

Table x Phase 1 Exploration Petrology Samples								
Sample Type	Easting*	Northing*	Site Description	Sample Description as Submitted	Lab	Sample No	Methods*	Results Summary
subcrop	492480	5447050	Central Resource, SW edge	fresh medium dolerite	MRT	G404001	TS, XRF	medium ophitic clinopx, plag dolerite
subcrop	492420	5447880	north of Central Resource	hornfelsed quartz sandstone	MRT	G404002	TS, XRF	partly recrystallised, metamorphosed quartz sandstone
broken quarry rock	491710	5446920	Port Authority quarry	fresh medium dolerite	MRT	G404003	TS, XRF	medium ophitic clinopx, plag dolerite
subcrop	492480	5447050	Central Resource, SW edge	fresh medium dolerite	J Payne	ID by cords	TS, XRF, ICPMS	medium clinopx, plag gabbro
subcrop	492420	5447880	north of Central Resource	hornfelsed quartz sandstone	J Payne	ID by cords	TS	partly recrystallised, metamorphosed quartz sandstone
drill core	492688	5447208	BB10-4 @ 89.9m	fresh medium dolerite	MRT	G404030	TS, XRF	medium ophitic clinopx, plag dolerite
drill core	492926	5447262	BB10-5 @ 32.5m	fresh medium dolerite	MRT	G404031	TS, XRF	medium ophitic clinopx, plag dolerite
drill core	492678	5447490	BB10-6 @ 38.6m	fresh medium dolerite	MRT	G404032	TS, XRF	medium ophitic clinopx, plag dolerite
drill core	492347	5447220	BB10-10 @ 53.9m	fresh dolerite breccia, with clay mineral matrix alteration	MRT	G404033	TS, XRF, XRD	smectite clays>stilbite, calcite alteration, fresh dolerite kernels
drill core	492345	5447220	BB10-11 @ 13.8m	fresh coarse dolerite	MRT	G404034	TS, XRF	medium-coarse ophitic clinopx, plag dolerite
drill core	492345	5447220	BB10-11 @ 88.15m	fresh medium dolerite	MRT	G404035	TS, XRF	medium ophitic clinopx, plag dolerite
drill core	492345	5447220	BB10-11 @ 124.3m	fresh fine magnetic chilled margin dolerite	MRT	G404036	TS, XRF	fine porphyritic high Fe2O3 clinopx, plag chilled dolerite
drill core	492145	5447247	BB10-12 @ 69.7m	fresh and weathered dolerite, zeolite, carbonate veining	MRT	G404037	XRF, XRD	laumontite-smectite clays alteration
drill core	491863	5447184	BB10-16 @ 42.7m	weathered clay mineral alteration in dolerite fracture	MRT	G404038	XRF, XRD	smectite clays>stilbite, Kspar alteration
drill core	492523	5446903	BB10-19 @ 71.45m	fresh fine magnetic chilled margin dolerite	MRT	G404039	TS, XRF	fine porphyritic high Fe2O3 clinopx, plag chilled dolerite
*collar location for drill core samples							*TS=thin section	

Report 090743 for:

**Alex Boronowski,  
Delta Mineral Corporation,  
2300 – 1066 West Hastings Street,  
Vancouver, BC V6E 3X2**

**November 2009**

**Samples: 492480E, 5447050N; 492424E, 5447879N**

**Summary:**

**Sample 492480E, 5447050N** is of medium grained gabbro. It contains coarser anhedral to subhedral prismatic grains of diopside and lesser ones of plagioclase that are intergrown with patches of finer grained prismatic to equant plagioclase, and much less abundant interstitial patches of extremely fine grained intergrowths of plagioclase and K-feldspar, associated with which are much less abundant chlorite and minor opaque, Minor disseminated opaque is probably in part ilmenite and in part pyrite.

**Sample 492424E, 5447879N** is of metamorphosed quartz sandstone that consists of granular quartz grains with interstitial selvages of pale brown material, probably including K-feldspar and/or sericite, and limonite. Some clusters of several adjacent quartz grains are in optical continuity, suggesting recrystallization and reorientation of these grains during metamorphism. Several interstitial patches contain spheroids, probably of quartz and/or K-feldspar. Interstitial cavities are moderately abundant.

**Photographic Notes:**

The scanned section shows the gross textural features of the sections; these features are seen much better on the digital image than on the printed image. Photo numbers are shown in the lower left corner of the photographs. The letter in the lower right-hand corner indicates the lighting conditions: P = plane light, X = plane light in crossed nicols; XQ = crossed nicols with the 1-wave-length quartz plate inserted. Locations of photographs are shown on the scanned section. Descriptions of the photographs are at the end of the report.

**John G. Payne, Ph.D., P.Geol.  
Tel: (604)-597-1080  
Fax: (604)-597-1080 (call first)  
email: jgpayne@telus.net**

**Sample 492480E, 5447050N**

**Gabbro**

Coarser subhedral prismatic grains of diopside and lesser ones of plagioclase are intergrown with patches of finer grained prismatic to equant plagioclase, and much less abundant interstitial patches of extremely fine grained intergrowths of plagioclase and K-feldspar, associated with which are much less abundant chlorite and minor opaque. Minor disseminated opaque is probably in part ilmenite and in part pyrite.

<b>mineral</b>	<b>percentage</b>	<b>main grain size range (mm)</b>	
<b>coarser grains</b>			
diopside	20-25%	0.5-1.2	(a few from 1.2-1.7 mm long)
plagioclase	15-17	0.3-0.7	
<b>finer grains</b>			
plagioclase	50-55	0.1-0.3	
ilmenite	0.5	0.1-0.3	
pyrite	0.3	0.05-0.2	
<b>interstitial patches</b>			
plagioclase-K-feldspar	4- 5	0.005-0.02	
chlorite	0.2	0.005-0.01	
opaque	minor	0.01-0.03	

Diopside forms a few subhedral prismatic grains (1.2-1.7 mm long), and is more common as anhedral equant grains (0.5-1 mm). Some large anhedral grains have irregular outlines and are interstitial to subhedral prismatic plagioclase grains along their margins.

Plagioclase forms scattered subhedral to anhedral prismatic grains from 0.5-1 mm in size. Some of these show weak compositional growth zoning from more-calcic cores to more-sodic rims.

Plagioclase is much more common in patches up to 2 mm across of subhedral to anhedral prismatic grains from 0.15-0.4 mm in size that form unoriented interlocking clusters.

Interstitial patches mainly less than 0.5 mm in size and locally up to 1 mm across are of intimate, in part graphic intergrowths of plagioclase and K-feldspar with scattered patches of greenish brown chlorite and minor disseminated opaque of uncertain composition.

Opaque forms disseminated anhedral to subhedral patches up to 0.5 mm in size. Some of the opaque in pyrite and some probably is ilmenite.

**Sample 492424E, 5447879N**

**Metamorphosed Quartz Sandstone**

The rock consists of granular quartz grains with interstitial selvages of pale brown material, probably including K-feldspar and/or sericite, and limonite. Some clusters of several adjacent quartz grains are in optical continuity, suggesting recrystallization and reorientation of these grains during metamorphism. Several interstitial patches contain spheroids, probably of quartz and/or K-feldspar. Interstitial cavities are moderately abundant.

<b>mineral</b>	<b>percentage</b>	<b>main grain size range (mm)</b>
<b>detrital grains</b>		
quartz	90-92%	0.03-0.07; 0.2-0.5
<b>interstitial patches</b>		
sericite/K-feldspar	4- 5	cryptocrystalline-0.01
limonite	0.3	cryptocrystalline
spheroids	0.1	0.03-0.05 mm diameter
opaque (pyrite)	minor	0.005-0.02
<b>cavities</b>	4- 5	0.3-1 mm

Quartz forms subrounded equant to slightly elongate grains that commonly are separated by interstitial seams of cryptocrystalline to extremely fine grained material. In places clusters up to 0.5 mm across of adjacent quartz grains are in optical continuity, and interstitial seams were partly destroyed during recrystallization. These patches grade texturally into grains from 0.3-0.5 mm in size that contain minor relic patches of interstitial material, which in turn grade texturally into grains from which the interstitial material was removed completely.

