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Petrographic Descriptions for Three Rock Samples, Arunta and Bynoe Prospects (Northern Territory)

REPORT # **4170**

CLIENT **Kingston Resources Ltd**

ORDER NO. **Proforma, N. Chalmers, 21 March 2017**

CONTACT **Neil Chalmers**

REPORT BY **Dr Douglas R Mason**

SIGNED

for Mason Geoscience Pty Ltd

DATE **20 April 2017**

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SUMMARY

1. Rock Samples

- Three rock samples from the East Arunta and Bynoe Projects (Northern Territory) have been studied using routine petrographic methods, supplemented by mineral confirmation by X-ray diffraction methods.

2. Brief Results

- A summary of rock names and mineralogy is provided in TABLE 1.
 - **East Arunta Prospect** (2 samples)
 - Sample 5111 represents a pegmatite composed of muscovite + quartz + minor albite + trace unknown. The muscovite is likely the host mineral for highly anomalous assays of Cs, Li, and Rb. The unknown mineral is metamict and unidentifiable, but may be a host for anomalous assay Ta and U. No lepidolite, spodumene or columbite-tantalite is observed.
 - Sample 5121 is part of a large amblygonite crystal, with formula $(\text{Li,Na})\text{Al}(\text{PO}_4)(\text{F,OH})$ containing 7.4% Li_2O . It displays its typical chalky white colour, weak cleavages, and moderately high density in the hand. It is the host mineral for highly anomalous Li reported by the client. XRD confirms the identification of amblygonite. Development of indistinct trails and patches containing tiny fluid inclusions indicate that the amblygonite has suffered incipient alteration after crystallisation.
 - **Bynoe Prospect** (1 sample)
 - Sample KN0105 represents a pegmatite composed of quartz + muscovite + trace unknown. The pegmatite mineralogy and texture is similar to sample 5111 from East Arunta Prospect, and it also contains the same metamict accessory mineral. Anomalous assays for Ca, Rb and Li likely are hosted by the muscovite. No lepidolite, spodumene or columbite-tantalite is observed.
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TABLE 1: SUMMARY OF ROCK NAMES AND MINERALOGY

SAMPLE	ROCK NAME	MINERALOGY*			
		Primary**	Alteration	Veins	Weath- ering
5111	Muscovite-quartz pegmatite	Mus, qtz, alb, unk	-	-	-
5121	Amblygonite (from amblygonite pegmatite)	Amb	-	-	-
KN0105	Weakly weathered quartz-muscovite pegmatite	Qtz, mus, unk	-	-	Hem, goe

NOTES

*: Minerals are listed in each paragenesis according to approximate decreasing abundance.

** : Only primary minerals currently present in the rock are listed. Others may have been present, but are altered.

Mineral abbreviations

Alb = albite; amb = amblygonite; goe = goethite; hem = hematite; mus = muscovite; qtz = quartz; unk = unknown mineral (metamict).

Bold min = mineral confirmed by XRD

1 INTRODUCTION

A collection of 4 surface grab rock samples was received from Mr Neil Chalmers (Kingston Resources Ltd, Sydney, NSW) on 28 March 2017.

It was indicated that the samples originate from the Arunta and Bynoe Projects located in the Northern Territory. Notes on each sample were provided by the client, with additional background information:

'I've managed to have collect 3 samples (5111 & 5121 from east Arunta and KN0105 from Bynoe area) which we'd like a petrological investigation completed on. I've had sodium peroxide fusion geochemistry done on duplicate samples to these and the results are attached. I have field photos and photos of the duplicate samples which were analysed (I'll put a thumb drive in post with samples). We're looking for petrological and any textural information you can give us from the samples. We'd like further analysis done on sample 5121 to confirm the lithium mineralogy (i.e. XRD) (see below, happy to discuss).'

Particular requests were:

- i) To prepare a thin section and petrographic description for each sample.
- ii) To confirm the mineralogy of sample 5121 by X-ray diffraction methods.

