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MEMORANDUM

To: Samuel Moyle

Cc: Graham Jeffress

Date: 4 April 2016

From: Ralph Porter

Re: **High level review of available granite, pegmatite and lithium data relating to Arunta region ELs 31058, 31199 and 31204 and comments on prospectivity for lithium and related mineralisation**

CSA Global Report: R158.2016

Introduction

CSA Global Pty Ltd, Perth was commissioned to acquire available data relating to Excedo's Arunta region tenements EL's 31058, 31199, and 31204. This compilation was to include historical exploration, geology, and geophysical data.

Once this data was assembled a high-level review was required of the Arunta region tenements with an emphasis on EL31058, to provide Excedo with some guidance as to the prospectivity or otherwise of the tenements for lithium (Li) and related mineralization such as tin (Sn), tantalum (Ta) and Niobium (Nb).

The pegmatite class considered most important for lithium mineralization (e.g. spodumene, petalite, amblygonite, and lepidolite) is the Lithium-Caesium-Tantalum (LCT) type[1][2].

Data availability and relevance

CSA Global found that there is no historical company exploration data directly relevant to Li exploration in the Arunta region. All reports collated relate to companies that have focused on Cu-Au and Au. One company, RB Mining carried out prospecting and small-scale eluvial/alluvial mining of several pegmatites/pegmatitic veins during the 1980s for Sn and Ta.

The most useful information located is whole rock geochemistry and mineral commodity occurrences provided by the NTGS[3].

[1] London, D, 2016. Rare-element Granitic Pegmatites. Chp 8, Reviews in Economic Geology, V 18, pp 165–193.
[2] Bradley, D, & McCauley, A, 2013, A preliminary deposit model for lithium-cesium-tantalum (LCT) pegmatites: U.S. Geological Survey Open-File Report 2013–1008, 7 p
[3] Frater KM, 2005. Tin-tantalum pegmatite mineralisation of the Northern Territory. Northern Territory Geological Survey, Report 16.

The NTGS whole rock geochemical data (separate data to the geochemical information contained in Report 16), while limited in terms of relevant assay data for Li-bearing pegmatites, does provide some useful information.

Review Results

EL31058

Information from Report 16 indicates there is little historic and no recent exploration data that is useful in relation to lithium-bearing pegmatites.

The host rock to the pegmatites is the high temperature - low-pressure metamorphic 1850-1820Ma Bullion Schist (biotite-muscovite schist) of upper greenschist to amphibolite grade (which is favourable). In the Barrow Creek area, the Bullion Schist is intruded by the 1803Ma S-type Bean Tree Granite, which is a tourmaline-bearing leucocratic granite considered to be the parent granite to the Barrow Creek pegmatites.

The Barrow Creek pegmatites form two main mineralised groups an eastern (Nb/Ta ≤ 1) and western group (Nb/Ta > 1) and the weakly mineralized Neutral Junction group located east of Barrow Creek, which mainly comprise mica ± Ta (Figure 1 and Figure 107 –NTGS Report 16).

