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Cu Porphyry Investigation

ANS Exploration Corp

Mineralogical Report MP6990a 26/01/2023

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Contents

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Client	ANS Exploration Corp		
Report title	Cu Porphyry Investigation		
Analysis required	simplified mineralogical investigation by optical microscopy		
Client reference	Cu Porphyry Investigation	**Client contact**	Richard Belcher <<richard@ans-exploration.com>>
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Limitations

This report relates only to those samples submitted and specimens examined and to any materials properly represented by those samples and specimens. This report is issued to the Client named above for the benefit of the Client for the purposes for which it was prepared. It does not confer or purport to confer on any third party any benefit or right pursuant to the Contracts (Rights of Third Parties) Act 1999.

Report key findings

This is a mineralogical report for ANS Exploration Corp to investigate twelve samples from a porphyry Cu deposit located within the Arabian-Nubian Shield.

The samples included a suite of mafic igneous and volcanic lithologies, that have been extensively altered and contained trace/minor to no sulphide mineralisation. Three main lithologies were recognised which include a) granodiorite, b) volcanics, predominantly basalt and c) diorite.

The variation of partially to ubiquitously altered granodiorites are present in samples ALCD-001, ALCD-002, ALCD-006, ALCD-008, ALCD-009, ALCD-011 and ALCD-012. The phaneritic granodiorites contain euhedral to subhedral crystals and are composed of plagioclase feldspar, quartz, amphibole, biotite, alkali feldspar and titanite, with varying degrees of alterations, that commonly entirely replace some of the magmatic phases, usually amphiboles, and consequently in samples ALCD-008, ALCD-009, ALCD-011 and ALCD-012 there is an absence of amphibole, with only biotite or chlorite present, mostly as overprinting phases. The granodiorite samples contain trace iron and titanium oxides, rare zircon, rutile and/or apatite.

Samples ALCD-003 and ALCD-004 represent altered aphanitic basalts, composed of fine plagioclase feldspar, with variable amounts of calcite, goethite and chlorite. Sample ALCD-007 may represent a porphyritic rock, that has undergone extensive alteration. The protolith is uncertain.

Samples ALCD-005 and ALCD-010 may represent diorite and quartz diorite, however due to the abundant potassic alteration, the definition of the protolith is slightly uncertain.

Alteration

Table 1 shows a simplified comparison based on the alteration type and presence of sulphide mineralisation across the samples, featuring the most common alteration types present within porphyry Cu system including sericitisation, propylitic and potassic alteration. Additional reference to calcite replacement, chloritisation and silicification was made to provide information over the alteration, where typical porphyry Cu alteration assemblage does not apply.

Table 1. Summary table of alteration types and presence of sulphide mineralisation[1].

Alteration	ALCD-001	ALCD-002	ALCD-003	ALCD-004	ALCD-005	ALCD-006	ALCD-007	ALCD-008	ALCD-009	ALCD-010	ALCD-011	ALCD-012
Propylitic alteration (chl+ep+cal)	✓	✓		✓		✓	✓	✓		✓	✓	✓
Potassic alteration (bt+K-fsp)					✓✓					✓✓	✓	
Sericitisation	✓	✓				✓		✓	✓	✓	✓	✓
Calcite replacement			✓						✓			
Chloritisation					✓							
Silicification							✓		✓			
Cu mineralisation	✓	✓		✓	✓		✓	✓		✓		✓
Pyrite			✓	✓	✓		✓	✓		✓		

The alteration in samples ALCD-001, ALCD-002, ALCD-006, ALCD-008, ALCD-011 and ALCD-012 contains evidence of sericitisation with a typical assemblage of propylitic alteration, which includes the presence of epidote/clinozoisite, chlorite and calcite replacement. Samples ALCD-001 and ALCD-002 represent the least altered of the granodiorite samples with a weak propylitic overprint and sericitisation of the feldspars. Epidote in all these samples occurs as granular agglomerations of small crystals, with minor subhedral to euhedral coarser crystals (up to 500-600 µm). Chlorite typically occurs as replacement of magmatic hornblende or biotite, rarely as

1 Relative abundance: ✓ - present, ✓✓ - dominant.

cross-cutting veins and often in close association with epidote. Calcite forms irregular, anhedral patchy replacement and is also present as veins and veinlets within the samples. Sericite occurs as fine white mica crystals, rarely reaching up to 100-200 µm.

Sample ALCD-003 contained only patchy calcite replacement and calcite filled veins and veinlets.

Samples ALCD-004 and ALCD-007 showed extensive propylitic alteration with abundant chlorite and minor epidote replacement in both samples with rare calcite patches and veinlets in sample ALCD-004.

Samples ALCD-005 and ALCD-010 were dominated by potassic alteration, with common hydrothermal biotite. Both samples also likely contained original primary biotite. Sample ALCD-005 additionally contained some minor chlorite replacement. Sample ALCD-010 displayed trace evidence of sericitisation and propylitic alteration, with minor feldspar replacement and the rare presence of epidote and chlorite with common calcite, as scattered irregular patches and calcite veins.

Sample ALCD-009 showed evidence of minor feldspar sericitisation, more common calcite replacement and extensive calcite veining with rare silicification and quartz veinlets.

Mineralisation

Sulphide mineralisation across the samples usually occurs in trace amounts as disseminated crystals of iron or iron-copper sulphides. Sample ALCD-001 contains traces of chalcopyrite and bornite. Sample ALCD-002 contains only traces of chalcopyrite. Sample ALCD-003 contains only trace pyrite mineralisation. Samples ALCD-004, ALCD-007 and ALCD-008 contain both pyrite and Cu sulphides, including chalcopyrite, chalcocite, covellite and bornite. Samples ALCD-005 and ALCD-010 contain traces of pyrite and chalcopyrite. Sample ALCD-012 contained the highest amount of Cu sulphides, predominantly unaltered chalcocite.

Pyrite is usually unweathered except for in samples ALCD-003 and ALCD-008 where it was rarely partially altered to goethite. Unaltered chalcopyrite, bornite, covellite and chalcocite were observed. Where altered, Cu sulphides tend to follow the typical oxidation pattern, where the Fe content is weathered out and the Cu:Fe ratio increases until Fe is removed altogether. As such chalcopyrite is replaced by bornite or covellite, while chalcocite is usually partially replaced by covellite.

Introduction

Scope

This is a mineralogical report for ANS Exploration Corp to investigate twelve samples from a porphyry Cu deposit located within the Arabian-Nubian Shield.

This report relates only to the samples examined (and any materials properly represented by those samples). It presents the findings of a mineralogical investigation by optical microscopy on thin sections prepared from selected sub-samples, with special reference to porphyry Cu mineralisation.

List of samples

Samples received			
Report no.	**Sample reference**	**Mass (g)**	**Type**
1	ALCD-001	37	Rock core Ø60 mm, half core
2	ALCD-002	41	Rock core Ø60 mm, half core
3	ALCD-003	50	Rock core Ø60 mm, half core
4	ALCD-004	66	Rock core Ø60 mm, half core
5	ALCD-005	58	Rock core Ø60 mm, half core
6	ALCD-006	58	Rock core Ø60 mm, half core
7	ALCD-007	91	Rock core Ø60 mm, half core
8	ALCD-008	84	Rock core Ø60 mm, half core
9	ALCD-009	62	Rock core Ø60 mm, half core
10	ALCD-010	90	Rock core Ø60 mm, half core
11	ALCD-011	80	Rock core Ø60 mm, half core
12	ALCD-012	77	Rock core Ø60 mm, half core

Methods of investigation

A detailed mineralogical investigation was requested, with special reference to porphyry Cu mineralisation.

The submitted samples were examined as received using a Nikon SMZ-U stereoscopic microscope with fibre optic illuminator. One thin section and one polished chip were prepared from each selected sample. The sections were examined by conventional transmitted and reflected light polarising microscopy using a Nikon research polarising microscope.

A visual estimate of relative phase abundance was made.

Digital photomicrographs were taken using a high resolution digital camera attached to the trinocular head of the microscope.

Sample description

The mineralogy of twelve submitted samples are summarised in Table 2. A simplified mineralogical description of each sample received (which includes annotated photomicrographs), based on a high-power microscopical examination of prepared thin and polished sections, follows Table 2.

Table 2. Summary table of mineral abundance[1].

Minerals		Sample details and relative mineral abundance[1]												Typical composition
		ALCD-001	ALCD-002	ALCD-003	ALCD-004	ALCD-005	ALCD-006	ALCD-007	ALCD-008	ALCD-009	ALCD-010	ALCD-011	ALCD-012	
Sulphides	Pyrite			☐	☐	☐		☐	☐		☐			FeS_2
	Chalcopyrite	☐	☐		☐	☐		☐	☐		☐		☐	$CuFeS_2$
	Chalcocite				☐			☐	☐				☐	Cu_2S
	Covellite				☐			☐	☐				☐	CuS
	Bornite	☐			☐			☐	☐				☐	Cu_5FeS_4
Gangue minerals		**ALCD-001**	**ALCD-002**	**ALCD-003**	**ALCD-004**	**ALCD-005**	**ALCD-006**	**ALCD-007**	**ALCD-008**	**ALCD-009**	**ALCD-010**	**ALCD-011**	**ALCD-012**	**Typical Composition**
Bulk Silicate Minerals	Quartz/ Microcrystalline quartz	■	■	□	□	⊡	■	⊡	■	■	⊡	■	■	SiO_2
	Plagioclase Feldspar	■	■	■■	■		■	■■	■	■	■	■	■	$(Na,Ca)(Al,Si)_4O_8$
	Alkali Feldspar	⊡	⊡			⊡	■		⊡	⊡	⊡	⊡	⊡	$KAlSi_3O_8$
	Amphibole	■	■			⊡	⊡	⊡						$Ca_2[Mg_4(Al,Fe^{+++})]Si_7AlO_{22}(OH)_2$
Phyllosilicates	Biotite					■	⊡				■	⊡		$K(Fe,Mg)_3(AlSi_3O_{10})(OH)_2$
	Muscovite/Sericite	□	⊡				□		□	□		□	□	$KAl_2(Si_3Al)O_{10}(OH,F)_2$
	Chlorite	⊡	□		■	⊡	⊡	⊡	⊡		□	□	⊡	$(Mg,Al,Fe^{++})_{12}(Si,Al)_8O_{20}(OH)_8$
Carbonates	Calcite	□	□	■	⊡	⊡		□	□	■	⊡	□	□	$CaCO_3$
Fe-Ti Oxides	Hematite	□	□				□	□	□	□		□		Fe_2O_3
	Goethite	□	□	⊡		□		□	□	□		□	□	FeO(OH)
	Ilmenite	□	□				□		□	□		□		$Fe^{2+}TiO_3$
	Rutile	□				□								TiO_2
Accessory Phases	Epidote	⊡	⊡		⊡		⊡	⊡	⊡		□	⊡	⊡	$Ca_2(Fe^{3+},Al)_3(SiO_4)_3(OH)$
	Clinozoisite	□	□		□				□					$Ca_2Al_3(SiO_4)_3(OH)$
	Titanite	□	□				□		□			□		$CaTiSiO_5$
	Zircon	□	□				□			□				$ZrSiO_4$
	Apatite						□				□	□		$Ca_5(PO_4)_3(OH,F,Cl)$

1 Relative phase abundance: ■■ major+ (>=50%) ■ major (>=10%), ⊡ minor (>=2<10%), ☐ trace (<2%).

ALCD-001

Sample as received

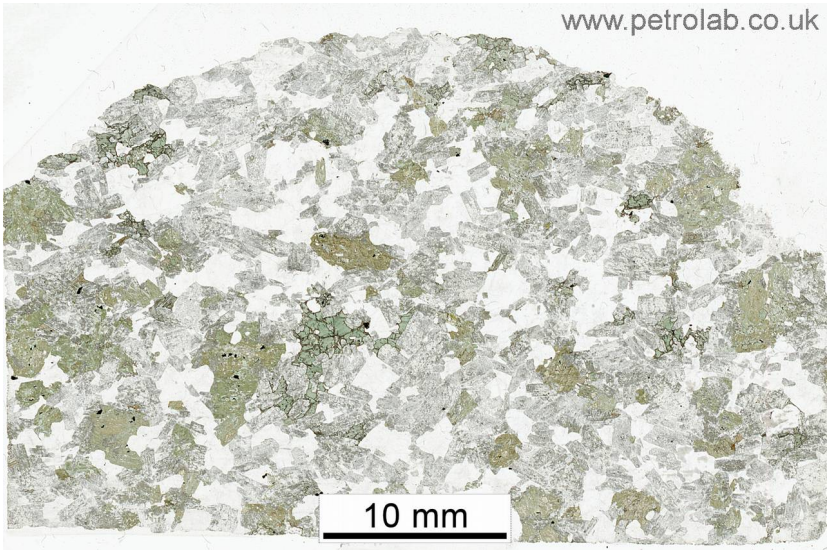
Sample ALCD-001		
Petrolab ID	**Date received**	**Type · properties**
#43572	25/11/2022	Rock core Ø60 mm, half core · 37 g

A **Sample ALCD-001**

Photograph of sample as received (scale in cm).

Image A
Nikon D7000 digital camera
Daylight balanced oblique light

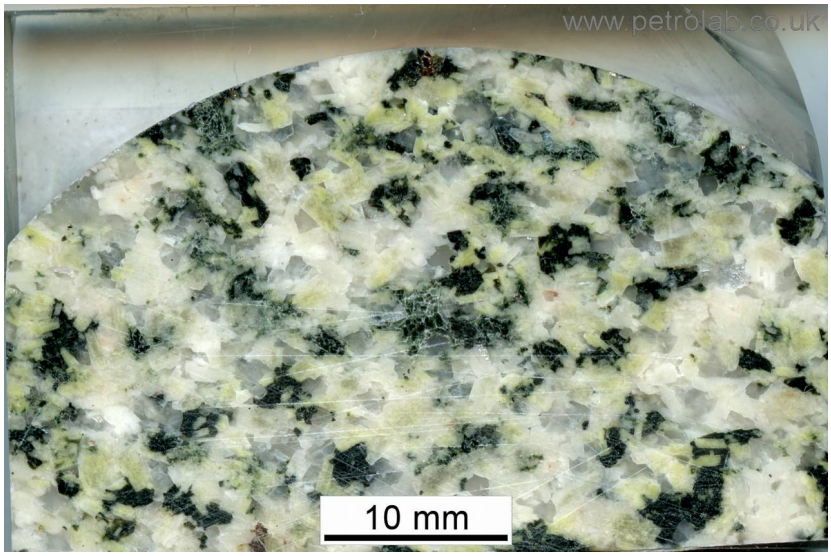
Section(s)



B **Sample ALCD-001**

Low magnification view of sample thin section.

Image B
Epson scanner
White cold cathode light



C **Sample ALCD-001**

Low magnification view of sample polished chip.

