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Prospect 602

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A MINERALOGICAL/GEOCHEMICAL APPRAISAL OF HEAVY MINERAL CONCENTRATES E.L. 15/76, DUNDAS, TASMANIA.

PMR 88/78

Sydney
SEPTEMBER 1978

P.J. CURTIS

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CONTENTS

KEYWORDS

TASMANIA	GOLD
9E L 15/76	NICKEL
8SK 55-Ø3	CASSITERITE
MINERALOGY	SULPHIDES
GEOCHEMISTRY	1978
TIN	HEAVY
MINERAL	

1. INTRODUCTION

There was no time to do statistical graphical work on elemental distributions, correlation coefficients, etc. so that correlation and comparison of compositions of various heavy concentrates is at the best, crude. Apart from this, without separating the various mineral components and analysing each phase the results would appear to be of doubtful value. In future if we do work of this nature it might be better to hire a Frantz Electromagnetic Separator to separate the ilmenite after having separated the magnetite with a hand magnet. Followed by removal of the limonite for separate analyses. This could be done using an ultrasonic separator.

As it happened, the spectrographic analysis (probably good enough for soil analysis) was not overly successful for determining Bi, Sb, W, Cr and Ti, in particular (Ref. 1) because of the abundance of iron present giving a multiplicity of intense iron lines which interfered with the important lines of some elements as above.

In the circumstances a limited assessment of the chemistry of heavy mineral species from the area is presented.

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2. SUMMARY

The area where most 'economic' heavy minerals occur is principally the N.E. sector and it is suspected that these could be partly or mainly derived from mine dumps to the north adjoining the Renison Mines. Associated minerals are those from basic rocks such as augite, hypersthene, actinolite, ilmenite and magnetite which are all present as major quantities. Other minerals present are appreciable tourmaline associated with cassiterite occurrences and 'ultramafic' anthophyllite, steatite, chrysotile and metamorphic actinolite, epidote and garnet reflecting ultramafic rocks and metasediments of the associated watershed. The N.W. sector, directly west of the N.E. sector and separated from it by a large serpentine mass and Dundas Group sediments, is mainly an alluvial plain and similarly has captured some economic heavy minerals (cassiterite, chalcopyrite and sphalerite, etc.) from the Renison Bell workings to the north(?). The gangue mineral association is similar to the N.E. area but greater quantities of metamorphic and basic rock minerals are seen here, though a wider variety of metamorphics occur and the adjoining presence of granitic rocks may be shown by the presence of major zircon and of obvious apatite.

Old mine workings on the Cuni ultramafics are seen in the N.W. sector and copper, lead, silver and bismuth mines on the N.E. sector which may be responsible for traces and minor lead-zinc minerals in alluvial 'heavies'. Traces of gold are present in alluvial heavy mineral suites from both the above areas.

The central-north area just to the south of the N.W. sector is similar with abundant metamorphics (actinolite, tremolite and anthophyllite) but dolomite and a greater abundance of ilmenite and rutile. Augite and hypersthene from fresh basic rocks are less obvious.

The central-east sectors (northerly and southerly) are separated for comparison purposes by an unsampled corridor of relief of Oonah Quartzite. The alluvials appear to occur within or flanking an upfaulted block of Proterozoic, Concert Schist. The northerly sector shows very little of derived economic minerals but an abundance of metamorphic and basic gangue minerals. Basic rock minerals (augite, hypersthene and ilmenite) are more dominant and cassiterite occurs as a minor component. Trace of gold, chromite, bismuthinite, hemimorphite, pyromorphite and vanadinite appear. The southern sector shows a dominance of basic rock minerals (augite, hypersthene, ilmenite and rutile) and a near absence of metamorphics other than minor epidote and traces of anthophyllite and garnet. Traces of bornite and arsenopyrite occur. The southern sector shows few metamorphics other than fine grains in rock fragments. Similarly there are few basic and ultramafic minerals.

In spite of the inadequacies of the spectrographic technique, the chemistry bears out very roughly the mineragraphic results. With high tin, boron, some economic metalliferous sulphides, zircon and high chrome - though with no polished section available it was difficult to differentiate between chromite and magnetite present. Tungsten, present in large quantities does not apparently occur as tungsten minerals, wolframite or scheelite. Tungsten may be within the cassiterite lattice or more likely where heavily oxidised is absorbed on limonite/goethite present. This also goes for arsenic as arsenopyrite which could hardly be missed if it were present. To the south of the N.W. and N.E. sectors there is a dramatic drop in ore-forming elements and associated elements/minerals as per Co, Ti, Y, Zr, B, Cr, V, W, As, Bi, Sb and Zn. To some extent but more sporadically this occurs with In, Ni, P, Cu and Pb. Mn, Ca and Ba show very little variation throughout the analytical results and are presumably associated with constantly occurring gangue material such as limonite:goethite. P may be present in unseen apatite. Copper and lead occur in sporadically occurring sulphides and carbonates, etc. and some

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copper, lead and nickel may also be adsorbed ions on iron/manganese oxides. Also indium is partly within the cassiterite lattice and partly adsorbed on limonite and it shows no relationship with Cu present.

A slight upsurge in antimony and zinc occurs in the southern part of the central-east (south) area within and just south of old Pb, Zn and Ag workings. This continues with, in addition an increase in Zr and B in the south sector of sampling.

To obtain a better perspective of geochemical relationships the results should be subjected to rigorous statistical analysis (Q, R mode cluster analysis) etc. Though, in view of Dr. Beevers' (the analyst) remarks, the very large abundance of iron present could have obscured the Bi, Sb, Cr and Ti spectrum in which case statistical analysis of the spectrographic results would be inconclusive for several elements.

From the continued mineralogical and chemical work, it would appear that the only areas justifying more detailed work are the north-east and north-west sectors just south of Renison Mines with the proviso that the heavy minerals recovered are not washed down from the Renison Mine dumps? Also possibly prospective is the southern part of the central-east (~ south) sector (refer map), but only from mineralogy.

3. MINERALOGICAL/GEOCHEMICAL SURVEY

3.1 Mineral Associations

N.E. Sector. Sample weights are variable (0.03 to 4.0 g). There is a great deal of rock material in the heavy mineral concentrates in this sector including amphibolite, mica and chlorite schist fragments. Some embedding by magnetite or other iron oxides has occurred to sink this non-heavy material which would otherwise have been mainly excluded from the heavy concentrates. The principal heavy minerals present in this sector are ilmenite, magnetite, limonitised magnetite and actinolite in places; in two cases augite is prominent and this would have washed in from an area outside the lease as no basic rocks are exposed here. The large amounts of cassiterite seen in some specimens are possibly 'wash' from dumps in the Renison mines just to the north of the lease. Tourmaline is common as a minor component in these concentrates. Other minerals present are traces to major spinel (chromite?), a little topaz, steatite, appreciable garnet (pink variety), hypersthene, traces of dolomite and corundum, traces to minor pyrite, pyrrhotite, chalcopyrite, epidote, anthophyllite and actinolite. The presence of anthophyllite, steatite and chromite suggest a serpentiniferous (metamorphosed) source. Hypersthene and augite - a dolerite source. Metamorphic minerals, garnet, anthophyllite, actinolite and epidote (show variable grades of metamorphism of sources) also appear as well as tourmaline and topaz ancillary to tin mineral-isation. Traces of fresh sulphide present would not be far from a sulphide source and much of the cassiterite is fresh. A trace of gold was seen in sample 004.

N.W. Sector. Sample weights (0.05 to 30.0 g). Again there is contamination with a whole host of rock fragments having iron oxide attachments. This includes quartz, chert, chlorite schist and actinolite schist. The latter from surrounding metamorphic rocks. A moderate metamorphic trend is noted here with the presence of much actinolite, tremolite, cummingtonite and appreciable anthophyllite (from metabasics and meta-ultramafics?) - possibly from hornfelsed rocks. This is closer to source of basic intrusives,with a great increase in ilmenite, augite and hypersthene. Sulphides (chalcopyrite, pyrite and marcastie) are locally present and in about similar quantities and distribution to those in the N.E. block but freshness indicates proximity of source in the damp West Tasmanian climate. Less cassiterite, tourmaline and absence of topaz shows appreciable distance from exposed tin (or from the mine dumps?). Interesting, garnet becomes much less obvious which may indicate greater distance from a high grade contact metamorphism.

Central North. Sample weights (0.02 to 12 g). A maintenance of the dominance of medium grade metamorphic minerals - actinolite, tremolite, cummingtonite and anthophyllite is noted, but less dominance by basic rock minerals augite and hypersthene. Ilmenite retains its importance, as per the N.W. sector and leucoxene (pseudomorphs) and rutile have increased. The more durable basic rock heavy minerals have increased and this may indicate a greater distance from a basic rock source? The pneumatolytic minerals cassiterite and tourmaline have receded from prominence and metamorphic garnet is present only as a trace.

Central East (~north). Sample weights (0.05 to 10 g). Very much more ferruginised gangue material than for the previous groups and this has reduced the absolute amounts of heavy minerals present. There is much haematite present as haematite pebbles but not a great deal of chert, some limonitic quartz is seen. Much of the gangue material is amphibolite schist. Actinolite maintains a dominant position, as does augite but less of it and tremolite is a major component.

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Rutile is dominant and much of this heavy mineral is from basic intrusives. Minor metamorphics such as garnet and staurolite (show fairly high grade contact metamorphic minerals) are seen and ultramafic (or mafic) hornblende, chrysotile and steatite are present in moderate amounts suggesting proximate ultramafic and basic masses. Magnetite has dropped to minor placement and sulphides pyrrhotite, chalcopyrite and sphalerite are fresh so that sulphide sources are close, and may be traced.

Central East (~south). Sample weights (0.05 to 15.0 g). Gangue mineral present is largely ferruginised; and chert, a little mica, amphibolite schist and a little steatite schist are seen. An increase in ilmenite is noted as is spinel (chromite?) and some olivine. Actinolite remains abundant in isolated specimens as does augite, hypersthene and tremolite but the diluting effect by 'loaded' gangue material has reduced the effectiveness of determining heavy minerals by eye. Sulphides (including arsenopyrite), tourmaline and cassiterite occur spottily and there are obvious signs of the proximity of ultramafics (olivine, hypersthene, antigorite and talc). Metamorphic minerals are relatively scarce except in rock fragments. Sulphides and tin occur spottily. Traces of bismuthinite and vanadinite occur. The presence of minor mineralisation is proximate but weathering of iron minerals (sulphides?) has ferruginised much of the heavy minerals released.

Southern Sector. Limonitised quartzite, quartz pebbles and less amphibolite, mica and chlorite schist make up the main 'loaded' gangue components. Similar to the Central East (~south) sector but actinolite and other metamorphic minerals are not much in evidence, though tremolite occurs spottily. Cassiterite is not seen and tourmaline occurs only in minor quantities. Minerals derived from basic rocks (ilmenite, hypersthene, augite and hornblende) occur sparsely, by number of samples, as do ultramafic steatite, anthophyllite and olivine. Minor sulphides are still evident. There are proximate metamorphic rocks (witness the rock fragments present) but as fine grained rocks; remote from metamorphic locus.

Remaining samples 360 to 622 in the sector represent resampling of other areas.

3.2 Mineralogical Chemistry

3.2.1 Antimony

High antimony in these specimens is inexplicable unless present as oxides or basic oxides of antimony in limonitic aggregates where these occur, or it may be present as tetrahedrite which occurs as fine inclusions in sphalerite. Arsenopyrite will accommodate up to 1.5 percent antimony only. It is significant that where Sb is reported (092) to be more than 10,000 ppm, only 0.05 g of sample was available, so the high result may be due to poor mixing during preparation of electrode for arcing.

High (1,000 ppm and more) antimony results appear in many samples from 004 to 064, and below sample 064 they become low (<30-500 ppm) except for 'high spots' at specimen 268 (also high lead), specimens 286, 288 and 290, 323, 334 and 350; and from 544 to 620 inclusive. This includes areas at the N.E. end of the prospect (E.L. 15/76) to the centre and the south-eastern area, mainly located in mine dumps existing on the Dundas group sediments.

There appears to be a direct relationship between antimony and zinc as mentioned above and this may be due to ore association.

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3.2.2 Arsenic

Reported as traces or minor amounts in specimens 004, 117, 126, 167, 268, 358, 403, 461 and 620. Since arsenopyrite crystals are rarely seen (good crystal forms and characteristic metallic silver yellow colours were seen on occasions where it was identified), then it must be assumed that the arsenic to a great extent is present in other mineral phases. In the northern samples (early samples in list) down to 164 there is a rough sympathy with antimony and this indicates an association with hydrothermal veins and possibly the presence of tetrahedrite-tennantite series minerals as well as minor arsenopyrite; (proximate mineralisation may be indicated by an out-cropping porphyry). There is also high zinc, lead, tin and tungsten mineralisation in this zone.

In the oxidised sample arsenic may be present in mixed oxides.

