

Location/Identification

MINFILE Number:	082ESW030	National Mineral Inventory Number:	082E6 Ag1
Name(s):	BEAVERDELL BEAVERDELL MINE, HIGHLAND-BELL, BELL (L.2343), HIGHLAND LASS (L.2341), TECH, LASS		
Status:	Past Producer	Mining Division:	Greenwood
Mining Method	Underground	Electoral District:	West Kootenay-Boundary
Regions:	British Columbia	Resource District:	Arrow Boundary Forest District
BCGS Map:	082E045		
NTS Map:	082E06E	UTM Zone:	11 (NAD 83)
Latitude:	49 25 56 N	Northing:	5477551
Longitude:	119 03 40 W	Easting:	350560
Elevation:	1524 metres		
Location Accuracy:	Within 500M		
Comments:	The Beaverdell is located 1.9 kilometres east of the town of Beaverdell. The location given is the centre of the Bell Crown Grant Lot 2343. The underground workings (2900 level) plot near the centre of Crown Grant Lot 3960s when they are projected to surface.		

Mineral Occurrence

Commodities: Silver, Lead, Zinc, Gold, Cadmium, Copper

Minerals

Significant:	Galena, Sphalerite, Pyrite, Tetrahedrite, Pyrargyrite, Chalcopyrite, Polybasite, Acanthite, Silver, Arsenopyrite, Pyrrhotite		
Associated:	Quartz, Calcite, Fluorite		
Alteration:	Chlorite, Clay, Calcite		
Alteration Type:	Propylitic, Argillic		
Mineralization Age:	Eocene		
Isotopic Age:	50 Ma	Dating Method:	Lead/Lead
		Material Dated:	Galena
Deposit	Character:	Vein, Shear	
	Classification:	Hydrothermal, Epigenetic	
	Type:	I05: Polymetallic veins Ag-Pb-Zn+/-Au	
	Shape:	Bladed	Modifier: Faulted
	Dimension:	150x1x0 metres	Strike/Dip: 045/50S
Comments:	Ore shoots up to 150 metres long were intersected. The Bell vein averages 0.9 metre and the Lass vein averages 1.5 metres width. Age date: Canadian Journal of Earth Sciences, Vol. 19, No. 6, p. 1276.		

Host Rock

Dominant Host Rock: Plutonic

Stratigraphic Age	Group	Formation	Igneous/Metamorphic/Other
Permian	Anarchist	Wallace	-----
Jurassic	-----	-----	Westkettle Batholith
Eocene	-----	-----	Unnamed/Unknown Informal
Isotopic Age		Dating Method	Material Dated
-----		-----	-----
-----		-----	-
50.6 +/- 1.5 Ma		Potassium/Argon	Whole rock

Lithology: Granodiorite, Quartz Latite Dike, Andesitic Tuff, Andesitic Lava, Hornblende Diorite Porphyry, Olivine Gabbro, Hornblendite

Comments: A quartz latite (Idaho-type) dike has been dated as Eocene age (Canadian Journal of Earth Sciences, Vol. 19, No. 6, page 1267).

Geological Setting

Tectonic Belt:	Omineca	Physiographic Area:	Okanagan Highland
Terrane:	Plutonic Rocks, Harper Ranch		
Metamorphic Type:	Regional	Relationship:	Pre-mineralization
Grade:	Greenschist		

Inventory

No inventory data

Summary Production

		Metric		Imperial	
	Mined:	1,198,829	tonnes	1,321,482	tons
	Milled:	1,170,226	tonnes	1,289,953	tons
Recovery	Silver	1,076,005,759	grams	34,594,388	ounces
	Gold	520,197	grams	16,725	ounces
	Zinc	13,900,078	kilograms	30,644,426	pounds
	Lead	11,598,238	kilograms	25,569,738	pounds
	Cadmium	58,171	kilograms	128,245	pounds
	Copper	11,657	kilograms	25,699	pounds

Capsule Geology

The former Beaverdell mine on the Bell (Lot 2343) Crown grant, is located 1.25 kilometres northwest of the summit of Mount Wallace and 3.00 kilometres east of Beaverdell, British Columbia (Assessment Report 15704).

