PASMINCO EXPLORATION

MT BLACK EL 12/88
WESTERN TASMANIA

PASMINCO-AUSTMIN JOINT VENTURE
ANNUAL REPORT

AUGUST 1990 - AUGUST 1991

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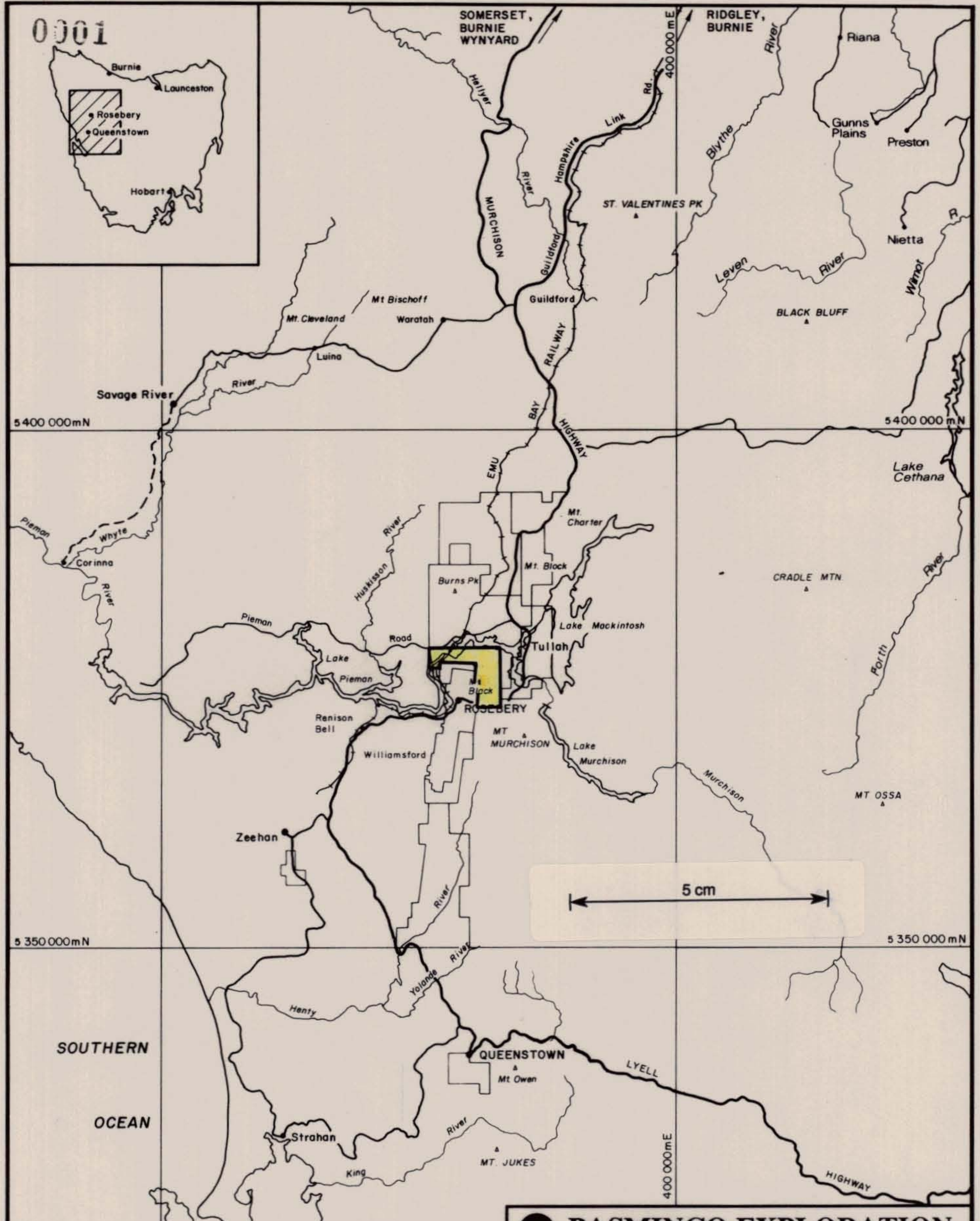
150002



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DATE: July, 1991
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REVISIONS:
DRAWING No.

E.L. 12/88 - MT. BLACK J.V.

LOCATION MAP

SCALE 1:500 000 (5 0 5 km)

FIG. No. 1

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1. SUMMARY

The major exploration activity on EL 12/88 in the period August 1990 to August 1991, was the drilling of hole BY1 (562.45m) near the Bastyan Dam. The hole was designed to test beneath massive basemetal sulphide boulders in the Hangingwall Epiclastics on the southern shore of Lake Rosebery, and for the possible occurrence of the Rosebery Host Rocks at depth just above the Rosebery Fault.

Hole BY1 did not intersect any significant mineralization or the Host Rocks. It It encountered traces of Zn and As in black shale and limestone bands, with best intersections of 0.5m @ 2.1% Zn, 0.1% As, and 13.5m @ 0.5% Zn.

Geological points of interest in the hole were the atypical nature of the lower part of the Hangingwall Epiclastics which contain interbeds of carbonate-rich 'Dundas Group like' sediments, and the low-angle east dip on the Rosebery Fault, highlighting again the listric shape of this major structure.

Other exploration work carried out in 1990-91 included: detailed geological mapping in the Bastyan area; a high-resolution aeromagnetic and radiometric survey of the entire EL; semi-regional gravity survey on Mt Black; preliminary geophysical/structural interpretation of the EL; new aerial photography and preparation of computer-generated topographic baseplans; lithogeochemical and petrological studies, and environmental rehabilitation.

Elements of the structural picture emerging from the magnetic and gravity surveys are the most significant results from the 1990-91 work. These carry important implications for future exploration. Strong evidence points to the Bastyan Dam vicinity being the prime target area on the EL. The prospective zone extends east to the old Langdons Pb-Zn-Ag working.

At Bastyan a fundamental sub E-W structure, positioned along the old Pieman River, is intersected by a strong NNW trending structure cutting across the western face of Mt Black. This structural setting is exactly the same as at Rosebery Mine. Further, the rocks at Bastyan are part of the Rosebery Mine sequence, and contain unequivocal evidence that massive sulphides formed in the vicinity.

A buried N-S basement margin is postulated from gravity data to exist under the western flank of Mt Black. This junctions with the Pieman E-W lineament in the area of the old Cutty Sark and Langdons workings. A large magnetic anomaly just east of Cutty Sark is considered to be part of a known zone of magnetite-pyrite-chalcopyrite mineralization that occurs in the volcanics above and along the line of the inferred basement margin.

Work on the EL in 1991-92 is recommended to concentrate on the Bastyan area and as far east as Langdons. Structural mapping, lithogeochemical sampling and further refinement of the geophysical/structural interpretation, is required in the lead-up to the proposed drilling of a deep hole into the northern dam abutment structural block. Like BY1, the hole would aim to test for the source of the massive sulphide debris in the Hangingwall Epiclastics near the dam.

Further east, the Cutty Sark magnetic anomaly and the general Cutty Sark - Langdons area, warrants sampling and mapping.

The semi-regional gravity coverage is recommended to be completed with three further traverses on the eastern slopes of Mt Black, and SG, magnetic susceptability and lithogeochemical data need collecting from the core of the Austmin drillholes on Mt Black.

The magnetic and gravity data indicates the volcanics on Mt Black are an east-dipping thrust wedge at least 2.5km thick. The volcanics are apparently more variable than shown in existing mapping. Currently, there are no exploration targets in these rocks and no work is recommended in this area of the EL. However, the situation could change with the recommended further processing and analysis of the geophysical data over the EL.

2. INTRODUCTION

This report catalogues work done on the Mt Black EL 12/88, Western Tasmania, in the period August 1990 to August 1991. The proposed work programme for the coming 12 months is also outlined.

The Mt Black EL is the subject of a Joint Venture between Austmin Resources NL (the EL holders), and Pasminco Exploration (the contributors and programme managers). The EL covers 21 sq km of Cambrian Mt Read Volcanics immediately north and east of the Rosebery Mine Lease - see Figures 1 to 4. The principal targets of the exploration programme are auriferous basemetal massive sulphide bodies similar to those of the Rosebery deposit.

Most of the EL covers the extremely rugged and thickly vegetated Mt Black massif which rises to an elevation of 929m. Vehicle access to this area is very limited and drilling requires helicopter support. The western part of the EL has reasonable vehicle access but is still heavily vegetated and rugged.

Units of the Rosebery Mine sequence occur on the EL near the Bastyan Dam and this area has been the principal focus of exploration during 1990-91. Mapping was undertaken at Bastyan late in 1990 to enable drillholes to be designed to test the sequence. Despite severe logistical difficulties posed by the hydro dam and lake, five potential drillsites were identified - see Figure 9.

In early 1991 drillhole BY1 (562.45m) was put down on the southern shore of Lake Rosebery near the dam, to test beneath outcropping massive sulphide boulders in the Mine Hangingwall Epiclastics unit. Lithogeochemical, petrological, SG and magnetic susceptability data, were collected from the drillcore.

Other exploration work on EL 12/88 during 1990-91 included:

* High resolution helicopter-borne aeromagnetic & radiometric survey of the EL.
* Semi-regional gravity survey over Mt Black.
* Consultant's geophysical/structural interpretation of the EL area based on the magnetic and gravity data (Leaman, 1991).
* Aerial photography coverage of the EL in colour and black & white, photogrammetry, and preparation of computer-generated topographic baseplans.
* Monitoring of the rehabilitation of the 1989 Mt Black drillsite 5 by Austmin.

3. TENURE

The Mt Black EL covers 21 square kilometres adjoining the Rosebery Mining Lease. The Licence was first granted on 2nd September 1988 to Austmin Resources NL and Climax Mining Ltd, for a renewable one year term. It was renewed in September 1989 and 1990, and a further one year renewal is being sought from September 1991.

Climax withdrew from the Joint Venture in March 1990 and were replaced in May that year by Pasminco Exploration, who are currently managing work done on the EL.

Within the EL boundary 1.5 sq km of land in the vicinity of the Bastyan Dam is vested in the H.E.C. The Licencee has the exploration rights to this area but work undertaken here is subject to the approval of the H.E.C. The EL and the H.E.C. vested area are shown in Figure 2.

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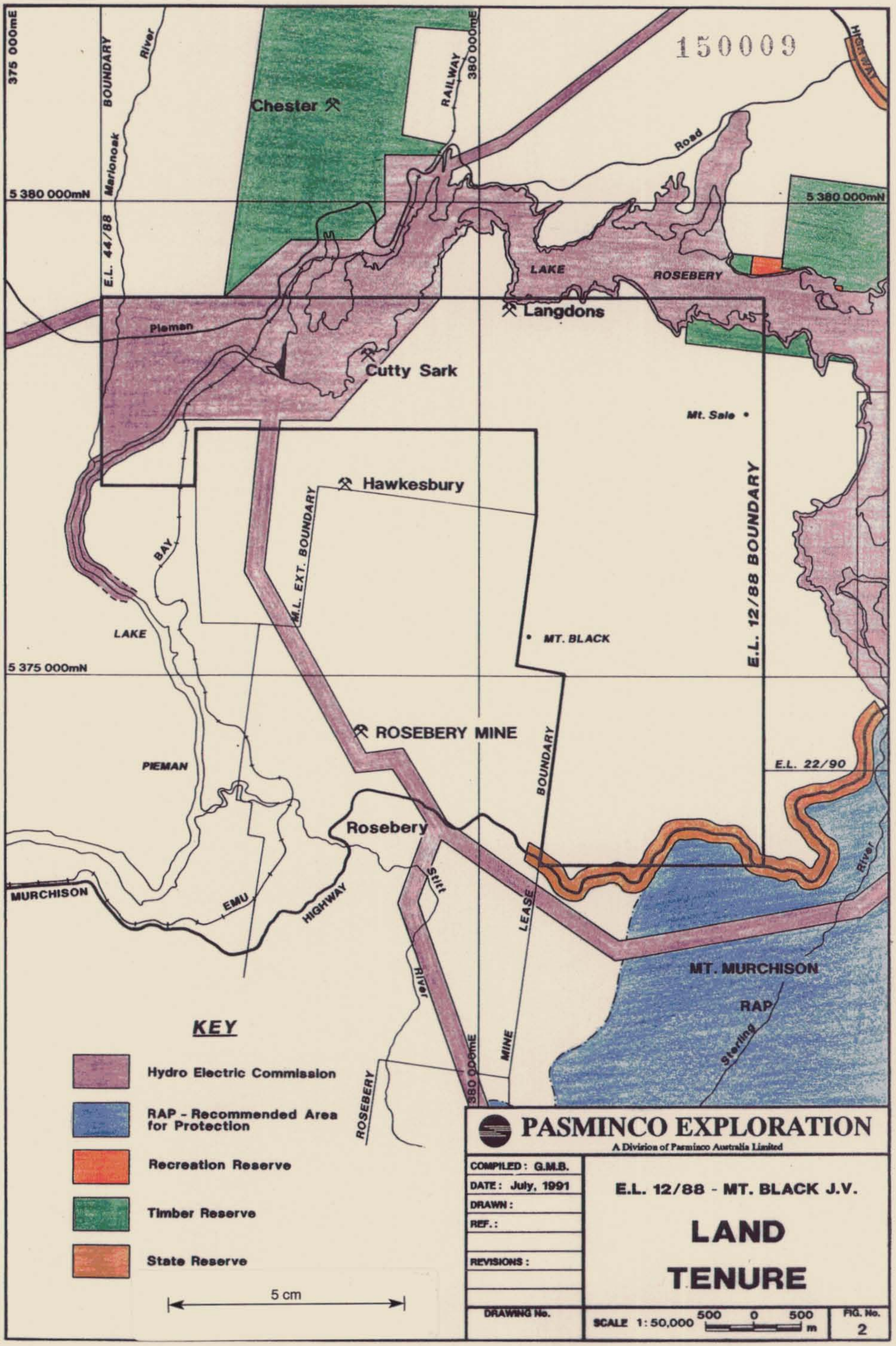

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E.L. 12/88 - MT. BLACK J.V.

LAND TENURE

SCALE 1: 50,000 500 0 500 m

FIG. No. 2

4. EXPENDITURE

Total expenditure on EL 12/88 during the twelve month period to 30th June 1991 was **$150,869**. Total expenditure on the EL since its granting in 1988 is now **$472,955**.

Details of 1990-91 expenditure are as follows:

	$
Personnel: salaries, wages and on-costs	15,282
Travel & Accomodation	779
Geological Contractors	19,070
Geophysical Consultants, including image processing	909
Petrography	1,613
Analytical Services	2,818
Track cutting, Gridding	1,720
Photogrammetry & Aerial photography	8,683
Drillsite access, Earthmoving	6,590
Drilling: contractor, core processing, storage etc.	50,688
Aeromagnetic survey	9,855
Gravity survey, including topographic survey control	4,069
Drafting services	887
Stores & Supplies	1,451
Vehicles, Plant & Equipment	1,657
Rehabilitation (including Austmin expenditure of $3,180)	3,586
Tenement costs	600
Office costs	7,189
Administration, Management Fee	13,426
TOTAL	**$150,869**

5. PREVIOUS EXPLORATION

The vigorous activities of the old prospectors in the Rosebery mining district resulted in less than half a dozen minor basemetal showings being found in the ground covered by EL 12/88. These all occur in the Cutty Sark area to the north of Rosebery and lie within the Mine sequence or the lower parts of the overlying Mt Black Volcanics. There are no known old workings on Mt Black itself.

Most previous systematic exploration of the area presently covered by EL 12/88 was done while it was part of EZ's EL 1/62, in the period between 1962 and 1988. In the latter half of its tenure, EZ were joined on EL 1/62 by Joint Venture partners Getty Oil (1978-1985) and Billiton (1985-1988).

As can be seen in Table 1, the work done by EZ and its partners falls into two catagories:

1. Broad scale geochemical and geophysical surveys over the dacitic to andesitic lava pile on Mt Black. (This area has very difficult access).
2. More-detailed surveys, including drilling, along the northern extension of the Rosebery Mine sequence (the relatively accessible Cutty Sark area).

On Mt Black itself exploration did not turn up any significant targets until the 1986 Billiton UTEM survey obtained several weak responses. These were subsequently drilled by the Climax-Austmin JV in early 1989, with four barren holes totalling 869m. The UTEM responses were attributed to rock type contrasts (Hine & Scott, 1989).

Although EZ, Getty and Billiton drilled six holes in the Cutty Sark vicinity, only one hole, Getty's CS1, falls within the boundaries of EL 12/88. Apart from elevated Zn values in shale lenses within the Hangingwall Epiclastics unit, none of these holes intersected any mineralisation of note.

However, the exploration at Cutty Sark discovered two features of the geology which bear on the prospectivity of the ground now covered by EL 12/88:

a) The Rosebery Host Rock horizon trends towards the area (Purvis, 1990).
b) Large boulders and rafts of massive basemetal sulphides exist in the Hangingwall Epiclastics in two separate localities near the Bastyan Dam.

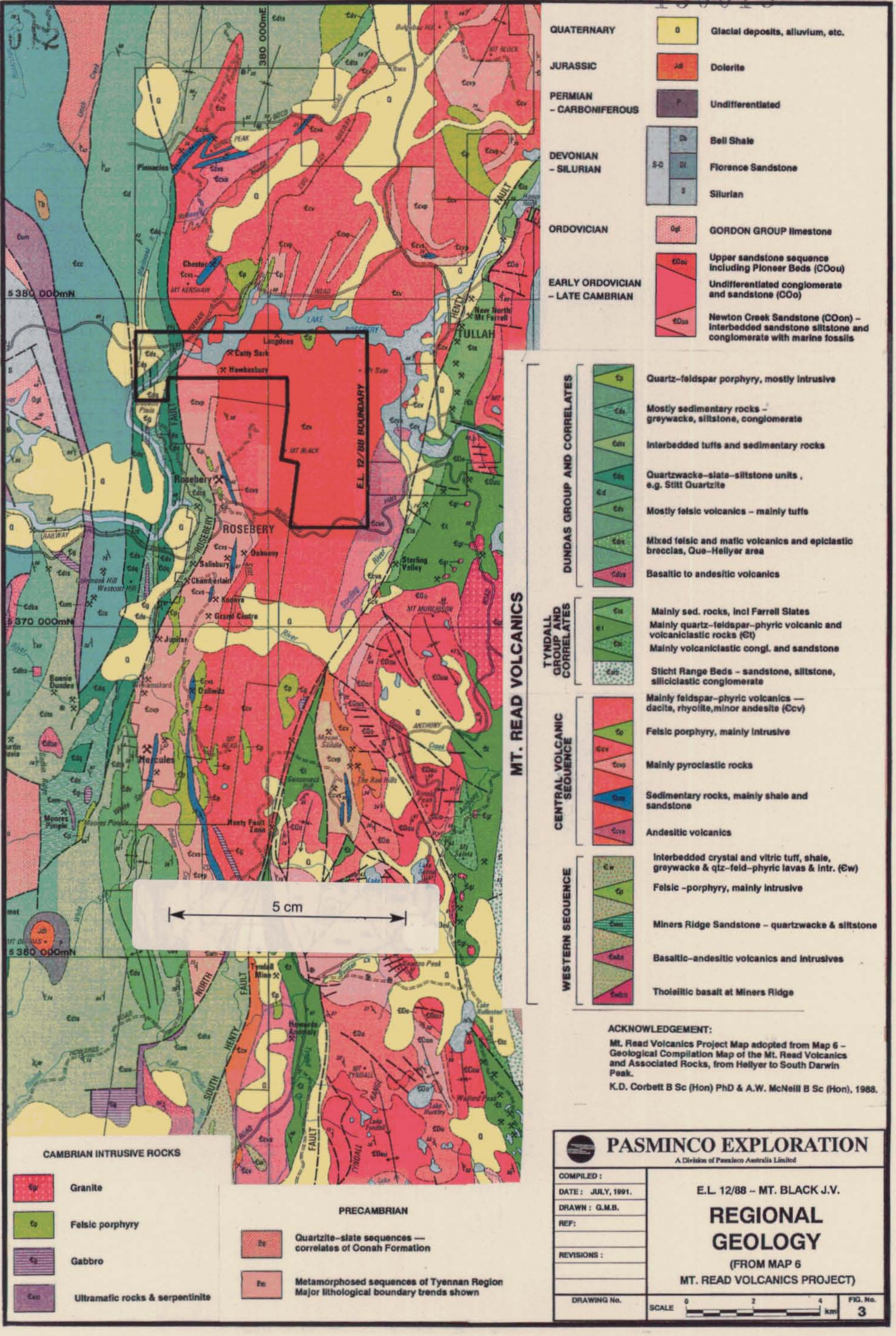
TABLE 1

EL12/88 - SUMMARY OF PREVIOUS EXPLORATION

TCR	YEAR	COMPANY	WORK DONE	RESULTS
87-2752	1987	Billiton-EZ	UTEM, CSAMT Robbies Ck, 1 DDH RED87-1 (607m)	Intersect 41m shear zone with magnetite pyrite
86-2622	1986	Billiton-EZ	UTEM 22 loops over EL1/62, select SIROTEM, BLEG gravels	Numerous weak UTEM responses recorded
85-2516	1985	EZ-Getty	Mapping creek sampling VLF, mags- Mt Black; DDH's Cutty Sark, Bobadil	No significant mineralisation in DDH's; weak EM responses
85-2313	1984	EZ-Getty	Dighem III; UTEM, 2 DDH's-Cutty Sark; VLF - Mt Black; DDH - Bobadil;	No significant mineralisation in DDH's Best intercept 20m @ 0.32%Zn
82-1738	1981	EZ-Getty	IP, soil samples, pits at Mt Sale;	No significant anomalies recorded
80-1468	1980	EZ-Getty	Langdons, Mt Sale mapping; soils, grad. IP	
80-1411	1979	EZ-Getty	Aeromagnetics, photogeol; INPUT Rosebery IP, soils., mapping-Cutty Sark; mags, IP soils, map Mt Sale area	Soil anomalies, magnetic anomalies Cutty Sark
79-1366	1979	EZ	Dipole-dipole IP Mt Black	IP responses downgraded
79-1342	1979	EZ	Gradient array EIP, magnetics- Mt Black, Langdons, Mt Sale	Numerous IP responses recorded
75-1126	1975	EZ	IP, soil sampling Bobadil area	Cu, Pb, Zn anomalies recorded
73- 959	1973	EZ	Mapping, TURAM, IP, DDH's Rosebery area	Palaeogeographic model outlined
72- 864	1972	EZ	Selected Turair Airborne EM, magnetics	Several weak conductors defined
71- 785	1971	EZ	Geol. mapping; reg stream sampling Cu, Pb, Zn, Mn	Pb, Zn, Mn anomalies recorded; low density
65- 407	1965	EZ	Selected IP surveys	

(From Austmin 1990)

150013


QUATERNARY
Glacial deposits, alluvium, etc.
JURASSIC
Dolerite
PERMIAN - CARBONIFEROUS
Undifferentiated
DEVONIAN - SILURIAN
Bell Shale
Florence Sandstone
Silurian
ORDOVICIAN
GORDON GROUP limestone
EARLY ORDOVICIAN - LATE CAMBRIAN
Upper sandstone sequence including Pioneer Beds (COou)
Undifferentiated conglomerate and sandstone (COo)
Newton Creek Sandstone (COon) - Interbedded sandstone siltstone and conglomerate with marine fossils
MT. READ VOLCANICS
DUNDAS GROUP AND CORRELATES
Quartz-feldspar porphyry, mostly intrusive
Mostly sedimentary rocks - greywacke, siltstone, conglomerate
Interbedded tuffs and sedimentary rocks
Quartzwacke-slate-siltstone units, e.g. Stitt Quartzite
Mostly felsic volcanics - mainly tuffs
Mixed felsic and mafic volcanics and epiclastic breccias, Que-Hellyer area
Basaltic to andesitic volcanics
TYNDALL GROUP AND CORRELATES
Mainly sed. rocks, incl Farrell Slates
Mainly quartz-feldspar-phyric volcanic and volcaniclastic rocks (Ɛt)
Mainly volcaniclastic congl. and sandstone
Sticht Range Beds - sandstone, siltstone, siliciclastic conglomerate
CENTRAL VOLCANIC SEQUENCE
Mainly feldspar-phyric volcanics — dacite, rhyolite, minor andesite (Ɛcv)
Felsic porphyry, mainly intrusive
Mainly pyroclastic rocks
Sedimentary rocks, mainly shale and sandstone
Andesitic volcanics
WESTERN SEQUENCE
Interbedded crystal and vitric tuff, shale, greywacke & qtz-feld-phyric lavas & intr. (Ɛw)
Felsic -porphyry, mainly intrusive
Miners Ridge Sandstone - quartzwacke & siltstone
Basaltic-andesitic volcanics and intrusives
Tholeiitic basalt at Miners Ridge
ACKNOWLEDGEMENT:
Mt. Read Volcanics Project Map adopted from Map 6 - Geological Compilation Map of the Mt. Read Volcanics and Associated Rocks, from Hellyer to South Darwin Peak.
K.D. Corbett B Sc (Hon) PhD & A.W. McNeill B Sc (Hon), 1988.
CAMBRIAN INTRUSIVE ROCKS
Granite
Felsic porphyry
Gabbro
Ultramafic rocks & serpentinite
PRECAMBRIAN
Quartzite-slate sequences — correlates of Oonah Formation
Metamorphosed sequences of Tyennan Region
Major lithological boundary trends shown
5 cm
ROSEBERY
TULLAH
E.L. 12/88 BOUNDARY
5 380 000mN
5 370 000mN
5 360 000mN
380 000mE
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E.L. 12/88 – MT. BLACK J.V.
REGIONAL GEOLOGY
(FROM MAP 6 MT. READ VOLCANICS PROJECT)
SCALE 0 2 4 km
FIG. No. 3

6. GEOLOGY

6.1. STRATIGRAPHY

The Mt Black EL comprises a largely east-dipping and east-facing sequence of Mt Read Volcanics, of broadly Lower to Middle Cambrian age and rhyolitic to andesitic composition. The eastern bulk of the EL is made up of the Mt Black Volcanics, while the narrow westward EL corridor cuts across the northern extension of the Rosebery Mine sequence (see Figures 4 & 5). The sequence can be summarized in descending stratigraphic order as follows:

Mt BLACK VOLCANICS

Rhyodacitic to andesitic lavas, intrusives, breccias. Minor epiclastics. Essentially unmineralised.

---------------Upper Thrust---------------

East-dipping. Associated magnetite-pyrite(-chalcopyrite) mineralization.

ROSEBERY MINE SEQUENCE

Incompletely represented on EL 12/88. Units present:

Hangingwall Epiclastics

Crystal-lithic sandstones & breccio-conglomerates. Some shale/siltstone bands. Minor basemetal sulphides.

Quartz-Feldspar Porphyry Intrusive

Altered, with minor pyrite.

Mine sequence units possibly present (known 550m south along-strike from EL):

Black Shale

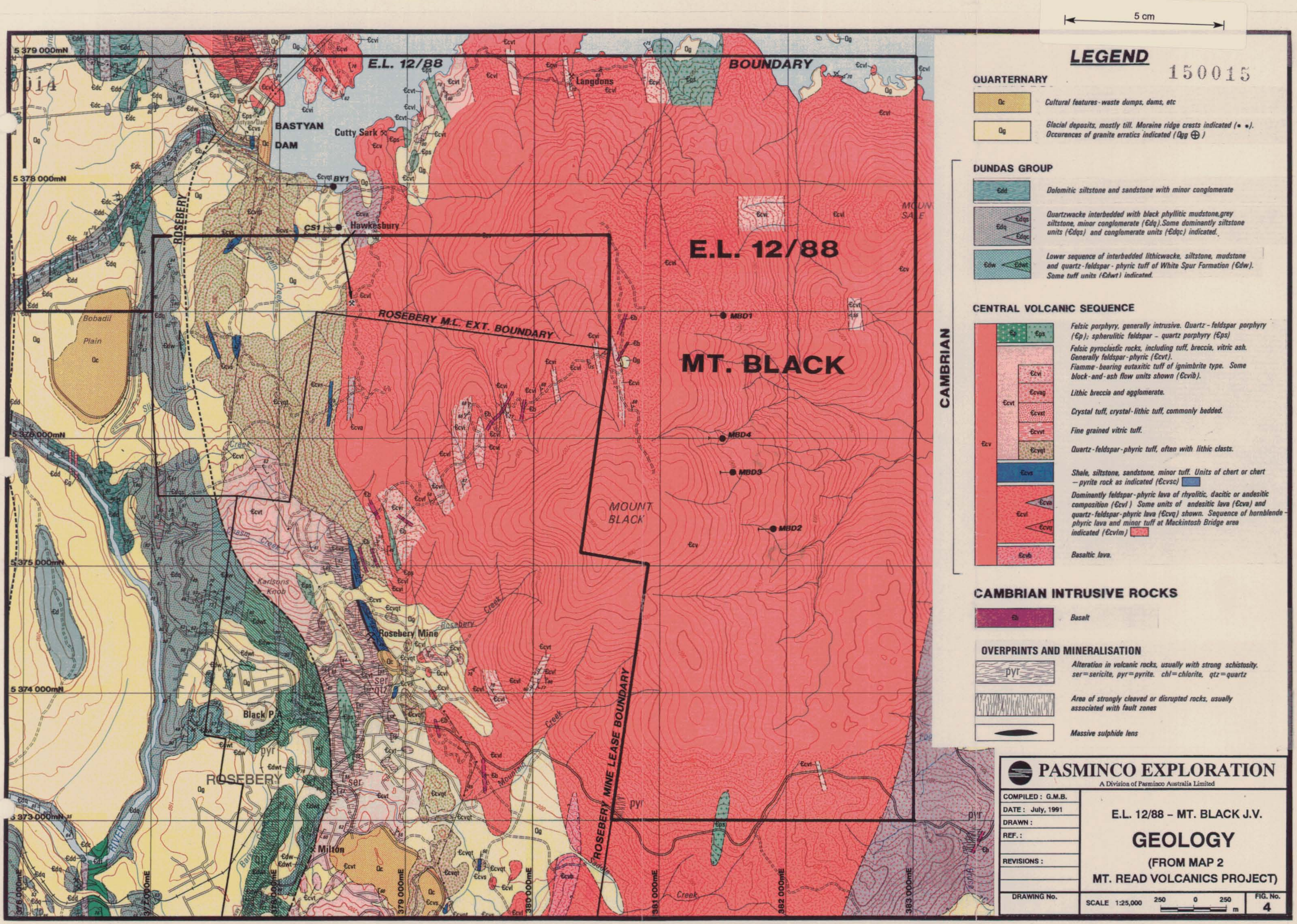
'Crystal Sandstone/Lava' (CSL)

Host Rocks (Altered tuffaceous sediments. Host to Pb-Zn orebody 2100m S of EL)

Footwall Sequence

---------------Rosebery Fault---------------

Major east-dipping thrust. Unmineralised.


5 cm
150015
5 379 000mN
5 378 000mN
5 376 000mN
5 375 000mN
5 374 000mN
5 373 000mN
378 000mE
377 000mE
379 000mE
380 000mE
381 000mE
382 000mE
383 000mE
E.L. 12/88
BOUNDARY
Langdons
BASTYAN
DAM
Cutty Sark
BY1
CS1
Hawkesbury
ROSEBERY
Bobadil
Plain
ROSEBERY M.L. EXT. BOUNDARY
E.L. 12/88
MT. BLACK
MBD1
MBD4
MBD3
MBD2
MOUNT
BLACK
Karlsons
Knob
Rosebery Mine
Black P.
ROSEBERY
Milton
ROSEBERY MINE LEASE BOUNDARY
RIVER
LEGEND
QUARTERNARY
Qc
Cultural features - waste dumps, dams, etc
Qg
Glacial deposits, mostly till. Moraine ridge crests indicated (• •). Occurences of granite erratics indicated (Qgg ⊕)
CAMBRIAN
DUNDAS GROUP
€dd
Dolomitic siltstone and sandstone with minor conglomerate
€dq
€dqs
€dqc
Quartzwacke interbedded with black phyllitic mudstone, grey siltstone, minor conglomerate (€dq). Some dominantly siltstone units (€dqs) and conglomerate units (€dqc) indicated.
€dw
€dwt
Lower sequence of interbedded lithicwacke, siltstone, mudstone and quartz-feldspar-phyric tuff of White Spur Formation (€dw). Some tuff units (€dwt) indicated.
CENTRAL VOLCANIC SEQUENCE
€p
€ps
Felsic porphyry, generally intrusive. Quartz-feldspar porphyry (€p); spherulitic feldspar - quartz porphyry (€ps)
€cvt
Felsic pyroclastic rocks, including tuff, breccia, vitric ash. Generally feldspar-phyric (€cvt).
€cvi
Fiamme-bearing eutaxitic tuff of ignimbrite type. Some block-and-ash flow units shown (€cvib).
€cvag
Lithic breccia and agglomerate.
€cvxt
Crystal tuff, crystal-lithic tuff, commonly bedded.
€cvvt
Fine grained vitric tuff.
€cvqt
Quartz-feldspar-phyric tuff, often with lithic clasts.
€cv
€cvs
Shale, siltstone, sandstone, minor tuff. Units of chert or chert - pyrite rock as indicated (€cvsc)
€cvl
€cva
€cvq
Dominantly feldspar-phyric lava of rhyolitic, dacitic or andesitic composition (€cvl) Some units of andesitic lava (€cva) and quartz-feldspar-phyric lava (€cvq) shown. Sequence of hornblende-phyric lava and minor tuff at Mackintosh Bridge area indicated (€cvlm)
€cvb
Basaltic lava.
CAMBRIAN INTRUSIVE ROCKS
€b
Basalt
OVERPRINTS AND MINERALISATION
pyr
Alteration in volcanic rocks, usually with strong schistosity. ser=sericite, pyr=pyrite. chl=chlorite, qtz=quartz
Area of strongly cleaved or disrupted rocks, usually associated with fault zones
Massive sulphide lens
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REVISIONS :
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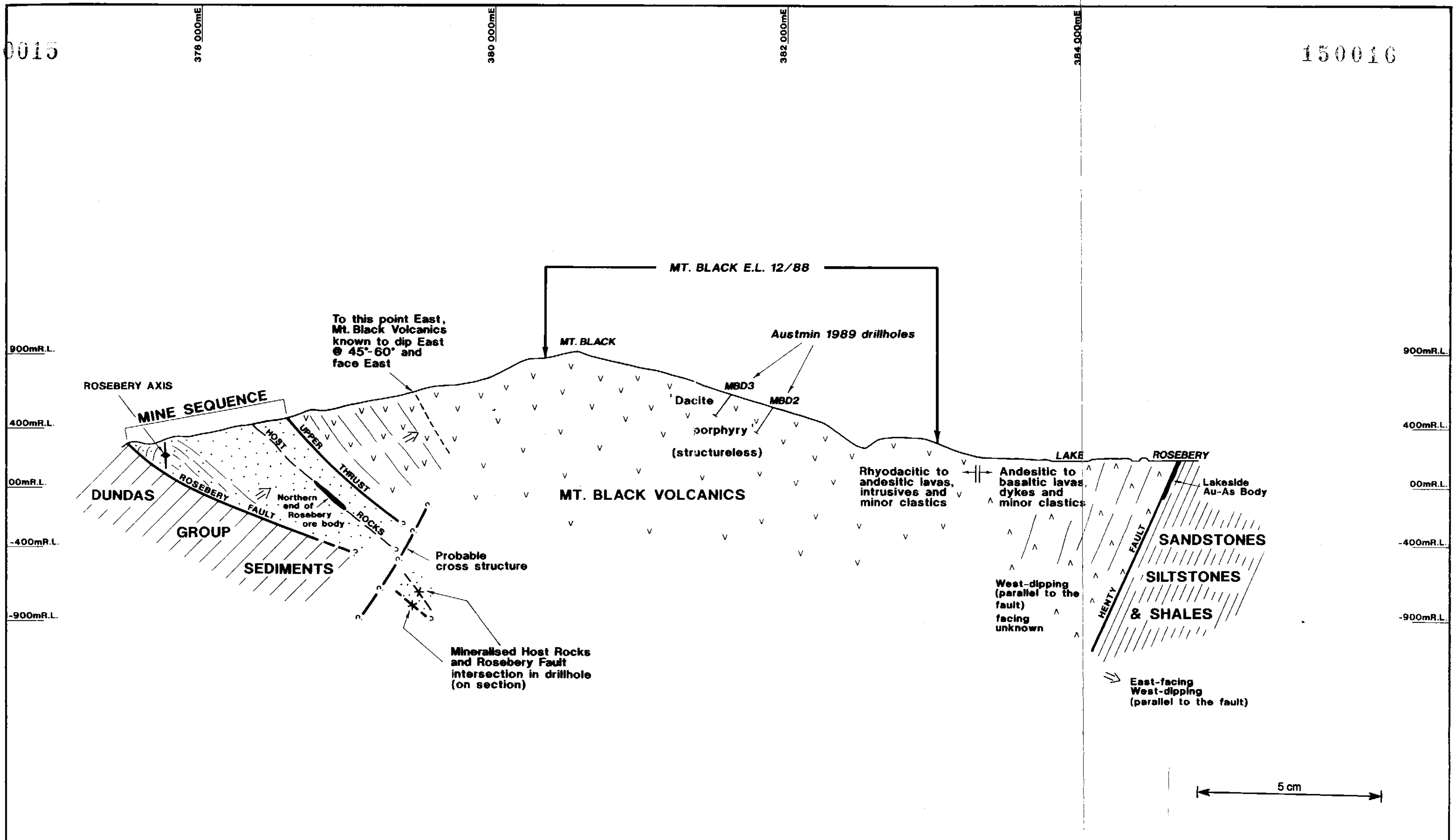
E.L. 12/88 – MT. BLACK J.V.
GEOLOGY
(FROM MAP 2
MT. READ VOLCANICS PROJECT)
SCALE 1:25,000
250 0 250
m
FIG. No.
4

0015

150016



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DATE: July, 1991	CROSS SECTION
DRAWN: G.M.B.	**375 500mN**
REF.:	THROUGH MT. BLACK
REVISIONS:	
DRAWING No.	SCALE 1:25,000 (250 0 250 m) — FIG. No. 5

West of Rosebery Fault:

DUNDAS GROUP SEDIMENTS

Stitt Quartzite

Quartzose sandstone. Unmineralized.

Chamberlain Shale

Deformed pyritic black shale and minor quartzose sandstone.

The Dundas Group is ascribed a Middle to Upper Cambrian age and regarded by Corbett & Lees (1987) and others, as younger than the volcanics in the Rosebery area. However, recent evidence from hole BY1 suggests at least some of these sediments were deposited contemporaneously with the volcanics (see Figure 10). This is discussed further in Section 7.

6.2. STRUCTURE

See Figure 5. Most of the volcanics on EL 12/88 lie on the 45^0 east-dipping eastern limb of a major anticline (the Rosebery Axis). This regional feature extends 20km from Hercules to Pinnacles, just east and parallel to the Rosebery Fault. In the Bastyan area the anticline has a northerly plunge of 20^0.

Drilling in the Rosebery area has shown that the eastern fold limb is consistently upright to a level at least 700m up into the Mt Black Volcanics (the limit of drilling). No structural information could be obtained from the massive dacitic lavas/intrusives encountered in the 1989 Austmin drilling further east on Mt Black. However, the recent gravity interpretation suggests the Mt Black Volcanics continue to dip eastwards all the way across the EL (Leaman 1991 - see Appendix 5).

The western edge of the volcanics has been thrust westwards over the buried margin of the Dundas Trough. This western edge is marked by three major parallel thrusts which, near surface at least, parallel the dip and strike of the volcanic sequence.

The largest structure, the Rosebery Fault, forms the actual contact between the volcanics and the Dundas Group sediments further west. Recent drilling north of Rosebery has shown that this thrust is listric, flattening and cutting across the volcanics at depth. It also has a low-angle southerly plunge (see Figure 6). Respectively 600m and 1100m to the east of the Rosebery Fault lie the Subsidiary Thrust and the Upper Thrust - the latter on the contact between the Mine sequence and the Mt Black Volcanics. Evidence suggests these latter structures are probably listric splays off the Rosebery Fault.

Mapping and drilling shows that the area around the Bastyan Dam is one of considerable structural complexity, which has yet to be fully resolved. See Figures 9 & 10. In the southern dam abutment at Bastyan the western fold limb is present on surface. The thick Hangingwall Epiclastics unit is exposed on both fold limbs, which explains why it makes up most of the surface outcrop here. Sub-surface, the western fold limb is apparently faulted out by the Subsidiary Thrust. However, on the northern side of the dam the Rosebery Axis and the western limb of the fold both appear to have been faulted off against the Rosebery Fault.

This indicates the existence of a major, but as yet unmapped, E-W structure broadly coinciding with the position of the dam and old Pieman River. This is supported by the findings of the geophysical interpretation, which indicate there are some important deep-seated structures here and that, very significantly, the structural setting around Bastyan shows similarities to that at Rosebery (Leaman 1991 - see Appendix 5).

6.3. MINERALIZATION

There is as yet no known in situ mineralization of consequence on EL 12/88. The vast majority of the Mt Black Volcanics which make up the bulk of the EL appear to be devoid of sulphides, although they contain widespread magnetite. Known primary sulphide showings in the Rosebery Mine sequence on the EL are relatively minor, but near the Bastyan Dam these clastic rocks contain coarse debris from a massive basemetal sulphide body (or bodies).