Image C
Epson scanner
White cold cathode light

Mineral identification

Sample ALCD-001			
Phase	**Formula**	**≈ s.g.**	**Abundance[1]**
Plagioclase feldspar, pl	$(Na,Ca)(Si,Al)_4O_8$	2.68	Major
Quartz, qz	SiO_2	2.65	Major
Amphibole, amp	$Ca_2[(Mg,Fe^{2+})_4(Al,Fe^{3+})]Si_7AlO_{22}(OH)_2$	3.16	Major
Alkali feldspar, afs	$KAlSi_3O_8$	2.55	Minor
Epidote, ep	$Ca_2(Fe^{3+},Al)_3(SiO_4)_3(OH)$	3.45	Minor
Chlorite, chl	$(Mg,Fe^{2+})_5Al(Si_3Al)O_{10}(OH)_8$	2.65	Minor
Clinozoisite, czo	$Ca_2Al_3(SiO_4)_3(OH)$	3.34	Trace
Sericite, ms	Fine-grained white mica alteration product	2.82	Trace
Titanite (sphene), ttn	$CaTiSiO_5$	3.55	Trace
Ilmenite, ilm	$Fe^{2+}TiO_3$	4.79	Trace
Calcite, cal	$CaCO_3$	2.71	Trace
Goethite, gth	$FeOOH$	4.27	Trace
Rutile, rt	TiO_2	4.25	Trace
Hematite, hem	Fe_2O_3	5.30	Trace
Zircon, zrn	$ZrSiO_4$	4.65	Trace
Chalcopyrite, ccp	$CuFeS_2$	4.20	Trace
Bornite, bn	Cu_5FeS_4	5.09	Trace

1 Visual estimate of abundance is approximate: Trace < 2% · Minor > 2% < 10% · Major > 10% · Major+ > 50%.

Sample summary

Sample ALCD-001

- The sample represents a phaneritic granodiorite composed of plagioclase feldspar, quartz, alkali feldspar, amphibole, chlorite and accessory minerals, predominantly titanite. The dominant phase in the sample is feldspar, predominantly plagioclase, characterised by its polysynthetic twinning, with a minor amount of alkali feldspar. Feldspar crystals are coarse and tabular, moderately to pervasively sericitised, with some mica crystals reaching up to 100 µm. This is commonly replaced by granular epidote crystals. Quartz is a major component of the sample and typically appears unaltered. Rarely it is cross-cut by fine epidote or calcite veinlets or contains very fine needles of rutile. Amphibole in this sample, probably hornblende is sub- to anhedral. It is characterised by a diamond shaped cleavage and in some instances is partially to completely replaced by chlorite. Some completely replaced amphibole crystals show very fine, euhedral epidote crystals within chlorite, aligned exactly in the diamond shaped cleavage direction. There are rare instances of more flaky chlorite, which appears to completely overprint earlier biotite crystals, however there is no relict biotite present in the sample. Rare calcite-epidote veinlets were observed in association to chlorite alteration. Titanite is an accessory phase, usually subhedral, interstitial with feldspar and amphibole crystals, rarely containing opaque phases. Epidote is commonly present as fine, granular agglomerations of ~20 µm crystals, sometimes within veinlets, with some crystals reaching up to 200 µm. There are other rare accessory minerals which include goethite, ilmenite, commonly intergrown with hematite and nearly euhedral zircon.
- The alteration assemblage includes sericitisation of feldspar crystals with further evidence of a weak propylitic alteration exhibited by the presence of epidote/clinozoisite, chlorite and calcite.
- Rare instances of fine (5 - 20µm), disseminated crystals of chalcopyrite and bornite were observed, some in association with titanite and chloritised amphibole.

Photomicrographs

D **Sample ALCD-001**

Photomicrograph of sample showing general texture of granodiorite composed of medium to coarse tabular altered feldspars, unaltered quartz, partially altered amphibole, titanite, with evidence of epidote alteration and sericitisation of feldspars.

Image D
Nikon Microphot-FXA petrological microscope
Cross polarised transmitted light
x25

ALCD-002

Sample as received

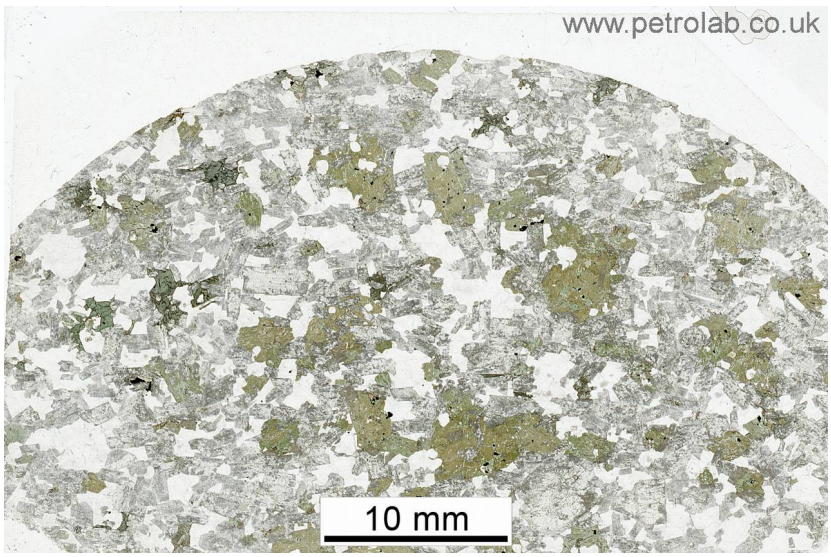
Sample ALCD-002		
Petrolab ID	**Date received**	**Type · properties**
#43573	25/11/2022	Rock core Ø60 mm, half core · 41 g

A **Sample ALCD-002**

Photograph of sample as received (scale in cm).

Image A
Nikon D7000 digital camera
Daylight balanced oblique light

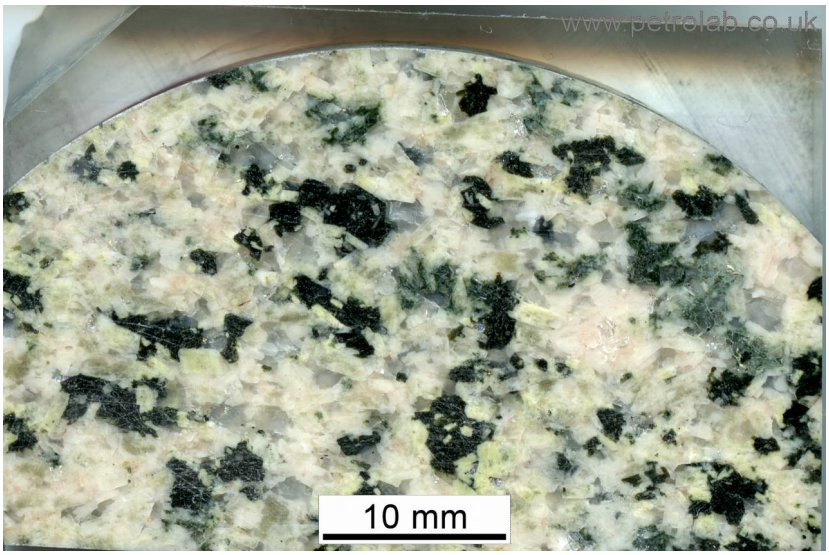
Section(s)



B **Sample ALCD-002**

Low magnification view of sample thin section.

Image B
Epson scanner
White cold cathode light



C **Sample ALCD-002**

Low magnification view of sample polished chip.

Image C
Epson scanner
White cold cathode light

Mineral identification

Sample ALCD-002			
Phase	**Formula**	**≈ s.g.**	**Abundance[1]**
Plagioclase feldspar, pl	$(Na,Ca)(Si,Al)_4O_8$	2.68	Major
Quartz, qz	SiO_2	2.65	Major
Amphibole, amp	$Ca_2[(Mg,Fe^{2+})_4(Al,Fe^{3+})]Si_7AlO_{22}(OH)_2$	3.16	Major
Alkali feldspar, afs	$KAlSi_3O_8$	2.55	Minor
Sericite, ms	Fine-grained white mica alteration product	2.82	Minor
Epidote, ep	$Ca_2(Fe^{3+},Al)_3(SiO_4)_3(OH)$	3.45	Minor
Clinozoisite, czo	$Ca_2Al_3(SiO_4)_3(OH)$	3.34	Trace
Chlorite, chl	$(Mg,Al,Fe^{2+})_{12}(Si,Al)_8O_{20}(OH)_8$	2.65	Trace
Titanite (sphene), ttn	$CaTiSiO_5$	3.55	Trace
Goethite, gth	$FeOOH$	4.27	Trace
Ilmenite, ilm	$Fe^{2+}TiO_3$	4.79	Trace
Hematite, hem	Fe_2O_3	5.30	Trace
Zircon, zrn	$ZrSiO_4$	4.65	Trace
Calcite, cal	$CaCO_3$	2.71	Trace
Chalcopyrite, ccp	$CuFeS_2$	4.20	Trace

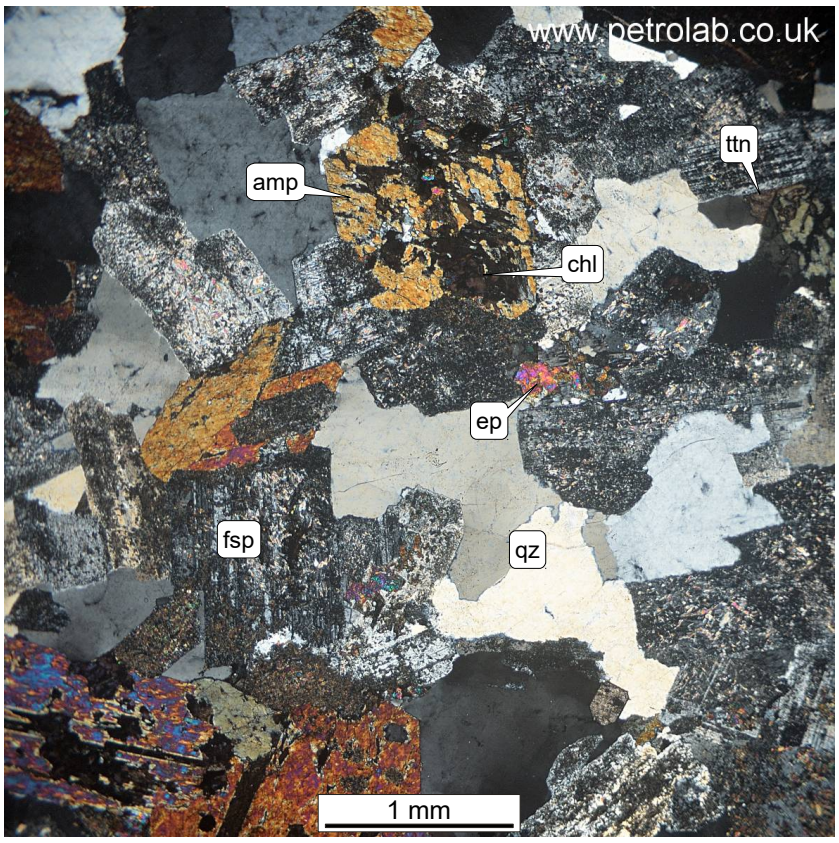
1 Visual estimate of abundance is approximate: Trace < 2% · Minor > 2% < 10% · Major > 10% · Major+ > 50%.

Sample summary

Sample ALCD-002

- The sample represents a phaneritic granodiorite composed of plagioclase feldspar, quartz, alkali feldspar, amphibole, chlorite and accessory minerals, predominantly titanite. The dominant phase in the sample is feldspar, predominantly plagioclase, characterised by its polysynthetic twinning, with a minor amount of alkali feldspar. Feldspar crystals are coarse and tabular, moderately to pervasively sericitised, with some mica crystals reaching up to 150 µm. This is commonly overprinted by granular epidote crystals. Quartz is a major component of the sample and typically appears unaltered. Rarely it is cross-cut by fine epidote or calcite veinlets. Amphibole in this sample, probably hornblende is sub- to anhedral, characterised by its two directions, diamond shaped cleavage is slightly to nearly completely replaced by chlorite. There are rare instances of more flaky chlorite, which appears to completely overprint biotite crystals, however there is no relict biotite present in the sample. Titanite is the most common accessory phase, usually subhedral, interstitial with feldspar and amphibole crystals. Epidote is commonly present as fine, granular agglomerations of ~20 µm crystals, sometimes veinlets, with some crystals reaching up to 450 µm. There are other rare accessory minerals which include goethite and ilmenite, commonly intergrown with hematite and nearly euhedral zircon.
- The alteration assemblage includes sericitisation of feldspar crystals with further evidence of a weak propylitic alteration, exhibited by the presence of epidote/clinozoisite, chlorite and calcite.
- Rare instances of fine (5 - 20µm), disseminated crystals of chalcopyrite were observed.

Photomicrographs



D **Sample ALCD-002**

Photomicrograph of sample showing general texture of granodiorite composed of medium to coarse quartz, amphibole, partially altered to chlorite, altered feldspar and titanite, with further evidence of epidote alteration and sericitisation.

Image D
Nikon Microphot-FXA petrological microscope
Cross polarised transmitted light
x25

ALCD-003

Sample as received

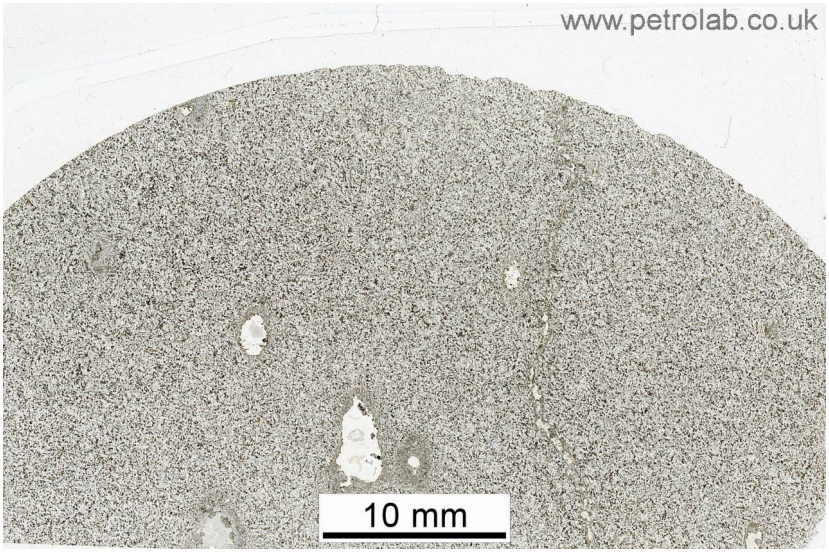
Sample ALCD-003		
Petrolab ID	**Date received**	**Type · properties**
#43574	25/11/2022	Rock core Ø60 mm, half core · 50 g

A **Sample ALCD-003**

Photograph of sample as received (scale in cm).

Image A
Nikon D7000 digital camera
Daylight balanced oblique light

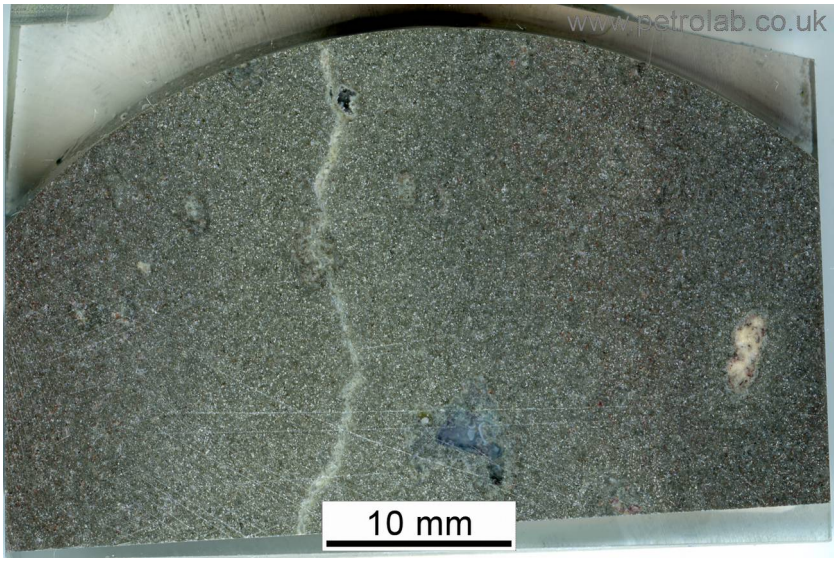
Section(s)



B **Sample ALCD-003**

Low magnification view of sample thin section.