Interstitial patches are mainly less than 0.5 mm in size and locally up to 1 mm across. Most are of cryptocrystalline material, probably dominated by sericite and/or K-feldspar with minor to locally moderately abundant limonite. A few patches are of slightly coarser grained K-feldspar.

Some interstitial patches contain one to several radial spherulites from 0.03-0.05 mm in diameter of K-feldspar or quartz(?).

Opaque (possibly pyrite) is concentrated in a few lenses up to 0.3 mm long as extremely fine anhedral grains.

Irregular cavities are common, mainly less than 1 mm in size. They probably represent leached interstitial material but some may represent original cavities in the sandstone.

## List of Photographs

<b>Photo Section</b>	<b>Description</b>
01 492480E, 5447050N	subhedral prismatic diopside megacryst intergrown with finer grained anhedral diopside and minor plagioclase, with patches of interlocking finer grained plagioclase, minor patches of much finer grained K-feldspar-plagioclase(?) and minor disseminated opaque.
02 492480E, 5447050N	fine grained anhedral diopside and anhedral to subhedral plagioclase and minor ilmenite, with a large interstitial patch of extremely fine grained intimate intergrowths of plagioclase and K-feldspar with minor patches of chlorite and minor patches and lenses of opaque.
03 492424E, 5447879N	quartzite: clusters of small grains of quartz in optical continuity (as shown by the clusters from 0.3-0.5 mm across of grains from 0.03-0.07 mm in size with same colour) suggest recrystallization of finer grained quartz sandstone to a coarser grained aggregate; interstitial patches of cryptocrystalline material, possibly including K-feldspar and/or sericite to account for the yellow stain on the offcut block. The photo was taken with the quartz-plate inserted to show the textures better than in crossed nicols alone.
04 492424E, 5447879N	quartz grains, showing various degrees of recrystallization from finer grained aggregates to coarser grains as indicated by varying amounts of interstitial material in the grains in the loci of the original interstitial matrix in the finer grained quartz sandstone; interstitial patches probably of K-feldspar, sericite, and limonite including a few spherulites of K-feldspar or quartz.



31 July 2009  
File: TB92047

**Delta Minerals Corporation**  
2300-1066 W. Hastings St.  
Vancouver, British Columbia  
V6E 3X2

**Attention: Mr. Gary Nordin**

Dear Sir,

**RE: PETROGRAPHIC EXAMINATION OF ROCK HAND SAMPLE  
VANCOUVER, BRITISH COLUMBIA**

We are pleased to present the result of the petrographic examination conducted on a rock hand sample received in our AMEC Hamilton laboratory on 15 April 2009. It is our understanding that the rock sample has been selected from a debris pile stored at an undisclosed mine site in British Columbia. The purpose of this examination is to provide preliminary evaluation of the potential suitability of this general rock type for use as a construction aggregate for use in Portland cement concrete.

This examination was limited to visual and microscopic examination of a single hand sample sized rock fragment. Results of the examination are presented below.

**Rock Type:** Gabbro

**Composition:** (Visual estimate of volume percent)

Major Constituents:

plagioclase feldspar – 75%

olivine – 15%

Minor Constituents:

alkali feldspar – 5%

amphibole – 3%

quartz – 1%

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sulphide – 1%

### Textures:

The maximum dimensions of the rock fragment measured 102mm by 54mm by 52mm. Composed of 85% to 90% mafic minerals, the hand sample contained dark grey/black and green coloured, medium to coarse grained crystals (1mm to 5mm) of plagioclase, olivine, and amphibole together with sporadic tan coloured alkali feldspar and rare colourless quartz. The hand sample itself was irregularly fractured resulting in an angular shape. The exterior surface of the sample appeared fresh, with minimal surface weathering, a smooth surface texture and no obvious visible fractures.

A 'fresh' surface of the rock fragment was exposed in order to examine the unweathered surface. The hand sample was difficult to fracture with a sledgehammer, breaking cleanly into thin shards and producing little fines. This response indicates a strong intercrystalline bond amongst the constituent minerals, with very little internal weathering. The lack of shards produced during fracturing is consistent with the crystallinity and interlocking texture of the rock. This texture would be expected to yield very low water absorption characteristics. Taken collectively, these characteristics would be expected to yield a highly durable construction aggregate which would be expected to be very resistant to abrasion and freezing and thawing situations.

Mineralogically, the composition of this rock fragment does not appear to have a high potential for alkali-silica reaction (ASR) when used in Portland cement concrete. Typically, silica-rich rocks have a potential for ASR, however, since this particular sample has a low proportion of free silica within it, the potential for ASR would be expected to be low. This assumption may be altered if the larger rock mass from which this hand sample is taken displays higher free silica within in.

Based on the observations noted in our petrographic examination of the hand sample, it is our opinion that the rock type represented within this specific hand sample can be classified as being of *Good* quality for use in construction aggregate. This quality category, as described in CSA 23A.2-15A, Petrographic Examination of Aggregates states *Good* quality (hard, strong) plutonic rocks have *"mainly very high strength; generally cannot be scratched; particles require strong blow to fracture with hammer, and breaks cleanly (produces little fines); minor medium strength (eg., micaceous and chloritic) zones which can be scratched and scraped with some difficulty; can have partial thin surface weathering; particle is altered but strong."*

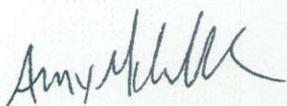
It is recommended that further testing of the source represented by this rock fragment be performed prior to use as a construction aggregate to confirm the rock quality findings of this petrographic report based on CSA A23.1-04/CSA A23.2-04, *Concrete materials and methods of concrete construction/Methods of test and standard practices for concrete*.

Delta Minerals Corporation  
Petrographic Examination of Rock Fragment  
31 July 2009

Should you have any questions, please do not hesitate to contact our office.

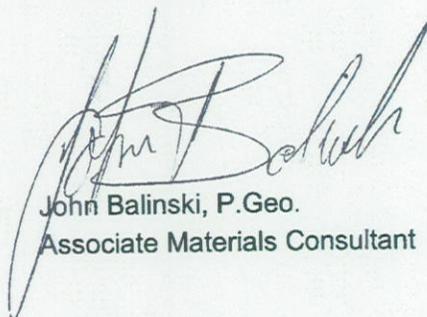
**AMEC Earth & Environmental**

Reviewed by,



for Martin Little, M.Sc., P.Ge.  
Geoscientist

ml:JB  
Photographs (4)



John Balinski, P.Ge.  
Associate Materials Consultant

# PHOTOGRAPHS

PROJECT NO. TB92047

PROJECT Petrographic Examination of Rock Hand Sample

LOCATION Vancouver, British Columbia

	<table border="1"> <tr> <td>PHOTOGRAPH</td> <td>1</td> </tr> </table>	PHOTOGRAPH	1
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<p>Photomicrograph showing the fresh fractured surface of the gabbro and the lack of weathering.</p>			

# Mineral Resources Tasmania

Department of Infrastructure, Energy and Resources



Ref: 69381, M10068-KCM2.DOC

MINERAL RESOURCES TASMANIA

A Division of  
DEPARTMENT of INFRASTRUCTURE,  
ENERGY and RESOURCES

Enquiries: Ralph Bottrill  
Phone: (03) 6233 8359  
Email: rbottrill@mrt.tas.gov.au  
Our File: Document2S

28/7/2010

K.C. Morrison Pty Ltd  
4 Westringa Road, Fern Tree, 7054

Attention: Ken Morrison

Dear Ken

## **JOB M10068: PETROLOGY, TIPPOGOREE HILLS FOR DELTA MATERIALS PTY LTD**

Ten rock samples from the above locations were submitted by yourself for petrography and photography, plus geochemistry and some XRD (X-ray diffraction) analyses. They were prepared and chemically analysed by XRF (X-Ray fluorescence) and examined by transmitted polarised light and stereo-microscopic techniques, plus XRD, , and the report is enclosed.

