Na ₂ O	2.80	Corundum	.00
K ₂ O	1.10	Magnetite	.00
P ₂ O ₅	.12	Hematite	.00
L.O.I.	1.83	Diopside	19.47
		Hypersthene	21.91
TOTAL	97.19	Quartz	.00
		Olivine	.87
		Nepheline	.00
		TOTALS	100.00

Norm. plag. An₄₆

The rock is a fine grained basalt or andesite porphyritic in plagioclase and clinopyroxene. One small irregularly shaped vesicle is filled with quartz; another is filled with albite, quartz and carbonate.

Chemically the rock has 52% SiO₂ and its normative feldspar composition is An₄₆. These features are consistent with andesite. There is an element of uncertainty whether this rock is Cambrian andesite or Tertiary basalt because of its unaltered nature. Apparent field distribution suggests Cambrian and the unaltered mineralogy may be a reflection of the rocks massive texture.

141160 Vesicular andesite /basalt

6700N 5930E

<u>Analyses</u>		<u>Catanorms</u>	
SiO ₂	53.50	Calcite	.00
TiO ₂	.59	Apatite	.29
Al ₂ O ₃	13.00	Pyrite	.00
Tot. Fe	8.10	Ilmenite	.88
MnO	.17	Orthoclase	<u>4.01</u>
MgO	6.10	Albite	<u>11.60</u>
CaO	10.00	Anorthite	<u>33.04</u>
Na ₂ O	1.20	Corundum	.00
K ₂ O	.63	Magnetite	.00
P ₂ O ₅	.13	Hematite	.00
L.O.I.	3.57	Diopside	13.57
		Hypersthene	23.26
TOTAL	97.99	Quartz	<u>11.35</u>
		Olivine	.00
		Nepheline	.00
		TOTALS	100.00

Norm. plag. 32.74

This is another sample of the same unit as 141159. It is a vesicular andesite or basalt, porphyritic in clinopyroxene and plagioclase. However it contains ovoid vesicles filled with quartz and carbonate and some feldspar phenocrysts have been very selectively replaced by quartz, epidote, chlorite and coricite. Veinlets of quartz are conspicuous.

Chemically this rock is consistent with silicified andesite or possibly basalt. Both 141159 and 141160 contain low enough TiO₂ to be andesite and are free of groundmass titanium-iron oxides which would be common in most basalts. The normative plagioclase composition of 141160 is no guide to classification because the carbonates in the rock alter the normative anorthite content.

The rock is probably Cambrian but final assessment must hinge on a field decision.

062

457063

95877

Vesicular dacite/andesite

5300E 1000N

Analyses

SiO ₂	57.60
TiO ₂	.62
Al ₂ O ₃	12.50
Tot. Fe	7.50
MnO	.15
MgO	5.10
CaO	6.10
Na ₂ O	2.60
K ₂ O	1.70
P ₂ O ₅	.27
L.O.I.	2.53
TOTAL	96.67

Catanorms

Calcite	.00
Apatite	.61
Pyrite	.00
Ilmenite	.93
Orthoclase	10.76
Albite	25.01
Anorthite	13.67
Corundum	.00
Magnetite	.00
Hematite	.00
Diopside	9.49
Hypersthene	22.11
Quartz	12.42
Olivine	.00
Nepheline	.00
TOTALS	100.00

Norm. plag.

An₄₂

This specimen closely resembles 141160 in being a fine grained greenish rock with pyroxene phenocrysts and ovoid vesicles filled with quartz and other minerals. Its thin section appearance is also essentially the same, except that minor secondary green biotite occurs as a replacement of some phenocrysts in addition to the other secondary minerals seen in 141160.

Chemically the rock has a simple dacite composition but it's likely that it was originally andesite and that the quartz veinlets and vesicle fillings have increased the normative quartz to that of a dacite.

95886 Extremely silicified and mineralised rhyolite lithic
feldspar quartz crystal tuff

7450N 5320E

<u>Analyses</u>		<u>Catanorms</u>	
SiO ₂	81.60	Calcite	.00
TiO ₂	.39	Apatite	.00
Al ₂ O ₃	8.00	Pyrite	.00
Tot. Fe	3.10	Ilmenite	.60
MnO	.00	Orthoclase	<u>16.93</u>
MgO	.47	Albite	<u>.49</u>
CaO	.00	Anorthite	<u>.00</u>
Na ₂ O	.05	Corundum	<u>6.14</u>
K ₂ O	2.60	Magnetite	.60
P ₂ O ₅	.00	Hematite	.00
L.O.I.	3.01	Diopside	.00
		Hypersthene	6.00
TOTAL	99.13	Quartz	<u>69.83</u>
		Olivine	.00
		Nepheline	.00
		TOTALS	100.00

Norm. plag. An₀

This is a conspicuously altered and mineralised rock with a very cherty aspect in fresh hand specimens but a fine grained volcanic appearance in weathered specimens. In thin section it is seen to consist largely of quartz irregularly distributed in abundance and grain size. Rare relict subhedral quartz phenocrysts and ghostly lithic fragments and replaced feldspar fragments indicate that the rock was a lithic crystal tuff prior to very extensive silicification and less conspicuous sericitisation. Very fine sulphides are distributed abundantly throughout the rock, increased grain sizes and abundances being noted in some obvious replacement veinlets and selectively pseudomorphed original fragments.

The extreme silicification is conspicuous in the chemistry of the rock and, although it is largely a guess, the original parentage may have been rhyolitic. Support for this is low iron and titanium and the presence of some quartz phenocrysts.

95857 Mineralised sericitised silicified dacite (?) crystal-
vitric tuff

7550N 5150E

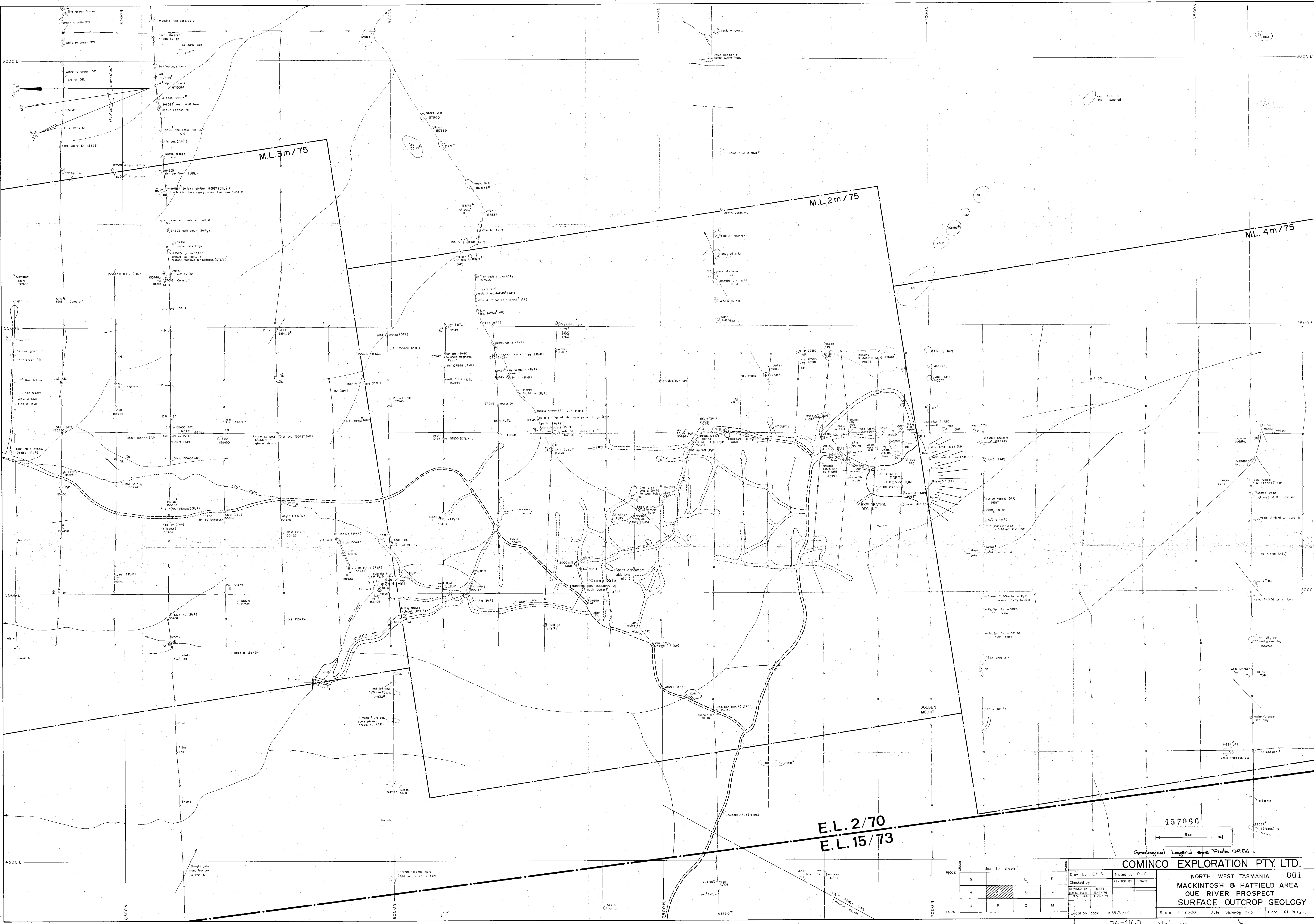
<u>Analysis</u>		<u>Catanorms</u>	
SiO ₂	66.49	Calcite	.00
TiO ₂	.49	Apatite	.68
Al ₂ O ₃	16.10	Pyrite	.00
Tot. Fe	3.90	Ilmenite	.77
MnO	.02	Orthoclase	<u>26.51</u>
MgO	.53	Albite	<u>2.01</u>
CaO	.24	Anorthite	<u>- .79</u>
Na ₂ O	.29	Corundum	<u>14.33</u>
K ₂ O	4.00	Magnetite	.00
P ₂ O ₅	.29	Hematite	.00
L.O.I.	3.37	Diopside	.00
		Hypersthene	8.62
TOTAL	95.84	Quartz	<u>47.58</u>
		Olivine	.00
		Nepheline	.00

TOTALS 100.00

Norm. plag. An₀

This pale green-grey rock has conspicuous small dark green droplet and shard-type shapes. These now consist of secondary green biotite, sericite, pennine and coarse quartz but their shapes are consistent with former vitric fragments. These fragments are set in a fine even-grained matrix of recrystallised quartz, feldspar and sericite. A notable feature is that very fine pyrite is disseminated abundantly and fairly evenly throughout the rock, a feature not conspicuous in hand specimen.

Chemically the rock has dacitic affinities but its norm reflects considerable silicification and sericitisation. Iron and titanium content are too low for an andesitic parentage.



E.L. 2/70
E.L. 15/73

457066
50m

Geological Legend see Plate GRB4

COMINCO EXPLORATION PTY. LTD.

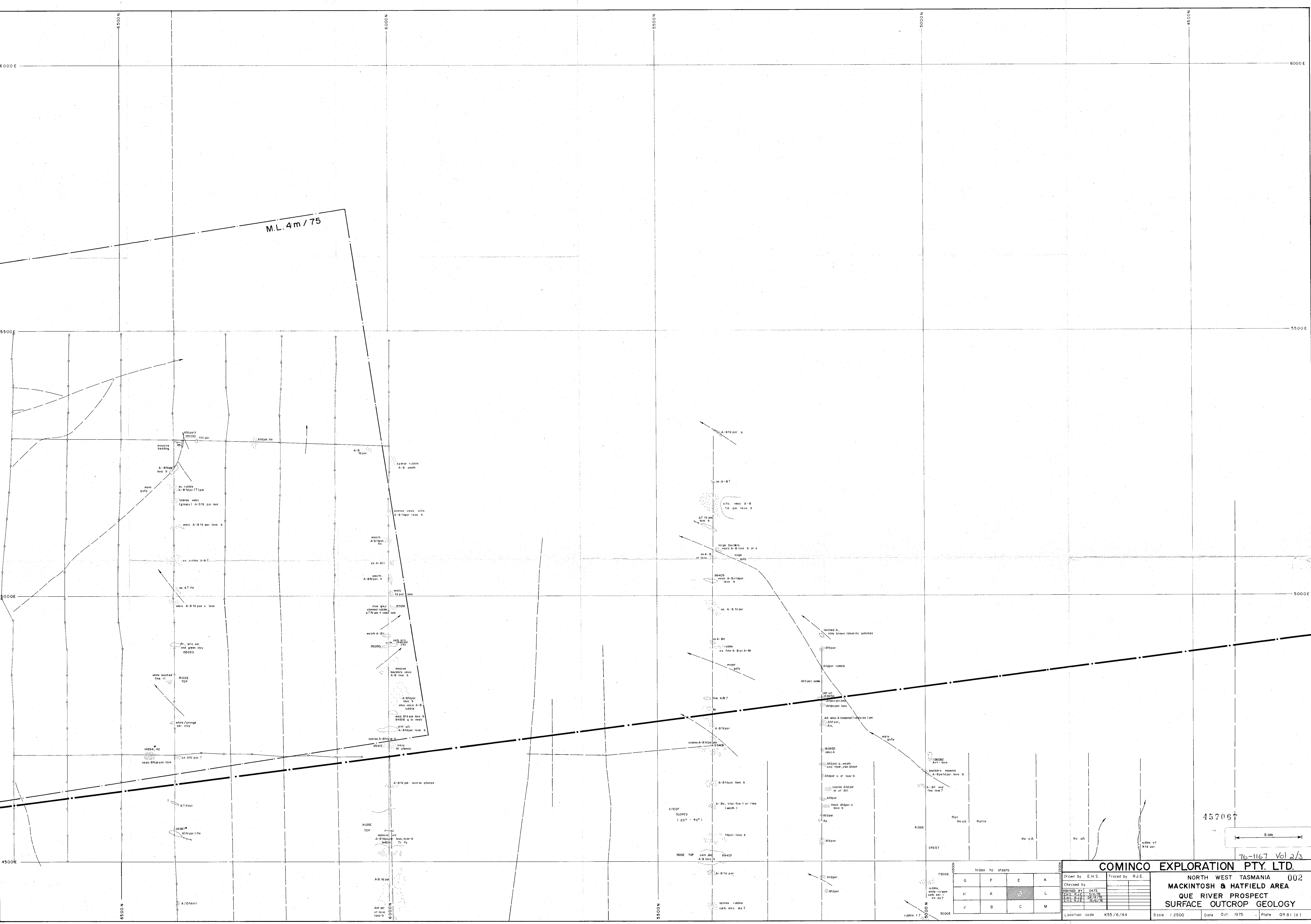
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MACKINTOSH & HATFIELD AREA
QUE RIVER PROSPECT
SURFACE OUTCROP GEOLOGY

Index to sheets			
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H	D	L	
J	B	C	M

Drawn by	E.H.S.	Traced by	R.J.E.
Checked by		Revised by	
Revised by		Revised by	
Revised by		Revised by	
Revised by		Revised by	

Location code K55/6/44

Scale 1:2500 Date September 1975 Plate GR B1(a)



457067

5 cm

76-1167 Vol 2/3

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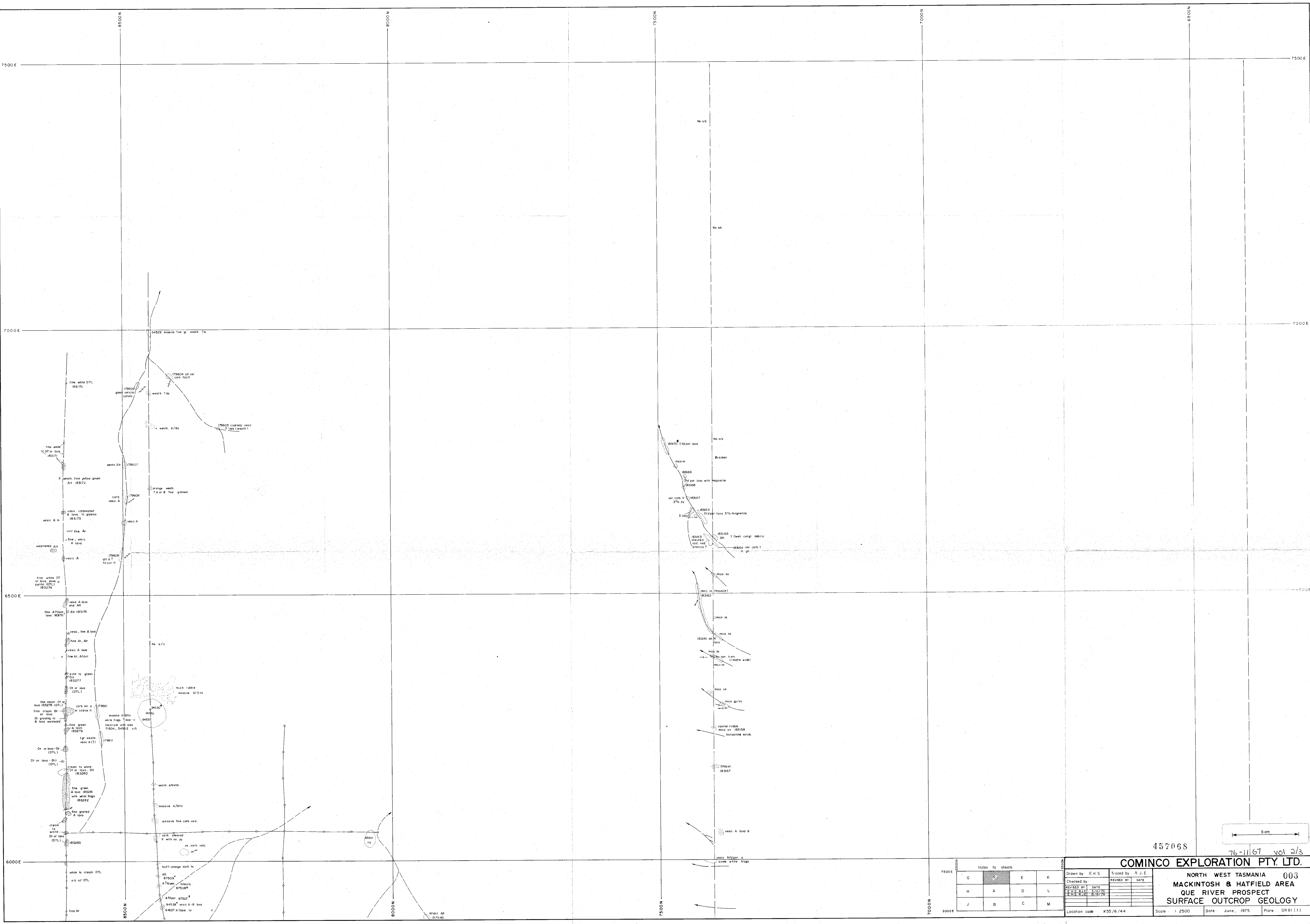
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QUE RIVER PROSPECT

SURFACE OUTCROP GEOLOGY

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1975	10/10		
1975	10/10		
Location code	K55/6/44	Scale	1:2500
Date	Oct. 1975	Plate	QR 81 (d)



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76-11/67 vol 2/3

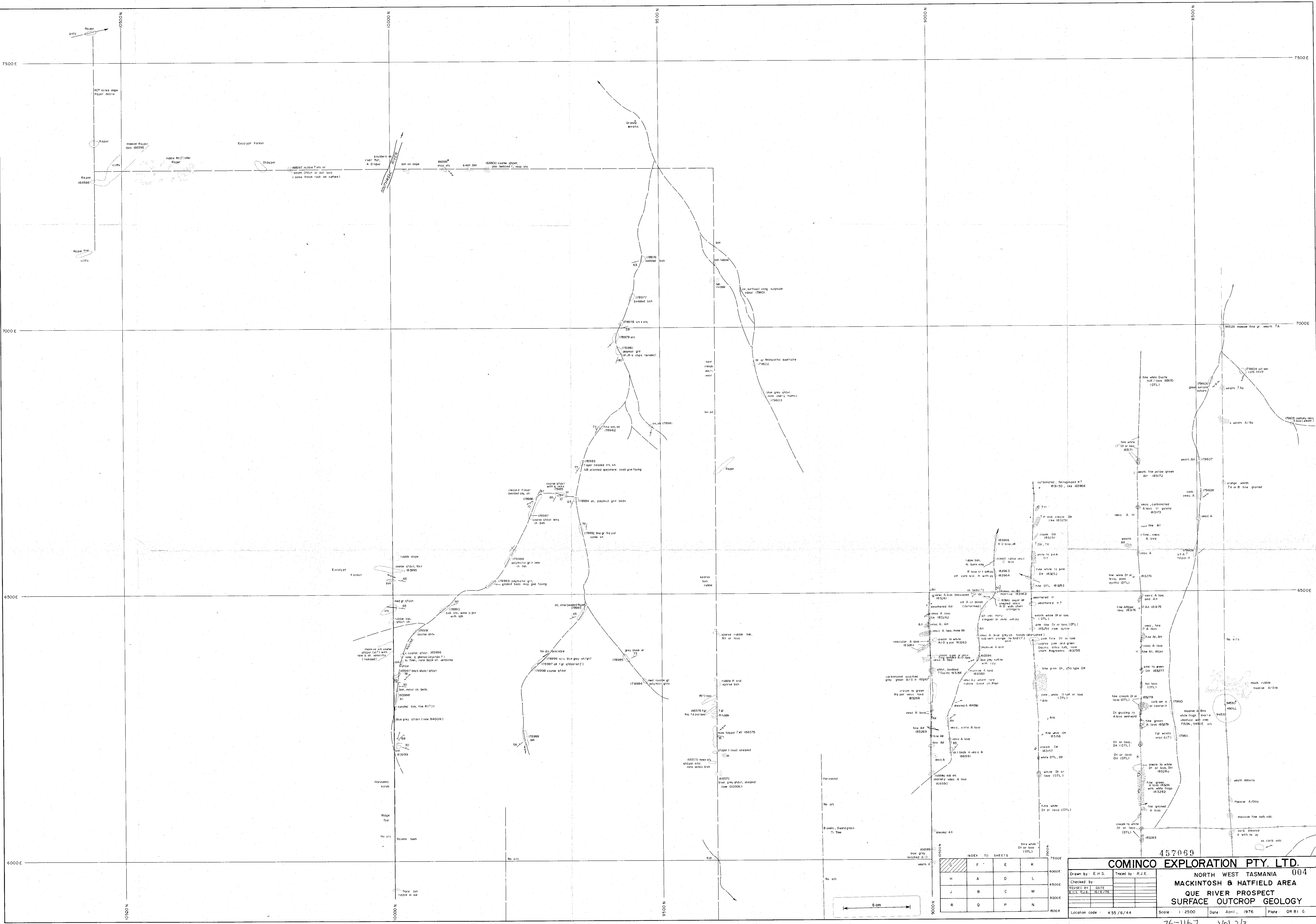
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NORTH WEST TASMANIA 003
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QUE RIVER PROSPECT
SURFACE OUTCROP GEOLOGY

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Checked by		Revised by	
Revised by	DATE	Revised by	DATE
E.H.S.	7/7/76		
R.J.E.	2/2/76		

Location code K55/6/44 Scale 1:2500 Date June, 1975 Plate QR81(1)



