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

MINERAL RESOURCES DIVISION
Geological Survey Branch

SILICA
OCCURRENCES IN BRITISH COLUMBIA

Compiled by G. Foye

A contribution to the Canada/British Columbia Mineral Development Agreement, 1985–1990

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VICTORIA
BRITISH COLUMBIA
CANADA

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INTRODUCTION

The element silicon constitutes about 26 per cent of the earth's crust and is the second most abundant element after oxygen. It occurs mainly in the form of oxides or silicates. Silica is the term used to describe any compound that is composed almost entirely of silicon dioxide (SiO_2). Quartz is the most common polymorph of silica found in nature and accounts for about 12 per cent of surficial terrestrial rock.

Silica deposits have formed during all geological periods and can be classified as either primary, secondary or replacement. Primary deposits consist of veins and pegmatites with sand, sandstone and quartzite making up the secondary deposits. Replacement deposits have formed by siliceous solutions metasomatically replacing country rock resulting in the formation of silicified zones. The bulk of the silica of commercial interest occurs in the form of quartzite and other sedimentary rocks and sands. To a lesser extent silica is also mined from pegmatite and vein occurrences. Most silica is produced from open-pit mining operations. Sometimes silica is produced as a by-product in operations such as the mining of pegmatites for feldspar or mica, or in the processing of feldspathic sands and kaolin.

Since silica is so common, there are large reserves worldwide. Economic factors are therefore very important in evaluating the potential of a particular deposit. Location with respect to the potential market is especially critical since it is generally not economic to transport silica long distances.

The intended use and the initial state of the silica raw material will dictate the level of processing that is required. This will range from little or no processing to smelting and refining processes. Specifications for the chemical and physical properties of the silica include the minimum silica content, the maximum amounts of various contaminants, and grain shapes and sizes. One of the main concerns is usually the purity of the silica. The purity of the material, especially of silica sands, can often be improved by benefication techniques which include screening, washing with water, leaching with acid, flotation and various methods that take advantage of differences in specific gravity between quartz and some of the contaminants.

Many silica uses require the silica raw material to be in the form of sand. This can be a naturally occurring state or can be achieved by crushing and grinding. Silica sand is derived from quartzites, sandstones with varying degrees of cementation, quartz conglomerates, chert deposits, quartz pegmatites, sands and gravels (alluvial, terrace and beach), and dune sands.

One of the principal uses of silica sand is in the manufacturing of various forms of glass, including fibreglass. The specifications for glass are precise and certain contaminants such as nickel, chromium, copper and cobalt cannot be tolerated. Specifications supplied by one glass manufacturer are as follows:

Silica	99.1 per cent minimum
Calcium carbonate	0.3 per cent maximum
Magnesium carbonate	0.3 per cent maximum
Iron & alumiium oxides	0.3 per cent maximum

Screen analysis based on U.S. screen numbers:

Retained on 16	0 per cent
Through 16 on 30	0 - 5 per cent
Through 30 on 100	95 - 100 per cent
Through 100	0 - 5 per cent

The specifications for silica to be used in the manufacture of optic fibres are even more exacting:

SiO_2	99.98 per cent minimum
Fe	< 3.0 parts per million
Co	< 4.0 parts per million
Cr	< 4.0 parts per million
Ni	< 4.0 parts per million
Cu	< 4.0 parts per million
Ti	< 2.0 parts per million
Zr	< 2.0 parts per million
Mn	< 4.0 parts per million
CaO / MgO	< 1.5 parts per million
Al_2O_3	< 2.0 parts per million
Na_2O	< 1.5 parts per million
K_2O	< 1.5 parts per million

Screen specifications based on U.S.A. standard series:

50	0.1 per cent retained
70	41.0 per cent retained
100	49.5 per cent retained
140	8.8 per cent retained
200	0.5 per cent retained

Silica sand is also used as a hydraulic fracturing sand for enhanced petroleum recovery, as an abrasive, and as filtration sand and foundry sand. The construction industry uses silica in applications such as stucco dash and as a component in cement manufacturing.

Chemical specifications, similar to those for glass, are required in the manufacture of ceramic ware, but a finer grain size is necessary. In addition to ceramics, finely ground (micronized) silica flour is also used as a filler in paint, plastics, rubber and a variety of other products.

Metallurgical processes yield products that are often an intermediate step towards further manufacturing. Silicon and ferrosilicon are two of the more important examples of these products. Their manufacturing process is very energy intensive and raw material sources are generally sought in areas of relatively inexpensive power. Ferrosilicon is used in the iron and steel industry for deoxidation of molten metal, as an alloying agent and for reduction of metal oxides in slag. It is also used when magnesium and nickel are manufactured by certain processes. In the metallurgical industry, silicon is alloyed with aluminum, copper and nickel. Silicon is also used by the chemical industry to produce silanes and silicones, from which many other products are made. Very high purity silicon is used to make semiconductors and photovoltaic cells.

Silica to be used in the production of silicon and ferrosilicon must be in "lump" form, with a size between 1.3 centimetres to 8.9 centimetres. Fines are undesirable and the rock must not decrepitate upon heating. A Dow Corning Corporation specification for silica to be used in silicon production is as follows:

SiO_2	99.4 per cent minimum
Fe_2O_3	0.15 per cent maximum
Al_2O_3	0.15 per cent maximum
CaO	0.05 per cent maximum
TiO_2	0.05 per cent maximum
P_2O_5	0.02 per cent maximum

Compounds of arsenic, phosphorous or sulphur are undesirable as they form poisonous gases in the smelter furnace. Silica raw material for ferrosilicon production has similar specifications.

Silicon carbide (carborundum) is used as an abrasive, a deoxidizer, a refractory material and in synthetic ceramics. It is produced by heating silica with an excess of carbon, in an electric furnace.

High purity mono-crystal quartz is used in electrical and optical applications. Due to its piezoelectric and dielectric properties quartz has many uses in electronics. Man-made or cultured quartz is becoming increasingly important although natural quartz crystal is still preferred in some applications. Only Brazil has produced significant quantities of high quality natural quartz mono-crystals. High quality quartz crystal that is not in mono-crystalline form is used as a feedstock for growing cultured quartz crystal. Some forms of quartz (amethyst, citrine, tigers-eye, etc.) qualify as gemstones.

Silica, therefore, has many diverse uses and since it is so readily available, it is likely that research for new uses will continue. Silica use in the manufacture of flat glass and glass containers is declining due to recycling and substitution by materials such as plastic and aluminum. At the same time there has been growth in optical fibre production. At present there is an oversupply of silicon and ferrosilicon due to weak demand in the steel and aluminum industries.

In Canada, the three major markets for silica are for glass, fibreglass and foundry sand. Production and trade figures for the 1970s and early 1980s indicate that Canada's silica production represents approximately 70 per cent of silica consumption in Canada. The country is therefore dependent on imports, particularly from the United States. Only a relatively small amount of silica is exported from Canada. Canada's production of silica sand in 1983 amounted to about 0.9 per cent of the world total. In 1984 British Columbia imports of silica sand from the United States amounted to 22,677 tonnes for foundry use, 41,860 tonnes for glass manufacturing, 8 tonnes for silex and crystallized quartz and 41,965 tonnes for unspecified uses. On the other hand, the bulk of production from the Hunt deposit in southeast British Columbia is exported to Washington State.

Although the bulk of silica production in North America occurs in eastern areas, due to the proximity of the major markets, there are some significant producers in British Columbia and adjacent areas. Most high-purity silicon metal produced in the United States comes from raw materials in the Pacific Northwest, due to the availability of relatively inexpensive hydroelectric power. In 1985 approximately 300,000 tonnes of silica were mined by four companies in the state of Washington. Of this amount the Lane Mountain Silica Company produced about 138,000 tonnes from its quartzite deposit in the northeast corner of the state. As of 1985 the Sil Silica Company was producing silica sand from sand dunes in an area just northeast of Edmonton, Alberta. The material is used mainly for fibreglass and sandblasting purposes. High-purity silica sand is produced from a deposit 130 kilometres north of Selkirk, Manitoba and processed in Selkirk. It is primarily used for making glass and fibreglass and in foundries.

Average prices for some silica products in the United States in 1985 are found in the 1985 Canadian Minerals Yearbook. They are quoted, by application, in $US per short ton f.o.b. mill or manufacturing plant, and are as follows:

	$
Metallurgical	7
Glass and Fibreglass	7 - 16
Foundry	12 - 16
Frac sand	24

	$
Filler	33
Amorphous silica	
Coarse	35 - 70
Very fine	100 - 200
Pyrogenic (fumed) silica	5,000 - 9,000
Quartz rock crystals	
For fusing	500 - 2,700
For piezoelectrical and optical use	5,500 - 13,000
Cultured quartz	55,000 - 90,000

GENERAL

The silica occurrences described in this Open File were considered at the time of writing to represent the most significant silica deposits known in British Columbia. References, listed by occurrence, are found at the end of the report. Each occurrence has been assigned a number with a prefix of "S". These numbers identify the deposits on the accompanying British Columbia silica occurrence map and in the bibliography. The occurrences are organized by genetic type as being quartzite, vein or pegmatite.

Many of the occurrences were examined in the field during 1981 and 1982 by staff of the Geological Survey Branch of the British Columbia Ministry of Energy, Mines and Petroleum Resources. This work, which included mapping and sampling, was under the supervision of Z. D. Hora, Industrial Minerals Specialist. Fieldwork in 1981 was carried out by M. Hanna and assistant J. Rublee. Occurrences examined at this time include Susie (S14), Fairview (S15), Quartz (S18), Winlaw (S27), White Elephant, Loumark, Rice, Cariboo Gold Quartz, Monashee quartzite, Quartzite Range Formation, Yanks Peak quartzite and Rocky Mountain Formation. Occurrences examined during 1982 by J. Pell and assistant G. Sutton include Nonda Quartzite (S6), Win (S9), Roundtop Mountain and Yanks Peak quartzite (S10), Bridesville (S11), FS (S17), Campania Island (S20), Banks Island (S21), Maple Bay (S23), Swan (S26), Marysville, Glacier Creek and Morris Summit. Much of the information in this report is a result of these field programs, but data from other sources have also been included.

There are many sedimentary units in British Columbia, ranging from Proterozoic to Mesozoic age, that contain quartzites (Monashee, Mahto, etc.). Those few quartzite occurrences that were examined and evaluated were chosen mainly because of their relative purity and ease of access.

Whenever possible, chemical analyses of samples collected from the occurrences have been provided. Some of the results were obtained from older reports, while others are from samples collected during the more recent fieldwork. In general the older silica analyses are quite reliable, while the margin of error for silica is about half a per cent in the more recent results. The reverse is true for the minor elements. This is largely due to the fact that during sample preparation carbide grinders are now used whereas previously ceramic grinders were used.

British Columbia has not been a major producer of silica. Some quartz, especially from veins, has been used as a flux in smelter operations. Often the quartz represented a gangue to base or precious metal mineralization. The Gypo quartz vein near Oliver produced about 600,000 tonnes of quartz up to 1968 when the main mining operations ceased. Most of this material was used in the building industry and to produce ferrosilicon. In more recent years a significant amount of production has taken place from the Moberly Mountain and Hunt deposits, in quartzite of the Mount Wilson Formation, near Golden. Silica sand from the Moberly Mountain deposit is sold for a variety of uses. Quarrying was begun in 1980 and the 1984 production was expected to reach 85,000 to 90,000 tonnes. The Hunt deposit has produced intermittently since 1980 at approximately 30,000 tonnes per year, with much of the product being shipped to a ferrosilicon plant in Wenatchee, Washington. Some of the fines have been used by cement producers in British Columbia and Alberta.

In broad terms the best sources of general purpose silica raw material in British Columbia are probably quartzite units, due to the large potential size of the deposits. This is exemplified by the Mount Wilson Formation in southeast British Columbia and by the Nonda quartzite east of Prince George. In most cases, however, the chemical and physical properties, or the location of the deposit, are more important than its genetic type. It is generally not economic to transport silica long distances and different uses of silica require different chemical and physical specifications. Since a small volume, high-purity quartz vein can be just as valuable as a larger tonnage quartzite occurrence, all genetic types should be evaluated.

Most of the mineral exploration in British Columbia has been directed toward base and precious metals. In many cases quartz bodies and quartzites have been regarded as barren rock or gangue, rather than as potential sources of silica. There are likely numerous silica occurrences in the province that have not been recognized and are therefore not documented.

QUARTZITE OCCURRENCES

MOUNT WILSON FORMATION

The Mount Wilson Formation is a Middle and/or Upper Ordovician quartzite unit occurring in southeast British Columbia, east of the Rocky Mountain Trench. Most of this unit was formerly known as the Wonah Formation.

The main area of Mount Wilson Formation exposure in British Columbia is a belt extending from Moberly Peak, 9 kilometres north of Golden, southeasterly for about 215 kilometres to a point about 35 kilometres north-northwest of Fernie (see accompanying silica occurrence map of British Columbia). The quartzites form northwesterly trending, generally narrow bands. Due to thrusting and folding, a number of subparallel bands outcrop in some areas. Thickness of the quartzite is quite variable and is as little as one metre in one measured section and up to several hundred metres in other areas. In a general sense regional thinning occurs toward the south and, in some places at least, a westerly thinning is also apparent. The Mount Wilson Formation is conformably overlain by the Upper Ordovician Beaverfoot Formation consisting mainly of dolomite. In areas the Mount Wilson Formation apparently rests on different ages of the underlying Lower and Middle Ordovician Glenogle Formation consisting of siltstones, sandstones and shales. Geological Survey of Canada Map 1497A indicates that the northwest end of the belt is truncated by thrust faulting.

In general the quartzite is compact, medium-grained, pure and resistant to weathering. It weathers white and very light grey with dark stains and light greyish orange stains on steep cliff faces. It is sometimes crossbedded in part and contains some friable sandstone zones. Bedding is inconspicuous but can usually be distinguished by slight differences in grain size between the different beds.

Another area of Mount Wilson Formation exposure in British Columbia occurs along the Alberta border, approximately 60 kilometres north of Golden. The type locality for the formation is in Alberta, just east of this area.

Due to the mountainous terrain much of the Mount Wilson Formation quartzite occurs in relatively inaccessible areas. Near Radium Hot Springs a small section outcrops within Kootenay National Park. The Moberly Mountain and Hunt quarries, which have recorded significant silica production, occur within the Mount Wilson Formation.

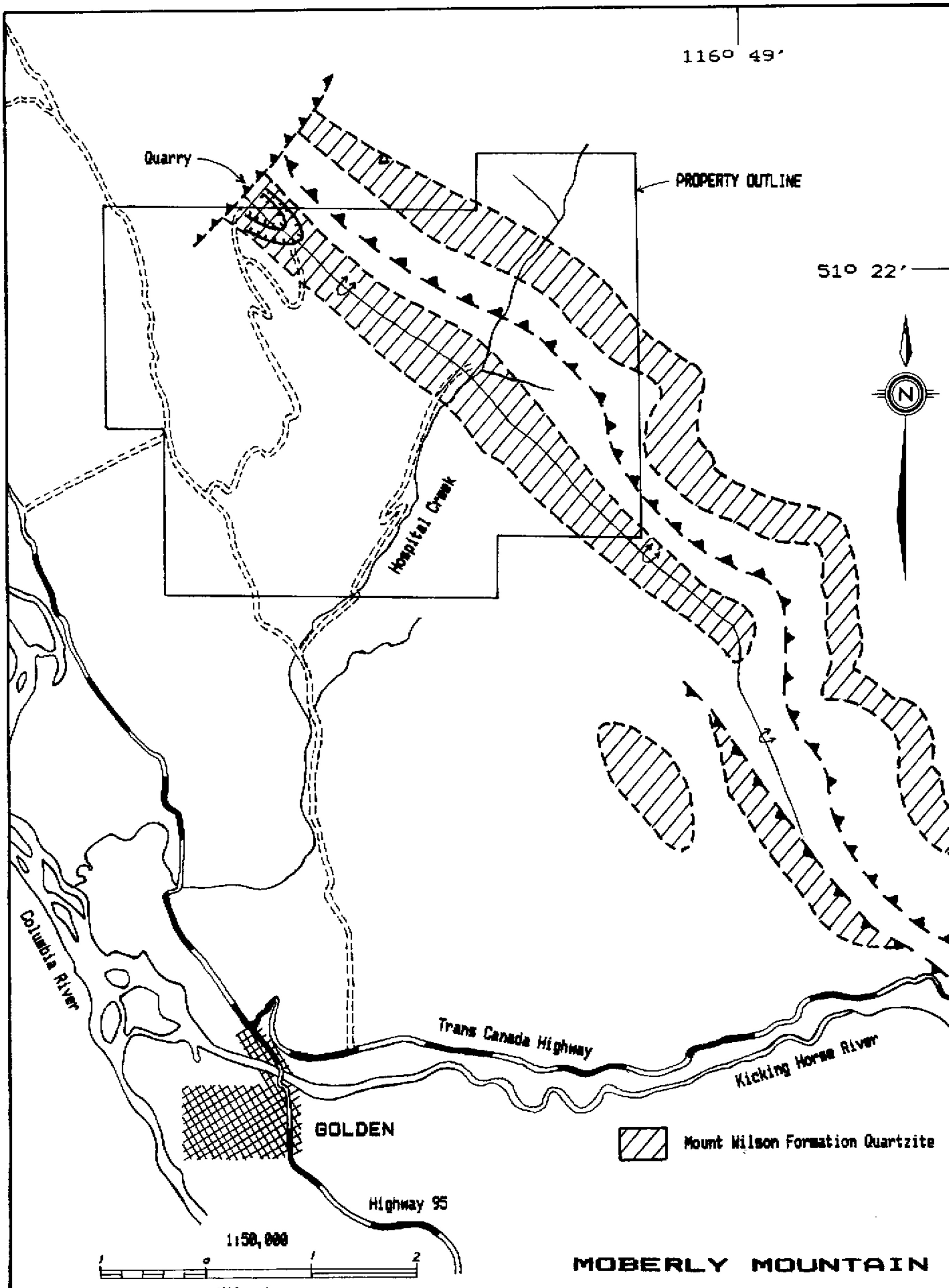
MOBERLY MOUNTAIN
(S1)
Type: Quartzite
Minfile: 082N 001 NTS: 082N 07W Elevation: 1524m
Latitude: 51° 22′ 18″ Longitude: 116° 57′ 49″

The property is located about 8 kilometres north of Golden, on the southwesterly slopes of Moberly Mountain. Access is via a bench road that leads north from the Trans-Canada Highway about 1 kilometre east of Golden. Approximately 4 kilometres from the highway a turn is made on to the Hospital Creek road and then on to a branch road that crosses the creek and leads to the eastern part of the property. A road heading northeasterly to the western part of the property and to the quarry joins the bench road about 1.5 kilometres north of Hospital Creek. Another access road branches off the Trans-Canada Highway about 5 kilometres north of Golden (Figure 1).

Two quartzite bands of the Mount Wilson Formation occur on the property (Figure 1). Both trend approximately 140 degrees and dip vertically to 74 degrees northeast. Geological Survey of Canada Map 1497A shows a thrust fault between the two bands. The northeasterly band has an average indicated true thickness of 790 metres, while the southwesterly band has an approximate true thickness of 455 metres. A friable sandstone zone, with a thickness of 90 to 120 metres, is located parallel and close to the southwest margin of the southwest quartzite band. An anticlinal axis trends down the middle of the southwest quartzite band.

The quartz sand is pale buff to almost white with scattered brown spots. Grains are rounded and fall into two distinct sizes with one group averaging 0.5 millimetre in diameter and the other 0.15 to 0.25 millimetre in diameter. The compact quartzite is frosty white and consists of quartz-cemented, well-rounded grains 0.125 to 0.25 millimetre in diameter.

Production from the deposit has focused on the friable sandstone. Work on a processing plant and an open pit mine began in 1980, with continuous production beginning in May, 1981. The processing plant is located below Donald Station, approximately 25 kilometres northwest of Golden along the Trans-Canada Highway. The 1984 production of all silica grades was expected to reach 85,000 to 90,000 tonnes. At the plant the material is crushed, washed, dried and separated into several sizes. The different sizes are sold for glass sand, sandblasting sand, foundry sand, filter media sand, etc. Some of the lump silica has been used in the manufacture of silicon carbide. The operation is run by Mountain Minerals Company Ltd. of Lethbridge, Alberta.



Geology from GSC Map 1497A

FIGURE 1

Estimated reserves in 1985 amounted to 10 million tonnes of friable sandstone and 50 million tonnes of quartzite.

Two grab samples collected in 1975 returned the following percentage values:

SiO_2	Fe_2O_3	CaO	Al_2O_3	LOI
99.61	0.07	.005	0.13	0.01
99.64	0.06	.005	0.10	0.02

A more recent chemical analysis of washed sand, by Mountain Minerals Company Ltd., returned:

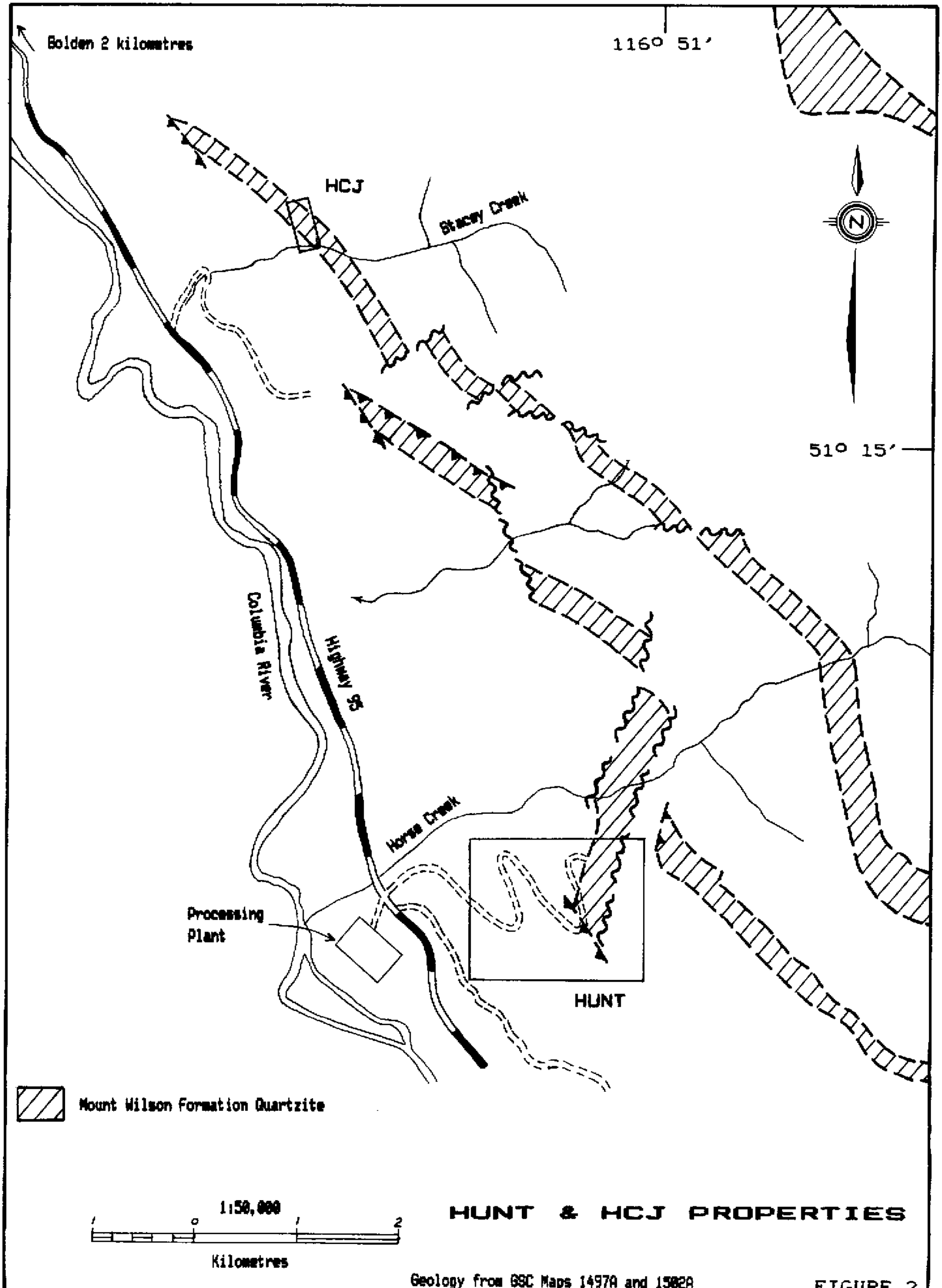
SiO_2	99.67 per cent
Fe_2O_3	0.02 per cent
Al_2O_3	0.06 per cent
CaO	0.06 per cent
MgO	0.02 per cent
Na_2O	0.01 per cent
K_2O	0.02 per cent
TiO_2	0.01 per cent
LOI	0.12 per cent

HUNT
(S2)
Type: Quartzite
Minfile: 082N 043 NTS: 082N 02W Elevation: 1219m
Latitude: 51° 12′ 40" Longitude: 116° 51′ 33"
Alias: Nicholson

The Hunt silica deposit is located about 12 kilometres southeast of Golden. Access is via the Campbell Road which joins Highway 95 from the east near the Horse Creek bridge and almost 5 kilometres south of Nicholson. About 1 kilometre from the highway another road from the east leads to the quarry (Figure 2).

Quartzite of the Mount Wilson Formation is exposed in faulted segments (Figure 2). It is massive, hard, firmly cemented, pale grey or bluish to white or light-buff coloured and weathers dull white. The quartz grains are 0.12 to 0.85 millimetre in diameter with most falling in the 0.25 to 0.50 millimetre range. A northeasterly trending transverse fault has the effect of repeating the uppermost bed of high quality silica.

The property is owned by Coastal Mining of Canada Ltd., a



HUNT & HCJ PROPERTIES

FIGURE 2

subsidiary of M. A. Hanna Company. Shipments from the deposit started in 1980 and have been made mainly to the Hanna Mining Company ferrosilicon plant in Wenatchee, Washington. The production rate has been approximately 30,000 tonnes per year. The rock is crushed, washed and screened to 5 to 10 centimetres prior to shipping. Since the start of operations the operator has been Bert Miller Trucking and Contracting of Golden. In 1984 it was reported that some of the finer grained waste from the quarry was used by Genstar for cement manufacturing in its plants in Delta, British Columbia and Edmonton, Alberta.

Open-pittable reserves were estimated in 1985 to be 3 million tonnes.

Random samples of equal-sized chips, collected in 1970, yielded the following per cent values:

SiO_2	Total Fe	Al_2O_3	CaO
98.76	0.07	1.13	nil
97.94	0.05	1.25	nil
98.24	0.05	.85	nil

Fourteen similar samples collected in 1974 returned silica values between 91 and 99 per cent, with an average of 95 per cent. Two samples, taken from the stockpile of processed material in 1985, yielded the following weight per cent values:

SiO_2	Fe_2O_3	Al_2O_3	MgO	CaO	Na_2O	K_2O	TiO_2	MnO	LOI
99.85	0.04	0.10	<.05	<.05	<.10	<.10	<.05	<.01	.32
99.90	0.04	0.10	.05	<.05	<.10	<.10	<.05	<.01	.31

HCJ
(S3)
Type: Quartzite
Minfile: 082N 046 NTS: 082N 07W Elevation: 1219m
Latitude: 51° 16′ 04″ Longitude: 116° 53′ 56″

The HCJ silica occurrence is situated about 5 kilometres southeast of Golden, on the north side of Stacey Creek. Access is via the Almberg Road which joins Highway 95 from the east, about 4.8 kilometres south of Golden. The showing is reached by staying on the north side of Stacey Creek (Figure 2).

Quartzite of the Mount Wilson Formation forms a continuous northwesterly trending cliff on the property. Four rock types have been recognized, forming bands in the quartzite:

1) Fine-grained, white to light grey, well-cemented glassy quartz grains
2) Medium-grained, less well-cemented white sandstone
3) Alternating layers of quartzite from 7.6 to 61 centimetres thick, with grey and greyish buff weathered surfaces
4) Rusty weathering quartzite

The beds strike 120 to 140 degrees and dip from 60 to 75 degrees northeast. Much of the quartzite is described as being very pure and thicknesses of 30 metres or more may be sufficiently free of impurities to constitute high grade silica.

The only recorded work on the showing is geological mapping done in 1972.

BRISCO
(S4)
Type: Quartzite
Minfile: 082KNE 012 NTS: 082K 16W Elevation: 900m
Latitude: 50° 50′ 52″ Longitude: 116° 17′ 04″

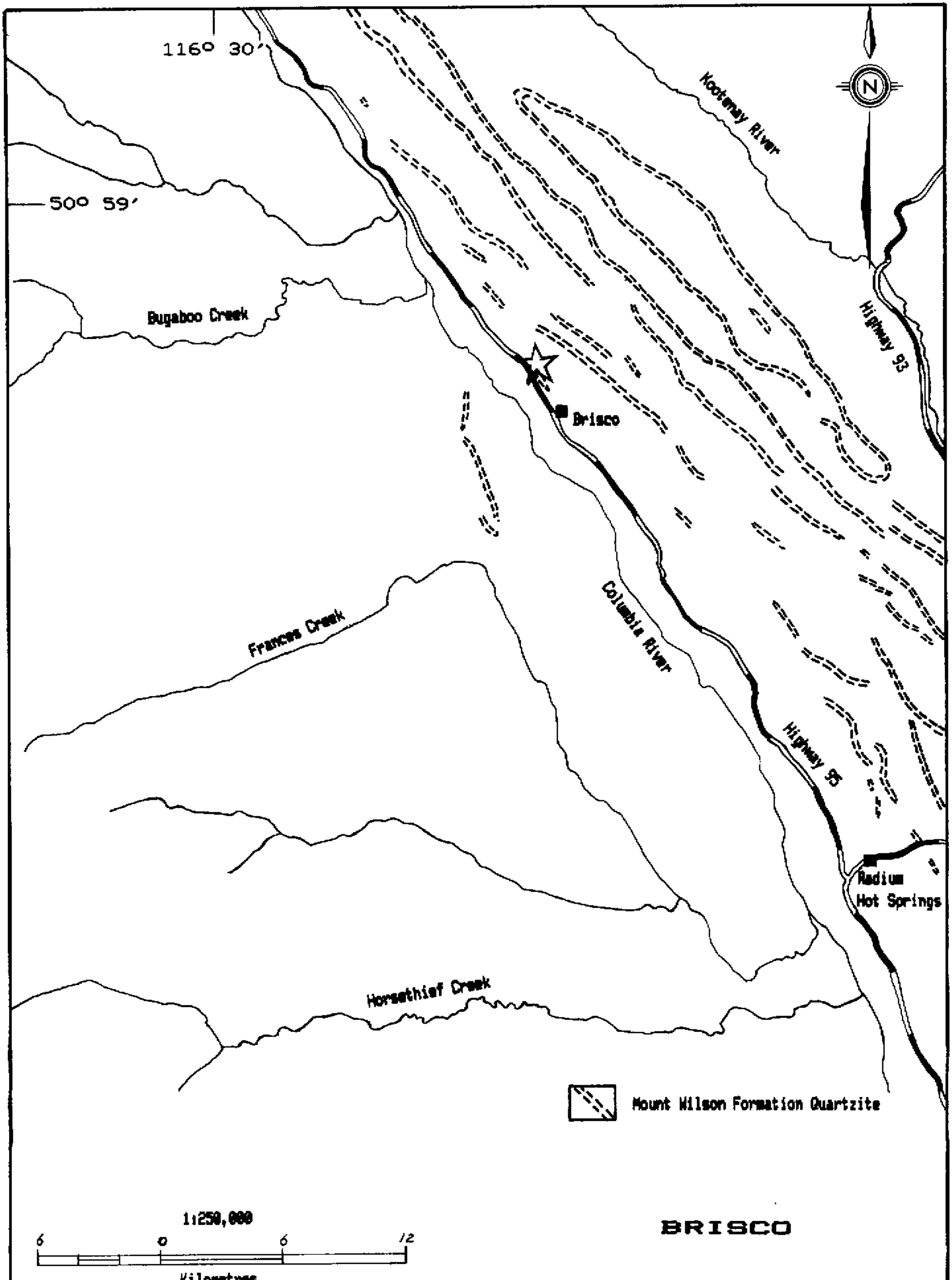
The Brisco deposit is located approximately 30 metres east of Highway 95, about 2.4 kilometres north of Brisco (Figure 3).

