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WOLLASTONITE OCCURRENCES IN BRITISH COLUMBIA

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KEYWORDS: Industrial minerals, wollastonite, calc-silicate skarn, metasomatic, filler.

INTRODUCTION

Wollastonite is an important mineral filler in paints and ceramic products. Presently most wollastonite used in North America (approximately 1 million short tons per year) is supplied by NYCO a division of Processed Minerals Inc. from New York State (Power, 1986). With the restrictions on the use of asbestos in the United States, an increased demand for wollastonite for short-fibre filler applications should be anticipated.

There is no record of wollastonite production in British Columbia and deposits have not been systematically documented. Limited geological mapping, sampling, petrographic examinations and semiquantitve evaluations of wollastonite were undertaken at selected sites during the 1988 field season (Figure 3-3-1).

Five sites, Sechelt, Little Billy mine, Fintry Point, Silence Lake mine and Horsethief Creek have potential to contain mineable reserves of wollastonite. This paper describes these occurrences and documents their size and physical characteristics.

Analytical and processing tests on bulk samples collected from each site are required to evaluate the economic potential of each deposit. These tests will determine recovery rates, brightness, aspect ratio (ratio between length of the crystal and its width), loss-on-ignition, iron content and other chemical and petrographic parameters.

SNAKE BAY AND WORMY LAKE DEPOSITS (MINFILE 092G 052, 053)

Drilling by Tri-Sil Minerals Incorporated during 1987/88 on a wollastonite skarn near Snake Bay, 5 kilometres north of Sechelt, has outlined a continuous body of wollastonite mineralization approximately 150 metres wide and up to 100 metres in depth, along a strike length of 450 metres (Figure 3-3-2). Possible and probable drill-indicated reserves are 291 000 tonnes of wollastonite (Goldsmith and Kallock, 1988).

Near Wormy Lake (local name), approximately 2.5 kilometres north-northwest of the Snake Bay deposit, wollastonite crops out intermittently over a distance of 600 metres. Preliminary mapping has documented these outcrops but no further work has been done (Figure 3-3-3).

GEOLOGY

Both the Snake Bay and Wormy Lake wollastonite are hosted by a north-trending limestone belt (Karmutsen Formation?) in a roof pendant within the Coast plutonic complex. Calc-silicate assemblages include wollastonite, two types of garnet, and diopside, found in varying proportions and randomly distributed throughout the skarn. A brief description of rock types at Snake Bay follows:

Limestone: Light to dark grey, fine to medium-grained, thinly bedded to massive crystalline limestone crops out in the north half of the skarn. Discontinuous, alternating light and dark grey beds between 1 and 5 centimetres thick strike east to northeast, dipping 50 to 80 degrees north and northwest. In places beds are isoclinally folded, plunging 50 degrees west. In siliceous zones boudins of quartz may be replaced by wollastonite, garnet or calcite, most often near contacts with intrusive rocks.

Skarn: Green, grey, brown to brownish black, fine to medium-grained banded skarn crops out throughout the property. Associated minerals include wollastonite, brown and black garnets, diopside, epidote, and occassionally pyrite and chalcopyrite. Remnant limestone beds up to 10 centimetres thick strike east to northeast and dip north or south 50 to 85 degrees.

Diorite: Diorite crops out east, west and south of the skarn and apophyses extend into the sediments. It is medium to coarse grained and consists of 60 to 70 per cent hornblende and biotite with minor pyrite and chalcopyrite.

Dykes: Greenish black to black andesite dykes between 0.5 and 3 metres wide intrude skarn, limestone and diorite. They generally strike west to southwest, dip steeply northwest at 65 and 90 degrees, and consist of a fine-grained groundmass with phenocrysts of plagioclose and/or hornblende. Contacts with host rocks are well defined. Where dykes intrude limestone, rock is thermally altered to marble (within 3 metres) and may contain wollastonite and/or garnet.

