REPORT ON E.L. 53/70

MT. LIVINGSTONE - STANLEY REWARD

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ABSTRACT·

Because of access difficulties the Exploration Licence Area 53/70 on the West Coast of Tasmania has not been well prospected in modern times. With the exception of some drilling by Aberfoyle in the Mt. Lindsay area, and some old workings at the Stanley Reward gossan and Livingstone Creek gossan, there has been no sub-surface exposure.

The host rock for all the major mines in the area, the Success Creek Phase, has been identified, and it traverses the area at least intermittently, from the south east corner near Renison Bell to the north west corner near the Rocky River mine area. For much of this distance it is in contact with the Meredith Granite or the Crimson Creek Argillite. However, as the latter formation is believed to be underlain at shallow depth by the Meredith Granite, the whole course of this Success Creek Phase within the area is highly prospective for tin.

Economic mineralisation within the area appears to be mainly cassiterite with some prospects also of zinc, copper, silver and lead in either stratabound replacement mineralisation, or there is a possibility of a carbonatite mineralised with base metal sulphides at the Stanley Reward.

The area does contain some known 'ore reserves':-

At Mt. Lindsay there is a drill indicated reserve of 73,300 tons of 0.926% Sn, and an inferred reserve of 26,600 tons of 0.407% Sn.

On the edge of the Stanley Reward there is a tin gossan, which detailed channel sampling showed as containing 740 tons per vertical foot of 1.14% Sn.

At Livingstone Creek 1¼ miles to the north west, there is a very large gossanous lode at least 800 ft. long and 25-100 ft. wide which requires sub-surface testing.

The future program should concentrate on ensuring adequate access initially, followed by detailed geological mapping. As there is little exposure, there must be a considerable amount of costeaning. The next seasons program should cost $52,000, and from then on it should be possible to operate effectively within the area for most of the year and in almost any weather.

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1. GENERAL DESCRIPTION

1.1 Location and Access

(a) Exploration Licence Area

Initially application was made for an Exploration Licence of 85 square miles in the Stanley River, Mt. Livingstone area in 1968. After repeated pegging and submissions an area of 40 square miles was granted as from the 10th of December 1970 and a further 4 square miles granted on the 17th of November, 1972. The licence is granted for all minerals.

(b) Location

The area is in the central west coast of Tasmania, roughly mid way between Renison Bell and Savage River. It contains most of the country drained by the Stanley River into the Pieman River.

(c) Access

The Pieman River has always been a major barrier to access from the east, south and west. The area to the north is densely vegetated for most of the 20-25 miles to Waratah.

At this stage in exploration the area is best approached from Renison or Zeehan. There is a vehicular track from Zeehan to the cage over the Pieman River near the entrance of the Stanley River. From the northern side of the cage there is a well defined foot track, mostly travelling along the ridges, to the Stanley Reward.

It is usually possible to ford the Pieman in summertime, (January through to March), when the river is often only 2-3 feet deep, near both the cage crossings. The rest of the year the river is generally too high.

A track to cross the Pieman near the Stanley has been marked out preparatory to bulldozing. Recently Renison Ltd. have improved the Comstaff track from Renison Bell to the Pieman-Wilson River junction. They have driven a track for about three miles north of the Pieman towards Mt. Lindsay. Part of this track could be used for access to our country east of the Stanley and then crossings of the Stanley constructed. However, although the Stanley is not a big river, there is almost instant runoff from its watershed and crossings would wash out frequently.

Most of the country west of the Stanley with the exception of Mt. Livingstone itself, is steep but fairly open. Here access is no problem, although the gullies generally contain dense vegetation.

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Until such time as the Pieman Dam at Stringers Rivulet is filled there will always be major problems in getting equipment and most supplies into the area. When the dam is filled barges could be used near the Stanley. Otherwise, we are limited to access in summer only by fords.

The practical approach is to construct a landing strip for fixed wing aircraft north of the Pieman. Fuel, diamond drills, men and supplies could then be brought in or out at most times of the year. Only earth moving plant would be stranded until the summer seasons.

A suitable site for a strip 2000 feet long is on an east-west ridge two miles south of Mt. Livingstone at an altitude of 1650 feet midway between the headwaters of the Paradise and Meredith Rivers. The area has no gullies, is reasonably flat, draining well and containing large quantities of gravels. There are no trees or mountains in line with the approaches. Prevailing winds would probably be from the west to south west.

(d) Infrastructure

If a mineable ore deposit were located in the area infrastructure costs would not be very high as access to markets would presumably be via the Emu Bay Railroad, which at Renison Bell is three miles from the south east corner of the property.

It is presumed that power from the Pieman River hydro electric scheme would traverse the southern margin of the area. There are ample supplies of water available within the area together with large numbers of skilled miners and contractors. Zeehan is growing rapidly in population with room for expansion.

With regard to location, Zeehan is 181 miles by road to Launceston, 180 road miles to Hobart, and 95 miles to Burnie. There is a bitumen landing strip at Zeehan which would be about 14 miles south east of the proposed landing strip near Mt. Livingstone.

1.2 Historical, Past Exploration

Although the area has been well prospected for alluvial tin and there has been modest scale mining at the Stanley Reward alluvial area and the Mt. Lindsay tin lodes, there has been very little in the way of geological investigations. Prospecting of this area has been greatly retarded because of access difficulties. Also, the Oonah Quartzite and Slate was generally regarded as unprospective.

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Waterhouse, (1914), has supplied most of the geological data. There has been subsequent regional investigation of some parts of the area by the Mines Department, (B.L. Taylor, 1954), and within a Doctoral thesis by D.I. Groves. Some regional work has also been carried out by Rio Tinto, (W.J.Atkinson, 1955/6), and Aberfoyle worked on part of the area for many years drilling the Mount Lindsay lodes.

1.3 Physiography and Geography

(a) Relief

The area of interest is generally mountainous, the highest point being Mt. Livingstone at 2564'.

The river system around the area consists of a series of tributaries running into the Pieman. The major watercourses are the Wilson and Stanley Rivers, the headwaters of the Paradise and Rocky Rivers, and Northridge Creek. The importance of the pattern of drainage is that all the rivers have been rejuvenated by uplifting within the region. This has resulted in a great degree of erosion, particularly at the headwaters, downcutting, and the subsequent dissection of the area and the formation of a series of ridges.

The Pieman River itself is in the process of downcutting and in places its banks are at an angle of 30° or more, adding to the difficulty of crossing the river when the water level is high.

(b) Rainfall

At Zeehan the average annual rainfall is 97 inches at an altitude of 500 feet. It is thought that the rainfall within the Licence area would be greater than this. Most of the rain falls from April to November.

(c) Vegetation

Button grass is the most common type of vegetation within this area giving clear open regions, particularly along erosional surfaces and the ridges. Thicker vegetation is usually confined to the rainforest areas, mainly around Mt. Lindsay, Mt. Livingstone, and along the Pieman valley, and the 'horizontal' scrub and bauera within the gullies and along the river beds.

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2. GEOLOGY

2.1 Regional Geology

The oldest rocks in the area would be the Whyte Schists of earlier Proterozoic age to the west of our area. They contain sericite schists, quartz mica schist, and a schistose quartzite riddled with barren, milky quartz, mostly highly deformed.

The Oonah Quartzite and Slate is believed to be of upper Precambrian to lower Cambrian age. It consists of sandstone, quartzites, siltstones and shales. The uppermost portion of the sequence contains spilitic lava flows and pyroclastic bands and is called the "Success Creek Phase" in the Renison area, and the "Success Creek Group" in the Zeehan area and west of the Wilson River. The main difference between the two being the presence of carbonates and sandstones in the "Phase" but not in the "Group".

As there are dolomites, calcite and calc silicates near the south western margin of the Meredith Granite plus sandstones in the horizon running around the western edge of this Granite, it is thought that the continuation of this sequence to the west of the Meredith Granite represents the "Success Creek Phase" rather than being part of the "Success Creek Group" as mapped by Taylor in 1954. The "Success Creek Phase" is recognised again at Mt. Bischoff to the north east of the Meredith Granite. Here it is called the Mr. Bischoff Sequence. There does appear to be stratigraphic continuity north and south of the Meredith Granite of other units as well.

Further to the north west of the Licence area at the Savage River Mine workings, it is understood that at least part of the iron ores represent the oxide facies of a large ?Proterozoic massive sulphide body associated with the dolomite and amphibolites. There are some dacites within the amphibolites.

Aeromagnetic patterns suggest southward repetition of the magnetite bodies just to the west of our area in the Paradise Creek and also at the Meredith River. It further suggests that the amphibolites diverge from the Rocky River towards Corinna. These may be what was called the Bernafai Volcanics. In addition, there is a sequence of magnetic lows trending south east from the Stanley Reward and close to the top of the Oonah Quartzite and Slate unit. This is coincident with the horizon of the Success Creek Phase. A small

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ridge of aeromagnetic highs runs from the Stanley Reward area to the Rocky River. It is thought that this would represent continuity of the hematite magnetite lodes all the way to the Rocky River Mine which is known to be a magnetite, hematite, pyrite and chalcopyrite deposit.

It appears that the Crimson Creek Formation lies in most places, conformably on the Oonah Quartzite and Slate. It consists predominantly of mudstones and shale with quartzites, greywacke and also minor intermediate to basic volcanics, chert, conglomerate and calcareous shales with some thin tuff horizons.

Mineralization appears to be located mainly in the "Success Creek Phase" and, to a lesser extent, in the Crimson Creek argillite. There appears to be both stratiform base metal mineralization, probably synvolcanic, and also replacement mineralisation derived from the Devonian granitic fluids. The economic minerals are cassiterite, chalcopyrite, sphalerite, silver and galena. There has been some nickel, copper, asbestos and osmiridium recovered from areas of Upper Cambrian ultramafic intrusion.

Most base metal mineralization appears to be related to the acid Mt. Read Volcanics; however, in some cases it appears to be associated with the more intermediate to basic volcanics. It is reported that the Mt. Read Volcanics are interbedded with the Oonah Quartzite and Slate at Que River and would be partly equivalent to it.

2.2 Geology Within the Licence Area

The area is comprised of the Oonah Quartzite and Slate, and its southern and south western contact with the Meredith Granite. There is also about 2 square miles of the Crimson Creek Formation between the Stanley Reward and the Mt. Lindsay mine. In addition, there are small areas of Pleistocene gravels at Livingstone Creek and the Stanley, both of which have been sluiced for tin.

(a) The Oonah Quartzite and Slate

Petrographic descriptions by Dr. G.J.H. McCall are attached. Samples Z1 to Z21 are of the Oonah Quartzite and Slate, and samples Z34 and Z35 are from the Success Creek Phase, or Lower Crimson Creek Formation.

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It is suspected that the mafic and ultramafic intrusions reported further south with the Cambrian units are also present in the Oonah Quartzite within the south west corner of our area, although these have not yet been found as outcrop. The aeromagnetic and geochemical results strongly support such a conclusion.

The intermediate to basic volcanics described south of the Pieman as Montana Melaphyres are suspected to also occur within the area north of the Pieman. These rocks normally weather deeply and even in an area of good exposure would be hard to find.

(b) The Crimson Creek Formation

Within the Exploration Licence area this unit contains a sequence of geosynclinal Cambrian sediments consisting mainly of greywackes with minor volcanics and shales which have been tightly folded and faulted. Around the Mt. Lindsay area and to the south east there has been a repetition of a favourable host rock, a dolomitic horizon by axial plane faulting.

The Formation within the Licence area is probably underlain at a shallow depth by the Meredith Creek Granite. In areas to the east and south east this formation is known to contain small bodies of Cambrian amphibolite, pyroxenite, serpentinite and undifferentiated basic and ultrabasic rocks.

In the Mt. Lindsay area the Alston Volcanics, probably of andesitic composition, contain pyrrhotite, chalcopyrite and actinolite as common minor constituents. The underlying Neagle Beds contain some thin tuff horizons, one of which at least, contains disseminated pyrrhotite and another chalcopyrite.

Most other rock units in this area carry abundant pyrite and pyrrhotite. The granite is believed to dip at 25 to 26^{o} in a south easterly direction underneath this formation.

(c) Stanley Reward Dolomite

Waterhouse, in 1914, described an extraordinary crystalline dolomite in contact with the granite, the Crimson Creek Formation and also the Oonah Quartzite. He could not correlate it with the Ordovician Gordon Limestone at all. As he could not visualise it as being intrusive to the granite it was considered to be pre Jurassic. However, it is also possible that this could be part of a carbonatite intrusion.

The age of the Stanley Reward dolomite is not known but it is known to be mineralised. Waterhouse described it as pure white but containing bands of magnetite and in thin section, forsteritic olivine. There had been subsequent silicification in places and the development of magnetite dykes 8-9 feet wide with magnetite present in massive, aggregate and scattered crystal form. This hardly seems consistent with a sedimentary dolomite.

Exposure of the dolomite was poor because of a thick covering, in places over 30' deep, of pug, believed to be derived from the weathered dolomite. However, Waterhouse observed disseminated pyrite in many places and also the presence of "asbestos". He also noted the presence of a pyritic area within the dolomite which contained only three minerals, pyrite, cassiterite in abundance, and stilbite. The cassiterite post dated the pyrite. Surface sluicing of the pug revealed abundant crystals of pyrite and pyrrhotite, galena and sphalerite.

There are, of course, a number of other possible explanations for the presence of the mineralised dolomite. However, it is not of great consequence at this stage how it got there. Dolomites in this environment and location make excellent host rocks for replacement mineralisation in an area which is known to be highly mineralised.

(d) The Meredith Granite

This intrusion of approximately 300 square miles in area is classified as an adamellite and is probably a multiple intrusion. From slope measurements confirmed by drill data, it slopes at an angle of 25 to 26 degrees in the south east under Mount Lindsay Mine and towards Renison. The contact on the south western margin appears to be nearly vertical.

The source of the cassiterite ore bodies at Mt. Bischoff, Renison and Queen Hill is believed to be replacement of the Success Creek Phase by means of Devonian granitic fluids. In the case of the Cleveland, Mt. Lindsay and Razorback Mines it was by replacement of the Crimson Creek Formation.

The granite has a considerable metamorphic aureole. It would undoubtedly be the source of the tin in the Livingstone Creek lode and the Stanley Reward, but it is surprising that there is not more cassiterite, boron or fluorine rich minerals present in the dolomite plug, which would have represented an ideal replacement medium if it were Devonian.

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2.3 Structural Geology

There is little detailed data available on the Exploration Licence area. Major structures were produced by the Tabbarabberan movements, with the major trends heading to the north west. Dips are generally very steep, and minor folding is intense and common.

From the south the following structures have been recognized:-

The Huskisson syncline trending N.W. in the south and swinging around to the N.N.E. in the north.

A N.W. trending anticline two miles east of where the Stanley River joins the Pieman.

The Northridge Fault crossing the Pieman at the Stanley River junction and heading N.W. to Northridge Creek.

A N.W. trending fault crossing the Pieman near where the Wilson River joins the Pieman. This is close to the Cambrian-Precambrian contact.

Two N.W. trending inferred faults crossing the Pieman roughly by Lone Hill Creek and the Western Rivulet.

An inferred fault trending W.S.W. from Mt. Livingstone with tight minor folds evident in resistant beds just south of Paradise Creek near the western edge of the Licence area.

Some closely spaced synclines and anticlines in the Crimson Creek Formation south east of Mt. Lindsay. These trend N.W.

At Mt. Lindsay, some very tight folding of the Crimson Creek Formation accompanied by axial plane faulting.

Taylor in his 1954 Report on the 'North Pieman Mineral Area', made a structural analysis of the country to the east of the Huskisson Syncline from which we extract the following paragraphs:

'The net result of these movements has been that the general area Rosebery - Renison Bell - Crimson Creek - Copper Nickel Field - North Dundas - Ringville - Williamsford - Rosebery, is a structural "high" occurring at the intersection of two fold axes roughly at right angles to each other, and further, it has been subjected to considerable stress from the east-directed pressure to the north and the west-

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directed pressure to the south. Thus it has been considerably contorted and fractured. The chief structural feature which has emerged from the present investigation is the extreme contortion and fracturing of the general area above specified. This has made it a most likely area for potential mineralisation.

Although the present writer has not extended the work outside the area of the two major folds, some evidence has been obtained to show that further folds exist parallel to the two mentioned. It is considered that, when the complete picture is formed, it will be shown that, over the North Pieman area and extending southwards to include the Dundas and Zeehan districts, there are a series of east-west trending anticlinal and synclinal axes, and that between Rosebery and the sea coast there is another series of such axes trending slightly west of north. The structural highs produced by the intersections of these fold axes, especially where fractured by tearing movements, are potential areas of mineralisation.'

From our own airphoto interpretation there appeared to be 28 ring structures observed in a band trending N.N.E. When some of these were examined on the ground however, they were found to be incomplete circles and these structures are now believed to be related to intense minor folding of the Oonah Quartzite. They occur both north and south of the Pieman River. The fold axes have not yet been determined but, in addition to the local N.W. trends, there are, in areas to the north east near Waratah, and to the north west near the Donaldson River, prevailing N.N.E. trends in the Oonah Quartzite and Slate.

Examination of the regional aeromagnetic data of Rio Tinto Exploration and the local aeromagnetic data of Aberfoyle Ltd. shows that the band of intense aeromagnetic highs related to the Savage River iron ore deposit splits into three groups around the Rocky River Mine area.

The main group continuing due south gives two spot highs which at outcrop are known to be magnetite deposits. The divergence to the south south-west is a continuous ridge which is probably related to the 'Bernafai Volcanics' To the south east there is another low ridge of magnetic highs which runs to the Stanley Reward area. This is flanked by a line of distinctive magnetic lows. These lows are thought to describe the Success Creek Phase, showing its continuity from the Pieman-Wilson River junction and extending at least to the Stanley Reward.

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The ridge of magnetic highs from Rocky River to the Stanley Reward area is coincident with the known magnetite skarn gossan in Livingstone Creek and the small gossan just north of the Stanley Reward. This may indicate continuity of the metamorphic effects of the granite intrusion all the way to Rocky River.

2.4 Economic Geology

Within this region there has been considerable mining development . Former mines of consequence include:-

Mt. Bischoff - Sn
Waratah area - Pb, Ag, Cu, Sn
Zeehan, Heemskirk area - Ag, Pb, Zn, Sn from many mines
Dundas area - Ag, Pb, Zn, Sn
Chester mine - pyrite

The major mines currently working are:-

Mt. Lyell - Cu, Ag
Rosebery, Mt. Read area - Zn, Pb, Cu, Ag, Au
Renison - Sn
Mt. Cleveland - Sn, Cu
Savage River - Fe

Two prospects at least have been suggested as likely for development in the near future:-

Queen Hill - Sn and base metals
Razorback - Sn

Many of these mines are, or were, of large size. Details of their output and geology is well documented. It would seem that such a high density of ore bodies in an area of poor exposure and difficult prospecting conditions suggests that the potential for repetition of mineralisation is good. Some of the ore bodies appear to be of submarine exhalative massive sulphide type, but in a number of cases the genesis of ore bodies is hard to explain adequately and ore controls are not known well enough.

Within the Exploration Licence area there has been lode mining for cassiterite at Mt. Lindsay and at the Stanley Reward, with alluvial mining for tin in the Stanley Reward area and the Livingstone Creek flats There was some lode and small scale alluvial mining for tin within the Meredith Granite. It would appear that access difficulties and high packing costs severely restricted economic development in this area of known mineralisation.

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2.5 Economic Potential

(a) Tin

Aberfoyle Ltd. examined the Mt. Lindsay Mine area from 1963 to 1970 and established drill indicated reserves of 600,000 tons of about 0.8% Sn. Details are not available as yet. Part of these reserves are known to exist within our Licence area and they are not covered by Mining Lease.

We have obtained a copy of the 1963-64 drill results showing an indicated 73,300 tons of 0.926%Sn with a further 26,600 tons of 0.407%Sn within our area.

Much of Aberfoyle's testing for Sn seemed to be based on the magnetite-tin connection and self potential anomalies. Their test results showed that although cassiterite occured outside magnetite and self potential highs, these geophysical techniques were still the primary search tools used.

Large scale geochemical anomalies for copper were also located. There were reports of abundant fluorite, axinite and a little scheelite in places. Further exploration in the Crimson Creek Formation seems justified.

At the north west margin of the Stanley Reward there is a small stanniferous gossan lode. It has a few small shafts and a small adit on the lode which, at outcrop, is 300 feet by 25 ft. Aberfoyle Ltd. systematically channel sampled this lode and came up with a result of 740 tons per vertical foot averaging 1.14 Sn at outcrop.

There is also a large stanniferous, skarn like gossan at the head of Livingstone Creek. This is a limonite-hematite-magnetite body with the iron oxides in a peculiar radiating or spherulitic crystalline form. It is cut in two by a central fault and is at least 800 feet long at outcrop, 25-100 feet wide, and up to 30 feet above the creek bed. It is entirely within sedimentary rocks. Thin sections and an occasional gossanous appearance show the presence of fine sulphides.

Surface testing by both Aberfoyle and ourselves showed tin values to be sporadic and variable with a maximum of 0.79%. For our most recent traverse we endeavoured to sample fresh rock - preferably magnetite. This line of samples showed reasonably consistent results averaging 0.44% Sn. There is also prospect for extension of this deposit as similar spherulitic limonite was found at least 600 ft. upstream of outcrop. The country here is very densely vegetated, and it appears that this deposit justifies some exposure and costeaning and, probably some subsurface testing.

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The Livingstone Creek and Stanley Reward alluvial flats would both contain substantial tin bearing alluvium. If access were improved and earth moving machinery could get into the area it would undoubtedly justify detailed testing and some treatment. Aberfoyle Ltd. carried out some early estimates of volume prior to trenching and testing the flats. They conservatively estimated 500,000 cubic yards of gravels at the Stanley Reward, and half this at Livingstone Creek. We do not have test results, but cassiterite is frequently evident.

There is also reputed to be a stanniferous gossan south west of Mt. Livingstone. The gossan was not located in the time available, but the markers mentioned were all located exactly as described.

It is likely that the western margin of the Meredith Granite beyond the upper Livingstone Creek deserves investigation for tin. The Success Creek Phase south east of the Stanley Reward would also seem to require prospecting when access is improved.

(b) Base Metals:

The dolomite plug at the Stanley Reward, described by Waterhouse as being at least 30 acres in extent, must make an important prospect, as it is known to contain sphalerite, galena, and in calcareous rock to the south east, chalcopyrite. If this is pre Devonian it should carry abundant cassiterite in a similar fashion to Mt. Bischoff and Renison. If it is post Devonian it would probably be a carbonatite containing sulphides with a good prospect of economic success.

There is a consistent major geochemical anomaly near the headwaters of Paradise Creek. Heavy media stream concentrates show grossly anomalous zinc and copper and, in some cases, lead and silver. There is a high proportion of sulphides in grain counts and this area appears to be subnormal in tin mineralisation. The anomalies are probably related to the inferred fault running east-west and roughly halfway between Mt. Livingstone and the airstrip ridge. This position is also on the ridge of aeromagnetic highs which probably relates to granitic metamorphic effects or to the presence of volcanics. This area is 1¼ miles from the nearest granite outcrop. Costeaning and detailed geochemical mapping of this area is proposed.

It was noted that there were numerous mining leases pegged in 1892 and 1898 in the headwaters of both the Paradise River and Meredith River for copper and gold. No development is known.

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In the south east corner of the Licence area there are major geochemical anomalies in the streams draining the high ridges north of the Pieman River. This area is precipitous in places with dense bush and horizontal scrub in gullies draining high button grass ridges. As the geochemical anomalies are for Ni, Cr, Cu, Zn, Ag and Au, and the area is on a continuation of local trends from Melba Flats and Cuni Mines, it is thought that basic and ultramafic intrusives are also present north of the Pieman. Country rocks are probably part of the Success Creek Phase and further investigation of mineralisation is proposed.

In the south west corner of the Licence area near Northridge Creek major geochemical anomalies occur for zinc, copper, lead and chromium. This area is north of the Northridge Fault and near a large aeromagnetic anomaly which is probably an ultrabasic intrusion. The area is comparatively open with easy access, but exposure is poor. Further investigation is indicated.

3. Investigations to Date:

3.1 Library Research

A considerable amount of research has been undertaken to extract as much published data as possible from early reports.

The Geological Survey Bulletin, 15 by L.L. Waterhouse, 1914, has been most helpful in his detailed observations. The most recent publication, Geological Survey Bulletin No. 54 by D.I. Groves et al, 1973, gives some good geological data on Mt. Bischoff to the north. In 1969 A. Jessup detailed useful stratigraphy in the Mt. Lindsay area, and in 1954, B. Taylor produced an unpublished report on the geology of the North Pieman district.

There is some regional 100 gamma aeromagnetics produced for Rio Tinto in 1956 and we have obtained a copy of the 10 gamma aeromagnetic data taken over our area as produced for Aberfoyle Ltd.

The initial reading of the Waterhouse Bulletin suggested that the dolomite in the Stanley Reward area may have been a carbonatite, if so, it contained sulphides and made a good exploration target. It did not appear to be an Ordovician dolomite and if it were pre Devonian, it would be very surprising if it did not contain tin whilst less receptive host rocks around it did contain tin. Structurally the area appeared to be suitable for carbonatite intrusion. The location was near the edge of a stable Precambrian block adjoining a deep seated fault, (rift valley). There was the association of undersaturated rocks and ultra-basics in the area. Seventeen diamonds were known to have been found in the area, so that it was likely that kimberlites were nearby, and this area of the west coast of Tasmania is known to have ore bearing carbonate pipes of somewhat unusual origin.