3.2.3 Barium

Seen as traces of baryte in samples 089, 095 and 106 and minor in 268, yet reports as 300 ppm or less Ba. In the spectrographic analysis large amounts of Ba (>10,000 ppm) are reported in sample 028 where baryte remains undetected. Unidentified witherite may have been present in some oxidised samples but with mainly 0.1 and less percent present the chances are that barium occurs mainly as fine particles of baryte (or other) associated with limonite aggregates. The element is almost invariably antipathetic with lead(?). This would indicate a breakdown of primary minerals and in many cases adsorption of selected ions on limonitic material.

3.2.4 Bismuth

No sympathy with lead content of samples is seen but several 'high' bismuth results (200 ppm and

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more) correspond with 'high' arsenic (e.g. 004, 017, 028, 035, 092, 124, 128 and McCooney) and nearly all samples come from alluvials in the block containing the Montezuma Fault zone, otherwise from two scattered positions to the west, roughly at a similar latitude. These correspond with unidentified particles of sulphide.

3.2.5 Boron

Relatively high (1,000 ppm and higher) to sample 052, intermittently high from 092 to 164 and with low results from 167 to 186, followed by few high results from 189 to 622 with McCooney Prospect having the highest result at > 10,000 ppm. The results correspond only very roughly with tourmaline present, or in some cases high B may correspond with no tourmaline seen in sample. However, high tourmaline present corresponds with the position of old mines on the Dundas Group prospects on Precambrian Concert Schist. From specimen 004 to 052 the presence of tourmaline can be equated with the presence of cassiterite and outcropping quartz porphyries but not so in the southern prospects, as per specimens 253 to 620 area where no intrusive quartz porphyries outcrop. Only a trace of possible alternative boron minerals (axinite) was seen in specimen 221.

3.2.6 Cadmium

All resulted are reported as < 3 ppm.

3.2.7 Calcium

Sympathy with other elements analysed does not occur. Where there is a rise in Y with a corresponding rise in Ca, this may be due to the presence of apatite. Calcium-rich minerals reported and present in the concentrate are extensive, including apatite, pyroxene and amphiboles.

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Specimens that contain greatest abundance of Ca (> 10,000 ppm) contain appreciable actinolite and dolomite (specimen 128); tremolite (specimen 145); augite and actinolite (specimen 100).

Multiplicity of variable calcium minerals present would obscure sympathetic trends with other elements.

The calcium is of variable concentration but decreases abruptly after sample 164 down the mineral series and going north to south of the lease. A decrease in augite (but not of hypersthene which was classified as orthopyroxene in southern panned samples) takes place.

3.2.8 Chromium

Generally correlates with high cobalt and only very roughly with high nickel - insufficiently so to suggest that Co and Cr are in any sort of stoichiometric relationship in one mineral, Mineralogy suggests chromium is in the magnetite > limonite > ilmenite lattices, though as a leached product it is adsorbed on to limonite particles. Abundant chromium is pretty much confined to the northern part of the area and is most likely related to run-off from the serpentine masses (in spite of the element's relationship with cobalt).

Samples with Cr results of more than 10,000 ppm are 004, 031, 041, 098, 100, 115, 124, 126, 546 and 620. Many (041, 098, 100, 102, 115) are probably related (taking into consideration drainage directions of streams) to outcropping gabbros and serpentine and to magnetite or an unidentified chromium mineral weathering from these. The remainder are situated on Dundas Group sediments and it is difficult to assign an origin for them.

Chromium is often a contaminant in spectrography, from the grinding procedure of sample. This may account for some high results.

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3.2.9 Cobalt

High Co (30 ppm and more) are from alluvium draining from the northerly gabbro > serpentine areas - these include samples 095, 098, 100, 102, 134, 141, 143 and 145. Others of high Co - 004, 047, 053, 115, 122, 124 and 149 are situated among mainly Cambrian, Dundas Group sediments.

Where high Co corresponds with high Cr as in 004, 098, 100, 102, 115, 124 the specimens are divided evenly among alluvium draining from gabbro/ serpentine and from sediments. The cobalt would appear to be present mainly in the magnetite lattice or from magnetite altered to limonite - also some cobalt may be in ilmenite, unidentified chromite or spinel reporting with magnetite(?).

3.2.10 Copper

High coppers (1,000 ppm and more) are fairly common and only in sample 017 (2,000 ppm and in 065, 1,000 ppm) was chalcopyrite seen. Other places where copper is reported, the element is very likely associated with limonite, as fine chrysocolla or other copper silicate, or with wad.

3.2.11 Gold

All results are reported as $<$ 3 ppm, yet a trace of gold was seen in specimens 004, 082, 120, 247, 251 and possibly 264 and 266.

3.2.12 Indium

From specimens 004 to 164 tin-rich zones, the relationship between In and Sn is sympathetic. After this the amount of In and Sn falls away to mainly $<$ 5 ppm In and $<$ 2 ppm Sn, except specimens 189 and 191 where a slight increase in values occurs and there is a sympathetic

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trend. Similarly a vague sympathetic In:Sn trend occurs from 566 to 622. Most specimens with a sympathetic Sn:In trend are in the N.E. sector of the lease flanking the northern part of the Montezuma Fault and in Dundas Group sediments south-east of Renison Bell mine. The remainder of sample locations from 566 to 622 are not detectable on the map.

It is interesting to note the antipathetic relationship between zinc and tin showing a virtual absence of distinctive zinc minerals, and for antimony and indium, and lead and indium, though there is a tendency for higher lead and antimony to occur in the high In zone of the N.E. block. Some In contents are higher than the average copper content in this zone. Similarly In is higher than Cr in places. Indium appears to be in the cassiterite lattice or in associated limonitic material in the N.E. block.

3.2.13 Lanthanum

Mostly reported as <100 ppm. Where greater as in samples 132 (300 ppm), 136 (200 ppm), then titanium ($>10,000$ ppm and 5,060 ppm) is high. Since rutile is present as a major component the La could be in the rutile mineral lattice, yet lanthanum normally sympathetic with yttrium, remains low (30 ppm).

3.2.14 Lead

Some occasional high leads ($>10,000$ ppm) occur in samples 065, 268 and 302 in the S.W. sector of the N.E. block of the lease, close to the Hecla (copper-bismuth-lead) and Ramsdale (lead-copper) mines and may have washed in as oxidised sulphide products from dumps on the latter mine and judging from the limonitic nature of most of the panned samples, the element could have been present in limonite-stained cerussite associated with limonitic aggregates. Specimen 268 comes from a stream

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west of Mt. Dundas and close to and east of the nearby Sth. Comet (lead, zinc) mine in the Dundas Group of sediments. The last in the list of samples high lead specimen shows only chalcopyrite as its 'economic' mineral component but since many of the minerals present are limonite stained it is possible that the lead is present as unidentifiable cerussite (altered weathered galena), adjoining and downstream from a group of mines (lead-silver), e.g. Comet Mine, Maestries Mine, etc.

Lead generally shows more isolated high result (1,000 ppm and more) in the N.E. block lease areas than elsewhere, shows a rough sympathy with other ore-bearing elements (Cu, Sb, Sn) and is rather insensitive to the chemical trends. In a general way though, lead shows some sympathy with Ba. Presumably all occurrences of lead-zinc are from acid volcanics associated with the Proterozoic Oonah Quartzite and Cambrian Dundas Groups of the area.

3.2.15 Manganese

Mainly present around 100 to 300 ppm and shows occasional highs (1,000 to 10,000 ppm). There are more specimens containing $>$10,000 ppm in the N.E. tin-rich part of the lease than elsewhere. In the majority of cases the manganese is present as wad mixed with limonite as dense aggregates. Where little limonite occurs as in samples 035, 041, 082 and McCoony Prospect, the most obvious common mineral in all these samples is ilmenite which as manganilmenite(?) can accommodate large amounts of Mn. No obvious manganese minerals are seen. Alternatively a red to pink garnet occurs in specimens 035, 041 and 082 and this may well be spessartite and this could explain part of the high Mn present.

3.2.16 Mercury

Most results are reported as $<$ 30 ppm. The one exception is specimen 100 (100 ppm). Unless there are traces of unidentified tetrahedrite present, it is difficult to explain this trace of mercury present.

3.2.17 Molybdenum

Below limits of 'quantitative' determination in that all results are reported as < 3 ppm.

3.2.18 Nickel

High nickel (50 ppm and above) is correlatable with high chromium except in samples 063, 095, 132, 151, 286 and 290. However, 095, 132, 286 and 290 drain off adjoining serpentine/gabbro bodies and there nickel is supposedly in the magnetite lattice or with limonite.

3.2.19 Niobium

All results are reported as < 20 ppm.

3.2.20 Phosphorous

This is moderately high in most samples from 004 to 064 from whence (in numerical sample progression) it declines to 304 and then rises again from 307 to 622 and McCooney Prospect. High P does not correspond with high Ca or with high La or Y. Where it is highest at > 10,000 ppm no apatite is seen, but traces of minerals occur in samples 124, 130, 132 with minor in 134 and traces in 296 and 463. There is little correspondence of analytical results with the apparent presence of apatite.

3.2.21 Silver

Mainly < 0.1 ppm, but increases appreciably and sporadically all the way through specimens (in numerical sequence) after specimen 124 reaching to 20.5 and 30 ppm at 136 and 141 probably from material eroded from surrounding Dundas Group sediments but interestingly where both lead and copper were low. Similarly for the group of specimens 180 to 191 adjoining the Pb, Ag and Pb-Zn mines in the eastern area, west and

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north-west of Mt. Dundas. Appreciable Ag (maximum 30 ppm) recurs all the way through the assay list to sample 584 occurs within the areas around known Pb-Zn prospects in the eastern part of the lease, delimiting the Proterozoic 'window' which flanks the west side of the Montezuma Fault. Silver is notably lacking from the N.E., Sn rich area, the N.W. area around and west of Cuni, and there are patchy areas in the eastern area where Ag is $<$ 0.1 ppm. High silver (20 or more ppm) is occasionally geochemically associated with high Pb ($>$10,000 ppm) in sample 302, or high Sb (1,000 or more ppm) in samples 461 and 564. No obvious mineral source occurs except that seen in sample 302 (presence of abundant chalcopyrite and pyrite). With the exception of sample 564 all other specimens contain appreciable limonitic material where Ag possibly resides in an oxidised form. In 302 it would be present preferably in the chalcopyrite lattice. Silver content of silicates is only to 15 ppm in some garnets (Wedepohl) which is recorded as having the highest content of Ag, for a rock forming mineral.

3.2.22 Tin

High indium sympathises roughly with tin (but not with zinc) and is therefore likely mainly in the cassiterite lattice. Boron is also high in the series from 017 to 034. Then further down the series, isolated high tins occur from specimens 080 to 092, 102, 122 to 134, where B is not particularly high. High Pb and Zn correspond very generally with high Sn in the north-east Dundas prospect indicating similar proximity to the base metal mineralisation here.

3.2.23 Titanium

This is high all the way through the series and only where more than 10,000 ppm titanium is present will the element be discussed. Many specimens drain off Dundas Group sediments (004, 017, 024, 026, 028, 031,

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035, 041, 047, 056 and 063) from the northernmost part and south of the area (and 544, 546 and 557) from Silurian and Cambrian sediments. Draining from gabbro are 052, 053, 128, 138, 145, 155 and 164. Most specimens containing titanium may be accounted for from the ilmenite and/or rutile present. Where analysis does not check with titaniferous minerals present (e.g. specimens 024, 031, 034, 061 and 128) the titanium is possibly with abundant limonitic aggregates present. Once again errors in reading the densities of titanium spec. lines may account for this. In one or two places (e.g. sample 143) chromite may have been counted as ilmenite although this would be invalid if the crystal forms were plain to see. Some spinel may have remained undetected since no polished section investigation was attempted.

3.2.24 Tungsten

Generally high (1,000 to > 10,000 ppm) in the samples of the N.W. and N.E. parts of the lease, i.e. the tin area, and falls off to < 50 ppm thereafter except for spot 'highs' (100 to 500 ppm). The high results stop at sample 149 close to the northern boundary of the lease. There is a rough sympathy between tungsten and tin in the samples and also of tungsten and indium. The close association of tin, tungsten and indium suggests that they occur in the same mineral cassiterite, but cassiterite will not contain tungsten in its lattice, so that the tungsten if present is there as wolframite or scheelite (not seen in the panned concentrates) or as possible wolframite inclusions in cassiterite(?), but more likely as inclusions or intergrowths of cassiterite within wolframite which was not identified in open dish. Absence of scheelite was proved using S/W ultraviolet light whence no bluish fluorescence was seen and no characteristically whitish resinous scheelite crystals. Particularly high results (> 10,000 ppm) are noted in sample 118 from Quarternary Older Alluvium in the north-west part of the lease and adjoining the Cuni area.

