



Tasmania

DEPARTMENT of  
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ENERGY *and* RESOURCES

MINERAL RESOURCES TASMANIA

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M07136

9 May 2008

Stonehenge Metals Limited  
Unit 3, Level 3  
1292 Hay Street  
WEST PERTH WA 6005

Attention: David Vaarwerk

Dear David

**JOB M07/136: PETROLOGY  
SWANSEA MINE AREA - ZEEHAN**

Nine rock samples from the above locations were submitted by Greg Lear for polished thin sectioning and brief petrography. They were prepared and examined by transmitted and reflected polarised light and stereo-microscopic techniques in our laboratories, and the report is enclosed.

An invoice for \$1116.50 covering these analyses (9 polished thin sections @ \$45.00 ea., 9 microscopic descriptions @ \$60.00 ea.; 1 XRD @ \$70.00 ea.; \$0 handling, \$101.50 GST) will be forwarded.

Yours sincerely

R S Bottrill  
**MINERALOGIST-PETROLOGIST**

Encl.

**Petrological Examination of Rock Samples  
from Swansea Mine area – Zeehan**

**MRT Mineralogical/Petrology Laboratory  
Job No. M07/136**

**An unpublished report for Stonehenge Metals Ltd.**

**R.S. Bottrill**

**5 May 2008**

# **Petrological Examination of Rock Samples from Swansea Mine area - Zeehan**

**An unpublished Mineral Resources Tasmania report  
for Stonehenge Metals Limited**

**R.S. Bottrill**

**MRT MinPet Job No. Job M07/136**

**5 May 2008**

## **SUMMARY**

Nine rock samples, from drilling near the Swansea mine, Zeehan, were found to be highly altered, veined and brecciated, metamorphosed mafic to intermediate volcanic rocks and a siliceous, volcanogenic conglomerate. The present mineralogies mostly comprise chlorite-albite-carbonate-quartz, mostly due to hydrothermal alteration but the volcanics to appear to have originally been andesitic to basaltic in composition. The rocks are interpreted to be highly altered sequence of tectonic and sedimentary breccias and conglomerates, perhaps equivalents of the early Cambrian Dundas group or Cleveland-Waratah Association. The rocks have been highly metasomatised and carbonate-altered at relatively low pressure and temperature, probably related to the underlying granite intrusion, and mostly contain some very minor mineralisation: minor pyrite and very minor chalcopyrite.

## INTRODUCTION

Nine samples, taken from diamond drillcore from Swansea QE2, drilled recently by Stonehenge Metals Limited at the Swansea prospect southwest of Zeehan, were submitted by Greg Lear for polished thin sectioning and brief petrography and ore petrology. They were prepared and examined by transmitted and reflected polarised light and stereomicroscopic techniques in the Mineral Resources laboratories, Hobart, and described below.

X-ray diffraction analysis (XRD) was also carried out on one sample, for mineralogical analysis in support of the petrographic analyses, and the results are included in appendix 1 below.

**Table 1: sample details.**

<b>Reg. No.</b>	<b>DDH/depth(m)</b>	<b>Field No.</b>
<b>C108789</b>	Swansea QE2/476.3	QE2/1
<b>C108790</b>	Swansea QE2/480.4	QE2/2
<b>C108791</b>	Swansea QE2/272.1	QE2/3
<b>C108792</b>	Swansea QE2/284.4	QE2/4
<b>C108793</b>	Swansea QE2/435.3	QE2/5
<b>C108794</b>	Swansea QE2/434.25	QE2/6
<b>C108795</b>	Swansea QE2/317.5	QE2/7
<b>C108796</b>	Swansea QE2/284.0	QE2/8
<b>C108797</b>	Swansea QE2/140.0	QE2/9

## PETROLOGICAL EXAMINATION

### Sample C108789 Swansea QE2/476.3 QE2/1

In hand specimen the rock sample is a fine grained, mottled (brecciated?) rock with reddish grey to greenish grey colour, with irregular bleached zones and off-white veins. There is no strong foliation or lamination. Mineralisation is represented by trace disseminated pyrite.

In thin section the rock is a breccia composed mostly of:

- Quartz, fine grained (<0.2mm), irregular to rounded, disseminated, ~15%
- Sericite, fine grained (<0.05mm), disseminated ~20%
- Albitic plagioclase, fine-medium grained (~0.1x0.5 mm), ~25%
- Carbonate (calcite +/- dolomite?), medium grained (<1mm), veins and disseminated ~30%
- Chlorite, green, fine grained (<0.1mm), disseminated ~10%
- Opaques (hematite), disseminated and in veins; <2mm aggregates, also colloidal, ~2%.