The reported banded dolomite-magnetite at the Stanley Reward, and biotite associated with pyroxenite and an orthoclase phlogopite vein nearby are suggestive of carbonate emplacement. A volcanic rock adjoining a ring dyke close to the dolomite was found to contain aergerine-augite. There are a number of reports which suggest that this possibility of a mineralised carbonatite should be examined more closely. However, the origin of the rock is not of great importance yet. It seems at this stage that the dolomite is more likely to be part of the Success Creek Phase which has been remobilised by the Devonian granite. Alternatively, it may be part of a Cambrian intrusive which has been altered by the granite. The important thing is that it is a preferred host rock for replacement mineralisation and it is known to be mineralised. As such it becomes a good exploration target regardless of genesis.

3.2 Aerial Photography

It was thought that we might have a number of carbonate intrusives with ring dykes and alkaline ultrabasic mineral assemblages. Accordingly, we attempted, on a test basis, aerial photography of the area using Ektachrome, black and white infra-red, (2 different filters), false colour infra-red and compared these with the black and white prints of the Lands and Survey Department. In addition, a small part of the area was photographed in stereo multiband photography by QASCO.

The latter method was by far the most useful photography and also the most expensive. From the information obtained from these tests we came to a number of conclusions:-

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(a) The vegetation changes which occurred in our button grass areas seemed to be more related to microclimate than to geological differences.

(b) When we knew what to look for the ordinary black and white prints were quite adequate.

(c) It is very doubtful if thermal scan devices would work adequately in this very wet climate. Evaporative cooling would minimise any temperature differences which might have occurred.

The aerial photography showed a band of 28 or more ring structures roughly following the course of the Stanley. Some of these were examined in field traverses. There were a number of bare patches in the south eastern part of the area roughly outlining the north west surface trends.

3.3 Geochemistry

(a) Water Samples

In an attempt to pick up any unusual dolomite or limestones, stream water samples were collected in 1971 and examined for Ca, Mg and F.

Fluorine was found to be below our limit of detection. Calcium and magnesium results seemed to have two distinct populations, one related to the upper Precambrian, lower Cambrian terrain, and the other to the middle Cambrian, Ordovician country. Results showed that there were not widespread dolomites or limestones in the area.

(b) Stream Sediment Sampling

West coast Tasmania is known not to give a good response to conventional -80 mesh stream sediment sampling. Because of recent uplift and rejuvenated streams there is little in the way of representative fines. Also, the area is known to be highly pyritic and high concentrations of humic acid are to be expected. From this it can be seen that sulphides would undoubtedly disperse rapidly, and to get a useful measure of drainage we must take a very large sample of coarse sediments, (-8 mesh in this case). For convenience this sample is panned down and later subjected to a heavy media separation using bromoform. The heavy fraction is then grain counted and analysed. About half the samples were analysed by AMDEL for a wide range of elements by emission spectroscopy. The other half were examined for Cu, Zn, Pb, and in some cases, Ag, by atomic absorption and for tin by X-ray Fluoroscopy carried out by Labtech. All samples were prepared in the same way by Labtech.

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In certain defined areas covering the inferred Success Creek Phase extension from the Cuni copper-nickel mines to the headwaters of Paradise Creek, and also the narrow north west trending band near Northridge Creek, anomalous chromium and nickel are reported. It is thought that the anomaly paralleling the Success Creek Phase indicates substantial continuity of mafic to ultramafic intrusives all the way from Cuni to the Rocky River Mine.

In the same two areas of anomalous chrome and nickel we also obtained consistent defined major geochemical anomalies for zinc, copper, and to a lesser extent, lead and silver. It is thought that the mafic to ultramafic intrusives are not likely to be the source of zinc mineralisation and it is expected that intermediate to acid volcanics would be present.

The chemical results of stream sediment sampling must be considered in conjunction with the petrological data in the next section.

Samples high in base metals were found to be high in sulphides with chalcopyrite, sphalerite, pyrite and pyrrhotite being recognised.

The sulphides are widespread and quite sharp changes in tin and base metal results occur across the inferred Success Creek Phase boundary. This suggests that mineralisation is from many veins or is stratabound.

(c) Soil Samples

Soils are known to be highly leached and it is thought that little useful result can be derived from large scale soil sampling. A few traverses have been made across the 'ring dykes'. The only one which has been analysed to date proved to have been subjected to an abnormal preparation. After panning to a -8 mesh concentrate it was then passed through an 80 mesh sieve before heavy media separation. The results achieved were still unencouraging. Some slope soils were tested in the most recent traverse with a few mildly anomalous results in the Paradise Creek area. These results are shown in Tables No. 5 & 6.

(d) Rock Samples

Assays were made of a few of the rock samples collected. These are shown in Table No.7(a) and their location shown on Drawing 1.Some anomalous tin, copper and zinc as indicated.

.../17

Sample density was about 6 per square mile over the whole area. The sample population is large enough for worthwhile statistical analysis. Results for base metals and tin were plotted individually as cumulative frequency percentage of occurrence against the logarithmic percentage of each metal.

These charts give a measure of background mineralisation, the level of anomalous results, and an indication of multiple sources of mineralisation, if these exist.

Results obtained were as follows:-

- Sn - background, 100 p.p.m.; threshold and low order anomalies, 800-4,000 p.p.m.; greater than 4,000 p.p.m., major anomalies.
- Cu - background, 80 p.p.m.; threshold 80-250 p.p.m.; major anomalies, greater than 250 p.p.m.
- Pb - background 45 p.p.m.; threshold 45-150 p.p.m.; major anomalies, greater than 150 p.p.m.
- Zn - background, less than 100 p.p.m., threshold 100-1,000 p.p.m., suggests a syngenetic population, with major anomalies in excess of 1000 p.p.m.

These charts are enclosed as Figures 5,6,7 and 8.

Preliminary work in the first year showed grossly anomalous rare earth, tin , uranium, copper, lead, and zinc results. Our detailed follow up work showed almost universally high tin figures, with specific areas of high base metal anomalies. These appeared to coincide with areas of subnormal tin distribution combined, in may cases,with high chromium and occasionally high nickel figures. These figures are displayed on the attached geochemical distribution maps.

The rare earths appear to be in a fixed ratio which matches up with the regular observation of monazite in samples. It is also reported in the Meredith Granite itself.

The niobium reported is also believed to come direct from the Meredith Granite. The closely related Heemskirk Granite is known to have a 10 inch vein of columbite in one area.

Cassiterite is observed in situ in the Meredith Granite and all the tin present is believed to be derived from the various phases of this rock.

The uranium is believed to come from small pegmatite veins on the southern margin of the Meredith Granite. This is thought to be unlikely to justify prospecting.

Analyses were made of some of the monazite samples These proved to contain 6% thorium, indicating that most, at least, of the monazite, is granitic in origin. Were it to contain less than 1% thorium then a carbonatitic source for the monazite would be more likely.

Samples of the alluvial 'pyrochlore' obtained from the Table Cape area, were acquired from the Tasmanian Museum. They were examined optically by Dr. G.J.H.McCall who reported that they seemed typical of pyrochlore. However, as the analysis carried out by the Mines Department showed no niobium or tantalum, a crystal was selected for microprobe analysis by the C.S.I.R.O. Perth. It proved to be uraninite.

3.4 Petrological

Enclosed as Table 8 we have the mineralogical composition of panned concentrates from the preliminary collection of stream sediment sampling.

As Table No. 9 and No. 10 we have grain counts for some samples from the main stream sediment sampling programme. This work has been carried out by C.I. Mathison of Labtech Pty. Ltd.

Appendix No. 1 is the thin section descriptions of Alister Barton, under the direction of Dr. G.J.H. McCall. Dr. McCall is responsible for the thin section descriptions shown in Appendix No. 2.

Further examination of some rocks in thin section was undertaken by Mr. Lin Sutherland of the Australian Museum.

There are also many excellent descriptions in the Geological Survey Bulletin No. 15 by Waterhouse, 1914.

There are numerous rock samples still held for study if required.

3.5 Geophysical

(a) Aeromagnetic Surveys

Rio Tinto Australian Exploration Pty. Ltd. carried out a regional aeromagnetic survey about 1956 which has since been published. This work is helpful in the gross regional sense, but it is not considered very accurate or controlled. There is little discrimination as contours are only at 100 gamma intervals.

There was a more sensitive survey carried out by the Aberfoyle Tin Development Partnership, believed to date about 1965. Contours at 10 gamma intervals were available over most of the Exploration Licence area and these have proved most useful in filling in details. Particulars of the survey and controls are not known. A print of this is enclosed as Drawing ~~11~~. 10

(b) Field Magnetometer Surveys

Minor local traverses have been made with a Jalander magnetometer. In one case it confirmed that part of the Stanley Reward dolomite area contained a high magnetic anomaly, presumably the area of banded magnetite dolomite, or magnetite dykes described by Waterhouse in G.S.B. 15. A traverse of this is shown in Figure 2.

Traverses over the Livingstone Creek hematite-magnetite lode are shown in Drawings 9 ~~and 10~~.

It is to be noted that Jessup, in Aberfoyle's Report on the Mt. Lindsay area in 1969, came to the conclusion that the distribution of tin in the mineralised horizons seems independent of the predominance of any one mineral. There was no apparent relationship between the tin assay and the amount of magnetite or sulphides. In general however, the magnetite-actinolite assemblage contained higher tin values.

A Jalander mangetometer was also used in some recent traverses to collect representative rocks of the Oonah Quartzite and Slate rock unit. It showed some of the local variations indicated by the Aberfoyle aeromagnetic data.

As replacement mineralisation would tend to be in carbonates if they are present, we might best look for mineralisation in local magnetic lows rather than highs.

It was noted that both the Renison mine and the Mt. Lindsay mine are in an area of very modest highs adjoining areas of considerable magnetic highs. The Zeehan mines appear to all be in a magnetic plateau or aeromagnetic lows. The Queen Hill area appears to have no magnetic expression.

(c) Scintillometer Surveys

Field traverses were conducted with a McPhar scintillometer. Results were uniform throughout the area -500-1000 cps over swamps and thick soil or scree cover and 1000-2000 cps on outcrop. Values from 2000-5000 were obtained in the Stanley Reward workings and a gully in the south east. This probably reflects monazite and suggests radiometrics may be useful in locating tin deposits.

Laboratory scintillometer counts were made of most stream sediment samples with no useful variation in results.

(d) Ultra Violet Examination

Most stream sediment samples were subjected to routine examination by long and short wave ultra violet with little useful results. A small amount of scheelite is reported in the Mt. Lindsay area. There is very little in the way of fluorescent material found at all.

(e) E-M Survey

A V.L.F. E-M machine was tested briefly over the Livingstone Creek hematite-magnetite lode. It consistently showed conductivity over the middle of the lode. This may have application for further work.

(f) Turair

This airborne Turam technique appears popular in our area. However, its use at this stage is limited by two factors:

1. It tends to show many anomalies. In one 5 square mile area nearby 95 anomalies were reported. To discriminate effectively one must have a reference standard nearby, preferably an ore body of the type sought.

2. Many areas of virgin bush in the west coast look alike and it can be very difficult to pick up locations from low level photographs.

For these reasons it is proposed not to use Turair in the near future.

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4. CONCLUSIONS.

The problem of exploration and possible development in this area has been one of access. When the Pieman River is stabilised and raised in level by the dam at Stringers Creek, this problem will have disappeared.

In the meantime, servicing of men and equipment can only be practically carried out by helicopter or fixed wing aircraft. To this end a 2000' landing strip is to be built as a requirement for the next stage of exploration. However, this brings up the difficulty experienced last summer when the bulldozer was unable to cross the Pieman to construct the landing strip. We must plan more carefully for the next summer season. In all probability the bulldozer will be left on the north side of the river for almost a year. Following development of access facilities the area can be prospected with reasonable efficiency.

Exploration Licence 53/70 is an area of considerable exploration potential. There are a number of large scale mines in the district extracting tin and base metals from the same rock units in the same environment. Sulphides have been shown to be widespread. Major geochemical anomalies are extensive and quite sharply defined. They appear to coincide with aeromagnetic anomalies.

It seems that most of the area of apparent base metal mineralisation appears to coincide with the extension of the described Success Creek Group, and that the distinction between the Success Creek Group and the Success Creek Phase is not justified in this area.

The exploration targets are seen to be fourfold:-

1. Stratabound replacement mineralisation in the south west corner of the area, as outlined by stream sediment geochemical anomalies.

2. Stratabound replacement mineralisation for Sn, Zn, Cu, Ag and Pb, along the whole length of the inferred Success Creek Phase running from the south east corner of the area to the north west corner.

3. Possibly separate to No. 2, but within the same horizon, a possible carbonatite pipe at the Stanley Reward.

.../22

4. Extensions of tin mineralisation in the Crimson Creek Formation between Mt. Lindsay and the Stanley Reward. This would be additive to established reserves at Mt. Lindsay.

The information presented is enough to show that this Exploration Licence area justifies substantial further expenditure on the next phases of exploration for the targets outlined.

5. RECOMMENDATIONS:

5.1 Access

The areas west of the Stanley River appear to be out most important targets at this stage. Access from the east of the Stanley River is possible but would be more subject to blockages due to wet weather and falling trees. Because the headwaters of this river are in an area of instant run off, there are many flash floods and any crossings of the Stanley would wash out frequently.

Accordingly, access within the area is based on a conversion of the existing foot track to a four wheel drive vehicle track running along the ridges from the Stanley River cage to the Stanley Reward and also with an extension to the landing strip. As work developed east of the Stanley River tracks could be built there, eventually connecting with the new track to Renison.

5.2 Geological

The most useful geological work would appear to be costeaning followed by detailed field mapping. This is justified through the presumed course of the Success Creek Group, (or Phase).

In particular, costeaning is required on the Stanley Reward dolomite to expose as much of this as possible. However, for most efficient working conditions this area should be left until after a dry spell, say mid-February.

Costeaning is specifically indicated at the Livingstone Creek lode, and probably at several points between this and the Stanley Reward. This could be done in wet weather.

.../23

Detailed mapping, initially along the gullies, then with costeans as indicated, would be required in the Paradise Creek area where the major geochemical anomalies occur.

Following after this work we would want to detail map the south east corner of the Exploration Licence area just north of the Pieman River.

A structural interpretation of the area could be most useful. It would be a suitable subject for field work by students of the University and we may be able to arrange such a project.

5.3 Geophysical

It is doubtful if we can get much useful data from geophysics at this stage unless we can obtain data from comparable areas nearby.

5.4 Costs

It seems that the only practical way to work the area is to get a bulldozer and tanker and a four wheel drive vehicle across the Pieman and leave them there for the best part of a year.

The amount of earthmoving required is only 700 bulldozer hours for a D6 machine as minimum size. It is doubtful if this could be done effectively by two or more machines in a few weeks only, as follow up work is sure to be required after appraisal and interpretation of results.

the cost of bulldozing, including low loader hire and one years amortisation, ($8,400), on top of 700 hours useage	$16,100
Fuel cost premium for air freight	1,400
Additional laborer	1,500
Messing	400
	$19,400
say	$20,000

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Bulldozer costs brought forward	$20,000
Geological mapping, petrology and assaying is estimated at	$12,000
Travelling costs, air freight and field supervision	$ 8,000
	$40,000
A general overhead of 30% should be added to the above figure giving a	$12,000
Total Budgeted Expenditure for the next summer season of:	$52,000

In the succeeding season we would expect detailed follow up on four areas, including a small amount of bulldozing and site preparation, some ground geophysics, ($8,000), and an estimated 3000 feet of diamond drilling, ($37,500).

All this succeeding stage would probably cost a total of $70,000.

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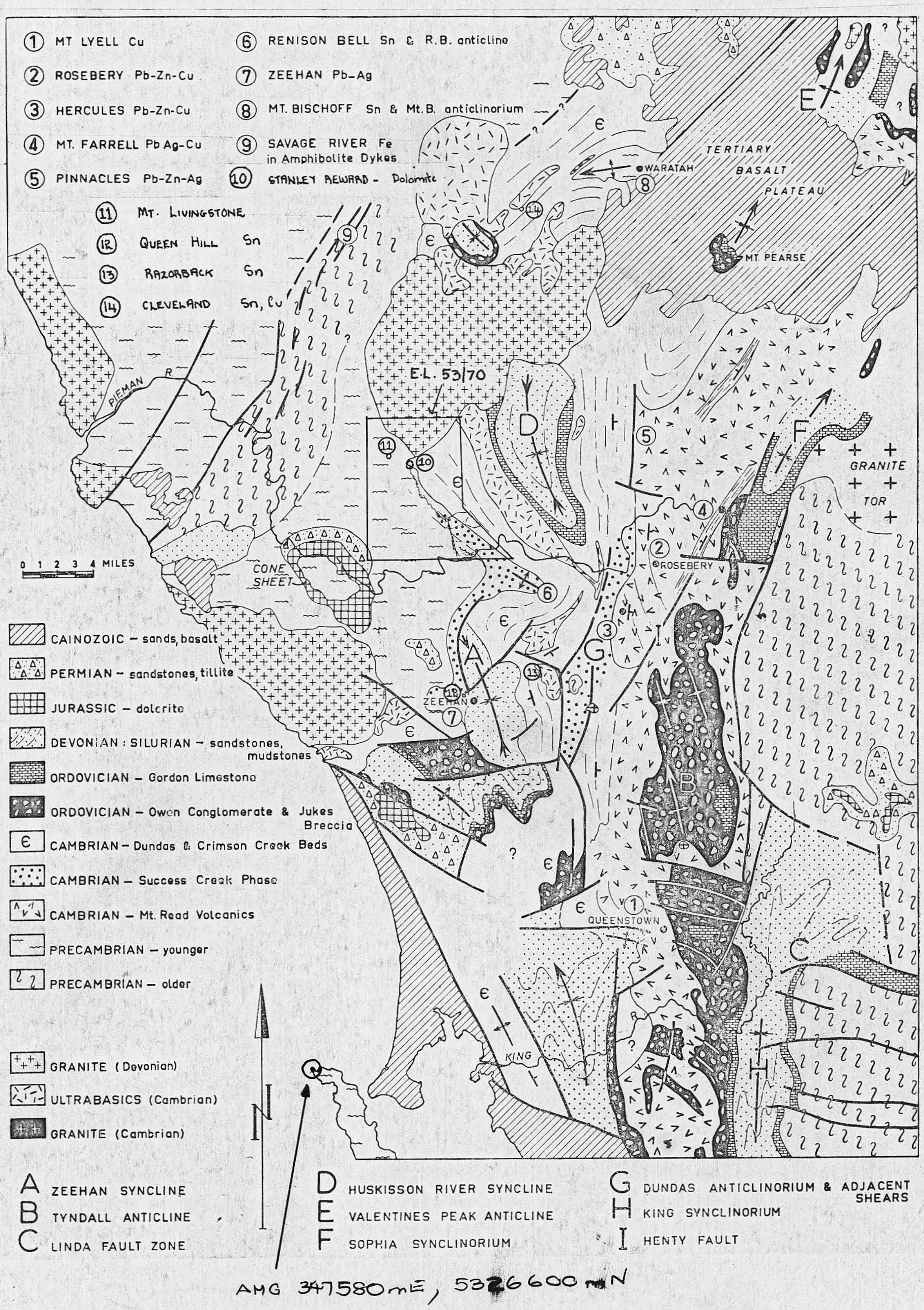

FIGURE 1:

Location Map Showing Regional Geology

SOURCE: Eighth Commonwealth Mining and Metallurgical Congress, 'Geology of Australian Ore Deposits' Volume 1., 1965.

AMG REFERENCE POINTS ADDED

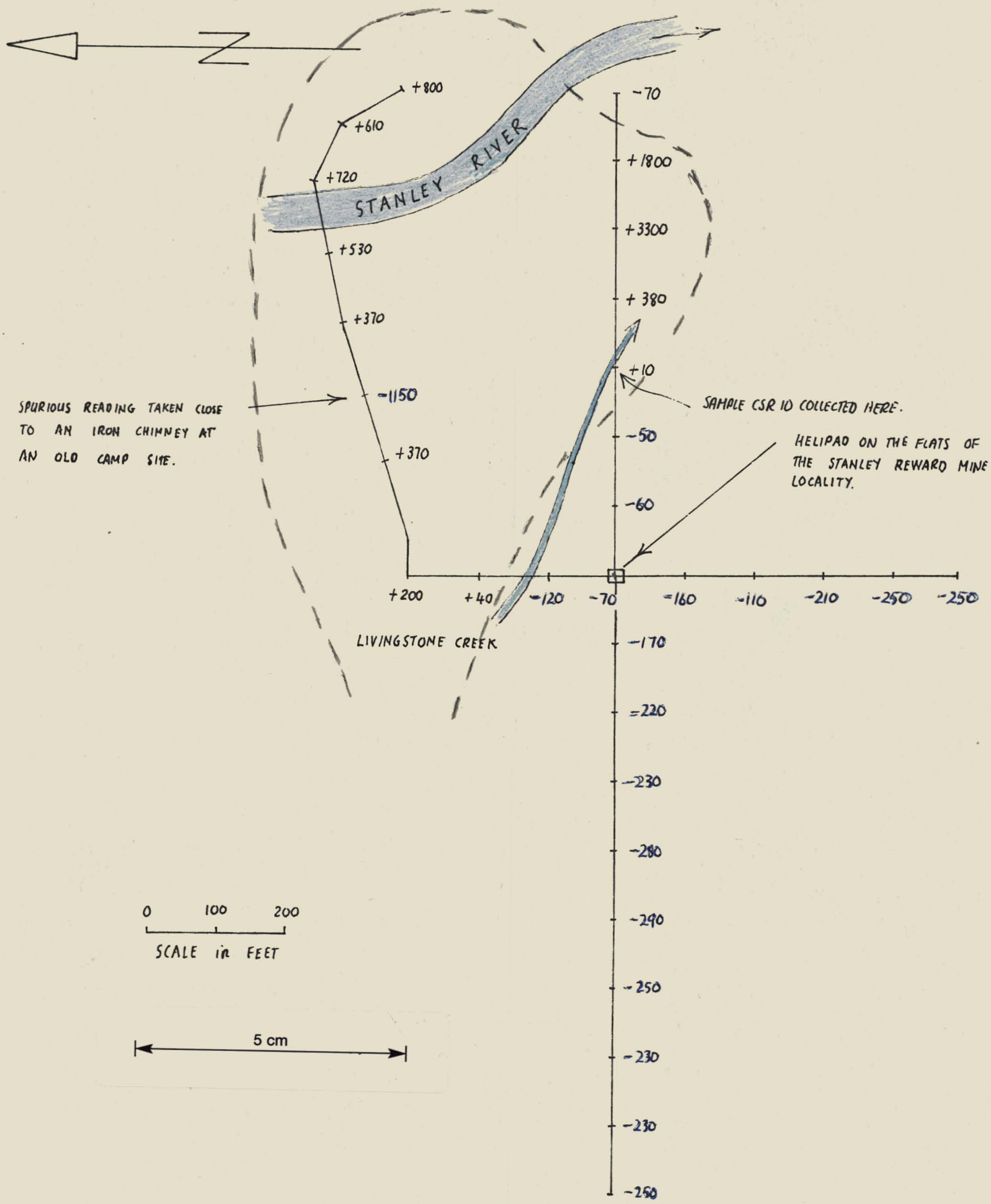

FIG. 2. Plot of reconnaissance magnetometer survey in the area of the Stanley Reward workings. Units are gammas. Area of positive values possibly co-incides with reported dolomite (Waterhouse, 1915).