Image B
Epson scanner
White cold cathode light



C **Sample ALCD-003**

Low magnification view of sample polished chip.

Image C
Epson scanner
White cold cathode light

Mineral identification

Sample ALCD-003			
Phase	**Formula**	**≈ s.g.**	**Abundance[1]**
Plagioclase feldspar, pl	$(Na,Ca)(Si,Al)_4O_8$	2.68	Major+
Calcite, cal	$CaCO_3$	2.70	Major
Limonite (goethite), gth	$Fe^{3+}O(OH)$	3.80	Minor
Microcrystalline quartz, Mqz	SiO_2	2.65	Trace
Pyrite, py	FeS_2	5.01	Trace

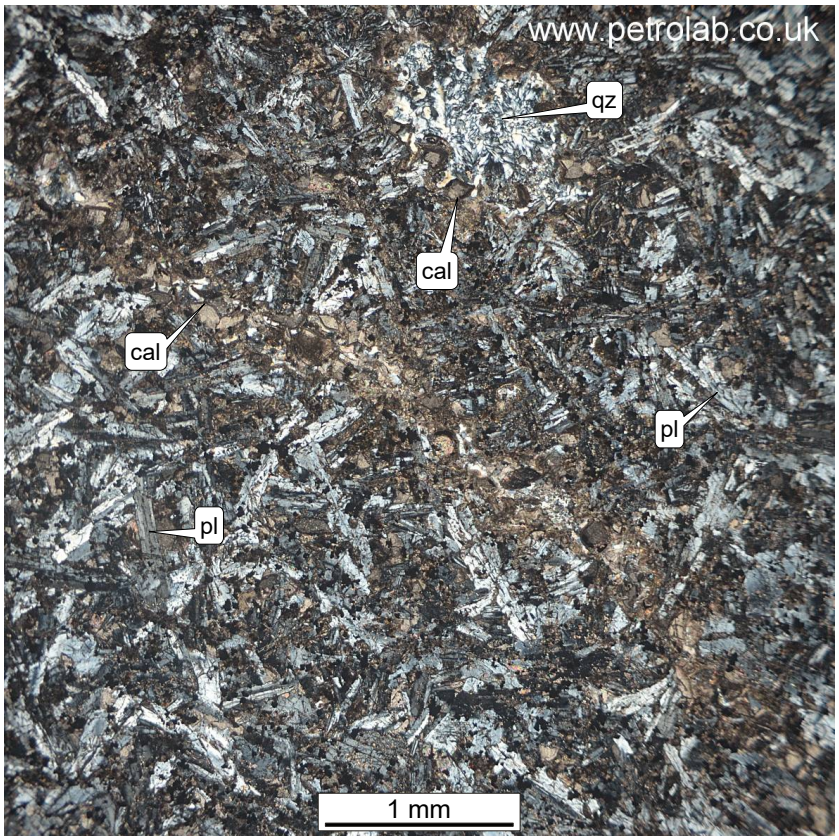
Sample summary

Sample ALCD-003

- The sample represents aphanitic basalt, composed predominantly of plagioclase feldspar, with common calcite replacement and remnants of iron oxy-hydroxides and other opaque phases. The sample contains a few larger vesicles and one main quartz-calcite vein that cross-cuts the sample. The calcite frequently formed an euhedral to subhedral lining on the vein, with some rhombic growths indicating that dolomite might also be present. Plagioclase feldspars, showing characteristic polysynthetic twinning are unaltered, however commonly replaced by patchy calcite, and rarely cut by very fine calcite veinlets. There are visible common, disseminated oxy-hydroxides, possibly goethite, interlocked between plagioclase crystals. They may represent remnants of iddingsite alteration after olivine, which are now partially to completely replaced by calcite. Rare secondary filled vesicles were observed, usually containing coarse calcite crystals or microcrystalline quartz (chalcedony). The vesicles were usually surrounded by calcite rim and very fine, needle like crystals of quartz.
- Fine (5 - 20µm), disseminated semi-euhedral pyrite crystals were observed, some partially oxidised to goethite.

1 Visual estimate of abundance is approximate: Trace < 2% · Minor > 2% < 10% · Major > 10% · Major+ > 50%.

Photomicrographs



D **Sample ALCD-003**

Photomicrograph of sample showing general texture of basalt composed of abundant plagioclase feldspar, with patchy calcite replacement and calcite veining, also containing microcrystalline quartz filled vesicle.

Image D

Nikon Microphot-FXA petrological microscope

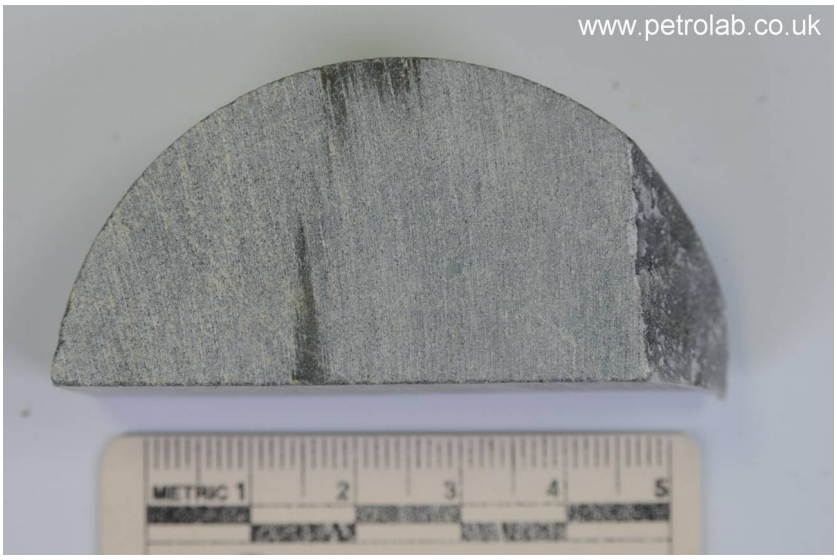
Cross polarised transmitted light

x25

ALCD-004

Sample as received

Sample ALCD-004		
Petrolab ID	**Date received**	**Type · properties**
#43575	25/11/2022	Rock core Ø60 mm, half core · 66 g

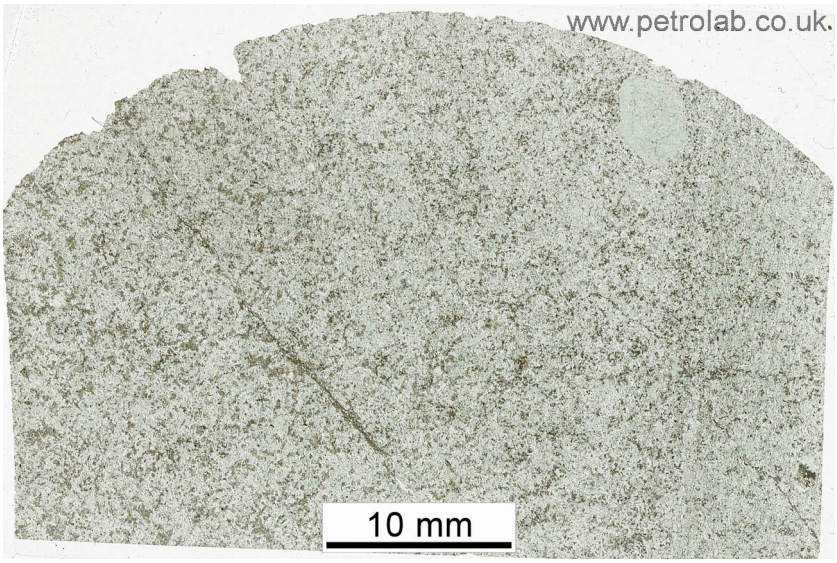


A **Sample ALCD-004**

Photograph of sample as received (scale in cm).

Image A
Nikon D7000 digital camera
Daylight balanced oblique light

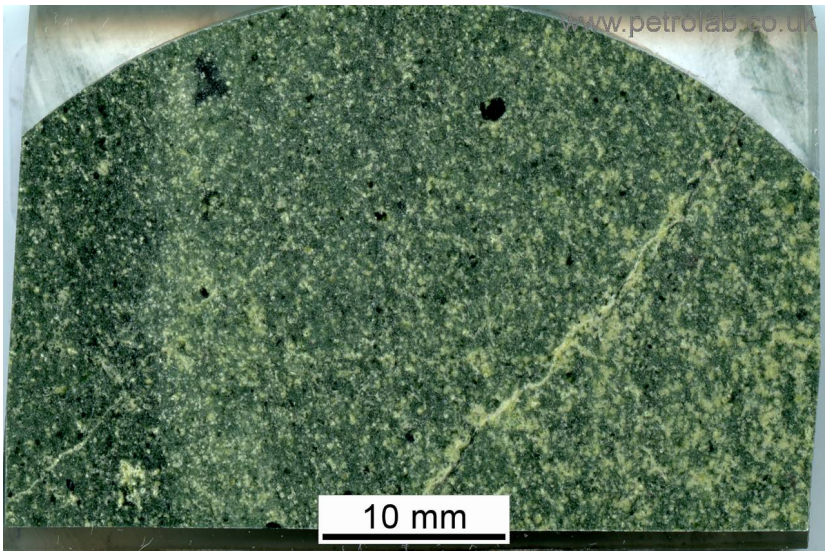
Section(s)



B **Sample ALCD-004**

Low magnification view of sample thin section.

Image B
Epson scanner
White cold cathode light



C **Sample ALCD-004**

Low magnification view of sample thin section.

Image C
Epson scanner
White cold cathode light

Mineral identification

Sample ALCD-004			
Phase	**Formula**	**≈ s.g.**	**Abundance[1]**
Plagioclase feldspar, pl	$(Na,Ca)(Si,Al)_4O_8$	2.68	Major
Chlorite, chl	$(Mg,Al,Fe^{2+})_{12}(Si,Al)_8O_{20}(OH)_8$	2.65	Major
Epidote, ep	$Ca_2(Fe^{3+},Al)_3(SiO_4)_3(OH)$	3.45	Minor
Calcite, cal	$CaCO_3$	2.70	Minor
Quartz, qz	SiO_2	2.65	Trace
Clinozoisite, czo	$Ca_2Al_3(SiO_4)_3(OH)$	3.34	Trace
Pyrite, py	FeS_2	5.01	Trace
Covellite, cv	CuS	4.68	Trace
Chalcocite, cc	Cu_2S	6.46	Trace
Bornite, bn	Cu_5FeS_4	5.09	Trace
Chalcopyrite, ccp	$CuFeS_2$	4.20	Trace

Sample summary

Sample ALCD-004

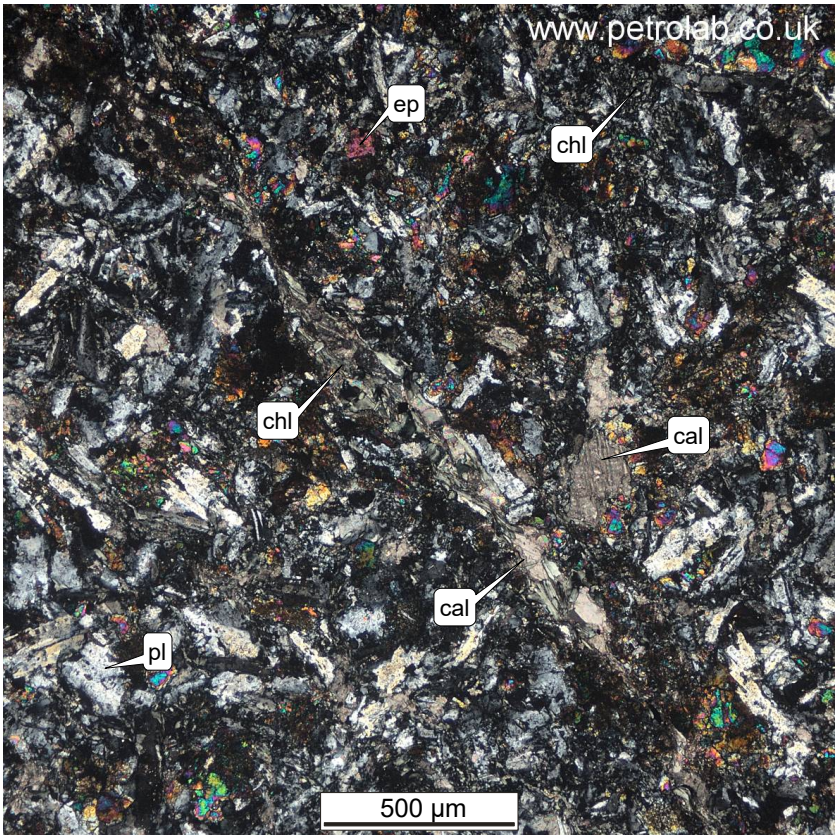
- The sample represents aphanitic rock composed of fine, tabular plagioclase and abundant patchy chloritic alteration, which gives it green colour macroscopically. The sample could potentially be a basalt, however due to the abundant alteration it is difficult to define the sample protolith with complete certainty. Plagioclase is commonly replaced by fine grained chlorite and granular epidote. There are some rare calcite-chlorite veinlets, that cross-cut the sample. Patchy carbonate was also observed within larger chlorite patches and throughout the sample. Very rare quartz filled vesicles were observed, but not enough to constitute a silicification overprint.
- The alteration assemblage is typical of propylitic alteration, which includes epidote/clinozoisite, chlorite and calcite that overprint the original rock texture.
- Rare, disseminated clusters of Cu sulphides were observed, typically < 20µm. The association typically included pyrite, chalcocite and covellite. Rare instances of bornite in association with

1 Visual estimate of abundance is approximate: Trace < 2% · Minor > 2% < 10% · Major > 10% · Major+ > 50%.

Sample ALCD-004

covellite were encountered.

Photomicrographs



D **Sample ALCD-004**

Photomicrograph of sample showing general texture of basalt composed of abundant plagioclase feldspar, with patchy calcite replacement and calcite/chlorite vein, also containing some major epidote alteration.

Image D
Nikon Microphot-FXA petrological microscope
Cross polarised transmitted light
x50

E **Sample ALCD-004**

Photomicrograph showing a particle composed of intergrown pyrite and chalcocite, partially altered to covellite, with some smaller disseminated grains of chalcocite and chalcopyrite, locked within the general rock texture.

Image E
Nikon Microphot-FXA petrological microscope
Plane polarised reflected light
x400

ALCD-005

Sample as received

Sample ALCD-005		
Petrolab ID	**Date received**	**Type · properties**
#43576	25/11/2022	Rock core Ø60 mm, half core · 58 g

A **Sample ALCD-005**

Photograph of sample as received (scale in cm).

