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Report No. TAS/6

SEPTEMBER, 1977

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COMSTAFF JOINT VENTURE
TASMANIA, AUSTRALIA

INTERIM REPORT ON THE
CHESTER AREA

VOLUME 1

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D.J. PERKIN
**AUSTRALIAN ANGLO
AMERICAN LIMITED**
MELBOURNE, VIC.

REPORT NO. TAS/6.

SEPTEMBER, 1977

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D.J. PERKIN

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PREUSSAG AUSTRALIA PROPRIETARY LIMITED
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CHESTER AREA.

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PREUSSAG AUSTRALIA PROPRIETARY LIMITED
COMSTAFF JOINT VENTURE
TASMANIA, AUSTRALIA.
INTERIM REPORT ON THE
CHESTER AREA.

INTRODUCTION.

This report covers field work on the Chester Area, North West Tasmania (see Fig.I) undertaken by the author over the period February-May, 1977. The aim of the work was to:-

- (i) Re-map the area mapped by R. Smith in 1974/75.
- (ii) Re-log the 13 holes (3025.5 m) logged by R. Smith.
- (iii) Establish an (alternative) geological interpretation.
- (iv) Map the S.W. Extensions grid.
- (v) Log DDH's CH1, CH2, and CH3 (445.5 m).
- (vi) Map the Chester Pyrite Mine at 1:500.
- (vii) Map the H.E.C. Road from the Murchison Highway to the Marionoak River and establish the regional setting of the mineralization.
- (viii) Re-assess the geochemistry and geophysics (I.P. and magnetics) and relate it to the new (re-established) grid.
- (ix) Establish a stratigraphic sequence at Chester, which may be directly correlated with the Rosebery mine sequence to the south.
- (x) Make recommendations for possible future work.

The area lies in dense rainforest 80 km south of Burnie and about 7 km along strike to the north of the Rosebery lead-zinc mine where mined and proven reserves aggregate 30 million tonnes of 0.5% Cu, 5.5% Pb and 18.0% Zn with 187 g/tonne Ag and 38 g/tonne Au, and 28% pyrite. Approximately 7 million tonnes of ore have been recovered from the Rosebery mine since it began production in 1905 (17)*

The Chester area mapped in the current programme centres on the old Chester pyrite mine workings. The pyritic ore, discovered in 1896 by Kershaw and Sandersen, produced a total of 97,000 tonnes of pyritic ore (50% pyrite) grading 27% S (average) (McIntosh-Reid 1918). This included 36,000 tonnes of 37% S exported, and 61,000 tonnes of seconds @ 21% S. The pyritic ore as exposed at Chester has a strike length of 140 m and is up to 120 m wide, with high grade massive pyritic ore (> 30% S) up to 33 m in width. The pyrite contains only trace to minor precious and base metals.

*) Refers to Bibliography.

REGIONAL GEOLOGY.

The area is considered to lie on the western flank of a north-pitching synclinorium comprised of acid volcanoclastics and clastics (shales and cherts) of the Primrose Pyroclastics of the Mt. Read Volcanics (Cambrian). The sequence generally dips steeply east (and faces east) and the Primrose Pyroclastics are overlain by the apparently non-marine intermediate lavas and tuffs of the Mt. Black Volcanics (see Figs. 2 and 3).

The 4000 m thick Mt. Read Volcanics are flanked to the west by the Rosebery Group, a 1400 m thick sequence of dolomitic and pyritic shales, siltstones, sandstones and conglomerates with occasional tuffaceous interbeds. The Rosebery Group is considered to dip and face steeply east although many facings are westward due to the tight nature of the folding in these essentially incompetent sediments.

The Rosebery Group is thought to be a part-equivalent of the Dundas Group (Middle to Lower Upper Cambrian) and overlies the Crimson Creek Argillite (pre-Mid-Cambrian) further to the west.

REGIONAL GEOLOGY - CHESTER AREA (Figs. 4, 5, 6, 7, 8).

Regional geological mapping on photo scale (1:10,000) from the Marion Oak River to the Murchison Highway (11 km) along the Hydro Electric Commission's (HEC) Pieman River access track, established the following succession, from west to east (oldest to youngest):-

<u>Top (East)</u>	<u>Thickness (m)</u>	<u>Lithology.</u>
Mt. Black Volcanics.	2200	Andesitic, dacitic, rhyodacitic and keratophyric lavas, autoclastic tuffs and ignimbrites.
Primrose Pyroclastics	710	Acid ignimbrites (vitric lapilli tuffs), fine clastics and volcani- clastics, re-worked acid tuff, and ash-fall tuff.
Rosebery Group Base (West)	1250	Dolomitic and pyritic shales, silt- stones, sandstones (in part fuchsitic) and red and green chert-pebble conglomerate.

The western-most unit recorded was a fine sheared black shale to the west of minor massive Pb-Zn sulphide bands (to 0.1 m) in a (?) silicified black shale. The western black shale horizon appears to be close to the base of the Rosebery Group (i.e., possibly the Westcott Dolomites or more probably the Munro Creek Slate and Quartzite as projected north from its exposure in the Pieman River (4) (6)*.

*) see Bibliography.

Further to the west the sequence is covered by eluvium and glacial till.

A summary of the Rosebery Group is given in Table I (Source (4), (6) and N. Hanson, E.Z. Co., pers. comm.).

Units identified on the traverse included a fuchsitic coarse arenite (fuchsitic conglomerate), the Stitt Quartzite(?) and the Chamberlain shales.

Two distinctive 3 m wide red and green conglomerate beds (separated by 9 m of green grey shale) appear to mark the eastern boundary of the so called Natone Volcanics, and this represents a good marker horizon.

The thickness of the Rosebery Group as exposed on the traverse was about 1250 m which is marginally thinner than that in the type area. This could be due to the transgressive nature of the Owen Shear or simply to the lack of exposure to the west.

The Owen Shear was exposed in several localities and the dip on the fault plane (marked by 1 cm of blue grey pug) varied from 37° to 40° East.

DETAILED GEOLOGY - CHESTER GRID.

Four 1 km by 2 km wide (approximately) sheets were mapped in detail on the Chester Grid from 10S to 1S (West Sheet and East Sheet), 00N to 10N (East Sheet) and 11N to 20N (East Sheet) (Figs. 9, 10, 11, 12, 13, 14 respectively). Mapping was completed on all road, track and railway cutting exposures as well as cut grid-line mapping (mainly on the west sheet) (see also Figs. 13, 14 West of Base Line).

This resulted in the differentiation of eight (8) lithologically distinct units which are summarized in Table 2. Units 1 to 7 may be correlated with the Primrose Pyroclastics as exemplified at Rosebery (15) and listed in Table 3, while unit 8 may be correlated with the Mt. Black Volcanics. The units have been established mainly on the basis of thin section descriptions coupled with field observations and identification.

The Primrose Pyroclastics are approximately 710 m thick while about 800 m of the base of the Mt. Black Volcanics was identified.

Also, another (discontinuous) unit (3A), an agglomerate or lava breccia occurs between Units 3 and 4 on the base line from about 7N to 18N. Its western contact is not fully exposed but it may be up to 200 m wide. This zone may represent a volcanic centre or vent area.

Units 2, 4 and 6 represent periods of quiescence within the volcanic pile during which the proportion of fine grained clastic sedimentation increases. These zones therefore are the most prospective for the development of lead-zinc-copper sulphide ore bodies. (However, only Unit 6 is underlain by vitric lapilli tuffs and therefore Unit 6 most closely resembles the Rosebery Mine Host Rock or Lode horizon stratigraphy.) Unit 6 is host to the Chester Pyrite mineralization and supports the contention that the Rosebery Lode Horizon is equivalent, in part at least, to Unit 6.

It appears that Unit 2 may be at the same stratigraphic level as that in which the Salisbury-Chamberlain prospects occur south of Rosebery while Unit 4 may represent the Hercules stratigraphic horizon.

The reported occurrence (McIntosh and Reid, 1918) of "a pyritic lode containing pockets of galena" uncovered on sections west of Chester by A.C. Gordon in 1897 (around 5N, 5W on the Chester metric Grid), may in fact be either the Hercules or the Salisbury-Chamberlain stratigraphic level. Certainly Unit 2, where sampled on the northern bank of the Pieman River, gave anomalous values (to 0.58% Pb, 0.16% Zn).

DETAILED GEOLOGY - CHESTER PYRITE MINE.

Mapping of the old Chester workings was completed on a scale of 1:500 (Fig.15) and a long section drawn up (Fig.16).

The bedded pyritic chert was subdivided on the basis of sulphur (and FeS) content, and dip, strike and plunge readings taken.

Five thin (< 1.0 m wide) sheared pelite (shale) bands were mapped within the pyritic chert and these all had a uniform 70° to 85° dip to the east. Plunges on micro-folds and lineations were consistently to the north and averaged 35° to 05° (Table 4).

Two minor (< 1.0 wide) andesitic dykes were seen to cut through the bedded pyritic chert obliquely and may represent post-ore emplacement along former fumarolic feeder channels or vents.

DIAMOND DRILLING.

Thirteen diamond holes (3025.5 m) previously drilled at Chester were re-logged while the three holes from the current programme (CH-1, CH-2, CH-3), totalling 445.5 m, were also logged and assayed (see Table 5 for details plus Appendices 1 to 16 for logs).

Logging of the drill holes confirmed the stratigraphy established on the H.E.C. road traverse and Units 4 to 8 were recognized in the core (see Sections: 10N - Fig.17; 8N - Fig.18; 7N - Fig.14; 6N - Fig.20; 5N - Fig.21; 4N - Fig.22; 2N - Fig.23; 1N - Fig.24).

The best intersections encountered in the drilling were:-

CP-3 2.4 m (D.T.) * x 5.24% Pb, 22.33% Zn, 65.4 g/t Ag
(Sect. 6N) from 516.5 m - 518.9 m in Unit 6
south of Chester Mine.

and

[illegible]

The best assays from the recent drilling (CH-1, CH-2, CH-3) are listed below. The holes did not encounter any significant mineralization:

CH-1	0.015% Pb,	0.045% Zn throughout.
CH-2	1 m x 0.18% Pb,	0.58% Zn 54.0-55.0 m.
CH-3	0.015% Pb,	0.25% Zn -

SOIL GEOCHEMISTRY.

The results of the A^o Horizon sampling programme are shown on the accompanying 1:5000 plans. Separate contours are shown for Cu (Fig.25); Pb (Fig.26); Zn (Fig.27); Mn (Fig.28) and Ba (Fig.29) which may be related to the 1:5000 reduced geology (Fig.30).

Inspection and comparison of the contours will show a disturbing, high correlation between very high manganese results and very high Pb, Ba, Cu, and Zn. Those areas highly anomalous in base metals and highly anomalous in manganese should be discounted especially when it may be demonstrated the manganese is concentrating as a placon in a placosol consisting of leached and bleached eluvium or glacial till. Such manganese/iron accumulations with their occluded base metals are clearly exotic in origin and unrelated to bedrock chemistry/mineralization.

A^o Horizon soil sampling can be shown to give rise to misleading and spurious anomalies in many cases while C horizon sampling has not yet been shown not to work.

All significant Cu, Pb, Zn, Ba anomalies without coincident manganese anomalism deserve further follow-up work. A case such as this occurs north of the Chester pyrite workings. Further follow-up work is required on this anomaly.

In view of the development of Fe/Mn placons (see Appendix 20) in the placosols of N.W. Tasmania, it would appear C horizon sampling is required for all geochemical work involving glacial till or eluvial cover.

GEOPHYSICS.

(a) GROUND MAGNETICS: (Fig.31)

Contouring of the ground magnetic survey results over the old Chester Grid demonstrates that magnetics are able to differentiate the slightly to moderately magnetic Unit 8 lithology (Mt. Black Volcanics) from the magnetite-free sulphur-rich (?aquazone) altered acid tuffs of the Primrose Pyroclastics. This technique may be a useful mapping tool in areas of deep cover.

The most highly altered and heavily pyritized acid tuff areas are characterized by an extremely low (relatively) magnetic response which is often fairly flat.

(b) INDUCED POLARIZATION:

The areas covered by I.P. at Chester are the two east sheets from Line ON to Line 19N. A report by D. Trussell (AAA Geophysicist) is appended (Appendix 17). The anomalies located in this survey should be related to Units 4 and 6 on the 1:5000 geological sheet. It appears that there may be a deep seated response on Line 12N north of the Chester Pyrite Mine and another response on Line 12N further to the east. These may reflect the postulated north plunging massive sulphide mineralization.

It appears that I.P. works extremely well when the sulphides source is shallow (Line 10N, 650 to 750 E).

MINERALIZATION.

Regional:

The 0.15 m (plus) wide massive galena-sphalerite mineralization located on the H.E.C. Road 250 m west of the Marionoak River is on the same stratigraphic level as that at Salmons Claim north of Rosebery (Input Anomaly GAJ). However, this mineralization may always be small and narrow.

Minor bedded chalcopyrite, galena and sphalerite (3 cm thick) in bedded dark chert was located on the H.E.C. Road within Unit 6. This however was very small and discontinuous.

The mineralization located just west of Tullabadine Creek near Mount Block however needs following up as there is considerable potential in that region for a Mackintosh - Mt. Farrell-type ore body (see Fig.32).

CONCLUSIONS.

1. Semi-regional geological traverses have established the continuation northward from Rosebery of:-
 - (i) The Rosebery Group;
 - (ii) The Owen Shear;
 - (iii) The Primrose Pyroclastics stratigraphy including the Host Rock - Lode Horizon.
2. The Chester Pyrite mine occurs at the Rosebery Mine stratigraphic level (Unit 6).
3. The Mt. Black Volcanics (Unit 8) occur about 140 m above the Chester Pyrite Stratigraphic Level (Unit 6).
4. The sulphide mineralization at Chester plunges northwards at 35° and DDH CP-6 passed 110 m below the limit of the pyrite body. (No drilling has been yet completed north of Chester Mine.)

5. A^o Horizon geochemical soil sampling in many cases provides spurious anomalies relating to exotic iron and manganese concentrations while potentially missing any possible mineralization obscured by deep eluvium or till (unreliable and invalid).
6. C horizon geochemical sampling, while expensive and difficult to operate, has not been proven unreliable or invalid.
7. Induced Polarization has been shown to be highly effective in locating shallow (?) massive sulphide concentrations in the Chester Area. With a suitably long charging time it may well be completely reliable over thick (to 50 m) glacial till.
8. Magnetic surveys are effective in denoting highly altered areas.

RECOMMENDATIONS.

1. It is suggested that Rosebery-type ore bodies should only be sought east of the Owen Shear Zone and probably about 700 m above the first volcanic unit of the Primrose Pyroclastics (Unit 6 stratigraphic level).
2. Unit 6, especially north of Chester, should be prospected in greater detail.
3. Search for ore east of Unit 7 and within the Mt. Black Volcanics is not recommended.
4. Three (3) drill holes are proposed to test the northward continuation of the Chester Mineralization on each of Lines 11N, 12N and 13N (total 600 m).
5. A^o Horizon geochemical sampling should be discontinued.
6. C horizon geochemical sampling should be instigated.
7. Induced Polarization should be utilized over all lines gridded within Units 1 to 7.
8. Magnetic surveys should be carried out as a matter of course.

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TABLE 1.STRATIGRAPHY OF THE ROSEBERY GROUP.

Unit	Thickness m (Range)	Lithology
Chamberlain Shale	350 - 330 m	Shale, tuffaceous siltstone.
Stitt Quartzite	550 - 200	Quartz sandstones and ^{argill.} ancillites ^{argillites} (black shales).
Natone Volcanics with Fuchsitic Conglomerate	130 - 300 10 - 20 m	Tuffs and lavas. Conglomerate and green chrome-mica.
Westcott Dolomite	90 - 250	Purple slates.
Munro Creek Shale and Quartzite.	400 - 600	Quartzites and Slates.
	1520 - 1350	

TABLE 2.

STRATIGRAPHY AS EXPOSED ALONG H.E.C. ROAD
FROM PIEMAN RIVER BRIDGE (WEST)
TO E.B. RAILWAY (EAST), CHESTER GRID.

Unit.	Approx. Thickness (Metres)	Lithology.
<u>TOP</u>		
Unit 8	800 mt	Rhyodacitic, andesitic and dacitic autobrecciated <u>lavas</u> (with tuffs) -(?keratophyric).
Unit 7	140	Upper ignimbrites (vitric lapilli tuffs).
Unit 6	100	Fine-grained sediments (clastics and volcaniclastics) including shale and chert.
Unit 5	100	Lower ignimbrites (vitric lapilli acid tuff) with qtz veinlets and disseminated galena/sphalerite.
Unit 4	160	Fine-grained chloritic and sericitic volcaniclastics and clastics - strongly sheared and foliated (-schist)
Unit 3	90	Chloritized re-worked acid tuff with shale fragments and disseminated galena-sphalerite and quartz carbonate veinlets.
Unit 2	10	(Sheared) Black shale with tuffaceous interbeds carrying blebs and transgressive veinlets of galena, sphalerite.
Unit 1	110 m	Med. grained ash-fall tuff (aquagene quartz-plagioclase crystal acid tuff) with disseminated galena, sphalerite.
<u>BASE</u>		
Fault (Owen Shear)		

TABLE 3

MT READ VOLCANICSTHICKNESSLITHOLOGYMT BLACK VOLCANICS

To 3000m

Mainly massive andesitic and dacitic chlorite-bearing (deuteric) lavas/autoclastic breccias made up mainly of albite-chlorite-quartz epidote.

PRIMROSE PYROCLASTICS
(ROSEBERY TYPE-AREA)

450m

Hanging wall massive pyroclasticsComprising

- (a) vitric tuff and vitric crystal tuff
- (b) crystal tuff and lithic tuff with rare slate/shale fragments and occasional thin sediment interbeds and faint stratification locally.

150m

Lode Horizon including "Host rock" and comprising:-

- 30m (a) Black shale/slate with occasional interbeds of volcanic wacke and crystal tuff
- 40m (b) Host rock of tuffaceous siltstone (tuffaceous and sericitic siltstone with crystal tuff interbeds and occasional thin pyrite interbeds).
- 18m (c) Ore - Pb-Zn-(Cu) ore
- 18-90m (d) Footwall schist - sericitic and chloritic ("Host rock" in part)

550m

Footwall Pyroclastics

- (a) Crystal tuffs
 (Vitric lithic crystal lapilli tuffs - Rhyolitic to Dacitic)

TOTAL PRIMROSE PYROCLASTICS

1150m

TOTAL MT READ VOLCANICS

4150m

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ORIENTATION OF SMALL-SCALE FOLD AXES, LINEATIONS AND FOLIATIONCHESTER PYRITE WORKINGS

STRUCTURE	PLUNGE & DIRECTION	FOLIATION	
		STRIKE	DIP
Meso-fold axis	87°/360°	360°	90°
Lineation	26°/015°	012°	76°E
Meso-fold axis	12°/350°	002°	86°E
Lineation	40°/010°	-	-
Lineation	15°/024°	020°	72°E
Meso-fold axis	30°/355°	-	-
Lineation	40°/014°	014°	78°E
Meso-fold axis	32°/360°	?	?
Meso-fold axis	65°/005°	-	-
Meso-fold axis	30°/340°	002°	88°E
Meso-fold axis	45°/010°	010°	90°
Meso-fold axis	26°/010°	-	-
Lineation	30°/360°	-	-
Meso-fold axis	35°/360°	-	-
Lineation	30°/352°	-	-
<u>Average</u>	36.4°/005° say 35° to 005°	-	-

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TABLE 5.

CHESTER DRILLING

Drill N. Line (Section)	Length	Old Co-ords.		New Co-ords.		Initial Azimuth and initial declin
		N	E	N	E (field)	
1. CP - 3 Line 6N RL 638	602.9	6.00N	1.20E	6N	110.4E	(s) 45° to 085° (L) 45° to 080° say 45 to 085
2. CP - 4 Line 4N	250.0	4.00N	7.01E	4N	702E	(s) 50° to 260° (L) 50° to 258° - 52 to 256
3. CP - 5 Line 6N RL 524	160.3	MCE 6.00N	7.04E	6N	646E	(s) 49° to 258° (L) 49° to 258° (6m Sth) 48 to 258
4. CP - 6 Line 10N	300.0	10.00	8.33	10N	821E	(s) 30° to 258° (30 to 258)
5. CP - 11 Line 6N RL 524	204.9	6.00N	6.20E	6N	589E	(s) 50° to 203° (L) 50° to 203° (3m Sth) -50 to 206
6. CP - 16 Line 4N	200.0	4.00N	6.00E	4N	600E	(s) 46° to 078° (L) 46° to 075° say 46° to 077
7. CP - 17 Line 5N	150.0	5.00N	6.04E	5N	604E	(s) 45° to 077° (L) 45° to 078° - 54 to 75
8. CP - 18 Line 6N RL 524	146.5	5.9 IN	5.77E	6N	575E	(s) 45° to 077° (L) 45° to 077° (9m Sth) 45 to 077 Calc.
9. CP - 19 Line 2N	120.0	2.00N	6.88E	2N	690E	(s) 19° to 259° (L) 19° to 259° (19 to 259)
10. CP - 20 Line 2N	166.6	2.00N	6.95E	2N	697E	(s) 45° to 078° (L) 45° to 078° (45 to 078)
11. CP - 21 Line IN	250.0	IN	6.1E	IN	611E	(s) 21° to 250° (L) 21° to 258° -22 to 255
12. CP - 22 Line IN	300.0	IN	6.17E	IN	619E	(s) 44° to 078° (L) 44° to 078° -46 to 080
13. CP - 23 Line 6N RL 490	175.0	530N 530N	723E 723E	6N	734E	(s) 30° to 250° (L) 30° to 250° -33 to 251
14. CH - 1 Line 8N	151.5	Proposed=800N		8N	748E	(P) 50° to 258° (6m Sth) 49 to 266
15. CH - 2 "Line 7N"	148.5	Proposed=700N		7N	752E	(P) 50° to 258° (26m Sth) -47 to 258

16.Ch - 3
Line 2N

145.5
Proposed=200N

2N 755E
760E(7m Nth)-49 to 259 (P) 50° to 258°

TOTAL

3471.7
=3500

BIBLIOGRAPHY

<u>Ref. No.</u>	<u>Author.</u>	<u>Year.</u>	<u>T i t l e.</u>
1	K.J. Finucane	1932	Preliminary Report on Geological Survey of the Rosebery District, Tasmania - I.
2	B. Campana, S.B. Dickinson, D. King and R.S. Matheson	1958	The Mineralized rift valleys of Tasmania.
3	M.R. Banks, M. Solomon	1960	Cambrian Succession in West Tasmania
	A.H. Blissett, A.B. Gulline	1960	The Proterozoic-Upper Cambrian Succession in West Tasmania
4	B. Campana, D. King	1963	Palaeozoic Tectonism, Sedimentation And Mineralization in West Tasmania
5	D.I. Groves, A.J. Noldart	1964	Geology of the Tullah Mining Field
5a	M. Solomon	1965	Geology and Mineralization Of Tasmania
5b	G. Hall, V.M. Cottle. P.B. Rosenhain, R.R. McGhie, J.G. Druett	1965	Lead-Zinc ore Deposits of Read-Rosebery
6	G. Loftus-Hills, M. Solmon, R.J. Hall	1967	The Structure of the Bedded Rocks West of Rosebery, Tasmania
7	C.E. Gee, J.B. Jago, P.G. Quilty	1970	The Age of the Mt Read Volcanics in the Que River Area, Western Tasmania
8	P.G. Quilty	1971	Cambrian and Ordovician Dendroids and Hydroids of Tasmania
9	R.L. Brathwaite	1972	The Structure of the Rosebery Ore Deposit, Tasmania
10	J.B. Jago, K.O. Reid, P.G. Quilty, G.R. Green, B. Daily	1972	Fossiliferous Cambrian Limestone From Within the Mt Read Volcanics, Mt Lyell Mine Area, Tasmania

BIBLIOGRAPHY (cont'd)

<u>Ref. No.</u>	<u>Author.</u>	<u>Year</u>	<u>T i t l e.</u>
11	J.B. Jago	1973	Paraconformable Contacts Between Cambrian and Junee Group Sediments in Tasmania
12	M.J. Rubenach	1974	The Origin and Emplacement of the Serpentine Hill Complex, Western Tasmania
13	M. Solomon, J.R. Griffiths	1974	Aspects of the Early History of the Southern Part of the Tasmania Orogenic Zone
14	K.D. Corbett, K.O. Reid, E.B. Corbett, G.R. Green, K.Wells, N.W. Sheppard	1974	The Mount Read Volcanics and Cambrian-Ordovician Relationships at Queenstown, Tasmania
15	R.L. Brathwaite	1974	The Geology and Origin of the Rosebery Ore Deposit, Tasmania
16	K.D. Corbett	1975	Preliminary Report on the Geology of the The Red Hills-Newton Creek area, West Coast Range, Tasmania
17	C.C.J. Burton	1976	Rosebery Zinc-Lead-Copper Orebody
18	M. Solomon, G.R. Green	1976	Ore Deposits fo Western Tasmania
19	N.C. White	19	Cambrian Volcanic Rocks of South- West Tasmania
20	B.L. Taylor B.Sc.	1954	Progress Report on the North Pieman Mineral Area

021

170022

APPENDIX

Nos. 1 - 16.

DRILL LOGS

022

170023

APPENDIX 1.

Page 1

AUSTRALIAN ANGLO AMERICAN LIMITED

PROJECT: COMSTAFF, TASMANIA

LOREHOLE No. CP-3

TYPE DDH

CO-ORDINATES (NEW) 6N 110.4E

INCLINATION 45°

DIRECTION 085°

DATE -

DATE -

LOGGED BY D.J. PERKIN

DRILL -

FINAL DEPTH 602.9m

N.W.P.S.

DEPTH		DRILLED METRES	REC. METRES	SAMPLE INT.	SAMPLE NO.	DESCRIPTION	ASSAY RESULTS					
FROM	TO											
						(0.0-149.8) Quartz crystal rhyolitic tuff with 10% pyrite (Range 2%-15% Pyrite) in essentially a siliceous matrix. Fine to medium grained. Moderately to strongly altered. Estimated quartz crystals 20% (Range 5-30% quartz) with subordinate altered plagioclase (15%) now greenish yellow sericite and ferroan dolomite alteration (2-5%).						
						Two x 0.5 cm slightly pyritic chert bands at 41.6 m (CBA = 30°).						
						Andesitic dykes (rarely flows) at:-						
						47.2-48.4 Fine grained, slightly vesicular with calcite in vesicles.						
						64.6-64.8 Vesicular with voids - lacking foliation.						
						69.5-71.2 As above.						
						76.4-77.7 Slightly vesicular.						
						80.3-81.8 No vesicles - Fine-medium grained with unaligned plagioclase crystals.						
						126.4-133.2 Vesicular with chlorite and ferroan calcite in vesicles and occasional sub-rounded (?) fragments - weak (?) CBA = 45°.						
						(149.8-243.2) Sheared sericite quartz crystal rhyodacitic tuff with 10% pyrite in mainly quartzofeldspathic matrix. Medium grained. Moderately to strongly altered and moderately sheared. Estimated quartz crystals 20% with subordinate altered plagioclase (now grey-white sericite) with moderate sericite in matrix (est. 15%) enhancing schistosity. Rare creamy ferroan dolomite alteration.						
						Chloritic andesitic dykes (rarely flows) at:-						
						162.9-163.7 (?) CBA = 40°						
						178.2-178.9 (?) CBA = 40°						
						188.5-190.4 (?) CBA = 40° - crystalline unaligned texture?						
						199.0-200.1 (?) - crystalline unaligned texture.						
						221.4-212.0 as above						
						233.0-233.4 as above						
						234.8-235.5 as above						
						2 to 5 cm bands of sub massive pyritic chert (to 50% pyrite) at:-						
						176.8 CBA = 50°						
						177.3 CBA = 70°						
						191.8 CBA = 21°?						
						202.0 CBA = 46°						
						221.7 CBA = 65°						

023

170024
APPENDIX 1.

Page 2

AUSTRALIAN ANGLO AMERICAN LIMITED

PROJECT: _____

BOREHOLE No. CP-3 (cont'd)

TYPE _____

CO-ORDINATES _____

INCLINATION _____

DIRECTION _____

DATE
START _____DATE
FINISH _____

LOGGED BY _____

DRILL _____

FINAL DEPTH _____

N.W.P.S.

DEPTH		DRILLED METRES	REC. METRES	SAMPLE INT.	SAMPLE NO.	DESCRIPTION	ASSAY RESULTS							
FROM	TO													
						(243.2-254.0) Quartz crystal rhyolitic tuff with 10% pyrite (2-15%) in essentially siliceous matrix. Fine to medium grained. Moderately to strongly altered. Estimate quartz crystal content 20% (5-30%) with subordinate altered plagioclase (now sericite).								
						A 0.05 cm band of pyritic chert occurs at 248.0 with a CBA = 60°.								
						(254.0-268.4) Tuffaceous chert (or cherty rhyolite) with 5-10% pyrite. Medium grained quartz-ferroan dolomite blebs (creamy colour) 10% with sericite and pyrite in cherty matrix. Occasional CBA = 65°. Moderately to strongly altered.								
						(268.4-508.5) Lithic lapilli dacitic (plagioclase quartz crystal) tuff. - coarse grained fragments (1 mm to 20 mm) to 60% in fine-medium grained siliceous (and quartzofeldspathic) matrix. Slightly to moderately altered (moderately chloritic with occasional minor more altered patches of pyrite/sericite). Essentially non-pyritic (< 3% Py). Greenish grey colour and characterised by void-filling secondary quartz (to 5%); ferroan dolomite (to 2%) and very fine grained buff leucoxene (1%) - slightly reworked?								
						Andesitic dyke at:-								
						316.5-316.9 - Slightly banded at margin (CBA = 30-35° - intrusive flow fragment alignment(?)).								
						(508.5-516.5) Fine to medium grained lithic (?) dacitic tuff. Moderately altered with moderate chlorite, greenish sericite and minor pyrite (est. ≈ 3% pyrite) - irregular 1.0 mm chlorite veins in places - Reworked(?) and transitional with a tuffaceous siltstone(?). CBA = 70°.								
						(516.5-518.9) Generally massive moderately banded galena and sphalerite with barite. Strongly altered with total greenish sericitic/quartz alteration of gangue in places. CBA = 45° (25°-60°).								
						(518.9-520.5) Fine grained lithic tuff with occasional (20%) lithic fragments to 2 mm in a fine grained matrix (80%). Moderately altered with chloritized fragments in greenish grey sericitic matrix. Minor pyrite only (< 3% py.). Minor secondary ferroan dolomite as blebs to 1 cm. - occasional to minor barite.								

024

AUSTRALIAN ANGLO AMERICAN LIMITED

PROJECT:

1 OREHOLE No. CP-3 (cont'd)

TYPE.....

CO-ORDINATES.....

INCLINATION.....

DIRECTION

DATE
START DATE _____
FINISH _____

LOGGED BY.....

DRILL

FINAL DEPTH _____

N.W.P.S.

[illegible]

025

170026

AUSTRALIAN ANGLO AMERICAN LIMITED

APPENDIX 1.

Page 1

PROJECT: _____

LOREHOLE No. CP-4

TYPE DDH

CO-ORDINATES (NEW) 4N: 702E

INCLINATION 50°

DIRECTION 258°

DATE -
STARTDATE -
FINISH

LOGGED BY D.J. PERKIN

DRILL -

FINAL DEPTH 250.0

N.W.P.S.

DEPTH		DRILLED METRES	REC. METRES	SAMPLE INT.	SAMPLE NO.	DESCRIPTION	ASSAY RESULTS					
FROM	TO											
						(0.0-116.2) Lithic (lapilli plagioclase crystal) dacitic tuff - greenish grey to greenish. Slightly to moderately altered with minor greenish sericite and moderate chlorite and little pyrite (<1%).						
						- moderate greenish sericite zones 47.8-51.0, and in 0.1 m wide patches throughout from 69.0-116.2.						
						Greenish-brown to pinkish more siliceous zone with moderate sericite (to 20%) and secondary quartz and ferroan dolomite (to 5% each) 78.0-80.0.						
						More altered grey siliceous sericite zones within lapilli tuff with pyrite to 5% and quartz ferroan dolomite (to 5% each) 94.6-98.4; 114.0-116.2.						
						Lapilli fragments to 2-3 cm disseminated sparsely throughout. CBA (schistosity?) = 30-60°.						
						Chloritic green andesitic dykes (?flows) at:-						
						3.3- 3.6 Slightly vesicular.						
						28.1-28.4 As above and slightly banded at margin with CBA = 35°.						
						(116.2-123.0) Lithic lapilli quartz plagioclase crystal rhyodacitic tuff. Grey. Moderately to strongly altered with moderate greenish grey sericite (to 30%), pervasive cherty silica, and pyrite to 5%.						
						Lapilli fragments to 20 mm.						
						Trace galena in quartz veinlet 117.6. Occasional ferroan dolomite/quartz blebs throughout.						
						A 1 cm (?) pelitic band 122.99-123.0.						
						(123.0-127.3) Andesitic dyke (?lava) - moderately banded and possibly fragmental in part. Vesicular with voids probably ex fine-grained sulphide (pyrite ± galena) CBA = 70-80°.						
						(127.3-152) Sheared sericitic quartz crystal rhyodacitic tuff with 5-10% pyrite in mainly quartzofeldspathic matrix-medium grained with occasional (?) lapilli sized fragments. Moderately to strongly altered and moderately sheared. Creamy to buff in colour with occasional ferroan dolomite blebs (?after plagioclase) to 5%.						
						- Probable thin (1cm) pelitic bands at 142.8 and 143.0.						
						- Pyritic to 10-20% in places while siliceous grey white pyrite-poor zone occurs 142.8-143.0.						
						CBA = 70-80°.						

027

PROJECT:

DIRECTION 258°

FINAL DEPTH 160.3

N.W.P.S.

[illegible]

028
170029

AUSTRALIAN ANGLO AMERICAN LIMITED

PROJECT: COMSTAFF TASMANIA

LOREHOLE No. CP-6

TYPE DDH

CO-ORDINATES (NEW) 10 N 821 E

INCLINATION -30°

DIRECTION 258°

DATE -
STARTDATE -
FINISH

LOGGED BY D.J. PERKIN

DRILL -

FINAL DEPTH 300.0

N.W.P.S.

DEPTH		DRILLED METRES	REC. METRES	SAMPLE INT.	SAMPLE NO.	DESCRIPTION	ASSAY RESULTS					
FROM	TO											
						(0.0-59.5) Lithic (lapilli) (quartz plagioclase crystal) dacitic tuff						
						- moderately altered with moderate chlorite and minor sericite and pyrite						
						(3%) and occasional ferroan dolomite alteration of plagioclase. CBA = 45-55°.						
						More sericitic and pyritic (5-10% pyrite) zones 0.0-12.2.						
						Green fine grained andesitic tuff/(?dyke) 54.6-56.8 with well defined						
						alternating bands and occasional vesicular voids (CBA Bands = 35-40°).						
						(59.5-78.0) Andesite dyke - green fine grained non-layered non-foliated,						
						structureless and massive. Occasional quartz and calcite veinlets throughout.						
						- Irregular margins - occasional calcite filled vesicles - possibly						
						two phases.						
						(78.0-86.0) Quartz plagioclase (lithic) rhyodacitic (lapilli) tuff.						
						- Medium coarse grained - moderately altered with moderate silicification,						
						sericite and occasional chlorite with pyrite 2-5%.						
						- Lithic fragments average 4mm. Grey-buff in colour overall.						
						(86.0-144.9) (Lithic lapilli quartz plagioclase crystal) rhyodacitic tuff.						
						- Grey to creamy buff in colour, medium-coarse grained.						
						Moderately - strongly altered with moderate sericite and pervasive						
						quartz and (average 5%) medium-coarse grained pyrite. CBA = 35-50°.						
						Occasional pyritized and sericitized lapilli to 3 cm - essentially						
						undestroyed outlines.						
						Very siliceous grey white (pseudo quartzite) zone 91.2-92.6.						
						Andesitic probable dykes 106.0-108.8 (slightly vesicular)						
						110.0-113.4 " "						
						118.0-134.3 This is a large mass of probable						
						dyke origin (- in spite of creamy margins with aligned "flow" texture,						
						this orientation is normal to distinctive banding/foliation in adjacent						
						pyritised/sericitized crystal tuff).						
						- Occasional hematite /calcite/quartz veinlets throughout - moderately						
						vesicular and quite fine grained.						

029
170030

AUSTRALIAN ANGLO AMERICAN LIMITED

PROJECT: CONSTAFF TASMANIA

LOREHOLE No. CR-6 (cont'd)

TYPE

CO-ORDINATES

INCLINATION

DIRECTION

DATE
START DATE
FINISH

LOGGED BY

DRILL

FINAL DEPTH

N.W.P.S.

DEPTH		DRILLED METRES	REC. METRES	SAMPLE INT.	SAMPLE NO.	DESCRIPTION	ASSAY RESULTS			
FROM	TO									
						(144.9-150.8) Andesitic dyke (tuff lava) - green, fine grained with flow alignment at sharp angle to schistosity at 146.3 and conformable contact 150.8 (wedge of altered rhyodacitic tuff 145.8-146.3)				
						- slightly vesicular.				
						(150.8-171.6) (Lithic quartz crystal) rhyolitic tuff. Grey to creamy in colour - fine medium grained.				
						Strongly altered (strong - moderate?) with pervasive silicic and sericitic (to 30%) alteration with moderate pyrite (10% - Range 5-20%).				
						Fine grained pelitic sediments (to 2 cm thick) at 151.6 and 151.8 and with associated very fine grained pyrite at 164.3.				
						- Fairly massive 2-4 cm fine-medium grained pyrite bands at 152.3 and 163.3. CBA = 45-55°.				
						Andesitic dykes at 154.7-156.3 and 163.4-171.4 (structureless with vesicles-fine grained at margins and coarser grained in the centres with slightly porphyritic plagioclase).				
						(171.6-228.0) (Lapilli) lithic (quartz plagioclase crystal) rhyodacitic tuff.				
						- moderately strongly altered with moderate pervasive silicification and greenish sericite (25-30%) and minor to moderate pyrite (Average 5%).				
						- Very occasional lapilli fragments to 3 cm - CBA = 60°.				
						- Fine-medium grained andesitic 187.9-189.1.				
						More pelitic zones (to 5 cm thick) at 183.5, 208.0, 209.0, 221.0, 226.0.				
						More silicic zone with less pyrite, less sericite 191.6-195.2.				
						(228.0-300.0) (Lapilli Lithic) quartz plagioclase crystal rhyodacitic tuff.				
						- Moderately altered to moderately strongly altered with 3-5% pyrite and moderate ferroan dolomite alteration of plagioclase, moderately sericitized and fairly pervasive silicic alteration; rare lapilli fragments to 15 mm.				
						CBA = 60-65°				
						E. O. H.				

030
170031

AUSTRALIAN ANGLO AMERICAN LIMITED

PROJECT: COMSTAFF TASMANIA

APPENDIX 1.

Page 1

BOREHOLE No. CP-11

TYPE DDH

CO-ORDINATES (NEW) 6 N; 589 E

INCLINATION 50°

DIRECTION 203°

DATE START

DATE FINISH

LOGGED BY D.J. PERKIN

DRILL

FINAL DEPTH 204.9

N.W.P.S.

DEPTH		DRILLED METRES	REC. METRES	SAMPLE INT.	SAMPLE NO.	DESCRIPTION	ASSAY RESULTS					
FROM	TO											
						(0.0-5.2) No core recovery.						
						(5.2-79.4 Medium grained lithic (plagioclase crystal) dacitic (lapilli) tuff. Greenish. Moderately altered with moderate chlorite sericite and minor pyrite (<1%).						
						Moderate secondary quartz and ferroan dolomite (5% each), ferroan dolomite replacing plagioclase.						
						Occasional lapilli fragments, especially 49.0-72.0.						
						CBA poorly defined - estimated 30-45°.						
						Pinkish brown more siliceous zones 55-63; 65-66; 68-72.						
						About 12x1 cm - 5 cm bands of very fine grained pelite (brown-grey shale) 72.3-77.3 with associated thin banded fine grained pyrite - micro folded in parts.						
						CBA varies 45°-50° (Range 30°-60°)						
						(79.4-116.1) Quartz crystal rhyolitic tuff with 10% pyrite (Range 2-15%) in essentially siliceous matrix. Moderately-strongly altered with sericite 15% and pyrite. Little ferroan dolomite or carbonatized plagioclase (<2%).						
						- 5 cm band of massive fine-medium grained pyrite 106.6. More carbonate (to 5-10%) 111.4-116.1.						
						CBA 40-50° (Average 45°).						
						(116.1-124.0) Andesite dyke - slightly vesicular in places.						
						(124.0-204.9) Quartz crystal rhyolitic tuff with 5% pyrite (Range 2-10%) in mainly siliceous matrix. Moderately-strongly altered with sericite (10%).						
						Lithic ferroan dolomite or carbonated plagioclase.						
						Reworked quartz fragments 124.0-128.8 with more sandy siliceous zone 127.0-127.3.						
						Carbonate blebs (to 10%) 128.8-135.2						
						Andesite dyke 135.2-136.3						
						More siliceous sandy zones lacking pyrite at:-						
						147.2-147.5						
						155.0-160.0						
						162.1-162.9						
						CBA 50-60° (Average 55°).						

170032

PROJECT: COMSTAFF TASMANIA

Page 1

LOREHOLE No. CP-16

TYPE DDH

CO-ORDINATES (NEW) 4 N, 600 E

INCLINATION.....46°

DIRECTION 077°

DATE
START DATE -
FINISH *****

LOGGED BY D. J. PERKIN

DRILL -

FINAL DEPTH 200.0 m

N.W.P.S.

[illegible]

170033

AUSTRALIAN ANGLO AMERICAN LIMITED

PROJECT: COMSTAFF - TASMANIA

APPENDIX 1.

Page 1

LOREHOLE No. CP-17

TYPE DDH

TYPE DDH

CO-ORDINATES (NEW).....5.....N:.....604 E

INCLINATION 45°

DIRECTION 077°

DATE _____
START DATE _____
FINISH

LOGGED BY D. J. PERKIN.....

DRILL

FINAL DEPTH 150 m

N.W.P.S.

[illegible]

034
170035

AUSTRALIAN ANGLO AMERICAN LIMITED

PROJECT: COMSTAFF TASMANIA

LOREHOLE No. CP-19

TYPE DDH

CO-ORDINATES (NEW) 2 N: 690 E

INCLINATION 19°

DIRECTION 259°

DATE START -

DATE FINISH -

LOGGED BY D.J PERKIN

DRILL -

FINAL DEPTH 120.0 m

N.W.P.S.

DEPTH		DRILLED METRES	REC. METRES	SAMPLE INT.	SAMPLE NO.	DESCRIPTION	ASSAY RESULTS					
FROM	TO											
						(0.0-45.3) Lithic (lapilli) (plagioclase crystal) dacitic tuff. Greenish grey to greenish. Slightly to moderately altered with minor greenish sericite (5-10%) and moderate chlorite and little pyrite (<1%); - occasional lapilli fragments to 1-2 cm.						
						Moderately altered more sericitic zones with pyrite to 5%, and ferroan dolomite and secondary quartz blebs to 5% each from 14.0-16.0, 27.0-30.0, 37.0-43.0, (poor recovery).						
						Andesitic dykes/(flows) 36.0-36.2 moderately vesicular						
						44.8-45.1 " "						
						(45.3-64.2) Lithic (lapilli) quartz plagioclase crystal rhyodacitic tuff.						
						Grey to creamy grey. Moderately - strongly altered with moderate greenish grey sericite (to 30%), pervasive cherty silica, and pyrite to 5%; - secondary quartz and ferroan dolomite to 10% and 5% respectively.						
						(64.2-67.1) Andesite dyke (?lava/tuff). Moderately layered especially at 64.2-64.3 where creamy in colour and reminiscent of very fine grained tuffaceous pelite (CBA = 40°).						
						Rarely vesicular.						
						(67.1-70.5) Lithic plagioclase crystal dacitic tuff. Greenish grey to buff grey - moderately altered with minor to moderate sericite, pyrite (to 3%).						
						(70.5-84.3) Andesitic dykes/(tuff lavas) - moderately layered and foliated throughout (CBA 40-60°) - green and chloritic - fine grained.						
						Moderately altered sericitic and pyritic (2-5%) lithic plagioclase crystal tuff interbeds 76.2-76.6 and 80.3-81.7.						
						(84.3-120.0) Lithic plagioclase crystal dacitic (lapilli) tuff. Greenish grey to buff grey. Moderately altered with minor to moderate sericite and chlorite with pyrite (2-5%) - some secondary quartz blebs throughout, especially 119.0-120.0, and occasional minor ferroan dolomite alteration of plagioclase.						
						CBA indistinct but 40-50° - occasional vitric lapilli fragments throughout interval.						
						E. O. H.						

035
170036

AUSTRALIAN ANGLO AMERICAN LIMITED

PROJECT: COMSTAFF TASMANIA

APPENDIX 1.

Page 1

LOREHOLE No. CP-20

TYPE DDH

CO-ORDINATES(NEW) 2 N; 697 E

INCLINATION.....45°.....