Initial prospecting began in the Beaverdell area in the late 1880s. The first ore was shipped in 1896. The major producing mines in the Beaverdell silver-lead-zinc vein camp, from west to east, were the Wellington (082ESW072), Sally and Rob Roy (082ESW073), Beaver (082ESW040), and Beaverdell (082ESW030), with numerous other small workings throughout the area. Production commenced on the Highland Lass in 1922. In 1930, R.B. Staples and associates obtained control of the Bell and Highland Lass, however production was recorded separately until the purchase was complete in 1936. Production continued under the amalgamated Highland-Bell mine owned by Highland-Bell Ltd. Highland-Bell Ltd. was purchased by Leitch Gold Mines Ltd. in 1946 but operations continued as the Highland-Bell mine. In 1953, a down-faulted section of the Lass vein system was found 229 metres vertically lower and developed by a 1600-metre adit. Teck Corp. assumed control of the mine in 1970. In 1986 and 1987, property exploration by Teck Corp. located an eastward ore extension with increased gold content on the lower (2900) level. This included an ore block containing 5442 tonnes grading 1371 grams per tonne silver (Assessment Report 15790). Production ceased in 1991.

Granodiorite of the Westkettle batholith underlies most of the area. It has been intruded by small quartz monzonite porphyry stocks including the Beaverdell, Tuzo Creek, Eugene Creek and Carmi stocks. Other granitic porphyry stocks that intrude the Westkettle batholith are the Beaverdell porphyry. These have been dated by potassium-argon methods as Eocene (Watson, P.H. (1981): Genesis and zoning of silver-gold veins in the Beaverdell area, south-central British Columbia; Leary, G.M. (1970): Petrology and structure of the Tuzo Creek molybdenite prospect near Penticton, British Columbia and Exploration in British Columbia 1995, pages 124-126. The Westkettle batholith has been correlated with the Nelson intrusions that has been dated by potassium-argon and uranium-lead methods as Middle Jurassic. The Westkettle batholith contains remnants of pendants and/or screens of metamorphosed Wallace Formation. The Wallace Formation is believed to be correlative with the upper sections of the Carboniferous to Permian Anarchist Group. Lithologies include metamorphosed andesitic tuffs and lavas, hornblende diorite porphyries, olivine gabbro and hornblendite, hornfels and minor limestone. The contact between the Wallace Formation and the Westkettle batholith is sinuous, trending north with gentle east dips. These are unconformably overlain by Oligocene tuffs and conglomerates and Miocene plateau basalts. Westkettle granodiorite or Beaverdell quartz monzonite are the dominant hostrocks. Mineralization rarely extends into the Wallace Formation to the east.

A series of dikes, ranging in composition from quartz latite and quartz monzonite porphyries to hornblende andesite porphyries, are found throughout the area. In the Beaverdell camp, fine-grained, brown andesite dikes, referred to as Wellington-type dikes, are believed to be pre-mineralization. One of these was dated by potassium-argon methods at 61.6 +/- 2.2 Ma (Watson, P.H., 1981). Quartz latite dikes are referred to as Idaho-type dikes and thought to be syn or post-mineralization. One of these has given a potassium-argon age of 50.6 +/- 1.5 Ma (Watson, P.H., 1981).

Beaverdell silver-rich veins are found in a 3.0 by 0.8 kilometre belt, referred to as the Beaverdell silver-lead-zinc vein camp. Five distinctly separate quartz vein systems are arranged roughly en echelon in this structural zone. The west-half contains the Wellington (Lot 2621), Sally (082ESW075,

Lot 2092) and Rob Roy (Lot 2093, also part of Sally) systems which all strike east and dip from 70 degrees south to vertical. The Wellington and Sally each comprise two separate veins and the Rob Roy three. In the central part of the zone, the Bell (082ESW030, Lot 2343) comprises two veins which strike east to northeast and dip south to southeast. The eastern part of the zone contains the upper and lower sections of the Lass (082ESW133) and Highland Lass (Lot 2341, also part of the Bell) vein which strikes northeast and dips 50 degrees southeast.

