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Prospect No. 7610

CSR LIMITED
MINERALS EXPLORATION AND DEVELOPMENT GROUP

DIAMOND DRILLING OF THE
DOCO PROSPECT,
EL. 12/72 (BULGOBAC), TASMANIA

EMR 112/85

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CONTENTS

	<u>PAGE NO.</u>
1. INTRODUCTION	1
2. SUMMARY	2
3. TITLE	3
4. PREVIOUS EXPLORATION ACTIVITY	4
4.1 Pre-1963	4
4.2 1963-1972	4
4.3 1972-1976	4
4.4 1977-1984	5
5. CSR TARGET AND PHILOSOPHY	7
5.1 Boco Prospect	7
5.2 Central Volcanics in Boco Area	7
5.3 North Pinnacles Area	7
5.4 Remainder of Title	8
6. EXPLORATION COMPLETED 1985	9
6.1 Geological Mapping	9
6.2 Drilling Access and Site Preparation	9
6.3 Diamond Drilling	9
6.4 Core Logging & Sampling	12
6.5 Geophysics	13
6.6 Geochemistry	13
6.7 Petrology	14
7. RESULTS AND INTERPRETATION	15
7.1 Geological Mapping	15
7.2 Diamond Drilling	15
7.3 Geochemistry	17
7.4 Geophysics	19
7.5 Geological Interpretation	19

CONTENTS (contd.)

	<u>PAGE NO.</u>
8. POSSIBLE FURTHER INVESTIGATIONS	24
9. REFERENCES	25

APPENDICES

- I DRILL LOGS - DDHs BBP 278, 279, 280
- II ANALYTICAL RESULTS - 1985
- III PETROLOGICAL REPORT - DR. B.J. BARRON
- IV TABULATED WHOLE ROCK AND TRACE ELEMENT ANALYSES
- V TABULATED RESULTS FOR EXPECTED AND RECORDED VALUES OF CSR STANDARD, GX1H

LIST OF ILLUSTRATIONS

<u>FIGURES</u>		<u>FACING PAGE NO.</u>
1	LOCATION PLAN, EL 12/72, TASMANIA (SCALE 1:100,000)	1
2	COMPARISON OF BOCO AND QUE RIVER VOLCANICS	18

<u>TABLE</u>		<u>ON PAGE NO.</u>
1	SULPHUR ISOTOPE ANALYSES BOCO DIAMOND DRILL HOLES	19

<u>PLANS (in pocket)</u>		<u>SCALE</u>
<u>DRG NO.</u>		
7610-1	DRILL HOLE TRAVERSES ACROSS THE BOCO ALTERATION ZONE	1:5,000
7610-3	DDH BBP 278 - CROSS SECTION	1:1,000
7610-4	EXPLORATION DIAMOND DRILL HOLES BBP 254, BBP 279	1:1,000
A0-521-0107	EXPLORATION DIAMOND DRILL HOLE BBP 251	1:1,000
7610-2	DDH BBP 280 - CROSS SECTION	1:1,000
A0-521-0105	EXPLORATION DIAMOND DRILL HOLE BBP 248	1:1,000

KEYWORDS

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PETROLOGY

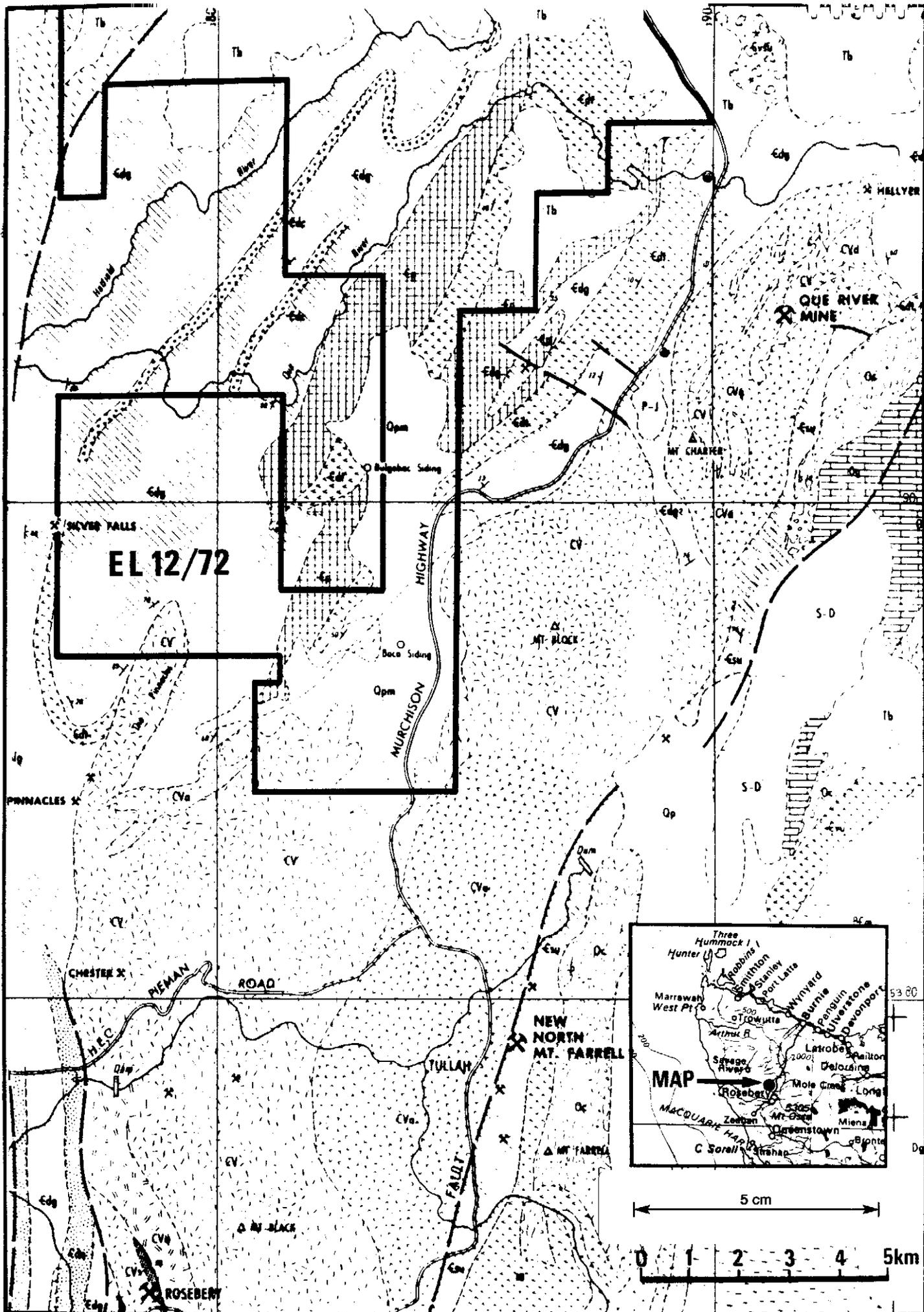
GEOCHEMISTRY

ALTERATION

RHYODACITE

DACITE

BOCO



GEOLOGY FROM GEOLOGICAL SURVEY OF TASMANIA BY K.D. CORBETT 'GEOLOGICAL COMPILATION OF THE MOUNT READ VOLCANICS, QUE RIVER TO MT DARWIN' 1984

FIG.1 LOCATION MAP EL 12/72 BULGOBAC, TASMANIA

1. INTRODUCTION

In 1985, CSR farmed into the Bulgobac Joint Venture on EL 12/72 (Bulgobac) in Western Tasmania (Figure 1). This Joint Venture was between the original licence holder, Electrolytic Zinc Company of Australasia Limited, and Getty Oil Development Co. Ltd.

The title, located mid-way between the Rosebery and Que River Mines, covers a belt of Cambrian volcanic rocks, the "Central Volcanics" of Corbett (1985), considered to be prospective for volcanogenic massive sulphide deposits similar to the Rosebery Mine. The remainder of the title in the main is underlain by a mixed sequence of volcanics, volcanoclastics and sediments of the Cambrian Dundas Group.

The main area of interest was the Boco prospect, a zone of quartz-sericite altered and pyritised acid volcanics within the "Central Volcanics". Previous diamond drilling of the Boco prospect by EZ had failed to locate significant base or precious metal mineralisation. Exploration is hampered by a mantle of up to 100 m of Tertiary glacial sediments.

2. SUMMARY

CSR Ltd. farmed into EL 12/72 (Bulgobac) to further test the Boco prospect. Previous drilling by the titleholder, Electrolytic Zinc Company of Australasia Limited, had located a pyritic, quartz-sericite alteration zone which was considered analogous to the alteration zones which are footwall to the nearby Rosebery and Hercules volcanogenic massive sulphide deposits. The Boco prospect is located in acid volcanics of the Mt. Read Volcanics of Cambrian age.

CSR tested for mineralisation east and north of Boco Siding with two diamond drill holes (BBP 278 and 279). DDH BBP 278 located no mineralisation or alteration. DDH BBP 279 explained the source of a previously reported downhole SIROTEM EM anomaly and established that the alteration zone was limited by a major fault structure. Disseminated pyrite was the only mineralisation intersected.

Following a review of the project, a third and final DDH was drilled to further test perceived favourable lithologies intersected in a previous hole (BBP 251). This third DDH, BBP 280, although not intersecting mineralisation other than pyrite, intersected lithologies which could be correlated to DDH BBP 251. Interpretation suggests that the stratigraphy in the area tested is sub-vertical and striking N-S, with the alteration zone being limited on the eastern side by a fault.

Sulphur isotope analyses indicate that the sulphur in the pyrite, and thus by association the quartz-sericite alteration, to be magmatic in origin. A sea water source for the sulphur would be expected for the formation of a volcanogenic massive sulphide deposit. Consequently, the Boco alteration zone is considered to be related to magmatically derived fluids and thus does not fit the target model.

CSR, with the downgrading of the Boco prospect, withdrew from the Joint Venture.

3. TITLE

EL 12/72 (Bulgobac) was granted to EZ in 1972. The area of EL 12/72 was held previously as a part of EL 5/63 by Comstaff Pty. Ltd. EL 12/72, which is subject to annual renewal, is due to expire on 23/12/87. A description of the licence can be found in EZ Report No. 128 - "Exploration Undertaken in EL 12/72 during 1976-77".

4. PREVIOUS EXPLORATION ACTIVITY

Previous exploration activity has been intensive as indicated below:

4.1 Pre-1963

Although the area of EL 12/72 was undoubtedly prospected in the 1890s through to the 1930s, the only documented mineral occurrence was McIntosh Reid's (1918) report of Samuel Smith's lode which was reported to extend from Boco Creek to Boco Siding. No further mention is made of Samuel Smith's lode in the literature. However, within the area of the Boco Prospect tested by diamond drilling, both of the major outcrops of altered volcanics show evidence of previous prospecting. Samuel Smith's lode was stated by McIntosh Reid to strike at 20° E of N and to dip 70° to the NW.

4.2 1963-1972

Exploration by Comstaff (EL 5/63) was essentially limited to regional stream sediment sampling, but two lines of dipole-dipole IP were completed over the glacial plain between the Murchison Highway and the EBR railway line in the vicinity of Boco Siding.

4.3 1972-1976

Exploration by EZ (EL 12/72) consisted of geological mapping and a helicopter-borne magnetic survey completed by Scintrex. The area of EL 12/72 was covered by an INPUT EM and magnetics survey flown by Geoterrex for Comstaff Pty. Ltd. as part of a larger survey undertaken on the surrounding EL 5/63. EZ purchased the data from this survey pertaining to EL 12/72 from Comstaff.

4.4 1977-1984

EZ, as manager, and Getty Oil Development Limited, as farm-in partner, undertook joint venture exploration of EL 12/72. Initial activity focussed on follow-up of INPUT EM anomalies considered to be of significance in the Boco area. Activity included gridding, geological mapping, gradient array IP with follow-up dipole-dipole IP, soil geochemistry and 3 diamond drill holes (DDHs BBP 207, 208, 209). Although pyritic altered volcanic rocks were intersected in BBP 207, the results were not considered sufficiently encouraging and subsequent activity focussed on other portions of the EL.

Gridding and geological/geochemical/geophysical surveys were undertaken in the Northern area (follow-up of INPUT EM anomalies), the Silver Falls area (proximal to the Silver Falls Prospect in EL 22/74 to the west held by Aberfoyle) and the North Pinnacles area (prospective volcanics north of the Pinnacles Prospect within EL 5/63). These surveys culminated in diamond drilling at North Pinnacles (DDHs NNP 213, 214, 215). Only anomalous, but sub-economic gold mineralisation was found.

Additional stream sediment geochemistry and geological mapping was completed over the northwestern segment of the EL to test the potential for sediment-hosted tin deposits. Results were not encouraging.

Following a review of the data on the Boco grid, interest in the altered volcanics outcropping, and intersected by DDH BBP 207 was re-kindled. An initial programme of vertical percussion/diamond drill holes (Nos. 1 to 12) was undertaken to obtain bedrock geological data. Due to the high costs of penetrating the glacial overburden which was up to 100 m in several

of the drill holes, the programme was changed to angled diamond drill holes drilled across the general trend of the alteration zone. Eight drill holes were completed, seven of which intersected altered and pyritised acid volcanics (the eighth hole, BBP 253, was abandoned short of the target depth due to drilling problems), but no significant base or precious metals were recorded. Geological correlation between drill holes was exceedingly limited as facing data were scarce and inconclusive.

At the conclusion of this work, the alteration zone remained open-ended and the decision was made to find an additional joint venture partner to assist in funding further exploration.

Previous exploration is documented in the numerous reports on EL 12/72 by the title holder, Electrolytic Zinc Company of Australasia Limited, e.g. EZ Report Nos. 128 (1977), 129 (1978), 130 (1979), 137 (1981), 145 (1982), 158 (1982), 159 (1982), T174 (1983), T179 (1984) and T194 (1984).

5. CSR TARGET AND PHILOSOPHY

Following a review of the data on EL 12/72, CSR assessed the potential of the area as follows.

5.1 Boco Prospect (see DRG No. 7610-1)

The quartz-sericite alteration zone located by diamond drilling is similar to the alteration zones associated with Cu-Pb-Zn volcanogenic sulphide mineralisation in the Rosebery to Hercules Mine areas 17 km to the SSW. The diamond drilling completed to the end of 1984 had not closed off the alteration zone, particularly to the east or southeast of DDH BBP 254. Furthermore, the drilling had failed to define the stratigraphy or structure adequately. An untested downhole SIROTEM EM anomaly was located to the east of BBP 254. CSR considered that further drill testing was warranted based on the available information.

5.2 Central Volcanics in Boco Area

The remainder of the southern-southeastern section of the EL was still considered to have potential for volcanogenic massive sulphides mineralisation, but as the complete area had been covered by grid-based surveys, it was considered that this potential was at a greater depth. Consequently new geophysical techniques would be required to adequately test the area.

5.3 North Pinnacles Area

The anomalous gold values located by diamond drilling provided some encouragement, but the area was not considered to be of significant potential.

013

5.4 Remainder of Title

The remainder of the EL, the geology of which is either Dundas Group rocks or Tertiary basalt cover, was not considered to have either untested potential or prospectivity for volcanogenic precious and base metal or replacement tin mineralisation.

Consequently, CSR's target was a base metal deposit in the Boco Siding area, but it was prepared to examine other areas of the EL. However, the terms of the Joint Venture required significant expenditures during the earning phases of the farm-in, including diamond drilling of the Boco Prospect within the first six month period.

CSR's philosophy was that the Boco alteration zone was the major target and that initial effort should be directed at resolving its significance. If the Boco Prospect produced encouraging results, then the potential of the surrounding area of Central Volcanics would be enhanced. Conversely if the Boco Prospect was downgraded, then CSR would withdraw from the Joint Venture as the Joint Venture required continued rapid expenditures which would not be justified.

014

6. EXPLORATION COMPLETED 1985

Other than a review of the available data, exploration by CSR was limited to the area of the Boco Prospect. Work completed included:

6.1 Geological Mapping

The northern alteration outcrop immediately west of Boco Siding was carefully inspected for any consistent structural data which may have enabled interpretation of the diamond drilling data. Exposures created by road construction for the Forestry Commission immediately west of Boco Siding were mapped (see DRG No. 7610-1).

6.2 Drilling Access and Site Preparation

Access tracks and drill sites were bulldozed for the three diamond drill holes completed. No new exposure of Cambrian rocks were obtained from this bulldozing.

6.3 Diamond Drilling

A total of 1601 metres of drilling were completed in three holes.

Overburden penetration was achieved by a combination of roller drilling (casing advancer) and diamond drilling. Penetration of the glacial overburden was slow and several weeks of drilling in each of DDHs BBP 278 and 279 was required to reach bedrock.

Holes completed were as follows:

P.V.C. casing (40 mm O.D.), to enable downhole EM geophysics to be undertaken, was inserted into the top 567 m of BBP 279. DDH BBP 280 was not cased due to problems in pulling steel casing and the collapse of the hole. DDH BBP 278, which intersected no altered or mineralised lithologies, was not cased for geophysics following discussions with EZ geologists.

BBP 278 and 279 were targetted to test the interpretation of an east-facing sequence with a north easterly strike. The modelled position of a possible massive sulphide body was to the east and north of Boco Siding. BBP 279 was sited to locate the eastern limits of the altered rocks intersected in BBP 254 and to test the down hole SIROTEM EM conductor to the east of BBP 254.

Following the drilling of BBP 278 and 279, which effectively tested the target postulated by CSR, the project was reviewed. CSR interpreted the eastern limit of alteration in the Boco Siding area to be fault-controlled, and with the lack of any geophysical or geological targets no further drilling could be justified on this model.

The following areas of the Boco alteration zone were then considered as possible targets.

- (i) The continuation south of the section drill tested by BBP 246 and 247. The available induced polarisation data (gradient array and dipole-dipole) indicated that the pyritic zone in BBP 246 and 247 continued to the southwest and had not been tested by BBP 253. (BBP 253 was abandoned before the target depth was reached.) However, consideration of the drilling, induced polarisation and mapping data suggested that the

anomaly represented a greatly reduced thickness of glacial overburden over weakly mineralised rocks. Thus, the anomaly was not further tested as there seemed no potential for the target deposit in the relatively small area.

- (ii) To the NNW of the section tested by BBP 254. Geological mapping undertaken by CSR of exposures on a recently constructed Forestry Commission access road to the west of Boco Siding had indicated possible NW striking, steeply SW dipping volcanics. These outcrops, which are of very limited extent, are overlain by volcanics striking to the NE-SW and dipping 25-50° to the NW. These exposures indicated that the induced polarisation surveys should have been effective on the areas with relatively thin (i.e. 1-10 m) of glacial cover. As no IP anomalies were present in the area no drill targets were evident.
- (iii) The zone between the section tested by BBP 250 and 251 and BBP 248. The lithologies intersected in BBP 251 were considered the most economically interesting and included a section of epiclastics with massive pyrite clasts and a banded pelitic ash horizon. BBP 280 was drilled to test the zone between BBP 250-251 and BBP 248 and aimed at intersecting the same stratigraphy as BBP 251. BBP 280 was collared to drill through the fault zone interpreted to be the eastern limit of the alteration zone intersected in BBP 248, 250 and 279.

6.4 Core Logging & Sampling

In addition to logging and sampling of CSR's DDHs BBP 278, 279 and 280, the previous drill core was

018

examined and sampled where appropriate. Representative lithologies from each drill hole completed prior to 1985 were mounted on masonite boards. Split drill core sampling was carried out on core from DDHs BBP 278 and 279. A mixture of split and chip sampling was undertaken on BBP 280. Chip samples were taken over intervals of 2 to 5 m from which the sample consisted of 2 to 4 cm of half the core taken every 50 or 30 cm.

6.5 Geophysics

No new geophysical surveys were undertaken, but core from DDHs BBP 278-280 was tested with a magnetic susceptibility meter. Sulphide-bearing intervals were tested for conductivity with a multimeter. The pre-1985 geophysical data were reviewed. Although hole BBP 279 was cased, no further downhole surveys were undertaken.

6.6 Geochemistry

Selected samples from all CSR DDHs and most of the pre-1985 DDHs were analysed for major and trace elements to enable rock type and alteration categorisation. Mineralised, visually altered intervals were analysed for selected major elements and trace elements. Standard and blank samples were inserted into both batches of samples analysed (Appendix II contains the analytical results). Several samples of BBP 278 were supplied to A.J. Crawford of the University of Tasmania for geochemical studies which comprised part of a university project. Dr. G. Green of the Tasmanian Department of Mines undertook analyses of sulphur isotopes on selected specimens from the pre-1985 drilling and from BBP 280.

6.7 Petrology

Consultant Dr. J. Barron undertook petrological studies of specimens from the CSR DDHs (see Appendix III).

7. RESULTS AND INTERPRETATION

7.1 Geological Mapping

Mapping of the new Forestry Commission access road immediately west of Boco Siding essentially confirmed the SW-NE trending topographic ridge, where exposed, to be a mixture of acid lavas and pyroclastics. Ash flow compaction foliations and flow banding indicate these rocks to strike NE-SW and to dip relatively flatly ($26-50^{\circ}$) to the NW. These observations are in accord with the previous 1:10,000 scale mapping (see DRG No. 7610-1).

However, outcrops in the road cutting between 5 387 050 mN 383 240 mE and 5 387 095 mN 383 380 mE indicate that an earlier sequence of volcanic rocks underlies the NE-SW striking and NW dipping volcanics. An oriented specimen taken from an outcrop of "pale grey, siliceous, streaky amygdaloidal lava" showed a primary foliation which strikes NW-SE and dips at 70° to the SW. This foliation was observed by slabbing the oriented specimen. A section of "cleaved ash flow tuffs" is overlain by uncleaved pyroclastics 40 m to the NE of the previous outcrop.

This mapping demonstrates the presence of an angular unconformity which will be discussed in the following section on geological interpretation.

7.2 Diamond Drilling

DDH BBP 278 was drilled to test the postulated extension of the alteration zone to the NE of Boco Siding (see DRG No. 7610-1). The hole intersected glacial overburden to 103 m and from 103 to 501 m (E.O.H.) penetrated variable feldspar phyric acid lavas

with minor basic intrusives. No significant alteration or mineralisation was recorded.

DDH BBP 279 was drilled to test the eastwards continuation of the pyritised alteration zone intersected by BBP 254 and the downhole SIROTEM EM anomaly reported to the east of BBP 254 (see DRG No. 7610-4). The hole intersected glacial overburden from 0 to 111.5 m, unaltered rhyolitic ash flows and lavas with minor epiclastic and basic intrusives from 111.5 to 587.3 m, lavas and fragmentals from 587.3 to 619.7 m and ash flow tuffs from 619.7 to 700 m (E.O.H.). Between 541.0 and 604.0 m, a shear and fault zone is probable. Alteration with no significant mineralisation other than pyritisation occurs from 587.3 to 645.8 m. Between 442.7 and 452.2 m, a fracture zone within lavas has 5-20% pyrite as stringers. No Au or Ag were detected within this zone and the base metal assays were 20 ppm Cu, 110 ppm Pb and 400 ppm Zn over the interval.

DDH BBP 280 was drilled to test the area mid-way between BBP 250, 251 and BBP 248 (see DRG No. 7610-1). This hole was drilled on the basis of the favourable rock types intersected in BBP 251 and was intended to provide geological data to enable interpretation of the stratigraphy. It was also hoped that the postulated fault interpreted as the eastern boundary of the alteration zone would be intersected. The hole intersected glacial overburden (0-74.9 m), brecciated acid lavas (or vitric tuffs) with minor intervals of basic and acid intrusives (74.9-171.0 m), vitric tuffs with minor intervals of basic and intermediate intrusives (171.0-268.6 m), epiclastics and vitric tuffs (268.6-302.5 m), banded vitric tuffs (302.6-319.5 m), epiclastics (319.5-329.0 m), vitric tuffs with minor intermediate lavas (329.0-350.9 m) and ash flow tuffs from 350.9 to 400 m (E.O.H.).

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The major lithologies are altered and pyritised between 74.9 m and 350.9 m. Other than pyrite, no mineralisation was recorded. From 74.9 to 206.0 m, the lithologies are tectonically brecciated suggesting a fault zone. The hole, at least in part, can be correlated with the hole to the north, BBP 251. A 2 cm thick band of massive pyrite was present at 302.5 m at the contact between vitric tuffs and epiclastics. Clasts of massive pyrite occur in the epiclastics uphole from the band of massive sulphides. Grading of these clasts could be interpreted as indicating an uphole facing, but this is not considered conclusive.

