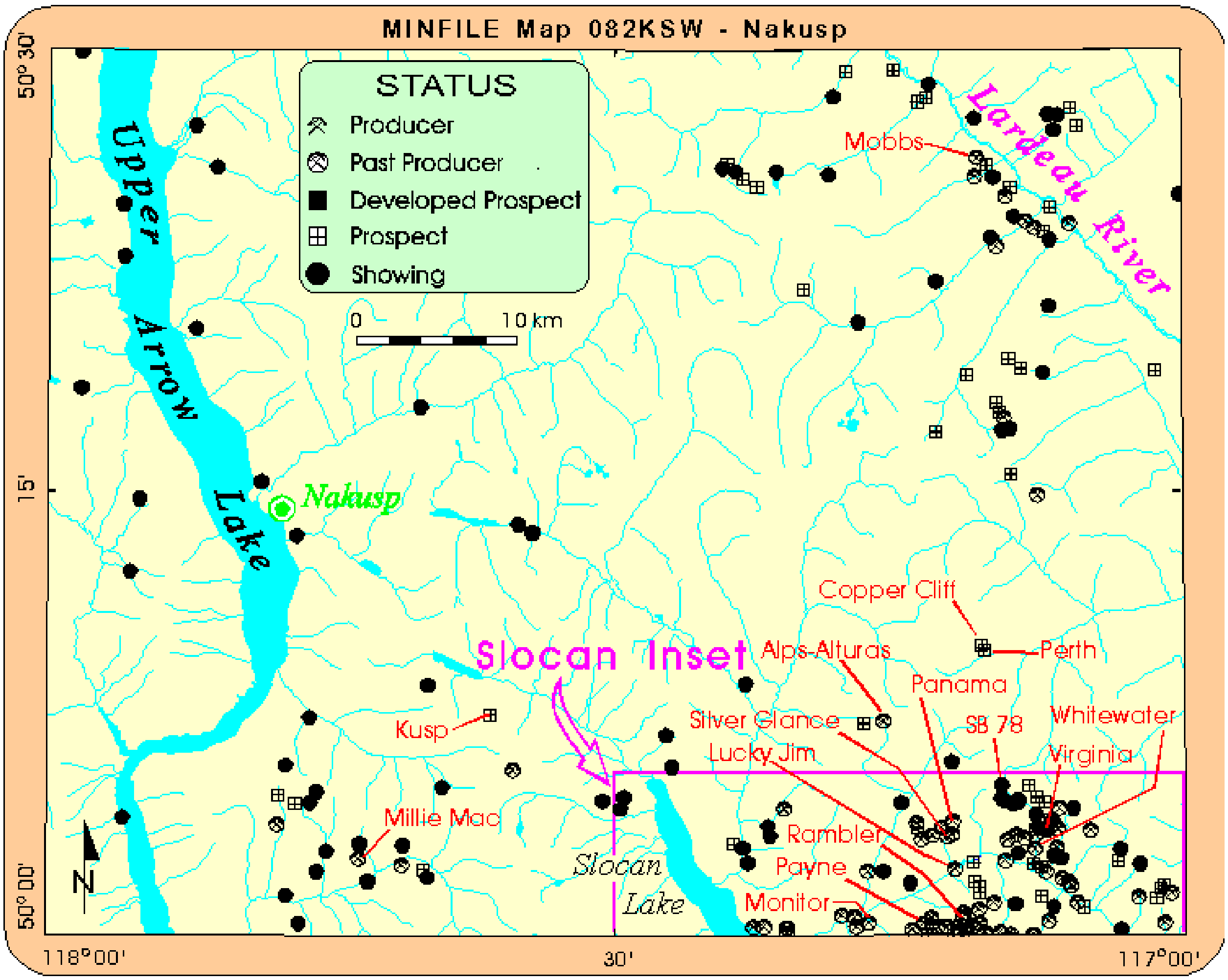
MINFILE
NTS 082KSW - NAKUSP

Original release date: January 1997
Researched and compiled by: K.J. Mountjoy, G.J. Arseneau and R.H. McMillan

The Nakusp map area is located in the southeastern part of British Columbia and contains 206 documented occurrences. It contains the northern portion of the Slocan mining district - the premier polymetallic silver vein mining camp in the province. Physiographically, the map sheet covers the Selkirk Mountains in the central part, the Monashee Mountains in the western part and in the extreme northeast, the Purcell Trench and Mountains. The western half of the map area is transected by Upper Arrow Lake. The northern end of Slocan Lake intersects the south-central part of the map area. The town of Nakusp lies along the eastern edge of Upper Arrow Lake. New Denver and Kaslo are located immediately south of the map area.



