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PETROGRAPHIC AND MINERAGRAPHIC DESCRIPTIONS

PETROGRAPHIC DESCRIPTIONS – NORTHERN TERRITORY

SUMMARY:

Based on the hand specimen and thin section descriptions the suite of samples provide evidence for a high level to subvolcanic felsic intrusive or diatreme that has actually vented. The development of vent breccia textures, evident in Samples OPET 0001, 0002 and 0003 provide evidence for this. Samples from deeper in the subvolcanic architecture confirm a composition for the felsic intrusive varying from leucotonalite to leucocratic monzogranite/granodiorite with depth.

The subvolcanic felsic intrusive has been autometasomatically altered to a clay/hematite – sericite – carbonate assemblage, particularly at shallower levels, although strong evidence for mineralisation is lacking. The felsic intrusive exhibits deformation textures attributable to subsolidus “squeezing” of the intrusive. The dolerite host has been pervasively metasomatically altered to sericite – Fe/Mg chlorite – hematite at shallower levels and exhibits low grade greenschist facies metamorphic textures at depth.

DESCRIPTIONS:

SAMPLE NO: OPET 0001

SAMPLE TYPE: Core

SECTION TYPE: Thin Section

FIELD IDENTIFICATION: Altered vent breccia.

DESCRIPTION: Variable heterolithic clasts occur in a pervasively altered matrix. The clasts include;

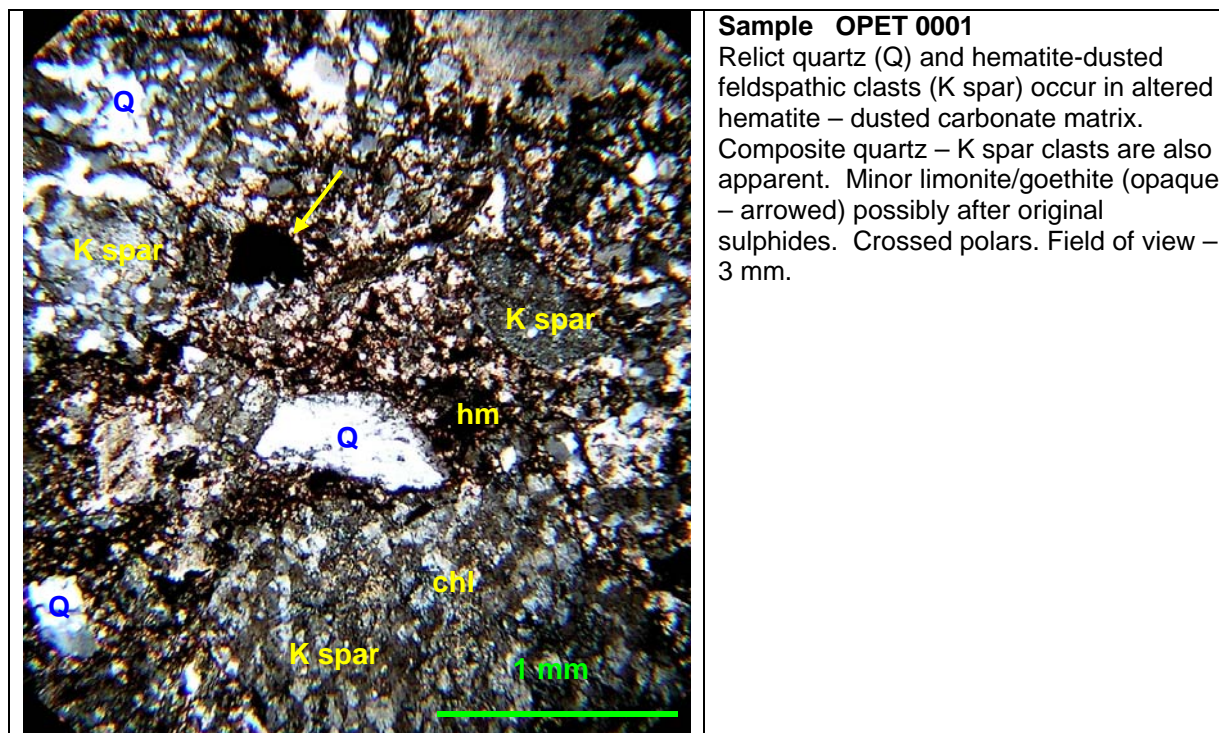
- hematite – dusted feldspathic – syenitic or trachytic(?) clasts dominated by fine anhedral potash feldspar aggregates locally containing Fe chlorite aggregates that may have pseudomorphed an original amphibole component,
- rare individual quartz clasts exhibiting distinctive deformation textures, and
- coarser grained (up to 4 mm) composite aggregates of anhedral quartz associated with hematite dusted and weakly sericite altered potash feldspar preserving fine granophyric textures.

The matrix has been penetrated by hematite-dusted carbonate and, along with fibrous Fe chlorite, defines an anastomosing schistosity that wraps the relict clasts. Similarly, quartz in the matrix has been attenuated parallel to the deformation. Carbonate lenses can show evidence of tensional

Comments: The breccia is consistent with a vent breccia that has involved clasts of the feldspathic – syenitic host as well as evidence of incipient alteration including hematite-dusting, Fe chlorite alteration and possible quartz alteration. The breccia matrix comprises a similar composition that has been pervasively metasomatically hematite – carbonate altered.

PIMA ANALYSIS: Phengite, montmorillonite, calcite.

CLASSIFICATION: *Pervasively metasomatically altered vent breccia comprising feldspathic (potash feldspar), quartz – feldspar and rare quartz clasts in a quartz – Fe chlorite – carbonate matrix.*



SAMPLE NO: OPET 0002

SAMPLE TYPE: Core

SECTION TYPE: Thin Section

FIELD IDENTIFICATION: Possible relict bedding apparent in an altered vent breccia.

