Province of British Columbia
Ministry of Energy, Mines and Petroleum Resources

MINERAL RESOURCE ASSESSMENT OF NISGA'A MEMORIAL LAVA BED RECREATION AREA

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May 1993

Information Circular 1993-9

EXECUTIVE SUMMARY

This study of the Nisga'a Memorial Lava Bed Recreation Area was undertaken to assess its mineral potential. The area is underlain dominantly by sedimentary rocks of the Jura-Cretaceous Bowser Lake Group. These strata generally have low mineral potential except where they are cut by younger, Tertiary intrusions. Around and in the intrusions there is potential for vein, skarn and porphyry type mineralization. Such intrusions underlie the area immediately south of Mount Phillipa in the study area, and Mount Priestly, just north of it. Fault breaks in the crust provide conduits for hot, mineralizing fluids; thus they also are prospective. A north-south fault lineament that is distinct on air photographs runs along the west side of the study area. The volcanic cinder cone in lava bed park lies on its southern extension. This volcano was active in the 1700s.

On a regional basis, the area has potential for precious and polymetallic (multi-metal) veins in the Bowser Lake Group rocks, molydenum within quartz stockworks in and adjacent to dikes and other intrusions, and coal measures in a possible northward extension of the Cretaceous Skeena Group sediments.

Within the Recreation Area, ground observations we made improved our knowledge of its mineral potential. Although we discovered several small showings of molybdenum mineralization, there is no evidence of extensive or pervasive hydrothermal alteration in either the sediments or the intrusive rocks. Thus the potential for a molybdenite deposit is moderate, but any deposit found would likely be small. There is a moderate potential for finding small polymetallic vein deposits, but little probability that they would be enriched in gold. On the energy side, there is some potential for a geothermal resource that might be tested in the future, but essentially no possibility of an economic coal deposit.

Although future exploration is possible, the potential for finding a major metallic mineral deposit is low.

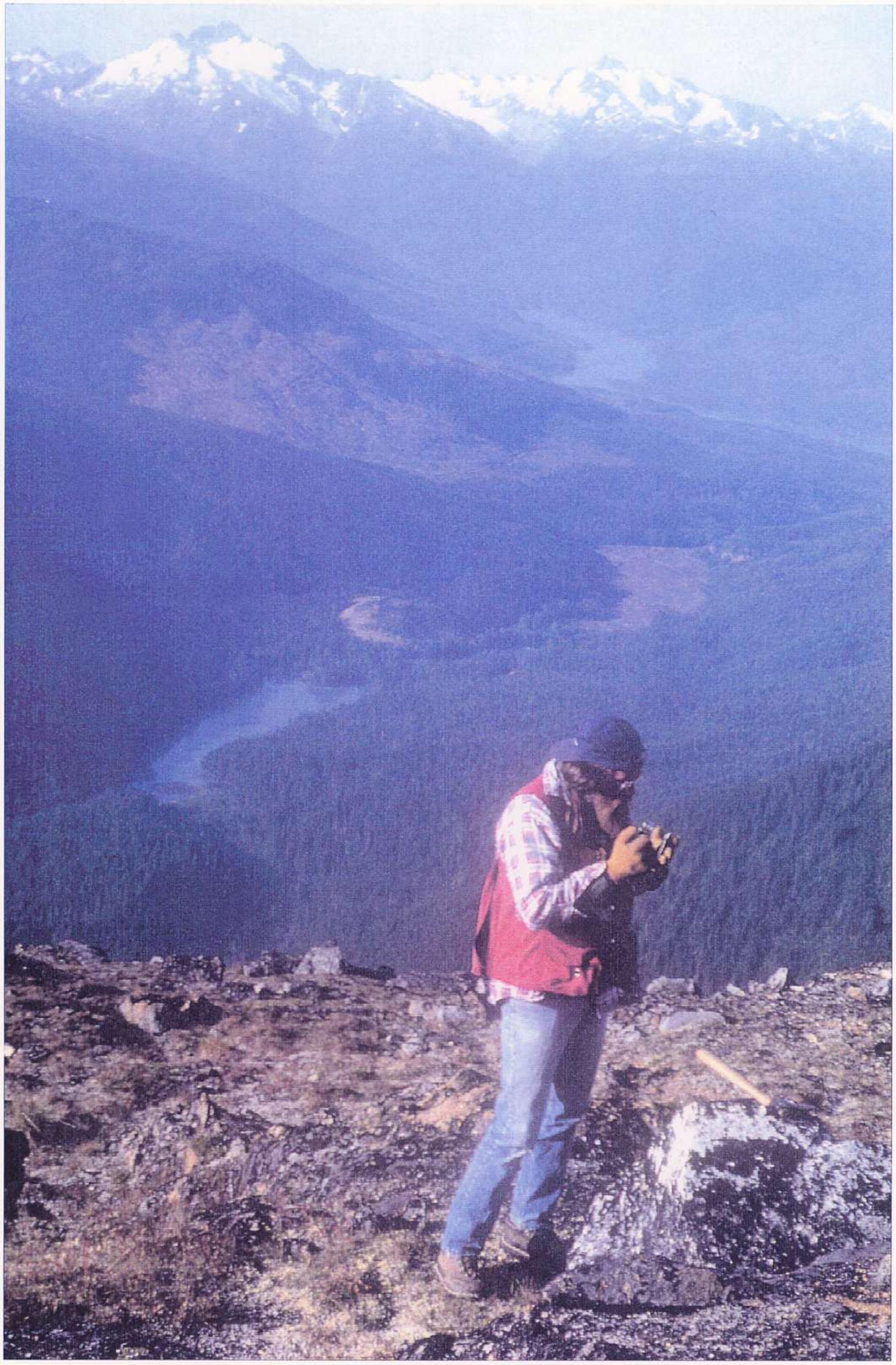
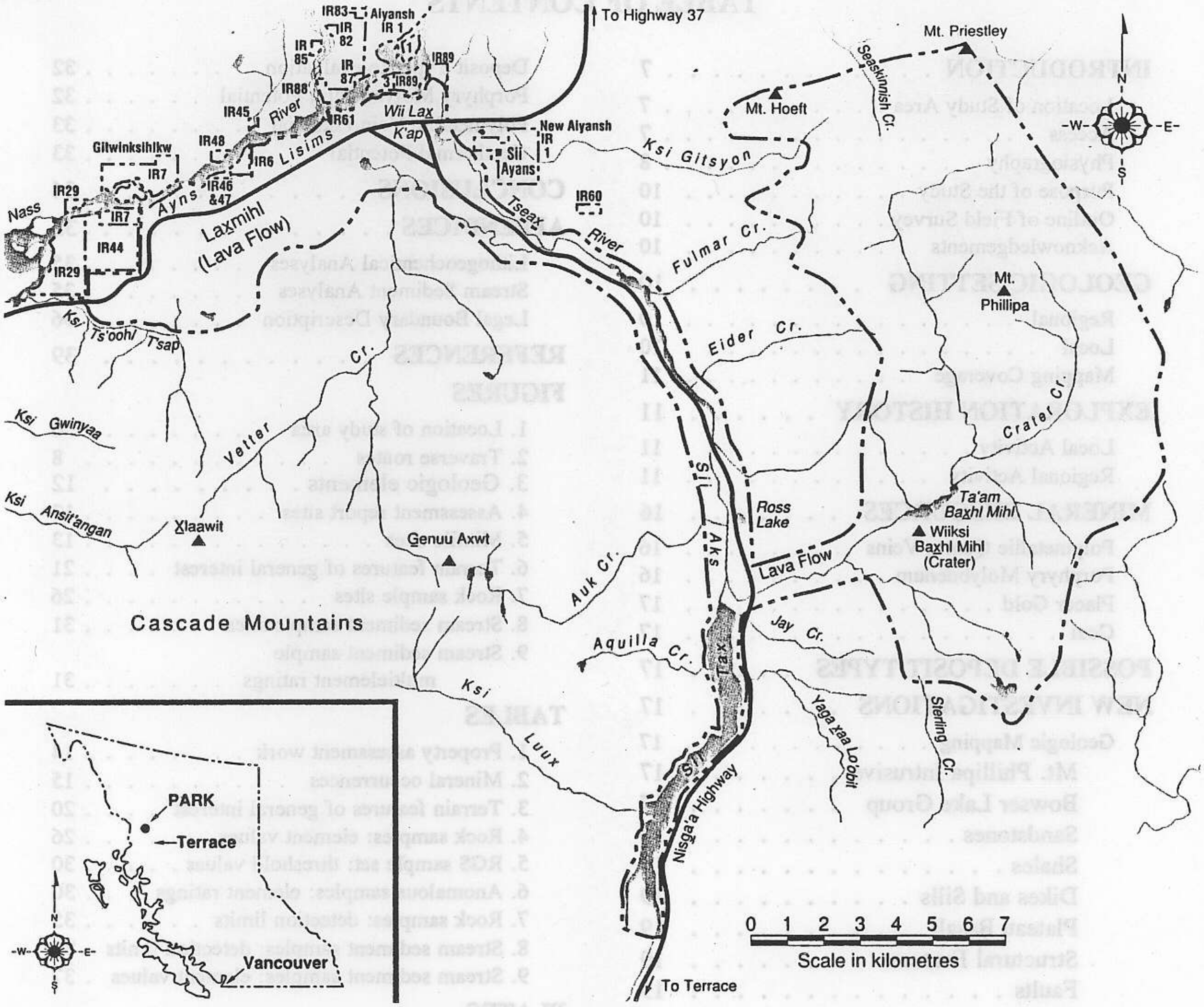


Plate 1. Prospecting on alpine ridges. Volcanic cone in middle distance; lava lake in background.

TABLE OF CONTENTS



Joint Nisga'a/BC Parks Committee
Minga Nisga'a/Mismaaksgum Gat

Figure 1. Location of study area.

INTRODUCTION

Location of the Study Area

The study area covers approximately 6440 hectares in NTS 103P/02W, near the town of Aiyansh, halfway between Terrace and Stewart. The area extends north from Nisga'a Memorial Lava Bed Park. The center of the study area is approximately at 55^{o} 11' north latitude and 128^{o} 53' west longitude (Figure 1). A legal boundary description is included in the Appendix.

Access

The area is reached by following the Kalum road north from the town of Terrace. North of Lava Lake the road parallels the western boundary of the study area. A logging road turnoff to the east provides access to the valley of Crater Creek. A foot trail from the logging road descends into the valley intersecting the lava flow about a kilometer below the volcanic cone. The study area may be entered by walking up the valley beyond the cone. The author found the valley bottom difficult to traverse.

The Kalum road joins the Nass road. Proceeding east along Nass road there is a turnoff, again to the right, to a logging road extending up Seaskinnish creek. The road provides access to the north side of the study area. It is to be upgraded for further use.