The map sheet is entirely within the Omineca tectonic belt, straddling the northern end of the Kootenay Arc, and includes the eastern edge of the Monashee Complex. Strata of the Kootenay Terrane in the northeastern portion are composed of the Upper Proterozoic to Lower Cambrian Hamill Group, Lower Cambrian Badshot Formation, Cambrian to Devonian(?) Lardeau Group and the upper Mississippian to (?)Permian Milford Group. Progressing to the southwest, Permian to Carboniferous Kaslo Group strata have been assigned to the Slide Mountain Terrane. The area east of Upper Arrow Lake is dominated by strata of the Quesnel Terrane, which includes the Triassic Slocan Group and Lower Jurassic Rossland Group. The Valhalla gneiss dome complex is exposed west of Upper Arrow Lake. This structure includes metamorphic rocks of the Proterozoic to (?)lower Paleozoic Monashee Complex and

Lower Proterozoic core (basement) gneiss. The northwest structural trend of these strata have been disrupted by two Middle Jurassic plutons - the Kuskanax batholith in the northwestern portion of the map area and the Nelson batholith along the southern margin. Several stocks of Cretaceous or Middle Jurassic age are located to the east and south of the Kuskanax batholith. The Poplar Creek, Mobb Creek, North Fork, Ruby Range and Rapid Creek stocks comprise Middle Jurassic intrusions related to and located east of the Kuskanax pluton. Cretaceous intrusions include the Goat Canyon-Halifax Creek and Wragge Creek stocks.

Stratified rocks in the Nakusp map area have been complexly folded, faulted and metamorphosed. The major structural feature, the Columbia River fault, is a complex zone more than 250 kilometres in length that extends north from the Nakusp area to the Mica Dam area. It marks the eastern boundary of the Shuswap and Monashee metamorphic complexes. It dips gently east with major normal, dip-slip displacements.

The oldest rock unit of the Kootenay Terrane in the northeast portion of the map area is quartzite of the Hamill Group. This quartzite is overlain by limestone of the Badshot Formation. Collectively, these units form a distinctive marker horizon outlining major structural features of the Kootenay Arc.

The Lardeau Group is part of the Kootenay Terrane, forming a broad belt northeast of the Kuskanax batholith, extending from the Nakusp and adjacent Lardeau map sheet (082KSE) northward into the Revelstoke map sheet (082LNE). The Lardeau Group has been subdivided into six formations. The lowest stratigraphic unit consists of micaceous schist and marble of the Index Formation, which is successively overlain by dark siliceous phyllite of the Sharon Creek Formation, massive grey quartzite of the Ajax Formation, dark siliceous phyllite and greenstone of the Triune Formation, green phyllite and greenstone of the Jowett Formation, and limestone, phyllite and grit of the Broadview Formation. The Sharon, Ajax and Triune formations are not separated on the accompanying MINFILE map. The Milford Group unconformably overlies the Lardeau Group along the eastern margin of the Kuskanax batholith. The unconformity, commonly faulted, is an angular unconformity marked locally by metaconglomerate and amygdaloidal basalt. North of Mount Cooper the unconformity is marked by a basal cobble conglomerate. A limestone unit which ranges in thickness from several metres to several hundred metres is present near the base of the Milford Group. The Milford Group consists mainly of grey and brown argillite and quartzite, however, it also contains a chert band which extends south of Mount Cooper along Blue Ridge.

The Kaslo Group consists of andesitic tuffs and breccia metamorphosed from greenschist to amphibolite grade near the Kuskanax batholith. Sills of serpentinite, hornblende and pyroxene metadiorite and metagabbro have preferentially intruded the upper part of Kaslo and Milford groups strata. The largest of these serpentinite bodies forms a lenticular belt along the Blue Ridge, immediately northeast of the contact between the Kaslo and Slocan groups.

Mesozoic strata of the Quesnel Terrane outcrop west of the Kaslo Group. These include the Slocan Group and the Rossland Group. Slocan Group sedimentary strata disconformably overlie the Kaslo Group. At the base, conglomerate and sedimentary breccia composed of Kaslo detritus define the disconformity. A unit consisting of one or more limestone beds up to 30 metres in thickness intercalated with argillite, phyllite and quartzite, comprises the lower sequence. This unit is host to the stratabound polymetallic “replacement” deposits in the Slocan mining district. The upper sequence is composed of argillite, phyllite and quartzite. Near the top of the sequence strata become tuffaceous passing into metadacite and meta-andesite flows and tuffs. Predominantly mafic volcanic strata of the Rossland Group comprise the youngest sequence of layered rocks in the Nakusp map sheet.

