MINERALOGY AND GEOCHEMISTRY OF BERYL AND RARE-METAL-BEARING GRANITIC PEGMATITES IN THE KOOTENAY REGION OF SOUTHEASTERN BRITISH COLUMBIA

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INTRODUCTION

LCT-granitic pegmatites as defined by (Cerny, 1991) are anomalously enriched in **L**i, Rb, **C**s, Be, Sn, Ga, **T**a>Nb, (B,P,F) and are host to many of the worlds most precious gemstones including emerald, chrysoberyl and topaz (Minas Gerais, Brazil), sapphire and ruby (Afghanistan and Pakistan), and gem tourmaline (Pala District, California). Twelve Minfile (MF) occurrences of LCT-pegmatites are recorded in BC, with all but one located within the Omineca Belt.

A review of BC-Minfile occurrences of beryl-bearing LCT-granitic pegmatites in southern BC reveals the majority are proximal to metaluminous to peraluminous granitoids either within the Cretaceous Bayonne magmatic belt (Geoscience Map 2002-1), or within, or near the eastern margins of the Valhalla and Monashee Complexes (Table I). Beryl, as well as gem quality corundum, cordierite, garnet, quartz and feldspar have been found in pegmatites, or in the alteration haloes of pegmatites. Some of these pegmatites also contain significant rare-metal mineralization, particularly Be, Ta, and Nb.

Two to three different ages of pegmatites are known in the Kootenay Region: 1) Beryl- and tourmaline-bearing dykes and stocks comprise major proportions of the Proterozoic Greenland Creek Stock, and the Hellroaring Creek Stock (Figures 1,2,5); 2) Significant gem-beryl-bearing pegmatites occur within and proximal to middle to late Cretaceous batholiths and stocks east and west of Kootenay Lake (Figures 1,5,11); and 3) Various gemstone varieties are associated with pegmatites of the Slocan Valley (Figure 13), related to either Eocene? or Cretaceous? plutonism.

The recent discovery of emerald and aquamarine in the Finlayson District of southeastern Yukon has piqued interest in the potential for gemstones in the Canadian Cordillera. Emeralds at Regal Ridge are hosted in and around quartz-tourmaline-scheelite veins proximal to a geochemically evolved middle Cretaceous granitoid, with associated pegmatites and aplites (Groat et al., 2002). Gemstone deposits of the Finlayson district and the Kootenay Region share two similar characteristics: I) Regional tectonic setting (Omineca belt, close to large-scale regional fault structures) and II) proximity to peraluminous Cretaceous intrusions.

The purpose of this paper is to provide a baseline description of the mineralogy and geochemistry of some of the historical and new pegmatite showings in the Kootenay Region. This study was funded through the Rocks to Riches Program, administered by the BC and Yukon Chamber of Mines. This paper complements other recently initiated studies of British Columbia pegmatites by Andrew Legun of the BC Geological Survey, and Lee Groat at the geology department of the University of British Columbia. A coordinated study, in light of the recent excitement from gem discoveries in the Yukon and North West Territories may yield significant investment potential for British Columbia.

Table I: Three groups of pegmatite associated deposits in southern BC, based on age and spatial or tectonic setting. Alphanumeric entries refer to Minfile reports. Data and discussions are presented for underlined entries only.

WEST	CENTRAL	CENTRAL TO EAST
Valhalla and Monashee Complexes	Bayonne Magmatic Belt	Bayonne Magmatic Belt
Eocene or Cretaceous?	Mid-late Cretaceous	Proterozoic
Airey Creek (BQ claims) 082FNW250	White Creek 082FNE159	Hellroaring Creek 082FNE110
Blu Starr 082FNW259	Midge Creek 082FSE091	Greenland Creek 082FNE112
Mount Begbie 082LNE015	Doctor Creek (Blue Hammer)	Lightening Creek
	Kootenay Gemstone (Laib and Topaz creeks)	Mathew Creek

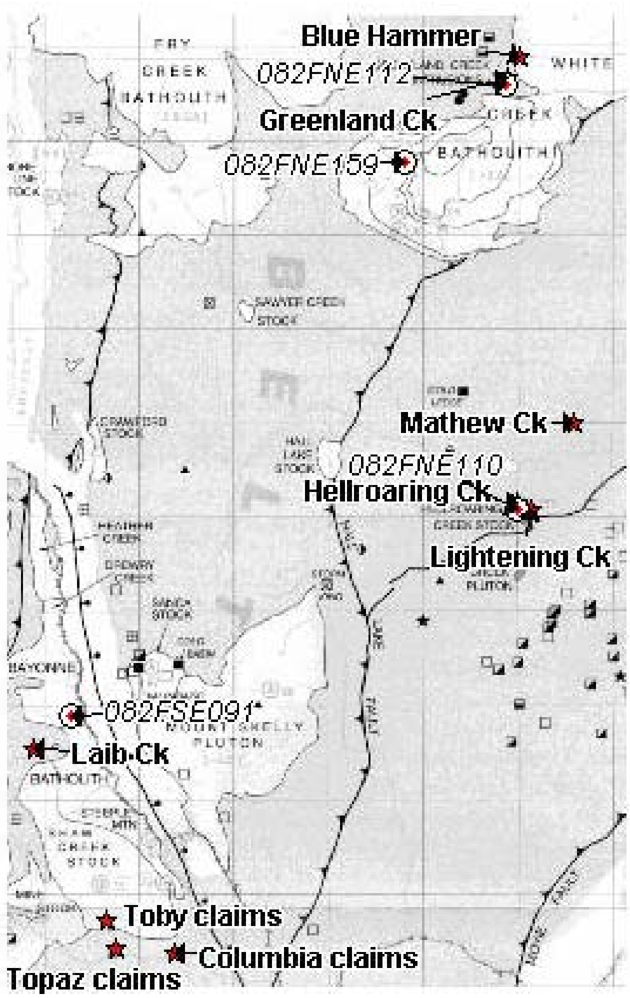


Figure 1 Field locations (stars) and known pegmatite Minfiles (circles with Minfile reference) within the Bayonne magmatic belt in the southern Kootenay Region (after Geoscience Map 2002-1). Grid squares are 10 by 10 km.

GEOLOGIC SETTING

Except for field locations in the Slocan Valley, all other field sites discussed in this report are located within the Cretaceous Bayonne Magmatic/Plutonic Belt (Figure 1). This belt comprises an 80 to 100 kilometre wide arcuate train of middle to late Cretaceous batholiths and stocks of granodioritic, monzonitic and quartz monzonitic compositions. Most of the plutonic bodies are post-metamorphic and are discordant to the country rock. Typically they form multiphase intrusions comprising significant volumes of metaluminous to weakly peraluminous, medium- to coarse-grained granitoids, with lesser strongly peraluminous two-mica granite and subordinate aplite and pegmatite (Logan et al., 2000). The belt is also host to two known Proterozoic pegmatitic stocks, namely the Hellroaring and Greenland Creek pegmatites (Smith and Brown, 1998) (Figure 1).

The Cretaceous White Creek Batholith and Proterozoic Hellroaring and Greenland Creek stocks straddle the central axis of the Purcell anticlinorium. The anticlinorium is a broad, gently north-plunging structural culmination cored by the Proterozoic Purcell Supergroup, and flanked by Late Proterozoic Windermere rocks and Lower Paleozoic cratonic rocks (Brown and Termuende, 1998). The Shaw Creek stock, west of Kootenay Lake is proximal to the westernmost limit of the Purcell anticlinorium where it is coincident with the Kootenay Arc (Carr, 1995).

Most of the field areas are underlain by argillites, siltstones and fine-grained quartzites of the Lower to Middle Aldridge Formation. The Lower Aldridge is typically rusty-brown and thinly bedded to laminated siltstone, argillite with lesser sandstone, in contrast to the middle Aldridge, which is a grey-weathered medium to thick bedded turbidite (Brown and Termuende, 1998). Locally, and especially adjacent to granitoid intrusions, much of the Aldridge is muscovite-biotite schist with localized influxes of tourmaline. Further to the west, the Shaw Creek stock intrudes grey siltites and black argillites of the La France Creek Group, dolomite and argillite of the Mt. Nelson Formation, and polymict conglomerate of the Windermere Group Toby Formation. Middle Aldridge lithologies south and east of the Shaw Creek stock predominately comprise biotite-muscovite or amphibolite schists with reports of upper amphibolite metamorphic assemblages (Archiblad et al, 1983).

The Middle Proterozoic Moyie Sills and lesser dykes are the oldest known intrusives in the area. They comprise extensive bodies of gabbro and diorite that intrude the lower and middle Aldridge Formation. Amphibolitic gabbro is the dominant lithology forming dark green to brown weathering sills, and rare crosscutting dykes. Sills in the field area east of Kootenay lake are 10 to 100 m thick and comprise up to 25% of the lower Aldridge section. The size and abundance of Moyie intrusions is significantly less within Middle Aldridge lithologies south of the Shaw Creek stock.

Major structures in the study area include the St. Mary fault, an east- to southeast trending reverse thrust truncated by the post tectonic Cretaceous Reade Lake stock (Hoy and van der Heyden, 1988), and the Hall Lake fault, a right lateral reverse fault that cuts obliquely across the Purcell anticlinorium. It is truncated by the White Creek Batholith in the Buhl Creek area (Reesor, 1996).

HELLROARING CREEK STOCK

The Hellroaring Creek stock is located approximately 20 kilometres southwest of Kimberly, BC, centered near 116^{o} 10' W longitude and 40^{o} 34' N latitude (UTM11 559 677 E / 5 490 561 N). The main body is exposed over approximately 10 square kilometres with the long axis of the pegmatite trending north-northwest for 4 kilometres within a package of lower Aldridge sediments and Moyie sills (Figure 2). The southernmost end of the pegmatite stock is truncated by the St Mary thrust fault, where the stock is in contact with siltite, quartzite and argillite of the Creston Formation.