457069

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J	B	C	M
R	O	P	N

Scale: 1:2500

Date: April, 1976

Plate: OR 81 G

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NORTH WEST TASMANIA 004

MACKINTOSH & HATFIELD AREA

QUE RIVER PROSPECT

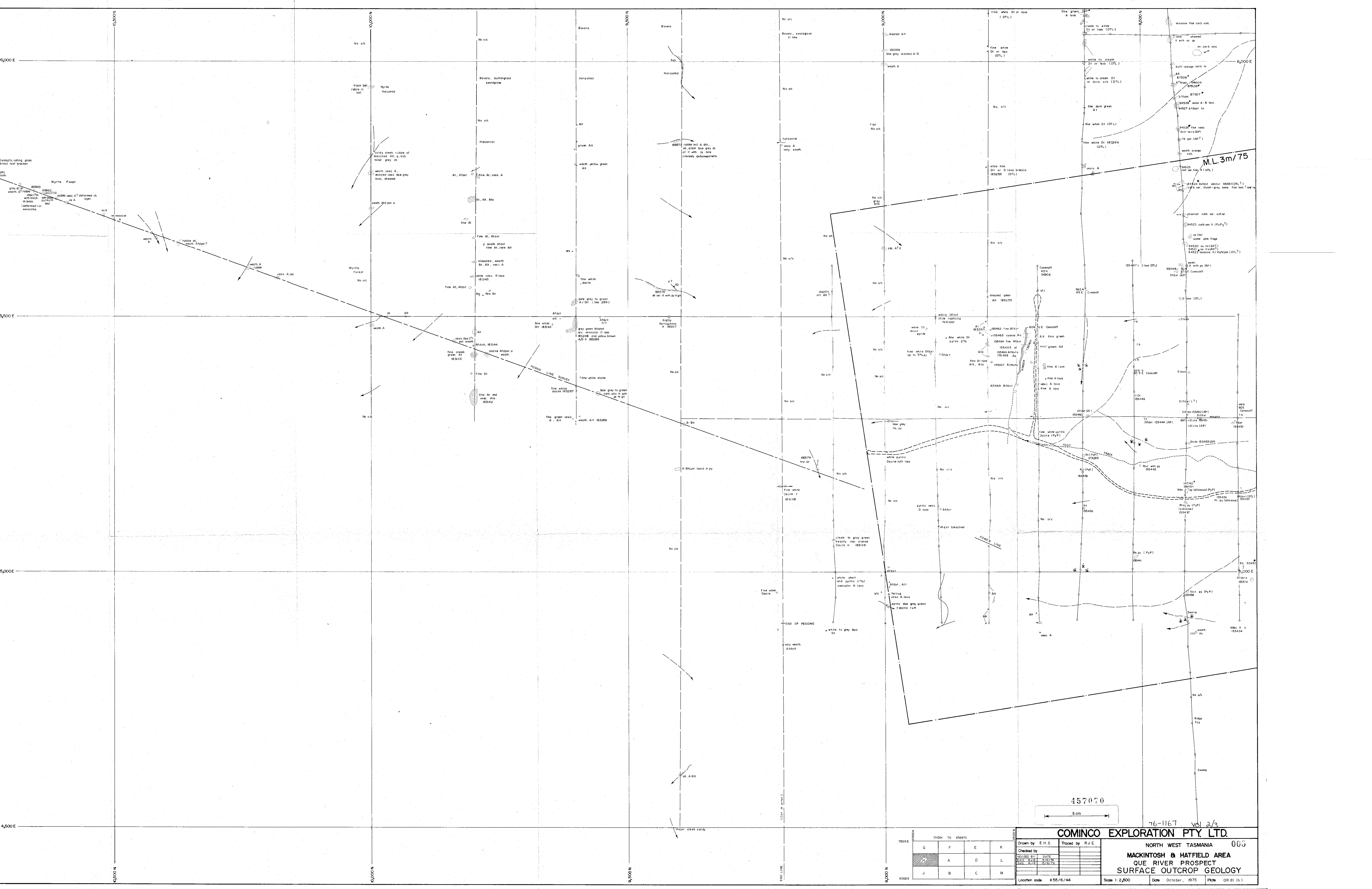
SURFACE OUTCROP GEOLOGY

Location code: K55/6/44

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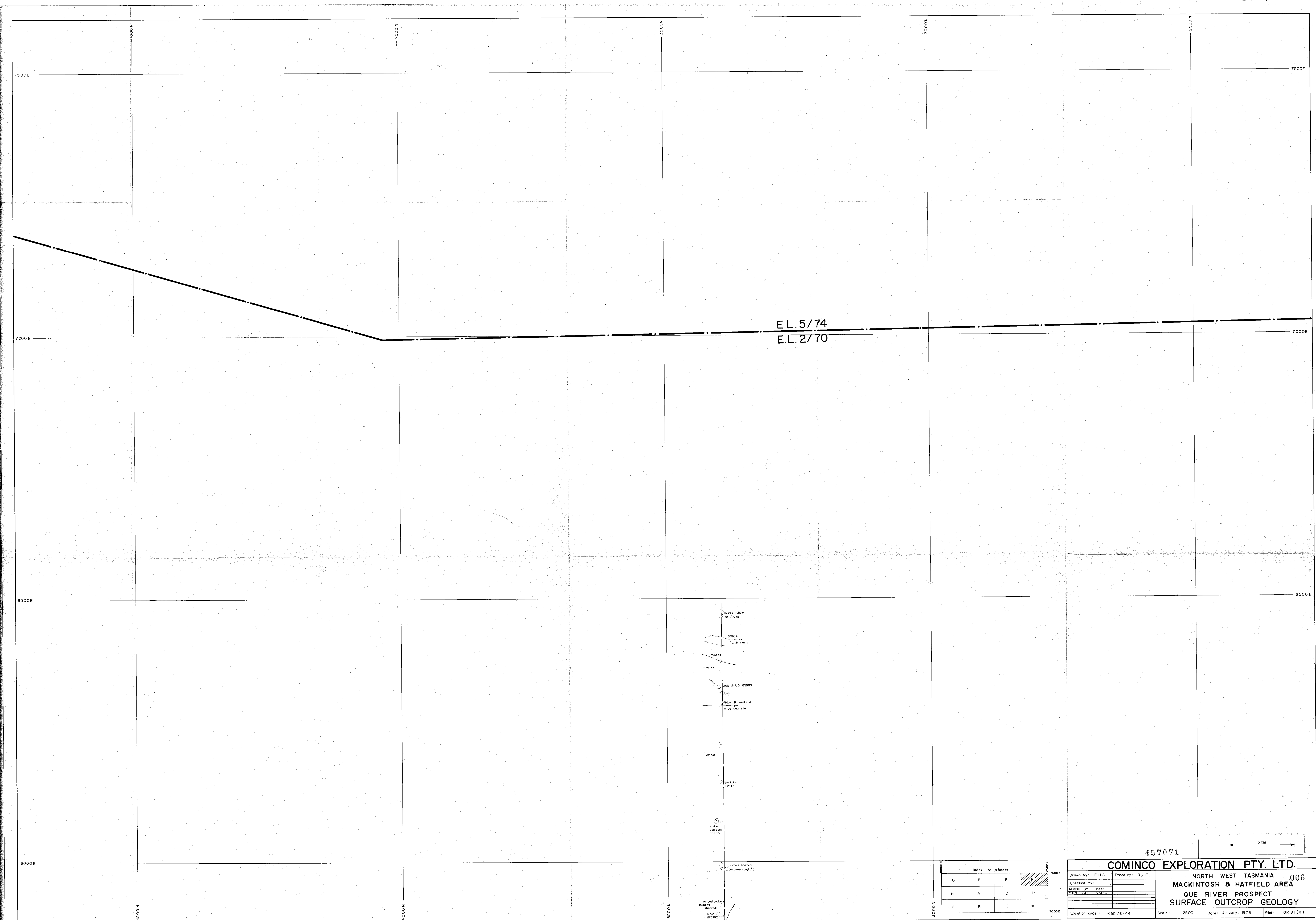
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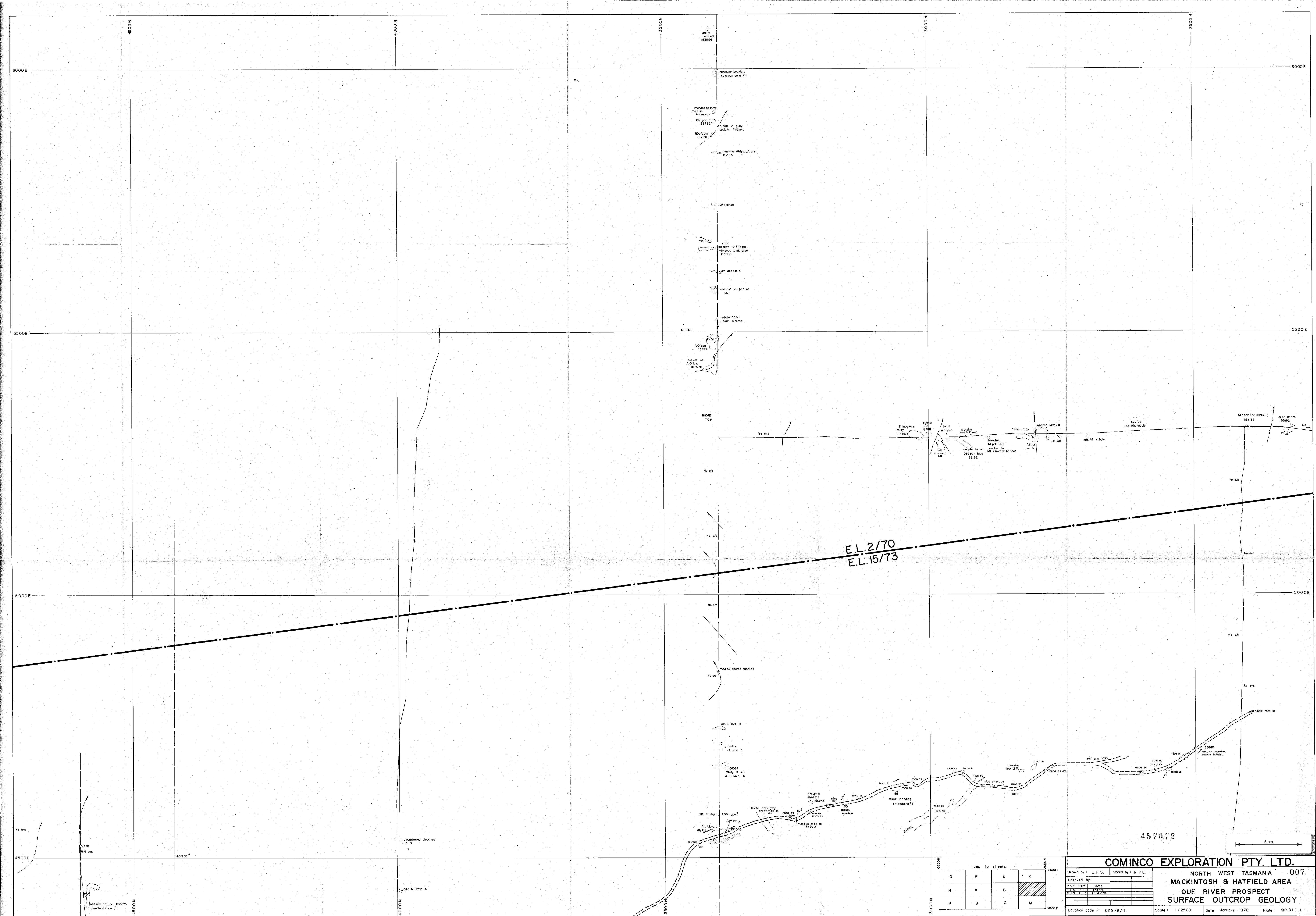


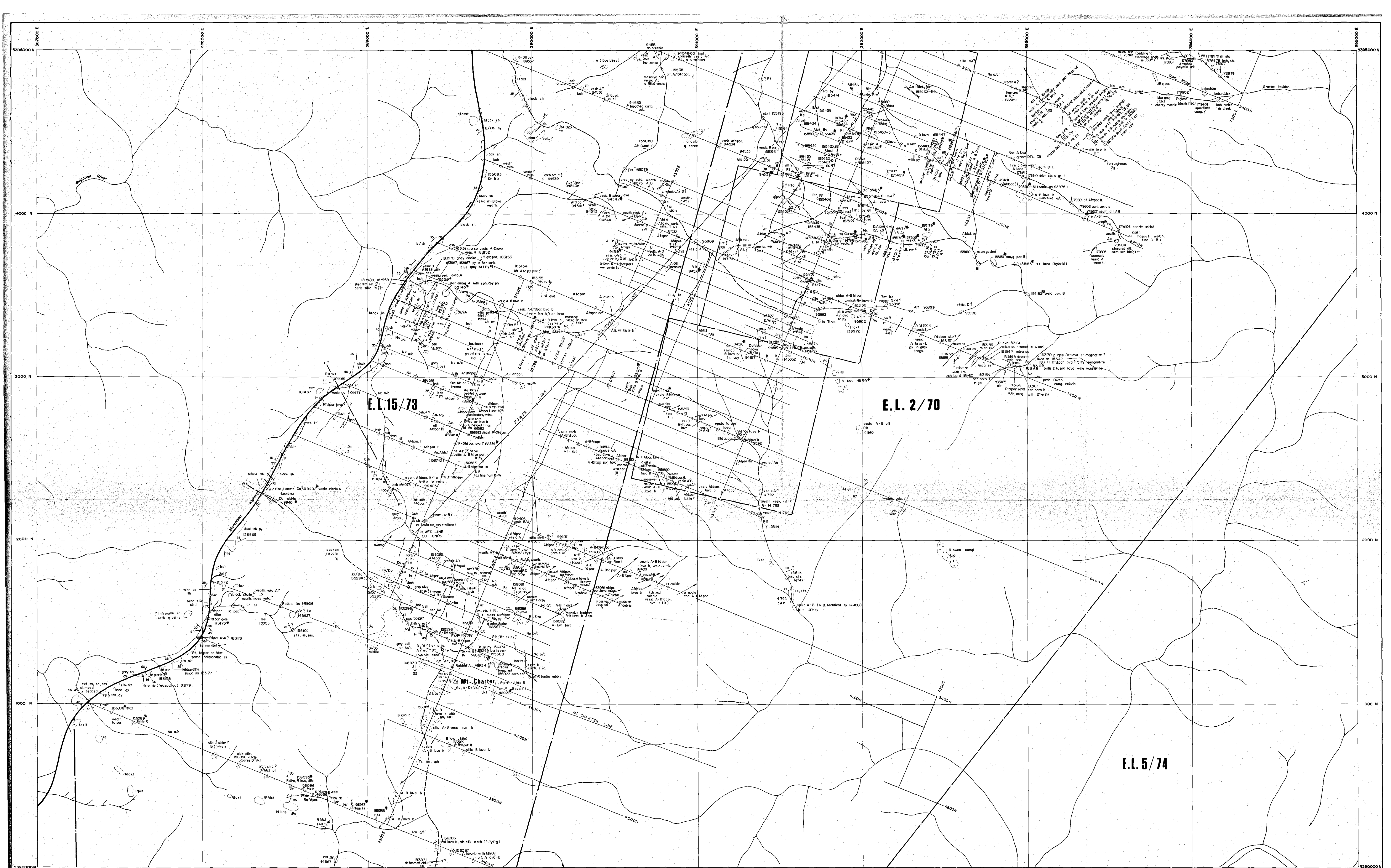
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Scale	1:2,500
Date	October, 1975
Plan	OR B1 (h)

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Revised date			

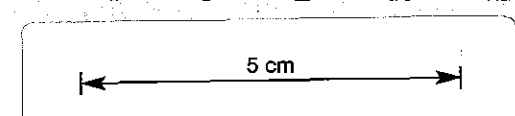
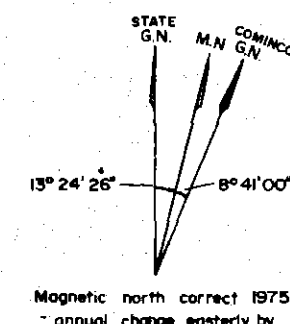






- Main road
- Secondary road
- Track
- Railway
- Abandoned railway
- Power transmission line
- Fence
- Mine
- Quarry or pit
- Trig. station
- River, creek
- Survey line
- Tenure boundary
- Bedding
- Cleavage
- Joints
- Faults

NOTE: For details of Geological Legend Refer: Drawg. No. GR84



Sheet A	Sheet B
Sheet C	Sheet D
Sheet E	Sheet F
Sheet G	Sheet H

Index to adjoining sheets

457073	
Mapping by: E.H. Skey, D.L. Ewington, I.B. Freytag, C.H. Young	
Geological Legend see Plate Q88a	
76-1167 vol 2/3	
COMINCO EXPLORATION PTY. LTD.	
NORTH WEST TASMANIA 008	
MACKINTOSH & HATFIELD AREA	
SURFACE OUTCROP GEOLOGY	
SHEET 'A'	
Drawn by: E.H.S.	Traced by: R.J.E.
Checked by:	
REVISED BY:	DATE
E.H.S. R.J.E.	10/8/75
E.H.S. R.J.E.	9/7/76
E.H.S. R.J.E.	20/2/76
E.H.S. R.J.E.	14/2/76
E.H.S. R.J.E.	11/8/76
Location code: K55/6/44	Scale: 1:10000
Date: July, 1975	Plate: DT61a

E.L.15/73

E.L.2/70

ANOMALY 1

1973/4 RECCO LINES

A.E.M. ANOMALY 4

457074

76-1167 Vol 2/3

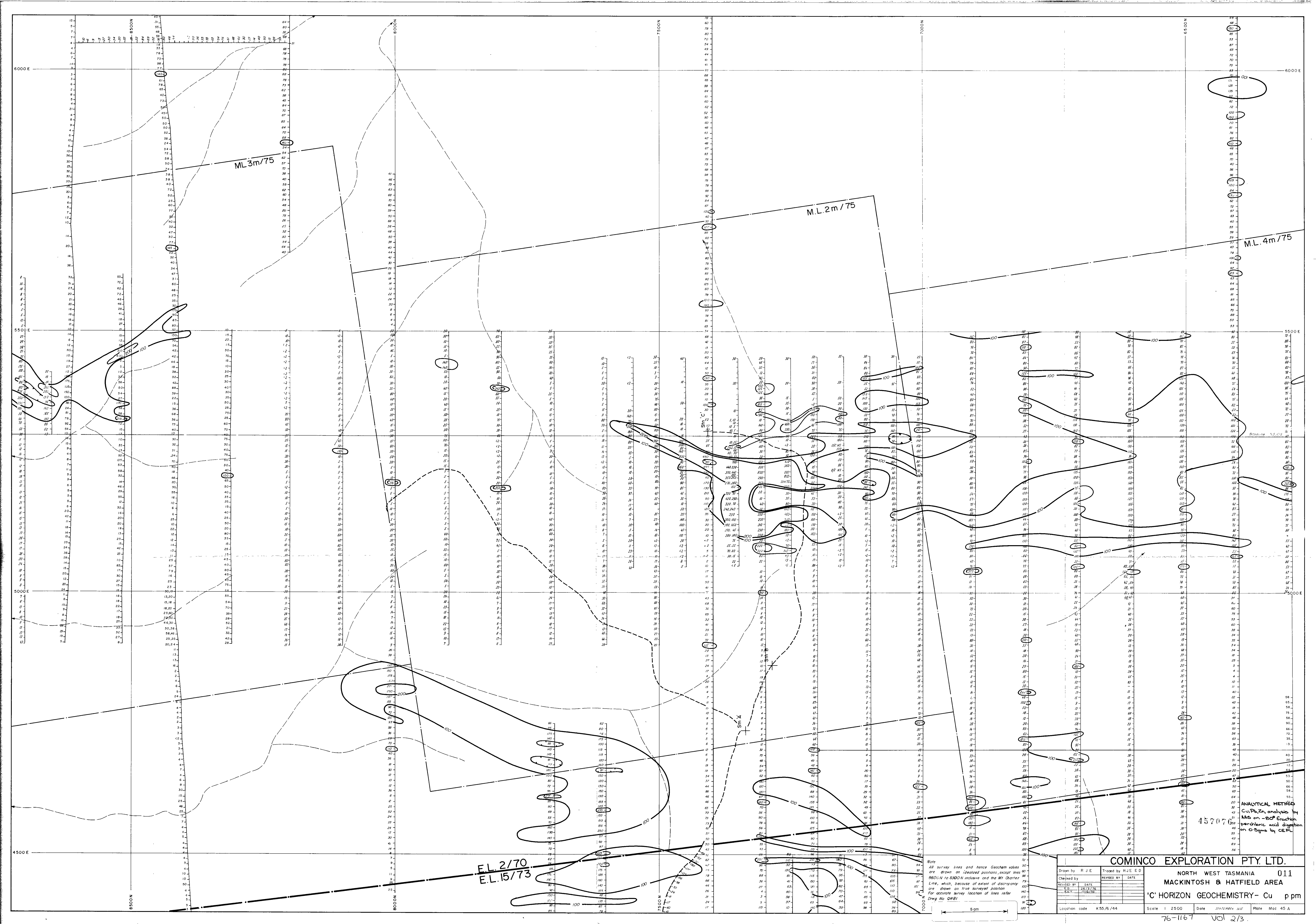
COMINCO EXPLORATION PTY. LTD.

NORTH WEST TASMANIA
MACKINTOSH & HATFIELD AREA
SURFACE OUTCROP GEOLOGY
SHEET "B"

Drawn by E.H.S.
Traced by R.J.E.
Checked by
REVISOR'S NAME
DATE
E.H.S. 17/12/75
R.J.E. 17/12/76
E.H.S. R.J.E. 26/02/76
E.H.S. R.J.E. 04/07/76
E.H.S. R.J.E. 11/07/76
Location code K55/6/44
Scale 1:10,000
Date January, 1976
Plate DT 61 b

Sheet C	Sheet G
Sheet B	Sheet F
Sheet A	Sheet J

Index to adjoining sheets



ANALYTICAL METHOD
Cu, Pb, Zn analysis by
AAS on -200 fraction
perchloric acid digestion
on 0.5gms by CEPL

45707

COMINCO EXPLORATION PTY. LTD.