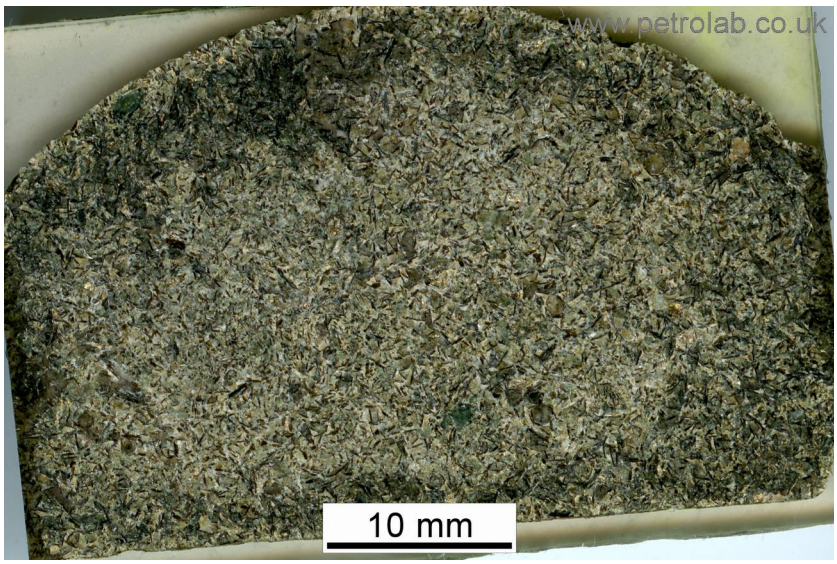
Image A
Nikon D7000 digital camera
Daylight balanced oblique light

Section(s)

B **Sample ALCD-005**

Low magnification view of sample thin section.

Image B
Epson scanner
White cold cathode light



C **Sample ALCD-005**

Low magnification view of sample polished chip.

Image C
Epson scanner
White cold cathode light

Mineral identification

Sample ALCD-005			
Phase	**Formula**	**≈ s.g.**	**Abundance[1]**
Biotite, bt	$K(Fe,Mg)_3(AlSi_3O_{10})(OH)_2$	3.09	Major
Alkali feldspar, afs	$KAlSi_3O_8$	2.55	Minor
Chlorite, chl	$(Mg,Al,Fe^{2+})_{12}(Si,Al)_8O_{20}(OH)_8$	2.65	Minor
Calcite, cal	$CaCO_3$	2.70	Minor
Amphibole, amp	$Ca_2[(Mg,Fe^{2+})_4(Al,Fe^{3+})]Si_7AlO_{22}(OH)_2$	3.16	Minor
Quartz, qz	SiO_2	2.65	Minor
Microcrystalline quartz, Mqz	SiO_2	2.65	Trace
Rutile, rt	TiO_2	4.25	Trace
Goethite, gth	$Fe^{+++}O(OH)$	3.80	Trace
Pyrite, py	FeS_2	5.01	Trace
Chalcopyrite, ccp	$CuFeS_2$	4.20	Trace

Sample summary

Sample ALCD-005

- The sample is composed of biotite, plagioclase feldspar, alkali feldspar, quartz and calcite with trace remnant amphibole. It probably represents a diorite, which is pervasively altered, leaving the texture of the protolith difficult to define. The biotite in the sample appears to be secondary (hydrothermal), probably after magmatic hornblende, as rare amphibole crystals, some nearly completely replaced by chlorite or biotite were observed. The biotite in the sample consists of coarser laths as well as randomly oriented aggregates of fine-grained biotite (shreddy biotite) Some of biotite is likely to be primary (cf. ALCD-010). There is also visible calcite replacement with patchy calcite crystals randomly distributed through the sample. Rare areas of microcrystalline quartz were observed as local replacement of sample groundmass. Rare goethite occurs in association with some biotite agglomerations.
- The alteration assemblage is typical of potassic alteration, which includes abundant biotite that

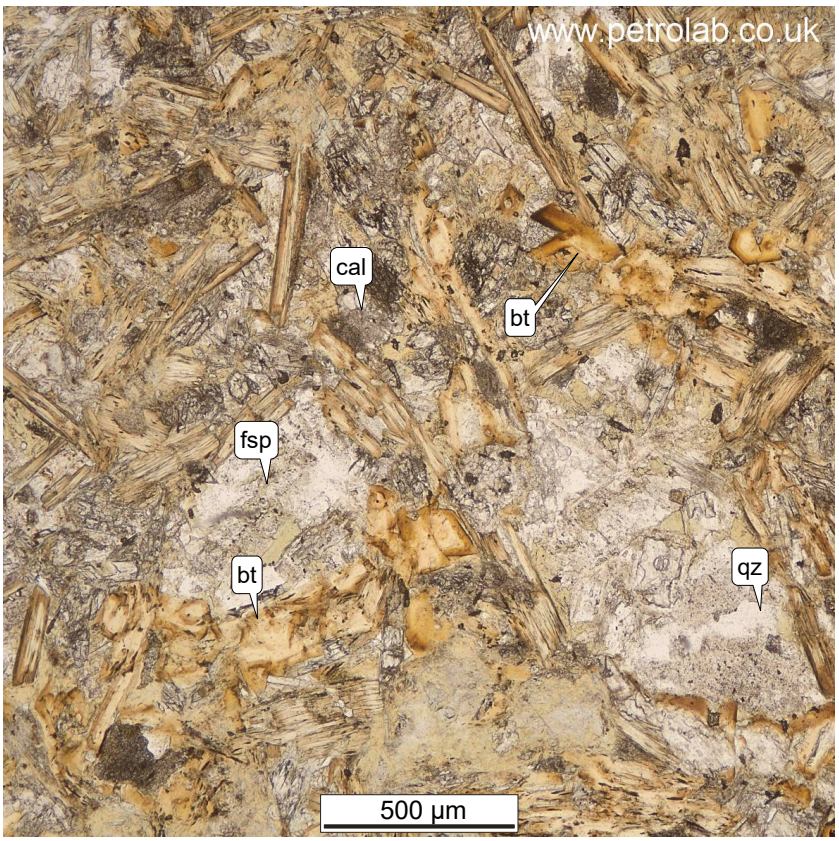
1 Visual estimate of abundance is approximate: Trace < 2% · Minor > 2% < 10% · Major > 10% · Major+ > 50%.

Sample ALCD-005

overprints the original rock texture.

- Very rare instances of fine (<5µm) pyrite and chalcopyrite were observed.

Photomicrographs



D **Sample ALCD-005**

Photomicrograph of sample showing common hydrothermal biotite with rare calcite replacement of the texture.

Image D

Nikon Microphot-FXA petrological microscope

Cross polarised transmitted light

x50

ALCD-006

Sample as received

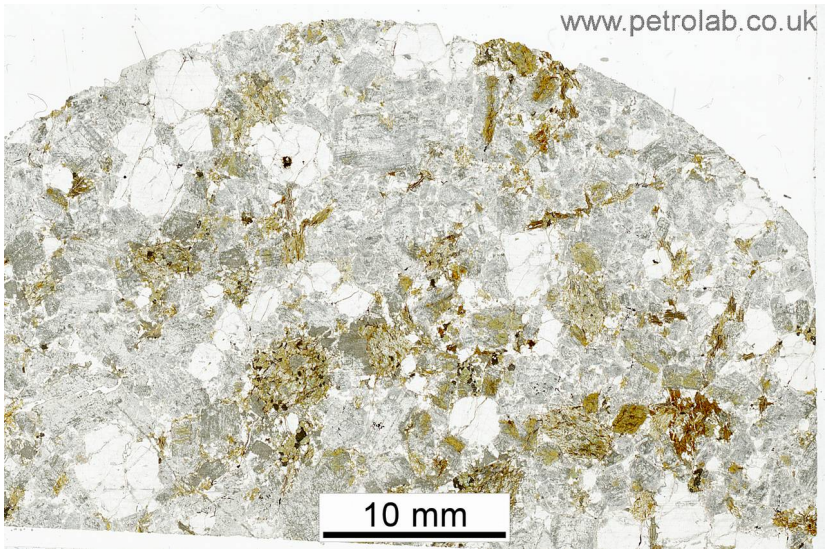
Sample ALCD-006		
Petrolab ID	**Date received**	**Type · properties**
#43577	25/11/2022	Rock core Ø60 mm, half core · 58 g

A **Sample ALCD-006**

Photograph of sample as received (scale in cm).

Image A
Nikon D7000 digital camera
Daylight balanced oblique light

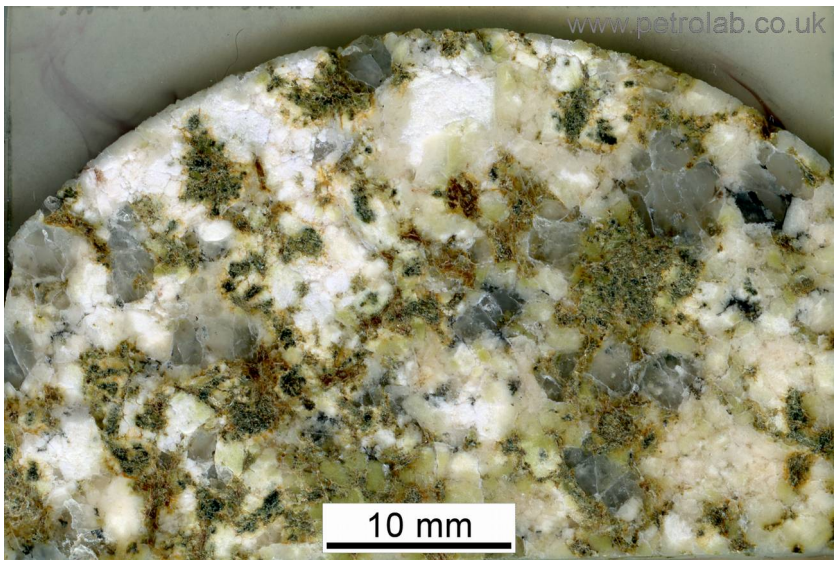
Section(s)



B **Sample ALCD-006**

Low magnification view of sample thin section.

Image B
Epson scanner
White cold cathode light



C **Sample ALCD-006**

Low magnification view of sample thin section.

Image C
Epson scanner
White cold cathode light

Mineral identification

Sample ALCD-006			
Phase	**Formula**	**≈ s.g.**	**Abundance[1]**
Plagioclase feldspar, pl	$(Na,Ca)(Si,Al)_4O_8$	2.68	Major
Alkali feldspar, afs	$KAlSi_3O_8$	2.55	Major
Quartz, qz	SiO_2	2.65	Major
Amphibole, amp	$Ca_2[(Mg,Fe^{2+})_4(Al,Fe^{3+})]Si_7AlO_{22}(OH)_2$	3.16	Minor
Epidote, ep	$Ca_2(Fe^{3+},Al)_3(SiO_4)_3(OH)$	3.45	Minor
Biotite, bt	$K(Fe,Mg)_3(AlSi_3O_{10})(OH)_2$	3.09	Minor
Chlorite, chl	$(Mg,Fe^{2+})_5Al(Si_3Al)O_{10}(OH)_8$	2.65	Minor
Sericite, ms	Fine-grained white mica alteration product	2.82	Trace
Apatite, ap	$Ca_5(PO_4)_3F$	3.20	Trace
Titanite (sphene), ttn	$CaTiSiO_5$	3.55	Trace
Zircon, zrn	$ZrSiO_4$	4.85	Trace
Ilmenite, ilm	$Fe^{++}TiO_3$	4.72	Trace
Hematite, hem	Fe_2O_3	5.30	Trace

Sample summary

Sample ALCD-006

- The sample represent a phaneritic granodiorite composed of plagioclase feldspar, quartz, alkali feldspar, amphibole, biotite, chlorite and accessory minerals, predominantly titanite and ilmenite. The dominant phase in the sample is feldspar, predominantly plagioclase, characterised by its polysynthetic twinning, with a major amount of alkali feldspar. Feldspar crystals are coarse and tabular, moderately to pervasively sericitised, with some mica crystals reaching up to 100 µm. This is commonly overprinted by granular epidote. Quartz is a major component of the sample and typically appears unaltered. Rarely it is cross-cut by epidote veinlets. Amphibole in this sample is anhedral and in most cases there is only visible an outline of amphibole crystals,

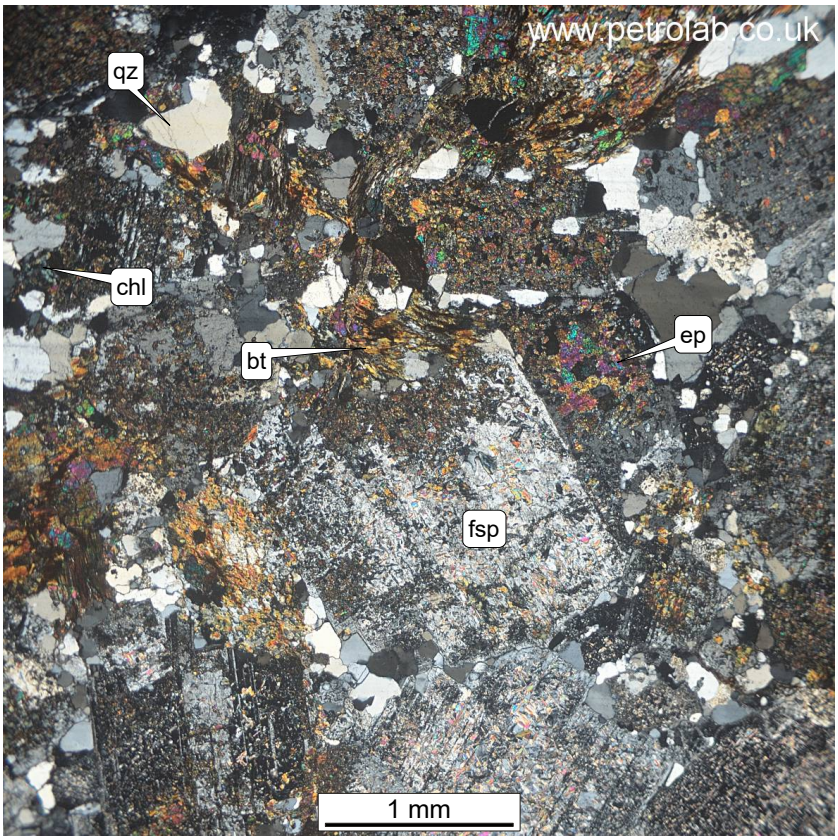
1 Visual estimate of abundance is approximate: Trace < 2% · Minor > 2% < 10% · Major > 10% · Major+ > 50%.

Sample ALCD-006

which are now nearly completely replaced by chlorite, biotite or combination of both phases. The biotite present within the sample is present in several forms, from partial potassic replacement of feldspar to overprinting interstitial alteration or complete pseudomorphic replacement of amphibole. There are also very rare subhedral grains that look original to the protolith. Titanite is an accessory phase, usually subhedral, interstitial with feldspar and amphibole crystals, rarely containing some opaque phases. Epidote is commonly present as fine, granular agglomerations of ~20 µm crystals, sometimes thin veinlets, with some crystals reaching up to 500 µm.