DIRECTION 078°

DATE
START DATE _____
FINISH _____

LOGGED BY D.J. PERKIN

DRILL

FINAL DEPTH 166.6.....

N.W.P.S.

[illegible]

036
170037

AUSTRALIAN ANGLO AMERICAN LIMITED

PROJECT: COMSTAFF TASMANIA

APPENDIX 1.

Page 1.....

LOREHOLE No.....CP-21.....

TYPE DDH.....

CO-ORDINATES (NEW) 1 N; 611 E

INCLINATION.....22.....

DIRECTION 255°

DATE START

DATE _____
FINISH _____

LOGGED BY D.J. PERKIN

DRILL

FINAL DEPTH 250 m

N.W.P.S.

DEPTH		DRILLED METRES	REC. METRES	SAMPLE INT.	SAMPLE NO.	DESCRIPTION	ASSAY RESULTS					
FROM	TO											
						(0.0-54.5) Lithic (lapilli) plagioclase crystal dacitic tuff. Medium grained. Greenish grey - greenish. Slightly - moderately altered with moderate primary chlorite and no visible pyrite (<1%) (essentially unsheared). Andesitic dyke/(? flow/tuff) 22.3-22.7 (slightly foliated - CBA = 70°) More altered grey quartz-sericite zones with up to 5% pyrite 0.0-12.0 and 35.0-35.3 and in smaller intervals throughout. CBA = 70°.						
						(54.5-114.0) Vitric lithic rhyodacitic lapilli tuff. Medium-coarse grained. Pinkish and yellowish green. Moderately altered with greenish sericite to 25%, pinkish quartz and quartzofeldspathic matrix. Wispy fluidal vitric texture with fragments averaging 1 cm throughout. Coarse grained lapilli fragments average 2-4 cm 74.8-79.3 (tuff lava Breccia). More altered finer grained (texturally destroyed) grey zones with sericite (to 30%), pervasive silica and pyrite to 5%, 79.9-82.0, 88.4-89.7. Occasional slightly dolomitized plagioclase crystals throughout (creamy ferroan dolomite blebs)						
						3 x 1 cm (?) tuffaceous chert beds 54.5-57.3 with distinctive cross fractures normal to banding/bedding. CBA fairly distinct throughout - 70-80°. Fine even grained light greenish andesitic dyke(?flow/tuff) 108.4-108.6 with CBA = 50?; creamy even grained medium grained rhyodacitic dyke/(?flow/tuff) 109.5-110.0 with CBA contact irregular 70°-35°.						
						(114.0-146.3) Lithic (plagioclase crystal) dacitic tuff. Greensih grey. Fine-medium grained. Moderately altered with moderate chlorite and variable minor sericite. More altered siliceous sericitic zones with average 5-10% pyrite 118.2-120.5 (with massive fine - medium grained pyrite 119.8-119.9 with CBA banding in pyrite = 50°) and at 130.0-133.7. Pink quartz-rich zone with moderate greenish sericite (no pyrite) 123.8-124.4 . CBA = 40-60° generally.						

038
170039

AUSTRALIAN ANGLO AMERICAN LIMITED

PROJECT: COMSTAFF TASMANIA

APPENDIX 1.

Page 1

BOREHOLE No. CR-22

TYPE DDH

CO-ORDINATES (NEW) 1 N; 619 E

INCLINATION 44°

DIRECTION 078°

DATE START -

DATE FINISH -

LOGGED BY D.J. PERKIN

DRILL -

FINAL DEPTH 300.0 m

N.W.P.S.

DEPTH		DRILLED METRES	REC. METRES	SAMPLE INT.	SAMPLE NO.	DESCRIPTION	ASSAY RESULTS					
FROM	TO											
						(0.0-36.2) Lithic (lapilli) plagioclase crystal dacitic tuff. Greenish.						
						Slightly - moderately altered with moderate chlorite (to 20%) and sericite						
						with patches (5 cm) of more intense sericite. CBA = 30-40°.						
						Moderately oxidised (oxidised completely in 1 m sections to 97 m, with						
						limonite on fracture planes to 214 m).						
						Lithic fragments up to 2 cm across.						
						(36.2-69.9) Lithic (lapilli) plagioclase crystal dacitic tuff. Yellowish-						
						buff. Moderately altered with moderate sericite (to 20%), accompanied by moderate						
						silicification and pyrite (2-5%). Ferroan dolomite alteration (5-10%) of						
						plagioclase. CBA = 35°.						
						(69.9-76.3) (Lithic) quartz plagioclase crystal rhyodacitic tuff. Grey.						
						Moderately - strongly altered with moderate sericite and pervasive silica						
						associated with pyrite (10% - range 2-20%) - trace Pb/ZnS.						
						(76.3-103.3) Lithic (lapilli) plagioclase crystal dacitic tuff. Greenish						
						grey to buff. Slightly - moderately altered with moderate ferroan dolomite						
						alteration of plagioclase crystals and moderate chlorite alteration of						
						lithic fragments and matrix (5-10%), and occasionally more sericitic zones.						
						Lapilli fragments to 1.5 cm.						
						Very poor recovery 91.1-103.3 but andesite dyke (tuff-lava), slightly						
						vesicular occurs 92.0-92.2.						
						CBA = 30°.						
						(103.3-300.0) Lithic (lapilli) dacitic tuff. No obvious plagioclase crystal						
						component. Slightly - moderately altered to 208.0 with minor chlorite and						
						occasional sericite zones and patches with moderately altered more siliceous						
						greenish sericitic zone 125.0-127.0 and moderate greenish sericite 135.0-156.0.						
						Essentially no alteration 208.0-300.0.						
						Lapilli fragments to 20 mm, CBA = 35-45°?						
						Green fine grained andesitic dykes/(?tuff.lavas) at:-						
						133.4-134.8 - Slightly foliated dyke (?) CBA = 30°.						
						171.9-172.1 - Irregular margins - dyke?						
						180.0-181.6 - Irregular dyke(?) with chilled margins - chlorite and calcite						
						filled vesicles.						

Page 2

PROJECT: COMSTAFF-TASMANIA

LOREHOLE No. CP-22

TYPE.....

CO-ORDINATES.....

INCLINATION.....

DIRECTION

DATE
START DATE
FINISH

LOGGED BY

DRILL

FINAL DEPTH

N.W.P.S.

[illegible]

040
170041

AUSTRALIAN ANGLO AMERICAN LIMITED

PROJECT: COMSTAFF TASMANIA

APPENDIX 1.

Page 1

LOREHOLE No. CP-23

TYPE DDH

CO-ORDINATES (NEW) 6 N; 734 E

INCLINATION 33°

DIRECTION 251°

DATE START

DATE FINISH

LOGGED BY D.J. PERKIN

DRILL

FINAL DEPTH 175.0m

N.W.P.S.

DEPTH		DRILLED METRES	REC. METRES	SAMPLE INT.	SAMPLE NO.	DESCRIPTION	ASSAY RESULTS				
FROM	TO										
						(0.0-64.2) Lithic (plagioclase crystal-lapilli) dacitic tuff. Medium grained, greenish. Moderately altered with moderate chlorite, minor sericite and trace pyrite (<2%). Occasional lapilli fragments to 2 cm. Ferroan dolomite and secondary quartz to 3% each.					
						Pink brown more siliceous zone 37.4-48.0 with ferroan dolomite 5-10%.					
						CBA about 45°.					
						(64.2-95.0) Fine-medium grained lithic (plagioclase crystal) lapilli dacitic tuff. Grey green to pink brown. Moderately altered with moderate chlorite, minor sericite and minor pyrite (1-5%) with trace Pb/Zn sulphides as disseminations and associated with quartz carbonate chlorite veining 64.2-74.5.					
						Ferroan dolomite and secondary quartz to 5% each.					
						Occasional lapilli fragments to 2 cm noted.					
						CBA average about 50°.					
						(95.0-163.6) Medium grained lithic (plagioclase crystal) lapilli dacitic tuff. Greenish-brown. Moderately altered with chlorite, minor sericite and trace pyrite (<1%). Lapilli fragments up to 3 cm. Ferroan dolomite and secondary quartz to 2% each.					
						CBA average about 55°.					
						Andesite dykes 135.5-136.5					
						150.6-155.5					
						(163.6-166.0) Andesitic dyke.					
						(166.0-175.0) Quartz crystal rhyolitic tuff with 5-10% pyrite. Grey-white. Moderately-strongly altered with sericite and pyrite and trace Pb/Zn sulphides.					
						More siliceous zone 166.0-172.0 with occasional quartz-rich "sandy" and "cherty" patches.					
						Submassive coarse grained pyrite 170.0-170.1. Ferroan dolomite to 5% 172.0-174.0.					
						More sericite 172.0-175.0 enhancing schistosity. Very sheared and broken 174.0-175.0 (sericite schist clay).					
						CBA average about 65°					
						E. O. H.					

041

170042

AUSTRALIAN ANGLO AMERICAN LIMITED

PROJECT: COMSTAFF TASMANIA

COREHOLE No. CH-1

TYPE DDH

CO-ORDINATES 8 N, 748 E

INCLINATION 49°

DIRECTION 266°

DATE - 1977
STARTDATE - 1977
FINISH

LOGGED BY D.J PERKIN

DRILL DDH

FINAL DEPTH 151.5m

N.W.P.S.

DEPTH		DRILLED METRES	REC. METRES	SAMPLE INT.	SAMPLE NO.	DESCRIPTION	Sample		ASSAY RESULTS (CHIP SAMPLING)				
FROM	TO						No. (EAD)	FROM	TO	Cu	Pb	Zn	
						(0.0-127.5) (Lithic lapilli) (quartz) plagioclase crystal dacitic tuff.	T4601	0	6	20	20	180	
						Greenish - greenish grey to buff. Medium (to coarse) grained. Slightly -	02	6	9	18	20	48	
						moderately altered with moderate chlorite and minor sericite (to 20% average	03	9	12	14	16	70	
						- 10%) and pyrite (to 3%) - occasional alteration of plagioclase to ferroan	04	12	15	18	20	56	
						dolomite.	05	15	18	14	24	76	
						Pinkish more siliceous moderately altered zones with more sericite and	06	18	21	16	36	60	
						pyrite (to 25% and 5% resp.) at:-	07	21	24	20	58	170	
						22.0-39.0	08	24	27	18	94	100	
						101.0-108.1	09	27	30	12	76	68	
						111.5-127.5	10	30	33	24	30	62	
						Green fine grained andesite dykes/(tuff-lavas) at:-	11	33	36	40	20	24	
						85.5-87.0 (tuff-lava?)	12	36	39	22	20	16	
						89.2-94.2 (dyke?)	13	39	42	34	26	28	
							14	42	45	22	26	32	
						(127.5-151.5) (Lithic lapilli) quartz plagioclase crystal rhyodacitic tuff.	15	45	48	26	20	28	
						Grey to grey-creamy-buff. Medium-coarse grained.	16	48	51	18	22	58	
						Moderately - strongly altered with moderate sericite (to 30%) and	17	51	54	22	30	460	
						pervasive silicification and moderate pyrite (5-10%). CBA is indistinct =	18	54	57	48	26	38	
						45°?	19	57	60	54	40	54	
						Moderate alteration of plagioclase to ferroan dolomite(?) with secondary	20	60	63	24	24	52	
						quartz?	21	63	66	50	24	52	
						Fine grained andesite dyke(?) 146.1-147.1.	22	66	69	28	26	50	
							23	69	72	20	30	34	
						E. O. H.	24	72	75	10	24	34	
							T4625	75	78	24	36	36	
							T4626	78	81	18	38	46	
							27	81	84	16	114	88	
							28	84	87	470	38	70	
							29	87	90	70	28	52	
							30	90	93	30	30	160	
							31	93	96	66	30	108	
							32	96	99	22	28	84	
							33	99	102	32	28	380	
							34	102	105	60	58	310	
							35	105	108	50	104	200	

042
170043

AUSTRALIAN ANGLO AMERICAN LIMITED

PROJECT: COMSTAFF TASMANIA

APPENDIX 1.

Page 2.....

LOREHOLE No. CH-1

TYPE.....

CO-ORDINATES.....

INCLINATION.....

DIRECTION

DATE
START *****DATE
FINISH

LOGGED BY

DRILL
.....

FINAL DEPTH

N.W.P.S.

[illegible]

AUSTRALIAN ANGLO AMERICAN LIMITED

PROJECT: COMSTAFF TASMANIA

LOREHOLE No. CH-2

TYPE DDH

CO-ORDINATES 7 N; 752 E

INCLINATION 47°

DIRECTION 258°

DATE - 1977
STARTDATE - 1977
FINISH

LOGGED BY D.J. PERKIN

DRILL -

FINAL DEPTH 148.5m

N.W.P.S.

DEPTH		DRILLED METRES	REC. METRES	SAMPLE INT.	SAMPLE NO.	DESCRIPTION	Sample No. (EAD) FROM TO Cu Pb Zn					
FROM	TO						ASSAY RESULTS (SPLIT CORE)					
						(0.0-89.8) (Quartz) plagioclase crystal dacitic tuff. Greenish to greenish - grey.	T4651	0	1	16	470	460
						Medium grained. Moderately altered with chlorite (10-20%) and sericite (20%) and minor pyrite (<3%). CBA = 40-50°.	52	1	2	6	200	470
						Minor quartz calcite, chlorite, galena, pyrite and dark (red) sphalerite in veinlets 24.0-26.0.	53	2	3	6	170	440
						More altered buff-pink zones 78.0-89.3 with more silification and more pyrite (5%) and minor calcite(?) and quartz veining.	54	3	4	64	29	1700
						Probable fine grained (altered?) rhyodacitic - trachy andesitic dyke/ (tuff-flow) 88.5-89.8.	55	4	5	30	330	440
						Finer grained zone 59.0-60.2 with disseminated blebs (to 5 mm) of galena/sphalerite.	56	5	6	18	290	480
							57	6	7	190	250	430
							58	7	8	80	82	270
							59	8	9	8	64	170
							60	9	10	200	1100	5600
							61	10	11	10	106	200
							62	11	12	10	66	360
							63	12	13	4	46	120
						(89.8-148.5) Quartz plagioclase crystal (Lithic?) rhyodacitic tuff. Grey to grey buff.	64	13	14	6	30	260
						Medium grained. Moderately-strongly altered with pervasive silic and sericitic (to 30%) alteration.	65	14	15	6	24	160
						Andesitic dykes/tuff-lavas) with calcite veinlets at:-	66	15	16	10	32	320
						91.9-92.3 (dyke?)	67	16	17	10	28	48
						93.7-94.2 (")	68	17	18	14	36	78
						3 cm quartz veinlets at 93.0.	69	18	19	16	62	86
						CBA = 45-55°.	70	19	20	16	44	58
						1 cm bed of chert with disseminated galena, sphalerite, pyrite at 94.2 (CBA chert = 25-30°).	71	20	21	14	62	58
						Pink more siliceous zone 122.8-148.5.	72	21	22	14	76	56
						Grey-green trachy-andesitic dyke (?) 131.2-131.4.	73	22	23	18	114	480
						Green andesitic dykes(?) 134.0-144.4 (with quartz-calcite veins)	74	23	24	26	550	2800
						147.3-148.5 (" " ")	75	24	25	98	34	9800
							76	25	26	16	330	280
							77	26	27	14	180	66
							78	27	28	20	200	92
							79	28	29	16	270	1400
						E. O. H.	80	29	30	20	260	1000
							81	30	31	20	114	980
							82	31	32	22	100	80
							83	32	33	14	40	78
							84	33	34	14	48	120
							85	34	35	16	42	44

170045

044

APPENDIX 1.

Page 2.....

AUSTRALIAN ANGLO AMERICAN LIMITED

PROJECT: COMSTAFF TASMANIA

LOREHOLE No. CH-2

TYPE

CO-ORDINATES

INCLINATION

DIRECTION

DATE
START DATE
FINISH

LOGGED BY

DRILL

FINAL DEPTH

N.W.P.S.

DEPTH		DRILLED METRES	REC. METRES	SAMPLE INT.	SAMPLE NO.	DESCRIPTION	Sample		ASSAY RESULTS (SPLIT CORE)				
FROM	TO						No. (EAD)	FROM	TO	Cu	Pb	Zn	
							T4686	35	36	16	24	60	
							87	36	37	16	22	30	
							89	37	38	14	22	34	
							89	38	39	8	22	36	
							90	39	40	22	30	48	
							91	40	41	12	20	32	
							92	41	42	14	20	38	
							93	42	43	12	24	46	
							94	43	44	12	30	78	
							95	44	45	10	28	54	
							96	45	46	12	30	44	
							97	46	47	20	36	60	
							98	47	48	62	40	700	
							99	48	49	12	32	82	
							T4700	49	50	10	70	180	
							01	50	51	6	104	190	
							02	51	52	8	36	86	
							03	52	53	8	38	80	
							04	53	54	10	40	170	
							05	54	55	48	1750	5800	
							06	55	56	12	450	170	
							07	56	57	12	350	180	
							08	57	58	8	300	110	
							09	58	59	30	1950	3400	
							10	59	60	70	36	7000	
							11	60	61	52	900	5800	
							12	61	62	440	200	1400	
							13	62	63	104	78	400	
							14	63	64	14	50	84	
							15	64	65	12	190	110	
							16	65	66	12	84	130	
							17	66	67	16	170	140	
							18	67	68	12	50	80	
							19	68	69	14	34	54	
							20	69	70	12	44	44	
							21	70	71	10	46	160	

170046

045

APPENDIX 1.

Page 3

AUSTRALIAN ANGLO AMERICAN LIMITED

PROJECT: COMSTAFF TASMANIA

LOREHOLE No. CH-2

TYPE

CO-ORDINATES

INCLINATION

DIRECTION

DATE
STARTDATE
FINISH

LOGGED BY

DRILL

FINAL DEPTH

N.W.P.S.

DEPTH		DRILLED METRES	REC. METRES	SAMPLE INT.	SAMPLE NO.	DESCRIPTION	Sample		ASSAY RESULTS (SPLIT CORE)				
FROM	TO						No. (EAD)	FROM	TO	Cu	Pb	Zn	
							T4722	71	72	12	34	40	
							23	72	73	12	36	38	
							24	73	74	14	30	48	
							25	74	75	16	58	74	
							26	75	76	14	32	48	
							27	76	77	20	56	68	
							28	77	78	12	72	140	
							29	78	79	12	60	70	
							30	79	80	26	270	700	
							31	80	81	80	300	430	
							32	81	82	74	90	240	
							33	82	83	52	54	34	
							34	83	84	52	104	120	
							35	84	85	28	106	180	
							36	85	86	48	150	180	
							37	86	87	52	480	380	
							38	87	88	32	410	280	
							39	88	89	200	94	200	
							40	89	90	160	114	380	
							41	90	91	50	220	220	
							42	91	92	102	240	380	
							43	92	93	20	32	94	
							44	93	94	16	52	88	
							45	94	95	24	23	3100	
							46	95	96	12	260	60	
							47	96	97	18	260	260	
							48	97	98	28	370	600	
							49	98	99	20	260	430	
							50	99	100	30	330	360	
							51	100	101	36	410	880	
							52	101	102	32	86	112	
							53	102	103	44	104	520	
							54	103	104	26	170	1700	
							55	104	105	24	470	4000	
							56	105	106	12	200	220	
							57	106	107	10	40	72	

170047

046

APPENDIX 1.

Page 4

AUSTRALIAN ANGLO AMERICAN LIMITED

PROJECT: COMSTAFF TASMANIA

LOREHOLE No. CH-2

TYPE

CO-ORDINATES

INCLINATION

DIRECTION

DATE
STARTDATE
FINISH

LOGGED BY

DRILL

FINAL DEPTH

N.W.P.S.

DEPTH		DRILLED METRES	REC. METRES	SAMPLE INT.	SAMPLE NO.	DESCRIPTION	ASSAY RESULTS (SPLIT CORE)					
FROM	TO						Sample No. (EAD)	FROM	TO	Cu	Pb	Zn
							T4758	107	108	8	70	78
							59	108	109	8	40	56
							60	109	110	14	50	24
							61	110	111	8	30	22
							62	111	112	10	34	32
							63	112	113	24	500	310
							64	113	114	34	430	550
							65	114	115	20	320	530
							66	115	116	18	108	1700
							67	116	117	16	200	1600
							68	117	118	16	90	290
							69	118	119	20	170	94
							70	119	120	24	54	116
							71	120	121	96	46	2100
							72	121	122	24	30	290
							73	122	123	26	80	1700
							74	123	124	24	84	550
							75	124	125	16	46	84
							76	125	126	26	52	86
							77	126	127	28	30	60
							78	127	128	24	62	106
							79	128	129	22	84	250
							80	129	130	22	68	114
							81	130	131	22	70	82
							82	131	132	44	48	26
							83	132	133	36	38	14
							84	133	134	22	30	36
							85	134	135	40	26	250
							86	135	136	52	26	200
							87	136	137	98	26	96
							88	137	138	38	24	180
							89	138	139	26	26	180
							90	139	140	50	28	82
							91	140	141	80	24	110
							92	141	142	22	26	130
							93	142	143	14	28	250

047

PROJECT: COMSTAFF TASMANIA

TYPE

CO-ORDINATES.....

INCLINATION.....

DIRECTION

DATE
START DATE _____
FINISH _____

LOGGED BY

DRILL

FINAL DEPTH

N.W.P.S.

[illegible]

170049
048

AUSTRALIAN ANGLO AMERICAN LIMITED

PROJECT: COMSTAFF TASMANIA

LOREHOLE No. CH-3

TYPE DDH

CO-ORDINATES 2 N; 755 E

INCLINATION 49°

DIRECTION 259°

DATE - 1977
STARTDATE - 1977
FINISH

LOGGED BY D.J. PERKIN

DRILL -

FINAL DEPTH 145.5m

N.W.P.S.

DEPTH		DRILLED METRES	REC. METRES	SAMPLE INT.	SAMPLE NO.	DESCRIPTION	Sample		ASSAY RESULTS (CHIP SAMPLING)				
FROM	TO						No (EAD)	FROM	TO	Cu	Pb	Zn	
						(0.0-145.5) Lithic lapilli dacitic tuff. Greenish - greenish grey and	T4810	0	6	8	20	50	
						yellowish. Medium (-coarse) grained with occasional lapilli fragments (10-	11	6	9	8	26	66	
						40 mm - average 15 mm).	12	9	12	12	114	88	
						Slightly moderately altered with moderate deuteritic chlorite and minor	13	12	15	12	30	78	
						sericite (5 cm patches of enhanced green sericitization throughout	14	15	18	10	24	68	
						parallel to foliation) CBA = 40-50°.	15	18	21	8	20	74	
						Occasional quartz-calcite-chlorite veinlets throughout.	16	21	24	6	26	92	
						(?) Silicified andesite dyke(?) 122.6-124.0 with fine grained quartz filling	17	24	27	8	38	120	
						voids (vesicles?).	18	27	30	14	40	100	
							19	30	33	10	40	86	
							20	33	36	6	40	112	
							21	36	39	8	34	98	
							22	39	42	10	28	90	
							23	42	45	8	22	140	
							24	45	48	14	60	88	
							25	48	51	14	28	210	
							26	51	54	16	44	180	
							27	54	57	14	24	370	
							28	57	60	14	30	200	
							29	60	63	8	28	210	
							30	63	66	14	35	370	
							31	66	69	18	42	300	
							32	69	72	12	48	160	
							33	72	75	14	150	470	
							34	75	78	30	80	400	
							35	78	81	12	28	104	
							36	81	84	10	32	100	
							37	84	87	10	38	170	
							38	87	90	16	52	290	
							39	90	93	12	30	250	
							40	93	96	10	32	84	
							41	96	99	6	28	74	
							42	99	102	14	50	220	
							43	102	105	14	30	102	
							44	105	108	14	40	130	
							45	108	111	14	26	210	

049

Page 2.....

FINAL DEPTH

[illegible]

APPENDIX 17

REVIEW OF 1974 CHESTER IP DATA.

051

170052

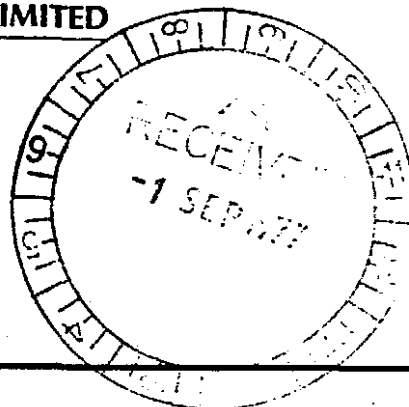
AUSTRALIAN ANGLO AMERICAN LIMITEDMEMORANDUM

To: D. Perkin

From: D. Trussell

Subject: Review of 1974 Chester IP Data

Date: 30th August 1977



An Ip Survey using a 60 m dipole dipole array was carried out over the following lines of the original Chester metric grid by Geoquest in 1974.

- Line 0 from 90E to 870E
- Line 1N from 90E to 1530E
- Line 2N from 90E to 840E
- Lines 3N to 5N, 7N, 10N, 12N to 14N, 16N to 19N from 90E to 960E
- Line 6N from 90E to 960E and 1320E to 1860E
- Line 8N from 90E to 1290E
- Line 9N from 90E to 2000E
- Line 11N from 90E to 1320E
- Line 15N from 90E to 1410E

This work was done using frequency domain equipment with a low frequency of 0.3Hz and a high frequency of 2.5Hz.

Significant IP anomalies and locations of low resistivity are marked on the accompanying plan.

North of Line 11N all-most all the data is of background magnitude. A small weak IP anomaly (labeled A) is the only exception. The best response is on Line 15N at 630E.

South of 12N both the IP and the resistivity data are quite complex. There are four main IP zones (labeled B, C, D and E) Well defined IP anomalies include -

Line 9N 1460E - a single line anomaly with an amplitude of 4.2%.

Line 8N 360E - part of Zone B. The source of this anomaly is within 20 metres of surface and has an amplitude of 6.5% (which is quite high for the general area). It has associated low resistivity.

Line 1N 450E - part of zone E. the source appears to have eastward dip on this line but this is not true of the lines to the north. The amplitude is 4%. A definite low resistivity anomaly is associated with the IP response. The source is within 20 metres of the surface.

052

170053

TO: D. Perkins
FROM: D. Trussell
RE: Review of 1974 Chester IP Data
DATE: 30th August 1977

Zone B is primarily a near surface zone. The isolated IP anomalies at 1170E on line IN and 1650E on Line 6N are also due to a near surface source. On the other hand Zone D has considerable depth extent.

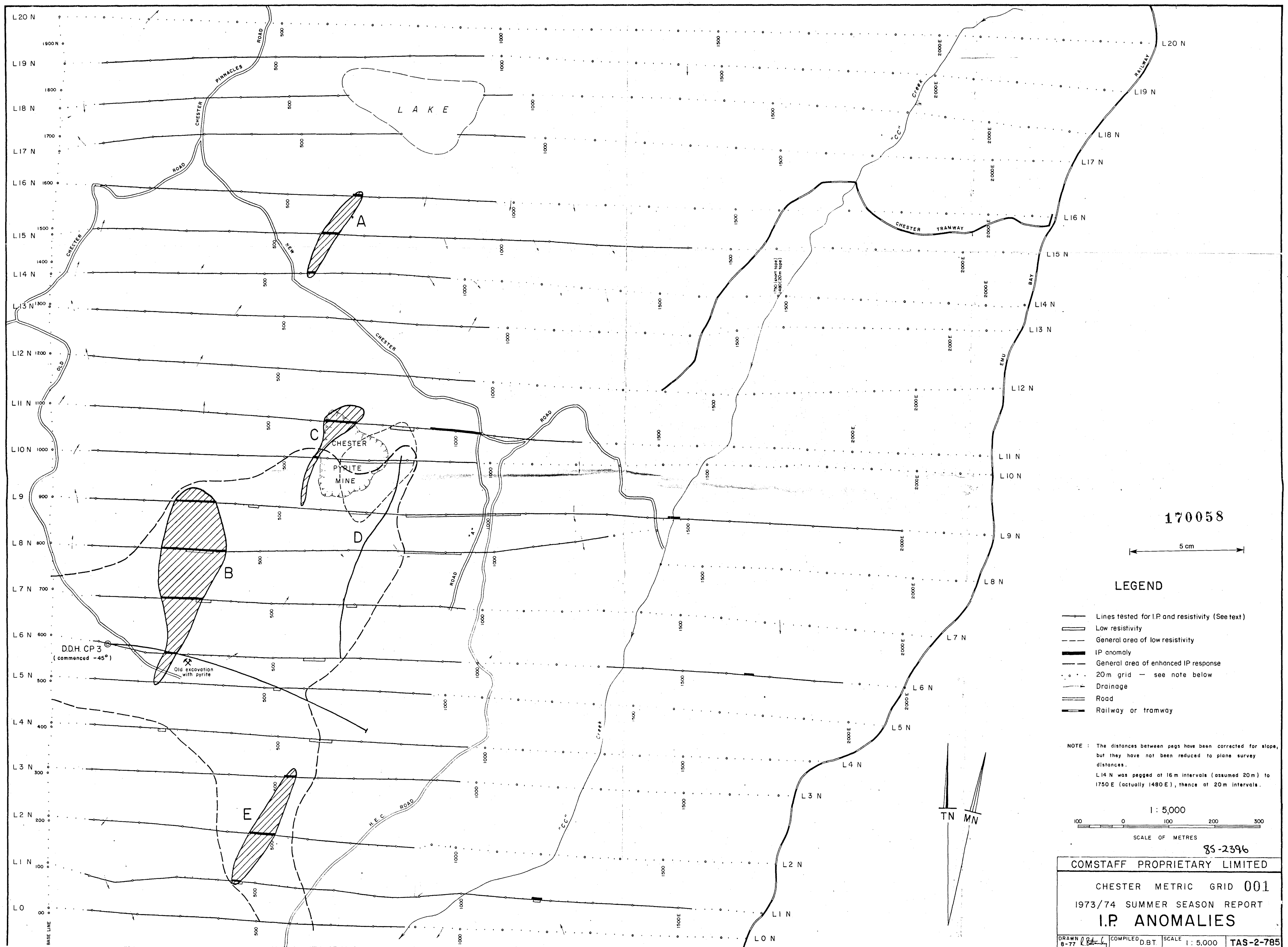
The Chester mine area responds as an area of low resistivity. The resistivity anomaly is centered 30 to 40 meters east of the Chester mine workings. There is some evidence that a minor halo surrounds the mine mineralization (note zones C and D nearly encircle the mine area).

Other IP and resistivity responses are scattered. No further geophysical conclusions can be drawn on them.



D. TRUSSELL

Encl:
DBT:SdeZ



053

170059

APPENDIX 18.

ASSAYS AND ANALYSES.

054

170060

EAD

Rock

GEOCHEMICAL AND MINERALOGICAL

LABORATORIES (WA) PTY. LTD.

21 WYNARD STREET, BELMONT, PERTH, W.A. 6104

Registered
Laboratory
Number 847



Phone: 65 4322 (3 Lines)
Telex: 92418
Cables: Geochem Perth

Your Ref. 77/13	Our Ref. P14342
Date In 29.3.77	Date Out 5.4.77
Client COMSTAFF PTY. LTD.	
Samples Identification As per sheets.	

ANALYTICAL REPORT

REMARKS * - These samples have been checked.

ANALYTICAL TECHNIQUE	ELEMENTS	PRECISION AT LEVEL		LIMIT OF DETECTION
AAS (HClO ₄)	Cu Pb Ni Zn	10%	300ppm	2
AAS (Aqua Regia)	Ag	20%	2ppm	0.2
Col/Fusion	Cr	10%	500ppm	20

AAS

Geochemical Analysis by Atomic Absorption Spectrophotometry. Sample attack by methods giving highest extraction within cost-limitations. Conditions carefully controlled to give high precision. Suitable for levels up to 1%.

Sorting

Sorting Analysis. As above but technique extended to operate in percentage range. Generally suitable for levels up to 15%.

Colorimetric

Geochemical Analysis by Colorimetry. Used for elements which cannot be determined by AAS due to poor sensitivity - Sample attack by methods giving highest extraction within cost limitations. Generally suitable for levels up to 1000 ppm. Above 1000 ppm AAS can usually be used.

PRECISION is determined with standards similar in composition to the samples. The value given is $\pm$ two standard deviations. This means that if the analysis is repeated sixteen times, on average only one result will differ from the mean by more than the value given. Results are usually rounded to the nearest 0.5 standard deviation.



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These results, comprising 2 pages,
have been obtained in accordance with
the Association's terms of registration.

P 2-25
NATA SIGNATORY

055

170061



GEOMIN LABORATORIES

SYDNEY - DARWIN - KALGOORLIE - PERTH

GEOCHEMICAL ANALYSIS

All results in parts per million unless otherwise stated.



Typist: P. Cardozo

P14342/1

REPORT No. SHEET No.

Analyst	CP	EC			EC	CP	EC
Sample No.	Cu	Ni	Mn	Fe	Pb	Zn	Ag
EAD T5801 * <i>MANRICH</i>	24	20	17.6	137	180	280	1.6
5802 <i>FL RICH</i>	14	20	1.4	247	220	220	1.8
5803 <i>MANRICH</i>	32	18	13.5	107	250	340	1.4
5804 "	54	20	16.4	127	400	600	2.4
5805 "	52	20	16.0	107	750	960	2.4
5806 <i>POUT</i>	6	68	0.01	0.87	40	44	0.2
5807 <i>MANRICH (SPR)</i>	6	42	0.02	1.07	50	42	0.4
5808 <i>FL RICH TOP</i>	14	68	0.02	3.47	290	470	0.8
5809 <i>ACD 1 - 10cm x 10cm x 10cm</i>	320	40	2.050	1.3	>2000 (3.55)	>1% (3.0)	20
5810 <i>ACD 2 - 10cm x 10cm x 10cm</i>	1550	84	1.450	1.5	>2000 (5.8)	>1% (8.8)	>30 (33)
INTERNAL STANDARD							
5811 <i>ACD 3 - 10cm x 10cm x 10cm</i>	9000	56	4.60	1.8	>2000 (37.2)	>1% (15.0)	>20 (3.5)
5812 <i>ACD 4 - 10cm x 10cm x 10cm</i>	7500	64	6.00	2.4	>2000 (26.4)	>1% (22.5)	>30 (3.5)
5813 <i>ACD 5 - 10cm x 10cm x 10cm</i>	450	46	3.00	2.4	>2000 (3.35)	>1% (45.0)	24
5814 <i>ACD 6 - 10cm x 10cm x 10cm</i>	114	84	1.900	6.0	>2000 (2.15)	>1% (11.5)	10.0
5815 <i>ACD 7 - 10cm x 10cm x 10cm</i>	110	72	7.000	12.0	>2000 (1.0)	>1% (9.3)	6.8
5816 <i>ACD 8 - 10cm x 10cm x 10cm</i>	76	84	7.50	5.5	180	560	1.2
5817 <i>ACD 9 - 10cm x 10cm x 10cm</i>	300	150	1.750	5.8	>2000 (0.25)	2600	4.0
EAD T5818 * <i>0.33%</i>	56	150			490	450	1.0

056

170062



GEOMIN LABORATORIES

SYDNEY — DARWIN — KALGOORLIE — PERTH

GEOCHEMICAL ANALYSIS

All results in parts per million unless otherwise stated.



REPORT No. SHEET No.

P14342/2

Analyst

RW

Sample No.

Cr

EAD T5818 *

3300

INTERNAL
STANDARD

170063

GEOCHEMICAL AND MINERALOGICAL
LABORATORIES (W.A.) PTY. LTD.

21 WYNWARD STREET, BELMONT, PERTH, W.A. 6104

Registered
Laboratory
Number 847



Phone: 65-4322 (3 Lines)
Telex: 92418
Cables: Geochem Perth

Your Ref. **77/13**

Our Ref: **F14342**

Date
In **29.3.77**

Date **4.4.77**

Client

COMSTAFF PTY. LTD.

Typist: P. Cardozo

ATOMIC ABSORPTION ASSAY

[illegible]

All results expressed as a percentage unless otherwise indicated.

"X" indicates that the content of the element sought is below the limit of detection.

"—" means not determined

P e-2



SYDNEY - DARWIN - KALGOORLIE - PERTH

GEOCHEMICAL ANALYSIS

All results in parts per million unless otherwise stated.



170064

Typist: D. McAuliffe
P14517/1

Analyst

Sample No.

EC

CP

EC

CP

Ag

Cu

Pb

Zn

EAD T 5819

0.4

10

34

60

20

0.4

6

24

66

21

0.4

22

40

40

22

1.8

56

106

1900

23

22

116

>2000

1600

EAD T 5824

13

8

1950

540

INTERNAL
STANDARD

059

21 WYNYARD STREET, BELMONT, PERTH, W.A. 6104

Registered
Laboratory
Number 847



Phone: 65-4322 (3 Lines)
Telex: 92418
Cables: Geochem Perth

Typist:D.McAuliffe

Your Ref. 72/18	Our Ref. P14517
Date In 18.5.77	Date Out 26.5.77
Client COMSTAFF PTY.LIMITED.	

[illegible]

* indicates that the content of the element sought is below the limit of detection.
 means not determined

P. e-22

060

170066

**GEOCHEMICAL AND MINERALOGICAL
LABORATORIES (WA) PTY. LTD.**
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Registered
Laboratory
Number 847



Phone: 65 4322 (3 Lines)
Telex: 92418
Cables: Geochem Perth

Your Telex Ref. Mr Farrell	Our Ref. P14662
Date In 22.6.77	Date Out 1.7.77
Client COMSTAFF PTY. LTD.	
Samples Identification As per sheets.	

ANALYTICAL REPORT

REMARKS

* = These samples have been checked.

ANALYTICAL TECHNIQUE	ELEMENTS	PRECISION AT LEVEL		LIMIT OF DETECTION
AAS (Aqua Regia)	Mn	10%	1000ppm	2
	Fe in % range	approximate only.		



Geochemical Analysis by Atomic Absorption Spectrophotometry. Sample attack by methods giving highest extraction within cost-limitations. Conditions carefully controlled to give high precision. Suitable for levels up to 1%.

Sorting

Sorting Analysis. As above but technique extended to operate in percentage range. Generally suitable for levels up to 15%.

Colorimetric

Geochemical Analysis by Colorimetry. Used for elements which cannot be determined by AAS due to poor sensitivity - Sample attack by methods giving highest extraction within cost limitations. Generally suitable for levels up to 1000 ppm. Above 1000 ppm AAS can usually be used.

PRECISION is determined with standards similar in composition to the samples. The value given is $\pm$ two standard deviations. This means that if the analysis is repeated sixteen times, on average only one result will differ from the mean by more than the value given. Results are usually rounded to the nearest 0.5 standard deviation.



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These results, comprising **9** pages, have been obtained in accordance with the Association's terms of registration.

P. e. j.
NATA SIGNATORY



GEOMIN LABORATORIES

SYDNEY - DARWIN - KALGOORLIE - PERTH

GEOCHEMICAL ANALYSIS

All results in parts per million unless otherwise stated.



REPORT No. SHEET No.

Typist: P. Cardozo
P14662/1

Analyst

EC

EC

Sample No.

Mr

Approx
Fe

T 5819 *	2600	1.4%
20	480	1.5%
21	80	2.1%
22	>1%	14.0%
23	>1%	19.0%
T 5824	750	1.75%
INTERNAL STANDARD		



SYDNEY - DARWIN - KALGOORLIE - PERTH

GEOCHEMICAL ANALYSIS

All results in parts per million unless otherwise stated.



170068

P14662/2

Analyst

EC

CP

Sample No.

Mn

Approx
Fe

T 5809	2050	1.3%
10	1450	1.5%
11	460	1.8%
12	600	2.9%
13 *	300	2.4%
14	1900	6.0%
15	7000	12.0%
16	750	5.5%
T 5817	1750	5.8%
INTERNAL STANDARD		

INTERNAL
STANDARD

084

170070

GEOCHEMICAL AND MINERALOGICAL

LABORATORIES (WA) PTY. LTD.

21 WYNARD STREET, BELMONT, PERTH, W.A. 6104

Registered
Laboratory
Number 847Phone: 65 4322 (3 Lines)
Telex: 92418
Cables: Geochem Perth

Ref. Mr Farrell	Ref. P14662
Date In 22.6.77	Date Out 1.7.77
Client COMSTAFF PTY. LTD.	
Samples Identification As per sheets.	

ANALYTICAL REPORT

REMARKS

* = These samples have been checked.

ANALYTICAL TECHNIQUE	ELEMENTS	PRECISION AT LEVEL		LIMIT OF DETECTION
AAS (Aqua Regia)	Mn	10%	1000ppm	2
Fe in % range approximate only.				
1) (DJT) 2) 1.2 3) 45 T 5809 - 5824 00E - 1620E 00E - 1520E				

AAS

Geochemical Analysis by Atomic Absorption Spectrophotometry. Sample attack by methods giving highest extraction within cost-limitations. Conditions carefully controlled to give high precision. Suitable for levels up to 1%.

Sorting

Sorting Analysis. As above but technique extended to operate in percentage range. Generally suitable for levels up to 15%.

Colorimetric

Geochemical Analysis by Colorimetry. Used for elements which cannot be determined by AAS due to poor sensitivity — Sample attack by methods giving highest extraction within cost limitations. Generally suitable for levels up to 1000 ppm. Above 1000 ppm AAS can usually be used.

PRECISION is determined with standards similar in composition to the samples. The value given is $\pm$ two standard deviations. This means that if the analysis is repeated sixteen times, on average only one result will differ from the mean by more than the value given. Results are usually rounded to the nearest 0.5 standard deviation.



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These results, comprising 9 pages, have been obtained in accordance with the Association's terms of registration.

P. C. J.

NATA SIGNATORY

GEOCHEMICAL ANALYSIS

All results in parts per million unless otherwise stated.



Typist: P. Cardozo
Pl4662/1

Analyst

EC

EC

Sample No

Mid

Approx
Fe

INTERNAL
STANDARD

-not requested G.T. 1% greater than 1%. T/F to follow X below limit of detection S/P sent previously I.S. insufficient sample SNR sample not received

These results are authentic only when accompanied by cover sheet signed by the registered NATA signatory

Analyst

EC

CP

Sample No.

Mn

Approx
Fe

These results are authentic only when accompanied by cover sheet signed by the registered NATA signatory

067



SYDNEY - DARWIN - KALGOORLIE - PERTH

GEOCHEMICAL ANALYSIS

All results in parts per million unless otherwise stated



170073

P14662/3

Analyst

EC

CP

Sample No

Mn

Approx
Fe

0100N	0000E	18	800
	20	20	800
	40	18	800
	60	18	650
	80 *	20	950
	100	2000	1.30
	120	1.37 > 1% 1.30	3.10
	140	120	650
	160	56	600
	180	14	600
INTERNAL STANDARD			
	200	38	700
	220	16	650
	240	370	1300
	260	60	700
	280 *	250	900
	300	16	500
	320	26	750
	340	10	200
	360	70	550
	380	10	700
	400	10	850
	420	64	750
	440	400	9000
	460	1.51 > 1% 1.30	4.00
0100N	0480E *	1.45 > 1% 1.50	5.00

—not requested G.T. 1% greater than 1%. T/F to follow X below limit of detection S/P sent previously I.S. insufficient sample SNR sample not received.

These results are authentic only when accompanied by cover sheet signed by the registered NATA signatory

068

170074



SYDNEY - DARWIN - KALGOORLIE - PERTH



P14662/4

GEOCHEMICAL ANALYSIS

All results in parts per million unless otherwise stated.

Analyst		CP	CP
Sample No		Mn	Approx Fe
0100N	0500E	7500	1.70
	520	8000	2.5%
	540	180	1200
	560	2650	1.50
	580	106	750
	600	100	1.10
	620	56	1350
	640	200	1.00
	660	320	1.20
	680 *	34	9000
INTERNAL STANDARD			
	700	80	1900
	720	250	1.50
	740	280	2700
	760	52	2800
	780	420	9000
	800	650	1.04%
	820	48	900
	840	48	1100
	860	98	1250
	880	98	1000
	900	240	1200
	920	60	1200
	940	150	1250
	1020	28	1100
0100N	1040E	16	800

-not requested G.T. 1% greater than 1%. T/F to follow X below limit of detection S/P sent previously I.S. insufficient sample SNR sample not received.
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069



SYDNEY - DARWIN - KALGOORLIE - PERTH

170075



P14662/5

GEOCHEMICAL ANALYSIS

All results in parts per million unless otherwise stated.

Analyst	CP	CP
Sample No	Mn	Approx Fe
0100N 1060	40	1000
1080	20	850
1100	40	900
1120	10	700
1180	54	1400
1200	58	2.70
1220	900	7.00
1240	1000	2.20
1260	250	2.00
1280	290	2.50
INTERNAL STANDARD		
1300	24	1050
1320	30	1600
1340	34	1900
1360	42	850
1380 *	18	600
1400	64	1250
1420	120	1650
1440	28	900
1460	32	800
1480	12	750
1500	40	750
1520	24	600
1540	8	600
1560	300	1000
0100N 1580E *	58	1700

—not requested G.T. 1% greater than 1%. T/F to follow X below limit of detection S/P sent previously I.S. insufficient sample SNR sample not received
 These results are authentic only when accompanied by cover sheet signed by the registered NATA signatory

REPORT No. SHEET No.