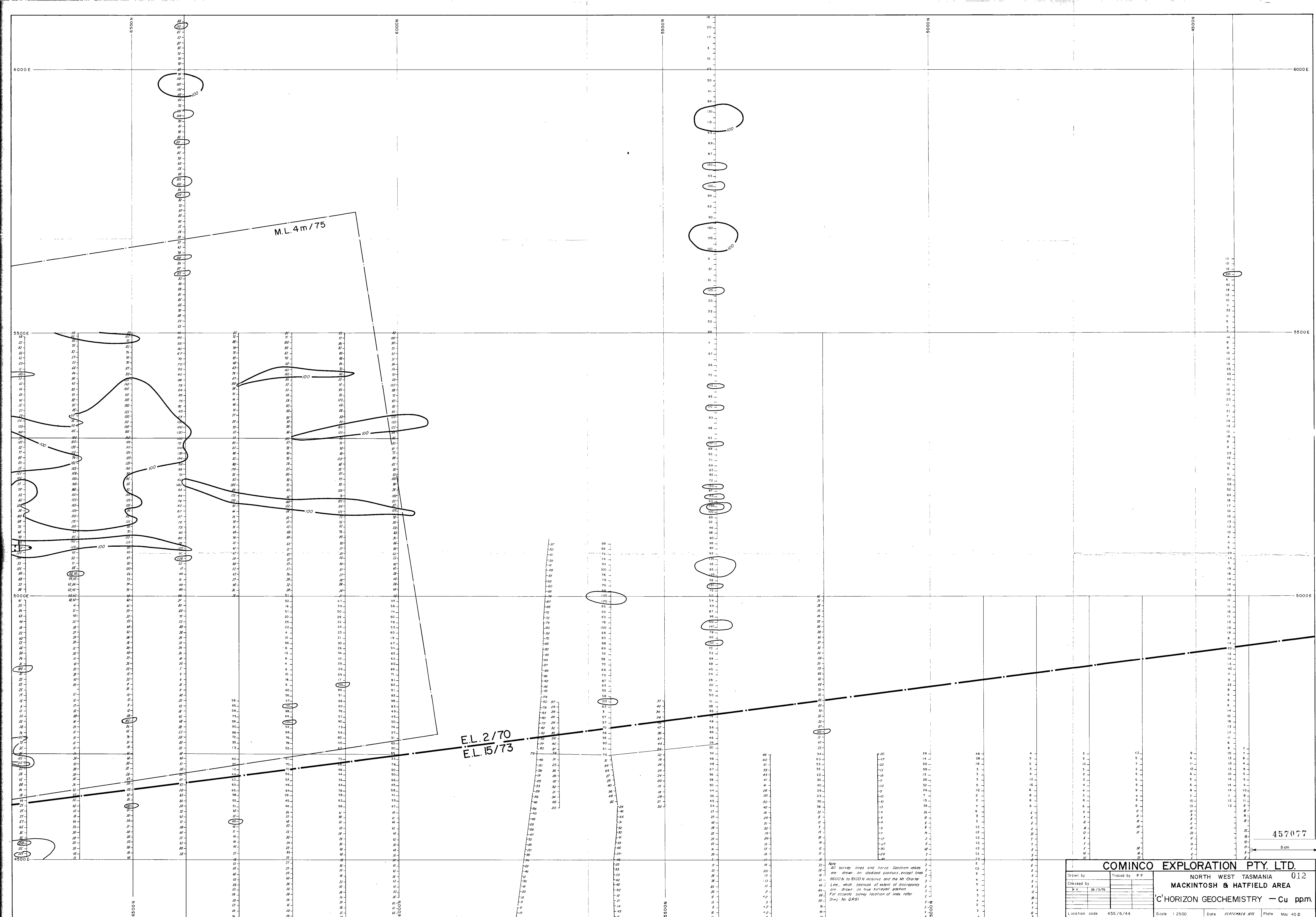
NORTH WEST TASMANIA 011

MACKINTOSH & HATFIELD AREA

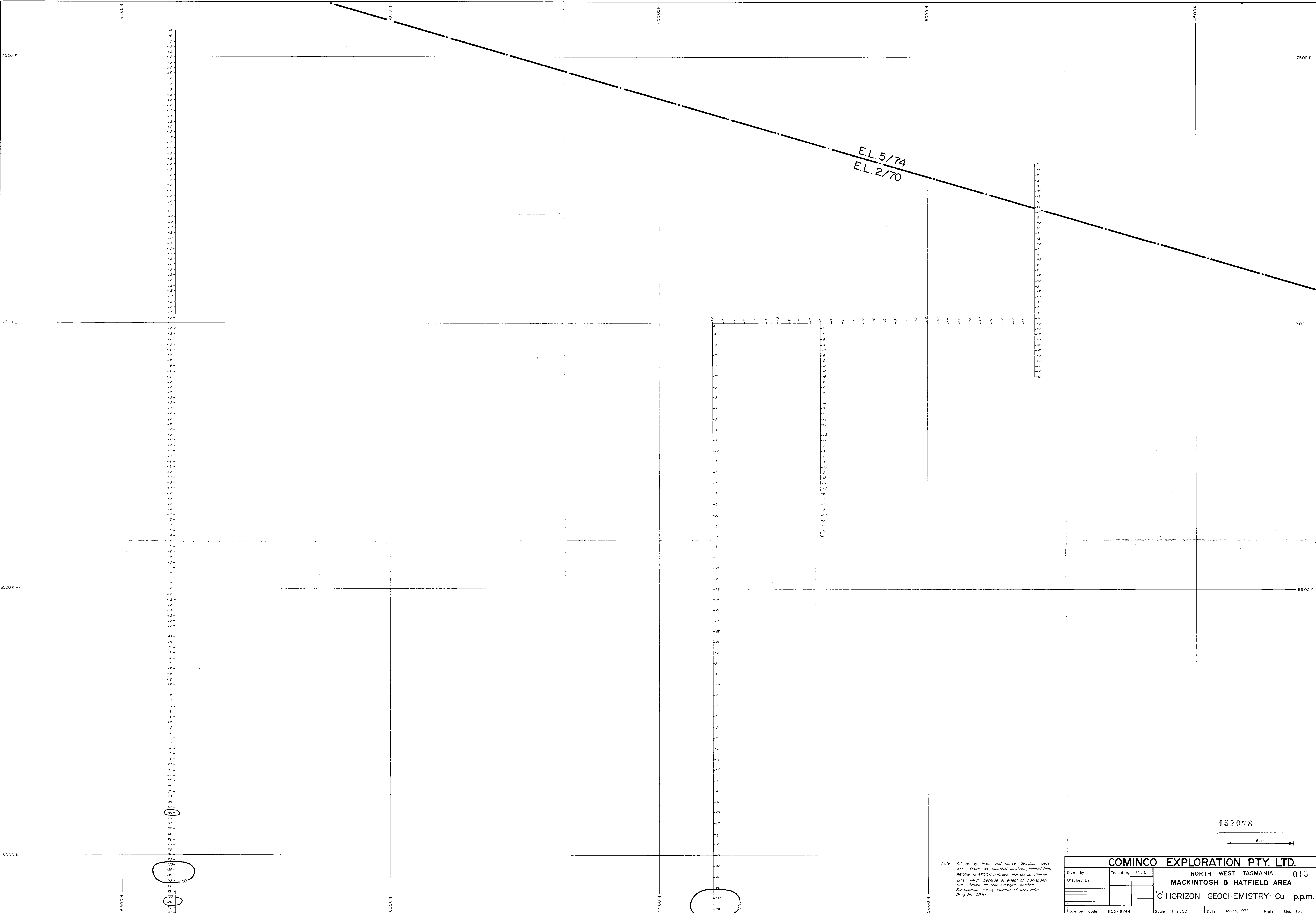
'C' HORIZON GEOCHEMISTRY - Cu ppm

Drawn by	R J E	Traced by	R J E
Checked by		Revised by	
Revised by		Revised by	
Revised by		Revised by	
Revised by		Revised by	
Revised by		Revised by	
Revised by		Revised by	
Revised by		Revised by	
Revised by		Revised by	
Revised by		Revised by	

Scale 1:2500 Date 21/11/84 Plot Mac 45 A



COMINCO EXPLORATION PTY. LTD.	
NORTH WEST TASMANIA 012	
MACKINTOSH & HATFIELD AREA	
C'HORIZON GEOCHEMISTRY - Cu ppm.	
Location code	K55/6/44
Scale	1:2500
Date	SEPTEMBER 1975
Plate	Mac 45 D

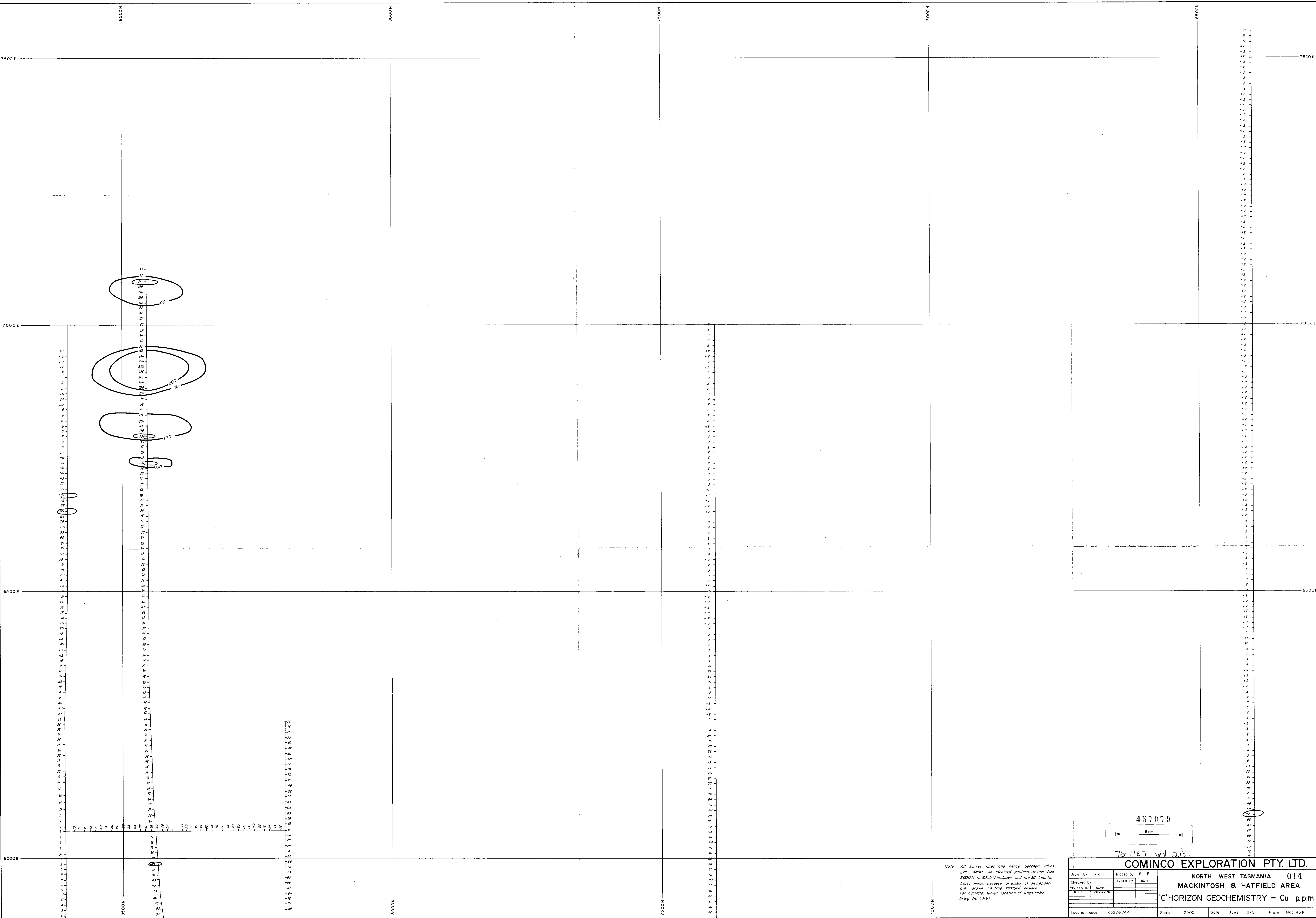


457078

5 cm

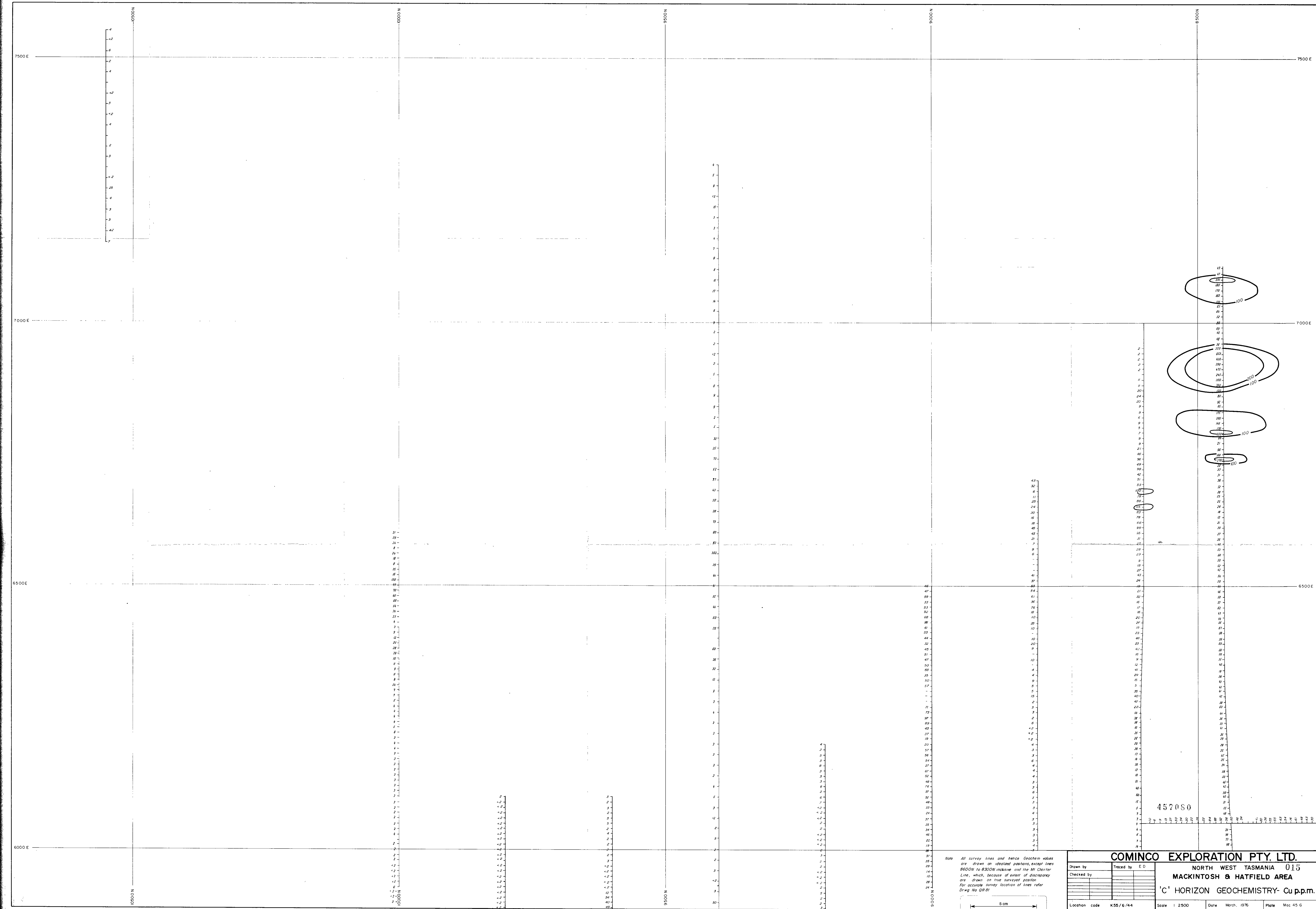
Note: All survey lines and hence Geochem values are drawn on idealized positions, except lines 8600N to 8300N inclusive and the Mt Charter Line, which, because of extent of discrepancy are drawn on true surveyed position. For accurate survey location of lines refer Drawg No. 0081.

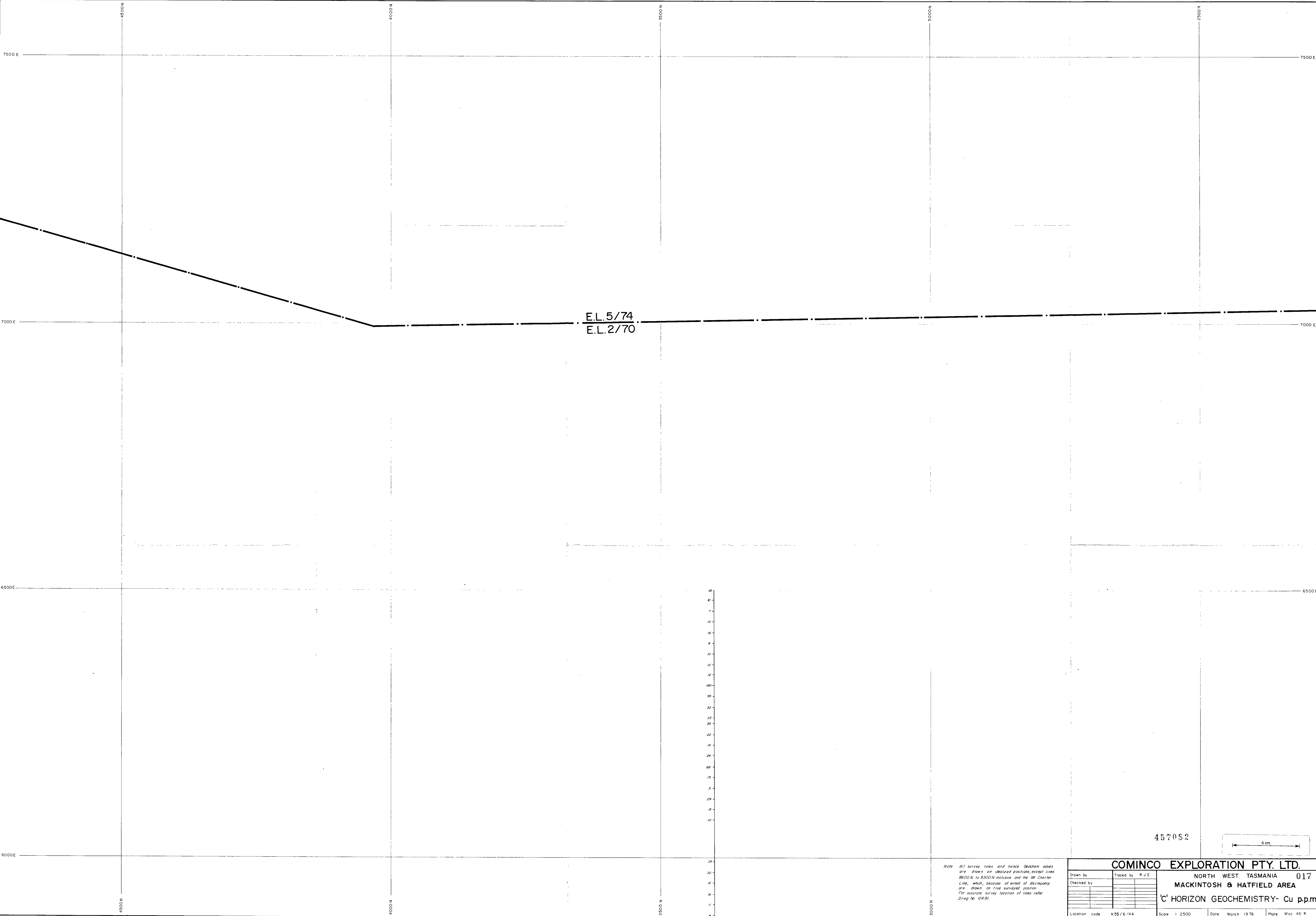
COMINCO EXPLORATION PTY. LTD.			
Drawn by		Traced by RJE	
Checked by			
Location code K55/6/44		Scale 1:2500	Date March, 1976
		Plate Mac 45E	



Note: All survey lines and hence Geochem values are drawn on idealized positions, except lines 8000N to 8300N, incline and the Mt Charter Line, which, because of extent of discrepancy are drawn on true surveyed position. For accurate survey location of lines refer Drawg No ORB1.

COMINCO EXPLORATION PTY. LTD.			
NORTH WEST TASMANIA 014			
MACKINTOSH & HATFIELD AREA			
C'HORIZON GEOCHEMISTRY - Cu p.p.m.			
Drawn by	R J E	Traced by	R J E
Checked by		Revised by	
Revised by	DATE	Revised by	DATE
5-2-8	28/7/76		
Location code	K95/6/44	Scale	1:2500
Date	June, 1975	Plate	Mac 45 F





E.L. 5/74
E.L. 2/70

457082

Note: All survey lines and hence Geochem values are drawn on idealized positions, except lines 8500N to 8300N inclusive and the Mt Charter Line, which, because of extent of discrepancy are drawn on true surveyed position. For accurate survey location of lines refer Draw No. GR-61

COMINCO EXPLORATION PTY. LTD.	
NORTH WEST TASMANIA 017	
MACKINTOSH & HATFIELD AREA	
'C' HORIZON GEOCHEMISTRY- Cu p.p.m.	
Drawn by	Traced by R J E
Checked by	
Location code	K55/E/44
Scale	1:2500
Date	March 1976
Plate	Mac 45 K

76-1167 Vol 2/3

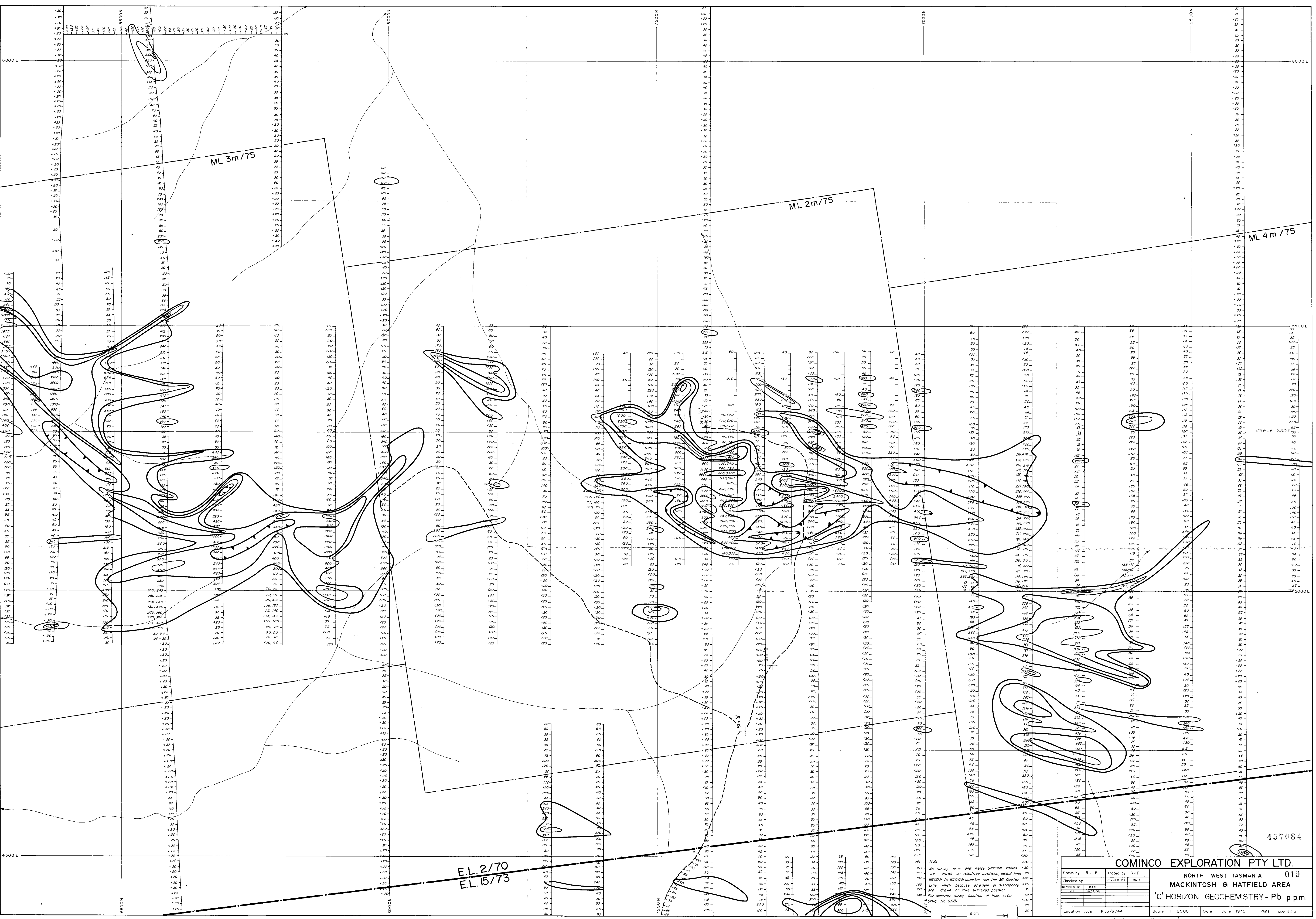


E.L. 2/70
E.L. 15/73

457083

Note: All survey lines and hence Geochem values are drawn on idealized positions, except lines 8600N to 8300N inclusive and the Mt Charter Line, which, because of extent of discrepancy are drawn on true surveyed position. For accurate survey location of lines refer Drawg No. GRB1

COMINCO EXPLORATION PTY. LTD.			
NORTH WEST TASMANIA			
MACKINTOSH & HATFIELD AREA 018			
C'HORIZON GEOCHEMISTRY- Cu p.p.m.			
Drawn by	Traced by R.J.E., E.D.		
Checked by			
Location code K55/6/44		Scale 1:2500	Date March, 1976
76-1167		vol 2/3	Plate Mac 45 L



E.L. 2/70
E.L. 15/73

COMINCO EXPLORATION PTY. LTD.

