000

DKSG

525001

MICROFILMED
OPEN FILE

PENNZOIL OF AUSTRALIA LIMITED

REPORT OF EXPLORATION PROGRESS TO MAY, 1975 ON EL 24/73

DIAL RANGE

J.M. Graham
Project Geologist
May, 1975

001

525002

TABLE OF CONTENTS

ABSTRACT

SUMMARY OF EXPLORATION COMPLETED DURING 1973 AND 1974 .

INTRODUCTION	Page No.	2
GEOLOGY	"	2
GEOCHEMISTRY	"	2, 3
GEOPHYSICS	"	3
FUTURE PLANS FOR 1975	"	3

EXPLORATION COMPLETED TO MAY 1975.

GENERAL COMMENTS	Page No.	3
BRIEF GEOLOGY OF DIAL RANGE TROUGH	"	4
GEOLOGY OF DIAL MINE GRID	"	4,5,6,7,8
DRILLING	"	8
Hole 1	"	8,9,10
Hole 2	"	10,11,12
THE MODEL	"	12
CONCLUSIONS & RECOMMENDATIONS	"	13

ENCLOSURES:

1. Map No. 40206, EL 24/73 Dial Range Geology - Dial Mine Grid. Scale 1cm= 25m.

2. Map No. 40207, EL 24/63 Dial Range - Drill Log - Dial Range No.1. Scale 1cm = 5m

3. Map No. 40208, EL 24/73 Dial Range - Drill Log - Dial Range No.2. Scale 1cm = 5m.

ABSTRACT

Geological evaluation of the Dial Mine grid area has shown that a succession of interbedded, easterly dipping, volcanic and sedimentary rock types forms part of the western limb of a syncline which has been structurally disrupted by extensive block faulting. As indicated initially by geochemistry and to some extent geophysics, results of drilling have confirmed that small scale discontinuous pods, disseminations, and fragments of pyritic sulphides containing minor copper values occur within coarse pyrocalstic units included within the pile.

However, the stratigraphic level of the coarse pyroclastics and the occurrence of fragmental sulphide within them suggest that more favourable environments may have existed within the volcanic pile for the accumulation of more massive sulphide bodies with potentially economic base metal concentrations.

The most favourable environment envisaged for the development of volcanogenic style stratabound massive sulphide bodies is within the lower stratigraphic levels of the keel region of the syncline which is thought to coincide with the location of the original basin deep.

In addition, it is possible that massive sulphide bodies could accumulate as flank deposits within thickening sections of coarse pyroclastic host rocks closely adjacent to a vent complex. This environment would be provided in the eastern limb of the syncline at various stratigraphic levels close to the volcanic centre which is assumed to be in the vicinity of the Lobster Creek volcanics.

Hence it is concluded that within and surrounding the Dial Mine grid area a number of highly prospective geological environments readily emerge which warrant continued detailed geological, geochemical and geophysical exploration.

1. The Dial Mine fault block where pods and disseminations of cupriferous pyrite occur associated with basal volcanic horizons, cherts and sediments.

2. To the north-west of the Dial Mine grid in the keel region of the syncline where the lowermost stratigraphic rock units are presumed to close.

3. The eastern limb of the syncline between the axis (Stantons Creek) and the Lobster Creek volcanics both within the grid and to the north-west where pods of pyritic sulphides associated with pyroclastic rocks are known (Keddies mine).

In view of the difficult nature of the terrain and the general lack of useful rock exposure it is recommended that the airborne E.M. technique of Turair be conducted along close spaced traverse lines over the environments outlined in an effort to expedite the discovery of near surface sulphide bodies which can then be evaluated on the ground by more comprehensive geological mapping, geochemical sampling and geophysical surveying.

003

525004

In recognition of the favourable environment provided by the Dial Range trough the survey should be extended to cover all the Lower Cateena sediments stratigraphically below the Kerrison volcanics both to the west and to the east of the Lobster Creek volcanics within the Exploration Licence area.

SUMMARY OF EXPLORATION COMPLETED DURING 1973 AND 1974.

INTRODUCTION

During 1973, as a result of a compilation study of the geology and mineral occurrences of western Tasmania, the Lower Cambrian sediments and volcanics infilling the Dial Range trough were identified as a permissive environment for the potential occurrence of stratabound or conformable base metal sulphide deposits of the volcanogenic style. As this area was also notably free of current exploration licences, a ground inspection was initiated to check geochemical anomalies established by previous investigators and to evaluate the general environment surrounding several known pyritic deposits with minor base metal associations within the Mt. Dial district.

Ground traversing in the vicinity of the old Dial Mine workings revealed a number of interesting zones of gossanous coarsely fragmental volcanic rock types (dominantly tuffaceous agglomerates) which occurred underlying a prominent ridge line immediately to the west of the old mine workings. Significant strike extension of the main zone along the ridge top was readily established by the prevelance of float boulders and intermittent outcrop trending in a north-westerly direction.

Following the granting of a 68 sq/Km Exploration Licence (EL 24/73) covering the general area a metric grid measuring 700m x 1200m was installed over the zone of interest in preparation for reconnaissance geological, geochemical and geophysical exploration.