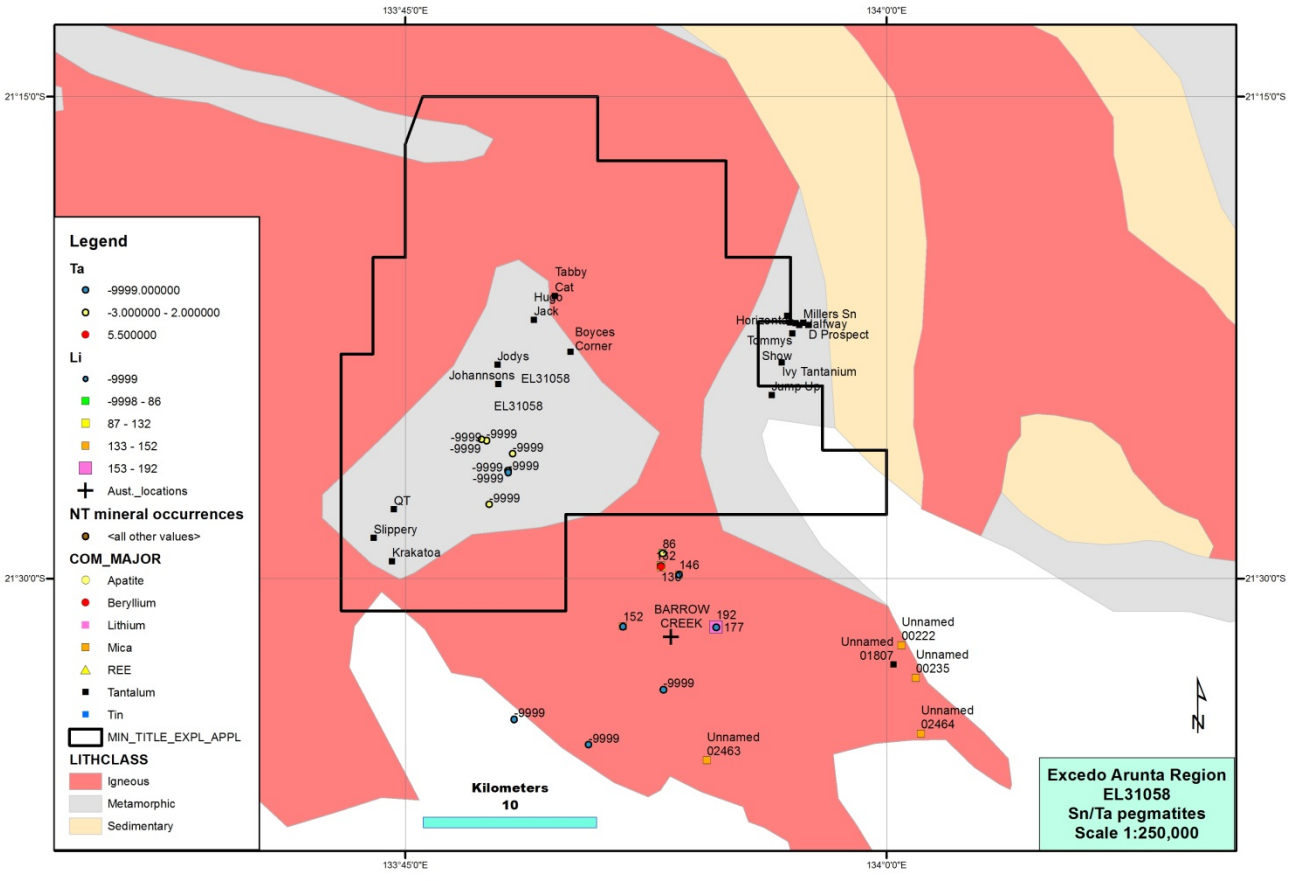


Figure 1. Pegmatites occurrences within or adjacent to EL31058

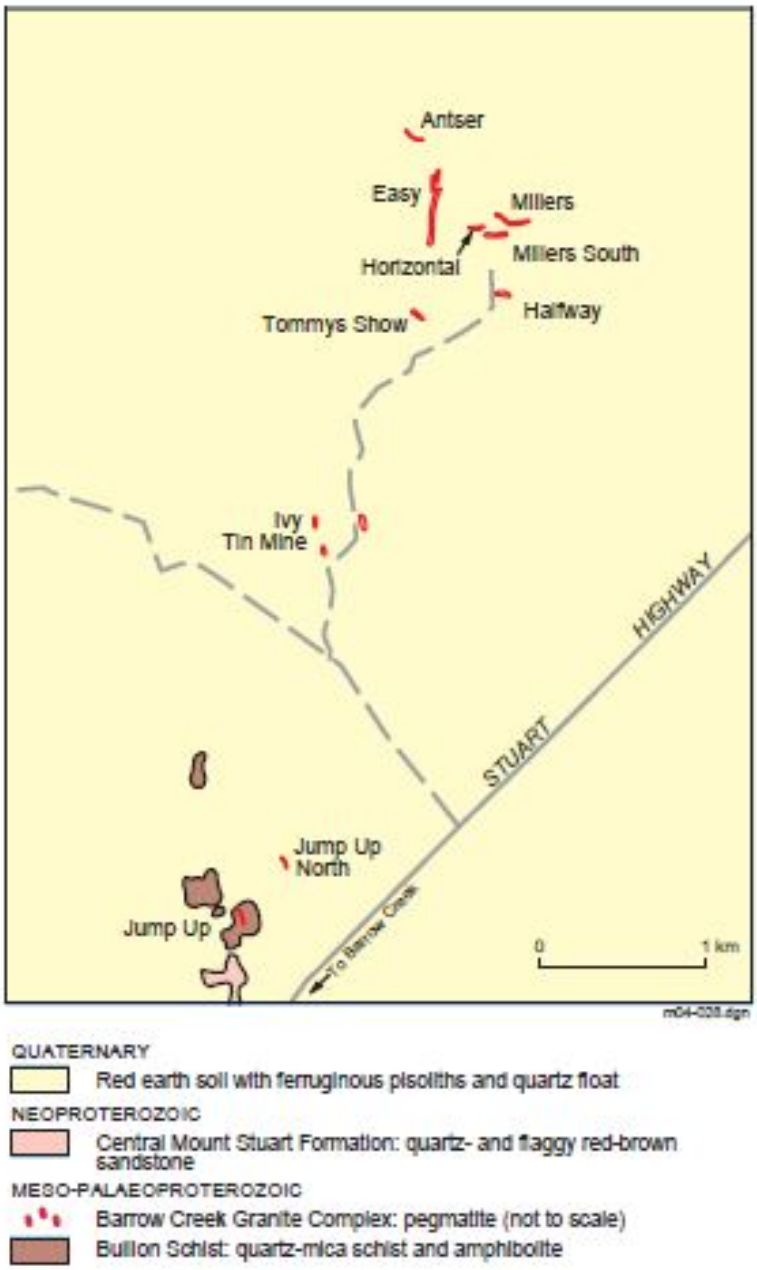


Figure 107. Pegmatite distribution, Eastern group, Barrow Creek pegmatite field.

Data in Table 39 of Report 16 indicates that the eastern group pegmatites (mostly outside the eastern boundary of EL31058) are moderately to highly fractionated, however these are all surface grab samples and not representative of the pegmatites. Some isolated high Ta and Sn assays indicate some potential, but most values are low. Li is present in a number of samples. The pegmatites inspected by the NTGS comprise mostly quartz-K-feldspar-muscovite- tourmaline with columbite (Ta), tapiolite (Ta), Sn and W.

Pegmatite (sample size)	Millers (5)	Horizontal (4)	Halfway (2)	Ivy (7)	Tommys Show (1)	Jump Up North (3)
Oxides (wt%)						
SiO_2	57.30	71.20	65.10	69.30	63.60	74.50