The rock is probably a carbonate-bearing volcanic breccia with large clasts of meta-andesitic rocks. The abundant fine disseminated quartz, lack of mafics and presence of small chlorite-carbonate filled amygdules (<2mm) in a homogeneous matrix of fine felted plagioclase laths probably indicates a vesicular, aphyric andesitic volcanic. The alteration is pervasive chlorite-calcite-sericite and is probably hydrothermal and presumably granite-related. There are also fine carbonate veins and patches, probably forming a matrix to the breccia.

Mineralisation comprises only trace disseminated and vein-hosted, anhedral to colloidal hematite. It includes small, irregular to fibrous aggregates to 0.4mm long, perhaps replacing skeletal magnetite?

**Sample C108790 Swansea QE2/480.4 QE2/2**

In hand specimen the rock sample is a fine grained, brecciated rock with dark grey clasts in an off-white carbonate matrix. There is no strong foliation. Mineralisation is represented by minor disseminated pyrite.

In thin section the rock is a breccia composed mostly of:

- Quartz, fine grained (<0.05mm), ~2%
- Albite, medium grained (1-2mm & 50-500 microns), ~30%
- Calcite(?), medium grained (<0.2mm), ~50%
- Chlorite, green, medium grained, ~10%
- Clinozoisite (?), fine grained, replacing plagioclase, ~10%
- Opaques (hematite), in veins, <1%.

The rock is a highly altered mafic volcanic breccia. The clasts appear to be basaltic, having a chlorite-albite matrix and some small phenocrysts. Plagioclase feldspar occurs as fine laths in the groundmass and as small phenocrysts, and is probably largely altered to very fine clinozoisite.

Alteration and/or low grade metamorphism is represented by the widespread carbonate-chlorite-clinozoisite alteration of the basaltic clasts, brecciated by late carbonate veins.

Mineralisation comprises only trace disseminated anhedral hematite in the carbonate veins.

**Sample C108791 Swansea QE2/272.1 QE2/3**

In hand specimen the rock sample is a fine grained, massive, dark grey, weakly laminated mafic rock cut by off-white quartz-carbonate veins. There is no metamorphic foliation. Mineralisation is represented by very minor disseminated sulphides.

In thin section the rock is a breccia composed mostly of:

- Quartz, fine grained (<0.05mm), veinlets, ~5%
- Albite, fine-medium grained (0.4x0.1mm), ~5%
- Calcite(?), very fine to coarse grained (<5mm), ~80%
- Chlorite, green, fine grained and replacing phenocrysts, ~8%
- Opaques (pyrite), <0.5mm, disseminated and in veins, <1%.

The rock is a matrix-supported mafic volcanic breccia which contains carbonate veins and infillings cutting a variably carbonate-altered mafic rock. The mafic clasts contain blocky, sparse, chloritised phenocrysts (orthopyroxene or olivine?) to 1mm. There are some small quartz-carbonate-chlorite veins, and fracture-related bleached zones.

Mineralisation comprises only traces of fine pyrite in veinlets.

**Sample C108792 Swansea QE2/284.4 QE2/4**

In hand specimen the rock sample is a fine grained, mottled (brecciated?) rock with green-grey clasts in an off-white matrix. There is no strong foliation. Mineralisation is represented by minor disseminated pyrite.

In thin section the rock is a breccia composed mostly of:

- Quartz, medium grained (<0.2mm), blebs, ~5%
- Albite, medium grained (<0.2mm), green ~5%
- Carbonate(?), medium-coarse grained (<5 mm), ~80%
- Chlorite, green, fine-medium grained, ~10%
- Opaques (pyrite and chalcopyrite), fine grained, <1%.

The rock is a matrix-supported breccia which contains a highly carbonate altered, quartz-bearing, fine grained mafic to andesitic volcanic or volcanoclastic clasts to a few mm diameter in a carbonate-rich breccia matrix. It exhibits some sparse altered plagioclase phenocrysts to 0.5mm, and some fine grained, chlorite-rich polymict breccia zones, perhaps indicating a tectonic breccia. It is more highly altered than previous samples, with little primary fabric remaining.

Mineralisation comprises only trace disseminated sulphides, mostly anhedral chalcopyrite (~0.2mm) with a faint trace of fine pyrite. Some chalcopyrite appears to replace pyrite; it is mostly hosted in the mafic clasts.