GEOLOGY

Float mapping over the grid outlined a sequence of volcanic rock types which were dominated by a number of variably metallized coarse pyroclastic types. A tuff breccia unit included within the thickest accumulation (150m) of coarse agglomeratic units, was identified as a possible explosion breccia associated with a nearby vent complex. The gossanous nature of the agglomerates and breccias indicated that original sulphide content ranged from < 1 vol % to greater than 10 vol %. Other units in the volcanic pile included barren to weakly metallized lithic tuffs, lavas, mudstones and siliceous flow banded and fragmental tuffites.

GEOCHEMISTRY

Rock chip sampling of metallized pyroclastic rocks indicated the presence of anomalous base metal values generally in excess of 1000 ppm copper, 250 ppm lead and 200 ppm zinc. The highest values recorded came from agglomerates in the region of the postulated vent zone.

004

525005

Soil sampling produced anomalous patterns for copper, lead and zinc which, although displaced down slope due to dispersion, broadly correlated with the metallized pyroclastic zones. Copper values in particular have reinforced the rock chip results to outline a significant copper anomaly.
Results from a magnetometer survey, although somewhat erratic, indicated that a magnetic high zone existed adjacent to the "vent zone" roughly coincident with the geochemical anomalies.

GEOPHYSICS

A VEM survey over the grid produced disappointing results and no continuous conductors were detected.
Scintrex Pty Ltd carried out a gradient array I.P. survey over the entire grid together with Turam over a portion of the grid. The Pole- Dipole I.P. technique was utilized along part of one line only. Results of the I.P. work indicated the existence of a deeply leached surface layer below which occurred an extensive area of disseminated sulphides in which horizons of greater sulphide concentration were included. The Turam technique detected very narrow zones of very high conductivity within a disseminated host.

FUTURE PLANS FOR 1975

In light of the encouraging results obtained from the exploration program, diamond drilling was warranted to test the mineral potential of the area. A multi-holed diamond drilling program was designed of which 3 holes were recommended as an initial phase to test the most promising combinations of geological, geochemical and geophysical data.

At this stage it was apparent that the geological picture required considerable refinement. Better definition of rock units was needed for stratigraphic control. This task of re-mapping the grid area was undertaken during the course of the drilling program.

GENERAL COMMENTS

Re-evaluation of the geology of the Dial Mine grid has resulted in a substantial upgrading of the state of knowledge and appreciation of the significance of the diverse number of volcanic rock types, the formational processes of the volcanic pile and the spatial relationships of potentially mineralized horizons. However as lateral continuity of rock units has been inhibited by such factors as abrupt facies changes, angular unconformities within the volcanolastic units, and persistent submarine mass movement, only a generalised speculative model can be generated to account for the formation and metallogenesis of this volcano-sedimentary environment. The inconclusive nature of the situation is further compounded by the limitations imposed by poor surface exposure and the presence of disruptive transcurrent structures. Although unsuccessful in intersecting significant sulphide mineralization the short drilling program has provided invaluable information on geologic, stratigraphic and structural controls.

005

525006

BRIEF GEOLOGY OF THE DIAL RANGE TROUGH

Within the greater grid area the sedimentary and volcanic rock types identified are considered to be members of a lower un-named unit of the Cateena mudstone group of Lower Cambrian age, which have been deposited unconformably on to the Pre-cambrian basement of an actively deforming basin known as the Dial Range trough. The origin of the volcanics is attributed to the contemporaneous development of a centrally located volcanic arc which has divided the trough into two adjacent subsidiary basins both of which received lavas and volcanic debris. The keratophyric volcanic rocks which form the arc are known as The Lobster Creek Volcanics and these are recognized as the most probable source for the already known minor base metal mineralization within the lower stratigraphic levels of the trough. In particular it is the portion of the Dial Range trough which lies to the west of the Lobster Creek Volcanics which is currently under investigation.

GEOLOGY OF THE DIAL MINE GRID (Refer: Map No.40206, Geology - Dial Mine Grid)

The Dial Range grid covers roughly 1000m x 700m and within this area both mapping and drilling have indicated that a sequence of interbedded sedimentary and volcanic rock types form the western limb of a simple but tightly folded syncline. Rock units within this limb strike to the north-west, face easterly and dip erratically but steeply to the east. Evidence suggests that the axial plane of the syncline has been faulted out and now coincides with a major north-west trending structural lineament which follows Stantons Creek on the east side of the grid. Regional considerations suggest that the compressed syncline may plunge to the south east with the result that the fold can be expected to close to the north-west.

As a result of faulting which both crosscuts and coincides with the general strike direction, the sequence of interbedded sediments and volcanics has been broken up into a series of related blocks. This faulting has effectively destroyed the continuity of the stratigraphic succession across the grid area from west to east as well as disrupting strike continuity of specific rock units.

