**PROJECT NAME:** Quartz Hill Project

**TENEMENT:** EL25296

**HELD BY:** Cazaly Iron Pty Ltd

**MANAGER & OPERATOR:** Epic Resources Ltd

**REPORT TYPE:** Partial Relinquishment Report

**REPORT TITLE:** Partial Relinquishment report for Quartz Hill REE-U Project

**ACTIVITY PERIOD:** 2nd November 2006 to 30th October 2012

**AUTHOR:** Robert Jewson

**DATE OF REPORT:** 31st of January 2013

**MAP SHEETS:** 1:250,000: Illogwa Creek SF53-15, 1:100,000 Quartz 5951

**COMMODITY:** Rare Earth Elements (REE) & Uranium

**KEY WORDS:** REE pegmatites, pegmatite zonation, Uranium pegmatites, rock chips

**ABSTRACT:**

*Location:* The Quartz Hill project is located approximately 220km ENE of Alice Springs and 46km SE of the Harts Range Settlement.

*Geology:* Quartz Hill lies within the Eastern Arunta Region towards the southern extent of the Northern Territory, towards the south eastern flank of the Etina Dome.

*Work Done:* During the period of holding the tenure at Quartz Hill, Epic Resources has conducted field based reconnaissance mapping and sampling activities in order to determine the extents and controls on mineralisation. No sampling was conducted within the areas subject to the partial relinquishment.

*Conclusion:* Preliminary mapping has indicated that the areas relinquished did not warrant further investigation.
SUMMARY:

The Quartz Hill Project ("the Project") consists of two granted exploration licences (EL25296 and EL24838) in the Harts Ranges, Northern Territory, approximately 220km east of Alice Springs. The Project is centred on the Harts Range Pegmatite Field whereby historical exploration has outlined the presence of uranium and rare earth mineralisation.
QUARTZ HILL PROJECT:

Location and Tenure:
The Quartz Hill Project is located in the eastern Harts Ranges in the Northern Territory approximately 220km east-northeast of Alice Springs, on the Illogwa Creek 1:250,000 Geological Map Sheet SF/53-15.

Access to the Quartz Hill Project area is possible via two routes from Alice Springs:

1. Heading east, along the sealed Ross Highway through to the historic gold workings of Arltunga, then northwards on grade tracks to Claraville station and from there on station tracks heading east to the project area. The journey takes just under four hours and is bitumen until the turnoff to Arltunga from the highway. This track is narrow in places and crosses a number of creeks and as such is only suitable for 4WD light vehicles.

2. Heading north on the sealed Stuart Highway, then east onto the well-maintained partial sealed Plenty Highway, turning south onto Abulindum Station tracks located east of the Harts Ranges township. This route takes approximately four and a half hours and is sealed for the first 170 km from Alice Springs but covers many more kilometres. This is the main route into Abulindum Station and is regularly maintained. Recent upgrading and widening of station tracks to accommodate exploration activates by Mithril Resources Ltd means that this is the most suitable route for heavy vehicles and drill rigs.
The Quartz Hill Project consist of two granted exploration licences EL25296 and EL24838 that cover a total of 28.5 km². Cazaly Iron Pty Ltd (“Cazaly”) is the current title holder of the tenement whilst Epic Resources Limited (“Epic”) is the current operator and manager.

<table>
<thead>
<tr>
<th>Tenement</th>
<th>Area km²</th>
<th>Date Granted</th>
<th>Holder</th>
<th>Operator/Manager</th>
</tr>
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<tr>
<td>EL25296</td>
<td>18.94</td>
<td>2/11/2006</td>
<td>Cazaly Iron Pty Ltd</td>
<td>Epic Resources Ltd</td>
</tr>
</tbody>
</table>

**REGIONAL GEOLOGY:**

**Structure:**
The Quartz Hill Project area is situated at the SE corner of the Arunta Inlier. Of Proterozoic age, this inlier is a complex of high grade metamorphic sedimentary and igneous rocks, located at the southern margin of the North Australian Craton. The contact with the Central Australian Craton is overlain by the Neoproterozoic Amadeus Basin. The Arunta Inlier merges with the Palaeoproterozoic Granites-Tanami Block to the NW and is bounded on all other sides by Palaeozoic Basins i.e. the Canning, Wiso, Georgina and Eromanga Basins.