GEOCHEMICAL ANALYSIS

All results in parts per million unless otherwise stated.



P14662/6



Analyst

CP

CP

Approx
Fe

Sample No

[illegible]

not requested G.T. 1% greater than 1%. T/F to follow X below limit of detection S/P sent previously I.S. insufficient sample SNR sample not received.
These results are authentic only when accompanied by cover sheet signed by the registered NATA signatory

071



SYDNEY - DARWIN - KALGOORLIE - PERTH

GEOCHEMICAL ANALYSIS

All results in parts per million unless otherwise stated.

170077

REPORT NO. SHEET NO.



P14662/7

Analyst

CP

CP

Approx

Fe

Sample No

0400S	0000E	12	700
	20	18	270
	40	108	1200
	60	12	700
	80	6	270
	100	14	300
	120	14	500
	140	10	300
	160	8	360
	180 *	12	500
INTERNAL STANDARD			
	220	190	2700
	240	56	1800
	260	14	1000
	280	2600	1200
	300	30	950
	320	24	1400
	340	18	1250
	360	10	1100
	380	18	600
	400	18	1300
	440	10	1850
	460	10	2600
	480	4	1200
	500 *	6	650
0400S	0520E	52	550

-not requested G.T. 1% greater than 1%. T/F to follow X below limit of detection S/P sent previously I.S. insufficient sample SNR sample not received

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072



SYDNEY - DARWIN - KALGOORLIE - PERTH

GEOCHEMICAL ANALYSIS

All results in parts per million unless otherwise stated.



170078

P14662/8

Analyst	CP	CP
Sample No	Mn	Approx Fe
0400S 0540E	24	700
560	12	650
580	10	500
600	20	600
620 *	18	600
640	10	1100
660	34	2000
680	36	1650
720	25	9600
780	8	650
INTERNAL STANDARD		
800	32	1100
820	10	800
840	20	1800
860	32	2600
920 *	26	1450
940	30	1500
960	18	1600
980	10	300
1000	14	360
1020	10	700
1040	14	1200
1060	14	600
1080	26	1350
1100	48	1750
0400S 1140E	16	750

-not requested G.T. 1% greater than 1%. T/F to follow X below limit of detection S/P sent previously I.S. insufficient sample SNR sample not received.

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LABORATORIES (W.A.) PTY. LTD.

21 WYNYARD STREET, BELMONT, PERTH, WA 6104

Registered
Laboratory
Number 847



Phone: 65-4322 (3 Lines)
Telex: 92418
Cables: Geochem Perth

Ref. Mr Farrell

1 Ref. P14662

Date 22.6.77

Date 1.7.77
Out

Client **COMSTAFF PTY. LTD.**

Typist: P. Cardozo

ATOMIC ABSORPTION ASSAY

[illegible]

All results expressed as a percentage unless otherwise indicated.

"X" indicates that the content of the element sought is below the limit of detection.

--" means not determined

P 2-25

N.A.T.A. SIGNATORY

075

170081

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Registered
Laboratory
Number 847



Phone: 65 4322 (3 Lines)
Telex: 92418
Cables: Geochem Perth

Your Ref.	Phone	Our Ref.	P14744
Date In	14.7.77	Date Out	26.7.77
Client PREUSSAG AUSTRALIA LTD.			
Samples Identification As per sheets			

ANALYTICAL REPORT

REMARKS

* = These samples have been checked.

Mn Ag to follow.

ANALYTICAL TECHNIQUE	ELEMENTS	PRECISION AT LEVEL		LIMIT OF DETECTION
AAS (HClO ₄)	Cu Ni Pb Zn	10%	200ppm	1
Code 09	Ba	10%	1000ppm	10
Fusion/Ext/AAS	Mo	20%	50ppm	0.5
Cal/Fusion	Sn	30%	30ppm	10
	Cr	10%	500ppm	20

AAS

Geochemical Analysis by Atomic Absorption Spectrophotometry. Sample attack by methods giving highest extraction within cost-limitations. Conditions carefully controlled to give high precision. Suitable for levels up to 1%.

Sorting

Sorting Analysis. As above but technique extended to operate in percentage range. Generally suitable for levels up to 15%.

Colorimetric

Geochemical Analysis by Colorimetry. Used for elements which cannot be determined by AAS due to poor sensitivity — Sample attack by methods giving highest extraction within cost limitations. Generally suitable for levels up to 1000 ppm. Above 1000 ppm AAS can usually be used.

PRECISION is determined with standards similar in composition to the samples. The value given is $\pm$ two standard deviations. This means that if the analysis is repeated sixteen times, on average only one result will differ from the mean by more than the value given. Results are usually rounded to the nearest 0.5 standard deviation.



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NATA SIGNATORY

076



REPORT No. SHEET No.

Typist: P. Cardozo

GEOCHEMICAL ANALYSIS

All results in parts per million unless otherwise stated.



P14744/1

Analyst

CP

EC

EC

SN

Sample No.

Cu

NI

Pb

Zn

-not requested G.T. 1% greater than 1%. T/F to follow X below limit of detection S/P sent previously I.S. insufficient sample SNR sample not received

* These are "See & Hear" reports only when as categorized by the sheet scored by the police as NATAs.



SYDNEY - DARWIN - KALGOORLIE - PERTH

GEOCHEMICAL ANALYSIS

All results in parts per million unless otherwise stated.



REPORT No. SHEET No.

P14744/1A

Analyst

RW

CP

SN

RW

Sample No.

Ba

Mo

Sn

Cr

INTERNAL
STANDARD

078

170084

**GEOCHEMICAL AND MINERALOGICAL
LABORATORIES (WA) PTY. LTD.**

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Registered
Laboratory
Number 847



Phone: 65 4322 (3 Lines)
Telex: 92418
Cables: Geochem Perth

Your Ref.	Phone	Our Ref.	P14744
Date In	14.7.77	Date Out	28.7.77
Client PREUSSAG AUSTRALIA LTD.			
Samples Identification As per sheet.			

ANALYTICAL REPORT

REMARKS

* = These samples have been checked.

ANALYTICAL TECHNIQUE	ELEMENTS	PRECISION AT LEVEL		LIMIT OF DETECTION
AAS (Aqua Regia)	Ag	20%	2ppm	0.2
	Mn	10%	1000ppm	1

AAS

Geochemical Analysis by Atomic Absorption Spectrophotometry. Sample attack by methods giving highest extraction within cost-limitations. Conditions carefully controlled to give high precision. Suitable for levels up to 1%.

Sorting

Sorting Analysis. As above but technique extended to operate in percentage range. Generally suitable for levels up to 15%.

Colorimetric

Geochemical Analysis by Colorimetry. Used for elements which cannot be determined by AAS due to poor sensitivity — Sample attack by methods giving highest extraction within cost limitations. Generally suitable for levels up to 1000 ppm. Above 1000 ppm AAS can usually be used.

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the Association's terms of registration

NATA SIGNATORY



SYDNEY - DARWIN - KALGOORLIE - PERTH

GEOCHEMICAL ANALYSIS

All results in parts per million unless otherwise stated.



REPORT No. SHEET No.

Typist: P. Cardozo
P14744/1

Analyst

EC

SN

Sample Nn

Ag

Mn

note requested G.T. 1% greater than 1%. T/F to follow X below limit of detection S/P sent previously I.S. insufficient sample SNR sample not received.

2000

170086

**GEOCHEMICAL AND MINERALOGICAL
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21 WYNARD STREET, BELMONT, PERTH, W.A. 6104

Registered
Laboratory
Number 847



Phone: 65 4322 (3 Lines)
Telex: 92418
Cables: Geochem Perth

Your Ref. Mr Farrell	Our Ref. P14788
Date In 25.7.77	Date Out 2.8.77
Client COMSTAFF PTY. LTD.	
Samples Identification As per sheet	

Handwritten notes: Xerox copy to D. Parker

ANALYTICAL REPORT

REMARKS

* - These samples have been checked.

ANALYTICAL TECHNIQUE	ELEMENTS	PRECISION AT LEVEL		LIMIT OF DETECTION
AAS (Aqua Regia)	Mn Fe in % range approximate only.	10%	1000ppm	1

AAS

Geochemical Analysis by Atomic Absorption Spectrophotometry. Sample attack by methods giving highest extraction within cost-limitations. Conditions carefully controlled to give high precision. Suitable for levels up to 1%.

Sorting

Sorting Analysis. As above but technique extended to operate in percentage range. Generally suitable for levels up to 15%.

Colorimetric

Geochemical Analysis by Colorimetry. Used for elements which cannot be determined by AAS due to poor sensitivity - Sample attack by methods giving highest extraction within cost limitations. Generally suitable for levels up to 1000 ppm. Above 1000 ppm AAS can usually be used.

PRECISION is determined with standards similar in composition to the samples. The value given is $\pm$ two standard deviations. This means that if the analysis is repeated sixteen times, on average only one result will differ from the mean by more than the value given. Results are usually rounded to the nearest 0.5 standard deviation.



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These results, comprising 1 pages,
have been obtained in accordance with
the Association's terms of registration.

P. C. L.

NATA SIGNATORY

083

170089

• APPENDIX 19.

DESCRIPTIONS OF THIN AND POLISHED SECTIONS.

084

170090


PREUSSAG

 Preussag Australia
 Proprietary Limited

Mr. I.R. Pontifex,
 I.R. Pontifex and Associates Pty. Ltd.,
 26 Kensington Road,
 ROSE PARK, S.A., 5067

Farrer House, 3rd Floor,
 24-28 Collins Street,
 Melbourne,
 Victoria, 3000.
 Australia.

Your ref.

Our ref. DJP/ec

Date 27th May, 1977

 Subject: Rock Samples.

Dear Ian,

Please find enclosed 37 rocks for thin section examination (A1-A37). A number of the samples may also need polished section work (e.g., A5, A6, A10(?), A12(?), A23, A24, A25(?), A36).

The rocks are from the same general area as those nine (9) samples sent to you around 9th May last, that is, the Rosebery - Tullah area, Tasmania.

The specimens come from the western portion of the Mt. Read Group (including the Mt. Black Volcanics and the Primrose Pyroclastics) and some of the black shale/siltstone rocks may belong to the Rosebery Group.

* A field description of the rocks is appended.

Apart from the normal petrological descriptions on all the rocks, would you care to comment on the following:-

1. Could you identify the principal (volcanogenic) alteration components and their proportion in each rock and comment on the overall intensity of alteration and is the yellow green alteration mineral pyrophyllite rather than montmorillonite or sericite?
2. Is the pink alteration wholly siliceous or is there a carbonate component?
3. Is it possible that the pink alteration (perhaps caused by finely divided hematite in a siliceous groundmass) is essentially a primary (or deuteric) feature consistent with the cooling of a predominantly terrestrial acid ashfall/flow tuff, on which is subsequently superimposed a volcanogenic alteration, or is the pinkish siliceous coloration just a function of oxygen fugacity in a subaqueous

Telephone: (03) 654 4955
 654 4867

Telex: 32156

.../2

085

170091



AUSTRALIA PTY. LTD.

To: Mr. I.R. Pontifex

Date: 27/5/77

Page: 2.

Re: Rock Samples (cont'd).

3. (cont'd).
volcanogenic alteration environment?
4. If moderate carbonate is present in the rocks, would it be possible to identify if it is calcite, dolomite, ankerite, or kutnahorite? etc.?
5. Have the vesicular (?) andesitic (?) dyke rocks suffered any severe volcanogenic alteration?
6. Is it relatively easy to differentiate between vitric and lithic tuffs in thin section?
7. Is there any evidence that samples A19 and A20 are in part terrestrial lapilli tuffs rather than subaqueous?
8. Do specimens A21 and A22 contain orthoclase or K-spar and are these rhyolites?
9. Are the rocks most heavily pyritized (or sulphidized) also the most strongly altered?
10. Do the siltstones (sandstones) and black shales have a partly tuffaceous origin or an acid volcanic provenance?
11. Are samples A31, A32, A33 all re-worked tuffs or tuffaceous arenites?
12. Comment on the degree of alteration of samples A34 to A37.

Hoping these queries do not prove too burdensome.

Best regards,

Yours sincerely,

PREUSSAG AUSTRALIA PTY. LTD.

c.c. - Mr. D.B. Orr.

per D.J. Perkin,
Senior Geologist.

Encl.
(under separate cover)

P.S.: Please send one copy (carbon) plus the invoice to this office, and send the original and another copy (plus samples) to: Mr. D.B. Orr, Divisional Geologist, Comstaff Pty. Ltd., P.O. Box 794, BURNIE, Tasmania, 7320.

A1	H-30	STRONGLY ALTERED VITRIC (LITHIC) LAPILLI (LABROCLASTIC) CRYSTAL TUFF (ALTERATION CONSISTS OF: YELLOWISH PYROPHYLLITE (20%); CHLORITE (20-40%); PINKISH CARBONATE AND/OR SILICA (40%); MINOR SULPHIDE
A2	H-30	STRONGLY ALTERED FINE GRAINED ACID TUFF (? PLAG X-TAL TUFF) (EST. 90% PINK CARBONATE +/OR QTZ; PYROPHYLLITE 4%); MINOR DISSEM. SULPHIDES + QTZ / CARB. REMAINING)
A3	H-30	AS ABOVE BUT 10% YELLOWISH GREEN PYROPHYLLITE
A4	H-30	AS FOR A3 BUT 15% YELLOWISH GREEN PYROPHYLLITE PLUS (?) CARBONATE MESS (5%)
A5	H-30	AS ABOVE BUT GREENISH WITH MORE PYROPHYLLITE (? 60%); CARBONATE / QTZ (? 20-30%); PYRITE (10%) + GALENA (0.5%)
A6	H-30	CROSSCUTTING SUBVOLCANIC VEINLET OF BASE METAL (Cu Pb Zn) SULPHIDES IN STRONGLY ALTERED ACID TUFF AS ABOVE. (EST. 50% GREENISH PYROPHYLLITE)
A7	H-30	MODERATELY-STRONGLY ALTERED ACID TUFF WALL ROCK (EST. CHLORITE 20-50%; PYROPHYLLITE 20-30%?)
A8	H-30	MODERATELY ALTERED FINE GRAINED GREENISH ACID TUFF (MINOR SULPHIDES ONLY)
A9	H-30	MODERATELY ALTERED PINKISH FINE GRAINED ACID TUFF
A10	H-32	MODERATELY-STRONGLY ALTERED PLAG X-TAL LITHIC / VITRIC LAPILLI TUFF (GREENISH); (EST. 20-30% PYROPHYLLITE; 20-30% CHLORITE; 1% PYRITE IN GROUNDMASS AND TO 15% PY. IN CHERT 'BOSS')
A11	H-33	GREEN (? ANDRESITE) DYKE ROCK - NON VESICULAR, NON FOLIATED?; FELSIC LAPILLI ALTERED TO CARBONATE (?) - WEATHER PINKISH BROWN?
A12	H-32	STRONGLY (?) ALTERED PLAG X-TAL LAPILLI LITHIC TUFF, - PYRITE-RICH (EST 1% PY) FROM CHERT 'BOSS' IN PINKISH CARBONATE / QTZ ALTERATION (EST 1% PY); ALSO PYROPHYLLITE ALTERATION 10-15%
A13	H-37	(?) ANDRESITE (?) DYKE, FOLIATED WITH VESICULAR CHLORITE CLOTS
A14	H-39	AS ABOVE
A15	H-43	MODERATELY (?) STRONGLY ALTERED PLAG X-TAL LITHIC (?) VITRIC (?) LAPILLI TUFF (EST. ACT 20% CHLORITE 20% PINK C., 10% PYROPHYLLITE)

ID	LOCATION	
A16	H-57	SLIGHTLY-MODERATELY ALT. MEDIUM COARSE PLAG. & TAL TUFF (MONO ANDREITE); (ALT. ALTERATION 10-15% PYROPHYLLITE, 10% CHLORITE)
A17	H-57	SLIGHTLY ALTERED ACID-INTERMEDIATE TUFF AS ABOVE (LESS ALT. THAN A16?)
A18	H-57	SLIGHTLY ALTERED LITHIC (VITRIC ACID-INT. TUFF AS ABOVE (LESS ALT. THAN A16?)
A19	H-62	UNALTERED TO SLIGHTLY ALTERED (CHLORITIC-? NEUTRIC) PILITIC (VITRIC LAPILLI TUFF; (PINK COLOURATION DUE TO SILICEOUS (? TERRESTRIAL ORIGIN) LITHIC FRAGMENTS? OR SUBSEQUENT WHOLE-ROCK SELECTIVE ALTERATION?) (VERY LITTLE CHLORITE)
A20	H-62	AS ABOVE IN FULL
A21	WT-36	MODERATELY ALTERED RHYOLITIC(?) TUFF. (PINK ORTHOCLASE & TAL?); (ALTERATION EST. 20-30% PYROPHYLLITE; 10-15% CHLORITE)
A22	WT-36	AS ABOVE IN FULL
A23	H.S. 105-22	STRONGLY ALTERED PLAG. & TAL VITRIC(?) LAPILLI TUFF - PINKISH; (ALTERATION EST. 70% PINK $SiO_2/(CO_3?)$; 20% GREENISH PYROPHYLLITE & MINOR DISSEM. CALC. (SPHAL/CPY?) - 0.5%)
A24	H.S. 105-22	AS ABOVE BUT MORE GREENISH. PYROPHYLLITE ALTERATION (EST. 30-40%); CHLORITIZATION (10-15%) OF (?) LITHIC FRAGMENTS, PLUS MORE PYRITE (1-5%) & LESS CALC.
A25	H.S. 105-26A	STRONGLY ALTERED ACID TUFF; (ALTERATION EST. CHLORITE 40%; SILICA 20-30%; PYRITE 5-8% - MINOR QUARTZ VEINING)
A26	H.S. 105-28	STRONGLY ALTERED & SILICIFIED ACID TUFF. (ALTERATION EST. SILICA 30-50%; CHLORITE 20-40%; PYROPHYLLITE 10%?; PYRITE 1-5%?)
A27	H.S. 105-35	POORLY SORTED(?) SANDSTONE DEPOSIT WITH SMALL BLACK (?) CARBONACEOUS OR BITUMINOUS CLASTS - MINOR DIAGENETIC MUSCOVITE - VERY ACID VOLCANIC DETRITUS SUGGESTIVE OF AN ACID VOLCANIC PROVENANCE?
A28	H.S. 105-35	AS ABOVE IN FULL - THESE ? CAN BE SEEN ARE INTERBEDS WITHIN A BITUMINOUS BLACK SHALE SEQUENCE - TURBIDITIC?
A29	H.S. 105-36	THINLY BEDDED BLACK SHALE (SLIGHTLY CHLORITIC) (?) DIFFERENTIAL SILTATION

NO.	LOCATION	DESCRIPTION
A30 (ASSAY SAMPLE - EQUIVALENT IS: T5821)	HS105-36	THIN-MEDIUM GRAINED (STRUCTURE) - SILTY BLACK SHALE (OCCASIONAL BITUMEN) PYRITE?; MINOR CARBONATE (SILTY?)
A31 (ASSAY SAMPLE EQUIVALENT IS: T5823)	PIRDS-31	(?) CROSS CUTTING COARSE GRAINED QTZ-PLAGIOCLASE SEDIMENTARY "SANDSTONE DYKE" INTRUDING SILENTED BLACK SHALE? (-? IMMOBILIZED STRUCTURE?) - MINOR SULPHIDES? (-REWORKED) TUFF?
A32 (ASSAY EQUIVALENT IS: T5823) A33	PIRDS-31 PIRLYC-33	AS ABOVE IN FULL SLIGHTLY ALTERED REWORKED TUFF? OR SLIGHTLY ALTERED ASH FALL TUFF? (MINOR CARBONACEOUS COMPONENT - SLIVERS OF SILENTED SHALE?) (- ESSENTIALLY VOLCANICALLY UNALTERED?)
A34	HS105-33	MODERATELY ALTERED (?) PLAGIOCLASE XTAL TUFF - STRONGLY CHROMITIZED (?) & MODERATELY PYRITIZED (?)
A35	HS105-33	MODERATELY - STRONGLY ALTERED LITHIC TUFF - (ALTERATION EST. 20-40% SiO_2 ; 30% CHROMITE; 1-2% PYRITE)
A36	HS105-33	STRONGLY ALTERED (?) LITHIC TUFF (ALTERATION EST. 30-50% CHROMITE; 10-15% PYRITE)
A37	HS105-33	MODERATELY - STRONGLY ALTERED LITHIC TUFF (SILENTED TUFFACEOUS SEDIMENT?) (ALTERATION EST. 20-40% CHROMITE; 10-30% SiO_2 ; 2-10% PYRITE)

COMMENTS(a) General

Within each of the descriptions each rock is given a rock name and comments given on alteration, mineralisation (if any) and comparisons with other samples where appropriate.

Throughout the suite the petrology establishes several groups of similar rocks, which to a large extent correlate with the different field number locations. Briefly these groupings are:-

Group 1

Fine crystal lithic tuff, of acid composition, which may be vaguely layered, commonly cleaved; devitrified, pervasively sericitised and with variable but generally minor carbonate, chlorite and lesser silicic alteration; rare sulphides. Minor sericitised plagioclase crystals and lesser smaller corroded quartz crystals are scattered.

This group includes samples -

A2 to A9 (inclusive)

?A25

?A26 (silicified and chloritised)

A34 to A37 (relatively more "porphyritic" than above)

It is characterised by a rock matrix of diffuse micro-crystalline quartz mosaic which consists largely of compacted, incipient fine spheroidal glass "grains" and fine single quartz crystal grains of apparent tuffaceous origin. They may be considered as welded tuffs, and they are differentiated from other vitric tuffs in the suite by the lack of shards, perlitic or other fluidal textures.

2.

This matrix is devitrified (which may be considered as a deuteric silicification). Also the matrix is pervasively sericitised, conceivably derived from felsic components in the original glassy matrix, and this also appears to be largely deuteric.

In your field notes "pyrophyllite" is widely used, to describe the fine micaceous material particularly where concentrations of this form greenish and yellowish domains, e.g. in A1 to A10. X-ray powder diffraction analysis of this mica in sample A1 identified it as sericite, and petrographic comparisons with this sericite throughout the suite indicates that indeed all of the ultrafine white mica is sericite.

The carbonate alteration in this group also appears to be largely deuteric, albeit slightly later than the sericite. Chlorite + silicic alteration (which may also be accompanied by accessory sulphides, seems fairly definitely to be distinctly later than and superimposed on the earlier sericite-carbonate alteration, in that it is relatively restricted to breccia fillings, invasion along cleavages, and later phases of pseudomorphic replacement of "phenocrysts".

It seems likely therefore that chloritic alteration is more indicative of "genuine" hydrothermal alteration which may accompany or signify potential sulphide mineralisation, rather than the relatively ubiquitous pervasive sericitic alteration. The genesis of the carbonate is somewhere between the sericitisation and chloritisation, but tends to be more closely related to the chloritisation.

3.

Group 2

Acid plagioclase crystal vitric tuff commonly with ignimbritic affinities; devitrified and pervasive sericitic alteration, common but variable carbonate and chlorite alteration, trace sulphides. Commonly flow characteristics indicate lava characteristics in which the rocks may be considered as tuff-lavas. Some contain coarse (>4 mm) fragments in which case the rock is also a lithic lapilli (tuff). This group includes -

A1, A10, A12, A22, A23, A24

The relationship of the alteration components are much the same as described for group 1.

As noted above, the vitric component in this group consists of sericitised cryptocrystalline quartz which is essentially devitrified glass, in which shards, fluxion and fluidal flow structures are preserved.

.../

Group 3:

Lapilli crystal vitric tuff or tuff lava, of dacitic to silicified andesitic composition, characterised by well-developed perlitic structures outlined by sericite-chlorite within the devitrified and sericitised glassy groundmass of the whole rock and/or welded lithic fragments of similar composition. Carbonate and chlorite alteration is much the same as described above. This group includes -

A 15, to A21

Samples A19 and A20 have the distinction of being the only ones to contain potash feldspar in the suite; they are rhyodacitic.

Group 4

Andesitic lava, vesicular sheared, pervasive carbonate, sericite-chlorite alteration and quartz enrichment, all probably deuteritic. This group compares with sample T2 previously described in report no. 2154.

A11, A13, A14, ?A25

5.

Group 5

Variably silty to fine sandy muscovite quartz sandstone, metamorphically recrystallised to become quartzitic. Intercalated with shale facies which is weakly pyritic carbonaceous and dolomitic.

Samples A25 to A30

There is no diagnostic evidence of a tuffaceous component in these.

Group 6

Coarser sediments, predominantly wackes derived from an acid porphyritic lava or crystal tuff provenance; mixed with shale, variably sericitised, carbonated and chloritised.

Samples A31 to A33

.../

6.

COMMENTS continued(b)Comments (as per your covering letter)

(1) The alteration components and their relationships are high-lighted in each description, and discussed in the general comments on rock group 1 above.

(2 and 3)

The pink "alteration" in almost all rocks consists of iron oxide dust dispersed mainly through siliceous domains, i.e. cryptocrystalline silica representing devitrified glass. Certainly carbonate is commonly mixed with this silica but this does not specifically give rise to a red colour. Samples 19 and 20 are the only samples to contain potash feldspar (as indicated by staining all slide offcuts for this mineral). This feldspar is distinctly reddish, and is the only case of this colour representing a specific mineral phase.

The red colour in the devitrified glass presumably formed from Fe components in the primary glass during devitrification. I know of no basis on which to relate this to terrestrial v. extraterrestrial environment.

(4) The carbonate species cannot be positively confirmed optically, however its acid reaction and generally high RI and marked change in RI in different orientation suggests a dolomitic to magnesian species. There is generally no colouration to indicate siderite; staining may help resolve the carbonate composition, but this could not be considered conclusive.

7.

(6.) It is generally not easy to differentiate between vitric and lithic tuffs in thin section. Generally where lithic fragments are present they are themselves very vitric and have a similar composition and when welded into one mass the outlines of original fragments are confused, and "lost" within the myriad of fluidal structures in the devitrified glass. Occasionally fragments of microcrystalline quartz (selectively pyritised in some samples, and chloritised in others) are fairly distinctive.

(7) Samples A19 and A20 show some of the most distinctive perlitic crack textures in the entire suite. This is characteristic of fairly quick cooling which is more likely to occur in a subaqueous, rather than terrestrial environment.

(8) Samples A21 and A22 do not contain potash feldspar, the reddish crystals are in fact plagioclase containing finely dispersed iron oxide dust.

(9) As noted above, sericitic alteration is more or less ubiquitous and apparently not related to the degree of pyritisation. Carbonate alteration is widespread but sporadic, and also not consistently related to sulphides. There does appear to be slightly more chlorite + "vein" quartz in rocks which also carry slightly more than normal pyrite.

(10-12) These questions are answered in some detail within the individual descriptions.

A1: lithic crystal vitric tuff, with ignimbritic affinities;
very extensive primary silicification (devitrification),
also widespread sericite chlorite carbonate alteration,
accessory sphalerite

Field comments: location H30, strongly altered vitric (?lithic)
lapelli plagioclase crystal tuff, composed of
yellowish pyrophyllite (20%), chlorite (20-40%),
pinkish carbonate and/or silica (40%),
minor sulphides

Minor volcanic fragments (10%) up to 15mm across, and smaller,
more abundant plagioclase crystals (15-20%), some in clusters, are
randomly disposed through a patchy extremely fine matrix of
essential silica, and minor sericite largely after glass.

The fragments consist of patchy masses of chlorite, mixed
with cryptocrystalline quartz, sericite and minor extremely fine
carbonate. They also contain minor scattered plagioclase crystals
(?phenocrysts). The quartz-sericite appears to be essentially
altered glass; the fragments may be considered as altered
intermediate tuff or glassy lava.

The scattered plagioclase (andesine) crystals are subhedral
to euhedral, commonly stressed, fractured and bent. Partings
within them are invaded by matrix material, but apart from this they
only show minor, patchy carbonate alteration.

The rock matrix consists mainly of patchy cryptocrystalline
quartz which shows a streaky layering. This contains abundant
irregular, streaky braided patches of sericite, minor chlorite,
and minor extremely fine disseminated carbonate. Also irregular
patches of carbonate. The pink areas referred to in field comments
are predominantly siliceous.

A1 contd. :

The steaky layering is interpreted as flow texture in an original glass, but localised areas of compacted shards (eutaxitic texture) indicates ignimbritic affinities.

Accessory patches of sphalerite (2-3%), up to 1.5mm across, are randomly scattered.

This rock has the characteristics of lithic crystal tuff; also ignimbritic, vitric tuff. The cryptocrystalline quartz is essentially devitrified glass, but may be considered as primary "silicification" (together with the primary and intimately related carbonate, chlorite and sericite alteration).

A2: very fine (crystal vitric) tuff of acid (?rhyolitic) composition; vaguely layered; devitrified, with associated essentially deuteric pervasive sericitic alteration, minor scattered carbonate and trace pyrite; minor quartz carbonate veins

Field comments: location H30; strongly altered, medium grained acid tuff (? plagioclase crystal tuff), estimated 90% pink carbonate or quartz, pyrophyllite 4%, minor sulphides quartz and carbonate veining

This is a massive very fine grained rock with a quite homogeneous composition (and texture). It consists essentially of microcrystalline (0.1mm) quartz, with subordinate (15-20%) extremely fine sericite throughout, along intergranular boundaries in the mosaic, in patches, and in variably continuous braided streaks which define a vague layering, and/or very weak cleavage.

Most of the quartz forms a somewhat diffuse mosaic (?including ?tridymite), although more or less discrete rarely spheroidal and poly-crystalline quartz grains of the same fine size are widely scattered. The majority of this quartz-sericite "matrix", certainly the "diffuse mosaic" is interpreted as altered and devitrified glassy material. However this is not obviously in-situ flow material as in A1 (and as in A10 and other samples above), but rather seems to be derived (from a volcanic vent) and deposited together with the fine tuffaceous-quartz-ash grains noted above. At what stage this diffuse vitric material devitrified is not clear.

....

A2 contd. :

Minor (7-10%) coarser (0.3 - 1.2mm) crystals of quartz and plagioclase are scattered; these are corroded and the plagioclase is extensively replaced by sericite + carbonate.

These slightly coarser crystal components justify the prefix "crystal" (tuff), compared with the finer ash size tuffaceous quartz in the general matrix described above.

Irregular grains and/or patches of carbonate (7-10%), which measure up to 0.8 mm are randomly scattered, and tend to be aligned along the vague layering defined by the sericite. These are essentially calcite, but minor very fine carbonate of higher RI ?magnesite or siderite also rare fine pyrite accompanies the calcite. Accessory extremely fine diffuse carbonate (3-5%) is dispersed through the microcrystalline quartz.

Veins of relatively quite coarse crystalline, euhedral quartz-calcite + accessory extremely fine ?siderite cut the rock.

100
A3: very fine acid (crystal lithic) tuff; vaguely layered;
devitrified and pervasively sericitised, fairly
extensively carbonatised

Field comments: locality H30, as for A2, but 10%
yellowish green pyrophyllite

Petrographically this rock is seen to have the same composition and texture as A2 with the exceptions that it lacks quartz-carbonate veins, contains slightly less scattered discrete patches of carbonate.

It contains a similar abundance of extremely fine sericite (10-15%), widespread along intergranular contacts of the quartz, also in thin streaky layers defining a weak cleavage, and rarely in vague patches where it usually replaces small plagioclase crystals. Extremely fine carbonate (10%) has a similar widespread distribution, and is noticeably more abundant in this form than in A2. This is the main difference between A2 and A3.

A4: very fine, acid (crystal vitric) tuff; vaguely layered; devitrified and pervasively sericitised, minor scattered carbonate and trace pyrite

Field comments: locality H30, as for A3, but 15% yellowish green pyrophyllite plus carbonate blebs

This rock is essentially the same as A2 (and thus very similar to A3). It consists of microcrystalline, largely diffuse quartz mosaic, with subordinate (15-20%) extremely fine sericite and minor fine diffuse carbonate (5-7%) intimately mixed throughout. This dispersed carbonate is less than in A3.

Discrete quartz (10-12%), and plagioclase (10%) crystals generally about 0.3mm, but rarely up to 1mm, are randomly disposed, slightly more abundant than in A3 and A4. The plagioclase is extensively replaced by fine sericite + carbonate. These quartz crystals are commonly euhedral.

Small patches of carbonate (10%) up to 3mm are scattered, and are coarser and slightly more abundant than in previous samples. Accessory small euhedral quartz crystals and trace fine pyrite (2-3%) accompanies these.

A5: fine acid crystal vitric tuff; vaguely layered;
devitrified and pervasively sericitised;
minor scattered carbonate and fine pyrite

Field comments: locality H30, as for A2 to A4 but greenish with
more pyrophyllite (?60%), carbonate/quartz (20-30%),
pyrite (10%), and galena (0.5%)

Most of the rock consists of a poorly defined microcrystalline mosaic of quartz, with abundant, fine, dispersed and short shredded streaks of sericite (25-30%), intimately intergrown. Much of the diffuse mosaic, devitrified glass material contains trace, intimately intergrown, ultra fine chlorite, which gives rise to the green colour in this rock, compared with the paler grey-brown samples above.

Much of the fine mica is parallel giving the rock a weak cleavage. This sericite comprises an estimated 25% of the rock, and it appears to be accompanied by minor clays.

Relatively discrete small (0.15 mm) grains of quartz (10-15%) are scattered and these are more abundant than in previous samples. Accessory (2-3%), small patches of sericite + carbonate appear to completely replace plagioclase crystals.

Carbonate is not dispersed throughout the quartz mosaic as in samples A2 to A4 above. However several small patches of carbonate (5%) - (?magnesite or siderite) - + associated small euhedral quartz crystals and pyrite are scattered.

....

A5 contd. :

Pyrite (5-7%) is certainly more abundant than in other samples. This is scattered as single euhedral to subhedral crystals up to 0.5 mm, which may occur alone in the quartz-sericite matrix, or selectively associated with patches of carbonate, or sericite. Lesser (2-3%) much finer (20 micron) pyrite is also dispersed.

This relatively abundant pyrite, and patches of siderite, with negligible disseminated carbonate are the essential differences between this rock and others in the suite.

A6: fine acid crystal vitric tuff; vaguely layered; devitrified, pervasively sericitised; veins of sphalerite, minor galena, pyrite and quartz with minor associated chlorite, clay and silicic alteration, negligible carbonate

Field comments: veins carrying base metal sulphides in altered acid tuffs as above (50% greenish pyrophyllite)

The host rock to these veins is indeed similar to the samples above. It consists of a fairly homogeneous, very fine (0.15mm) aggregate of quartz, made up of microcrystalline diffuse micromosaic and abundant, evenly scattered euhedral grains. This is the combination of devitrified glass and quartz ash crystals as in the samples above. Trace ultra fine chloritic alteration material after glass is intimately intergrown with the diffuse quartz domains.

Very fine sericite (30%), $\pm$ minor clays is ubiquitous along intergranular contacts through this mosaic, commonly in short discontinuous shredded streaks defining a weak cleavage. Minor patchy and streaky concentrations of sericite are after plagioclase, and/or felsic lathic fragments.

The mineralised veins consist predominantly of zoned, coarse crystalline sphalerite, with accessory galena and trace fine pyrite. Minor quartz forms part of some veins. Patches of vein quartz very locally replace the host rock adjacent to the veins.

....

A6 contd. :

Minor localised patches of green and colourless clay have a similar mode of occurrence.

The slightly greater extent of sericitisation through the quartz matrix (than seen in other samples) may be partly due to the mineralisation, although generally this would appear to have virtually the same genesis as in the rocks above. The minor chlorite and "genuine" hydrothermal silicification are however specifically related to the mineralisation.

A7: fine crystal vitric tuff; devitrified and sericitised as above; brecciated with chlorite-carbonate + minor quartz mineralisation filling fractures, trace sphalerite and galena

Field comments: locality H30, strongly altered acid tuff wall rock (estimated chlorite 20-50%, pyrophyllite 20-30%)

The bulk of this rock is essentially the same as A6, i.e. it consists of a poorly defined microcrystalline quartz mosaic, including relatively discrete fine tuff quartz, which has been extensively pervasively sericitised (+ minor clays). The sericite defines a very weak cleavage. There are rare scattered, slightly coarser quartz and altered feldspar crystals.

The difference with this rock however is that it is brecciated, and the fractures which form a random network on variable scale are selectively mineralised by chlorite (20%), carbonate (15-20%), vein and/or cryptocrystalline quartz (5-7%) and rare sphalerite. A small galena grain enveloped in quartz occurs in one fracture.

A8: fine crystal lithic tuff; devitrified,
sericitised, minor coarser sericite and carbonate
in scattered patches and veinlets $\pm$ accessory
sphalerite and pyrite; finer dispersed pyrite

Field comments: locality H30; strongly altered fine grained,
greenish acid tuff, minor sulphides

The bulk of this rock is essentially the same as A6 and A7.
It consists of a fairly homogeneous, mosaic of fine grained (0.1mm)
to diffuse microcrystalline quartz including minor to subordinate
relatively discrete tuff quartz grains. This mosaic has been
pervasively sericitised (30%), with minor associated clays.

Minor small (0.5mm), somewhat streaky patches of relatively
coarser sericite (7-10%) $\pm$ carbonate and minor patches of
carbonate (5-7%) of similar size are randomly scattered. These
appear to be segregations of alteration materials. The carbonate
has quite high relief and seems most likely to be magnesite.
Several veinlets of this same carbonate, intimately mixed with
fine muscovite and quartz occur at random.

Accessory small grains of sphalerite and fine crystals of
pyrite accompany the carbonate patches and veinlets. Accessory
fine pyrite is disseminated.

- A9: fine crystal vitric tuff; devitrified and sericitised, scattered patches of coarser sericite and/or carbonate, minor fine dispersed carbonate

Field comments: locality H30, extensively altered pinkish, fine grained acid tuff

This rock is basically very similar to those above. It consists of a vaguely layered, partly diffuse microcrystalline mosaic of quartz which has been very extensively, pervasively sericitised, $\pm$ minor intimately intergrown carbonate, ?clay and extremely fine chlorite. The minor fine dispersed carbonate makes the pervasive alteration in this rock rather like A3, rather than the several samples immediately above where carbonate is more or less restricted to patches.

Minor relatively coarse (1mm) crystals of plagioclase (10%) and quartz (3-5%) are randomly disposed and extensively altered to sericite $\pm$ carbonate. Minor fairly discrete patchy grains of carbonate (10%) of this same size are scattered, more or less along the vague bedding. Single fairly coarse flakes of chlorite accompany some carbonate.

Minute secondary titania granules are dispersed.

A10: coarse plagioclase crystal, vitric tuff or tuff-lava, with ignimbritic affinities; extensive devitrification and sericitic alteration of the glassy matrix, and carbonate sericite $\pm$ chlorite alteration of plagioclase crystals

Field comments: locality H32; strongly altered plagioclase crystal lithic, vitric tuff, estimate pyrophyllite (20-30%), chlorite (20-30%), pyrite (1%) in groundmass, but up to 15% in chert bombs

As indicated in the accompanying field notes, this rock is decidedly different to the A1-A9 series above. Macroscopically it is slightly more cleaved than the more massive "tougher" rocks above.

In thin section the groundmass is seen to consist of a crypto-crystalline silica (after siliceous glass) with numerous intimately intergrown streaky lenses and flame textured patches (flamme) of extremely fine sericite. Abundant shards crowd small local areas, giving rise to eutaxitic (or fluxion) texture in the matrix.

These streaky flow structures tend to wrap around and weave between randomly scattered plagioclase crystals (20%). These crystals have an average size of about 1mm.; they are generally stressed, fractured, commonly invaded and replaced variably by patchy carbonate, sericite and minor chlorite. Irregular envelopes of carbonate also more or less enclose most of these altered plagioclase crystals.

The flow textures outlined mainly by sericite in the devitrified glass matrix give this rock a glassy flow (-lava) characteristic. The shards suggest a partial ignimbritic genesis, and the mode of occurrence of the plagioclase crystals indicate a (crystal) tuff.

A11: andesitic ?lava; very weakly vesicular; complete pervasive carbonate, sericite-chlorite ?deuteric-alteration; and enrichment in deuteric quartz

Field comments: locality H33; green (?andesitic) dyke rock, massive, feldspar laths altered to carbonate, weathered pinkish-brown

This rock has a homogeneous, fine grained massive, although very vaguely layered texture and composition. It consists of a loosely packed aggregate of subhedral to euhedral carbonate crystals (30-35%), and minor, rather diffuse quartz crystals (10%) of the same size (0.5 mm), within a matrix of extremely fine sericite-chlorite, with minor admixed extremely fine quartz and clusters of secondary titania granules.

Most of the quartz has a vague spherulitic extinction, and rare slightly larger quartz grains form clusters with carbonate. This appears to have formed in interstices by deuteric enrichment.

There is no positive (relict) crystalline texture which confirms the original andesite dyke rock suggested in the field comments or indeed of a crystalline lava. However certainly it has the gross composition of a carbonated (chloritised and sericitised) andesitic facies (possibly grading to basaltic as suggested by the ubiquitous fine titania minerals), with the quartz being essentially a deuteric enrichment component. The spheroidal clusters of quartz-carbonate conceivably fill vesicles.

../

.A11contd. :

Thus the rock is interpreted as an andesite, very weakly vesicular, with complete pervasive carbonate-chlorite-sericite alteration, and minor deuteric enrichment in quartz.

Such a rock may be found as a genuine extrusive lava, or a high-level, chilled and non-porphyritic dyke. (It is similar to sample T2 previously described in report no.2154, with the notable exception of the extensive carbonate alteration.)

A12: (lithic) plagioclase crystal, vitric (lapilli) tuff, with ignimbritic affinities; complete devitrification and minor sericitic alteration of matrix, scattered carbonate and localised fine pyrite

Field comments: locality H32; altered plagioclase crystal lapilli, lithic tuff pyritic, pinkish carbonate/quartz alteration

At least one half of this rock consists of a matrix of cryptocrystalline quartz (devitrified glass), with subordinate, intimately intergrown, streaky, extremely fine sericite $\pm$ accessory equally fine chlorite. Loosely compacted shards are preserved in diffuse microcrystalline quartz.

Plagioclase crystals (30%), rarely measuring up to 3mm, are randomly scattered. These are stressed, and broken and invaded along fractures by the matrix material $\pm$ carbonate.

Carbonate (15-20%) is randomly scattered as small (0.1mm), single euhedral crystals, rarely in irregular very small patches more or less associated with plagioclase.

Several fragments of microcrystalline quartz (volcanic exhalative material) measure up to 10mm across. These contain fine scattered carbonate and are selectively mineralised by fine disseminated pyrite.

.... /

A12 contd. :

This rock is a (lithic) plagioclase crystal tuff in which the nature of the matrix indicates an essential vitric component of ignimbritic affinities. It is only the several lithic fragments which are large enough to justify the term lapilli.

The pink colour, obvious in hand specimen, and referred to in field comment, is not obvious in thin section, but it does correspond with the general devitrified glassy matrix (?hematite dust), rather than a specific mineral phase. Certainly it is not directly related to carbonate.

- A13: slightly sheared andesitic lava; weakly vesicular with minor deuteric quartz enrichment; complete chloritic-sericitic (hydrothermal) alteration, also probable carbonatisation (now removed to produce small cavities). Compares with T2 in former report.

Field comment: locality H37; andesitic dyke ? foliated with vesicular chlorite clots

This is a fairly homogeneous, fine grained, vaguely layered and weakly foliated rock. Also small cavities are obvious in hand specimen, more abundant in some layers than in others. Petrographically it consists of a very fine layered mass of chlorite and sericite in similar abundance. These apparently, pseudo-morphically replace a primary fine crystalline mat of interlocking plagioclase microlites and fine mafic crystals, and/or interstitial mafic glass.

Small (0.05 mm) clouded clumps of secondary titaniferous material (10%), and small (0.15mm) diffuse bleb-like grains of quartz (10%) are scattered throughout.

Numerous ?subhedral to less commonly subrounded cavities are widespread (10-15%), varying in size from 0.1 to several mm, and include the cavities noted in hand specimen. Almost invariably these are lined by titania and/or iron oxides. Some are filled by the same material, chlorite and rarely diffuse quartz. Most of these are interpreted to be original carbonate crystals as seen in sample A11, which has a virtually identical groundmass. Some rounded cavities, particularly when filled with quartz, may be genuine vesicles as recorded in T1 to T4 in previous report 2154. Indeed this sample A13, is very similar to T2 in that suite.

The rock is interpreted as a hydrothermally altered, sheared vesicular andesitic lava.

A14: cleaved and layered andesitic lava, weakly vesicular, minor deuteritic quartz enrichment, complete sericite-chlorite alteration

Field comments: locality H39, but rock type as for A13

This rock is petrologically essentially the same as A13, except that it is slightly more enriched in deuteritic quartz and has less cavities. (Thus it is also similar to A11 in this suite, and T2 in the former suite.)

It consists predominantly of a layered and quite distinctly cleaved, and layered mass of sericite, subordinate chlorite and minor clouded, secondary titaniferous material, almost certainly representing completely altered basaltic or andesitic groundmass. Minor sericitised, incipient phenocrysts are present.