- The alteration includes sericitisation of feldspar crystals, with further alteration assemblage typical of propylitic alteration exhibited by the presence of epidote, chlorite and calcite, with additional evidence of potassic alteration with the partial replacement of feldspars by biotite.
- There are no sulphides present in the sample. There are rare instances of zircon and ilmenite containing small inclusions or unmixings of hematite.

Photomicrographs



D **Sample ALCD-006**

Photomicrograph of sample showing general texture of granodiorite, containing partially altered feldspar crystals with visible fine mica laths on their surface, quartz, biotite, partially altered to chlorite and common epidote replacement.

Image D

Nikon Microphot-FXA petrological microscope

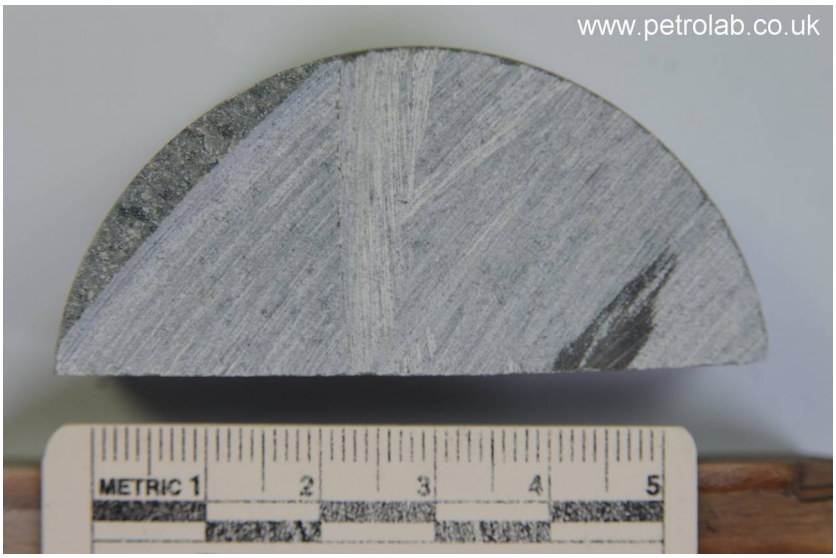
Cross polarised transmitted light

x25

ALCD-007

Sample as received

Sample ALCD-007		
Petrolab ID	**Date received**	**Type · properties**
#43578	25/11/2022	Rock core Ø60 mm, half core · 91 g

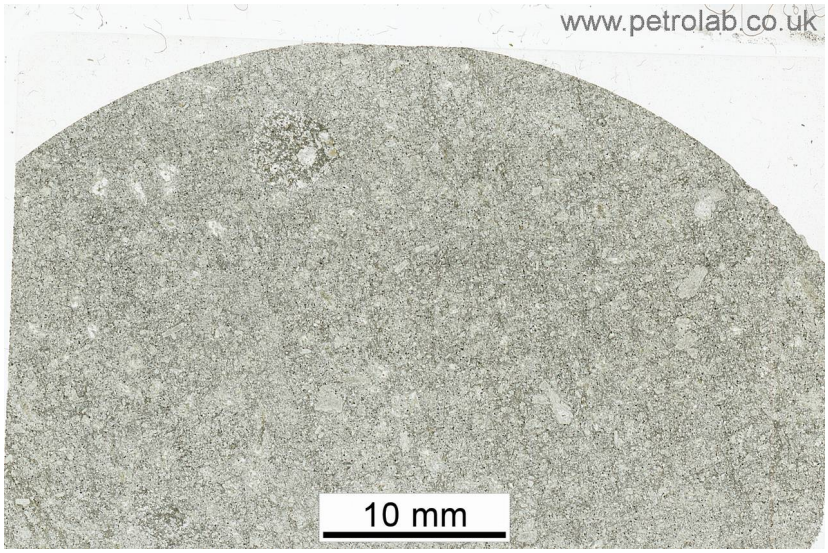


A **Sample ALCD-007**

Photograph of sample as received (scale in cm).

Image A
Nikon D7000 digital camera
Daylight balanced oblique light

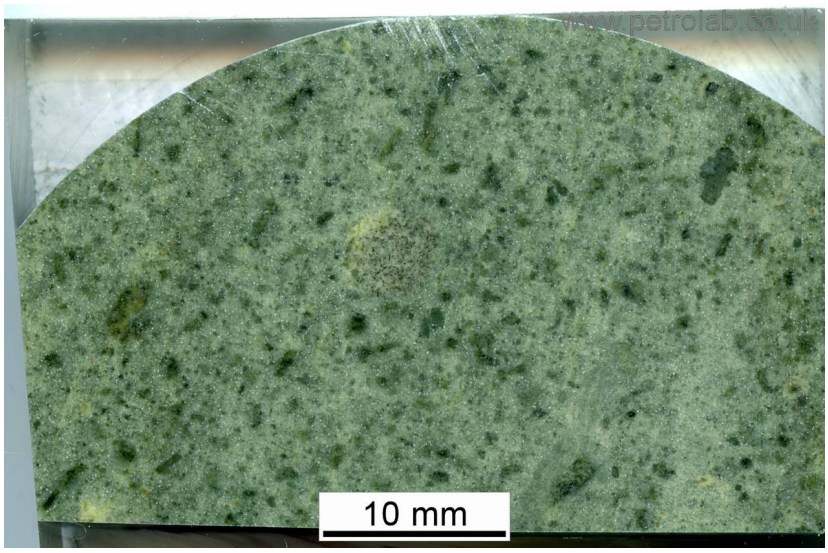
Section(s)



B **Sample ALCD-007**

Low magnification view of sample thin section.

Image B
Epson scanner
White cold cathode light



C **Sample ALCD-007**

Low magnification view of sample polished chip.

Image C
Epson scanner
White cold cathode light

Mineral identification

Sample ALCD-007			
Phase	**Formula**	**≈ s.g.**	**Abundance[1]**
Plagioclase feldspar, pl	$(Na,Ca)(Si,Al)_4O_8$	2.68	Major+
Amphibole, amp	$Ca_2[(Mg,Fe^{2+})_4(Al,Fe^{3+})]Si_7AlO_{22}(OH)_2$	3.16	Minor
Quartz, qz	SiO_2	2.65	Minor
Chlorite, chl	$(Mg,Fe^{2+})_5Al(Si_3Al)O_{10}(OH)_8$	2.65	Minor
Epidote, ep	$Ca_2(Fe^{3+},Al)_3(SiO_4)_3(OH)$	3.45	Minor
Calcite, cal	$CaCO_3$	2.70	Trace
Goethite, gth	$Fe^{+++}O(OH)$	3.80	Trace
Hematite, hem	Fe_2O_3	5.30	Trace
Chalcopyrite, ccp	$CuFeS_2$	4.19	Trace
Pyrite, py	FeS_2	5.01	Trace
Covellite, cv	CuS	4.68	Trace
Bornite, bn	Cu_5FeS_4	5.09	Trace
Chalcocite, cc	Cu_2S	5.65	Trace

Sample summary

Sample ALCD-007

- The sample is composed of fine tabular plagioclase and abundant chloritic and epidote alterations, which gives it green colour macroscopically. Within the fine groundmass of plagioclase, there are coarser phenocrysts of amphiboles, nearly to pervasively altered to chlorite, with the remaining outlines of their original habits. The sample could potentially represent an igneous rock with porphyritic texture, however due to the abundant alterations and overprinted texture it is difficult to define the rock protolith. Plagioclase appears unaltered, however is commonly replaced by fine grained chlorite and granular epidote. There are some rare calcite-chlorite veinlets, cross-cutting the sample. Patchy carbonate was also observed

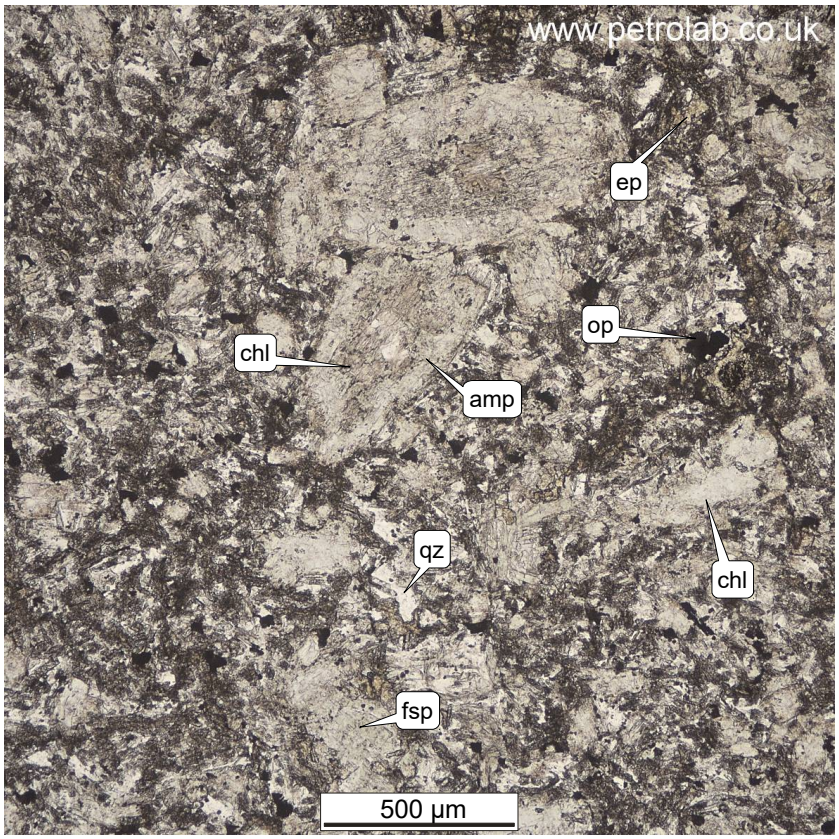
1 Visual estimate of abundance is approximate: Trace < 2% · Minor > 2% < 10% · Major > 10% · Major+ > 50%.

Sample ALCD-007

randomly distributed throughout the sample. Rare vug shaped voids are filled with secondary quartz, and quartz itself appears to represent a weak silicification overprint that has irregularly overprinted parts of the section.

- The alteration assemblage is typical of propylitic alteration, which includes the presence of epidote, chlorite and calcite replacement. A weak silicification overprint is also observed.
- Disseminated crystals of chalcopyrite and pyrite were observed, typically < 5µm. Rare instances of larger chalcopyrite crystals, chalcopyrite partially altered to bornite or covellite, and chalcocite altered by covellite were encountered. Nearly cubic goethite was observed, which could potentially represent pseudomorphs after earlier pyrite crystals. There were also very rare instances of hematite.

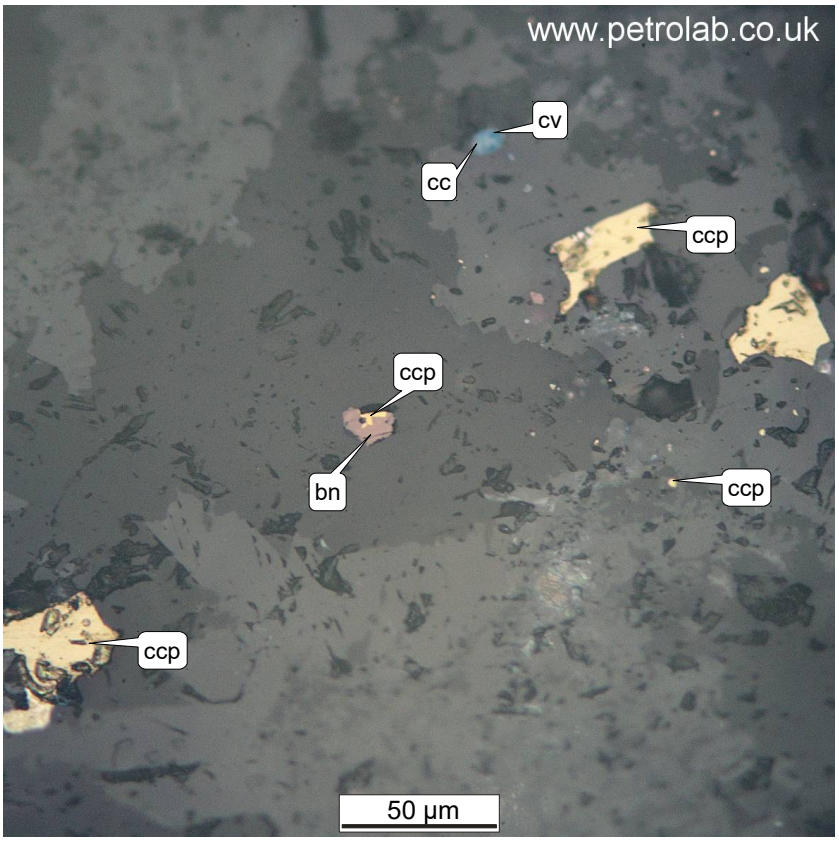
Photomicrographs



D **Sample ALCD-007**

Photomicrograph of sample showing general texture of the rock that has been pervasively altered. In the view visible common epidote alteration and chloritisation of amphibole crystals, with only outlines of the original crystals.

Image D
Nikon Microphot-FXA petrological microscope
Plane polarised transmitted light
x50



E **Sample ALCD-007**

Higher magnification image showing disseminated crystals of chalcopyrite, some altered to bornite and covellite and chalcocite.

Image E
Nikon Microphot-FXA petrological microscope
Plane polarised reflected light
x400

ALCD-008

Sample as received

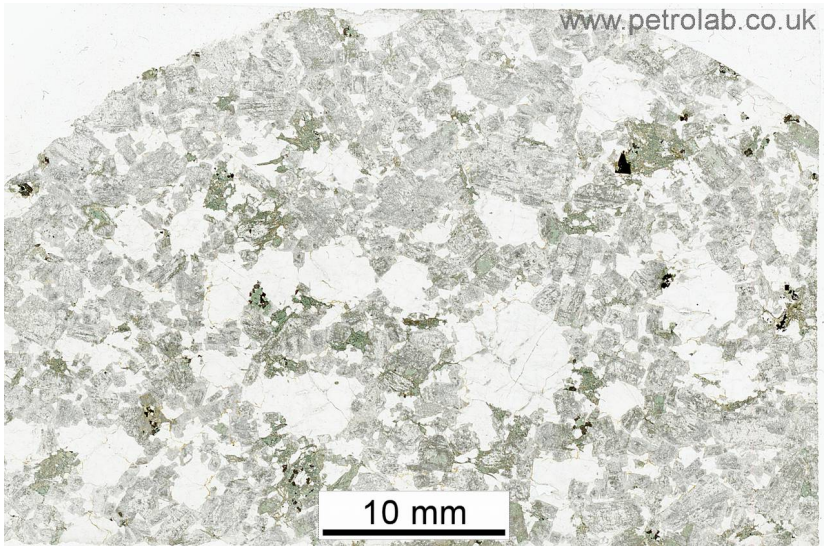
Sample ALCD-008		
Petrolab ID	**Date received**	**Type · properties**
#43579	25/11/2022	Rock core Ø60 mm, half core · 84 g

A **Sample ALCD-008**

Photograph of sample as received (scale in cm).