In general, quartz breccia veins and stockworks are so complex that continuous mineralized sections are a maximum of a few metres before being faulted or disrupted. Nevertheless, some mineralized zones have been found that extend up to 150 metres horizontally. Faults have been classified into five types based on their orientation, with each type having common orientation, kind of movement and age relationship: (1) high angle, north striking normal faults, (2) low angle, north trending strike-slip faults, (3) northeast-striking, high angle normal faults (terminal faults), (4) northeast-trending 'slice' faults and (5) crossfaults. The northeast-striking, high angle normal faults pose the greatest obstacle to systematic exploration and mining, as these faults are commonly spaced a few metres apart dividing veins into short segments in a northwest-downward direction.

Vein-type mineralization of the Beavertell camp is characterized by a high silver content. Mineralization is composed of galena, sphalerite and pyrite with lesser amounts of arsenopyrite, tetrahedrite, pyrrhotite, chalcopyrite, polybasite, acanthite, native silver and pyrrhotite. The gangue minerals in veins are mainly quartz with lesser amounts of calcite, fluorite and sericite with rare barite. 'Ore ground' has been described as propylitic altered granodiorite, quartz diorite and quartz monzonite of the Westkettle batholith, up to 15 metres wide. These zones are characterized by sericite, clay minerals, chlorite, calcite, epidote and hematite. The fault-bounded veins commonly have a banded texture defined by outer, crudely parallel sulphide stringers. The wallrocks are brecciated and sheared over 30 to 150 centimetres width adjacent to veins. Weak sericite alteration of feldspars is pervasive in the Westkettle batholith.

The interpretation of galena lead-lead isotope age data coupled with geometrical and age relationships between dikes and veins suggests mineralization was formed around 50 Ma, coeval with Eocene stocks (Canadian Journal of Earth Sciences, Vol. 19, No. 6, pages 1264-1274, 1982).

The Beavertell mine is composed of the Highland Lass (Lot 2341) past producer (082ESW133) and Bell (Lot 2343) where the Upper and Lower Lass vein system were mined and which have accounted for the majority of production. Most of the veins are hosted in granodiorite of the Westkettle batholith. Some mineralization locally extends for short distances into Wallace Formation rocks which overlie the batholith at the eastern end of the mine area, although the mineralized structures tend to horsetail and disperse.

The mineralized quartz veins occupy fissures along east-trending faults in the western part of the mine area and along northeast-trending faults in the eastern portion of the system (part of Bell, Upper Lass, Lower Lass). Towards the east the veins generally exhibit progressive increases in width, and intensity and extent of wallrock alteration. Propylitic alteration is found in the wallrock up to 8 metres from the veins. Thin section studies show amphiboles almost entirely converted to chlorite and feldspars replaced by clay and calcite. The Bell and Lass veins average 0.9 and 1.5 metres wide respectively, but are rarely continuous for more than 5 to 10 metres without offset.

A series of widely spaced, north to northeast striking, southeast-dipping faults divide the mineralized system into large blocks, often with up to 100 metres of vertical displacement between them. The West Terminal fault separates the Bell and Upper Lass veins and the East Terminal fault separates the Upper and Lower Lass vein. The East Terminal fault has displaced downwards the eastern-half of the Lass vein (Lower Lass) by 213 metres. The veins are chopped into small segments by northeast striking, closely spaced normal faults which flatten the dip to the northwest and generally show less than a metre displacement.