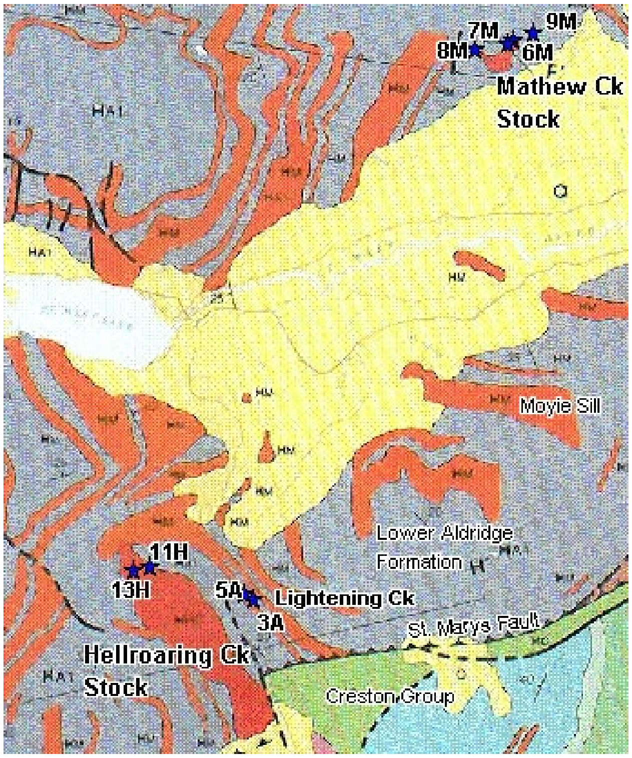


Figure 2 Field locations in the St. Mary river valley 20 kilometres west of Kimberley BC (after Reesor, 1996). Pegmatite comprises major volumes of the Proterozoic Hellroaring Creek stock and Mathew Creek stock. St. Mary's lake (upper left) is approximately 3 kilometres long.

The pegmatite stock is up to 1.5 kilometres wide. Historical drilling, over the last 50 years for rare-metals and industrial grade feldspar, has encountered pegmatite thicknesses up to 150 metres (MF 082FNE110). Previous workers have noted several intrusive phases in outcrop and in drill core, including granodiorites, muscovite-tourmaline and tourmaline-muscovite granites, leucogranites, and aplite (EMPR ass rpt 26701). Essential features of the stock, as a whole, are the widespread occurrences of micropegmatite and pegmatite textures, with localized segregations of very large K-feldspar, tourmaline and micas. Significant mineralization includes the near ubiquitous presence of black tourmaline (locally in excess of 10%), minor garnet to several percent, and accessory beryl and fluroapatite.

Significant alteration related to the Hellroaring creek stock was reported in Chapleau Resources Ltd. news release dated November 24, 2000:

"The Hellroaring Stock is a multiphase granitic intrusive strongly altered by albitization and griesenization processes… Both intrusive and country rocks were subjected to intensive griesenization and bear elevated to high grades of beryllium, cesium, and rubidium."

Several satellitic intrusions and dyke swarms are reported to occur within hundreds of metres to a few kilometres of the main Hellroaring Creek body. The pegmatite at *Lightening Creek* is traced in outcrop for 100 metres, and consists of coarsely crystalline pegmatite with an estimated 30 metres of thickness. It is located immediately east of the confluence of Lightening Creek with Angus creek. The *Lower Jack Showing*, located 6 kilometres southwest of the main body, comprises a 20 to 50 metre thick dyke which sporadically outcrops over 500 metres. Several occurrences of pegmatite dykes are also reported on the hill side facing the main body, on the west side of Hellroaring Creek.

The *Mathew Creek Stock*, located approximately 10 kilometres to the northeast, is tentatively considered a satellitic intrusion of the Hellroaring Creek Stock. It is exposed over an area about 1000 by 300 metres, and comprises simple micropegmatite textures and lithologies to the west, with an eastwards progression to medium- and coarse -grained beryl-bearing pegmatite. The general textures and mineralogy of the pegmatite is comparable to those identified at the Hellroaring Creek stock.

Field Observations

The author spent two days on the main pegmatite body, and one day at each of the satellitic pegmatites at Lightening Creek and Mathew Creek. Notes and impressions gathered at each site are as follows:

Stop 11H: Hellroaring Creek pegmatite (main zone)

UTM 11 559555E / 5491462N in the vicinity of Bearcat drilling and trenches at 1433 metre (EMPR ass rpt 15760): The area is underlain by broad exposures of equigranular pegmatite with average 1 to 3 centimetre crystal sizes comprising 50% feldspar, 30% quartz, 15% muscovite, and minor but variable black tourmaline and garnet.

Subordinate volumes of the main body are represented by a coarse to very coarse pegmatite comprising a core assemblage of megacrystic euhedral K-feldspar crystals (up to 50 by 30 centimetres), coarse euhedral silvery muscovite to 20 centimetres commonly intergrown with anhedral light grey and occasionally smoky quartz. Where visible, beryl crystals are commonly found within quartz-muscovite assemblages at the margin between the coarse core assemblage and the fine to medium -grained pegmatite assemblage. The beryl occurs as white to yellowish-white, opaque, euhedral to subhedral hexagonal crystals, with 0.3 to 1 centimetre diameter crystals the most common, but occasional crystals 2 to 5 centimetres in diameter and up to 15 centimetres long, were noted.

Occasional pods of banded garnetiferous aplite were also noted within the main area. One notable occurrence in particular (Figure 3) occurs as a 10 to 50 centimetre thick pod along the contact between medium- and coarse-grained pegmatite assemblages. Arcuate accumulations of garnet and black resinous oxide crystals delineate crystallization fronts within the aplite pod. The outer interface, with the medium-grained pegmatite, is rich in muscovite and fine-grained tourmaline. Aplite pods similar to these found at the Tanco pegmatite in southeastern Manitoba, are known to contain economic grades of Ta +/- Nb mineralization.

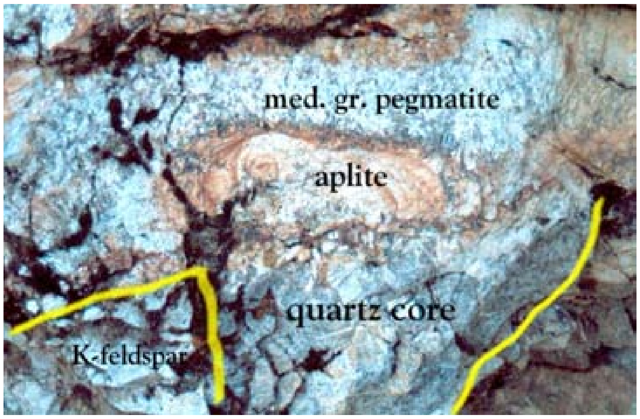


Figure 3 Garnet- and oxide-bearing aplitic albite pod sandwiched between a quartz core and medium-grained pegmatite (above) and very coarse-grained K-feldspar pegmatite (left). Aplite pod is approximately 80 centimetres wide.

A sample of dark grey altered (tourmalinized) host rock (possible xenolith) was collected in this area, and tested for geochemical signatures, particularly Be and Cr.

Stop 13H: Hellroaring Creek pegmatite (south_central)

UTM 11 559269E / 5491422N: Medium-grained pegmatite at this location is crosscut by a late 3 to 10 centimetre wide vuggy quartz-muscovite vein containing subordinate euhedral feldspar crystals and a tourmaline laden alteration selvage. A single, one centimetre diameter, translucent, light yellowish-green, euhedral beryl crystal was found within one of the vugs. Several other poor quality Fe-stained, opaque beryls were also noted in vugs, and within the alteration halo around the vein. The mineralogy and texture of this vein is consistent with a greisen style origin. This is the first and only reference I know of, pertaining to beryl crystals with gem potential at the Hellroaring Creek stock.

Stops 2-5A: Lightening Creek pegmatite

UTM 11 561250 / 5490851: Overall mineralogy and distribution of medium- and coarse-grained pegmatites is similar to the main Hellroaring Creek body except for slight variations in mineral modes, and a notable elevated tourmaline content. Overall pegmatite grain size and modal abundance of tourmaline increases from east to west over the 100 metres of exposure. Mineral mode is noted below:

Feldspar (60%): bluish-grey, euhedral to subhedral, 0.5 to 2 centimetre long in medium-grained pegmatite, with albite twinning (plagioclase). Crystal sizes exceed 30 centimetres in length in coarse pegmatite.

Quartz (25%): light-grey, sub- to anhedral, dispersed as matrix throughout. Occasional intergrowth with muscovite.

Muscovite (10%): silver to silvery-green, euhedral books to 2 centimetres in medium-grained pegmatite, and 15 by 10 by 5 centimetres in coarse pegmatite.

Tourmaline (0.5 to 5 %): black, euhedral columns averaging 0.5 by 3 centimetres. Exceptional crystals in coarse pegmatite reach 20 by 10 centimetres. Occasional 'boron blasts' are noted in very coarse assemblages. Size and abundance of crystals are highly variable.

Fluroapatite? (trace): possibly identified as grey, subhedral, pseudohexagonal crystal with dimensions 20 by 10 centimetres.

Beryl (trace): rare, white, opaque, euhedral, hexagonal crystals up to 3 by 12 centimetres, hosted in medium- to coarse-grained feldspar-quartz-muscovite-tourmaline pegmatite.

Stops 6-9M: Mathew Creek Stock

UTM 11 564916E / 5499824N: This coordinate (stop 8M) represents the westernmost outcrop examined. Approximately 900 metres to the east (stop 9M), the pegmatite was drilled in 2001, where beryl abundances are greatest (EMPR ass rpt 26701). The pegmatite is medium- to coarse-grained with the following mineral mode:

Feldspar (65%): Porphyritic K-feldspar is generally discernable from finer grained matrix-filling plagioclase. K-feldspar is blocky, pinkish-white and visibly perthitic. 5 by 3 centimetre blocks are common in the coarser grained assemblage. The ratio of K-feldspar to plagioclase is close to 3:2, but appears to increase in favour of K-feldspar from west to east.

Muscovite (15%): Is silver to reddish silver with euhedral books up to 3 by 3 by 1.5 centimetres.

Quartz (17%): Occurs typically as light-grey, anhedral matrix, and occasionally as quartz-rich segregations or cores, especially at the main area of drilling towards the east.