NORTH WEST TASMANIA 019

HACKINTOSH & HATFIELD AREA

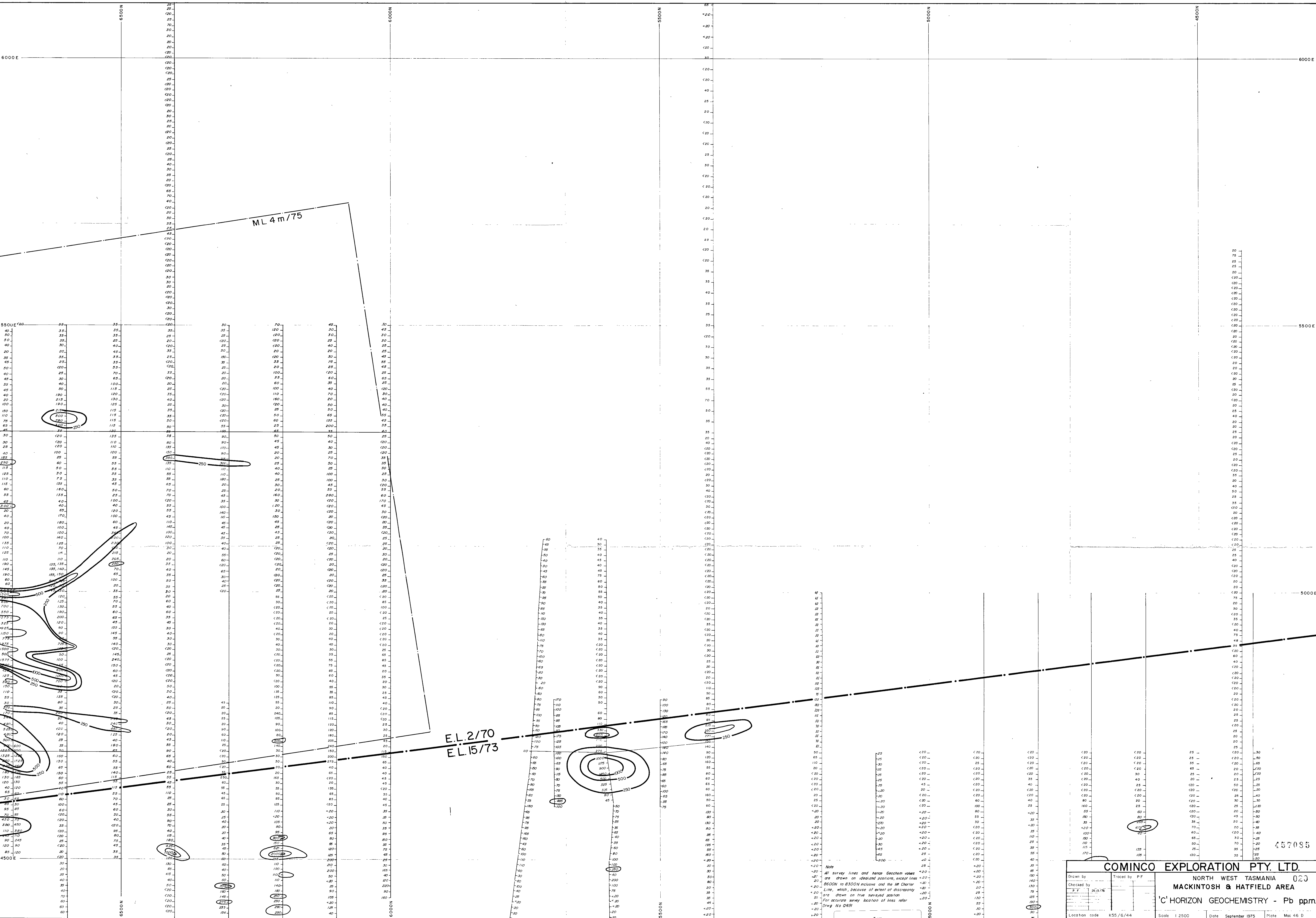
'c' HORIZON GEOCHEMISTRY - Pb p.p.m.

Drawn by	R J E	Traced by	R J E
Checked by		Revised by	
Revised by		Revised by	
Revised by		Revised by	
Revised by		Revised by	

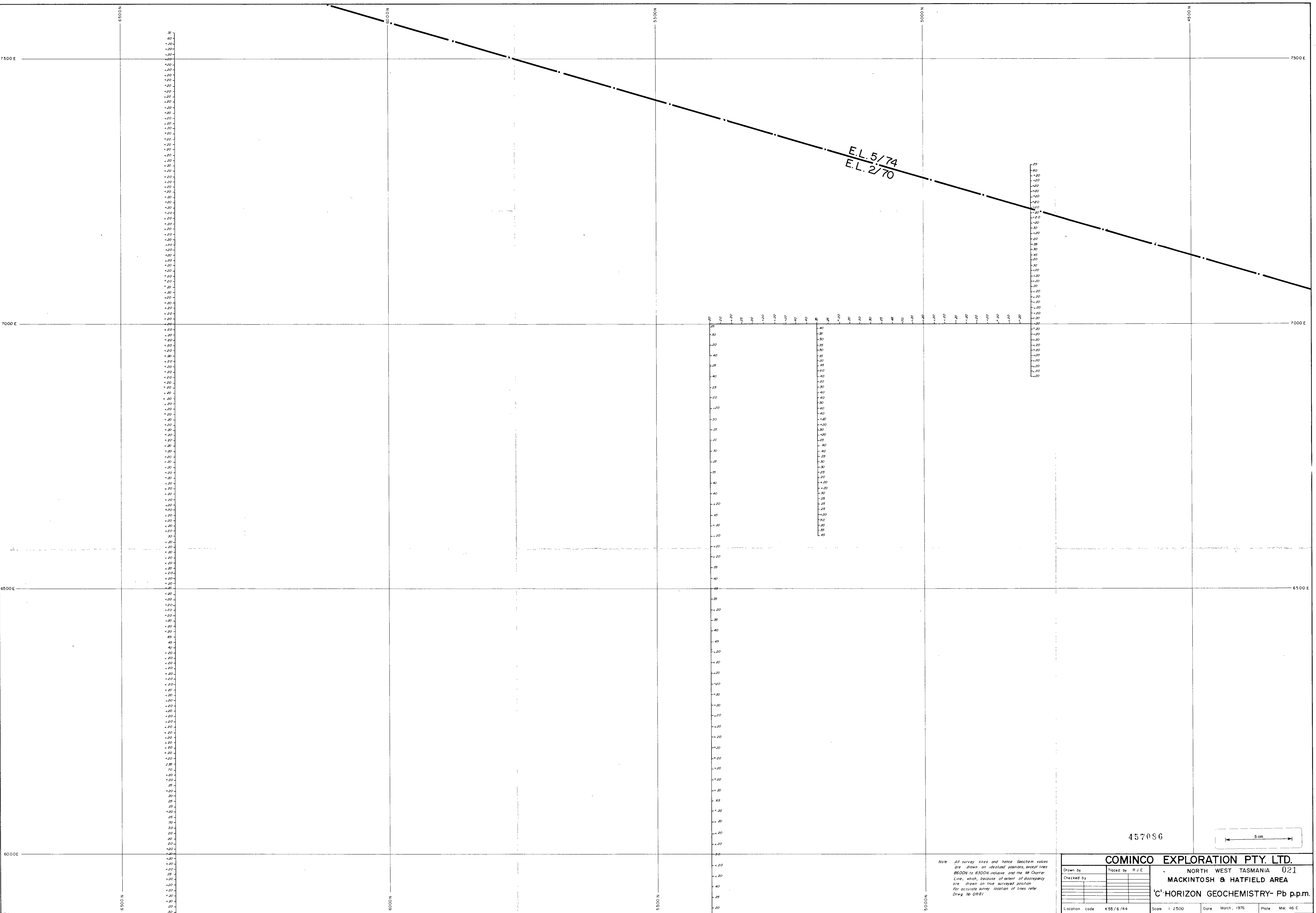
Location code K 55/6/44

Scale 1:2500 Date June, 1975 Plate Mac 46 A

76-1167 VOL 2/3



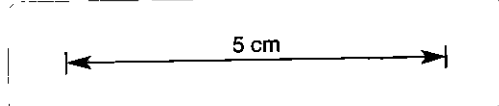
COMINCO EXPLORATION PTY. LTD.	
NORTH WEST TASMANIA 020	
MACKINTOSH & HATFIELD AREA	
'C' HORIZON GEOCHEMISTRY - Pb ppm.	
Drawn by	Traced by P.F.
Checked by	
P.F.	26/8/76
Location code	K55/6/44
Scale	1:2500
Date	September 1975
Plate	Mac 46 D

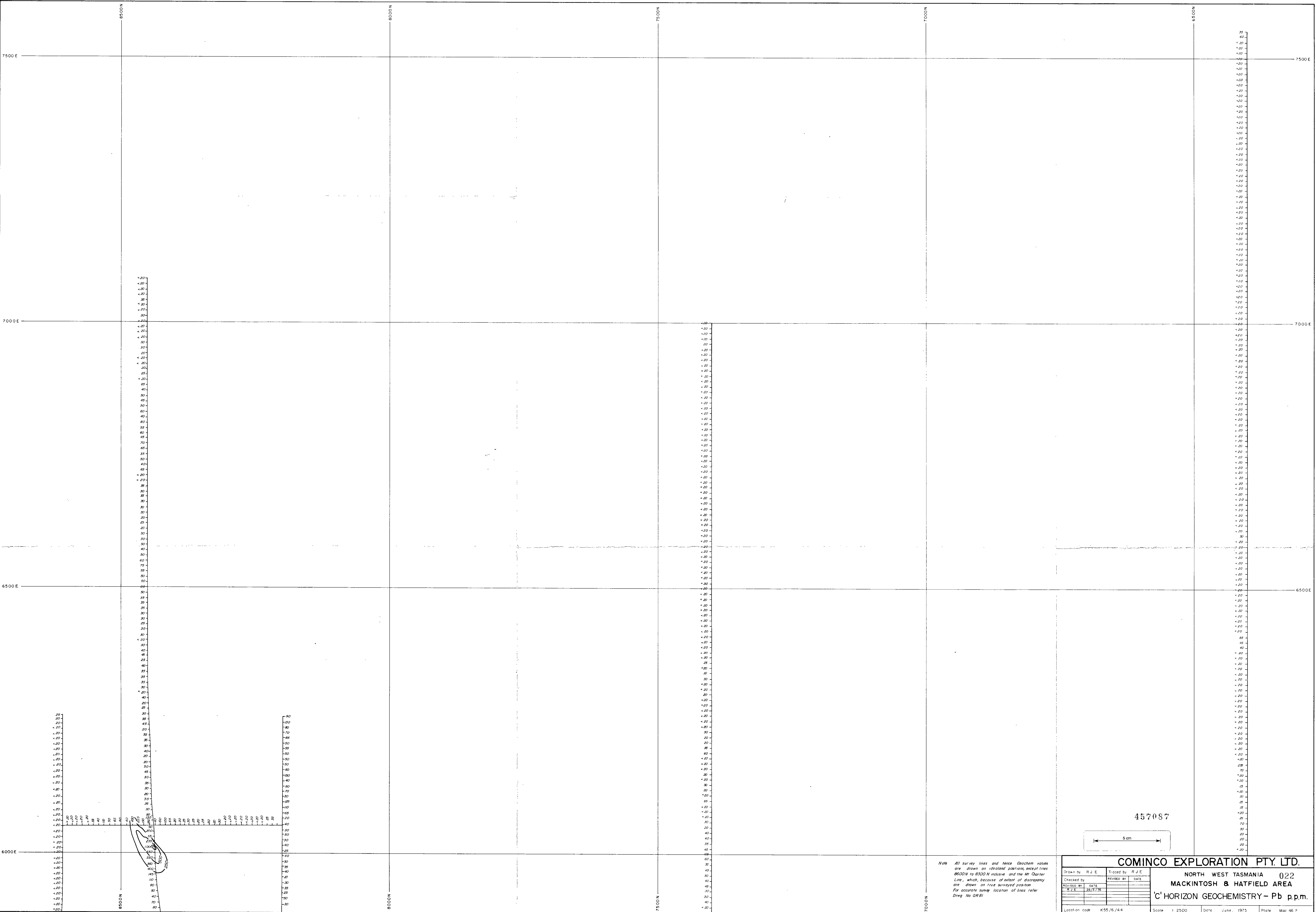


Note: All survey lines and hence Geochem values are drawn on idealized positions, except lines 8600N to 8300N inclusive and the M Charter Line, which, because of a latent discrepancy are drawn on true surveyed position. For accurate survey location of lines refer Drawg No ORB1.

COMINCO EXPLORATION PTY. LTD.			
Drawn by		Traced by R J E	
Checked by			
Location code K55/6/44		Scale 1:2500	Date March, 1976
		Plate	Max 46 E

457086

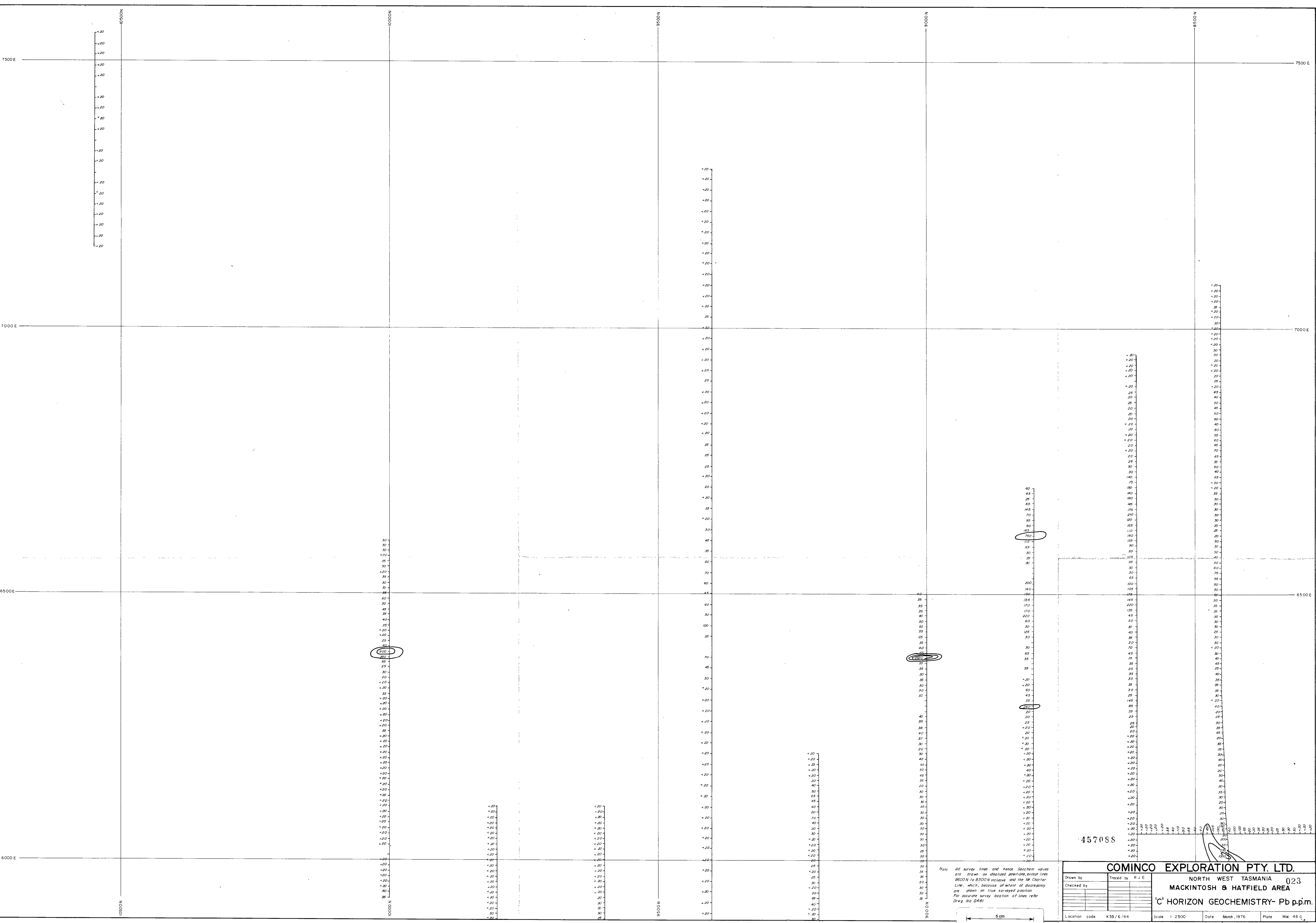




Note All survey lines and hence Geochem values are drawn on idealized portions, except lines 8600N to 8300N inclusive and the Mt Charter Line, which, because of extent of discrepancy are drawn on true surveyed position. For accurate survey location of lines refer Drawg No ORR/

457087
5 cm

COMINCO EXPLORATION PTY. LTD.			
NORTH WEST TASMANIA 022			
MACKINTOSH & HATFIELD AREA			
'C' HORIZON GEOCHEMISTRY - Pb p.p.m.			
Drawn by	R J E	Traced by	R J E
Checked by		Revised by	
Revised by		Date	
R J E	26/07/96		
Location code	K55/6/44	Scale	1:2500
		Date	June, 1975
		Plate	Mac 46 F

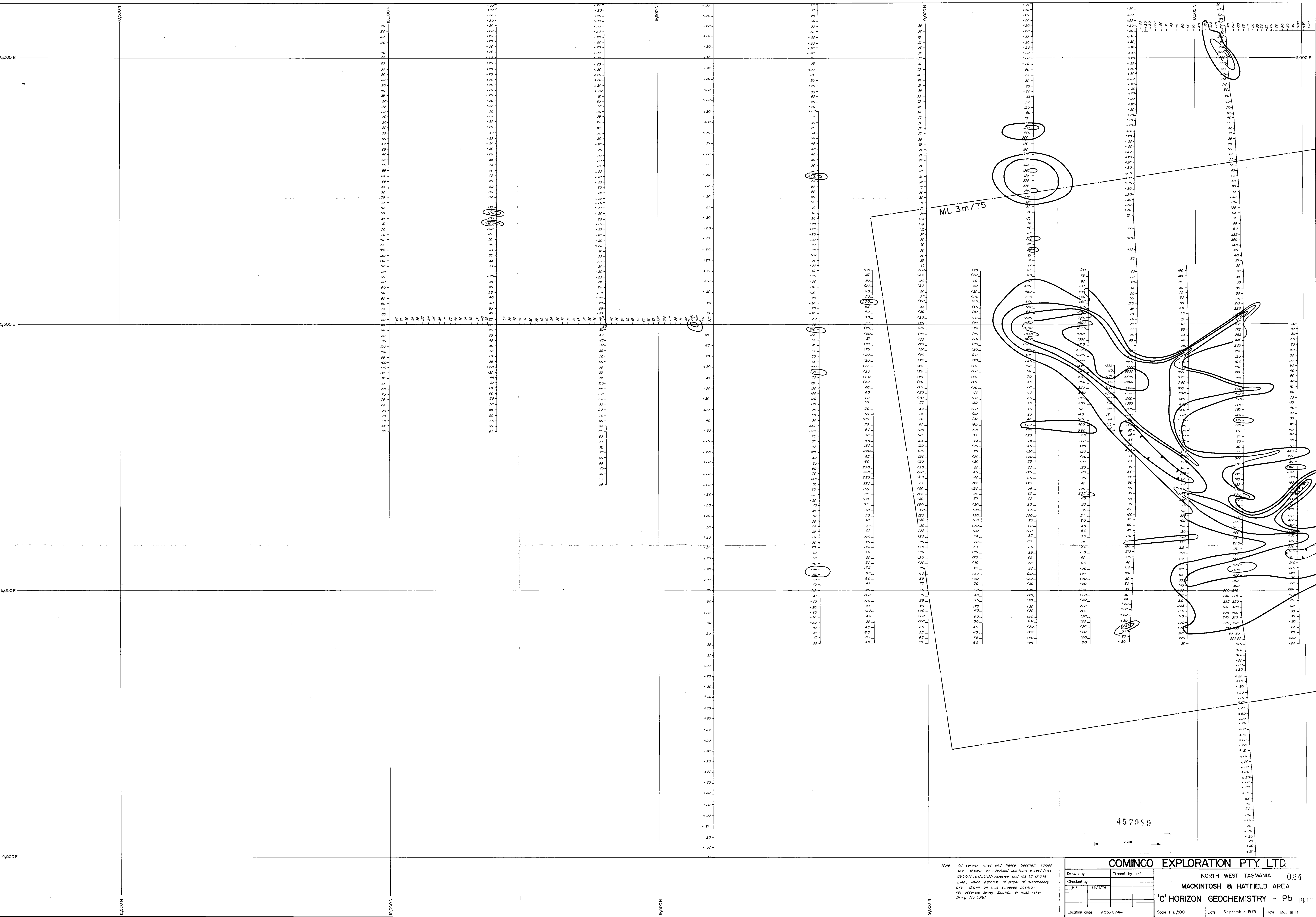


457088

COMINCO EXPLORATION PTY. LTD.
NORTH WEST TASMANIA 023
MACKINTOSH & HATFIELD AREA
C' HORIZON GEOCHEMISTRY- Pb p.p.m.

