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## SILICA ASSESSMENT

(Project 4-2, Canada-Newfoundland Mineral Exploration & Evaluation Program)

A.J. Butler and B.A. Greene

Introduction

A program of assessment of the silica resources of the province was carried out by the Mineral Resources Division from 1965 to 1969 (Butler and Bartlett, 1967). The results of this investigation were not published, although large reserves of flux grade silica, such as that used in the reduction of phosphorous at Long Harbour, were outlined. The present investigation was initiated in 1972 as Project 4-2 of the Canada-Newfoundland Mineral Exploration and Evaluation Agreement, to fill gaps in the existing data, to determine whether or not the province has reserves of high grade silica for possible use in the manufacture of ferrosilicon, silicon metal, and glass, and to publish the results of both investigations as a comprehensive report on silica in Newfoundland. Field work was completed in late July of 1973, and compilation of the final report is in progress.

Silica deposits in Newfoundland occur within the Random and Hawke Bay Formations, and in metaquartzites and quartz veins.

The Random Formation

General Geology

The Random Formation is a sequence of orthoquartzites, siltstones, and shales which occurs at or near the base of the Cambrian in southeast Newfoundland. The present work indicates that the definition of the formation (Christie, 1950; McCartney, 1967; Walcott, 1900) should be extended to include quartzites in Fortune Bay, formerly referred to the Blue Pinion Formation (Widmer, 1950); and in Placentia Bay, formerly referred to the Brigus Formation (Rose, 1948; Van Alstine, 1948), because comparison of stratigraphic sections suggests that lithological continuity exists between these quartzites and those traditionally assigned to the Random.

The present outcrop area of the Random Formation is divisible into three north-trending belts of differing thickness and lithology:

1. The eastern belt, extending across the western Avalon and Bonavista Peninsulas. In this belt the Random is in most places subdivisible into three quartzite and two siltstone-slate members. The formation thickness increases from 10 feet along the eastern margin of the belt to 500 feet near the center.

2. The central belt, extending along the western shore of Placentia Bay to Milton in Trinity Bay. The Random Formation in this area is composed mainly of siltstones and shales, with very thin quartzite beds, and is usually less than 150 feet thick.

3. The western belt, extending from the southwestern Burin Peninsula to the north shore of Fortune Bay. The Random Formation here is composed of interbedded quartzites and red beds, and is usually more than 500 feet thick.

Contacts between the three belts are gradational.

Both upper and lower contacts of the formation are conformable in the central belt, but disconformities occur at the upper contact in the eastern and western belts, and at the lower contact in the eastern belt.

Fossils were discovered for the first time within and below the Random Formation, in exposures from the western belt formerly referred to the Blue Pinion Formation. Fossils below the Random Formation are mostly hyolithids, but also include Epiphyton sp. and an orthoconic form resembling Volborthella sp. The early Middle Cambrian inarticulate brachiopods Acrothele sp. and Linnarssonina sp., and Cruziana-type arthropod trails occur within the formation. These discoveries support previous suggestions (McCartney, 1967) that the Random is diachronous, and indicate that, in the Fortune Bay area at least, it is of Cambrian age.

### Economic Geology

Fifteen deposits of flux grade silica are known within the Random Formation (Table 1). Major deposits at Argentia, Fortune, Long Harbour, Bellevue-Thornlea, and Long Cove have been outlined by drilling; the remainder have been mapped and surface sampled (Butler and Bartlett, 1967). The deposits that have been drilled contain some 20 million tons of material collectively averaging 95.6% SiO<sub>2</sub>, 1.9% Al<sub>2</sub>O<sub>3</sub>, 0.9% Fe<sub>2</sub>O<sub>3</sub>. Beneficiation tests carried out on the Fortune deposit indicate that the grade can be increased to 97.56% SiO<sub>2</sub>, 1.35% Al<sub>2</sub>O<sub>3</sub>, 0.32% Fe<sub>2</sub>O<sub>3</sub> by using the +20 mesh fraction.

