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The petrology of metalimestones from the uppermost Argyll Group and lowermost Southern Highland Group (Dalradian) of Northern Ireland

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The petrology of metalimestones from the uppermost Argyll Group and lowermost Southern Highland Group (Dalradian) of Northern Ireland

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Terminology

For brevity, ‘metalimestones’ and ‘metadolostones’ are referred to simply as limestones and dolostones in the main body of this report.

Contents

Figure MRC 123b. MRC 123 a in plane-polarised light. Note the apparent homogeneity of the vein, revealed to be heterogeneous under CL in Figure MRC 123a.

Summary

Thin sections of seven samples of metacarbonate rocks from the Tayvallich Subgroup (Argyll Group) within the Dalradian of Northern Ireland, have been studied by optical petrography and cathodoluminescence (CL) imaging. Two of the metacarbonate samples are metadolostones and the remaining five are calcitic metalimestones. Mineral assemblages are dominated by calcite or dolomite, but subordinate quartz, feldspar and white mica are ubiquitous. Grain boundaries are only moderately well equilibrated texturally and the CL imaging reveals variable chemical heterogeneity on the grain-scale. In the dolomite-bearing samples, CL images reveal relict, diffuse calcitic domains; calcite-dolomite boundaries do not match optically-visible grain boundaries. Inclusion trails reveal dolomite growth zones. Locally, these show growth of euhedral crystal surfaces into voids, some of which are now lined with clay. This indicates that dolomitisation postdates metamorphism and deformation and is thought to have occurred at a much later date. Calcitic metalimestone samples from Torr Head have some thin, poorly-crystalline, calc-silicate bearing layers that contain epidote, green chlorite, very fine-grained ?plagioclase and ?grossular or ?vesuvianite. These are thought to represent volcanic or volcaniclastic debris. The petrography of thirteen thin sections of samples described in a previous report (Thomas, 2000) is also included.

1 Introduction

This brief report describes the petrology and cathodoluminescent imaging of twenty metacarbonate rock samples collected from outcrops within the Dungiven, Torr Head Limestone and Claudy formations of the Dalradian of Northern Ireland. The Dungiven and Torr Head Limestone formations lie within the Tayvallich Subgroup (Argyll Group) whilst the Claudy Formation lies in the lowermost part of the overlying Southern Highland Group.

The report continues the work undertaken in 1999 and 2000, as discussed in Thomas (Thomas, 2000), where the background to the limestone study is outlined, and includes petrographical descriptions of the rocks described in Thomas (2000). The sample locations and lithostratigraphy are given in Table 1.

2 Geology

The limestones are exposed intermittently in Counties Londonderry, Tyrone and Antrim (Figure 2; Appendix A). Those that crop out in the Co. Londonderry – Co. Tyrone area are disposed around the hinge of the southeast-facing F_2 Sperrin Nappe on the northwest side of the Sperrin Mountains. The lithostratigraphy across this structure and the Sperrin Mountains is a subject of much debate (Arthurs, 1976; Alsop and Hutton, 1993, 1994; Arthurs, 1994; Smith and Johnston, 1994). Staff in the Geological Survey of Northern Ireland interpret the structure and lithostratigraphy to show that the core of the Sperrin Nappe is occupied by Argyll Group strata (the Newtonstewart Formation) fringed by the Dungiven Formation and the succeeding Claudy Formation. Alsop and Hutton (1993) take an alternative view, interpreting all the strata in the Sperrin Mountains as belonging to the Argyll Group and placing the core of the Sperrin Nappe in Glenelly, southeast of the main Sperrins ridge. The existing GSNI interpretation of the lithostratigraphy in the Sperrin Mountains is used for the purposes of this report.

The three samples from Torr Head come from excellent cliff exposures of the Torr Head Limestone Formation and are taken from one thin bed. A particular feature of these thin beds is the presence of thin siliciclastic laminae in other wise pure limestones.

Metamorphic grade locally reached lower amphibolite facies, but is generally restricted to greenschist facies over most of the area from which the samples were collected. At present, there are no geothermobarometric estimates of metamorphic conditions. In discussion of the phase relations in the limestones, I consider temperatures in the range 300–550°C and pressures of 4 to 5 kbars.

3 Petrographical descriptions

The petrological descriptions for each of the samples listed in Table 1 are given in this section. The figures relating to the MRC samples are appended at the end of the document and are referred to by sample number. The original scanned images are recorded on the accompanying CD. In order to keep the document size to manageable proportions, images for the GSNI samples are not included in this report. Instead, the images for these samples are included on the accompanying CD volume.

MRC 95

Oldmill Bridge [23766 38400]

Lithology: Dolomitised metasandstone (doQ)

Mineralogy:

Principal phases: Quartz, plagioclase, dolomite, calcite; thin seam of white mica

Accessory phases: ?epidote, zircon, clay minerals infilling voids

Dominantly quartz and plagioclase feldspar, with subordinate dolomite. Grainsize generally between 0.5 and 1 mm. Quartz and plagioclase are anhedral, rounded, locally elongate with patchy, intergranular dolomite. No good metamorphic fabric; some of the plagioclase and quartz grains have aligned inclusions. Rhombohedral cleavage in dolomite is well seen, together with growth zones delineated by thin inclusion lines at crystal faces (Figure MRC 95). The dolomite is untwinned and undeformed and is growing into voids in places that are now filled with clay minerals.

Fine-grained accessory phases occur as inclusions in plagioclase and quartz, but are rare as intergranular material. A thin seam of white mica/clay mineral occurs in an uneven, approximately layer-parallel fracture.

Interpretation

This appears to be a silicate-rich rock that has been dolomitised. The texture and abundance of dolomite and the presence of clay-filled voids suggests that there may have been an earlier carbonate phase (possibly calcite) that was dissolved out and replaced by dolomite and clay. The sample is noted as being taken from an outcrop close to brittle faulting and thrusting. Although the textures in the thin section do not suggest significant cataclastic deformation, adjacent faulting may well have opened up the rock to dolomitising fluids. The dolomitisation probably significantly post-dates Grampian metamorphism and deformation.

MRC 102

Bessy Bell [23866 38173]

Lithology: Dolomitised metalimestone (doL^{L})

Mineralogy:

Principal phases: Dolomite, quartz, plagioclase, white mica.

Accessory phases: Haematite

Dominantly dolomite, with some relict calcite revealed by CL imaging (Figures MRC 102 a, b). Quartz and plagioclase with white mica are subordinate but retain a relict metamorphic fabric. Grainsize varies widely. Dolomite crystals can reach 1.5 mm across. Haematite is scattered widely throughout the section, occurring along grain boundaries and replacing dolomite along cleavage planes in places.

The dolomite has angular crystal faces and appears to be replacive; there is some evidence for crystallisation of dolomite into voids. The dolomite is strained, showing undulose extinction and locally shows evidence for brittle fracture. In some larger dolomite crystals, strain is being accommodated by recrystallisation into sub-grain domains. White mica flakes are quite commonly bent around dolomite crystal faces.

Clusters of quartz, plagioclase and white mica grains retain a metamorphic fabric, mainly defined by a white mica schistosity. Locally developed elongate ‘augen’ of quartz and plagioclase and widely separated mica foliae suggest that the fabric observed is not a primary deformation fabric. White mica alignment is less well developed within the dolomite-rich domains.

Haematite is common along grain boundaries and dolomite cleavage planes and is abundant in an area of dolomite crystals that appear to have grown into a void.

Interpretation

CL imaging, dolomite textures and the observation of bent mica flakes at dolomite grain boundaries, provide evidence that the dolomite is a later phase replacing calcite. In a combined CL-ppl image and a CL-only image (Figures MRC 102 a, b), patchy, diffuse, relict calcite can be seen within dolomite. It is of note that the calcite also appears to have been coarse-grained prior to dolomitisation and this may be evidence that the calcite in this rock had the very coarse grained character observed in other limestones of Tayvallich ‘age’ from Northern Ireland and the Southwest Scottish Highlands.

It is thought that the haematite results from late infiltration of fluid.