Subrounded bleb-like grains of quartz (10-12%), average size about 0.3mm, and with diffuse spheroidal extinction, are scattered through interstices, more abundant in some layers than in others. Rarely they occur in vesicles. These are interpreted as deuteritic enrichment.

Accessory small cavities after carbonate, as far more abundant in A13, are scattered.

A15: heterogeneous lapilli tuff composed of a fused aggregate of plagioclase crystal vitric tuff, and/or glassy lava fragments; devitrified, sericitised and locally weakly carbonatised

Field comments: location H43; altered plagioclase crystal lithic vitric lapilli tuff

Patchy vaguely layered domains in this rock, up to several cm in maximum dimension, consist of glassy lava "fragments" of closely related composition, more or less fused into the one heterogeneous pyroclastic rock.

The matrix in all of these patchy domains consists of cryptocrystalline silica (devitrified glass) intimately mixed with highly irregular networks, and streaky patches of sericite $\pm$ minor ?clays and/or chlorite. Perlitic, confused streaky flow textures, and minor shards, all indicate the very fluid vitric nature of the original glass. The intensity of sericitic alteration varies, but probably forms about 25% of the rock.

Small plagioclase crystals, variably broken, stressed and bent have a sporadic distribution. They are partly invaded by the matrix, $\pm$ carbonate. Minor carbonate occurs locally in some domains. Minor patches of coarse quartz are scattered. Trace extremely fine pyrite is present.

The gross composition appears to be dacitic, possibly gradational to (silicified) andesitic

A16: heterogeneous (?lapilli) tuff or gross dacitic to (silicified) andesitic composition, composed of devitrified sericitised and weakly chloritised glass and scattered plagioclase crystals

Field comments: locality H57; altered medium grained dacitic plagioclase crystal tuff

This rock is very similar to A15, in that it consists of a fused, heterogeneous aggregate of devitrified and simultaneously sericitised volcanic glass in which fine discontinuous perlitic and streaky flow textures are preserved. Also minor stressed and fractured plagioclase crystal (20%) and accessory quartz crystals, are erratically scattered partly invaded by the matrix $\pm$ carbonate. Irregular patches of carbonate are scattered (7-10%).

The only essential difference from A15 is that this sample contains more obvious chlorite (7-10%), mixed with sericitic alteration products after glass (as in A15), but also in extremely small independent flakes and streaks. Trace fine pyrite is scattered.

The various domains are texturally so variable within themselves, and so similar to each other that individual fragments are difficult to positively define. However the overall heterogeneity would indicate that this rock is a pyroclastic.

A17: heterogeneous (lapilli) tuff of gross dacitic to (silicified) andesitic composition; of devitrified sericitised, weakly chloritised and carbonated glassy fragments, carrying plagioclase and minor quartz crystals

Field comments: locality H57; altered acid-intermediate tuff as for A16, but less altered

In hand specimen, and in thin section this rock is essentially the same as A16, and thus also very similar to A15 from field location no. H43. It consists of a fused mass of patchy domains, and definite volcanic fragments of glassy tuff or lava. They are all composed of devitrified and to a lesser extent sericitised glassy matrix, with fine interrupted perlitic texture preserved, and carrying plagioclase crystals in variable abundance, and minor quartz crystals, which have an average size of about 1.2mm, and are variably stressed, fractured, and invaded by the matrix material $\pm$ carbonate. Minor patches of carbonate (7-10%) and accessory fine chlorite is scattered.

It differs from A16 and A15 in containing minor (5%) euhedral crystals of Fe-Ti oxides up to 0.5mm, which are largely altered to secondary titaniferous material. These occur in A16 but to a slightly lesser abundance.

In petrographic detail the rock is not found to be any less altered than A16.

A18: glassy, porphyritic andesitic lava or tuff-lava;
completely devitrified (silicified) with
associated sericite-chlorite alteration

Field comments: locality H57; altered lithic (?vitric)
acid to intermediate tuff as for A16 and A17,
but less altered than A16

This rock has a similar gross composition as A15 - A17 above, but a somewhat more homogeneous overall texture and carbonate is absent. Euhedral plagioclase crystals up to 3mm (25-30%), are scattered with similar orientation, as individuals and rarely in clumps, through a turbid microcrystalline groundmass. This groundmass consists of diffuse microcrystalline to cryptocrystalline quartz, intimately mixed with quite abundant, extremely fine sericite, chlorite and ?clays.

Incipient perlitic and fluxion structures are locally preserved in the groundmass. Corroded-looking euhedral grains of Fe-Ti oxides (5-7%) are scattered, as in A17. Accessory bleb-like quartz grains of deuteric origin are also scattered.

This rock appears to be very largely of glassy andesitic lava deuterically silicified, with associated sericitic and chloritic alteration. However several clumps of plagioclase, aggregated with quartz and sericite-chlorite do indicate a fragmental component which indicates at least a tuff-lava.

A19: glassy, porphyritic tuff-lava of rhyodacitic composition, with perlitic groundmass replaced by quartz minor chlorite and potash felspar

Field comment: location H62; unaltered to slightly altered ?lithic ?vitric lapilli tuff

This rock has quite a homogeneous texture. It has a groundmass of perlitic glass, replaced by diffuse microcrystalline to cryptocrystalline quartz, and minor (15%) potash felspar, (largely indicated by staining). Exceptionally well formed perlitic textures are outlined by a sericite-chlorite mixture.

Phenocrysts of subhedral to euhedral plagioclase (20-25%) are scattered. These have an average size of about 1mm; they are commonly fractured and weakly invaded by groundmass material ± carbonate. Minor (5-7%) smaller quartz phenocrysts are scattered.

Minor irregular patches of carbonate, and accessory altered and corroded Fe-Ti crystals are scattered.

Small aggregates of feldspars ± quartz and carbonate may constitute fragments (as in A18), or simply be a glomeroporphyritic texture. Also the potash felspar in the glassy groundmass has a patchy distribution which appears to largely coincide with the diffuse reddish patches seen in hand specimen. However some plagioclase crystals are reddish due to iron oxide dust. Thus there is some fragmental aspect to the rock, although no really clearly defined fragments.

.../

A19 contd. :

The rock seems most appropriately called a glassy tuff-lava, and in view of the potash felspar is considered to have a rhyodacitic composition.

It seems that this rock type contributes to the tuffs A15-A17, but the glassy matrix is more sericitised in those rocks, with a complete breakdown of any potash felspar which may have been present.

A20: glassy porphyritic tuff-lava of gross
rhyodacitic composition, perlitic groundmass
replaced by quartz and potash felspar, with
minor chlorite

Field comments: as for A19

This rock is essentially the same in hand specimen and thin section as A19, with the exception that reddish fragments, average size about 10mm, are more clearly defined. On the stained offcut, these also show a more positive reaction to stain indicating a greater concentration of diffuse, microcrystalline potash felspar replacing, or indeed primarily forming, the perlitic glass matrix.

Thus this rock is also a porphyritic glassy lava with silicified and to a lesser extent, chloritised and sericitised groundmass, incorporating potassic (rhyolitic) fragments of similar textural composition. These make the rock a tuff-lava. As in A19, there is less sericitic alteration than in the similar but relatively more "genuine" pyroclastics A15-A17 above.

A22

Field comments: as for A21

This rock is essentially the same as A21 with the exception of slightly more numerous plagioclase crystals (reddish due to dispersed iron oxide dust); and a slightly more extensive random network of quartz veining.

A23: ignimbritic vitric tuff-breccia, devitrified sheared and sericitised particularly through interfragmental areas; minor carbonate, trace galena, pyrite and ?sphalerite

Field comments: locality HS 10S-22; altered plagioclase crystal, ?vitric lapilli tuff, pinkish SiO_2 or carbonate, greenish pyrophyllite disseminated sulphides

On a sawn surface, this rock is seen to consist of a loosely packed aggregate of lobate to lenticular domains of pinkish cryptocrystalline material. These measure about 5 to 10mm by 10 to 30mm.

Petrographically these are seen to consist of cryptocrystalline quartz crowded with ultrafine streaky sericite and with accessory scattered carbonate. This is devitrified and altered glass, fine shards are fairly well preserved indicating ignimbritic affinities. Accessory very small plagioclase crystals are scattered.

Areas between these domains consist of shredded streaky, relatively concentrated sericite with minor clays and ultrafine silica + minor carbonate.

Several quartz grains cut the rock, and accessory very fine grains of galena, pyrite and ?sphalerite occur, both in the sericite and in the siliceous domains.

The rock is interpreted as an ignimbritic vitric tuff-breccia, devitrified probably sheared and sericitised. The quartz veins are pre-shear.

A24: ignimbritic vitric tuff-breccia, devitrified
sheared sericitised chloritised and carbonated,
particularly between ?breccia domains;
accessory pyrite, trace galena

Field comments: locality HS10S-22; as for A23, more greenish
pyrophyllite alteration chloritisation of
lithic fragments, more pyrite (5%)

This is similar to A23 in that it consists predominantly
of cryptocrystalline quartz with intimately mixed fine sericite.
Relict, fine, fluidal or fluxion structure, local, compacted
masses of shard textures are preserved. This is devitrified
ignimbritic glass.

Domains of this composition are rather irregular, with
areas between them occupied by streaky relatively concentrated
sericite (but with minor ultrafine silica).

Chlorite (10%) and carbonate (12-15%) are scattered
± fine quartz, variably as individual crystals through crypto-
crystalline silica, in localised clumps, and more or less as a rim
enveloping some ?welded fragments of that silica. The carbonate
appears to be magnesite.

Rare microcrystalline quartz fragments, and minor
quartz veins cut the rock. Accessory pyrite, trace galena
accompany the chlorite-carbonate-quartz. Petrographically there
are no obvious "chloritised fragments" as referred to in the
field comments even though the hand specimen appears to be
a lithic pyroclastic.

A25: vaguely layered, distinctly cleaved, fine (crystal) vitric tuff; silicified sericitised and chloritised; accessory disseminated pyrite and Fe-Ti oxides

Field comments: locality HS 10S-26A; altered acid tuff

This is a fairly homogeneous, vaguely layered and weakly sheared rock. It consists of a rather diffuse mosaic of poorly defined, incipiently spherulitic quartz grains, grains of cryptocrystalline silica intimately mixed with sericite and minor tuff-quartz crystals, all with an average size of about 0.2mm. This is interpreted as devitrified, silicified and sericitised glassy groundmass material.

Interstitial areas between the grains contain turbid sericite, the variably continuous cleavage planes are defined by fine sericite and chlorite.

Irregular patches of sericite $\pm$ chlorite $\pm$ clays pseudomorph minor plagioclase crystals.

The rock is interpreted as an acid (crystal) vitric tuff, and is essentially the same as A2 to A9 above, but without carbonate and with more chlorite.

Fine (0.3 mm) sulphides are scattered and locally form loose aggregates associated with quartz and chlorite. In polished section these are identified as pyrite which forms 5-7% of the sample. Corroded and oxidised crystals of Fe-Ti oxide (1-2%) are also scattered. In this section (and in hand specimen) there is no evidence of base metal sulphides.

A26: (crystal) lithic vitric tuff, silicified
sericitised, sheared and weakly chloritised,
minor carbonate in veins and scattered;
accessory pyrite

Field comments: locality HS 105-28; altered and silicified
acid tuff

On a sawn surface the fragmental nature of this rock is more clearly shown than in most tuffs described above. Irregular fragments up to several cm across of microcrystalline quartz, incorporate irregular patches of fine chlorite, sericite and clays. These are randomly disposed through a streaky-layered matrix, with chloritised cleavage planes which has a similar composition to A25, except that it is more extensively pervasively argillised and sericitised, and locally silicified. This matrix however is interpreted to have been primarily vitric.

Patches of sericite and/or carbonate seem likely to replace plagioclase crystals. Veins of carbonate cut all domains and may be accompanied by quartz + pyrite. Corroded and oxidised Fe-Ti oxide grains (2-3%) are disseminated.

The fragments in this rock are sufficiently distinctive to classify the rock as "lithic".

A27: massive, fairly poorly sorted, fine to coarse grained, muscovite quartz sandstone (partly metamorphically recrystallised to quartzite)

Field comments: location HS 10S-35; poorly sorted sand-siltstone

This rock consists of a massive aggregate of the following detrital components, which range in size from 0.1 to 0.7 mm. The grains are variably angular to subangular.

single quartz crystal grains (generally stressed)	approx 50%
grains of microcrystalline quartz	30%
fragments of sericitic quartz siltstone	10%
muscovite (mainly detrital)	10%
heavy minerals (zircon, tourmaline, Fe-Ti oxides)	2-3%

The single quartz crystal grains (particularly the coarser ones) appear to have a metamorphic or meta-plutonic provenance. The polycrystalline quartz may be variably interpreted as derived from fine meta-quartzite, volcanic exhalative silica, vein quartz; gradational to in-situ metamorphically recrystallised quartz. The reasonable abundance of detrital muscovite would suggest a metamorphic provenance.

There is no positive evidence of material derived from a volcanic terrane; and only minor diagenetic muscovite as very fine flakes forming discontinuous foliae, more or less through intergranular areas.

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A28: massive, fine to medium grained, moderately sorted, muscovite quartz sandstone, recrystallised and thus quartzitic

Field comment: locality HS 105-35; as for A27, as 3m beds interlayered with black shale

This rock is very similar to A27, although it is generally finer and slightly better sorted. Also it is "cleaner" and contains more muscovite. It consists of a tightly packed aggregate of the following detrital components, moderately recrystallised and thus tending to be quartzitic.

single quartz crystals grains	approx 60%
composite (cryptocrystalline to microcrystalline) quartz grains	15-20%
sericitic quartz siltstone fragments	5-10%
detrital muscovite	10%
diagenetic muscovite (sericite)	5-7%
heavy mineral grains (tourmaline, zircon, ?monazite, Fe-Ti oxides)	1-2%

Grain size ranges from 0.1 to 0.4mm. Comments on the component grains are the same as given for A27. Metamorphic crystallisation, and the resultant development of sutured intergranular boundaries is more advanced than in A27, thus making it difficult to resolve genuine polycrystalline detrital grains. The greater abundance of intergranular diagenetic muscovite (sericite) has resulted from this, and from an inherently greater clay component.

There is no evidence diagnostic of a volcanogenic origin of the components, and objectively the rock does not really have turbidite characteristics.

A29: weakly dolomitic and pyritic; thin bedded to laminated, intercalated, carbonaceous silty shale and quartz siltstone facies

Field comments: locality HS 105-36; thin bedded black shale, ?tuffaceous interbeds

Laminae and thin beds of dark coloured (almost certainly carbonaceous), silty shale, are interbedded with a similar abundance of (shaly) siltstone.

The darker shale layers consist of extremely fine muscovite, at least some of which appears to be detrital, intimately mixed with fine quartz silt, with intergranular areas clouded with ultrafine ?carbonaceous material.

The paler grey layers consist mainly of a metamorphically microcrystalline aggregate of very fine quartz sand, and quartz silt, with minor fine mica and carbonaceous dust which are more abundant in the shale facies.

Accessory to minor very fine turbid carbonate (dolomite) occurs in the silty layers, to a lesser extent in the shale. Accessory very fine euhedral pyrite is disseminated through the shale, to a lesser extent through the silt.

There is no evidence of a tuffaceous component.

A30: weakly pyritic, dolomitic shale silt and
very fine sand facies in thin bedded, micro-slumped
and locally cross-bedded intercalated sequence

Field comments: locality HS 10S-36; thin bedded ?tuffaceous
sandy-silty-black shale, minor pyrite
and carbonate

This rock is comprise of essentially the same facies
as A29, but it is not as regularly bedded, as manifest by the
small scale slumping and transcurrent bedding structures seen
on the sawn surface.

Laminations and thin beds of silty black shale are
irregularly interbedded with lenticular, variably continuous and
slumped thin beds of metamorphically recrystallised shaly
siltstone to very fine quartz sandstone. At least some of the
fine muscovite which comprises the shale component, appears to
be detrital.

Minor (10-12%) fine carbonate (dolomite) is widespread
through the different facies, and has the same average grain
size as that in a given shale-silt-fine sand layer. Several
veins of turbid carbonate $\pm$ quartz, rarely carry trace pyrite.

Accessory to minor (3-5%) extremely fine pyrite is
disseminated.

There are no components diagnostic of a tuffaceous
provenance.

A31: quartz plagioclase crystal tuff or greywacke derived from an acid volcanic terrane, mixed with black shale; superimposed chlorite-carbonate-sericite alteration

Field comments: locality P1RD, S-31; coarse quartz felspar "sandstone dyke" cross cutting sheared black shale, possible reworked tuff, ?imbricate structure

The "sandstone" dyke areas in this section consist of a loosely packed, poorly sorted aggregate of grains ranging in size from 0.1 to 5mm, of the composition listed below, randomly disposed through a heterogeneous, somewhat sheared matrix of chlorite-carbonate-sericite.

The grains are:-

single crystal quartz, stressed and fractured but variably euhedral to subrounded and embayed indicating a volcanic origin	30%
plagioclase crystals, also probably volcanic, virtually completely replaced by sericite-carbonate	30%
stressed, polycrystalline quartz fragments derived from ?vein material or metamorphic terrane (or possibly vein quartz dislocated in-situ)	10-15%

The matrix (30%) commonly invades the fractured grains. In hand specimen, and to a less obvious degree in thin section, these domains are seen to intrude "black-shale". This "black-shale" consists of a mass of ultrafine sericite chlorite studded with diffuse blobs of carbonate. Fine carbonaceous material occurs along shear planes. Stressed veins of quartz and/or carbonate form a random network along shears and/or breccia planes.

.../

A31 contd. :

These carry trace pyrite. Blebs of cryptocrystalline quartz in the "shale" suggest that it is tuffaceous(although these may be diatoms).

The rock may be interpreted as a quartz-plagioclase crystal tuff, or a greywacke, derived from an acid tuff or porphyry (lava), which became confused with a black shale facies at soft sediment stage. The intimately associated shale suggests a predominantly clastic rather than direct volcanoclastic origin. It has been subsequently sheared, carbonated, chloritised and sericitised.

A32: mixed facies of volcanically derived wacke and shale;
(possibly a reworked quartz plagioclase crystal tuff);
sheared, extensive carbonate-sericite and minor
chlorite alteration

Field comments: as for A31

Quartz crystals (30%) average size 2mm, rounded to subhedral and embayed, stressed and fractured; also plagioclase crystals (30%), completely replaced by sericite, are all randomly disposed through a matrix of sericite chlorite fine carbonate.

Irregular streaky, lenticular and flame-like domains of sericitic shale (30%), are also randomly disposed.

This rock is interpreted as a sheared and altered, mixed facies of volcanically derived wacke and shale. Conceivably it is a reworked, acid crystal tuff.

Veins of chlorite ± carbonate cut the rock.

A33: quartz felspar crystal tuff, mixed with minor shale,
or volcanically derived wacke; weak sericitic alteration
of plagioclase, more extensive secondary chlorite-
sericite through the matrix

Field comment: P1 RLYC-33, slightly altered reworked tuff or
ash fall tuff, slivers of shale

This rock consists largely of a loosely packed, poorly
sorted, aggregate of subhedral to subrounded and embayed single
quartz crystals (20%), and of subhedral to euhedral single
plagioclase crystals (40-50%), average size about 1.8mm.

The plagioclase is turbid with fine flecks of sericite
alteration, but certainly this is not as extensive as in A31
and A32.

The matrix between these grains consists of clouded
extremely fine chlorite sericite and minor quartz, and this forms
about 40% of the rock. Locally the chlorite is relatively
concentrated to form fairly discrete vein-like masses ± trace
titania granules. Trace fine pyrite is scattered.

Minor slivers of sheared black shale are obvious in hand
specimen but less apparent more or less as shale fragments in
the thin section.

Consistent with the interpretation of A31 and A32, this rock
may be considered as a volcanically derived wacke, i.e. quite
likely a reworked acid tuff. In thin section however, it is
objectively very difficult to differentiate this from a crystal
tuff, mixed with minor fine clastic detritus. These alternate
interpretations therefore remain, but the petrology does confirm
the relatively less extensive alteration noted in the field comments.

A34: (lithic) quartz plagioclase vitric tuff;
devitrified extensive sericitic, subordinate
chloritic and carbonate alteration

Field comments: locality HS 10S-33; moderately altered
plagioclase crystal tuff, chloritised
and pyritised

This rock consists large of a diffuse microcrystalline mosaic of quartz, with subordinate, fine sericite (20%) dispersed throughout, and minor fine chlorite (10-12%) widespread more or less along intergranular contacts. This diffuse quartz mosaic is largely after vitric tuff material.

Euhedral crystals of plagioclase (25-30%) and of quartz (10-15%) are scattered. The plagioclase is generally extensively replaced by sericite $\pm$ carbonate. Quartz is subrounded, embayed, fractured and invaded by the matrix.

Small patches of carbonate are scattered (7-10%) and several carbonate veins $\pm$ quartz and chlorite, post-date several sheared quartz veins. Minor chloritised and carbonatised fragments are scattered.

This is similar to the tuff group A2 to A9, except there are more coarser quartz crystals, and more chlorite than normal in that group.

A35: (lithic) quartz plagioclase vitric tuff;
brecciated, devitrified extensive pervasive
sericitic alteration, minor chlorite-quartz-
+ pyrite mainly along fracture network

Field comments: HS 10S-33; moderately to strongly altered
lithic tuff

Most of this rock has a fairly homogeneous composition, essentially the same as A34, and thus similar to the tuff group A2 to A9. It is however slightly more strongly sericitised (30%), than most of those samples (including sericitised felspar crystals).

The fragmental texture implied in the field comments is due to more or less in-situ fracturing (brecciation) and the random fracture network is erratically mineralised by chlorite and rarely fine quartz, and pyrite. Locally these three minerals form batches up to 3mm across.

There are minor small poorly defined fragments of altered glass groundmass, similar to the bulk of the rock, to justify the term lithic.

A36: quartz plagioclase crystal vitric tuff,
devitrified pervasively sericitised, minor fairly
widespread carbonate, patchy more restricted
chlorite alteration ± quartz and pyrite

Field comments: HS 10S-33; strongly altered lithic tuff

The bulk of this rock consists of a diffuse
microcrystalline mosaic of quartz crowded with sericite
(25-30%). Fine chlorite (7-10%) is widespread along
intergranular boundaries through the mosaic. Fine
carbonate (15-20%) is ubiquitous.

As in the tuff group A2 to A9, and in A34, A35, the
incipient spheroidal nature of individual "grains" forming
most of this mosaic are interpreted to be after glass,
the more distinct fine quartz grains are interpreted as fine
quartz crystal ash, and together they are considered to
constitute a vitric tuff or crystal vitric tuff.

Coarser (1-3mm) euhedral plagioclase crystals (20%)
and euhedral to rounded corroded quartz crystals (10%) are
randomly scattered. The plagioclase is completely replaced
by sericite.

Ragged small patches and discontinuous veins of
chlorite ± quartz are scattered.

This is more distinctive than in most other rocks of this
type. Pyrite (5-7%) is slightly coarser and more abundant than
in most rocks; it is disseminated more or less associated
with chlorite-quartz.

A37: quartz plagioclase crystal lithic tuff,
devitrified, pervasively sericitised, fairly
extensively chloritised, minor carbonate,
trace pyrite

Field comments: locality HS 106-33; altered lithic tuff
or sheared tuffaceous sediment

This rock is so similar to A36 that a separate
description is not justified.

Chlorite commonly accompanies the sericite replacing
scattered plagioclase crystals. Minor clots of carbonate-
chlorite are scattered. Veins of chlorite + quartz and
carbonate cut the rock and clearly post-date the pervasive
sericitic alteration.

Small euhedral, to subrounded and corroded quartz
crystals (10-15%) are slightly more abundant than in A36.
Disseminated carbonate is less than in A36. Trace fine
pyrite and titaniferous granules have a random distribution.

(ASSAY) SAMPLES T5819 - T5824

THIN/POL. SECT. NO. (I.R.P.)	SAMPLE No.	REMARKS & LOCATION	PPM & %				Mn%	Fe%	Mn + Fe %
			Cu	Pb	Zn	Ag			
Rep.No.2158 (?) A15	T 5819	- Limonitic lapilli tuff - limonite stained. Located above proposed drill site on Cnr at 5 S 625E.	10	34	60	0.4	0.26	1.4	1.66
(?) A15	T 5820	As above	6	24	66	0.4	480	1.5	1.6
A29;A30	T 5821	Black shale with minor pyrite on road corner 5378600N; 600N; 377 150E.	22	40	40	0.4	80	2.1	2.1
-	T 5822	Secondary Mn crust (1 cm) coating rounded acid volc. pebbles (crust only sample) (location 9S; 320W - soil results were 72 Cu, 52 Pb, 105 Zn).	56	106	1900	1.8	12.8	14.0	26.8
A31;A32	T 5823	Cross cutting quartz (carbonate galena) veinlet in black shale in 10 m shale band on corner at 5378400N; 377550E.	116	<u>0.58</u>	0.16	22	1.45	19.0	20.5
-	T 5824	Galena bearing 0.2 m wide black shale wedge within reworked acid tuff - highly altered & chloritized.	8	<u>0.2</u>	540	13	750	1.75	1.8

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170147

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Chester

Mr. I.R. Pontifex,
Ian R. Pontifex & Associates Pty. Ltd.,
Box 91,
NORWOOD, S.A. 5067

JP/SJC

9th May, 1977.

Dear Ian,

Please find enclosed 9 rocks for petrological examination. Samples T1 to T4 are for thin section work and T5 to T9 are sulphide bearing for thin/polished section determination.

The rocks are from the Primrose Pyroclastics of the Mt. Read Group located north of Rosebery, Tasmania.

A brief description of the samples follows:-

<u>Assay No.</u>	<u>Sample No.</u>	<u>Field Ref.</u>	<u>Remarks</u>
	T1	H54a	(?) Propylitized andesitic dyke/flow.
	T2	H59	chloritized andesitic varicular dyke/flow.
	T3	C6	Sheared chloritic andesitic dyke seen to transect bedded pyritic chert).
	T4	C25	Fine grained sheared chloritic andesitic/doleritic dyke.
	T5	M.F.4	Remobilized sheared massive synsedimentary volcanogenic lead zinc sulphide ore (Mt. Farrell Mine).
T5S13	T6	H82 N.F. N.E. 1/4 N.E. 1/4 N.E. 1/4	Remobilized sheared massive synsedimentary volcanogenic Cu Pb Zn sulphide within tuffaceous turbidite sequence (8kms west of T5)

.../2.

ASSAY No	SAMPLE No	FIELD REF.	REMARKS
T5810	T7	H63/B2 HEC ADULT (now down 16V)	Submassive sulphides in sedimentary (bedded) chert - slightly carbonaceous.
(T5810)	T8	H63/B2 "	As above in full (This chert bed has max. thickness of 3 cms and is flanked by moderately altered acid tuffs).
T5812	T9	H69 C(RLY)	Possible bedded chert containing submassive sulphides.

In addition to the routine mineralogical descriptions, could you please comment on the following:-

1. Based on field evidence, T3 is a definite dyke rock intruding and cutting across the bedding of a pyritic chert at right angles. How similar are rocks T1, T2 and T4 to T3 and could these also be dykes, rather than flows (or tuffs).
2. What evidence is there that the massive sulphide of sample T5 was originally synsedimentary?
3. Is there a close similarity between sample T6 and sample T5 and is there evidence that T6 was originally synsedimentary?
4. Sample T7 occurs as a lenticular bedded chert underlain and overlain by slightly altered acid volcanics. What evidence is there for its synsedimentary nature, as distinct from hydrothermal quartz vein containing base metal sulphides.
5. Sample T9 is less convincing in hand specimen as base metal sulphide bearing chert (remobilized?). Is the rock more likely to have hydrothermal or synsedimentary affinities?

Hoping you can shed some light on the above queries.

Best regards,

Yours sincerely
Preussag Australi Pty. Ltd.

R.J. Perkin

c.c. I.B. Orr.

P.S. Please send one copy (carbon) plus the invoice to this office and send the original and another copy (plus samples to):-

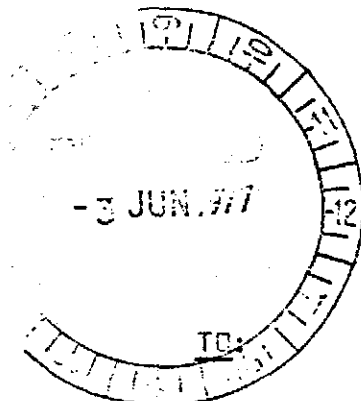
D.B. Orr, Divisional Geologist,
Comstaff Pty. Ltd.,
Box 794, Burnie, Tasmania 7320

Ian R. Pontifex & Associates Pty. Ltd.

TEL. 332 6744
A.H. 31 3816

26 KENSINGTON ROAD, ROSE PARK
SOUTH AUSTRALIA

P.O. BOX 91, NORWOOD
SOUTH AUSTRALIA 5067



MINERALOGICAL REPORT NO. 2154

31st May, 1977

✓

COPY TO:

Mr. D. B. Orr,
Divisional Geologist,
Comstaff Pty. Ltd.,
P.O. Box 794,
BURNIE, Tasmania 7320

Mr. D. J. Perkin,
Preussag Australia Pty. Ltd.,
3rd Floor, Ferrer House,
24-28 Collins Street,
MELBOURNE, Victoria 3000

YOUR REFERENCE:

DGP/SJC
Letter from D.J. Perkin dated
9/5/77

MATERIAL:

Nine Rock Samples

IDENTIFICATION:

T1 to T9

WORK REQUESTED:

Petrographic and mineragraphic
examination and comments as
specified

SAMPLES & SECTIONS:

Sent to Mr. D.B. Orr by (air) post
to the above Burnie address

PONTIFEX & ASSOCIATES PTY. LTD.

COMMENTS - (as requested in your covering letter)

(1) Samples T1 to T4 have a similar bulk mineralogy to the extent that they are interpreted to have the same genesis. They are primary andesites (or basic andesites), but the original plagioclase is completely sericitised, the original mafic minerals (including interstitial basic glass), are completely chloritised. Also minor late-stage primary quartz partly replaces these components and/or is located in primary interstices.

This alteration is essentially deuteric-hydrothermal, but assisted by retrogression due to moderate shear stress in the slightly cleaved rocks T1, T2 and T4.

In such microcrystalline rocks it is difficult to objectively, positively differentiate between flow (lavas), and chilled high-level (non-morphitic) dyke rocks - which also appears to be the main field problem.

The orientation of microlite pseudomorphs in T1, T2 and in T4, considered together with vague primary layering, abundant probably interstitial glass, and together with the vesicles in these rocks, classifies them fairly conclusively as effusive (i.e. etc.). (It is acknowledged however that high-level dykes may also have flow orientation textures - but rarely vesicles.)

The texture in T3 is different, but it is microcrystalline and apparently chilled, thus there is really insufficient petrographic evidence to objectively identify it as an effusive or intrusive (dyke). However compared with T1, T2 and T4 it does lack flow structures and vesicles, former minute hornblende and pyroxene crystals are evident and some fragments are present. Thus the petrology may be interpreted to confirm the intrusive-dyke mode of occurrence of this rock, and also indicates that it is a minor intrusive phase of the flow rocks T1, T2, T4.

(2) It is very difficult to conclusively prove from the completely objective macro or micro examination of a single hand specimen, that sulphides, e.g. in sample T5, are "syndimentary". This sample consists of a layered sequence of intercalated Pb-In sulphides, acid tuff, carbonaceous (i.e. graphitic) slate, dolomite and chert. These layers are variably brecciated, recrystallised and remobilised essentially in-situ, which seems to be predominantly tectonic, but minor, primary intraformational type brecciation may be postulated.

Tectonic reconstitution and mobilisation of quartz (to produce what may be termed dynamomorphitic quartz) has induced localised silicification.

The intercalated and layered nature of the sulphides and the textural evidence that they have suffered the same reconstitution as the host rock facies, indicates that they are inherent to the rock. The composition of these facies, indicates a tuffaceous dolomitic-black shale environment, conceivably on the flanks of a turbidite sequence.

The evidence thus indicates, particularly in the context of this whole suite, that the sulphides in T5 have syndimentary and intimately related volcanogenic origin.

(3) Sample T6 is similar to T5 in a general sense, although there is no positive tuff component, and carbonate is absent; carbonaceous (graphitic) slate is more abundant. Textures indicate probable intraformational brecciation and superimposed tectonic reconstitution, and the sulphides are essentially the same.

Thus there is not really a specific relation between T6 and T5, but the mode of occurrence of the sulphides and the host rock do indicate a "syndimentary" genesis.

original very faint

3.

(4) As noted above, the reported mode of occurrence of sample T7, and the broader consideration of its context in the entire suite, provides at least as much evidence that the sulphides in that sample are "syndimentary", as does the detailed mode of occurrence of those sulphides themselves.

However the layered nature of the sulphides and intimate intergrowth with reconstituted dolomitic-chert, and dynamomorphite quartz indicates their inherent nature.

It is noted that the precise origin of this dynamomorphite quartz in this and other samples is not clear. It has certainly been mobilised, stressed and recrystallised, but whether it derived "locally" from some cm distance, or "locally" in terms of the whole sequence from some metres distance, is not clear. It has some characteristics of epithermal-volcanogenic quartz which may have permeated a disturbed volcanic-sedimentary sequence. However it has not selectively carried sulphides or introduced them into T5 to T8 in an epigenetic sense.

(5) Sample T9 is principally an altered rhyolitic glass, and the petrology confirms your field interpretation of hydrothermal affinities. Although it is broadly banded, the sulphides form slightly coarser aggregates with slightly coarser and better crystalline quartz and carbonate gangue, suggesting void filling. However the composition and mode of occurrence of the sulphides, and of the gangue is identical to T5 to T8 and in this context it may be concluded to be genuinely remobilised, synvolcanogenic mineralisation. Certainly there is no specific wall rock alteration in the rhyolite host rock in contact with the sulphides, and genuine epigenetic introduction of these sulphides from an external hydrothermal source.

original very faint

I1: andesitic ?glassy lava; extremely fine-grained and non-porphyritic; accessory small vesicles; complete pervasive chloritic sericitic and minor silicic, deuteric alteration

Field comment: H54; (?) propylitised andesitic dyke/flow

This rock is quite homogeneous, extremely fine grained, and has a poorly developed cleavage. It consists largely of a tightly packed mat of similarly oriented (relict), minute plagioclase laths (or microlites), completely replaced by sericite (+ clay), and to a lesser extent by extremely fine secondary quartz. The similar orientation appears to be due to primary flow, although some laths are oblique to this direction.

The plagioclase laths are intimately intergrown with a similar abundance of equally fine crystals and/or matrix composed of chlorite + clays, and clouded by ultra fine secondary titanite granules. These components have formed from mafic (hornblende) crystals and/or basic glass, in a primary volcanic groundmass.

Larger (0.3mm) irregular and vague, rounded to amoeboidal patches of coarser chlorite (10-12%), appear to be after small phenocrysts and/or fill vesicles. Chlorite surrounding small voids scattered along one layer are almost certainly relict vesicles.

Vague veinlets of chlorite cut the rock, very fine streaky shreds of sericite + chlorite parallel to the flow orientation give rise to the foliation. Thus although most chlorite and sericite is deuteric, at least some is retrograde due to stress.

T2: extremely fine, andesitic, vesicular lava;
enriched in deuteric quartz, complete pervasive
sericitic and chloritic alteration also essentially
deuteric but possibly partly retrograde, due to
minor shear stress

Field comment: H59; chloritised andesitic vesicular dyke/flow

This is a fairly homogeneous, extremely fine-grained rock,
weakly cleaved with coincidental layering on a scale of about 10mm.
The layering is most clearly manifest by abundant small vesicles
in some bands, generally void, but some are filled by fine
euhedral calcite.

In thin section the sample is seen to consist essentially of
a fine layered mass of poorly defined sericite pseudomorphs after
plagioclase (40-60%), average size of 0.2mm in maximum dimension,
intimately intergrown with equally fine chlorite (30-40%), the
majority of which appears to pseudomorph primary mafic crystals.
Minor, slightly larger sericite and rare chlorite replicas are
also present.

Fine (0.1 to 0.3mm) quartz grains (10-15%) are widely
scattered. These are variably subangular to rounded, and they
generally have undulose extinction, many with a diffuse radial
pattern, rarely with a superimposed concentric pattern. They are
interpreted as primary interstitial voids, including mini-vesicles,
filled with deuteric quartz.

Ultra fine secondary titanite granules are dispersed
mainly through chlorite.

The vesicles noted macroscopically in bands, tend to be
elongate parallel to the layering, those represented in the section are
void, generally rimmed by chlorite. This elongation may be primary,
but seems most likely due to superimposed moderate stress, which
produces the weak cleavage, and effectively destroys the primary flow
texture which is manifest in the otherwise similar rock T1.

T3: micro-andesitic dyke rock; complete pervasive silicic sericitic and chloritic alteration of deuteric origin

Field comment: C6; sheared chloritised andesite dyke
(transects bedded pyritic chert)

This is a homogeneous, massive extremely fine-grained rock. It consists of small (0.1 to 0.3mm) subhedral to euhedral crystals of plagioclase (30-35%), of amphibole and lesser pyroxene, evenly but quite randomly distributed through a predominantly chloritic "matrix". The plagioclase crystals are pseudomorphically replaced by cryptocrystalline quartz and clouded sericite, the mafic crystals are replaced by quartz.

The chloritic "matrix" forms 50-55% of the rock and is commonly admixed with minor sericite and cryptocrystalline quartz, also it contains minor extremely fine secondary titanite granules.

Locally this chlorite is seen to form replacement replicas after hornblende crystals, although these are not as clearly defined on the silicified replicas. The way the chlorite forms on and around the plagioclase suggests an incipient, microscopic, ophitic texture, or a primary interstitial basic glass. Certainly there is no suggestion of a common, primary, flow-alignant texture; nor is there a clearly defined cleavage as in T1 and T2. Minor chloritised fragments are present.

The combination of field and petrographic evidence identifies this rock as a micro-andesitic dyke rock, with complete, pervasive silicic, sericitic and chloritic alteration of primary (deuteric) origin.

T4: extremely fine, andesitic (7glassy) lava;
complete pervasive chloritic, sericitic and minor
silicic alteration of deuteric origin

Field comment: C25; fine grained, sheared chloritic
andesitic/doleritic dyke

This is an extremely fine-grained massive rock, with a moderately well developed cleavage. It consists essentially of minor secondary quartz, and more abundant sericite, and chlorite with disseminated titanite granules. Thus it has virtually the same bulk mineralogical composition as T1, 2, and 3. Texturally it is most like T1.

Original plagioclase microlites are similarly oriented and fairly tightly packed into a very fine wavy layered mat: these are completely replaced by secondary quartz and (clay)-sericite. They have an (interstitial) matrix of chlorite which occasionally may be locally identified as a replacement product after mafic crystals, but generally it is interpreted to replace interstitial mafic glass.

Minute titanite granules, including rutile crystals are dispersed through the chlorite. Several rounded clumps of coarse, chlorite, more or less surrounded by quartz and/or clay-sericite appear to be incipient vesicles.

Several veins of quite coarse grained chlorite, and minor interstitial quartz cut the rock, as relatively late concentrations of the late-stage, a deuteric, pervasive alteration.

T5: complex, thin-layered syngenetic sequence of
 Zn-Pb sulphides, acid tuff, carbonaceous slate,
 dolomite and ?chert; brecciated recrystallised
 remobilised, and silicified, essentially in-situ

Field comment: M.F.4; remobilised sheared, massive synsedimentary
 volcanogenic PbZn sulphide ore (Mt. Farrell Mine)

In thin section, irregular layers of Zn-Pb sulphide up to
 10mm thick are fairly continuous through, and more or less
 intercalated with, a texturally complex (breccia) aggregate of
 predominantly quartzose composition, but with minor carbonate and
 carbonaceous (sericitic) slate, and possible impure chert.

Fragments in this aggregate are angular, quite irregular
 and measure up to 2mm. They are randomly disposed, locally broken
 and consist of the following, listed in order of decreasing abundance:

silicified quartz crystal tuff
 sericitic siliceous slate (carbonaceous)
 microcrystalline carbonate (dolomite)
 dolomite and/or sericitic ?chert, which
 may be confused with siliceous siltstone

Fragments of a given composition tend to be more abundant
 in some layers than in others; they are stressed, partly recrystallised
 and show considerably more or less in-situ dislocation.
 The evidence indicates a complex primary, syngenetic, banded sequence
 of sulphides and the facies types listed above, in which primary
 sedimentary brecciation may have occurred before the post-sedimentary
 tectonic brecciation.

The breccia aggregate and to a lesser extent the silicified
 has been penetrated by 'vein' quartz and minor carbonate. This
 this seems to be in-situ recrystallised material, however some of it
 may be epithermal (?volcanogenic). (This however does not imply
 that the sulphides are epigenetic.)

T5 contd. :

Examination of the polished section reveals dominant sphalerite, minor to subordinate galena, accessory pyrite and chalcopyrite. As noted, these are quite distinctly layered. The sphalerite is quite coarse, fractured and recrystallised commonly to form zoned crystals. It also commonly penetrates through adjacent breccia domains described above - a further manifestation of its more or less in-situ remobilisation.

Galena may also be quite coarse and is also recrystallised, manifest largely as veinlets and braided networks through sphalerite and non-sulphide fragments.

Pyrite occurs as minute euhedral crystals as trains through sphalerite-galena, or as clusters within the breccia, and scattered through the mobilised 'vein' quartz noted above. Chalcopyrite occurs as very small, conchoidal grains, located in fractures and veins in sphalerite, in small pyrite clusters, and scattered through 'vein' quartz. It is relatively concentrated in a single layer through the section. Ultra fine, (1-10 micron) minute chalcopyrite grains are also exsolved within some sphalerite, commonly quite broader in dust-like clouds.

The presence of ultra fine graphite in some shale fragments was also confirmed in polished section. Ultra fine pyrite also occurs in these fragments.

T6: layer of variably sheared, brecciated and recrystallised quartz, pyrite, subordinate sphalerite, and minor galena more or less inter alated with dislocated and primarily slumped graphitic sericitic slate

Field comment: H.82.N.F. Remobilised, sheared, massive, synsedimentary, volcanogenic Cu-Pb-Zn sulphide in tuffaceous turbidite sequence (6 kms east of T5)

The sulphide-rich layer in this rock consists largely of coarse (3mm) euhedral pyrite crystals, and relatively finer irregularly lenticular aggregates of pyrite, also subordinate sphalerite and minor galena. These form a loosely packed breccia aggregate with stressed and recrystallised, fine quartzose fragments. It is difficult to determine if these quartzose fragments are siliceous siltstone, silicified slate, or impure chert. Interfragmental areas are filled by discontinuous, highly irregular patches of remobilised "clean" quartz, which grade into the quartzose fragments, thus further obscuring their identity.

In polished section the pyrite is seen to be extensively stressed, fractured and recrystallised; locally converted to marcasite, and locally sheared out along slip planes. Several "generations" of pyrite could be objectively nominated according to its various textural forms, however overall it is considered to have essentially the one primary genesis, but extensively reconstituted more or less in-situ.

T6 contd. :

Sphalerite is moderately coarse and relatively concentrated in discontinuous layers mainly along the margins of the pyrite. Smaller, and lesser galena grains are scattered, mainly in the limits of the sphalerite layer. Highly irregular veins and patches of (remobilised) sphalerite and galena have a sporadic distribution through intricate fracture patterns in pyrite.

Trace small grains of chalcopyrite accompany sphalerite, but this mineral is less abundant than in T5. The ultra fine exsolved chalcopyrite in sphalerite common in T5, is very rare in this T6 sample.

The relatively non-sulphide layer in this sample consists predominantly of sericitic carbonaceous slates. Locally this is dislocated and/or elongated, and incorporates small siliceous siltstone breccia fragments (of intraformational type) also localised, extremely small patches of remobilised quartz from the adjacent sulphide-quartz breccia layer.

There is no evidence of definite tuffaceous component, although extremely fine tuff detritus could contribute to the slate. Certainly the rock type and incorporated probable intraformational-type fragments are characteristic of turbidite facies suggested in field comments.

I7: thin layered, recrystallised dolomitic-chert, largely invaded and replaced by (7re) mobilised quartz; variably continuous layers of locally mobilised sphalerite, lesser galena, trace chalcopyrite, also trains of fine pyrite crystals

Field comment: H63/82. Submassive sulphides in sedimentary (?bedded) chert - slightly carbonaceous

This is an extremely fine grained, thin banded siliceous rock with minor, intercalated and variably continuous thin streaky sulphide layers. It consists largely of stressed (7re)-mobilised quartz and this is intimately confused with patchy, diffuse microcrystalline quartz mosaic containing minor, scattered granules, and variably continuous bands of fine euhedral carbonate (dolomite) crystals. This latter combination appears to represent the essential host rock, which partly in accordance with the field rock name, may be interpreted as a recrystallised dolomitic chert.

Sulphides occur mainly as variably continuous streaks, stringers and streaky layers along the rock banding, and consist chiefly of sphalerite, minor to subordinate pyrite and galena and trace chalcopyrite. These have been locally mobilised, some or late within the confines of primary layers. The mass metal sulphides form highly irregular, commonly skeletal grains largely intergrown with the silicate host and composite one with the other. Minute exsolved inclusions of chalcopyrite are fairly common in sphalerite. Pyrite tends to form small euhedral crystals, albeit fractured and stressed, and to form fairly continuous to locally thin layers.