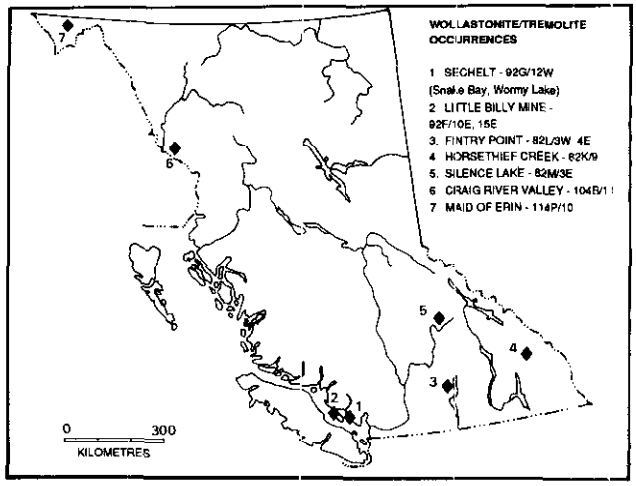

Figure 3-3-1. Wollastonite/tremolite occurrences in British Columbia.

British Columbia Ministry of Energy, Mines and Petroleum Resources, Geological Fieldwork, 1988, Paper 1989-1.

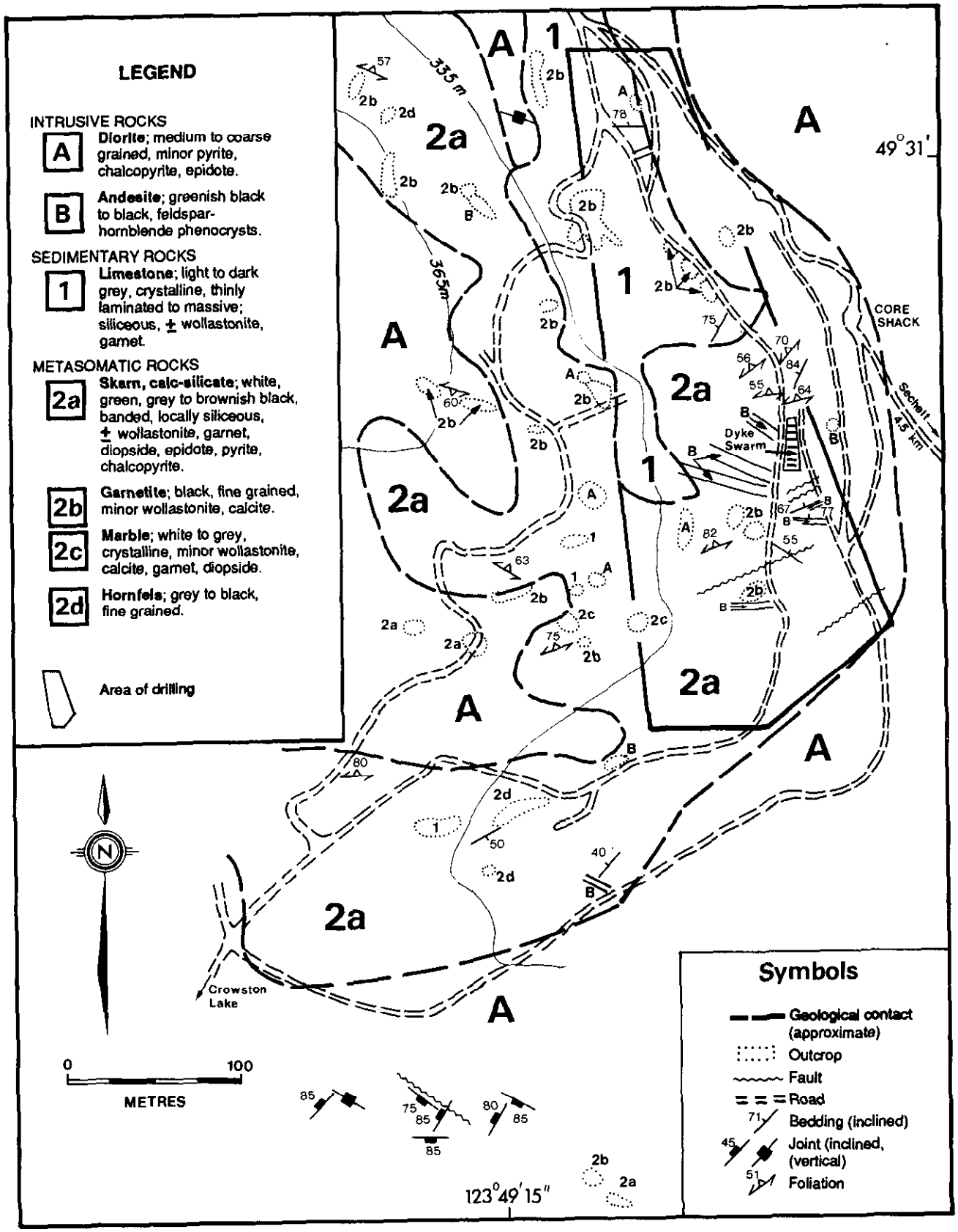

Figure 3-3-2. Snake Bay wollastonite-garnet skarn.