MRC 107

Mary Gray [24297 38541]

MRC 108

Victoria Bridge [2355 3906]

Lithology: Metalimestone (L^{L})

Mineralogy:

Principal phases: Calcite, subordinate quartz, plagioclase and white mica

Accessory phases: zircon,

Dominantly calcite, with only small amounts of plagioclase, quartz and white mica, with grainsizes up to ~1 mm. Calcite is elongate, forming a grain-shape fabric that is parallel to a white mica foliation. Calcite grain boundaries, although not sutured, are not straight and good triple point contacts are only locally developed (Figures MRC 107 b; MRC 108 b). Calcite twinning is extensive, dominated by Type I and II twins, although some grains with Type IV twins (Burkhard, 1993) are present very locally. Plagioclase occurs locally as large, commonly sericitised, anhedral grains with quartz inclusions. There is patchy replacement of plagioclase by carbonate in parts of MRC 108. Quartz occurs in small equant grains with straight extinction. White mica flakes are generally scattered throughout the section, although there are local concentrations in films/laminae. The CL image is typical of calcite-rich metamorphosed limestones (Figures MRC 107 a, 108 a). The flat orange colour shows that there is little chemical variation within the grains and only limited alteration at grain boundaries and along cleavage planes.

Interpretation

Typical metamorphosed calcitic limestone. The CL image suggests that the chemistry of this limestone may have remained little altered following diagenesis. The Type I and Type II calcite twins are typical of limestones subject to deformation at temperatures of < 300°C that probably arises after metamorphism during the cooling phase (Burkhard, 1993). The presence of, albeit rare, of grains with Type IV twins is consistent with the higher temperatures that these rocks experienced during the prograde part of the metamorphic history. The lack of clinozoisite indicates that these rocks have not been infiltrated by hydrous fluids (see discussion in Thomas, 2000).

MRC 121, 122, 123

Torr Head [32342 44047]

Lithology: Metalimestone (L^L)

Mineralogy:

Principal phases: Calcite, quartz, plagioclase

Accessory phases:

In calcsilicate-rich laminae: Quartz, plagioclase, epidote, ?grossular or?vesuvianite.

In carbonate host: Quartz, ?plagioclase, ?epidote

These three sections are treated together as they come from the hand specimen and are very similar mineralogically and texturally (Figures MRC 121 a, b, 122 a, b, and 123 a, b). Calcite is the dominant phase, but all three sections include thin, but prominent, silicate-rich layers that include quartz, plagioclase, an epidote – probably clinozoisite – and chlorite.

The carbonate component is coarsely-crystalline calcite, with individual crystals up to 8 mm across. These crystals have patchy or undulose extinction and patches and strings of new, smaller crystals are present, particularly along the boundaries of the larger crystals. The features suggest that the large crystals are recrystallising to form smaller crystals in response to stress. The large crystals are dusted to a greater or lesser extent with very fine grained material that appears to include an epidote (clinozoisite), quartz and possibly plagioclase. This silicate contamination is essentially the same as that forming the silicate-rich layers, described below. The material is scattered evenly throughout the calcite matrix and has had no effect on calcite crystal growth via grain boundary pinning and pre-dates the coarse calcite crystals.

All three sections contain distinct, thin (3 – 10 mm) silicate-rich layers. The layers contain quartz, plagioclase feldspar, chlorite, epidote (clinozoisite), ?grossular, calcite, and pyrite.

Clusters of chlorite and epidote occur within a groundmass of fine grained quartz and plagioclase. In MRC 121, clinozoisite commonly occurs as randomly-orientated, ragged, bladed crystals with chlorite. A layer-parallel, undulating flow-like fabric is defined by elongate quartz and plagioclase grains and elongate trails of fine grained granular epidote; this fabric is thought to be essentially primary and sedimentary in origin.

The silicate-rich layer in MRC 121 has a very sharp base and a gradational top where it passes up into the overlying calcite. Fine grained granular epidote/zoisite is scattered throughout the overlying limestone. The silicate layer margins are richer in chlorite whilst the centres are more clinozoisite-rich. Although this feature is particularly well-seen in the thicker silicate-rich layer in MRC 121, it is also observed in the layers in the other two sections. The presence of chlorite requires Mg and at least some Fe in the local bulk composition. The chlorite is heavily intergrown with zoisite and may be replacing the latter phase. Calcite is present in the silicate-rich layers only in small amounts, but is common around the zoisite-chlorite intergrowths on the layer margins. The textural evidence suggests that the chlorite has gown via the low-grade CMASCH reaction zoisite + dolomite = calcite + chlorite.

The mineralogy of the siliceous bands is consistent with a metaigneous composition and textural features indicate a sedimentary origin. The fine-grained weathered material is considered most likely to have been derived from an eroding volcanic source.

Cathodoluminescence imaging of MRC 122 and 123 (Figure MRC 122 a, MRC 123 a) reveals little variation, suggesting that any variation in calcite Mn or Fe/Mn is small. However, the CL image of MRC 121 (Figure MRC 121 a) shows more darkly luminescent calcite associated with a domain less rich silicate material. More luminescent calcite coincides with a domain in which more abundant silicate material has a streaky texture (Figures MRC 121 a, b). The mineralogy of the fine streaky material is difficult to establish optically due to the fine grain size, but appears to be epidotic, at least in part.

Interpretation

This is a relatively pure metalimestone with thin layers of silicate impurity that are thought to represent volcanogenic detritus. Superficially similar material is scattered throughout the calcite matrix, indicating deposition of this material coevally with the primary carbonate sediment. It is thought that the primary carbonate sediment was probably fine, mud- or silt-grade material.

GSNILS1

Glenconway, stream section [26353 41479]

Lithology: Metadolostone (L^D)

Mineralogy:

Principal phases: Dolomite, quartz, plagioclase feldspar

Accessory phases: White mica

The dominant phase is fine-grained (0.1 – 1.0 mm), anhedral, ragged dolomite with sutured grain boundaries and abundant very fine dark inclusions, at least some of which are thought to be graphite. The dolomite is non-luminescent under CL. Rhombohedral terminations locally suggest growth into voids, possibly due to secondary replacive porosity. Dolomite grains have undulose extinction.

Fine grained quartz and plagioclase are rounded to ragged and difficult to distinguish optically. Some quartz grains are clearly detrital. In other places, quartz appears to be filling angular voids. White mica occurs as sparsely scattered flakes.

Interpretation

Dolomitised limestone. The stability of quartz + dolomite places indicates a low grade of metamorphism (mid to low greenschist facies), although the temperature at which tremolite and calcite form at the expense of dolomite and quartz is heavily dependant on the fluid composition.

GSNILS2

Ballyholly Quarry [25742 41082]

Mineralogy:

Principal phases: Calcite, quartz, plagioclase feldspar and white mica.

Accessory phases:

Calcite is the dominant phase, with small amounts of fine-grained (<0.05 mm) quartz, plagioclase feldspar and white mica. The calcite is elongate, the elongation forming an aligned grain-shape fabric. Grain size varies from 0.1 to ~0.15 mm. Twinning is abundant (Type I and II). Good, straight grain boundaries are developed locally with some triple point contacts, but, overall, the sample is not well-equilibrated texturally.

Interpretation

Pure metalimestone.

GSNILS3

Tirglassan Quarry [25975 40708]

Mineralogy:

Principal phases: Calcite, quartz, plagioclase feldspar, white mica.

Accessory phases:

Calcite is the dominant phase. The calcite grains are between 0.1 and 0.3 mm long and flattened and elongate, forming a grain-shape fabric. Grain boundaries are uneven to sutured and good triple point contacts are uncommon, showing that the rocks is poorly texturally equilibrated. Minor amounts of quartz, plagioclase and white mica flakes occur at grain boundaries and as inclusions in calcite. These silicate impurities generally occur singly, but are in small clusters in places.

Interpretation

Metalimestone

GSNILS4

Rallagh Quarry East [26588 40567]

Mineralogy:

Principal phases: Calcite

Accessory phases: Quartz, plagioclase feldspar

Elongate, coarse-grained, optically continuous calcite plates are 10 to 15 mm long and have strings of finer grained, clear calcite grains along grain boundaries. The plate are dusted with abundant black ?graphite inclusions that show an alignment fabric. The calcite plates overgrow this fabric. Though the fabric is broadly aligned across the section, in detail, it is discontinuous across calcite plate boundaries. The fabric predates the growth of the plates and the development of the strings of clear calcite at grain boundaries. The silicate content is very low. The paucity of silicate probably facilitated growth of the large calcite plates by reducing the possibility of grain-boundary pinning.

