



MINFILE Detail Report
BC Geological Survey
Ministry of Energy, Mines and Petroleum Resources

Location/Identification

MINFILE Number:	104B 021	National Mineral Inventory Number:	104B1 Cu1
Name(s):	GRANDUC LEDUC, VAUGHN K., JK		
Status:	Past Producer	Mining Division:	Skeena
Mining Method	Underground	Electoral District:	Stikine
Regions:	British Columbia	Resource District:	Skeena Stikine Natural Resource District
BCGS Map:	104B029		
NTS Map:	104B01W	UTM Zone:	09 (NAD 83)
Latitude:	56 12 40 N	Northings:	6230390
Longitude:	130 20 42 W	Easting:	416576
Elevation:	975 metres		
Location Accuracy:	Within 500M		
Comments:	The mine is on the east side and near the head of Leduc Glacier on Lots 6566 and 6567.		

Mineral Occurrence

Commodities:	Copper, Silver, Gold, Lead, Zinc, Cobalt, Magnetite		
Minerals	Significant:	Pyrite, Chalcopyrite, Pyrrhotite, Magnetite, Sphalerite, Galena, Arsenopyrite, Bornite, Cobaltite	
	Associated:	Quartz, Calcite, Magnetite, Apatite	
	Alteration:	Epidote, Calcite, Tourmaline, Sericite, Graphite	
	Alteration Type:	Epidote, Carbonate, Sericitic	
	Mineralization Age:	Triassic	
	Dating Method:	Lead/Lead	Material Dated: Galena
Deposit	Character:	Massive, Stratiform, Vein	
	Classification:	Volcanogenic, Syngenetic	
	Type:	G04: Besshi massive sulphide Cu-Zn	
	Shape:	Tabular	Modifier: Folded, Sheared
	Dimension:	1200x760x240 metres	
	Comments:	Granduc deposit comprising several orebodies.	

Host Rock

Dominant Host Rock:	Metasedimentary		
Stratigraphic Age	Group	Formation	Igneous/Metamorphic/Other
Jurassic	Hazelton	Unuk River	-----
Tertiary	-----	-----	Hyder Pluton
Isotopic Age	Dating Method		Material Dated
210 +/- 24-14 Ma	-----		210 +/- 24-14 Ma
-----	-----		-
Lithology:	Quartz Biotite Schist, Quartz Sericite Schist, Quartzite, Meta Chert, Biotite Epidote Actinolite Schist, Andesitic Tuff, Argillite, Siltstone, Iron Formation		
Comments:	Age date from Paper 1988-4; Alldrick et.al. 1990.		

Geological Setting

Tectonic Belt:	Intermontane	Physiographic Area:	Boundary Ranges
Terrane:	Stikine		
Metamorphic Type:	Regional		

Grade: Amphibolite

Inventory

Ore Zone: GRANDUC **Year:** 2013
Category: Combined **Report On:** Y
Quantity: 11,320,000 tonnes **NI 43-101:** Y

Commodity	Grade
Silver	12.4 grams per tonne
Gold	0.17 grams per tonne
Copper	1.47 per cent

Comments: updated resource estimate for the Granduc Main zone was reported, using a 0.8 per cent copper equivalent cut-off

Reference: Morrison, R., McKinnon, C. (2013-02-28): Preliminary Economic Assessment of the Granduc Copper Project

Ore Zone: GRANDUC **Year:** 2013
Category: Inferred **Report On:** Y
Quantity: 30,520,000 tonnes **NI 43-101:** Y

Commodity	Grade
Silver	13.3 grams per tonne
Gold	0.17 grams per tonne
Copper	1.40 per cent

Comments: updated resource estimate for the Granduc Main zone was reported, using a 0.8 per cent copper equivalent cut-off

Reference: Morrison, R., McKinnon, C. (2013-02-28): Preliminary Economic Assessment of the Granduc Copper Project

Ore Zone: GRANDUC **Year:** 2013
Category: Inferred **Report On:** Y
Quantity: 37,100,000 tonnes **NI 43-101:** Y