**Sample C108793 Swansea QE2/435.3 QE2/5**

In hand specimen the rock sample is a fine grained, mottled (brecciated?) rock with dark green-grey clasts in an off-white matrix. There is no strong foliation. Mineralisation is represented by minor disseminated pyrite.

In thin section the rock is a breccia composed mostly of:

- Quartz, coarse grained, highly angular to rounded, <4mm, <5%
- Igneous & metamorphic clasts (<5mm), ~5%
- Albite, medium grained (<1mm), ?tr
- Carbonate (?), medium grained (<0.2mm), ~70%
- Chlorite, green, fine grained, ~20%
- Sericite ~2%
- Amphibole (green), ~2%.

The rock is a matrix-supported breccia which contains polymict, highly angular to rounded clasts of various igneous & metamorphic clasts, including quartz-muscovite greisen, quartz-amphibolite (with coarse grained, altered green-brown amphibole), and felsic to mafic volcanics in a variably chlorite and carbonate-rich matrix.

No mineralisation was observed.

**Sample C108794 Swansea QE2/434.25QE2/6**

In hand specimen the rock sample is a fine grained, dark green-grey brecciated rock with off-white carbonate veining. There is no strong foliation. Mineralisation is represented by trace disseminated chalcopyrite in veins.

In thin section the rock is a breccia composed mostly of:

- Quartz, fine grained (<1mm), colourless, ~5%
- Albite, medium grained (<0.2mm), green ~??%
- Calcite(?), medium grained (<1mm), ~50%
- Chlorite, green, fine grained, ~45%
- Opaques (chalcopyrite and pyrite), <2mm, ~1%.

The rock is probably a highly altered and brecciated, unsorted, volcanogenic, pebbly sandstone or greywacke which contains highly angular to rounded clasts of quartz, sandstone, mafic to intermediate volcanic rocks, carbonate and chloritic to 4 mm in a fine grained chlorite-carbonate matrix. The polymict nature suggests a sedimentary precursor, but may have a component of both sedimentary and tectonic breccias; few primary textures probably remain.

Mineralisation comprises only trace disseminated sulphides, mostly anhedral chalcopyrite (~0.2mm) with a faint trace of fine, anhedral pyrite (<0.2mm). The pyrite is mostly hosted by the carbonate veins while the chalcopyrite appears to occur mostly as irregular grains near the contacts of the mafic clasts and carbonate veins.

**Sample C108795 Swansea QE2/317.5 QE2/7**

In hand specimen the rock sample is a fine grained, medium grey rock with off-white carbonate veining and brecciation. There is no strong foliation. Mineralisation is represented by trace disseminated chalcopyrite.

In thin section the rock is a breccia composed mostly of:

- Quartz, fine grained (<0.5mm), irregular, angular, ~15%
- Albite, medium grained (<0.5mm), highly sericitised, ~25%
- Calcite(?), coarse grained (<2mm), ~35%
- Chlorite, green, fine grained, ~20%
- Opaques (chalcopyrite and pyrite), ~2%.

The rock is a matrix-supported breccia which contains jigsaw-fit clasts of altered volcanic rocks and quartz in a carbonate rich matrix. The clasts were probably quartzofeldspathic, but are highly altered to sericite and clinozoisite? Sparse coarser quartz grains and mafic clots may represent recrystallised phenocrysts, suggesting a dacitic precursor.

Mineralisation comprises minor to trace disseminated sulphides, mostly euhedral pyrite (<2mm) with lesser amounts of fine, irregular grains of chalcopyrite (<0.5mm). The pyrite is mostly hosted by the carbonate veins while the chalcopyrite appears to occur mostly as irregular grains near the contacts of the mafic clasts and carbonate veins.

**Sample C108796 Swansea QE2/284.0 QE2/8**

In hand specimen the rock sample is a fine grained, green-grey rock with off-white carbonate veining. There is no strong foliation. Mineralisation is represented by trace disseminated chalcopyrite.

In thin section the rock is a breccia composed mostly of:

- Quartz, fine grained (<0.05mm), clots and veinlets, ~5%
- Albite, medium grained (<0.2mm), green ~5%
- Calcite(?), medium grained (<0.5mm), ~80%
- Chlorite, green, fine grained, ~8%
- Opaques (pyrite), ~1%.

The rock is very similar to C108794. It is a matrix-supported breccia which contains clasts of altered mafic rocks and quartz in a chlorite rich matrix. The polymict nature suggests a sedimentary breccia rather than a tectonic breccia.

