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COMMONWEALTH ALUMINIUM CORPORATION LIMITED

E.L. 7/74 TASMANIA

REPORT ON ALL INVESTIGATIONS

TIN SPUR - OLIVERS HILL - DEVONIAN AREAS

OPEN FILE

P.W. ASKINS.
MAY, 1980.

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1. INTRODUCTION

E.L. 7/74 was first granted on 18th July, 1974. On 29th October, 1974 an additional 9km² in the Moina area previously held as reserve by the Mines Department, was incorporated in the licence. On 1st November, 1976 an additional 80km² was added to the E.L. to cover further limestone areas in the Mayberry area. Also on 1st November, 1976 an additional 18km² in the Oliver's Hill area was released from Mines Department Reserve (SR 1976 No. 39) and incorporated in the E.L. At the renewal date of 18th July, 1979 the previous area of 488km² was reduced to 405km² by relinquishing an area east of Mayberry and a small area of overlap of the National Park in the south west of the licence area. The present E.L. boundary is as shown on Fig. 2.

The Exploration Licence was transferred from Comalco Ltd. to Commonwealth Aluminium Corporation Ltd., early in 1979.

This report covers work done in a search for Sn, W, Au, Ag, Pb, Zn mineralization in the areas around Tin Spur and Oliver's Hill, shown on Figs. 1 and 2. This area is broadly coincident with the former Mines Department Reserve. Other areas of E.L. 7/74 have been dealt with in separate reports.

A joint venture with the Shell Company of Australia Ltd. presently covers all of E.L. 7/74 except for this area. It is now proposed to offer this area for farm-out.

A precise definition of the area is all that areas, enclosed with the grid co-ordinates:

commencing at NW corner: 428 355mE, 5406 000mN.

thence E to: 432 000mE, 5406 000mN.

thence S to: 432 000mE, 5403 000mN.

thence W to: 428 390mE, 5403 000mN.

thence generally N to point of commencement.

2. WORK DONE BY PREVIOUS INVESTIGATORS

Detailed investigations including geological mapping, sampling, geochemical and geophysical surveys and diamond drilling have been carried out by the Mt. Lyell Mining and Railway Co. Ltd. (in their E.L. 8/65), (Dandy, 1970; Omnes, 1970; McKibben, 1971, 1972) and by the Department of Mines (Jennings, 1958, 1963, Baker, 1971, Leaman, 1974). Old investigations are by Twelvetrees (1913) and Reid (1919). Copies of the relevant parts of all these reports are in Appendix 1.

Previous work was directed towards evaluating for its Pb - Zn potential a zone of outcrops of "ferromanganese" gossan extending for about 2km on the northern slopes of Oliver's Hill. Sampling of the gossan gave erratic values up to 8.8% Pb and 600 ppm Ag; soil sampling outlined a distinctly anomalous zone with values over 500 ppm and exceeding 1700 ppm in places; but diamond drilling failed to locate any unweathered base metal mineralization, and it was concluded that the mineralization persisted to only shallow depths.

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3. WORK DONE BY COMMONWEALTH ALUMINIUM CORPORATION LTD.

The Commonwealth Aluminium Corporation Ltd's investigations were directed initially to assessing the potential for Sn, W mineralization. Initial samples of the gossans and adjacent rocks from the area showed that some of the gossan and limonitic sandstone at the Tin Spur end of the line of gossans contained over 1000 ppm Sn, whereas at the Devonian Mine end Sn values were uniformly low. Jennings (1958) thought that the area near the Falls Mine had some potential for Sn mineralization in the flat lying fault and/or unconformity between Moina sandstone and the underlying Cambrian "porphyry". It was therefore decided in late 1979 to grid the area between the Falls Mine and the Tin Spur gossan in order to evaluate two possible styles of Sn mineralization, namely (a) an altered fractured fault/unconformity zone below a cap rock of Moina sandstone, and (b) associated with the gossans which were thought to be weathered pyritic sandstone beds containing galena/sphalerite/cassiterite in a fractured zone above the Dolcoath Granite.

Subsequently another grid, the Devonian Grid, was constructed in order to further evaluate the Au mineralization around the Devonian Mine and the adjacent Pb rich gossans which had been drilled by the Mines Department and Mt. Lyell.

Details of all investigations are covered below.

4. REGIONAL GEOLOGY

The regional geology is adequately covered on the Mines Department "Sheffield" and "Middlesex" one inch to one mile sheets. Fig. 3 (from Baker, 1971) shows the geological setting. Full details of the regional geology are in Jennings (1958, 1963). (See Appendix 1). Other aspects of the regional geology are in Askins (1980).

The oldest rocks are Cambrian "porphyries", probably welded tuffs. These are overlain by Ordovician Roland Conglomerate of greatly variable thickness (only a metre or so at Tin Spur, yet a few km distant more than 300m at Mt. Roland and Mt. Claude) and then Ordovician Moina sandstone which in places is characterized by the abundance of "tubicoles" - worm burrows. The Moina sandstone is the host rock for most of the mineralization investigated in this area.

There is a prominent NW fold-fracture system in the area - here called the Cethana fracture zone - it is popularly stated that this fracture system is Tabberabberan in age (ie M. Devonian) but I believe that the system commenced at the end of the Cambrian, corresponding closely to the end of volcanicity. NW trending grabens developed into which the Roland Conglomerate was deposited as a (?) continental conglomerate; the widespread presence of hematite in the conglomerate is evidence of deposition in an oxidizing environment. Much of the Moina sandstone is however, very pyritic. Some of the pyrite is clearly syngenetic, occurring as framboid rich beds.

The Devonian Dolcoath granite was emplaced into this fracture system. The known tin, tungsten, mineralization of the area is directly related to the granite. Lead-zinc-copper-gold deposits in the area may be remobilized from Cambrian volcanogenic deposits beneath - the granite may merely have

acted as a heat source.

The surface extent of the Dolcoath granite is small, but gravity data shows that there is a large sub-surface batholith. The granite crops out in the Forth River valley less than 1 km from the gossans on Tin Spur.

The granite has a distinct gross E-W trend and also lies in the NW Cethana fracture zone, suggesting that the granite has been localized at the intersection of the Cethana fracture zone and an E-W trending system.

Tin-tungsten mineralization of the district has a pronounced E-W trend from Stormont to Tin Spur. This is interpreted to be due to a shallow E-W trending granite cusp.

5. TIN SPUR GRID

A. GENERAL

Both this grid area and the Devonian Grid lie on Crown Land so no landholders were notified. However the track into the area comes off the Cockatoo Road (Lorinna Road) on Cockatoo Ridge where there is a locked gate on leasehold land held by a Mr. E.M. Febey (of Claude Road, phone 91.1375).

B. GRIDDING

A grid was placed over the area on contract by Poltock Bros. with minor extensions by our staff. The gridded area of about 0.6km^2 covers Tin Spur from the Falls Mine south east to Mines Department drill hole OH 6 (=DOM6). The grid was not extended further south east over the main Pb bearing gossanous areas on the flanks of Oliver's Hill because these areas contain no tin (on the basis of surface and core samples). A separate grid covering part of this Pb bearing gossanous area and the old Devonian gold mine was constructed later (see "Devonian Grid" section of this report).

The grid consists of SE trending lines spaced 100m apart with pegs every 50m, with all distances corrected for the steep slopes. Grid line slopes are recorded on plan TAS-79-310.

C. SURVEYING

The boundary between E.L. 7/74 and CRAE's E.L.7/73 is very close to the Tin Spur grid. The exact position of the boundary (defined on a metric grid basis) was located on the ground by K.R. Michell, Authorised Surveyor. The boundary

is shown on the geological map of Tin Spur (plan TAS-80-334) and on Fig. 4.

D. GEOLOGICAL MAPPING

Geological mapping was completed at a scale of 1:2500 over the gridded area by R. Poltock on contract. The plan, with amendments by P.W. Askins is TAS-80-334.

Notes on the geology by R. Poltock are Appendix 2.

E. SOIL SAMPLING

Bedrock samples were collected every 25m along the grid lines, using a hand auger where necessary. In most areas soil is less than 30cm deep.

Samples were sieved to -20 mesh instead of -80 mesh, (in order to prevent loss of discreet grains of cassiterite/wolframite), and analysed by Comlabs, Adelaide for Sn, W, Pb, Zn, Cu. Samples from one line, 800S, near known gold mineralization in trench 2 (see below), were also analysed for Au, but since only one sample was anomalous, 0.25 ppm, and the remainder all less than the detection limit of 0.05 ppm, Au analyses were not carried out for the remainder of the grid.

The analyses are plotted on plan TAS-80-311 and contours for Sn, Pb, Zn and Cu are plans TAS-80-330, 331, 332, 333.

Very distinct partially overlapping Pb and Sn anomalies occur. The Pb anomaly is associated with the gossan in the SE of the grid whereas the Sn anomalous area is close to the Razorback on Tin Spur, in Moina Sandstone and for the most part in a silicified or leached fracture zone up to 200m wide(?)

trending NW and dipping about 50° SW. The main part of the Sn anomaly, with values above 300 ppm, is over 600m long; values exceed 750 ppm in several places. Lead values in the main part of the anomaly exceed 800 ppm, though values of more than 2000 ppm are common and peak value is 9600 ppm. A zinc anomaly is broadly coincident with the Pb anomaly. A weak copper anomaly is also broadly coincident with the Pb and Zn anomalies, but there is a weak copper anomaly in the south west of the grid, possibly corresponding to a higher background Cu content of Cambrian "porphyry". The Cu, Pb and Zn anomalies also tail away to the north and then into Tin Spur Creek; this is presumably due to simple movement of gossany material downslope. Tungsten values are uniformly low.

F. ROCK SAMPLING

Samples of rocks from outcrops, old trenches and dumps were collected and analysed by Amdel and Comlabs chiefly for Sn, W and Au. All results are tabulated in Appendix 3 and are plotted on the geological plan TAS-80-334. W contents are all nearly negligible (<180 ppm), but Sn ranges from 6 ppm up to 4.3% (over a width of about 1m, in highly fractured originally pyritic, now limonitic quartzite). Gold occurs in significant quantity in some samples, up to 1.40 ppm, but overall around 0.1 ppm or less.

A suite of samples was collected in the Griffin and Richards adits on the SW slopes of the razorback, and sent to Comlabs for Sn, W, Au, Ag analyses. Samples were collected in or adjacent to a fractured faulted pyritic zone in Moina sandstone, striking NW and dipping SW, about one metre wide.

The geology location of samples and analyses are in Appendix 4.

For the lower cross cut, samples collected in the fracture zone over an exposed 15m length range up to 1.15% Sn and average 1420 ppm Sn. Au ranges up to 2 ppm (with one isolated high value of 15 ppm) and averages 0.2 ppm Au (not including the 15 ppm value). Ag values range up to 46 ppm and average 11 ppm, and W does not exceed 85 ppm in any samples.

For the upper cross cut, samples collected in the fracture zone over an exposed 9 metres range up to 1.35% Sn and average 3600 ppm Sn. Au ranges up to 0.25 ppm and averages about 0.05 ppm. Ag ranges up to 26 ppm and averages 8 ppm, and W is again very low.

TRENCHING

Two backhoe trenches dug to bedrock (at 0.5m depth) were dug within the tin-anomalous zone. Continuous rock chip samples were collected every 0.5m on the floor of the trenches and samples were analysed for Sn, Au by Comlabs.

Trench 1, (near 500S/450W), all in Moina sandstone, has only relatively low values of Sn and Au. Sn ranges up to 600 ppm and averages 210 ppm and Au ranges up to only 0.25 ppm and averages 0.08 ppm, over a continuous length of 22.5m. Data is plotted in Appendix 5.

Trench 2, (near 850S/450W and near the old Thomas shaft), however, intersected some relatively high values, for example:

Metreage, proceeding SW:	Average ppm:	Highest value ppm:
0 - 2.0	Sn 2600	3650
4.5 - 7.0	Sn 2870	6050
9.0 - 10.5	Sn 2480	5150
20.0 - 24.5	Sn 2660	4200
46.0 - 48.0	Sn 2760	4450
61.0 - 62.0	Sn 2100	2200
24.0 - 57.5	Au 1.1	8.1

Confirmatory check analyses were run by Comlabs and by Amdel, as detailed in Appendix 5.

Trench 2 is entirely in Moina sandstone, some originally very pyritic (but weathered and limonitic at the surface), some now a hard quartzite and some soft and porous. Sn occurs as very fine black cassiterite on joints in the quartzites, and disseminated in the porous sandstone. The nature of the Au is unknown.

A suite of samples was re-collected from Trench 2, namely 0 - 0.5 etc. to 11.5; 18.5 - 19 etc to 62.0; and 69.0 - 69.5 etc to 77.5. These were to be analysed as a check against the first samples but this has not been done; the samples are stored in Devonport.

There is a possibility that some of the high Au and Sn values are caused by fine gold and cassiterite which has concentrated in the soil profile and lodged in joints over the top several cm of weathered bedrock. To check this possibility and avoid sampling errors caused by this in the future deeper trenches should be constructed with a Poclair type digger and samples collected at least 0.5 metres below the present samples.

G. PETROGRAPHIC WORK

Initial samples sent to W. Fander for petrographic work show that the sandstone in places has been recrystallized and metasomatized, with development of topaz, (which is not visible in hand specimens). See copy of report CMS/79/12/47 in Appendix 6.

Samples from Trench 2 were sent to W. Fander to assess the nature and distribution of tin and gold in the sandstones. The sandstones were either leached, porous and sheared, or hard, quartzitic; all contain topaz. Cassiterite disseminated in

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the leached sandstone was found to be very fine grained, 10 μm to 30 μm in size; in the quartzite cassiterite occurs in quartz veinlets or on fractures and is also fine, from 5 to 150 μm , with clusters to 250 μm .

Two samples TS 21 and 22 from areas in the trench had analyses of 3.5 and 0.6 to 4.8 ppm Au (and 2300 and 120 ppm Sn respectively) but no gold could be found in the samples so the nature of the Au mineralization in the sandstones/quartzites remains unknown. Two samples of spoil from the trench where the high Au values occur were carefully panned down, with the aid of detergent so as not to lose fine flaky gold, but no gold was recovered. This suggests that either gold is very spotty and was not present in the panned samples, or the gold is so fine grained that it cannot be recovered in a dish.

H. GROUND MAGNETICS SURVEY

Readings every 25m along 50 metre spaced lines were taken with a Geometrics G816 proton precession magnetometer mounted on a 3m high pole. All readings were corrected for diurnal drift using a base station magnetometer.

Data is on plan TAS-79-312 and contours on plan TAS-79-315.

There is a magnetically active area over the basalt, but elsewhere there is low magnetic relief and the data have not yet aided interpretation of geology or structure.

I. ELECTRICAL INDUCED POLARISATION SURVEY

An E.I.P. gradient array survey was carried out by our personnel using a Scintrex 3.5kw time domain transmitter and IPR7 receiver. A 25 metre receiving dipole was used with the

distance between stations being 25 metres. Each 100m grid line was surveyed.

Data was recorded and processed on field cards and profiles of resistivity and chargeability plotted. Resistivity profiles and chargeability profiles are plans TAS-79-322, 321, and contours are on plans TAS-80-335, 336.

There are very distinct NW trending highs and lows in both the resistivity and the chargeability. The two main tin anomalous zones correspond to resistivity highs and chargeability lows - this is consistent with their being altered fractured zones, silicified and relatively depleted in pyrite compared to the adjacent sometimes pyrite rich sandstones.

The resistivity and chargeability data will doubtless assist in geological interpretation of the area if further detailed investigations are carried out.

J. DIAMOND DRILLING

a) By Mines Department.

One hole was drilled here by the Mines Department in 1975. The hole, OH6 (or DOM6), was logged by P. Askins and some sections marked out for sampling. The splitting was carried out by the Mines Department and samples were sent to Amdel for analysis at Commonwealth Aluminium Corporation Ltd's expense. Full logs and analyses are in Appendix 7.

A summary log is: OH6, vertical, co-ords 1400S/460W

0 - 12m	Basalt.
12 - 16m	Mudstone (Tertiary lake sediment).
16 - 17m	Soil? very iron stained.
17 - 23m	Gossan - soil (apparently a soil horizon derived from gossan).

- 23 - 26m Claystone (?Ordovician, completely weathered siltstone).
- 26 - 28m Gossan, orange, has appearance of re-weathered pre-existing black gossan.
- 28 - 36m Sandstone, weathered, iron stained.

b) By Commonwealth Aluminium Corporation Limited.

Three diamond drill holes were completed. Full logs and analyses are in Appendix 8. A light 4WD track along Tin Spur was constructed to give access for drilling and possible trenching.

The first drill hole, TSD 1 at 500W/870S, declination 70° towards 045°M was to test a wide fractured zone of tin mineralization in Moina sandstone and obtain stratigraphic information.

A summary log is: TSD 1

- 0 - 153m Moina sandstone, very fractured pyritic in places; quartzite in places; siltstone interbeds.
- 153 - 154m Conglomerate.
- 154 - 218m "Porphyry" (welded tuff, Cambrian).

Much of the core has been split and analysed; highest Sn value is 2550 ppm over 1 metre and highest Au is 0.25 ppm. A zone of fractured sandstone, some of it soft and porous, from 17.10 to 29.00m averages 1090 ppm Sn.

The second hole TSD 2 at 1100S/565W, vertical was to test a lead and tin anomaly, corresponding to a fractured zone.

A summary log is: TSD 2

- 0 - 37m Moina sandstone, similar to TSD 1.
- 37 - 42m Quartzite and calc silicate rock containing some disseminated sphalerite and galena.
- 42 - 113m Moina sandstone, fractured zone probably intersected 102-111m.

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Sn values are all less than 250 ppm. Between 36.75 and 37.45m is 2.5% Pb, 2.65% Zn and 39 ppm Ag, and between 21.00 and 23.80 is about 0.5% Pb, 0.4% Zn and 11 ppm Ag; elsewhere Pb, Zn and Ag values are low. Au values are all low to negligible except for one interval of fractured sandstone 104.0 to 105.0 with 5 ppm Au.

The third hole TSD 3, at 1100S/555W, declination 65° towards 045°M was to further test the same anomaly drilled by TSD 2 and obtain definitive information on the dip of the bedding and of the fracture zone in the Moina sandstone.

A summary log is: TSD 3

0 - 63m	Moina sandstone, very fractured pyritic after 20m.
63 - 67m	Quartzite and calc silicate rock containing a little disseminated sphalerite and galena.
67 - 80m	Moina sandstone.

Sn reaches 7000 ppm over 0.20m at 66.0 in a vein, and the adjacent calc silicate rock contains about 1500 ppm Sn from 65.00 to 67.00. Elsewhere Sn does not exceed 720 ppm, and is mostly less than 250 ppm. Pb and Zn values range up to 0.4% in a couple of patchy places, but are mostly less than 1500 ppm. Au values are also low to negligible except for a 1m zone of 1.5 ppm in calc silicate rock plus quartz vein at 65.00 to 66.00. Ag is patchy and ranges up to 18 ppm.

K. CONCLUSIONS & RECOMMENDATIONS FOR FUTURE WORK

There clearly exists at Tin Spur a fractured zone in which there are altered beds of sandstone carrying Sn and Au mineralization. The style of mineralization with most potential seems to be the leached porous often soft sandstones which contain disseminated cassiterite and gold. These altered

mineralized rocks are patchy in their distribution and the area must be regarded as a bulk low grade Sn and Au target.

Appendix 9 is an initial financial feasibility analysis of Tin Spur. A potential exists for 2 million tonnes of 0.3% Sn, 0.1 ppm Au and a further 2 million tonnes of 1 ppm Au. This is found to be a viable target.

Accordingly further work to assess the area is recommended. This is recommended to consist of: (a) a minimum of trenching (due to the fact that the area is visible from the Mt. Claude roadside lookout), to assess for example the nature and distribution of gold in fresher rock beneath Trench 2. (b) Percussion drilling. The very soft nature of some of the sandstone renders diamond drilling of little value, and the probable erratic mineralized zones necessitate percussion drilling.

A program of percussion drilling originally proposed by The Commonwealth Aluminium Corporation Ltd. (but not now to be carried out) is in Appendix 10. This involves 25 metre deep holes at 25 metre intervals, which should establish whether a bulk low grade body is likely to exist or not. If successful, deeper holes would be necessary, but the initial drilling to only 25m is recommended so as to minimize difficulties caused by sampling below the water table.

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6. DEVONIAN GRID

A. GENERAL

After finding Au disseminated in sandstone at Tin Spur it was thought possible that Au might exist disseminated in sandstone in the flat area at the Devonian Mine where old records reported eluvial gold. Also if the gold was very fine grained it may not be recoverable with a dish and consequently the old prospectors might not have discovered it. The area also contains the prominent lead rich gossans previously evaluated by the Mines Department and Mt. Lyell. A grid was therefore planned for the area to assess the potential for bulk low grade gold mineralization, and to re-assess the potential for stratabound lead-zinc-silver mineralization which could extend down dip from the gossans.

B. GRIDDING

A 900m x 400m grid (SE trending lines 100m apart, pegs every 50m) was constructed by our personnel over the old Devonian gold mine area, extending over part of the gossans previously evaluated by the Mines Department. Grid line slopes are recorded on plan TAS-80-339. Plans on file in the Devonport office show the Mines Department grid and the Mt. Lyell grid, which were both different. Only traces of these grids could be found on the ground.

C. GEOLOGICAL MAPPING

The grid was geologically mapped at 1:2500, see plan TAS-80-394. Areas including and beyond this grid were mapped by the Mines Department; a plan was reduced from the Mines Department original at 1:2400 to 1:2500, the same scale as TAS-80-394; this plan is on file in the Devonport office.

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Essentially the area is covered almost entirely by Moina sandstone, overlain to the north-west by massive Tertiary basalt. Gossan, consisting of gritty very exotic looking goethite, outcrops in two main zones, which seem to be beds dipping SE (from the drill section data). Quartz-feldspar porphyry dykes outcrop poorly; these are presumably Devonian and related to the Dolcoath Granite below. There is presumably a near vertical fractured zone or zones passing NW through the area, in the areas of the gossans and porphyry dykes. This fracture zone is interpreted to have been the plumbing system to bring fluids carrying Pb, Zn, Au, Ag etc from some point below; these elements are possibly leached from the underlying Cambrian tuffs by meteoric waters heated by the granite. Superimposed(?) Sn mineralization, especially at the Tin Spur end, is possibly due to true metasomatic fluids derived from the granite. The host rock for mineralization was presumably originally pyrite rich sandstone beds which have received the Pb etc by addition.

D. ROCK SAMPLING

A few surface rock or dump samples have been collected and analysed; the data is in Appendix 3, and results are plotted on the geological plan TAS-80-394.

Samples collected by the Mines Department, chiefly of gossans, are reported in Jennings (1958, 1963) in Appendix 1.

E. SOIL GEOCHEMICAL SAMPLING AND PANNING

A trial line along 100N of auger soil samples was treated in two ways:

- (a) the -80 mesh fraction of soil collected at bedrock was analysed for Au, Pb, Zn, Sn As and
- (b) the whole soil profile (at intervals indicated in Appendix 11) down to bedrock was carefully panned down.

Two panned samples contained visible fine grained gold (100W and 200W on line 100N), but all the -80 mesh soils contained less than 0.05 ppm Au, suggesting that Au distribution is spotty and that there may not be ultra fine grained gold in the sandstones. (Ultrafine gold would report in analysis but would be lost by panning).

The pan concentrates are stored in Devonport.

Nevertheless the entire grid was soil sampled and the -80 mesh fraction sent for Au, Sn, Pb, Zn, As analyses.

Analyses are plotted on plan TAS-80-340 and contours of Pb and As are on plans TAS-80-393 and 392.

Gold in measureable amounts occurs in only a few spotty places, chiefly associated with the gossans (see plan TAS-80-392).

There is a distinct Pb and As anomaly associated with the gossans.

F. GROUND MAGNETICS SURVEY

A survey to cover the grid was carried out in the same way as for the Tin Spur grid, except that readings were only taken along the 100 metre lines because of extremely dense vegetation in the south of the grid.

Data is on plan TAS-80-340 and contours are on TAS-80-391.

The area around the gossan in the north is distinctly anomalous; elsewhere the contours show a broad regional gradient, probably corresponding to a deep magnetic Cambrian source.

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G. DIAMOND DRILLING

a) By The Mt. Lyell Mining & Railway Company Ltd.

Mt. Lyell drilled 2 holes, OH 1, 2, in 1971. Details of their program are in Omnes (1970), Dandy (1970), McKibben (1971, 1972) in Appendix 1.

The program was designed to intersect an I.P. target and also test the gossans at depth but no mineralization apart from the gossans was intersected.

The core of OH 1 and OH 2 was borrowed on "permanent loan" from Mt. Lyell in Queenstown, and is now transferred from the original wooden boxes into aluminium trays and is stored in Devonport. The core was to be logged and split in detail, in a search for disseminated Au or Sn mineralization in the sandstone - this has not yet been done and is recommended.

b) By the Mines Department

The Mines Department did some follow up drilling in 1974, 1975 with similar targets and results to Mt. Lyell. The holes are OH 1, 2, 3, 4, 5 (=DOM, 1, 2, 3, 4, 5).

The first three holes were logged and analysed by the Department and logs/analyses appear in Appendix 7, together with a few corrections and comments by P. Askins.

Holes OH 4 and 5 were logged by P. Askins and some sections marked out for sampling. The splitting was carried out by the Mines Department and samples were sent to Amdel for analyses at the Commonwealth Aluminium Corporation Ltd's expense. Full logs and analyses are also in Appendix 7.

A summary log is:

- OH4 0 - 7m Sandstone.
- 7 - 12m Gossan, black, manganese/hematite/
 limonite rich, exotic textures common.
- 12 - 17m Sandstone, gossanous.
- 17 - 20m Siltstone.
- 20 - 22m Sandstone, gossanous.
- 22 - 39m Sandstone, weathered, some leached, some
 iron stained.
- 39 - 69m Sandstone, fresh, locally rich in very fine
 grained pyrite. No sulphides apart from
 pyrite observed except for trace of fine
 galena(?) on joints over last metre of core.
- OH5 0 - 5m Sandstone, gossanous (similar to 12-17 in
 OH 4).
- 5 - 18m Siltstone - claystone.
- 18 - 30m Sandstone, leached weathered.

Tin does not exceed 100 ppm in any sample of the Mines Department core, but silver reaches 150 ppm and lead 8%, zinc 1% in the gossans. Most gold values were negligible or less than 0.05 ppm, the limit of detection.

c) By the Commonwealth Aluminium Corporation Ltd.

The drilling by Mt. Lyell and the Mines Department plus geological mapping shows that the drilling was done down dip of bedding and that the gossan is probably a bed. See cross sections on plan Tas-80-394. More drilling was thought necessary to evaluate whether there is strata-bound high silver, lead-zinc mineralization down dip of the gossans below the zone of weathering. True thickness of the known gossan mineralization is about 15m and strike length over 700 metres (not incorporating an extra 600m of possible strike length beneath the basalt towards Tin Spur).

Accordingly a 150m diamond hole was planned to test unweathered down-dip extensions of the gossans, and also test the possible Au mineralization in sandstone in the Devonian mine area. An access track was constructed and hole DEV D1 drilled from 100N/275W at 60° towards 045°M. Full logs of the core are in Appendix 8, but the core has not yet been split and analysed. Splitting and analyses are recommended in a search for disseminated Au or Sn mineralization.

A summary log is:

DEV D1	0 - 21	Sandstone, leached, altered?
	21 - 34	Quartzite, (silicified), sandstone (? host to Devonian Mine Au mineralization?)
	34 - 36	Siltstone
	36 - 39	Quartz-feldspar porphyry dyke.
	39 - 74	Sandstone, mostly tubicular.
	74 - 83	Sandstone, altered.
	83 - 138	Sandstone and quartzite.
	138 - 141	Sandstone, altered.
	141 - 158	Sandstone with some pebbly hematitic grit beds.

No galena-sphalerite rich beds were intersected; this is possibly because the hole is sited too far from the main fracture (feeder zone).

H. CONCLUSIONS & RECOMMENDATIONS FOR FURTHER WORK

The hole DEV D1 failed to intersect galena - sphalerite rich beds probably because the hole was located too far from the main fracture (feeder) zone. The Mt. Lyell and Mines Department holes were probably badly sited and were either down dip or not deep enough to intersect unweathered mineralization in the main fracture zone, which is possibly around the area of the outcropping quartz feldspar porphyry dyke.

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Ignoring weathering effects there is a potential zone of lead-zinc-silver mineralization outcropping or covered by basalt, of strike length 1000+ metres, say 100m down dip (in the fracture zone) and 15m wide - this is about 4.5 million tonnes (at density 3.0).

If weathered gossanous material is excluded then this tonnage potential drops dramatically. However in the fracture zone below the zone of weathering there might also be further parallel beds which do not outcrop and could have a substantial tonnage potential.

Accordingly further work in this area is recommended in a search for Pb-Zn-Ag mineralization, and could take the form of gridding an expanded area, I.P. and E.M. surveys and diamond drilling.

Core of Mt. Lyell's OH 1, 2 needs to be logged, and this core plus that of DEV D1 needs to be split and analysed in a search for bulk low grade Au and/or Sn mineralization similar to that which occurs at Tin Spur.

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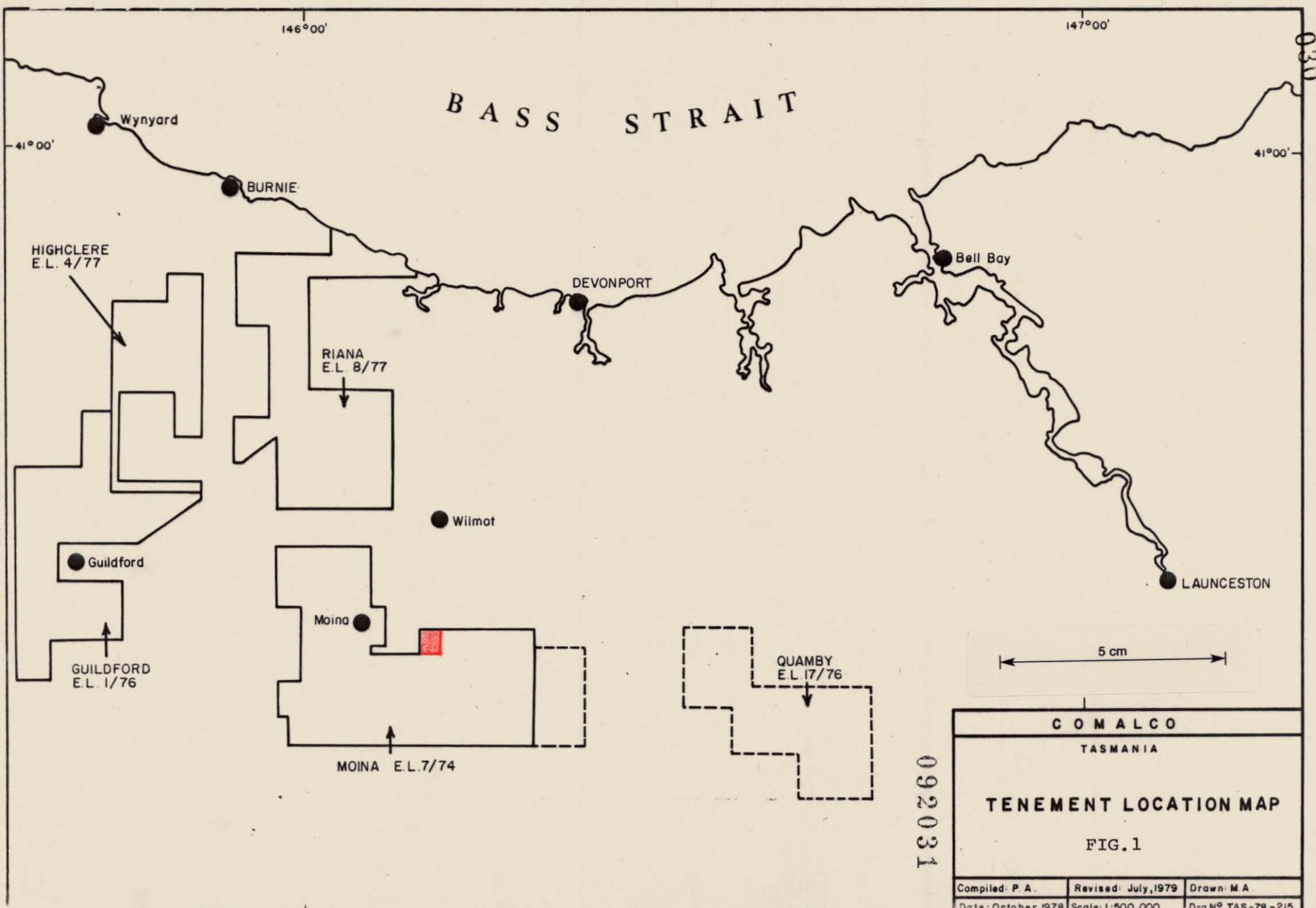
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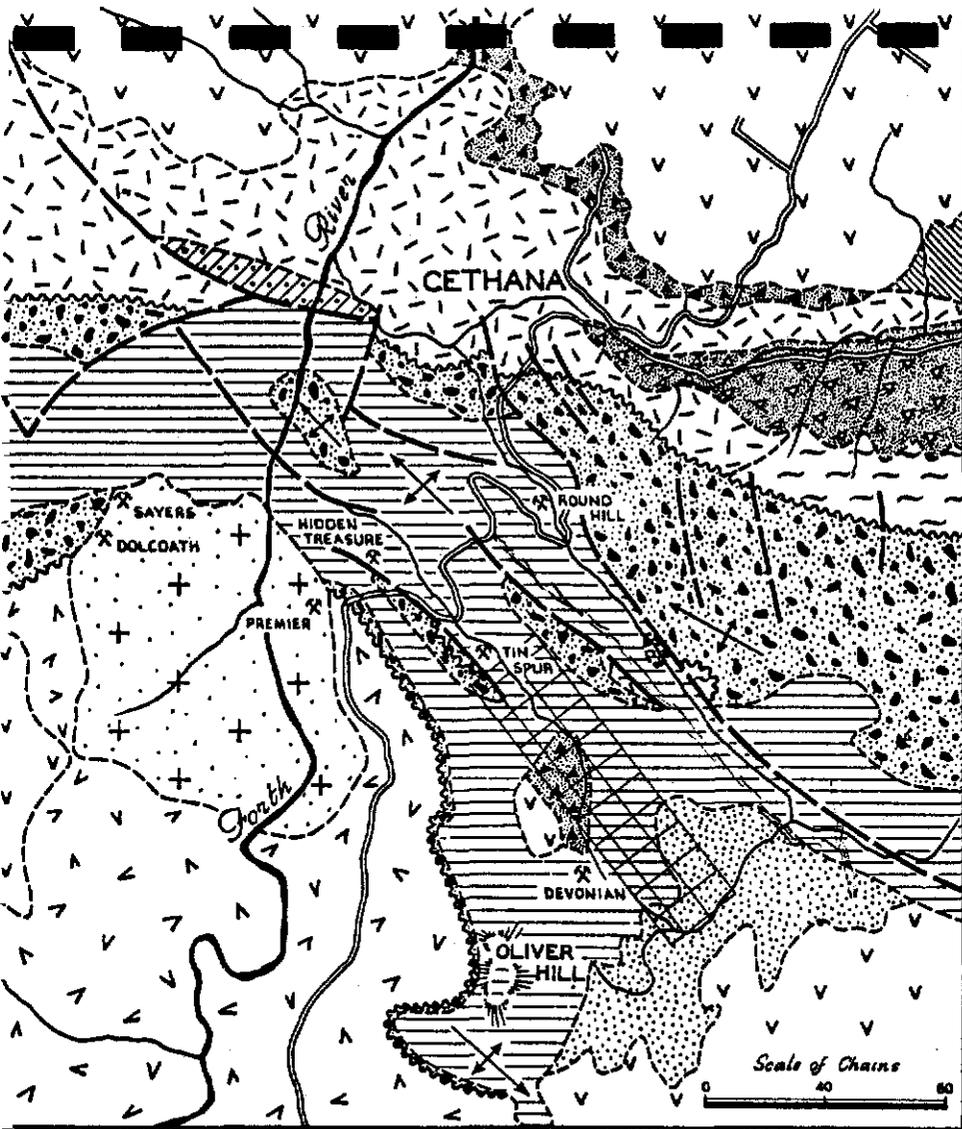
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TASMANIA		
TENEMENT LOCATION MAP		
FIG. 1		
Compiled: P. A.	Revised: July, 1979	Drawn: M. A.
Date: October, 1978	Scale: 1:500,000	Drg N° TAS-78-215



QUATERNARY	CAMBRIAN
Basalt talus	Bull Creek Formation
Quartzite & congl. talus	Lorinna Greywacke
Marsh deposits	Minnon Keratophyre
ORDOVICIAN	Gog Range Greywacke
Gordon Limestone	Undifferentiated
Moina Sandstone	TERTIARY Basalt
Roland Conglomerate	DEVONIAN Dolcoath Granite

Geology adapted from Sheffield & Middlesex 1 mile mapping

99.11

FIGURE 47. Geological map of the Oliver Hill

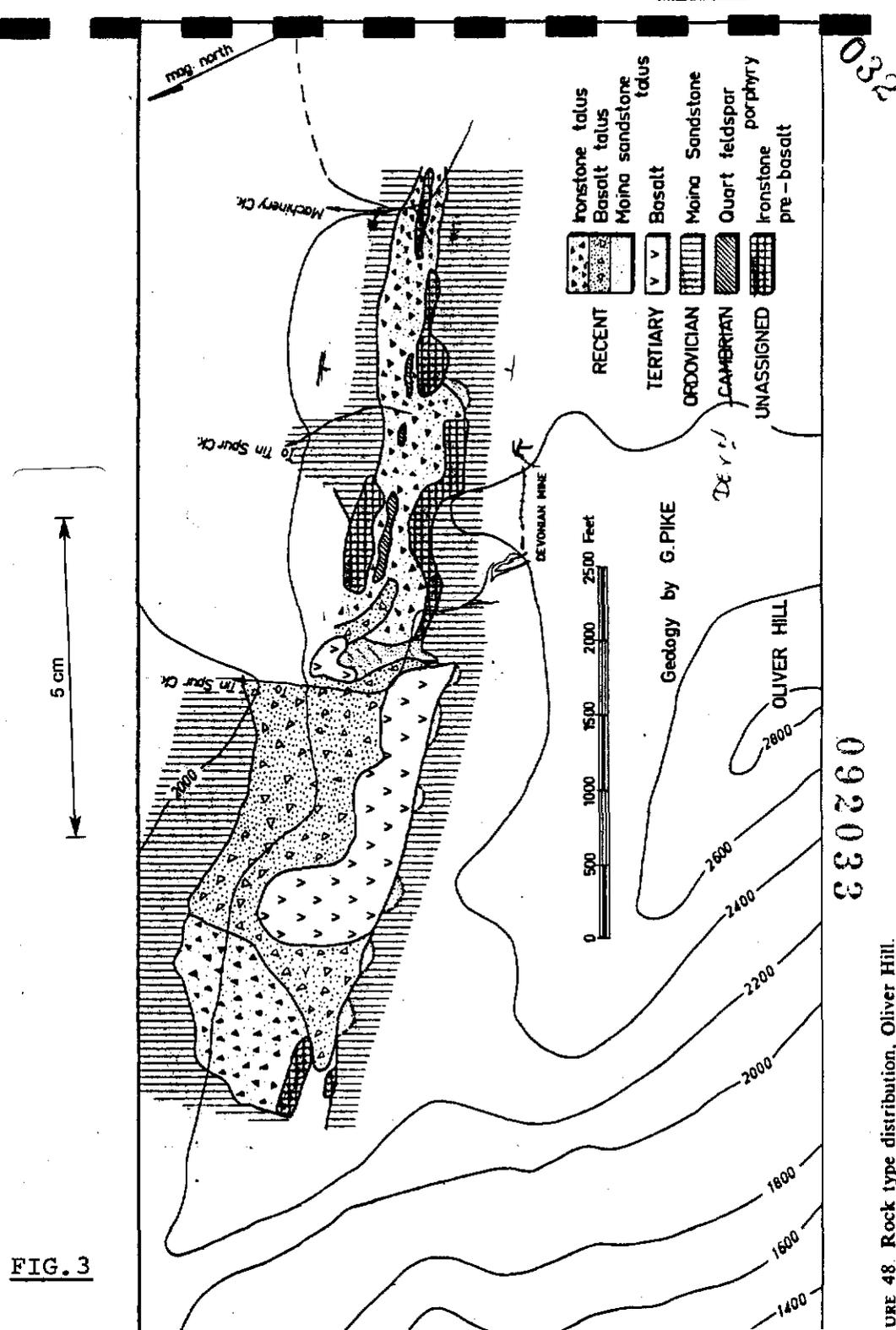


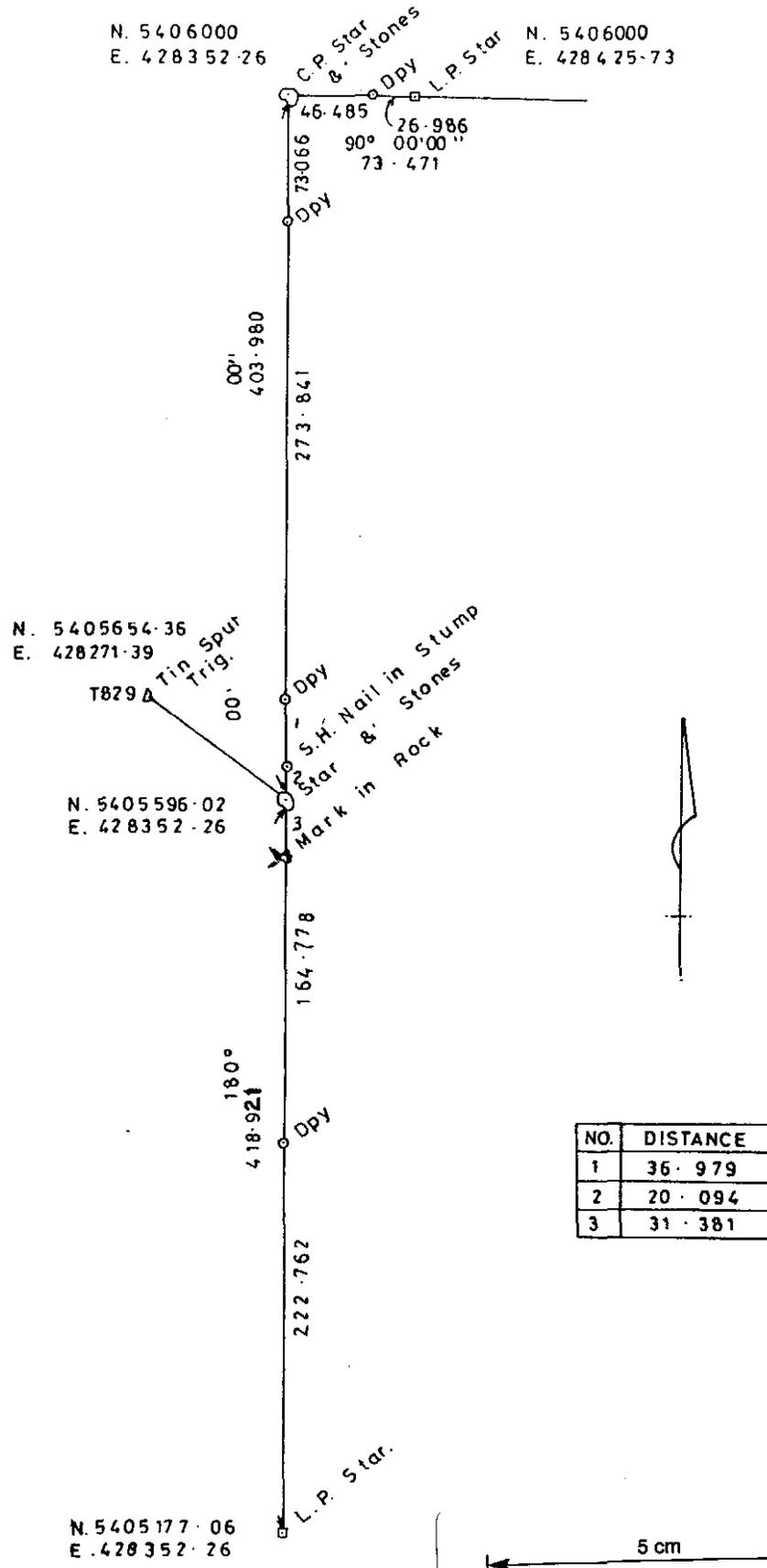
FIG. 3

URE 48. Rock type distribution, Oliver Hill.

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FIG. 4

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ALL MEASUREMENTS ARE IN METRES.

K.R. MICHELL AUTHORISED SURVEYOR INC. URBAN PLANNERS & SURVEYORS		DEVONPORT PENGUIN SMITHTON	DRAWING NO. 8035
COMALCO LTD. LEASE CORNER & PARTIAL BOUNDARY MARKING TIN SPUR RIDGE - LORINNA			 K.R. MICHELL M.I.S.
DRAWN: L.W	SCALE: 1:4,000	DATE: 17-3-80	

APPENDIX 1

EXTRACTS FROM PREVIOUS REPORTS:

- a) Twelvetrees, 1913
- b) Reid, 1919
- c) Jennings, 1958
- d) Jennings, 1963
- e) Baker, 1971
- f) Leaman, 1974
- g) Dandy, 1970
- h) Omnes, 1970
- i) McKibben, 1971
- j) McKibben, 1972

fine-grained quartzose granite. A 5-inch vein showing a little wolframite in oxidised quartz has been left on the west side of the drive.

The trenches extend over a length of 6 chains, and have shown the lode existing at a vertical height of about 100 feet above adit-level; and the adit, if continued, would come below the large body of lode-matter exposed here and there in the trenches. Nothing payable has been disclosed so far, but proofs of the existence of a strong metaliferous formation have been obtained by the excavations at surface, and facilities for adit-driving are excellent.

(11)—YORK'S ALLUVIAL SECTION; 1521-M, 80 ACRES.

This is a vacant section south of Urquhart's. It was previously 5470-M, in the name of D. Davies. It is separated from the Forth River by a narrow strip of unsurveyed land.

The shingle workings near the old camp contain stones of granite with little or no quartz. There is here some indeterminate occurrence of bluish rock, too soft and decomposed for identification, and there is some olivine basalt, besides quartz porphyry, in the banks of the race. A boulder-wash 6 feet thick lies below 5 feet of overburden. The present bottom is clay, which probably rests on granite bed-rock. There is very little fall, and the whole flat appears to be a terrace of the ancient Forth River. The large boulders cannot have belonged to the present creek. If this ground is the old Forth channel, much tin or wolfram need not be expected, as the river above this section flows through rocks of the porphyroid suite.

Further west are creek workings on a granite bottom rising into the hill. The stone here consists mostly of rubble from the hillside. A little wolfram ore is said to have been obtained from these workings; but the wash is not promising, though it may carry small quantities of wolfram and tin ore.

(12)—THE TIN SPUR PROPERTIES AND B. L. THOMAS' MINE.

The Tin Spur properties comprise a group of nearly a dozen sections east of the Forth on the southern side of Tin Spur Creek, which flows north-west for a couple of miles and joins the Forth River a third of a mile below the cage.

The country-rock is the pipe-stem sandstone, sometimes indurated, at other times quite friable. In its white, granular condition it has been mistaken for an igneous rock, and has received the local name of porphyry.

At intervals from top to bottom of the spur (a vertical distance of 1800 feet), tin ore has been found and prospected at different times. The highest point at which it has been discovered is Machinery Creek, which flows through the easternmost section of the old Devonian Mine, where both tin ore and monazite occur. A small tributary of this creek near S. Resrdon's hut carries both gold and tin ore. The creek bottom is of a soft clayey nature, with veinlets of quartz, and appears to consist of granite porphyry rock. At the hut itself sandstone with the familiar pipe-stems is seen. South and east of this is the basalt of Oliver's Country, beneath which the tin-bearing rock must pass.

A little north of this is a wide outcrop marked by loose boulders of ironstone, with which manganese is associated. About 10 chains further north a little work was done on its continuation, where it is said to have yielded traces of gold and some silver. It seems worthy of a trial in depth, though sinking will be necessary, as the country is too flat for tunnelling. The probabilities are that the formation will descend into tin-bearing pyritic lodestuff.

A mile north-west of this, and on the same line of country, are two 80-acre sections, formerly belonging to W. T. York (2209-M) and P. Ashworth. York's section has been surveyed for Mr. B. L. Thomas, 5429-M.

On these a considerable amount of prospecting work has been done. On Thomas' section two long tin-bearing lodes, the main and western lodes, have been trenched upon in some eight or nine excavations on each lode. The two lodes are roughly parallel, though somewhat divergent, the distance between them increasing to 4 chains. Their direction is approximately north-west-south-east. The western lode has been opened upon in eight places, and has been bored into to depths of 20 and 25 feet. The formation comprises a belt of soft yellowish sandstone for a width of 20 feet, containing bands carrying finely-divided tin ore. These excavations are on a line of 10 chains falling towards the Forth River. The prospects are fair, and the best have been obtained from the three lowest openings.

The main or western lode has been shown in nine cuts, revealing a micaceous iron formation 4 or 5 feet wide, carrying a little tin ore and, it is stated, some gold.

Fe
90ssams

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find
the
map

100m

200m

eastern?

eastern?

These lodes can be tested by adits lower down the hill. The section is called the "Coronation" by Mr. Thomas. Formerly it used to bear the name of the Old Stag.

North of the above is a long narrow spur, called the Razorback, which passes north-west into Ashworth's old section. This ridge is the Tin Spur. Large blocks of pipe-stem sandstone are scattered profusely on its crest.

A deep cut on the north side marks the place where tin ore was first struck on the spur. The cut has been driven south-westerly across the beds of white sandstone, in which are seams and veinlets of finely-divided tin ore. Other excavations have also shown good tin.

There hardly seems to be any other way of working this ground than by open-cut, but whether it is payable or not will depend upon the quantity of dead or poor rock existing between the ore-bands.

The Tin Spur mine workings proper are passed through by the Lorinna-road on the south side of Tin Spur Creek. Just above the road, near the head of the old aerial tramway, is an open-cut in sandstone striking north 60 degrees west, and dipping south-westerly. The occurrence seems to be one of dissemination in the rock, for indications exist of finely-divided scattered tin ore. There are also veinlets of ore-bearing quartz which traverse the rock. Some tin ore is certainly present, but judging from what is visible at present, some fresh discovery would have to be made to convert the mine into a payable proposition. The concentrating facilities are none too good, as the ore-stuff had to be sent down to the 5-acre section below the road, and the concentrates would have to be packed up again. The power-water was obtained from a little fall in the Tin Spur Creek a few hundred feet above the river.

(13)—THE LEWIS SYNDICATE'S MINE.

The ground applied for by this Devonport syndicate is traversed by the new road to Lorinna, on the east side of the Forth south of the cove.

The rock is granite, being the eastern extension of the Dolcoath granite stock, which has been cut through by the Forth River. Wolframite and bismuthinite veins traverse the rock, and are attended by greisen modifications of the original granite. The granite extends up the hill to the east, where it finally abuts against the undenuded cover of pipe-stem sandstone. One or two excavations have been

The Spur
area
just
in CRA
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Mine?

made below the road, where a felspathic-quartz granite is traversed by veins of quartz up to 4 or 5 inches wide, carrying odd bunches of sulphide of bismuth. The same mineral is also disseminated through patches of the greisenised rock. A little fluorite is showing. The mineral is clean, but not plentiful. A little of it has been sent away to market.

A little further along the road to the south a fine-grained granite shows scales of molybdenite on joint faces of the rock. Further still, outside the boundary of the granite, a lode formation about 6 feet wide shows some scattered molybdenite. This is in a blue quartz-porphyrone, which, adjoining the intrusive granite, has been penetrated by veins proceeding from the granite magma. It is such phenomena as this that illustrate the difficulty which sometimes arises in determining decisively the derivation of ores met with in the porphyroid series. Here, of course, there can be no doubt of their granitic origin, but in a few instances they appear to be authigenic.

B.—GOLD MINES.

(1)—FIVE-MILE RISE GOLDFIELD.

This field extends up the hill on the western side of the Forth Valley from the Lorinna bridge. The track which passes through the field is the old road cut by the Van Diemen's Land Company to Middlesex Plains and thence to Surrey Hills.

The Forth River at the bridge is about a couple of chains wide, and in dry weather 3 feet deep. A few chains above the bridge the bedrock of the stream is hard sandstone, but 6 or 7 chains below it and east of the bank cliffs of bluish-grey limestone are exposed, dipping at a low angle to the north-east. The escarpment rises here to 40 or 50 feet above the river-bank. This limestone apparently underlies the Lorinna township to the east. Where concealed by grass and superficial gravel, its existence beneath the surface of the farm lands is still shown by sundry circular depressions in the soil. Some of these are seen in front of Mr. Geo. Sloane's house and on the road.

The Five-mile Rise consists of beds of pipe-stem sandstone, with alternating beds of shale. The general strike of these beds is north-easterly and the dip north-westerly. A few hundred yards south of the track up the hill they

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little gold would find its way into the stream from the Five-mile Rise, from the Dove River, from the porphyroid schists above Campbell's Reward, from the granite on Urquhart's, Sayer's, and the Narrawa Creek, not to mention Bull Creek. But all this would not amount to much in the aggregate.

(10)—CAMPBELL'S REWARD GOLD MINE.

The new road to Lorinna on the east side of the Forth passes through these abandoned sections. The workings are not in a condition for inspection. The mine is in rock belonging to the porphyroid division. Mr. A. Campbell informed the writer that it was originally prospected for a couple of years, and was then floated into a company. The gold was free, and in barbed and wire form, and occurred in a narrow vein of kaolin, which widened out and carried a foot to 15 inches of barren quartz. The gold was accompanied by a good deal of silver, and was worth less than £3 per ounce.

(11)—EVENDEN AND REARDON'S MINE.

This is on the western brow of Oliver's Hill, 1600 or 1700 feet above the Forth River. There is a junction here of igneous porphyroid with the pipe-stem rock. The line of junction trends south-easterly up and down the hill, and the pipe-stem beds dip away southerly. A formation of quartz is developed between the two rocks, and when the shaft was sunk on it four years ago by Messrs. S. Reardon and H. Evenden tests yielded returns of 10 to 15 dwt. The shaft was sunk 30 feet, and the value fell off to 4 dwt. Below this, on the slope of the hill, are four trenches or excavations, crossing the formation, and showing its auriferous character to continue. The gold which was panned off from the sandstone and ferruginous bands in the porphyry is extremely fine. About 6 chains further south a bold outcrop occurs showing the junction between the two sets of rock. The junction evidently marks a line of deposition of gold, but the values of the stone along the lines are apparently erratic. The pipe-stem beds here strike west-north-west, with a dip to the north-east. They continue to the top of Oliver's Hill, about 2100 feet above the Forth.

(12)—DEVONIAN MINE.

The sections which belonged to this abandoned mine are vacant. They are situate on the tableland behind Oliver's Hill, at an elevation of about 1800 feet above the level of the Forth River, about a mile east from the river in a direct line and 3 miles north-north-east from Lorinna.

The country in which the lodes occur is a laminated felspathic sandstone belonging to the pipe-stem series: this passes below the plateau basalt about half a mile east of the mine. The lode bears west 20 degrees north. The shaft is on Section 416-93G, 10 acres. The lode has been stoped out east and west from the shaft. The surface excavation west of the shaft shows a main vein 4 inches wide and one on each side of the trench, with other veinlets between them. When sinking was first begun it is said that a pennyweight of gold per dish could be washed. Some stuff panned off on the present visit showed rough gold in the dish.

Further north a parallel lode was sunk on prior to the Devonian shaft at the head of some alluvial ground which was worked up to that point. The ferruginous quartz in the outcrop looks favourable, but yields no colours.

(13)—BELL MOUNT GOLDFIELD.

This old field is situate between Bell Mount and the river, on Bell Creek and its tributaries, a creek system draining into the Wilmot River, and comprising Bell Creek, Mosquito Creek, Poverty Creek, Basalt Creek, &c.

Ridges of wash exist between the various creeks; and the present separate ridges, some of which are 50 or 60 feet high, must have been continuous over the whole area—and the body of drift was then a wide body of material extending across the positions of the existing creeks. The latter at a later period excavated their channels in it, and collected part of its gold contents.

It is now 20 years since work was at its height on the field. At one time as many as 200 men were at work, but this feverish activity spent itself in about 18 months, as the yield gradually fell off, and it is now a deserted place, though naturally there still remains work for prospectors in the way of exploring the margins of the field and seeking indications which may shed further light on the source of the gold of this deposit.

Within a couple of years about 4000 oz. of gold were won, i.e., as estimated by those who are locally most com-

accessory minerals, gold, pyrite, arsenopyrite, sphalerite, chalcopyrite, and monazite in lesser amounts, and associated with fluor spar, topaz, beryl, laumontite, calcite, &c. (2) Galena-chalcopyrite ore-bodies contained in fractures in quartzite rock. (3) Gold-pyrite veins in sandstone. The deposits occur as fissure fillings, impregnations in quartzite, or as replacements, and all are contained in garnet rock or in quartzite, or in both.

The ores of tin, tungsten, bismuth, and molybdenum occur near the intrusive rock, and in some cases in the granite, while the greater part of the more soluble constituents, such as sulphides of iron, copper, lead, and zinc, remain in solution until a zone of lower temperature and pressure is reached. Here is a splendid illustration of the zonal distribution of ores. Cassiterite and wolfram occur also in pegmatitic veins, which are particularly rich in pneumatolytic minerals, especially those containing fluorine and boron. These minerals are also found in stockworks, which consists of masses of rock traversed by numbers of small veins. Such a group of fissures, with the intervening granite altered to greisen, and impregnated with ore, is that exposed in the open-cut workings of the Squib Mine. Although in general not a contact-metamorphic mineral, cassiterite occurs in far greater abundance associated with wolfram, molybdenite, and bismuthinite in quartz veins contained in garnet and quartzite rocks, very little having been found in the granite. At Tin Spur the tinstone occurs in soft, friable sandstone, and is free from wolfram, which is found in pegmatitic veins in the granite outcropping 10 chains southward. It is remarkable that the sandstones in which the tin ore is contained show very little alteration, while a few yards away from the lodes they have been transformed into hard, glassy quartzites, impregnated with pyrite.

Molybdenite, wolfram, and bismuthinite are found locally in igneous and metamorphosed sedimentary rocks, deposition being in the order named. Molybdenite occurs also scattered through the massive granite in joint planes and cracks, and at the point of contact between granite and the invaded rock. South of the Premier Mine it is found in porphyroid (felspar porphyry), near the point of contact with granite. Wolfram and bismuthinite and bismuth are almost invariably closely associated, having been deposited contemporaneously and under like conditions. It has been constantly observed that bismuth ores are more prominent near the surface, this component

of the lodes decreasing rapidly in amount from a depth of 100 feet. Inclusions of bismuthinite in quartz crystal are commonly noted; it is found also in garnet rock at the S. and M. Mine, some distance away from the lodes, and it is a constituent of the galena-chalcopyrite ore of the Round Hill Mines, thus showing a wide range of occurrence.

Fluorine in one form or another invariably accompanies tinstone and wolfram. It is usually found in the forms of fluor spar and topaz, which occur here in great abundance as constituents of the lodes, and also of the pegmatitic rocks in which they are contained. Muscovite is remarkable by its absence, excepting where pneumatolytic action has taken place. The variety gilbertite, a secondary mineral, is a common constituent of the lodes, especially those contained in the metamorphic rocks. A lithium bearing mica (lepidolite) is found accompanying the ores in pegmatite veins.

The exact relationship of boron in the formation of the deposits is not definitely established. In this locality, tourmaline, a boron mineral, and common associate of tin deposits, is not developed near the ore-bodies, but it occurs, although very sparingly, in the form of thin laths as an accessory component of the quartz-porphry marginal rock. The absence of tourmaline is offset to some extent by the presence of boron-bearing vesuvianite in the metamorphosed limestone rock in considerable amount.

The major portion of the tinstone, wolfram, bismuthinite, and molybdenite components of the lodes occur on the walls, the central part being made up largely of quartz. These ores in their quartz matrix are found strongly adhering to the walls, showing that at the time of their deposition the temperature of the enclosing rock had been raised approximately equal to that of the ore-bearing solutions. The narrow veins carry considerably higher percentages than do the wide ones. The reason for this is that the solutions coming into contact with the slightly colder rock deposited their metallic contents first, and in the inverse order of their solubility.

In some instances there were two slightly separated periods of deposition, as evidenced by a second occurrence of ore separated from the first by almost barren quartz. Under normal conditions not all the metallic content was deposited at one time, for irregular masses of wolfram and bismuthinite occur toward the middle part of the lodes. There is a tendency towards the concentration of ore in

TIN
SPUR

(13)—Section 7902-m, 40 Acres (J. S. Morgan).

(a) Situation, &c.