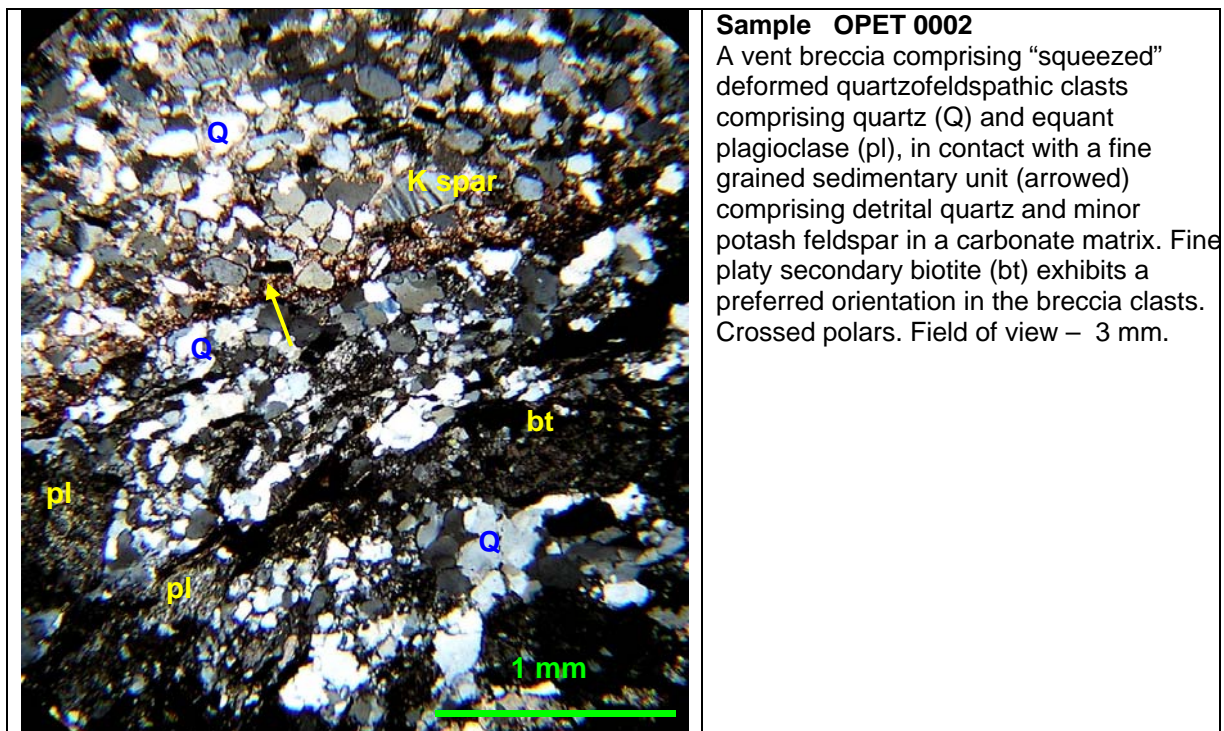
DESCRIPTION: Two distinctive units are present in thin section;

- A fine grained unit containing fine (~0.15 mm), subangular to subrounded detrital quartz (>85 vol%) and subordinant detrital potash feldspar – microcline (2 vol%) and plagioclase – albite (1 vol%). The detrital grains are moderately sorted, grain supported and occur in a carbonate matrix.
- A coarse grained unit comprises a chaotic mix of quartzofeldspathic clasts, occasional rounded detrital quartz, tabular plagioclase and minor potash feldspar - microcline. The quartzofeldspathic clasts comprise stressed quartz associated with altered (hematite-dusted), equant plagioclase – albite and appear to have been subject to subsolidus “squeezing” or deformation. The quartzofeldspathic clasts contain platy green secondary biotite paralleling an anastomosing schistosity. The clasts occur in a hematite-dusted carbonate matrix. Secondary carbonate has also penetrated the matrix.

Comments: The clastic units probably have a sedimentary origin with the coarser grained unit exhibiting possible vent-breccia textures punctuated by quieter depositional phases. Carbonate has penetrated the matrix and is typically hematite dusted and has an ankeritic composition suggesting a possible metasomatic hydrothermal origin.

PIMA ANALYSIS: Fe/Mg chlorite, phengite, ankerite.

CLASSIFICATION: *Pervasively metasomatically altered (hematite-dusted carbonate) vent breccia intercalated with finer grained sedimentary units. The vent breccia contains deformed quartzofeldspathic clasts in a carbonate matrix..*



SAMPLE NO: OPET 0003

SAMPLE TYPE: Core

SECTION TYPE: Thin Section

FIELD IDENTIFICATION: Possible altered vent breccia with coarse clasts.

DESCRIPTION: Variable clasts occur in an altered breccia matrix. The breccia comprises a chaotic mix of quartzofeldspathic clasts that have locally preserved indistinct granophyric textures. The feldspathic component has a locally preserved a tubular habit and has a plagioclase – albite composition. The feldspathic component has been pervasively altered to fine scaly sericite and dusted clays and hematite.