The block to the west of Revells Creek which is essentially a thick section of sediments containing minor volcanic horizons represents a lower stratigraphic level in the overall volcano-sedimentary pile. The sediments are weakly pyritic and consist dominantly of laminated mudstone/siltstone with narrow intercalations of fine sandstone. Narrow zones of coarser sediments such as sandstones, greywackes, pebble conglomerates and slump breccias, all of which could possibly be tuffaceous, also occur frequently. Due to their weak pyrite content these sediments weather to a variety of fawn, yellow, pink and mauve coloured banded claystones. Hole 2 which was drilled to the west at -60° from location 1400E on section 2200W, penetrated the sedimentary environment of this block at depth after passing through a boundary fault which separates the western block from a central block. The central block contains the thickest development of variably mineralized agglomerates, tuffs and lavas with minor interbedded sediments. Dip angles measured in the core of Hole 2 indicate that the sediments generally dip between 50° & 70° to the east. Facing directions

006

525007

established from graded bedding suggest that small scale, tight folding has occurred adjacent to the fault zone. This folding is probably related to early crumpling or slumping within the deforming basin. However other examples of graded bedding lower in the hole indicate that the facing direction is normal and to the east. Slump breccias and zones of coarse graded sediment occur commonly while erratic dips in the sandstone members indicate crossbedding.
The full extent of the volcanic zone at the edge of the grid in the western block is not known. The volcanic horizon consists of interbedded coarse gossanous tuffaceous agglomerates, lavas and minor tuffs.
The gossanous nature of the coarse pyrocalstics, which is typical of others elsewhere in the grid area, indicates that sulphide existed as pods, veins and as variably sized fragments of former massive and banded sulphide lenses which have been disrupted after deposition by later episodes of explosive volcanism. The accompanying lavas, which range in composition from acid tuffites to soft weathering, more intermediate varieties, occur as massive, flow banded or weakly fragmented units. The lavas contain only minor amounts of metallization.

It is associated with this volcanic zone within the western block that the best lead-zinc soil geochemistry was recorded, which was coincident with a copper anomaly thus suggesting that this environment may be both geochemically and stratigraphically closer to a possible ore horizon.

The central block which is bounded by Revells Creek, Stantons Creek and lines 2000N and 2300N, has the greatest stratigraphic continuity and the thickest section of variously mineralized coarse pyrocalstic units.
Surface mapping and drilling have shown that the stratigraphic section grades upwards from lower members consisting of assorted lapilli tuffs, cherts, intermediate lavas and minor weakly mineralized coarse, tuffaceous agglomerates and tuffites (intersected by Hole 2) into an overlying section dominated by multiple bands of variously metallized coarse tuffaceous agglomerates and lavas interbedded with subordinate amounts of assorted lapilli tuffs and weakly pyritic sediments (intersected in Hole 1) which grades into an upper zone between Sun Dial Road and Stantons Creek containing predominantly sediments with lesser amounts of lapilli tuffs and lavas.
Results from soil sampling indicate that the strongest copper anomaly was associated with the zone of thickest accumulation of coarse pyrocalstics. These coarsely brecciated units contain abundant gossanous pods and veins together with an assortment of rock type fragments which include sediments, cherts, tuffs, lavas together with gossan after sulphide fragments. Many of the chert and lava fragments show evidence of original sulphide now in the form of disseminated limonitic pits. The narrow zone of very coarse gossanous breccia identified by the original mapping as reflecting a close proximity to a possible vent zone was not recognized as such in the drill hole (Hole 1) which was orientated to intersect this environment at depth. Once again the nature of the fragment constituents

007

525008

of the agglomerates and breccias in conjunction with the associated copper anomaly tends to suggest that lower zones of concentrated or massive sulphide with significant base metal content may hve been fragmented by later episodes of volcanism and blasted to higher stratigraphic levels as agglomeratic and tuffaceous material. Both mapping and drilling (Hole 1) have shown the sedimentary units towards the lower stratigraphic levels of the central block to be similar to those in the western block. They consist mainly of weakly pyritic laminated mudstone/siltstone with thin sandy bands and frequent narrow zones of coarser sandstones, greywackes, pebble conglomerates and slump breccias. Pyrite occurs as sporadic cross-cutting veinlets, bedding plane veneers and filaments, disseminations within the narrow sandy bands, and to a lesser extent as disseminations in the coarser sediments. However, this mildly reducing environment appears to suffer a degree of facies change towards the upper stratigraphic levels above the major volcanolastic accumulation where pyrite becomes less common and thick units of light coloured sandstones and un-stained mudstone/siltstones become more frequent. Angle measurements from the bottom of Hole 1 indicate that the sediments dip generally between 50^{o} and 70^{o} to the east. Within the sandstone beds, frequent crossbedding is reflected by erratic dip angles. Many examples of graded bedding established that no overturning of the east facing sediments has occurred.