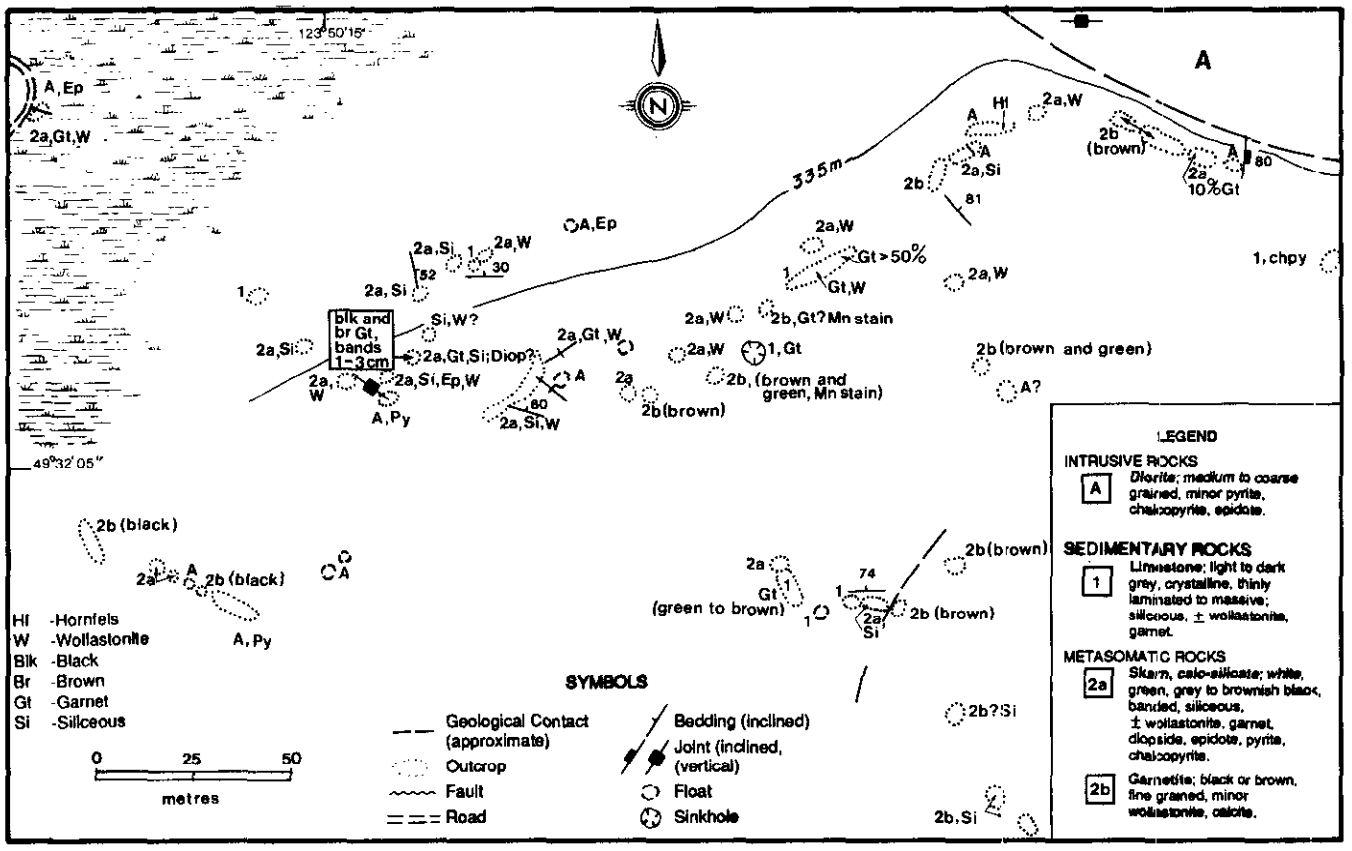

Figure 3-3-3. Wormy Lake – geological outcrop map.

Plate 3-3-1. Snake Bay – white wollastonite and brown garnet (dark grey in photo) replacing limestone.

Plate 3-3-2. Snake Bay – white "augens" of wollastonite replacing grey crystalline limestone.