Between the Paleozoic and up to the Middle Jurassic, there were three phases of regional, approximately coaxial folding. The first phase is characterized by broad, recumbent, southeast plunging coaxial anticlines such as the Meadow Creek anticline, which is exposed in lower Meadow Creek. Asymmetric, macroscopic folds comprising the second phase of deformation rise to the northeast towards the crest of the Purcell anticlinorium. The third phase is limited to the area northwest of the eastern contact of the Kuskanax batholith and the Lardeau River. It consists of two or more episodes of non-coaxial folds plunging to the east. Rocks in the northeast corner of the map area lie on the western limb of the north trending Purcell anticlinorium, which comprises part of the northern portion of the Kootenay Arc. To the west, stratified rocks are more complexly deformed and metamorphosed adjacent to the Kuskanax batholith on the eastern side of Upper Arrow Lake, and within the Monashee Complex on the western side of Upper Arrow Lake. The Columbia River fault is a complex fault system composed of numerous cataclastite, mylonite and fault zones which have truncated regional folds and metamorphic isograds during the Middle Jurassic to (?)middle Cretaceous.

Two episodes of greenschist regional metamorphism have affected stratified rocks. The first is probably Devonian and the second is probably Jurassic; the metamorphic isograds possibly developed shortly after Middle Jurassic deformation. Generally, metamorphic grade increases from northeast to southwest with isograds subparallel to regional structural trends. Amphibolite grade metamorphism has been reached adjacent to the Kuskanax batholith. In the southern part of the Nakusp map area, biotite and chlorite zones of metamorphism are displayed in Milford and Slocan groups strata. The Valhalla Complex displays amphibolite to granulite grade metamorphism.

The alkalic Kuskanax batholith and associated stocks constitute the dominant plutonic suite in the Nakusp map area. Monzonite is the dominant rock type and contains albite and microcline, and finer grained augite-aegirine or alkalic amphibole phenocrysts. Several associated stocks are composed of leucogranite or leucosyenite. Contacts of the Kuskanax batholith are generally conformable with regional structures and emplacement is believed to be pre to syntectonic. The granodioritic to granitic Nelson batholith and associated stocks form a mid-Jurassic calcalkaline suite that is also concordant and parallel to the northwest trend of the enclosing country rock. The Cretaceous Goat Canyon-Halifax Creek stock is composed of granite, granodiorite and monzonite. The Wragge Creek stock, also of Cretaceous age, is composed of quartz monzonite, granodiorite and quartz diorite. Numerous feldspar porphyry stocks outcrop along the contact between the Kaslo Group and the overlying Slocan Group. Although their age is unknown, they could be correlative with the Nelson batholith.

Mining has been important in the Nakusp map area since silver was discovered in the late 1800s in the Slocan area. Significant silver, lead and zinc has been produced from polymetallic silver-lead-zinc veins and from polymetallic silver-lead-zinc “replacement” deposits hosted in limestone of the Slocan Group. Polymetallic veins have been classified into “wet ore” or “dry ore” types by Cairnes (1934) and others. The wet ore types are the most important type in this area. They typically have abundant galena and sphalerite associated with silver-rich sulphide minerals. Gangue minerals, consisting chiefly of quartz and siderite, are vertically zoned as exemplified in such past producers as the **Payne** (082KSW006) and the **Whitewater** (082KSW033). Galena is typically abundant in the upper portions while sphalerite is associated with the siderite-rich zone. The lower quartz-rich zone is usually barren. The **Silver Glance** (082KSW028) and **Panama** (082KSW055) are examples of the “dry ore” type which are rich in quartz; the silver-bearing minerals including argentite, tetrahedrite, pyrargyrite, jamesonite and native silver are relatively abundant with galena and sphalerite of minor importance. The limestone-hosted “replacement” deposits are typically rich in sphalerite and low in silver. Quartz is the predominant gangue mineral and is more abundant than ore minerals. Controls on ore deposition are enigmatic. However, the following factors are thought to be important: (1) favourability of competent wallrock lithologies, (2) cross-fractures consisting of joints, conjugate shear planes, tension cracks or linking fractures and (3) the absence of strong gouge (Hedley, 1952). Larger orebodies tend to be oriented oblique to the main direction of fault movement.