0018

NORTH
SOUTH
150019
4800m N
4600m N
4400m N
4200m N
4000m N
3800m N
3600m N
3400m N
3200m N
3000m N
2800m N
2600m N
2400m N
2200m N
2000m N
1800m N
1600m N
1400m N
1200m N
3400m RL
3000m RL
2800m RL
2600m RL
2400m RL
2200m RL
E.L. 12/88
(PASMINCO / AUSTMIN JV)
MINE LEASE EXTENSION
(PASMINCO / BILLITON J.V. AREA)
CONSOLIDATED MINE LEASE
(100% PASMINCO)
Surface profile along trace of Host Rocks
Northern outcrop limit of overlying Black Shale Unit
Possible upper limit of overlying Black Shale Unit
Massive sulphide rafts to 8×1m in HW Epiclastics
Massive sulphide clasts in Hangingwall Epiclastics
LAKE ROSEBERY (3209m RL)
Northerly plunge (20°)
CS2 (End) Entirely in HW Epiclastics
CS1 (End) Entirely in HW Epiclastics
Rosebery Fault in BY 1
(NB; Actual position - no Host Rocks intersected)
BY 1 (End) HW Epiclastics only
107R
ROSEBERY FAULT
Rosebery Fault in 107R
Rosebery Fault in 109R
99R
71R
49R
56R
B LENS OREBODY
8 LEVEL
9 LEVEL
10 LEVEL
11 LEVEL
12 LEVEL
13 LEVEL
15 LEVEL
17 LEVEL
87RD1
86R
84R
78R
R3480
PROPOSED 18 LEVEL FOOTWALL DRIVE
74R
65R
5 cm
LEGEND
● – Drillhole with ore grade intersection (i.e. ≥ 7.5% Zn)
○ – Drillhole with no ore grade intersection
(Plotted drillhole positions are intersection with mid-point of Host Rock)
Interpreted intersection of Rosebery Fault with Host Rocks (except in BY 1)
Orebody outline
Note: Section co-ordinates are Rosebery Mine Grid
PASMINCO EXPLORATION
ROSEBERY NORTH END EXTENSIONS
LONGITUDINAL PROJECTION ALONG HOST ROCK HORIZON
DRAWN BY : J.G.P.
DRAFTSMAN: T.G.D.S.
DATE : Aug.'90
REVISIONS :
J.G.P. June '91
J.G.P. July 1991
FILE NO. PERF5
SCALE 1:5,000
Metres
FIG. 6

6.3.1. Mineralization in the Mt Black Volcanics

Although the majority of the Mt Black Volcanics are barren, there are several areas on the EL where they do host minor mineralization:

Cutty Sark / Langdons:

Two well-known mineralized occurrences lie within the basal parts of the Mt Black Volcanics on the southern shore of Lake Rosebery. These are the Cutty Sark group of old Cu-Au-Bi workings, and the Langdons Pb-Zn-Ag-Au prospect 1.5km further to the ENE. See Figure 4.

The Cutty Sark mineralization occurs within dacitic/andesitic lavas as a tight grouping of intensely chloritised patches, typically 10-30m across, containing disseminated and veinlet sulphides. Dump sampling by Billiton in 1986 obtained values up to 4.5% Cu, 0.95g/t Au, 34g/t Ag and 0.53% Bi. The high bismuth values are not typical of Cambrian volcanogenic mineralization in the Mt Read Volcanics, although the other metal values are.

Langdons comprises sulphides in brecciated quartz-siderite fissure fill hosted by a sequence of altered andesite lava, volcanic breccia and cherty volcaniclastic sandstone (Randell et al, 1986). The fissure strikes east-west (F.FitzGerald, pers comm 1991). Billiton outcrop sampling got values up to 24% Pb, 1.5% Zn, 4.8g/t Au, 530g/t Ag and 0.33% As. Apart from the gold value, the metal ratios are not dissimilar to the mineralization at Farrell, which is regarded as Devonian age but formed from dissolved Cambrian sulphides (Solomon _in_ Burrett & Martin, 1989).

The recent geophysical work (Leaman 1991, see Appendix 5), suggests the Langdons and Cutty Sark mineralization is associated with deep-seated E-W structures positioned along the old Pieman River.

Pieman Road Zone:

Along the northern boundary of the EL in the Bastyan area there is widespread minor pyritization of the Mt Black Volcanics - see Figure 4. While there are occasional thin Pb-Zn veins with quartz-siderite gangue which are probably of Devonian age, most of the sulphides are apparently associated with the southern end of a sericite-pyrite alteration zone extending 2km north to the Chester pyrite deposit.

Murchison Highway Zone:

In the SW corner of the EL there is a small zone of pyritization in Mt Black lavas exposed in road cuts along the Murchison Highway 2km east of Rosebery - see Figure 4. Early EZ soil and rock chip sampling failed to detect any base or precious metals in the zone.

The pyritization is believed to be due to a buried spine of Devonian granite, one of several which are inferred from the gravity data to exist sub-surface just south of the Rosebery deposit (Leaman, pers comm 1990).

Summit Zone:

About 1km NE of the summit of Mt Black, a zone of strong chlorite alteration contains magnetite-hematite and minor pyrite. As mapped and sampled by Getty and Billiton in the period 1984-86, the alteration occurs within dacitic to andesitic lavas, volcaniclastics and sediments, containing traces of Zn and As.

Austmin drilled the zone with hole MBD4 in 1989, encountering strongly chloritised 'dacite porphyry' with thin dolerite dykes. Both rock types are cut by quartz-chlorite-calcite veinlets, containing magnetite-hematite and rare pyrite. Sampling showed the zone is totally devoid of base or precious metals.

The Upper Thrust Zone:

Extending northwards for at least 2km from the vicinity of the Rosebery Mine is a zone of patchy magnetite-pyrite-chalcopyrite mineralization within altered and deformed dacitic to andesitic lavas, just above and parallel to the Upper Thrust at the base of the Mt Black Volcanics. The zone is apparently associated with early movements of this structure.

The zone has not yet been shown to extend onto EL 12/88, but a recently located aeromagnetic anomaly east of the Cutty Sark workings suggests it does (see Section **7.4.2.**). The best known development of the zone is at AMG 5,377,000mN -

only 600m south of the EL boundary. Here, it gave a UTEM response which Billiton drilled in 1987 (hole RED 87-1), intersecting patchy magnetite-pyrite over a 70m interval. Unfortunately, base and precious metal values were low (best intersect: 0.4m @ 0.13% Cu, 0.12g/t Au). On the surface above the hole is the best outcropping expression of the zone - the old Hawkesbury workings, where selected dump samples assayed to 1.2% Cu & 0.23g/t Au (Randell et al 1986).

6.3.2. Mineralization in the Rosebery Mine Sequence

Massive Sulphide Debris at Bastyan:

The most significant indications of mineralization on the EL are within the Rosebery Mine sequence at Bastyan, where large boulders and rafts of massive basemetal and pyritic sulphides are located within debris flows of the Hangingwall Epiclastics unit.

The locations of the two main occurrences are shown in Figure 9. Both were exposed as a result of H.E.C. excavations during the contruction of the dam in the early 1980's, and are now submerged beneath Lake Rosebery. Small sulphide clasts (-30mm) are not uncommon elsewhere in the HW Epiclastics at Bastyan.

The major occurrence comprises a group of at least five massive sulphide rafts, the largest of which, according to H.E.C. files, is 8.5 x 1m. It is clear from H.E.C. photographs and descriptions that the sulphide rafts were only semi-lithified at the time of incorporation into the HW Epiclastics. Unfortunately, no samples of the sulphide material were collected.

The other important sulphide occurrence lies on the southern shore of Lake Rosebery about 350m SE of the first, and at normal lake level is covered by about 3m of water. It comprises a group of massive sulphide boulders up to 2m diameter, some of which are deformed suggesting they were only partly lithified at the time of incorporation into the HW Epiclastics (FitzGerald, pers comm).

The author sampled these boulders during a period of low lake level in 1986, for maximum values of 35.5% Zn, 0.8% Pb, 0.25g/t Au, 20g/t Ag, 0.07% As and 0.1% Sn (Randell et al, 1986). The high Zn:Pb ratio and presence of Sn is not representative of normal Cambrian volcanogenic mineralization in West Tasmania.

The HW Epiclastics at Bastyan tend to be much coarser than at the Rosebery Mine, 2.5km further south. Rafts of shale and siltstone up to 50m long are not uncommon, and there are occurrences of bouldery debris-flows. Because of its coarseness, this debris (particularly the sulphides), is not believed to have been transported more than a few hundred metres.

As has been well documented (Purvis in Randell et al, 1986), evidence points to a southward sediment transport direction for the Cambrian units. Thus the source of the massive sulphide debris at Bastyan could perhaps lie north at depth (down the 20^{o}N plunge) from the known occurrences. However, the evident structural complexities and presence of lake and dam make this area extremely difficult to drill.

Other Mineralization in the Mine Sequence:

There are widespread minor basemetal sulphides and pyrite in the Hangingwall Epiclastics and Quartz-Porphyry units in the Bastyan area. Most of the shale lenses and rafts contain minor fine disseminated and veinlet sphalerite (+pyrite), giving typical values of 4m @ 0.92% Zn (hole BD1), and 13.5m @ 0.5% Zn, 0.02% As (recent hole BY1).

In 1986 Billiton sampled pyritic parts of the quartz-porphyry unit and found traces of gold and silver (up to 0.57g/t Au and 46g/t Ag).

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7. RESULTS OF 1990-91 WORK

The 1990-91 exploration programme centred around the drilling of hole BY1. Other activities included detailed mapping in the Bastyan area, aeromagnetic, radiometric and gravity surveys, a geophysical/structural interpretation of the EL area, petrological and lithogeochemical studies, preparation of topographic base plans from new aerial photography, and monitoring of rehabilitation work.

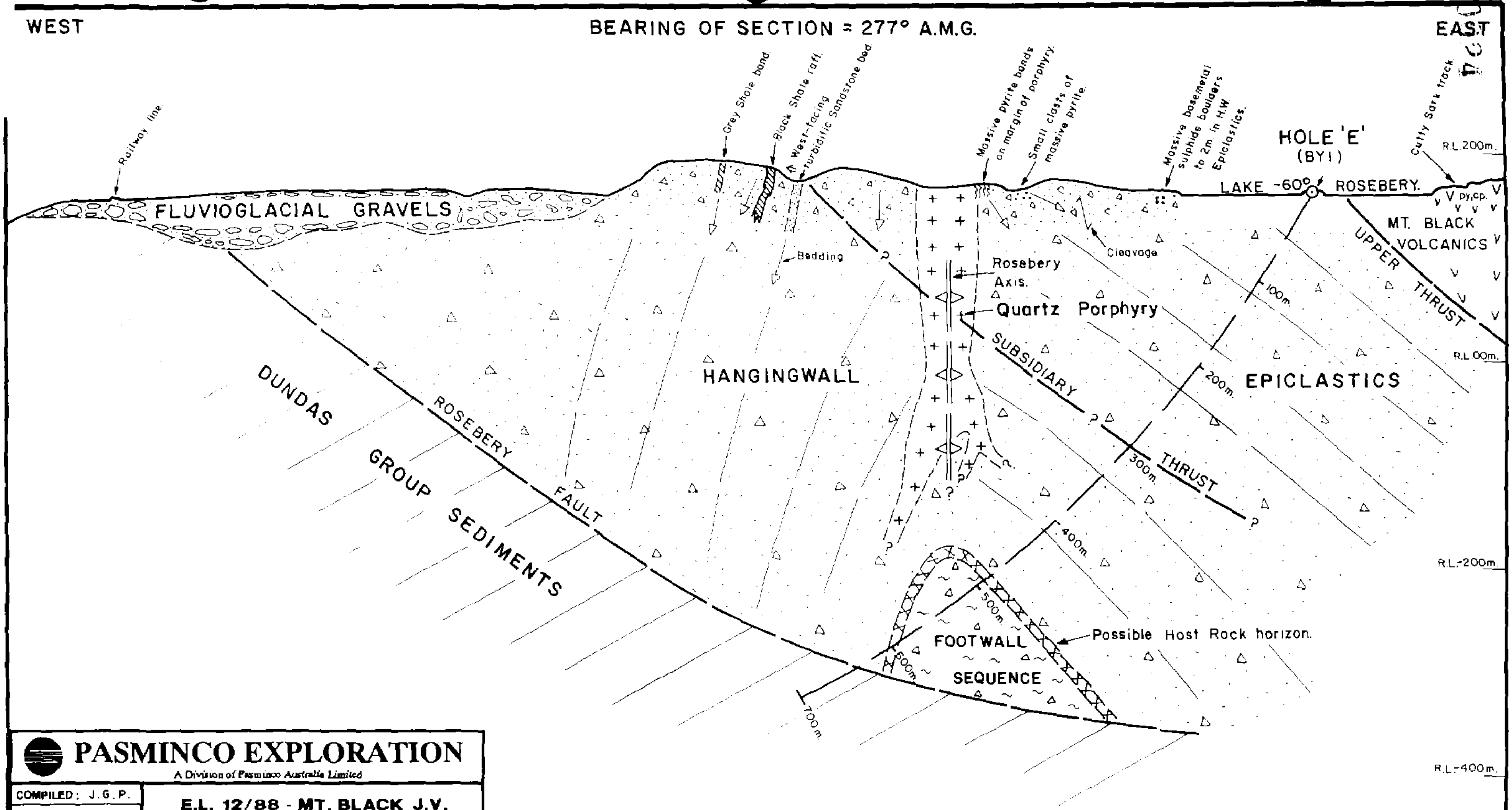
7.1. DRILLHOLE BY1

Between January and March 1991, hole BY1 was put down to 562.45m on the southern shore at Lake Rosebery. The location of the hole is shown in Figure 9 and the completed drillsection in Figure 10.

The hole was designed to test beneath outcropping massive basemetal sulphide boulders in the Hangingwall Epiclastics and for the possible occurrence of the Rosebery Host Rocks at depth just above the Rosebery Fault - see Figure 7 (the interpretative drill section drawn prior to the drilling of the hole). The summary log of the hole is shown in Table 2.

BY1 collared in the Mt Black Volcanics, went through the Upper Thrust at 60m and into the Hangingwall Epiclastics. In the hole the latter contain no sulphide bodies or clasts as seen on surface, the only mineralization being minor Zn values in a band of black calcareous shale, assaying 13.5m @ 0.5% Zn, 0.02% As. (This shale is also mineralized on surface above the hole in the very minor old 'Robbie Burns' workings).

At 282m the hole passed through a highly disturbed zone (correlated with the Subsidiary Thrust on surface), and into a sequence atypical of the Hangingwall Epiclastics. While this sequence does contain normal HW-type crystal-lithic sandstones, these are interbedded with carbonate-cemented quartzo-feldspathic sandstones and impure limestones, more reminiscent of Dundas Group sediments west of the Rosebery Fault. The intermixture of units is a primary depositional feature and not structural.



PASMINCO EXPLORATION
A Division of Pasminco Australia Limited

COMPILED: J.G.P.	E.L. 12/88 - MT. BLACK J.V.
DATE: Dec., 1990	BASTYAN DAM AREA
DRAWN: N.W.D.S.	INTERPRETIVE DRILL SECTION FOR
REF.:	HOLE-BY1
REVISIONS:	PRIOR TO DRILLING
DRAWING No.	SCALE 1:5000 50 0 50 m — FIG. No. 7

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TABLE 2

SUMMARY LOG OF HOLE BY1

0 - 58.9m: **MT BLACK VOLCANICS**

Amygdaloidal dacitic lava to 33.7m, then tuffaceous siltstone. Minor py, locally 2% in siltstone.

58.9 - 60.5m: **MAJOR FAULT (The 'Upper Thrust').** Highly broken. Minor py.

60.5 - 281.7m: **HANGINGWALL EPICLASTICS**

60.5 - 106.3m: **FINE CRYSTAL-LITHIC BRECCIO-CONGLOMERATE** Minor py.

106.3 - 159.9m: **RHYOLITE LAVA** *Minor veins py-gn-sp in upper 15m.*

159.9 - 219.1m: **INTERCALATED VOLCANICLASTICS & SEDIMENTS** Deformed & silicified volcaniclastics, tuffaceous claystone and xyl sst. Minor py-sp.

219.1 - 247.9m: **CALCAREOUS BLACK SHALE** 1-3% sp-py-gn-aspy, most in carb veins.

247.9 - 281.7m: **INTERCALATED CRYSTAL SANDSTONE & CALCAREOUS BLACK SHALE** Sst: minor dissem sp-py. Shale: 1-2% py-sp, in carb-qtz veins.

281.7 - 283.3m: **DISTURBED CONTACT ZONE** Probably the 'Subsidiary Thrust'.

283.3 - 507.3m: **MIXED SEQUENCE**

283.3 - 302.5m: **DETEXTURED FINE DACITIC VOLCANICLASTIC** Trace dissem py-sp.

302.5 - 317.5m: **BLACK SHALE & GREY SILTSTONE** 3% sp & py.

317.5 - 333.4m: **QUARTZO-FELDSPATHIC SANDSTONE** Minor to 1% sp-py.

333.4 - 408.1m: **CRYSTAL SANDSTONE, QUARTZO-FELDSPATHIC SANDSTONE, CALCAREOUS SHALE, & MINOR LIMESTONE** To 3-4% py-sp-aspy in 1st conglomerate

408.1 - 507.3m: **SILICIFIED & DETEXTURED CRYSTAL-LITHIC SANDSTONE** Trace py.

507.3 - 508.5m: **ROSEBERY FAULT** Brecciated mixture of rocks above & below. 1% py.

508.5 - 562.45m: **DUNDAS GROUP**

508.5 - 553.6m: **HIGHLY DEFORMED BLACK GRAPHITIC SHALE (Chamberlain Shale)** Patchy syngenetic py -av 2-3% (up to 10-15%) to 526m.

553.6 - 562.45m: **FINE QUARTZOSE SANDSTONE (Stitt Quartzite)** Numerous interbeds of deformed black shale. Trace py.

END OF HOLE

In places this mixed sequence contains minor disseminated pyrite-sphalerite-arsenopyrite, concentrated in thin limestone stretched-pebble conglomerate bands and calcareous shale. Best intersect was 0.5m @ 2.1% Zn, 0.1% Pb, 0.1% As, but there were several zones up to 2m @ 0.7% Zn.

No Host Rocks were intersected in the hole. Within the mixed sequence, two detextured sandy sub-units which superficially show some resemblance to Rosebery Footwall Sequence, have lithogeochemical values which are unequivocally from HW Epiclastics (see Section 7.2.).

At 508m the hole intersected the Rosebery Fault at an RL about 100m higher than expected. The unmineralized 1.25m zone of brecciation and crushing has a dip of 25^{O}E in the hole, which is considerably less than the 38^{O}E dip for the fault at surface in this area, highlighting again that the fault is listric, ie: it is flattening with depth.

West of the Rosebery Fault the hole passed into units of the Dundas Group: the highly deformed black graphitic and pyritic Chamberlain Shale, and the Stitt Quartzite.

Above the Rosebery Fault the sequence in the hole dips 50 -70^{O}E. Apart from local reversals around visible folds in some shale bands, facings are to the east (uphole), indicating the sequence is upright. How the mixed sequence in the hole between the Subsidiary Thrust and the Rosebery Fault correlates with the west-facing detextured Hangingwall Epiclastics outcropping on surface between these structures, is not known. The limestones and quartzo-feldspathic sandstones in the hole have not been seen on surface. See Figure 10.

7.2. LITHOGEOCHEMISTRY

Five samples were taken of core from hole BY1 and analysed for a comprehensive range of trace elements and oxides, to determine the level of hydrothermal alteration and to assist in rock identification. The geochemical results are shown on page 14 of Appendix 1.

There is extensive silicification, bleaching, carbonatisation, sericitisation and detexturing of the rocks in the Bastyan area, both on surface and in the drillhole. This alteration is particularly strong in the southern abutment of the dam, beneath which BY1 was drilled. The cause of the alteration and detexturing has been the subject of some debate.

The lithogeochemical values from the BY1 samples, especially those for Na_2O which range from 2.7% to 4.1%, and the Alteration Index* values which range from 37 to 60, indicate the level of genuine Cambrian hydrothermal alteration is low.

Green (1990) uses the value for 10,000 Rb divided by K_2O to determine the level of Devonian alteration in the Rosebery area, with values of 70 or more being indicative of substantial Devonian input. The BY1 samples all have values for 10,000 Rb / K_2O of between 37 and 47, indicating the Bastyan detexturing and alteration is not related to a Devonian intrusion.

The geophysical interpretation based on the gravity and magnetic data also sees no evidence for Devonian granite subsurface in the area north of Rosebery (Leaman, 1991). This point is further confirmed by the 10,000 Rb / K_2O values of between 24 and 61 in drillholes between Bastyan and the Rosebery Mine, none of which indicate any appreciable Devonian alteration effects. (However, it is interesting to note that the higher values are in holes at depth closest to the Mine - Devonian granite exists at depth immediately south of the orebody).

Two lithogeochemical samples were taken from an extensive detextured and altered interval of in the lower part of BY1, to assist in identifying the rock association. These samples, at 422.75m and 476.4m, were of sandy feldspar-phyric volcaniclastics with some slight similarities both in hand specimen and thin section to the Rosebery Footwall Sequence (although the presence of minor phenocrystal quartz was noted, which is not a normal feature of the Footwall Sequence).

Green (1990) showed that the Rosebery Host Rocks and Hangingwall Epiclastics tend to have higher Ti/Zr ratios than the Footwall Sequence, which is also more uniform. He quotes Ti/Zr ratios for all Footwall samples as being between 5.6 and 9.4.

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The Alteration Index: $$A.I. = \frac{100 \times (K_2O + MgO)}{(Na_2O + CaO + K_2O + MgO)}$$

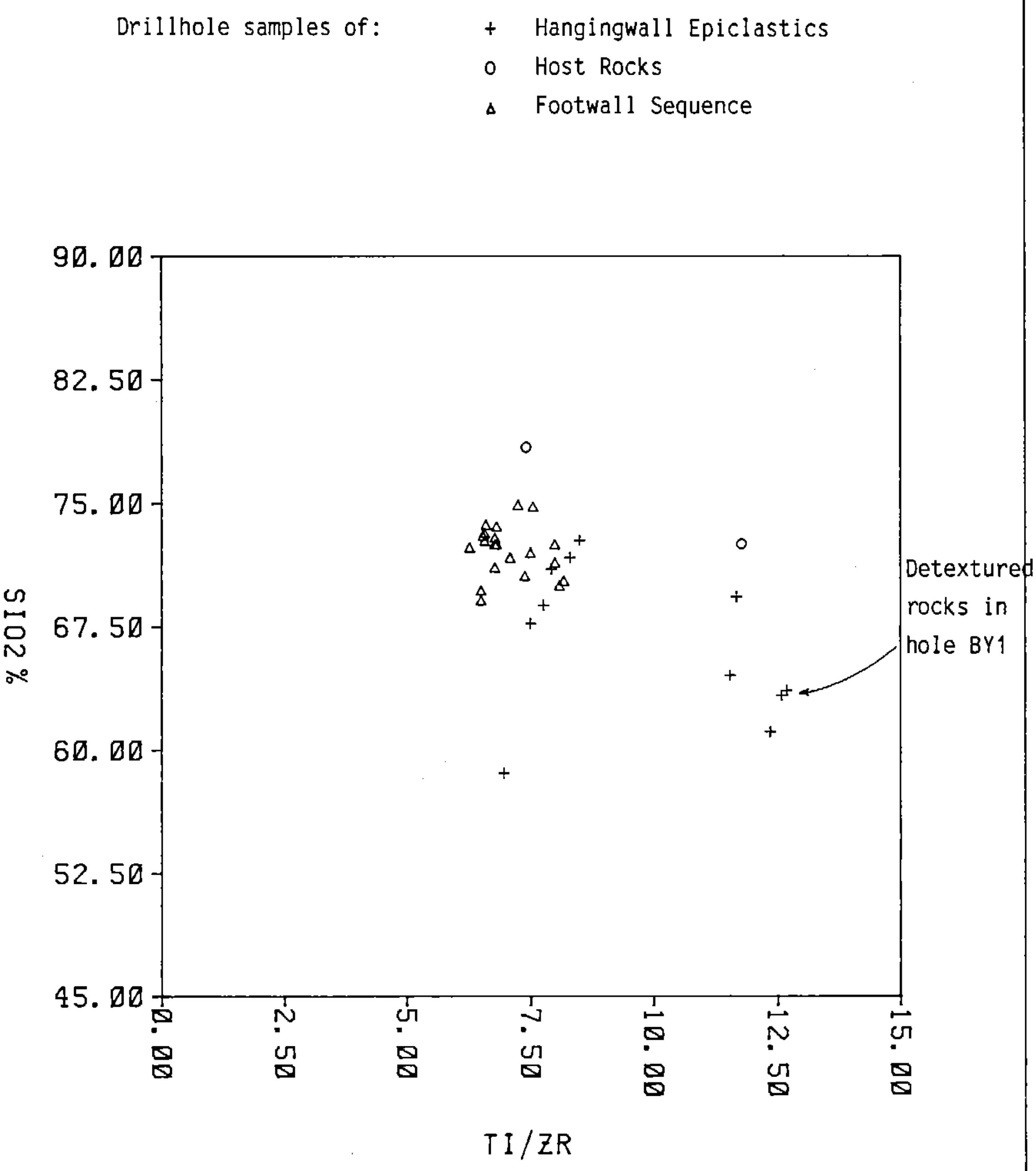

FIGURE 8. SIO2 VS TI/ZR
ROSEBERY MINE - NORTHERN EXTENSIONS

A compilation by the author of Ti/Zr v SiO_2 for Footwall and Hangingwall samples in a spread of drillholes north of the Mine is shown in Figure 8. The samples of Footwall Sequence have Ti/Zr values in the tight range of 6.27 to 8.18. (Visually, the Footwall in this area appears of very homogeneous composition and the geochemistry is confirming this).

Hangingwall Epiclastics in the same drillholes have Ti/Zr ratios ranging from 6.95 to 12.69, with clear indications of two major groupings - one with Ti/Zr ratios and SiO_2 values essentially the same as the Footwall and the other with much higher Ti/Zr ratios but lower SiO_2. The two samples of Host Rocks also show this division. **This suggests the HW Epiclastics and Host Rocks are partly derived from the same source as the Footwall Sequence and partly from some other volcanic source of markedly different composition.**

The two detextured samples from BY1 have Ti/Zr ratios of 12.58 and 12.69, clearly indicating they are from the Hangingwall Epiclastics and not the Footwall - see Figure 8. Although taken over 50m apart, the chemical signatures of the two samples are almost identical and they are obviously the same rock-type.

7.3. GEOLOGICAL MAPPING

Detailed geological mapping was carried out at Bastyan prior to the drilling of BY1, mainly to enable the design of possible future drillholes. Five potential drillsites were identified, including that subsequently used by BY1. The geology of the Bastyan area, and the drillsites, is shown in Figure 9.

The mapping demonstrated that major structural changes take place in the Mine sequence between the northern and southern abutments of the dam, ie: along the position of the old Pieman River. The evidence points to a fundamental, broadly E-W striking, structure or zone of dislocation in this area, but no mappable structure has yet been delineated on the ground.

As mentioned in Section **6.2.**, *the structural change involves the relative offset* to the west of rocks on the northern side of the river, with the loss of the anticlinal axis and western fold limb against the Rosebery Fault. (The axis and both fold limbs are present on the south side of the river). It is possible that the structural change comprises a broad zone of ductile deformation rather than a brittle fault, but it is hard to see how a ductile zone could be responsible for the amount of observed change over the short distance involved.

The general vicinity of the structural offset at Bastyan is marked by three features not noted elsewhere:

1. Extensive strong silica-sericite-carbonate alteration and associated detexturing.

2. Thick quartz-ankerite veins, commonly with shallow dips.

3. A conjugate set of cleavages, with near-parallel strikes but with steep east and west dips. These are best developed towards the western end of the southern dam abutment, but are also present in thin sections of the core from the upper part of BY1, several hundred metres further east.

7.4. GEOPHYSICAL SURVEYS

Full details of geophysical surveys carried out in 1990-91 are given in Consultant David Leaman's preliminary report (Leaman 1991), which appears in Appendix 5. Only a brief summary of the work done, the results and Leaman's findings, is provided here.

7.4.1. Work Done

Geophysical work carried out on the EL this year included:

1. A high-resolution helicopter-borne *aeromagnetic and radiometric survey*, flown February 1991, over the EL area south and east of 5 378,000mN / 381,000mE. (The rest of the EL had already been covered by surveys flown in February-March 1990).

2. A semi-regional gravity survey over Mt Black, mainly in the area west of

380,000mE. Although done in late 1990, results were not available until June 1991 due to delays in the completion of survey levelling. (Note, the Bastyan area was covered by gravity in early 1990).

3. Preliminary interpretation of the magnetic and gravity data by Consultant David Leaman.

4. Collection of SG and magnetic susceptability measurements on core from hole BY1. (These are tabulated in Appendix 2).

The gravity and magnetic surveys were designed to extend and integrate with the existing geophysical coverage Pasminco has over the greater Rosebery area. As with this previous work, the principal aims of the 1990-91 surveys were to:

* Define alteration zones within the volcanics.
* Assess the structural controls.
* Aid mapping of the volcanics.
* Identify mineralized signatures if present.

7.4.2. Results and Leaman's Conclusions

According to Leaman, the latest magnetic survey shows considerably improved feature recognition and location over the 1986 Mines Department survey. Processing of the magnetic data is still in progress. There are no plans at present to process the raw radiometric data.

A major magnetic anomaly exists over Mt Black Volcanics immediately east of the Cutty Sark workings. The anomaly is over 1km long, with a trend slightly east of north. Although this anomaly is apparently shallow, the source is not known. The author considers that the anomaly may be the northern continuation of the zone of magnetite-pyrite mineralization associated with the Upper Thrust further south, even though the trend of the Cutty Sark anomaly is away from the Thrust. (See Section **6.3.1.** and Figure 4D, Appendix 5).

On Mt Black itself, the magnetic and to a lesser extent the gravity data, show that the geological character of the volcanics is nowhere near as homogeneous as shown on present geological maps. The Mt Black Volcanics are evidently varied and lensey, with an overall easterly dip right across the EL. They apparently form a shallow wedge with a maximum thickness of 2.5 - 3km, floored by the east-dipping Upper Thrust / Rosebery Fault. The bulk of the Mt Black Volcanics have negligible magnetic properties (Leaman, 1991).

Structurally, several important trends and linears are delineated by the geophysical surveys (see Figure 7 in Appendix 5). Of most significance is a fundamental sub E-W structural zone positioned along the old Pieman River near the northern boundary of the EL. The old Langdons and Cutty Sark workings, and the northern dam abutment at Bastyan, all broadly lie on the zone, which extends further east and west. A NNW trending structure extending along the western face of Mt Black, through the Hawkesbury workings and intersecting the E-W one in the vicinity of the dam, is also considered to be significant.

In work with gravity and magnetic data in the Rosebery area since 1986, Leaman (1986a, 1986b, 1987), has shown that a major E-W structural zone and its intersection by NNW trending structures, apparently exerted some control on the location of the Rosebery deposit. The structures can be seen in Figure 7, Appendix 5. Leaman considers the E-W structure was the fundamental Cambrian 'mineralizer'. This structure also later exerted control on granite intrusion in the Rosebery area during the Devonian.

On EL 12/88 the sub E-W structure along the Pieman River exactly parallels the one at Rosebery, 4km further south, and also shows a spatial relationship with known sites of mineralization. At Bastyan, its intersection with a NNW trending structure (one of Leaman's 'critical nodes'), mirrors the structural setting of the Rosebery deposit. The E-W structure is regarded by Leaman as the most significant in terms of future exploration on the EL.

According to Leaman, modelling of the gravity data suggests a correlation between the buried edge of shallow PreCambrian basement (to the east under Mt Black) and outcropping mineralization in the overlying volcanic rocks, both on the EL (Cutty Sark / Langdons), and at Rosebery itself. He places the basement margin in the vicinity of 379,000 - 380,000mE, extending broadly N-S.

(The author would here note that the Upper Thrust zone of magnetite-pyrite (-chalcopyrite), which although apparently of little economic consequence is actually the most extensive zone of mineralization known in the Mt Black Volcanics, lies directly above Leaman's postulated basement margin and extends along it for at least 2km. The 1km long Cutty Sark magnetic anomaly, probably the northern continuation of the Upper Thrust zone, also lies above the inferred basement margin.)

Leaman concludes:

1. Sub E-W and NNW trending structures have been defined and are important. Mineralized sites in the volcanics on the EL can be linked to these structures or their intersections ('critical nodes').

2. All known mineralization on the EL lies in the general vicinity of a postulated buried basement boundary, which suggests this is exercising a fundamental control on location of mineralization.

3. The Mt Black Volcanics are lithologically variable, dip east at moderate angles and are depth limited, with a maximum thickness between 2.5 -3km. They are cut off by the Rosebery Fault or associated east-dipping thrusts.

4. No evidence of alteration responses is seen in the geophysical data.

Leaman recommends up to 3 further gravity traverses on the eastern face of Mt Black, and that the gravity and magnetic data be further processed and analysed, particularly to more accurately define basement structures and other linears.

He also recommends exploration focus on sites involving the intersection of significant trends, especially the sub E-W, NNW and basement junctions. Although Leaman doesn't say so, at the present state of knowledge on EL 12/88 this implies concentrating on the general area between Bastyan and Langdons.

7.5. PREPARATION OF NEW BASEPLANS

In January 1991, the entire EL was flown for new aerial photography. The work was done as part of a contract between Pasminco and H.E.C. Enterprises for the latter to produce a new set of computer-generated topographic baseplans for the greater Rosebery area.

The aerial photography involved colour at 1:10,000 scale, and black & white at

1:22,000 scale. The black & white photography was used by the H.E.C. in the computer-controlled photogrammetry to produce a set of topographic baseplans at scales ranging from 1:2,500 to 1:10,000.

The computer tapes have been provided to Pasminco, enabling new plans to be printed in future on the Company's computer at any scale required.

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8. ENVIRONMENTAL REHABILITATION

During 1990-91 two programmes of environmental rehabilitation following exploration activities, were in progress on the EL:

1. Monitoring of rehabilitation of 1989 Austmin drillsite 5 on Mt Black. (Programme under the management of Austmin Resources).

2. Rehabilitation of drillhole BY1 site at Bastyan. (Pasminco).

8.1. MONITORING REHABILITATION OF AUSTMIN DRILLSITE 5, MT BLACK

Austmin's report on the continuing monitoring of the rehabilitation of drillsite 5 appears in Appendix 4.

Drillsite 5 is located 1.7km NNE of the summit of Mt Black, at 5 377,000mN, 381,250mE. It comprises a 2250m^2 cleared area and 250m bulldozed access track. The site was formed in January-February 1989 but was never actually used for drilling.

The site was rehabilitated in April 1990 and a two year monitoring programme began in July 1990. The monitoring is being carried out by Botanical Consultant Alan Gray of Hobart. Grey made 3 site visits during 1990-91, to set up and monitor site observation stations.

Full details of the monitoring techniques and results are given in Appendix 4. Grey regards the progress of rehabilitation as very satisfactory with healthy regrowth. Local cuttings of King Billy Pine (Athrotaxis selaginoides), taken from the vicinity of drillsite 5 during December 1990, were propagated in Hobart and 32 were planted back on the site in April 1991.

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8.2. REHABILITATION OF BY1 DRILLSITE

Pasminco hole BY1 was drilled on the southern shore of Lake Rosebery near the Bastyan Dam, in January-March 1991. The BY1 site was chosen with the full realization that a special effort would have to be made to minimize the environmental impact of the drilling. See Plate 1.

The drillsite lies on a small scrub-covered peninsula jutting out from the southern shore of Lake Rosebery. It is almost totally surrounded by water and the hole collar is only 1m above full lake level. The ground at the site is not the natural surface, the area having been heavily modified by H.E.C. quarrying and logging operations during the building of the Bastyan Dam around 1980. The original forest cover on the site was probably removed at this time.

Steps were taken to minimize environmental damage during site preparation and drilling, and to facilitate rehabilitation of the site. The programme was discussed with the H.E.C. prior to drilling as the site is on H.E.C. vested land. All environmental work on the site was supervised by Pasminco's Senior Technician, Hans Rae.

Steps taken to minimize environmental impact included:

1. Minimal clearing and site earthworks using an excavator, with retention of as much of the scrub cover as possible, in order to screen the site from view from the lake.
   See Plate 2.

2. Use of an existing bulldozed logging track for access for the rig, without upgrading to 4WD standard. Daily access for men and materials during drilling was by boat or walking only. Core and rubbish was removed by boat.

2. Formation of plastic-lined ring drain and outer low bund around perimeter of site to contain all drilling effluent and cuttings.

3. Pumping of drill effluent from the ring drain to a deep sump constructed on old Getty drillsite CS1, 350m south and uphill from the BY1 site. Drainage

from the sump passed through a straw-lined channel to trap oils and greases.

On the completion of drilling in mid-March 1991, all rubbish and equipment was removed from the site. The vacant site was then re-covered with stockpiled soil and a vegetative mulch (see Plate 3), and replanted with seedlings of Eucalyptus, Acacia and Leptospermum species. (These seedlings were raised in Pasminco's Rosebery nursery from locally-derived seed). See Plate 4.

9. DISCUSSION

Some results of the 1990-91 programme carry important implications for future exploration on the EL. Leaman's delineation of a fundamental sub E-W structure along the position of the old Pieman River is very significant, given the apparent 'deep-seated mineralizer' role of an identical structure at Rosebery Mine.

The existence of this fundamental lineament is confirmed not only by the structural picture at Bastyan (see below), but also by the atypical signatures of the "Cambrian" mineralization along it: the high Bi at Cutty Sark, the 'Farrell-like' Pb-Zn-Ag values at Langdons, and the traces of Sn in the massive sulphide boulders at Bastyan. These 'anomalies' are suggestive of other, deep-seated, fluid inputs - some of which are apparently Devonian.

Nd to mention the geology!

In the vicinity of the Bastyan Dam this fundamental E-W structure is intersected by a strong NNW trend, forming what Leaman terms a 'critical node'. The NNW structures are implicated in the location of mineralization elsewhere in the volcanics, including Rosebery. The structural setting at Bastyan is exactly analogous to that at Rosebery Mine. Identification of this situation is the most significant result from exploration to date on the EL.

Attention is already drawn to the Bastyan area by the outcrop there of the Rosebery Mine stratigraphy and the presence within it of basemetal massive sulphide debris. (This combination was the reason hole BY1 was drilled).

So, the prime area on the EL on the basis of stratigraphy, lithology and existing mineralization, is also the prime area on the basis of structural setting. Clearly, future exploration on the EL has to be directed foremost at the Bastyan area.

What is equally clear is that exploration at Bastyan will not be easy. Quite apart from the very real difficulties posed by the lake and dam, the local structure is complex and not fully understood at the present time. There are obvious major structural changes between the southern and northern abutments of the dam, with the changes apparently taking place across a broadly east-west axis somewhere in the position of the old river. This is undoubtably a manifestation of Leaman's fundamental E-W structural zone.

The rocks at Bastyan are notable for their extensive detexturing, silica flooding, and associated sericite-carbonate alteration. They contain numerous thick veins of quartz-ankerite. Lithogeochemical studies have shown that the detexturing and alteration is apparently not of Cambrian hydrothermal origin nor is it due to a Devonian intrusive. The most likely cause seems to be the intensity of structural deformation concentrated in the local area.

This level of deformation suggests any mineralized body at Bastyan could be heavily modified - possibly even totally dismembered. Such a body could have an irregular shape and unconformable orientation. It may be remobilized and injected into overlying, otherwise barren, stratigraphy. Thus, although the structure and stratigraphy are similar to that at Rosebery, there could be danger in thinking that any orebody at Bastyan must also be similar to Rosebery.

At the present time, the existence of massive sulphide debris in the Hangingwall Epiclastics at Bastyan points to this unit, or units lower in the Rosebery Mine stratigraphy, being the prime targets to host mineralization in this area. However, an example that changes can perhaps be expected, is the Chester pyrite deposit 2.5km north of the dam. Chester is sitting within units that can basically be equated with the Mt Black Volcanics, at a higher stratigraphic level than the Mine sequence.

It is here worth mentioning that the heavily detextured Hangingwall Epiclastics around the dam may lend themselves to oxygen isotope sampling, to try and map out any probably-unrecognisable zones of Cambrian hydrothermal alteration. Green (1990) states: "oxygen isotopes offer the greatest potential for the recognition of geochemical anomalies related to Cambrian hydrothermal activity in the post ore sequences." At Rosebery, Green showed that oxygen isotopes were the halo indicator extending the greatest distance from massive sulphides. Oxygen isotopes work best in areas free of Devonian granite-related alteration effects and Bastyan fits that requirement.

The zone between Bastyan and the postulated basement margin around Cutty Sark - Langdons (Leaman, 1991), along the Pieman River E-W structure, is also an important exploration target. While the Cutty Sark and Langdons mineralized occurrences in themselves do not appear to be significant, they are indicators of a structural setting that may prove of economic importance.

The largest zone of mineralization in the Mt Black Volcanics, the Upper Thrust magnetite-pyrite zone, follows the buried basement margin northwards from Rosebery for 2km, and possibly for 4km if the Cutty Sark magnetic anomaly proves part of the zone. This very large and strong magnetic anomaly is sited over the intersection of the postulated basement margin and the Pieman River E-W structure, and obviously warrants further examination.

The remainder of the EL has little to recommend it on present knowledge. There are no known targets or prospective areas within the volcanics on Mt Black, and the geophysical/structural interpretation by David Leaman suggests they are too thick (2.5km at least), to consider exploration of the possible underlying Rosebery Mine sequence.

However, completion of the gravity coverage on Mt Black, as recommended by Leaman (1991), is warranted to improve knowledge of the structural picture.

10. CONCLUSIONS

1. The Bastyan Dam vicinity is the prime target area on the EL. The prospective zone extends 2.5km east to the old Langdons Pb-Zn-Ag workings.
At Bastyan, the structural setting is identical to that at Rosebery Mine, the stratigraphy is part of the sequence hosting the Rosebery orebody, and there is unequivocal evidence that massive sulphides formed in the vicinity.