About 1/2 mile south-west of Round Hill the road to Lorraina passes through this section, which lies north-west of the Falls Mine.

Tin ore was discovered here over 30 years ago by T. L. Johnson and his partner (Jordan). A company was organised in Launceston by F. G. Dull for the purpose of developing this ore-body, but the operations which followed were not productive of success. Seven years ago P. C. Ashworth and party of six men erected a small primitive concentrating plant in Tin Spur Creek Valley to treat the rich fine-grained tinstone exposed in trenches and shallow shafts along the southern side of the road. The machinery was quite unsuited to the purpose of recovering this fine-grained ore, and after running for two weeks operations ceased.

(b) The Ore-bodies.

The minerals, other than tinstone, contained in the ore-bodies vary in amount in the different lodes. The main lode in some parts contains pyrite and malachite in abundance, while a chain distant these minerals are not present in the ore. Neither wolfram nor bismuthinite has been detected in the lodes on this section. Gold is always present, and in the Star of Peace lode small rich pockets occur. Limonite in fine grains occurs in a small trench 2 chains east of main tunnel.

The lodes are contained in sandstone or quartzite at or near the junction with garnet-epidote rock. Sandstone overlies the garnet rock, into which the lodes have not yet been followed. The transposition of these rocks has been brought about by faulting movements, similar junctions being noticeable also at other points in this locality.

The main lode is that developed by Ashworth's workings, and it is the continuation of the Falls line. It occurs here under conditions almost identical with those at the Falls Mine, showing also a close mineralogical similarity. At Ashworth's workings the brown to black coloured, fine to medium grained tinstone occurs in payable amount over a width of 5 feet. Bulk samples of this soft tin-bearing sandstone showed by assay the presence of over 2 per cent. tin. The quantity of this high-grade ore available for treatment has not yet been determined.

At the surface the constitution of the lode varies greatly from point to point. In some places it is gossanous and pyritic, and in others there is an almost entire absence of pyrite. This lode has not been traced into the underlying garnet-rock. Its strike is 50 degrees west of north, and its dip 70 degrees south-westerly.

Below Gorey's tunnel a large gossanous formation is cut in the road, and outcrops continuously along the northern fall of the hill on the lower side of the road. This formation is composed of porous sandstone heavily impregnated with limonite. It contains a little tin and silver and a trace of gold.

The Star of Peace lode is on the northern side of the main gossanous formation, and is about 3 chains distant therefrom. Friable sandstone, carrying a little gold and tinstone, has been cut in the road bank and in two trenches farther down the hill. In each of these openings the metallic minerals, tinstone and gold, are found in amounts not sufficient to pay for exploitation. In this loosely aggregated sandstone formation quartz crystals of wonderful development and clearness occur in great abundance. This formation is stated to be tin-bearing over a width of 6 feet, but dish prospects are obtainable only from a narrow band 6 inches wide.

In Tin Spur Creek tubicolar quartzite, underlying garnet rock, carries abundant pyrite and a little chalcopyrite. This rock dips south-west at an inclination of 45 degrees. The garnet rock shows a peculiar surficial relief, due to unequal weathering. It contains much oxide of iron, some of it derived probably from its own decomposition, and it disintegrates to a yellowish-brown soil. This garnet rock contains a little tinstone and traces of bismuthinite; wolfram is not present.

On the north side of the creek trenches have been cut across a hematitic formation encased in sandstone. This formation does not contain minerals of economic importance.

Between the Star of Peace lode and the Falls Mine, a porphyry dyke intruding the tubicolar strata is exposed in the road-cutting. This is the continuation of the tinstone-bearing dyke recently discovered on the Falls Mine. The porphyry consists of a number of fracture-fillings, the smaller branching from the larger. They strike 30 degrees east of north, and dip in a north-westerly direction. Tests made of the limonite-bearing porphyry showed the presence of a little tin and silver. Interbedded with the sand-

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stones here are light-green bands of shale. Hard quartzite, in which the tubicolar casts are still easily discernible, outcrops here, and extends through the Falls property on the east and through the remainder of this section on the west side. The original sandstone has been completely silicified and heavily impregnated with pyrite. A number of samples were taken and submitted to Mr. W. D. Reid, Government Assayer, for examination, who reported the contents as follows:—

Description of Ore.	Footage Sampled.	Locality - sample taken.	Tin.	Silver.	Gold.
			Per Cent.	Per Ton.	Per Ton.
Soft siliceous sandstone	45	On road west of Ashworth's workings	0.80	...	...
Soft siliceous sandstone	100	On road west of Ashworth's workings	0.70	...	...
Gossanous silica	45	On road east of Ashworth's workings	0.45	...	...
Gossanous silica	45 to 75	Road east of Ashworth's workings	0.30	...	...
Gossanous sandstone	75 to 110	Road east of Ashworth's workings	0.16	...	...
Garnet-epidote rock	15	Road near Main tunnel	0.20	...	...
Garnet-epidote	10	Tin Spur Creek	0.87	...	...
Ironstone sandstone	5	Outcrop below road	0.18	...	...
Sandstone lode material	5	Ashworth's trench	2.70	...	...
Sandstone lode material	2	East side of Ashworth's	1.80	...	...
Sandstone	...	Duff's shaft, selected ore	2.20	...	...
Sandstone	...	Bulk sample from Duff's shaft	1.20	...	...
Sandstone detrital material	...	South-west corner of section	0.50	...	...
Gossanous sandstone	...	Outcrop below road	...	3 dwts. 16 gra.	Trace

CRAE
ground
NW part
of Tin Spur

(c) Developments.

The first improvements, carried out many years ago under the supervision of F. G. Duff, consist of—an underlay shaft, 50 feet deep, sunk in sandstone, at an inclination of 72 degrees to the south-west; Gorey's or main tunnel, driven 230 feet on a bearing south 22 degrees west, towards Duff's shaft; and west tunnel, near Ashworth's workings, driven 100 feet in a direction 40 degrees west of south. The latter works consist of a number of trenches cut by Joseph Drew nine years ago near the eastern boundary, and Ashworth's shafts and trenches on the main ore-body further westward. In addition to this work on the main lode, several trenches have been cut across the Star of Peace lode, and also across the garnet-epidote formation outcropping in Tin Spur Valley.

The main, or Gorey's, tunnel commences at a point 1 chain on the south side of the road and 8 chains eastward of Ashworth's workings. It was driven to cut the small tinstone veinlets exposed in Duff's shaft, but stopped short of the required distance. At the approach, and a few feet in from the entrance, a kaolin-gossanous formation is passed through. This formation, which is certainly worthy of attention, has not been carefully tested for tinstone. It appears to be on the line of the main lode traversing this and the Falls syndicate's property eastward. Beyond the lode-formation very hard quartzite (altered tubicolar sandstone) heavily impregnated with pyrite comes in, and continues for 190 feet, at which point it gives place to garnet rock. The garnet rock comes in at the foot of the drive, and gradually rises at an inclination of 14 degrees, until at 230 feet from the entrance it occupies the whole tunnel. At the junction of the quartzite and the garnet-rock a soft kaolin band, a little malachite, and a vein of pyrite 3 inches wide occur. In the face, pyrite, in the forms of pentagonal dodecahedra and cubes, occurs in solid veinlets from $\frac{1}{2}$ to 1 inch thick. Sulphate of iron is found on the walls of the tunnel near the end.

Duff's shaft has been sunk southward of the main lode through sandstone impregnated with tinstone. The tinstone occurs in a highly crystallised form, and is found more commonly on the joints and bedding-planes of the rock. Close by tinstone is found also in the younger conglomerates.

Ashworth's workings are not extensive, but they show the richest ore exposed on this section. They consist of two vertical shafts, 30 feet apart, about 40 feet deep, and a shal-

low-level tunnel. The soft friable sandstone in which the fine-grained, brown to black tin oxide is contained dips south-westerly out of the shafts which bottom on hard quartzite.

South-eastward of these workings several small trenches, cut through sandstone and conglomerate detrital material, show fine prospects of tin oxide, most of which is found as facings on the joints of the sandstone. Farther towards the Falls Mine, on a north-south ridge, a deep trench, cut by J. Drew, through sandstone detritus exposes tinstone ore of fair value.

(d) General Remarks.

It is possible to recover a considerable amount of tinstone by ground-slucing the detrital material, which covers a considerable portion of this property, but as so much of the tin ore is found adhering to the sandstone its complete separation could only be effected after crushing. The rich ore exposed in Ashworth's workings is made up in part of very fine material, most of which would be lost in treatment by slucing methods. It appears, therefore, that concentrating machinery is necessary to effect the complete separation and recovery of the ore. This mine is too small in itself to warrant the erection of costly machinery, and in any case further exploratory work should precede any expenditure in this connection.

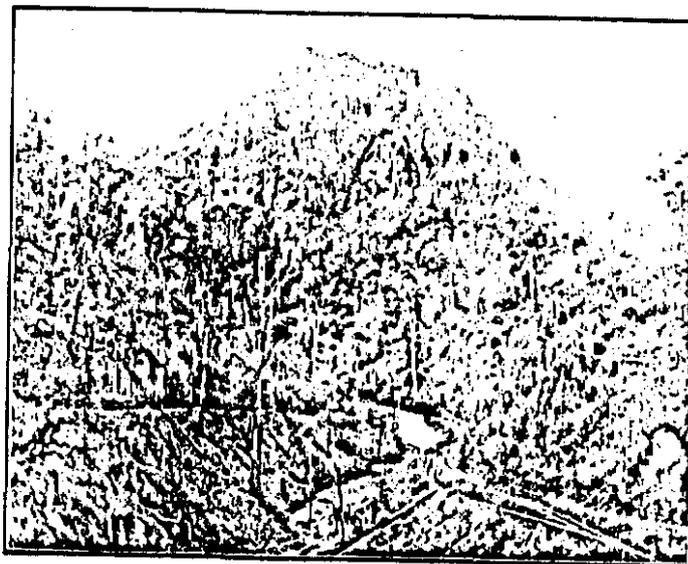
It is recommended, for the purpose of more economical exploitation, that the owners of this property amalgamate their interests with those of the Falls syndicate.

(14)—Falls Mine: Section 7903-M, 40 Acres (Lessee: E. F. Blyth).

The tinstone lode on this section was discovered by R. Magee and B. L. Thomas nine months ago. The property is conveniently situated on the northern fall of Tin Spur, about 1 mile south-west from Round Hill. Lorinna-road to Sheffield passes through the section within 5 chains of the outcrop of the lode. Staverton railway terminus is 9 miles distant, and the township of Sheffield 16 miles.

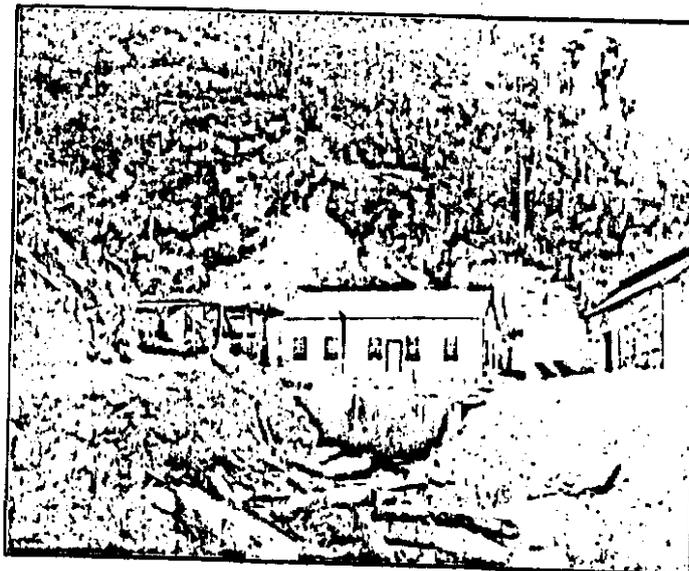
(a) The Ore-bodies.

The main lode outcrops along the face of a steep hillside, and consists of gossanous material carrying tinstone in considerable quantity. The tinstone is fine to medium grained,



[A. M. Reid Photo.

Photo. No. V.—Round Mountain.



[A. M. Reid Photo.

Photo No V—Entrance to No 1 Tunnel Round Hill Mine

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and well crystallised. It is commonly black in colour, though the fine material is of a prevalent brownish tone. *dyke* The gossanous material in which the ore is contained is derived from the decomposition of porphyry, the limonite constituent being an alteration product of the pyrite introduced at the time the tinstone deposits were formed. A little development has been made by crosscutting the ore-body 25 feet and driving along its course south-easterly for 40 feet. These workings are at a very shallow level, and have not entered solid rock. The crosscut discloses gossanous material 15 feet wide resting on greyish porphyry, which greatly resembles sandstone at first sight. On the hanging-wall chloritic material occurs in cellular quartz, and the face shows much pyrite and quartz veinlets traversing the rock in all directions. The gossan contains a good deal of silica and undecomposed porphyry. This lode, evidently the south-eastern continuation of the porphyry dyke exposed in the road-cutting, has been traced over 100 feet on both sides of the tunnel opening.

About 5 chains south of the outcrop tubicolar conglomerates and sandstones, overlying porphyry rock, form a great escarpment over 100 feet high, and extend fully 1 mile south-eastward. This escarpment has been formed along a line of weakness due to extensive faulting. Other results of the faulting movements are the transposition of garnet and quartzite, and porphyroid and quartzite. At the faulted junctions of these rocks the tinstone ore-bodies have been formed. The greater part of the property is occupied by tubicolar sandstones and conglomerates, which are folded into a series of anticlines and synclines.

Two deep trenches sunk by W. Cook in angular to sub-angular detrital material at the southern boundary show fair tinstone prospects. The detritus is as much as 12 feet deep, and carries payable tin oxide in bands, and also a little gold. Rees Creek could be conducted by water-race to this point.

The flat ground in Tin Spur valley above the Falls was bored by P. Ashworth. It is reported that tin oxide was recovered from each bore-hole, but the quantities are unknown.

(b) Exploration.

The work at present in hand (the construction of a water-race from Tin Spur Creek to a point 60 feet above the workings, for the purpose of conducting the water required for sluicing operations) will soon be completed. It is intended

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to use this water for the purpose of the recovery of a large portion of the tinstone contained in the gossan, and by its removal ascertain the extent and nature of the undecomposed ore-body. This is regarded as a sound and cautious policy to follow.

The conditions for mining and treatment are unusually good, and exploratory work can be carried on at a minimum cost. The outlook is decidedly promising, and if the unaltered porphyry prove to be as rich as the outcrop a profitable future may be anticipated by the owners.

(15)—*The Premier Mine: Lease 8070-m, 80 Acres (Lessee: J. P. Kelly).*

(a) Situation, &c.

This property, until recently owned by J. S. McLean, is situate south of and adjoining the Hidden Treasure lease. The Lorrana-Sheffield-road passes through the western portion of the section.

(b) Ore-bodies.

The ore-bodies consist of mineral-bearing quartz veins contained in pegmatite, which is composed of quartz, felspar, and massive muscovite. They contain wolfram, molybdenite, and bismuthinite, accompanied by pyrite, chalcopyrite, and arsenopyrite. Accessory minerals are fluorspar, topaz, and muscovite. The granites here are traversed by numerous pegmatite dykes, all of which carry mineral-bearing veins.

No. 1 open-cut workings are situate 5 chains east of the road, and 200 feet higher up. The open-cut is 20 feet long, 6 to 10 feet wide, and in the end is 20 feet deep. The rock here is a pegmatite consisting essentially of coarsely crystallised quartz and felspar, the former predominating, with also pinites in subordinate amount. Variations occur in which the felspar component is insignificant, and the rock then greatly resembles greisen. In this rock, quartz veins carrying metallic minerals occur over a width of 4 feet. The quartz crystals, 2 to 3 inches long, occurring in cavities in the fissures exhibit typical comb structure. Wolfram is the dominant metallic mineral constituent, and is found embedded in the quartz or implanted on the quartz crystals and encased in very thin walls of silica. Bismuthinite, in acicular and massive forms, a little bismutite, and molybdenite are also present, but in subordinate quantities, and native bismuth is reported. The gold and silver con-

tent is small, but appears fairly constant. Pyrite in thin bands and in botryoidal form is fairly abundant, and chalcopyrite is met with in small quantity here and there. Green-coloured muscovite is found as a secondary mineral in the granite near the veins, and also implanted on quartz and wolfram.

No. 2 workings consist of an open-cut 15 feet long, from the end of which a tunnel has been driven 12 feet. It is situate 5 chains south-west of No. 2 workings. The lode is a fracture-filling, 4 to 6 inches wide, in pegmatite granite. Wolfram, bismuthinite, and molybdenite contained in a quartz gangue occur coarsely crystallised and highly developed. Molybdenite flakes 1 inch in diameter are commonly found, both in the lode and in the adjacent granite. At this point the granite contains a little biotite. Pyrite and green fluorspar are accessory lode minerals.

No. 4 Workings.—On the western side of the road, about 1 chain down the hill, and at a point a little south-westward of No. 1 workings, a number of small open-cuts have been put in on veins of bismuthinite-bearing quartz contained in pegmatite, made up chiefly of coarsely-crystallised felspar, quartz, and pinites. The bismuthinite occurs both in acicular and massive forms, sometimes in pieces sufficiently large to be separated by knapping. Pyrite and arsenopyrite accompany the bismuthinite, and secondary muscovite (green and black) and purple to green fluorspar are common accessory minerals. Molybdenite is also present. Neither wolfram nor cassiterite have been detected in this formation. The veins are from 3 to 8 inches wide, and from 2 to 4 feet apart. They strike 60 degrees west of north, and dip south-westerly at an inclination of 60 degrees. The top cut is about 10 feet square, and the lower 8 feet by 6 feet.

Samples from the several faces were found to contain—

	No. 1 Workings	No. 2 Open-cut	Drill-boring, No. 2 Open-cut	No. 4 Open-cut Workings
Tungstic acid (WO ₃)	Per cent. 0.52	Per cent. 2.2	Per cent. 0.4	Per cent. ...
Bismuth	Per cent. 0.13	4.21
Gold (per ton)	1 dwt. 7 gr.
Silver (per ton)	1 oz. 10 dwt.
Molybdenum	...	Nil	0.2	...

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The trend of the lode is north-west, and the dip is south-westerly at an inclination of 60 degrees.

Fifty feet lower down the hill the vein outcrops again, and where exposed is seen to contain wolfram in fair quantity.

Samples of ore from the narrow vein exposed in the tunnel showed the following metallic content:—

Tungstic acid (WO ₃)	5.9 per cent.
Molybdenum (MO)	8.05 „

Surface ore, 2 chains north and 50 feet below the tunnel:—

Tungstic acid	10.2 per cent.
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Surface ore from parallel formation 1½ chain to the south and 40 feet higher than tunnel:—

Tungstic acid	3.4 per cent.
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These samples were taken from the clean vein-material, unmined with wall-rock, a considerable amount of which will be broken with the vein-material in the exploitation of the lode, thereby rendering the average grade very much below that quoted here.

These small workings produced 30 cwt. of high-grade ore, containing over 20 per cent. tungstic acid.

There are several other parallel formations, none of which is at all developed, but they all have promise of becoming profitable sources of wolfram.

(d) General Remarks.

The pegmatitic detrital material already referred to as containing payable quantities of wolfram and molybdenite offers the greatest prospect for cheap and profitable exploitation. The only difficulty to be overcome is that of a sufficient water-supply for the operation of ground-sluicing. Tin Spur Creek is the only permanent stream suitable for the purpose in the vicinity, but the larger portion of this water is used by the Falls Syndicate in operating their mine, and is therefore not available. As there is an abundant supply obtainable from several small creeks flowing through the property during the winter months, it seems advisable to confine operations on this property to the period covering the rainy season.

The several veins require more thorough development before an estimate can be made of their true value.

(17)—Section 7814-M, 80 Acres (Leases: B. L. Thomas and E. J. Rees). *Tin Spur*

Situate near the summit of Oliver's Hill, at an elevation of 2330 feet above sea-level, and 1400 feet above Lorinna-road, the physical conditions are admirably suited for economic exploitation. The property at the present time is held under option for purchase by Messrs. D. Griffin and F. Richard, of Latrobe, who are exploring the lode by means of a crosscut adit, the entrance to which is 70 feet below the outcrop. On the surface the lode, 3 to 8 inches wide, is largely made up of gossanous material, the tin contents varying greatly from point to point. Rich specimen stone was obtained from the outcrop directly above the end of the adit, but the lode is patchy and in some places it is very small and barren. The vein is contained in hard mineralised quartzite, through which barren quartz veinlets ramify in all directions. Like so many similar occurrences in this locality, the veins are remarkably persistent in a linear direction. The dip is 52 degrees west of south.

The crosscut, sent in 72 feet in a direction north 70 degrees east, intersected the lode at 69 feet. From this point a south-east drive follows the course of the lode 40 feet. It is very poor at this level, and although a little gossan appears and a thin vein of quartz, the bulk of the formation consists of kaolin contained between sandstone walls. Facings of cassiterite on the sandstone occur in the crosscut. Pyrite is the most common metallic constituent of the lode-material. Developmental work here is very disappointing, and the results afford little encouragement for further exploration.

Gold up to 14 dwt. per ton is reported to have been recovered from shafts sunk on a ferro-manganese formation by T. Dawson and T. Terry about 28 years ago. These workings are situate near the south-east corner of the section. It is understood that the gold content of this ore-body, which extends into the neighbouring sections, is very irregularly distributed.

At the head of Rees Creek alluvial ground of small extent contains fair tin prospects.

An east-west lode-formation, about 7 chains north-west of the shafts sunk on the gold-bearing ferro-manganese ore, composed of yellowish shaly material, contains a little tin-stone. A body of iron pyrites in sandstone occurs between the latter and Griffin's workings. These constitute the

whole of the known mineral occurrences on the property, and while no payable ore-shoots have as yet been developed, they are worthy of continued attention.

(18)—Section 7869-m, 40 Acres (Lessee: E. J. Rees).

This is an undeveloped property, situate south and adjoining the Premier section. Granite occupies the greater part of the surface, which rises steeply towards the east from the banks of the Forth River. In the road-cutting near the centre of the section molybdenite veinlets on the walls of cracks in the granite are commonly noted.

One chain south from the northern boundary, near the north-east corner, a small cut has been put into decomposed granite containing wolfram. The lode-formation is about 5 feet wide, and consists of a number of mineralised contraction joints or fissures. One such fissure shows fairly good wolfram prospects, but the average content is low.

Just over the southern boundary of this section the granite-porphyrroid contact-rock carries a fair amount of molybdenite. The contact-rock is a form of greisen consisting essentially of quartz and brown mica. It has been developed by means of a small open-cut sent in from road-level—this is known as Reardon's cut.

(19)—Section 7416-m, 30 Acres (Lessee: E. F. Blyth).

Situated south of the Falls Mine and east of the Premier, and near the granite contact with porphyroid and sandstone, this section is one which may be expected to contain ore-bodies. Up to this time no developmental work of any kind has been attempted. Samples of vein-material broken from an outcrop were found to contain—

Silver, 4 dwt. 11 gr. per ton.
Gold, 2 dwt. 17 gr. per ton.
Tin, 0.40 per cent.

On the northern part of the section tin oxide and gold have been recovered from detrital material. The surface is wholly occupied by sandstone.

These results are encouraging, and suggest that the property is worthy of a little more attention.

(20)—Section 7870-m (E. F. Blyth).

Lying between the Hidden Treasure section on the west and the Falls Mine on the east, this property offers considerable inducement to prospectors. The greater part of the surface is occupied by tubicolar conglomerates and sandstones. At the south-west corner the underlying porphyroid crops out, and at this angle of the section granite also is seen. A little tinstone shows as facings on the conglomerate at this point, and a little gold and tinstone have been recovered from the north-eastern part. Nothing of any appreciable value, however, has been discovered up to this time.

(21)—Lease 7892-m, 40 Acres (Lessee: E. J. Rees).

This property is situate north and adjoining Lease 7890-m, held in the name of E. F. Blyth, and occupies portion of the south-western slopes of Tin Spur.

Very little prospecting has as yet been done, and no openings of any kind have been made. At the time of the writer's visit, the survey of the boundaries had not been commenced, and therefore it was found difficult to fix the position of the prospects. Near the south central part of the section cassiterite (tinstone) occurs in small quartzose veins, 3 to 5 inches wide, contained in schistose porphyroid. Veinlets of quartz traverse the porphyroid in all directions, and cavities in them filled with highly-developed quartz crystals and muscovite mica are commonly noted. The tubicolar conglomerate directly overlying the porphyroid at the point of junction shows facings of cassiterite.

The very slight alteration of the porphyroid at the granite contact suggests a thinning-out of the granitic mass at this point. This is another instance of the general occurrence of tinstone outside the granite boundary.

No work at all has been done on these small veinlets. It is, therefore, impossible to form an opinion of their prospective value. A specimen broken from the outcrop contains 22.4 per cent. tin. This is no criterion of the true average value.

(22)—Section 1414-m, 40 Acres.

Situate north-west and adjoining Morgan's lease, No. 7902-m, and close to the Forth River, this section is on the Falls Mine line of lode. The surface is occupied by

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ir. The adit is now in very poor condition and no ore can be seen in the drive. Reid, however, reports that a lode striking north-west and dipping flatly south-west, composed of galena, sphalerite, pyrite and chalcopyrite was encountered here. A few lumps of ore consisting of small blebs of galena in hard, grey quartzite can be found on the dump and were doubtless derived from the drive. The lode does not appear to have been at all promising judging by the amount of work done on it.

Open Cut Workings.—The only production of note in this area came from these workings. They consist of a trench 30 feet long from the end of which a short drive was put in. The trench is in rather disturbed, fine-grained, yellow sandstone and grey quartzite all very weathered. The drive is along the same faulted anticline as that in which the ore body at No. 3 adit was contained. The quartzites in the drive have behaved as competent units during the faulting whilst the shaley beds beneath these are crushed, brecciated and mineralised. The puggy, mineralised, fault zone itself forms the main ore body but ore deposition has also extended into the softer beds on either side of the fault. This fault zone has been stoped overhead for a short distance and a winze 25 feet deep has been put in in the centre of the drive. A few tons of ore are stacked outside, samples of which assay:—

		Zinc		Lead		Silver			Gold		
		%	%	Ozs.	dwts.	grns.	Ozs.	dwts.	grns.		
Average Ore	(1)	2.2	4.0	5	8	10	0	0	6		
	(2)	2.6	3.2	3	19	17			trace		
Selected Galena	(3)	0.5	34.8	54	16	0	0	0	12		

Samples (2) and (3) contain traces of copper.

No. 2 Adit.—This has been put into explore the ore body encountered in the open cut workings at a greater depth. It commences on the hillside 40 feet vertically beneath these workings and has been driven for 124 feet along a bearing of 229°. At 80 feet the drive has been put in along a bearing of 297° for 40 feet, directly beneath the open cut. As far as the drive the adit is in grey-green argillites overlain by quartzite and dipping north at about 15°. From here to the face it is in hard, blocky quartzite dipping steeply south. The drive is along the axis of the faulted anticline exposed in the workings above and No. 3 adit. No ore is exposed in the drive but Reid reported "very little galena between the bedding planes".

No. 1 Adit.—This lies 180 feet vertically beneath the No. 3 adit and has been driven from near the south bank of Claude Creek along a bearing of 220° to intersect the No. 3 adit ore body at depth. The adit is 302 feet long and is in hard, blocky quartzite throughout, except for a few thin slate brands. Near the face of quartzite is somewhat shattered and carries numerous quartz veins. The quartzites are gently undulating to 290 feet where an anticlinal axis is crossed. A few shears cut the adit and have been indicated on the plan. The adit has not been driven far enough to intersect the mineralised fault zone in the open cut workings at No. 3 adit. No other mineralisation has been encountered in this adit.

(c) Conclusions

Summarizing the important points in this area we have:—

1. All the mineralisation is related to the same faulted anticline which appears to plunge gently north-west (approximately 5°).
2. The deposits worked in the open cut and intersected by the No. 3 adit apparently represent the remnants of more extensive ore bodies which have been largely removed by denudation.
3. The beds beneath the No. 3 adit are dominantly massive quartzites and are not favourable host rocks. Both the low level exploratory adits have failed.
4. To prospect beds higher in the formation it would be necessary to explore the anticline further to the north-west.
5. The geological structure in that direction is concealed beneath extensive talus accumulations.

Hence, the prospect of further ore bodies to the north-west should not be discounted but it is considered that the area does not offer sufficient encouragement to warrant exploration as a separate venture.

(3) THE TIN SPUR AREA

(a) History

The sections originally worked in this area have long been abandoned. Apart from some desultory prospecting no serious work has been done here for about 35 years. When Twelvetees and Reid visited the area a good deal of work was being carried on at the various leases and Reid, in particular, in a subsequent type-written report was impressed with the possibilities of the area. The area has hardly seemed to have justified his enthusiasm.

Since many of the workings which were open at the time of Reid's visit have since collapsed it is not possible to re-examine the area as critically as one would like. The lodes which Reid referred to in several of the sections now appear difficult to visualise.

From a geological point of view the area is of great importance. Reid described porphyry intrusions into the "pipe stem" (Moina) Sandstones. If this is correct then these porphyries must be of post-Ordovician and presumably Lower Devonian age. This is contrary to some of the recent findings with regard to these rocks and it is desirable to clear up this problem. However, whilst the writer disagrees with Reid in this matter it should be realised that at the time of his visit the area was opened up much more thoroughly and that Reid had access to exposures which are now obliterated.

(b) Geology

The Moina Sandstones, here consisting of dense, white quartzites and friable sandstones, often packed with tubicolar casts, occupy the majority of this area. The remainder is occupied by Roland Conglomerate except for the small patch of Dundas Group porphyry exposed beneath the scarp of the Tin Spur Creek Fault.

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Over a good deal of the area the bed rock is concealed beneath extensive soil, talus and fluvio-glacial deposits. Outcrop generally is poor and the detailed structure is difficult to interpret.

The main fault is the Tin Spur Creek Fault. This is a large thrust fault trending north-west and dipping south-west at 30° to 35°. The rocks are folded along north-west trending axis into a series of fairly sharp anticlines and synclines. A major synclinorium with its axis roughly along Magee Creek is the main fold, the others being essentially drag-folds on the limbs of this major structure and drag dips up against the Tin Spur Creek Fault. In general there is comparatively little folding in the rocks on the upper plane of this fault but the rocks lying beneath the thrust plane are much more disturbed.

In his reports on this area Reid referred to porphyry sills within the Moina Sandstones. After a careful examination of all the accessible workings and outcrops throughout the area the writer can find no evidence for such sills. As mentioned earlier, grit beds in the Moina Sandstones sometimes resemble sheared porphyries and it seems likely to the author that these porphyry sills of Reid are in fact such grit beds.

Reid (page 117) says that the "greyish porphyry, . . . greatly resembles sandstone at first sight". Also in an earlier inspection of the field Twelvetees (page 95) stated "The country rock is the pipe-stem sandstone, sometimes indurated at other times quite friable. In its white, granular condition it has been taken for an igneous rock and has received the local name of porphyry".

A careful examination of the outcrops combined with the fact that fragments of the Cambrian porphyries may be found in the base of the Roland Conglomerate has convinced the writer that Reid misinterpreted these rocks.

The occurrence of skarn rock in this area has been referred to earlier. This garnet-epidote rock or, perhaps more correctly, tactite, certainly does occur near the mouth of Tin Spur Creek. Reid also reports that it is present in this locality in association with some of the ore bodies. The present study of the area has revealed no trace of this. The point is discussed more fully in connection with the description of the lower workings.

(c) Mining Properties

Since most of the old workings are now in poor condition it is convenient to group these into two sets of workings; (i) those at the Falls Mine; and (ii) the workings around Gorey's Tunnel, Duff's shaft and Ashworth's workings; here called the Lower Workings.

i. Falls Mine

The discovery of tin at this locality was made by R. Magee and B. L. Thomas about 1918. The mine is situated just above the road cutting of the present Lorinna Road a few chains west of Tin Spur Creek. The original outcrop as described by Reid was of "a lode consisting of gossanous material carrying tinstone in considerable quantity". The original lode has since been removed in the open cut workings.

The property was originally worked by driving a crosscut adit for about 25 feet under the gossanous material and driving along the lode for about 40 feet. Only a few feet of these workings are now visible in the open cut. The rocks in the cut are deeply weathered and covered by the toe of extensive talus accumulations from the scarp of the Tin Spur Creek Fault which lies about three chains up the hill south of the open cut.

The lode material was described by Reid to "contain a good deal of silica and undecomposed porphyry". The rocks now found *in situ* in the cut at the Falls Mine consist of deeply weathered, ferruginous sandstones and siltstones, but numerous porphyry boulders are present in the overlying talus. Some of these porphyry boulders are quite large and in small exposures could have been taken for *in situ* outcrops. Since all the rocks are so deeply weathered and covered by extensive superficial deposits it is difficult to pick up any reliable structure in the open cut. However, no porphyry *in situ* can be found in this cut or in the road cuttings in this vicinity. The only porphyry occurring in place in this area is that lying unconformably beneath the Roland Conglomerate and exposed by the upthrown block of the Tin Spur Creek Fault.

Small quantities of cassiterite can be washed from the material forming the face of the open cut but none of this is in commercial quantities. The two "lodes" in this cut are separated by a barren zone and on sampling were both found to contain only traces of tin.

After a thorough search of the area no commercial deposits of tin were located although small tails of tin can be obtained by washing the detritus from many parts of the hill-side. In the road cuttings between the Falls Mine and the Dolcoath Granite, a distance of over half a mile, cassiterite can be seen at many points. The tinstone is almost exclusively found as tiny black crystals associated with quartz in facing along the major joints. None of these occurrences in the cuttings show the slightest possibility of being a commercial proposition. There is a tendency for the tin to be concentrated along the strong joints associated with the Tin Spur Creek Fault on both the upthrown and downthrown side of it.

The concentration of tin which led to the establishment of the Falls Mine has probably been due to simple gravity concentration of the metal in the detritus below the scarp of the Tin Spur Creek Fault. The Moina Sandstones on the downthrown side of the fault at the mine have been slightly mineralised and carry pyrite, cassiterite and quartz in friable sandy beds. However, this mineralisation on its own is not a commercial proposition and it is only when the weathering products of these rocks have been concentrated in talus accumulations that they become payable. Such concentrations are extremely erratic and unlikely to be of large scale economic importance.

ii. Lower Workings

The majority of work carried out at Tin Spur was in connection with these deposits. A number of lodes were worked in the vicinity of the old road on the western side of Tin Spur and also on the nose of Tin Spur itself between the old and the new roads.

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The original discovery of tin in this vicinity was made by T. L. Johnston and Jordan about 1889 and the ore bodies were explored sporadically for about 35 years or so before being finally abandoned. The lodes have been regarded as an extension of the Falls line of lode. However, it is unlikely that those lodes persist for this distance. The deposits are more likely to be isolated ones associated with fractures and brecciation close to the Tin Spur Creek Fault.

The workings have been abandoned for so long that they are now in very poor condition. Ashworth's shafts and the West Tunnel have collapsed and are no longer accessible. Duff's shaft is partially filled with water and is also inaccessible. Gorey's tunnel was blocked by a fall at the entrance but was cleared out and re-examined.

Reid reported skarn rock in this tunnel but a close examination has failed to reveal this although the tunnel is still in fairly good condition at the point where this rock is reputed to occur. A sheared quartzite fairly heavily iron-stained is present which may superficially resemble skarn rock. A sample of this was examined by the petrologist Mr. G. Everard and he reports:—

"The specimen is a fine grained, greyish-brown sheared rock. The colour is somewhat blotchy and irregular, weathered surfaces are fairly heavily iron stained.

In thin section the granularity is not uniform, one part having an average grain size of .25 mm. and another .02 mm., while another part is intermediate. The texture in each part is granular, and the minerals present are quartz, biotite and sericite. The quartz grains of any part are equidimensional, anhedral and interlocking. Biotite is present interstitially and as veinlets and irregular patches; it is very fine grained. Sericite occurs as shreds and patches of small size.

The rock is a quartzite."

The presence or absence of skarn rock in this tunnel is most important from a structural point of view. If it were present it would require an extremely complicated structure to account for its presence in Gorey's tunnel. After re-examining the tunnel the writer is satisfied that the rock does not occur in these workings.

Since most of the workings in which the lodes occurred are now inaccessible it is impossible to comment upon them. Reid (page 114) quotes assays from Duff's shaft and Ashworth's workings which appear attractive, but these workings have since been abandoned. It seems likely that the ore bodies were rich in the detrital material at the surface but that at depth they were unpayable. Such tin as can be found around Duff's shaft and the nearby sluicings consists of very fine grained cassiterite along joints and fractures. However, these "lodes" are extremely erratic and are quite unpayable.

As with the Falls Mine the only payable tin recovered in this area was probably concentrations in the superficial deposits formed by the weathering of the quartzites and sandstones. The parent rocks carry small quantities of disseminated tin and pyrite in certain beds. Similarly to the Falls Mine there is a fairly persistent zone near the Tin Spur Creek Fault where primary tin occurs along joints. These primary "ore bodies" are not payable but where concentration of the weathered sandstones occurs, reasonably rich pockets of tin could occur locally.

iii. General Remarks

As it stands, the known workings of Tin Spur are not payable. Nevertheless there is a fairly persistent zone of tin bearing rocks in the area paralleling the Tin Spur Creek Fault for over a mile.

As mentioned earlier the actual fault plane is not well exposed anywhere. However, in mapping the fault over some distance it has been possible to locate it within a few feet at most points. There is no evidence as to whether the fault zone has acted as a lode channel or whether payable deposits of primary ore may be found within the fault zone itself.

This theory is attractive due to the associated disseminations in the rocks near the fault but cannot be suggested with confidence. Of all the workings in this area Duff's shaft is the only opening which could pierce the fault zone. Since this shaft is inaccessible it cannot be demonstrated that it does in fact intersect the fault. However, it would be expected to on structural ground. The records contain no reference to any enrichment of ore at the point where Duff's shaft would be expected to intersect the fault.

The tin which has been produced in this area has been very largely derived from secondary deposits. Such deposits may be easily worked by prospectors and the area may well repay serious prospecting by small parties in search of rich pockets of detrital material. The old water races put in by the original companies to the Falls Mine and to the Lower Workings could be fairly easily restored and water could therefore be diverted from Tin Spur Creek to the ground lying below the Falls Mine.

The thickest superficial deposits are those lying below the scarp of Tin Spur Creek Fault. The majority of this deposit has not been tested and it is therefore possible that further small enriched patches may occur to the north-west and south-east of the Falls Mine. The search for this kind of deposit is essentially a prospector's proposition and may pay well for single men or very small parties but is of little interest to large concerns since such deposits are likely to be very small in extent.

To seriously test this area for further primary tin deposits it would be necessary to drill the area thoroughly along the Tin Spur Creek Fault. Any drilling there should commence on the upthrown (south-west) side of the fault and penetrate well into the brecciated sandstones on the lower plane of the fault.

Although no payable primary ore bodies of any size have been found in this area the widespread minor occurrences of tin suggest that it would be unwise to ignore the possibility of payable deposits occurring in this area.

(d) Conclusions

- (1) No payable deposits of tin are at present exposed in this area.
- (2) Most of the tin won in the past has come from detrital deposits.
- (3) The primary tin is present as disseminations with pyrite in friable beds in the Moira Sandstones and as facings along joints in the denser quartzites.

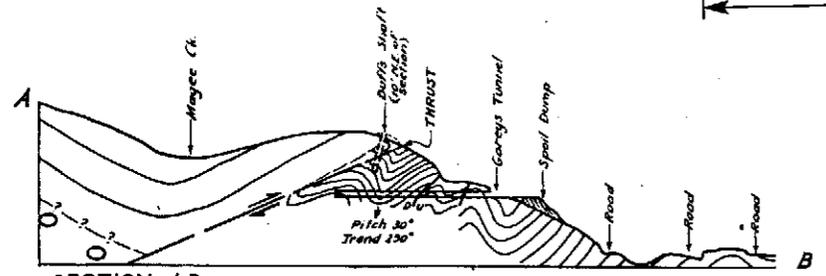
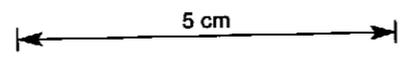
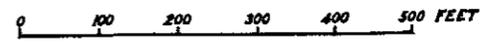
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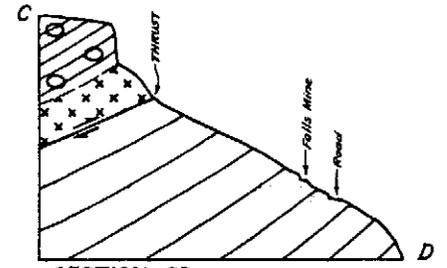
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FIG. 15

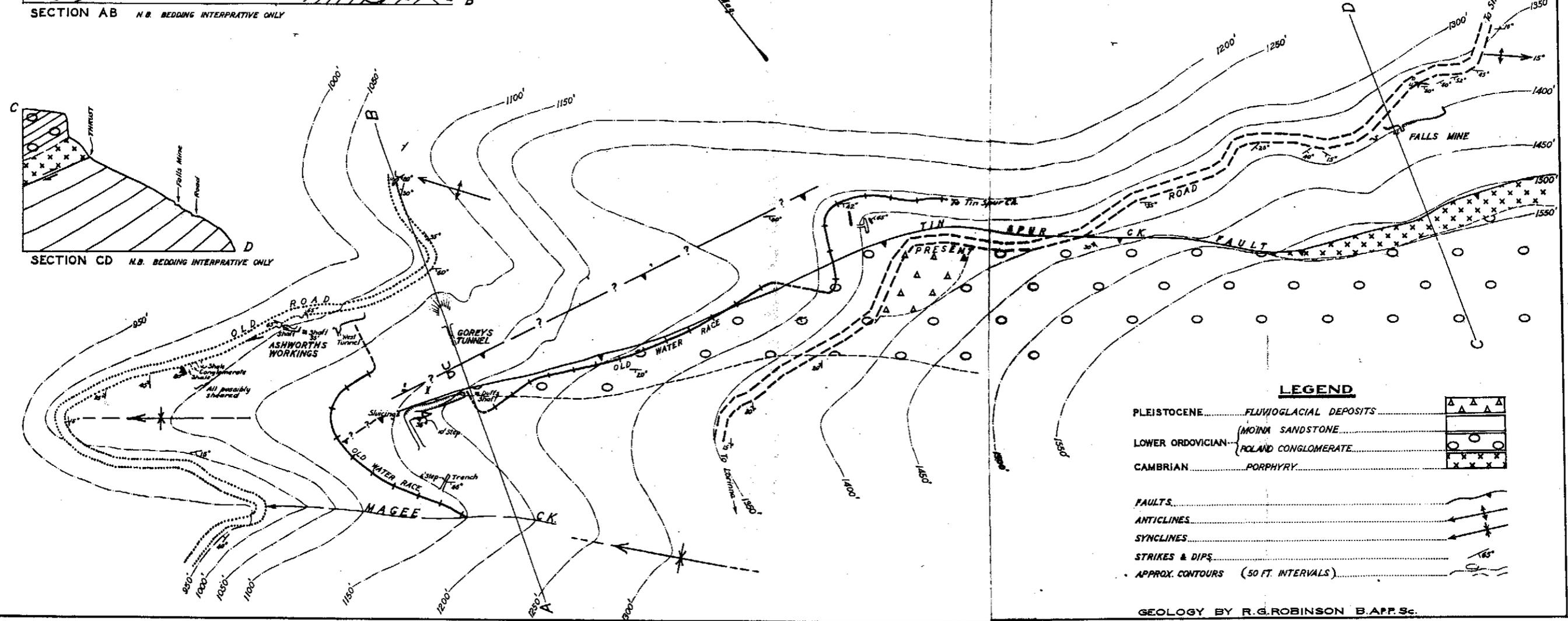
TIN SPUR AREA



SECTION AB N.B. BEDDING INTERPRATIVE ONLY



SECTION CD N.B. BEDDING INTERPRATIVE ONLY



LEGEND

PLEISTOCENE	FLUVIOGLACIAL DEPOSITS	
LOWER ORDOVICIAN	MOINA SANDSTONE	
	POLAND CONGLOMERATE	
CAMBRIAN	PORPHYRY	
FAULTS		
ANTICLINES		
SYNCLINES		
STRIKES & DIPS		
APPROX. CONTOURS (50 FT. INTERVALS)		

GEOLOGY BY R.G. ROBINSON B.A.P.P.Sc.

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At Johnson's reef an outcrop of dense hematite contained a vein of pyrite 4 to 12 inches wide which was said to have carried gold at the surface. This vein also must have been unpayable below ground as workings were abandoned within a few feet of the surface.

In 1934 the shaft was unwatered and a parcel of ore broken from below the 50 foot level. This returned 14 dwts. of gold from 2½ tons of stone. The tunnel level was extended 12 feet and a crosscut put out for 24 feet. In the following year the mine was taken over by J. Godwin who unwatered the shaft to the 50 foot level and carried out some driving and crosscutting.

The Devonian Mine

This mine was on section 416-93G, 10 acres, taken up by J. J. Wilson in 1895. It lies at an elevation of about 2400 feet a.s.l. about a mile to the NE of Olivers Hill, 2½ miles NE of Lorinna at approximately 414250E/888400N. The workings lie close to the ferromanganese deposits on Olivers Hill and are indicated on Fig. 19.

The mine has been abandoned for many years now and the shaft is inaccessible. Only the surface workings consisting of some trenches may be examined. Twelvetrees (1913) described the lodes as a main vein 4 inches wide and another vein on either side of the trench with other veinlets between them. He also stated that at the surface one dwt. of gold to the dish could be obtained.

The lode is contained within the crush zone of a NW trending thrust fault in Molna Sandstone. Since the original works were carried out the dump has been retreated but the results of this have not been recorded.

Samples taken during a recent survey of the area showed the following results:—

(1) From a 9 inch vein in underlay shaft.

Au—nil
Ag—7 dwts. 20 grs./ton.
Pb—0.8%
Mn—Trace
Fe—2.5%

(2) Flat 3 inch vein in underlay shaft.

Au—1 dwt. 20 grs./ton.
Ag—3 dwt 7 grs./ton.
Pb—1.8%
Mn—Trace
Fe—1.3%

(3) Ferruginous sandstone from dump.

Au—nil
Ag—nil
Pb—nil
Mn—0.14%
Fe—32.1%

The indications are that the lode here was probably similar to those on the Five Mile Rise. That is, a mineralized fault zone relatively rich in gold at the outcrop but passing into sulphides with poor gold values at depth.

(b) IRON PROSPECTS

The Powerful Mine, Lorinna

In earlier reports this mine is sometimes referred to as Reardon and Day's mine.

It is situated at approximately 8810N/4114E on the east side of the Forth River near its confluence with the Dove River.

The mine was started about 50 years ago by S. Reardon and a local syndicate to explore some bold outcrops of a quartz and specularite lode which carried small quantities of gold. The lode occurs in the Dove Granite about a mile north of its boundary with Precambrian schist of the Dove Group. In the vicinity of the mine the granite is everywhere deeply weathered and no specimens of the country rock suitable for petrological examination were found. The granite is medium to coarse grained and consists of kaolinized pink and green feldspars with rounded and embayed quartz crystals and altered biotite.

The mine was described by Twelvetrees (1913) and Reid (1919a) who regarded the granite as a member of the "porphyroid" series, i.e., the Cambrian rocks thereabouts. Despite this, Reid noted that the granite "greatly resembled" the Devonian biotite granites.

The assumption that the Dove Granite was a plutonic member of the Cambrian rocks was considered by Twelvetrees to indicate that at depth the lode might prove to contain economic sulphide mineralization. It has been noted elsewhere in this report that the Dove Granite is associated with sulphide deposits in contrast to the marked tin-tungsten association of the Dolcoath Granite. This supports Twelvetrees's view, though the relegation of the Dove Granite to the Cambrian is not considered to be valid. Development work on the mine indicated that the lode showed no sulphide mineralization at the depths explored and had little economic value.

The detailed workings were described adequately by Twelvetrees and Reid. They consist essentially of a number of small trenches and open cuts on the hillside above the road and an adit driven in from road level for about 100 feet.

This consists of a quartz hematite lode containing varying quantities of pyrite. Robinson (pers. comm.) stated that the lode strikes 320°M and dips to the west at about 75°, whilst Twelvetrees gave the strike as NW and the dip 30° to the SW. As Twelvetrees's observations were made upon outcrops which have since been removed and Robinson had access to exposures in the adit which were not available to Twelvetrees it seems probable that both writers are partly correct and that the dip of the lode is variable. This may account for the variation in thickness given by Reid (1919a) and Robinson (pers. comm.). Reid estimated the lode to be from "8 to 14 feet wide" from the surface workings; Twelvetrees gave 40 to 50 feet for the width of the lode system together with "horses" of granite, and Robinson considered the horizontal width to be 190 feet. In the adit only 7 feet 6 inches horizontal width is encountered but the adit has not been driven far enough to prove the overall lode width.

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the property was worthy of attention. However, further prospecting failed to disclose any worthwhile mineralization and the prospect has been abandoned for many years.

Other small galena veins near the Devon mine in leases 4665-93M, 1978-93M, 3289-93M and 3288-93M were prospected at various times when the Devon mine was operating but these also proved to be too small and erratic to be of value.

The Silver Dove prospect is located about a mile downstream from the Devon Mine and was considered by Reid (1919b) to be worthy of further attention. Reid reported a 3 inch vein of pyromorphite at this prospect and noted that a tunnel 20 feet long driven on the lode disclosed no improvement in value. This tunnel was subsequently extended to at least 150 feet (Nixon, field notes) without encountering any worthwhile mineralization.

The chances of locating payable lodes in the bed of the Dove River are slender. The river has cut a deep youthful gorge along its course and outcrops along the river are good. The stream has been thoroughly prospected in the past and has been traversed during the course of this survey and no signs of workable mineralization have been discovered although small veins and odd mineralized patches may be found at many places.

The valley sides are precipitous and covered by dense vegetation so that lodes outcropping along the upper slopes of the valley may well have escaped detection. Geologically there are no special structures or features in the Precambrian rocks which are particularly favourable for ore deposition. The unconformities between the Precambrian, Cambrian and Ordovician rocks along the north side of the valley appear to be the most favourable sites for future prospecting.

The difficulties of providing access into the Dove Valley are great and all the orebodies located so far have been small. It is clear that only large and/or high grade orebodies could be mined profitably in this area and future prospectors should bear this in mind before expending capital on an access route to prospects.

(d) FERRO-MANGANESE DEPOSITS

Olivers Hill

The conspicuous outcrops of ferro-manganese in this vicinity were noted by Reid (1919a) and doubtless attracted the attention of prospectors for many years. Several adits, small shafts and trenches were put in on the deposits in an effort to explore them but no production resulted. The gossanous nature of the material no doubt led prospectors to believe that the outcrops must be the capping of a sizeable sulphide orebody. Leases 7125M, Evenden and Hanson, 36 acres, 1915, and 11722M, Evenden and Stone, 1937, have been held in the vicinity of the deposits.

Reid considered the deposits as being worthy of further investigation as a source of ferro-manganese but made no mention of sulphide mineralization in connection with them. He quoted an assay of selected ore containing 22% iron oxide and 68% manganese oxide. This manganese content is far higher than in any of the samples taken during a recent survey of the deposit, carried out by Robinson following the discovery of silver-lead in association with the ferro-manganese. The following report is an extract of unpublished notes made by Robinson.

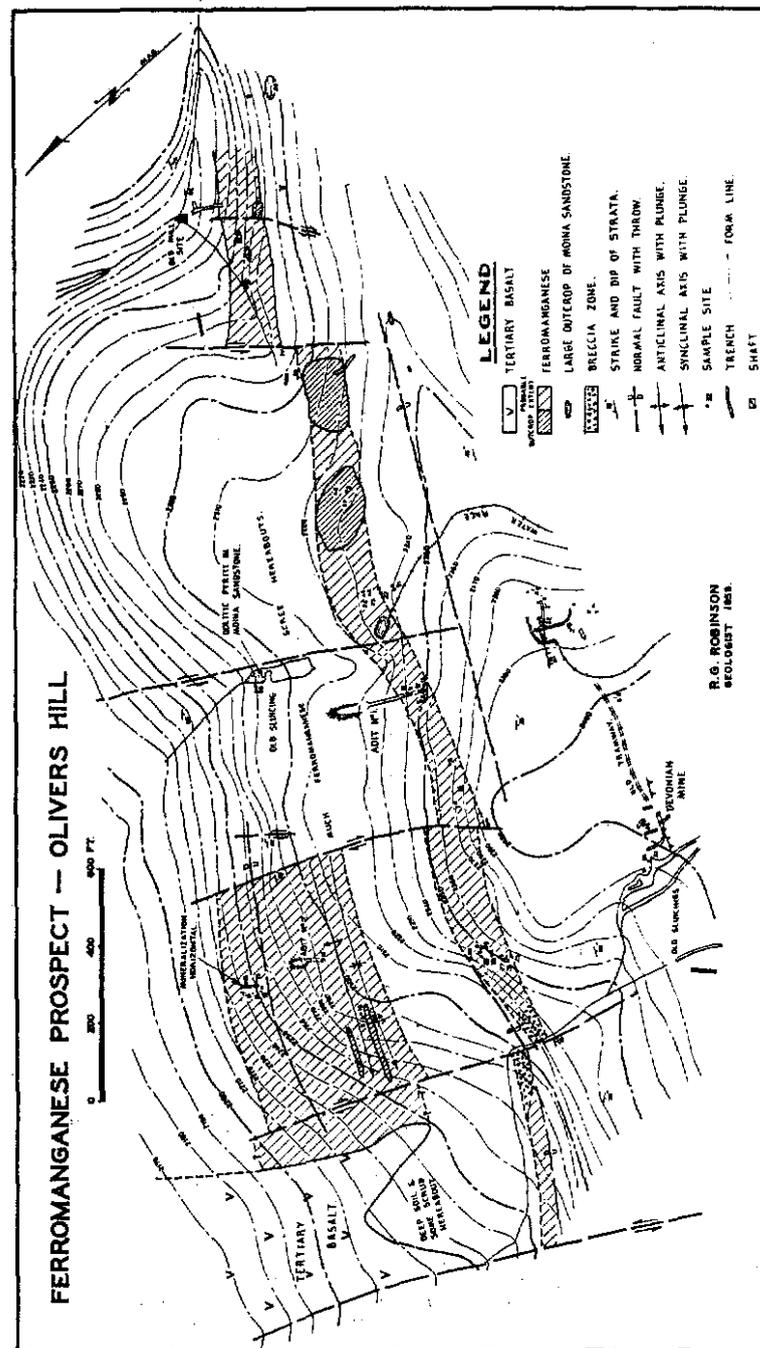


FIGURE 19.

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"Introduction

The main ferro-manganese outcrops on Olivers Hill occur at 888250N/414400E and 888900N/413610E. They are conspicuous by the occurrence of large black outcrops of ferro-manganese which have attracted the attention of prospectors from the early days of gold mining in the vicinity. The early workers considered that the outcrops were the capping of tin or gold lodes but despite the amount of work done their efforts were unrewarded.

The present examination resulted from the discovery of lead in the deposits and work was diverted toward assessing the lead/ferromanganese potential of the occurrences. The survey was carried out by plane table and telescopic alidade and all the old workings together with the surface geology is indicated on the plan (Fig. 19).

Geology

The host rock in the area is the Moira Sandstone which here forms a cuesta with an average dip of 30° to the NE. The deposits are about 1 mile from the Dolcoath Granite but lie at a much higher elevation. The top of the granite is about 1000 feet a.s.l. whilst the ferro-manganese bodies lie between 2400 and 2300 feet.

Near the orebodies the Moira Sandstone is folded along a WNW trending axis and the individual folds have a shallow but variable plunge. The folds are cut by two sets of faults, thrusts trending parallel to the folds and wrench faults, sometimes with normal displacement also, which trend roughly NE.

Apart from the Moira Sandstone the only other rocks present in the area are Tertiary basalt and superficial deposits of talus and soil.

The Moira Sandstone consists of quartz sandstone, often ferruginous, together with about 10% of shale. The lowest beds are very often chocolate coloured and highly ferruginous.

Within the area several occurrences of pyritic spherulites have been noted. They suggest a single bed or group of beds which is repeated by folding or faulting. These beds would probably form a useful marker horizon for detailed mapping as they have also been recorded in the same formation elsewhere in the district (Jennings, 1958). The pyrite in these beds weathers to produce a gossanous outcrop which has been prospected widely by the early workers.

As shown on the accompanying plan, the ferro-manganese bodies outcrop as two roughly parallel lodes trending WNW and aligned parallel to the regional structure. The outcrops in the area are poor and whilst some care has been taken to depict the probable outcrop distribution accurately a good deal of extrapolation has been necessary. The continuity of outcrop is insufficient to establish whether all the outcrops represent a single mineralized bed but this seems to be indicated.

The "lodes" have been disrupted and offset by both NW and NE trending faults, which are presumably of Tabberabberan age.

Two adits were driven under the ferro-manganese outcrops and these both show that the mineralization does not persist even to shallow depths. No. 1 Adit was driven in a poorly cemented friable sandstone showing minor manganese staining and is in poor condition due to extensive falls from the back. The sandstone in

No. 2 Adit was more firmly cemented and coherent and some of the joints carried ferro-manganese coatings which appeared to be secondary. All of the shafts in the area, even those sited immediately alongside bold outcrops of ferro-manganese, bottomed in leached ferruginous sandstone.

It may therefore be postulated that the main outcrops are simply surface enriched cappings underlain at shallow depth by leached sandstone. The primary orebody, if it exists, has not been encountered in any of the openings so far made. Lead values in the surface outcrops are erratic but may average as much as 2.7% whilst in the leached material beneath the surface the average grade appears to be about 0.6%. Manganese and iron values are similarly low and erratic as indicated by the sampling programme. The deposits are therefore considered to be sub-economic by present standards. Details of the sampling are given below. The location of all samples is given on the geological plan (Fig. 19)."

Sample No.	Au oz/ton	Ag oz/ton	Sn %	Pb %	Mn %	Fe %	Zn %
1	Nil	0.8	Nil	1.0	20.5	32.6	N.D.
2	Nil	1.6	Nil	3.3	18.1	36.7	N.D.
3	Nil	2.10	Nil	3.9	17.0	18.4	N.D.
4	Nil	2.4	Nil	5.3	22.9	23.9	N.D.
5	Nil	Trace	Nil	1.5	5.4	25.5	N.D.
6	Nil	0.6	Nil	0.7	23.6	11.1	N.D.
7	Nil	Trace	Nil	1.1	2.2	43.0	N.D.
8	Nil	Trace	Nil	0.4	0.2	34.7	N.D.
9	Nil	0.5	Nil	0.7	1.5	19.7	N.D.
10	Nil	Nil	Nil	0.1	0.98	5.8	0.2
11	Nil	Nil	Nil	0.1	0.16	10.5	0.15
12	Nil	Nil	Nil	0.1	Trace	3.8	0.15
13	Nil	0.33	Nil	0.1	0.61	12.5	0.2
14	Nil	1.64	Nil	0.2	0.92	11.9	0.1
15	Nil	Nil	Nil	1.0	1.02	12.9	0.2
16	Nil	0.72	Nil	1.8	0.98	23.8	0.2
17	Nil	0.36	Nil	1.4	1.08	11.8	0.2
18	Nil	Nil	Nil	0.1	0.04	3.8	0.2
19	Nil	Trace	Nil	Nil	0.49	7.5	N.D.
20	Nil	0.55	Nil	Nil	1.02	10.3	N.D.
21	Nil	Nil	Nil	Nil	Trace	3.2	N.D.
22	Nil	Nil	0.06	Nil	Trace	17.9	N.D.
23	Nil	Nil	Nil	Nil	Trace	10.4	N.D.
24	Nil	0.39	Nil	Nil	Trace	14.2	N.D.
25	Nil	Nil	Nil	Nil	0.16	5.2	N.D.
26	Nil	0.65	Nil	0.1	0.19	14.6	N.D.
27	Nil	Nil	Nil	1.0	1.38	32.3	N.D.
28	Nil	Nil	Nil	Nil	0.86	7.3	N.D.
29	Nil	0.39	Nil	0.9	3.46	12.7	N.D.
30	Nil	Nil	Nil	Trace	0.14	2.4	N.D.
31	Nil	0.39	Nil	8.8	Trace	2.5	N.D.
32	0.09	0.16	Nil	1.8	Trace	1.3	N.D.
33	Nil	N.D.	Nil	N.D.	N.D.	N.D.	N.D.
34	Nil	Nil	Nil	Nil	0.14	32.1	N.D.
35	Nil	Nil	Nil	Nil	Trace	1.0	N.D.
36	Nil	2.25	Nil	4.7	N.D.	8.2	N.D.
37	Nil	Trace	Nil	2.2	N.D.	41.1	N.D.

