Industrial Minerals

BLUE BERYL / AQUAMARINE OCCURRENCES IN THE HORSERANCH RANGE, NORTH CENTRAL BRITISH COLUMBIA (NTS 104P07, 10)

By G.J. Simandl[1], G. Payie[2] and B. Wilson[3]
[1] B.C. Geological Survey and School of Earth and Ocean Sciences at University of Victoria, Victoria, British Columbia
[2] B.C. Geological Survey, Victoria, British Columbia
[3] Alpine Gems, Kingston, Ontario

INTRODUCTION

This paper describes part of a reconnaissance study carried out on the MRX and Harvey Lake prospects in the Horseranch Range of north-central British Columbia. The main objective of this study was to test the potential of the area to host emerald or other gem-quality beryl deposits. The prospects are located about 70 and 85 kilometres southeast of Watson Lake, Yukon (Figure 1) and are accessible by helicopter.

Beryllium was first detected by the British Columbia Department of Mines in 1949, in the area called the MRX prospect and previously referred to as Cassiar Beryl (MINFILE # 104P 024). The first beryl crystals were discovered by prospector Einar Hagen in 1953; numerous beryl-bearing pegmatite blocks were found in talus by Holland (1956). The prospects now belong to Esmeralda Exploration International Inc. and were staked to cover ultramafic rocks described by Gabrielse (1963) and Plint (1991). The six pale-blue beryl occurrences in the Harvey Lake area described in this paper represent new discoveries.

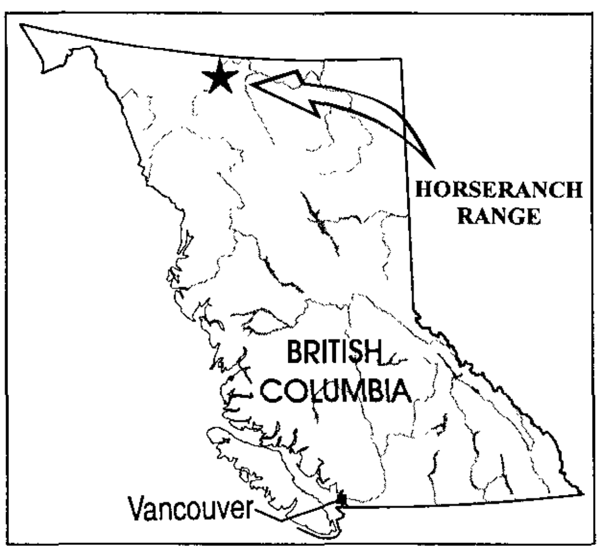

Figure 1. Location of Harvey Lake and MRX properties, Horseranch Range, north-central British Columbia.

Gem-quality beryl ($Be_3Al_{12}Si_6O_{18}$) designations according to colour are aquamarine (light blue), heliodor (yellow-green), morganite (pink), emerald (green) and red beryl (informally known as bixbite - red). Emerald is a highly-prized, grass-green coloured variety of beryl. Only red beryl from Utah is more valuable than emerald. The green colour is caused by the substitution of trace amounts of chromium and/or vanadium for aluminum, nevertheless, only chromium-coloured, gem-quality beryls are universally accepted as emeralds. In nature, the coexistence of beryllium with chromium is not common.

Emerald mineralization is known to occur in "Colombia-type" shale hosted deposits, pegmatites and "schist-hosted" ultramafic or mafic rock hosted deposits (Simandl and Hancock,1996). The Horseranch Range is worth investigating for either pegmatite- or schist-hosted emerald mineralization. In this area, ultramafic rocks (potential sources of chromium) are closely associated with granitic rocks or pegmatites (potential sources of beryllium).

GEOLOGICAL SETTING

The general geology of the Horseranch Range area (Figure 2) is described by Gabrielse (1963, 1985), Plint and Erdmer (1988, 1989) and Plint (1991) and detailed geology is given by Plint (1991). The Horseranch Range is underlain by the Proterozoic and/or Cambrian Ingenika Group, Cambrian Atan Group, Cambrian and Ordovician Kechika Group and Ordovician and Silurian Sandpile Group. The Ingenika Group consists mainly of medium to high-grade schists, quartzites, marbles and minor orthogneiss. The overlying Atan Group consists mainly of quartzite. The Kechika Group is composed mainly of chloritic phyllite and schists and the Sandpile Group of dolostones and dolomitic limestones. Foliation and synchronous early Cretaceous or younger regional metamorphism was followed by mesoscopic to macroscopic, upright folding about northwest and southeast-plunging axes that define the overall structure of the range. Rapid Eocene uplift and cooling occurred during dextral, oblique-slip mylonitization along the western margin of the Range that is believed to be related to regional mid-Cretaceous to Tertiary strike-slip motion