Location code K55/E/44 Scale 1:2500 Date March, 1976 Plate Max 46 G

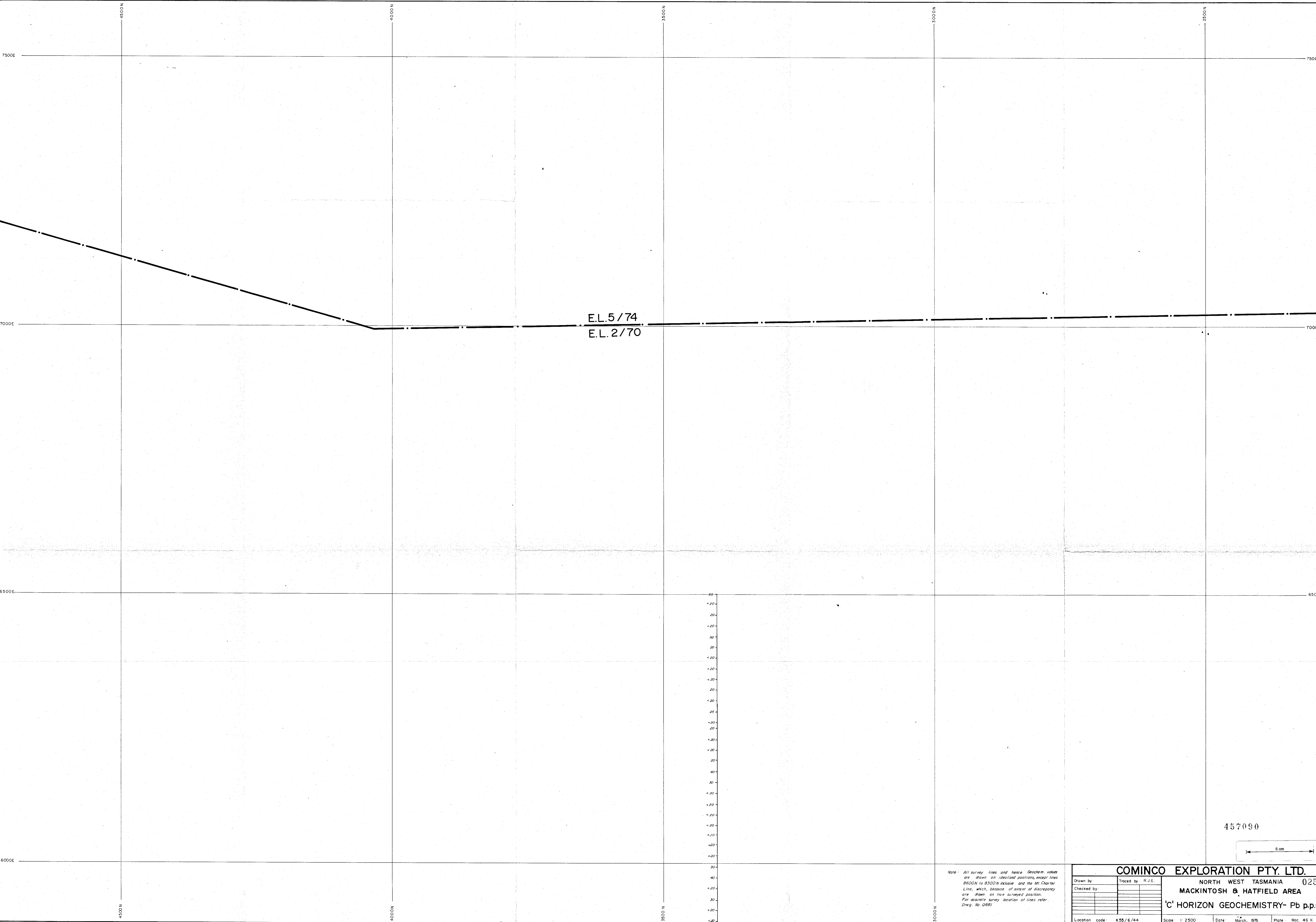
76-1167 vol 2/3



Note: All survey lines and hence Geochem values are drawn on idealized positions, except lines BE00N to B300N inclusive and the Mt Charter Line, which, because of extent of discrepancy are drawn on true surveyed position. For accurate survey location of lines refer Draw No DB81

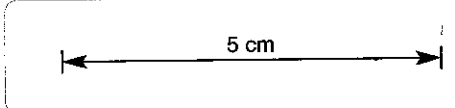
COMINCO EXPLORATION PTY. LTD.	
NORTH WEST TASMANIA 024	
MACKINTOSH & HATFIELD AREA	
'C' HORIZON GEOCHEMISTRY - Pb ppm	
Drawn by	Traced by P.F.
Checked by	
P.F.	26/3/75
Location code	K55/6/44
Scale	1:2,500
Date	September 1975
Plate	Mac 46 H

76-1167 vol 2/3



E.L. 5/74
E.L. 2/70

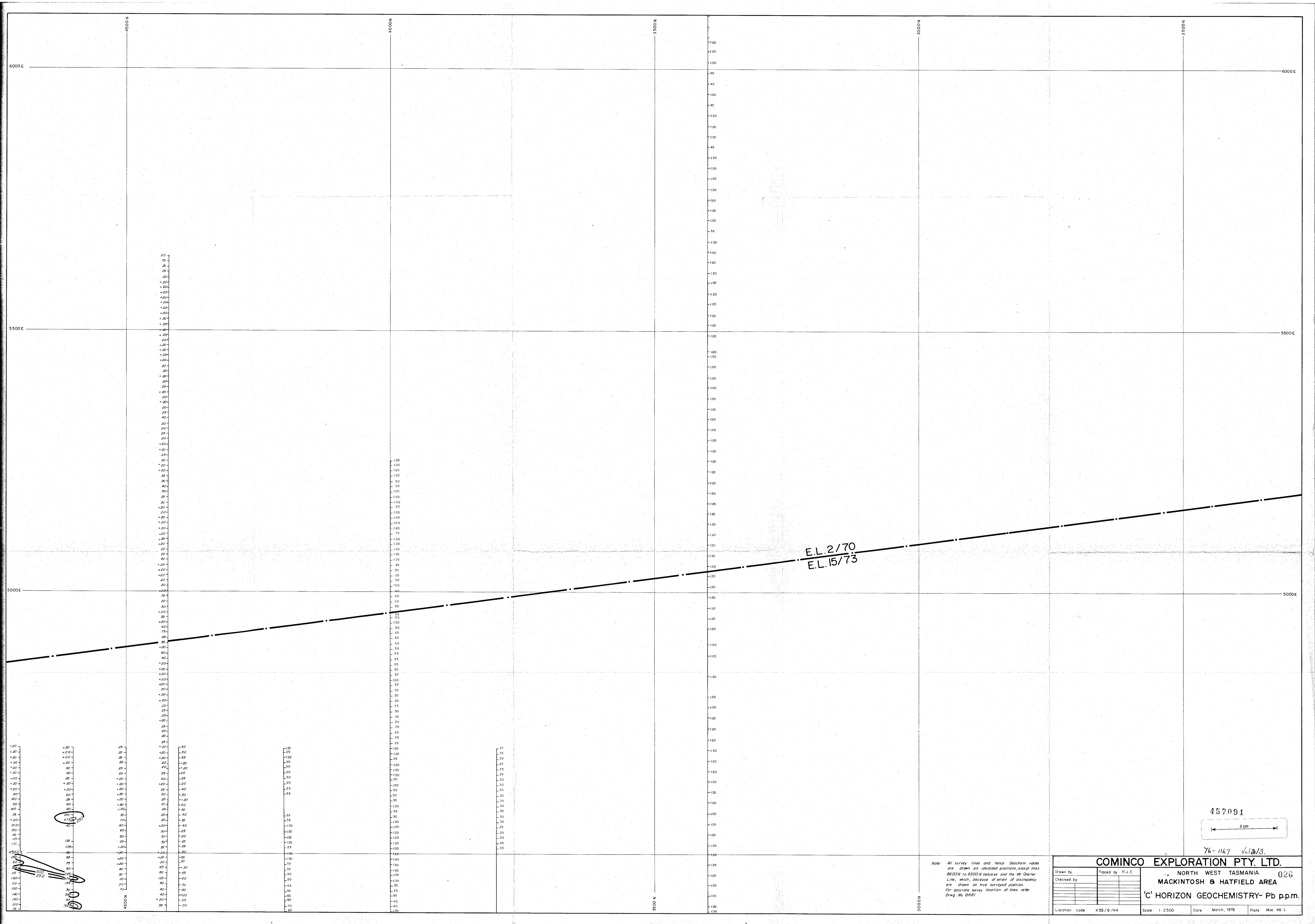
457090



Note: All survey lines and hence Graham values are drawn on idealized positions, except lines 8600N to 8300N inclusive and the Mt. Charter Line, which, because of extent of discrepancy are drawn on true surveyed position. For accurate survey location of lines refer Dwg. No. QRB1

COMINCO EXPLORATION PTY. LTD.			
Drawn by		Traced by R.J.E.	
Checked by			
Location code: K55/6/44		Scale: 1:2500	Date: March, 1976
		Plate: Mac 46 K	

NORTH WEST TASMANIA 025
MACKINTOSH & HATFIELD AREA
'C' HORIZON GEOCHEMISTRY- Pb p.p.m.



Note: All survey lines and hence Geochem values are drawn on idealized positions, except lines 8600N to 8300N inclusive and the 86 Quarter Line, which, because of extent of discrepancy are drawn on true surveyed position. For accurate survey location of lines refer. Draw. No. Q981

COMINCO EXPLORATION PTY. LTD.	
NORTH WEST TASMANIA 026	
MACKINTOSH & HATFIELD AREA	
'C' HORIZON GEOCHEMISTRY- Pb p.p.m.	
Drawn by	Traced by R.J.E.
Checked by	
Location code	K55/6/44
Scale	1:2500
Date	March, 1976
Plate	Mac 46 L

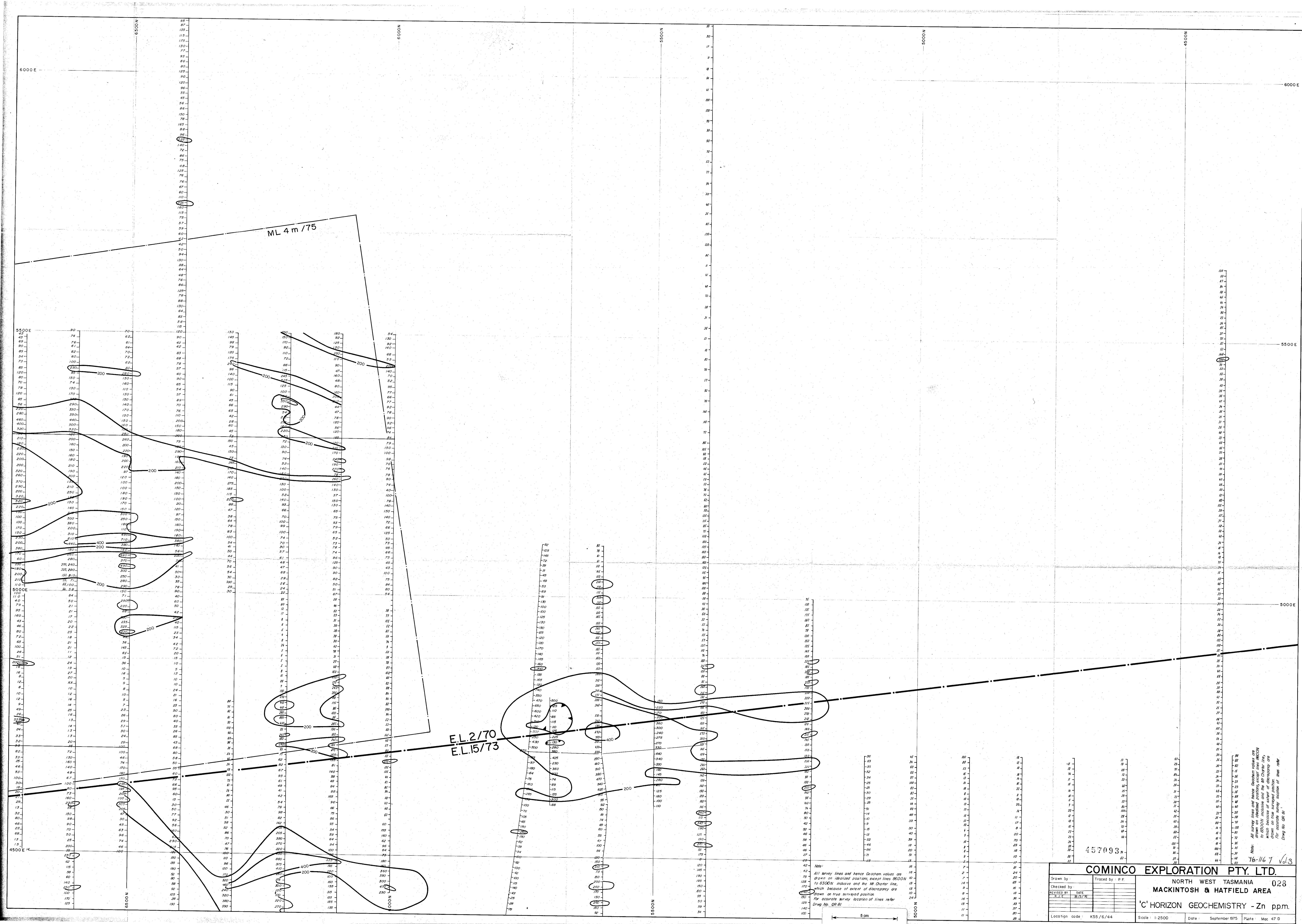


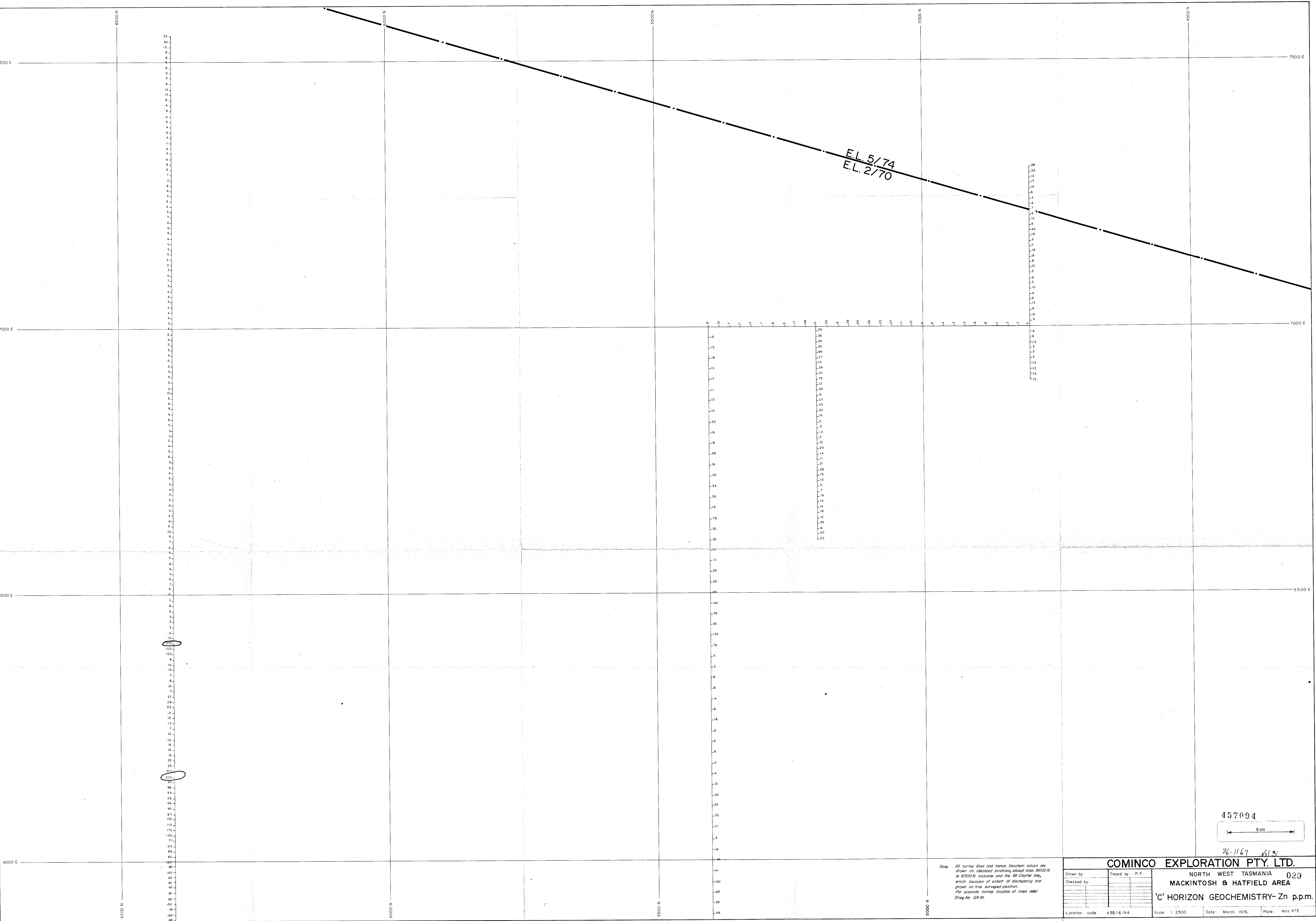
457092
76-1167/613

COMINCO EXPLORATION PTY. LTD.
NORTH WEST TASMANIA 027
MACKINTOSH & HATFIELD AREA
'C' HORIZON GEOCHEMISTRY - Zn ppm

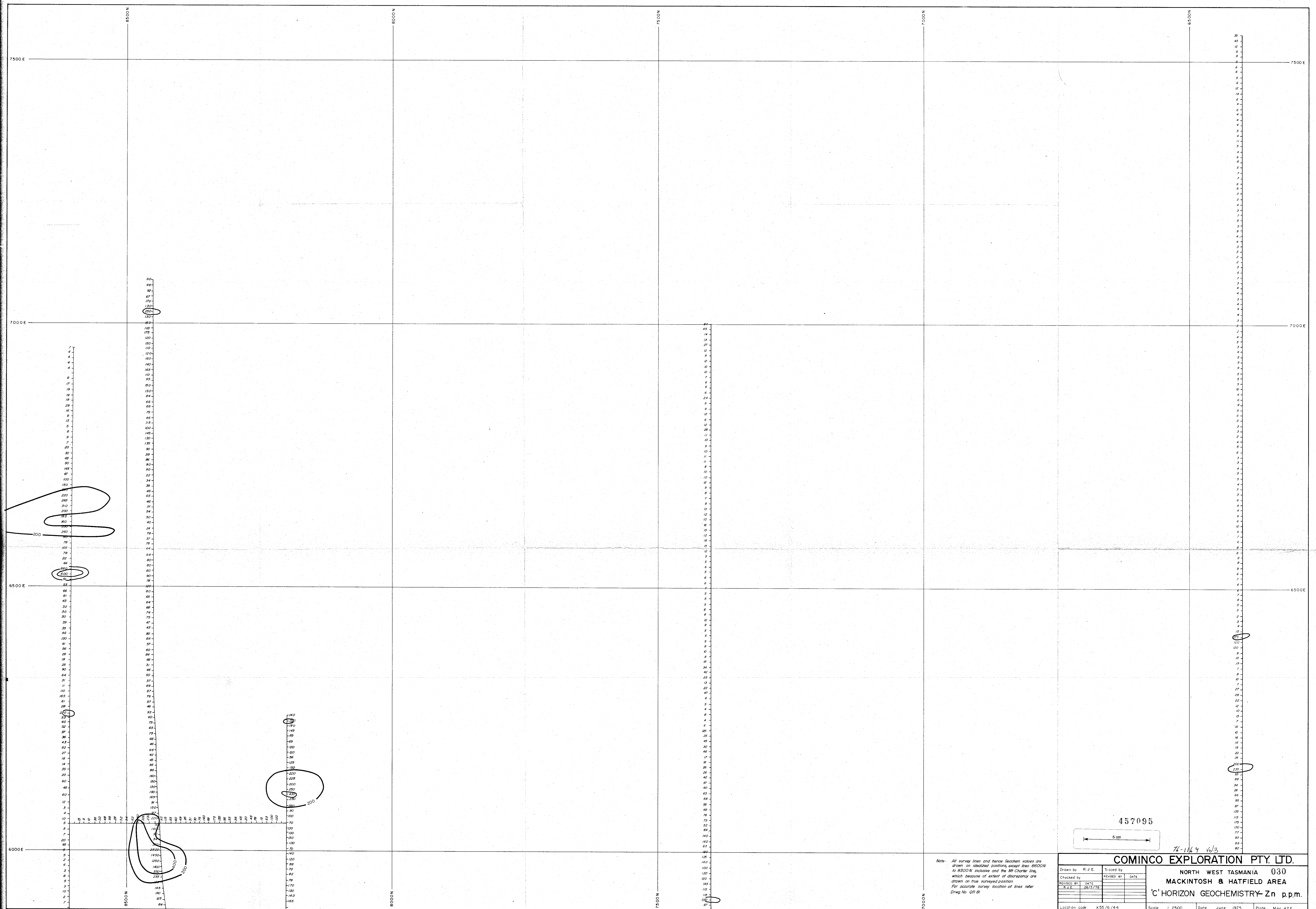
Drawn by R.J.E. Traced by R.J.E.
Checked by R.J.E. Revised by R.J.E.
Revised by R.J.E. Date 10/7/76
Location code K55/6/44 Scale 1:2500 Date June, 1975 Plate Mac 47A

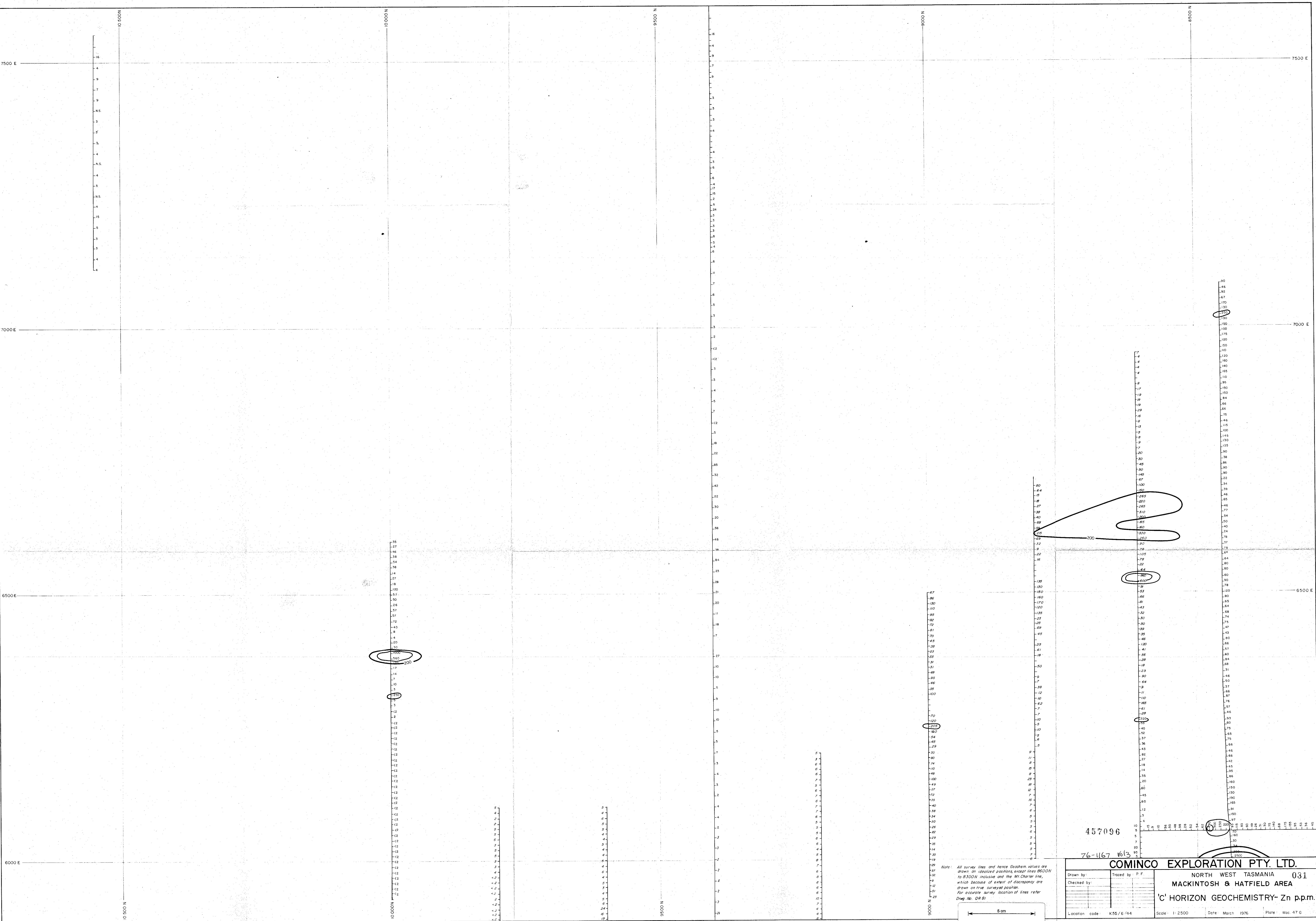
NOTE -
All survey lines and hence Geochron values are
open on indicated locations, except line 8500N
to 8500N inclusive and the M Charter line,
which because of safety of discrepancy are
drawn on true surveyed position.
For accurate survey location of lines refer
Draw No. GRI 81





COMINCO EXPLORATION PTY. LTD.			
NORTH WEST TASMANIA 029			
MACKINTOSH & HATFIELD AREA			
'C' HORIZON GEOCHEMISTRY- Zn p.p.m.			
Drawn by:	Traced by: P.F.		
Checked by:			
L. location code	K55/6/44	Scale	1:2500
Date:	March 1976	Plate:	Moc 47E





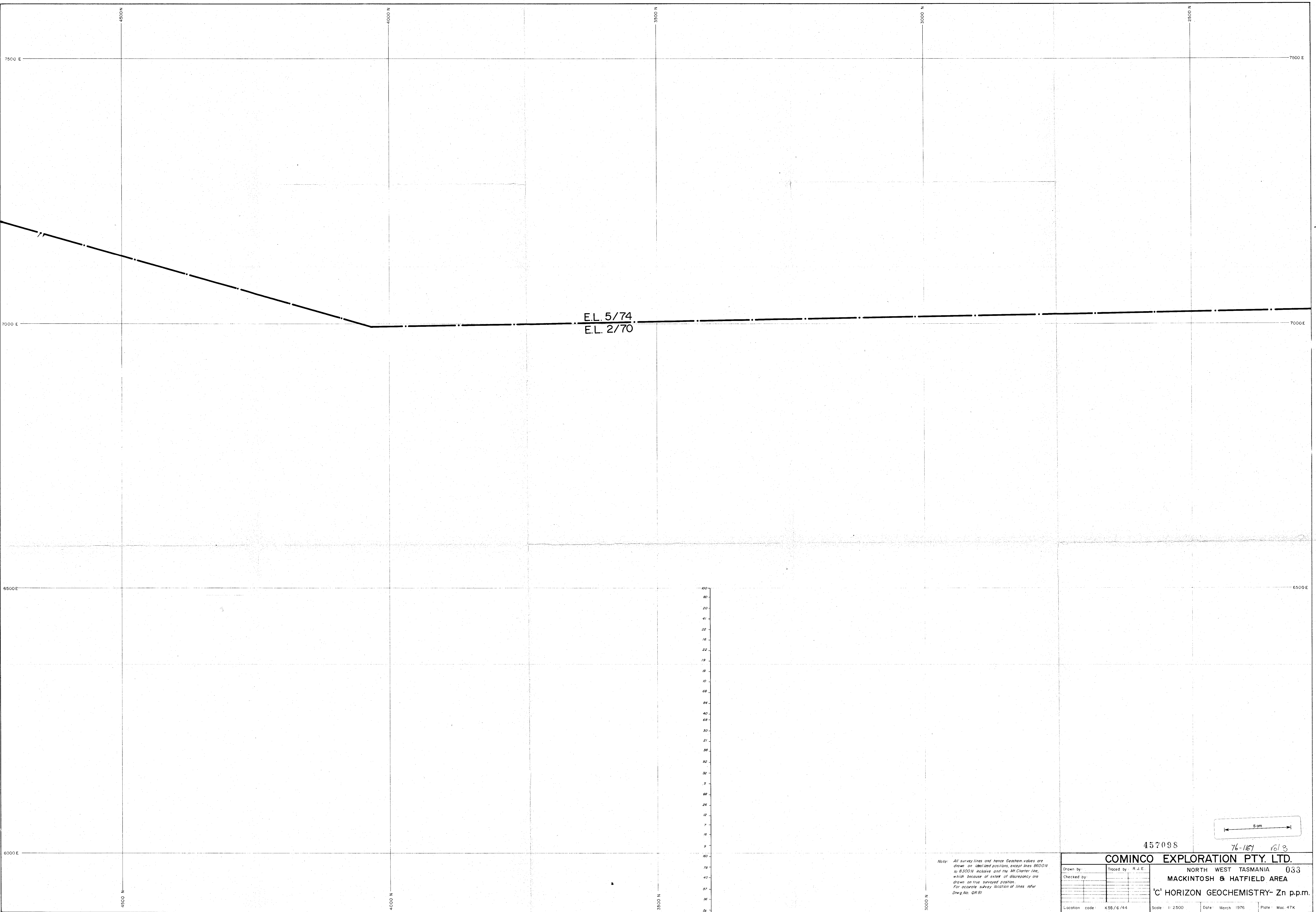
Note: All survey lines and hence Geochem values are drawn on idealized positions, except lines 8600N to 8300N inclusive and the Mt Charter line, which because of error or discrepancy are drawn on true surveyed position. For accurate survey location of lines refer Draw No. DR 81.