The Arunta complex is transected by a series of regional and local scale east-west and northwest-southeast trending faults, which have been the loci of multiple phases of north-over-south thrusting during the Proterozoic and later the Carboniferous Alice Springs Orogeny. This orogeny was responsible for retrograde metamorphism along the east-west structures, more widespread in the Harts Ranges than in the Central Province where it is intensely focussed on these structures. Metamorphic grades range from greenschist to granulite in the Northern Province and from amphibolite to granulite in the Central and Southern Provinces, with greenschist grades being associated with the retrogression in the south and central provinces.

**Stratigraphy:**
Stratigraphy is largely overprinted by the structural thrusting and the division of the Inlier into structural provinces, but there are divisions of groups based on age dating and relationships. The older basement rocks have been considered to be the Strangways Metamorphic Complex, but age dating by AGSO suggests the Weldon and Aileron Metamorphics in the Napperby area to the west may be older.

The Harts Range Group in the south eastern Arunta is essentially a pelitic and calcareous metasedimentary assemblage metamorphosed predominantly to amphibolite facies. The basal unit, the Entia Gneiss, has attained granulite facies but has been retrogressed to amphibolite facies and affected by the Palaeozoic Alice Springs Orogeny. PNC believed the Entia Gneiss was possibly older than the Strangways Metamorphics. The bulk of the Harts Range Group, the Irindina Gneiss
and the younger Brady Gneiss, show little evidence of having exceeded amphibolite facies and are clearly younger than the Entia. The Bruna Gneiss, a felsic intrusive, or less likely a part-extrusive porphyroblastic rock, has been dated at 1750Ma but this date only puts a minimum age to the sequence. Studies at Adelaide University suggest the dominant metamorphism within the Harts Range Group is related to the Alice Springs Orogeny.

Post-orogenic platform cover sediments are sporadically distributed throughout the Arunta Inlier. At least three age groups were named but the Hatches Creek Group (1830-1800Ma) and the Reynolds Range Group (1820-1780Ma) are now both considered SMC equivalents. The Simpsons Gap Metasediments of the Iwupataka Metamorphic Complex (1660Ma) are truly cover.

The youngest sediments are the neo-proterozoic Amadeus Basin to the south and the Ngalia Basin in the centre, which cover substantial portions of the Inlier and have little enough deformation to be significant oil and gas reservoirs.

**Igneous Intrusives:**
The Arunta Inlier has a complex and virtually continuous history of igneous activity. There are at least six major recorded felsic igneous intrusive episodes. Of these the Ngadarunga Granite (1880Ma), the Napperby-Huckitta-Jervois Granites (1780-1760Ma) and the Yarangunyi Granite (1600-1570Ma) are the most extensive and geologically most important. Other recorded igneous events, of relatively small areal extent, are the Andrew Youngs Igneous Complex (1635Ma), Mordor Igneous Complex (1200Ma), Stuart (mafic) Dyke Swarm (1050Ma), Gum Tree Granite (990Ma), Mud Tank Carbonatite (730Ma) and the Harts Range Pegmatites (520,400Ma).

**PROJECT GEOLOGY:**
The Harts Range region has undergone repeated and substantial crustal reworking between Proterozoic and Palaeozoic times, and is now thought to represent an ancient and strongly altered/metamorphosed version of a continental collision zone. Much work was done in the 1990’s on the Harts Range region by Arnold and Fogly et al and Mawby (1996) of the University of Adelaide, with the assistance of PNC.

The two key findings by the Adelaide workers in the Harts Range region are as follows:

• Crust south of the Illogwa Shear Zone dates from between 1500-1250Ma compared to 450-300Ma in the Harts Range area; ie: the Illogwa Schist Zone is a major crustal scale tectonic feature.