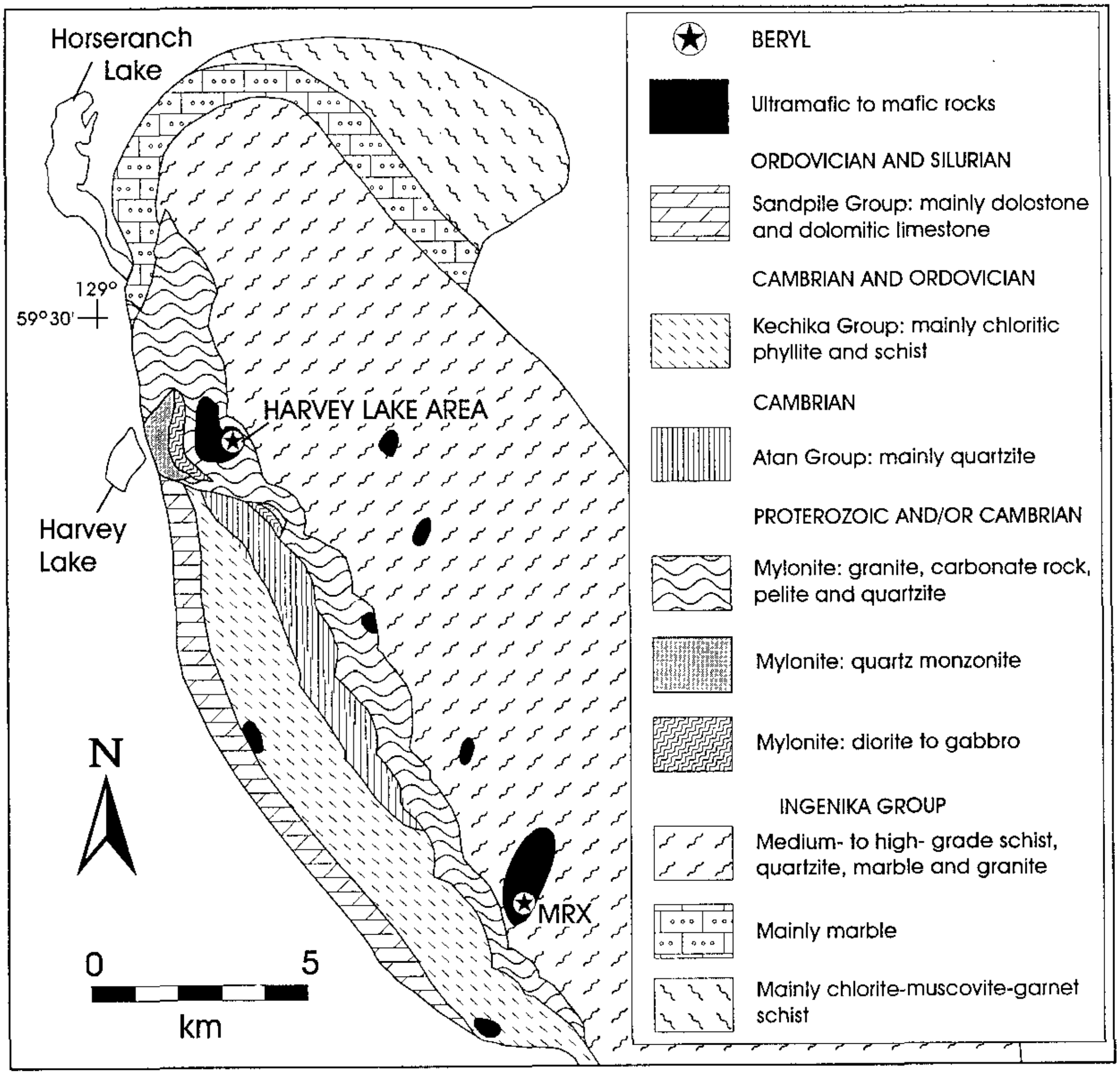

Figure 2. General geology of the northern portion of the Horseranch Range showing the MRX and Harvey Lake properties (modified from Plint, 1991).

along the nearby Kechika fault (Plint, 1991; Plint and Parish, 1994).

The igneous rocks in the Horseranch Range consist of granite dikes, pegmatites and ultramafic and mafic rocks. Granites are dated by U-Pb zircon to be mid-Cretaceous and Eocene age. These granitic dykes occur in the Ingenika Group and Eocene granite is mylonitized in the mylonite zone

Ultramafic and mafic rocks are exposed as undeformed bodies in the Ingenika and Kechika Grroup and mylonitized to undeformed bodies in the mylonite zone (Plint 1997, personal communication). They are undated but assigned an Eocene age (Plint,1991) based on their field relations with the mylonite zone. Plint(1991) reports sharp but ambiguous contacts between granite and the mafic to ultramafic rock in the MRX area. A mylonite zone, trending northwest- southeast, (Figure 2), is interpreted to be a Riedel shear or splay of the mid-Cretaceous dextral slip Ketchika fault. Radiometric and fission tracks record Eocene mylonitization and cooling (Plint, 1991; Plint and Parish, 1994). The field relationships between felsic dikes and mafic and ultramafic rocks in the Harvey Lake and MRX areas, the age of these rocks relative to mylonitization are important criteria for emerald exploration and are discussed below in light of our field observations.

