Current Research (1986) Newfoundland Department of Mines and Energy, Mineral Development Division, Report 86-1, pages 21-26

MARBLE ASSESSMENT - INSULAR NEWFOUNDLAND

A. F. Howse
Mineral Deposits Section

ABSTRACT

An assessment of Newfoundland's marble deposits was initiated in 1985. The project's aim is to determine the potential value of this marble for such industrial applications as fillers, whiteners and dimension stone.

Marble of potential commercial value occurs at a number of localities in western Newfoundland. At White Bay, deposits exist in the Cambro-Ordovician Coney Arm Group and in the Eocambrian White Bay Group. In the same area, a newly identified unit of marble and calc-silicate rocks occurs within the Precambrian terrane of the Long Range Mountains. White high-purity marble is found in the Ordovician St. George Group at several sites around Canada Bay on the Great Northern Peninsula. In and around Corner Brook, marble deposits are hosted by the St. George Group and Table Head Formation.

INTRODUCTION

Newfoundland's marble deposits initially attracted interest because of their potential commercial use in the building industry. Early attempts to quarry ornamental building stone from white marble deposits at Clay Cove in White Bay and Canada Harbour on the Great Northern Peninsula were unsuccessful (Edgar, 1928; Bain, 1937). Initial work by Muir (1935) and Howse (1936) on marbles in the White Bay and Canada Bay areas resulted in a more detailed study by Bain (1937) into the potential use of marble for dimension stone. Goudge (1965) explored the possibilities of producing terrazzo chips (for use in floor tiles) from marble deposits near Corner Brook and Sop's Arm. Further evaluation of Newfoundland marble deposits was carried out during larger surveys of the island's limestone resources, e.g., Lee (1956), McKillop (1963), Besaw (1973), DeGrace (1974). These studies were primarily concerned with identifying limestone and marble that are chemically suitable for such industrial applications as cement and quicklime manufacturing, together with metallurgical use.

Changes in the marble industry in recent years emphasize the need for this province to re-examine its marble resources. The most significant development is the increased demand for crushed and ground stone in industrialized countries, where this material far outranks dimension stone in terms of tonnage and value (Harbean and Bates, 1984). The uses for crushed and ground marble range from landscaping and terrazzo flooring to extensive application as mineral filler. Mineral fillers, in addition to providing bulk and strength to finished products, may also add and enhance certain attractive physical properties such as whiteness, brightness and smoothness. The purest and whitest grades of ground calcium carbonate are used in the production of paint, plastics and paper; lower grades are used in a diversity of products such as carpet backing, asphaltic compounds, putty, linoleum and rubber.

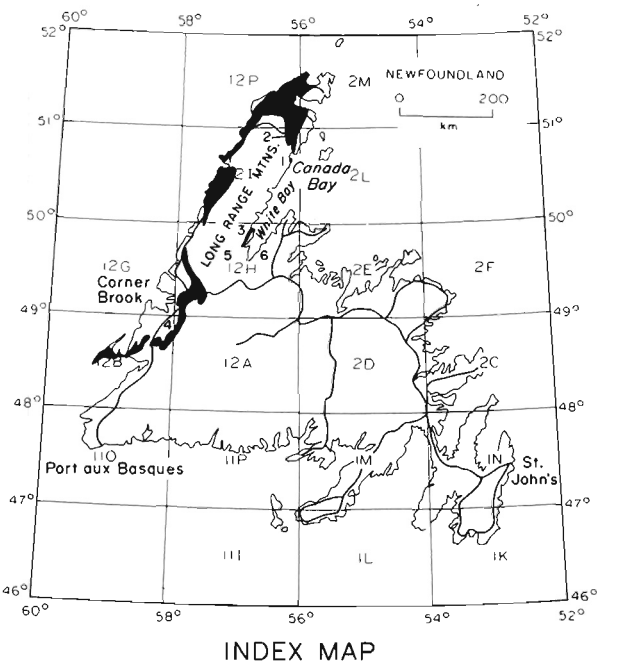


Figure 1: *Distribution of carbonate rocks in western Newfoundland (shaded area). Marble deposits were investigated at (1) Canada Bay (2) Roddickton (3) Sop's Arm (4) Corner Brook (5) Upper Humber River and (6) Purbeck's Cove.*