Interpretation

Pure metalimestone with notable early (?sedimentary/diagenetic) fabric defined by graphite inclusions in the large calcite plates.

GSNILS5

Rallagh Quarry West [26574 40570]

Mineralogy:

Principal phases: Calcite, quartz, plagioclase feldspar, epidote (clinozoisite)

Accessory phases: Green-brown biotite

Calcite dominates the mineralogy, forming grains generally between 1 and 1.5 mm in size. Calcite grains with abundant inclusions are overgrown by largely inclusion-free calcite. In the CL image of the thin section (Figure 6), the clear calcite is paler orange, indicating either a more Mn-rich calcite or a lower Fe/Mn ratio compared to the patchily dark, inclusion-rich grains. Texturally, the paler calcite is clearly and irregularly overgrowing the earlier, inclusion-rich calcite crystals and is in optical continuity with it.

Grain boundaries are uneven generally and triple point contacts are not widely developed. This indicates that the matrix is in a state of textural disequilibrium.

There is extensive, patchy development of silicates, including quartz, plagioclase feldspar and clinozoisite; the latter looks as though it is replacing the former, although this is difficult to establish for certain optically. Small amounts of green-brown biotite are present locally.

Interpretation

The presence of clinozoisite apparently replacing plagioclase feldspar suggests that this limestone has been infiltrated by a hydrous fluid phase, resulting in the reaction plagioclase + calcite = clinozoisite. It may be that the clear, paler orange luminescent calcite is also related to metamorphic fluid infiltration, but it may equally have resulted from fluid infiltration during diagenesis.

GSNILS6

Ashlamaduff stream section [27920 41169]

Mineralogy:

Principal phases: Calcite, plagioclase, quartz, white mica

Accessory phases: Graphite, minor haematite

Calcite dominates the mineralogy. Elongate crystals up to 2 mm long define a grain-shape fabric. Type I and II twins are ubiquitous. Plagioclase occurs as clots and small masses of individual grains; it is generally altered. Quartz occurs as small rounded grains, locally grouped in clusters. White mica flakes form strings and felts that are parallel to the calcite grain-shape fabric and define a locally penetrative fabric. This fabric is crenulated locally. Graphite appears to occur as black, very fine grained material scattered throughout the calcite. It also locally concentrated with the white mica strings and felts. The CL image shows flat, pale-orange luminescent calcite, indicating that there is no significant variation in either Mn content or Fe/Mn. A vein that only appears in CL imaging and is overprinted by the grain-shape fabric is discussed in Thomas (2000).

Interpretation

Metalimestone.

GSNILS7

Butterlope Glen [2491 3952]

Mineralogy:

Principal phases: Dolostone with subordinate plagioclase, quartz, calcite, white mica

Accessory phases:

The dolomite forms blocky and equant crystals c. 0.1 – 0.5 mm across that are extensively dusted with inclusions. Sparse white mica laths define a weak grain alignment fabric. Quartz is abundant, but plagioclase is subordinate; both commonly occur in small, elongate clusters. Graphite? dust is scattered throughout, although some dolomite rims are clearer. Small ?relict grains of luminescent calcite are observed under CL illumination.

Interpretation

Dolostone. The dolomite is probably replacive. The stability of dolomite in the presence of quartz generally indicates low metamorphic grade and the dolomite may well be diagenetic in origin.

GSNILS8

Longlands Road Quarry [2522 4040]

Mineralogy:

Principal phases: Calcite, quartz, plagioclase, white mica

Accessory phases: Graphite, minor sulphide (?pyrite)

Calcite is the dominant phase. Elongate crystals 0.25 – 1.0 mm in length define a grain-shape fabric. Grain boundaries are smooth to weakly uneven, but not sutured and Type I and II twins are ubiquitous. Approximately equal amounts of quartz and plagioclase feldspar are concentrated in small clusters and strings. Scattered, fine grained opaque minerals dust the calcite crystals; most appears to be graphite, but there is a minor amount of sulphide. In CL, the calcite is weakly orange-brown luminescent. Interiors of some grains are significantly more darkly luminescent, indicating lower Mn and/or higher Fe/Mn.

Interpretation

It appears that the weakly orange-brown luminescent calcite is replacing the darker calcite, suggesting fluid infiltration. However, the presence of plagioclase + calcite rather than clinozoisite suggests that this infiltration was pre-metamorphic, particularly since the current grain boundary architecture is radically different to the distribution of the dark luminescent calcite.

GSNILS9

Balix Hill [2480 3958]

Mineralogy:

Principal phases: Calcite, quartz, plagioclase

Accessory phases: white mica

Calcite is the dominant phase. Generally equant, extensively twinned calcite crystals between 0.2 and 1.0 mm across commonly have ragged outlines and sutured grain boundaries. The calcite is also dusted with abundant very fine inclusions. These are of unknown composition, but may be graphitic. Fine grained quartz and feldspar are scattered throughout, locally forming small clusters. White mica is only present in small amounts and the flakes are randomly orientated. There is no preferred orientation or fabric in the section. In CL, the calcite is medium to dark orange brown. As in GSNILS8, the textures revealed in CL suggest that the paler orange calcite is replacing the darker luminescent material.

Interpretation

Metalimestone

GSNILS10

Drain Quarry [24580 40185]

Mineralogy:

Principal phases: Dolomite, quartz, white mica, ?plagioclase feldspar

Accessory phases: Sulphide and ?graphite

Dusty, equant, blocky-looking dolomite crystals predominate. They commonly have rhombic terminations and grain boundaries are uneven and locally sutured; undulose extinction is present locally. Quartz is abundant and concentrated in patches and strings. Plagioclase feldspar is probably present, but is difficult to determine optically. Interpretation

Metalimestone

GSNILS12

Kennedy Quarry, Bonds Glen [24985 40700]

Mineralogy:

Principal phases: Calcite, quartz, plagioclase

Accessory phases: White mica

Calcite is very abundant, with only small amounts of silicate impurity. Calcite crystals are 0.2 – 0.5 mm long and elongate, defining a grain-shape fabric. Grain boundaries are generally straight and triple point contacts are common, indicating a degree of textural equilibrium. The calcite is ubiquitously twinned. Quartz and feldspar grains are small and generally isolated. Rare small flakes of white mica are aligned with the calcite grain shape fabric. In CL, calcite grain have patchy variations in luminescence from pale to dark orange. The darker orange patches are not evenly scattered across grains, indicating that the grain shape fabric post-dates the development of the chemical variation responsible for the variations in luminescence.

Interpretation

Pure metelimestone

GSNILS13

Lough Ash Road [24945 40125]

Mineralogy:

Principal phases: Calcite, plagioclase, quartz, white mica

Accessory phases: Sulphide

Calcite is very abundant and there is only minor silicate impurity. Equant to oblate calcite crystals form a weak grain shape fabric, but good triple-point contacts are only developed locally, twinning is ubiquitous. Quartz and plagioclase feldspar grains are widely scattered, locally occurring as small elongate clusters and strings roughly parallel to the grain-shape fabric. Sparse white mica flakes are roughly aligned with the grain shape fabric. Small amounts of sulphide are present. Under CL the calcite is generally pale orange-brown luminescent with sparse patches of darker luminescent calcite. As in other samples, the patches are not evenly distributed across grains and the current grain boundary architecture post-dates the chemical variation revealed by the luminescence.

Interpretation

Pure metalimestone

Appendix 1

Sample location and lithology details for the MRC samples from M R Cooper (GSNI). Similar details for the GSNILS samples described in the report are given in Thomas (2000).

Newtownstewart (Sheet 25)

MRC 95

Oldmill Bridge [23766 38400]

Grey/white mostly recrystallised metalimestone, siliciclastic content variable. Interbedded with quartzite and semipelitic schist. Thrust and brittle normal faulting in close vicinity.

Dungiven Formation, Tayvallich Subgroup.

MRC 102

Bessy Bell [23866 38173]

Mottled, dolomitised and mineralised calc-silicate. Interbedded with semipelitic schist.

Dungiven Formation, Tayvallich Subgroup.

MRC 107

Mary Gray [24297 38541]

Grey metalimestone, siliciclastic content variable. Interbedded with Dungiven Formation, Tayvallich Subgroup.

MRC 108

Victoria Bridge [2355 3906]

Grey metalimestone, siliciclastic content variable. Interbedded with semipelitic schist.