There is no evidence of graphite, or other dark material, as is commonly dispersed in I6, and to a lesser extent in I5.

T8: layered, stressed and recrystallised dolomitic "chert", extensively invaded by mobilised quartz; intercalated layers of recrystallised sphalerite, subordinate galena, minor pyrite and trace chalcopyrite

Field comment: H63/82. As for T7 (in a chert bed maximum thickness of 3cm, flanked by altered acid tuffs)

Petrologically this sample is indeed essentially the same as T7. It is fairly distinctly layered on a scale of about 5mm, these are composed of relatively greater or lesser concentrations of the essential phases described in T7. These are -

- (1) Diffuse microcrystalline to cryptocrystalline quartz with minor dispersed dolomite granules, and traces of fine dolomite crystals. This seems most likely to be recrystallised dolomitic chert.
- (2) Confused irregular masses of stressed, partly recrystallised, mobilised quartz, which extensively invade the much finer quartz mosaic of type (1).

Fine eulachites occur in variably continuous thin layers, intercalated and/or intergrown with both types of quartz. Numerous fine stringers of sulphide also cut across the layering.

In polished section sphalerite is found to be the dominant sulphide, with slightly subordinate galena. These are relatively concentrated in layers where they are widespread along intergranular contacts through the various size quartz mosaic. These attained this mode of occurrence by localised remobilisation, concurrent with the reconstitution of quartz.

T8 contd. :

Pyrite is a minor sulphide and has a far more restricted distribution. Small subhedral to euhedral crystals of pyrite, commonly fractured and rehealed in-situ, form fairly continuous trains, generally through sphalerite-galena grains. Some pyrite occurs as individual crystals.

Accessory chalcopyrite is widespread as minute, bleb-like, exsolved inclusions in sphalerite, rarely as single small grains filling voids in sphalerite.

T9: thin layered sequence of altered rhyolite, and bands of relatively coarse, euhedral (recrystallised) pyrite, and of sphalerite + chalcopyrite, with intergranular mobilised quartz and minor carbonate

Field comment: H69 (RLV) Possible bedded chert containing submassive sulphides

This rock is distinctly layered on a scale of about 10mm. Macroscopically an extremely fine grained siliceous band carrying small patches of sphalerite + galena is seen gradational into a fairly coarse granular pyritic layer, which forms fairly sharp contact with a wavy sphalerite layer, which in turn is in contact with fairly coarse quartz. Locally granular pyrite transgresses the sphalerite layer.

In thin section the fine quartz band is identified as cryptocrystalline quartz, intimately mixed with a similar mass of ultra fine sericite in irregular, random streaky and mottled patches. This is characteristic of devitrified and primarily altered rhyolitic glass. Accessory, minute, single quartz crystals with corroded margins are scattered, as incipient phenocrysts. Accessory, small patches of microcrystalline calcite, single crystals of pyrite and carbonate are scattered.

The pyrite layer consists of a loosely packed aggregate of euhedral pyrite crystals with quite coarse and euhedral quartz and subordinate carbonate crystals in between. The quartz is stressed but not brecciated as the mobile quartz phase in other samples.

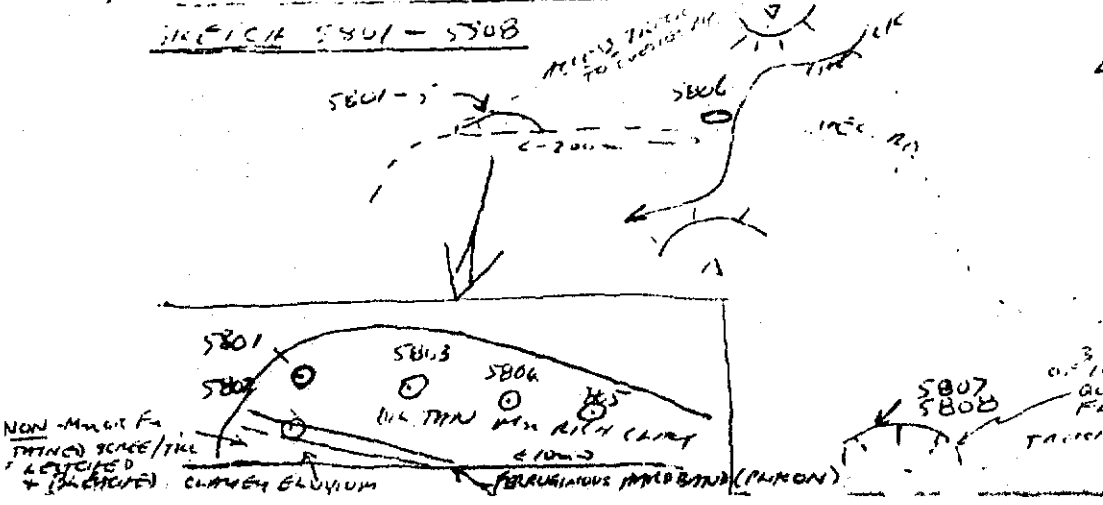
T9 contd. :

The sphalerite layer consists of a fairly continuous aggregate of quite coarse stressed, subhedral, and apparently recrystallised sphalerite with intergranular quartz and minor carbonate the same as within the pyrite. This carries abundant small irregular patches, and ultra fine exsolved blebs of chalcopyrite, more or less distributed along crystallographic directions. Rare traces of very fine galena, and several small pyrite crystals also occur as inclusions in sphalerite.

Rare single grains of chalcopyrite and sphalerite. Chalcopyrite inclusions occur independently in the quartz gangue.

The zone of coarse quartz referred to in the previous paragraph consists of stresses, coarse mosaic of recrystallised quartz, the same as intergranular to the sulphides, but without associated carbonate.

Sample No.	LOCATION	DESCRIPTION	Gr	Cu	Pb	Zn	Ag	Mn	Fe	Mn+Fe
T5801	HEC RD - CHARTER LK	BLACK MUD - 100% CLAY, 50% SAND	-	24	150	280	1.6	17.6	13.0	30.6
T5802	"	HEC RD - CHARTER LK	-	14	220	220	1.8	1.4	24.0	25.4
T5803	"	HEC RD - CHARTER LK	-	32	250	340	1.4	13.5	10.0	23.5
T5804	"	HEC RD - CHARTER LK	-	54	400	600	2.4	16.6	12.0	28.6
T5805	"	HEC RD - CHARTER LK	-	52	750	960	2.4	11.6	10.0	21.6
T5806	"	HEC RD - CHARTER LK	-	6	40	44	0.2	0.41	0.5	0.91
T5807	"	HEC RD - CHARTER LK	-	6	50	62	0.4	0.02	1.0	1.02
T5808	"	HEC RD - CHARTER LK	-	14	290	470	0.8	0.02	3.4	3.42
T5809	"	HEC RD - CHARTER LK	-	324	3.55%	8.6%	2.0	0.21	1.3	-
T5810	"	HEC RD - CHARTER LK	-	1550	5.80%	8.8%	33	0.15	1.5	-
T5811	"	HEC RD - CHARTER LK	-	4000	37.2%	15.0%	309	0.05	1.8	-
T5812	"	HEC RD - CHARTER LK	-	7500	26.0%	22.5%	387	0.6	2.9	-
T5813	"	HEC RD - CHARTER LK	-	450	3.35%	4.5%	24	0.03	2.4	-
T5814	"	HEC RD - CHARTER LK	-	114	2.15%	11.5%	10	0.19	6.0	-
T5815	"	HEC RD - CHARTER LK	-	110	1.0%	9.3%	6.8	0.70	12.0	-
T5816	"	HEC RD - CHARTER LK	-	76	150	560	1.2	0.04	5.5	-
T5817	"	HEC RD - CHARTER LK	-	300	0.25%	0.26%	4.0	0.18	5.8	-
T5818	"	HEC RD - CHARTER LK	0.33%	56	490	450	1.0	-	-	-



NOTE: THIN/POLISHED SECTIONS

THE FOLLOWING SAMPLES HAVE BEEN DESCRIBED IN IR PENTON (31/1/77) REPORT 254:-

T5813 TC

T5810 TT

(T5810) TS

T5812 T9

Mr. I.R. Pontifex,
I.R. Pontifex and Associates Pty. Ltd.,
P.O. Box 91,
NORWOOD, S.A., 5067

4th
xx

DJP/ec

13th July 1977

Rock Samples.

Dear Ian,

Under separate cover we forwarded 17 rock samples for petrological examination (T1-T17). Samples T1, T8, T9-T11 and T16 may also need polished section work. (ref. our Transmittal Note No. 0137 A)

The specimens come from the Primrose Pyroclastics (Mt. Read Group) and the (?) Rosebery Group, N.W. Tasmania.

A field description of the rocks is appended.

The rocks are a representative suite taken progressively through the sequence from east to west as illustrated diagrammatically below:-

Sample No.	Lithology	Thick- ness(m)	Remarks
T1 (East)	(?) Re-worked acid tuff with minor galena/ sphalerite. (Location in road between T1 and T2)	70+	Similar location to A33 (M.R.2158)
T2-T4	(Sheared) black shale with trace galena/ sphalerite.	6 to 10	Similar location to A31-32 (M.R.2158)
T5-T9	Strongly altered pyro- clastics with minor galena/sphalerite.	100	--
----- Fault -----			
T10- T11	(Sheared) black shale with minor galena/ sphalerite and pyrite.	90+	--
----- Fault or Hiatus -----			
T12- T17 (West)	Green (red) pebble conglomerate and associated green(+grey) siltstone and shale.	6 and 100	--

I.R. Pontifex and Associates P/L.

13/7/77

2.

Re: Rock Samples (cont'd).

In addition to routine rock descriptions, could you comment on the following queries.

1.
 - (i) Is there any evidence that T1 is a re-worked tuff?
 - (ii) Is the disseminated base metal sulphide mineralization (T1) accompanied by volcanogenic alteration?
2.
 - (i) Do black shale samples T2-T4 have abundant evidence of an acid volcanic provenance?
 - (ii) What evidence is there for:- (T2-T4)
 - (a) volcanogenic mineralization?
 - (b) volcanogenic alteration?
 - (iii) What is the origin of the gypsum/calcsite (?) in geodes and encrustations?
3.
 - (i) As a group, how do altered and mineralized pyroclastics T5-T8 compare with groups A20-A21 or A34-A37? (M.R.2158)
 - (ii) Are T5-T8 rocks ash-fall, ash-flow or re-worked tuff?
 - (iii) Is there evidence of very intense (volcanogenic) alteration in samples T5-T8?
4.
 - (i) Do black shale samples T10-T11 contain evidence indicative of their provenance?
 - (ii) What is the nature of the mineralization and alteration present in minor amounts?
(A serpentine-like (?) mineral was noted on fracture planes in T10-T11.)
 - (iii) Is there a direct comparison with samples T2-T4 above?
 - (iv) Is there a similarity with previous specimens A27-A30? (M.R.2158)
5.
 - (i) Is there any similarity between samples T12-T17 as a group and other shales and siltstones previously described (e.g., T10-T11; A27-A30)?
 - (ii) Does the evidence for the provenance of samples T12-T17 virtually exclude an acid volcanic terrain and does it strongly indicate an ophiolite belt instead?

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13/7/77

3.

Re: Rock Samples (cont'd).

5. (cont'd)

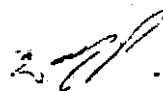
- (iii) Is it possible to infer whether samples T12-T17 may be older or younger than the suite of acid volcanics and shales described above on the basis of provenance? (ceteris paribus)

Hoping you can give some thought to the above queries.

Best regards.

Yours sincerely,

PREUSSAG AUSTRALIA PTY. LTD.



D.G. Perkin,
Senior Geologist.

P.S.:

Please send one copy (carbon) plus the invoice to this office and send the original and another copy (plus invoice) to:-

Mr. D.B. Orr,
Divisional Geologist,
Comstaff Pty. Ltd.,
P.O. Box 794,
Burnie, Tasmania, 7320.

(DJP)

cc - Mr. D.B. Orr.

Encl.

SAMPLES FOR PETROGRAPHIC EXAMINATION / 11/5/81

T₁ - T₁₇ (T5825 - T5841) - 4 CORRAL VOLCANICS, SOUTHERN CALIFORNIA

- MC (HARD), + RICHNESS, BUT WE ARE NOT SURE OF THE CORRAL C.

N.	FIELD N.	FIELD DESCRIPTION & REMARKS
T ₁	T5825	ACID TUFF (REWORKED) & DISSEM. CARBONATE SILTSTONE (?)
T ₂	T5826	SILTSTONE (GREEN) (SILTSTONE?) & (LIMONITE) (SILTSTONE?) & (LIMONITE) (SILTSTONE?)
T ₃	T5827	SILTSTONE - SLIGHTLY LIMONITIC (FINE GRANULAR) LIMONITIC CLASTS
T ₄	T5828	SILTSTONE (GREEN) (SILTSTONE?) & (LIMONITE) (SILTSTONE?) & (LIMONITE) (SILTSTONE?)
T ₅	T5829	SILTSTONE (ACID TUFF (REWORKED)) & MODERATE LIMONITE (25%), OCCAS. PYRITE & TRACES OF GFT. + SPINEL - MODERATELY CARBONATE & (LIMONITE) (SILTSTONE?)
T ₆	T5830	QZ. PLAC. XTR. TUFF (REWORKED) - GREENISH GRAY - SLIGHTLY (LIMONITE) (SILTSTONE?)
T ₇	T5831	- NO LIM. BUT TRACES PYRITE ONLY (PLAC. QZ. XTR. TUFF (REWORKED)) - SILTSTONE - MODERATE (LIMONITE) (SILTSTONE?)
T ₈	T5832	MOD. GREEN SILTSTONE - CARBONATE MINERALIZATION TO 2% (SILTSTONE) (SILTSTONE?)
T ₉	T5833	QZ. XTR. TUFF - GREENISH - MODERATELY CARBONATE & (LIMONITE) (SILTSTONE?)
T ₁₀	T5834	FRAGS. + VENTILATES - SL. PYRITIC (<1%) & TRACES V. FINE GRANULAR (SILTSTONE) (SILTSTONE?)
T ₁₁	T5835	QZ. XTR. TUFF - GREENISH GRAY (REWORKED?) - MODERATELY CARBONATE & (LIMONITE) (SILTSTONE?)
T ₁₂	T5836	SILTSTONE (?) - MINOR PYRITE PLUS MINOR V. FINE GRANULAR (SILTSTONE) (SILTSTONE?)
T ₁₃	T5837	SILTSTONE (BLUER SILTSTONE & LATE SILTSTONE + FINE GRANULAR) PYRITE AS DISSEM. MINERALIZATION
T ₁₄	T5838	FRAGS. + LAYERS (PYRITE?) IN LAYERED QZ. (CARBONATE) (SILTSTONE) (SILTSTONE?)
T ₁₅	T5839	BLUER SILTSTONE - MODERATELY SILTSTONE WITH ONLY TRACES (SILTSTONE) (<1%)
T ₁₆	T5840	PYRITE (<0.1%) + MOD. CARBONATE + MINOR QZ. - CARBONATE VENTILATES
T ₁₇	T5841	POLYMET. CARBONATE & SUBORDINATED GREEN, RED & PURPLE CLAST FRAGS. + OCCAS.
T ₁₈	T5842	PURPLE SILTSTONE & GREEN BASAL / ULTRABASIC / IGNEOUS FRAGS (ULTRABASIC / BASAL / IGNEOUS)
T ₁₉	T5843	AS ABOVE IN FULL - OCCASIONATE QZ. VENT. & OCCASIONATE MOD. CARBONATE
T ₂₀	T5844	PYRITE IN QZ. (CARBONATE) [AZURITE] VENTILATES / FRAGMENT
T ₂₁	T5845	AS FOR T ₁₂ - RED & GREEN SILTSTONE CLASTS + ONLY BASAL / IGNEOUS
T ₂₂	T5846	IN GREENISH CARBONATE MASS (ULTRABASIC) - SOME QZ. + FINE GRANULAR SILTSTONE
T ₂₃	T5847	GREENISH SILTSTONE (? GREEN BEDDING?)
T ₂₄	T5848	AS ABOVE BUT MORE SILTSTONE?
T ₂₅	T5849	GREEN SILTSTONE & OCCAS. GREENISH SILTY LAMINATIONS

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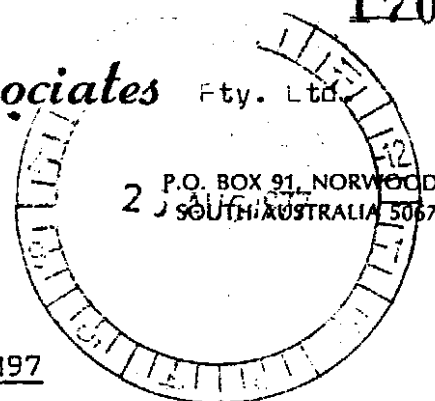
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Jan R. Pontifex & Associates

Pty. Ltd.

TEL. 332 6744
A.H. 31 3816

26 KENSINGTON ROAD, ROSE PARK
SOUTH AUSTRALIA



JRP

MINERALOGICAL REPORT NO. 2197

24th August, 1977.

TO:

Mr. D.B. Orr,
Divisional Geologist,
Comstaff Pty. Ltd.,
P.O. Box 794,
BURNIE, Tasmania 7320

COPY TO:

Mr. D.J. Ferkin,
Freusseg Australia Pty. Ltd.,
4th Floor, Farrer House,
24-28 Collins Street,
MELBOURNE. Victoria 3000

YOUR REFERENCE:

Your letter dated 13/7/77
Transmittal No. 0137A

MATERIAL:

Rock samples

IDENTIFICATION:

T1 to T17

WORK REQUESTED:

Petrographic descriptions and
comments as requested

SAMPLES & SOLUTIONS:

Sent to Mr. D.B. Orr at his address
shown above.

PONTIFEX & ASSOCIATES PTY. LTD.

I1: (quartz) plagioclase crystal tuff;
possibly reworked, minor carbonate-
sericite-silicic alteration closely
associated with shearing, fine sulphides
tend to accompany this alteration

Field note: (?) reworked acid tuff with minor galena sphalerite.

This is a fairly homogeneous, sheared, volcanoclastic sediment. It consists of a loosely packed aggregate of plagioclase crystals (40%) and quartz crystals (10-12%), and rare cherty rock fragments, ranging in size from 0.5 to 3mm, but with large proportions of crystals about 2mm. These crystals have a volcanic origin, of ? leucodacite or quartz-andesite composition, they are commonly euhedral stressed and bent, broken crystals show no evidence of abrasive rounding.

The matrix consists of very fine quartz and plagioclase detritus, intimately mixed with clays, diffuse cryptocrystalline quartz mosaic and shredded streaks of sericite which indicates fairly extensive shearing. Minor attenuated patches of carbonate are scattered, and carbonate veins ± quartz cuts through both matrix and crystals.

Accessory fine sulphides are scattered and rarely occur in the carbonate veins. They tend to accompany carbonate, sericite and fine quartz in the matrix.

T1 Contd.

This is a (quartz) plagioclase crystal tuff, there is no real evidence that it has been reworked, although the sorting is perhaps slightly better than expected in an ash fall tuff. If it is partly erosional, certainly the components have not travelled far. As previously noted in report 2153 it is difficult to prove whether this rock type is predominantly a primary tuff, or a tuff which is predominantly erosional.

The minor carbonate, sericite silicic alteration is superimposed and largely hydrothermal (? volcanogenic) and this occurred during or after shearing. The fine sulphides do tend to accompany this alteration.

T2: sericitic shale; with accessory disseminated carbonate crystal replicas cut by numerous veins and veinlets of epithermal quartz + carbonate replicas and sericite.

Field note: sheared black shale, trace galena and sphalerite.

In thin section this shale is seen to consist essentially of a compact foliated mass of sericite + clays, and minor ultrafine silica including disseminated quartz silt. Limonite replicas after fine euhedral carbonate crystals are widely disseminated.

Minor, coarser quartz crystals, and a lens of closely packed small quartz crystals, are by comparison with similar, more abundant crystals in T3, identified as volcanogenic.

Several veins up to 3mm wide, and local networks of veinlets consist mainly of epithermal quartz. These also contain variable concentrations of sericite, and limonite replicas after fine crystalline carbonate. In the context of this suite these could well be volcanogenic.

(See comments at end of description T4).

T3: plagioclase crystal tuff, or highly
tuffaceous, sericitic shale; patchy
chloritic alteration and minor
epithermal quartz

Field note: As for T2.

This rock consists of generally single plagioclase crystals (10-15%), sericitised lithic fragments and/or plagioclase crystals (10-15%), and minor quartz crystals (3-5%), with an average size of about 0.5mm, all randomly disposed through a 'shaly' matrix.

These crystals (and fragments) are of volcanic derivation, probably from the same source as crystals in T1, but the paucity of quartz suggests that this source is not particularly acid.

The shale matrix has a similar gross sericitic composition to T2, but it has a streaky, lenticular and rarely contorted texture where it weaves between the coarser components. Also abundant patches and lenses of chlorite are intercalated.

Minor irregular patches and variably continuous veins of epithermal quartz occur through the sample. These are equated with similar material in T2; locally these are accompanied by chlorite.

(See comments at end of description T4)

T4: sericitic shale; disseminated replicas
after fine carbonate crystals; veins of
epithermal quartz sericite and altered
carbonate

Field note: As for T2.

This sample is essentially the same as T2. It is a shale composed of a fine foliated mass of sericite + clays and extremely fine quartz, including minor quartz 'silt', - probably of tuffaceous origin.

Limonite replicas after fine euhedral carbonate crystals (10%) are disseminated. Irregular patches and veins of epithermal quartz, carry sericite and some are crowded with limonite replicas after carbonate.

COMMENTS T2 to T4>

These samples which represent the one shale unit, consist essentially of (siliceous) sericitic shale. One sample (T3) is crowded with tuff crystals of the type seen in T1, and considering that the shale domains, could be alteration products from, and/or extremely fine detritus of volcanic material, sample T2 may be classified as a tuff. The relative paucity of quartz indicates that the components are not derived from a particularly acid source, but probably from a 'quartz-andesite'.

This volcanic association indicates that the disseminated carbonate crystals, the chloritic domains in T2, and the epithermal sericite-quartz-carbonate veins and veinlets in all three samples, have a volcanogenic origin.

The small amounts of gypsum/calcite referred to in your letter may be the primary altered carbonate noted above, or secondary, material derived from this primary carbonate.

Accessory very fine opaques are scattered, but there is no positive evidence of base metal sulphides. Conceivably geochemical analyses would assist in determining the presence (or not) of such minerals.

I5: (quartz) plagioclase crystal tuff;
of ash-fall type; ubiquitous sericitic-
silicic alteration; superimposed shear-
breccia planes mineralised by chlorite
± quartz and carbonate and with minor
pyrite

Field note: strongly altered pyroclastic, minor galena and
sphalerite.

This rock has a fairly complex texture, but a fairly
uniform composition. Basically it consists of a random loosely
packed, poorly-sorted, and vaguely layered aggregate of
plagioclase crystals (35%) and quartz crystals (5-7%), within
an extremely fine, (chloritic) sericitic siliceous matrix.
The plagioclase crystals have a calcic-oligoclase composition,
they are variably subhedral to euhedral, flecked by sericite
alteration, and some are stressed, bent and broken.

These crystals, and the quartz crystals range in
size from 0.1 to 1.5mm.

The matrix consists of diffuse cryptocrystalline
silice with intimately mixed shredded sericite and minor
chlorite, fine dispersed quartz-felspar detritus, including
grains of apparent devitrified glass. Minor small irregular
patches of carbonate and accessory fine sulphides are scattered.

T5 Contd.

This rock as described is a (quartz) plagioclase crystal tuff. Its texture and composition is further complexed by a superimposed fairly open network of shears and/or breccia planes, which are mineralised by chlorite, locally by epithermal quartz and carbonate. Fine pyrite is relatively more abundant in these areas, than in the general rock matrix.

This network more or less isolates specific domains within the tuff, to emphasise its fragmental texture, but on a broader scale than the primary tuff.

T6: (lithic ?) quartz plagioclase crystal
tuff, siliceous matrix is sheared, fairly
extensively sericitised with minor
carbonate and patchy silicic alteration

Field note: as for T5.

This rock is similar to T5, but it contains more
quartz grains, and there is negligible chloritic mineralisation.

It consists of a vaguely layered, random, loosely
packed aggregate of single plagioclase crystals (20-25%),
subrounded and deeply embayed quartz crystals (15-20%), which
are generally poorly sorted ranging in size from 0.1 to 4mm.
The plagioclase is flecked with sericite.

The matrix consists of diffuse cryptocrystalline
quartz, with variable (but locally predominant) fine sericite,
minor extremely fine quartz-felspathic detritus and minor
chlorite. Sericite commonly occurs in fairly concentrated
shredded streaks, which may cut through crystals and this
indicates shearing, although some braided and attenuated
patches of fine sericite in the groundmass may be largely altered
glass.

Minor fine carbonate (10-12%) is fairly widespread,
through the matrix and partly invading fractures in crystals.
Trace fine pyrite crystals are scattered.

I7: plagioclase quartz crystal tuff, extensively sheared with extensively associated sericite and carbonate alteration, more restricted patches of hydrothermal albite, and quartz accompanied by accessory galena and sphalerite

Field note: as for I5.

This crystal tuff is similar to I6, but there are less total crystals, and relatively more quartz crystals than plagioclase, and the rock is more extensively altered, notably carbonated.

Single, commonly subrounded and embayed quartz crystals (20%) and subhedral to euhedral plagioclase crystals (10-15%), are scattered more or less in layers, through an ultrafine siliceous sericitic matrix.

The rock has been quite strongly sheared, manifest as extensive shredded streaks and wavy variably continuous foliae of sericite throughout the matrix and through many of the crystals, particularly plagioclase. Quartz crystals are also very stressed.

Carbonate forms about 30% of this rock and occurs in attenuated patches, lenses and stringers through the matrix, cutting through some coarser crystals. Patches of fine, secondary (hydrothermal) albite and quartz mosaic locally accompanies the carbonate. It is this quartz rather than the carbonate alone, or the sericite alteration alone, that small grains of galena and sphalerite are selectively associated with.

T8: plagioclase crystal tuff; matrix pervasively replaced by cryptocrystalline quartz and microcrystalline albite; the whole rock brecciated and mineralised by chlorite, minor carbonate

Field note: as for T5.

This plagioclase crystal tuff is characterised very largely by the nature of its groundmass. Variably euhedral and some broken plagioclase crystals (20-25%), ranging in size from 0.3 to 1.2mm are poorly sorted but have a vaguely layered distribution through a microcrystalline matrix. These crystals are stressed and some are bent, but there is negligible alteration. They have an oligoclase composition. Quartz crystals are absent.

The matrix consists of patchy cryptocrystalline quartz gradational into and intimately mixed with microcrystalline feathery micromosaic of plagioclase (? albite).

This rock is brecciated, with a random, widespread fracture network mineralised by chlorite, and subordinate very fine carbonate, and trace extremely fine sulphides.

T9: fine plagioclase crystal tuff; sheared,
with associated, ubiquitous sericitic
alteration + minor carbonate, later
minor quartz veins carry trace pyrite

Field note: as for T5

This crystal tuff has a similar primary composition as T5 but it is generally finer grained. Fine crystals of plagioclase (35%) and generally finer quartz (7%) have a random but vaguely layered distribution through an extremely fine siliceous-sericitic matrix. The crystals are stressed, and the feldspar is quite extensively flecked by fine sericite + clay.

The matrix consists of cryptocrystalline silica with abundant shredded sericite + admixed clays along variably continuous shear planes. The matrix commonly invades and partly replaces the plagioclase tuff crystals.

Fairly numerous random veins of quartz cut the rock and appear to be superimposed on the shearing and ubiquitous sericitic alteration. They carry trace fine pyrite.

Minor (5-7%) small patches and discontinuous veins of carbonate are scattered; these seem to be more closely related to the sericitic alteration, rather than to the (later) quartz veining.

COMMENTS: Samples T5 - T9

This group of samples consist essentially of ash fall crystal tuffs, with variations in primary composition as follows:

- T5 and T9 more plagioclase tuff crystals than quartz crystals,
- T6 similar abundance of these crystals,
- T7 quartz crystals > plagioclase,
- T8 exclusively plagioclase crystals.

The matrix in all samples except T8 is essentially the same, viz. cryptocrystalline silica + clays. crowded with shredded streaky and braided fine sericite which seems to be mainly associated with the fairly widespread shearing through this group.

There is an increase in the proportion of matrix in relation to crystals from T5 through to T8; but in T9 crystals form a similar proportion of the rock as in T5.

The matrix in T8 consists of microcrystalline albite and quartz, (no sericite) apparently the products of pervasive hydrothermal alteration.

The tuffs show variable superimposed tectonic modification + follow-up mineralisation as follows:

- T5 is sheared and brecciated, with following chlorite + minor carbonate mineralisation.
- T6 is sheared with minor carbonate.
- T7 is quite extensively sheared, with correspondingly quite extensive carbonate and hydrothermal quartz + trace associated sulphides.

- 2 -

T8 no evidence of shear, but this rock is brecciated with chlorite + carbonate mineralisation (as well as albite-quartz).

T9 sheared, with superimposed quartz veining carrying trace sulphides.

This group of T5 - T9 as a whole appear to compare with group 1 in report 2158, i.e. A34 - A37; (also samples 25 and 26), more-so than with any other single group previously described. The vitric component described in this previous group 1 is equivalent to the cryptocrystalline siliceous matrix referred to above. (However I would need to make further reference to those thin sections to confirm these comparisons). Certainly there is no evidence of flow characteristics in T5 - T9 as recorded for A24 and A23.

T10: Sheared and brecciated mixed facies of dolomite and subordinate pyritic and tuffaceous shale, accessory fine galena grains are scattered

Field note: sheared black shale with minor galena/sphalerite and pyrite.

The most distinctive single components in this rock are fine tuff quartz crystals, scattered more or less within bands of sheared matrix.

This matrix consists of abundant shredded streaks of sericite within ultrafine argillaceous-siliceous material with dispersed extremely fine pyrite, quartz silt and/or fine tuff detritus. Minor fragments of cryptocrystalline quartz, and/or clays, similar in size to the tuff quartz crystals, are scattered. Minor carbonaceous material also occurs in this matrix.

Flattened microcrystalline carbonate (dolomite or magnesite) occur as small, roughly lenticular fragments roughly layered in the plane of the schistosity. More extensive carbonate forms the irregular lighter colored bands up to 20mm thick, seen in hand specimen to be intercalated with the 'black' shale. This carbonate appears to be an inherent rock forming mineral.

Streaky lenses and patches of the shaly material, pyrite, and of diffuse 'chert' are intergrown with these carbonate bands.

COMMENTS ON T10 - T11

Sample T10 contains as much dolomite as shale component. The shale component is tuffaceous, with tuff quartz crystals indicating minor acid volcanic contribution. There are no characteristics diagnostic of a specific genesis in T11.

The extensive carbonate in T10 appears to be an inherent (chemical) sedimentary component, although the less likely possibility exists that it represents extensive pervasive alteration - mineralisation.

The tuffaceous shale in T10 may be compared with similar material in T2 - T4 above, notably T3. The more clastic shale of T11 is similar to T2 and T4 (by virtue of it being a shale) but T11 seems to be more carbonaceous.

Minor pyrite in lenses in T10, and dispersed in T11 is inherent. Accessory fine galena in T10 (only), is also inherent, albeit separate from pyrite. Minor chlorite lines, and fills fractures and various structural contacts in T10 and T11.

Samples A28 to A30, as described appear to contain intercalated shale facies similar to T10 and T11, by virtue of the shale characteristic and the minor pyrite, carbon and dolomite. (There is no tuffaceous material in A28 to A30).

T12: pebble conglomerate of mainly fine
clastic material, minor pebbles of
chloritised numerous epigenetic quartz
and chlorite veins

Field note: green (red) pebble conglomerate and associated
green (+ grey) silt stone and shale.

This rock consists largely of a random, generally
poorly sorted and loosely packed aggregate of rounded to
subrounded, coarse grains (about 1mm) to pebbles (up to 12 mm
and rarely 50mm across). The pebbles consist predominantly of
fine sediments, viz. clay-stone, silty-argillites, silt-stones,
and rare silty argillaceous-fine sandstones. These may be
very deep-water clastic sediments or possibly very fine
homogeneous tuffs. Accessory pebbles of chloritised basalt,
and of chert are also present. Several clasts are distinctly
reddish.

The matrix between the pebbles consists of variably
clays and silty or coarse sandy clastic detritus. The
quartz grains are subangular to subrounded, without any
characteristics, diagnostic of a specific genesis, except
polycrystalline quartz grains which are probably derived from
metaquartzite. Some chloritic clays are present.

Distinctively green chlorite is fairly widespread
along fractures in the matrix, and running around the margins
of pebbles. This, plus minor quartz constitutes epigenetic veining.

T13:

pebble conglomerate, of mainly
silicified argillite pebbles, minor
clasts of quartz sandstone and chert,
minor chlorite veins

Field note: as for T12

This rock has a similar composition and texture to T12, although the pebbles have a more consistent silicified claystone, or argillite composition, rather than mixtures of clay, silt and sand. None-the-less there are minor pebbles of fine quartz-sandstone silty sandstone, and of chert. Several of the cherty clasts carry leached voids after minute euhedral carbonate crystals. There are no features diagnostic of a specific genesis, but the pebbles are mainly derived from extremely fine (deep water) sediments. There are no basaltic clasts as in T12.

The matrix between pebbles consists of mixed clays, silt and quartz sand, essentially as in T12 including chloritic clays. Here chlorite veins are present, of the type seen to be far more abundant in T12.

T14:

as for T12 and T13

Field note: as for T12

The composition and texture of this rock includes essentially the same variations described in T12 and T13. Pebbles consist mainly of silicified 'clay-stone', silty and sandy argillite, minor fine quartz sandstone. Clasts of chloritised basalt and chert with leached carbonate crystals are also present. Patches of chlorite or chloritic clays are more abundant in the matrix than in T12 and T13. Chlorite veins are rare, quartz veins are absent. Rare clasts of ? volcanic glass are present.

T15, T16, T17: variably silty, laminated to thin
 bedded chloritic and sericitic grey
 to green shale

Field note: as for T12

Although these samples have slight macroscopic differences in color, and layering (bedding) petrologically they are very similar. They consist essentially of intimate mixtures of clays (including essential chloritic clays), variably metamorphically converted to extremely fine sericite and chlorite. The rocks are quite well preserved, and locally weakly lineated.

Quartz silt and ? basic rock fragments of usually fine silt size are dispersed. Minor fine carbonate is dispersed in T17.

Variations in the relative abundance of these components and variations in grain size from clay to coarse silt give rise to intercalated thin beds (to 7mm thick in T15) or more numerous and more rapidly alternating laminations in T17. Bedding interfaces are planar, and generally quite sharp, although gradation does occur across some, bedding interfaces, notably in T15.

Sample T16 is quite homogeneous, with negligible inter beds.

COMMENTS T12 to T17

The shale samples T15 to T17 appear to represent a different shale facies to the T10 - T11 and T2 - T4 groups above. Also they appear to differ from A28 - A30 in previous report 2158, but further reference to those sections is needed to confirm this opinion.

Generally the T15 - T17 shales are structurally more homogeneous (albeit laminated). The sedimentary breccia structures in T2 - T4, and in T11 and T12, also the micro slumping and cross bedding in A30, are all absent from the uniform planar bedded shales T15 - T17.

In composition the T15 - T17 shales lack acid tuff detritus, pyrite and carbonaceous material reported in groups T10 - T11 and T1 - T4; they lack pyrite and carbon also reported in A28 - A30. Minor extremely fine carbonate is dispersed in T17, but this mineral is more abundant and coarser in the other shale groups. Fine quartz sand and detrital muscovite in A28 - A30 are lacking in T15 - T17.

Most components in T15 - T17 are too fine to resolve their provenance but there is no positive indication of acid volcanic material. There is some evidence of detritus from a basic igneous terrain. In the context of your questions these shales T15 - T17 may be interpreted as flysch facies.

- 2 -

The pebble conglomerates T12 - T14 do not contain any acid volcanic detritus. The abundant siliceous-claystone pebbles appear to be abyssal sediments, either clastic clays and/or ultra fine, homogeneous, deep-water tuffs, quite distal from any volcanic centre.

The assemblage of pebbles of this nature, with clasts of chloritised basalt, chert + disseminated leached carbonate, and the chloritic clays in the matrix of these conglomerates may be interpreted to have derived from facies constituting an ophiolite suite. Missing however are ultramafic rocks and spilites but these may be represented respectively by the chlorite and altered basalt clasts.

The evidence does not mutually exclude some contribution to these conglomerates from clastic (and chemical) sediments, unrelated to an ophiolite sequence, (however an acid volcanic provenance can be confidently excluded).

There is no objective petrological evidence which establishes the relative age of the T12 - T17 samples to the other samples in the suite.

However it may be postulated that the shales at the base of your stratigraphic column represent flysch facies, followed by the conglomerates which represent a reworked ophiolite sequence, and which was originally older than the flysch shales.

The conglomerates in turn are followed by pyritic carbonaceous and dolomitic shales and acid to intermediate

.../3

- 3 -

pyroclastics. Thus the sequence you present may be interpreted in terms of the evolution postulated for the Lachlan Geosyncline viz.

ophiolite stage (earliest)

flysch stage

acid volcanic stage

fine relatively shallow marine sediments (latest)

SAMPLES FOR PETROGRAPHIC INVESTIGATION / 115594

71-717 (75525-75841) - LITHOLOGICAL DESCRIPTIONS

- THE (1000) + RAILWAY CUT AT THE TOWN OF BARRINGTON

Field No.	Field Description & Remarks	Gr	Ph	Zn	Al	Fe	Si	Al	Fe	Si	Al	Fe
11 T5525	Acid tuff (unconsolidated) & disseminated carbonaceous material (L17)	12	520	960	0.6	240	10	30	0.17	120	11	
12 T5826	SHALED (grey) (carbonaceous) siltstone (?) & clayey (carbonaceous) siltstone (?)	9	220	620	0.8	620	<10	28	0.45	110	22	
13 T5827	SHALED (grey) (carbonaceous) siltstone (?) & clayey (carbonaceous) siltstone (?)	2	450	1600	2.0	620	<10	28	0.65	140	20	
14 T5828	SHALED (grey) (carbonaceous) siltstone (?) & clayey (carbonaceous) siltstone (?)	10	270	700	0.8	700	<10	27	0.37	116	22	
15 T5829	SHALED (grey) (carbonaceous) siltstone (?) & clayey (carbonaceous) siltstone (?)	4	92	250	0.6	400	10	19	0.10	44	61	
16 T5830	SHALED (grey) (carbonaceous) siltstone (?) & clayey (carbonaceous) siltstone (?)	10	118	270	0.6	520	10	30	0.04	65	80	
17 T5831	SHALED (grey) (carbonaceous) siltstone (?) & clayey (carbonaceous) siltstone (?)	16	750	4200	1.6	520	10	66	0.21	118	160	
18 T5832	SHALED (grey) (carbonaceous) siltstone (?) & clayey (carbonaceous) siltstone (?)	23	34	84	0.6	50	10	190	0.15	300	32	
19 T5833	SHALED (grey) (carbonaceous) siltstone (?) & clayey (carbonaceous) siltstone (?)	74	70	150	0.4	760	10	23	0.04	54	61	
20 T5834	SHALED (grey) (carbonaceous) siltstone (?) & clayey (carbonaceous) siltstone (?)	15	500	200	2.0	340	10	63	>11	150	160	
21 T5835	SHALED (grey) (carbonaceous) siltstone (?) & clayey (carbonaceous) siltstone (?)	34	160	200	2.0	860	10	19	0.17	100	140	
22 T5836	SHALED (grey) (carbonaceous) siltstone (?) & clayey (carbonaceous) siltstone (?)	12	24	76	0.6	120	10	56	0.04	160	240	
23 T5837	SHALED (grey) (carbonaceous) siltstone (?) & clayey (carbonaceous) siltstone (?)	20	26	56	0.4	120	<10	92	0.06	220	220	
24 T5838	SHALED (grey) (carbonaceous) siltstone (?) & clayey (carbonaceous) siltstone (?)	23	24	50	0.4	100	<10	140	0.09	240	340	
25 T5839	SHALED (grey) (carbonaceous) siltstone (?) & clayey (carbonaceous) siltstone (?)	52	40	130	1.0	280	<10	28	0.03	160	240	
26 T5840	SHALED (grey) (carbonaceous) siltstone (?) & clayey (carbonaceous) siltstone (?)	230	60	140	1.0	160	30	44	0.04	160	260	
27 T5841	SHALED (grey) (carbonaceous) siltstone (?) & clayey (carbonaceous) siltstone (?)	46	48	140	1.4	260	10	18	0.07	100	200	

APPENDIX 20.

PLACOSOLS: ANOTHER PROBLEM IN EXPLORATION GEOCHEMISTRY.

PLACOSOLS: ANOTHER PROBLEM IN EXPLORATION GEOCHEMISTRY

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(Received March 23, 1976; revised and accepted September 15, 1976)

ABSTRACT

Tilsley, J.E., 1977. Placosols: another problem in exploration geochemistry. *J. Geochem. Explor.*, 7: 21-30.

Placosols, which consist of an accumulation of humified organic material above a leached near-surface mineral soil horizon underlain by an impermeable iron oxide layer, develop in regions of cool moist climate.

Active placosols can presently exist in North Atlantic and Pacific maritime regions, and under similar climatic conditions in the southern hemisphere. They may also be present in wet high-altitude equatorial latitudes.

The most important feature of placosols is the placon, a thin (1-30 mm) iron oxide layer, that forms 20-150 cm below surface. The placon is essentially impervious to water and effectively divides the soil into two separate hydrologic and chemically dissimilar environments. Due to strongly acid conditions above the placon, base metals are leached from the soil and severely depleted or completely absent in the minus 50-mesh fraction. Below the placon, chemical conditions are reducing and neutral to slightly basic; metals are relatively stable and distribution patterns reflect those existing before placosol development.

Placosols are particularly sensitive to rainfall and temperature patterns and can be considered relatively transient pedologic conditions. "Relic" placosols are found to be extensive in eastern North America and northern Europe.

The influence of placosol development on hydrologic systems and metal distribution should be considered in planning, and interpreting results of, geochemical surveys in areas where active or relic placosols may be present.

INTRODUCTION

A thin, continuous iron oxide layer which forms between 20 and 150 cm below surface is the distinctive feature of placosols. This layer, the placon, is almost completely impervious to water and forms an effective barrier to migrating metals, complexes and ions. The soil above the placon is strongly leached and depleted in base metals. Below the placon, chemical conditions are usually reducing and neutral to basic. Two separate hydrologic systems are developed.

There is little reference to this phenomenon in the geochemical literature. However, field observations in Newfoundland, mainland eastern Canada,

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Ireland and Scotland, suggest that it is of significance to many geochemical programs. The purpose of this contribution is to describe some of the problems created by existence of a placon and to describe the environment in which placosols occur. The terminology utilized is that proposed by FitzPatrick (1971). His classification emphasizes the placon and related horizons which may be superimposed upon any pre-existing soil or unconsolidated parent material. Other classifications suggest that placic horizons are confined to podzols, a concept which, on the basis of our field experience, we find to be too restrictive. A comparison of various systems of terminology is given in Fig. 1.

ACTIVE AND RELIC PLACOSOLS

Placosol formation is a phenomenon most frequently related to particular maritime or moist alpine climatic conditions that exist in interglacial and early post-glacial times. Presently the area of influence of these special conditions is diminishing and many regions in which placosols formed since the last glaciation no longer experience the required combination of rainfall.

TYPICAL PLACOSOL SECTION	DESCRIPTION	COMPARATIVE TAXONOMY			
		FitzPatrick	Condon	U. S. A. (2)	World (3)
	Living vegetation on sandstone, gravel, etc.				
	Organic layer degree of humification increasing with depth thickness 10 to 200 mm	Hydromorphan (H)	Organic Material Reactive phase (O ₁ , O ₂ , O ₃)	Histic Epipedon	Histic A
	Strongly bleached horizon pronounced bleaching of oxide surfaces thickness 5 to 50 cm	Condon (C)	(A ₁)	Able Horizon (A ₂)	Able E (E)
	Thin oxide overlayer thickness 10 to 30 mm	Placon (P ₁)	Ironpan (B ₁)	Plac (Horizon)	Plac (Horizon)
	Parent material usually the chemically unmodified parent material with oxide over thickness variable	Iron (in) Sesquioxide (S ₁) Depending on previous Pedogenic condition	Parent material of various origin, unchanged by current pedogenic processes (C)		
	Bedrock	Fresh rock (A ₁)	Rock (R)	Lithic contact (R)	Lithic and/or pseudolite (R)
NATIONAL SOIL SURVEY COMMITTEE, 1968 U. S. DEPT. OF AGRICULTURE HANDBOOK NO. 4 INTERNATIONAL SOCIETY OF SOIL SCIENCE COMMISSION No. 5 1955 BULL. 31 1967					

Fig. 1. Placosol section with comparison of terminologies.

temperature and humidity. Here, well-preserved to totally destroyed placons can be expected depending on regional and local, present and past climate.