2. Elements of the structural picture emerging from the geophysical surveys have a very important bearing on the economic potential of the EL area. The validity and relevance of these structures is confirmed by the way they integrate with aspects of the known geology, especially the location of known mineralization.

3. Most significant amongst these structural elements is a fundamental E-W lineament along the old Pieman River, particularly its intersection at Bastyan with a NNW structure (a 'critical node'). This 'node' is an exact repetition of the structural setting of the Rosebery deposit.

4. A postulated buried basement margin, orientated N-S at approximately 380,000mE, is also exercising control over known mineralization. The area around the Cutty Sark and Langdons workings, where the Pieman E-W structure intersects the basement margin, is prospective as a similar situation also occurs at Rosebery. An obvious target here is a large magnetic anomaly immediately east of the Cutty Sark Cu-Au-Bi workings, which is apparently part of a 4km long zone of magnetite-pyrite-chalcopyrite mineralization within the volcanics directly above the basement margin.

5. Exploration at Bastyan will not be easy due to logistical dificulties posed by the hydro dam and lake, and problematic geology caused by the strong local structural deformation. Future drilling may have to be directed more at structural rather than stratigraphic targets.

6. The magnetic and gravity data suggest the volcanics on Mt Black are an east-dipping wedge at least 2.5km thick, floored by the Rosebery Fault thrust complex. The volcanics appear more lithologically variable than shown in current mapping. There are no known exploration targets in these rocks.

11. RECOMMENDATIONS

It is recommended that work in 1991-92 be concentrated in the area around the Bastyan Dam, and east as far as the old Langdons working (see Figure 4).

At Bastyan, detailed structural mapping, combined with lithogeochemical and oxygen isotope sampling, with further refinement of the geophysical/structural interpretation, is recommended prior to the drilling of a deep drillhole into the northern dam abutment structural block.

The primary aim of this drillhole would be to test for the source of the massive sulphide debris which occurs within the Hangingwall Epiclastics near the dam, but an important secondary purpose is to gain further information on the complex subsurface structure of the geology. To this end, it is recommended that orientated core be obtained in all future drilling in this area.

The magnetic anomaly east of the Cutty Sark workings requires ground checking and sampling, to establish its geological context. The Cutty Sark to Langdons area requires mapping with emphasis on structure, and sampling for assay, petrology and lithogeochemistry.

The semi-regional gravity coverage of the area east of the summit of Mt Black should be completed by carrying out the three traverses recommended by Leaman (1991, - see p15, Appendix 5).

The aeromagnetic and gravity data should also be further processed and analysed to try and locate other 'critical nodes' (intersection of important linears). To assist in this, SG and magnetic susceptibility measurements need to taken of the core in the four Austmin drillholes on Mt Black. This core should also be sampled for lithogeochemistry.

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KEYWORDS

LEAD, ZINC, VOLCANOGENIC, MASSIVE SULPHIDE, MT READ VOLCANICS, THRUST, GEOLOGY, LITHOGEOCHEMISTRY, AEROMAGNETICS, GRAVITY, PETROGRAPHY, ROSEBERY, BASTYAN DAM, MT BLACK.

Plate 1

Hole BY1 in progress near Bastyan Dam,
March 1991. View looking NW.

Plate 2

View of BY1 site from Lake Rosebery.

Plate 3

BY1 site after drilling, with replaced soil and vegetative mulch.

Plate 4

Planting Eucalyptus, Acacia and Leptospermum seedlings amongst the mulch on the rehabilitated BY1 site.

APPENDIX 1

LOG OF DRILL HOLE BY1

PASMINCO EXPLORATION
DIAMOND DRILL HOLE LOG

LOCATION	WESTERN TASMANIA
PROJECT	MT BLACK EL 12/88
PROSPECT	BASTYAN DAM
DESIGNED BY	J.G. PURVIS
LOGGED BY	J.G. PURVIS
RELOGGED	
COMMENCED	16·1·91
COMPLETED	13·3·91
DRILLED BY	DIAMOND DRILLING TAS
DRILL RIG	LONGYEAR 38

OBJECTIVE

TO TEST:

1. PROSPECTIVE ROSEBERY MINE SEQUENCE IN VICINITY WHERE MASSIVE SULPHIDE CLASTS AND RAFTS OCCUR IN HANGINGWALL EPICLASTICS.
2. POSSIBLE OCCURRENCE OF ROSEBERY HOST ROCKS AROUND ANTICLINAL AXIS IMMEDIATELY ABOVE ROSEBERY FAULT.

RESULT

HOLE INTERSECTED WIDESPREAD MINOR TRACES OF BASEMETAL SULPHIDES IN SHALE HORIZONS AND LIMESTONE BANDS, INTERPRET AS PART OF A MIXED SEQUENCE OF HANGINGWALL EPICLASTICS AND DUNDAS GROUP SEDIMENTS.

LOCATION/SURVEY DATA (AMG)

Grid	AMG	RMG		
Northing m	5 377 974·6	3808·9	RL Collar m	160·4 (3209·9 RMG)
Easting m	378 419·9	301·6	Bearing Collar	276°45′
DH Survey Type	SINGLE SHOT DOWNHOLE CAMERA		Dip Collar	−60°
			Length Hole m	562·45

Depth m	Bearing	Dip	Depth m	Bearing	Dip
30	276°	−58°45′			
57	272°40′	−53°45′			
75	273°10′	−53°			
90	272°40′	−52°45′			
105	272°10′	−52°15′			
120	272°30′	−51°45′			
150	272°10′	−50°15′			
180	272°	−48°30′			
210	272°	−47°30′			
240	271°30′	−47°			
270	271°10′	−46°30′			
299·5	271°40′	−45°15′			
332·5	272°40′	−44°15′			
360	272°40′	−44°30′			
390	272°40′	−44°30′			
420	273°	−44°			
450	273°10′	−44°			
480	273°10′	−44°			
510	273°10′	−43°30′			
540	271°40′	−42°45′			
562	271°10′	−42°30′			

SIGNIFICANT INTERSECTIONS (PPM UNLESS SPECIFIED)

From m	To m	Interval m	Pb	Zn	Ag	Au	As	Comments
220·5	234·0	13·5	43	5040	<1	0·025	212	BLACK SHALE
366·0	366·5	0·5	1150	2·14%	5	0·01	1100	LIMESTONE PEBBLE CONGLOMERATE
373·0	375·0	2·0	540	7250	1	0·015	300	CARBONATE-RICH SANDSTONE

SIGNIFICANT CORE LOSS

From m	To m	% Lost
0	4·5	14
543·3	547·75	19

POOR GROUND CONDITION ZONES

From m	To m	Condition
0 22	12·5 33·7	BADLY FRACTURED AND BROKEN IN PLACES
521	558	MODERATELY BROKEN WITH SEVERAL VERY BADLY BROKEN ZONES DUE TO FAULTS, WORST 544·6–548m

HOLE SIZE

Size	Depth m
HQ	141m
NQ	562·45m

HOLE CONDITIONS AFTER COMPLETION

Collar	CEMENTED, WITH SCREW-ON STEEL CAP.
Steel Casing	NQ STEEL CASING PLACED 0–15m.
PVC Casing	UNSLOTTED, 40mm, PLACED TO BASE.
Ground Water	- / CORE PHOTOGRAPHED AND STORED AT TULLAH COMPOUND.
Wedge	
Drill Pad	REHABILITATED AND PLANTED.

PASMINCO EXPLORATION
DIAMOND DRILL CORE LOG

PROJECT BASTYAN DAM, MT BLACK EL 12/88

Graphic Scale 1:

CORE RECOVERY

Interval (m)	Recov.	(%)
0 - 1.2	0.75	62
1.2 - 3.2	1.9	95
3.2 - 4.5	1.2	92
4.5 - 7.1	2.6	100
7.1 - 9.4	2.3	100
9.4 - 10.5	1.1	100
10.5 - 12.5	2.0	100
12.5 - 15.6	3.1	100
15.6 - 16.5	0.9	100
16.5 - 19.4	2.9	100
19.4 - 20.8	1.4	100
20.8 - 22.5	1.7	100
22.5 - 24.1	1.6	100
24.1 - 25.5	1.4	100
25.5 - 27.1	1.6	100
27.1 - 28.5	1.4	100
28.5 - 30.0	1.35	90
30.0 - 31.5	1.5	100
31.5 - 34.5	3.0	100
34.5 - 35.1	0.6	100
35.1 - 37.1	2.0	100
37.1 - 40.2	3.1	100
40.2 - 43.3	3.1	100
43.3 - 45.2	1.9	100
45.2 - 46.9	1.7	100
46.9 - 49.5	2.6	100
49.5 - 51.1	1.5	94
51.1 - 54.0	2.9	100
54.0 - 55.2	1.2	100
55.2 - 56.3	1.1	100
56.3 - 57.6	1.3	100
57.6 - 58.5	0.9	100
58.5 - 60.2	1.6	94
60.2 - 61.5	1.2	92
61.5 - 64.5	3.0	100
64.5 - 67.5	2.85	95
67.5 - 70.4	3.05	105
70.4 - 71.6	1.2	100
71.6 - 73.5	1.9	100
73.5 - 76.5	3.0	100
76.5 - 78.9	2.4	100
78.9 - 82.0	3.1	100
82.0 - 85.0	3.0	100
85.0 - 86.8	1.8	100
86.8 - 89.7	2.9	100
89.7 - 91.5	1.8	100
91.5 - 94.5	3.0	100
94.5 - 97.5	3.0	100
97.5 - 100.5	3.0	100
100.5 - 103.5	3.0	100
103.5 - 106.4	2.9	100
106.4 - 108.6	2.2	100
108.6 - 111.7	3.1	100
111.7 - 114.8	3.1	100
114.8 - 117.9	3.1	100
117.9 - 121.0	3.1	100

DESCRIPTION

From m | Interval m | (incl. LITHOLOGY, STRUCTURE & ALTERATION) | Depth | Graphic Lithology | Struct. | MINERALISATION | CODES: LITHO | STRUCT | ALTN | MIN

0 - 58.9m: MT BLACK VOLCANICS:

0 - 33.7m: AMYGDALOIDAL DACITIC LAVA

Lithology: Pale fawny-grey at top, pale greenish-grey at depth.
Massive, fl gr, fairly uniform.
Abund amygdales after vesicles, commonly flattened & drawn out by flowage of lava (65°/LCA). Very abund above 6m & below 15.8m.
Amygdales av 1-4mm, gen calcite, but smallest either qtz or chlor.
Lava feld › qtz-phyric, felds av 1-2mm, qtz ‹1mm, neither abund & gen visible only where amygdales sparse or absent (eg: 6-11m).
All in fl gr felsic groundmass with minor sericite.
Alteration: Weak sericite-chlorite-silica-bleaching.
Weakly oxidised, mainly above 12m & none below 30m. Prominent Fe & Mn oxides on fractures & leaching of carbonate.
Qtz-carb-chlor veins throughout - leached, limonitic & vuggy in ox areas.
Structure: Gen fractured & broken, badly in places above 12.5m & below 22m, esp around strong fault 28.5 - 29.2m where lava strongly cleaved (70°/LCA) & detextured to fl gr sericite schist with qtz-limonite veins.
Basal contact apparently normal bedding, sharp & sl irreg, 68°/LCA.

Samples: 84055A @ 21.4m - petrology; 84055B @ 21.5m - W.R. geochem.

Mineralisation: Minor dissem pyrite, locally 1% towards base. Rare dissem leucoxene.

33.7 - 58.9m: VITRIC TUFFACEOUS SILTSTONE/CLAYSTONE

Lithology: Pale greyish-green with creamy bleached zones.
Massive, fine & even-grained (slight coarsening of grainsize with depth). Not hard - lacks silic character.
Composed largely of finely-comminuted volcanic glass, apparently deposited sub-aqueously.
Alteration: Rock is sericitic, but genuine alteration is weak: sericite-chlorite-bleaching. Numerous tiny veinlets of chlorite, in places defining zones of net-vein fracturing & brecciation. 550mm qtz vein 150mm below upper contact.
Structure: Bedding gen absent or poorly developed - minor irreg interbeds of fine sandy xyl-rich material in uppermost few metres. Good bedding @ 35.5m: 77°/LCA.
Mod cleaved: 70°/LCA @ 34.5m; 65°/LCA @ 40m; 55°/LCA @ 54m.
Mod fractured & broken, badly around faults & adjacent to lower contact.
Faults, (all // cleav): 50°/LCA @ 45.7m; 70°/LCA @ 51m & @ 55.25 -56.25m (several); 78°/LCA @ 58.7m.
Inc bleached & broken below 56m -totally bleached & detextured at base.

Mineralisation: Minor dissem pyrite, locally to 2% (eg: 39.5 -42m). Often assoc with chlorite. Trace cp.

CORE RECOVERY

121.0 - 124.1	3.1	100
124.1 - 127.2	3.1	100
127.2 - 130.3	3.1	100
130.3 - 133.4	3.1	100
133.4 - 136.5	3.1	100
136.5 - 139.5	3.0	100
139.5 - 140.9	1.4	100
Change to NQ		
140.9 - 142.5	1.35	84
142.5 - 145.5	3.0	100
145.5 - 148.5	3.0	100
148.5 - 151.5	3.0	100
151.5 - 154.5	3.0	100
154.5 - 157.5	3.0	100
157.5 - 160.5	3.0	100
160.5 - 163.5	3.0	100
163.5 - 166.5	3.0	100
166.5 - 169.5	3.0	100
169.5 - 172.5	3.0	100
172.5 - 175.5	3.0	100
175.5 - 178.5	3.0	100
178.5 - 181.5	2.85	95
181.5 - 182.4	0.85	94
182.4 - 184.5	2.0	95
184.5 - 187.5	3.0	100
187.5 - 190.5	3.0	100
190.5 - 193.5	3.0	100
193.5 - 196.5	3.0	100
196.5 - 199.3	2.8	100
199.3 - 202.3	3.0	100
202.3 - 204.9	2.6	100
204.9 - 207.9	3.0	100
207.9 - 210.9	3.0	100
210.9 - 214.0	3.1	100
214.0 - 217.1	3.1	100
217.1 - 220.2	2.95	95
220.2 - 222.0	1.8	100
222.0 - 225.0	3.0	100
225.0 - 228.1	3.1	100
228.1 - 231.1	3.0	100
231.1 - 234.2	3.1	100
234.2 - 237.2	3.0	100
237.2 - 240.3	3.1	100
240.3 - 241.5	1.2	100
241.5 - 242.2	0.6	86
242.2 - 243.7	1.2	80
243.7 - 245.7	1.85	92
245.7 - 248.8	3.05	98
248.8 - 251.9	3.1	100
251.9 - 254.9	3.0	100
254.9 - 255.6	0.7	100
255.6 - 257.0	1.4	100
257.0 - 258.3	1.25	96
258.3 - 261.4	3.1	100
261.4 - 264.4	3.0	100
264.4 - 267.5	3.1	100
267.5 - 270.6	3.1	100
270.6 - 270.8	0.2	100

DESCRIPTION

From m | Interval m | (incl. LITHOLOGY, STRUCTURE & ALTERATION) | Depth | Graphic Lithology | Struct. | MINERALISATION | CODES: LITHO | STRUCT | ALTN | MIN

58.9 - 60.5m: MAJOR FAULT ZONE ('UPPER THRUST')

Lithology: Cream. Highly broken & clayey zone of intensely crushed & milled rock, with shattered frags of detextured silif & sericitised unidentifiable volcs.
Structure: Upper & lower margins sharp @ 65°/LCA (// cleavage in rocks above & below). Measureable shearing angles within zone: 65 -70°/LCA.

Mineralisation: Minor fi gr dissem pyrite, trace gn & sp.

60.5 - 507.3m: HANGINGWALL EPICLASTICS:

60.5 - 106.3m: FINE CRYSTAL-LITHIC BRECCIO-CONGLOMERATE

Lithology: Pale greenish-grey; cream above 71.6m. Hard; v hard at depth.
Uppermost 0.8m fi gr, detextured & highly cleaved, with abrupt lower limit 65°/LCA - could poss be part of unit above fault.
Rock charact by abund coarse, fractured qtz xyls & xyl frags, av 2-3mm, max 10mm, coarser & more abund below 75m. Xyl frags angular but larger qtz commonly rounded - these poss eroded qtz amygdales.
Lesser feld xyls, av 1-2mm, in places albitised.
Polymict lithics to 70mm, av 5-10mm, angular to sub-rounded. Most commonly pink albitised & silif silic lavas; also tuff-seds (incl grey shale), qtz-porphyry, intermediate-mafic lavas, & pumice.
All in strongly-lineated matrix of sericite & silica, containing visible fine flattened pumice frags in places.
Upper 14m of unit finer gr, & sl reworking below fault @ 86m, with matrix fines-depleted, inc in xyl abund & diffuse bands of larger lithics.
Alteration: Mod-strong silif, inc with depth. Weak-mod sericite > chlor alt. Patches of weak albitisation & bleaching. Weak carb alt 90 -100m.
V common spidery carb and/or chlorite veinlets.
Structure: Bedding rarely evident: 60°/LCA @ 75.7m; 50°/LCA @ 90m & 103m. Mod bedding-// cleavage (strongest above 87m): 58°/LCA @ 67m & 78m; 55°/LCA @ 84m; 50°/LCA @ 95m; 45°/LCA @ 103m.
Sl broken above 86.25m & in basal 1m, worst breaking assoc with faults: 55°/LCA @ 69.2m; 75°/LCA @ 86 -86.25m (strong); 45°/LCA @ 105.5 -106.2m (strong); all faults same sense as cleavage.
Basal contact sharp: 55°/LCA (same sense as cleav).

Mineralisation: Minor fine dissem pyrite & trace sp-gn.
Minor sp-gn>cp @ 61.5 -62.5m, dissem & veinlets, conc in some lithics.

106.3 - 159.85m: RHYOLITE LAVA

Lithology: Bleached creamy to 128.5m, grey-green below this.
Massive, v uniform, fi-med gr granular siliceous rock.
Hard (v hard above 128.5m).
Abund qtz phenos, av 1mm or less (uncommonly to 3mm), & felds, av 1mm (commonly to 2mm). Phenos evenly distributed through silica-sericite groundmass. Qtz xyls are sl resorbed in silif sections.
Alteration: Above 128.5m: v strongly silif, bleached, mod sericitised & trace albitisation. Below 128.5m: weak-mod sericite-chlorite alt, with patchy silif & bleaching.
Abund spidery chlorite veinlets in places below 120m. Occ qtz-carb veins.
Structure: Gen unbroken. Minor breaking around small faults @ 118m (30°/LCA), 120.55m (40°/LCA), & 139.3m (25°/LCA). Weakly cleaved in places.
Basal contact sharp, 60°/LCA, sl sheared with qtz veining.

Samples: @ 153.75m: 031301A - Petrology; 031301B - W.R. Geochem.

Mineralisation: In upper 10 -15m: minor py >gn-sp, gen vein-style, with some assoc dissem.
Trace leucoxene.

PASMINCO EXPLORATION
DIAMOND DRILL CORE LOG

HOLE No. BY 1

PROJECT BASTYAN DAM, MT BLACK EL 12/88

Graphic Scale 1:

CORE RECOVERY

270.8 - 273.6	2.8	100
273.6 - 276.6	3.0	100
276.6 - 279.7	3.1	100
279.7 - 282.8	2.95	95
282.8 - 284.1	1.2	92
284.1 - 285.6	1.3	87
285.6 - 288.4	2.8	100
288.4 - 291.4	3.0	100
291.4 - 292.5	1.1	100
292.5 - 294.2	1.7	100
294.2 - 297.3	3.1	100
297.3 - 298.5	1.2	100
298.5 - 301.5	2.95	98
301.5 - 303.8	2.3	100
303.8 - 306.9	3.1	100
306.9 - 307.4	0.5	100
307.4 - 309.7	2.3	100
309.7 - 311.8	2.1	100
311.8 - 312.5	0.7	100
312.5 - 315.6	3.1	100
315.6 - 318.7	3.1	100
318.7 - 319.7	1.0	100
319.7 - 322.7	3.0	100
322.7 - 325.7	3.0	100
325.7 - 328.7	3.0	100
328.7 - 331.7	3.0	100
331.7 - 334.7	3.0	100
334.7 - 337.7	3.0	100
337.7 - 340.7	3.0	100
340.7 - 343.7	3.0	100
343.7 - 346.7	3.0	100
346.7 - 349.7	3.0	100
349.7 - 351.4	1.7	100
351.4 - 352.7	1.3	100
352.7 - 355.7	3.0	100
355.7 - 358.7	3.0	100
358.7 - 361.55	2.85	100
361.55- 364.6	3.05	100
364.6 - 367.6	3.0	100
367.6 - 370.6	3.0	100
370.6 - 373.6	3.0	100
373.6 - 376.6	3.0	100
376.6 - 379.6	3.0	100
379.6 - 382.65	3.05	100
382.65- 385.65	3.0	100
385.65- 388.65	3.0	100
388.65- 391.35	2.7	100
391.35- 394.4	3.05	100
394.4 - 397.45	3.05	100
397.45- 400.5	3.05	100
400.5 - 403.5	3.0	100
403.5 - 406.5	3.0	100
406.5 - 409.5	3.0	100
409.5 - 412.6	3.1	100
412.6 - 415.7	3.1	100
415.7 - 418.7	3.0	100
418.7 - 421.65	2.95	100
421.65- 424.7	3.05	100

DESCRIPTION

From m | Interval m | (incl. LITHOLOGY, STRUCTURE & ALTERATION) | Depth | Graphic Lithology | Struct. | MINERALISATION

CODES: LITHO | STRUCT | ALTN | MIN

Mineralisation: Trace sulphides below 120m.

159.85 - 163.4m: POSSIBLE VOLCANICLASTIC (LAVA MARGIN?)

Lithology: Grey-green. Hard. Essentially unbroken.
Weakly-banded & lineated, variably-textured, feld & qtz-phyric volc similar to lava above. Abund felds, 1-3mm, & qtz 1-2mm. In fi gr sericite > qtz matrix.
Irreg bands and diffuse patches of variable grainsize. These bands gen 75 - 80°/LCA (prob 1° layering).
Patches & bands of massive pale grey cherty silica, gen small, but large zone 162.45 - 163.3m. Several silic apparent lithics to 5mm.
Alteration: Weak-mod sericite-chlorite.
Structure: Mod cleaved, strongest at upper & lower contacts.
Basal contact sharp, sl irreg, 50°/LCA.

Mineralisation: Minor dissem pyrite & leucoxene.

163.4 - 176.75m: VITRIC TUFFACEOUS CLAYSTONE/SILTSTONE

Lithology: Creamy-khaki. Hard, but only sl silic.
Mostly comprises weakly cleaved, massive & uniform, fi gr sericitic rock apparently composed almost entirely of finely-comminuted glass, sub-aqueously deposited & reworked in places.
Partly-banded variable interval 167.25 -170.4m, includes strongly-cleaved bands with deformed albitised felds to 3mm & minor small qtz xyls, also patches & bands of grey chalcedonic silica (2° silif).
Alteration: Weak genuine sericite-chlorite-bleaching alteration. Strong patchy silif in variable zone 167.25 - 170.4m, otherwise silif absent.
Numerous chlor-qtz-carb veinlets & occ qtz-carb veins.
Structure: Rare bedding: 65°/LCA @ 168.5m; 60°/LCA @ 171.3m.
Mod fractured & broken 164 -166.5m, otherwise essentially unbroken.
Gradational change at base - marked inc in cleavage, deformation & silif.

Mineralisation: Minor persistent sp>py>gn in chlor-qtz-carb veinlets in uppermost 2m.
V minor sulphides elsewhere - dec with depth.

PASMINCO EXPLORATION
DIAMOND DRILL CORE LOG

PROJECT BASTYAN DAM, MT BLACK EL 12/88

HOLE No. BY 1

Graphic Scale 1:

CORE RECOVERY

Interval (m)	Length (m)	Recovery (%)
424.7 - 427.65	2.95	100
427.65- 430.65	3.0	100
430.65- 433.65	3.0	100
433.65- 436.65	3.0	100
436.65- 439.7	3.05	100
439.7 - 441.4	1.6	94
441.4 - 442.05	0.65	100
442.05- 443.5	1.45	100
443.5 - 444.9	1.35	96
444.9 - 448.0	3.1	100
448.0 - 451.05	3.05	100
451.05- 454.1	3.05	100
454.1 - 456.95	2.85	100
456.95- 460.0	3.05	100
460.0 - 463.0	3.0	100
463.0 - 466.0	3.0	100
466.0 - 469.0	3.0	100
469.0 - 472.1	3.1	100
472.1 - 475.1	3.0	100
475.1 - 478.15	3.05	100
478.15- 481.2	3.05	100
481.2 - 484.25	3.05	100
484.25- 487.35	3.1	100
487.35- 490.4	3.05	100
490.4 - 493.45	3.05	100
493.45- 496.45	3.0	100
496.45- 499.5	3.05	100
499.5 - 502.55	3.05	100
502.55- 505.6	3.05	100
505.6 - 508.65	3.0	98
508.65- 511.7	3.05	100
511.7 - 514.7	3.0	100
514.7 - 517.7	3.0	100
517.7 - 520.7	3.0	100
520.7 - 523.7	3.0	100
523.7 - 524.65	0.8	84
524.65- 525.55	0.85	94
525.55- 526.8	1.25	100
526.8 - 529.7	2.9	100
529.7 - 532.7	3.0	100
532.7 - 535.7	3.0	100
535.7 - 537.9	2.15	98
537.9 - 539.15	1.25	100
539.15- 539.7	0.5	91
539.7 - 540.85	1.15	100
540.85- 543.3	2.45	100
543.3 - 544.7	1.25	89
544.7 - 545.05	0.15	43
545.05- 545.4	0.25	71
545.4 - 546.3	0.65	72
546.3 - 547.4	1.1	100
547.4 - 547.6	0.1	50
547.6 - 547.75	0.1	67
547.75- 547.95	0.2	100
547.95- 549.2	1.25	100
549.2 - 549.5	0.3	100
549.5 - 552.45	2.95	100
552.45- 555.4	2.9	98

DESCRIPTION

From m | Interval m | (incl. LITHOLOGY, STRUCTURE & ALTERATION) | Depth | Graphic Lithology | Struct. | MINERALISATION | CODES: LITHO | STRUCT | ALTN | MIN

176.75 - 206.5m: DEFORMED & ALTERED FINE VOLCANICLASTICS?

Lithology: Variably-textured interval. Poss lithological change @ 191.5m. Grey-green with mottled cream & white colours in places.
V hard. Largely unbroken.
Fi-med gr. Below 191.5m a more granular rock with variable grainsize.
1° rock type not readily identifiable due to strong cleavage, deformation & silif, but rock apparently a fine vitric volcaniclastic.
Feldspars 1-3mm (often deformed), & v minor qtz xyls, scattered throughout fi gr silica-sericite matrix with common 1-5mm pumice frags.
Rare indistinct lithic clasts to 25mm - some of feld-phyric lava.
Alteration: Strong silif (sl patchy), weak-mod sericite-chlorite-carb alt. Local albitisation above 192m.
Structure: 181.95 -182.4m: fi gr vitric claystone band, finely bedded 60°/LCA. Cleavage: 65°/LCA @ 178.5m, 185m, 192m.
Weak augen texture developed in places in upper part of unit, esp around strong fault @ 180.7m (25°/LCA - same sense as cleav).
Fault 182.4m, approx 70°/LCA (same as cleav). Broken 180.6 -182.5m.
Basal contact abrupt but indistinct due to alt. 45°/LCA. Samples: 031302 @ 185.9m, 031303 @ 204.3m (for Petrology).

Mineralisation: Trace py-sp-gn.
Minor dissem leucoxene & assoc black titaniferous oxides.

206.5 - 219.1m: MASSIVE CRYSTAL SANDSTONE

Lithology: Pale greenish-grey. Much less silif, cleaved & deformed than unit above.
A med gr, granular, qtz & feld xyl-rich rock. Siliceous & hard.
Massive, unbedded, gen uniform - sl grainsize variations. Evidence of reworking inc with depth with xyls densely packed in places below 212m.
Xyls & xyl frags av <1mm, gen abraded. Qtz occ to 6mm & rounded, felds to 3mm.
Uncommon lithics 3-5mm, gen fi gr, silic & unident, some felsic lavas.
Stringers of carbonaceous material in basal 1m.
Alteration: Weak-mod silif (strong in basal 3m), mod sericite >chlorite-carb alt. Occ qtz-carb veins.
Structure: Cleavage gen weak, strongest towards contacts. 60°/LCA @ 217m.
Basal contact broken by strong fault v approx 30°/LCA (same sense as cleavage & bedding).

Samples: 031304 @ 209.9 -210.45m (W.R. Geochem).

Mineralisation: Minor dissem sp-gn>py throughout.
Inc with depth & up to 1% in basal 1m.
Minor persistent dissem leucoxene.

219.1 - 247.85m: CALCAREOUS BLACK SHALE

Lithology: Dark grey to black. Mod carbonaceous - minor graphite in places.
Highly calcareous. Common v thin beds of grey limestone below 236m. Carb also in abund, often highly irreg. sweat-out veins, veinlets and small patches, all ± qtz.
Alteration: Basal 300mm chloritic.
Structure: Several beds (to 150mm) of feld-qtz xyl sst in basal 5m, with up-hole fining in one of these @ 245m.
Fine, fairly-regular bedding evident below 236m. Above this, bedding gen disrupted by mod-strong bedding-// cleavage. Deform strongest near top contact, with brecciation of carb-qtz sweat-outs.
Bedding: 70°/LCA @ 231m; 78°/LCA @ 237.5m; 58°/LCA @ 243.1m; 60°/LCA @ 246.35m. Cleavage: 68°/LCA @ 223m.
Mod broken above 220.6m & 240.4 -244.5m. Faults @ 240.9m (20°/LCA - same sense as bedding); & 244.25m (angle unknown).
Basal contact sharp, sl irreg, bedding 80°/LCA.

Samples: 031305 - 031315, 1.5m intervals between 219.1 - 235.5m (for assay). Results in geochem ledger at back of log.

Mineralisation: Above 235m: 2-3% sp>py>gn-aspy.
Mainly in carb±qtz sweatouts.
Locally 3-5% sulphs around 221m & 233m.
Below 235m: 1-2% py>sp>gn-aspy, dec with depth. Assoc with carb in sweatouts & lst beds.

CORE RECOVERY

555.4 - 556.7	1.3	100
556.7 - 557.75	1.05	100
557.75 - 559.5	1.75	100
559.5 - 562.45	2.95	100
END OF HOLE.		

DESCRIPTION (incl. LITHOLOGY, STRUCTURE & ALTERATION)

247.85 - 254.2m: CRYSTAL SANDSTONE

Lithology: Pale greyish-green. Med gr. Gen massive. Hard. Unbroken.
Abund densely-packed abraded feld xyl grains av 1-2mm. Much lesser qtz xyl grains av 1mm or less. In subordinate qtz >sericite-chlorite matrix.
Becoming coarser gr with depth. Some diffuse bands of silty material above internally-brecciated zone @ 249.65m.
Rare angular fi gr silic lithics to 5mm near base of unit.
Alteration: Weak-mod sericite-chlorite-silif alt (silif patchy). Rare carb.
Structure: Basal contact 65°/LCA - disrupted bedding with evidence of soft-sediment movement, incl some intraformational brecciation in basal 0.1m of sst.

Mineralisation: Minor fi gr dissem sp-py (locally 1%). Also in qtz veins. Minor fi gr dissem leucoxene - more than in units above.

254.2 - 260.6m: CALCAREOUS BLACK SHALE

Lithology: Dark grey to black, weakly carbonaceous.
Highly calcareous - basically, a carbonaceous limestone. Some silty intervals, & several feld-qtz xyl sst beds to 200mm below 256.5m.
V common irreg carb±qtz veinlets.
Structure: Finely bedded - gen fairly regular. Bedding: 67°/LCA @ 256.5m. Weak bedding-// cleavage. Sl broken by fracts.
Gradational bedding contact at base with thin regular interbeds of grey shale & xyl sst over basal 100mm. 74°/LCA.

Mineralisation: 1% py>>sp, trace gn-aspy. Patchy, conc in carb veinlets.

260.6 - 272.7m: CRYSTAL SANDSTONE

Lithology: Pale greyish-green. Med gr. Massive & unbedded. Hard.
Abund densely-packed abraded xyls, of feld (av 1-2mm, to 3mm), with lesser qtz xyl grains. In fi gr silica-sericite matrix.
Black shale band 60°/LCA @ 266.25 - 266.7m.
Even-grained, except for finer-gr sst intervals in uppermost 1m & for 0.8m above black shale band.
Alteration: Mod silica-sericite >chlorite alt. Weak-mod carb alt below 268m.
Structure: Weak cleavage, stronger in basal 2m. Unbroken.
Basal contact a 100mm very strongly cleaved zone, 55°/LCA (same sense as bedding in shale below), - an abrupt lithological change, overprinted by structural movement.

Mineralisation: Minor sp>py, locally 1% (eg: basal 1m) Dissem & in tiny carb-qtz veinlets. 1-2% persistent fine gr dissem leucoxene.

272.7 - 281.7m: CALCAREOUS BLACK SHALE

Lithology: Dark grey to black. Gen only weakly carbonaceous.
Highly calcareous, with thin beds of limestone. Several beds of sericitic feld>qtz-xyl sst, esp near base, gen < 50mm, to 130mm.
Common irreg carb ± qtz veinlets & patches.
Structure: Thinly bedded - mildly folded & deformed in places.
Bedding: 74°/LCA @ 276.7m; 50°/LCA @ 278.5m; 61°/LCA @ 280.4m.
Downhole fining in two xyl sst beds @ 278.5m.
Weak-mod bedding-// cleavage. Broken by fract almost //LCA @ 275.85 -276.25m, otherwise unbroken.
Basal contact sharp, 70°/LCA - bedding deformed by cleavage.

Samples: 031316 @ 272.7 - 273.3m (for assay).

Mineralisation: Upper 0.5m: 3% sp>py, minor gn, aspy & tourmaline - in carb-qtz veinlets & dissem. Elsewhere, 2% py & minor gn, aspy, cp & tourm - mainly in veinlets but also dissem.

281.7 - 283.3m: DISTURBED CONTACT ZONE

Lithology: Mottled pale grey & khaki. Probably a reactivated old major fault zone.
Complex intermixing of shale from unit above, & detextured-sericitised- silif-carbonatised xyl sst of unit below.
Structure: Strongly cleaved. Mod broken - v badly at faults. V strong fault 60°/LCA (// bedding in shale above) @ 281.95 -282.25m. Second fault 60°/LCA @ 283.2 -283.3m.

Mineralisation: V minor py & sp.

CORE RECOVERY From m	Interval m	%	RQD	DESCRIPTION From m	Interval m	(incl. LITHOLOGY, STRUCTURE & ALTERATION)	Depth	Graphic Lithology	Struct.	MINERALISATION	LITHO	STRUCT	ALTN	MIN
						283.3 - 302.5m: DETEXTURED QUARTZ-SERICITE-CARBONATE ROCK (PROBABLE FELDSPAR-CRYSTAL SANDSTONE)								
						Lithology: Cream, pale grey-green at depth. Massive. V hard. Uniform. A fi-med gr rock with granular nature evident below 288m. 1° texture almost totally oblit except in basal 5-10m, where unit is largely composed of densely-packed silif feldspar grains, av 1mm, rare qtz xyls & rare poss lithic clasts to 7mm. Indistinct remanent feldspars gen visible even at top of unit where detexturing strongest.				V minor finely dissem py-sp>gn. 1% v finely dissem leucoxene & titaniferous oxides.				
						Alteration: Unit detextured by strong silif & mod sericite-carb alt. Trace chlor. Some devel of crystalline 2° carb.								
						Structure: Mod cleaved (65°/LCA @ 294m). Gen unbroken. Occ small broken zones due to shears at low angle to LCA. Basal contact sharp: 5°/LCA - bedding deformed by faulting (see below). Contact first appears in core at 301.2m, - sheared 5°/LCA.								
						Samples: 031317 @ 296.25m (for Petrology).								
						302.5 -317.55m: THINLY BEDDED BLACK SHALE & GREY SILTSTONE								
						Lithology: Black to pale khaki-grey. Essentially unaltered. Above 309.4m predom black mod carbonaceous shale - sl graphitic in places. Below this mainly sl sericitic siltstone. Thin interbeds throughout of highly calcareous fi gr qtzose sst - above 309.4m these commonly highly deformed & boudinaged. Minor intervals of massive, med-coarse gr, silif, qtz-feld xyl sandstone. Abund irreg carb±qtz veinlets, esp in black shale intervals.				3% sp & py (varies 1% to +5%). minor gn-aspy-cp. Sulphides fi gr, mainly in carb veinlets & dissem in deformed calc sst. Occ as thin massive py veinlets.				
						Structure: Bedding gen deformed above 313.5m, with some folding, pull-aparts & off-sets across fracts. Bedding regular at base. Bedding: 45°/LCA @ 307.5m; 50°/LCA @ 315.5m. Up-hole fining in sst @ 314m; downhole-fining in sst @ 316.5m (fold nose evident @ 314.5m). Occ broken zones above 313.25m, assoc with faults.				Minor fine detrital leucoxene in sst - some in layers.				
						Strongest faults: Broken qtz-carb veined zone immediately beneath upper contact @ 302.65 -303m: 20°/LCA (sub-// contact). 310.5 -311.3m: Major fault, 10°/LCA - lithified carb-cemented fault breccia suggests fault is old. Bedding beneath fault pulled in // to it. Basal contact sharp - normal bedding plane 60°/LCA.				303.55 - 304.25m: 5 -7% fi gr light brown sp & minor py-gn, as diffuse stringer-like replacements of matrix in fine xyl sst band.				
						Samples: 031318 - 031327; 0.7 to 2m intervals 302.5 - 317.65m.								
						317.55 - 333.45m: MASSIVE QUARTZO-FELDSPATHIC SANDSTONE								
						Lithology: Greenish-grey. Med gr. V uniform. Hard. Composed of densely-packed gen-abraded, quartz & feldspar xyl grains, av 1mm or less, occ to 2mm, in v subordinate matrix of chlorite & carbonate. Unbedded & gen even-grained, but minor variations in grainsize reflect diffuse layering. At 323.75 - 324.25m & 331 - 332.6m: grey, partly-calcareous siltstone/shale rip-ups, angular & often irreg, from 5 -60mm. Larger clasts surrounded by 10 -20mm bleached carbonate reaction rim.				Minor to 1% sp>py, gen dissem, some in carb veinlets. 5% sp-py, in uppermost 0.1m, & patches of 2-3% sp>py in basal 2m.				
						Alteration: Mod-strong carbonitisation, weak chloritisation. Rare patches of silif.								
						Structure: Bedding in 80mm siltstone band @ 320.3m: 64°/LCA. Ditto @ 332.15m: 66°/LCA (25mm band). Unbroken. Uncleaved. Basal contact a bedding plane, 68°/LCA. Basal 20mm of sst is sl finer gr.				1-2% fi gr dissem leucoxene				

PASMINCO EXPLORATION
DIAMOND DRILL CORE LOG

PROJECT BASTYAN DAM, MT BLACK EL 12/88

Graphic Scale 1 :

CORE RECOVERY				DESCRIPTION						MINERALISATION	CODES			
From m	Interval m	%	RQD	From m	Interval m	(incl. LITHOLOGY, STRUCTURE & ALTERATION)	Depth	Graphic Lithology	Struct.		LITHO	STRUCT	ALTN	MIN

333.45 - 335.2m: HIGHLY CALCAREOUS CARBONACEOUS SHALE

Lithology: Dark grey - only sl carbonaceous. Carb content dec with depth - in upper half unit contains abund thin beds (< 1mm) of carbonate.
Numerous carb veins & veinlets throughout.
Structure: Fine & regularly bedded, 70°/LCA. Unbroken.
Basal contact sharp - bedding 85°/LCA, with calcite veinlet on it.

Samples: 031328 @ 333.45 - 334.5m (Assay).
031329 @ 333.9m (Petrology).

Mineralisation: To 334.5m: Minor to 1% py-sp, trace gn-aspy-cp, dec with depth. Mainly in tiny sulphide veinlets or in carb veinlets.