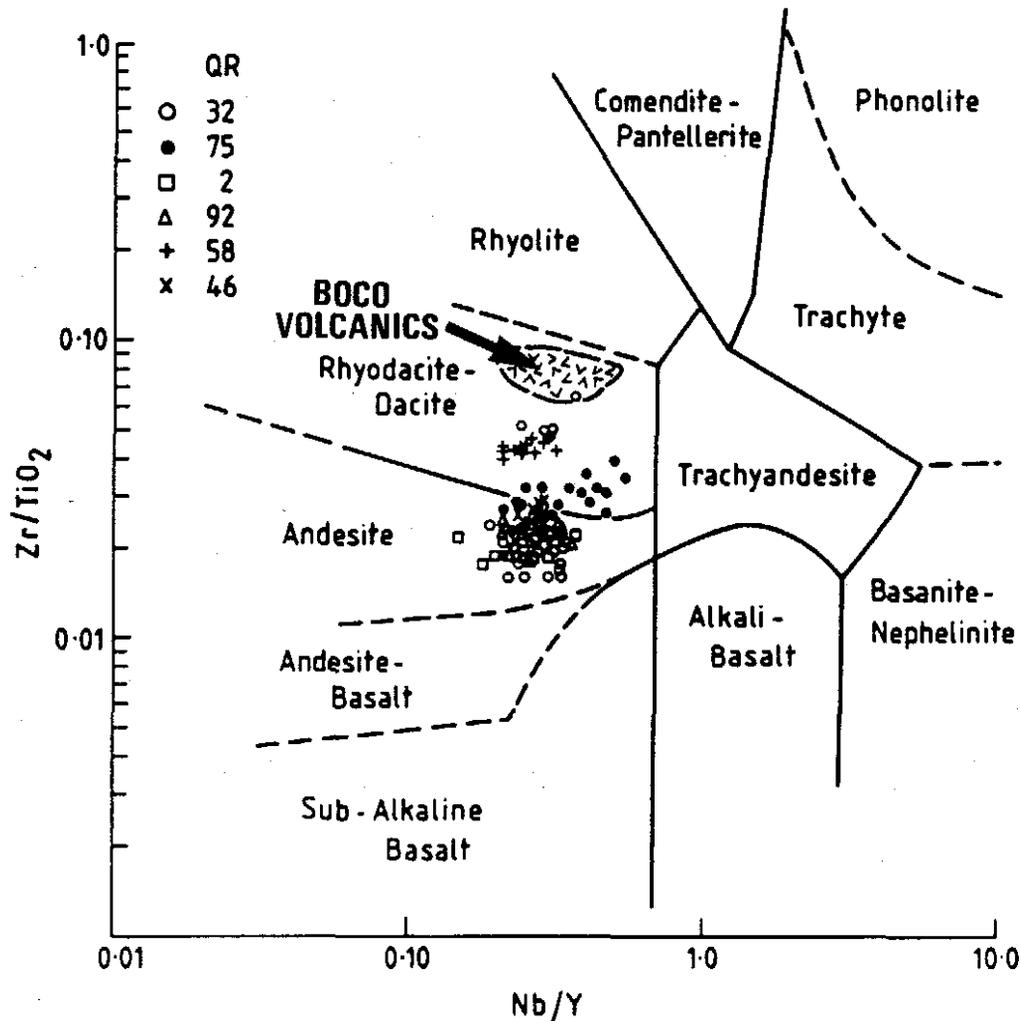
7.3 Geochemistry

Geochemical analyses confirmed that no significant mineralisation was present in the three holes drilled by CSR.

Analyses of the pre-1985 drilling and the drilling done by CSR showed that visual logging of drill core had correctly identified the limits of alteration (see drill logs, Appendix I). No statistical study has been undertaken on the geochemical data, but it is obvious that visually identified alteration can be correlated with depletion in Na_2O and Sr.

Whole rock analyses were undertaken on selected specimens from most of the drill holes. Results of these analyses are tabulated in Appendix IV. CSR analytical standards were run with these analyses and indicated some problems with the accuracy of the laboratory employed. Comparisons of the expected and recorded values for the main standard employed are contained in Appendix V.

If the analyses of the so-called "immobile elements" are accepted as reported by the analytical



Plot of Zr/TiO_2 vs Nb/Y for host volcanic rocks at Que River (after Winchester and Floyd, 1977). The samples plot in a very restricted array in fields defined by fresh andesites, dacites and rhyodacites.

(FROM WHITFORD ET AL. 1982)

**FIG. 2 COMPARISON OF BOCO & QUE RIVER VOLCANICS
EL 12/72 BULGOBAC TASMANIA**

laboratory, then the rocks can be characterised as per Winchester and Floyd, 1977.

Figure 2 shows the approximate field of the main Boco volcanics, excluding the basic and intermediate intrusives, plotted for Zn/TiO_2 versus Nb/Y . The diagram used is taken from Whitford et al's (1982) study of the volcanics of the Que River volcanogenic deposit 10 km to the NE. The Boco volcanics plot in the upper section of the Rhyodacite-Dacite field in contrast to the Que River volcanics which plot mainly in the Andesite field.

Even if the analyses used for the Boco volcanics are re-calculated in line with the analytical errors indicated by the CSR standard, the effect is only to move the field for the Boco volcanics slightly down towards the Andesite field.

Although not shown on the above diagram, data for a limited number of acid volcanics in the Rosebery-Hercules area were plotted and these indicate a similar field to the Boco volcanics.

The results for samples collected by Dr. A.J. Crawford of the University of Tasmania were not available at the time of writing this report. However, these analyses should be more accurate than those obtained by CSR.

Sulphur isotope analyses on samples from the pre-1985 drilling were completed by the Tasmanian Department of Mines. These analyses indicate the sulphur to be "light" in comparison to that of the base metal deposits within the Mt. Read Volcanics. This suggests the pyritisation was not generated by a seawater-dominated system. The sulphur isotope results are shown in Table 1.

TABLE 1
SULPHUR ISOTOPE ANALYSES
BOCO DIAMOND DRILL HOLES

Sample No.	DDH	m	$\delta^{34}\text{S}$
1	BBP 246	304.5	+0.2%
2	BBP 247	140.2	+4.7%
3	BBP 251	93.5	-1.2%
4	BBP 251	265.2	-0.7%
3	BBP 254	300.4	-0.1%

Values precise to $\pm 0.1\%$

7.4 Geophysics

Magnetic susceptibility measurements made on the CSR drill core indicate susceptibilities of zero for all rock units except some narrow basic intrusive. Basic intrusives within the altered volcanics have zero susceptibilities indicating the probable destruction of magnetite after intrusion.

Tests with a multimeter on the pyrite stringer zone between 442.7 m and 452.2 m in BBP 279 indicate significant conductivity due to the pyrite veining. Consequently, this stringer zone is considered to be the source of the downhole SIROTEM EM anomaly recorded to the east of BBP 254 (DRG No. 7610-4)

7.5 Geological Interpretation

The results generated by CSR are best separated into those relating to regional interpretation and those limited to the Boco alteration zone.

7.5.1 Regional Geology

The angular unconformity mapped on the Forestry road is interpreted to represent the angular unconformity between the volcanics which host the Hercules Mine and those of the White Spur area to the south and west of Hercules. Corbett (1985) had previously correlated the White Spur volcanics with his "Western Sequence". However, recent interpretations by Corbett (pers. comm.) indicate the Western Sequence to be restricted to the area to the SE of the Henty Fault. The volcanics at White Spur are now considered to be the basal sequence of the Dundas Group. Consequently, the NE-SW striking volcanics to the west of Boco Siding are now interpreted as basal Dundas Group. Corbett (1984) shows this contact as several hundreds of metres to the NW of the Forestry road.

Whole rock analyses indicate the volcanics at Boco are similar to the Primrose Pyroclastics in Rosebery-Mt. Read area. The Boco volcanics are essentially rhyodacitic in composition in contrast to the predominantly andesitic volcanics which host the Que River deposit.

7.5.2 Boco Alteration Zone

Prior to the CSR drilling, the Boco alteration zone was considered to have potential for the discovery of a significant base metal deposit.

Visually and chemically the alteration is identical to that observed at Rosebery Mine, except that it is dominantly silica-sericite with no chlorite.

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Drilling of BBP 278 located no alteration/mineralisation and did not help explain the stratigraphy or structure.

Drilling of BBP 279 indicated the eastern limit of the alteration to be a major fault zone. The footwall of the alteration zone in BBP 254 and 279 indicated a moderate dip to the east.

The eastern limit of the alteration zone is recorded as a fault in DDH BBP 250 and probably in DDH BBP 248. CSR's analyses indicate the volcanics immediately east of the fault are not significantly altered. Consequently, a vertical fault has been interpreted (DRG No. 7610-1) as being the eastern limit of the alteration in the northern section of the alteration zone. Previous drill core logging by EZ had recorded a fault as forming the western limit of the alteration in BBP 242 and BBP 246.

It is possible that these faults are related to the postulated fault along Boco Creek to the SSW. McIntosh Reid (op cit) reported Samuel Smith's lode to extend up Boco Creek with a strike of 20° E of N and a dip of 70° to the NW. It is suggested that the Boco alteration and pyritisation is a continuation of Samuel Smith's lode.

Correlation is possible between DDHs BBP 251 and 280. The "banded vitric tuff" in BBP 280 (302.6-319.5 m) is correlated with the "pelitic ash" in BBP 251 (262.35-273.2 m). The core angles from primary layering indicate either vertical or horizontal stratigraphy. If, as is considered more likely, the layering is vertical then the unit correlated above has a northerly strike.

In BBP 280, a 2 cm thick band of massive pyrite is present at 302.5 m at the contact between banded vitric tuffs and epiclastics. Clasts of massive pyrite occur in the epiclastic uphole from the band of massive sulphides. Grading of these clasts could be interpreted as indicating an uphole (east) facing, but this is not considered conclusive.

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Similar sulphide clasts occur in BBP 251 and were also observed in core selected from near the bottom of BBP 254 to the north of BBP 251.

No similar lithologies were observed in BBP 248 to the south of BBP 280, but this can be explained by the vertical fault which truncates the alteration to the east.

The interpretation of north-striking, vertically dipping stratigraphy supports the occurrence of an angular disconformity as mapped on the Forestry road.

The northern alteration zone, as shown on DRG No. 7610-1, appears to have a western limit which parallels the stratigraphy in BBP 248, 280 and 251. The western limit of the alteration then swings rapidly to the northeast in BBP 254 and is interpreted to trend easterly to the vertical fault which forms the eastern boundary of the alteration. The section drilled by BBP 254 and 279 indicates that the footwall of the alteration dips moderately to the east. However, as BBP 279 has been projected onto the cross-section (DRG No. 7610-3) this alteration footwall could be considerably steeper if the strike has swung dramatically from north to east.

Thus, in the northern area of alteration the lithologies are interpreted to be vertically dipping with a northerly strike. The alteration zone is truncated at the east by a vertical fault and appears, at least at its northern end, to have a footwall contact which dips moderately east and thus cross-cuts the vertically dipping stratigraphy.

Facing data to the west of the vertical fault suggest the stratigraphy could well face east, e.g. BBP 280.

The lack of any significant base or precious metal mineralisation at Boco is discouraging. The sulphur isotope analyses suggest the pyritisation and thus the quartz sericite alteration is not related to a sea water dominated circulating brine system. The sulphur isotopes suggest the source of the sulphur is magmatic and although the alteration could be due to circulating meteoric water, it is considered the pyritisation and alteration are more likely due to magmatic sources.

The limited number of fluorine analyses done on core; 1 analysis from BBP 279 and 11 analyses from BBP 280, appear to indicate anomalously high fluorine levels in comparison to other available data on similar volcanic rocks (see Appendix IV). This could be reflecting magmatic fluids related to the pyritisation and alteration.

The lack of a seawater-dominated circulating brine system strongly mitigates against the probability of finding base metal mineralisation associated with the Boco alteration zone even though the volcanics can reasonably be equated with the same lithologies which host the Rosebery and Hercules Mines.

029

8. POSSIBLE FURTHER INVESTIGATIONS

CSR, having downgraded the potential of the Boco alteration zone, considers the following investigations are warranted in order to understand the Boco-type alteration zone and thus be able to identify similar zones without considerable diamond drilling expenditure.

- (a) Additional sulphur isotope analyses (being undertaken by the Department of Mines). Samples for these analyses were taken from BBP 280.
- (b) Consideration has been given to Pb isotope analyses on pyrite concentrates from the alteration zone. These analyses should be undertaken to confirm that the mineralising event is Cambrian and not Devonian in age.
- (c) The Department of Mines, as part of the Mt. Read Volcanics Project, will undertake oxygen isotope studies on the Boco alteration zone as an example of a basemetal-barren system in the Mt. Read Volcanics.

The following geophysics should be completed at the Boco prospect.

- (a) Downhole SIROTEM should be completed on BBP 279 to confirm that the pyrite stringer zone (442.7-452.2 m) is the source of the SIROTEM anomaly located during logging of BBP 254.
- (b) The probability that the clay-rich zone towards the base of the glacial overburden is channelling the electrical geophysics and thus preventing penetration into the underlying Cambrian volcanics, should be tested. This could be established by resistivity measurements on an area of varied clays exposed along the recently constructed Forestry Commission road west of Boco Siding.

9. REFERENCES

- CORBETT, K.D. (1985) : Geological Compilation Map of the Mount Read Volcanics, Que River to Mt. Darwin Tas. Dept. of Mines Unpublished Report 1985/11
- REID, A. McIntosh (1918) : "The North Pieman and Hushisson and Sterling Valley Mining Fields" Bull. 28, Tas. Dept. of Mines
- WHITFORD, D.J.; SUN, S-S; TOGASHI, Y. (1982) : "Petrological and Geochemical Studies at Que River, Part 3" CSIRO Inst. Energy and Earth Resources, Restricted Investigation Report 1332R
- WINCHESTER, J.A.; FLOYD, P.A. (1977) : "Geochemical Discrimination of Different Magma Series and their Differentiation Products Using Immobile Elements" Chem. Geol. 20, p. 325-344

REW/SGL

October 1985

APPENDIX I

DDHs BBP 278, 279, 280

069042

STATE LOCATION PROJECT NUMBER INCLINATION AZIMUTH T/M/GRID DATE STARTED DATE COMPLETED CONTRACTOR DRILLER

LOG SCALE VISUAL LOG SUMMARY DESCRIPTION

277 5 - 278 5 banding is brecciated - magnific
@ 276 8 80m band of chert
all washed long to 8mm
Manganese 4.0 - 5% (Sample of massive
aggregation of py to 15mm diam
py 100% to 5mm is due to pyrite aggregation)

278 5 - 287 6 XTM-VITRIC-LITHIC ASH FLOW
Xtm zone - like ash flow
like pyroclastic
pyroclastic, often by lava
Xtm are lighter + + olive color (not often present)
Variable weak pyroclastic
Xtm zone - 1-2% fine dense pyrite
Varying - regularity of chert, generally of
size 2 1/4 to 1 1/2 and for 12 of
not for 57 of red

287 6 - 302 5 EPICLASTIC
ROAD 6 found rubble of pyro will occur to
left pyroclastic chert many dark are
indicating due to post red deposition + in alteration
ground. Making a road is not so clear as
in road as one passes on road
Road 1 302 5 < 30° 35' elongated
with 10cm of more massive pyrite + ground mass
of pyrite to 1/2 to 1/3 right in road
30 cm of red rubble from 302 5 carbon washed long
about of some massive py to 5 cm like
some other chert of massive py to 2 cm also occur
Analysis of the red of 295 6
2184732 @ 296 7 "washed pyroclastic of
oxide content"

ACCEPTED ASSAY

LOGGED BY DATE OF LOGGING

CO-ORDINATES N/S R/L AREA INFLUENCE NUMBER HOLE NUMBER

DEPTH START DEPTH FINISH DEPTH INTERVAL SAMPLE NUMBER

287 6 287 6 287 6 287 6 1/4 cm
288 6 287 6 287 6 287 6 1/4 cm
291 6 287 6 287 6 287 6 1/4 cm
293 6 287 6 287 6 287 6 1/4 cm
295 6 287 6 287 6 287 6 1/4 cm
297 6 287 6 287 6 287 6 1/4 cm
298 6 287 6 287 6 287 6 1/4 cm
302 5 287 6 287 6 287 6 1/4 cm

THE FOLLOWING SAMPLES ARE SAVED IN CORE

287 6 287 6 287 6 287 6 1/4 cm
288 6 287 6 287 6 287 6 1/4 cm
291 6 287 6 287 6 287 6 1/4 cm
293 6 287 6 287 6 287 6 1/4 cm
295 6 287 6 287 6 287 6 1/4 cm
297 6 287 6 287 6 287 6 1/4 cm
298 6 287 6 287 6 287 6 1/4 cm
302 5 287 6 287 6 287 6 1/4 cm

302 5 287 6 287 6 287 6 1/4 cm
298 6 287 6 287 6 287 6 1/4 cm
297 6 287 6 287 6 287 6 1/4 cm
295 6 287 6 287 6 287 6 1/4 cm
293 6 287 6 287 6 287 6 1/4 cm
291 6 287 6 287 6 287 6 1/4 cm
288 6 287 6 287 6 287 6 1/4 cm
287 6 287 6 287 6 287 6 1/4 cm

HOLE NUMBER
PAGE 8 OF 11
HOLE SIZE
ASSAY TYPE

ACCEPTED ASSAY



AREA: [Grid] PROJECT NUMBER: [Grid] DATE STARTED: [Grid] CO-ORDINATES N/S: [Grid] COLLAR R.L.: [Grid] AREA OF INFLUENCE: [Grid] HOLE NUMBER: 668-27A
 STATE: [Grid] LOCATION: [Grid] INCLINATION: [Grid] AZIMUTH T/M/GRID: [Grid] DATE COMPLETED: [Grid] CONTRACTOR: [Grid] E/W: [Grid] DEPTH: [Grid] DRILL TYPE: [Grid] HOLE SIZE: [Grid] ASSAY TYPE: [Grid]
 LOGGED BY: [Grid] DATE OF LOGGING: [Grid] PAGE 14 OF 15

DEPTH (M)	METERS	SUMMARY DESCRIPTION	VISUAL LOG	LOG SCALE	ROCK TYPE	S.G.	START DEPTH	FINISH DEPTH	SAMPLE INTERVAL	SAMPLE NUMBER	ACCEPTED ASSAY									
											Na ₂ O	Sr	Cr	Ni	V	TiO ₂	SiO ₂			
100	570.6-575.0	Basalt, fine grained or fine grained fault breccia. Matrix gray fine grained matrix with fine angular clasts.																		
100	572.8-576.4	Weakly sheared / chert at 65° to 70° to conf. Trace fossils in veins. Weakly veined with carbonate and chlorite.																		
100	572.1-577.5	CARBONATE - FUSCITE VEINS																		
100	578.4-578.9	BASIC INTRUSIVE, moderately carbonate veined.																		
100	578.9-581.1	LAVA, massive, variably sheared 11-27 vein breccia. Minor fuscite with carbonate bedded 580.6																		
100	581.1-583.7	BASIC INTRUSIVE, moderately carbonate veined.																		
100	582.7-589.8	Lava, massive, fine to gray, locally sheared at 60° to core. Moderately to strongly carbonate veined with trace fuscite. Dis. & vein py at 18-27.				587.3	588.3		A184651						40				35	
100	587.1-587.3	BASIC INTRUSIVE, sheared at 60°, carbonate veins.				588.2	589.3		A184652						1.05				25	
100	587.1-587.3	BASIC INTRUSIVE, sheared at 60°, carbonate veins.				589.3	593.3		A184653						25				30	
100	587.3-615.8	QUARTZ-SERICITE-PYRITE ALTERATION ZONE				593.3	596.3		A184654						15				20	
100	587.3-619.7	LAVAS and LAVA FRAGMENTAL				596.3	598.8		A184655						25				25	
100	592.3-601.0	alteration by contact metamorphism down hole, pale gray to dark gray. Trace to 11, due py, weakly veined. Minor fuscite at 586, 586				599.6	602.3		A184656						25				25	
100	586.4-590.2	Brecciated, fine grained breccia, has clasts (hard) near base.				602.3	603.2		A184657						50				60	
100	599.5-603.2	Brecciated lava, fine grained breccia. Fuscite at 602.2-602.2.				603.2	606.2		A184658						25				20	
100	601.0-619.2	Extremely altered, brown & long fuscite. Approx 2% diss. fine py. Weakly veined.				606.2	609.2		A184659						20				25	
100	601.0-619.2	Extremely altered, brown & long fuscite. Approx 2% diss. fine py. Weakly veined.				609.2	612.2		A184660						20				20	
100	T/S A184688 @ 600.7m	"brecciated, platy, altered acidic tuff / crystal tuff (fine fuscite zone)				612.2	615.2		A184661						35				25	
100	T/S A184689 @ 606.7m	altered weakly mineralized, poorly sorted? shaly to pumiceous tuff?				615.2	618.5		A184662						45				35	

069071



AREA: 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25

PROJECT NUMBER: 20 21 22

DATE STARTED: 00 00 00 00 00 00

CO-ORDINATES N/S: 00 00 00 00 00 00 00 00 00 00

COLLAR R.L.: 00 00 00 00 00 00 00 00

AREA OF INFLUENCE: 00 00 00 00 00 00 00 00

HOLE NUMBER: 00 00 00 00 00 00 00 00 00 00 00 00

STATE: 00 00

LOCATION: 00 00 00 00 00 00 00 00 00 00 00 00

INCLINATION: 00 00

DATE COMPLETED: 00 00 00 00 00 00

E/W: 00 00 00 00 00 00 00 00 00 00

DEPTH: 00 00 00 00 00 00 00 00

DRILL TYPE: 00 01

HOLE SIZE: _____ TO _____

CONTRACTOR: _____

DRILLER: _____

LOGGED BY: _____

DATE OF LOGGING: _____

ASSAY TYPE: _____ TO _____

METERS	SUMMARY DESCRIPTION	VISUAL LOG	ROCK TYPE	S.G.	START DEPTH	FINISH DEPTH	SAMPLE INTERVAL	SAMPLE NUMBER	ACCEPTED ASSAY							
									Na ₂ O	Sr	Cr	Ni	V	TiO ₂	SiO ₂	
617.2-619.9	Massive layer with 60% - 10% disseminated pyrite decreasing down hole				617.2	619.9		A184663				35		30		
619.9-621.8	Ash Flow, feldsparitic breccia dips dominantly < 1/2 cm but occ. up to 2 cm. Returned to original position. 21 dm fine pyrite. Occ. carbonate / quartz veins. Int. altered				619.9	621.8		A184664				95		16		
621.8-627.8	7/8 A184690 @ 621.9 m "Altered unaltered unaltered schistose buff"				621.8	627.8		A184665				80		60		
627.8-636.2	epidestitic, altered, but approx. 1-2 dm py. decreasing down hole. Altered grey matrix but do 20% part cherts				627.8	636.2		A184666				120		65		
636.2-640.5	Basic Intensive, unaltered. Occ. carbonate veins				636.2	640.5		A184667				80		50		
640.5-645.8	624-624.7 large open vesicular porphyry 628-628.9 } epidestitic or Ash Flow, moderately to weakly altered, alteration decreasing down hole, locally part alteration increasing & pyrite decreasing down of to trace 642.5-643.5 dm. pyrite localized to 66 7/8 A184691 @ 643.8 m				640.5	645.8		A184668				40		30		
645.8-645.8	CONTINUED OVER PAGE "altered, weakly unaltered, unaltered schistose buff"				645.8	645.8		A184669				25		30		
645.8-645.8					645.8	645.8		A184670				40		90		
645.8-645.8					645.8	645.8		A184671				95		59		

DOWN HOLE SURVEYS

DEPTH (m)	DIP	BEARNG (magnetic)	DEPTH (m)
146	-68°	272.5°	199
213	-66°	272.0°	
312	-62°	274.0°	259
379	-40°	277.0°	439
555	-36°	288.0°	491
645	-32°	294.0°	589
			700

DIP AZIMUTH (magnetic)

DIP	AZIMUTH (magnetic)
-66.3	271.0
-43	273.0
-39	281.0
-37	285.0
-34.5	290.0
-30	296.0

069072

071

APPENDIX II
ANALYTICAL RESULTS - 1985

072

ANALABS

069075

Phone (09) 458 7999

A division of MacDonald Hamilton & Co. Pty. Ltd.
52 Murray Road, Welshpool, W.A. 6106

Telex AA92560

ANALYTICAL REPORT No. 999.0 08 30578

THIS REPORT MUST BE READ IN CONJUNCTION WITH THE ACCOMPANYING ANALYTICAL DATA

ORDER No.

PROJECT

CSR Limited
Box 483 GPO
Sydney
NSW 2001

30243

B000

DATE RECEIVED

RESULTS REQUIRED

1.5.85

ASAP

No. OF PAGES
OF RESULTSDATE
REPORTEDNo.
OF COPIES

TOTAL No. OF SAMPLES

3

21

DATE OF SAMPLES	REFER FLOW	SAMPLE NUMBERS	PRE-TREATMENT						ANALYSIS			
			DRY	CRUSH	SPLIT	PUL- VERISE	SIEVE	OTHER SEE REMARKS	NONE	REFER TO ANALYSIS SECTION	PREPARATION	METHOD
	SC	A184651-671	1	2	4	3 5					Ag Bi Cu Pb Zn Ni Cr Co Au	102 101 359

RESULTS
TOCSR Limited
Minerals Division
Box 483 GPO
Sydney NSW 2001

Att. The Chief Geologist

RESULTS
TO

REMARKS

Field Sample Despatch Sheet
10494

STATE OF SAMPLES	ANALYSIS — PREPARATION	ANALYSIS — METHOD
whole core WC	perchloric acid A1	atomic absorption AAS
split core SC	hydrochloric acid A2	x-ray fluorescence XRF
cutting CU	nitric acid A3	spectrophotometry SPEC
rock Ro	aqua regia A4	colorimetry COL
soil SO	nitric-perchloric A5	chromatography CHR
pulp PU	HF mixture A6	titration TTN
water WA	HF under pressure A7	other chemicals means CHEM
tissue TI	fusion A8	miscellaneous MISC
stream sediment SS		fluorescence FLUOR
heavy mineral HM		inductively coupled plasma ICP

AUTHORISED OFFICER

R. P. ...

073

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069076

ANALYTICAL DATA

SAMPLE PREFIX

REPORT NUMBER

REPORT DATE

CLIENT ORDER No.