Beryl (trace to X%): Occurs as white to light-bluish-grey, opaque, subhedral to euhedral crystals (Figure 4). Towards the west, rare beryl crystals are found in several outcrops, up to 4 by 1 centimetres in size. At the main area of drilling in the east, there is spectacular abundances of beryl, locally approaching several percent. Crystals up to 15 by 5 centimetres were noted, with average size of 4 by 1 centimetres.

Tourmaline is generally absent from the pegmatite assemblages, but occurs, up to 10%, in metasomatically altered tourmalinized schist host rock at the eastern extent of the pegmatite.

Several evolving textural and mineralogical features, i.e. increase in grain size, beryl abundance and K-feldspar: plagioclase ratio, strongly suggest a west to east increase in fractionation and mineralization potential.

Figure 4 Beryl crystals in medium -grained pegmatite of the Mathew Creek stock, near the main drilling site.

Drilling on the property occurred at the eastern limit of the exposed part of the Mathew Creek stock. Results showed BeO greater than 1000 g/t over 6 metres (including. 2908 g over 1 metre), and Ta_2O_5 approaching 100 g/t over several metres (EMPR ass rpt 26701). These values, although not exceptional, are significant and could be considered encouraging. Does the pegmatite continue in the subsurface towards the east and northeast?

Significance and Interpretations of the Hellroaring Creek Stock

Based on the known mineralogy and geochemistry of the pegmatites at Hellroaring Creek and Mathew Creek, the pegmatites can be classed as beryl - (columbite) pegmatites as defined by Cerny (1991).

The volume of pegmatite at the Hellroaring Creek stock is impressive, rivaling the size of world class economic LCT-pegmatites such as the Greenbushes pegmatite in Australia (with dimensions 3300 by 400 by >500 metres) and the Tanco pegmatite in Manitoba (1650 by 800 by 125 metres) (Cerny, 1991). In contrast to the above pegmatites however, the Hellroaring Creek stock comprises a simple mineralogy: feldspar, quartz, muscovite, biotite, tourmaline, beryl, garnet, apatite, and occasional oxides, including columbite and ilmenite. The internal zonation of the pegmatite is also relatively simple with only localized, discontinuous pods of more texturally and chemically evolved lithologies, in contrast to the Greenbushes and Tanco pegmatites which exhibit broad concentric and/or layered internal zonation patterns. The Hellroaring Creek pegmatite is structurally complex in that it is interpreted as a multiphase system of dyke swarms (EMPR ass rpt 26701), however, internal zonation within individual intrusions appears limited.

The Mathew Creek stock, although significantly smaller than the Hellroaring Creek stock, exhibits encouraging Be and Ta content, and unexplored potential along both strike and dip directions.

Classic models of fractionation and evolution of mineralization in pegmatites suggest the farther a pegmatite forming melt traveled from its parental source, the more fractionated and enriched in incompatible elements such as Be, Li, Rb, Cs, Ta the resulting pegmatite will be (Cerny, 1992). In the case of the Hellroaring Creek stock and surrounding 'satellitic' pegmatites, it is tempting to ask whether the main stock is proximal to a parental source, and if the satellites represent more distal expressions of this system.

GREENLAND CREEK STOCK

The Greenland Creek stock is a north to northwest trending swarm of pegmatite dykes and sills that intrude lower Aldridge sediments and Moyie Sill gabbros and diorites (Figure 5). The elongate and arcuate lobe shaped intrusions have a total average strike length of approximately 2 kilometres, with individual lobes 100 to 500 metres wide. The stock is located approximately 45 kilometres northwest of Kimberley BC, and straddles the west trending ridge between Greenland and Skookumchuck creeks.

Preliminary work on the geological setting, mineralogy and age relationship of the Hellroaring Creek stock to the White Creek batholith and the Greenland

Creek stock, was undertaken by Smith and Brown (1998). Several historical and ongoing exploration projects occur within a 10 kilometre radius of the pegmatite (Brown and Termuende, 1998), but no exploration work has been directed specifically to the Greenland Creek pegmatites. In 2000, Kennecott Canada Exploration drilled one hole on the Greenland Creek Ag-Pb-Zn showing (MF 082FNE107), located approximately 2 kilometres west of the pegmatitic stock. Hole DH-G00-01 intersected feldspar-muscovite-quartz-tourmaline pegmatite at 228 metres depth and remained in pegmatite to the bottom of the hole at 295 metres (Coombs, 2000).

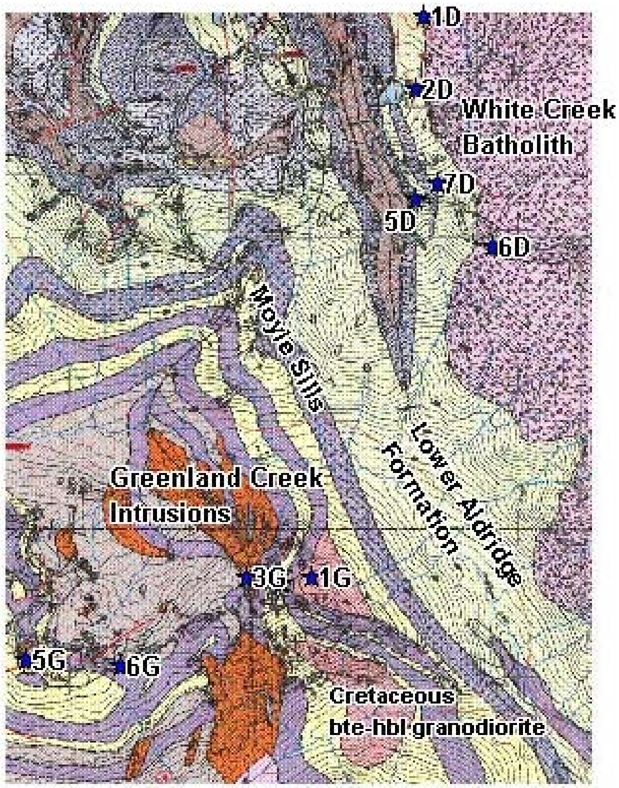


Figure 5 Geology and field sites (stars) visited near the headwaters of Greenland Creek and Doctor Creek (after Greig, 2001). The main body of the Greenland Creek stock is approximately 500 m wide.

Field Observations

The author and assistant set up camp near the eastern limit of the pegmatite swarm, 100 metres north of the ridge line at stop 1G: UTM 11 – 558601E / 5536682 N. Two and a half days were spent examining the pegmatites along the ridge, for two kilometres to the westernmost exposure at stop 5G: UTM11 556709 / 5536133.

Stops 1G-4G: Pegmatites in the eastern one-third of the observed area are composed primarily of fine-grained tourmaline-bearing pegmatitic quartz monzonite to granite, with subordinate but significant volumes of medium- to coarse-grained K-feldspar-quartz-muscovite +/-tourmaline, garnet- and/or beryl-bearing pegmatite. The coarse-grained pegmatite assemblages commonly exhibit significant internal zonation (Figure 6). The best exposures of more evolved pegmatite assemblages were found near camp, at the base of a 300 metre high talus slope. As boulders are typically not large enough to preserve the entire thickness of a zoned pegmatite, it is not possible to ascertain if the pegmatites are zoned symmetrically or layered asymmetrically with respect to central quartz core zones observed up to 1 metre in width. Mineral mode appears to vary systematically from outer zones to inner zones: quartz content increases markedly from 10% to more than 90%, with concurrent increase in muscovite, and decrease in tourmaline content (Figure 6).

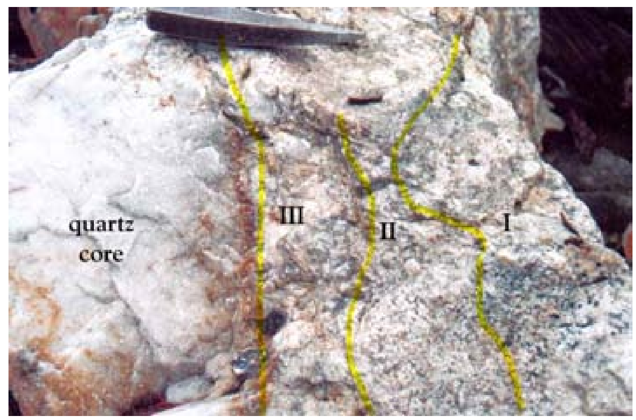


Figure 6 Zoned pegmatite of the Greenland Creek intrusion (stop 2G). I: Fine- to med-grained tourmaline-garnet bearing feldspar +/-muscovite pegmatite. II: Fine- to med-grained feldspar-muscovite pegmatite. III: Medium- to coarse-grained blocky K-feldspar-muscovite pegmatite with quartz matrix. Note: From outer to inner zones (I to quartz core) modal quartz and muscovite increase, tourmaline decreases.

At least four beryl occurrences were noted in the medium- to coarse-grained pegmatite assemblages: three north of the ridge, and one south of the ridge. They occur as white to light-grayish-green, opaque to rarely semi-translucent, euhedral hexagonal crystals. Three to seven millimetre diameter crystals are typical, with visible lengths approaching three centimetres.

Localized vuggy quartz-tourmaline-muscovite-fluorite veining, was observed crosscutting both coarse - grained pegmatites in the talus area, and Aldridge sediments at the 2440 metre peak overlooking the talus area.

Stop 5G: At the western edge of the field area is a 100 by 300 metre exposure of medium-grained pegmatite averaging 45% feldspar, 40% quartz, and 15% muscovite. Minor tourmaline and garnet were noted in zones poor in muscovite. Several discontinuous quartz cores were noted, as well as a zoned contact along the southeast margin. The zoned marginal assemblage comprises a 10 centimetre tourmalinite contact zone, followed by a 3 to 5 centimetre light-bluish microcrystalline quartz zone, containing an unknown jarositic-stained, soft, equant mineral. This zone was, in turn, in contact with a tourmaline bearing aplite, followed by standard medium - grained pegmatite (sample 5G-1).

Greisen-like alteration is also noted locally (sample 5G-3).