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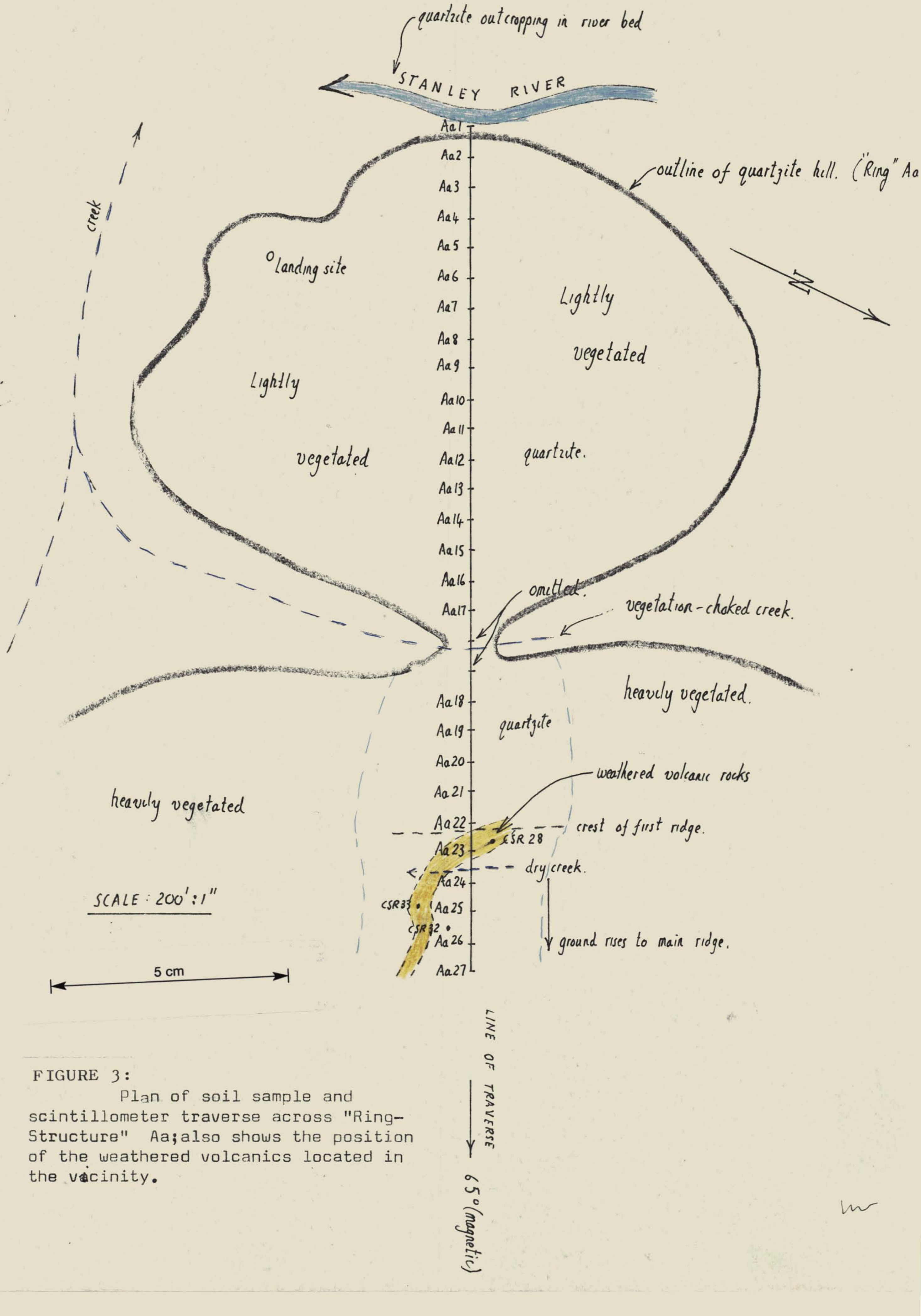

FIGURE 3:

Plan of soil sample and scintillometer traverse across "Ring-Structure" Aa; also shows the position of the weathered volcanics located in the vicinity.

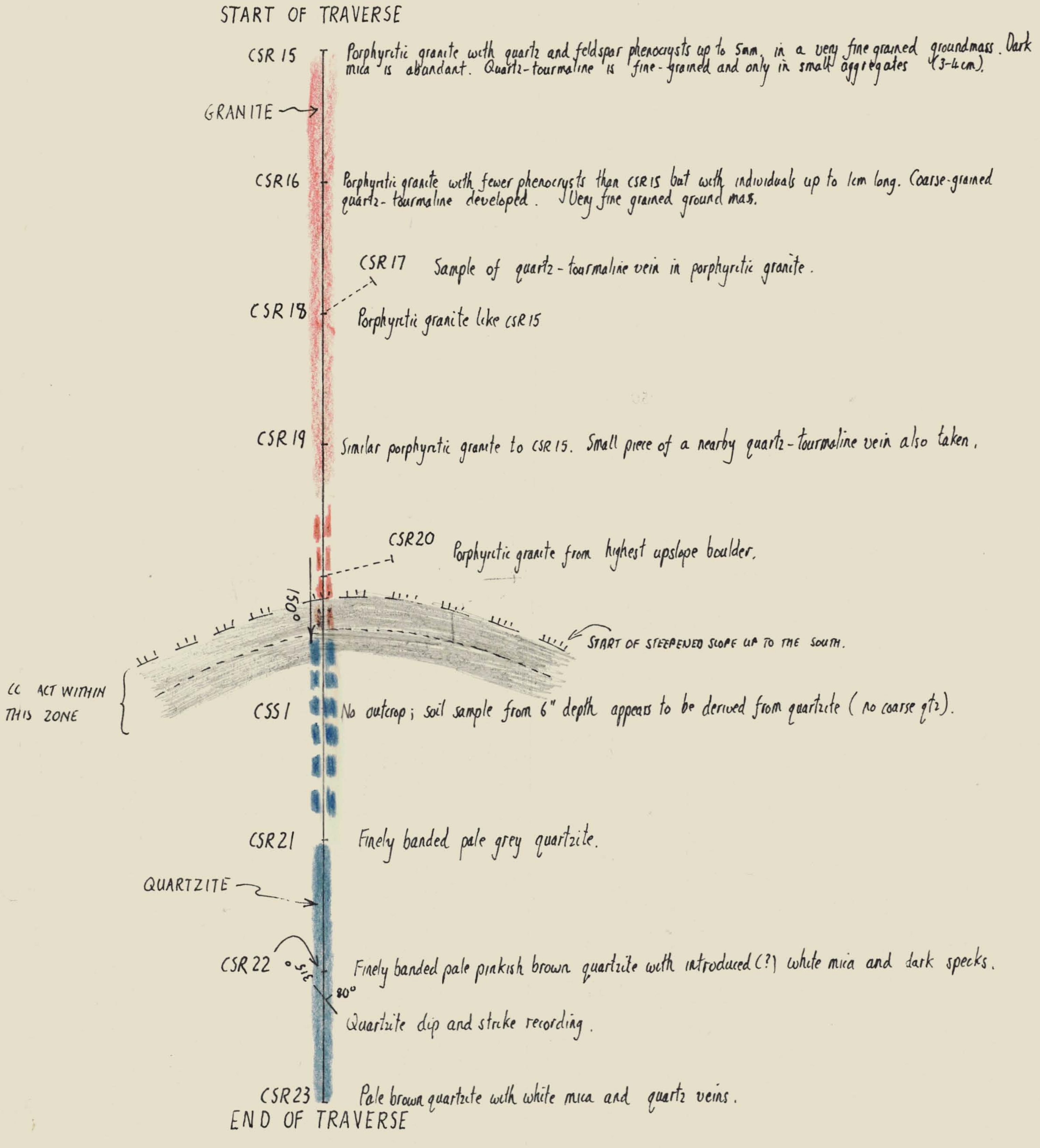

FIGURE 4: Plot of rock sample traverse across granite - quartzite contact on the crest of a spur approximately $\frac{3}{4}$ mile on a bearing of about 310° from Mount Livingstone trig. point. Scale is fifty feet to an inch. Traverse bears 150°.

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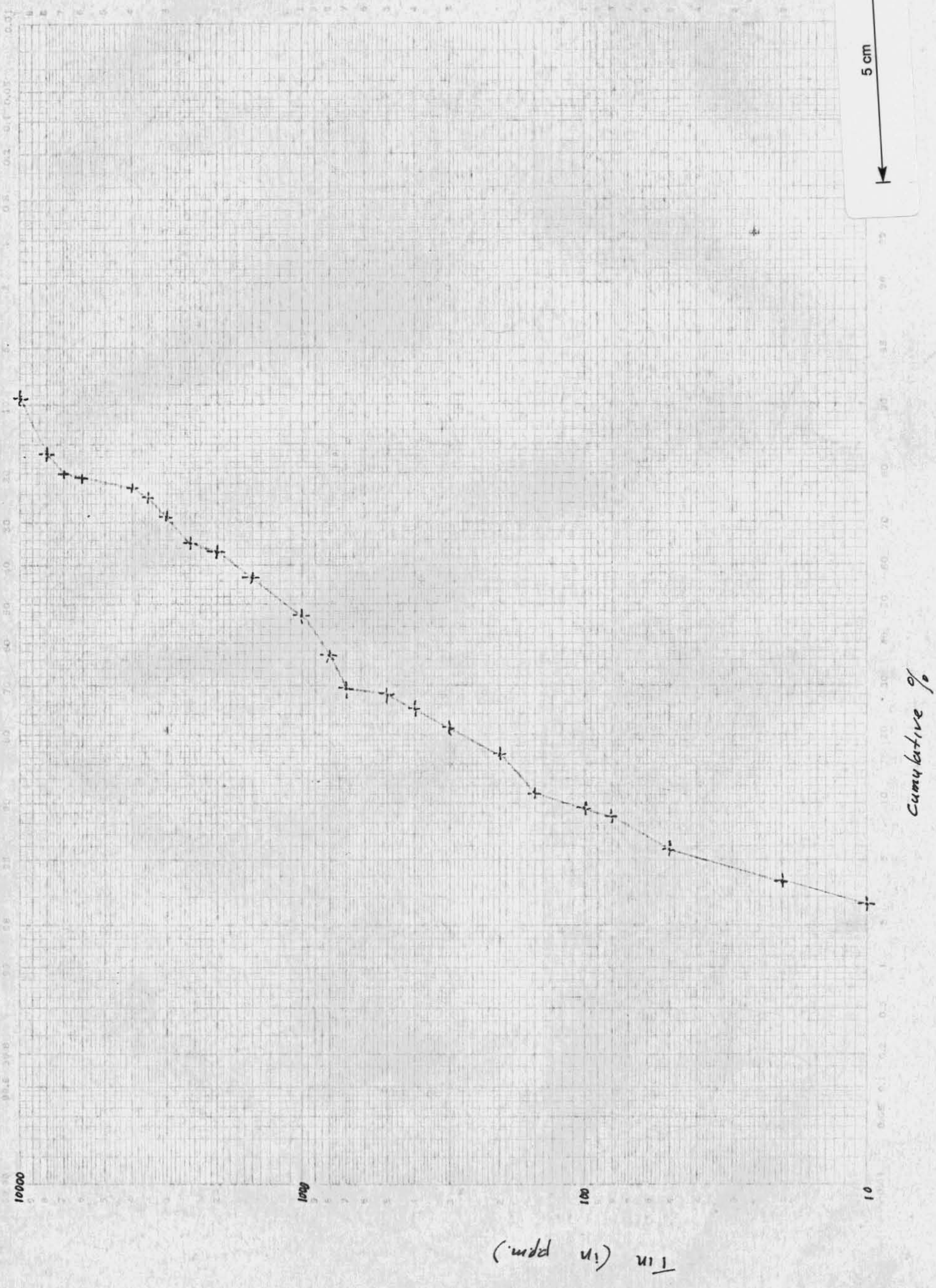
Figure 5:

Log Probability Cumulative Frequency % of Tin:



5 cm

Figure 6:

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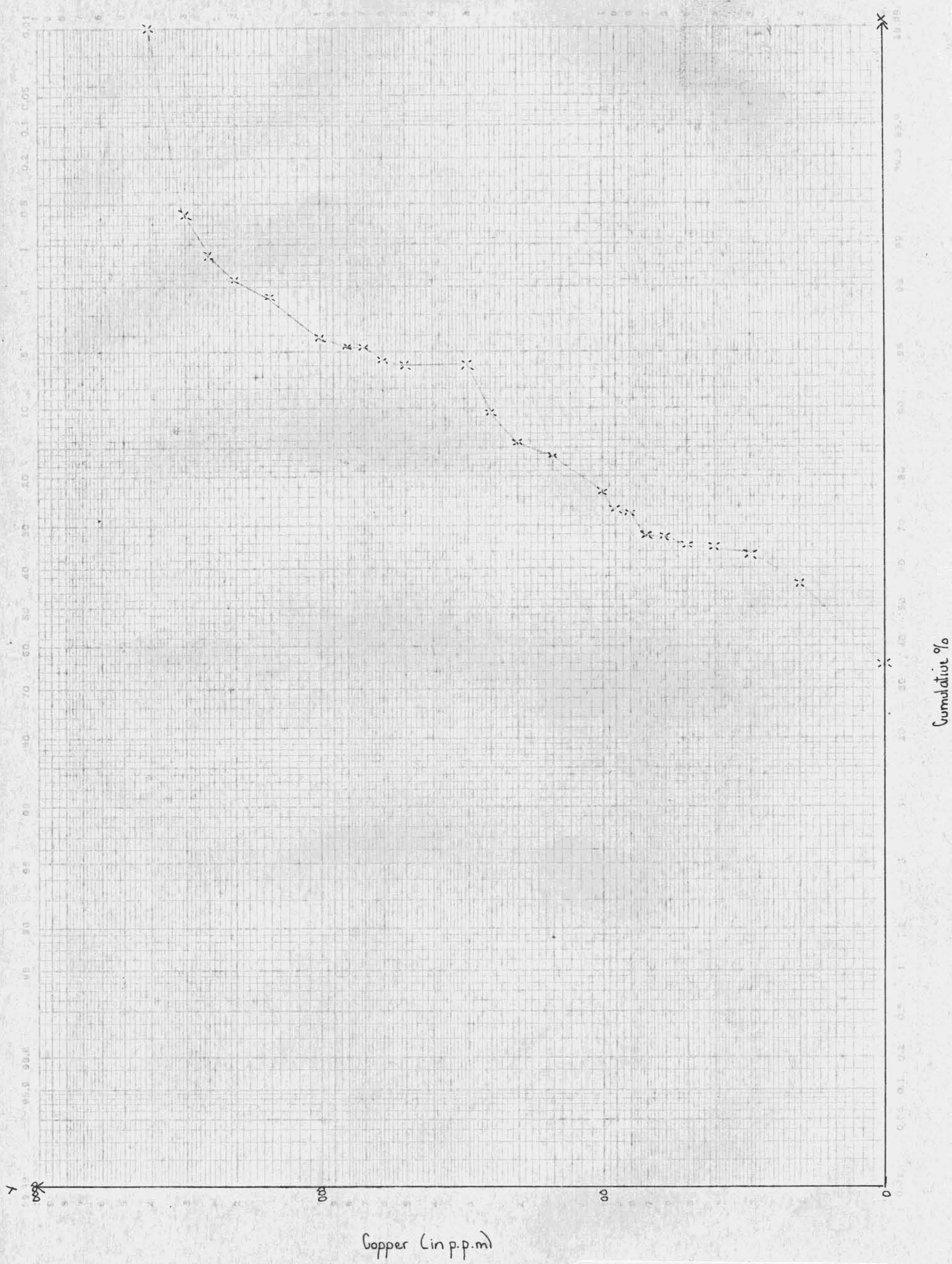
Log Probability Cumulative Frequency % of Copper:



5 cm

Figure 7:

Log Probability Cumulative Frequency % of Lead:

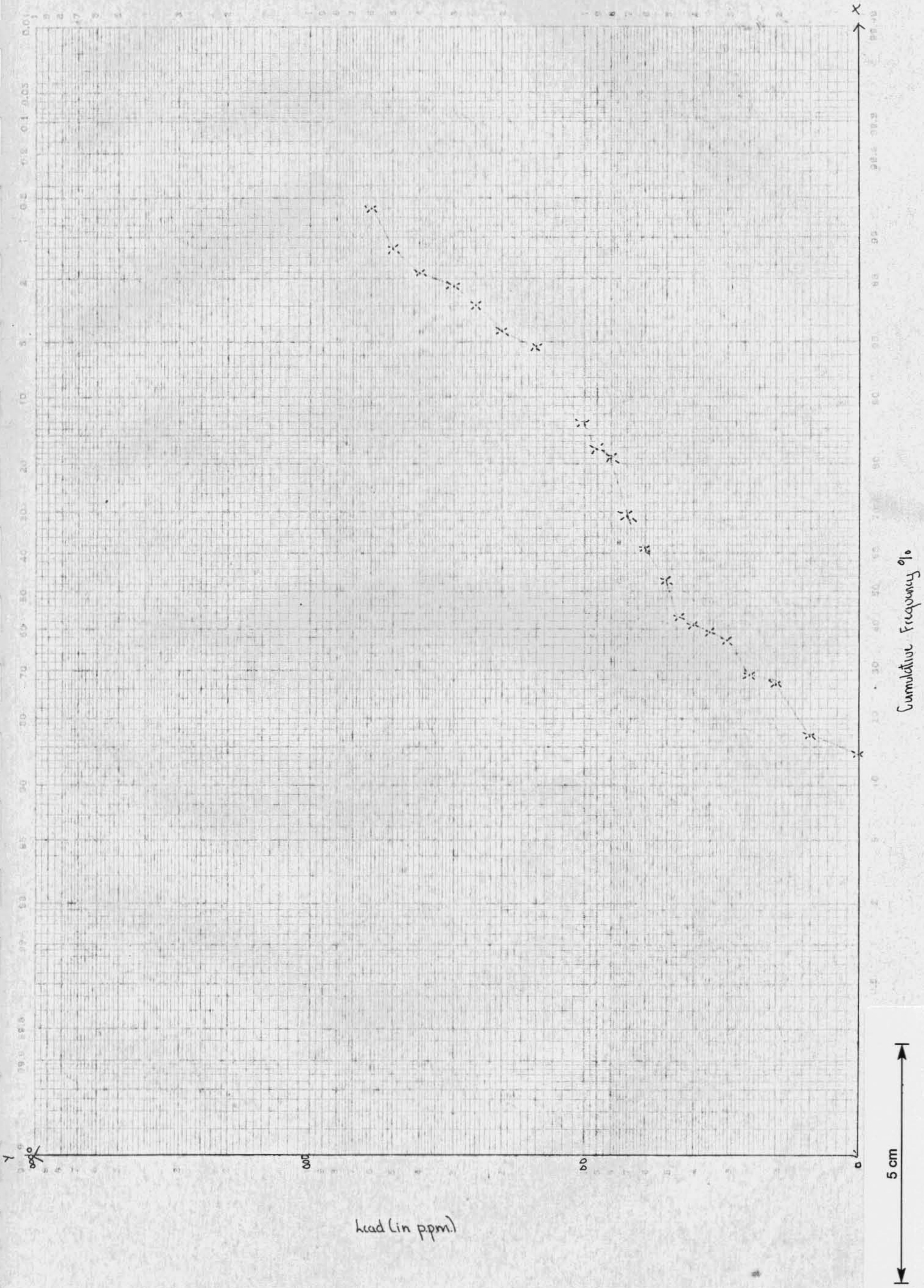


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Figure 8:

<u>Log probability Cumulative Frequency % of Zinc:</u>

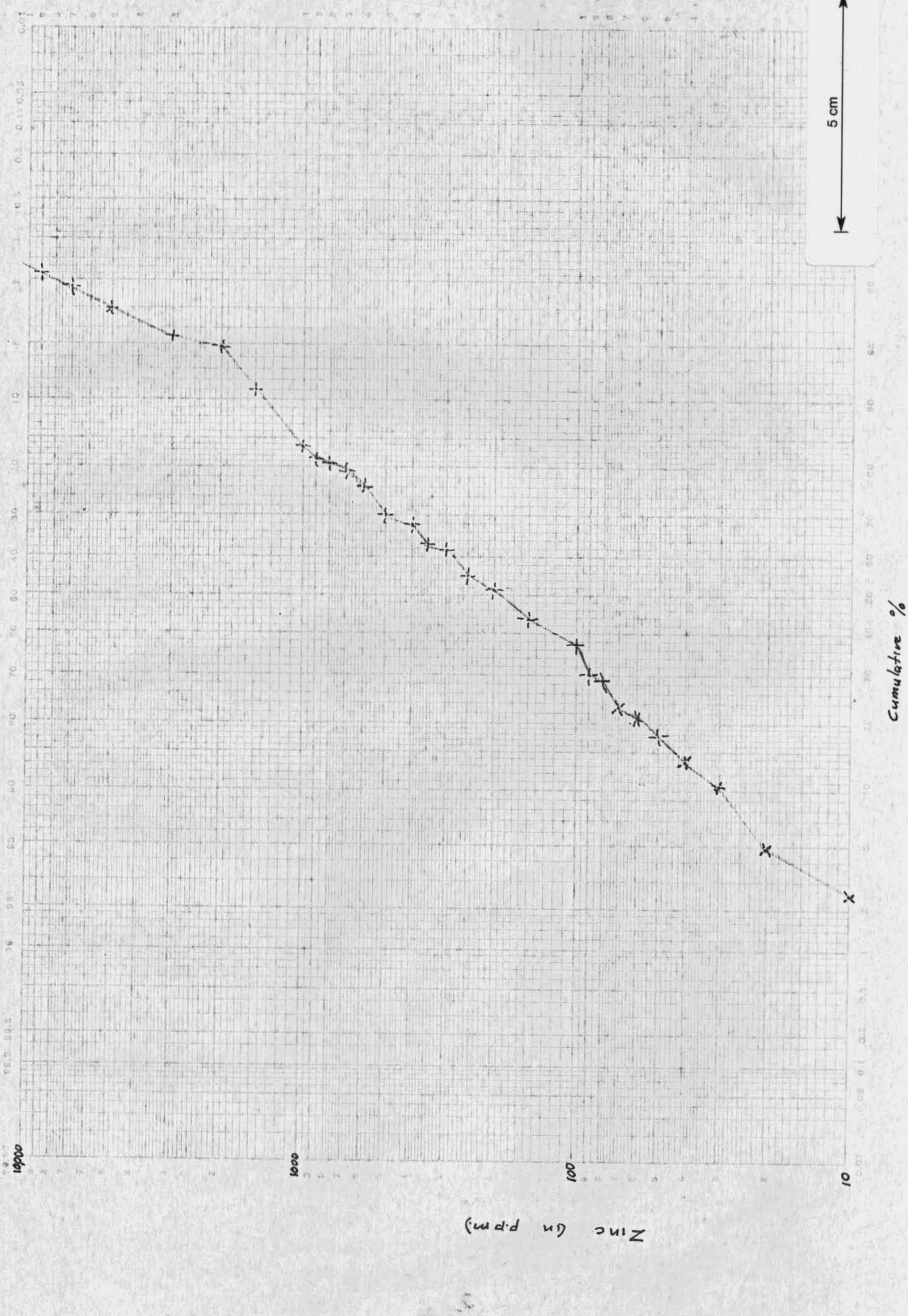

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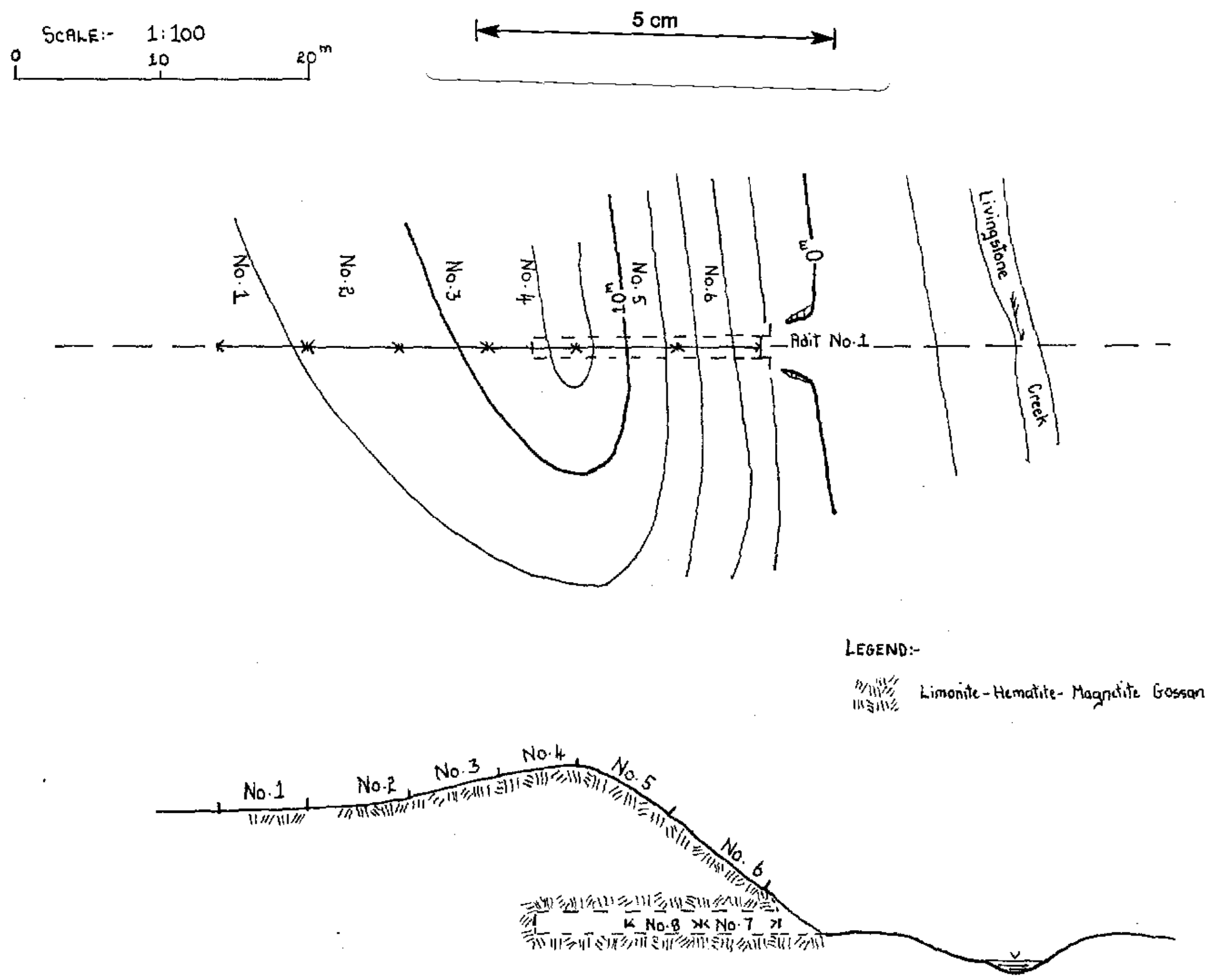
FIGURE NO. 9:

