PATHFINDER EXPLORATION PTY LTD
- GEOCHEMISTRY - PETROLOGY - GEOLOGY

11 Dennison Drive
Ocean Reef, WA 6027
Phone 618 9300 6689
Fax 618 9300 4429

Email: pfinder@bigpond.net.au
Web: www.pathfinderexploration.com.au

PETROGRAPHIC AND MINERAGRAPHIC DESCRIPTIONS

BRIEF PETROGRAPHIC DESCRIPTIONS - ANNINGIE TIN FIELD, NT

SAMPLE NO: B140 **LOCATION:** Anningie Tin Field, NT

SAMPLE TYPE: Rock Chip

SECTION TYPE: Thin Section

FIELD IDENTIFICATION: Pegmatite containing spodumene (Li – 1.5 %).

MINERALS PRESENT:

Quartz	52%
Clinopyroxene – spodumene	40%
Plagioclase - oligoclase (?)	8%
Sericite	tr

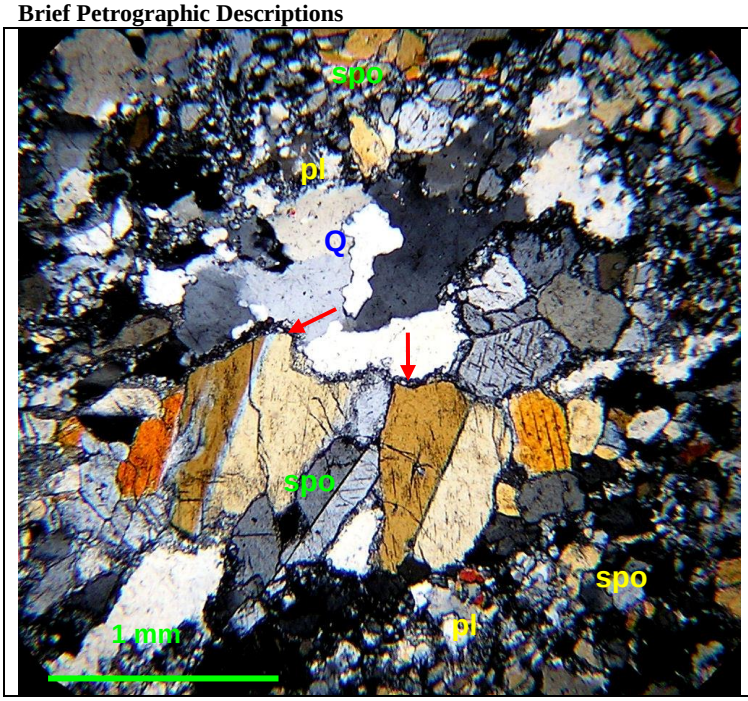
DESCRIPTION: Spodumene forms an integral part of the pegmatite matrix as fine to medium grained anhedral aggregates associated with interstitial quartz. Medium grained, anhedral to tabular plagioclase – oligoclase occurs interstitially to spodumene in a portion of the matrix. Secondary plagioclase as "ghost" veins cross-cuts the assemblage. Plagioclase has been incipiently altered to fibrous sericite.

Spodumene typically occurs as fine, anhedral to subhedral aggregates associated with interstitial quartz and plagioclase. Spodumene typically occurs as discrete grains (50 – 200 μm) and exhibits a network to anastomosing texture suggesting that the spodumene has been tectonised and recrystallised. Spodumene has locally developed feathery symplectic and fibrous textures along grain boundaries.

Host Comments: Spodumene represents the dominant component of the pegmatite host and would appear to have undergone a deformation phase, possibly within a shear zone. The development of symplectic to fibrous spodumene only represents a very minor component.

ANALYSIS: **Li – 1.5%,** Si – 36.8%, K – 0.41%, Fe – 0.73%, Al – 8.65%, Ca – 0.03%, Cr – 68 ppm, Cs – 49.8 ppm, Mg – 60 ppm, Mn – 232 ppm, Rb – 215 ppm, Nb – 6 ppm, Ta – 14.9 ppm, Sn – 37 ppm, U – 0.5 ppm.

CLASSIFICATION: *Fine to medium grained spodumene dominates in a pegmatite host that appears to have been deformed, possibly within a shear zone.*



Sample B140
Fine to medium grained spodumene (spo) locally exhibits symplectic textures (arrowed) in contact with interstitial quartz (Q). Minor interstitial plagioclase (pl). Crossed polars. Field of view – 3 mm.