Stop 6G UTM 11 557339E / 5536097N: Located on the ridge, at the saddle, midway between the eastern and western stops. Mineralogy of this 30 by 100 metre exposed pegmatite is unique. The rock mode is:

75% medium-grained quartz-plagioclase-tourmaline pegmatite. Mineral mode: 60% quartz, 25% plagioclase, 8% black tourmaline, and subordinate K-feldspar (5%), and muscovite (2%). Tourmaline crystals are up to 6 by 2 centimetres.

15% monomineralic light-grey to white quartz, host to occasional large tourmaline crystals.

10% fine -grained aplite (sample 6G-2)

One occurrence of light-bluish white, opaque beryl was noted in the medium -grained tourmaline-bearing pegmatite. At this same locality, a broad exposure of medium-grained pegmatite is transitional to quartz-tourmaline dykes and sills extending out into the surrounding host sediments.

WHITE CREEK BATHOLITH

The middle Cretaceous White Creek batholith is well exposed over a 435 square kilometre area, in the southern Purcell mountains, approximately 45 kilometres northwest of Cranbrook, BC (Figures 1 & 5). The long axis of the exposed bilobate intrusion trends northeasterly, and comprises a complex multiphase southern lobe, and a single-dominant-phase northern lobe. The details of the mineralogy and phase relations of the batholith are described and mapped by Ressor (1958, 1996). Age relationships of the phases are summarized by Smith and Brown (1998).

The southern lobe is composed of a broad succession of generally younging-outward, concentric phases of leucoquartz monzonite, porphyritic quartz monzonite, hornblende-biotite granodiorite, biotite granodiorite, and quartz monzonite. The northern lobe is mapped exclusively as porphyritic quartz monzonite.

Aplite and pegmatite phases are reportedly widespread, but are particularly associated with the porphyritic quartz monzonites. Reesor (1958) reported the aplites and pegmatites are particularly plentiful east of the headwaters of White Creek along the contact to the northeast and down Skookumchuck Creek. Conversely, aplites and pegmatites are absent in the leucoquartz monzonites, and rare in the medium-grained quartz monzonites and mafic-rich granodiorites of the south and west parts of the batholith (southern lobe?).

Rice (1941) noted, "Pegmatite and aplite dykes are common on the borders and in places carry small amounts of black tourmaline and blue-green beryl." One such locality mentioned, west of Mt. Alton (Mulligan 1968), likely corresponds to Minfile 082FNE159.

Field Observations

The purpose of the traverse in this area was to explore the western contact of the White Creek Batholith between Doctor Creek and Greenland Creek (Figure 5). At the time of writing, the area is blanket staked by Eagle Plains Resources as a prospective area for Ag-Pb-Zn Sullivan-style mineralization, and also includes several W+/-Mo mineralized quartz greisen and skarn showings.

S**top 1D to 5D**: The traverse started at the Silver Key Ag-Zn-Pb-Cu mine (MF 082KSE053) and continued south past Shrimp Lake (Figure 7), a local name for the tarn at the headwaters of the southern most tributary of Doctor Creek.

Figure 7 Looking north from stop 5D towards Shrimp Lake.

From here the traverse headed southwards up talus and outcrop, to the peak at stop 5D. Well exposed Lower Aldridge and Moyie Sills were examined for signs of pegmatite and aplite intrusions (Figure 8). No aplite or pegmatite were observed, but a 3 to 5 metre wide quartz sill with notable workings was noted at stop 5D, 50 metres south of the peak. On the ridge, approximately 50 metres east of this same peak, is an occurrence of tourmalinized and albite altered diorite (sample 5D-2), proximal to several veins of tourmaline bearing granite (sample 5D-3).

Figure 8 Looking east from stop 5D at rusty lower Aldridge sediments with interbedded grey Moyie diorite sills, and lesser white granitic dykes and veins. Note contact between lower Aldridge sediments and White Creek batholith farther along ridge.

Stop 6D: Blue Hammer showing (UTM 11 559824 E / 5538897 N): Excellent exposure of the contact between the White Creek batholith and Aldridge sediments in this area allowed for careful examination of aplite and pegmatitic dykes and veins hosted within K-feldspar megacrystic quartz monzonite, over a 1500 by 500 metre area (Figure 9). Intrusive phases of the White Creek batholith at this locale are described below:

Figure 9 Crosscutting relationships of the three phases in the White Creek Batholith within 5 metres of the Aldridge sediment contact. Three-millimetre long, blue gemmy beryl crystals were found in the 2-3 centimetre wide phase III vein in this photo.

Phase I: K-feldspar megacrystic quartz monzonite, is the dominant phase of the batholith in the area. Euhedral K-feldspar megacrysts greater than 10 centimetres long are pervasive and account for up to 50% of the rock.

Phase II: Medium-grained tourmaline bearing aplite or microgranite crosscuts phase I as veins and dykes up to 10's of metres thick. Contacts between phases I and II are sharp.

Phase III: Fine- to medium-grained beryl-bearing K-feldspar-quartz pegmatite crosscuts phases I and II. Micas are conspicuously rare, but where present, biotite is more common than muscovite. Occasional skeletal intergrowths of tourmaline and quartz were noted. Other minor constituents include fine-grained red garnet, and locally, up to 1% pyrite cubes to 1 centimetre. Contacts with phase II are sharp to diffuse over 1 to 3 centimetres. Contacts with phase I are sharp.

Two gem quality beryls in excess of 8 millimetres in diameter have been found in phase III, in addition to dozens of transparent to translucent crystals less than 3 millimetres (Figure 10). A later beryl-bearing phase has also been noted. Walnut-sized vugs containing inwardly growing euhedral beryl crystals have been noted in quartz-mica +/-tourmaline greisen veins up to 5 centimetres wide. At one location, this vein type was observed crosscutting phase III pegmatite.

Figure 10 Blue and blue-green aquamarine crystals from the Blue Hammer showing.

In the field area, the volume and number of occurrences of both aplite and pegmatite are greatest at the batholith-sediment contact. Overall rock mode, within 100 metres of the contact, is approximately 75% K-feldspar megacrystic granite (phase I), 20% aplite (phase II) and <5% pegmatite with or without visible beryl (phase III). Cursory traverses in the area revealed an almost complete lack of aplite and pegmatite at distances greater than 100 to 200 metres from the contact. Distances beyond 200 metres were not explored.

Granitoid intrusions as dykes, sills or veins, into the host rocks, also appear to be limited.

This is the first recorded account of beryl crystals associated with the northern lobe of the White Creek batholith. The pegmatite phase in which the beryl crystals are found, appears to be more abundant in areas that also contain significant volumes of aplite. This pegmatite is most often found crosscutting aplite, but beryl-bearing pegmatite veins are also found crosscutting the main body of K-feldspar megacrystic quartz monzonite.

SHAW CREEK STOCK

The Shaw Creek stock is a late Cretaceous, 130 square kilometre intrusion composing the central to southern one-third of the middle to late Cretaceous multiphase Bayonne batholith (Figures 1, 11). The stock is typically light-grey to pinkish-grey biotite +/- hornblende granite with abundant K-feldspar megacrysts averaging 2 to 3 centimetres. Leucoquartz monzonite is locally abundant.

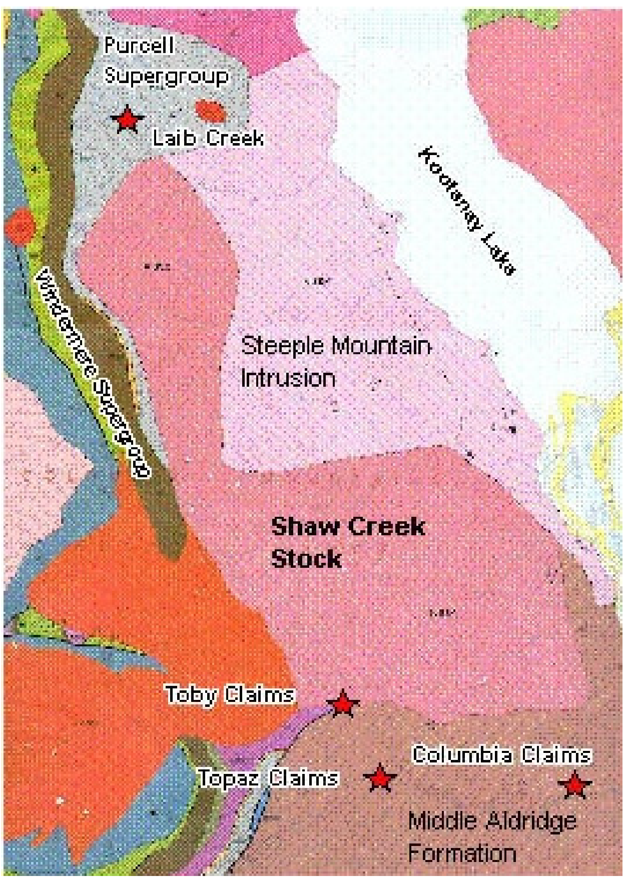


Figure 11 Geology and field sites in the area of the Late Cretaceous Shaw Creek stock (after Reesor, 1996). Kootenay Lake is approximately 5 kilometres wide.

An overview of the area stratigraphy, igneous intrusions, and structural and metamorphic setting is detailed by Brown et al. (1994). The Shaw Creek stock intrudes the Aldridge Formation along the southern and southeastern portion of the map area. Semipelites of the Aldridge Formation in this area have been metamorphosed to amphibolite facies (sillimanite-kyanite-staurolite) (Brown et al., 1994), an expression of the deformation related to the formation of the Kootenay Arc. To the west and southwest, the Shaw Creek stock intrudes grey siltites and black argillites of the La France Creek Group, dolomite and argillite of the Mt. Nelson Formation, and polymict conglomerate of the Windermere Group Toby Formation.

Other intrusions in the area include biotite-hornblende-epidote granodiorite of the Jurassic Mine Stock to the southwest, and biotite-muscovite leucomonzogranite of the mid-Cretaceous Steeple Mountain stock to the east. Eocene Coryell stocks, less than 1 square kilometer, intrude surrounding lithologies approximately 5 kilometres west and northeast of the northernmost extent of the Shaw Creek stock. Lamprophyre dykes are also noted in the region.

