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The petrography of some rocks from the Anio Creek area

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INTRODUCTION

Nineteen thin sections (including eight polished) were submitted for description and interpretation in regard to the geophysical anomalies (Richardson, 1994) and mineralisation in the vicinity of Anio Creek, northwest of Cradle Mountain. The rocks were collected by Dr K. Corbett and J. Pemberton of Mineral Resources Tasmania. The petrographic descriptions are appended and summarised, and are discussed below.

SUMMARY OF DESCRIPTIONS

This suite of rocks encompasses:–

(a) quartz-feldspar ± hornblende ± biotite porphyries belonging to a suite of dykes affiliated with the Bonds Range Porphyry body (AC5, AC8, AC9, AC13, AC15, Iris 1);

(b) Precambrian quartz-muscovite ± biotite ± chlorite schist (AC6, AC10, AC11, AC16A, AC16B);

(c) crystal vitric tuff of the Back Creek Beds (AC7, AC14);

(d) a Tertiary basaltic sandstone (Iris 2);

(e) vein quartz (AC12); and

(f) breccia within the Back Peak Beds (AC1, AC2, AC3, AC4).

Sulphide mineralisation, usually minor, occurs in the breccias, one tuff, three schists, three porphyries and the vein quartz.

The breccias are clast-supported and contain angular to rounded clasts, up to about 50 mm in size, of most of the above rock types (except the Tertiary sandstone) plus rare possible granitic clasts. The matrix comprises fine grained quartz-chlorite-pyrite-tourmaline ± muscovite; some textures indicate open-space filling and others replacement. Sulphides, other than pyrite, are mostly rare but sample AC1 contains about 2–5% chalcopyrite plus traces of pyrrhotite, sphalerite and galena. Magnetite is sporadically present as fine inclusions in pyrite. Tourmaline and pyrite mostly show skeletal textures, indicating very rapid growth. Textures in the matrix indicate that the breccias were emplaced after the regional deformation. Wallrock alteration is not prominent, but probably includes the introduction of minor pyrite, tourmaline, quartz, sericite and chlorite.

The schist from the Mt Remus Mo-Co-V prospect (AC16A, AC16B) is also weakly mineralised, containing pyrite and traces of molybdenite, chalcopyrite, tourmaline and allanite. The sulphides are mostly present in highly deformed quartz-chlorite veins, and are also deformed and brecciated (more so than in the Anomaly 13 breccias and other rock types), i.e. are pre- or syn-deformational. No discrete vanadium or cobalt minerals could be detected. The chloritic vein quartz in AC12 (from near Anomaly 13, probably from a schist environment) is similar, with abundant pyrite, minor chalcopyrite, galena, pyrrhotite, allanite and other minerals, again highly deformed. The other schists examined, from outside of the Mt Remus prospect, contain little pyrite, hydrothermal tourmaline or quartz veins. The schist-hosted mineralisation thus appears to pre-date the breccia-hosted mineralisation. The traces of yellow-brown and orange-brown tourmaline in the schist may be recrystallised detrital grains, in contrast to the green-brown, hydrothermal tourmaline in the breccia near Anomaly 13, although this needs analytical confirmation.

Small amounts of pyrite appear to be present in some of the porphyry and tuff, but most could not be examined in reflected light. Significant sulphides are present in porphyry AC5, which contains disseminated and vein-style occurrences of pyrite, chalcopyrite and arsenopyrite. This sample also contains disseminated tourmaline, and magnetite inclusions in pyrite. Most porphyries are moderately altered, particularly sericitised, epidotised and chloritised, but significant veining is rare.

ORIGIN OF THE MAGNETIC ANOMALIES

There is little in the rocks examined to relate to the magnetic anomaly, other than traces of pyrrhotite and magnetite in the veins and breccias. These minerals are early formed and/or pyritised, suggesting a possible external source from rocks underlying the area.

Magnetite-rich sequences, such as the Savage River deposits, are a possible source and it is worth noting that some tourmalinisation and chloritisation is also associated with those deposits. Sulphides (mostly pyrite) are abundant at Savage River, and cobalt, copper and vanadium are enriched (Coleman, 1975), as in the Mt Remus prospect. Some of this type of mineralisation at depth could have reacted with, and been sampled by, hydrothermal fluids in the breccia pipes and veins. This may explain the relative quartz and mica-poor nature of the mineralisation.