The main objectives of the 1985 project were to identify deposits of white high-calcium marble and to assess the variability of the marble's physical and chemical properties. Deposits in three broad geographical areas, White Bay, Canada Bay and Corner Brook (Figure 1), were sampled extensively. All samples collected during the 1985 field season have been sent to the Department of Mines and Energy

This project is a contribution to the Canada-Newfoundland Mineral Development Agreement, 1984-1989

geochemical laboratory for chemical analyses. Selected representative samples are also being prepared for tests to determine their whiteness and brightness qualities. When the chemical and physical analyses are completed, the results will be released as an open file.

WESTERN WHITE BAY

On the west side of White Bay, clastic-carbonate rocks of the Cambro-Ordovician Coney Arm Group (Lock, 1969; Smyth and Schillereff, 1982) flank and unconformably overlie the Long Range Complex. A belt of mainly limestone and marble extends south from Cobbler Head for approximately 40 km (Figure 2). The carbonates are increasingly recrystallized and deformed southwards. Marble deposits near Sop's Arm have been considered as possible sources of ornamental building stone (Bain, 1937) and material for terrazzo flooring (Goudge, 1965). Large reserves of high purity limestone exist on the western shore of Great Coney Arm (Lee, 1956; Bedford, 1957). Recent road construction has greatly improved access to these areas, and in 1985 these deposits were re-examined to determine their potential for industrial uses. Descriptions of the deposits that were investigated during 1985 are given below.