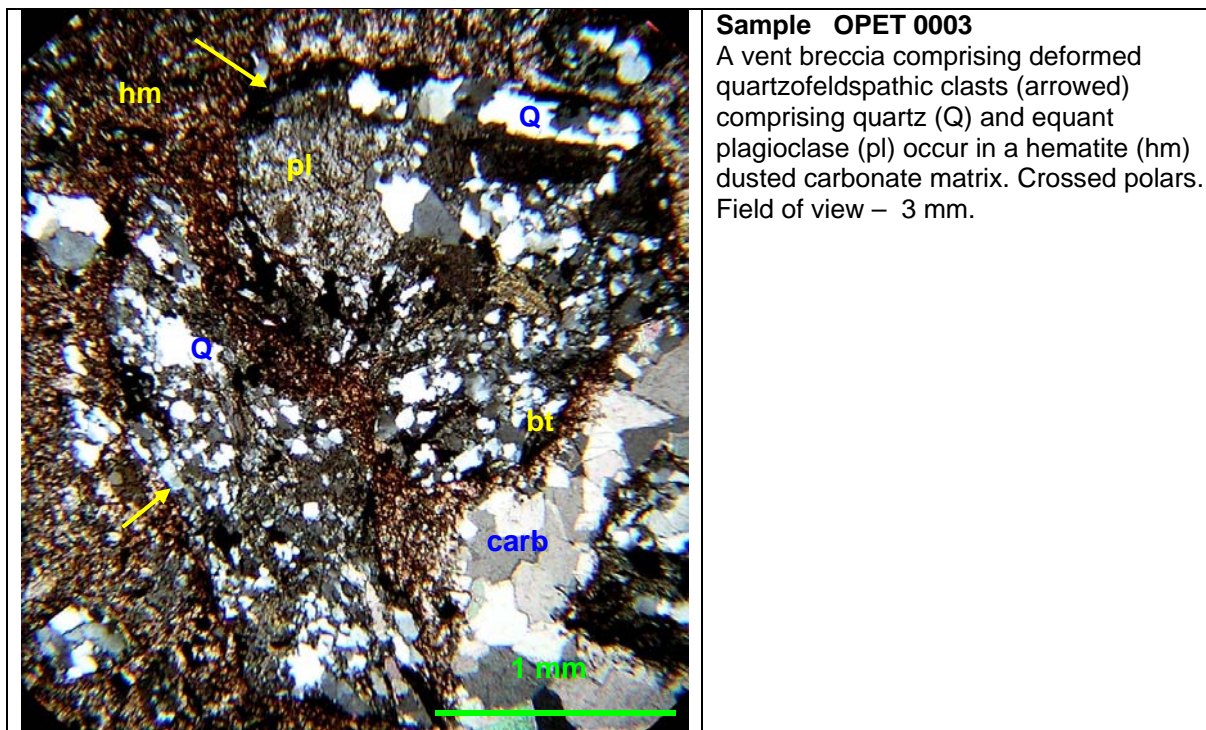
There is evidence that the clasts have been deformed and contain platy secondary biotite to Fe chlorite as an alteration overprint. Fine grained leucoxene aggregates and monazite occur as accessories.

The matrix has been invaded by fine anhedral to microcrystalline hematite dusted carbonate as well as late sparry carbonate that is relatively clear of inclusions.

Comments: The clastic compositions strongly suggests a felsic granophyric intrusive origin. The clasts have been (auto)metasomatically altered to clay/hematite – sericite – secondary biotite in a metasomatic hematite-dusted carbonate matrix.

PIMA ANALYSIS: Dolomite, montmorillonite, phengite.

CLASSIFICATION: *Pervasively metasomatically altered (hematite-dusted carbonate) vent breccia containing deformed quartzofeldspathic clasts with a possible felsic granophyric origin. The clasts occur in a hematite – dusted carbonate matrix..*



SAMPLE NO: OPET 0004

SAMPLE TYPE: Core

SECTION TYPE: Thin Section

FIELD IDENTIFICATION: Distinctive feldspar phenocrysts or xenocrysts occur in a felsic host in a contact with a fine grained mafic – dolerite host.

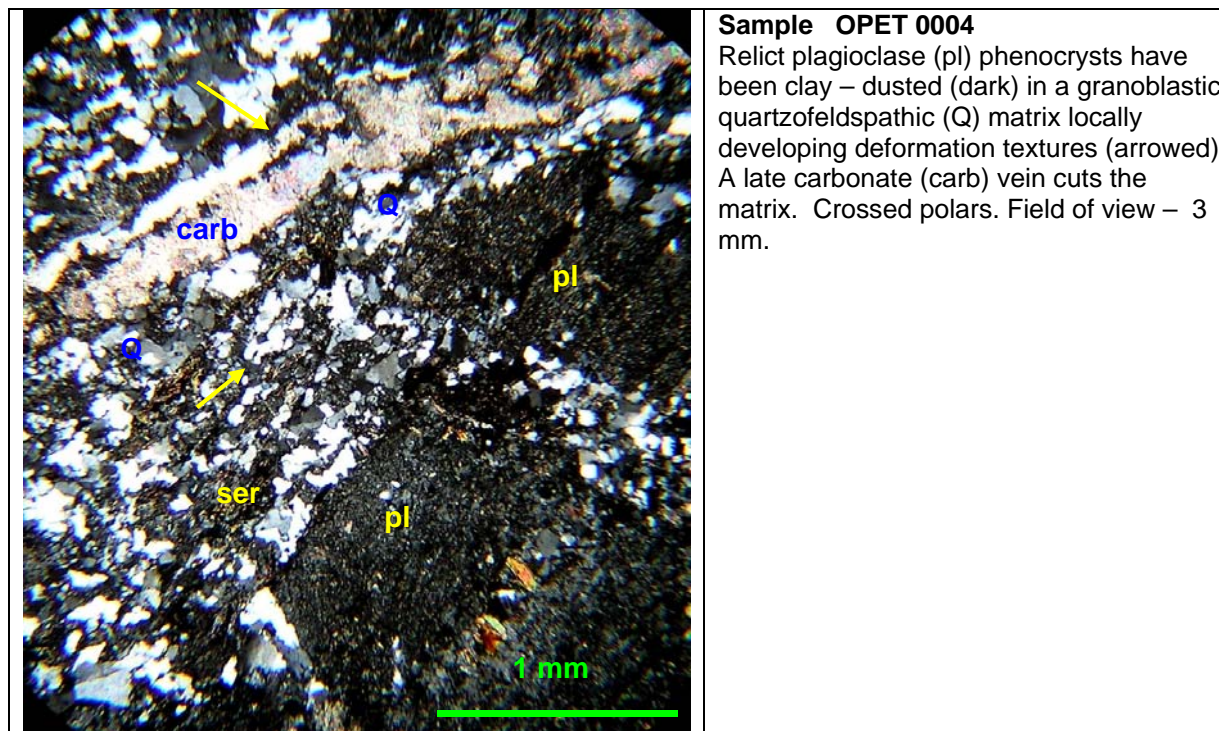
DESCRIPTION: The felsic phase comprises coarse equant to tabular plagioclase – albite that has been pervasively clay dusted and replaced by patchy carbonate. The feldspar phenocrysts or possible xenocrysts occur in a deformed quartzofeldspathic matrix comprising granoblastic quartz grains locally developing serrated grain boundaries. Ragged secondary biotite occurs in the matrix and can be associated with residual leucoxene. Late carbonate veining.