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Chromium, tin, antimony and lead vary from 1,000 to 3,000 ppm for this sample. This would appear to be a convenient low-lying drainage area from neighbouring old mine dumps. Tungsten shows more consistent highs (1,000 to 10,000 ppm) in samples from the north-east, high tin area. Sample 034 ($>$ 10,000 ppm) adjoins two small quartz porphyry outcrops.

3.2.25 Vanadium

Any vanadium present will most likely be substituting for Ti^{4+} in magnetite. Titanium and vanadium are roughly sympathetic in a few places where titanium is high and this may be due to the presence of abundant magnetite with minor ilmenite and absent rutile (e.g. specimen 128). Generally speaking, there is no sympathy between Ti and V. More often than otherwise high magnetite corresponds with high V (samples 004, 034, 038, 041, 100, 102 and 115 etc.). There are also the exceptions (samples 035, 124 and 126) where V is high and magnetite is present in minor quantities. Only in a few specimens (100, 102, 115, 132, 134 and 143) do high vanadium (300 ppm and more) correspond with proximity to basic/ultrabasic rocks.

3.2.26 Yttrium

Progressing through analyses, the content is quite variable until sample 202 and varies from $<$ 10 ppm to 500 ppm and to some extent is correlatable with high tin and boron. Yttrium cannot be correlated with any other single element analysed in this exercise, though the element is commonly present in minerals where Ca occurs and with F if present.

3.2.27 Zinc

Only traces of minor amounts of sphalerite were detected in samples 063, 089, 247, 262, 284, 302, 403 and 561 scattered over the eastern part of the area mainly to the immediate north-west of Mt. Dundas, partly in Concert schists.

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3.2.28 Zirconium

Present in zircon where it occurs, yet where zircon reports at 5,000 ppm in samples 004, 017 and 3,000 ppm in sample 026, then no zircon was seen in the sample. The mineral was missed in other samples and was probably finely embedded in chlorite schist or other heavy rock fragments present. In one or two places where the mineral was present in major amounts, zirconium was reported in small amounts (300 ppm).

3.3 Chemistry - As A Comparison by Catchment Sectors

The north-east sector is characterised by high W, Sn, Ba, As, Ti, Zn, P, B, In and Sb and some sporadically high Cr. This would indicate a high pneumatolytic/hydrothermal zone (Sn, B; W, As, Sb, In, P) and proximity of ultrabasic (Cr), basic rocks (Ti), and granitic material (Zr). Only sporadic high Pb, Zn, Cu and Ba shows the lower but still high proximity of economic sulphides, but no sedimentary Pb, Zn, Cu sulphide deposits. Indium does not sympathise with B, Zn and Pb or the presence of tourmaline and is possibly distributed among cassiterite and different Fe^{3+} rich mineral phases. High yttrium does not sympathise with insensitive (to chemical methods) La. It could be associated with Ca in apatite but apparently is not (cf. Y with P content). It is however, roughly coincident with Ti and Zr and may be in the lattice of ilmenite or zircon, substituting for Fe^{3+} of Fe^{4+}. Boron and tin both decrease dramatically below 053 (numerical sequence) in the southerly part of the sector possibly indicating a modification of catchment source.

North-west Sector. It is suggested that cobalt here is in the magnetite/spinel lattice. It sympathises roughly with chromium and is sporadically high (compared with the north-east sector) compared with other sectors of the area. As for the north-east sector - In, Pb, Sb, Sn, Zn, Cr, Ti, W, Bi and As, all remain relatively high, indicating a mineralised catchment of such an area. There is however, a slight drop in W, As, In, Pb and a dramatic fall in Y but little difference for P. If the W and In are in the cassiterite lattice (as suggested for the north-east sector) there is a variation in composition of cassiterite for the N.W. sector as the relationship of

W, In and Sn is not maintained except sporadically. An increase in distance from sulphide shedding areas (or change in drainage pattern) and also a phasing out of cassiterite and tourmaline may indicate a greater distance from pneumatolytic tin-producing area to the north of Zeehan. There is a continued proximity to eroding ultramafic and basic rock sources (with maintenance of Cr, and Ti, V 'highs').

Central-north Sector. A number of scattered samples which were taken from an area just south of but falling between the N.E. and N.W. sectors with some run-off from serpentine and Dundas sediments. All elements as indicated show a median decrease compared with more northerly areas - In, Pb, Sn, Sb, Zn, As, Bi, Cr, Ni, Ti and V. This indicates an increase in distance from all mineralisation areas of sulphides and tin, and grades into the southerly areas of absence of the ore forming elements. P, Y, W and B show few scattered high results among a background of low results. This may indicate a decrease in apatite (P, Y) and remoteness from pneumatolysis.

Central-east (north). Abrupt decreases occur in In, Sb, Sn, As, Bi, Zn, W, As, Zr, P, B and Cr, shows catchment from less mineralised areas including ultramafic minerals, sulphides and tin except for sporadically 'high' As, In, Pb, Zr, P and B; also Mn shows sources of sporadic mineralisation or of waddy/limonitic absorptive material which adsorbs the metal ions in solutions from weathering sulphide zones. Depending on whether Zr is from granite direct or is secondary from sediments there would still indicate a greater remoteness from a granite source as are shown by 'lower' P and B. Barium (from sediments?) continues with a number of sporadically high results in a background of low results but this is not linked with Ca content.

Central-east (south). Continuing the pattern as per central-east (north) but sporadic increases in Pb, Sb, Zn and W. These are associated with limonite from isolated pockets of eroding mineralisation. The slight upwards increase

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in Ni, Bi and As background may indicate the presence of significant pyrite (confirmed by mineragraphy). According to the mineragraphy there is appreciable tourmaline in this area and chemistry shows a very slight increase in Sn background.

Southern Sector. Compared with the central-east sectors, there is a sharp but spasmodic increase in Zr, and as granite is not seen to occur in the area this may be due to catchment from Silurian sediments - but still the zircon appears very fresh(?). Titanium, as an increase in ilmenite and/or rutile has also increased slightly (confirmed in mineragraphy). Increase in P and B are not obvious since there is no greater apatite and tourmaline content. No obvious immediately proximate serpentiniferous mass could account for the increase in Cr in specimens 323 and 350 although the doleritic Mt. Dundas (source of increased Ti) is on the eastern relief side of drainage. Nickel is very low here and indicates absence of ultramafics and/or virtual absence of pyrite.

Appreciable chromium present in samples 323, 334 and 350 is from limonite, spinel or magnetite in the specimens and originates from not too distant serpentine masses, though nickel in these specimens is minimal, titanium is high indicating proximity to basic rocks (from Mt. Dundas, dolerite), as is zircon (from micaceous sediments). High boron of some results does not equate with minimal observed tourmaline present.

Without statistical analysis it would be difficult to follow any definite trends between central-east, north and southern sectors and possibly these sectors should not have been included in separate sectors for appraisal of chemistry.

Resampling. From 361 to 622 are rarely marked on the map of sample plots and many are from a later resampling programme of already sampled areas.

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PJC/SS
8/9/78

APPENDIX I

027

223028

========= 272-5733

8th March, 1978.

Mr. P. Macnamara,
P.O.Box 196,
ZEEHAN.
TASMANIA.

Dear Phil,

At long last you have got the results for batch A2218 in your possession. The samples in this batch were quite the filthiest we have ever had to deal with by emission spectrography, mainly due to the very intense iron lines in the spectrum. With manyof the elements, in particular Bi, Sb, W, Cr, Ti, the results are nothing more than an educated guess since very intense iron lines are either sitting on top of, or are closely adjacent to the analyte lines.

Certainly the values for these elements would not be up to the normal precision for Emission Spectrography, and if you really want more precise values we should choose a different technique -- perhaps XRF for some or AAS where suitable.

If ever you are over in Adelaide I would love to show you the problems your samples created. Anyhow, I do hope you can get some value out of the results. As you will see, there is nothing left of some samples, and very little of others, but we do have quite a lot of samples with sufficient sample left for more work if required. We have all the samples packed ready for shipment to Peter in Sydney but will await your further instructions before sending them.

Kindest regards,

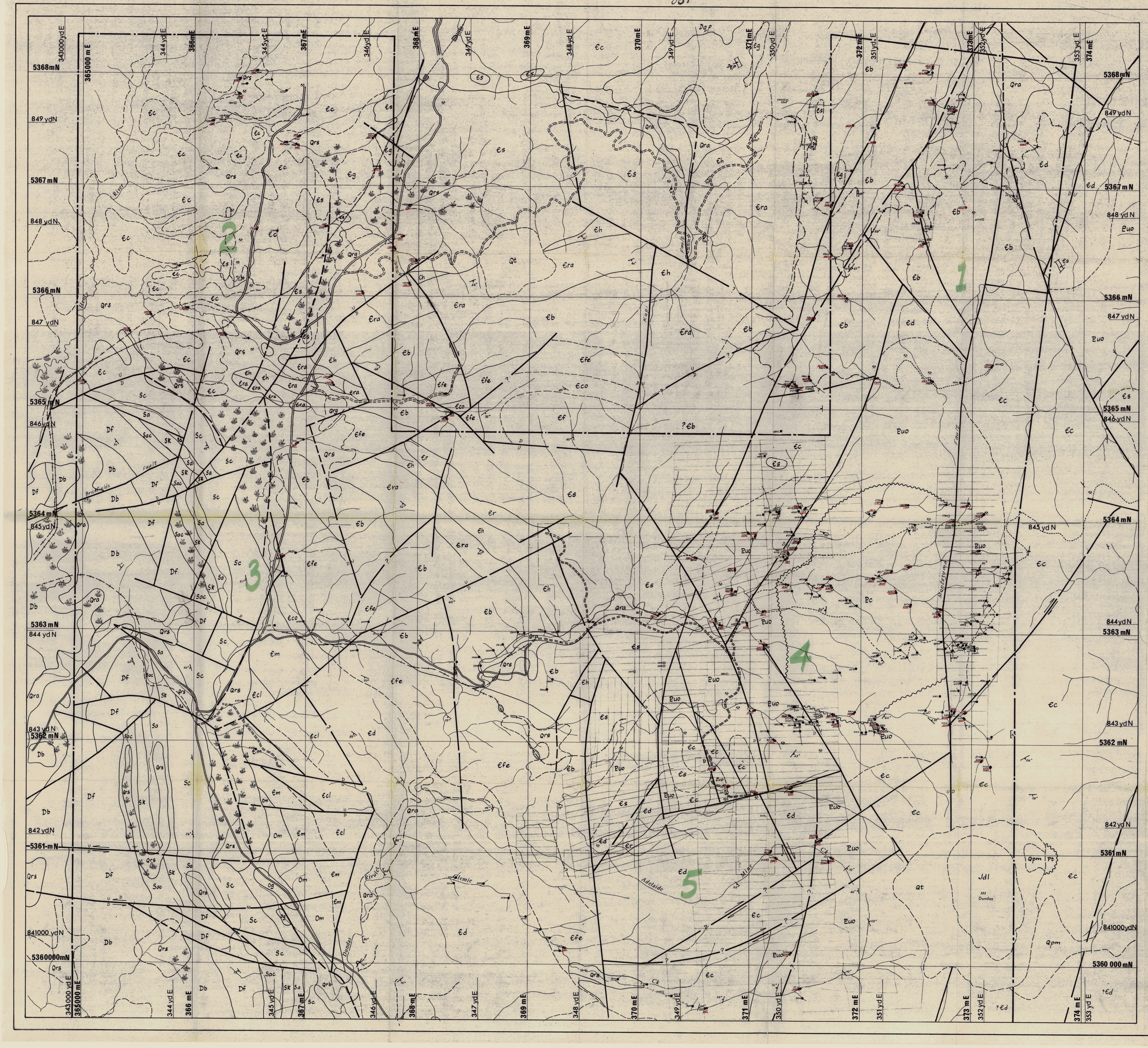
Roy B.