An invoice for \$4,394.50 covering these analyses will be forwarded shortly.

10 XRF majors @ \$144 each	\$1,440.00
10 XRF traces @ \$125 each	\$1,250.00
10 crushings @ \$7 each	\$ 70.00
3 semi-quantitative XRD	\$ 210.00
8 thin sections @ \$25 each	\$ 200.00
8 microscopic descriptions @ \$60 each	\$ 480.00
3 photos @ \$15 each	\$ 45.00
3 hours compilation @ \$60 per hour	\$ 300.00
Handling	\$ 0.00
GST	<u>\$ 399.50</u>
Total	\$4,394.50

Yours Sincerely,

R S Bottrill  
**MINERALOGIST-PETROLOGIST**

# **Petrographic, mineralogical and geochemical analyses, Tippogoree Hills**

**MRT Mineralogical/Petrology Laboratory  
Job No. M10068**

**An unpublished report for Delta Materials Pty Ltd**

**R S Bottrill**

**12<sup>th</sup> January, 2010**

# Petrographic, mineralogical and geochemical analyses, Tippogoree Hills

MRT Mineralogical/Petrology Laboratory  
Job No. M10068

An unpublished report for Delta Materials Pty Ltd

R S Bottrill

12th January, 2010

## Summary

*Representative portions of the rocks were examined mineralogically by polarised and stereomicroscopy and by X-ray Diffraction (XRD), to determine the mineralogy, and major and trace element analysis by XRF.*

*The rocks are all typical Jurassic dolerite, and typical alteration assemblages in such rocks.*

*There are some clays, calcite and zeolites in fractures, and minor quartz, but no other deleterious materials were detected.*

## INTRODUCTION

Ten rock samples from the Georgetown area were submitted for petrological and geochemical analysis; the samples were identified as:

**Table 1: Sample details**

MRT				
Reg No.	Field No.	Location	Rocktype	Treatment
G404030	P001, BB10-4/89.9m	Tippogoree Hills	dolerite	XRFM, XRFT, TS
G404031	P002; BB10-5/32.5m	Tippogoree Hills	dolerite	XRFM, XRFT, TS
G404032	P003; BB10-6/38.6m	Tippogoree Hills	dolerite	XRFM, XRFT, TS
G404033	P004; BB10-10/53.9m	Tippogoree Hills	dolerite	XRFM, XRFT, TS, XRD
G404034	P005; BB10-11/13.8m	Tippogoree Hills	dolerite	XRFM, XRFT, TS
G404035	P006; BB10-11/88.15m	Tippogoree Hills	dolerite	XRFM, XRFT, TS
G404036	P007; BB10-11/124.3m	Tippogoree Hills	dolerite	XRFM, XRFT, TS
G404037	P008; BB10-12/69.7m	Tippogoree Hills	dolerite	XRFM, XRFT, XRD
G404038	P009; BB10-16/42.7m	Tippogoree Hills	dolerite	XRFM, XRFT, XRD
G404039	P010; BB10-19/71.45m	Tippogoree Hills	dolerite	XRFM, XRFT, TS

The samples were all prepared, examined and analysed in the MRT laboratories, Rosny and Mornington. Eight were prepared as thin sections, and three were tested by XRD (X-ray diffraction).

The ten XRF (X-ray fluorescence) analyses are listed in Appendices 1 and 2, and the 3 XRD analyses in Appendix 3.

The sample descriptions and analyses are summarised below.

## SAMPLE DESCRIPTIONS

### **G404030 P001, BB10-4/89.9m, Tippogoree Hills dolerite**

The sample is medium to dark grey in colour, medium grained, and is equigranular and homogenous in texture with no macroscopic indication of any veins, clasts, vesicles, weathering or alteration.

One thin section of the aggregate was prepared and examined. It contains about 35-45 % pyroxenes (probably augite and pigeonite, medium grained, 0.5-2mm), about 35-45 % plagioclase (calcic, medium grained, 0.2-1mm), about 5-10% mesostasis, ~3% opaques and <5% clay alteration. The texture is generally subophitic. The mesostasis is fine grained, pale brown material interstitial to plagioclase and pyroxenes, and consists of skeletal to radiating, plumose or granophyric aggregates (~0.2-1mm) of quartz, alkali feldspars, apatite, magnetite and other minerals, formed by rapid crystallisation of doleritic fluid. The clay alteration is disseminated, probably formed during cooling of the dolerite, and is probably mostly smectites (montmorillonite?).

The quartz content is about 5-10 %, and appears relatively unstressed, although it is mostly sub-microscopic in the mesostasis and so its texture cannot be easily determined.

The rock is typical of non-granophyric and non-chilled margin parts of Tasmanian Jurassic dolerites.

**G404031 P002; BB10-5/32.5m, Tippogoree Hills dolerite**

The sample is medium to dark grey grey in colour, medium grained, and is equigranular and homogenous in texture with no macroscopic indication of any veins, clasts, vesicles, weathering or alteration.

One thin section of the aggregate was prepared and examined. It contains about 35-45 % pyroxenes (probably augite and pigeonite, commonly brown, medium grained, 0.5-1.5 mm), about 35-45 % plagioclase (calcic, medium grained, 0.2-0.8 mm), about 10% mesostasis, ~3% opaques and <5% clay alteration. The texture is generally subophitic. The mesostasis is fine grained, medium brown material interstitial to plagioclase and pyroxenes, and consists of skeletal to radiating, plumose or granophyric aggregates (~0.2-1mm) of quartz, alkali feldspars, apatite, magnetite and other minerals, formed by rapid crystallisation of doleritic fluid. The clay alteration is disseminated, probably formed during cooling of the dolerite, and is probably mostly smectites (montmorillonite?).

The quartz content is about 5-10 %, and appears relatively unstressed, although it is mostly sub-microscopic in the mesostasis and so its texture cannot be easily determined.

The rock is typical of non-granophyric and non-chilled margin parts of Tasmanian Jurassic dolerites.

**G404032 P003; BB10-6/38.6m, Tippogoree Hills dolerite**

The sample is medium to dark grey grey in colour, medium grained, and is equigranular and homogenous in texture with no macroscopic indication of any veins, clasts, vesicles, weathering or alteration.

One thin section of the aggregate was prepared and examined. It contains about 35-45 % pyroxenes (probably augite and pigeonite, commonly brown, medium grained, 0.5-2 mm), about 35-45 % plagioclase (calcic, medium grained, 0.2-0.8 mm), about 10% mesostasis, ~3% opaques and <5% clay alteration. The texture is generally subophitic. The mesostasis is fine grained, pale brown material interstitial to plagioclase and pyroxenes, and consists of skeletal to radiating, plumose or granophyric aggregates (~0.2-1mm) of quartz, alkali feldspars, apatite, magnetite and other minerals, formed by rapid crystallisation of doleritic fluid. The clay alteration is disseminated, probably formed during cooling of the dolerite, and is probably mostly smectites (montmorillonite?).

The quartz content is about 5-10 %, and appears relatively unstressed, although it is mostly sub-microscopic in the mesostasis and so its texture cannot be easily determined.

The rock is typical of non-granophyric and non-chilled margin parts of Tasmanian Jurassic dolerites.

**G404033 P004; BB10-10/53.9m, Tippogoree Hills dolerite**

The sample is mostly dark greenish grey in colour, medium grained, and is equigranular and homogenous in texture with some white to green clayey to zeolitic alteration about fresh kernels of grey dolerite with bleached rims. No clasts or vesicles were noted.