PAGE

		999.0 08 3857				9.5.85		38243		1 OF 1	
TUBE No.	SAMPLE No.		Cu	Pb	Zn	Co	Cr	Ni	Ag	Bi	
1	184651		15	30	140	20	40	35	X	X	
2	184652		5	30	200	35	105	75	X	X	
3	184653		X	X	100	15	25	30	X	X	
4	184654		X	X	60	15	15	20	X	X	
5	184655		X	10	300	20	25	25	X	X	
6	184656		5	5	140	10	25	25	X	X	
7	184657		5	20	200	25	50	60	X	X	
8	184658		5	5	275	10	25	20	X	X	
9	184659		X	10	175	10	20	25	X	X	
10	184660		5	X	50	10	20	20	X	X	
11	184661		5	5	85	10	25	25	X	X	
12	184662		5	20	155	10	45	35	X	X	
13	184663		20	15	115	35	35	30	X	X	
14	184664		5	20	95	20	45	45	X	1	
15	184665		5	15	70	10	80	60	X	X	
16	184666		5	5	35	10	120	65	X	X	
17	184667		5	15	170	15	30	50	X	X	
18	184668		5	20	150	25	40	30	X	X	
19	184669		5	20	135	25	25	30	X	X	
20	184670		5	X	30	30	40	40	X	X	
21	184671		5	X	20	10	95	55	X	X	
22	184680		X	X	70	10	35	30	X	X	
23	184681		X	X	110	30	5	20	X	X	
24	184682		55	X	165	25	95	45	X	X	
25	184683		5	5	30	5	35	35	X	X	

Results in ppm unless otherwise specified

T = element present; but concentration too low to measure

X = element concentration is below detection limit

— = element not determined

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OFFICER*R. J. L.*

074

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069077

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REPORT DATE

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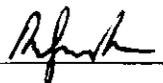
		999.0 08 3057			9.5.85		30243			2 OF 6	
TUBE No.	SAMPLE No.		Cu	Pb	Zn	Co	Cr	Ni	Ag	Bi	
1	184684		5	X	40	10	35	25	X	X	
2	184685		20	110	480	10	115	80	X	1	
3	184686		5	X	45	10	55	40	X	X	
4	184701		X	X	35	5	35	30	X	X	
5	184702		70	5	170	30	125	55	X	X	
6	184703		5	5	80	20	15	20	X	X	
7	184704		X	X	40	5	45	35	X	X	
8	184705		5	5	90	10	45	35	X	X	
9	184706		X	X	30	5	10	20	X	X	
10	184707		X	X	30	5	35	30	X	X	
11	184708		X	5	20	X	25	30	X	X	
12	184709		5	10	50	10	60	55	X	X	
13	184710		5	X	40	10	55	60	X	X	
14	184711		X	5	45	5	30	30	X	X	
15	184712		X	10	105	10	30	35	X	X	
16	184713		5	20	30	10	70	50	X	X	
17	184714		1350*	1.28%*	0.51%*	15	40	30	200*	19	
18	184715		1025*	0.50%*	0.51%*	25	25	40	200*	15	
19	184716		825*	0.49%*	0.700*	30	30	35	200*	30	
20	184718		825*	0.48%*	0.675*	35	30	35	200*	42	
21											
22											
23											
24											
25											

Results in ppm unless otherwise specified

T = element present; but concentration too low to measure

X = element concentration is below detection limit

-- = element not determined

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ANALYTICAL DATA

SAMPLE PREFIX

REPORT NUMBER

REPORT DATE

CLIENT ORDER No.

PAGE

		999.0 08 3057				9.5.85		30243		3 OF 6	
TUBE No.	SAMPLE No.		Cu	Pb	Zn	Co	Cr	Ni	Pg	Bi	
1	STD 3036		160	570	250	30	275	165	1.7	26	
2	RPT 18465		20	30	150	30	50	45	X	X	
3	RPT 184670		5	20	20	25	70	35	X	X	
4	STD 3036		160	580	240	30	255	150	1.6	26	
5	RPT 184713		5	10	30	10	65	45	0.2	X	
6											
7											
8											
9											
10											
11											
12											
13	NOTE: * Analysed by Method 104										
14	1/3 - Insufficient Sample										
15											
16											
17											
18											
19											
20											
21											
22											
23	DETECTION		5	5	5	5	5	5	0.2	1	
24	DIGESTION										
25	METHOD		101	101	101	101	101	101	101	102	

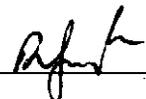
Results in ppm unless otherwise specified

T = element present; but concentration too low to measure

X = element concentration is below detection limit

— = element not determined

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069079

ANALYTICAL DATA

SAMPLE PREFIX

REPORT NUMBER

REPORT DATE

CLIENT ORDER No.

PAGE

999.0 08 3057

9.5.85

30243

4 OF 6

TUBE No.	SAMPLE No.		Ru							
1	184651		X							
2	184652		X							
3	184653		X							
4	184654		X							
5	184655		X							
6	184656		X							
7	184657		X							
8	184658		X							
9	184659		X							
10	184660		X							
11	184661		X							
12	184662		X							
13	184663		X							
14	184664		X							
15	184665		X							
16	184666		X							
17	184667		X							
18	184668		X							
19	184669		X							
20	184670		X							
21	184671		X							
22	184680		0.008							
23	184681		0.011							
24	184682		0.008							
25	184683		0.008							

Results in ppm unless otherwise specified
 T = element present; but concentration too low to measure
 X = element concentration is below detection limit
 — = element not determined

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069080

ANALYTICAL DATA

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REPORT NUMBER

REPORT DATE

CLIENT ORDER No.

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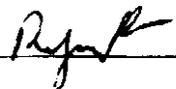
9.5.85

30243

5 OF 6

TUBE No.	SAMPLE No.		Ru							
1	184684		X							
2	184685		X							
3	184686		X							
4	184701		X							
5	184702		X							
6	184703		X							
7	184704		X							
8	184705		X							
9	184706		X							
10	184707		X							
11	184708		X							
12	184709		X							
13	184710		X							
14	184711		X							
15	184712		X							
16	184713		X							
17	184714		I/S							
18	184715		I/S							
19	184716		I/S							
20	184718		I/S							
21										
22										
23										
24										
25										

Results in ppm unless otherwise specified
 T = element present; but concentration too low to measure
 X = element concentration is below detection limit
 — = element not determined

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078

ANALABS

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069081

ANALYTICAL DATA

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REPORT DATE

CLIENT ORDER No.

PAGE

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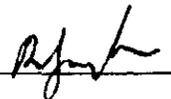
30243

6 OF 6

TUBE No.	SAMPLE No.		Ru							
1	STD 3036									
2	RPT 184651									
3	RPT 184670									
4	STD 3036									
5	RPT 184713									
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										
16										
17										
18										
19										
20										
21										
22										
23	DETECTION		0.008							
24	DIGESTION									
25	METHOD		359A							

Results in ppm unless otherwise specified
 T = element present; but concentration too low to measure
 X = element concentration is below detection limit
 — = element not determined

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 OFFICER



079

069082

ANALABS

DEF / REF / REV / File 7610

Phone (09) 458 7999

A division of MacDonald Hamilton & Co. Pty. Ltd.
52 Murray Road, Welshpool, W.A. 6106

Telex AA92560

ANALYTICAL REPORT No.

999.0 00 3057A

THIS REPORT MUST BE READ IN CONJUNCTION WITH THE ACCOMPANYING ANALYTICAL DATA

CSR Limited
Box 483 GPO
Sydney
NSW 2001



ORDER No.	PROJECT
30243	B000
DATE RECEIVED	RESULTS REQUIRED
1.5.85	ASAP

No. OF PAGES OF RESULTS	DATE REPORTED	No. OF COPIES	TOTAL No. OF SAMPLES
		3	24

STATE OF SAMPLES	REFER BELOW	SAMPLE NUMBERS	PRE-TREATMENT						ANALYSIS				
			DRY	CRUSH	SPLIT	PUL-VERISE	SIEVE	OTHER SEE REMARKS	NONE	REFER TO ANALYSIS SECTION	PREPARATION	METHOD	
SC		A184680-686 A184701-716,718	1	2	4	3 5					Ag Bi Cu Pb Zn Co Ni Cr V Zr As Ba Sr Y Nb Rb Mo W La Sb Sn Au A1203 Si02 Ti02 Fe203 Mn0 Ca0 K20 LOI Mg0 P203 Na20		102 101 401 359 408 402 104

RESULTS TO

CSR Limited
Minerals Division
Box 483 GPO
Sydney NSW 2001
Att. The Chief Geologist

RESULTS TO

REMARKS

Field Sample Despatch Sheet
10493

STATE OF SAMPLES	ANALYSIS — PREPARATION	ANALYSIS — METHOD
whole core WC	perchloric acid A1	atomic absorption AAS
split core SC	hydrochloric acid A2	x-ray fluorescence XRF
cutting CU	nitric acid A3	spectrophotometry SPEC
rock Ro	aqua regia A4	colorimetry COL
soil SO	nitric-perchloric A5	chromatography CH+
pulp PU	HF mixture A6	titration TTN
water WA	HF under pressure A7	other chemicals means CHEM
tissue TI	fusion A8	miscellaneous MISC
stream sediment SS		fluorescence FLUOR
heavy mineral HM		inductively coupled plasma ICP

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ANALYTICAL DATA

SAMPLE PREFIX

REPORT NUMBER

REPORT DATE

CLIENT ORDER No.

PAGE

999.0 08 3057A

24.5.85

30243

1 OF 3

TUBE No.	SAMPLE No.	Na2O%	V	As	Rb	Sr	Y	Zr	Nb	Mo
1	184680	2.25	8	2	130	85	35	170	10	6
2	184681	2.05	190	3	90	130	30	150	10	X
3	184682	1.80	220	4	25	180	30	150	10	X
4	184683	2.65	10	X	170	110	40	270	15	3
5	184684	3.55	8	X	100	200	35	200	10	X
6	184685	1.40	9	15	150	75	35	250	10	10
7	184686	2.30	5	2	140	85	40	190	10	5
8	184701	3.85	5	X	110	210	40	200	15	X
9	184702	1.95	230	X	30	160	35	150	7	X
10	184703	4.30	170	X	55	230	40	140	7	X
11	184704	0.29	30	4	150	50	40	170	10	7
12	184705	3.95	25	40	95	90	25	230	10	9
13	184706	2.75	10	3	160	110	40	260	8	6
14	184707	2.05	9	3	160	95	40	260	10	7
15	184708	2.80	15	X	150	120	35	250	10	3
16	184709	2.65	6	3	140	75	35	170	8	9
17	184710	3.05	15	X	170	95	35	210	15	5
18	184711	2.15	10	8	160	95	35	180	10	10
19	184712	1.75	30	2	150	100	35	230	10	7
20	184713	2.35	20	2	140	110	25	190	15	9
21										
22										
23	DETECTION	0.01	5	2	5	2	5	5	3	3
24	DIGESTION									
25	METHOD	104	401	401	401	401	401	401	401	402

Results in ppm unless otherwise specified

T = element present: but concentration too low to measure

X = element concentration is below detection limit

— = element not determined

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ANALYTICAL DATA

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REPORT NUMBER

REPORT DATE

CLIENT ORDER No.

PAGE

999.0 08 3057A

24.5.85

30243

2 OF 3

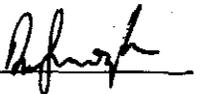
TUBE No.	SAMPLE No.	Sn	Sb	Ba	La	W	MgO%	Al2O3%	SiO2%	P2O5%
1	184680	4	X	450	40	X	0.40	11.2	75.9	0.021
2	184681	X	X	460	55	X	3.05	15.3	55.9	0.341
3	184682	X	6	370	160	X	7.40	10.4	49.9	0.572
4	184683	X	X	1000	50	X	0.30	12.5	72.2	0.039
5	184684	X	X	800	60	X	0.30	12.7	70.3	0.066
6	184685	5	3	650	35	X	0.25	11.8	70.8	0.034
7	184686	X	X	960	35	X	0.20	11.7	73.9	0.023
8	184701	X	3	1150	70	X	0.50	13.4	70.8	0.076
9	184702	4	X	680	170	X	5.50	11.5	49.5	0.607
10	184703	6	X	480	40	X	2.35	14.6	56.9	0.427
11	184704	X	X	320	45	X	0.70	11.6	72.0	0.060
12	184705	5	6	330	30	X	0.70	12.7	72.8	0.039
13	184706	X	X	920	50	X	0.20	12.6	73.0	0.041
14	184707	3	X	610	45	X	0.15	12.4	68.8	0.034
15	184708	X	X	560	40	X	0.70	13.7	73.4	0.043
16	184709	5	X	940	30	X	0.10	11.7	75.6	0.021
17	184710	8	X	500	40	X	0.45	13.7	73.0	0.021
18	184711	5	X	1350	45	X	0.45	12.0	73.5	0.021
19	184712	4	X	450	45	X	0.80	12.4	70.9	0.055
20	184713	6	X	600	65	X	0.65	13.8	72.6	0.069
21										
22										
23	DETECTION	3	3	20	20	10	0.05	0.1	0.1	0.005
24	DIGESTION									
25	METHOD	402	402	401	401	401	408	408	408	402

Results in ppm unless otherwise specified

T = element present; but concentration too low to measure

X = element concentration is below detection limit

- = element not determined

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A division of MacDonald Hamilton & Co. Pty. Ltd.

069085

ANALYTICAL DATA

SAMPLE PREFIX

REPORT NUMBER

REPORT DATE

CLIENT ORDER No.

PAGE

999.0 08 3057A

24.5.85

30243

3 OF 3

TUBE No.	SAMPLE No.	K2O%	CaO%	TiO2%	MnO%	Fe2O3%	As	LOI%		
1	184680	2.30	2.05	0.21	0.05	2.25	2	2.70		
2	184681	1.90	3.70	0.92	0.19	9.55	3	6.20		
3	184682	0.68	7.50	0.64	0.30	12.00	4	8.70		
4	184683	5.25	1.35	0.30	0.05	2.90	X	1.45		
5	184684	2.90	2.55	0.29	0.08	3.60	X	2.90		
6	184685	4.40	1.35	0.29	0.03	5.40	15	3.25		
7	184686	5.00	1.85	0.24	0.05	2.10	2	2.20		
8	184701	3.35	1.20	0.30	0.07	3.85	X	1.75		
9	184702	1.05	8.45	0.68	0.37	11.60	X	8.75		
10	184703	1.50	4.35	1.15	0.18	9.75	X	4.33		
11	184704	3.75	2.70	0.29	0.10	3.00	4	4.78		
12	184705	2.15	1.70	0.31	0.04	2.70	40	2.21		
13	184706	5.25	1.35	0.30	0.05	2.95	3	1.53		
14	184707	5.05	3.05	0.30	0.09	2.80	3	3.21		
15	184708	3.20	1.40	0.34	0.04	2.10	X	2.62		
16	184709	4.55	1.10	0.22	0.04	1.65	3	1.51		
17	184710	3.30	1.00	0.24	0.04	2.15	X	2.07		
18	184711	4.60	0.55	0.23	0.07	4.15	8	1.36		
19	184712	2.95	2.90	0.33	0.08	3.35	2	3.50		
20	184713	3.10	1.50	0.30	0.05	2.45	2	2.86		
21										
22										
23	DETECTION	0.01	0.01	0.01	0.01	0.01	2	0.01		
24	DIGESTION									
25	METHOD	408	408	408	408	408	401	408		

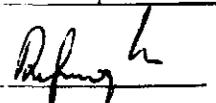
Results in ppm unless otherwise specified

T = element present; but concentration too low to measure

X = element concentration is below detection limit

- = element not determined

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083

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A division of MacDonald Hamilton & Co. Pty. Ltd.

069086

ANALYTICAL DATA

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REPORT NUMBER

REPORT DATE

CLIENT ORDER No.

PAGE

999.0 08 3057A

23.5.85

30243

1 OF 3

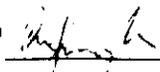
TUBE No.	SAMPLE No.	Na2O	MgO %	Al2O3%	SiO2%	P2O5	K2O %	CaO %	TiO2%	V
1	184714	800	X	4.25	71.7	0.030	0.40	1.25	0.66	75
2	184715	100	X	0.75	42.5	0.009	0.03	0.07	0.87	130
3	184716	200	X	1.25	43.4	X	0.05	0.07	1.40	140
4	184718	100	X	1.15	43.5	X	X	0.06	1.40	160
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										
16										
17										
18										
19										
20										
21										
22										
23	DETECTION	50	0.05	0.05	0.1	0.007	0.01	0.01	0.01	5
24	DIGESTION									
25	METHOD	104	408	408	408	402	408	408	408	401

Results in ppm unless otherwise specified

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— = element not determined

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ANALYTICAL DATA

SAMPLE PREFIX

REPORT NUMBER

REPORT DATE

CLIENT ORDER No.

PAGE

		999.0 08 3057A				23.5.85		30243		2 OF 3	
TUBE No.	SAMPLE No.	MnO %	Fe2O3 %	As	Rb	Sr	Y	Zr	Nb	Mo	
1	184714	0.01	13.0	3400	20	40	X	95	X	X	
2	184715	0.03	51.0	140	7	3	5	110	X	X	
3	184716	0.04	49.7	320	8	5	15	140	5	X	
4	184718	0.04	49.6	310	7	3	15	130	4	X	
5											
6											
7											
8											
9											
10											
11											
12											
13											
14											
15											
16											
17											
18											
19											
20											
21											
22											
23	DETECTION	0.01	0.1	2	5	3	5	5	3	3	
24	DIGESTION										
25	METHOD	408	408	401	401	401	401	401	401	402	

Results in ppm unless otherwise specified

T = element present; but concentration too low to measure

X = element concentration is below detection limit

— = element not determined

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085

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SAMPLE PREFIX

REPORT NUMBER

REPORT DATE

CLIENT ORDER No.

PAGE

999.0 08 3057A

23.5.85

30243

3 OF 3

TUBE No.	SAMPLE No.	Sn	Sb	Ba	La	W	LOI%			
1	184714	260	200	390	25	X	5.46			
2	184715	470	50	690	95	25	3.34			
3	184716	1850	85	1250	80	35	2.60			
4	184718	1850	95	1200	75	30	2.59			
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										
16										
17										
18										
19										
20										
21										
22										
23	DETECTION	10	10	20	20	10	0.01			
24	DIGESTION									
25	METHOD	402	402	401	401	401	403			

Results in ppm unless otherwise specified

T = element present; but concentration too low to measure

X = element concentration is below detection limit

— = element not determined

AUTHORISED
OFFICER*[Signature]*

086

Phone (09) 458 7999

ANALABSA division of MacDonald Hamilton & Co. Pty. Ltd.
52 Murray Road, Welshpool, W.A. 6106

069089

Telex AA92560

ANALYTICAL REPORT No. 999.0 08 3168

THIS REPORT MUST BE READ IN CONJUNCTION WITH THE ACCOMPANYING ANALYTICAL DATA

ORDER No.

PROJECT

30824

7610

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ASAP

CSR Ltd.
GPO Box 483
Sydney
N.S.W. 2001No. OF PAGES
OF RESULTSDATE
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TOTAL No. OF SAMPLES

3

89

REFER BELOW	SAMPLE NUMBERS	PRE-TREATMENT							ANALYSIS		
		DRY	CRUSH	SPLIT	PUL- VERISE	SIEVE	OTHER SEE REMARKS	NONE	REFER TO ANALYSIS SECTION	PREPARATION	METHOD
S	212801-29,31-39	1	2		3				Cu Pb Zn Cr Ni		101
S	212901-09,11-19, 21-39,41-49			4	5				Ag		102
S	212830,910,920, 940,950				1				Au Tl V		359 135 401

REMARKS

RESULTS

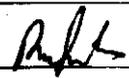
TO

As Above
Attn: R. Williams

RESULTS

TO

STATE OF SAMPLES	ANALYSIS — PREPARATION				ANALYSIS	METHOD	
whole core	WC	perchloric acid	A1	cold acid	CA	atomic absorption	AAS
split core	SC	hydrochloric acid	A2	specific sulphide	SS	x-ray fluorescence	XRF
cutting	CU	nitric acid	A3	other mixed acids	Ma	spectrophotometry	SPEC
rock	Ro	aqua regia	A4	alkaline attack	AA	colorimetry	COL
oil	SO	nitric-perchloric	A5	volatilization	VO	chromatography	CHR
slip	PU	HF mixture	A6	ignition	IG	titration	TTN
water	WA	HF under pressure	A7	pressed powder (XRF)	PP	other chemicals means	CHEM
tissue	TI	fusion	A8	glass fusion (XRF)	GF	miscellaneous	MISC
stream sediment	SS					fluorescence	FLUOR
heavy mineral	HM					inductively coupled plasma	ICP

AUTHORISED OFFICER 

087

ANALABS

A division of MacDonald Hamilton & Co. Pty. Ltd.

069090

ANALYTICAL DATA

SAMPLE PREFIX

REPORT NUMBER

REPORT DATE

CLIENT ORDER No.

PAGE

999.0 08 3168A

5.8.85

30824

1 OF 4

TUBE No.	SAMPLE No.	Cu	Pb	Zn	Cr	Ni	Ag	Au	Tl	V
1	212801	18	9	17	6	37	X	X	0.5	20
2	212802	8	2	100	5	29	X	0.04	0.5	95
3	212803	10	5	47	16	42	0.2	X	0.5	50
4	212804	19	32	81	14	56	0.1	0.04	0.5	50
5	212805	18	30	145	7	35	X	0.04	0.5	15
6	212806	7	20	83	2	10	X	X	0.5	75
7	212807	8	29	113	2	9	X	0.02	0.5	65
8	212808	8	11	134	2	7	X	0.06	0.5	20
9	212809	12	11	450	1	8	0.2	0.06	0.5	30
10	212810	5	8	23	2	6	X	0.02	1.0	35
11	212811	7	6	35	3	6	X	X	1.0	9
12	212812	4	4	49	2	7	X	X	1.0	20
13	212813	6	1	25	1	7	X	X	0.5	20
14	212814	4	3	25	1	6	0.1	X	0.5	X
15	212815 (BLANK)	3	X	9	16	5	X	X	X	9
16	212816	6	4	13	1	6	X	0.02	1.0	6
17	212817	8	8	27	1	6	X	0.02	1.0	6
18	212818	4	3	19	1	6	X	X	1.0	6
19	212819	4	4	18	1	7	X	X	1.0	X
20	212820	7	8	33	1	8	X	0.02	1.0	X
21	212821	4	11	59	4	20	X	X	1.0	6
22	212822	4	4	26	X	6	0.1	X	1.0	X
23	212823	6	2	15	X	6	0.1	X	1.0	X
24	212824	7	7	31	1	5	X	X	1.0	6
25	212825	8	7	205	1	7	0.1	X	0.5	15

Results in ppm unless otherwise specified

T = element present; but concentration too low to measure

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AUTHORISED
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ANALABS

A division of MacDonald Hamilton & Co. Pty. Ltd.

069091

ANALYTICAL DATA

SAMPLE PREFIX

REPORT NUMBER

REPORT DATE

CLIENT ORDER No.

PAGE

999.0 08 3169A

5.8.85

30824

2 OF 4

TUBE No.	SAMPLE No.	Cu	Pb	Zn	Cr	Ni	Ag	Au	Tl	V
1	212826	7	3	8	1	6	X	X	1.0	15
2	212827	8	X	14	1	7	X	X	0.5	20
3	212828	9	3	11	X	6	X	X	0.5	9
4	212829	7	9	53	1	7	X	X	0.5	15
5	212830 (K2)	1050	4920	5540	55	35	460.0	1.06	0.5	140
6	212831	6	6	47	1	7	X	X	0.5	10
7	212832	6	9	27	X	6	0.7	X	0.5	X
8	212833	15	14	92	1	9	X	X	0.5	X
9	212834	5	9	54 13	1	7	X	X	1.0	X
10	212835 (BLANK)	8	15	35	1	8	X	0.02	0.5	30
11	212836	13	5	110	3	11	X	X	0.5	120
12	212837	12	5	19	2	7	X	X	1.0	20
13	212838	4	16	14	1	4	X	X	0.5	10
14	212839	7	14	67	1	5	X	X	0.5	6
15	212901	4	1	30	1	6	X	X	0.5	9
16	212902	80	61	20	5	25	1.9	0.02	2.0	10
17	212903	8	X	5	1	5	0.1	X	X	10
18	212904	7	X	6	1	6	X	X	0.5	10
19	212905	16	1	7	1	7	0.1	X	0.5	15
20	212906	9	1	8	1	7	X	X	0.5	25
21	212907	10	3	17	X	8	X	X	0.5	20
22	212908	13	5	12	1	10	X	X	X	70
23	212909	4	3	71	1	26	X	X	0.5	170
24	212910 (t)	76	8	43	17	55	0.1	X	1.0	55
25	212911	5	4	27	1	10	X	X	0.5	50

Results in ppm unless otherwise specified

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ANALABS

A Division of MacDonald Hamilton & Co. Pty. Ltd.

069092

ANALYTICAL DATA

SAMPLE PREFIX

REPORT NUMBER

REPORT DATE

CLIENT ORDER No.