The mafic host exhibits a fine to medium grain size and has preserved interlocking lathlike forms associated with dark limonitic forms and secondary biotite to Fe chlorite. The feldspathic component in the matrix has been altered to fibrous sericite and Fe to Fe/Mg chlorite.

Comments: The felsic intrusive has the same composition as previously described felsic clasts occurring within the interpreted vent breccia. The plagioclase – phyric intrusive has a leucotonalite composition and has been (auto)metasomatically altered to clay/hematite – sericite – secondary biotite. The deformation textures are identified as having a possible subsolidus “squeezing” origin. The felsite has intruded a pervasively altered (sericite - Fe to Fe/Mg chlorite – clay) mafic to intermediate host preserving lathlike forms.

PIMA ANALYSIS: Fe/Mg chlorite, muscovite, montmorillonite, calcite.

CLASSIFICATION: *Pervasively metasomatically altered (clay – sericite - carbonate – secondary biotite), plagioclase – phyric felsic intrusive, identified as a leucotonalite, intruding an altered (sericite – clay – Fe to Fe/Mg chlorite) mafic to intermediate host.*



SAMPLE NO: OPET 0005

SAMPLE TYPE: Core

SECTION TYPE: Thin Section

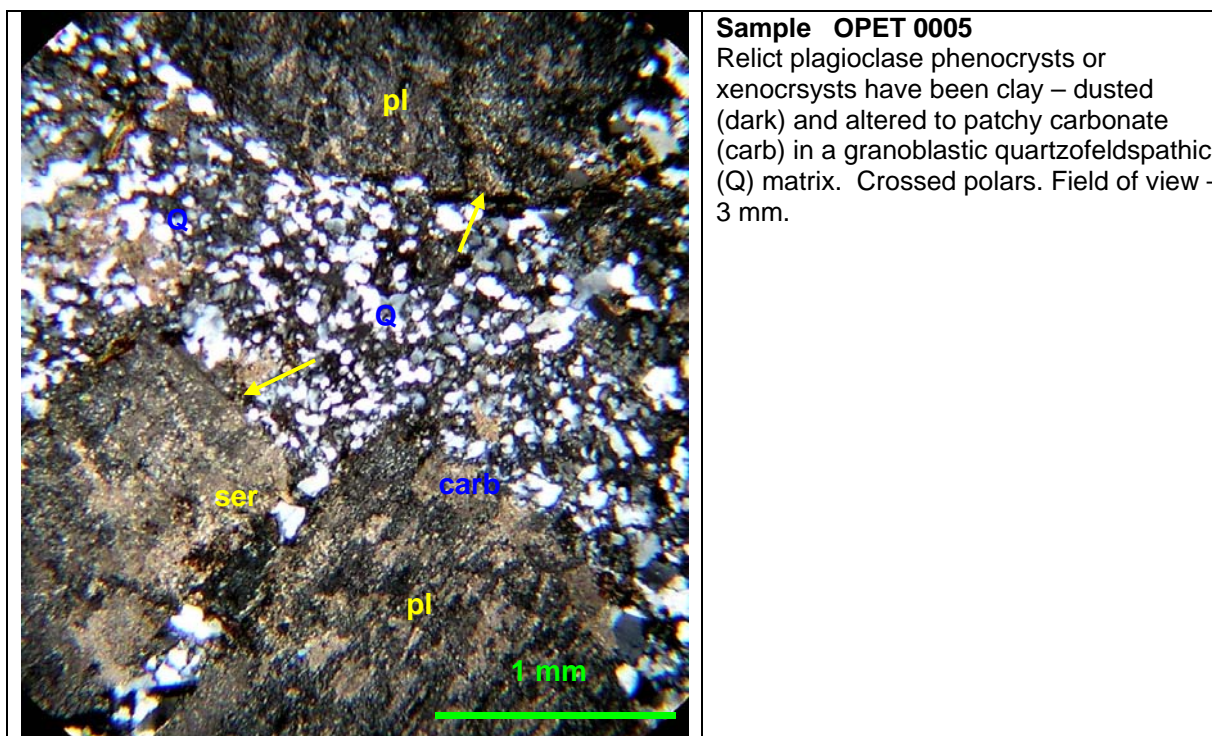
FIELD IDENTIFICATION: Distinctive feldspar phenocrysts or xenocrysts occur in a felsic host.

DESCRIPTION: Similar to OPET 0004, with distinctive coarse grained, equant to tabular plagioclase – albite that has been pervasively clay dusted and replaced by patchy carbonate occurring in a quartzofeldspathic matrix. The feldspar phenocrysts or possible xenocrysts occur in a deformed quartzofeldspathic matrix comprising granoblastic grains locally developing serrated grain boundaries. Ragged to platy secondary biotite to Fe chlorite occurs in the matrix as part of the alteration overprint.

Comments: The felsic intrusive has the same composition as the felsite described in Sample OPET 0004 and previously described felsic clasts occurring within the interpreted vent breccia. The plagioclase phenocrysts or probable xenocrysts occur in the fine grained quartzofeldspathic matrix and suggest a leucotonalite composition for the intrusive. The felsite has been pervasively autometamatically altered to clay – sericite - carbonate – secondary biotite.