The eastern fault block which is only partially covered by the eastern extremities of the Dial Range grid is bounded on the western side by a north-west trending fault which has confined Stantons Creek. This fault can be seen as a persistent lineament on aerial photographs and is thought to coincide with the local synclinal axis. Although insufficient mapping has been accomplished to confirm spatial relationships, the eastern block would seem to represnet the uplifted eastern limb of the folded syncline. Subsequent erosion has stripped away all the overlying lateral equivalents of the variously metallized pyrocalstics, lava tuffs and sediments within the central block to reveal a basal section of massive feldspar crystal tuffs. This feldspathic tuff is fine to medium grained with an even texture. Minor quartz occurs in the groundmass and relic hornblende laths can be identified frequently. Weak fracturing and poorly developed quartz veining is common throughout while limonite exists on fractures and as sparse veins. Persistent sericitic alteration accompanies areas where fracturing and limonitic veining is better developed. Although no surface equivalents of this extensively outcropping feldspathic tuff have been recognized within other fault blocks to the west of Stantons Creek, it is possible that the pyritic strongly argillized feldspathic tuff intersected in Hole 2 immediately above the Revells Creek fault may be a prospective correlative.

Within the south-eastern corner of the grid another important but poorly defined fault block has been identified. It is within this section of volcanics, sediments and minor cherts that the old Dial Mine workings and other adits are located. Old records report that one of the Dial Mine adits intersected pyritic mineralization

008

525009

up to 2'6" wide within brecciated "slates and quartzites". Assays of up to 3.2% copper with traces of silver and gold were recorded. Surface mapping has not been able to conclusively define the orientation of the block so that the general strike direction remains indefinite. However, a north-north-east strike indicated by very steeply dipping banded pyritic tuffs and lavas exposed within the Dial Mine adit does tend to confirm vague rock unit trends established from float mapping.

Two separate volcanic horizons have been identified which consist largely of metallized lavas and tuffites with minor associated tuffaceous and agglomeratic components. The general lack of coarse pyroclastic material suggests that these metallized volcanic horizons may represent a much lower stratigraphic environment which has been conducive for the development of massive sulphide bodies. Disruption of those sulphided horizons and the other surrounding rock types provide the probable source for the fragments comprising the coarse pyroclastics which occur at higher stratigraphic levels.

One line 2000N, a small exposure of siliceous fragmental lava (tuffite) containing fresh sulphides was discovered in the bed of Stantons Creek. This metallized lava unit is presumed to be the lowermost of the two zones identified as geological considerations suggest that the interbedded sequence of volcanics and sediments faces to the north-west. The sulphides exist as small pods, fragments and disseminated blebs of pyrite with subordinate amounts of accompanying chalcopyrite. A rock chip sample from the outcrop assayed 2700 ppm copper and very low levels for lead, zinc, silver and gold.

A small area of scattered white chert fragments was noted lying between the two volcanic horizons at the southern end of the block. However, the true stratigraphic relationship is not known. The volcanics and chert are contained within a sedimentary sequence which is dominated by laminated siltstone/mudstone. Lesser amounts of coarser sandstone, greywacke, pebble conglomerate and lapilli tuffs occur both above and below the volcanic zones. The presence of minor pyrite in the sediments has produced a general weak iron-staining, while thin conformable gossanous bands were noted in fine sediments on line 1900N between the chert occurrence and Stantons Creek.

At the northern end of the grid, a northern fault block is separated from the central block by an east-west structural break. Despite very poor exposure, float mapping has indicated that the block is comprized of agglomerates, tuffs, lavas and sediments comparable to those adjacent in the central block. In general, the volcano-sedimentary environment represented by the two block appears to be similar although the strike continuity of specific rock units is broken by the crosscutting structure. Both the thickness and the frequency of the coarse gossanous pyroclastic units in this northern block decrease to the north west where thicker sections of lavas and tuffs have developed instead. In addition results from initial rock chip geochemistry indicate that the base metal content of these mineralized pyroclastics also dies off to the north-west.

003

525010

A similar east-west crosscutting fault at the southern end of the grid has truncated the strike extension of the coarse pyroclastic units within the central block. In contrast to the central block, the environment to the south is predominantly sedimentary and lacks volcanic components. These sediments appear identical in many respects to those observed to the north and west. Similar discolouration suggests a weak pyrite content.

DRILLING

The correlation of geochemical and geophysical anomalies with favourable geology led to the identification of priority rated target areas which warranted evaluation by drilling. Initially 3 holes were proposed to test the base metal potential of the best target zones. However due to an unexpected deep level of oxidation no sulphide mineralization was encountered in the target horizons intersected. In addition the deep weathering created drilling problems which resulted in excessive core loss from the oxidized zone.

In view of the disappointing results which emerged, the drilling was terminated after the completion of the second hole.
It became apparent that considerable revision and redesigning of the drilling program was needed in order to test the target horizons effectively.
Associated Diamond Drillers performed the work using a trailer mounted Mindrill F30 rig which utilized HQ, NQ and BQ wire line coring equipment.
All the sections of the core that were split were assayed for copper, lead, zinc, silver and gold by Robertson Research of Bowral, N.S.W.

Hole 1 (Refer Map No. 40207 - Drill log - Dial Range No.1)

Location - This hole was drilled on section to the west at an angle of -50° from grid location 2100N 1650E.

Description - The hole was intended to test the base metal potential of a thick section of east dipping gossanous coarse agglomerates, lavas and tuffs which included a narrow zone of very coarse breccia, recognized as a possible "vent breccia". Associated with this pyroclastic zone were certain encouraging geophysical and geochemical responses.