Image A
Nikon D7000 digital camera
Daylight balanced oblique light

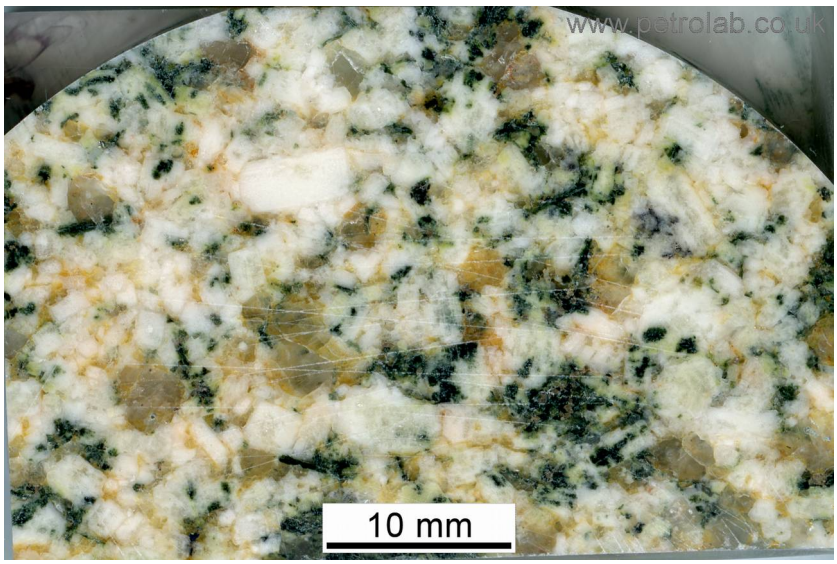
Section(s)



B **Sample ALCD-008**

Low magnification view of sample thin section.

Image B
Epson scanner
White cold cathode light



C **Sample ALCD-008**

Low magnification view of sample polished chip.

Image C
Epson scanner
White cold cathode light

Mineral identification

Sample ALCD-008			
Phase	**Formula**	**≈ s.g.**	**Abundance[1]**
Plagioclase feldspar, pl	$(Na,Ca)(Si,Al)_4O_8$	2.68	Major
Quartz, qz	SiO_2	2.65	Major
Alkali feldspar, afs	$KAlSi_3O_8$	2.55	Minor
Chlorite, chl	$(Mg,Al,Fe^{2+})_{12}(Si,Al)_8O_{20}(OH)_8$	2.65	Minor
Epidote, ep	$Ca_2(Fe^{3+},Al)_3(SiO_4)_3(OH)$	3.45	Minor
Sericite, ms	Fine-grained white mica alteration product	2.82	Trace
Calcite, cal	$CaCO_3$	2.70	Trace
Clinozoisite, czo	$Ca_2Al_3(SiO_4)_3(OH)$	3.34	Trace
Titanite (sphene), ttn	$CaTiSiO_5$	3.55	Trace
Limonite (goethite), gth	$Fe^{3+}O(OH)$	3.80	Trace
Chalcopyrite, ccp	$CuFeS_2$	4.20	Trace
Bornite, bn	Cu_5FeS_4	5.09	Trace
Covellite, cv	CuS	4.68	Trace
Chalcocite, cc	Cu_2S	6.46	Trace
Hematite, hem	Fe_2O_3	5.30	Trace
Ilmenite, ilm	$Fe^{2+}TiO_3$	4.79	Trace
Pyrite, py	FeS_2	5.01	Trace

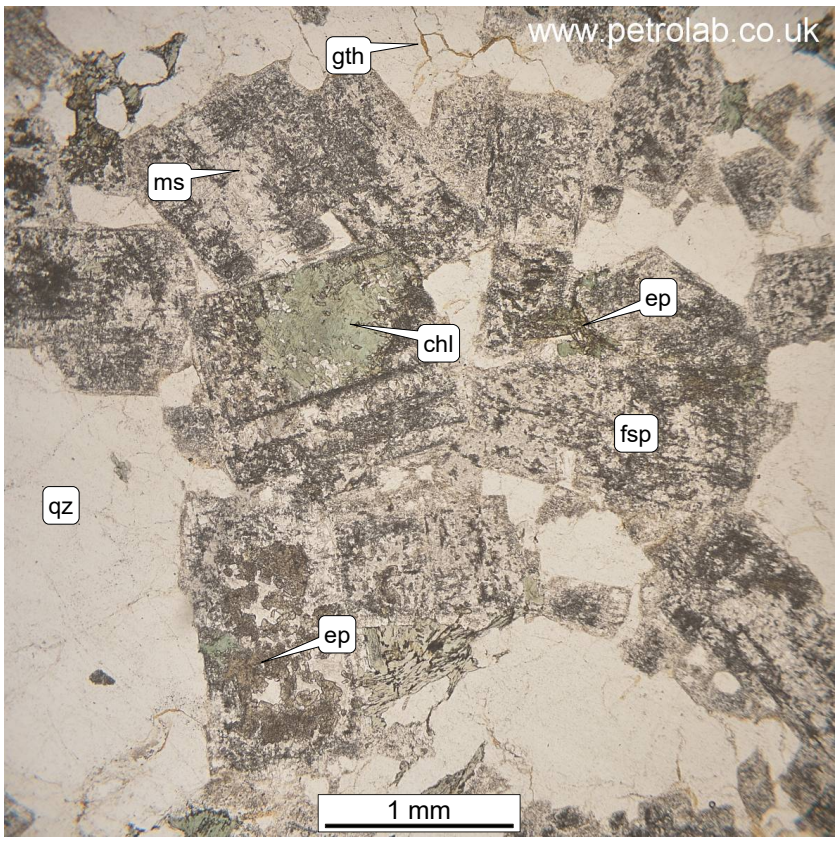
1 Visual estimate of abundance is approximate: Trace < 2% · Minor > 2% < 10% · Major > 10% · Major+ > 50%.

Sample summary

Sample ALCD-008

- The sample represents a phaneritic granodiorite composed of plagioclase feldspar, quartz, alkali feldspar, chlorite and accessory minerals, predominantly titanite. The dominant phase in the sample is plagioclase feldspar, characterised by its polysynthetic twinning, with a minor amount of alkali feldspar. Feldspar crystals are coarse and tabular, slightly to pervasively sericitised, with some mica crystals reaching up to 200 µm. This is commonly overprinted by granular epidote crystals replacing their original crystal habits. Quartz is a major component of the sample and typically appears unaltered. Rarely it is cross cut by fine goethite/limonite veinlets. Amphibole in this sample is completely replaced by chlorite. There are rare instances of more flaky chlorite, which appears to completely overprint biotite crystals, however there is no relict biotite present in the sample. Titanite is an accessory phase, usually subhedral, interstitial with feldspar and chlorite. Epidote is commonly present as fine, granular agglomerations of ~20 µm crystals, sometimes veinlets, with some crystals reaching up to 500 µm. Epidote and chlorite are strongly associated with each other, which reflects their origin through propylitic alteration. Rare, patchy calcite replacement was present, scattered irregularly across the sample. There are other rare accessory minerals which include ilmenite, some containing inclusions of hematite. Thin limonite/goethite outlines of some quartz crystals were observed.
- The alteration includes sericitisation of feldspar crystals, with further evidence of the alteration assemblage typical of propylitic alteration exhibited by the presence of epidote/clinozoisite, chlorite and calcite replacement.
- Rare cubic pyrite crystals were observed, some were partially oxidised and contained goethite rims. Disseminated Cu sulphides are present as fine crystals of chalcopyrite, covellite and chalcocite, with some occurring in associations including chalcopyrite, bornite and covellite.

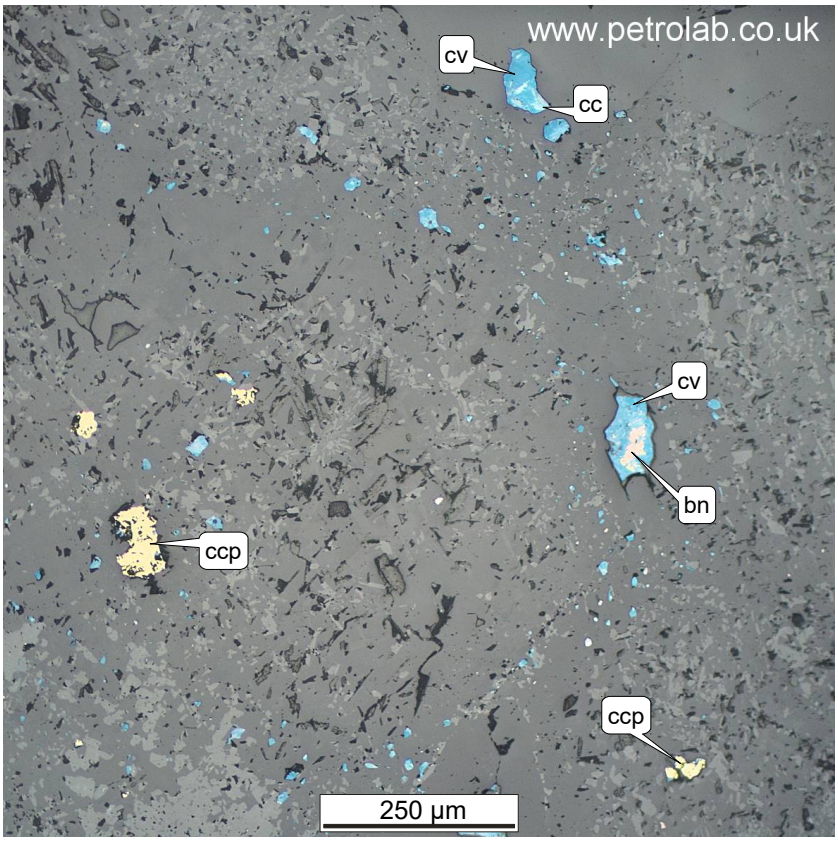
Photomicrographs



D **Sample ALCD-008**

Photomicrograph of sample showing general texture of granodiorite, with sericitised feldspar crystals, patchy epidote alteration and chlorite replacement. There are also visible thin goethite/limonite veinlets, usually visible at some crystal boundaries.

Image D
Nikon Microphot-FXA petrological microscope
Plane polarised transmitted light
x400



E **Sample ALCD-008**

Photomicrograph showing disseminated Cu sulphides including, chalcopyrite. covellite, chalcocite and bornite, with some containing a mixture of multiple Cu phases.

Image E

Nikon Microphot-FXA petrological microscope

Plane polarised reflected light

x100

ALCD-009

Sample as received

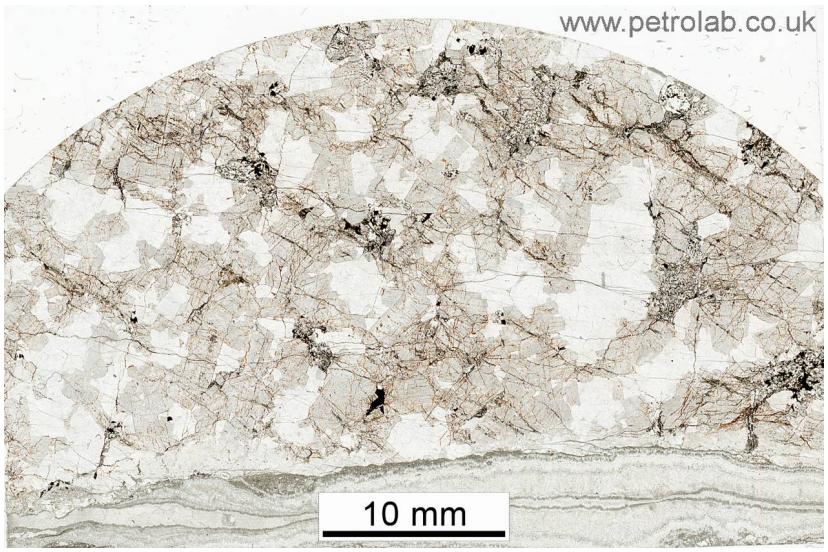
Sample ALCD-009		
Petrolab ID	**Date received**	**Type · properties**
#43580	25/11/2022	Rock core Ø60 mm, half core · 62 g

A **Sample ALCD-009**

Photograph of sample as received (scale in cm).

Image A
Nikon D7000 digital camera
Daylight balanced oblique light

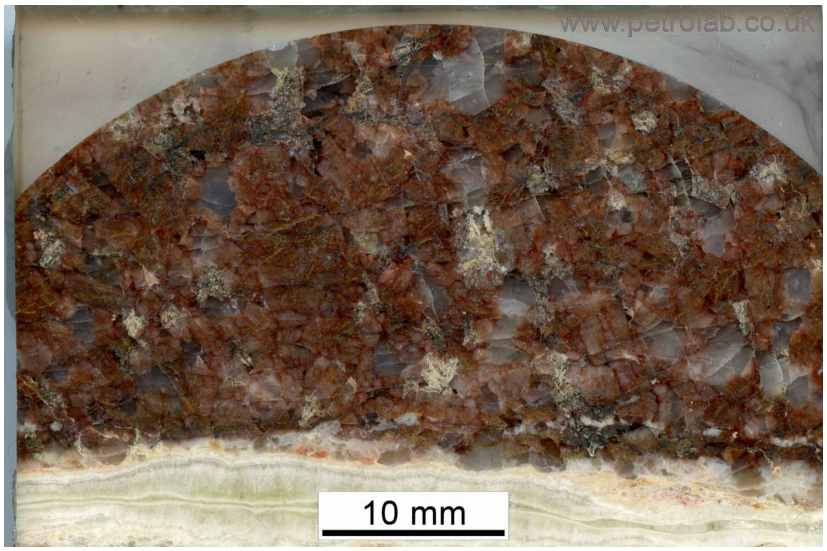
Section(s)



B **Sample ALCD-009**

Low magnification view of sample thin section.

Image B
Epson scanner
White cold cathode light



C **Sample ALCD-009**

Low magnification view of sample polished chip.

