

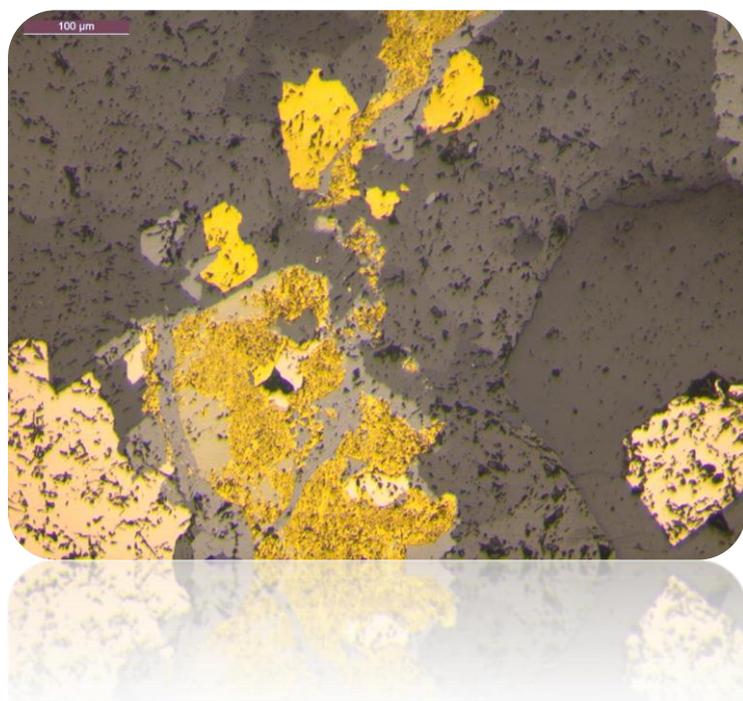
Mineral Resources Tasmania

Laboratory Report

LJN2018-091

LJN2018-113, LJN2017-009, LJN2018-146, LJN2018-147.15

MINERALOGY / PETROLOGY, RAZORBACK DEPOSIT



An unpublished Mineral Resources
Tasmania Report for:

Mineral Resources Tasmania

By: R S Bottrill and L Unwin

Date: 24 April 2020

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SUMMARY

These samples are mostly siliceous carbonate rocks, with variable quartz and talc contents, and some mineralisation. Notably, the only significant carbonate detected is magnesite. Wollastonite was previously described from these drillholes but could not be confirmed and appears very doubtful. There are no detectable asbestiform minerals in the samples examined. The mineralisation includes pyrrhotite-rich zones rich in tin, zinc, copper and lead sulphides, including stannite. The carbonates contain some stringers of disseminated chromite, and thus appears to be highly altered and sheared ultramafic rocks.

INTRODUCTION

We inspected several drillholes from the Razorback mine and took six samples for testing (Table 1), to determine their mineralogy and petrology.

Table 1: Sample details.

Reg. No.	Field No.	Location	Sample Description
C113259	RZS4/69.8	Razorback	Dolostone breccia
C113260	RC3/264.0	Razorback	Talc-carbonate-ore
C113261	RC3/250.4	Razorback	Wollastonite-ore?
C113262	RZS6/176.7	Razorback	Ore zone
C113263	RZS6/209.1	Razorback 207.1?	Transition zone
C113264	RZS6/218.8	Razorback	Conglomerate

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SAMPLE PREPARATION

The samples were split into representative subsamples and examined by stereomicroscopy, and analysed for mineralogy by XRD (X-Ray diffraction), in the Mineral Resources Tasmania (MRT) laboratories, Rosny. The sulphides were analysed by optical microscopy and XRD but may be more complex than described below.

SAMPLE DESCRIPTIONS

C113259

Under the stereomicroscope the sample C113259 is a breccia, containing pale grey, angular, cherty clasts to a few cm, in a white medium grained carbonate matrix (Fig. 1). No mineralization or veining was evident, except some small (<0.5mm) black specks of chromite(?).



Fig. 1: C113259, RZS4/69.8 Carbonate-silica breccia: white carbonate with grey quartz clasts. FOV: about 150 mm.

Under polarised light the rock is a mottled quartz/carbonate rock (Fig. 2 - 4). The carbonate (mostly magnesite by XRD) is fine to coarse grained (~0.1 - 2 mm) in patches inter-grown with fine grained quartz (chert). There are patches of opaques, which appear to be mostly altered chromite grains (fig 3, 3 & 6) and some rounded pyrite grains to ~0.3mm. No other mineralisation was detected. It has a breccia texture and is probably a silica-rich listwanite - a highly altered ultramafic.

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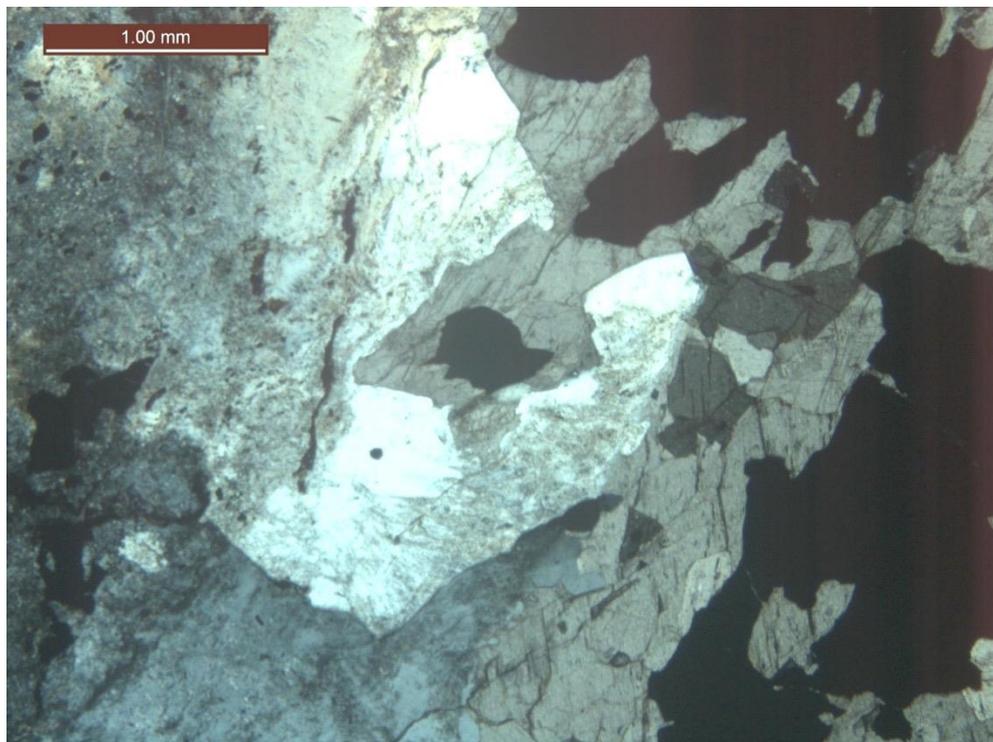


Fig. 2. Sample C113259. Polarised transmitted light, cross polars, showing euhedral to subhedral dolomite with growth zoning.

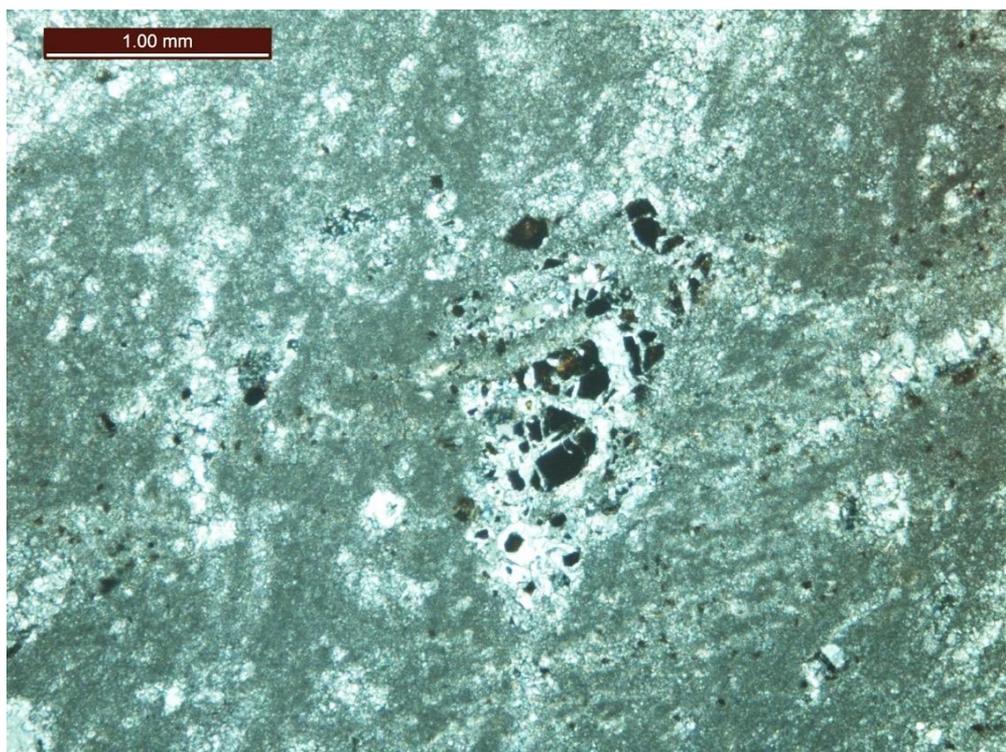


Fig. 3. Sample C113259 showing relict chromite in a matrix of fine grained carbonate-altered ultramafic. Polarised transmitted light, cross polars.