PAGE

999.0 08 3168A

5.8.85

30824

3 OF 4

TUBE No.	SAMPLE No.	Cu	Pb	Zn	Cr	Ni	Ag	Au	TI	V
1	212912	10	2	10	1	9	X	X	X	25
2	212913	9	1	12	1	8	X	X	0.5	40
3	212914	10	X	13	2	8	X	X	0.5	30
4	212915	8	3	14	2	7	X	X	0.5	25
5	212916	3	1	29	1	7	X	X	0.5	25
6	212917	3	X	26	1	9	X	X	1.0	40
7	212918	6	4	71	11	47	X	X	0.5	65
8	212919	8	21	69	46	59	X	X	1.0	110
9	212920 (X2)	1050	4920	5540	56	35	440.0	0.98	0.5	170
10	212921	4	8	272	270	220	0.5	0.08	X	250
11	212922	5	25	330	7	31	0.1	X	X	50
12	212923	7	16	291	4	23	0.3	X	X	50
13	212924	3	12	223	2	26	X	X	0.5	190
14	212925	3	1	69	2	14	X	X	X	50
15	212926	4	6	210	170	235	X	0.04	X	230
16	212927	5	3	234	210	215	X	0.06	0.5	320
17	212928	4	30	104	1	10	X	X	0.5	25
18	212929	4	20	67	1	8	X	0.02	X	20
19	212930	10	12	93	10	44	X	0.10	X	60
20	212931	5	11	72	1	7	X	0.04	X	10
21	212932	3	7	65	1	10	X	X	X	30
22	212933	4	11	50	1	9	X	0.02	0.5	25
23	212934	4	18	62	1	8	X	0.04	0.5	20
24	212935	4	4	10	13	6	X	X	X	15
25	212936	4	10	46	X	6	X	X	0.5	10

Results in ppm unless otherwise specified

T = element present; but concentration too low to measure

X = element concentration is below detection limit

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Pauling L

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069093

ANALYTICAL DATA

SAMPLE PREFIX REPORT NUMBER REPORT DATE CLIENT ORDER No. PAGE

999.0 08 3168A 5.8.85 30824 4 OF 4

TUBE No.	SAMPLE No.	Cu	Pb	Zn	Cr	Ni	Ag	Au	Tl	V
1	212937	24	18	44	X	8	X	0.04	0.5	25
2	212938	9	10	65	X	6	X	X	X	30
3	212939	4	10	33	1	7	X	X	0.5	30
4	212940	1050	4920	5540	56	35	440.0	1.06	0.5	130
5	212941	10	21	54	1	9	0.7	0.08	X	20
6	212942	5	6	93	1	7	X	X	0.5	20
7	212943	6	6	13	X	5	X	X	0.5	20
8	212944	9	6	55	X	8	X	X	X	20
9	212945	10	8	206	X	6	X	X	1.0	15
10	212946	5	7	66	1	7	X	X	0.5	45
11	212947	12	5	192	1	11	X	X	0.5	210
12	212948	6	2	12	X	6	X	X	0.5	40
13	212949	5	3	121	X	8	X	X	1.0	150
14	212950 GX1	84	7	40	7	59	X	0.04	2.0	55
15										
16										
17										
18										
19										
20										
21										
22										
23	DETECTION	1	1	1	1	1	0.1	0.02	0.5	5
24	DIGESTION									
25	METHOD	102	102	102	102	102	102	329	135	401

Results in ppm unless otherwise specified
 T = element present; but concentration too low to measure
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069094

Phone (09) 458 7999

A division of MacDonald Hamilton & Co. Pty. Ltd.
52 Murray Road, Welshpool, W.A. 6106

Telex AA92560

ANALYTICAL REPORT No. 999.0 08 3168

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PROJECT

30824

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PRE-TREATMENT

ANALYSIS

REFER
BELOWSAMPLE
NUMBERS

DRY

CRUSH

SPLIT

PUL-
VERISE

SIEVE

OTHER
SEE
REMARKS

NONE

REFER TO
ANALYSIS
SECTION

PREPARATION

METHOD

212(901), (903-904), (909), (910), (932, 933, 934), (938, 939), (950), (802, 803), (806, 807), (809, 810, 811), (819, 820, 821, 822, 823), (832, 833, 834), (836), (839)
(Pls Note that () is 1 sample.)Na2O
Y Zr As Ba Sr
Nb Rb W La
Sb Sn Mo
Al2O3 SiO2 TiO2
Fe2O3 MnO CaO
K2O MgO LOI
P2O5
F
104
401
401
402
408
408
408
402
129

RESULTS

TO

As Above

RESULTS

TO

REMARKS

STATE OF SAMPLES

ANALYSIS — PREPARATION

ANALYSIS METHOD

whole core WC
split core SC
cutting CU
rock Rq
oil SO
pulp PU
water WA
tissue TI
stream sediment SS
heavy mineral HMperchloric acid A1
hydrochloric acid A2
nitric acid A3
aqua regia A4
nitric-perchloric A5
HF mixture A6
HF under pressure A7
fusion A8cold acid CA
specific sulphide SS
other mixed acids Ma
alkaline attack AA
volatilization VO
ignition IG
pressed powder (XRF) PP
glass fusion (XRF) GFatomic absorption AAS
x-ray fluorescence XRF
spectrophotometry SPEC
colorimetry COL
chromatography CHR
titration TTN
other chemicals means CHEM
miscellaneous MISC
fluorescence FLUOR
inductively coupled plasma ICP

AUTHORISED OFFICER

Prof. [Signature]

092

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069095

ANALYTICAL DATA

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PAGE

				999.0 08 3168E	6.8.85	30824	1 OF 1			
TUBE No.	SAMPLE No.			SiO2%	TiO2%	Fe2O3%	MnO%	CaO%	K2O%	MgO%
1	212901			71.4	0.28	2.45	0.07	1.19	4.11	0.35
2	212903,04			80.6	0.22	2.15	0.01	X	3.19	0.10
3	212909			66.0	0.85	2.45	0.02	0.06	3.92	1.15
4	212910	STD.	GX IH	71.7	0.48	4.10	0.02	0.05	4.54	0.21
5	212932 ,33,34			77.0	0.24	2.20	0.01	X	4.03	0.45
6	212938 ,39			74.1	0.35	2.75	0.01	0.05	4.20	0.35
7	212950	STD	GX IH	72.5	0.48	4.14	0.02	0.04	4.62	0.31
8	212802 ,03			66.2	0.49	5.10	0.11	0.98	2.31	1.55
9	212806 ,07			67.8	0.52	4.65	0.08	1.51	3.94	0.80
10	212809 ,10,11			73.4	0.31	3.05	0.01	0.09	4.17	0.60
11	212819 ,20,21,22,23			75.6	0.24	2.15	0.06	0.46	4.25	0.55
12	212832 ,33,34			73.3	0.27	2.65	0.02	0.22	4.18	0.50
13	212836			58.2	1.00	9.05	0.18	1.54	1.89	1.85
14	212839			73.2	0.26	2.50	0.04	0.56	3.06	0.45
15										
16										
17										
18										
19										
20										
21										
22										
23	DETECTION			0.1	0.01	0.05	0.01	0.01	0.01	0.05
24	DIGESTION									
25	METHOD			408	408	408	408	408	408	408

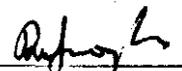
Results in ppm unless otherwise specified

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069096

ANALYTICAL DATA

SAMPLE PREFIX

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999.0 08 3168F

31.7.85

30824

1 OF 1

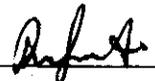
TUBE No.	SAMPLE No.			LOI%	P205%	F				
1	212901			2.36	0.030	900				
2	212903,04			1.92	0.011	400				
3	212909			5.44	0.048	1000				
4	212910	STD	GXIH	2.96	0.053	1200				
5	212932,33,34			2.66	0.014	700				
6	212938,39			3.11	0.048	500				
7	212950	STD	GXIH	2.39	0.064	800				
8	212802,03			2.62	0.112	700				
9	212806,07			4.62	0.117	800				
10	212809,10,11			3.51	0.046	800				
11	212819,20,21,22,23			3.03	0.023	800				
12	212832,33,34			3.29	0.025	600				
13	212836			5.08	0.361	900				
14	212839			2.70	0.034	700				
15										
16										
17										
18										
19										
20										
21										
22										
23	DETECTION			0.01	0.007	100				
24	DIGESTION									
25	METHOD			408	402	129				

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ANALYTICAL DATA

SAMPLE PREFIX

REPORT NUMBER

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PAGE

			999.0 08 3168C	5.8.95	30824			1 OF 1	
TUBE No.	SAMPLE No.		Na2O	Y	Zr	As	Ba	Sr	Nb
1	212901		24900	50	260	2	690	95	10
2	212903,04		650	20	180	3	140	8	10
3	212909		550	30	170	X	320	20	7
4	212910	STD GX IH	I/S	55	300	7	390	90	9
5	212932,33,34		550	30	200	X	660	8	15
6	212938,39		550	35	250	3	630	15	15
7	212950	STD GX IH	I/S	55	290	10	390	90	10
8	212802,03		43500	40	220	4	750	230	15
9	212806,07		1000	35	240	9	830	60	9
10	212809,10,11		900	35	240	8	940	20	10
11	212819,20,21,22,23		850	35	210	7	1350	30	15
12	212832,33,34		800	35	230	2	680	10	10
13	212836		4150	40	170	7	460	120	150
14	212839		27000	35	220	10	370	75	10
15									
16									
17									
18									
19									
20									
21									
22									
23	DETECTION		50	5	5	2	20	5	3
24	DIGESTION								
25	METHOD		104	401	401	401	401	401	401

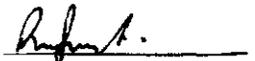
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PAGE

999.0 08 31680

5.8.85

30824

1 OF 1

TUBE No.	SAMPLE No.			Rb	W	La	Sb	Sn	Mo	R 1203%
1	212901			260	X	55	X	X	4	13.15
2	212903,04			90	X	40	X	X	6	10.15
3	212909			190	X	40	X	4	5	17.35
4	212910	STD	GX IH	330	40	30	X	9	200	12.00
5	212932,33,34			140	X	20	X	4	8	12.30
6	212938,39			140	X	30	X	3	4	13.60
7	212950	STD	GX IH	330	45	30	X	6	190	11.80
8	212802,03			95	X	85	X	4	8	14.35
9	212806,07			170	X	40	X	3	X	13.30
10	212809,10,11			170	X	40	X	X	5	12.75
11	212819,20,21,22,23			190	X	45	X	7	X	12.05
12	212832,33,34			150	X	40	X	4	3	12.45
13	212836			90	X	70	X	X	X	14.35
14	212839			140	X	35	X	X	4	11.70
15										
16										
17										
18										
19										
20										
21										
22										
23	DETECTION			5	10	20	3	3	3	0.05
24	DIGESTION									
25	METHOD			401	401	401	402	402	402	408

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ANALYTICAL REPORT No. 999.0 08 3168

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		3	89

STATE OF SAMPLES	REFER BELOW	SAMPLE NUMBERS	PRE-TREATMENT						ANALYSIS			
			DRY	CRUSH	SPLIT	PUL-VERISE	SIEVE	OTHER SEE REMARKS	NONE	REFER TO ANALYSIS SECTION	PREPARATION	METHC
		212905-08, 11, 14, 22-25, 28-31, 35-37, 40-49, 212801, 04, 05, 08, 12-14, 16-18, 24-31, 35-37, 38								Na2O Ba Sr Rb		104 401

RESULTS
TO

As Above

RESULTS
TO

REMARKS

STATE OF SAMPLES	ANALYSIS — PREPARATION	ANALYSIS — METHOD
whole core WC	perchloric acid A1	atomic absorption AAS
split core SC	hydrochloric acid A2	x-ray fluorescence XRF
cutting CU	nitric acid A3	spectrophotometry SPEC
rock Ro	aqua regia A4	colorimetry CO ²
soil SO	nitric-perchloric A5	chromatography CH ²
pulp PU	HF mixture A6	titration TTN
water WA	HF under pressure A7	other chemical means CHEM
tissue TI	fusion A8	miscellaneous MISC
stream sediment SS		fluorescence FLUOR
heavy mineral HM		inductively coupled plasma ICP

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069100

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PAGE

999.0 08 31688

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30824

1 OF 3

TUBE No.	SAMPLE No.	Na2O	Ba	Sr	Rb					
1	212905	650	160	10	100					
2	212906	600	180	9	110					
3	212907	550	170	10	120					
4	212908	650	300	7	140					
5	212911	650	220	15	130					
6	212914	650	190	9	100					
7	212922	350	270	10	110					
8	212923	350	270	15	110					
9	212924	2100	190	15	170					
10	212925	23300	390	75	95					
11	212928	650	590	9	170					
12	212929	2750	510	20	140					
13	212930	400	520	10	130					
14	212931	400	520	9	140					
15	212935	150	60	X	X					
16	212936	500	580	7	140					
17	212937	750	240	30	110					
18	212940	250	660	X	7					
19	212941	650	510	9	120					
20	212942	600	480	10	110					
21	212943	550	330	20	90					
22	212944	550	420	20	100					
23	212945	500	720	8	110					
24	212946	6050	1100	55	190					
25	212947	15800	1250	130	110					

Results in ppm unless otherwise specified
 T = element present; but concentration too low to measure
 X = element concentration is below detection limit
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ANALYTICAL DATA

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PAGE

999.0 08 3168B

1.8.85

30824

2 OF 3

TUBE No.	SAMPLE No.	Na2O	Ba	Sr	Rb					
1	212948	10400	1300	80	160					
2	212949	47500	520	240	55					
3	212801	700	780	30	120					
4	212804	15200	1150	85	160					
5	212805	1400	730	15	150					
6	212808	900	730	20	130					
7	212812	800	1300	35	210					
8	212813	1300	2200	90	190					
9	212814	2350	2250	110	190					
10	212816	800	1300	30	160					
11	212817	800	1250	25	200					
12	212818	800	1000	15	190					
13	212824	800	820	10	140					
14	212825	1050	760	15	150					
15	212826	1000	1000	25	130					
16	212827	1100	3000	75	140					
17	212828	950	690	10	130					
18	212829	900	840	9	160					
19	212830 <i>G125</i>	200	600	5	9					
20	212831	900	870	15	190					
21	212835	4450	610	25	150					
22	212836	4150	460	120	90					
23	212837	3700	820	25	160					
24	212838	1900	630	70	120					
25										

Results in ppm unless otherwise specified
 T = element present; but concentration too low to measure
 X = element concentration is below detection limit
 - = element not determined

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099

ANALABS

A division of MacDonald Hamilton & Co. Pty. Ltd.

069102

ANALYTICAL DATA

SAMPLE PREFIX

REPORT NUMBER

REPORT DATE

CLIENT ORDER No.

PAGE

		999.0 08 3168B				1.8.85	30824			3 OF 3	
TUBE No.	SAMPLE No.	Na2O	Ba	Sr	Rb						
1	DETECTION	50	20	5	5						
2	DIGESTION										
3	METHOD	104	401	401	401						
4											
5											
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25											

Results in ppm unless otherwise specified

T = element present; but concentration too low to measure

X = element concentration is below detection limit

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APPENDIX III

PETROLOGICAL REPORT - DR. B.J. BARRON

101

B.J. BARRON, B.Sc., Ph.D., (Sydney)

PETROLOGIST

069104

7 Fairview Ave.,
St. Ives,
SYDNEY NSW 2075
Tel (02) 449 5839

Our ref: C7/85/311a

Your ref: Purchase order 30826.
Field sample despatch sheet 10499.

PETROGRAPHIC EXAMINATION OF TWENTY NINE
DRILL CORE SAMPLES (FIELD SAMPLE
DESPATCH SHEET 10499).

Report No: C7/85/311a

15th August, 1985.

For: CSR Minerals Division.


Dr. B.J. Barron,
Consulting Petrologist.

SUMMARY

A variety of volcanic tuffaceous and possibly reworked tuffaceous material of acid to acid-intermediate primary composition is represented in all three drill holes BBP 279, BBP 278 and BBP 280, with sparse intersections of altered intermediate-basic fine grained dyke rocks.

The samples of BBP 279 include partly silicified and intensely argillically altered lithic/vitric tuffaceous rocks of acidic primary composition with recognisable pumiceous, microporphyrific, perlitic and flow banded lithic fragments and glass shards (samples A 184679, A 184687, A 184688 (from fracture zone), A 184689, A 184690 and A 184691). The last two samples (A 184690 and A 184691) could represent part of a submarine slumped hyaloclastic "scree" derived from the breakup of hot volcanic glassy material by sudden cooling and penetration of sea water. Three samples contrast with those above in that they represent ?related volcanic flows of sparsely porphyritic alkali feldspar rhyolite (A 184676, A 184678) and sparsely porphyritic and vesicular quartz alkali feldspar trachyte (A 184677), that are considerably less altered than the fragmental tuffaceous lithologies. The sample A 184764 is an altered and veined, sparsely porphyritic intermediate ?dyke rock; while the ?related sample A 184675, also of intermediate composition, is strongly chlorite altered, veined and autobrecciated but may be a volcanic flow rock rather than a shallow intrusive type.

Six samples represent the hole BBP 278, and all are igneous non-fragmental lithologies. Partly altered, veined and weakly flow banded, sparsely porphyritic rhyolite is represented by the samples A 184722, A 184723 and A 184725 which now contain secondary assemblages amongst the phases albite, "sericite", carbonate, ?montmorillonite and chlorite. Trachytic flow rocks include A 184720 (similar to A 184677 from BBP 279) and A 184724 which are sparsely porphyritic types with recognisable microlitic trachytic fine grained groundmass fractions. The sample A 184721 is an altered microporphyrific intermediate/basic igneous rock with a sub-ophitic groundmass texture and shallow intrusive emplacement.

The twelve samples from BBP 280 comprise dominant fragmental tuffaceous lithologies of acidic primary composition with

recognisable altered and deformed, very fine grained, once-rhyolitic and ?ignimbritic, microporphyritic, pumiceous and devitrified fragments (A 184730, A 184733, A 184735, A 184736 and A 184737), while crystal (altered feldspars and quartz chips) as well as volcanic lithic debris is represented in the samples A 184726, A 184732 and A 184734. Non-fragmental volcanic flow rocks include intensely argillically altered, veined and mineralised, fine grained, sparsely microporphyritic acid-intermediate types (A 184727), and similarly altered recognisably once-vesicular acidic flow rocks A 184729 and A 184731. The quartz-chlorite-carbonate altered sample A 184728 of intermediate primary composition most likely has shallow intrusive emplacement with a holocrystalline microporphyritic texture.

SUMMARY TABLE

SAMPLE NUMBER	DEPTH METRES	ROCK TYPE	DIAGNOSTIC TEXTURES	SECONDARY MINERALOGY	SULPHIDES %
A 184764	BBP 279 240.7	Altered, veined fine grained sparsely porphyritic ?dyke rock (intermediate).	Sparse plagioclase and altered mafic phenocrysts. Fine decussate holocrystalline matrix.	Albite, chlorite, quartz, carbonate, sericite. Carbonate, quartz veins.	-
A 184675	BBP 279 324.7	Altered, veined auto-brecciated volcanic flow rock of intermediate composition.	Fine to medium grained and micro-porphyritic fragmental.	Albite, chlorite, sphene, carbonate. Carbonate, quartz, chlorite veins.	-
A 184676		Sparsely porphyritic alkali feldspar rhyolite.	Sparsely porphyritic devitrified microlitic groundmass.	Albite, chlorite, carbonate, sericite. Quartz, sericite, carbonate veinlets.	-
A 184677	BBP 279 422.0	Sparsely porphyritic and vesicular quartz alkali-feldspar trachyte.	Plagioclase phenocrysts. Microlitic K-feldspar-rich groundmass. Quartz-filled cavities or vesicles.	Chlorite, albite. Quartz, carbonate veinlets.	-
A 184678	BBP 279 523.0	Sparsely porphyritic alkali-feldspar rhyolite. Similar to A 184676 and A 184677.	Sparse plagioclase phenocrysts, devitrified microlitic groundmass.	Carbonate, sericite, quartz, albite.	trace
A 184679	BBP 279 458.9	Altered lithic/vitric tuff of felsic composition.	Pumiceous and flow banded lithic fragments. Cuspate glass shards.	Albite, quartz, sericite, carbonate.	-
A 184687	BBP 279 489.7	Banded (?slumped) acidic crystal/lithic tuff.	Pumiceous micro-porphyritic and perlitic, once-glassy unsorted fragments.	Carbonate, cherty quartz, albite, "sericite", ?montmorillonite. Quartz carbonate veins.	~3% dusty pyrite.

SAMPLE NUMBER	DEPTH METRES	ROCK TYPE	DIAGNOSTIC TEXTURES	SECONDARY MINERALOGY	SULPHIDES %
A 184688	BBP 279 640.7 0	Brecciated, foliated, altered acidic lithic/crystal tuff. (From fracture zone).	?Pumiceous, flow banded, ?sedimentary fragments.	Quartz, "sericite" ?montmorillonite, leucoxene (Chlorite, carbonate).	4% to 5%
A 184689	BBP 279 606.7	Altered, weakly mineralised, poorly sorted ?rhyolitic pumiceous tuff.	Pumiceous, flow banded fragments. Coarsely devitrified fragments.	"Sericite", quartz, ?montmorillonite.	3% to 5%
A 184690	BBP 279 621.9	Altered, silicified, mineralised rhyolitic tuff.	Pyroclastic, fragmental flow banded and vesicular, devitrified. Sparse microphenocrysts.	Quartz, "sericite" carbonate, albite.	<5%
A 184691	BBP 279 643.8	Altered, weakly mineralised, unsorted rhyolitic tuff. Similar to A184689 and A184690.	Pyroclastic fragmental flow banded, vesicular and porphyritic fragments.	?Montmorillonite, "sericite", albite, quartz.	3% - 5%
A 184720	BBP 278 183.3 to 196.0	Partly altered porphyritic ?trachyte. Similar to A184677.	Plagioclase, mafic phenocrysts.	Albite, carbonate, sericite and sphene.	-
A 184721	BBP 278 217.2 to 223.1	Altered micro-porphyrritic shallow ?intrusive intermediate/basic igneous rock.	Mafic microphenocrysts. Sub-ophitic groundmass.	Chlorite, carbonate, sphene, quartz.	trace
A 184722	BBP 278 235.7	Altered, veined microporphyritic flow banded alkali-feldspar rhyolite.	Sparse phenocrysts, flow banded groundmass.	Sericite, carbonate, (quartz, chlorite, albite).	-
A 184723	BBP 278 327.0	Altered, veined, sparsely porphyritic, weakly flow-banded rhyolite. Similar to A184722.	Sparse phenocrysts. Devitrified microlitic groundmass.	Carbonate, sericite.	-
A 184724	BBP 278 441.9	Porphyritic, once-vesicular fine grained trachytic igneous rock.	Sparse phenocrysts, trachytic groundmass.	Chlorite, carbonate, albite, (quartz).	-
A 184725	BBP 278 453.2	Partly altered, veined, finely flow banded, sparsely porphyritic rhyolite. Similar to A18722, A18723 and A184676.	Sparse phenocrysts, fine devitrified groundmass.	Albite, sericite, carbonate. ?montmorillonite, chlorite.	-

SAMPLE NUMBER	DEPTH METRES	ROCK TYPE	DIAGNOSTIC TEXTURES	SECONDARY MINERALOGY	SULPHIDES %
A 184726	BBP 280 214.2	Banded and slumped altered and mineralised fine grained acidic tuff.	Fragmental pyroclastic, crystal and volcanic lithic debris (mostly quartz).	"Sericite", quartz ?montmorillonite, chlorite, minor ?anhydrite.	5% to 8%
A 184727	BBP 280 245.2	Altered, veined, mineralised, fine grained porphyritic acid-intermediate igneous rock.	?Mafic phenocryst sites.	Chlorite, carbonate quartz, ?montmorillonite, sericite.	~ 10%
A 184728	BBP 280 249.9	Altered vesicular microporphyritic fine grained shallow ?intrusive intermediate igneous rock. (?micro-diorite).	HolocrySTALLINE microporphyritic texture.	Quartz, chlorite, carbonate, albite.	-
A 184729	BBP 280 265.4	Altered porphyritic vesicular volcanic rock of ?trachytic composition.	Sparse feldspar phenocrysts in fine grained microlitic groundmass.	Albite, sericite, carbonate, chlorite, quartz.	-
A 184730	BBP 280 275.6	Altered, weakly banded vitric tuff.	Altered deformed fine rhyolitic and ?ignimbritic fragments.	Quartz ?montmorillonite, sphene, "sericite".	5% - 8%
A 184731	BBP 280 285.6	Mineralised, altered porphyritic and vesicular acidic igneous rock.	Sparse, plagioclase ?quartz phenocrysts and sparse vesicle sites.	Albite, quartz, carbonate, ?montmorillonite, sericite.	10%
A 184732	BBP 280 296.7	Altered, unsorted fragmental (or partly reworked ?tuff of acidic composition.	Poorly sorted lithic fragments of several different acid volcanic lithologies.	Quartz ?montmorillonite "sericite".	-
A 184733	BBP 280 303.6	Altered, veined, fractured mineralised, banded vitric ?tuff.	Small deformed, altered <u>pumiceous</u> ?glass shards. Quartz chips.	Quartz, "sericite". Montmorillonite. Carbonate.	Minor
A 184734	BBP 280 333.0	Altered, veined, weakly mineralised acidic lithic ?tuff.	Vague outlines of fine grained fragments. Rare angular quartz grains. ?Mafic crystal sites.	Quartz, ?montmorillonite, dusty rutile/sphene (carbonate, chlorite, sericite)	Trace

SAMPLE NUMBER	DEPTH METRES	ROCK TYPE	DIAGNOSTIC TEXTURES	SECONDARY MINERALOGY	SULPHIDES %
A 184735	BBP 280 334.6	Altered, silicified, mineralised, ?slumped (or brecciated), partly "welded" vitric tuff.	Unsorted ?slumped vitric tuffaceous lithic fragments.	Quartz, sericite, ?montmorillonite (chlorite).	8%
A 184736	BBP 280 339.0	Altered, silicified mineralised fine grained fragmental (or brecciated ?"welded" vitric tuff (or ignimbrite).	Poorly defined lithic fragments of ?welded tuff (or ignimbrite). Small quartz chips, microphenocryst sites.	?montmorillonite quartz.	5% to 8%
A 184737	BBP 280 369.6	Altered, silicified unsorted acidic lithic tuff with pumiceous and tuffaceous fragments.	Pumiceous, ?flow banded and devitrified fragments, some with altered phenocryst sites.	Carbonate, sericite, quartz, ?montmorillonite.	Trace

108

BBP 279

Sample No. A 184674 240.7 m

Rock Type. A strongly altered and veined, sparsely porphyritic rather fine grained igneous rock, most likely of intermediate primary composition and extrusive or very shallow intrusive (?dyke) emplacement.

Hand Specimen. A fine grained mid-grey compact drill core sample with sparse medium grained pale grey ?feldspar crystal sites. The rock is cut by several branching white veins that give a positive reaction with cold dilute HCl (i.e., they contain calcite); one vein is offset by a narrow microfracture. K-feldspar staining proved negative.

Thin Section. This is a sparsely porphyritic igneous rock with a voluminous fine grained but possibly holocrystalline texture suggesting shallow intrusive emplacement (?dyke rock, or else a rather coarsely grained volcanic flow rock). It is a feldspar-rich lithology containing conspicuous scattered albitised plagioclase phenocrysts and aggregates, and sparse carbonated mafic phenocryst sites that could have been a pyroxene. Other sparse mafic phenocryst sites retain shapes that suggest the presence of previous amphibole, but now are converted to chlorite and sphene. Accessory opaque microphenocrysts are partly converted to clouded leucoxene.

The overall texture of most of the sample is dominated by a dense decussate mat of albitised prismatic plagioclase crystals intergrown with ubiquitous, partly degraded opaque granules, numerous interstitial and mafic crystal sites now converted to chlorite ± quartz. The entire rock is lightly dusted with minute aggregates of carbonate and sericite.

The conspicuous white veins of the hand specimen contain mostly granular carbonate (calcite) with subordinate quartz and sparse patches of clouded leucoxene-altered sphene.

This sample may be described as a strongly altered and veined, sparsely porphyritic rather fine grained igneous rock most likely of intermediate primary composition, and extrusive or very shallow intrusive (?dyke) emplacement.

109

Sample No. A 184675 324.7 m

Rock Type. Altered and veined ?autobrecciated volcanic flow rock, incorporating closely related finer and coarser material of intermediate (andesitic to trachyandesitic) primary composition.