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Section 6: Geochemistry

41. Geochemical investigations in the vicinity of Oliver Hill, north-west Tasmania

W. E. BAKER

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ABSTRACT

Anomalous lead values have been detected in the vicinity of Oliver Hill, 12 miles SW of Sheffield, NW Tasmania. This area stands over 2,000 feet above sea level and lies amongst the western foothills of Mt Claude. The predominant outcrop is of Ordovician Moina Sandstone with sporadic occurrence of ironstone for about a mile along the northern flank of Oliver Hill. The ironstone has been found to carry up to 6.84% lead with a median value of 200 scatter samples of 0.67%. Zinc and copper are far less abundant with median values of only 0.11% and 0.01% respectively.

Soils of the area are dominated by podzolic humus-rich sands although in the proximity of the ironstone these are modified by the presence of a considerable amount of iron oxide. A soil survey on a 100 ft interval grid over the northern flank of the hill yielded 540 samples which defined a substantial lead anomaly with a range of values from 5 to 14,000 ppm and a median value of 140 ppm which is high compared with a world average figure of 12 ppm. Median values for zinc and copper are below average although within the range obtained from the samples statistical analysis yields anomalies similar to that obtained for lead.

For ground and creek waters, only lead with ranges of 10-115 ppb and 5-25 ppb respectively has values above the average range for fresh waters. Preliminary study of vegetation indicates that the metal present in eucalypt leaves does not reflect the soil content of the metal. For lead, the ash of leaves generally contains less than 100 ppm whereas the supporting soils range from 50-5,000 ppm.

INTRODUCTION

Oliver Hill is situated about 12 miles SW of Sheffield in NW Tasmania. It stands at about 2,500 ft above sea level and lies amongst the western foothills of a range of mountains which include Mts Claude, Vandyke and Roland. These are part of the divide between the Mersey and Forth Rivers and they form the eastern extremity of an arc of mountain ranges underlain by Precambrian and Palaeozoic rocks which sweep around from the west coast of the State. Drainage from Oliver Hill is carried by NW trending creeks into the Forth River

The vegetation is variable with the poorer soils (podsoils) carrying fairly open eucalypt forest dominated by white top stringybark (*Eucalyptus delegatensis* R. T. Baker). Where there has been repeated burning, thick stands of ti-tree (*Melaleuca ericifolia* Sm.) laced with vines (*Bauera rubioides* Andr.) have developed. More fertile soils overlying basalt (stony kraznozems) are restricted to the NW slopes of Oliver Hill and in places these support a more dense forest in which the eucalypts are subordinate to musk (*Olearia argophylla* F. Muell.) and dogwood (*Bedfordia salicina* D.C.).

GEOLOGICAL SETTING

The regional geology of the area is shown in Figure 47. The predominant formation cropping out on Oliver Hill is the Moina Sandstone of Ordovician age. The basal formation of the Ordovician, the Roland Conglomerate, is less than 100 ft thick in the vicinity of Oliver Hill although it thickens rapidly to 800 ft on Mt Roland to the NE. The Ordovician rocks unconformably overlie Cambrian volcanics and both are intruded by the Dolcoath Granite of Devonian age, which occurs as a small stock about 1 mile NW of Oliver Hill. A partial cover of Tertiary basalt and sediments, Pleistocene fluvioglacials, Recent alluvium and talus occurs in the area. Detail of rock outcrop along the NE slope of Oliver Hill is given in Figure 48. The major structure is unknown but minor folding in the Moina Sandstone is assymetric with steep SW-facing limbs and shallow plunges to the SE. At the southern end of the NE slope of Oliver Hill a narrow strip of quartz porphyry with abundant bi-pyramidal quartz phenocrysts crops out within the Moina Sandstone. The contacts between these rock types are obscured by thick soil but as the porphyry is similar to rocks assigned to the Cambrian in other studies which have been summarised by Carey (1947) it is likely that it occurs in faulted relationship with the Moina Sandstone. Along this zone there is also sporadic development of black ironstone. This crops out everywhere at a lower level than the basalt and at one point, near the Tin Spur, it can be traced to the lower edge of a thin basalt flow. It is thus likely that the ironstone is of pre-basalt age. Much of the ironstone, particularly in the Tin Spur area, occurs as dispersed float with few outcrops. In marginal areas some Tertiary gravels have been cemented by iron derived from the earlier ironstone.

PREVIOUS INVESTIGATIONS

Although there is no record of production a small amount of alluvial gold was won around 1895 from the Devonian Mine, high on the NE slope of Oliver Hill. There has also been prospecting for tin on the N slopes of Oliver Hill where it falls away along Tin Spur into the Forth Valley. There is no record of base metal prospecting on Oliver Hill although 2 miles to the N, at Round Hill there was spasmodic mining activity (from 1880 to 1927) on several small orebodies which yielded about 4,700 tons of lead. The more important of these were developed into softer beds of the Moina Sandstone where these were involved in a sheared anticlinal crest (Jennings, 1958). During 1958 the southern part of Oliver Hill was mapped by R. G. Robinson of the Department of Mines and some of the ironstone (then referred to as ferromanganese) was sampled. The assay results were extremely variable and whilst values of up to 8.8% lead were obtained, the majority of samples gave only trace or nil returns for the metal. Zinc, copper, silver and gold were also detected in some samples. The interpre-

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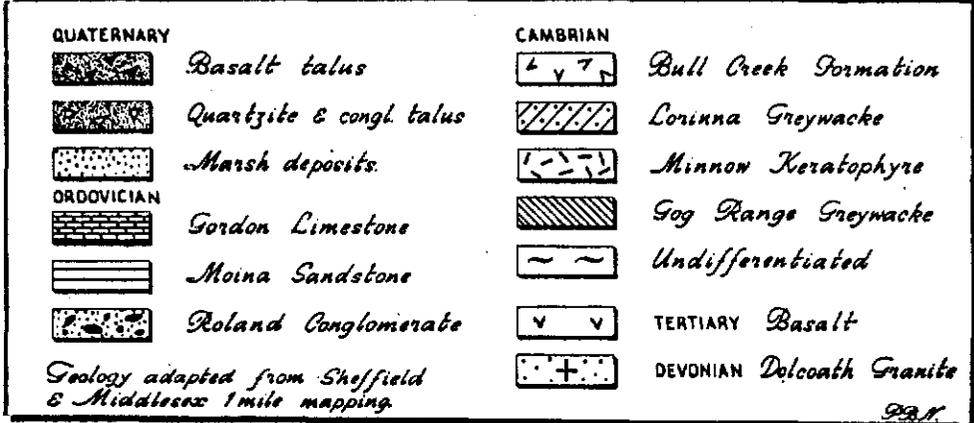
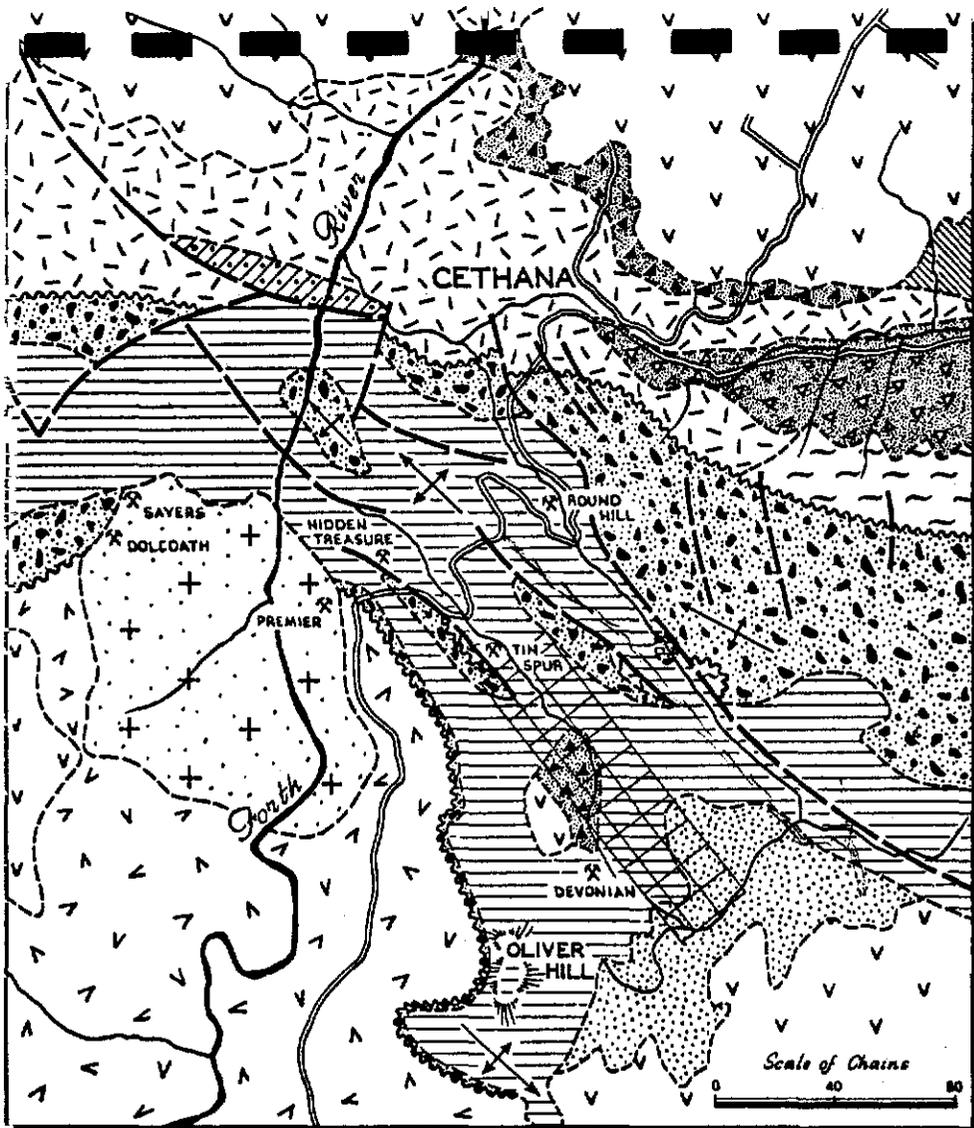


FIGURE 47 Geological map of the Oliver Hill area

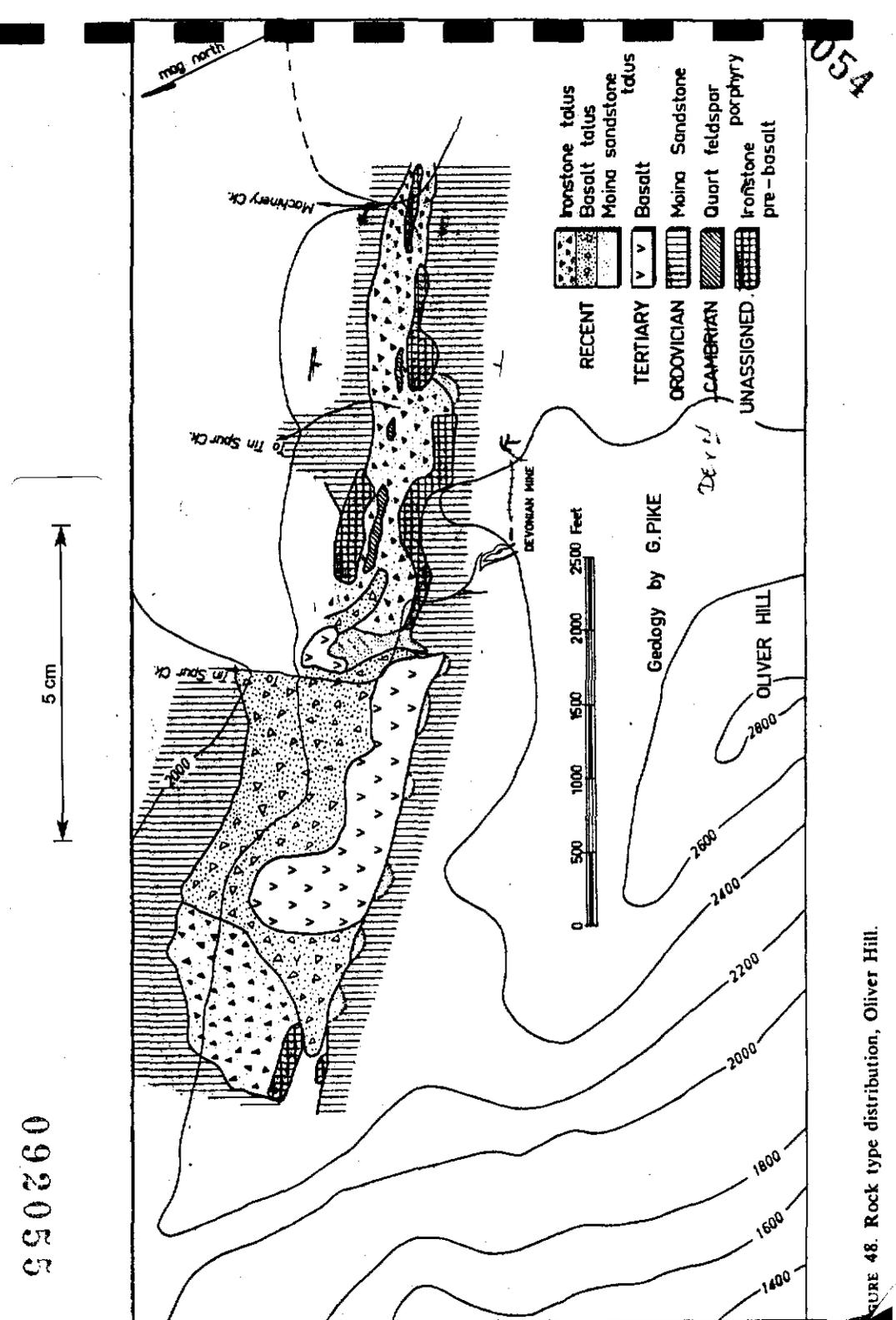


FIGURE 48. Rock type distribution, Oliver Hill.

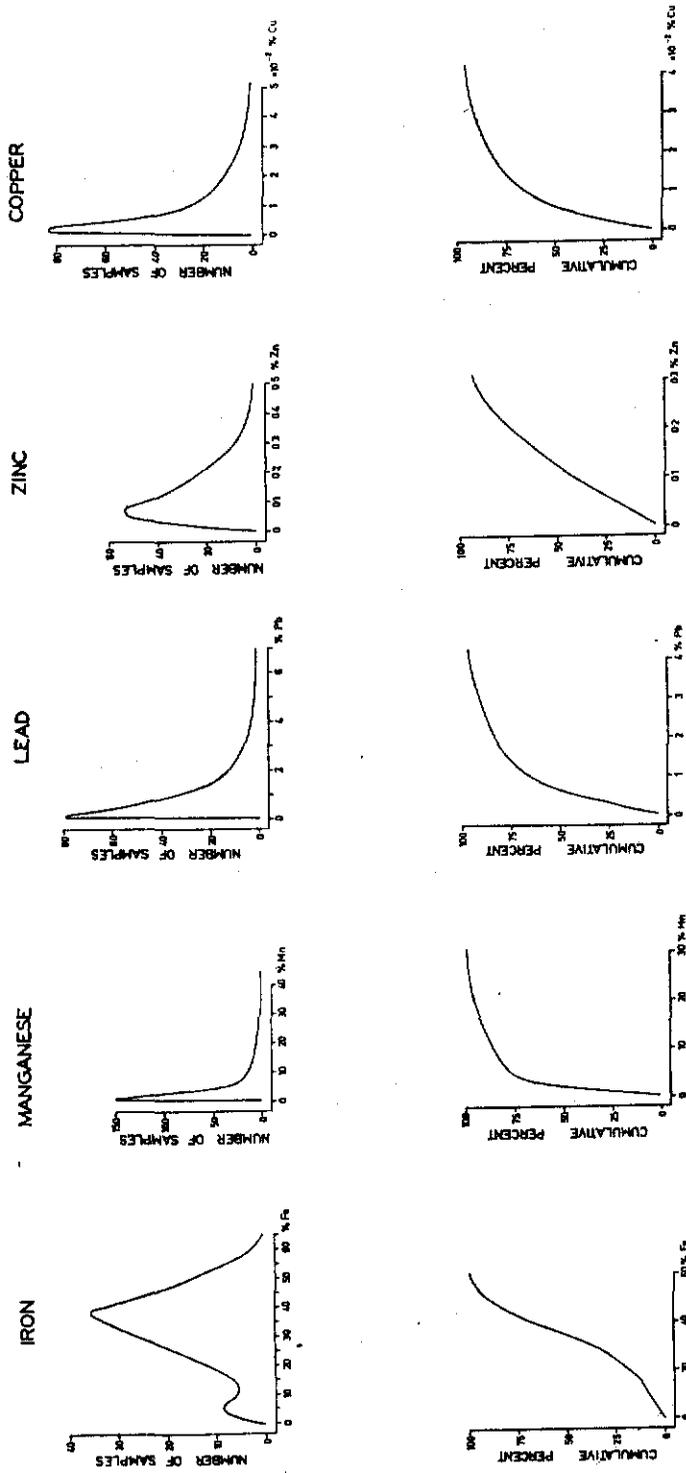


FIGURE 49. Lead, zinc and copper distribution in ironstone, Oliver Hill.

tation then favoured for these ironstones was that they were iron-rich sediments and no further work was undertaken. The results of Robinson's survey were compiled by Jennings (1963). In 1966 stream sediment analysis was applied to exploration throughout the region by a private company and as this revealed nothing of interest in creeks draining Oliver Hill the area was not investigated further.

GEOCHEMICAL INVESTIGATIONS

Study of the ironstone

The current project was commenced by the Department of Mines in March 1969 with a re-assessment of the ironstone. As no survey grid existed at this time an uncontrolled scatter sampling of the ironstone was carried out along the NE slope of Oliver Hill for a distance of about a mile. This yielded 200 samples which were analysed for iron, manganese, lead, zinc and copper. The metals were extracted with hot concentrated hydrochloric acid and the analyses were carried out by atomic absorption spectrophotometry of solutions which were 10% v/v hydrochloric acid and 5% w/v ammonium acetate. The results are given in Table 1. The statistical consideration of geochemical results at present used in the Department of Mines follows the procedures outlined by Yufa and Gurvich (1964) which make use of the median and quartile values to establish averages and deviations for populations of unknown distribution type. The range of lead values is from 0.01% to 6.84%, with a median value of 0.67% and with a quarter of the values exceeding 1.5%. The lead distribution in the ironstone is thus more regular than was suggested by the earlier analyses. Zinc and copper values are far less significant with median values of only 0.11% and 0.01% respectively. Even allowing for differences in mobilities of the three metals during development of the ironstone these results suggest that the parent mineralisation was dominated by galena as was the case at Round Hill. Manganese ranges from 0.01% to 40.43% with a median of 0.54% whilst iron ranges from 0.86% to 62.24% with a median of 35.16%. Most of the material carries little manganese and the term ironstone is preferable to ferromanganese.

In Figure 49 the analytical data are presented as frequency and cumulative per cent curves. The frequency curve for iron is bimodal although one maximum is weak and the majority of the population of values gives rise to a slightly negatively skewed distribution curve. The bimodal character is also apparent in the break in slope in the cumulative per cent curve. The two populations represented in these curves probably reflect the fact that whilst the bulk of the samples were taken from the pre-basalt(?) ironstone sufficient iron-cemented Tertiary gravels were inadvertently included and these produce the weaker maximum. The curves for manganese, lead, zinc and copper differ from those of iron, and all have a strongly positively skewed form. This suggests that manganese is associated with the base metal sulphides whereas the iron may be derived from pyrite which does not necessarily have any quantitative relationship to the former sulphides. Hematite and pyrite spherulites also occur in bands in the Moina Sandstone and these could also be a source of iron. Where manganese is of high value in the ironstone the lead content is also generally high although high lead is not always accompanied by high manganese. Tests of correlation can only be used as guides with data that departs widely from normality as in this study. The data were transformed to logarithms to remove some of the skewness and

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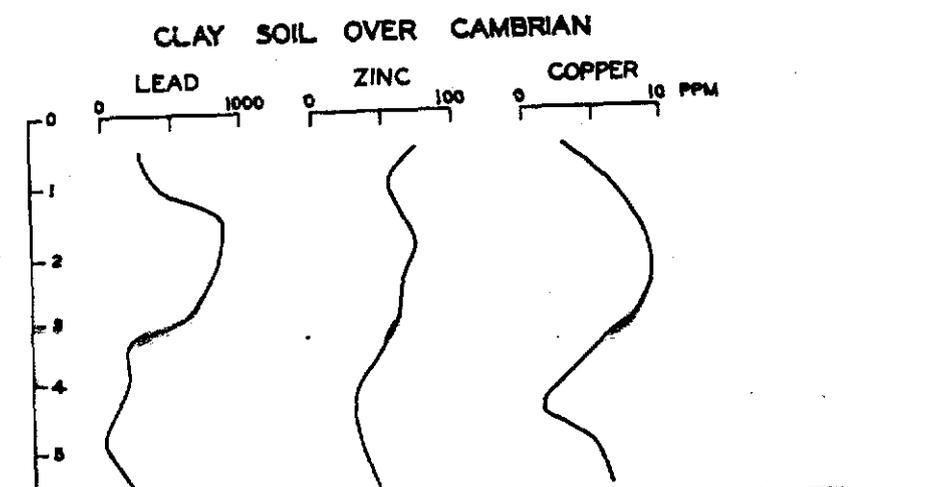
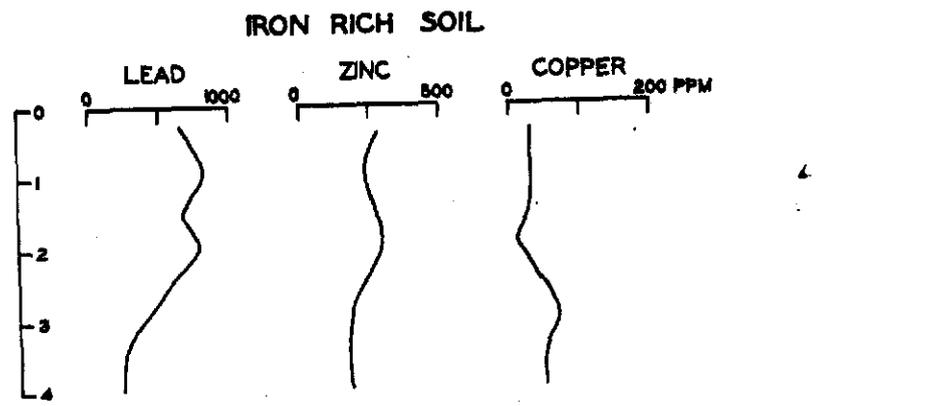
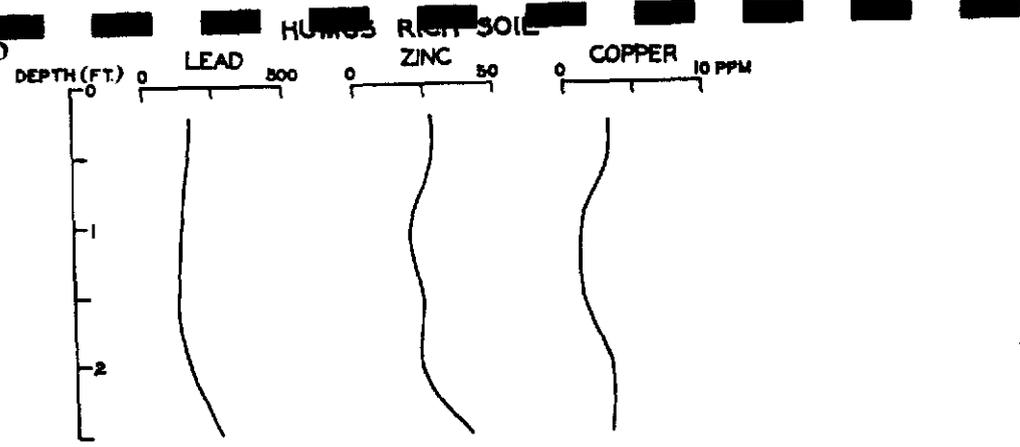


Fig. 50. Lead, zinc and copper in soil from Oliver Hill

correlation coefficients were calculated for these values. These are given in Table 2 where it can be seen that the tendency for high manganese and lead to go together is supported by a correlation coefficient of 0.666. Zinc and copper show a weaker correlation with lead whilst zinc shows no correlation with copper.

The results obtained from the study of the ironstone were sufficiently encouraging to warrant more detailed investigations. A rectangular grid of 100 ft interval aligned approximately SW (214° mag.) and NW (304° mag.) was surveyed over the NE slope of Oliver Hill and a soil sampling programme was undertaken.

Soil studies

The major soil type throughout the area of interest is a humus-rich sandy podsol, although close to ironstone outcrop this is modified by the presence of considerable amounts of iron oxides. Over the limited occurrence of Cambrian porphyry the soils are also podzolic, containing less humus but more clay than the soils over Moina Sandstone. These soil types were sampled through to bed-rock and the distribution of metals with depth examined. Soil samples were sieved to - 80 mesh and 0.25 g quantities were ashed prior to extraction with concentrated hydrochloric acid and determination of the metals by atomic absorption spectrophotometry. From the metal distribution through the soil profiles (fig. 50) it can be seen that there is little variation with depth in the humus podsols whilst in the iron-rich soils and soils over Cambrian porphyry the metal values tend to be more variable. A sampling depth of 12-18 in was selected as giving an average figure for metal content, regardless of soil type, and was considered to be deep enough to be reasonably free from surface burning.

Sampling over the grid yielded 540 samples which were analysed for lead, zinc and copper. The metal values are given in Table 3. Sample designation is by grid co-ordinates with distances in feet approximately NW and SW from the grid origin near Machinery Creek. Median (M_s) and quartile values were obtained from this data and the standard deviation above the median (S_s) calculated. The median value for lead of 140 ppm is well above the average figure of 12 ppm given by Vinogradov (1959) whereas the values for zinc and copper of 20 ppm and 4 ppm respectively are less than the average values of 50 ppm and 20 ppm given by the former author. If the data of Table 3 are considered in conjunction with the geological map (fig. 48) the relationship of metal variation and rock type becomes apparent. Over barren Moina Sandstone the contents of lead, zinc and copper are comparable although they vary in detail and generally copper is lower than lead and zinc. In the vicinity of ironstone there is a marked increase in metal values with lead showing a much larger increase than zinc or copper. Where basalt blankets the area the amount of lead in the soils decreases whilst zinc and copper increase, reflecting the relative abundance of these metals in the parent rock.

The ability of iron oxides and humus to concentrate metals has been well documented (Vinogradov, 1959; Hawkes and Webb, 1962). No formal correlation tests were undertaken during the course of the present study to examine this possibility, although the results of analysis of a limited number of samples (Tables 4 and 5) suggest that these factors have little bearing on the metal distri-

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ion in this case. The data in these tables which are arranged in order of increasing content of ferric oxide and organic matter show no evidence of an accompanying increase in trace elements.

Geochemical maps were prepared from the data of Table 3 and these are shown in Figures 52-54. Contours have been drawn at metal values approximately the median plus one and two deviations ($M_e + 1S_e$ and $M_e + 2S_e$). The lead anomaly is a tolerably striking feature which shows an approximately linear trend over a distance of about a mile. The zinc and copper anomalies are far less spectacular but they show the same general distribution pattern. It is obvious from the magnitude of lead values in the soil and the extent of their distribution that a considerable quantity of this metal has migrated through the environment. The hopeful viewpoint would be that the source of the lead may be a local deposit of the metal. This has to be somewhat moderated by the fact that the evidence suggests that the ironstone is pre-basalt in age and if this is the case the parent mineralisation could have been subjected to an extensive period of erosion before being covered by basalt. Also any mineralisation may be in the form of relatively small pods as in the case of the Round Hill mines, although at Oliver Hill the ironstone is far more extensive than that recorded from the former mines.

Some preliminary studies of metal distribution in ironstone and adjacent soil have been undertaken. The results of these are given in Table 6. Whilst the data are too few in number to make a conclusive assessment of metal migration in the soils of the area, the relative mobilities of iron and manganese are of interest. Comparison of the Fe:Mn ratios between ironstone-soil pairs shows that iron is variably enriched in the soil or alternatively manganese is relatively more mobile. This is shown very markedly by sample 00-750 in which a manganese content of 30.05% in the ironstone falls to 0.45% in the adjacent soil, whilst iron decreases from 9.96% to 5.86%. From a consideration of analyses from a number of countries Vinogradov (1959) has shown that in general the Fe:Mn ratio decreases from about 50 in rocks to 30 in soils. This suggests that iron is a little more mobile than manganese. The reason for the high mobility of manganese at Oliver Hill is not yet clear but it is possibly related to the activity of humic acids which are moderately abundant at this locality. Movement of manganese is often attributed to the mobility of the Mn^{2+} ion which is held to be relatively mobile in acid solutions although Hemstock and Low (1953) present evidence that oxidation can occur in dilute manganese solutions over a wide range of pH values. It would appear that the existence of Mn^{2+} is an unlikely situation in the present study in view of the fact that the parent material is an oxidised body (ironstone). Heintze and Mann (1947) have shown that Mn^{3+} compounds are soluble in the sodium salts of several organic acids (citric, tartaric, malic and salicylic) and it is possible that humic acids may likewise take the manganese ion into solution. Whilst this could explain the mobility of manganese it does not account for the extreme leaching of manganese relative to iron. Fe^{3+} compounds react with organic acids in a manner similar to those of Mn^{3+} although Schnitzer and Skinner (1964) have shown that the solubility of iron-soil organic matter compounds in the organic acids noted above is dependent upon the amount of metal in the organic matter complex. Experimental studies are being undertaken to provide data which may allow more adequate discussion

Ratios are also given in Table 6 for lead, zinc and copper. These are generally of erratic nature due to the extreme values of lead relative to zinc and copper. For sample 00-750 the lead content of the ironstone is fairly small and a normal decrease in the associated soil is evident. Thus the expected low mobility of lead and moderate mobility of zinc and copper in slightly acid groundwaters is evident in the ratios for this sample.

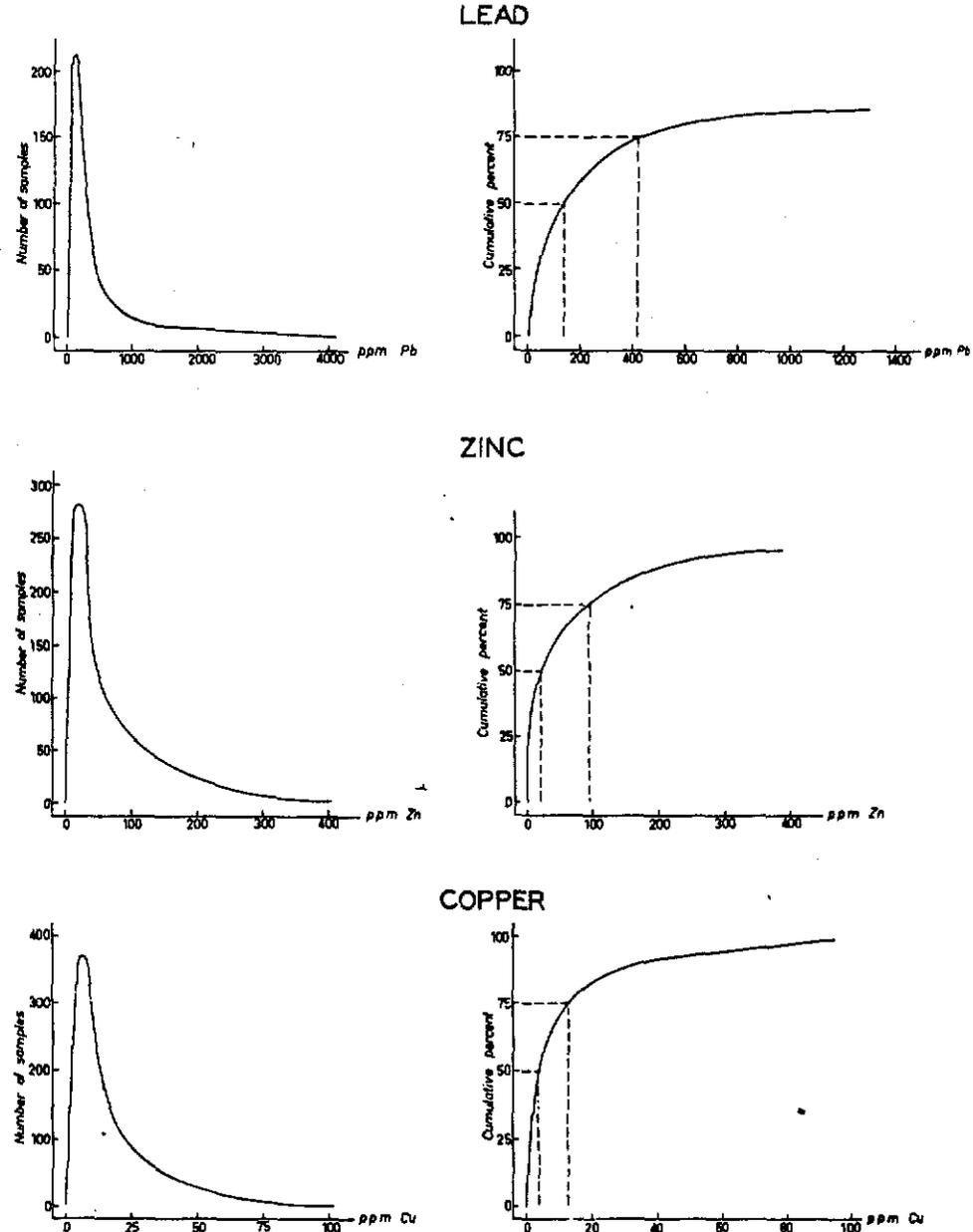


FIGURE 51. Frequency and cumulative frequency curves for lead, zinc and copper in soil-

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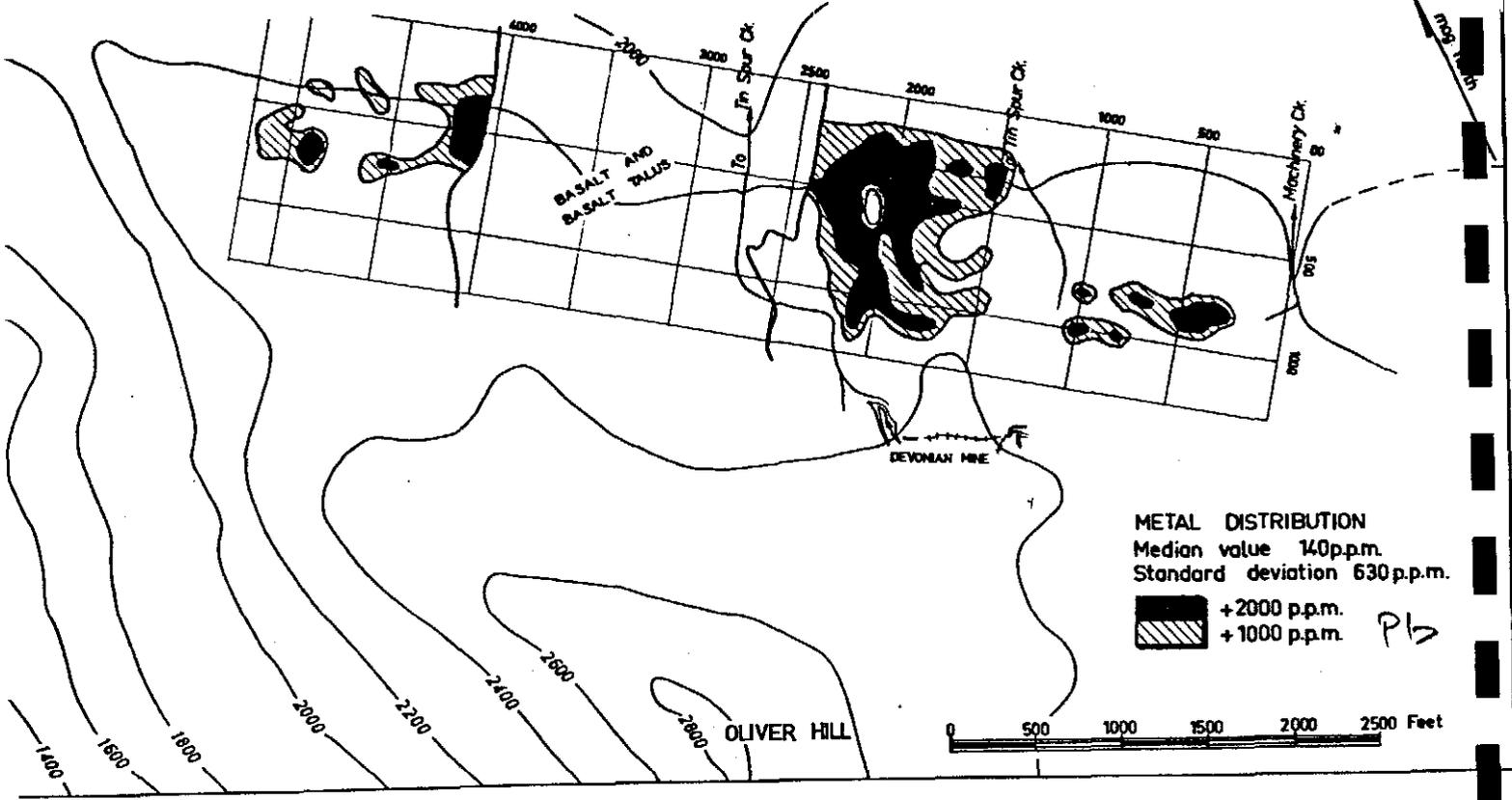


FIGURE 52. Anomalous lead in soil, Oliver Hill.

5 cm

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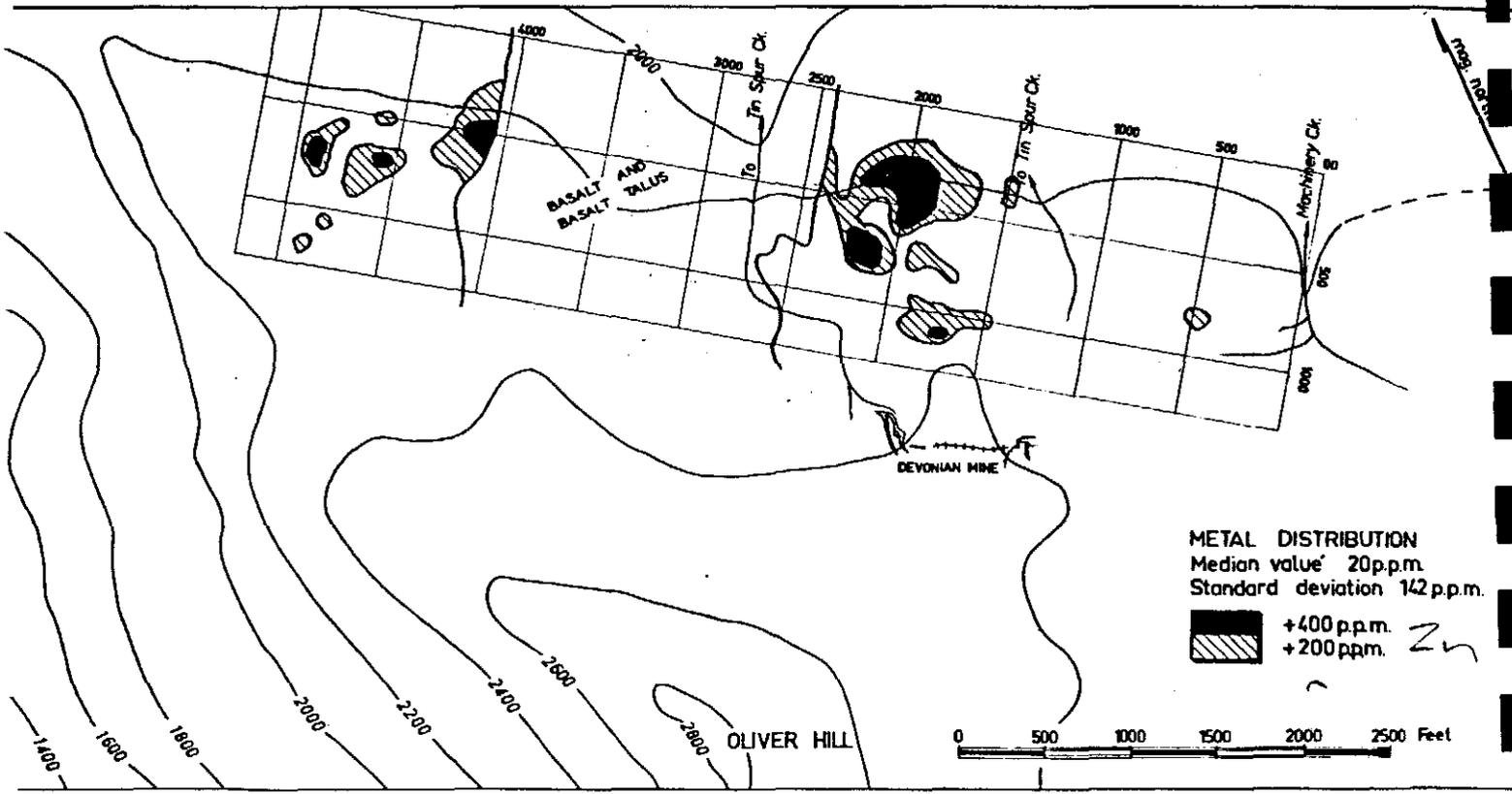


FIGURE 53. Anomalous zinc in soil, Oliver Hill.

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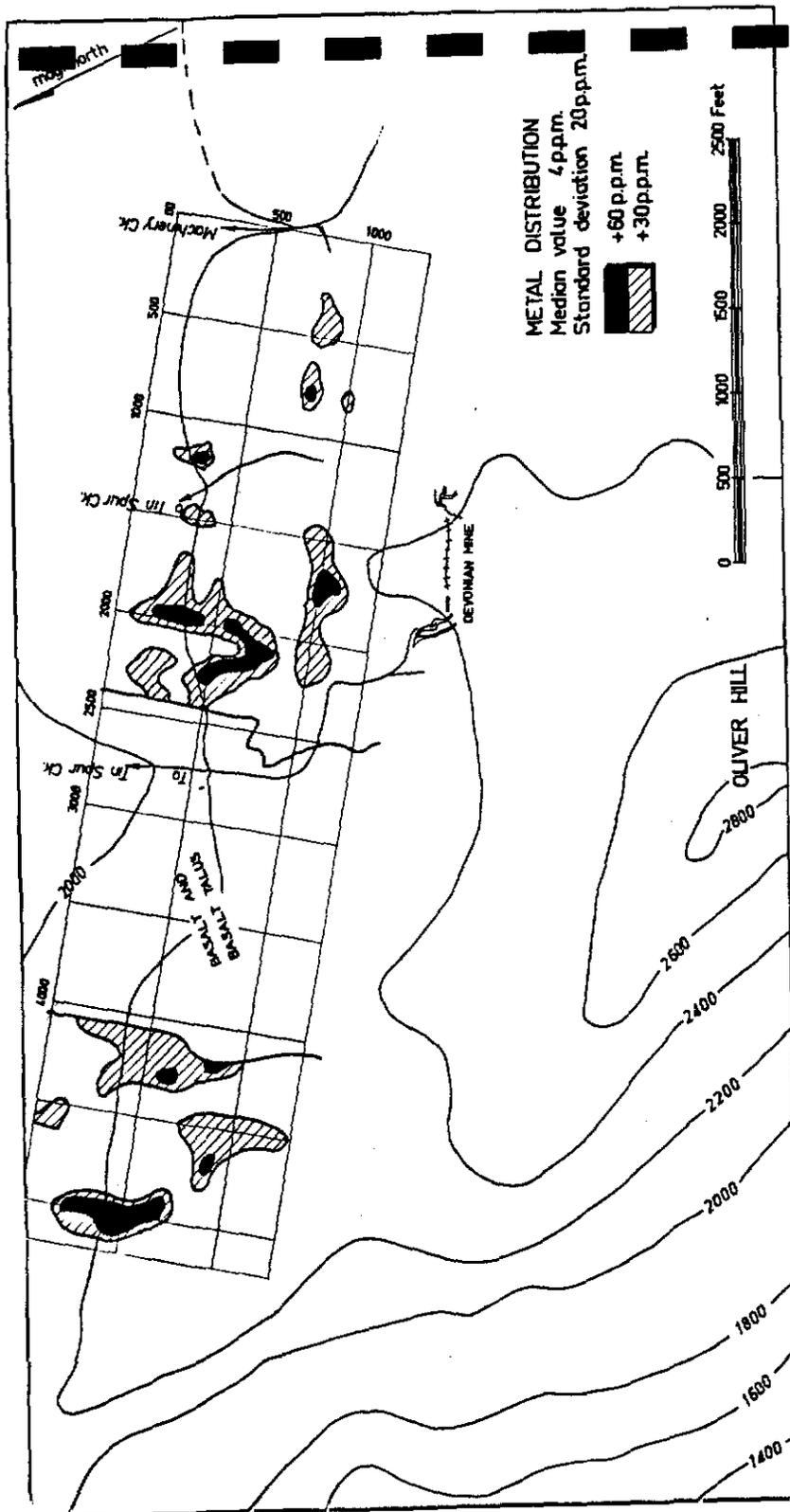


FIGURE 54. Anomalous copper in soil, Oliver Hill.

5 cm

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A number of groundwater and creek samples from the area were analysed for lead, zinc and copper. These waters are all acidic with the pH of the groundwaters ranging from 4.0-5.0 whilst that of the creeks is in the range 5.0-5.5. The results (Table 7) show a range of 5-115 ppb* lead, 25-150 ppb zinc and 2-10 ppb copper. In Tin Spur Creek which is the main drainage channel out of the area the values fall to 5, 25 and 2 ppb respectively. Ranges for river water given by Hawkes and Webb (1962) are 0.3-3 ppb lead, 1-200 ppb zinc and 0.2-30 ppb copper. Thus it is seen that whilst lead is above the range and may have aroused some interest had water analysis been undertaken during regional geochemical reconnaissance, the values for zinc and copper are very low in the respective ranges. Since the humic acid content of the waters is relatively high it is possible that the metals present are in the form of humic complexes and this would reduce the likelihood of their entering into exchange reactions with stream sediments. Under these conditions it is not surprising that a stream sediment survey in which samples were analysed for zinc, copper and tin revealed nothing of interest in Tin Spur Creek.

The leaves of eucalypts were also analysed and the values compared with those of the supporting soil. These results (Table 8) which are presented on an air-dry leaf and ash basis indicate that the metal values of eucalypt leaves do not reflect the metal distribution in the supporting soil. In all but one leaf sample (1800-950) lead is low regardless of the concentration in the soil whereas zinc and copper are high relative to their content in the soils. It would appear that the sampling of eucalypt leaves does not offer a means of biogeochemical prospecting.

CONCLUSIONS

The substantial geochemical anomaly detected in the vicinity of Oliver Hill gives this area some priority as an exploration target. Very little is known about the relationship between the various rock units of the area and it would be advantageous to have a cut across these at a point which would reveal the Moira Sandstone, Cambrian porphyry and the ironstone. This should yield evidence of the attitude of the strata and enable some prediction to be made as to the likely position of possible mineralisation related to the surface ironstone. Geophysical investigations of the area may also be of value in further delineating the source of the geochemical dispersion. Regardless of whether or not these measures clarify the interpretation of the geochemical data it will ultimately be necessary to design a drilling programme to thoroughly test the area keeping in mind the difficulties posed by the structural environment found at Round Hill.

ACKNOWLEDGMENTS

The writer wishes to express his thanks to I. B. Jennings, Chief Geologist, Department of Mines, Tasmania for introducing him to the Oliver Hill area and for much useful discussion. Thanks are also due to K. Williams, A. Jackson and S. Harris who assisted with the sampling of the area. P. Nankivell, H. Mackinnon and T. R. Bellis produced the illustrations for this report from the writer's rough originals.

* parts per billion. 10^{-9} .

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TABLE 1. METAL CONTENT OF IRONSTONE FROM OLIVER HILL

Sample No.	% Fe	% Mn	% Fe+Mn	% Pb	% Zn	% Cu
1	0.86	5.53	6.39	2.555	0.072	0.010
2	8.05	0.01	8.06	0.050	0.007	0.016
3	8.89	0.03	8.92	0.027	0.006	0.012
4	12.42	0.21	12.63	0.168	0.179	0.001
5	13.06	0.03	13.09	0.977	0.053	0.004
6	13.53	0.07	13.60	0.167	0.038	0.001
7	6.39	7.26	13.65	0.472	0.035	0.007
8	4.32	9.86	14.18	0.670	0.048	0.017
9	15.72	0.56	16.28	0.442	0.038	0.003
0	2.19	14.34	16.53	1.248	0.026	0.001
1	18.57	0.03	18.60	0.013	0.081	0.001
2	18.83	0.28	19.11	0.508	0.127	0.004
3	19.12	0.06	19.18	0.025	0.081	0.001
4	19.09	0.16	19.25	0.140	0.033	0.022
5	19.15	0.14	19.29	0.398	0.134	0.014
6	19.72	0.16	19.88	0.190	0.044	0.009
7	20.00	0.07	20.07	0.012	0.067	0.001
8	20.45	0.17	20.62	0.408	0.197	0.016
9	9.08	12.12	21.20	0.916	0.067	0.004
0	1.39	19.90	21.29	2.198	0.089	0.014
1	10.00	11.38	21.38	1.760	0.067	0.005
2	21.74	0.03	21.77	0.012	0.014	0.003
3	13.11	8.93	22.04	0.146	0.088	0.004
4	22.05	0.03	22.08	0.056	0.071	0.001
5	15.77	6.82	22.59	4.329	0.081	0.011
6	5.73	17.31	23.04	0.731	0.066	0.006
7	22.99	0.12	23.11	0.187	0.067	0.012
8	22.07	1.16	23.23	0.123	0.108	0.004
9	3.71	19.52	23.23	0.689	0.029	0.010
0	24.34	0.03	24.37	0.013	0.209	0.006
1	24.34	0.07	24.41	0.629	0.142	0.016

Sample No.	% Fe	% Mn	% Fe+Mn	% Pb	% Zn	% Cu
32	17.24	7.29	24.53	1.900	0.247	0.022
33	24.91	0.32	25.23	3.029	0.470	0.005
34	23.34	1.93	25.27	0.836	0.098	0.001
35	25.61	0.28	25.89	0.094	0.234	0.005
36	25.94	0.06	26.00	0.025	0.016	0.002
37	25.94	0.18	26.12	1.099	0.039	0.031
38	4.02	22.21	26.23	0.708	0.030	0.009
39	26.39	0.16	26.55	0.743	0.261	0.024
40	26.34	0.24	26.58	0.357	0.055	0.018
41	3.86	23.21	27.07	0.917	0.031	0.016
42	27.07	0.04	27.11	0.983	0.032	0.031
43	26.05	1.27	27.32	0.201	0.087	0.019
44	27.41	0.21	27.62	0.888	0.232	0.006
45	28.05	0.45	28.50	0.285	0.051	0.015
46	28.65	0.12	28.77	0.441	0.072	0.006
47	21.77	7.27	29.04	0.503	0.034	0.005
48	28.60	0.45	29.05	0.199	0.024	0.002
49	27.04	2.16	29.20	0.813	0.088	0.017
50	25.00	4.23	29.23	1.017	0.067	0.002
51	28.05	1.21	29.26	0.956	0.108	0.006
52	29.35	0.06	29.41	0.025	0.174	0.001
53	29.44	0.07	29.51	0.214	0.089	0.009
54	29.72	0.11	29.83	0.211	0.048	0.001
55	24.61	5.24	29.85	1.885	0.266	0.005
56	24.57	5.77	30.34	2.702	0.304	0.036
57	30.24	0.12	30.36	0.575	0.120	0.008
58	10.61	20.11	30.72	6.842	0.067	0.006
59	18.83	11.92	30.75	2.040	0.125	0.001
60	31.00	0.06	31.06	0.044	0.124	0.004
61	30.94	0.16	31.10	0.571	0.057	0.028
62	31.12	0.04	31.16	0.022	0.104	0.005
63	31.04	0.12	31.16	0.444	0.110	0.009
64	31.50	0.07	31.57	0.074	0.053	0.002
65	15.83	15.76	31.59	1.738	0.273	0.004
66	31.00	0.74	31.74	0.242	0.096	0.001
67	31.85	0.06	31.91	0.012	0.136	0.004
68	31.96	0.43	32.09	0.341	0.379	0.008
69	31.46	0.92	32.38	0.386	0.213	0.002
70	32.32	0.27	32.59	0.170	0.019	0.002
71	31.04	2.02	33.06	0.983	0.138	0.004
72	17.05	16.21	33.26	5.847	0.255	0.049
73	32.45	0.81	33.26	0.621	0.129	0.004
74	33.28	0.07	33.35	0.649	0.257	0.025
75	23.01	10.82	33.83	3.806	0.494	0.004
76	33.75	0.16	33.91	0.321	0.204	0.006
77	27.52	6.63	34.15	0.977	0.078	0.001
78	34.21	0.29	34.50	0.784	0.095	0.035
79	2.72	31.80	34.52	3.010	0.074	0.013
80	34.11	0.62	34.73	0.749	0.094	0.005
81	34.68	0.16	34.84	0.816	0.129	0.018
82	34.65	0.21	34.86	0.708	0.127	0.017
83	35.19	0.20	35.39	0.649	0.106	0.050
84	35.55	0.21	35.76	0.241	0.024	0.002
85	35.68	0.12	35.80	0.408	0.098	0.009
86	35.68	0.12	35.80	0.134	0.159	0.001
87	34.69	0.15	35.84	1.813	0.063	0.033
88	36.01	0.03	36.04	0.313	0.073	0.005
89	32.28	4.39	36.67	1.248	0.216	0.003

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TABLE I. METAL CONTENT OF IRONSTONE FROM OLIVER HILL—continued

Sample No.	% Fe	% Mn	% Fe+Mn	% Pb	% Zn	% Cu
90	36.67	0.07	36.74	0.167	0.184	0.005
91	36.67	0.07	36.74	0.181	0.184	0.005
92	36.71	0.08	36.79	0.959	0.125	0.009
93	32.28	4.52	36.80	1.713	0.167	0.002
94	36.01	0.85	36.86	0.369	0.225	0.005
95	36.71	0.19	36.90	0.696	0.093	0.043
96	8.34	28.77	37.11	1.614	0.219	0.012
97	37.26	0.08	37.34	0.339	0.147	0.012
98	37.26	0.14	37.40	0.187	0.041	0.009
99	37.26	0.14	37.40	0.632	0.272	0.010
100	37.54	0.05	37.59	0.313	0.079	0.005
101	37.54	0.09	37.63	1.387	0.050	0.033
102	36.66	1.15	37.81	0.199	0.106	0.048
103	29.39	8.50	37.89	2.491	0.193	0.007
104	37.73	0.23	37.96	0.522	0.078	0.006
105	38.31	0.21	38.52	0.242	0.118	0.001
106	38.90	0.69	38.59	2.456	0.244	0.012
107	32.76	6.01	38.77	1.589	0.081	0.013
108	38.85	0.11	38.96	0.633	0.046	0.027
109	38.85	0.29	39.14	0.850	0.288	0.009
110	38.35	0.92	39.27	0.567	0.175	0.022
111	26.72	12.70	39.42	2.696	0.415	0.008
112	9.44	30.03	39.47	4.693	0.265	0.010
113	38.90	0.57	39.47	0.199	0.043	0.005
14	39.51	0.15	39.66	0.614	0.115	0.009
15	18.09	22.27	40.36	3.043	0.089	0.015
16	40.17	0.21	40.38	0.341	0.186	0.013
17	36.85	3.76	40.61	1.141	0.285	0.006
18	39.39	1.32	40.71	0.702	0.041	0.011
19	39.92	0.92	40.84	0.562	0.147	0.002
20	40.68	0.18	40.86	0.571	0.102	0.010
21	41.29	11.67	40.96	1.862	0.038	0.007
22	40.52	0.47	40.99	0.288	0.268	0.001
23	41.11	0.12	41.23	0.261	0.195	0.005
24	31.10	10.15	41.25	0.836	0.179	0.002
25	41.37	0.03	41.40	0.488	0.039	0.064
26	31.89	9.64	41.53	3.573	0.207	0.006
27	40.73	0.84	41.57	0.211	0.142	0.065
28	1.18	40.43	41.61	2.864	0.269	0.007
29	37.76	4.52	42.28	1.099	0.354	0.004
30	39.51	3.08	42.59	2.427	0.227	0.048
31	34.16	8.44	42.60	5.289	0.083	0.030
32	26.42	16.22	42.64	2.360	0.164	0.017
33	40.58	2.06	42.64	0.916	0.187	0.001
34	35.14	7.57	42.71	3.904	0.090	0.029
35	42.31	0.62	42.93	0.308	0.089	0.030
36	42.57	0.52	43.09	0.571	0.305	0.005
37	43.29	0.07	43.36	0.649	0.036	0.027
38	41.90	1.61	43.51	1.043	0.493	0.003
39	39.08	4.53	43.61	3.177	0.197	0.013
40	41.80	2.12	43.92	1.219	0.189	0.013
41	42.97	1.23	44.20	0.722	0.291	0.001
42	40.07	4.52	44.59	3.116	0.087	0.035
43	30.64	14.15	44.79	2.194	0.187	0.004
44	44.69	0.19	44.88	0.064	0.190	0.002
45	39.92	5.00	44.92	3.358	0.219	0.017
46	38.35	6.99	45.34	2.491	0.234	0.034
47	40.29	5.07	45.36	0.990	0.069	0.026

TABLE I. METAL CONTENT OF IRONSTONE FROM OLIVER HILL—continued

Sample No.	% Fe	% Mn	% Fe+Mn	% Pb	% Zn	% Cu
148	45.43	0.16	45.59	1.363	0.207	0.005
149	45.41	0.27	45.68	0.257	0.060	0.041
150	45.53	0.15	45.68	0.386	0.069	0.010
151	42.62	3.20	45.82	1.427	0.142	0.005
152	44.96	0.97	45.93	1.037	0.152	0.006
153	42.57	3.47	46.04	0.925	0.079	0.001
154	44.69	1.62	46.31	0.731	0.095	0.023
155	38.00	8.74	46.74	1.885	0.211	0.008
156	46.68	0.14	46.82	2.729	0.129	0.017
157	46.68	0.25	46.93	0.201	0.049	0.008
158	46.68	0.26	46.94	0.559	0.138	0.015
159	33.75	13.32	47.07	4.334	0.215	0.005
160	47.15	0.03	47.18	0.027	0.029	0.001
161	44.78	2.41	47.19	1.219	0.301	0.009
162	47.31	0.17	47.48	0.990	0.164	0.044
163	47.31	0.75	48.06	0.559	0.186	0.003
164	47.95	0.60	48.55	0.699	0.370	0.009
165	48.54	0.12	48.66	2.205	0.132	0.015
166	48.54	0.13	48.67	2.298	0.165	0.018
167	48.67	0.25	48.92	0.229	0.101	0.001
168	47.74	1.73	49.47	1.157	0.096	0.005
169	37.76	12.17	49.93	3.582	0.232	0.009
170	49.31	0.67	49.98	0.481	0.208	0.004
171	49.31	0.71	50.02	0.201	0.099	0.004
172	49.31	0.71	50.02	0.408	0.189	0.004
173	50.13	0.23	50.36	0.060	0.096	0.001
174	49.88	0.61	50.49	3.374	0.180	0.018
175	49.88	0.68	50.56	0.731	0.345	0.005
176	50.61	0.13	50.74	0.854	0.111	0.007
177	35.63	15.14	50.77	4.339	0.219	0.009
178	51.16	0.11	51.27	0.348	0.172	0.125
179	50.03	1.27	51.30	0.425	0.065	0.006
180	46.35	4.93	51.28	1.585	0.268	0.001
181	51.47	0.05	51.52	0.352	0.069	0.011
182	51.72	0.23	51.95	0.134	0.081	0.001
183	52.20	0.10	52.30	0.543	0.112	0.009
184	52.20	0.27	52.47	0.425	0.150	0.010
185	52.20	0.28	52.48	0.498	0.106	0.005
186	53.35	0.47	53.82	0.366	0.064	0.012
187	25.94	28.33	54.27	3.160	0.219	0.005
188	54.91	0.07	54.98	1.077	0.176	0.006
189	54.46	0.89	55.35	0.515	0.220	0.005
190	50.55	4.92	55.47	1.310	0.129	0.004
191	54.81	0.66	55.47	0.211	0.114	0.001
192	40.73	15.53	56.26	1.889	0.190	0.007
193	54.88	0.99	55.87	0.678	0.137	0.005
194	56.27	0.63	56.90	0.180	0.098	0.003
195	57.12	0.11	57.23	0.813	0.500	0.004
196	57.12	0.21	57.33	1.248	0.207	0.004
197	57.19	0.24	57.43	1.637	0.213	0.007
198	58.71	0.21	58.92	1.080	0.179	0.004
199	56.34	3.71	60.05	1.152	0.304	0.018
200	62.24	0.07	62.31	0.179	0.464	0.005