J.R. Beevers, B.Sc.,Ph.D.
Managing Director.

cc. Mr. P. Curtis

APPENDIX II

SEE FICHE 2



REFERENCE

Period		Symbol	Unit
QUATERNARY	Q	Qra	Alluvium
		Qrg	Gravels
		Qt	Conglomerate talus
		Qt	Dolerite talus
		Qrs	Older alluvium marsh deposits, downwash etc.
		Qpf	Fluvioglacial & lacustrine deposits
		Qpm	Moraine
PERMIAN	P	Pt	Zeehan Glacial Formation
DEVONIAN	D	Db	Bell shale
		Df	Florence quartzite
SILURIAN	S	Sac	Austral Creek siltstone
		Sk	Keel Quartzite
		Sa	Amber slate
		Sc	Crotty quartzite
		S	Unassigned
ORDOVICIAN	O	Og	Gordon limestone
		Om	Moina sandstone
		Oz	Mt. Zeehan conglomerate
CAMBRIAN	Є	Єm	Misery conglomerate
		Єcl	Climie Formation
		Єf	Fernflow Formation
		Єco	Comet Formation
		Єfe	Fernfields Formation
		Єb	Brewery Junction Formation
		Єra	Razorback conglomerate
		Єh	Hodge slate
		Єr	Red Lead conglomerate
		Єd	Dundas Group unassigned
		Єc	Crimson Creek Formation
		Є	Cambrian unassigned
PROTEROZOIC	P	Puo	Oonah quartzite & slate
		Pc / Pw	Concert schist / Whyte schist

IGNEOUS ROCKS

Period		Symbol	Unit
		Jdl	JURASSIC Dolerite
DEVONIAN	D	Dqp	Quartz porphyry
CAMBRIAN	Є	Єg	Gabbro, norite and dolerite
		Єs	Serpentinite and pyroxenite

- ● Stream sediment (M)
- ● Panned concentrate (P)
- □ Rock chip, float (R, F)
- ■ Limonite (L)

Underlined numbers correspond to analysis sheet

5 cm

Dundas 1:25,000

223038

PACMINEX PTY. LIMITED

78-1303

DRAINAGE SAMPLE NUMBERS

PETROGRAPHY OF HEAVY MINERALS IN PANNED CONCENTRATES

E. L. 15/76 - North Sheet

DUNDAS, WEST TASMANIA

SCALE	1 : 10 000	K 555-6
DRAWN	P.M.M./ P.H.	
DATE		
REVISED		

APPENDIX III

SEE FICHE 2

HEAVY MINERALS CONTENT

MINERALS PRESENT

SAMPLE NUMBERS	ROCK / MISC. TYPES PRESENT	APPROX. WT. OF CONCENTRATE (G)	ACTINOLITE	ANATASE	ANDALUSITE	ANGLESITE	ANHYDRITE	ANTHOPHYLLITE	ANTICORITE	APATITE	ARSENOPYRITE	AUGITE/PIGEONITE	AXINITE	BARYTE	BIOTITE	BISMUTHINITE	BORNITE	CASSITERITE	CERUSSITE	CHALCOPYRITE	CHLORITE	CHROME MICA	CHRYSOTILE
004	C/Mj	0·1									Tr							Mn					
017	D/Mj; E/Mj	0·5									Tr							Mn	Tr	Mn			
024	E/Mj	0·4																Mj/30					
026	L/Mj (20), E/Mj (30)	0·3																Mj/40					
028	L/Mj (40)	4·0	Mj							Tr								Mn					
031	A/Mj	2·0																Mj/5					
034	L/Mj (20)	1·0																Mj/2	Tr	Tr			
035	L/Mj (40)	4·0	Mj									Mj							Tr				
038	K/Mj	2·0										Mj/40											
041	E/Mj (20)	0·06																Mn/1					
044	E/Mj (40)	0·2																Tr					
047	E/Mj (60), L/Mj (15)	0·1						Mn										Tr					
052	A, I, C, Mj, B/Tr	0·03																Tr					
053	I/Mj	0·5																					Mn
056	B/Mj (>70), A/Mj (>20)	0·2																					
063	A/Mj, F, B/Mn.	0·3																		Tr			
065	B/Mn, A/Mj (>70)	4·0																		Tr			Tr
061	C, D, E, L/Mj, B/Mn.	0·3																			Mn		
068	D/Mj, B/Tr.	0·2																					
071	M/Mn, A, D/Mj (>95)	1·0																			Mn		
075	D, O/Mj, M, J/Mn	1·0																		Mn			
076	J/Mj, R/Mn, B/Tr	0·05																					
080	B/Mj	0·15																Mn			Mn		
082	B/Mn	1·0																					
089	E/Mj, (>75), J/Tr	0·1												Tr						Mn			
092	E/Mj	<0·05																					
095	E/Mj, D/Mj	30·0	Mn									Mj		Tr						Tr			
098	T/Mj, D/Mn	5·0	Mn					Mn				Mj											
100	T/Mj	30·0	Mn					Mj				Mj											Mn
102	T/Mn	2·0	Mj									Mj											
104	J, G/Mj	<0·03	Mj									Mn											
106		0·2												Tr									
108	J/Tr	2·0							Tr														
110	B/Tr	10·0						Tr	Tr			Mn											
115	B/Mn	<0·05	Mn																				
117	O/Mj, E/Mj	0·2	Mn					Tr	Tr			Mn											
118	B/Mn, G/Mj	0·1	Mn									Tr											
120	B/Mj	0·2	Tr									Tr								Mn			
122	G/Mn	5·0																Mn					
124	G/Mn	0·1	Mn							Tr													
126	R/Tr	<0·05									Tr									Tr			
128	D/Mj	0·1	Mj					Tr										Tr					
130	E, G/Mj	0·1	Mn							Tr		Mn						Mn					
132	L/Mj	0·05								Tr								Mn					
134	A/Mj, B, J/Mn	0·1								Mn													
136	B/Tr, J/Mj	0·05																		Tr			
138	C, L/Mj	0·1							Tr														
141	B/Tr, A/Mj	0·05										Tr											
143		5·0	Mj									Tr											
145	A/Mj	7·0	Mj					Mj															
147	A/Mj, J/Mn	0·1	Mj									Mn											
149	T/Mj (>40),	10·0										Mn											
151	A/Mj, J/Mn, T/Mj (>50)	2·0																					
153	B/Mj, J/Mn	12·0																					
155	B/Mn, J/Mn	1·0																					
157	B/Mn, A/Mj	1·0																					
158	B/Tr, F, D/Mj	<0·02																					
160	A/Mj (>90), T/Tr, B/Mn, M/Mn	7·0	Tr																				
162A	C, R/Mj	<0·02																					
162B	A/Mj	4·0																		Tr			
164	T/Mn, A/Mj	1·0	Mn						Tr														
167	D/Mj, J/Mn	4·0									Tr									Tr			
169	B/Tr, A, C/Mj	1·0																					
172	B/Tr, C, R, D/Mj (>95)	10·0																					
176	B/Tr, A, J, G/Mj	0·3																Tr					
178	O, G, /Mj	0·1	Mj																				
180	B/Tr, E, G, V/Mj	3·0	Mj																				
182	O, G, E/Mj	0·1	Mj																				
184	D, O/Mj	0·1	Mn														Mn			Mn			
186	E, G/Mj (>95)	0·1	Mj																	Tr			
189	E/Mj (>95)	2·0	Mn																				
191	O, E, J/Mj	2·0																					
194	E(>70), J/Mj	2·0																					
196	W, E/Mj (>60) J/Mj	4·0																					
198	W, M/Mj (>95)	1·0																					
200	A, G/Mj (90)	0·05	Mj																				
202	A/Mj (>80), X/Mj (>5)	2·0																					
204	D/Mj (>80), G, M/Mj	1·0	Mj																				
206	A, X/Mj (~20), A/Mj (~70)	0·1	Mj																				
208	D/Mj (>70)	0·1	Mj/5									Tr											
210	L/Mj, V/Mj (>80)	1·0																		Tr			
212	D, A, Q/Mj	0·5							Mj			Mn											
215	E/Mj, V/Mn	7·0	Mj																	Tr			
217	A/Mj, L/Mn	1·0										Mn											
219	L/Mj	0·1													Tr								
221		5·0											Tr										
223	A/Mj (>90)	0·2																					
225	A/Mj	0·5	Mn									Mj											
227	G/Mn (3), E/Mj (>95)	0·5	Mn																				
229	G, O, E/Mj (>90)	0·2	Mj									Mn											
231	L/Mn, D, E/Mj (>97)	0·5	Mn																				
233	L/Mn, D, E/Mj (50)	0·5	Mn						Tr			Mn											
235	A/Mj (50)	0·2																					
239	L/Mj (60), E, O/Mj (30)	1·0										Tr											
242	E, O/Mj (>90)	2·0																					
245	E/Mj (>80)	0·05			Tr																		
247	A, E/Mj (>70), O, G/Mj (10)	0·05	Mj													Tr				Mn/2			
249	G/Mj, A, E/Mj (>80)	0·15	Mj																				
251	G/Mj (>70)	0·05	Mn			Tr														Tr			Mn
253	D/Mj (60), L/Mj (30)	0·05													Tr								Mn
255	Z/Mj (>80), E, A/Mj (10)	0·05																					
257	A, Z/Mj (>80) A/Mj (10)	0·1																					Tr
260	E/Mj (>95)	0·1																Mn					
262	E/Mj (>95)	0·1																Tr		Tr			
264	E/Mj (70), Y/Mn	0·05							Mn														
266	E/Mj (35), L/Mj (35)	0·05																		Tr			
268	A, R, P/Mj (>90)	0·1									Mn			Mn	Mn		Tr	Mn					
271	E, A, G/Mj (>98)	1·0																					
273	E, A, G, P/Mj (>98)	1·0	Mj																				
275	R, Q, E/Mj (>90)	0·07										Mn											
277	E/Mj (>90)	1·0	Tr?																				
279	D, E, /Mj (>79)	4·0										Mn											
281	D, E/Mj, T/Mn	1·0																				Tr	
284	E/Mj	6·0																					
286	E/Mn	1·0																					
288	D, E/Mj (>85)	2·0							Tr													Tr	Mn
290	C, E/Mj (>70)	0·15							Tr														Mn
292	I, E/Mj (88)	2·0	Tr						Tr														Tr
294	D, E/Mj (90)	0·1																					
296	E/Mj (>90)	0·04							Tr	Tr										Tr			Mn
298	E/Mj (>85)	1·0	Mn						Mn											Mn/1			Tr
300	D, E/Mj (>90)	1·0																					
302	E/Mj (10)	15·0																		Mj/10			
304	R/Mn, B/Tr, E/Mj (>90)	0·2																					
307	D/Mj (10), J/Tr.	3·0										Mn											
310	G/Mn (2), E/Mj (10)	5·0										Mn/3										Tr	
315	B, J, B, R, E/Mj (>30)	0·1										Mj/20					Mn						
323	C, E/Mj (>70)	1·0																					
334	E/Mj (20)	0·08																					
350	E/Mj (~50), J, K/Mj (~10)	0·07		Tr																			
352	E/Mj (20)	0·1		Mn				Tr				Mj/20											
361		1·0						Tr				Mj/20											
358	A/Mn (3), L/Mn (2), E/Mn (4)	1·5									Tr	Mj/10											
360		0·1		Mn								Tr									Tr		
394	G/Mj (>80)	6·0										Mj/10											
403	C, L, J/Mj (>90)	1·0								Tr							Mn						
423	R, L/Mj (>95)	0·2					Tr				Tr								Tr				
425	E, L/Mj (>95)	3·0																					
451	E, L, /Mj	0·2	Mn																				
461	L/Mj (>90), E/Mn	0·1									Mn						Mn	Tr		Mn			
544	E, Z, /Mj	4·0										Mn											
546	L/Mj (30),	1·0																					
557	E/Mj (20), L/Mj (25)	1·0																					
561	L/Mj (35)	0·1	Mj	Mn/2								Mj/20											
584	Q/MJ (49)	10·0										Mj											
564		20·0	Mn					Mj/20				Mj/10											
566	E/Mj (~25)	4·0		Tr																		Tr	
620		50·0		Mn							Mn												
622		10·0																					
McC.		3·0	Mj/5									Mj/5						Mn		Mn/2			