Hand Specimen. A mid-grey very fine grained compact sample which is cut by a sparse wispy network of pale grey veinlets. K-feldspar staining proved negative but acid etching of the offcut reveals a poorly defined fragmental texture. The rock is very strongly magnetic.

Thin Section. This sample exhibits a rather poorly defined partly fragmental relict texture in which barely recognisable medium sized angular volcanic igneous lithic fragments of closely related types are evident. These rarely exceed 2 mm to 3 mm across, and include altered volcanic material of intermediate primary composition. Textures of these fragments are mainly dominated by a dense decussate mat of fine grained albitised plagioclase microlites intergrown with dusty magnetite granules and interstitial secondary minerals including chlorite and clouded sphene ± carbonate. Also common throughout the rock are ?fragments and patches with an open decussate texture marked by a framework of unoriented albitised plagioclase crystals set in a dense matrix of green chlorite and partly degraded magnetite crystals. Enclosing the recognisably coherent volcanic fragments are poorly defined branching zones comprising abundant small broken angular albitised plagioclase crystals "suspended" in an abundant matrix of green chlorite and magnetite dust. Several deformed lithic fragments in such narrow brecciated zones are of a sparsely plagioclase porphyritic type with a very fine grained "trachytic" groundmass containing ubiquitous flow-oriented microlites and very abundant fine dusty opaque oxides.

Irregular narrow veins of carbonate ± quartz and chlorite commonly follow the branching zones of fine brecciation.

This sample may be described as an altered and veined ?autobrecciated volcanic flow rock, incorporating closely related finer and coarser material of intermediate (andesitic to trachyandesitic) primary composition.

110

Sample No. A 184676

Rock Type. Partly altered and veined, sparsely porphyritic alkali-feldspar rhyolite (or rhyodacite).

Hand Specimen. A compact fine grained red-brown drill core sample containing sparse medium to coarse grained pale grey ?feldspar crystal sites and aggregates. K-feldspar staining gave very strong positive results for the abundant fine grained groundmass fraction but not for certain of the sparse phenocryst sites.

Thin Section. The sparsely porphyritic and fine grained devitrified groundmass texture of this rock clearly indicates volcanic igneous origin. Only about 10% of phenocrysts and glomeroporphyritic aggregates are present including both albite and K-feldspar, and these phases are set in a voluminous groundmass in which poorly defined irregular shaped interlocking quartz- and K-feldspar-rich domains enclose myriads of unoriented albite microlites (see staining of offcut). Small accessory patches of chlorite possibly pseudomorph previous mafic crystals (?biotite), together with sphene and relict zircon grains. Other accessory secondary phases include sparse patches of carbonate, sericite and chlorite. A network of narrow joint located veinlets contain almost monomineralic granular quartz, while later crosscutting wispy trails contain sericite and/or carbonate.

This rock contains approximately equal major proportions of quartz and K-feldspar in the voluminous devitrified fine grained groundmass fraction, and retains a clear sparsely porphyritic igneous texture. It may be described rather simply as a partly altered and veined, sparsely porphyritic alkali-feldspar rhyolite (or rhyodacite).

Sample No. A 184677 422 m

Rock Type. Partly altered, sparsely porphyritic and vesicular quartz alkali-feldspar trachyte.

Hand Specimen. A fine grained pale pink to mid-grey mottled drill core sample containing scattered medium grained pink feldspar phenocrysts

111

and aggregates. K-feldspar staining gave overall weak positive results for the voluminous fine grained groundmass fraction of the sample. The rock is cut by several mid-grey siliceous very narrow veinlets.

Thin Section. As in the previous sample, the present rock retains a clear sparsely porphyritic igneous texture defined by approximately 10% of albitised plagioclase phenocrysts and aggregates rarely exceeding 3 mm across. The clouded albite phenocrysts are crammed with red-brown hematite dust and peppered with wispy sericite and carbonate aggregates, and are "suspended" in a voluminous fine grained groundmass fraction dominated by clouded albite microlites intergrown with substantial interstitial clouded K-feldspar and quartz. In addition, microgranular quartz fills numerous highly irregular vesicles or miarolitic cavities. Accessory primary phases in this rock include small crystal chlorite-altered mafic phenocryst sites, partly degraded (leucoxene-altered) sites of previous titaniferous opaque oxides and small crystals of apatite. Sparse small euhedral sulphide crystals and aggregates also are accessory, and the rock is cut by numerous narrow veinlets filled with quartz and/or carbonate.

This sparsely porphyritic and vesicular volcanic rock appears to contain about 10% to 15% of groundmass quartz and very abundant alkali feldspars, suggesting a primary composition of quartz alkali-feldspar trachyte prior to partial alteration.

Sample No. A 184678 523 m

Rock Type. Partly altered, sparsely porphyritic alkali-feldspar rhyolite.

Hand Specimen. A compact siliceous pale grey fine grained drill core sample for which K-feldspar staining gave very strong positive results in the very fine grained groundmass fraction of the rock outlining sparse scattered medium grained phenocryst sites that lack this phase. K-feldspar is also lacking from several branching narrow veins.

112

Thin Section. This sample has a texture and mineralogy somewhat similar to that of the previous sample A 184676 and both are related to the sample A 184677. The present rock contains sparse albitised plagioclase phenocrysts and aggregates mainly less than 2 mm across, that are scattered throughout a devitrified quartz and K-feldspar-rich mosaic enclosing numerous albite microlites. Primary accessory phases include rare mafic crystal sites pseudomorphed by pale brown montmorillonite and titaniferous oxides now marked by aggregates of sphene granules.

Alteration patches of carbonate are common, and carbonate also fills several well rounded sites that once may have been vesicles. Wispy trails and patches of sericite also are common, and narrow veinlets that cut across the rock in several different directions contain microgranular assemblages amongst the phases quartz, carbonate and albite. Rare traces of sulphides are accessory.

This sample appears to contain more than 20% of groundmass quartz but also contains very dominant K-feldspar and albite. It may be identified as a partly altered, sparsely porphyritic alkali-feldspar rhyolite.

<u>Sample No.</u>	A 184679 458.9 m
<u>Rock Type.</u>	"Sericite"-and carbonate-altered lithic/vitric tuff containing abundant vesicular and flow-banded pumiceous material and devitrified felsic volcanic fragments.
<u>Hand Specimen.</u>	An unsorted fragmental drill core sample containing numerous angular pink and dark grey fragments up to 1 cm across scattered throughout a pale grey fine grained matrix fraction. K-feldspar staining proved negative.
<u>Thin Section.</u>	This strongly altered sample exhibits a clearly recognisable, very poorly sorted lithic fragmental relict texture of pyroclastic origin. Highly irregular shaped, strongly altered, once-pumiceous

lithic fragments predominate and these have been incorporated into the rock in various different directions marked by their original flow banding. These sericite (or illite, pyrophyllite etc.) and carbonate-altered fragments produce a fiamme- or flame-like texture. Also present are numerous angular to subrounded, very fine grained felsic volcanic lithic fragments now comprising mostly albite \pm quartz, sericite, carbonate and a somewhat variable proportion of pale red-brown ferric oxide dust. The sites of sparse altered phenocrystic debris are now filled with quartz, "sericite" and carbonate \pm albite.

the voluminous matrix fraction is extremely fine grained and strongly altered. Nevertheless a clear texture of "sericite"-altered angular to cusped glass shards and small pumiceous fragments is evident, and these are in turn "suspended" in a microcrystalline cherty siliceous matrix with patches of carbonate.

This sample may be described as a "sericite"- and carbonate-altered lithic/vitric tuff containing abundant vesicular and flow banded pumiceous material, and devitrified felsic volcanic fragments.

Sample No. A 184687 489.7 m

Rock Type. Irregularly banded (or slumped) argillically altered and weakly mineralised crystal/lithic tuff containing material from a fairly acidic igneous source.

Hand Specimen. A pale grey, fine grained drill core sample containing numerous pale pink fragments rarely exceeding 2 mm across. The rock appears to have a complex slumped layering. K-feldspar staining is negative except for a single lithic fragment which accepts a weak positive stain. The rock is cut by several narrow vein-like fractures.

Thin Section. Unsorted fragmental texture is characteristic of this irregularly banded or slumped sample which has undergone very strong alteration and associated development of patchy carbonate and microcrystalline

114

secondary cherty quartz. Nevertheless, abundant angular crystal debris and lithic fragments can be recognised. Common crystal debris includes numerous cleavage fragments of albitised, sericitised and carbonated feldspar, sparse small angular fragments of quartz, and rare magmatically rounded but broken angular quartz grains. Lithic debris includes very fine grained, once-glassy pumiceous types in which quartz-filled vesicle sites are set in a mat of wispy "sericite" (or illite, pyrophyllite etc.), and pale brown wispy ?montmorillonite. Quartz and albitised feldspar microporphyritic lithic fragments are present, certain of which appear to retain textures of perlitic cracking in strongly "sericitised" groundmass fractions. Elsewhere are the vague outlines of former lithic fragments now marked by clusters of dusty sulphides and dense birefringent argillic products.

The recognisable, relatively coarse fragmental material is set in a microcrystalline felsic mosaic of secondary products including wispy argillic products, cherty quartz and secondary albite. Disseminated dusty pyritic sulphides account for approximately 3% of the total thin section area. Several narrow veined or brecciated zones contain abundant microgranular quartz and carbonate.

This sample may be identified as a irregularly banded (or slumped) argillically altered and weakly mineralised crystal/lithic tuff containing material from a fairly acidic igneous source.

<u>Sample No.</u>	A 184688 600.7 m
<u>Rock Type.</u>	Brecciated, foliated and intensely altered lithic ?tuffaceous sample containing crystal and lithic debris, mostly likely from a fairly acidic volcanic source.
<u>Hand Specimen.</u>	A fine grained compact drill core sample that contains finely but irregularly banded angular pale grey lithic fragments with pale yellow-green foliated bands. Microfractures separate fragments in different orientations. Very fine grained dusty sulphide mineralisation is not particularly obvious in the hand specimen. K-feldspar staining proved negative.

Thin Section. This is a very complex deformed, brecciated and altered sample in which relict textures are not well preserved. Very vague outlines of possible pumiceous and flow banded silicified lithic fragments, as well as fragments possibly of sedimentary origin up to about 3 mm or 4 mm across are present, while elsewhere are poorly preserved, deformed and polygonised quartz-altered crystal debris. Many of the coherent lithic fragments now consist only of numerous patches of granular quartz, set amongst wispy, very pale yellow-brown birefringent argillic products (?illite, pyrophyllite ± montmorillonite). Foliation-like zones that enclose the more competent lenses and fragments, are somewhat wavy and branching, and these are marked by dense trails of translucent pale yellow degraded dust (stained ?leucoxene) that once may have been titaniferous oxides. Several of the mechanically deformed zones contain patchy chlorite and carbonate in addition to "sericite" and quartz.

The irregularly disseminated dusty sulphides are drawn out subparallel to the lensed foliation and comprise approximately 4% to 5% of the total thin section area.

The sample may be rather tentatively described as a brecciated, foliated and intensely altered lithic ?tuffaceous sample containing crystal and lithic debris, most likely from a fairly acidic volcanic source. This rock may represent part of an unstable mechanically brecciated and deformed fracture zone.

Sample No.

A 184689 606.7 m

Rock Type.

Argillically altered and weakly mineralised, poorly sorted ?rhyolitic pumiceous tuff.

Hand Specimen.

A very fine grained mid-grey drill core sample with vague outlines of poorly sorted lithic fragments, mostly less than 1 cm across. The rock contains sparse but quite dense patches of fine grained sulphides. K-feldspar staining proved negative.

Thin Section.

In spite of intense argillic alteration, fragmental relict textures in this sample are quite well preserved. Deformed pumiceous fragments comprise most of the rock and these are generally less than 5 mm across. The fragments have more or less random relict magmatic flow directions which are now marked by dense wispy trails of very fine grained birefringent layer silicates (possibly including illite, pyrophyllite etc., and montmorillonite, as well as minor low birefringent clay), while microgranular quartz aggregates now occupy vesicle sites and possible sites of previous microphenocrysts. Sparse, coarsely devitrified fragments now contain more granular quartz than wispy trails of sericite.

Patchy sulphides are partly selectively located in certain restricted vein-like matrix zones that enclose several recognisable lithic fragments but which also contain a significantly larger proportion of secondary quartz. Elsewhere the sulphides are finer grained and unevenly disseminated. Sulphides account for about 3% to 5% of the total thin section area.

The rock may be described as an argillically altered and weakly mineralised, poorly sorted lithic tuff containing ubiquitous unoriented flow banded and once-vesicular rhyolitic pumiceous fragments. This sample could represent part of a submarine slumped hyaloclastic "scree" derived from the breakup of hot volcanic glassy material by sudden cooling and penetration of seawater.

Sample No.

A 184690 621.9 m

Rock Type.

Intensely argillically altered and partly silicified, weakly mineralised and veined rhyolitic tuff.

Hand Specimen.

A compact fine grained mid-grey mottled drill core sample with quite well defined outlines of unsorted irregular shaped lithic fragments. Several conspicuous branching veins are filled with dark grey siliceous material. K-feldspar staining proved negative and very fine grained sulphides are not particularly obvious.

Thin Section. This sample is quite similar to the preceding sample A 184689. It retains excellent pyroclastic fragmental relict textures in spite of intense silicification, wispy argillic alteration, including "sericite" (illite or pyrophyllite etc.), and traces of patchy carbonate alteration. The rock contains very abundant unsorted and unoriented finely flow banded and vesicular angular volcanic lithic fragments. Certain fragments retain textures of a folded and contorted fine flow banding and others show coarse quartz-rich devitrification but with a narrow flow banding now marked by trails of opaque dust. Still others retain evidence of very sparse microphenocrysts or else once may have been themselves tuffaceous (banded welded tuff).

Sparse fine grained sulphides are sparsely disseminated and more rarely are selectively located in certain of the intensely altered flow banded fragments. Several narrow anastomosing and branching veinlets contain mostly granular quartz, traces of carbonate and are not significantly mineralised. Sulphides in this rock account for somewhat less than 5% of the total sample.

The pyroclastic fragmental relict textures of this intensely altered, weakly mineralised and veined sample indicate its origin as an unsorted lithic tuff containing very abundant unoriented fine grained flow banded and possibly tuffaceous, rhyolitic glassy fragments that could represent part of an altered marine deposit of hyaloclastic "scree" as in the previous sample A 184689.

Sample No. A 184691 643.8 m

Rock Type. Intensely argillically altered and weakly mineralised unsorted rhyolitic tuff.

Hand Specimen. A compact fine grained drill core sample containing very abundant irregular shaped unsorted pink fragments set in a pale grey matrix. No K-feldspar was detected by staining.

Thin Section. Intense argillic alteration has partly obscured the relict textural features of this sample. Nevertheless, a clear fragmental (pyroclastic) texture is readily identified in which a variety of closely related flow banded, vesicular and porphyritic lithic fragments of acidic affinity are selectively altered along certain flow bands and within vesicle sites to wispy pale yellow-brown birefringent clay (?montmorillonite) ± sericite (or illite pyrophyllite etc.), while the alternate bands now comprise microgranular polygonised albite ± quartz. Sparse coarse grained broken phenocrysts and aggregates of albitised plagioclase are preserved (reaching up to about 2 mm across). The flow banded devitrified lithic fragments once again are unsorted with unoriented primary flow directions, many were vesicular and some retain evidence of alteration along curving perlitic cracks.

The rock now has a simple secondary mineralogy amongst the essential phases; birefringent argillic products, quartz and albite, while disseminated fine grained sulphides are accessory. The latter occupy about 3% to 5% of the total thin section area. Certain sulphides are selectively located in narrow branching trails within weakly foliated "sericite"-rich zones or ?microfractures. The rock is cut by several narrow unmineralised branching quartz veins with sparse small patches of carbonate.

The sample thus may be described as an intensely argillically altered and weakly mineralised, unsorted rhyolitic tuff that is clearly related to the previous samples A 184689 and A 184690.

BBP 278

Sample No. A 184720 183.3 m - 196 m

Rock Type. Partly altered porphyritic volcanic rock of intermediate (most likely trachytic) primary composition.

Hand Specimen. A compact fine grained mid-grey drill core sample enclosing numerous medium to coarse grained pink feldspar crystals and aggregates and fewer dark green-grey mafic ?phenocrysts. K-feldspar staining gave weak positive results for the fine matrix fraction, and acid etching reveals ubiquitous decussate (unoriented) feldspar microlites.

119

Thin Section. Porphyritic igneous texture is well marked in this partly altered sample by numerous medium grained subhedral prismatic shaped crystals and aggregates of albitised plagioclase and fewer of clouded and weakly sericitised simple twinned albite phenocrysts that once may have been K-feldspar. Sparse elongate acicular mafic phenocryst sites that now are filled with an extremely fine grained, very pale green birefringent layer silicate once may have contained an amphibole. The fine grained groundmass fraction of this rock contains a fine grained decussate mat of much smaller albitised plagioclase laths clouded by red-brown limonitic oxide dust, with an interstitial microgranular felsic mosaic of K-feldspar intergrown with patches of dark green chlorite and rare small anhedral grains of quartz. Primary accessory phases include acicular apatite and opaque oxides while carbonate, "sericite" and sphene are minor secondary phases.

The exact primary composition of this rock is partly masked by alteration, particularly development of albite, however it was clearly strongly feldspathic and of intermediate type, possibly of trachytic affinity. This rock is texturally and mineralogically quite similar to the previous sample A 184677.

Sample No. A 184721 717.2 m - 223.1 m

Rock Type. Strongly altered fine grained microporphyritic to subophitic shallow ?intrusive (?dyke) rock of rather basic primary composition.

Hand Specimen. A mid green-grey, fine grained massive drill core sample cut by several branching narrow discontinuous grey veins. The latter give a strong reaction with cold dilute HCl but K-feldspar staining proved negative. The rock is quite strongly magnetic.

Thin Section. Strong selective alteration has affected this sample and a clear relict igneous texture is preserved. The latter is defined by sparse scattered sites of altered mafic microphenocrysts and aggregates, set in a voluminous subophitic groundmass fraction with similar altered mafic crystal sites partly enveloping and partly interstitial between abundant small prismatic plagioclase laths which form a decussate framework

for the rock. In addition are present ubiquitous evenly disseminated small opaque oxide (magnetite) crystals and aggregates. The rock thus appears to have had a rather fine grained but yet holocrystalline basic igneous parent.

Alteration of the mafic crystal sites in this sample includes assemblages amongst the phases chlorite, carbonate (calcite) and sphene. Vein assemblages include carbonate (calcite) granular quartz and traces of sulphides.

This rock retains a fine grained microporphyritic subophitic holocrystalline texture and most likely is of very shallow ?intrusive (?dyke) emplacement. Its exact composition is masked by strong selective alteration but it appears to be of basic or intermediate-basic affinity.

<u>Sample No.</u>	A 184722 235.7 m
<u>Rock Type.</u>	Partly altered and veined microporphyritic finely flow banded alkali-feldspar rhyolite (or rhyodacite).
<u>Hand Specimen.</u>	A very fine grained compact dark pink sample with narrow flow banding poorly defined by alternating narrow pale pink or dark grey bands. K-feldspar staining gave very strong positive results, particularly for alternating dark pink bands, but not for several microphenocryst sites. A conspicuous white vein gives a positive reaction with cold dilute HCl indicating the presence of calcite.
<u>Thin Section.</u>	The sparsely porphyritic texture of this very fine grained acidic igneous rock is marked by stout subhedral albitised feldspar phenocrysts and glomeroporphyritic aggregates. Smaller accessory microphenocrysts include partly degraded opaque oxides and rare small mafic crystal sites marked by trails of sphene granules and carbonate or else aggregates of green chlorite. The voluminous very fine grained flow banded groundmass fraction almost certainly once was mostly glassy but now consists of a devitrified felsic mosaic comprising intergrown anhedral domains of quartz and K-feldspar, enclosing ubiquitous minute prismatic albite micro-

121

lites. The flow banding is not particularly well defined in thin section, but appears to be partly compositional and partly dependent on crystallinity. Minor alteration is to wispy sericite and small patches of carbonate. The conspicuous white vein of the hand specimen is filled with very abundant granular carbonate (calcite) with subordinate quartz, traces of chlorite and albite.

This is a partly altered and veined microporphyritic, finely flow banded alkali-feldspar rhyolite (or rhyodacite).

Sample No. A 184723 327.0 m

Rock Type. Partly altered and veined, sparsely porphyritic, weakly flow banded rhyolite (or rhyodacite).

Hand Specimen. A dark pink fine grained sample with barely discernable narrow flow banding. Sparse pale grey medium grained ?feldspar crystal sites are not affected by the positive stain for K-feldspar. The rock is cut by a network of narrow branching grey veinlets, several of which react with cold dilute HCl (presence of calcite).

Thin Section. This sample has a texture and mineralogy very similar to the previous sample A 184722. It is a sparsely porphyritic, very fine grained igneous rock with medium grained subhedral albitised feldspar phenocrysts and aggregates. Several of these once may have been K-feldspar rather than plagioclase. Accessory microphenocrysts include leucoxene-altered opaque oxide grains, and smaller accessory crystals of zircon and sphene. These crystals are "suspended" in a voluminous, very fine grained devitrified groundmass now comprising an intergrown mosaic of anhedral equant quartz and K-feldspar domains enclosing ubiquitous unoriented minute albitised plagioclase microlites. The weak flow banding is not evident in thin section.

Patchy carbonate alteration has affected this rock and a light dusting of sericite is evident. Several narrow discontinuous branching veins are filled with granular carbonate while other veins now contain microgranular quartz. A pattern of later narrow fractures is marked by trails of sericite.

122

This igneous sample which appears to contain a high proportion of groundmass quartz and K-feldspar, retains a distinct sparsely porphyritic fine grained devitrified (weakly flow banded texture, and may be described as a partly altered and veined, sparsely porphyritic, weakly flow banded rhyolite (or rhyodacite).

Sample No. A 184724 441.9 m

Rock Type. Sparsely porphyritic, once-vesicular, strongly trachytic fine grained igneous rock of intermediate (possibly trachyandesitic) primary composition.

Hand Specimen. A dark green-grey, very fine grained drill core sample with sparse, small disseminated pale grey patches, certain of which react with cold dilute HCl indicating the presence of calcite. K-feldspar staining proved negative. The rock is quite strongly magnetic.

Thin Section. This is a partly altered, fine grained, sparsely porphyritic igneous rock with a well defined trachytic groundmass texture. The sparse medium grained phenocrysts and aggregates include mostly plagioclase, with subordinate chlorite-carbonate-altered mafic microphenocryst sites, and accessory microphenocrysts of partly degraded titaniferous opaque oxides. The voluminous groundmass fraction comprises a felted mat of flow aligned plagioclase microlites intergrown with dusty black opaque oxides and substantially degraded titaniferous oxides. Interstitial chlorite is very common and certain small anhedral quartz patches also appear to be interstitial. Elsewhere quartz is present in irregular to elongate vesicle sites commonly intergrown with carbonate and/or chlorite.

Alteration of the rock is selective preserving quite clearly its sparsely porphyritic and once-vesicular, strongly trachytic texture. Its exact primary composition is masked by the alteration but this appears to be intermediate (possibly trachyandesitic) rather than basic. Its overall fine grain size suggests extrusive or very shallow intrusive emplacement.

123

Sample No. A 184725 453.2 m

Rock Type. Partly altered and veined, finely flow banded, sparsely porphyritic rhyolite (or rhyodacite).

Hand Specimen. A very dark pink to grey, very fine grained drill core sample with sparse medium grained sites of ?phenocrysts. A narrow flow banding is marked by alternating dark pink and dark grey bands. K-feldspar staining gave strong positive results for most of the rock, but not for several narrow discontinuous veinlets.

Thin Section. Sparse medium grained, partly altered and albitised plagioclase phenocrysts and aggregates commonly intergrown with altered mafic microphenocryst sites define a distinctly porphyritic igneous texture in this sample. The phenocrysts are "suspended" in an exceptionally fine grained devitrified groundmass fraction similar to that in the previous samples A18722 and A18723 and an earlier sample A 184676. The albitised plagioclase phenocrysts contain abundant patchy sericite and carbonate alteration, as well as minor patchy brown birefringent ?montmorillonite. Mafic microphenocryst sites that retain subhedral shapes suggesting the presence of previous amphibole, however, now are completely filled with dense carbonate ± patchy chlorite and partly degraded sphene clusters. Accessory opaque oxide microphenocrysts rarely are associated with the glomeroporphyritic clusters. Once again the phenocrysts are scattered throughout a devitrified matrix fraction dominated by a felsic mosaic of intergrown quartz and K-feldspar (see staining) enclosing ubiquitous albitised feldspar microlites. Small zircon and apatite crystals are accessory.

The rock may be described as a partly altered and veined, finely flow banded, sparsely porphyritic rhyolite (or rhyodacite).

BBP 280

Sample No. A 184726 214.2 m

Rock Type. Banded and slumped, fine grained acidic tuff which is intensely argillically altered and quite well mineralised.

124

Hand Specimen. A mid to pale grey, very fine grained sample which has a poorly defined, deformed (most likely slumped) layering. It contains patchy fine grained disseminated sulphide mineralisation. K-feldspar staining proved negative.

Thin Section. This sample has undergone intense pervasive argillic and patchy siliceous alteration, but in spite of this a relict fragmental (pyroclastic) texture is quite clearly preserved. The vague deformed layering of the hand specimen is not particularly obvious in the present thin section except for a fairly abrupt increase in the proportion and size of recognisable poorly sorted angular fragments. The coarsest of these reaches about 2 mm across, and the fragments include both lithic and crystal debris. The crystal component mostly is angular to irregular partly polygonised quartz with subordinate outlines of completely altered prismatic crystals that were almost certainly once feldspars. The lithic debris includes rare, very altered, once-porphyrific igneous fragments with "sericite" altered prismatic feldspar sites in a cherty and clay-altered mineralised matrix. Other fragments that are now a cherty quartz-rich mosaic possibly were once glassy, while others could have been themselves tuffaceous.

The voluminous rock matrix consists of ubiquitous wispy "sericite" (or pyrophyllite, illite etc.), ± low birefringent clay (possibly kaolinite), and ?montmorillonite intergrown with microgranular quartz, accessory chlorite, degraded sphene and clusters of minute subhedral birefringent crystals (?anhydrite). Ubiquitous pyritic sulphide dust accounts for about 5% to 8% of the total thin section area.