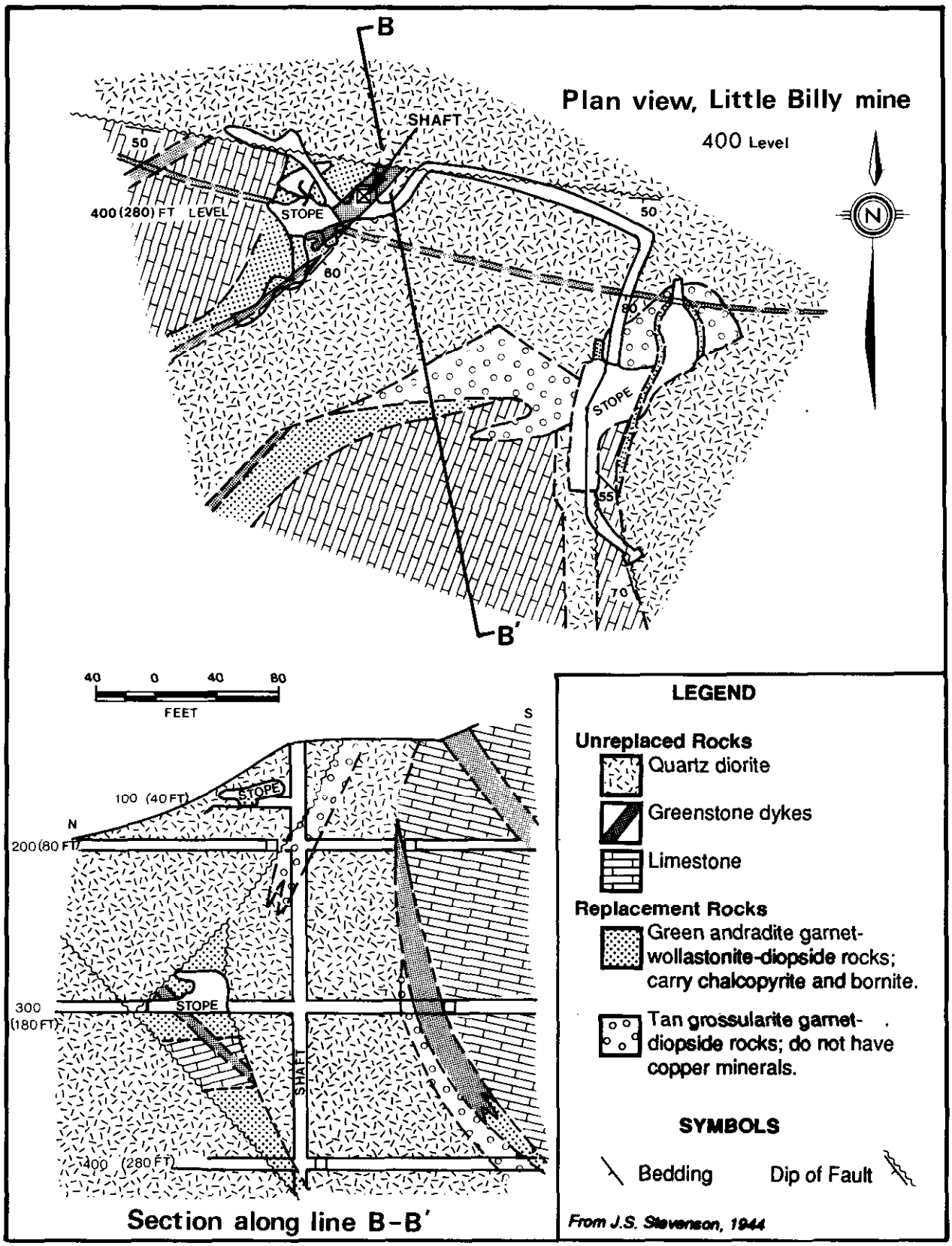

Figure 3-3-4. Little Billy mine – wollastonite occurs in replacement rocks.

Calc-silicate rocks: Wollastonite and garnet occur in parallel alternating bands which suggests preferential replacement of carbonate beds of slightly different chemical composition. The more siliceous units form wollastonite and the argillaceous beds are replaced by garnet (Plates 3-3-1 and 3-3-2). Wollastonite replaces carbonate randomly; fibres less than 1 millimetre long occur in bands up to 8 centimetres thick. Determining the percentage of wollastonite relative to carbonate in the field is difficult, and grade varies from 5 to 75 per cent. Brown to green garnet (grossularite?) forms bands up to 20 centimetres thick. A fine-grained black variety, andradite(?), occurs in isolated pods and lenses of garnetite.