****

SAMPLE NO: B161 **LOCATION:** Anningie Tin Field, NT

SAMPLE TYPE: Rock Chip

SECTION TYPE: Thin Section

FIELD IDENTIFICATION: Fine grained, possibly sheared, Li – mineralised pegmatite containing spodumene (Li – 0.854 %).

MINERALS PRESENT:

Quartz	25%
Clinopyroxene – spodumene	33%
Plagioclase - oligoclase (?)	42%

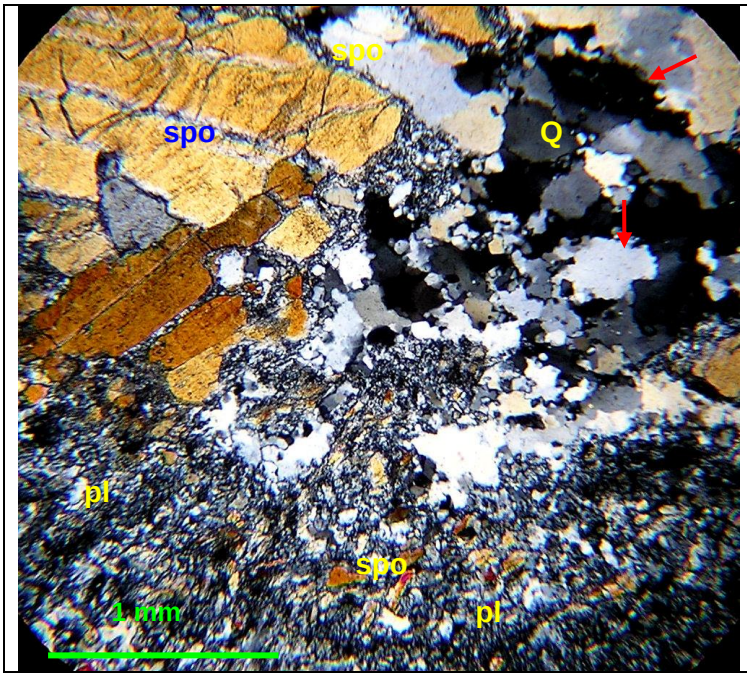
DESCRIPTION: Portions of the matrix have retained coarser grained primary textures with medium grained, tabular spodumene associated with interstitial quartz exhibiting ubiquitous undulose extinction and sutured grain boundaries.

Fine grained portions of the matrix dominate in the sample and comprise fine (50 to 150 μm), anhedral to tabular spodumene associated with microcrystalline plagioclase and interstial quartz. The plagioclase component has probably been recrystallised or annealed during ongoing deformation.

Comments: The matrix typically contains fine grained spodumene closely associated with plagioclase and quartz. The coarser grained spodumene – quartz aggregates are interpreted to represent relicts of primary pegmatite within a sheared host with the same composition, albeit with a higher plagioclase content.

ANALYSIS: **Li – 0.854%,** Si – 37%, K – 0.2%, Fe – 0.42%, Al – 8.73%, Ca – 0.01%, Cr – 68 ppm, Cs – 41.6 ppm, Mg – 60 ppm, Mn – 77 ppm, Rb – 117 ppm, Ta – 8.3 ppm, Sn – 15 ppm..

CLASSIFICATION: Fine grained spodumene – plagioclase – quartz assemblage interpreted to represent a sheared spodumene – rich pegmatite host.



Sample B161
A coarser grained relict pegmatite assemblage, occurring in the fine grained matrix, comprises tabular spodumene (spo) associated with quartz (Q) exhibiting sutured grain boundaries (arrowed). The fine grained matrix comprises fine tabular spodumene associated with microcrystalline or annealed plagioclase (pl) associated with quartz (Q). Crossed polars. Field of view – 3 mm.

SAMPLE NO: B168 **LOCATION:** Anningie Tin Field, NT

SAMPLE TYPE: Rock Chip

SECTION TYPE: Thin Section

FIELD IDENTIFICATION: Fine to medium grained pegmatite containing spodumene (Li – 2.15 %).