The rock may be described as a banded and slumped, fine grained acidic tuff which is intensely argillically altered and quite well mineralised.

Sample No. A 184727

Rock Type. Intensely argillically altered, veined and mineralised, very fine grained porphyritic igneous rock, most likely of acid-intermediate primary composition.

Hand Specimen. A pale brown to pale green mottled, very fine grained sample containing numerous, more or less evenly disseminated dark green medium grained mafic crystal sites. The rock is cut by narrow branching pale green, partly mineralised veinlets or fracture zones. K-feldspar staining proved negative.

Thin Section. As in the previous sample A 184726, the present rock also has undergone intense pervasive argillic alteration. Selective alteration of certain crystal sites, however, has preserved distinct subhedral to euhedral crystal outlines up to about 2 mm across of possible mafic phenocryst sites now filled with almost monomineralic chlorite ± carbonate ± quartz. Also present are abundant elongate but irregular shaped patches of granular quartz that once may have been vesicle sites. These sites are "suspended" in a voluminous very fine grained matrix fraction comprising a very dense wispy pale brown birefringent layer silicate phase (?montmorillonite) ± patches of carbonate and sericite. The abundant sulphides partly are disseminated and partly located in veins with granular to "shredded" quartz and minor sericite. Pyritic sulphides comprise approximately 10% of the present thin section area.

This sample may be only tentatively described as an intensely argillically altered, veined and mineralised, very fine grained porphyritic igneous rock, most likely of acid-intermediate primary composition.

Sample No. A 184728 249.9 m

Rock Type. Substantially altered vesicular and microporphyritic fine grained but holocrystalline shallow intrusive igneous rock of intermediate (possibly microdiorite) primary composition.

Hand Specimen. A mid green-grey, rather massive fine grained drill core sample with sparse, quite large (up to 1 cm across) amygdales filled with pale pink calcite (strong reaction with cold dilute HCl). K-feldspar staining proved negative but the rock is moderately magnetic.

126

Hand Specimen. A pale brown to pale green mottled, very fine grained sample containing numerous, more or less evenly disseminated dark green medium grained mafic crystal sites. The rock is cut by narrow branching pale green, partly mineralised veinlets or fracture zones. K-feldspar staining proved negative.

Thin Section. As in the previous sample A 184726, the present rock also has undergone intense pervasive argillic alteration. Selective alteration of certain crystal sites, however, has preserved distinct subhedral to euhedral crystal outlines up to about 2 mm across of possible mafic phenocryst sites now filled with almost monomineralic chlorite ± carbonate ± quartz. Also present are abundant elongate but irregular shaped patches of granular quartz that once may have been vesicle sites. These sites are "suspended" in a voluminous very fine grained matrix fraction comprising a very dense wispy pale brown birefringent layer silicate phase (?montmorillonite) ± patches of carbonate and sericite. The abundant sulphides partly are disseminated and partly located in veins with granular to "shredded" quartz and minor sericite. Pyritic sulphides comprise approximately 10% of the present thin section area.

This sample may be only tentatively described as an intensely argillically altered, veined and mineralised, very fine grained porphyritic igneous rock, most likely of acid-intermediate primary composition.

Sample No. A 184728 249.9 m

Rock Type. Substantially altered vesicular and microporphyritic fine grained but holocrystalline shallow intrusive igneous rock of intermediate (possibly microdiorite) primary composition.

Hand Specimen. A mid green-grey, rather massive fine grained drill core sample with sparse, quite large (up to 1 cm across) amygdales filled with pale pink calcite (strong reaction with cold dilute HCl). K-feldspar staining proved negative but the rock is moderately magnetic.

Hand Specimen. A pale brown to pale green mottled, very fine grained sample containing numerous, more or less evenly disseminated dark green medium grained mafic crystal sites. The rock is cut by narrow branching pale green, partly mineralised veinlets or fracture zones. K-feldspar staining proved negative.

Thin Section. As in the previous sample A 184726, the present rock also has undergone intense pervasive argillic alteration. Selective alteration of certain crystal sites, however, has preserved distinct subhedral to euhedral crystal outlines up to about 2 mm across of possible mafic phenocryst sites now filled with almost monomineralic chlorite ± carbonate ± quartz. Also present are abundant elongate but irregular shaped patches of granular quartz that once may have been vesicle sites. These sites are "suspended" in a voluminous very fine grained matrix fraction comprising a very dense wispy pale brown birefringent layer silicate phase (?montmorillonite) ± patches of carbonate and sericite. The abundant sulphides partly are disseminated and partly located in veins with granular to "shredded" quartz and minor sericite. Pyritic sulphides comprise approximately 10% of the present thin section area.

This sample may be only tentatively described as an intensely argillically altered, veined and mineralised, very fine grained porphyritic igneous rock, most likely of acid-intermediate primary composition.

Sample No. A 184728 249.9 m

Rock Type. Substantially altered vesicular and microporphyritic fine grained but holocrystalline shallow intrusive igneous rock of intermediate (possibly microdiorite) primary composition.

Hand Specimen. A mid green-grey, rather massive fine grained drill core sample with sparse, quite large (up to 1 cm across) amygdales filled with pale pink calcite (strong reaction with cold dilute HCl). K-feldspar staining proved negative but the rock is moderately magnetic.

Thin Section. This sample retains a clear relict holocrystalline microporphyritic igneous texture marked by a dense decussate framework of unoriented plagioclase laths (average length about 0.3 mm). These are now converted to albite and crammed with dusty inclusions of sericite with subordinate carbonate and chlorite. Interstitial sites are filled with quartz (at least some of which is of primary origin), together with chlorite and carbonate. Small interstitial opaque oxides are ubiquitous and ?titaniferous opaque oxides are partly degraded to pale brown stained sphene. The rock contains sparse subhedral felsic and mafic microphenocryst sites that are also converted to chlorite ± carbonate ± quartz. Elsewhere in the rock are developed sparse well rounded vesicle sites that are now filled with simple zoned secondary assemblages, mainly chlorite peripherally and calcite centrally, while some very small vesicle sites now contain dense radiating quartz with concentric zones of inclusions.

The sample thus may be tentatively identified as an albite-chlorite-carbonate altered vesicular and microporphyritic fine grained but holocrystalline rock of intermediate (possibly microdiorite) primary composition. This rock could be of shallow intrusive emplacement.

Sample No. A 184729 265.4 m

Rock Type. Partly argillically altered porphyritic and once-vesicular very fine grained igneous rock of acid-intermediate (possibly trachytic) primary composition, and shallow ?intrusive emplacement.

Hand Specimen. A pale brown-grey, fine grained drill core sample with scattered medium grained white to pale grey ?crystal sites and numerous dark grey patches. K-feldspar staining proved negative.

Thin Section. Extensive fine grained argillic alteration has partly obscured the finer relict textural features in the groundmass fraction of this rock. Nevertheless it retains a sparsely porphyritic igneous texture with phenocrysts and aggregates ranging in size up to about 2 mm across, set in a groundmass of partly flow oriented to partly decussate plagioclase microlites. The phenocrysts include mostly albite crowded

with dusty inclusions of sericite and subordinate small irregular shaped patches of carbonate. Recognisable mafic phenocryst sites are very scarce, and these may have included an amphibole. These sites are now filled with granular assemblages amongst the phases carbonate, chlorite and water-clear secondary albite \pm quartz. Opaque oxide microphenocryst sites now are degraded to clouded sphene dust. The voluminous groundmass fraction now comprises a dense mat of albitised plagioclase microlites partly converted to dense wispy sericite (?pyrophyllite \pm montmorillonite, illite etc., and patchy carbonate), intergrown with dusty opaque oxides and small patches of interstitial quartz enclose subophitically certain of the groundmass plagioclase crystals. In addition the rock contains abundant subrounded amygdales filled with secondary quartz \pm secondary albite, traces of carbonate and small patches of chlorite.

The sample thus may be described as a partly argillically altered porphyritic and once-vesicular fine grained shallow ?intrusive igneous rock of acid-intermediate (possibly trachytic) primary composition.

Sample No.

A 184730 275.6 m

Rock Type.

Intensely argillically altered and silicified, weakly banded vitric tuff, with abundant fine grained disseminated and vein-located pyritic sulphide mineralisation.

Hand Specimen.

A rather massive very fine grained cherty siliceous pale grey drill core sample crossed by somewhat irregular lensed dark grey bands. The rock contains sparse fine grained disseminated sulphides which are also partly concentrated in narrow bands subparallel to those above. K-feldspar staining proved negative.

Thin Section.

Relict textural features are barely recognisable in this intensely argillically altered and silicified fine grained rock. However, phase contrast microscopy reveals the poorly defined outlines of flattened once-glassy vesicular pumiceous fragments, and possible small altered fragments of flow banded rhyolite and ignimbrite. There are no

recognisable sites of previous crystal debris.

Alteration of the rock is extreme and a simple secondary assemblage is represented comprising very abundant microcrystalline cherty quartz intergrown with wispy, very pale brown birefringent clay (most likely montmorillonite). The dark grey bands of the hand specimen are not clearly represented in thin section, but appear to be marked by trails of minute dusty birefringent ?sphene inclusions. Accessory secondary phases include small patches of apatite and clusters of minute "sericite" flakes. The latter are associated with some of the sulphide aggregates and also dense aggregates of sericite are located in mineralised veins together with granular quartz. The sulphides include very abundant pyrite and account for approximately 5% to 8% of the total rock.

This sample may be only tentatively identified in terms of its primary lithology as an intensely argillically altered and silicified, weakly banded vitric tuff with abundant fine grained disseminated and vein located pyritic sulphide mineralisation.

<u>Sample No.</u>	A 184731 285.6 m
<u>Rock Type.</u>	Significantly mineralised, strongly altered porphyritic and vesicular igneous rock of rather acidic primary composition.
<u>Hand Specimen.</u>	A compact fine grained drill core sample comprising a mid grey fraction with abundant small anhedral dark grey patches (?crystal sites), sharply in contact with a grey pink fraction enclosing numerous medium grained pink ?crystal sites. K-feldspar staining proved negative but a pale grey vein assemblage reacts with cold dilute HCl suggesting the presence of calcite.
<u>Thin Section.</u>	This is an intensely altered rock in which sparsely porphyritic igneous relict textural features are only barely recognisable. Medium grained sites of previous phenocrysts and aggregates include albitised plagioclase (a little of which remains) and certain quartz aggregates which

131

could represent polygonised quartz phenocrysts. Also present are numerous subrounded quartz aggregates that almost certainly represent previous vesicles. The groundmass fraction of this rock includes a quartz-rich mosaic with patches of a quartz/altered feldspar intergrowth. Needles of apatite and degraded opaque oxides are relict primary accessory phases.

The pink colouration of the hand specimen appears to be partly due to the presence of hematite dust in the relict albitised feldspar crystal sites, with a sharply defined "front" where feldspar is largely replaced by the secondary assemblage. Carbonate alteration particularly affects certain albitised plagioclase phenocryst sites, but the majority of groundmass feldspar is almost completely replaced by exceptionally fine grained wispy pale brown birefringent clay (?montmorillonite). Small patches of "sericite" are accessory. Disseminated sulphides are common (about 10% of the sample) and to a lesser extent these are vein-located with carbonate (calcite) and quartz.

The sample may be described as a significantly mineralised, strongly altered porphyritic and vesicular igneous rock of rather acidic primary composition.

<u>Sample No.</u>	A 184732 296.7 m
<u>Rock Type.</u>	Strongly altered unsorted fragmental (or even partly ?reworked) ?tuff containing a variety of lithic debris from a porphyritic acidic igneous source.
<u>Hand Specimen.</u>	A poorly sorted, distinctly fragmental sample containing pale green-grey, mid green-grey and mid-grey lithic clasts and/or fragments ranging in size up to about 2 cm across. These are set in a fine grained mid-grey ?siliceous matrix. Sparse clusters of sulphides are present. K-feldspar staining proved negative.
<u>Thin Section.</u>	This is a very poorly sorted sample containing numerous irregular shaped coarse to medium sized lithic fragments of several

different acidic volcanic lithologies. Recognisable relict textural features in certain fragments include completely altered euhedral prismatic shaped feldspar phenocryst sites, rare quartz microphenocrysts, degraded opaque oxide microphenocrysts and a coarsely devitrified quartz-rich groundmass fraction with abundant intergrown wispy ?montmorillonite and dusty sulphides. Others contain completely altered felsic phenocryst sites now comprising dense "sericite", as well as phenocryst sites of degraded ragged biotite, polygonised quartz and opaque oxide microphenocrysts, set in a very fine grained devitrified quartz-rich groundmass. Still others are themselves fragmental with highly silicified ?igneous fragments set in a matrix of dense wispy sericite or else pale brown wispy ?montmorillonite.

The rock matrix in which the coarser fragments are "suspended" contains abundant much smaller polygonised siliceous debris, clay-altered ?feldspar crystal sites, in turn set amongst dense cherty quartz and a branching network of pale brown birefringent wispy ?montmorillonite veinlets as well as patchy disseminated pyritic sulphides.

This tuffaceous sample may have been partly reworked in a sedimentary environment, but relict textures suggest the presence only of several different types of acidic igneous material. The rock may be described as a strongly altered, unsorted tuffaceous fragmental or even partly ?reworked ?tuff containing a variety of lithic debris from a porphyritic acidic igneous source.

<u>Sample No.</u>	A 184733 303.6 m
<u>Rock Type.</u>	Veined, partly fractured and partly mineralised, weakly banded fine grained vitric ?tuff that is converted to montmorillonite ± cherty quartz.
<u>Hand Specimen.</u>	A fine grained pale grey, compact ?siliceous sample with a fine subparallel layering which is partly deformed, fractured and veined. Patches of sulphide mineralisation are located along certain of the veined branching fractures. K-feldspar staining proved negative.

Thin Section. This is a very fine grained sample in which the weak fine layering of the hand specimen is not particularly evident. It contains only very sparse silt sized angular quartz grains scattered throughout a very fine grained "matrix" now consisting of very abundant wispy ?montmorillonite intergrown with microcrystalline cherty quartz. The patches of montmorillonite resemble those of small, partly deformed pumiceous glass shards, and there is no "normal" heavy detrital component as in common sedimentary lithologies. The birefringent clay also marks out an incipient conjugate foliation.

Narrow branching veins and fractures are now filled with dense granular quartz intergrown with fine grained patchy pyritic sulphides with traces of carbonate and patches of decussate "sericite" flakes.

Relict textures are not clearly preserved in this sample, but it appears to be a veined, partly fractured and partly mineralised, weakly banded, very fine grained vitric ?tuff that is converted to dense montmorillonite ± cherty quartz.

Sample No. A 184734 333.0 m

Rock Type. Weakly mineralised, veined, argillically altered and silicified lithic ?tuff of acidic primary composition.

Hand Specimen. A pale grey, fine grained cherty siliceous drill core sample which is cut by several prominent pale grey quartz veins. K-feldspar staining proved negative.

Thin Section. Relict textural features are very poorly preserved in this very fine grained, strongly altered sample and only vague outlines of finely banded but unoriented once ?glassy ?volcanic or tuffaceous lithic fragments, ranging in size up to about 2 mm across, are present. The fine banding in these poorly defined fragments equally may be rhyolitic flow banding, or else of vitric tuffaceous origin and now is marked by alternating layers of microgranular quartz and very fine grained pale brown wispy

birefringent clay (most likely montmorillonite). Rare crystal debris includes angular quartz grains up to 0.3 mm across, rare small subhedral zircon crystals and sparse deformed prismatic shaped mafic crystal sites now converted to granular quartz intergrown with rutile needles and/or sphene dust, traces of green carbonate, and dusty pyritic sulphides. Elsewhere are heavily mineralised fragments now converted largely to granular quartz with patchy carbonate, green chlorite and traces of sericite. Sparse titaniferous opaque oxide crystal sites now are degraded to patchy brown stained translucent leucoxene ± sphene.

The prominent veins of the hand specimen are filled mainly with granular quartz (crammed with minute fluid inclusions), and rare traces of sulphides, and have narrow rims of dense sericite, carbonate and green chlorite.

This rock type may be only tentatively identified in terms of its primary lithology as a fine grained lithic tuff of acidic composition which has undergone intense pervasive silicification and argillic alteration with later quartz veining and fine dusty disseminated mineralisation.

<u>Sample No.</u>	A 184735 334.6 m
<u>Rock Type.</u>	Intensely argillically altered silicified and mineralised slumped or brecciated, partly "welded" vitric tuff.
<u>Hand Specimen.</u>	A mottled, fine grained sample with clear outlines of numerous pale grey lithic fragments (up to 2 cm across), set in a very pale green-grey matrix with a wavy foliation. The rock contains sparse fine grained disseminated sulphide mineralisation but K-feldspar staining proved negative.
<u>Thin Section.</u>	As in the previous sample the present rock has undergone extreme pervasive argillic alteration and strong microcrystalline cherty silicification. However, unsorted slumped tuffaceous lithic

135

fragments retain excellent relict textures of partly deformed (flattened) glass shards. The direction of elongate and flattened shards is different in the poorly defined adjacent fragments. Sparse subhedral sites of previous medium grained crystals and aggregates are now completely replaced by granular secondary quartz \pm pyritic sulphides, while mineralised vein-like patches also contain granular quartz \pm sericite.

Alteration of the rock has produced a simple secondary assemblage similar to that of the previous sample, with pale yellow-brown wispy ?montmorillonite replacing previous glass shards intergrown with dense microgranular cherty quartz.

Minute dusty disseminated sulphides are ubiquitous with less common coarse aggregates associated with quartz, traces of chlorite and sericite. Sulphides comprise about 8% of the thin section area.

This rock retains clear relict tuffaceous textures of previous abundant, partly flattened and deformed glass shards preserved in ?slumped unsorted lithic fragments up to 2 cm across. It has undergone intense argillic alteration, silicification and fine disseminated mineralisation.

<u>Sample No.</u>	A 184736 339.0 m
<u>Rock Type.</u>	Strongly argillically altered, partly silicified and mineralised fine grained fragmental or brecciated ?"welded" vitric tuff (or ignimbrite).
<u>Hand Specimen.</u>	A mottled, very fine grained moderately siliceous, pale green-grey sample with abundant mid-grey fragments, mainly about 2 mm to 3 mm across. The very fine grained matrix fraction is weakly foliated. The rock is cut by several conspicuous dark grey vein-like domains. K-feldspar staining proved negative.
<u>Thin Section.</u>	Intense alteration, as in the previous sample, has produced a rather simple secondary assemblage again including almost

136

equal major proportions of wispy very fine grained pale brown birefringent clay (?montmorillonite) and quartz. Relict textural features, however, are not as clearly preserved as in the previous sample, but vague outlines of lithic fragments are marked by adjacent finely banded domains in different orientations. This fine discontinuous banding most likely is due to a layering produced by flattened (or "welded") altered glass shards rather than magmatic flow banding. Sparse small quartz chips are accessory, and certain patches of dense, very fine grained sulphides appear to outline prismatic shapes of previous ?microphenocrysts. Dusty disseminated sulphides and those developed along a fine grained altered fracture zone comprise about 5% to 8% of the rock. Lensed branching quartz veinlets are largely unmineralised.

This strongly argillically altered and partly silicified sample may be only tentatively identified in terms of its original lithology as a fine grained fragmental rock enclosing unoriented irregularly banded fragments of ?"welded" vitric tuff (ignimbrite).

<u>Sample No.</u>	A 184737 369.6 m
<u>Rock Type.</u>	Intensely argillically altered and partly silicified unsorted lithic tuff comprising unoriented banded, once-glassy ?pumiceous and ?tuffaceous fragments, as well as sparse crystal debris.
<u>Hand Specimen.</u>	An irregularly mottled pale yellow-green and mid-grey, very fine grained cherty siliceous sample with a deformed and dis-oriented fine layering and numerous poorly defined lithic fragments. K-feldspar staining proved negative.
<u>Thin Section.</u>	As in several previous samples this rock retains a fragmental relict texture in which adjacent poorly sorted fragments exhibit different directions of a previous fine lamination or layering. Certain of these fragments exhibit selective alteration with vague outlines of possible small vesicle sites, as well as layered or ?flow banded clasts or fragments with relict textures of coarse ?devitrification. Sparse prismatic crystal sites are completely replaced by very fine grained

137

carbonate ± sericite, while previous titaniferous opaque oxide sites now contain stained leucoxene. The very fine grained once-glassy fragments now are converted to wispy pale brown birefringent clay (montmorillonite) and cherty microgranular quartz in approximately equal major proportions, with accessory small anhedral patches of pale brown fine grained carbonate. Small zircon grains form a minor relict accessory phase. Several narrow irregular veins contain dense decussate fine grained sericite intergrown with granular quartz and carbonate. Small pyritic sulphide crystals are accessory as are sparse dusty disseminated pyritic sulphides.

The rock thus may be identified as an intensely argillically altered and partly silicified lithic tuff, comprising unsorted fragments of banded once-glassy ?pumiceous and ?tuffaceous fragments, as well as sparse crystal debris.

APPENDIX IV

TABULATED WHOLE ROCK AND TRACE ELEMENT ANALYSES

DDH NO. INTERVAL		BBP 248 567.0- 577.0	BBP 248 319.0- 331.0	BBP 246 272.0- 287.0	BBP 250 337.0- 355.0	BBP 242 195.0- 213.0	BBP 253 114.7- 128.0	BBP 253 319.0- 336.0	BBP 253 436.5- 448.5	BBP 278 183.3- 196.0	BBP 278 217.2- 223.1	BBP 278 438.2- 442.5	BBP 278 447.5- 457.0	BBP 278 324.9- 339.0
SAMPLE NO.		A184709	A184710	A184711	A184712	A184713	A184706	A184707	A184708	A184701	A184702	A184703	A184704	A184705
SiO ₂	%	75.6	73.0	73.5	70.9	72.6	73.0	68.8	73.4	70.8	49.5	56.9	72.0	72.8
TiO ₂	%	0.22	0.24	0.23	0.33	0.30	0.30	0.30	0.34	0.30	0.68	1.15	0.29	0.31
Al ₂ O ₃	%	11.7	13.7	12.0	12.4	13.8	12.6	12.4	13.7	13.4	11.5	14.6	11.6	12.7
Fe ₂ O ₃	%	1.65	2.15	4.15	3.35	2.45	2.95	2.80	2.10	3.85	11.60	9.75	3.00	2.70
FeO	%													
MnO	%	0.04	0.04	0.07	0.08	0.05	0.05	0.09	0.04	0.07	0.37	0.18	0.10	0.05
MgO	%	0.10	0.45	0.45	0.80	0.65	0.20	0.15	0.70	0.50	5.50	2.35	0.70	0.70
CaO	%	1.10	1.00	0.55	2.90	1.50	1.35	3.05	1.40	1.20	8.45	4.35	2.70	1.70
Na ₂ O	%	2.65	3.05	2.15	1.75	2.35	2.75	2.05	2.80	3.85	1.95	4.30	0.29	3.95
K ₂ O	%	4.55	3.30	4.60	2.95	3.10	5.25	5.05	3.20	3.35	1.05	1.50	3.75	2.15
P ₂ O ₅	%	0.021	0.021	0.021	0.055	0.069	0.041	0.034	0.043	0.076	0.607	0.427	0.060	0.039
SO ₃	%													
CO ₂	%													
H ₂ O ⁺	%													
H ₂ O ⁻	%													
L.O.I.	%	1.51	2.07	1.36	3.50	2.86	1.53	3.21	2.62	1.75	8.75	4.33	4.78	2.21
Total	%													
Ag	ppm	x	x	x	x	x	x	x	x	x	x	x	x	x
As	ppm	3	x	8	2	2	3	3	x	x	x	x	4	40
Au	ppm													
Ba	ppm	940	500	1350	450	600	920	610	560	1150	680	480	320	330
Co	ppm	10	10	5	10	10	5	5	x	5	30	20	5	10
Cr	ppm	80	55	30	30	70	10	35	25	35	125	15	45	45
Cu	ppm	5	5	x	x	5	x	x	x	x	70	5	x	5
F	ppm													
La	ppm	30	40	45	45	65	50	45	40	70	170	40	45	30
Mo	ppm													
Nb	ppm	8	15	10	10	15	8	10	10	15	7	7	10	10
Ni	ppm	55	60	30	35	50	20	30	20	30	55	20	35	35
Pb	ppm	10	x	5	10	20	x	x	5	x	5	5	x	5
Rb	ppm	140	170	160	150	140	160	160	150	110	30	55	150	95
Sb	ppm	x	x	x	x	x	x	x	x	3	x	x	x	6
Sc	ppm													
Sn	ppm													
Sr	ppm	75	95	95	100	110	110	95	120	210	160	230	50	90
Tl	ppm													
V	ppm	3	x	8	2	2	10	9	15	5	230	170	30	25
W	ppm	x	x	x	x	x	x	x	x	x	x	x	x	x
Y	ppm	35	35	35	35	25	40	40	35	40	35	40	40	25
Zn	ppm	50	40	45	105	30	30	30	20	35	170	80	40	90
Zr	ppm	170	210	180	230	190	260	260	250	200	150	140	170	230