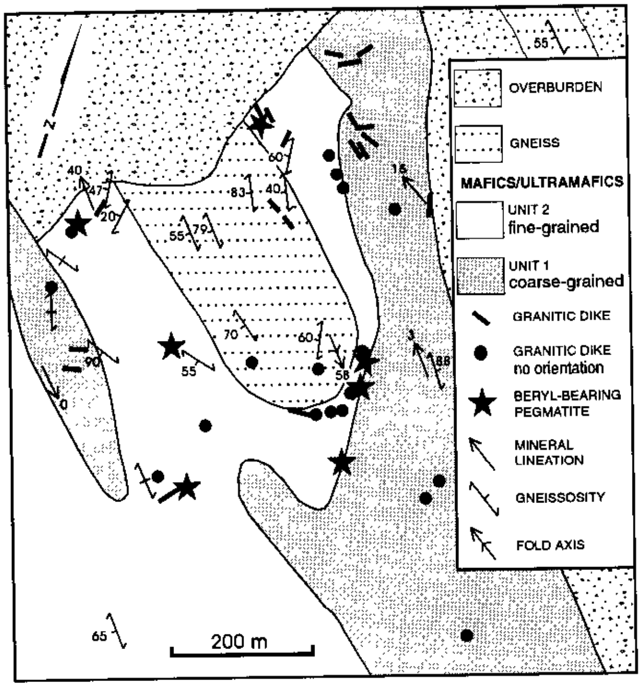

Figure 3. Geological setting of the Harvey Lake beryl showings. Note the distribution and orientation of the pegmatite and granite dikes. For location see Figure 2. For the detailed descriptions of ulramafic and mafic rocks see the text.

ULTRAMAFIC COMPLEX

The ultramafic and mafic rocks in the Harvey Lake area were briefly described by Gabrielse (1963). Additional outcrops, southeast of Harvey Lake, were discovered during regional mapping by Plint (1991, Figure 2). It is not yet clear, if these rocks are part of a larger igneous complex connected at depth, or if they are slivers of the single body, displaced by tectonic activity. Plint (1991) describes sharp contacts between the mafic rocks and surrounding lithologies. In the Harvey Lake area, the contacts are only rarely exposed. An electromagnetic geophysical survey is scheduled to be released by the Geological Survey of Canada later this year and could be useful to clarify the situation.

Based on 1997 field observations, the Harvey Lake ultramafic/mafic zone (Figure 3) is divided into two units depending on the dominant rock textures. The first unit is a coarse-grained, phenocrystalline, commonly biotite-bearing ultramafic unit with a knobby weathered appearance. The second unit is medium-grained, nearly equigranular and dominantly mafic rock. The contacts between these two units and enclosing lithologies are poorly exposed. Where a contact is exposed, both units are commonly separated from the gneissic rocks by granitic dikes or sills having locally lepidoblastic texture and foliation. No metasomatic or contact metamorphic effects were recognised in the wallrocks adjacent to the complex, however, this may be masked by the relatively high metamorphic grade of the surrounding lithologies.

The coarse-grained, porphyritic, biotite-bearing, ultramafic unit is weathered surfaces and a knobby appearance caused by resistance characterised by a dark brown or rusty colour on of phenocrysts to weathering. On a fresh surface they are dark green, nearly black or dark brown. The main constituents are clinopyroxene (possibly diopsidic), olivine, biotite/phlogopite, hornblende and orthopyroxene. Biotite, hornblende and clinopyroxene exhibit poikilitic textures and contain rounded olivine grains. Accessory minerals are plagioclase, titanite, apatite, sulphides and oxides. Locally, carbonate (<<0.5%) appears to fill microfractures. The Cr_2O_3 content of these rocks attains 0.28 weight percent, indicating that these rocks are indeed a potential source of chromium needed for emerald formation.

The lithologies of the medium-grained unit are beige, green or brown on weathered surfaces and dark green or beige on a freshly broken surface. They have subequigranular and hypidiomorphic texture and consist mainly of feldspar (10 to 60%), pyroxene (<40%), hornblende (<25%), biotite (0 to 10%) and rounded olivine crystals (0 to 25%). Reaction rims separate olivine from plagioclase. The cores of some of the plagioclase crystals are sericitized. Minor constituents are secondary chlorite after biotite and rarely serpentine after pyroxene or olivine. Oxides, sulphides, apatite and titanite generally form less than 1% of the rock.

The rocks of these two units may be classified as amphibolites, olivine mica pyroxenites, olivine pyroxene hornblendites, pyroxene hornblendites, olivine pyroxene gabbros or possibly diorites, depending on the proportions of the mafic minerals and the composition of the feldspars. The mafic and ultramafic rocks of the Harvey Lake and MRX sites, if viewed as a single complex, have similarities with Alaskan-type intrusions, as defined by Taylor (1967) and Nixon *et al.* (1997). Both the rocks of the Horseranch Range and Alaskan-type intrusions contain olivine, member of spinel group, diopsidic (?) clinopyroxene and phlogopite mica in what may be early cumulates. Hornblende, biotite, magnetite and plagioclase dominate in mesocratic units. More detailed petrology and mineral chemistry studies are in progress in order to confirm this Alaskan-type affinity, as first proposed by Plint (1991).

Pegmatites and Granitic Rocks

Dikes of granitic composition crop out throughout the MRX and Harvey Lake claim groups and were also described elsewhere within the northern half of the Horseranch Range by Plint (1991) and Gabrielse (1963). According to Plint, these dikes commonly cut the main foliation in all units and also the folds in the schist complex. They are also deformed in the mylonite zone.