• The Harts Range Group amphibolite facies metamorphism is Alice Springs Orogeny age and, unlike the Entia Dome sequence, there is no evidence for an earlier metamorphic event.
The key features of the Harts Range in order of interpreted age, are:

- The Entia Dome, a pre-1850Ma feature which forms basement to the Irindina Supracrustal sequence.

- The emplacement of the younger granites (1780Ma) which form the exposed Inkamulla and Huckitta Domes. The position of the (inferred/buried) Mt. Muriel Dome is uncertain but is assumed to be post Entia as it has apparently indented the SW margin of the Entia Dome.

Recently presented Magneto-Telluric data from a team consisting of Adelaide University and NTGS geologists (Selway et al., 2007) suggests the Entia dome system is a deep-crustal feature that can be shown extending to the mantle. One of the two traverses crossed the Arunta from north to south and skirted around the dome to the east, and showed a major subduction zone to the north of the dome which extends to the mantle. Oxidation of the rocks around the dome extends some 20km, with the area of greatest oxidation in the Quartz Hill vicinity.

The Hardings Springs Slide is a NNE-SSW defined shear system along the SE margin of the Entia Dome. The development of the Florence Creek Shear (mylonite) Zone may have been coeval with emplacement of the Bruna Gneiss (Ding et al.) but probably pre-dates that event. The Florence Creek structure represents a zone of south directed thrusting and granulation-recrystallisation with an apparent absence (less H2O?) of the widespread retrogression typical of the younger transgressive Illogwa Schist Zone.
The Bruna Gneiss (1750Ma) is sill-like and is apparently strongly controlled by pre-existing structures. It follows the major shear zones, part of the Horse Fault and rims the margin of the Entia Dome. Interestingly the outcrop area of the Bruna Gneiss is broadest where it encounters the Yambla Corridor.

All the major structures, their conjugate structures and the shear zones show evidence of reactivation and retrogression to varying degrees. Many of the uranium prospects PNC were working on can be shown to be related to this late stage retrogressive overprint.

A very important point to note is that the presence of mixed igneous mantle types, the deep seated subduction structures, significant amounts of fluid alteration and veining (particularly in mafic material), the presence of Cu in carbonates and shear zones in the area and magnetite in pegmatites in the project area all indicate that the Harts Range is highly likely to be prospective for IOCG deposits. The age and types of the source fluids and magmas suggest that if present, these IOCG deposits are likely to be uraniferous.

**HISTORICAL EXPLORATION:**
Unnamed Explorers, <1970's:
Prior to the 1970’s mining and prospecting activities in the project area and
surrounds were primarily concerned with the mining of pegmatite-associated mica
from the Harts Ranges-Plenty River Mica Field (Joklik, G. F. 1955).

Esso Australia Ltd, Late 1970’s:
During the late 1970’s Esso Australia Ltd conducted exploration in the southern Harts
Range and indentified minor uranium mineralisation, but no rare earth elements
(REE) mineralisation was reported.

PNC Exploration, 1992:
Work undertaken by PNC Australia is by far the most comprehensive and of the
greatest value for future exploration activities. Several company reports, including
PNC, report that one of the mica mines on the Quartz Hill project was known to
contain uraniferous minerals, but the location or occurrence is not detailed. PNC
initially flew airborne exploration and followed up with ground exploration
campaigns. In general this work consisted of large-scale airborne magnetic and
radiometric surveys followed by ground mapping and rock chip sampling.