PIMA ANALYSIS: Fe/Mg chlorite, muscovite, montmorillonite, calcite

CLASSIFICATION: *Pervasively metamatically altered (clay – sericite - carbonate – secondary biotite), plagioclase – phyric felsic intrusive, identified as a leucotonalite.*



SAMPLE NO: OPET 0006

SAMPLE TYPE: Core

SECTION TYPE: Thin Section

FIELD IDENTIFICATION: Fine grained altered mafic to intermediate – possible dolerite host.

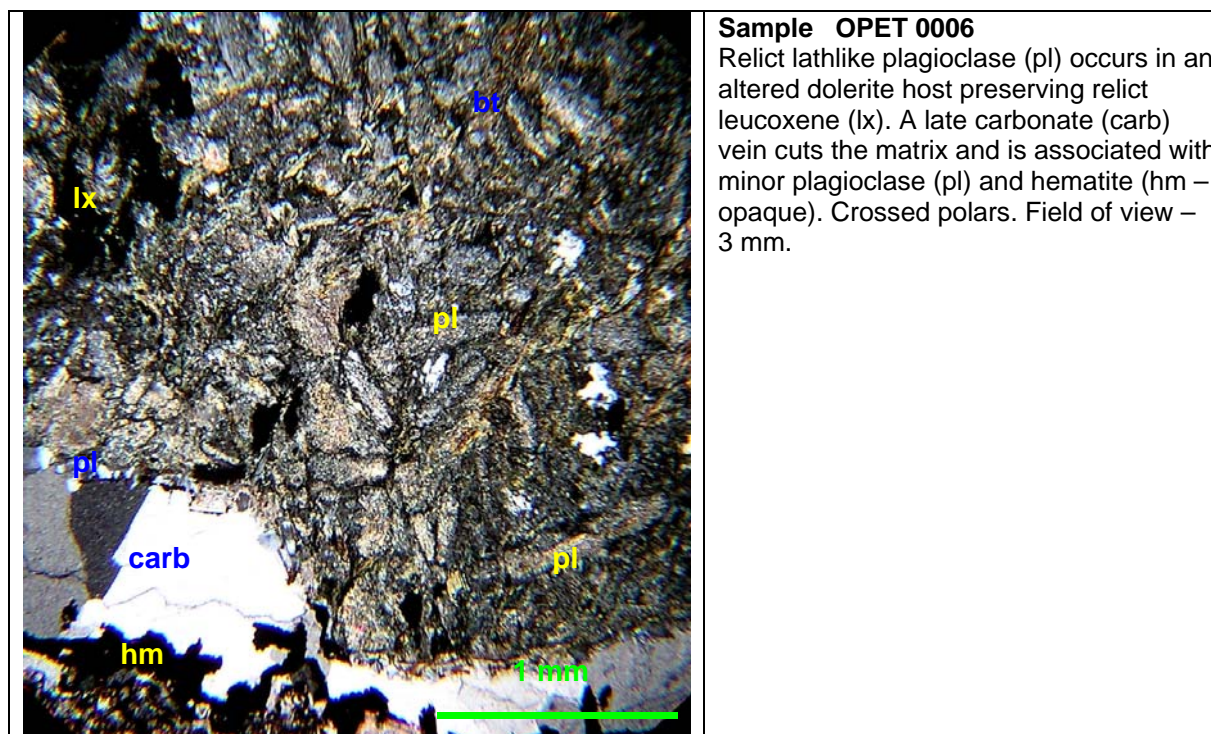
DESCRIPTION: Relict lathlike forms are randomly distributed through an altered host. The relict equant to lathlike forms after original plagioclase have been pervasively altered to scaly sericite. The original ferromagnesian component has been replaced by secondary biotite to Fe chlorite plus residual leucoxene. Fibrous secondary biotite to Fe chlorite exhibits a preferred orientation. Fine to medium grained phyrlic to skeletal leucoxene is distributed through the matrix.

A late carbonate vein cuts the matrix and is associated with minor secondary plagioclase and rimmed by hematite.

Comments: The preserved lathlike textures and relict leucoxene support a doleritic precursor. The mafic assemblage has been pervasively metasomatically altered to sericite – secondary biotite to Fe chlorite, possibly as a syn-tectonic phase.

PIMA ANALYSIS: Pyrophyllite(?), phlogopite.

CLASSIFICATION: *Pervasively metasomatically altered (sericite - secondary biotite to Fe chlorite), mafic, identified as a dolerite.*



SAMPLE NO: OPET 0007

SAMPLE TYPE: Core

SECTION TYPE: Thin Section

FIELD IDENTIFICATION: Distinctive feldspar phenocrysts or xenocrysts occur in a felsic host in a contact with a fine grained mafic – dolerite host.

