84-1084 — 13176

11/85

Geology of the VTS Quarry Group

(Lot No. 492,496)

Greenwood Mining Division

83E/1W

82

Lat. 49° 02'   Long. 118° 23'

Owner: Consolidated Non-Metallics Ltd.

Operator: VTS Quarry Limited

Consultant: J. Richardson, P.Eng.

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Period of Work: 1 July - 18 September, 1984

Date Submitted: 26 September, 1984

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GEOLOGY OF THE VTS QUARRY PROPERTY

Introduction

V.T.S. Quarry is a non-metallic mineral producer specializing in dolomite and quartz. The quarry property is 5 kilometers east of Grand Forks, B.C. (Figure 1). At present, the property contains proven reserves of approximately 1 million tons of high grade dolomite and 5 million tons of 98%+ quartzite, plus a mill capable of grinding saleable products from either rock type. Possible reserves of feldspar exist and are being tested for commercial viability. The property was geologically mapped on a scale of 1:1200 over an area of 150 ha.

Location and Access

As stated above, the V.T.S. Quarry property is approximately 5 kilometers east of the town of Grand Forks (Figure 1). The property lies adjacent to the Interprovincial Highway #3. The Kettle Valley Branch of the C.P.R. is within 1 km of the property and the Burlington and Northern railroad is approximately 3 km south, across the Kettle River.

Elevations on the property range from 1,750' (540 m) on the river flats to approximately 2,500' (772 m) on the crest of the quartzite beds. The river flats are a mixture of till and lacustrine sands with no outcrops. The hillside is a parkland terrain with better than 80% outcrop.

Previous Work

The property is composed of 9 claims which are as follows:

Claim	Lot #	Record #	Record Date
Beaver	496	12,502	Sept. 30/50
Beaver 3	496	4,068	June 18/84
Silica 1	496	36,838	Oct. 9/73
Silica 2	496	36,994	March 14/74
Erwin 2	492	3,473	Feb. 14/83
Gold 1	496	3,927	Nov. 24/83
Gold 2	496	3,928	Nov. 24/83
Gold 3	496	3,929	Nov. 24/83
Gold 4	496	3,930	Nov. 24/83