PNC Exploration (Australia) Pty Ltd studies of the pegmatite-type uranium
mineralisation at Quartz Hill identified the mineralisation to be characterised by
uranium-bearing Y/Nb/Ta/Ti/REE oxides of variable mineralogy within feldspar or
quartz which are imbedded within or immediately adjacent to, east and southeast-
trending pegmatites. These pegmatites are thought to have a metamorphic source,
derived from partial melting during the Alice Springs Orogeny. U-Pb dating of
uranium minerals from uraninite-type and pegmatite-type mineralisation indicates
that uranium precipitation and remobilisation occurred in three main phases at 550
Ma, 425 Ma and 350 Ma. The Quartz Hill pegmatite is related to an event at 425 Ma
(Drake-Brockman et al 1996a). The K-feldspar rich Quartz Hill pegmatite is found both
sub-parallel to and cross-cutting the gneissic layering and contains intergrown
samarskite, uraninite, coffinite(?), and U-tanteuxenite, all of which contain uranium
along with variable amounts of yttrium, niobium, tantalum and titanium. Using data
from Drake Brockman et al, (1996) and Drake-Brockman (1995) the REE character of
the prospects in the Quartz Hill Project are highlighted in the figure below:
PNC also mention a small number of “low order” anomalies they traversed, including a possible allanite occurrence in an aplite vein in gneiss to the north of Quartz Hill. In this second rank of anomalies they include “Lone Pine” (also reported as “Cone Hill”), which lies to the northwest of Quartz Hill in a series of large pegmatites that host an abandoned mica mine, which PNC state had known uranium minerals. They found “numerous fragments of a black glassy mineral” later identified as “a member of the fergusonite-samarskite series” in the scree as well as several hotspots on the working face.

New Era Exploration, 2007-2009:
Follow-up of the airborne anomalies resulted in the discovery of mineralisation at the Quartz and Feldspar (named Spartacus by Newera Uranium Ltd) pegmatite prospects. Quartz was a priority 1 anomaly on the “quartz blow” outcrop known as Quartz Hill. Ground checks located hotspots within soil and quartz scree and on the pegmatite vein near the spur of the ridge, and a small pit was blasted on the pegmatite. Copper has been indicated on the Geological Survey map at Quartz Hill but PNC found none, whereas they located uranium rich samarskite intergrown with uraninite and coffinite, with some alteration to uraniferous tanteuxenite. Samples were in what they reported as “brecciated pegmatite”.

Feldspar was a strong anomaly caused by float of a uranium rich mineral associated with a large E-W pegmatite. The mineral was massive, black, and glassy, had a conchoidal fracture and did not show weathering. It was identified as a Y-Nd>U mineral of the fergusonite series plus alteration products. They found only one ground based radiometric anomaly roughly 30x30m in extent and reported it was
cause of a small mineral occurrence spread by movement of float downhill, though they did mention other hot-spots. The mineral assayed 6.8% U. Further prospecting was limited.

The exploration activities carried out by Newera consisted of acquisition and analysis of open file data by CSA Australia, public domain geophysical data, topographic map data, satellite imagery, a VTEM survey, and rock chip sampling. Analysis of the data and sampling of outcrops by Newera showed the Harts Range pegmatites contain significant uranium mineralisation, including the presence of uraninite minerals, and high REE values. Cursory analysis of the True Grit (i.e. Lone Pine) and Brave Heart prospects (near Feldspar) and other prospects on the leases suggests for each the presence of sufficient pegmatite for substantial scale. Samples of a heavy black highly radioactive mineral, a light apparently cubic mineral and a slightly denser version of the same material were found in the pegmatites at both True Grit and Brave Heart. It is believed that these may be one of the uraninite minerals and a tantalum-niobium solid solution series, or perhaps ilmenite. Reported petrological results contain uraniferous rare earth minerals samarskite and euxenite, grading in excess of 1000 ppm uranium collected from within a pegmatite system with a strike extent of over 1300 m. The minerals also occur as inclusions within garnets, which are common in the pegmatite system. Samarskite and euxenite are highly radioactive materials forming a solid solution, and contain significant amounts of niobium, tantalum and other REEs in an iron oxide matrix which also contain up to 38% U. Both massive and crystalline forms are present on the project and specimens found to date are up to 55 mm in diameter in a further pegmatite named Spartacus by Newera (the Spartacus prospect coincides with the location of PNCs Feldspar prospect). The Spartacus prospect consists of a 2km long ENE trending low ridge line with abundant course grained pegmatitic feldspar and quartz float. The mineralised pegmatites at Spartacus outcrop as a pair of overlapping, sub-parallel units each in excess of 650 m long with an interpreted lateral extent of in excess 100m. Smaller parallel external units surround the main pegmatites and they contain internal rafts of the host granitoids gneiss. Concentrations of mineralisation were not determined, but mapping evidence suggests the minerals occur throughout the pegmatites with higher density clusters or patches. In addition to the pegmatite analysis, two magnetic high “bullseye” anomalies on the Quartz Hill project were investigated with a view to exploring for Iron Oxide Copper Gold (IOCG) mineralisation. A series of field mapping and VTEM surveys were conducted which lead to downgrading of the targets and a cessation of exploration.