335.2 - 408.15m: VARIABLE SEQUENCE OF CRYSTAL SANDSTONE, QUARTZO-FELDSPATHIC SANDSTONE, CALCAREOUS CARBONACEOUS SILTSTONE/SHALE & MINOR LIMESTONE

Lithology: Creamy-fawn or creamy-green, with dk grey & black siltstone/shale bands. Hard.
Highly variable, fine to coarse gr, gen carbonate-bearing (both calcareous & dolomitic), sedimentary sequence.
To 366m: predom massive sst with minor shale.
Below 366m: 50% sst, 50% siltst/shale, thinly interbedded with common soft-sed deformation of siltst/shale beds & numerous rip-ups of same in sst. Siltst/shale >> sst below 400m.
Two interbedded sst types:
a) Qtzo-feldspathic sst: densely-packed abraded feld & qtz grains (av 1mm), & minor sub-rounded lithics (1-5mm), in v subord carb or chlor matrix. Minor grainsize variations (diffuse bedding). Uncleav. Atypical of sst in Rosebery HW, & poss the reworked equiv of b).
b) Xyl sst: strongly-silif (no carb), partly-detextured & weakly-cleaved, feld >qtz xyl sst, (xyls av 1-2mm, qtz occ to 4mm). Xyls packed but gen euhedral, esp feld. Minor angular or subangular lithics av <5mm.
Grey limestone 387.5 - 390.5m. At 366 - 366.5m, 376.1 - 377m, & 398.1 - 398.7m, diffuse bands of stretched-pebble limestone conglomerate (cream to grey lst clasts typically 30 - 50mm long & 10mm wide, in sst matrix). Lst clasts commonly have bleached reaction rims.
Alteration: Patchy strong silif (+ weak sericte-chlorite-bleach alt). Silif ubiquitous in the xyl sst. No silif of siltstone/shale bands, & only minor patchy silif of quartzo-feldspathic sst.
In places qtzo-feld sst matrix (& some felds) replaced by bright green clayey chlorite (colour due to trace amounts of fuchsite ?). This commonly seen immediately downhole of shale bands, suggesting ponding of alteration fluid. This alteration best developed in uppermost sst interval @ 336.2 - 340m, which is also notable for several % dissem leucoxene. Also seen 371-373m.
Numerous veins, veinlets & patches of carb±qtz (both calcite & dolomite).
Structure: Gen unbroken. Cleavage gen weak or absent.
Bedding: 66°/LCA @ 344m; 80°/LCA @ 355.65m; 66°/LCA @ 366.7m; 75°/LCA @ 375m & 386.4m; 65°/LCA @ 401.5m.
Up-hole fining in sst @ 342.5 - 343.45m & 348.6 - 349m. Down-hole fining in base of sst @ 355.6m.
Up-hole facings at 366.7, 367m, 374.45m, 375.1 - 375.5m & 404.8m (grading, scour & fill features, flame structures). Fold nose 405.65 - 406.2m.
344.05 - 344.25m: unbroken lithified major fault breccia 65°/LCA (same sense as bedding), with cement of silica-carbonate containing disoriented frags of cleaved xyl sst (ie: fault post-cleav).
Fault 75°/LCA @ 356.95m (sense unknown).
Basal contact sharp & unbroken, 60°/LCA (deformed bedding - basal 200m m of unit is highly deformed due to movement along contact zone).

Samples: 031330 @ 336.9m (Petrology & X-Ray). 031332 @ 383m (Petrology).
Assay samples: 031331, 031333 - 031344, (see geochem ledger).

Mineralisation:

To 366m: trace dissem sp-py.
366 - 366.5m: 3-4% dissem py-sp >gn-aspy-tet, in lst cong
366.5 - 375m: 1-2% py>sp>gn-aspy, dissem & in qtz-carb veins. Trace tourmaline & assoc po.
375 - 376.1m: 3-4% sp>py>aspy-gn, mainly dissem in carb sst bands.
376.1 - 377m: (lst cong) 2-3% py-sp & minor aspy & po (latter in massive clots to 30x10mm with rims of tourm & trace assoc cp).
377 - 387.5m: Minor to 1% py>sp
387.5 - 390.5m: (lst) 1-2% py-sp>aspy-po. Mainly in carb veinlets.
390.5 - 398.1m: Minor py-sp-aspy.
398.1 - 398.7m: (lst breccio-cong) 1-2% sp>py-aspy, dissem.
398.7 - 403.75m: Minor to 1% py-sp>aspy.
403.75 - 405m: 1-2% sp>po-py-aspy, mostly in carb veinlets & patches.
405 - 408.15m: Minor to 1% py-po-sp>aspy.

Minor to 2% leucoxene >titanif oxides as fine dissem - sometimes bedded, esp in carbonate-rich qtzo-feld sst.

CORE RECOVERY				DESCRIPTION							CODES			
From m	Interval m	%	RQD	From m	Interval m	(incl. LITHOLOGY, STRUCTURE & ALTERATION)	Depth	Graphic Lithology	Struct.	MINERALISATION	LITHO	STRUCT	ALTN	MIN
						408.15 - 507.3m: GRANULAR SILICA-SERICITE-CARBONATE ROCK AFTER SILICIFIED & DETEXTURED CRYSTAL-LITHIC SANDSTONE								
						Lithology: Creamy-grey or fawn. Hard. Massive. Med gr. Uniform. Gen unbroken. 1° texture largely oblit by silif & assoc detexturing, but clear evidence orig rock type is a feld>qtz-xyl sst containing scattered small lithics. No obvious layering - sl variations in grainsize (eg: upper 5m is finer gr). Alt & detexturing inc below 470m. Rock composed of abund (gen indistinct) felds & lesser qtz xyls, av 1mm or less, to 2mm max, in subord matrix of silica>sericite>carbonate (dolo). Some of the qtz xyls show signs of abrasion. Scattered angular or subang (occ subrounded) lithic frags throughout, av <6mm, to 20mm. Tending to become larger & more numerous with depth. Lithics predom grey silif feld-phyric lava, often pyritic. 15mm clast of amygdaloidal lava @ 486.85m. Zones with fine pumice frags below 450m.				Trace pyrite - conc in lava lithics. Minor to 1% dissem leucoxene.				
						Alteration: Mod-strongly silif, inc with depth. Mod sericitised & bleached (both stronger approaching fault at base); weakly chloritised in uppermost 20m. Trace albitisation, esp 448 -456m. Rare fuchsite @ 455m - 463m & 482 -483m. Rock contains much dispersed dolomite (1° or alteration?), & abund irreg carb (calcite & dolomite) veinlets & occ qtz-carb veins.								
						Structure: Weakly cleaved: 55°/LCA @ 421.5m; 45°/LCA @ 454.5m; 65°/LCA @ 468m, 481.5m & 501.5m. Major faulted zone 439 -445m (badly broken), with major faults @ 439 -439.7m (45°/LCA?, centered on 300mm crushed zone at top); & @ 444.55 - 444.6m, 55°/LCA. Occ lithified breccia zones (esp below 480m) - probably old structures. Basal 5m (unbroken) is highly deformed & retextured fl gr qtz-sericite-carbonate cataclasite. Sharp contact to fault zone proper, 50°/LCA.								
						Samples: 031345 @ 431.75m (Petrology). 031346 @ 422.75m (W.R. geochem). 031347 @ 477.7m (Petrology). 031348 @ 476.4m (W.R. geochem).								

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PASMINCO EXPLORATION
DIAMOND DRILL CORE LOG

HOLE No. BY1

PROJECT BASTYAN DAM, MT BLACK EL 12/88

Graphic Scale 1:

CORE RECOVERY				DESCRIPTION						MINERALISATION	CODES			
From m	Interval m	%	RQD	From m	Interval m	(incl. LITHOLOGY, STRUCTURE & ALTERATION)	Depth	Graphic Lithology	Struct.		LITHO	STRUCT	ALTN	MIN

507.3 - 508.55m: ROSEBERY FAULT

Lithology: Creamy-grey. Mod broken - badly broken in places above 508m.
Centered on 300mm of highly crushed & milled rock 507.4 - 507.7m.
Lithologically, a deformed & partly brecciated mixture of silica-sericite rock from the silif detextured unit above, & black or grey sericitic shale & qtzose sst from unit below.
Upper unit rocks dominate above 508m & lower unit lithologies below this.
Structure: Shear planes/cleavage/deformed beds, all oriented 65 -75° /LCA, with most 65 -70°/LCA.
Basal limit to zone crenulated, approx 65°/LCA.

Mineralisation: 1% pyrite, patchy dissem. Trace gn>sp.

508.55 - 553.6m: HIGHLY DEFORMED BLACK GRAPHITIC SHALE (CHAMBERLAIN SHALE)

Lithology: Black & grey. Highly deformed & cleaved black graphitic shale with abund deformed, pulled-apart & brecciated thin interbeds of carb-cemented qtzose siltstone/fine sst.
Common tiny veinlets of carb & occ veins of qtz-carb.
Structure: Bedding: 60°/LCA @ 528.3m; 55°/LCA @ 542.3m;
Below 521m gen mod broken, with badly broken zones @ 524.1 -525.6m; 536.5 -538m; 544.6 -548m (v badly broken).
Some tight folding & local crenulation of cleavage, esp adjacent to faults. Cleavage (bedding-//): 70°/LCA @ 510.8m & 518m; 75°/LCA @ 539.5m; 60°/LCA @ 551.7m;
Major faults (angle unknown) @ 544.65 - 545.45m, 547.2 - 548.1m, & 549.2 - 549.3m (all part of one major faulted zone).
Numerous smaller faults, shears & fractured zones throughout.
Basal contact sharp - deformed bedding (cleavage), 45°/LCA.

Samples: (For assay): 031349 @ 512.5 - 513.5m; 031350 @ 513.5 - 515m; 031351 @ 516.7 - 518.8m; 031352 @ 520 - 521m.

Mineralisation: Shale variably pyritic, dec with depth
Mainly as irreg patches & thin bands of ultra-fi gr py, after smeared & deformed thin beds of massive syngenetic py.

508.55 - 526m: 2-3% py, locally 10 -15%,
(best zones: 512.5 - 515m: 5% py; 516.7 - 518.8m: 5 - 7%py; 519.9 - 522.4m: 3 -5% py).
526 - 534m: 1-2% py.

Below 534m, minor to 1% py.

PASMINCO EXPLORATION
DIAMOND DRILL CORE LOG

HOLE No. BY 1

PROJECT BASTYAN DAM, MT BLACK EL 12/88

Graphic Scale 1 :

CORE RECOVERY				DESCRIPTION							CODES			
From m	Interval m	%	RQD	From m	Interval m	(incl. LITHOLOGY, STRUCTURE & ALTERATION)	Depth	Graphic Lithology	Graphic Struct.	MINERALISATION	LITHO	STRUCT	ALTN	MIN
						553.6 - 562.45m: QUARTZOSE SANDSTONE (STITT QUARTZITE) Lithology: Grey. Massive fine qtz sst with numerous highly deformed black shale interbeds. Sst silif & v hard, shale soft. Common carb & qtz veins & veinlets. Structure: Bedding: 52°/LCA @ 555m; 58°/LCA @ 559m; 50°/LCA @ 562.4m. Cleavage weaker than in unit above. Badly broken 556.7 -558m, around major fault @ 557.4m with 150mm of carb-cemented fault breccia, 40°/LCA. Sl broken elsewhere.				Trace dissem py.				
						END OF HOLE								

PASMINCO EXPLORATION
DIAMOND DRILL CORE ASSAY DATA

PROJECT BASTYAN DAM, MT BLACK EL 12/88

HOLE No. BY1

SAMPLE						ASSAYS (ppm unless specified)							COMMENTS
Number	Type	From m	To m	Interval m	Recovered m	Cu	Pb	Zn	Ag	Au	Ba	As	
031305	SPLIT NQ	219·1	220·5	1·4		35	15	2550	<1	0·02	910	200	BLACK SHALE
031306	" "	220·5	222·0	1·5		25	5	3550	<1	0·025	910	230	" "
031307	" "	222·0	223·5	1·5		30	10	4700	<1	0·02	780	230	" "
031308	" "	223·5	225·0	1·5		15	5	1900	<1	0·02	900	200	" "
031309	" "	225·0	226·5	1·5		30	10	6200	<1	0·025	830	190	" "
031310	" "	226·5	228·0	1·5		30	190	5900	<1	0·025	820	220	" "
031311	" "	228·0	229·5	1·5		20	25	2350	<1	0·02	800	260	" "
031312	" "	229·5	231·0	1·5		20	30	5800	1	0·02	810	170	" "
031313	" "	231·0	232·5	1·5		50	95	8700	<1	0·03	810	170	" "
031314	" "	232·5	234·0	1·5		80	15	6250	<1	0·03	800	240	" "
031315	" "	234·0	235·5	1·5		45	10	2000	<1	0·02 0·04	820	200	" "
031316	SPLIT NQ	272·7	273·3	0·6		45	190	2050	1	0·025	920	110	BLACK SHALE
031318	SPLIT NQ	302·5	303·55	1·05		45	60	910	1	0·01	780	220	BLACK SHALE
031319	" "	303·55	304·25	0·7		20	30	500	<1	0·025	850	52	SANDSTONE
031320	" "	304·25	305·5	1·25		30	55	1250	<1	0·015	1050	130	BLACK SHALE
031321	" "	305·5	307·0	1·5		45	340	1450	1	0·025	1050	260	" "
031322	" "	307·0	309·0	2·0		50	335	2200	2	0·035	990	240	" "
031323	" "	309·0	311·0	2·0		5	35	175	<1	0·015	700	19	FAULT ZONE
031324	" "	311·0	313·0	2·0		25	105	1450	1	0·01	1400	130	SILTSTONE
031325	" "	313·0	315·0	2·0		60	480	3750	1	0·02	1450	240	" "
031326	" "	315·0	316·5	1·5		55	515	2000	1	0·01	1480	86	" "
031327	" "	316·5	317·65	1·15		55	270	4350	1	0·025	1200	32	" "
031328	SPLIT NQ	333·45	334·5	1·05		55	560	3650	2	0·01	1200	130	CARBONACEOUS LIMESTONE
Laboratory ANALABS, CBEE				Analytical Method		AAS	AAS	AAS	AAS	F/A	XRF	HYDRIDE	
Job No. 0152; 0153		Date FEB/APRIL 1991		Detection Limit		2	5	2	1	0·008	10	1	

PASMINCO EXPLORATION
DIAMOND DRILL CORE ASSAY DATA

PROJECT BASTYAN DAM, MT BLACK EL 12/88

HOLE No. BY1

SAMPLE						ASSAYS (ppm unless specified)														COMMENTS
Number	Type	From m	To m	Interval m	Recovered m	Cu	Pb	Zn	Ag	Au	Ba	As								
031331	SPLIT NQ	366.0	366.5	0.5		105	1150	2.14%	5	0.01	600	1100								LIMESTONE CONGLOMERATE
031333	" "	366.5	368.0	1.5		25	170	2050	1	<0.008	1600	86								CARBONATE SANDSTONE
031334	" "	368.0	369.5	1.5		15	50	1250	<1	<0.008	1450	37								" "
031335	" "	369.5	371.0	1.5		10	35	430	<1	<0.008	1100	41								" "
031336	" "	371.0	373.0	2.0		10	30	270	<1	<0.008	960	34								" "
031337	" "	373.0	375.0	2.0		45	540	7250	1	0.015	1500	300								" "
031338	" "	375.0	376.1	1.1		20	230	2050	1	<0.008	1050	160								" "
031339	" "	376.1	377.0	0.9		25	85	775	1	<0.008	610	27								LIMESTONE CONGLOMERATE
031340	" "	377.0	378.5	1.5		10	35	740	<1	<0.008	1400	86								CARBONATE SANDSTONE
031341	SPLIT NQ	387.5	389.0	1.5		45	25	530	1	<0.008	890	75								LIMESTONE
031342	" "	389.0	390.5	1.5		50	250	1900	1	0.025 0.015	960	130								" "
031343	SPLIT NQ	398.1	398.7	0.6		25	40	4900	<1	0.025	440	700								LIMESTONE BRECCIO-CONGLOMERATE
031344	SPLIT NQ	403.75	405.0	1.25		30	90	930	1	0.01	1000	120								CALCAREOUS SILTSTONE/SHALE
031349	SPLIT NQ	512.5	513.5	1.0		20	50	30	3	0.015	740	100								BLACK SHALE WITH 5-7% PYRITE
031350	" "	513.5	515.0	1.5		20	55	20	4	0.01	770	93								" " " " " "
031351	SPLIT NQ	516.7	518.8	2.1		20	50	25	2	0.01	770	87								BLACK SHALE WITH 5-7% PYRITE
031352	SPLIT NQ	520.0	521.0	1.0		20	55	25	2	0.01 0.01	730	70								BLACK SHALE WITH 5-7% PYRITE
Laboratory ANALABS, COBEE				Analytical Method		AAS	AAS	AAS	AAS	F/A	XRF	HYDRIDE								
Job No. 0153; 0155		Date APRIL 1991		Detection Limit		2	5	2	1	0.008	10	1								

PASMINCO EXPLORATION

DIAMOND DRILL CORE ASSAY DATA

T900

PROJECT BASTYAN DAM, MT BLACK EL 12/88

HOLE No. BY1

SAMPLE

Number	Type	From m	To m	Interval m	Recovered m
031301B	SPLIT NQ	153.25	153.95	0.7	0.7
031304	" "	209.9	210.45	0.55	0.55
031346	NQ CORE	422.65	422.85	0.2	0.2
031348	" "	476.3	476.55	0.25	0.25
84055B	SPLIT NQ	21.4			

ASSAYS (ppm unless specified) (→ % from Al_2O_3)

Number	Cu/Pb	Zn/Ag	V	As	Rb	Sr	Y	Zr	Nb	Ba	Al_2O_3	SiO_2	TiO_2	Fe_2O_3	MnO	CaO	K_2O	MgO	P_2O_5	Na_2O	SO_3	COMMENTS
031301B	2/<1	53/<0.1	5	<3	110	150	31	170	11	870	16.42	68.8	0.22	3.05	0.07	0.32	2.98	2.12	0.039	3.01	<0.01	RHYOLITE LAVA IN HW EPICLASTICS
031304	5/18	100/<0.1	15	<3	100	160	45	280	15	750	13.56	71.0	0.37	2.14	0.12	2.40	2.35	0.93	0.057	3.10	0.11	CRYSTAL SST IN HW EPICLASTICS
031346	5/4	39/<0.1	48	7	120	200	45	310	12	890	15.57	63.3	0.65	3.94	0.16	2.43	2.80	1.68	0.126	4.08	0.12	DETEXTURED VOLCANICLASTIC SST?
031348	8/3	19/<0.1	52	<3	170	170	42	350	15	980	17.87	63.6	0.74	1.98	0.13	2.01	3.63	1.22	0.143	4.11	0.09	" " " ?
84055B	9/4	106/<0.1	7	16	140	90	34	280	18	580	13.94	69.7	0.31	3.13	0.25	2.09	3.13	0.76	0.045	2.70	0.07	AMYGDALOIDAL DACITE IN MT BLACK VOL[illegible]

Laboratory ANALABS

Job No. 0157 **Date** 22.4.91

	Cu/Pb	Zn/Ag	V	As	Rb	Sr	Y	Zr	Nb	Ba	Al_2O_3	SiO_2	TiO_2	Fe_2O_3	MnO	CaO	K_2O	MgO	P_2O_5	Na_2O	SO_3
Analytical Method	AAS	AAS	XRF	XRF	XRF	XRF	XRF	XRF	XRF	XRF	XRF	XRF	XRF	XRF	XRF	XRF	XRF	XRF	XRF	AAS	XRF
Detection Limit	1	1/0.1	5	3	5	5	4	5	3	10	0.05	0.1	0.01	0.01	0.01	0.01	0.01	0.01	0.005	0.01	0.01

T90062

PASMINCO EXPLORATION
DIAMOND DRILL CORE LOG
PETROLOGICAL DESCRIPTIONS

PROJECT: BASTYAN DAM, MT BLACK EL 12/88

HOLE No. BY 1

Graphic Scale 1:

84055A BY1, 21.4m.

This sample consists of subhedral phenocrysts of plagioclase (1 - 2 mm) in a fine recrystallised groundmass of quartz and feldspar, with minor Fe oxides and a trace of pyrite. The rock has a pervasive 'dusting' of fine sericite which partially obscures many of the textures, particularly of the groundmass. In addition to the plagioclase phenocryst the rock contains abundant round vesicles (0.5 - 2 mm) which are filled by chlorite, quartz and carbonate. Where present, the carbonate typically occurs in the core of the vesicles.

The thin section is also cut by several narrow veins of carbonate and a relatively thick (8 mm) vein of quartz and carbonate. Nevertheless the principal alteration of the groundmass and plagioclase phenocrysts has involved the pervasive development of sericite which does not exhibit any preferred orientation.

The presence of abundant vesicles and the even distribution of phenocrysts is consistent with the interpretation that this sample represents a lava flow. However, it does not exclude the possibility of a shallow intrusive origin. The predominance of plagioclase phenocrysts, and lack of quartz phenocrysts, together with the relatively silicic groundmass suggests a dacitic composition.

031301A BY1, 153.75m.

This rock consists of abundant anhedral to subhedral quartz phenocrysts many of which are partially resorbed and embayed, and subhedral phenocrysts of feldspar which are largely replaced by fine sericite and patches of carbonate. The groundmass is composed of fine grained quartz, feldspar, sericite and chlorite with minor disseminated Fe oxides.

The fine-grained silicic groundmass contains relict spherulites (~ 0.05 mm diameter) some of which have only been weakly recrystallised.

The alignment of sericite depicts one major cleavage with a weak second cleavage developed approximately 90° to the principal one. There is also some minor patchy development of carbonate in the groundmass and several narrow cross-cutting chlorite-quartz veins.

The general textural features of this rock indicate it was extruded as a lava and quenched forming a glassy groundmass which ultimately devitrified forming spherulites. The presence of delicately resorbed phenocrysts which are often unbroken further supports a relatively non-violent effusive mode of emplacement.

The rhyolitic lava has been subjected to moderate hydrothermal alteration resulting in the development of abundant sericite and chlorite in the groundmass and sericite replacing feldspar phenocrysts. Subsequent deformation has produced at least two distinct cleavages.

031302 BY1, 185.9m

This sample is a clastic rock composed of a variety of relatively fine grained pumice material. The most obvious clasts are elongate tubular pumice fragments about 0.5 2.0 mm long which display variable orientation of flow-aligned tubular vesicles. The original vesicular character has been pseudomorphed by addition of silica, and highlighted by alternating thin parallel layers of sericite and minor chlorite. Some fragments contain sparse subhedral plagioclase phenocrysts (up to 0.5 mm long) which typically exhibit only minor carbonate or sericite alteration.

The matrix between the pumice fragments appears to be dominated by fine recrystallised quartz, feldspar, sericite and minor chlorite. The sericite and chlorite define two principal cleavages which are at a relatively high angle to each other.

Much of the fine-grained quartzo-feldspathic material in the matrix was probably originally fine ash or smaller unwelded pumice fragments.

There are some very fine-grained disseminated Fe oxides in the groundmass and some associated with a late cross-cutting quartz-chlorite-rich vein.

There is a small amount of carbonate throughout the matrix and several late cross-cutting veins of carbonate and quartz with minor chlorite.

The textures of this specimen are most consistent with it being a volcaniclastic which may have been deposited as some sort of pumiceous mass-flow deposit. The pumice was clearly solidified at the time of deposition as indicated by their variable orientation, and there is no evidence of welding in this section.

The rock has experienced weak sericite-chlorite-carbonate alteration and subsequent deformation has resulted in two very weak cleavages. The presence of sparse plagioclase phenocrysts in a dominantly silicic groundmass implies a dacitic composition.

031303 BY1, 204.3m.

This sample is similar to 031302 in that it is composed of abundant tubular pumice fragments. However, the fragments in this sample are generally larger (0.5 - 4.0 mm) and the proportion of silicic matrix appears to be somewhat less.

The strongly flow-banded pumice fragments are composed of very fine-grained recrystallised quartz-rich bands which alternate with chlorite- and sericite-rich layers.

The matrix consists of abundant very fine-grained recrystallised quartz and feldspar with chlorite-rich patches some of which have a 'shard-like' form. The latter probably represent original glassy fragments which have been partly broken up during transport and deposition. However, many have quite open structures and exhibit no evidence of flattening. There are very sparse examples of subhedral plagioclase phenocrysts which have been substantially replaced by sericite. However, sericite alteration throughout the sample is comparatively weak and tends to be concentrated around clast margins.

The matrix contains patchy carbonate alteration with one very large patch within the field of the thin section examined. There are also a number of late cross-cutting veins composed of quartz-chlorite and carbonate. These are sometimes zoned from chlorite at the margin to carbonate and quartz in the interior. There is magnetite, sphene and a trace of pyrite disseminated throughout the matrix.

This rock has very similar components to 031302 and probably has a similar broadly dacitic composition. General textural features also imply a similar mode of origin and deposition — probably some sort of pumiceous mass-flow deposit.

031317 BY1, 296.25m.

This sample is also a clastic rock although the similar textures in many of the clasts and matrix tends to obscure clast boundaries. Clasts are typically rounded and vary from 0.5 to > 6 mm in size, the larger of these being distinguished by the presence of cross-cutting quartz veins which end at the clast margins. Other clasts are distinguished by slightly coarse-grained recrystallised quartz-feldspar-rich assemblages. The matrix is very fine-grained and also dominated by quartz and feldspar with variable fine sericite, chlorite and carbonate. Subhedral plagioclase phenocrysts occur in some of the clasts but the quartz phenocrysts are absent suggesting a broadly dacitic composition. The alteration is patchy but locally quite strong resulting in overprinting of the original textures and substantial replacement of the plagioclase phenocrysts by sericite and carbonate. The sericite alteration exhibits a weak cleavage. Patchy carbonate alteration also locally results in virtually complete replacement of the silicic volcanic fragments. Aggregates of pyrite are disseminated throughout the rock but most frequently appear to be associated with the most intense patches of carbonate alteration.

This sample displays clear evidence of a clastic origin and the lithic fragments appear to be mainly of the same broad silicic (dacitic) volcanic composition. The fine silicic matrix may represent a fine ash component associated with the eruption of these silicic volcanics and both these components were probably deposited in some sort of slumping or mass-flow event.

031329 BY1, 333.9m.

The fine scale laminations apparent in handspecimen reflect primary bedding layers which are relatively rich in quartz or carbonate. The relatively quartz-rich layers occur on the scale of 0.1 - 1.0 mm thick and consist of grains of quartz (0.02 mm), relatively coarse-grained carbonate and minor sericite. The carbonate-rich layers consist of the same phases but detrital quartz grains are more widely dispersed. Fine-grained stringer-like aggregates of of pyrite are disseminated throughout the rock. Some pyrite aggregates run parallel to bedding and are restricted to specific layers.

In addition the sample is traversed by relatively late veins (0.2 mm wide) of recrystallised carbonate, quartz, pyrite and hematite. Several anhedral aggregates of hematite exhibit narrow overgrowths of magnetite ? probably reflecting changing fO_2 conditions. The veins are zoned from quartz at the margins to carbonate and magnetite in the interiors. Magnetite stringers appear to extend from these cross-cutting veins out along specific quartz-carbonate-rich layers.

The regular variations in mineralogy between specific bedding layers suggest that the carbonate in this rock is primary and that it represents an impure limestone. Fine detrital quartz and clay minerals (now sericite) were also being deposited at the same time as the carbonate giving rise to the rhythmic banding.

Perhaps during folding, fracturing of the rock provided pathways for fluids which resulted in the remobilisation of carbonate and quartz. Iron also carried by later fluids has reacted with the carbonate host precipitating hematite and pyrite.

PETROLOGICAL DESCRIPTIONS

031330 BY1, 336·9m.

This sample consists of very angular quartz grains, some very fine-grained silicic lithic fragments and abundant chlorite pseudomorphs probably after ferromagnesian phases, set in a fine-grained silicic matrix. The chlorite pseudomorphs have a prismatic form which suggests hornblende (this is the green clayish alteration mineral noted in your letter). There is also a trace of detrital zircon and disseminated Fe oxides. A considerable portion of the matrix has also experienced alteration to sericite with subordinate carbonate.

The section is traversed by several large veins (1.0 mm - 10 mm wide) which are composed almost entirely of coarse-grained quartz and carbonate.

This rock appears to be clastic in origin with a polymodal source contributing angular quartz, rounded fine-grained silicic lithic fragments (these may have been silicic volcanic glass), and also an abundant detrital mafic phase (hornblende ?) which has subsequently been altered to chlorite.The matrix appears to be recrystallised fine silicic material probably after volcanic ash. Following deposition, the rock was subject to hydrothermal alteration which resulted in partial replacement of the matrix and chlorite pseudomorphs by sericite.

031332 BY1, 383m.

In hand specimen this sample includes a fine-grained dark portion (siltstone) which exhibits a sharp contact with a relatively coarse-grained light coloured 'sandy' portion. The fine-grained portion is dominated by fine sericite and chlorite with dispersed fine angular grains of quartz, and minor sphene, Fe oxides and a trace of pyrite. In addition, there is a significant proportion of relatively large (0.1 mm) rhombic porphyroblasts of carbonate (dolomite) scattered throughout this layer.

The relatively coarse-grained material adjacent to the fine calcareous siltstone layer displays some igneous textural features. It is composed of medium-grained (0.5 - 1.5 mm) interlocking tabular crystals of plagioclase with subordinate interstitial quartz. This material has been cross-cut by later veins rich in quartz and carbonate that also contain accessory Fe oxides and ?rutile. The veins appear to have experienced weak thermal metamorphism which has produced some annealing of the carbonate (incipient triple junctions) and to a lesser extent, quartz.

The relatively coarse-grained igneous textured plagioclase has been partly replaced by carbonate associated with vein development,. and it is possible that the carbonate in the siltstone layer also originated principally from the vein-related fluids as quartz-carbonate-rich veins also cross-cut that layer.

The thin section examined traverses the contact between a weakly metamorphosed siltstone unit and what appears to be a narrow intrusive porphyrite (andesite?) dyke. Examination of the core indicates that the 'dyke' varies somewhat in width and is transgressive to the apparent bedding/cleavage orientations. The major problem with the interpretation that it represents a dyke is the relatively coarse grain size and apparent lack of a chilled margin against the siltstone. The alternative interpretation is that this layer represents a thin sandy unit rich in plagioclase feldspar. As many of the grain boundaries in the thin section examined are obscured by carbonate alteration, it is conceivable that the interlocking textures observed were within a lithic clast. It should be fairly obvious from an examination of the core either side of this sample as to which of these alternatives seems more reasonable.

The lithological character of 031330 and 031332 are broadly compatible with these samples being part of the Dundas Group. However, my knowledge of the Dundas sediments is not broad enough to provide a definite confirmation.

031345 BY1, 431·75m.

Clastic textures are also difficult to distinguish in this sample due to similar clast and matrix compositions, together with the obscuring effects of quite strong sericite and carbonate alteration. Rounded clasts of recrystallised silicic volcanic material appear to be about 0.5 to 1.5 mm diameter. These appear to be slightly coarser-grained than the matrix and less altered.

Abundant relatively large (0.5 - 3 mm) subhedral plagioclase crystals appear to be scattered throughout the fine-grained silicic groundmass. Some of these may in fact be within silicic clasts but the extensive nature of the alteration makes this impossible to ascertain. The feldspars are extensively sericitised and also partially altered to carbonate, and some (least altered) samples have altered cores with a later unaltered overgrown rim. Although widespread, the sericitic alteration does not define a cleavage. Patchy carbonate alteration occurs throughout the matrix and clasts. Carbonate also appears to be commonly remobilised into later fractures where it is associated with quartz and chlorite. Aggregates of sphene with associated fine needles of ?rutile are distributed throughout the rock together with zircon and Fe oxides.

This sample appears to be a volcaniclastic rock with a dacitic composition. It has some similarities to 031317 but contains a greater proportion of plagioclase phenocrysts. The extensive nature of the sericite (and carbonate) alteration has obscured many of the critical textural features of the rock.

031347 BY1, 477·7m.

This sample is very similar to 031345 but is less altered. It contains the same array of relatively coarse-grained recrystallised silicic and feldspar-bearing clasts in a very fine-grained quartz-feldspar-rich matrix. It also contains abundant subhedral to angular (broken) plagioclase crystals within the matrix. The relative abundance of feldspar crystals is more typical of an epiclastic rock than primary igneous rocks, as they become concentrated in the former due to sorting processes.

All of the feldspar crystals show extensive sericite (and carbonate) alteration, with occasional unaltered overgrowths. In contrast, the fine-grained matrix is only weakly altered in general, although there are several patches of more intense sericite and carbonate alteration. The rock contains no quartz in the form of phenocrysts either in clasts or reworked in the matrix, but fine-grained quartz is abundant and it also occurs in narrow cross-cutting veins.

Throughout the matrix there occur segregations of accessory phases including sphene, zircon, secondary Fe oxides, minor pyrite and a brownish, very fine grained, high relief phase which occurs as stumpy prismatic crystals or bundles of fine acicular crystals. This may be rutile (or possibly cassiterite) but definite identification would require a microprobe analysis.

This sample has similar composition and textures to 031345 and implicitly a similar origin as a submarine mass-flow deposit. Both 031347 and 031345 are similar to the Rosebery footwall rocks in that they represent plagioclase-phyric volcaniclastics rich in lithics, and do not contain any quartz phenocrysts.

APPENDIX 2

SG MEASUREMENTS &
MAGNETIC SUSCEPTIBILITY READINGS
ON BY1 DRILL CORE

S G READINGS

DDH No	DEPTH (m)	DRY weight (gm)	WET weight	Volume (cc)	S G	Comment
BY 1	20.80	1083	—	407	2.66	Whole HQ core
	40.70	559	—	225	2.48	" "
	65.30	935	—	345	2.71	" "
	80.20	880	—	323	2.72	" "
	100.00	1289	—	473	2.73	" "
	114.70	696	—	259	2.69	" "
	139.12	891	—	327	2.72	" "
	164.00	648	—	252	2.57	Whole NQ core
	176.00	617	—	226	2.73	" "
	197.00	518	—	191	2.71	" "
	222.00	676	—	244	2.77	" "
	240.00	786	—	278	2.83	" "
	254.00	694	—	256	2.71	" "
	270.00	892	—	324	2.75	" "
	290.00	674	—	247	2.73	" "
	307.00	664	—	235	2.83	" "
	320.00	817	—	294	2.78	" "
	340.00	553	—	207	2.67	" "
	360.00	607	—	218	2.78	" "
	380.10	538	—	194	2.77	" "
	400.15	461	—	162	2.85	" "
	419.85	722	—	264	2.73	" "
	446.00	432	—	157	2.75	" "
	460.00	502	—	183	2.74	" "
	480.00	896	—	328	2.73	" "
	500.00	417	—	150	2.78	" "
	520.00	509	—	183	2.78	" "
	540.00	777	—	276	2.82	" "
	560.50	899	—	325	2.77	" "

END OF HOLE

Pg 1

MAGNETIC SUSCEPTIBILITY READINGS

DDH No	From (m)	To	Reading	Comment
BY 1	1.20		·05	HQ whole core
	3·20		·12	" "
	4·50		·06	" "
	7·10		·07	" "
	9·40		·00	" "
	10·50		·09	" "
	12·50		·08	" "
	15·60		·09	" "
	16·50		·10	" "
	19·40		·08	" "
	20·80		·07	" "
	22·50		·08	" "
	24·20		·13	↓
	25·50		·13	
	27·10		·06	
	28·50		·06	
	30·00		·10	
	34·50		·13	
	31·50		·19	
	35·10		·21	
	37·10		·12	
	40·20		·15	
	43·3		·12	
	45·20		·08	
	46·90		·12	
	49·50		·08	
	51·10		·08	
	54·00		·09	
	55·20		·16	
	56·30		·11	
	57·60		·12	
	58·50		·06	
	60·50		·06	
	61·50		·11	
	64·50		·08	
	67·50		·01	
	70·40		·10	
	71·60		·09	

Pg 2 0090

MAGNETIC SUSCEPTIBILITY READINGS

DDH No	From	To	Reading	Comment
BY1	73·50		·13	HQ WHOLE CORE
	76·50		·08	↓
	78·90		·06	
	82·00		·11	
	85·00		·20	
	86·80		·15	
	89·70		·10	
	91·50		·11	
	94·50		·07	
	97·50		·10	
	100·50		·11	
	103·50		·11	
	106·40		·07	
	108·60		·03	
	111·70		·04	
	114·80		·03	
	117·90		·03	
	121·00		·09	
	124·10		·06	
	127·20		·10	
	130·30		·09	
	133·40		·14	
	136·50		·03	
	139·50		·16	
	141·00		·04	NQ WHOLE CORE
	142·50		·08	↓
	148·50		·10	
	151·50		·07	
	154·50		·07	
	157·50		·06	
	160·50		·08	
	163·50		·06	
	166·50		·09	
	169·50		·08	
	172·50		·04	
	175·50		·10	
	178·50		·07	
	181·75		·08	

MAGNETIC SUSCEPTIBILITY READINGS

DDH No	From	To	Reading	Comment
BY 1	182.40		·02	NQ whole core
	184·5		·01	
	187·5		·07	
	190·5		·05	
	193·5		·10	
	196·5		·06	
	199·30		·02	
	202·3		·06	
	204·9		·10	
	207·9		·11	
	210·9		·04	
	214·0		·09	
	217·1		·06	
	220·2		·17	
	222·0		·14	
	225·0		·21	
	228·1		·16	
	231·1		·18	
	234·2		·17	
	237·2		·16	
	240·3		·15	
	241·10		·18	
	242·3		·14	
	243·7		·16	
	245·7		·14	
	248·8		·17	
	251·9		·11	
	254·9		·23	
	255·6		·20	
	257·5		·19	
	258·3		·22	
	261·4		·12	
	264·4		·15	
	267·5		·12	
	270·6		·14	
	270·8		·12	
	273·6		·12	
	276·6		·15	

MAGNETIC SUSCEPTIBILITY READINGS

DDH No	From	To	Reading	Comment
BY 1	279·7		·16	NQ whole core.
	282·8		·08	
	284·2		·15	
	285·6		·06	
	288·4		·10	
	291·4		·05	
	292·5		·05	
	294·2		·05	
	297·3		·07	
	298·5		·08	
	301·5		·11	
	303·8		·11	
	306·9		·11	
	307·4		·14	
	309·7		·08	
	311·9		·10	
	312·5		·12	
	315·6		·16	
	318·7		·24	
	319·7		·19	
	322·7		·36	
	325·7		·26	
	328·7		·28	
	331·7		·24	
	334·7		·17	
	337·7		·06	
	340·7		·15	
	343·7		·10	
	346·7		·10	
	349·7		·04	
	352·7		·03	
	355·9		·08	
	358·7		·27	
	361·55		·29	
	364·6		·20	
	367·6		·12	
	370·6		·20	
	373·6		·14	

MAGNETIC SUSCEPTIBILITY READINGS

DDH No	From	To	Reading	Comment
BY1	376·6		·07	whole NQ core
	379·6		·11	"
	382·65		·15	"
	385·65		·07	"
	388·65		·12	"
	391·35		·13	"
	394·40		·14	"
	397·45		·09	"
	400·5		·13	"
	403·5		·09	"
	406·5		·10	"
	409·5		·67	"
	412·6		·10	"
	415·7		·05	"
	418·7		·17	"
	421·6		·12	"
	424·7		·12	"
	427·6		·15	"
	430·6		·13	"
	433·6		·07	"
	436·6		·07	"
	439·7		·01	"
	441·4		·01	"
	442·3		·01	"
	443·5		·01	"
	444·9		·07	"
	448·0		·21	"
	451·0		·01	"
	454·1		·06	"
	456·9		·09	"
	460·0		·09	"
	463·0		·07	"
	466·0		·11	"
	469·0		·13	"
	472·1		·08	"
	475·1		·07	"
	478·1		·07	"
	481·2		·20	"

MAGNETIC SUSCEPTIBILITY READINGS

DDH No	From	To	Reading	Comment
BY1	484·2		·06	whole NQ core
	487·3		·14	"
	490·4		·08	"
	493·4		·08	"
	496·4		·14	"
	499·5		·12	"
	502·5		·09	"
	505·6		·12	"
	508·6		·07	"
	511·7		·07	"
	514·7		2·26	"
	517·7		·08	"
	520·7		·20	"
	523·7		·10	"
	524·6		·07	"
	525·5		·07	"
	526·8		·12	"
	529·7		·14	"
	535·7		·12	"
	537·9		·09	"
	539·1		·14	"
	540·8		·08	"
	543·3		·06	"
	544·7		·17	"
	545·0		·08	"
	545·4		·18	"
	546·6		·08	"
	547·3		·20	"
	547·8		·08	"
	549·1		·08	"
	549·5		·08	"
	552·4		·11	"
	555·4		·20	"
	556·7		·09	"
	557·7		·06	"
	559·5		·07	"
	562·4		·21	"
	END	OF	HOLE	

APPENDIX 3

PETROLOGY OF OUTCROP SAMPLES
BASTYAN DAM AREA

0570 Geochempet Services

PETROLOGICAL and GEOCHEMICAL CONSULTANTS

REGISTERED IN QUEENSLAND

Principal: A.S. Joyce B. Sc. (Hons), Ph.D.
200 Chapel Hill Road
Chapel Hill, Qld. 4069

Telephone: (07) 892 1789
A/H 378 6467

PETROLOGICAL REPORT ON ELEVEN SAMPLES FROM NORTH OF ROSEBERY

prepared for

PASMINCO EXPLORATION

Order No. : T 052

Ref. : J.G. Purvis

Stan Joyce

A. S. Joyce, B.Sc.(Hons), Ph.D.

13th February, 1991

GENERAL COMMENTS

1. There is no single factor responsible for concealing the primary textures in Samples 84027 - 84035. Alteration involving mainly sericite, chlorite and in some cases silicification has blurred primary textures in many cases. Incipient metamorphic foliation and/or fracturing and granulation is a factor in some cases.

   I do not believe that the rocks have been hornfelsed.

2. The rocks are interpreted to have originated as follows :

84027	porphyritic intermediate lava
84028	volcaniclastic arenite
84029	dacitic volcanolithic arenite
84030	volcanolithic arenite with muddy laminations
84031	porphyritic dacite
84032	porphyritic quartz andesite
84033	vitric crystal tuff (unwelded or poorly welded)
84034	vitric crystal tuff (unwelded or poorly welded)
84035	volcaniclastic arenite

3. The slatey, sericitic, laminated siltstone samples 84036 and 84047 yield no indication of facing directions.

Sample Number : 84027

Identification : Moderately carbonated, intensely sericitized and silicified, abundantly porphyritic intermediate lava

Description ;

The sample is a mildly porous, mildly limonite-stained, light olive grey hand specimen of slightly weathered, finely crystalline, moderately hard rock speckled with small, altered phenocrysts.

A cobaltinitrite staining test revealed no K-feldspar.

In thin section the sample displays many porous, completely altered phenocrysts (mainly 0.5 to 3mm) set in a sutured mosaic of quartz grains (0.1 to 0.3mm) riddled with inclusions of sericite and fine, secondary rutile and with concentrations of sericite around the sutured grain boundaries. There are sparse limonitic aggregates after inferred fine sulphides.