Geophysics - The gradient array I.P. survey indicated an underlying strong but limited chargeability high accompanied by a resistivity low around 1575- 1600E. A less intense chargeability high occurred between 1675 - 1700E.
The Turam survey defined a weak conductor below grid position 1612.5E

010

525011

while a multiple source was indicated further west between 1400 - 1450E. The geophysical anomalies were interpreted as responding from varying concentrations of sulphides.

Geochemistry - The highest copper-in-soil anomaly (peak 1000 ppm) was related to the gossanous pyroclastic zone. The copper anomaly was also supported by a low order lead zone together with anomalous mercury values. One rock chip sample taken from a massive hematitic gossan within the coarse pyroclastics assayed 5500 ppm copper.

Geology & Mineralization

Between 0 and 100.95m Hole 1 penetrated a section of essentially volcanic rock types which are dominated by at least 8 discrete zones of coarse tuffaceous agglomerate.
Other volcanic rocks of lesser abundance include lavas, tuffites, cherts, lithic tuffs and lapilli tuffs. The volcanic horizons are separated by a narrow sedimentary and volcano-sedimentary members. The presence of narrow gossans, limonitic pods, vughs and pores within the agglomerates indicates that while a portion of the original sulphide may have been syngenetic, a significant part of it was a fragmental form. Sulphide mineralization has been irregularly distributed both within and between the agglomeratic zones. Massive gossans are infrequent with the thickest reaching only 30cms in width.
The level of total oxidation extended to a depth of 85m down hole. Below 85m weak concentrations of pyrite occur as sporadic disseminations, sparse crosscutting veins and fracture veneers within lithic and lapilli tuffs, lavas and sediments. Only a very thin veneer of chalcocite has developed on the pyrite grains and veins. The low order residual levels of copper reflected in the assays from the gossanous agglomerates indicate that only low grade primary copper mineralization can be expected in these zones. Lead, zinc, silver and gold results were not significant.

Between 100.95m and 145.95m the hole entered a weakly pyritic sedimentary sequence which is typified by laminated mudstones and siltstones with thin intercalations of sandstone. Restricted zones of coarser sediments which grade from sandstones to greywackes, conglomerates and slump breccias occur intermittently. Several minor zones of coarse pyroclastics and lavas are interbedded with the sediments. The sediments contain persistent weak pyrite without any recognisable base metal associations. The pyrite is noticeable as isolated crosscutting veinlets, fine disseminations in the coarser sandy sediments, and as thin bedding plane veneers in the mudstones. Minor visible blebs of chalcopyrite are recognisable in several pyrite veins at the bottom of the hole. This was confirmed by an assay result of 700 ppm copper.
The measurement of innumerable bedding angles indicated that the sediments dip between 60° and 75° to the east. Identification of graded bedding within the fine grained sediments confirmed a normal facing direction to the east.

011

525012

Conclusions

Despite the fact that narrow gossans and gossanous zones where intersected within the coarse pyroclastics no correlation could be made between these zones and the geophysical anomalies. The hole was successful in establishing both the stratigraphic significance of the coarse pyroclastics within the volcanic pile and the style of the sulphide mineralization contained within them. Sulphide has occurred both in syngenetic form as pods and disseminations and as fragments disrupted from a lower stratigraphic source. It is considered unlikely that more concentrated sulphide masses will occur in the coarse pyroclastic horizons. However it is postulated that massive lenses of sulphide mineralization may have accumulated in more favourable environments at lower stratigraphic levels. A considerable thickening of the weakly mineralized coarse pyroclastic wedge towards the volcanic vent may provide potential for a bulk low grade copper ore body. Also small higher grade sulphide lenses could be expected as flank deposits in this environment.

Hole 2 (Refer: Map No. 40208; Drill log - Dial Range No.2)

Location:
This hole was drilled on section to the West at an angle of -60° from grid location 2200N 1400E.

Target Description:
The hole was intended to test the source of several significant IP and EM anomalies which were underlying an area of strong copper and weaker lead and mercury geochemical anomalies. However no geological explanation could be presented for these phenomenon as the zone occupied by the various anomalies coincided with a creek valley the slopes of which were covered in soil and talus.

Geophysics
The gradient array I.P. survey established an anomalous zone at 1275-1425E. The Turam survey defined associated conductors at locations 1362E and 1438E.

Geochemistry
A strong copper-in-soil zone (high 530 ppm) was located between 1375-1575E which was supported by a lead peak of 90 ppm. An additional weaker copper (peak 340ppm) and lead (peak 90 ppm) occurred further east around 1200E. This anomalous soil geochemistry was associated with coarse gossanous pyroclastics and lavas which were expected to dip steeply east. Mercury peaks correlated with the copper anomalies but were usually displaced roughly 25m uphill from the copper.

Geology & Mineralization

Between 0 and 11.00m Hole 2 penetrated an intermediate lava which was generally massive with sections of flow banding. Occassionally the flow bands have interbedded limonitic laminae.