**DEPOSIT MODELS:**

**Rare Earth Pegmatite Systems**

**Pegmatite Classes:**
Granitic pegmatites are commonly ranked into three hierarchies (class-type-subtype) depending on their mineralogy-geochemistry characteristic (Table 2).
Pegmatite classes show a strong relationship to depth of emplacement, ranging from the deeply-seated abyssal class to the typical shallow-level miarolitic class. The further subdivision of classes of granitic pegmatites into types and further into subtypes is based on mineralogical-geochemical criteria of the dominant mineralogy (Cerny, P. 1991; Ercit, T. S. 2005). A further classification concept for rare-element granitic pegmatites was introduced by Černý (1991) and is used to genetically classify granitic pegmatites and their associated granites. The definitions are based on: their bulk compositions, special characteristics of their trace elements chemistry, and the characteristics of their genetically associated granites. The three populations are the: LCT - Lithium-Cerium-Tantalum family; NYF - Niobium-Yttrium-Fluorite; and a „mixed character population (Černý 1991).

**Internal Zones:**
Internal zonation in REE-enriched granitic pegmatites range from unzoned to strongly zoned across most classes (Figure 5; figure 5 in Ercit 2005). Except for the miarolitic class, zoning is similar for all classes where it can vary from asymmetric to high symmetric. The optimal zoning pattern from the earliest-formed outer zones to the generally latest-formed central zones is (Ercit, T. S. 2005):

i. Border zone [BZ]
ii. Wall zone [WZ]
iii. Intermediate zone(s) [IZ]
iv. Quartz core [QC]
v. Pocket zone [PZ]
vi. Late units of apparent replacement origin [LR]

Few pegmatite bodies display all zones with most displaying a subset of zones related to their class (setting), evolution, and level of erosion. The level of erosion is an important aspect when it is consider that granitic pegmatites are three-dimensionally zoned and only some sections of a zoned body will display the full breadth of zoning. Typically, the section in the vicinity of the greatest thickness or maximum amount of „bulging will expose the maximum number of zones that have developed in a pegmatite body. External exomorphic zones developed during metasomatic exchange in the host rock immediately adjacent to a pegmatite body are rarely recognised in the field, but can cause additional elemental enrichment in the pegmatite and host rock is sufficiently developed.
### TABLE 1: CLASSIFICATION OF GRANITIC PEGMATITES (MODIFIED AFTER CERNY, 1991)