The Mount Wilson Formation quartzite in this area forms a bed 60 to 90 metres thick, striking northwest and dipping steeply to the northeast. Dolomite overlies the quartzite. The quartzite is hard, massive, white and medium to fine-grained.

Quarrying operations took place in 1964 when 2450 tonnes of silica were shipped. A test shipment was apparently sent to Wenatchee, Washington, but further shipments were refused due to a high calcium content.

A 1964 sample of pieces picked randomly from the muck pile assayed as follows:

SiO_2	98.66 per cent
Al_2O_3	0.47 per cent
Fe_2O_3	0.06 per cent
CaO	0.08 per cent



Geology from GSC Map 1326A

FIGURE 3

RED CLOUD
(S5)
Type: Quartzite

Minfile: 082JSW 001	NTS: 082J 05E	Elevation: 1100m
Latitude: 50° 19' 50"	Longitude: 115° 39' 40"	

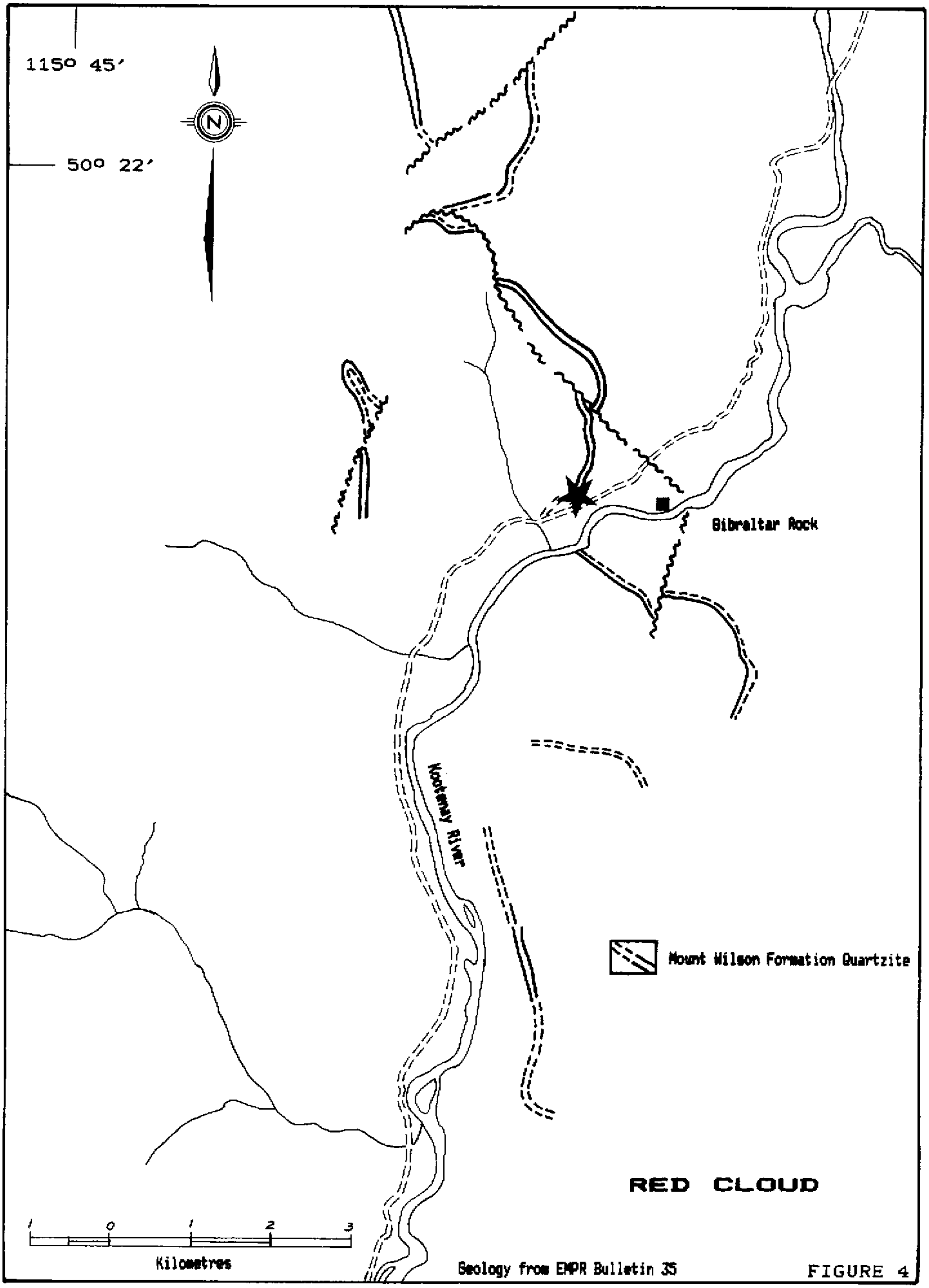
The small quarry on the Red Cloud property is readily accessible via a road that follows along the west side of the Kootenay River, north from Canal Flats (Figure 4). A road that joins the main road from the north, a short distance southwest of Gibraltar Rock, is followed for about 550 metres to the quarry.

The quarry is situated on a band of Mount Wilson Formation quartzite which, at the quarry, is 18.3 to 21.3 metres wide. Shale and limestone constitute the wallrock. The quartzite band strikes northeasterly with dips of 40 to 50 degrees to the west. Quartzite at the quarry is described as a hard white rock with grey streaks and occasional yellowish sandy patches. Fractures at intervals of 8 centimetres or greater are numerous.

As of 1967 the quarry was reported to measure approximately 30 by 3 by 3 metres. A small trial shipment was produced in 1967, but there is no record of any production since that time.

A 1967 grab sample of randomly picked loose muck pieces assayed as follows:

SiO_2	98.56 per cent
Al_2O_3	0.65 per cent
Total Fe	0.12 per cent
CaO	0.05 per cent



115° 45′
50° 22′
N
Gibraltar Rock
Kootenay River
Mount Wilson Formation Quartzite
RED CLOUD
1 0 1 2 3
Kilometres
Geology from EMPR Bulletin 35

FIGURE 4

LONGWORTH

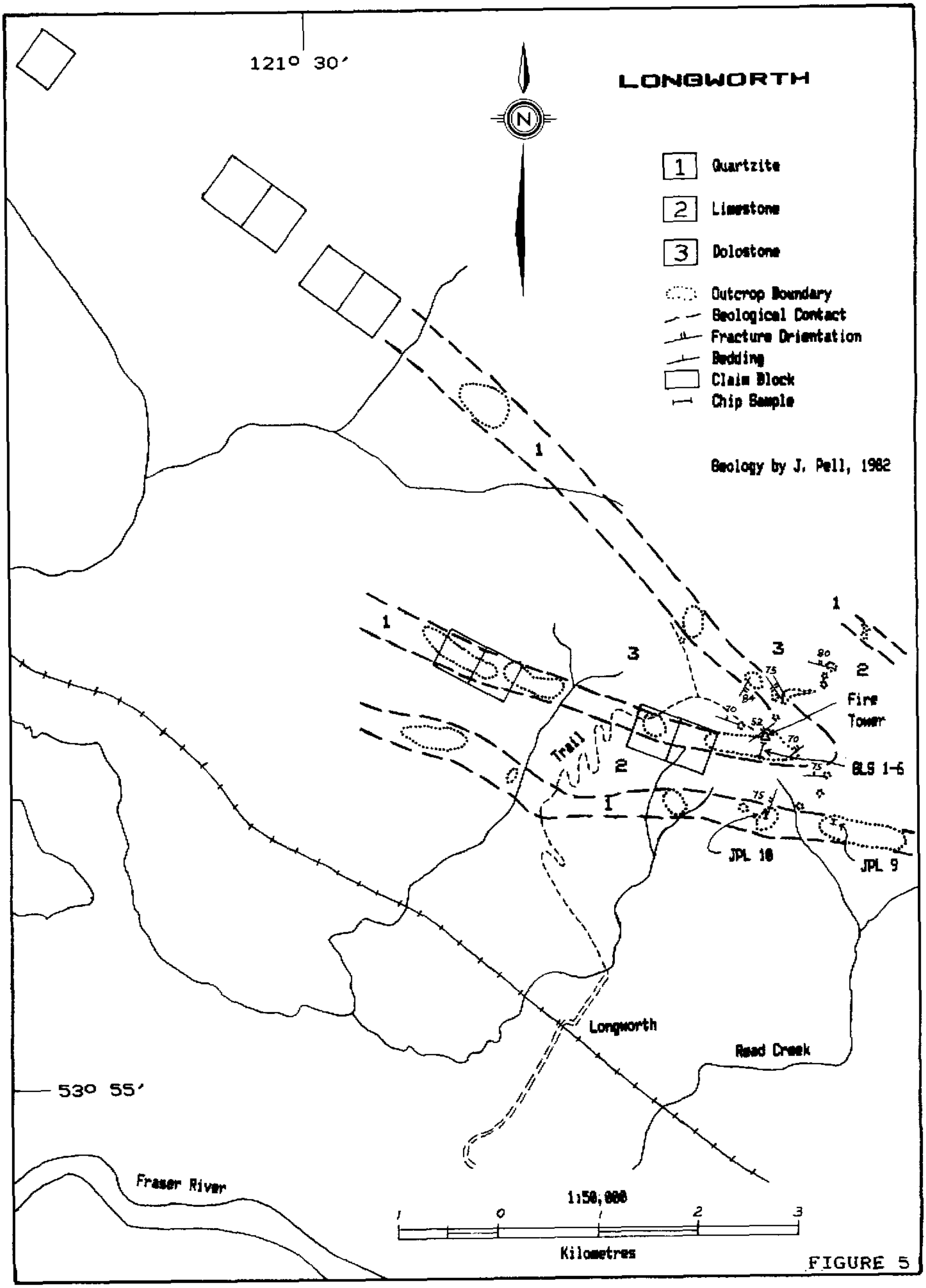
(S6)
Type: Quartzite
Minfile: 093H 038 NTS: 093H 13E Elevation: 1554m
093H 14W
093I 04E
Latitude: 53° 56′ 45" to 54° 00′ 50" Longitude: 121° 26′ 20" to 121° 32′ 30"
Alias: Nonda Quartzite, Snow, Rain, Long, Doll

Quartzite showings are located along the western flank of Bearpaw Ridge, a northwesterly trending landform situated about 80 kilometres east of Prince George. The ridge lies just northeast of the Fraser River and the Rocky Mountain Trench. As of 1986, Consolidated Silver Standard Mines Limited. held nine claims in five noncontiguous blocks covering quartzite showings over a distance of about 10 kilometres (Figure 5). The closest road access on the north side of the Fraser River apparently terminates at Sinclair Mills, approximately 7 kilometres west of the most westerly claim. Access, especially to the more easterly claims, can also be gained via the Longworth Access Road from Highway 16 on the south side of the Fraser River. Arrangements must be made for a boat to cross the river. From Longworth, a road and then a trail lead to a fire tower and some quartzite showings on Bearpaw Ridge. The Canadian National Railway line is at the most about 5 kilometres southwest of the claims, on the north side of the Fraser River.

Bearpaw Ridge is mainly underlain by a folded sequence of sedimentary and volcanic rocks which are all, or in part, Lower Silurian and equivalent to the Nonda Formation which is outlined on the accompanying silica occurrence map of British Columbia. Quartzite with lesser shale and limestone underlies the claims.

Quartzites in the vicinity of the four southeastern claims were examined by Geological Survey Branch personnel in 1981 and 1982. The main quartzite band outcrops above an elevation of 1200 metres and outlines a synformal structure open to the northwest. All five claim groups are located on this band, with three blocks on the northern limb and two on the southern limb (Figure 5). Two other quartzite bands have been mapped; one occurring downslope to the south and the other to the northeast of the main exposure. Thicknesses up to about 400 metres have been reported.

The quartzite is very pure, massive and homogeneous. It is composed of extremely well-rounded and and well-sorted quartz grains, averaging 0.5 millimetre in diameter which are cemented by silica. Bedding is rarely apparent in outcrop, but dips of 70



121° 30′
LONGWORTH
N
1 Quartzite
2 Limestone
3 Dolostone
Outcrop Boundary
Geological Contact
Fracture Orientation
Bedding
Claim Block
Chip Sample
Geology by J. Pell, 1982
Fire Tower
BLS 1-6
JPL 10
JPL 9
Trail
Longworth
Reed Creek
53° 55′
Fraser River
1:50,000
Kilometres

FIGURE 5

to 80 degrees east have been measured. The quartzite is pinkish white to buff on fresh surfaces and weathers grey to white. In places it is cut by minor white quartz veins. Impurities include muscovite in cavities, limonite on microfractures, minor calcite and possible hydrocarbons. Shale clasts that vary from 1 to 7 millimetres in size are present in at least two localities in the lower quartzite band. They comprise much less than 5 per cent of the rock.

The claims were first staked in 1974. A relatively small amount of work, consisting of blasting, trenching and sampling, has been carried out since that time. Consolidated Silver Standard Mines Limited. has been evaluating the quartzite as a potential source of silica for the production of ferrosilicon and silicon metal. The company determined that the following chemical specifications had to be met:

SiO_2	99.5	per cent minimum
Al_2O_3	0.25	per cent maximum
Fe_2O_3	0.10	per cent maximum
CaO	nil	
LOI	0.2	per cent maximum

Forty two samples were collected from the five claim groups by Consolidated Silver Standard Mines in 1985; 28 had the required chemical specifications. Assays for SiO_2 ranged from 98.84 per cent to 99.80 per cent. Twelve of 16 samples tested gave acceptable thermal shock results.

Chip samples of clean white quartzite were collected by the Geological Survey Branch in 1982 in the vicinity of the fire tower, each about 10 metres across. The first two samples in the following table were taken from the lower quartzite band while the others were from a line across the main quartzite band, just below the fire tower (Figure 5). Values are in weight per cent:

	SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	Na_2O	K_2O	TiO_2	MnO	LOI
JPL-9	99.40	0.18	<.05	<.03	<.03	<.04	.06	<.04	.003	1.0
JPL-10	98.84	0.20	.04	<.03	<.03	<.03	.05	<.04	<.002	<0.1
GLS-1	98.76	0.16	<.04	<.03	<.03	<.04	.05	<.04	<.002	0.3
GLS-2	98.76	0.17	<.04	<.03	<.03	<.03	.05	<.04	<.002	0.2
GLS-3	98.91	0.19	<.04	<.03	<.03	<.04	.07	<.04	<.002	<0.1
GLS-4	99.35	0.21	<.04	<.02	<.03	<.03	.06	<.03	<.002	<0.1
GLS-5	99.32	0.20	<.04	<.02	<.03	<.03	.06	<.03	<.002	<0.1
GLS-6	99.30	0.25	<.04	<.02	<.03	<.03	.07	<.03	<.002	0.3

KOOT

(S7)
Type: Quartzite
Minfile: 082JSW 025   NTS: 082J 04W   Elevation: 1067m
Latitude: 50° 08′ 43"   Longitude: 115° 45′ 12"
Alias: Canal Flats

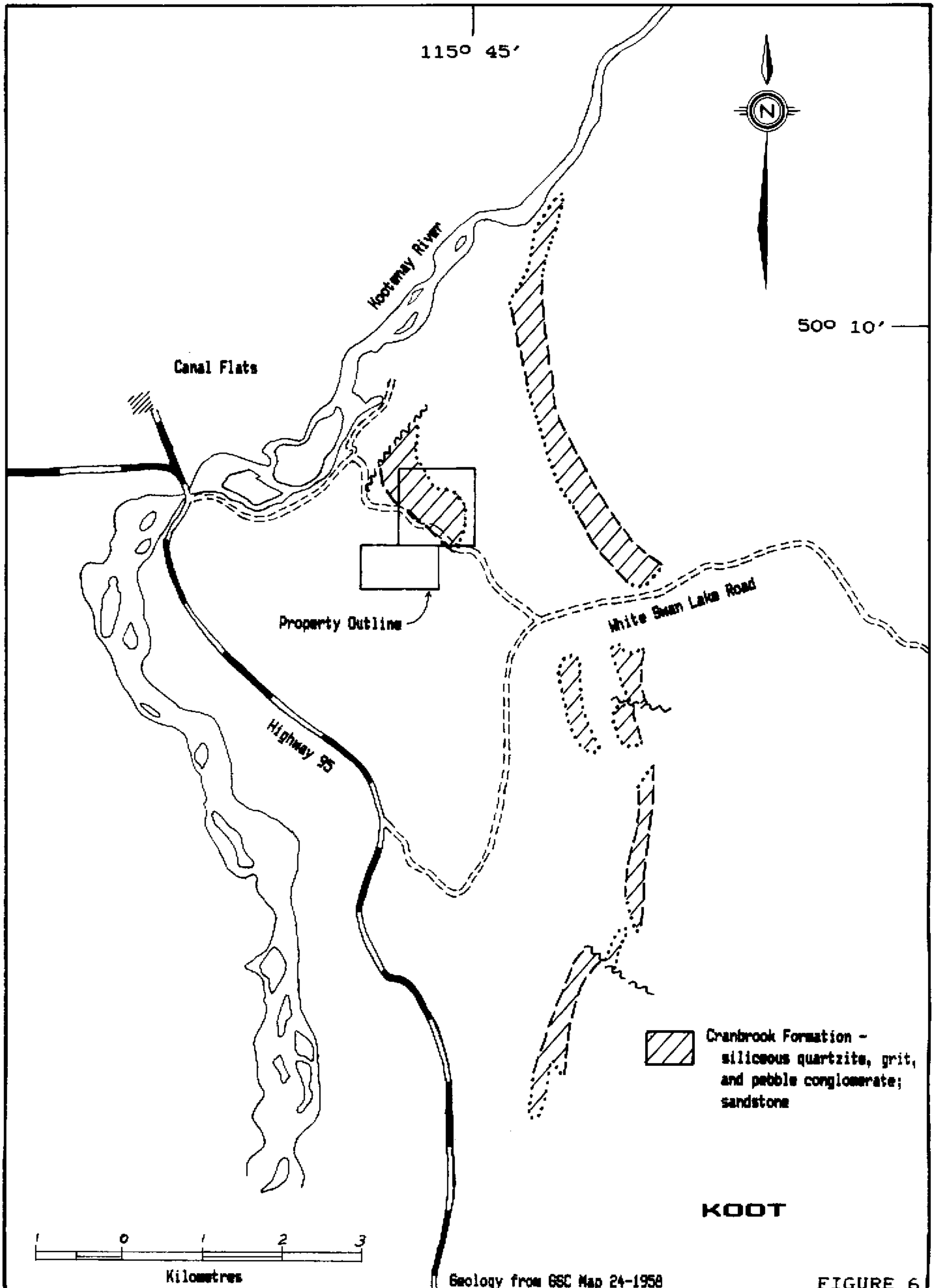
The Koot claims are located almost 4 kilometres east-southeast of Canal Flats. Access is via the Whiteswan Lake Road which heads easterly from Highway 95 at a point about 5 kilometres south of Canal Flats. This road is followed for approximately 5 kilometres and then a bush road heading northwesterly is taken for another 2 kilometres (Figure 6).

The quartzite on the claims is part of the Lower Cambrian Cranbrook Formation which is primarily comprised of siliceous quartzite, grit and pebble conglomerate, and sandstone. Cominco Ltd. drilled three core holes in January, 1981 and another five holes in September and October, 1981. All the holes were inclined and ranged in depth from 19.5 metres to 81.7 metres. All of the rocks encountered were quartzites.

The quartzite is dense, poorly bedded, milky and medium to coarse-grained. It appears to be steeply dipping and ranges from a fairly competent rock to one that contains numerous hairline fractures. Limonite generally occurs on fracture surfaces and sometimes interstitially to quartz grains.

Weight per cent values of composite samples, generally representing core lengths of 20 metres, are as follows:

	SiO_2	Al_2O_3	Fe_2O_3	CaO	MgO	S(Total)	P	LOI
1	99.01	0.44	0.25	.029	.022	.024	.006	0.26
1	98.97	0.42	0.14	.018	.014	.046	.005	0.21
1	99.22	0.25	0.10	.010	.007	.010	.006	0.20
2	99.24	0.32	0.27	.013	.008	.049	.006	0.26
2	99.28	0.36	0.17	.012	.008	.032	.006	0.17
2	97.48	0.47	0.44	0.32	.22	.011	.007	0.64
3	97.27	0.51	0.28	0.57	.43	.010	.006	1.06
3	98.50	0.64	0.24	.021	.018	.017	.007	0.30
3	99.06	0.29	0.26	.013	.009	.052	.006	0.23
4	98.97	0.47	0.17	.008	.013	.024	.006	0.24
4	99.15	0.30	0.29	.008	.010	.040	.005	0.21
4	99.07	0.31	0.24	.007	.007	.052	.005	0.24
4	98.78	0.51	0.28	.010	.012	.052	.006	0.33
5	99.10	0.38	0.19	.010	.012	.032	.004	0.26
5A	99.07	0.42	0.22	.014	.015	.056	.005	0.24
5A	98.91	0.51	0.23	.012	.014	.052	.006	0.25
5A	98.70	0.69	0.25	.013	.022	.054	.006	0.27
6	99.27	0.30	0.14	.014	.011	.026	.003	0.18



115° 45′
50° 10′
Kootenay River
Canal Flats
Property Outline
White Swan Lake Road
Highway 95
Cranbrook Formation - siliceous quartzite, grit, and pebble conglomerate; sandstone
KOOT
1 0 1 2 3
Kilometres
Geology from GSC Map 24-1958

FIGURE 6

	SiO_2	Al_2O_3	Fe_2O_3	CaO	MgO	S(Total)	P	LOI
6	99.25	0.34	0.11	.009	.010	.016	.004	0.18
6	98.87	0.42	0.34	.011	.012	.056	.007	0.30
6	98.93	0.40	0.33	.011	.012	.032	.006	0.26
7	99.05	0.28	0.24	.010	.011	.056	.004	0.23
7	98.34	0.33	0.62	.011	.011	.096	.007	0.37
7	98.67	0.47	0.40	.010	.015	.034	.006	0.30
7	99.24	0.28	0.14	.010	.012	.022	.006	0.17

The Geological Survey Branch collected a sample in 1982 from the Cranbrook Formation in the vicinity of Marysville, approximately 60 kilometres to the south. The sample was taken above a small abandoned quarry at a point directly above the magnesite bed at the north end of the magnesite belt near St. Mary River. This sample yielded the following weight per cent values:

SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	Na_2O	K_2O	TiO_2	MnO	LOI
97.53	0.86	0.30	.07	<.02	<.009	.27	.11	<.004	0.4

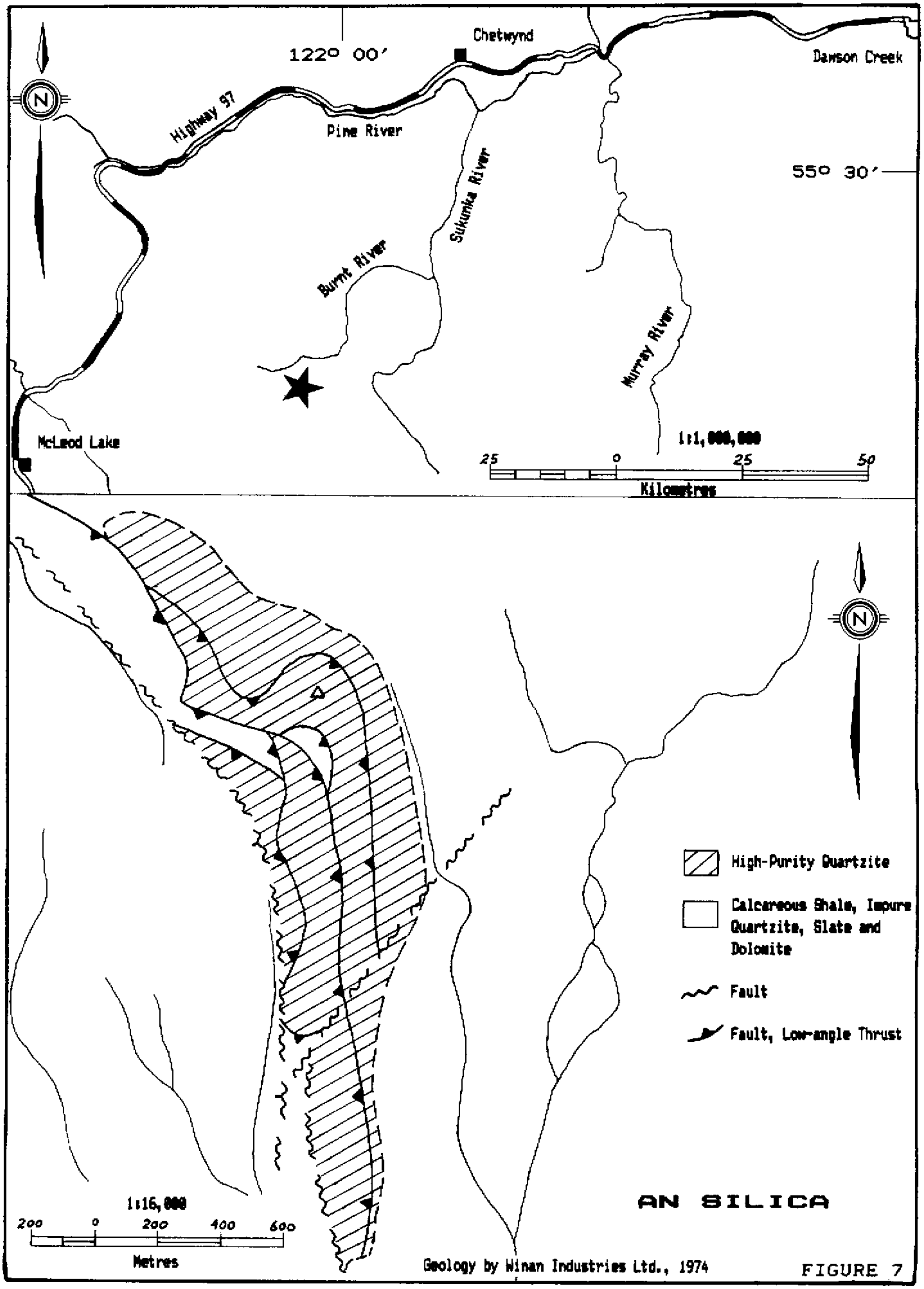
AN

(S8)
Type: Quartzite
Minfile: 093O 013 NTS: 093O 01E Elevation: 1707m
Latitude: 55° 05' 33" Longitude: 122° 07' 50"
Alias: Anzak

The An silica occurrence is situated just west of the continental divide, near the head of Anzac River. It is about 3 kilometres southeast of Mount Kinney and 32 kilometres west of the Sukunka air strip. There is apparently no road access. The location is shown on Figure 7.

Geological Survey of Canada Map 11-1961 indicates that the quartzite is probably part of the Cambrian and earlier Misinchinka Group. A zone of high-purity quartzite is shown on Figure 7. Records show that as of 1979 five holes had been drilled in a relatively small area. According to information provided by Consolidated Silver Standard Mines Ltd. these holes suggest the presence of a substantial tonnage of silica with the following analysis:

SiO_2	99.43	per cent
Fe_2O_3	0.09	per cent
Al_2O_3	0.08	per cent
CaO	0.011	per cent
LOI	0.18	per cent



Geology by Winan Industries Ltd., 1974

FIGURE 7

As of 1986 the claims were owned by Consolidated Silver Standard Mines Limited. The deposit has been proposed as a source of silica for the production of silicon metal.

WIN

(59)
Type: Quartzite
Minfile: 093O 014 NTS: 093O 02W Elevation: 1250m
Latitude: 55° 02' 00" Longitude: 122° 54' 00"

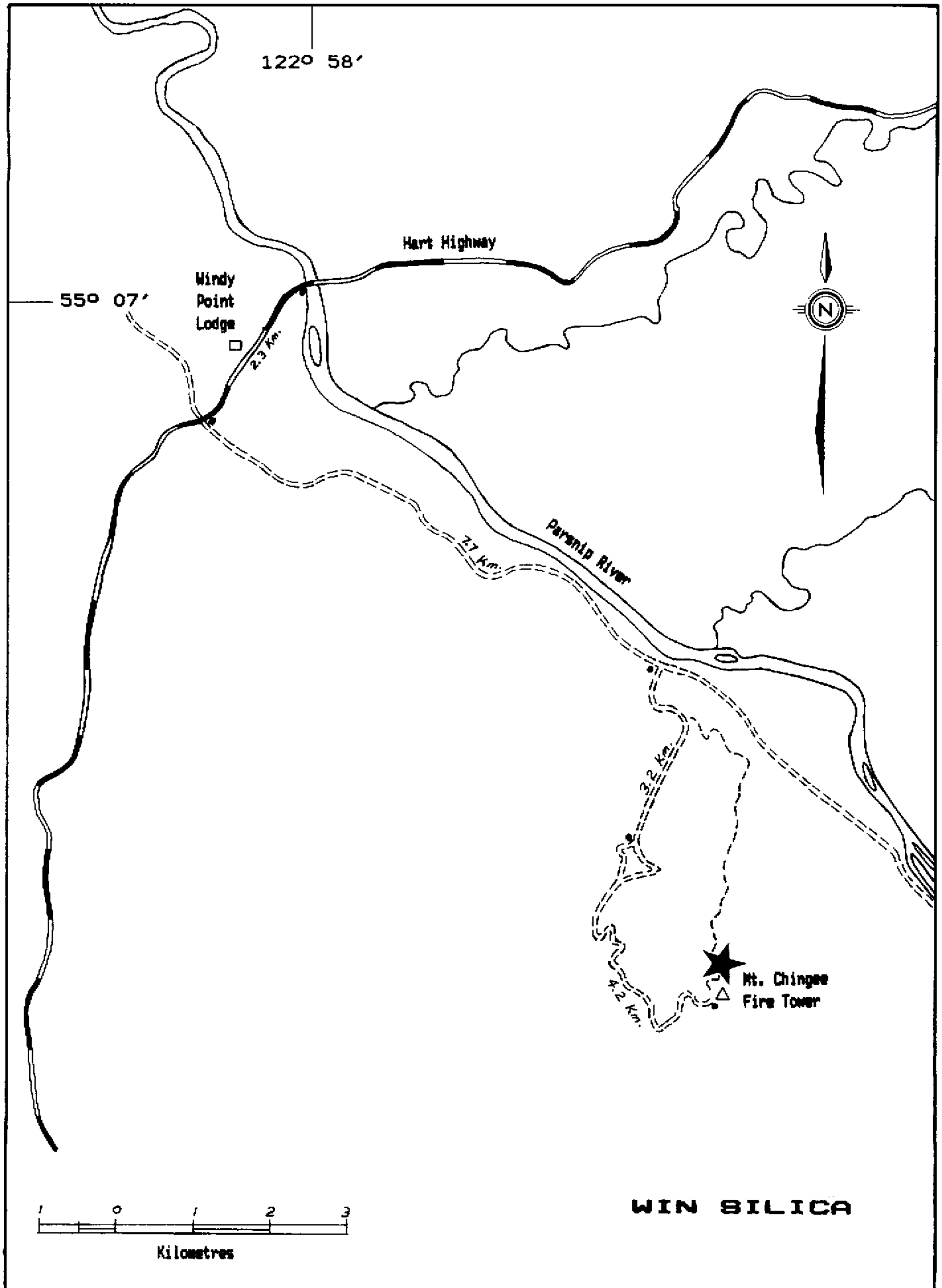
The Win silica showing is situated about 35 kilometres south-southeast of Mackenzie. Access is via a road heading southeasterly from the Hart Highway at a point 2.3 kilometres south of the bridge over the Parsnip River. This road is followed for 7.7 kilometres to a road heading southerly which is followed for another 7.4 kilometres to the Mount Chingee fire tower and telecommunications tower. The prospect is approximately 400 metres north of the towers (Figure 8).