Mineralisation comprises minor to trace disseminated sulphides, mostly euhedral pyrite (<1mm) with lesser amounts of fine, irregular grains of chalcopyrite (<0.5mm). The pyrite is mostly hosted by the carbonate veins while the chalcopyrite appears to occur mostly as irregular grains near the contacts of the mafic clasts and carbonate veins.

**Sample C108797 Swansea QE2/140.0 QE2/9**

In hand specimen the rock sample is a mottled pink-red conglomerate with fine grained, siliceous and hematitic clasts. There is no visible foliation and no indication of veining. Mineralisation is possibly represented by abundant disseminated fine hematite.

In thin section the rock is a breccia composed mostly of:

- Quartz, fine grained (<0.05mm), ~80%
- Carbonate (calcite?), medium grained (<0.2mm), ~10%
- Chlorite, green, fine grained, <5%
- Opaques (hematite, rutile), ~5-10%.

The rock is a clast-supported conglomerate which contains well rounded, oblate, variably hematitic, volcanic, chert, mudstone, greywacke and laterite clasts to a few cm diameter, hosted by a carbonate-rich matrix.

Mineralisation comprises abundant disseminated hematite, in three forms: colloidal, platy and aggregates:

- The colloidal hematite (>5%?, <1micron?) is non-reflective and finely dispersed in some rocktypes, probably comprising mostly volcanics, and is probably of low-temperature formation, perhaps relating to pre-depositional weathering under lateritic conditions.
- The euhedral hematite grains (<1%, ~10-40 microns) are also dispersed in various rocktypes, but may be related to the late stage carbonate alteration.
- The hematite aggregates (~1%) are rounded to irregular and sometimes euhedral/skeletal in outline; some of these may represent altered pedogenic ironstone nodules (~0.5mm diameter) especially where more massive and rounded, others (angular to euhedral grains, ~0.1-0.5mm) are probably altered ilmenite, pyrite and/or magnetite grains.

## DISCUSSION AND INTERPRETATION

These rock samples, from drilling near the Swansea mine, Zeehan, were found to be mostly highly altered, veined and brecciated, low grade metamorphosed mafic to intermediate volcanic rocks and breccias, with one carbonate-hematite altered siliceous, volcanogenic conglomerate. The breccias are thought to be a mixture of sedimentary breccias (with polymict clasts and chloritic matrices) and tectonic breccias (with volcanic clasts in vein carbonate matrices).

The present mineralogies of the volcanic breccias mostly comprise chlorite-albite-carbonate-quartz, mostly resulting from low grade metamorphism and hydrothermal alteration. The volcanics appear to have originally been andesitic to basaltic in composition. The rocks are interpreted to be part of a highly altered sequence of volcanic-rich tectonic and sedimentary breccias and conglomerates, commonly associated with ultramafic complexes in the Zeehan district. These are perhaps equivalents of the early Cambrian Dundas group or Cleveland-Waratah Association. The rocks have been highly metasomatised and carbonate-altered at relatively low pressure and temperature, probably related to the underlying granite intrusion.

The rocks mostly contain only very minor mineralisation: minor pyrite and very minor chalcopyrite. There is no good evidence for any pre-existing magmatic sulphides or syngenetic sulphides occurring within these volcanogenic sequences. The sulphides were only seen as minor vein components and as sporadic disseminations in some of the volcanics, possibly related to reaction of these rocks with weakly sulphidic hydrothermal fluids. The hydrothermal fluids may have been granite-related, but there is no definitive evidence mineralogically.

Some of the rocks are hematitic, possibly due to locally more oxidised hydrothermal fluids, but some of these rocks were probably ferruginous when deposited, probably due to pre-depositional lateritic weathering.

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DEPARTMENT OF INFRASTRUCTURE ENERGY AND RESOURCES

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**Mineral Resources Tasmania**

**Client:** G. Lear

**Sample Source:** Stonehenge

**MRT Job Number:** M136/07

**Analysis:** Approximate Mineralogy

**Method:** X-Ray Diffraction

**Results** (approx wt %)

Sample	50%-65%	35%-50%	25%-35%	15%-25%	10%-15%	5%-10%	2%-5%	<2%
108795	Quartz			Chlorite	Ankerite	Mica	Calcite <sup>1</sup> , Pyrite	Zeolite <sup>2</sup>

<sup>1</sup> slightly contracted lattice - probably some replacement of Ca by Mg, etc

<sup>2</sup> probably Stilbite/Stellerite type

Peak overlap may interfere with identifications and quantitative calculations

Amorphous material (e.g. organic matter) and minerals present in trace amounts may not be detected by x-ray analysis



**Analyst:** R.N. Woolley

**Date:** 27 March 2008