Image C
Epson scanner
White cold cathode light

Mineral identification

Sample ALCD-009			
Phase	**Formula**	**≈ s.g.**	**Abundance[1]**
Plagioclase feldspar, pl	$(Na,Ca)(Si,Al)_4O_8$	2.68	Major
Quartz, qz	SiO_2	2.65	Major
Calcite, cal	$CaCO_3$	2.70	Major
Alkali feldspar, afs	$KAlSi_3O_8$	2.55	Minor
Chlorite, chl	$(Mg,Al,Fe^{2+})_{12}(Si,Al)_8O_{20}(OH)_8$	2.65	Minor
Limonite (goethite), gth	$Fe^{3+}O(OH)$	3.80	Trace
Sericite, ms	Fine-grained white mica alteration product	2.82	Trace
Microcrystalline quartz, Mqz	SiO_2	2.65	Trace
Hematite, hem	Fe_2O_3	5.30	Trace
Ilmenite, ilm	$Fe^{2+}TiO_3$	4.79	Trace
Zircon, zrn	$ZrSiO_4$	4.85	Trace

Sample summary

Sample ALCD-009

- The sample represents a phaneritic granodiorite composed of plagioclase feldspar, quartz, alkali feldspar and accessory minerals. The dominant phase in the sample is plagioclase feldspar, characterised by its polysynthetic twinning, with a minor amount of alkali feldspar. Feldspar crystals are coarse and tabular, slightly sericitised, containing fine mica laths. Quartz is a major component of the sample and typically appears unaltered. There is a minor amount of Microcrystalline quartz, after chlorite overprinting earlier mafic minerals. There are no relic biotite, chlorite or amphibole to distinguish the magmatic protolith. Rare zircon crystals were observed. Calcite commonly occurs in the sample as fine, irregular patches across the sample. or as fine veinlets or major veining.
- The sample is severely fractured. There are three main types of veins in the sample. Goethite/limonite veinlets and filled fractures are the most common and cut the sample in no

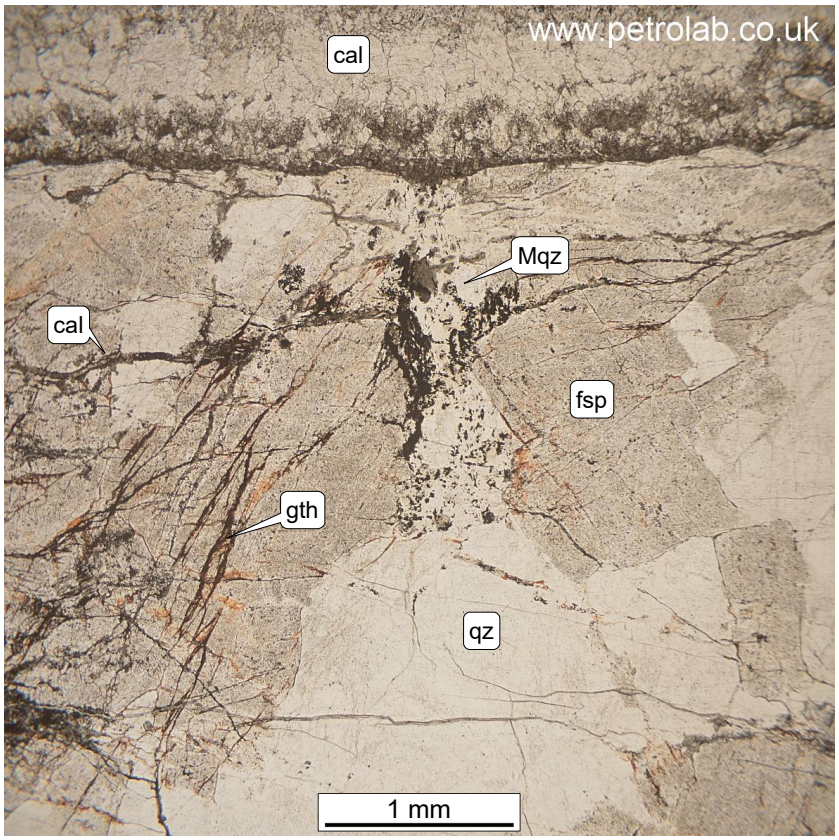
1 Visual estimate of abundance is approximate: Trace < 2% · Minor > 2% < 10% · Major > 10% · Major+ > 50%.

Sample ALCD-009

particular direction. Limonite also occurs at crystal boundaries. This contributes to the brownish red appearance of the sample macroscopically. There are very rare quartz veinlets. There is a main calcite vein, containing some quartz inclusions and smaller quartz veins, with several parallel and branching calcite veinlets within the sample.

- The alteration includes weak sericitisation of feldspar crystals. There is also evidence of minor silicification and calcite replacement.
- Rare skeletal hematite and ilmenite were observed. No sulphide minerals were present.

Photomicrographs



D **Sample ALCD-009**

Photomicrograph showing main calcite vein (top), with numerous calcite and limonite/goethite filled veinlets running across the sample. The fracturing is locally common.

Image D
Nikon Microphot-FXA petrological microscope
Plane polarised transmitted light
x25

ALCD-010

Sample as received

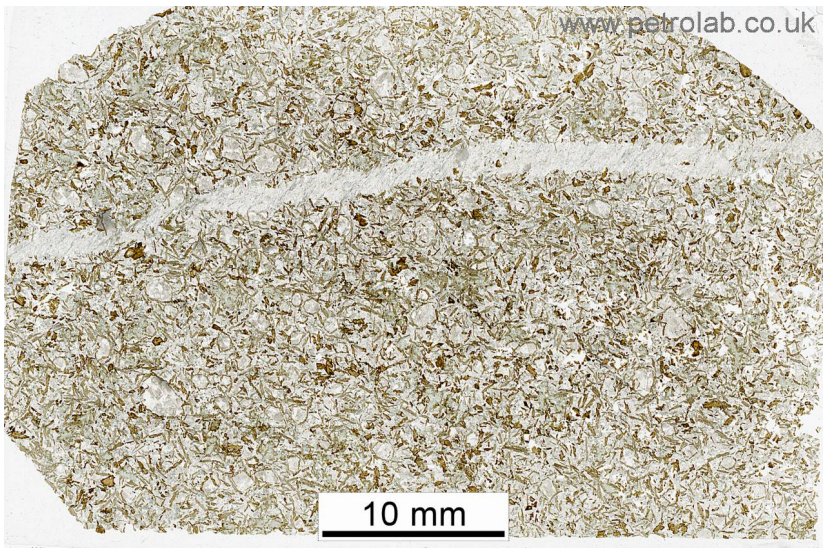
Sample ALCD-010		
Petrolab ID	**Date received**	**Type · properties**
#43581	25/11/2022	Rock core Ø60 mm, half core · 90 g

A **Sample ALCD-010**

Photograph of sample as received (scale in cm).

Image A
Nikon D7000 digital camera
Daylight balanced oblique light

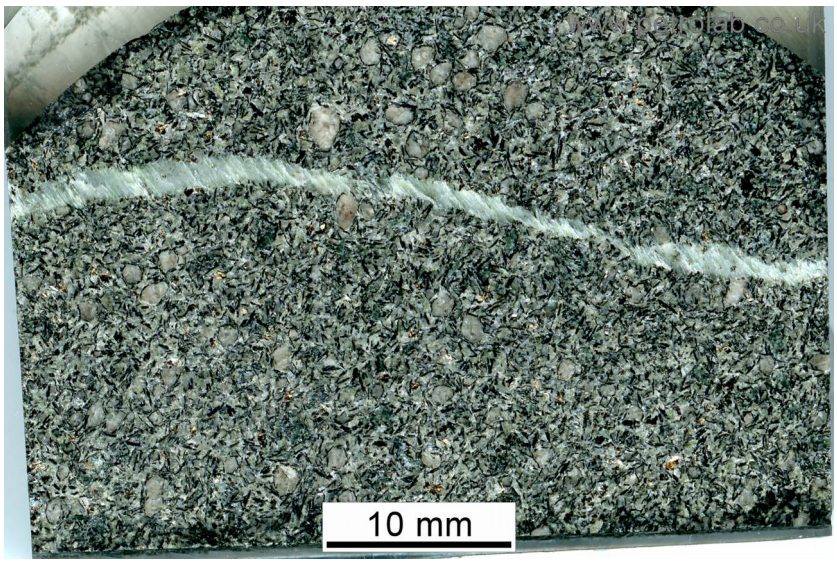
Section(s)



B **Sample ALCD-010**

Low magnification view of sample thin section.

Image B
Epson scanner
White cold cathode light



C **Sample ALCD-010**

Low magnification view of sample polished chip.

Image C
Epson scanner
White cold cathode light

Mineral identification

Sample ALCD-010			
Phase	**Formula**	**≈ s.g.**	**Abundance[1]**
Plagioclase feldspar, pl	$(Na,Ca)(Si,Al)_4O_8$	2.68	Major
Biotite, bt	$K(Fe,Mg)_3(AlSi_3O_{10})(OH)_2$	3.09	Major
Alkali feldspar, afs	$KAlSi_3O_8$	2.55	Minor
Quartz, qz	SiO_2	2.65	Minor
Calcite, cal	$CaCO_3$	2.70	Minor
Apatite, ap	$Ca_5(PO_4)_3F$	3.20	Minor
Chlorite, chl	$(Mg,Al,Fe^{2+})_{12}(Si,Al)_8O_{20}(OH)_8$	2.65	Trace
Epidote, ep	$Ca_2(Fe^{3+},Al)_3(SiO_4)_3(OH)$	3.45	Trace
Pyrite, py	FeS_2	5.01	Trace
Chalcopyrite, ccp	$CuFeS_2$	4.20	Trace

Sample summary

Sample ALCD-010

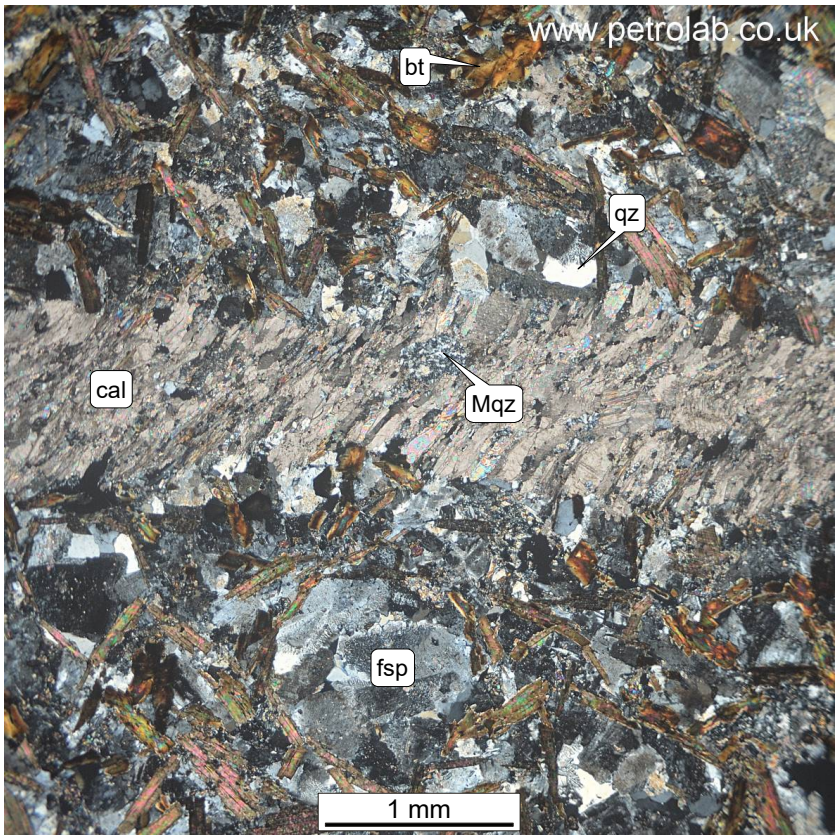
- The sample probably represents a quartz diorite. The sample is composed of plagioclase feldspar, quartz, alkali feldspar, biotite, chlorite and calcite. Feldspars are very slightly sericitised. Some plagioclase feldspars show myrmekitic textures with characteristic vermicular intergrowths of quartz. Quartz is unaltered. Chlorite primarily occurs as the alteration of magmatic amphibole. Biotite appears to be both primary with euhedral habits and secondary (hydrothermal), with secondary biotite often associated with calcite veining. Biotite is partially altered to chlorite. There is a trace, patchy calcite replacement, randomly distributed across the sample. There are also rare crystals of epidote present within the rock texture. One calcite vein cross-cuts the sample.
- The alteration assemblage is typical of potassic alteration, which includes abundant biotite that overprints the original rock texture, with additional evidence of minor sericitisation of feldspars and weak propylitic alteration, which includes the presence of epidote, chlorite and calcite assemblage.

1 Visual estimate of abundance is approximate: Trace < 2% · Minor > 2% < 10% · Major > 10% · Major+ > 50%.

Sample ALCD-010

- Rare, small crystals of pyrite and chalcopyrite were observed, randomly distributed within the sample.

Photomicrographs



D **Sample ALCD-010**

Photomicrograph showing general texture of quartz diorite with common biotite, containing main calcite vein, running through the sample.

Image D
Nikon Microphot-FXA petrological microscope
Cross polarised transmitted light
x25

ALCD-011

Sample as received

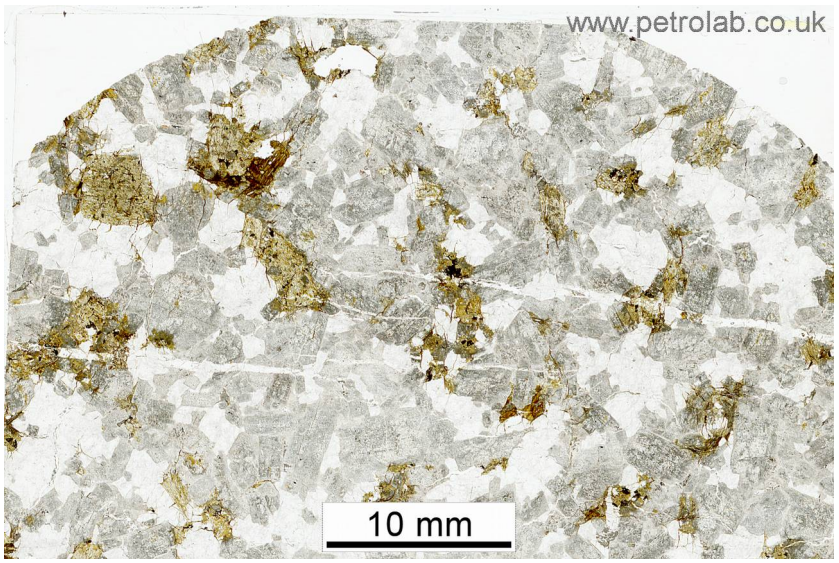
Sample ALCD-011		
Petrolab ID	**Date received**	**Type · properties**
#43582	25/11/2022	Rock core Ø60 mm, half core · 80 g

A **Sample ALCD-011**

Photograph of sample as received (scale in cm).

Image A
Nikon D7000 digital camera
Daylight balanced oblique light

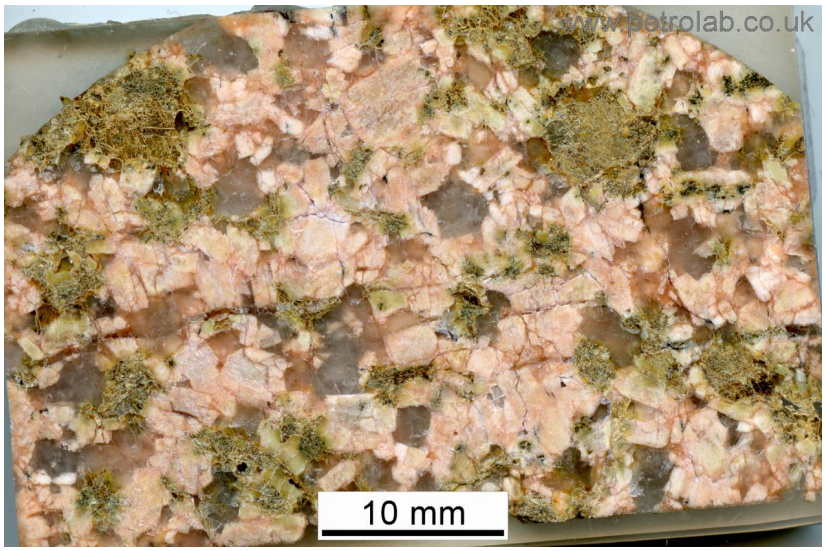
Section(s)



B **Sample ALCD-011**

Low magnification view of sample thin section.

Image B
Epson scanner
White cold cathode light



C **Sample ALCD-011**

Low magnification view of sample thin section.