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ANALYTICAL COEFFICIENTS FOR METALS IN IRONSTONE FROM OLIVER HILL

	Fe	Mn	Fe+Mn	Pb	Zn	Cu
c	1.000	-0.381	0.713	-0.084	0.314	0.000
n	-0.381	1.000	0.101	0.666	0.222	0.041
e+Mn	0.713	0.101	1.000	0.285	0.471	0.073
b	-0.084	0.666	0.285	1.000	0.374	0.357
n	0.314	0.222	0.471	0.374	1.000	-0.008
u	0.000	0.041	0.073	0.357	-0.008	1.000

TABLE 3. METAL CONTENT OF SOIL SAMPLES FROM OLIVER HILL

Sample No.	Metal content ppm			Sample No.	Metal content ppm		
	Pb	Zn	Cu		Pb	Zn	Cu
00- 00	220	10	2	300- 00	120	10	2
- 100	190	15	5	- 100	170	10	5
- 200	170	5	2	- 200	240	20	2
- 300	210	15	5	- 300	250	10	5
- 400	40	15	5	- 400	40	10	2
- 500	140	15	5	- 500	70	10	5
- 600	260	25	15	- 600	20	10	2
- 700	890	50	40	- 700	140	25	10
- 800	90	20	10	- 800	2830	145	55
- 900	20	15	10	- 900	90	15	10
-1000	60	20	10	-1000	10	10	10
-1100	10	20	10	-1100	20	10	2
-1200	5	20	5	-1200	20	5	2
-1300	10	10	2	-1300	20	10	2
100- 00	110	15	2	400- 00	130	20	5
- 100	150	15	5	- 100	100	20	2
- 200	150	20	2	- 200	110	15	5
- 300	160	10	2	- 300	70	10	5
- 400	50	15	5	- 400	40	10	5
- 500	20	10	5	- 500	180	10	10
- 600	20	15	5	- 600	170	10	10
- 700	130	15	5	- 700	70	40	10
- 800	5	10	10	- 800	2420	110	30
- 900	10	15	10	- 900	3020	80	30
-1000	10	15	10	-1000	20	10	10
-1100	5	5	5	-1100	20	10	10
-1200	5	10	5	-1200	50	10	10
-1300	5	25	2	-1300	50	10	10
200- 00	240	20	5	500- 00	210	20	5
- 100	180	20	5	- 100	80	10	2
- 200	100	10	2	- 200	140	15	2
- 300	40	10	2	- 300	80	10	10
- 400	80	10	5	- 400	260	10	5
- 500	30	10	10	- 500	320	15	5
- 600	210	10	10	- 600	90	15	2
- 700	60	30	10	- 700	260	10	2
- 800	20	15	10	- 800	3020	270	40
- 900	5	15	10	- 900	2420	140	30
-1000	10	10	10	-1000	40	15	10
-1100	20	15	10	-1100	20	10	5
-1200	20	15	10	-1200	210	20	5
-1300	5	15	10	-1300	60	20	5

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TABLE 3. METAL CONTENT OF SOIL SAMPLES FROM OLIVER HILL—continued

Sample No.	Metal content ppm			Sample No.	Metal content ppm		
	Pb	Zn	Cu		Pb	Zn	Cu
600- 00	110	10	2	1000- 00	160	15	5
- 100	170	10	5	- 100	260	20	2
- 200	230	20	5	- 200	120	10	2
- 300	50	15	2	- 300	140	15	2
- 400	100	10	2	- 400	40	15	2
- 500	380	10	10	- 500	50	25	5
- 600	130	10	10	- 600	240	25	5
- 700	280	10	10	- 700	100	30	5
- 800	1300	50	20	- 800	2430	35	5
- 900	1030	55	20	- 900	740	30	5
-1000	50	10	10	-1000	5460	50	10
-1100	60	10	10	-1100	50	25	5
-1200	70	10	10	-1200	20	25	5
-1300	160	10	10	-1300	40	25	5
700- 00	260	20	2	1100- 00	240	20	5
- 100	120	15	5	- 100	210	20	2
- 200	180	15	2	- 200	100	15	2
- 300	170	25	5	- 300	70	15	5
- 400	190	10	2	- 400	20	15	2
- 500	320	10	5	- 500	70	10	2
- 600	160	10	2	- 600	20	10	2
- 700	400	35	20	- 700	230	15	5
- 800	3560	145	45	- 800	25	25	5
- 900	240	20	10	- 900	730	35	5
-1000	80	10	10	-1000	400	30	5
-1100	110	15	2	-1100	20	5	10
-1200	70	10	2	-1200	5	5	10
-1300	110	15	2	-1300	20	5	2
800- 00	220	20	5	1200- 00	240	10	5
- 100	180	20	5	- 100	450	15	10
- 200	240	15	2	- 200	580	25	55
- 300	230	15	5	- 300	1200	25	225
- 400	260	10	2	- 400	330	10	5
- 500	150	20	5	- 500	210	15	10
- 600	290	30	5	- 600	200	25	5
- 700	690	25	5	- 700	360	30	5
- 800	1980	130	140	- 800	230	25	5
- 900	530	20	15	- 900	70	25	5
-1000	2860	85	30	-1000	90	35	5
-1100	390	10	10	-1100	80	35	5
-1200	90	10	10	-1200	20	25	5
-1300	280	10	10	-1300	80	25	5
900- 00	280	50	25	1300- 00	280	25	2
- 100	240	25	5	- 100	280	25	10
- 200	220	25	5	- 200	490	20	10
- 300	390	25	5	- 300	730	25	15
- 400	210	20	5	- 400	280	10	10
- 500	60	25	5	- 500	170	10	20
- 600	150	25	5	- 600	50	15	10
- 700	400	25	5	- 700	580	10	10
- 800	240	30	5	- 800	230	30	5
- 900	590	70	10	- 900	150	25	5
-1000	1090	175	25	-1000	240	60	5
-1100	150	20	5	-1100	210	15	10
-1200	330	20	5	-1200	30	5	5
-1300	50	20	5	-1300	70	5	10

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TABLE 2. METAL CONTENT OF SOIL SAMPLES FROM OLIVER HILL—continued

Sample No.	Metal content ppm			Sample No.	Metal content ppm		
	Pb	Zn	Cu		Pb	Zn	Cu
1400- 00	310	10	5	1800- 00	360	35	20
- 100	400	15	5	- 100	600	50	25
- 200	460	25	10	- 200	1290	130	25
- 300	590	45	25	- 300	1870	245	40
- 400	220	5	10	- 400	1820	155	20
- 500	60	15	10	- 500	2120	275	35
- 600	30	15	10	- 600	1900	115	25
- 700	130	15	10	- 700	1140	165	20
- 800	780	65	25	- 800	500	115	15
- 900	890	30	15	- 900	3340	80	15
-1000	360	15	10	-1000	1650	325	70
-1100	60	20	10	-1100	3030	210	55
-1200	30	20	10	-1200	60	25	10
-1300	20	35	10	-1300	150	25	10
1500- 00	380	30	10	1900- 00	240	20	10
- 100	600	80	25	- 100	380	50	15
- 200	1280	110	25	- 200	2410	280	30
- 300	2340	245	45	- 300	4180	450	35
- 400	2170	230	45	- 400	2810	465	25
- 500	590	110	15	- 500	2670	550	45
- 600	540	30	10	- 600	2030	165	20
- 700	1130	120	25	- 700	2050	250	10
- 800	600	105	20	- 800	2390	325	20
- 900	1320	175	55	- 900	1280	190	25
-1000	1420	200	45	-1000	1160	140	30
-1100	260	10	5	-1100	2650	200	25
-1200	40	5	2	-1200	90	10	2
-1300	40	5	2	-1300	140	10	10
1600- 00	320	25	10	2000- 00	330	25	10
- 100	390	45	15	- 100	560	150	35
- 200	1070	90	20	- 200	1180	320	60
- 300	1880	150	15	- 300	4450	580	80
- 400	1460	80	10	- 400	2710	410	85
- 500	1160	60	15	- 500	2140	565	45
- 600	370	100	15	- 600	4700	610	90
- 700	360	65	15	- 700	1380	180	55
- 800	1100	155	40	- 800	1650	215	30
- 900	900	75	15	- 900	2390	95	25
-1000	1820	220	40	-1000	2120	150	55
-1100	280	50	15	-1100	470	65	25
-1200	20	20	10	-1200	130	65	10
-1300	280	15	10	-1300	130	20	10
1700- 00	400	20	5	2100- 00	380	35	20
- 100	400	20	10	- 100	400	80	25
- 200	1050	120	25	- 200	2740	380	25
- 300	2240	225	45	- 300	6870	500	20
- 400	1940	230	20	- 400	6240	510	20
- 500	2600	225	25	- 500	220	10	2
- 600	390	60	15	- 600	90	10	5
- 700	490	80	10	- 700	5390	500	65
- 800	1600	260	65	- 800	4140	470	115
- 900	130	25	10	- 900	1230	110	15
-1000	1700	300	65	-1000	2290	145	50
-1100	5310	420	70	-1100	6240	410	45
-1200	80	5	2	-1200	1840	110	20
-1300	100	5	20	-1300	590	30	15

TABLE 3. METAL CONTENT OF SOIL SAMPLES FROM OLIVER HILL—continued

Sample No.	Metal content ppm			Sample No.	Metal content ppm		
	Pb	Zn	Cu		Pb	Zn	Cu
2200- 00	960	155	30	2900- 840	30	115	25
- 100	380	105	25	3000- 840	50	85	20
- 200	1370	110	35	3100- 860	50	105	40
- 300	2300	365	35	3200- 860	30	145	45
- 400	2810	500	25	3300- 860	40	125	55
- 500	2800	265	130	3400- 880	80	120	40
- 600	2650	170	75	3500- 860	30	115	35
- 700	2510	495	80	3600- 900	30	100	30
- 800	5060	515	30	3700- 900	50	110	45
- 900	980	125	25	3800- 900	50	95	45
-1000	1720	150	45	3900- 860	40	90	45
-1100	210	30	15	4000- 800	40	130	55
-1200	70	15	2	4100- 60	140	30	25
-1300	5	5	2	- 160	280	110	35
2300- 00	300	15	5	- 260	1050	250	50
- 100	580	90	35	- 360	4620	275	45
- 200	1140	105	50	- 460	7470	610	60
- 300	1380	95	25	- 560	5620	580	40
- 400	2330	170	50	- 660	2960	325	35
- 500	2360	140	65	- 760	130	85	55
- 600	3930	280	50	- 860	80	75	45
- 700	1530	155	25	- 960	120	35	20
- 800	1410	130	25	-1060	260	50	20
- 900	560	100	25	-1160	60	50	15
-1000	260	45	10	-1260	80	55	10
-1100	150	10	2	4200- 00	100	65	5
-1200	5	5	2	- 100	280	130	10
-1300	5	5	10	- 200	240	105	15
2400- 00	240	50	25	- 300	1060	165	10
- 100	400	80	25	- 400	2940	380	45
- 200	1050	160	30	- 500	3030	460	50
- 300	1940	200	35	- 600	2720	290	50
- 400	1700	230	25	- 700	800	225	55
- 500	2170	175	35	- 800	110	90	60
- 600	340	90	20	- 900	600	95	70
- 700	310	70	20	-1000	400	80	30
- 800	150	45	10	-1100	260	85	25
- 900	90	25	5	-1200	120	60	40
-1000	60	30	5	-1300	110	40	10
-1100	50	25	5	4300- 00	190	135	2
-1200	60	20	10	- 140	220	80	2
-1300	5	15	2	- 240	200	75	2
2500- 780	30	30	5	- 340	1120	130	55
- 880	20	30	5	- 440	600	140	35
- 980	130	35	5	- 540	840	180	50
2600- 660	130	95	30	- 640	1330	305	65
- 760	70	90	25	- 740	300	130	40
- 860	330	120	50	- 840	340	160	20
- 960	70	80	20	- 940	350	100	20
-1060	40	35	5	-1040	210	60	25
2700- 760	90	110	35	-1140	180	80	10
- 860	90	105	40	2800- 720	50	105	50
- 960	30	90	35	- 820	60	165	55
2800- 720	50	105	50	- 920	40	160	65

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Sample No.	Metal content ppm			Sample No.	Metal content ppm		
	Pb	Zn	Cu		Pb	Zn	Cu
4400- 00	240	75	20	4800- 00	5	20	2
- 120	370	150	15	- 60	40	40	5
- 220	550	150	10	- 160	50	35	5
- 320	1030	135	40	- 260	210	35	5
- 420	590	85	5	- 360	510	45	5
- 520	430	100	5	- 460	790	140	10
- 620	210	170	2	- 560	580	275	5
- 720	1010	90	15	- 660	900	180	25
- 820	260	40	10	- 760	720	180	15
- 920	220	40	5	- 860	230	140	35
-1020	190	60	5	- 960	210	160	10
-1120	240	100	20	-1060	570	210	20
-1220	60	80	5	-1160	400	130	120
-1300	80	30	10	-1260	80	115	2
4500- 00	350	95	25	4900- 00	5	20	2
- 120	510	120	40	- 80	5	45	2
- 220	350	100	10	- 180	50	35	5
- 320	530	120	15	- 280	200	40	5
- 420	560	145	25	- 380	1640	45	5
- 520	600	140	15	- 480	150	45	5
- 620	90	85	5	- 580	810	110	20
- 720	2360	330	30	- 680	13970	435	125
- 820	270	115	30	- 780	2110	460	20
- 920	140	95	55	- 880	390	120	4.5
-1020	180	90	45	- 980	10	75	5
-1120	260	140	50	-1080	20	60	5
-1220	230	120	50	-1180	160	215	60
-1300	50	80	30	-1280	30	75	5
4600- 00	180	100	45	5000- 00	5	15	2
- 100	600	90	55	- 100	5	20	2
- 200	290	90	5	- 200	460	55	100
- 300	380	35	5	- 300	540	65	95
- 400	1190	85	10	- 400	830	150	140
- 500	930	220	10	- 500	1030	185	140
- 600	80	115	5	- 600	580	75	70
- 700	1260	490	15	- 700	1390	155	75
- 800	1150	200	45	- 800	390	70	20
- 900	590	100	50	- 900	40	65	5
-1000	360	95	40	-1000	40	40	5
-1100	210	60	25	-1100	10	25	2
-1200	250	60	20	-1200	110	50	2
-1300	120	70	15	-1300	60	40	5
4700- 00	590	85	15	5100- 00	20	15	2
- 100	460	75	15	- 120	5	35	2
- 200	500	115	5	- 220	70	80	30
- 300	2360	145	20	- 320	350	130	35
- 400	650	85	5	- 420	290	75	60
- 500	280	130	2	- 520	990	85	370
- 600	400	130	2	- 620	1080	55	10
- 700	870	210	5	- 720	1540	45	10
- 800	480	225	10	- 820	960	45	5
- 900	910	335	80	- 920	600	35	5
-1000	320	95	10	-1020	400	50	20
-1100	480	120	15	-1120	180	70	20
-1200	180	85	10	-1220	240	105	15
-1300	210	45	5	-1300	110	80	5

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Sample No.	Metal content ppm			Sample No.	Metal content ppm		
	Pb	Zn	Cu		Pb	Zn	Cu
5200- 00	5	5	2	5200- 740	120	35	5
- 140	5	10	2	- 840	330	45	5
- 240	30	10	5	- 940	5	25	2
- 340	190	20	2	-1040	110	20	2
- 440	70	15	2	-1140	60	25	5
- 540	480	40	20	-1240	40	55	2
- 640	930	50	40				

TABLE 4. IRON OXIDE AND TRACE METAL CONTENT OF OLIVER HILL SOILS

Sample No.	Fe ₂ O ₃ %	Trace metals (ppm)		
		Pb	Zn	Cu
4900- 380	0.09	1640	45	5
1000-1000	0.29	5460	50	10
5100- 620	0.35	1080	55	10
5000- 500	0.53	1030	185	140
1400- 900	1.13	890	30	15
1800- 900	1.35	3340	80	15
1100- 900	1.88	730	35	5
1100- 800	2.88	2430	35	5
4700- 400	2.91	650	85	5
4400- 520	3.57	430	100	5
5200- 640	5.30	930	50	40
1600- 600	5.59	370	100	15
2000- 800	6.07	1650	215	30
4500- 520	7.07	600	140	15
4800- 760	7.56	720	180	15
1700- 800	8.78	1600	260	65
4800- 660	9.15	900	180	25
5000- 500	9.44	1030	185	140
4100- 660	10.20	2960	325	35
700- 800	11.30	3560	145	45
1500- 900	12.60	1320	175	55
800-1000	13.00	2860	85	30
1400- 800	14.00	780	65	25
5100- 520	14.20	1080	85	370
900-1000	21.00	1090	175	25

5. ANI ATT ND E M CO NT O LVE LL
SOILS

Sample No.	Organic matter %	Trace metals (ppm)		
		Pb	Zn	Cu
600- 900	4.0	90	15	10
00- 900	5.2	20	15	10
00- 800	5.2	90	20	10
100- 800	5.2	5	10	10
200- 600	5.6	210	10	10
200-1100	6.0	20	15	10
200- 800	6.0	20	15	10
200-1200	6.4	20	15	10
100- 900	6.8	10	15	10
600-1000	7.2	50	10	10
200-1300	8.0	5	15	10
200-1000	8.0	10	10	10
400- 600	8.8	170	10	10
100-1000	9.2	10	15	10
400-1000	9.6	20	10	10
600- 600	9.6	130	10	10
200- 700	10.8	60	30	10
00-1000	11.2	60	20	10
200- 500	11.6	30	10	10
600- 700	11.6	280	10	10
500-1100	12.4	20	10	5
200- 900	13.2	5	15	10
600- 500	20.0	380	10	10
400-1300	14.4	50	10	10
500-1000	18.0	40	15	10

TABLE 6. METAL CONTENT AND METAL RATIOS FOR IRONSTONE AND ASSOCIATED SOIL FROM OLIVER HILL

Sample No.	Fe (%)	Mn (%)	Pb (ppm)	Zn (ppm)	Cu (ppm)	Metal ratios			
						Fe:Mn	Pb:Zn	Pb:Cu	Zn:Cu
00- 750	9.96	30.05	3625	1325	80	0.3	2.7	45.3	16.6
	5.86	0.45	725	70	<5	13.0	10.4	145.0	>14.0
600- 950	16.71	17.94	28400	700	40	0.9	40.6	710.0	17.5
	6.92	1.42	4350	250	<5	4.6	17.4	870.0	>50.0
800-1000	17.00	20.63	57100	850	120	0.8	67.2	475.8	7.1
	6.56	0.21	4950	175	20	31.2	28.3	247.5	8.8
1600-1000	40.80	6.73	20200	3575	130	6.1	5.7	155.4	27.5
	7.97	0.33	2000	250	40	24.2	8.0	50.0	6.3
1700- 800	38.69	3.47	9800	2500	60	11.2	3.9	163.3	41.7
	5.39	0.24	1500	200	30	22.5	7.5	50.0	6.7
1800- 900	29.01	12.56	43500	4225	90	2.3	10.3	483.3	46.9
	4.81	0.15	6950	250	30	32.1	27.8	231.7	8.3
1900- 900	19.64	21.08	64400	3500	40	0.9	18.4	1610.0	87.5
	4.16	0.21	1575	250	<5	19.8	6.3	315.0	>50.0
2000- 750	20.63	13.90	35000	1800	250	1.5	19.4	140.0	7.2
	2.93	0.13	1075	150	<5	22.5	7.2	215.0	>30.0
4900- 700	44.49	1.29	8150	3150	60	34.5	2.6	135.8	52.5
	12.07	0.13	7000	475	140	92.9	14.7	50.0	3.4
4950- 700	20.14	11.66	16600	2925	40	1.7	5.7	415.0	73.1
	15.24	0.21	10300	600	20	72.6	17.2	515.0	30.0

TABLE MET ENT OF UND CR WATERS IN THE VICINITY OF OLIVER HILL

Sample No.	Sample type	Metal content (ppb)		
		Pb	Zn	Cu
900- 900	Groundwater	115	40	4
900-1000	Groundwater	20	25	10
900-1100	Groundwater	110	135	8
900- 00	Creek	5	95	8
1000-1000	Groundwater	25	25	10
1000- 600	Creek	25	35	10
1400-1100	Groundwater	10	55	8
1400- 900	Groundwater	25	130	10
1400- 800	Groundwater	10	150	10
-	Tin Spur Creek	5	25	2

TABLE 8. METAL CONTENT OF EUCALYPT LEAVES AND SOIL FROM OLIVER HILL

Sample No.	Metal content of leaves (ppm)						Metal content of soils (ppm)		
	Air-dry leaves			Ash of leaves			Pb	Zn	Cu
	Pb	Zn	Cu	Pb	Zn	Cu			
400- 950	1.6	18.3	5.6	36	405	124	50	<1	2
400- 700	2.8	10.6	2.6	67	252	62	180	14	<1
450- 900	2.0	11.7	4.0	62	366	125	5475	355	88
600- 900	0.8	12.5	3.0	25	391	94	2850	148	14
620-1000	0.8	12.5	3.4	32	500	136	95	14	6
900- 850	0.4	12.4	3.8	10	302	93	500	24	6
1400- 850	0.8	14.1	3.6	31	542	138	790	138	10
1800- 950	14.0	16.4	2.8	530	630	108	3390	376	24
1800-1120	2.4	11.7	3.0	57	278	72	780	122	<1
1800- 850	0.4	11.0	3.0	12	334	91	1400	106	14

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19. Oliver Hill gravity survey.

D.E. Leaman

Mineralisation has been suspected on the north-east flank of Oliver Hill south of Mt Claude for many years. There have been some minor attempts to work gold and tin in the area. Of greater interest has been the extensive ironstone 'gossan' which is spread across the upper slopes of the hill. A recent geochemical study (Baker, 1971) has shown very high concentrations of lead. The geological environment is also detailed by Baker (1971) and in simple terms consists of a thick sequence of Moina sandstone and quartzite which is intruded by quartz feldspar porphyry. The porphyry is restricted to a narrow zone which is also occupied by sheared mudstone indicating some faulting in the area.

Until recently Oliver Hill was covered by an exploration licence held by the Mt Lyell Mining and Railway Company. During the company's tenure of the licence, some geological mapping and geophysical surveys were undertaken by Compagnie Générale de Géophysique. Resistivity, IP, magnetic and self-potential methods were employed and although the survey could be criticised for using too broad an observation spacing in the 'anomalous' regions, little of note was found. There were narrow, but small and elongate, IP anomalies and two bore holes were drilled to test one such feature.

The drilling showed that over 150 m of quartzite and conglomerate overlies sheared Cambrian porphyry and slate. The log from one hole suggested that the 'gossan' zone extends to a depth of more than 30 m. Apart from demonstrating the presence of disseminated pyrite in the quartzite, no other mineralisation was seen. Certainly there was no trace of a massive lead ore. It was therefore concluded that the IP anomalies were related either to the disseminated pyrite (which is unlikely), or to a narrow shear zone. The magnetic survey was apparently non-informative although no details were reported. The self-potential anomalies also appear related to a possible shear zone near the 'gossan'. At this point the lease was relinquished and the Department of Mines decided to establish whether or not any ore was present.

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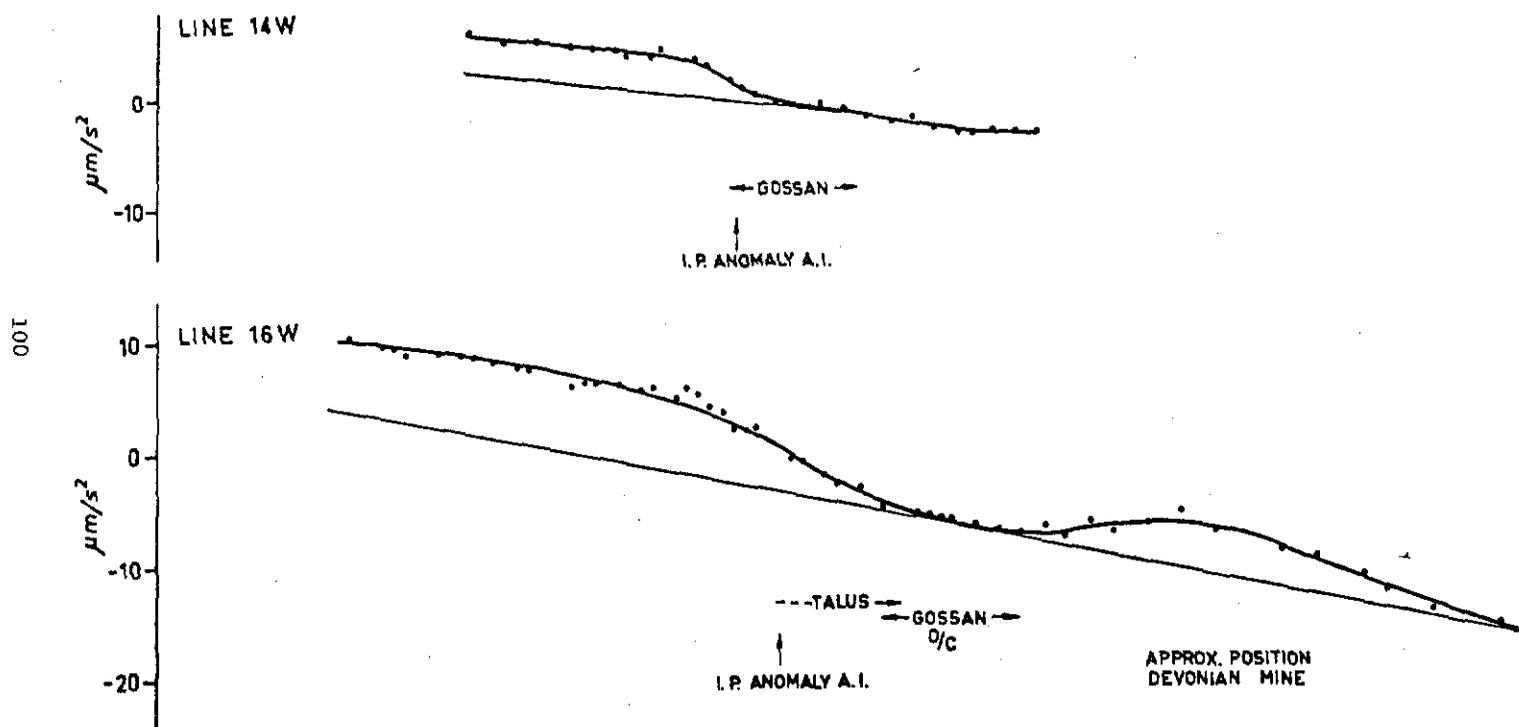
It has been recognised for some time that the gossan may represent the exhumed remains of an ore body that had been weathered and eroded before Tertiary volcanism capped the area with basalt. As most of the more obvious geophysical techniques had been employed, and the results were either indistinctive or of inadequate quality to establish the presence or absence of ore, it was decided to attempt a pilot gravity survey of the gossanous area immediately north of the Devonian mine.

GRAVITY SURVEY

A section of the Oliver Hill geochemical anomaly, between lines 14W and 21W was selected for examination. This section also covers several large 'gossan' outcrops. It was believed that if any reasonable amount of ore were present it would be revealed by testing in this zone.

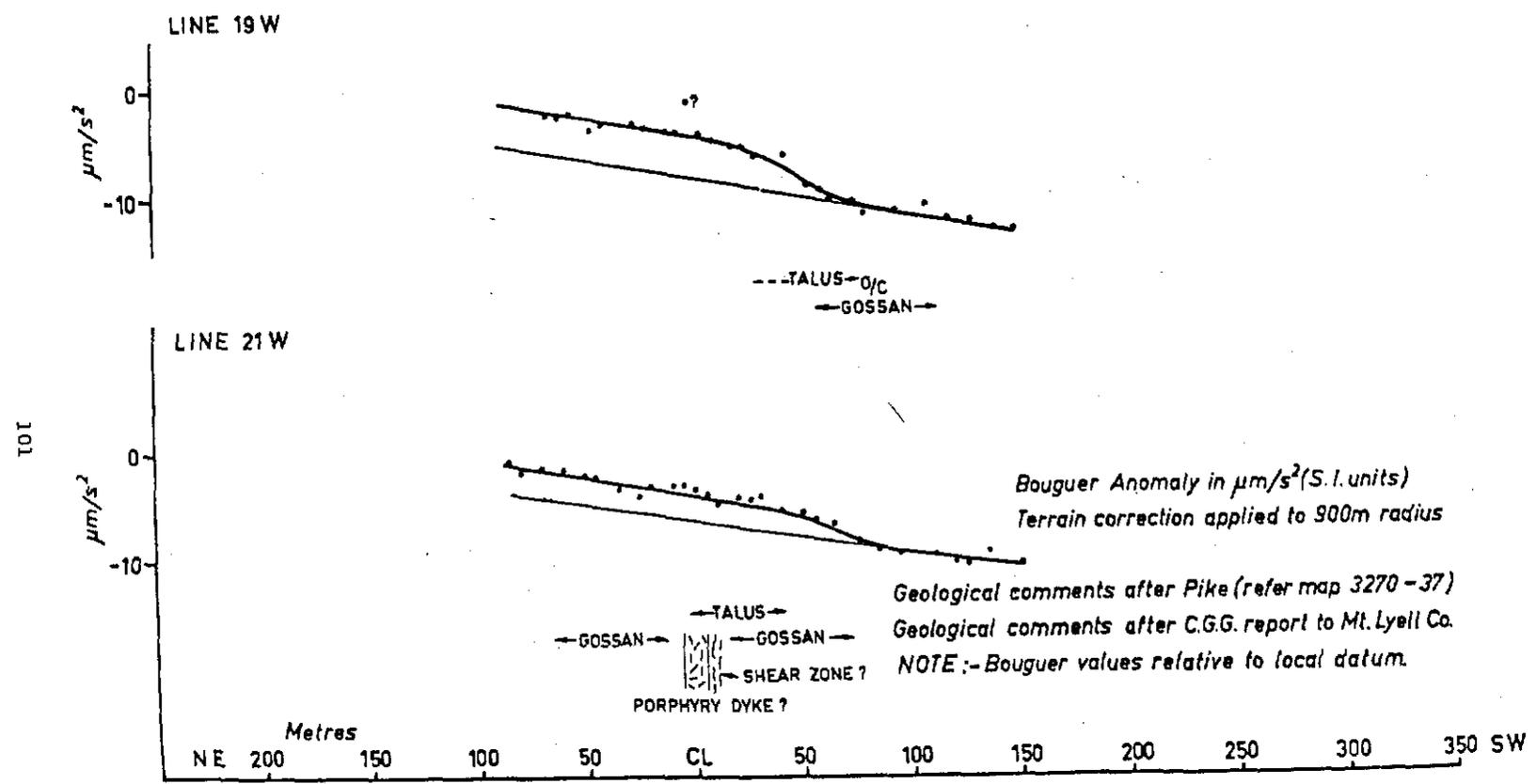
Four traverses approximately perpendicular to the gossan outcrops were prepared and surveyed (14, 16, 19 and 21W) as well as a single centre line traverse from 12W to 23W. The basic station interval was 5 m although 10 m intervals were used away from the gossanous zones.

Observations were made using Worden meter No. 913 with a scale constant of 0.94 μ gal/div. All stations were levelled to an accuracy better than 1 cm, and terrain corrected to a radius of 900 m. Corrections beyond this radius were common to all stations. Traverse lines were surveyed and positions were



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LINE 19 W



Distances in metres along Mines Dept Imperial Grid.

Figure 27. Gravity profiles, Oliver Hill

Lines 14 W } are Mines Dept (Imperial) grid lines
16 W }
19 W }
21 W } not the same as the Mt Lyell Grid.

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accurate to better than one metre. Since the survey was corrected relative to a base station in the area, absolute errors in latitude position can be disregarded. A density of 2670 kg/m³ was used in the Bouguer correction.

Some density determinations were made of rocks in the area and the results are as follows:

Material	Density (kg/m ³)
Roland Conglomerate	2650
Moina Quartzite	2630-2670
Interbedded black shale	2680
Interbedded conglomerate	2720
Quartzite with pyrite	2840
Interbedded schist	2680-2730
Porphyry intrusive	~2750-2760
Cambrian porphyrite	~2850
Ironstone (gossan)	2500-2670

Density determinations on the gossan are regarded as very unreliable due to the range of textures and composition. The great bulk of the Ordovician rocks have densities about, or slightly less than, the Bouguer density. Cambrian rocks occur at a depth of about 100 m. By way of contrast, the source ore if present would have a density of up to three times that of the country rock, thus any reasonably massive dissemination would also be apparent.

RESULTS

The four transverse profiles are shown in Figure 27. The base line traverse is strictly non-anomalous. Each of the four profiles shown have several features in common.

- (1) There is a consistent regional gradient of about 1.5 $\mu\text{m/s}^2/50 \text{ m}$ (0.15 mgal/50 m) from north to south.
- (2) There is a distinct step of up to 6 $\mu\text{m/s}^2$ from north to south near the centre line. This step is shifted southward between traverses in a way suggestive of a fault or shear. The structure is south of the known sheared material and the ironstone material may well occupy a crush zone.
- (3) There is no consistent relationship between any part of the gravity profiles and the 'gossan'. The ironstone 'gossan' has no anomaly.
- (4) There is a slight scatter of values of 1.5 $\mu\text{m/s}^2$ indicating surface variations (soil effects) and imbalances in terrain adjustments. Since the effect appears random, no importance can be attached to features less than 10-15 m wide and having amplitudes of the order of 1 $\mu\text{m/s}^2$.

Only line 16W shows any divergence from the above pattern, possibly due to its southern extension. In the region of the Devonian mine workings there is an anomaly of up to +4 $\mu\text{m/s}^2$ spread over 150 m of traverse. Since the anomaly appears to have a point or line source it may be inferred that the source is either a denser patch of Moina Sandstone or a dense interbedded lithological unit. If the latter is the case a steep dip to the south is implied and the unit width is less than 50 m. Any lateral extension of this feature is unknown and therefore it is not possible to give a reliable estimate of the excess mass. In this context a denser patch of Moina Sandstone could be presumed as slightly mineralised. However the descriptions given in previous reports (e.g. Jennings, 1963, p. 132) suggest that the Devonian mine

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The mineralisation would be insufficient to cause an anomaly of this scale.

CONCLUSIONS

The lack of anomalies correlatable with 'gossan' suggests that over much of the area the material either has a density equivalent to the surrounding quartzites or is only a surface covering. Certainly no dense orebody underlies 'gossan'.

If the step anomaly observed is due to simple faulting (north side up) of the Cambrian basement, then assuming a density contrast of 200 kg/m³ the throw would be about 200 m. However the inflexion is too abrupt to be related to a fault of this throw, at the depth apparently indicated by drilling, unless the Cambrian rocks are very close to the surface north of the centre line and were angled steeply south-west. As a fault was encountered it appears possible that the throw is correct and that the Ordovician cover is thin to the north. Conglomerate was encountered in the upper part of the second hole at shallow depth supporting this assertion.

REFERENCES

BAKER, W.E. 1971. Geochemical investigations in the vicinity of Oliver Hill, north-west Tasmania. *Tech.Rep.Dep.Mines Tasm.* 14:158-183.

JENNINGS, I.B. 1963. One mile geological map series. K/55-6-45. Middlesex. *Explan.Rep.geol.Surv.Tasm.*

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3. OLIVER'S HILL AREA

3.1 Previous Work

A geochemical and geological survey during May and June 1969 by the Tasmanian Department of Mines revealed ferromanganese zones over 1 mile long on the northern slopes of Oliver's Hill. Two subparallel ferromanganese bodies outcrop over approximately 1,200 ft. (elsewhere along strike, one body only outcrops). The bodies trend W.N.W. subparallel to the strike of the adjacent Moira Sandstone which

3.2 dips steeply to the north. Adjacent and subparallel to the ferromanganese bodies, small areas of quartz felspar porphyry (characterized by the occurrence of rounded quartz phenocrysts) occur. The geochemical soil survey conducted by the Department of Mines revealed a zone at least 2500 ft. long containing concentrations of lead in excess of 1700 p.p.m. with associated weak copper and zinc anomalies (in excess of 100 p.p.m. and 300 p.p.m. respectively). Basalt and basaltic talus covers much of the ground along the strike of the ferromanganese zones.

Robinson (unpublished report 1958) did not believe that the ferromanganese mineralisation persisted with depth as indicated in exposures within shallow adits, and postulated that the ferromanganese occurred as surface enriched cappings underlain at shallow depths by leached sandstone. However, his sampling gave erratic values up to 8.8% lead and 20 oz/ton silver, which suggests a source other than leached sandstone.

3.2 Access

In accordance with the recommendations of K. Reid in an appendix to the "Progress Report of 1969", 3400 ft. of access road were constructed and 10 grid lines spaced at 800 ft. intervals were out across the area of interest. In all, 44,000 ft. of grid lines were out. The grid lines were used in carrying out a gradient array geophysical survey, geochemical sampling, and a ground magnetic survey.

3.3 Geochemistry

(1) Soil Sampling (Maps 8, 9, 10)

Sampling of the 'B' horizon at 100 ft. intervals was carried out over the grid. The results were in fairly close agreement with the results obtained by the Department of Mines.

3.4 Geophysics (Map 11)

(1) Contract Geophysical Survey (by C.G.O.) From report "Geophysical Survey at Moana E.L. 8/65" by G. Omes of C.G.O.

"(1) Magnetometry

The measurements of the vertical component of the magnetic field show that all anomalies coincide with the basalt outcrops, elsewhere there is strictly no anomaly.

(2) Apparent Resistivity

The Electrical Sounding carried out at OO-1450S shows that the true resistivity of the sandstone is about 10,000 ohm-m.

Three narrow NW-SE conductive anomalies run across the area. The asymmetry of the main one, A1, shows that the conductive lode dips steeply northeastward.

Two main resistant axes are parallel to the conductive axes.

A transverse fault interrupts and shifts the axes between profiles 32W and 40W.

A1 is the only conductive axis which coincides with gossans.

(3) Induced Polarisation

The chargeability axes are parallel to the northwestward resistivity trends. The shapes of anomalies and the comparison of measurements carried out with two different current line lengths (profile 0) show that the polarizable bodies are narrow lodges dipping steeply northeastward. Eight main anomalies were detected.

A1: A1 is the main anomaly with a maximum amplitude on profile 16W. It coincides with a strong conductive axis. A gossan lies along A1 between profiles 8W and 16W. The total length of the anomaly is 2000 ft.

A2: A2 coincides with a resistivity low on profile 56W but on profiles 48W and 40W there is no apparent correlation between the chargeability and apparent resistivity values.

A3: A3 runs from profile 48W to profile 56W and probably extends outside the surveyed areas, there is no apparent correlation between the chargeability and apparent resistivity values.

A4: A4 coincides with a conductive axis on profile 56W on the north-eastern limit of the surveyed area.

A5: A5 coincides with a resistant axis on profile 56W. A5 probably extends outside the surveyed area.

A6: A6 is well defined on profile 24W only. It coincides nearly with a resistant axis, a gossan lies 150 ft. southwestward from A6. The gossan may be associated with the mineralisation which gives rise to A6. The position of the gossan may be explained by the complete oxidation of the upper part of the lode and by the northeastward dip.

A7: A7 is well defined on profile 0 only, it is probably due to shallow rooted small mineralisation. It does not show up with the longer current line.

A8: A8 on profile 0 has not a larger lateral extension than A7 but it is rooted deeper. A8 does not coincide with any resistivity anomaly.

(4) Self Potential

A small -25mv anomaly coincides with a gossan near A1 on profile 16W. The amplitude is small but the anomaly appears to be well defined and its position fits with the northeastward dip of the conductive and polarizable lode. The S.P. anomaly is perhaps due to a sulphide mineralization electrically continuous but some manganese oxides also give rise to S.P. anomalies. The first possibility appears more likely because the amplitude of I.P. anomaly A1 is a maximum on 16W and is not due to the gossan. There is no other significant S.P. anomaly within the surveyed area.

(5) Conclusions and Recommendations

Eight I.P. anomalies were detected, they fit in three different categories.

(A) I.P. anomalies associated with conductive axes:

A1, A4, small part of A2. A1 is also associated with an S.P. anomaly on profile 16W.

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The conductive axes have a larger extension than the I.P. axes. This fact could be explained as follows: lower resistivities are due to both sulphides and clay minerals located in a stratum or shear zone, although the extension of the sulphide mineralization is smaller than the extension of the clayey shear zones or strata.

(B) I.P. anomalies associated with resistant axes or zones:

A2, A5, A6.

These anomalies are probably due to disseminated sulphides, perhaps pyrite, in sandstone.

(C) I.P. anomalies which do not seem to be related to any apparent resistivity features:

A3, A7, A8.

Two anomalies, A1 and A2, inside the surveyed area are more than 2,000 feet long.

We recommend to start drilling anomaly A1 (2 holes) and anomaly A2 (1 hole).

Anomaly	Profile	Position of EIS	Dip	Length
A1	16W	600 feet from base line	45° SW	450 feet
A1	8W	350 feet from base line	45° SW	300 feet
A2	48W	650 feet from base line	45° SW	450 feet

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DISCUSSION

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3. GEOPHYSICAL RESULTS IN OLIVERS HILL

3-1. Magnetometry

The measurements of the vertical component of the magnetic field show that all anomalies coincide with the basalt outcrops, elsewhere there is strictly no anomaly.

3-2. Apparent Resistivity

The Electrical Sounding carried out at 00 - 1450S shows that the true resistivity of the sandstone is about 10,000 ohm.m.

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Two main resistant axes are parallel to the conductive axes.

A transverse fault interrupts and shifts the axes between profiles 32W and 40W.

A1 is the only conductive axis which coincides with gossans.

3-3. Induced Polarization

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any indication of low resistivity

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Eight main anomalies were detected.

A1 : A1 is the main anomaly with a maximum amplitude on profile 16W. It coincides with a strong conductive axis. A gossan lies along A1 between profiles 8W and 16W. The total length of the anomaly is 2,000 feet.

A2 : A2 coincides with a resistivity low on profile 56W but on profiles 48W and 40W there is no apparent correlation between the chargeability and apparent resistivity values. A2 extends outside the surveyed area, within the surveyed area it is more than 2,000 feet long.

A3 : A3 runs from profile 48W to profile 56W and probably extends outside the surveyed areas, there is no apparent correlation between chargeability and apparent resistivity values.

A4 : A4 coincides with a conductive axis on profile 56W on the northeastern limit of the surveyed area.

A5 : A5 coincides with a resistant axis on profile 56W. A5 probably extends outside the surveyed area.

A6 : A6 is well defined on profile 24W only. It coincides nearly with a resistant axis, a gossan lies 150 feet southwestward from A6. The gossan may be associated with the mineralization which gives rise to A6. The position of the

gossan may be explained by the complete oxidization of the upper part of the lode and by the northeastward dip. ✓

A7 : A7 is well defined on profile 0 only, it is probably due to a shallow rooted small mineralization. It does not show up with the longer current line.

A8 : A8 on profile 0 has not a larger lateral extension than A7 but it is rooted deeper. A8 does not coincide with any resistivity anomaly.

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A1, A4, small part of A2. A1 is also associated with a S.P. anomaly on profile 16W.

The conductive axes have a larger extension than the I.P. axes. This fact could be explained as follows : lower resistivities are due to both sulfides and clay minerals located in a stratum or shear zone although the extension of the sulfide mineralizations is smaller than the extension of the clayey shear zones or strata.

(2). I.P. anomalies associated with resistant axes or zones :

A2, A5, A6.

These anomalies are probably due to disseminated sulfides, perhaps pyrite, in sandstone.

(3). I.P. anomalies which do not seem to be related to any apparent resistivity feature :

A3, A7, A8.

Two anomalies, A1 and A2, inside the surveyed area are more than 2,000 feet long.

We would recommend to start drilling anomaly A1 (2 holes) and anomaly A2 (1 hole).

Anomaly	Profile	Position of rig	Dip	Length
A1	16W	600 feet from base line	45°SW	450 feet
A1	8W	350 feet from base line	45°SW	300 feet
A2	48W	650 feet from base line	45°SW	450 feet

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2. OLIVER'S HILL AREA

Geological mapping by the Tasmanian Department of Mines during May, 1969 revealed zones of ferromanganese cappings over one mile long on the northern slopes of Oliver's Hill. Subsequent geochemical soil sampling showed a broad zone of anomalous lead concentrations (up to 1700 ppm) with associated, weak copper and zinc anomalies.

Work conducted in this area by Mt. Lyell is adequately detailed by Dandy (1970). In summary this work consisted of geological mapping, soil sampling, magnetometry and a detailed gradient array IP coverage (conducted by C.G.G.).

A total of 8 IP anomalies were outlined. Anomaly A1 coincided with a "gossan" zone and an SP anomaly was detected on traverse 16W. Two diamond drill holes were recommended by C.G.G. to test this anomaly. Logging operations conducted on Oliver's Hill during the winter of 1970 severely damaged the access road, rendering it completely impassable. In order to regain access to the area approximately 1/4 mile of new road was constructed.

Two diamond drill sites and a small water storage dam were constructed to enable the diamond drilling program to begin.

Drilling of D.D.H. Oliver's Hill 1 commenced on June 25th, 1971 and had advanced 100 ft. in Moine Sandstone at the end of the 1970-71 year. Drilling is continuing.

4. OLIVER'S HILL AREA4.1 Introduction

Geological mapping by the Department of Mines during March, 1969 revealed outcrops of ironstone "gossan" extending for approximately one mile on the northern slopes of Oliver's Hill (refer Map 3). Subsequent geochemical soil sampling showed a broad zone of anomalous lead concentrations with associated weak copper and zinc anomalies. The results of these investigations are detailed by Baker (1971).

Work conducted in this area by Mt. Lyell has been adequately detailed in the Annual Report for 1969-70. In summary this work consisted of geological mapping, soil sampling, magnetometry and a detailed gradient array I.F. coverage.

A total of 8 I.P. anomalies were outlined; of which anomaly A1 (refer Map 3) was considered to represent a favourable drilling target. Anomaly A1 coincided with an ironstone "gossan" outcrop and an S.P. anomaly was recorded on line 16W. Two diamond drill holes were recommended by Compagnie Generale de Geophysique to test this anomaly.

4.2 Diamond Drilling Results

Drilling of D.D.H. Oliver's Hill No. 1 (refer Map 4) commenced on June 25th, 1971.

The hole was collared on line 8W/360S in soil containing blocky "gossan" boulders to a depth of 59 ft. From 59 - 112 ft. the hole intersected massive ironstone "gossan" and passed into highly weathered Moina Sandstone with strong iron oxide staining from 112 - 166 ft. Typical facies of the Moina Sandstone were intersected from 166 - 470 ft. and contained only very minor traces of disseminated pyrite. Roland Conglomerate occurred from 470 - 540 ft., at which depth the hole was completed.

08A

No economic mineralisation was intersected in this hole. It is apparent that the hole was collared too close (see section) to the I.P. axis to give an optimum intersection. This was due to an error in co-ordinates quoted by C.G.G. Nevertheless, the results obtained suggest a shallow "gossan" and indicate the general geological structure.

D.D.H. Oliver's Hill No. 2 was collared on line 16W/600S on July 26th, 1971. The hole passed through typical Moina Sandstone from 0 - 442 ft. with a narrow intrusion (?) of quartz-feldspar porphyry from 79 - 101 ft. From 442 - 561 ft. the hole intersected typical red, haematitic facies of the Roland Conglomerate, passing into massive dark green, chloritised quartz-feldspar porphyry from 561 - 800 ft.

Mineralisation was present as rare finely disseminated specks of pyrite in the Moina Sandstone and as very minor traces of pyrite and galena in the porphyry. No evidence of economically significant mineralisation was observed.

4.3 Interpretation and Recommendations

The results of the drilling program significantly downgrade the potential of the Oliver's Hill area.

Although D.D.H. Oliver's Hill No. 1 did not provide a particularly good test of anomaly A1 on line 8W, the "gossan" appears to extend to a depth of about 100 ft. beneath the surface.

D.D.H. Oliver's Hill No. 2 provided an effective test both of anomaly A1 and also of the depth extensions of the extensive "gossan" outcropping on line 16W.

085

The source of the I.P. anomaly on line 16W is apparently unrelated to sulphide mineralisation; however the anomaly may reflect the presence of a thin intrusive sheet (?) of quartz porphyry within the Moina Sandstone. This sheet (?) of porphyry is present as a narrow intersection in D.D.H. Oliver's Hill No. 2 and outcrops sporadically between lines 8W and 16W. It is variably weathered to a yellow clayey matrix and hence could possibly give rise to both an I.P and S.P. response.

D.D.H. Oliver's Hill No. 2 passed beneath an extensive surface outcrop of ironstone "gossan" at a vertical depth of 500 - 600 ft. without intersecting any trace of economic sulphide mineralisation.

The following conclusions may be drawn:

- (i) I.P. anomaly A1 is unrelated to sulphide mineralisation.
- (ii) The "gossan" outcrops have no demonstrated depth extension. In particular, on line 16W, no significant depth extension of the surface "gossan" is present.

It is considered that the Oliver's Hill ironstone "gossan" outcrops may represent Cretaceous surface erosional deposits which were buried by Tertiary basalt and have subsequently been re-exposed. A source for the high lead contents of the "gossan" material may have been a galena deposit similar to that developed in the Round Hill Mine area. A similar view to the above hypothesis is suggested by Baker (1971, p.166).

It is the writer's opinion that the potential for discovery of a sizeable economic mineral deposit in the Oliver's Hill area is limited. It appears unlikely that any possible mineralisation would represent a target of sufficient interest to this Company.

No further drilling was recommended in the Oliver's Hill area and accordingly the area was relinquished as part of a general reduction of E.L. 8/65 on November 12th, 1971.

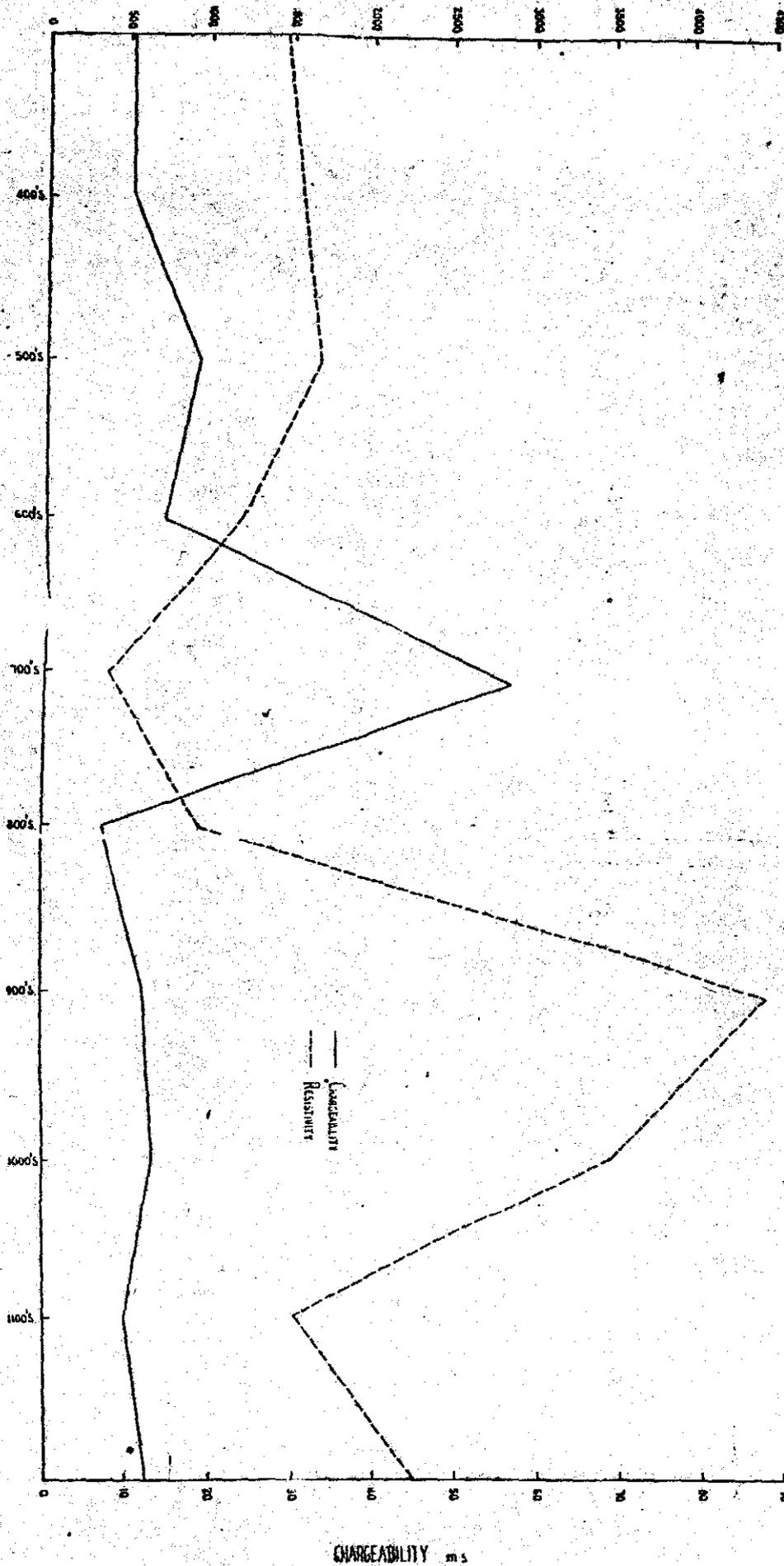
5. SHEPHERD AND MURPHY MINE - TI TREE CREEK SKARN ZONE

In the 1970-71 Annual Report on the Moina Area, McKibben (1971 p.35) outlined a program of diamond drilling to test an area adjacent to

086

RESISTIVITY - Ohm/cm

092087

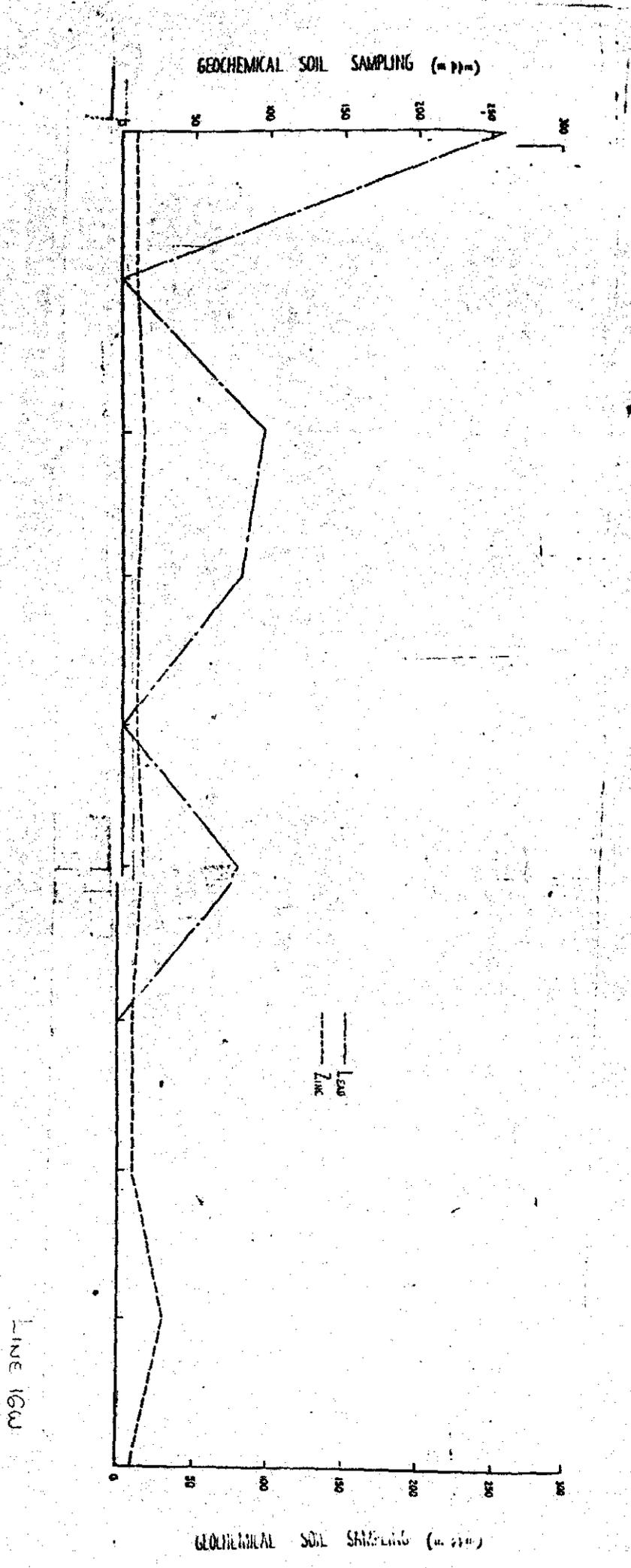


LINE 16M

85-1430
1/2

087

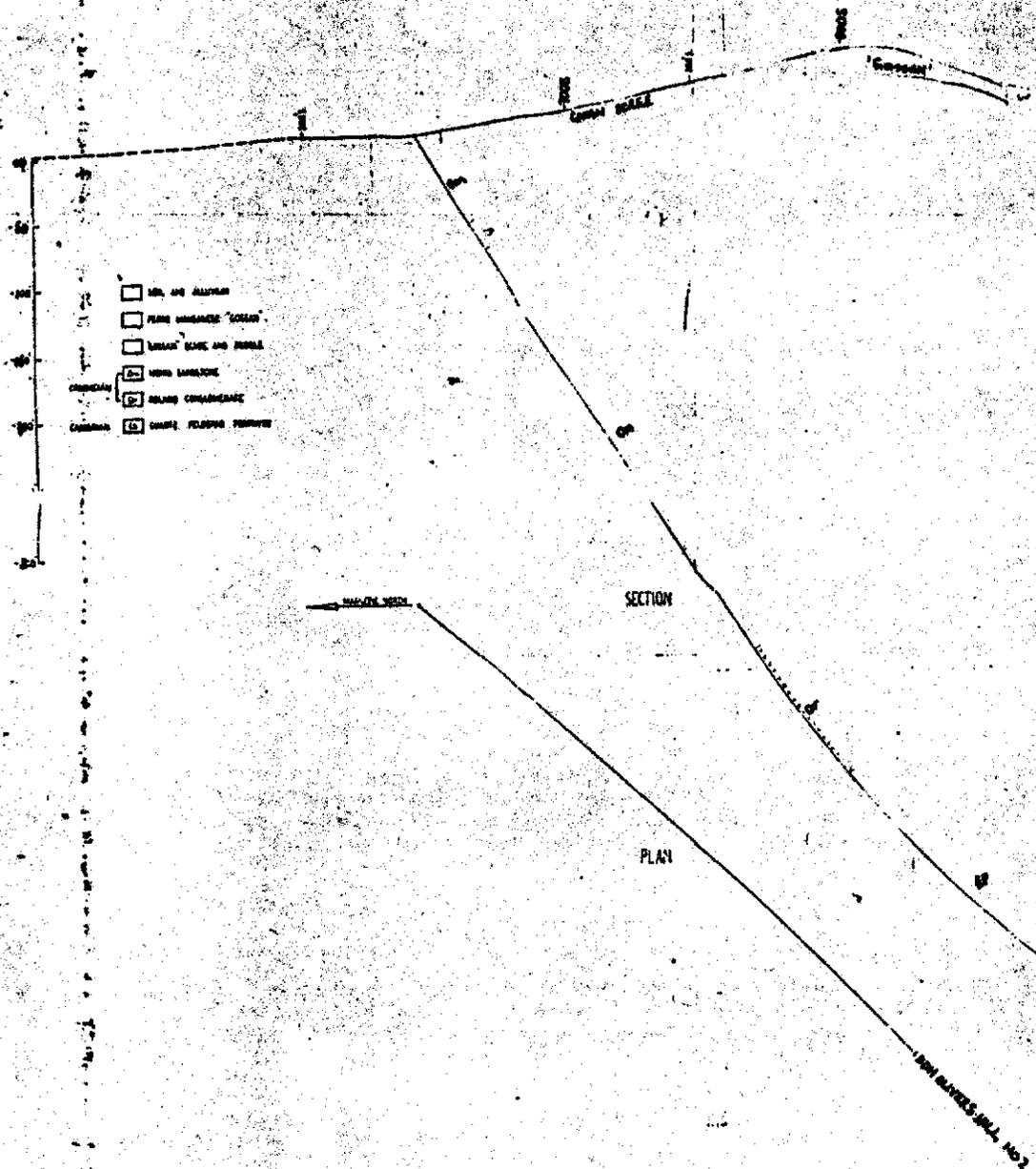
092088



85-1430
1/2

092089

85-1430
112



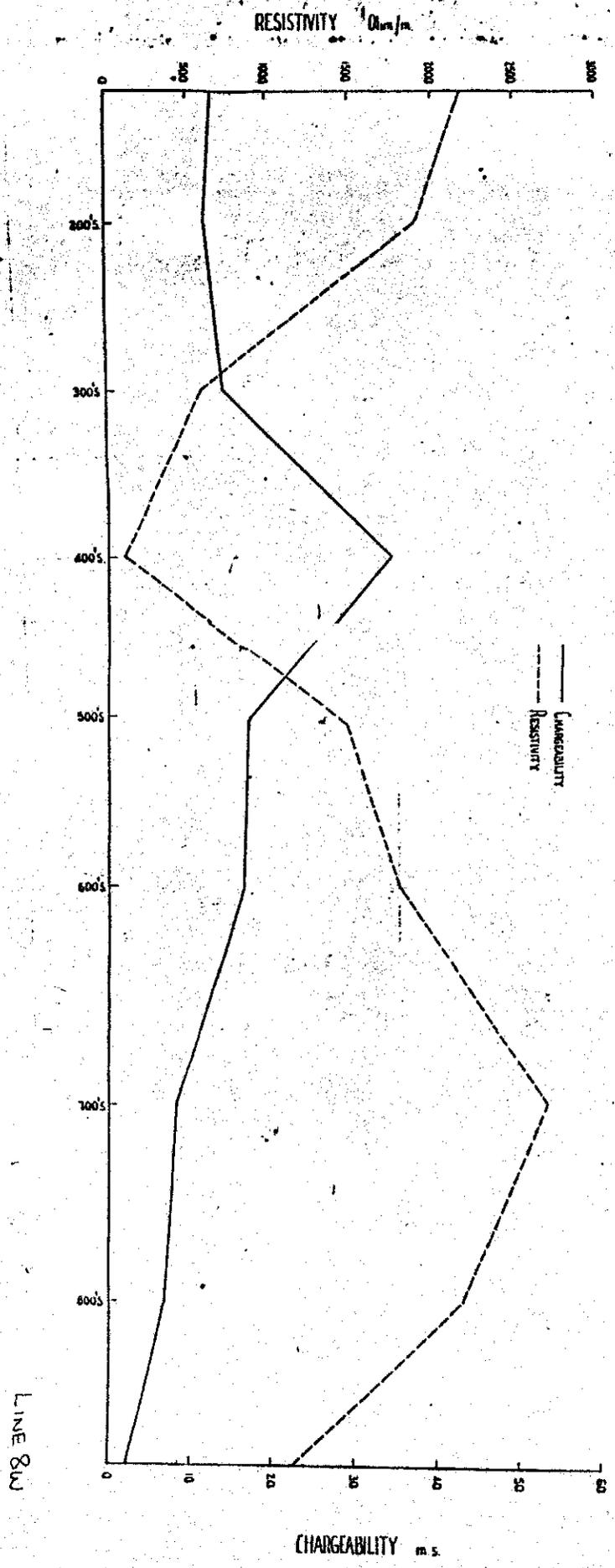
SCALE 1:5000 - 1:10000

THE MOUNT LYELL M. & R. COY. LTD.
EXPLORATION DEPARTMENT
MORIA E.L. 8/65
OLIVER'S HILL GRID
GEOLOGICAL & DRILLING RESULTS ON LINE 16W