Excerpts from this report were provided by email to Mr Chalmers on 18 April 2017. This report contains the full results of this work.

2 METHODS

2.1 Thin Sections and Petrography

At Mason Geoscience Pty Ltd conventional transmitted polarised light microscopy was used to prepare the routine petrographic descriptions. Modal mineral abundances are optical estimates, and are considered to have approximate absolute errors as follows: ± 5 vol.% at an abundance of 20 vol.%, ± 3 vol.% at 10 vol.%, and ± 2 vol.% at 5 vol.%. Paragenetic stages of development of each rock are indicated in the mineral modal list, where each mineral is assigned to a numerical paragenesis (paragenesis 1 is earliest; paragenesis 2 overprints 1; paragenesis 3 overprints both 2 and 1; etc). **The paragenetic stages display relative timing insofar as they can be determined within each sample**, and are not meant to be directly equated between samples although this may be correct for some samples.

2.2 Mineralogy by X-ray Diffraction (XRD)

Small subsamples were taken from samples 5111, 5121 and KN0105A, and they were submitted for mineral identification by XRD methods at the laboratories of Greencap (Adelaide, South Australia). The results are provided with the description, and the full laboratory report is provided in APPENDIX 1.

3 PETROGRAPHIC DESCRIPTIONS

The petrographic descriptions are provided in the following pages.

SAMPLE : KN0105 (Bynoe Prospect, Northern Territory)

CLIENT NOTES : Float adjacent to small pits, high Cs, Rb, Ta moderate Li, again could the Cs-Ta-Li be in weathered lepidolite or is there weathered spodumene or other minerals hosting elevated LCT mineralogy? Field description - yellow + orange brown mica + qtz + orange feld? Pegmatite, petrology taken

ASSAY DATA : K = 4.33 %; Cs = 772.8 ppm; Li = 764 ppm; Rb = 1953.9 ppm; Ta = 200.5 ppm; U = 5.2 ppm

SECTION NO. : KN0105 (Section A: paler massive rock; Section B: Coarser grained with darker reddish brown ferruginous staining)

HAND SPECIMEN : The surface grab rock sample is composed of several centimetre-sized rock fragments. All represent massive pegmatitic rock composed of lustrous flakes of colourless mica and intergrown milky white quartz. Ferruginous yellow-orange-red stains of weathering origin irregularly pervade the rock along grain boundaries, in larger diffuse patches, and along fractures. Two subsamples were taken: KN0105A is finer-grained, massive; KN0105B is coarser-grained and stained by more abundant iron oxide.