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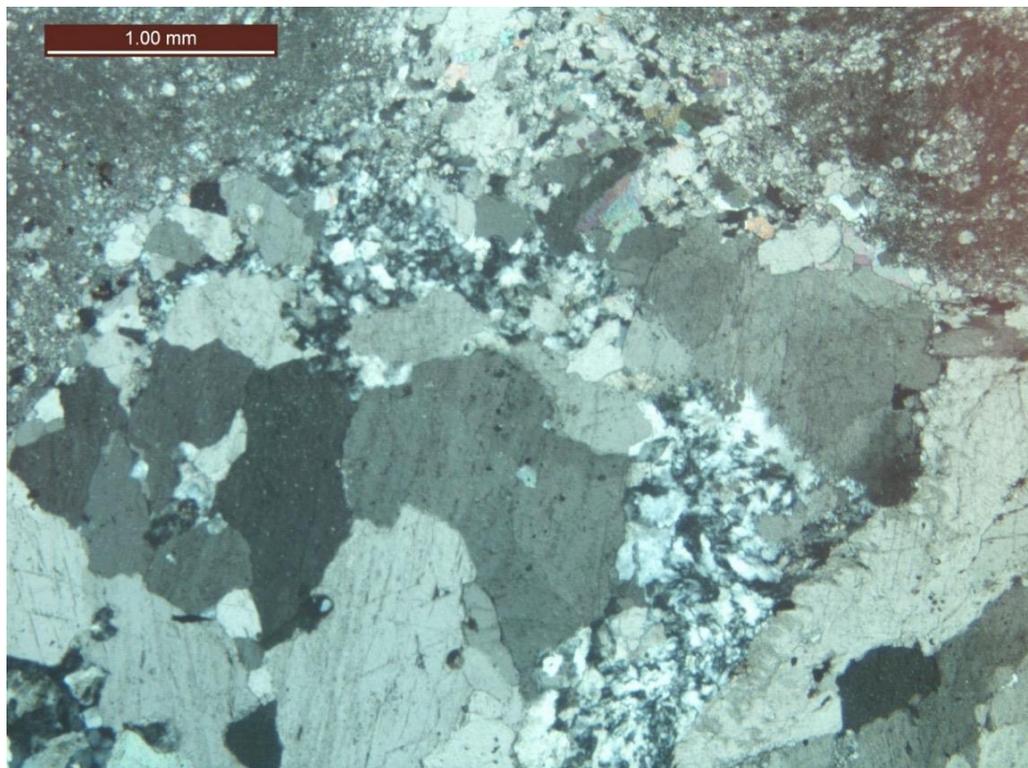


Fig. 4. Sample C113259 Coarse carbonate and fine grained quartz breccia. Polarised transmitted light, cross polars.

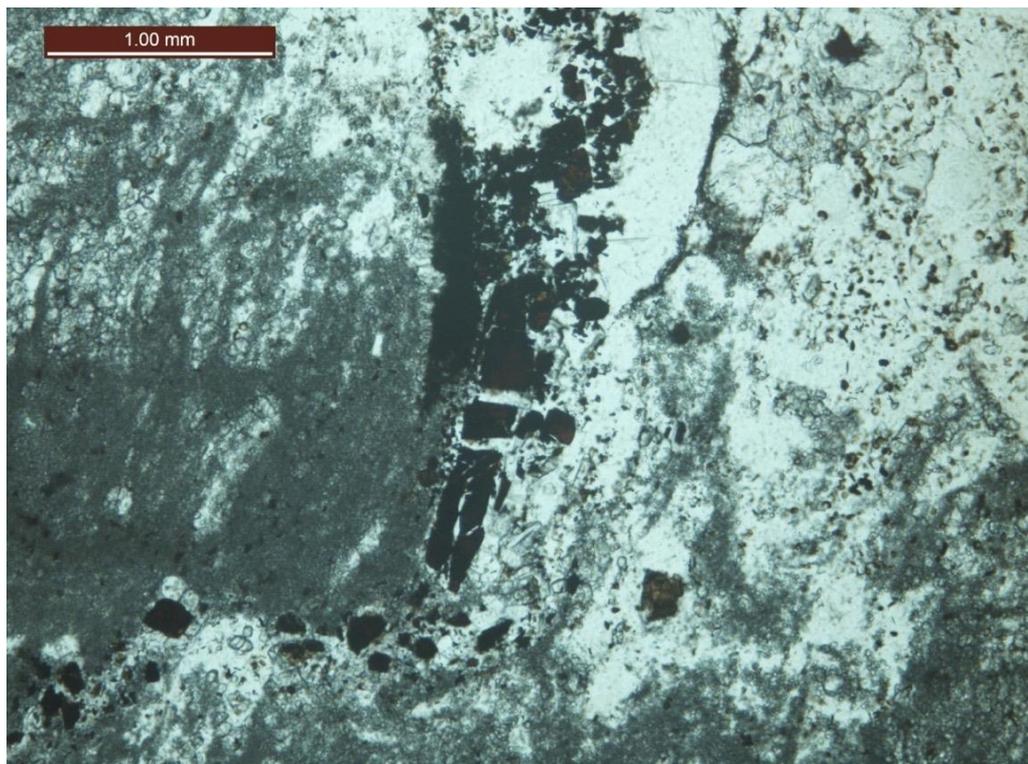


Fig. 5. Sample C113259 showing relict chromite in a carbonate-altered ultramafic. Polarised transmitted light, plane polars.

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Fig. 6. Sample C113259 showing relict chromite in a carbonate-altered ultramafic. Polarised transmitted light, plain polars.

C113260 RC3/264.0

Under the stereomicroscope, the sample C113260, is a carbonate breccia containing white clasts to a few mm in a pale grey matrix with disseminated sulphides to a few mm (Fig. 7).



Fig. 7: C113260 RC3/264.0 talc-carbonate-ore: fine grained talc-dolomite with disseminated sulphides. FOV: about 90 mm.

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Under polarised light, the rock is a mottled talc-quartz-carbonate rock with abundant sulphides (Fig. 8). The carbonate (mostly magnesite by XRD) is medium to coarse grained (~0.2-1 mm) and inter-grown with fine grained talc. The rock has a breccia texture and is probably a carbonate-altered ultramafic.

The sulphides include abundant pyrrhotite as irregular crystals and laths to a few mm long, with some patchy alteration to pyrite and marcasite (Fig 9, 10). Stannite occurs as irregular rounded grains, to about 0.2 mm, commonly inter-grown with fine chalcopyrite-rich aggregates, appearing to be breaking down of unidentified minerals (Fig 11). Iron-rich sphalerite is very common, sometimes overgrowing chalcopyrite, pyrrhotite and stannite (Fig 10, 11). Galena is sparse, sometimes inter-grown with pyrrhotite crystals (Fig. 9). Chalcopyrite occurs commonly as irregular grains to 0.2mm, mostly inter-grown with pyrrhotite and stannite (Fig 11). Pyrite occurs as fine to coarse primary grains (to 0.5mm), commonly inter-grown with pyrrhotite, as well as inter-growths with marcasite (Fig. 12). Marcasite is common as laths to 0.1mm replacing pyrrhotite (Fig. 10).



Fig. 8. Sample C113260 Coarse carbonate and fine grained sulphide-quartz breccia. Polarised transmitted light, cross polars.