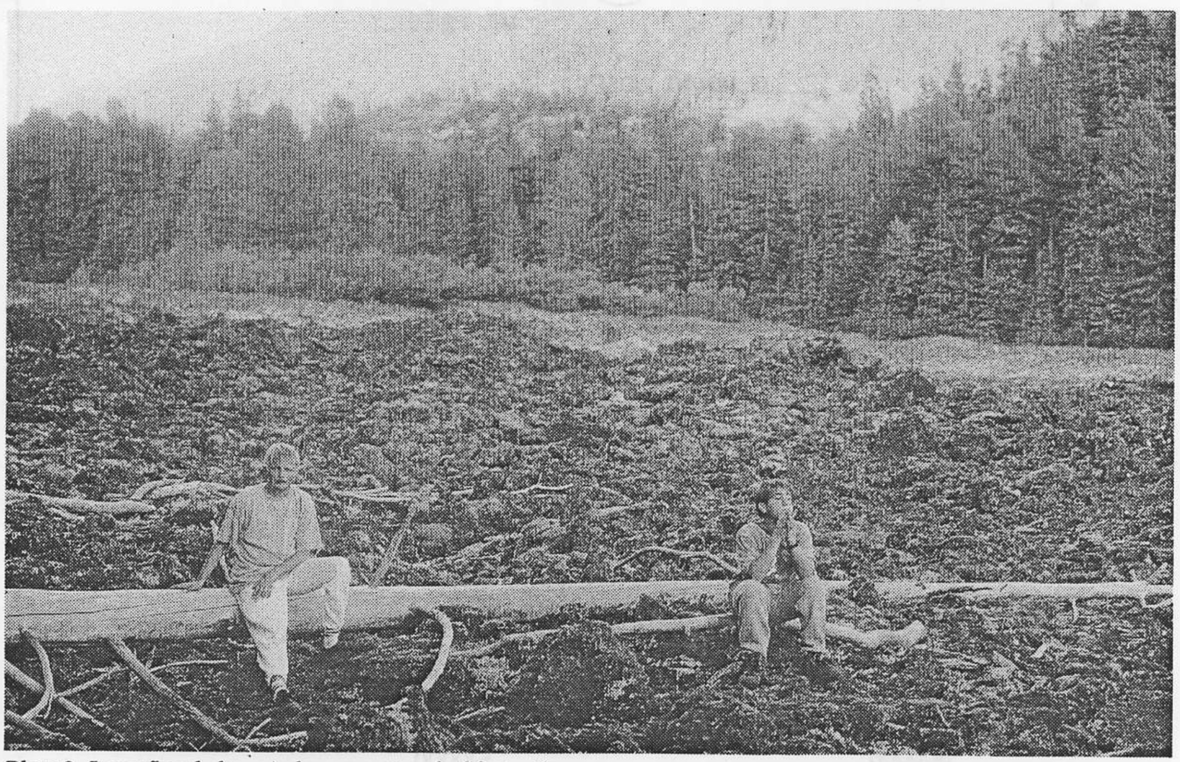


Plate 2. Lava flow below cinder cone at end of footpath.

The road ends below the ridge between Mt. Hoeft and Mt. Priestly. From the viewpoint of the ridge it appears possible to scramble up to the ridge from the road.

The most direct access to alpine ridges is by helicopter.

Physiography

The area lies in the Nass Ranges regional landscape (Youds, 1989). This landscape is typified by a temperate coastal montane climate and by rugged and serrate ranges. These ranges alternate with valley systems in north to south trending belts.

The study area encompasses the northern half of the watershed of Crater Creek. Ridges defining the watershed are mostly at elevations of 1500 to 1800 metres. Maximum elevation, represented by the peak of Mt. Priestly, is 2350 metres. Lava Lake, representing local base level, is only 172 metres above sea level. Relative relief is thus high.

Several small ice fields are present, the largest north of Mt. Phillipa.

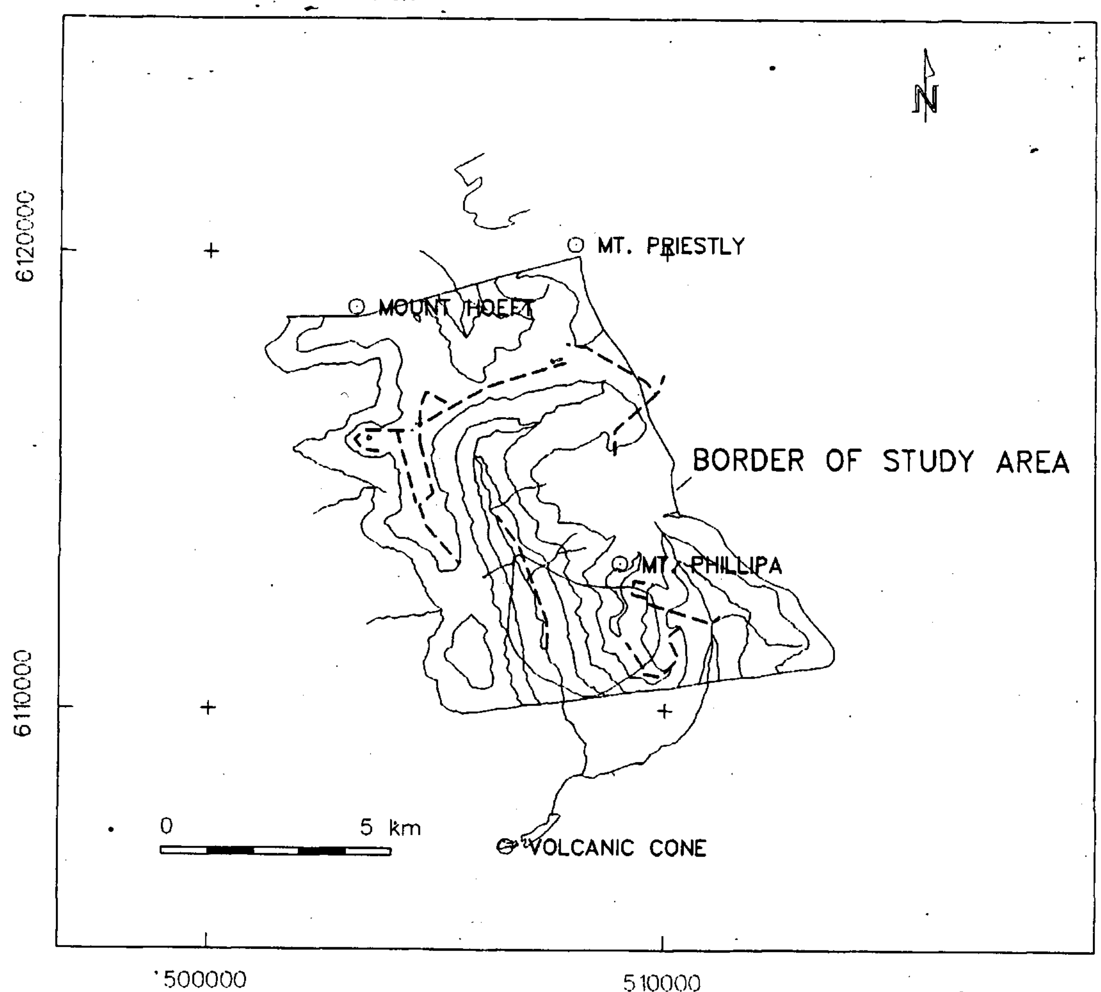


Figure 2. Traverse routes.

Plate 3. Upper valley of Crater Creek.

Purpose of the Study

The purpose of the field study was to gather information to help assess the potential for undiscovered mineral resources within the recreation area. Existing data was regional in relevance and needed to be augmented by local work.

Outline of Field Survey

A week in August 1992 was spent in the study area. Nass Camp was used as a base. A helicopter based at Nass Camp greatly expedited the work, providing access to alpine ridges without transit costs from Terrace. Work focussed on the following:

- Examination of nearby Minfile showings.
- Mapping and prospecting the ridges bounding the drainage basin of the Crater Creek valley.
- Rock and stream sediment sampling.
- Prospecting and mapping the border of the intrusive body south of Mt. Phillipa.

Traverses undertaken are shown in Figure 2.

Acknowledgments

Funding for this study was provided by the Ministry of Environment, Lands and Parks. Direction was provided by W.J. McMillan of the Ministry of Energy, Mines and Petroleum Resources. District Geologist Paul Wojdak provided regional expertise and facilitated local arrangements. Prospector Dan Ethier ably assisted the writer in the field, and demonstrated a sharp eye for mineralization.

GEOLOGIC SETTING

Regional

The area is situated just east of the contact between the Tertiary Coast Plutonic Complex and the Mesozoic Bowser sedimentary basin. In this setting, sediments are intruded by satellite granitic stocks of the Coast Complex.

Local

The study area is underlain mainly by rocks of the Bowser Lake Group. This succession of siltstones, mudstones, sandstones and greywackes is of Jurassic-Cretaceous age.

Just north of the study area a granitic intrusion underlies the area of Mt. Priestly. It has been dated at 49 million years by the potassium-argon (K-Ar) method. It is thus Tertiary (Eocene) in age. A second granitic intrusion, probably of similar age, lies immediately south of Mt. Phillipa within the study area.

A Quaternary cinder cone south of the study area was active in the 1700s but is now apparently extinct. One or more basalt flows emitted from a source near the cone descended the valley of Crater Creek, the Tseaux River, and spread out in the main Nass valley, destroying two aboriginal villages. Characteristics of the flow and volcanic cone are reported by Hanson (1924) and by Sutherland Brown (1969).

A north-south structural lineament that is quite distinct on air photos, and is interpreted to be a fault, transects the west side of the study area. The cone appears to lie on its southern extension.

Elements of the geology are shown in Figure 3.

Mapping coverage

The area was mapped on a reconnaissance scale by Hanson (1923). Hanson noted an area underlain by intrusive rock within the present study area. Carter and Grove (1971) further defined this as two separate intrusives, one in the vicinity of Mt. Phillipa and the other at Mt. Priestly. The location and dimensions of the area underlain by intrusive rock was not well defined at a 1:250 000 scale of compilation.

South of the study area, along the structural trend, there has been more recent mapping at a scale of 1:125 000 (Van der Heyden and Hill, 1985).

EXPLORATION HISTORY

Local Activity

There are no current valid mineral claims in the stndy area and there is no record of exploration. The cinder cone and lava flow immediately to the south are protected from exploration activities. A mineral reserve was established in 1971, and the Nisga'a Memorial Lava Bed Park was created in April 1992.