SAMPLE NUMBERS	CORDIERITE	CORUNDUM	CUMMINGTONITE	DOLOMITE	EPIDOTE	FLUORITE	GALENA	GARNET	GOLD	HAEMATITE *	HEMIMORPHITE	HORNBLENDE	HYPERSTHENE	ILMENITE	LEUCOXENE	LIMONITE *	MAGNETITE	MAGNESITE	MARCASITE	MONAZITE	METALLIC IRON
004				Mn				Tr	Tr					Mj/12		Tr	Mj/8				
017														Mj		Mj	Mj				
024																Mn	Mn				
026														Mn			Mn				
028								Tr						Mn	Mn	Mn	Mj				
031																Mj/90	Tr				Tr
034		Tr						Tr						Mj/30			Mj/40				
035		Tr			Mn			Mj/5						Mj/20		Tr	Mn				
038				Tr	Mn/2			Mj					Mj/30	Mn/3		Mn/2	Mj/12				
041				Tr				Mn/2						Mj/10		Mj	Mj/60				
044								Mn/2						Mn/5		Mj	Mj/40				
047													Mj	Mj/20			Mn	Tr			
052				Tr										Mn			Mn				
053														Mj			Mn				
056		Tr												Mn							
063				Tr				Tr									Mj				
065																			Mn		
061				Tr										Mn	Mj		Mj				
068																	Tr				
071														Mn			Mn				
075								Mn						Mj			Mj				
076														Mn	Mj		Mj				
080								Mn						Mn	Mn		Mj				
082								Mn	Tr					Mj			Mj				
089				Tr				Mn						Mn	Mn		Mn				
092								Mn					Tr								
095													Mn	Mj			Mj				
098													Mn	Mj			Mj				Tr
100													Mn	Mj/60			Mj/20				
102													Mn			Mj	Mj				
104		Mn											Mn	Mn			Mj				
106														Mj	Mj		Mj				
108														Mn		Mj/>95	Mn				
110													Tr	Mj/>75			Mj/>20				
115		Tr	Mn										Tr	Mj/>70			Mj/>20				
117		Tr	Mn										Mj/5	Mn			Mj	Tr			
118			Mn										Mn	Mj	Mn	Mj	Mn				
120			Tr						Tr				Tr				Mj		Mn		
122				Mn										Mj/>95			Mn				
124								Tr						Mj/>95			Tr				
126								Tr						Mj			Mn				
128			Mn	Mj										Mn			Mj				
130			Mn	Mn										Mj			Mn				
132					Tr									Mj		Mj	Mn				
134	Mn							Tr						Mj			Mn				
136		Tr															Mn				
138														Mn			Mj				
141					Tr									Mn			Mj				
143														Mj/>95			Mj				
145			Tr										Tr	Mj			Mn				
147														Mj			Mn				
149			Tr											Mj/30			Mn				
151								Tr						Mn							
153														Mj	Mj	Mj					
155														Mj/>70	Mj						
157														Mj	Mj		Mn				
158														Mj	Mj		Mn				Tr
160					Tr																
162A														Mj	Mj		Mn				
162B														Mj	Mj		Mn				
164				Tr				Tr						Mj	Mj		Mn				
167																	Tr				
169					Mn												Tr				
172																					
176																					
178								Mn									Tr				
180																	Tr				Tr
182														Mn			Tr				
184				Mj				Mn						Mj							
186								Mn						Mn	Mj		Tr				
189				Mn				Mn						Mn	Mj						
191				Mj				Mn							Mj		Mn				
194										Mn				Mn	Mj		Tr				
196														Tr							
198														Mn			Tr				
200														Mn		Mj	Tr				
202	Tr									Mj/>10				Mj		Mj	Tr				
204															Mn						
206																Mj	Tr				
208				Mn						Mj				Mn/3							
210					Tr			Mn									Tr				
212														Tr							
215								Tr		Mj				Mj			Tr				
217										Mj				Mn			Tr				
219																	Tr				
221								Mn		Mj		Mn	Mn	Mn	Mn						
223								Mn						Mn	Mn	Mj	Mn				
225														Mj	Mn	Mj			Tr		
227														Mn/3			Tr				
229														Mn/3			Tr				
231														Mn			Tr				
233			Mn		Mj/30			Mn						Mn/3			Tr				
235				Mn				Mn						Mn		Mj					
239								Mn						Mn		Tr	Tr				
242														Mj			Mn				
245				Mn				Tr									Tr				
247								Tr	Tr								Tr				
249														Mj			Mn		Tr		
251								Mn	Tr					Mn			Mn		Tr		Tr
253																	Tr				
255														Mn							Tr
257								Mn						Mn/2		Mj	Tr				
260								Tr						Mn/3		Mn	Mn		Mn		
262													Tr	Mn/2							
264									Tr?							Mn	Mj/>25				
266									Tr?					Mn			Mj/25				
268		Mn												Tr			Mn				
271																Tr	Tr				
273														Mn		Mn	Mn			Mn	
275	Tr							Mn						Mj		Tr	Tr				
277				Mn							Tr					Tr	Mn				
279														Mj	Mj/80	Tr	Tr				
281														Mj/40			Mj/5				
284				Mj										Mj			Mn	Mj			
286														Mj		Tr	Mj/5				
288														Mj/5	Tr	Tr					
290														Mj/25							
292														Mj/5							
294														Mj/5							
296														Mj			Tr				
298														Mj/5			Mn				
300														Mj			Mn				
302				Mj/30										Mj/10			Mn				
304														Mj/5			Tr				
307													Mj/50	Mj/15			Tr				
310													Mj/50	Mj/15			Tr				
315													Mj/15	Mj/5			Mn				
323					Tr									Mj/20			Mj/4				
334								Tr					Mj/10	Mj/20			Tr				
350								Tr						Mj			Mn				
352			Tr										Mj/25	Mj/30			Tr				
361			Tr										Mj/55	Mj/15			Mn/1				
358								Mn					Mj/10	Mj/10			Tr				
360					Mn/2							Tr	Mj/55	Mj/20			Mj/20				
394													Mj/5				Tr				
403	Tr													Mn			Tr				
423			Tr					Tr						Mn			Tr				
425		Tr		Tr		Tr		Tr						Mn/3			Tr				
451														Mn/3			Mn				
461							Tr										Mn				
544		Tr		Mj	Tr								Mj/20	Mj/10			Mn/4				
546													Mj/60				Tr <1				
557					Tr			Tr					Mj/50				Tr				
561					Mn								Mj/50								
584								Tr					Mj/30		Mj/10		Mj/5			Mn	
564			Mn		Mn/3							Mn	Mj/60				Mn/3			Tr	
566								Tr					Mj/60	Mj	Mj/5		Tr				
620													Mj/>85		Mn					Tr	
622								Mn/1					Mj/>90				Tr				
McC.													Mj/47			Mn	Mj/25		Mn/1		

SAMPLE NUMBERS	OLIVINE	ORTHOPYROXENE *	PYRITE	PYRRHOTITE	PYROLUSITE	PYROMORPHITE	RUTILE	SIDERITE	SPECULARITE	SPHALERITE	SPHENE	SPINEL	STAUROLITE	STEATITE	TOPAZ	TOURMALINE	TREMOLITE	VANADINITE	VERMICULITE	ZIRCON	ZOISITE	VISUAL APPEARANCE	GRAIN SIZE
004						Tr	Mn					Mn				Tr						br, bl	m
017			Tr	Tr																		br, bl	c
024							Tr													Mn		gr, bl	m
026							Mn									Tr						gr, bl	c
028							Mn								Tr	Mj						y, bl, gr	c
031																						y, br	c
034			Mn				Tr					Mn				Mn				Tr		dk	f
035							Mn							Mn/4		Tr				Tr		bl, wh	c
038							Tr									Mn				Mn		y, br	f-m
041												Tr				Mn				Mn		br, bl	m
044							Mn/1					Tr								Mn/3		y, bl	c
047				Tr			Mn					Mj		Tr		Mn				Mn		bl, gn	m
052			Mn				Mn									Mn				Mn		y, bl	f
053												Mj								Mn		y, bl	c
056							Mn															y, bl	m-f
063			Tr				Tr			Mn										Tr		y, gr	m-f
065							Mn													Tr		y, br	c
061							Tr													Tr		y, wh, gr	c
068																				Tr		y, bl	m-f
071																				Tr		y br	c-f
075			Mn				Mn													Mn		bl, br	m-f
076							Tr															bl, wh	c
080							Mj													Tr		bl, wh	c
082							Mn									Tr				Mn		bl, y	m
089			Mn			Tr	Mn			Tr												bl, wh	c
092						Mn	Tr													Mn		gr	f
095																	Mn					bl, wh	c-m
098																						bl, wh	m
100																	Tr					bl	m
102																						bl	m
104																						gr, wh	f-c
106							Mn							Tr			Tr			Mn		bl, wh	m-f
108														Mn						Mn		bl, br	c
110																						bl	m
115																						bf, bl	f
117			Mn				Mn					Tr					Mn			Mn		mv, br	f
118			Tr														Mn					y, bl	f
120			Mn					Mj								Tr	Mn					br	m
122							Mn													Mn		bl	m
124			Tr			Tr	Mn									Tr	Tr			Mj		bl	c
126			Mn				Mn										Mn			Mn		bl	f
128							Mn					Mn					Mn			Tr		bl, wh	m
130			Mn				Mn															bl, wh	m-c
132							Mj				Mn					Tr				Mn		y, bl	f
134							Mn					Mn								Mn		bl,	m
136							Mj													Mn		gr, wh	c-f
138							Mn				Tr									Tr		bl, br	m
141			Tr				Mn										Mj					bl	m
143							Tr										Mj			Tr		bl, wh	m
145																	Mj			Tr		gr, bl	c
147							Mn										Mj			Tr		y	f
149																	Mn					bl	c
151																						gr	m-f
153							Mn													Tr		br	c-f
155							Mn															bl, bf	m-f
157			Tr				Tr															gr, br, o	c-f
158																						gr, y	c-f
160							Mn													Tr		br, bl	c
162A																	Mn					bl, bf	m
162B							Mn										Mn					bl, bf	m-c
164							Mj									Tr	Mn			Mn		bl, gr	m-f
167			Mj																			br	c
169							Tr															y, br, bl	c
172			Mn/2				Mn															br, y	c
176							Mn									Tr						br, y	c-m
178			Mn																			gr, y, br	c-f
180			Mn	Tr																		br, y	c-f
182				Tr			Mn									Mn						br, y	m-f
184			Mn							Mn				Mn			Mn					dk.br, y	c-m
186			Mn				Tr															br, wh	c-m
189			Tr				Mn															br, bl	c-m
191			Mn																			br, wh	c-m
194							Tr															br, bl	c-f
196							Tr															br, bl	c-f
198							Mn									Tr						br, y	c-f
200				Tr			Tr									Mj				Mn		y, wh	c-f
202			Mn				Tr									Mn				Tr		br	m
204				Mn			Tr									Mn						br, y	c-f
206							Tr									Mn				Mn		lt.br, wh	c
208																Mn						dk.br, y	c-m
210									Tr											Mn		dk.br, y	c-m
212		Mj												Tr		Tr						lt.br	c-m
215		Mj							Mn					Tr		Tr						dk.br.y	c
217							Mj				Mn					Tr				Tr		dk.br, y, wh	c-m
219			Tr				Mn		Tr							Mn				Tr		dk.br, wh	c-f
221																Tr						y, br	m
223		Mn	Tr																			y, br, wh	c-f
225	Mn	Mj					Tr									Tr						Lt.br, y	m-f
227			Mn	Tr																		dk.br, wh	c-m
229		Mn					Tr		Mn								Mj					dk.br, Lt.br, y	m-f
231														Tr								y, br	c-m
233							Mn		Mn					Tr								bl, y	c-f
235		Mj/40	Mn			Tr										Mn						dk.br, wh	m-f
239		Mn							Tr											Tr		bl, br, wh	c-m
242				Tr			Mn						Mn			Tr						dk.br, wh	c-f
245			Tr				Mn				Tr			Mn		Mn						dk, br, wh	m-f
247			Mn/3		Mj/10		Mn		Mj	Mn								Tr				y	c-m
249		Mj/>10	Mn																			Lt.br, y	c
251																Mn/3	Mj/>70					Lt.br, wh	m-f
253							Mn		Mn							Mn/3						dk.br,	c-f
255							Tr									Mn/3						br, bl, wh	c-f
257							Mn/2					Mn				Mn						dk, br, wh	m-f
260			Tr			Tr										Tr				Mn		Lt.br, wh	c
262			Mn				Mn			Tr						Tr				Mn		Lt.br, wh	c-m
264			Mn			Tr	Tr									Mn				Tr		dk.br.	c-f
266																Mn	Mj					Lt.br	c
268			Mn				Tr									Tr	Mj			Tr		Lt.br	m-f
271			Mn														Mj					y, bl	c-m
273		Mn	Tr																			dk.br	c-m
275																Mn				Mn		y, br	m-f
277							Mn					Mn				Mn				Mn		dk, Lt br	c-m
279																Mn						bl, br, wh	c-m
281								Tr				Mj				Tr				Mn		Lt.br, dk.br	c-m
284			Mj/15			Tr		Mn		Mn												dk.br, wh	m
286		Mn										Mj										bl	m
288				Mn						Mn										Mn		y, br	c
290							Tr					Mj								Mn		bl, wh	c
292			Mj/10																			Lt.dk.br	c-m
294			Mn				Mn/2				Mn					Tr				Mn/2		Lt.dk.br	m
296			Mn								Tr					Mn/2						dk.br	m-f
298			Mn				Mn/3	Tr									Mn			Mn/2		dk.br	c
300							Mn/2									Tr				Tr		dk.br	c-m
302			Mj/30	Mn			Mn			Mn												dk.br, wh	c-m
304			Mn				Mn/2															Lt.dk.br	c-m
307	Mj/10						Mn										Mj/10					gn, wh	f
310	Mj/10		Tr														Mj/10					gn, gr	f
315	Mj/5		Mn	Tr										Mn		Tr	Mj/10			Mn		bl, wh	m-f
323				Tr			Mn				Mn	Mj?				Tr				Mn/4		dk.br, bl	m-f
334							Mj/10									Mn				Mn	Mj/30	y, bl, wh	m-f
350				Tr			Mj/30										Mn/2			Mn		gr, Lt.br	m-f
352			Mn				Mn/4									Mn						br, wh	c
361	Mj/10						Tr									Tr				Tr		y, bl	m
358			Tr				Mn									Tr				Tr		gn, bl, wh	m
360																Tr				Tr		bl, gn	c-m
394																						dk, Lt.br,	c
403			Tr				Tr			Tr						Tr				Mn		dk.Lt.br	c
423			Mn				Mn									Tr	Mn			Tr		dk.Lt.br.	c
425			Mn				Tr									Tr	Mj			Tr		dk.br.	c
451			Mn	Tr			Tr										Mn			Tr		Lt.br	c
461			Mn													Mj/10	Mj			Mn		Lt.br	c-f
544							Mn									Tr				Tr		dk.br, wh	m
546							Mj/5									Mn	Mj					bl, wh	c-m
557							Tr									Mn	Mj					y, bl	c-f
561							Mn			Tr					Tr	Mn				Mn/2		br, wh	c
584							Mj/5							Mn/2		Mn/3				Mj/6		gr, wh	m-f
564																Tr				Tr		y, bl	c-f
566							Mj/3							Mn/1		Mn/2				Mj/1		bl, wh	m-f
620							Mj/10									Mn/3						bl	m
622											Mn/3									Mn/3		bl	c-f
McC.			Mn/2											Mn/1		Mn/2			Mn/2	Mn/3		bl, br	c-m