880

089

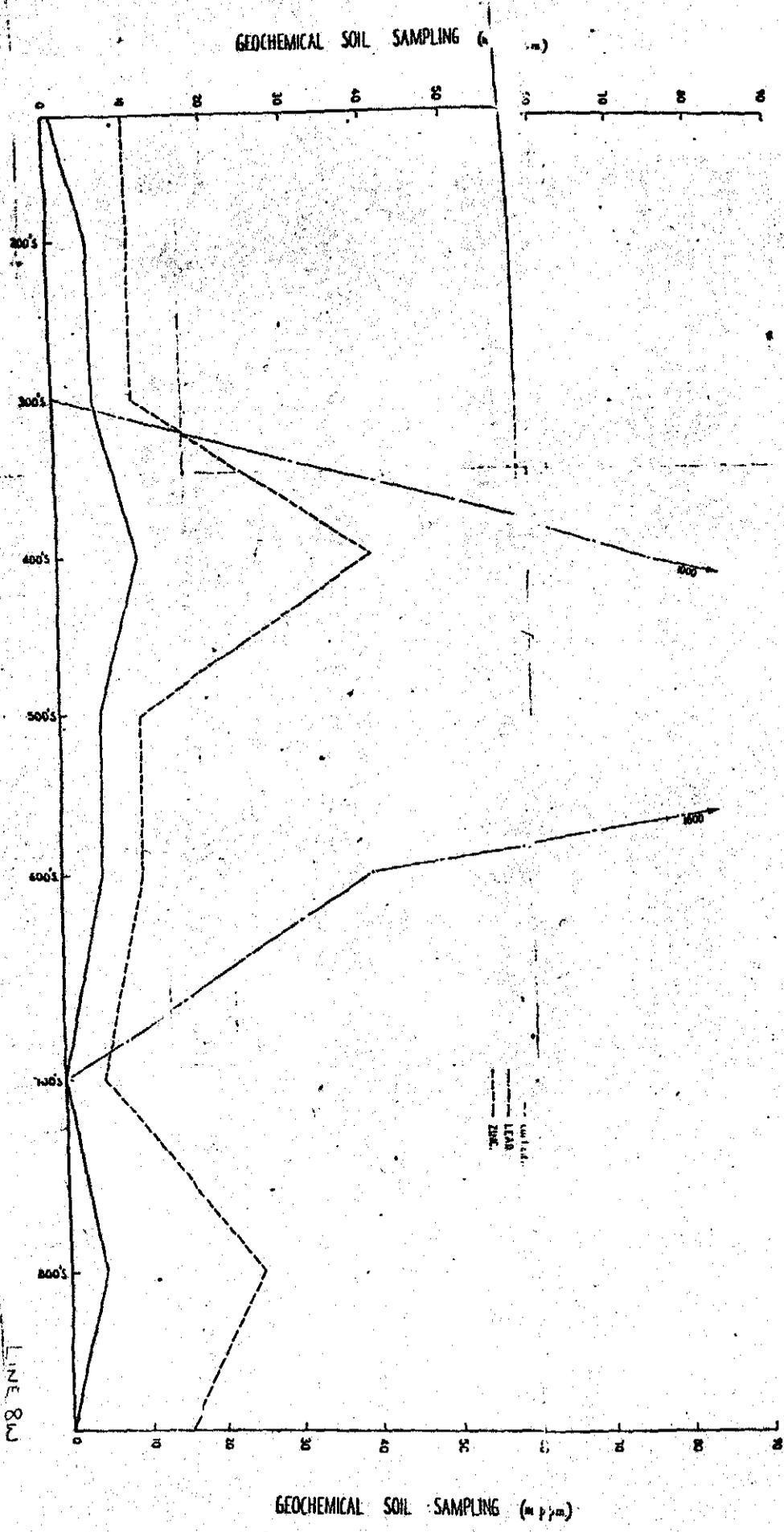
092090



85-1430
1/2

090

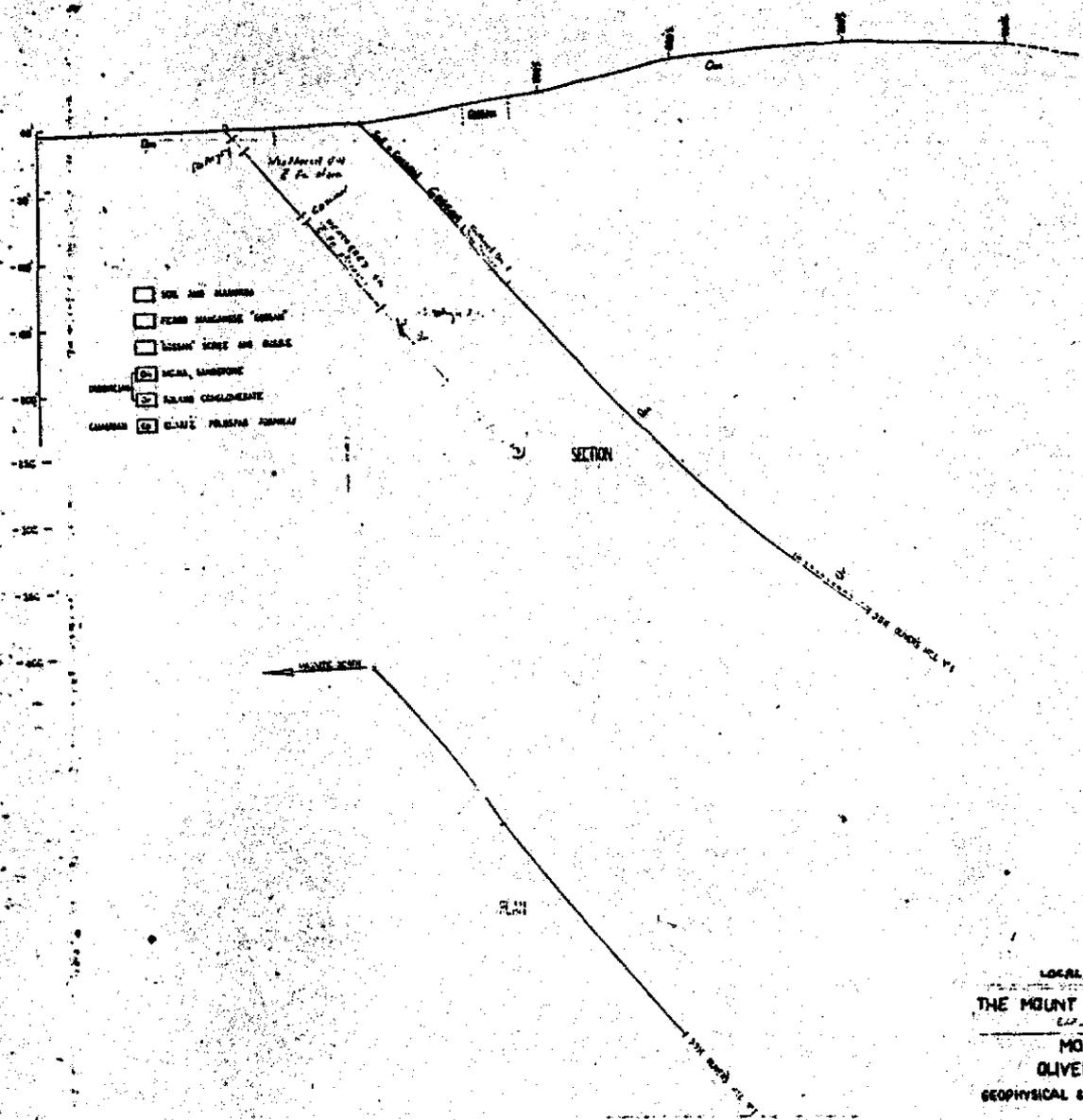
092091



85-1430
1/2

092092

85-1430
1/2



091

R. Poltock, Nov. 1979.

STRATIGRAPHY

Cambrian

One rock type predominates, this is probably a tuff, composed of quartz crystals set in a mauve to pale yellow groundmass. Originally the rock may have been altered but lathe like crystal shapes can still be recognised.

This rock could be similar to the quartz hornblende porphyries in the Iris Mine area.

Ordovician

Conglomerates composed of quartzite pebbles and cobbles unconformably overlie the sheared Cambrian rocks. This unit which is about 10-15m thick forms a scarp along the eastern flank of Tin Spur. In places it has been recrystallized, pebble boundaries fusing with the matrix.

Sandstone appears to conformably overlie the conglomerate, this unit also recrystallized in most places to a quartzite. It is generally well bedded but this is difficult to recognise due to jointing. Within the sandstone several characteristic horizons occur, these could be used to determine more detailed structure.

From the base these are:

- (1) Quartzites pale cream to pink.
- (2) Dark maroon fine conglomerate, this composed primarily of matrix with scattered fragments of quartz and red quartzite.
- (3) Quartz grit, composed of sub rounded quartz grains, probably derived from Cambrian tuffs or granite.
- (4) Sandstones with occasional siltstone beds, the latter highly cleaved.
- (5) Sandstone - tubicular, this is the dominant rock type.

Sandstones in the southern part of grid underlying the gossans are soft with iron staining.

Tertiary

Greybilly conglomerates and grit unconformably overlie the above sandstones, two types occur having a siliceous or ferruginous cement.

The latter, most commonly forming gossanous, broken outcrops in the south of the grid, appears to underlie the basalts.

Siliceous greybilly usually occurs as large blocks probably close to in situ. It differs from the Ordovician

conglomerate, sorting is poor, blocks angular and of sandstone not quartzite. An unconformity is exposed at 960S 450W where it overlies sandstone.

Basalt

This doesn't outcrop but occurs as loose massive blocks in a brown soil, greatest area covered on lines 1300-1400S, 750-500W. Remnants of flows also occur in Tin Spur Creek south of line 500S. This indicates that the pre basaltic topography in the Tin Spur - Tin Spur Creek area was similar to the present.

STRUCTURE

The Cambrian-Ordovician rocks have been folded, faulted and jointed, most trends fall between 100-120°M. Two major features are readily apparent.

1. Tin Spur Fault. This is exposed in the Falls Mine Fig. 1 and the Lorinna Road at 160W 25N. The fault trends at 110° roughly paralleling Tin Spur Creek which it probably cuts where sandstone outcrop ceases and basalt begins.

Sandstone in the NE is down thrown against Cambrian rocks in the SW, the latter being cleaved and parallel to the fault trends.

2. Syncline in conglomerate and sandstones which unconformably overly Cambrian tuffs on the E slope of Tin Spur but on Western side the contact may be a thrust fault.

Between lines 0-400S the main syncline trend is SSE with minor NE-SW crossfolding which is probably terminated by a fault parallel to the 400S line.

Further south of line 400 the syncline has a SE trend with a southerly plunge, in section Fig. 2 this fold is asymmetrical suggesting the presence of a major fracture with a SE trend occurring between 350-400W on 500S line. This fracture if it exists could be relevant to mineralization.

In the SW corner of the grid an anticline - syncline occur with a more easterly trend, these disappear beneath the Tertiary rocks.

Within these major folds smaller ones exist with wave lengths of less than 4m, these may exist in zones of greater deformation e.g. fold outcropping 750S 470W.

Structure and Mineralization

All mineralization seen occurs in zones of faulting, and jointing in the Cambrian tuffs and Ordovician sandstones. Two main types of mineralization occur.

(1) Falls Mine Fig. 1. Here highly altered Cambrian rocks occur in a fault zone.

(2) Quartz veins in sandstone, two main types occur both carrying anomalous tin and in some cases gold:-(a) apparently

094
barren white quartz in tension gash and joints e.g. 850-900S,
400-450W.

(b) quartz pyrite cassiterite veins occurring on joint faces,
these weather to a gossanous material. The joints trend 305°
and dip 55° to west, most intensive workings occur at 600-
700S, 500-550N. Here an adit, the lowest working is partly
in brecciated pyrite conglomerate, Cambrian rocks would occur
less than 20m below here.

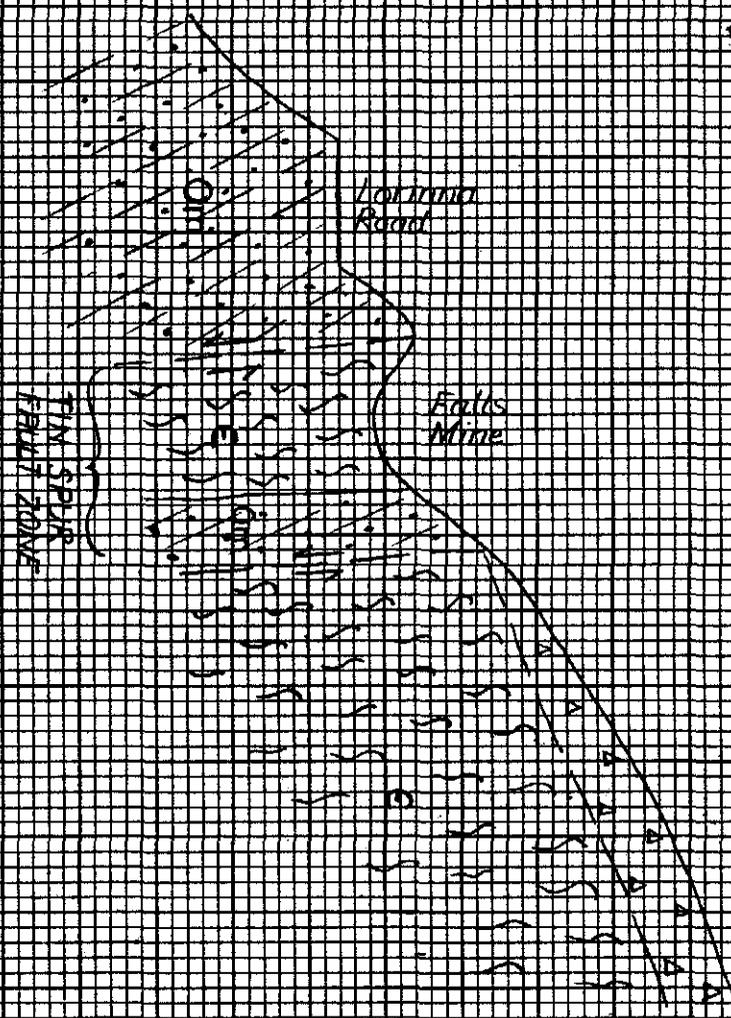
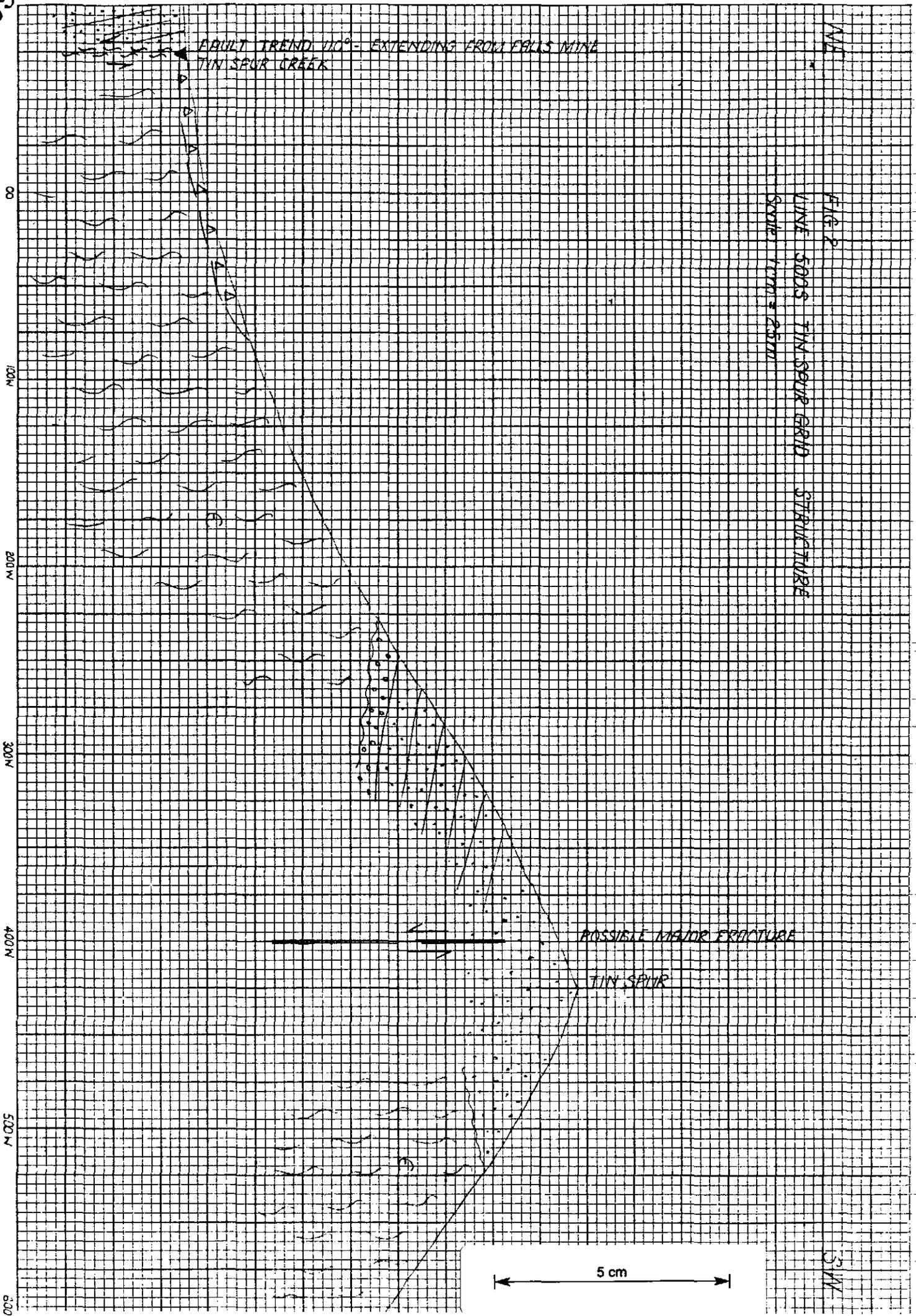


FIG. 1
 FALLS MINE STRUCTURE
 LINE OF SECTION 45N
 (Diagram - not to scale)

0996



NE

FIG. 2
LINE 500S TIN SPUR GRID
Scale 1 cm = 20m

STRUCTURE

POSSIBLE MAJOR FRACTURE

TIN SPUR

5 cm

SW

PROJECT TIN SPUR / DEVONIAN

SUBJECT ROCK SAMPLE ANALYSES

PREP. BY P. ASKINS

DATE MAY 1980 SHEET 1 OF 5

TABLES

SAMPLE NO.	ANALYSES, ppm							OTHERS				DESCRIPTION
	Sn	W	Pb	Zn	Ag	Au	As	Cu	Cd	Sb		
PA/T/OL 1	960	40	1000	300	1	-	1500	800	<3	50	Grab samples - surface Gossan, Tin Spur near 1200S / 500W to 600W	
2	270	25	3000	3000	1	-	3000	100	20	50	"	
3	1200	25	5000	4000	2	-	3000	150	50	50	"	
4	760	10	700	100	0.2	-	800	250	<3	30	Fractured sst with qtz stringers; some limonitic pit near 1140S / 540W Tin Spur.	
5	26	<10	1500	400	1.0	<0.05	140	200	<3		Gossan float, near Mines Dept Drill holes OH 2, 3 Devonian Grid 200N / 050W	
6	<4	<10	60	<20	0.6	<0.05	12	15	<3		Sandstone with some quartz veinlets, south of sample 5	
7	8	<10	700	1000	4	<0.05	940	100	<3		Ditto, some gossany, from north of sample 5	
8	20	10	80	20	1.0	<0.05	30	15	<3		Quartz-feldspar porphyry, weathered, at drill site of OH 2, 3	
9	8	10	3000	150	2.0	0.05	1200	60	<3		"Sheared" siltstone adjacent to OH 2, 3	
10	10	<10	>1%	1500	20	0.10	910	250	<3		Gossan uphill from No. 1 Adit, near Devonian Grid co-ords 50N / 75W	
11	38	10	1500	700	0.7	<0.05	115	100	<3		Dump of weathered limonitic silty sandstone No. 1 Adit. 25N / 25W	
12	<4	10	~1%	1000	100	<0.05	350	200	<3		Gossan near Devonian Grid co-ords 225S / 25E	

PROJECT

SUBJECT

PREP. BY

DATE

SHEET

2 OF 5

TABLES

SAMPLE NO.	ANALYSES, ppm.							OTHERS			DESCRIPTIONS
	Sn	W	Pb	Zn	Ag	Au	As	Cu	Mo		
PA/T/OL 13	<4	10	~1%	5000	15	<0.05	1450 Bi <4	100 Be 10	<3	Gossan scree, base of hill, on road north of Devonian Grid.	
14	120	40	5000	5000	8	0.2	2950 Bi <4	300 Be 7	<3	Gossan grab sample, same ^{area} as sample 1, 2, 3	
15	1850	20	1500	3000	0.8	0.3	4100 Bi 38	300 Be 15	<3	Similar to sample 4.	
PA/T/MOINA 14	120	15								Quartz rich porphyry (welded tuff? - Cambrian) dump, Falls Mine	
PA/T/TS 1	55	<10				0.05				Grab of ss, some qtz veinlets off trench dump Tin Spur Grid 975S/565W	
2	46	10				<0.05				Sandstone outcrop with much irregular qtz veinlets, some limonite, 900S/510W	
3	28	<10				<0.05				Quartz veinlet ± limonite after pyrite 890S/510W	
4	4400	40				0.05				Gossanous sandstone with irreg qtz veinlets Grab over 20cm wide zone, 815S/450W	
5	36	<10				<0.05				Spoil ex trench in ss. 780S/460W	
6	3200	30				<0.05				Similar, at 790S/455W	
7	50	<10				<0.05				Veinlet network strike 120° width ~ 1m at anticline, 760S/475W	
8	4.3%	180				<0.05				Pit, chip of various exposed limonitic sandstone 780S/470W	

PROJECT
 SUBJECT
 PREP. BY
 DATE
 SHEET 3 OF 5
 No.

COMALCO LIMITED

092100

SAMPLE NO.	ANALYSES, ppm							DESCRIPTIONS	
	Sn	W	Pb	Zn	Ag	Au	OTHERS		
PA/T/TS 9	2.35%	100				0.15		Gossany vein 20cm wide, strike 120° dip 50S 750S/470W	
10	3600	25				0.05		Griffin + Richards upper cross cut. Chip sample at entrance across 2m py rich ss.	
11	820	25				<0.05		Cambrian 'porphyry' with tourmaline? veins Cleavage 150° dip 60W 700S/575W	
12	NOT ANALYSED								Coarse cassit. in thin vein parallel to unconformity 110° strike, 20°S dip; 700S/575W
13	6	<10				<0.05		Sandstone with quartz veinlets 1300S/180W	
14	18	<10				<0.05		Ditto at 1300S/800W	
15	380	15			<1	<0.05		Grab ss/qtzite over area around 500S/450W	
16	THIN SECTION ONLY								Bedded qtzite with black specks, near sample 15
17	THIN SECTION ONLY							} Specimens of gossanous sandstone from pit at 780S/470W. Same site as sample 8.	
18	THIN SECTION ONLY								
19	THIN SECTION ONLY								
20	THIN SECTION ONLY								Tin Spur Trench 2 at 1.5m. Dissem f cassit in porous ss. Trench 2 at 23m. Qtzite with f cassit along fractures

PROJECT _____
 SUBJECT _____
 PREP BY _____
 DATE _____
 SHEET 4 OF 5

SAMPLE NO.	ANALYSES, ppm							DESCRIPTIONS
	Sn	W	Pb	Zn	Ag	Au	OTHERS	
PA/T/TS 21	THIN SECTION ONLY							Trench 2 at 46.0 m Flat lying originally pyritic now limonitic fracture ~5cm wide.
22	THIN SECTION ONLY							Trench 2 at 54 m Limonitic sandstone
24	120	10	110	140	<1	0.10	Cu 40	Ss, calc-silicate rock, some arsenopyrite; grab from dump at 825S/525W
25	1200	25	4	10	<1	<0.05	Cu 115	Quarry at Cethana Lake - pyritic sandstone. Collected by A. Rowe (In CRAE EL7/73)
RP/T/TS								Falls Mine; highly altered Cambrian rocks + quartzites with qtz veining. [Co-ords are Tin Spur Grid.]
110S/100W	4150	60					<0.05	Ditto
130S/100W	175	15					<0.05	
420S/475W	48	10					<0.05	Sandstone with quartz veining
420S/510W	910	15					0.15	Gossanous material on joint face in sandstone
500S/315W	48	15					<0.05	Quartzite with minor quartz veining
650S/510W	1.78%	90					0.10	Quartz-py vein now gossanous, in quartzite
650S/525W	1.85%	100					0.60	Dump sample from workings on above vein
700S/500W	1050	80					0.45	Same joint and veining as at 650S/510W
875S/440W	2450	30					0.15	Quartz vein in sandstone
895S/425W	2550	35					0.35	Ditto
900S/470W	1050	40					1.10	Sandstone and gossan
900S/485W	600	20					0.90	Sandstone, iron staining
910S/575W	430	30					0.25	Sandstone, very soft, with minor gossan
920S/575W	1300	40					0.35	Ditto

PROJECT

SUBJECT

PREP. BY

DATE

SHEET

5 OF 5

TABLES

SAMPLE NO.	ANALYSES ppm										DESCRIPTIONS
	Sn	W	Pb	Zn	Ag	Au	Cu	Bi	Co		
RP/T/TS											
1100S/520W	130	15				0.35					Sandstone + gossan
1100S/545W	1650	30				0.20					Sandstone + quartz breccia
1100S/860W	12	10				0.05					Quartz porphyry
1140S/525W	1700	25				1.40					Sandstone + gossan
RD/T/TS											
698S/504W	4800	55			37	<0.05					Continuous chip samples pyritic + limonitic quartzite in small cut in fracture system
698S/505W	3400	35			7	<0.05					
PA/T/DEV											DEVONIAN GRID AREA
1	10	<10	4150	8	2	0.65	14				Qtz vein 15cm wide strike 120 dip 40S parallel to bedding, in trench
2	6	<10	3400	3700	<1	0.10	65				Gossany float, near
3	<4	<10	185	8	<1	<0.05					Gossanous sandstone, MnO ₂ coating ~50N/500W (beyond grid limits)
4	<4	10	600	230	<1	<0.05					Soft sandstone off trench dump 100S/375W
5	12	10	195	4	<1	<0.05					Devonian Mine dump, sandstone with some quartz veinlets 100N/250W
PA/T/MOINA 16	6	35	24	30	<1	0.05	4	<10	4		Hematite lens within conglomerate at Lookout Mt Claude.

NOTE ON ANALYTICAL METHODS: Samples PA/T/OL 1-15, PA/T/MOINA 14 by AMDEL Sn, W XRF, Au AAS, other analyses semi quant. spectro. All other samples by COMLABS. Sn, W XRF, other elements AAS

APPENDIX 4

GRIFFIN & RICHARDS ADITS, TIN SPUR

LOGS AND ANALYSES



COMLABS Pty Ltd
COMPUTERISED ANALYTICAL LABORATORIES

OUR REF.: COM 790045
YOUR REF.: Con. No. 557802
RD/T/TS

305 SOUTH ROAD
MILE END SOUTH
STH. AUST. 5031
TEL.: (08) 43 5722
TELEX: AA 89323

Mr P. Askins
Commonwealth Aluminium Corporation Ltd
P.O. Box 691
DEVONPORT 7310

4.1.80

Dear Paul,

Enclosed are the assays for the 93 rock samples delivered to our laboratory on the 21st December 1979. After extensive investigation it appears that the distribution of Sn in the sample is very erratic and hence sampling is a major problem. After preliminary crushing the sample was split and $\frac{1}{2}$ kg of sample was pulverised to ~~-80#~~ and an analytical split was then taken. It appears that to obtain more consistency in the Sn values between different splits it would be necessary to pulverise the entire sample (sometimes 4 kg) to ~~-80#~~ before taking the analytical split. This procedure is very time consuming and costly. Good duplication was obtained however for Ag, Au and W.

I would be pleased to discuss this problem at greater length if you require further information.

Yours sincerely,

Harry Fishman
Managing Director

COMLABS Pty Ltd
COMPUTERISED ANALYTICAL LABORATORIES

ANALYTICAL REPORTJOB COM 790045Results in ppm

<u>Sample</u>	<u>Sn</u>	<u>W</u>	<u>Au</u>	<u>Ag</u>
RD/T/TS 1	145	20	<0.05	5
2	95	15	<0.05	1
3	1300	15	0.1	13
4	6000	30	1.9	22
5	1.15%	50	1.1	46
6	650	35	0.1	11
7	770	40	0.25	13
8	2000	20	0.15	18
9	270	10	0.05	5
10	4600	40	0.45	30
11	2900	40	1.0	90
12	1300	25	0.45	7
13	190	25	0.05	1
14	760	20	0.1	11
15	990	20	0.1	3
16	200	25	<0.05	6
17	320	30	<0.05	12
18	360	25	0.05	4
19	430	20	0.1	5
20-21	200	10	0.15	2
21-22	130	10	<0.05	2
22-23	90	10	<0.05	2
23-24	55	<10	<0.05	1
24-25	65	10	<0.05	<1
25-26	170	<10	<0.05	<1
26-27	185	10	<0.05	<1
27-28	190	10	<0.05	<1
28-29	60	<10	<0.05	<1
29-30	60	<10	<0.05	<1

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092106

ANALYTICAL REPORT

JOB COM 790045

Results in ppm

<u>Sample</u>	<u>Sn</u>	<u>W</u>	<u>Au</u>	<u>Ag</u>
RD/T/TS 30-31	210	10	<0.05	<1
31-32	85	<10	<0.05	<1
32-33	46	<10	<0.05	<1
33-34	48	<10	<0.05	<1
34-35	70	15	<0.05	<1
35-36	42	<10	<0.05	<1
36-37	65	<10	<0.05	<1
38	240	25	<0.05	7
39	640	35	0.15	26
40	4550	25	<0.05	<1
41	1.27%	35	<0.05	19
42	5450	30	<0.05	2
43	2950	35	0.05	16
44	1.35%	90	0.15	10
45	7150	75	0.1	7
46	3900	50	0.15	19
47	6750	55	0.25	2
48	280	<10	<0.05	2
3A	180	20	<0.05	2
4A	250	10	0.15	3
5A	420	15	<0.05	2
6A	230	15	±0.05	2
7A	410	25	<0.05	2
8A	630	25	<0.05	4
9A	300	30	0.05	3
10A	610	15	0.1	8
11A	1800	20	0.05	1
RD/T/TS 12A	2800	60	0.4	7

ANALYTICAL REPORTJOB COM 790045Results in ppm

<u>Sample</u>		<u>Sn</u>	<u>W</u>	<u>Au</u>	<u>Ag</u>
RD/T/TS	13A	4200	60	0.2	24
	14A	470	20	0.2	15
	15A	230	25	0.05	4
	16A	350	15	0.1	3
	17A	680	25	0.05	4
	40A	930	20	<0.05	5
	41A	550	20	<0.05	4
	42A	610	40	<0.05	2
	43A	830	20	<0.05	8
	44A	970	20	<0.05	6
	45A	1950	25	<0.05	6
	46A	1000	20	<0.05	3
	3B	2100	40	0.2	1
	4B	700	20	0.15	8
	5B	890	25	0.15	8
	6B	450	20	0.1	8
	7B	260	15	0.15	<1
	8B	480	35	0.25	1
	9B	350	25	0.1	<1
	10B	410	15	0.1	<1
	11B	210	10	0.2	<1
	12B	2050	20	15	6
	13B	510	20	1.4	5
	15B	2500	25	0.8	1
	16B	520	20	0.3	2
	17B	2500	85	0.25	2
	40B	930	50	0.1	8
RD/T/TS	41B	510	55	0.3	3

107.

092108

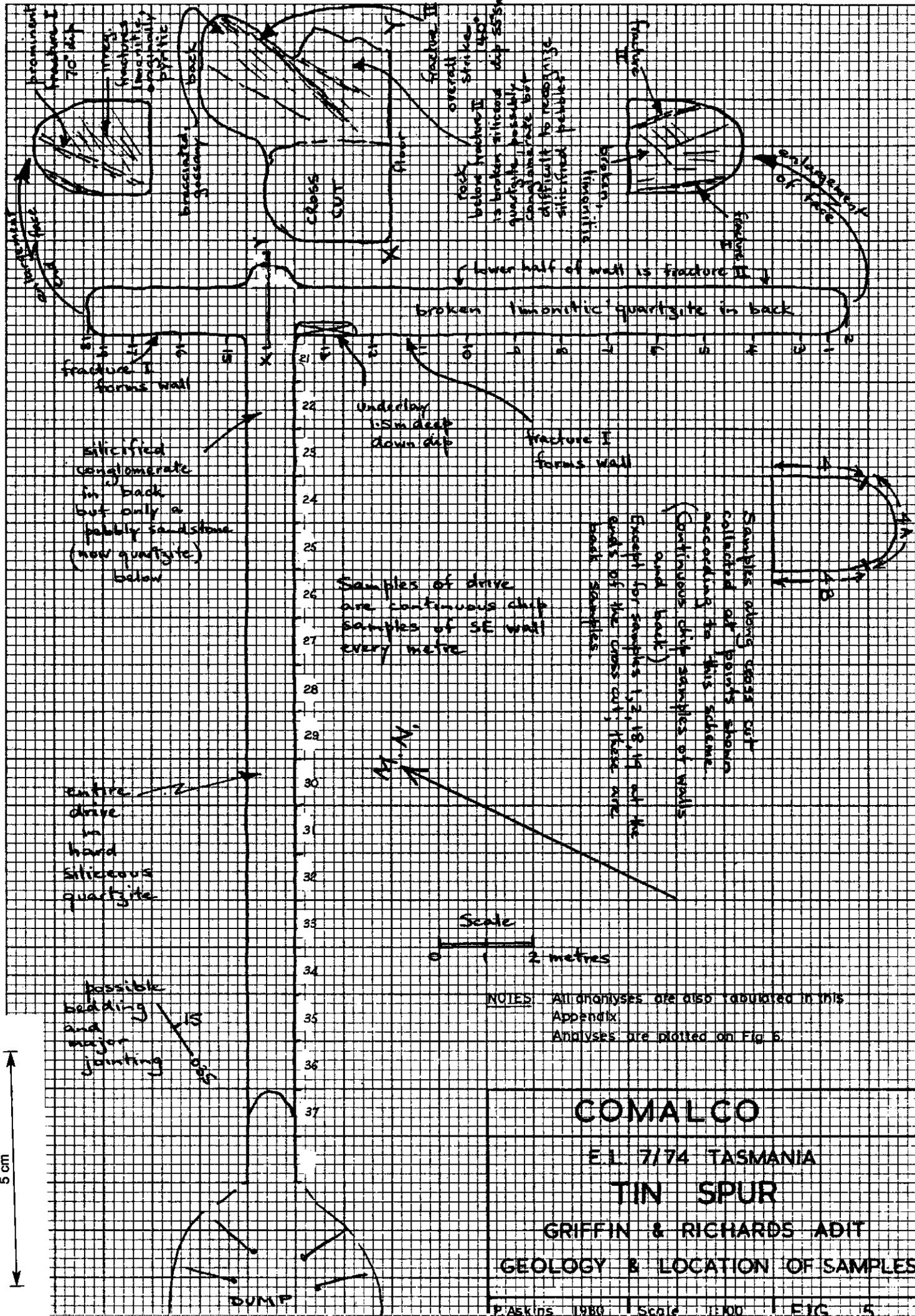
ANALYTICAL REPORT

JOB COM 790045

Results in ppm

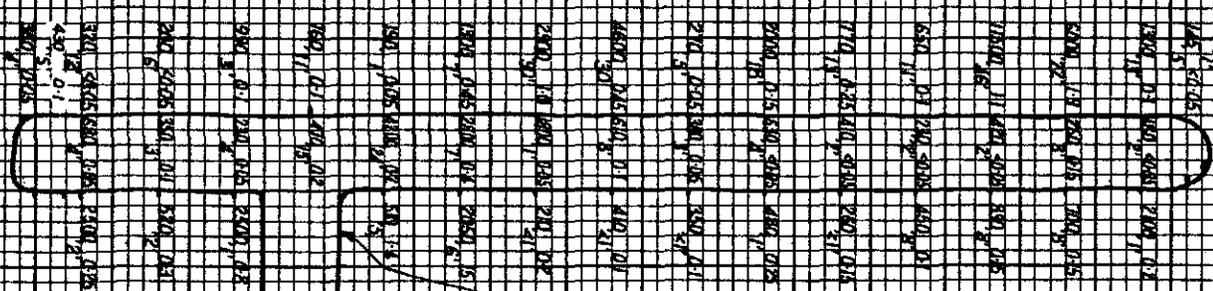
<u>Sample</u>		<u>Sn</u>	<u>W</u>	<u>Au</u>	<u>Ag</u>
RD/T/TS	42B	380	<10	<0.05	2
	43B	370	10	<0.05	7
	44B	4450	20	<0.05	1
	45B	800	20	<0.05	<1
	46B	150	25	<0.05	1
698S/504W		4800	55	<0.05	37
698S/505W		3400	35	<0.05	7
PA/T/TS	15	380	15	<0.05	<1

Method of Analysis : Sn, W : XRF 1/2
 Ag : AAS 3
 Au : AAS 5



NOTES All analyses are also tabulated in this Appendix
Analyses are plotted on Fig. 6

COMALCO
 EL 7/74 TASMANIA
 TIN SPUR
 GRIFFIN & RICHARDS ADIT
 GEOLOGY & LOCATION OF SAMPLES



130 <0.05 <2
 90 <0.05 <2
 55 <0.05 <1
 85 <0.05 <1
 110 <0.05 <1
 185 <0.05 <1
 190 <0.05 <1
 60 <0.05 <1
 60 <0.05 <1
 210 <0.05 <1
 85 <0.05 <1
 46 <0.05 <1
 48 <0.05 <1
 70 <0.05 <1
 42 <0.05 <1
 65 <0.05 <1

Weighted average along cross-cut of all
 samples from NE wall and back (not
 including SW wall)
 Sn 1420 ppm
 Au 0.2 ppm
 Ag 111 ppm

- NOTES
1. Scheme of analyses: Sn Au Ag ppm.
 2. Samples continuous chip samples as explained on Fig. 5
 3. W analyses not plotted; all are less than 65ppm and are tabulated in this Appendix.

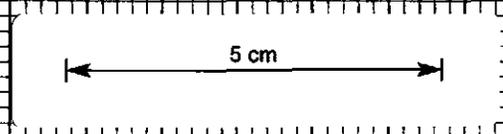
COMALCO

E-1 7/74 TASMANIA

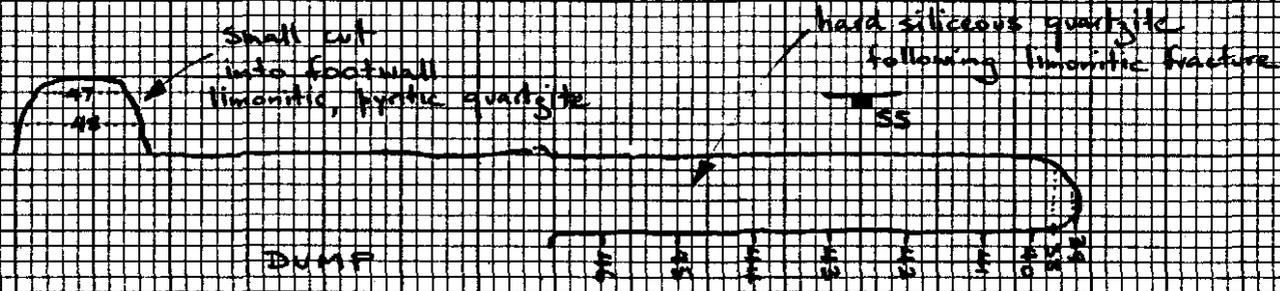
TIN SPUR

GRIFFIN & RICHARDS ADIT

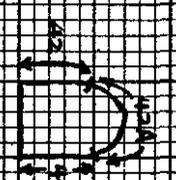
SAMPLE ANALYSES



LOCATION OF SAMPLES

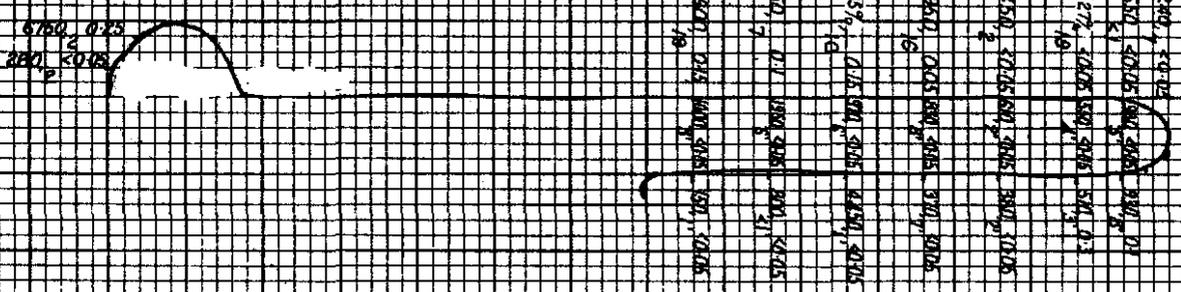


M.N. approx



continuous chips
 sample of wall
 chips
 collected of
 points shown
 according to this
 scheme
 lengths for bulk samples 35, 20

ANALYSES

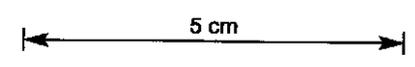


Average of all samples from NE wall
 and back (not including SW wall)

Sn 3600
 Au \approx 0.05
 Ag 8

NOTES: 1. Scheme of analyses Sn Au Ag
 2. W analyses not plotted: all are less than 90 ppm and are tabulated in this Appendix.

COMALCO
 E.L. 7/74 TASMANIA
TIN SPUR
 GRIFFIN & RICHARDS
 UPPER CROSS CUT
 GEOLOGY, ANALYSES



APPENDIX 5

LOGS AND ANALYSES OF TRENCHES

TIN SPUR

TRENCH 1

LOG AND ANALYSES

Comments	Graphic Log	— ppm —					
		Sn	Au	Ag			
		XRF	COMLABS AAS	AAS			
	0						
	0.5	130	<0.05	<1			
	1.0	130	<0.05	<1			
	1.5	350	<0.05	<1			
	2.0	490	0.05	<1			
	2.5	270	0.10	<1			
	3.0	80	0.05	<1			
	3.5	270	0.05	<1			
	4.0	250	0.05	<1			
	4.5	330	0.05	<1			
	5.0	175	0.05	<1			
	5.5	60	0.05	<1			
	6.0	720	0.15	<1			
	6.5	165	0.25	<1			
	7.0	500	0.25	<1			
	7.5	220	0.20	<1			
	8.0	230	0.15	<1			
	8.5	65	0.10	<1			
	9.0	75	0.15	<1			
	9.5	34	0.10	<1			
	10.0	240	0.05	<1			
	10.5	185	0.10	<1			
	11.0	38	0.10	<1			
	11.5	26	0.05	<1			
	12.0	24	0.05	<1			
	12.5	28	0.05	<1			
	13.0	42	0.10	<1			
	13.5	500	0.10	<1			
	14.0	210	0.15	<1			
	14.5	75	0.10	<1			
	15.0	270	0.10	<1			
	15.5	38	0.25	<1			
	16.0	30	0.05	<1			
	16.5	44	0.10	<1			
	17.0	75	0.25	<1			
	17.5	70	0.10	<1			
	18.0	75	0.05	<1			
	18.5	380	0.05	<1			
	19.0	600	0.05	<1			
	19.5	300	<0.05	<1			
	20.0	380	0.05	<1			
	20.5	550	<0.05	<1			
	21.0	290	<0.05	<1			
	21.5	70	0.05	<1			
	22.0	85	<0.05	<1			
	22.5	320	<0.05	<1			

Relatively soft white silty sandstone

cleavage? parallel bedding?

Harder sandstone

Softer more friable sandstone

Silty sandstone with very fine grained mica on cleavage &/or bedding? faces

Trace irregular quartz veinlets

M.N

53m 127°M to 500S/450W

Average for entire trench: 210 0.08

Continuous chip samples along floor of trench, at depth 0.5 to 1.0m below surface.

COMMONWEALTH ALUMINIUM CORP. LTD.
E.L. 7/74 MOINA
TIN SPUR PROSPECT

TRENCH 2 LOG AND ANALYSES, ppm

Comments	Graphic Log	Averages		Sn	Sn	Sn	W	Au	Au	Au	Ag	
		COMLABS		XRF	XRF	XRF		AAS	AAS	AAS	AAS	
		Sn	Au	Comlabs	Comlabs repeat	Amdel	Comlabs	Comlabs	Comlabs repeat	Amdel	Comlabs	
Very soft friable white sandstone very porous in places containing fine black disseminated cassiterite.	[Dotted pattern]											
		0									<1	
		0.5							0.15		<1	
		1.0	2600						0.95		<1	
		1.5	(2m)						0.15		<1	
		2.0							0.05		3	
		2.5							<0.05		3	
		3.0							<0.05		2	
		3.5							0.15		2	
		4.0							0.15		3	
Old trench crosses here, trend 049°M	[Dotted pattern]	4.5						0.1		<1		
		5.0						0.05		<1		
		5.5	2870						0.1		<1	
		6.0	(3m)						0.05		<1	
		6.5							<0.05		<1	
		7.0							<0.05		<1	
		7.5							<0.05		<1	
		8.0							0.35		<1	
		8.5							<0.05		<1	
		9.0							<0.05		<1	
Budding approx 20°W White sandstone	[Dotted pattern]	9.5	2480					0.7		<1		
		10.0	(2m)						<0.05		<1	
		10.5							<0.05		<1	
		11.0							<0.05		<1	
		11.5							<0.05		<1	
		12.0							<0.05		<1	
		12.5							<0.05		<1	
		13.0							<0.05		<1	
		13.5							<0.05		<1	
		14.0							<0.05		<1	
M.N. ←	[Dotted pattern]	14.5						<0.05		<1		
		15.0						<0.05		<1		
		15.5							<0.05		<1	
		16.0							<0.05		<1	
		16.5							<0.05		<1	
		17.0							<0.05		<1	
		17.5							<0.05		<1	
		18.0							<0.05		<1	
		18.5							<0.05		<1	
		19.0							<0.05		<1	
Harder sandstone or quartzite Some pyrite casts Some irregular quartz veinlets	[Dotted pattern]	19.5						<0.05		<1		
		20.0						0.05		<1		
		20.5							0.1		<1	
		21.0							<0.05		<1	
		21.5	2660						0.2		<1	
		22.0	(5m)						0.05		<1	
		22.5							<0.05		<1	
		23.0							0.15		<1	
		23.5							<0.05		<1	
		24.0							<0.05		<1	
CREST OF HILL Soft friable white sandstone	[Dotted pattern]	24.5						0.4		<1		
		25.0						2.45		<1		
		25.5						1.0		<1		
		26.0						0.5		<1		
		26.5						0.85		<1		
		27.0						1.3		<1		
		27.5						0.8		<1		
		28.0						1.05		<1		
		28.5						1.25		<1		
		29.0						0.45		<1		
M.N. ← Soft friable white sandstone	[Dotted pattern]	29.5						0.65		<1		
		30.0						1.0		<1		
		30.5						2.9		<1		
		31.0						0.5		<1		
		31.5						0.6		<1		
		32.0						0.5		<1		
		Limonic sandstone	[Dotted pattern]									

TRENCH 2 cont.

Comments	Graphic Log	Averages		Sn XRF Comlabs	Sn XRF Comlabs repeat	Sn XRF Amdel	W XRF Comlabs	Au AAS Comlabs	Au AAS Comlabs repeat	Au AAS Amdel	Ag AAS Comlabs	Bi Amdel	As	Sb	Be	Mo	Cu	Pb	Zn	La	Sc	Y	Yb	Ge	Ga	Less than detect
		Sn	Au																							
		Spectrographic																								
				760				1.7																		
				1600				1.8																		
				650				0.5																		
				550				0.25																		
				760				0.8																		
				380				0.25																		
				2050				0.7																		
				800				0.65																		
				550				0.3																		
				1050				0.7																		
				780				0.4																		
				520				0.4																		
				1550				0.6																		
				1650				1.1																		
				930				0.6																		
				1600				0.6																		
				130				0.05																		
				135				0.2																		
				120				0.35																		
				185				0.45																		
				50				0.05																		
				80				0.1																		
				24				0.05																		
				430				0.7																		
				480				0.4																		
				80				0.2																		
				680				0.5																		
				2300	2300	2500		3.5	3.4	3.2			30	2500	<30	1	<3	400	500	150	50	3	20	2	2	25
				4450	4400	4750		8.1	7.95	7.0			80	6000	<30	1	<3	250	400	150	<50	3	<10	<1	2	25
				1950	1950	2200		5.2	5.2	4.7			50	6000	30	<1	<3	400	400	250	<50	3	<10	<1	2	20
				1550	1500	1650		1.3	1.1	1.0			20	2000	<30	<1	<3	400	300	<20	<50	3	10	1	2	20
				3550	3550	3900		1.5	1.6	1.1			40	2500	<30	2	<3	250	2000	50	50	3	10	2	2	20
				360	370	400		0.55	0.6	0.55			20	800	<30	1	<3	80	1500	20	50	3	40	3	2	20
				180	180	180		0.4	0.45	0.40			10	600	<30	2	<3	100	1500	80	50	3	80	10	1	20
				340	330	350		0.6	0.6	0.55			15	600	<30	1	<3	80	1000	50	50	3	60	8	1	20
				1250	1250	1350		3.0	2.8	2.6			50	1500	<30	1	<3	250	1000	20	50	3	20	1	1	10
				1650	1600	1750		1.1	0.8	0.8			40	1000	<30	1	<3	150	800	<20	50	<3	20	1	1	15
				1050	1000	1100		0.9	0.9	0.85			50	3000	<30	2	<3	150	2500	60	100	3	20	2	2	15
				320	310	340		0.75	0.8	0.75			80	2000	<30	2	<3	150	1500	40	100	3	30	2	2	10
				1350	1350	1450		0.75	0.75	0.70			50	2500	<30	1	3	200	1000	60	50	3	30	2	2	10
				620	620	680		0.2	0.45	0.20			40	600	<30	<1	<3	80	1000	<20	50	3	10	1	1	25
				100	100	110		0.1	0.15	0.10			5	400	<30	<1	<3	50	1000	<20	<50	<3	10	1	1	20
				85				0.2																		
				120				0.6																		
				410				1.65																		
				610				4.8																		
				1000				3.3																		
				4100				3.0																		
				1300				0.25																		
				1450				0.45																		
				2050				0.4																		
				480				<0.05																		
				440				<0.05																		
				330				0.1																		
				780				0.1																		
				370				1.0																		
				1450				<0.05																		
				2050				0.05																		
				2200				<0.05																		
				2050				<0.05																		
				680				<0.05																		
				185				<0.05																		
				50				<0.05																		
				185				<0.05																		
				600				0.05																		

M.N. ←

TRACK crosses

M.N. ←

Nb (<20), Ce (<300), Ta (<100), Co (<5)
In (<10), Cd (<5)

TRENCH 2 cont.

Comments	Graphic Log	Averages		Sn	Sn	Sn	W	Au	Au	Au	Au
		Sn	Au	XRF Comlabs	XRF Comlabs repeat	XRF Amdel	XRF Comlabs	AAS Comlabs	AAS Comlabs repeat	AAS Amdel	AAS Comlabs
				155				0.05			<1
				175				<0.05			<1
				95				<0.05			<1
White sandstone				120				0.1			<1
				55				<0.05			<1
				85				<0.05			<1
				225				<0.05			<1
				105				<0.05			<1
				140				<0.05			<1
				150				0.05			<1
				1050				0.2			<1
				1750				0.1			<1
				290				0.1			<1
Limonitic sandstone				570				0.05			<1
				490				0.05			<1
				940				0.1			<1
				580				0.05			<1
				800				0.55			<1
			1.35	1250				1.3			<1
			(4.5m)	530				1.45			<1
				1050				1.9			<1
				500				0.7			<1
				350				2.1			<1
			700				2.1			<1	
			620				1.8			<1	
			480				0.25			<1	

M.N. ←

10° trend of trench

0.75° 12.5°

peg
8005 } 500W

APPENDIX 6

PETROGRAPHIC REPORTS



Central Mineralogical Services

231 Magill Road
Maylands, S.A. 5069
Telephone 42 5659

Mr. P. Askins
Geologist
Comalco Ltd.
Exploration Department
P.O. Box 691
DEVONPORT / TAS. 7310

14th January, 1980

REPORT CMS 79/12/47

YOUR REFERENCE: PA/T/TS
DATE RECEIVED: 24th December, 1979
SAMPLE NOS.: PA/T/TS 16, 17, 18
SUBMITTED BY: P. Askins
WORK REQUESTED: Petrology

H.W. Fander

H.W. Fander, M. Sc.

Copy to:
Mr. A.H. Bartlett
Exploration Manager
Comalco Ltd.
G.P.O. Box 2773Y
MELBOURNE / VIC. 3001

Three samples were received for section preparation and brief petrological description, with emphasis on any tin minerals present; no assays were given.

PA/T/TS 16 (T.S. 30557)

This is a well-indurated orthoquartzite, possibly incipiently metamorphosed; it is bland and featureless, and contains no tin minerals (at least in the section examined).

The framework consists of closely-packed, rounded quartz and occasional chert grains, averaging 0.5 mm in size; their long axes show bedding-orientation, and there is a suspicion of grading. The grains are well-cemented by quartz overgrowths in optical continuity, and limited recrystallization has taken place. Both grains and cement show strain-extinction. No other minerals are present.

The rock is a mature, well-sorted/sized sediment containing few, if any, detrital heavy minerals (though these may occur elsewhere), and hydrothermal alteration is absent.

PA/T/TS 17 (T.S. 30558)

This is a metasomatised orthoquartzite, i.e. a quartzose sediment which was fractured and partly replaced by topaz.

The rock consists of small subangular to subrounded quartz grains, averaging 0.10 mm in size, closely-packed and cemented by quartz overgrowths. Detrital heavy mineral grains are relatively conspicuous and include zoned tourmaline, zircon, leucoxene and possible occasional ?cassiterite grains; the evidence is meagre and would need verification by assay.

The rock is fairly extensively fractured, providing access for replacive topaz which forms branching veins of poorly-defined, granular crystals and interstitial patches replacing quartz cement. The topaz veins/zones contain goethite and small cavities after pyrite crystals. There is no evidence of introduced cassiterite, even though the situation would seem to be favourable. A whitish, opaque, ultrafine leucoxene-like substance is also present with the topaz and could be a form of SnO_2 ; electron-probe micro-analysis is probably needed to check this; and would only be justified if an assay showed significant Sn.

PA/T/TS 18 (T.S. 30559)

This is a brecciated and very weakly metasomatised orthoquartzite; it may well be correlatable with 16, but both rocks are rather featureless.

The framework consists of originally rounded and subrounded quartz grains (and occasional chert), averaging 0.2-0.3 mm in size with scattered coarser grains, cemented by quartz overgrowths. There are occasional lenses of fine silty quartz. Detrital heavy minerals are very scarce.

The whole rock is severely stressed and is brecciated in places, with cavities partly lined with hematite and goethite. Ultrafine ?topaz has pervaded the rock, occurring as minute ($< 20 \mu$) granular crystals in streaks and sporadic patches replacing quartz cement on a fine scale. No tin minerals were identified.

H.W. Fander, M. Sc.

120

092121

Central Mineralogical Services



231 Magill Road
Maylands, S.A. 5069
Telephone 42 5659

Mr. P. Askins
Geologist
Comalco Ltd.
Exploration Department
P.O. Box 691
DEVONPORT / TAS. 7310

24th March, 1980

REPORT CMS 80/3/4

YOUR REFERENCE: PA/T/TS Trench 2
DATE RECEIVED: 6th March, 1980
SAMPLE NOS.: PA/T/TS - 19, 20, 21, 22
SUBMITTED BY: P. Askins
WORK REQUESTED: Petrology

H. W. Fander
H.W. Fander, M. Sc.

Copy to:
Mr. P.W. Stainton
Senior Geologist - Exploration
Comalco Ltd.
G.P.O. Box 2773Y
MELBOURNE / VIC. 3001

CENTRAL MINERALOGICAL SERVICES PTY. LTD.

Date 24th March, 1980

SAMPLE REPORT (Mineralogy, Petrology, Ore Microscopy)

Job No. CMS 80/3/4 Date Received: 6.3.1980Reference PA/T/TS Trench 2Sample No. PA/T/TS 19Nature of Sample: Hand SpecimenDESCRIPTION SECTION No. 31070

a. Hand Specimen:

Pale, porous, quartzose rock.

b. Microscopic:

This is a sheared, silicified metaquartzite; it is weakly mineralised, containing very fine-grained cassiterite.

The original rock may have been an impure sandstone, perhaps feldspathic or calcareous, in which less stable minerals were leached, causing the porosity. Relict detrital, subrounded quartz grains have been preserved, but much of the quartz is recrystallized or replaced by later quartz and/or topaz. Thus, the rock now consists of relict detrital quartz with interstitial fine quartz and generally poorly defined topaz patches. The detrital quartz shows marked strain-extinction, and it is inferred that the rock was sheared prior to the introduction of the metasomatic-pneumatolytic minerals.

Cassiterite occurs as small, dark brown grains and subhedral crystals, ranging from 10 μ to 30 μ in size and embedded in quartz-topaz. A white- to cream-coloured opaque mineral resembling leucoxene is also widespread interstitially, and may well be ultrafine cassiterite. The relatively poor, fine-grained development of the cassiterite suggests low-energy conditions of formation.

H.W. Fander, M. Sc.

IDENTIFICATION

PA/T/TS 19

Sheared Metaquartzite
with Cassiterite

CENTRAL MINERALOGICAL SERVICES PTY. LTD.

Date 24th March, 1980

SAMPLE REPORT (Mineralogy, Petrology, Ore Microscopy)

Job No. CMS 80/3/4 Date Received: 6.3.1980

Reference PA/T/TS Trench 2

Sample No. PA/T/TS 20

Nature of Sample: Hand Specimen

DESCRIPTION SECTION No. 31071

a. Hand Specimen:

White, fine-grained, quartzose rock, with cavities after pyrite cubes.

b. Microscopic:

This is a fine-grained metaquartzite, quartz-veined and weakly mineralised.