Placosols in which the placon is presently developing or being maintained are termed *active*. Such an environment exists in much of Newfoundland and the western Scottish highlands.

We have observed widespread evidence of previously active placosols in central Newfoundland, mainland eastern Canada, northeastern Scotland and in Ireland. These we have designated *relic* placosols.

FORMATION OF PLACOSOLS

Placosols form during periods of cool, humid weather with abundant rainfall. Under these conditions pre-existing soils become water-saturated and support the growth of sedges and sphagnum moss. Due to the vegetation mat, acid conditions prevail and the underlying material is strongly leached. A portion of the iron in the zone below the organic mat is mobilized and precipitated as a thin, continuous but irregular, essentially impermeable, limonitic layer, the *placon*, 20–150 cm below the base of the organic horizon or *hydromoron*. The placon prevents vertical drainage of the soil, and consequently the soil above the placon is usually continually water-saturated. This promotes development of peat from the organic material and produces anaerobic conditions in the mineral soil between the placon and the peat. This horizon, the *candon*, normally has low pH (3–4.5) accompanied by strongly reducing conditions. In the candon there is usually little evidence of previous soil structures. Frequently ferric oxide concentrations have been reduced to the ferrous state with a resulting grey to grey-green matrix color and prominent bleaching of cobble and boulder surfaces. (Figs. 2 and 3)

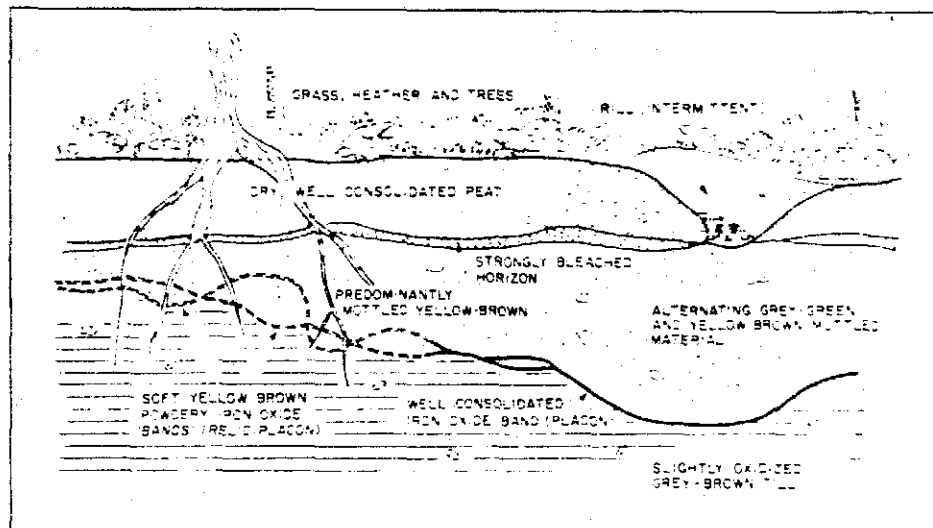


Fig. 2. Sketch of relic and preserved placons exposed in reservoir bank, Lang, Sutherland, Scotland.

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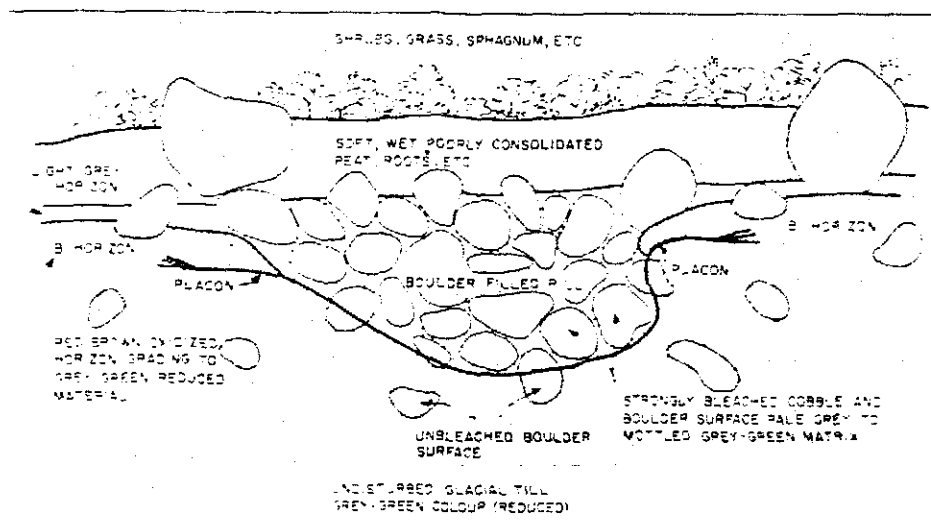


Fig. 3. Sketch of placon development across axis of boulder filled rill, from exposure in road cut, Burn Peninsula, Newfoundland.

In southern Newfoundland, where "active" placosols are abundant, the "soil" below the placon is usually water-saturated, sandy, bouldery till that has a pore water pH of 6.8–7.2.

The placon traces the boundary between the two environments and gives the impression of being the result of rapid chemical change at this surface. Considering the stability relations of iron oxides, rising pH related to proximity to the upper surface of the groundwater sheet should result in precipitation of hematite and limonite (Garrels and Christ, 1965). A distinct difference in pore-water pH has been observed across the placon and, although Eh measurements were not taken, it is evident from field observations that Eh is also in the appropriate range.

FitzPatrick (1971) suggests that the placon may be formed at the interface between moist soil near surface and relatively dry deeper levels, or at the upper surface of a pre-existing soil unit.

Based on detailed studies in southern Newfoundland and observations in other regions where active placosols exist, we conclude that relatively dry soil below the placon is related to reduction in groundwater recharge area with spread of placon development, or to climatic change with reduced rainfall. In the latter case, evidence of deteriorating placon strength and increased permeability is frequent, as anaerobic conditions are replaced by aeration of the soil as a consequence of periodic drying of the peat and candon.

In all localities where we have studied placosols, local continuity of an active placon seems limited by distribution of freely draining soil and location of the true spring line. If drainage is good to a depth of 1.5 m there is usually a gradual change from strongly bleached soil immediately below the

organic mat to a red-brown oxide layer (B horizon) that grades over 20–40 cm to grey, reduced parent material. In some localities the B horizon may be seen to grade laterally into a hard, impervious placon as vertical drainage becomes restricted or the upper limit of the water table approaches surface (Figs. 2 and 3). Downslope from the true spring line, placon development is usually discontinuous, the soils being completely water-saturated and showing little pedologic development. The occasional placon encountered is either relic from a previous development, or underlies hummocks or small hills of glacial material or alluvium. Placones are frequently observed to extend into relatively well-drained areas beneath the bed and short distances (5–10 m) on each side of coarse gravel and boulder-filled rills.

Placosols can form, under appropriate climatic conditions, on any pre-existing soil, but are most commonly developed in relatively permeable material. Placones often develop in alluvium and in glacial deposits. They are frequently the first pedologic unit to form after deposition or exposure from beneath glacial ice.

RECOGNITION OF PLACOSOLS

Active placosols are easily recognized in exposed profiles by their distinctive principal horizons: a thick mat of partially decomposed vegetable matter (hydromoron) at surface, followed by a strongly leached and reduced zone (candon) 20–150 cm thick which terminates abruptly against a hard, dark reddish-brown, amorphous, 1–30 mm horizon (placon). Below the placon there is usually little if any alteration of pre-existing structures.

Relic placosols may show some or all of the characteristics of an active placosol in any degree of preservation. Periodic drying of the hydromoron and candon results in aeration of these horizons and oxidation of ferrous iron to the red ferric state with consequent color change in the candon from grey or grey-green to mottled red-brown. As aeration becomes predominant over anaerobic conditions the placon becomes friable and porous. It can no longer support a perched water table, vertical drainage is restored and other soil development (frequently podzolic) becomes dominant. In most cases where placosols have existed, evidence of the placon will remain when all other features have been destroyed. This may be simply an undulating red iron oxide band near the base of the B horizon or, particularly beneath present or former rills, a thin, relatively continuous layer of soil more or less cemented by 0.5–1.0 mm thick plates of limonite (Fig. 2).

When exposed soil profiles are not available, certain surface conditions will serve to identify areas where active or relic placosols are probable. The most obvious indication is abundant surface water especially on granular, porous material deposited on slopes of 5–35%. Blanket peats are unlikely to form on overburden-covered surfaces unless an active placon is present during accumulation of most of the organic material. "Perched" ponds on glacial deposits, talus slopes or alluvium must be supported by an impervious

layer. This is almost invariably a placon. Terraced bogs can form only on material in which an active supportative placon is developed.

HYDROLOGIC SYSTEMS IN PLACOSOLS

There are two distinctly separate hydrologic systems in active placosols. Precipitation falling onto soils in which placons are developed runs off rapidly since the mineral soil and overlying vegetation mat are usually perpetually water-soaked and unable to absorb significant additional moisture. In the unlikely event that the horizon above the placon were dry, the volume of water that could be accepted is limited by the shallow depth to the impermeable layer and rapid saturation results. Water in the system above the placon usually has a low dissolved element content since the candon is usually strongly leached and deficient in available metal. Circulation of water above the placon is restricted to saturation of the candon and organic layer and direct surface run-off. Stream discharge fluctuates rapidly, rising within several hours after precipitation begins and falling back to normal within eight to ten hours or less after rain stops.

Terraced bogs and perched ponds are supported by placons. Some of the ponds studied in Newfoundland are as large as 2000–5000 m². Several exist on hillsides with slopes up to 35%. Small perched ponds and terraced bogs are often seen on even steeper scree, and till-covered slopes in the mountains of western and northwestern Canada.

There is usually little exchange of water across the placon, although occasionally we have observed small ponds perched on till-covered hillsides to be underlain by a breached placon that permits groundwater to enter during wet weather and through which the pond may completely drain in a matter of hours if the water table drops during a dry period.

Below the placon, groundwater moves down slope as a sheet restricted by the impermeable layer above and the bedrock below. Recharge is by percolation of precipitation through areas of freely draining soils on higher ground. A limited contribution is made through breached placons during periods of dry weather when the groundwater table drops. This is normally a minor source and of only local influence.

In some areas a significant contribution to the groundwater sheet may come from bedrock and be derived from streams flowing, in part, directly on bedrock and from lakes formed in bedrock depressions at elevations above the point under consideration (Fig. 4). In these circumstances the incidence of springs through the placon is more common and hydromorphic distribution of metals and ions may be observed in the peat and locally in mineral soils adjacent to the groundwater source.

The water table reaches surface at the level of most major streams and lakes, or at the true spring line. This hydrologic system may be complicated by bedrock topography and several spring lines may exist between the height of land and the major drainage channels. Groundwater coming to surface at any

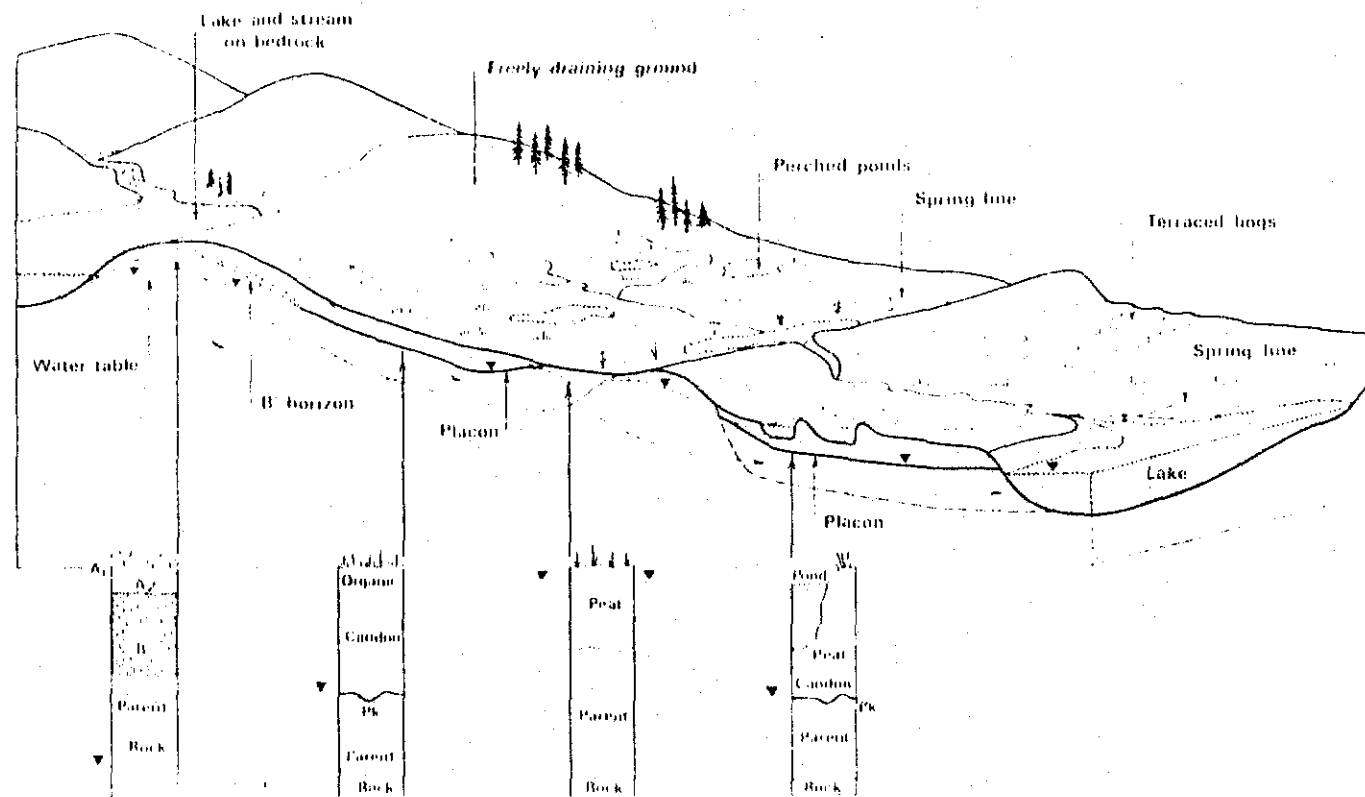


Fig. 4. Typical development and distribution of placosols.

point may have travelled 1000 m or more from point of entry as precipitation or from streams or lakes (Tilsley, 1975).

INFLUENCE ON PLACOSOLS ON GEOCHEMICAL SURVEYS

Mobility of any particular element will be influenced by water chemistry and its distribution will be controlled by chemical change along the flow path. It is not intended to discuss these factors in detail herein but simply to draw attention to the physical controls and to suggest that all factors must be carefully considered in planning geochemical surveys in areas of placsol development and in interpretation of results from such surveys.

Secondary distribution of trace elements in active placosols is complicated by the existence of two hydrologic systems and by notably different chemical conditions above and below the placon.

Hydrogeochemical surveys are directly effected because of the sampling problem involved. Each sample site must be studied to determine the history of the water collected at that point and to determine from which hydrologic system it comes, or more frequently, what portion of the sample is contributed by each. Determination of temperature and pH of water at time of sampling have been found by us to be very helpful in establishing which system is being sampled.

There is a variety of geochemical sampling problems presented within the placosols themselves. The most evident is the strongly leached nature of the candon. The hydromoron, or the peat layer, may act as a metal collector especially near groundwater springs. In other areas there is normally little available metal to be concentrated, the source being limited to the candon in the immediate area. Collection of soil samples from above the placon is ineffective since any anomalous concentration of soluble metals will have been destroyed in all but the youngest placsol. Sampling below the placon, however, will show the metal distribution at this level prior to placsol development. If the placon lies less than 30 cm from the top of the mineral soil, previous horizons may be preserved. In other cases the sample will represent C-horizon or, perhaps, undisturbed glacial material. There is no appreciable metal or ion movement across the placon. The placon can thus prevent geochemical detection of a mineral deposit that lies within as little as 1-1.5 m below surface (Tilsley, 1975).

Relic placosols will have experienced the metal depletion noted in the candon of active placosols. Until a subsequent soil is fully developed, and all traces of the placon and candon have been destroyed, care must be taken to sample horizons that will not have been metal-depleted during the time placosols existed.

Hydrogeochemical surveys in areas of relic placosols present no particular problems since the two separate hydrologic systems characteristic of active placosols can not exist subsequent to destruction of the placon.

DISTRIBUTION OF ACTIVE AND RELIC PLACOSOLS

Active placosols have been recognized in the British Isles, eastern Canada, Scandinavia, northern Germany, northern France, Alaska and western Canada, as well as at higher altitudes in Malaysia and the Solomon Islands (FitzPatrick, 1971).

Based on climatic comparison, placosols can also be expected in southern latitudes of South America, northern Pacific maritime areas and perhaps at higher altitudes in parts of New Zealand and Tasmania.

Relic placosols are more widely distributed than active placosols in both northern and southern maritime regions. Relic placosols are broadly observed below blanket peats over much of northern Scotland, for example, while active placosols are largely confined to the west coast. In mainland eastern Canada, relic placosols are widespread but active placosols are limited to restricted coastal areas and to coastal and central Newfoundland where humidity and rainfall are generally high.

CONCLUSIONS

The influence of placosol development on trace element distribution in soils must be taken into consideration when planning and interpreting results of geochemical exploration programs in maritime and alpine areas where this soil type is likely to exist. Hydrogeochemical programs must be planned with consideration of the two hydrologic systems that develop with formation of the placosol. Interpretation of results should be based on detailed study of water chemistry and probable flow path to each sample location.

Relic placosols are much more widely distributed today than active placosols. The conditions that existed during their active stage strongly influence metal distribution in present soils. Sampling and interpretation approaches should be modified accordingly.

ACKNOWLEDGEMENTS

The author wishes to thank Dr. David S. Robertson for his discussions and review of the paper.

Constructive criticisms of the original manuscript by one of the referees in particular was exceptionally helpful and much appreciated.

REFERENCES

- FitzPatrick, E.A., 1971. *Pedology; A Systematic Approach to Soil Science*. Oliver and Boyd, Edinburgh, 306 pp.
- Garreis, R.M. and Christ, C.L., 1965. *Solutions, Minerals, and Equilibria*. Freeman, Cooper and Company, San Francisco, Calif., 450 pp.

Tilsley, J.E., 1975. Application of geophysical, geochemical and deep overburden sampling techniques to exploration for fluorspar in glaciated terrain. In: M.J. Jones (Editor), *Prospecting in Areas of Glaciated Terrain*, 1975. Institution of Mining and Metallurgy, London, pp. 126-133.

Canada Department of Agriculture, 1974. *The System of Soil Classification for Canada*. Publ. 1455, rev. ed., 255 pp. (Ottawa, Ont.).

Soil Science Society of America, 1973. *Glossary of Soil Science Terms*. Madison, Wisc., 33 pp.

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6	Regional Geology - Southern Sheet.
7	Regional Geology - Western Sheet.
8	Regional Geology - Southern Sheet Alternative Interpretation.
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11	" " 1N-10N East. "
12	" " 11N-20N East. "
13	" " 0 -10N West. "
14	" " 10N-20N West. "
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20	DDH CP3, 5, 11, 18, 23, - Section 6N.
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23	DDH CP19, 20, CH3 - Section 2N.
24	DDH CP21, 22 - Section 1N.
25	A° Soil Geochem. Values ppm Copper.
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27	" " Zinc.
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30	Chester Area - Reduced Composite Regional Geology - Interpretation.
31	Composite Summary Ground Mag. - I.P. - Soil Geochem. Anomalies.
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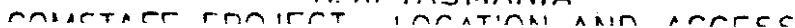


FIG. 2.

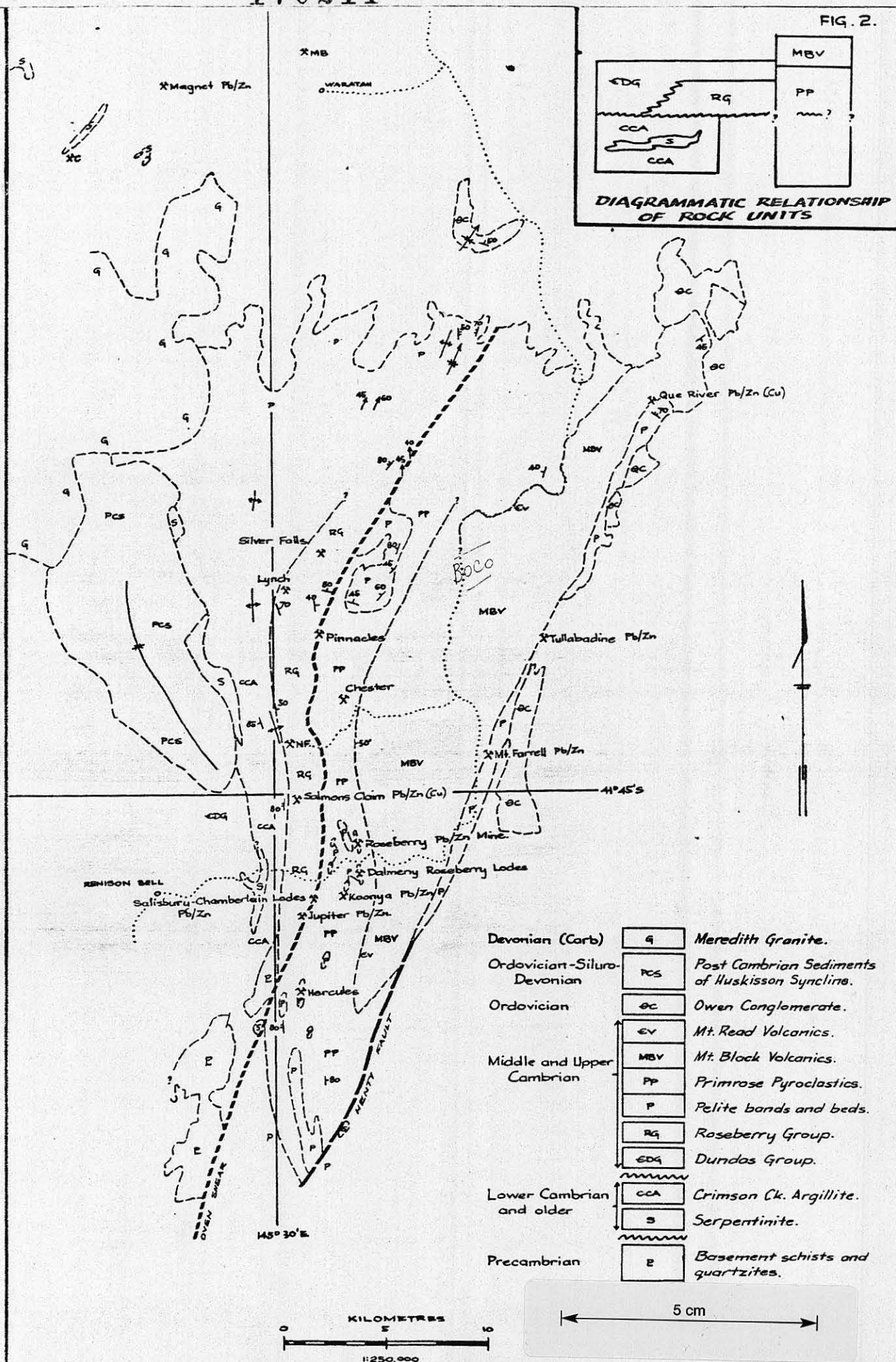


FIG. 2.

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A.S.C.

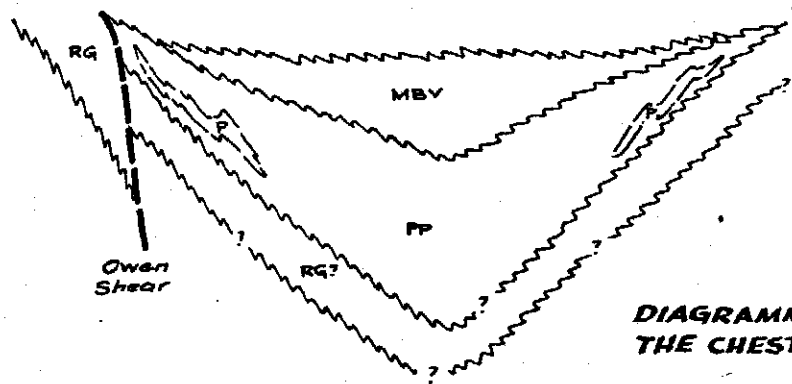
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ROSEBERRY-CHESTER-PINNACLES - REGIONAL GEOLOGY

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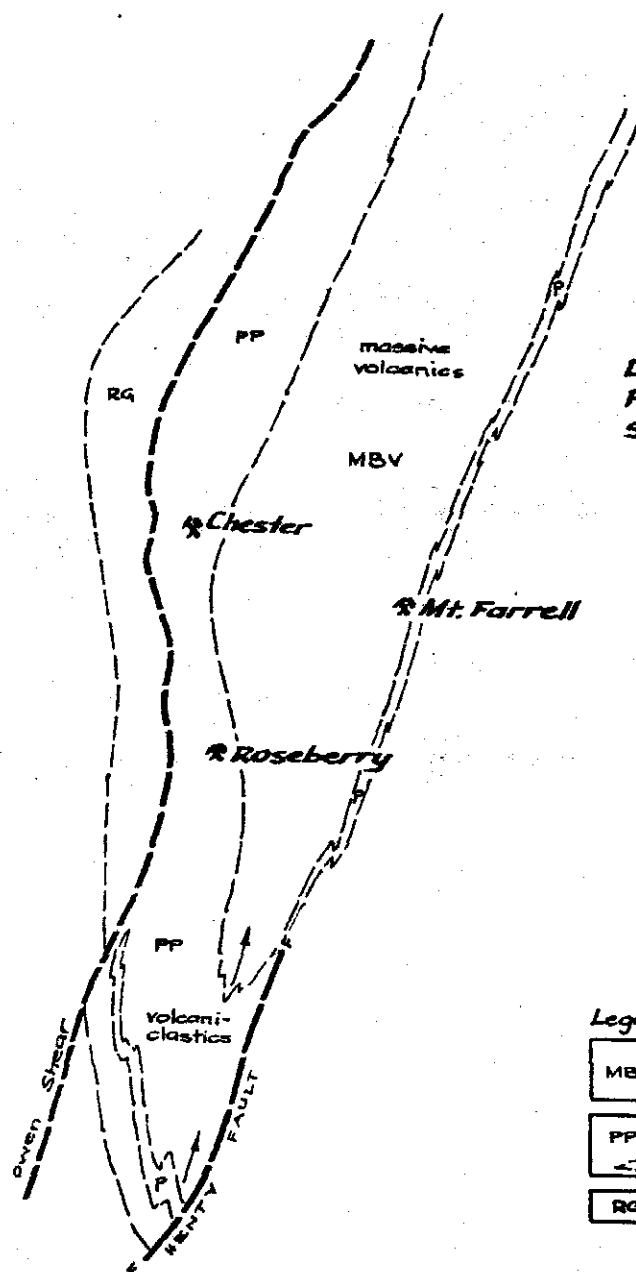
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FIG.3.



DIAGRAMMATIC PLAN THROUGH
THE CHESTER-MT. FARRELL AREA



DIAGRAMMATIC PLAN OF
POSTULATED NORTH PLUNGING
SYNCLINORIUM

Legend:

- | | |
|-----|--|
| MBV | Mt. Read Volcanics (EV)
Mt. Black Volcanics. |
| PP | Primrose Pyroclastics.
Pelite bands and beds. |
| RG | Roseberry Group. |

5 cm

KILOMETRES
0 5 10
1:250,000

FIG.3.

Prepared:
D. J. P.

Drawn:
A. S. C.

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SKETCH OF REGIONAL GEOLOGY

Date:
Sept. '77

A.A. 101

Legend:

1AH Strongly altered
 2AH Moderately-strongly altered.
 3AH Moderately altered.
 4AH Slightly-moderately altered.
 5AH Slightly altered.
 6AH Unaltered.

----- Chert band.
 ----- Pelite band.
 ----- Pyrite band.

AT Acid tuff.
 QXT Quartz crystal tuff.
 PXT Plag. crystal tuff.
 QPXT Quartz plag. crystal tuff.
 LiT Lithic tuff.
 ViT Vitric tuff (ignimbrite)
 ViLiT Vitric lithic tuff.
 LaT Lapilli tuff.
 LiViLoT Lithic vitric lapilli tuff.

F/ Float.
 bl.sh. (black) shale.
 Qsst. Quartz siltstone.
 Qss. Quartz sandstone.
 G.T. Glacial till.
 rhy Rhyolite.
 rhydac Rhyodacite.
 dac. Dacite.
 and. Andesitic (dyke)
 Q Quartz.

2°Q Secondary quartz.
 Qv Quartz veining.
 Kfeld. K. feldspar.
 MnSt. Manganese staining.
 limpy Limonite after pyrite.
 Hb. Hornblende.
 mag. Magnetite.

st.shd Strongly sheared.
 shd. Moderately sheared.
 sl.shd Slightly sheared.
 w.shd Weakly sheared.

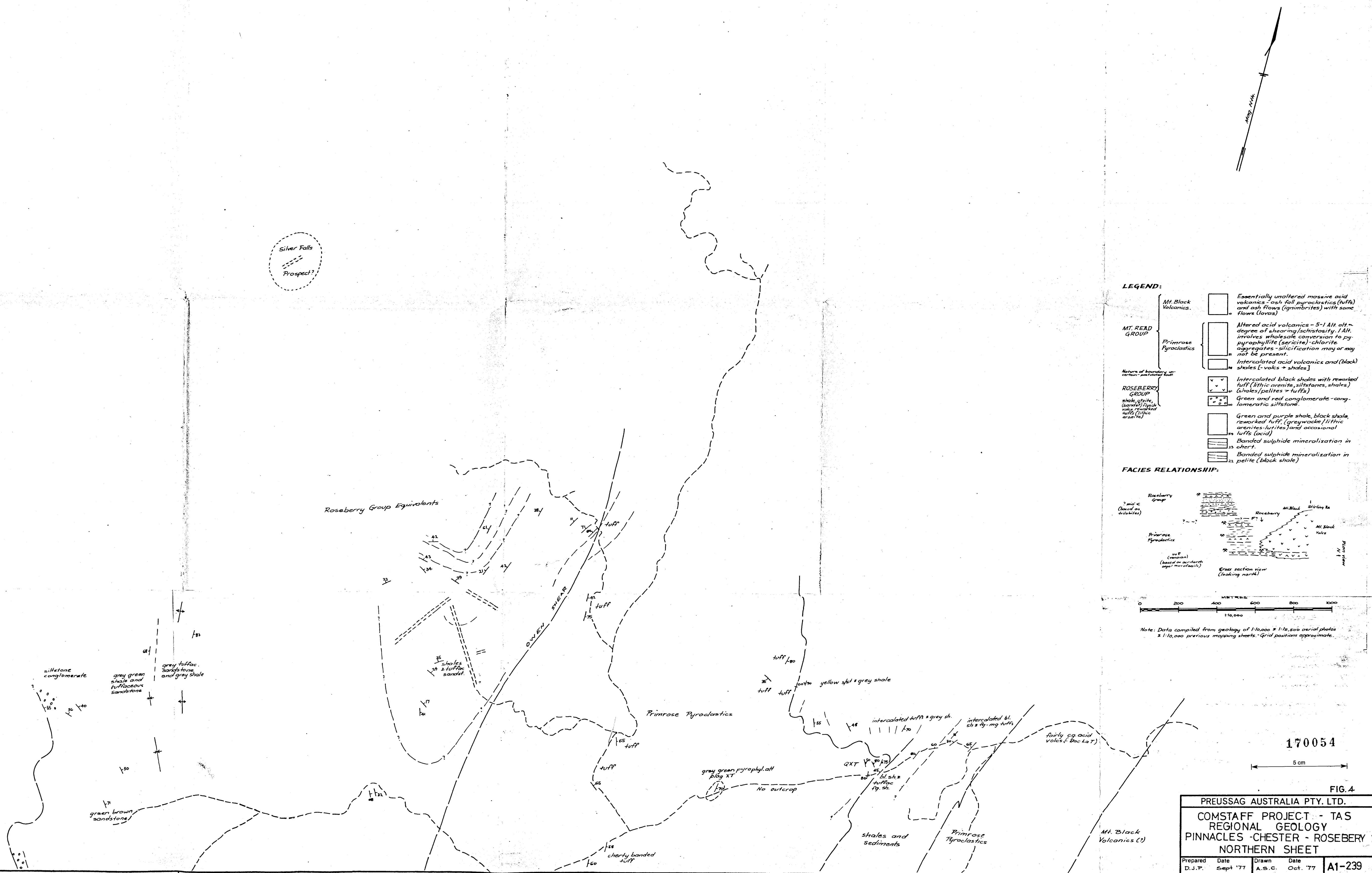
f.g. fine grained.
 mg. Medium grained.
 c.g. Coarse grained.
 mod. Moderately.

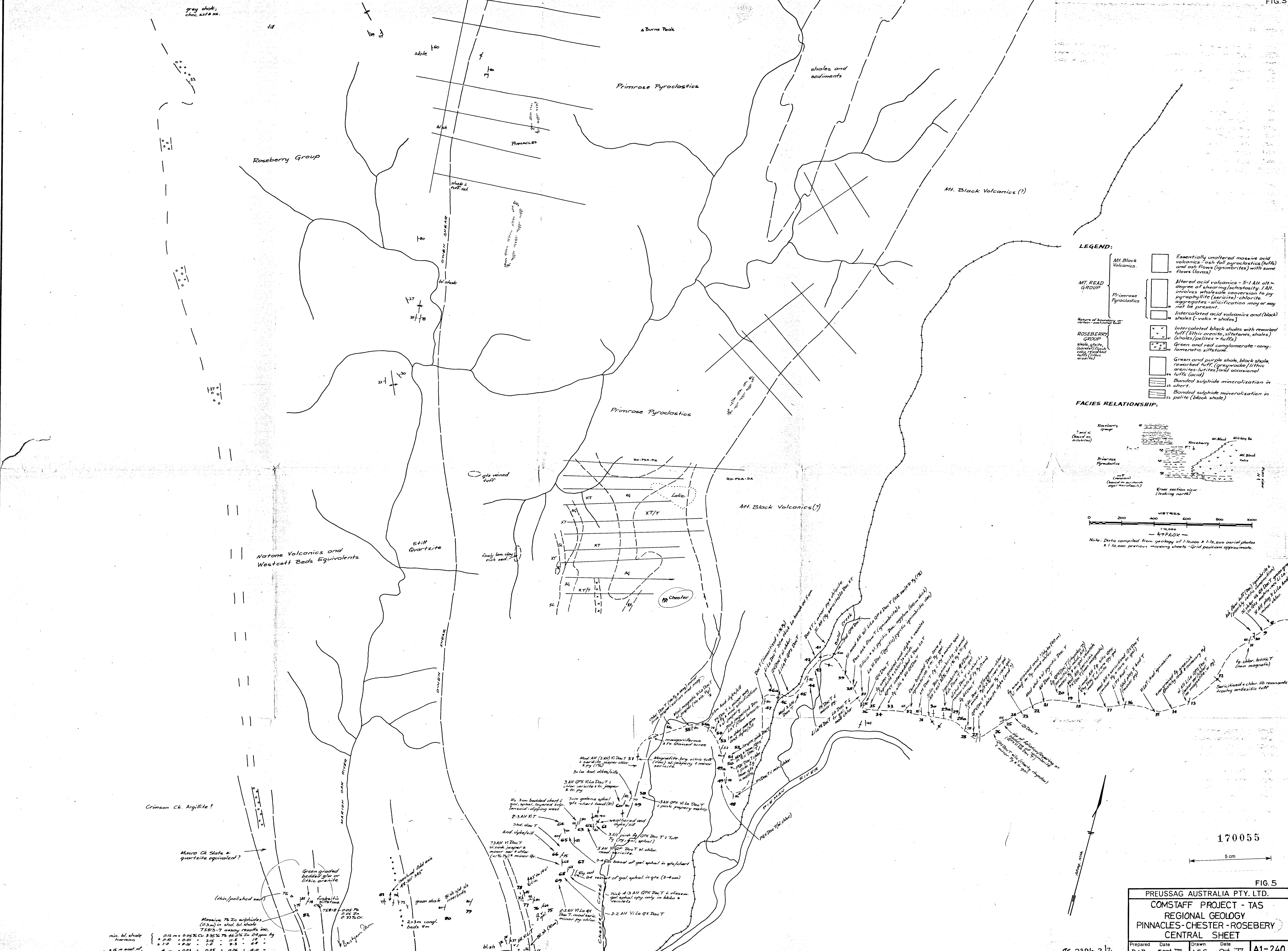
▽TS Thin section/polished section sample.
 o Assay sample.

∞/x Dip and strike of bedding.-vertical.
 ∞/x Dip and strike of foliation.-vertical.
 (O) Outcrop/Float boundary
 [] Outcrop mapping by R.N. Smith 1974-5.

∞/x Strike & dip of bedding with facing
 / Fault
 62 Traverse point.