The quartzite is normally a buff white, well-sorted, fine to medium-grained rock, however grit-sized quartz grains may constitute up to 40 per cent of the rock. It is generally pure although it sometimes contains traces of sericite as well as minor hematite and limonite stains, especially on joint surfaces. Rare, rounded black grains that are possibly tourmaline have also been reported. The unit has been traced for 700 metres along strike and its width has been roughly estimated at 150 metres.

Numerous pure, massive, opaque, white quartz veins of varying widths intrude the quartzite. The quartz veins may account for over 70 per cent of the rock volume over widths of tens of metres. Bleaching of the quartzite is common over widths of 1 to 3 centimetres along the veins. Bleached zones also occur in areas with no quartz veins. Regular jointing occurs at 0.2 to 15 centimetre spacings (averaging about 1 centimetre) in both the quartz and the quartzite.

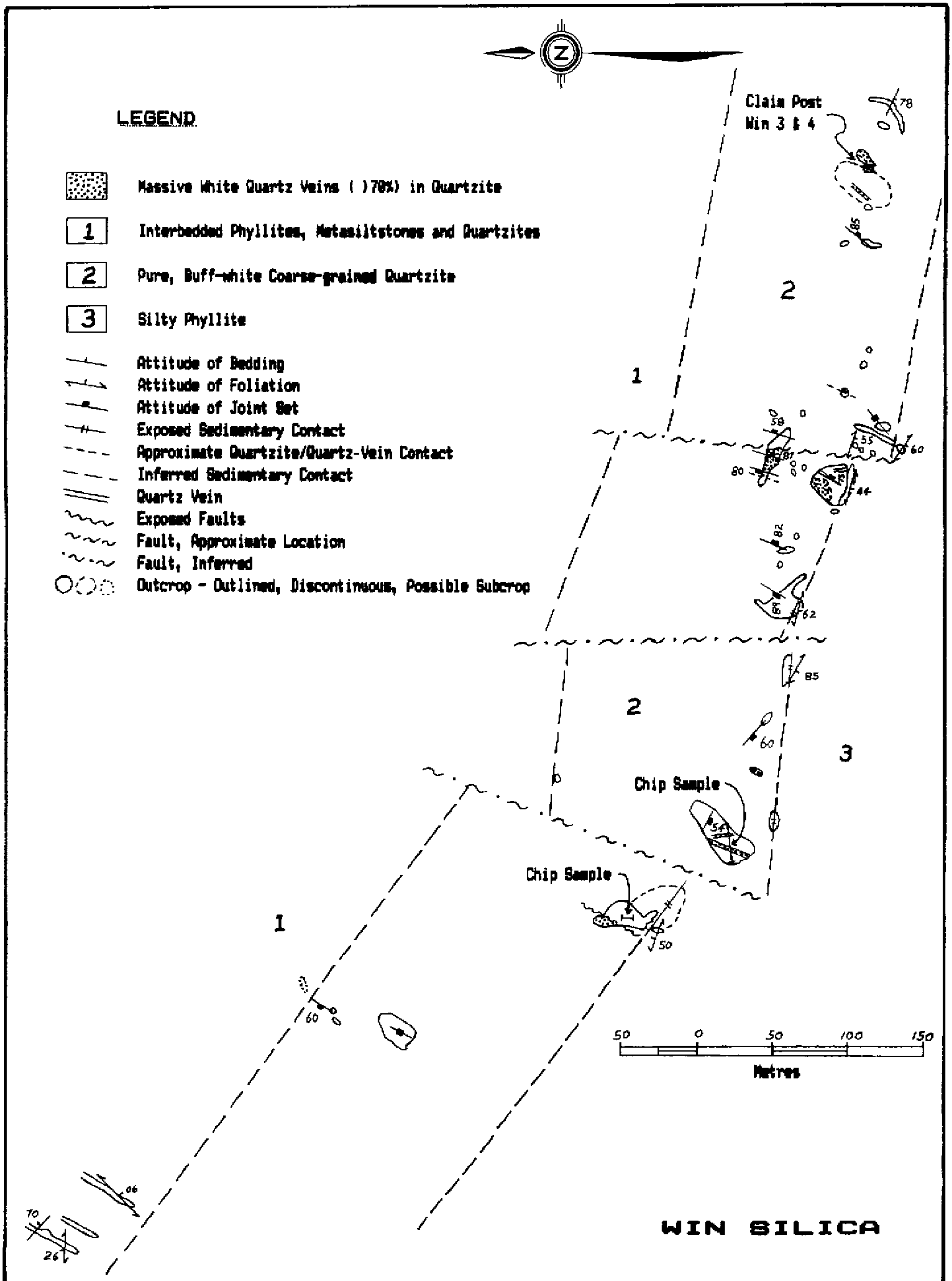
To the south the quartzite is in contact with a silty phyllite. A well-developed foliation cuts alternating clay-rich / silt-rich compositional bands at an angle of about 50 degrees. The contact is gradational over about 1.3 metres. Narrow (less than 10 centimetres) lensoid quartz veinlets are present parallel to the foliation in the phyllite.

Strata on the north side of the quartzite consist of highly



122° 58′
55° 07′
Hart Highway
Windy
Point
Lodge
2.3 Km.
7.7 Km.
Parsnip River
3.2 Km.
4.2 Km.
Mt. Chingee
Fire Tower
N
1
0
1
2
3
Kilometres
WIN SILICA

FIGURE 8



LEGEND
Massive White Quartz Veins ( )70%) in Quartzite
1 Interbedded Phyllites, Metasiltstones and Quartzites
2 Pure, Buff-white Coarse-grained Quartzite
3 Silty Phyllite
Attitude of Bedding
Attitude of Foliation
Attitude of Joint Set
Exposed Sedimentary Contact
Approximate Quartzite/Quartz-Vein Contact
Inferred Sedimentary Contact
Quartz Vein
Exposed Faults
Fault, Approximate Location
Fault, Inferred
Outcrop - Outlined, Discontinuous, Possible Subcrop
Claim Post
Win 3 & 4
Chip Sample
Chip Sample
50 0 50 100 150
Metres
WIN SILICA
Geology by M. Hanna, 1981

FIGURE 9

deformed interbedded metamorphosed pelites, siltstones and dirty and clean quartzites (Figure 9).

Trenching and drilling have been carried out on the claims by Consolidated Silver Standard Mines Ltd. Drilling in 1974 reportedly indicated the presence of up to 9 million tonnes of clean quartzite.

Three samples collected by the Geological Survey Branch in 1981 were analyzed. Two samples were chip samples of the quartzite (Figure 9) while the third consisted of a collection of core pieces. Values are by weight per cent.

SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	Na_2O	K_2O	TiO_2	MnO
94.14	2.94	0.28	0.08	<0.02	<0.226	0.274	0.066	<0.003
96.02	1.93	0.09	0.05	<0.02	<0.226	0.154	0.033	0.005
96.10	1.73	0.16	0.05	0.02	<0.226	0.176	<0.014	0.003

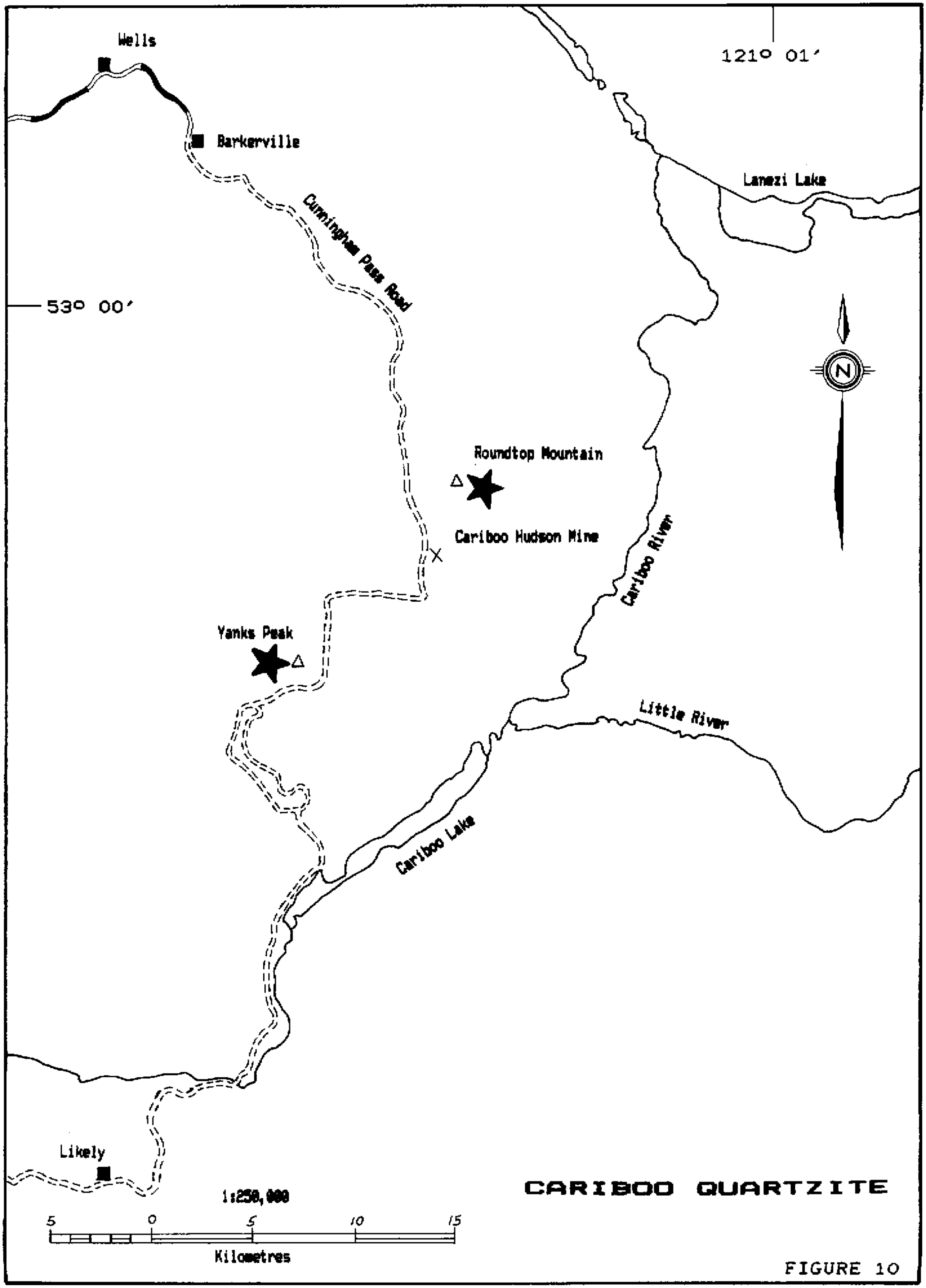
CARIBOO

(S10)
Type: Quartzite
Minfile: 093A 006 NTS: 093A 14W
Latitude: 52° 54′ 40" Longitude: 121° 17′ 50" (Roundtop Mtn.)
Latitude: 52° 51′ 00" Longitude: 121° 25′ 00" (Yanks Peak)

Quartzite occurs in the Precambrian to Lower Paleozoic Snowshoe Group. Recent mapping by L. C. Struik of the Geological Survey of Canada indicates that quartzite is present at several horizons. Geological Survey Branch personnel examined quartzite showings in the Roundtop Mountain and Yanks Peak areas during 1982.

The quartzite units that were investigated were formerly known as the Yanks Peak quartzite. This unit was previously described as extremely hard and massive, and ranging in thickness from a few metres to about 60 metres. It was also described as having thin interbeds of dark slaty material and often exhibiting a noticeable coarsening to gritty material or to a pea-pebble conglomerate toward the base.

It now appears that the Yanks Peak and Roundtop Mountain quartzites are quite different and may not be part of the same formation.



CARIBOO QUARTZITE

FIGURE 10

Access to the area is via the Cunningham Pass Road. Turn off Highway 26 on to the Bowron Lake Road approximately 2 kilometres north of Barkerville. A few hundred metres from the highway, turn south onto the 3100 logging road and continue for about 17 kilometres. From this point take the Cunningham Pass Road to the south. The Roundtop Mountain occurrences are reached by following the Bralco Trail from the old Cariboo Hudson mine. Yanks Peak is reached by taking the Cunningham Pass Road for another 10 kilometres past the mine (Figure 10).

ROUNDTOP MOUNTAIN AREA

Refer to Figure 11 for a map showing quartzites in the Roundtop Mountain area. Two main types of quartzite are present. One type is a white to pinkish weathering, micaceous to slightly feldspathic quartzite. The subrounded grains vary slightly in size but are mostly less than 1 millimetre in diameter. Occasional 2 to 3 millimetre-sized eyes of blue or white quartz may be present. Rusted-out pinhead-sized porphyroblasts constitute 5 per cent of the rock in places. In other places freshly broken surfaces are mottled with rust staining. The second type of quartzite is medium grey weathering and micaceous. It is generally comprised of fine, well-rounded grains, but larger sub-rounded blue quartz eyes up to 3 centimetres in diameter are common. Thin, white quartz veins with various orientations cut this quartzite.

A zone that may have the most economic potential is known as the Quartz Comb and is situated on the ridge to the southeast of the summit of Roundtop Mountain (Figures 11 and 12). Extensive quartz veining, constituting up to 50 per cent of the outcrop, occurs in white to pinkish quartzite. The quartzite is fine-grained and, although locally extensively rust stained, is relatively pure. Some rust staining is also present along fractures in the vein quartz.

Chip samples averaging about 50 metres in length were collected across quartzite of the Quartz Comb by the Geological Survey Branch in 1982 (Figure 12). These yielded the following weight per cent values:

	SiO_2	AL_2O_3	Fe_2O_3	MgO	CaO	Na_2O	K_2O	TiO_2	MnO	LOI
GSR-2	95.12	2.36	0.87	0.03	<.15	.12	.52	.19	.017	0.5
GSR-3	97.05	0.90	1.09	<0.03	<.03	<.04	.22	.07	.013	0.2
GSR-4	96.04	1.67	0.54	<0.03	<.03	.04	.44	.20	.008	0.1
GSR-5	96.88	1.29	0.62	<0.03	<.03	.04	.33	.11	.004	0.2
GSR-16	97.57	1.17	0.24	<0.02	<.03	.07	.23	.09	<.002	0.3

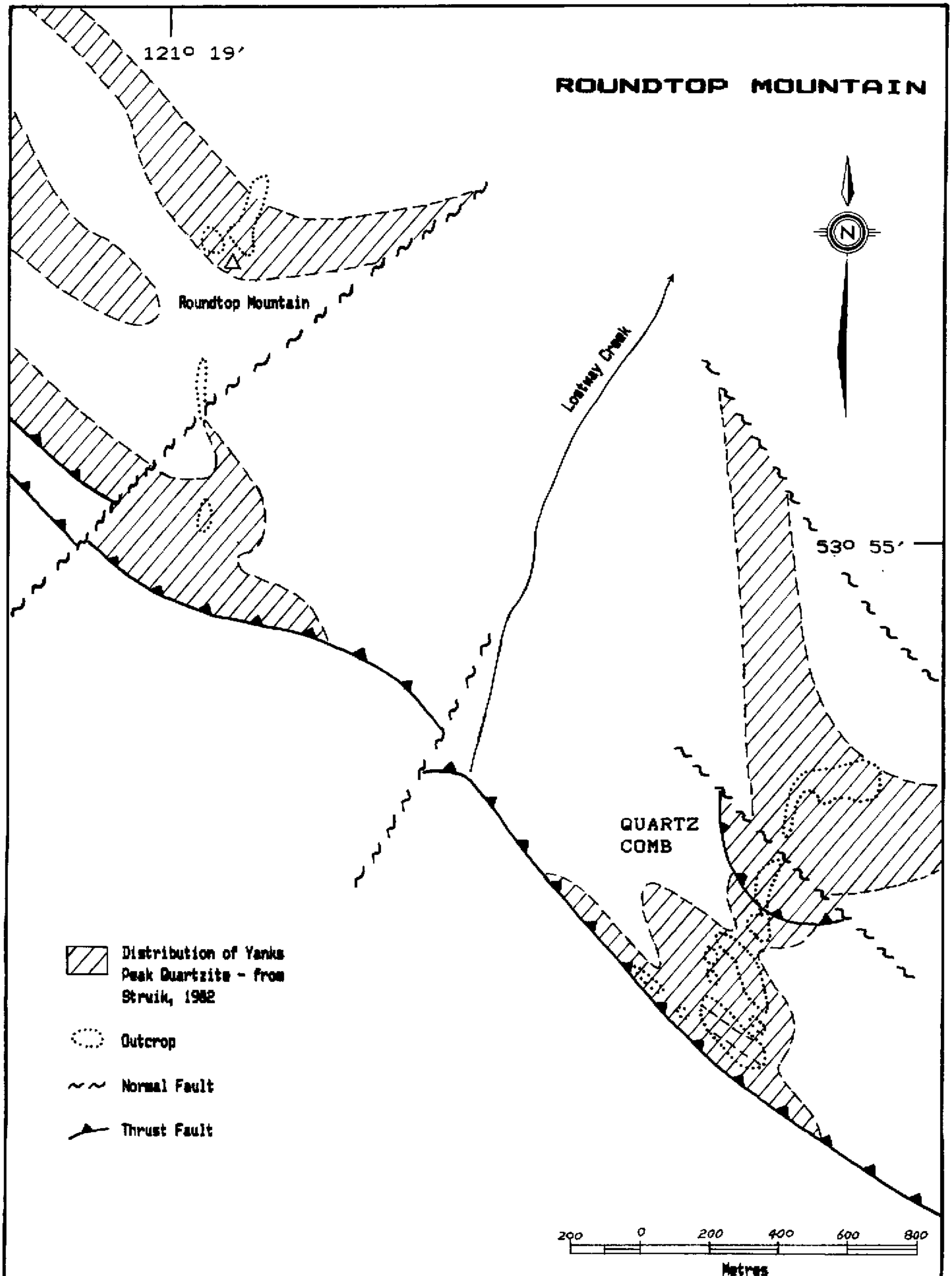
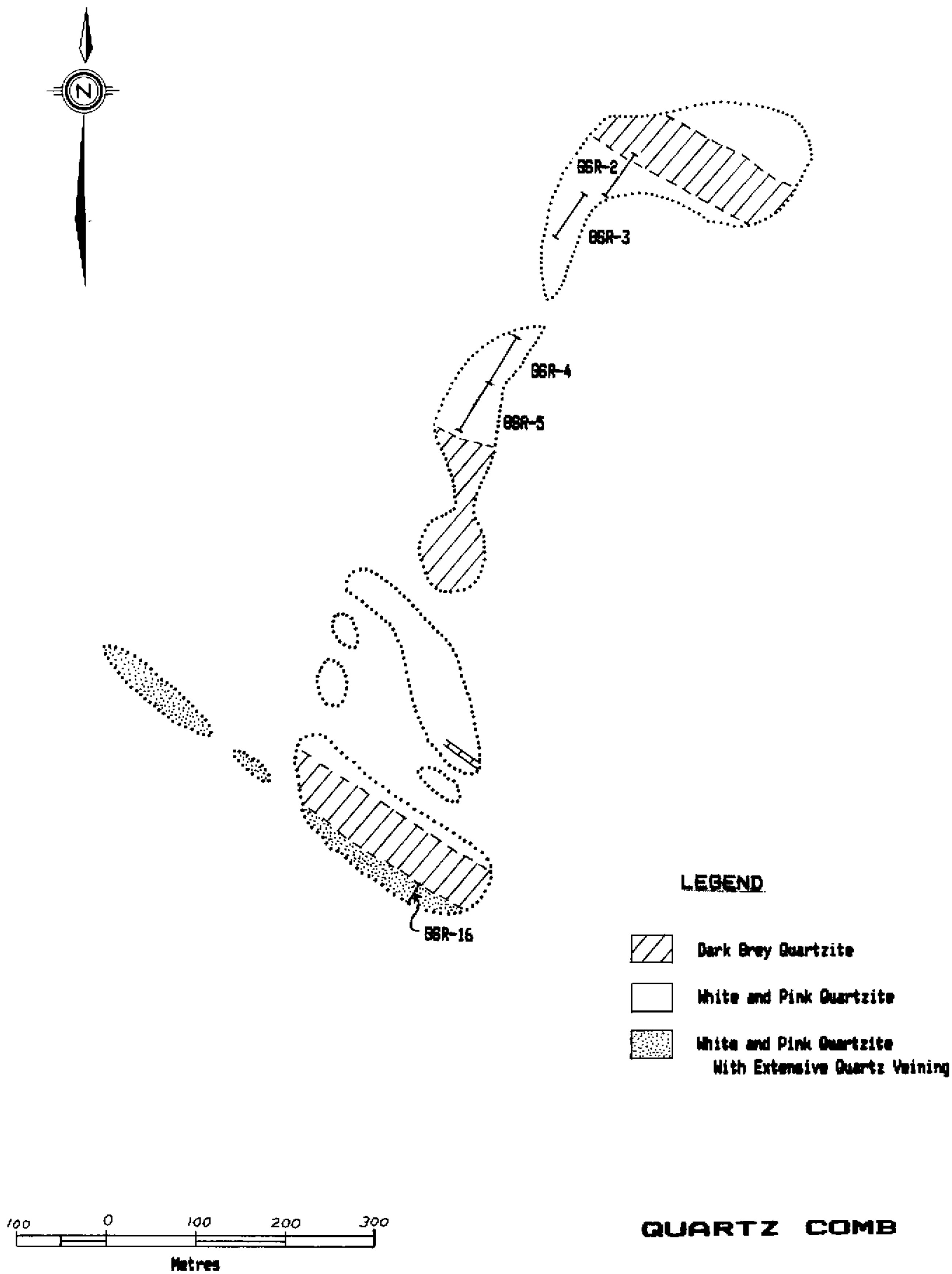

121° 19′
ROUNDTOP MOUNTAIN
Roundtop Mountain
Lostway Creek
53° 55′
QUARTZ COMB
Distribution of Yanks Peak Quartzite - from Struik, 1982
Outcrop
Normal Fault
Thrust Fault
200 0 200 400 600 800
Metres

FIGURE 11



QUARTZ COMB

Geology by J. Pell, 1982

FIGURE 12

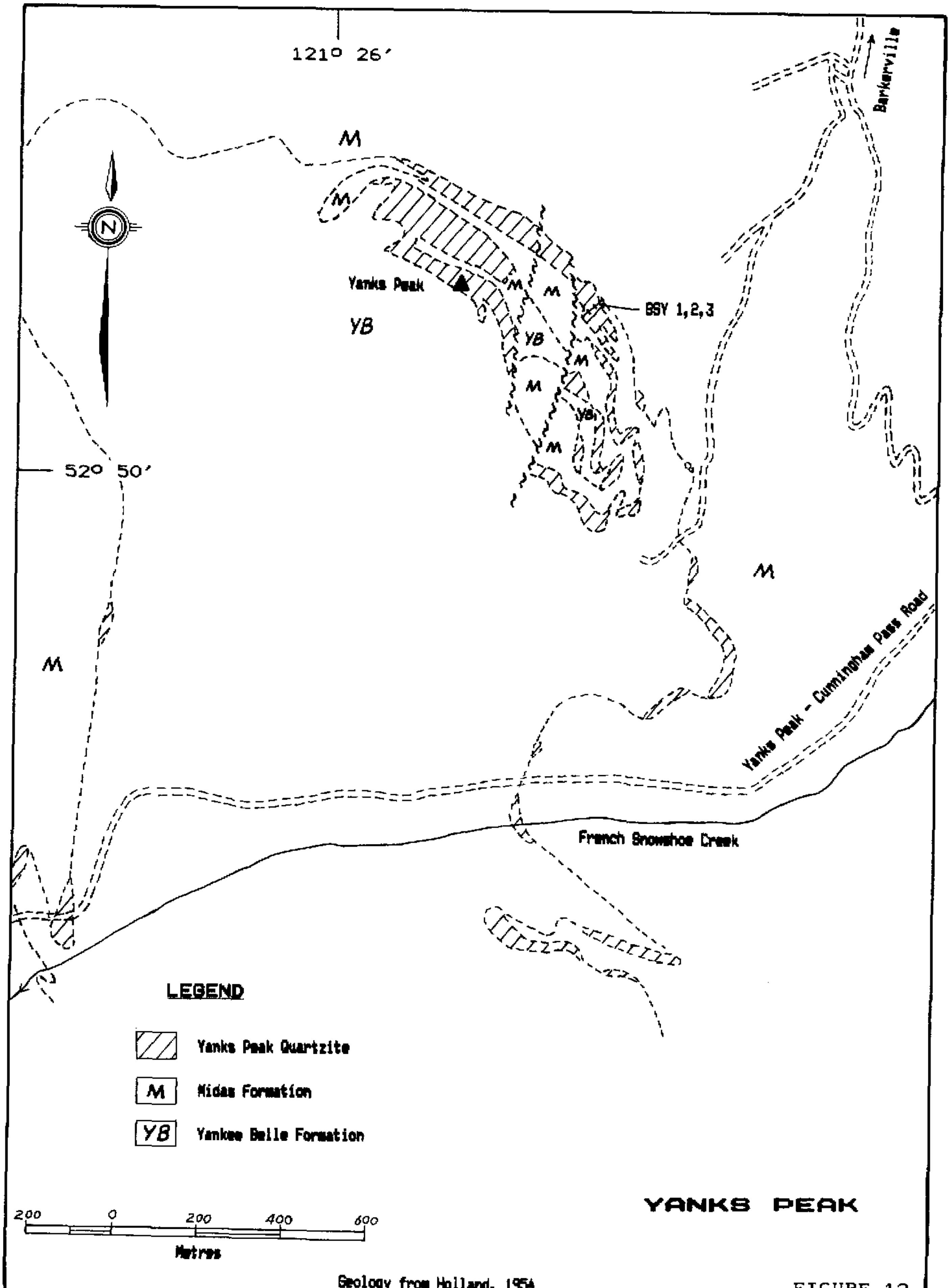

121° 26′
Barkerville
M
N
Yanks Peak
YB
BSY 1,2,3
52° 50′
Yanks Peak - Cunningham Pass Road
French Snowshoe Creek
LEGEND
Yanks Peak Quartzite
Midas Formation
Yankee Belle Formation
YANKS PEAK
200
0
200
400
600
Metres
Geology from Holland, 1954

FIGURE 13

YANKS PEAK AREA

Figure 13 is a map of quartzites in the Yanks Peak area. The quartzite is more homogeneous than in the Roundtop Mountain area. It is variable in colour and is generally massive and fine grained with well-sorted and well-rounded grains. Minor white mica is present throughout and minor, thin discontinuous beds of foliated micaceous quartzite are also present. Coarse-grained milky quartz veins, up to 1 metre thick and commonly containing well-formed quartz crystals, occur throughout the quartzite. Some specular hematite is present in the veins.

Samples from a chip line across the quartzite were collected by the Geological Survey Branch in 1982 (Figure 13). These returned the following weight per cent values:

	SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	Na_2O	K_2O	TiO_2	MnO	LOI
GSY-1	95.56	2.02	0.54	.07	<.03	<.04	.45	.15	<.002	0.9
GSY-2	97.18	1.21	0.55	.03	<.03	<.03	.28	.09	<.002	0.6
GSY-3	98.92	0.56	0.20	<.03	<.03	<.03	.14	.04	<.002	<0.1

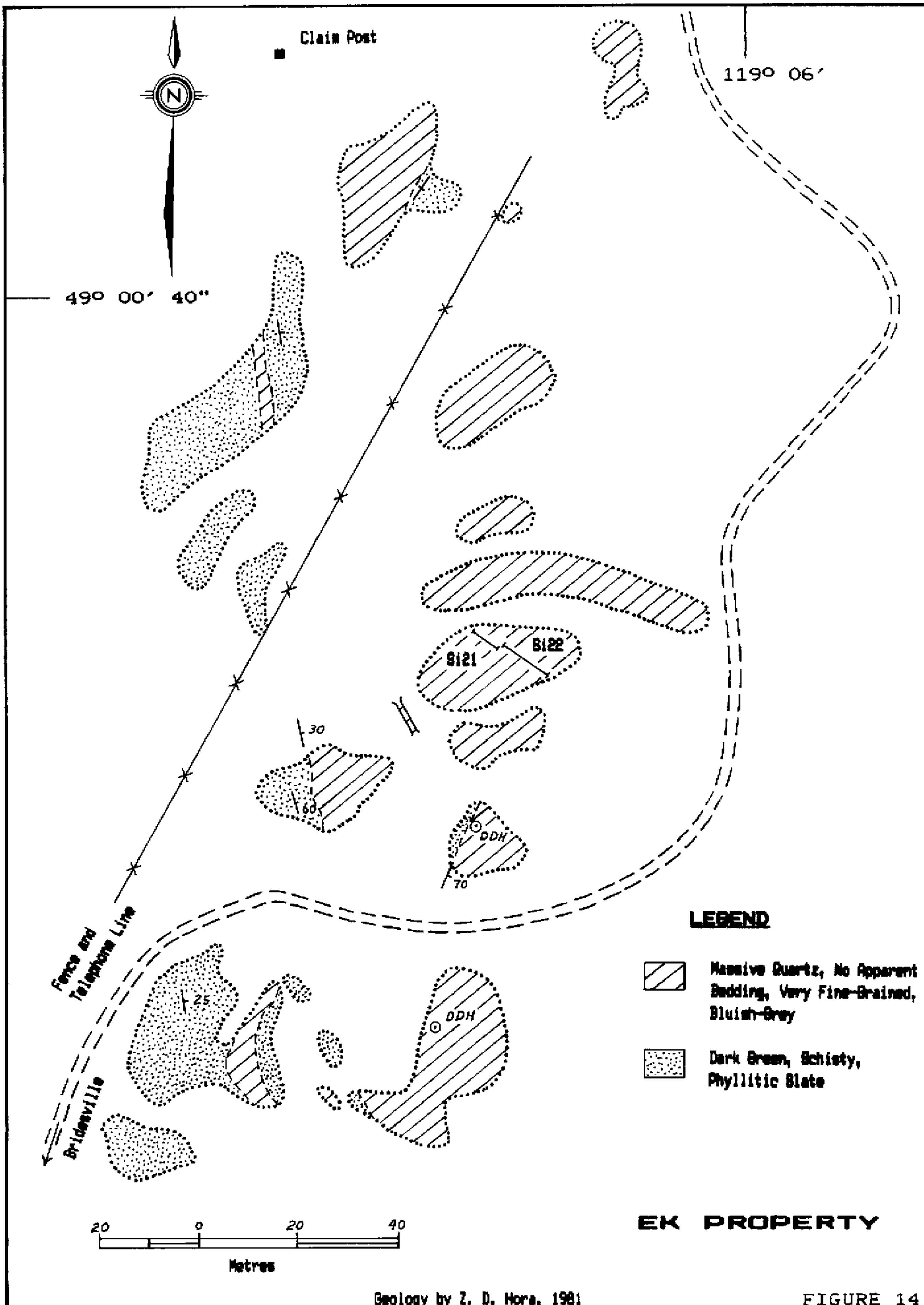
EK

(S11)
Type: Quartzite
Minfile: 082ESW 144 NTS: 082E 03E Elevation: 1250m
Latitude: 49° 00′ 40" Longitude: 119° 06′
Alias: Bridesville, Kuhn

The quartzite occurrence is situated about 5 kilometres southeast of Bridesville and is readily accessible from Highway 3 over approximately 6.4 kilometres of good gravel road.