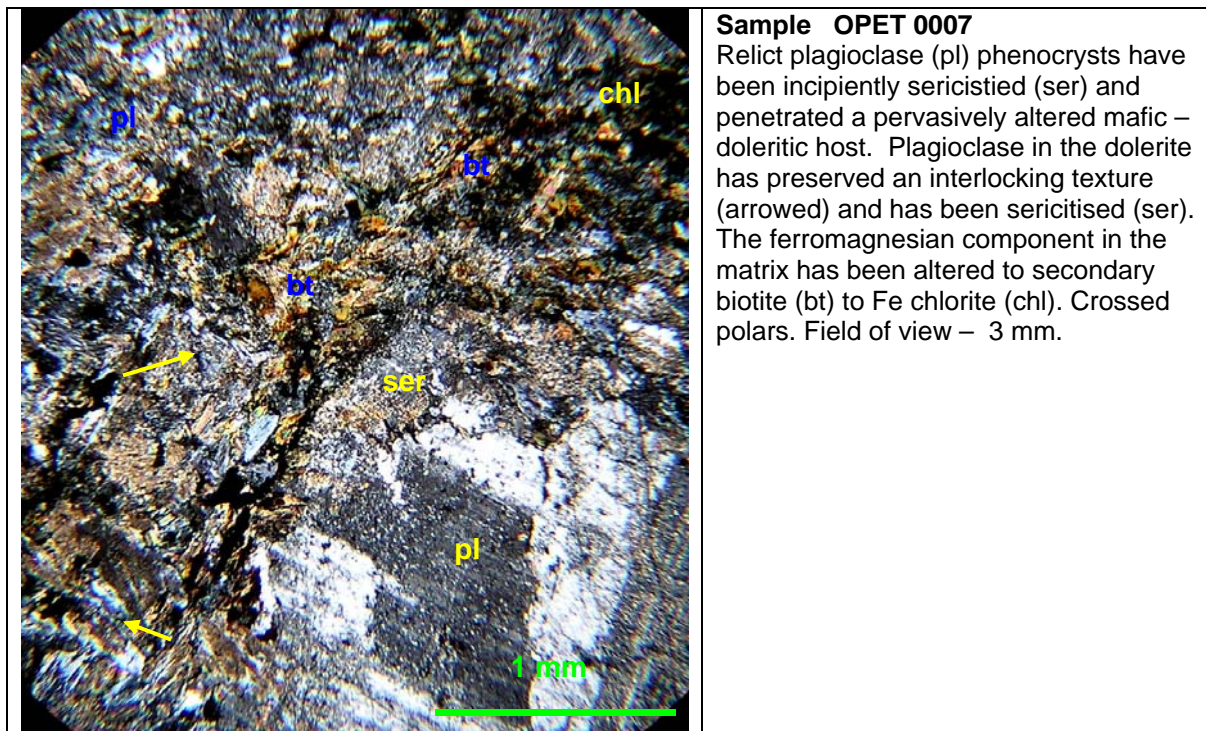
DESCRIPTION: Like Sample OPET 0004, the felsic phase comprises distinctive, coarse equant to tabular plagioclase – albite that has been clay/hematite dusted and incipiently sericitised. The feldspar phenocrysts or possible xenocrysts have been locally deformed (deformed multiple twinning) and occur in a quartzofeldspathic matrix comprising granoblastic quartz grains developing serrated grain boundaries. Ragged secondary biotite to Fe chlorite occurs in the matrix.

The plagioclase xenocrysts have impinged onto the mafic host that exhibits a fine to medium grain size and has preserved interlocking lathlike forms after original plagioclase. The ferromagnesian matrix has been replaced by secondary biotite to Fe chlorite plus residual leucoxene.

Comments: The felsic intrusive is consistent with previously described leucocratic intrusives that has penetrated and probably altered (secondary biotite to Fe chlorite, sericite) the dolerite host. The deformation of some plagioclase xenocryst is attributed to subsolidus “squeezing” of the felsic intrusive.

PIMA ANALYSIS: Fe chlorite, muscovite (illite), montmorillonite, calcite.

CLASSIFICATION: *Altered (clay/hematite – sericite - secondary biotite to Fe chlorite), plagioclase – phyric felsic intrusive, identified as a leucotonalite, intruding an altered (sericite – Fe chlorite) mafic – doleritic host.*



SAMPLE NO: OPET 0010

SAMPLE TYPE: Core

SECTION TYPE: Thin Section

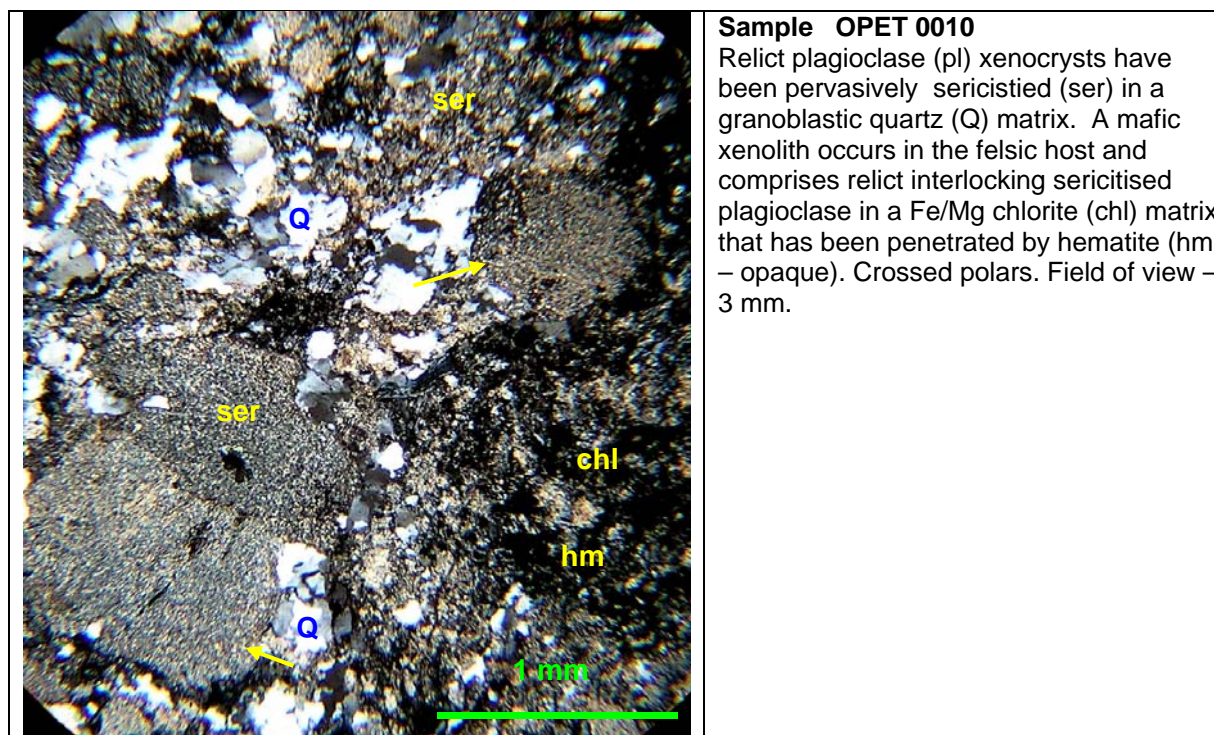
FIELD IDENTIFICATION: Distinctive feldspar xenocrysts occur in an altered fine grained mafic – dolerite host.