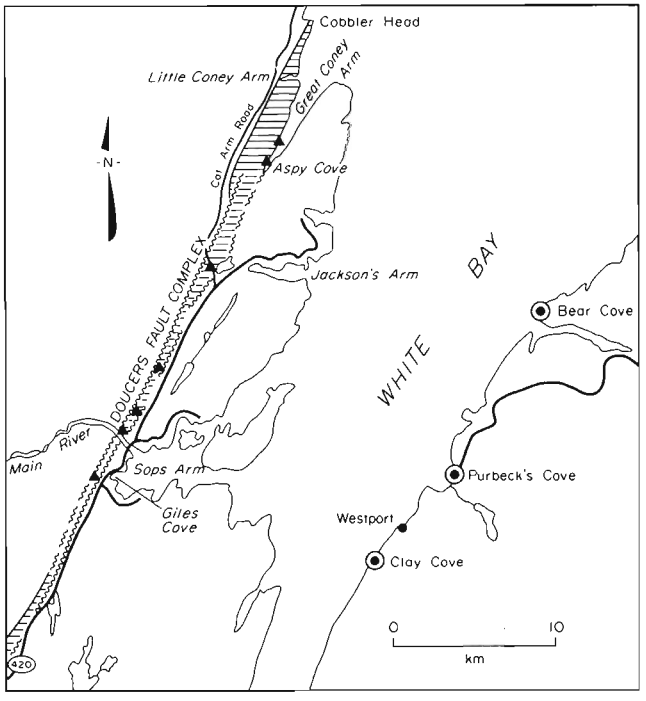


Figure 2: *Locations of marble and limestone deposits in the White Bay area.*

Sop's Arm - Jackson's Arm

Multicolored marble is exposed in a gravel quarry on the north bank of Main River, approximatly 100 m west of highway 420. The stone is a fine grained, cream-colored breccia cut by an extensive network of slender,wavy, reddish-brown and orange calcite veins, which impart a pale orange-brown color to the deposit. A 30 m wide, north-south trending, steeply dipping zone is exposed. It is bounded on the west by granite and on the east by shale, although the actual contacts with these rocks are not exposed. Irregular fractures occur throughout the exposure, but are more pronounced in its western parts. In the eastern part of the section, the marble is fine grained and homogeneous, but is cut by numerous veinlets of red calcite. The unsound, broken condition of the stone eliminates any potential this deposit has as a source of dimension stone. However, the marble is highly decorative and is thus a potential source of chips for terrazzo flooring, if significant reserves exist. Similar marble is sporadically exposed in a cliff that parallels Route 420, about 5 km north of Main River. The red-tinted stone contains pink, white and gray bands. It, too, is highly fractured, although the degree of fracturing is variable from outcrop to outcrop.

A great variation in color and texture is a characteristic feature of Sop's Arm marbles. South of Main River, for example, the marble is generally lighter coloured, more massive and more competent. An example of this can be seen on the west bank of Doucer's Brook, just 250 m west of Route 420 near Giles Cove. This deposit, which Bain (1937) considered as having the best dimension stone potential, has a uniformly light color and less pronounced veining than the material described previously. The relative hardness, abrasion resisting qualities, and attractive color of the marble favour its use as terrazzo chips. Any potential developer, however, will have to first prove the existence of significant tonnage of marble of uniform quality.

Marble breccia is exposed in a cliff near the southwest corner of a small pond about 2.5 km north of Main River, just west of the highway to Jackson's Arm. It has a very distinctive texture consisting of small dark gray marble clasts in a white calcite matrix. The fragments range up to 2 cm across and stand out prominently in the white calcite background. The outcrop is strongly fractured containing one set of vertically dipping joints trending 030 and another dipping subhorizontally into the outcrop. The marble tends to slab into vertical sheets along the vertical joints. Samples of this marble were cut with a tile saw and polished. The results indicate a unique, highly decorative stone which potentially could be used for such purposes as trophy bases and other small ornamental objects.

Coney Arm

Carbonate rocks of the Coney Arm Group are exposed, almost continuously, along the west shore of Coney Arm, White Bay. The rocks consist of dark gray, recrystallized limestone, dolostone and marble. After a brief reconnaissance survey, Lee (1956) estimated a reserve of some 187 million tonnes of limestone in the area. Bedford (1957) did a more selective and detailed study, which included some cross-sectional sampling. He concluded that the linear ridge along the coast between Coney Arm and Aspy Cove contained approximately 30 million tonnes of stone grading over 96 percent calcium carbonate and 1.20 percent magnesium carbonate. This is a conservative figure, based on a strike length

of 1200 m and a maximum quarryable distance inland of 150 m. This reserve estimate was subsequently revised by Brinco Limited to over 46 million tonnes grading 97.1 percent $CaCO_3$ and 0.7 percent MgO. The limestone unit continues for several kilometres south of Coney Arm Bottom and is transected by the new Cat Arm access road, west of Jackson's Arm Pond. It is likely that the long linear ridge between the bottom of Coney Arm and Jackson's Arm Pond contains additional large reserves of limestone, although of undetermined quality. Extensive sampling for chemical and physical analyses was conducted in 1985 along the west coast of Coney Arm, and along the Cat Arm access road. The recrystallized limestone and marbles that were examined, are too dark for high-grade filler, however, they maybe suitable for possible industrial uses, such as cement manufacturing. These deposits are readily accessible and are situated close to a deep-water port.

In the course of this study, minor amounts of sphalerite and galena (estimated at 0.5 percent), were noted in thick bedded, recrystallized gray dolostone in a small area on the north shore of Little Coney Arm. The honey-colored sphalerite is finely disseminated in the dolostones. It resembles in style those occurrences recorded in platformal carbonate rocks on the northwest side of the Great Northern Peninsula, i.e., near the base of the Port au Port Group as described by Knight (1984). The occurrence, which was discovered by colleague John Tuach, is the first Pb-Zn showing found in the Coney Arm Group.