139

069142

DDH NO. INTERVAL		BBP 279 217.0- 227.0	BBP 279 237.0- 242.0	BBP 279 319.0- 330.0	BBP 279 374.0- 381.0	BBP 279 418.0- 426.0	BBP 279 441.0- 450.0	BBP 279 516.0- 530.0	BBP 279 697.6- 698.2
SAMPLE NO.		A184680	A184681	A184682	A184683	A184684	A184685	A184686	A212901
SiO ₂	%	75.9	55.9	49.9	72.2	70.3	70.8	73.9	71.4
TiO ₂	%	0.21	0.92	0.64	0.30	0.29	0.29	0.24	0.28
Al ₂ O ₃	%	11.2	15.3	10.4	12.5	12.7	11.8	11.7	13.15
Fe ₂ O ₃	%	2.25	9.55	12.00	2.90	3.60	5.40	2.10	2.45
FeO	%								
MnO	%	0.05	0.19	0.30	0.05	0.08	0.03	0.05	0.07
MgO	%	0.40	3.05	7.40	0.30	0.30	0.25	0.20	0.35
CaO	%	2.05		7.50	1.35	2.55	1.35	1.85	1.19
Na ₂ O	%	2.25	2.05	1.80	2.65	3.55	1.40	2.30	2.490
K ₂ O	%	2.30	1.90	0.68	5.25	2.90	4.40	5.00	4.11
P ₂ O ₅	%	0.021	0.341	0.572	0.039	0.066	0.034	0.023	0.030
SO ₃	%								
CO ₂	%								
H ₂ O ⁺	%								
H ₂ O ⁻	%								
L.O.I.	%	2.70	6.20	8.70	1.45	2.90	3.25	2.20	2.36
Total	%								
Ag	ppm	x	x	x	x	x	x	x	x
As	ppm	2	3	4	x	x	15	2	2
Au	ppm								
Ba	ppm	450	460	370	1000	800	650	960	690
Co	ppm	10	20	25	5	10	10	10	
Cr	ppm	35	5	95	35	35	115	55	1
Cu	ppm	x	x	55	5	5	20	5	4
F	ppm								
La	ppm	40	55	160	50	60	35	35	55
Mo	ppm								
Nb	ppm	10	10	10	15	10	10	10	10
Ni	ppm	30	20	45	35	25	80	40	6
Pb	ppm	x	x	x	5	x	110	x	1
Rb	ppm	130	90	25	170	100	150	140	260
Sb	ppm	x	x	6	x	x	3	x	x
Sc	ppm								
Sn	ppm								
Sr	ppm	85	130	180	110	200	75	85	95
Tl	ppm								
V	ppm	8	190	220	10	8	9	5	9
W	ppm	x	x	x	x	x	x	x	x
Y	ppm	35	30	30	40	35	35	40	50
Zn	ppm	70	110	165	30	40	480	45	30
Zr	ppm	170	150	150	270	200	250	190	260

Ti/Zr

7.4

36.8

25.6

6.7

8.7

7.0

7.6

6.5

140

069143

DDH NO. INTERVAL	BBP 280 74.9- 85.0	BBP 280 104.9- 108.0	BBP 280 190.0- 202.0	BBP 280 211.0- 221.0	BBP 280 261.5- 268.6	BBP 280 278.5- 287.6	BBP 280 289.6- 295.6	BBP 280 307.6- 317.6	BBP 280 332.7- 342.0	BBP 280 344.6- 347.4	BBP 280 395.0- 400.0	
SAMPLE NO.	A212903 A212904	A212909	A212932 A212933 A212934	A212938 A212939	A212802 A212803	A212806 A212807	A212809 A212810 A212811	A212819 To A212823	A212832 A212833 A212834	A212836	A212839	
SiO ₂	%	80.6	66.0	77.0	74.1	66.2	67.8	73.4	75.6	73.3	58.2	73.2
TiO ₂	%	0.22	0.85	0.24	0.35	0.49	0.52	0.31	0.24	0.27	1.00	0.26
Al ₂ O ₃	%	10.15	17.35	12.30	13.60	14.35	13.30	12.75	12.05	12.45	14.35	11.70
Fe ₂ O ₃	%	2.15	2.45	2.20	2.75	5.10	4.65	3.05	2.15	2.65	9.05	2.50
FeO	%											
MnO	%	0.01	0.02	0.01	0.01	0.11	0.08	0.01	0.06	0.02	0.18	0.04
MgO	%	0.10	1.15	0.45	0.35	1.55	0.80	0.60	0.55	0.50	1.85	0.45
CaO	%	x	0.06	x	0.05	0.98	1.51	0.09	0.46	0.22	1.54	0.56
Na ₂ O	%	0.065	0.055	0.055	0.055	4.350	0.100	0.090	0.085	0.080	0.415	2.700
K ₂ O	%	3.19	3.92	4.03	4.20	2.31	3.94	4.17	4.25	4.18	1.89	3.06
P ₂ O ₅	%	0.011	0.048	0.014	0.048	0.112	0.117	0.046	0.023	0.025	0.361	0.034
SO ₃	%											
CO ₂	%											
H ₂ O ⁺	%											
H ₂ O ⁻	%											
L.O.I.	%	1.92	5.44	2.66	3.11	2.62	4.62	3.51	3.03	3.29	5.08	2.70
Total	%											
Ag	ppm	x	x	x	x	0.2	x	0.1	x	0.2	x	x
As	ppm	3	x	x	3	4	9	8	7	2	7	10
Au	ppm											
Ba	ppm											
Co	ppm											
Cr	ppm	1	1	1	1	11	2	2	1	1	3	1
Cu	ppm	8	4	4	7	9	8	8	5	9	13	7
F	ppm											
La	ppm	40	40	20	30	85	40	40	45	40	70	35
Mo	ppm											
Nb	ppm	10	7	15	15	15	9	10	15	10	150	10
Ni	ppm	6	26	9	7	36	10	7	10	7	11	5
Pb	ppm	x	3	12	10	4	20	8	6	11	5	14
Rb	ppm	90	190	140	140	95	170	170	190	150	90	140
Sb	ppm	x	x	x	x	x	x	x	x	x	x	x
Sc	ppm											
Sn	ppm											
Sr	ppm	8	20	8	15	230	60	20	30	10	120	75
Tl	ppm											
V	ppm	10	170	25	30	73	70	24	1	x	120	6
W	ppm	x	x	x	x	x	x	x	x	x	x	x
Y	ppm	20	30	30	35	40	35	35	35	35	40	35
Zn	ppm	6	71	57	49	74	98	30	30	58	110	67
Zr	ppm	180	170	200	250	220	240	240	210	230	170	220

7.5 30.0 7.2 8.4 13.4 13.0 7.7 6.9 7.0 35.3 7.1

141

069144

142

STANDARD NO. SAMPLE NO.	STANDARDS RUN WITH BBP 278, 279				
	GX24 A184714	GX25 A184715	GX26 A184716	GX26 A184718	
SiO ₂	%	71.7	42.5	43.4	43.5
TiO ₂	%	0.66	0.87	1.40	1.40
Al ₂ O ₃	%	4.25	0.75	1.25	1.15
Fe ₂ O ₃	%	13.0	51.0	49.7	49.6
FeO	%				
MnO	%	0.01	0.03	0.04	0.04
MgO	%	x	x	x	x
CaO	%	1.25	0.07	0.07	0.06
Na ₂ O	%	800	100	200	100
K ₂ O	%	0.40	0.03	0.05	x
P ₂ O ₅	%	0.030	0.009	x	x
SO ₃	%				
CO ₂	%				
H ₂ O ⁺	%				
H ₂ O ⁻	%				
L.O.I.	%	5.46	3.34	2.60	2.59
Total	%				
Ag	ppm	292	700	890	890
As	ppm	3400	140	320	310
Au	ppm	I/S	I/S	I/S	I/S
Ba	ppm	390	690	1250	1200
Bi	ppm	19	15	33	43
Co	ppm	15	25	30	35
Cr	ppm	40	25	30	35
Cu	ppm	1350	1025	825	825
F	ppm				
La	ppm	25	95	80	75
Mo	ppm	x	x	x	x
Nb	ppm	x	x	5	4
Ni	ppm	30	40	35	35
Pb	ppm	1.28	0.50	0.49	0.49
Rb	ppm	20	7	8	7
Sb	ppm	200	50	85	95
Sc	ppm				
Sn	ppm	260	470	1850	1850
Sr	ppm	40	3	5	3
Tl	ppm				
V	ppm	75	130	140	160
W	ppm	x	25	35	30
Y	ppm	x	5	15	15
Zn	ppm	0.51	0.51	0.3700	0.3675
Zr	ppm	95	110	140	130

069145

STANDARD NO. SAMPLE NO.		STANDARDS RUN WITH BBP 280						
		GX1H A212910	GX1H A212950	GX25 A212920	GX25 A212940	GX25 A212830	PDE'S BLANK A212815	PDE'S BLANK A212935
SiO ₂	%	71.7	72.5					
TiO ₂	%	0.48	0.48					
Al ₂ O ₃	%	12.00	11.80					
Fe ₂ O ₃	%	4.10	4.14					
FeO	%							
MnO	%	0.02	0.02					
MgO	%	0.21	0.31					
CaO	%	0.05	0.04					
Na ₂ O	%	I/S	I/S		0.025	0.020		0.015
K ₂ O	%	4.54	4.62					
P ₂ O ₅	%	0.053	0.064					
SO ₃	%							
CO ₂	%							
H ₂ O ⁺	%							
H ₂ O ⁻	%							
L.O.I.	%	2.96	2.39					
Total	%							
Ag	ppm	0.1	x	440	440	460	x	x
As	ppm	7	10					
Au	ppm	x	0.04	0.98	1.06	x	x	
Ba	ppm	390	390		660	600		60
Bi	ppm							
Co	ppm		7	56	56	55	16	13
Cr	ppm	17	84	1050	1050	1050	3	4
Cu	ppm	76	800					
F	ppm	1200	30					
La	ppm	30	190					
Mo	ppm	200	10					
Nb	ppm	9	59	35	35	35	5	6
Ni	ppm	55	7	4920	4920	4920	x	4
Pb	ppm	8	330		7	9		x
Rb	ppm	330	x					
Sb	ppm	x	6					
Sc	ppm	9	90		x	5		x
Sn	ppm	90	2.0	0.5	0.5	0.5	x	x
Sr	ppm	1.0					x	x
Tl	ppm	55		170	130	140	9	15
V	ppm	40	55					
W	ppm	40	45					
Y	ppm	55	55					
Zn	ppm	43	40	5540	5540	5540	9	10
Zr	ppm	300	290					

143

069146

STANDARD NO.		STANDARDS - ACCEPTED VALUES - AUGUST 1985			
		GX1H	GX25	GX24	GX26
SiO ₂	%	73.3			
TiO ₂	%	0.47			
Al ₂ O ₃	%	12.05			
Fe ₂ O ₃	%	4.4			
FeO	%				
MnO	%	0.015			
MgO	%	0.43			
CaO	%	0.11			
Na ₂ O	%	0.95			
K ₂ O	%	4.62			
P ₂ O ₅	%	0.05			
SO ₃	%				
CO ₂ ⁺	%				
H ₂ O ⁺	%				
H ₂ O ⁻	%				
L.O.I.	%	2.9			
Total	%				
Ag	ppm	0.65	608	292	703
As	ppm	11	153.6	3610	287
Au	ppm	0.97	0.204	3.32	
Ba	ppm	400			
Bi	ppm	11.0			
Co	ppm	5.8			
Cr	ppm	170	57.7		60.8
Cu	ppm	70	1064	1340	826
F	ppm				
La	ppm	30			
Mo	ppm	200			
Nb	ppm	13			
Ni	ppm	48			
Pb	ppm	12	4600	1.27	0.4241
Rb	ppm	325			
Sb	ppm	x			
Sc	ppm				
Sn	ppm	9			
Sr	ppm	90			
Tl	ppm				
V	ppm	x			
W	ppm	55			
Y	ppm	42			
Zn	ppm	40	0.4968	0.4580	0.3746
Zr	ppm	255			

144

069147

APPENDIX V

TABULATED RESULTS FOR EXPECTED AND RECORDED VALUES OF
CSR STANDARD, GX1H

TABLE 1

Comparison between expected and recorded values of silicate
analysis of GX1H

Analysis by Analabs Report 999.0 08 3168, July 1985

Element	Recommended		Actual	
	Value	Range	Value 1	Recorded 2
SiO ₂	73.2	72.2 - 74.2	71.7	72.5
TiO ₂	0.47	0.44 - 0.50	0.48	0.48
Al ₂ O ₃	12.05	11.55 - 12.55	12.0	11.8
Fe ₂ O ₃	4.4	4.1 - 4.7	4.1	4.14
MnO	0.015	0.01 - 0.02	0.02	0.02
MgO	0.43	0.36 - 0.49	0.21	0.31
CaO	0.11	0.07 - 0.13	0.05	0.04
Na ₂ O	0.95	0.80 - 1.10		
K ₂ O	4.62	4.4 - 4.8	4.54	4.62
P ₂ O ₅	0.05	0.045 - 0.055	0.053	0.064
LOI	<u>2.9</u>	2.6 - 3.2	<u>2.96</u>	<u>2.39</u>
	<u>99.19</u>		<u>96.11</u>	<u>96.36</u>
F	0.13	0.11 - 0.15	0.12	0.08

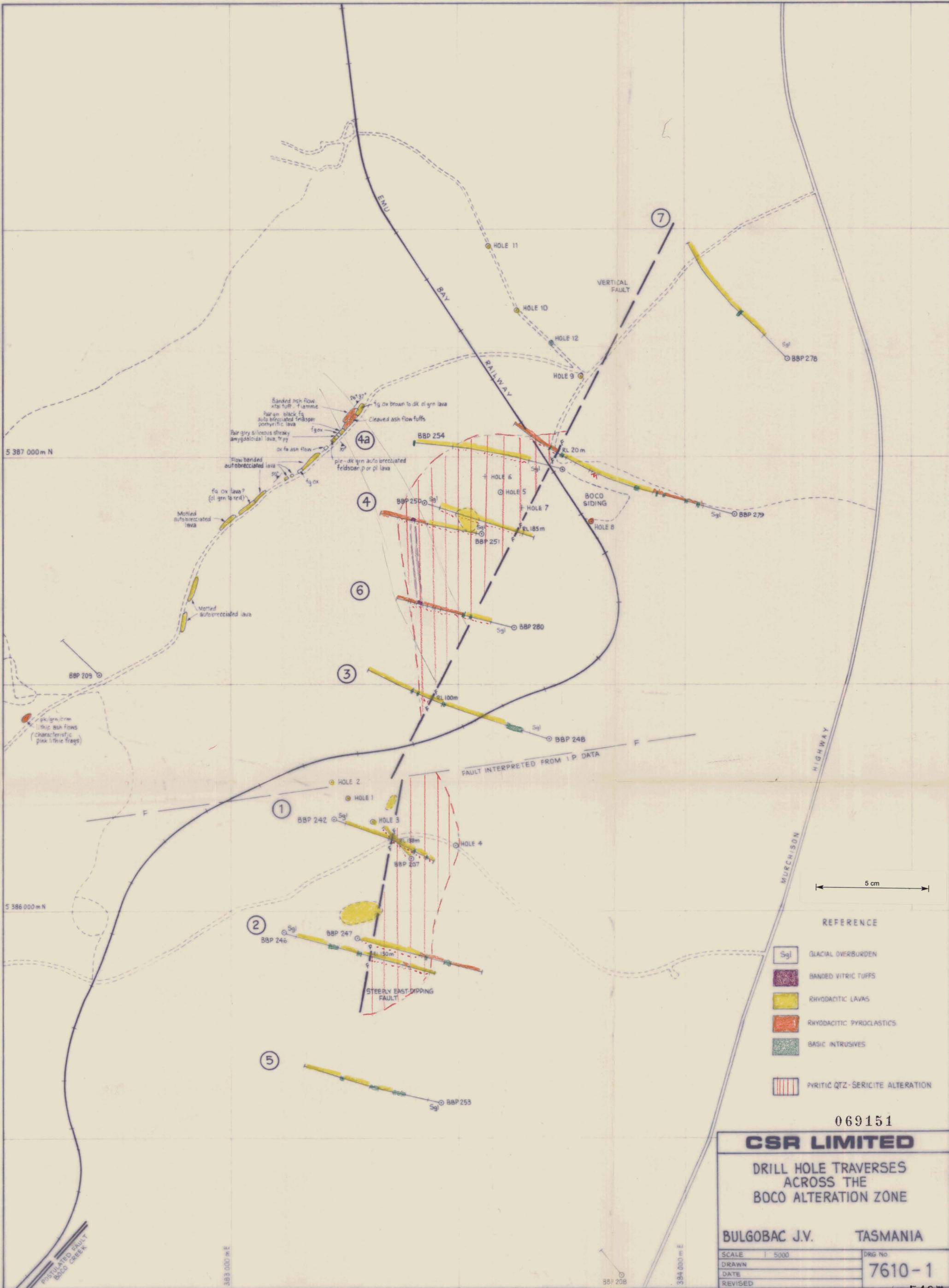
All values expressed as %

TABLE 2

Comparison between expected & recorded values of silicate analysis of GX1H

Analysis by Analabs, Report 999.0 08 3168, July 1985

Element	Expected Value	Expected Range	Actual Value Reported		Comment
			1	2	
As	11	9- 13	7	10	OK but low
Ba	400	370-430	390	390	Great
Cr	170	160-180	17	7	Poor - dissolution method?
Cu	70	62- 78	76	84	OK
La	30	20- 40	30	30	Great
Mo	200	190-210	200	190	OK
Nb	13	11- 15	9	10	Low
Ni	48	38- 58	55	59	OK but high
Pb	12	10- 14	8	7	Low
Rb	325	315-335	330	330	Good
Sb	x	x	x	x	Below detection
Sn	9	7- 12	9	6	OK but low
Sr	90	85- 95	90	90	OK
V	x	x	x	x	Below detection
W	55	50- 60	40	45	Low
Y	42	36- 48	55	55	High
Zn	40	36- 44	43	40	OK
Zr	255	245-265	300	290	High



5 cm

REFERENCE

- Sgl GLACIAL OVERBURDEN
- BANDED VITRIC TUFFS
- RHYODACITIC LAVAS
- RHYODACITIC PYROCLASTICS
- BASIC INTRUSIVES
- PYRITIC QTZ-SERICITE ALTERATION

069151

CSR LIMITED

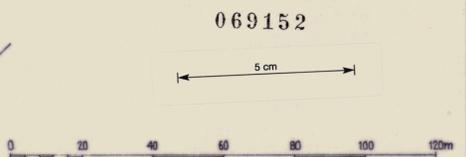
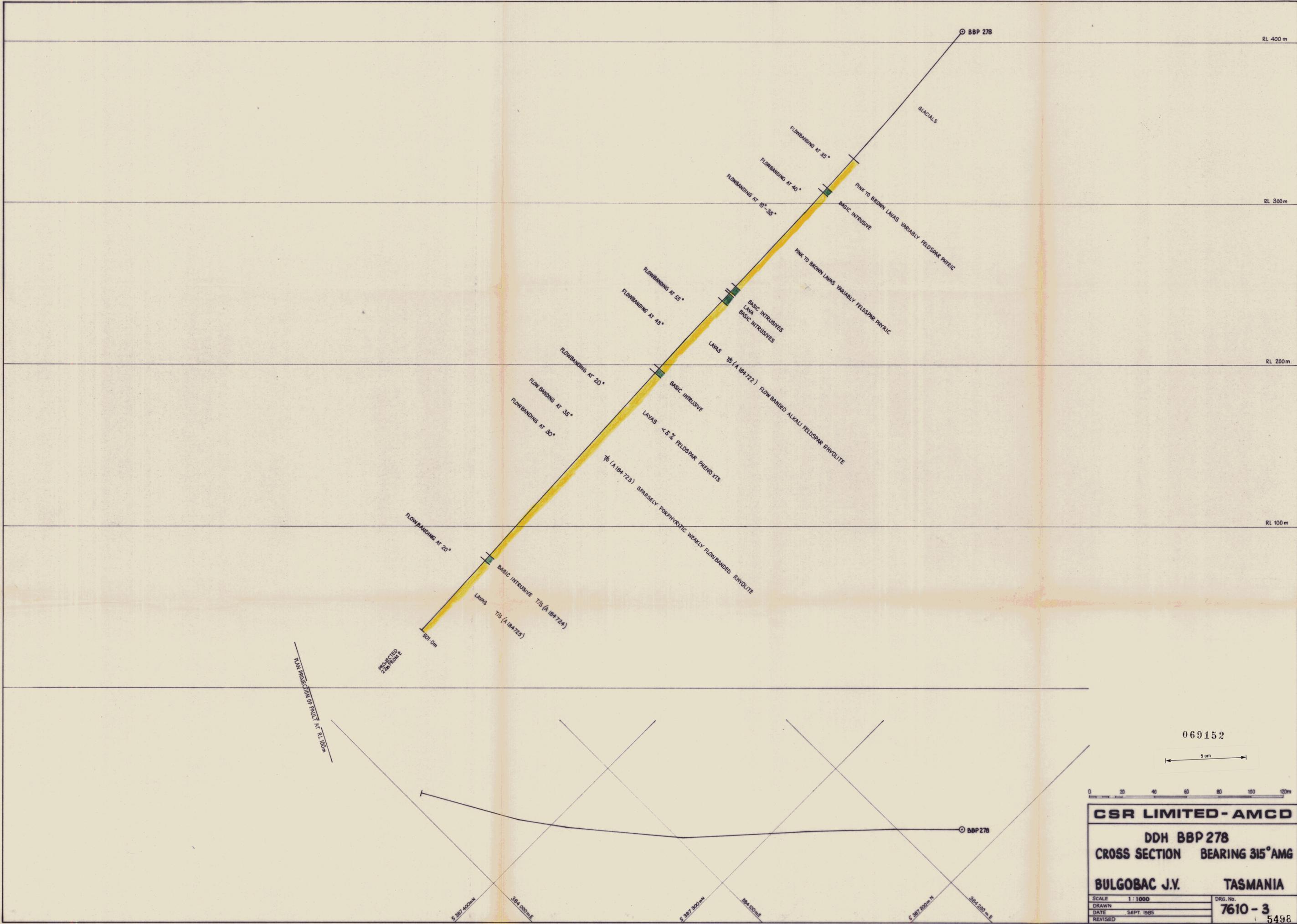
DRILL HOLE TRAVERSES
ACROSS THE
BOCO ALTERATION ZONE

BULGOBAC J.V. TASMANIA

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DRAWN	7610-1
DATE	
REVISED	

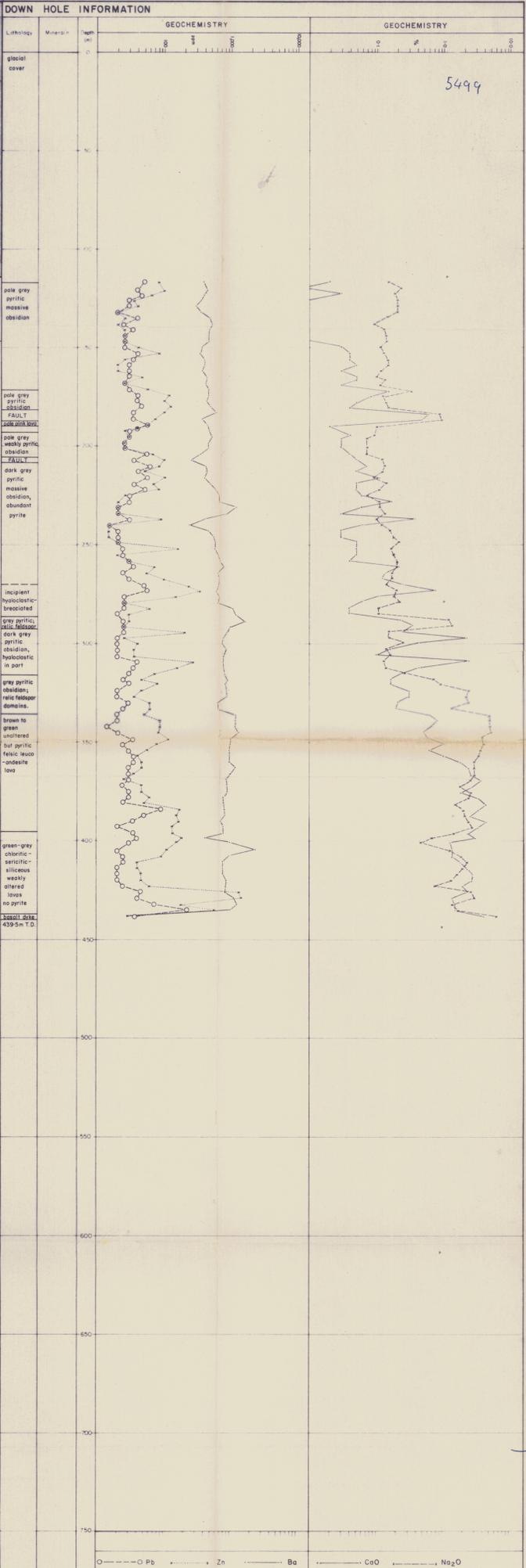
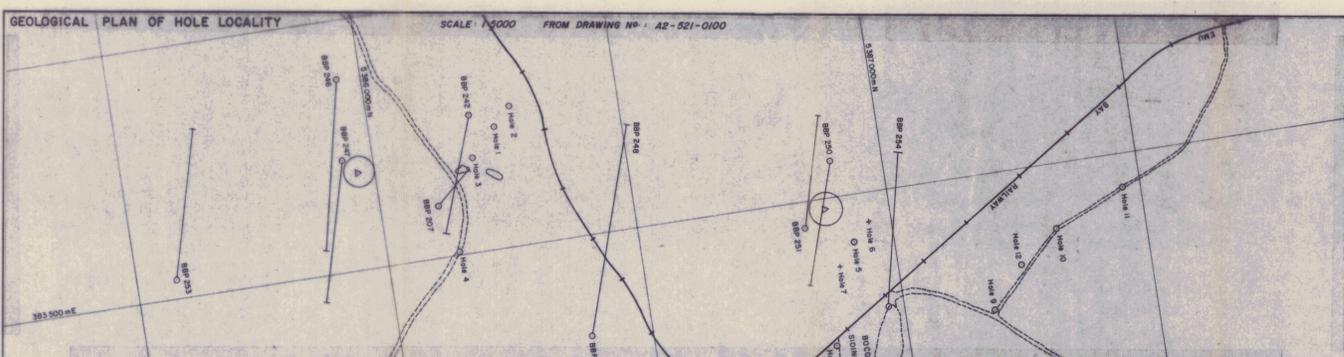
85-2508

5497



CSR LIMITED-AMCD	
DDH BBP 278	
CROSS SECTION BEARING 315°AMG	
BULGOBAC J.V.	TASMANIA
SCALE 1:1000	DRG. No.
DATE SEPT 1985	7610-3
REVISED	5498