Commodity	Grade
Magnetite	13.3 per cent

Comments: an inferred magnetite resource using a 2.8 per cent magnetite cur-off

Reference: Morrison, R., McKinnon, C. (2013-02-28): Preliminary Economic Assessment of the Granduc Copper Project

Ore Zone: GRANDUC **Year:** 2012
Category: Indicated **Report On:** Y
Quantity: 10,400,000 tonnes **NI 43-101:** Y

Commodity	Grade
Silver	10.6 grams per tonne
Gold	0.14 grams per tonne
Copper	1.25 per cent

Comments: Estimates were based on a 40 Canadian dollar NSR cut-off.

Reference: Assessment Report 35977.

Ore Zone: GRANDUC **Year:** 2012

Category: Inferred
Quantity: 36,600,000 tonnes

Report On: Y
NI 43-101: Y

Commodity	Grade
Silver	9.7 grams per tonne
Gold	0.13 grams per tonne
Copper	1.26 per cent

Comments: Estimates were based on a 40 Canadian dollar NSR cut-off.
Reference: Assessment Report 35977.

Ore Zone: GRANDUC
Category: Indicated
Quantity: 9,890,000 tonnes

Year: 1969-B
Report On: Y
NI 43-101: N

Commodity	Grade
Copper	1.7900 per cent

Comments:
Reference: Open File 1992-1.

Ore Zone: GRANDUC
Category: Indicated
Quantity: 39,316,435 tonnes

Year: 1969-A
Report On: Y
NI 43-101: N

Commodity	Grade
Copper	1.7300 per cent

Comments: Ore reserves before production began in 1971. The reserve does not take into account the total production to 1984 of 15.2 million tonnes of ore.
Reference: Granduc Mines Ltd. Annual Report 1969.

Capsule Geology

The Granduc property straddles the northerly trending South Unuk Shear Zone separating the upper greenschist to amphibolite facies metasedimentary and volcanic rocks of the Upper Triassic Stuhini Group from the lower greenschist grade metavolcanic and sedimentary rocks of the Hazelton Group. Large pre-tectonic to syn-deformational elongate plutons and dikes of the Triassic John Peakes plutonic suite, including the Bucke Stock exposed north of the Granduc Mine, composed of hornblende diorite, monzonite, gabbro and syenite, intrude the Stuhini Group metasedimentary and metavolcanic rocks.

The Granduc ore deposit comprises a series of concordant massive sulphide lenses, localized within a complex sequence of volcanic-sedimentary rocks that have been deformed by cataclasis.

The volcanic rocks east of the Granduc orebodies are pillow lavas intercalated with graphitic siltstones, thin bedded lithic and crystal tuffs and volcanic sandstones. This sequence is overlain by the ore zone, graphitic siltstones, silty argillites, thin bedded lenticular gypsum-bearing limestones and quartz pebble and quartz cobble conglomerate lenses. These rocks underwent several periods of later deformation, intrusion, alteration, faulting and erosion, culminating in Tertiary time with Hyder plutonism. The ore deposit lies along part of the deformed, overturned west limb of a north trending anticlinal fold. The less deformed rocks to the east of the ore deposit include a complex volcanic-sedimentary sequence, which is considered to be part of the Lower-Middle Jurassic Hazelton Group.

Recrystallization of the rocks in the ore horizon has converted the fine-grained laminated rocks to compositionally banded, brown to pale grey quartz-rich biotite and sericite schists, quartzites and metacherts. Feldspathic and andesitic tuffs are converted to massive, or banded biotite, and biotite-epidote-actinolite schists. Massive rocks are more common in the lower half of the ore horizon. The upper part of the orebody occurs in the finely laminated quartz-rich brown biotite schists which are derived from silty argillites.

Several steep north trending faults cut the orebodies. The Western and Granduc graphitic fault zones are west of the ore zone. Several of the orebodies

have been offset by apparent right-hand strike-slip movement.