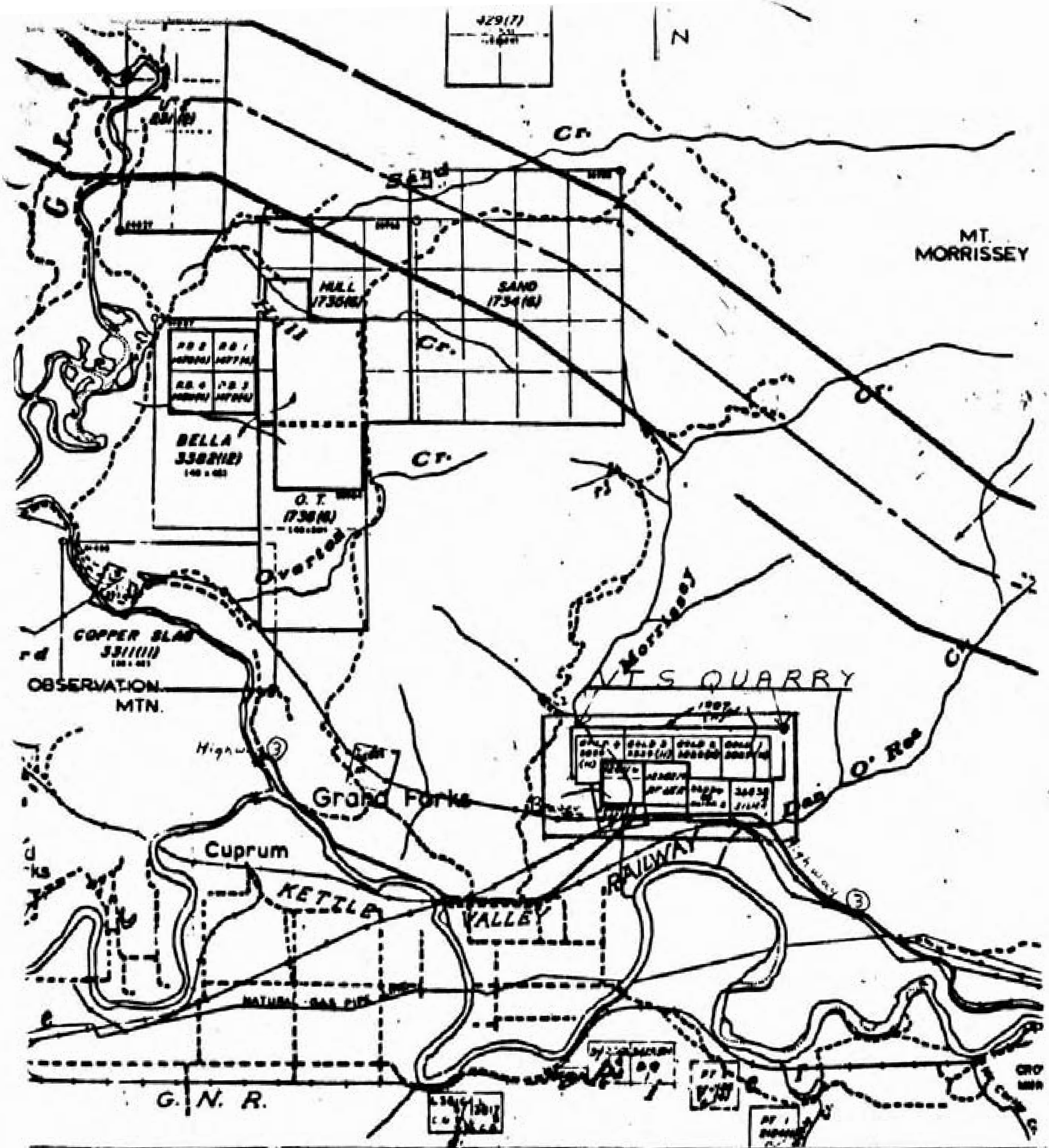

Figure 1

V T S QUARRY CLAIMS LOCATION MAP 82E/1W

Scale 1:50,000

The main source of information on this area is the work of Preto (1969). The works of earlier authors exist but are either too general or concentrate on the metallic mineral deposits in this region. These deposits have been mined extensively since the 1890's and include such famous deposits as the Phoenix Mine.

A new map of the Princeton sheet, which includes Grand Forks, is presently being prepared by Dr. D. Templeman-Kluit of the Geological Survey of Canada (per. comm. 1984). This map will not be published until late 1985 or early 1986. Preliminary findings from Templeman-Kluit's work will be used. These findings came from a meeting in Vancouver, which I had with Dr. Templeman-Kluit on the 17th of August, 1984. In several cases, this work differs markedly from that of Preto (1969).

Regional Setting

The V.T.S. Quarry property occurs within a series of very high-grade metamorphic rocks known as the "Grand Forks Gneisses" (Templeman-Kluit per. comm. 1984). The age of these gneisses is not certain; it is possible that they are latest Proterozoic to early Cambrian. These gneisses cannot be correlated with certainty to any other rock units in British Columbia.

The original rock units consisted, from bottom to top, of (1) a sandstone, a limy unit and another sandstone; all are found within the quartzite quarry; (2) a unit of limy shale; (3) a unit of limestone. In most cases, the conversion to dolomite occurred after the units were laid down.

In the Jurassic, this region was subjected to high-grade metamorphism (sillimanite-kyanite grade or 450° - 500° C). This metamorphism partly melted the limy shale. The melted fraction was emplaced in the section as alaskites. All the feldspar bearing rocks appear to have originated in this fashion.

The last event to affect these rocks was a doming process in the Eocene. This process acted on the gneisses by elevating the central block. This block is roughly bounded by the Granby River on the west and Christina Lake on the east. The elevated block shed its covering rocks along the west dipping Granby River Fault and along the east dipping Christina Lake Fault.

At this time an igneous event emplaced fine grained andesite-dacite dikes along faults and fractures in the now cool and non-reactive rocks.