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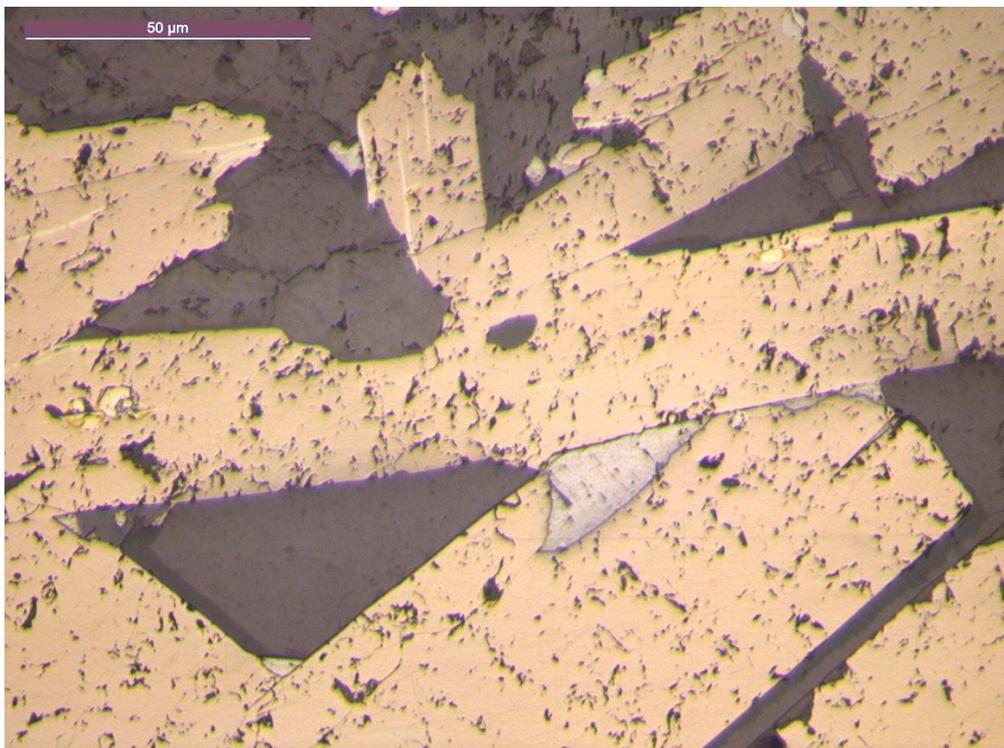


Fig. 9. Sample C113260. Pale grey galena, pale pinkish brown pyrrhotite, creamy pyrite and marcasite, plus dark grey carbonate and quartz. Polarised reflected light, plane polars.

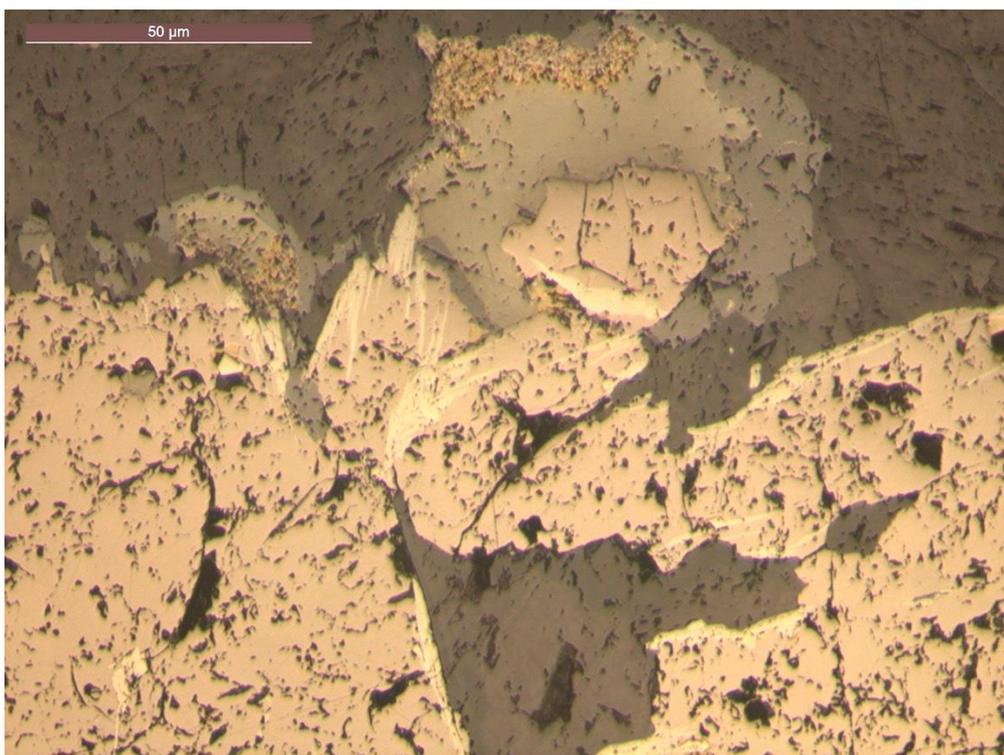


Fig. 10. Sample C113260. Pale pinkish brown pyrrhotite, with some fine inclusions of creamy pyrite and bladed marcasite, plus dark grey carbonate and quartz, pale grey stannite, medium grey sphalerite. The stannite contains fine grained patches of altered material. Polarised reflected light, plane polars.

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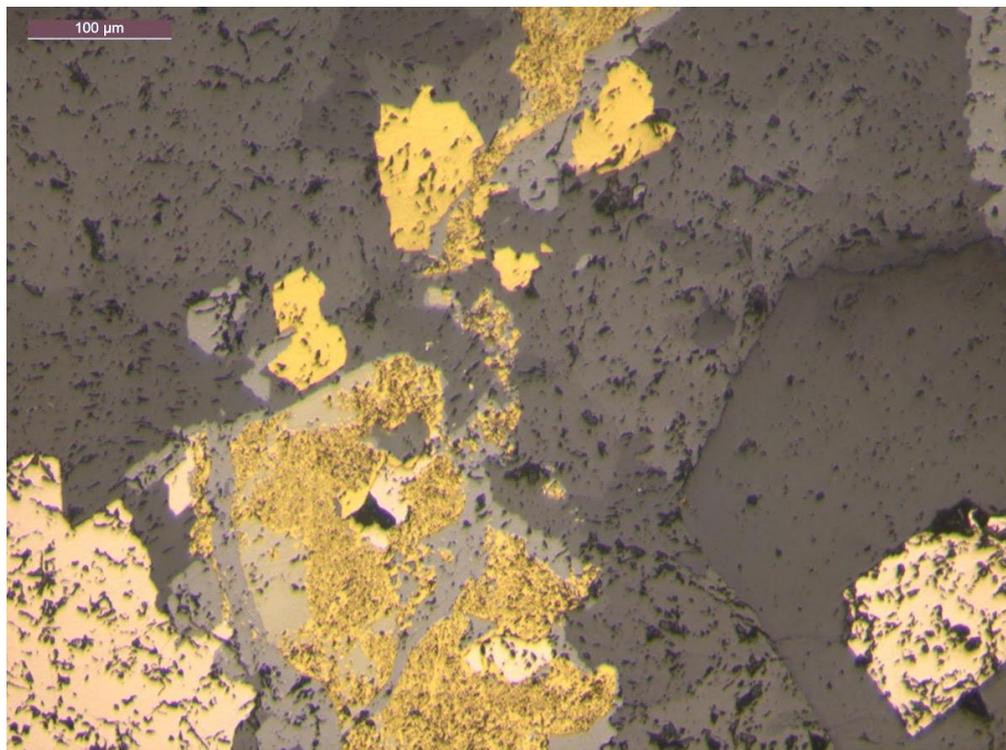


Fig. 11. Sample C113260. Yellow chalcopyrite, pale grey stannite, medium grey sphalerite, pale pinkish brown pyrrhotite, white pyrite, plus dark grey carbonate and quartz. The stannite contains fine grained patches of altered material. Polarised reflected light, plane polars.