LIVINGSTONE CREEK LIMONITE-HEMATITE-MAGNETITE LODE:



Number	Sample	Fe %	Cu p.p.m	Pb p.p.m	Zn p.p.m	Sn %	Description
No. 1	Channel Sample	60.0	90	40	215	0.43	
2	" " "	59.5	130	48	276	0.45	
3	" " "	60.0	78	64	255	0.46	
4	" " "	58.8	112	74	391	0.47	
5	" " "	57.6	108	56	317	0.48	
6	" " "	57.6	136	51	372	0.52	
7	Chip Sample	59.7	158	124	467	0.21	
8	Chip Sample	53.4	274	54	402	0.44	
9	Spot Chip Sample	50.1	273	133	708	0.34	
10	" " "	61.1	58	58	121	0.31	Limonite rich Magnetite
11	" " "	63.1	33	61	170	0.43	" " "
12	" " "	58.6	68	112	329	0.47	Large Hedenbergite crystal
13	" " "	59.3	36	49	173	0.46	" "
14	" " "	59.1	58	53	300	0.51	Limonite and Magnetite + Hedenbergite
15	" " "	51.3	49	67	290	0.47	Limonite + Hedenbergite
16	" " "	56.4	80	49	244	0.63	" " " "
17	" " "	—	10	<1	6	<0.05	Quartz, Au 0.05 dwt/ton

039

677040

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G.P.O. Box U1938, Perth, Western Australia, 6001
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Field Sheet No:—

Line No.:—

TABLE NO: 1

Project/Charge/ Despatch Note No.:—

Date:— 15-NOV-72

Any queries please quote Lab. Sheet Number:— 5517/1

SAMPLE	WT.HM.	% H.M.
A 1	2.3	0.30
A 4	4.0	0.40
A 9	10.6	1.06
A 10	2.2	0.23
A 11	2.2	0.31
A 15	1.9	0.21
A 33*	1.5	0.12
A 34	2.7	0.25
A 35	5.3	0.45
A 36	7.0	0.50
A 38	7.8	0.89
A 40	0.5	0.06
A 41	1.8	0.18
A 43	2.0	0.20
A 44	12.3	1.28
A 49	2.4	0.25
A 61	8.9	1.00
A 64	0.2	0.02
A 65	0.6	0.06
A 66	0.2	0.02
A 68	3.1	0.31
A 73	2.8	0.22
A 74	0.4	0.03
A 79	0.7	0.04
A 83	1.0	0.12
A 85	1.5	0.12
A 89	56.8	4.54
A102	2.2	0.18
A104	1.0	0.11
A106	0.5	0.04
A108	0.4	0.02
A109	0.5	0.04
A112	2.2	0.20
A113	1.0	0.08
A116	0.9	0.07
A117	1.7	0.14
A118	0.1	0.04
A120	7.0	0.58
A122	6.5	0.63
A124	0.8	0.06
A126	0.4	0.04
B 2	35.0	4.00
B 5	24.0	3.00
B 6	13.4	1.70
B 9	12.1	1.20
B 13	0.5	0.04
B 15	0.4	0.03
B 16	0.3	0.03
...... WEIGHT IN GRAMS		
METHOD	109	109

FORM S34 FOR METHOD DETAILS SEE PRICE LIST

JOB NO 5517 RACK NO 4954

040

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Line No.:—

Project/Charge/Despatch Note No.:— TABLE NO: 1

Date:— 15-NOV-72

Any queries please quote Lab. Sheet Number:— 5517/2

SAMPLE	WT.HM.	% H.M.
B 17	0.7	0.08
B 21	0.5	0.04
B 22	2.0	0.10
B 24	1.0	0.09
B 25	0.5	0.04
B 26	0.4	0.04
B 28	0.8	0.10
B 30	1.2	0.13
B 31	1.3	0.14
B 33	0.4	0.03
B 36	1.2	0.14
B 37	0.3	0.03
B 38	0.3	0.03
B 50	0.3	0.03
B 52	1.2	0.15
B 54	1.1	0.13
B 55	1.2	0.17
B 59	4.2	0.62
B 60	0.3	0.03
B 63	0.2	0.03
B 64	0.7	0.09
B 69	0.5	0.06
B 70	0.2	0.02
B 73	0.3	0.03
B 74	3.3	0.47
B 76	1.4	0.20
C 3	25.0	3.57
C 7	108.0	10.04
C 8	172.5	15.00
C 9	80.5	8.28
C 11	159.2	79.30
C 13	19.8	2.82
C 14	36.2	3.71
C 15	67.4	11.20
C 19	0.4	0.04
C 20	0.4	0.05
C 27	45.6	4.44
C 30	33.0	3.88
	...... WEIGHT IN	GRAMS ......
METHOD	109	109

FORM S34 5517 —— FOR METHOD DETAILS SEE PRICE LIST

JOB NO 5517 FUR RACK NO 4955

RACK NO 4954

TABLE 2

RESULTS OF SEMIQUANTITATIVE SPECTOGRAPHIC ANALYSIS OF HEAVY MINERAL FRACTIONS

Sample Number	Be (1)	Nb (20)	Ta (100)	Sn (1)	Ce (300)	Th (1000)	La (100)	Y (10)	Sr (50)	U %	Cu	Pb	Zn
1	1	20	X	1200	1000	X	600	2000	X	0.005	5	75	1350
2	1	X	X	400	600	X	200	1200	X	0.005	10	60	1450
2	1	X	X	3000	300	X	200	1000	X	0.005			
3	10	50	X	10000	600	X	300	600	50		85	65	280
4	10	300	X	8000	8000	1000	4000	10000	80	0.075	5	85	55
5	20	100	X	10000	2000	400	800	3000	X	0.01	30	50	45
7	1	20	X	800	1800	400	800	1500	X	0.01	5	80	1250
8	3	X	X	3000	2000	400	1000	2000	X	0.01	5	70	1100
9	1	20	X	10000	X	X	100	100	50		2900	140	14000
10	20	50	X	300	8000	2000	4000	5000	50		10	45	35
13	3	20	X	10000	X	X	100	150	50		2200	125	9000
14	20	50	X	1200	6000	800	3000	3000	X				
15	20	X	X	400	1000	400	600	1000	X				
15	15	30	X	1500	2000	800	1000	1800	X		5	40	65

<u>MAGNETIC FRACTIONS:</u>

Sample Number	Be (1)	Nb (20)	Ta (100)	Sn (1)	Ce (300)	Th (1000)	La (100)	Y (10)	Sr (50)
1	1	X	X	150	X	X	X	10	X
2	1	X	X	60	X	X	X	10	X
8	1	X	X	60	X	X	X	15	X
9	X	X	X	3000	X	X	X	30	X
13	X	X	X	3000	X	X	X	10	X

<u>NOTE</u>: Samples analysed by Amdel. Results in ppm. X= below detection limit.
[redacted]tec[redacted]n l[redacted]ts [redacted]gi[redacted]fo[redacted]ch [redacted]men[redacted]n b[redacted]ket[redacted]

042

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TABLE NO:3

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Line No.:—

Project/Charge/Despatch Note No.:—

Date:— 24-NOV-72

Any queries please quote Lab. Sheet Number:— 5517A/1

SAMPLE	AG	CU	PB	% SN	ZN
A 1	BLD	10	20	BLD	35
A 4	BLD	35	35	BLD	80
A 9	BLD	5	35	BLD	25
A 10	BLD	5	15	BLD	10
A 11	BLD	5	30	BLD	10
A 15	BLD	20	10	BLD	10
A 33	BLD	55	75	BLD	175
A 34	BLD	250	180	BLD	620
A 35	BLD	110	90	BLD	265
A 36	BLD	30	55	0.11	590
A 38	BLD	140	75	BLD	265
A 40	BLD	60	135	BLD	250
A 41	BLD	40	65	BLD	220
A 43	BLD	95	75	BLD	245
A 44	BLD	270	100	0.20	295
A 49	BLD	10	75	18.75	235
A 61	BLD	15	20	0.10	85
A 64	BLD	20	60		240
A 65	BLD	5	20	BLD	175
A 66	BLD	1400	80		700
A 68	BLD	10	65	BLD	115
A 73	BLD	5	55	BLD	100
A 74	BLD	25	50		220
A 79	BLD	3600	50	BLD	1400
A 83	BLD	20	30	BLD	310
A 85	BLD	15	55	0.53	65
A 89	BLD	30	115	0.40	115
A102	BLD	530	100	1.95	137
A104	BLD	940	210	0.07	2700
A106	BLD	20	90	~~0.12~~ 0.24	550
A108	BLD	10	65		150
A109	BLD	15	120	BLD	120
A112	BLD	5	30	0.56	15
A113	BLD	5	50	0.61	35
A115	BLD	5	135	0.11	50
A117	BLD	5	70	BLD	20
A118					
A120	BLD	15	25	BLD	30
A122	BLD	5	15	BLD	30
A124	BLD	25	70	BLD	360
A126	BLD	40	260		470
B 2	BLD	15	35	BLD	30
B 5	BLD	10	30	0.08	15
B 6	BLD	10	45	BLD	30
B 9	BLD	15	25	BLD	30
B 13	BLD	10	75	~~7.28~~ 14.56	1600
B 15	BLD	10	60		110
B 16	BLD	20	60		140
....	BLD	0.05	....		
METHOD	101B	101B	101B	SN1	101B

Sn · BLD <0.05

MISSING VALUES ARE INSUFFICIENT SAMPLES.

FORM S34 FOR METHOD DETAILS SEE PRICE LIST

308 5517 RACK 5007

043

677044

TABLE NO. 3

Duplicate

LABTECH PTY. LTD.

ANALYSTS

(Formerly Analytical Division of Sampey Exploration Services)
237 Great Eastern Highway, Midland
G.P.O. Box U1938, Perth, Western Australia, 6001
Telephone: 74 2566 • Telegrams: "Exserv" Perth

Field Sheet No:—

Line No.:—

Project/Charge/Despatch Note No.:—

Date:— 24-NOV-72

Any queries please quote Lab. Sheet Number:— 5517A /2.

SAMPLE	AG	CU	PB	% SN	ZN
B 17	BLD	15	75	BLD	90
B 21	BLD	10	110	BLD	60
B 22	BLD	10	105	BLD	120
B 24	BLD	55	65	BLD	85
B 25	BLD	20	55	0.15	170
B 26	BLD	110	50	BLD	280
B 28	BLD	75	100	BLD	640
B 30	BLD	10	55	BLD	80
B 31	BLD	15	70	BLD	1600
B 33	BLD	15	95		285
B 36	BLD	55	240	BLD	1800
B 37	BLD	85	125		50
B 38	BLD	640	70		4700
B 50	BLD	170	30		990
B 52	BLD	115	75	0.11	650
B 54	BLD	115	65	BLD	1100
B 55	BLD	240	60	BLD	95
B 59	BLD	10	70	BLD	130
B 60	BLD	20	70		70
B 63					
B 64	BLD	275	65	BLD	55
B 69	BLD	15	60	BLD	115
B 70					
B 73	BLD	15	40		50
B 74	BLD	95	80	BLD	145
B 76	BLD	80	75	BLD	1700
C 3	BLD	15	25	BLD	25
C 7	BLD	10	50	BLD	650
C 8	BLD	10	50	0.25	650
C 9	BLD	10	75	0.32	1500
C 11	BLD	5	35	BLD	1150
C 13	BLD	5	50	BLD	15
C 14	BLD	10	30	BLD	30
C 16	BLD	15	45	0.05	900
C 19	BLD	25	60		1900
C 20					
C 27	BLD	10	45	0.34	1000
C 30	BLD	15	50	0.15	540
	BLD	0.05			
METHOD	101B	101B	101B	SN1	101B

Sn = BLD < 0.05

MISSING VALUES ARE INSUFFICIENT SAMPLE.

FORM S34 FOR METHOD DETAILS SEE PRICE LIST

JOB 5517 ROCK - 500 ?

[redacted] Lab. 4303/72. [redacted] Sem-[redacted]quantit[redacted]ve [redacted]tro[redacted]hid[redacted]analysis schemes A1,A2,A3,A4,A5 & A6 BATCH ....

Results in ppm unless otherwise stated. Detection limits in brackets

Sample No.	0	1	2	3	4	5	6	Sample No.	0	1	2	3	4	5	6
A1	AN°2	AN°3	AN°5	AN°6	AN°7	AN°8	AN°12	A2 Contd.	AN°2	AN°3	AN°5	AN°6	AN°7	AN°8	AN°12
Co (5)	5	10	20	5	5	30	5	Ge (1)	1	1	x	1	x	1	1
Ni (5)	20	30	50	30	10	50	20	As (50)	x	x	x	x	x	x	x
Cr (20)	500	100	300	50	400	500	500	Sb (30)	x	x	x	x	x	x	x
V (10)	150	200	250	150	150	250	100	A3							
W (50)	x	x	50	x	x	50	x	Te (20)							
Mo (3)	x	x	x	x	x	x	x	Tl (1)							
Mn (10)	100	50	800	50	100	800	3,000	P (100)							
Ta (100)	x	x	x	x	x	x	x	A4							
Nb (20)	x	x	50	20	20	50	100	Na (50)							
Be (1)	3	3	3	3	3	3	3	Li (1)							
Th (100)	x	x	x	x	x	x	x	A5							
Pt (10)	x	x	x	x	x	x	x	K (5)							
Pd (10)	x	x	x	x	x	x	x	Rb (10)							
Os (10)	x	x	x	x	x	x	x	Cs (30)							
Ir (2)	x	x	x	x	x	x	x	A6							
Rh (2)	x	x	x	x	x	x	x	Ba (50)	200	300	200	200	200	200	200
Ru (2)	x	x	x	x	x	x	x	Sr (10)	x	x	x	x	x	x	x
A2								Y (10)	50	50	200	100	150	50	50
Cu (0.5)	2,000	50	100	1,500	50	1,000	150	La (100)	300	600	200	800	200	100	200
Pb (1)	20	50	3	30	3	20	20	Ce (300)	600	1,200	400	1,600	400	x	400
Zn (20)	1,000	3,000	200	3,000	500	2,500	2,500	Nd (300)	300	300	x	300	x	x	x
Sn (1)	50	10	100	300	3	120	10	Pr (100)	x	x	x	x	x	x	x
Cd (3)	x	x	x	x	x	x	x	Ti (100)	>10,000	>10,000	>>10,000	>10,000	>10,000	>>10,000	>>10,000
Bi (1)	x	x	x	x	x	x	1	Er (100)	x	x	x	x	x	x	x
Ag (0.1)	1	0.5	x	1	0.1	1	0.1	Sc (50)	50	50	100	100	100	100	100
[illegible] (3)	x	x	x	x	x	x	x	Eu (50)	x	x	x	x	x	x	x
[illegible] (1)	30	20	10	80	10	50	50								

[illegible]lts are sem[illegible]quantitative. El[illegible]ents apparently present in concentrations of [illegible]conomic interest [illegible]

6779 15

TABLE NO. 4(a)

[redacted] DEL [redacted] LYTI [redacted] SE [redacted] ICE [redacted]

045

JOB: ..A303/72 Semi- antitative Spectrographic Analysis : emes A1,A2,A3,A4,A5 & A6 BATCH ......2..

Results in ppm unless otherwise stated. Detection limits in brackets

Sample No.	7	8	9
A1	AN° 13	AN° 14	AN° 16.
Co (5)	30	6	×
Ni (5)	80	10	10
Cr (20)	1,000	1,000	400
V (10)	30	250	10
W (50)	50	×	×
Mo (3)	×	×	×
Mn (10)	500	50	30
Ta (100)	×	×	×
Nb (20)	80	×	×
Be (1)	3	3	1
Th (100)	×	×	×
Pt (10)	×	×	×
Pd (10)	×	×	×
Os (10)	×	×	×
Ir (2)	×	×	×
Rh (2)	×	×	×
Ru (2)	×	×	×
A2			
Cu (0.5)	10,000	500	2,000
Pb (1)	3,000	5	100
Zn (20)	>10000	1,000	200
Sn (1)	800	20	250
Cd (3)	×	×	20
Bi (1)	1	×	20
Ag (0.1)	30	0·1	20
[illegible] (3)	×	×	×
[illegible] (1)	10	50	10

Sample No.	7	8	9
A2 Contd.	AN° 13	AN° 14	AN° 16.
Ge (1)	3	3	×
As (50)	×	×	200
Sb (30)	×	×	50
A3			
Te (20)			
Tl (1)			
P (100)			
A4			
Na (50)			
Li (1)			
A5			
K (5)			
Rb (10)			
Cs (30)			
A6			
Ba (50)	×	200	300
Sr (10)	×	×	×
Y (10)	1,000	100	200
La (100)	6000	200	3,000
Ce (300)	12,000	400	6,000
Nd (300)	9000	×	2,000
Pr (100)	1000	×	200
Ti (100)	>10,000	>10,000	>10,000
Zr (100)		×	
Sc (50)	50	×	×
Eu (50)		×	

677046

046

677047

8 SEP 1972

amdel
The Australian Mineral Development Laboratories
Flemington Street, Frewville, South Australia 5063
Phone 79 1662, telex AA82520

Please address all correspondence to the Director
In reply quote: AN3/283/0 - 956/73

4 September 1972

RECEIVED
8 SEP 1972

The Manager
Sampey Exploration Services
PO Box 134
MIDLAND WA 6056

REPORT AN956/73

YOUR REFERENCE: Order 1934

IDENTIFICATION: As listed

DATE RECEIVED: 28/8/72

Enquiries quoting AN956/73 to Officer in Charge please.

Analysis by: R.R. Robinson

Officer in Charge, Analytical Section: A.B. Timms

per [signature]

for F.R. Hartley
Director

pkm

c.c. Labtech Pty Ltd
237 Great Eastern Highway
MIDLAND WA 6056

[redacted] AIDFI ANALYTICAL SERVICE [redacted]

S[redacted] Quantitative S[redacted]trographic Analysis Schemes A1,A2,A_,A4,A5 & A6 BATCH 047

Form 60

Results in ppm unless otherwise stated. Detection limits in brackets

Sample No	A37	A39	A45	A46	A47	A48	A62
A1							
Co (5)	300	50	250	250	100	50	5
Ni (5)	1,000	150	800	500	150	200	100
Cr (20)	>>10,000	5,000	>10,000	>10,000	10,000	>10,000	5,000
V (10)							
W (50)	x	x	x	x	x	50	50
Mo (3)	10	3	3	x	3	10	x
Mn (10)	2,500	500	1,500	3000	8,000	1,000	800
Ta (100)	x	x	x	x	x	x	x
Nb (20)	100	x	200	50	80	100	200
Be (1)	1	1	1	1	1	3	3
Th (100)							
Pt (10)	x	x	x	x	x	x	x
Pd (10)							
Os (10)	x	x	x	x	x	x	x
Ir (2)							
Rh (2)							
Ru (2)							
A2							
Cu (0.5)	150	250	300	100	1,500	250	(30)
Pb (1)	150	50	80	50	10,000	150	80
Zn (20)	400	400	600	200	>10,000	600	100
Sn (1)	1,500	3	3,500	800	1,000	200	1,000
Cd (3)							
Bi (1)	x	1	1	3	150	1	x
Ag (0.1)	0.1	0.1	0.3	0.1	60	0.1	0.1
Au (3)	x	x	x	x	x	x	x
Ga (1)							

Sample No.	A37	A39	A45	A46	A47	A48	A6[2]
A2 Contd.							
Ge (1)							
As (50)	x	50	80	x	4,000	100	50
Sb (30)							
A3							
Te (20)							
Tl (1)							
P (100)	x	200	100	x	x	200	x
A4							
Na (50)							
Li (1)							
A5							
K (5)							
Rb (10)							
Cs (30)							
A6							
Ba (50)							
Sr (10)							
Y (10)							
La (100)							
Ce (300)							
Nd (300)							
Pr (100)							
Ti (100)							
Er (100)							
Sc (50)							
Eu (50)							

Results are semi-quantitative. Elements ...

AMDE[redacted]ANALY[redacted]AL [redacted]ICE

JOB: ....95/73..

Form 60

Semi-Quantitative Spectrographic Analysis Schemes A1, A2, A3, A4, A5 & A6   BATCH ... 048

Results in ppm unless otherwise stated.   Detection limits in brackets

Sample No	A63	A88	A101	A119	B12	B58	C4
A1							
Co (5)	80	80	300	300	500	10	5
Ni (5)	100	30	500	500	1,500	300	80
Cr (20)	>10,000	150	>10,000	14,000	>10,000	8,000	400
V (10)							
W (50)	x	50	2,000	50	50	50	x
Mo (3)	x	3	x	3	3	3	3
Mn (10)	300	500	1,000	50	2,000	250	100
Ta (100)	x	x	x	x	x	x	x
Nb (20)	80	30	200	20	1,000	300	x
Be (1)	1	5	3	3	3	3	1
Th (100)							
Pt (10)	x	x	x	x	x	x	x
Pd (10)							
Os (10)	x	x	x	x	x	x	x
Ir (2)							
Rh (2)							
Ru (2)							
A2							
Cu (0.5)	300	150	200	150	30	250	150
Pb (1)	100	30	100	500	50	80	50
Zn (20)	60	200	1400	5,000	200	5000	200
Sn (1)	200	200	>10,000	8,000	3,000	200	1
Cd (3)							
Bi (1)	x	x	x	x	x	x	x
Ag (0.1)	0.1	0.1	0.1	0.3	0.1	3	0.1
Au (3)	x	x	x	x	x	x	x
Ga (1)							

Sample No	A63	A88	A101	A119	B12	B58	C4
A2 Contd.							
Ge (1)							
As (50)	50	50	x	100	200	x	50
Sb (30)							
A3							
Te (20)							
Tl (1)							
P (100)	x	200	300	300	x	100	200
A4							
Na (50)							
Li (1)							
A5							
K (5)							
Rb (10)							
Cs (30)							
A6							
Ba (50)							
Sr (10)							
Y (10)							
La (100)							
Ce (300)							
Nd (300)							
Pr (100)							
Ti (100)							
Er (100)							
Sc (50)							
Eu (50)							

048

6720149

[redacted]

049

049

AML – ANALYTICAL SERVICE

JOB: 956/73

Semi-Quantitative Spectrographic Analysis Schemes A1, A2, A3,A4,A5 & A6 BATCH ....

Form 60

Results in ppm unless otherwise stated. Detection limits in brackets

Sample No	C15							
A1								
Co (5)	20							
Ni (5)	100							
Cr (20)	50							
V (10)								
W (50)	X							
Mo (3)	3							
Mn (10)	200							
Ta (100)	X							
Nb (20)	X							
Be (1)	1							
Th (100)								
Pt (10)	X							
Pd (10)								
Os (10)	X							
Ir (2)								
Rh (2)								
Ru (2)								
A2								
Cu (0.5)	300							
Pb (1)	50							
Zn (20)	600							
Sn (1)	200							
Cd (3)								
Bi (1)	X							
Ag (0.1)	0.1							
Au (3)	X							

Sample No	C15							
A2 Contd.								
Ge (1)								
As (50)	X							
Sb (30)								
A3								
Te (20)								
Tl (1)								
P (100)	300							
A4								
Na (50)								
Li (1)								
A5								
K (5)								
Rb (10)								
Cs (30)								
A6								
Ba (50)								
Sr (10)								
Y (10)								
La (100)								
Ce (300)								
Nd (300)								
Pr (100)								
Ti (100)								
Er (100)								
Sc (50)								
Eu (50)								

677050

TABLE NO:- 4(b)

050

677051

Duplicate

23 JUN 1972

amdel
The Australian Mineral Development Laboratories

Flemington Street, Frewville, South Australia 5063
Phone 79 1662, telex AA82520

Please address all correspondence to the Director
In reply quote: AN3/283/0 - 5737/

21 June 1972

DISTRIBUTION

The Manager
Sampey Exploration Services
PO Box 134
MIDLAND WA 6056

REPORT AN5737/72

YOUR REFERENCE:	Order 1928 (ref. no. 5267)
IDENTIFICATION:	As listed
DATE RECEIVED:	8/6/72

Enquiries quoting AN5737/72 to Officer in Charge please.