Regional activity

To assess the regional potential a larger area, some 250 000 hectares enclosing the study area was chosen. This area includes all MINFILE and assessment work sites in the vicinity. The distribution of assessment work sites is shown in Figure 4 and mineral deposit

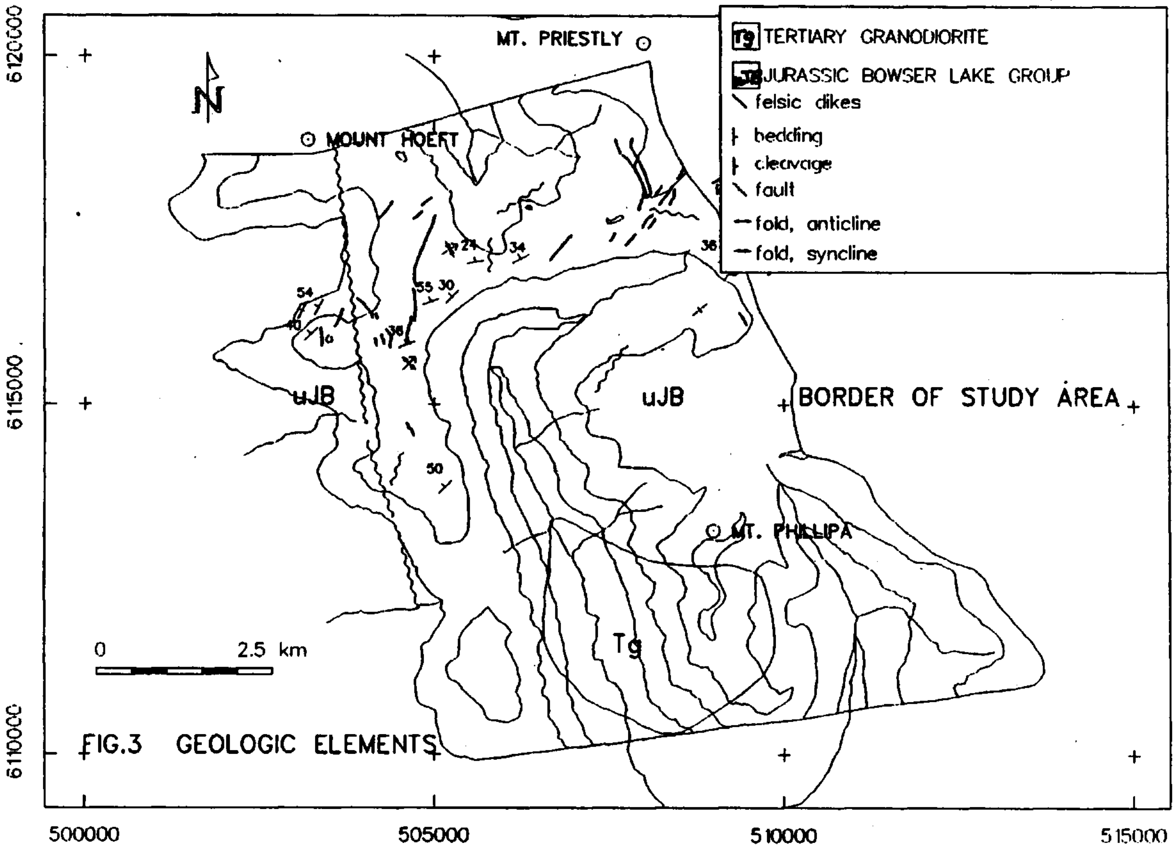


Figure 3. Geologic elements.

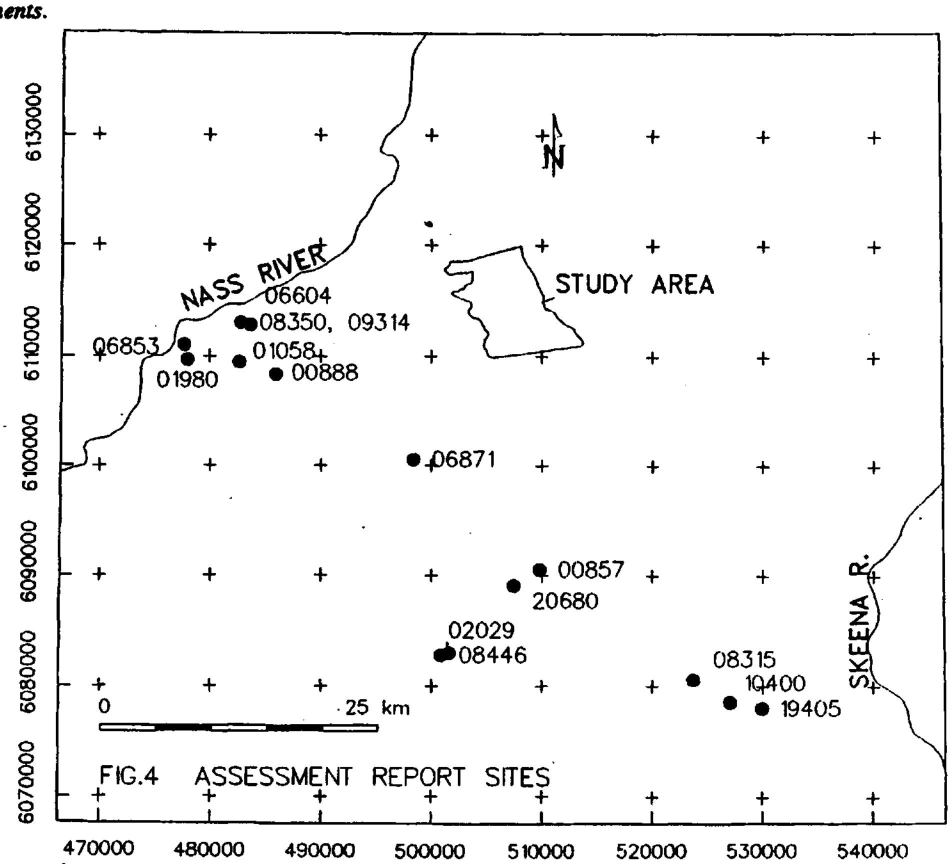


Figure 4. Assessment report sites.

sites in Figure 5. Table 1 summarizes the latest assessment work carried out on each property and Table 2 the mineral occurrences.

Prospectors and miners in the early part of the century focussed on developing narrow polymetallic vein deposits found south and south-southeast of the study area. Mineral showings such as the Hunter, Hope Silver (Silver Ghost), Bermaline (Frankie Blue), July and September were discovered and tested during this period. These early properties, accessed by packhorse trails, are well described by Kindle (1937a, 1937b). Most of the small workings on these lode veins were abandoned in the 1930's. Small shipments of high grade ore were made but the quantities and grades were not recorded.

Until the 1950s there was a small amount of placer gold produced, principally from Douglas and Lorne Creeks in the south. The total recorded production was about 11 kilograms of gold, but the actual unrecorded production may have been much greater. Most of the gold recovered came from hydraulic mining of an ancient gravel-filled channel of Lorne Creek known as Dry Hill pit.

In the 1960s, 1970s and early 1980s companies explored for porphyry molybdenum deposits along the east margin of the Coast Plutonic Complex. Intrusive bodies carrying molybdenum (and copper) mineralization were discovered in the area (Big Joe, Macex, SLC claims). Geochemistry was the key to at least one discovery. The SLC claims were staked and eventually drilled by Newmont Exploration based on joint Federal and B.C. government Regional Geochemical Survey (RGS) silt sample results of 48 ppm molybde-

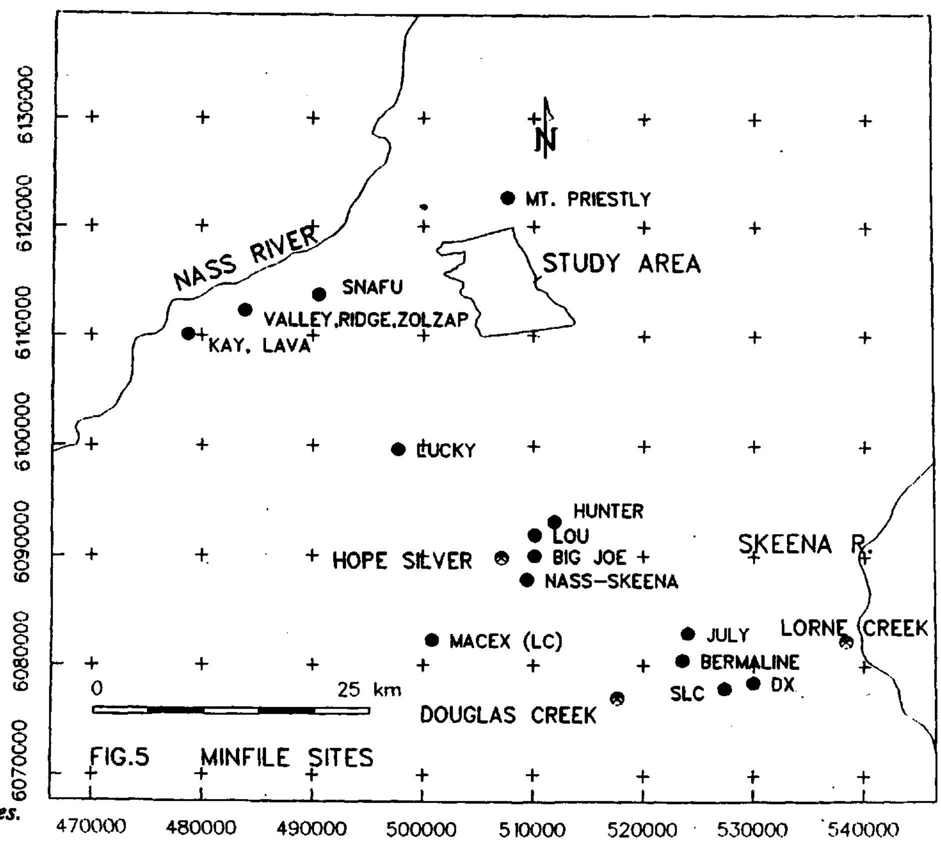


Figure 5. MINFILE sites.

num, 184 ppm copper and 14 ppm tungsten.

During this time quartz-filled shear zones carrying minor copper, lead and zinc were found on Cedar Creek (Lou showing). There was a small amount of production from the Hope Silver property in 1966 when five tonnes of sorted ore were shipped. 7527 grams of silver, 151 kilograms of copper, and 292 kilograms of lead were recovered from this shipment.

There has been little exploration work during the last five years. Additional electric current conductors, possibly indicative of hidden breccia veins have been found in drift covered areas surrounding the old workings of the Hope Silver (Silver Ghost) property. A narrow but hereto unknown quartz vein carrying lead and copper was found in pursuing gold bearing quartz float on the DX property. This property lies on well prospected ground in the valley of South Lorne Creek.