Al_2O_3	28.14	17.55	22.90	18.94	23.7	16.03
CaO	0.10	0.18	0.12	0.24	0.23	0.08
Fe_2O_3	0.83	0.82	1.27	0.91	0.86	1.01
K_2O	7.22	4.46	6.16	1.96	6.81	3.84
MgO	0.11	0.11	0.15	0.65	0.17	0.05
MnO	0.02	0.04	0.01	0.03	0.02	0.05
Na_2O	0.73	0.50	0.62	0.10	0.29	2.63
P_2O_5	0.07	0.08	0.01	0.03	0.03	0.06
TiO_2	0.034	0.021	0.090	0.024	0.090	0.009
LOI	4.14	3.00	3.69	6.95	3.70	1.90
Trace elements (ppm)						
Ba	238	268	53	276	140	62
Be	12	22	9	13	17	105
Cs	601	129	115	59	390	117
Ga	79	40	45	37	73	49
Hf	5.0	4.5	0.5	1.5	0.5	0.5
La	74	46	6	86	5	7
Li	105	54	87	296	100	228
Nb	103	228	58	118	50	73
Rb	4610	1438	1400	673	3350	1170
Sn	248	10778	350	3771	220	1205
Sr	29	88	15	70	20	11
Ta	154	436	65	117	81	46
W	8	7	12	9	10	11
Y	58	11	1	3	1	3
Zr	45	43	8	18	8	8

Table 39. Average of chemical data for pegmatite grab samples, Eastern group, Barrow Creek pegmatite field: Millers, Horizontal, Halfway, Ivy, Tommys Show , Jump-Up north.