Rocks at Wormy Lake are similar to those at Snake Bay. Outcrop distribution in the mineralized area at the southeast end of the Lake is shown in Figure 3-3-3.

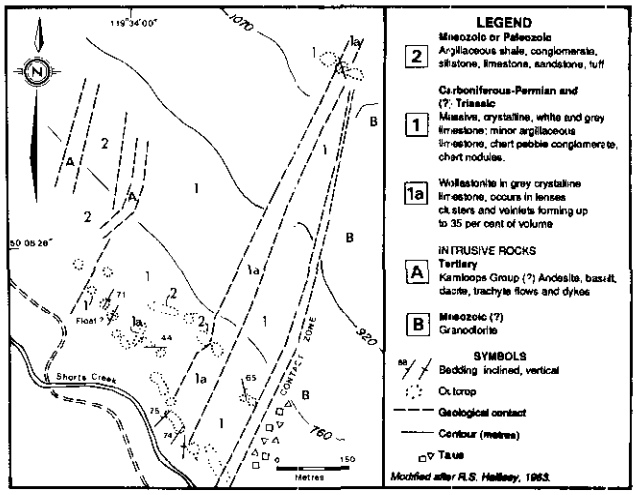

Figure 3-3-5. Fintry Point wollastonite skarn.

LITTLE BILLY MINE (MINFILE 092F 105)

A 30-kilogram sample of massive white wollastonite was collected for processing studies from waste dumps at the abandoned Little Billy mine near Vananda on the northeast shore of Texada Island (Figure 3-3-1).

No wollastonite mineralization crops out at the mine but J.S. Stevenson (1945) reports zones of wollastonite skarn are present in the mine between the 100 and 400-foot levels, along the contacts between quartz diorite and limestone of the Quatsino Formation (Figure 3-3-4). The zone plunges 45 degrees south along the contact and consists of coarse-bladed wollastonite, garnet, diopside, bornite, chalcopyrite, pyrite, molybdenite, magnetite, sphalerite, galena, scheelite, gold and silver. Wollastonite-garnet textures indicate these phases crystallized simultaneously and are of metasomatic origin (Ettlinger and Ray, 1988). Reserve estimates based on Stevenson's 1944 report, indicate approximately 100 000 tonnes of wollastonite-rich skarn is present in the old mine workings.

FINTRY POINT (MINFILE 082L 014)

Wollastonite skarn crops out 6 kilometres west of Fintry point on the west shore of Okanagan Lake approximately 27 kilometres southwest of Vernon. It is hosted in Permo-Carboniferous limestone of the Thompson assemblage (formerly Cache Creek Group), approximately 100 metres west of a large granitic body and occurs along a zone 30 to 80 metres wide having a strike length of 850 metres and an exposed vertical extent of 500 metres (Figure 3-3-5). The site was first described by Hallisey (1963). A description of the rock types follows:

Calc-Silicate Rocks: Wollastonite occurs as irregular lenses, clusters and stringers in steeply-dipping grey to black crystalline limestone and forms up to 35 per cent of the host rock.

Fibres range to 12 centimetres in length but average 2 to 3 centimetres. Associated minerals include calcite and quartz in stringers and lenses, minor garnet and diopside and clinopyroxenes along the limestone-granodiorite contact. In hand specimen wollastonite is easily identified by its radial crystal growth. Examined in thin section it forms fibrous aggregates randomly speckled by fine-grained diopside crystals. Boundaries between wollastonite skarn and its carbonate host are sharp with only minor crosscutting veinlets of calcite and quartz. A zone of garnet-quartz skarn 1 to 2 metres wide crops out along the limestone-granodiorite contact. The rock is brown, fine grained and in sharp contact with both sediments and the intrusive. Hallisey reports it is composed of 65 per cent grossularite, 25 per cent quartz and 10 per cent altered diopside (tremolite-actinolite).

Unaltered Sedimentary Rocks: White to grey to black, fine to medium-grained crystalline limestone crops out immediately west of the skarn contact zone and west of the wollastonite zone. Remnant beds strike north and dip steeply east or west between 60 and 90 degrees. Interbedded black argillite and fine-grained sandstone with minor pockets of conglomerate are exposed at lower elevations.