TABLE 1
PROPERTY ASSESSMENT WORK

A. R. Number	Year	Claim Name	Work Done		Target
00857	66	Big Joe	SOIL		Porphyry Molybdenum
02029	69	Macex	IPOL	MAGG	Porphyry Moly-copper
08315	80	Frankie Blue	HYDG	PROS	Vein
08446	80	Lc	GEOL	SOIL	Porphyry Moly-copper
10400	81	Slc	DIAD		Porphyry Moly-copper
19405	89	Dx	PROS		Gold Vein
20680	90	Silver Ghost	EMGR	GEOL	Breccia Vein
00888	66	Bolo	GEOL		Unknown
01058	67	Kay	GEOL		Porphyry Molybdenum
01980	69	Kay	ROCK	SOIL	Porphyry Molybdenum
06604	77	Ridge	LINE		Porphyry Molybdenum
06853	78	Lava	PROS		Porphyry Molybdenum
06871	78	Twin	PROS		Porphyry Molybdenum
08350	80	Valley	PROS	SOIL	Porphyry Molybdenum
09314	81	Zolzap	GEOL	LINE	Porphyry Molybdenum

Codes:
DIAD=SURFACE DIAMOND DRILLING
EMGR=ELECTROMAGNETIC, GEOPHYSICS
GEOL=GEOLOGICAL
HYDG=WATER GEOCHEMISTRY
IPOL=INDUCED POLARISATION, GEOPHYSICS
LINE=LINE CUTTING
MAGG=MAGNETIC, GEOPHYSICS
PROS=PROSPECTING
ROCK=ROCK GEOCHEMISTRY
SOIL=SOIL GEOCHEMISTRY

TABLE 2
MINERAL OCCURRENCES

MINFILE	NAME	COMMODITIES						STATUS	HOST ROCK	DEPOSIT FORM	ASSESSMENT REPORT NO.
103I 024	SEPTEMBER	AG						SHOW	Bowser Lake Group	Polymetallic quartz vein	
103I 026	BERMALINE	AG	PB	CU	AU	ZN	MO	SHOW	Bowser Lake Group	Quartz veins	8315
103I 204	DOUGLAS CREEK	AU						PAPR	Gravel	Placer	
103I 025	JULY	CU	AG					SHOW	Bowser Lake Group	Polymetallic quartz vein	
103I 115	LOU	ZN	PB	CU	AG	AU		SHOW	Bowser Lake Group	Polymetallic quartz vein	
										in shear	
103I 022	HOPE SILVER	AG	CU	PB	ZN			PAPR	Bowser Lake Group	Polymetallic quartz fault	26680
										breccia	
103I new	DX	CU	AG	PB				SHOW	Feldspar Porphyry	Quartz vein	19405
103I 222	HUNTER	AG	PB	ZN	CU			SHOW	Bowser Lake Group	Polymetallic quartz vein	
103I 002	NASS-SKEENA	COAL						SHOW	Skeena Group	Stratabound fossil fuel	COAL 229
103I 023	BIG JOE	MO						SHOW	Granodiorite	Narrow quartz veins	857
103I 021	MACEX	CU	MO					SHOW	Bowser Lake Group	Quartz veins near intrusive	7570, 8446
103P 236	MT. PRIESTLY	MO						SHOW	Granite	Unknown	
103P 232	SNAFU	MO						SHOW	Feldspar porphyry	Disseminated, quartz veins	8656
103P 238	LUCKY	MO	CU					SHOW	Granodiorite Porphyry	Quartz veins	6871
103P 225	KAY, LAVA	MO						SHOW	Monzonite Porphyry	Disseminated, quartz veins	6853, 8856
103P 231	VALLEY,RIDGE	MO						SHOW	Monzonite Porphyry	Disseminated, quartz veins	8350, 9314
	ZOLZAP										
SHOW= SHOWING											
PAPR= PAST PRODUCER											

MINERAL RESOURCES

Polymetallic Quartz Veins

Commodities within these veins include lead and zinc with silver, copper, and very minor gold. Minerals carried by these veins include one or more of galena, sphalerite, chalcopyrite, tetrahedrite, pyrrhotite and arsenopyrite. The veins generally are associated with shears, faults and dikes in the Bowser Lake Group. The veins may also be hosted in intrusive stocks. The veins consist of silicified and brecciated host rock in linear trends, irregular fracture veinlets, or quartz bands interlayered with gangue. The veins are usually narrow (less than a metre) and short (a few tens of metres). They may follow bedding or crosscut it. One of the better examples of this deposit type is the Hope Silver property (MINFILE 103I 022) where a 6 to 9-metre-wide breccia zone strikes southeast and dips steeply southwest. Veining and sulphide mineralization is best developed in the sheared footwall of the zone. The breccia is hosted in dark grey siltstones. Ore minerals include pyrite, sphalerite, galena, chalcopyrite and tetrahedrite.

Shear zones of similar strike and dip continue for several hundred feet southeast of the old workings. Some have narrow quartz-breccia vein development.

Porphyry Molybdenum

Numerous molybdenite showings are known north and west of the study area. The showings are associated with small intrusive stocks and dike swarms near the eastern margin of the Coast Plutonic Complex. The intrusives are often elongate suggesting emplacement along faults (Carter 1981).

Molybdenite occurs in stockworks of quartz veinlets and as disseminations and fracture coatings within the intrusive or adjacent to it in its country rock. Molybdenite is also found in gouge zones and shears. The intrusive may be largely unaltered as at the MT. PRIESTLY and BIG JOE properties or it may be pyritic, with areas of brecciation and silicification as at the LUCKY. The intrusion may be porphyritic. Porphyritic granodiorites or monzonites with crowded euhedral phenocrysts of plagioclase constituting up to 40 % of the rock by volume are locally known as "Alice Arm type porphyries" as at the SNAFU and LUCKY showings. Mineralization is also found in late phases of the intrusive, such as aplitic and alaskitic dikes.

The intrusive may vary in form, being equidimensional or elongate (dike-like). Molybdenite may be accompanied by some chalcopyrite as at the MACEX, LUCKY showings. Certain directions of fracturing or veining may carry more mineralization.

Placer Gold

Modest placer gold deposits are localized in the gravels of Douglas and Lorne Creeks. Both creeks head in the same mountain (Duffell and Souther, 1964). No other creeks in the area have been productive.

Coal

South of the study area, six coal seams are exposed along the steep banks of Little Cedar River over a distance of about half a mile. Two of the seams are about a meter thick and contain 20-30% ash. The seams trend generally east northeast. Dip varies from 50 to 20 degrees. The seams occur in the Skeena Group, a sequence of carbonaceous sandstones and shales that elsewhere contains major reserves of coal (Klappan coalfield). The Skeena Group forms a northwest trending belt of exposures, bounded by faults (Hill and van der Heyden, 1985).

POSSIBLE DEPOSIT TYPES

Based on regional data the study area was seen to have potential for precious and polymetallic veins in Bowser Lake Group, molybdenum in quartz stockworks associated with intrusive stocks and dikes,and coal in a possible northern extension of Skeena Group sediments.

NEW INVESTIGATIONS

Geological Mapping

Mt. Phillipa Intrusive

The body was remapped. It underlies an area about two by three kilometers in dimension. The intrusive consists of biotite granodiorite, well exposed on the ridges south of Mt. Phillipa and along the eastern wall of Crater Creek valley. On the west side of Crater Creek valley the contact of the intrusive can be traced across the tops of a set of gullies near the valley bottom. The rock is generally equigranular and uniform. It is cut by occasional narrow barren quartz veins that may contain large crystals of hornblende. The texture is unlike that of the crowded porphyries of the "Alice Arm type". Near its north and southeast borders there are some aplitic and alaskitic dikes with muscovite mica rather than biotite. There are also minor zones of clay and silica alteration including vuggy quartz breccia zones.

Bowser Lake Group

It was not possible to subdivide the Bowser Lake Group in the study area. Bowser

Plate 4. Intrusive contact at Mt. Phillipa. Reddish hornfels underlies peak.

Plate 5. Felsic dike sets in the Mt. Hoeft area.

sequences are dominated by either sandstone or shale.

Sandstones: The sandstone layers are graded with load casts at their bases indicative of rapid deposition, and contain siltstone rip-up clasts indicative of erosion. The more massive sandstones show features consistent with deposition from density currents (turbidites). The sandstones display parallel lamination and are often overlain by thin beds of rippled to laminated siltstone. A few bedding surfaces display migrating dune ripples.

Some sandstone beds are calcareous, flaggy-weathering, and weather to an orange brown color. Locally such sandstones contain bivalve fossils. These sandstones were probably deposited in shallower seawater than the turbidites.

Shales: The shales consist of grey-black siltstones, mottled mudstones and grey paper shales grading into fine sandstones. Some of the siltstones are pyritic and siliceous.

Dikes and Sills: Numerous thin dikes and sills are present in the study area. Represented are feldspar porphyries, mafic rich to mafic poor syenites and granodioritic rocks. Grain size varies considerably, possibly reflecting volatile content and depth of emplacement below the surface.

Plateau basalt: An area shown to be underlain by plateau basalt on older maps (Carter and Grove, 1971) was not found during the field study. Well jointed red hornfels underlies the ridge where plateau basalt was previously identified. Possibly it was misidentified as columnar basalt from the air. Alternatively the basalt might be in the valley bottom and hidden from view.

Structural Features

The structure of the area is complex and difficult to discern in detail due to a lack of marker units in the sediments of the Bowser Lake Group.

Faults: The principal structural feature of the area is the Western fault, a major north-northwest trending fault zone that transects the study area near its western margin. The young volcanic cone also lies along the extension of this lineament. The fault is apparently the northern extension of a fault identified in NTS 103I (G.S.C. Open File 1136), and believed to be part of a a major structure underlying the Kalum-Kitimat Valley (Duffel and Souther, 1964). The geology in the south suggests that the east side of the fault has moved upward and northward relative to the west side. Fracturing and composite quartz veining is associated with the Western fault in the study area.

A few small faults are identified on the geology map; many others are suspected.

Folds: We recognized several northeast trending plunging folds. The best exposed fold underlies the ridge separating Crater Creek and Seaskinnish drainage on the north. It is an asymmetric open syncline. The northwest limb dips steeply and the southeast limb dips at a low angle (24°) to the east. The southeast limb forms the "rib" of the ridge as well as the dip slope of the headwall of Seaskinnish Creek. There is a well developed axial planar cleavage here and throughout the area which obscures bedding in all but the more massive sandstones. Cleavage is easily mistaken for bedding in the area.

Dikes and Sills: Late sills and dikes are boudined, and faulted in step-wise fashion. Flow banding in some suggests they were emplaced while in a plastic state. Exposures on valley walls show convoluted patterns of emplacement, suggesting the host rock was undergoing deformation during emplacement.

Terrain Features of General Interest

The location of interesting features is shown in Figure 6, listed in Table 3 below, and described.

TABLE 3
TERRAIN FEATURES OF GENERAL INTEREST

FEATURE	UTM NORTH	UTM EAST	ELEVATION
FOSSIL BIVALVES	6116850	505250	5440' (1660m)
FOSSIL BIVALVES	6117600	509100	5640' (1720m)
WALLROCK REMNANT	6121700	505800	5250' (1600m)
VALLEY FILL BASALT	6128200	516900	3200' (980 m)
ASH & PUMICE	6111400	509400	5610' (1710m)
TARN AT NOSE OF FOLD	6115700	504700	5250' (1600m)
MOLYBDENITE ROSETTES	6111000	509500	5575' (1700m)
TURBIDITES	6118100	508100	5950' (1815m)

Ash & Pumice: Volcanic ash and pumice are preserved on outcrops of granodiorite on the alpine ridge five kilometers to the northeast of the volcanic cone. The ridge provides a down valley view of the cone and lava flow. The pumice lying in the rocky hollows of the alpine environment is loose, not incorporated in the thin soil. From the vantage point of the alpine environment it could have been deposited the previous night rather than a few centuries ago. Nearby blue-grey rosettes of molybdenite can be found within quartz veins cutting a granodiorite dike (*see* Prospecting).

Valley Fill Basalt: Basalts outcrop north of the study area near Mt. Hoadley about 12.5 kilometres northeast of Mt. Priestly. Examination of air photos and aeromagnetic maps suggested basalt outcropped in two valleys rather than on mountain slopes as represented by Carter and Grove (1971). The area was flown to confirm the presence of basalt lava flows similar to the Aiyansh flow.