A summary of some key fractionation pairs, based on data in Table 39, is provided below. Note increasing fractionation is indicated by decreasing K/Rb, decreasing K/Cs, decreasing Ba/Cs, and increasing Rb/Sr. All the pegmatites are moderately fractionated with Millers and Tommys the most fractionated of the group. The general trend, based on very limited data, is from least fractionated in the southern pegmatites Ivy and Jump Up, with fractionation increasing to the north.

Millers - K/Rb 12.9, K/Cs 98 and Nb/Ta 0.67 – mod. fractionated pegmatite

Horris – K/Rb 25.8, K/Cs 286, Nb/Ta 0.52

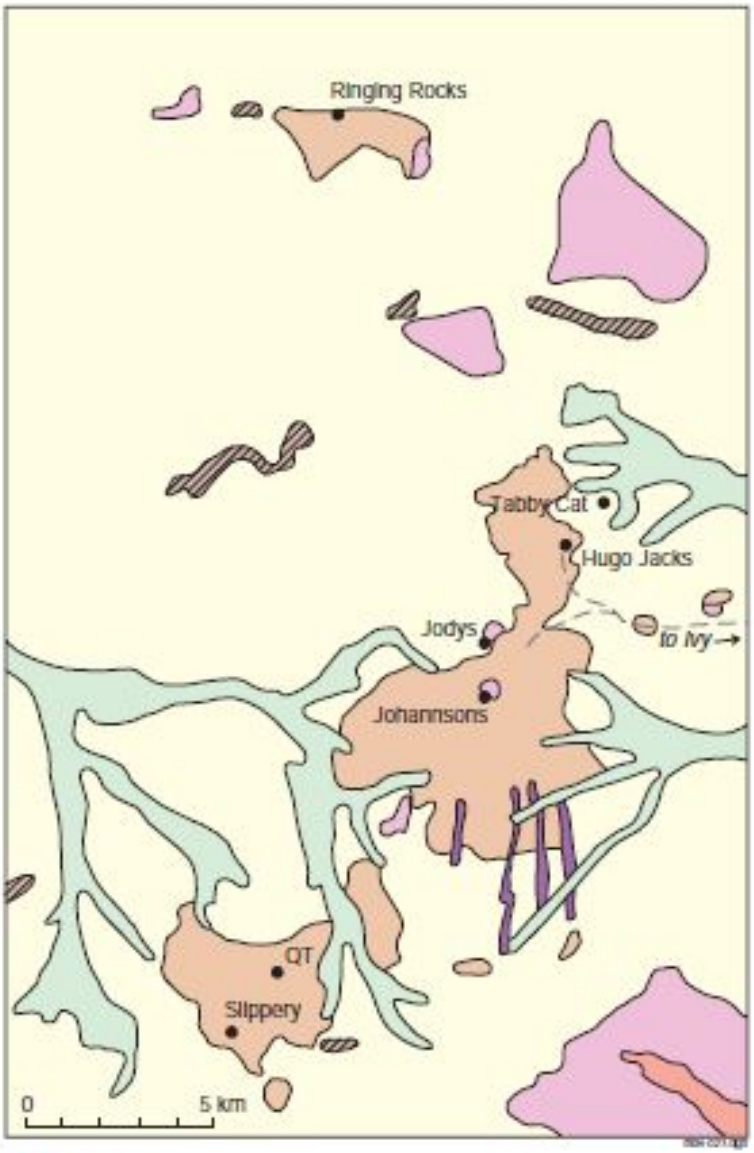
Halfway – K/Rb 36.5, K/Cs 444, Nb/Ta 0.89

Ivy – K/Rb 23, K/Cs 271, Nb/Ta 1 – mod. fractionated pegmatite – note higher Li content.

Tommy's – K/Rb 16.7, K/Cs 143, Nb/Ta 0.6

Jump up – K/Rb 27, K/Cs 271, Nb/Ta 1.58

The Western group of pegmatites (Figure 1 and Figure 109 – NTGS Report 16) contain Be (Hugo Jacks) and Nb/Ta >1 and contain some lithium (Li) and their chemical make-up is shown in Table 42 extracted from Report 16. Fractionation pairs have not been calculated for all the pegmatites, due to time constraints, but it is worth Excedo calculating these and plotting.