Schists and volcanic rocks of the Permo-Triassic Anarchist Group are the main rock types underlying the area. The general trend of the units is northwest to west, with dips of 30 to 55 degrees to the northeast.

Very fine-grained quartzite outcrops on several small knolls over an area of about 200 by 100 metres (Figure 14). The quartzite exhibits no apparent bedding but contains local quartz-cemented breccia zones. The surrounding rocks are mainly phyllitic slate, however, siliceous bands and, less commonly, fine-grained, massive, greenish-grey volcanic rocks are also present.



Claim Post
N
119° 06′
49° 00′ 40″
Bl21
Bl22
30
60
DDH
70
Fence and Telephone Line
25
DDH
Bridesville
LEGEND
Massive Quartz, No Apparent Bedding, Very Fine-Grained, Bluish-Grey
Dark Green, Schisty, Phyllitic Slate
20
0
20
40
Metres
EK PROPERTY
Geology by Z. D. Hora, 1981

FIGURE 14

Some diamond drilling was done on the occurrence in 1966 and 1967. Analyses of core samples from a 20-metre interval averaged over 99.5 per cent SiO_2, with some erratic high values in iron, calcium and alumina.

Two chip samples (Figure 14) collected by the Geological Survey Branch in 1982 yielded the following weight per cent values:

	SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	LOI
S121	99.0	0.04	0.06	<0.02	<0.03	0.1
S122	99.9	0.10	0.11	<0.02	0.35	0.5

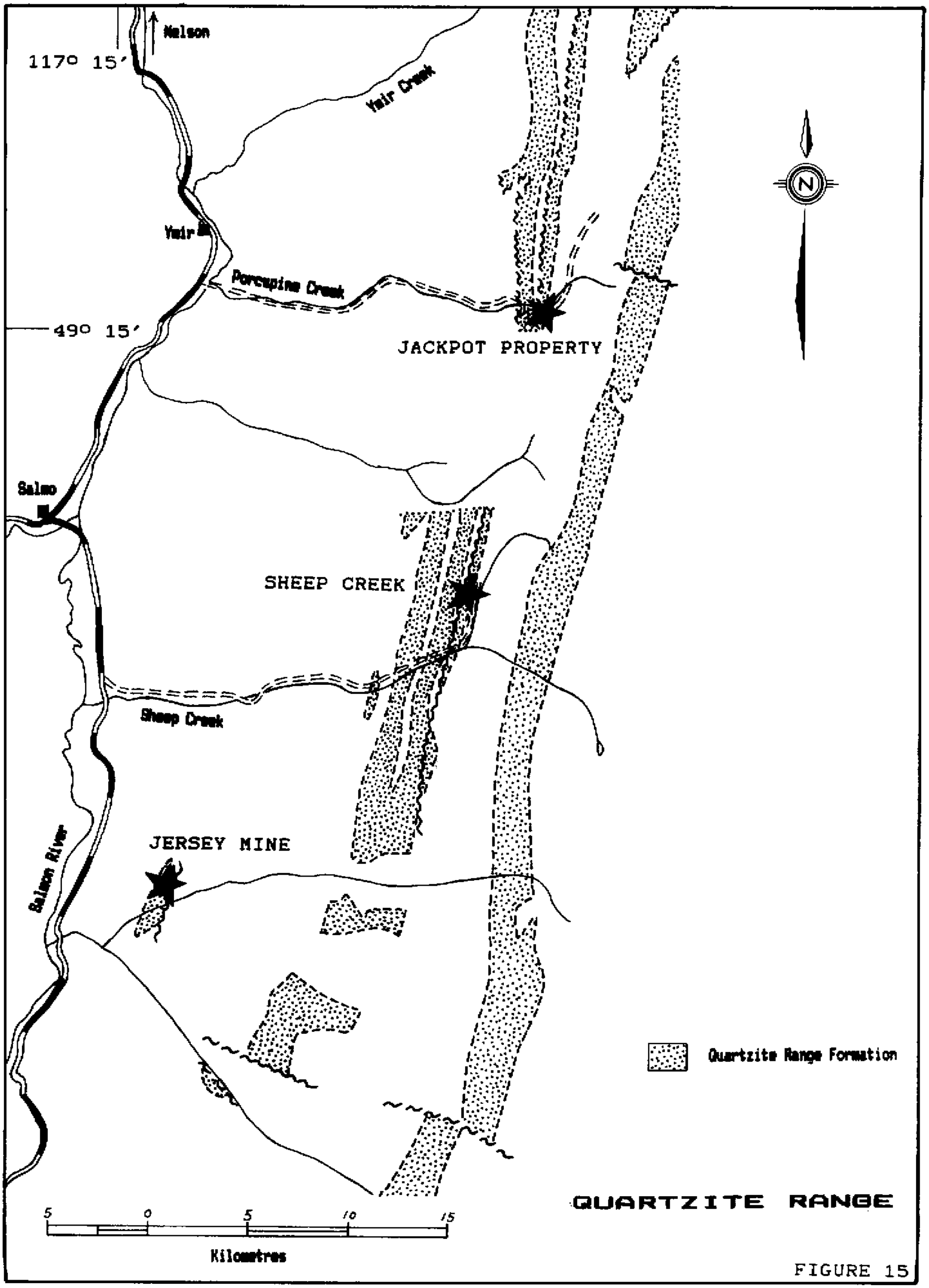
QUARTZITE RANGE FORMATION

(S12)
Type: Quartzite
Minfile: 082FSW 295
NTS: 082F 03E, 06E
Latitude: 49° 06'
Longitude: 117° 13' 20" (Jersey Mine)
Alias: Jersey Mine

The Lower Cambrian Quartzite Range Formation, consisting of phyllitic quartzite to a purer white quartzite, has been mapped in the Salmo area (Figure 15). Further north, the Quartzite Range Formation together with the Reno Formation form the Hamill Group which extends north to the vicinity of Revelstoke.

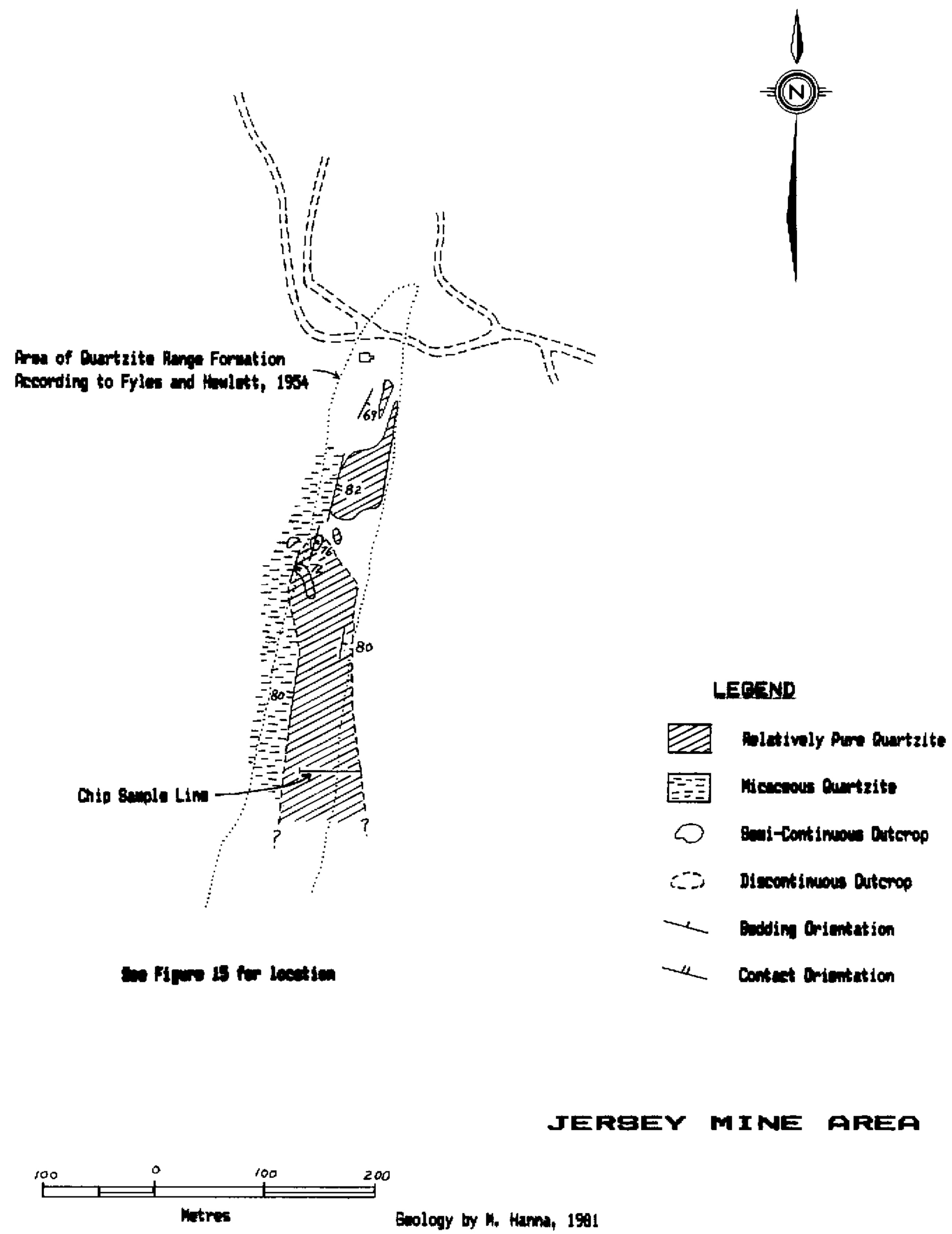
In 1981 the Geological Survey Branch examined three exposures of the Quartzite Range Formation (Figure 15). One occurrence is at the site of the Jersey lead/zinc mine. A quartzite outcrop trending at 014 degrees was mapped for 400 metres along strike but a ridge suggests that the quartzite continues southwards for a considerable distance. A bed of relatively pure, fine to medium-grained quartzite, up to about 75 metres wide, is flanked on both sides by micaceous banded quartzite. The relatively pure quartzite contains minor sericite and has patches and streaks of limonite and hematite staining on weathered surfaces. It is well jointed. Figure 16 is a geology map of the quartzite at the Jersey mine.

Five samples were collected by the Geological Survey Branch in 1981 along a chip sample line across the quartzite (Figure 16). They returned the following weight per cent values:



QUARTZITE RANGE

FIGURE 15



See Figure 15 for location

JERSEY MINE AREA

Geology by M. Hanna, 1981
(After Fyles & Hewlett, 1954)

FIGURE 16

SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	Na_2O	K_2O	TiO_2	MnO
95.59	2.07	0.26	<.04	<.02	<.226	.173	.044	.004
94.59	2.34	0.17	.04	<.02	<.226	.200	.045	.007
95.69	2.11	0.26	<.04	<.02	<.226	.235	.044	.004
95.87	1.86	0.29	<.04	<.02	<.226	.259	.062	.005
95.23	2.73	0.33	.04	.03	<.226	.443	.062	.005

Another exposure of the Quartzite Range Formation was examined on the Jackpot property on Porcupine Creek. This quartzite is significantly less pure than that at the Jersey mine and has a strongly developed micaceous banding.

An occurrence of somewhat purer quartzite was examined in the Sheep Creek valley. A fine-grained white quartzite outcrops over a width of 8 metres. It can be followed for at least 100 metres in a series of discontinuous outcrops.

SHUSWAP LAKE

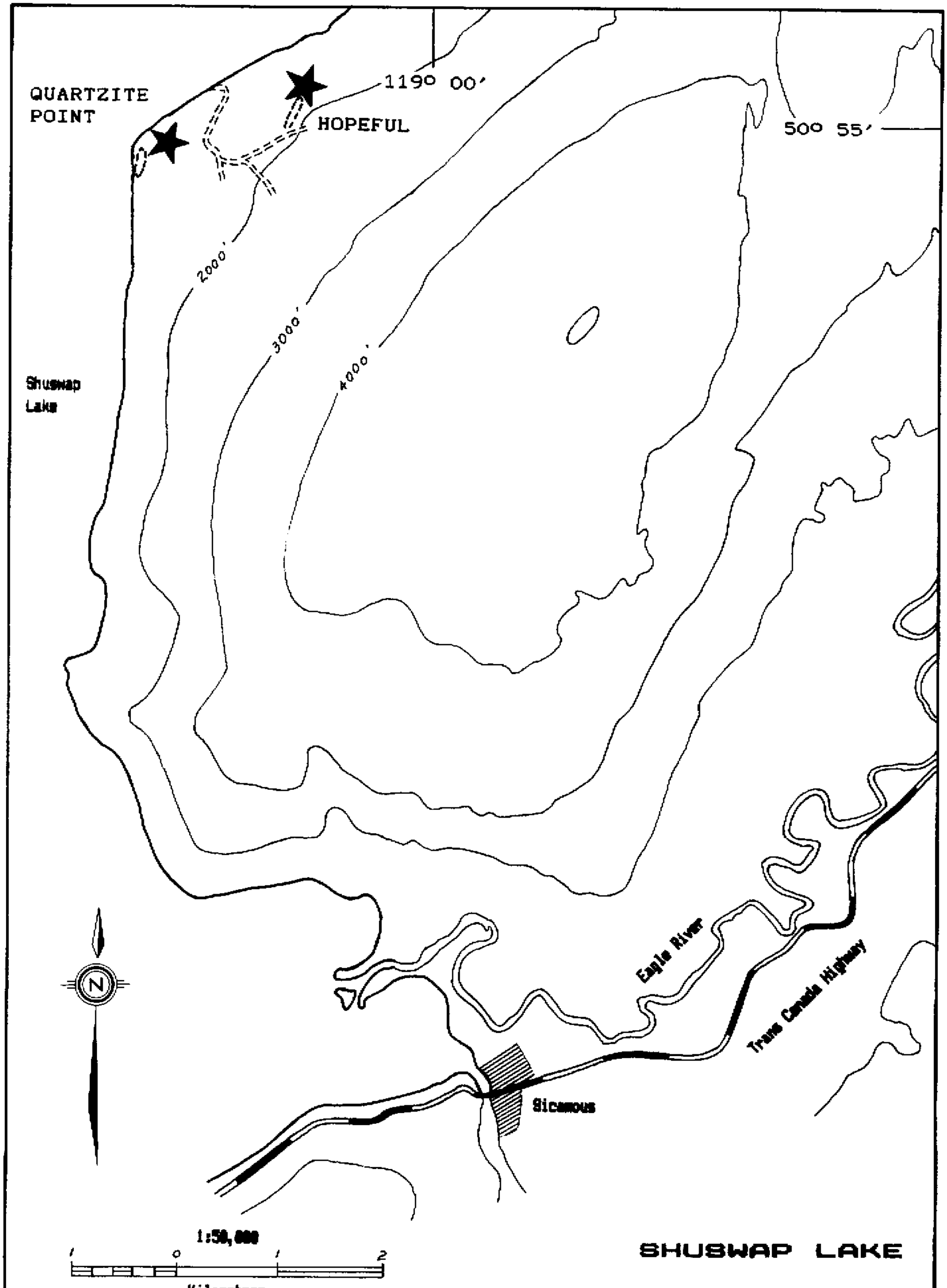
(S13)
Type: Quartzite
Minfile: 082LNW 026, 027 NTS: 082L 14E
Latitude: 50° 54′ 52" Longitude: 119° 02′ 24" (Quartzite Pt.)
50° 55′ 08" 119° 01′ 11" (Hopeful)
Alias: Quartzite Point, Hopeful

Two silica showings occur near the east shore of Shuswap Lake at Quartzite Point, about 9.4 kilometres northwest of Sicamous. The Quartzite Point showing occurs close to the shore while the Hopeful occurrence is about 1.5 kilometres to the northeast (Figure 17).

Both showings are within the Precambrian Monashee Group. At Quartzite Point the quartzite occurs as a band 7.6 to 9.1 metres thick, between layers of gneiss. It is exposed for 275 metres along the beach and trends northeasterly with a gentle dip to the southeast. It is medium-grained and white to glassy, with patches of brown stain on fracture surfaces. Some quarrying has been done at the site.

Assay values reported in 1928 for a representative sample collected from a trench at Quartzite Point are:

SiO_2	98.20 per cent	CaO	0.57 per cent
Fe_2O_3	0.12 per cent	MgO	0.34 per cent
Al_2O_3	0.77 per cent	LOI	0.17 per cent



QUARTZITE POINT
HOPEFUL
119° 00′
50° 55′
2000′
3000′
4000′
Shuswap Lake
Eagle River
Trans Canada Highway
Sicamous
N
1:50,000
1 0 1 2
Kilometres
SHUSWAP LAKE

FIGURE 17

Assay values from a chip sample across the entire width of the quarry exposure were reported in 1958 as follows:

SiO_2	97.48 per cent
Al_2O_3	0.59 per cent
Fe	0.02 per cent

At the Hopeful showing a medium-grained white quartzite band 9.1 to 12.2 metres thick is interbedded with biotite-hornblende gneiss. The quartzite has a strike of 035 degrees and dips 10 degrees to the southeast. Although much of it is glassy to milky white, some is stained yellow to brown. Scattered patches of pyrite are present.

VEIN OCCURRENCES

SUSIE

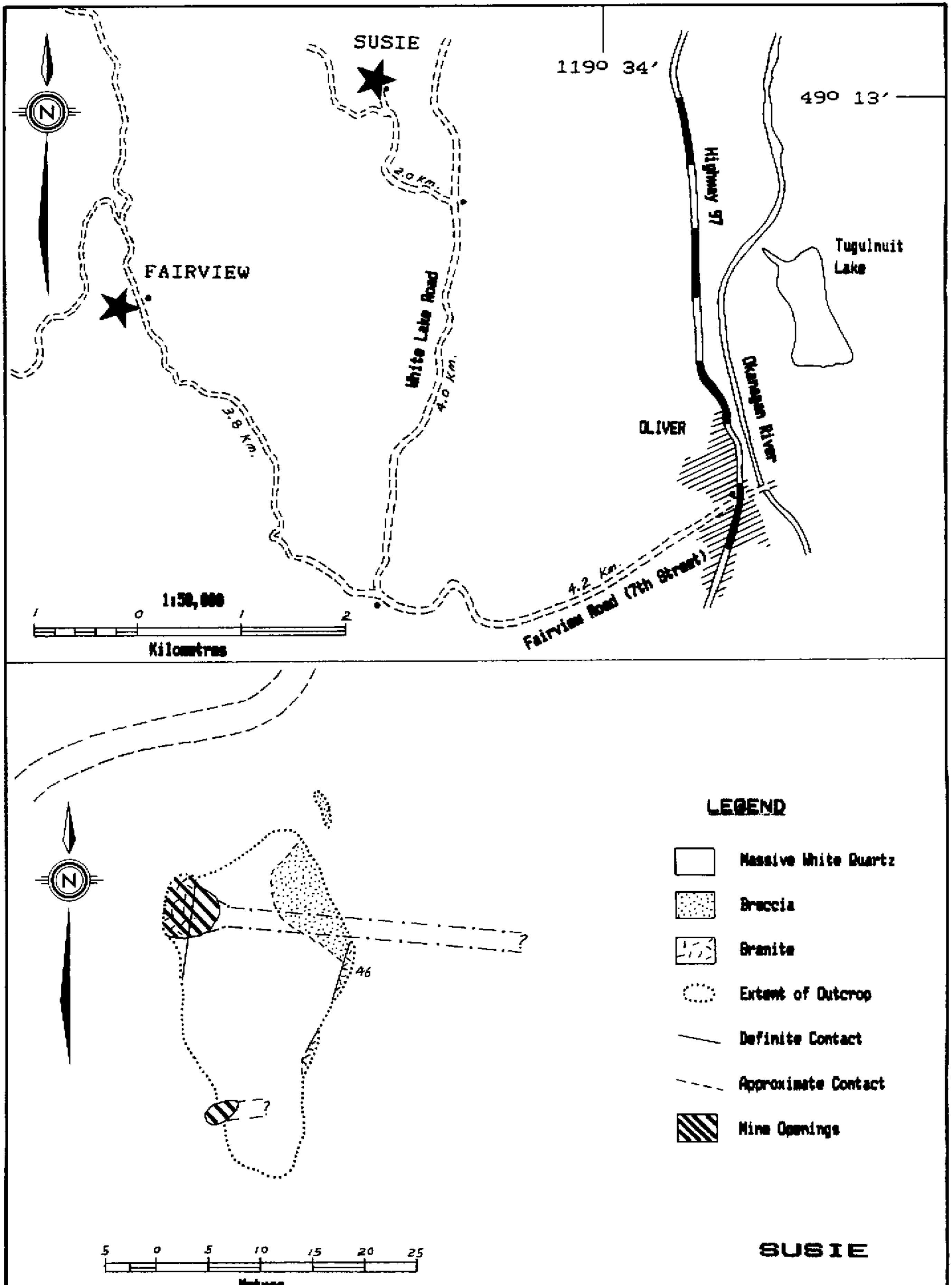
(S14)
Type: Vein
Minfile: 082ESW 171 NTS: 082E 04E Elevation: 610m
Latitude: 49° 13′ 06" Longitude: 119° 35′ 46"

The Susie deposit is located approximately 4.5 kilometres northwest of Oliver (Figure 18). Access from Oliver is via Fairview Road (7th Street) for about 4.2 kilometres to the White Lake Road which heads north. This road is followed for about 4 kilometres to a road heading westerly. The property is about 2 kilometres down this road. It is situated on the Susie Crown Grant (L.1917) which, as of 1986, was owned by the Fairview Mining Company Ltd. of Wallace, Idaho.

Precious and base-metal mineralization is hosted by a quartz body within granitic rocks. Visible mineralization consists of pyrite, galena, chalcopyrite and sphalerite. The Susie claim was Crown-granted in 1901 and underground development work commenced in the early 1900s. There is recorded production for certain years during the period 1960 - 1976. Most, if not all, of the ore was shipped to Trail where the silica was used as a flux. Production for the period 1974 - 1976 was 13,222 tonnes containing 5.05 grams per tonne gold, 92.18 grams per tonne silver, 0.033 per cent copper, 0.33 per cent lead and 0.15 per cent zinc.

The quartz is massive and milky white and outcrops on a knoll with maximum dimensions of 35 metres in a north-south direction and 20 metres in an east-west direction (Figure 17). The footwall contact with granite is fairly sharp and is oriented at 008 degrees / 56 degrees east while the hangingwall contact is more diffuse and irregular, but has an approximate attitude of 016 degrees / 46 degrees east. Altered granite xenoliths which are separated by white quartz veinlets occur over a width of several metres at the hangingwall contact.

In hand specimen the quartz appears to have very few impurities, although limonite staining of fractures is present around small pockets (0.5 centimetre diameter) of pyrite, galena and pyrrhotite. Fractures in the quartz vary from closely spaced (average 1 to 2 centimetres apart) to widely spaced (40 - centimetre spacing). A major joint set cuts most of the outcrop at 025 degrees / 68 degrees northwest; other less well-developed joints are also present.



Geology by M. Hanna, 1981

FIGURE 18

A representative chip sample across the north face of a decline entrance was collected by the Geological Survey Branch in 1981. It assayed as follows:

SiO_2	96.57 per cent	Na_2O	<0.226 per cent
Al_2O_3	1.33 per cent	K_2O	0.041 per cent
Fe_2O_3	0.05 per cent	TiO_2	<0.014 per cent
MgO	<0.04 per cent	MnO	0.005 per cent
CaO	<0.02 per cent		

FAIRVIEW

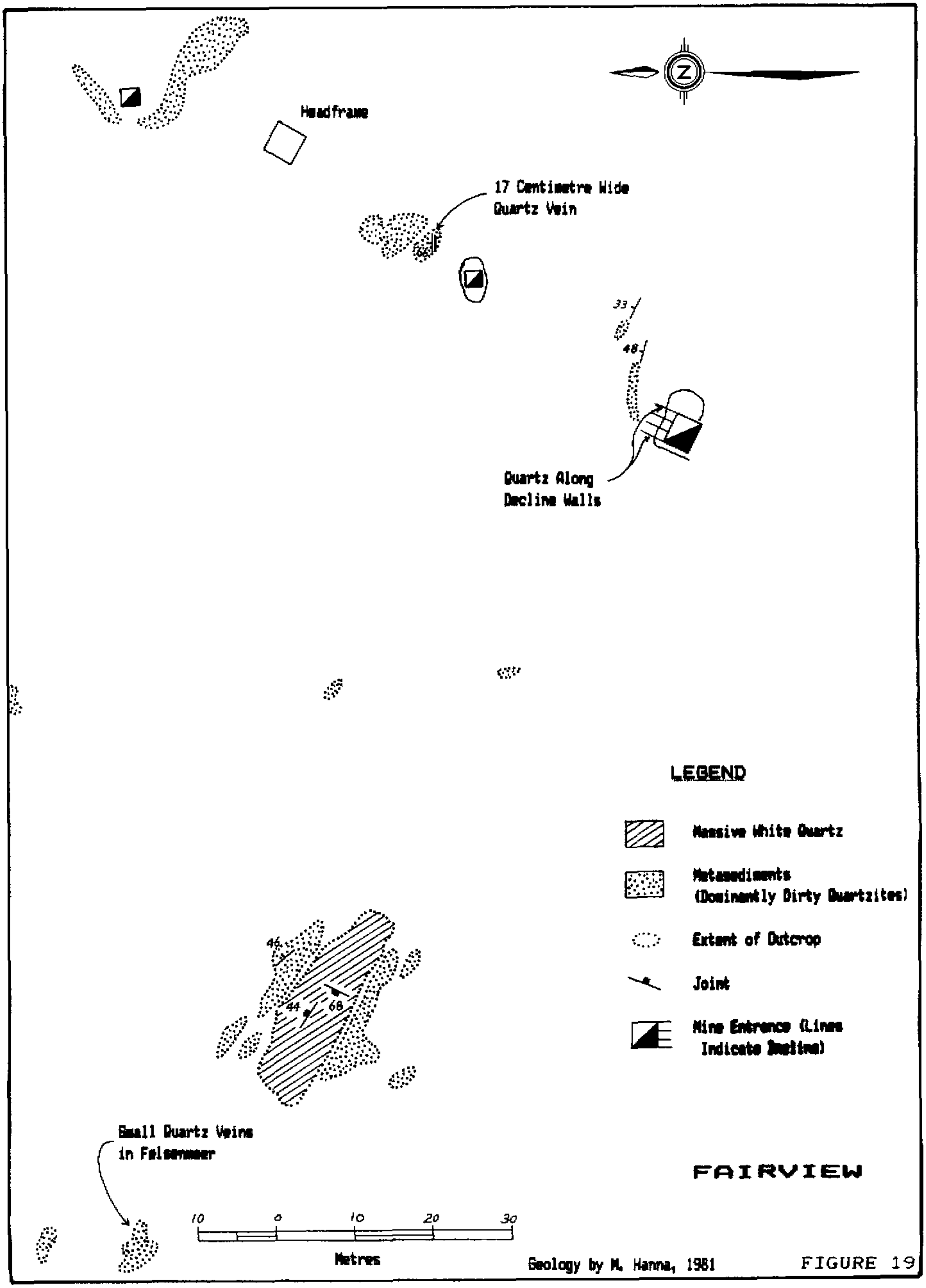
(S15)
Type: Vein
Minfile: 082ESW 172 NTS: 082E 04E Elevation: 850m
Latitude: 49° 12′ Longitude: 119° 38′

Access to the Fairview mine area is by the Fairview Road from Oliver, a distance of about 8 kilometres (Figure 18).

The quartz vein was mined in the past primarily for its gold content, although it is reported that about 320,000 tonnes of quartz was shipped to Trail for use as a flux. Mining operations took place on two levels referred to here as the Fairview headframe and the Fairview upper level.

The immediate area of the mine openings in the Fairview headframe area is underlain by slightly metamorphosed sediments dominated by finely laminated quartzites, impure quartzites and a few metagreywackes. Minor narrow (1.5 to 2.0 millimetres) quartz veins cut the sediments but no major quartz outcrop exists adjacent to the mine entrances. However, 100 metres west of the headframe there is a large outcrop of massive white quartz measuring 17 metres by 31 metres and striking 118 degrees with a northeasterly dip. Several xenoliths of metasediment occur within the quartz and the quartz is jointed and fractured. Limonite and hematite staining occurs along fractures and around cavities where sulphides have been leached out. Quartz is also exposed in the walls of a decline. Refer to Figure 19 for a geology map of the Fairview headframe area.

Metasedimentary rocks in the area of the Fairview upper level (1 kilometre west of the headframe) are generally less siliceous, finer grained and contain more chlorite and biotite. An intrusion of coarse-grained, equigranular granite occurs just north of the mine entrance. Although there is no significant



Z
Headframe
17 Centimetre Wide
Quartz Vein
33
48
Quartz Along
Decline Walls
46
44
68
LEGEND
Massive White Quartz
Metasediments
(Dominantly Dirty Quartzites)
Extent of Outcrop
Joint
Mine Entrance (Lines
Indicate Incline)
Small Quartz Veins
in Felsenmeer
10
0
10
20
30
Metres
FAIRVIEW
Geology by M. Hanna, 1981

FIGURE 19

quartz in outcrop in this area, there are abundant quartz chips in the dump material.