One thin section of the aggregate was prepared and examined. It contains about 40-50 % pyroxenes (probably augite and pigeonite, commonly brown, medium grained, 0.5-2 mm), about 35-45 % plagioclase (calcic, medium grained, 0.2-0.6 mm), about 10% mesostasis, ~3% opaques and <5% clay alteration. The texture is generally subophitic. The mesostasis is fine grained, medium brown material interstitial to plagioclase and pyroxenes, and consists of skeletal to radiating, plumose or granophyric aggregates (~0.2-1mm) of quartz, alkali feldspars, apatite, magnetite and other minerals, formed by rapid crystallisation of doleritic fluid. The clay alteration is variable, disseminated to pervasive, probably formed during cooling of the dolerite, and is probably mostly smectites (montmorillonite?). Some zones are almost totally altered to clays, zeolites? and calcite.

The rock is typical of non-granophyric and non-chilled margin parts of Tasmanian Jurassic dolerites.

XRD indicates the white veins are composed of clays (smectite) and zeolites (stilbite).

The quartz content of the matrix is about 5-10 %, and appears relatively unstressed, although it is mostly sub-microscopic in the mesostasis and so its texture cannot be easily determined.

**G404034 P005; BB10-11/13.8m, Tippogoree Hills dolerite**

The sample is medium to dark grey grey in colour, medium grained, and is equigranular and homogenous in texture with no macroscopic indication of any veins, clasts, vesicles, weathering or alteration.

Two thin sections of the aggregate were prepared and examined. It contains about 35-45 % pyroxenes (probably augite and pigeonite, pale brown, medium grained, 1-5 mm), about 35-45 % plagioclase (calcic, medium grained, 0.5-1 mm), about 15% mesostasis, ~3% opaques and <5% clay alteration. The texture is generally subophitic. The mesostasis is fine grained, medium brown material interstitial to plagioclase and pyroxenes, and consists of skeletal to radiating, plumose or

granophyric aggregates (~0.2-1mm) of quartz, alkali feldspars, apatite, magnetite and other minerals, formed by rapid crystallisation of doleritic fluid. The clay alteration is disseminated, probably formed during cooling of the dolerite, and is probably mostly smectites (montmorillonite?).

It is typical of non-granophyric and non-chilled margin parts of Tasmanian Jurassic dolerites.

The quartz content is about 5-10 %, and appears relatively unstressed, although it is mostly sub-microscopic in the mesostasis and so its texture cannot be easily determined.

**G404035 P006; BB10-11/88.15m, Tippogoree Hills dolerite**

The sample is medium to dark grey in colour, medium grained, and is equigranular and homogenous in texture with no macroscopic indication of any veins, clasts, vesicles, weathering or alteration.

One thin section of the aggregate was prepared and examined. It contains about 40-50 % pyroxenes (probably augite and pigeonite, commonly brown, medium grained, 0.5-1 mm), about 35-45 % plagioclase (calcic, medium grained, 0.2-0.6 mm), about 10% mesostasis, ~3% opaques and <5% clay alteration. The texture is generally subophitic. The mesostasis is fine grained, medium brown material interstitial to plagioclase and pyroxenes, and consists of skeletal to radiating, plumose or granophyric aggregates (~0.2-1mm) of quartz, alkali feldspars, apatite, magnetite and other minerals, formed by rapid crystallisation of doleritic fluid. The clay alteration is disseminated, probably formed during cooling of the dolerite, and is probably mostly smectites (montmorillonite?).

The quartz content is about 5-10 %, and appears relatively unstressed, although it is mostly sub-microscopic in the mesostasis and so its texture cannot be easily determined.

It is typical of non-granophyric and non-chilled margin parts of Tasmanian Jurassic dolerites.

**G404036 P007; BB10-11/124.3m, Tippogoree Hills dolerite**

The sample is dark grey in colour, fine grained, and appears finely porphyritic and homogenous in texture with no macroscopic indication of any veins, clasts, vesicles, weathering or alteration.

One thin section of the aggregate was prepared and examined. It contains about 30-40 % pyroxenes (probably augite and pigeonite, commonly brown, fine to medium grained, 0.1-1 mm), about 35-45 % plagioclase (calcic, medium grained, 0.2-0.5 mm), about 20% mesostasis, ~5% opaques and <5% clay alteration. The texture is generally

subophitic to intersertal and is porphyritic, with ~10% of euhedral pyroxene phenocrysts to about 0.6-1 mm long, with 0.1-0.3 mm pyroxenes in a plagioclase and mesostasis-rich groundmass. The mesostasis is fine grained, medium brown material interstitial to plagioclase and pyroxenes, and consists of skeletal to radiating, plumose or granophyric aggregates (~0.2-1mm) of quartz, alkali feldspars, apatite, magnetite and other minerals, formed by rapid crystallisation of doleritic fluid. The clay alteration is disseminated, probably formed during cooling of the dolerite, and is probably mostly smectites (montmorillonite?).

The quartz content is about 5-10 %, and some is relatively coarse grained (<0.5mm) as polycrystalline clots in the mesostasis. It appears relatively unstressed, although it is mostly sub-microscopic in the mesostasis and so its texture cannot be easily determined.

The rock is typical of chilled margin parts of Tasmanian Jurassic dolerites.

**G404037 P008; BB10-12/69.7m, Tippogoree Hills dolerite**

The sample is white to pale brown, fine grained and homogenous in texture.

No thin section of the aggregate was prepared, but XRD indicates smectite and zeolites (laumontite), typical of veins and joints in many such dolerites.

**G404038 P009; BB10-16/42.7m, Tippogoree Hills dolerite**

The sample shows weathered greenish dolerite, medium grained, and equigranular and homogenous in texture, with white to pale yellow green vein-material, fine grained and homogenous in texture.

No thin section of the aggregate was prepared, but XRD indicates smectite, zeolites (stilbite) and K-spar, typical of veins and joints in many such dolerites (except for K-spar).

**G404039 P010; BB10-19/71.45m, Tippogoree Hills dolerite**

The sample is dark grey in colour, fine grained, and appears finely porphyritic and homogenous in texture with no macroscopic indication of any veins, clasts, vesicles, weathering or alteration.

One thin section of the aggregate was prepared and examined. It contains about 30-40 % pyroxenes (probably augite and pigeonite, commonly brown, fine to medium grained, 0.1-1 mm), about 35-45 % plagioclase (calcic, medium grained, 0.2-0.5 mm), about 20% mesostasis, ~5% opaques and <5% clay alteration. The texture is generally subophitic to intersertal, with about 10% of pyroxene microphenocrysts (to about 1mm), in a groundmass with Pyroxenes about 0.1mm in size. The mesostasis is fine grained, medium brown material interstitial to plagioclase and pyroxenes, and consists of skeletal to radiating, plumose or granophyric aggregates (~0.2-1mm) of

quartz, alkali feldspars, apatite, magnetite and other minerals, formed by rapid crystallisation of doleritic fluid. There are minor quartz-clay veinlets. The clay alteration is disseminated, probably formed during cooling of the dolerite, and is probably mostly smectite (montmorillonite?).

The quartz content is about 5-10 %, and is relatively coarse grained (<0.5mm), mostly as polycrystalline clots surrounded by clays, and this may represent amydules. It also occurs in thin veinlets with clays. It appears relatively unstressed, although it is mostly sub-microscopic in the mesostasis and so its texture cannot be easily determined.

The rock is typical of chilled margin parts of Tasmanian Jurassic dolerites.

## SUMMARY

The rocks are all typical of central to chilled margin parts of Tasmanian Jurassic dolerites, and are composed mostly of fine to coarse grained pyroxenes and medium grained plagioclase with minor to major amounts of mesostasis. There is minor quartz in the mesostasis and possible amydules.

Alteration consists of clays (smectites), zeolites (laumontite and stilbite) and calcite, with only trace of quartz veins.