Dungiven Formation, Tayvallich Subgroup.

Ballycastle (Sheet 8)

MRC 121,122, 123

(three overlapping thin sections from one bed).

Torr Head [32342 44047]

Dark grey, bedded metalimestone. Within bed variation from siliciclastic to pure coarsely crystalline metalimestone. Metalimestones associated with thick metabasite sills. Sequence shows brittle faulting.

Torr Head Limestone Formation, Tayvallich Subgroup.

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Tables

Table 1. Location, lithological and lithostratigraphical details of the samples of limestone and dolostone discussed in the report.

Sample	Formation	Location	Grid Reference (Irish Grid)	Lithology	Detailed lithostratigraphical position or member
GSNILS 1	Claudy Formation	*Glenconway, stream section*	26353 41479	Metadolostone	top
GSNILS 2	Claudy Formation	*Ballyholly Quarry*	25742 41082	Metalimestone	top
GSNILS 3	Claudy Formation	*Tirglassan Quarry*	25975 40708	Metalimestone	middle
GSNILS 6	Claudy Formation	*Ashlamaduff stream section*	27920 41169	Metalimestone	middle
GSNILS 8	Claudy Formation	*Longlands Road Quarry*	2522 4040	Metalimestone	Alla Limestone Member
GSNILS 10	Claudy Formation	*Drain Quarry*	24580 40185	Metadolostone	Alla Limestone Member
GSNILS 12	Claudy Formation	*Kennedy Quarry, Bonds Glen*	24985 40700	Metalimestone	Bonds Glen Limestone Member
GSNILS 13	Claudy Formation	*Lough Ash Road*	24945 40125	Metalimestone	not given
GSNILS 4	Dungiven Formation	*Rallagh Quarry East*	26588 40567	Metalimestone	top
GSNILS 5	Dungiven Formation	*Rallagh Quarry West*	26574 40570	Metalimestone	top
GSNILS 7	Dungiven Formation	*Butterlope Glen*	2491 3952	Metadolostone	not given
GSNILS 9	Dungiven Formation	*Balix Hill*	2480 3958	Metalimestone	not given
MRC 95	Dungiven Formation	*Oldmill Bridge*	23766 38400	Dolomitised metasandstone	not given
MRC 102	Dungiven Formation	*Bessy Bell*	23866 38173	Dolomitised metasandstone	not given
MRC 107	Dungiven Formation	*Mary Gray*	24297 38541	Metalimestone	not given
MRC 108	Dungiven Formation	*Victoria Bridge*	2355 3906	Metalimestone	not given
MRC 121	Torr Head Formation	*Torr Head*	32342 44047	Metalimestone	not given
MRC 122	Torr Head Formation			Metalimestone	not given
MRC 123	Torr Head Formation			Metalimestone	not given

Figures

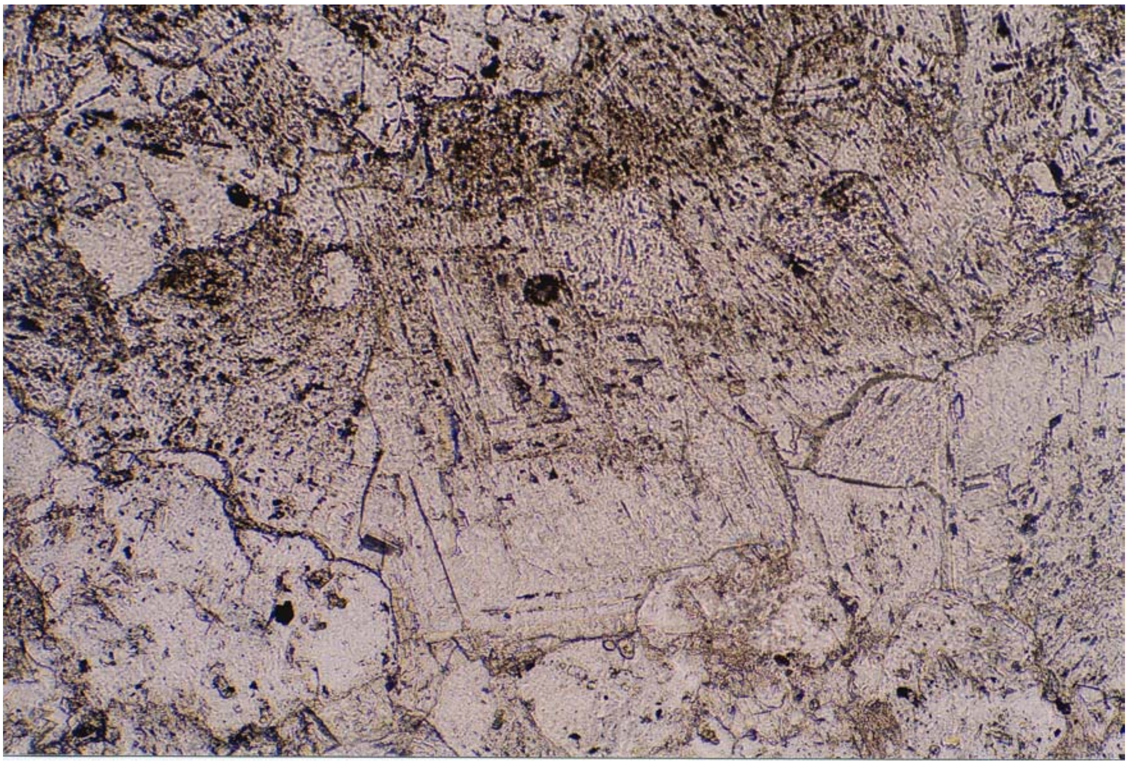

Figure MRC 95 Rhombohedral terminations in dolomite crystals

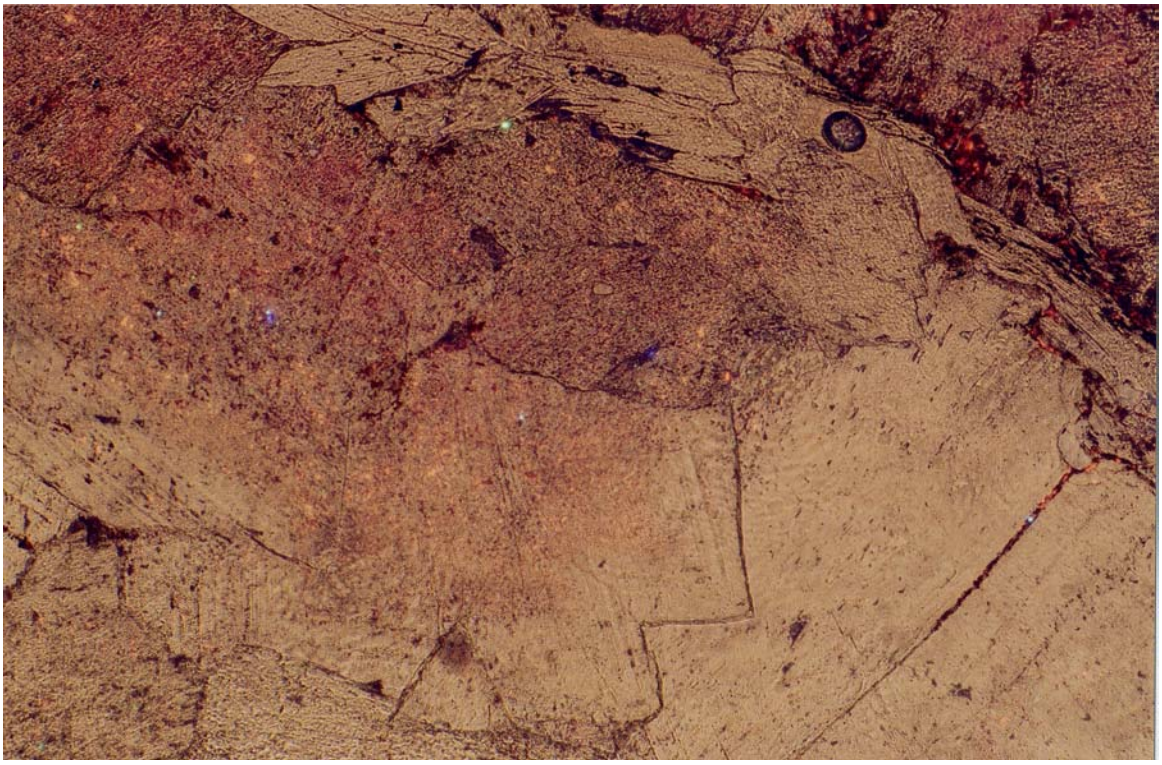

Figure MRC 102a. A combined cathodoluminescence and plane polarised light image, showing relict calcite (reddish orange) in buff-coloured, non-luminescent dolomite.