The pegmatitic and granitic dikes, lenses and pods, in the study areas, are less than 3 metres thick and some of them are interpreted to extend along strike more than a hundred metres. Most of them, however, are less than 1 metre in thickness and outcrop less than 10 metres along strike. These rocks are white or cream-coloured on a fresh surface and white on weathered surfaces. They weather with a positive relief and crop out along cliff faces or form knob-like features and frost-heaved block-trains in areas with moderate relief. These granitic rocks were observed to crosscut not only schists and marbles, but also mafic/ultramafic rocks. In the MRX area, they are mostly parallel to, or cut foliation at low angle. They were described to occur over an area of 750 metres by 5 killometres (Holland, 1956). In the Harvey Lake area virtually all our work was concentrated within the ultramafic complex, where the level of rock exposure does not permit to determination of the contact orientations of many of the coarse-grained granite and pegmatite dike. The orientation of dikes (Figure 3) suggest that substantial proportion of dikes trnd discordantly to the schistosity and mylonitic foliation. Some of the dikes within mafic rocks have lepidoblastic textures and display C/S ("Cisaillement" / "Schistosité") fabric as defined by Hanmer and Passchier (1991), suggesting that mafic and ultramafic rocks of the area may be older than previously interpreted. Mafic rocks may be more competent than granitic rocks, which are preferentially mylonitized. The tectonic fabric is only rarely observed in mafic rocks. Most contacts between granitic dikes and mafic/ultramafic rocks are sharp and bear no signs of interaction, however there are two exceptions. One of the pegmatites in the MRX area is separated from the mafic host by 1 centimetre thick schistose, biotite-rich zone. An other exception occurs on the Harvey Lake claim group, where in a single outcrop, the contacts of irregular pods and lens of pegmatite rocks within the more differentiated end-members of the mafic-ultramafic suite are diffuse and gradual over 10 to 20 centimetres.

Most of the granitic rocks are relatively homogeneous and fine-grained (1 to 3 millimetres), particularly those with well developed lepidoblastic texture. Granitic and pegmatitic dikes consist mainly of alkali and perthitic feldspars, plagioclase (probably albite), quartz and pale green muscovite. The muscovite may form coarse books up to 5 centimetres in diameter within pegmatites or occur as disseminated flakes in foliated or massive, fine-grained dikes. Minor black tourmaline is widespread within the dikes. It may be microscopic to over 10 centimetres in length and the size of the crystals appears to be in some cases independent of the size of matrix-forming minerals. Large tourmaline crystals are often fractured. Fine-grained, red or brown, euhedral garnet (<2mm) appears to be widespread but not universally present throughout. Where present, it forms less than one percent of the granitic rocks. Locally, in pegmatites, individual garnets may exceed 4 millimetres in diameter. Light-coloured beryls, varying in length from a few millimetres to 7 centimetres, are described below in the section on mineralization. Zircon and apatite are present in trace amounts. Some of the dikes are zoned, in terms of mineralogy, granulometry and textures.

A sketch of a zoned, beryl-bearing dyke from the Harvey Lake area is shown in Figure 4. The central zone of the pegmatite consists of randomly oriented crystals of muscovite (<1 cm, < 1%), quartz (<2 cm, <5%), feldspar (3-4 cm, >90%), tourmaline (<15 cm, <5%), beryl (<2 cm, trace), garnet (<0.5 cm, trace). Only the coarsest tourmaline and mica books are shown at scale. The central zone is surrounded by a muscovite (<3 cm, 50%), quartz (<1 cm, 30%) feldspar (<1 cm, 20%) zone with local planar fabric, which is in turn in contact with medium-grained (2 mm) "mylonite-like" tourmaline-bearing and tourmaline-free zones. There is no readily observed planar fabric in the equigranular mafic host rock.

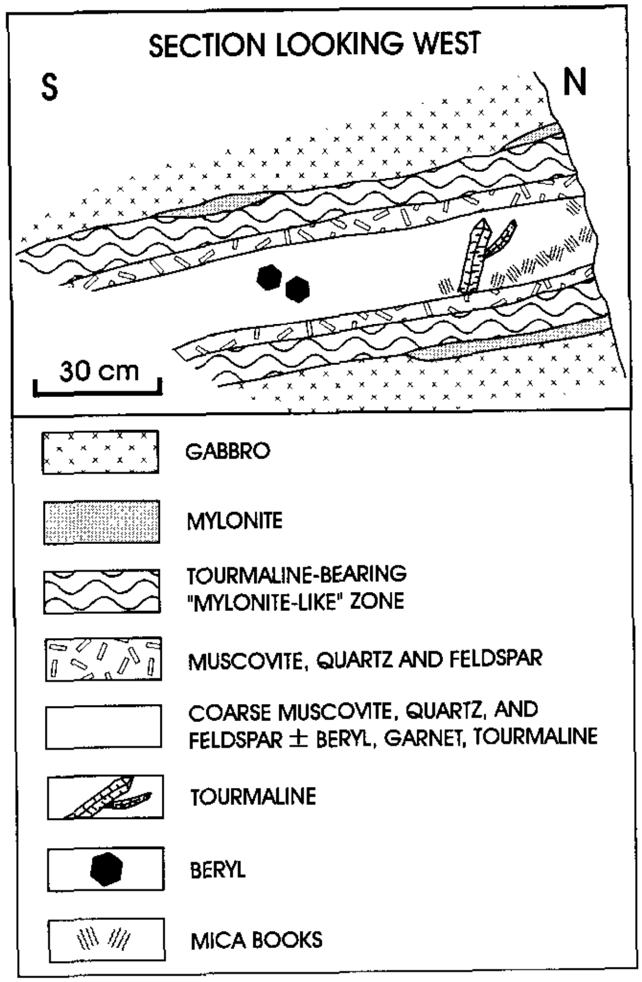

Figure 4. Sketch of a symmetrically zoned, beryl-bearing granite dike, Harvey Lake area. Vertical section looking west.