* Earthy

* Enstatitic hypersthene

REFERENCE

Rock Types Represented

- A Limonitic aggregates
- B Limonitic magnetite aggregates
- C Limonitic micaceous aggregates
- D Limonitic pitted cherts
- E Limonitised quartzite and quartz pebbles
- F Limonitised shale
- G Actinolite / tremolite schist
- I Sandy (quartzose) micaceous aggregates
- J Chlorite schist
- K Calc silicate rock
- L Amphibolite schist
- M Chlorite schist, pyrite
- N Pyroxene: chlorite rock
- O Limonitised schist
- P Pyritic carbonaceous shale
- Q Pyroxenite fragment
- R Mica schist
- S Chert
- T Magnetite pseudomorphic (of amphibolites)
- V Limonitised pyrite aggregates
- W Hematite pebbles
- X Pyritic actinolite schist
- Y Serpentiferous rock
- Z Talc schist (?)

Terms of Quantity

- Mj major (5 volume per cent or more)
- Mn minor (1 to 5 volume percent)
- Tr traces (less than 1 volume percent)
- Mj/20 ← approx. volume percentages

Abbreviations for Colours of Mineral Particles

- bf buff
- bl black
- br brown
- gn green
- gr grey
- mv mauve
- o orange
- y yellow
- wh white
- dk dark
- lt light

Grain Size

- f fine grained
- m medium grained
- c coarse grained

223032

HEAVY MINERALS CONTENT

EL 15/76

78-1303

DUNDAS, TASMANIA

APPENDIX IV

TABLE 2

MINERAL ABUNDANCE BY AREAL SECTOR, DUNDAS

(a) N.E. SECTOR (specimens 004-089)

Major	Minor	Trace
Actinolite	Anthophyllite	Apatite
Augite	Chalcopyrite	Cerussite
Cassiterite	Chrysotile	Gold
Garnet	Epidote	
Hypersthene	Pyrite	
Ilmenite (+ leucoxene)	Rutile	
	Steatite	
Magnetite	Zircon	
Spinel	Sphalerite	
Tourmaline		

(b) N.W. SECTOR (specimens 090-145)

Major	Minor	Trace
Anthophyllite	Apatite	Antigorite
Actinolite (great increase over NE block)	Chalcopyrite	Baryte
	Cassiterite	Gold
Augite (great increase over NE block)	Chrysotile	
	Cordierite	
Hypersthene (more pervasive than NE block)	Corundum	
	Cummingtonite	
Ilmenite (+ leucoxene) (much heavier than NE block)	Garnet	
	Marcasite	
	Rutile	
Magnetite	Tourmaline	
Siderite	Tremolite	
Tremolite	Pyrite	
Zircon	Pyromorphite	
	Sphalerite	

/....

(c) <u>CENTRAL NORTH SECTOR</u> (specimens 147-164)

Major	Minor	Trace
Actinolite	Apatite	Antigorite
Anthophyllite	Augite	Chalcopyrite
Dolomite	Cassiterite	Corundum
Ilmenite (+ leucoxene, more so than for NW)	Pyrite	Epidote
Magnetite	Sphene	Tourmaline
Rutile (increases over NE and NW)	Spinel	Hypersthene
Tremolite	Zircon	Garnet
	Cummingtonite	

(d) <u>CENTRAL (northerly) EAST SECTOR</u> (Specimens 167 to 223; 251 to 257 and 284 to 304).

Major	Minor	Trace
Actinolite	Augite	Apatite
Antigorite (1 spl only)	Chrysotile	Biotite
Chalcopyrite (1 spl)	Epidote	
Dolomite	Garnet	
Ilmenite (but less for NE and NW blocks)	Hornblende (1 spl only)	
Leucoxene	Marcasite	
Magnesite	Pyrrhotite	
Orthopyroxene/hypersthene	Sidierite	
Pyrite	Spahlerite	
Tremolite	Sphene	
Rutile	Steatite	
	Tourmaline	
	Zircon	

/....

(e) CENTRAL (southerly) EAST SECTOR (specimens 225 to 249; 260 to 281 and 307 to 310).

Major	Minor	Trace
Actinolite (1 spl only)	Antigorite	Apatite
Augite	Arsenopyrite	Bismuthinite
Dolomite	Baryte	Chrome mica
Epidote	Biotite	Cordierite
Hypersthene	Cassiterite	Gold (?)
Ilmenite (increase in abundance) + leucoxene	Chalcopyrite	Hemimorphite
	Corundum	Pyromorphite
Limonite	Cummingtonite	Siderite
Magnetite	Garnet	Sphene
Olivine	Monazite	Vanadinite
Orthopyroxene	Pyrrhotite	
Pyrite	Rutile	
Pyrolusite	Sphalerite	
Specularite	Steatite	
Spinel (chromite?)	Tourmaline	
	Zircon	

(f) SOUTHERN SECTOR (specimens 315 to 360)

Major	Minor	Trace
Augite	Anatase	Anthophyllite
Hypersthene	Epidote	Arsenopyrite
Ilmenite	Pyrite	Bornite
Magnetite	Sphene	Garnet
Olivine	Steatite	Hornblende
Rutile	Tourmaline	Pyrrhotite
Spinel(?)	Zircon	
Zoisite (1 spl only)		

N.B. Major (5 volume % or more)
Minor (1 to 5 volume %)
Trace (<1 volume %)