Alternatively, wallrock reactions above a granite can cause extensive formation of magnetite and pyrrhotite (Kwak, 1987), and we may just be seeing the results of minor, late stage, fluid leakage from this event.

MINERALISED BRECCIAS IN ANIO CREEK NEAR ANOMALY 13 — DISCUSSION

These breccias contain sulphides in a Fe-chlorite-tourmaline-quartz ± sericite matrix, and textures indicate an origin from silica-boron-iron-sulphur - rich fluids. Some of the quartz replacement textures are similar to those in the northeastern gold deposits, which were probably deposited by boiling hydrothermal fluids (Taheri and Bottrill, 1994). The skeletal growth of pyrite and tourmaline in these breccias is also indicative of very rapid growth. The boiling of magmatic-hydrothermal fluids forming quartz veins at Anio Creek is a major conclusion of Taheri (1994).

Paragenetically the sulphides in the breccia are relatively late, forming syn- or post-crystallisation of the matrix, but some grains have still been slightly brecciated, probably after consolidation of the breccia. Most tourmaline partly replaces chlorite.

Alteration of clasts is minor and includes weak tourmalinisation, chloritisation, pyritisation, sericitisation and silicification. The system had rather low fluid/rock ratios, as indicated by the relative lack of alteration of wallrocks and clasts, and the lack of veining. Perhaps only a relatively small granitic pluton or apophysis is involved, or most of the fluid was vented in unidentified structures, as granites can expel considerable quantities of fluid (J. Taheri, pers. comm.).

The sulphide-depositing fluids forming the breccia infill are almost certainly granitic in origin (as suggested by anomalous, late-stage tourmaline and anomalous Mo and Bi; Corbett and Pemberton, 1994) but the matrix infill assemblages are unusual in being relatively poor in granite-related minerals (quartz, micas and feldspars), and volatiles (e.g. anhydrite, fluorine and carbonates), whilst being chlorite rich. The possible granitic (coarse-grained quartz-chlorite) clasts in the breccia also support a granitic origin. Further geochemistry of the mineralised and unmineralised rocks in the area, concentrating on granite-related trace elements such as Mo, Bi, W, Sn, F and B, could confirm this.

Copper-rich mineralisation, as some of these samples are, is usually also characteristic of moderate to high temperature hydrothermal systems (Evans, 1980). The minerals pyrrhotite and magnetite, both present as apparently unstable early phases altering to pyrite, are also typical of high-temperature hydrothermal systems, but may also reflect a low sulphur fugacity or low oxidation potential (Hedenquist *et al.*, 1994).

The mineralised breccias appear to have formed by fluids sourced from a granitoid, or perhaps meteoric-derived fluid equilibrating with the cooling granitoid. These fluids probably ponded in structural traps immediately above the granitoid body, causing some chlorite-biotite-muscovite-tourmaline-pyrrhotite-magnetite alteration in the aureole, until overpressuring or tectonic movement caused the fluids to be released upwards. A rapid rise in the overpressured fluid caused brecciation of the wallrocks in the pipe-like body, and the clasts were carried upwards some distance. The release of pressure associated with this event caused fluid boiling and precipitation of some of the components; silica, Fe, Cu, S and B (Taheri, 1994). This precipitated material filled voids and silicified finely comminuted clastic material (rock flour), rapidly sealing the system. Some comparisons and contrasts with some other breccia-pipe deposits are made below.

COMPARISON WITH OTHER BRECCIA-STYLE DEPOSITS

The breccia pipe style of sulphide deposit is quite variable in terms of nature and mineralisation, and is found in most hydrothermal ore deposits, including Mississippi Valley type, volcanogenic massive sulphide type, epithermal Au-Ag, and perhaps most importantly in porphyry copper deposits.

They are particularly important in magmatic arc settings, where Sillitoe (1985) classified them into six broad groups according to genesis:

(1) magmatic-hydrothermal (derived from late magmatic fluids, e.g. some porphyry Cu-Mo deposits);

(2) phreatic (caused by magmatic heating and expansion of meteoric pore fluids, e.g. some epithermal deposits, porphyry-related deposits, Kuroko footwall ores);

(3) phreatomagmatic (cool meteoric fluids interacting explosively with magmas, e.g. some epithermal deposits, porphyry-related deposits);

(4) magmatic diatremes (pyroclastic-type deposits formed by eruption of breccia pipes at surface, e.g. some Cu, Mo and Au deposits);

(5) intrusion breccias (mechanical disruption of wallrocks due to magma movement);

(6) tectonic breccias (fault related).