Intrusive Rocks: A large body of fresh-looking, coarse-grained granodiorite outcrops immediately east of the sedimentary package. It contains 40 per cent plagioclase, 30 per cent orthoclase, 10 to 15 per cent quartz and 10 to 20 per cent biotite and hornblende.

Sills of porphyritic basalt intrude the sedimentary package along bedding planes, west of the limestone-granodiorite contact. The basalt is fine grained, with small, randomly spaced plagioclase phenocrysts in a brown groundmass. Hallisey (1963), identified the groundmass as mainly fine-grained sercitized plagioclase feldspar with finely disseminated pyrite throughout. He found occassional remnants of augite, usually altered to chlorite and sericite.

SILENCE LAKE (MINFILE 082M 123)

Dimac Resource Corporation's open-pit tungsten mine, approximately 30 kilometres northeast of Clearwater, operated briefly during 1981/82. The area is underlain by calcareous and non-calcareous biotite schist, marble and quartz-feldspar-biotite gneiss that are thermally and metasomatically altered by intrusions of quartz monzonite, quartz diorite and related granitic phases (Figure 3-3-6).

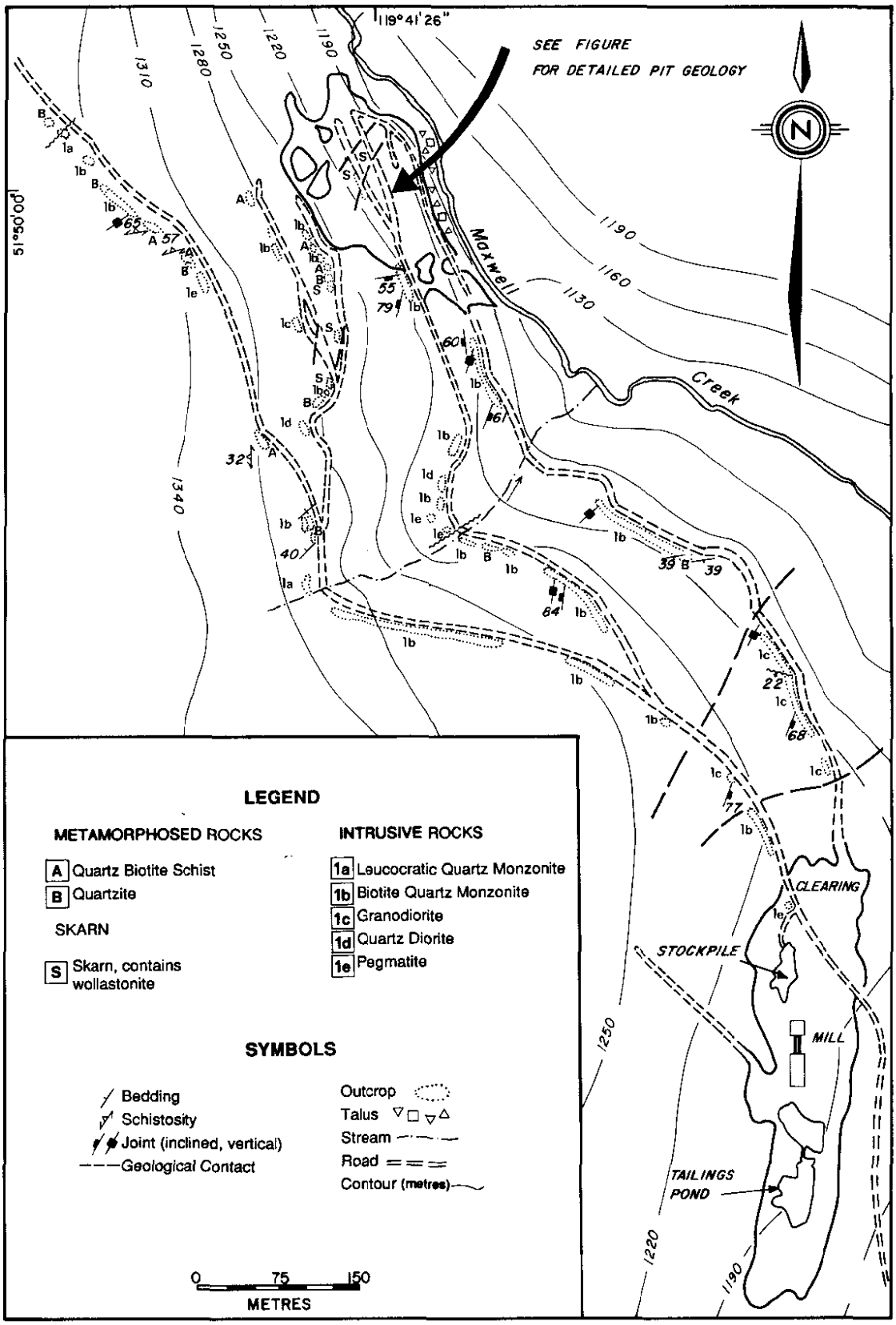

Figure 3-3-6. Geological outcrop map – Silence Lake mine.