Figure 5 shows a zoned, beryl-bearing pegmatite with a quartz core from the Harvey Lake area, surrounded by a muscovite (<4 cm, 20%) feldspar (<3 cm, 80%), quartz (<8 mm, <10%) zone with traces of garnet (2-8 mm). Beryl was observed in the feldspar-quartz-muscovite zone. C/S fabric developed at the contact between coarse mica and feldspar zones.

Figures 6 shows a number of granitic dikes. The thickest dike has a pegmatitic core (pod). The pegmatite core consists mainly of quartz, feldspar and muscovite books 1 to 10 centimetres in diameter. Tourmaline (<1 cm) and garnet (<2 mm) are present in traces. Granitic dike consists mainly of feldspar (75-85%), quartz (10 -20%), muscovite (<2%) and garnet (<0.5%). One of the few beryl crystal found in an outcrop in the MRX

TABLE 1
CHEMICAL COMPOSITION OF THE GRANITIC INTRUSIVE ROCKS; MRX (MRX SERIES) AND HARVEY LAKE (GS97 SERIES) AREAS.

SAMPLE	UNITS	MRX-8G	MRX-8E	MRX-8C	GS97-25	GS97-61	GS97-63	GS97-58	GS97-55	GS97-57
SiO2	%	74.40	74.00	74.00	73.60	76.70	75.30	76.40	75.10	75.40
TiO2	%	0.01	0.01	0 02	0.01	0.02	<0.00	0.00	0 01	0.00
Al2O3	%	15.30	15.00	15.40	15.40	14.50	14.60	14.70	13.90	14.80
Fe2O3	%	0 63	1.50	0 44	0.59	0 91	0.67	1.02	0 77	0.67
MnO	%	0.09	0.51	<0 01	0.06	0 07	0.17	0.15	0 11	0.05
MgO	%	<0.01	<0.01	0.02	<0.01	0.07	0.02	0.03	0 03	<0.01
CaO	%	1 67	0.43	3.21	0.56	0.90	0.58	0.74	0.53	0.47
Na2O	%	4.39	5.04	4.85	4.06	3.82	5.93	4.61	5.24	4.60
K2O	%	3.36	3.05	1.66	5.33	2.33	2.55	1.68	3 16	3.38
P2O5	%	0.05	0.07	0.12	0.11	0.20	0.11	0.07	0 13	0.06
Cr2O3	%	0.02	0.03	0.03	0.01	0.02	0.01	<0.01	0.02	0.02
S	%	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01
LOI	%	0.35	0.50	0.35	0.50	0.85	0.30	0.75	0.35	0.60
SUM	%	100.30	100 20	100.20	100.30	100.50	100.30	100.20	99.40	100.10
Li	ppm	39.00	57 00	29.00	132.00	162.00	13.00	55.00	15.00	40.00
Be	ppm	17.00	118.00	164.00	26.00	206.00	30.00	36.00	150.00	21.00
B	ppm	<10.00	138.00	<10.00	132.00	767.00	141.00	593.00	670.00	197.00
Sc	ppm	0.50	0.70	0.50	0.60	0.90	0.50	0.70	0.50	0.80
V	ppm	<10.00	<10.00	<10 00	<10.00	<10.00	<10.00	<10.00	<10.00	<10.00
Co	ppm	<1.00	<1.00	<1.00	<1.00	<1.00	<1 00	<1.00	<1.00	<1.00
Ni	ppm	2.00	<1.00	10.00	1.00	2.00	2.00	<1.00	2.00	1.00
Cu	ppm	<0.50	<0.50	9.30	<0.50	<0.50	<0.50	<0.50	1.60	<0.50
Zn	ppm	11 80	26.70	8.50	20.90	47.60	16.90	41.40	34 50	25.60
Ge	ppm	<10.00	<10.00	<10.00	<10.00	<10.00	<10.00	<10.00	<10.00	<10.00
As	ppm	<1.00	<1.00	<1.00	<1.00	1.00	<1.00	<1.00	<1.00	<1.00
Se	ppm	<3.00	<3.00	<3.00	<3.00	<3.00	<3.00	<3.00	<3.00	<3.00
Br	ppm	3.00	2.00	3.00	3.00	3.00	3.00	3.00	2.00	2.00
Rb	ppm	273.00	364.00	105.00	403.00	383.00	294.00	290 00	361.00	454.00
Sr	ppm	119.00	10.00	286.00	35.00	41.00	66.00	42 00	18.00	14.00
Y	ppm	<2.00	<2 00	<2.00	<2.00	<2.00	<2.00	<2 00	<2.00	<2.00
Zr	ppm	35.00	47.00	23.00	17.00	11.00	30.00	28 00	20.00	21.00
Nb	ppm	17.00	19.00	17.00	19.00	111.00	12.00	44.00	16.00	30.00
Mo	ppm	<1.00	<1.00	<1.00	<1.00	<1.00	<1 00	<1.00	<1.00	<1.00
Pd	ppb	n.d.	n.d.	n.d.	n d	n.d.	n.d.	n.d.	n.d.	n.d.
Ag	ppm	<0 20	<0.20	0.20	<0.20	<0.20	<0 20	<0.20	<0.20	<0.20
Cd	ppm	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
Sn	ppm	<10.00	<10.00	<10.00	<10.00	135.00	<10.00	50.00	<10.00	58.00
Sb	ppm	<0.20	0.20	<0.20	0.30	0 80	<0.20	0.60	0 90	0.80
Cs	ppm	9.00	12.00	7.00	20.00	36 00	7.00	21.00	32.00	32.00
Ba	ppm	130.00	32 00	173.00	44.00	11.00	45.00	<2.00	9.00	18.00
Hf	ppm	3.00	3 00	2.00	1.00	1.00	2.00	1.00	2.00	1.00
Ta	ppm	6.00	4.00	27.00	8.00	52.00	1.00	17 00	9.00	9.00
W	ppm	<3 00	<3.00	<3.00	<3.00	5.00	<3.00	3 00	<3.00	<3.00
Pt	ppb	n.d.	n d	n.d.	n.d.	n.d.	n.d.	n d	n.d.	n.d.
Au	ppb	n.d.	n d	n.d.	n d.	n.d.	n.d.	n.d.	n.d.	n.d.
Pb	ppm	27.00	18.00	18.00	38.00	<2 00	20.00	8.00	23.00	18.00
Bi	ppm	<5.00	<5.00	<5.00	<5.00	14 00	<5.00	5.00	<5.00	<5.00
La	ppm	1.70	3.80	1.30	2 90	2.40	1.10	3.10	1.20	1.70
Ce	ppm	3.00	8.00	<3.00	5.00	<3.00	<3.00	6.00	<3.00	<3.00
Nd	ppm	<5.00	5.00	<5.00	<5 00	<5.00	<5 00	<5.00	<5.00	<5.00
Sm	ppm	0.50	1.30	0.40	0.60	0.30	0 40	0.40	0.30	0.30
Eu	ppm	0.30	<0.20	0.30	0.30	<0.20	<0.20	<0.20	<0.20	<0.20
Tb	ppm	<0 50	<0.50	<0 50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Yb	ppm	0.40	1.20	<0.20	0.70	0 20	0.80	0.90	0.40	0.40
Lu	ppm	0.08	0 17	<0.05	0.11	<0.05	0.12	0.12	0.06	0.07
Th	ppm	1.00	1 00	<1.00	1.00	1.00	<1.00	2.00	<1.00	1 00
U	ppm	17.50	8.90	7.80	1.20	16.30	1.30	4 70	1.20	2.50