Upper Humber River

White to pale gray marble is exposed in cliffs along a woods road, which follows the north bank of the Upper Humber River about 10 km west of the Sop's Arm highway. The occurrences are part of a lens-shaped unit of marble and calc-silicate rocks mapped by Erdmer (1984), within the Precambrian terrane of the Long Range Mountains.

The marble is white gray or pale pink with green bands, is extremely coarse grained, and is strongly jointed and fractured. Banding in the marble trends 150 to 170 and dips steeply eastward. Minute flakes of mica with rusty haloes occur in the stone. Other impurities include graphitic and quartz-rich zones, which greatly detract from the stone's potential for use as a filler. Representative samples of the outcrops were collected for physical and chemical tests. Whiter and probably purer marble has been noted in this area (D. Reusch, personal communication, 1984; B. Mercer, personal communication, 1985), although these occurrences were not examined during the study. This marble unit may warrant further detailed assessment.

EASTERN WHITE BAY

Marble deposits occur within the Eocambrian White Bay Group at Purbeck's Cove, Clay Cove and Bear Cove on the western coast of the Baie Verte Peninsula (Hibbard, 1983). These deposits were investigated during the 1985 field season; descriptions of the individual deposits are given below.

Purbeck's Cove

White marble forms a cliff overlooking the north side of the community of Purbeck's Cove. The marble exhibits great variation in texture on both outcrop and hand specimen scale, and varies from extremely fine grained to coarsely crystalline. It is highly fractured and cut by conjugate joints. Although the exact size of the deposit is unknown because of structural complications and lack of exposure, a strike (040) length of 225 m of continuous marble was measured, with an average outcrop width of 9 m. Bain (1937) considered the marble to be unsuitable for building and ornamental stone because of the severe jointing. The marble may have potential as a filler and whitener. Small quantities of this stone have been used locally for agricultural lime.

Clay Cove

A deposit of white marble at Clay Cove, approximately 6 km south of Purbeck's Cove, was worked on a small scale in the late 1920's. The marble is grayish white to white, with local brown streaks, and varies texturally from aphanitic material to coarsely crystalline stone. A small brook which flows across the deposit has polished some of the quarried fragments to a brilliant white. The rocks are strongly jointed, but generally the degree of fracturing is less than other similar deposits in the area (notably the one at Purbeck's Cove). The size of the deposit could not be accurately determined because of lack of bedrock exposure. It was traced for 37 m along strike (180) and is at least 30 m wide; it has a block configuration. The deposit was sampled along its strike and dip (80 W); the results will provide the first analytical data for this marble prospect.

An exposure of blue marble underlies a point of land on the south side of Clay Cove. Projecting offshore, the bed strikes 030 and dips vertically. A central 4 m wide zone of black and blue-gray marble, containing white carbonate veinlets, is flanked by mixed blue marble and carbonate schist. This deposit is too small to be of any economic significance.

Bear Cove

Highly decorative crystalline marble and marble breccia are exposed in several localities on the west shore of Bear Cove, (a recently abandoned community, situated near the entrance to Western Arm). The small well exposed deposit at White Point is a pod-like structure surrounded on three sides by metaclastic rocks. Hibbard (1983, pages 35 to 36), thought the marble represents 'a debris flow, a channel or a depositional block', and suggested a similar origin for the deposits at Clay Cove and Purbeck's Cove. The latter deposits are significantly bigger and also appear to have a blocky configuration. The white marble at Bear Cove contains pink bands and is highly fractured. It has a very coarse texture and the deposit is flanked by carbonate-breccia. Similar carbonate-breccia float was observed near the Purbeck's Cove deposit.