A random chip sample (Figure 19) was taken across the large quartz outcrop in the Fairview headframe area by the Geological Survey Branch in 1981. Weight per cent values for this sample are as follows:

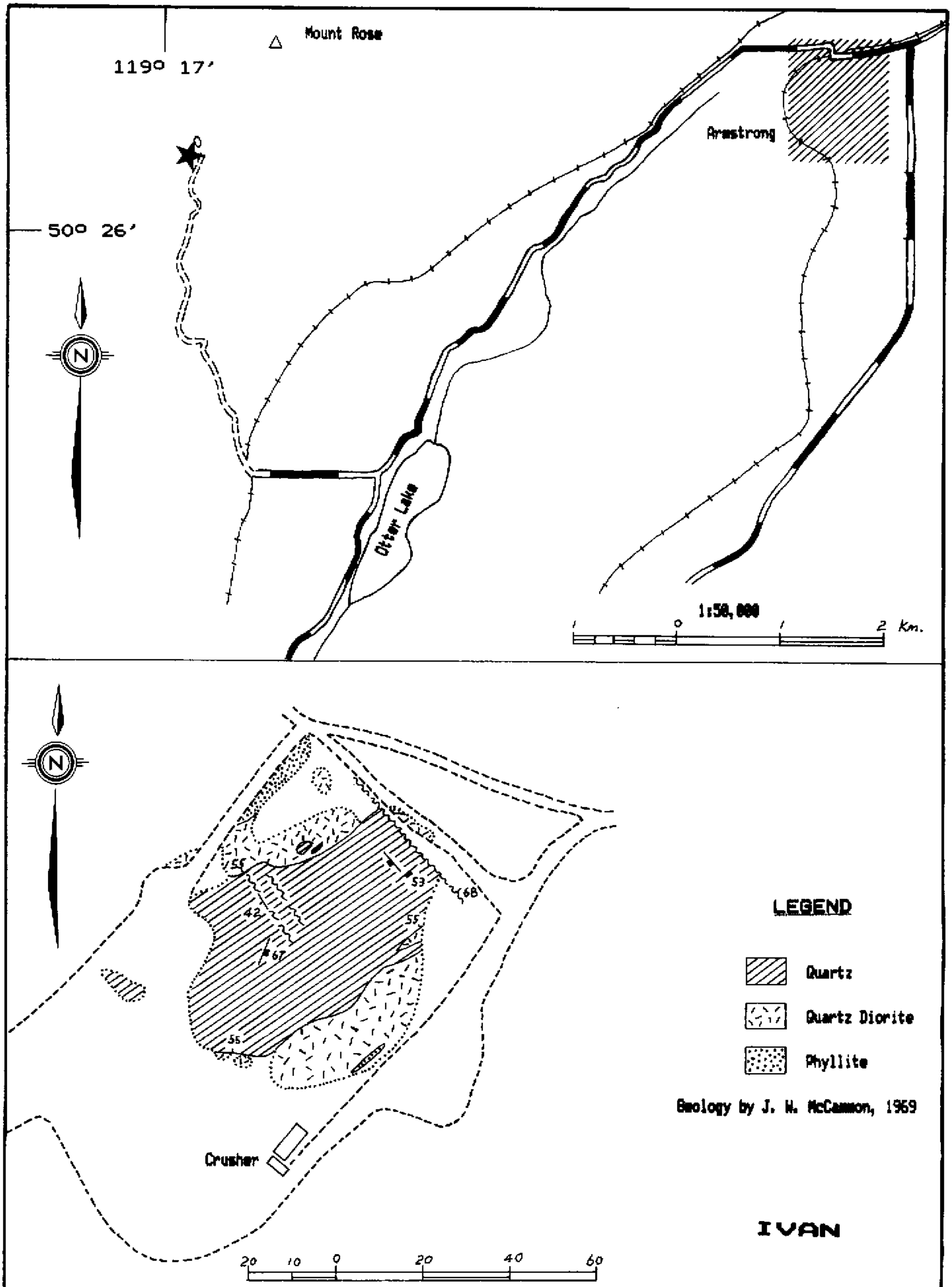
SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	Na_2O	K_2O	TiO_2	MnO
96.71	1.63	0.12	<.04	<.02	<.226	.029	<.014	.006

IVAN

(S16)
Type: Vein
Minfile: 082LSW 066 NTS: 082L 06W Elevation: 802m
Latitude: 50° 26′ 23" Longitude: 119° 16′ 44"
Alias: Mount Rose

The Ivan deposit is located 6.4 kilometres west of Armstrong (Figure 20). Access to the quarry is via the Otter Lake Road, either southwesterly from Armstrong or northeasterly off Highway 97 near the northeast end of Okanagan Lake and the Grandview Bench road heading west from opposite Otter Lake. At a point about 1.2 kilometres west of the Otter Lake Road the main road makes a right angle turn to the south. A road heading northwesterly from this point leads to the quarry, a little over 4 kilometres to the north.

Geological Survey of Canada Map 1059A indicates that the area is mainly underlain by argillite of the Upper Paleozoic Cache Creek Group. Granitic bodies related to the Coast Plutonic Complex intrude these rocks. The massive and milky white quartz of the Ivan occurrence is a vein that is exposed for 76 metres along strike and averages 30 metres in plan width. The quartz outcrop forms a knob 12 metres high. It is hosted by a quartz diorite that intrudes phyllite. The vein has an attitude of 070 degrees / 55 degrees north and is truncated at the northeast end by a fault and covered by overburden to the southwest. Vein contacts are sharp and sinuous. A few small scattered pockets of galena, chalcopyrite, pyrite, pyrrhotite and limonite occur, mainly along the hangingwall, near the fault at the northeast end. The quartz is highly shattered with abundant fractures at 2 to 15-centimetre spacings and fall mainly into two sets. Many fracture surfaces are iron stained. Figure 20 is a geological plan of the occurrence.


Mount Rose
119° 17'
50° 26'
N
Armstrong
Otter Lake
1:50,000
1 0 1 2 Km.
N
55
53
68
42
55
67
55
LEGEND
Quartz
Quartz Diorite
Phyllite
Geology by J. W. McCammon, 1969
Crusher
IVAN
20 10 0 20 40 60
Metres
FIGURE 20

Quarrying operations are reported for the years 1968, 1969 and 1973, with a total production of 4234 tonnes for these years. Quartz was mined mainly from a face across the southwest end of the outcrop. Crushing and screening took place at the site. Two hand-sorted shipments were used for the manufacture of cultured silica crystals. The balance was processed into chips for stucco dash, exposed aggregate and other similar uses.

A sample of randomly picked equal-sized chips from loose muck in the quarry, taken in 1969, analyzed as follows:

SiO_2	99.56 per cent
Total Fe	0.076 per cent
Al_2O_3	0.27 per cent
CaO	0.056 per cent

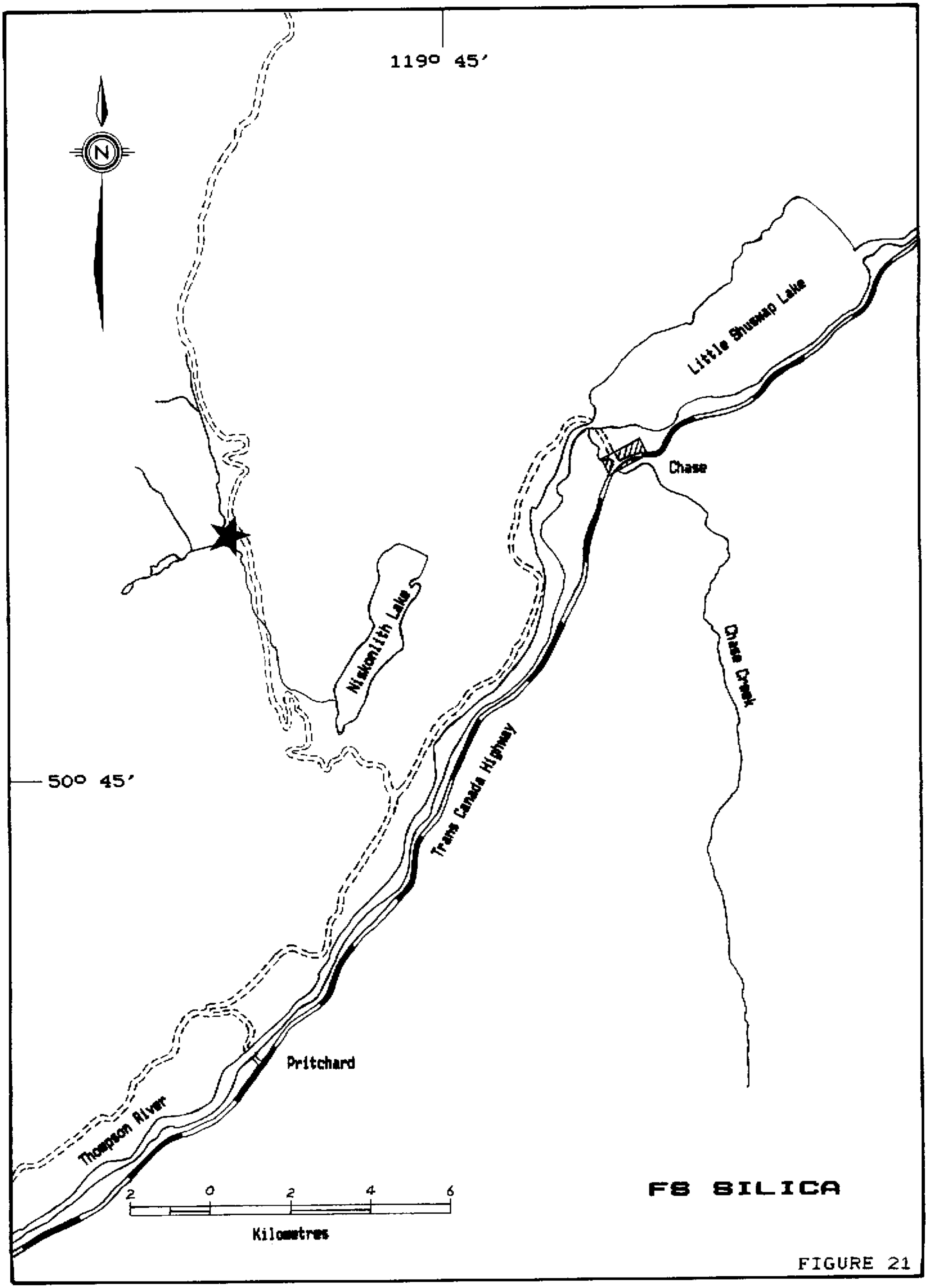
FS

(S17)
Type: Vein
Minfile: 082LNW 031 NTS: 082L 13W Elevation: 1082m
Latitude: 50° 48′ 25″ Longitude: 119° 49′ 42″
Alias: Chase

The FS quartz-vein occurrence is situated on Niskonlith Creek approximately 10 kilometres west of Chase (Figure 21). Access is via a road that crosses the South Thompson River just north of Chase and then follows the river in a southwesterly direction for almost 12 kilometres to the intersection with the McGillivray Lake Road. The property is located approximately 12 kilometres north of this intersection, on the west side of McGillivray Lake Road.

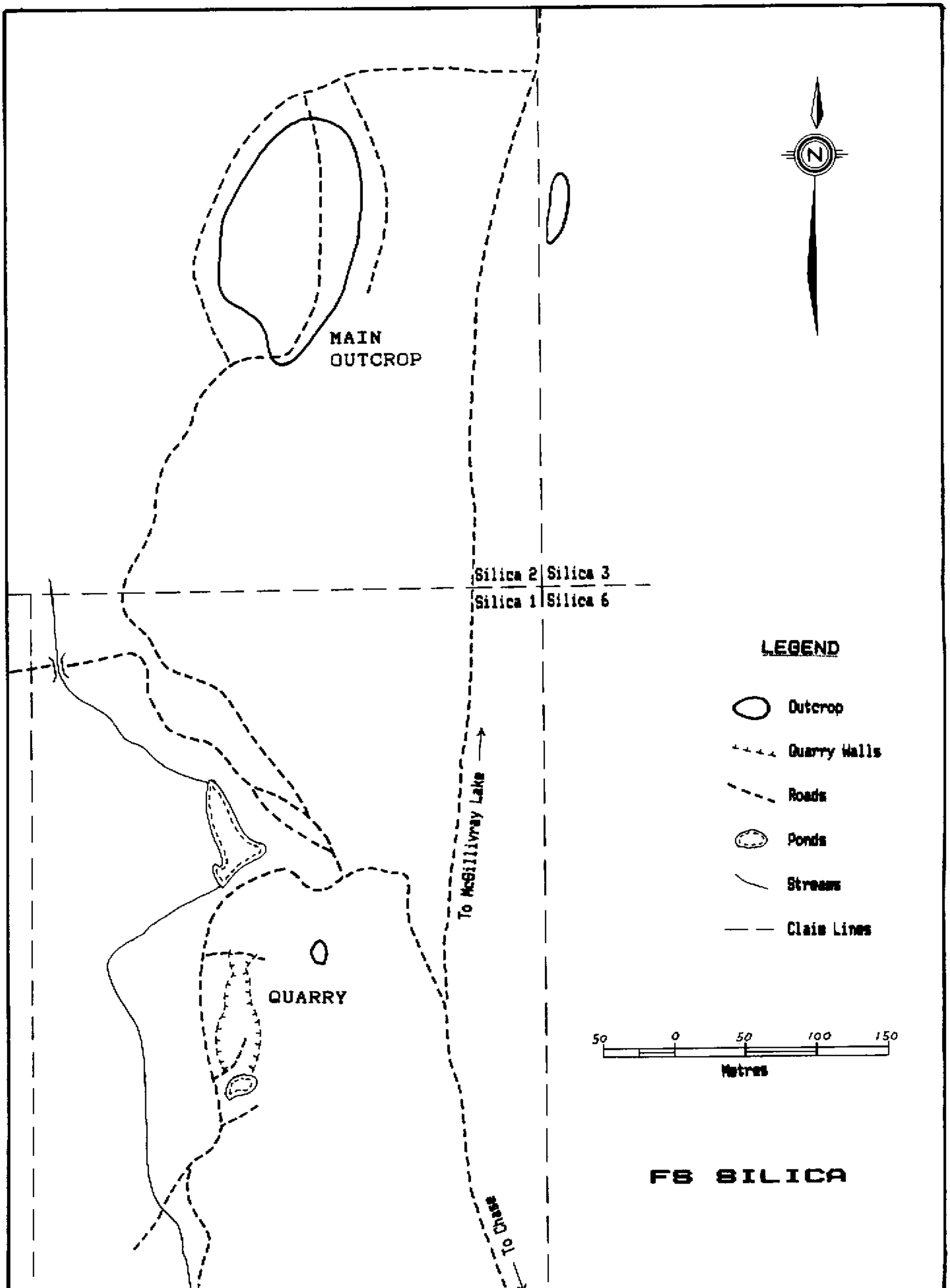
Two outcrops of a thick milky white quartz vein occur on the property, about 400 metres apart (Figure 22). Diamond drilling has established continuity between the two outcrops. A fault zone appears to host the quartz veining. Geological Survey of Canada Map 1059A shows the occurrence lies near the contact between Coast Plutonic Complex rocks to the south and Mount Ida Group metamorphic rocks to the north.

At the southern outcrop the quartz vein strikes northerly, dips steeply and is 3.5 to 15 metres wide (J. Pell, 1982). A quarry on the vein is elongated in a north-south direction and, as of 1982, measured 110 by 35 metres. Figure 23 is a geologic map of the quarry. The quartz is milky white and coarse-grained



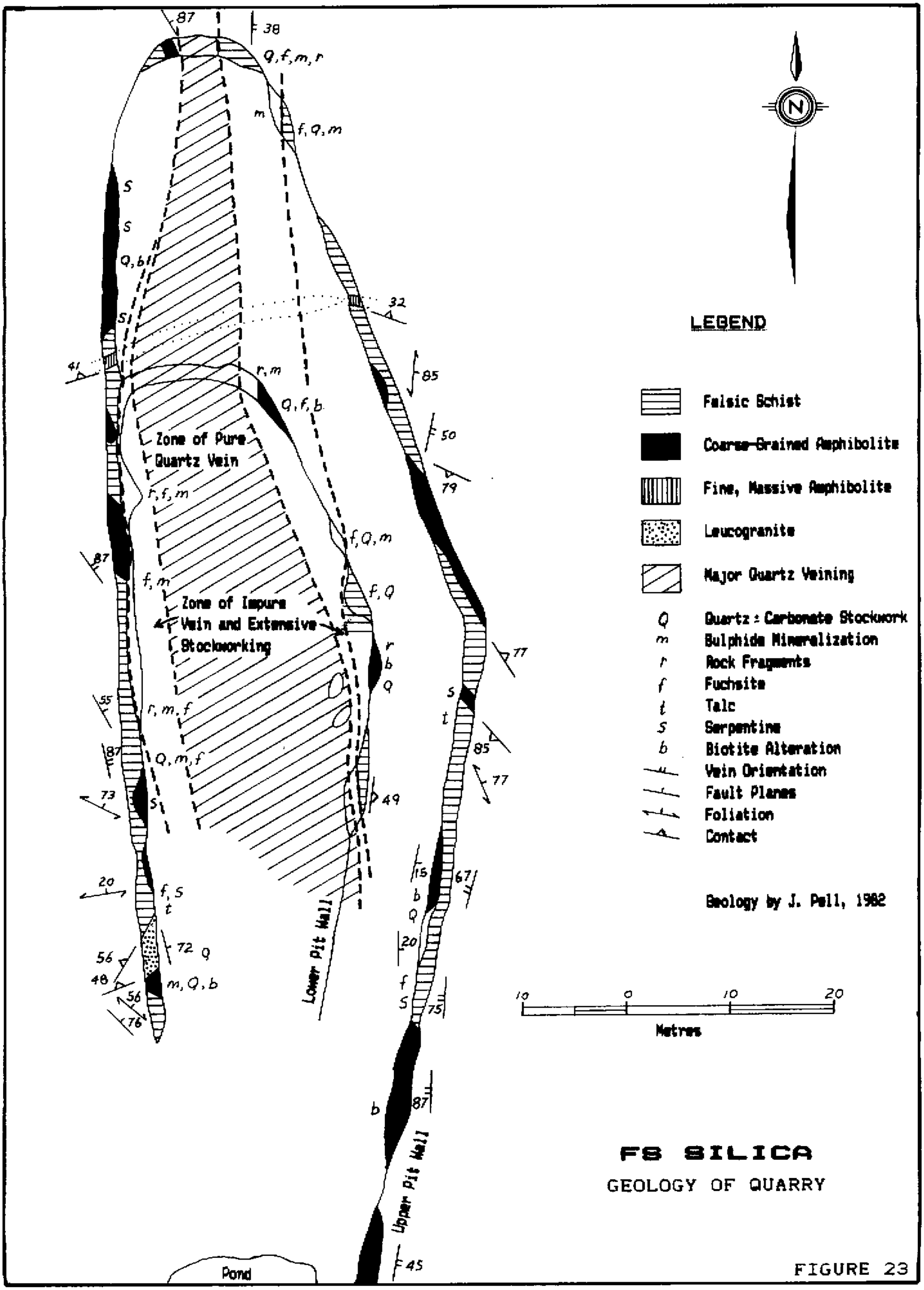
FS SILICA

FIGURE 21



MAIN
OUTCROP
Silica 2
Silica 3
Silica 1
Silica 6
To McGillivray Lake
QUARRY
To Chase
LEGEND
Outcrop
Quarry Walls
Roads
Ponds
Streams
Claim Lines
50
0
50
100
150
Metres
FS SILICA

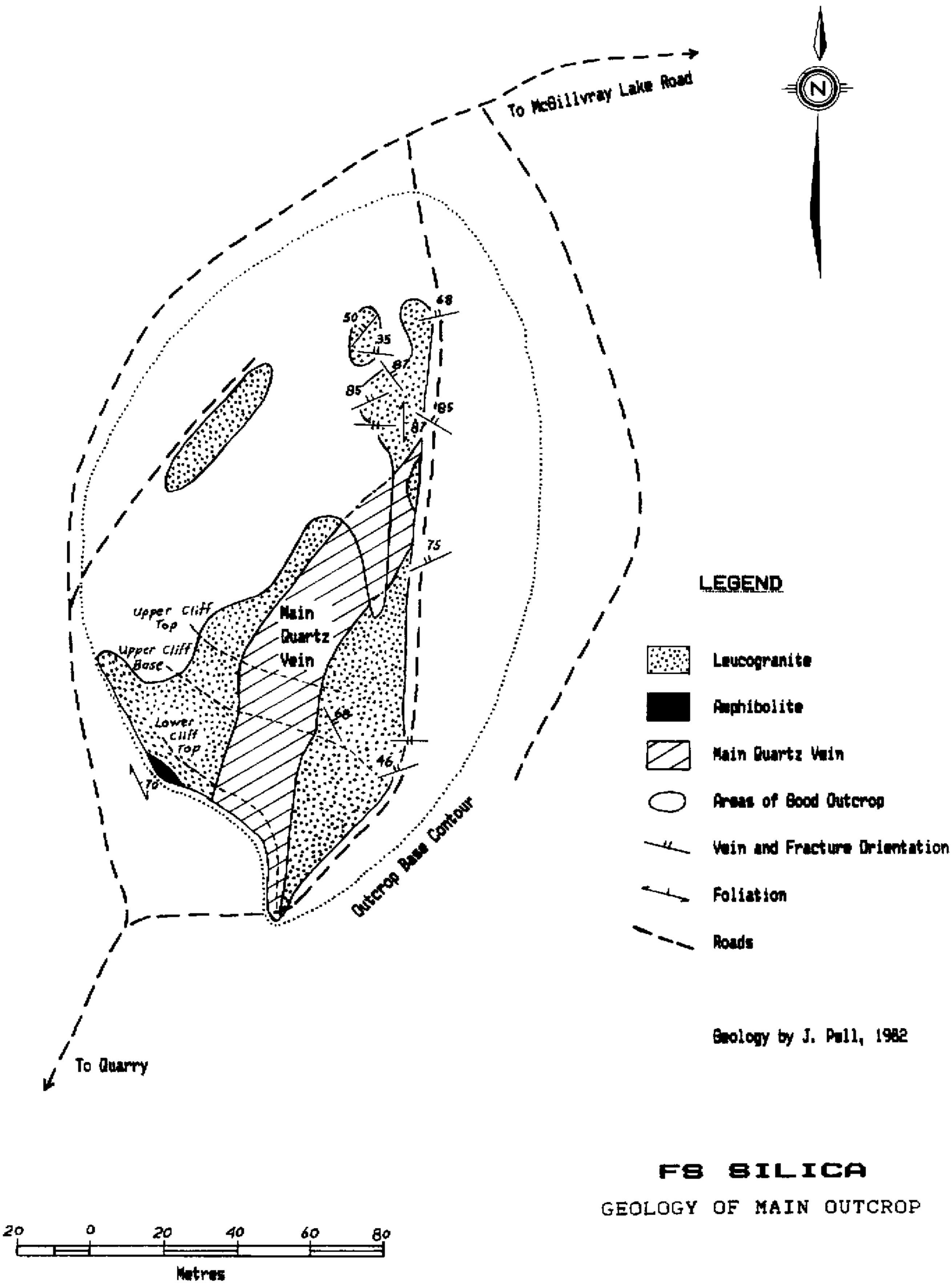
FIGURE 22



FS SILICA

GEOLOGY OF QUARRY

FIGURE 23



FS SILICA

GEOLOGY OF MAIN OUTCROP

FIGURE 24

with occasional well-formed crystals reaching 10 to 20 centimetres in length. Minor impurities that are present throughout the width of the vein include seams of fuchsite and reddish rust-stained patches. The vein has been visually estimated to be greater than 98 per cent quartz. Several shipments were made to the silicon carbide plant in Portland, Oregon and to the Corning silicon plant in Springfield, Oregon. Other potential uses for the silica would be as roofing chips, stucco dash, and similar products for residential construction and the building industry in general. The country rock consists of metavolcanic rocks which are predominantly felsic schists and amphibolites. A zone of impure vein quartz up to 7.5 metres wide is transitional to extensive quartz stockworking in altered country rock on either side of the main vein. The pit walls contain variable amounts of quartz stockwork veining. The impure margins of the main vein, and the quartz stockwork veining, are mineralized with pyrite, chalcopyrite, pyrrhotite, sphalerite, galena, scheelite and possibly tungstenite.

The northern outcrop, which has been referred to as the granite dome outcrop, is composed mainly of leucocratic granitic rocks and measures approximately 120 by 200 metres (Figure 24). A quartz vein 20 metres wide strikes 040 degrees with a steep dip. The quartz is coarse-grained, massive and milky white. Minor yellow and orange rust staining occurs on fractures and rare grains of sulphides are present in the quartz. Quartz stockwork veining occurs throughout the granite.

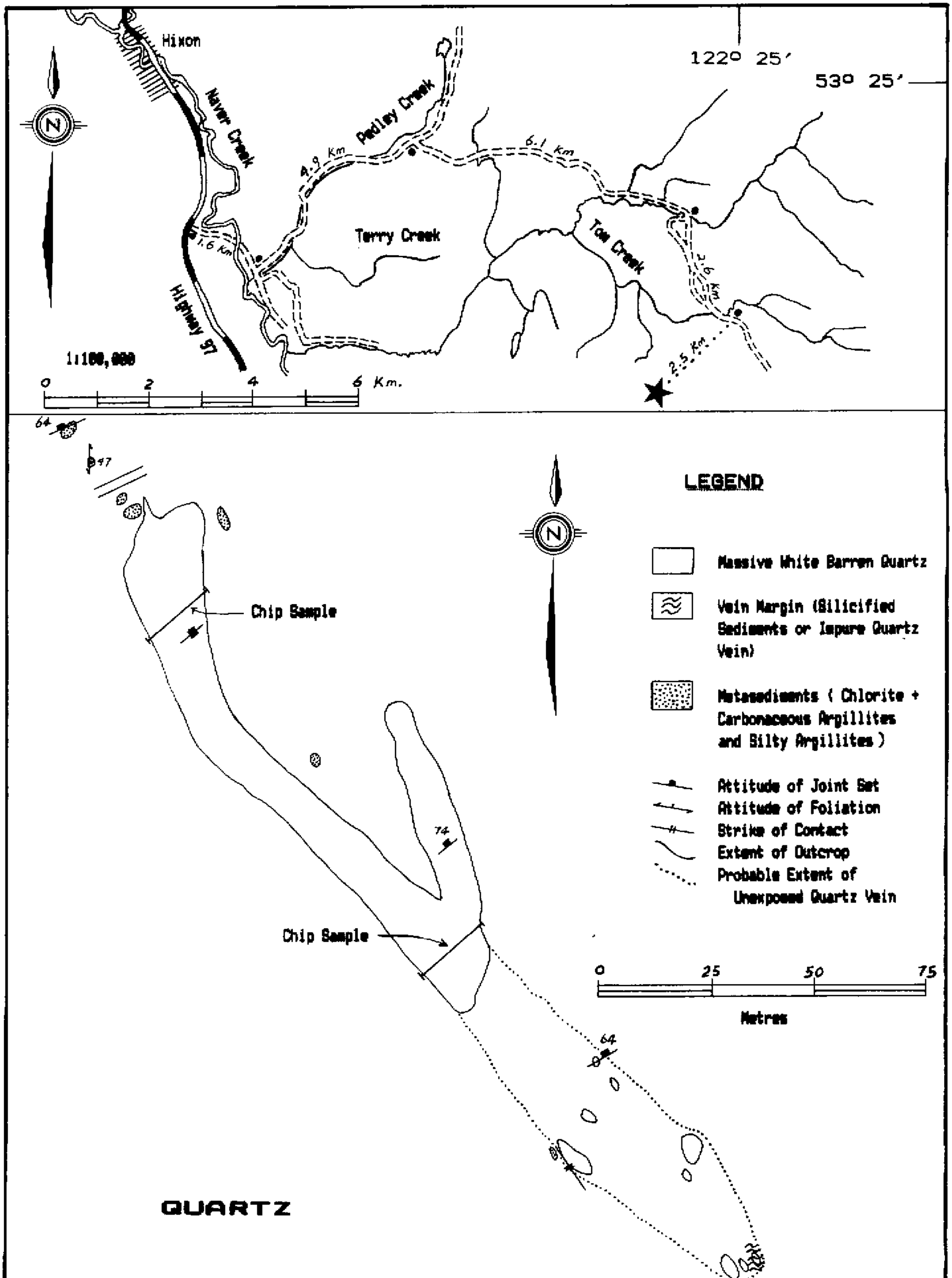
A random chip sample, collected from the northern vein in 1969, yielded:

SiO_2	99.74 per cent
Total Fe	0.064 per cent
Al_2O_3	trace
CaO	nil

QUARTZ

(S18)
Type: Vein
Minfile: 093G 029 NTS: 093G 08W Elevation: 945m
Latitude: 53° 21′ 48″ Longitude: 122° 26′ 17″

The Quartz claims are located approximately 10 kilometres east-southeast of Hixon (Figure 25). Access to the property is via a gravel road to the east off Highway 97, about 2.9



Geology by M. Hanna, 1981

FIGURE 25

kilometres south of Hixon. After 1.6 kilometres on this road a logging road that heads easterly is followed for about 13.6 kilometres to Tom Creek. The remaining 2.5 kilometres to the quartz vein must be completed on foot.

Geological Survey of Canada Map 49-1960 shows that the area is mainly covered by Quaternary deposits. The most prominent bedrock unit in the vicinity of the showing is an Upper Triassic and Lower Jurassic sequence of sedimentary and volcanic rocks. Surface exposures indicate that the quartz vein is at least 205 metres long and up to 21 metres wide. The vein strikes at about 140 degrees and, at the approximate midpoint of its probable surface extent, it bifurcates to the northwest. The quartz is opaque, white, massive and very pure in appearance. Near the vein margins trace limonite and manganese stain are present on fractures. Several smaller quartz veins intrude the country rock. A regular joint set striking 050 to 060 degrees, dipping sub-vertically at the northwest end to 64 degrees northwest at the southeast end, is present in the quartz.

The country rock varies from a meta-argillite to a more siliceous metasediment.