### **R.S. Bottrill**

Mineralogist-petrologist

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**Plate 1: photomicrographs**

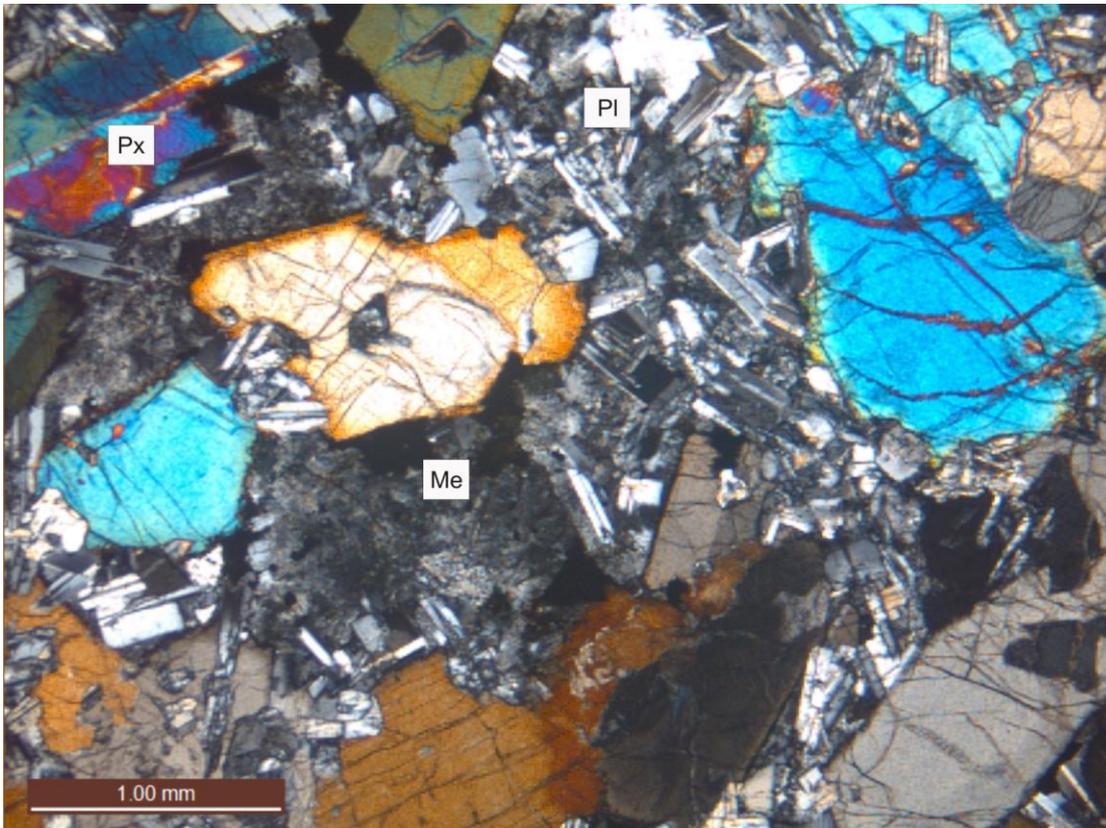


Fig. 1. Sample G404034, x2.5, Polarised light, crossed polars, FOV: 3x4.5mm, showing coarse grained pyroxenes (Px) , medium grained plagioclase (Pl) and patches of murky mesostasis (Me).

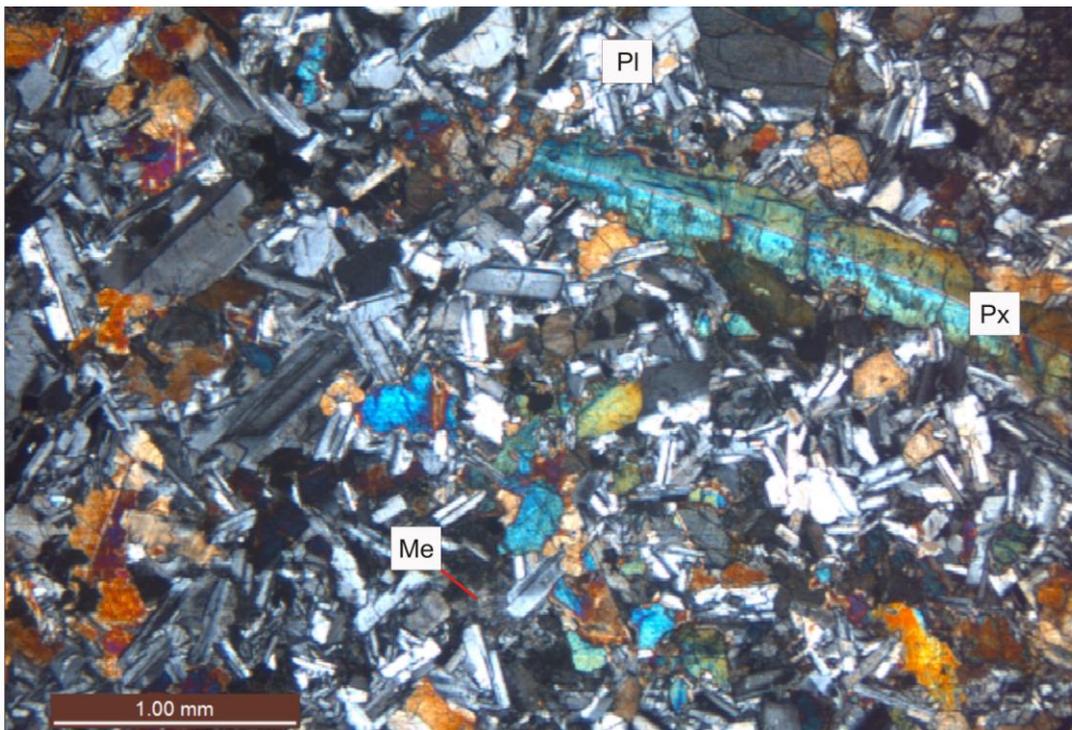


Fig. 2. Sample G404035, x2.5, Polarised light, crossed polars, FOV: 3x4.5mm, showing medium and coarse grained pyroxenes (Px) , medium grained plagioclase (Pl) and patches of murky mesostasis (Me).



Fig. 3. Sample G404036, x2.5, Polarised light, crossed polars, FOV: 3x4.5mm, showing medium and coarse grained pyroxenes (Px) , medium grained plagioclase (Pl) and patches of murky mesostasis (Me).

*Appendix 1: XRF analysis (majors)*

<b>Reg No</b>	G404030	G404031	G404032	G404033	G404034	G404035	G404036	G404037	G404038	G404039
<b>Lab No</b>	20100113	20100114	20100115	20100116	20100117	20100118	20100119	20100120	20100121	20100122
<b>SiO2 (%)</b>	52.94	53.31	53.31	53.20	53.12	53.78	54.18	51.73	57.06	54.22
<b>TiO2 (%)</b>	0.45	0.51	0.50	0.48	0.51	0.55	0.61	0.49	0.36	0.61
<b>Al2O3 (%)</b>	14.04	14.87	15.13	12.15	14.07	14.78	14.62	13.61	15.56	14.69
<b>Fe2O3 (%)</b>	0.58	0.92	1.00	6.33	0.78	0.80	1.92	3.95	7.92	1.99
<b>FeO (%)</b>	7.20	7.30	7.00	1.80	8.10	7.70	7.20	5.40	0.30	7.00
<b>MnO (%)</b>	0.18	0.16	0.16	0.27	0.18	0.16	0.17	0.15	0.03	0.18
<b>MgO (%)</b>	9.92	8.16	8.29	10.97	8.21	7.83	7.02	8.98	5.70	6.93
<b>CaO (%)</b>	11.03	10.98	11.24	4.82	11.32	10.89	10.35	9.81	1.37	10.22
<b>Na2O (%)</b>	1.41	1.68	1.60	0.43	1.67	1.70	1.96	1.25	0.47	1.71
<b>K2O (%)</b>	0.62	0.68	0.66	0.65	0.68	0.74	0.88	0.56	0.55	0.80
<b>P2O5 (%)</b>	0.06	0.07	0.07	0.07	0.07	0.08	0.09	0.06	0.01	0.09
<b>Cl (%)</b>	0.003	0.003	0.002	0.016	0.002	0.002	0.002	0.003	0.040	0.006
<b>CO2 (%)</b>	0.20	0.10	0.10	1.10	0.10	0.10	0.20	<0.1	0.10	0.10
<b>S (%)</b>	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	<0.01
<b>SO3 (%)</b>	<0.02	<0.02	<0.02	<0.02	<0.02	0.02	<0.02	<0.02	<0.02	<0.02
<b>H<sub>2</sub>O<sup>+</sup> (%)</b>	0.95	0.88	0.95	7.68	1.27	1.06	1.00	3.99	10.32	1.40
<b>TOTAL</b>	99.58	99.62	100.01	99.95	100.08	100.19	100.20	99.98	99.75	99.94
<b>L.O.I.</b>	0.35	0.17	0.27	8.58	0.47	0.33	0.40	3.39	10.39	0.72