A comparison of the nature of these breccias with the Anio Creek geology (Corbett and Pemberton, 1994) and mineralisation points to the first two styles as being most applicable (there is a gradation between these; Sillitoe, 1985). The magmatic-fluid model (1) is the best fit, as it appears to be the only system which may contain significant components of magnetite and pyrrhotite. The mineralogy of these systems is highly variable, but the pyrite, chalcopyrite, quartz, tourmaline, sericite, chlorite assemblage is common.

One of the classic non-granitoid related deposits is the Tsumeb deposit, Namibia, where a massive sulphide-bearing pipe cuts Precambrian dolomite and chert (Weber

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and Wilson, 1977). The ores are complex and unusual, being rich in copper, lead, arsenic, zinc, silver, cadmium, germanium, gallium, arsenic and vanadium. The genesis is enigmatic but related to intrusion of a "pseudoaplite" of uncertain nature.

Breccia pipe deposits are poorly known in Tasmania. Tin-bearing greisen pipes are recognised in granite in the Heemskirk (Blissett, 1962) and Ben Lomond (Blissett, 1959) tin fields, but are poorly described and may not be breccias. Stockwork Cu-Au deposits in the VMS deposits (e.g. Que River) may be related in origin to breccia systems. Breccia pipes are thought to occur along the major gold-bearing lodes in northeastern Tasmania, and may contain most of the economic gold (Taheri and Bottrill, 1994).

MT REMUS PROSPECT

This Co-Mo-V-pyrite prospect is very poorly understood, although known since at least 1928 (Nye, 1928). Unfortunately there were insufficient samples, analyses and geological information in this study to understand the mineralisation or produce a reasonable ore deposit model. The occurrence of vanadium is particularly interesting, and is discussed further below. The occurrence of molybdenite, tourmaline and allanite are all suggestive of a granitic origin. The cobalt and vanadium are more typical of mafic-hosted than granitic deposits, and this could indicate granitic fluid reaction with underlying (unexposed) rock types. The sulphides differ from those in the breccia near Anomaly 13 in being more deformed, and are mostly present in foliated quartz veins rather than an undeformed chloritic breccia. Pyrite, chlorite and tourmaline are features typical of both deposits.

VANADIUM

Vanadium was noted by Nye (1928) to be present, up to 4.4%, in the Mt Remus Co-Mo-pyrite ores, but mineragraphic and petrographic investigations of the Mt Remus samples by Stillwell (1932), and in this study, failed to identify any vanadium minerals. The mineralogy of this element, which may exist in nature in several oxidation states (+3, +4 and +5), is extremely complex and variable. It is an essential component of more than 70 minerals, including sulphides, oxides, hydroxides, sulphates, phosphates, silicates and numerous vanadates, and may also be a significant component of many common minerals, including oxides, hydroxides, silicates and carbonates (e.g. Evans and Landergren, 1969; Flohr, 1994). Few vanadium minerals are common, and many are characterised by bright colours (e.g. red, yellow and green) although some are black or colourless.

Only five vanadium minerals have been reported in Tasmania: carnotite, goldmanite, pascoite, sulvanite and vanadinite (Bottrill, in prep.); only goldmanite (St Dizier skarns; Kwak, 1987) and sulvanite (Rosebery ores; D. Huston, pers. comm.) have been adequately confirmed and the other occurrences are doubtful (Bottrill, unpublished data). It is possible, but unlikely, that the vanadium in these minerals was sourced in the underlying granites in both areas. Vanadium is usually won as a by-product of various iron ores (usually in metamorphosed mafic rocks), or in sediment-hosted uranium deposits, but an unusual Ti-Nb-V deposit is also known, associated with alkaline igneous complexes and carbonatites at Magnet Cove, Arkansas (Flohr, 1994).

Stillwell (1932) considered, after various microchemical tests, that the vanadium at Mt Remus was not present as a sulphide (e.g. patronite) or a silicate (e.g. roscoelite or vanadian chlorite), but as a distinct vanadium-rich mineral of unknown identity. The high vanadium values were not repeated in more recent studies (Burns, 1963), suggesting analytical error (G. Green, pers. comm.) but it seems unlikely that the repeated analyses by both Nye (1928) and Stillwell (1932) could all be in error. There is no obvious correlation with molybdenum or other constituents.