Clastic textures are still recognisable, and the original rock was a fine-grained orthoquartzite with an average grainsize of 0.1 mm; it probably contained minor interstitial clays, which were converted to fine, poorly defined topaz. There are scattered, euhedral cavities after complex pyrite crystals, possibly syngenetic-diagenetic in origin.

The rock is cut by veins of columnar quartz, apparently formed by replacement of the existing rock; These veins contain patches of topaz and small, dark cassiterite crystals. These range in size from 5 μ to 150 μ , with clusters up to 250 μ . Crosscutting fractures (i.e. cutting the veins) are also present; topaz and cassiterite crystals occur along these fractures, and the cassiterite is very dark reddish-brown, 5 μ to 150 μ in size and of granular shape.

The mineralisation is very similar in style and mineral assemblage to that in PA/T/TS 19; the colour of the cassiterite is regarded as a good correlation factor.

H.W. Fander, M. Sc.

IDENTIFICATION

PA/T/Ts 20

Mineralised
Metaquartzite

Date 24th March, 1980

CENTRAL MINERALOGICAL SERVICES PTY. LTD.

SAMPLE REPORT (Mineralogy, Petrology, Ore Microscopy)

Job No. CMS 80/3/4 Date Received: 6.3.1980

Reference PA/T/TS Trench 2

Sample No. PA/T/TS 21

Nature of Sample: Hand Specimen

IDENTIFICATION,
PA/T/TS 21
Limonitised Quartzite

DESCRIPTION SECTION No. 31072

a. Hand Specimen:

Brown, fine-grained, quartzose and limonitic rock, friable in parts.

b. Microscopic:

This rock may be termed a limonitic quartzite for convenience; the limonite unfortunately obscures details of importance in interpretation; only minor traces of cassiterite were actually recognised, though there are white, leucoxene-like patches which may be cassiterite, as the assay would suggest. The presence of traces of introduced tourmaline throughout is consistent with the possibility of cassiterite being present.

The original rock was an even-grained orthoquartzite; clastic textures are still recognisable. It consisted dominantly of small, subrounded quartz grains, interstitial clays, and detrital heavy minerals. Small, pale green, prismatic tourmaline crystals have formed, replacing quartz. Films and patches of limonite are abundant, and there are scattered small (< 50 μ) whitish opaque patches with a leucoxene-like appearance; these actually consist of minute grains.

A heavy-liquid separation was carried out on material crushed to -36 mesh; the sink fraction consisted dominantly of limonite and limonite/quartz composites, with tourmaline, traces of cassiterite, detrital zircon, and iron-stained quartz. The polished section of this fraction revealed no gold; minor traces of fine pyrite were detected.

H.W. Fander, M. Sc.

Date 24th March, 198012A
CENTRAL MINERALOGICAL SERVICES PTY. LTD.

SAMPLE REPORT (Mineralogy, Petrology, Ore Microscopy)

Job No. CMS 80/3/4 Date Received: 6.3.1980Reference PA/T/TS Trench 2Sample No. PA/T/TS 22Nature of Sample: Hand SpecimenDESCRIPTION SECTION No. 31073

a. Hand Specimen:

Pale, friable, quartzose rock.

b. Microscopic:

This is a sheared, brecciated orthoquartzite which is very weakly metasomatised, containing traces of poorly defined topaz with associated minor traces of ultrafine ?cassiterite.

The rock consists of fairly poorly sized, subangular to subrounded quartz grains, showing crude sorting into coarser and finer layers, with interstitial clays which are mostly subtly altered to (i.e. replaced by) fine topaz. Detritally rounded heavy mineral grains are scattered through the rock.

Fine fracturing has occurred throughout along grain-boundaries; in addition, there are more pronounced fractures, with accompanying small-scale brecciation, filled with topaz. Fine needles of opaque rutile and occasional aggregates of ultrafine ?cassiterite are embedded in the topaz.

Portion of the rock was crushed to -36 mesh BSS, and a 50 g fraction was separated in TBE (SG = 2.95). The sink fraction consisted of topaz, detrital zircon, tourmaline, oxidised pyrite, and conspicuous rutile. A polished section was prepared of this fraction this showed widespread, minute (mostly < 2 μ) pyrite blebs in quartz, sometimes in large numbers. However, no gold was detected.

H.W. Fander, M. Sc.

IDENTIFICATION,
PA/T/TS 22
Brecciated Orthoquartzite

APPENDIX 7

DIAMOND DRILLING BY MINES DEPARTMENT

LOGS AND ANALYSES

DIAMOND DRILL LOGS AND ANALYSES

NOTES:

A. Bedding angles quoted are measured from the core axis

B. Abbreviations used:

(a) Grain sizes

<u>f</u>	very fine grained	grains not visible to naked eye.
f	fine grained	less than 1 mm
m	medium grained	1 - 10 mm
crs	coarse grained	1 - 2 cm
<u>crs</u>	very coarse grained	2 cm +

(b) Degrees of Chemical weathering:

- 127
- | | | |
|-------|------------------------------------|--|
| CW | Completely weathered | <ul style="list-style-type: none"> * Crumbles and disintegrates when gently shaken in water. |
| HW | Highly weathered | <ul style="list-style-type: none"> * All of fabric weathered. * Iron oxide staining permeates the fabric grain boundaries. * Weakened to the extent that pieces the size of 5 cm diameter core can be broken and crumbled by hand. * Gives a dull sound when struck with a hammer. * Does not disintegrate when soaked in water |
| MW | Moderately weathered | <ul style="list-style-type: none"> * Most of the fabric weathered. * Iron oxide staining permeates the fabric grain boundaries. * Pieces the size of 5 cm diameter core cannot be easily broken by hand. * Does not ring when struck with a hammer. |
| SW | Slightly weathered | <ul style="list-style-type: none"> * Some of the fabric weathered (Much feldspar weathered to clay/sericite). * Fine grained rocks may have a bleached appearance. * Iron oxide staining not usually throughout the fabric. * Strength approaches that of fresh rock. * Rings when struck with a hammer. |
| Frst. | Fresh with limonite stained joints | <ul style="list-style-type: none"> * Fabric not weathered. * No iron oxide staining in the fabric. * Joint faces are superficially coated or stained with limonite. (Possibly also stained with manganese oxides). |
| Fr | Fresh | <ul style="list-style-type: none"> * Fabric not weathered. * Joints not limonite stained (but may be coated with other mineral including chlorite, calcite, pyrite, quartz or clay.) |

No sulphide minerals such as pyrite are present in any rock which is more weathered than slightly weathered. In a slightly weathered rock most sulphides are usually converted to oxides, carbonates etc

DRILLING TARGET - Iron Formation intersected Mt. Lyell DDHI for possible sulphides -
 REMARKS - none intersected.

SURVEY DATA			ASSAY DATA										
DEPTH feet	Bearing mag.	Inclin. degs.	SAMPLE No.	FROM ft. m.	TO ft. m.	RECOVERY ft. m.	%	Pb%	Zn%	Cu%	Au	Ag	Sr%
			OH 1	26.45	28.00	0.88	57	0.41	0.06	0.03	Tr.	3	0.03
										W03.6			
										0.01			

GEOLOGICAL LOG Logged by:- A.J. FOLDART

FROM ft. m.	TO ft. m.	RECOVERY ft. m.	%	DESCRIPTION	SECTION Core	Sample
0.00	2.74	0.75	27	Rubble and weathered friable sandstone		
2.74	6.65	1.92	57	Quartzite - feldspar porphyry - very weathered		
6.65	8.00	1.05	77	Pale grey quartzite with quartzite veining		
8.00	11.74	2.55	68	Pale grey pebble quartzite for first 1m then approximately 1m alternating bands red and brown and dark grey pebbly quartzite.		
11.74	12.32	0.58	100	Mottled red-light grey quartzite		
12.32	18.96	5.23	79	Pale grey quartzite - mainly leached and friable in places strong/limonitic staining 15m - 16m and 18m - 18.5m in shear zone		
18.96	19.85	0.87	98	Dark brown mottled pebbly quartzite		
19.85	24.60	4.58	96	Dark grey pebbly quartzite contorted near fault at 21.35m, minor quartz veining and faulting common		
24.60	26.45	0.35	10	Very leach and friable pale grey quartzite		
26.45	28.00	0.88	57	0.13m iron stained clay then 0.75m ironstone "gossan" with remnant small blocks of sandstone		
28.00	29.55	0.50	32	Pale grey - whitish clay		
29.55	30.20	0.17	26	Shattered and fragmented quartz and quartzite		

Continued over -

DEPARTMENT OF MINES - TASMANIA
 DIAMOND DRILL CORE RECORD

HOLE No. - OH 1	MAP SHEET No. 45	DISTRICT OLIVER HILL	LOCATION OF SITE -
30.5m north east from Mt. Lyell DDH No.1			
RL. OF SITE - 784.3 m	SITE SURVEY ON MAP No. - 3270	CORE SIZE - B.Q.	
BEARING OF HOLE - 234°	AIR PHOTO No. -	COMMENCED - 19-12-74	
INCLINATION OF HOLE - 50°	DRILL - F 20C	COMPLETED - 21-2-75	
CO-ORDS. OF SITE -	DRILLER - W. TUXWORTH	FINAL DEPTH - 77.10m	

DDH OH 1				GEOLOGICAL LOG		Page:— 2	
FROM	TO	RECOVERY		DESCRIPTION	SECTION		
		m	%		Core	Sample	
30.20	31.20	0.90	90	Oxidised and limonitic friable and broken sandstone			
31.20	33.78	2.23	87	Strongly leached partly oxidised quartzite broken and shattered in part			
33.78	35.80	1.95	97	Medium grey quartzite - some worm casts and brecciation - part oxidised last 0.8m			
35.80	46.87	10.92	98	Dark grey quartzite brecciated and contorted in part in oxidised zone 41.5m to 41.9m - oxidised pinkish zone 43.85m to 44.50m fault zones 39.30 and 42.30m.			
46.87	49.20	2.13	91	Medium grey quartzite part leached and oxidised			
49.20	55.00	4.34	75	Dark grey quartzite leached and part oxidised and strongly contorted and limonite banding after 52.00m			
55.00	58.10	3.04	98	Dark grey quartzite contorted at end.			
58.10	59.30	1.05	87	Very contorted dark grey quartzite			
59.20	61.45	2.10	93	Dark grey quartzite brecciated throughout			
61.45	61.58	0.13	100	Irregular wedge shaped contact			
61.58	63.68	1.23	63	Weathered and leached quartzite felspar porphyry contact 550 to long axis			
63.68	77.10	13.42	100	Dark grey quartzite - brecciator in part with worm casts.			
END OF HOLE.							

Further notes by P.W. Askins: OH 1

- up to 60.55 "Contorted" is actually sedimentary slumping and bioturbation. There are sandy worm burrows in dark muddy material.
- 60.55 - 61.45 Dark green fine grained altered sandstone with fine grained disseminated pyrite.
- 63.68 - 69.14 Relatively unaltered; minor drusy quartz veinlets.
- 69.14 - 70.00 Similar to 60.55 - 61.45. Specks of sphalerite and leached sphalerite. Trace galena in veinlets.
- 70.00 - 76.00 Only traces of sulphides (visible), - as very fine variably weathered along joints.
- 76.00 - 77.10 Some alteration with a little dark sulphides along fractures.

DRILLING TARGET:— To Test mineralization below western "gossan"													
REMARKS:— Two gossan zones intersected													
SURVEY DATA						ASSAY DATA							
DEPTH feet	Bearing mag.	Inclin. degs.	SAMPLE No.	FROM ft. to ft.	TO ft. to ft.	RECOVERY for assay		Pb%	Zn%	Cu%	Au	Ag	Sn%
			OH2	9.80	10.90	0.85	77	3.6	0.20	0.02	Tr	68	<0.03
			OH3	10.90	12.00	0.55	50	7.2	0.45	0.04	"	72	"
			OH4	12.00	13.40	1.15	82	4.5	0.33	0.03	"	55	"
			OH5	13.40	14.88	1.40	97	5.4	0.40	0.03	"	101	"
			OH6	14.88	16.04	1.16	100	5.1	0.27	0.03	"	93	"
			OH7	16.04	17.60	1.54	99	6.6	0.25	0.03	"	150	"
			OH8	17.60	21.75	1.25	31	3.9	0.17	0.02	"	22	"
								WO ₃ all <0.01					

GEOLOGICAL LOG

Logged by:— A.J. Holdart

FROM ft. to ft.	TO ft. to ft.	RECOVERY for assay	%	DESCRIPTION	SECTION Core Sample
0.00	2.20	0.88	40	Some quartz feldspar porphyry rubble (c. 2m) and rest leached sandstone.	
2.20	4.50	1.17	51	Dark ironstone with remnant sandstone poie.	
4.50	6.00	1.40	93	Very weathered sandstone with iron stone development along joint planes.	
6.00	9.80	2.95	77	Very weathered and kaolinised sandstone - some iron development, along joints last 0.5m.	
9.80	10.90	0.85	77	Strong development of manganese iron stone with remnant sandstone poie.	
10.90	13.40	1.70	68	Massive manganese dark red brown-black iron formation.	
13.40	17.66	3.81	89	Vuggy mottled tan-black iron formation.	
17.66	21.65	1.25	32	As above-friable with silica grains.	
21.65	27.20	3.43	62	Limonitic sandy sediments.	
27.20	30.58	0.55	16	Clay.	
30.58	35.12	0.60	13	Limonitic ironstone.	
35.12	36.64	0.30	20	Kaolinised sediments.	
Continued over:—					

DEPARTMENT OF MINES — TASMANIA
DIAMOND DRILL CORE RECORD*

HOLE No.— OH2	MAP SHEET No. 45	DISTRICT Oliver Hill	LOCATION OF SITE:—
On baseline 222 metres N.W. from Mt. Lyell DDH No.2.			
R.S. OF SITE:— 784.4m	SITE SURVEY ON MAP No.— 3270	CORE SIZE:— 3.0.	
BEARING OF HOLE:— 210°	AIR PHOTO No.—	COMMENCED:— 10/3/75	
INCLINATION OF HOLE:— 50°	DRILL:— F20C	COMPLETED:— 2/4/75	
CO-ORDS. OF SITE:—	DRILLER:— W. Tuxworth	FINAL DEPTH:— 55.00	

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OH2		GEOLOGICAL LOG				Page: 2
FROM	TO	RECOVERY		DESCRIPTION	SECTION	
		gms	%		Core	Sample
36.64	40.62	2.56	67	Limonitic ironstone at first grading to brown black iron formation very vuggy in part.		
40.62	41.60	0.40	41	Brown limonitic ironstone very leached toward end.		
41.60	45.24	2.94	78	Pinkish quartzite part leached 44m - 44.5m.		
45.24	49.62	3.43	78	Pale grey quartzite leached in places 46m and 48m.		
49.62	52.46	1.35	48	Limonitic sandstone very leached 51.70m to 52m.		
52.46	55.80	3.34	100	Dark grey quartzite leach in part last 1m with worn casts.		
END OF HOLE						
Continued over						

ASSAY DATA

SAMPLE No.	FROM	TO	RECOVERY		ASSAY RESULTS						
			gms	%	Pb	Zn	Cu	Au	Ag	Sn	MoS
OH9	36.64	38.18	0.90	59	2.0	0.23	0.23	Tr	10	0.03	0.01
OH10	38.18	39.45	0.73	56	4.1	0.13	0.02	"	39	"	"
OH11	39.45	40.62	1.06	91	3.0	0.18	0.02	"	34	"	"
OH12	40.62	41.60	0.40	41	0.41	0.11	0.01	"	7	"	"

DRILLING TARGET— To test at depth mineralisation in DDH 02													
REMARKS— One gossan zone intersected													
SURVEY DATA				ASSAY DATA									
DEPTH feet	Bearing mag.	Inclin. degs.	SAMPLE No.	FROM ft. III	TO ft. III	RECOVERY		Pb%	Zn%	Cu%	Au	Ag	Sn%
			OH13	6.35	8.60	1.00	44	1.3	0.22	0.02	Tr	70	<0.03
			OH14	8.60	9.30	0.50	72	5.3	0.25	0.03	"	69	"
			OH15	9.30	10.90	1.45	90	6.4	0.31	0.03	"	72	"
			OH16	10.90	12.08	1.10	93	7.6	0.16	0.05	"	140	"
			OH17	12.08	13.68	1.50	93	6.5	0.30	0.04	"	54	"
			OH18	13.68	15.25	1.30	83	3.1	0.25	0.02	"	11	"
			OH19	15.25	16.94	1.45	81	2.6	0.31	0.01	"	27	"
								Mo ₃ all <0.01					

GEOLOGICAL LOG				Logged by— A.J. Noldart									
FROM ft. III	TO ft. III	RECOVERY		DESCRIPTION	SECTION								
ft. III	ft. III	ft. III	%		Core	Sample							
0.0	2.05	0.95	47	Quartz feldspar porphyry									
2.05	3.65	1.15	64	Very weathered sandstone									
3.65	5.45	1.05	66	Weathered sandstone partly altered to limonitic sandstone with some iron development from joints									
5.45	6.35	0.65	72	Weathered sandstone									
6.35	8.60	1.00	44	Strong development of limonitic iron with remnant sandstone cores									
8.60	14.08	4.85	88	Brown-black manganese iron formation									
14.08	15.25	1.00	85	Patchy development of black iron formation in limonitic sandstone									
15.25	16.94	1.45	81	Strong development limonitic ironstone with remnant sandstone pods									
16.94	18.20	1.00	74	Limonitic ironstone with up to 50% remnant sandstone pods									
18.20	20.00	0.05	3	Limonite-sandstone rubble									
20.00	21.65	0.25	15	Pink sandstone with some limonitic iron									
21.65	23.20	0.25	16	Limonitic sandstone with some limonitic iron - heavily sheared									
Continued over—													

DEPARTMENT OF MINES — TASMANIA
DIAMOND DRILL CORE RECORD

HOLE No.— OH 3	MAP SHEET No. 45	DISTRICT <u>Olivers Hill</u>	LOCATION OF SITE—
On baseline 222 metres N.W. from Mt. Lyell DDH No.2			
R.L. OF SITE— 784.4m	SITE SURVEY ON MAP No.— 3270	CORE SIZE— B.R.	
BEARING OF HOLE— 270° 210°	AIR PHOTO No.—	COMMENCED— 10/4/75	
INCLINATION OF HOLE— 65°	DRILL— F20C	COMPLETED— 16/5/75	
CO-ORDS. OF SITE—	DRILLER— J. Foxworth	FINAL DEPTH— 16.94m	

COMALCO LIMITED
DRILL HOLE LOG

5 cm

TAS-78-118

HOLE NO: OH 4
(MINES DEPT)
PROJECT: DEVONIAN

LOCATION: OLIVERS HILL
DEVONIAN/CLD CO-ORD
220M/SOW
ORIENTATION: VERTICAL

CORE SIZE:
0-24.30 N
24.30-69.33 B

Photographed:
yes

DATE DRILLED: 1975
LOGGED BY: P. ASKINS
SCALE: 1:250

FROM	TO metres	GRAPHIC LOG	ROCK NAME	ORIGINAL ROCK (if different to rock name)	RECOVERY (not measured)	WEATHERING	COLOUR	GRAIN SIZE	FABRIC TEXTURE COMPOSITION	MINERALIZATION (Sulphides cassiterite etc)	SCHEELITE by UV lamp	reaction to dilute HCl	BEDDING	FRACTURES BRECCIATION VEINING ETC	REMARKS
7.00		SANDSTONE		GOOD	MW	off white iron stained	m	mostly massive locally bedded	all now secondary limonite + Mn rich limonite as patches veinlets and staining (after pyrite)			5mm 80-90° at 6.50		
11.80		Fe. Fe. Fe. Fe.	GOSSAN	Py + gn rich sandstone	GOOD		black	f	Mn rich, massive. Exotic textures strolactitic growths in VUGGY places. Scattered grains white quartz ~ 1mm thru out.						
17.00		Fe. Fe. Fe.	GOSSAN SANDSTONE	pyritic Sandstone	FAIR	MW	black to orange	f- m	mixed iron stained sandstone and more massive gossan. Gossan sections seem to be beds						layering 70-80° in places
19.50		Fe. Fe.	SANDSTONE SILTSTONE		POOR	HW CW	orange f-m	f-m	Very broken sandstone + iron stained clay + silty material, variable black gossan bedded black gossan bedded						
21.35		Fe. Fe.	GOSSAN + SANDSTONE			HW	orange f-m	f-m	black gossan + some exotic textures, pachy sandstone beds thru out - dollo but orange limonite instead of black						
22.00		Fe.	SANDSTONE			MW	orange m	m	black gossan + some exotic textures, pachy sandstone beds thru out - dollo but orange limonite instead of black						
24.30		Fe.	GOSSAN + SANDSTONE		GOOD	MW	orange m	m	Similar to 19.50-22.00 but black gossan has scattered Pb, Zn, Ag (see note on page 2)						
28.95		SANDSTONE			SW	orange m	m	leached distinctly bedded						
		SANDSTONE			SW	orange m	m	not leached, more massive						

HOLE No. OH 4
 PROJECT ANALYSES OF SPLIT CORE, ppm
 x indicates below limit of detection
 DATE

ANALYTICAL LAB		AMDEL															
ANALYTICAL METHOD		XRF CODE BI		S-Q'IVE SPECT'IC CODE A2	SEMI-QUANT'IVE SPECTROGRAPHIC CODE A1		S-Q'IVE SPECT'IC CODE A2	AAS CODE C1 PL > 5000 ppm CODE FI		SEMI-QUANT'IVE SPECTROGRAPHIC CODE A2		AAS CODE C3	SEMI-QUANT'IVE SPECTROGRAPHIC CODE A1		SEMI-QUANTITATIVE SPECTROGRAPHIC CODE A2		
DETECTION LIMIT		4	10	1	3	1	1	5	2	3	0.1	0.05	10	5	50	30	1
FROM	TO	Sn	W	Bi	Mo	Be	Cu	Pb	Zn	Cd	Ag	Au	Mn	Co	As	Sb	Ge
7.00																	
8.85	1.85	70	25	3	x	2	200	5.4%	1800	x	50	0.30	>10000	70	2000	x	x
10.35	1.50	60	15	x	x	1	100	7.0%	6000	100	100	x	>10000	80	5000	30	x
11.80	1.45	60	20	x	x	1	150	5.5%	1300	x	30	0.10	>10000	40	1000	30	x
12.80	1.00	55	20	x	x	x	100	2.8%	1300	x	30	0.10	>10000	20	400	x	x
14.00	1.20	x	30	x	x	x	40	1.4%	6000	x	30	x	>10000	60	500	x	3
17.00	3.00	x	x	x	x	1	100	1.4%	6000	x	30	x	>10000	50	400	x	1
19.50	2.50	8	10	x	x	x	40	5500	760	x	5	x	10000	x	400	x	x
21.35	1.85	50	30	x	x	x	10	3.8%	7000	x	20	x	10000	40	400	x	1
22.00	0.65	100	40	x	x	2	150	2.1%	1200	x	25	x	>10000	30	1500	50	2
22.80	0.80	10	30	x	x	1	150	3800	520	x	8	x	10000	10	500	x	x
24.30	1.50	42	20	x	x	2	100	1.4%	1800	x	7	x	>10000	15	700	x	x
25.60	1.30	x	x	x	x	1	50	870	310	x	1	x	1000	x	300	x	x
26.95	1.35	x	x	x	x	2	70	900	140	x	8	x	700	x	100	x	x

Page 1 of 2

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	lt	Sn	W	Bi	Mo	B ₂	Cu	Pb	Zn	Cd	Ag	Au	Mn	Co	As	SG	Gr	
2																		
	34.15																	
5	35.15	1.00	X	15	X	X	20	490	38	X	5	X	200	X	X	X	1	
	36.60	1.45	4	10	X	X	1	50	1850	250	X	7	X	500	X	X	X	
	38.60	2.00	X	X	X	X	3	70	1600	880	X	8	X	500	X	300	X	X
0	40.00	1.40	X	10	X	X	2	70	5200	50	X	10	0.05	300	X	400	X	X
5	45.94																	
	47.50	1.56	X	X	X	X	4	70	2200	210	X	10	X	300	30	X	X	X
5	54.66																	
	56.00	1.34	X	X	X	X	3	70	2300	75	X	15	X	500	20	300	X	X
0	59.45																	
	60.45	1.00	X	X	X	X	X	70	310	20	X	4	X	200	15	X	X	1
5	65.40																	
	66.40	1.00	X	X	X	X	1	150	700	75	X	20	X	300	70	150	50	1
0																		
5																		

HOLE No. OH 4		COMALCO																
PROJECT		ANALYSES OF SPLIT CORE, ppm													DATE			
		x indicates below limit of detection																
ANALYTICAL LAB		AMDEL																
ANALYTICAL METHOD		SEMI-QUANTITATIVE SPECTROGRAPHIC CODE A1							S-Q'IVE SPECT'IC CODE A2		SEMI-QUANT'IVE SPECTROGRAPHIC CODE A1		SEMI-QUANTITATIVE SPECTROGRAPHIC CODE A1					
DETECTION LIMIT		1	100	100	5	20	10	50	10	10	3	100	10	300	50	20	1	
FROM	TO	INTERV.	Ga	Ta	Ti	Ni	Cr	V	Sr	Zr	In	Sc	Th	Y	Ce	La	Nb	Yb
7.00																		
8.85	1.85		x	x	300	x	50	30	x	70	x	5	x	40	x	x	x	3
10.35	1.50		1	x	200	x	50	20	x	70	x	x	x	30	x	x	x	1
11.80	1.45		x	x	500	x	50	40	x	300	x	3	x	40	x	x	x	1
12.80	1.00		x	x	1500	30	400	70	x	300	x	4	x	40	x	x	x	1
14.00	1.20		x	x	1500	20	300	80	x	300	x	4	x	x	x	x	x	x
17.00	3.00		x	x	500	30	150	50	x	200	x	5	x	20	x	x	x	2
19.50	2.50		4	x	2000	20	250	70	x	300	x	3	x	20	x	x	x	1
21.35	1.85		x	x	600	30	200	50	x	200	x	x	x	x	x	x	x	x
22.00	0.65		x	x	800	30	200	80	x	300	x	5	x	40	x	x	x	3
22.80	0.80		x	x	2000	30	300	80	x	300	x	4	x	20	x	x	x	2
24.30	1.50		x	x	600	30	150	50	x	200	x	5	x	30	x	x	x	3
25.60	1.30		x	x	500	10	150	40	x	200	x	3	x	20	x		x	2
26.95	1.35		x	x	1500	30	200	60	x	200	x	4	x	20	x	x	x	2

	Int	Ga	Ta	Ti	Ni	Cr	V	Sr	Zr	In	Sc	Th	Y	Ce	La	Nb	Yb
34.15																	
35.15	1.00	2	X	3000	30	600	80	X	300	X	4	X	30	X	X	X	3
36.60	1.45	X	X	1500	40	300	70	X	150	X	3	X	30	X	X	X	2
38.60	2.00	X	X	600	50	200	70	X	200	X	4	X	20	X	X	X	1
40.00	1.40	3	X	3000	30	700	80	X	250	X	4	X	40	X	X	X	5
45.94																	
47.50	1.56	4	X	5000	40	300	100	X	250	X	7	X	70	X	X	X	15
54.66																	
56.00	1.34	2	X	4000	40	500	80	X	200	X	5	X	40	X	X	X	7
59.45																	
60.45	1.00	X	X	800	30	200	70	X	300	X	3	X	20	X	X	X	4
65.40																	
66.40	1.00	2	X	2000	100	300	80	X	200	X	3	X	20	X	X	X	3

COMALCO LIMITED
DRILL HOLE LOG

5 cm

TAS-78-118

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Page 1 of 1

HOLE No: OHS (MINES DEPT) PROJECT: DEVONIAN		LOCATION: OLIVERS HILL COMALCO DEVONIAN GRID CO-ORD: 0853/010W		CORE SIZE: 0-1.52 H 1.52-30.04 N		photographed: Yes		DATE DRILLED: 1975 LOGGED BY: P. ASKINS SCALE: 1:250								
FROM	TO	GRAPHIC LOG	ROCK NAME	ORIGINAL ROCK (if different to rock name)	RECOVERY	WEATHERING	COLOUR	GRAIN SIZE	FABRIC TEXTURE COMPOSITION	MINERALIZATION (Sulphides cassiterite etc)	SCHHEELITE by UV lamp	reaction to dilute HCl	BEDDING	FRACTURES BRECCIATION VEINING ETC	REMARKS	
0		Fe	GOSSANY SANDSTONE		GOOD FAIR	HW	black to orange	f-m	mixed ferruginous sandstone and massive orange-red limonite or patchy black goethite? - MnO ₂ rich gossan		NOT TESTED	NOT TESTED				
5	462	Fe	CLAYSTONE		POOR	HW CW	orange	f	almost all pale clay, variably ferruginous					orig. bedding disoriented by drilling, or brecciated.		
10	1374	A	SANDSTONE		POOR	HW CW			broken clayey ferruginous sandstone							
15	1830	A	SANDSTONE		GOOD	MW HW			leached, distinctly bedded. Some MnO ₂ staining on joints.					20° 1930 55° 22.00		
20																
25																
30																

5
10
15
20
25
30

092141

3000 END OF HOLE

HOLE No.		COMALCO														DATE	
PROJECT		ANALYSES OF SPLIT CORE, ppm															
		x indicates below limit of detection															
ANALYTICAL LAB		AMDEL															
ANALYTICAL METHOD		XRF CODE B1		S-Q'IVE SPECT'IC CODE A2	SEMI-QUANT'IVE SPECTROGRAPHIC CODE A1		S-Q'IVE SPECT'IC CODE A2	AAS CODE C1 Pb > 5000 ppm CODE F1		SEMI-QUANT'IVE SPECTROGRAPHIC CODE A2		AAS CODE C3	SEMI-QUANT'IVE SPECTROGRAPHIC CODE A1		SEMI-QUANTITATIVE SPECTROGRAPHIC CODE A2		
DETECTION LIMIT		4	10	1	3	1	1	5	2	3	0.1	0.05	10	5	50	30	1
FROM	TO	Sn	W	Bi	Mo	Ba	Cu	Pb	Zn	Cd	Ag	Au	Mn	Co	As	Sb	Ge
0.00	1.52	28	x	x	x	x	50	1.2%	900	x	4	x	3000	30	150	30	x
3.10	1.58	44	x	x	x	1	100	1.4%	690	x	6	x	10000	10	400	30	x
4.62	1.52	10	15	x	x	2	100	8000	900	x	1	x	1500	x	400	x	x
6.14	1.52	44	25	x	x	1	100	4500	1300	x	0.4	x	1000	15	200	x	x
7.66	1.52	24	25	x	x	2	70	3100	430	x	1	x	1000	20	x	30	x
21.34																	
22.86	1.52	x	x	x	x	1	30	3100	550	x	8	x	3000	10	x	x	x
25.90																	
27.42	1.52	x	x	x	x	x	70	1050	360	x	1	x	700	5	x	x	x

HOLE No. OH 5
 PROJECT ANALYSES OF SPLIT CORE, ppm
 x indicates below limit of detection
 DATE

ANALYTICAL LAB		AMDEL																	
ANALYTICAL METHOD		S-Q'IVE SPECT'IC CODE A2		SEMI-QUANTITATIVE SPECTROGRAPHIC CODE A1						S-Q'IVE SPECT'IC CODE A2		SEMI-QUANT'IVE SPECTROGRAPHIC CODE A1		SEMI-QUANTITATIVE SPECTROGRAPHIC CODE A1					
DETECTION LIMIT		1	100	100	5	20	10	50	10	10	3	100	10	300	50	20	1		
FROM	TO	Ca	Ta	Ti	Ni	Cr	V	Sr	Zr	In	Sc	Th	Y	Ce	La	Nb	Yb		
0-00	1-52	x	x	400	x	200	30	x	150	x	3	x	10	x	x	x	1		
3-10	1-58	x	x	100	x	80	10	x	50	x	4	x	30	x	x	x	5		
4-62	1-52	x	x	x	40	40	x	x	50	x	5	x	20	x	x	x	3		
6-14	1-52	1	x	800	x	200	50	x	200	x	7	x	20	x	x	x	1		
7-66	1-52	7	x	5000	30	400	250	x	300	x	10	x	30	x	x	x	4		
21-34																			
22-86	1-52	2	x	700	x	200	60	x	100	x	5	x	20	x	x	x	4		
25-90																			
27-42	1-52	x	x	1000	x	300	100	x	200	x	5	x	10	x	x	x	1		

COMALCO LIMITED
DRILL HOLE LOG

5 cm

TAS-78-118

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09/1/77

30

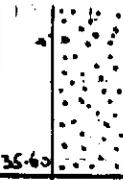
HOLE No: OH 6 (MINES DEPT.)		LOCATION: TIN SPUR COMALCO TIN SPUR GRID CO-ORD 1400S/460W AMG COORD 42899484 E, 540466606 N		CORE SIZE: NOT RECORDED		DATE DRILLED: 1975 LOGGED BY: P. ASKINS									
PROJECT: TIN SPUR		ORIENTATION: VERTICAL		photographed: NO		SCALE: 1:250									
FROM	TO	GRAPHIC LOG	ROCK NAME	ORIGINAL ROCK (if different to rock name)	RECOVERY	WEATHERING	COLOUR	GRAIN SIZE	FABRIC TEXTURE COMPOSITION	MINERALIZATION (Sulphides cassiterite etc)	SCHHEELITE by UV lamp	reaction to dilute HCl	BEDDING	FRACTURES BRECCIATION VEINING ETC	REMARKS
0		✓	BASALT		RECORDED	Fst. HW locally	blue	m.	massive						
5		✓													
10	12-22	✓													
15	16-44														
20	22-84	~	GOSSANY SOIL		NOT		orange		mixture of CW ss, soil, gossan, clay. Probably Tertiary soil horizon						
25	25-70	|||||	CLAYSTONE			CW		f.	Ironstained massive, micaceous- looking. ? CW Ordovician siltstone?						
30	28-28	.....	GOSSAN CLAY						Very irregular, texturally, mostly orange limonite. Looks like reweathered equivalent of black MnO ₂ rich gossan					

0
5
10
15
20
25
30

0
5
10
15
20
25
30

30
25
20

30
25
20



SANDSTONE

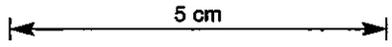
MW orange f-m

limonite rich
well bedded

not
tested

not
tested

50-60° 33 →
60-70° 34 →



HOLE No. **OH 6** **COMALCO**
 PROJECT **ANALYSES OF SPLIT CORE, ppm** DATE
x indicates below limit of detection

ANALYTICAL LAB		AMDEL															
ANALYTICAL METHOD		XRF		S-Q'IVE SPECT'IC	SEMI-QUANT'IVE SPECTROGRAPHIC		S-Q'IVE SPECT'IC	AAS CODE C1		SEMI-QUANT'IVE SPECTROGRAPHIC		AAS CODE C3	SEMI-QUANT'IVE SPECTROGRAPHIC		SEMI-QUANTITATIVE SPECTROGRAPHIC		
DETECTION LIMIT		CODE B1		CODE A2	CODE A1		CODE A2	PL > 5000 ppm	CODE F1	CODE A2			CODE A1	CODE A2			
FROM	TO	4	10	1	3	1		5	2	3	0.1	0.05	10	5	50	30	1
INTERV.		Sn	W	Bi	Mo	Ba	Cu	Pb	Zn	Cd	Ag	Au	Mn	Co	As	Sb	Ge
25.70																	
28.28	2.58	14	X	X	X	20	70	7500	9000	30	7	X	10000	50	3000	X	X
28.90																	

HOLE No. OH 6

COMALCO

PROJECT

ANALYSES OF SPLIT CORE, ppm

DATE

x indicates below limit of detection

ANALYTICAL LAB		AMDEL																
ANALYTICAL METHOD		SEMI-QUANTITATIVE SPECTROGRAPHIC CODE A1								S-Q'IVE SPECT'IC CODE A2		SEMI-QUANT'IVE SPECTROGRAPHIC CODE A1		SEMI-QUANTITATIVE SPECTROGRAPHIC CODE A1				
DETECTION LIMIT		1	100	100	5	20	10	50	10	10	3	100	10	300	50	20	1	
FROM	TO	INTERV.	Ca	Ta	Ti	Ni	Cr	V	Sr	Zr	In	Sc	Th	Y	Ce	La	Nb	Yb
25-70																		
28-28	2-58		x	x	1000	40	200	70	x	300	x	4	x	30	x	x	x	4
28-90																		

APPENDIX 8

DIAMOND DRILLING

BY

COMMONWEALTH ALUMINIUM CORPORATION LIMITED

LOGS AND ANALYSES

(See explanation beginning at start Appendix 7)

COMALCO LIMITED
DRILL HOLE LOG

5 cm

TAS-78-118

HOLE No: TSD 1

LOCATION:
COMALCO Co-ORDS
875 S/500W

CORE SIZE: 0-1.5H
1.5-61.80 NQ
61.80-218.20 BQ

DATE DRILLED: 1980
LOGGED BY: P. ASKINS
SCALE: 1:250

PROJECT: TIN SPUR

ORIENTATION: -70° towards 045°M
66° at 50m; 60° at 100; 58° at 150; 54° at 200m

photographed: yes

FROM	TO	GRAPHIC LOG	ROCK NAME	ORIGINAL ROCK (if different to rock name)	RECOVERY	WEATHERING	COLOUR	GRAIN SIZE	FABRIC TEXTURE COMPOSITION	MINERALIZATION (Sulphides cosiderite etc)	SCHHEELITE by UV lamp	reaction to dilute HCl	BEDDING	FRACTURES BRECCIATION VEINING ETC	REMARKS
0	7.00		SANDSTONE		74 75 80	SW-MW	off-white to iron stained orange	fm	Typical Moira sandstone Well bedded in places	limonite after pyrite on joints and disseminated	NIL		80° S-40° →		
7.00	9.00					Frst SW	blue				NIL			very cracked much py or limonite	
9.00	18.75					SW-MW			as at 0-7.00 but no obvious bedding.		NIL				
18.75	19.80		SILTSTONE		71 104 30	HW	blue	ff	Soft, clayey		NIL				
19.80	26.00		SANDSTONE			SW			as at 0-7.00		NIL		80° 22° →		
26.00			QUARTZITE SANDSTONE			Frst SW	off white, iron stained	m	hard, recrystallized		NIL		80° 28° →	very cracked with much lim. along fractures +/or bedding	

TESTED

NOT

5 cm

HOLE No. TSD 1

COMALCO

PROJECT

ANALYSES OF SPLIT CORE, ppm

DATE 1980

x indicates below limit of detection

ANALYTICAL LAB
ANALYTICAL METHOD
DETECTION LIMIT

COMLABS

XRF XRF AAS AAS

4 10 0.05 1

FROM # TO	INTERV. #	Sn	W	Au	Ag	Int. x Sn							
1.00													
2.00	1.00	22	<10	<0.05	<1								
3.00	1.00	65	<10	<0.05	<1								
4.00	1.00	50	<10	<0.05	<1								
5.00	1.00	70	10	<0.05	<1								
6.00	1.00	70	<10	<0.05	<1								
7.00	1.00	420	10	<0.05	<1								
8.00	1.00	6	15	<0.05	<1								
9.00	1.00	14	10	<0.05	<1								
10.00	1.00	22	10	<0.05	<1								
11.00	1.00	55	10	0.05	<1								
12.00	1.00	530	30	0.65	<1								
13.00	1.00	55	15	0.05	<1								
14.00	1.00	36	10	<0.05	<1								
15.00	1.00	110	<10	<0.05	<1								
17.1	2.10	10	10	<0.05	<1	21.00							
18.75	1.65	1000	15	0.25	3	1650.0							
19.8	1.05	1150	45	0.35	<1	1207.0							
20.5	0.70	330	10	<0.05	2	231.0							
21.75	1.25	1050	20	0.03	1	1312.50							
23.00	1.25	2350	100	0.02	4	2937.50							
24.00	1.00	155	25	0.25	1	155.0							
25.00	1.00	190	15	<0.05	<1	190.0							
26.00	1.00	2550	40	<0.05	<1	2550.0							
27.00	1.00	170	20	<0.05	<1	170.0							
28.00	1.00	290	30	<0.05	<1	290.0							
29.00	1.00	2250	25	<0.05	<1	2250.0							
30.00	1.00	820	25	<0.05	<1	820.0							

Weighted over
11.90m = 1090

COMALCO LIMITED
DRILL HOLE LOG

5 cm

TAS-78-118

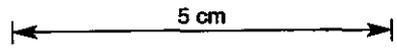
HOLE No: TSD 2		PROJECT: TIN SPUR		LOCATION: COMALCO TIN SPUR GRID CO-ORD 1100S/56S W			ORIENTATION: VERTICAL			CORE SIZE: 0-27.00 NQ 27.00-112.75 BQ			DATE DRILLED: 1980 LOGGED BY: P. ASKINS			SCALE: 1:250	
FROM	TO	GRAPHIC LOG	ROCK NAME	ORIGINAL ROCK (if different to rock name)	RECOVERY	WEATHERING	COLOUR	GRAIN SIZE	FABRIC TEXTURE COMPOSITION	MINERALIZATION (Sulphides cassiterite etc)	SCHHEELITE by UV lamp	reaction to dilute HCl	BEDDING	FRACTURES BRECCIATION VEINING ETC	REMARKS		
0			SANDSTONE		37 23	MW HW	off white	m			NIL			Some irreg quartz veinlets			
	3.70																
	4.30																
	5.20					SW	pl green	f-m	massive, poorly bedded	silty lim after dissem py.			55°				
5			TUBICULAR SANDSTONE			SW local Fr cores	pale orange to reddish	m	Typical tubicular sandstone with indistinct bedding	Originally f-m dissem py, now limonite.	NIL		70° 880°	Very minor quartz veins, some drusy.			
10																	
15	15.00				86	Frst local SW	blue gray			1800 especially below here bleached zones for 1cm either side of some joints.				3cm qtz & limonite at 90° 2000			
20													70° 2150°				
	22.00																
	23.70		QUARTZITE	SANDSTONE		Frst	white gray	m m	broken silty beds rotated by shearing?	± dissem py dissem py + f sl, gn	NIL NIL		0°-20°	qtz vns & py, sl, gn	SHEAR ZONE?		
	23.80	M															
25		M					gray to off white	m	original tubicular sandstone visible in places	Dissem py + f sl, gn throughout except where silicification is intense	NIL		70° 2505°	Some irreg qtz veins.			
	28.60	M			88												
30			SANDSTONE								NIL						

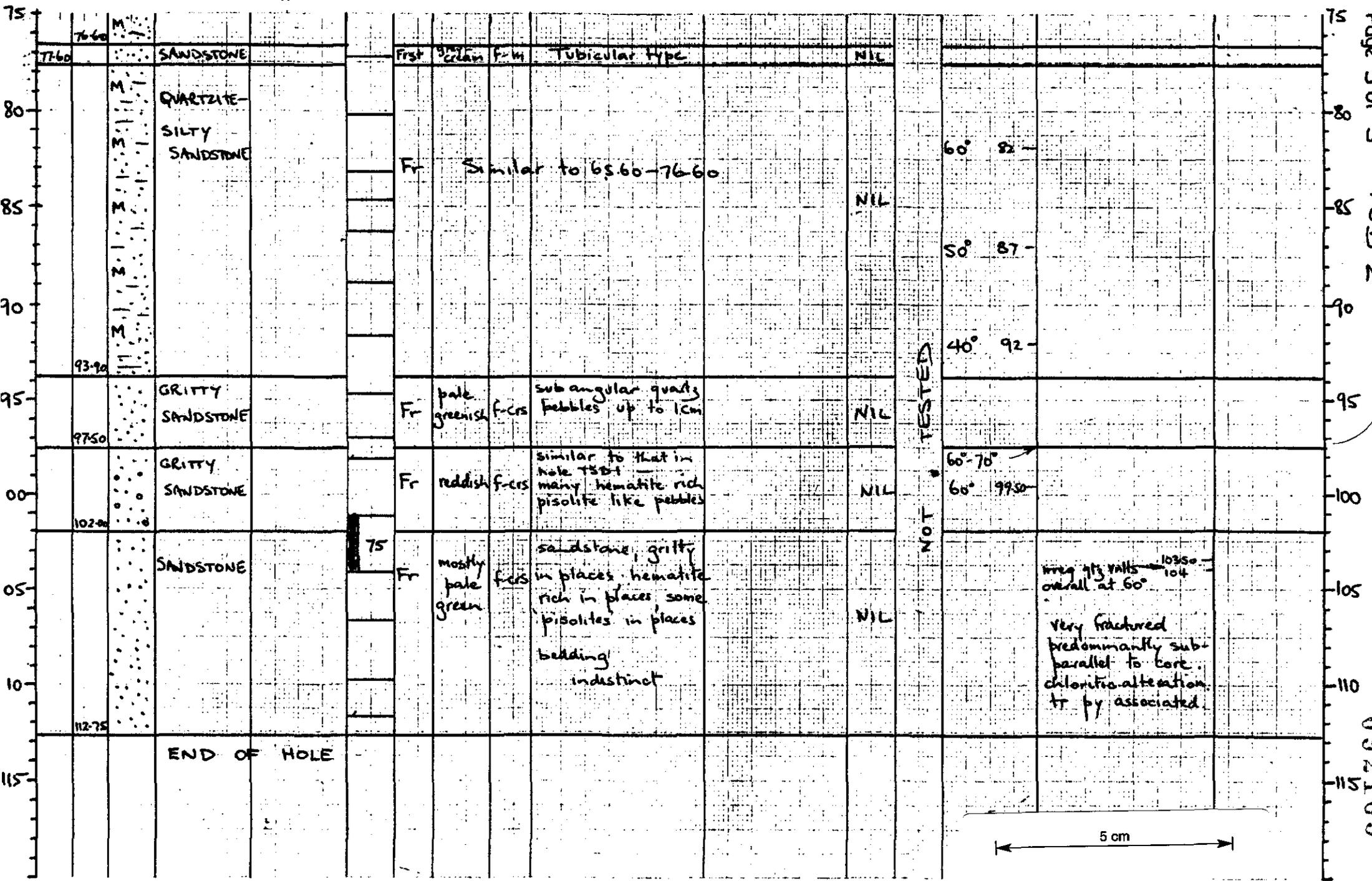
NOT TESTED

166
LOG - 118
C
032260
25
30

30	32.60	SANDSTONE		Frst	grey m	softer, bioturbated	much f-f dissem py	NIL		30
35	36.75	QUARTZITE CALC. S. SANDST.		Frst	grey-green m	Probably a diopside bearing quartzite; bleached along fractures	crs dissem sl at 34.7	NIL	80° 32.60	35
37.45		ALT SS		Frst	greys f-m	interbedded, altered	Dissem f-m gr sl	NIL	80°	Some minor vnlts
38.75		QUARTZITE, CS, RK calc. ss.		Frst	greys f-m		Dissem f-m gr sl py	NIL		ditto; chl rich frs at 20°
41.55		SANDSTONE		Fr, SW locally	greys f-m	interbedded ss, some dirty + porous friable ss which is greisen like under magnification	f dissem black specks; f py in pl sw porous ss	NIL	80°	
45		SANDSTONE-SILTSTONE		Frst	greys f-m	finely bedded, wispy looking bedding due to bioturbation	trace f dissem py	NIL	80°	
55	55.75	SANDSTONE		Frst	white m-crs	gritty beds; porous in places		NIL	50° steepens to 70°	fracture parallel to core
60	65.60	QUARTZITE-SILTY SANDSTONE		Frst	white-cream f-crs	recrystallized siliceous hard white quartzite interbedded with cream silty sandstone which has bioturbated bedding		NIL	80° 63-	
70		QUARTZITE-SILTY SANDSTONE				Similar to above but less quartzite and more silty sandstone		NIL	80°	

NOT TESTED





HOLE No TSD 2

COMALCO

PROJECT

ANALYSES OF SPLIT CORE, ppm

DATE

x indicates below limit of detection

ANALYTICAL LAB
ANALYTICAL METHOD
DETECTION LIMIT

FROM #	TO #	INTERV. #	Sn	Au	Ag	Cu	Pb	Zn	Bi	Cd	Zn No			
4.30														
5	5.00	0.70	8	0.1	<1	10	660	8	<10	<1				
	6.00	1.00	<4	0.05	<1	14	125	6	<10	<1				
	7.00	1.00	16	<0.05	<1	6	180	6	<10	<1				
	8.00	1.00	8	0.05	4	18	185	6	<10	<1				
	9.00	1.00	14	<0.05	1	14	390	6	<10	<1				
10	10.00	1.00	10	<0.05	<1	16	175	10	<10	<1				
	11.00	1.00	18	<0.05	<1	6	90	6	<10	<1				
	12.00	1.00	8	<0.05	<1	6	80	6	<10	<1				
	13.00	1.00	14	<0.05	<1	8	95	6	<10	<1				
15	14.00	1.00	75	<0.05	<1	6	125	8	<10	<1				
	15.00	1.00	6	<0.05	<1	14	470	20	<10	<1				
	16.00	1.00	24	<0.05	1	20	1150	185	<10	4				
	17.00	1.00	16	<0.05	5	46	750	105	<10	4				
	18.00	1.00	6	<0.05	2	34	550	80	<10	3				
	19.00	1.00	16	0.01	5	65	870	44	<10	3				
20	20.00	1.00	10	<0.05	3	26	360	44	<10	<1				
	21.00	1.00	20	<0.05	4	40	1250	46	<10	1				
	22.00	1.00	115	<0.05	16	130	6350	3500	<10	24				
	22.7	0.30	85	<0.05	10	85	4450	3400	<10	26				
	23.8	1.10	55	0.05	9	105	5300	5100	<10	34				
25	24.8	1.00	50	<0.05	4	70	1800	920	<10	6				
	25.8	1.00	22	<0.05	3	34	2200	840	<10	10				
	26.8	1.00	16	<0.05	<1	32	300	145	<10	2				
	27.8	1.00	20	<0.05	3	85	1200	65	<10	1				
	28.6	0.80	12	<0.05	<1	24	225	120	<10	1				
30	29.6	1.00	10	<0.05	2	22	2350	440	<10	3				

		Sn	Au	Ag	Cu	Pb	Zn	Bi	Cd.
75	75.6	1.00	<4	<0.05	<1	4	60		
	76.6	1.00	8	<0.05	<1	4	60		
80									
	84.75	8.15							
85	85.75	1.00	10	<0.05	<1	8	110		
	87.0	1.25	<4	<0.05	<1	<4	60		
	88.0	1.00	<4	<0.05	<1	<4	28		
	89.0	1.00	12	<0.05	<1	<4	32		
90									
	93.9	4.90							
95	95.0	1.10	6	<0.05	<1	4	14		
	96.1	1.10	10	<0.05	<1	<4	12		
	97.5	1.40	10	<0.05	<1	4	10		
	98.5	1.00	22	<0.05	<1	<4	20		
100	100.0	1.50	14	<0.05	<1	<4	10		
	101.0	1.00	<4	<0.05	<1	<4	22		
	102.0	1.00	24	<0.05	<1	<4	10		
	103.0	1.00	24	<0.05	<1	<4	10		
	104.0	1.00	55	<0.05	2	8	18		
105	105.0	1.00	115	5.0	4	20	55		
	106.0	1.00	75	<0.05	<1	4	30		
	107.0	1.00	50	<0.05	<1	4	12		
	108.0	1.00	55	<0.05	<1	4	12		
	109.0	1.00	44	<0.05	<1	4	14		
110	110.0	1.00	38	<0.05	1	12	28		
	111.0	1.00	46	<0.05	<1	8	18		
	112.0	1.00	18	0.05	<1	8	6		
	112.75	0.75	12	<0.05	<1	4	6		
115									
120									

COMALCO LIMITED
DRILL HOLE LOG

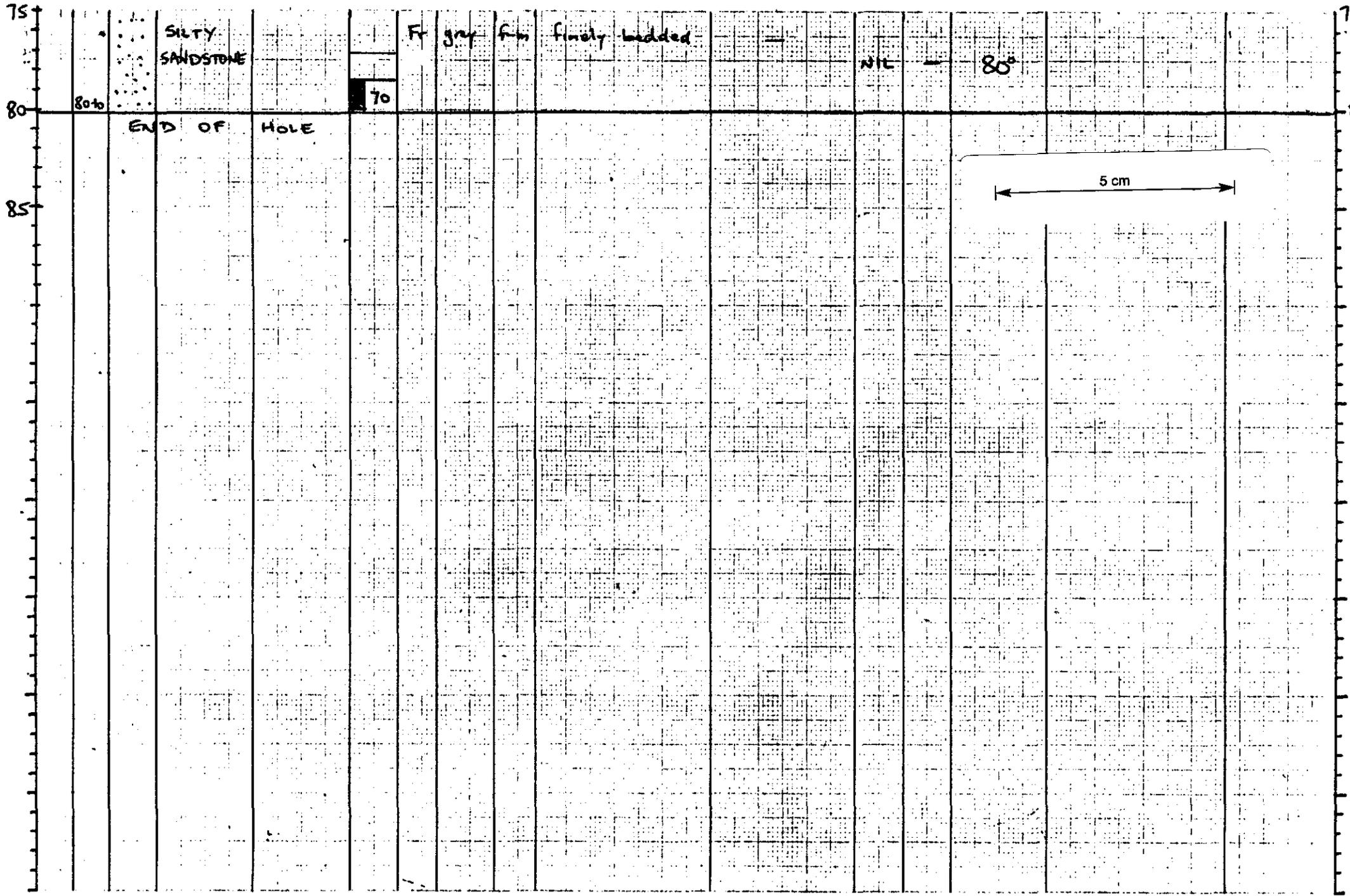
TAS-78-118



HOLE NO: TSD3
PROJECT: TIN SPUR
LOCATION: Comalco Tin Spur Grid Co-ords 1100S / SSSW
ORIENTATION: -60° towards 045°M
CORE SIZE: 0-34 NQ
34-80.10 BQ
DATE DRILLED: 1980
LOGGED BY: P. ASKINS
SCALE: 1:250

FROM	TO	GRAPHIC LOG	ROCK NAME	ORIGINAL ROCK (if different to rock name)	RECOVERY	WEATHERING	COLOUR	GRAIN SIZE	FABRIC TEXTURE COMPOSITION	MINERALIZATION (Sulphides cassiterite etc)	SCHEELITE by UV lamp	reaction to dilute HCl	BEDDING	FRACTURES BRECCIATION VEINING ETC	REMARKS
300			NO CORE												
	1250		TUBICULAR SANDSTONE		82	SW reddish	cream to	f-m	Typical tubicular sandstone.	Dissemin Py or limonite after pyrite thru out, and on joints	NIL		40° 9 -		
	1450					Fst	greys		11 Siltstone interbed				40° 1450 -		1950 - Very fractured, broken
	1950					SW-MIM	oranges		2350 Siltstone interbed				45°-50° 1750 -		
	2135														
	2450					Fst	greys								
	2620		SANDSTONE		90	SW	oranges	f-m	mostly fairly massive, tends to quartzite	fractoidal 2610 - ditto → 2810 -			?		Very fractured in most places
	2835					Fst	greys		Budding mostly indistinct						

NOT TESTED



HOLE No TSD 3

COMALCO

PROJECT

ANALYSES OF SPLIT CORE, ppm
x indicates below limit of detection

DATE

ANALYTICAL LAB
ANALYTICAL METHOD
DETECTION LIMIT

FROM TO	INTERV. m	Sn	Au	Ag	Pb	Zn							
5.00													
6.00	1.00	12	<0.05	<1	670	14							
7.00	1.00	<4	<0.05	<1	360	8							
8.00	1.00	12	<0.05	<1	320	8							
9.00	1.00	6	<0.05	<1	1050	8							
10.00	1.00	20	<0.05	<1	1050	12							
11.00	1.00	16	<0.05	<1	240	8							
12.00	1.00	6	<0.05	<1	300	8							
13.00	1.00	10	<0.05	<1	130	6							
14.00	1.00	20	<0.05	2	200	16							
15.00	1.00	12	<0.05	9	260	8							
16.00	1.00	38	<0.05	3	430	8							
17.00	1.00	55	0.05	4	280	8							
18.00	1.00	46	<0.05	13	730	12							
19.50	1.50	350	0.10	6	1100	30							
20.00	0.50	270	0.15	1	1200	30							
21.1	1.10	720	<0.05	<1	500	34							
22.0	0.90	70	0.10	5	210	8							
22.9	0.90	65	0.05	<1	100	12							
23.5	0.60	55	0.05	1	250	16							
24.5	1.00	110	0.10	1	290	20							
25.35	0.85	430	<0.05	3	44	10							
26.1	0.75	410	0.20	2	90	14							
27.3	1.20	65	0.15	3	95	8							
28.3	1.00	50	0.05	6	520	10							
29.1	0.80	280	0.20	5	170	18							
29.65	0.55	175	<0.05	1	80	28							

COMALCO LIMITED
DRILL HOLE LOG

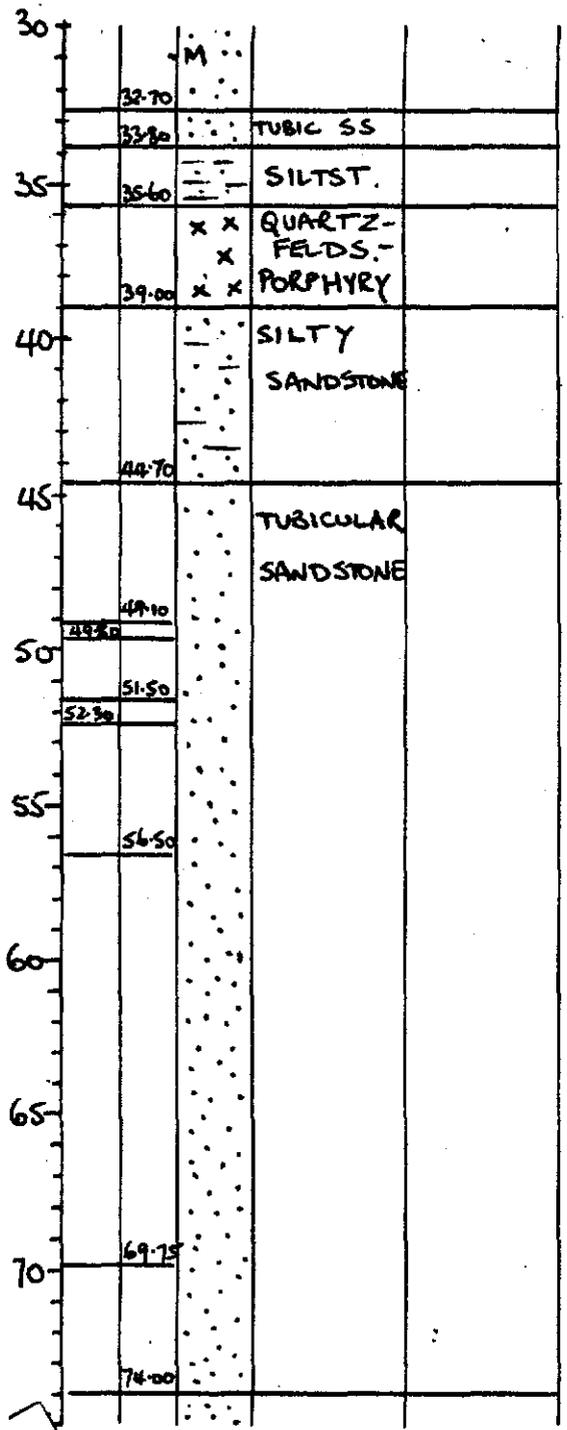
5 cm

TAS-78-118

HOLE No: DEV D 1	LOCATION: COMALCO DEVONIAN GRID CO-ORDS: 100N/27SW	CORE SIZE: 0-52 NQ 52-157-80 BQ	DATE DRILLED: APR 1980
PROJECT: DEVONIAN	ORIENTATION: -60° → 045°M 54° at 100m; 47° at 150m.	photographed: NO split: NO	LOGGED BY: P. ASKINS SCALE: 1:250