Analysis by: R.R. Robinson

Officer in Charge, Analytical Section: A.B. Timms

ABT

for F.R. Hartley
Director

jw

c.c. Labtech Pty Limited
237 Great East Highway
MIDLAND WA 6056

[redacted] 5[redacted]/72 [redacted] S[redacted]Qua[redacted]ati[redacted]Spec[redacted]gra[redacted]An[redacted]ysis S[redacted]eme A1[redacted]A3 [redacted]

Form 25 Results in ppm unless otherwise stated. Detection limits in brackets. A3

	Sample No.	Co (5)	Ni (5)	Cr (20)	Os (10)	W (50)	Mo (3)	Mn (10)	Ta (100)	Nb (20)	Be (1)	Pt (10)	P (100)
1	A 50	x	30	300	x	100	3	2,000	x	200	5	x	3,000
2	51	5	10	300	x	300	3	500	x	100	5	x	2,000
3	52	x	20	200	x	1500	x	1,500	x	150	3	x	10,000
4	53	30	50	5,000	x	x	x	1,500	x	20	1	x	x
	54	80	80	10,000	x	50	3	300	x	x	1	x	x
6	55	500	1000	>10,000	x	x	x	1200	x	x	1	x	x
7	58	10	30	3,000	x	x	3	100	x	20	1	x	x
8	69	50	500	5,000	x	300	3	[illegible]	x	80	10	x	500
9	70	30	10	200	x	3,000	x	1,000	x	50	5	x	3000
10	71	30	400	3,000	x	50	3	800	x	100	10	x	500
11	82	10	30	300	x	80	3	1,000	x	50	15	x	100
12	86	80	30	300	x	x	x	3,000	x	200	x	x	x
13	87	50	30	250	x	x	x	4,000	x	200	x	x	x
14	90	10	30	300	x	500	x	4,000	x	150	10	x	1,000
15	91	x	50	100	x	1,000	3	1000	x	200	5	x	10,000
16	92	5	30	200	x	50	x	500	x	50	5	x	200
17	93	10	50	100	x	1,000	3	2,000	x	150	3	x	10,000
18	94	20	30	150	x	x	x	3,200	x	200	x	x	x
19	95	20	30	150	x	50	3	1,200	x	50	5	x	1,000
20	96	10	20	300	x	50	3	[illegible]	x	20	3	x	x

Results are semi-quantitative. Elements apparently present in concentrations of economic interest should be redetermined by an appropriate accurate analytical technique. X = Not detected

Geo A_1, A_2. 54 × 197

AMDEL ANALYTICAL SERVICE

JOB 5737/77. Semi-Quantitative Spectrographic Analysis Scheme A1+A3 BATCH 2

Form 25 Results in ppm unless otherwise stated. Detection limits in brackets. A3

	Sample No.	Co (5)	Ni (5)	Cr (20)	Os (10)	W (50)	Mo (3)	Mn (10)	Ta (100)	Nb (20)	Be (1)	Pt (10)	F (100)
1	A 97	20	30	300	x	800	3	800	x	80	10	x	500
2	100	10	300	200	x	x	3	1,500	x	100	1	x	1,000
3	121	20	50	300	x	x	x	300	x	50	1	x	x
4	B 1	10	50	200	x	x	x	500	x	50	3	x	500
5	3	20	500	200	x	50	x	800	x	50	10	x	500
6	4	10	30	500	x	50	x	1,000	x	50	5	x	x
7	7	10	50	100	x	x	x	800	x	20	5	x	2,000
8	10	5	30	150	x	x	x	800	x	30	10	x	x
9	11	10	40	5,000	x	x	x	1,500	x	80	15	x	100
10	12	30	30	200	x	50	x	1,300	x	80	15	x	300
11	35	30	40	4,000	x	x	x	1,200	x	100	15	x	x
12	40	80	500	5,000	x	x	x	3,000	x	100	x	x	x
13	41	500	1,000	>10,000	x	x	x	500	x	x	1	x	x
14	43	500	1,500	>10,000	x	100	x	250	x	x	1	x	x
15	45	20	30	2,000	x	100	x	1,000	x	50	5	x	5,000
16	46	300	200	>10,000	x	x	x	1,500	x	20	1	x	x
17	47	80	100	4,000	x	x	x	2,500	x	20	1	x	x
18	48	200	150	>10,000	x	x	x	300	x	20	1	x	x
19	49	100	150	10,000	x	x	5	300	x	x	1	x	x
20	53	50	50	300	x	x	5	500	x	50	5	x	x

Results are semi-quantitative. Elements a[illegible]

677053

[redacted]

Form 25 Results in ppm unless [redacted] stated. [redacted] limits in [redacted]

053

	Sample No.	Co (5)	Ni (5)	(20)	Os (10)	W (50)	Mo (3)	Mn (10)	Ta (100)	Nb (20)	Be (1)	P (10)	F (100)
1	B 73	500	1,000	>10,000	x	x	3	300	x	x	1	x	x
2	75	30	50	10,000	x	50	3	800	x	20	5	x	100
3	C 1	20	50	2,000	x	50	x	1,500	x	20	5	x	100
4	6	80	80	4,000	x	50	3	2,500	x	80	3	x	x
5	10	80	100	3,000	x	x	3	500	x	x	3	x	x
6	12	80	80	500	x	100	3	300	x	x	5	x	x
7	17	50	50	5,000	x	x	x	2,500	x	20	1	x	x
8	18	300	100	>10,000	x	80	x	2,000	x	50	3	x	100
9	21	500	1,500	>10,000	x	50	x	1,000	x	x	1	x	x
10	24	1,000	1,500	>10,000	x	x	x	1,000	x	x	1	x	x
11	25	1,000	1,000	>10,000	x	50	x	1,500	x	20	1	x	x
12	26	800	500	>10,000	x	x	x	1,200	x	x	1	x	x
13	28	200	150	>10,000	x	50	x	2,000	x	50	3	x	500
14	29	1,000	2,200	>10,000	x	[illegible]	x	,000	x	x	1	x	x
15													
16													
17													
18													
19													
20													

Results are semi-quantitative. Elements apparently present in concentrations of economic interest should be redetermined by an appropriate accurate analytical technique. X = Not detected at limit quoted

677054

AMDEL ANALYTICAL SERVICE

JOB 5737/72 — Form 23

Semi-Quantitative Spectrographic Analysis Scheme A2 — BATCH 4

Results in ppm unless otherwise stated. Detection limits in brackets.

	Sample No.	Cu (0.5)	Pb (1)	Zn (20)	Sn (1)	Cd (3)	Bi (1)	Ag (0.1)	Au (3)	Ga (1)	Ce (1)	As (50)	Sb (30)
1	A 50	250	20	100	1 000		5	0.1	x			50	
2	A 51	20	20	60	2 500		x	0.1	x			20	
3	A 52	10	30	100	>10000		2	0.1	x			50	
4	A 53	100	10	200	150		x	x	x			x	
5	A 54	8	30	400	50		x	x	x			x	
6	A 55	10	5	1500	1 000		x	x	x			x	
7	58 2 [illegible]	20	3	40	10		x	x	x			x	
8	63	30	20	200	3,000		x	0.1	x			50	
9	70	20	50	x	300		x	x	x			x	
10	71	20	50	400	1,000		x	x	x			50	
11	82	150	10	200	3,000		1	0.1	x			100	
12	86	200	30	400	50		x	x	x			x	
13	87	150	30	400	80		x	x	x			x	
14	90	20	20	80	>10,000		1	x	x			x	
15	91	20	50	30	>10,000		x	x	x			300	
16	92	5	20	100	10,000		1	x	x			x	
17	93	80	50	300	>10,000		5	0.1	x			x	
18	94	300	150	100	500		x	x	x			x	
19	95	10	20	80	800		x	0.1	x			x	
20	96	5	5	80	2 000		x	0.1	x			100	

677055

Form 23

Results in ppm unles otherwise stated. Detection limits in brackets.

055

	Sample No.	Cu (0.5)	Pb (1)	Zn (20)	Sn (1)	Cd (3)	Bi (1)	Ag (0.1)	Au (3)	Ga (1)	Ge (1)	As (50)	Sb (30)
1	A 97	10	20	80	10,000		30	0.1	x			x	
2	100	10	40	400	3,000		3	0.1	x			50	
3	121	10	15	100	800		x	0.1	x			x	
4	B 1	10	10	50	300		x	0.1	x			x	
5	3	100	10	300	800		50	0.1	x			50	
6	4	10	5	50	200		x	0.1	x			x	
7	7	3	30	100	20		x	0.1	x			x	
8	12	20	10	200	3,000		1	0.1	x			200	
9	11	5	20	500	1,500		x	0.1	x			x	
10	18	30	20	100	10,000		1	0.1	x			200	
11	35	100	20	80	2,000		20	0.1	x			50	
12	40	250	120	50	400		x	x	x			50	
13	41	20	3	2,000	800		x	x	x			x	
14	42	28	5	1,000	10,000		x	x	x			x	
15	45	30	30	100	3,000		x	x	x			50	
16	46	10	10	600	2,000		x	x	x			x	
17	47	50	10	150	80		x	x	x			x	
18	48	80	30	800	300		x	0.1	x			x	
19	49	150	20	300	80		x	x	x			x	
20	53	30	5	100	1,000		20	0.1	x			50	

Results are semi-quantitative. Elements apparently present in concentrations of economic interest should be redetermined by an appropriate accurate analytical technique. X = Not detected

677056

JOB .5727/[illegible]

Form 23

AMDEL ANALYTICAL SERVICE

Semi-Quantitative Spectrographic Analysis Scheme A2

BATCH ....9.......

Results in ppm unless otherwise stated. Detection limits in brackets.

	Sample No.	Cu (0.5)	Pb (1)	Zn (20)	Sn (1)	Cd (3)	Bi (1)	Ag (0.1)	Au (3)	Ga (1)	Ge (1)	As (50)	[illegible] (50)
1	6 72	10	5	1,500	[illegible]		x	x	x			x	
2	78 75	10	10	30	50		x	x	x			x	
3	C 2	10	10	30	800		x	x	x			50	
4	6	300	30	300	10,000		10	0.1	x			100	
5	10	80	5	200	40		x	0.1	x			[illegible]	
6	12	1,200	10	30	8,200		30	0.1	x			200	
7	17	20	20	400	300		x	x	x			x	
8	18	5	20	600	3,000		1	x	x			x	
9	21	5	10	1,000	2,000		x	x	x			x	
10	24	10	5	800	500		x	x	x			x	
11	25	5	20	600	2,000		x	x	x			x	
12	26	10	15	600	120		x	x	x			x	
13	28	10	80	500	1,000		3	x	x			x	
14	29	5	3	1,500	1,000		x	x	x			x	

057

TABLE NO 5

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ANALYSTS

(Formerly Analytical Division of Sampey Exploration Services)
237 Great Eastern Highway, Midland
G.P.O. Box U1938, Perth, Western Australia, 6001
Telephone: 74 2566 • Telegrams: "Exserv" Perth

Field Sheet No:— 677058

Line No.:—

Project/Charge/ Despatch Note No.:—

Date:— 31-OCT-72

Any queries please quote Lab. Sheet Number:— 5509/1

SAMPLE	CU	PB	SN	ZN			
AA 1	5	30		10			
AA 2	5	15		10			
AA 4	10	5		10			
AA 7	10	20		10			
AA10	10	10		10			
AA13	5	5		10			
AA16	10	10		5			
AA18	5	10		5			
AA21	10	10		10			
AA23	10	25		30			
AA24	5	15		10			
AA27	5	5		10			
METHOD	101B	101B	XRF	101B			

FORM S34 FOR METHOD DETAILS SEE PRICE LIST

JOB NUMBER 5509 RACK NUMBER 4921

058

TABLE NO: 5

LABTECH PTY. LTD.

ANALYSTS

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237 Great Eastern Highway, Midland

G.P.O. Box U1938, Perth, Western Australia, 6001

Telephone: 74 2566 • Telegrams: "Exserv" Perth

Field Sheet No:— Duplicate

Line No.:—

Project/Charge/Despatch Note No.:—

Date:— 1-NOV-72

Any queries please quote Lab. Sheet Number:— 5509/1

SAMPLE		CU	PB	SN	ZN			
AA 1		5	30	<500	10			
AA 2		5	15	<500	10			
AA 4		10	5	<500	10			
AA 7		10	20	<500	10			
AA10		10	10	<500	10			
AA13		5	5	<500	10			
AA16		10	10	<500	5			
AA18		5	10	<500	5			
AA21		10	10	<500	10			
AA23		10	25	<500	30			
AA24		5	15	<500	10			
AA27		5	5	<500	10			
METHOD		101B	101B	XRF	101B			

FORM S34 FOR METHOD DETAILS SEE PRICE LIST

JOB 5509 RACK 4921

TABLE NO 6

677060

LABTECH PTY. LTD.
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237 Great Eastern Highway, Midland
G.P.O. Box U1938, Perth, Western Australia, 6001
Telephone: 74 2566 ● Telegrams: "Exserv" Perth

Field Sheet No:—

Line No.:—

Project/Charge/ Despatch Note No.:—

Date:— 15-MAR-75

Any queries please quote Lab. Sheet Number:— 5693/1

SAMPLE	CR	CU	NI	PB	ZN
PS2500S	15	BLD	10	5	10
PS2501S	10	BLD	10	5	5
PS2502S	10	BLD	10	5	10
PS2503S	5	5	10	5	5
PS2504S	5	5	10	5	5
PS2505S	5	BLD	5	5	5
PS2506S	5	5	5	5	5
PS2507S	5	BLD	5	5	5
PS2508S	5	BLD	5	10	5
PS2509S	5	BLD	5	10	5
PS2510R	15	35	15	20	10
PS2511S	10	5	5	5	5
PS2512R	5	55	5	65	25
PS2513R	15	15	15	15	10
PS2514S	10	5	5	10	10
PS2515S	10	5	BLD	5	5
PS2516S	5	5	BLD	10	10
PS2517S	5	BLD	BLD	5	10
PS2518S	5	BLD	BLD	5	5
PS2519S	10	BLD	BLD	5	5
.... NO QUALITY CONTROL ON CHROMIUM					
METHOD	101B	101B	101B	101B	101B

FORM S34 FOR METHOD DETAILS SEE PRICE LIST

JOB NUMBER 5693 RACK NUMBER 5423

677061 TABLE NO: 7(a)

ANALYSIS OF ROCK SAMPLES, E.L. 53/70:

No.	Sn%	Ba	S	Ag	Cu	Pb	Zn	Co	Ni	Mn	Cr
ASR 9					840	5	20	-	-	-	-
11					75	65	70	-	-	-	-
15	8.50										
BSR 1	0.17	< 10	< 5	< 1	130	10	85	20	15	150	-
12	0.53	10	< 5	< 1	5	15	520	30	25	3700	-
13	0.11										
14	0.31	< 10	< 5	< 1	190	10	210	25	20	2000	-
23					45	45	40				
24/4	0.025	< 10	5	< 1	45	10	60	25	20	4000	-
24/7	0.79	< 10	5	< 1	20	10	160	25	5	1600	-
26	0.68	20	< 5	< 1	310	20	320	75	15	1800	-
27	0.01										
CSR 6					25	-	30	-	4600	-	1100
7					10	-	75	500	1900	-	6400
12	0.76	< 10	< 5	< 1	810	70	230	25	20	200	-
13	2.50	< 10	< 5	< 1	150	15	70	25	5	280	-
27	0.92	< 10	< 5	< 1	280	15	110	20	5	130	-
34c	0.025										

C90

Analysis of Rock Samples Livingstone Creek TABLE No 7(b)

Sample	Fe%	Sn%	ppm Cu	ppm Pb	ppm Zn	Au dwt/ton
S-1	60.0	0.43	90	40	215	
S-2	59.5	0.45	130	48	276	
S-3	60.0	0.46	78	64	255	
S-4	58.8	0.47	112	74	391	
S-5	57.6	0.48	108	56	317	
S-6	57.6	0.52	136	51	372	
S-7	59.7	0.21	158	124	467	
S-8	53.4	0.44	274	54	402	
S-9	50.1	0.34	234	133	718	
S-10	61.1	0.31	58	58	121	
S-11	63.1	0.43	33	61	170	
S-12	58.6	0.47	68	112	329	
S-13	59.3	0.46	36	49	173	
S-14	59.1	0.51	58	53	300	
S-15	57.3	0.47	49	67	290	
S-16	56.4	0.63	80	49	244	
S-17	-	<0.05	10	<1	6	<0.05

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SPECTROMETER SERVICES PTY. LTD.

BY ....

LABTECH PTY. LTD.
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237 Great Eastern Highway, Midland • G.P.O. Box U1938, Perth, Western Australia, 6001

677063

JOB NO. 5267

APPROXIMATE COMPOSITION OF HEAVY MINERAL FRACTIONS:

NOTE:

1. Values given are only very approximate and are in volume %.

2. The presence of weathered fragments of schistose rocks, and of an extremely wide range of grainsize precludes accurate estimation and identification.

3. Approximate analyses for Pb, Zn, Cu, Ag, Ni, Sn, and possibly W, should be made on the more interesting samples.

C.I. Mathison

26th June, 1972

RECEIVED 30 JUN 1972

Telephone: 74 2566 • Telegrams: "Exserv" Perth
Offices at: Albion Qld. (Phone 621 414), Botany, N.S.W. (666 9021), Kalgoorlie, W.A. (211 395).

NO:- 8

677064

LABTECH PTY. LTD.

ANALYSTS

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A MEMBER OF THE SAMPEY GROUP

237 Great Eastern Highway, Midland • G.P.O. Box U1938, Perth, Western Australia, 6001 • Telephone: 74 2566 • Telegrams: "Exserv" Perth

JOB NO. 5267: APPROXIMATE COMPOSITION OF HEAVY MINERAL FRACTIONS

Sample Number	Schist	Limonite + ilmenite	Magnetite	Zircon	Rutile	Cassiterite	Monazite	Chromite	Sulphide	Tourmaline	Garnet	Carbonate	Andalusite	Amphibole	?Diopside	?Corundum
A32	80	12		3			tr	tr		5						
A37	35	40	2	10	tr		tr	3		10						
A39	95	2	1	2			tr	tr		tr						
A42	30	50	2	10	tr		1	2		5						
A45	20	65	tr	10	tr		tr	tr		5	tr					
A46	-	10	-	tr				tr		tr	tr				90	
A47	-	10	tr	2	tr			tr	85	3	tr					
A48	42	45	5	tr			tr	tr	tr	3	tr					tr
A56	50	40	tr	3			tr	tr	tr	3		tr		3		tr
A57	20	60	5	1		?tr	tr		10	5	2			tr		2
A59			no	samples						no	samples					
A60	15		tr		5	?tr	tr		tr	10	tr			tr		5
A62	-	5	tr	2	tr		tr			3	tr		?90	tr		1
A63	-	15	tr	2	tr			tr		3			?80			tr
A67	50	40	tr	6	tr			tr	tr	4				tr		
A75	5	45	tr	6	1		3	tr		15	tr	tr	?25	tr		
A76	-	30	tr	10	tr			tr		10			?50			
A78	10	35	tr	5	tr		5	tr		25			?20	tr		
A80	40	20	tr	10	tr		10			20				tr		
A81	10	50	tr	10	tr		10	tr	5	15			tr			
A84	30	50	tr	10	tr		tr	tr		10			tr			
A88	50	45	tr	3	tr		tr			2						
A101	10	75	tr	10	tr		tr		tr	5						
A103	70	10	tr	12	2	?tr				6						
A105	40	30	tr	15	tr		5	tr		10						
A110	5	50	tr	15	tr		5			20	tr		?5			
A114	-	55	tr	10	3	?tr	2	tr	tr	20			?10			tr
A115	-	50	tr	7	3		2	tr		13			?25			
A119	30	15	tr	7	tr	?tr	tr		40	5			?3			
A123	-	60	tr	12	2	?3	tr			13			?10			
A125	-	45	tr	20	tr	?tr	2		tr	18			?15			
B12	5	35	tr	25	3	?	5	tr		27	tr					
B14	10	30	tr	20	3	?	7			30						
B19	5	40	tr	25	tr		tr			30						
B23	10	35	tr	30	3	?	7			15						
B27	25	40	tr	12	2	?1	5			15						
B29	40	40	tr	10	tr	?	2			8						
B34	55	10	tr	20	tr	?	2			13				tr		
B51	50	30	tr	15	tr	?	1			4						
B57	10	20	tr	55	2	?	2	tr		11						
B58	30	30	tr	30	2	?	1			7						
B62	-	18	tr	65	2	?2	3			10			tr			
B65	-	15	tr	60	2	?1	2			15			tr			
B66	5	10	tr	15	2	?2	1			63			2	tr		
B67	15	20	tr	20	tr	?3	2		tr	40		tr				
C4	50	40	tr	6	tr	?				4		tr		tr		
C5	40	55	tr	3	tr		tr			2						
C15	45	50	tr	3	tr		tr	tr		2		tr		tr		
C22	-	6	tr	12	tr	?2	10			70				tr		
C23	50	10	tr	10	tr	?	5	tr		20		5				

TABLE NO: 9:

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JOB NO. 5114

Sample No.	2	3	5	6	7	8	12	13	14	16
Opaques	tr	tr	20	tr	tr	15	30	65	5	10
Limonite	5	5	tr	5	5	tr	tr	tr	tr	10
Leucoxene	tr	tr	tr	tr	tr	tr	tr	tr	tr	tr
Andalusite	50	45	60	55	65	60	55	?tr	70	20
Tourmaline	25	40	10	20	10	10	10	10	15	10
Quartz ± Felspar	20	10	10	20	20	15	5	15	10	20
Zircon	tr	tr	tr	tr	tr	tr	tr	10	tr	-
Rutile	-	-	tr	tr	tr	tr	tr	tr	tr	-
Spinel	-	-	tr	-	-	-	-	-	-	-
Cassiterite	-	-	-	-	-	-	tr	tr	tr	-
TOTAL	100	100	100	100	100	100	100	100	100	100*

* includes 30% altered rock fragments.

NOTE:

1. Opaques generally appear to be mainly ilmenite (except sample 13 where they cannot be identified).

2. Compositions are given in estimated volume percentages. Relative error approx. ± 30% of values given.

3. The mineralogy indicates that the main rocks in the source area are argellaceous sediments, probably intruded by granite with associated tourmaline metasomatism.

Offices at: Albion Qld. (Phone 621 414), Botany, N.S.W. (666 9021), Kalgoorlie, W.A. (21 395).

TABLE NO: 10

MINERALOGICAL COMPOSITION OF PANNED CONCENTRATES

Sample 1	Oversize:	quartz	ilmenite
		metasediment	chromite
		magnetite	heavy silicate (tourmaline, hornblende)
		limonite	limonite
			monazite
			zircon
			garnet
			rutile
			cassiterite
			magnetite
Sample 2	Oversize:	quartz	ilmenite
		metasediment	apromite
			limonite
			tourmaline
			amphibole
			monazite
			zircon
			garnet
			rutile
Sample 3	Oversize:	metasediment	ilmenite
			limonite
			tourmaline
			hornblende
			chromite
			monazite
			zircon
			cassiterite
			rutile
Sample 4	Oversize:	tourmaline	ilmenite
		quartz	tourmaline
			monazite
			zircon
			cassiterite
			rutile
Sample 5	Oversize:	tourmaline	tourmaline
		quartz	limonite
		limonite	andalusite
			ilmenite
			monazite
			zircon
			cassiterite
			rutile
			pyrite

C129/7-STR
3 AUGUST 1971

Sample 6	Oversize:	felspar quartz metasediment	andalusite ilmenite tourmaline zircon chromite rutile monazite cassiterite corundum
Sample 7	Oversize:	quartz magnetite metasediment	ilmenite chromite hornblende tourmaline monazite zircon rutile garnet
Sample 8	Oversize:	quartz chromite magnetite limonite	chromite ilmenite tourmaline monazite zircon rutile
Sample 9	Oversize:	quartz felspar metasediment	ilmenite chromite sphalerite zircon cassiterite rutile Chalcopyrite monazite
Sample 10	Oversize:	tourmaline quartz	tourmaline andalusite monazite zircon garnet rutile corundum
Sample 11	Oversize:	quartz felspar metasediment	tourmaline ilmenite chromite andalusite cassiterite zircon monazite rutile spenel
Sample 12	Oversize:	felspar quartz metasediment	ilmenite chromite tourmaline zircon monazite cassiterite andalusite gold

C129/7-STR
3 AUGUST 1971

Sample 13	Oversize:	Metasediment quartz felspar	limonite ilmenite sphalerite altered silicates hornblende pyrite Chalcopyrite monazite zircon
Sample 14	Oversize:	quartz felspar metasediment	tourmaline ilmenite monazite zircon andalusite rutile cassiterite
Sample 15	Oversize:	tourmaline quartz	ilmenite amphibole monazite zircon chromite rutile cassiterite zircon
Sample 16			tourmaline ilmenite monazite zircon rutile cassiterite
Sample 17			ilmenite chromite tourmaline hornblende zircon carbonate cassiterite
Sample 18			tourmaline ilmenite hornblende monazite
Sample 19			tourmaline ilmenite monazite zircon cassiterite garnet.

C129/7-STR
3 AUGUST 1971

067

Appendix No 1

677069

ROCK SAMPLES :

THIN SECTION DESCRIPTIONS

AND LOCALITIES

VALLEY PROJECT

Compiled : Alistair Barton

Date : 25/9/1972

068

677070

1. INTRODUCTION

From the rock samples collected from the Stanley River area, twenty were thin sectioned. These were:-

ASR 5	BSR 13	CSR 5
ASR 7	BSR 24	CSR 6
ASR 9	BSR 25	CSR 16
ASR 10	BSR 27	CSR 18
ASR 11		CSR 21
ASR 15		CSR 22
		CSR 30
		CSR 33
		CSR 34 (c)
		CSR 36

Hogen-Esch and Lee collected series "A", Barton and Masters collected series "B", and Milne and Buckingham collected series "C".

Thin sectioning and microscopic descriptions was done by A. Barton with help from J. Leishman.