Columnar basalt is observed in the two valleys. The basalt forms a high flat terrace above the present incised creeks. The edge of the terrace where it has been eroded is marked by continuous line of columnar basalt, apparently in several layers. Where the two lobes join, the inside margin of the terrace "welded to the valley wall", can be continuously traced from one valley into the other. Glimpses into the incised canyons of each valley suggest the present creeks have cut below the floor of the basalt, i.e.. the ancient valley bottom. In each lobe the basalt thickens toward the valley junction. The downstream thickening, horizontal layers, and spectacularly uniform cooling features suggest these lobes originated by ponding of lava (in a lava lake?). Unexplained is the nature and location of the barrier that was responsiblo for ponding of the lava. East of the valley junction only a remnant of the basalt terrace is preserved as a flat topped promontory against

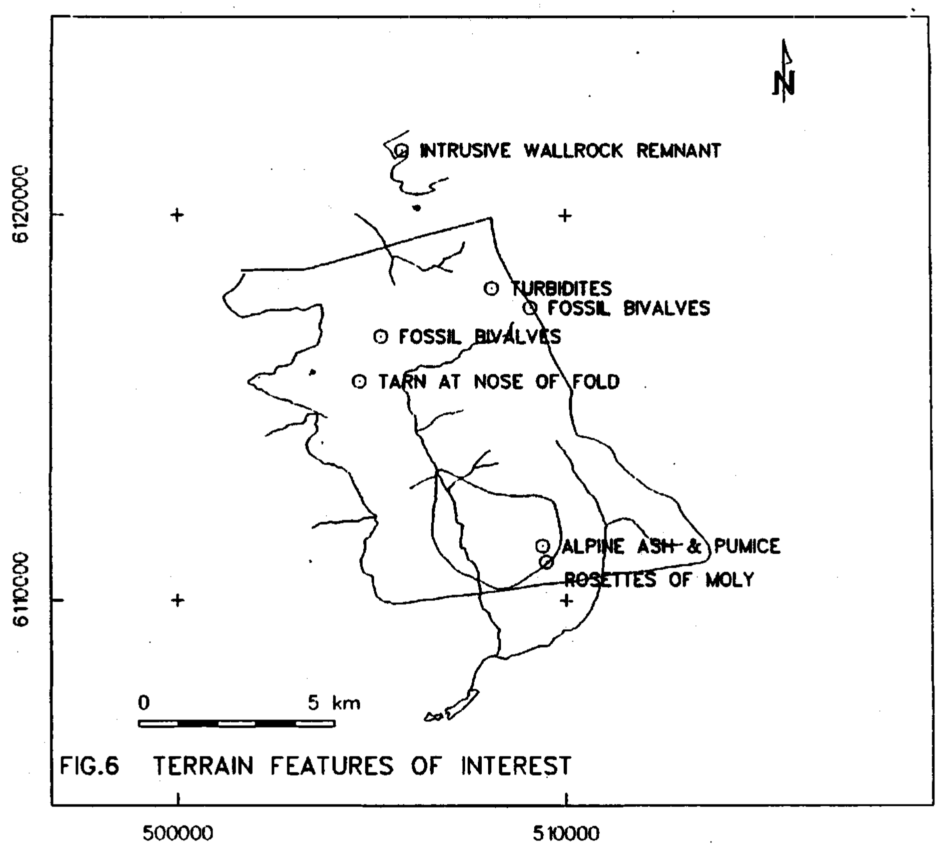


Figure 6. Terrain features of general interest.

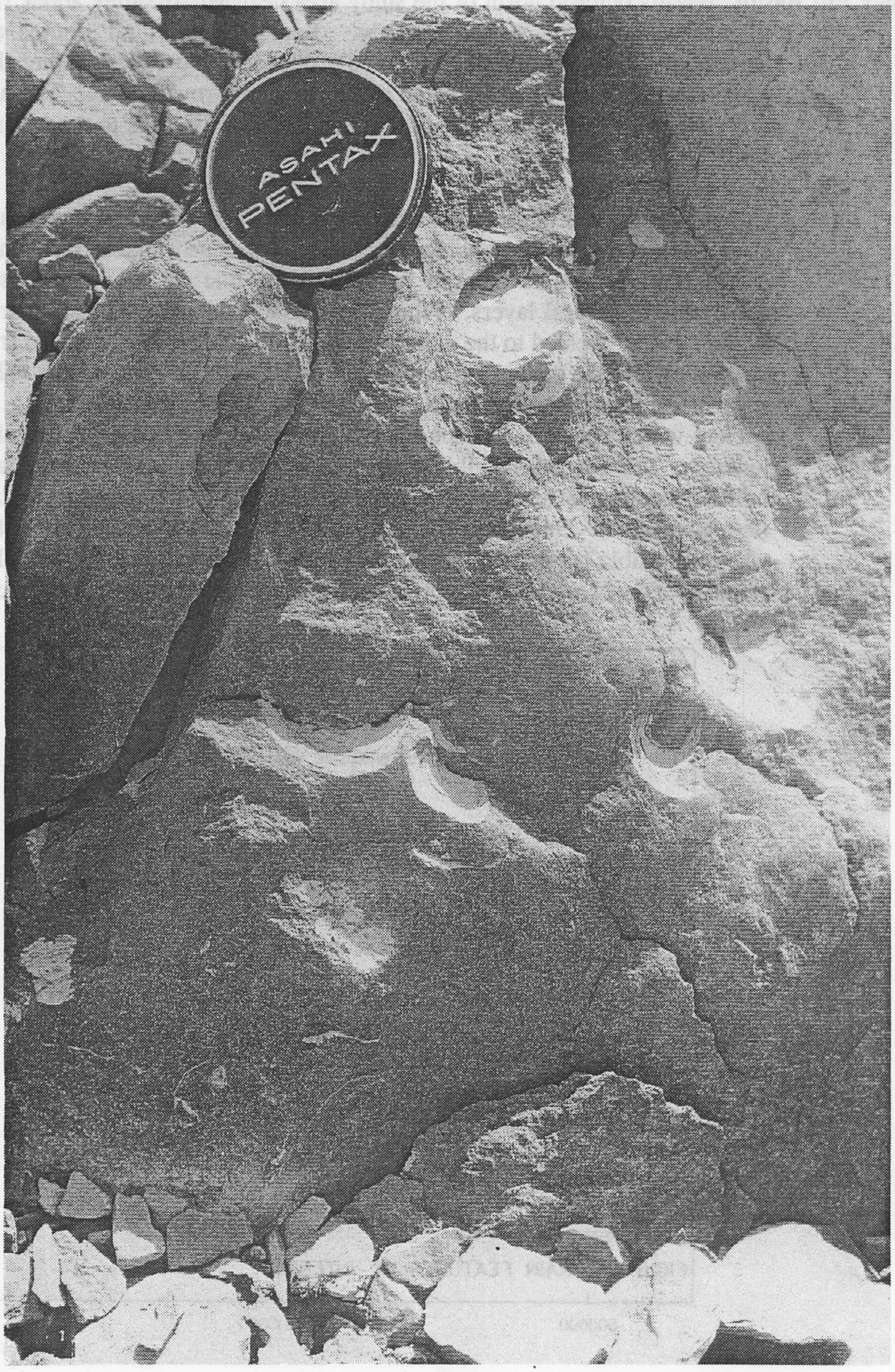


Plate 6. Fossil bivalves in sandstones of Jurassic-Cretaceous Bowser Lake Group.

plate 7. Plunging fold outlined in tarn.

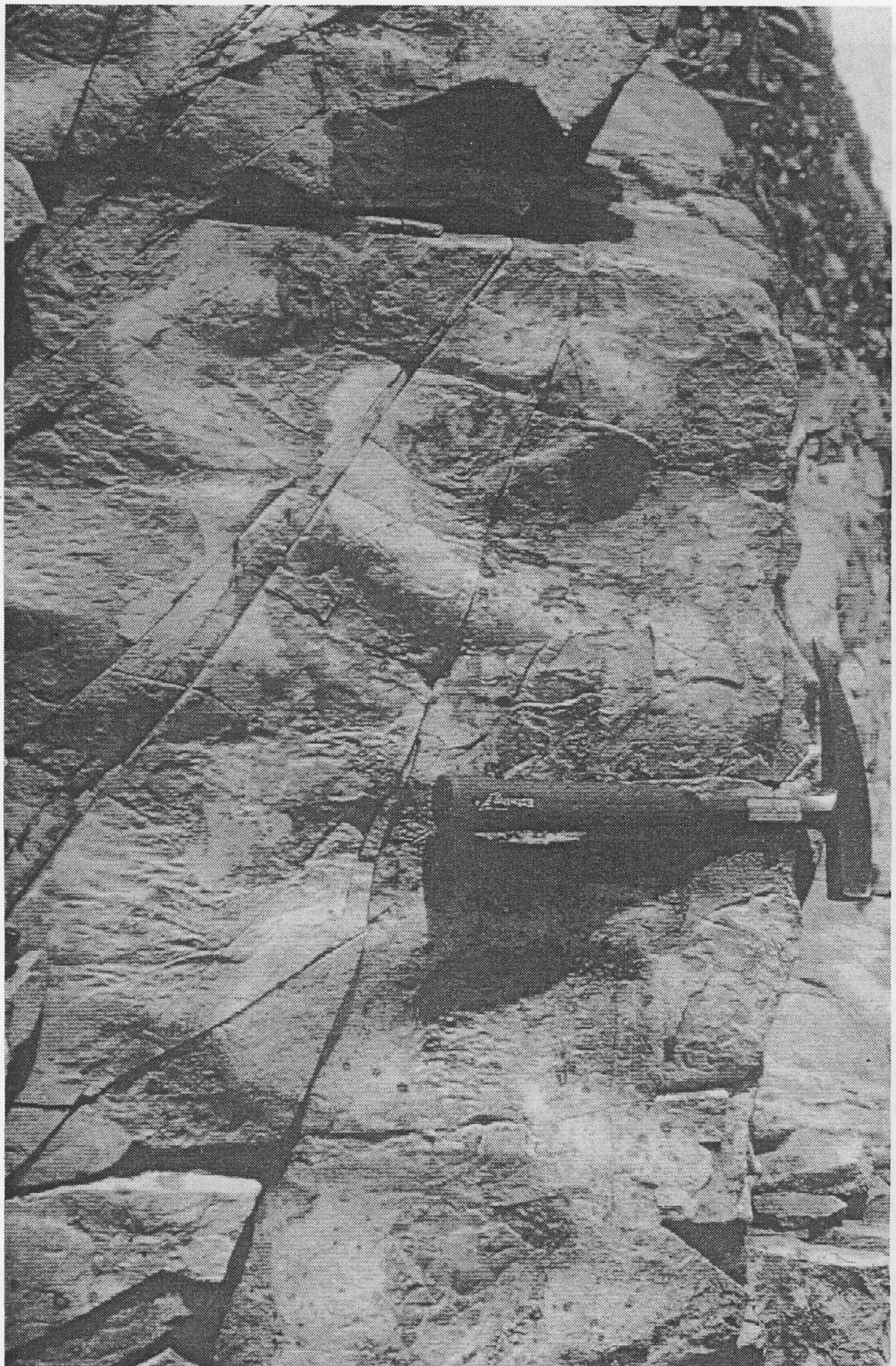


Plate 8. Lunate ripples on sandstone bed, Bowser Lake Group.

the valley wall. The promontory is draped by glacial deposits, obscuring bedrock underneath. The single valley continues eastward and joins the north trending Kiteen valley. If basalt was present east of the promontory, it has been subsequently eroded out.