Many of the former phenocrysts have prismatic shapes of plagioclase style, but they are now pseudomorphed by sericite and limonite-stained pores after inferred carbonate. There are a few small phenocrysts of inferred ilmenite, now completley leucoxenized.

Several porous quartz fracture veins (0.2 to 1mm wide) cut the rock.

An approximate mode is :

20-25%	porous sericitic pseudomorphs of phenocrysts
0.1-0.2%	leucoxenized oxide phenocrysts
50-60%	groundmass secondary quartz
20-30%	groundmass sericite
0.5-1%	groundmass secondary rutile
tr	limonite after inferred sulphides
1-2%	porous quartz veins

Comments and Interpretations :

This rock is thought to have originated as abundantly porphyritic intermediate lava, but it has been intensely sericitized, silicified and moderately carbonated. It was also cut by fissure veins of quartz and probable carbonate.

Weathering has removed all inferred carbonate. There are indications that the rock carried traces of sulphides.

Sample Number : 84028

Identification : Possible volcaniclastic arenite, now deformed and moderately altered

Description :

The sample is a hand specimen of slightly weathered, hard, partly siliceous dark greenish grey rock with indistinct finely fragmental textures. A few specks of pyrite are visible.

A staining test reveale dno K-feldspar.

In thin section the sample is seen to be heavily fractured, lcoally granulated and moderately altered. Primary textures are substantially obscured beyond the observations that there are many phenocrysts and/or phenoclasts of plagioclase and hints of sandy volcaniclastic textures (confused by the existence of some patches of tectonic granulation).

Phenocrysts/clasts of plagioclase are about 0.3 to 1.5mm in size and only slightly sericitized. Much of the rest of the rock is fine, anhedral, mainly untwinned plagioclase (0.01 to 0.03mm) and subordinate quartz, sericite, chlorite and fine rutile. Chlorite and to a lesser extent quartz form thin fracture veins. Subhedral multifaceted pyrite is disseminated as grains about 0.02 to 0.4mm in size. Numerous irregular pores, possibly after carbonate are present as patches and probable veins.

An approximate mode is :

30-35%	phenocrysts/clasts of plagioclase
20-25%	fine plagioclase
10-15%	fine quartz
12-18%	sericite
8-12%	chlorite
0.20.3%	rutile
1-2%	pyrite
5-7%	pores after possible carbonate

Comments and Interpretations :

This rock carried many phenocrysts or phenoclasts of plagioclase and may have been a volcaniclastic arenite.

Primary textures have been substantially obscured by tectonic fracturing, local granulation and alteration involving development of sericite, chlorite, quartz, rutile, pyrite and probably carbonate. Quartz, chlorite and inferred carbonate also developed as veins. Pyrite is present in disseminated style.

The deformation is of tensional style.

Sample Number : 84029

Identification : Dacitic volcanolithic arenite, moderately altered and mildly deformed

Description :

The sample is a slightly weathered hand specimen of hard, mottled, yellowish and light greenish grey rock.

A staining test revealed no K-feldspar.

In thin section the rock is seen to be moderately altered and mildly deformed, but there are moderately preserved primary textures apparently indicating moderately sorted, densely packed, mainly coarsely sand-sized mineral and rock fragments. Clasts are mainly 0.5 to 4mm. There is a foliated, minor sericitic matrix and numerous fracture-controlled but partly replacement style veins of carbonate.

Mineral clasts and equivalent phenocrysts within lithic clasts are quartz of β form and lightly sericitized plagioclase. Moderately rounded lithic clasts are lightly sericitized, abundantly porphyritic dacite; inferred mafic mineral components are now altered to sericite, fine rutile and inconspicuous, minor chlorite. Calcite patches and veins range from about 0.05 to several millimetres thick. Pyrite is present in trace amounts as clusters of 0.01 to 0.05mm grains. In weathered parts of the sample the calcite is stained by limonite.

It is difficult to discriminate quantitatively between sand-sized phenoclasts and equivalent phenocrysts within lithic clasts, but the bulk of the rock seems to have consisted of rounded rock fragments.

An approximate mode is :

30-35%	plagioclase phenocrysts/clasts
5-8%	quartz phenocrysts/clasts
35-45%	fine plagioclase and quartz (within lithic clasts)
8-10%	sericite
10-15%	calcite
0.5-1%	chlorite
0.1%	rutile
tr	pyrite

Comments and Interpretations :

This rock is considered to have originated as volcanolithic arenite, composed of moderately sorted, densely packed, rounded clasts of porphyritic dacite.

Mild deformation has generated some sericitic foliation and abundant irregular fractures now veined by calcite. In addition to sericite and chlorite, a moderate degree of alteration has generated minor chlorite and traces of rutile and pyrite.

Sample Number : 84030

Identification : Deformed, pyritic, heavily sericitized, laminated arenite and slate

Description :

The sample is a slightly weathered hand specimen of mainly light olive grey rock with vaguely sandy textures and a slaty cleavage.

A staining test revealed no K-feldspar.

In thin section the rock is seen to be heavily altered and deformed. Poorly preserved primary textures seem to be consistent with alternating layers of coarsely sand-sized lithic clasts and pelitic rock.

The pelite layers are 2 to 5mm thick and mildly crenulated and disrupted by discordant sericitic foliation. They consist of abundant sericite, fine quartz and pyrite (0.01 to 0.1mm)

The sandy layers are thicker (2 to at least 20mm) and have quite poorly preserved sandy textures apparently indicating feldspar phenocrysts/clasts (up to 1mm) and stretched lithic clasts (commonly 2 to 3mm). There are remnants of phenocrystal plagioclase, but grains are heavily sericitized and in some cases silicified. There are a few rutile aggregates after titaniferous oxide phenocrysts. The bulk of the sandy textured regime is now sericite, fine quartz, minor chlorite and traces of rutile and pyrite.

A set of fracture veins (0.03 to 0.5mm wide) orientated at a high angle to bedding and the sericitic foliation carries chlorite, quartz and minor calcite.

An approximate mode of the whole section is :

60-70%	sericite
25-35%	quartz
3-5%	chlorite
0.5-1%	pyrite
0.1-0.2%	rutile
0.1-0.2%	calcite
tr	remnant plagioclase

Comments and Interpretations :

It seems that this rock originated as sandy textured volcanolithic coarse arenite with some muddy laminations.

Pervasive heavy sericitization and subordinate silicificaiton has been followed by shear foliation and probably related, but late regular fracture veining by chlorite-quartz-calcite.

Disseminated pyrite is unevenly spread through the rock. It may relate to the formation of sericite.

Sample Number : 84031

Identification : Heavily sericitized porphyritic dacite

Description :

The sample is a hand specimen of mildly limonite-stained, yellowish to pale olive grey, moderately hard, altered, finely crystalline rock with altered feldspar phenocrysts and small quartz phenocrysts.

A staining test revealed no K-feldspar.

In thin section the sample is seen to be heavily sericitized, but primary textures are of abundantly porphyritic, finely crystalline, volcanic style. Phenocrysts are subhedral, corroded and about 0.2 to 3mm in size. The groundmass grains are anhedral and about 0.1mm.

The phenocrysts are lightly to moderately sericitized plagioclase prisms, deeply embayed quartz, completely leucoxenized inferred ilmenite and rutile-sericite pseudomorphs of inferred mafic silicates. The groundmass consists of primary quartz, heavily sericitized plagioclase and rutilated mafic minerals.

Porous quartz fissure veins are 0.05 to 0.1mm wide.

An approximate mode is :

8-12%	lightly to moderately sericitized plagioclase phenocrysts
2-3%	rutile-sericite after mafic silicate phenocrysts
1-2%	quartz phenocrysts
0.5-1%	leucoxene after oxide phenocrysts
60-70%	heavily sericitized groundmass plagioclase
18-20%	groundmass quartz
2-3%	leucoxene, rutile and sericite after mafic groundmass minerals
0.5-1%	porous quartz veins

Comments and Interpretations :

This rock is thought to have originated as porphyritic dacite lava, but it has been heavily sericitized and thinly fracture-veined by quartz accompanied by some weatherable, anhedral mineral (perhaps carbonate).

Sample Number : 84032

Identification : Incipiently foliated, moderately to heavily altered, porphyritic quartz andesite

Description :

The sample is a lightly weathered hand specimen of greenish grey rock finely speckled with greyish orange feldspar phenocrysts or clasts.

A staining test revealed no K-feldspar.

In thin seciton the sample is seen to be moderately to heavily altered, but moderately preserved primary textures seem to be of simple, porphyritic finely crystalline, volcanic style. Phenocrysts are 0.3 to 2mm and groundmass grains are 0.03 to 0.05mm. A chloritized microdiorite xenolith is about 5mm in size.

The main phenocrysts are lightly sericitized plagioclase prisms. Quartz forms sparse corroded and embayed phenocrysts. Former small oxide phenocrysts are now leucoxene and fine rutile. Inconspicuous mafic silicate phenocrysts are now chlorite. The groundmass features moderately to heavily sericitized, anhedral plagioclase; quartz, chlorite and leucoxene/rutile are minor components. There is an incipient sericitic foliation.

Pyrite forms sparse aggregates with chlorite and quartz. Several thin fracture veins carry quartz, chlorite and limonitic and porous indications of former carbonate.

An approximate mode is :

7-9%	plagioclase phenocrysts, lightly sericitized
0.5-1%	quartz phenocrysts
0.3-0.5%	chloritized phenocrysts
0.2-0.3%	oxide phenocrysts, altered to leucoxene/rutile
40-50%	groundmass plagioclase
30-40%	groundmass sericite
6-8%	groundmass chlorite
3-5%	groundmass quartz
0.1%	groundmass leucoxene/rutile
tr	pyrite
0.3-0.4%	veins of quartz-chlorite-carbonate
0.5-1%	microdiorite xenoliths

Comments and Interpretations :

This rock is thought to have originated as porphyritic quartz andesite, probably representing lava.

It is now moderately to heavily altered to sericite-chlorite-leucoxene/rutile-pyrite, mildly veined by chlorite-quartz-carbonate and incipiently foliated.

Sample Number : 84033

Identification : Moderately carbonated and chloritized, intensely sericitized vitric crystal tuff

Description :

The sample is a hand specimen of slightly weathered, greenish grey, fine-grained rock.

A staining test revealed no K-feldspar.

In thin section the sample is seen to be intensely altered, but well preserved primary textures involve subhedral and broken phenoclasts (0.1 to 1.5mm) scattered through a matrix of unwelded or poorly welded vitric shards about 0.2 to 0.5mm long.

The main phenoclasts have prismatic shapes of feldspar style, but they are now completely altered to carbonate, chlorite and clay of kaolinitic style. There are a very few phenoclasts of quartz. The formerly vitroclastic matrix now consists of sericite, fine quartz, chlorite, minor calcite and traces of fine rutile.

Multifaceted, fine grains of pyrite (0.02 to 0.1mm) are dissemianted sparsely through the rock.

Several thin fracture veins carry quartz and calcite.

In terms of original components the rock consisted of about :

8-12%	feldspar phenoclasts
tr	quartz phenoclasts
88-92%	vitric shards

In terms of present mineralogy the rock consists of about :

45-55%	sericite
30-40%	quartz
5-7%	chlorite
4-6%	calcite
3-5%	clay of kaolinitic style
0.2-0.4%	pyrite
0.1-0.2%	rutile
0.2-0.3%	veins of quartz and calcite

Comments and Interpretations :

Remnant textures plainly indicate that this rock originated as unwelded or poorly welded vitric crystal tuff. It has been moderately carbonated and chloritized and intensely sericitized. Traces of disseminated pyrite formed and a few thin fracture veins of quartz and calcite.

0079 **Sample Number** : 84034

Identification : Intensely sericitized and carbonated vitric crystal tuff

Description :

The sample is a hand specimen of slightly weathered, light olive grey rock with hints of vitric tuffaceous textures.

A staining test revealed no K-feldspar.

In thin section the sample is seen to be intensely altered, but moderately preserved primary textures are of tuffaceous style, involving many subhedral and broken phenoclasts (about 0.3 to 3mm) set in a matrix with suggestions of vitroclastic and pumiceous shapes.

The main phenoclasts appear to have been feldspar, now heavily to completely altered to sericite and calcite. There are a few rutile-sericite aggregates and rutile aggregates after inferred mafic silicate and oxide phenoclasts, and a very few phenoclasts of quartz. The matrix is now sericite, fine quartz, some carbonate and traces of fine rutile.

Fine pyrite is very sparsely disseminated through the rock. A 0.5mm wide fracture vein carries quartz and minor calcite.

In terms of original components the rock consisted of about :

40-45%	feldspar phenoclasts
2-3%	mafic silicate phenoclasts
0.1%	oxide phenoclasts
tr	quartz phenoclasts
50-60%	pumiceous and vitroclastic matrix

In terms of present mineralogy the rock consists of about :

45-55%	sericite
20-30%	calcite
15-20%	quartz
6-8%	remnant plagioclase
1-2%	rutile
0.1%	pyrite
0.5-0.7%	vein quartz and calcite

Comments and Interpretations :

Primary textures are partly obscured, but this rock seems to have originated as vitric crystal tuff, similar to that represented by 84033, but richer in feldspar phenoclasts and coarser grained.

The rock is intensely sericitized and carbonated. There are traces of disseminated pyrite and minor veining by quartz with calcite.

Sample Number : 84035

Identification : Incipiently foliated, lightly altered volcaniclastic arenite

Description :

The sample is a hand specimen of speckled light grye and greenish grey, hard rock.

A staining test revealed no K-feldspar.

In thin section the sample displays moderately preserved primary textures of coarsely sandy, volcaniclastic style. There appear to be moderately sorted, densely packed, subrounded phenoclasts and lithic clasts, mainly 0.5 to 2mm in size.

The main phenoclasts are lightly sericitized, prismatic plagioclase. A very few are quartz. The lithic clasts are mildly chloritic and sericitic, finely quartzofeldspathic aggregates with hints of vitroclastic textures. Some sericite is mildly foliated. Pyrite is present sparsely as disseminated, multifaceted grains. Unevenly distributed anhedral to rhomboid pores suggest dissolved calcite.

Some early, thin fracture-controlled but partly replacement style veins carry chlorite. Later, thicker veins (up to 1mm wide) carry mildly strained quartz and some anhedral pores, possibly after calcite.

In terms of primary clasts the rock consisted of about 40-50% plagioclase clasts, 50-60% lithic clasts and a few quartz clasts. In terms of present mineralogy it consists of about :

35-45%	remnant plagioclase phenoclasts
20-25%	fine plagioclase
15-20%	quartz
10-12%	sericite
3-5%	chlorite
0.3-0.4%	pyrite
0.2-0.3%	rutile
3-5%	pores after inferred calcite

Comments and Interpretations :

This rock seems to have originated as a volcaniclastic arenite composed mainly of plagioclase phenoclasts and fragments of probably dacitic vitric tuff.

Light alteration has generated sericite-chlorite-rutile-pyrite. Early veins carried chlorite and later veins carried quartz and probable carbonate. The rock is incipiently foliated.

Sample Number : 84036

Identification : Quartz-veined, slatey, finely laminated siltstone and claystone

Description :

The sample is a hand specimen of slightly weathered, finely laminated, medium dark grey siltstone cut discordantly by some very light grey to whitish veins.

A staining test revealed no K-feldspar.

In thin section the sample displays distinctive, but quite subtle laminations regularly crenulated by a sericitic foliation orientated at about 30° to the bedding.

The laminations are noticed mainly because of stylolite-like concentrations of very fine carbonaceous (or probably graphitic) matter. Closer inspeciton reveals lenticular, incipiently transposed alternations of "cherty' quartz and sericite; former layers were about 0.2 to 0.3mm thick. Very fine secondary rutile and a few remnant detrital clasts of muscovite and of quartz silt are scattered through the rock. There are also evenly disseminated rhomboid pores (0.05 to 0.1mm) after inferred carbonate.

Relatively thick, generally steeply discordant fissure veins (generally 0.5 to 2mm wide) carry mildly strained quartz of varied grainsize and anhedral pores after possible carbonate.

An approximate mode is :

40-45%	sericite
40-45%	"cherty" quartz
3-5%	disseminated pores after inferred carbonate
0.2-0.3%	fine rutile
tr	detrital muscovite
3-4%	detrital coarse quartz silt
0.3-0.5%	carbonaceous matter or graphite
8-12%	porous quartz veins

Comments and Interpretations :

This rock is considered to have originated as very finely, very regularly laminated siltstone and claystone. It carried minor carbonaceous matter and carbonate.

Low grade metamorphism has rendered the rock sericitic and induced a slaty foliation inclined at about 30° to bedding and incipiently transposing it.

There is no graded bedding, scour structures nor any other features which would permit determination of facing direction.

Sample Number : 84047

Identification : Quartz-veined, slatey, laminated siltstone

Description :

The sample is a hand specimen of slightly weathered, dark grey, finely laminated siltstone.

A staining test revealed no K-feldspar.

In thin section the sample displays fine sedimentary laminations (about 0.1 to 2mm thick) slightly crenualted and incipiently transposed by slatey sericitic foliation inclined at about 10° to the bedding.

The thickest layers carry angular clasts of quartz of coarse silt to fine sand size (mainly 0.04 to 0.3mm) and a few apparently detrital flakes of muscovite within a matrix of finer "cherty" quartz, sericite, very fine, wispy carbonaceous matter or graphite, brown sphalerite, fine rutile and rhomboid pores after inferred carbonate.

The thin layers are mainly sericite, "cherty" quartz, fine graphite or carbonaceous matter and pores.

Two discordant fracture veins (0.3 to 0.5mm wide) carry faintly strained quartz, anhedral brown sphalerite, subhedral pyrite and some anhedral pores after possible carbonate.

An approximate mode is :

35-45%	sericite
35-45%	"cherty" quartz
10-15%	coarser silt and sand grains of quartz
5-10%	disseminated pores after inferred carbonate
0.2-0.3%	disseminated sphalerite
0.1-0.2%	fine rutile
0.2-0.3%	detrital muscovite
0.3-0.5%	carbonaceous matter or graphite
0.5-1%	porous veins of quartz-sphalerite-pyrite

Comments and Interpretations :

This rock is considered to have originated as finely laminated siltstone, carrying minor carbonate, carbonaceous matter and sphalerite.

Low grade metamorphism has rendered the rock sericitic and induced a slaty foliation inclined at about 10° to the bedding.

Quartz veins carry sulphides and pores after possible calcite.

There is no graded bedding, scour structures nor any other features which would permit determination of facing direction.

APPENDIX 4

MONITORING OF REVEGETATION AT MT BLACK DRILL SITE 5

(Austmin Resources Report)

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MONITORING OF REVEGETATION AT DRILL SITE 5

EL 12/88, MT BLACK, ROSEBERY, TASMANIA

AUGUST 1990 TO JUNE 1991

Austmin Resources NL
June 1991

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1.0 INTRODUCTION

In July 1990, Austmin Resources NL adopted a programme to conduct monitoring observations and assessments of the revegetation of Drill Site 5 within EL 12/88, Mt Black. The monitoring programme is being undertaken by Austmin Resources NL's botanical and environmental consultant, Mr Alan Gray, and will cover a period of over 2 years. The programme was designed to quantify the natural emergence of revegetation at the site and egress track during the first three to four years after respreading of topsoil and humus and to test and compare the growth of transplanted seedlings and cuttings, as well as to ensure the continuing rehabilitation of the site.

The monitoring procedures and methodology envisaged were detailed in a previous document entitled "Programme for the Establishment of Monitoring Stations at EL 12/88 - Mt Black, Tasmania (July 1990)". In the field, the procedures detailed in this previous document have been enhanced and implemented.

During the period of this report, three site visits were conducted. The site observation stations were installed and the initial monitoring was conducted on 10th to 13th August, 1990. The stations were monitored and other data was collected during subsequent visits on 14th to 16th December, 1990 and 13th and 14th April, 1991.

2.0 INSTALLATION VISIT - AUGUST 1990

2.1 Establishment of Observation Stations

Ten monitoring "quadrats" 1 metre square, were located at various positions over the area of the site. Six of the stations were placed within the perimeter of 10 metres distance from the forest edge. Station "one" was placed on a line corresponding magnetic north, the compass sightings being taken from a sighting roughly surveyed as being the approximate centre of Site 5. Five stations were then each located at 60 degrees of bearing clockwise around the site. The remaining four stations were placed at a distance of 5 metres out from the centre sighting, the stations located on the North, South, East, West axes.

The placement of all ten stations was seen to provide an acceptable and random distribution of both the undisturbed area respread in February 1989 and the respread area in April 1990. An additional four quadrats were located on the egress track. One was located at each end of the track and two were placed at 80 metre intervals along the track.

2.2 Marking of Observation Stations

Each quadrat station was delineated by four slender steel pegs and identified with marked plastic ribbons.

2.3 Photography of Observation Stations

Each of the stations were photographed. The film used was 400ASA colour print and each photo was taken at a "standard" distance downslope almost at midday.

2.4 Recording of Station Characteristics and Vegetation

All site and track stations were thoroughly scanned and a description of each was recorded using a portable tape recorder. Each seedling or layering sprout encountered was marked for future reference with a coloured tooth pick placed close by. The presence and "health" of that vegetation occurring within was described and recorded.

2.5 Transplant Vegetation Observation and Assessments

A number of seedlings which were transplanted during the site recovery in April 1990 were located, marked, numbered and assessed. In total 50 plants within the site and 25 plants along the egress track were chosen on a "as found" random basis. It was decided that some naturally occurring recruits found with the replants should also be marked and included in the sample for monitoring. Thus the 75 marked plants include a number of recruit specimens not contained within any of the assessment stations.

Each of the plants were closely examined and an assessment of approximate size and condition recorded.

2.6 Relevant Observations

A. It was quite apparent that recruit vegetation in the form of seedlings and "re-sprouting" by layering was occurring at site 5.

This recruitment was, as would be expected, only occurring in that vegetation debris originally respread over the site following clearing operations and not in that debris respread during operations in April 1990.

B. There were some isolated instances of what appeared to be browsing of some of the layering by possibly possums.

C. Since April 1990, precipitation had washed and settled most suspended or otherwise unstable soil and humus. As well the action of rainwater etc had aerated and sweetened previously anaerobic pockets of soil noted in April 1990.

D. The condition of the King William Pines and other species on the boundaries of the site and track do not appear to have deteriorated since observations and assessments were first made in April 1989.

E. A few scattered plants of the invasive "cutting grass" (Grahnice grandis) were noted but were not removed. Recent information indicates that the presence of this sage is conducive to the establishment of King William Pine.

3. FIELD VISIT - DECEMBER 1990

3.1 Examination of Quadrats

All quadrats were examined thoroughly while listening to the previous take recorded descriptions of each. Few changes were observed in most of the quadrats, these being minor additions of, or improvements in plant health.

3.2 Replants

All marked replants were relocated and their health assessed and compared with last observations. Almost without exception those replants/recruits had grown or improved in health.

3.3 General Site Conditions

There had been a marked change in the appearance of the respread soil and branch litter etc. The surface had weathered to a dull grey colour throughout. Although there were a few small areas where water still lay on the surface, overall drainage and precolation of water was considered very good. Large scale subsidence or movements of soil was not evident.

3.4 Health of Trees on Site Periphery

Some considerable time was spent examining all Athrotaxis, as well as other species which had presumably suffered disturbance during site clearing. These broad-scale visual observations did not detect any indication of decline in the health or vigour of any trees adjacent to the site periphery or the Egress Track.

3.5 Fruiting of Athrotaxis Trees

There was little evidence of cone initiation in any of the Athrotaxis trees surrounding the site.

3.6 Collection of Material

During the visit, further seedlings, chiefly of Athrotaxis Seleginoides, were located, removed and taken to our consultant's nursery for potting and replanting during the April field visit.

Cutting material of Athrotaxis was also collected and approximately 150 cuttings were planned to be set.

4.0 FIELD VISIT - APRIL 1991

4.1 Examination of Quadrats

Of the recruits recorded during previous visits, very few were found to be "missing". Overall there had been a small net increase in recruit numbers, including new appearances of Plyllocladus (celery top) seedlings.

4.2 Replants and Marked Recruits

Almost all plants had maintained good condition and a large proportion had made significant new growth. Some recruit sprouts of Anodepotalum (horizontal) showed signs of leaf damage in the form of browsing. During the assessment two specimens of grasshoppers were observed and collected. an entomologist with the Tasmanian Department of Primary Industry who examined the specimens advised that the insects do not occur in plague numbers and pose no real threat to the regrowth of Anodepotalum.

4.3 Health of Trees on Site Periphery and Track Side

Again careful observations were made and no decline in the trees could be detected.

4.4 Fruiting of Athrotaxis Trees

Cone production on many Athrotaxis trees surrounding the site and along the track was observed. Fruiting was not "heavy" but the cones were large and healthy and contained good sound seed.

4.5 Replanting of Athrotaxis

Cutting material of Athrotaxis taken from local trees in December 1990 was treated and placed in a sterile , inert cutting medium and propagated under mist with bottom heat. Rooted cuttings were planted into small pots with sterile potting mixture and grown up.

Twenty well established cuttings plus twelve Athrotaxis collected from elsewhere on Mt Black during the previous survey and taken back to Hobart for potting and establishment were planted on the site and along the track.

It was found that the thirty plants so placed comfortably filled most of the remaining spaces. There are still a further 100 cuttings available and being held at our consultants nursery in Hobart. At this stage, we do not think that further plantings should be undertaken. There is presently a good number and representation already established on the site and along the track. Overcrowding should be avoided.

Interest will now focus on the recruitment of seedlings following the production of cones for the first time since the site was rehabilitated.

Established cuttings will be maintained in the nursery and used for future replacement of lost plantings, should these occur.

APPENDIX 5

GEOPHYSICAL SURVEYS - ACQUISITION REPORT & PRELIMINARY INTERPRETATION

(Report by D E Leaman)

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GEOPHYSICAL SURVEYS
EL 12/88 MT BLACK J.V.

ACQUISITION REPORT
INCLUDING PRELIMINARY INTERPRETATION
for
PASMINCO EXPLORATION

by
Dr. D.E. Leaman

July 1991

MTBLACK

CONTENTS

FIGURES

SUMMARY

Compilation of available gravity and magnetic data in the region of the Mt Black EL 12/88 has enabled a preliminary appraisal of the volcanics of the area and any associated mineralisation. Much of the magnetic data used in this analysis was recently acquired and has still to be fully integrated and adjusted in common with other surveys peripheral to the licence area. Although the gravity coverage has been improved it is still limited and patchy due to access problems.

These limitations do not seriously degrade the present analysis which suggests that the Rosebery Fault shallows eastward and is probably never more than about 4 km below surface. A sub-parallel thrust surface is also implied and the volcanics which form Mt Black rest upon these structures. The volcanics do not appear to be altered in any significant way and to possess properties comparable with those determined regionally. Some members of the volcanic pile are markedly more magnetic permit mapping of units and structure. Volcanic units dip east but are truncated by westward dipping structures near the andesites and Henty Fault system on the lower eastern slopes of Mt Black.

Combination of the gravity and magnetic analyses indicates that there may be a relationship between the nature of the Rosebery and Henty Fault systems and the emplacement of granites leading to disruption of the volcanic pile. The pile itself seems to have been located above relatively shallow basement and the structural limits of the basement might well have controlled location of mineralisation. All mineralised sites lie close to an inferred major basement junction.

Trend and lineament analysis has been limited by the current data presentations but a suite of trends can be identified, if not always accurately located. Dominant trends are NW, NE, sub E-W and NNW. The latter pair appear to be relevant to mineralised sites.

The recently acquired magnetic data should be properly integrated and re-presented in high quality contour and image forms. Some additional gravity coverage is also advised if gradients are to be properly defined. Review may then identify important nodal positions since several are suggested by the present work.
More detailed analysis of the magnetic and gravity data near such nodes is then advised in order to assess possible alteration patterns. Other methods may also be required.

INTRODUCTION

EL 12/88, Mt Black, is located east and north of the Rosebery Mine lease area in central western Tasmania (Figure 1A). The western boundaries of the licence area are defined by those leases (see Figure 1B) and are somewhat irregular as a result. This report generally considers the area of the licence as being more rectangular. An important extension of the licence extends west of the Rosebery Fault south of the Bastyan Dam and Lake Rosebery (see Figure 2A).

The body of the licence area covers Mt Black, Mt Sale and their foothills.

The geology of the area is shown in Figures 2A, B (reproduced from Corbett & McNeill, 1986). Available mapping is not detailed east of the "Cutty Sark" or "Hawkesbury" prospects and a relatively massive and ill defined volume of Mt Read Volcanics are indicated across most the area. The lack of detail in all basemaps generally reflects lack of knowledge in this area.

Gravity and magnetic surveys in the Mt Black area have been completed recently. This report describes the data acquired and provides an initial interpretation with the specific objectives of provision of a basic geological and structural understanding of the Mt Black Volcanics and an improved appraisal of the prospectivity of the region.

Gravity and magnetic data in the area have only been reviewed in the grossest regional terms previously (Leaman, 1986a, b; 1988). Results have indicated that these data sets could reveal much information about structural setting and control within the area. The regional data available were shown , however, to lack resolution due to line spacing or terrain clearance excesses.

Detailed magnetic surveys undertaken by Pasminco Exploration in adjacent areas have demonstrated the value of such data sets and led to review of many elements of the region. The surveys reported here represent an extension of this work and findings.
The particular aims of these surveys have been to upgrade the regional data base and to
a) define alteration within the volcanics,
b) assess structural controls,
c) aid mapping and subdivision of the volcanics and
d) identify any mineralisation signatures present.
e) review anomalous characater within the Dundas Group rocks.

This report outlines survey specification, presents the results of survey and provides a preliminary interpretation.

MAGNETIC SURVEY

SPECIFICATION

Specifications for the survey were determined by the previous experience provided by the Mines Department survey (Leaman, 1986a) and other recent (1990) surveys for Pasminco Exploration and the need to resolve possible alteration features, subtle trends, and the contribution due to various parts of the Cambrian volcanic pile. Leaman (1986a) has established the general viability of magnetic methods for assessment of alteration and mineralised sites in areas free of strong interference effects such as introduced by Tertiary basalt or Cambrian ultramafics.

Many of the features sought are known to be subtle and all previous regional data have lacked the necessary data resolution - in terms of low clearance, close sampling and line density. Detail, once lost due to variable or excessive clearances, is not recoverable. Since the reliability of the regional data set was not known, and there is limited information available on the variability of contrasts within the volcanics it was important to ensure that the best practicable specification was defined.

The compilations of magnetic field intensity displayed in Figures 4A-D derive from three surveys in the general area in the past two years by divisions of Pasminco or its parent company. The areas involved are recognisable in Figure 4B where differing presentations are evident. Each survey was specified similarly but one, north of 5378 000 mN, was varied after consultation with joint venture partners. Survey 1 is located north of 5378 000 mN; survey 2 is located south and west of 381 000 mE, 5378 000 mN and survey 3 is located south and east of 381 000 mE, 5378 000 mN.

Specifications were as follows.

	1	2	3
Line spacing:	200	100	100 metres E-W
Tie line spacing:	1000	1000	1000 metres N-S
Nominal terrain clearance:	100	80	80 m.
Sample interval:	< 10	< 10	< 10 m.
Magnetometer sensitivity:	< 0.1	< 0.1	< 0.01 nT.

The line balance and orientation reflects a general compromise in order to obtain cost effective coverage, the general form of the terrain and the need to define sub E-W or NW-SE and SW-NE trends as suggested by regional analysis of the Mines Department survey. Rigorous draping necessitated use of a helicopter. Use of fixed wing aircraft, a higher nominal clearance and general wide variation in that clearance effectively destroyed much of the resolving power of the Mines Department across significant parts of the Cambrian volcanics and adjacent Dundas Group. Only high relief features were defined by that survey in this area.

Multichannel radiometric data were also specified but no commitment was made toward processing of that data pending inspection of the raw data.
(This data has not yet been fully processed and it is possible that no further analysis will be undertaken).

SURVEY

Surveys 1 and 2 were flown between February 23 and March 4, 1990 and survey 3 was flown between February 1 and 8, 1991 - all by Geo Instruments Pty Ltd under the supervision of Zoltan Beldi using G813 proton precession (1, 2) and G833 helium vapour magnetometers (3) in a towed bird and Geometrics GR 3001 (1, 2) and GR800 spectrometers. The survey was flown using an Aerospatiale Squirrel helicopter. Some infill and correction flights were required for surveys 1 and 2 and these were completed on March 17, 1990.

An equivalent magnetometer was used as base station and the survey was completed over several days.

Survey tracking was visual supported by colour video using topographic basemaps and aerial photographs with a recovery scale of 1: 10000. Data pickup was undertaken by D. Morrison.

No line coverage details can be provided for this particular area due to the preparation of a composite map, pending compilation of an integral and corrected version of all surveys.

PROCESSING

Flight path digitising, processing, gridding and mapping were performed by Pitt Research, Adelaide (surveys 1, 2) and Kevron Geophysics and D. Morrison (survey 3).
IGRF 1985 suitably updated was removed from the data and a scalar of 5000, 4700 and 62000 nT were added to residual data. (There seems no way of preventing this poor practice of confusing the residual values and generating uneccesary problems at survey boundaries)
The stability of gridding and acquisition was tested by pixel image maps for line misties (1, 2) and the many cross ties generated by survey (3) were adjusted by spline interpolations in both directions.

A contour interval of 5 or 2 nT was selected for the primary presentation (Surveys 1 and 2-3 resp.). Comparison of the survey fragments used to assemble a map across Mt Black reveals some variation in quality of processing and nature of filtering. Most of the appearance differences which relate to survey 1 are due to the coarser contour interval but the differences between surveys 2 and 3 reflect application of an undefined filter during the contouring process. Much of the detail evident in survey 2 has been lost in the presentation of survey 3 which has a smoother more aesthetically pleasing - but more useless, in exploration terms - form. This type of map is standard practice but the results for survey 2 show what can be achieved. Survey 2 also carries some disguised problems but most of these relate to the identification and separation of contours - heavy lines are multiples of 4, 8 or 16 and not 10 and 50, and all are poorly labelled in high relief areas.

The problems noted are being resolved at the time of preparation of this report. This has not been possible previously due to patchy ground coverage and very recent acquisition of some of the data. Contour maps for survey 3 were only supplied in June, 1991.
The three data sets are to be integrated and re-presented as a corrected drape with less filtering and more rigorous contouring in detail. The geophysical branch of the Division of Mineral Resources has been commissioned to undertake this work.

Radiometric data have not been corrected, levelled or compiled.

DATA PRESENTATION

Currently available compilations have been assembled and are shown in Figures 4A-D. A revised version of this compilation (see notes above) should be available soon and will be presented in the next report.
Maps used as bases have been derived from Corbett & McNeill (1986). See Figure 4A.

The specifications were closely approximated for the bulk of these surveys. The effective terrain clearance was 80-120 m for at least 85 - 90% of the entire area and the line coverage, including tie line intersections, was satisfactory - as far as can be determined from review of analogue records. Some loss of specification is evident about some steeper slopes and across some valleys. Re-processing should resolve some of these issues provided the terrain clearance is not excessive locally. The 0.01 nT precision, 0.2 second sampling, or spacing of about 7m, exceeded these conditions.

COMPARISON WITH PREVIOUS DATA

The previous regional survey described by Corbett et al (1982) and Leaman (1986a) has been reproduced as Figure 3 and may be compared with the new compilation (Figures 4A, B). Contour intervals are generally 2 or 5 nT for the new survey and 5 or 10 for the old.

The regional survey can be seen to provide a reasonably reliable view of the magnetic field in terms of the location and identification of

all significant responses but there was clearly considerable loss of resolution and definition in many areas. Specific examples relate to the detailed patterns observed within exposures of the volcanics on Mt Black.
The lower clearance, higher resolution and better constrained flight path with closer line spacings has considerably improved feature recognition and location. The significance of some of this detail is discussed below.

Character correlation of the older data was used to suggest possible sub E-W alteration corridors (approx 5374 000, 5379 000 mN) and many NE-SW and NW-SE fractures generally (see Leaman, 1987). The validity of many of these was unknown. Alteration responses had not been recognised previously.

GRAVITY DATA

Gravity data presented in Figure 5 have been assembled from the acquired data base maintained by Pasminco Exploration and the confidential files of the Division of Resources (TASGRAV). Pasminco Exploration has commissioned gravity surveys across its Rosebery Mine Lease in recent years and an additional survey was extended onto the Mt Black joint venture area during late 1990. Results of these traverses were provided during June 1991 after completion of levelling. The traverses were observed by a team from the Division of Mineral Resources under the leadership of Dr. R. Richardson. Terrain corrections and data checking was provided by Leaman Geophysics and reductions and compilation by the Division. All results relevant to EL 12/88 are included in the Appendix.

The Bouguer anomalies are based on a reduction density of 2.67 gm/cc and include a 22 km terrain correction. No other assumptions are included.

Figures 6A, B present the anomalies as residuals after correction for gross crustal and mantle effects using the process described by Leaman & Richardson (1989). Model MANTLE88 was used for the regional separation.

Contour character and detail in each map reflects the station coverage which remains generally poor east of 380 000 mE. Stations on Mt Black are limited to tracks and large portions of the area contain only one station per square kilometre.

PRELIMINARY INTERPRETATION

COMMENTS

The following comments outline possible correlations and implications within the gravity and magnetic data sets with respect to the exposed geology and mineralised sites.

The magnetic data is considered in two parts; that near the Bastyan Dam north of the Rosebery Mine and extension of the host sequence east of the Rosebery Fault, and the main body of Mt Black.

The major magnetic anomaly in the Bastyan area is east of "Cutty Sark" and "Hawkesbury". The trend of this anomaly is not, on first inspection, consistent with other trends in the area. It tends slightly east of north, much as the regional mapping would imply for the body of Mt Black and units north of Lake Rosebery. Locally N-S or west of north effects are predominant. Regional data show this feature to be truncated or terminated near the upper thrust on the face of Mt Black near Rosebery Mine (Figure 2A).

The geological section shown in Figure 2A and much of the description which follows was based on information provided by J.G. Purvis and it illustrates the current knowledge about the region. The section is well defined at its western end and the positions of both Rosebery Fault and upper thrust surfaces are known. The Rosebery Fault is believed to shallow eastward but this has not been confirmed. The Fault dips east at about 45 degrees near Rosebery Mine but the effective dip near Lake Rosebery is much less than this. The Mt Black Volcanics which lie above the upper thrust dip east and face east. The large magnetic anomaly described above appears to be related to these rocks; gradients imply no great depth of burial. It is feasible that a portion of the volcanics has been cut out by the intersection of faults around the west face of Mt Black.

A marked anomaly is associated with the Bastyan Dam (see Figure 4C) and can be rejected from analysis.
There are no obvious correlations between the magnetic field and the location of the Rosebery Fault, although there are some very subtle suggestions of position, and this indicates that the rocks near the fault are either not magnetised, are comparable in properties to those beneath it or the field is dominated by units beneath the fault. Only one substantial response has been observed within the area of exposed Dundas Group rocks and this does not seem systematic in view of the described lithology (376 600 mE, 5379 000 mN). Repetition of the lithology nearby should have resulted in a duplicate response. The site should be reviewed.

The very large anomalies at the western edge of the EL are related to mafic and ultramafic rocks. The response of these units swamps the field locally and also imposes a gradient to the east.
Minor responses evident in the volcanics east of the Rosebery Fault are difficult to assess using the present compilation and variable

contour definition.

The observed character of the magnetic field across the main body of Mt Black cannot be correlated with extant geological information. The basemap (Figure 2B) and section (Figure 2A) indicate how little is known. Dips and facings within the volcanics have not been established. While the mapping of Corbett & McNeill (1986) indicates the existence of some variations within the volcanics and the presence of mafic dykes, with some peripheral porphyries - such as on the southern shore of Lake Rosebery at 381 000 mE and on the Murchison Highway at 381 500 mE, the body of the mountain appears monolithic. The magnetic field and, to a lesser extent, the gravity field both deny this implication.

Parts of the magnetic field are highly disturbed and anomalies have moderate amplitude. There is little evidence of systematic patterns or substantial unit continuity and the character is zonal across Mt Black. Those zones free of disturbing sources are hatched in Figure 7.
Very few correlations may be made. Mafic volcanics near Saddle Creek in the SW of the EL do generate a response while the andesites to the east - and which abut the Henty Fault - do not. Responses appear to extend into the region of andesitic exposure but there is no strong correlation between mapped boundaries and magnetic field. This means either that the andesites are non magnetic and not thick or they dip east. There is no clear association between response and the detailed lithological variations mapped across the summit of Mt Black.
Some anomalies appear to curl around the body of Mt Black but this may be an artifact of the terrain, its source distribution, or various disruptive influences.

Most anomalies appear to be sourced within the terrain at shallow depths depending on the presumption that the magnetometer was about 100 m above ground. It would appear that most effects are caused by units that are exposed or virtually exposed and are not generated at substantial depths.

Gravity data do not offer any substantial clarifications due to limited coverage. The residual field does, however, subdivide Mt Black into zones of higher and lower density. A central low density zone extends N-S from Lake Rosebery to the Murchison Highway at an approximate easting of 381 000 mE and so appears to correlate with exposures of quartz porphyries. The systematic nature of the response suggests that it is real and fundamental. The marked anomaly couplet near the crest of Mt Black (381 500 mE, 5376 000 mN) may be an artifact of survey or incomplete correction (see Evaluation, next section). Volcanics to east and west of this central axis are denser. This pattern corresponds approximately with the terrain and would imply that the rocks of Mt Black are of lower density than the Bouguer assumption of 2.67 gm/cc.
This implication cannot be supported since all rock determinations, at least of the western side of Mt Black, suggest a bulk density in excess of 2.72 gm/cc. Consider hole 113RD1 north of Rosebery Mine.