CANADA BAY AREA

Commercial interest in the Canada Bay marble deposits began early in this century, when they were investigated as a potential source of ornamental building stone. Despite a long history of assessment by government and private in-

interests, the early attempts in 1913 by the Colonial Trading Company to quarry the Canada Harbour white marble deposits remain the only serious effort to exploit this resource. DeGrace (1974) has discussed the assessment history of the Canada Bay marble deposits and readers are referred to his detailed account for more background information. The white marbles of Canada Bay occur with bluish-gray marble in strongly deformed zones within parautochthonous St. George Group carbonates, which underlie the Hare Bay Allochthon (Knight, 1984). A zone containing scattered outcrops of white marble extends from an area approximately 3 km south of Canada Harbour northwards to Penny's Pond on the Conche road (Figure 3). All of the known occurrences were investigated in 1985; three of the most significant deposits are described below.

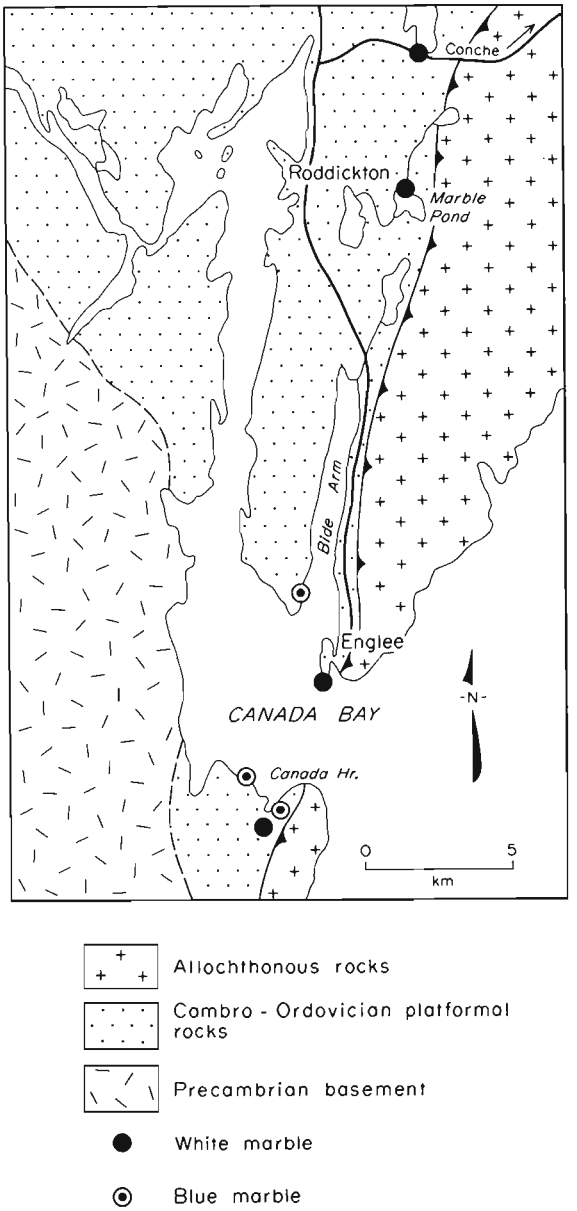


Figure 3: *Generalized map of Canada Bay area showing main geological elements and location of marble deposits.*

Canada Harbour Deposit

The Canada Harbour deposit is located approximately 250 m south of the abandoned settlement of Canada Harbour where it forms Marble Ridge, a prominent topographic feature. The white marble is gradationally overlain by blue-gray marble and dolomite. The deposit is structurally complex and bedding features are not apparent. Bain (1937) showed the white marble as occupying the core of an upright anticline, with the blue-gray marble on its flanks. The exact thickness of the white marble unit is unknown. In an old quarry near the crest of the hill, the unit is at least 20 m thick.

The marble is generally white, but is also ivory or cream and, in places, has a distinctive pink hue. It is extremely fine grained and breaks with a conchoidal fracture. Some of the whiter stone has a porcellaneous texture and breaks much more irregularly.