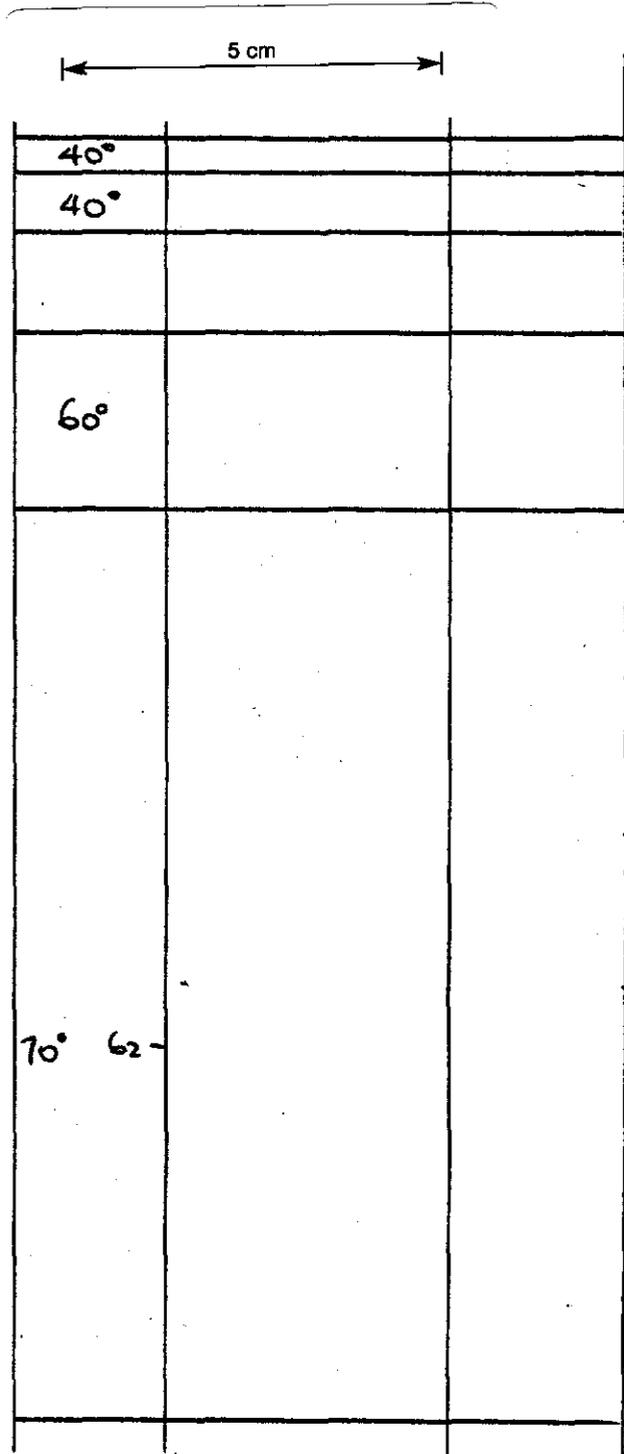
FROM	TO	GRAPHIC LOG	ROCK NAME	ORIGINAL ROCK (if different to rock name)	RECOVERY	WEATHERING	COLOUR	GRAIN SIZE	FABRIC TEXTURE COMPOSITION	MINERALIZATION (Sulphides cassiterite etc)	SCHHEELITE by UV lamp	reaction to dilute HCl	BEDDING	FRACTURES BRECCIATION VEINING ETC	REMARKS
0			SILTY SANDSTONE		MEASURED	SW	off white	fm	Fairly massive - has bleached appearance, altered? Some is tubicular on close inspection		NOT TESTED	NOT TESTED	60° 9.50		CORE NEEDS TO BE SPLIT AND ANALYSED ESPECIALLY IN ALTERED AND SILICIFIED PLACES, FOR Au, Sn, Ag, (Pb, Zn).
15									Minor unaltered? tubicular sandstone, reddish						
15	11.50-12.00														
15	15.60-15.90														
20	20.40				NOT MEASURED	MW					NOT TESTED	NOT TESTED	45° 18.50	Increasing minor quartz veinlets	
25			QUARTZITE SANDSTONE				Frst white	m	Silicified recrystallized				60° 28.00	Irregular quartz veinlets	

Page 1 of 4
 09:17:60



SW	red	f-m	Typical tubicular ss
Frst-SW	dk grey	f-f	fine dark carbonaceous? siltstone; sandy at top, bleached + altered below
SW	cream	f matrix	Uniform texture 10% phenocrysts. Felds mostly altered or weathered + leached out.
Frst	off white	f-f	? altered
Frst	gray		
SW			← altered, bleached
Frst	gray		←
SW			
Frst	gray		
SW	red		
Frst	gray		

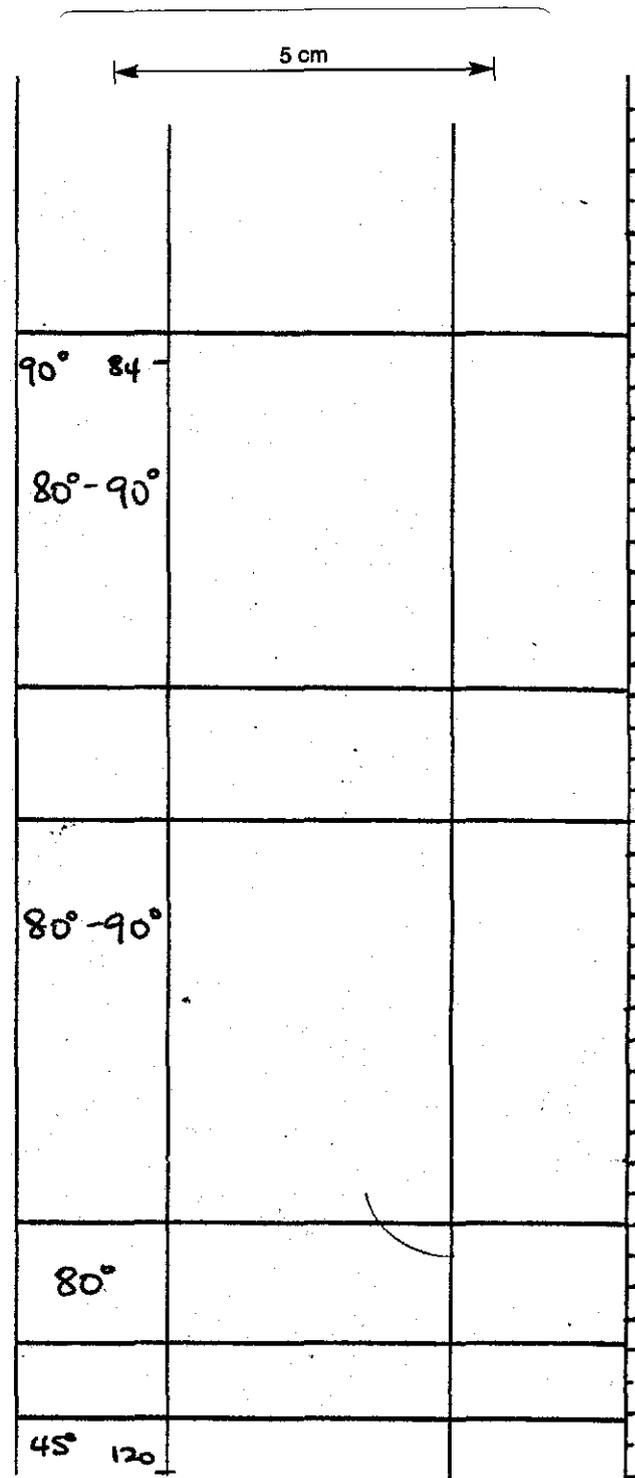
MEASURED
 NOT



NOT TESTED

NOT TESTED

75
80
85
90
95
100
105
110
115
120

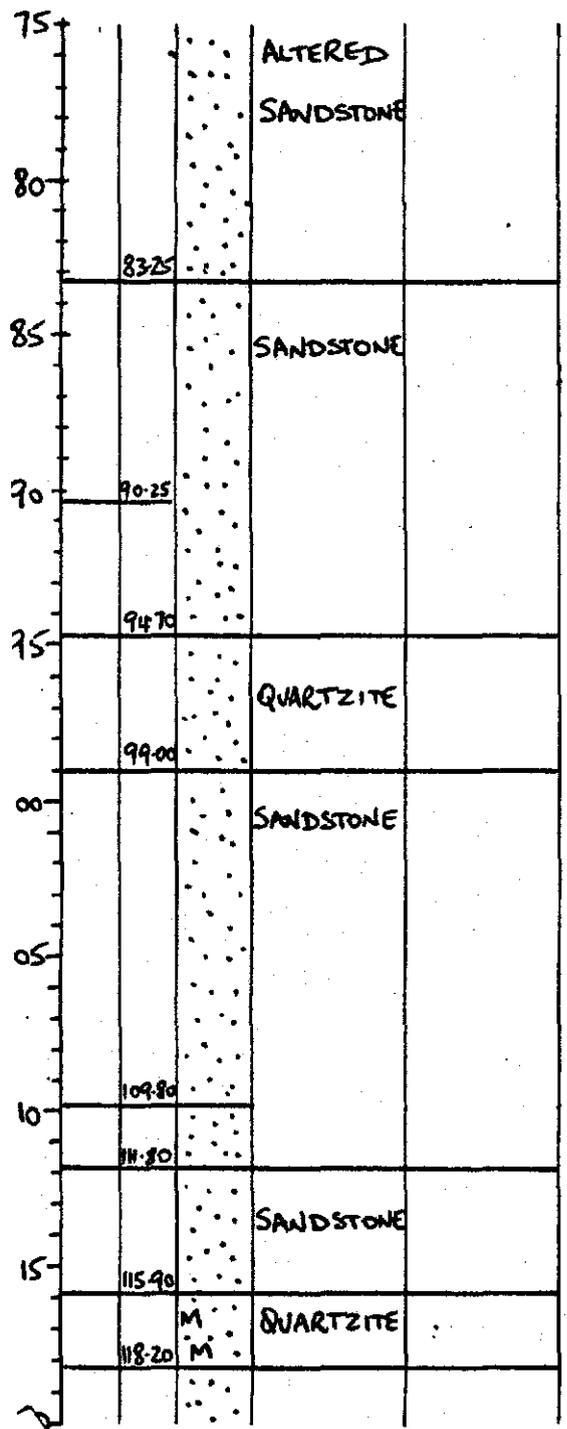


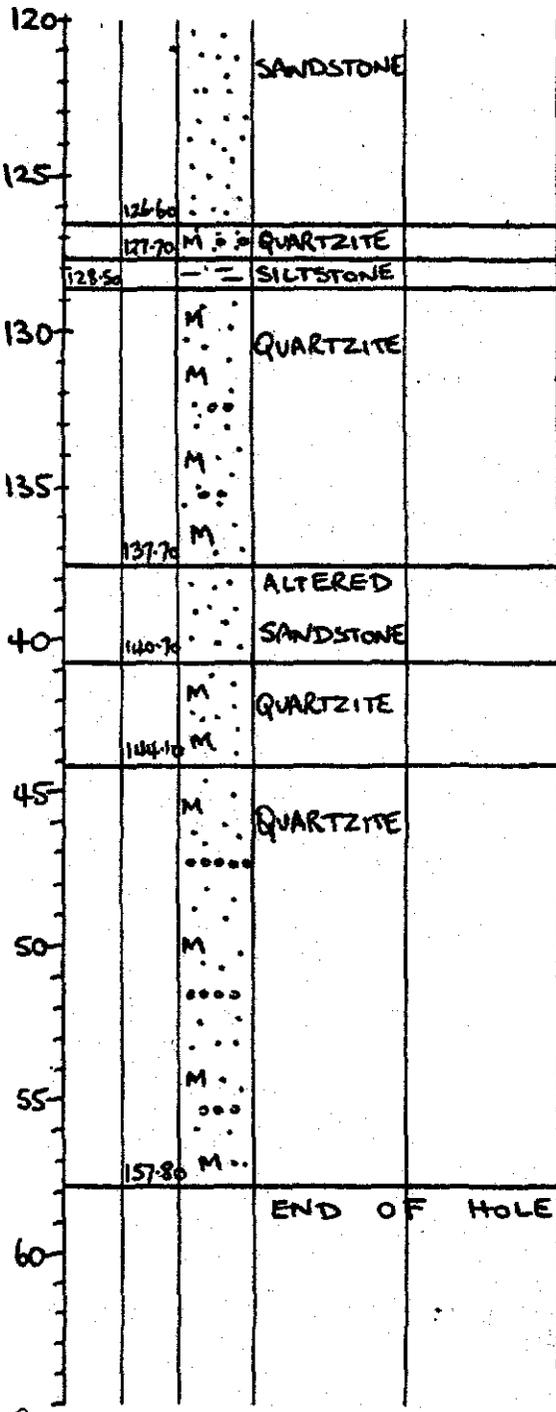
NOT TESTED

NOT TESTED

SW	orange	Altered, leached tubicular sandstone. Broken, soft, some porous	
MW			
Fr	grey	Finely bedded Not tubicular -90.25 Tendency towards hornfels	Much dissem py
Fr		Very silicified	
Fst		Finely bedded as at 83-25 - 90.25. But locally silicified	Dissem f-m py
SW			
Fst		Slightly tubicular	
Fst		Silicified sandstone as above. Minor grt bed SW	

NOT MEASURED



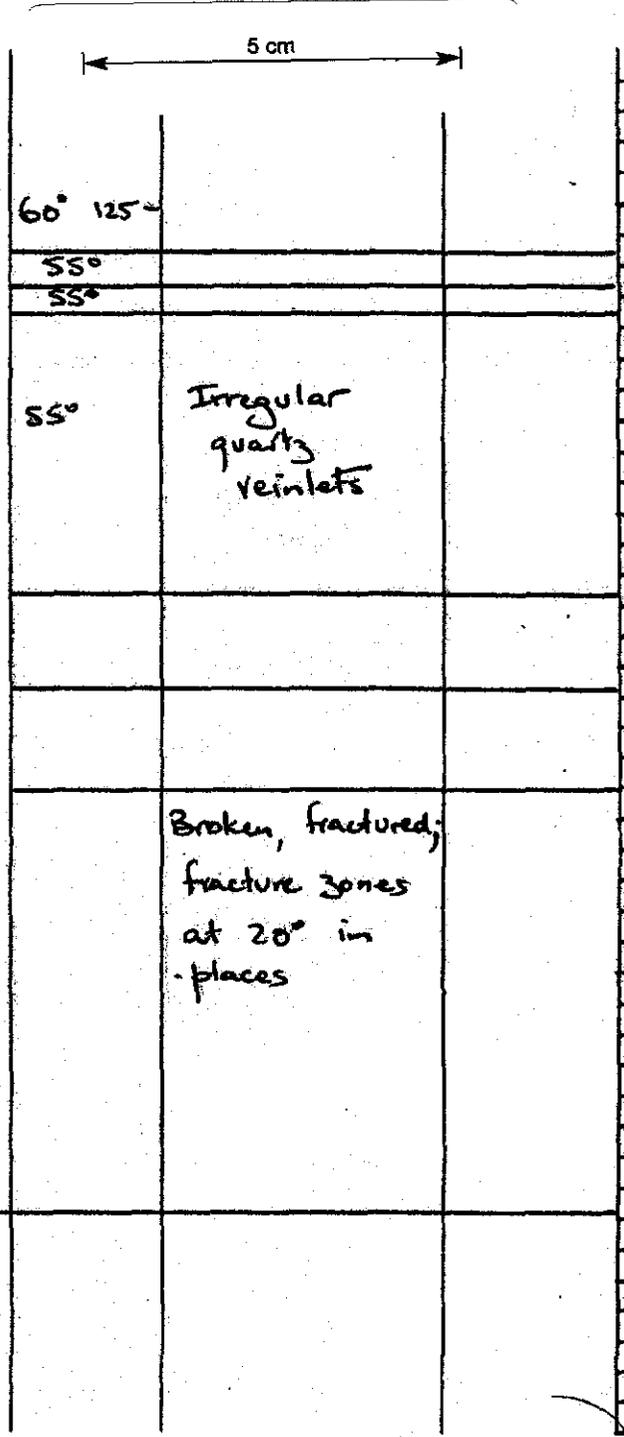


Frst		Silty sandstone, some tubicular, well bedded	
Frst		Bedded, pebbly, silicified	
Frst	off. white	Locally pebbly, silicified ss.	Hematite 131.80 rich
Frst		Same sandstone as above but broken, greenish, chloritic.	
Frst		Similar to 128.50 - 137.70 but not pebbly	
SW-MW		Pebbly in places, Hematite rich in places	

NOT RECORDED

NOT TESTED

NOT TESTED



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E.L. 7/74 TIN SPURINITIAL FINANCIAL FEASIBILITY ANALYSIS.

P.W. ASKINS.

February, 1980.

A. Summary

In a zone of potentially more than 17 million tonnes of low grade open pittable tin and gold mineralization disseminated in sandstone there is assumed to be 2 million tonnes of 0.3% Sn, 0.1ppm Au and a further 2 million tonnes of 1ppm Au.

Present information suggests that the Sn is as fine grained clean cassiterite and so is easily beneficiated by conventional gravity means. The Au is assumed to be amenable to conventional cyanidation.

The attached financial analysis for an 8 year life, 500,000 tonne per year operation shows that it generates cash flows each year of about \$2.8 million, payback in the fifth year of production, capital repaid 1.9 times over the life of the mine and DCF ROI of 14.1%.

This just falls short of Comalco's acceptable investment guidelines and shows that this is a viable target for exploration.

B. Assumptions1. Size and Grade.

Assume prospective area is that of 200ppm Sn in soil

Area $43 \times 50 \times 50m^2 = 107500m^2$

Depth say av. 75m; vol. = 8,062,500

Density say 2.2

Mass = 17,737,500

Potential of say 17 million tonnes

If only 12% of this potential prospective zone is as patches of economic grade

tonnage 2 million tonnes

grade say 0.3% Sn 0.1ppm Au

Also potential for extra 2 million tonnes of 1ppm Au.

Summary: 2 million tonnes 0.3% Sn 0.1ppm Au

+ 2 million tonnes 1ppm Au

2. Ore: waste 1:1

3. Concentrate freight costs negligible

4. Sn as cassiterite concentrate \$140/m.t.u. Au \$600/oz.

- 5. Recovery 65% of the Sn
70% of the Au

It is assumed that both the Sn and Au are amenable to simple beneficiation methods.

- 6. Royalty to Tas. Government:- 2½% of proceeds, i.e. of gross sales less transport, handling and selling.
- 7. 8 year mine life i.e. 500,000t/year
for 300 day year i.e. 1,660t/day
- 8. Ore mining cost: open pit - \$1.80/t,
- 9. Waste mining cost: \$1.80/t
- 10. Treatment costs: \$6.00/t (average)
- 11. Overhead and indirect costs: \$2.70/t
- 12. Reclamation costs: ~ 20¢/t
- 13. Capital costs:

Mill	\$10	million
Development	\$ 1	million
Exploration & proving	\$0.8	million
No town	-	
TOTAL	<u>\$11.8</u>	million
- 14. Depreciation over mine life of all capital cost.
- 15. Federal tax rate: 46%

C. Operating Profits Calculations.

		<u>Each yr. of production.</u>
Tonnes of ore milled	Type 1	250,000 tonnes
	Type 2	250,000 tonnes
Grade of ore	Type 1	0.3% Sn 0.1ppm Au
	Type 2	1ppm Au
Tonnes of product in mill feed	Sn	750 tonnes
	Type 1 Au	25,000g
	Type 2 Au	250,000g
	Total Au	275,000g
Recovered tonnes	Sn, 65% recovery	490 tonnes
	Au, 70% recovery	190,000g
Gross value	Sn	\$6,860,000
	Au	\$3,800,000
Total say		\$10.6 million
Charges beyond concentrator		
	Freight	negligible
	No refining, marketing costs	-
	Royalties 2½% of \$10.5 million	~ 0.3 million
Receipts after charges		\$10.3 million
Equivalent to \$20.60/t ore milled		
Operating Costs: Mining costs \$1.80/t		
	Waste costs \$1.80/t of ore mined	
	Milling \$6.00/t	
	Overhead/indirect \$2.70/t	
	Reclamation <u>\$0.20/t</u>	
	TOTAL \$12.50/t	\$6.25 million
∴	Operating profits \$8.10/t	\$4.05 million

	END OF YEAR	OPERATING PROFIT	LESS DEPRECIATION	EQUALS TAXABLE INCOME	LESS INCOME TAX	EQUALS NET PROFIT AFTER TAX	ADD DEPRECIATION	EQUALS CASH FLOW	CUM. CASH FLOW	DCF AT 15%	DCF AT 12%
EVEL.	0	(5,900)	-	-	-	(5,900)	-	(5,900)	(5,900)	(5,900)	(5,900)
	1	(5,900)	-	-	-	(5,900)	-	(5,900)	(11,800)	(5,900)	(5,900)
	2	4,050	1,475	2,575	1,185	1,390	1,475	2,865	(8,935)	2,166	2,864
ROD.	3	4,050	1,475	2,575	1,185	1,390	1,475	2,865	(6,070)	1,882	2,039
	4	4,050	1,475	2,575	1,185	1,390	1,475	2,865	(3,205)	1,638	1,820
	5	4,050	1,475	2,575	1,185	1,390	1,475	2,865	(340)	1,424	1,626
	6	4,050	1,475	2,575	1,185	1,390	1,475	2,865	2,525	1,238	1,451
	7	4,050	1,475	2,575	1,185	1,390	1,475	2,865	5,390	1,077	1,296
	8	4,050	1,475	2,575	1,185	1,390	1,475	2,865	8,255	936	1,157
	9	4,050	1,475	2,575	1,185	1,390	1,475	2,865	11,120	814	1,033
										£ -635	+1,486

(Thousands of dollars)

Capital repaid in 5th year of production.

Capital repaid 1.9 times over life of mine.

$$\begin{aligned}
 \text{DCF ROI} &= 12 + \left(\frac{1486}{1486 + 635} \right) (15 - 12) \\
 &= 12 + \frac{1486}{2121} \cdot 3 = 14.1\%
 \end{aligned}$$

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RAW MATERIALS DIVISION
EXPLORATION DEPARTMENT

092182

TASMANIA ACTION PLAN

EXPLORATION PROJECT:

TIN SPUR - PHASE II

PROGRAMME:

YEAR 1980.....

Action unit:

1. SURVEY
2. ACCESS TRACKS, PADS
3. PERCUSSION DRILLING
4. PROCESS DRILL SAMPLES
5. ANALYSES
6. DATA COMPILATION, MAPPING
7. DECISION POINT, ABANDON OR PROCEED TO PHASE III.
8. REPORT WRITING, DRAFTING.
- 9.
- 10.

	J	F	M	A	M	J	J	A	S	O	N	D	To be done by
1. SURVEY													2 Adelaide staff
2. ACCESS TRACKS, PADS													G. Atkinson & dozer co
3. PERCUSSION DRILLING													Contractor
4. PROCESS DRILL SAMPLES													R.D. & J.B
5. ANALYSES													Comlabs
6. DATA COMPILATION, MAPPING													P.W. Askin
7. DECISION POINT, ABANDON OR PROCEED TO PHASE III.													P.W. Askin
8. REPORT WRITING, DRAFTING.													P.W. Askin O. Hedditc]
9.													
10.													

ESTIMATED COST: \$60,000

COST CODE: 25.07.018

OBJECTIVE: Tin, gold, bulk low grade mineralization.

REMARKS: See attached pages for costing. Phase I is completed but this costing does not include costs for phase I which are still in the pipeline and will be paid in March.

Phase II involves 62 percussion holes. If analyses received are consistently poor, program could be aborted at 40 holes for a total of \$47,000.

PREPARED BY: P. Askins

DATE: 12-3-80

1. SURVEY

Air fares x2 Adelaide/Devonport return	\$ 360.00
Salaries x2 Adelaide field assistants x3 weeks @ \$200/week	1200.00
+ salary on costs 15%	180.00
Food and supplies to Adelaide assistants, \$5/day, each	150.00

2. ACCESS TRACKS

Bulldozer contractor - 40 hours @ \$30	\$ 1200.00
Comalco field assistant - 1 week @ \$200 + 15%	230.00

3. PERCUSSION DRILLING

Contractor

a) establishment	\$ 550.00
b) rate \$65.00/hour, estimated 50m per 10hr. day i.e. \$15/m *	
program requires 62 holes of 25m i.e. 1550m	23250.00

(*this figure and drilling rate confirmed by Chris Young, Aberfoyle who has done percussion drilling on hourly basis).

4. PROCESSING OF SAMPLES

2 Comalco field assistants R. Duraj and J. Burton, 30 days (6 weeks) at 450 + 370 = 820/fortnight	\$ 2460.00
+ 15% on cost (\$370) + 2 hours/day overtime (\$820)	1190.00

5. ANALYSES

Quotation based on minimum of 40 holes, 25m, i.e. 1000 samples, Comlabs, Adelaide.

Freight 1550 samples, 1550 kg backloading @ \$0.52/kg	\$ 800.00
Sample prep. Crushing 0.60 x 1550	
Splitting 0.40 x 1550	2790.00
Pulverizing 0.80 x 1550	
Analyses Sn XRF @ \$2.00	3100.00
Au AAS @ \$2.50	3875.00
Additional analyses say 500 x Ag, Pb, Zn @ \$3.00	1500.00

6. DATA COMPILATION

And management, P.W. Askins	\$ 5000.00
Report writing costs	500.00

7. SUPPORT STAFF

Secretary, Devonport - 3 weeks @ \$200.00 + 15%	690.00
Mechanic - 3 weeks @ \$200.00 + 15%	690.00

8. <u>OFFICE</u> - on costs - 3 months x \$570.00	1700.00
---	---------

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9.	<u>REPAIRS</u> to vehicles, parts, consumables etc. 3 months @ \$1000.00 (based on February costs, Devonport base)	\$ 3000.00
10.	<u>SUB TOTAL</u>	\$54415.00
11.	Contingencies @ 10%	5000.00
		<hr/>
	TOTAL	\$60000.00
		<hr/>

Paul Ashman

J.M. Rigney Blasting Services Pty. Ltd.

P.O. Box 70.,
EAST DEVONPORT 7310

25th February, 1980

Comalco Limited,
 P.O. Box 691.,
DEVONPORT, Tas. 7310

Attention: Mr. P.W. Askins

Dear Sir,

Further to recent discussions between yourself and the writer regarding drilling at your Lorinna Road lease, we take pleasure in submitting the following proposal for your consideration.

We quote:

one only Atlas-Copco R.O.C. 601 drilling rig fitted with a D.C.T. dust collector and powered by a 900cfm Atlas-Copco portable air compressor.

The above equipment will be available complete with operator, fuel, drill rods, bits and couplings at a rate of \$62.00 per hour, but subject to the following conditions:-

1. Comalco Limited to pay an establishment cost of \$550.00.
2. Comalco Limited to pay J.M. Rigney Blasting Services Pty. Ltd. a minimum of 8 hours per day of any day worked.
3. Fair wear and tear on drill steels to be the responsibility of J.M. Rigney Blasting Services Pty. Ltd., however, should any consumables be lost through "bogged" condition at over 25 metres in depth, Comalco Limited would be responsible for replacement at cost.
4. Comalco Limited pay all board and lodging expenses for the operator at either Devonport or Sheffield.

We wish to advise that due to the nature of this particular job, the Company is unable to give a metre price, however, under normal conditions this equipment is capable of drilling at a rate of 20 metres per hour.

Yours faithfully,
J.M. RIGNEY BLASTING SERVICES PTY. LTD.

Brian G. Chaffey
Brian G. Chaffey,
DIRECTOR.

Ragnheim
 27.2.80
 He will not quote a
 net wage rate

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092186 TIN SPUR Pa-

DRILLING & BLASTING CONTRACTOR
R.S. & S.J. RICKARDS
MAIN ROAD, KETTERING 7155
PHONE 67 4517

18th March, 1980

Mr. Askin,
Comalco Ltd. Exploration Dept.,
P.O. Box 691,
DEVONPORT,
Tasmania. 7310

Dear Mr. Askin,

We hereby submit our tender for test hole drilling at "Tin Spur" site.

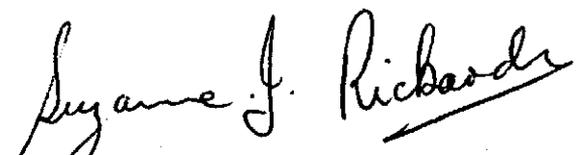
Drilling Price: \$11 per metre.
\$40 per hr. moving between each test hole
Plus cost of Mobilisation and Demobilisation

Where possible, reasonable access to Test Holes.

The above price being for:

Atlas Copco R.O.C. 601 with COP.131EL Drifter
Atlas Copco 900 Compressor
Atlas Copco Dust Collector, Rods and Bits.

Yours faithfully,


S.J. Rickards

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39736

NOTE- ALL CORRESPONDENCE TO BE ADDRESSED TO THE DIRECTOR OF MINES

5/7/74

TIN SPUR

Pa-

092187



TASMANIA

DEPARTMENT OF MINES

TELEPHONE: 30 8033

G.P.O. BOX 124 B
HOBART
TASMANIA 7001

12 MAR 1980

Mr P.W. Askins,
Senior Geologist,
Exploration Department,
Commonwealth Aluminium Corporation
Limited,
P.O. Box 691,
DEVONPORT,
Tasmania. 7310

Dear Sir,

Exploration Licence, Moina

I refer to your letter of 4th March, 1980 regarding construction of tracks and pads in the above Exploration Licence.

Permission is granted to construct the required tracks and pads. The work should be carried out with the minimum of disturbance and if the drilling indicates that no further work is required the area should be rehabilitated. I note that no trees will be removed.

I should be glad if you will keep me informed of the progress with this investigation.

Yours faithfully,

(J.G. Symons)
DIRECTOR OF MINES

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PROJECT DEVONIAN No. _____
 SUBJECT PAN CONCENTRATES, DEVONIAN GRID TRIAL LINES, 100N, 00
 PREP. BY R. DURAJ / P. ASKINS DATE MAY 1980 SHEET 1 OF 1

Samples taken with 6cm diameter hand auger.

STATION 100N/ /	DEPTH, metres	MASS OF CONCENTRATE, g.	STATION 100N/ /	DEPTH metres	MASS OF CONCENTRATE, g.
00	0 - 1.9	19.5	375W	0 - 0.9	21.0
25W	0 - 2.0	23.0	400W	0 - 0.8	12.0
	2.0 - 3.0	15.5			
	3.0 - 4.0	16.0			
	4.0 - 5.0	13.5			
	5.0 - 5.5	13.0			
	5.5 - 5.6	10.5			
(? soft porphyry dyke here ?)					
50W	0 - 1.0	23.5	00	0 - 1.1	15.0
	1.0 - 1.4	18.5	25W	0 - 0.9	15.5
75W	0 - 1.0	18.0	50W	0 - 0.8	24.5
100W	0 - 0.5	13.5	75W	0 - 1.0	18.5
125W	0 - 0.5	13.0		1.0 - 2.0	15.0
150W	0 - 0.2	20.5		2.0 - 3.0	9.5
175W	0 - 0.5	19.5		3.0 - 4.0	6.5
200W	0 - 0.5	16.5		4.0 - 5.0	10.5
225W	0 - 1.0	10.5	(? soft porphyry dyke here ?)		
250W	0 - 0.9	11.5			
275W	0 - 0.4	13.5			
300W	0 - 0.5	23.5			
325W	0 - 0.4	23.0			
350W	0 - 1.1	20.5			

APPENDIX 12

ANALYTICAL METHODS USED.A. AMDEL

- CODE A Semi quantitative analyses by emission spectroscopy.
- CODE B XRF. All XRF analyses are by Code B1 unless otherwise stated.
- B1 XRF, accuracy \pm 5%, detection limits as quoted.
- B2 XRF, accuracy \pm 3%, detection limits as quoted.
- CODE C AAS
- C1 Bi, Cd, Co, Cr, Cu, Fe, Mn, Ni, Pb, Zn, accuracy \pm 5%, detection limits as quoted. Dissolution in hot HClO_4 .
- C2 Ag, Mo, accuracy \pm 5%. Dissolution in hot HCl + HNO_3 ?
- C3 Au, accuracy dependent on sample, detection limit 0.05 ppm. Details of method not available, but dissolution in HCl + HNO_3 .

B. COMLABS

XRF analyses identical to Code B of Amdel.
AAS analyses identical to Code C of Amdel.

092190

D of M	A.O.	CC	CCM	DSME
RECEIVED			19 MAY 1980	
ANSWERED			E&IL	
REF. No.			drill holes	

PLANS

- TAS-80-337 TIN SPUR - Proposed sites for percussion drill
- TAS-79-310 TIN SPUR - Grid line slopes
- TAS-80-334 Geology
- TAS-79-311 Analyses of -20 mesh Soil Samples
- TAS-80-330 Tin in -20 mesh Soil - Contours
- TAS-80-331 Lead in -20 mesh Soil - Contours
- TAS-80-333 Zinc in -20 mesh Soil - Contours
- TAS-80-332 Copper in -20 mesh Soil - Contours
- TAS-79-312 Proton Precession Magnetism Data
- TAS-79-315 Proton Precession Magnetism Contours
- TAS-79-321 Gradient Array E.I.P. Chargeability Profiles
- TAS-79-322 Gradient Array E.I.P. Resistivity Profiles
- TAS-80-336 Gradient Array E.I.P. Chargeability Contours
- TAS-80-335 Gradient Array E.I.P. Resistivity Contours
- TAS-80-339 DEVONIAN GRID - Grid Line Slopes
- TAS-80-394 Geology & Drill Sections
- TAS-80-340 Analyses of -80 mesh Soil Samples
- TAS-80-393 Pb in -80mesh Bedrock Soil, Contours
- TAS-80-392 As in -80mesh Bedrock Soil, Contours
- TAS-80-340 Proton Precession Magnetism, Data Sheet
- TAS-80-391 Proton Precession Magnetism, Contours
- 3270-37 OLIVERS HILL - Sheffield - Geological Survey

OPEN FILE

80-1430

00 200m S 400m S 600m S 800m S 1000m S 1200m S 00

- ⊙ Percussion drill holes to be drilled first, to depths of 25m
- Fill in holes, dependent partly on analyses received, 25m or deeper

200mW 200mW

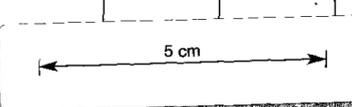
400mW 400mW

600mW 600mW

800mW 800mW

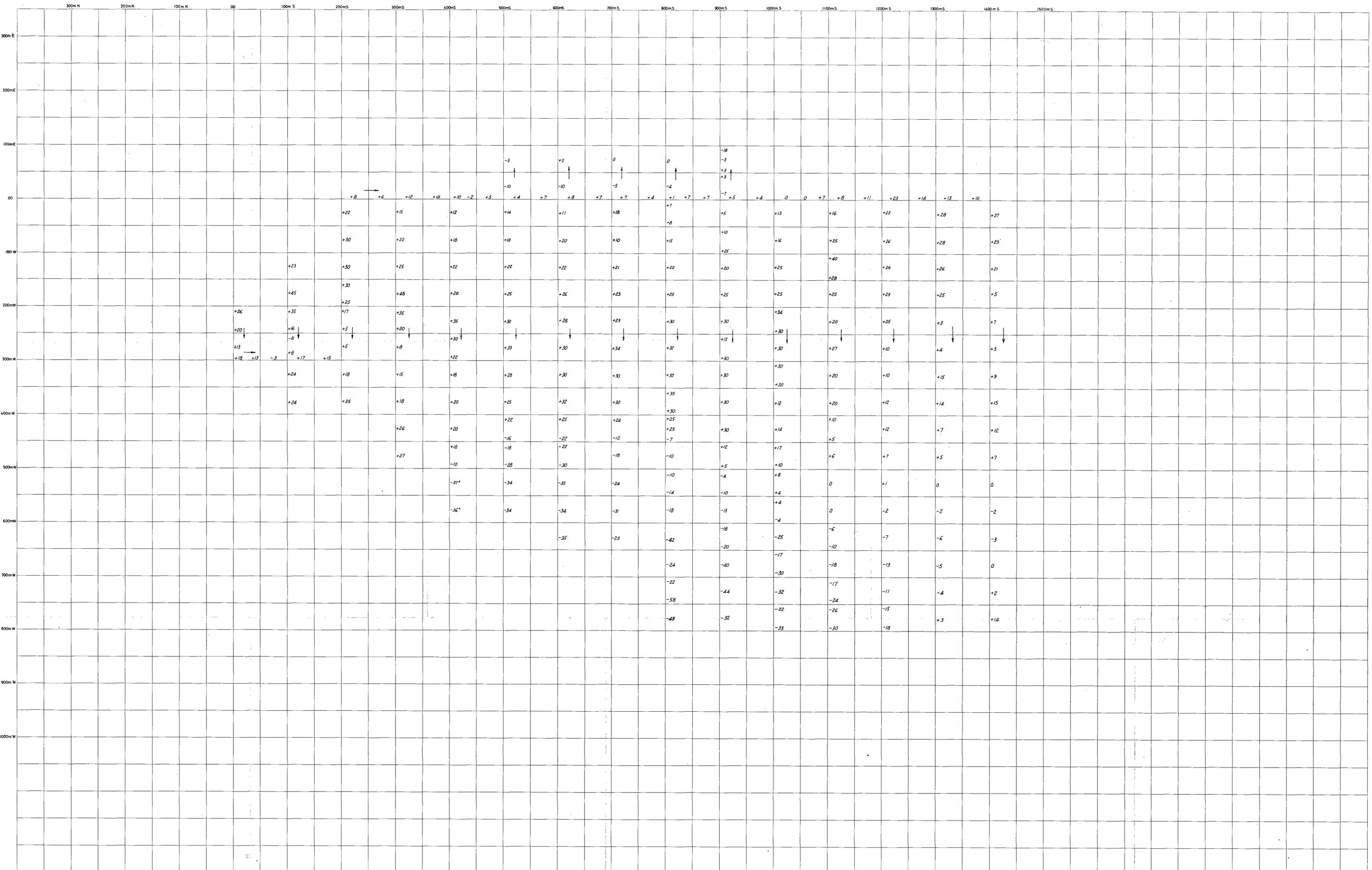
E.L. 7/73
CRAE

Sn ppm in -80 mesh soil



COMALCO 85-1430/2		
E.L. 7/74 TASMANIA		
TIN SPUR 3198		
PROPOSED SITES FOR PERCUSSION DRILL HOLES		
Compiled: P. Askins	Revised	Drawn: O. Hedditch
Date: Mar. 1980	Scale: 1:2500	Drg. No TAS-80-337

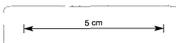
092184



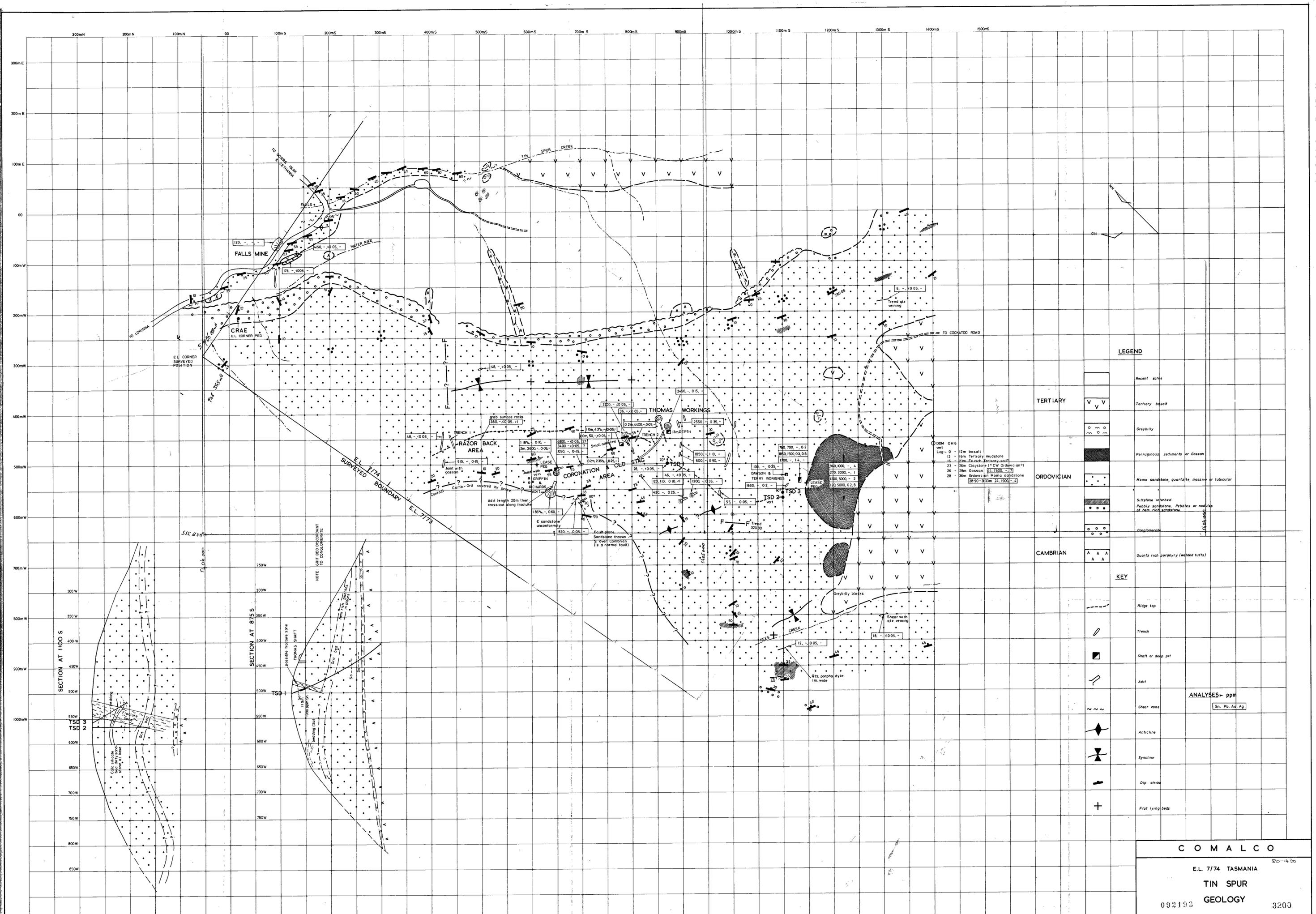
COMALCO

E.L. 7/74 TASMANIA
TIN SPUR

GRID LINE SLOPES 3199
092192



Compiled	O Hedditch	Revised		Drawn	O Hedditch
Date	Oct 1979	Scale	1:2500	Org No	TAS-79-310



LEGEND

- Recent scree
 - Tertiary basalt
 - Greyblity
 - Ferruginous sediments or Gossan
 - ORDOVICIAN
 - Moira sandstone, quartzite, massive or tubular
 - Siltstone interbedded, Pebbly sandstone, pebbles or nodules of fine, rick sandstone
 - Conglomerate
 - CAMBRIAN
 - Quartz rich porphyry (welded tuffs)
- KEY**
- Ridge top
 - Trench
 - Shaft or deep pit
 - Adit
 - Shear zone
 - Anticline
 - Syncline
 - Dip strike
 - Flat lying beds

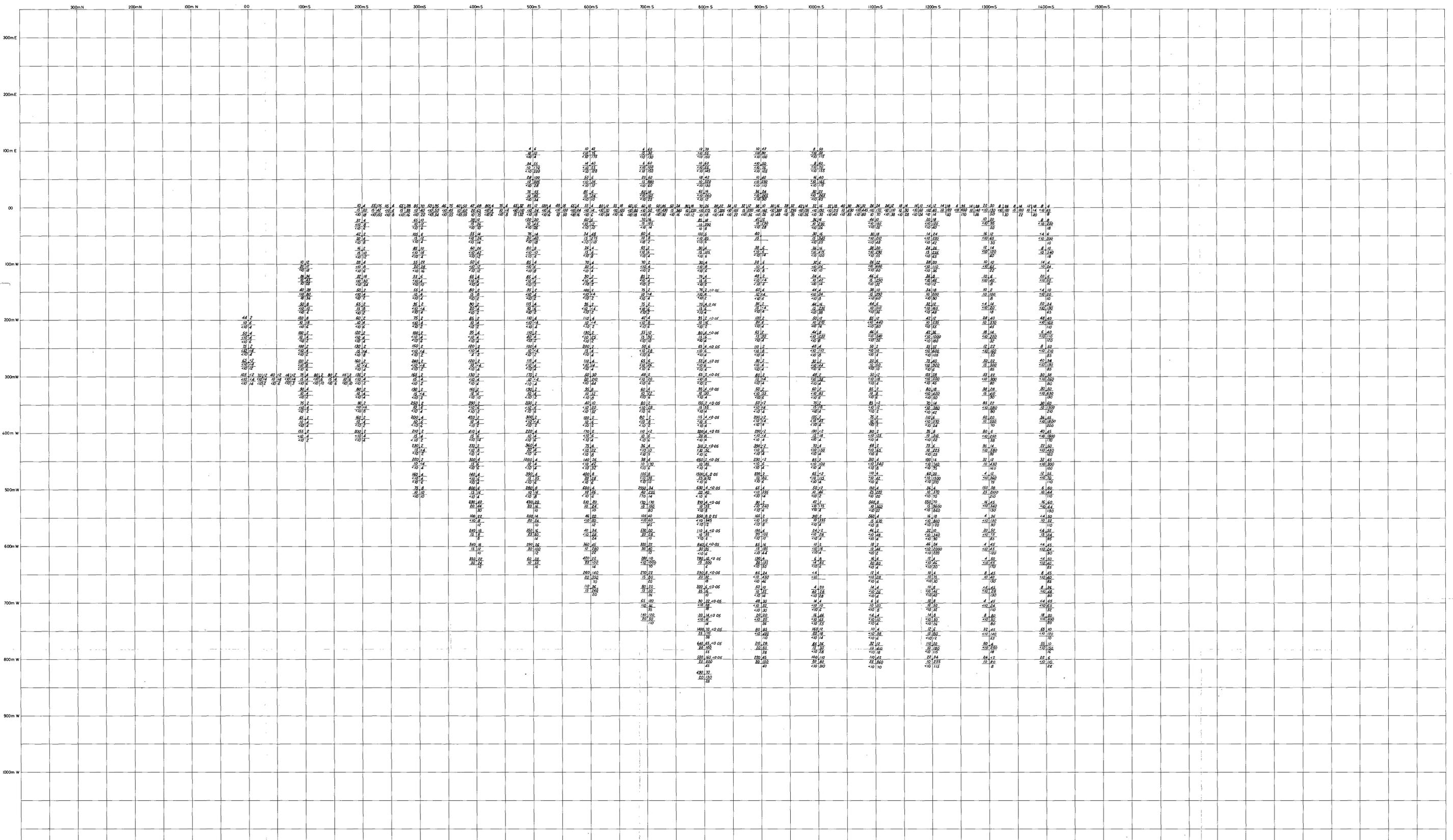
ANALYSES - ppm
Sn, Pb, Au, Ag

COMALCO

E.L. 7/74 TASMANIA
TIN SPUR
GEOLOGY
092193 3200

Compiled R Pollock Revised P W Askins May, 1980 Drawn O Heddrich
Date Feb 1980 Scale 1:2500 Drg No TAS-80-334

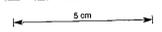


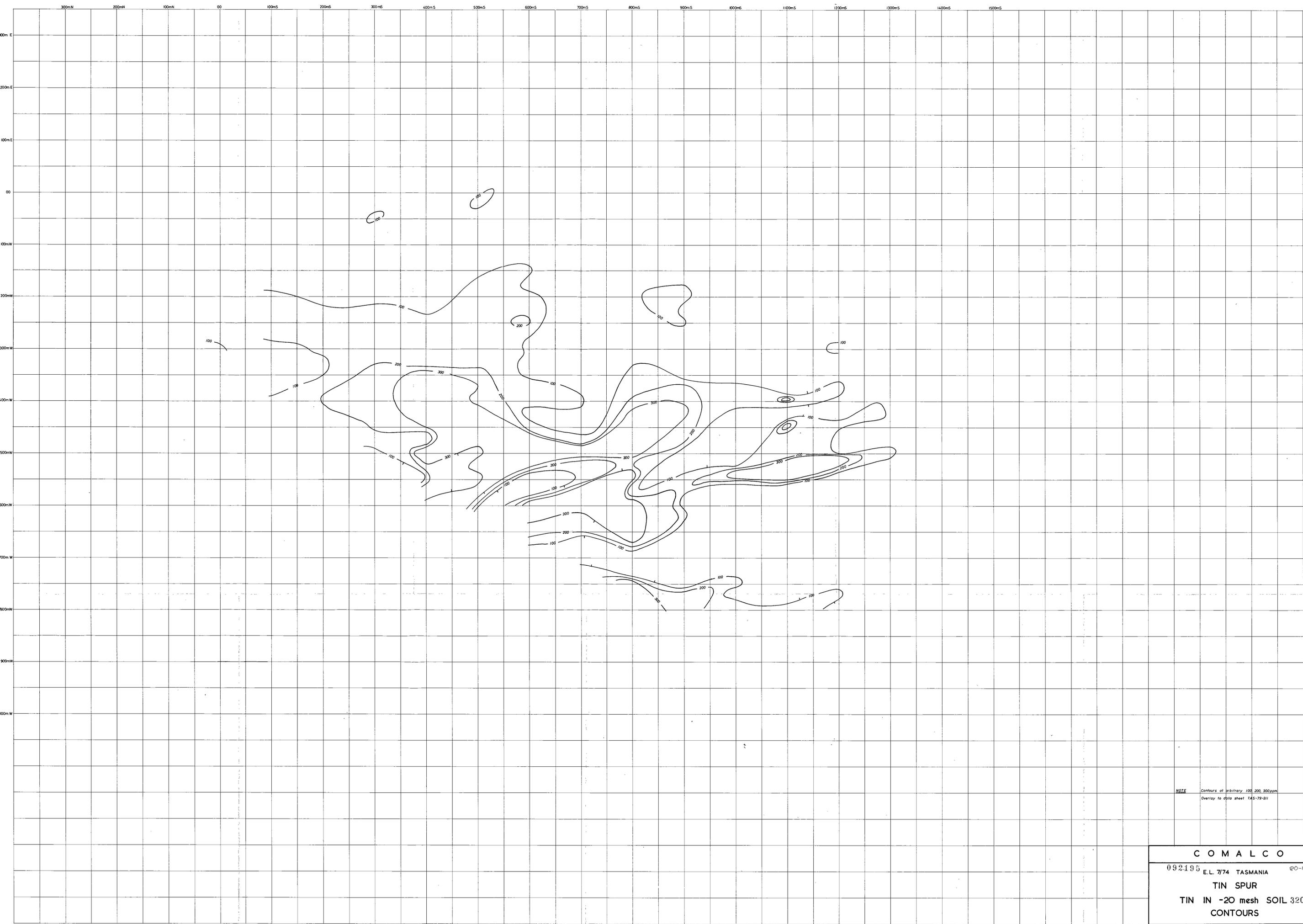


NOTES Key ppm Sn Cu Au
W Pb Bi Zn
Analyses of -20 mesh bedrock collected with hand digger
Analyses by Comalco
Cu, Pb, Zn, Bi by AAS after hot acid digestion
Sn, W by XRF

COMALCO
 092194EL 7/74 TASMANIA 50-4.30
TIN SPUR 3201
 ANALYSES OF -20 mesh
 SOIL SAMPLES

Compiled	O Heddtich	Revised	March 1980	Drawn	O Heddtich
Date	Nov 1979	Scale	1:2500	Drp No	TAS-79-311





NOTE
Contours at arbitrary 100, 200, 300pm
Overlay to data sheet TAS-79-311

C O M A L C O

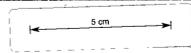
092195 E.L. 774 TASMANIA 80-14 20

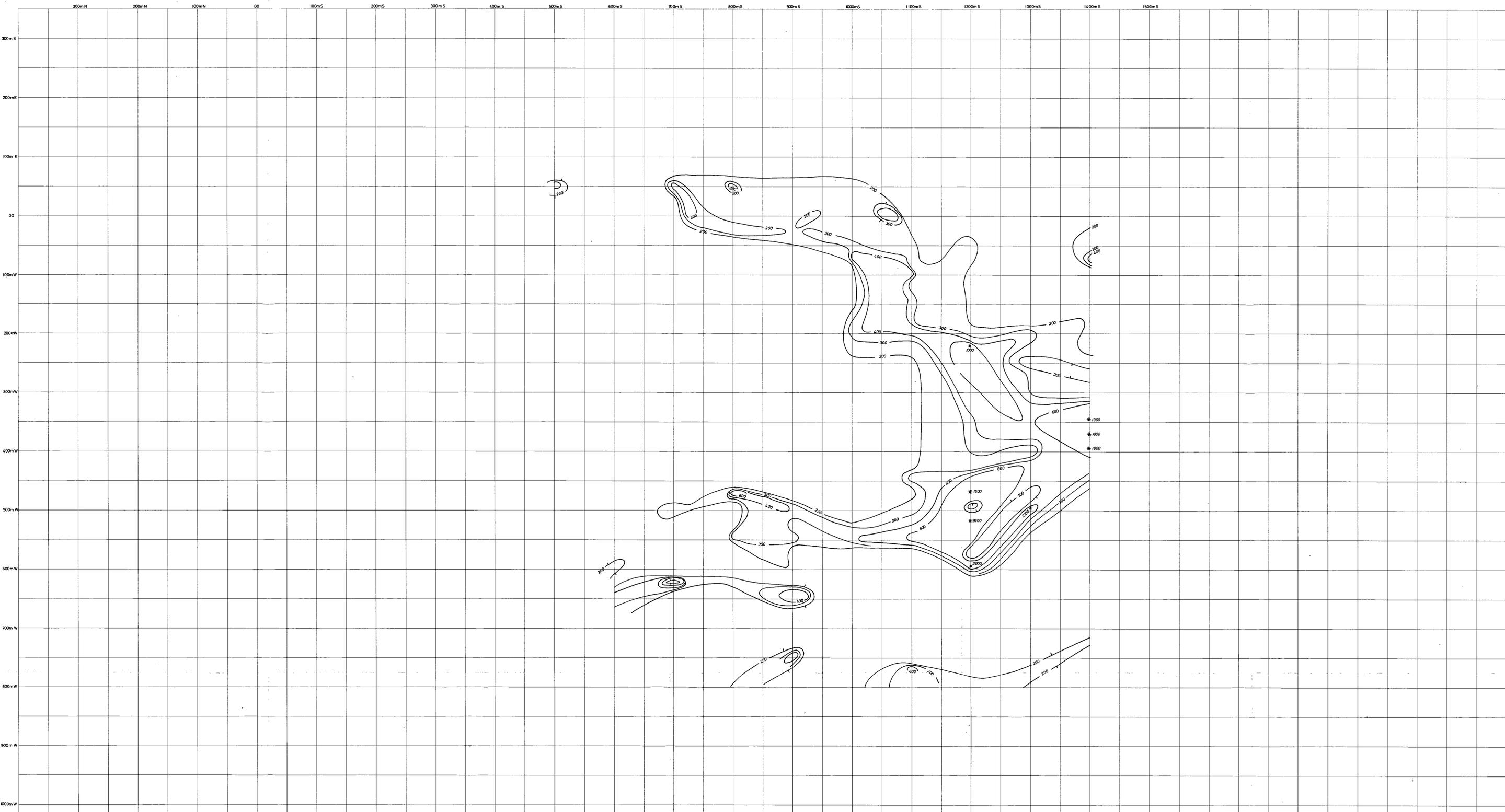
TIN SPUR

TIN IN -20 mesh SOIL 3202

CONTOURS

Compiled	P. Atkins	Revised		Drawn	O. Hedditch
Date	Jan 1980	Scale	1:2500	Dwg. No.	TAS-80-330



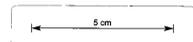


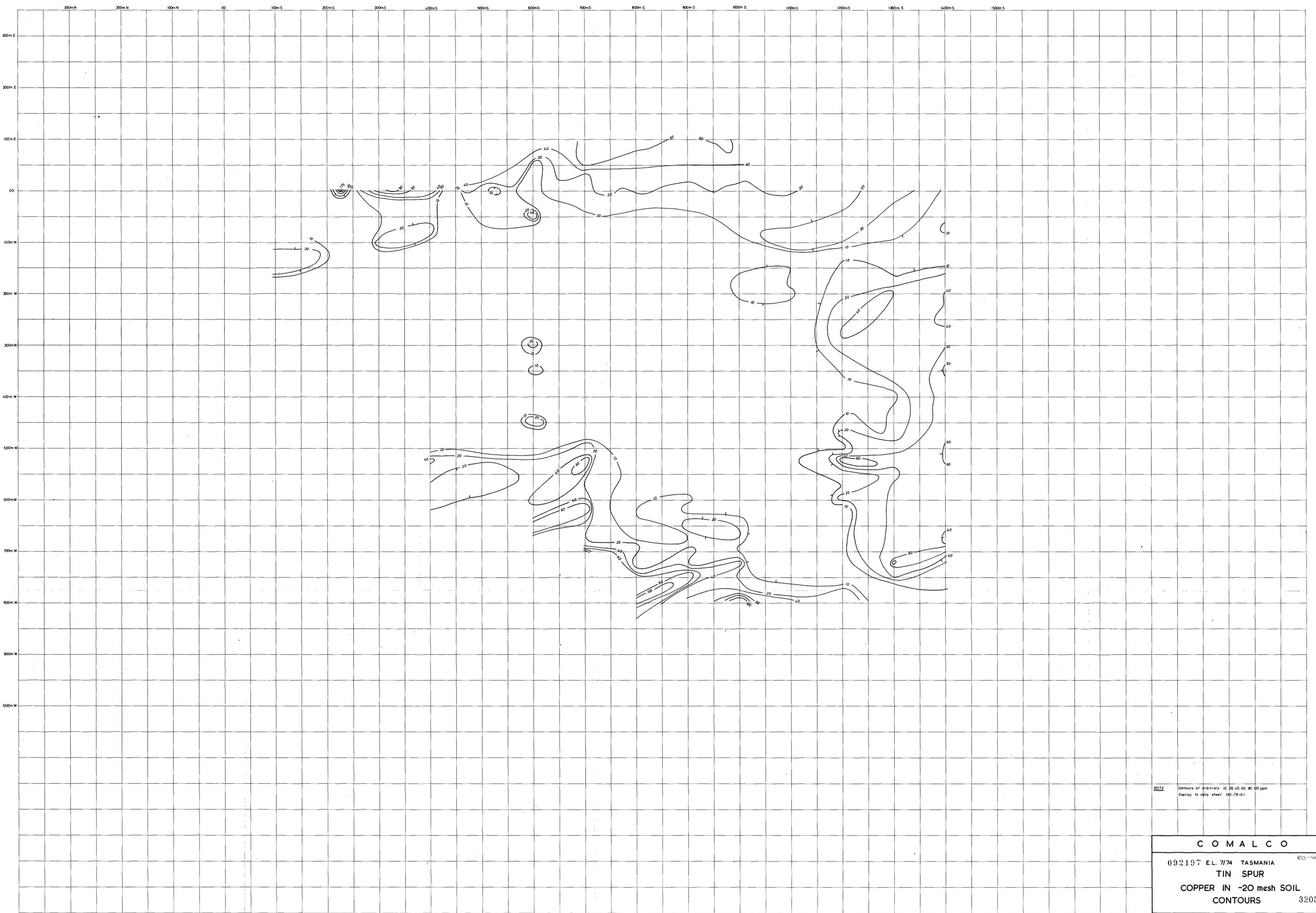
NOTE Contours at arbitrary 200, 400, 600 ppm
 Overlay to data sheet TAS-79-311

C O M A L C O

092196 E.L. 7/74 TASMANIA 80-1430
TIN SPUR
LEAD IN -20 mesh SOIL
CONTOURS 3203

Compiled P. Atkins	Revised	Drawn O. Hedrich
Date Jan 1980	Scale 1:2500	Drw No TAS-80-331