MINERALS PRESENT:

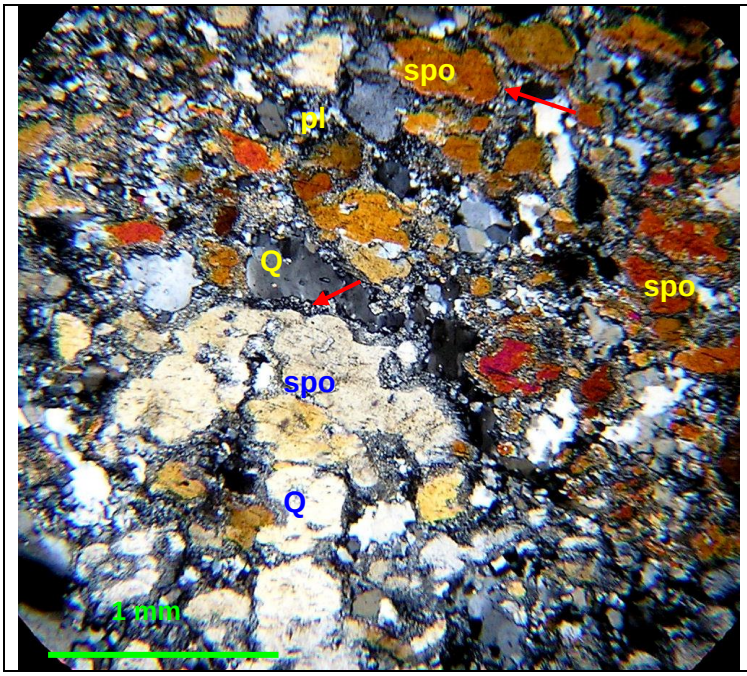
Quartz	38%
Clinopyroxene – spodumene	52%
Plagioclase - oligoclase (?)	10%

DESCRIPTION: The spodumene component has increased and typically occurs as fine anhedral aggregates associated with interstitial quartz and minor limpid plagioclase. Spodumene can occur as coarse anhedral aggregates with the local development of coarse grained oikocrysts (up to 2.5 mm), as a relict phase in the matrix. Finer grained portions of the matrix comprise fine anhedral to fibrous spodumene aggregates that would appear to follow an anastomosing schistosity. Similarly, coarser grained spodumene can be rimmed by fibrous spodumene paralleling the schistosity.

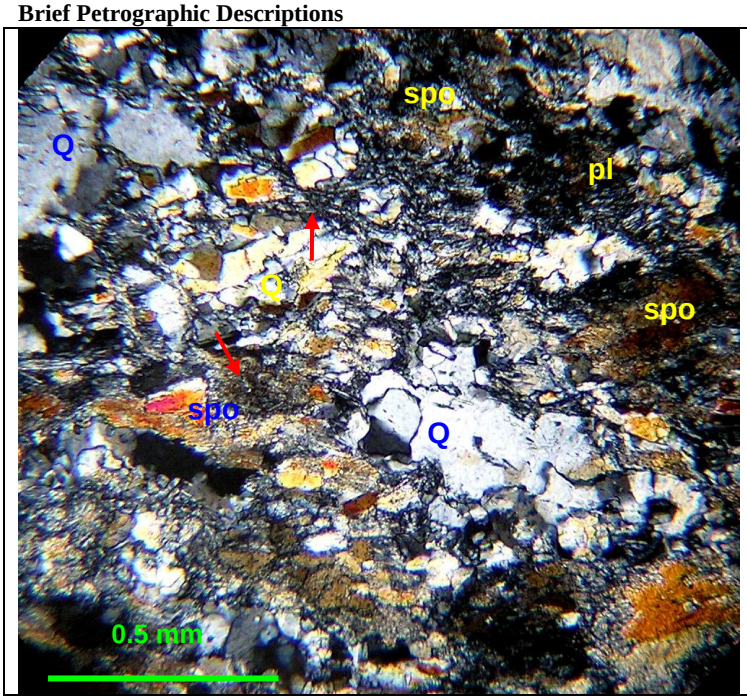
Comments: The spodumene – quartz – minor plagioclase pegmatite assemblage has preserved relict coarser grained and oikocrystic textures, and has been subject to deformation within a probable shear zone. The resulting fibrous spodumene component is closely associated with quartz and possibly, plagioclase.