APPENDIX V

SEE FICHE 2

035

78-1303
EL 15/76

Sample Description		Weight mgs	ES-1 Co ppm	Cr ppm	Mn ppm	Mo ppm	Nb ppm	Ni ppm	ES-2 Cu ppm	In ppm	Pb ppm	Sb ppm	Sn ppm	Zn ppm	ES-3 Ba ppm	ES-1 V ppm	W ppm	ES-2 Ag ppm	As ppm	Au ppm	Bi ppm	Cd ppm
N.E. Sector 22030	602004	146	30	>10,000	500	<3	<20	50	1,000	50	100	3,000	3,000	1,000	300	300	500	<0.1	5,000	<3	200	<3
	17	1019	5	300	300	<3	<20	30	2,000	50	300	3,000	>10,000	1,000	1,000	50	500	<0.1	>10,000	<3	300	<3
	24	995	20	3,000	300	<3	<20	100	200	100	300	100	>10,000	1,000	200	50	1000	<0.1	>10,000	<3	<1	<3
	26	610	<5	200	300	<3	<20	20	200	100	300	200	>10,000	100	100	50	1000	<0.1	>10,000	<3	<1	<3
	28	2980	10	100	200	<3	<20	30	300	50	3,000	200	>10,000	100	>10,000	<10	1000	<0.1	>10,000	<3	200	<3
	31	2320	20	>10,000	>10,000	<3	<20	30	30	<5	30	<30	>10,000	<20	2,000	500	500	<0.1	>10,000	<3	<1	<3
	34	1073	<5	300	100	<3	<20	50	30	50	100	2,000	>10,000	1,000	2,000	200	>10000	<0.1	>10,000	<3	300	<3
	35	2955	20	3,000	>10,000	<3	<20	50	50	50	100	2,000	3,000	1,000	500	300	5000	<0.1	5,000	<3	300	<3
	38	1457	10	3,000	500	<3	<20	50	50	50	100	1,000	1,000	2,000	500	300	3000	<0.1	5,000	<3	100	<3
	41	128	10	>10,000	>10,000	<3	<20	30	50	50	2,000	1,000	5,000	2,000	1,000	500	3000	<0.1	>10,000	<3	100	<3
	44	230	<5	300	300	<3	<20	30	50	<5	200	1,000	1,000	1,000	300	30	3000	<0.1	3,000	<3	30	<3
	47	198	10	300	200	<3	<20	30	20	<5	100	2,000	1,000	2,000	300	30	1000	<0.1	3,000	<3	20	<3
	52	156	10	300	100	<3	<20	30	30	50	1,000	1,000	>10,000	1,000	500	30	1000	<0.1	>10,000	<3	<1	<3
	53	808	30	5,000	100	<3	<20	50	<0.5	<5	<1	1,000	200	<20	500	500	3000	<0.1	50	<3	<1	<3
	56	118	<5	20	300	<3	<20	<3	50	<5	50	<30	500	<20	500	<10	300	<0.1	1,000	<3	<1	<3
	61	356	10	200	300	<3	<20	10	30	10	100	1,000	1,000	1,000	500	10	1000	<0.1	1,000	<3	<1	<3
	63	340	10	300	>10,000	<3	<20	100	30	30	30	2,000	1,000	1,000	500	50	3000	<0.1	1,000	<3	100	<3
	65	2155	<5	20	5,000	<3	<20	30	1,000	300	>10,000	30	300	<20	1,000	50	2000	<0.1	1,000	<3	<1	<3
	68	757	<5	20	300	<3	<20	3	30	<5	100	500	300	<20	500	50	2000	<0.1	500	<3	<1	<3
	71	1213	<5	50	500	<3	<20	5	30	<5	100	500	50	<20	1,000	50	2000	<0.1	500	<3	<1	<3
	75	946	<5	1,000	300	<3	<20	10	30	10	100	1,000	200	500	100	50	3000	<0.1	1,000	<3	100	<3
	76	179	5	1,000	300	<3	<20	5	30	30	100	2,000	300	1,000	30	50	2000	<0.1	1,000	<3	200	<3
	80	357	<5	100	300	<3	<20	5	30	30	200	1,000	5,000	200	30	50	1000	<0.1	5,000	<3	<1	<3
	82	748	<5	100	>10,000	<3	<20	10	30	50	200	1,000	2,000	1,000	30	50	1000	<0.1	3,000	<3	<1	<3
	89	291	<5	200	300	<3	<20	20	500	50	1,000	500	2,000	1,000	200	100	500	<0.1	3,000	<3	<1	<3
N.W. Sector	92	32	Not enough Sample						500	50	2,000	>10,000	>10,000	2,000	not enough sample	Not Enough Sample.			>10,000	<3	>10,000	
	95	17,685	50	300	300	<3	<20	100	500	50	20	5,000	500	1,000	500	100	1000	<0.1	5,000		200	
	98	5099	100	>10,000	300		<20	200	100	50	30	5,000	500	1,000	100	300	3000	<0.1	1,000		300	
	100	12,111	200	>10,000	500		<20	100	100	30	<1	3,000	500	1,000	100	200	1000	<0.1	500		200	
	2	2054	50	>10,000	300		<20	100	300	30	20	2,000	>10,000	1,000	200				3,000		300	
	4	31	Not enough Sample						300	30	50	2,000	500	1,000	not enough sample	Not Enough Sample.			1,000		200	
	6	310	<5	500	5,000	<3	<20	30	200	30	20	2,000	1,000	3,000	100	100	<50	<0.1	3,000		100	
	8	1270	<5	1,000	1,000	<3	<20	20	20	10	100	100	500	100	100	50	<50	<0.1	1,000		<1	
	10	7580	50	30	100	<3	<20	<3	1,000	10	300	1,000	2,000	1,000	100	10	500	<0.1	1,000		200	
	15	128	50	10,000	300	<3	<20	100	500	50	500	1,000	3,000	1,000	50	300	1000	<0.1	2,000		200	
	17	757	<5	300	300	<3	<20	30	500	50	300	1,000	2,000	1,000	100	30	500	<0.1	2,000		<1	
	18	130	5	3,000	300	<3	<20	50	500	50	1,000	1,000	2,000	1,000	200	10	>10000	<0.1	2,000		100	
	20	415	5	100	300	<3	<20	<3	20	10	500	1,000	300	<20	100	10	300	<0.1	1,000		<1	
	22	6806	30	3,000	300	<3	<20	100	500	10	100	1,000	>10,000	1,000	100	30	1000	<0.1	5,000		200	
	24	364	50	>10,000	300	<3	<20	200	1,000	10	100	1,000	>10,000	1,000	30	300	2000	<0.1	>10,000		200	
	26	88	<5	>10,000	200	<3	<20	50	20	10	100	3,000	3,000	1,000	30	300	1000	2	2,000		300	
	28	219	<5	3,000	200	<3	<20	20	50	10	50	3,000	>10,000	1,000	1,000	500	200	0.5	5,000		200	
	30	451	<5	300	100	<3	<20	100	50	20	100	1,000	>10,000	100	<30	200	<50	<0.1	>10,000		<1	
	32	107	<5	100	50	<3	<20	100	50	10	100	3,000	5,000	2,000	30	300	100	1	5,000		20	
	34	163	50	5,000	100	<3	<20	20	50	20	100	3,000	>10,000	1,000	30	300	300	0.5	3,000		30	
	36	70	<5	300	100	<3	<20	20	50	<5	100	2,000	1,000	1,000	1,000	300	300	20.1	1,000		10	
	38	265	<5	200	100	<3	<20	50	100	50	30	3,000	1,000	1,000	30	200	100	1	1,000		30	
	41	82	50	2,000	200	<3	<20	100	300	<5	100	3,000	500	1,000	30	300	1000	30	500		10	
	602143	4782	100	5,000	300	<3	<20	30	200	30	50	5,000	1,000	1,000	1,000	300	1000		1,000		10	
Central North Sector	602145	3373	50	2,000	100	<3	<20	100	100	10	500	3,000	1,000	1,000	30	100	500	<0.1	500	<3	100	<3
	47	307	<5	200	200	<3	<20	50	300	30	200	2,000	500	1,000	500	50	<50	1	2,000	<3	30	<3
	49	7287	200	3,000	200	<3	<20	2,000	200	30	100	5,000	2,000	1,000	500	50	2000	0.5	1,000	<3	300	<3
	51	1318	<5	100	100	<3	<20	100	50	<5	30	200	100	100	1,000	30	<50	<0.1	500	<3	<1	<3
	53	5225	<5	20	1,000	<3	<20	3	200	5	300	<30	2,000	20	1,000	10	<50	0.2	3,000	<3	<1	<3
	55	611	<5	100	200	<3	<20	20	50	<5	30	<30	1,000	20	1,000	100	<50	<0.1	2,000	<3	<1	<3
	57	1145	<5	200	100	<3	<20	30	30	5	50	1,000	1,000	1,000	100	200	<50	<0.1	2,000	<3	<1	<3
	58	22	Not	Enough	Sample.				30	10	300	1,000	2,000	1,000	not enough sample	Not Enough Sample.			2,000	<3	<1	<3
	60	4020	<5	30	100	<3	<20	<3	100	<5	100	<30	500	<20	500	<10	<50	<0.1	2,000	<3	<1	<3
	62 (A)	46	Not	Enough	Sample.				30	10	50	500	300	<20	not enough sample	Not Enough Sample.			<50	<3	<1	<3
	62 (B)	2709	<5	200	100	<3	<20	20	100	30	<1	500	1,000	1,000	<30	50	<50	<0.1	2,000	<3	100	<3
	64	577	<5	1,000	100	<3	<20	50	100	30	50	2,000	1,000	2,000	1,000	50	<50	0.1	2,000	<3	100	<3
Central East (south) Sector	67	1537	<5	20	20	<3	<20	10	10	<5	<1	<30	<1	<20	1,000	50	<50	<0.1	50	<3	<1	<3
	69	590	<5	100	30	<3	<20	5	30	<5	<1	<30	<1	<20	300	50	<50	<0.1	50	<3	<1	<3
	72	5383	<5	100	300	<3	<20	10	30	<5	100	50	1,000	20	500	50	<50	0.5	1,000	<3	<1	<3
	76	409	<5	50	100	<3	<20	30	10	<5	10	<30	<1	20	500	30	<50	<0.1	50	<3	<1	<3
	78	333	<5	<20	100	<3	<20	10	10	<5	20	<30	<1	<20	500	30	<50	<0.1	50	<3	<1	<3
	80	680	<5	<20	300	<3	<20	10	30	<5	20	<30	<1	<20	1,000	20	<50	<0.1	50	<3	<1	<3
	82	298	<5	200	500	<3	<20	30	10	<5	20	30	<1	<20	100	50	<50	1.0	50	<3	<1	<3
	84	483	<5	100	2,000	<3	<20	10	30	<5	100	30	<1	20	500	50	<50	2.0	50	<3	<1	<3
	86	196	<5	20	100	<3	<20	5	30	<5	50	<30	<1	<20	2,000	50	<50	0.1	50	<3	<1	<3
	89	1082	<5	50	30	<3	<20	30	100	10	300	50	30	20	500	50	<50	1.0	50	<3	<1	<3
	91	2460	<5	200	>10,000	<3	<20	30	100	20	1,000	100	100	<20	300	100	<50	3.0	300	<3	100	<3
	94	2508	<5	<20	200	<3	<20	30	30	<5	200	<30	<1	<20	500	50	<50	<0.1	200	<3	<1	<3
	96	2544	<5	<20	20	<3	<20	20	50	<5	<1	<30	<1	<20	1,000	50	<50	<0.1	200	<3	<1	<3
	98	1535	<5	<20	30	<3	<20	5	30	<5	<1	<30	<1	<20	1,000	50	<50	<0.1	<50	<3	<1	<3
	200	171	<5	50	100	<3	<20	5	10	<5	<1	<30	<1	<20	500	50	<50	<0.1	50	<3	<1	<3
	2	2030	<5	<20	100	<3	<20	10	100	5	50	<30	<1	<20	500	50	<50	0.5	300	<3	<1	<3
	4	810	<5	50	200	<3	<20	10	50	<5	<1	50	30	<20	100	50	<50	<0.1	100	<3	<1	<3
	6	165	<5	30	100	<3	<20	<3	30	<5	50	<30	<1	<20	500	10	<50	<0.1	100	<3	<1	<3
	8	364	<5	20	30	<3	<20	3	30	<5	<1	<30	<1	<20	5,000	50	<50	<0.1	50	<3	<1	<3
	10	1200	<5	<20	100	<3	<20	<3	10	<10	10	<30	<1	<20	1,000	20	<50	0.5	200	<3	30	<3
	12	440	<5	<20	200	<3	<20	<3	10	<10	10	<30	<1	100	500	50	<50	1.0	100	<3	100	<3
	15	7777	<5	<20	200	<3	<20	<3	30	<10	30	300	100	200	200	100	<50	1.0	300	<3	530	<3
	17	1524	<5	20	200	<3	<20	<3	3	<10	50	300	300	<20	3,000	30	<50	<0.1	200	<3	20	<3
	19	222	<5	<20	200	<3	<20	<3	50	<10	300	30	100	30	300	10	<50	0.5	200	<3	100	<3
	21	1764	<5	30	100	<3	<20	<3	30	<10	100	300	100	<20	300	30	<50	0.3	200	<3	10	<3
	23	308	<5	<20	200	<3	<20	<3	30	<10	50	500	200	20	100	20	<50	<0.1	100	<3	50	<3
Central East (south) Sector	25	320	<5	<20	500	<3	<20	<3	50	<10	300	<30	50	30	500	100	<50	0.1	100	<3	50	<3
	27	821	<5	<20	200	<3	<20	<3	30	<10	20	<30	<1	<20	500	30	<50	<0.1	100	<3	20	<3
	29	577	<5	<20	100	<3	<20	<3	20	<10	20	<30	<1	<20	300	30	<50	<0.1	100	<3	20	<3
	31	1003	<5	<20	200	<3	<20	<3	30	<10	50	<30	<1	<20	2,000	<10	<50	0.1	100	<3	30	<3
	33	573	<5	<20	200	<3	<20	<3	20	<10	50	<30	3	<20	1,000	10	<50	<0.1	50	<3	20	<3
	35	548	<5	<20	200	<3	<20	<3	30	<10	50	<30	3	<20	3,000	10	<50	1.0	50	<3	30	<3
	39	811	<5	<20	200	<3	<20	<3	30	<10	50	<30	50	<20	300	10	<50	0.5	100	<3	30	<3
	42	1176	<5	30	200	<3	<20	<3	30	<10	100	<30	20	<20	200	10	<50	0.1	100	<3	50	<3
	45	96	<5	<20	200	<3	<20	<3	10	<10	100	<30	20	30	100	10	<50	0.1	50	<3	30	<3
	47	102	<5	<20	300	<3	<20	<3	10	<10	100	<30	<1	<20	1,000	<10	<50	<0.1	30	<3	20	<3
	602249	847	<5	<20	200	<3	<20	<3	20	<10	50	<30	<1	<20	500	10	<50	<0.1	100	<3	30	<3
	602251	69	<5	<20	200	<3	<20	<3	20	<10	100	<30	50	20	500	10	<50	<0.1	100	<3	30	<3
	53	147	<5	50	200	<3	<20	<3	20	<10	100	<30	20	100	1,000	20	<50	<0.1	100	<3	30	<3
Central East (south) Sector	55	41		Not	Enough	Sample.			100	30	300	500	30	1,000		not received		<0.1	200	<3	100	<3
	57	152	<5	<20	200	<3	<20	<3	50	30	200	50	30	3,000	50	10	<50	1	200	<3	200	<3
Central East (south) Sector	60	399	<5	20	200	<3	<20	20	50	10	100	<30	10	100	300	30	<50	.3	100	<3	100	<3
	62	423	<5	50	200	<3	<20	20	50	10	300	50	100	50	2,000	30	<50	0.5	200	<3	100	<3
	64	124	<5	50	300	<3	<20	<3	30	<10	200	500	30	<20	1,000	30	<50	0.5	200	<3	50	<3
	66	117	<5	<20	100	<3	<20	<3	20	<10	50	30	3	100	300	<10	<50	0.5	100	<3	50	<3
	68	592	<5	<20	500	<3	<20	<3	50	<10	>10,000	2,000	50	<20	300	10	<50	.1	200	<3	100	50
	71	538	<5	<20	300	<3	<20	<3	50	<10	500	<30	20	<20	300	10	<50	3.0	100	<3	100	<3
	73	1180	<5	<20	100	<3	<20	<3	100	30	300	<30	10	<20	200	10	<50	.5	100	<3	200	<3
	75	189	<5	50	300	<3	<20	<3	30	<10	50	300	20	1,000	100	20	<50	1	100	<3	5	<3
	77	894	<5	50	300	<3	<20	<3	100	<10	100	<30	10	20	100	20	<50	0.5	100	<3	100	<3
	79	4660	<5	50	300	<3	<20	<3	100	<10	100	200	200	50	50	10	<50	0.5	200	<3	100	<3
	81	1087	<5	20	300	<3	<20	20	10	<10	100	300	20	<20	100	10	<50	0.5	50	<3	20	<3
Central East (north) Sector	84	8512	<5	<20	200	<3	<20	<3	30	<10	500	30	20	<20	<30	<10	<50	1.0	100	<3	50	<3
	86	672	<5	30	300	<3	<20	100	20	<10	500	1,000	300	1,000	100	100	500	1.0	200	<3	100	<3
	88	1443	<5	30	300	<3	<20	50	30	30	200	1,000	200	1,000	<30	20	<50	<0.1	200	<3	200	<3
	90	311	<5	30	300	<3	<20	100	30	<10	300	1,000	200	1,000	<30	100	300	<0.1	200	<3	200	<3
	92	1688	<5	<20	2,000	<3	<20	<3	50	<10	300	<30	100	<20	1,000	<10	<50	3	200	<3	200	<3
	94	713	<5	30	100	<3	<20	<3	10	30	100	200	20	50	230	30	<50	<0.1	200	<3	100	<3
	96	174	<5	100	100	<3	<20	30	10	<10	300	500	100	100	<30	100	<50	0.5	200	<3	100	<3
	98	1922	<5	50	100	<3	<20	3	50	10	100	<30	200	<20	<30	50	<50	0.5	500	<3	30	<3
	300	1122	<5	300	1,000	<3	<20	0	50	<10	200	500	500	<20	<30	100	<50	30	1000	<3	30	<3
	2	22.03 g	<5	20	1,000	<3	<20	<3	30	<10	>10,000	500	300	<20	<30	10	<50	30	300	<3	30	1,000 <3
	4	686	<5	50	300	<3	<20	<3	20	<10	100	<30	200	100	<30	20	<50	<0.1	300	<3	30	<3
Central East (south) Sector	7	2058	<5	30	300	<3	<20	3	50	<10	100	50	200	2,000	<30	100	<50	20	1000	<3	100	<3
	10	2566	<5	20	300	<3	<20	3	20	30	30	<30	3	3,000	<30	100	<50	20	100	<3	100	<3
Southern Sector	15	265	<5	30	300	<3	<20	3	10	100	100	50	10	100	<30	50	<50	<0.1	100	<3	100	<3
	23	1205	<5	1,000	300	<3	<20	10	100	<10	200	2,000	500	1,000	<30	100	200	0.3	300	<3	100	<3
	34	205	<5	500	200	<3	<20	10	100	50	300	2,000	100	1,000	<30	100	<50	0.3	300	<3	100	<3
	50	182	<5	1,000	100	<3	<20	3	50	30	300	2,000	100	1,000	30	100	100	0.3	100	<3	30	<3
	52	411	<5	30	1,000	<3	<20	3	20	20	100	<30	1	500	100	100	<50	<0.1	100	<3	100	<3
	58	1525	<5	30	500	<3	<20	3	10	<10	30	<30	50	2,000	<30	200	<50	0.3	300	<3	100	<3
	60	490	<5	20	300	<3	<20	3	10	30	50	<30	50	2,000	30	200	<50	0.3	300	<3	100	<3
Resampled Areas	61	1573	<5	20	300	<3	<20	3	10	30	30	<30	<1	1,000	<30	100	<50	<0.1	100	<3	100	<3
	94	5198	<5	<20	30	<3	<20	<3	100	30	500	<30	<1	50	<30	20	<50	<0.1	100	<3	100	<3
	403	3157	<5	20	100	<3	<20	<3	20	<10	50	<30	<1	50	300	30	<50	<0.1	100	<3	100	<3
	23	449	<5	<20	100	<3	<20	<3	100	<10	100	500	500	100	<30	20	<50	2.0	2000	<3	300	<3
	25	4401	<5	30	200	<3	<20	10	50	50	200	50	30	20	<30	100	<50	30	100	<3	50	<3
	51	768	<5	100	200	<3	<20	30	50	<10	100	500	30	20	<30	100	<50	<0.1	100	<3	100	<3
	61	255	<5	30	200	<3	<20	20	200	<10	100	1,000	50	1,000	<30	100	<50	30	1000	<3	200	<3
	544	4957	<5	1,000	300	<3	<20	20	200	30	100	1,000	50	1,000	<30	500	<50	1.0	300	<3	200	<3
	46	1826	<5	>10,000	2,000	<3	<20	20	100	30	100	3,000	100	1,000	30	300	500	1.0	300	<3	100	<3
	57	287	<5	200	100	<3	<20	<3	100	10	100	2,000	100	1,000	<30	50	<50	0.5	300	<3	100	<3
	61	1114	<5	2,000	200	<3	<20	20	30	30	100	2,000	100	1,000	50	100	200	0.5	300	<3	100	<3
	64	12.86 g	<5	2,000	100	<3	<20	20	20	30	100	2,000	200	1,000	<30	100	300	20	500	<3	100	<3
	66	5259	<5	2,000	200	<3	<20	20	30	20	100	2,000	200	2,000	<30	200	500	0.5	300	<3	100	<3
	602584	9208	<5	1,000	200	<3	<20	20	100	30	100	2,000	300	1,000	<30	100	50	0.3	1000	<3	100	<3
	602620	46.19 g	50	>10,000	200	<3	<20	20	100	50	100	3,000	300	1,000	30	100	1,000	0.1	300	<3	100	<3
	602622	21.80 g	20	5,000	100	<3	<20	20	100	30	100	3,000	300	1,000	30	100	300	0.1	500	<3	100	<3
McCooneys Prop.		4050	10	50	>10,000	<3	<20	10	300	30	1,000	1,000	>10,000	1,000	<30	100	<50	30	>10,000	<3	300	<3