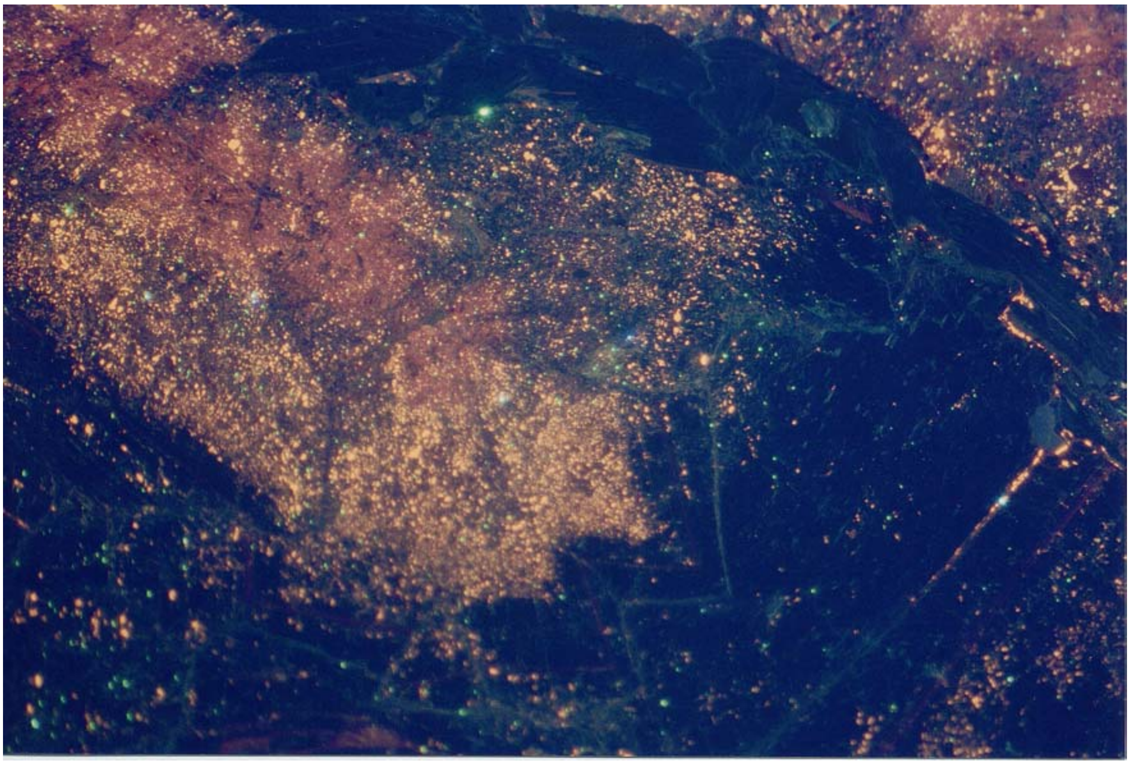

Figure MRC 102b. Cathodoluminescence image, showing the relict calcite enclosed in dolomite.

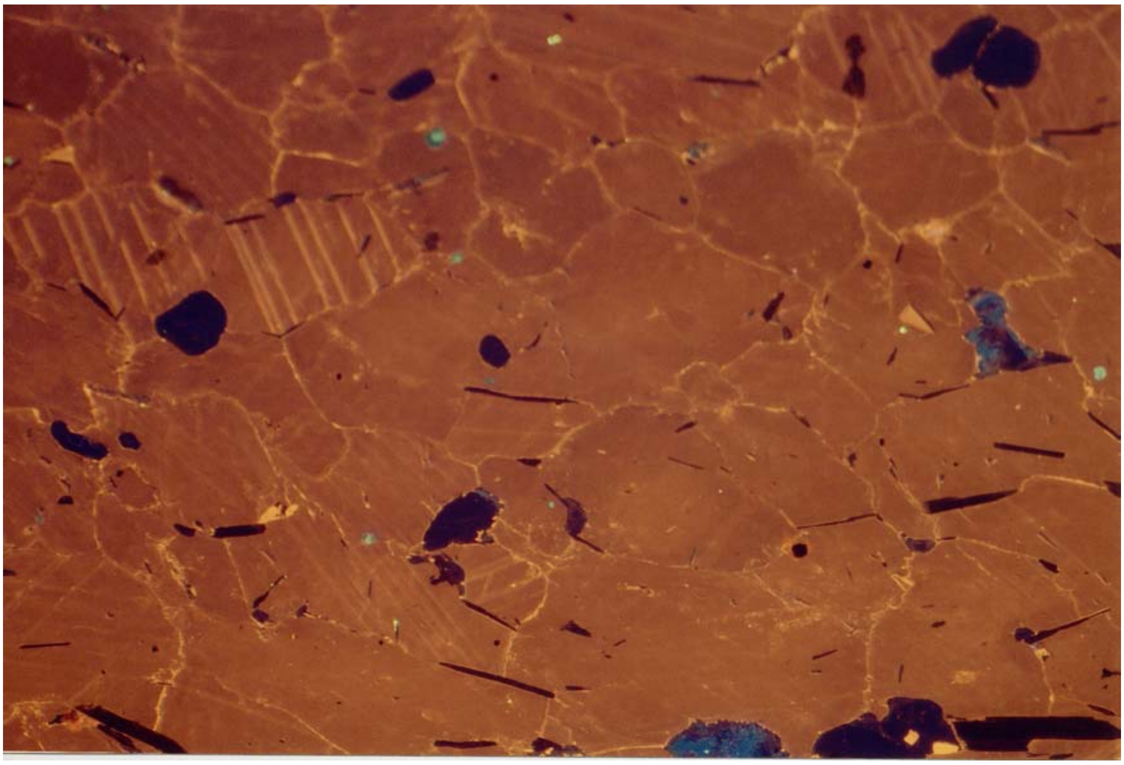

Figure MRC 107a. Cathodoluminescence image showing dark, orange-brown luminescent calcite crystals with more luminescent calcite at the grain boundaries.

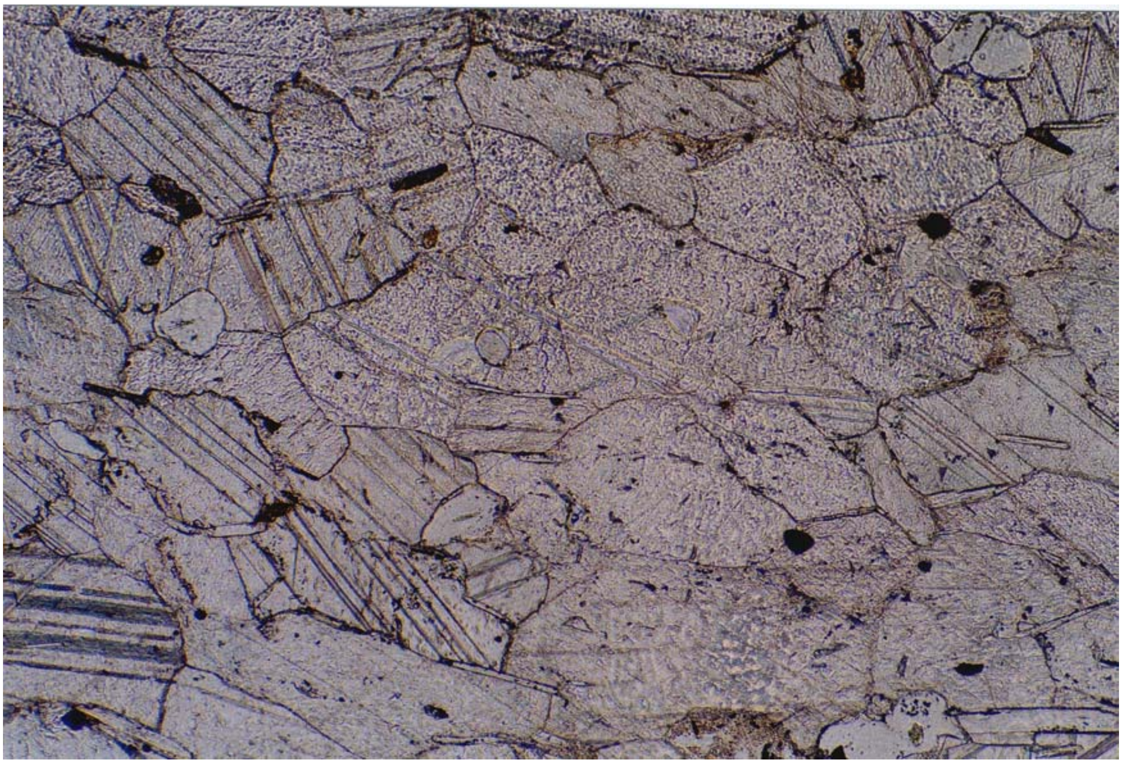

Figure MRC 107b. Plane-polarised light image of MRC 107a.