ANALYSIS: **Li – 2.15%,** Si – 38.5%, K – 0.06%, Fe – 0.6%, Al – 9.02%, Ca – 0.04%, Cr – 68 ppm, Cs – 26.8 ppm, Mg – 241 ppm, Mn – 465 ppm, Rb – 40.1 ppm, Nb – 19 ppm, Ta – 52 ppm, Sn – 42 ppm, U – 0.7 ppm.

CLASSIFICATION: Coarse grained, anhedral and oikocrystic spodumene occurs as a relict phase in a sheared, fine grained quartz – spodumene – minor plagioclase pegmatitic matrix.



Sample B168
Fine to medium grained spodumene (spo) locally occurs as coarser grained oikocrysts associated with interstitial quartz (Q). Spodumene is rimmed by fibrous spodumene (arrowed). Crossed polars. Field of view – 3 mm.



Sample B168
Detail of the sample showing the development of fibrous spodumene (arrowed) adjacent to anhedral spodumene associated with interstitial quartz (Q). The fibrous texture parallels an anastomosing schistosity. Crossed polars. Field of view – 1.5 mm.

****

SAMPLE NO: B178 **LOCATION:** Anningie Tin Field, NT

SAMPLE TYPE: Rock Chip

SECTION TYPE: Thin Section

FIELD IDENTIFICATION: Fine to medium grained pegmatite containing spodumene (Li – 1.845 %).

MINERALS PRESENT:

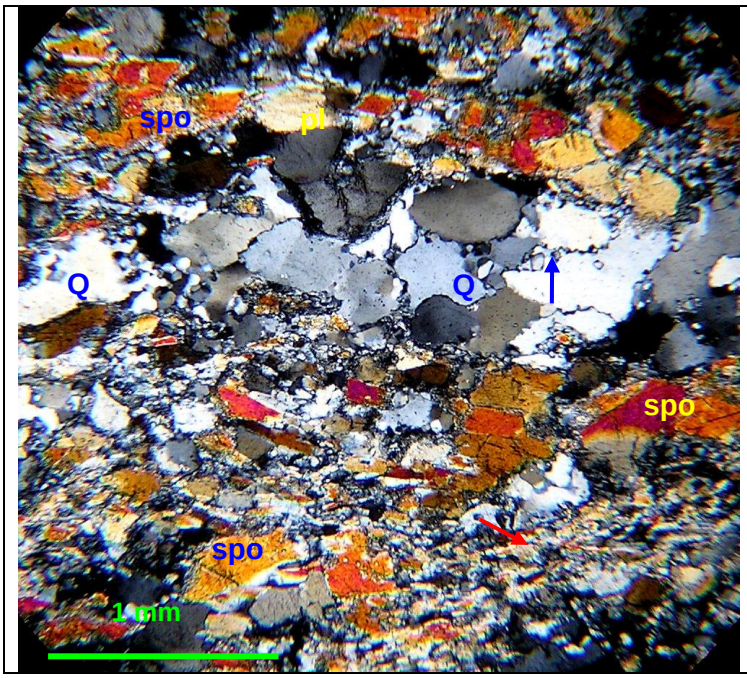
Quartz	42%
Clinopyroxene – spodumene	50%
Plagioclase - oligoclase (?)	8%
Muscovite/sericite	tr

DESCRIPTION: Fine to medium grained spodumene occurs in a quartz matrix. Finer grained spodumene has been oriented parallel to an anastomosing schistosity, with fibrous spodumene rimming coarser grained phases and similarly paralleling the schistosity. The quartz component exhibits ubiquitous undulose extinction and sutured grain boundaries. Fine, limpid plagioclase occurs interstitially. Coarser grained spodumene – quartz aggregates probably represent pegmatite relicts in the sheared host.

Comments: The spodumene – quartz – minor plagioclase pegmatite assemblage has preserved relict coarser grained textures and has been subject to deformation within a probable shear zone.

ANALYSIS: **Li – 1.845%,** Si – 37.8%, K – 0.53%, Fe – 0.62%, Al – 9.05%, Ca – 0.03%, Cs – 112.5 ppm, Mg – 121 ppm, Mn – 232 ppm, Rb – 518 ppm, Nb – 14 ppm, Ta – 44.5 ppm, Sn – 71 ppm, U – 0.7 ppm.

CLASSIFICATION: A spodumene – quartz – minor plagioclase assemblage has been deformed within a probable shear zone.