The several ore zones, which make up the Granduc deposit, comprise pancake-like, overlapping, and commonly merging lenses, which extends vertically for 760 metres, laterally for 1200 metres and over a 120 to 240 metre lenticular width. The orebodies, designated as A to F, consist mainly of pyrite, chalcopyrite, pyrrhotite, magnetite, sphalerite, galena, arsenopyrite, bornite and cobaltite. Gangue includes blocks of brecciated country rock, quartz as lenses, stringers and blebs, recrystallized coarse-grained calcite as lenses and stringers, and apatite. Minor alteration minerals consist of calc-silicate lenses and tourmaline.

Individual ore zones, which are up to a few tens of metres thick and extend laterally up to hundreds of metres, consist of massive lenses, irregular streaks and blebs, and veinlets of sulphide. Repeated deformation of the massive sulphide lenses resulted in an irregular and feathery nature to the orebodies, which have been called stringer lodes. The magnetite-apatite-calcite assemblage occurs as thinly banded layers intercalated with calc-silicate, limestone bands up to 6 metres thick, graphitic quartzofeldspathic beds and the massive sulphide lenses.

By 2006 the copper deposit was considered part of a sulphide facies banded iron formation occurring near the top of the Hazelton Group at the stratigraphic contact between mafic pillow lava and tuff with overlying sedimentary rocks that include chert, argillite and tuff (Fieldwork 2006). The 2006 program extended the mineral horizon 770 metres with four holes intersecting, on average, 2.0 per cent copper over true widths of 3-6 metres. Two holes deviated off target and another that targeted a magnetic anomaly intersected gabbro rich in magnetite. Prospecting led to discovery of magnetite iron formation with minor chalcopyrite in the JK zone north of the Granduc deposit.

Total production from 1971 to 1978 and from 1981 to 1984 included mining of 15.5 million tonnes of ore from which 124,048,961 grams of silver, 2,000,061 grams of gold and 190,143,710 kilograms of copper were recovered.

Ore reserves before production began in 1971 were 39,316,435 tonnes grading 1.73 per cent copper (Granduc Mines Ltd. Annual Report 1969). Inventory in 1986 was reported as 9.89 million tonnes grading 1.79 per cent copper with minor gold and silver (Open File 1992-1).

WORK HISTORY

Icefield barriers delayed discovery of the well-exposed mineralization around Granduc Mountain until 1931 when prospectors Dawson and Fromholz hiked into the Leduc Valley from the Unuk River in Alaska. However, the copper showings were not staked until 1951 when Kvale and McQuillan staked them for the Helicopter Exploration Company Ltd. The Granby Mining company did the first systematic surface and underground exploration in 1952, but development did not take place until a joint venture by ASARCO and Newmont Mining Corporation Ltd were able to finance the challenging work needed to put the deposit into production. Mine development commenced in the early 1960s punctuated by the February 18, 1965 avalanche disaster in the Leduc camp. Production began in 1968 utilizing the 18 km Tide tunnel connecting the mine workings to the upper Salmon River valley to produce 2000 ton per day of copper ore. Production ceased in 1977 because of low metal prices. In 1979 the mine was acquired by Esso Minerals Canada Ltd and operated until closure in May 1984. Following the closure in 1984 the property remained dormant and the mill structure at Tide Lake was removed after heavy snow collapsed the roof. The discovery of the North Zone, located about 3 km north of the main mine workings, was the last significant development and no copper mineralization has been discovered west of the Granduc fault on Granduc Mountain.

In 1991, a small surface exploration program was funded by Hecla. The program focused on several surface mineralized zones on the Property and comprised surface sampling and mapping by Cambria Geological Ltd. In 1993, Hecla financed a field program that retained Cambria to conduct additional mapping and sampling. Cambria conducted the work and in addition, supervised the funding of the Mineral Deposits Research Unit ("MDRU") of the University of BC to conduct structural mapping, geochronology and lithogeochemistry of the Property (Dawson, et al, 1994). Granduc Mines Ltd. passed into the ownership of Glencairn Gold Corporation, but no work was done on the Property.