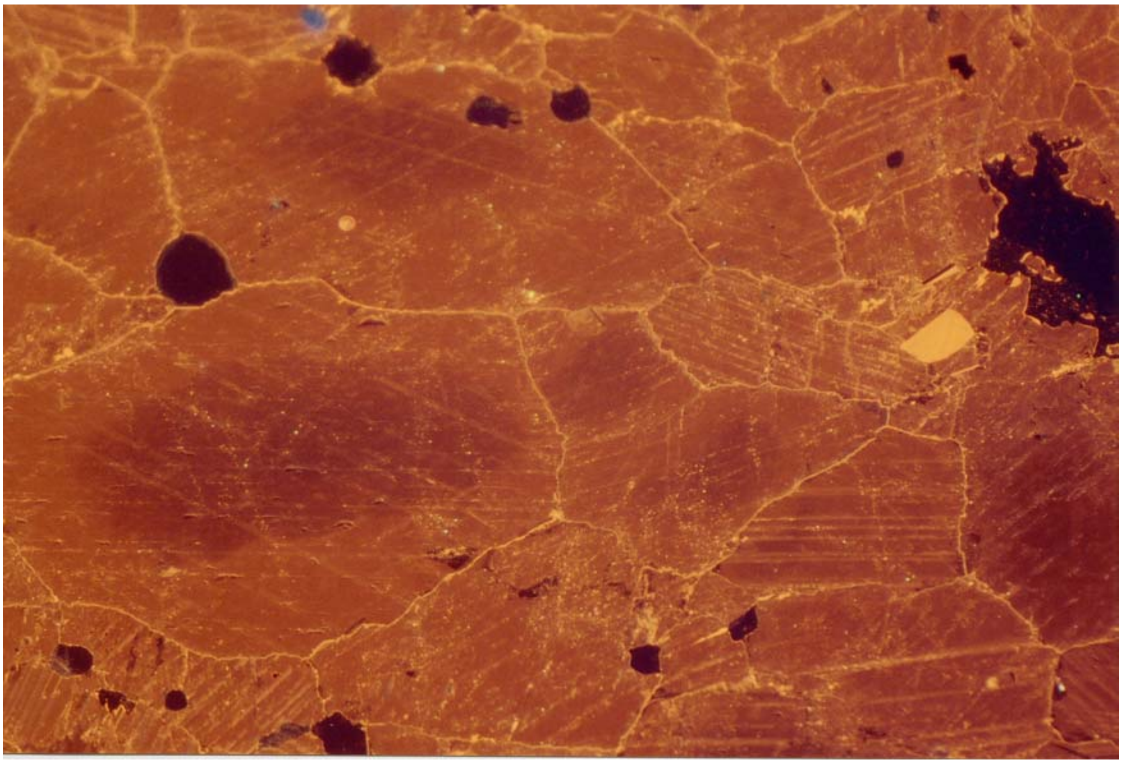

Figure MRC 108a. Cathodoluminescence image, showing orange-brown luminescent calcite crystals. Note the darker luminescence of many cores compared to rims.

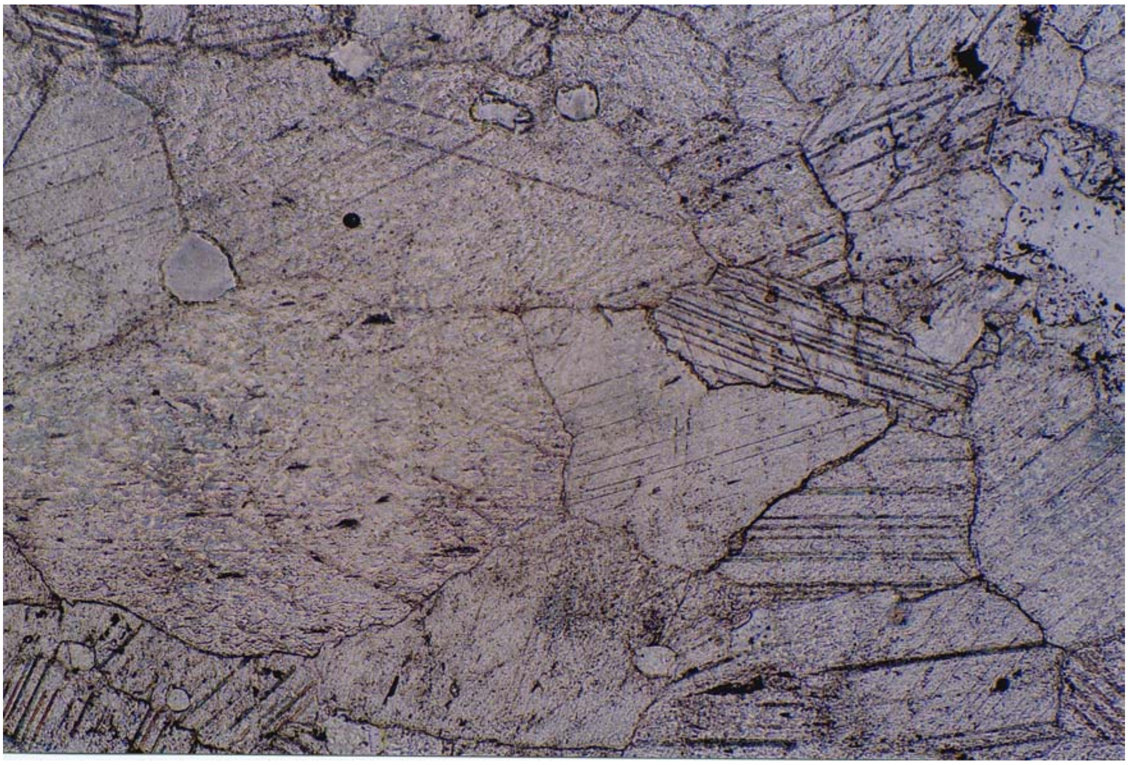

Figure MRC 108b. Plane-polarised light image of MRC 1088a.