Sample B178
Fine to medium grained spodumene (spo) is associated with quartz (Q) exhibiting undulose extinction and sutured grain boundaries (blue arrow) in the foliated matrix. Finer grained spodumene in the matrix parallels an anastomosing schistosity (red arrow). Crossed polars. Field of view – 3 mm.

****

SAMPLE NO: B183 **LOCATION:** Anningie Tin Field, NT

SAMPLE TYPE: Rock Chip

SECTION TYPE: Thin Section

FIELD IDENTIFICATION: Medium to coarse grained sheared pegmatite, possibly containing spodumene (Li – 3490 ppm).

MINERALS PRESENT:

Quartz	68%
Spodumene	4%
Potash feldspar – microcline	5%
Plagioclase - oligoclase	16%
Muscovite/sericite	7%
Clay	tr

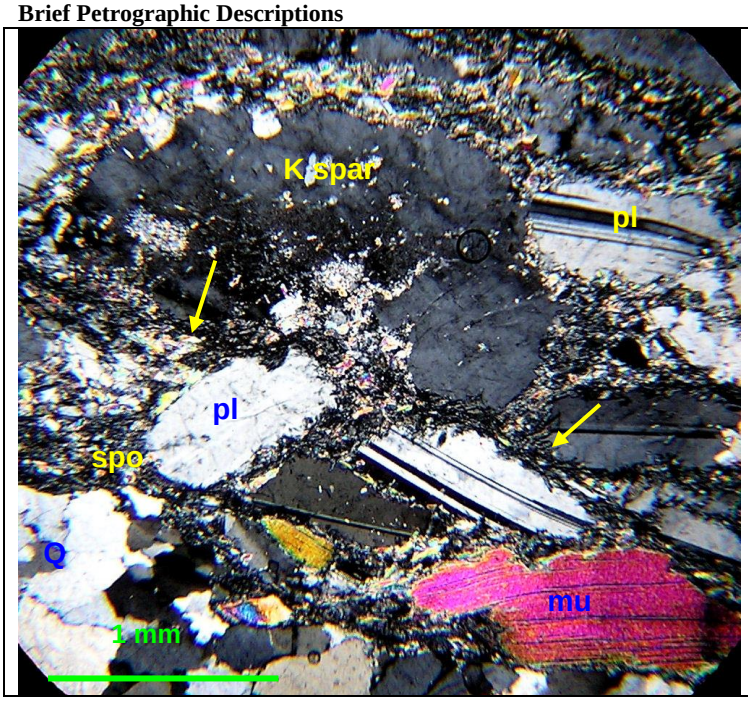
DESCRIPTION: The medium to coarse grained pegmatite comprises a series of schlieren or lenses comprising quartz–rich portions and quartzofeldspathic portions. The assemblages appear to have undergone further deformation.

The quartz – rich lenses comprise anhedral quartz exhibiting ubiquitous undulose extinction and sutured grain boundaries, consistent with a deformation overprint.
The quartzofeldspathic portions exhibit a variable, fine to coarse grainsize with equant to lathlike plagioclase associated with anhedral potash feldspar – microcline, platy muscovite and interstitial quartz. Fibrous spodumene and scaly sericite occur interstitially and parallel an anastomosing schistosity, as part of a deformation overprint.

Comments: The pegmatite host comprises quartz, plagioclase, potash feldspar and platy muscovite as a medium to coarse grained pegmatite assemblage that has undergone further deformation, possibly within a shear zone.
The Li mineral phase has been identified as fibrous spodumene that parallels an anastomosing schistosty and may have been remobilised during deformation of the Li-rich host. There is a possibility that the fibrous Li mineral is eucryptite although the refractive index and lack of a flourescent signature (pink/red) downgrades this possibility.

ANALYSIS: **Li – 3490 ppm,** Si – 35.7%, K – 1.48%, Fe – 0.62%, Al – 9.16%, Ca – 0.07%, Cs – 311 ppm, Mg – 181 ppm, Mn – 542 ppm, Rb – 1985 ppm, Nb – 65 ppm, Ta – 111 ppm, **Sn – 829 ppm**, Th – 0.6 ppm, U – 4.5 ppm.