Two chip samples from across the vein (Figure 25), collected in 1981 by Geological Survey Branch personnel, returned the following weight per cent values:

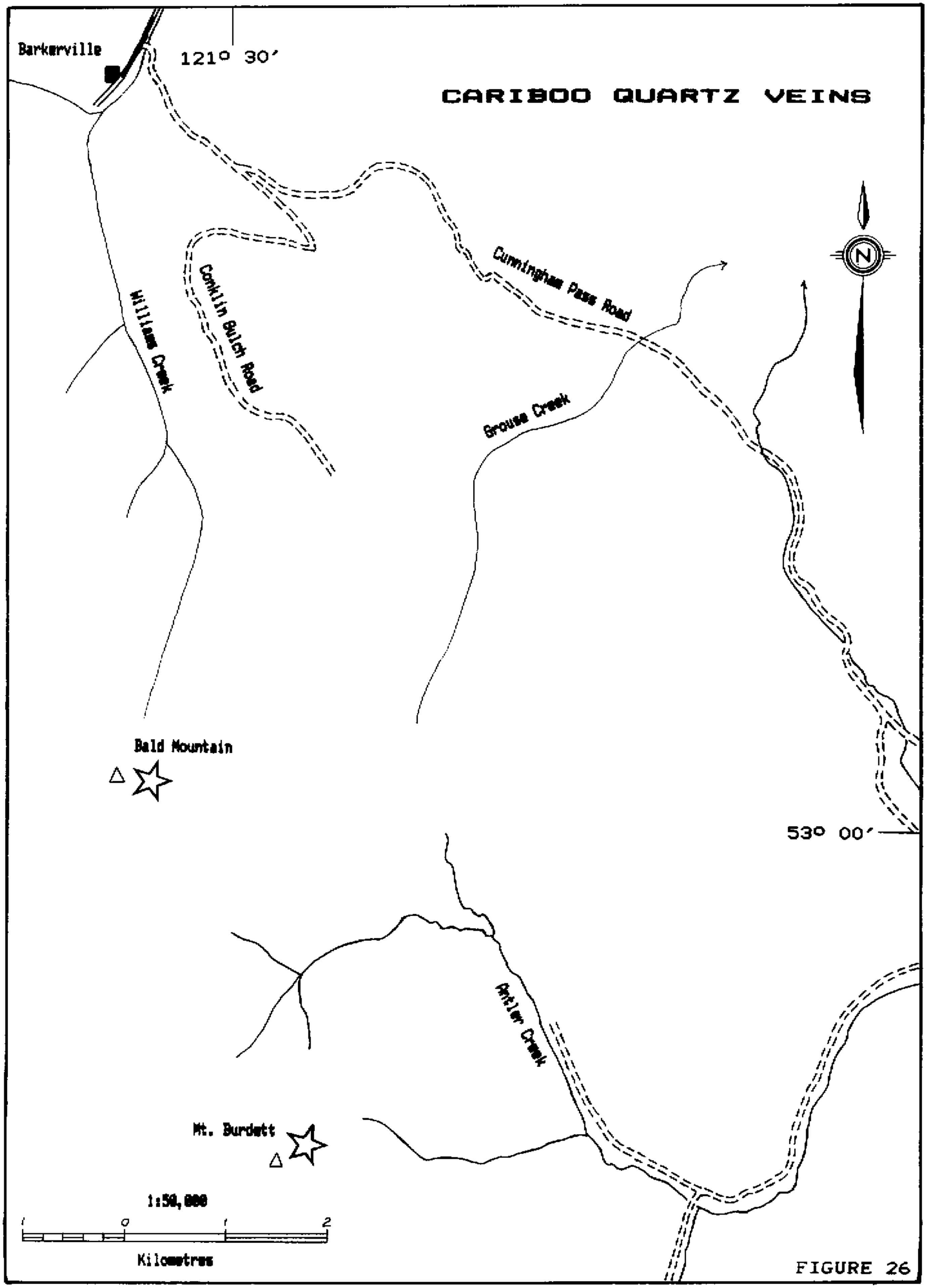
SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	Na_2O	K_2O	TiO_2	MnO
96.24	1.58	0.24	<.04	.02	.236	.016	<.014	.014
95.51	1.37	0.09	<.04	<.02	<.226	<.010	<.014	.007

Three assays of chip samples collected in 1974 by Consolidated Silver Standard Mines averaged just better than 99 per cent SiO_2, with acceptable contaminants.

CARIBOO

(S19)
Type: Vein
Minfile: 093A 140 NTS: 093A 14W
093H 04E
Latitude: 52° 58′ 15″ Longitude: 121° 29′ 30″ (Mt.Burdett)

Quartz veining occurs in a belt at least 40 kilometres long that varies in width from about 0.5 to 5 kilometres. The belt extends from the area of Roundtop Mountain northwesterly to the



CARIBOO QUARTZ VEINS
Barkerville
121° 30′
Cunningham Pass Road
Conklin Gulch Road
Williams Creek
Grouse Creek
Bald Mountain
53° 00′
Antler Creek
Mt. Burdett
1:50,000
1 0 1 2
Kilometres
FIGURE 26

Sugar Creek area and generally corresponds with the strike of host rocks. The veins outcrop prominently on grassy uplands of plateau surfaces, particularly on top of Mount Burdett and Bald Mountain. These two localities were examined by Geological Survey Branch personnel in 1982.

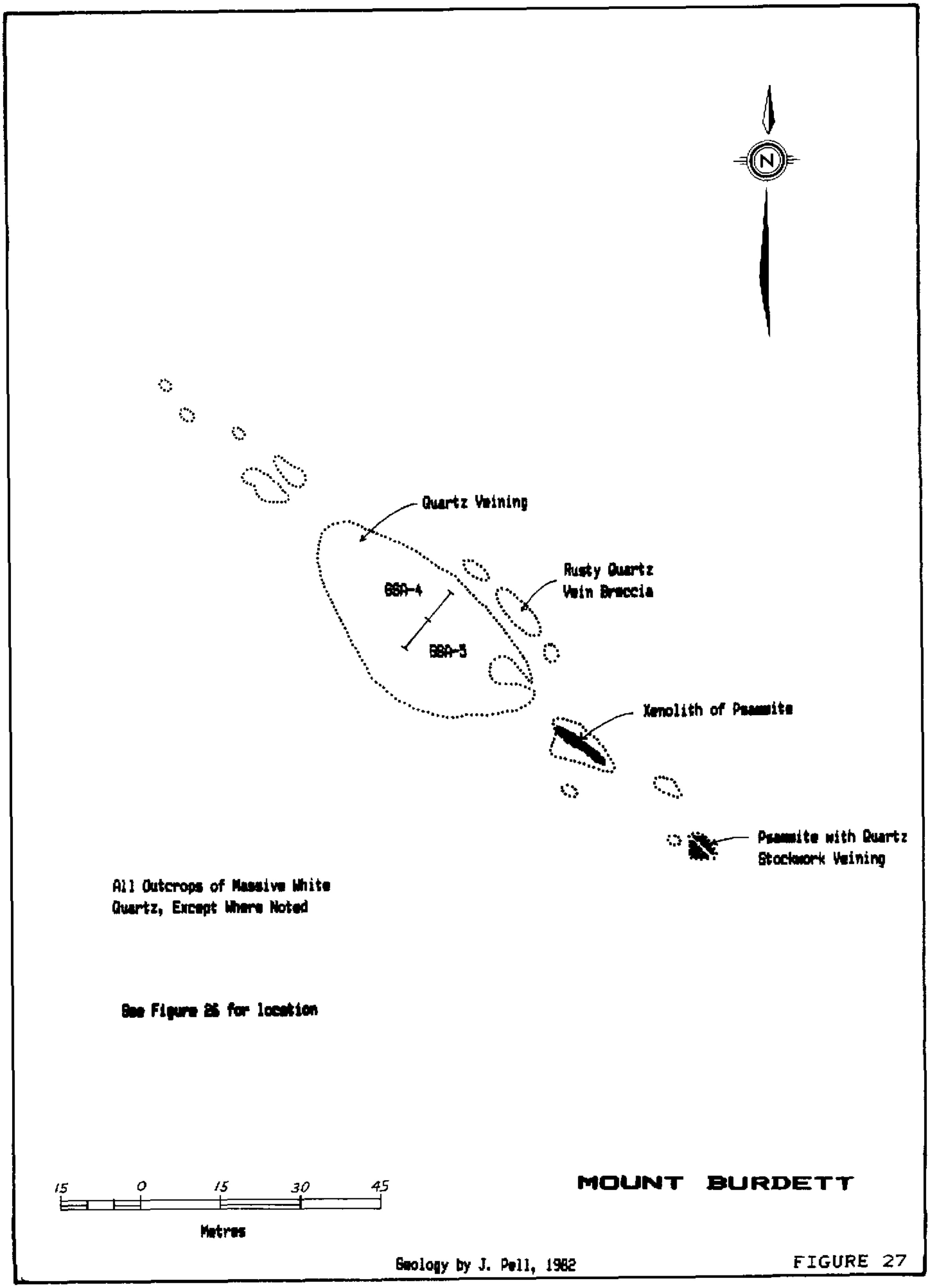
Bald Mountain and Mount Burdett are respectively 7 kilometres and 10 kilometres south of Barkerville (Figure 26). Road access is possible to within about 2 kilometres of each location.

The area has been intensely prospected for gold and a considerable amount of attention has been paid to quartz veining. A. Sutherland Brown (EMPR Bulletin No. 38) proposed a classification consisting of four types of quartz veins as follows:

1) Strike veins constitute the largest type, but are relatively few in number. For a long time these veins were referred to as 'A' veins. They are normally sparsely mineralized or barren of sulphide minerals, but may contain large isolated masses of pyrite. They generally strike 130 to 150 degrees and have a steep to 60-degree dip to the northeast.
2) Transverse veins, the smallest and most numerous type of vein, strike at 030 to 055 degrees and dip 70 degrees southeast to vertical.
3) Diagonal veins, up to about 1.5 metres wide, strike at 070 to 090 degrees with a steep southeast dip.
4) Northerly striking veins are relatively rare. They trend at 000 to 020 degrees and dip 45 to 80 degrees east.

In terms of silica potential the strike or 'A' veins are the most important and it is this type that was examined on Bald Mountain and Mount Burdett. The general area is underlain by Snowshoe Group metasedimentary rocks of Precambrian to Early Paleozoic age. The veins consist of massive coarse-grained milky quartz. They pinch and swell but have a general strike of 310 degrees and are steeply dipping. Surrounding metasediments strike 330 degrees and have moderate dips. Locally the veins are extensively fractured with the fracturing nearly perpendicular to strike. Fractures commonly carry limonitic staining. Inclusions of country rock ranging in size from 5 to 10 centimetres by 10 to 20 centimetres are common within a few centimetres of the contacts. All the veins contain small amounts of muscovite (2 per cent or less). No sulphide mineralization was noted.

On Bald Mountain, vein outcrops are widely scattered and vary in size from 1 by 3 metres to 1.5 by 10 metres. A prominent swarm of parallel veins outcrops on Mount Burdett in an area just over 100 metres wide. There are at least four major veins with the largest being up to 37 metres in width and traceable for 470



MOUNT BURDETT

FIGURE 27

metres through discontinuous outcrop (Figure 25).

Two chip samples each representing about 10 metres across the thickest portion of the large vein on Mount Burdett (Figure 27) yielded the following per cent assays:

	SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	Na_2O	K_2O	TiO_2	MnO	LOI
GSA-4	97.72	0.30	0.13	<.03	<.03	.07	.05	<.04	.003	0.2
GSA-5	98.73	0.30	0.04	<.03	<.03	<.03	<.02	<.04	<.002	0.3

CAMPANIA ISLAND

(S20)
Type: Vein
Minfile: 103H 041 NTS: 103H 03W Elevation: 25m
Latitude: 53° 01′ 26″ Longitude: 129° 25′ 08″

The silica prospect is situated a little over 0.5 kilometre from the west shore of Campania Island (Figure 28). Campania Island is located in Hecate Strait, approximately 160 kilometres south of Prince Rupert and 640 kilometres northwest of Vancouver. Access is either by float plane or by boat.

Granitic rocks of the Coast Plutonic Complex underlie the island. In the vicinity of the silica occurrence the rocks are mainly medium to coarse-grained granites and quartz diorites. The rocks are generally well jointed in an east-west direction.

Three showings comprise the prospect (Figure 29). The central outcrop is the main showing and is referred to as the Quartz Dome (Figure 30). It measures approximately 105 by 35 metres, elongated in a direction of 355 degrees. The outcrop consists of a vein of coarse anhedral milky white quartz. Up to about 5 per cent of the vein consists of granitic inclusions that appear to be most numerous along the southern and northern margins. The western contact is exposed intermittently and has a variable steep east and west dip while the eastern contact is rarely exposed. The quartz is strongly fractured; fractures show no preferred orientation. Impurities consist of minor muscovite and very local rusty stains along the fractures (J. Pell, 1982).

Three outcrops aligned north-south occur 160 metres east of the Quartz Dome (Figure 29). The two northern outcrops contain only narrow quartz-stockwork veining. A quartz vein with an outcrop area of 10 by 31 metres cuts the southern exposure. It consists of highly fractured, coarse-grained milky white quartz.

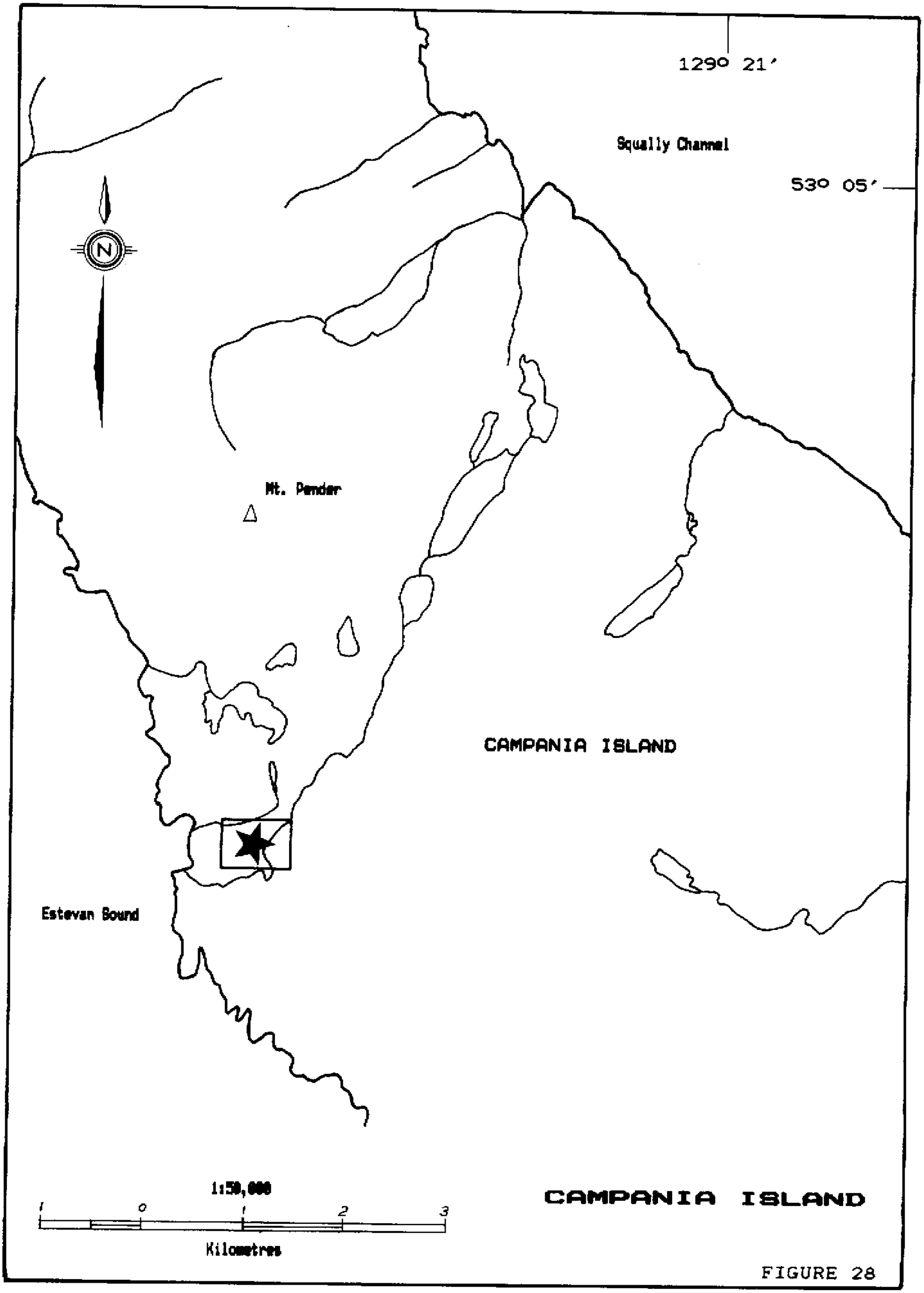

129° 21′
Squally Channel
53° 05′
Mt. Pender
CAMPANIA ISLAND
Estevan Sound
1:50,000
1 0 1 2 3
Kilometres
CAMPANIA ISLAND

FIGURE 28

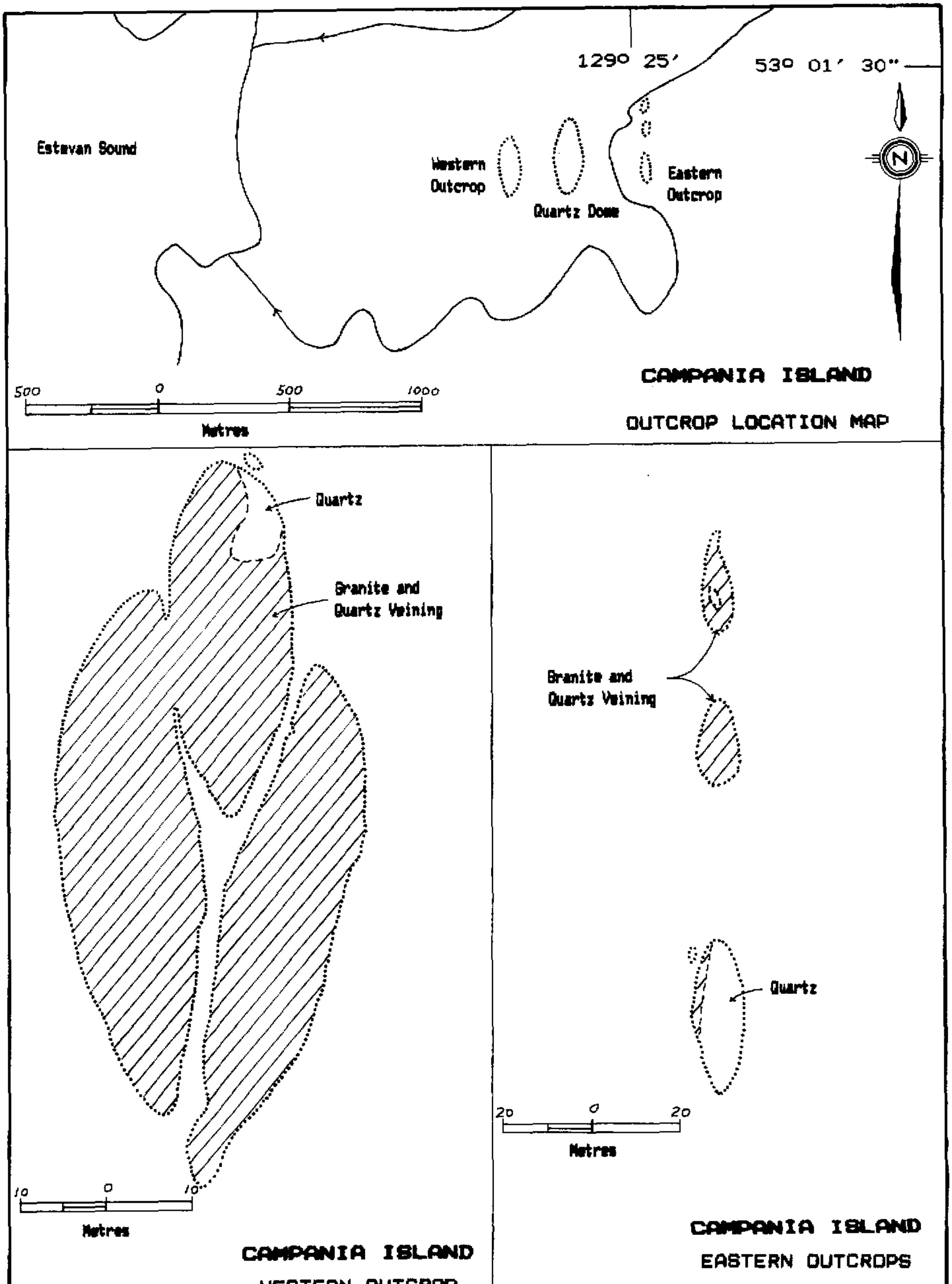

129° 25′
53° 01′ 30″
Estevan Sound
Western Outcrop
Quartz Dome
Eastern Outcrop
N
500
0
500
1000
Metres
CAMPANIA ISLAND
OUTCROP LOCATION MAP
Quartz
Granite and Quartz Veining
10
0
10
Metres
CAMPANIA ISLAND
WESTERN OUTCROP
Granite and Quartz Veining
Quartz
20
0
20
Metres
CAMPANIA ISLAND
EASTERN OUTCROPS
Geology by J. Pell, 1982

FIGURE 29

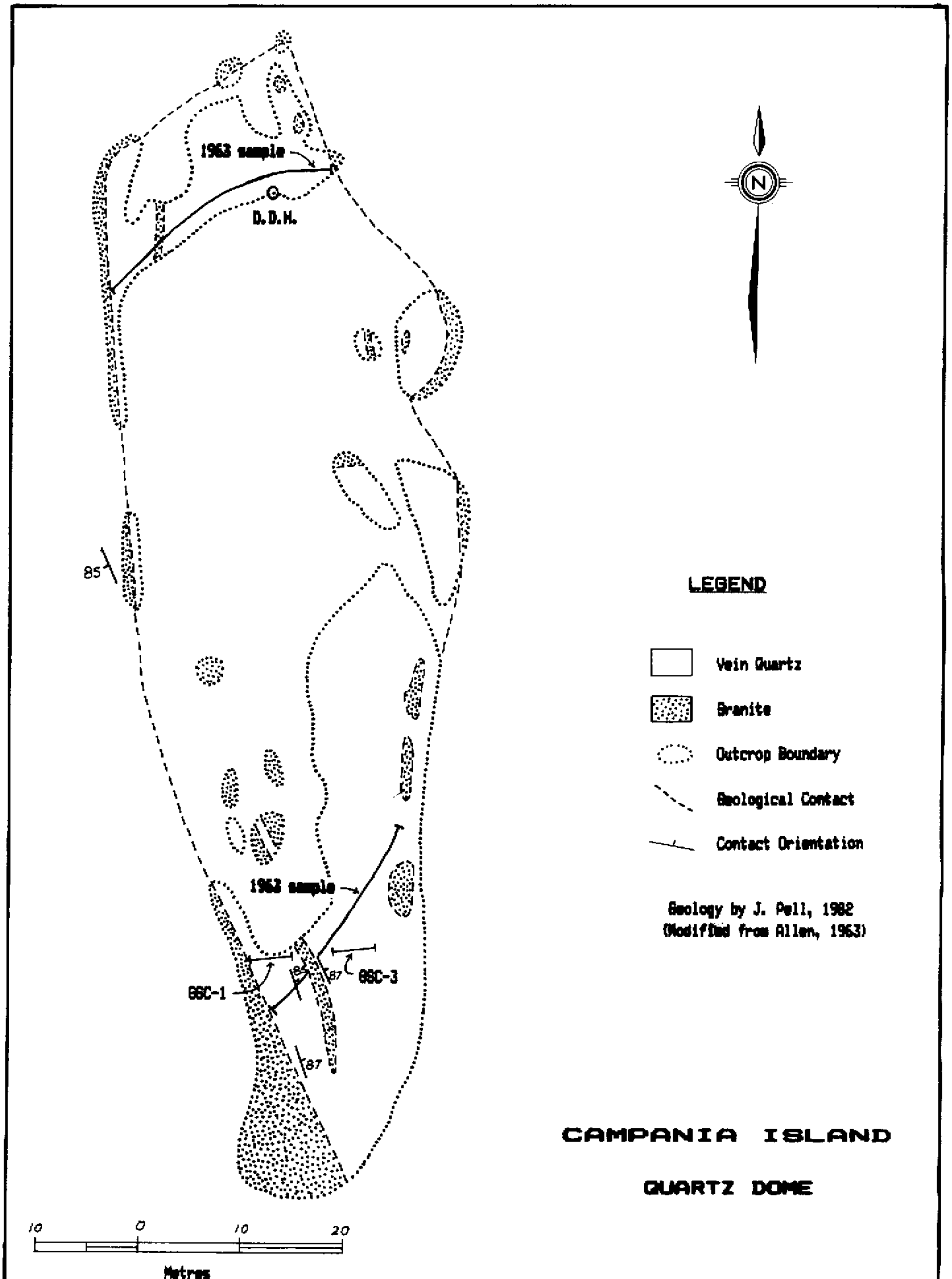

1963 sample
D.D.H.
85
1963 sample
GGC-1
85
87
GGC-3
87
N
LEGEND
Vein Quartz
Granite
Outcrop Boundary
Geological Contact
Contact Orientation
Geology by J. Pell, 1982
(Modified from Allen, 1963)
CAMPANIA ISLAND
QUARTZ DOME
10
0
10
20
Metres

FIGURE 30

The fractures are generally clean but minor amounts of white mica may be present in the quartz. A few small granite inclusions occur near the exposed western contact which strikes 005 degrees with a steep dip.

An outcrop cut by quartz stockwork veining lies 70 metres west of the Quartz Dome (Figure 29). A quartz mass measuring 4 metres by 6 metres is exposed at its northern end. Otherwise, only thin, randomly oriented veins are present.

Chip samples were collected from the Quartz Dome in 1963 (A. Allen, 1963). Samples over a width of 23.2 metres across the vein at a point 12 metres from the north end, and over 21.3 metres across the vein at the south end, averaged 98.84 per cent SiO_2. The best assay obtained was 99.96 per cent SiO_2 from a 3-metre section of a drill hole. In 1975 open-pit reserves were estimated at more than 270,000 tonnes.

The following samples of clean white quartz were collected by Geological Survey Branch personnel in 1982 (see Figure 30). Values are in weight per cent.

	SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	Na_2O	K_2O	TiO_2	MnO	LOI
GSC-1	99.73	0.05	0.07	<.02	<.03	<.03	.02	<.04	<.002	0.8
GSC-3	99.84	0.06	<0.04	<.02	<.03	<.03	<.01	<.03	<.002	0.2

BANKS ISLAND

(S21)
Type: Vein
Minfile: 103G 022 NTS: 103G 08E Elevation: 15m
Latitude: 53° 28′ 11" Longitude: 130° 02′ 37"
Alias: Donaldson Creek

A silica prospect is located on the east side of Banks Island between Patsey Cove and Donaldson Lake (Figure 31). Banks Island is situated on the British Columbia coast approximately 100 kilometres south of Prince Rupert. Access to the deposit is by float plane or by boat.

The occurrence is on the reverted Margaret Crown Grant (L.110). Interest in the property dates back to at least 1907, due to the presence of sulphide mineralization.

Geological Survey of Canada Map 23-1970 indicates that Banks Island is largely underlain by Coast Plutonic Complex rocks.

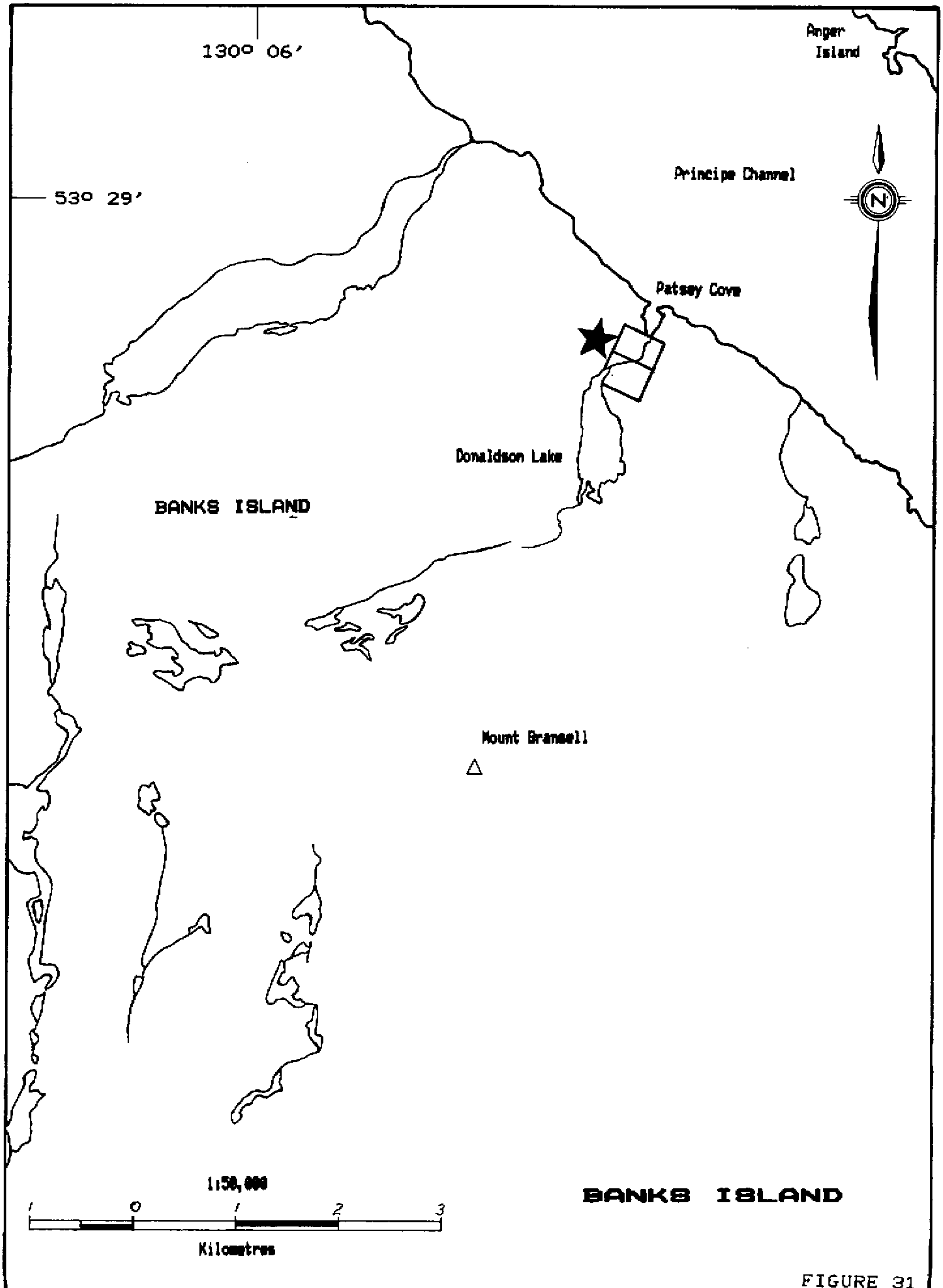

130° 06′
53° 29′
Anger Island
Principe Channel
N
Patsey Cove
Donaldson Lake
BANKS ISLAND
Mount Bramsell
1:50,000
1 0 1 2 3
Kilometres
BANKS ISLAND

FIGURE 31

There are also some exposures of Permian and/or older metasediments, consisting mainly of thinly laminated micaceous quartzite, crystalline limestone, skarn and schist. The vicinity of the showing is underlain by a gneissic diorite-migmatite complex near the contact with hornblende biotite quartz diorite.