≡ Swamp.
 ≡≡≡ Cliff.
 ~~~~~ Creek.  
 +++++ Railway.  
 === Road-track.  
 Δ Crest.





**LEGEND:**

**Mt. Black Volcanics:** Essentially unaltered massive acid volcanics - ash fall pyroclastics (tuffs) and ash flows (agglomerates) with some flows (lavas)

**MT. READ GROUP**

**Primrose Pyroclastics** Altered acid volcanics - 5-1 Ah alt - degree of shearing/actinostasis. 1 Ah involves wholesale conversion to pyrophyllite (sericite) - chlorite aggregates - silicification may or may not be present.

**ROSEBERRY GROUP** Intercalated acid volcanics and (black) shales [- vokes + shales]

**Nature of boundary in certain "unfossiliferous" units** Intercalated black shales with reworked tuff (lithic arenite, siltstones, shales) (shales/pelites + tuffs)

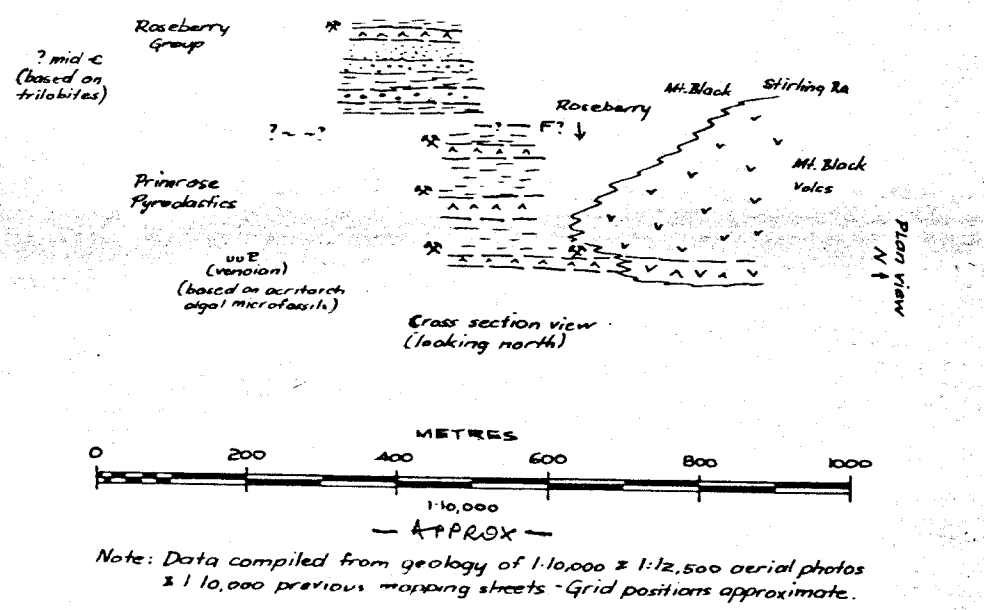
**Stitt Quartzite** Green and red conglomerate - conglomeratic siltstone

**Green and purple shale, black shale, reworked tuff, (greywacke) lithic arenites, lutrites and occasional tuffs (acid)**

**Banded sulphide mineralization in chert**

**Banded sulphide mineralization in pelite (black shale)**

**FACIES RELATIONSHIP:**



170055

5 cm

FIG. 5

PREUSSAG AUSTRALIA PTY. LTD.

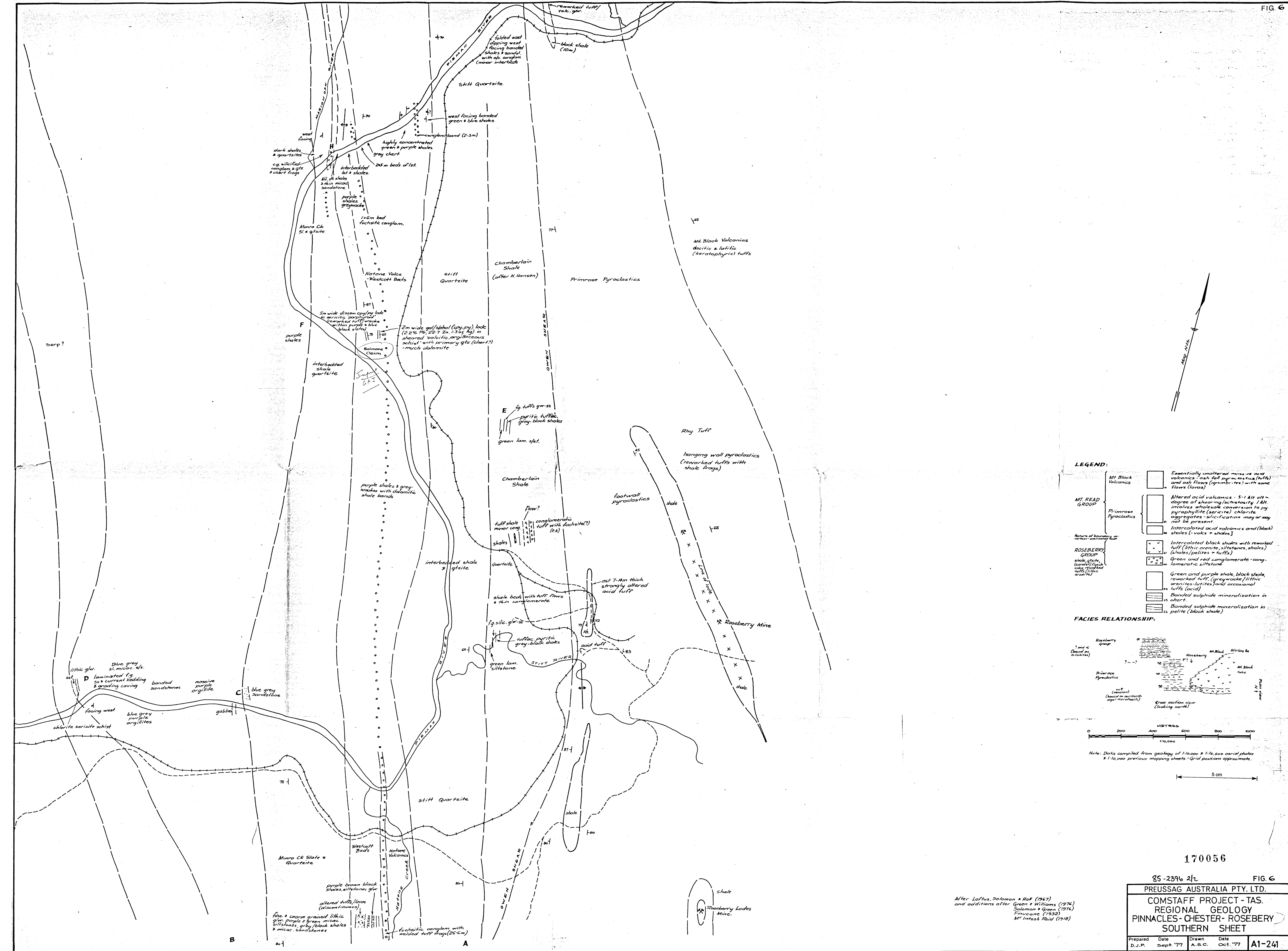
COMSTAFF PROJECT - TAS

REGIONAL GEOLOGY

PINNACLES-CHESTER-ROSEBERRY

CENTRAL SHEET

Prepared Date Sept '77 Drawn Date Oct '77 A1-240

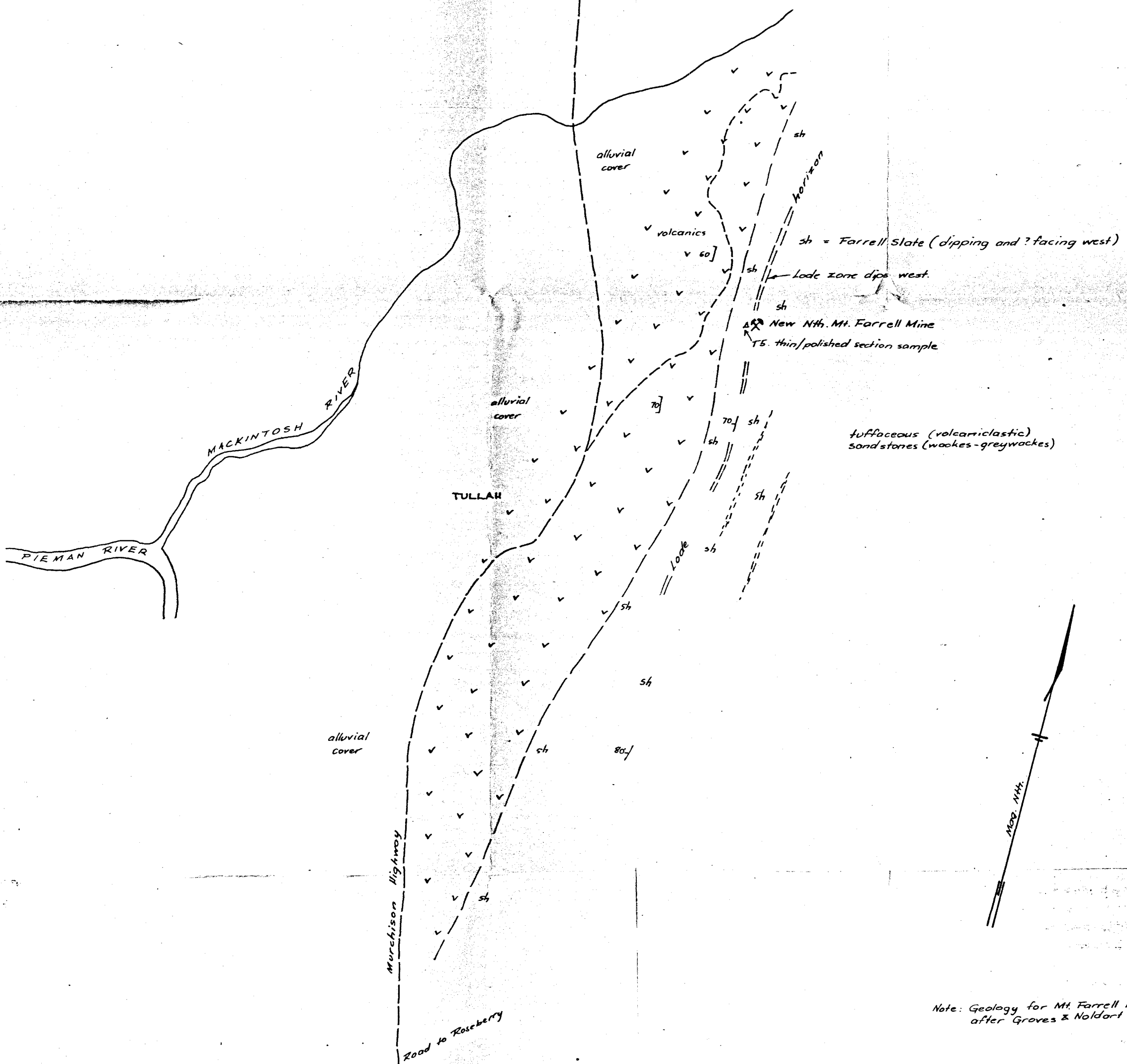
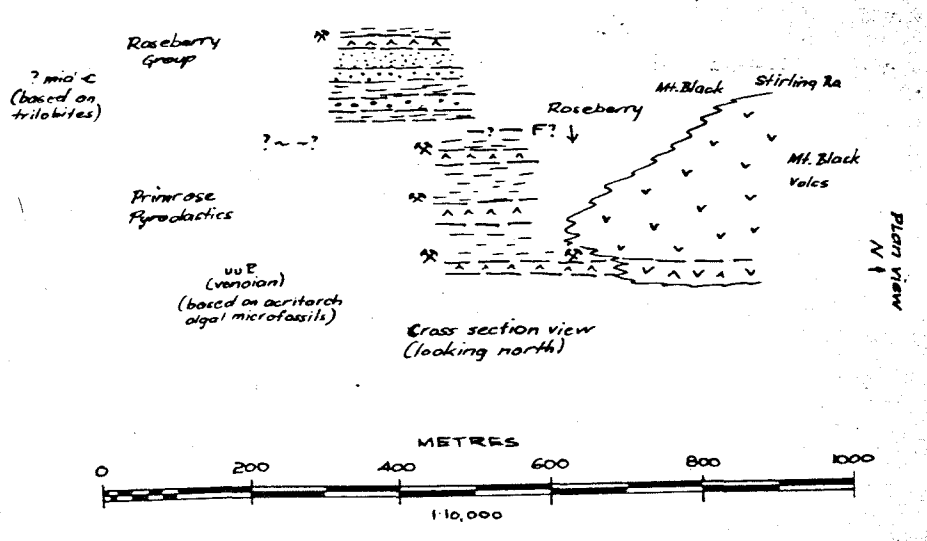


12. over ground out of the (1) & 5-20% H<sub>2</sub>O + some siliceous material  
 7. magmatic material  
 6. Silic. porphy and or and/or 100%  
 5. 100% fused and 100% mag. (or wide flow 2) or. epide 1/2  
 4. 100% LIT (6 mag mag) or. chert & 4  
 3. 100% LIT (6 mag mag) or. chert & 4  
 2. 100% LIT (6 mag mag) or. chert & 4  
 1. Road to Waratah Burnie  
 1. Fine grained & even grained 100% mag  
 2. Pyrox. big and (1) dacite & 100%  
 epide, chert, 100% 100% (pyroxylized)

LEGEND:

- MT. BLACK  
 Volcanics. [Symbol] Essentially unaltered massive acid volcanics - ash fall pyroclastics (tuffs) and ash flows (ignimbrites) with some flows (lavas)
- MT. READ  
 GROUP  
 Primrose  
 Pyroclastics [Symbol] Altered acid volcanics - 5-1 Alt. alt. degree of shearing/schistosity. 1 Alt. involves wholesale conversion to py. pyrophyllite (sericite)-chlorite aggregates - silicification may or may not be present.
- Nature of boundary in certain postulated fault
- ROSEBERRY  
 GROUP  
 shale, gneiss, (sandstone) light volcan. reworked tuffs (lithic arenite) [Symbol] Intercalated acid volcanics and (black) shales [- volcs + shales]  
 [Symbol] Intercalated black shales with reworked tuff (lithic arenite, siltstones, shales) (shales/pelites + tuffs)  
 [Symbol] Green and red conglomerate - conglomeratic siltstone.  
 [Symbol] Green and purple shale, black shale, reworked tuff, (greywacke/lithic arenites-lutites) and occasional tuffs (acid)  
 [Symbol] Banded sulphide mineralization in chert.  
 [Symbol] Banded sulphide mineralization in pelite (black shale)

FACIES RELATIONSHIP:

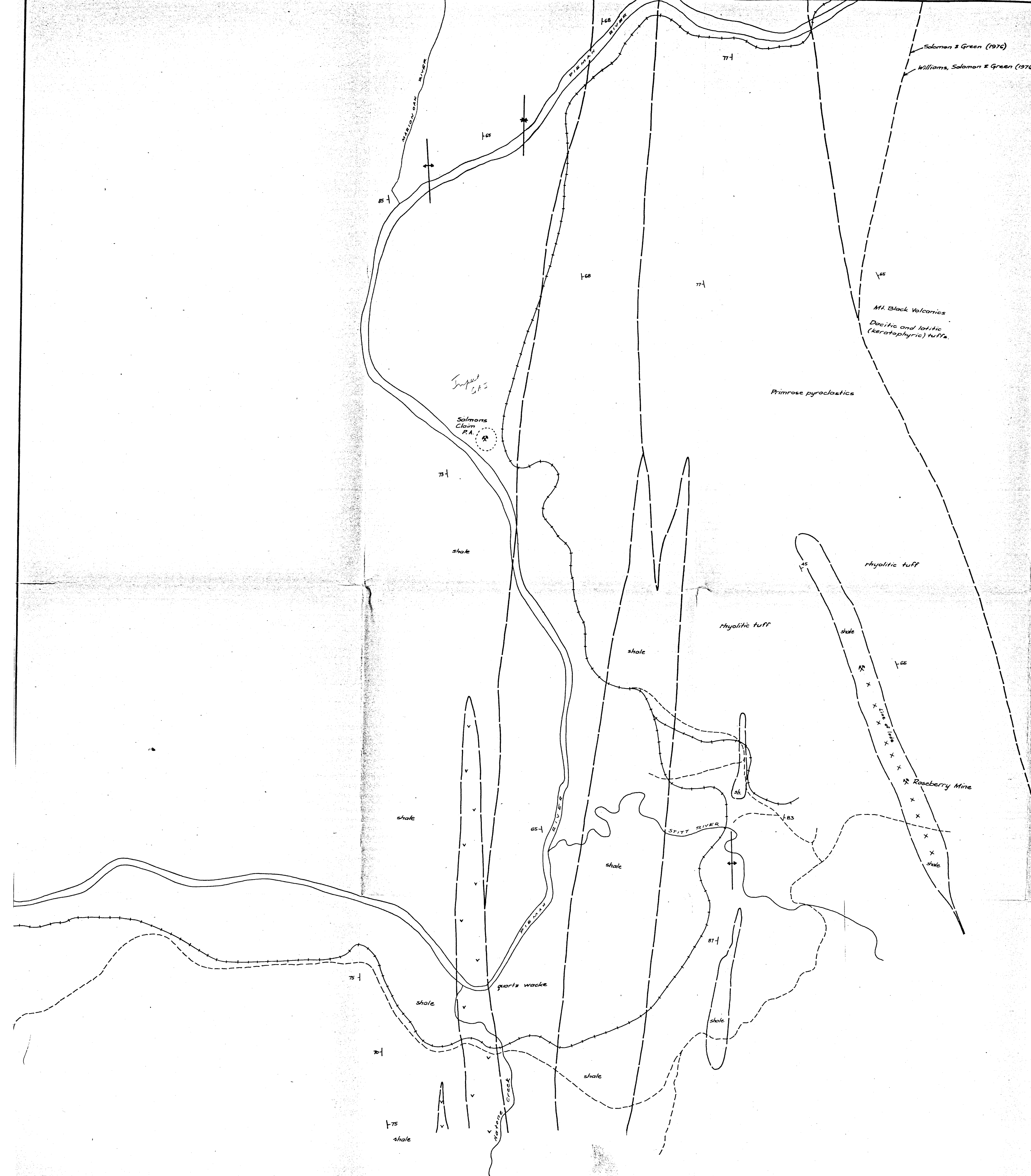


170057

5 cm

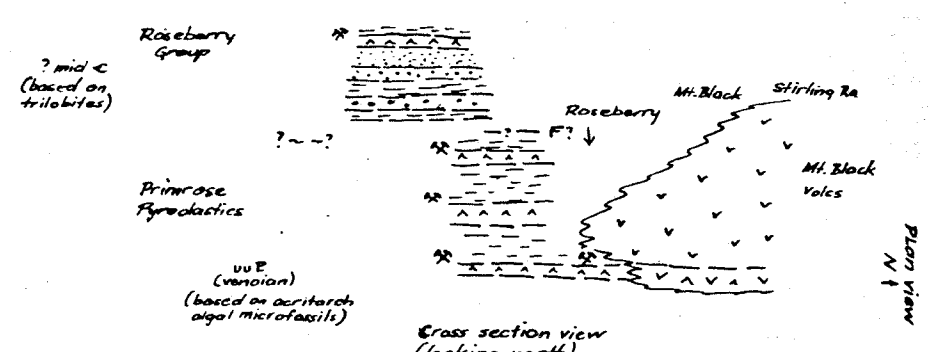
85-2396 2/2 FIG. 7  
 PREUSSAG AUSTRALIA PTY. LTD.  
 COMSTAFF PROJECT - TAS  
 REGIONAL GEOLOGY  
 PINNACLES - CHESTER - ROSEBERRY  
 EASTERN SHEET

|                      |                  |                   |                  |        |
|----------------------|------------------|-------------------|------------------|--------|
| Prepared<br>D. J. P. | Date<br>Sept '77 | Drawn<br>A. S. C. | Date<br>Oct. '77 | A2-037 |
|----------------------|------------------|-------------------|------------------|--------|



## LEGEND:

- MT. READ GROUP**
- Mt. Black Volcanics
  - Primrose Pyroclastics
- ROSEBERRY GROUP**
- Essentially unaltered massive acid volcanics - ash fall pyroclastics (tuffs) and ash flows (agglomerates) with some flows (lavas)
  - Altered acid volcanics - 5-1 km alt - degree of shearing/schistosity 1 km. involves wholesale conversion to pyrophyllite (sericite) - chlorite aggregates - silicification may or may not be present.
  - Intercalated acid volcanics and (black) shales (volcs = shales)
  - Intercalated black shales with reworked tuff (lithic arenites, siltstones, shales) (shales/pelites = tuffs)
  - Green and red conglomerate - conglomeratic siltstone
  - Green and purple shale, black shale, reworked tuff (greywacke/lithic arenites/lutites) and occasional tuffs (acid)
  - Banded sulphide mineralization in altered.
  - Banded sulphide mineralization in pelite (black shale)
- FACIES RELATIONSHIP:**



0 200 400 600 800 1000  
METRES  
1:10,000

Note: Data compiled from geology of 1:10,000 & 1:10,000 aerial photos & 1:10,000 previous mapping sheets. Grid positions approximate.

170222

5 cm

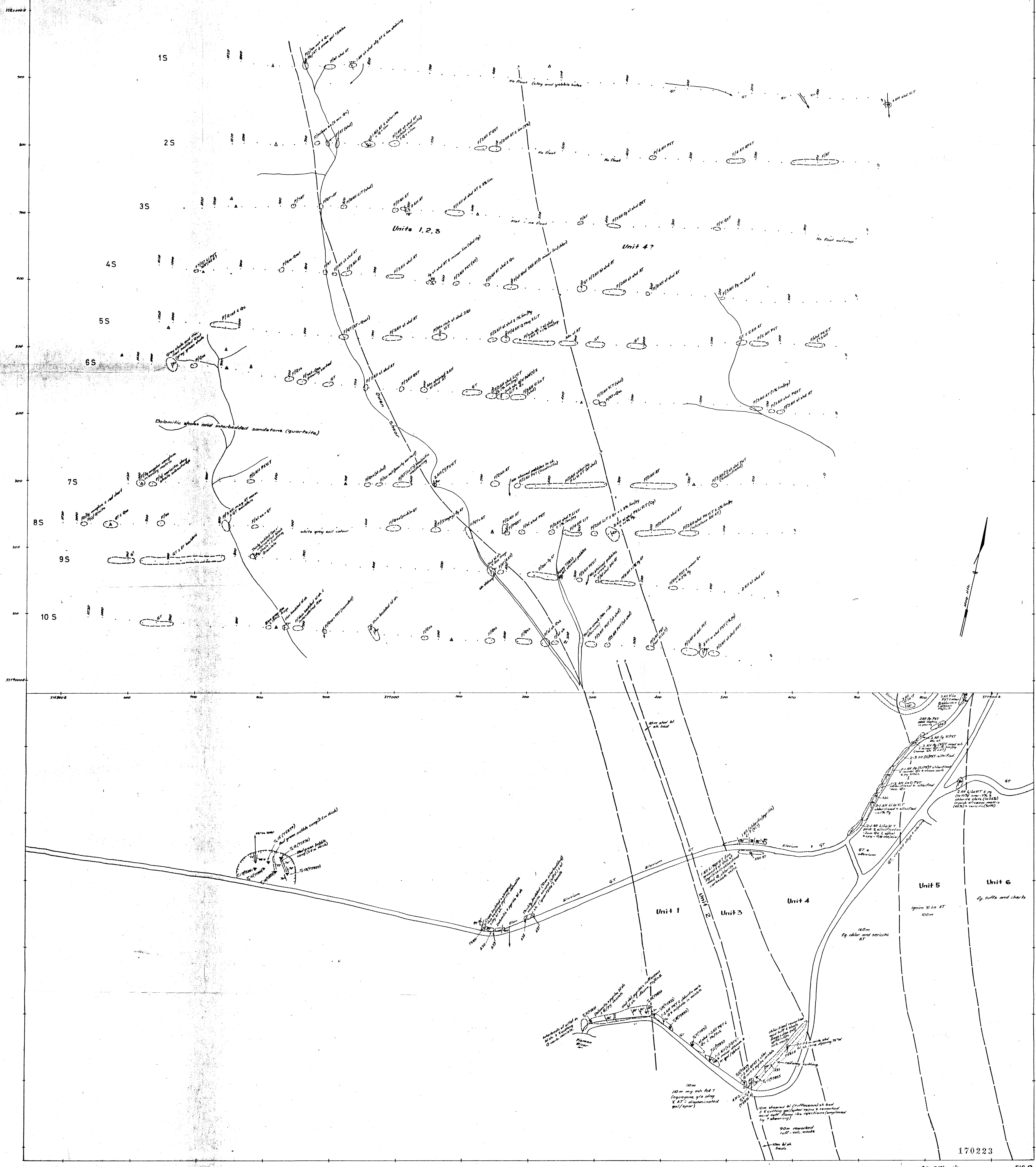
85-2596 2L

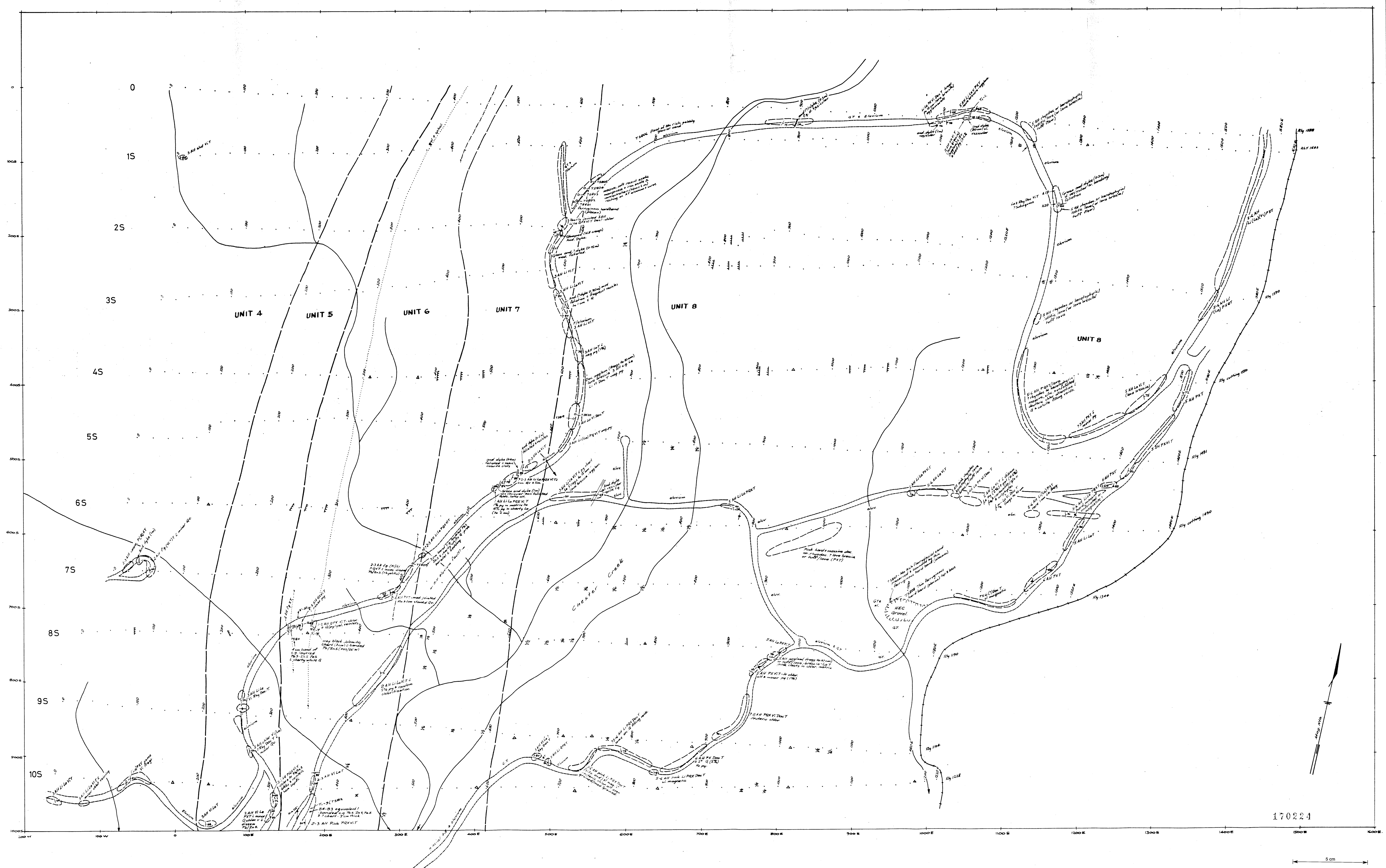
FIG. 8

PREUSSAG AUSTRALIA PTY. LTD.  
COMSTAFF PROJECT - TAS.  
REGIONAL GEOLOGY  
SOUTHERN SHEET  
ALTERNATIVE INTERPRETATION

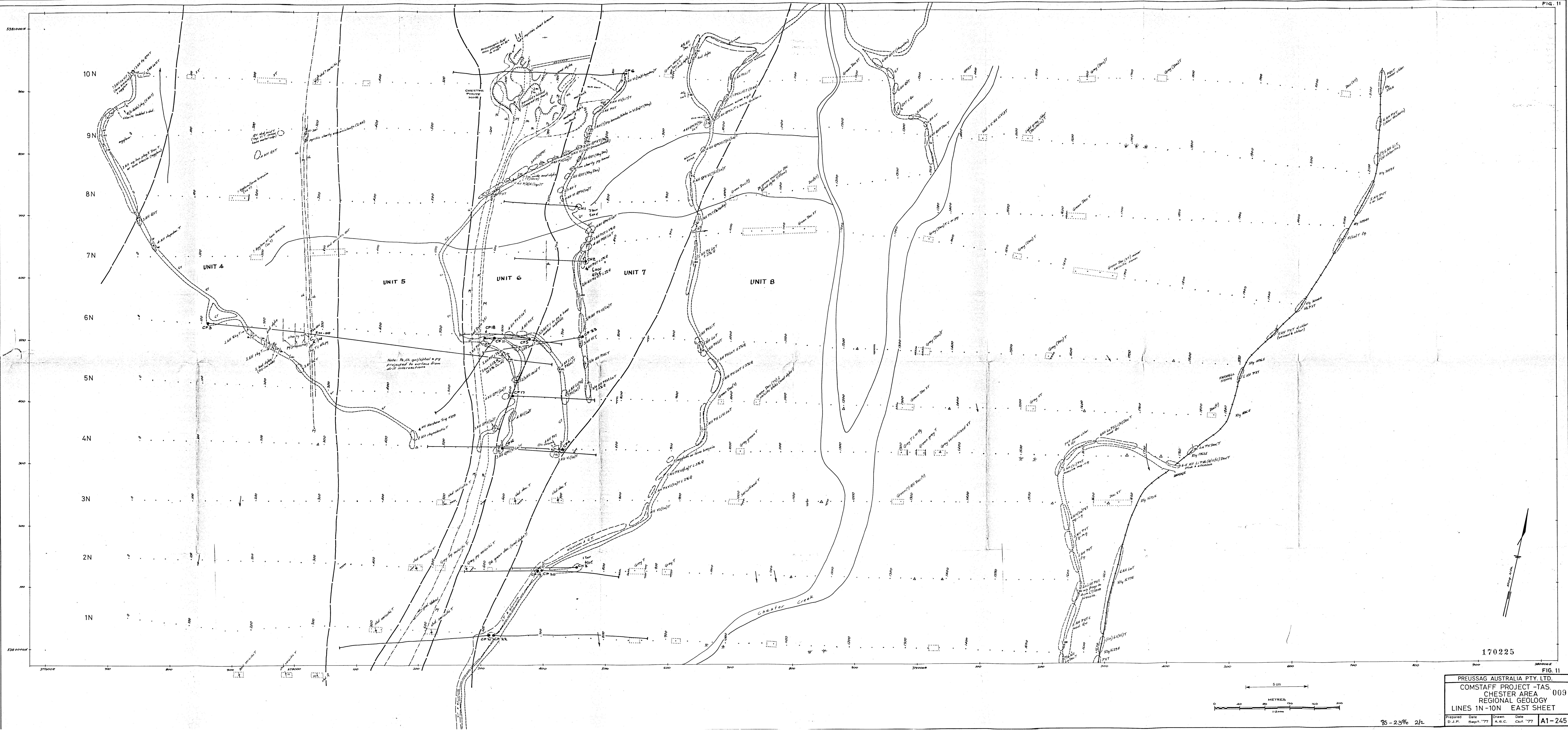
Prepared Date Drawn Date  
D.J.P. Sept. '77 A.S.C. Oct. '77 A1-242

Roseberry geology after Braithwaite (1974)





170224



170225

PREUSSAG AUSTRALIA PTY. LTD.  
COMSTAFF PROJECT - TAS.  
CHESTER AREA 009  
REGIONAL GEOLOGY  
LINES 1N-10N EAST SHEET

|          |           |        |          |
|----------|-----------|--------|----------|
| Prepared | Date      | Drawn  | Date     |
| D.J.P.   | Sept. '77 | A.G.C. | Oct. '77 |

A1-245

35-2396 2/L



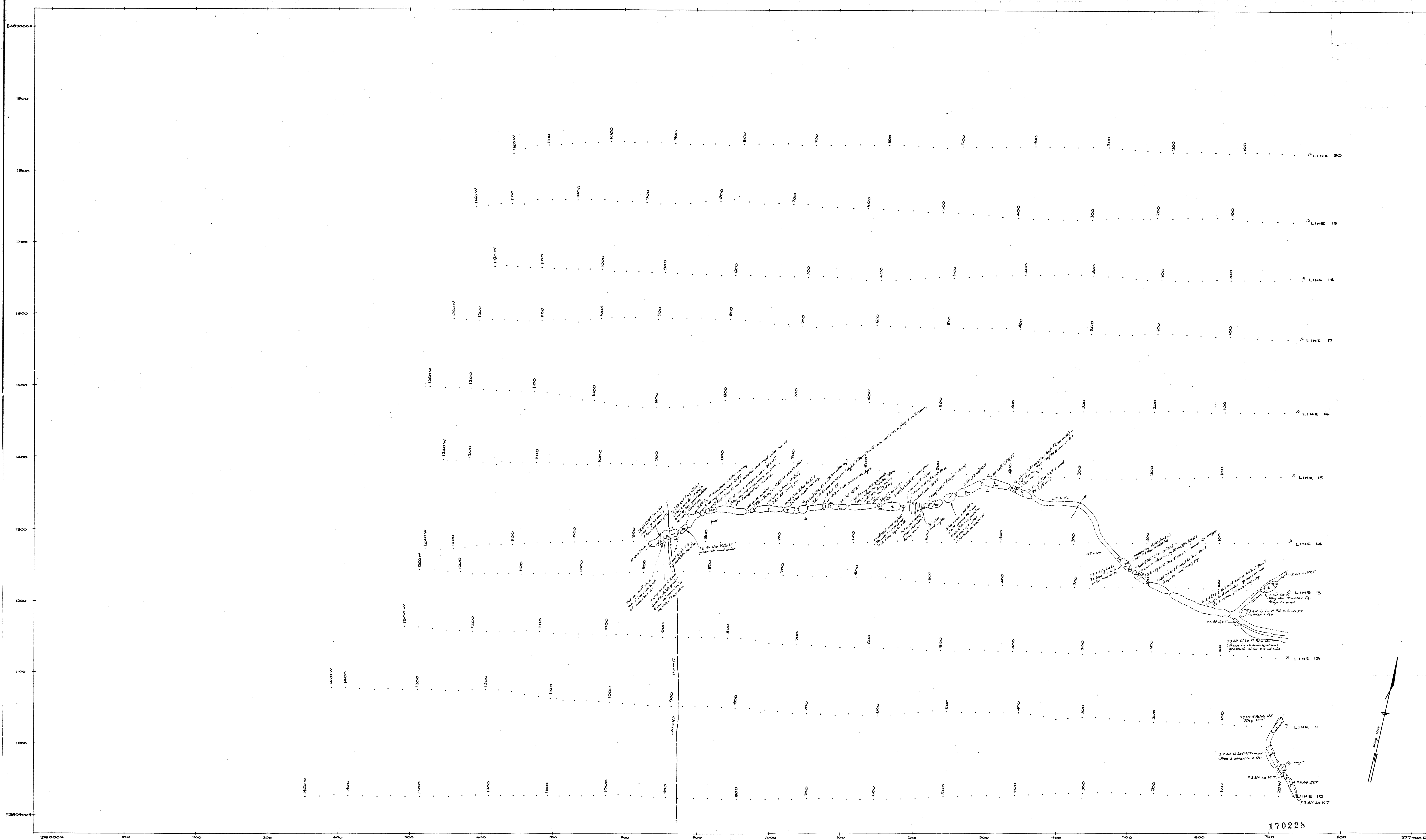


FIG 13

FIG 13

FIG 13

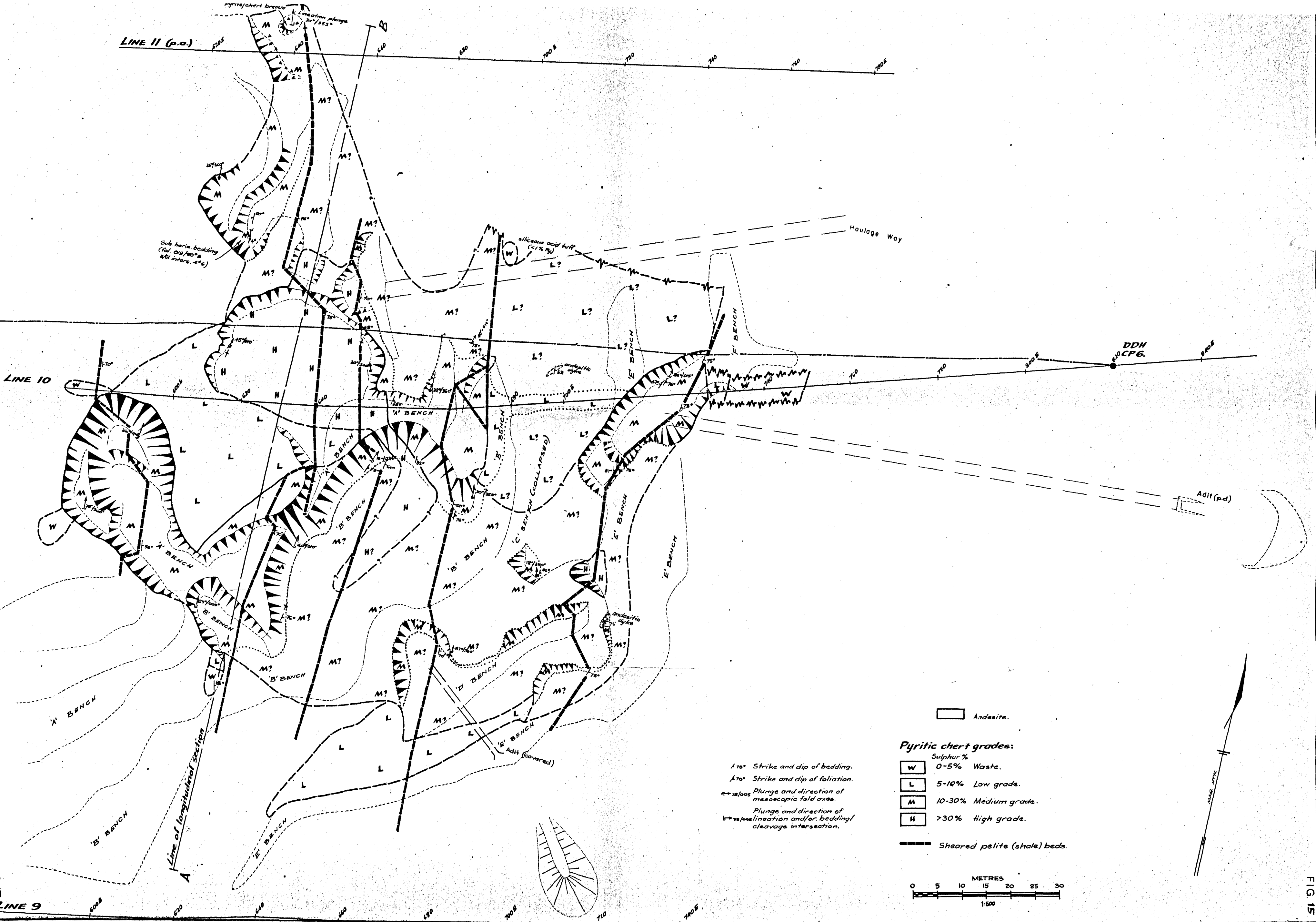




170229

5 cm

PREUSSAG AUSTRALIA PTY. LTD. FIG. 15  
COMSTAFF PROJECT-TAS  
CHESTER PYRITE WORKINGS  
GEOLOGICAL MAP 013:  
85-2396-1/2  
A2-034  
Prepared Date Sept. '77  
Drawn Date Sept. '77  
A.S.C.



Andesite.

Pyritic chert grades:

| Sulphur % |               |
|-----------|---------------|
| 0-5%      | Waste.        |
| 5-10%     | Low grade.    |
| 10-30%    | Medium grade. |
| >30%      | High grade.   |

Sheared pelite (shale) beds.

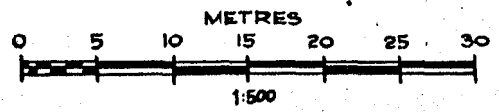
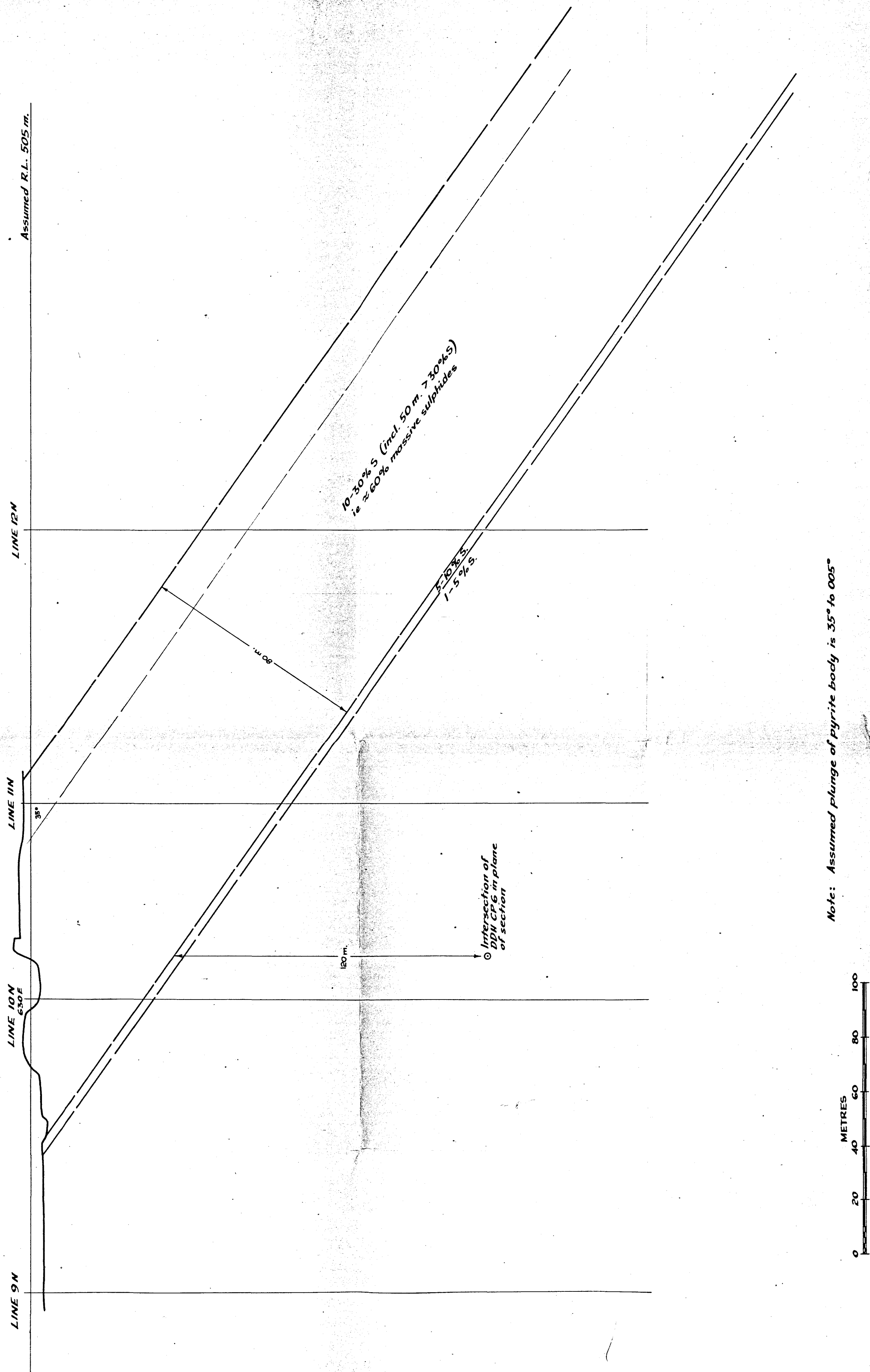


FIG. 15

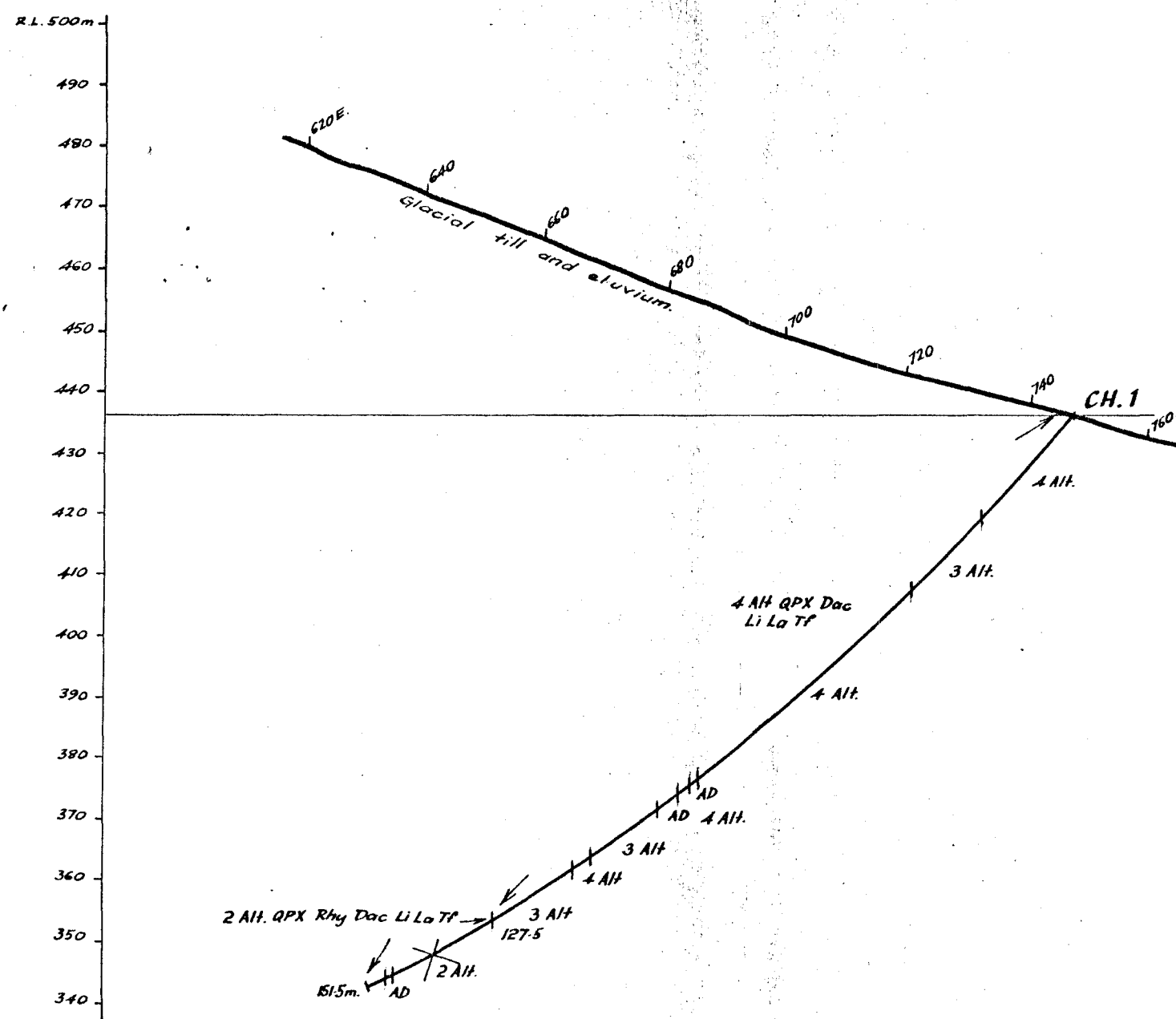


Note: Assumed plunge of pyrite body is 35° to 005°

170230 FIG. 16

|                                                                                                                 |                  |                 |                   |
|-----------------------------------------------------------------------------------------------------------------|------------------|-----------------|-------------------|
| PREUSSAG AUSTRALIA PTY. LTD.                                                                                    |                  |                 |                   |
| COMSTAFF PROJECT - TAS.<br>CHESTER PYRITE WORKINGS<br>LONGITUDINAL SECTION LOOKING<br>WEST THROUGH L10N. 630 E. |                  |                 |                   |
| Prepared<br>D.J.P.                                                                                              | Date<br>Sept.'77 | Drawn<br>A.S.C. | Date<br>Sept. '77 |
|                                                                                                                 |                  |                 | A2-035            |





## LEGEND:

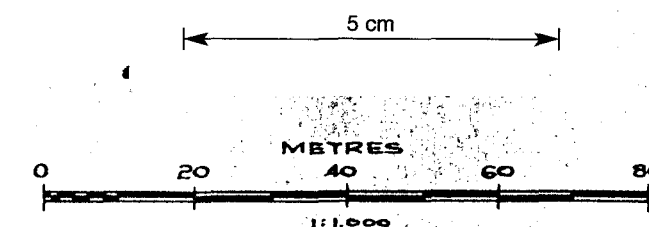
|             |             |                                   |
|-------------|-------------|-----------------------------------|
| 2           | Rhy Tf      | Rhyolitic tuff.                   |
| 9           | Rhy Dac Tf  | Rhyodacitic tuff.                 |
| 12          | Dac Tf      | Dacitic tuff.                     |
| 1           | 1 Alt.      | Strongly altered.                 |
| 2           | 2 Alt.      | Moderately-strongly altered.      |
| 3           | 3 Alt.      | Moderately altered.               |
| 4           | 4 Alt.      | Slightly-moderately altered.      |
| 5           | 5 Alt.      | Slightly altered.                 |
| AD          | AD          | Andesitic dyke.                   |
| CT 5-10 Py  | CT 5-10 Py  | Cherty tuff with 5-10% pyrite.    |
| PC 10-30 Py | PC 10-30 Py | Pyritic chert with 10-30% pyrite. |
| PC > 30 Py  | PC > 30 Py  | Pyritic chert with >30% pyrite.   |