Legend: gn = garnet, mu= muscovite, tm = tourmaline. MRX-8G - granite dike - gn >mu > tm; MRX-**8c** - pegmatite, local cataclastic texture, gn>mu> tm ; GS97--25 - Pegmatite, local cataclastic texture, mu>tm>gn, sericitization along fractures; GS97-61 - Pegmatite mu>>tm, local cataclastic texture, feldspar sericitized along fractures. GS97-63 - Mylonitized granite dyke, tm>gn>mu, GS97-55 - Granite dike - gn>tm>mu and GS97-57a - Homogenous granitic dike - tm>gn.

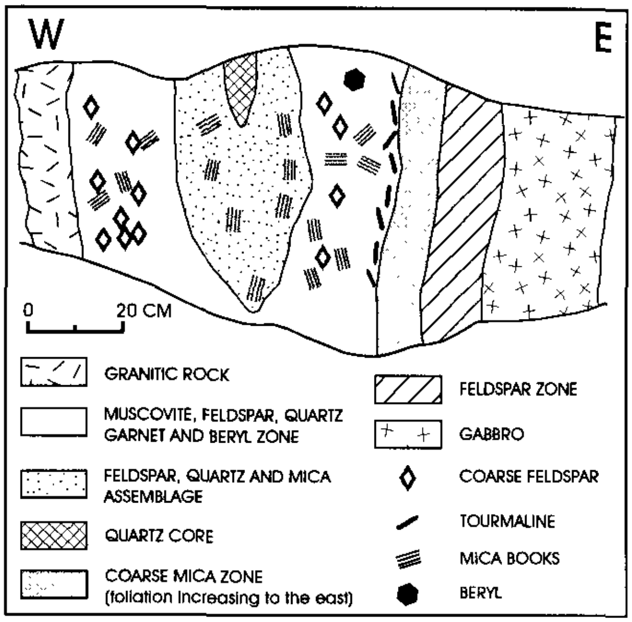

Figure 5. Sketch of a zoned, beryl-bearing pegmatite with quartz core. Vertical section looking west.

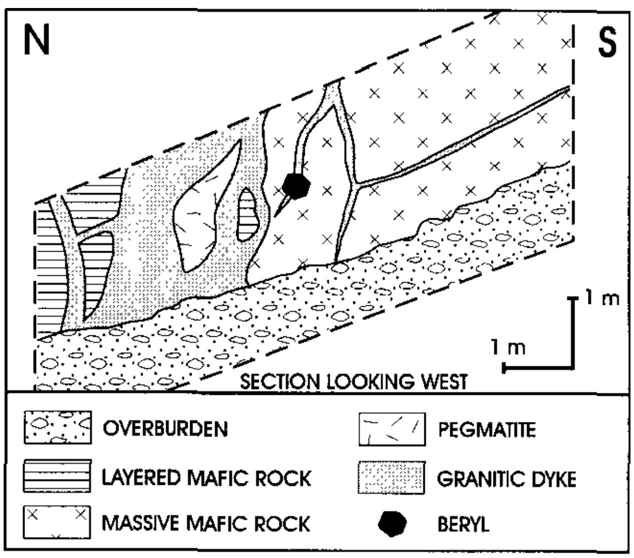

Figure 6. Granitic dike within a pegmatitic pod. One of the few in-situ aquamarine crystal found in the MRX area is within this granitic dike. Vertical section looking west.

area is in the thin granitic dikes (Figure 2). It is glassy, transparent, pale blue-green in color about 8 mm in length. It occurs within a 3 to 4 centimetre thick apophysis of a larger granite dike.