Major metallic minerals in the quartz veins are galena, native silver and pyrrhotite. The gangue material is mainly quartz with some altered wallrock fragments included in the vein and small concentrations of calcite and occasional fluorite. Some supergene silver mineralization is present, chiefly as native silver wires and plates. Native silver is especially abundant close to fault intersections. However, most of the mineralization is of hypogene origin.

Two zones of distinctive mineralization are recognized in the Lass vein system. The boundary between these two zones trends north and lies within the Lower Lass, about 120 metres east of the East Terminal fault. In contrast to the lower eastern part (Lower Lass), the upper western portion (Upper Lass) of the vein system is characterized by high silver and moderate zinc and lead values, more gangue, and thinner veins within multiple vein and stringer zones. The lower east end of the Lower Lass however, contains high gold, moderate to high zinc and lead values and low silver values. Silver associates with galena, sphalerite and antimony sulphosalts and gold associates with pyrite and chalcopyrite.

Reserve figures are not computed at the Beavertell mine due to the extensively faulted vein, but in 1989 approximately 3400 tonnes of ore was milled per month.

The Beavertell mine was the longest producing mine in the area; almost continuously between 1913 and 1991. Over this period, 1,198,829 tonnes of ore were mined from which 1,076,005,759 grams of silver, 520,197 grams of gold, 11,598,238 kilograms of lead, 13,900,078 kilograms of zinc and 58,171 kilograms of cadmium were recovered.

Bibliography

EMPR AR 1901-1058; 1902-H182,H303; 1903-H247; 1906-H253; 1913-K156;

1916-K255,K517; 1917-F204,F212,F449; 1918-K210,K220; 1919-N168,
N174; 1920-N155; 1921-G185,G188; 1922-N172; 1923-A184,A301; 1924-
B19,B168; 1925-A47,A202-A206; 1926-A12,A206-A208,A210; 1927-C11,
C232,C233; 1928-C11,C252-C254; 1929-C12,C260-C262; 1930-A11,A219;
1931-A11,A123; 1932-A12,A125,A126; 1933-A14,A153; 1934-A7,D9,D10,
A25,A29; 1935-A7,A25,A30,D14,G52; 1936-A34,D56; 1937-A29,A31,A36,
A41,D34; 1938-A27,A29,A34,D39,D40; 1939-A29,A42,A93,A94; 1940-A24,
A78,A79; 1941-A19,A25,A73,A74; 1942-A21,A23,A26,A70,A71;
1943-A38,A40,A45,A70; 1944-A68; 1945-A94,A95; 1946-A35,A133; 1947-
A153,A275; 1948-A125; *1949-A138-A143,A145-A148; 1950-A116,A117,
A291; 1951-A41,A132,A133,A308,A309; 1952-A41,A138,A139,A331; 1953-
A43,A108,A215,A270; 1954-A12,A48,A78,A118,A203,A258; 1955-A47,44,
45,172; 1956-A48,74,182; 1957-A44,3,37,38,151; 1958-A44,35; 1959-
A46,57; 1960-A53,62,63; 1961-A47,63,278; 1962-A48,67,283; 1963-A47,
67,68,270; 1964-A53,109; 1965-A53,166; 1966-191; 1967-A52,223,224;
1968-A52,224; 1969-A53; 1970-A52; 1971-A52; 1972-A52; 1973-A52;
1974-A119; 1975-A93; 1976-A102; 1977-114; 1978-126; 1979-127

EMPR INDEX 3-189,199; 4-122

EMPR ASS RPT 18, *15704, 15790, 16771

EMPR BC METAL MM00002

EMPR GEM 1969-301; 1970-409; 1971-385; 1972-42,43; 1973-22,48;
1974-24,57,58

EMPR GEOLOGY 1975-G30-G33

EMPR ENG INSP (Mine Plans); Annual Report 1989; 1990

EMPR MAP 65 (1989)

EMPR MINING 1975-1980, Vol.I, p. 8; 1981-1985, pp. 6,33; 1986-1987,
pp. 49-50; 1988, Vol. 1, pp. 46