In 2004, the patented mining claims covering the Granduc mine property were purchased by Glenn Zinn. In 2005, Bell Copper acquired the Property, initially under Option from Glencairn Gold Corporation, (later renamed Central Sun Mining Inc.), which became a subsidiary company of B2Gold Corp. Bell Copper conducted field exploration and diamond drilling programs in the summer seasons of 2005 and 2006. Subsequent staking by Teuton Resources surrounded the crown grants and their claims were in turn enclosed partially by Bell Resources claims. The Teuton Resources claims were optioned by Bell in 2005 and exploration work began.

In 2005, a 1,206 line-kilometre AeroTEM II survey was completed comprising magnetic and electromagnetics which revealed extensions of the deposit magnetic anomalies to the south under the South Leduc glacier. Follow-up diamond drilling occurred in five holes, totalling 2,087.62 metres, at the south extension of the main mineralized horizons of the Granduc Mine, under the north side of the South Leduc Glacier. The magnetic anomalies were related to magnetite-iron-formation-hosted copper mineralization.

In 2006, Bell Copper conducted a limited diamond-drilling program and surface prospecting. Work included: prospecting in an area where massive sulphide boulders were discovered on the north side of Granduc Mountain; due to glacial melting this area was exposed and the discovery was termed the "JK Zone". Diamond drilling was completed in 12 holes, for a total of 3,927.84 metres, at the south side of the South Leduc Glacier and under the South Zone.

In 2010, Castle Resources acquired the Granduc property from former owners Bell Copper Corporation. Castle continuously conducted exploration

on the property from summer 2010 to summer 2015. Between 2010 and 2012, 115 holes were drilled for a total of 60,826.36 metres on the main zone and the North zone. Drilling was targeted at verifying the Granduc orebody, twinning some of the historic Granduc drilling and expanding the known main zone orebody and North zone orebody.

In 2011 during the drilling program, SRK consulting of Vancouver was commissioned to perform a resource estimation. In 2012/2013 Tetra Tech was commissioned to perform an updated resource estimation as part of a Preliminary Economic Assessment of the Granduc orebody using all historic Granduc drill hole data as well as all Castle drill hole data from 2010 to 2012.

These following resources calculations are sourced from “the Technical Report and Resource Estimate on the Granduc Mine Project by SRK Consulting (Canada) Inc., 2012”, as reported in Assessment Report 35977. An Indicated Resource of 10.4 million tonnes grading 1.25 per cent copper, 0.14 gram per tonne gold and 10.6 grams per tonne silver was estimated and; an Inferred Resource of 36.6 million tonnes grading 1.26 per cent copper, 0.13 gram per tonne gold and 9.7 grams per tonne silver was estimated. Estimates were based on a 40 Canadian dollar NSR Cut-off (SRK Consulting, Effective Date February 21, 2012).

In 2013, Castle personnel catalogued all drill core from 2010 to 2012 due to lack of time to perform such task during drilling. In February 2013, an updated resource estimate for the Granduc Main zone was reported, using a 0.8 per cent copper equivalent cut-off, with a measured and indicated resource of 11,320,000 tonnes grading 1.47 per cent copper, 12.4 grams per tonne silver and 0.17 gram per tonne gold, an inferred resource of 30,520,000 tonnes grading 1.40 per cent copper, 13.3 grams per tonne silver and 0.17 gram per tonne gold and an inferred magnetite resource (using a 2.8 per cent magnetite cut-off) of 37,100,000 tonnes grading 13.3 per cent magnetite (Morrison, R., McKinnon, C. (2013-02-28): Preliminary Economic Assessment of the Granduc Copper Project).

In 2014 and 2015 no surface exploration was conducted due to continued difficult market conditions; however, site reclamation activities were conducted at the Portal camp.

In 2016, the Granduc property was put under care and maintenance until market conditions improved or a strategic partner was found to carry on exploration and development activities.

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Placer Dome File

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Date Coded:	1985/07/24	Coded By:	BC Geological Survey (BCGS)	Field Check:	N
Date Revised:	2020/05/12	Revised By:	Karl A. Flower (KAF)	Field Check:	N