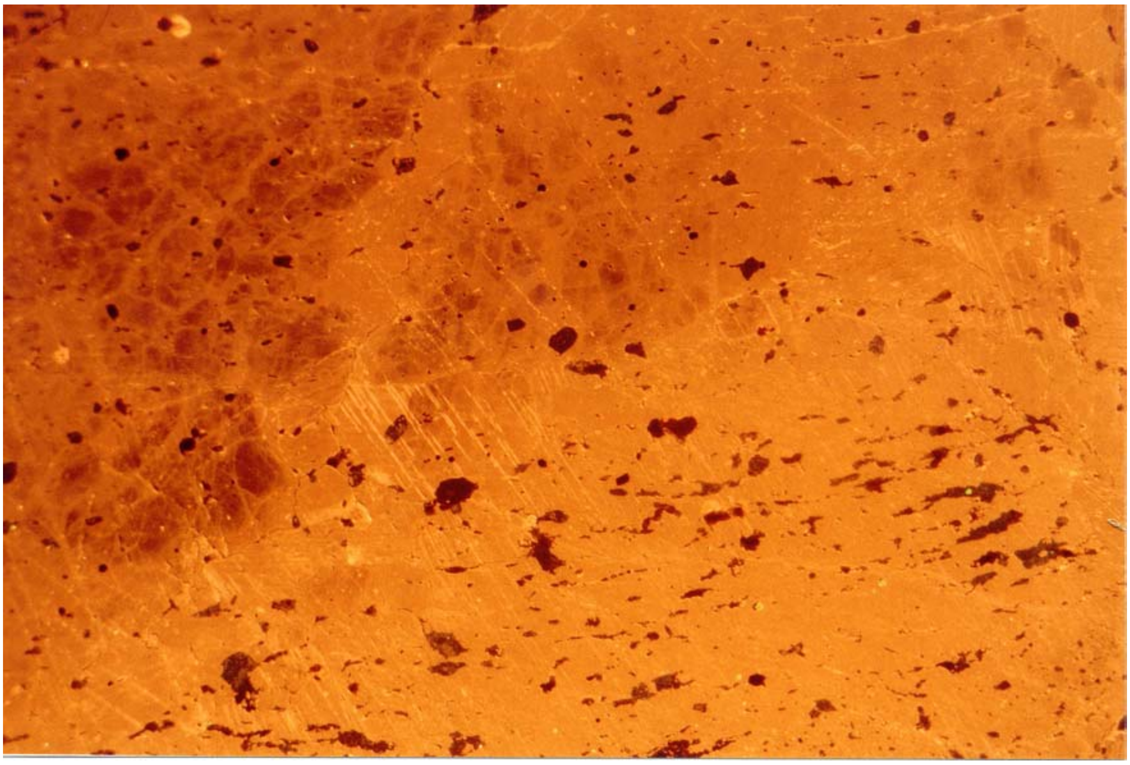

Figure MRC 121a. CL image. Note the variations in tone associated with texturally different silicate material. See Figure MRC 121b below, and text for discussion.

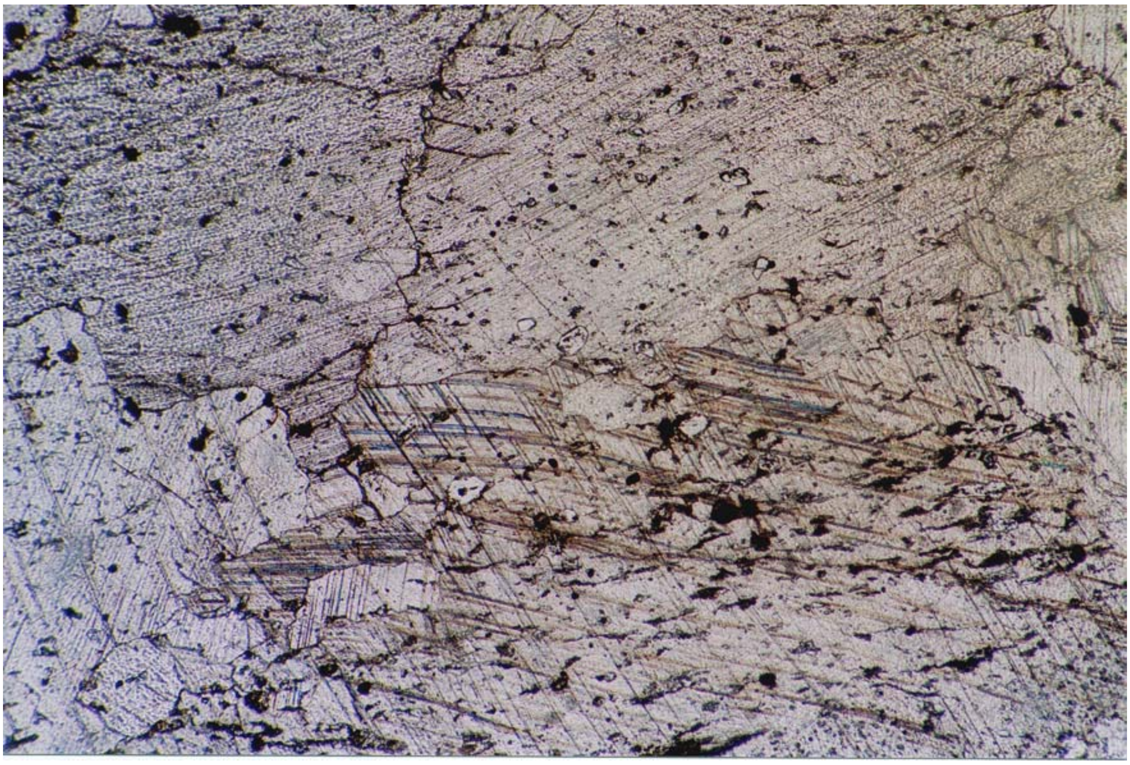

Figure MRC 121b. Plane-polarised light image of MRC 121a.

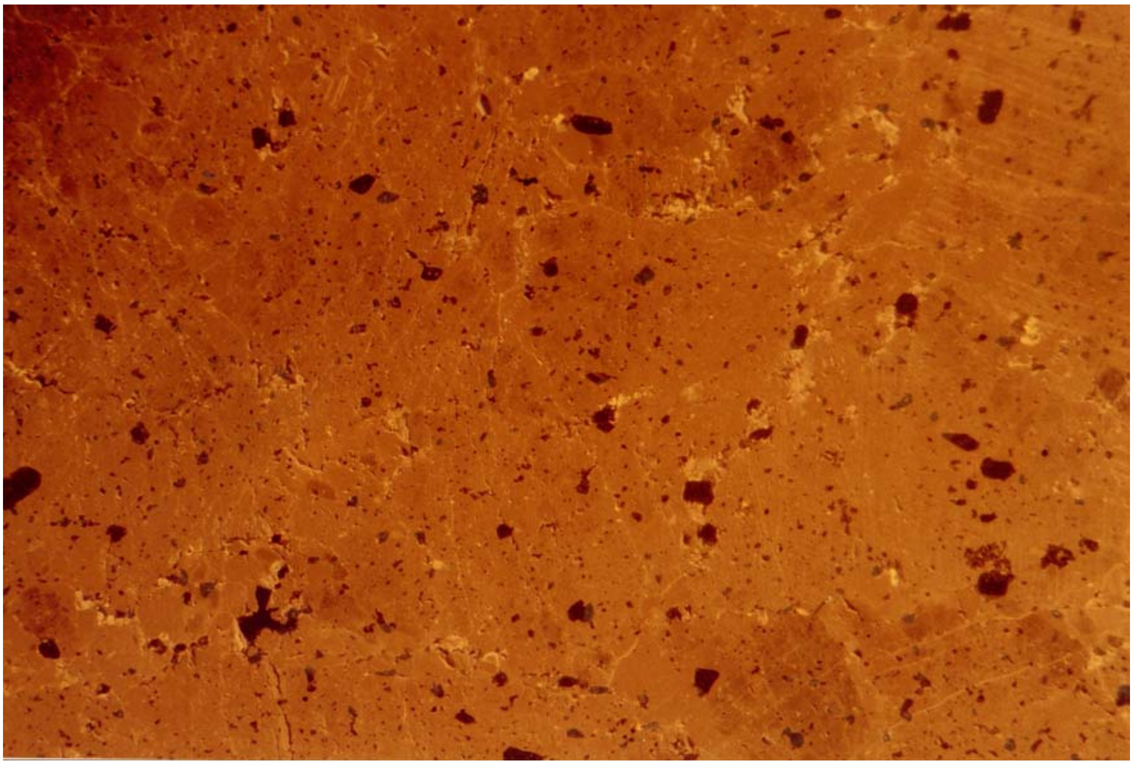

Figure MRC 122a. Cathodoluminescence image showing little variation. Isolated interiors of some grains are darker in tone, indicating lower Mn contents and/or higher Fe/Mn.