QUATERNARY
- Alluvium in active stream channel deposits and floodplains: sand, gravel, silt and clay
- Red earth soils with ferruginous pisoliths

NEOPROTEROZOIC
- Central Mount Stuart Formation: quartz sandstone and flaggy red-brown sandstone

PALAEOPROTEROZOIC
- Quartz and quartz breccia veins
- Barrow Creek Granite Complex
- Amphibolite dykes and sills
- Bullion Schist: pelites, lithic and quartz arenite

Figure 109. Pegmatite distribution, Western pegmatite, Barrow Creek pegmatite field.

Pegmatite (sample size)	Hugo Jacks (4)	Tabby Cat (3)	Johannsons (3)	Jodys (2)	Ringing Rocks (4)	Neutral Junction (3)
Oxides (wt%)						
SiO_2	73.40	63.90	69.60	67.80	75.80	75.30
Al_2O_3	15.40	21.13	17.40	19.90	13.48	14.53
CaO	0.28	0.21	0.51	0.27	0.56	0.05
Fe_2O_3	1.08	1.63	1.25	0.90	1.25	1.91
K_2O	2.85	7.94	3.61	1.18	2.25	4.09
MgO	0.08	0.25	0.14	0.85	0.13	0.19
MnO	0.07	0.08	0.03	0.01	0.03	0.05
Na_2O	3.83	1.27	4.86	0.09	4.42	0.54
P_2O_5	0.23	0.14	0.13	0.04	0.13	0.04
TiO_2	0.018	0.073	0.020	0.015	0.024	0.060
LOI	2.19	2.45	2.09	8.42	0.98	2.34
Trace elements (ppm)						
Ba	105	112	122	120	19	80
Be	163	13	189	7	4	12
Cs	54	715	43	10	12	44
Ga	42	48	34	28	27	40
Hf	2.9	0.5	1.3	2.3	0.6	0.5
La	8	6	4	44	9	5
Li	111	480	52	25	29	570
Nb	103	40	53	15	5	82
Rb	1000	3367	710	165	256	850
Sn	1415	143	30	15	10	198
Sr	43	14	37	70	9	4
Ta	43	46	27	3	2	46
W	14	21	7	5	3	26
Y	7	4	3	12	8	2
Zr	58	8	15	54	22	12

Table 42. Average of chemical data for pegmatite grab samples, Western group, Barrow Creek pegmatite field: Hugo Jacks, Tabby Cat, Johannsons, Jodys, Ringing Rocks, Neutral Junction.

Western pegmatite fractionation pairs

Tabby Cat pegmatite

K/Rb 19.5, K/Cs 9.2, Nb/Ta 0.86 – moderately fractionated

The review of the whole rock geochemical data (obtained from the NTGS) looked at two aspects.

The first aspect was the granite major-element chemistry i.e. the potential 'fertile' parent granite to Li-bearing pegmatites. While the assay data is very limited, the whole rock geochemistry of the granites indicates they are generally peraluminous [Al2O3/(CaO+Na20+K2O) is >1 – range of values 1.53 to 1.69] and high in silica [68-74% SiO2); which indicates they have the potential to produce Lithium-Caesium-Tantalum (LCT) type pegmatites. The peraluminous classification alone does not indicate the granites are 'fertile' granites capable of producing LCT type pegmatites.

The second aspect addressed was content of highly mobile trace elements such as Li, Rb and Cs and rare elements Be, Nb, Ta and Hf, which indicate that the granite has elevated values of the many of the aforementioned elements and therefore is likely a 'fertile' granite. The fractionation pairs of K/Rb and K/Cs indicate moderate fractionation.