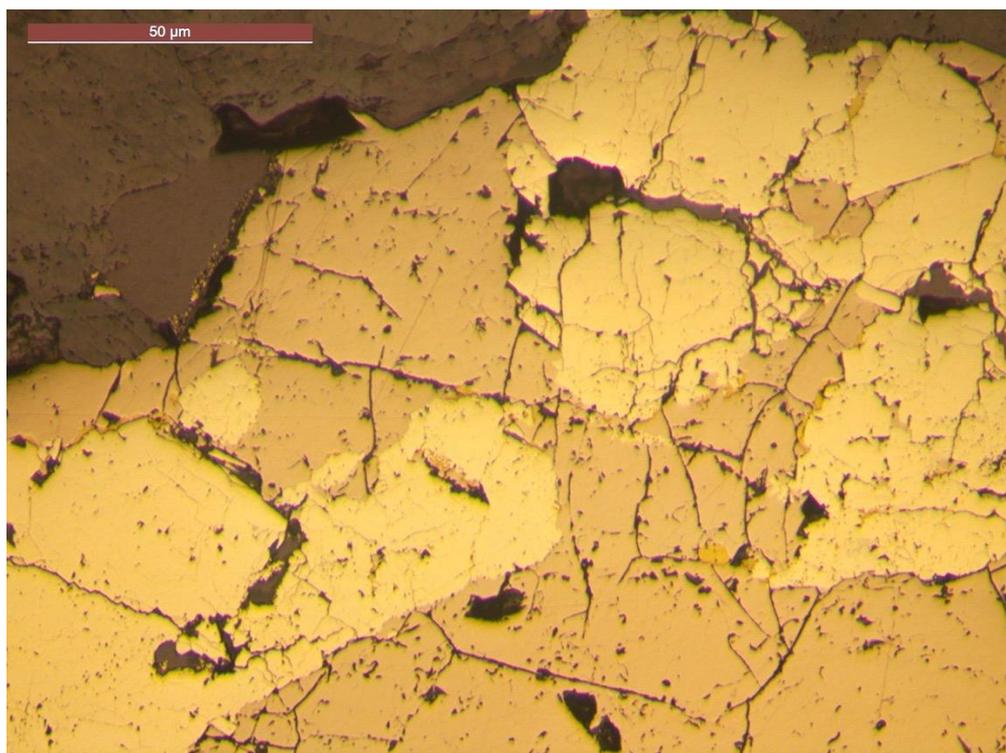


Fig. 12. Sample C113260. Pinkish brown pyrrhotite, white pyrite, sparse yellow chalcopyrite, plus dark grey carbonate and quartz. Polarised reflected light, plane polars.

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C113261 RC3/250.4

Under the stereomicroscope the sample C113261 is a breccia containing thin white veins cutting pale grey carbonate (Fig. 13). No mineralization or veining was evident.



Fig. 13: C113261 RC3/250.4 Laminated and sulphidic carbonate rock.

Under polarised light the rock is a sheared, roughly laminated and mottled talc/carbonate rock (Fig. 14). The carbonate (mostly magnesite by XRD) is medium to coarse grained (~0.2-1 mm) and inter-grown with fine-medium grained talc and minor quartz and sulphides. It has a breccia texture and is probably a carbonate-altered ultramafic.

The sulphides are in similar assemblages to C113260 but with perhaps less pyrrhotite and more pyrite, chalcocopyrite, stannite and sphalerite (Fig. 15, 16). Most sulphides are in grains <1mm across. Pyrite is sometimes skeletal (Fig. 16), and the sulphides may show evidence of zoning: sphalerite-chalcocopyrite-stannite (Fig. 15).

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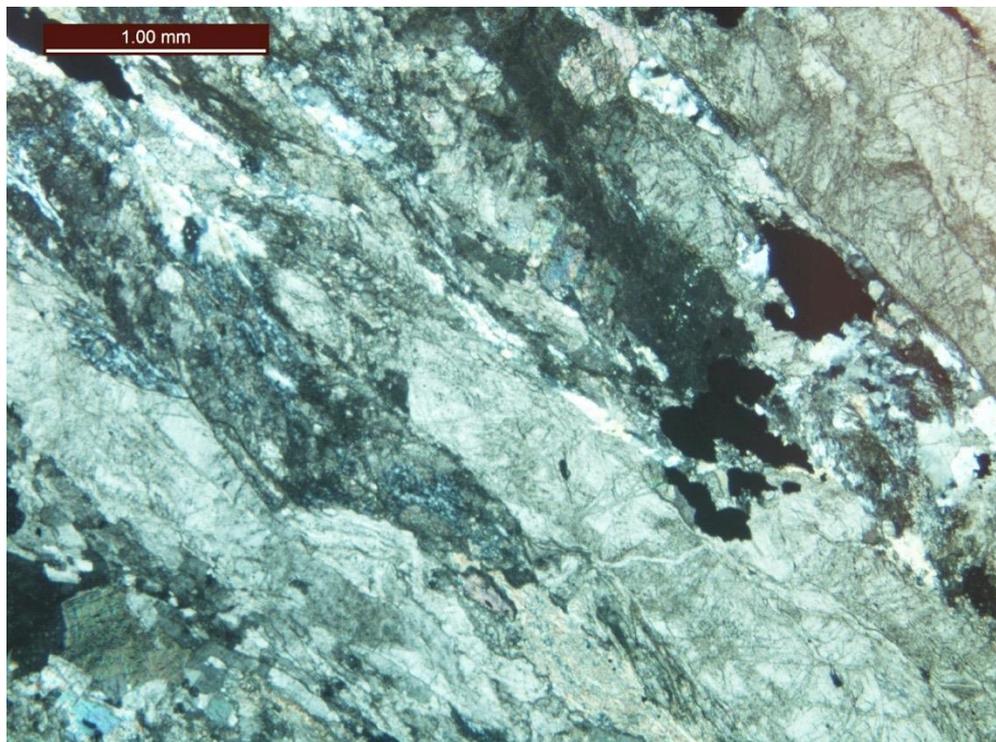


Fig. 14. Sample C113261. Polarised transmitted light, cross polars, showing disseminated sulphides in a coarse magnesite matrix.

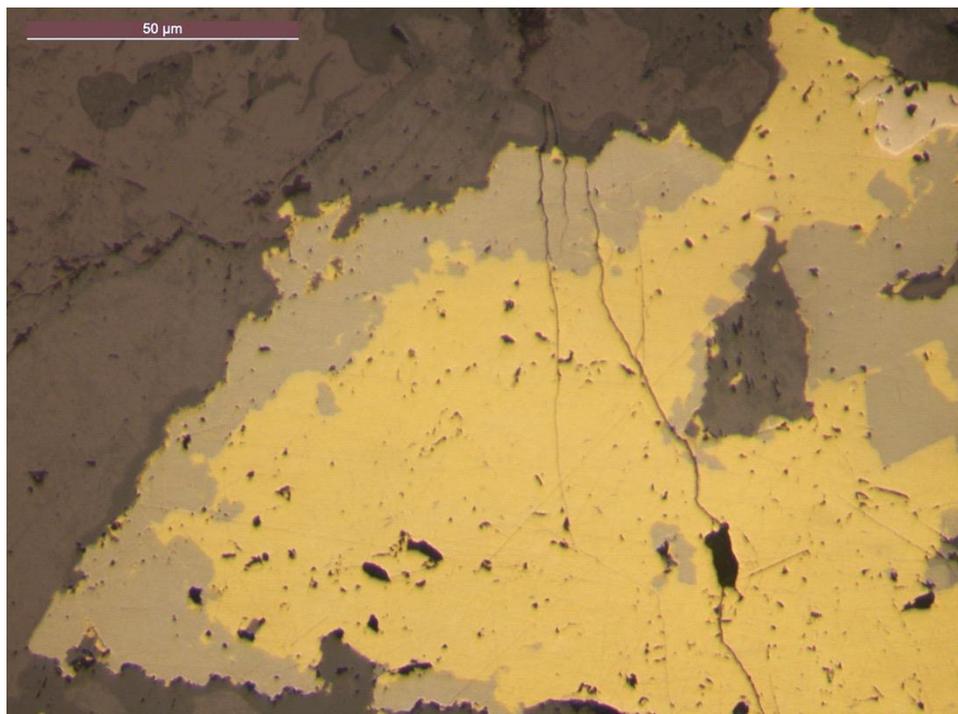


Fig. 15. Sample C113261 Coarse chalcopyrite (yellow), overgrowing sphalerite (medium grey), and altering to stannite (light grey) with minor pale brown pyrrhotite and dark grey carbonates. Polarised reflected light, cross polars.