Rice (1941) noted that the Bayonne Batholith in general has a highly variable nature and,

> "Masses of pegmatite and dykes of pegmatite and aplite occur everywhere. Some of the pegmatite dykes are over 100 feet wide. A few large crystals of blue-green beryl, pink garnet, magnetite, and a little black tourmaline were seen in these pegmatites."

The details of the above quote refers to the historical Midge Creek showing (MF 082FSE091).

Recent mapping carried out by the author for Cream Minerals Ltd. outlined a further northward extension of the Shaw Creek stock into the Laib Creek area, not previously mapped by Reesor (1996). Beryl showings in the vicinity of the Shaw Creek stock were recently discovered by prospector Lloyd Addie of Nelson BC. In the fall of 2002, Cream Minerals Ltd. of Vancouver, BC, entered into an option agreement with Mr. Addie, to develop the property as an aquamarine and emerald gemstone property. The property includes two large claim groups covering the northern, western and southern contacts of the Shaw Creek stock. More than 25 kilometres separates the northernmost and southernmost showings. In 2003, Cream Minerals Ltd. engaged the author to do geologic mapping and oversee the exploration program in the search for gem-beryl mineralization.

Field Observations

Along the northern and western margins of the Shaw Creek stock, pegmatite and aplite is common as schlieren, dykes, and veins hosted by granite, particularly within one kilometre of the margin. Along the southern contact, pegmatite dykes are observed occasionally within granite dykes, but occur more commonly as pegmatite sills and dykes within Aldridge sediments, typically at a distance greater than one kilometre south of the contact.

Laib Creek (OMG claims)

The OMG claims in the Laib Creek area are underlain by a previously unrecognized lobe of the Shaw Creek stock, which is several square kilometres in area.

Six different rock types were recognized within the property area. In order of abundance they are: biotite +/- muscovite granite (G), K-feldspar-muscovite pegmatitic granite (PG), micaceaos meta-arkose (mma) with subordinate interlayered amphibole-bearing metapelite, garnetiferous sodic aplite (A), medium- to coarse -grained K-feldspar +/- muscovite +/- beryl pegmatite (P), and K-feldspar megacrystic granite (Gk). Textural and cross-cutting relationships suggest the following temporal sequence from oldest to youngest: mma – Gk – G – A – PG – P.

Beryl crystals are most commonly found in the coarser grained P unit, with rare occurrences in the finer grained PG unit. Beryl abundance is generally less than 1%, however volumes greater than 5 % have been noted. Beryl crystals in the pegmatite are pale- to medium- ice-blue to greenish-blue in colour and range up to 10 centimetres in diameter. Some of the best quality aquamarines are found within or along the margin of quartz cores within surrounding coarse-grained pegmatite.

At two known locations, 10 to 30 centimetre wide quartz veins appear to extend out of the quartz cores, through the host coarse-grained pegmatite, and into surrounding aplite and/or sedimentary lithologies. These veins comprise 90% light-grey to smokey quartz with subordinate K-feldspar, trace beryl and molybdenite, and up to 5% vugs, lined with rhimes of very fine -grained micas and/or clays, and occasionally beryl crystals. Several gemmy ice-blue, translucent to transparent, euhedral aquamarine crystals, to 6 millimetres in diameter, have been found in this vein type. Molybdenite occurs as sparse, yet coarse disseminations up to 1.5 centimetres. Smokey quartz is most prevalent in and around vuggy sections of the veins.

In general, quantity and quality of aquamarines in the Laib Creek area, tend to be correlative to increasing grain size of the host pegmatite, presence of zonation in the pegmatite, and presence of smoky quartz. However, some of the bluest crystals were found in narrow pegmatite segregations hosted within thick 3 to 10 meter wide aplite pods (Figure 12).

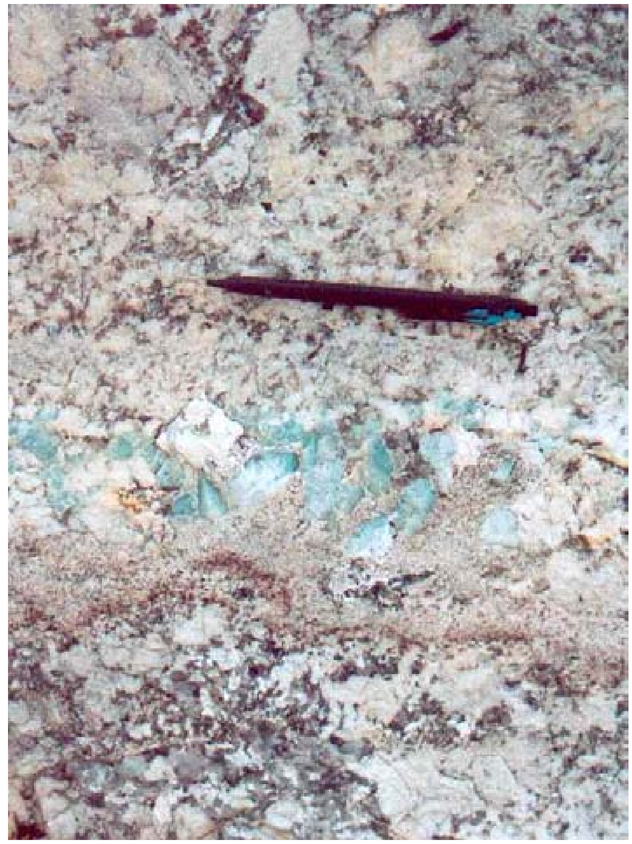


Figure 12 Abundant blue, subhedral to euhedral, translucent and opaque beryl crystals in aplitic albite segregation at centre of medium- to coarse-grained K-feldspar-muscovite pegmatite. Beryl crystals also in pegmatite at bottom of photo within smoky quartz matrix. Location: Laib Creek

Topaz Creek (Toby, Topaz, Columbia claims)

Three claim groups at or near the southern margin of the Shaw Creek stock, were prospected and mapped to outline beryl mineralization. The most significant beryl crystals were found on the Toby claims, which straddle the contact between the Shaw Creek stock and the Mount Nelson Formation.

Preliminary mapping on the Toby claims, discerned five rock types. In order of abundance they are biotite granite (G), schistose semi-pelite (SSP), a mylonitic to cataclastic mafic intrusion or gabbro (M), pegmatitic granite or pegmatite (P), and aplite (A). Textural and cross-cutting relationships suggest the following temporal sequence from oldest to youngest: SSP – M – G – PG – A – P.

The beryl-bearing unit is a fine- to medium-grained K-feldspar-muscovite-biotite pegmatite with a light grey to smokey quartz matrix. The main showing contains bluish-green beryls, some with significant gemmy sections. The largest beryl collected to date is a euhedral, hexagonal, translucent crystal with dimensions of 4 by 0.8 centimetres. The pegmatite is 20 to 30 centimetres wide and is hosted in unit M with distinct, sharp margins. In the area of the best mineralization, pegmatite and granite dykes are hosted in a 50 metre wide zone comprising dominantly dark grey mylonitic and cataclastic gabbro dykes.

The Topaz and Columbia claims are located 1 to 2 kilometres south and southeast, respectively, of the Toby claims. Unlike the claim groups to the north, pegmatites in the Topaz creek area occur as sills and lesser dykes hosted in sediments of the Aldridge Formation. Pegmatite mineralogy consists of feldspar, with significant quartz and muscovite, minor transient red garnet and black tourmaline, and trace white to yellow and rarely pale blue beryl.

On the Columbia claims, 1 to 1.5 metre wide pegmatite sills are most common, hosted in biotite-muscovite schists, containing relict aluminosilicate porphyroblasts. Light bluish-white and yellowish white, opaque beryls are the most common, while translucent beryl crystals up to 5 centimetres long are noted occasionally.

On the Topaz claims, beryl occurs as subhedral to euhedral white, opaque crystals hosted in pegmatite sills and dykes similar to those on the Columbia claims. White opaque beryls, 1 to 3 centimetres wide, were also found on a 50 by 100 metre bluff comprising pegmatitic granite and subordinate fine- to medium-grained pegmatite. Quartz-cassiterite veins occur locally along the margins of the pegmatoid units.

The large outcrop of pegmatite at this location is well foliated in at least two orientations and comprises a mineralogy slightly different than the local pegmatite sills. Textural and mineralogical features of the large pegmatite are somewhat similar to those observed at the Proterozoic Hellroaring Creek stock.

The area has been explored previously for base metal potential (MF 082FSE004). The Minfile report mentions the existence of quartz-cassiterite veins associated with galena and sphalerite, however no reference is made to pegmatites in the area.

SLOCAN VALLEY

Field work in the Slocan Valley included a reconnaissance examination of pegmatites along the Little Slocan River Forest Road, and a detailed viewing of the BQ claim near Yolanda Creek (Figure 13).

Interesting mineralization with gem potential for garnet and moonstone was noted at stop S2.

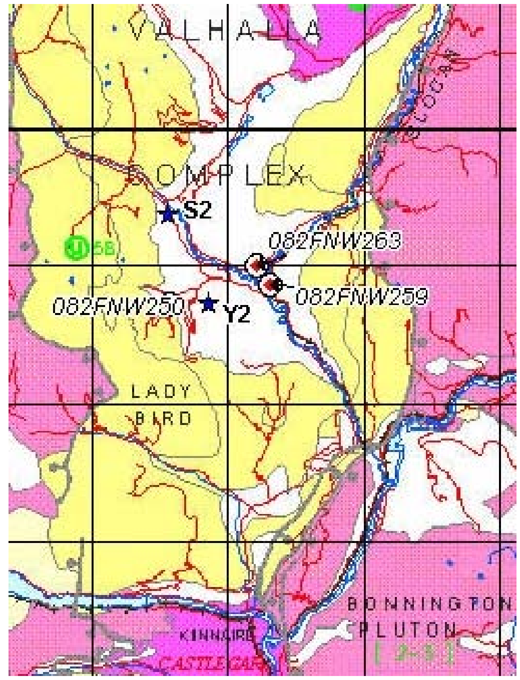


Figure 13 Geology, Minfile and field sites (stars) in the Slocan Valley (after Geoscience Map 2002-1). Grid squares are 10 by 10 km.