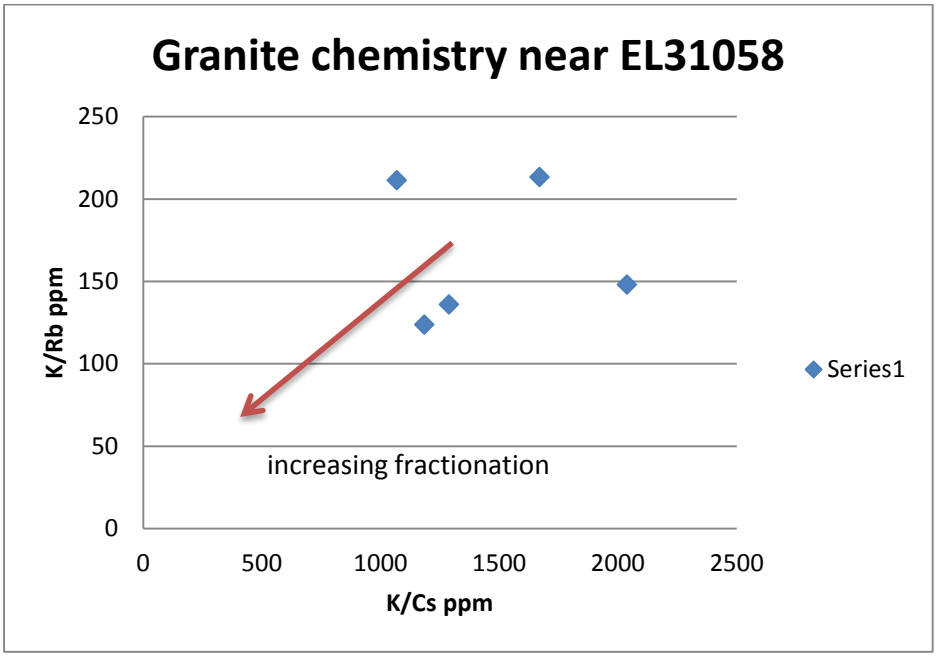


Figure 2. Whole rock geochemical data from 5 granite samples located southeast of EL31058, arrow indicates direction of increasing fractionation

Based on available data relating to rocks within or adjacent to EL31058 a number of key ratios were calculated as follows and plotted on Figure 2 : Note these samples are from granites, not pegmatites.

K/Rb range 136-213 - indicating moderately fractionated granites SE of EL31058 and probably a 'fertile' granite

K/Cs range 1069-2038 - indicating as above

Mg/Li range 12-100 indicating possible fertile granite(s)

Nb/Ta – not calculated due to no Ta assays

These indices provide some encouragement in conjunction with the existence of pegmatites containing Sn and Ta minerals for LCT type pegmatites.

EL31199

This tenement covers the Napperby pegmatite group. The main pegmatite occurrence of Double Dams is located about 18km NE of Mt Denison. The pegmatite(s) apparently contain elevated Be and are not highly evolved. The pegmatite(s) are hosted in granite; which if the source granite, significantly lowers the potential for lithium-bearing pegmatites. A number of elevated Li values apparently in schists are grouped in the SW of the tenement and these indicate some potential for the presence of lithium bearing pegmatites (Figure 3).