## The Hawke Bay Formation

### General Geology

The Hawke Bay Formation is a sequence of gently dipping orthoquartzite, shale, siltstone and dolomite that conformably overlies Lower Cambrian rocks of the Forteau Formation. It is best exposed along the north and south shore of Hawke Bay and in the Highlands of St. John on the Great Northern Peninsula, and is assumed to extend as far south as Bonne Bay. The March Point Formation of the Port au Port area is suggested to be a southern extension of the Hawke Bay Formation. In most localities the formation is bounded by faults. For convenience in this report the formation is divided lithologically into two members, the lower quartzite member and the upper siltstone-dolomite member.

Thickness of the formation varies considerably; a maximum exposure of 350 feet of quartzite is recorded in the Highlands of St. John. Nowhere has there been noted any rocks overlying the Hawke Bay Formation, except where the formation is in fault contact with overlying rocks, as in the type section at Hawke Bay. Composite thicknesses up to 240 feet (Beckett, 1965) have been proposed, however, type section measurements (Schuchert and Dunbar, 1934) show 70 - 80 feet are exposed. In the Canada Bay area the early Middle Cambrian Cloud Rapids Formation disconformably overlies the Forteau Formation; the intervening Hawke Bay Formation was probably removed by erosion.

Abundant mud cracks, ripple marks and cross bedding suggest deposition in shallow water. Abundant feldspar and angular grains indicate rapid deposition near the source area, which probably lay to the west.

### Economic Geology

Three quartzite occurrences are located in the Hawke Bay area with a wide range of tonnages; however, grades are generally about 94%  $\text{SiO}_2$  with  $\text{Al}_2\text{O}_3$  over 2%. More selective work, particularly in the Highlands of St. John could probably indicate higher grades.

Quartzite in the Bonne Bay area, also assumed to be a part of the Hawke Bay Formation, grades at 96.5%  $\text{SiO}_2$  for a little over 1 million tons, however, this deposit is within Gros Morne National Park and not available for future development.

## Quartz Veins and Metaquartzite Deposits

### General Statement

Quartz veins, at Diamond Cove and Garrison Hills on the south coast, Jocko Pond in central Newfoundland, LaScie on the Burlington Peninsula and at Topsail near St. John's were studied during the program. Quartz veins are generally of higher grade than orthoquartzite deposits but tonnages for these particular deposits are generally low, i.e. less than 1 million tons (Table 1) and in many cases the high grade zones are intimately intermixed with country rock.

A metaquartzite deposit at Grey River, on the south coast, was examined. About 12 million tons are recoverable and beneficiation tests show that grades of 98.1%  $\text{SiO}_2$ , 0.7%  $\text{Al}_2\text{O}_3$  and 0.4%  $\text{Fe}_2\text{O}_3$  can be attained by using the +20 mesh fraction and washing.<sup>2, 3</sup> This deposit is located in a relatively undeveloped part of the island and is accessible only by aircraft and boat.