The surface of the basalt lobes is forested, swampy, pitted with ponds. Linear grooves, apparent on airphotos, suggest the lobes have been overridden by valley glaciers. Data from similar basalts in the region (Grove 1986) suggest they may be about half a million to a million years old.

Wallrock Remnant: North of the study area hornfelsed wallrock of the Mt. Priestly intrusive is preserved as a spectacular erosional remnant against the glacial valley wall. Elsewhere the valley wall consists of pale intrusive rock except for the dark tear-shaped outline of the baked wallrock.

Tarn at Nose of Fold: On the ridge above the valley in the northwest corner of the study area, a small horseshoe-shaped tarn outlines the plunging nose of an anticlinal fold.

Fossil Bivalves: Fossil marine bivalves with both valves intact were found at several localities. In addition pyritic pseudomorphs of shells with fibrous aragonite(?) occur in black shales near the retreating glacial tongue at the head of Crater Creek.

Prospecting

The locations of samples the prospector collected for lithogeochemical analysis is shown in Figure 7 and the results of analyses in Table 4.

Intrusive border: A molybdenum showing occurs in a granodiorite dike peripheral to the Mt. Phillipa intrusive. The dike trends 240 degrees and cuts hornfelsed sediments. Within it several sets of narrow quartz veins contain scattered coarse rosettes of molybdenite. The veins are only a few centimetres wide and cut the dike at a slightly oblique angle; none extend beyond the dike margin. A total of perhaps 15 veins were found over a strike length of 70 metres. The dike is 3 to 5 metres in width and terminates to the southwest at a fault. To the northeast the dike continues a few tens of metres to a steep drop-off but few veins occur. A metre chip sample across a set of narrow veins returned modest values for molybdenum (0.04%), perhaps due to the nugget effect in a small sample (45748).

The intrusive near its margin is cut by occasional drusy quartz veins, and aplitic and alaskitic dikes that carry minor pyrite and traces of molybdenite. One sample of pyritic, molybdenite-bearing intrusive (sample 45746, Figure 7) also returned a response in silver (27 g/t) and copper (.05%).

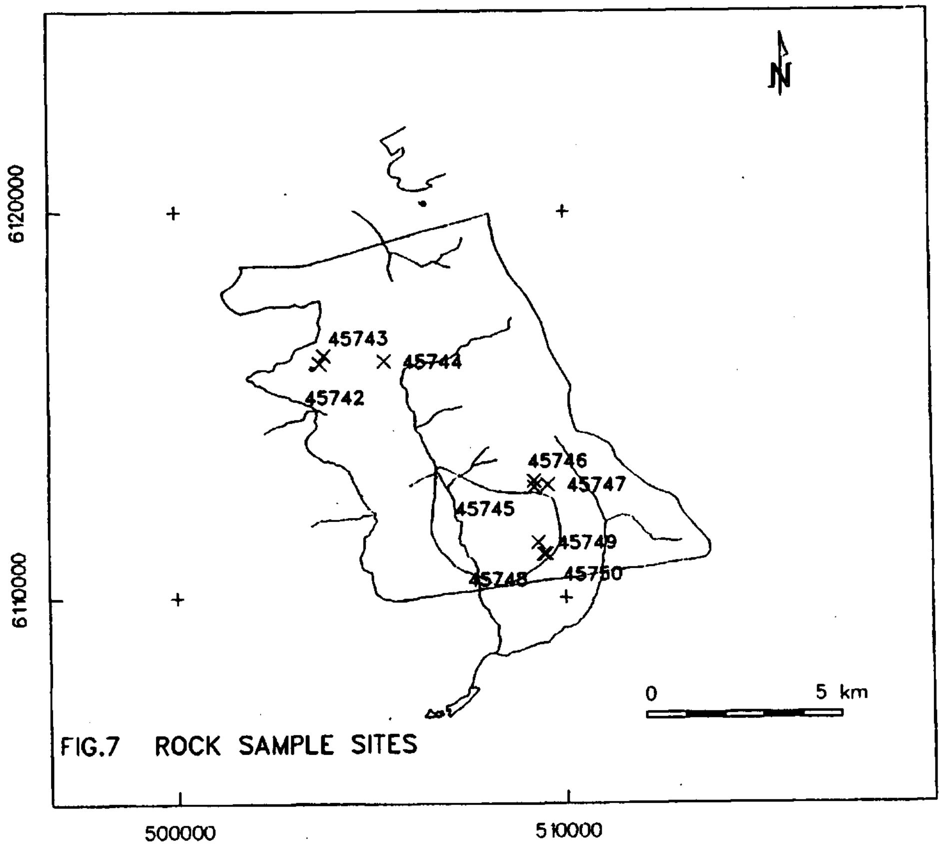


Figure 7. Rock sample sites.

TABLE 4
ROCK SAMPLES: ELEMENT VALUES

UTM North	UTM East	Sample No.	Sample Type	Rock Type	Zn ppm	Cu ppm	Pb ppm	Ni ppm	Co ppm	Ag ppm	Mo ppm	Au ppb
6116050	503700	45742	Select	Q-Py V in SLSN	135	15	16	2	146	3	-	40
6116250	503800	45743	Select	"Black" Shale	91	40	18	32	38	0	-	10
6116100	505350	45744	Select	Fine Py Dike	26	3	27	3	30	1	-	65
6112850	509200	45745	Float	Q-Py-C Y GRDR	124	179	96	0	84	2	47	45
6113000	509200	45746	Select	PY GRDR	157	511	211	0	85	27	1153	40
6112900	509550	45747	Select	Silicified SLSN	59	545	14	37	80	2	6	5
6111100	509450	45748	Chip	Q V in dike	-	-	-	-	-	0	415	5
6111400	509300	45749	Select	Py-Mo GRDR	-	-	-	-	-	2	1600	10
6111100	509500	45750	Select	Q V in dike	-	-	-	-	-	2	318	5

Zn=ZINC
Cu=COPPER
Pb=LEAD
Ni=NICKEL

Co=COBALT
Ag=SILVER
Mo=MOLYBDENITE
Au=GOLD

V=VEINS
GRDR=GRANODIORITE
SLSN=SILTSTONE
Q=QUARTZ
Py=PYRITE

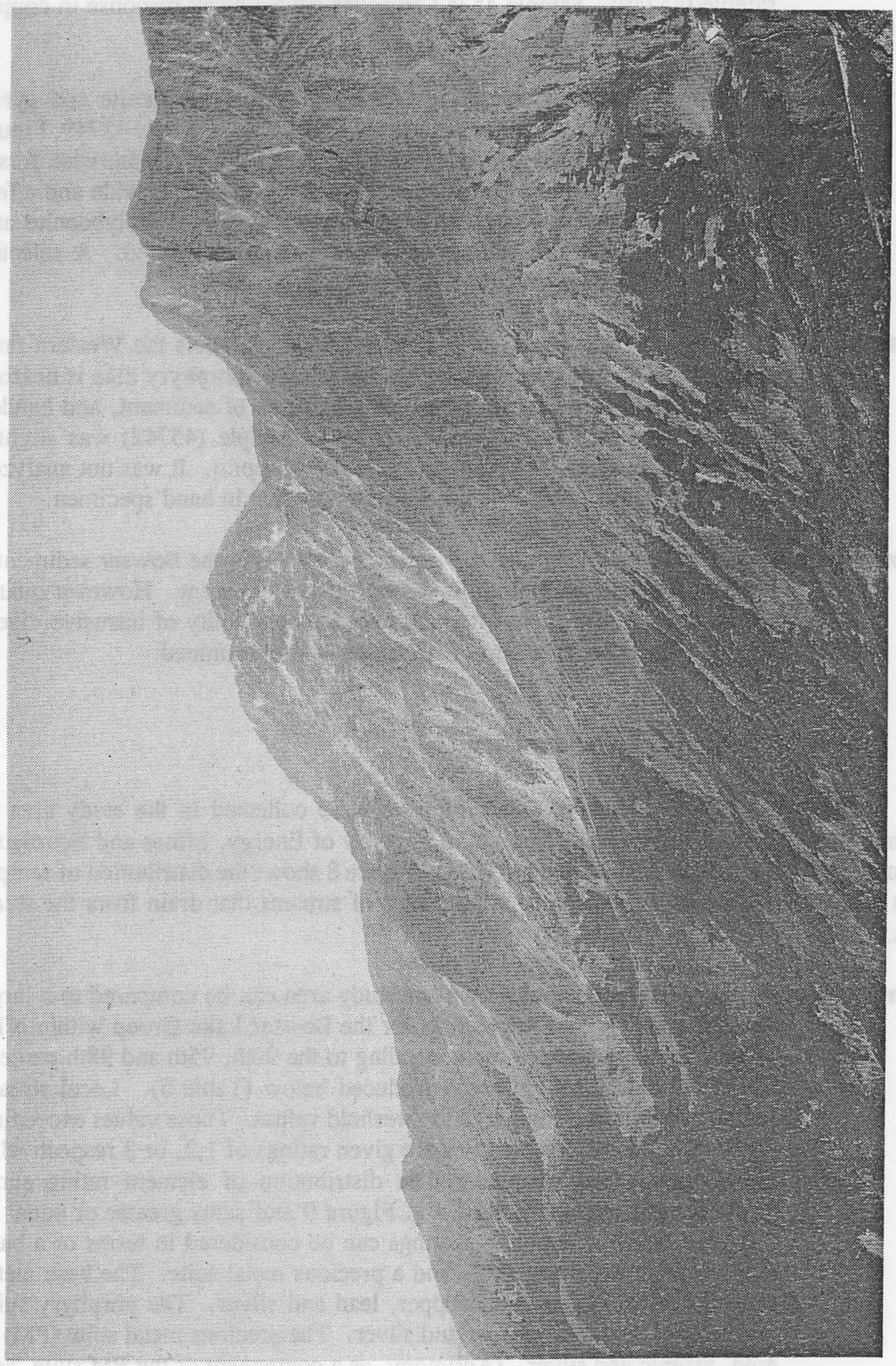


Plate 9. Wallrock remnant, Mt. Priestly intrusive.

This was not repeated in nearby localities (45745, 45747) or in similar rock sample (45749). Sample 45747 however gave a weak response in copper (0.05%).

Intrusive: A molybdenum showing consisting of disseminated molybdenite and pyrite occurs within granodiorite at the head of a rock gully (sample 45749, Figure 7). Exposure is good and consists of a patchy zone in otherwise fresh, equigranular intrusive. The zone is less than half a meter wide and a few meters long. Surrounding exposures contain traces of molybdenite and signs of very weak shearing. No other zones were found. A selected sample (45749) assayed 0.16% molyhdenum.