| Pe          | Pe          | Pelite (shale) band (bed).        |
| CH          | CH          | Chert.                            |
| Li          | Lithic      | P Plagioclase.                    |
| La          | Lapilli     | X Crystal.                        |
| Vi          | Vitric      | Q Quartz.                         |
|             |             | X Core bedding/foliation angle.   |
| Pb/Zn/Cu S  | Pb/Zn/Cu S  | Lead, zinc, copper sulphide.      |
|             |             | Disseminated.                     |

170232

Field collar coords.: 8N, 748 E (6m. Sth)

Assumed R.L.: 436m

Measured decl &amp; brg.: -49° to 266



85-2396 4L

FIG. 18

PREUSSAG AUSTRALIA PTY. LTD.

COMSTAFF PROJECT-TAS.

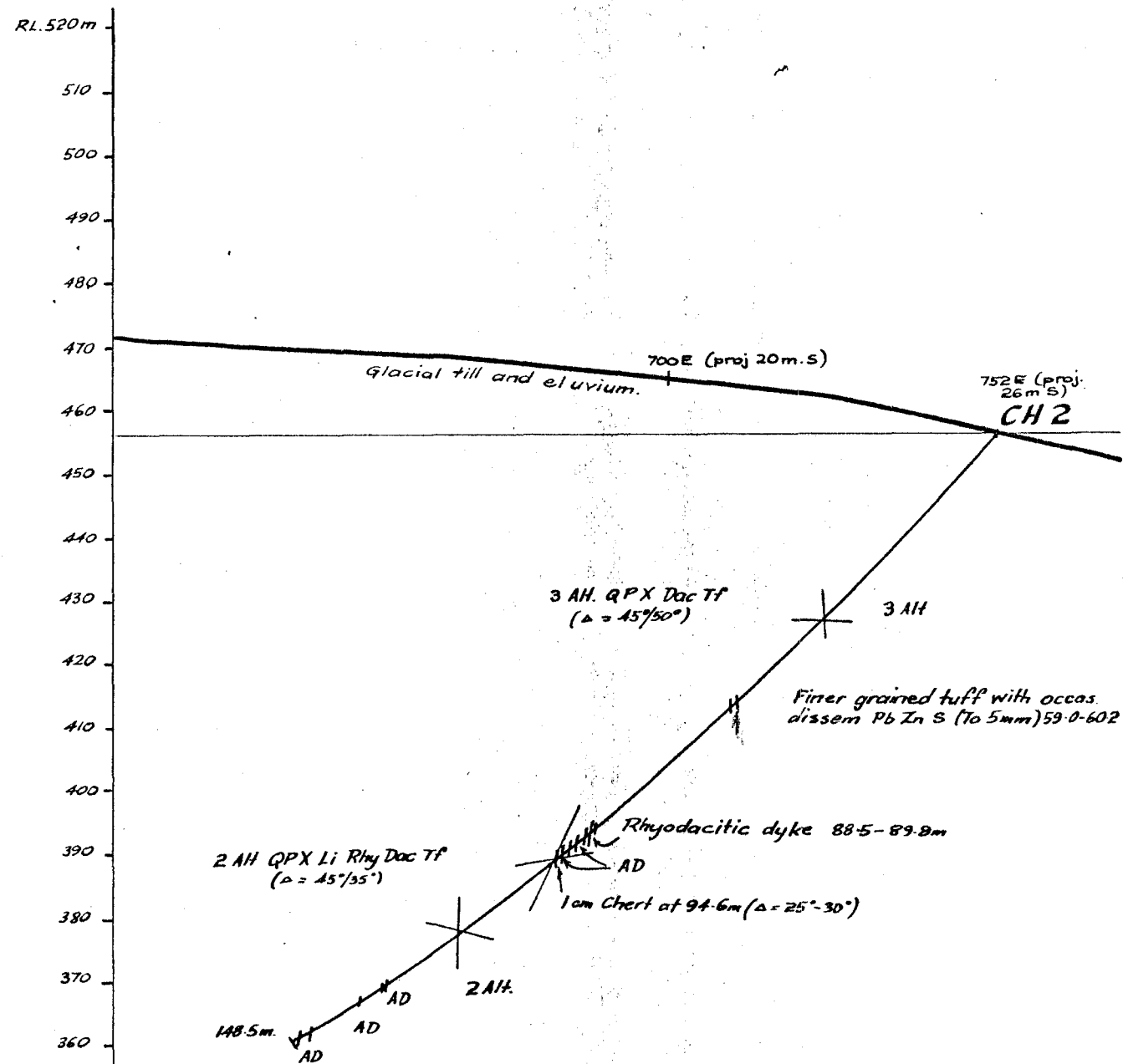
CHESTER AREA

016

DDH CH1 - SECTION 8N

Prepared  
D.J.P.Date  
Aug. 77Drawn  
A.S.C.Date  
Aug. 77

A3-021



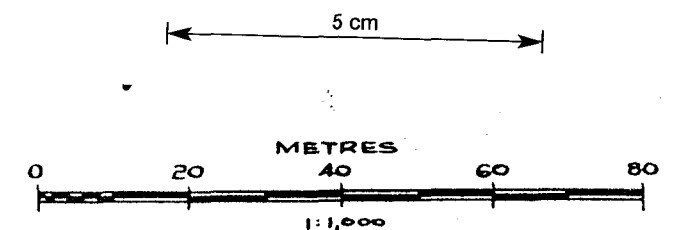
## LEGEND:

|  |             |                                   |
|--|-------------|-----------------------------------|
|  | Rhy Tf      | Rhyolitic tuff.                   |
|  | Rhy Dac Tf  | Rhyodacitic tuff.                 |
|  | Dac Tf      | Dacitic tuff.                     |
|  | 1. Alt.     | Strongly altered.                 |
|  | 2. Alt.     | Moderately-strongly altered.      |
|  | 3. Alt.     | Moderately altered.               |
|  | 4. Alt.     | Slightly-moderately altered.      |
|  | 5. Alt.     | Slightly altered.                 |
|  | AD          | Andesitic dyke.                   |
|  | CT 5-10 Py  | Cherty tuff with 5-10% pyrite.    |
|  | PC 10-30 Py | Pyritic chert with 10-30% pyrite. |
|  | PC >30 Py   | Pyritic chert with >30% pyrite.   |
|  | Pe          | Pelite (shale) band (bed).        |
|  | CH          | Chert.                            |
|  | Li          | Lithic.                           |
|  | La          | Lapilli.                          |
|  | Vi          | Vitric.                           |
|  |             | Core bedding/foliation angle.     |
|  | Pb/Zn/CuS   | Lead, zinc, copper sulphide.      |
|  |             | Disseminated.                     |

170233

Field collar coords.: 7N. 752 E. (26m. Sth.)

Assumed R.L.: 456m.

Measured decl & brg.:  $47^\circ 25'$ 

85-2396 2L

FIG. 19

PREUSSAG AUSTRALIA PTY. LTD.

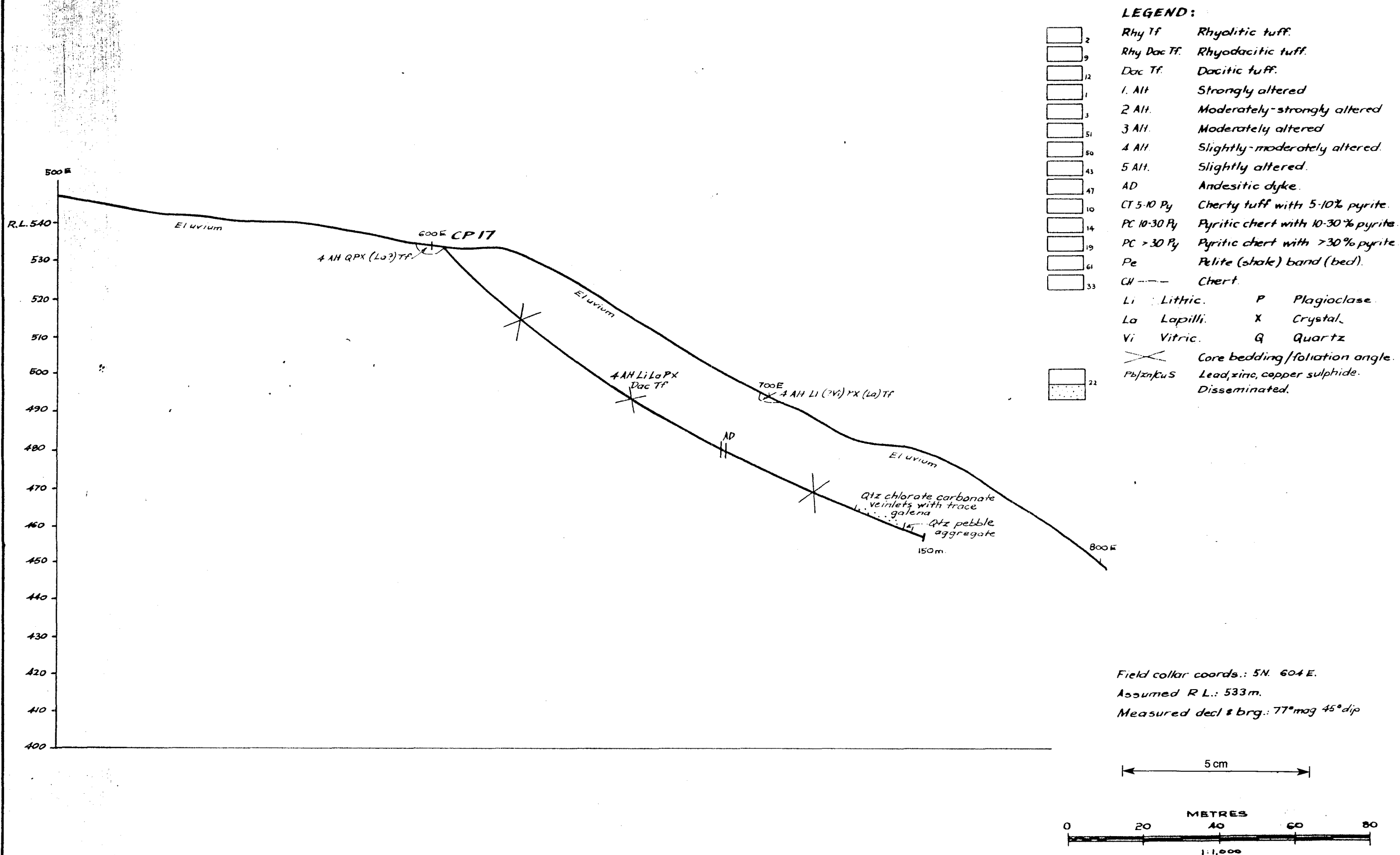
COMSTAFF PROJECT-TAS.  
 CHESTER AREA 017  
 DDH CH2 - SECTION 7N.

|                    |                 |                 |                 |        |
|--------------------|-----------------|-----------------|-----------------|--------|
| Prepared<br>D.J.P. | Date<br>Aug. 77 | Drawn<br>A.S.C. | Date<br>Aug. 77 | A3-022 |
|--------------------|-----------------|-----------------|-----------------|--------|



- 

|                      |                   |                   |                   |        |
|----------------------|-------------------|-------------------|-------------------|--------|
| Prepared<br>D. J. P. | Date<br>Sept. '77 | Drawn<br>A. S. C. | Date<br>Sept. '77 | A1-233 |
|----------------------|-------------------|-------------------|-------------------|--------|



170235

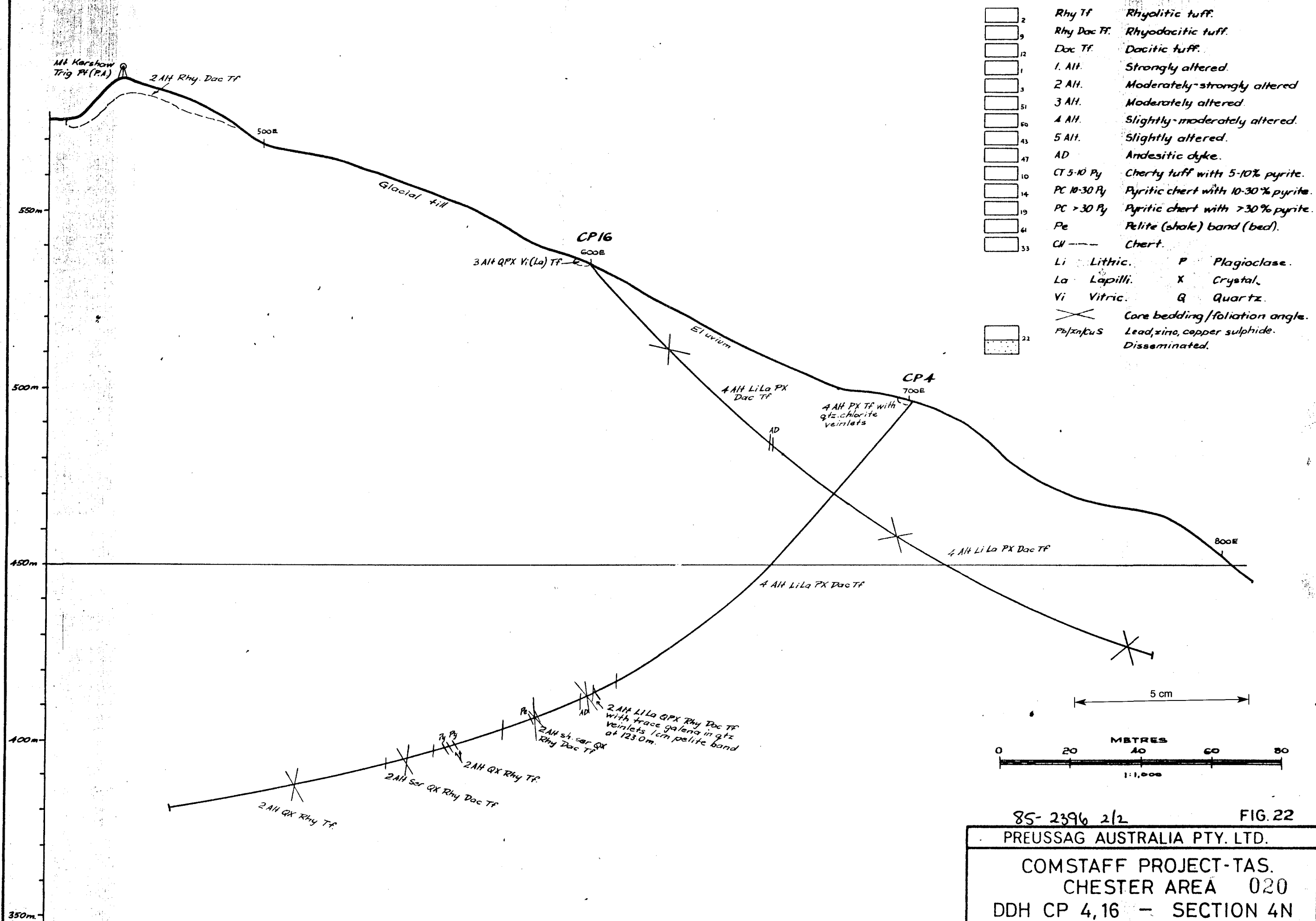
85-2396 2/2

FIG. 21

PREUSSAG AUSTRALIA PTY. LTD.

 COMSTAFF PROJECT-TAS.  
 CHESTER AREA  
 DDH CP 17 — SECTION 5N <sup>019</sup>

|                    |                 |                 |                 |        |
|--------------------|-----------------|-----------------|-----------------|--------|
| Prepared<br>D.J.P. | Date<br>Aug. 77 | Drawn<br>A.S.C. | Date<br>Aug. 77 | A3-025 |
|--------------------|-----------------|-----------------|-----------------|--------|



170236

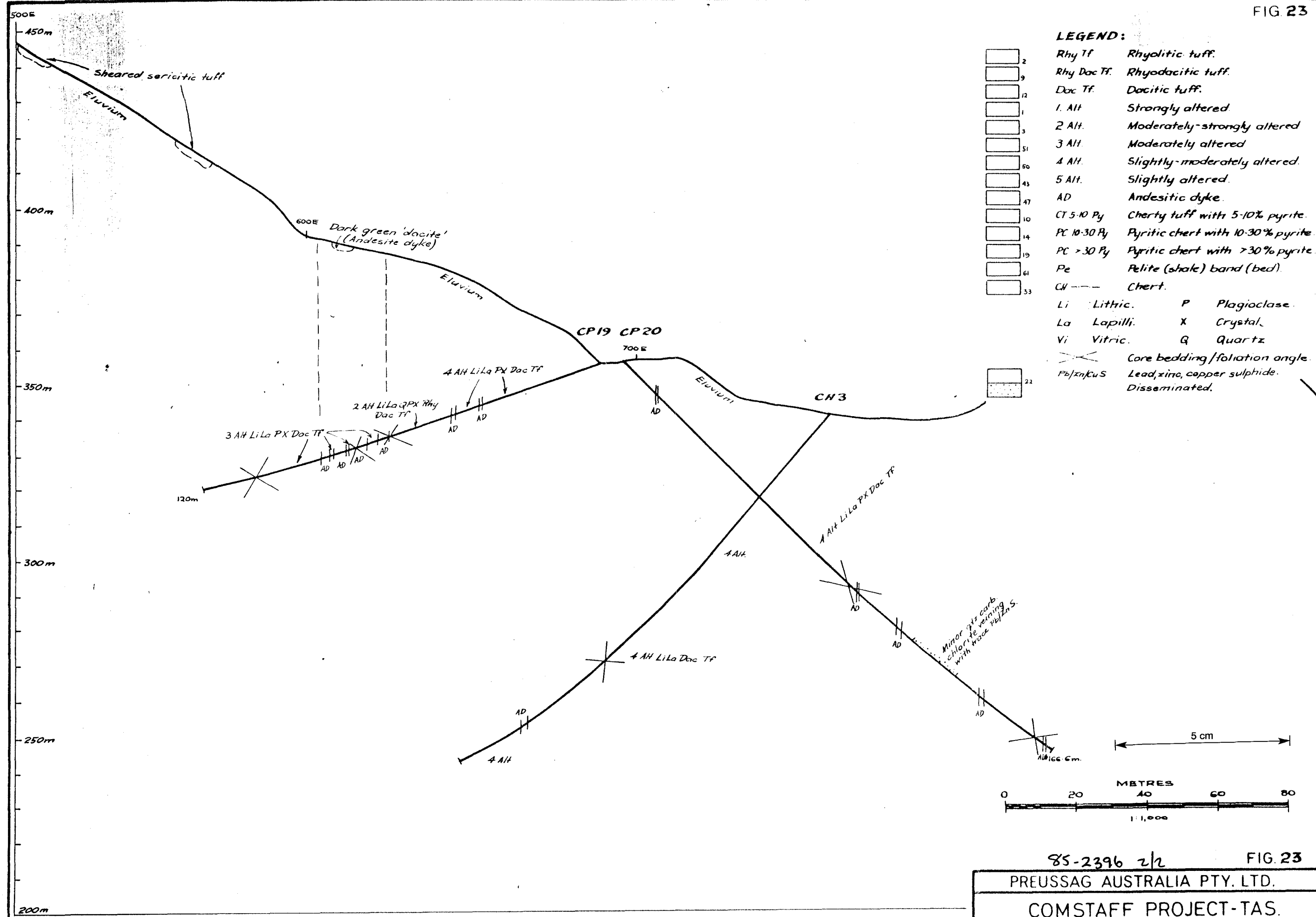
85-2396 2/2

FIG. 22

PREUSSAG AUSTRALIA PTY. LTD.

COMSTAFF PROJECT-TAS.  
 CHESTER AREA 020  
 DDH CP 4,16 - SECTION 4N

|          |         |        |         |        |
|----------|---------|--------|---------|--------|
| Prepared | Date    | Drawn  | Date    | A3-027 |
| D.J.P.   | Aug. 77 | A.S.C. | Aug. 77 |        |



85-2396 2/2

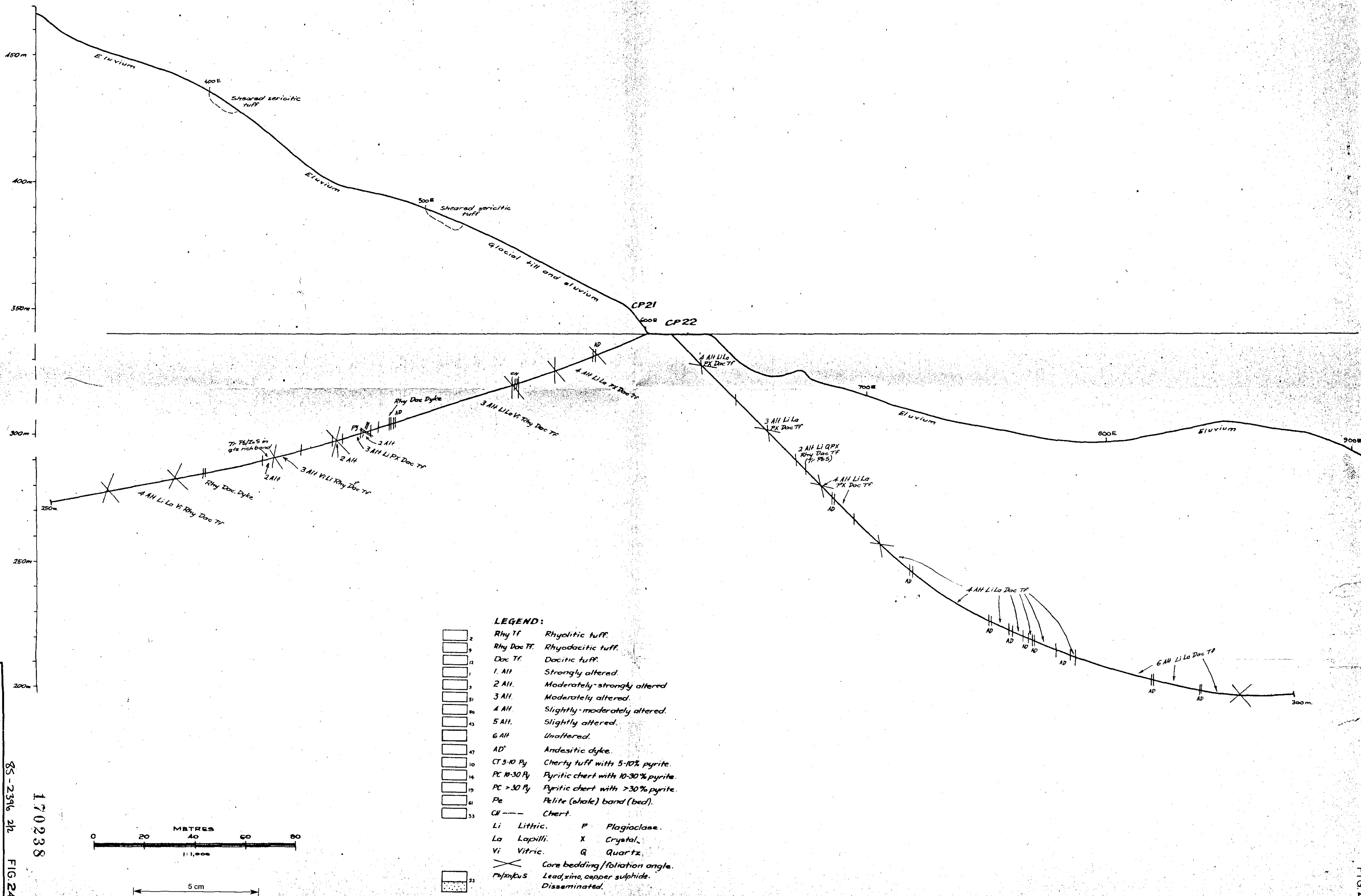
FIG 23

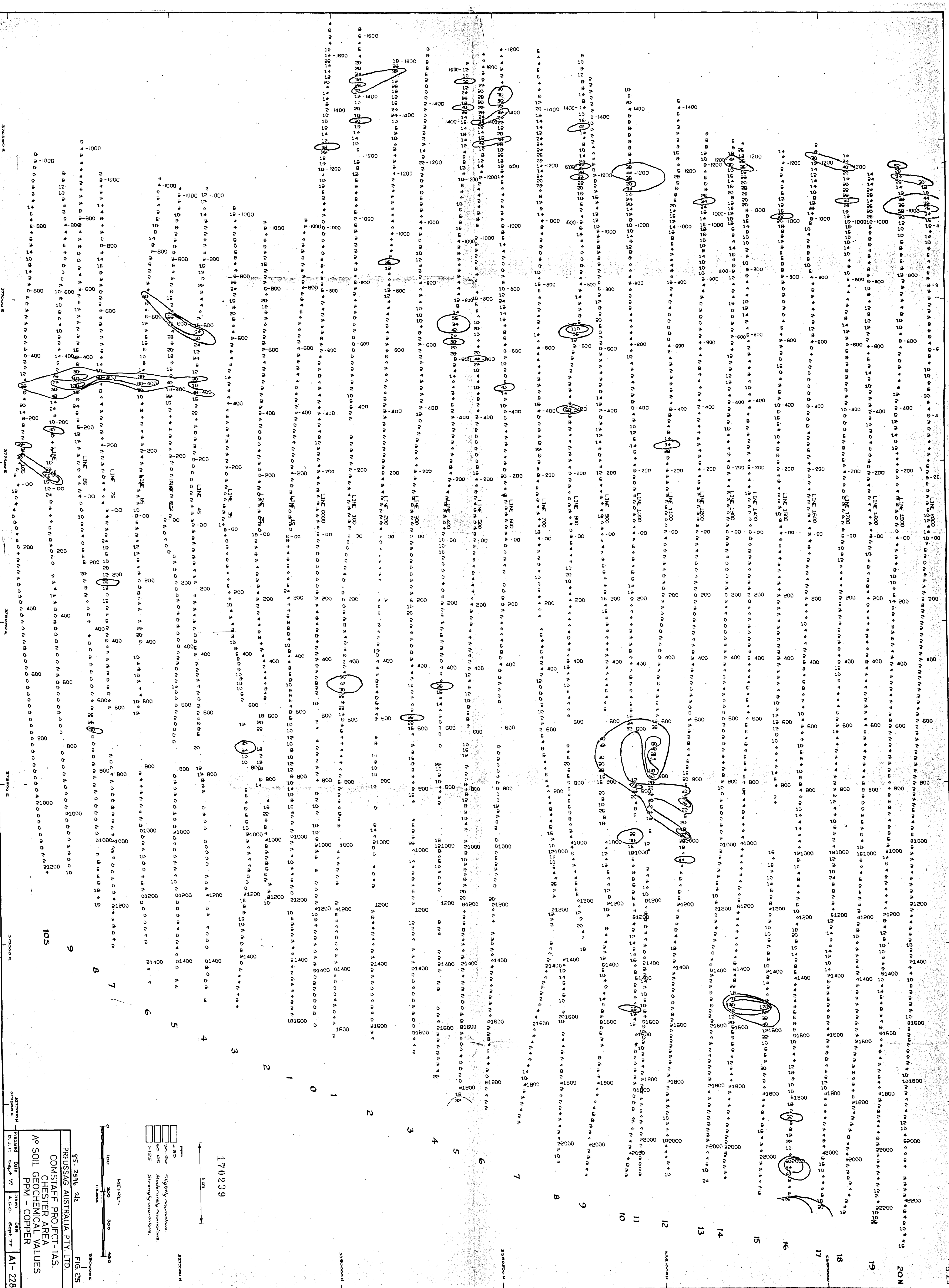
PREUSSAG AUSTRALIA PTY. LTD.

COMSTAFF PROJECT-TAS.  
 CHESTER AREA 021  
 DDH's CP19,20 CH 3 - SECTION 2N

|          |         |        |         |        |
|----------|---------|--------|---------|--------|
| Prepared | Date    | Drawn  | Date    |        |
| DJP      | Aug. 77 | A.S.C. | Aug. 77 | A3-026 |

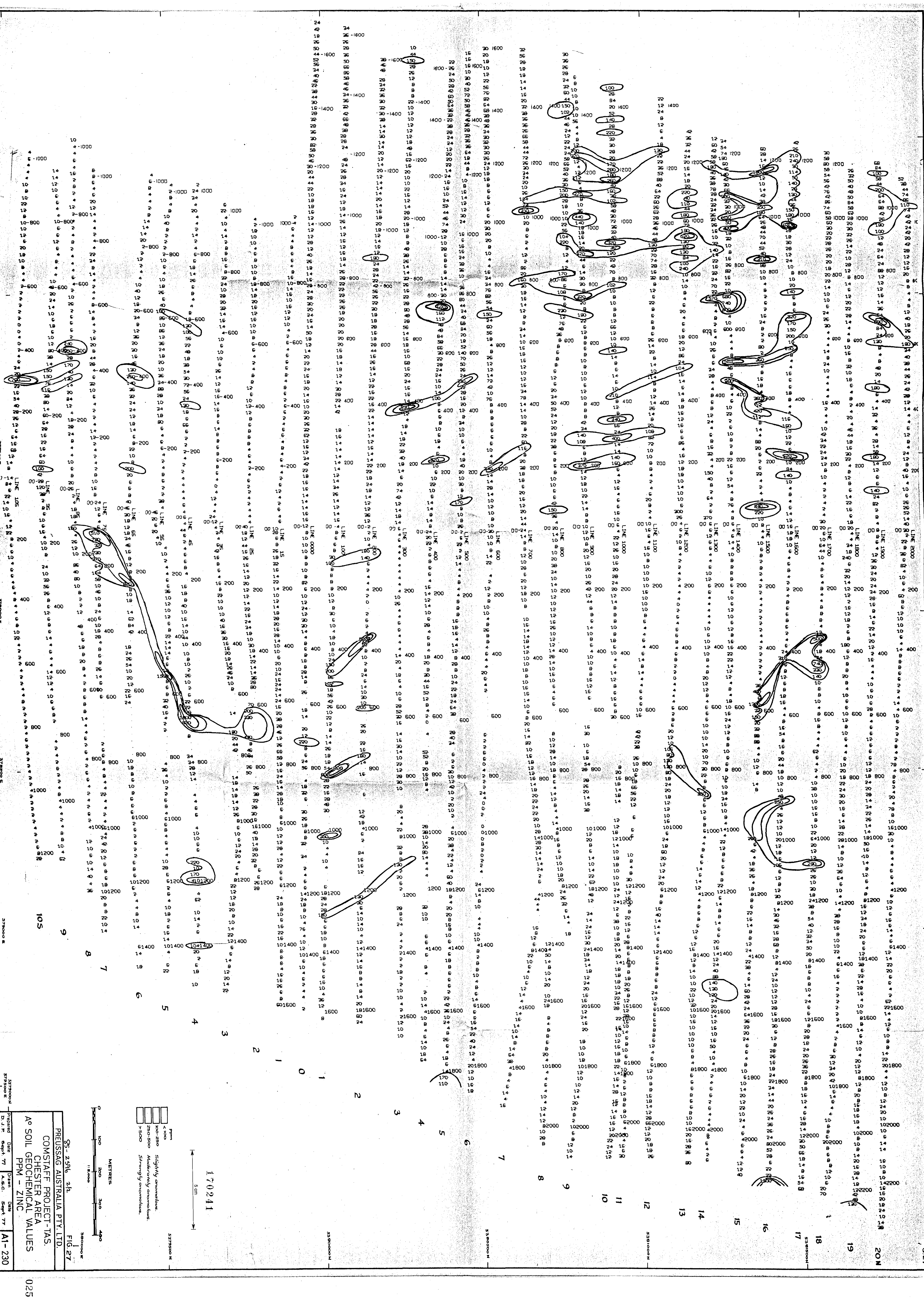
170237





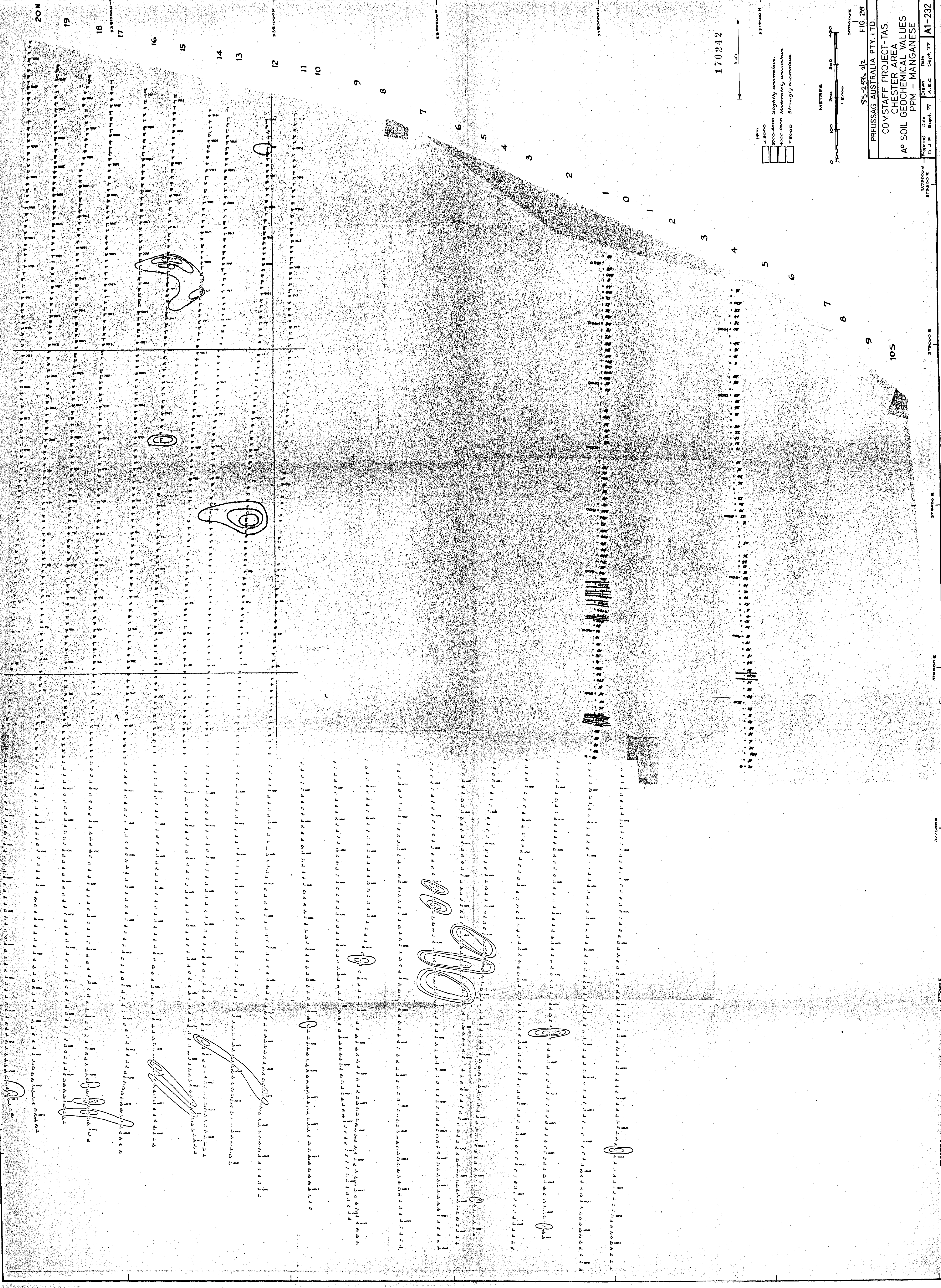


PREUSSAG AUSTRALIA PTY. LTD.  
COMSTAFF PROJECT-TAS.  
CHESTER AREA  
PPM - LEAD  
FIG. 26



COMSTAFF PROJECT-TAS.  
CHESTER AREA  
A<sup>0</sup> SOIL GEOCHEMICAL VALUES  
PPM - ZINC

170241  
170242  
170243  
170244  
170245  
170246  
170247  
170248  
170249  
170250  
170251  
170252  
170253  
170254  
170255  
170256  
170257  
170258  
170259  
170260  
170261  
170262  
170263  
170264  
170265  
170266  
170267  
170268  
170269  
170270  
170271  
170272  
170273  
170274  
170275  
170276  
170277  
170278  
170279  
170280  
170281  
170282  
170283  
170284  
170285  
170286  
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170288  
170289  
170290  
170291  
170292  
170293  
170294  
170295  
170296  
170297  
170298  
170299  
170300



35-235 2/2 FIG. 28

PREUSSAG AUSTRALIA PTY. LTD.

COMSTAFF PROJECT-TAS.

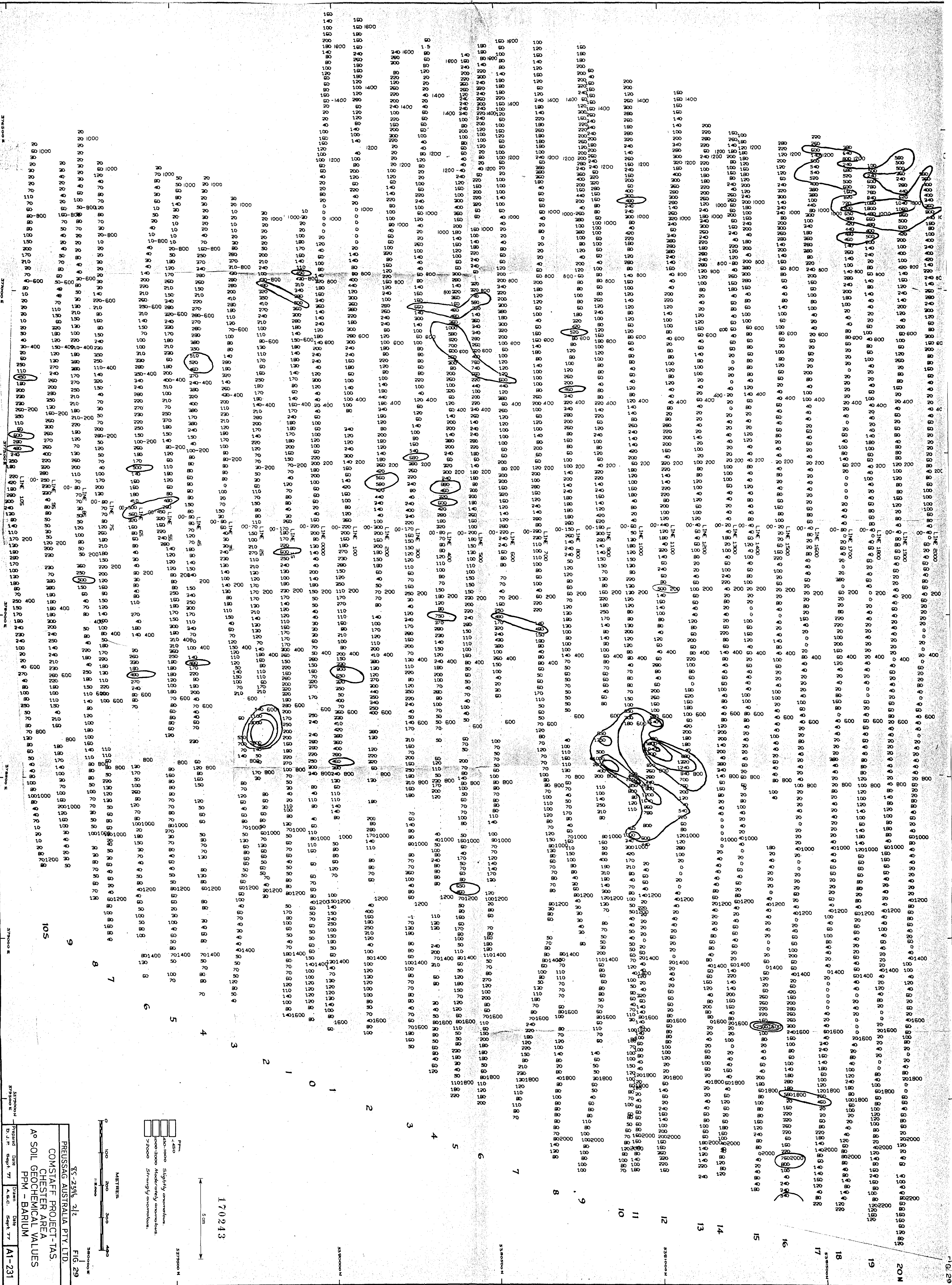
CHESTER AREA

A° SOIL GEOCHEMICAL VALUES

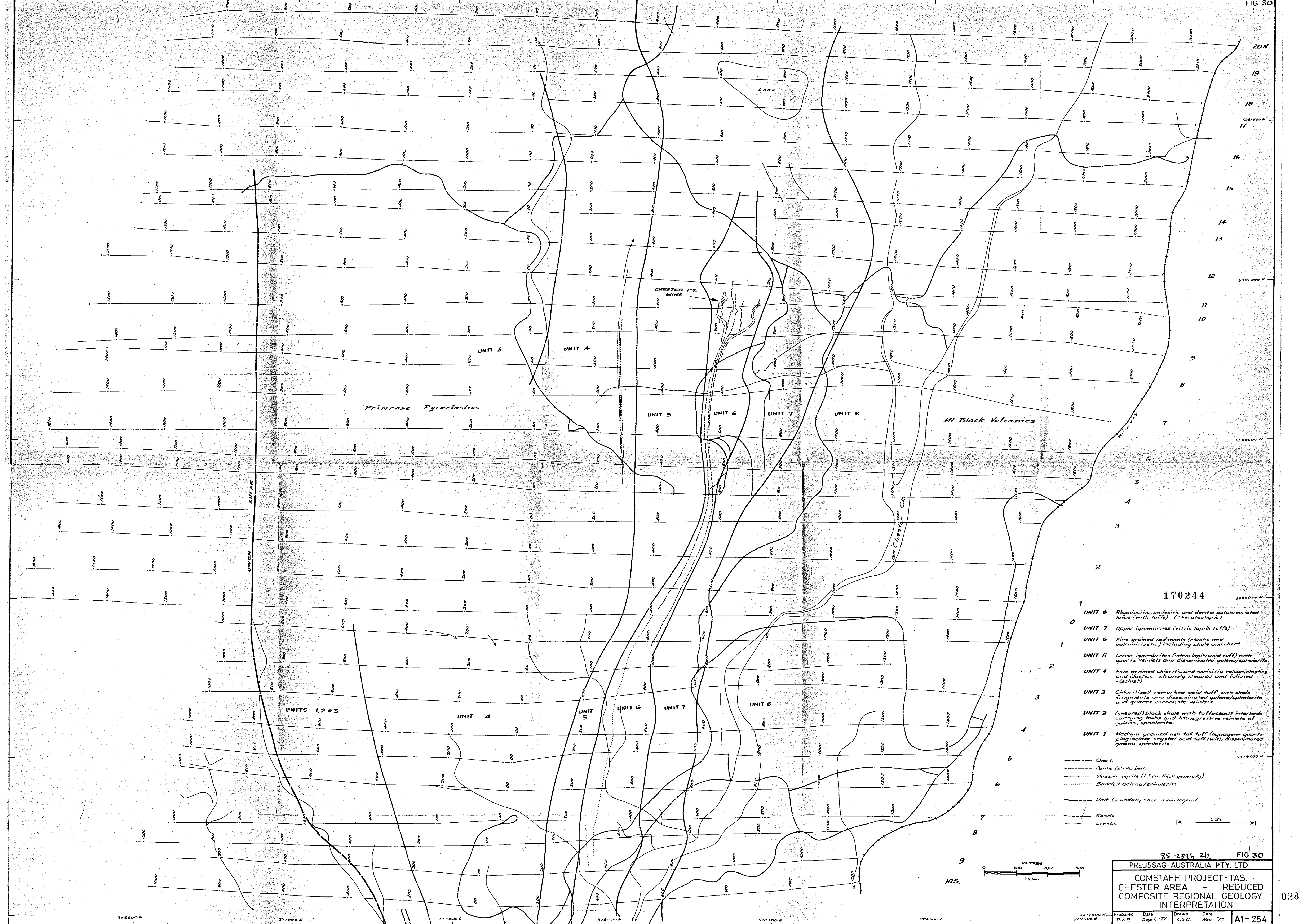
PPM - MANGANESE

| Prepared | Date     | Drawn    | Date     |
|----------|----------|----------|----------|
| D. J. F. | Sept. 77 | A. S. C. | Sept. 77 |

AI-232



|                                                                                     |                 |                 |                 |        |    |
|-------------------------------------------------------------------------------------|-----------------|-----------------|-----------------|--------|----|
| PREUSSAG AUSTRALIA PTY. LTD.                                                        |                 | 85-2596         | 212             | F16    | 29 |
| COMSTAFF PROJECT-TAS.<br>CHESTER AREA<br>A° SOIL GEOCHEMICAL VALUES<br>PPM - BARIUM |                 |                 |                 |        |    |
| Prepared<br>D.I.P.                                                                  | Date<br>Sept 77 | Drawn<br>A.C.C. | Date<br>Sept 77 | AI-231 |    |



- 170244
- UNIT 8 Rhyolitic, andesitic and dacitic outbrecciated lavas (with tuffs) - (?) keratophytic
  - UNIT 7 Upper ignimbrites (vitric lapilli tuffs)
  - UNIT 6 Fine grained sediments (clastic and volcanoclastic) including shale and chert.
  - UNIT 5 Lower ignimbrites (vitric lapilli acid tuff) with quartz veinlets and disseminated galena/sphalerite.
  - UNIT 4 Fine grained chloritic and sericitic volcanoclastics and clastics - strongly sheared and foliated (schist)
  - UNIT 3 Chloritized reworked acid tuff with shale fragments and disseminated galena/sphalerite and quartz carbonate veinlets.
  - UNIT 2 (sheared) black shale with tuffaceous interbeds carrying blebs and transgressive veinlets of galena, sphalerite.
  - UNIT 1 Medium grained ash-fall tuff (aqueous quartz, plagioclase, crystal acid tuff) with disseminated galena, sphalerite.

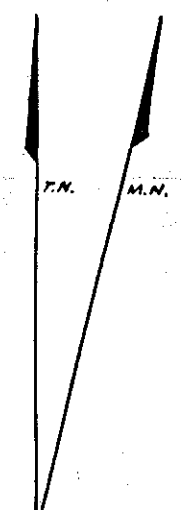
--- Chert  
--- Pelite (shale) bed.  
--- Massive pyrite (1.5 cm thick generally)  
--- Banded galena/sphalerite.  
--- Unit boundary - see main legend.  
--- Roads  
--- Creeks.



Geochemical anomalies:  
 — Cu, Pb, Zn  
 - - - - Hg > 250 ppb.

I.P. Anomaly.  
 R Resistivity.  
 F Frequency effect.

550 gammas.  
 550-600  
 600-650  
 650-700  
 700-750  
 750-800  
 > 800 gammas.



0 100 200 300  
 METRES  
 1:5,000

55-2896 2/2  
 PREUSSAG AUSTRALIA PTY. LTD.  
 COMSTAFF PROJECT-TAS  
 CHESTER METRIC GRID-COMPOSITE  
 SUMMARY GROUND MAGNETICS-I.P.  
 & SOIL GEOCHEMICAL ANOMALIES

Prepared Date: Sept 77  
 Drawn Date: Oct 77  
 A1-238

170245  
 5 cm



|          |           |          |          |        |
|----------|-----------|----------|----------|--------|
| Prepared | Date      | Drawn    | Date     | A3-028 |
| D. J. P. | Sept. '77 | A. S. C. | Oct. '77 |        |