In this hole, which is typical of the Rosebery region, the mineralised host and footwall sequence possessed densities of 2.69-2.74 gm/cc, the hanging wall epiclastics and shale are comparable at 2.70-2.76 gm/cc and the Mt Black Volcanics range from 2.72-2.78 gm/cc. A bulk density of around 2.75 gm/cc could be expected for this sequence. The residual anomalies therefore imply substantial variations in the constitution of Mt Black - or of the rocks beneath it. Dundas Group rocks beneath the Rosebery Fault possess comparable properties (based on determinations near the Rosebery Fault north and south of Rosebery Mine).

Similar problems may be inferred for the magnetic responses. Several anomalies imply, at least modest, magnetic contrasts. Most determinations of volcanics near Rosebery Mine are of the order of 0.0001 to 0.001 SI (approx 0.000001 to 0.0001 cgs). This susceptibility appears to low to account for the Mt Black anomalies, and especially that which extends from Rosebery Mine to Lake Rosebery at about 380 000 mE. The measured properties are, however, consistent with the reduced field levels observed in association with the immediate mine sequences.

These issues are further addressed below in terms of the quantitative evaluation of the potential fields.

Both compilations, and the older magnetic compilation (Figure 3), suggest a number of important and repetitive trend and linear features. These have been traced across the Mt Black EL and, in the gravity case, are largely based on regional and other data outside the EL. Most trends shown in Figure 7 are suggested in data particular to this licence area.
Figure 7 reflects the additional detail provided by the magnetic surveys. Dominant trends are NE-SW, NW-SE, NNE-SSW and E-W to ENE. NNW-SSE features appear rarely but at least one is very pronounced.

The trend compilation shown in Figure 7 has been based on the contoured compilations of the gravity and magnetic fields shown in Figures 3, 4, 5 and 6. Many trends are not easily identified in the present magnetic compilation due to differences in contouring character and procedures. It is possible, for example, to identify many subtleties in the results of survey 2 (SW of 381 000 mE, 5378 000 mN) but few are evident in survey 3 which is east of it. It is expected that image presentation of the data and coherent and detailed plotting of it (now underway, see page 4) will improve both resolution and expressions of continuity of such features.

The patterns indicated are generally reproduced in each data set but must be considered a very preliminary attempt at trend analysis given the present data and presentations.

The sub E-W structures described by Leaman (1986a, 1987) have been confirmed and a strong correlation with mineralised sites is evident. It also appears that the relatively rare NNW trend is also significant.

QUANTITATIVE EVALUATION

The nature of the gravity and magnetic data sets and the issues raised in general discussion have been reviewed by considering a series of sections across the Mt Black licence area.

Each section was selected from the viewpoint of sampling the various features of the fields recognised as well as the availability of data (gravity case). Two dimensional modelling was directed at general evaluation of structure, property implications and recognition of those features which are abnormal.

Reference profiles have been derived from upward continuation of the data sets in order to reliably include the effect of the high relief terrain. The location of all profiles is shown in Figure 8.

Figures 9 to 14 represent sample results of the analysis and have been selected to show the types of ambiguity involved in the present interpretation as well as its significance for structural setting and assessment of rock properties.
The geological basis for each section was derived initially from Figure 2A.

Line GRAVITY 5 5373 000 mN, 375 - 385 000 mE

This line extends from west of the Rosebery Fault to east of the Henty Fault south of Tullah. Rosebery Mine is 1 km north of the section at 378 500 mN.
Figure 9 presents two solutions for this well constrained residual gravity profile.
The better controlled elements of each model include the wedge-like form of Mt Black and the Rosebery and thrust faults near the centre of the section and the undoubted presence of Devonian granite a little east of the eastern end of the profile. The effect of the granite dominates the gravity field to the east of Tullah.
The two models suggest that the general character of the field is dominated by a second granite which extends west to Pine Hill. Densities employed in each section for all Cambrian and Devonian rocks are similar and, due to the presence of granite, are well constrained and consistent with measured properties. The andesitic rocks east of Mt Black adjacent to the Henty Fault are denser than the bulk of the volcanic sequence and probably dip east.
The models differ in their explanation of the general levels of the gravity field beneath Mt Black; the first uses additional granite while the second uses a combination of granite (confirmed at Colebrook Hill) and siliceous Precambrian rocks. The latter, if present, must occur at relatively shallow depths since the mass balance cannot be achieved if a thick Dundas Group-like succession (or volcanics) is included. Both models can be fitted with a near neutral curve fit shift difference (2 mGal is reasonable, provided other sections confirm it).

The implications of this section were reviewed at 5377 000 mN.

Line GRAVITY 6 5377 000 mN, 375 - 385 000 mE

Figure 10 presents one of the solutions found for line G6. As suggested by J.G. Purvis it employs a shallower dip for the Rosebery Fault and does not preclude the further shallowing of this structure eastward. Additional granites can not be employed at this northing to account for any aspect of the field west of about 383 000 mE. The model shows that if the possibility of shallow Precambrian basement is allowed then a solution no unlike that of #2 in Figure 9 can be found. The model is not unique west of about 379 000 mE and a deep trough fill of Dundas Group rocks, or a combination of these and Oonah-type Precambrian rocks (with or without Crimson Creek and Success Creek sequences) can be included. The model recognises the probable combination as exposed near the Hatfield River to the west of Burns Peak (see Corbett & McNeill, 1986).

Modelling has also suggested that the gravity field determinations are deficient near 381 000 mE. The dip in the observed profile cannot be modelled using any reasonable properties or structures. Checking has shown that this part of the profile depends upon a single regional station and a height or correction error seems likely.

Mineralisation near Lake Rosebery, about 1 km north of this section, is also indicated and there is a marked correlation, within the definition of both data and model, between the limit of shallow basement and mineralised sites. This would also have been observed in Figure 9 (for line 5) had the site not been occupied by a granite spine south of Rosebery Mine.

Line MAGNETICS 1 5378 000 mN, 376 - 384 000 mE

The structure inferred for the Mt Black zone gravitationally (Figure 10) can be compared with the magnetic solution in Figure 11. The gravity calculation could not be superimposed due to lack of data but both methods imply a shallow wedge of volcanics with a maximum thickness of about 3 km.

Figure 11 considers the options and uncertainties implicit in the primary interpretation of the Mt Black area.
The upper model (M1-2) shows that it is possible to find a solution in which units near the Rosebery Fault dip west - contrary to observation (Figure 2A) - and so appear to form an antiform within Mt Black. Much of the region can then be modelled with properties comparable with those generally observed in the volcanics of the area. Two units are, however, exceptional and strongly magnetised. These occur in the hanging wall of the upper thrust.
The lower model (M1-3) shows that a comparable fit can be obtained using slightly higher contrasts overall and general easterly dips.
The critical difference between these two solutions lies not in the failure of the first to be consistent with observations on the western side of Mt Black but in the requirements to fit the curves. In the first case there is a positive differential of 20 nT and -20 nT in the second. If either of these differentials can be shown to be

unique or indicative then the style and property elements of the models can be resolved. This factor was reviewed and tested for all other profiles. The negative differential was found to be consistently credible and possible, the positive differential was not. This finding provides support for any structural implications suggested. Any feasible solution must have, approximately, this differential.

Line MAGNETICS 2   5376 000 mN, 379 - 384 000 mE

Modelling illustrated for this line (Figure 12) indicates the range of possibilities allowed given the curve fitting restraints. The Figure shows that it is possible to develop opposing solutions, including one not supported geologically (upper, M2-2).
The diagram demonstrates the definite limits which may be imposed on
i) the contrasts or properties likely or implied, and
ii) the maximum probable thickness of sources (or volcanic pile)
Given the comments of J.G. Purvis concerning the moderation in dip of the Rosebery Fault northward these sections certainly show an excessive thickness since the limiting dip is about that of the fault south of Rosebery Mine.
It is on this point that the sections can be discriminated given the similarity of their curve fitting parameters. There is scope in the lower section (M2-3) for substantial thinning of section (up to 50%) while retaining either the contrasts of the section or the more subdued contrasts of the upper section. This is purely the effect of geometry of source.

The issue must now be faced; what attitude of volcanics do the data support? All sections can only be coherently matched (see below, including an interlocking cross line) magnetically with the negative differential of -20 nT and Figure 11 shows that this requires easterly dips - only these are possible. The gravity data and limited geological implications at the west end of Mt Black indicate the same conclusion.

Figure 12 also shows that the bulk of the Mt Black Volcanics have negligible magnetic properties and yield the quiet zones in Figures 4B, D and 7 and much of the remainder have properties consistent with typical measured values. Some limited units are magnetically distinctive and presumably mappable.

The data presented in Figure 12 also suggest that there is some correlation between response and the geometry of the terrain as well given that parts of the volcanics are magnetic and exposed. This is better seen in Figure 13 (below) but the effect is suggested by the irregularities in the profile near the crest of the Mt Black ridge at about 381 000 mE.

Line MAGNETICS 3   5374 000 mN, 379 - 384 000 mE

This line (Figure 13) samples the highest part of the range and the andesites on the eastern face. The andesites enter the section at its eastern limit and the general lack of response in the region from 383

000 mE demonstrates their lack of magnetic properties. The slight rise in observed response near 384 000 mE is due to the Murchison Granite some way further east.

The model also shows that eastward dips predominate within the pile but that the eastern portion appears to be structurally terminated by a west-dipping structure. This must be sympathetic to both Henty Fault and margin of andesitic rocks. A comparable pattern is evident in Figure 12 within the pile at a position slightly west of the mapped andesite junction or its northward extension.

The bulk of the volcanics at this northing is relatively non magnetic and less than double the contrast of most volcanics in the north Rosebery area. At least two units are strongly magnetised, however, as also seen in previous profiles.
This profile also demonstrates the effect of terrain, a magnetic terrain, upon the magnetic response. Note the rise in response of both the observed data and the modelled data near 381 500 mE. Both effects reflect the shape of the surface and have nothing to do with changes in the volcanics. The fit is imperfect since a detailed review of terrain shape is required and has not been attempted.

Line MAGNETICS 4   380 000 mE, 5372 000 mN - 384 000 mE, 5378 000 mN

Figure 14 presents a tie line for the modelling net. This line can be used to check the implications of other lines and test their assumptions within the constraints of the simple modelling undertaken.
It confirms the curve fitting requirements, the general dip of volcanic units within Mt Black and a somewhat thinner overall section with a shallowing Rosebery Fault just as suggested by J.G. Purvis. The implied contrasts for the volcanics are also a little less than for some other sections and, for two thirds of the profile, are fully compatible with property measurements generally.
It should be remarked here that the property data base does contain a proportion of sequences and measurements which are consistent with all the values in Figure 14. The values are not unrealistic, therefore, and it would appear that units are mappable and distinct.

A comment is also required concerning the curve fitting parameters which have been referred to throughout this text. These offer a critical test of model, concept and property consistency and integrity. In the gravity cases the match of residual data to models should be very close and both curves should be shifted the same amount. Minor differences may be introduced from the base levels of the regional separation, any continuations, or noise in the data. In this case these fit within 0 to 2 mGal which is acceptable and credible.
The magnetic case may be more difficult to assess in absolute terms since each survey may contain an artificial base station value, usually assigned at commencement of survey, which may prove to be atypical by up to 100 nT (usually of the order of 30 nT). Then, when a residual is created all values will carry a shift of this amount.

When such data is modelled the observed and calculated profiles will then be shifted differing amounts in order to match properly. Note that the modelled profile always has a true base level of zero. Thus assessment of an interpretation depends firstly upon deriving the observed zero level (artificial and possibly fortuitously correct - even properly correct if the survey observers are aware of the issue, but this is rare) and then ensuring that any analysis maintains the proper parity or differential. In this case, for the data assumptions made, this seems to be about -20 nT meaning that the observed base level was too low by this amount.

There is a corollary. If models of the same rocks, using the same data set, property assumptions and processing assumptions, lead to differing shifts for matches on various profiles then one, some or all of the models are incorrect.

EXPLORATION SIGNIFICANCE

The data available, and this analysis of it, have been somewhat limited and restrict the non structural information derived.

Raw profiles have not yet been examined and few deductions are possible concerning alteration responses but there appear to be few. Most of the anomaly patterns, in terms of their definition in the available presentations, do not suggest such modifications. This may not be true near "Hawkesbury" where the contoured presentation is more detailed but further comments must await review of the actual observations.

Perhaps the most important inferences are shown in Figure 7. This diagram, based on approximate location of significant features and trends, suggests that each of the known mineralised sites can be linked to significant fracture sets.
Rosebery Mine is located within a sub E-W corridor, as originally suggested by Leaman (1986a) and there are now suggestions that some NNW control may have been applied as well. Modelling such as shown in Figures 9 and 10 also suggests that the site lies near a major basement boundary. This may also be a crucial factor in ore location if it could be properly evaluated. Does the junction actually lie slightly to the east, so allowing the ore horizon to be stretched out along the Rosebery Fault system? Such a site might be beneath Mt Black. Unfortunately any mineralisation would probably be deep since there is no suggestion of any thinning or section repetition in the work done.

Other sites such as "Cutty Sark" and "Langdons" also appear to lie near significant sub E-W corridors but lack other obvious controls. The latter comment may be a function of extant presentations. The "Hawkesbury" site may lie near a lesser sub E-W feature but does lie on a subsdiary NNW feature. There is scope for some refinement of these features and implied critical nodes. Figure 10 associates all of these sites with the major, inferred basement junction.

CONCLUSIONS

Although the present work is preliminary and partly restricted by the current data coverages or compilations a number of important conclusions and inferences can be drawn.

1. Some distinctive trend patterns can be defined. While NW, NNW, NE and sub E-W features can be recognised and approximately located in all data sub sets (location accuracy is presently variable due to the contouring packages used by contractors) the most important appear to be NNW and near E-W.
   Mineralised sites can be linked with these or their intersections.

2. Structural analysis of Mt Black and its volcanics suggests that these units generally dip east at moderate angles. Inferred properties are consistent with known values. Much of the volcanic association is virtually non magnetic but some units are mappable magnetically. The most strongly magnetised occur on the west face of Mt Black.

3. The geological implication of a Rosebery Fault wedge, possibly shallowing in dip to the east is generally supported. The analysis shows that the volcanic pile and its magnetic sources are depth limited and probably do not exceed 2.5 or 3 km in thickness. There are no suggestions of a complex internal structure within the Mt Black block. The gravity data, though variable in coverage, do not define any anomalous core.

4. No evidence of alteration responses has been seen although the data employed were not in an ideal format for judgments.

5. Some of the magnetic anomalies observed across Mt Black are due to interactions between slightly magnetic terrains and the shape of the land surface itself. Caution is therefore required before accepting any response as an anomaly. Many of these features may not be apparent in drape data and a more distant form of processing is required to locate them, and remove them.

6. Regional gravity modelling suggests that some fundamental control of mineralised sites may be applied by the location of major basement boundaries or junctions. Such a structure lies in the general vicinity of all mineralisation in the Mt Black area.

7. The implied relationships between basement, volcanic blocks, westward transfers along the Rosebery Fault and associated systems, the Henty Fault system and the Granite Tor-Pine Hill Granites raises the question of origins. Is it possible that the Rosebery Fault system motions are directly related to the emplacement of the granites? These compressive sub-horizontal features override other elements of the sequence and structure. If this is so then some limits might be imposed on the scale of the displacements.

RECOMMENDATIONS

The preliminary work reported here and the conclusions drawn from it indicate that some further work is justified.

Most further needs are related to the presentation, processing and use of the data since it appears that the body of Mt Black, if of interest, is simply too thick to be of economic interest at the present time.

Several data and presentation deficiencies have been described but all can be simply overcome.

Gravity data should be upgraded with the acquisition of no more than two or three E-W lines across the eastern face of Mt Black. Stations should be no more than 200 m apart on these lines in order to insure against local effects and confirm the general character of the form of the volcanics.

Magnetic data, from all surveys, must be reconstituted in a standard form and plotted in detail. This is underway at the time of writing. Such integrated compilations should be re-assessed for trends and fracture controls in both image and map forms.
Available exposures along the gravity profiles, or other access, should be checked for minimum magnetic properties, as should core from the shallow drilling atop Mt Black. The implied contrasts should be confirmed. If the inferred properties cannot be supported for substantial volumes then the interpretation must be reviewed.

Both gravity and magnetic data should be analysed in an attempt to more accurately define any basement structures since these may be integral to control of mineralisation and hence exploration.

Observed magnetic data in the area west of "Langdons" and Rosebery Mine should be examined for suggestions of alteration character. Focus should be generally applied for this review, and for application of all other methods, at those sites in which significant trend intersections have been recorded - with emphasis on those involving sub E-W, NNW and basement junctions.

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APPENDIX

DETAILS OF GRAVITY STATIONS WITHIN EL 12/88

The tabulation lists station number (year and survey number code)
easting and northing in AMG coordinates
elevation
observed and theoretical gravity
22 km terrain correction
Bouguer anomaly for reduction density of 2.67 gm/cc

Station No	East (m)	North (m)	Elev (m)	Gobs	Gtheo	Terr Corr	B.A. (mgal)	File Name
9051.6949	384369.8	374723.9	169.30	980.272437	980.338561	1.63	-31.19	*PAS913A
9051.6950	384099.9	374489.8	175.59	980.271367	980.338746	2.10	-30.74	*PAS913A
9051.6951	384083.2	374208.0	198.45	980.266578	980.338973	3.57	-29.79	*PAS913A
9051.6952	384082.5	373992.7	220.66	980.262764	980.339147	2.30	-30.68	*PAS913A
9051.6953	383880.1	373846.2	241.73	980.259868	980.339263	2.89	-28.96	*PAS913A
9051.6954	383637.6	373769.6	264.94	980.256504	980.339322	2.66	-28.04	*PAS913A
9051.6955	383345.8	373628.6	297.72	980.250865	980.339432	2.72	-27.28	*PAS913A
9051.6956	383456.7	373430.8	317.02	980.246334	980.339593	3.13	-27.77	*PAS913A
9051.6957	383618.1	373237.4	341.47	980.240857	980.339751	4.41	-27.31	*PAS913A
9051.6958	383627.8	372912.9	377.10	980.234310	980.340013	4.13	-27.39	*PAS913A
9051.6959	383394.0	372915.3	400.22	980.231911	980.340008	3.30	-26.07	*PAS913A
9051.6960	383104.3	372979.1	420.50	980.229512	980.339953	2.47	-25.25	*PAS913A
9051.6961	382882.5	373026.4	442.35	980.225756	980.339912	2.13	-25.01	*PAS913A
9051.6962	382774.9	373231.9	466.85	980.220356	980.339744	2.02	-25.53	*PAS913A
9051.6963	382517.2	373332.3	489.49	980.216217	980.339660	1.86	-25.29	*PAS913A
9051.6964	382389.3	373353.8	491.83	980.215844	980.339641	1.93	-25.12	*PAS913A
9051.6965	382167.5	373377.8	489.82	980.216217	980.339618	1.90	-25.15	*PAS913A
9051.6966	381974.9	373218.2	470.83	980.219256	980.339745	2.32	-25.55	*PAS913A
9051.6967	381841.4	373011.8	449.40	980.222755	980.339910	2.23	-26.52	*PAS913A
9051.6968	381731.0	372830.9	430.21	980.227696	980.340054	1.88	-25.85	*PAS913A
9051.6969	381541.1	372889.5	409.77	980.231376	980.340004	1.97	-26.05	*PAS913A
9051.6970	381236.4	372862.1	387.23	980.235218	980.340022	2.17	-26.46	*PAS913A
9051.6983	382057.0	373587.0	523.97	980.208513	980.339448	2.02	-25.84	*PAS913A
9051.6984	381843.0	373663.0	540.26	980.204958	980.339384	2.70	-25.45	*PAS913A
9051.6985	381620.0	373747.0	605.12	980.191118	980.339313	3.68	-25.47	*PAS913A
9051.6986	381509.0	373918.0	632.44	980.185325	980.339173	4.55	-24.88	*PAS913A
9051.6987	381389.0	374094.0	660.61	980.178472	980.339030	4.93	-25.67	*PAS913A
9051.6988	381374.0	374333.0	676.42	980.174468	980.338837	4.80	-26.50	*PAS913A
9051.6989	381192.0	374500.0	684.34	980.173158	980.338699	4.73	-26.18	*PAS913A
9051.6990	381040.0	374704.0	675.58	980.174477	980.338533	4.49	-26.66	*PAS913A
9051.6991	381157.0	374907.0	675.55	980.174544	980.338370	4.87	-26.06	*PAS913A
9051.7006	381304.5	375102.3	700.59	980.168809	980.338215	5.01	-26.57	*PAS913A
9051.7007	381355.6	375335.5	712.12	980.165512	980.338027	5.11	-27.31	*PAS913A
9051.7008	381321.6	375572.6	715.95	980.164718	980.337835	4.73	-27.54	*PAS913A
9051.7009	381285.1	375817.9	723.17	980.162663	980.337637	4.66	-28.04	*PAS913A
9051.7010	381175.9	375997.2	704.07	980.168742	980.337491	4.36	-25.88	*PAS913A
9051.7011	381279.6	376166.6	680.54	980.172948	980.337355	5.00	-25.52	*PAS913A
9051.7012	381330.2	376373.1	688.30	980.170138	980.337189	5.27	-26.37	*PAS913A
9051.7013	381209.7	376558.4	697.29	980.169201	980.337038	4.90	-25.76	*PAS913A
9051.7014	381123.2	376735.6	700.24	980.168781	980.336894	4.53	-25.82	*PAS913A
9051.7015	381015.9	376937.8	732.33	980.160943	980.336729	4.65	-27.06	*PAS913A
9051.7016	380792.7	377048.3	687.67	980.171705	980.336637	4.67	-24.98	*PAS913A
9051.7017	380721.0	377274.6	639.46	980.182286	980.336453	4.15	-24.22	*PAS913A
9051.7024	380639.6	377476.8	602.36	980.190085	980.336289	3.73	-23.97	*PAS913A
9051.7025	380511.5	377682.2	569.79	980.197005	980.336121	3.55	-23.48	*PAS913A
9051.7026	380531.0	375401.7	928.14	980.113564	980.337963	16.86	-24.93	*PAS913A
9051.7027	380734.5	375512.9	851.14	980.135328	980.337876	10.15	-24.94	*PAS913A
9051.7028	380935.6	375641.8	781.75	980.152236	980.337774	6.93	-24.81	*PAS913A
9051.7029	380905.4	375862.1	741.86	980.161048	980.337596	5.40	-25.20	*PAS913A
9051.7030	380818.4	376095.6	745.86	980.160436	980.337406	4.20	-26.03	*PAS913A
9051.7031	380735.0	376256.5	721.82	980.165904	980.337275	4.43	-24.94	*PAS913A
9051.7032	380623.1	376475.1	714.36	980.167060	980.337097	4.27	-25.23	*PAS913A
9051.7033	380682.3	376628.9	693.44	980.171839	980.336974	4.07	-24.64	*PAS913A
9051.7034	380711.9	376879.9	676.72	980.175003	980.336772	4.58	-24.06	*PAS913A
9051.7035	380671.4	377108.6	648.83	980.180489	980.336587	4.72	-23.73	*PAS913A
9051.7036	380617.6	376541.2	701.77	980.169870	980.337044	4.31	-24.80	*PAS913A
9051.7037	380463.6	376632.0	670.50	980.176733	980.336969	4.40	-23.93	*PAS913A

Station No	East (m)	North (m)	Elev (m)	Gobs	Gtheo	Terr Corr	B.A. (mgal)	File Name
9051.7038	380307.8	376526.3	658.59	980.179208	980.337052	5.07	-23.21*	PAS913A
9051.7039	380125.6	376398.7	626.37	980.186147	980.337152	4.36	-23.42*	PAS913A
9051.7050	380193.7	372188.3	243.59	980.261895	980.340552	4.10	-26.64*	PAS913A
9051.7051	380395.0	372184.9	276.03	980.256829	980.340558	3.90	-25.53*	PAS913A
9051.7101	384554.5	374866.4	173.03	980.272055	980.338448	1.38	-30.98*	PAS913A
9051.7102	384444.9	375066.2	174.12	980.272342	980.338285	1.41	-30.29*	PAS913A
9051.7103	384326.5	375169.0	171.12	980.273861	980.338201	1.46	-29.22*	PAS913A
9051.7104	384174.2	375369.0	173.56	980.274253	980.338037	1.52	-28.13*	PAS913A
9051.7105	384098.7	375657.1	165.55	980.275782	980.337804	1.63	-27.83*	PAS913A
9051.7106	383993.4	375847.8	167.92	980.276299	980.337648	1.80	-26.52*	PAS913A
9051.7107	383870.2	375989.7	159.85	980.277627	980.337532	1.72	-26.74*	PAS913A
9051.7108	384040.0	375387.0	160.15	980.276987	980.338021	1.66	-27.87*	PAS913A
9051.7092	383490.0	376060.0	159.80	980.277646	980.337471	2.59	-25.80*	PAS913B
9051.7093	383610.0	375930.0	159.90	980.277751	980.337577	2.05	-26.32*	PAS913B
9051.7094	383730.0	375760.0	159.80	980.277809	980.337716	2.15	-26.33*	PAS913B
9051.7095	383790.0	375530.0	159.90	980.277092	980.337902	2.35	-27.01*	PAS913B
9051.7096	383430.0	376290.0	159.60	980.277694	980.337284	2.87	-25.33*	PAS913B
9051.7097	383390.0	376520.0	159.70	980.277531	980.337098	3.10	-25.05*	PAS913B
9051.7098	383430.0	376680.0	159.80	980.277598	980.336969	2.93	-25.01*	PAS913B
9051.7099	383660.0	376790.0	159.80	980.277770	980.336884	2.56	-25.12*	PAS913B
9051.7100	383870.0	376930.0	159.90	980.277627	980.336773	2.37	-25.33*	PAS913B
9051.7123	384040.0	377210.0	159.60	980.276853	980.336549	2.77	-25.53*	PAS913B
9051.7124	384120.0	377470.0	159.60	980.277579	980.336341	2.53	-24.84*	PAS913B
9051.7125	384120.0	377710.0	160.10	980.277923	980.336147	1.79	-24.94*	PAS913B
9051.7126	384140.0	377920.0	160.10	980.278277	980.335978	1.61	-24.60*	PAS913B
9051.7127	384060.0	378110.0	160.10	980.278583	980.335823	1.47	-24.28*	PAS913B
9051.7128	383900.0	378410.0	160.10	980.279051	980.335579	1.53	-23.51*	PAS913B
9051.7129	383690.0	378430.0	159.60	980.278239	980.335560	1.81	-24.12*	PAS913B
9051.7130	383560.0	378310.0	159.10	980.278029	980.335655	2.43	-23.90*	PAS913B
9051.7131	383490.0	378520.0	160.10	980.279032	980.335485	2.39	-22.57*	PAS913B
9051.7132	383380.0	378660.0	159.60	980.279491	980.335370	2.10	-22.39*	PAS913B
9051.7133	383190.0	378590.0	160.10	980.278564	980.335424	2.41	-22.96*	PAS913B
9051.7134	383060.0	378750.0	159.60	980.278640	980.335294	2.07	-23.19*	PAS913B
9051.7135	382890.0	378860.0	159.10	980.279080	980.335202	1.73	-23.10*	PAS913B
9051.7136	382650.0	378860.0	159.60	980.279166	980.335199	1.68	-22.96*	PAS913B
9051.7137	382360.0	378850.0	159.10	980.279520	980.335204	1.79	-22.60*	PAS913B
9051.7138	382180.0	378830.0	159.60	980.279319	980.335217	1.99	-22.52*	PAS913B
9051.7139	381900.0	378830.0	160.10	980.278612	980.335214	2.83	-22.28*	PAS913B
9051.7140	381560.0	379210.0	160.10	980.279759	980.334902	2.61	-21.04*	PAS913B
9051.7141	381410.0	379190.0	160.60	980.279806	980.334916	2.47	-21.05*	PAS913B
9051.7142	381240.0	379150.0	160.10	980.279835	980.334946	2.41	-21.21*	PAS913B
9051.7143	381020.0	379140.0	160.10	980.280103	980.334952	2.59	-20.77*	PAS913B
9051.7144	380810.0	379000.0	159.10	980.279577	980.335062	2.37	-21.82*	PAS913B
9051.7145	380580.0	379000.0	159.60	980.279644	980.335059	1.83	-22.19*	PAS913B
9051.7146	380370.0	379030.0	159.60	980.280523	980.335032	1.80	-21.32*	PAS913B
9051.7147	380420.0	379320.0	160.10	980.280982	980.334798	1.91	-20.42*	PAS913B
9051.7148	380320.0	379520.0	160.10	980.281374	980.334635	1.79	-19.98*	PAS913B
9051.7149	380320.0	379690.0	159.60	980.281852	980.334498	1.77	-19.48*	PAS913B
9051.7150	380120.0	379940.0	159.10	980.282291	980.334294	1.83	-18.88*	PAS913B

01

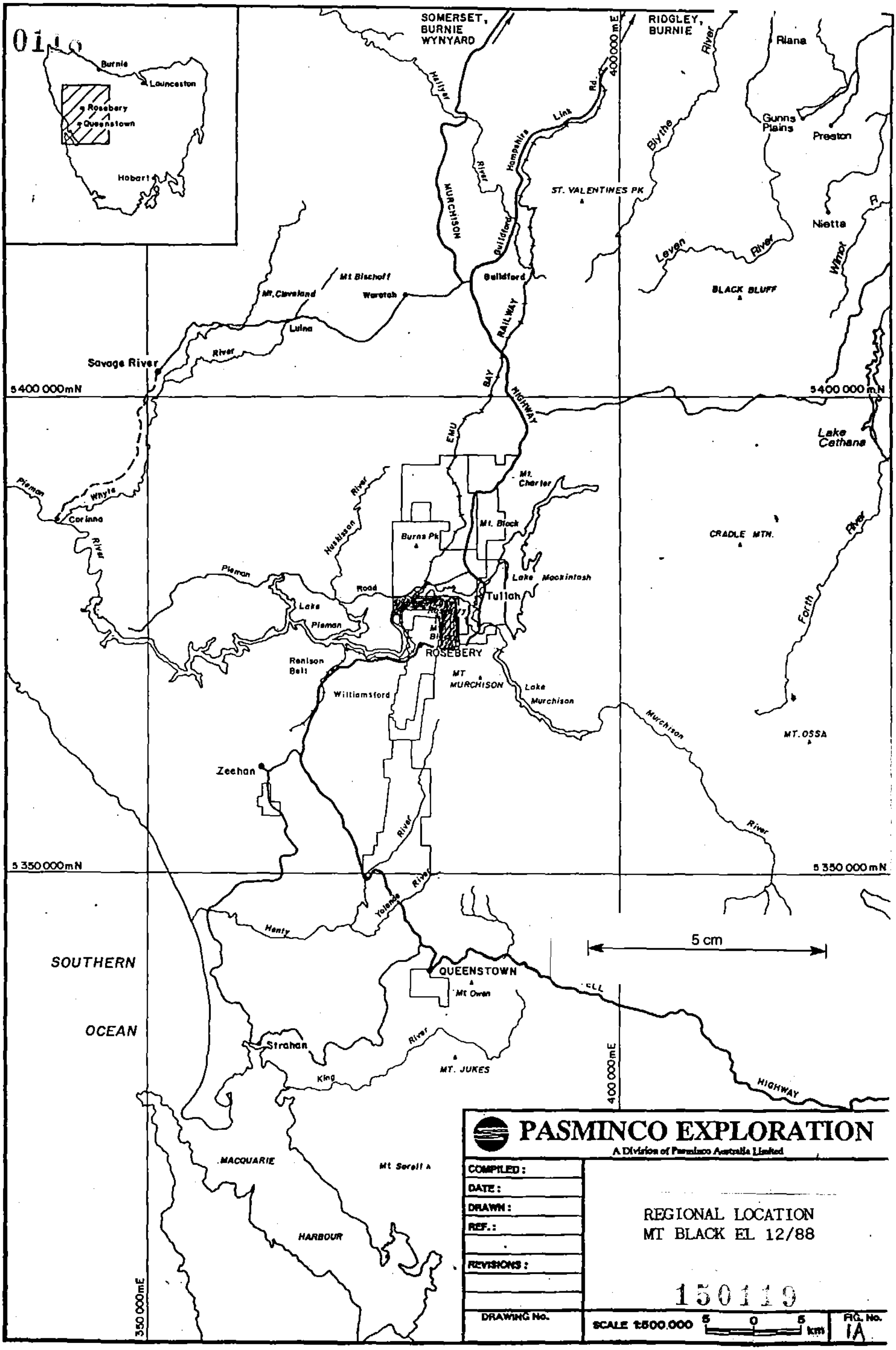
150118

Report submitted on behalf of Leaman Geophysics

by

Dr. D. E. Leaman, B.Sc., Ph.D.,
F. Aus. I.M.M., M.M.I.C.A.

Date: 28/7/91

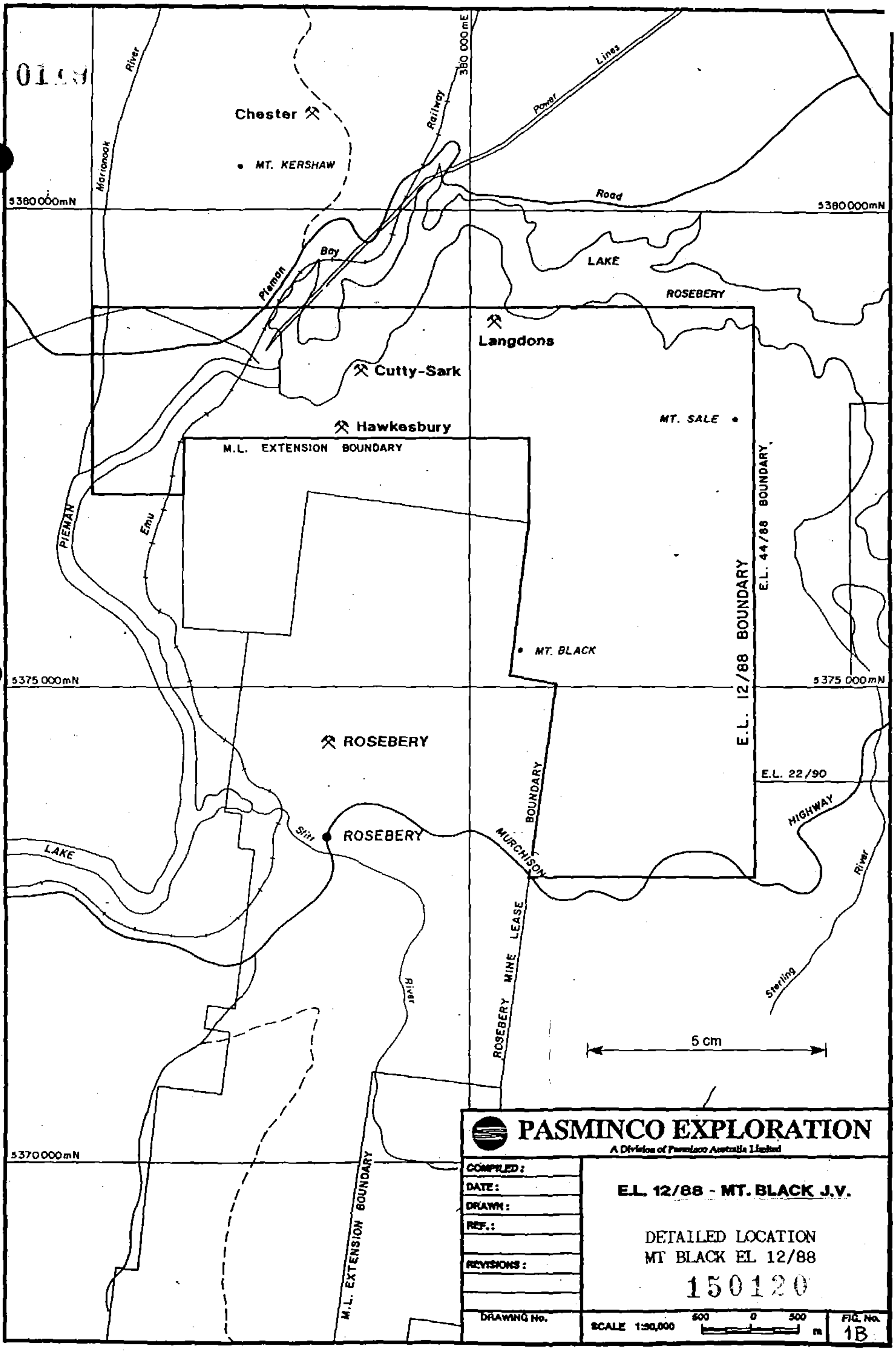


PASMINCO EXPLORATION

A Division of Pasminco Australia Limited

COMPILED :	
DATE :	
DRAWN :	REGIONAL LOCATION
REF. :	MT BLACK EL 12/88
REVISIONS :	
	150119
DRAWING No.	SCALE 1:500,000 5 0 5 km

FIG. No. 1A

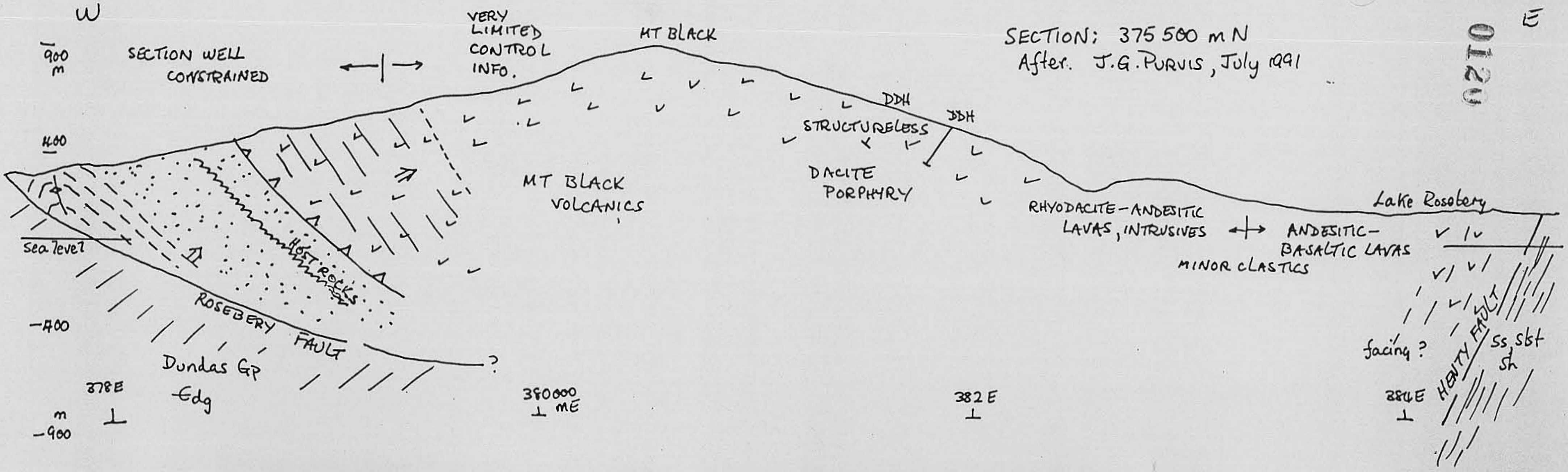


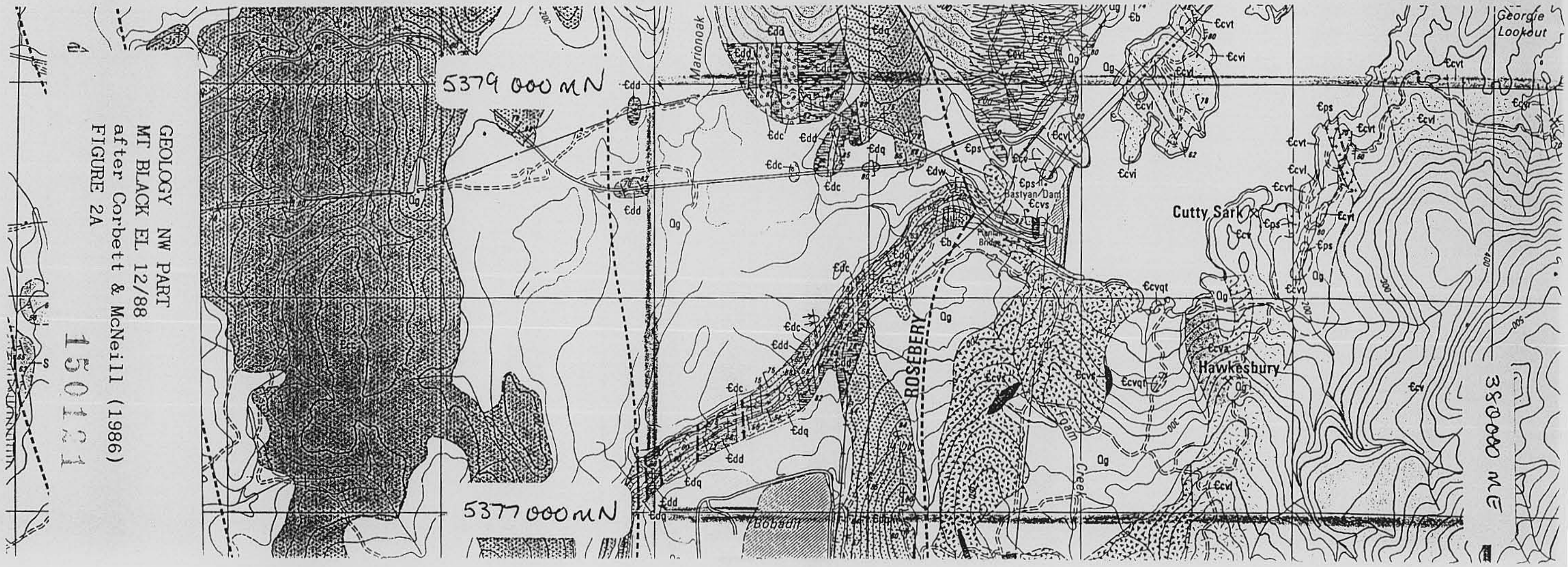
PASMINCO EXPLORATION

A Division of Pasminco Australia Limited

COMPILED:	**E.L. 12/88 - MT. BLACK J.V.**
DATE:	
DRAWN:	
REF.:	DETAILED LOCATION MT BLACK EL 12/88
REVISIONS:	150120
DRAWING No.	SCALE 1:50,000 (500 0 500 m)
	FIG. No. 1B