Impurities in the marble include chlorite and sericite, which occur as thin coatings along joints and bedding planes. Small amounts of quartz are also present. The deposit is also strongly fractured with joints that parallel and cross-cut the bedding. These features make the Canada Harbour deposit unsuitable as a source of building stone. However, the whiteness and high purity of some of the marble makes it a potential source of high-grade filler.

Marble Pond

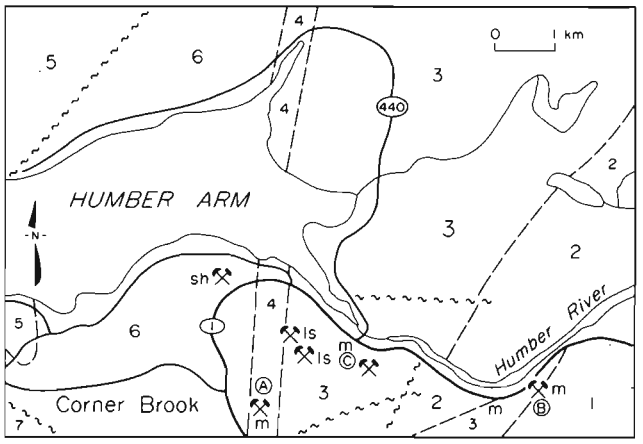
A deposit of white marble is exposed in the bed of Marble Brook, where it flows into Marble Pond, 3.5 km east of Roddickton. The flat-lying marble apparently extends southward beneath the pond and can be traced continuously northward along the brook for about 50 m. However, it sporadically outcrops along the brook for several hundred metres. The stone has a slightly gray cast, a finely crystalline texture, and breaks into thin slabs not more than 2 cm in thickness. Widely spaced vertical joints trend 340 to 250. The stone appears to be suited for tiles and other applications requiring flat, thin slabs.

Conche Road

White marble is exposed just north and south of the Conche highway (Route 432) about 3.5 km east of its junction with the main Roddickton-Englee highway (Route 433). The north-south trending, eastward dipping (50°) zone strikes across the highway and extends beneath Penny's Pond. The marble is also exposed in the bed of an access road that leads from Route 432 to Penny's Pond. The middle and top of the zone contains sections of high-purity, soft, white marble. Sections of cream-colored dolomitic marble are also present. In both locations, the marble is poorly exposed and it is difficult to estimate its width. However, south of the road, it is at least 50 m wide. North of the road, near Penny's Pond, samples were collected across a width of 22 m. These thicknesses are approximate because in both sites the contacts of the marble were not observed. The Conche Road deposit may be the most promising deposit in the Canada Bay area.

CORNER BROOK AREA

Carbonate rocks of the St. George Group in the Corner Brook area host several active and dormant quarries (Figure 4). Several quarries were visited, but only the Junction Quarry appears to contain marble with the degree of whiteness necessary for commercial use as filler. This quarry is located at the base of a 100 m cliff on the south side of the Trans Canada Highway, approximately 6 km east of Corner Brook. Between 1925 and 1943, limestone from the Junction Quarry was used in the local pulp and paper mill.



LEGEND

ALLOCHTHONOUS ROCKS

Cambrian

HUMBER ARM GROUP

7 Cooks Brook Formation

6 Irishtown Formation

5 Summerside Formation

AUTOCHTHONOUS ROCKS

Middle Ordovician

4 Table Head Group

Early Ordovician

3 St. George Group

Cambrian

2 Grand Lake Group

Late Precambrian to Ordovician

1 Mt. Musgrave Group

Limestone.....Ls	Dormston Quarry.....A
Marble.....m	L. House Quarry.....B
Shale.....Sh	Junction Quarry.....C

Figure 4: *Local geology of the Corner Brook area including location of limestone and marble quarries.*

Coarsely crystalline white marble, together with black or dark gray and pink-banded marble, is exposed in a high vertical cliff wall at the Junction Quarry. The white marble section was sampled along approximately 15 m of the southwest quarry face. The whole sequence dips steeply northwestward, toward the highway.