From 11.00m to 13.00m gossanous, leached, coarse tuffaceous agglomerate was intersected which contains one narrow massive porous gossan between 11.10m and 11.55m. The coarse agglomerate is similar in most respects to those seen in Hole 1. The general

012

525013

gossanous nature indicates that sulphide had occurred originally as small syngenetic pods, disseminations, and as fragments. An assay result of 1000 ppm for the whole section suggests that only minor copper mineralization had been present of which most was probably confined to a narrow zone now occupied by massive honeycomb gossan. In addtion the coarse agglomerates contain several thin chert bands which displayed disseminated limonitic pitting.
Results for lead, zinc, silver and gold were non-significant.

Between 13.10m and 44.17m very high core loss occurred. The core recovered consisted mainly of plugs of massive clay and sandy clay separated by nine zones of chert pebbles. The clays are the weathering products of tuffs, lavas and tuffaceous sediments. Most of the chert is white or grey and is generally massive. Minor banding occurs. However in a few sections the chert pebbles are limonitic and iron-stained.

From 44.17m - 46.40m a weakly gossanous band of tuffaceous agglomerate was encountered which contains minor interbedded narrow siliceous gossanous pods.
A residual copper result of 1650 ppm indicates that minor mineralization had occurred originally with pyritic sulphides. No significant results were obtained for lead, zinc, silver and gold.

Between 46.40m and 58.60m strongly kaolinized, weakly pyritic crystal and lithic tuff predominate. The tuff section grades down from medium grained quartz crystal tuff through finer grained quartz crystal lithic tuff with chloritized mafics to medium grained quartz crystal lithic tuffs with interbeds of mudstone/siltstone and greywacke. The degree of kaolinization increases towards the base of the tuff section where a zone of pugh indicates a fault. The fault separates the overlying collection of pyroclastics, lavas and cherts from a sedimentary environment below.
The base of oxidation extends down to 47.40m. Between 47.40m and the fault zone at 58.60m, sparse pyritic quartz veins and very fine disseminations of pyrite occur in the tuffs.
The extensive kaolinization of the tuff section is attributed to acid leaching effects associated with the base of oxidation and the fault zone.
No significant values for copper, lead, zinc, silver and gold were obtained from the tuffs.

From 58.60m down to the bottom of the hole at 115.062m only sedimentary rocks were intersected. The sediments consist predominantly of laminated mudstone/siltstone with thin intercalations of sandstones. These finer sediments are interbedded with frequent narrow zones of graded coarser sediments such as sandstones, greywackes, conglomerates, and occassional slump breccias.
The sediments contain very low concentrations of pyrite which is seen most commonly as sporadic cross-cutting veins, minor fine disseminations in coarser sandy bands, and as infrequent bedding plane veneers in the mudstones.

013

525014

Traces of chalcopyrite occurs in occasional pyrite veins. Assay results from the sediments generally indicate background values for copper, lead, zinc, silver and gold although isolated high results up to 520 ppm for copper reflect the presence of minor chalcopyrite.

Examination of bedding angles and grading within the sediments reveals that small scale tight folding has occurred immediately below the fault zone. However towards the bottom of the hole folding is absent and the sediment have an east facing with dips 50^{o} - 70^{o} to the east. Erratic dips within the sandstone members indicates that crossbedding is common.

Although they appear very similar the section of sediments intersected in Hole 2 contain lower concentrations and less persistent pyrite than the sedimentary section encountered in Hole 1.

Conclusions

As for Hole 1, no obvious sources were located by the drilling to explain both the geophysical anomalies and the geochemical anomalies. However, important geological stratigraphic and structural relationships were established. Although of uncertain significance the volcanic environment explored by the hole appears more favourable for massive sulphide development than that seen in Hole 1. The volcanic section is stratigraphically lower in the volcanic pile and the reduction in quantity of the coarse pyroclastics in favour of the presence of fine tuffs, lavas and cherts indicates a more quiescent environment in which massive sulphide lenses could develop.

THE MODEL

In order to formulate a tentative model for the volcano-sedimentary environment identified in the Dial mine grid area it is necessary to envisage the development of a narrow south-east trending trough adjacent to the western edge of an active volcanic arc. This actively deforming trough was subsequently infilled by an interbedded diversity of pyroclastics, lavas and sediments. Lateral tectonic processes tightly folded or compressed the sequence so that a synclinal axis coincided with the most probable location of the original trough axis or basin low.

Within the context of this trough environment it is assumed that the most favourable location for the development of stratiform massive sulphide bodies of the volcanogenic style would be within restricted basin lows associated with volcano-sedimentary rock types deposited at low stratigraphic levels during the initial phases of volcanism. It is also envisaged that massive sulphide bodies may develop as flank deposits within thickening sections of coarse pyroclastic or lava host rocks closely adjacent to the volcanic source or vent system at various stratigraphic levels within the pile.