85-2508

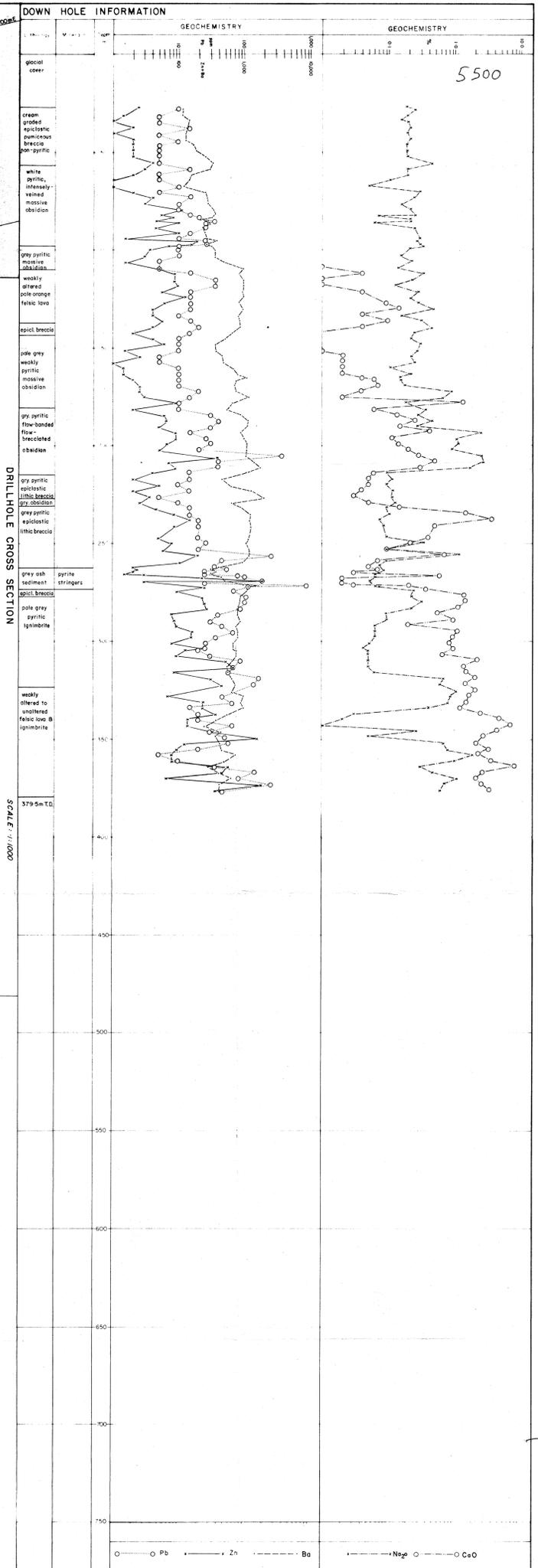
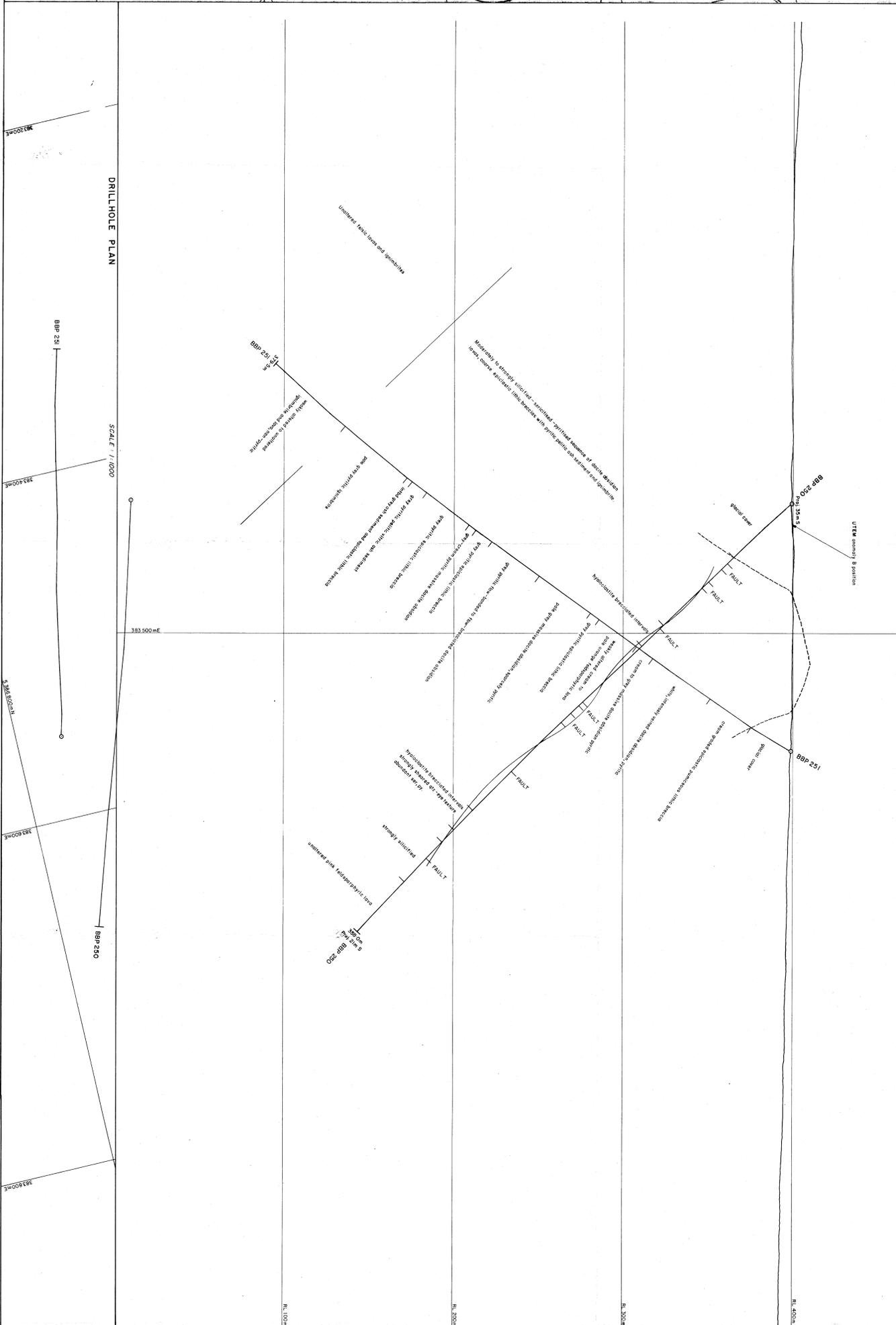
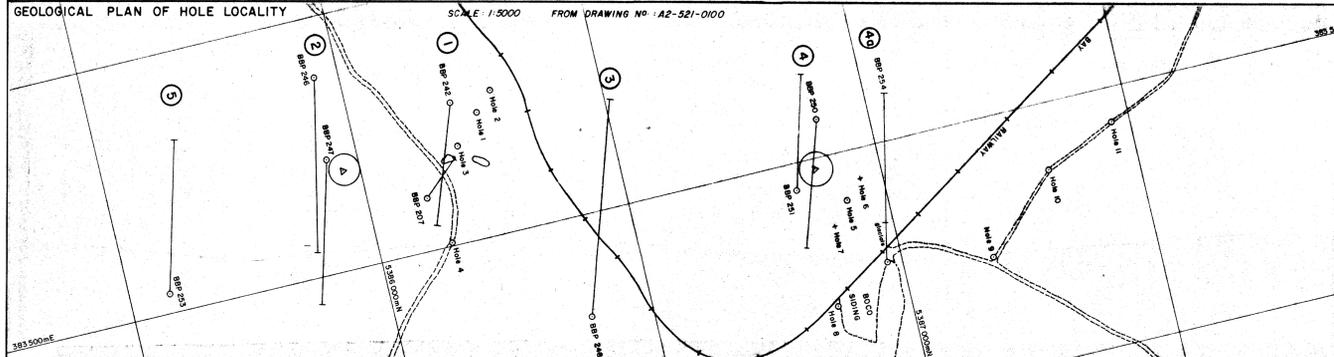


SUMMARY OF COMPLETED HOLE				SPECIFICATIONS OF PROPOSED HOLE			
CO-ORDINATES	NORTHING	EASTING	R L	CO-ORDINATES	NORTHING	EASTING	R L
LOCAL GRID				LOCAL GRID			
A.M.G.	5,386,970.3	383,728.6	395.7	A.M.G.			
AZIMUTH	285° A.M.G.	DIP	50°	TOTAL DEPTH	439.5m	ESTIMATED DEPTH	
COMMENCEMENT DATE	2-3-84	COMPLETION DATE	7-5-84	ESTIMATED COMMENCEMENT			
INTERNAL SURVEY INFORMATION				ANTICIPATED GEOLOGY			
DEPTH	AZIMUTH	DIP	DEPTH	AZIMUTH	DIP	DEPTH	LITHOLOGY
236m	280°	40°	439.5m	274°	34°		
287m	278°	39°					
338m	276°	37°	0-236m				No surveys, survey gear jammed @ 236m, requiring rods to be pulled.
389m	274°	36°					
DRILLED GEOLOGY (SUMMARISED)				MINERALOGY AND SAMPLES			
DEPTH	LITHOLOGY	DEPTH	MINERALOGY AND SAMPLES				
0-170m	Glacial cover.						
170-335m	STRONGLY SILICIFIED - SERICITISED - PYRITISED DACITE OBSIDIAN LAVA and MINOR LAVA FRAGMENTALS.						
170-208m	Pale grey weakly pyritic massive to flow-banded obsidian.						
208-315m	Dark grey pyritic massive obsidian. Abundant pyrite. Hypoblastic intervals within 270.0-286.2m, 292.5-308.45m.						
315-45m	Grey pyritic obsidian. Relict feldspar-phryic domains.						
335-3-439.5m	WEAKLY ALTERED LEUCO-ANDESITE LAVAS.						
335-3-395.0m	Unaltered but pyritic lavas.						
395-0-436.35m	Green-grey weakly chloritic - sericitic - siliceous lavas, no pyrite.						
436.35-439.5m	Basaltic dyke.						
LOGGED BY: Rod Saulty DATE: October, 1984							
SAMPLE DATA							
SAMPLE INTERVAL	SAMPLE NUMBER	SAMPLE TYPE	ELEMENTS DETERMINED	AS	MS	W	TH
170.0-439.5m	61401-61508	split	Ca, Fe, Zn, Ag, Pb, Mn, Co, Ni, As, Hg, S, Ba, Sr, Cu, SiO ₂ , Au	AS5	AS5	XRF	wt / AS5
NOTES				SCALE: As shown	Survey	Revised	
				Reference:	Date:	REF No:	
				Drawn:	Checked:	7610-4	

5499

069153

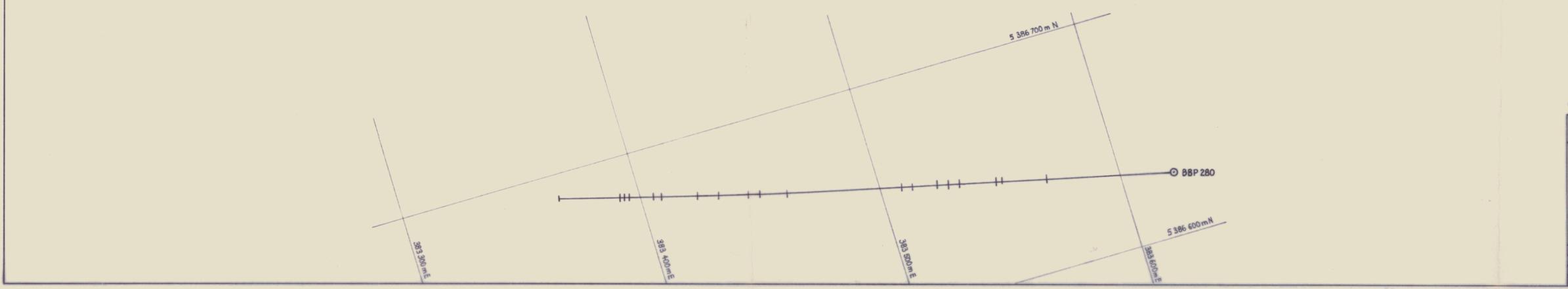
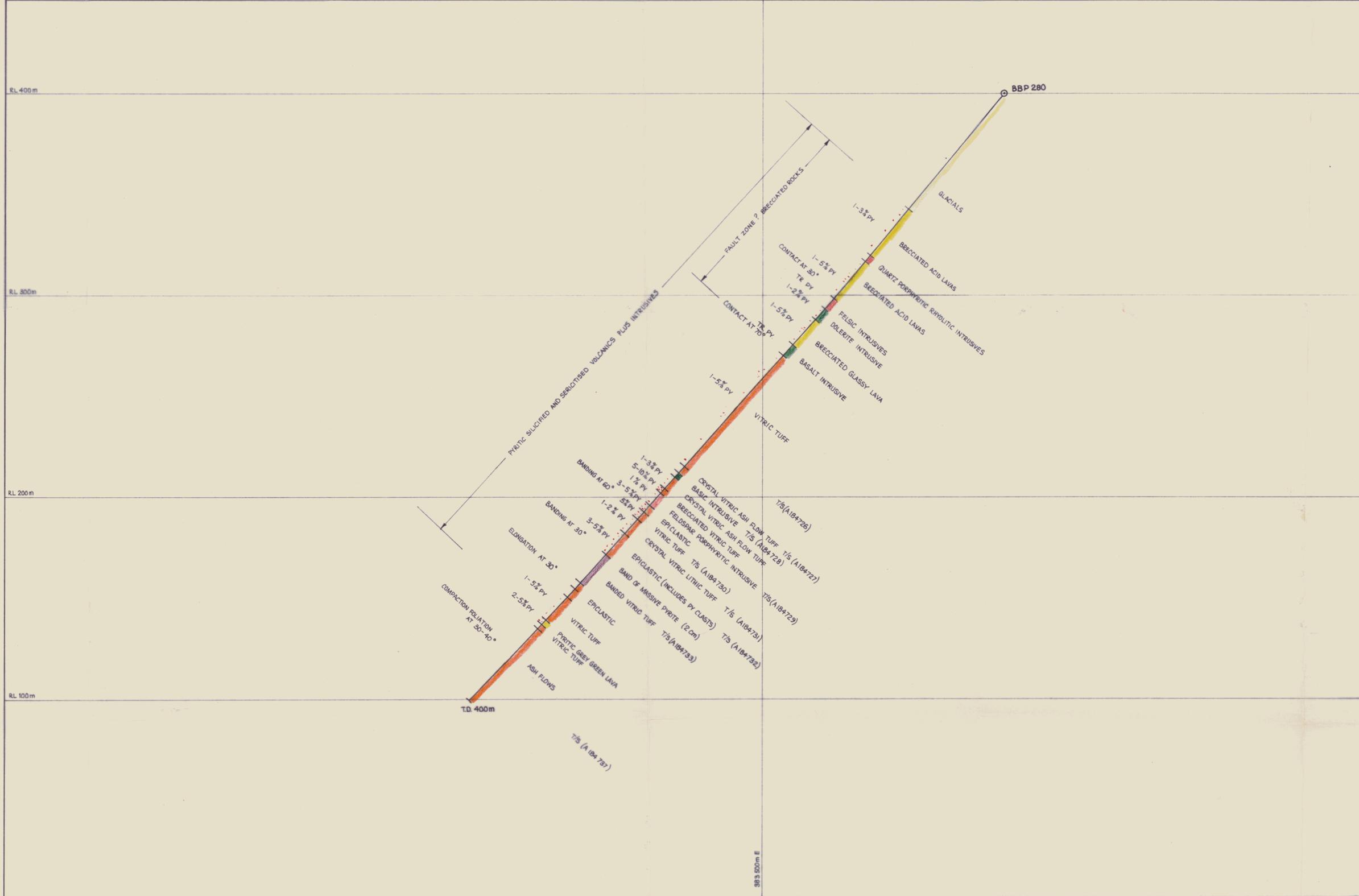
ELECTROLYTIC ZINC CO. OF ASIA LTD.
 PROJECT: BULGOBAC J.V. TAS.
 SPECIFICATIONS AND SUMMARY OF RESULTS
 EXPLORATION DIAMOND DRILL HOLES
 No. BBP 254
 No. BBP 279



SUMMARY OF COMPLETED HOLE				SPECIFICATIONS OF PROPOSED HOLE			
CO-ORDINATES	NORTHING	EASTING	R L	CO-ORDINATES	NORTHING	EASTING	R L
LOCAL GRID				LOCAL GRID			
A.M.G.	5 386 826.7	383 551.6	399.0	A.M.G.			
AZIMUTH	285° A.M.G.	-60°	TOTAL DEPTH	379.5m	DEPTH		
INSTALLMENT DATE	20-12-83	COMPLETION DATE	26-1-84	ESTIMATED COMMITMENT			
INTERNAL SURVEY INFORMATION				ANTICIPATED GEOLOGY			
DEPTH	AZIMUTH	DIP	DEPTH	AZIMUTH	DIP		
50m	280°	-55.5°	303m		-50°		
100m	281°	-55°	369m	285°	-48°		
200m	283.5°	-54°					
253m	281.5°	-53°					
HOLE SIZE	FROM	TO	HOLE SIZE	FROM	TO		
HW	0	9.0m	NQ	18.5m	33.0m		
HQ	9.0m	18.5m	BQ	33.0m	379.5m		
DRILLED GEOLOGY (SUMMARISED)							
DEPTH	GEOLOGY	DEPTH	GEOLOGY	DEPTH	GEOLOGY		
0-270m	Fluvioglacial cover.						
27.0m	Cream altered graded epiclastic.						
56.5m	cream altered intensely veined breccia.						
57.0m	white altered intensely veined dolomite.						
97.85m	cream to grey pyritic dolomite.						
109.9m	weakly altered feldspathic ignimbrite.						
137.2m	grey pyritic epiclastic breccia.						
143.5m	pale grey dolomite.						
180.7m	grey pyritic dolomite obsidian flow.						
214.9m	grey pyritic dolomite breccia.						
227.0m	grey pyritic dolomite.						
227.0m	grey pyritic dolomite.						
230.0m	grey pyritic dolomite.						
230.0m	grey pyritic dolomite.						
262.35m	grey pyritic pelitic ash.						
273.2m	sediment.						
276.95m	grey pyritic dolomite breccia.						
276.95m	grey pyritic dolomite.						
323.5m	weakly altered to unaltered volcanics.						
379.5m	volcanics.						
<p>AIM OF HOLE</p> <p>The second hole in Traverse 4 in a programme of across-strike drilling of the concealed quartz-sericite-pyrite alteration zone.</p> <p>NOTES</p> <p>This hole was targeted to intersect at depth the western side of the alteration horizon which was not tested by BBP 250. The complex sequence encountered indicates that BBP 250 was drilled down-dip. BBP 251 encountered 300m true thickness of alteration, open to the east. The hole also tested the UTEM anomaly B position with negative results.</p> <p>069154</p> <p>ELECTROLYTIC ZINC CO OF ASIA LTD</p> <p>PROJECT: BULGOBAC J.V. TAS.</p> <p>SPECIFICATIONS AND SUMMARY OF RESULTS</p> <p>EXPLORATION DIAMOND DRILL HOLE No BBP-251</p> <p>SCALE: As shown Survey: R.A.S. Revis: 85-2608</p> <p>Reference: Date: 1-2-84 REF No: A0-521-0107</p> <p>Drawn: R.J.R. Checked: R.A.S.</p>							

5500

5500



CSR LIMITED - AMCD

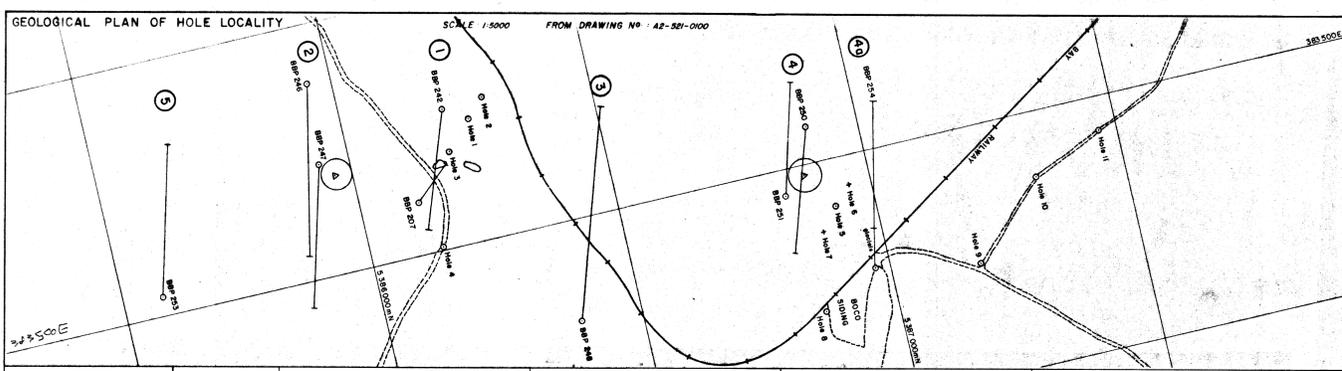
DDH BBP 280

CROSS SECTION BEARING 294° AMG

BULGOBAC J.V. TASMANIA

SCALE	1:1000	DRG. No.	
DRAWN			
DATE	SEPT 1985		
REVISED			

7610-2



DOWN HOLE INFORMATION		GEOCHEMISTRY	GEOPHYSICS
Depth (m)	Interval (m)		
0	0-10		
10	10-20		
20	20-30		
30	30-40		
40	40-50		
50	50-60		
60	60-70		
70	70-80		
80	80-90		
90	90-100		
100	100-110		
110	110-120		
120	120-130		
130	130-140		
140	140-150		
150	150-160		
160	160-170		
170	170-180		
180	180-190		
190	190-200		
200	200-210		
210	210-220		
220	220-230		
230	230-240		
240	240-250		
250	250-260		
260	260-270		
270	270-280		
280	280-290		
290	290-300		
300	300-310		
310	310-320		
320	320-330		
330	330-340		
340	340-350		
350	350-360		
360	360-370		
370	370-380		
380	380-390		
390	390-400		
400	400-410		
410	410-420		
420	420-430		
430	430-440		
440	440-450		
450	450-460		
460	460-470		
470	470-480		
480	480-490		
490	490-500		
500	500-510		
510	510-520		
520	520-530		
530	530-540		
540	540-550		
550	550-560		
560	560-570		
570	570-580		
580	580-590		
590	590-600		
600	600-610		
610	610-620		
620	620-630		
630	630-640		
640	640-650		
650	650-660		
660	660-670		
670	670-680		
680	680-690		
690	690-700		
700	700-710		
710	710-720		
720	720-730		
730	730-740		
740	740-750		
750	750-760		
760	760-770		
770	770-780		
780	780-790		
790	790-800		
800	800-810		
810	810-820		
820	820-830		
830	830-840		
840	840-850		
850	850-860		
860	860-870		
870	870-880		
880	880-890		
890	890-900		
900	900-910		
910	910-920		
920	920-930		
930	930-940		
940	940-950		
950	950-960		
960	960-970		
970	970-980		
980	980-990		
990	990-1000		

SUMMARY OF COMPLETED HOLE				SPECIFICATIONS OF PROPOSED HOLE			
CO-ORDINATES	NORTHING	EASTING	R L	CO-ORDINATES	NORTHING	EASTING	R L
LOCAL GRID	TRAVERSE 3			LOCAL GRID	TRAVERSE 3		
A.M.G.	5 386 378.6	383 698.4	376.3	A.M.G.			
DIP	285° A.M.G.	4° - 50°	TOTAL DEPTH	577.5m	DIP	285° A.M.G.	4° - 50°
COMMENCEMENT DATE	5-9-83	COMPLETION DATE	24-11-83	EST. MATHS. COMM. EMENT	Sept. 1983		
INTERNAL SURVEY INFORMATION				ANTICIPATED GEOLOGY			
DEPTH	AZIMUTH	DIPE	DEPTH	AZIMUTH	DIPE	DEPTH	AZIMUTH
130m	289°	45°	406m	291°	40.5°		
217m	288°	45.5°	490m	294°	37°		
325m	289°	44°	574m	296°	31°		
HOLE SIZE	FROM	TO	HOLE SIZE	FROM	TO		
HW	0	7.0	NQ	21.0	123.5		
HQ	7.0	21.0	BQ	123.5	577.5		
DRILLED GEOLOGY (SUMMARISED)							
DEPTH	LITHOLOGY						
0-90.5m	Glacial cover						
90.5-	Unaltered to weakly altered felsic intermediate lavas (basalt-andesites), rhyolite, silicified, and basalt dykes.						
388.2-	Moderately to strongly pyrite - altered felsic lavas and fragments, esp. 388.2-396.7, 402.0-404.1, strongly pyritic.						
431.35-	Unaltered basalt-andesites - rhyolite silicified with basalt dykes. Sporadic strong alteration (Epy).						
577.5-							
NOTES							
RESULT: This hole intersected a much-reduced width of alteration, which does not appear to be hosted by the brecciated dolerite intrusion intersected to the south.							
DRAWN BY: Rod Saintry DATE: November, 1983							
SAMPLE DATA				ELECTROLYTIC ZINC CO. OF ASIA LTD			
DEPTH	INTERVAL	SAMPLE NO.	ANALYSIS	PROJECT	DATE	REVISED	REF. NO.
376.5-377.0m	58462	split	Cu, Pb, Zn, Ag, Fe, Mn, Co, Ni, Bi, Hg, SiO2, Ca, Sr, Ba, S	BULGOBAC EL12/72	9-12-83		AO-521-0105
388.2-389.2m	58463						
390.6-391.0m	58464						
391.0-394.9m	58465						
395.4-396.0m	58466						
402.1-404.1m	58467						
404.1-407.4m	58468						
407.4-410.7m	58469						
446.75-446.9m	58470						
499.9-503.0m	58471						
503.0-506.6m	58472						
514.0-523.0m	58473						
SCALE: As shown Survey: R.A.S. Reference: Date: 9-12-83 Drawn: R.J.R. Checked: R.A.S.							

5502

069156

A.M. OF HOLE

Across-strike drilling of quartz-sericite-pyrite alteration zone on traverse No. 3.

NOTES

RESULT: This hole intersected a much-reduced width of alteration, which does not appear to be hosted by the brecciated dolerite intrusion intersected to the south.

8cm

95-2508

AO-521-0105

5502