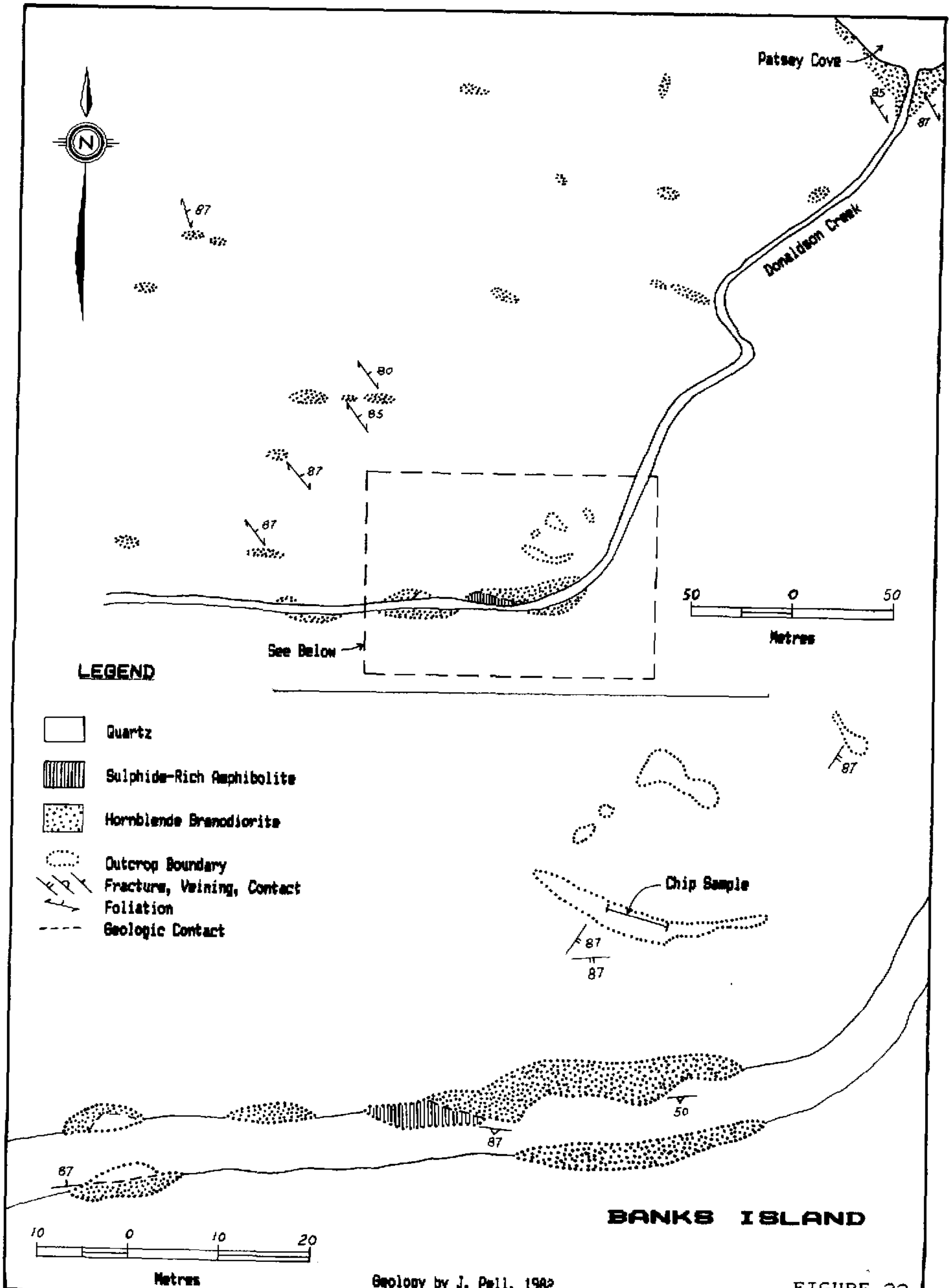
Several outcrops of pure white quartz occur on the northwest side of Donaldson Creek (Figure 32). The outcrops define a northeasterly trending body exposed over an area measuring at least 20 by 30 metres. Contacts are not exposed. The quartz is usually massive, coarse-grained and milky white, but minor amounts of smoky quartz are present. Some zones are intensely fractured with the fracture surfaces being clean or rust-stained. Orange-weathering quartz, with a slightly granular texture, occurs in one place.

Two other small bodies of quartz are exposed in Donaldson Creek to the southwest of the main group of outcrops. This quartz is white weathering, coarse-grained and massive. It contains veinlets of magnetite as well as amphibolitic inclusions and is therefore less pure than the quartz in the main outcrops. The inclusions, which are not necessarily confined to the edge of the vein, are rich in actinolite and are mineralized with pyrite, pyrrhotite and magnetite. Smoky quartz is associated with the inclusions. A larger body of mineralized amphibolite measuring 6 by 18 metres occurs further to the east in the creek (J.Pell, 1982).

A chip sample taken over approximately 7 metres along the south face of a cliff was collected by the Geological Survey Branch in 1982 (Figure 32). The sample was comprised mainly of clean white vein quartz with minor amounts of smoky and rust-stained quartz. It assayed as follows:

SiO_2	99.26	per cent
Al_2O_3	<0.04	per cent
Fe_2O_3	<0.05	per cent
MgO	<0.03	per cent
CaO	<0.03	per cent
Na_2O	<0.04	per cent
K_2O	<0.02	per cent
TiO_2	<0.02	per cent
MnO	<0.002	per cent
LOI	<0.1	per cent

In 1975 reserves were estimated to be at least 9,000 tonnes of silica with a grade of 98.8 per cent SiO_2.



Geology by J. Pell, 1982

FIGURE 32

ANYOX

(S22)
Type: Vein
Minfile: 103P 112 & 264 NTS: 103P 05W
Latitude: 55° 25′ Longitude: 129° 49′
Alias: Macy, May, Quartz Point, Golakeish

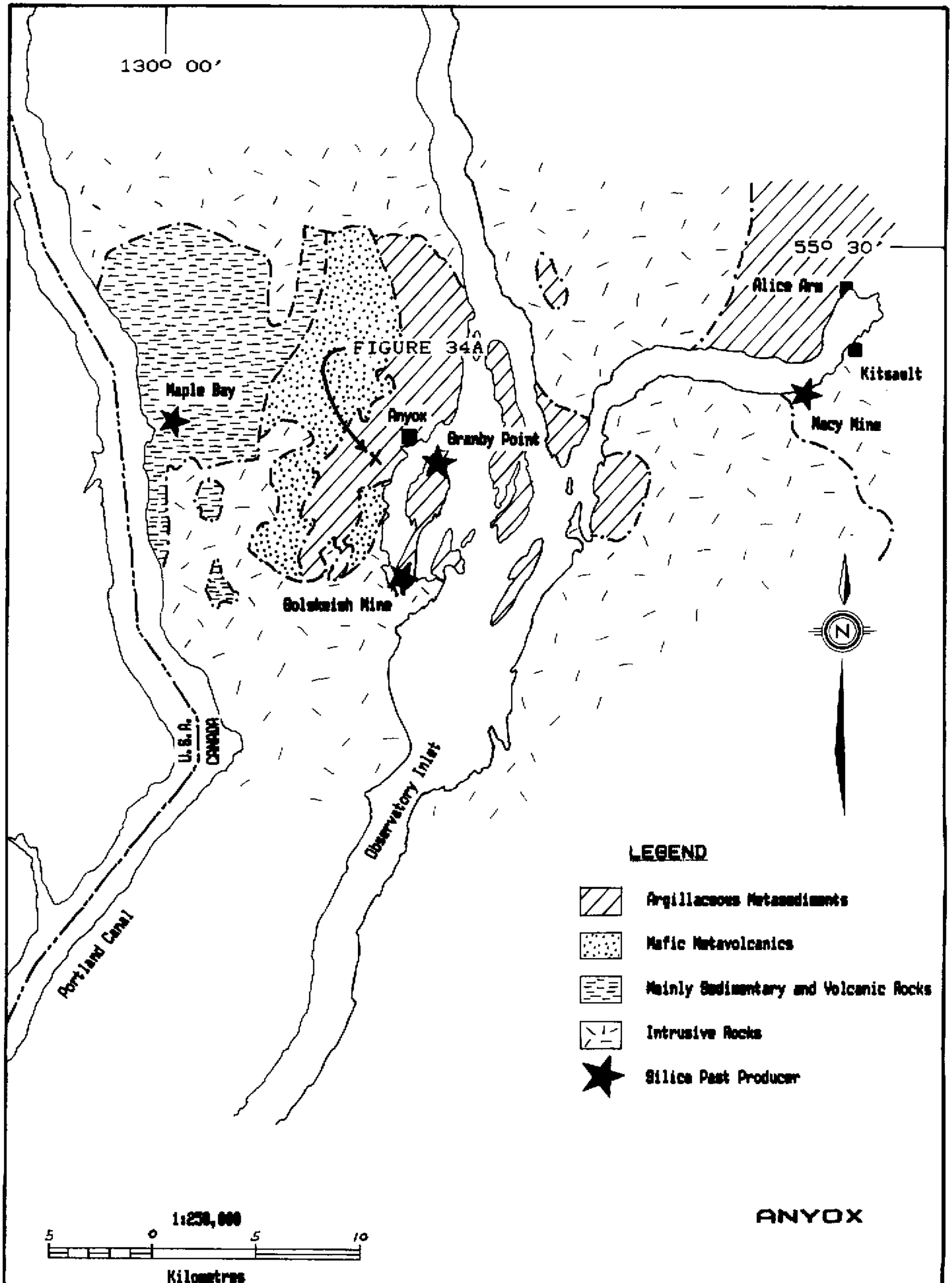
A number of quartz veins outcrop in the area of the old Anyox copper smelter, approximately 130 kilometres north of Prince Rupert. The occurrences are in the vicinity of Granby Point on Observatory Inlet (Figure 33).

Some of these veins were mined solely as a flux for the Anyox smelter and are relatively free of metallic mineralization. Other veins were mined for both their precious metal and silica content. Properties that produced silica include the Quartz Point (Granby Point) mine, the May Quartz mine, the Macy mine, the Golakeish mine and the Quartz claim group.

The area is predominantly underlain by Upper Triassic to Lower Jurassic argillaceous metasediments and some metavolcanic rocks (Figure 33). Based on a 1982 examination by the Geological Survey Branch, two types of quartz veins can be distinguished. One type comprises large white quartz veins which are usually barren or contain only traces of sulphides. This type is present only in argillite and the veins usually occur in lit-par-lit fashion (J. Pell, 1982). Zones of veining may be over 10 metres thick but individual veins rarely exceed 2 metres in thickness (Figure 34A). The quartz has coarse to medium equant grains and is milky white. Low gold values are often present.

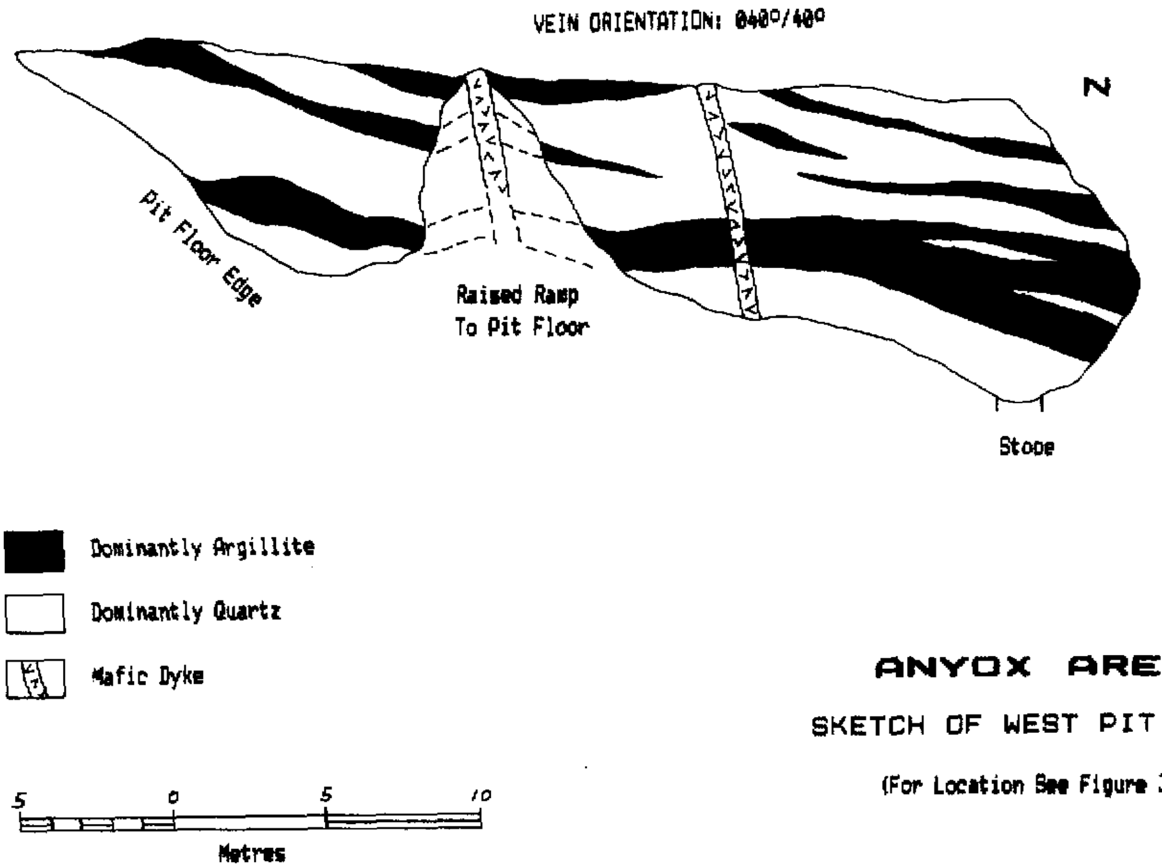
The second type of quartz vein is best-developed in argillite, but some veins also occur in metabasalt. These veins, which are up to 30 centimetres wide, crosscut bedding and foliation. They are fine to coarse-grained with a granular to anhedral massive texture. Sulphides are common and extensive limonite-staining occurs in places.

Neither type of vein seems to offer the potential for a substantial tonnage of relatively pure mineable quartz.



After Carter and Grove, 1972

FIGURE 33



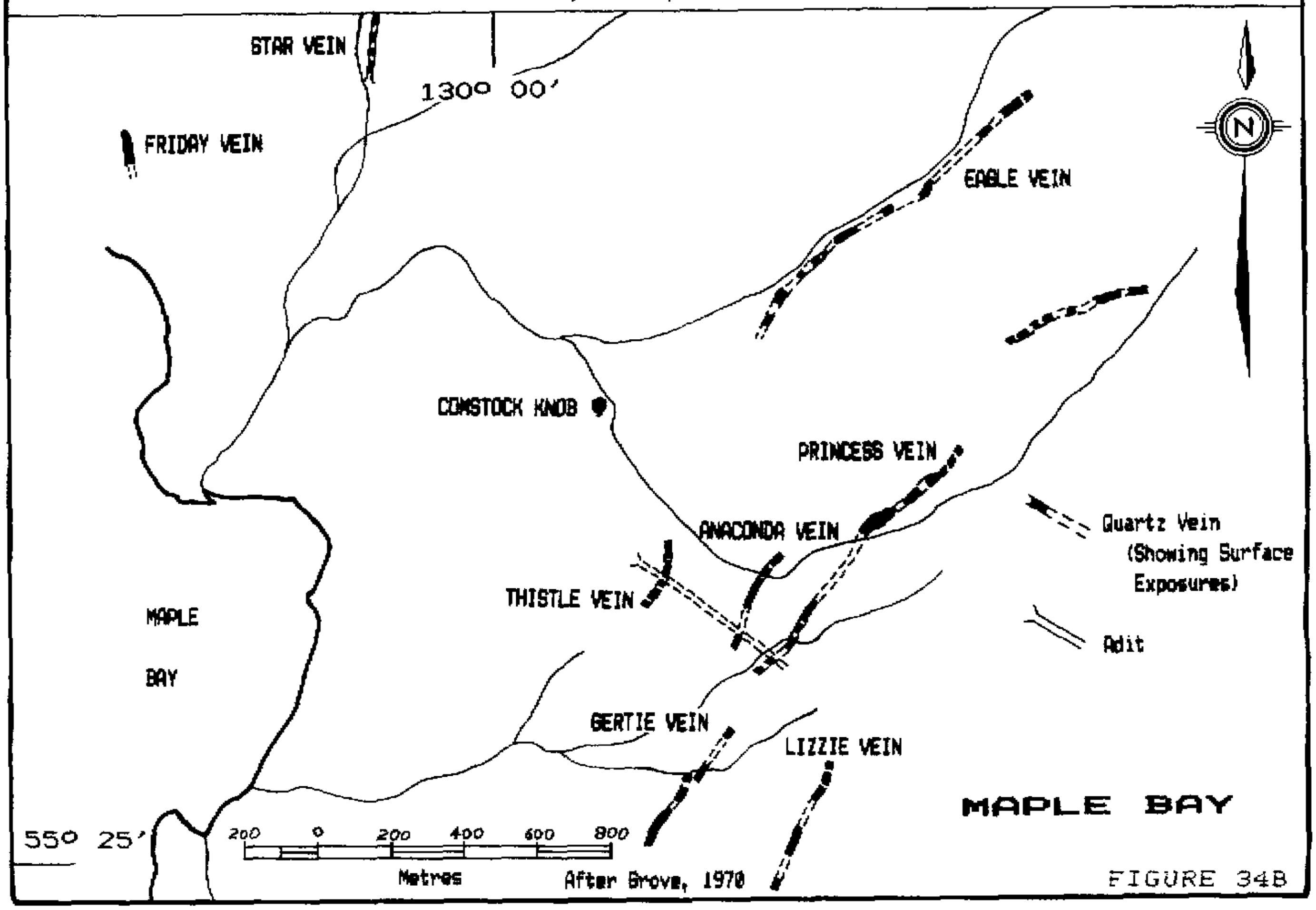
ANYOX AREA

SKETCH OF WEST PIT WALL

(For Location See Figure 33)

By J. Pell, 1982

FIGURE 34A



MAPLE BAY

After Grove, 1970

FIGURE 34B

MAPLE BAY

(S23)
Type: Vein
Minfile: 103O 025 NTS: 103O 08E Elevation: 90m
Latitude: 55° 26' 00" Longitude: 130° 00' 50"

Maple Bay is situated on the east shore of the Portland Canal (Figure 33), approximately 60 kilometres south of Stewart and 130 kilometres north of Prince Rupert. Access is by float plane or boat.

At least 15 quartz-chalcopyrite-pyrrhotite-pyrite veins have been explored in the Maple Bay area. Mineralization was first located in 1902, but development work has been sporadic. In 1916 about 3600 tonnes of copper-bearing siliceous flux was shipped to Anyox.

An examination in 1982 by the Geological Survey Branch indicated that the area is mainly underlain by intermediate to mafic volcanic rocks, siltstones and some felsic lithologies, either tuffs or sheared cherty sediments. These units have been assigned a Jurassic age (Grove, 1986). Intermediate (andesites and/or dacites) and mafic volcanic rocks are interbedded while siltstones and silty argillites are interbedded with fine sands. These rocks form an easterly dipping sequence which has been intruded by medium to coarse-grained hornblende-bearing diorites.

A north-northeasterly trending cataclastic zone, with a width of over 2 kilometres, cuts across the country rocks in the Maple Bay area (Grove, 1970). The quartz-vein system, which has been traced for about 6 kilometres along strike, is largely confined to this cataclastic zone.

The main quartz veins in the area are shown on Figure 34B. Two types can be distinguished. Mineralized veins such as the Star, Comstock, Eagle, Thistle, Anaconda and Princess are dominantly north-northeasterly striking (015 to 020 degrees) and dip steeply east. They consist of fine-grained granular-textured quartz varying in colour from milky white to rusty orange-brown and salmon pink. Scattered chloritic stringers are present and sulphides such as pyrite, pyrrhotite and chalcopyrite are ubiquitous. Vein thickness varies from less than half a metre (Star and Princess veins) to over 10 metres (Comstock and Knob veins).

The second type of vein is represented by the Friday vein (Figure 34B) which strikes 350 degrees and has a near-vertical dip. The quartz is coarse-grained and mainly milky white. Minor reddish brown staining occurs along fractures and some rusty weathering zones are present locally. Well-formed prismatic crystals occasionally line voids. Only very minor amounts of sulphide mineralization are present, but some siltstone inclusions occur along the western edge of the vein. The Friday vein is 4 to 5 metres wide and is exposed over a strike length of approximately 50 metres. It represents the best potential as a silica source in the Maple Bay area. The quartz appears to be relatively pure and the occurrence is only 500 metres from the shore.

VAL PROPERTY

(S24)
Type: Vein
Minfile:082ESE 071 NTS: 082E 02E Elevation: 1402m
Latitude: 49° 02′ 40" Longitude: 118° 39′ 04"
Alias: Sil, Mike, Mint

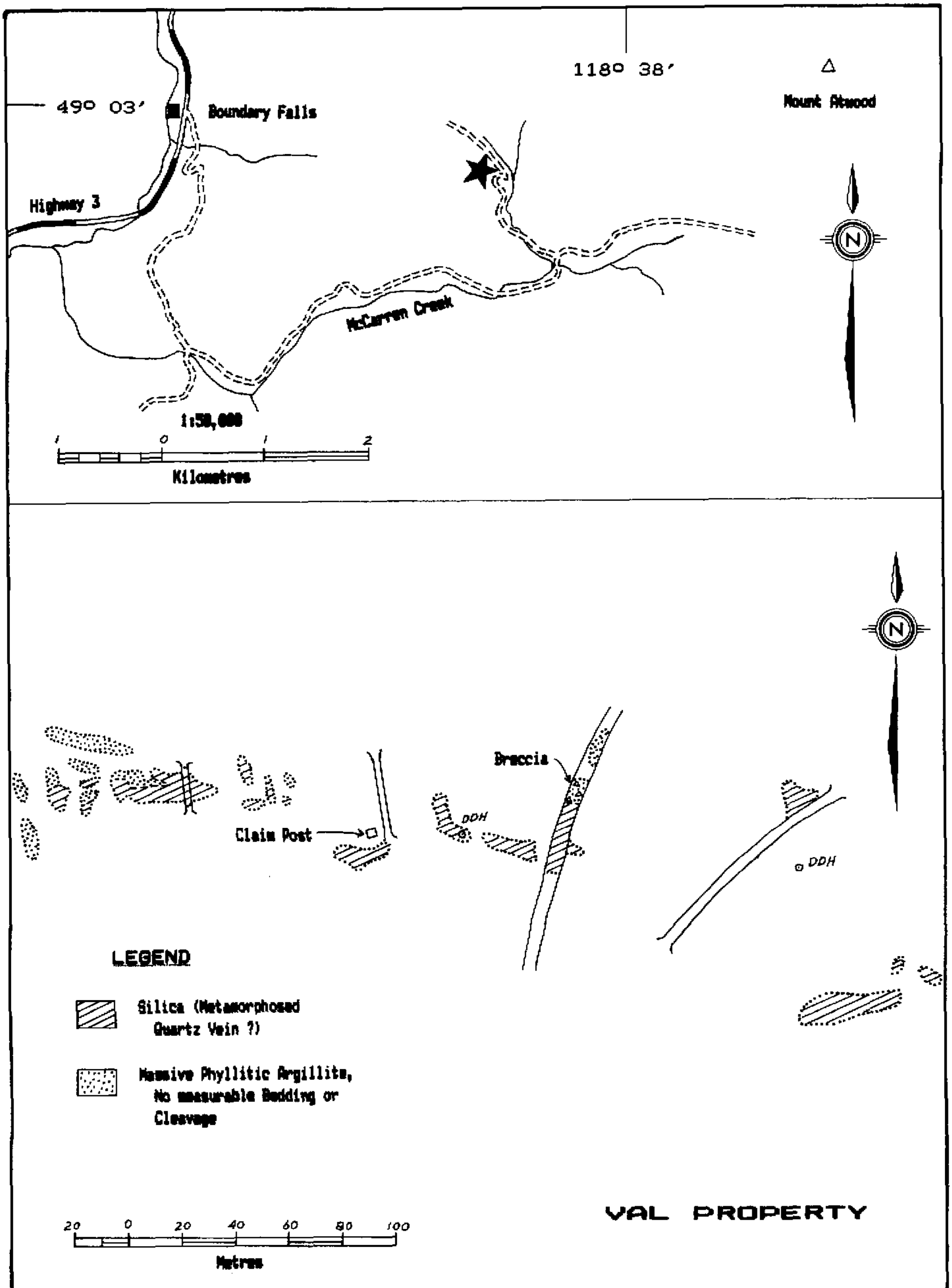
The Val property is located about 6.4 kilometres south of Greenwood. Access is via the McCarren Creek Road which turns east off Highway 3 at Boundary Falls, approximately 4.8 kilometres south of Greenwood. After about 9 kilometres a left turn is made onto a little-used logging road which is followed for another 3 kilometres to the property (Figure 35).

The area is mainly underlain by phyllites of the Permian(?) Anarchist Group which have been intruded by dioritic and andesitic dykes. Silica occurs in large tabular bodies and is a white, very fine-grained massive rock. Although the origin of the silica is not certain, examinations by the Geological Survey Branch indicate that it is probably a quartz vein. Another theory (Tribe, 1983) is that the silica is a remobilization of a cherty member of the surrounding sedimentary formation.

Silica has been mapped over a length of approximately 350 metres in the main zone (Figure 35). A smaller zone of silica exposure occurs about 400 metres to the east.

Four chip samples collected in 1983 (Tribe, 1983) averaged 96.8 per cent SiO_2. A sample collected by the Geological Survey Branch yielded the following weight per cent values:

SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	Na_2O	K_2O	TiO_2	MnO	LOI
98.70	0.02	<.25	<.02	.04	<.009	<.02	.04	<.004	0.4



49° 03′
118° 38′
Boundary Falls
Mount Atwood
Highway 3
McCarren Creek
1:50,000
1 0 1 2
Kilometres
N
Breccia
Claim Post
DDH
DDH
LEGEND
Silica (Metamorphosed Quartz Vein ?)
Massive Phyllitic Argillite, No measurable Bedding or Cleavage
20 0 20 40 60 80 100
Metres
VAL PROPERTY

FIGURE 35

PEGMATITE OCCURRENCES

GYPO

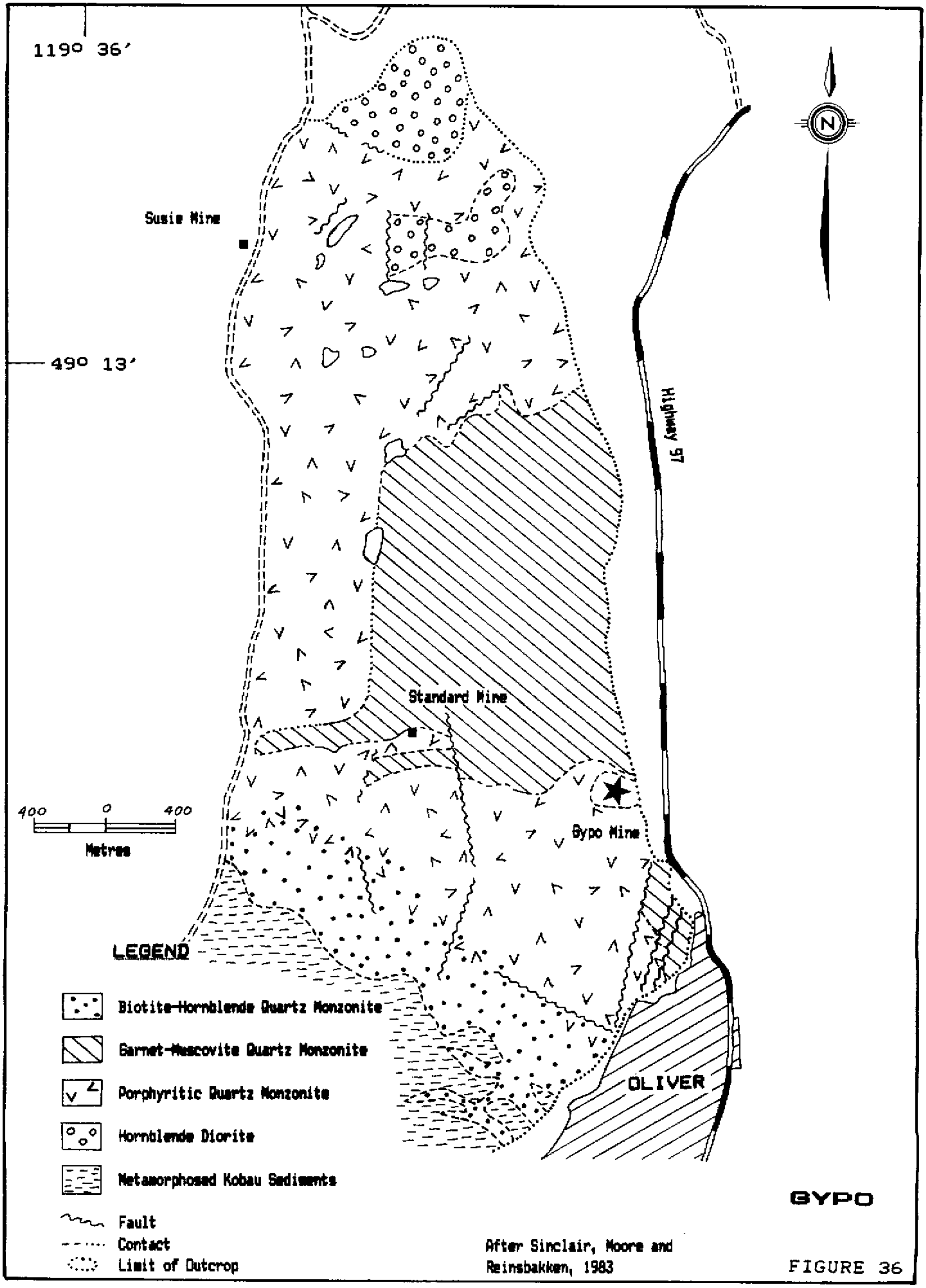
(S25)
Type: Pegmatite
Minfile: 082ESW 084 NTS: 082E 04E Elevation: 350m
Latitude: 49° 11′ 45″ Longitude: 119° 33′ 30″
Alias: Oliver Silica, Pacific Silica

The Gypo silica deposit is located on the west side of Highway 97 on the northern outskirts of the town of Oliver (Figure 36). It is on the Gypo Crown Grant (L.3098s) which, as of 1986, was owned by Osborne Lakevold of Oliver. The claim was originally Crown-granted to Cominco in 1927 which owned it until at least the early 1970s. Early interest in the property was in part directed toward small amounts of metallic mineralization associated with quartz veining. Small shipments made in 1926 and 1941 were apparently partly for the silica which was used as a flux and partly for the metallic content.

Intermittent quarrying took place for some years prior to 1953. In 1947, for example, 22,400 tonnes were shipped for use as a smelter flux. Mining operations are reported for each year during the period 1953 to 1968. Mining ceased in 1968 due to caving of part of the quarry wall. Annual production ranged up to 54,400 tonnes in 1960. Total production to the end of 1968 is estimated at close to 600,000 tonnes. Since 1968 small shipments have been made from stockpiles and from limited sorting of slumped material from the quarry floor. Small fluorite shipments are reported for the years 1958 and 1966 to 1968.

A large proportion of the production has been used in the building industry, especially as stucco dash. Small amounts have also been used in the preparation of special cements, as a flux and as poultry grit. In 1956 a second pit and plant were started to produce coarse lump silica for the production of silicon and ferrosilicon. The metallurgical silica was shipped to Washington and Oregon while the main markets for the balance of production were in British Columbia and Alberta.