A summary of the thin section descriptions will be given, together with the location of samples. An appendix with the full descriptions will follow.

2. ROCK DESCRIPTIONS AND LOCALITIES

2.1 ASR 5 :- The rock is a vein rock which is composed of anhedral quartz - 50%, tourmaline (schorlite) - 50%, and minor accessories - <1%. The rock was formed when magmatic volatiles crystallized in fissures or joints through which it was permeating.

The sample was taken 100 yards upstream from the sediment sample A71, in the granite.

2.2 ASR 7 :- The sample is a holocrystalline medium-grained, hypidiomorphic granular granite which is composed of quartz - 40%, biotite - 5%, plagioclase - 15%, orthoclase - 35%, sericite - 4%, opaque minerals - <1%, and monazite - <1%. The biotite is thought to have crystallized first and was embayed, and gathered in clumps when it passed into a higher thermal zone. The crystallization of the other minerals, except sericite, followed.

The sample was taken 10 yards upstream from sediment sample A2 which was taken in a small stream just off from Stanley River.

2.3 ASR 9 :- The sample which was described as banded quartz-tourmaline with sulphides along jointing in the granite, in the hand specimen, was taken 100 yards upstream from A3 creek in the Stanley River.

The rock is a hypidiomorphic granular, fine-grained vein rock which is composed of quartz - 70%, tourmaline - 25%, and sulphides - 5%. There seems to be two stages of crystallization; firstly, the subhedral quartz, followed by the anhedral quartz-tourmaline-sulphide assemblage.

2.4 ASR 10 :- This sample is the parent granite for ASR9 and was taken next

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to the ASR 9 sample.

The rock is a holocrystalline, medium grained granite with a hypidiomorphic granular fabric. It consists of quartz - 54%, tourmaline - 10%, feldspar - 20%, sericite - 5%, and sulphides - 1%. It is thought to be a late stage crystallization granite because it contains the volatile minerals.

2.5 ASR 11:- This silicified slab of Crimson Creek Formation was taken about midway between A80 and A 80 on Salmon Creek.

The rock can be called a sandy claystone which is texturally immature, and it is composed of quartz - 30%, rock fragments - 5%, sulphides - 12%, sericite - 2%, minor accessories - 1% and the clay matrix - 50%. The rock fragments consist mainly of metasediments. The rock type could be indicative of a lagoon type environment.

8.5% Sn

2.6 ASR 15:- This sample was picked up in a boulder pile from old workings near where A 100 was taken.

The rock is a holocrystalline vein rock which is composed of a quartz - 65%, tourmaline (schorlite) - 20%, cassiterite - 15% and accessories - <1%. Most of the anhedral to subhedral casserite crystals occur in clumps. The rock was probably formed when emanating fluids crystallized in cracks or fissures within the granite.

0.11% Sn base metals n.d.

2.7 BSR 13:- This sample which was taken in the small creek bounding the Livingstone Creek Iron Anomaly, was described in the hand specimen as thinly banded quartz-tourmaline.

The thin section description confirms this. The rock is composed of quartz - 60%, tourmaline - 40% and a black opaque mineral (magnetite?). The banding is due to concentrations of quartz and tourmaline respectively. It was probably formed when emanating fluids metasomatized the country rock.

2.8 BSR 24:- This sample was taken from the Livingstone Creek Iron Anomaly and is described as spherulitic hematite. (4000 Hm Mn) 2414 = 0.025% Sn; 1600 " " 2417 = 0.74% Sn

The spherulitic texture was not discernable in the thin section and the minerals occurred in irregular masses. Gas vesicles occur in some abundance (2 - 3%), while the rock consists of hematite, -25%, limonite - 15%, goethite - 5%, while 55% of the slide area has been lost to slide cutting processes.

2.9 BSR 25:- This sample was found at the base of the Livingstone Creek Iron Anomaly but was not found in situ.

The rock consists of angular quartzite fragments cemented by hematite (or magnetite?), goethite and limonite. It is composed of quartz - 70%, hematite - 15%, and limonite and goethite - 15%. The quartz occurs in the quartzite fragments or as single grains cemented in the iron oxides. Because a fault is thought to divide the iron anomaly, this rock could be fault breccia which was cemented by iron oxides.

2.10 BSR 27:- This sample was taken 200' N.E. from Livingstone Creek downstream of the iron anomaly.

The rock is a poikilitic, holocrystalline, hypidiomorphic granular granite

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which is slightly porphyritic. The rock consists of quartz - 45%, plagioclase - 5%, orthoclase -45%, biotite - 2%, sericite - 2%, muscovite - <1%, and kaolin (?) - <1%. The plagioclase is strongly zoned, with the inner zone being strongly sericitized. The orthoclase gives the granite its slightly porphyritic texture, with crystals up to 10mm in length.

2.11 CSR 5:- This sample was collected from a small conical hill on the left bank of the Harman River. The hand specimen was described as a serpentinite with abundant chromite.

The thin section description showed it to be a dunite which has been serpentinized, with a dominant mesh structure prevailing. The rock is composed of olivine - 40%, antigorite - 59%, and opaque minerals (spinel or chromite ?) - 1%.

2.12 CSR 6:- This sample was taken in the same locality as CSR 5, and was described in the hand specimen as a serpentinized peridotite.

The rock has a mesh structure and is composed of antigorite - 75%, talc - 10%, olivine - 5%, enstatite - <1%, limonite - 6%, chromite or magnetite - 1%, and chlorite - 1%. The original rock was probably a peridotite which has been serpentinized, with later weathering to produce limonite and chlorite.

2.13 CSR 16:- This rock was taken from a rock traverse across the granite-quartzite contact. The rock can be described as a "granitic" quartzite because of the development of large feldspar and quartz crystals. The rock has a granoblastic, poikiloblastic and porphyroblastic texture but no orientation is present. It is composed of quartz - 90%, orthoclase - 3%, biotite - 2%, plagioclase - 1%, tourmaline - 1%, muscovite - 1%, and secondary sericite - 2%. The rock was probably formed when emanating fluids from the granite intrusion metasomatized the psammite at the contact.

2.14 CSR 18:- This rock was taken from the same rock traverse as CSR 16.

This rock can be described as a "granite-quartzite", because there is a greater development of a granite texture even though the sample was taken closer to the quartzite. The rock has a granoblastic and porphyroblastic texture but no orientation is present. It is composed of quartz - 80%, plagioclase - 7%, orthoclase - 5%, biotite - 5%, sericite - 2% and minor accessories - 1%. Metasomatism of the country rock by emanating fluids probably caused its formation.

2.15 CSR 21:- The rock was taken from the same traverse as CSR 18, but was taken further away from the granite.

The rock is a quartz-muscovite-hornfels, showing typical hornfels texture. The original bedding of the psammite(?) is still preserved and is due to varying concentration of quartz, muscovite and chlorite, as well as bands of larger and smaller quartz grains. The hornfels consist of quartz - 50%, muscovite - 35%, tourmaline - 1%, black opaques (magnetite?) - 1%, chlorite - 10%, limonite - 1%. The hornfels was formed due to contact metamorphism at the contact when the granite intruded the psammite ?

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2.16 CSR 22:- This rock comes from the same granite contact zone as CSR 21, but it is taken further away from the granite.

The rock is a quartzite showing a typical hornfels texture. The bedding of the original psammite is still preserved (same reasons as CSR 21). It consists of quartz - 65%, muscovite - 30%, tourmaline - <1%, heavy opaques (magnetite) - 2%, and limonite staining - 3%. Contact metamorphism at the contact produced the quartzite.

2.17 CSR 30:- The rock was taken south of the actual granite-quartzite contact.

It is a quartz-tourmaline metasomatic replacement rock with a polygonal texture developed in the quartz. This polygonal texture indicates that the tourmaline-sulphide fluids entered the country rock and replaced the psammite, but the quartz was recrystallized. The rock consists of quartz - 70%, tourmaline - 29%, and sulphides - 1-2%.

2.18 CSR 33:- This weathered volcanic rock was taken just east of the Stanley River, downstream from Livingstone Creek.

The volcanic rock is extremely weathered with very few original minerals able to be properly identified. The rock consists of plagioclase - 10%, orthoclase - 15%, clinopyroxene - 15%, black opaque mineral (magnetite?) - 5%, the secondary minerals due to weathering process; chlorite (penninite) - 15%, limonite staining - 2%, and the unknown dirty, speckeldy secondary mineral - 15%. Due to slide cutting; 22% of unknown grains have been removed. The black opaque mineral occurs in a long thin needle-like form. Because of the extreme weathering, the type and paragenesis cannot be given.

2.19 CSR 34 (c) :- This rock was collected at the Livingstone Creek Iron Anomaly.

The rock is a tourmaline-zoisite (?) metasomatic rock which was found in a quartzite. Irregular banding occurs due to concentrations of tourmaline and zoisite respectively. The rock is composed of zoisite - 50%, tourmaline - 45%, opaques (magnetite or sulphides ?) - 2%, and quartz - 3%. The zoisite ? is hard to distinguish due to the smallness of the grain and the anhedral shapes. Metasomatism of the psammite by emanating tourmaline-zoisite-opaque fluids replaced the psammite and formed the banded rock.

2.20 CSR 36 :- This rock was collected from along the Wilson River.

This rock is a homogeneous, equi-grained orthochemical sediment which is composed of microcrystalline calcite ooze - 35%, the euhedral calcite crystals (maybe dolomite ?) - 60%, quartz - 2%, and carbonaceous matter - 3%. The rock can be described as a carbonaceous coarse calcilutite which has been formed due to the possible recrystallization of a micrite.

3. APPENDIX

DETAILED THIN SECTION DESCRIPTIONS

3.1 ASR 5 :- The vein rock is slightly poikilitic, hypidiomorphic, and holocrystalline. It is fine-grained; the crystals varying in length from 4 mm to very small crystals.

The rock is composed of tourmaline - 50%, quartz - 50%, and minor accessories - <1%; the accessories consisting of a little limonite staining and some very small opaque crystals.

The tourmaline variety is schorlite and it is identified by its slate blue, olive, buff and neutral grey colours with strong pleochroism. Zoning is also characteristic. Birefringence is moderate to strong with cross sections showing no birefringence. The crystals are 2mm to very small crystals (0.05mm) in size. There are some subhedral grains but most crystals are anhedral and have very irregular shapes.

The quartz consists of anhedral grains made up of composite grains with some grains showing strong undulose extinction. Crystals are generally 1 to 2mm in size, with some larger and smaller grains. The absence of cleavage and twinning, lack of alteration, and the low birefringence and relief are all characteristic of quartz.

Paragenesis :- The rock is composed of magmatic volatiles which crystallized out in fissures through which it was permeating.

3.2 ASR 7 :- The rock is a holocrystalline, medium-grained, hypidiomorphic granular granite.

The granite is composed of quartz (40%), biotite (5%), plagioclase (oligoclase ? 15%), orthoclase (35%), sericite (4%), opaque minerals (<1%), and monazite (<1%).

The quartz is composed of anhedral grains which show undulose extinction, hence indicating that pressure was involved during formation. The quartz envelops biotite crystals and embayed crystals of quartz, but is at times enveloped by potash feldspar. The quartz is distinguished from the feldspars due to its unaltered state.

The biotite occurs as single grains or in clumps, but without any orientation; the grains being $\frac{1}{2}$ to 1mm in length. The brown to olive-brown colour and the strong pleochroism identify the biotite. Pleochroic haloes are also present.

The type of plagioclase is difficult to identify because of the sericitization of the grains, which masks the extinction, and the very few grains present. Those crystals which were present indicate it to be oligoclase. The plagioclase was identified by the albite twinning.

The orthoclase, which has been sericitized to some extent encloses subhedral grains of quartz, plagioclase, and crystal clusters of biotite which have been embayed. Zoning occurs and twinning (simple) within the orthoclase crystals which range in sizes from 7mm to 1mm in length.

The sericite is formed by secondary processes from the alteration of feldspar to sericite. It occurs as small flecks and minute shreds.

The opaque minerals occur as anhedral grains of about 0.05mm. Most opaques occur in the biotite or are associated with it.

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The rock is a granite if based on *Nockold's Classification.

Paragenesis :-

The biotite crystallized from the magma first but was embayed when it passed into a higher thermal zone. This was followed by the crystallization of the other minerals except the sericite which was formed due to secondary processes.

* A Petrography of Australian Igneous Rocks - Joplin, G.

3.3 ASR 9 :- This rock is a hypidiomorphic granular fine-grained vein rock which is composed of quartz - 70%, tourmaline - 25%, and sulphides - 5%.

The quartz occurs as anhedral grains with some subhedral grains which are no larger than 2mm but they do occur as very tiny crystals. The subhedral crystals are generally enclosed in other quartz grains or partly or wholly enclosed in the tourmaline grains and the sulphide grains. There seems to be two stages of crystallization, firstly, the subhedral quartz grains (which contain specks of unidentifiable minerals), and secondly, the quartz, tourmaline sulphide mineral assemblage.

The tourmaline occurs mostly as anhedral grains with some subhedral grains. The tourmaline, together with the sulphides, seem to be the last to crystallize out because of their irregular shape. The crystal sizes vary from 2mm to very tiny crystals. The tourmaline variety is schorlite due to the olive green, slate blue, and brown colours together with strong pleochroism.

The sulphides (hand specimen identification) occur as the late stage crystallizing mineral. Crystals are irregularly shaped and commonly enclose quartz crystals. The grains vary from 2-3mm in size down to very small crystals, but some of them occur as composite grains.

Paragenesis :-

These are vein minerals which have orientation in the field specimen, but due to the size of the slide, the orientation is not observable. There are two stages of crystallization. Firstly, the subhedral quartz, which was followed by the anhedral quartz, tourmaline and sulphides.

3.4 ASR 10 :- The rock is a holocrystalline, medium-grained granite with a hypidiomorphic granular fabric, and it consists of quartz - 64%, tourmaline - 10%, feldspar - 20%, sericite - 5%, and sulphides - 1%.

The quartz occurs as anhedral, with some subhedral crystals, which vary in size from 2 to ¼mm in length. Many are embayed, and vacuoles and microlites are common in many crystals. Undulose extinction is present, indicating that strain was present during formation. The quartz is distinguished from the feldspar by the lack of alteration.

The type of feldspar could not be distinguished because of the high degree of alteration or sericitization which has occurred. The

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feldspar crystals vary in length from 2mm to <1mm.

Schorlite is the tourmaline variety and it is distinguished by the olive-brown, slate blue, greenish colours and the distinct pleochroism and zoning. Most crystals are 1 to 2mm in length but some are much smaller. The crystals are subhedral to anhedral in shape and occur mainly in association with the pockets of quartz, and the sulphides.

The sericite occurs due to the secondary alteration of the feldspar, and is present as small radiating crystals and shards throughout the feldspars.

The black opaque minerals which have been described as sulphides in the hand specimen, occur with the quartz-tourmaline clumps. The crystals vary in size from 1mm to <0.25mm.

Paragenesis :- The so-called "granite" is a late stage crystallization product which contains the volatile minerals tourmaline and sulphides. Secondary processes have sericitized the feldspars.

3.5 ASR 11 :- The rock is a highly silicified grey slab of the Crimson Creek Formation which contains pyrite mineralization.

Texture :- The rock consists of 90% terrigenous material and 10% orthochemical material. The rock is bedded or layered with some thick grey clay bands developed and a small fault cuts the actual slide. The rock is non porous.

The grain sizes vary from sand size (0.5mm to 0.25mm)- 35%, to silt size - 2%, down to clay sized particles - 50%. The sand size fraction is moderately sorted and ranges from medium sized sand grains to very fine sand grains. These grains are sub-angular to rounded and occur as elongate to compact grains.

The silt size fraction consists of subangular but compact grains.

The mud fraction has a ratio of silt sized particles to clay particles of 1:25. Therefore, the textural name (based on Folk's classification) is a sandy claystone.

Because of the high clay percentage, the rock is texturally immature. The bonding agents are the clay matrix with later cementation provided by silicification.

Mineral Composition :- The rock is composed of quartz - 30%, rock fragments - 5%, sulphides - 12%, sericite - 2%, minor accessories - 1%, and the clay matrix - 50%.

The rock fragments consist of quartzite - 2%, and highly sericitized unidentifiable grains - 3%.

The rock fragments are well rounded.

The quartz grains are well rounded to subangular and have straight to undulose extinction.

The sericite occurs as small flecks and platy aggregates and is recognized by its colourlessness and second order interference colours.

The silicified clay matrix is brown and in the clay bands it is a strong moderate brown colour.

The pyrite development occurs in the clay matrix and in some rock fragments. Perfect cubic crystals have formed in the clay bands, while irregular development occurs in the sandy claystone areas.

Accessories include sphene, a little limonite staining, and some small muscovite flakes.

Paragenesis :-

The rock seems to be formed in a lagoon type environment where clay particles can settle together with sand grains which could have been wind blown into position. The grey colour of the rock which is probably due to the pyrite, indicates a reducing environment. The textural name of the rock could be called a sandy claystone. Later compaction and local metamorphism resulted in the silicification.

3.6 ASR 15 :- The rock is a holocrystalline vein rock which is composed of quartz - 65%, tourmaline - 20%, cassiterite - 15%, and accessories - 1%.

The quartz occurs as anhedral crystals which range in size from 4mm to 0.2mm. Many crystals show undulose extinction due to stain. The quartz is identified by its low relief ($<$ balsam), grey, white and yellowish interference colours, and its unaltered state.

The tourmaline variety is schorlite which is distinguished by its duck-egg blue, green to olive colours, the zonal structure in the cross section and the strong pleochroism. Most crystals are anhedral to subhedral which vary in length from 3mm to $\frac{1}{4}$mm in size.

The cassiterite occurs as anhedral to subhedral grains of 1 to 2mm in length with some crystals being very small. It is distinguished by its colour, which is colourless but a brown flecked colour occurs due to the very high relief. Simple twinning occurs and one set of cleavage is distinct. Extinction occurs obliquely to the twin plane. The high order interference colours are masked by the neutral colour of the mineral. Most of the cassiterite crystals occur in groups of crystals.

The accessories include small crystals of muscovite enclosed in quartz and a black opaque mineral (sulphides?) which occurs as anhedral grains.

Paragenesis :-

The rock is formed when emanating fluids crystallize out along a joint plane or crack.

3.7 BSR 13 :- The rock consists of thinly banded quartz-tourmaline which was probably formed when a volatile quartz-tourmaline fluid was injected into the country rock and metasomatism occurred. The banding occurs due to concentrations of alternating quartz and tourmaline crystals. Most crystals are xenoblasts and are mostly equigranular.

The rock consists of quartz - 60%, tourmaline - 40%, black opaque mineral (magnetite) - 1%.

The xenoblastic quartz has straight extinction and the crystal size is no greater than 0.5mm in length. The quartz is recognised by its low relief, white interference colour, and unaltered state (due to weathering).

The tourmaline consists mainly of xenoblastic crystals, but some odd subidioblastic crystals occur. The size of the crystals is no greater than 0.5mm. The tourmaline variety is schorlite and is distinguished

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by the olive-green to orangy-brown colour and the strong pleochroism. Parallel extinction and "isotropic" cross sections are also indicative of schorlite.

The magnetite? occurs as very small crystals and is generally associated with the tourmaline.

Both the tourmaline and quartz have a slightly sutured crystal outline but a hornfelsic texture is certainly not developed.

Paragenesis :-

The rock was possibly formed when introduced fluids from the emplacement of the granite magma metasomatized the country rock to form banded quartz-tourmaline.

3.8 BSR 24 :-

Spherulitic Hematite :- The spherulitic texture is not discernable although there are some straight thin blank spaces in the slide where crystals could have been plucked out, but these are not radiating in texture. 55% of the grains or matrix could have been lost in the slide cutting process, depending on the original amount of solids present.

Gas vesicles up to 1mm in length but generally ½mm in diameter occur with some abundance, 2-3%.

Very small anhedral to subhedral crystals of a high relief mineral occurs. These occur within the iron matrix and in the gas vesicles but due to the very high relief, and second order interference colours, the crystals could be the corundum in the grinding powder ?

The rock consists of goethite, limonite and hematite. The goethite is distinguished by its crystalline form and parallel extinction. Limonite has not these properties. The hematite is opaque and black in colour. Goethite - 5%, limonite - 15%, hematite - 25%.

The iron oxides all occur in irregular masses.

3.9 BSR 25 :- The rock consists of quartzite fragments cemented by an opaque oxide, (hematite and/or magnetite), goethite, and limonite. It is composed of quartz - 70%, hematite - 15%, and limonite-goethite - 15%.

The quartzite fragments consist of anhedral quartz grains ranging in size from 1mm to less than 0.25mm. Some secondary quartz cementing occurs. Limonite and/or goethite, together with hematite or magnetite, occur as grains and veinlets in the quartzite fragments.

As well as the quartzite fragments, quartz grains are cemented into a limonite-goethite-hematite matrix. Most of these grains are embayed and very angular in shape. There was no undulose extinction in the quartz grains, or in the quartz particles comprising the quartzite fragments. This could indicate recrystallization of the quartz particles in the original quartzite.

The goethite distinguished from the limonite and hematite by its reddish colour and parallel extinction. Limonite is distinguished from the opaque oxides by its brownish colour, whereas hematite is present in the areas which are completely black.

Paragenesis :- The rock could have been formed in a fault zone as a

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fault is thought to be near where the rock was picked up. The fault occurred in quartzites, and fragments of quartzites were later cemented by iron oxides.

3.10 BSR 27 :- The rock is a poikilitic, holocrystalline, hypidiomorphic granite which is slightly porphyritic.

The rock consists of quartz - 45%, plagioclase - 5%, orthoclase - 45%, biotite - 2%, sericite - 2%, muscovite - 1%, and kaolin? - 1%.

The quartz crystals are anhedral and vary in size from 4mm to 0.25mm. Most quartz grains have undulose extinction and some enclose biotite, plagioclase and muscovite. Secondary vein quartz occurs between grain boundaries and is generally less than 0.01mm thick.

The plagioclase occurs as subhedral crystals which range in length from 6mm to 1mm. Most crystals are highly sericitized. The plagioclase is distinguished by the albite twinning and by using the Michel-Levy method, the type of plagioclase is found to be oligoclase. Strong zoning occurs in most crystals and the inner zone of these crystals is more susceptible than the outer to secondary alteration.

The subhedral grains of orthoclase range from 10mm to 1mm and most grains have been altered in part to sericite. The orthoclase encloses plagioclase in some crystals and hence has a slightly perthitic texture. The carlsbad twinning, the secondary alteration and the extinction angles distinguish the orthoclase.

The typical biotite crystals are ½ to 2mm in length and are subhedral. Pleochroic haloes are present. The typical olive brown colour, the form, and the straight extraction are distinctive of biotite.

The sericite occurs as minute shard-like grains and is formed by secondary processes.

The tourmaline (schorlite) occurs as small graphic crystals of less than ½mm in length and are enclosed in orthoclase crystals. The schorlite is distinguished by its colour and strong pleochroism.

The muscovite occurs in small subhedral crystals of less than 0.05mm in length and are enclosed in the feldspars. The colourless crystals, the slight change in relief on rotation of the stage, the interference colours and the low to zero extinction angle determines muscovite.

The kaolin? occurs due to the weathering of the plagioclase. The kaolin is distinguished by the veinlet type replacement form and the low relief. The slight iron oxide colouration could explain the brownish-yellow colour and the yellowish interference colours which are not distinctive of kaolin.

Paragenesis :-

Crystallization of the granite magma with the orthoclase (remnant) crystallizing out very early. Possible remelting of the granite with the remnant orthoclase remaining (it encloses tourmaline and muscovite). Recrystallization occurs and hence the slight porphyritic nature of the rock.

3.11 CSR 5 :- The rock is a holocrystalline, equi-grained ultrabasic which has a dominant mesh structure. It is allotriomorphic granular.

The rock is composed of olivine - 40%, antigorite - 59% and accessory opaque minerals - 1%.

The olivine is distinguished by its high relief, large axial angle and higher birefringence from diopside. Irregular fractures can be distinguished where serpentinization has occurred. Before serpentinization of the rock, the olivine occurred in crystals of about 1 to 3mm in size, but since serpentinization, the maximum crystal size is ½mm. Weak carlsbad twinning occurs. The olivine crystals remaining are anhedral, but the crystal outlines before serpentinization cannot be properly defined.

The antigorite has low relief, and a slightly anomalous maximum interference yellow colour. It occurs as anhedral aggregates of fibro-lamellar structure. It occurs between the original olivine crystals and the fractures in the olivine crystals.

The opaque minerals are euhedral to subhedral grains of spinel or chromite (described as chromite in the hand specimen). The euhedral grains occur as equant octahedra, and most grains are very small.

Paragenesis :-

The rock is a dunite which has been emplaced and later serpentinized to give the typical mesh structure.

3.12 CSR 6 :- The rock has a mesh structure with some remnant crystals of olivine remaining. Limonite has replaced the olivine in some places but mostly the original rock type has been serpentinized.

The serpentinite consists of antigorite, talc, olivine, limonite, magnetite? or chromite?, chlorite and enstatite.

The antigorite forms the mesh structure and replaces the olivine and enstatite. It comprises 75% of the rock. The low interference colours, structure, colour (colourless) and low relief distinguish the antigorite.