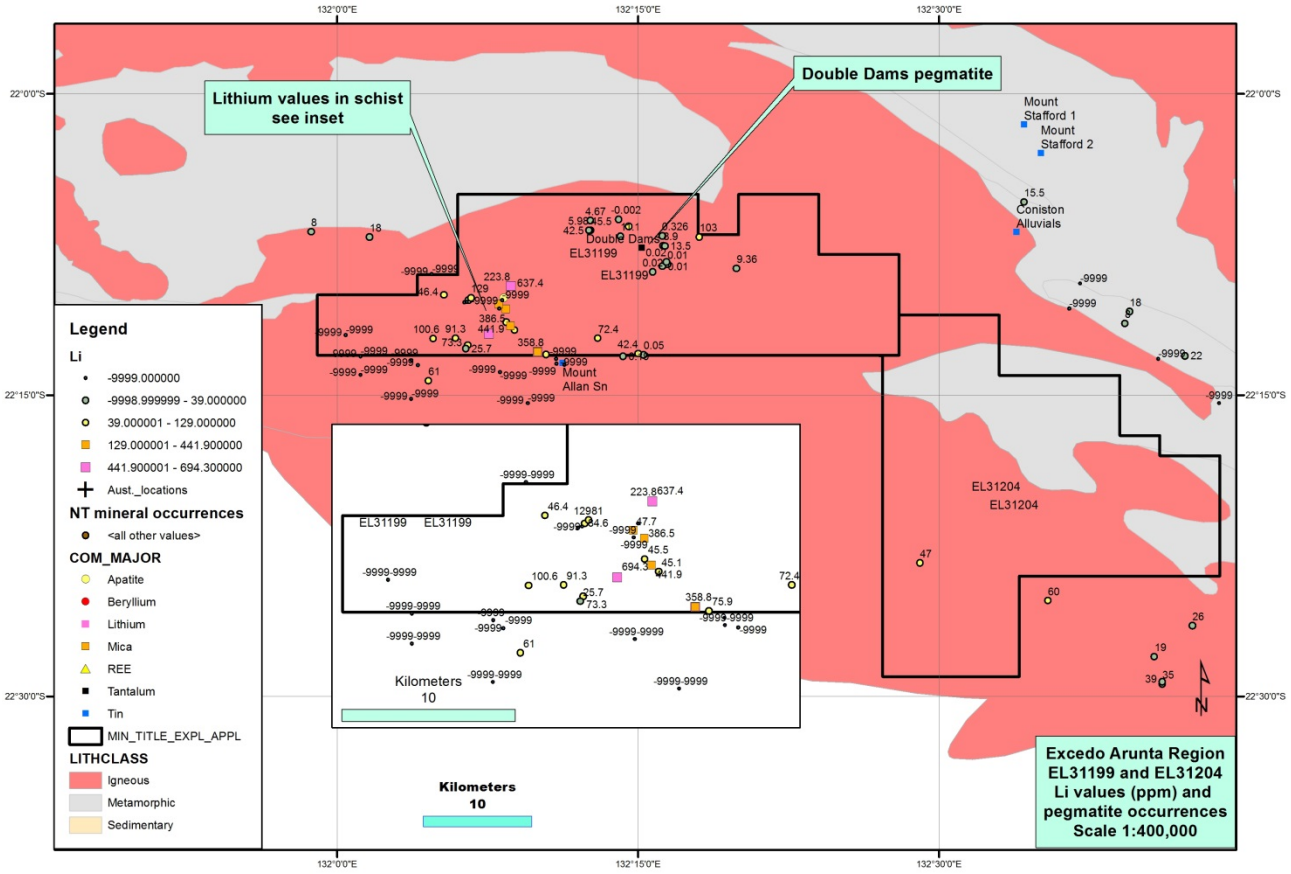


Figure 3. Showing the location of the Double Dams pegmatite and whole rock geochemical values for lithium (inset) within EL31199.

EL31204

There is very little information relevant to EL31204, but as the tenement contains a significant area of metamorphic sediments and, if a potential source granites can be identified close by, is prospective.

Conclusions

- There is insufficient geological and geochemical information to draw any definitive conclusions with respect to prospectivity for lithium mineralization.
- **EL31058**: most past work has involved shallow auger and trenching of several pegmatites and prospecting for eluvial/alluvial Sn and Ta mineralization. The known pegmatites are described as being generally less than 20 m in width, steeply dipping and up to a few hundred metres in length. The information gained from work by the NTGS indicates the pegmatites in the Barrow Creek region are most likely of the LCT type and therefore should be prospective for lithium.
- **EL31199**: there is little past exploration information, however the lithium values located in schists is definitely worth following up as these may indicate the presence of Li-bearing pegmatites.
- **EL31204**: there is no information to allow any conclusions to be drawn about this tenement, however if a 'fertile' granite is present then prospecting of the schist rock units for pegmatites is recommended.
- Lithium-enriched pegmatites are generally the some distance away (up to 10km) from the source 'fertile' granite contacts.
- If pegmatites are not well exposed, then soil sample traverses to detect lithium and other mobile elements aureoles and Sn and Ta associated with lithium bearing pegmatites would provide some useful information

Recommendations

It is recommended that Excedo carry out fieldwork to characterize possible fertile granites and known and 'new' pegmatites by:

- Sampling of possible 'fertile' granites to identify fractionation trends, for example in EL31204.
- Mapping of pegmatites, especially mineralogical zonation.
- Collecting systematic broad spaced 'channel' rock samples across known and any new pegmatites located to ascertain their lithium content and characterize their geochemistry. This will provide information on regional fractionation trends and help place the pegmatites into a zoning framework relative to their parental granites.