CLASSIFICATION: *A pegmatite host comprising quartz, plagioclase, potash feldspar and platy muscovite has undergone further deformation possibly within a shear zone. Fibrous spodumene occurs interstitially as an anastomosing phase paralleling the schistosity.*



Sample B183
Fibrous spodumene (spo - arrowed) and scaly sericite parallel an anastomosing schistosity that has penetrated the pegmatite host. The host comprises quartz (Q), plagioclase (pl), platy muscovite (mu) and potash feldspar (K spar). Crossed polars. Field of view – 3 mm.

****

SAMPLE NO: B190 **LOCATION:** Anningie Tin Field, NT

SAMPLE TYPE: Rock Chip

SECTION TYPE: Thin Section

FIELD IDENTIFICATION: Fine to medium grained pegmatite, possibly containing spodumene (Li – 1.975%?).

MINERALS PRESENT:

Quartz	23%
Potash feldspar – microcline	7%
Plagioclase - oligoclase/albite	63%
Muscovite/sericite	4%
Clay	1%
Opaques – limonite	2%

DESCRIPTION: The pegmatite host exhibits variable compositions and textures. Coarser grained portions of the matrix comprise interlocking lathlike plagioclase associated with interstitial quartz. A secondary plagioclase - albite phase is evident and has preserved feathery granophyric textures. This secondary phase appears to have progressively replaced lathlike oligoclase plagioclase. Fine grained muscovite occurs interstitially.
A coarser grained phase in the matrix comprises moderately oriented, equant to lathlike plagioclase associated with interstitial potash feldspar – microcline and coarse platy muscovite. Potash feldspar has been clay dusted.

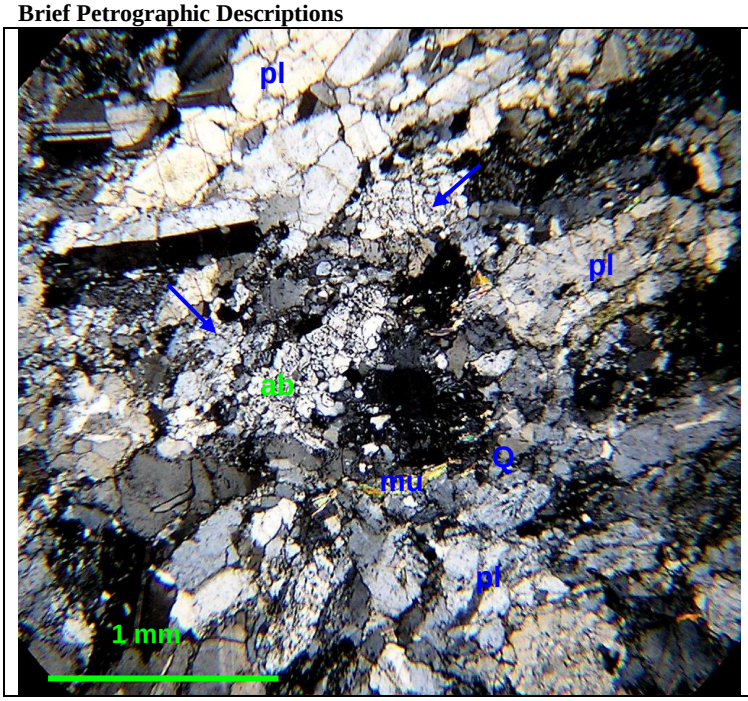
Sericite alteration of the feldspathic component represents a retrograde event associated with shearing and microfracturing of the matrix. Clay and Fe – oxide (limonite) have penetrated the matrix in the weathering profile.

Comments: There is little evidence of Li mineralisation in this pegmatite sample. The sample was scanned for spodumene (high relief), eucryptite (low birefringence) and amblygonite (high birefringence) without success. The high Li assay could not be substantiated based on the petrographic study.

The pegmatite appears to have evolved, evident as superimposed phases; a coarser grained primary phase containing coarse platy muscovite and potash feldspar has been followed by a finer grained phase dominated by oriented lathlike plagioclase that appears to have been overprinted by albite exhibiting feathery granophyric textures.

ANALYSIS: **Li – 1.975%,** Si – 36.3%, K – 0.22%, Fe – 0.54%, Al – 9.05%, Ca – 0.04%, Cs – 85.7 ppm, Mg – 121 ppm, Mn – 232 ppm, Rb – 364 ppm, Nb – 15 ppm, Ta – 52.9 ppm, **Sn – 194 ppm,** U – 1.4 ppm.