The talc occurs as long fibrous aggregates with a parallel arrangement. Some shreds are bent. The upper third order interference colours, parallel extinction, relief, and colour indicate that it is either talc or sericite, but due to hand specimen observations of the rock, it can be considered to be talc. It comprises 5% of the total rock.

The remnant olivine occurs in small crystals (½mm) of which many show cleavage traces. The olivine has been serpentinized or has been replaced by limonite (weathering effects). The olivine comprises 5% of the total rock, but the grains which have been plucked from the slide (7% of slide area) are likely to be olivine.

The remnant enstatite occurs in small crystals of the same length as the olivine. It is distinguished from olivine by the low order interference colour and the slightly lower relief. It comprises 1% of the total rock.

The limonite replaces? the olivine and enstatite? due to weathering?. In some places it has only partly replaced the olivine. It occurs in small lumps no greater than 0.25mm. It comprises 5% of the total rock.

The chromite or magnetite occurs as small black anhedral crystals scattered throughout the rock. It comprises 1% of the rock.

The green chlorite occurs in one crystal and is probably due to weathering. It comprises 1% of the rock.

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Paragenesis :-

The original rock was probably a peridotite (due to olivine and enstatite remnants) which has been serpentinized to produce antigorite and talc, with later weathering to produce limonite and chlorite.

3.13 CSR 16 :- The rock can be described as a "granitic" quartzite in that there is a development of large quartz and feldspar crystals. The rock has a granoblastic, poikiloblastic, and porphyroblastic texture but no orientation is present.

The quartzite is composed of quartz - 90%, orthoclase - 3%, biotite - 2%, tourmaline - 1%, muscovite - 1%, plagioclase - 1%, secondary sericite - 2%.

The quartz occurs as large porphyroblasts (4-5mm) with abundant vacuoles and undulose extinction, and as very small xenoblasts. These small xenoblasts are poikiloblastic. Many of the xenoblasts have undulose extinction.

The orthoclase occurs as large subidioblastic porphyroblasts (4mm long) as well as small xenocrysts. The porphyroblasts are poikiloblastic.

The biotite crystals have a slightly radiating structure indicating formation from nucleation.

The tourmaline and muscovite both occur as small embayed crystals and are found in the porphyroblasts and the "groundmass". These were probably volatiles introduced during the later stages of the granitic emplacement.

The plagioclase occurs as subidioblastic crystals (large and small) and was probably introduced with the orthoclase at the same time as the other volatiles.

The sericite was formed due to secondary processes acting on the feldspars, and to the alteration? of the biotite during the granite emplacement.

Paragenesis :-

The granitic magma intruded the quartzites and emanating magmatic fluids metasomatized the quartzite at the contact. This resulted in the formation of biotite, feldspars, and possibly quartz.

3.14 CSR 18 :- This rock, which was taken in and about the granitic contact, is nearly the same as CSR 16. It can be described as a "granite-quartzite", except that there is a greater development of a granitic texture.

The rock has a granoblastic and porphyroblastic texture but no orientation is present.

The "granite-quartzite" consists of quartz - 80%, plagioclase - 7%, orthoclase - 5%, biotite-5%, sericite - 2%, and minor accessories - 1%.

The quartz occurs as porphyroblasts (3-4mm), most of which have undulose extinction, and as very small xenoblasts which also have undulose extinction.

The plagioclase, the orthoclase and the biotite were probably introduced as fluids when the emplacement of the granite took place. Metasomatism resulted in the formation of porphyroblasts, which range in size from 4mm to 1mm; and in smaller subidioblasts and xenoblasts. All the porphyroblasts have sutured outlines. The Michel Levy's extinction

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angle method indicates that the plagioclase is oligoclase. Both the feldspars have been sericitized to a small extent.

The plagioclase is distinguished by the albite twinning, whereas the orthoclase has simple twinning or none at all. The alteration of the orthoclase distinguishes it from the clear, unaltered quartz. Biotite is distinguished by its colour, pleochroism and parallel extinction. The alteration product of the feldspars, sericite, occurs as small shards or aggregates. It is distinguished by its colourlessness, straight extinction, and form.

The minor accessories include magnetite ?, muscovite and very high relief, colourless, anhedral crystals which are too small to be identified.

Paragenesis :-

The granitic magma intruded the quartzite and magmatic fluids permeated the quartzite at the contact. Metasomatism resulted in the formation of biotite, quartz and feldspar crystals. The rock could be defined incorrectly as a "granite-quartzite".

3.15 CSR 21 :- This rock was taken from the same rock traverse as CSR 18 but is further away from the granite.

The rock is a quartz-muscovite-hornfels showing typical hornfels texture. The original bedding of the psammite? is still preserved and is due to the varying concentrations of the muscovite, chlorite and quartz grains respectively, but is also highlighted by the bands of larger and smaller quartz grains as well.

The hornfels consist of quartz - 50%, muscovite - 35%, tourmaline - 1%, black opaques (magnetite?) - 3%, chlorite - 10%, limonite - 1%.

The quartz exists as small xenoblastic grains, but in some cases dissolution has occurred to 2 or 3 grains and they have formed one irregular grain. The original bedding seems to be due to bands of fine sand size alternating with bands of silt size grains. The quartz is distinguished by its low relief and white interference colour.

The poikilitic muscovite has a subparallel orientation along the different bedding, and also highlights the bedding by its concentration along bedding which consists of very small grained quartz; the coarse quartz particle bands being practically free of muscovite and chlorite. The muscovite is distinguished by its moderate relief, parallel extinction, one developed set of cleavage and its colourlessness. No radiating structure occurs.

The chlorite, which is penninite due to the anomalous "Berlin blue" interference colour, occurs in the same form as the muscovite, except that a radiating structure of the crystals is developed. The penninite occurs along bands where the silt sized quartz grains occur. It is distinguished by its greenish colour, the pleochroism, and the anomalous "Berlin blue" interference colour.

The tourmaline occurs as small xenoblasts, but larger ones (up to 1mm) do occur and these are usually poikiloblastic. These crystals are scattered throughout the rock.

The black opaques occur as small xenoblasts scattered throughout the rock in the same way as the tourmaline.

../14

The limonite has had a secondary introduction due to small fissures developing in the rock. It has coated and filled the fissures and has stained the surrounding muscovite grains.

Paragenesis :-

The original psammite was intruded by the granite and contact metamorphism resulted in the production of a quartz-muscovite hornfels. The original bedding has been preserved but muscovite growth has occurred, with greater concentrations occurring in the very fine-grained or silt size layers.

3.16 CSR 22 :- This rock comes from the same granite contact zone as CSR 21, but it is taken further away from the granite.

The rock is a quartzite showing typical hornfels structure. The bedding of the original psammite is due to the concentrations of different sized quartz grains while the concentration of the muscovite grains only occurs in the bands of very fine sized quartz grains. There is no preferred orientation of the muscovite crystals.

The quartzite consists of quartz - 65%, muscovite - 30%, tourmaline - $<1\%$, heavy opaques (magnetite?) - 2%, and limonite - 3%.

The muscovite occurs as embayed xenoblastic grains which have a slight porphyroblastic and poikiloblastic development. Some crystals have limonite staining and a slight radiating structure while the other crystals have an idioblastic development. According to A. Spry, (Metamorphic Textures) this is due to free growth beginning from nucleation.

The quartz occurs as small granoblastic xenoblasts which generally have straight to slightly undulose extinction, and these crystals cause the embayments and poikiloblastic nature of the muscovite.

The magnetite or heavy opaques occur as very small xenoblasts evenly scattered throughout the rock.

The limonite staining in the muscovite probably owes its occurrence to the weathering of the magnetite grains because many magnetite grains have a brownish tinge around them.

The tourmaline, which is distinguished from the muscovite by its orange-brown colour and strong pleochroism, occurs in xenoblasts which are slightly poikiloblastic and are the same size as the muscovite crystals.

Paragenesis :-

The original psammite was intruded by the granite and contact metamorphism produced a quartzite with typical hornfels structure. The muscovite was developed due to growth from nucleation, and tourmaline was probably developed by the same process due to its similar form to muscovite.

3.17 CSR 30 :- The rock (in the hand specimen) is a quartz-tourmaline metasomatic rock which is typical to BSR 13, but a polygonal texture is present, i.e., in the quartz the rock is polygonized or recrystallized quartz found within the granite itself. Irregular banding occurs and this is again due to concentrations of alternating quartz and tourmaline. Emanating fluids (tourmaline-sulphides) have entered the quartzite and replacement takes place with recrystallization of the quartz.

../15

The rock consists of quartz - 70%, tourmaline - 29%, sulphides - 1-2%.

The quartz occurs in xenoblastic or anhedral crystals and vary in size from 2mm to 0.1mm but most crystals are 0.25mm in size. Some quartz crystals are enclosed in the tourmaline. In the quartz rich bands, polygonal texture exists. This is thought to occur when stained quartz grains, when metamorphism occurs, break down due to the lattice structure, being unstable.

All the quartz grains have straight extinction, no undulose extinction being present; hence recrystallization indicated. The quartz is distinguished by the low relief, uniaxial positive interference figure, and the low interference colours.

The tourmaline is brownish-orange in colour and it exhibits strong pleochroism. This is indicative of schorlite. The schorlite crystals are mostly xenoblastic but some subidioblastic crystals do occur. The length varies from 2mm down to 0.1mm but most crystals are 0.25mm long. Many tourmaline crystals are slightly poikiloblastic. There is an alignment of tourmaline crystals along the bands.

The sulphides were recognised under reflected light by its yellow colour. It occurs as mostly anhedral crystals but some occur as subhedral crystals. It is mostly associated with the tourmaline rich bands. One long streak of crystals about 4 mm long occurs.

Some secondary quartz veining running parallel and within the tourmaline rich bands occurs, but why it occurs in such a way is not known.

Paragenesis :-

The rock is probably a metasomatic replacement rock which was formed when tourmaline and sulphide fluids entered and replaced the quartzites in bands. The quartz was recrystallized, producing the polygonal texture.

3.18 CSR 33 :- The volcanic rock is extremely weathered with very few original minerals able to be properly identified. The texture is also unrecognizable.

The rock consists of plagioclase - 10%, orthoclase - 15%, clinopyroxene - 15%, black opaque mineral (magnetite?) - 5% and the secondary minerals, due to weathering processes; chlorite (penninite) - 15%, limonite staining - 2%, and the unknown dirty, speckeldy, secondary mineral - 15%. Due to the slide cutting process, 22% of unknown grains have been removed.

The remnant clinopyroxene is most likely aegerine-augite because the extinction angle is 15-20^{0}. Twinning occurs. All crystals are embayed and highly weathered. The crystals were subhedral and ranged from 1 mm to ½ mm.

The feldspars are all highly weathered and the crystal lengths are generally 1 mm. long. The plagioclase is identified by the albite twinning, but the identification of orthoclase is risky because it was based on the high degree of weathering, low relief, and the absence of albite twinning.

The penninite is distinguished by the anomalous "Berlin"blue interference colour and the greenish colour with slight pleochroism. The relief is moderately high, which distinguishes it from antigorite. The crystals occur up to 1 mm. in length and there is twinning according to the pennine law.

The black opaque mineral occurs in a long thin, needle like form, the needles generally being ½ mm. in length. It is most likely magnetite.

Because of the extreme weathering of the rock, no paragenesis is given.

3.19 CSR 34 (c) :- The rock is a tourmaline-zoisite metasomatic rock which was found in a quartzite. There is no bandind as found in BSR 13, but a concentration of tourmaline and zoisite respectively which thins and thickens irregularly to give the irregular bands.

The rock is composed of zoisite? - 50%, tourmaline - 45%, opaques (magnetite? or sulphides?) - 2%, and quartz - 3%.

The zoisite is hard to distinguish due to the smallness of the grains which are no larger than a ¼ mm., but the mineral is most likely a member of the Epidote group. The mineral must be the ferrian variety of zoisite which has normal interference figures. The high relief, weak birefringence, slight yellow to grey interference colours and the biaxial interference figures are indicative of zoisite. All grains are anhedral.

The tourmaline is easily distinguishable by the brownish to olive green colours and strong pleochroism which is indicative of schorlite. The schorlite occurs as small anhedral granule aggregates; the same as for the zoisite.

The opaques, which could be either magnetite or sulphides, occurs mainly with the tourmaline in the tourmaline rich streaks. The crystals are anhedral and sutured in texture and occur scattered around in small clumps within the streaks.

The quartz occurs as small anhedral crystals in the same form as the zoisite but is scattered throughout the rock. The quartz is distinguished by its low relief. Some of the grains have undulose extinction. These could be the remaining quartz grains remaining from the psammite into which the granite intruded.

Paragenesis :-

The quartz was probably the remnant of the psammite into which the granite intruded. Introduced magmatic fluids metasomatized the psammite and tourmaline, zoisite, and the opaques were formed into an irregularly banded rock.

3.20 CSR 36 :- The rock is a homogeneous equi grained calcilutite which could have possibly been dolomitized ? Because the thin section was not stained, dolomite cannot be detected.

The euhedral crystals of carbonate which make up the majority of the rock range in size from 0.1 to 0.02 mm. These crystals have most likely been recrystallized from a former limestone type, although no former structures or texture can be found. Microcrystalline calcite ooze occurs between these euhedral crystals, and a possible source type for the recrystallized euhedral crystals could be a micrite (Folk)* . (The euhedral crystals could also be dolomite).

The composition of the rock is microcrystalline calcite ooze - 35%, the euhedral crystals - 60%, quartz - 2%, carbonaceous matter - 3%.

The microcrystalline calcite ooze has a blackish tint about it which is caused by very fine carbonaceous matter. The carbonaceous matter also occurs as small round grains scattered throughout the rock, although clusters of grains occur in places.

* Folk, R.L. - Petrology of Sedimentary Rocks.

../17

The quartz occurs as detrital grains, but there is a slight development of secondary quartz from the dissolution of the detrital grains.

Secondary veins of white calcite also occur.

Paragenesis :-

The rock can be described as a carbonaceous coarse calcilutite which has been formed due to the possible recrystallization of a micrite.

* * * * * * * *

677087

085

4. REFERENCES

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Joplin, G.A.	1968	A Petrology of Australian Igneous Rocks. 2nd Edition. Angus and Robertson.
....	1968	A Petrology of Australian Metamorphic Rocks. Angus and Robertson, Publishers.
Kerr, P.F.	1959	Optical Mineralogy. 3rd Edition. McGraw-Hill Book Co.
Pettijohn, F.J.	1957	Sedimentary Rocks. Second Edition. Harper and Row, Publishers.
Spry, A.	1969	Metamorphic Textures. Permagon Press.

* * * * * * * * * * * *

REPORT ON 12 SAMPLES FROM TASMANIA   FOR J.T. IRVING:

The samples were taken to Mr. B. Stovic for thin section preparation: Mr. Bob Stovics bill was paid.

The samples are siltstones, cherts and a peculiar chalcedony bonded aggregate of oolitic to sub-polygonal equidimensional bodies. This may be of organic origin - it is certainly not clastic - but it could be a rhyolitic pisolitic tuff.

Z1 Fine blue and buff mottled siltstone (handspecimen)

This consists of angular quartz clasts, together with areas of sericitic and chloritic material that could be broken down felspars, but are probably clusterings of original intergranular clay minerals, in an incipient stage of metamorphic crystallisation. These rocks have been described as schists, but in truth, these particular specimens show but the merest hint of metamorphism. Lithic clasts and volcanic clasts are absent, and this is not a greywacke: nor does it appear to be arkosic, there being no felspars preserved, (though if the sericite clusters are after felspars the classification would be arkosic siltstone). I would refer to it as a quartzose siltstone.

Z2 Slightly coarser textured blue and buff mottled siltstone:

A slightly coarser variant of Z1.

Z4 Grey mottled siltstone:

Again, coarser with markedly angular quartz grains preserving most of their clastic outlines making up the coarse fraction. The mica has recrystallised locally into well formed flakes of sericite, but most of the clay mineral fraction remains in the fine sericite-chlorite matrix to the quartz grains. There is some sign of strain in the undulose extinction of the quartz grains, but deformation and recrystallisation effects are minimal.

Z19 Grey mottled siltstone:

Identical with Z4.

Z6 Grey cavernous siltstone - fine sandstone:

More uneven textured and coarser than the other specimens, this rock also shows much larger

Z6 cont: well-formed flakes of sericite. However, it is of the same essential character. The turbid areas have a distinct grain outline and could be after clastic felspars, which have decomposed. The rock is laced with minute stringers of opaque material which also forms irregular patches. These patches are yellow limonitic areas on the more weathered part of the cut surface.

Z8 Coarse and fine banded siltstone:

The coarser bands show recrystallisation to an interlocking mosaic, a not uncommon feature of such banded rocks. There is some felspar preserved in this mosaic and the rock was clearly arkosic. There is much fine sericite in the intergranular interstices, in the finer fraction, which preserves clastic outlines to the quartz grains.

Z20 Siliceous siltstone:

This is finer grained than other samples described above. The quartz grains are angular preserving their clastic outlines almost completely. The inter-granular matrix, the original clay mineral fraction, now consists of a very fine aggregate of sericite and chlorite.

Z21 Siliceous siltstone;

Similar to Z20, there is some indication that part of the fine sericite could have come from the breakdown of felspars

Z34 Rhyolitic 'pisolitic' ash (tuff) or organic remains of obscure origin:

This is a very odd rock. In hand specimen it has a creamy colour, and the very random sorting of a very fine siliceous tuff. However, in thin section it has a quite different character, and is seen to be composed of a remarkably size-sorted aggregate of rounded, spherical or subrounded polygonal bodies of very fine chert, bonded with coarser chalcedony, which, here and there has a distinct fibrous cavity filling habit. There is a substantial opaque mineral content.

The sorting and sphericity of the more perfect bodies rules out any clastic origin. The polygons suggest some obscure organic origin. I have seen very similar pisolitic tuffs in active volcanic terrains, but they are a couple of orders coarser.

.../3

Z34 I have never seen such polygonal bodies in an ash or tuff. I think this is of obscure organic origin, and that it could be a silicified organic chert, possibly not unrelated to the radiolarian cherts.

Z34W This is a weathered version of Z34. They are essentially the same rock type.

Z35 Chert:

This is an extremely fine grained ferruginous chert. It is hematite stained and shows a very faint lamination.

All specimens were checked for sulphides: Z1, Z8 and Z19 carry a speck or two of sulphides. Z6 does not seem to have preserved any of the sulphides.

No reaction for carbonates was found on any specimen.

The sediments of this assemblage do not have greywacke character. Sorting is too good and lithic clasts are absent. A slower accumulation with a less emphasised source terrain is indicated. They are of much slower accumulation. They are not quartzites either, lacking maturity. The clay fraction is well in evidence, and they are thus of only moderate maturity.

Dr. G.J.H. McCall

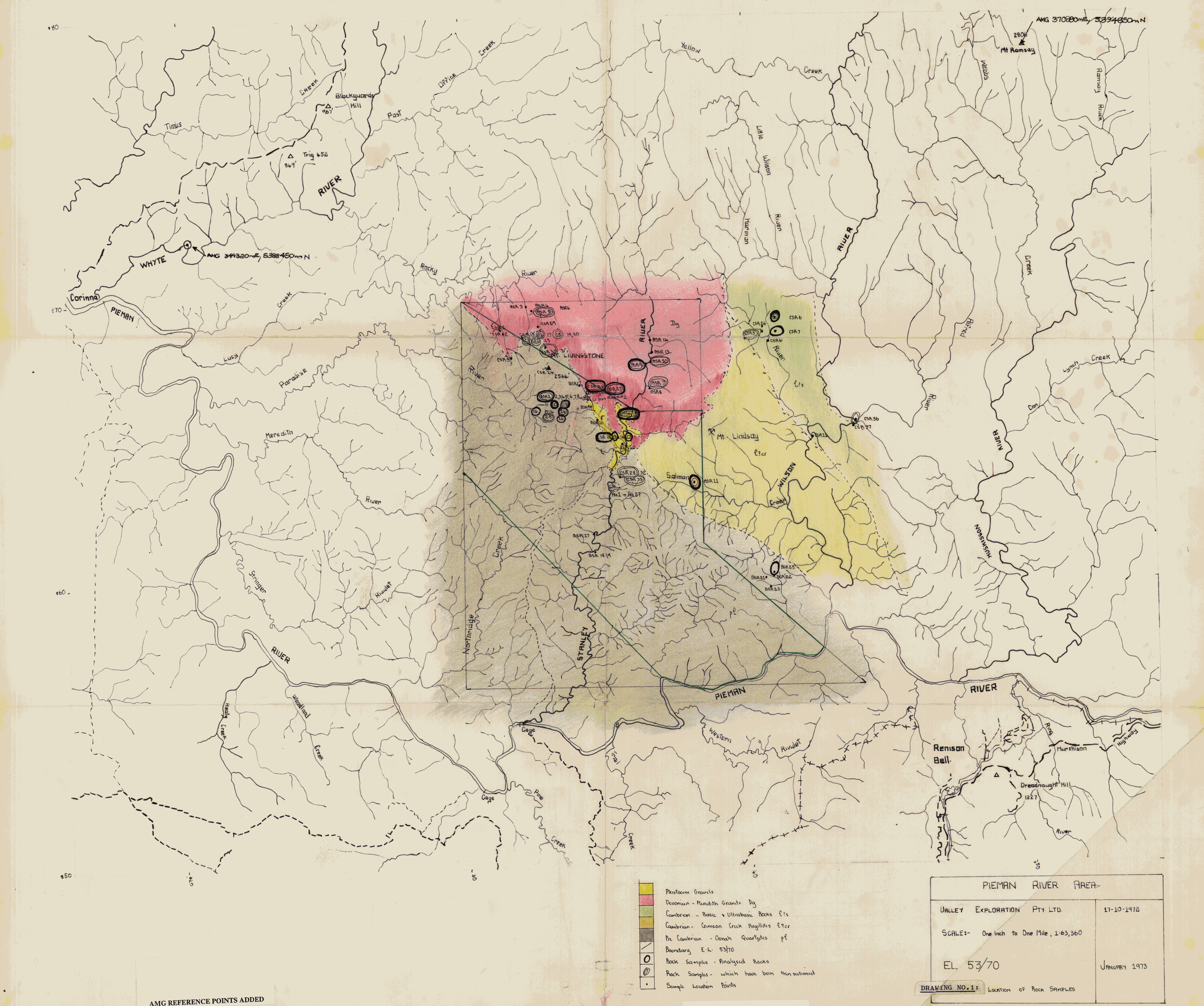
18-3-1973

37 Marama Drive,

Frankston, Victoria,

3199.

Return to IBJ



AMG REFERENCE POINTS ADDED

677091 73-957 2117

5 cm

- • Stream Sample Points
- •10 LABTECH Data
- •10 AMDEL Data
- o Below Detection Limit
- N Insufficient Sample

PIEMAN RIVER AREA:-	
VALLEY EXPLORATION PTY. LTD.	17-10-1972
SCALE:- One Inch to One Mile, 1:63,360	
SAMPLE LOCATION POINTS:- TIN	MARCH 1973
DRAWING No:3	

677092 73-957 2118

• Stream Sample Location

• 20 LABTECH RESULTS

0 Below Detection Limit

N Insufficient Sample Size.

5 cm

PIEMAN RIVER AREA:-	
VALLEY EXPLORATION PTY. LTD.	17-10-1972
SCALE:- One Inch to One Mile, 1:63,360	
SAMPLE LOCATIONS FOR COPPER:- LABTECH +	MARCH 1973
DRAWING No: 4	

2119

677093 73-957

73-957

• Stream Sample Location
•10 LABTECH Data
AMDEL Data
o Below Detection Limit
N Insufficient Sample.