Significant past producers include the Payne, Whitewater and **Lucky Jim** (082KSW023). The Payne produced 110,604 tonnes of ore intermittently over 21 years from 1893 to 1939, with about 116 tonnes of silver, 17,376 tonnes of lead and 1024 tonnes of zinc recovered. Several past producers, such as the Whitewater, have features of both vein and “replacement” deposit types. A total of about 108 tonnes of silver, 54 kilograms of gold, 23,132 tonnes of zinc, 13,942 tonnes of lead, 39 tonnes of cadmium and 45 kilograms of copper were recovered from 471,063 tonnes of ore at the Whitewater. The Lucky Jim, a polymetallic silver-lead-zinc limestone “replacement” deposit, was one of the most significant zinc producers in the Slocan mining camp, with about 79,798 tonnes of zinc, 18 tonnes of silver, 2 kilograms of gold, 3697 tonnes of lead and 194 tonnes of cadmium recovered from the 1,065,798 tonnes mined. The **Monitor** (082KSW004), which contained more gold than average for silver-lead-zinc veins in the area, produced, from 18,308 tonnes, about 12 tonnes of silver, 31 kilograms of gold, 1379 tonnes of lead and 420 tonnes of zinc intermittently from 1896 to 1958. The **Rambler** (082KSW018) was one of the most consistent producers, with 189,421 tonnes ore produced over 32 years from 1895 to 1927, then intermittently until 1951. From this, about 109 tonnes of silver, 839 grams of gold, 10,527 tonnes of lead, 2654 tonnes of zinc, 3 tonnes of cadmium and 327 kilograms of copper were recovered. The Panama and Silver Glance were significant producers of the “dry ore” type polymetallic silver-lead-zinc veins in this part of the Slocan mining camp. The Panama produced 2666 tonnes of ore from which 3,838,539 grams of silver, 845 grams of gold, 11,759 kilograms of lead, 2911 kilograms of zinc and 919 kilograms of copper were recovered. From 276 tonnes mined at the Silver Glance, 1,575,336 grams of silver, 404 grams of gold and 26 kilograms of lead were recovered.

The **Millie Mack** property (082KSW051), located on Blue Grouse Mountain, 22 kilometres west Slocan Lake, is a deformed and boudinaged quartz vein hosted in graphitic schist of the Slocan Group. The vein is mineralized with galena, sphalerite, arsenopyrite, chalcopyrite and pyrite. Potential reserves have been reported at 1,542,070 tonnes grading 4.79 grams per tonne gold and 222.82 grams per tonne silver. Intermittent production from 1899 to 1979, was 382 tonnes, resulting in 671,794 grams of silver, 9829 grams of gold, 32 kilograms of copper, 20,611 kilograms of lead, and 1085 kilograms of zinc. The property also contains a large graphitic shear zone with 8,889,580 tonnes of graphite.

An ultramafic belt in the Kaslo Group adjacent to its contact with the Slocan Group has been explored for gabbroid Ni-Cu-PGE type showings such as **SB 78** (082KSW064). Strong serpentinization has occurred in this ultramafic belt resulting in several serpentinite-hosted magnesite-talc showings; the **Virginia** (082KSW144) being an example of this type of showing. The **Copper Cliff** (082KSW111), **Perth** (082KSW079) and **Kusp** (082KSW161) are volcanogenic massive sulphide occurrences hosted in Kaslo and Slocan groups strata.

In the northeast part of the map, near Poplar Creek, several polymetallic veins in Lardeau Group metasediments produced small amounts of gold, silver, and lead. The **Mobbs** (082KSW096) produced 40,496 grams of silver, 62 grams of gold and 26 kilograms of lead from 14 tonnes.

Other occurrences contain diverse commodities such as molybdenum, tungsten, asbestos, uranium, and limestone. The **Alps-Alturas** (082KSW049) shipped 95 tonnes, averaging 57 per cent antimony.

SELECTED REGIONAL REFERENCES (082KSW - NAKUSP)

Billingsley, P. (1951): Pend D'Oreille-Slocan Geology Map; *B.C. Ministry of Energy, Mines and Petroleum Resources*, scale 1:126,720, in Property File, 082F General File.