457096

76-1167 V6(2)

COMINCO EXPLORATION PTY. LTD.	
NORTH WEST TASMANIA 031	
MACKINTOSH & HATFIELD AREA	
'C' HORIZON GEOCHEMISTRY- Zn p.p.m.	
Drawn by:	Traced by: P.F.
Checked by:	
Location code: K55/G/44	Scale: 1:2500
Date: March 1976	Plate: Mac. 47 G





Note: All survey lines and hence Geochem values are drawn on idealized positions, except lines 6000N to 6300N, inclusive and the Mt Charter line, which because of extent of discrepancy are drawn on true surveyed stations. For accurate survey location of lines refer Drawg No. QR 81

457098			
COMINCO EXPLORATION PTY. LTD.			
NORTH WEST TASMANIA 033			
MACKINTOSH & HATFIELD AREA			
'c' HORIZON GEOCHEMISTRY- Zn p.p.m.			
Drawn by:	Traced by: R.J.E.		
Checked by:			
Location code:	K55/6/44	Scale:	1:2500
Date:	March 1976	Plate:	Mac 47K



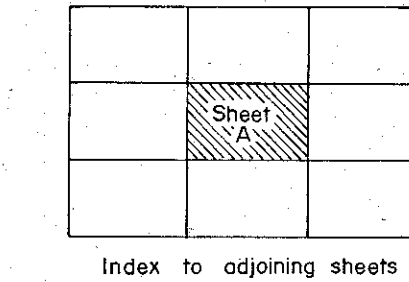
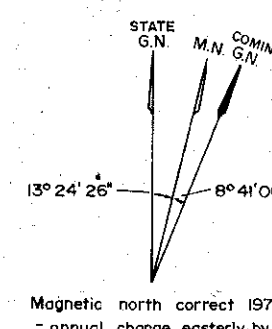
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19	39	10	24
26	36	9	16
33	33	8	10
40	30	7	5
47	27	6	0
54	24	5	-5
61	21	4	-10
68	18	3	-15
75	15	2	-20
82	12	1	-25
89	9	0	-30
96	6	-1	-35
103	3	-2	-40
110	0	-3	-45
117	-3	-4	-50
124	-6	-5	-55
131	-9	-6	-60
138	-12	-7	-65
145	-15	-8	-70
152	-18	-9	-75
159	-21	-10	-80
166	-24	-11	-85
173	-27	-12	-90
180	-30	-13	-95
187	-33	-14	-100
194	-36	-15	-105
201	-39	-16	-110
208	-42	-17	-115
215	-45	-18	-120
222	-48	-19	-125
229	-51	-20	-130
236	-54	-21	-135
243	-57	-22	-140
250	-60	-23	-145
257	-63	-24	-150
264	-66	-25	-155
271	-69	-26	-160
278	-72	-27	-165
285	-75	-28	-170
292	-78	-29	-175
299	-81	-30	-180
306	-84	-31	-185
313	-87	-32	-190
320	-90	-33	-195
327	-93	-34	-200
334	-96	-35	-205
341	-99	-36	-210
348	-102	-37	-215
355	-105	-38	-220
362	-108	-39	-225
369	-111	-40	-230
376	-114	-41	-235
383	-117	-42	-240
390	-120	-43	-245
397	-123	-44	-250
404	-126	-45	-255
411	-129	-46	-260
418	-132	-47	-265
425	-135	-48	-270
432	-138	-49	-275
439	-141	-50	-280
446	-144	-51	-285
453	-147	-52	-290
460	-150	-53	-295
467	-153	-54	-300
474	-156	-55	-305
481	-159	-56	-310
488	-162	-57	-315
495	-165	-58	-320
502	-168	-59	-325
509	-171	-60	-330
516	-174	-61	-335
523	-177	-62	-340
530	-180	-63	-345
537	-183	-64	-350
544	-186	-65	-355
551	-189	-66	-360
558	-192	-67	-365
565	-195	-68	-370
572	-198	-69	-375
579	-201	-70	-380
586	-204	-71	-385
593	-207	-72	-390
600	-210	-73	-395
607	-213	-74	-400
614	-216	-75	-405
621	-219	-76	-410
628	-222	-77	-415
635	-225	-78	-420
642	-228	-79	-425
649	-231	-80	-430
656	-234	-81	-435
663	-237	-82	-440
670	-240	-83	-445
677	-243	-84	-450
684	-246	-85	-455
691	-249	-86	-460
698	-252	-87	-465
705	-255	-88	-470
712	-258	-89	-475
719	-261	-90	-480
726	-264	-91	-485
733	-267	-92	-490
740	-270	-93	-495
747	-273	-94	-500
754	-276	-95	-505
761	-279	-96	-510
768	-282	-97	-515
775	-285	-98	-520
782	-288	-99	-525
789	-291	-100	-530
796	-294	-101	-535
803	-297	-102	-540
810	-300	-103	-545
817	-303	-104	-550
824	-306	-105	-555
831	-309	-106	-560
838	-312	-107	-565
845	-315	-108	-570
852	-318	-109	-575
859	-321	-110	-580
866	-324	-111	-585
873	-327	-112	-590
880	-330	-113	-595
887	-333	-114	-600
894	-336	-115	-605
901	-339	-116	-610
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922	-348	-119	-625
929	-351	-120	-630
936	-354	-121	-635
943	-357	-122	-640
950	-360	-123	-645
957	-363	-124	-650
964	-366	-125	-655
971	-369	-126	-660
978	-372	-127	-665
985	-375	-128	-670
992	-378	-129	-675
999	-381	-130	-680

Note: All survey lines and horizon (beach) values are drawn on idealized positions except lines BROWN, 10 8300 N inclusive and the M. Charter line, which because of a variety of discrepancy are drawn on the surveyed position. For accurate survey location of lines refer Dreg No. 0181.

COMINCO EXPLORATION PTY. LTD.			
NORTH WEST TASMANIA 034			
MACKINTOSH & HATFIELD AREA			
'C' HORIZON GEOCHEMISTRY- Zn p.p.m.			
Drawn by:	Traced by:	P.F.	
Checked by:			
Location code:	K55/6/44	Scale:	1:2500
Date:	March 1976	Plate:	Max 47L



- Main road
- Secondary road
- Track
- Railway
- Abandoned railway
- Power transmission line
- Fence
- Mine
- Quarry or pit
- Trig. station
- River, creek
- Survey line
- Tenure boundary



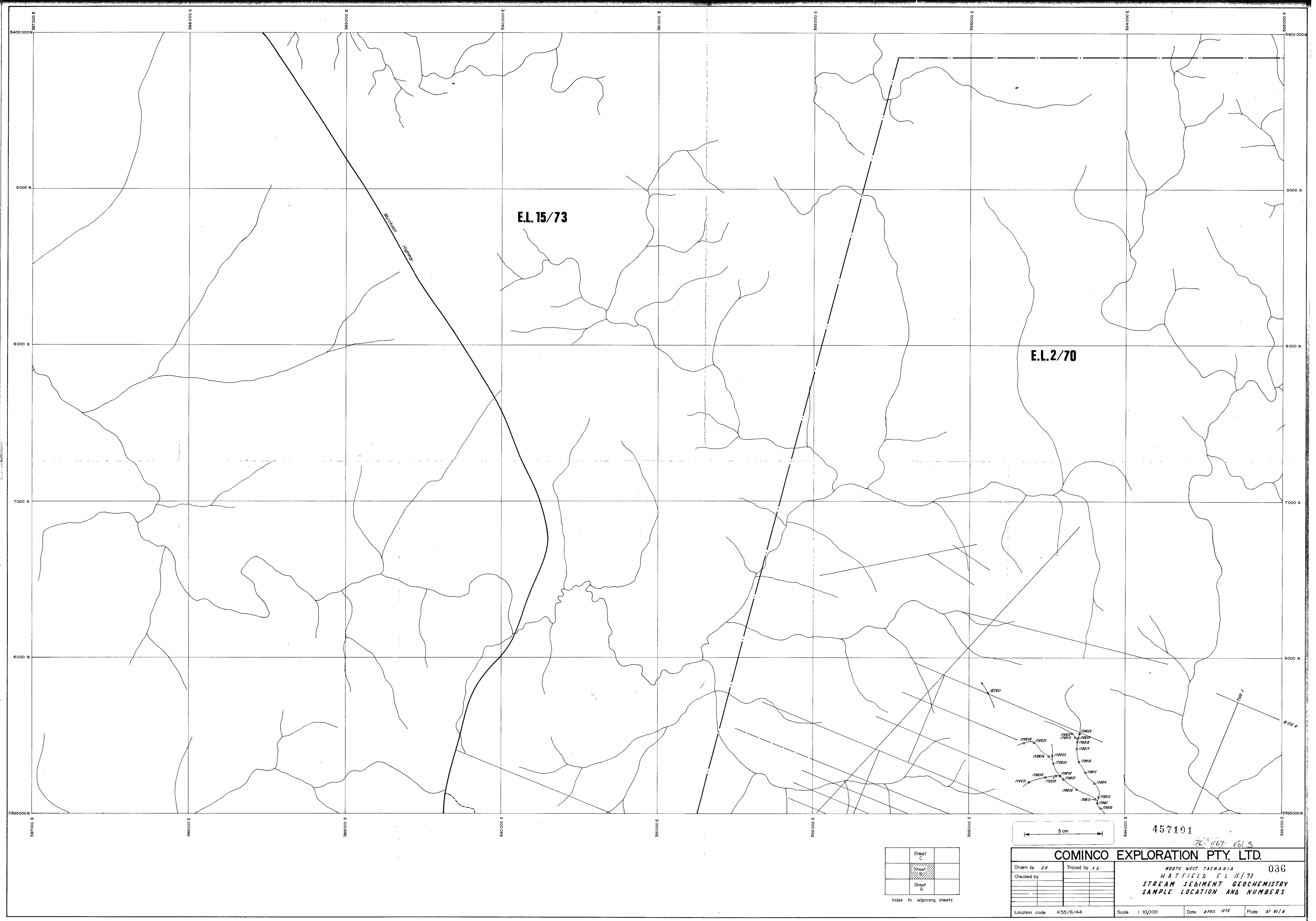
457100

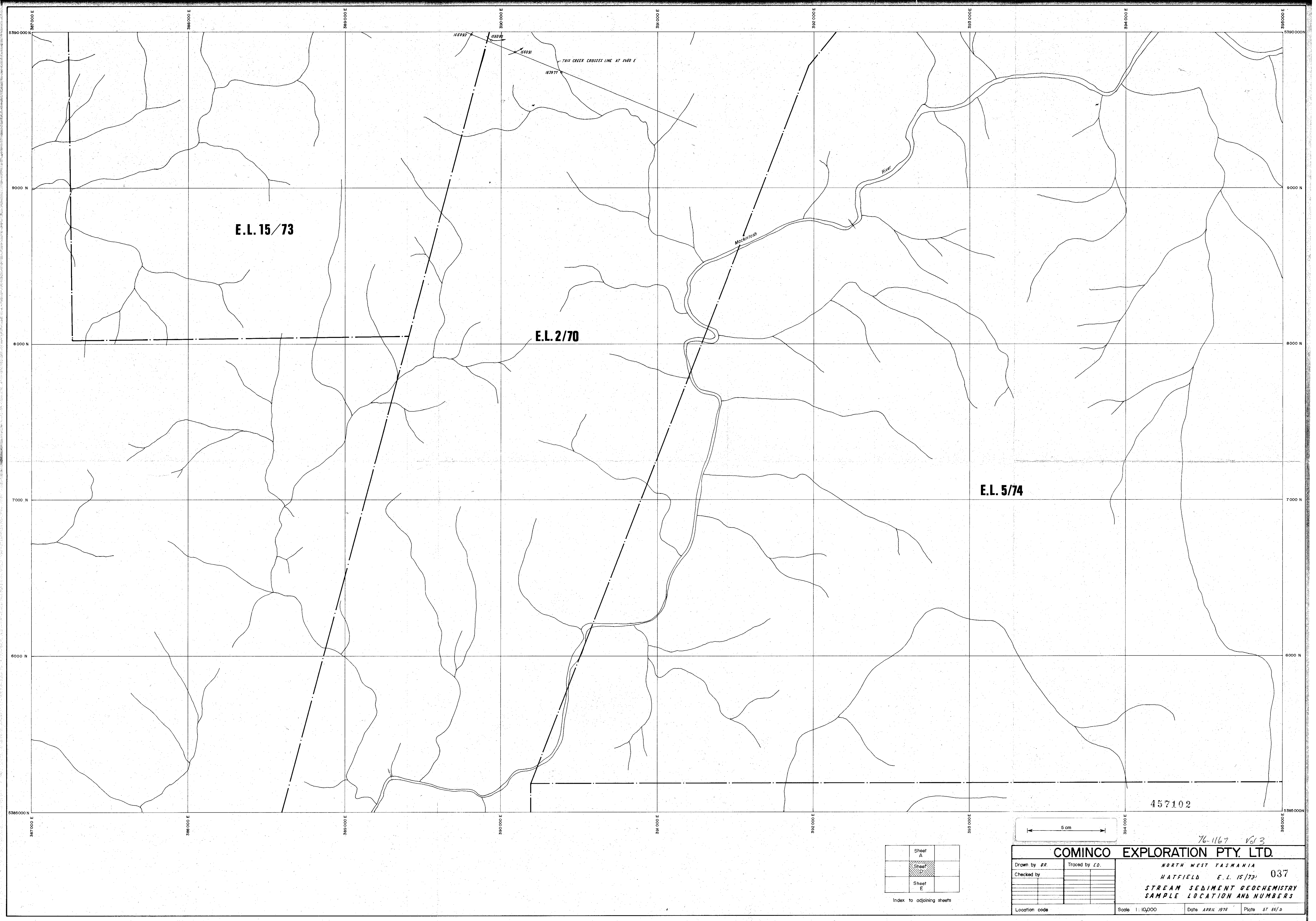
5 cm

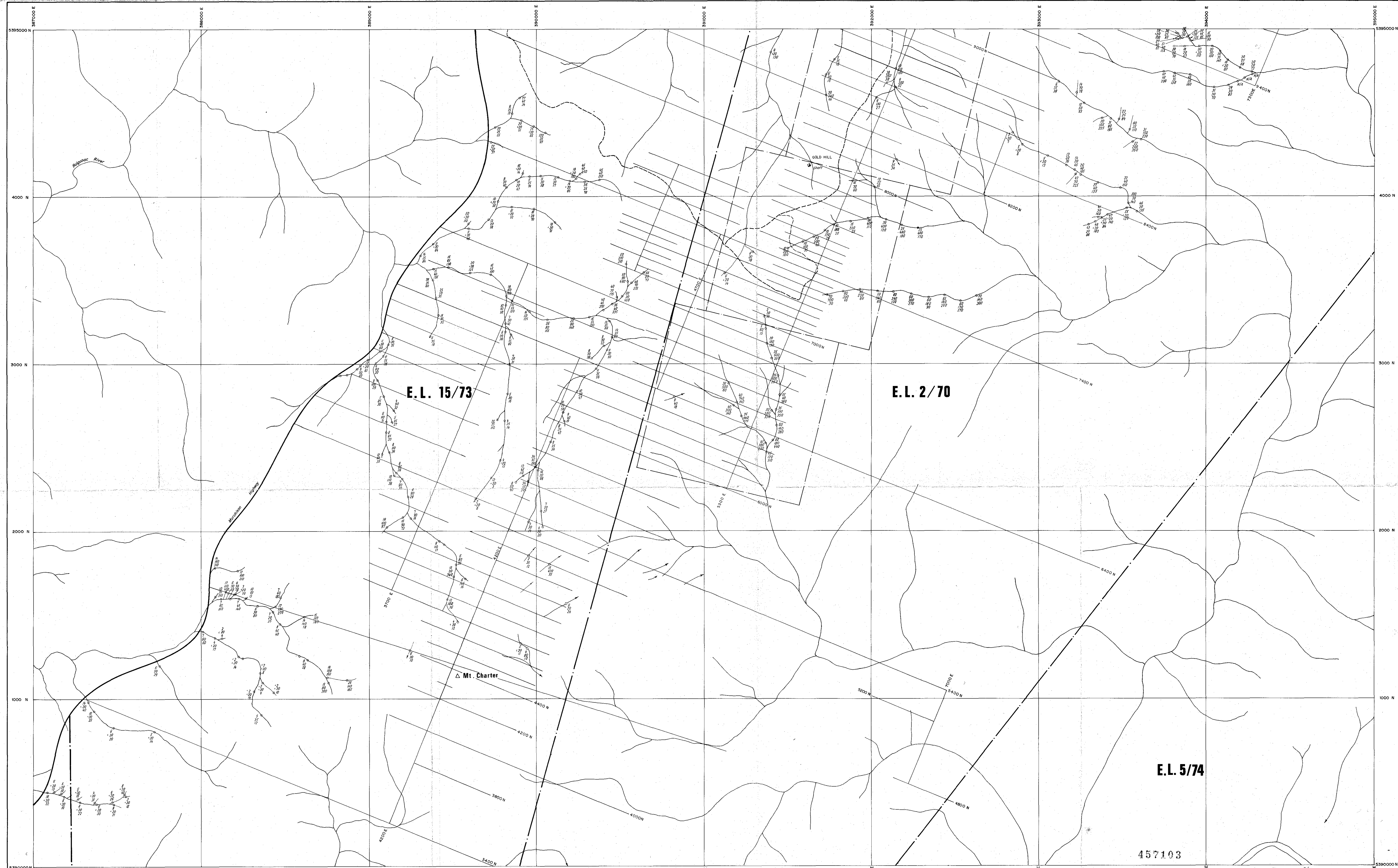
76-1167 Vol. 3

COMINCO EXPLORATION PTY. LTD.
NORTH WEST TASMANIA
HATFIELD E.L. 15/73 AND MACKINTOSH E.L. 2/70
STREAM SEDIMENT GEOCHEMISTRY
SAMPLE LOCATION AND NUMBERS 035

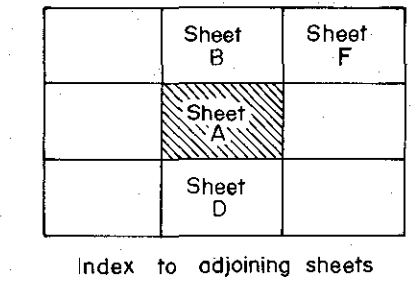
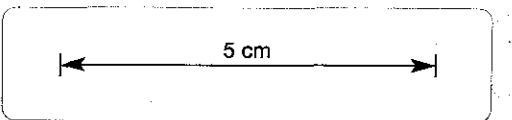
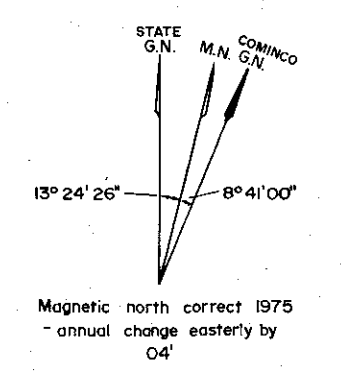
Drawn by G.P.	Traced by E.D.
Checked by	
Location code K55/6/44	Scale 1:10000
Date JUNE 1975	Plate DT 85/ A







- Main road
- Secondary road
- Track
- Railway
- Abandoned railway
- Power transmission line
- Fence
- Mine
- Quarry or pit
- Trig. station
- River, creek
- Survey line
- Tenure boundary
- Copper
- Lead
- Zinc



ANALYTICAL METHOD.
Cu, Pb, Zn analysis by AAS on -40° fraction, perchloric acid digestion on 0.5gms by CEP.