Western fault: A quartz breccia zone, up to 4 meters wide, parallels the Western fault and is traceable for over 150 meters. A feldspar porphyry dike is nearby. The vein consists of quartz cemented fragments of sediment, and banded quartz with disseminated pyrite. A select sample (45742) was slightly anomalous in silver (3.2 ppm) and cobalt (146 ppm). It was not analyzed for molybdenum. Molybdenite was not apparent in hand specimen.

Bowser sediments: Erratic thin lacy quartz veining is common in the Bowser sediments. No spatial relationship with intrusive rocks is apparent. However quartz breccias were seen more often than not in the vicinity of intrusive dikes. These breccias were barren of sulphides where examined.

Stream Sediment Geochemistry

Eleven additional stream sediment samples were collected in the study area to augment those already collected as part of the Ministry of Energy, Mines and Petroleum Resources, regional geochemical survey (RGS). Figure 8 shows the distribution of sample sites relevant to the study. It includes sample sites of streams that drain from the study area.

Element Evaluation: Analytical results from the study area can be compared to a large data set of 1213 sample locations for the Bowser Lake Group within NTS 103P. Threshold values corresponding to the 90th, 95th and 98th percentiles for the regional set are reproduced below (Table 5). Local stream sediment values are compared to threshold values. Those values exceeding the 90th, 95th, 98th percentiles are given ratings of 1,2, or 3 respectively. These ratings are summed. The distribution of element rating sums (multielement ratings) is shown in Figure 9 and sums greater or equal to three are listed in Table 6. Ratings can be considered in terms of a base metal suite, a porphyry suite, and a precious metal suite. The base metal suite (BM) comprises zinc, copper, lead and silver. The porphyry suite (PO) is molybdenum, copper and silver. The precious metal suite (PM) is gold, arsenic and silver. (Antimony, as a component of the PM suite, and

Plate 10. Site of molybdenite showing in rocks of Mt. Phillipa intrusive.

tungsten, in the PO suite, were not considered due to low concentrations and incomplete analyses) Higher ratings in these suites are described below as anomalies.

TABLE 5
RGS SAMPLE SET: THRESHOLD VALUES

Element	Total No. of Samples	Percentile 90th	95th	98th
Zinc	1213	184	230	310
Copper	1213	72	86	110
Lead	1213	14	18	33
Nickel	1213	123	140	152
Cobalt	1213	27	32	41
Silver	1213	0.3	0.5	0.8
Manganese	1213	2700	4400	8700
Iron	1213	4.9	5.3	5.85
Arsenic	1213	32	55	80
Molybdenum	1213	3	5	8
Tungsten	1213	2	4	9
Mercury	1213	170	200	260
Uranium	1213	2	3	5
		ppm	*ppm*	*ppm*

TABLE 6
ANOMALOUS SAMPLES: ELEMENT RATINGS
(*see* text for explanation)

Lab No.	Zn	Cu	Pb	Ni	Co	Ag	Mo	As	Au	SUM	BM	PO	PM
781037	1	2	0	0	3	1	0	2	0	9	4	3	3
45860	0	0	0	0	0	0	3	0	0	3	-	3	-
45862	0	0	0	0	0	0	3	0	0	3	-	3	-
45863	2	0	2	0	2	1	0	1	0	8	5	1	2
45865	1	0	2	0	0	0	0	0	0	3	3	-	-
45866	0	0	0	0	0	0	3	0	0	3	3	-	-
45868	0	1	1	3	2	0	0	0	0	7	2	-	-

BM=BASE METAL SUITE
PO=PORPHYRY SUITE
PM=PRECIOUS METAL SUITE

Anomalies

Base Metal Suite: Sample 781037 is weakly anomalous in zinc-copper-silver. The sample site is just outside the north end of the study area on Seaskimish Creek near Mt. Priestly. No mineralization to account for the anomaly was noted during a traverse on the ridge above the headwaters of the creek.

A weak zinc-lead-silver anomaly is present at the head of Crater Creek

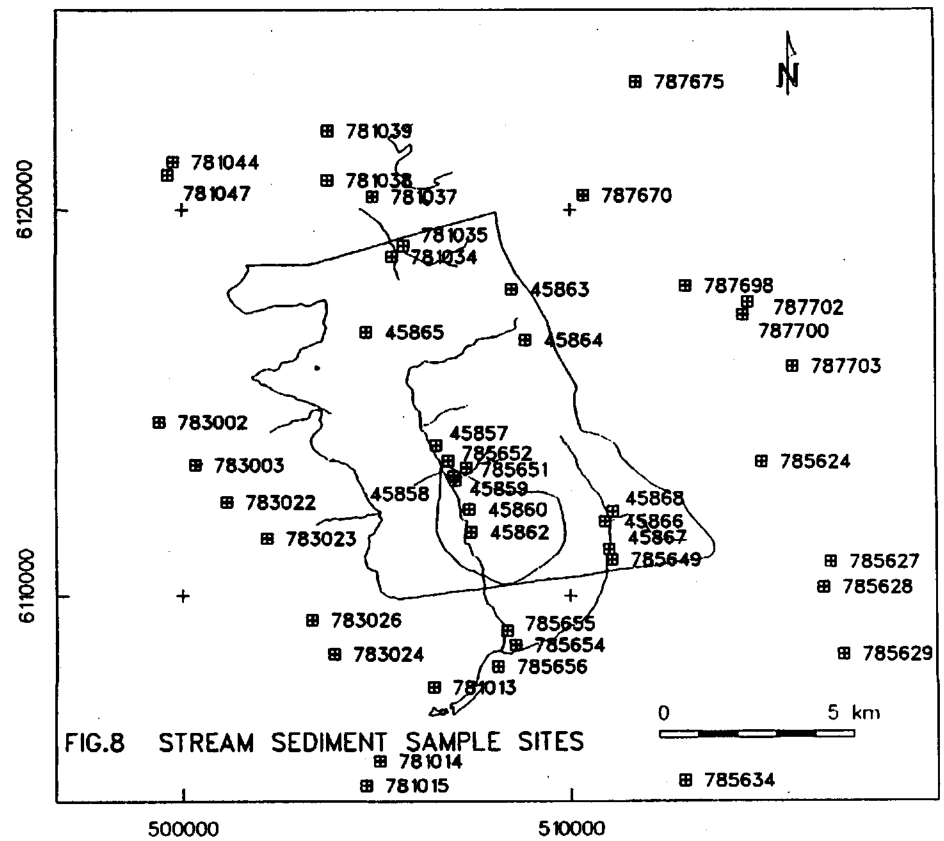


Figure 8. Stream sediment sample sites.

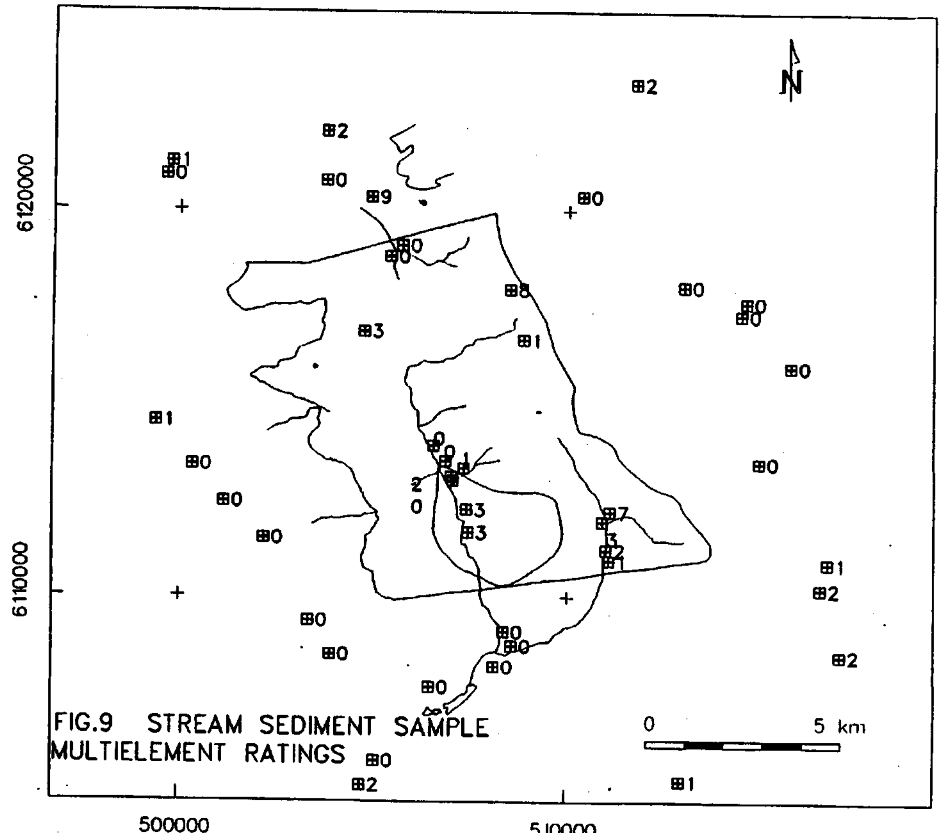


Figure 9. Stream sediment sample multielement ratings.

(sample 45863). Nearby are dark pyritic shales which tend to have elevated base metal and silver values. These are likely responsible for the higher values.

Porphyry Suite: A molybdenum anomaly is recognized in sample 45866 downstream of bedrock sample 45746 at the north end of the intrusive. The anomaly is about twice the 95th percentile for a granitic source.

Samples 45860, 45862 which reflect drainage from the core of the intrusive, are anomalous in molybdenum. Sample 45860 at 48 ppm is six times the 95th percentile or thrice the 98th percentile and well over detection limits of 1 ppm. This must be considered highly anomalous.

Two other samples with sediment derived from the hornfelsed border of the intrusive are not anomalous.

In summary three of five sampled drainages peripheral to the intrusive are anomalous in molybdenum. One sample is highly anomalous.

Precious Metal Suite: Gold is not anomalous in either stream silts or bedrock where sampled. A weak silver-arsenic anomaly is present in sample 781037 described above..

MINERAL POTENTIAL

Deposit Type Re-evaluation

Geologic mapping, prospecting, sampling, and delineation of major structures has resulted in a re-evaluation of the possible types of deposits and resources within the study area.

- Lack of gold geochemical response and historical data (*i.e.* no gold placer in streams draining the area) indicate that there is little potential for gold bearing precious metal veins.
- Younger coal-bearing strata are not preserved against the Western Fault as they are to the south in NTS 103 I/15. There is no coal potential.
- There is limited porphyry molybdenum and polymetallic vein potential.
- There is geothermal potential.

Porphyry molybdenum potential

The Mt. Phillipa intrusive is geochemically anomalous in molybdenum and selective samples from the east and north side of the intrusive carry modest amounts of molybdenite.

Certain geologic features characterize significant porphyry molybdenum deposits; these must be considered to evaluate potential. According to Carter (1981) these features include:

- base metal sulphide-bearing late quartz-carbonate veins
- evidence of multi-stage intrusion, and porphyritic textures
- large scale alteration in patterns (pyritic, potassic)
- several stages of molybdenum mineralization.