Billingsley, P. (1960): Selkirk--Lardeau-Slocan Generalized Sections; *B.C. Ministry of Energy, Mines and Petroleum Resources*, scale 1:253,440, in Property File, 082F General File.

Cairnes, C.E. (1934): Slocan Mining Camp, British Columbia; *Geological Survey of Canada*, Memoir 173, 137 pages, Map 273A, scale 1:48,000.

Cairnes, C.E. (1935): Description of Properties, Slocan Mining Camp, British Columbia; *Geological Survey of Canada*, Memoir 184, 274 pages.

Fyles, J.T. (1969): Evolution of the Slocan Syncline in South-central British Columbia: Discussion, *Canadian Journal of Earth Science*, Vol. 6, pp. 802-806.

Hedley, M.S. (1945): Geology of the Whitewater and Lucky Jim Mine Areas; *B.C Ministry of Energy, Mines and Petroleum Resources*, Bulletin 22.

Hedley, M.S. (1945): Geology and Ore Deposits of the Sandon Area, Slocan Mining Camp, British Columbia; *B.C Ministry of Energy, Mines and Petroleum Resources*, Bulletin 29, 130 pages.

Höy, T. et al. (1994): Mineral Potential Project: Kootenay Area; *B.C. Ministry of Energy, Mines and Petroleum Resources*, Open File 1994-8.

Hyndman, D.W. (1968): Petrology and Structure of the Nakusp Map-area, British Columbia, *Geological Survey of Canada,* Bulletin 161, Map 1234A.

LeRoy, O.E. and Drysdate, C.W. (1917): Slocan Mining Area, *Geological Survey of Canada,* Summary Report 1916, Map 1667.

Maconachie, R.J. (1940): Lode-Gold Deposits, Upper Lemon Creek Area and Lyle Creek-Whitewater Creek Area, Kootenay District; *B.C. Ministry of Energy, Mines and Petroleum Resources*, Bulletin 7.

MEMPR (1981): Slocan Valley Planning Program, Mineral Resources Technical Report; *B.C. Ministry of Energy, Mines and Petroleum Resources*, in Property File, 082F General File.

Northcote, K.E. (1982): Slocan Valley Planning Area Program, Mineral Resources Technical Report; *B.C. Ministry of Energy, Mines and Petroleum Resources*, in Property File, 082F General File.

Orr, J.F.W. and Sinclair, A.J. (1971): Mineral Deposits in the Slocan and Slocan City Areas of British Columbia, *Western Miner*, February 1971.

Read, P.B. (1966): Petrology and Structure of the Poplar Creek Map-area, British Columbia; *University of California*, Ph.D. Thesis.

Read, P.B. (1971): Poplar Creek and Trout Lake Areas, British Columbia; *Geological Survey of Canada,* Map 1277A, scale 1:63,360.

Read, P.B. (1973): Petrology and Structure of the Poplar Creek Map-area, British Columbia; *Geological Survey of Canada*, Bulletin 193, Map 1277A.

Read, P.B. and Wheeler, J.O. (1975): Geology and Mineral Deposit Maps of Lardeau (West-half) Map Area; *Geological Survey of Canada*, Open File 288, map scale 1:125,000.

Read, P.B. and Wheeler, J.O. (1977): Geology, Lardeau, West-half; *Geological Survey of Canada*, Open File 432, map scale 1:125,000.

Read, P.B. and Wheeler, J.O. (1977): Mineral Deposits, Lardeau, West-half; *Geological Survey of Canada*, Open File 464, 2 maps, scales at 1:125,000 and 1:50,000.

Reesor, J.E. (1973): Geology of the Lardeau Map-area, East-half, B.C.; *Geological Survey of Canada*, Memoir 369, 129 pages, Map 1326A, scale 1:250,000.

Ross, J.V and Kellerhals, P. (1968): Evolution of the Slocan Syncline in South-central British Columbia, *Canadian Journal of Earth Science*, Vol. 5, pp. 851-872.

Wheeler, J.O. (1966): Lardeau (west-half) Map-area (82K W1/2); *Geological Survey of Canada*, Paper 66-1, pp. 102-103.

Wheeler, J.O. (1968): Lardeau (west-half) Map-area, British Columbia (82K W1/2); *Geological Survey of Canada*, Paper 68-1, Part A, pp. 56-58.

Wheeler, J.O. and McFeely, P. (1991): Tectonic Assemblage Map of the Canadian Cordillera and Adjacent parts of the United States of America; *Geological Survey of Canada*, Map 1712A, scale 1:2,000,000.