<table>
<thead>
<tr>
<th>Class</th>
<th>Type</th>
<th>Typical Minor Elements</th>
<th>Peak Metamorphic Environment</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abyssal</td>
<td></td>
<td>U, Th, Zr, Nb, Ti, Y,</td>
<td>high P-T (6-10 km, 700-800°C): upper amphibolite to granulite facies</td>
<td>Grenville province, Canada</td>
</tr>
<tr>
<td>Muscovite</td>
<td>(some, but giant muscovite crystals)</td>
<td></td>
<td></td>
<td>Appalachian mica belt, USA</td>
</tr>
<tr>
<td>Muscovite-Rare-Element</td>
<td></td>
<td>Y, REE, Ta, Nb, Ti, U,</td>
<td>mod-high P, moderate T (3-7 kbars, 540-650°C): amphibolite facies</td>
<td>Bijar belt, India</td>
</tr>
<tr>
<td>Rare-Element</td>
<td>Rare-Earth</td>
<td>REE, U, Th, Be, Nb&gt;Ta, F</td>
<td>generally mod-low P, moderate T (2-4 kbars, 500-650°C): upper greenschist to amphibolite facies, can be variable</td>
<td>Barringer Hill, USA</td>
</tr>
<tr>
<td></td>
<td>Beryl</td>
<td>Be, Nb</td>
<td>mod-low P, mod. T (2-4 kbars, 500-650°C): upper greenschist to amphibolite facies</td>
<td>Creer Lake, Canada</td>
</tr>
<tr>
<td></td>
<td>Complex</td>
<td>Li, Rb, Cs, Ta, Be</td>
<td>mod-low P, mod. T (2-4 kbars, 500-650°C): upper greenschist to amphibolite facies</td>
<td>Tanco, Canada</td>
</tr>
<tr>
<td></td>
<td>Albite-Spodumene</td>
<td>Li, Sn, (Be, Ta)</td>
<td>mod-low P, mod. T (2-4 kbars, 500-650°C): upper greenschist to amphibolite facies</td>
<td>Preissac-Lacorne, Canada</td>
</tr>
<tr>
<td></td>
<td>Albite</td>
<td>Ta, (Sn)</td>
<td>mod-low P, mod. T (2-4 kbars, 500-650°C): upper greenschist to amphibolite facies</td>
<td>Hongshaxin, China</td>
</tr>
<tr>
<td></td>
<td>(LCT affiliation)</td>
<td>Li, Be, B, F</td>
<td>low P (1.5-3 kbars)</td>
<td>San Diego, USA</td>
</tr>
<tr>
<td></td>
<td>(NYF affiliation)</td>
<td>Y, REE, Ti, U, Th, Zr,</td>
<td>very low P (1-1.5 kbars)</td>
<td>Pikes Peak, USA</td>
</tr>
</tbody>
</table>

The Border Zone [BZ] is generally a thin, fine-grained zone developed at the contact with the host rock. It is generally rich in calcic plagioclase, with lesser amount of alkali feldspar and minor minerals. The Wall Zone [WZ] is distinctive due to the development of alkali feldspar-quartz graphic to quasi-graphic textures, which are much coarser and pegmatoidal compared to the BZ. The WZ is more potassic consisting predominantly of potassium feldspar, with quartz, plagioclase, biotite, and sometimes muscovite. The Intermediate Zone [IZ] generally consists of large crystals of blocky potassium feldspar, and quartz sometime with large decimetre- to metre-size laths of biotite. The Quartz Core [QC] is usually buckywhite monomineralic quartz. The Pocket Zone [PZ] is generally restricted to the miarolitic class of pegmatites whose shallow depth of emplacement allows phase separation to occur (Table 2). The Pocket Zones are generally well zoned domains surrounding a cavity and represent the last stages of crystallisation from the melt. If levels of the more incompatible elements (e.g. Be, B, & F) are high enough then the miarolitic pocket zones can host gemmy crystals of beryl, topaz, and schorl. The Late Units of Apparent Replacement Origin [LZ] are sodic in composition with saccharoidal albite and a variety of accessory minerals are typically located near the contacts of the IZ and QC. The discordant nature of these zones has historically lead researchers to ascribe their formation to metasomatic replacement by a later fluid (Ercit, T. S. 2005). However, more recent experimental modelling suggest they are a product of disequilibrium crystallization of pegmatite melt-fluid (Ercit, T. S. 2005); hence the “apparent” term in their description.

MINERALISATION:

Economic Mineralisation:
Historically, REE-enriched pegmatites have been exploited for their major-minerals contents: feldspar, quartz, and muscovite (e.g. Joklik, G. F. 1955; Simmons, W. B. et al. 1980). Recent world demands for REE has provided greater interest in economic concentrations of the REE, Nb, Sc, Y, U, Th, and Be in pegmatite bodies. In granitic pegmatites niobium (Nb), tantalum (Ta), and titanium (Ti), are concentrated by complex oxide phases (i.e. euxenite, aescynite, samarskite and fergusonite groups). Generally, Nb>Ta in overall concentration, while Ti is more complex as it is dispersed between oxide and silicate phases including ilmenite, biotite and titanite. Niobium, tantalum, and titanium are similar in size and charge and substitute readily into each other’s minerals phases. Although, the behaviour of Nb and Ta appear similar they form their own mineral oxides concentrated in the latest-formed intermediate unit of the pegmatite. Consequently, for REE-enriched pegmatites of the abyssal and muscovite-rare element class (Table 2), Nb and Ta oxides tend to concentrate in the wall units or in the outer parts of intermediate units.