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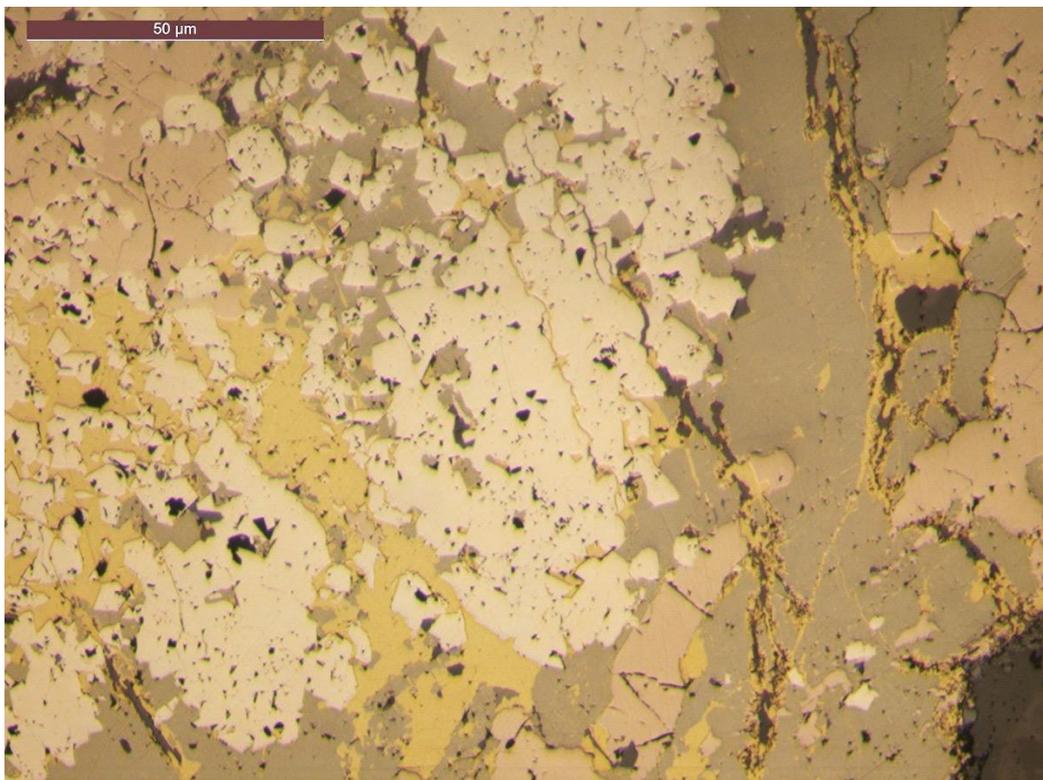


Fig. 16. Sample C113261 Creamy, skeletal pyrite, coarse chalcopyrite (yellow), stannite (light grey), pale brown pyrrhotite and dark grey carbonates and quartz. Polarised reflected light, cross polars.

C113262 RZS6/176.7

Under the stereomicroscope the sample C113262 is an altered polymict breccia containing pale grey to pale pinkish brown, angular, clasts to a few cm, in a white medium grained carbonate matrix (Fig. 17). No mineralization or veining was evident, except some small (<0.5mm) black specks of sulphides.

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Fig. 17: C113262 RZS6/176.7 transition zone, between conglomerate and carbonate zone. FOV: about 120 mm.

Under polarised light the rock is a mottled serpentine/carbonate rock with disseminated sulphides (Fig. 18). The carbonate (probably mostly magnesite by comparison with above samples) is coarse grained (~1-3 mm) and inter-grown with fine grained talc. There are minor patches of disseminated coarse sulphides (Fig. 19, 20). It has a very altered breccia texture and is probably a carbonate-altered ultramafic.

The sulphides include pyrrhotite (irregular crystals and laths to a few mm long) (Fig 19), with some coarse pyrite (Figs. 19 - 20). Stannite occurs as irregular rounded grains, to about 10 μ m. Sphalerite is very common, sometimes as inclusions in pyrite (Fig. 20). Chalcopyrite forms as blebs and veinlets in pyrite (Fig. 20). Marcasite is commonly lath like and probably all secondary, in pyrrhotite.



Fig. 18. Sample C113262. Polarised transmitted light, cross polars, showing disseminated sulphides in a coarse grained magnesite matrix.

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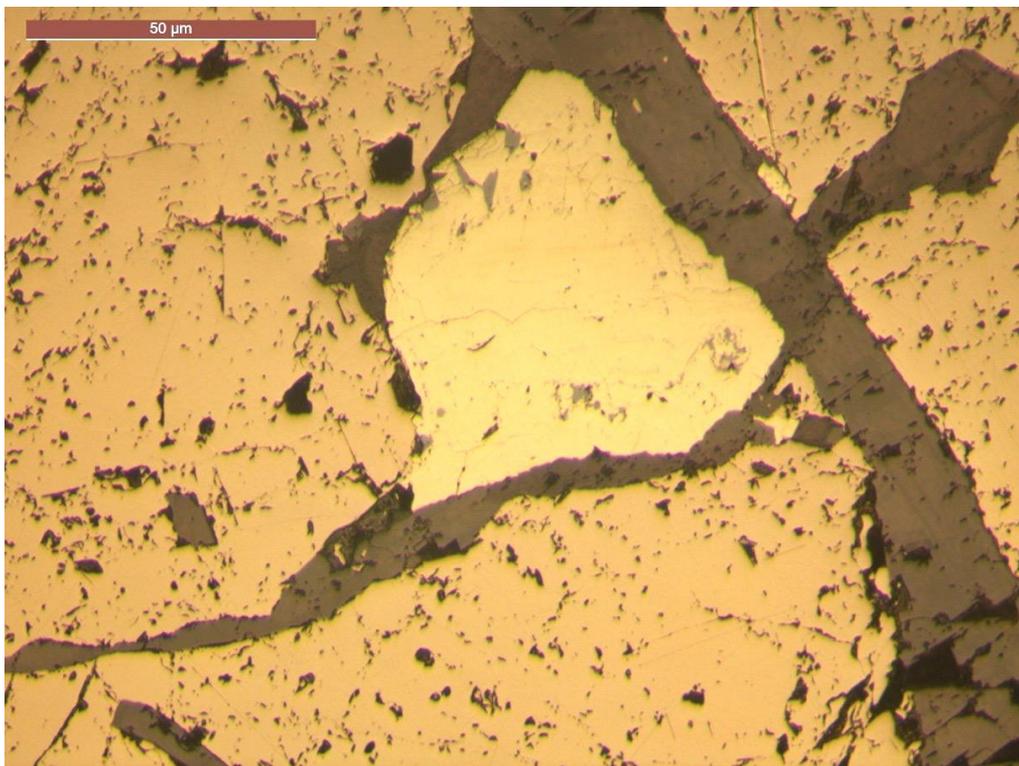


Fig. 19. Sample C113262. Creamy-white pyrite, pale brown pyrrhotite and dark grey carbonates. Polarised reflected light, cross polars.

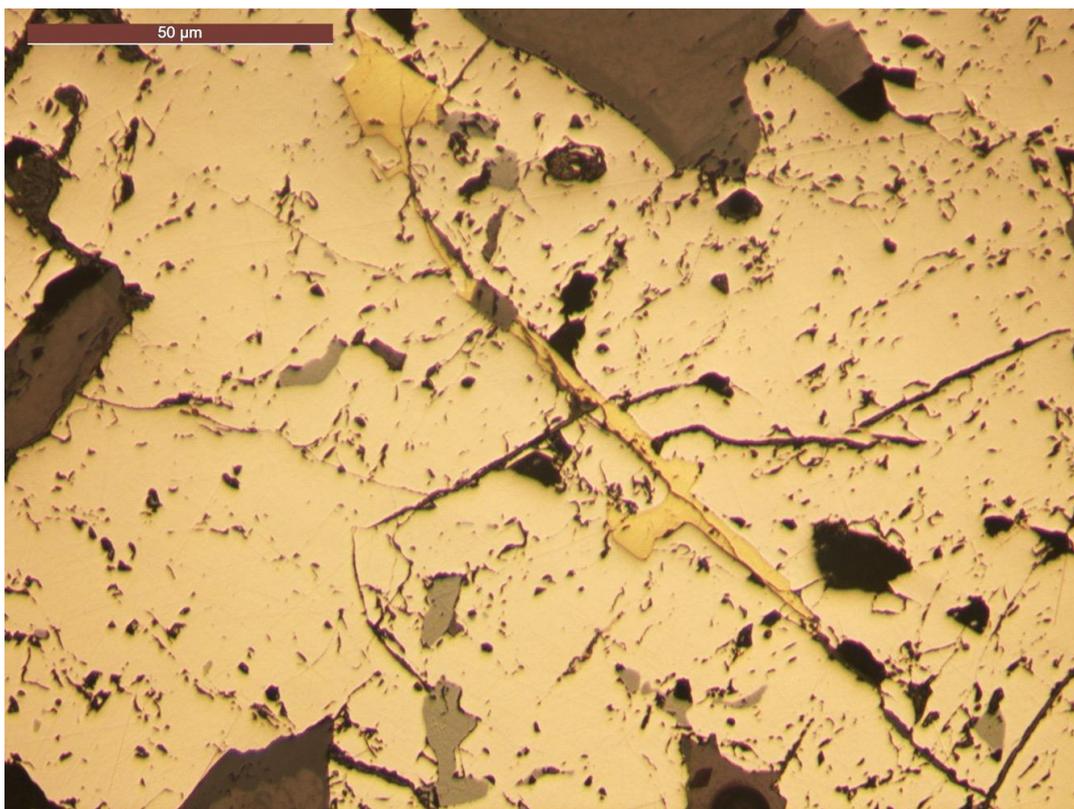


Fig. 20. Sample C113262. Polarised reflected light, plane polars, showing coarse grained pyrite with inclusions of sphalerite (grey) and chalcopyrite veinlets (yellow).