DESCRIPTION: There is evidence that the dolerite (xenolithic?) host has been flooded and metasomatised by a felsic host. The felsic portion of the matrix has preserved sericitised, medium to coarse equant to tabular feldspar xenocrysts in a granoblastic quartz matrix containing ragged to platy Fe to Fe/Mg chlorite. The mafic host exhibits a fine to medium grainsize and interlocking sericitised lathlike plagioclase associated with interstitial Fe/Mg chlorite replacing the ferromagnesian matrix. Hematite has penetrated the matrix as part of the metasomatic alteration overprint.

Comments: The mafic phase probably represents a xenolith in a felsic intrusive that has progressively assimilated and altered the mafic host.

PIMA ANALYSIS: Fe/Mg chlorite, muscovite (illite), montmorillonite.

CLASSIFICATION: *An altered (sericite – Fe/Mg chlorite) mafic – doleritic xenolith occurs in the altered (sericite - secondary biotite to Fe chlorite), plagioclase – phyric felsic intrusive host.*



SAMPLE TYPE: Core

SECTION TYPE: Thin Section

FIELD IDENTIFICATION: Felsic intrusive in contact with a metamorphosed mafic host.

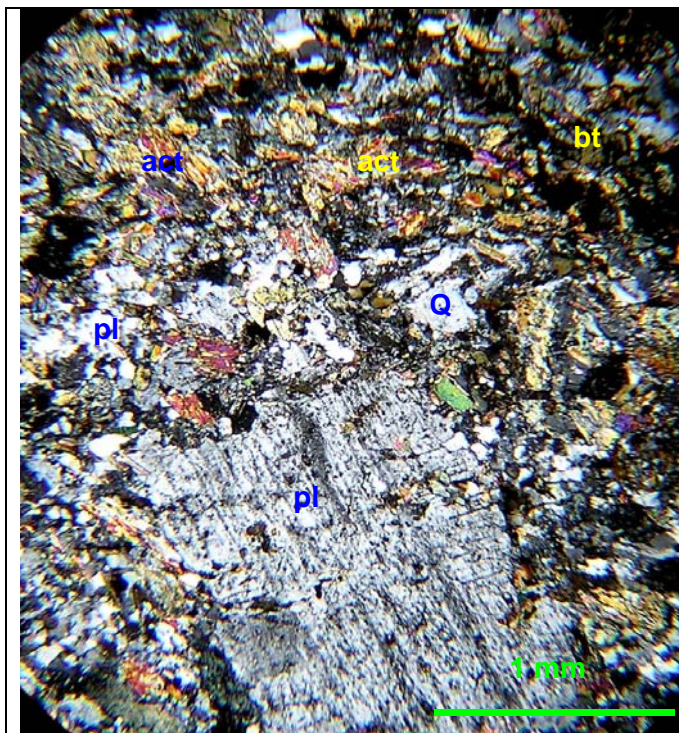
DESCRIPTION: The felsic intrusive contains plagioclase – albite and potash feldspar – microcline phenocrysts (and oikocrysts) in a fine to medium grained quartzofeldspathic matrix. The feldspathic component has been incipiently sericitised. Fine epidote aggregates occur in the matrix, as part of the alteration overprint, and can be associated with platy biotite and accessory zircon.

The mafic host contains occasional plagioclase xenocrysts in a fine grained matrix comprising ragged actinolite associated with platy biotite and interstitial limpid plagioclase. Minor quartz occurs interstitially.

Comments: The mafic phase exhibits an assemblage that is stable under greenschist facies with the presence of biotite confirming a metasomatic component. The felsite has preserved plagioclase and potash feldspar phenocrysts to xenocrysts.

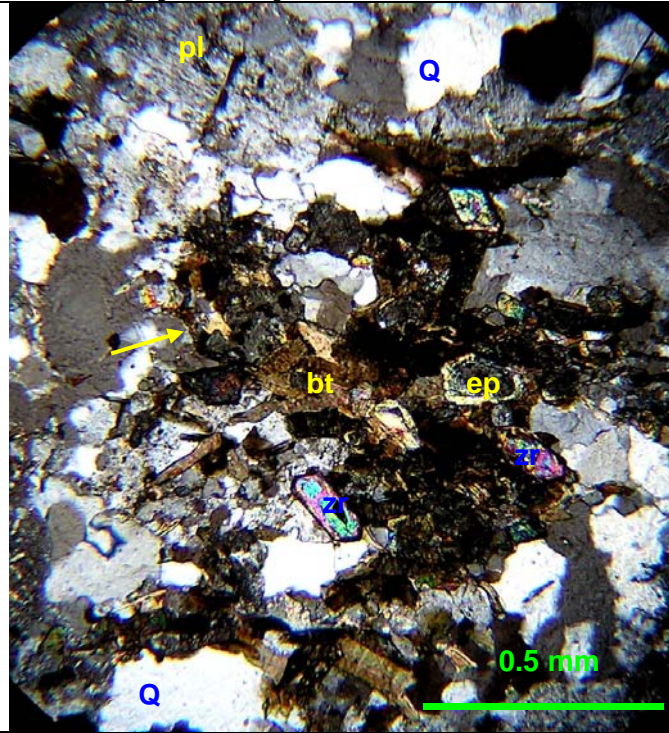
PIMA ANALYSIS: Fe/Mg chlorite, montmorillonite, ankerite.

CLASSIFICATION: A low grade – greenschist facies metamorphosed and metasomatised (actinolite – biotite – limpid plagioclase) mafic – dolerite in contact with a plagioclase and potash feldspar – phyrlic felsic intrusive.



Sample OPET 0015

A plagioclase (pl) xenocryst occurs in the metamorphosed mafic host comprising ragged actinolite (act) associated with platy biotite (bt) and interstitial limpid plagioclase (pl) and minor quartz (Q). Crossed polars. Field of view – 3 mm.