At the mine, skarn rocks are hosted in quartz biotite schist and quartzite close to an intrusion of massive biotite-muscovite quartz monzonite (Figure 3-3-7). A brief description of these rock types follows:

Wollastonite Skarn: The mining operation exposed a 15 to 20-metre section of siliceous skarn containing up to 35 per cent wollastonite (Plate 3-3-3). Poor rock exposure along strike prevents detailed examination but similar wollastonite skarn outcrops 170 metres south-southwest of the main showing (Figure 3-3-6).

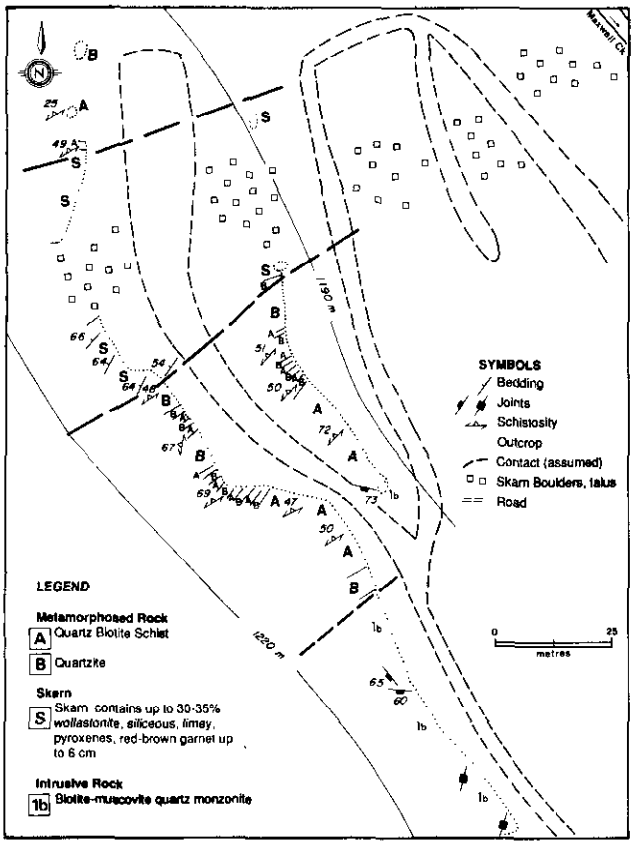

Figure 3-3-7. Geological sketch – open pit area of Silence Lake mine.

Plate 3-3-3. Silence Lake mine – Looking west-southwest.

S = Zone contains wollastonite, garnet, quartzite
B = Quartzite

In the pit wollastonite occurs in calc-silicate zones which strike northeast and dip 60 to 70 degrees northwest. Individual wollastonite bands are up to 100 centimetres wide and consist of massive fresh-looking white wollastonite with fibres up to 3 centimetres long. Clusters of red-brown garnet (grossularite) commonly form 20 to 30 per cent of the rock volume. Thin quartzite beds are intercalated with the calc-silicates, with contacts clearly defined and sharp. Accessory minerals include diopside and relict calcite. Two other skarn mineral assemblages have been identified by Dimac, (Dickinson, 1980; Falconer, 1986) a siliceous garnet skarn, consisting of coarsely crystalline garnet (andradite-grossularite), diopside, idocrase, scheelite and quartz, and a pyroxene skarn consisting of medium to coarsely crystalline garnet (iron and manganese-rich grossularite), actinolite, vesuvianite, diopside and pyrrhotite.

Schist and Quartzite: Brown to grey, medium-grained biotite schist crops out north, south and west of the skarn zone. The schist contains 40 to 50 per cent quartz, 20 per cent feldspar, 20 per cent biotite. A well-developed foliation strikes northeast. The schist is intercalated with massive beds of grey medium-grained quartzite.

Intrusive Rocks: A medium-grained, equigranular, orange-brown-weathering quartz monzonite crops out south of the skarn along the mine access road. In places biotite may form up to 15 per cent of the rock.