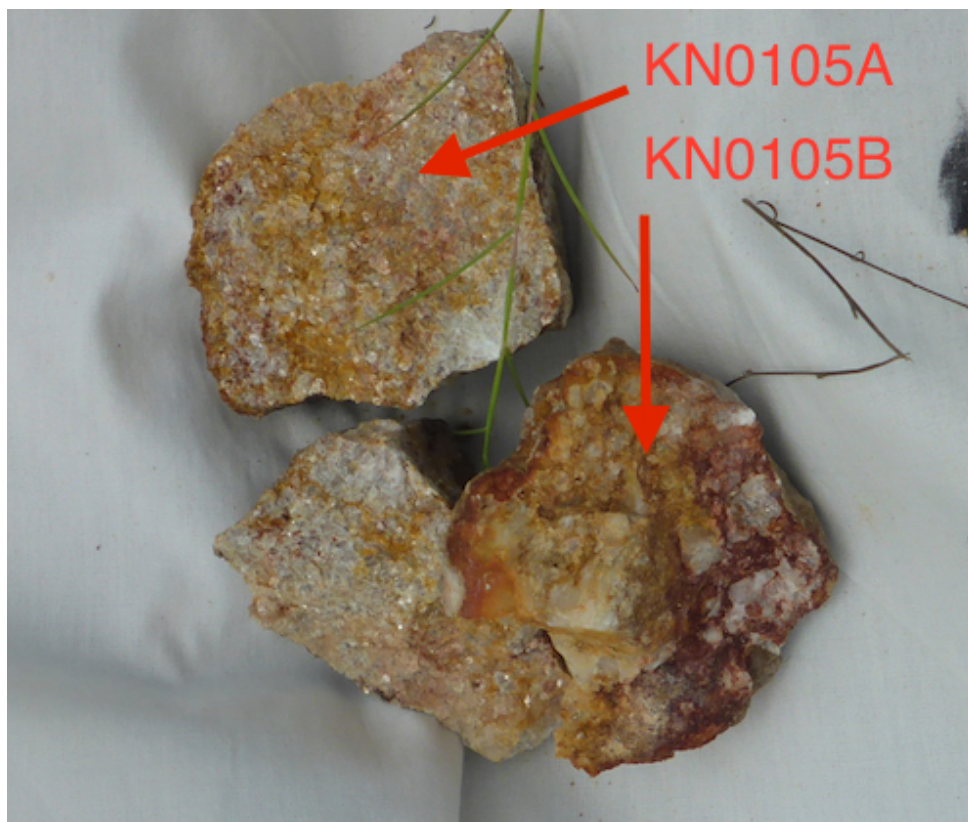


FIG. 3: Macrophotograph of sample KN0105 showing subsamples of this work (courtesy of N. Chalmers, Kingston Resources Ltd)

ROCK NAME : Weakly weathered quartz-muscovite pegmatite

PETROGRAPHY :

A visual estimate of the modal mineral abundances gives the following:

Mineral	Vol %	Origin
Quartz	69	Pegmatitic 1
Muscovite	30	Pegmatitic 1
Unknown	Tr	Pegmatitic 1
Goethite/hematite	Tr (0-3)	Weathering 2

Mineralogy of KN0105A by XRD: Muscovite > quartz >> kaolinite

In both thin sections, this sample displays a massive inequigranular crystalline texture, partly modified by oxidation.

Quartz is abundant, forming large anhedral grains of centimetre size. They are essentially unstrained. They are clouded by abundant fluid inclusions ~2-8 µm in size. Many are filled by a dark bubble in dark fluid, and are inferred to be CO₂-rich in composition. Another population of single-phase inclusions of similar size are colourless, and are inferred to be H₂O-rich in composition.

Muscovite is moderately abundant. It forms smaller colourless plates ~0.2-1.0 mm in size concentrated in dense aggregates, and it also forms larger plates ~2 mm in size which are intimately intergrown in the quartz.

An unknown mineral occurs as a few grains in 1 section, but is absent from the other section. It forms small subhedral prismatic grains ~0.4-0.8 mm in size, grouped in a single small cluster. It is absent elsewhere in the section. All of the grains display high relief, and a drab yellowish brown colour with isotropic character from metamict alteration.

Red-brown hydrated iron oxide minerals (goethite/hematite) occur as cryptocrystalline patches and trails, mostly concentrated around the boundaries of muscovite flakes. This is responsible for the patchy reddish colouring of the sample in hand specimen.

INTERPRETATION :

This sample represents a pegmatitic rock which crystallised to form the massive inequigranular assemblage of quartz + muscovite + trace unknown. Entrapment of abundant fluid inclusions in quartz confirms that hydrothermal fluid pervaded the system during crystallisation, and the 2 types of inclusions suggests that the system may have been undergoing vapour phase separation ('boiling').

It is likely that the abundant muscovite hosts the anomalous K, Cs and Rb detected by assay. The Cs and Rb likely substitute for K in the muscovite lattice.

It is possible that the trace unknown mineral hosts the Ta recorded in the assay data, but it is metamict and not readily identifiable.

No spodumene (colourless) or columbite-tantalite (very dark red-brown to black) is observed. Neither of these minerals suffer the metamict alteration observed in the trace unknown mineral grains of this sample.