A marble deposit of potential economic interest is exposed in the Dormston Quarry about 1 km southeast of Corner Brook. This dormant quarry is located in north-south striking, westerly dipping (60) beds of the Table Head Formation. The black, fine to medium grained marble has a tendency to break into cubic fragments which, according to Goudge (1977), could potentially yield terrazzo chips of extremely high quality.

ACKNOWLEDGEMENTS

Greg Stapleton provided cheerful, competent help throughout the summer. Barry Wheaton demonstrated great versatility in switching daily from small-boat operator to part-time cook. The logistical arrangements of Wayne Ryder, Sidney Parsons and Ted Hall are gratefully acknowledged, as are the excellent services provided by the geochemical laboratory under Hank Wagenbauer and drafting office under Ken Byrne. Paul Dean offered his usual shrewd advice during timely visits to our camp. This report has benefited from a critical review by Sean O'Brien.

REFERENCES

Bain, G.W.
1937: Marble deposits of north Newfoundland. Bulletin Number 11, Geological Survey of Newfoundland, 43 pages.

Bedford, J.P.
1957: Report on Coney Arm limestone. British Newfoundland Exploration Company, private report, 5 pages, [12H/15 (291)].

Besaw, D.M.
1973a: Limestone evaluation: Canada Bay area. Newfoundland Department of Mines and Energy, Mineral Development Division, unpublished report, 16 pages, [12I/9 (67)]

DeGrace, J.R.
1974: Limestone resources of Newfoundland and Labrador. Department of Mines and Energy, Mineral Development Division, Report 74-2, 117 pages.

Edgar, W.J.
1928: Report of Newfoundland marble properties. Unpublished Report, [12I (3)].

Erdmer, P.
1984: Summary of field work in the northern Long Range Mountains, western Newfoundland. *In* Current Research. Newfoundland Department of Mines and Energy, Mineral Development Division, Report 84-1, pages 103-113.

Goudge, M.F.
1965: Possibilities of producing terrazzo chips from Newfoundland marble. Unpublished Brinex Report, [NFLD (711)].

Harben, P.W. and Bates, R.L.
1984: Geology of the nonmetallics: Metal Bulletins Inc., New York, 392 pages.

Hibbard, J.
1983: Geology of the Baie Verte Peninsula, Newfoundland. Newfoundland Department of Mines and Energy, Mineral Development Division, Memoir 2, 279 pages.

Howse, C.K.
1936: Report on marble in Newfoundland. Unpublished report, Geological Survey of Newfoundland, 4 pages, [Nfld. (152)].

Knight, I.
1984: Mineralization in Cambro-Ordovician Rocks, western Newfoundland. *In* Mineral Deposits of Newfoundland - A 1984 Perspective. Compiled by H. Scott Swinden. Newfoundland Department of Mines and Energy, Report 84-3, pages 37-44.

Lee, B.W.
1956: Limestone investigation. Newfoundland Department of Mines and Resources, unpublished report, 35 pages [Nfld. (92)].

Lock, B.E.
1969: The Lower Paleozoic geology of western White Bay, Newfoundland. Unpublished Ph.D. thesis, Cambridge University, Cambridge, England, 343 pages.

McKillop, J.H.
1963: Geology of the Corner Brook Area, Newfoundland, with emphasis on the carbonate deposits. Unpublished M.Sc. Thesis, Memorial University of Newfoundland, 102 pages.

Muir, C.D.
1935: Report on marble at Canada Bay. Newfoundland Department of Mines and Energy, Mineral Development Division, unpublished report, 4 pages. [NFLD (152)]

Smyth, W.R. and Schillereff, H.S.
1982: The pre-Carboniferous geology of southwest White Bay. *In* Current Research. Newfoundland Department of Mines and Energy, Mineral Development Division, Report 82-1, pages 78-98.

Note: Mineral Development Division file numbers are included in square brackets.