**Appendix 2: Trace element analyses (XRF)**

Reg No		G404030	G404031	G404032	G404033	G404034	G404035	G404036	G404037	G404038	G404039
Lab No	DL	20100113	20100114	20100115	20100116	20100117	20100118	20100119	20100120	20100121	20100122
As	3	<3	<3	3	<3	<3	<3	<3	<3	<3	<3
Ba	5	155	175	170	125	175	210	240	150	86	220
Bi	1	<1	1	1	1	1	1	1	2	<1	2
Ce	5	13	14	21	10	15	22	23	18	6	23
Co	2	44	42	42	59	42	42	43	46	26	43
Cr	1	350	240	250	320	48	190	135	370	305	120
Cs	3	<3	3	4	<3	5	<3	7	8	4	<3
Cu	2	57	69	65	55	64	77	82	67	63	82
Ga	1	13	15	14	11	15	15	16	13	20	16
La	6	<6	7	<6	<6	<6	<6	14	12	<6	8
Mo	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Nb	1	3	6	4	6	4	6	5	5	5	7
Nd	7	11	<7	<7	9	<7	8	15	9	<7	12
Ni	2	130	100	105	130	91	94	83	135	91	78
Pb	2	3	5	6	4	5	4	6	4	2	5
Rb	1	25	29	28	24	27	30	37	28	18	31
Sb	2	<2	<2	<2	<2	<2	<2	2	<2	3	<2
Sc	2	42	42	40	45	45	42	43	45	44	43
Sn	2	<2	<2	<2	2	<2	<2	2	<2	3	<2
Sr	1	95	110	110	78	115	125	180	130	31	145
Th	2	<2	<2	2	<2	<2	<2	2	<2	<2	<2
U	1	<1	2	1	<1	<1	<1	2	1	<1	2
V	2	230	240	220	150	260	230	250	210	91	250
W	2	<2	<2	<2	2	<2	3	2	<2	<2	<2
Y	1	15	17	16	13	18	20	21	18	8	21
Zn	1	63	72	66	69	69	70	75	73	61	74
Zr	2	70	79	77	75	75	87	95	75	54	97

### *Appendix 3: XRD analysis*

**Client:** K. Morrison  
**Sample Source:** Tipogoree Hills  
**MRT Job Number:** M10/068  
**Analysis:** Approximate Mineralogy  
**Method:** X-Ray Diffraction

#### **Results**

<b>Sample</b>	<b>Minerals Identified</b>
G404033 (white)	dominant Smectite, trace Stilbite
G404037 (white)	major Laumontite, minor Smectite, ?
G404038 (very pale yellow-green)	dominant Smectite, trace Stilbite, K-Feldspar

? possible second zeolite

Peak overlap may interfere with identifications (e.g. Rutile and K-Feldspar) and quantitative calculations  
Amorphous material (e.g. organic material; glass) and minerals present in trace amounts may not be detected

**Analyst:** R.N. Woolley  
**Date:** 30 June 2010

# **Petrographic, mineralogical and geochemical analyses, Tippogoree Hills**

**MRT Mineralogical/Petrology Laboratory  
Job No. M09124**

**An unpublished report for Ken Morrison**

**R S Bottrill**

**12<sup>th</sup> January, 2010**

# Petrographic, mineralogical and geochemical analyses, Tippogoree Hills

MRT Mineralogical/Petrology Laboratory  
Job No. M09124

An unpublished report for Ken Morrison

R S Bottrill

12th January, 2010

## Summary

*Representative portions of the rocks were examined mineralogically by polarised and stereomicroscopy and by X-ray Diffraction (XRD), to determine the mineralogy, and major and trace element analysis by XRF.*

*Two of the rocks are typical Jurassic dolerites, and one is a metamorphosed sandstone..*

*The quartz is low in content in the dolerites and probably unstressed; that in the sandstone is ~95% but also unstressed; there is probably very little AAR risk with these particular materials.*

*There are very minor clays but no other deleterious materials were detected.*

## INTRODUCTION

Three rock samples from the Georgetown area were submitted for petrological analysis; the samples were identified as:

<b>MRT Reg No.</b>	<b>Field No.</b>	<b>Location</b>	<b>Rocktype</b>
G404001	BBR-0001	Tipogorree Hills	dolerite
G404002	BBR-0002	Tipogorree Hills	dolerite
G404003	BBR-0003	Tipogorree Hills	sandstone

The samples were examined and analysed in the MRT laboratories, MRT, Rosny and Mornington.

The XRF results are listed in Appendix 1, indicating typical analyses for Jurassic dolerites. An XRD analysis in Appendix 2 was used to confirm mullite in the sandstone.

### **G404001 BBR-0001                      Tipogorree Hills                      dolerite**

The sample is dark grey in colour, medium grained, and is equigranular and homogenous in texture with no macroscopic indication of any veins, clasts, vesicles, weathering or alteration.

Two thin sections of the aggregate were prepared and examined. It contains about 30-40 % pyroxenes (probably augite and pigeonite, medium-coarse grained, 1-3mm), about 30-40 % plagioclase (calcic, medium grained, 0.5-1mm), about 15% mesostasis, ~5% opaques and <5% clay alteration. The texture is generally subophitic. The mesostasis is fine grained material interstitial to plagioclase and pyroxenes, and consists of skeletal to radiating, plumose or granophyric aggregates of quartz, alkali feldspars, apatite, magnetite and other minerals, formed by rapid crystallisation of doleritic fluid. The clay alteration is variable, sometimes pervasive, probably formed during cooling of the dolerite, and is probably mostly smectites (montmorillonite). It is typical of non-granophyric and non-chilled margin parts of Tasmanian Jurassic dolerites.

The quartz content is about 5-10 %, and appears relatively unstressed, although it is mostly sub-microscopic in the mesostasis and so its texture cannot be easily determined.

**G404002 BBR-0002**

**Tipogorree Hills**

**dolerite**

The sample is dark grey in colour, medium to coarse grained, and is equigranular and homogenous in texture with no macroscopic indication of any veins, clasts, vesicles, weathering or alteration. It is similar to G404001, but slightly coarser.

Two thin sections of the aggregate were prepared and examined. It contains about 30-40 % pyroxenes (probably augite and pigeonite, medium-coarse grained, 1-5 mm), about 30-40 % plagioclase (calcic, medium grained, 0.5-1 mm), about 15% mesostasis, ~5% opaques and <5% clay alteration. The texture is generally subophitic. The mesostasis is fine grained material interstitial to plagioclase and pyroxenes, and consists of skeletal to radiating, plumose or granophyric aggregates of quartz, alkali feldspars, apatite, magnetite and other minerals, formed by rapid crystallisation of doleritic fluid. The clay alteration is variable, sometimes pervasive, probably formed during cooling of the dolerite, and is probably mostly smectites (montmorillonite). It is typical of non-granophyric and non-chilled margin parts of Tasmanian Jurassic dolerites.

The quartz content is about 5-10 %, and appears relatively unstressed, although it is mostly sub-microscopic in the mesostasis and so its texture cannot be easily determined.

**G404003 BBR-0003**

**Tipogorree Hills**

**quartz arenite**

The sample is off-white to cream in colour, medium grained (<0.5mm), with sparse quartz granules to 3mm and is otherwise equigranular and homogenous in texture with no macroscopic indication of any veins, clasts, vesicles, coatings, weathering or alteration.