CONCLUSIONS

The nature and origin of the mineralisation at the Mt Remus prospect and the breccias near Anomaly 13, Anio Creek, may be quite different, although a Devonian granite-derived fluid could be implicated in both. The former deposit appears to be pre-deformational, vein-hosted, Mo-Co-V and the latter essentially post-deformational, breccia-hosted Cu-Au. Further work, including further sampling, chemical analyses, and microprobe studies, will be required to adequately understand the nature of the mineralisation.

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APPENDIX 1
Petrographic descriptions

AC1

This rock is a coarse breccia, with angular to rounded clasts of various rock types, up to about 50 mm in size, in a highly pyritic, and chalcopyrite-bearing, matrix.

The clasts include hornfelsed(?) sandy mudstone (Back Creek Beds?), micaceous quartzite (Precambrian?), quartz porphyry (Bonds Range Porphyry), coarse-grained chlorite (pseudomorphous after biotite?) and possibly granite (coarse-grained quartz-chlorite). The matrix (15–25% of the rock) is fine to coarse-grained quartz, sulphides and iron-rich chlorite, with minor tourmaline. The breccia is clast supported, and in places there is little matrix, with deformation-induced compaction of clasts. There is some crustiform texture in the matrix, suggesting open-space filling, and the quartz is only slightly deformed.

The tourmaline is fine grained and highly skeletal, with green-brown colours. It is a trace constituent of the matrix and is abundant in some quartzite clasts.

Pyrite comprises about 5–10% of the breccia, mostly in the matrix, and is quite coarse grained (<5 mm) and euhedral in part. It has been extensively brecciated and veined by chalcopyrite and quartz. Inclusions are minor but include chalcopyrite. Limonitic weathering is slight. There is also minor pyrite in some clasts (mudstone and porphyry).

There is about 2–5% chalcopyrite in the rock, almost all in the quartz matrix. It occurs as irregular blebs to about 5 mm, and as small inclusions and veins in pyrite. There is slight alteration to covellite and chalcocite.

Other sulphides include fine-grained marcasite aggregates with pyrite, probably pseudomorphic after pyrrhotite, and trace sphalerite, all in the matrix.

AC2

This rock is a coarse, clast-supported breccia, with angular to rounded clasts of various rock types, up to about 50 mm in size, in a pyritic matrix.

The clasts include hornfelsed(?) mudstone and tuff(?) (Back Creek Beds?) and quartz porphyry (Bonds Range Porphyry).

The matrix (~40% of the rock) comprises fine to medium-grained quartz, sulphides and Fe-chlorite, with minor tourmaline. Quartz is commonly 'woodpile textured', with small, randomly-oriented, subhedral to euhedral crystals in a finer groundmass, indicating a silicification origin. There is some minor quartz-pyrite micro-veining of clasts.

The tourmaline is fine grained (<0.1 mm) and highly skeletal, with green-brown colours. It comprises ~1% of the matrix.

Pyrite comprises about 5–10 % of the matrix, and is up to 1 mm in size. It is amoeboid, sieve-textured and is brecciated in part; it has rare fibre textures in some veinlets. Inclusions include quartz, and limonitic alteration is slight. There is also minor pyrite in some tuff and porphyry clasts, disseminated and in microveinlets.

AC3

This rock is a coarse, clast-supported breccia, with large angular to rounded tuffaceous clasts, up to about 50 mm in size, in a pyritic matrix.

The only two clasts observed were of tuffaceous sandstone (Back Creek Beds?, with included quartz arenite clasts).

The matrix (~20% of the rock) comprises fine to medium-grained quartz, sulphides and chlorite, with minor tourmaline and sericite. Quartz is commonly 'woodpile textured', with small, randomly-oriented, subhedral to euhedral prismatic crystals in a finer groundmass, probably indicating an origin by silicification. There is some minor quartz-chlorite veining of clasts. There are irregular laminae, defined by variable (rhythmic?) quartz/chlorite ratios, suggesting graded bedding.

The tourmaline is fine grained (<0.1 mm) and highly skeletal, with green-brown colours. It comprises ~1–2% of the matrix, and is closely related to chlorite in distribution (largely replacing it).