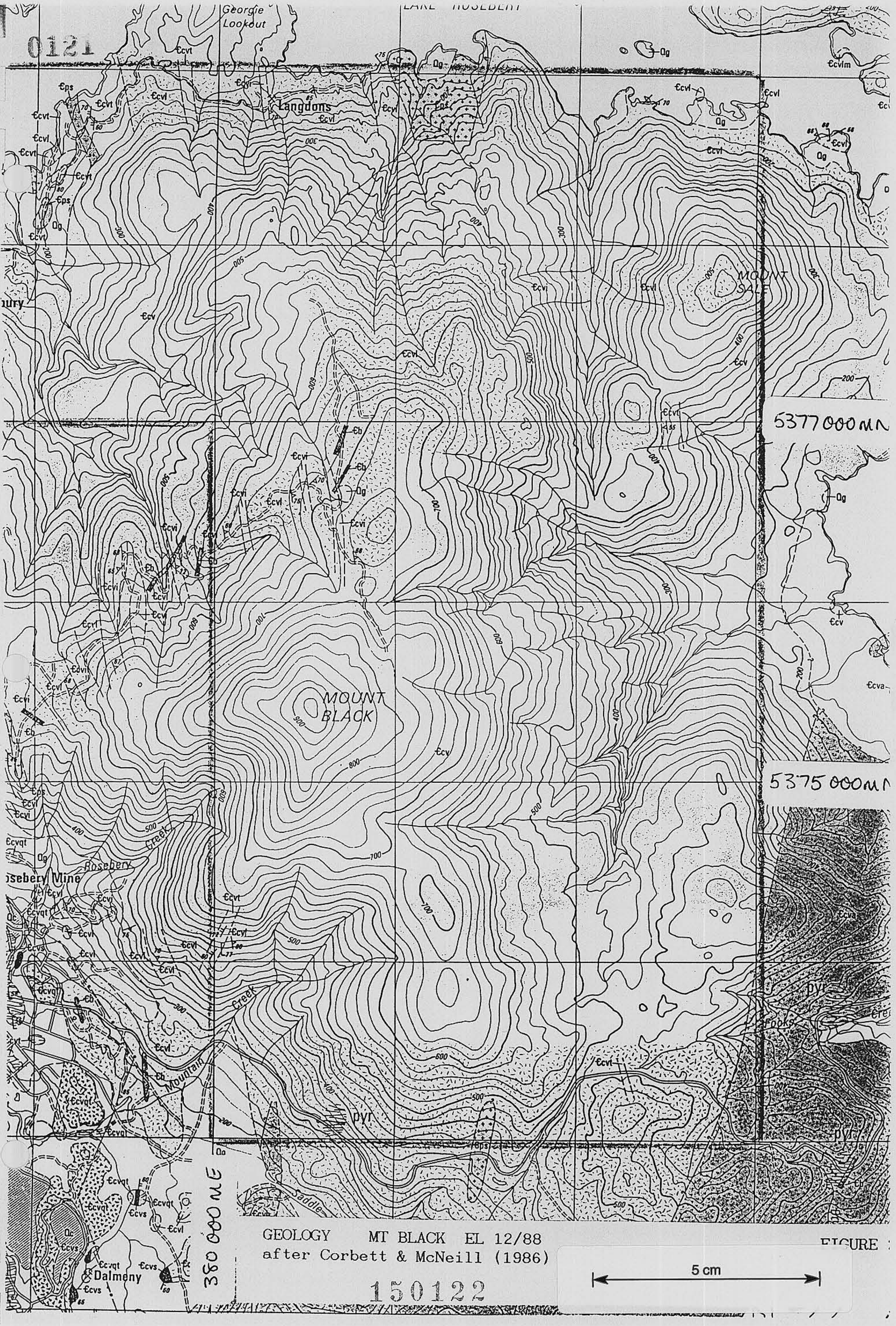
0120





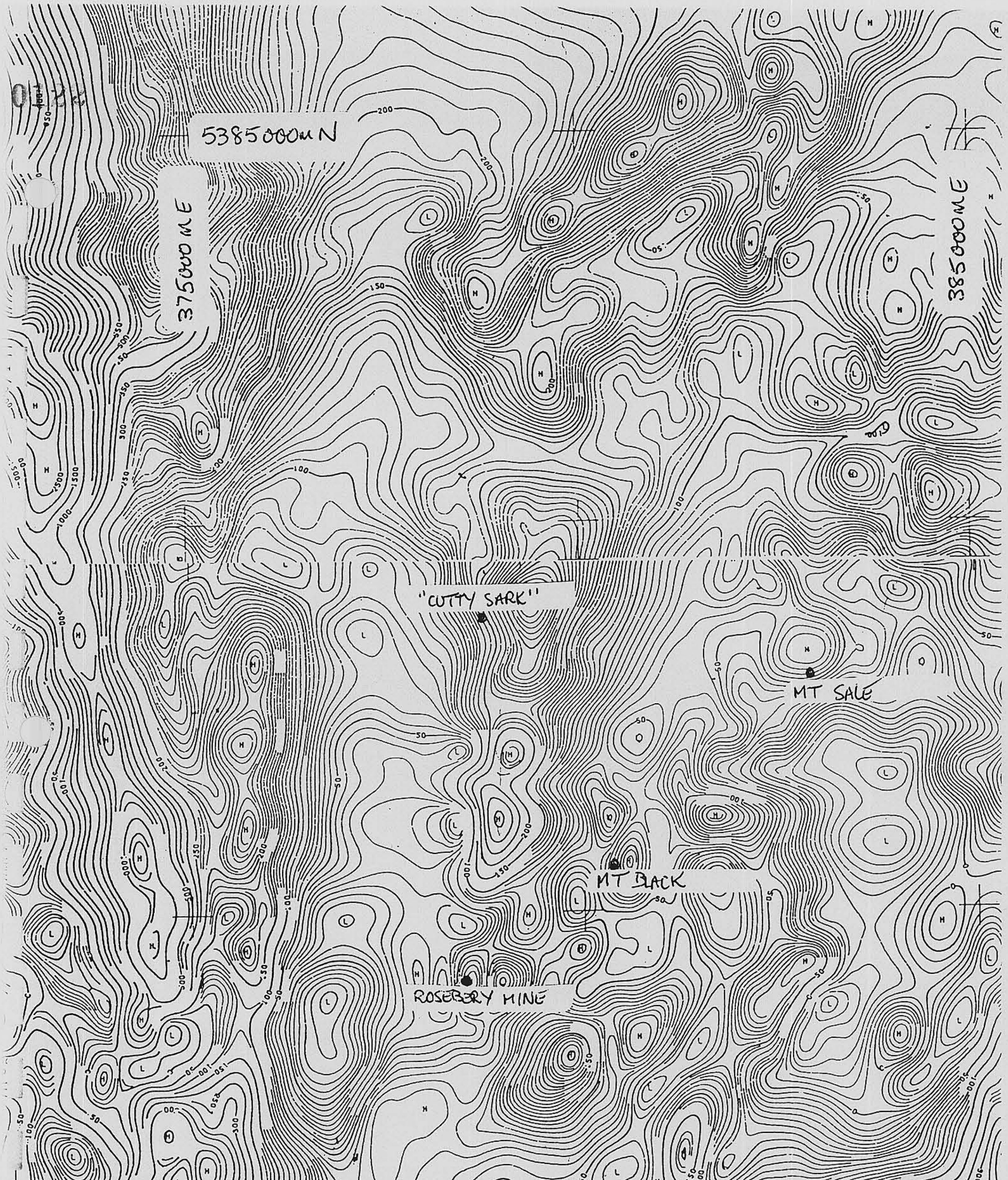
GEOLOGY NW PART
MT BLACK EL 12/88
after Corbett & McNeill (1986)
FIGURE 2A

150121



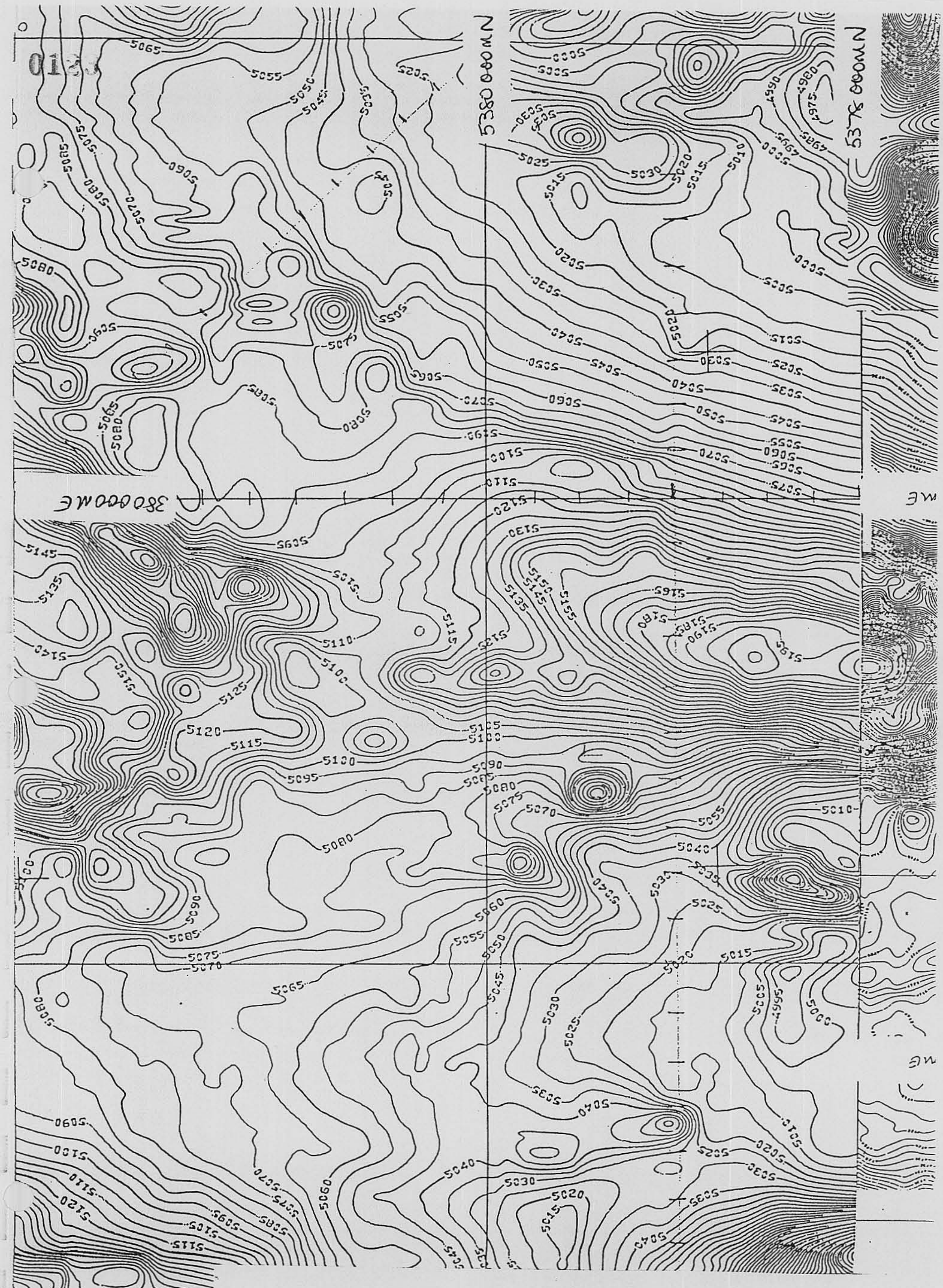
GEOLOGY MT BLACK EL 12/88
after Corbett & McNeill (1986)

FIGURE



EXTRACT OF 1981 MINES DEPARTMENT REGIONAL SURVEY IN MT BLACK AREA
FIGURE 3

150123



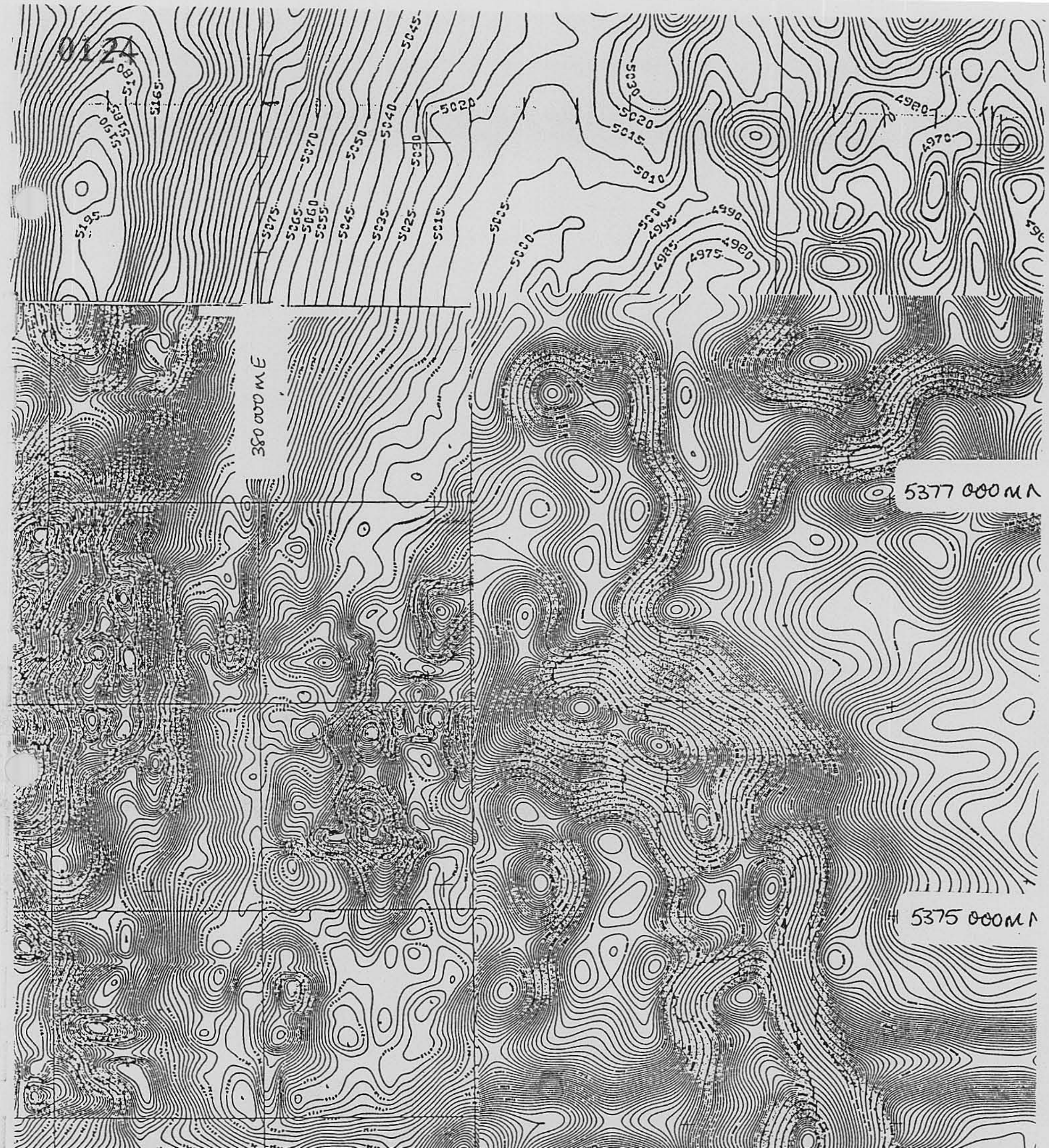
CONTOURS OF RESIDUAL MAGNETIC FIELD (contour interval 2 nT)

EL 12/88 MT BLACK NW

FIGURE 4A

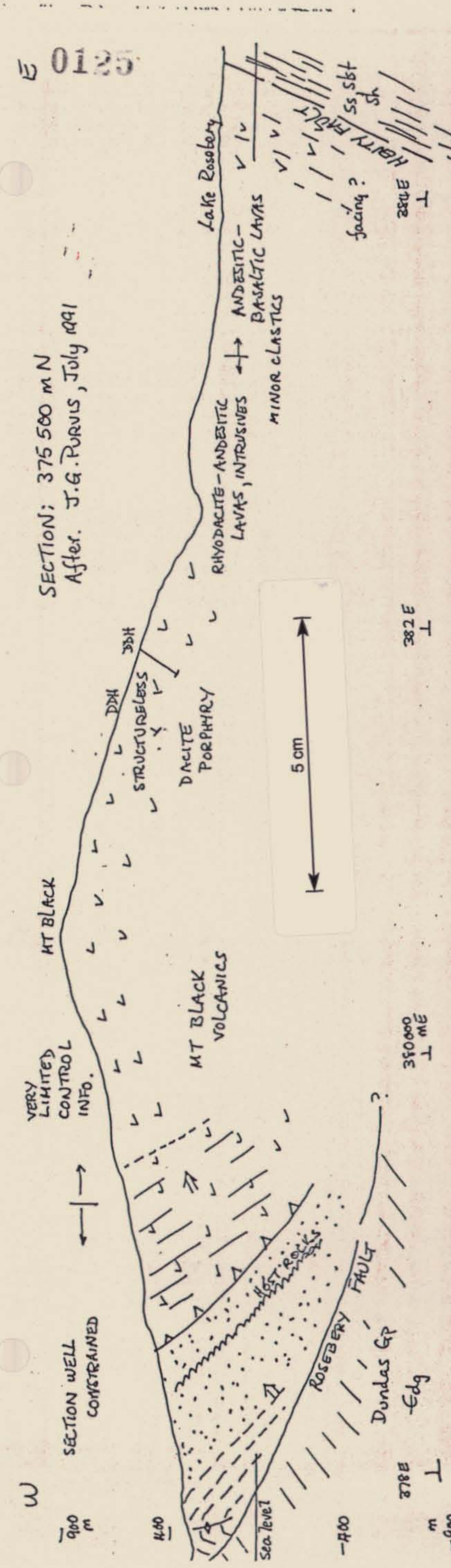
5 cm

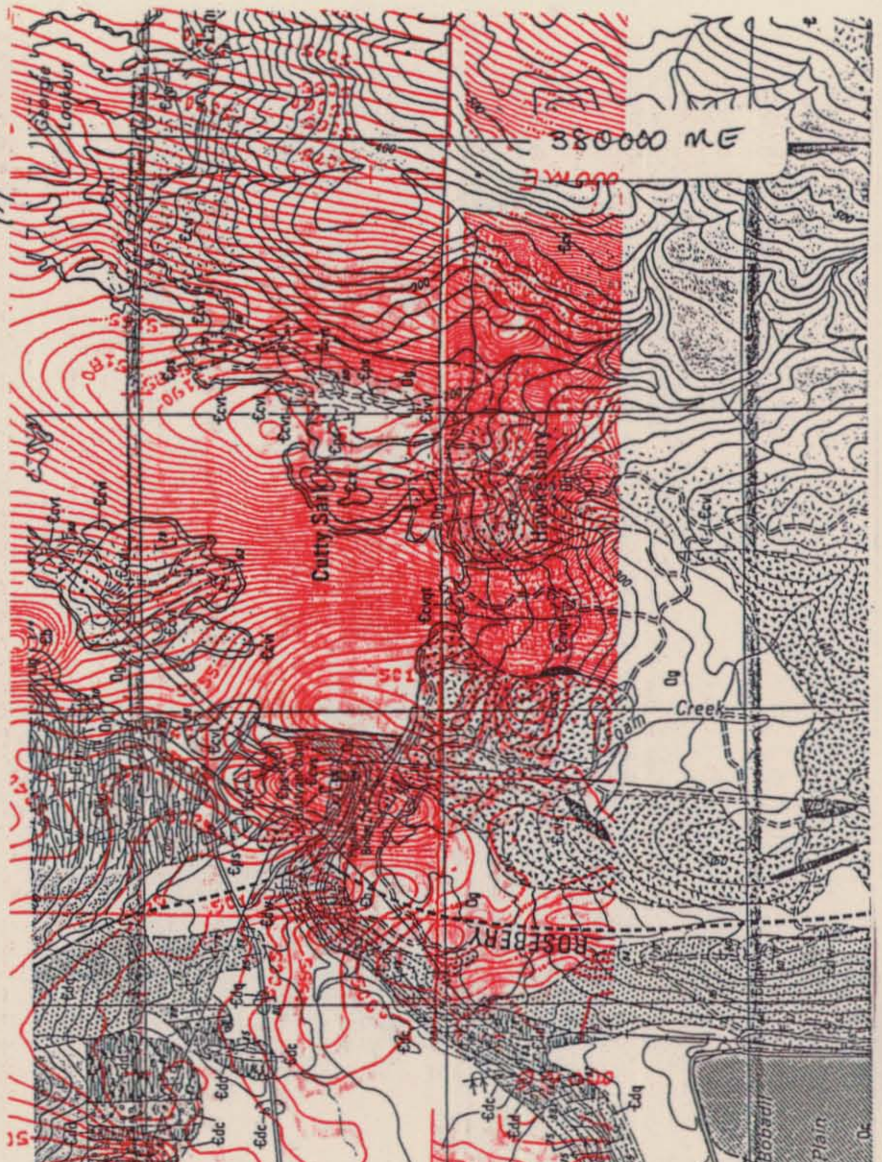
150124



CONTOURS OF RESIDUAL MAGNETIC FIELD   EL 12/88 MT BLACK
(Contour interval 2nT)   FIGURE 41

E 0125

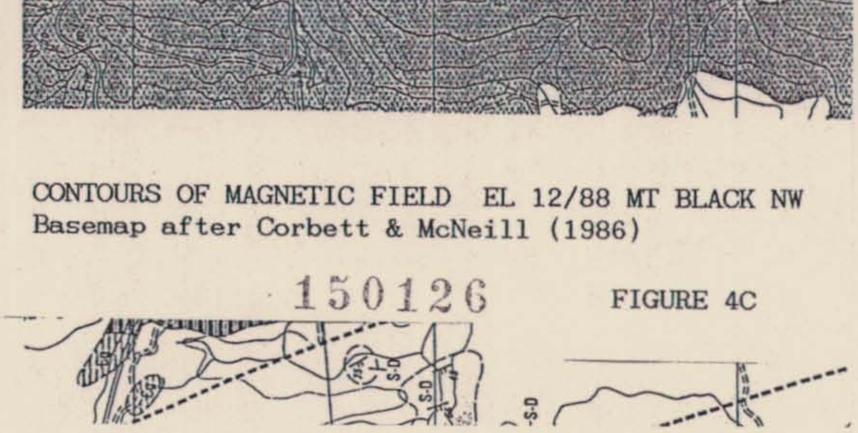


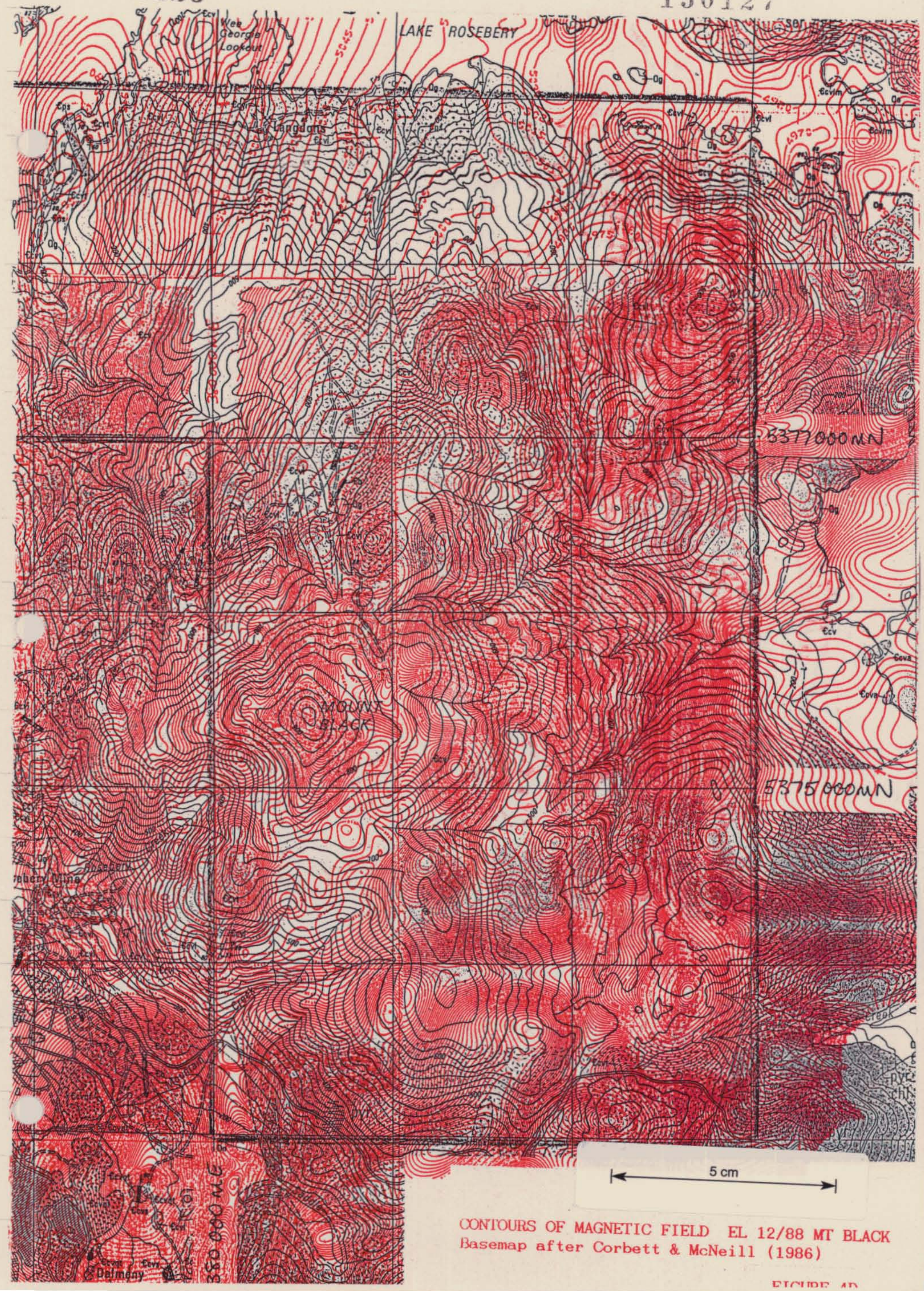


CONTOURS OF MAGNETIC FIELD EL 12/88 MT BLACK NW
Basemap after Corbett & McNeill (1986)

150126

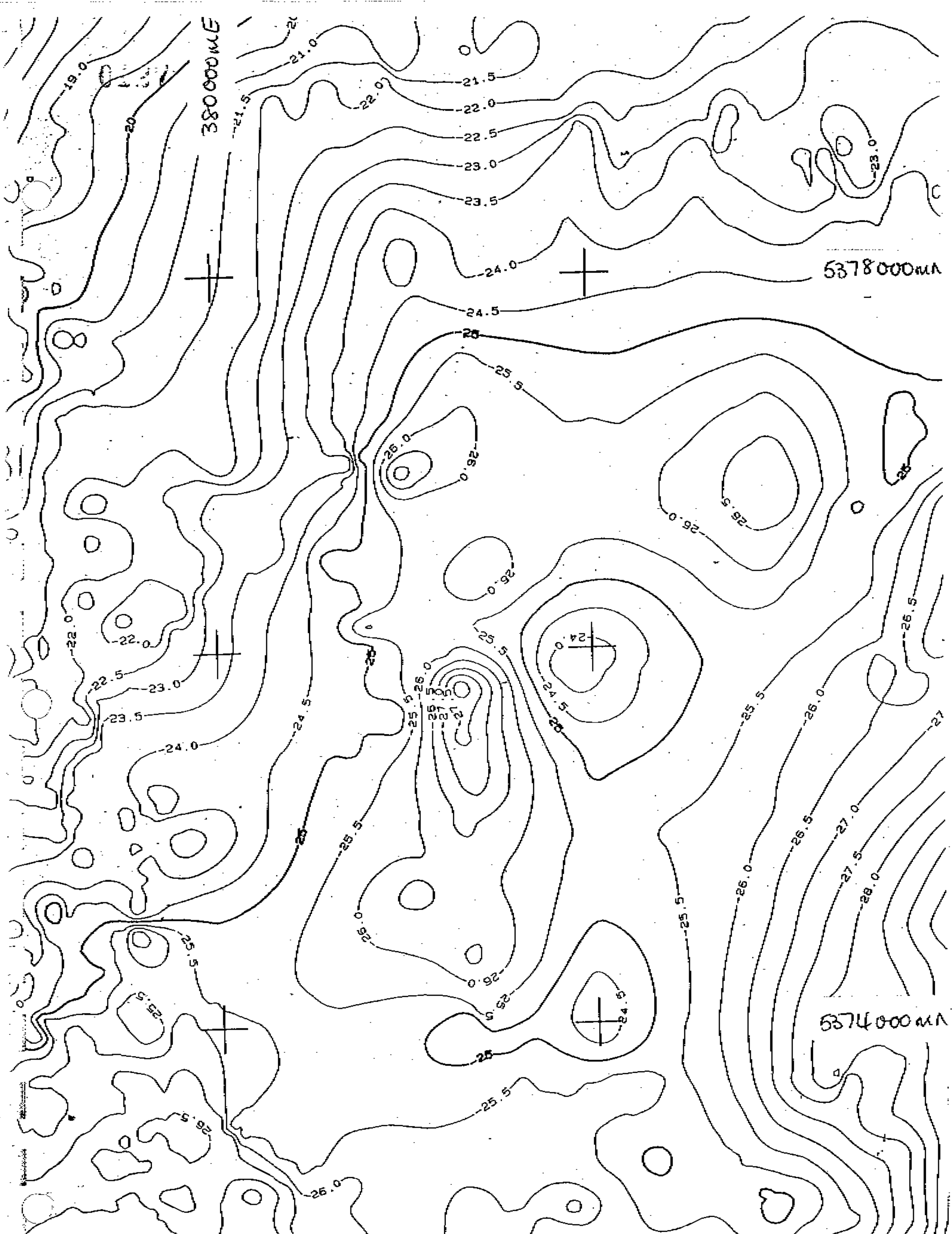
FIGURE 4C





CONTOURS OF MAGNETIC FIELD EL 12/88 MT BLACK
Basemap after Corbett & McNeill (1986)

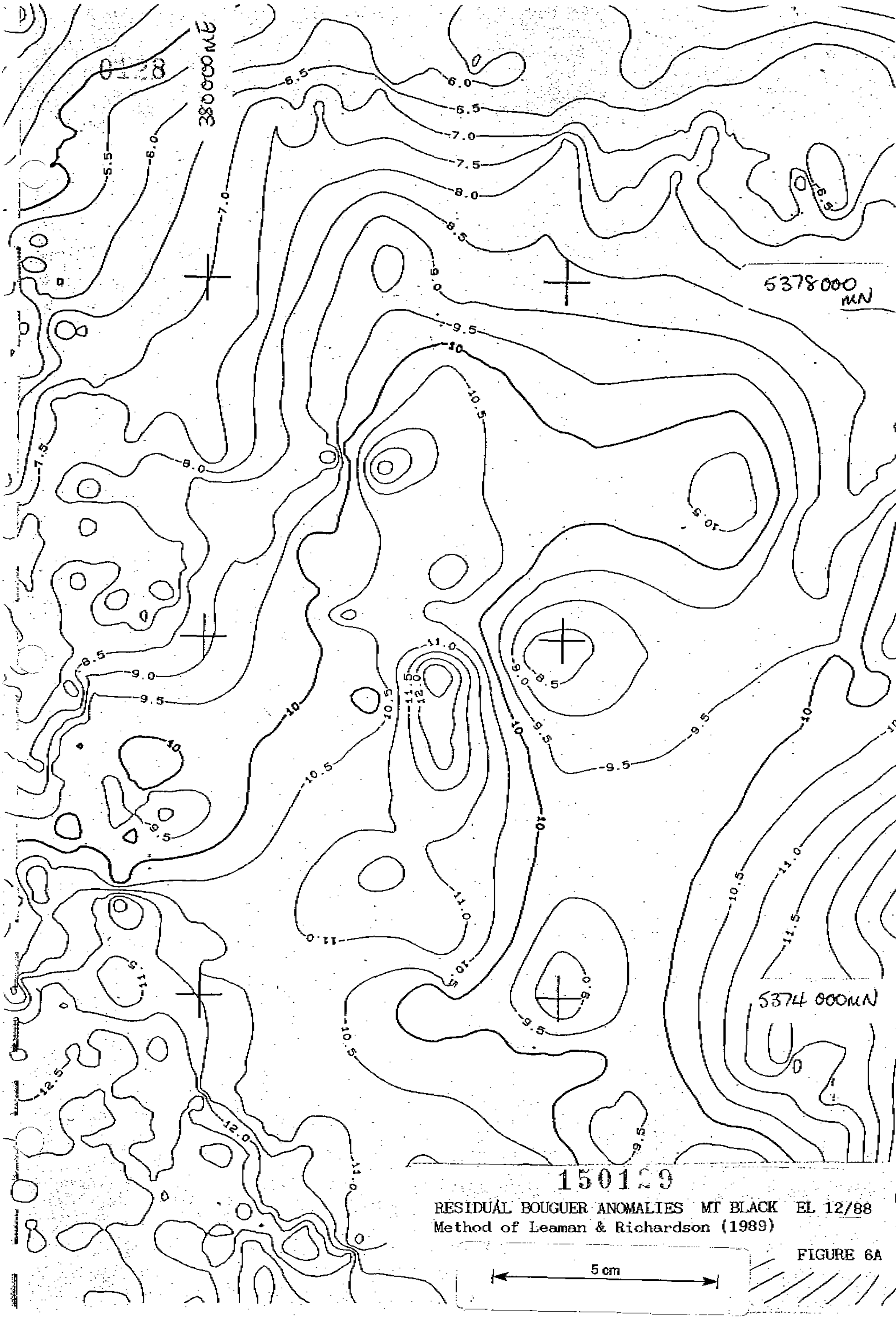
FIGURE 4D



150128 FIGURE 5

BOUGUER ANOMALIES MT BLACK EL 12/88
Reduction density 2.67 gm/cc

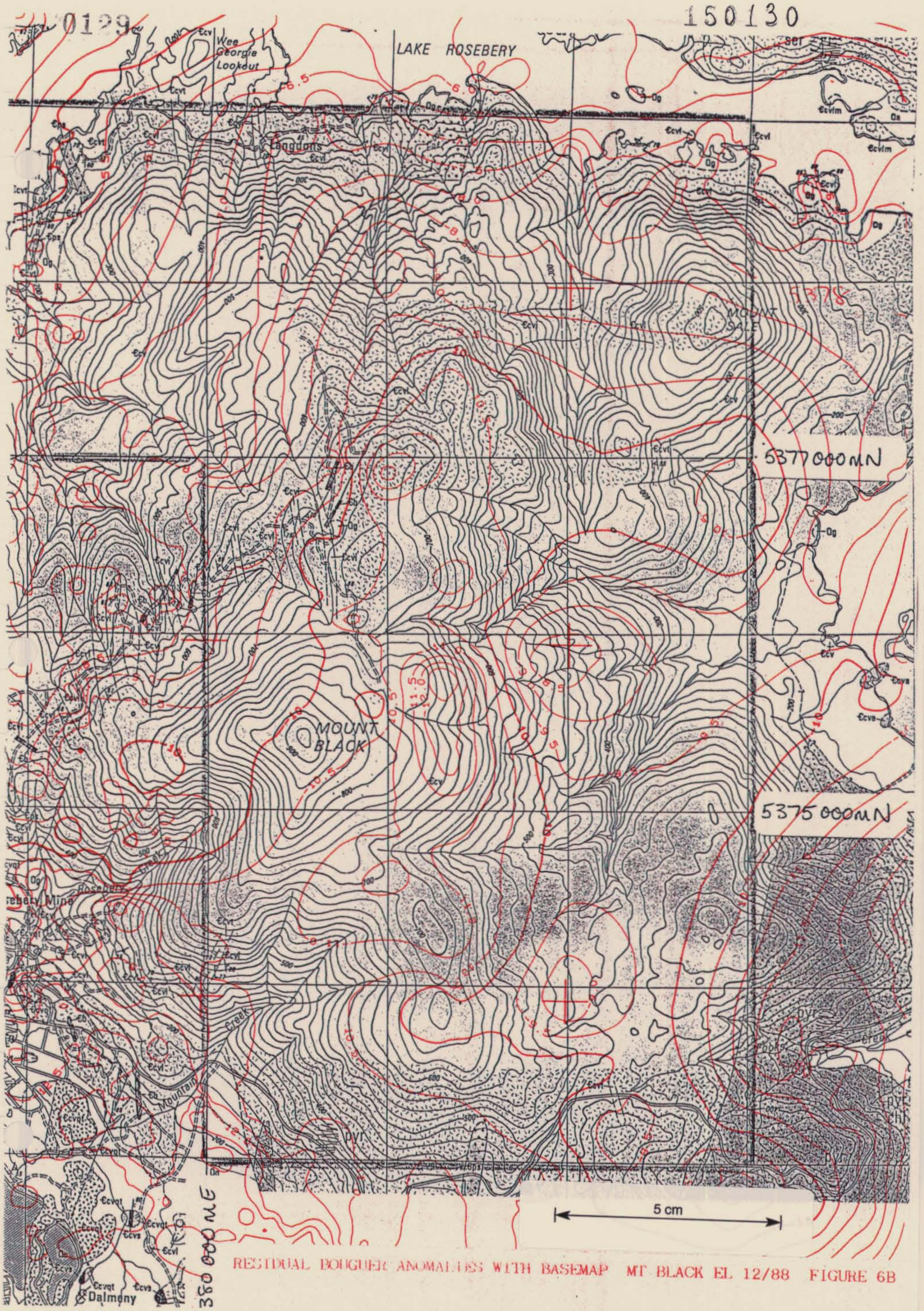
5 cm



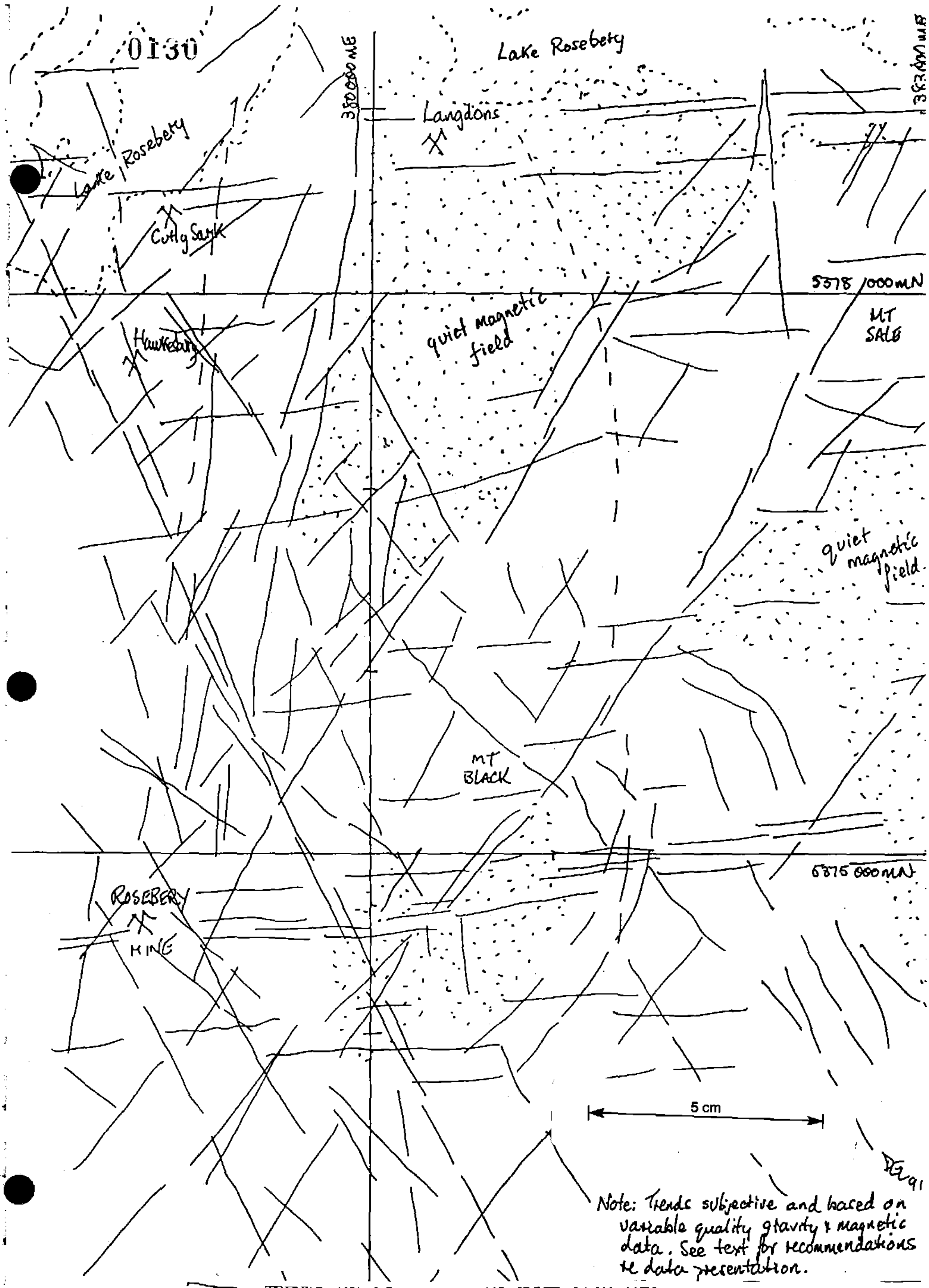
150129

RESIDUAL BOUGUER ANOMALIES MT BLACK EL 12/88
Method of Leaman & Richardson (1989)