The Mt. Phillipa intrusive lacks these characteristic features. There is no variation in texture or mineralogy that would suggest separate intrusive phases are present. There is some sericitic, silicic, pyritic alteration but it is weak and patchy. Disseminated mineralization within the intrusive is localized and the potential volume of mineralized rock very small. Molybdenite oecurs in rare quartz vein sets but these are confined to a dike. They do not form a of appreciable density and size.

Other showings in the area have not been examined since the early 1980s. Some of them have better multielement geochemical signatures for porphyry mineralization. For example the SLC claims have an associated stream sediment anomaly in tungsten, copper and molybdenum.

The intrusive does not have any defined associatlon with precious metals in stream geochemistry but a single bedrock sample carried silver. Gold values are quite low, not exceeding 11 parts per billion in stream sediments or 65 ppb in hand specimen.

It is concluded the potential for a larger porphyry molybdenum deposit is low, but the potential is moderate for a smaller deposit.

Polymetallic Vein Potential

The potential for a small base metal vein deposit is moderate, based on rather weak geochemical anomalies. The best host structure would be the Western fault.

Geothermal Potential

As described previously the Western fault forms the east margin of a major fault zone whose topographic expression is the Kalum-Kitimat Valley. The volcanic cone at Aiyansh and the hot springs at Lakelse, south of Terrace, indicate an active part of the zone (Duffell and Souther, 1964). The Lakelse hotsprings are the hottest in B.C. (186° Fahrenheit). No earthquake activity is ascribable to the zone but available data is too recent to be conclusive.

South of the study area Skeena Group sediments are preserved as fault bounded segments within the Western fault zone. There are as well a number of elongate (dike-like) emplacements of Tertiary intrusives. Fracturing and faulting in the zone together with hotsprings and recent volcanism suggests geothermal potential is present in the Kalum-Kitimat valley.

This potential extends into the study area along the Western fault. The area immediately north (and south) of the volcanic cone should be considered to have moderately high potential.

CONCLUSIONS

Ground observations have improved the mineral status of the area. Several showings in molybdenite were found. The potential for a molybdenum deposit is moderate, but a small deposit is more likely. The Mt. Phillipa intrusive lacks indications that an extensive or pervasive hydrothermal system developed.

At this time, large low grade molybdenum deposits in British Columbia remain unexploited. Further there is no exploration activity on molybdenite showings nearby.

There is moderately high potential for a geothermal resource.

Although future metal exploration is possible the likelihood of a major deposit is small.

APPENDIX

Lithogeochemical Analyses

Rock samples collected for assay were passed through a jaw crusher, split and then pulverized in a tungsten-carbide ring mill. Multi-element analysis was done by Eco-Tech Laboratories of Kamloops B.C. Samples were analyzed by Inductively Coupled Plasma Emission Spectroscopy (ICP-ES). In addition three samples were analyzed for silver and molybdenum by atomic absorption spectroscopy (AAS). Gold was analyzed by fire assay with atomic absorption finish (FA-AAS).

Geochemical detection limits for each element is listed below in Table 7, together with the analytical method utilized.

TABLE 7
ROCK SAMPLES: DETECTION LIMITS

ELEMENT	METHOD	DETECTION LIMIT
Zn	ICP	-
Cu	ICP	-
Pb	ICP	2 ppm
Ni	ICP	1 ppm
Co	ICP	1 ppm
Ag	ICP	0.1 ppm
Mn	ICP	1 ppm
Fe	ICP	0.01%
Mo	ICP	1 ppm
Bi	ICP	5 ppm
Ba	ICP	2 ppm
V	ICP	2 ppm
Au	AAS	5 ppb

Stream Sediment Analyses

Samples collected complement data from a previously released Regional Geochemical Survey for 103P and 103I. Samples were prepared for analysis (sieving to -80 mesh) by the Analytical Services Laboratory, Geological Services Branch, Ministry of Energy, Mines and Petroleum Resources. Samples were analyzed by induced neutron activation (INNA) or by atomic absorption spectrometry (AAS) according to the suitability of the method for the element sought. Activation Laboratories Ltd. performed the INNA analysis. Gold was done by fire assay (FA) preconcentration with an AAS finish. Archived samples from 1978 have recently been re-analyzed for gold and other elements by INNA. Results were available and this data is included in the geochemical tables below (Tables 8, 9).

Geochemical detection limits for each element is listed below in Table 8 together with the analytical method utilized.

TABLE 8
STREAM SEDIMENT SAMPLES: DETECTION LIMITS

Element	Method	Detection Limit
Zn	AAS	2 ppm
Cu	AAS	2 ppm
Pb	AAS	4 ppm
Ni	AAS	5 ppm
Co	INNA	1 ppm
Ag	AAS	0.2 ppm
Mn	AAS	5 ppm
Fe	INNA	0.01%
As	INNA	0.5 ppm
Mo	INNA	1 ppm
Hg	INNA	1 ppm
Au	INNA/AAS	2 ppb/5 ppb

Nisga'a Memorial Lava Bed Recreation Area Legal Boundary Description

All those parcels or tracts of Crown land, together with all that foreshore or land covered by water, situated in Cassiar District and lying within the following described boundaries:

Commencing at the summit of Mount Hoeft;

Thence northeasterly in a straight line to the summit of Mount Priestly, being a point on the easterly boundary of the watershed of Seaskinnish Creek;

Thence southerly along the easterly boundary of the watershed of Seaskinnish Creek and continuing in a general southeasterly direction along the southeasterly boundary of the watershed of Creater Creek to a point on the 1981 metre (6500 foot) contour located 5150 metres distant on a bearing of 112 degrees and 30 minutes from the summit of Mount Philippa;

Thence southwesterly in a straight line on a bearing of 263 degrees, a distance of 8325 metres to a point on the 1372 metre (4500 foot) contour;

Thence in a general northeasterly direction along said 1372 metre (4500 foot) contour to a point thereon lying due west of the summit of Mount Hoeft;

Thence due east to said summit of Mount Hoeft, being the point of commencement.

The whole containing 6440 hectares, more or less.

Note: The above is a reproduction of the legal boundary description. It is presented as a guide only and does not supersede the original legal description.

TABLE 9
STREAM SEDIMENT SAMPLES: ELEMENT VALUES

Sample	UTM		Rock	Zn	Cu	Pb	Ni	Co	Ag	Mo	As	Au
No.	North	East	Type	*ppm*	*ppm*	*ppm*	*ppm*	*ppm*	*ppm*	*ppm*	*ppm*	*ppb*
781013	6107639	506470	SLSN	140	46	10	66	19	0.2	1	24.0	5
781014	6105736	505079	SLSN	146	48	12	103	22	0.1	1	19.0	9
781015	6105100	504720	SLSN	178	54	11	108	25	0.6	3	18.0	5
781034	6118798	505412	SLSN	114	34	7	43	18	0.2	1	12.0	3
781035	6119084	505716	SLSN	154	44	6	44	20	0.3	1	18.0	3
781037	6120339	504925	SLSN	230	94	8	74	46	0.4	3	68.0	8
781038	6120761	503749	SLSN	156	50	10	62	22	0.3	1	24.0	3
783003	6113397	500346	SLSN	122	40	9	54	19	0.3	1	22.0	0
783022	6112441	501161	SLSN	140	48	12	56	18	0.2	1	24.0	0
783023	6111485	502205	SLSN	182	66	13	75	25	0.3	2	27.0	3
783024	6108500	503922	SLSN	126	36	5	48	15	0.2	1	14.0	0
783026	6109368	503348	SLSN	108	36	8	56	16	0.2	1	13.0	0
785624	6113495	514924	SLSN	122	48	8	100	19	0.1	1	12.0	6
785625	6113495	514924	SLSN	116	46	6	96	17	0.1	1	11.0	6
785627	6110892	516709	SLSN	110	42	5	130	18	0.1	1	18.0	5
785628	6110224	516521	SLSN	124	46	8	134	20	0.1	2	35.0	6
785629	6108505	517040	SLSN	150	42	9	124	24	0.1	2	45.0	6
785634	6105235	512944	SLSN	126	62	9	132	24	0.1	1	24.0	6
785649	6110943	511073	SLSN	146	74	10	80	22	0.1	1	19.0	6
785650	6110943	511073	SLSN	150	76	10	82	24	0.2	1	20.0	7
785651	6113318	507327	SLSN	192	70	4	84	26	0.2	1	12.0	6
785652	6113507	506857	SLSN	124	48	6	64	15	0.1	1	14.0	0
785654	6108731	508586	SLSN	128	56	8	82	18	0.1	1	23.0	6
785655	6109099	508375	SLSN	126	42	6	59	14	0.1	1	12.0	2
785656	6108178	508137	SLSN	134	52	10	106	20	0.1	2	22.0	7
787670	6120370	510345	SLSN	138	38	6	39	15	0.1	1	18.0	11
787698	6118048	512973	SLSN	160	64	13	75	20	0.2	1	6.0	6
787699	6118048	512973	SLSN	164	66	12	72	20	0.1	1	5.0	5
787700	6117310	514454	SLSN	132	38	4	80	26	0.1	2	2.0	3
787702	6117641	514587	SLSN	144	60	10	74	22	0.2	1	17.0	6
787703	6115987	515728	SLSN	132	52	8	66	18	0.1	1	12.0	5
45857	6113900	506550	SLSN	163	40	9	69	18	0.3	0	8.5	2
45858	6113100	507000	SLSN	191	74	12	94	25	0.3	1	19.0	4
45859	6113000	507050	SLSN	180	72	9	90	25	0.1	1	17.0	2
45860	6112250	507400	GRDR	65	23	6	12	8	0.1	48	6.6	2
45862	6111650	507450	GRDR	40	11	6	5	5	0.1	21	2.5	2
45863	6117950	508500	SLSN	263	65	22	91	33	0.4	0	38.0	3
45864	6116650	508850	SLSN	162	69	15	94	20	0.2	1	28.0	2
45865	6116850	504750	SLSN	188	54	28	72	26	0.2	5	26.0	8
45866	6111950	510900	GRDR	141	55	7	38	17	0.3	18	30.0	2
45867	6111205	511000	SLSN	166	81	16	113	26	0.1	1	26.0	8
45868	6112200	511100	SLSN	165	75	16	174	37	0.2	1	26.0	5
781039	6122037	503764	SLSN	176	68	4	48	32	0.2	5	24.0	3
787675	6123307	511700	SLSN	184	58	19	94	27	0.1	2	10.0	11
787678	6125195	512227	BSLT	30	14	1	4	4	0.1	1	2.0	0
781044	6121236	499788	SLSN	210	56	10	69	26	0.3	1	11.0	2
781047	6120887	499643	SLSN	134	38	7	56	17	0.2	1	11.0	2
783002	6114517	499409	SLSN	72	16	2	28	15	0.3	4	9.0	0
785500	6129794	491630	SLSN	86	28	4	54	14	0.1	1	10.0	5

SLSN= SILTSTONE
GRDR= GRANODIORITE
BSLT= BASALT

Zn=ZINC
Cu=COPPER
Pb=LEAD
Ni=NICKEL

Co=COBALT
Ag=SILVER
Mo=MOLYBDENITE
Au=GOLD

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