Yolanda Creek (BQ claim)

Pegmatites at the BQ claim (stop Y2) occur as quartz monzonite boudined sills hosted in gneissic metasediments and fine to medium-grained quartz monzonite intrusions (Figure 14).

Figure 14 Prospector Ed Varney at his aquamarine-bearing pegmatite showing (BQ claim, Slocan Valley).

Gem quality aquamarine crystals up to 10 centimetres in length have historically been extracted from very coarse -grained vuggy quartz- K-feldspar pegmatite (Figure 15).

Figure 15 Cut aquamarine gemstone from the BQ claim.

GEOCHEMISTRY

During the course of the 12 field days devoted to this project, a total of 78 samples were collected. This included 42 intrusive and sedimentary samples for whole rock analysis, 27 single crystal K-feldspar and muscovite samples for trace element analysis, 6 beryl crystals for probe analysis, and 3 unknown oxide minerals for XRD identification. Out of the 78 samples collected during field work, 35 of the whole-rock samples were analysed. Samples come from the Hellroaring Creek stock, Lightening Creek, Mathew Creek Stock, Greenland Creek stock, White Creek batholith, and intrusives of the Slocan Valley.

Cream Minerals Ltd. provided a total of 32 analyses from sampling completed by the author in the summer and fall of 2003. Fourteen compositions are from the northern claim groups (OMG, Cultas), the remainder from the southern claim groups (Topaz and Columbia).

All analyses were done by Acme Analytical labs in Vancouver BC, using the analytical packages in Table 2. Analyses provided by Cream Minerals Ltd. did not include Group 4A elements.

Table 2 Analytical packages for whole rock analysis by Acme Labs (http://www.acmelab.com/cfm/index.cfm).

Package	Elements
Group 4A: ICP-ES	Al_2O_3,Fe_2O_3,MgO,CaO,Na_2O,K_2O,TiO_2, P_2O_5,MnO,Cr_2O_3,Ba,Ni,Sc.
Group 4B: ICP-ES&MS	Be,Co,Cs,Ga,Hf,Nb,Rb,Sn,Sr,Ta,Th,U, V,W,Zr,Y,La,Ce,Pr,Nd,Sm,Eu,Gd,Tb,Dy ,Ho,Er, Tm,Yb,Lu
Group 1DX: ICP-MS	Mo,Cu,Pb,Zn,Ni,As,Cd,Sb,Bi,Ag,Au,Hg, Tl,Se

Five different rock types were analyzed:

1) Moyie sill gabbros and diorites
2) Sediments proximal to the Shaw Creek stock
3) Cretaceous granite host to pegmatite
4) Aplite
5) Pegmatite

Average compositions of the different rock types are presented in Table 3. Average compositions of pegmatites from 8 different areas are presented in Table 4.

Significant correlation coefficients for selected pegmatite elements are summarized in Table 5.

Geochemistry of pegmatites

Plots of individual contents (Figures 16 a-i) of pegmatite analyses highlight compositional variations, mineralization trends, and suggest geochemical tools for future geochemical sampling procedures.

There is a discernable inverse correlation between Na2O and K2O (Figure 16b) that corresponds to observed mineral modes at the different properties. K2O vs. Rb (Figure 16d) and Rb vs. Cs (Figure 16e) both exhibit discernable positive correlations. Highest average values of K and Rb occur in pegmatites at White Creek, Mathew Creek and Shaw Creek, respectively. These relationships can be interpreted as a rough, first-pass determinations of relative fractionation of the different pegmatite bodies.

Nb vs. Ta (Figure 16f), Be vs. Ta (Figure 16g), and Be vs. Rb (Figure 16h), all exhibit good to moderate positive correlations. In figures 16g and 16h, there appears to be two parallel but diverging trends at Be > ~50 ppm. Highest average Be contents occur at Mathew Creek, Greenland Creek, and Shaw Creek, while highest Nb and Ta contents occur at Shaw Creek, followed by White Creek, and Mathew Creek. The highest average Ta/Nb value (0.69) occurs at Mathew Creek.

Sn, W, and Bi exhibit moderate to strong positive correlations to each other and moderate to weak positive correlations against Mo, and Cu. This suite of five elements does not correlate well against the suite of LCT-signature elements (K, Rb, Cs, Be, Ta, Nb) mentioned above, and suggests different styles and/or timing of mineralization.

Table 3 Average whole rock compositions by rock type. n (x,y) = number of analyses included in the average (Individual analyses that include Group 4A, Total no. of analyses)

	Moyie gabbro/diorite	Shaw Creek sediments	Cretaceous granite	All aplite	All pegmatite
n	4,8	2,15	4,5	4,5	18,30
SiO2 %	51.67	69.03	71.01	73.12	74.88
Al2O3	13.74	14.78	14.43	15.80	14.32
Fe2O3	14.52	6.23	3.52	0.77	1.17
MgO	4.79	1.77	0.53	0.21	0.17
CaO	9.04	0.65	1.25	1.00	0.68
Na2O	1.92	0.51	3.56	6.06	3.72
K2O	0.56	2.59	3.25	1.91	3.57
TiO2	1.60	0.73	0.25	0.06	0.07
P2O5	0.14	0.45	0.18	0.20	0.22
MnO	0.20	0.12	0.27	0.06	0.05
Cr2O3 *	0.010	0.006	0.001	bd	0.003
Ba (ppm)	110.00	534.23	429.25	101.75	241.44
Ni (ppm)**	79.00	26.00	21.00	bd	27.67
Sc (ppm)	40.25	13.00	3.25	3.00	3.09
LOI	1.55	2.95	1.55	0.75	1.07
SUM	99.76	99.81	99.85	99.93	99.92
Be (ppm)	3.67	5.80	8.25	48.25	99.94
Co	38.68	12.20	2.70	1.20	1.28
Cs	5.98	32.07	11.43	8.65	13.58
Ga	22.83	21.94	21.13	20.10	17.79
Hf	3.23	7.83	3.73	3.13	2.36
Nb	6.90	25.05	59.28	29.75	17.03
Rb	31.40	278.77	236.90	197.68	299.34
Sn	13.00	17.87	4.75	23.75	37.88
Sr	173.18	87.64	215.38	55.83	69.48
Ta	0.48	2.93	5.60	9.85	5.60
Th	4.83	14.05	29.65	6.37	2.59
U	1.30	3.99	19.05	6.10	3.11
V	443.25	101.67	27.25	21.50	17.60
W	26.30	4.43	4.75	9.98	4.48
Zr	101.73	263.12	117.13	74.68	41.89
Y	31.90	39.33	12.03	7.70	10.84
La	14.40	42.27	43.25	5.93	7.78
Ce	34.08	96.57	76.85	12.15	15.89
Pr	3.93	10.76	7.43	1.48	1.85
Nd	17.03	41.34	24.18	5.25	6.95
Sm	4.13	8.31	3.55	1.35	1.72
Eu*	1.30	1.39	1.04	0.26	0.56
Gd	4.64	6.87	2.36	1.21	1.44
Tb	0.80	1.13	0.35	0.22	0.28
Dy	5.11	6.65	1.97	1.19	1.67
Ho*	1.04	1.38	0.35	0.22	0.42
Er	3.11	3.95	1.03	0.65	1.04
Tm*	0.45	0.62	0.18	0.20	0.26
Yb	2.87	3.88	1.27	0.85	1.07
Lu	0.43	0.58	0.22	0.15	0.16
Mo	0.35	0.78	9.40	6.68	1.52
Cu	71.75	23.41	5.88	6.58	8.01
Pb	2.88	4.08	6.45	12.03	6.50
Zn	47.75	55.67	19.25	23.75	19.11
Ni	17.43	12.73	2.28	1.30	2.53
As**	3.85	11.46	2.33	0.95	5.29
Cd**	bd	0.20	bd	0.10	0.23
Sb**	bd	0.10	0.63	0.25	0.10
Bi	0.10	1.00	0.15	1.13	1.88
Ag**	bd	0.17	0.50	0.20	0.73
Au**	1.70	0.85	3.10	1.10	2.18
Hg	bd	0.01	0.02	bd	0.02
Tl	0.20	0.69	0.25	0.10	0.19
Se**	0.80	0.50	bd	bd	bd
Ta/Nb	0.07	0.12	0.09	0.33	0.33
Ga/Al2O3	1.66		1.46	1.27	1.24
Rb/K2O	56		73	104	84

* significant number of contents below detection lead to exaggerated average cont

** majority of contents below detection - average numbers high and suspect

Table 4 Average *pegmatite* whole rock compositions by area. n = number of analyses included in average. ASI (aluminum saturation index) = mol. Al2O3/(CaO+Na2O+K2O)