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C113263 RZS6/207.1

Under the stereomicroscope the sample C113263 is a sheared green/white rock containing white to dark green-grey, angular clasts and bands to a few cm across, in a white to green, medium grained carbonate (magnesite?) matrix (Fig. 21). No mineralization or veining was evident, except some small ($<0.5\text{mm}$) black specks of magnetite or chromite(?).

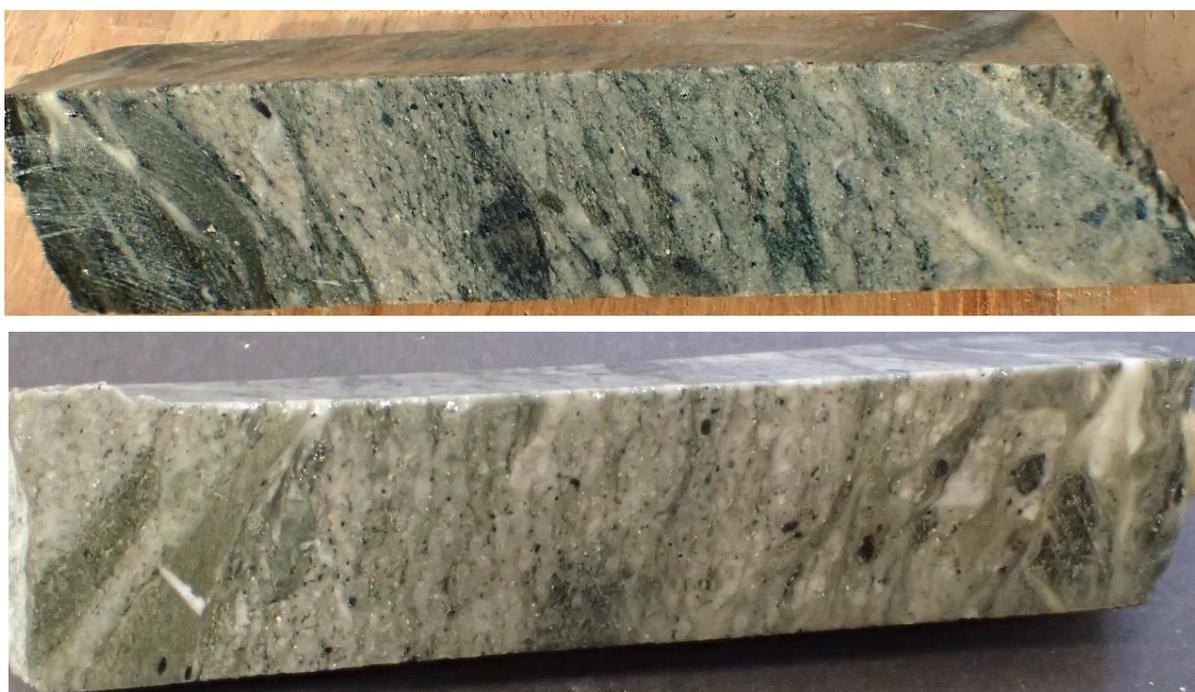


Fig. 21a,b. C113263 RZS6/209.1 Highly sheared, carbonate-chlorite conglomerate

Under polarised light the rock is a mottled to weakly banded chlorite/carbonate rock (Fig. 22). The clasts are mostly chlorite and the matrix (mostly calcite by XRD) is fine to medium grained ($\sim 0.1\text{-}0.5\text{ mm}$) and inter-grown with fine grained serpentine (Lizardite). It has a breccia texture and is probably a sheared, carbonate altered ultramafic rock.

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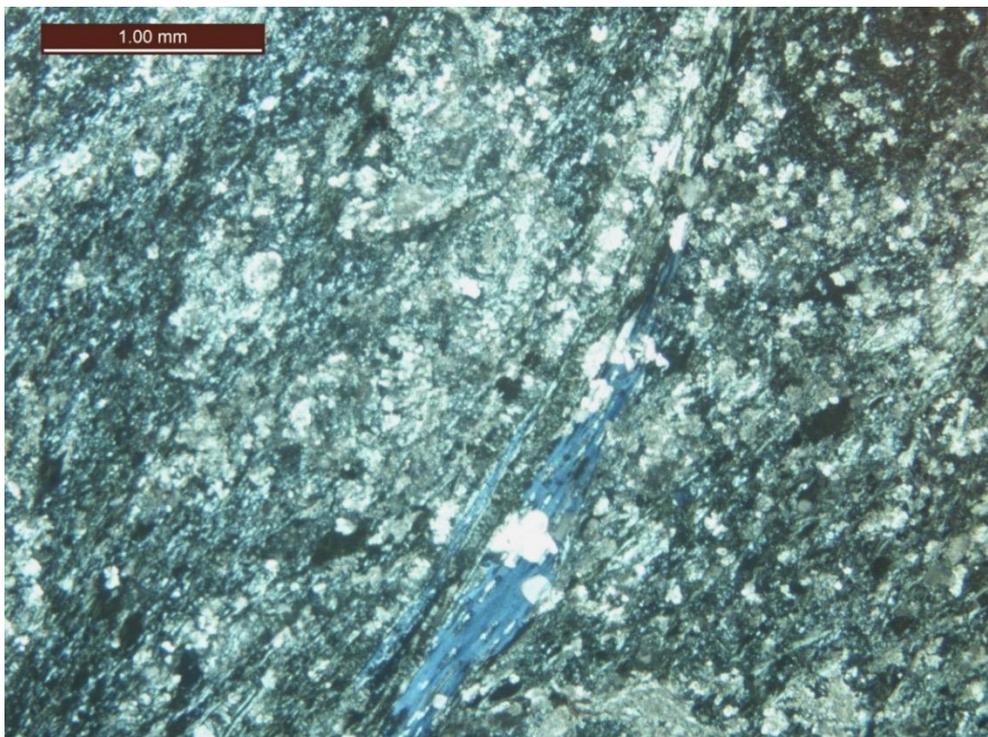


Fig. 22. Sample C113263. Carbonate-chlorite-rock. Polarised transmitted light, cross polars, showing a disseminated chlorite flakes in a carbonate matrix.