HORSETHIEF CREEK (MINFILE 082K 031)

A recently discovered calc-silicate occurrence approximately 30 kilometres west of Invermere and immediately south of Horsethief Creek was staked by G. Plassmann and B. Bechel in June, 1988 (Figure 3-3-1). The property is underlain by dolomitic sediments of the Proterozoic Dutch Creek and Mount Nelson formations which consist of

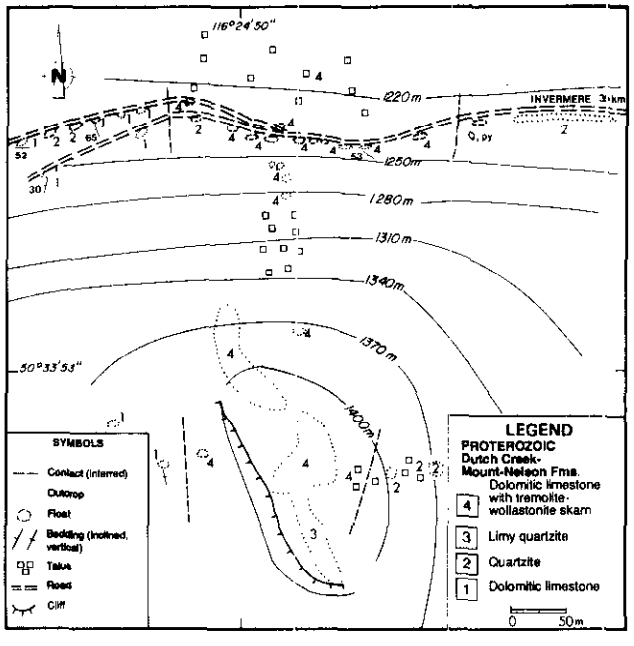

Figure 3-3-8. Geological sketch of the Horsethief Creek calc-silicate prospect.

argillites, limestone and dolomite (Grant, 1987). Brief rock-type descriptions follow:

Calc-silicate Rocks: Tremolite and wollastonite(?) occur in clusters of radiating fibres up to 10 centimetres long and in lenses or veins in siliceous dolomitic limestone. The more massive occurrences are found at the top of a prominent hill and along a 30-metre cliff. Massive white to pale green calc-silicate skarn outcrops over an area measuring approximately 110 by 175 metres (Figure 3-3-8). In this area calc-silicate occurs in veins 15 to 20 centimetres wide which strike northwest and are intercalated with beds of quartzite and cut by occassional veinlets of calcite.

Dolomitic Limestone: Dark grey to black dolomitic limestone crops out west of the hill and along Horsethief Creek. Beds strike generally north and dip between 30 and 65 degrees west.

Quartzite: Pale brown to light grey, massive, sometimes cherty quartzite crops out east of the hill and along the road. This unit marks the eastern extent of the calc-silicate zone.

Intrusive Rocks: No intrusive rocks were found in place on the property. Only occasional large boulders of a coarse-grained, grey to mauve granite were observed and these probably originate from a large granitic body immediately to the north-northwest.

MISCELLANEOUS OCCURRENCES

Reports of wollastonite-bearing skarns in the Craig River valley in the Iskut River area, (MINFILE 104B 005) and the Maid of Erin claims north of Rainy Hollow (MINFILE 114P 007) 5 kilometres west of the Haines-Whitehorse Highway, were checked briefly in the field.

At Craig River, Kerr (1948) reported: "In Craig Valley, near the masses of hornblende granodiorite, the limestone is largely converted into wollastonite and silica". An examination of the contact on the southeast flank of Seraphim Mountain ("Seraphine Mountain" of Kerr, 1935) failed to locate this occurrence.

Drill logs from Falconbridge's Maid of Erin claims note wollastonite occurring in four drill holes over sections up to 2 metres wide (Wilson, 1983). Examination of outcrop and core left on site could not confirm substantial quantities of wollastonite.

SUMMARY

Of the eight sites described, one – Snake Bay near Sechelt – is in an advanced stage of exploration with possible and probable reserves of wollastonite outlined. Five other sites; Wormy Lake, Little Billy mine, Fintry Point, Silence Lake and Horsethief Creek contain significant amounts of wollastonite/tremolite. Additional exploration is necessary to fully assess the potential of each site and processing tests on bulk samples are required to document each deposit's potential to produce wollastonite which will meet industry specifications.

ACKNOWLEDGMENTS

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