EMPR FIELDWORK 1975, pp. 27-29; 1976, p. 15; *1982, pp. 227-249;
1988, pp. 360, 361

EMPR INF CIRC 1984-1, p. 25; 1985-1, p. 42; 1986-1, p. 47; 1987-1,
p. 30; 1988-1, p. 68; 1989-1, p. 30; 1990-1, p. 46; 1991-1, p. 58

EMPR IR 1984-2, pp. 99-100; 1984-3, pp. 105-106; 1984-5, pp. 113-114;
1986-1, pp. 109-110

EMPR OF 1989-5; 1992-1; 1998-10

EMPR MIN STATS 1985, p. 48; 1987, pp. 35,37,65-66; 1990, pp. 25,29,
32,68-70

EMPR PF (Christopher, P.A. (undated): Highland Bell Mine (Beaverdell mine); Report on Beaverdell Mine; Highland Bell - Uranium Specimens;
Verzosa, R.S. (1972): Surface Geology Map of Beaverdell; Verzosa, R.S. (1972): Geology and History of the Highland Bell Mine; Unknown
(1973): Highland Bell Production to 1972; Goetting, B. (1974-03-29): RE: Beaverdell Mine; Smith, D. (1975): Notes on the Highland Bell Mine)

EMR MP RESFILE (Highland-Bell Mine Res.)

EMR MIN BULL MR 166

EMR MP CORPFILE (Highland-Bell Mines Ltd.; Highland Lass Ltd.;
Mastadon-Highland Bell Mines Ltd.; Leitch Mines Ltd.; Beaver
Silver Mines Ltd.; Sally Mines Ltd.; Teck Corp.)

GSC EC GEOL 1928, Vol. 23, pp. 434-441

GSC MAP 538A; 539A; 37-21; 15-1961; 1736A

GSC MEM *79, pp. 89,92,120-122

GSC OF 481; 637; 1505A; 1565; 1969

GSC P 37-21

CANMET IR 1947-2268; 1950-MC2640; 1951-MD2748; 1968-68-72)

CIM *Volume II, 1957: Structural Geology of Canadian Ore Deposits,
pp. 136-141

CJES Vol. 19, No. 6, pp. 1264-1274, 1982; Vol.23 (1986)

GCNL #233(Oct.24), 1969; #51(Mar.14), 1989; #206(Oct.24), 1990

MIN REV Nov/Dec 1981, pp. 23,24; May/June 1989, p. 27;

N MINER Oct.20, 1983; Oct.29, 1990

W MINER 1946, Vol. 19, May, pp. 38-43, Jun., pp. 54-58; 1948, Vol. 21,
Dec., pp. 158,159

*Watson, P.H. (1981): Genesis and Zoning of Silver-Gold Veins in the
Beaverdell Area, South-central British Columbia, M.Sc. Thesis,
University of British Columbia, 156 pp.
CMH 1988-89, p. 434; 1989-90, pp. 437,438
FIN POST Survey of Mines 1975, pp. 150,151
N MINER MAG May 1987, p. 56

EMPR PFD 900075, 1534, 1540, 1536, 1537, 1538, 1539, 1541, 1542, 1543, 903011, 903036, 903422, 904083, 904991, 751995, 751996,
751997, 752948, 752949, 880567, 880568, 880569, 880570, 880571, 880572, 880573, 880574, 880575, 826344, 600101, 600102, 600103,
600104, 600105, 600107, 600108, 600109, 600110, 600111, 600112, 600113, 600114, 600116, 600126, 600106, 600127, 600583, 801990,
802665, 672550, 672569, 672571, 672572, 672573, 672574, 672578, 672579, 672580, 672582, 672583, 672587, 672590, 672593, 672594,
672599, 673682

Date Coded:	1985/07/24	Coded By:	BC Geological Survey (BCGS)	Field Check:	N
Date Revised:	2008/02/21	Revised By:	Karl A. Flower (KAF)	Field Check:	N