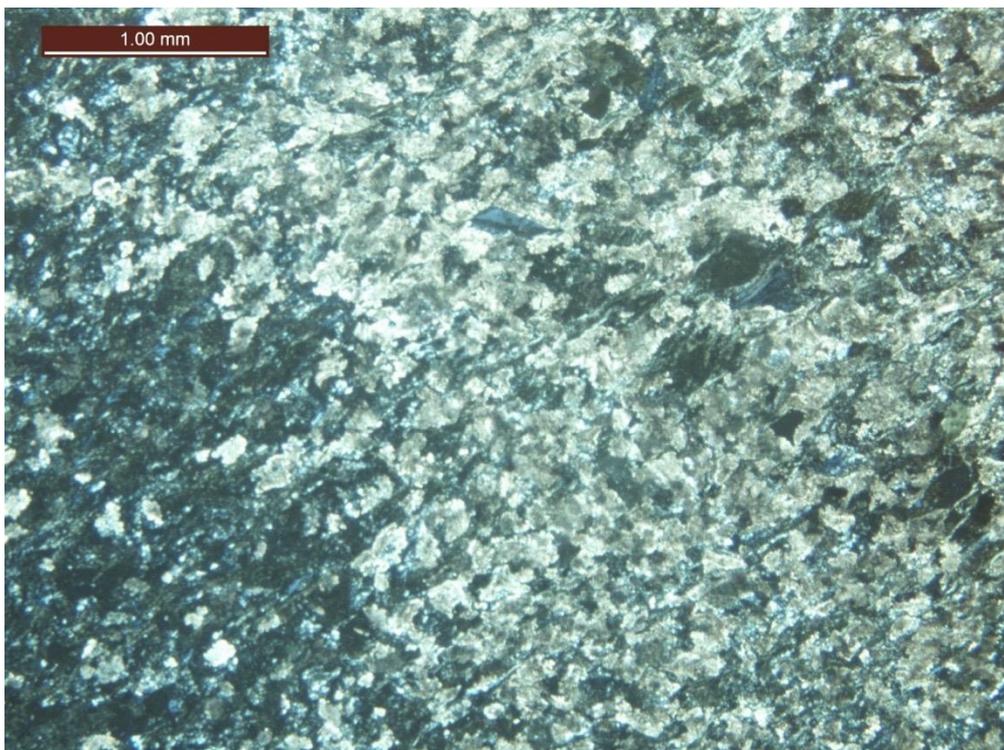


Fig. 23. Sample C113263 carbonate-chlorite-rock. Polarised transmitted light, cross polars, showing a disseminated chlorite flakes in a carbonate matrix.

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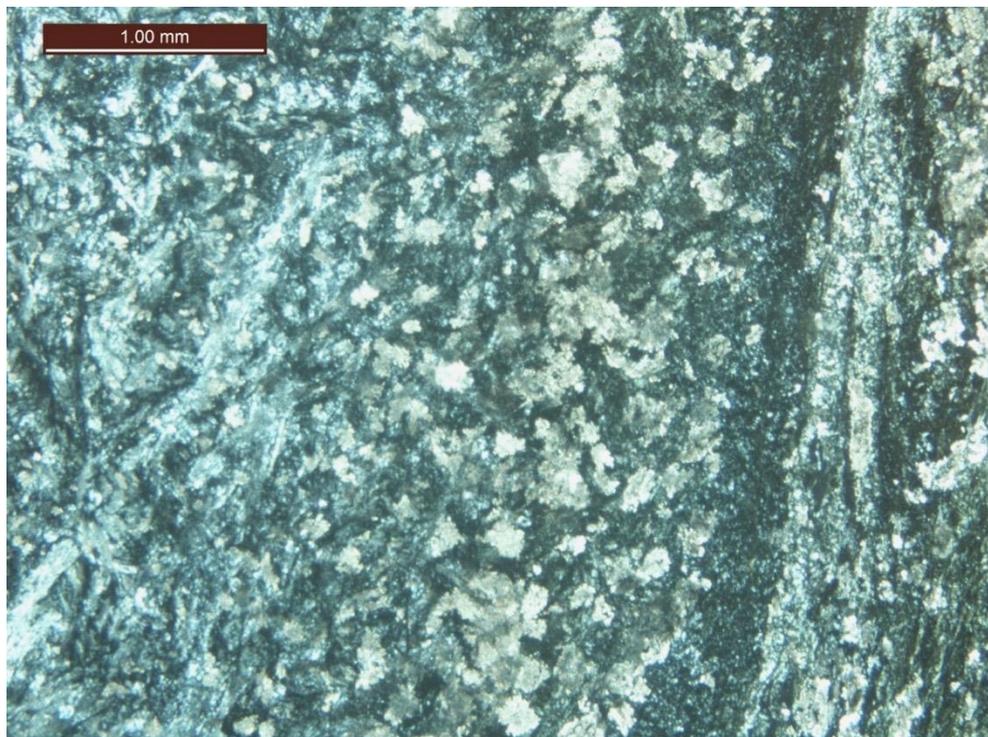


Fig. 24. Sample C113263 carbonate-chlorite rock. Polarised transmitted light, cross polars, showing bands of chlorite in a mostly carbonate-rich rock.

C113264 RZS6/218.8

Under the stereomicroscope the sample C113264 is a polymict breccia-conglomerate containing white to dark grey, angular to well-rounded clasts to a few cm diameter, in a white medium grained carbonate matrix (Fig. 25). No mineralization or veining was evident, except some small ($<0.5\text{mm}$) black specks of magnetite or chromite(?).

Under polarised light the rock is a conglomerate (Fig. 26). The clasts are mostly chlorite with minor carbonates and mostly well rounded and unfoliated, although some are highly angular and schistose. The matrix is mostly medium grained carbonate (magnesite? $\sim 0.1 - 1\text{ mm}$). It is probably a conglomerate formed by deposition of chloritized mafics into a carbonate sediment, with some later carbonate overprinting.

There are small patches of inter-grown pyrite and marcasite to $\sim 0.2\text{mm}$, rather porous and skeletal, probably replacing pyrrhotite (Fig 27).

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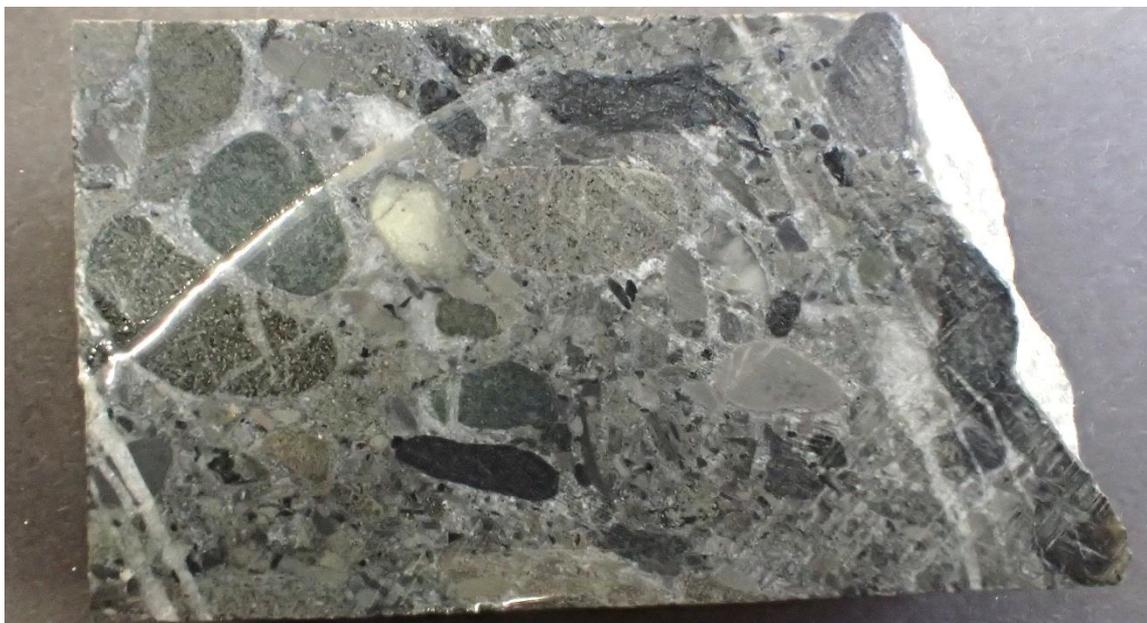


Fig. 25. C113264 RZS6/218.8 Carbonate-chlorite conglomerate. White diagonal line is a saw cut.



Fig. 26. Sample C113264 Conglomerate. Polarised transmitted light, cross polars, showing rounded clasts of siliceous and chloritic rock in a carbonate matrix.