Two thin sections of the aggregate were prepared and examined. It contains about 95 % quartz, with small clay patches (some possibly kaolinized feldspars). The quartz grains were probably rounded and well sorted except for sparse granules, but have been welded and recrystallised to unusual amoeboidal textures.

XRD indicates trace mullite, confirming the rock has been affected by thermal metamorphism, forming a hornfelsed sandstone.

The quartz content is about 95 %, but appears relatively unstressed due to static recrystallisation.

**R.S. Bottrill**

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**Plate 1: photomicrographs**

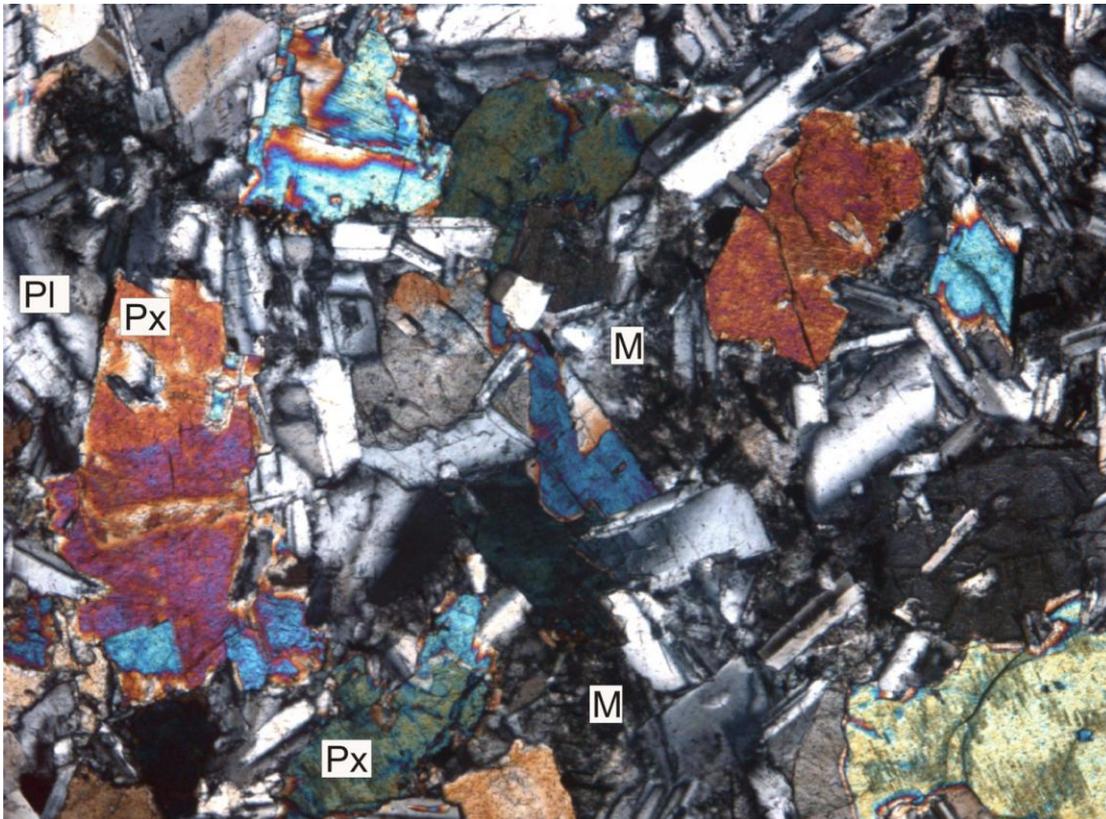


Fig. 1. Sample G404001, x6.3, Polarised light, crossed polars, FOV: 1.7x1.1mm, showing coarse pyroxenes (Px) , finer plagioclase (Pl) and patches of murky mesostasis (M).

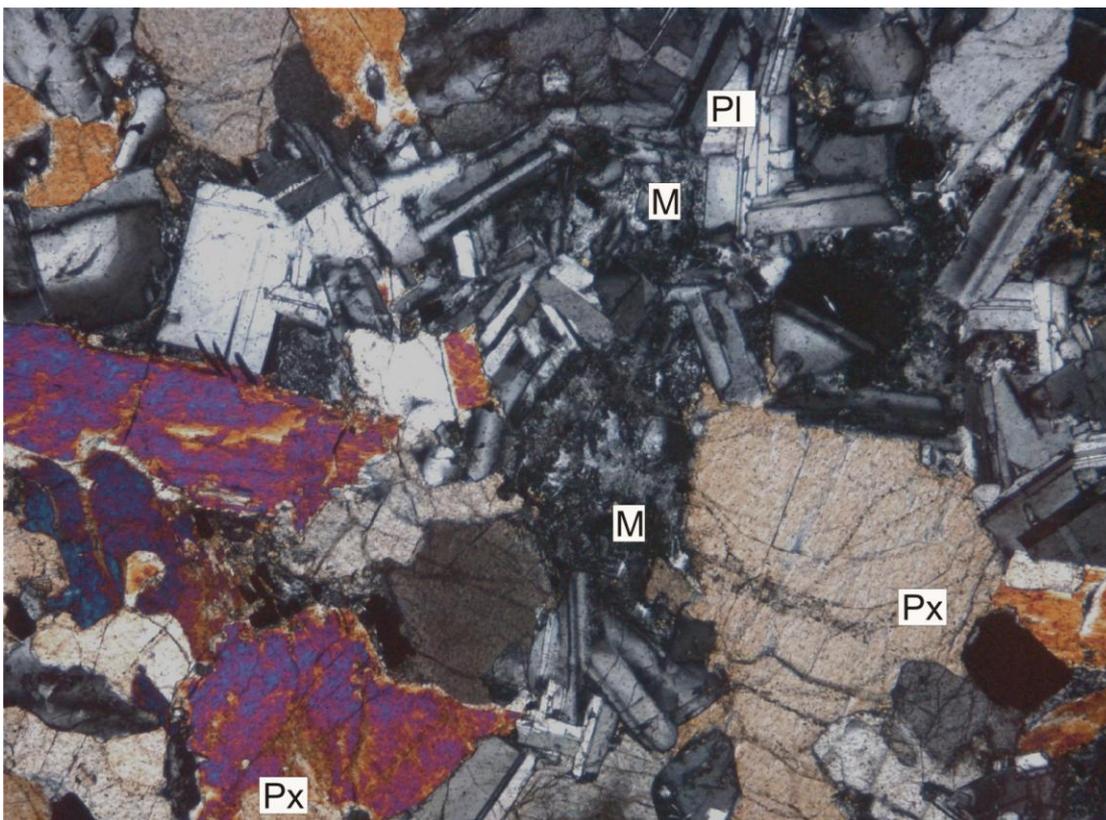


Fig. 2. Sample G404002, x6.3, Polarised light, crossed polars, FOV: 1.7x1.1mm, showing coarse pyroxenes (Px) , finer plagioclase (Pl) and patches of murky mesostasis (M).