The quartz occurs within Middle Jurassic intrusive rocks that form what has been termed the Oliver plutonic complex or the Oliver granite. The pluton is comprised mainly of medium-grained quartz monzonite that occurs in three distinct phases (Figure 36). Massive medium-grained garnet-muscovite quartz monzonite forms a central core that is surrounded by a porphyritic quartz monzonite. A hornblende-biotite quartz monzonite lies to the south. The pluton is cut by a variety of dykes. Numerous



GYPO

FIGURE 36

relatively pure quartz veins occur within the complex. Large quartz veins and plugs, such as the Gypo quartz body, are restricted to the porphyritic quartz monzonite phase. The veins formed mainly by open-space filling although there is evidence of some wallrock replacement. The veins are mostly moderately to steeply dipping with variable strike direction.

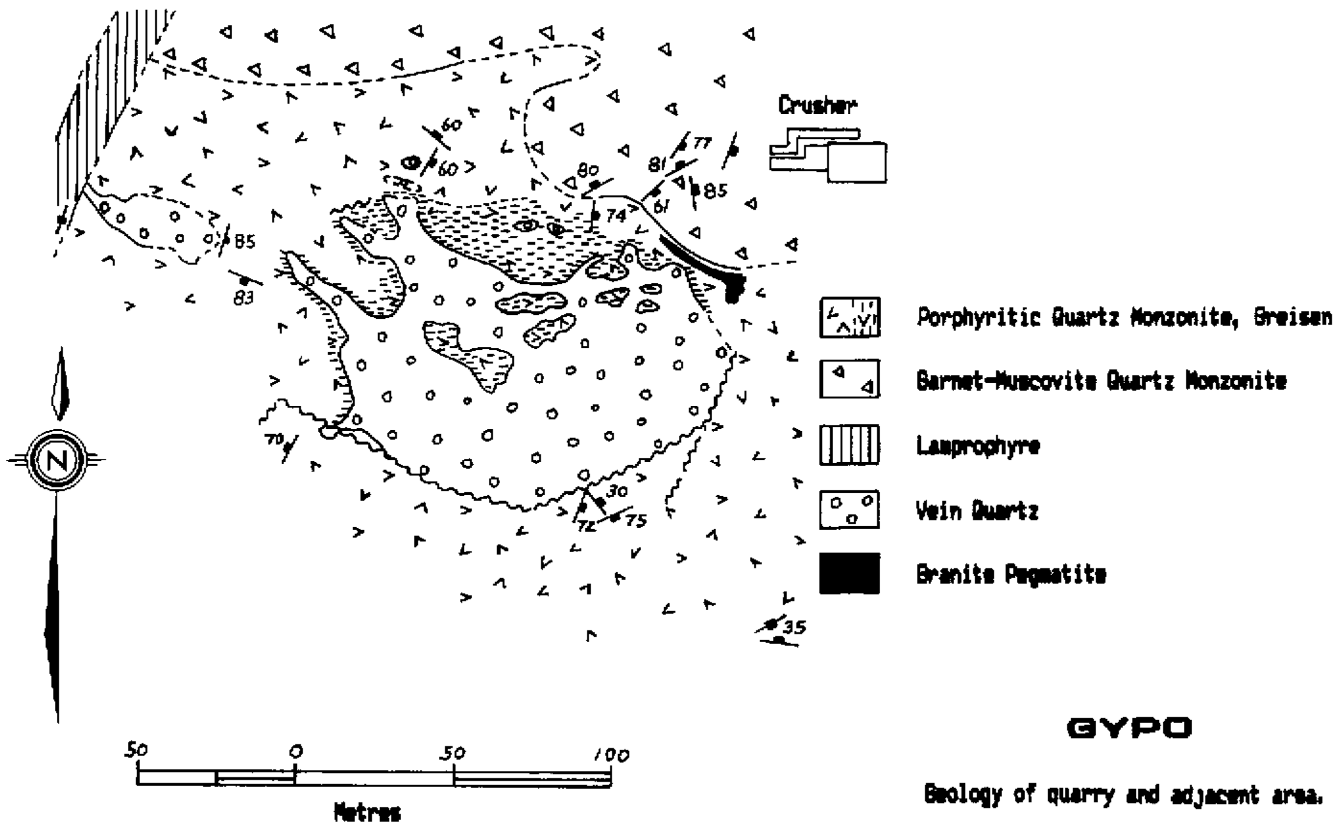
The Gypo quartz body strikes east and dips south at 55 to 60 degrees. At the quarry it has an approximate true thickness of 45 metres and a known strike length of about 150 metres. To the west, a thinner extension of the main body continues for another 90 metres. The hangingwall side is a narrow shear zone while the footwall exhibits intense alteration for distances up to 30 metres from the quartz. This alteration forms a greisen consisting predominantly of muscovite with lesser amounts of quartz. A near-vertical lamprophyre dyke, striking roughly north-south with a width of about 15 metres, cuts the quartz body near the western exposures. Figure 37 shows the geology in the vicinity of the quarry.

Three stages of quartz mineralization are recognized at the Gypo deposit (Sinclair, Moore and Reinsbakken, 1983). The earliest or Stage I quartz is grey in colour and is confined to country rock, alteration zones and marginal parts of the body. Stage II white quartz makes up more than 95 per cent of the quartz material. Where the white quartz is relatively undeformed it can be seen that it is principally in the form of large crystals up to 0.6 metre in diameter and 2 metres in length. The deposit is therefore classified as a quartz pegmatite. Intensive fracturing has produced numerous closely spaced joint surfaces. Stage III quartz occurs in the form of thin delicate boxworks.

A series of irregular pods of colourless or light pink to apple-green fluorite, up to 2 metres or more in average diameter, are sporadically distributed along a zone that more or less parallels the walls of the quartz body. Coarse-grained muscovite occurs intermixed with quartz near the footwall. Small pods of sulphides form less than 1 per cent of the quartz material. Small amounts of calcite occur in the quartz as thin veinlets, seams and locally filling small drusy cavities. Manganese stain is present on some crystal faces and joint surfaces.

Weight per cent assay values were reported in 1958 for four samples collected across the quarry faces. These are as follows:

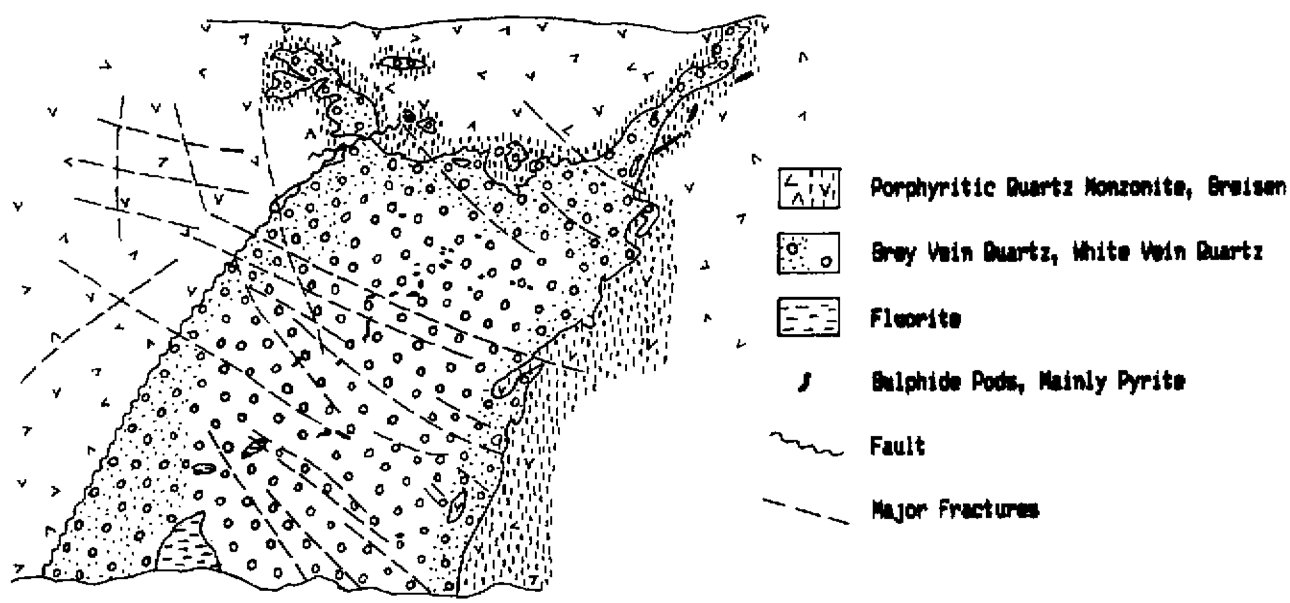
SiO_2	Al_2O_3	Fe
97.40	0.70	0.03
97.48	0.75	0.04
98.12	0.86	0.03
98.78	0.61	0.02



GYPO

Geology of quarry and adjacent area.

After Sinclair, Moore and Reinsbakken, 1983



Projection of near-vertical quarry face onto a vertical N-S section essentially perpendicular to the vein strike.

GYPO

20 0 20 40

Metres

After Sinclair, Moore and Reinsbakken, 1983

FIGURE 37

It is reported that most concentrates produced from the mine had a purity greater than 99 per cent silica.

SWAN

(S26)
Type: Pegmatite
Minfile: 082ENW 066 NTS: 082E 12W Elevation: 1311m
Latitude: 49° 43′ 00" Longitude: 119° 54′ 00"

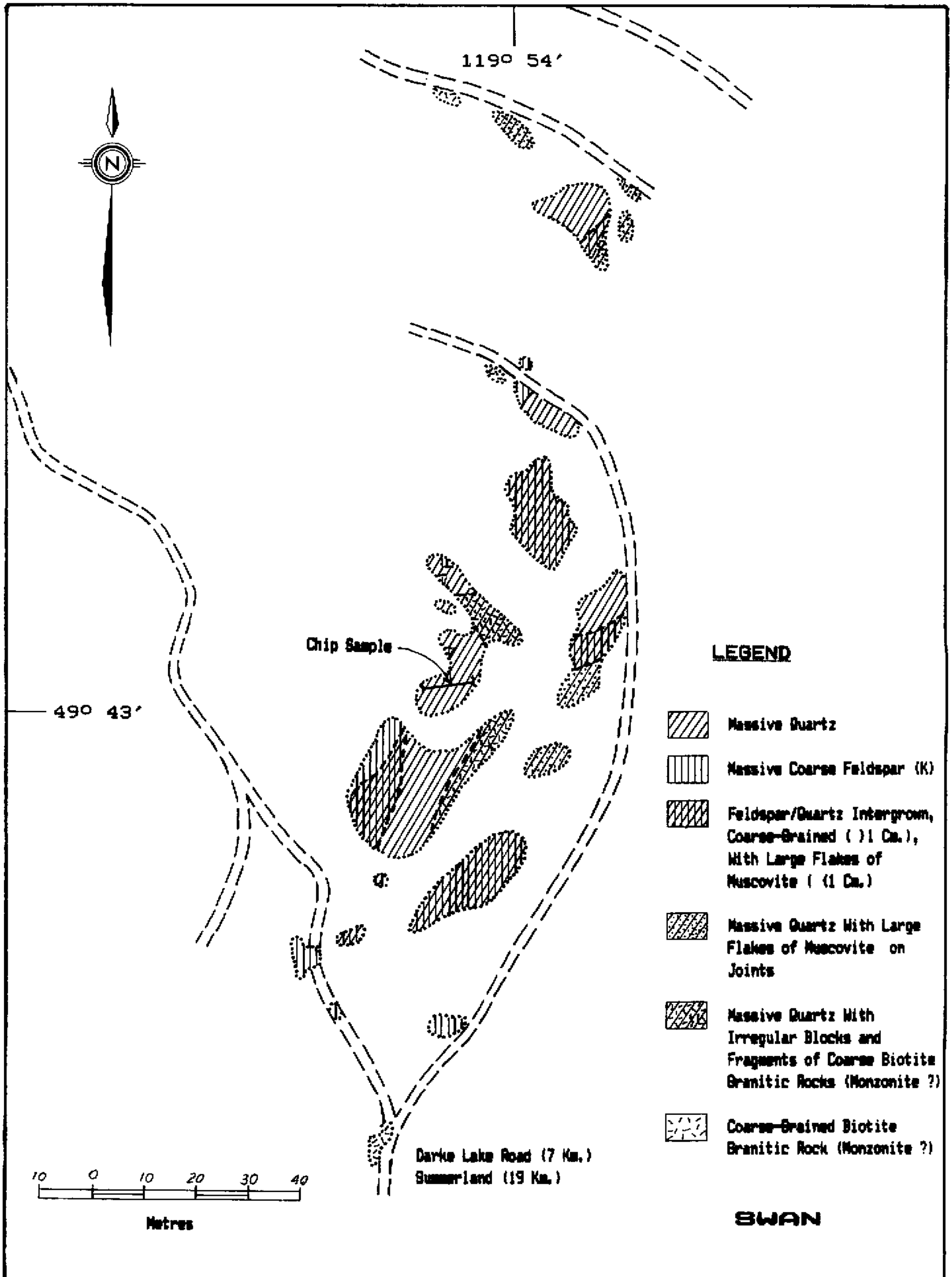
The Swan occurrence is located approximately 20 kilometres northwest of Summerland. It is 2.4 kilometres west of Darke Lake, just outside Darke Lake Provincial Park. The property is accessed by driving approximately 27 kilometres on a gravel and dirt road from Summerland. The showing, which has a vertical exposure of about 75 metres, is on a steep northeast-facing slope.

A quartz-pegmatite body is exposed in scattered outcrops, road cuts and trenches over an area of approximately 60 by 120 metres (Figure 38). It is hosted by an altered, coarse-grained, quartz monzonite(?) (G. White, 1976). Masses of the intrusive rock are sometimes present within the quartzose mass. In exposed areas pure quartz constitutes approximately 25 per cent of the pegmatite body. Approximately 10 per cent is contaminated by muscovite, 55 per cent is intergrown with feldspar and 10 per cent is composed of massive feldspar. Some limonitic staining on joints occurs close to the western contact but elsewhere there is no visible rust or sulphides.

A sample weighing about 6.8 kilograms was collected from the north outcrop boundary southerly along the central portion of the outcrop for about 100 metres (J. Mitchell, 1972). It consisted of small chips that were either lying loose or chipped off the outcrop. Assay results are as follows:

SiO_2	98.93	per cent
Al_2O_3	0.67	per cent
Fe_2O_3	0.033	per cent
CaO	0.09	per cent
MgO	0.07	per cent

A chip sample (Figure 38) collected by the Geological Survey Branch yielded:



Geology by Z. D. Hora

FIGURE 38

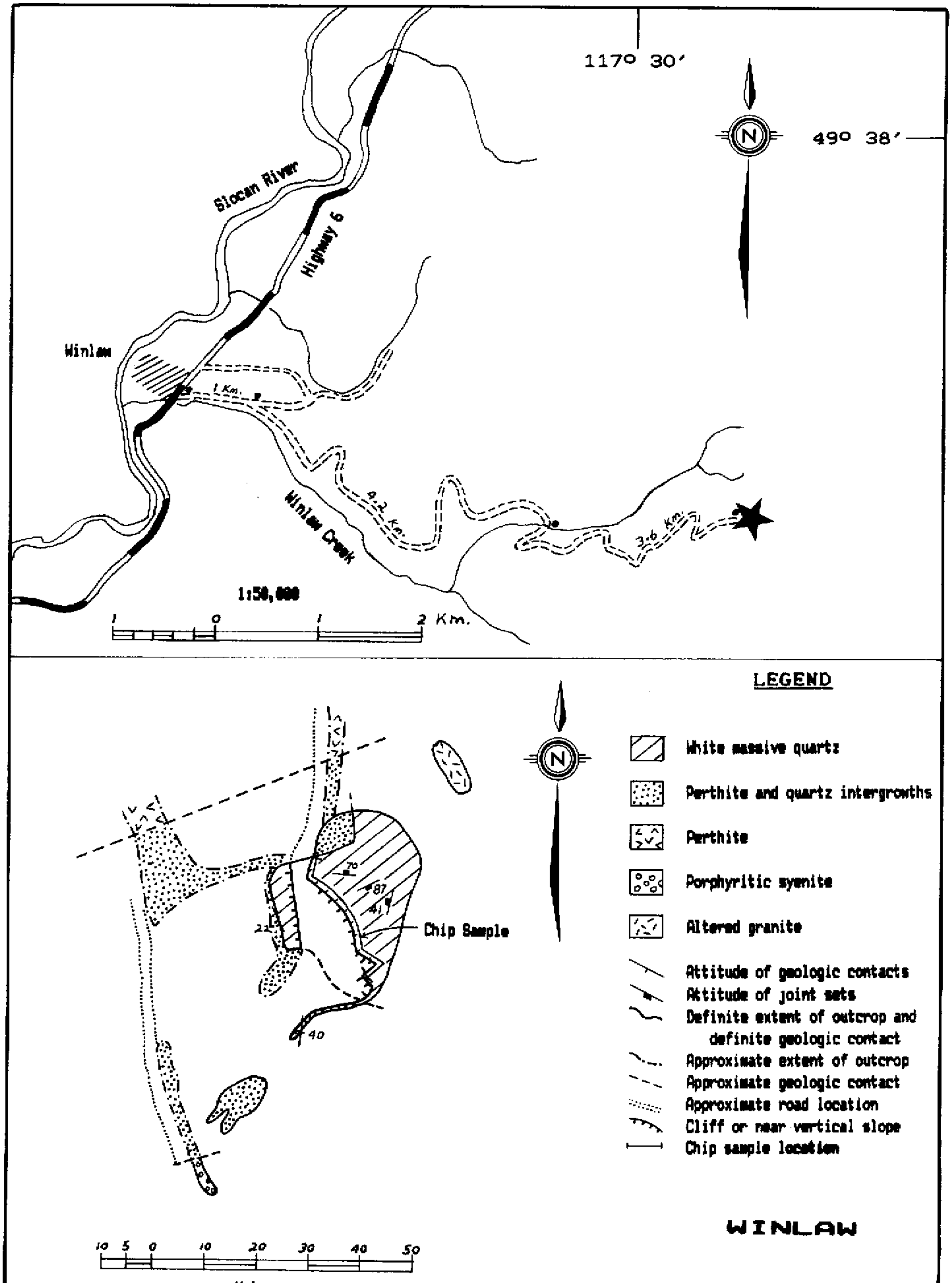
SiO_2	99.54	per cent
Al_2O_3	0.03	per cent
Fe_2O_3	<0.25	per cent
MgO	<0.02	per cent
CaO	<0.02	per cent
Na_2O	<0.009	per cent
K_2O	<0.02	per cent
TiO_2	<0.04	per cent
MnO	<0.004	per cent
LOI	0.2	per cent

WINLAW

(S27)
Type: Pegmatite
Minfile: 082FNW 218 NTS: 082F 11W Elevation: 1524m
Latitude: 49° 36' 01" Longitude: 117° 29' 03"
Alias: Snowdrift

The Winlaw silica occurrence is a quartz-pegmatite body within the Nelson Batholith. It is situated on the south side of the north fork of Winlaw Creek, approximately 6 kilometres east of Winlaw (Figure 39). Access from Winlaw is east via the Paradise Valley Road for 1 kilometre. A four-wheel-drive road to the southeast is then followed for 4.2 kilometres to a bridge over Winlaw Creek. The occurrence is another 3.6 kilometres from the bridge via a trail suitable for walking or motorbike use.

Geological Survey of Canada Map 1090A indicates that the area is underlain by rocks of the Cretaceous Nelson Batholith. In Geological Survey of Canada Memoir 308 H. W. Little notes that, in general, pegmatitic phases of the batholith are confined mainly to small, irregular masses enclosed in porphyritic granitic rocks. The Winlaw quartz body is a massive irregular pod of pegmatitic quartz exposed over an area of approximately 35 by 26 metres (Figure 39). A perthite / quartz intergrowth, with euhedral perthite crystals reaching 15 centimetres in length, borders the quartz body on the south, west and northwest sides. The northeast extent of the quartz is limited by granitic rocks while the eastern margin is covered by overburden. Rocks surrounding the pegmatitic facies are mainly porphyritic syenites. Jointing is strongly developed in three directions within the quartz. Some of the joints host fine-grained specularite and hematite staining. Large vugs, containing remnant fluorite and second generation quartz crystals, typically reach 15 by 15 by 4 centimetres in size.



117° 30′
49° 38′
N
Slocan River
Highway 6
Winlaw
1 Km.
4.2 Km.
3.6 Km.
Winlaw Creek
1:50,000
1 0 1 2 Km.
LEGEND
White massive quartz
Perthite and quartz intergrowths
Perthite
Porphyritic syenite
Altered granite
Attitude of geologic contacts
Attitude of joint sets
Definite extent of outcrop and definite geologic contact
Approximate extent of outcrop
Approximate geologic contact
Approximate road location
Cliff or near vertical slope
Chip sample location
Chip Sample
70
87
41
21
40
WINLAW
10 5 0 10 20 30 40 50
Metres
Geology by M. Hanna, 1981

FIGURE 39

In 1963 it was reported that crushed silica was shipped to Edmonton and sold chiefly for stucco chips, on an experimental basis (British Columbia Minister of Mines, Annual Report 1963, p.152). An estimate given in 1976 stated that 100,000 tonnes of high-grade silica-rock with assays up to 99.6 per cent silica were present (British Columbia Ministry of Energy, Mines and Petroleum Resources, Exploration in British Columbia 1976, p.207).

A sample consisting of chips taken at 1.5-metre intervals in 1961 returned the following values:

SiO_2	99.12	per cent
Fe	0.007	per cent
Al_2O_3	0.60	per cent

Three chip samples of massive white quartz were taken from across the face of the exposure by the Geological Survey Branch in 1981 (Figure 39). These gave the following per cent assays:

SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	Na_2O	K_2O	TiO_2	MnO
97.65	1.96	0.30	<.04	.02	<.226	<.010	<.014	.007
96.56	2.61	0.08	<.04	<.02	<.226	<.010	<.014	.006
98.39	1.18	0.07	<.04	<.02	<.226	<.010	<.014	.007

OTHER OCCURRENCES

A number of occurrences have been noted in the past as possible sources of silica and some have recorded minor production for flux purposes. Information on many of these occurrences is very scant.

The potential of the following occurrences is unknown, mainly due to the fact that they are remotely located or their exact location is uncertain.

NAME	TYPE	MINFILE #	LATITUDE	LONGITUDE
Crystal	Pegmatite?	082FNW 244	49° 33′	117° 18.5′
Deserted Bay	Vein	092JW 028	50° 05′	123° 45′
Thurlow Island	Vein?	092K 135	50° 27.4′	125° 22′
Porcher Island	Vein?		54° 03′	130° 27′

The following occurrences are considered to have a very low potential for production of high-purity silica. Many of the veins contain too many impurities in the form of sulphides or due to brecciation and contamination. Some of the quartzites are rich in mica or carbonate material. The sand occurrences are mainly feldspathic.

NAME	TYPE	MINFILE #	LATITUDE	LONGITUDE
Ramshead	Quartzite	082ESE 036	49° 01.9′	118° 22.8′
Bailey	Vein or Pegmatite	082ESE 037	49° 0.3′	118° 24.6′
Loumark	Vein	082ENE 043	49° 58′	118° 40′
Rice	Vein	082FNE 055	49° 34′	116° 04′
Flathead Area	Quartzite	082GSE 026	47° 07′	114° 42′
Winfield	Quartzite	082LSW 073	50° 04′	119° 21′
White Elephant	Vein	082LSW 042	50° 08.8′	119° 33.2′

NAME	TYPE	MINFILE #		LATITUDE	LONGITUDE
Monashee Quartzite	Quartzite	082LNE	016	50° 58.1'	118° 22.4'
			017	50° 57.8'	118° 24.0'
			021	50° 31.0'	118° 12.0'
			022	50° 42.0'	118° 05.0'
Valemount	Glacio-lacustrine sand	083D	016	52° 49.7'	119° 17'
SW Coastal Area	Glacio-marine sand				
Scuzzy Creek	Glacio-lacustrine deltaic fan sand	092HNW	052	49° 50'	121° 35'
Gisby	Vein			49° 58'	121° 30.5'
Cache Creek	Quartz Schist	092INW	008	50° 38'	121° 20.5'
Golden Contact	Vein	092JNE	079	50° 37.2'	122° 31.2'
Blue Bells	Vein	092K	026	50° 28.7'	125° 18'
Mark, Laura Lee	Silicified Tuff	092L	199	50° 03.5'	127° 06.1'
Sic	Silicified Volcanics	092L	276	50° 07'	127° 17.5'
Apple Bay	Silicified Volcanics	092L	150	50° 36.4'	127° 41'
H & W	Silicified Volcanics	092L	269	50° 36.5'	127° 42'
McLeod River	Vein			54° 57'	123° 20'
Tenakihi Range	Vein	094C	083	56° 12.5'	125° 05'
Glacier Creek	Vein	103P	054	55° 59'	129° 55'

NAME	TYPE	MINFILE #	LATITUDE	LONGITUDE
Morris Summit	Vein	104B 120	56° 13.3′	130° 05.4′
Bert	Quartzite	082GSW 003	49° 29.3′	115° 52.4′
Kalispell	Vein	082FNW 166	49° 51.9′	117° 24.5′
Trixie V	Vein		49° 15.1′	117° 19.6′
Blackstone	Vein		49° 10.6′	117° 07.7′
Goat A	?	082LNW 047	50° 42.5′	119° 08′
Bulldog	Vein	082FNE 088	49° 38.8′	116° 06′
Cheakamus Bridge	Quartzite	092GNW 023	49° 55′	123° 09.6′
Buse Lake	Siliceous Volcanics	092INE 123	50° 37.2′	120° 01.5′
Colby Bay	Chert	103G 020	53° 34.3′	130° 15′
Deadman Inlet	Quartzite	103G 017	53° 37.8′	130° 29.3′
Gurd Island	Quartzite	103G 010	53° 53.7′	130° 39.8′
White Rock	?	082LSW 078	50° 25′	119° 03.6′

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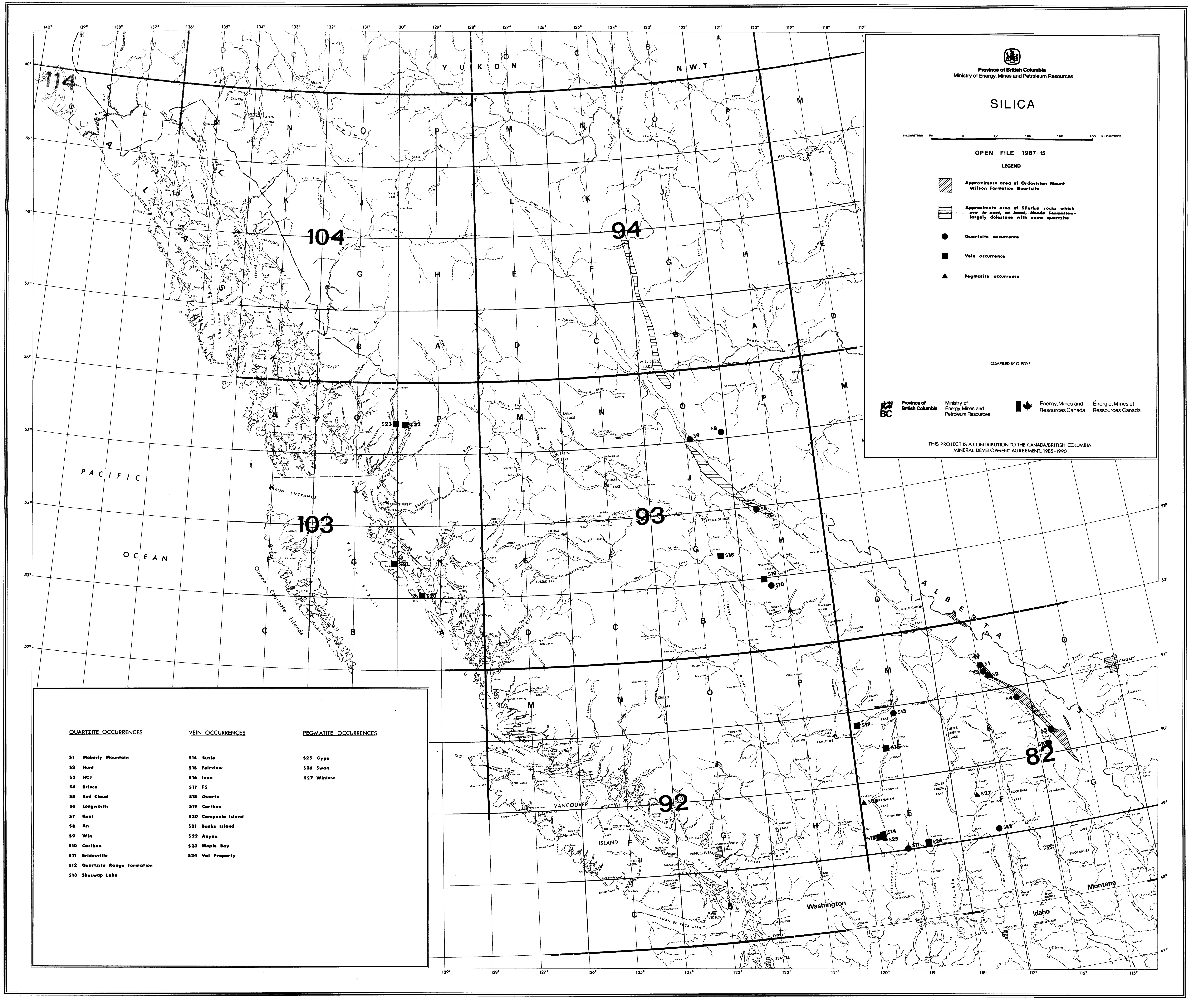
Province of British Columbia
Ministry of Energy, Mines and Petroleum Resources
SILICA
KILOMETRES 50 0 50 100 150 200 KILOMETRES
OPEN FILE 1987-15
LEGEND
Approximate area of Ordovician Mount Wilson Formation Quartzite
Approximate area of Silurian rocks which are in part, at least, Nonda Formation-largely dolostone with some quartzite
Quartzite occurrence
Vein occurrence
Pegmatite occurrence
COMPILED BY G. FOYE
Province of British Columbia
Ministry of Energy, Mines and Petroleum Resources
Energy, Mines and Resources Canada
Énergie, Mines et Ressources Canada
THIS PROJECT IS A CONTRIBUTION TO THE CANADA/BRITISH COLUMBIA MINERAL DEVELOPMENT AGREEMENT, 1985-1990
QUARTZITE OCCURRENCES
S1 Moberly Mountain
S2 Hunt
S3 HCJ
S4 Brisco
S5 Red Cloud
S6 Longworth
S7 Koot
S8 An
S9 Win
S10 Cariboo
S11 Bridesville
S12 Quartzite Range Formation
S13 Shuswap Lake
VEIN OCCURRENCES
S14 Susie
S15 Fairview
S16 Ivan
S17 FS
S18 Quartz
S19 Cariboo
S20 Campania Island
S21 Banks Island
S22 Anyox
S23 Maple Bay
S24 Val Property
PEGMATITE OCCURRENCES
S25 Gypo
S26 Swan
S27 Winlaw
YUKON
N.W.T.
ALASKA
ALBERTA
PACIFIC OCEAN
Washington
Idaho
Montana
U.S.A.
VANCOUVER
VICTORIA
CALGARY
PRINCE GEORGE
KAMLOOPS
Queen Charlotte Islands
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