Location/Identification

MINFILE Number: 092HSE038

National Mineral Inventory Number: 092H8 Au2

Name(s): NICKEL PLATE
NICKEL PLATE MINE, MASCOT GOLD, SUNNYSIDE, BULLDOG

Status: Past Producer
Mining Method Underground, Open Pit
Regions: British Columbia
BCGS Map: 092H040
NTS Map: 092H08E
Latitude: 49 21 55 N
Longitude: 120 02 04 W
Elevation: 1722 metres
Location Accuracy: Within 500M
Comments: South pit, on the southern slopes of Nickel Plate Mountain, 3 kilometres northeast of Hedley.

Mining Division: Osoyoos
Electoral District: Yale-Lillooet
Resource District: Okanagan Shuswap Forest District

UTM Zone: 10 (NAD 83)
Northing: 5472293
Easting: 715303

Mineral Occurrence

Commodities: Gold, Silver, Arsenic, Copper, Zinc, Cobalt, Lead, Bismuth, Nickel, Molybdenum

Minerals

Significant: Pyrrhotite, Arsenopyrite, Pyrite, Chalcopyrite, Sphalerite, Galena, Bismuth, Gold, Electrum, Tetrahedrite, Copper, Gersdorffite, Molybdenite, Tetradymite, Hedleyite, Cobaltite

Significant Comments: Trace galena, native bismuth, native gold, electrum, tetrahedrite, native copper, gersdorffite, molybdenite, tetradymite, hedleyite, cobaltite, erythrite, pyrargyrite, breithauptite and maldonite.

Associated: Pyroxene, Garnet, Carbonate, Scapolite, Quartz, Biotite, Orthoclase, Wollastonite

Associated Comments: Also calcite, epidote, chlorite, clinozoisite, prehnite, axinite, magnetite, marcasite and titanite.

Alteration: Pyroxene, Garnet, Carbonate, Scapolite, Quartz, Biotite, Orthoclase, Wollastonite

Alteration Comments: Also calcite, epidote, chlorite, clinozoisite, prehnite and axinite.

Alteration Type: Skarn

Mineralization Age: Unknown

Deposit

Character: Podiform, Massive, Disseminated

Classification: Skarn

Type: K04: Au skarn

Shape: Tabular

Comments: The deposit is hosted in a discontinuous zone of garnet pyroxene skarn alteration up to 300 metres thick and 6 square kilometres in area.

Host Rock

Dominant Host Rock: Sedimentary

Stratigraphic Age	Group	Formation	Igneous/Metamorphic/Other
Upper Triassic	Nicola	Hedley	------
Lower Jurassic	------	------	Hedley Intrusions

Isotopic Age	Dating Method	Material Dated
225 Ma	Fossil	Conodont
199 Ma	Uranium/Lead	Zircon

Lithology: Calcareous Siltstone, Tuffaceous Siltstone, Limestone, Garnet Pyroxene Skarn, Diorite Porphyry Sill, Diorite Porphyry Dike

Geological Setting

Tectonic Belt: Intermontane | **Physiographic Area:** Thompson Plateau

Terrane: Quesnel, Plutonic Rocks

Metamorphic Type: Contact

Inventory

Ore Zone: NICKEL PLATE | **Year:** 1996

Category: Proven | **Report On:** Y

Quantity: 696,655 tonnes | **NI 43-101:** N

Commodity	Grade
Gold	2.8400 grams per tonne

Comments: Estimated reserves at January 1, 1996.

Reference: Information Circular 1997-1, page 9.