CLASSIFICATION: *Pegmatite exhibiting a variable composition and texture, with an initial coarse quartz – plagioclase – potash feldspar – platy muscovite phase followed by plagioclase (oligoclase) – subordinate quartz phase, overprinted by feathery granophyric albite.*



Sample B190
Fine to medium grained lathlike plagioclase (pl) associated with minor quartz (Q) as well as fine platy muscovite (mu) in the pegmatite host. Lathlike plagioclase (pl) appears to have been overprinted by feathery granophyric (arrowed) albitic plagioclase (ab). Crossed polars. Field of view – 3 mm.

****

SAMPLE NO: B196 **LOCATION:** Anningie Tin Field, NT

SAMPLE TYPE: Rock Chip

SECTION TYPE: Thin Section

FIELD IDENTIFICATION: Fine grained, possibly sheared, Li – mineralised pegmatite containing spodumene (Li – 1.72% %).

MINERALS PRESENT:

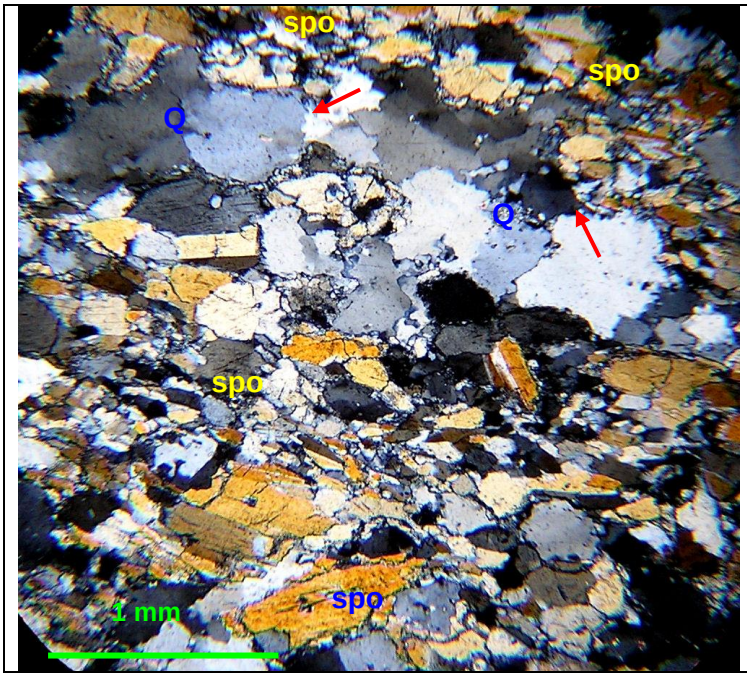
Quartz	58%
Clinopyroxene – spodumene	38%
Plagioclase - oligoclase (?)	4%

DESCRIPTION: Broadly similar to Sample B161, with fine to medium grained anhedral to tabular spodumene associated with interstitial quartz and broadly exhibiting a network-like texture. Lathlike spodumene exhibits a moderate orientation. Minor limpid plagioclase is typically associated with the spodumene aggregates. The quartz component in the matrix exhibits ubiquitous undulose extinction and sutured grain boundaries.

Comments: The matrix contains fine to medium grained spodumene closely associated with minor plagioclase and quartz, and should represent a metallurgically "clean" sample. Spodumene exhibits a moderate weak to orientation and may represent a syn-to post-tectonic phase in the evolution of the pegmatite host although field evidence will be required to confirm this. The stress textures in the quartz component confirms ongoing deformation.

ANALYSIS: **Li – 1.72%,** Si – 36.7%, K – 0.06%, Fe – 0.78%, Al – 8.07%, Ca – 0.02%, Cs – 60.8 ppm, Mg – 121 ppm, Mn – 774 ppm, Rb – 65.3 ppm, Ta – 82.5 ppm, **S – 900 ppm**, Sn – 100 ppm..

CLASSIFICATION: Fine to medium grained spodumene – minor plagioclase – quartz assemblage possibly representing a syn-to late-tectonic phase in the evolution of the pegmatite host.



Sample B196
Fine to medium grained, anhedral to lathlike spodumene (spo) parallels a weak to moderate schistosity and is associated with interstitial quartz (Q). Quartz (Q) exhibits sutured grain boundaries (arrowed) and undulose extinction. Crossed polars. Field of view – 3 mm.

****