Image C
Epson scanner
White cold cathode light

Mineral identification

Sample ALCD-011			
Phase	**Formula**	**≈ s.g.**	**Abundance[1]**
Plagioclase feldspar, pl	$(Na,Ca)(Si,Al)_4O_8$	2.68	Major
Quartz, qz	SiO_2	2.65	Major
Alkali feldspar, afs	$KAlSi_3O_8$	2.55	Minor
Biotite, bt	$K(Fe,Mg)_3(AlSi_3O_{10})(OH)_2$	3.09	Minor
Epidote, ep	$Ca_2(Fe^{3+},Al)_3(SiO_4)_3(OH)$	3.45	Minor
Chlorite, chl	$(Mg,Fe^{2+})_5Al(Si_3Al)O_{10}(OH)_8$	2.65	Trace
Sericite, ms	Fine-grained white mica alteration product	2.82	Trace
Titanite (sphene), ttn	$CaTiSiO_5$	3.55	Trace
Calcite, cal	$CaCO_3$	2.70	Trace
Limonite (goethite), gth	$Fe^{3+}O(OH)$	3.80	Trace
Ilmenite, ilm	$Fe^{++}TiO_3$	4.72	Trace
Hematite, hem	Fe_2O_3	5.30	Trace
Apatite, ap	$Ca_5(PO_4)_3F$	3.15	Trace

Sample summary

Sample ALCD-011

- The sample represents a phaneritic granodiorite composed of plagioclase feldspar, quartz, alkali feldspar, biotite, chlorite and accessory minerals, predominantly ilmenite. The dominant phase in the sample is plagioclase feldspar, characterised by its polysynthetic twinning, with a minor amount of alkali feldspar. Feldspar crystals are coarse and tabular, slightly to pervasively sericitised, with some mica crystals reaching up to 100 µm. Several have been partially overprinted by biotite indicative of potassic alteration. In addition, some sericitised feldspar crystals are rarely overprinted by granular epidote crystals that additionally replace their original crystal habits. Quartz is a major component of the sample and typically appears unaltered. It is

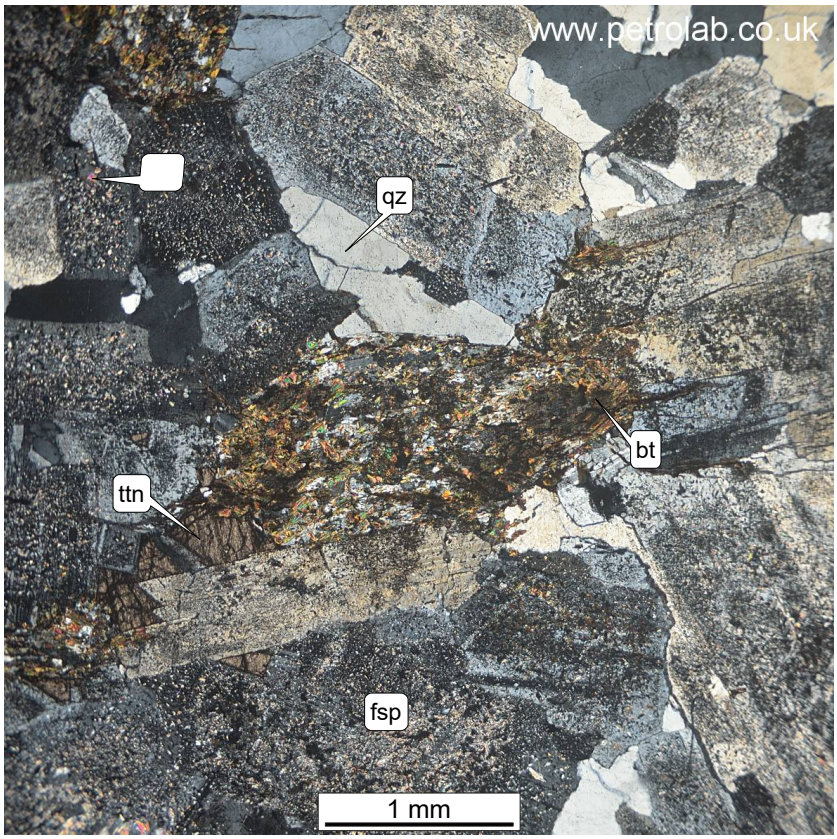
1 Visual estimate of abundance is approximate: Trace < 2% · Minor > 2% < 10% · Major > 10% · Major+ > 50%.

Sample ALCD-011

commonly fractured and sometimes filled with goethite or secondary quartz. Amphibole is absent in the sample. The biotite present within the sample is present in several forms, from partial potassic replacement of feldspar to overprinting interstitial alteration. There are also rarer subhedral grains that look original to the protolith and, coupled with the absence of amphibole suggest a slightly different granodioritic protolith to the other samples. The biotite is currently partially altered to chlorite. Titanite is an accessory phase, usually subhedral, interstitial with feldspar and biotite crystals. Epidote is present as fine, granular agglomerations of ~20 µm crystals, with some crystals reaching up to 300 µm. Rare ilmenite with exsolutions of hematite and apatite inclusions were observed.

- The alteration includes evidence of a slight sericitisation of feldspar crystals, with further alteration assemblage typical of propylitic alteration exhibited by the presence of epidote, chlorite and calcite, with additional potassic alteration containing biotite overprinting feldspars.
- There is no evidence of sulphide mineralisation.

Photomicrographs



D **Sample ALCD-011**

Photomicrograph showing typical texture of granodiorite containing slightly altered feldspars, unaltered quartz and partial biotite replacement after amphibole.

Image D
Nikon Microphot-FXA petrological microscope
Cross polarised transmitted light
x25

ALCD-012

Sample as received

Sample ALCD-012		
Petrolab ID	**Date received**	**Type · properties**
#43583	25/11/2022	Rock core Ø60 mm, half core · 77 g

A **Sample ALCD-012**

Photograph of sample as received (scale in cm).

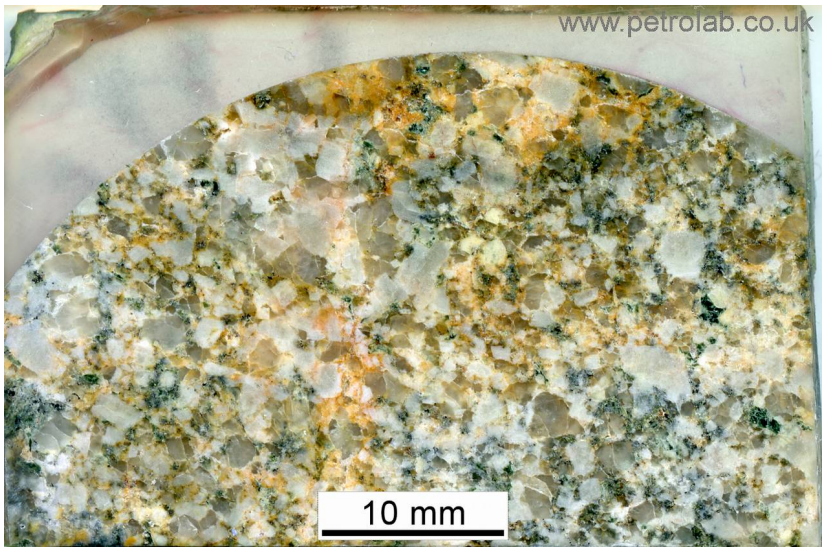
Image A
Nikon D7000 digital camera
Daylight balanced oblique light

Section(s)

B **Sample ALCD-012**

Low magnification view of sample thin section.

Image B
Epson scanner
White cold cathode light



C **Sample ALCD-012**

Low magnification view of sample polished block.

Image C
Epson scanner
White cold cathode light

Mineral identification

Sample ALCD-012			
Phase	**Formula**	**≈ s.g.**	**Abundance[1]**
Plagioclase feldspar, pl	$(Na,Ca)(Si,Al)_4O_8$	2.68	Major
Quartz, qz	SiO_2	2.65	Major
Alkali feldspar, afs	$KAlSi_3O_8$	2.55	Minor
Chlorite, chl	$(Mg,Fe^{2+})_5Al(Si_3Al)O_{10}(OH)_8$	2.65	Minor
Epidote, ep	$Ca_2(Fe^{3+},Al)_3(SiO_4)_3(OH)$	3.45	Minor
Chalcocite, cc	Cu_2S	6.46	Trace
Limonite (goethite), gth	$Fe^{3+}O(OH)$	3.80	Trace
Sericite, ms	Fine-grained white mica alteration product	2.82	Trace
Calcite, cal	$CaCO_3$	2.70	Trace
Microcrystalline quartz, Mqz	SiO_2	2.65	Trace
Covellite, cv	CuS	4.68	Trace
Bornite, bn	Cu_5FeS_4	5.09	Trace
Chalcopyrite, ccp	$CuFeS_2$	4.20	Trace

Sample summary

Sample ALCD-012

- The sample represents a phaneritic granodiorite composed of plagioclase feldspar, quartz, alkali feldspar, chlorite and accessory minerals, predominantly titanite. The dominant phase in the sample is plagioclase feldspar, characterised by its polysynthetic twinning, with a minor amount of alkali feldspar. Feldspar crystals are coarse and tabular, in most cases pervasively sericitised, with some mica crystals reaching up to 300 µm. This is commonly overprinted by granular epidote crystals. Quartz is a major component of the sample and typically appears unaltered. There is no evidence of relic amphibole or biotite crystals, however there is present medium to coarse-grained chlorite, often occurring as replacement after earlier mafic minerals or as

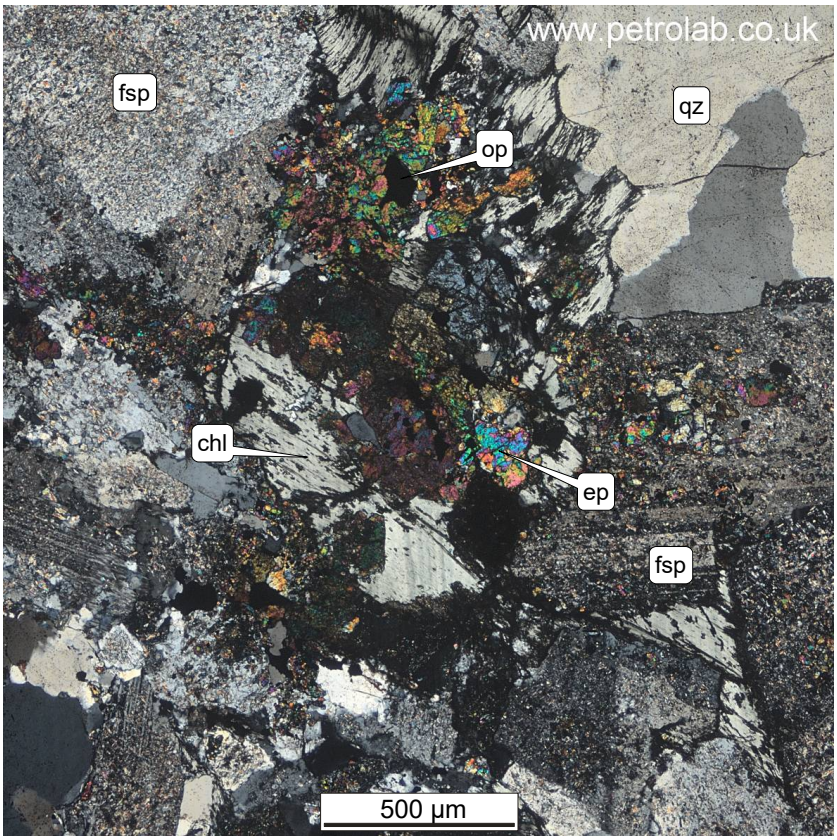
1 Visual estimate of abundance is approximate: Trace < 2% · Minor > 2% < 10% · Major > 10% · Major+ > 50%.

Sample ALCD-012

interstitial grains introduced during propylitic alteration. Titanite is an accessory phase, usually subhedral, interstitial with feldspar and chlorite crystals. Epidote is commonly present as fine, granular agglomerations of ~20 µm crystals, with some crystals reaching up to 600 µm. It is often associated with chlorite. Patchy calcite replacement was observed. There are other rare accessory minerals which include ilmenite, commonly intergrown with hematite and nearly euhedral zircon crystals.

- The alteration includes sericitisation of feldspar crystals, with further evidence of alteration assemblage typical of propylitic alteration exhibited by the presence of epidote, chlorite and calcite. There is also a small amount of goethite forming along some superficial fractures within the sample.
- Chalcocite is the most abundant Cu sulphide in the sample and occurs as disseminated, anhedral crystals, rarely altered to covellite. Rare instances of chalcopyrite and bornite were observed. Overall, there is trace amount of chalcocite in the sample, however it is locally present in minor amounts.

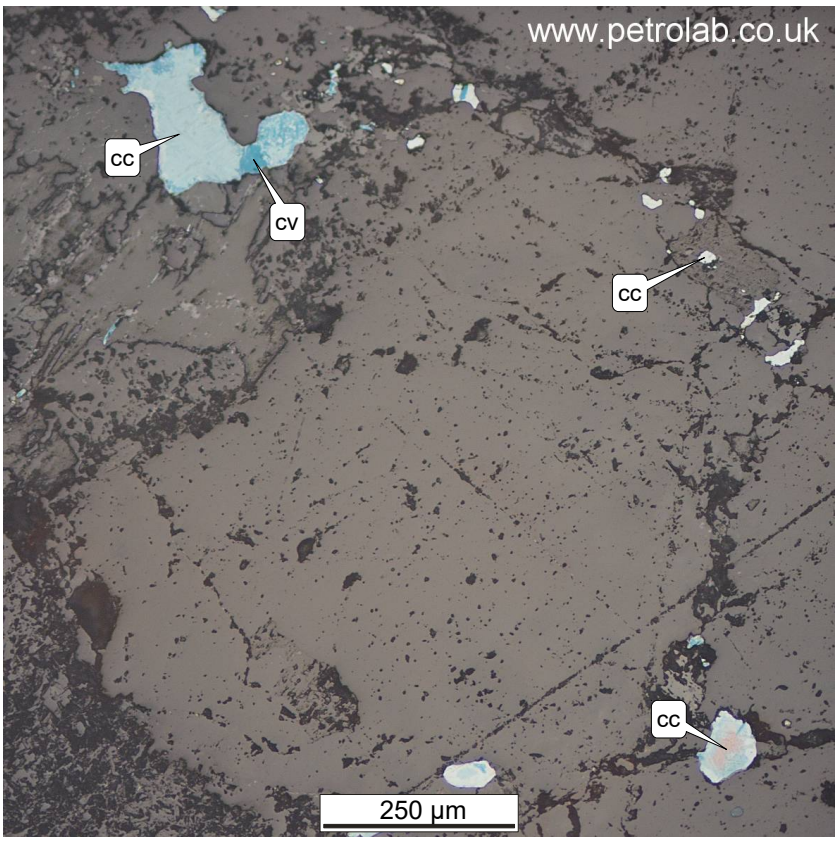
Photomicrographs



D **Sample ALCD-012**

Photomicrograph of sample showing a typical granodiorite texture containing altered feldspar crystals, unaltered quartz with interstitial chlorite, replaced by granular epidote.

Image D
Nikon Microphot-FXA petrological microscope
Cross polarised transmitted light
x50



E **Sample ALCD-012**

Photomicrograph showing disseminated occurrences of chalcocite, sometimes altered to covellite.

Image E

Nikon Microphot-FXA petrological microscope

Plane polarised reflected light

x100