Pyrite comprises about 5% of the matrix, and is up to 0.5 mm in size. It is anhedral to subhedral, sieve-textured (including rutile) and is relatively undeformed but with minor brecciation. There is also minor pyrite in some clasts (disseminated and in veins).

AC4

This rock is a coarse, clast-supported breccia, with angular to rounded clasts of various rock types up to about 50 mm in size, in a pyritic matrix.

The clasts include sandy, micaceous, tuffaceous mudstone and siltstone (Back Creek Beds?), micaceous quartzite and quartz arenite (Precambrian?), and coarse-grained vein quartz.

The matrix (~35% of the rock) is fine to medium-grained quartz, sulphides, mica and Fe-chlorite, with minor tourmaline. There is some minor quartz-chlorite veining of clasts. The mica and chlorite are coarse grained but finely intergrown and probably represent altered biotite.

The tourmaline is fine grained (<0.1 mm) and highly skeletal, with green-brown colours. It comprises <1% of the matrix and is abundant (<30%) in some clasts.

Pyrite comprises about 5% of the matrix, and is up to 1 mm in size. It is anhedral to euhedral, sieve-textured (including magnetite), slightly brecciated and limonitic. There is also minor pyrite in some porphyry clasts (disseminated and in veins), and in some siltstone clasts.

AC5

This rock is a quartz-feldspar-hornblende porphyry (Bonds Range Porphyry). The matrix has a very fine-grained granular texture and there is moderate alteration of labile phenocrysts; plagioclase is partly altered to sericite, hornblende(?) is completely altered to aggregates of sericite ± pyrite ± chlorite ± rutile ± tourmaline (green), and ilmenite is altered to sphene. Chlorite blebs occur, plus traces of apatite, zircon, clinozoisite, rutile, brookite(?) and monazite(?). Several microveinlets of mica ± quartz, pyrite and chalcopyrite cut the rock

The sulphide mineralogy is dominated by pyrite (~2%). This is present in stringers and microveinlets, plus disseminated in the groundmass. It is anhedral to euhedral, <0.1 mm, partly poikilitic and banded, only slightly brecciated and partly altered to limonite. Inclusions include magnetite, galena and ilmenite(?). Chalcopyrite is disseminated as small blebs, partly altered to covellite, in the porphyry matrix, plus occurring as inclusions in pyrite and quartz phenocrysts, and in veinlets. Arsenopyrite is also common as zoned, euhedral crystals <0.1 mm, in the matrix.

AC6

This rock is a fine to medium-grained Precambrian quartz-muscovite schist. There are traces of tourmaline (orange-brown), chlorite and leucoxene but there is no evidence for any alteration or mineralisation.

AC7

This rock is a crystal vitric tuff, with abundant angular quartz fragments in a fine-grained quartz-sericite ± chlorite matrix with devitrified shard textures. It is probably part of the Back Creek Beds. It is weakly laminated and pyritic, with microveinlets of quartz and pyrite. The pyrite is up to 0.5 mm in size, hosted in matrix and veinlets, is limonitic, and probably comprises about 0.5% of the rock

AC8

This rock is a quartz-feldspar-biotite-hornblende porphyry (Bonds Range Porphyry). The matrix has a relatively coarse (~0.5 mm) snowflake texture, containing fine-grained biotite, actinolite, apatite, zircon and monazite(?). There is moderate alteration of labile phenocrysts; plagioclase is partly altered to epidote-clinozoisite and sericite, hornblende (green-brown) is partly altered to fibrous actinolite ± sphene, and ilmenite is partly altered to sphene. There are traces of a relict blue amphibole in the amphibole aggregates and there is a trace of pyrite.

AC9

This rock is a quartz-feldspar-hornblende porphyry (Bonds Range Porphyry). The matrix has a medium-grained (~0.1 mm) granular texture and there is extensive alteration of labile phenocrysts. Plagioclase is largely altered to sericite, biotite is extensively chloritised, and the minor hornblende is completely altered to actinolite-chlorite-biotite-limonite aggregates. The quartz is partly recrystallised. There is some limonite pseudomorphic after pyrite, apparently undeformed.

AC10

This rock is a fine to medium-grained Precambrian quartz-muscovite schist, similar to AC6 but more weathered. There are traces of tourmaline (orange-brown, partly poikiloblastic), minor albite and patches of manganoan clinozoisite but there is no evidence for any hydrothermal alteration or mineralisation.