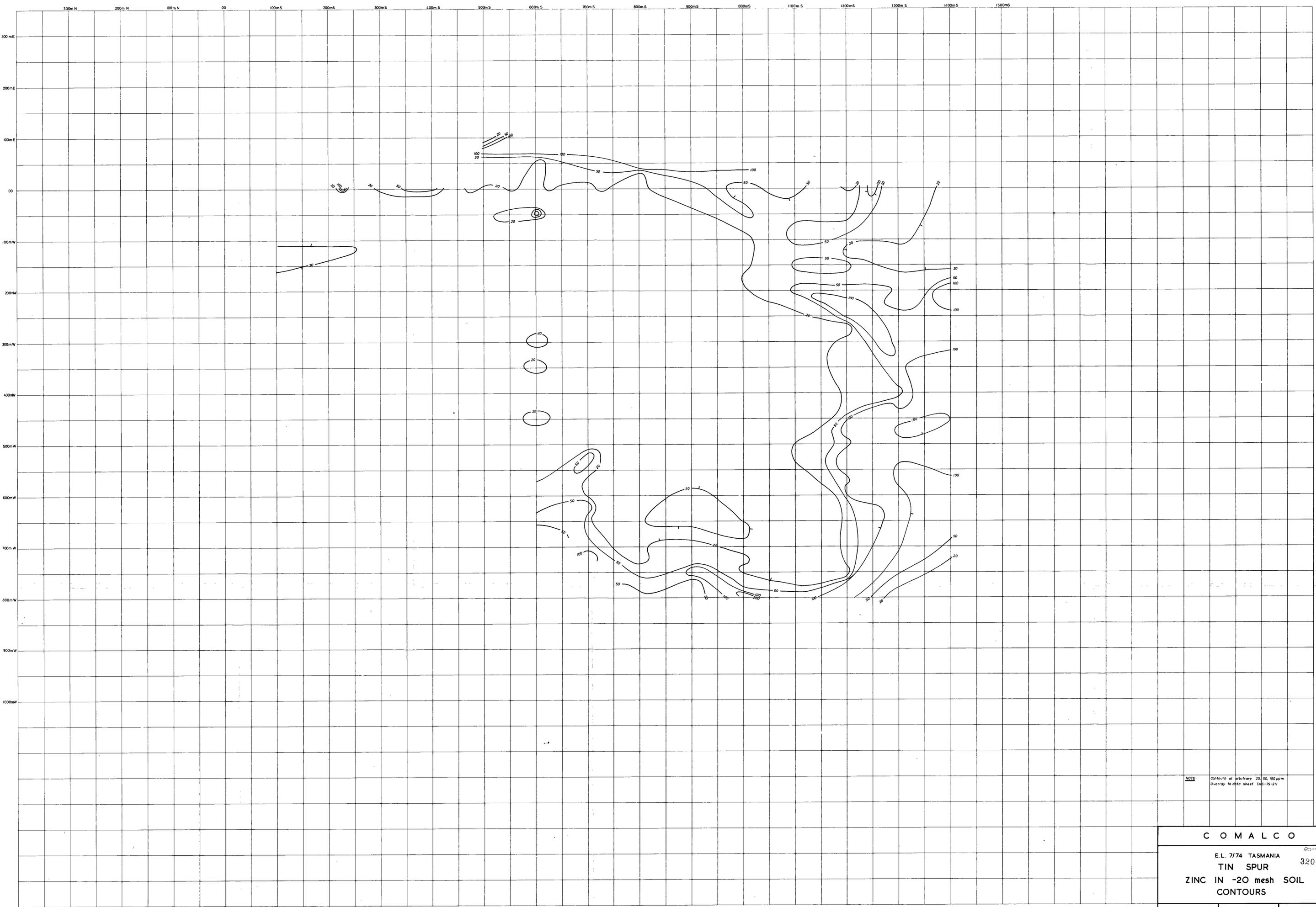




NOTE: Contours of arbitrary 10, 20, 40, 60, 80, 100 ppm
 Overlay to data sheet TAS-79-311

C O M A L C O			
092197 E.L. 7/74 TASMANIA			80-112-20
TIN SPUR			
COPPER IN -20 mesh SOIL			
CONTOURS			
			3205
Compiled	P. Askins	Revised	Drawn
Date	Jan 1980	Scale	1:2500
			Eng. No. TAS-80-332





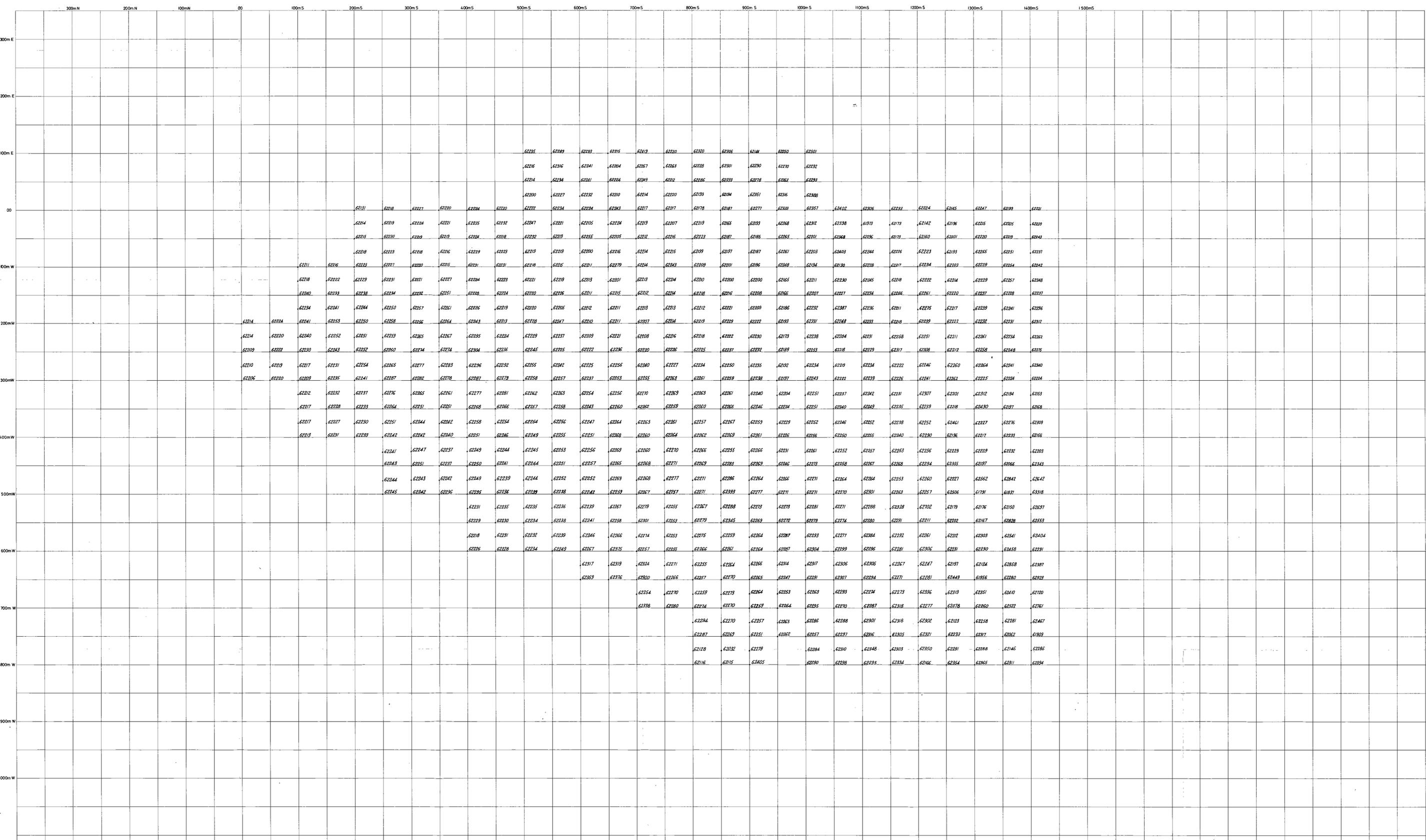
NOTE: Contours of arbitrary 20, 50, 100 ppm
Overlay to data sheet TAB-79-311

C O M A L C O

E.L. 7/74 TASMANIA 3204
TIN SPUR
ZINC IN -20 mesh SOIL
CONTOURS

Compiled: P. Askins	Revised:	Drawn: O. Heddlitch
Date: Jan 1980	Scale: 1:2500	Dwg No: TAS-80-333





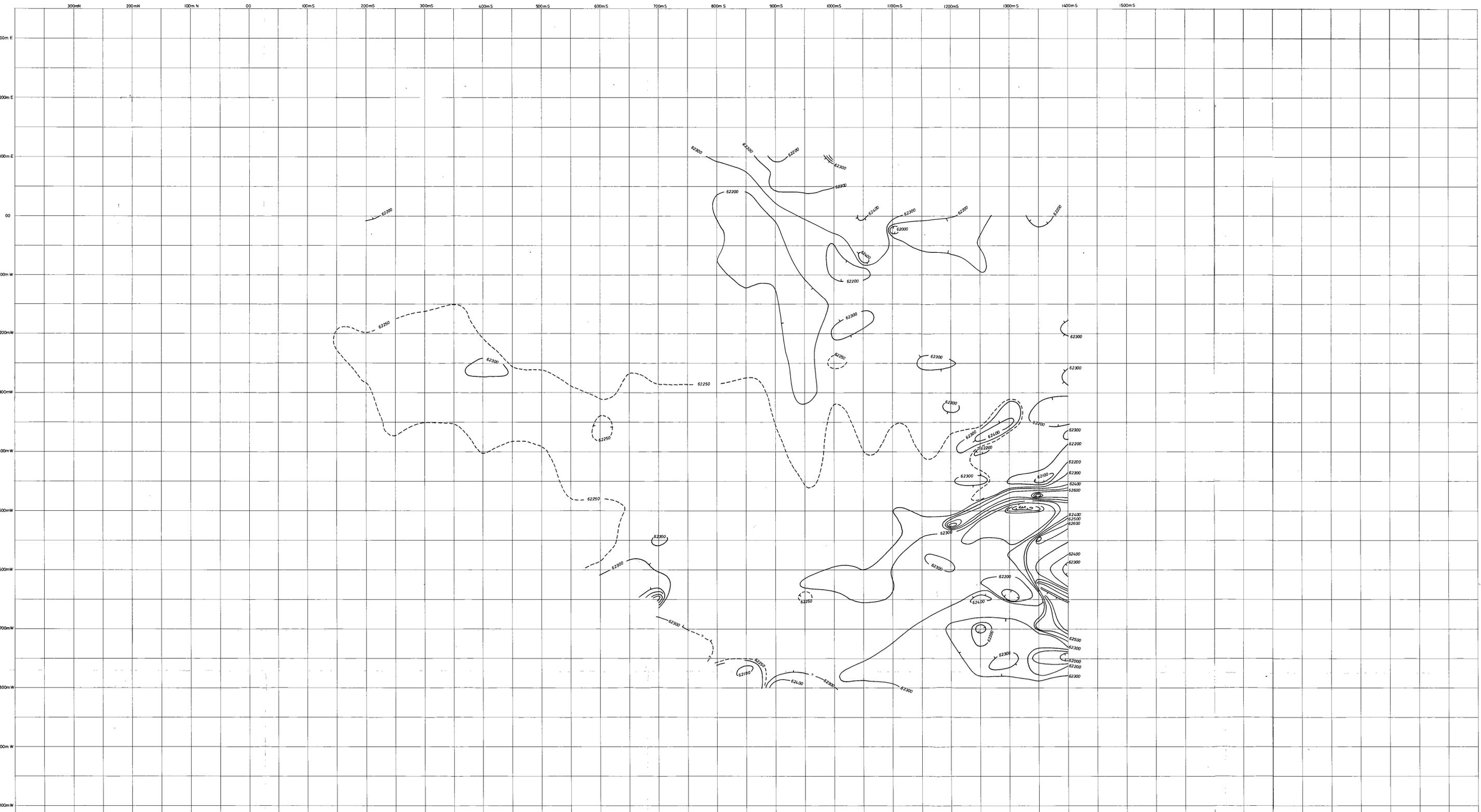
NOTE: Readings taken with Geometrics G 815 Proton Precession magnetometer mounted on 2m pole. Readings corrected for diurnal drift recorded on base station at 90° 47' 55".

C O M A L C O

092198 E.L. 7/74 TASMANIA 80-14 30
TIN SPUR
PROTON PRECESSION MAGNETICS
DATA, nT 3206

Compiled	O Hedditch	Revised		Drawn	O Hedditch
Date	Nov 1979	Scale	1:2500	Drw	No TAS-79-312





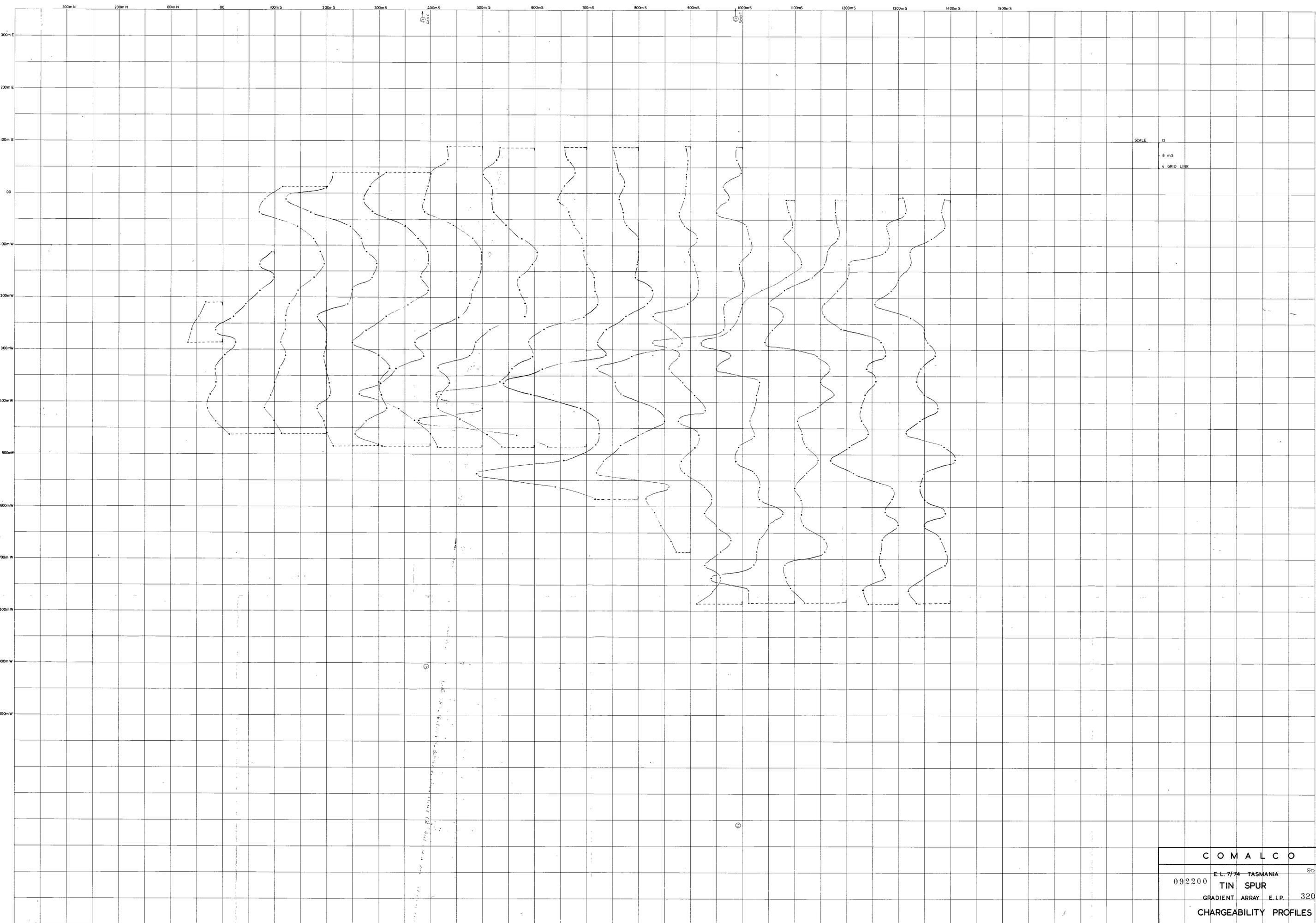
NOTE: Overlays data sheet TAS-79-312
 Readings at 50 x 25m spacing with Geometrics G816
 Proton Precession magnetometer mounted on 2m pole
 Readings corrected for diurnal drift

C O M A L C O

092199 E.L. 7/74 TASMANIA 80-1430
TIN SPUR 3207
PROTON PRECESSION MAGNETICS
CONTOURS, nT

Compiled P Askins	Revised	Drawn O Hedditch
Date Dec 1979	Scale 1:2500	Dwg No TAS-79-315

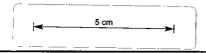


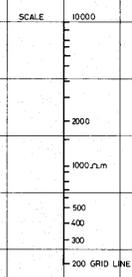
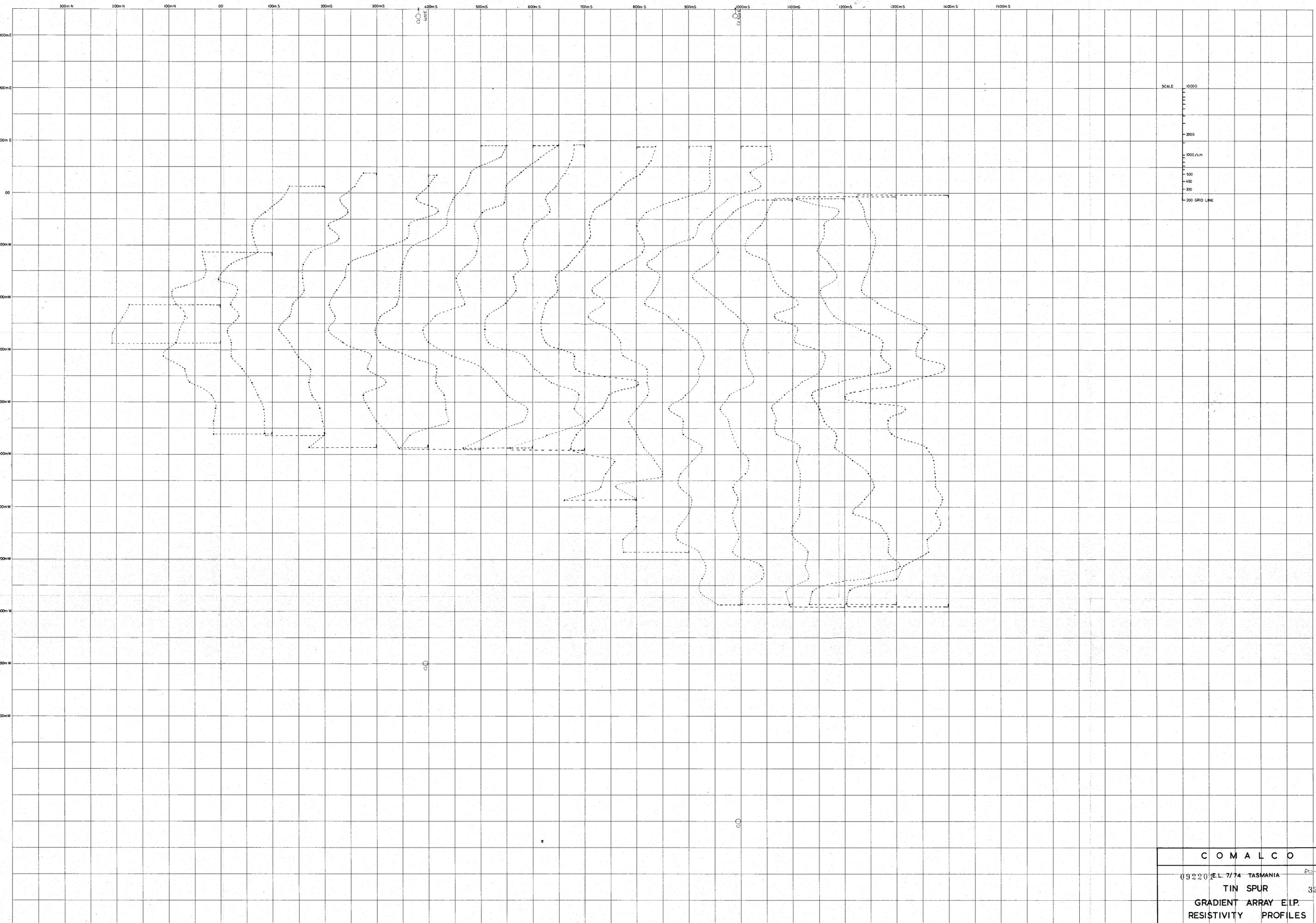


SCALE 1:2
 8 ms
 4 GRID LINE

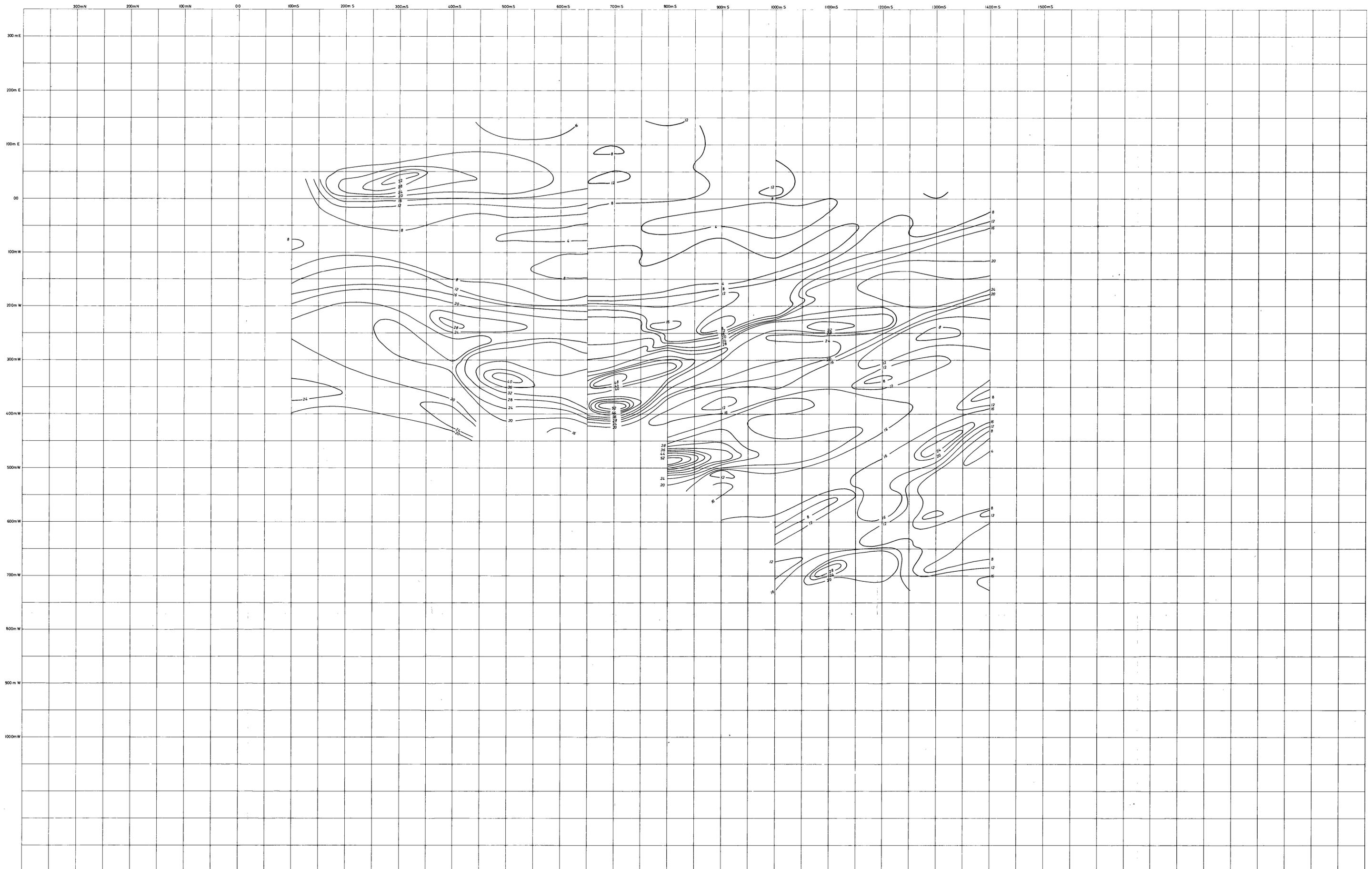
C O M A L C O
 E.L. 7/74 TASMANIA
 092200 TIN SPUR
 GRADIENT ARRAY E.L.P. 3208
CHARGEABILITY PROFILES

Compiled	G. Shelton	Revised		Drawn	G. Shelton
Date	Dec 1979	Scale	1:2500	Dir	No TAS 79 321

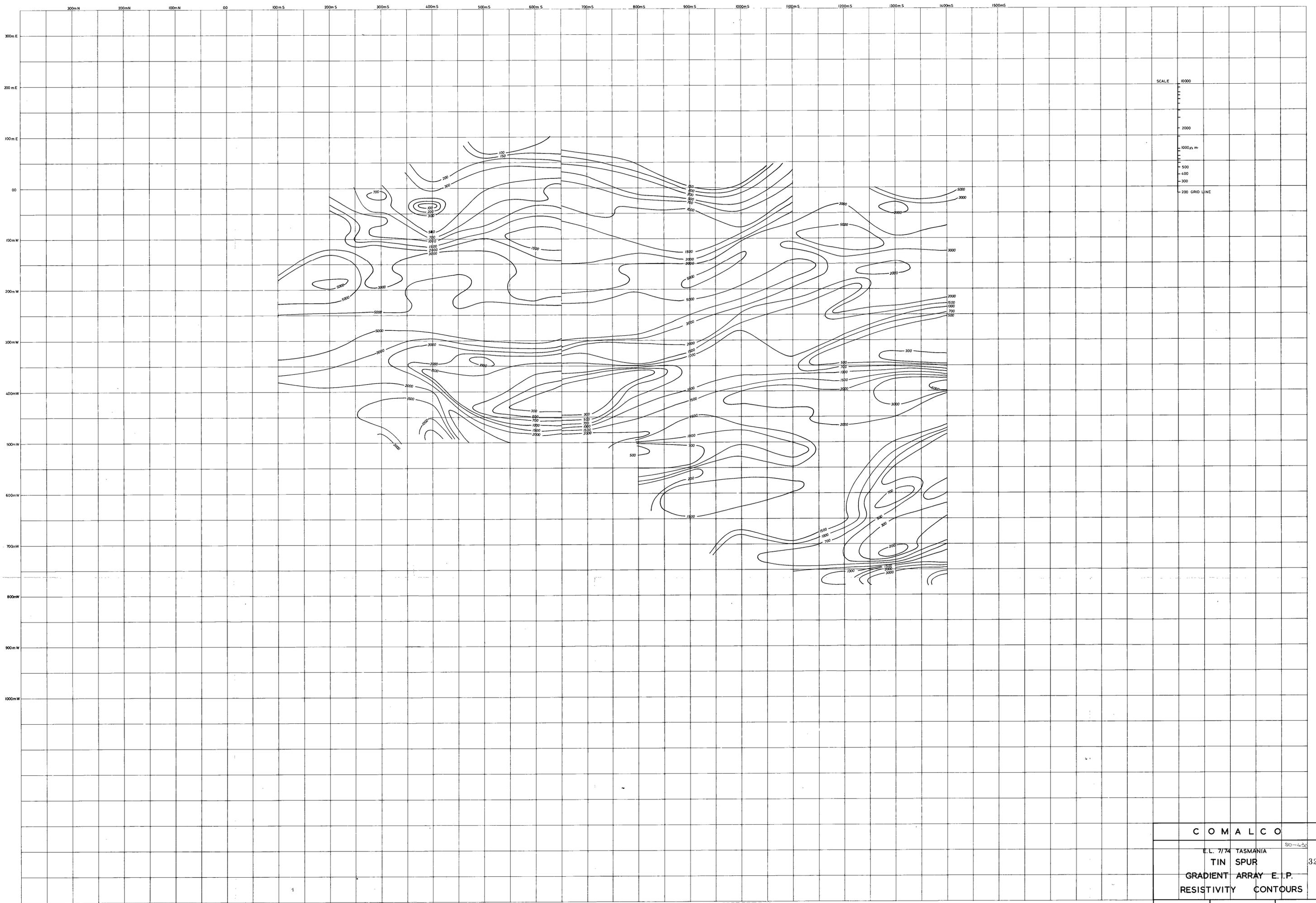




C O M A L C O		
(19220) E.L. 7/74 TASMANIA	80-1430	
TIN SPUR 3209		
GRADIENT ARRAY E.I.P.		
RESISTIVITY PROFILES		
Compiled: G. Shovelton	Revised:	Drawn: G. Shovelton
Date: Dec: 1979	Scale: 1:2500	Orig. No: TAS-79-322



C O M A L C O		
092202	E.L. 7/74 TASMANIA	50-1430
TIN SPUR		3210
GRADIENT ARRAY E.I.P.		
CHARGEABILITY CONTOURS		
Compiled G Shelton	Revised	Drawn O Heddich
Date Feb 1980	Scale 1:2500	Dwg No TAS 80 336



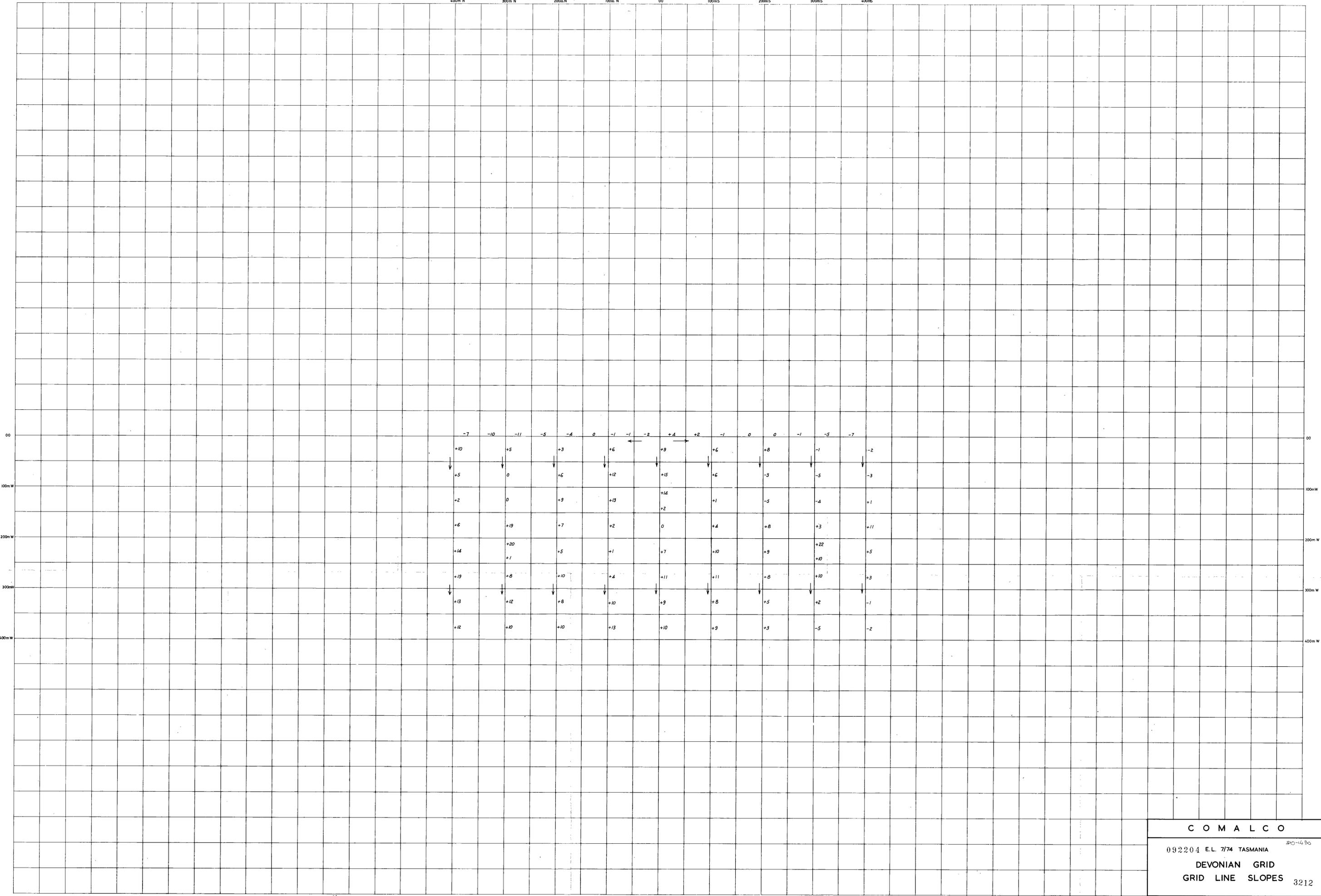
SCALE 10000
2000
1000
500
400
300
200 GRID LINE

COMALCO			
E.L. 7/74 TASMANIA TIN SPUR			3211
GRADIENT ARRAY E.T.P.			
RESISTIVITY CONTOURS			
Compiled	G. Shovelton	Revised	Drawn O. Heddlitch
Date	Feb. 1980	Scale	1:2500

092203

5 cm

400m N 300m N 200m N 100m N 00 100m S 200m S 300m S 400m S



5 cm

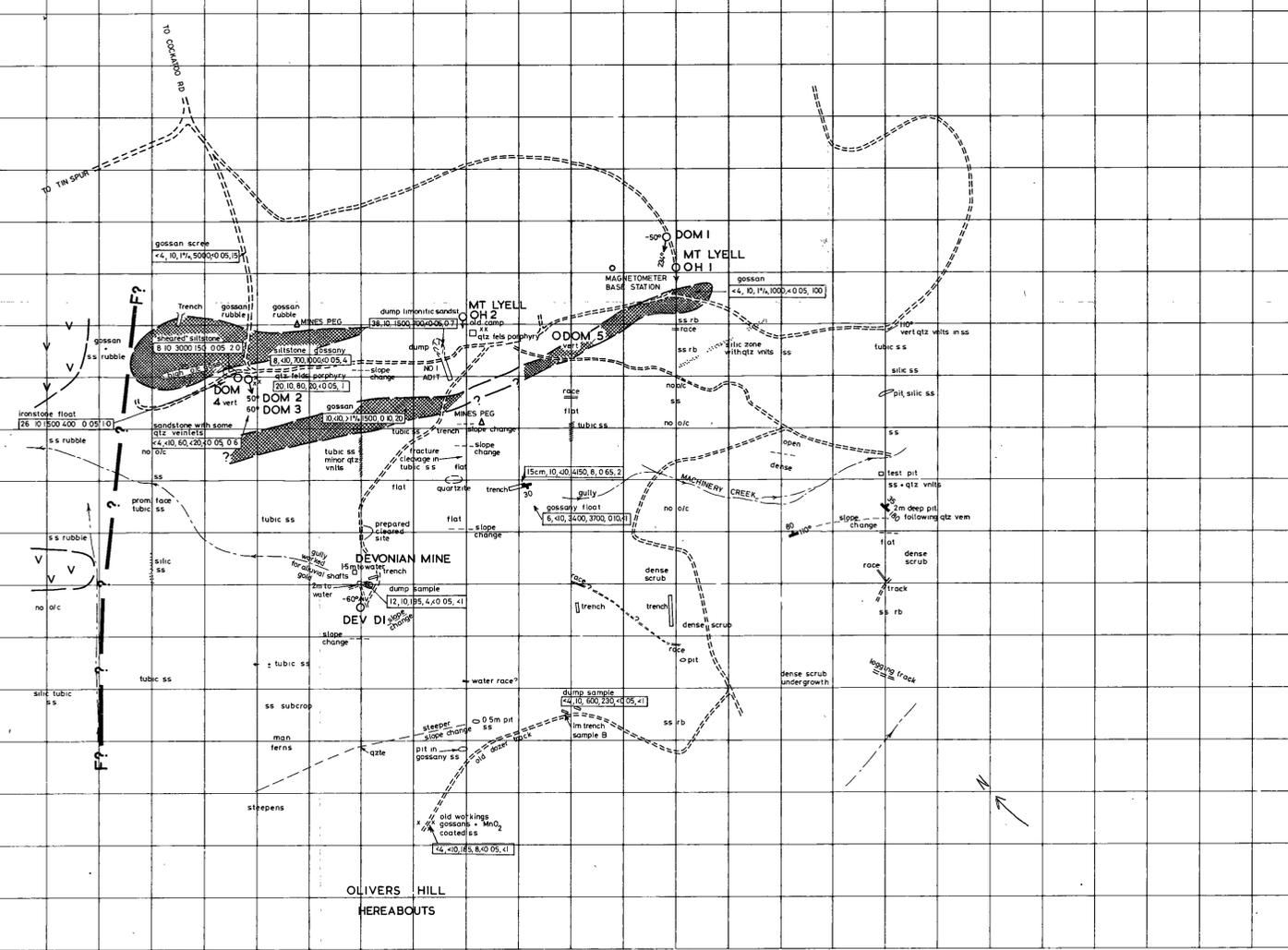
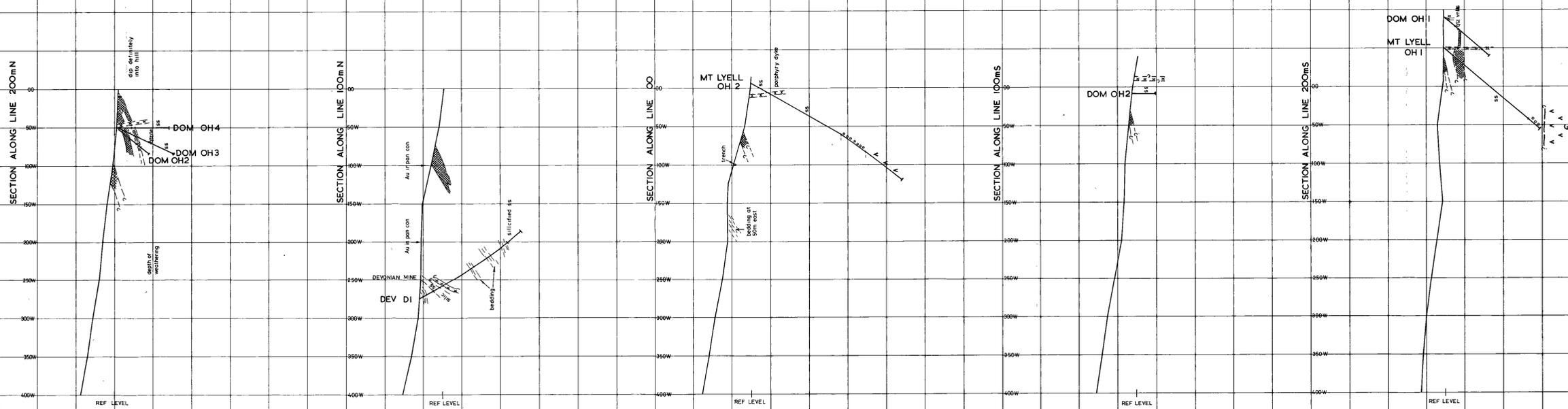
C O M A L C O

092204 E.L. 7/74 TASMANIA SPC-14/30

DEVONIAN GRID

GRID LINE SLOPES 3212

Compiled	O. Heddtich	Revised	O. Heddtich
Date	Mar 1980	Scale	1:2500
Dwg No	TAS-80-339		



TERTIARY	V V V	Basalt
DEVONIAN	X X X X X	Iron-manganese rich gossan after pyritised galena-bearing sandstone
	X X X X X	Quartz-feldspar porphyry
ORDOVICIAN		Silicified sandstone
		Mona sandstone usually fibular
CAMBRIAN	A A A	Wolgal conglomerate
	A A A	"Porphyry" - welded tuffs

Key to sample analyses Sn, W, Pb, Zn, Au, Ag

NOTE DOM 1, 2, 3, 5 ARE MINES DEPT DIAMOND DRILL HOLES OH 1, 2, 3, 5

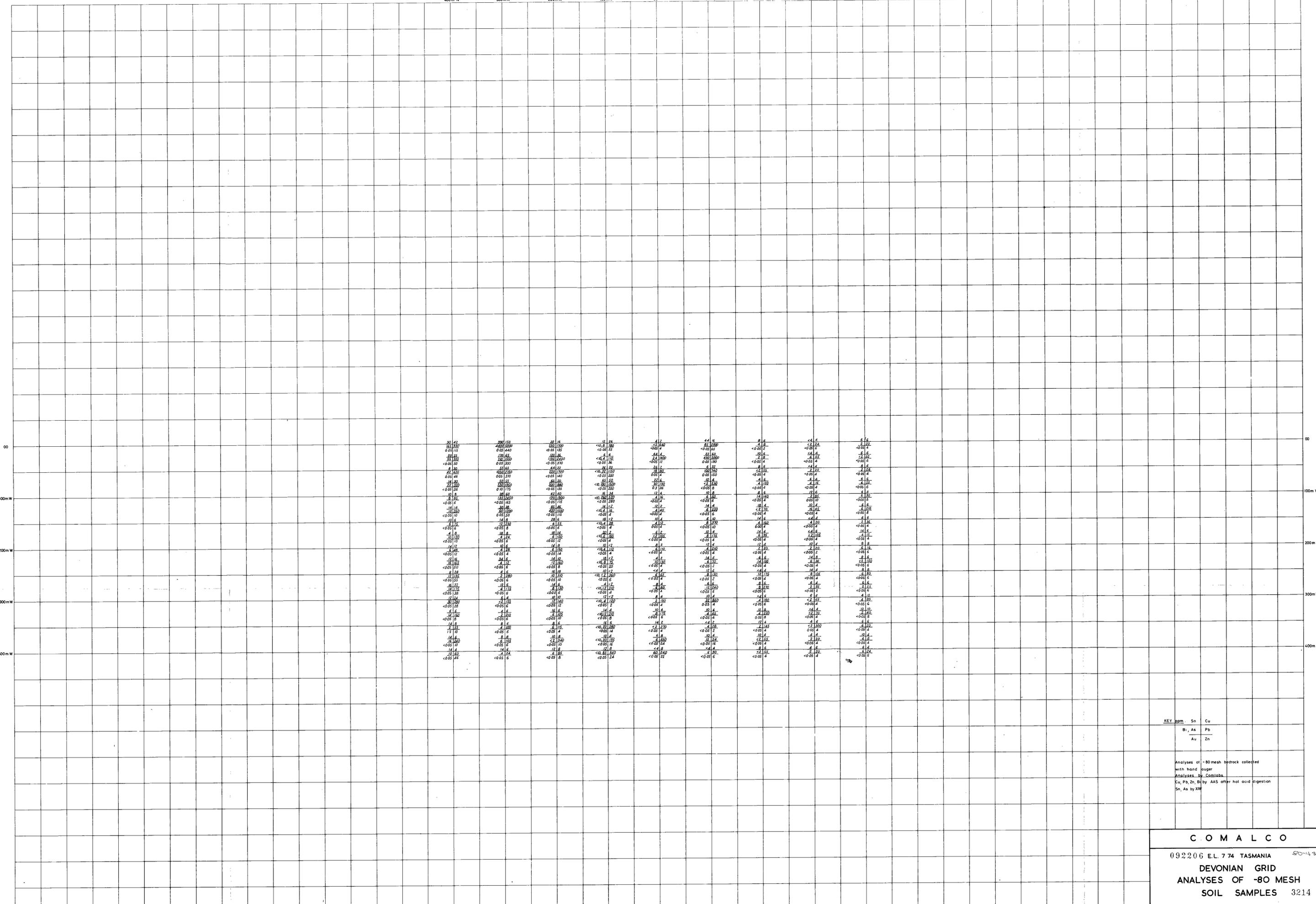
C O M A L C O

92205 E.L. 7/74 TASMANIA 870-430

**DEVONIAN GRID
GEOLOGY
AND
DRILL SECTIONS 3213**

Compiled P.W. Askins	Revised	Drawn O. Heddtich
Date May, 1980	Scale 1:2500	Dr. No. TAS-80-394

400m N 300m N 200m N 100m N 00 100m S 200m S 300m S 400m S



400m N 300m N 200m N 100m N 00 100m S 200m S 300m S 400m S

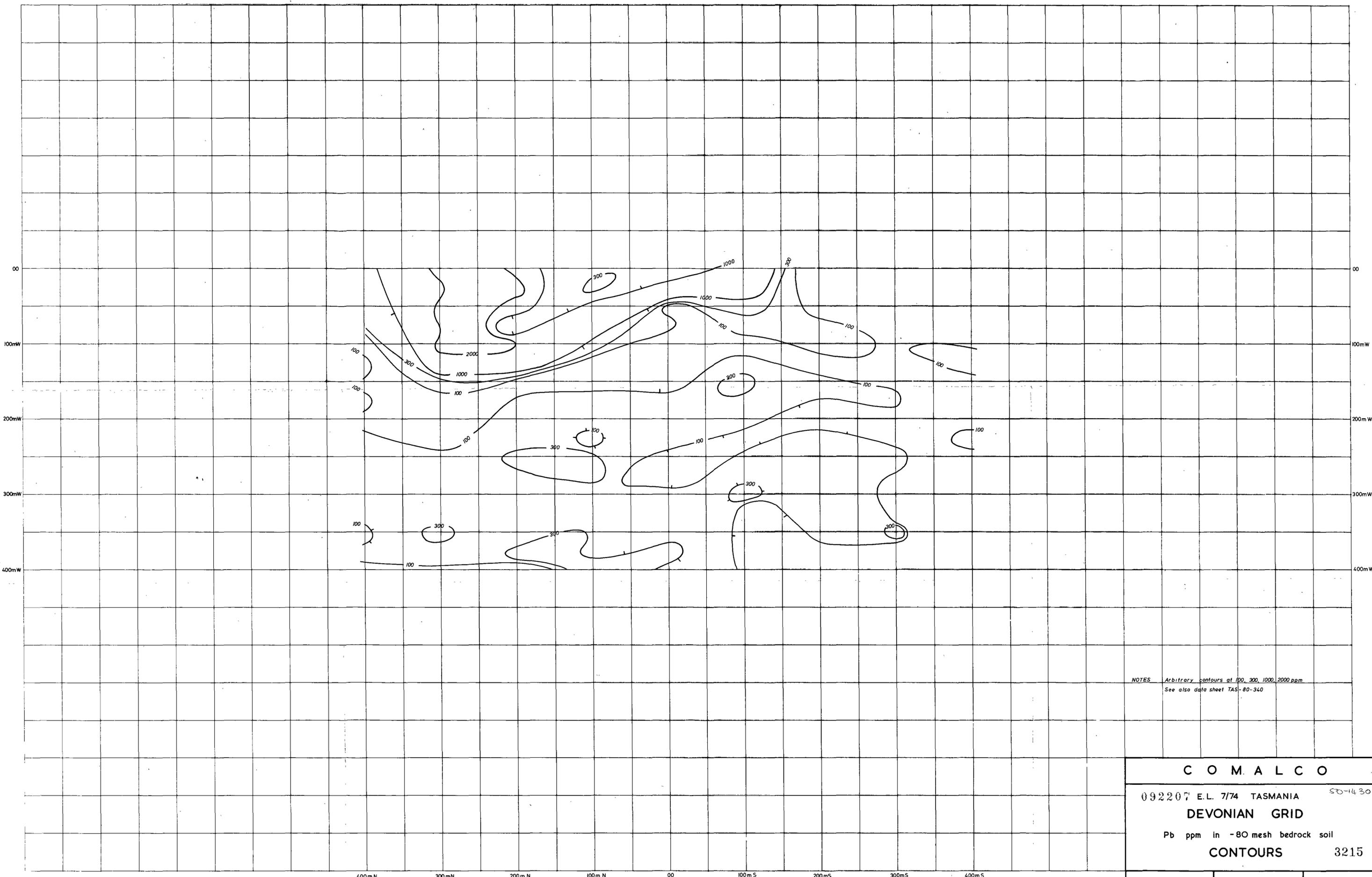
5 cm

KEY ppm Sn Cu
Bi, As Pb
Au Zn

Analyses of -80 mesh bedrock collected with hand auger. Analyses by Comlabs. Cu, Pb, Zn, Bi by AAS after hot acid digestion. Sn, As by XRF.

C O M A L C O
092206 E.L. 774 TASMANIA
DEVONIAN GRID
ANALYSES OF -80 MESH
SOIL SAMPLES 3214

Compiled O Hedditch Revised Drawn O Hedditch
Date Mar 1980 Scale 1:2500 Drg. No. TAS - 80-340



NOTES: Arbitrary contours at 100, 300, 1000, 2000 ppm.
See also data sheet TAS-80-340

C O M A L C O

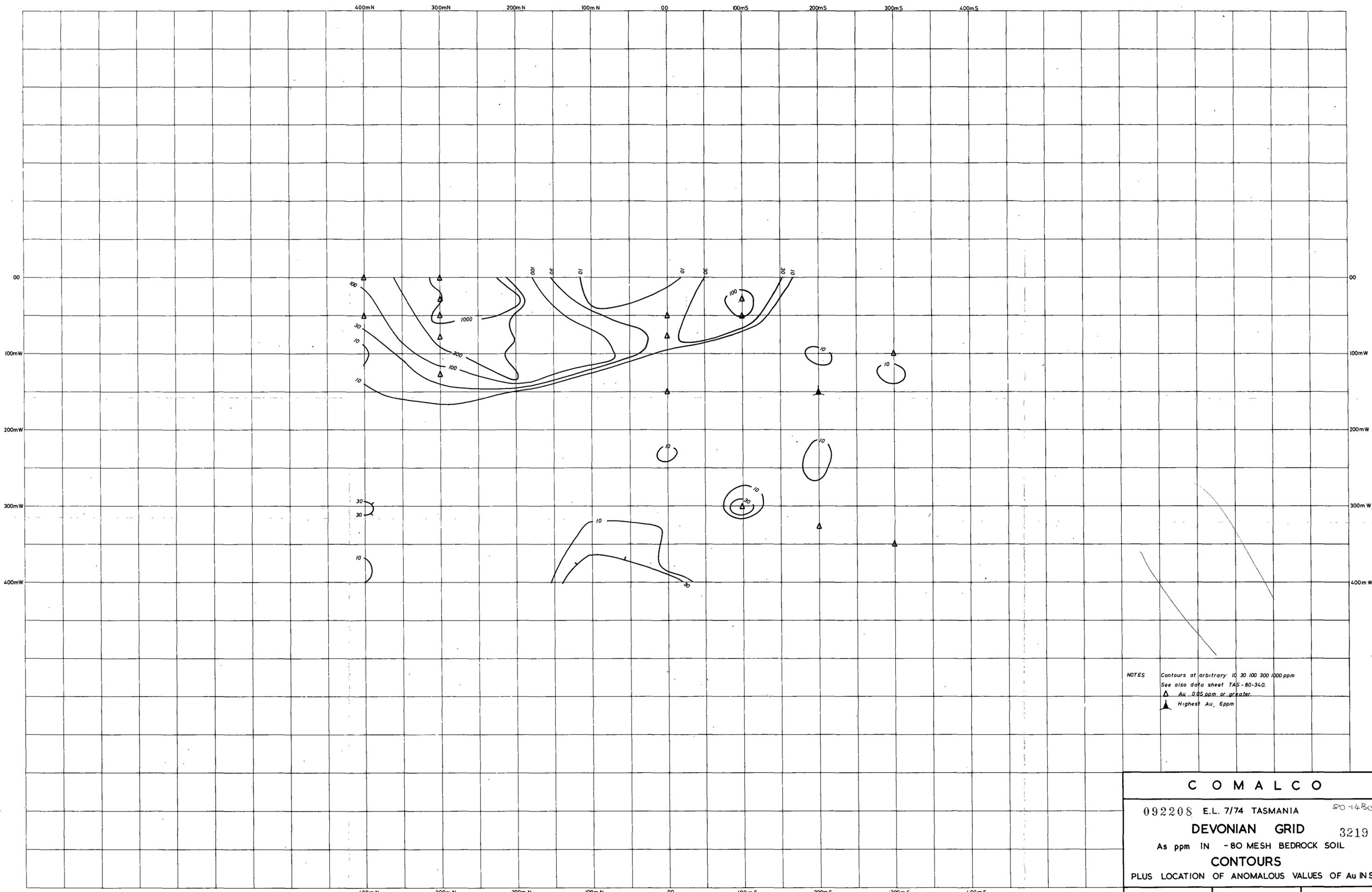
092207 E.L. 7/74 TASMANIA 50-1430

DEVONIAN GRID

Pb ppm in -80 mesh bedrock soil

CONTOURS 3215

Compiled	P W Askins	Revised		Drawn	O Hedditch
Date	May, 1980	Scale	1:2500	Drg No	TAS - 80 - 393



NOTES
 Contours at arbitrary 10 30 100 300 1000 ppm
 See also data sheet TAS-80-340.
 ▲ Au 0.05ppm or greater.
 ▲ Highest Au, 6ppm

C O M A L C O

092208 E.L. 7/74 TASMANIA SP0-14B0

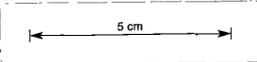
DEVONIAN GRID 3219

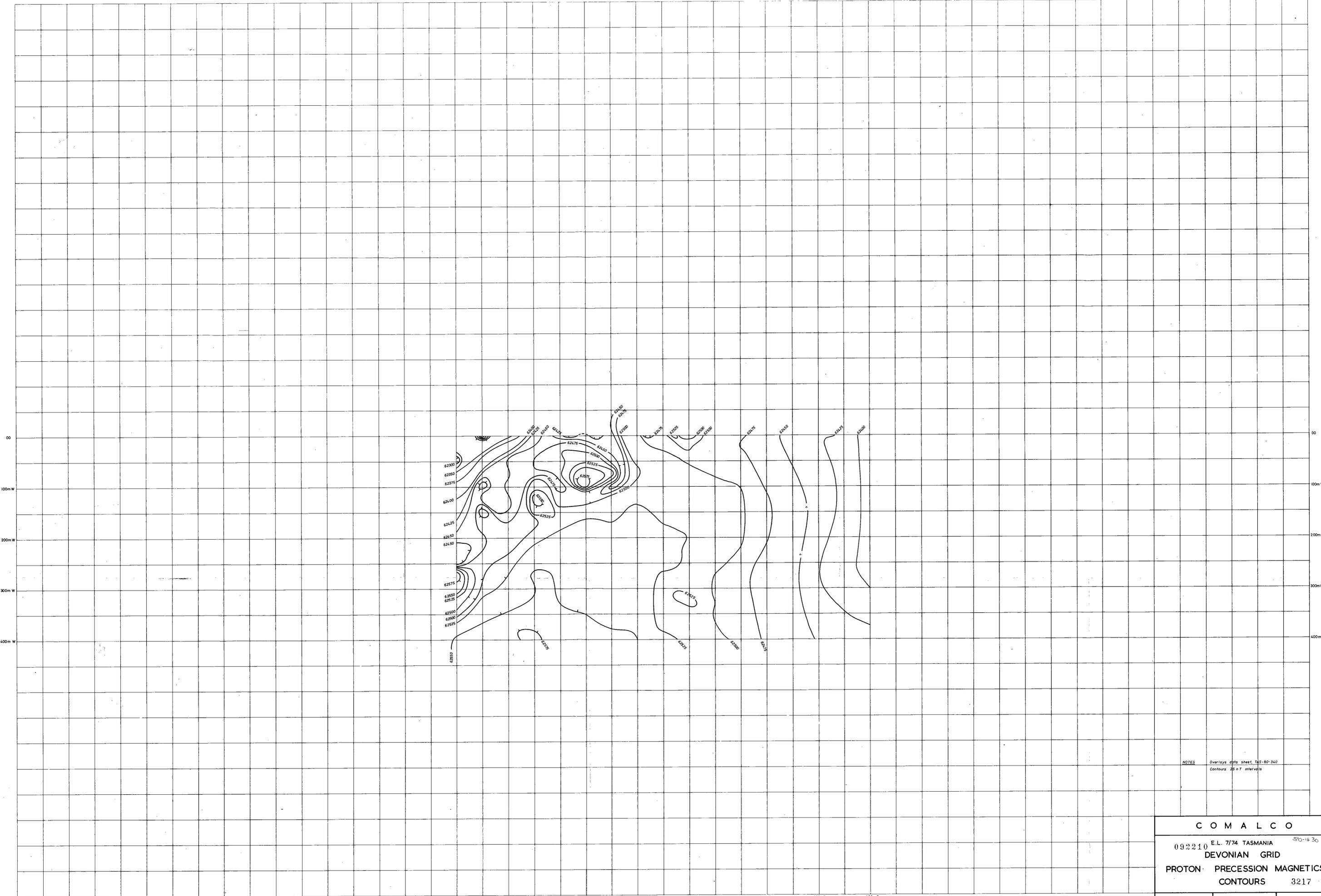
As ppm IN -80 MESH BEDROCK SOIL

CONTOURS

PLUS LOCATION OF ANOMALOUS VALUES OF Au IN SOIL

Compiled P Askins	Revised	Drawn O Hedditch
Date 1st May 1980	Scale 1 2500	Drg No TAS 80 392





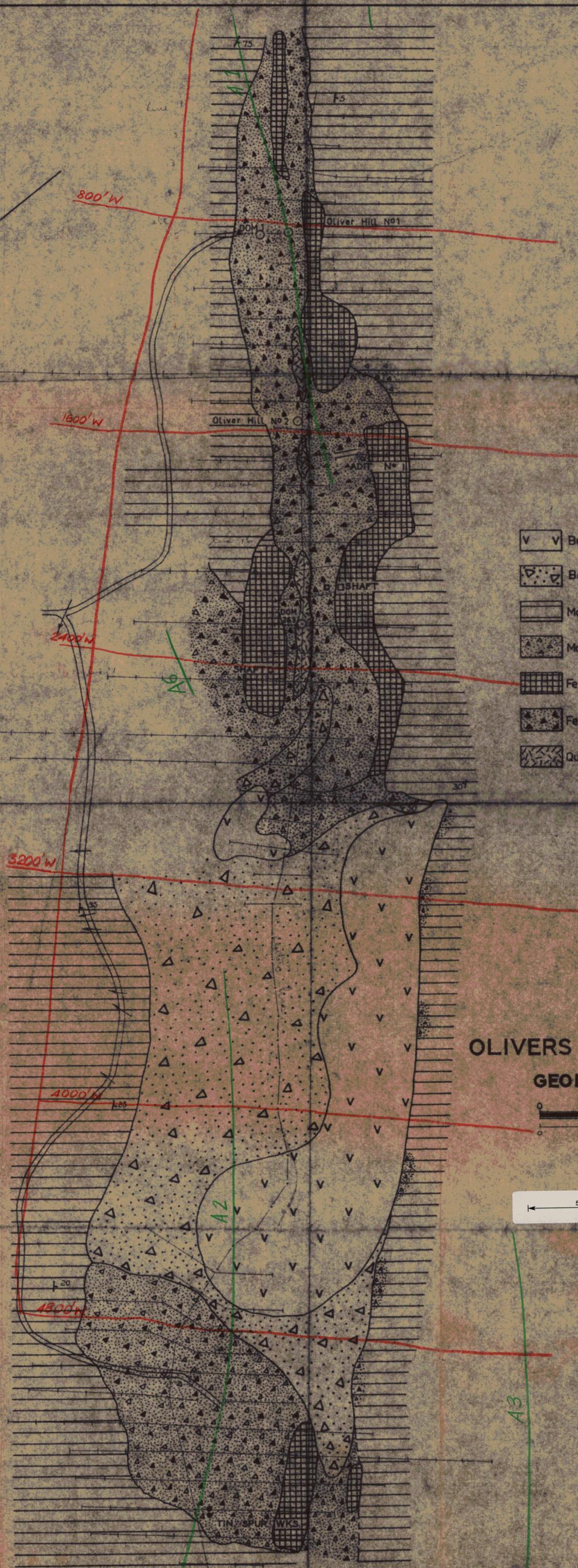
NOTES
 Overlays data sheet TAS-80-340
 Contours 25 nT intervals

C O M A L C O

092210 E.L. 7/74 TASMANIA 570-14 30
DEVONIAN GRID
PROTON PRECESSION MAGNETICS
CONTOURS 3217

Compiled	P. W. Askins	Revised		Drawn	O. Hedditch
Date	April 1980	Scale	1:2500	Dwg. No.	TAS-80-391

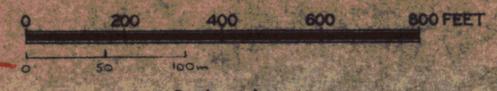




- Basalt
- Basalt talus
- Maine Sandstone
- Maine Sandstone talus
- Ferromanganese
- Ferromanganese talus
- Quartz feldspar porphyry

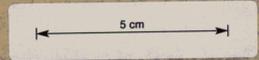
center line corals shown on grant profiles

OLIVERS HILL - SHEFFIELD GEOLOGICAL SURVEY



Geology by
G. PIKE

Close to 1:2500



— I.P. Trends
— Mt Lyell grid