Summary Production

		Metric		Imperial	
	Mined:	14,604,948	tonnes	16,099,199	tons
	Milled:	13,675,146	tonnes	15,074,268	tons
Recovery	Gold	66,166,980	grams	2,127,318	ounces
	Silver	15,941,519	grams	512,532	ounces
	Copper	981,030	kilograms	2,162,801	pounds
	Zinc	4	kilograms	9	pounds

Capsule Geology

Gold-bearing skarn mineralization in the Hedley camp is hosted in Upper Triassic Nicola Group rocks and is genetically related to the Early Jurassic Hedley Intrusions, a suite of subalkalic, calcalkaline dioritic intrusions. A series of facies changes recognized within the Nicola succession is related to deposition across a fracture-controlled basin margin. This is economically important as the gold mineralization in the Hedley district is lithologically, stratigraphically and structurally controlled.

Most of the area is underlain by the Nicola Group which contains three distinct stratigraphic packages. The oldest, the Peachland Creek Formation, largely comprises mafic tuffs and minor conglomerate; while the youngest, the Whistle Creek Formation, is essentially an andesitic to basaltic volcaniclastic sequence. Between these two formations is a predominantly sedimentary succession that hosts most of the gold-bearing skarns in the camp. Several east-to-west facies changes are recognized in this sequence, which progressively thickens from 100 metres in the east to over 700 metres in the west.

The easternmost and most proximal facies, the French Mine Formation, has a maximum thickness of 150 metres and comprises massive to bedded limestone interlayered with thinner units of calcareous siltstone, chert pebble conglomerate, tuff, limestone boulder conglomerate and limestone breccia. It hosts the auriferous skarn mineralization at the French (092HSE059) and Goodhope (092HSE060) mines.

Further west, rocks stratigraphically equivalent to the French Mine Formation are represented by the Hedley Formation which hosts the gold-bearing skarn at the Nickel Plate mine. The Hedley Formation is 400 to 500 metres thick and characterized by thinly bedded, turbiditic calcareous siltstones that display some soft sediment structures, and units of pure to gritty, massive to bedded limestone that reach 75 metres in thickness and several kilometres in strike length.

The most distal facies to the west is represented by the Stemwinder Mountain Formation which is at least 700 metres thick and characterized by a monotonous sequence of black, organic-rich, thinly bedded calcareous argillite and turbiditic siltstone, and dark impure limestone beds that seldom exceed 3 metres in thickness.

Two Jurassic plutonic suites are recognized in the area. The oldest, the subalkalic, calcalkaline Hedley Intrusions is economically important. It forms major stocks (Toronto, Aberdeen, Stemwinder, Banbury) up to 1.5 kilometres in diameter and swarms of thin sills and dykes up to 200 metres in thickness and over 1 kilometre in length. The sills and dykes are mostly coarse-grained, massive diorites and quartz diorites with minor gabbro, while the stocks range in composition from gabbro through granodiorite to quartz monzonite. The Hedley Intrusions invade the Upper Triassic rocks over a broad area. Varying degrees of sulphide-bearing calcic skarn alteration are developed within and adjacent to many of these intrusions, particularly the dyke and sill swarms.

The second plutonic suite comprises coarse-grained, massive biotite hornblende granodiorite to quartz monzodiorite, of Early to mid-Jurassic age. It generally forms large bodies, such as the Bromley batholith which outcrops northwest of Hedley, and the Cahill Creek pluton which generally separates the Nicola Group rocks from the highly deformed Apex Mountain Complex further to the southeast. Some minor skarn alteration is also locally present but it is generally sulphide-poor and not auriferous.

Two distinct phases of folding has taken place in Nicola Group rocks. The youngest phase resulted in a major north-northeast striking, easterly overturned asymmetric anticline which is the dominant structure in the district; the axial plane of this fold dips steeply west. A related, but poorly developed northerly striking axial planar cleavage is present in some argillites, and the axes of smaller scale folds related to this deformation dip gently north and south. The oldest phase of folding occurred during the emplacement of the Hedley Intrusions but is only recognized in the Nickel Plate mine area. It produced small-scale northwesterly striking, gently plunging fold structures that are an ore control at the mine as well as a series of westerly to northwesterly striking fractures.