5 cm

PIEMAN RIVER AREA:-	
VALLEY EXPLORATION PTY. LTD.	17-10-1972
SCALE:- One Inch to One Mile, 1:63,360	
SAMPLE LOCATIONS:- LEAD LABTECH + DATA	MARCH 1973
DRAWING No: 5	

677094 2120

73-957

- Sample Location Points
- •10 Labtech Data
- Amdel Data
- 0 Below Detection Limit
- N Insufficient Sample

5 cm

PIEMAN RIVER AREA:-	
VALLEY EXPLORATION PTY. LTD.	17-10-1972
SCALE:- One Inch to One Mile, 1:63,360	
SAMPLE LOCATION POINTS:- ZINC	MARCH 1973
DRAWING No: 6	

677095

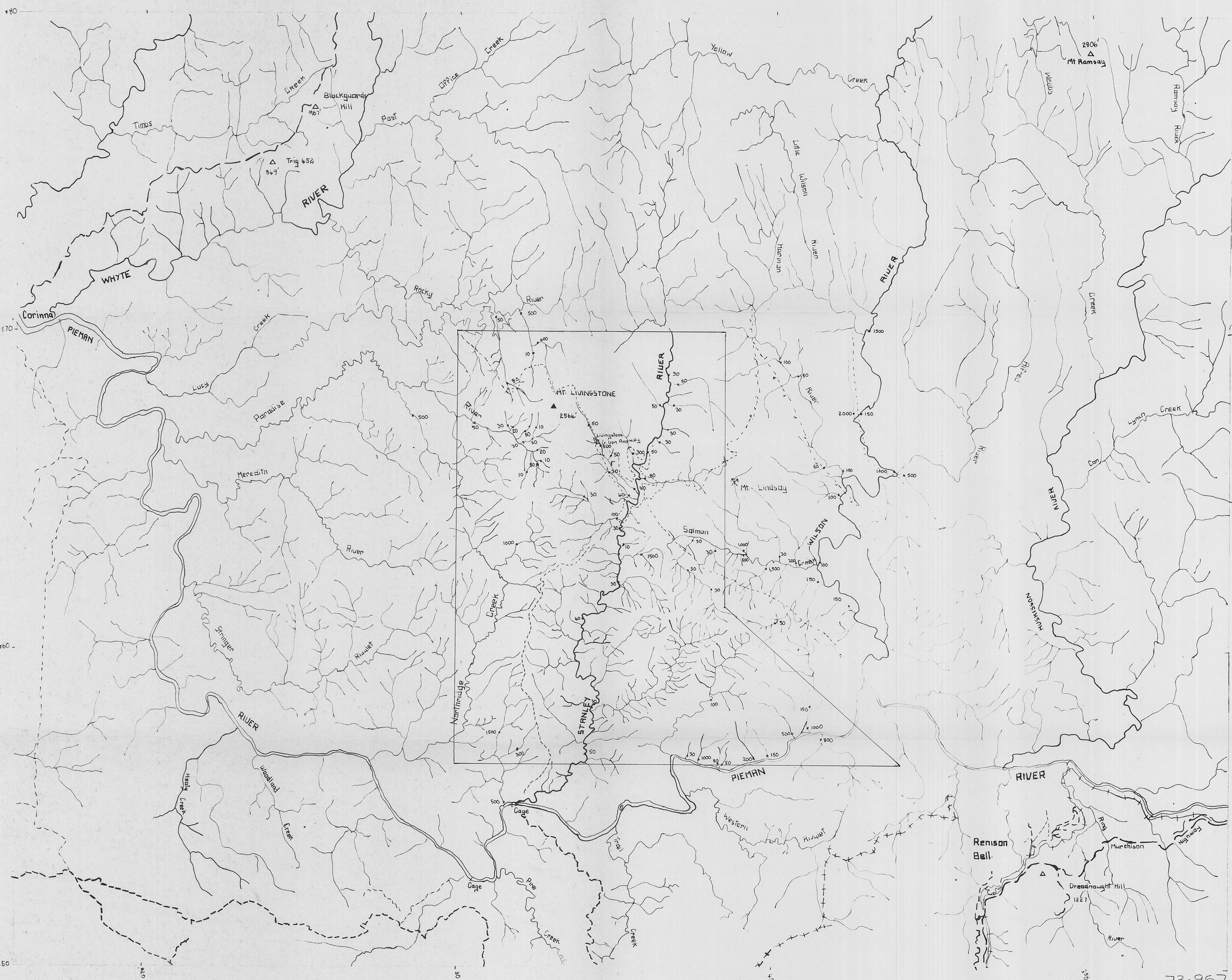
2121

73-957

PIEMAN RIVER AREA:-	
VALLEY EXPLORATION PTY. LTD.	17-10-1972
SCALE:- One Inch to One Mile, 1:63,360	
SAMPLE LOCATIONS: CHROME AMDEL DATA	MARCH 1973
DRAWING No. 7	

677096

2122



73-957

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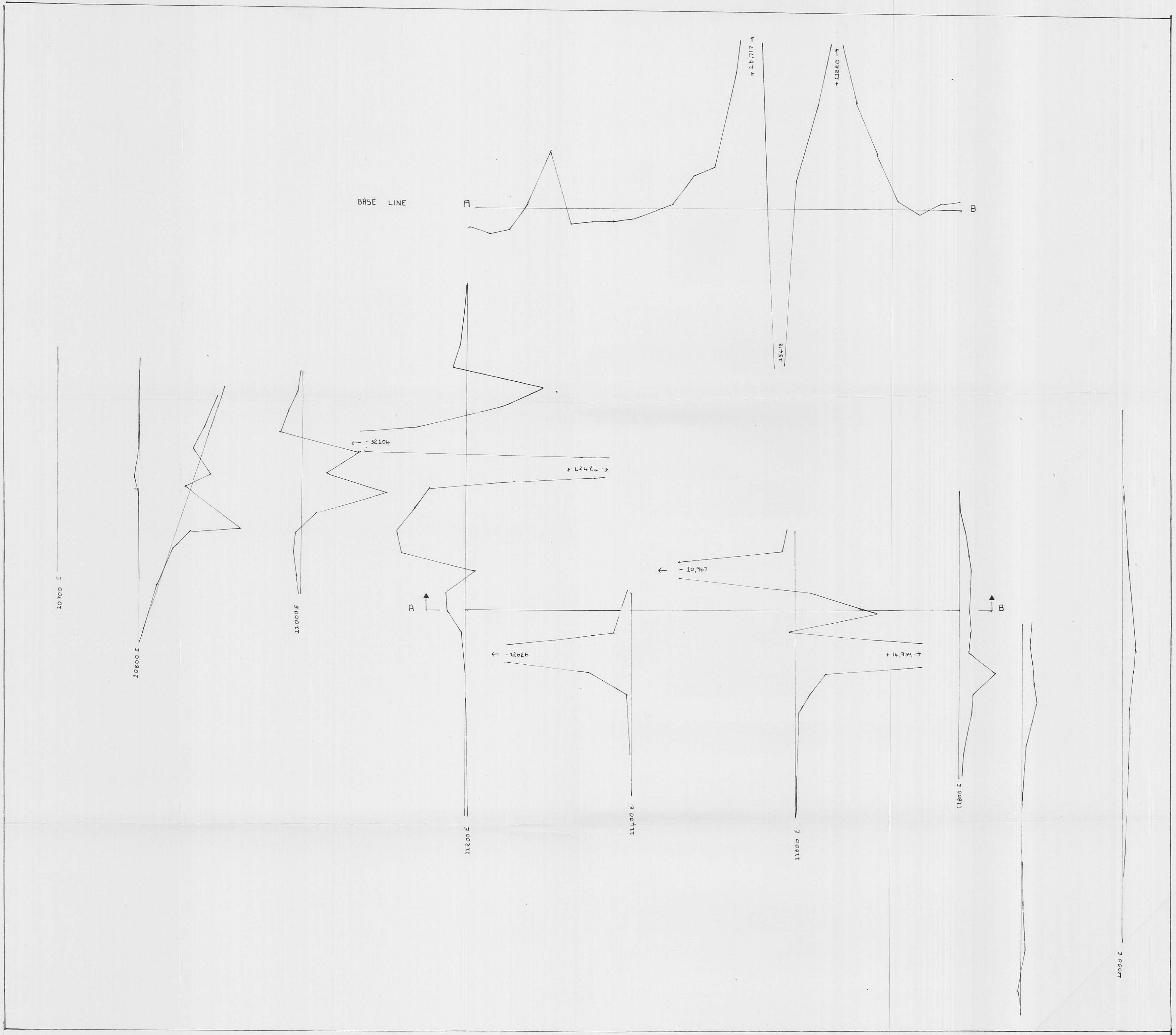
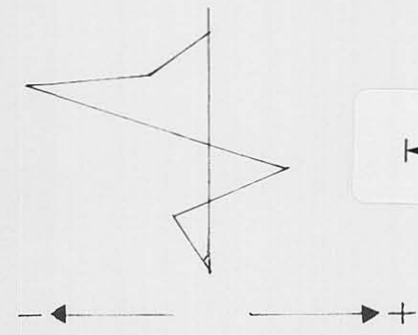
DRAWING No: 8	

677097 2123





5 cm

Vertical Scale:-

1" = 4000 GAMMAS

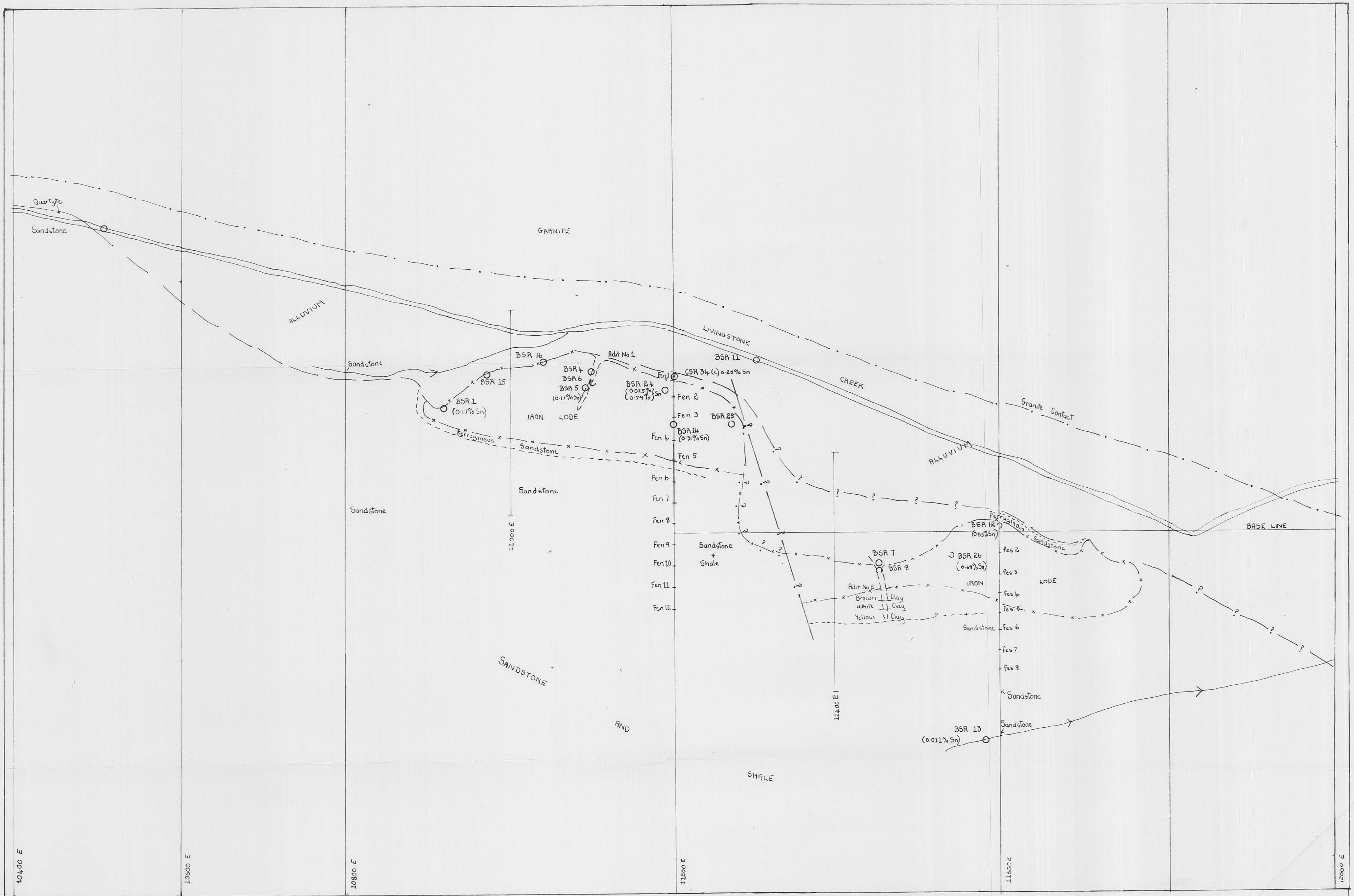
Horizontal Scale:-

1" = 80'

Magnetometer Readings were taken at 25' intervals

VALLEY EXPLORATION PTY LTD	
MAGNETIC SURVEY OF THE LIVINGSTONE CREEK IRON ANOMALY	25-9-1972
DRAWING No: 9	

677098 73-957 2124



SCALE:-

1" : 80'

○ Rock Samples

Fes/Fen Soil Samples

Iron Lode Outline

Geological Contact (Alluvium - Sandstone) Approximate Position

Granite Contact

Ferruginous Sandstone Boundary - Inferred

Fault (Attitude Unknown)

5 cm

VALLEY EXPLORATION PTY. LTD.

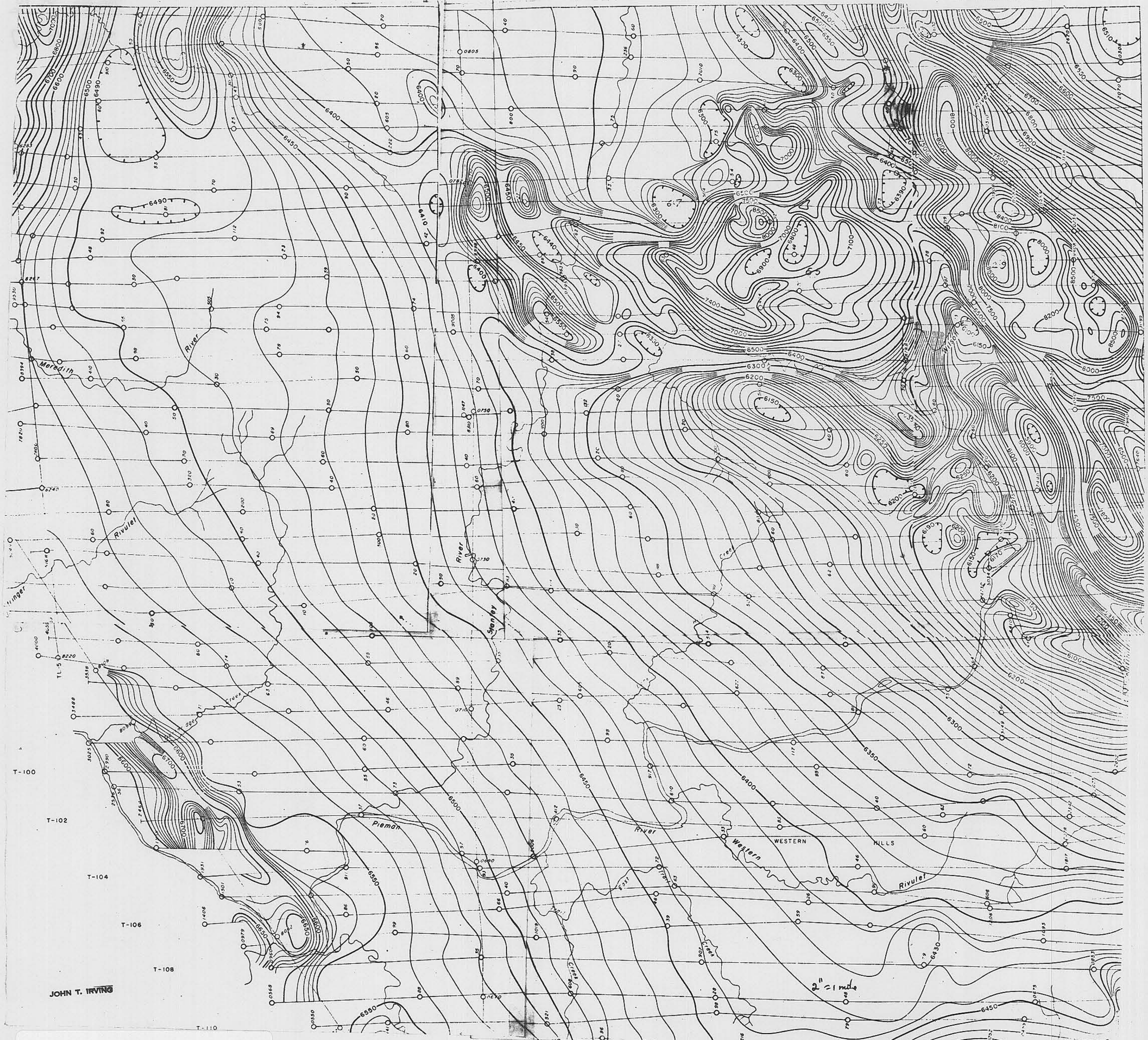
GEOLOGY OF THE LIVINGSTONE CREEK IRON ANOMALY 1972

DRAWING No: 9 A.

677099 73-957 2125

JOHN T. IRVING

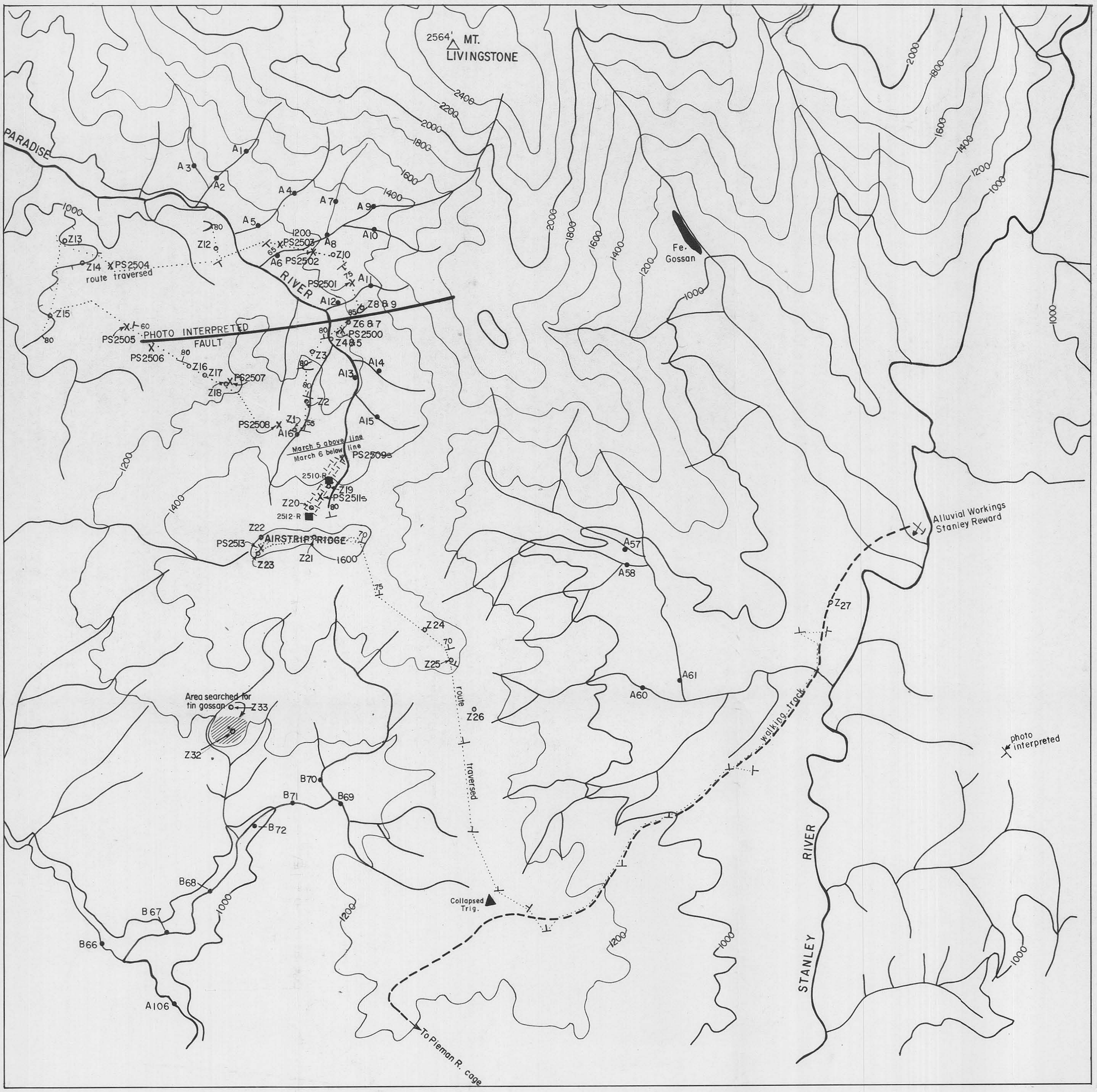
Drawing No: 10



5 cm

677100

2126



N

SCALE

0 1/4 1/2 3/4 1 mile

1 inch = 1 quarter mile

5 cm

LEGEND

CONTOUR INTERVAL 200 feet
■ INDICATES GOSSANOUS CRUST
ZONE OF MAGNETIC LOW
•A16 REM. SAMPLE NUMBERS
oZ21 ROCK SAMPLE (notes recorded)
XPS2501 = SCREE SOIL (sample suffix 'R' = rock chip sample)

11

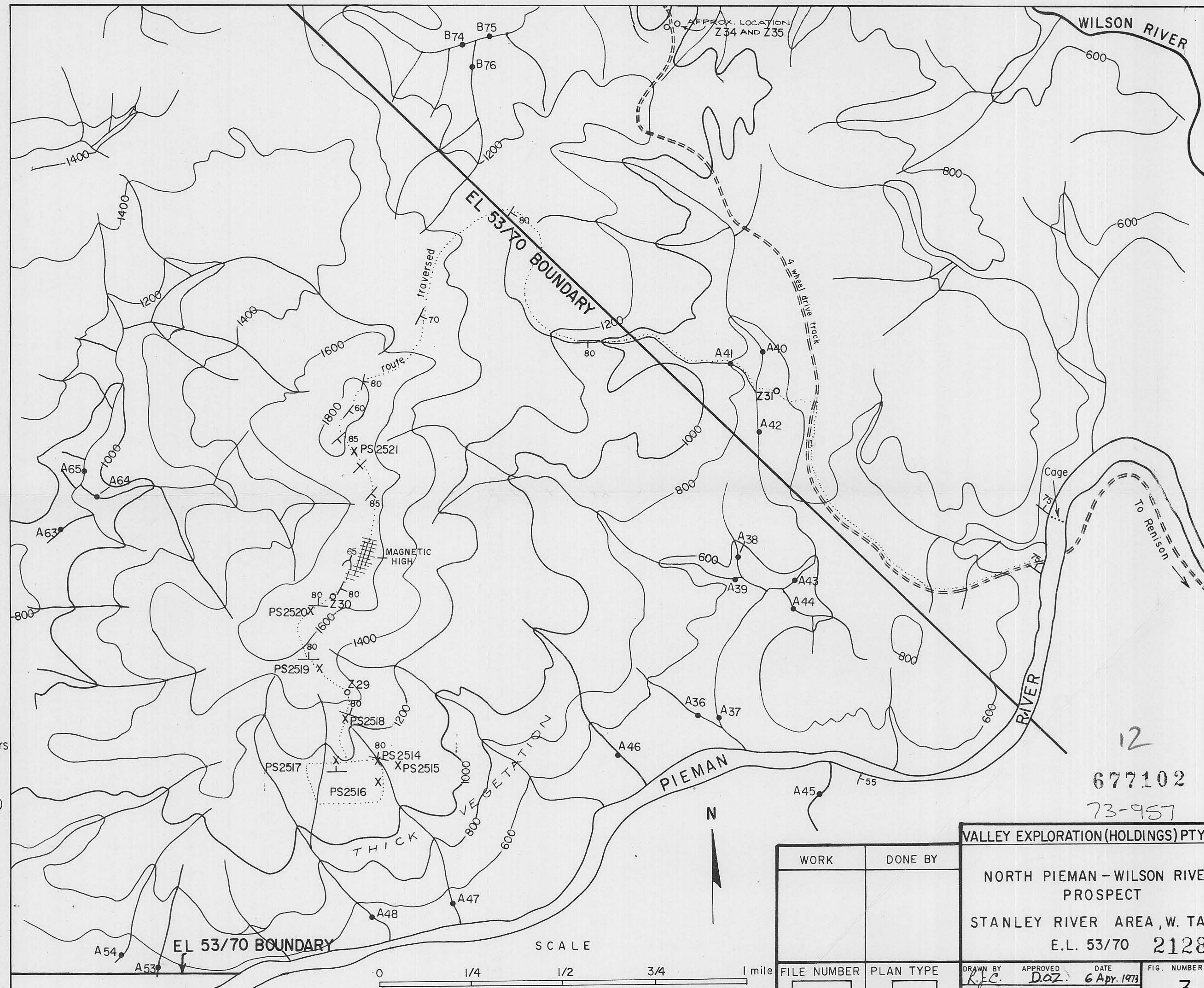
677101

73-957

WORK	DONE BY	VALLEY EXPLORATION (HOLDINGS) PTY. LTD. UPPER PARADISE RIVER PROSPECT STANLEY RIVER AREA, W. TAS. E.L. 53/70 2127	
FILE NUMBER	PLAN TYPE	DRAWN BY R.J.C. APPROVED D.O.Z. DATE 5-Apr. 1973 PLAN NUMBER Drawing No 11	FIG. NUMBER 2

PREPARED BY EXSERV PTY. LTD.

C 129/7 - STR



5 cm

LEGEND

Contour interval = 200 feet

A41● = REM. sample numbers

Magnetic high

○ Z29 Rock Sample (notes recorded)

X PS2519 Scree Soil

12

677102

73-957

WORK	DONE BY

FILE NUMBER	PLAN TYPE

VALLEY EXPLORATION (HOLDINGS) PTY. LTD.

NORTH PIEMAN – WILSON RIVER PROSPECT

STANLEY RIVER AREA, W. TAS.

E.L. 53/70 2128

DRAWN BY	APPROVED	DATE	FIG. NUMBER
K.J.C.	D.O.Z.	6 Apr. 1973	3
PLAN NUMBER	Drawing No: 12		

C129/7 - STR

PREPARED BY EXSERV PTY. LTD. MIDLAND, W.A.