Thus, there are two unrelated igneous events, the alaskites and the andesite-dacite intrusions, which entered the meta-sedimentary section. These, plus the high-grade regional metamorphism and N-S regional block faulting must be taken into account when attempting to unravel the history of this deposit.

QUARRY SETTING

Sedimentary Units

The quarry property is situated within the east-west trending "Morrisey Creek Antiform" of Preto (1969). This structure, which approximately parallels the Kettle River Valley, has a steeply dipping to vertical south limb. The units which have been mapped within the property have nearly vertical dips. Locally, there are secondary folds whose wave length is approximately 10 meters.

A sharp topographic break occurs to the west of the dolomite quarry. It is due to a linear draw and a recessive weathering dacite dike. The meta-sedimentary units to the west of the dike dip at 30° W and strike approximately N-S. An almost 90° change in dip and 60° change in strike across the dike means that the dike may have been emplaced along a N-S trending block fault, herein called the Quarry Fault (Figure 2). If this fault follows the regional trend it will be downthrown to the west.

Several changes in lithology have been noted across the quarry fault. A marble unit occupies the valley floor to the west of the fault. Within this unit are prominent chert beds whose equivalents do not occur in the quarried dolomite. The unit overlying this marble is a biotite-hornblende migmatite. It is also not found east of the fault, though its well banded texture is recognizable even from a distance. The conspicuous pegmatite bodies visible in the quarry area also disappear west of the fault.

The sedimentary section within this quarry contains large quantities of established, good grade, saleable, silica and dolomite. Preliminary measurements on exposed material give an estimate of one million tons of in-place dolomite and five million tons of in-place quartzite.

INTRUSIVE ROCKS

The intrusive rocks within the "Morrisey Creek Antiform" occur in two separate stages. The first stage includes both the alaskite pegmatites and the felsic gneisses. Both rock types were introduced as irregular bodies into the sediments during the final stages of metamorphism. The only difference between the felsic gneisses and the pegmatite is that the gneisses were introduced before deformation had ceased and thus were strained by the final deformation stages.

The cross-cutting relationships of the alaskite bodies can be clearly seen in an outcrop just to the west of the quartzite quarry. Here a body of pegmatite intrudes and cuts across the bedding of the biotite gneiss. The pegmatite does not pick up any visible inclusions of the gneiss within it. All feldspar-bearing bodies are low in iron. They may be suitable for commercial feldspar production, if the iron requirements are not too severe.

The contact zone between the feldspar-bearing bodies and the dolomite has developed a reaction rim on all contacts mapped. In most cases, the zone is approximately I meter in width. The contact zone appears to be a mixture of dolomite, serpentine, mica, quartz and several unknown, non-carbonate, minerals.

The second stage of intrusives are dark green-grey, fine grained andesite or dacite dikes. These dikes are of Eocene age. They formed long after their host rocks had cooled. The walls of the dikes are sharp, and it appears that no reaction has taken place with any host rock.

The dikes were emplaced along fractures. This would explain the apparently complete cross cutting relationship seen in a dike in the old ornamental stone dolomite quarry. In the quarry, a conspicuous dark dike cuts through both dolomite and a pegmatite body without offsetting or reacting with either host rock.

CONTAMINANTS

Dolomite

The dolomite deposit contains three main non-carbonate minerals. These are: feldspar, as vein-like bodies, especially near the pegmatite boundaries; serpentine, as vein-like fracture fillings and light green disseminated bands, probably replacing olivine and anthophyllite; mica, as light brown (probably Mg rich phlogopite) disseminated bands and occasional fracture fillings. There are several other minor minerals such as Anthophyllite, Spinel and Rutile within the mica bands but they are not common enough to cause problems.

The serpentine is not considered a contaminant, as it enhances the colour of the stone. Its occurrence is too widespread to be able to quarry stone for serpentine separately. The feldspar and mica are considered contaminants. The feldspar bands, in particular, should be avoided as they occasionally contain dark mica and rusty weathering spots, probably sulphides.

Quartzite

At present, no identifiable minerals except quartz, feldspar and disseminated hematite have been found in the quartzite quarry. None of these minerals may be considered a contaminant.