The Nickel Plate and Hedley Mascot (092HSE036) mines were largely developed on a single, very large, westerly dipping skarn- related gold deposit. It was discovered in 1898 and mined in several underground operations until 1955. During the process of development the two mines were connected underground at several points. Two old mill tailings piles from the Nickel Plate mine are currently being reprocessed by heap leach methods (see Candorado, 092HSE144).

Open pit mining resumed at the Nickel Plate in April 1987. Measured geological (proven) reserves are 6 million tonnes grading 2.57 grams per tonne gold (Mineral Exploration Review 1990, page 62). Current mineable reserves (as of November 1991) are 1.762 million tonnes grading 2.6 grams per tonne gold, with a strip ratio of 11.5 to 1 (R. Arksey, personal communication, 1991). Thirty-nine thousand tonnes of ore and waste are being mined each day from the North pit, of which 3400 tonnes are milled. The Central and South pits are now mined out (D. Bordin, personal communication, 1992).

The gold deposit is hosted within the upper part of the Hedley Formation where a discontinuous zone of garnet pyroxene skarn alteration, up to 300 metres thick and 6 square kilometres in area, is developed peripherally to the Toronto stock and swarms of Hedley Intrusions dykes and sills. The alteration zone on surface is subcircular in shape and westerly dipping. It lies parallel to, but locally crosscuts, the gently dipping hostrocks which comprise calcareous and tuffaceous siltstone with interbeds of impure limestone. The bulk of the zone extends a considerable distance north and northeast of the Toronto stock within an area of more intense deformation, but to the south the skarn alteration only extends 30 to 150 metres beyond the intrusive contact.

Swarms of Hedley diorite porphyry sills, 1 to 25 metres in thickness, locally make up 40 per cent of the skarn-altered section. In addition, several diorite porphyry dykes have followed west to northwest striking fault zones; mineralization and alteration tend to follow these dykes, forming deep keels of skarn that locally extend below the main alteration envelope. Skarn development is mostly confined to the Hedley Formation, but alteration extends locally up into the overlying "Copperfield conglomerate" (a limestone boulder conglomerate 1 to 200 metres thick, often found at the base of the Whistle Creek Formation and which forms an important stratigraphic marker horizon in the district).

The main episode of skarn development occurred during a period of folding that accompanied and immediately followed the emplacement of the diorite sills and dykes. Most of the sills and dykes within the skarn envelope are bleached and altered. The exoskarn is dark green to brown-coloured and typically consists of alternating layers of garnet-rich and clinopyroxene-rich alteration which reflect the original sedimentary bedding. Overall however, the Nickel Plate skarn is pyroxene-dominant compared to garnet.

Preliminary studies suggest that at least two stages of mineral growth are present in the skarn. The main minerals formed during the early stage were biotite, orthoclase, iron-rich pyroxene, garnet, quartz, wollastonite and carbonate. The later stage of skarn alteration is largely restricted to the outer and lower margins of the envelope, normally within 100 metres of the skarn front. This late-stage alteration is rarely seen in the central or upper parts of the skarn zone, except along fractures or dyke and sill margins. It resulted in the introduction of sulphides and gold, accompanied by abundant scapolite, calcite and quartz with minor amounts of epidote, chlorite, clinozoisite, prehnite, orthoclase and local axinite.

The gold-bearing sulphide zones normally form semi-conformable, tabular bodies situated less than 100 metres from the outer and lower skarn margins. They are both lithologically and structurally controlled along northwesterly plunging minor folds, fractures and sill-dyke intersections.

There are significant geochemical and mineralogical variations throughout the deposit. The main Nickel Plate ore zone near the Nickel Plate glory hole, in the northern part of the deposit, consists primarily of arsenopyrite, pyrrhotite and chalcopyrite with carbonate, pyroxene, scapolite, garnet and quartz. Arsenopyrite often forms coarse, wedge-shaped crystals up to 1 centimetre in length and the sulphides occur as disseminations and fracture-fillings within the exoskarn. The Sunnyside ore zones in the central part of the deposit are strongly controlled by either sill-dyke intersections or fold hinges. Although the sulphide mineralogy and textures resemble those in the Nickel Plate zone, pyrrhotite dominates in the Sunnyside zones. The mineralization in the southern part of the deposit (Bulldog zone) comprises lenses and pods of massive to semimassive sulphide mineralization; it is noticeably richer in chalcopyrite and contains higher silver and zinc values.