Overall, the internal structure of pegmatites in the Harvey Lake area is more complex than that of those in the MRX area. There are also more in situ beryl occurrences relative to the number of pegmatite and granite dike outcrops in the Harvey Lake area than in the MRX area. These observations suggest a possible zoning within the pegmatite field on the scale of the Horseranch Range.

Representative chemical analyses of the granitic and pegmatitic rocks are given in Table 1. Eight out of the nine dikes analyzed can be referred to as peraluminous and one as subaluminous (Figure 7).

MINERALIZATION

Most of the beryls in the MRX area, previously described by Holland (1956), were found in the coarse-grained blocks of granite dike and pegmatite in talus slopes of the Camp Creek valley that were probably derived from local dikes. Eight of such talus block occurrences and few bluish beryls were found in outcrop during our reconnaissance work in 1997, but only one aquamarine crystal was found in outcrop. This contrasts markedly with the Harvey Lake area where all beryls discovered in 1997 were in outcrops. Both in the MRX and in Harvey Lake areas, pale-blue beryl is irregularly distributed in the granitic and pegmatite lithologies. Beryl was observed in zoned pegmatites, as well as in fine- to medium-grained homogeneous granitic dikes. Beryl crystals are entirely enclosed by hostrock, except where exposed on outcrop surfaces by weathering. No beryl was observed in foliated dikes. Miarolitic cavities, such as those bearing aquamarine-beryl in the famous pegmatite province of Minas Gerais in Brazil, or those bearing emerald as described in the emerald mines of Byrud, Norway (Werner, 1995), were not observed during this reconnaissance study.

Spatial distribution of beryl-bearing granitic dikes within the Harvey Lake area is shown on Figure 3. The beryl is pale blue in colour and mostly translucent, but in several cases crystals are nearly colourless and transparent. The individual crystals vary in size from a few millimetres to several centimetres in length and were not observed to form more than 0.5% of the rock on the outcrop scale. There appears to be no relationship between the colour of the beryl and the distance from a contact with ultramafic rocks. Most of the beryl crystals are transluscent to subtransluscent and microfractured. Unlike tourmaline, the microfractures do not appear healed or filled-in. As a result, only small crystals or portions of some larger crystals can be cut as gemstone.

Figure 8 shows three cut stones from the MRX claims. The largest of these gems is 0.94carat. No extensive metasomatic zones, such as those described by Frantz *et al.* (1996) and Martin-Izard (1995, 1996) in the Franqueira alexandrite, emerald and phenakite occurrence in northwestern Spain, were observed in our study areas. This suggests little, or no element exchange between the granitic rocks and ultramafic rocks.

The chemical compositions of the pegmatites and beryl-bearing and beryl-free fine-grained dikes are *shown in Table 1. The beryllium (Be) content ranges* between 17 and 206 ppm. The latter value corresponds roughly to the minimum concentration required to form beryl in a granitic rock (0.050 weight % BeO) as described by Solodov (1971). However, the beryllium content is too low to be of interest as a source of ore for

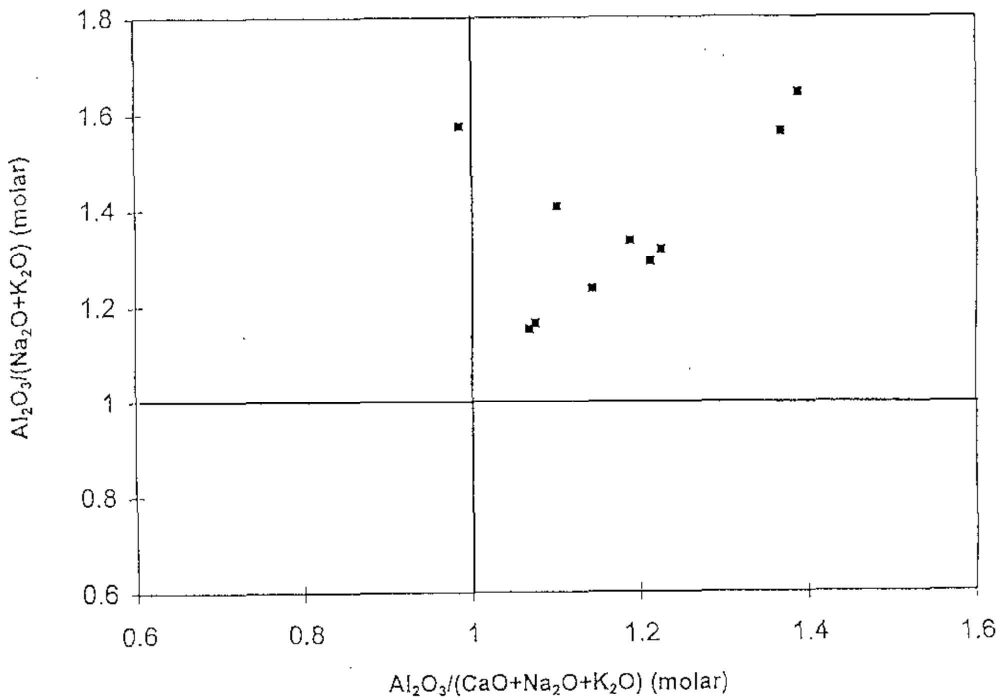

Figure 7. Shand index diagram showing granitic and pegmatitic rocks from MRX and Harvey Lake claims (modified from Maniar and Piccoli, 1980 and Cerny, 1991).

beryllium hydroxide production, which can be subsequently converted to beryllium metal alloys or oxide.