	Lightening Creek	Slocan BQ claims	Hellroaring Creek	Greenland Creek	Shaw Creek S	Shaw Creek N	Mathew Creek	White Creek
n	3	4	3	4	5	7	3	1
SiO2 %	74.20	74.72	76.83	75.39	nd	nd	73.76	73.02
Al2O3	14.77	14.46	13.31	14.24	nd	nd	14.59	14.87
Fe2O3	0.90	1.12	0.96	0.97	nd	nd	2.13	0.76
MgO	0.06	0.15	0.07	0.21	nd	nd	0.33	0.14
CaO	1.10	0.95	0.31	0.68	nd	nd	0.31	0.49
Na2O	6.12	2.87	5.12	3.17	nd	nd	1.82	3.67
K2O	1.08	4.52	2.32	3.92	nd	nd	4.70	6.14
TiO2	0.02	0.03	0.03	0.04	nd	nd	0.23	0.04
P2O5	0.67	0.11	0.11	0.15	nd	nd	0.17	0.07
MnO	0.06	0.04	0.05	0.03	nd	nd	0.07	0.09
Cr2O3 *	0.002	0.002	bd	0.001	0.001	0.004	0.008	bd
Ba (ppm	26.67	580.50	30.00	239.50	177.90	92.46	191.00	323
Ni (ppm	20.00	26.00	22.50	28.33	nd	nd	47.00	bd
Sc (ppm	1.00	4.50	1.50	2.00	nd	nd	12.00	1
LOI	1.00	0.88	0.83	1.10	nd	nd	1.77	0.5
SUM	99.98	99.90	99.94	99.92	nd	nd	99.89	99.83
Be (ppm	35.67	4.75	29.00	183.50	170.60	96.86	253.33	92
Co	0.50	1.30	0.50	0.73	0.90	2.35	2.57	0.5
Cs	22.43	5.35	8.70	8.70	16.96	14.40	26.00	16.9
Ga	18.43	16.43	13.73	17.70	19.92	30.69	20.00	27.2
Hf	bd	2.37	1.25	1.60	1.40	8.23	4.27	1.9
Nb	14.07	5.38	10.07	16.78	36.82	75.30	24.37	72.4
Rb	197.10	252.33	254.77	313.88	364.96	403.30	425.47	491.3
Sn	48.00	79.00	11.00	40.25	35.60	2.67	34.33	7
Sr	25.97	154.00	11.73	64.60	57.98	44.36	37.17	151.7
Ta	3.90	1.83	2.60	5.98	10.40	51.71	8.53	24.5
Th	0.90	2.30	0.67	1.70	1.52	16.56	6.80	5.5
U	0.70	2.48	1.93	4.28	3.08	11.46	3.77	9.7
V	bd	5.00	bd	7.00	bd	21.50	64.00	5
W	2.60	5.18	2.40	6.68	3.78	2.53	4.17	5.7
Zr	4.53	45.65	12.80	26.70	24.58	91.00	128.10	28.4
Y	2.47	19.30	1.33	14.18	3.80	9.40	13.27	10
La	3.03	7.58	3.85	6.05	3.20	8.24	18.20	6.3
Ce	7.23	14.80	6.37	13.75	5.82	16.71	39.53	12.4
Pr	0.86	1.55	0.74	1.91	0.62	1.74	4.41	1.43
Nd	2.63	5.73	3.70	7.45	2.04	6.01	15.17	4.7
Sm	1.40	1.25	1.10	1.93	0.44	1.31	3.23	1.1
Eu*	0.12	0.69	bd	0.49	0.22	0.36	0.81	0.19
Gd	1.05	1.44	0.58	1.77	0.45	1.23	2.38	0.98
Tb	0.18	0.33	0.09	0.38	0.09	0.21	0.41	0.24
Dy	0.61	2.63	0.32	2.13	0.57	1.39	2.31	1.34
Ho*	0.07	0.59	bd	0.40	0.15	0.47	0.59	0.23
Er	0.13	1.91	0.08	1.27	0.33	0.88	1.19	0.76
Tm*	bd	0.29	bd	0.20	0.19	0.24	0.50	0.15
Yb	0.18	1.82	0.12	1.37	0.39	1.01	1.14	1.22
Lu	0.02	0.27	0.02	0.20	0.06	0.16	0.25	0.17
Mo	0.83	1.03	1.13	3.55	2.04	8.16	0.73	0.9
Cu	1.63	12.23	1.63	17.55	3.28	3.63	3.77	3.9
Pb	4.77	13.68	4.23	3.70	4.88	2.54	5.53	3.9
Zn	11.00	29.25	3.00	21.50	5.60	11.00	28.67	13
Ni	1.53	1.53	1.33	2.53	1.04	1.60	6.60	1
As**	9.73	0.60	7.80	1.50	0.65	bd	3.93	0.8
Cd**	0.50	0.10	0.10	0.10	0.10	0.30	0.10	bd
Sb**	0.10	0.10	bd	0.10	bd	0.10	0.10	0.1
Bi	0.17	7.10	0.20	4.13	0.40	7.10	1.67	0.7
Ag**	bd	0.40	0.10	1.20	0.10	bd	bd	bd
Au**	0.80	0.80	0.60	5.25	0.60	4.73	2.65	bd
Hg	bd	0.04	bd	0.02	0.01	0.01	bd	bd
Tl	0.15	0.20	0.10	0.13	0.13	0.18	0.33	0.1
Se**	bd	bd	bd	bd	bd	bd	bd	bd
Ta/Nb	0.28	0.34	0.26	0.36	0.28	0.69	0.35	0.34
Ga/Al2C	1.25	1.14	1.03	1.24	nd	nd	1.37	1.83
Rb/K2O	183	56	110	80	nd	nd	90	80
ASI	1.11	1.31	1.18	1.47	nd	nd	1.76	1.10

* significant number of contents below detection lead to exaggerated average content

** majority of contents below detection - average numbers high and suspect

Table 5 Significant correlations (pegmatite only)

Element	Strong correlation $r^2 > 0.8$	Moderate correlation $0.8 > r^2 > 0.60$	Significant correlation $0.59 > r^2 > 0.45$
Be		Ta	Nb, Ga
K		Rb	
Rb		K,Nb	Mn,Sn,W,Ta,Cs
Cs		P	Mn,Ga,Nb,Rb
P		Ca,Cs	Mn
Ta	Nb	Be,Ga	Rb,U,Mn
Nb	Ta	Rb,Bi	Mn,U
Ga		Nb,Ta	Be,Cs,Rb
W	Bi	Sn,Cu	Rb,Zn,Mo
Sn		W,Cu,Pb,Bi	P,Cs,Rb,Zn
Mo		Bi,W	Si

Select geochemistry of host sediments and Moyie sills

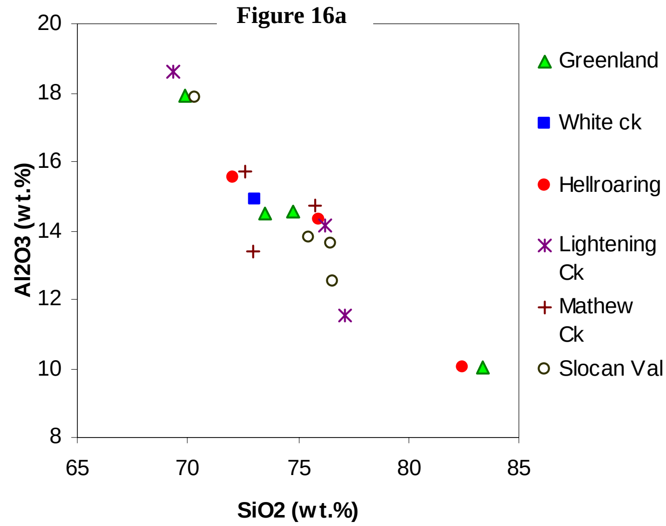
Known chromophore elements contained in emerald are Cr and V. These elements attain significant contents within mafic and ultramafic lithologies, but are extremely low in uncontaminated felsic granitoids. Special geologic environments are required to mix mafic source Cr and V with felsic Be-bearing granitoids. One important component of an emerald exploration program is the assessment of Cr and V in potential host rocks to Be-bearing granitoids. Tables 6 and 7 report Cr and V statistics of Moyie gabbro/diorite and sediments proximal to beryl occurrences discussed in this report. Additional geochemical data for Moyie intrusions can be found in Hoy and Fournier (2001).

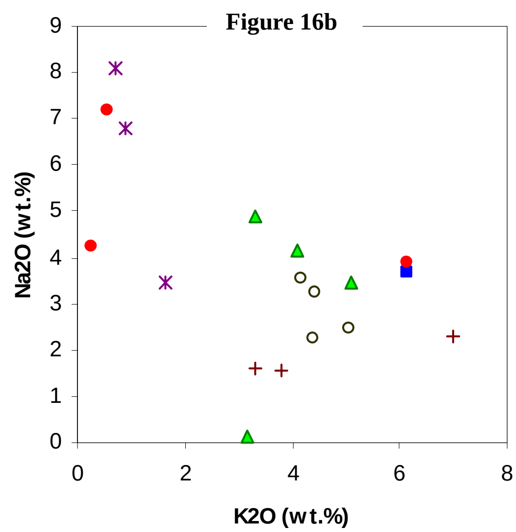
Table 6 Chromium in host rocks

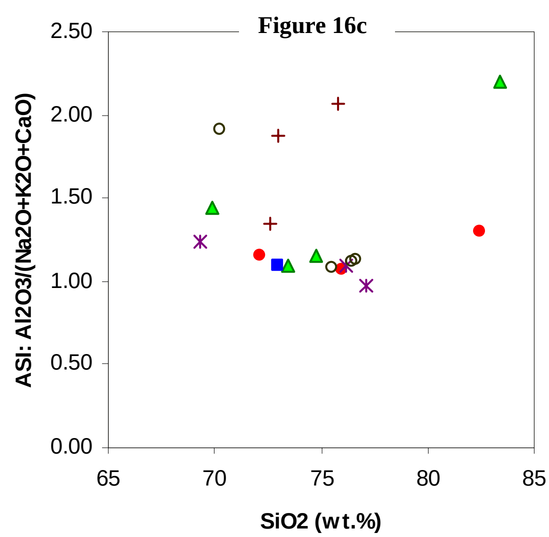
Cr2O3 %	n	Average	Max	Min	Stdev
Moyie gabbro/diorite	8	0.008	0.018	<0.001	0.007
Psammite and pelite from Shaw Creek	15	0.006	0.010	<0.001	0.002

Table 7 Vanadium in host rocks

V (ppm)	n	Average	Max	Min	Stdev
Moyie gabbro/diorite	8	362	763	56	209
Psammite and pelite from Shaw Creek	15	102	374	25	110







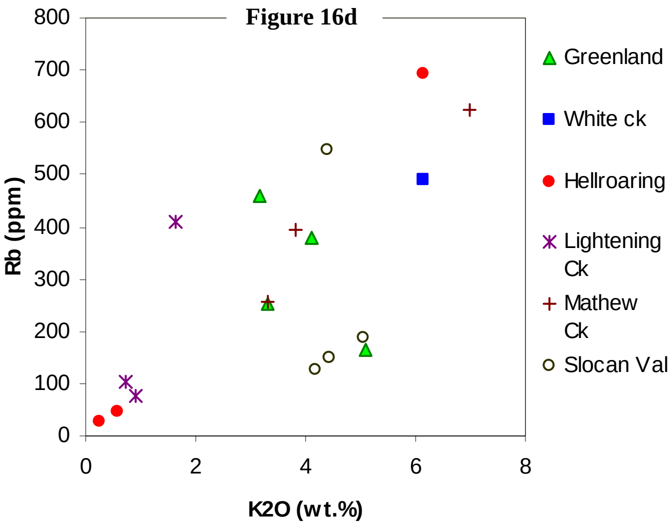


Figure 16d
Rb (ppm)
800
700
600
500
400
300
200
100
0
0
2
4
6
8
K2O (wt.%)
Greenland
White ck
Hellroaring
Lightening Ck
Mathew Ck
Slocan Val