014

525015

In terms of an actual model, geological evaluation of the Dial Mine grid has shown that the grid mostly straddles a portion of the western limb of the synclinal structure which is thought to coincide with the original basin deep or axis. Continuing tectonism throughout the deformed trough resulted in disruption to the symmetry of the syncline which acquired a plunge to the south-east and locally within the grid area the presumed axis was replaced by an axial plane fault which now confines Stantons Creek. In addition the stratigraphic continuity of both limbs of the syncline has been disrupted to such an extent by block faulting that adjacent blocks now reveal volcano-sedimentary sections representing a variety of depositional environments due to their origin from different stratigraphic levels within the original trough. Identification of this configuration and the spatial relationships between fault blocks has enabled the location of those geological environments considered more favourable for the development of volcanogenic style massive sulphide bodies to be predicted both within and around the Dial Mine grid area.

CONCLUSIONS & RECOMMENDATIONS

When the geological picture of the Dial Mine grid area and the surrounds are reviewed in light of the postulated model a number of highly prospective environments can be readily identified which warrant continued exploration by geological, geochemical and geophysical methods. The environment where massive sulphide bodies form in basinal lows is identified with the keel region of the syncline while the other environment where massive sulphides occur as flank deposits is best provided on the eastern limb of the syncline close to the volcanic centre which is assumed to be in the vicinity of the Lobster Creek volcanics to the east of the grid area.

Those environments recommended for additional exploration are:-

1. The Dial Mine fault block where pods and disseminations of cupriferous pyrite occur associated with basal volcanic horizons, cherts and sediments.

2. To the north-west of the Dial Mine grid in the keel region of the syncline where the lowermost stratigraphic rock units are presumed to close.

3. The eastern limb of the syncline between the axis (Stantons Creek) and the Lobster Creek volcanics both within the grid and to the north-west where pods of pyritic sulphides associated with pyroclastic rocks are known (Keddies Mine).

In view of the difficult nature of the terrain and the general lack of useful rock exposure it is recommended that the airborne E.M. technique of Turair be conducted along close spaced traverse lines over the environments outlined in an effort to expedite the discovery of near surface sulphide bodies which can then be evaluated on the ground by more comprehensive geological mapping, geochemical sampling and geophysical surveying.

015

525016

In recognition of the favourable environment provided by the Dial range trough the survey should be extended to cover all the Lower Cateena sediments stratigraphically below the Kerrison volcanics both to the west and the east of the Lobster Creek volcanics within the Exploration Licence area.

TASM. MINES DEPT.

• MADE IN BRITAIN •

1200E 1300E 1400E 1500E 1600E 1700E 1800E 1900E 2000E 2100E 2200E 2300E

2500N
2400N
2300N
2200N
2100N
2000N
1900N

T.N. M.N.
12°17'

LEGEND

GEOLOGY

- Tuffaceous Agglomerate - coarsely fragmental with angular rock fragments ranging up to 1 metre diameter, rock types as in fragments: andesite, dacite, acid tuffs, mudstone, sandstone, chert, rhyolite in tuffaceous matrix. Variably recrystallised. Some units barren, fumarolic, pyritic and base metal mineralised. Locally intruded by porphyritic andesite dykes.
- Lavas - mostly siliceous acid lavas (+ fine grained) Tuffs and minor intermediate fine grained lavas. Many devitrified and well weathered. Many show flow banding and minor fragmental matrix. Lithophysae are common. Rhyolite, minor dacite. Intrusive equivalents common.
- Tuffs - Lithic tuffs, lapilli tuffs and ash tuffs. mostly bedded, some massive.
- Feldspathic crystal Tuff - Feldspar crystal tuff and quartz feldspar crystal tuff generally fine to medium grained and well fractured. Relic hornblende laths common. Tuffs are massive and weakly flattened in places with minor fumarolic quartz veins. Weathered sericitic alteration where fractured and fracturing stronger.
- Tuffaceous Sediments
- Clay - decomposed fine grained Tuffs and lavas. Sometimes relic banding.
- Chert
- Mudstone/Siltstone - laminated mudstone and siltstone with minor narrow Sandstone bands. Includes narrow zones of coarser grained sediment such as conglomerate, greywacke, pebble conglomerate. Weathers pink, mauve, ochre, yellow due to minor pyritic content.
- Sandstone
- Coarse Sediments - coarse sandstone, greywacke, pebble conglomerate and slump breccias

MINERALISATION

- Narrow massive gossan. (after Sulphide lenses)
- Gossanous zones (after 1-10 Vol% Sulphide as small pods, stringers, fragments and dissemminations)

STRUCTURE

- Faults - mostly interpreted from airphotos
- 50° Dip
- 330° Strike

Creeks — Access Tracks — DIAL RANGE N°1 (-50°) DIAMOND DRILL HOLE

5 cm

PENNZOIL OF AUSTRALIA LIMITED SUBSIDIARY OF DUVAL CORPORATION			COUNTRY: Australia
EL 24/73 DIAL RANGE			STATE: Tasmania
TYPE: GEOLOGY - DIAL MINE GRID			LATITUDE: 41°10'S
			LONGITUDE: 146°02'E
DATA BY: J.M.G.	DRAWN BY: J.M.G.	DATE: May '75	MAP No.: 40206
Scale: 1cm. = 25 metres			PLATE No.:

75-1094 TAS. MINES DEPT. 070

4105027

LEGEND

GEOLOGY

TUFFACEOUS AGGLOMERATE – coarsely fragmental with local rock fragments ranging up to 5cms. Fragmental rock mainly chert, tuff & lava, but also mudstone & rare to siltstone, in a siliceous tuffaceous matrix. Variably poorly sorted, silicified with limonitic casts and pores indicating original sulphide content generally 1-10 Vol.% Sulphide occurs as small lenses & pods, fragments, narrow veins & stringers, blebs and fine disseminations.