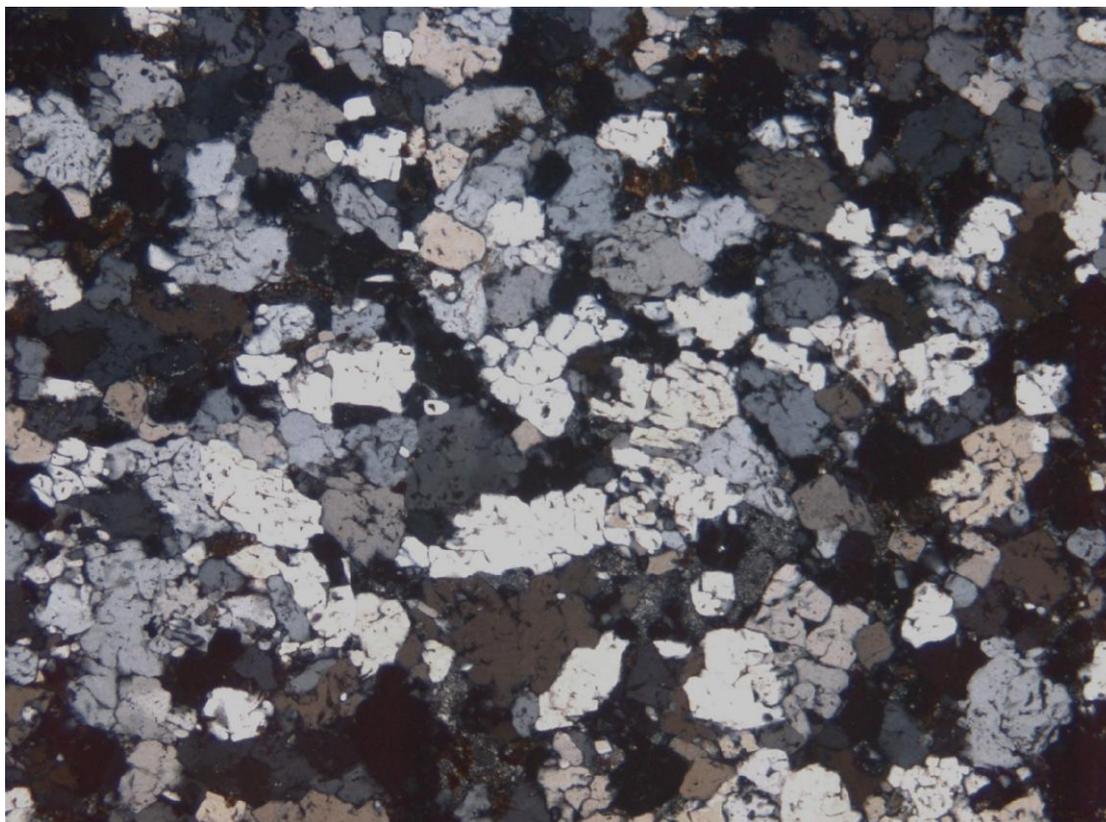


Fig. 3. Sample G404003, x6.3, Polarised light, crossed polars, FOV: 1.7x1.1mm, showing medium grained quartz and traces of clays (brown).

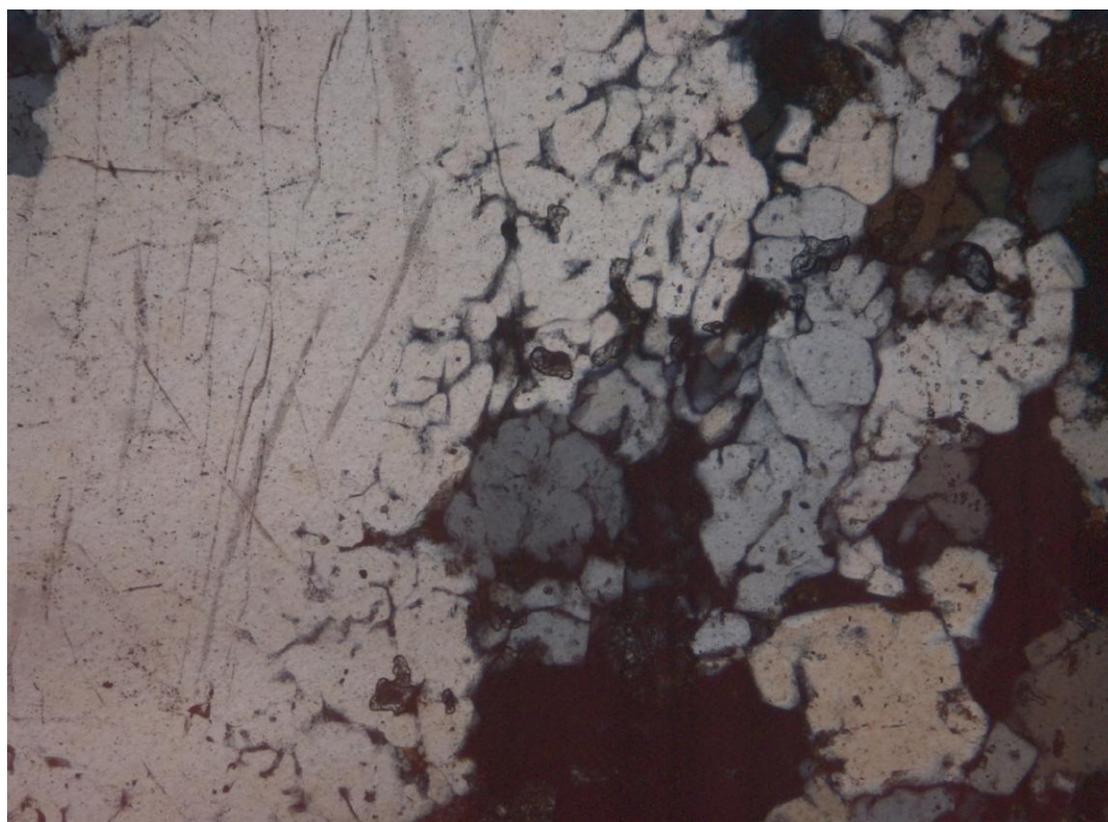


Fig. 3. Sample G404003, x16, Polarised light, crossed polars, FOV: 0.7x0.4mm, showing amoeboid recrystallisation of quartz.

*Appendix 1: XRF analysis*

		Reg No	G404001	G404002
		Lab No	20090448	20090449
	Detection	Field No	BBR-0001	BBR-0002
Wt. %	Limit			
SiO <sub>2</sub>			51.81	52.70
TiO <sub>2</sub>			0.38	0.47
Al <sub>2</sub> O <sub>3</sub>			15.47	15.42
Fe <sub>2</sub> O <sub>3</sub>			1.23	0.87
FeO			6.60	6.80
MnO			0.16	0.15
MgO			8.58	8.07
CaO			12.20	11.68
Na <sub>2</sub> O			1.46	1.52
K <sub>2</sub> O			0.47	0.62
P <sub>2</sub> O <sub>5</sub>			0.05	0.06
SO <sub>3</sub>			0.04	0.04
CO <sub>2</sub>			0.10	0.20
H <sub>2</sub> O <sup>+</sup>			1.06	1.26
TOTAL			99.61	99.85
L.O.I.			0.43	0.70
S			0.01	0.01
Cl			0.001	0.001
As (ppm)	3		3	bdl
Ba (ppm)	5		130	180
Bi (ppm)	1		1	bdl
Ce (ppm)	5		12	18
Co (ppm)	2		40	42
Cr (ppm)	1		195	190
Cs (ppm)	3		3	bdl
Cu (ppm)	2		56	58
Ga (ppm)	1		15	14
La (ppm)	6		bdl	7
Mo (ppm)	1		bdl	bdl
Nb (ppm)	1		5	5
Nd (ppm)	7		bdl	10
Ni (ppm)	2		100	100
Pb (ppm)	2		5	6
Rb (ppm)	1		21	26
Sb (ppm)	2		bdl	bdl
Sc (ppm)	2		40	39
Sn (ppm)	2		bdl	bdl
Sr (ppm)	1		120	135
Th (ppm)	2		2	3
U (ppm)	1		bdl	bdl
V (ppm)	2		210	220
W (ppm)	2		1	2
Y (ppm)	1		14	19
Zn (ppm)	1		58	63
Zr (ppm)	2		57	73

**Appendix 2: XRD analysis**

**Client:** K. Morrison  
**Sample Source:** Tipogoree Hills  
**MRT Job Number:** M128/09  
**Analysis:** Approximate Mineralogy  
**Method:** X-Ray  
Diffraction

**Results** (approx wt %)

Sample	>80%	65%-80%	50%-65%	35%-50%	25%-35%	15%-25%	10%-15%	5%-10%	2%-5%	<2%
BBR-0003	Quartz						Smectite		K-Feldspar	Mullite

Peak overlap may interfere with identifications (e.g. Rutile and K-Feldspar) and quantitative calculations  
Amorphous material (e.g. organic material; glass) and minerals present in trace amounts may not be detected

**Analyst:** R.N. Woolley  
**Date:** 21 December  
2009