AC11

This rock is a fine to medium-grained Precambrian muscovite-biotite-albite schist. The albite is coarse grained and poikiloblastic, with cloudy sericite patches. There are traces of chlorite, sphene, tourmaline (yellow-brown-green, hydrothermal?), medium to coarse-grained pyrite and probably ilmenite.

AC12

This rock is massive vein quartz, highly deformed, with stylolitic chlorite-pyrite lamellae. Pyrite comprises about 5% of the rock, and is coarse grained (<3 mm), poikiloblastic, anhedral and brecciated. Other sulphides associated with pyrite include traces of chalcopyrite (inclusions, fracture-fillings and attached grains, up to 40 µm in size), galena (very fine inclusions) and pyrrhotite (fine inclusions). There are traces of other mineral inclusions in the pyrite, including carbonates, quartz, chlorite, cassiterite or rutile(?), allanite (?) and tremolite(?). The ore mineralisation is pre- or syn-deformational.

AC13

This rock is a quartz-feldspar porphyry (Bonds Range Porphyry), similar to AC8, but more altered. The matrix has a medium-grained snowflake/spherulitic texture, with spherulitic overgrowths on quartz, and there is extensive alteration of labile phenocrysts. Plagioclase is almost completely altered to sericite, and the former presence of hornblende is represented by minor, relatively small leucoxene-chlorite aggregates. Chloritic patches may indicate vesicle filling or fluid immiscibility. There is no evidence for any mineralisation.

AC14

This rock is a lithic crystal vitric tuff (Back Creek Beds). The matrix is very fine grained, with recrystallised shards. There is moderate alteration of labile phenocrysts. Plagioclase is slightly altered to sericite. Quartz is strongly brecciated. Wispy aggregates of green biotite-quartz-chlorite ± feldspar phenocrysts appear to be pumice. There are minor quartz-muscovite ± chlorite veinlets, but no evidence for any mineralisation.

AC15

This rock is a quartz-feldspar-hornblende porphyry (Bonds Range Porphyry). The matrix has a relatively coarse snowflake texture, with inter-spherulite chlorite and carbonate, and there are microgranular/spherulitic overgrowths on quartz phenocrysts. There is moderate alteration of labile phenocrysts; plagioclase is partly altered to sericite, while hornblende has probably completely altered to minor chlorite-carbonate aggregates. There is no evidence for any mineralisation.

AC16A

This rock is a fine to medium-grained Precambrian quartz-muscovite-chlorite schist. It is crenulated and shows evidence of both ductile and brittle deformation, with abundant quartz ± chlorite ± pyrite veinlets. These vary from highly stressed boudins to relatively undeformed veinlets, indicating a range in ages for the veins from pre-deformational to post-deformational. Some quartz-chlorite blebs may be pseudomorphs after cordierite. There are traces of small green-brown-blue tourmaline crystals disseminated in the schist. The sulphides are pre- or syn-deformational.

The rock is relatively sulphidic, with up to 3% pyrite, mostly distributed within quartz-chlorite veinlets. Some is disseminated in the schist and some is in stylolites and vein selvages. There are traces of chalcopyrite and pyrrhotite as inclusions in pyrite. Rare flakes of molybdenite, associated with pyrite, and small disseminated crystals of allanite, are present in the quartz-chlorite veinlets.

AC16B

This rock is a fine to medium-grained Precambrian quartz-muscovite-chlorite schist, with crenulated cleavage. There are traces of green-brown tourmaline, disseminated in the schist, and thin quartz ± chlorite veinlets.

There is a trace of pyrite, some disseminated and some in late-stage fractures cross-cutting the schistosity. These are irregular in shape and up to 60 μm in size. There are also rare, small, disseminated chalcopyrite blebs.

Iris 1

This rock is a quartz-feldspar-biotite-hornblende porphyry (Bonds Range Porphyry). The matrix is medium-grained, recrystallised, granular quartz-sericite. The biotite and hornblende are extensively hematised and sericitised. Feldspars are completely sericitised. There is no obvious mineralisation.

Iris 2

This rock is a volcanic sandstone of Tertiary age, with glassy basaltic ash and minor quartz sand, sandstone, chert and other siliceous clasts. There are traces of zeolites, but no other alteration or mineralisation is visible.