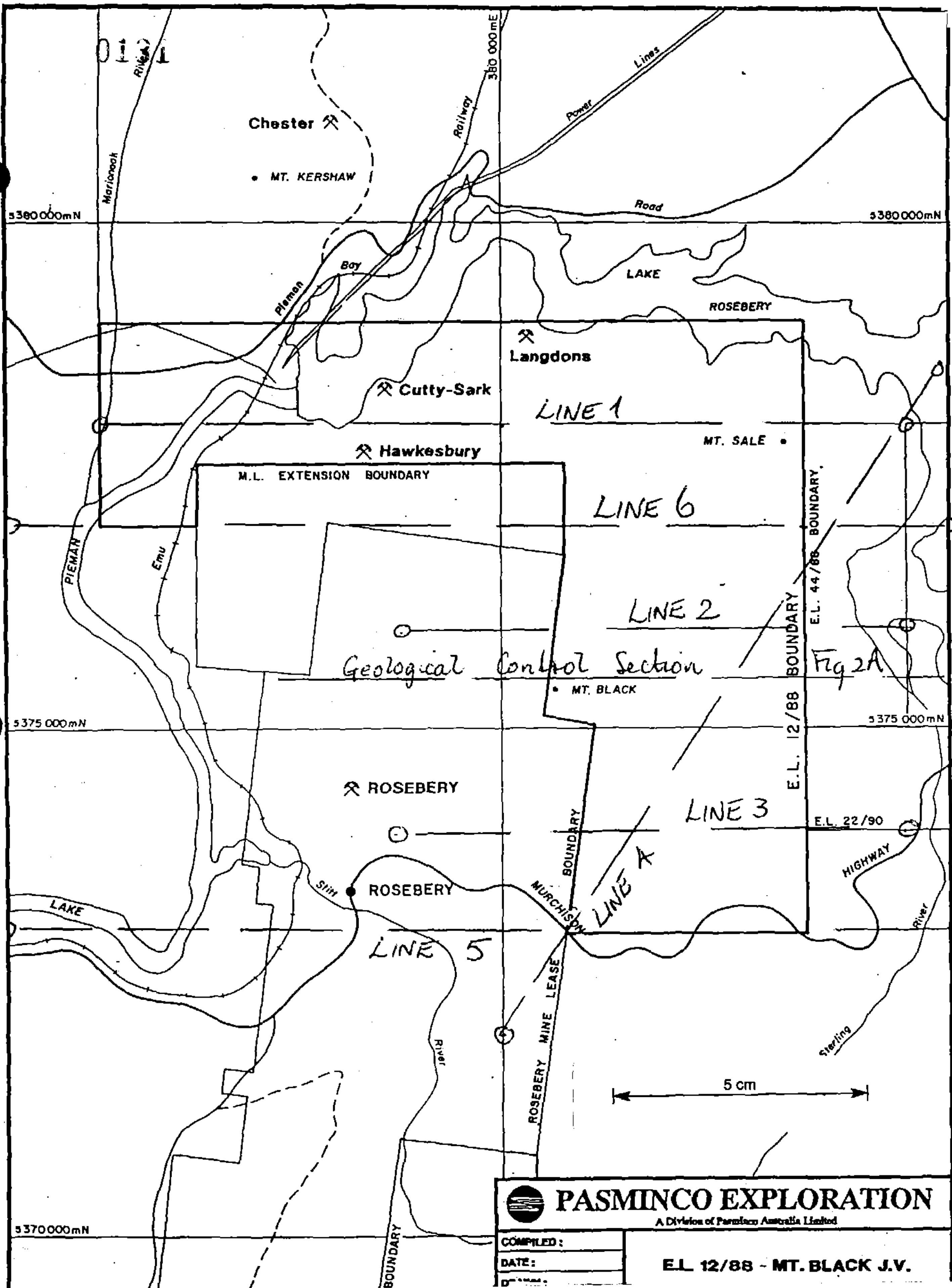
FIGURE 6A



RESIDUAL BOUGUER ANOMALIES WITH BASEMAP MT BLACK EL 12/88 FIGURE 6B

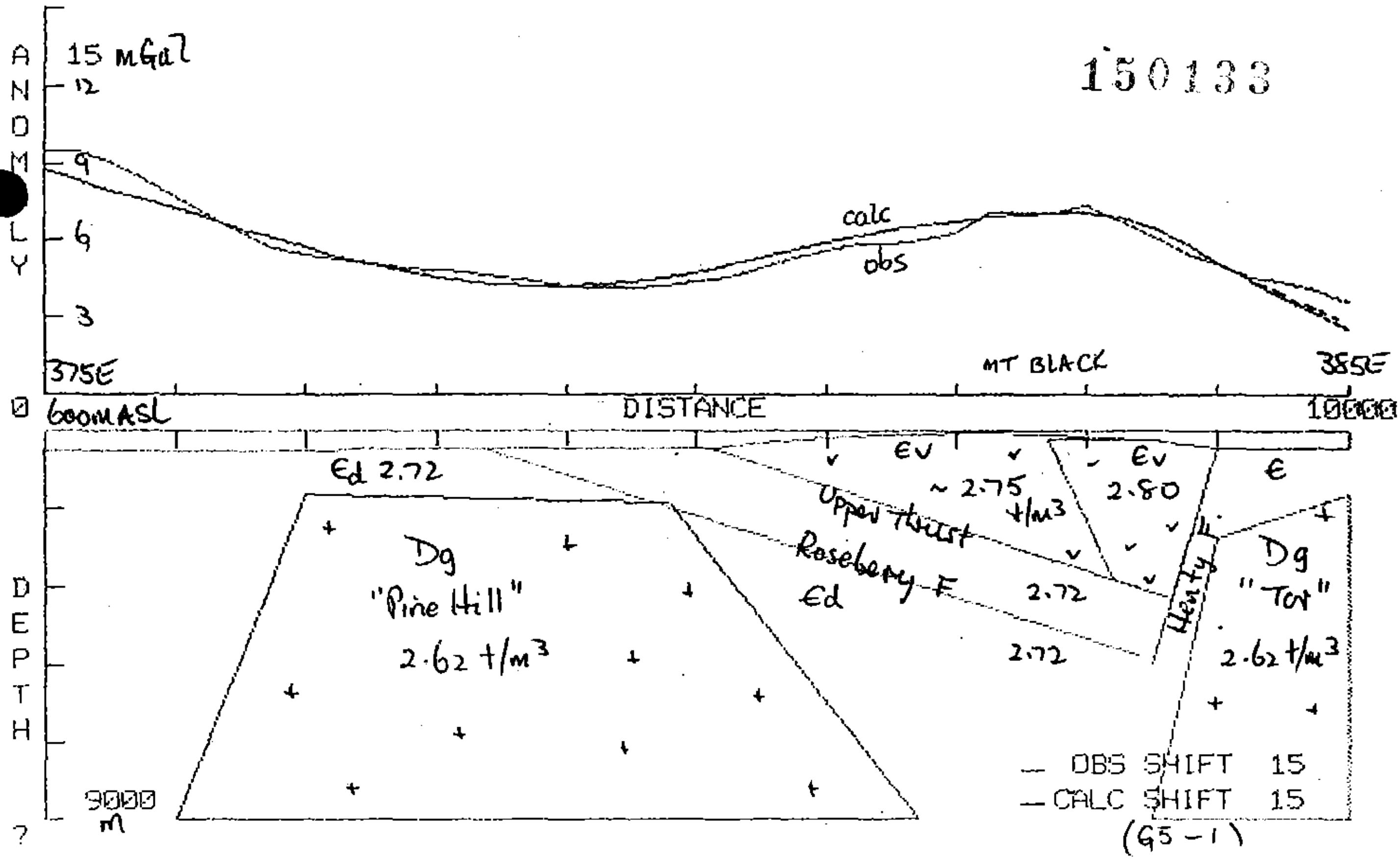


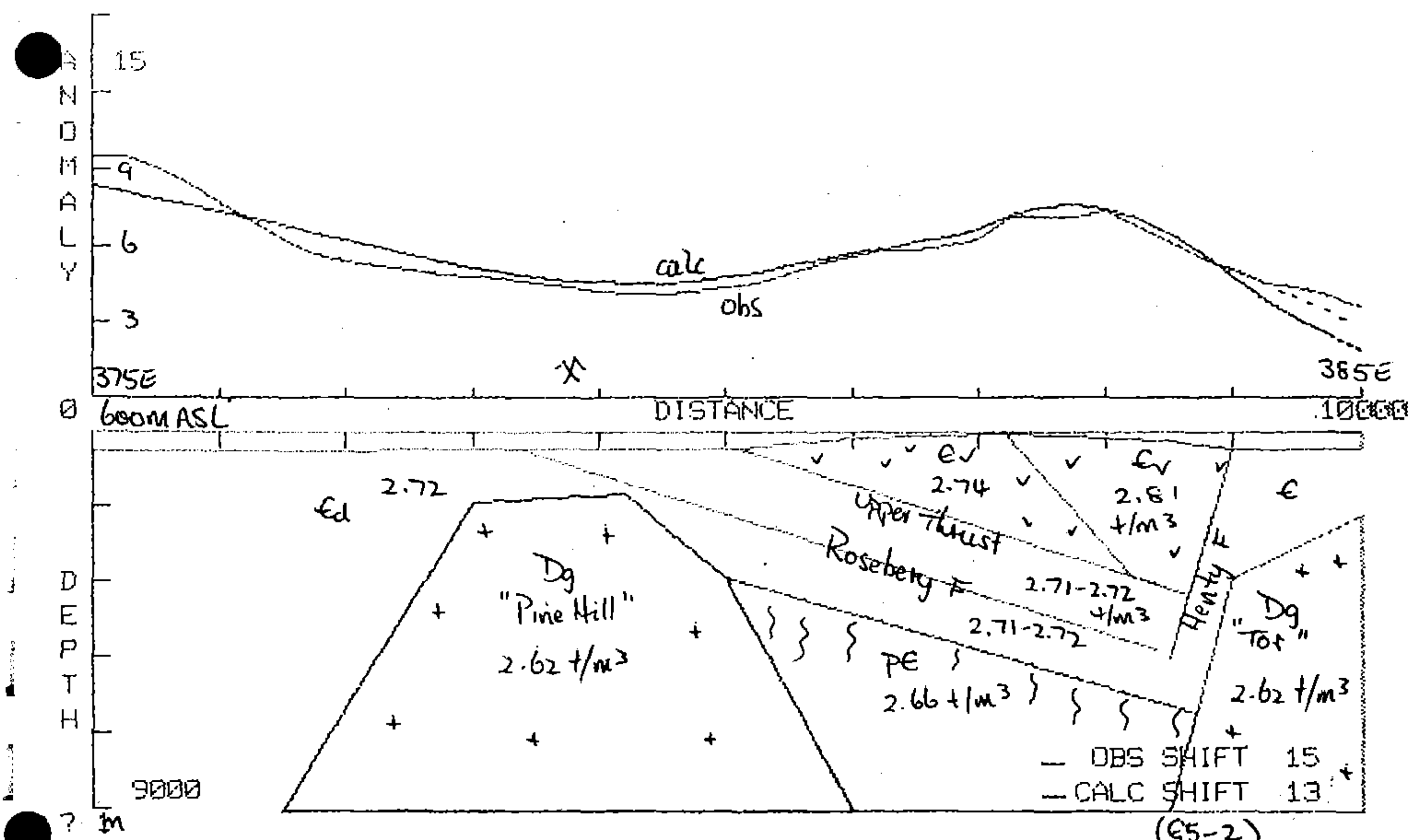
TRENDS AND LINEAMENTS INFERRED FROM CURRENT GRAVITY AND MAGNETIC COMPILATIONS MT BLACK EL 12/88 FIGURE 7



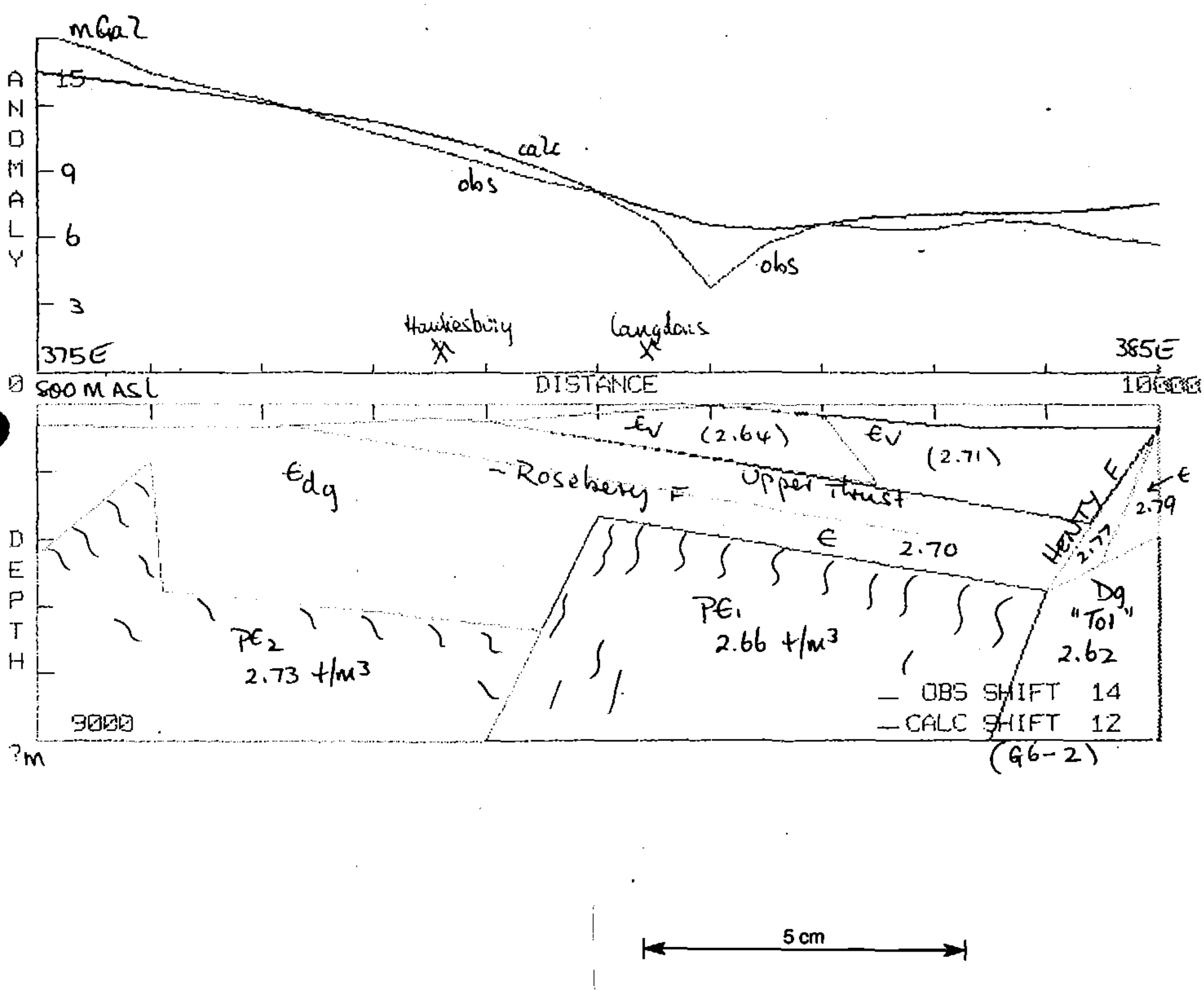
150132

LOCATION OF MODELLED SECTIONS MT BLACK EL 12/88 FIGURE 8

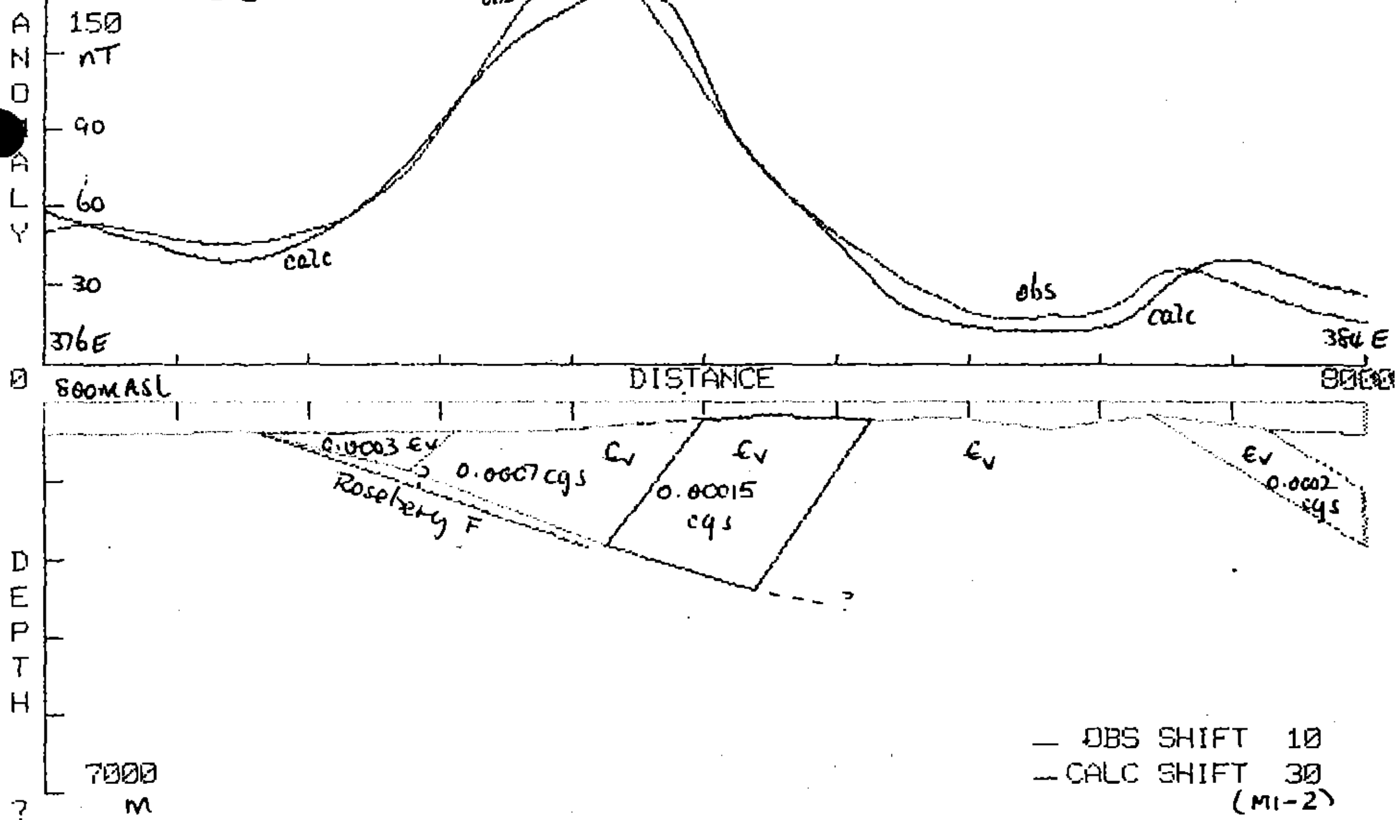


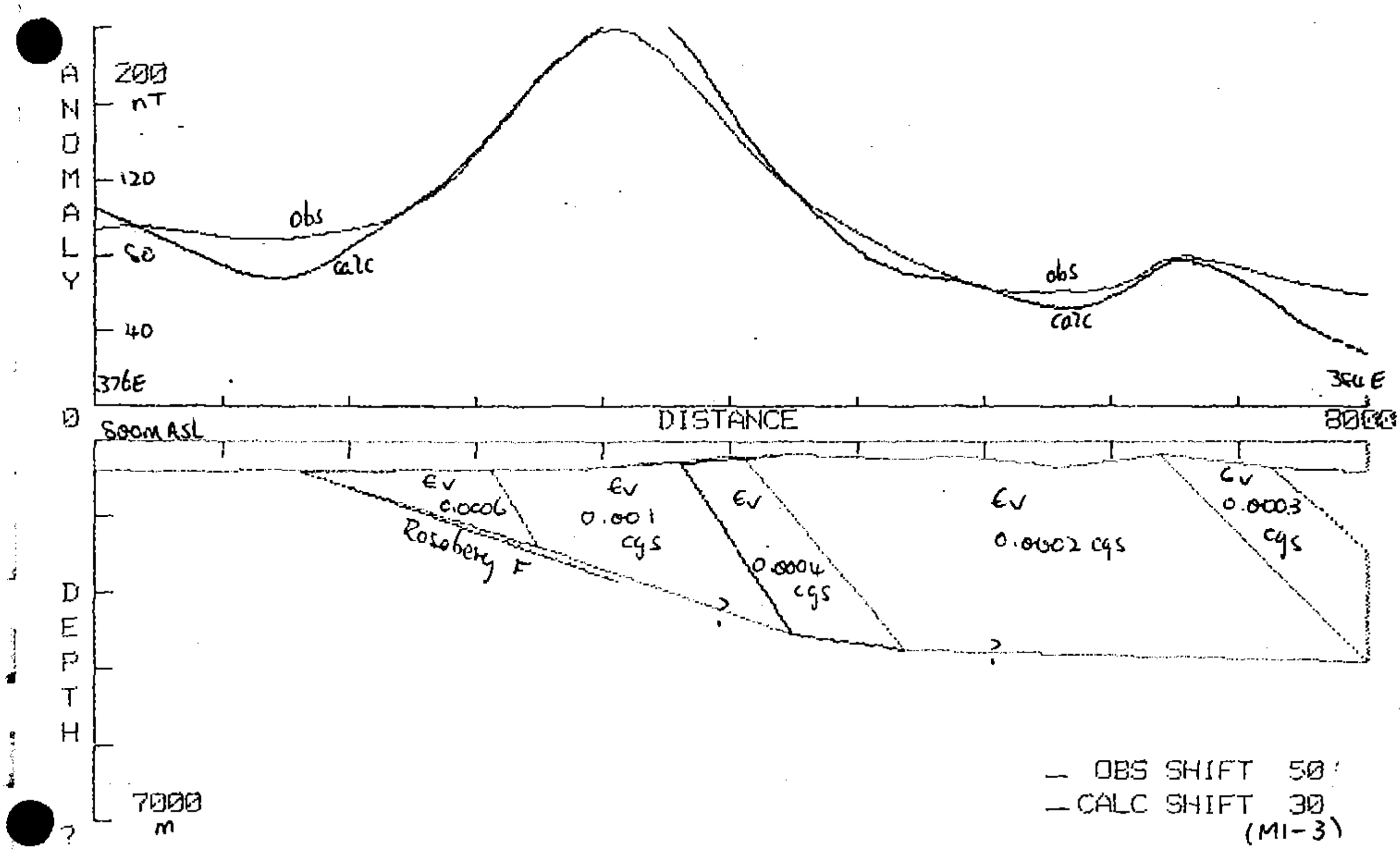


2D GRAVITY MODEL: LINE 5 5373 000 MN, 375 - 385 000 ME FIGURE 9



2D GRAVITY MODEL: LINE 6 5377 000 MN, 375 - 385 000 ME   FIGURE 10

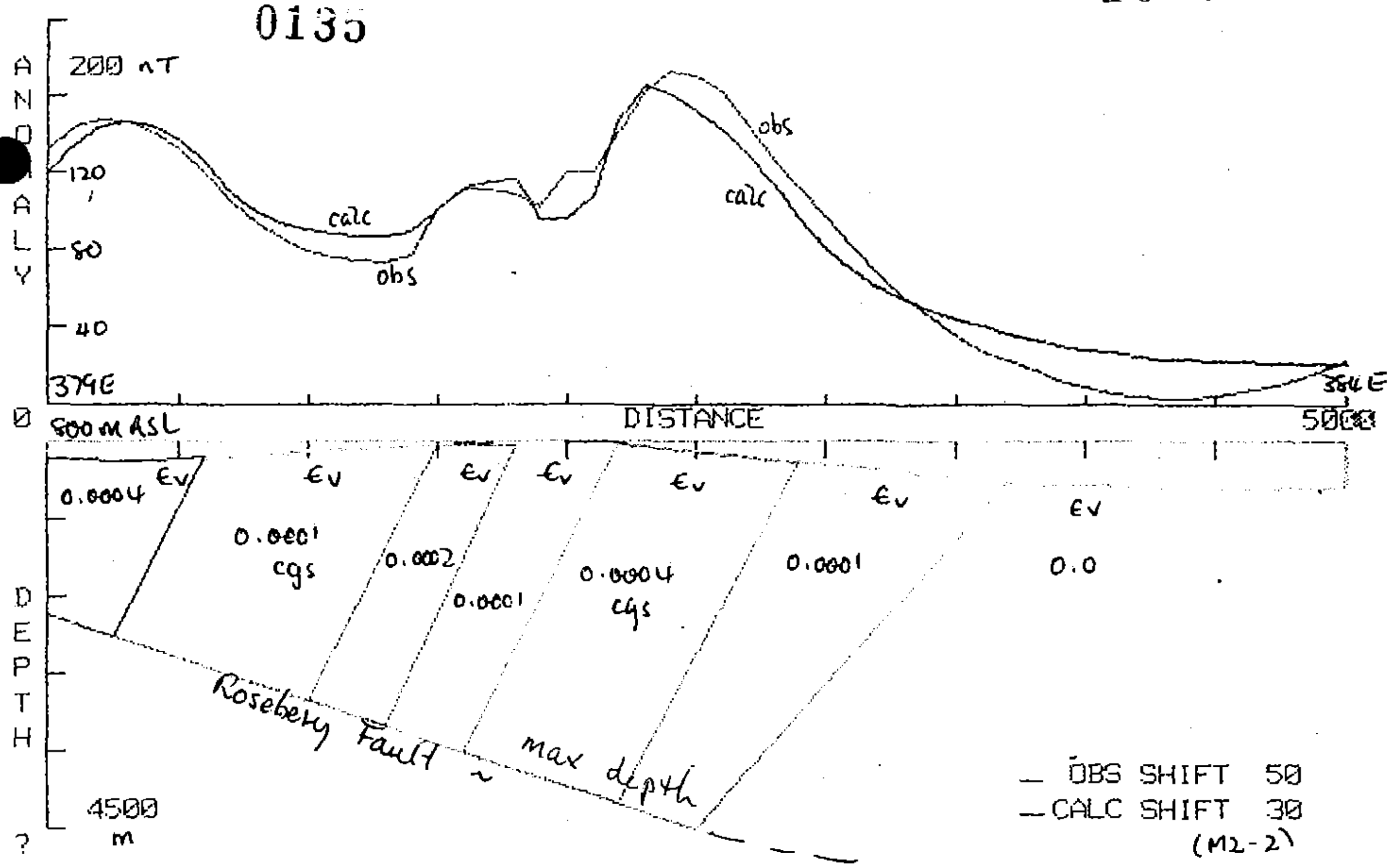


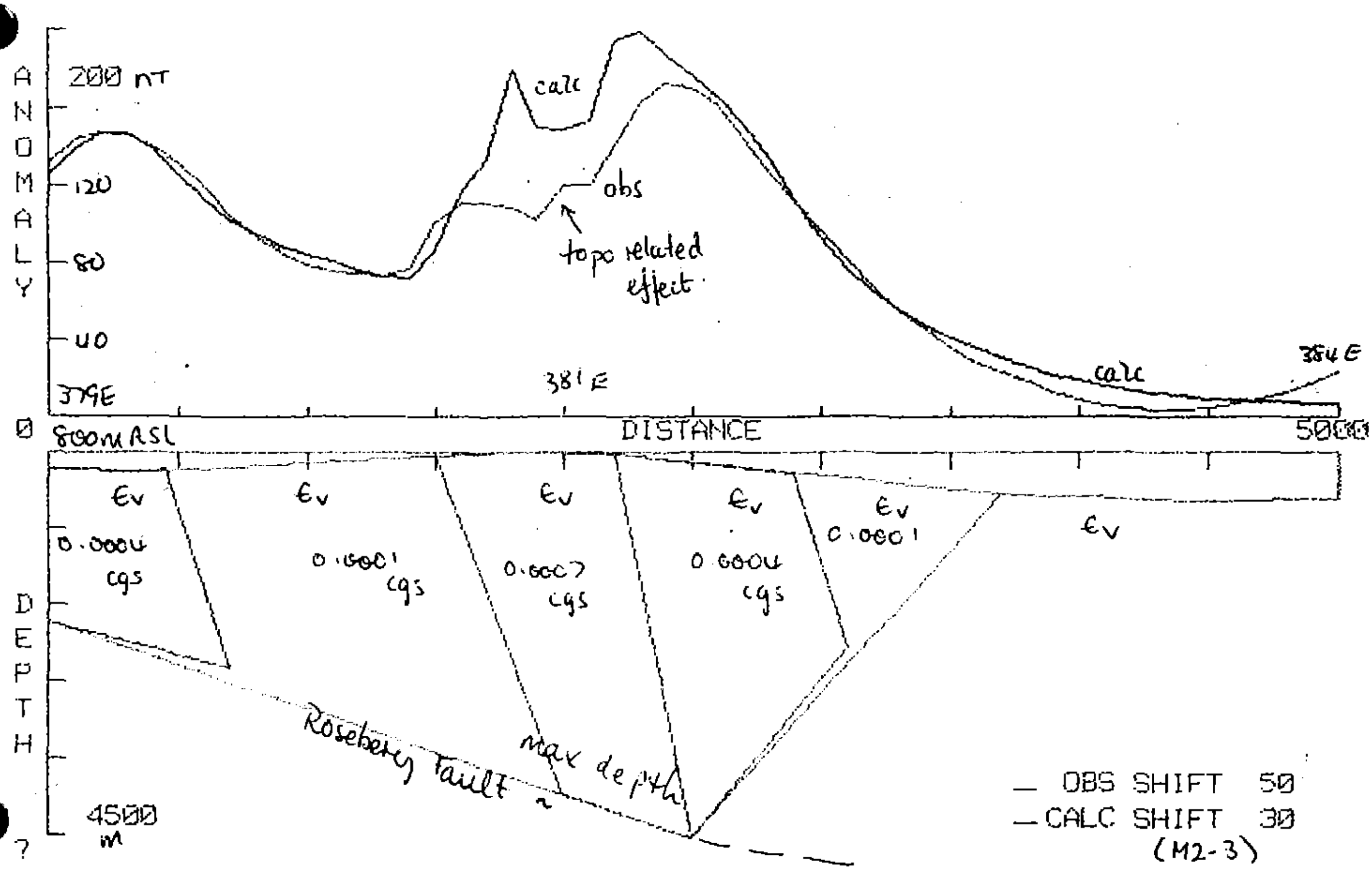


JR July 91

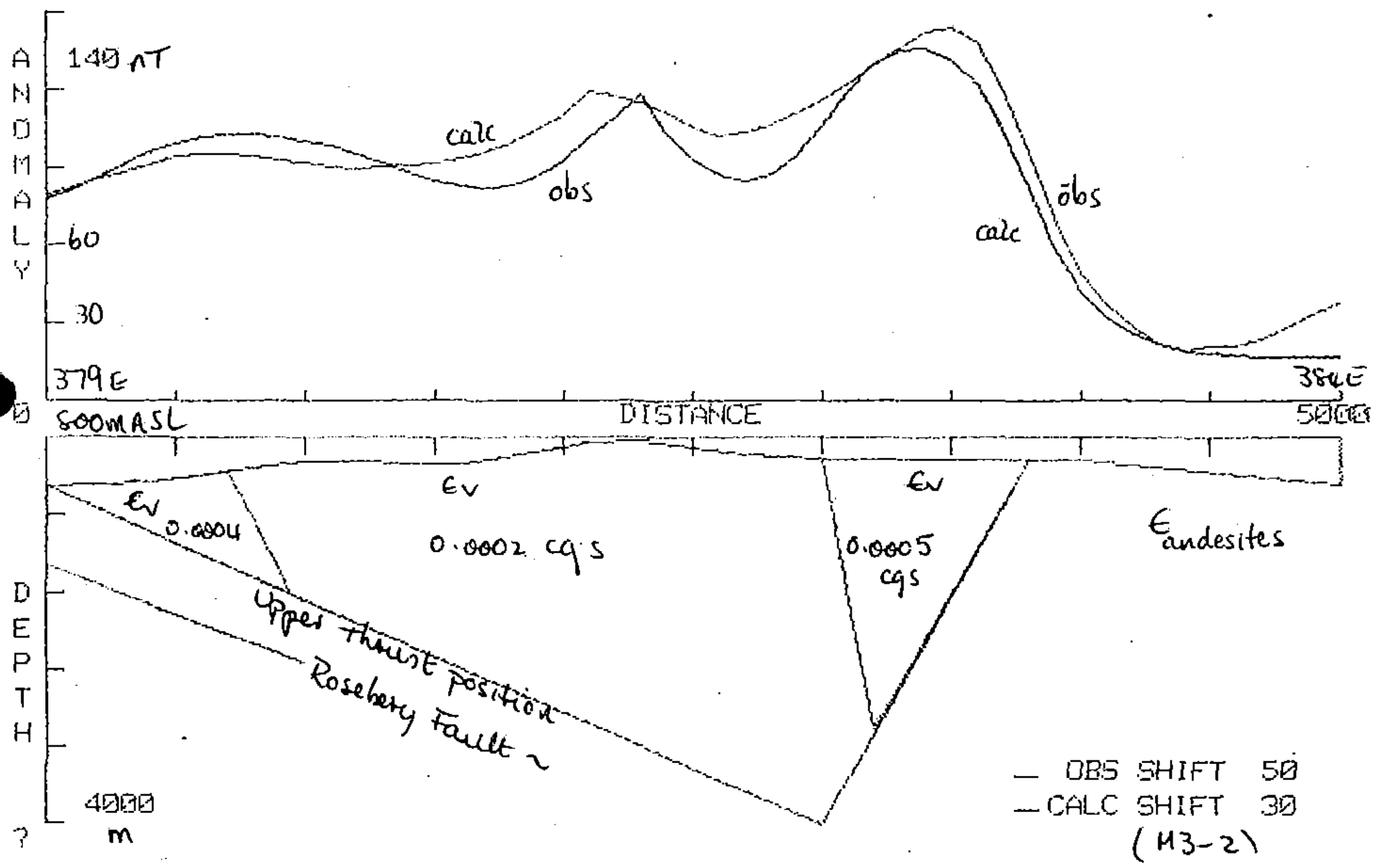
2D MAGNETICS MODEL: LINE 1 5378 000 MN, 376 - 384 000 ME FIGURE 11

0135

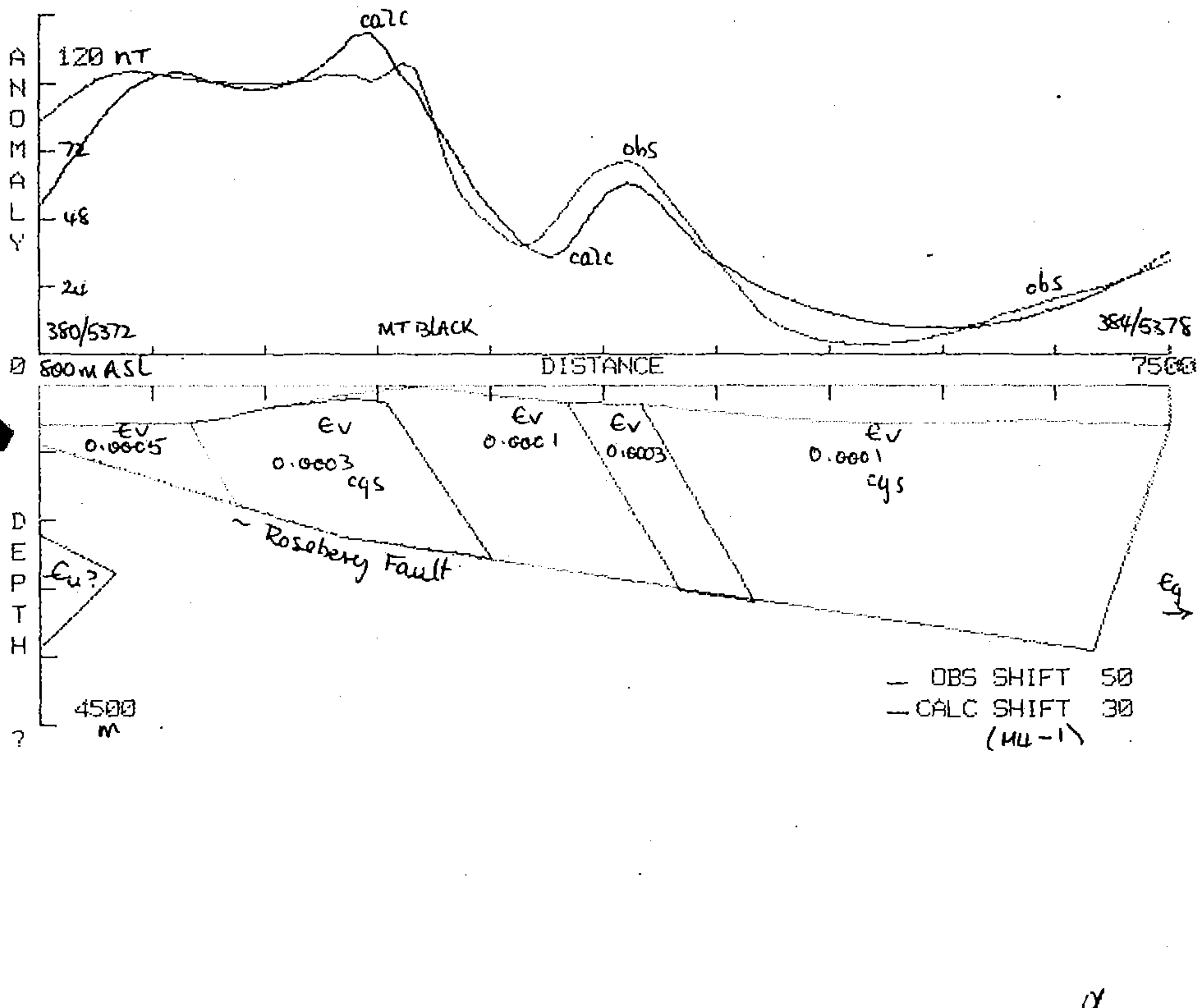




2D MAGNETICS MODEL: LINE 2 5376 000 MN, 379 - 384 000 ME FIGURE 12



2D MAGNETICS MODEL: LINE 3 5374 000 MN. 379 -384 000 ME FIGURE 13



2D MAGNETICS MODEL: LINE 4 380000/5372000 - 384000ME/5378000MN
FIGURE 14

GENERAL COMMENTS

1. There is no single factor responsible for concealing the primary textures in Samples 84027 - 84035. Alteration involving mainly sericite, chlorite and in some cases silicification has blurred primary textures in many cases. Incipient metamorphic foliation and/or fracturing and granulation is a factor in some cases.

   I do not believe that the rocks have been hornfelsed.

2. The rocks are interpreted to have originated as follows :

84027	porphyritic intermediate lava
84028	volcaniclastic arenite
84029	dacitic volcanolithic arenite
84030	volcanolithic arenite with muddy laminations
84031	porphyritic dacite
84032	porphyritic quartz andesite
84033	vitric crystal tuff (unwelded or poorly welded)
84034	vitric crystal tuff (unwelded or poorly welded)
84035	volcaniclastic arenite

3. The slatey, sericitic, laminated siltstone samples 84036 and 84047 yield no indication of facing directions.

10168

LEGEND

MT. BLACK VOLCANICS.

- Dacitic to andesitic lavas
- Dacitic volcaniclastics (mostly probable ignimbrites and lava breccias).
- UPPER THRUST.

HANGINGWALL EPICLASTICS.

- Crystal-lithic sandstones and breccias (with shale lenses).
- Quartz-feldspar Porphyry.
- ROSEBERY FAULT.

DUNDAS GROUP SEDIMENTS.

- Siltstones and shales.

- 42° Bedding.
- Bedding facing.
- 65° Cleavage.
- 65° 80° Conjugate cleavages.
- 82° 67° Conjugate cleavages with same strike.
- fb 80° Flow banding in lavas and pyroclastics.
- F 75° Fault, with dip.
- 45° Thrust, with dip.
- Geological contact.
- Anticlinal axis.
- CS 1 Existing drillhole.
- A Potential drillhole.
- dtx Detextured zones (characterised by strong to intense silica - sericite - carbonate alteration and numerous thick quartz - carbonate veins).
- 43° Vein, with dip.

100 0 100 200 300 400 500

metres

150140

5 cm

91-3286.

PASMINCO EXPLORATION
A Division of Pasminco Australia Limited

COMPILED : J.G.P.	E.L. 12/88 - MT. BLACK J.V.
DATE : Nov. 1990	BASTYAN DAM AREA
DRAWN : N.W.D.S.	
REF:	**GEOLOGY**
REVISIONS : J.G.P. - July, 1991.	
DRAWING No.	SCALE 1: 5000 (approx.)
FIG. No. 9	

10169

N.W. Coast Computer Aided Drafting Centre. Phone (004 354315)
REF: PEBYISEC Fax. (004 354495)