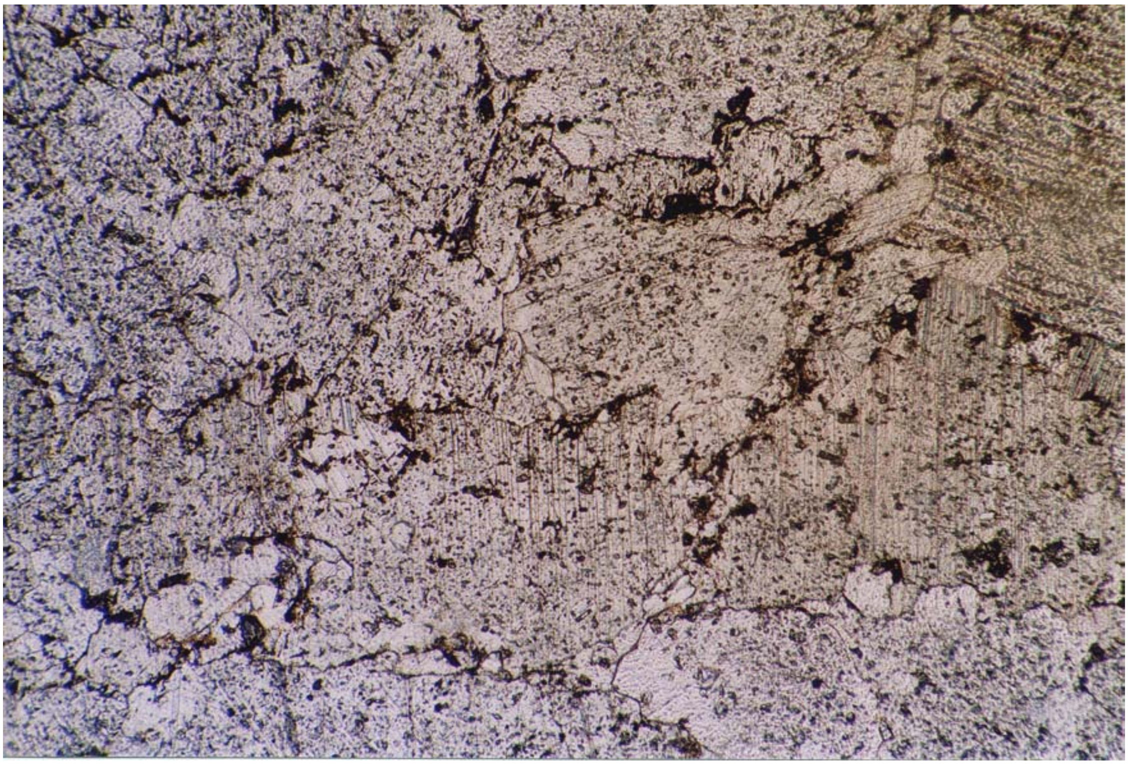

Figure MRC 122b. Plane-polarised light image of MRC 122a. Note the presence of local, silicate-free domains in the margins of some grains.

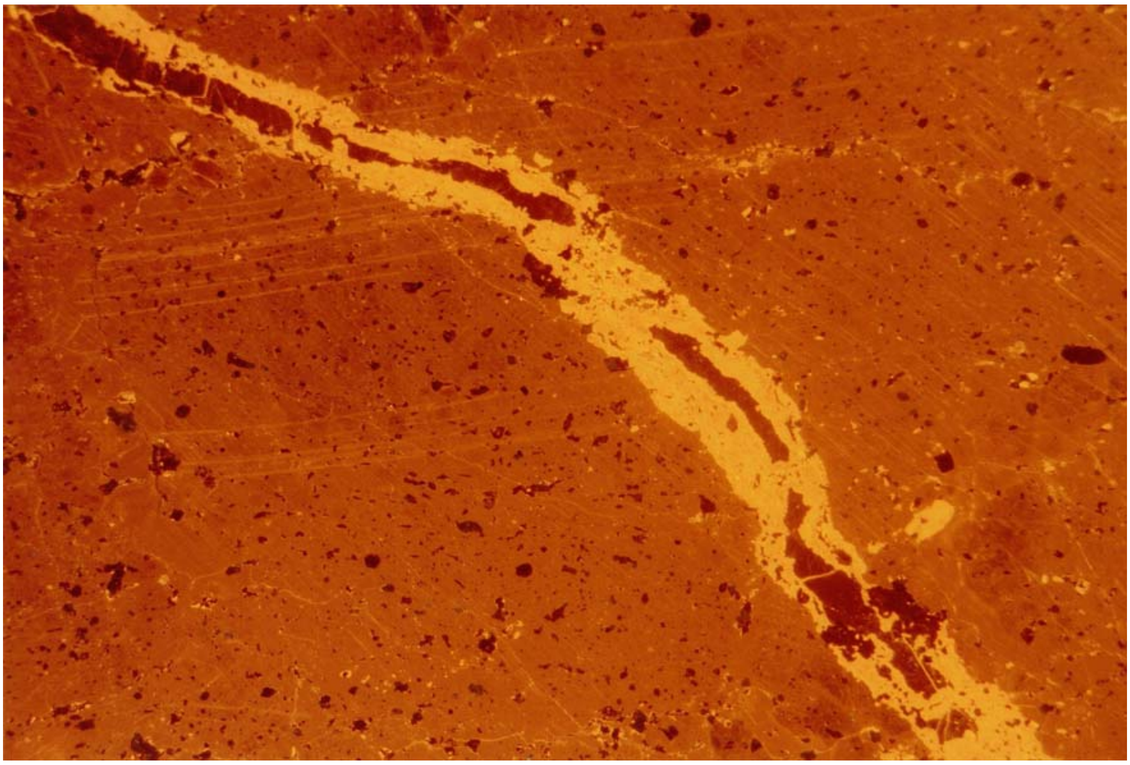

Figure MRC 123a. Cathodoluminescence image showing flat luminescence in host calcite and two generations of calcite in a late vein in a brittle fracture.

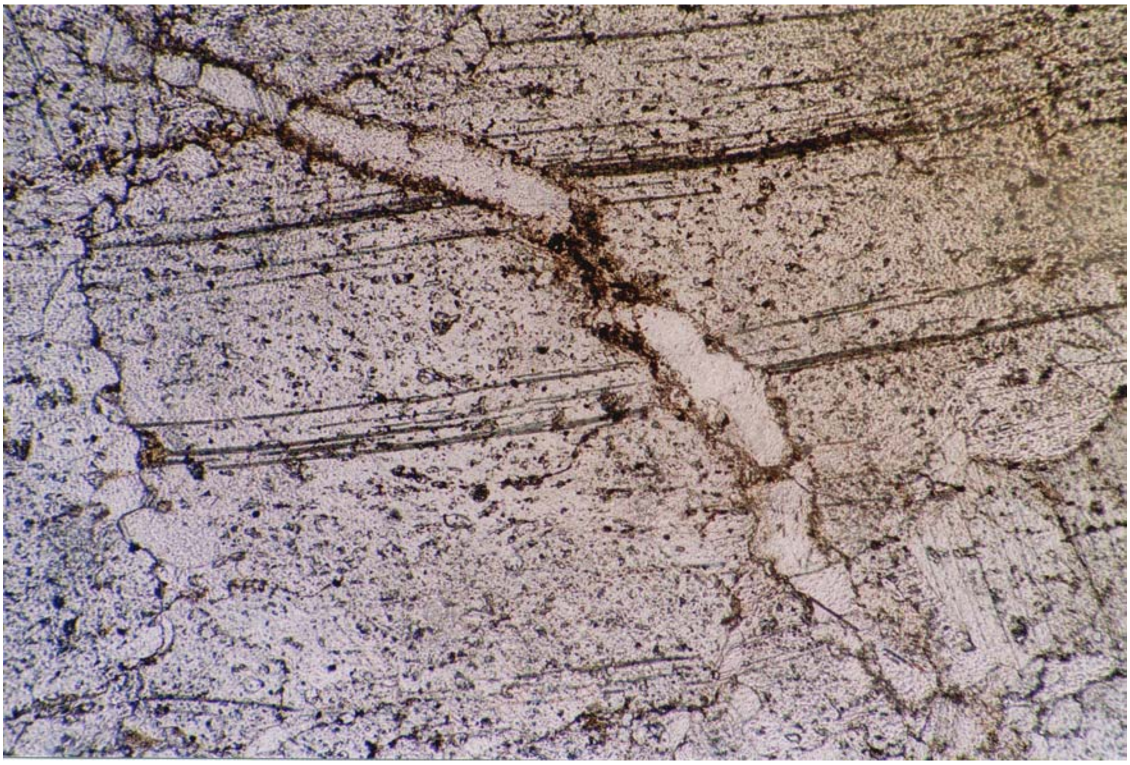

Figure MRC 123b. MRC 123a in plane-polarised light. Note the apparent homogeneity of the vein, revealed to be heterogeneous under CL in Figure MRC 123a.