TUFF – Includes lithic tuff, lapilli tuff and ash tuff. Mostly bedded, some massive.

LAVA – Includes siliceous acid lavas (fine grained), Tuffite, minor intermediate, fine grained lavas, devitrified lavas and fine grained welded tuffs. Some lavas show flow banding and a weak fragmental texture, others are massive. Often thin limonitic laminae indicating trace amount of sulphide.

CLAY – mostly after decomposed tuffs and lavas.

MUDSTONE / SILTSTONE – Laminated mudstone and siltstone with narrow interbeddings of sandstone. Minor narrow zones of coarser grained sediments. Often contains weak pyrite & traces of chalcopyrite and thin veins and sooty black fractures. Rare dolomitic beds or sandy beds.

Coarse sandstone, greywacke, pebble conglomerate and slump breccia. Traces of pyrite in veins and as disseminations in sandstones.

MINERALISATION

Massive Sulphide (Massive gossan)

1 – 10 Vol.% Sulphide (Strongly limonitic gossanous)

< 1 Vol.% Sulphide (Weakly limonitic)

COORDINATES : 2100N 1650E
COLLAR ELEVATION :
BEARING : 270°T (GRID WEST)
INCLINATION : -50° (ACID TEST AT HOLE END -60°)
TOTAL DEPTH : 145.95 metres
STARTED : 24-2-75 COMPLETED : 19-3-75
DRILLED BY : ASSOCIATED DIAMOND DRILLERS

525018

5 cm

1800E

75-109h

PENNZOIL OF AUSTRALIA LIMITED SUBSIDIARY OF DUVAL CORPORATION	COUNTRY. Australia
E.L. 24/73 DIAL RANGE	STATE. Tasmania
TYPE DRILL LOG – DIAL RANGE No 1 ON SECTION 2100N	LATITUDE. 41° 10' S
DATA BY J.M.G. / DRAWN BY J.M.G. / DATE 15-5-75	LONGITUDE. 146° 02' E
Centimeters 1 2 3 4 5 6 7 8 9 Centimeters / metres 0 10 20 30 40 50 60 70 80 90 100 metres	MAP No. 40,207
	PLATE No.

TAS. MINES DEPT

071

COORDINATES : 2200N 1400E
COLLAR ELEVATION :
BEARING : 270°T (GRIDWEST)
INCLINATION : -60° (ACID TEST AT HOLE END -62°)
TOTAL DEPTH : 115.062 metres.
STARTED : 24-3-75 COMPLETED : 9-4-75
DRILLED BY : ASSOCIATED DIAMOND DRILLERS.

LEGEND

GEOLOGY

TUFFACEOUS AGGLOMERATE – Coarsely fragmental with most rock fragments ranging up to 5cm. Fragment types include chert, tuffite, lava, tuff and siltstone. Set in a siliceous tuffaceous matrix, variably gossanous when clouded with limonitic casts and veins indicating original sulphide content generally <10 Vol%. Sulphide occurs as small lenses and pods, fragments, narrow veins, beds and fine disseminations.

TUFF – Includes lithic tuff, lapilli tuff and ash tuff. Mostly bedded, some massive.

LAVAS – Includes siliceous acid lavas, tuffite, minor intermediate lavas, devitrified lavas and fine grained welded tuffs. Some lavas show flow banding and a weak fragmental nature, others are massive.

CLAY – often decomposed tuffs and lavas

CHERT

SILTSTONE/MUDSTONE – Laminated siltstone and mudstone with narrow interpolations of sandstone, minor narrow zones of coarser graded sediments such as sandstone, greywacke, pebble conglomerates and occasional slump breccia. Weakly pyritic with traces of chalcopyrite (in core)

Coarse sandstone, greywacke, pebble conglomerate, and slump breccia. Trace pyrite (in core)

MINERALISATION

Massive Sulphide (Massive gossan)

1-10 Vol.% Sulphide (strongly limonitic/gossanous)

< 1 Vol% Sulphide (weakly limonitic)

525019

5 cm

1200E 1250E 1300E 1350E 1400E 1450E 1500E 1550E 1600E

75-1094

PENNZOIL OF AUSTRALIA LIMITED SUBSIDIARY OF DUVAL CORPORATION	COUNTRY. Australia
EL 24/73 DIAL RANGE	STATE. Tasmania
TYPE DRILLLOG - DIAL RANGE N°2 ON SECTION 2200N	LATITUDE 41°10'S
DATA BY J.M.G. / DRAWN BY J.M.G. / DATE 26-5-75	LONGITUDE 146°02'E
Centimeters 1 2 3 4 5 6 7 8 9 Centimeters metres 0 5 10 15 20 25 30 35 40 metres	MAP No. 40,208
	PLATE No.

072 TAS. MINES DEPT