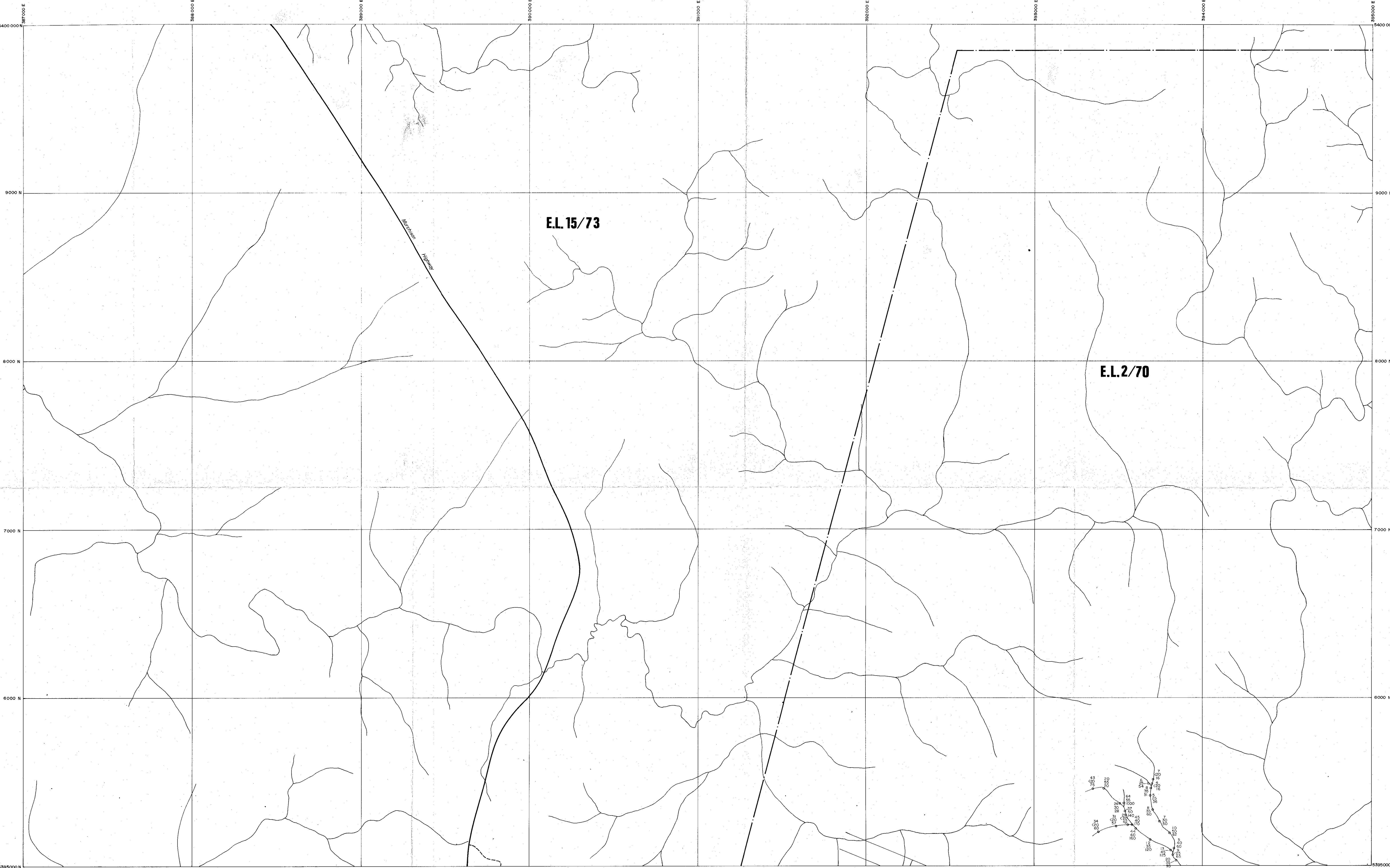
COMINCO EXPLORATION PTY. LTD.

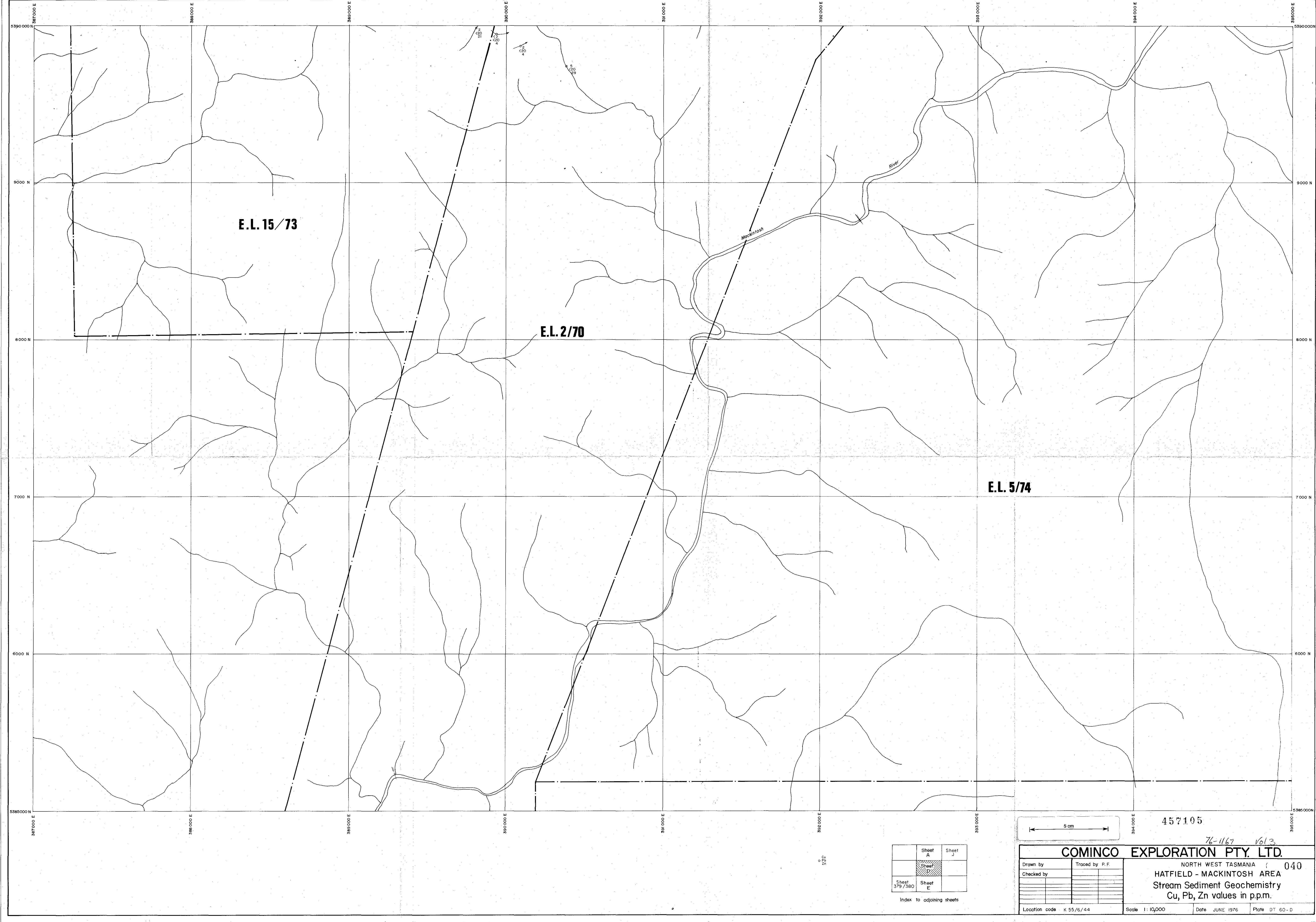
NORTH WEST TASMANIA 038
HATFIELD EL15/73 & MACKINTOSH EL2/70
STREAM SEDIMENT GEOCHEMISTRY
Cu, Pb, Zn values in p.p.m

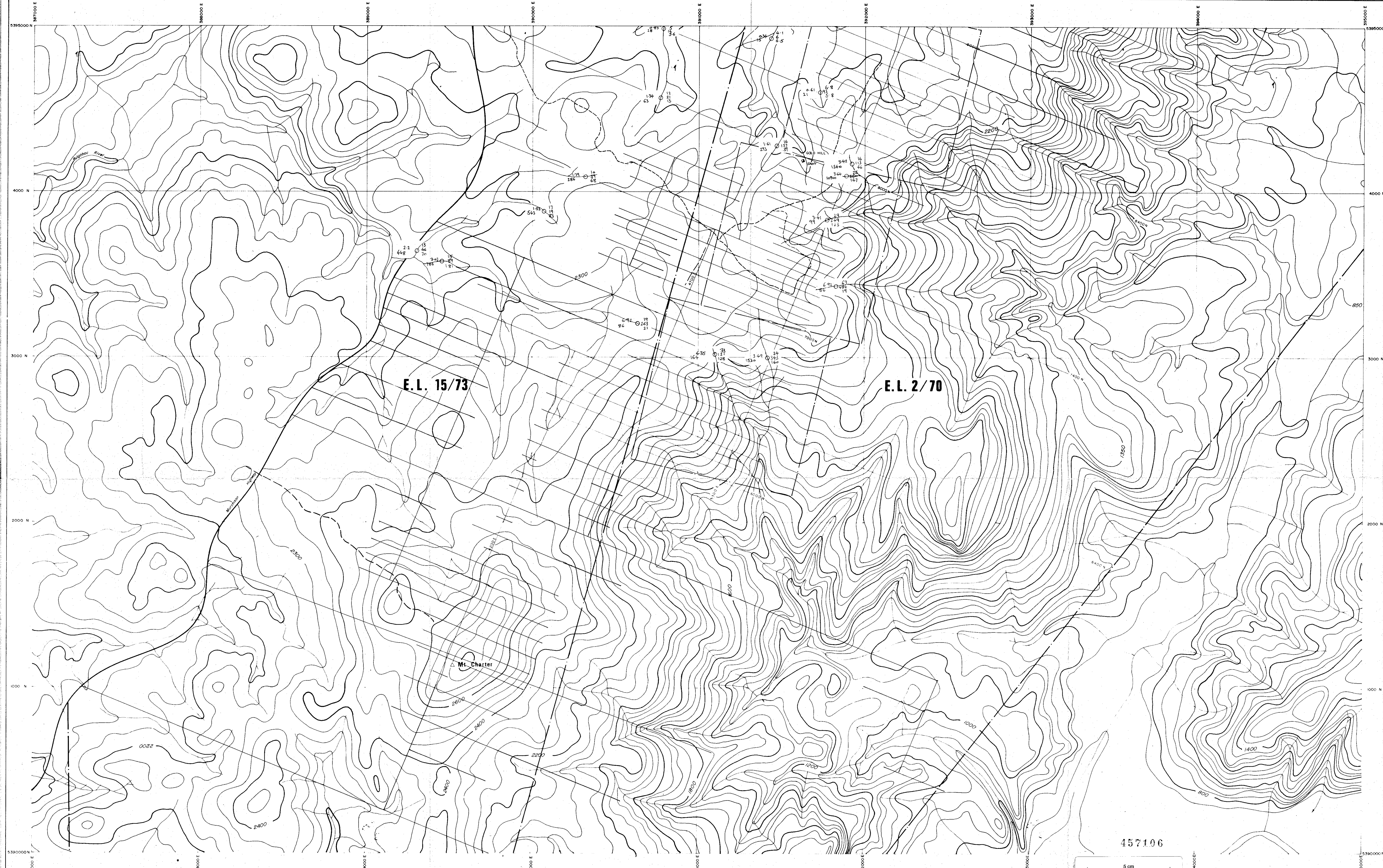
Drawn by	Traced by E.D.
Checked by	
Location code	K55/6/44
Scale	1:10000
Date	May 1976
Plate	DT 60/ A

457103

76-1167 Vol. 3





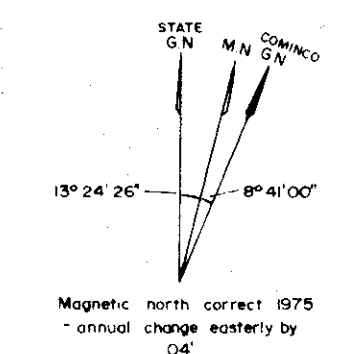


- Main road
- Secondary road
- Track
- Railway
- Abandoned railway
- Power transmission line
- Fence
- Mine
- Quarry or pit
- Trig. station
- River, creek
- Survey line
- Tenure boundary

iron
manganese
all p.p.m. except iron (%)

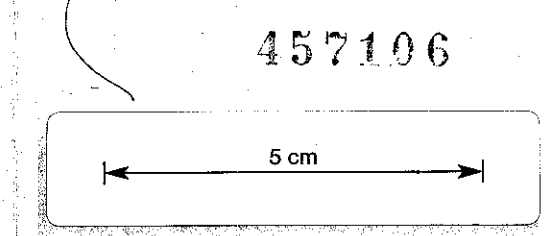
○ lead
○ zinc

Base sheet and contours enlarged from
1:31,680 Tasmanian Lands Dept. Topo.
Contour interval 50 feet



Sheet B
Sheet A
Sheet D

Index to adjoining sheets



457196

CHEMLABS REPORT: ANALYSIS OF HUMUS SAMPLES, SEPTEMBER 1975

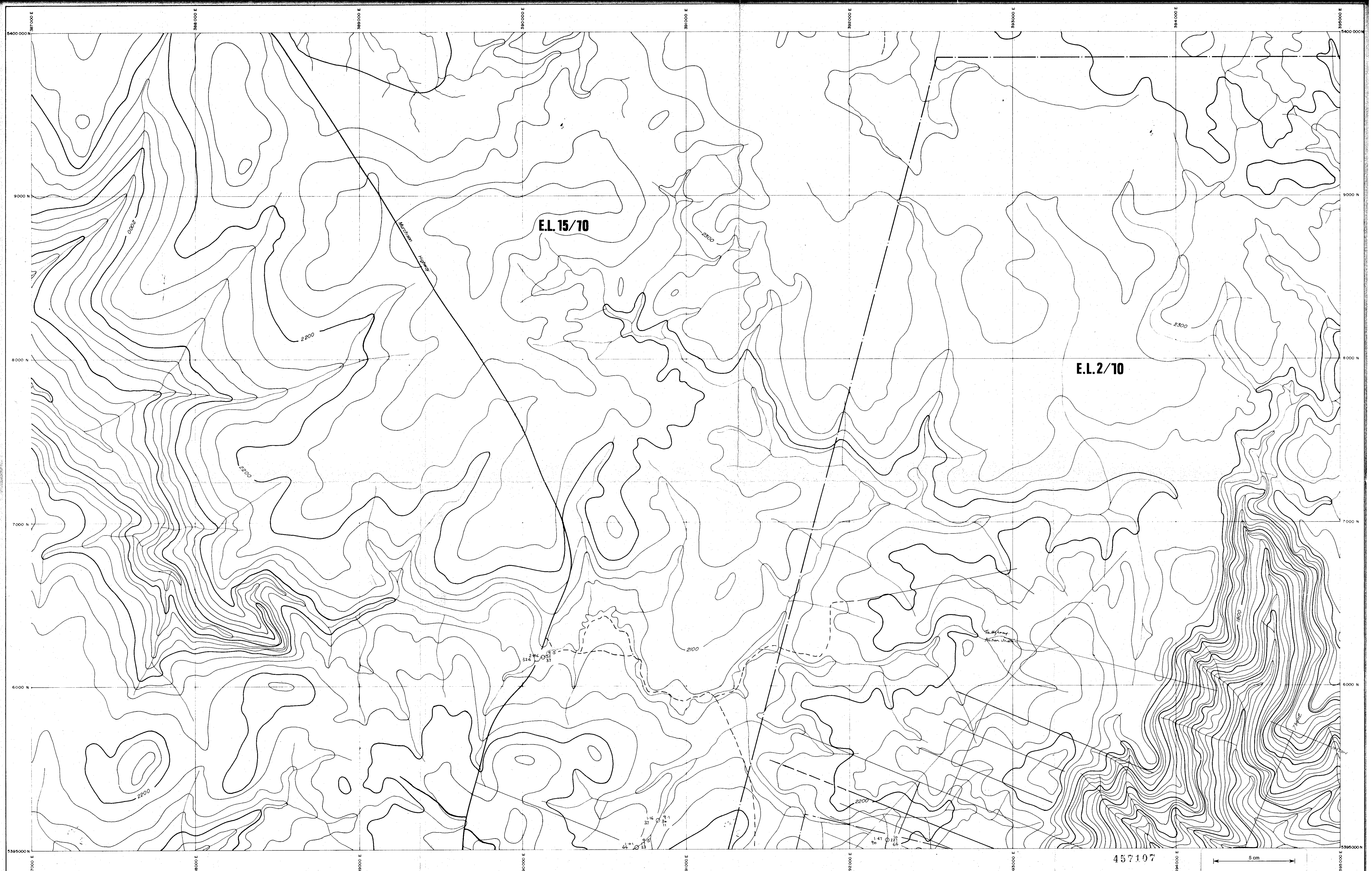
COMINCO EXPLORATION PTY. LTD.

NORTH WEST TASMANIA 041
MACKINTOSH E.L. 2/70 - HATFIELD E.L. 15/73
STREAM HUMUS

Drawn by KERD
Checked by

Traced by

Location code K55/6/44
Scale 1:10000
Date MAY 1976
Plate DT 66 A



Base sheet and contours enlarged from
1:31,680 Tasmanian Lands Dept. Topo.
Contour interval 50 feet

Iron $\circ$ copper
manganese $\circ$ lead
zinc $\circ$
all $\mu\text{g/g}$ except iron (%)

Sheet C
Sheet B
Sheet A

Index to adjoining sheets

CHEMLABS REPORT: ANALYSIS OF HUMUS SAMPLES, SEPTEMBER 1975

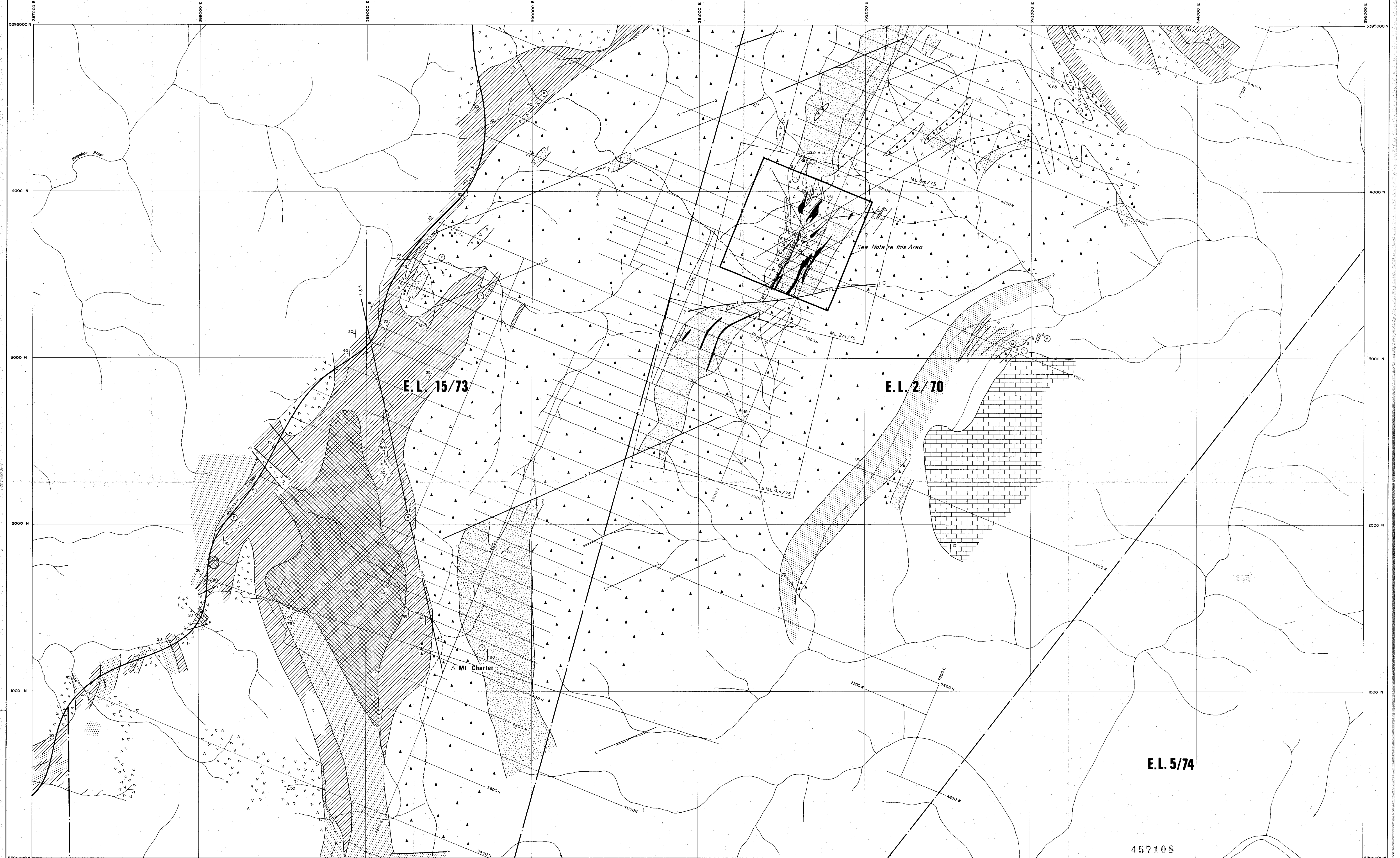
COMINCO EXPLORATION PTY. LTD.

Drawn by KERO	Traced by
Checked by	
Location code K55/E/44	Scale 1:10,000

26-1164
Vol 3

NORTH WEST TASMANIA
DUNDAS TROUGH 042
STREAM HUMUS

Date MAY 1976
Plate DT 66 B



Main road
Secondary road
Track
Railway
Abandoned railway
Power transmission line
Fence
Mine

Quarry or pit
Trig. station
River, creek
Survey line
Tenure boundary
Dip and strike of bedding
Dip and strike of cleavage

Td Tertiary Basalt
35 Jurassic (P) Dolomite-Diorite
10 Ordovician Conglomerate, grit, sandstone
24 Cambrian-Devonian lavas and pyroclastics with visible quartz (commonly) light grey cream or orange colorations. Intrusions shown in overprint

63 Mica sandstones, grits, dark greenish brown when fresh, light grey in a/c
53 Shales (black, grey)
53 Breccia (Sedimentary)
22 Cherts (blue-grey, white black)

49 Andesite-Basalt (lavas, lithic tuffs, agglomerates, lava breccias typically fresh, light grey in a/c)
49 Scoriaeous and coarsely vesicular (>3mm) andesite-basalt lavas (intrusions shown in overprint)
59 Cambrian-Intermediate to acid (diolite rhyolite) lavas and pyroclastics within andesite sequence (includes DTL, MTL, GP mine groups) typically pink light red brown to fawn coloration

7 Altered (sericite-carbonate-chlorite) and apatite fragments and lavas (PyP at mine sequence) Blue grey colour when fresh
L Photo lineament
F Interpreted Fault
LG Geophysical lineament
LC Geochemical lineament
19 Pyrite and/or base metal occurrence
11 Magnetite occurrence

5 cm

STATE GN MN GN
13° 24' 26" 13° 41' 00"
Magnetic north correct 1975
annual change westerly by 0.4°

Index to adjoining sheets

Sheet B	Sheet F
Sheet D	

Map compiled from fact geology, (1971-76 mapping) soil geochemistry and Induced Polarisation data

NB. For detailed Interpretation of Ore Bearing Zone between 7300N - 7900N, refer to Drwg No. QR 83 at scale 1:2500

COMINCO EXPLORATION PTY. LTD.	
Drawn by E.H.S.	Traced by R.J.E.
Checked by	
Location code K55/6/44	Scale 1:10000
Date June, 1976	Plate DT 62 A

76-1167 NORTH WEST TASMANIA 043
V013 DUNDAS TROUGH
MACKINTOSH E.L.2/70 - HATFIELD E.L.15/73
Preliminary Interpretive Geology