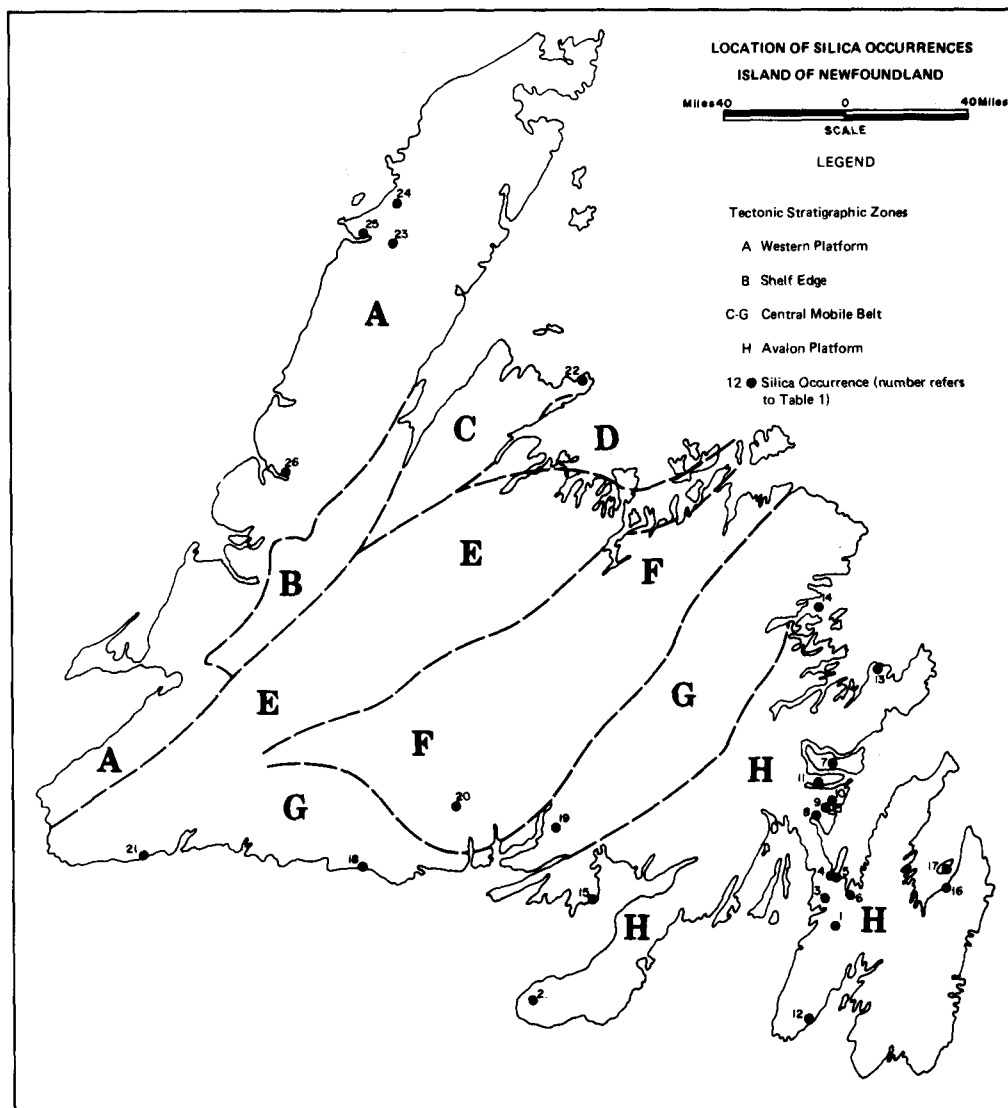


Table 1

## Summary of Silica Deposits, Island of Newfoundland

MODE OF OCCURRENCE	FORMATION	MAP NO.	LOCALITY	GRADE			TONNAGE
				SiO <sub>2</sub>	Al <sub>2</sub> O <sub>3</sub>	Fe <sub>2</sub> O <sub>3</sub>	
Ortho-quartzite	Random	1	Argentia	94.7	2.3	1.4	7,628,000
		2	Fortune	96.4	1.5	0.5	8,860,000
		3	Long Harbour	95.0	2.1	1.6	2,559,500
		4	Bellevue	Not economic			
		5	Thornlea	95.2	2.2	0.8	410,000
		6	Long Cove	96.5	1.6	0.2	350,000
		7	Random I.	95.0	3.0	0.7	3,200,000
		8	Sunnyside	97.6	-	0.6	500,000
		9	Deer Harbour	97.1	1.7	0.4	1,000,000
		10	St. Jones Without	97.2	1.3	0.7	90,000
		11	St. Jones Within	97.6	1.2	0.5	100,000
		12	Branch	94.4	2.1	1.7	3,000,000
		13	Keels	97.3	-	-	
		14	Lockers Flat Island	96.9	-	-	
Vein Quartz Ortho-quartzite Meta-quartzite Vein quartz	Bell Island	15	Blue Pinion Cove	96.0	2.0	-	
		16	Topsail	98.8	0.4	0.2	60,000
		17	Bell Island	93.8	2.8	-	
		18	Grey River	95.5	1.9	-	12,000,000
		19	Garrison Hills	97	2.0	1.0	1,200,000
		20	Jocko Pond	97	1.91	0.49	1,200,000
		21	Diamond Cove	99	0.26	0.16	1,000,000
		22	La Scie	99.1	0.18	0.64	150,000- 500,000
		23	West Lake	93.8	2.5	0.36	2,000,000
		24	Highlands of St. John	92.0	4.0	0.5	10,000,000
Ortho-quartzite	Hawke Bay	25	Hawke Bay	97.9	1.5	0.26	500,000
		26	Dicks Point	96.5	1.0	0.5	1,626,000

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