**Sample OPET 0015**

Detail of the felsic intrusive showing an aggregate of epidote (ep), platy biotite (bt) and accessory zircon (zr) occurring in the quartzofeldspathic matrix. Crossed polars. Field of view – 1.5 mm.

SAMPLE NO: OPET 0016

SAMPLE TYPE: Core

SECTION TYPE: Thin Section

FIELD IDENTIFICATION: Coarse feldspar phenocrysts or xenocrysts occur in a felsic host in a contact with a fine grained, altered mafic – dolerite host.

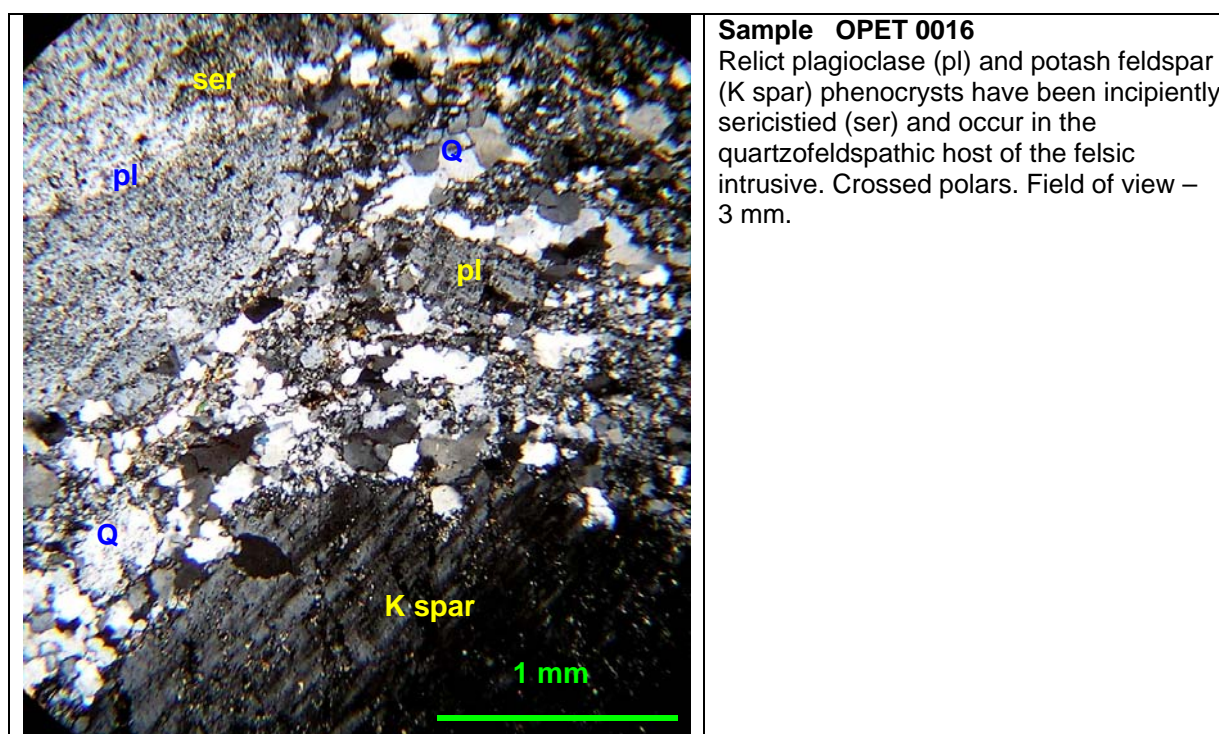
DESCRIPTION: Corroded plagioclase – albite and coarse grained potash feldspar – orthoclase xenocrysts occur in a quartzofeldspathic host. The feldspathic component has been incipiently sericitised and occur in a fine to medium grained matrix comprising granoblastic quartz, interstitial quartz and platy biotite – anhedral to subhedral epidote aggregates.

The mafic host that exhibits a fine to medium grainsize and has preserved interlocking lathlike plagioclase that has been incipiently sericitised. The ferromagnesian matrix has been replaced by secondary biotite to Fe chlorite plus residual leucoxene. Hematite has penetrated the matrix as part of the alteration overprint.

Comments: The felsic intrusive has a leucocratic monzogranite to granodiorite composition. The mafic component has been metasomatically altered associated with the introduction of hematite.

PIMA ANALYSIS: Fe/Mg chlorite, muscovite.

CLASSIFICATION: *Altered (sericite - secondary biotite and epidote), plagioclase and potash feldspar – phyric felsic intrusive, intruding an altered (sericite – Fe to Fe/Mg chlorite - hematite) mafic – doleritic host.*



SAMPLE NO: OPET 0026

SAMPLE TYPE: Core

SECTION TYPE: Thin Section

FIELD IDENTIFICATION: Felsic intrusive in contact with a metamorphosed mafic host.

DESCRIPTION: The felsic intrusive contains plagioclase – albite and potash feldspar – microcline phenocrysts in a fine to medium grained quartzofeldspathic matrix. The matrix comprises granoblastic quartz that can exhibit deformation textures. Epidote aggregates occur in the felsic matrix. The feldspathic component has been incipiently sericitised and clay – dusted. Trace accessory pyrite.

The mafic host comprises a medium grained metamorphic assemblage with ragged actinolite associated with interstitial sericitised plagioclase. Fine, anhedral to subhedral epidote forms an integral part of the assemblage. A secondary plagioclase vein cuts the matrix.

Comments: The mafic doleritic phase exhibits an assemblage that is stable under greenschist facies. The felsic intrusive has preserved plagioclase and potash feldspar phenocrysts to xenocrysts supporting a monzogranite to granodiorite composition.

PIMA ANALYSIS: Montmorillonite, Fe/Mg chlorite.

CLASSIFICATION: *A low grade – greenschist facies metamorphosed (actinolite – epidote) mafic – dolerite in contact with a plagioclase and potash feldspar – phyric felsic intrusive.*