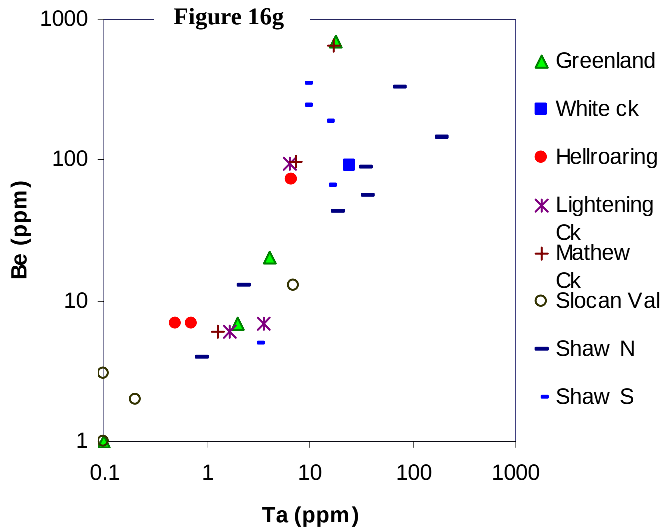


Figure 16g
Be (ppm)
1000
100
10
1
0.1
1
10
100
1000
Ta (ppm)
Greenland
White ck
Hellroaring
Lightening Ck
Mathew Ck
Slocan Val
Shaw N
Shaw S

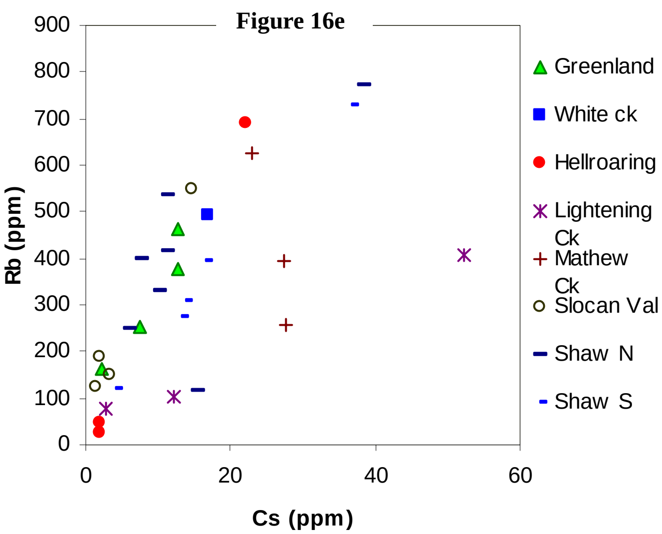


Figure 16e
Rb (ppm)
900
800
700
600
500
400
300
200
100
0
0
20
40
60
Cs (ppm)
Greenland
White ck
Hellroaring
Lightening Ck
Mathew Ck
Slocan Val
Shaw N
Shaw S

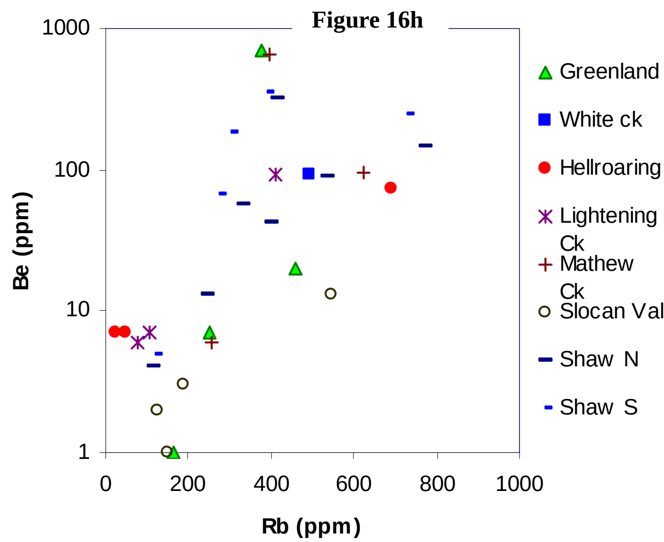


Figure 16h
Be (ppm)
1000
100
10
1
0
200
400
600
800
1000
Rb (ppm)
Greenland
White ck
Hellroaring
Lightening Ck
Mathew Ck
Slocan Val
Shaw N
Shaw S

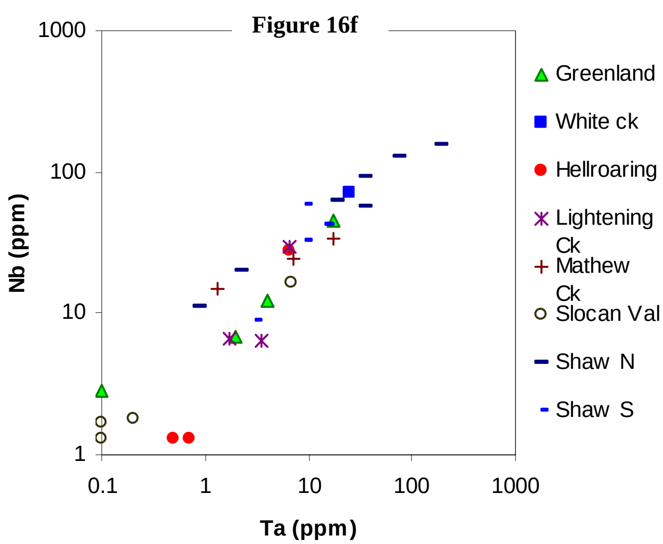


Figure 16f
Nb (ppm)
1000
100
10
1
0.1
1
10
100
1000
Ta (ppm)
Greenland
White ck
Hellroaring
Lightening Ck
Mathew Ck
Slocan Val
Shaw N
Shaw S

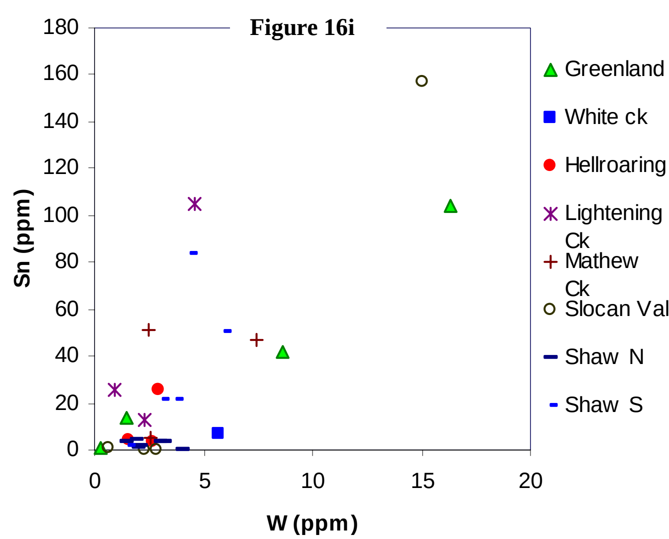


Figure 16i
Sn (ppm)
180
160
140
120
100
80
60
40
20
0
0
5
10
15
20
W (ppm)
Greenland
White ck
Hellroaring
Lightening Ck
Mathew Ck
Slocan Val
Shaw N
Shaw S

CONCLUSIONS

Granitic pegmatites are enigmatic deposits host to some of the worlds most rare and precious commodities. In comparison to base and precious metal deposits they are relatively small, with limited alteration and geochemical signatures, making them a difficult deposit type to locate and asses for economic potential.

LCT-granitic pegmatites in the Kootenay Region exhibit a consistent enrichment in Be in early and late magmatic (pegmatite) phases, as well as in pneumatolytic or greisen assemblages. Geochemical data presented here indicate that Be enrichment tends to coincide with enrichments in Ta, Nb, Rb, Cs, and K. Based on the known pegmatite occurrences in the region, it is apparent that there are two target commodity deposit types: I) gemstones in pegmatite or in the alteration halos of pegmatite bodies, and II) rare-element mineralization (e.g. Li, Be, Ta, Nb, Cs) associated with pegmatite.

Pegmatites with the best potential for both commodity types appear to share the following petrologic and mineralogical characteristics:

1. Variable textures with both fine-grained aplite and coarse-grained pegmatite phases present.
2. Extremely coarse-grained pegmatite. These tend to exhibit greater variety and abundance of exotic minerals and ultimately rare-metal contents.
3. Well developed zonation.
4. High ratio of K-feldspar to plagioclase.
5. Significant smoky quartz in the pegmatite especially when accompanied with vugs or miarolitic cavities.
6. Late generations of greisen-style alteration as veins and fracture fill. Common mineralogy includes quartz-muscovite +/-fluorite +/-tourmaline +/-scheelite +/-molybdenite, associated with vugs and rimes of fine-grained white micas and/or clays. Euhedral beryl crystals were noted within vugs of this vein type at the Blue Hammer showing, Laib Creek, and Hellroaring Creek.

The best quality aquamarine and emerald generally comes from pegmatites hosted in middle to late Cretaceous granitoid stocks or batholiths. The pegmatites tend to form as dykes or schlieren with preferred orientations within the granitoid, generally within 100 metres of the contact with neighboring country rocks. Xenoliths and/or roof pendants are generally abundant.

Beryl crystals associated with the Proterozoic pegmatites at Hellroaring, Mathew and Greenland Creek stocks, are invariably white to yellow and opaque. Gem potential appears to be low, however, accumulations of beryl can exceed several percent of the pegmatite volume. The Be mineralization is generally associated with elevated Ta and Nb contents. Considering the substantial size of the Proterozoic pegmatites, there is considerable potential for the discovery of economic reserves of rare-metal commodities.

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