Preto (1969) noted tourmaline and feldspar along joint planes in some of the quartzite. This material should be noted on the face as the joint planes would be readily visible. It could be separated if it was found to be a problem.

Feldspar

All feldspar bodies on the property contain iron-bearing minerals. These minerals occur as either biotite clumps or as garnets.

The feldspar body with the least contamination appears to be the intrusive to the east of the old dolomite quarry. Most contaminants here are in the form of garnets.

In the remainder of the bodies the contaminants do not appear to be very easily removed as they have intergrown with the feldspar. Some bodies have biotite and minor quartz growing around the edges of large feldspar grains. Such material occurs on the upper benches of the eastern dolomite quarry.

If commercial feldspar production is to be attempted, the iron poor material may have to be selectively mined. A washing plant may be required to remove the unwanted material.

CONCLUSIONS

The V.T.S. quarry property is part of a belt of very highly metamorphosed sedimentary rocks. These rocks are known as the "Grand Forks Gneisses" and are bounded by the Granby River Fault to the west and the Christina Lake Fault to the east.

The quarry property consists of three sedimentary units and two igneous units. The sedimentary units, from bottom to top, are quartzite, biotite gneiss and dolomite. The older igneous unit is the feldpathic pegmatite-gneiss, the younger is the andesite-dacite dikes.

The dolomite quarry is much more complex than the quartzite quarry. The dolomite quarry contains approximately 30% pegmatite and 10% contact rock. The contact rock contains sufficient mica and other contaminants to make it unsuitable as ornamental stone. The quartzite quarry has few impurities, its main contaminant is disseminated hematite. This contaminant is responsible for the colour of the golden quartz ornamental stone.

Very little engineering work has been done on the quarry. Such work as drilling, bulk sampling, surveying of existing workings and detailed ore volumes have not been done. This should be completed before any large scale production targets are finalized.

RECOMMENDATIONS

1. Drilling and surveying of the quarry should begin immediately. A diamond drill should be used as it gives a better idea of the nature of the impurities within the dolomite and quartzite bodies. The surveying, preferably a topographic map drawn by a professional surveyor, will give points on which to tie future mapping and production volumes.

2. A larger area than the immediate quarry should be geologically mapped. The detailed map recently produced differs from that of Preto (1969). (It may be advantageous to determine what lies outside the mapped area.)

3. A larger scale bulk sampling of the feldspar might be advisable. This sampling would check both the continuity of the iron-poor portions of the body and also determine if a separation technique for the iron minerals was available.

4. A sampling of the carbonate west of the break might be advisable. If the two carbonate horizons are not correlatable then the magnesium content of the western carbonate horizon may be quite different than that encountered in the quarried dolomite.

MINERALOGY OF THE V.T.S. QUARRY

The assemblage of minerals within the dolomite quarry, of the V.T.S. Quarry property, is a rare, very high temperature magnesium-rich chemical system. The occurrence here of the assemblage Carbonate-Olivine-Spinel-Mica is at odds with the Carbonate-Pyroxene-Mica+Scapolite proposed for the area by Preto (1969). It is possible he saw this assemblage; the quarry site is mentioned in his paper, but did not note its different mineralogy.

The abundant serpentine which exists in the quarry appears to be an alteration product of olivine, and occasionally other magnesium silicates. Major amounts of possibly unaltered olivine exist with mica on the upper bench of the western quarry.

West of the fault, the marble contains the assemblage diopside-mica-serpentine. This is more in line with the description provided by Preto (1969) for the mineralogy of the area. This assemblage is also consistent with the interpretation of the fault being downthrown to the west. The olivine-spinel-mica equilibrium temperature is higher than that of the diopside-mica assemblage. The quarry dolomite may well have experienced temperatures in excess of 800° C (Kearnes, 1978).