Grain boundary relationships suggest the following three stages of sulphide deposition: (1) pyrite; (2) arsenopyrite and gersdorffite; and (3) pyrrhotite, chalcopyrite and sphalerite. Gold mineralization is related to the latter two stages, and minor amounts of magnetite are associated with the first and last sulphide phases. Pyrrhotite and arsenopyrite are the most common sulphides. Present in lesser amounts, but locally dominant, are pyrite, chalcopyrite, and cadmium-rich sphalerite with minor amounts of magnetite and cobalt minerals. Trace minerals include galena, native bismuth, gold, electrum, tetrahedrite, native copper, gersdorffite, marcasite, molybdenite, titanite, bismuth tellurides (hedleyite, tetradymite), cobaltite, erythrite, pyrargyrite and breithauptite. Trace amounts of maldonite have recently been identified. The native gold, with hedleyite, occurs as minute blebs, generally less than 25 microns in size, within and adjacent to grains of arsenopyrite and gersdorffite. In the South pit area, electrum occurs in close association with chalcopyrite, pyrrhotite, sphalerite and native bismuth; it tends to be concentrated in microfractures within and around the sulphides. Secondary gold enrichment is also present in some weathered, near-surface, oxide-rich zones and along certain faults. The resulting red hematitic clay zones may carry gold grading over 34 grams per tonne (Paper 1989-3).

A recent preliminary statistical study shows a strong positive correlation between gold and bismuth reflecting the close association of native gold with hedleyite, while the moderate positive correlation between gold, cobalt and arsenic confirms the observed association of gold, arsenopyrite and gersdorffite. The high positive correlation between silver and copper may indicate that some silver occurs as a lattice constituent in the chalcopyrite. The gold and silver values are relatively independent of each other despite the presence of electrum, and there is generally a low correlation between gold and copper. Gold:silver ratios in the Nickel Plate and Sunnyside zones are greater than 1 with silver averaging 2 parts per million. By contrast, in the southern part of the deposit where electrum is present, the gold:silver ratio is less than 1, with silver averaging 17 grams per tonne (Paper 1989-3).

Reserves at January 1, 1995 were estimated by the company at 2,900,000 tonnes grading 2.64 grams per tonne gold (Information Circular 1996-1, page 7). Mining and milling are projected to cease towards the end of 1996.

In 1995, with mineable reserves dwindling and with support from the Explore B.C. Program, Homestake Canada Inc. drilled 947 metres in 7 holes on the Cahill 1-2 claims optioned from Locke Goldsmith, in an effort to locate mineralization similar to that of the nearby profitable Canty deposit, now exhausted. This work was concentrated at the central end of the optioned claims and on adjoining Homestake claims. Only one of the seven holes penetrated the Tertiary cover to basement and intersected 23.9 grams per tonne gold over 2.4 metres. The south end of the claims remains untested (Explore B.C. Program 95/96 - A65).

Reserves estimated by the company at January 1, 1996 were 696,655 tonnes grading 2.84 grams per tonne gold (Information Circular 1996-1, page 9). The mine was closed in October of 1996.

Production from 1904 to 1996 totalled 14,604,948 tonnes yielding 15,941,519 grams of silver, 66,166,980 grams of gold, 981,030 kilograms of copper and 4 kilograms of zinc.

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Date Coded:	1985/07/24	**Coded By:**	BC Geological Survey (BCGS)	**Field Check:**	N
Date Revised:	1996/11/04	**Revised By:**	George Owsiacki (GO)	**Field Check:**	Y