Sample Description	ES-3 Ca ppm	La ppm	Ti ppm	Y ppm	Zr ppm	ES-4 Hg ppm	P ppm	ES-6 B ppm
602004	1,000	<100	>10,000	500	5,000	<30	3,000	3,000
17	1,000	<100	>10,000	300	3,000	<30	3,000	1,000
24	500	<100	>10,000	100	5,000	<30	5,000	3,000
26	500	<100	>10,000	200	3,000	<30	3,000	2,000
28	100	<100	>10,000	100	1,000	<30	3,000	5,000
31	>10,000	<100	>10,000	100	2,000	<30	1,000	1,000
34	<100	<100	1,000	<10	1,000	<30	3,000	>10,000
35	2,000	<100	>10,000	500	5,000	<30	3,000	5,000
38	3,000	<100	>10,000	<10	1,000	<30	3,000	5,000
41	100	<100	>10,000	100	>10,000	<30	3,000	5,000
44	100	<100	>10,000	100	5,000	<30	3,000	3,000
47	100	<100	>10,000	<10	3,000	<30	1,000	3,000
52	100	<100	>10,000	500	3,000	<30	5,000	3,000
53	100	<100	>10,000	<10	1,000	<30	>100	100
56	100	<100	5,000	<10	100	<30	1,000	100
61	100	<100	>10,000	<10	500	<30	1,000	200
63	<100	<100	5,000	<10	500	<30	2,000	300
65	<100	<100	300	<10	500	<30	1,000	300
68	<100	<100	300	<10	<100	<30	>10,000	100
71	<100	<100	300	<10	< 100	<30	2,000	50
75	<100	<100	3,000	<10	300	<30	1,000	100
76	<100	<100	5,000	<10	300	<30	1,000	100
80	<100	<100	3,000	<10	500	<30	1,000	300
82	300	<100	>10,000	200	5,000	<30	1,000	300
89	<100	<100	5,000	<10	500	<30	1,000	200
92	not enough sample			-	-	<30	>10,000	3,000
95	300	<100	1,000	<10	100	<30	1,000	50
98	300	<100	1,000	<10	100	100	3,000	50
100	5,000	<100	5,000	<10	200	<30	3,000	50
2	1,000	<100	>10,000	<10	100	<30	>10,000	50
4	- not enough sample			-	-	<30	3,000	5,000
6	3,000	<100	>10,000	<10	5,000	<30	2,000	3,000
8	<100	<100	3,000	<10	300	<30	1,000	200
10	300	<100	5,000	<10	3,000	<30	1,000	100
15	<100	<100	3,000	<10	1,000	<30	1,000	1,000
17	<100	<100	5,000	<10	1,000	<30	1,000	2,000
18	1,000	<100	>10,000	<10	2,000	<30	1,000	1,000
20	<100	<100	3,000	<10	1,000	<30	1,000	100
22	1,000	<100	>10,000	<10	3,000	<30	>10,000	100
24	500	<100	>10,000	<10	3,000	<30	>10,000	100
26	200	<100	5,000	<10	5,000	<30	5,000	300
28	>10,000	<100	>10,000	<10	5,000	<30	2,000	1,000
30	1,000	<100	3,000	<10	5,000	<30	2,000	300
32	5,000	300	>10,000	30	5,000	<30	2,000	1,000
34	2,000	<100	5,000	30	5,000	<30	2,000	1,000
36	3,000	200	5,000	30	5,000	<30	1,000	500
38	3,000	<100	3,000	30	>10,000	<30	3,000	2,000
41	5,000	<100	5,000	30	2,000	<30	2,000	300
43	2,000	<100	3,000	30	3,000	<30	3,000	200
45	>10,000	<100	>10,000	30	1,000	<30	2,000	300
602147	>10,000	<100	5,000	50	2,000	<30	1,000	300
49	1,000	<100	3,000	30	1,000	<30	2,000	100
51	1,000	<100	5,000	<10	2,000	<30	500	200
53	1,000	<100	3,000	50	500	<30	3,000	1,000
55	1,000	<100	>10,000	20	2,000	<30	1,000	300
57	1,000	<100	3,000	10	1,000	<30	2,000	300
58	not enough sample					<30	2,000	1,000
60	1,000	300	2,000	200	500	<30	1,000	1,000
62A	not enough sample					<30	<100	1,000
62B	1,000	<100	5,000	30	1,000	<30	2,000	500
64	2,000	<100	>10,000	50	3,000	<30	2,000	1,000
67	50	<100	3,000	<10	300	<30	500	30
69	300	<100	3,000	<10	100	<30	<100	500
72	500	<100	3,000	50	200	<30	500	300
76	50	<100	1,000	<10	100	<30	100	200
78	50	<100	500	<10	100	<30	100	200
80	50	<100	500	<10	<100	<30	100	500
82	500	<100	2,000	200	200	<30	<100	300
84	500	<100	1,000	200	300	<30	300	300
86	100	<100	500	<10	100	<30	500	100
89	100	<100	1,000	50	<100	<30	1,000	100
91	500	<100	1,000	500	<100	<30	1,000	200
94	500	<100	1,000	<10	<100	<30	1,000	20
96	100	<100	1,000	<10	<100	<30	500	100
98	300	<100	1,000	<10	<100	<30	<100	200
200	300	<100	2,000	<10	2,000	<30	<100	200
2	300	<100	3,000	30	200	<30	1,000	300
4	50	<100	500	<10	100	<30	500	200
6	50	<100	500	<10	<100	<30	300	200
8	100	<100	2,000	<10	<100	<30	<100	100
210	20	<100	3,000	<10	100	<30	1,000	30
12	20	<100	5,000	<10	100	<30	1,000	100
15	20	<100	3,000	<10	100	<30	1,000	100
17	30	<100	1,000	<10	<100	<30	100	50
19	<20	<100	1,000	<10	<100	<30	2,000	2,000
21	20	<100	1,000	<10	100	<30	300	300
23	20	<100	2,000	<10	100	<30	300	100
25	20	<100	5,000	<10	300	<30	1,000	100
27	30	<100	3,000	<10	<100	<30	300	10
29	30	<100	1,000	<10	100	<30	300	30
31	<20	<100	300	<10	<100	<30	300	30
33	50	<100	2,000	<10	<100	<30	300	50
35	20	<100	1,000	<10	<100	<30	500	300
39	<20	<100	100	<10	<100	<30	500	100
42	<20	<100	300	<10	<100	<30	1,000	200
45	30	<100	1,000	<10	<100	<30	300	200
47	<20	<100	500	<10	<100	<30	<100	200
49	20	<100	500	<10	<100	<30	500	100
51	<20	<100	500	<10	100	<30	100	300
602255	not enough sample					<30	500	2,000
57	20	<100	5,000	<10	100	<30	1,000	300
60	20	<100	2,000	<10	<100	<30	1,000	200
62	<20	<100	1,000	<10	100	<30	500	200
64	<20	<100	1,000	<10	<100	<30	500	100
66	<20	<100	2,000	<10	300	<30	500	200
68	50	<100	2,000	<10	200	<30	500	200
71	30	<100	2,000	<10	<100	<30	300	50
73	50	<100	3,000	<10	<100	<30	1,000	30
75	30	<100	3,000	<10	100	<30	1,000	1,000
77	30	<100	3,000	<10	<100	<30	1,000	50
79	<20	<100	2,000	<10	<100	<30	500	50
81	<20	<100	1,000	<10	<100	<30	<100	50
84	<20	<100	<100	<10	<100	<30	500	50
86	<20	<100	1,000	<10	100	<30	300	100
88	<20	<100	1,000	<10	<100	<30	500	50
90	<20	<100	2,000	<10	<100	<30	500	50
92	30	<100	500	<10	<100	<30	1,000	200
94	<20	<100	300	<10	<100	<30	1,000	200
96	<20	<100	300	<10	<100	<30	500	2,000
98	<20	<100	500	<10	<100	<30	1,000	200
300	<20	<100	500	<10	100	<30	1,000	100
2	<20	<100	<100	<10	<100	<30	100	50
4	<20	<100	100	<10	<100	<30	500	100
7	<20	<100	1,000	<10	<100	<30	5,000	100
10	100	<100	2,000	<10	<100	<30	3,000	200
15	<20	<100	100	<10	<100	<30	2,000	100
23	<20	<100	2,000	<10	1,000	<30	1,000	2,000
34	<20	<100	3,000	<10	2,000	<30	1,000	3,000
50	<20	<100	5,000	<10	5,000	<30	2,000	2,000
52	<20	<100	300	<10	100	<30	2,000	200
58	50	<100	500	<10	<100	<30	3,000	200
60	20	<100	1,000	<10	<100	<30	3,000	100
61	30	<100	1,000	<10	<100	<30	3,000	100
94	<20	<100	1,000	<10	<100	<30	1,000	100
403	<20	<100	300	<10	<100	<30	2,000	100
423	<20	<100	100	<10	<100	<30	3,000	300
425	<20	<100	100	<10	<100	<30	2,000	100
61	<20	<100	100	<10	<100	<30	3,000	500
544	1,000	<100	>10,000	<10	500	<30	3,000	100
46	<20	<100	>10,000	<10	1,000	<30	3,000	300
57	<20	<100	>10,900	<10	100	<30	1,000	200
61	20	<100	3,000	<10	200	<30	1,000	200
64	1,000	<100	1,000	<10	200	<30	2,000	100
66	<20	<100	2,000	<10	300	<30	2,000	100
84	<20	<100	2,000	<10	300	<30	3,000	300
620	<20	<100	2,000	<10	500	<30	3,000	100
22	<20	<100	2,000	<10	1,000	<30	3,000	200
McCooneys Prop.	20	<100	2,000	<10	100	<30	>10,000	>10,000