MINERALOGY OF V.T.S. DOLOMITE QUARRY

MAIN MINERALS

Symbols: xls

M	=	massive	C	=	common
A	-	abundant	R	=	rare

Mineral	Location	Rarity
Dolomite	main mineral	M A
Phlogopite	common accessory, violet to brown colour	xls C
Serpentine	near contact zones vein and fracture fillings	M C
Anthophyllite	constituent of mica amphibole veins	xlc M C
Feldspar (Albite or Microcline)	occurs as vein fillings near mica contacts fairly pure with little or no iron	M C
	Accessories (preliminary identification)	
Spinel	blue octahedrons in mica veins and disseminated in dolomite	xls M R
Rutile	Ruby red tetragonal crystals with mica and spinel in anthophyllite veinlets	xls R
Zeolite (Ferrierite?)	terminate cluster in open fractures on the eastern-most contact of the dolomite and pegmatite	xls v R

Mineral	Location	Rarity
	ACCESSORIES (inclusions)	
Biotite	veinlets and masses near pegmatite contacts, largely in eastern quarry, black (as opposed to brown for the phlogopite)	M MR
Garnet (Almandine)	occurs with biotite, feldspar dirty red colour	xls M R
Sulphide (Pyrite?)	occurs with feldspar on the upper bench of the western quarry, and with phlogopite in rare lenses within the dolomite	M? R
Sillimanite	occurs as honey-coloured needles with feldspar, biotite and garnet in veinlets on the upper bench of the western quarry	xls R

UNKNOWNS

tan to light brown disseminated grains	occur with other impurities, most common to the east of the eastern access road may be a chondrodite	xls M C
bright green hexagonal xls on joint planes	occur in contact zone in eastern quarry, fairly soft may be apatite?	xls R
metallic trigonal crystals with spinel-rutile	occur as a minor accessory in some of the anthophyllite veins may be ilmenite or arsenopyrite	xls R

REFERENCES

Kearnes, L.E. (1978)

The Amity Area, Orange County,
New York Mineralogical Record V9, N2, pp. 85-95.

Preto, V.A.(1969)

Geology of the Grand Forks Group
G.S.C. Paper 69-22 76 pp

ITEMIZED COST STATEMENT

Consulting Fees and Expenses

Consulting Fees (field work, travel time) Report writing and map preparation, literature research	$ 7,800.00
Accommodation, motels and meals (Grand Forks)	2,050.00
Transportation to/from Grand Forks - Vancouver per 22¢/km	1,264.00
Drafting and printing services	60.00
Assessment work, recording and grouping	100.00
Total	$11,424.00

STATEMENT OF QUALIFICATIONS

R. Gunter

Graduated in Geology from Queens' University, Kingston, Ontario, with a B.Sc. (Honours) in 1977 and from the University of Windsor with an M.Sc. in Geology in 1980. Worked with various companies on non-metallics, coal and uranium throughout Canada since graduation.

Have authored or co-authored several in-house feasibility studies of properties ranging from a Nb-Zr prospect in Labrador to a coal property north of Hinton, Alberta.

Written by:

Richard Gunter 28 Sept /84

Endorsed by:

James Richardson.
28 Sep /84

PROFESSIONAL ENGINEER
PROVINCE OF BRITISH COLUMBIA
JAMES RICHARDSON


N
Covered Interval
QUARRY FAULT
Open Quarry
O JOINS O' below
Beaver 3
Beaver 4
Developing Benches
Covered Interval
Open Quarry
LEGEND
Igneous Rocks
EOCENE
ANDESITE DACITE
Black-green medium, coarse grained
sharp, non reactive boundaries
TRIASSIC
ALASKITE (PEGMATITE?)
White, coarse grained, K spar
rich, some shows straining
Meta sediments
CAMBRIAN ?
DOLOMITE-MARBLE
Coarse grained, relatively pure
white, not all bodies correlatable
BIOTITE SCHIST
Black, medium grained thin
bedded, heterogeneous
QUARTZITE
White to golden colour, coarse
grained crystalline
MIGMATITE
Light and dark layering, to 1 meter
thick, very prominant and continuous
"SILICATE BODY"
Blue-grey, white veinlets and masses
minerals unknown, consistant appearance
O-O' separation line
Figure 2
V.T.S. QUARRY
GRAND FORKS B.C. 82E11W
GEOLOGICAL MAP
Scale 1:12,000
0
50m
100m
Scale m.
TO ACCOMPANY REPORT BY R.Gunter Sept. 84