DISCUSSION

Beryl deposits can be important for gemstones or as sources of beryllium hydroxide. Emerald deposits are known to occur in pegmatites cutting relatively unaltered mafic rocks, such as the Shelby deposit in the United States where emerald-bearing pegmatite is enclosed by olivine gabbro and hornblende gabbro (Sinkankas, 1959). However, most mafic or ultramafic rock-hosted emerald deposits are of the "schist-hosted" variety, where mafic or ultramafic rocks were transformed into talc-chlorite-carbonate schists, chlorite-serpentine-biotite schists, etc. The "schist-hosted" deposits may be associated with suture zones, such as the Pakistan deposits described by Kazmi et al. (1989), and may not be spatially associated with pegmatites.

In the Horseranch Range, the cross-cutting relationships suggest that mafic and ultramafic rocks are older than most of pegmatites and granitic dikes. If both ultramafic and granitic rocks predate or are of the same age as the mylonites, then the possibility exists that suture-related, "schist-hosted" emerald deposits could be present in the area.

Both ultramafic rocks and pegmatites are curretly being dated to complement the data of Plint (1991). The geochemistry, mineral chemistry and petrology in progress will permit the classification of the pegmatites and confirm or reject the hypothesis that the Horseranch ultramafic/mafic rocks belong to an Alaskan-type complex. Such complexes are known to be favourable hosts for platinum group element mineralization and are a source of PGE placers (Nixon *et al., 1997*).

SUMMARY

Several granitic dikes and pegmatites with low concentrations of pale blue beryl were discovered in the Harvey Lake and MRX claim area. The number of the beryl-bearing dikes is encouraging. Some of the small crystals are transparent and relatively fracture free. Portions of some of the large crystals could be judged near gem-quality beryl or aquamarine. No accompanying emerald mineralization was discovered. However, the properties were not adequately covered by mapping and prospecting to establish their gem beryl potential.. Beryl-bearing pegmatites are not restricted to ultramafic and mafic hosts and more pale blue beryl and aquamarine-bearing pegmatites will probably be discovered in the area. The uniformity in color of the beryl throughout the area suggests that it is less likely that emerald mineralization will be encountered in pegmatites. On the other hand, if the felsic dikes and the ultramafic complex are pre- or syn- mylonitic, then there is a possibility that "suture-related" emerald mineralization will be encountered. There is also a

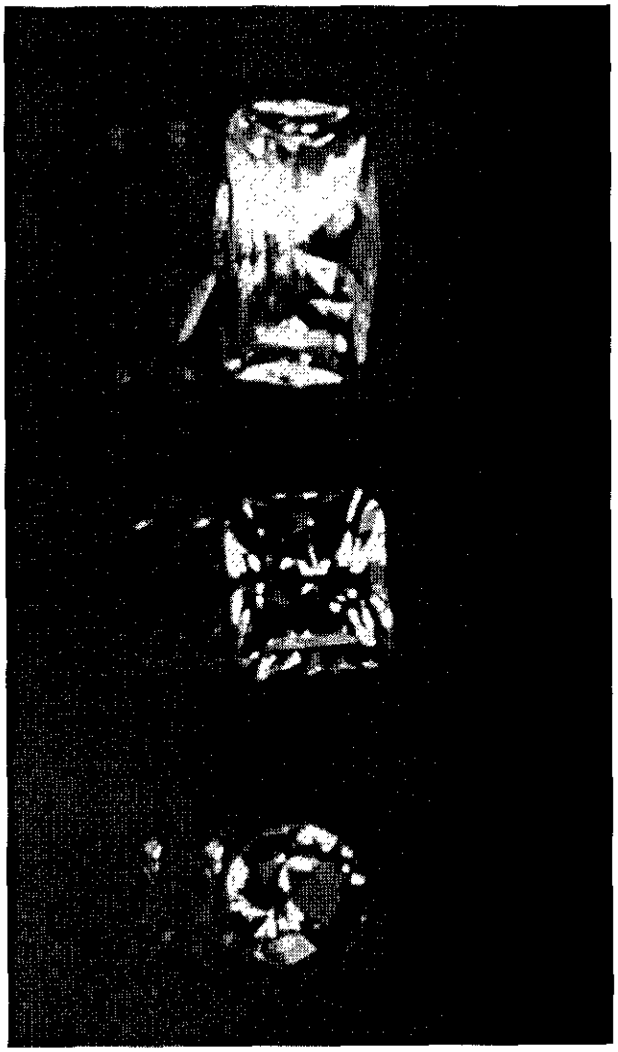

Figure 8. Cut, pale blue beryl gems, from MRX claims cut by B. Wilson. Courtesy of the Esmeralda Exploration International Inc. The largest stone weights 0.94 carat.

geological potential to discover larger beryl-bearing pegmatites that could be looked upon as potential sources of beryllium. The beryllium grades of the 9 samples that were analysed are not economic, and the visually estimated beryllium grades of pegmatites encountered to date also indicate subeconomic grades.

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