E.L.15/73

E.L.2/70

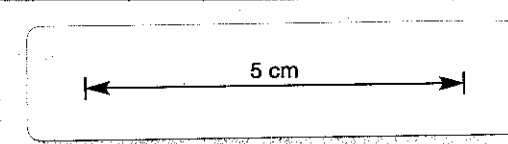
Mackintosh
Trough

457109

N.B. For details of Legend
refer Drwg. No. DT62 A

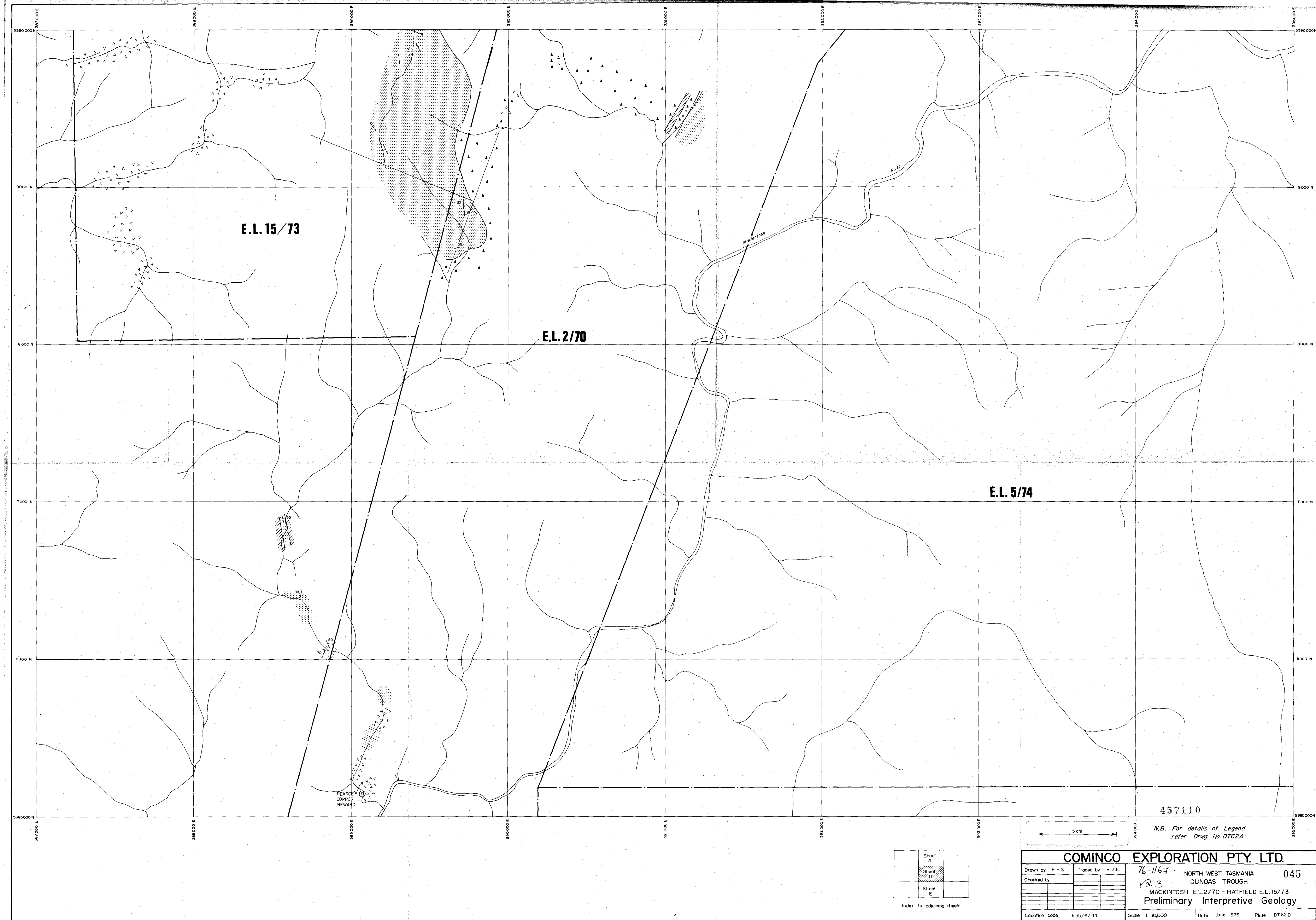
Sheet C	
Sheet B	
Sheet A	

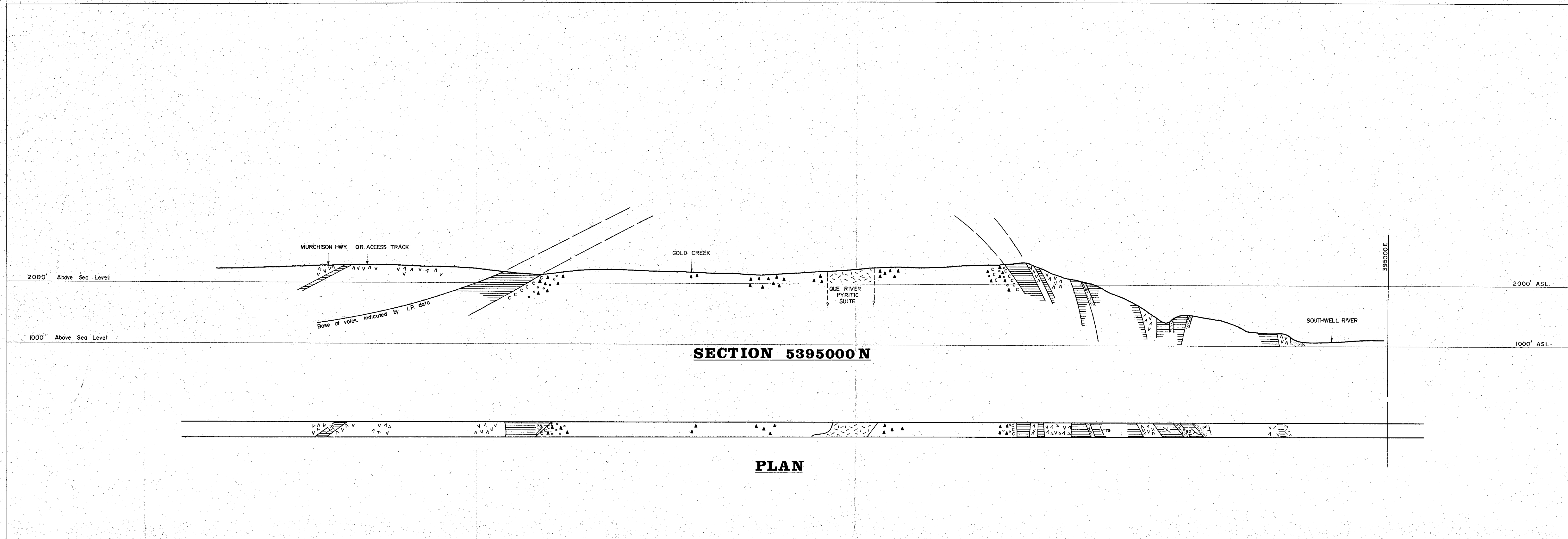
Index to adjoining sheets



COMINCO EXPLORATION PTY. LTD.	
Drawn by E.H.S.	Traced by R.J.E.
Checked by	
Location code K55/6/44	Scale 1:10,000
Date June, 1976	Plate DT62B

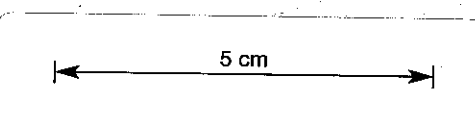
76-1167 NORTH WEST TASMANIA 044
Vol 3 DUNDAS TROUGH
MACKINTOSH E.L.2/70 - HATFIELD E.L. 15/73
Preliminary Interpretive Geology





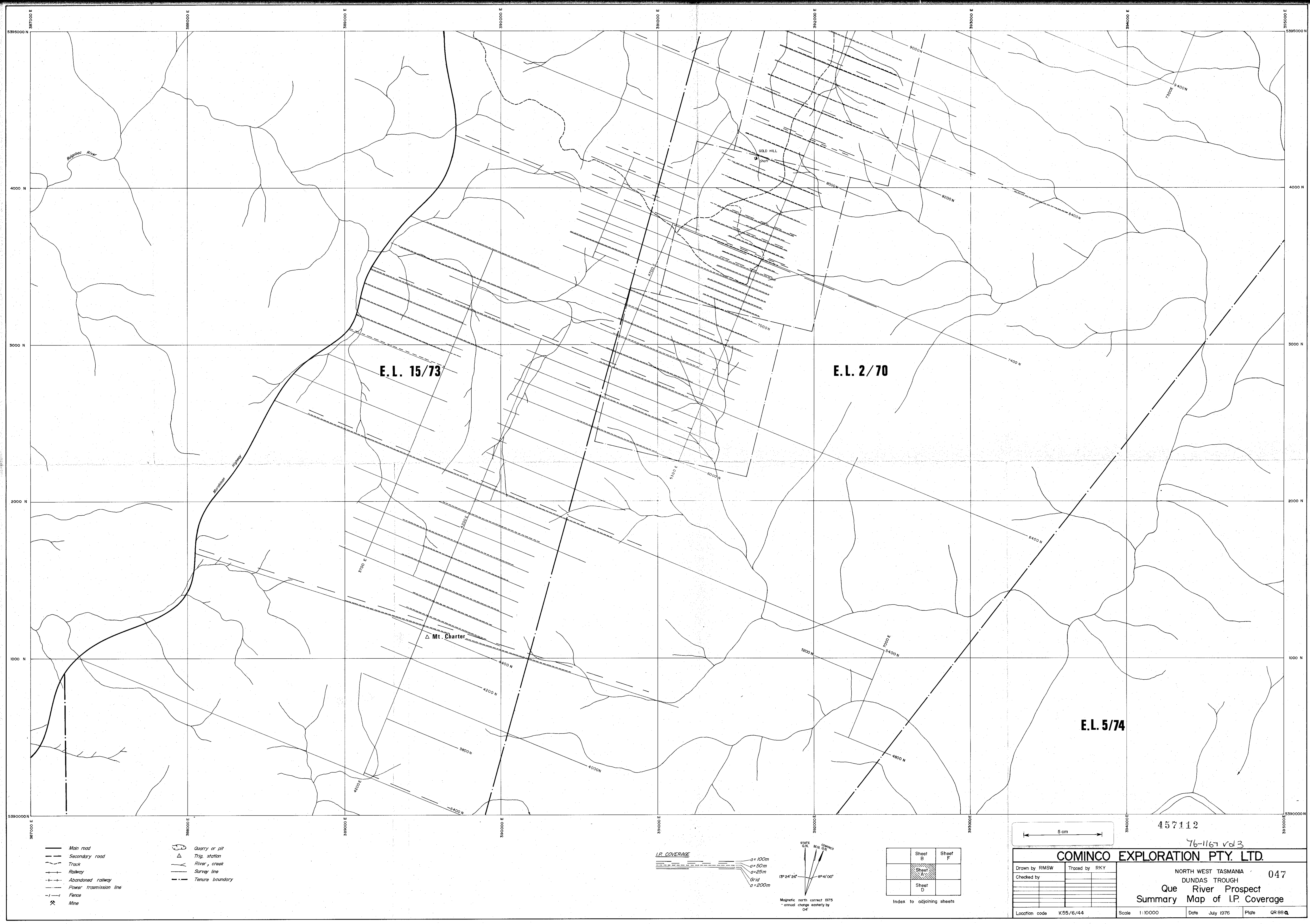
- LEGEND —
- Rhyolitic volcanics (quartz, feldspar porphyries, crystal tuffs, lithic tuffs, agglomerates)
 - Carbonaceous, locally graphitic, pyritic shales, siltstones also in Southwell catchment
 - Mica sandstones, grit
 - Andesitic (basaltic) volcanics (lava-breccia agglomerates)
 - Vesicular to scoriaceous andesites (dacites?)
 - Cherts (pyritic locally)
 - Pyritic Pyroclastic suite of Que River zone

457111



Cominco Exploration Pty Ltd			
NORTH WEST TASMANIA			
MACKINTOSH & HATFIELD AREA			
Interpretive Cross Section through 5395000N			
Drawn by: E.H.S.	Traced by: R.J.E.		
Checked by:			
Location code: K55/6/44	Scale: Vert. & Horiz. 1:10,000	Date: June, 1976	Plate: DT 63

76-1184 V6.13



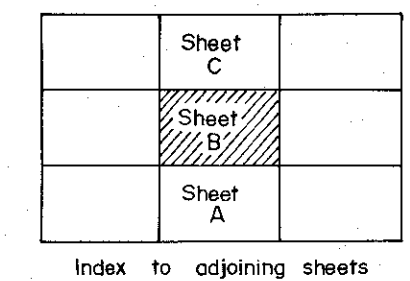
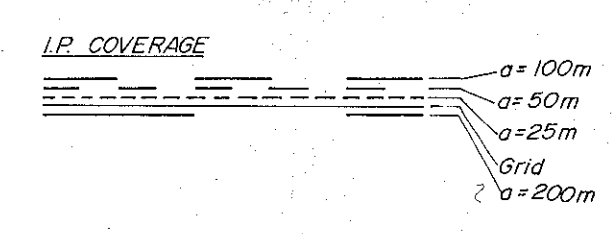
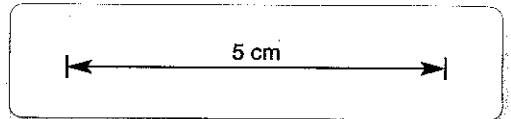


E.L. 15/73

E.L. 2/70

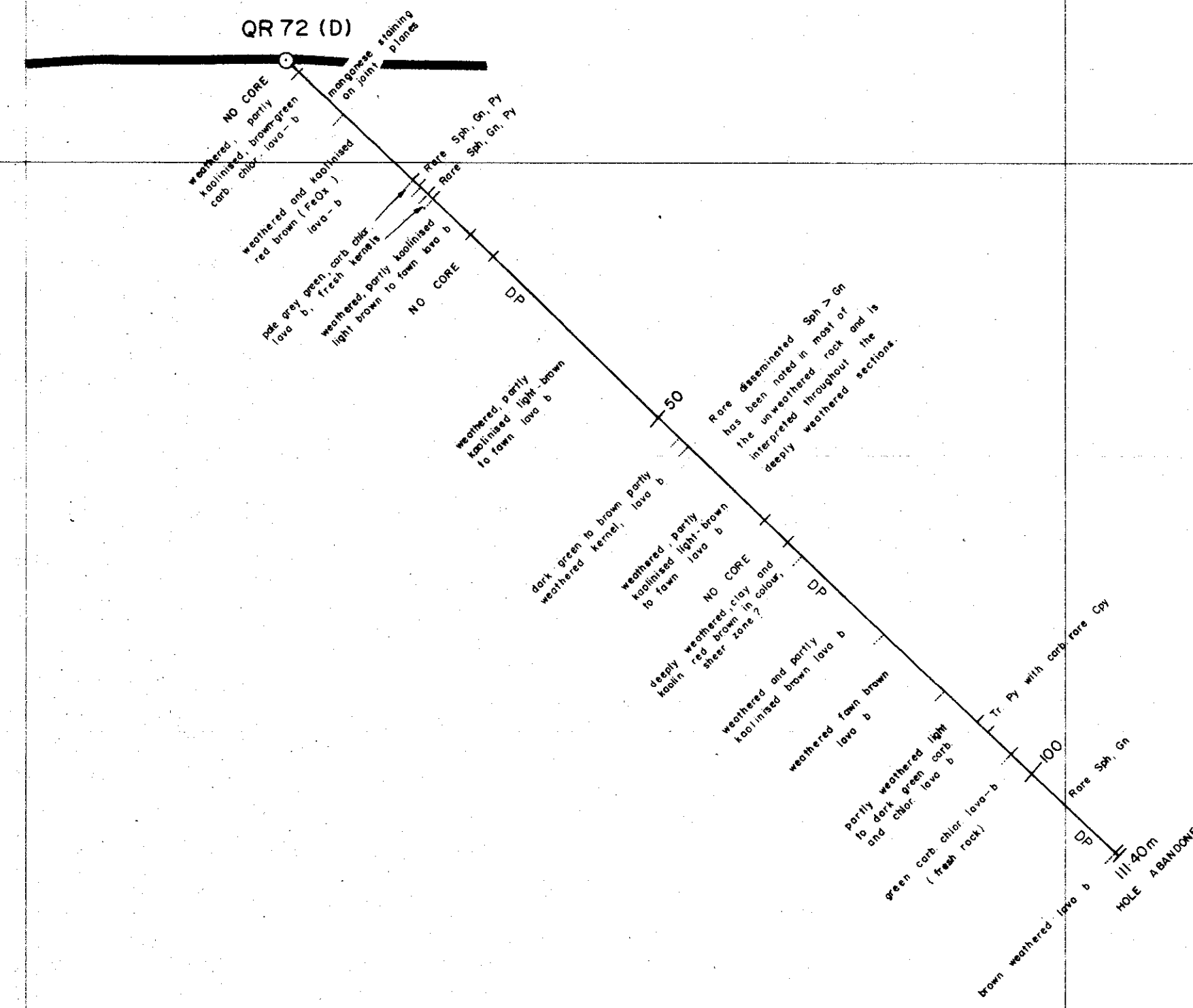
Marsden Highway

457113



COMINCO EXPLORATION PTY. LTD.			
Drawn by RMSW	Traced by RKY	76-1167	NORTH WEST TASMANIA
Checked by		Vol 3	DUNDAS TROUGH
			Que River Prospect
			Summary Map of I.P. Coverage
Location code	K55/6/44	Scale	1:10,000
		Date	July 1976
		Plate	QR88 b

043



REFERENCE

					Sulphate cement
				Py 5 (SO)	Pyrite 5%, locally 50%
				Py 5 + O	Pyrite 5-10%
				Gn 2 + O	Galenic 2%
				Sgn 5	Sphalerite 5%
				Cpy 15	Chalcophyllite 45%
				Ba 5	Bornite 5%
Geological context					
Unit variation					
Serpentine rich, locally serpentine				serpentine	
Chalrite rich, locally chromite				chal(ite)	
Carbonate rich, locally carbonated				carb (SO)	
Graphite, locally oxidized				graph	
Vesicular, amorphoidal				vesic	
Probable unaged character				stibious	
Foliation produced bedding/flow bending					
Cleavage					
Fault unmeasured orientation					
Fault measured					
Fault zone unmeasured orientation				FAULT ZONE	
Fault zone measured				FAULT ZONE	
				Q vein	quartzite vein
				C vein	carbonate vein

VOLCANICS

Fragment Size	Rock Composition	Fragment Type	Descriptive / Genetic Notes
< 4mm	Rhyncho (RH) Hypocrite (HO) Dactyl (DI) Andesite (A) Diorite (D) Gneiss (GN) Gneiss (GN) Eclogite (E) Basalt (B)	shd, shd, etc.	Tuft (1) Tuft - base (1, 1000)
> 4mm < 32 mm (> 20 mm fragments add particle count)		lithic (L) pumice (p) (> 5% crystal component)	
vitr. fragments, glass shards + with total area			Tuft (1)
(if < 4mm add particle count)		hornblende (hb) feldspar (fd) quartz (q) (> 5% crystal component)	Tuft - base (1, 1000)
Fragments < 4mm 5-10% fragments > 32mm		Fragmented fragments, define agglomerate and tuft agglomerate angular fragments define breccia and tuft breccia	Tuft Agglomerate (1) Tuft Breccia (10)
Fragments > 4mm 50 % fragments > 32mm total particle count fragments > 20mm			Agglomerate (1) Breccia (10)
No visible fragments			Pumice (p)
Uniform groundmass with phenos		specify phenos, f.d.s, etc.	Porphyry (gp) Porphyritic: none (p)
			Massive structures with phenocrysts composition name above

INTRUSIONS

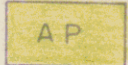
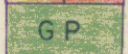
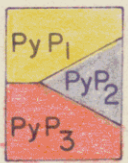
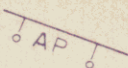
<u>SEDIMENTS</u>	Reworked Tuff	(wt)	457114
	Sandstone	(ss)	
	Siltstone	(sl)	
	Shale	(sh)	
	Chert	(ch)	

457114

COMINCO EXPLORATION PTY LTD

Drawn by C.H.Y.	Traced by R.U.E.	76-1167 Vol 3 NORTH WEST TASMANIA MACKINTOSH WEST EL 2/70 QUE RIVER PROSPECT SECTION 7600N	049
Checked by	Revised by Date		
Revised by Date			
Location code: K55/6/44	Scale: 1:500	Date: Dec. 1975	Plate: QR47/76

GEOLOGICAL LEGEND & COLOUR CODE

DERWENT SERIES							
Nº	CODE	NAME	ROCK COLOUR	ALTERATION	INTERPRETED COMPOSITION	TEXTURE	SULPHIDES
48		ANDESITIC PYROCLASTICS	Green	Chlorite (carbonate)	Andesite - Basalt	lfapxnbxt/ta, lfahbxt, lta, vesic lava - b	Pyrite < 1% rare traces base metals
59		DACITIC TUFF-LAVA	Buff-pink, partly green also light grey	Weak sericite, rich carbonate	Dacite - (rhyolite?)	fdxt-lava, lava-b, some vesic	Pyrite generally < 2% locally 10%
64		MAGNETITE BEARING TUFF-LAVA	Mid-dark brown	Carbonate	Dacite (?)	fine f-lava, fdxt-lava	Pyrite < 1%
46		GREEN PYROCLASTICS	Off white to blue grey, characteristic brilliant green spotting	Sericite, carbonate, green illite - hydromuscovite	Dacite	lta, vesic fragments	Pyrite < 3%
6		PYRITIC-PYROCLASTICS (grouped - PyP - on summary plans)	Blue grey	Sericite, carbonate silica, chlorite	Probably dacite	lt, ta, fdxt	Py 5%, also stringer Sph, Gn, Cpy
27			Grey off white to orange	Sericite, carbonate silica, chlorite	Probably dacite	lfadxt, ta, a	Py 5% rare stringer mineralization
11			Green, yellow-green often mottled	Sericite, carbonate silica chlorite	Probably dacite	l, lt, ta, often vitric, some vesic	Py 3-5%, including stringer mineralization
<u>SULPHIDES</u>							
12		Greater than 5% combined base metals (Cu, Pb, Zn)					
29		Massive Pyrite > 60%					
32		Pyrite 25% - 60%					
33		Pyrite 10% - 25%					
<u>NOTE</u>							
1) Since a number of the groups defined above represent alteration, it will be apparent that intermediate types occur.							
2) Within PyP ₁ some units contain a large number of typical GP fragments.							
3) PyP ₂ is pyritised, bleached, sericified and carbonated. Texturally similar to some AP types with shredded carbonate rich limic fragments containing orange brown phenocrysts.							
 Limit of ANDESITIC PYROCLASTICS, plotted on Drill Hole							

DRILL HOLE TRACE

Geological contact		Sulphide content	
Unit variation		Py 5 (50)	Pyrite 5% locally 50%
Sericite rich, locally sericitic ser (ser)		Py 5-10	Pyrite 5-10%
Chlorite rich, locally chloritic chlor (chlor)		Gn 2	Galenite 2%
Carbonate rich, locally carbonated carb (carb)		Sph 5	Sphalerite 5%
Silicified, locally silicified silic (silic)		Cpy 15	Chalcopyrite 15%
Vesicular, amygdaloidal vesic		Ba 5	Barite 5%
Probable original character - eg - siliceous			
Foliation probable bedding/flow bedding			
Cleavage			
Fault unmeasured orientation			
Fault measured orientation			
Fault zone unmeasured orientation			
Fault zone measured orientation			
q vein		quartz vein	
c vein		carbonate vein	

VOLCANICS

CLASSIFICATION

FRAGMENT SIZE	ROCK COMPOSITION	FRAGMENT TYPE	DESCRIPTIVE/GENETIC NAME
< 4 mm	Rhyolite (R)	ash, dust, etc.	Tuff (t) Tuff-lava (t-lava)
	Rhyodacite (RD)		
	Dacite (D)		
	Andesite (A)		
	Diorite (Di)		
	Granodiorite (GD)		
	Dolerite (Do)		
	Trachyte (T)		
> 4 mm < 32 mm (> 20 mm fragments add prefix coarse)	Basalt (B)	lithic (l) pumice (p) (> 5% l or p component)	Tuff (t) Tuff-lava (t-lava)
vitric fragments, glass shards visible with hand lens		vitric (v)	Tuff (t)
(if > 4 mm add prefix coarse)		pyroxene (px) hornblende (hb) feldspar (fd) crystal (x) quartz (q) (> 5% crystal component)	Tuff-lava (t-lava)
Fragments > 4 mm		Rounded fragments define agglomerate and tuff agglomerate angular fragments define breccia and tuff breccia	Tuff Agglomerate (ta)
5-50% fragments > 32 mm			Tuff Breccia (tb)
Fragments > 4 mm			Agglomerate (a)
50% fragments > 32 mm			Breccia (b)
(add prefix coarse if fragments > 10 cm)			Lava Breccia (lava-b)
No visible fragments			Pumice (p)
Uniform groundmass with phenos		specify phenos, fd, q, etc.	Porphyry (por) Porphyritic lava (por lava)
Massive structureless volcanic (indicate with composition name above)			
INTRUSIONS			
as above in volcanics			dyke, sill, etc.
SEDIMENTS			
	Reworked Tuff (rwt)		
	Sandstone (ss)		
	Siltstone (sts)		
	Shale (sh)		
	Chert (ch)		
	Conglomerate (co)		
	Greywacke (gy)		

457115

COMINCO EXPLORATION PTY. LTD.

76-1167 NORTH WEST TASMANIA
V613 QUE RIVER PROSPECT

GEOLOGICAL LEGEND

050

Scale 1:50,000

Scale

Date

Plate

QR 84