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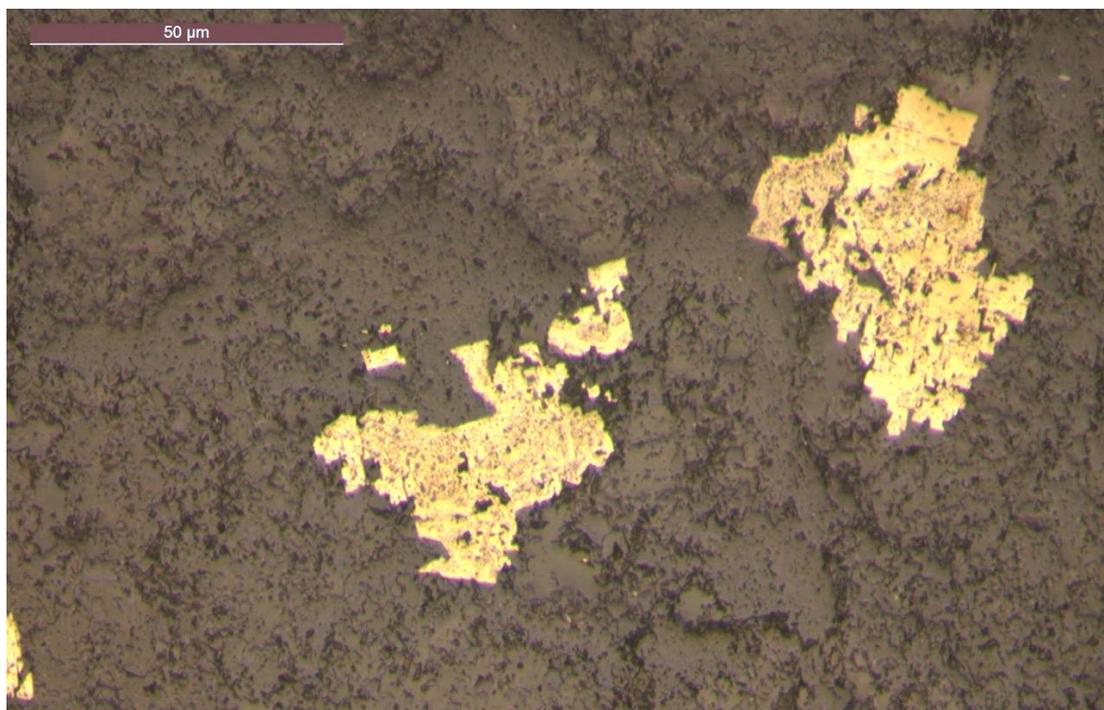


Fig. 27. Sample C113264. RZS4/69.8 Polarised reflected light, plane polars, showing fine grained, skeletal, porous pyrite, in carbonate matrix.

XRD ANALYSES

The samples were prepared, examined and analysed in the MRT laboratories, Rosny Park, Tasmania. They were run on a Rigaku Miniflex 600 X-Ray Diffractometer system: a 600W generator 150mm goniometer with a Cu tube; 40kV/15mA, sample spinner and a D/teX Ultra High Speed 1D Detector with Be window, -3° to 145° 2θ scanning range and 2° - 140° 2θ measuring range, with a scanning speed of 0.01 to 100 $^{\circ}$ /min, A graphite monochromator and a K β Ni- filter, The analysis software used is the PDXL2 using the ICCD database.

The results are shown in Appendix 1 and summarised in Table 2. These indicate mostly magnesite, with lesser talc and quartz. There is trace ankerite in one sample. No sulphides, sulphates or oxides were detected.

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Table 2: XRD Summary (approx. wt.%)

Phase name	C113259	C113260	C113261
Magnesite	67	63	82
Quartz	33	10	5
Ankerite	<1		
Talc		27	13

ASBESTOS CHECK

There is no detectable fibrous to asbestiform serpentine (chrysotile) in any samples examined.

SUMMARY AND DISCUSSION

C113259 RZS4/69.8

This is a quartz-magnesite breccia formed by alteration of ultramafic rocks.

C113260 RC3/264.0

This is a quartz-magnesite-talc-sulphide breccia formed by alteration of ultramafic rocks. It includes tin, copper, lead and zinc sulphides.

C113261 RC3/250.4

This is a quartz-magnesite-talc-sulphide breccia formed by alteration of ultramafic rocks. It includes tin, copper, lead and zinc sulphides.

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C113262 RZS6/176.7

This is a quartz-magnesite-talc-sulphide breccia formed by alteration of ultramafic rocks. It includes disseminated tin, copper, lead and zinc sulphides.

C113263- RZS6/209.1 Razorback 207.1? transition zone

The rock is a mottled to weakly banded serpentine/chlorite/carbonate rock and is probably a sheared, carbonate altered ultramafic rock.

C113264 RZS6/218.8 Razorback conglomerate

This is probably a conglomerate formed by deposition of chloritized mafics into a carbonate sediment, with some later carbonate overprinting.

The mineralized zones were very complex and most tin appears to be present as stannite, rather than cassiterite.

Wollastonite was previously described from these drillholes but could not be confirmed and appears very doubtful for such magnesium-rich and Ca-poor assemblages.

R S Bottrill

L Unwin

Mineralogist/Petrologist

Technical Officer

Disclaimers

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This and other data collected in MRT laboratories may enter the MRT databases but every attempt will be made to ensure it remains closed file and not be available externally, unless at your request.

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Appendix 1: MRT Laboratory Report

Client: P Harding/S Newett
Sample Location: Razorback Mine, Dundas
Job Number: LJN2018-091
Analyses: Approximate Mineralogy and Asbestos Identification
Methods: XRD
Analyst: L Unwin
Lab Manager: R Bottrill
Date: 18/7/2019

Analysis Results – C113259

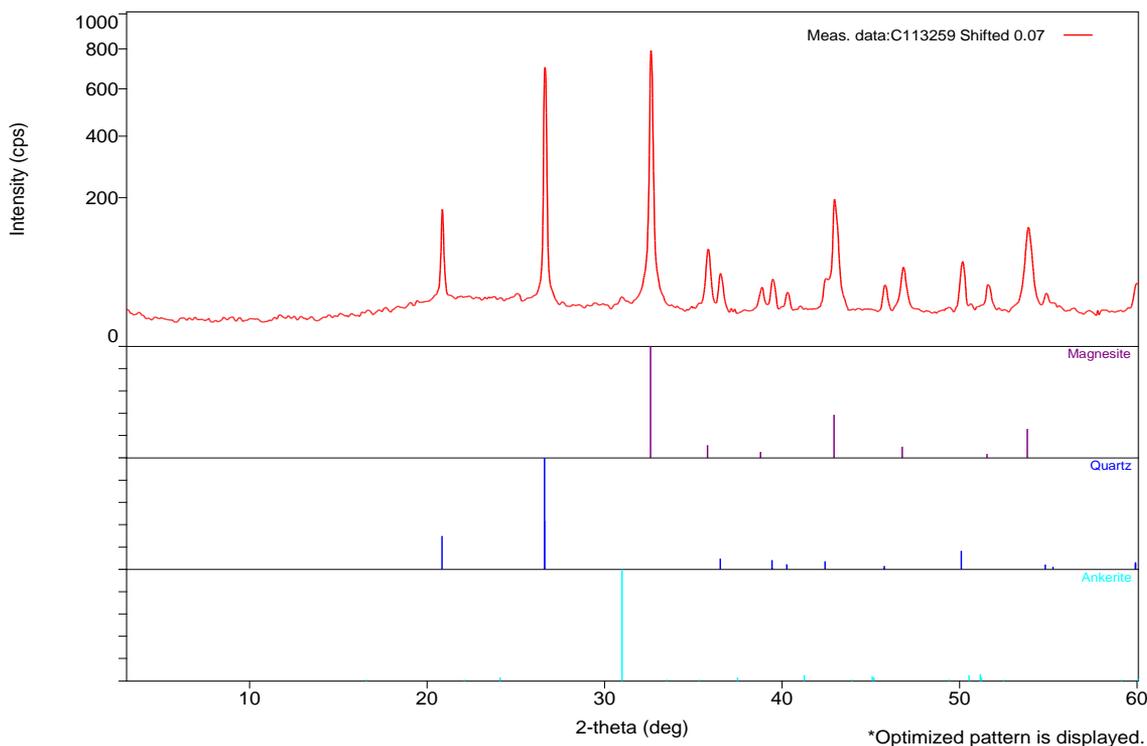
General Information

Analysis date	2019/07/18	Measurement date	2018/08/16
Sample name	LJN2018-90 Razorback	Operator	lunwin
File name	C113259.ras		
Comment	Shifted 0.07		

Quantitative Analysis Results

Phase name	Content (%)	Formula
Magnesite	67(3)	MgCO ₃
Quartz,	33(3)	SiO ₂
Ankerite	<1(6)	Ca(Fe ²⁺ ,Mg)(CO ₃) ₂

Phase Data Pattern



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Analysis Results – C113260

General information

Analysis date	17/08/2018	Measurement date	17/08/2018
Sample name	LJN2018-091 Razor Back	Operator	L Unwin
File name	C113260.ras		
Comment	Shifted 0.07		

Quantitative analysis results

Phase name	Content (%)	Formula
Magnesite	63(3)	MgCO ₃
Talc	27(2)	Mg ₃ Si ₄ O ₁₀ (OH) ₂
Quartz	10(10)	SiO ₂

Phase data pattern