Zirconium (Zr) is also sufficiently incompatible to be enriched in the granitic pegmatite system. The atomic properties of zirconium are sufficiently different to exclude them from the Nb-Ta-Ti phases and it tends to concentrate in its own silicate phase zircon.
The lanthanide elements (REE and Y) are carried by a number of phases in REE-enriched pegmatites, but in the vast majority of examples minerals of the epidote and monazite groups are the main concentrators of LREE, whereas (Nb,Ta)-oxides, gadolinite-group minerals and fluorite are the main concentrators of Y and HREE (Ercit, T. S. 2005). Broadly, LREE are concentrated in earlier formed phases, while Y and HREE are concentrated in the later, more fractionated parts of the system (i.e. apparent replacement zones). Scandium is generally enriched in REE-enriched granitic pegmatites where it can be dispersed throughout a number of different early and late silicate and oxide phases (e.g. epidote, spessartine, fluorite, and columbite-group) due to its similar ionic charge and radii of common transition elements (e.g. Fe$^{2+}$, Mn$^{2+}$, and Al$^{3+}$).

The actinide elements uranium and thorium are known to concentrate in REE-enriched pegmatites but little research has been done in this area. Of the available studies it was concluded that less-fractionated pegmatite bodies have higher Th/U ratios than more highly fractionated bodies (Ercit, T. S. 2005). There is considerable variability in the style and type of mineralisation in pegmatites. For many classes of pegmatites, mineralisation occurs in a distinct potassic assemblage consisting of potassium feldspar, quartz, and biotite (or muscovite). The biotite-bearing assemblages are common, while the muscovite-bearing less common and are mainly found in the muscovite-rear element class (Table 2). Nonetheless, in all classes mineralisation is directly associated with the micas. The other major style of mineralisation occurs in sodic associations composed of albite and quartz. Most of the time these occur as discreet bodies in central location within the pegmatite body as late possible replacement origins or as part of wall zones or outer regions of intermediate zones.

**Harts Range Pegmatites:**

At least two pegmatite suites have been noted in the Harts Range region (Joklik, G. F. 1955; Hussey, K. J. 2003). A mica-poor potassic suite which tends to be hosted in the Entia Gneiss complex and a mica-rich sodic suite which occurs in the Irindina and Brady Gneisses (Hussey, K. J. 2003). Most pegmatite sampled by PNC was of the potassic class. Using the pegmatite classification scheme of Černý (1991) and the historical data of PNC Australia (Drake-Brockman 1995; Drake-Brockman J, G. G., Thevissen J and Vieru C 1996; Drake-Brockman J, G. G., Thevissen J and Vieru C 1996), the mica-rich sodic pegmatites appear analogous to LCT-Type pegmatites which are enriched in Li, Rb, Cs, Be, Ga, Sn, and Nb<Ta (Table 2). It should be noted that these class of pegmatites have rare-metal potential, but are not considered prospective for REE mineralisation (Hussey, K. J. 2003). Conversely, the mica-poor potassic pegmatites appear analogous to NYF-Type pegmatites which are enriched in Y, REE, Sc, Ti, Be, Th, U, F and Nb>Ta (Table 2), and are considered prospective for REE mineralisation (Hussey, K. J. 2003). This is highlighted by the recorded occurrences of the REE-bearing phases in the potassic pegmatites of the
Harts Range pegmatite field (e.g. samarskite, monazite, allanite, euxenite, and xenotime).

**Figure 4:** Alkali whole rock showing potassic nature of the Quartz Hill pegmatite sampled by PNC

**Figure 5:** Ternary plot of U-Ta-Nb (ppm) from the Harts Range pegmatite sampled by PNC
CONCLUSIONS:

Through the process of the exploration conducted by Epic Resources and that of its predecessors it was determined that the areas relinquished did not meet the targeting requirements of the company and were therefore relinquished.
REFERENCES


