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NEWFOUNDLAND DIMENSION-STONE SITE STUDIES, 2002

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ABSTRACT

During 2002, seven potential and past-producing dimension-stone sites were examined. A dormant quarry on the Burin Peninsula had produced some large blocks of pink, coarse-grained porphyritic granite from the Ackley Granite. The Loon Bay Granite, northeast of Campbellton, had also produced several large blocks of grey, medium-grained, equigranular granite for use as monument bases.

The Frederickton tonalite was examined to determine its potential as a source of grey granite monument bases; there is some potential for large blocks but the common occurrence of dyking and access costs may hinder development. The Pools Cove conglomerate, south of Pools Cove, has potential as a source of grey conglomerate. The Rose Blanche Granite was used in the reconstruction of the nearby lighthouse. This granite occurs as 1-m-thick sheets and is amenable to production of small blocks from this limited resource. The Table Point Formation limestone, northwest of Roddickton, produces attractive polished samples but the intensity of jointing probably precludes its use as a dimension stone. The Canada Bay Marble is an attractive white, streaky rock that polishes well; however, fracturing is common and there is only a very limited amount of massive marble.

PAST-PRODUCERS

ACKLEY GRANITE DIMENSION-STONE QUARRY, BURIN PENINSULA HIGHWAY

The eastern edge of the extensive Devonian Ackley Granite is exposed along, and to, the west of the Burin Peninsula highway (Route 210), about 25 km south of the community of Swift Current. Quarrying was carried out under mining lease 163 (105877), located in the vicinity of UTM coordinates 585450E, 5294310N, altitude 180 m, NAD 27 (Figure 1), issued to Eugene Kenny, and the surrounding ground is held by Kevin Brewer (Licence number 7859M; 8 claims).

The area around the quarry is gently undulating to flat, devoid of trees and contains only isolated patches of stunted spruce and a few alders in the low ground, near streams. The generally thin, sandy, weathered-granite overburden does not support vegetation other than grasses and low shrubs. The granite in the area outcrops as a series of generally low-lying whalebacks. Scattered granite glacial erratics are also found in the area. The nearest supply of water is a large pond located about 400 m south of the quarry and across the highway. There are no power lines near the site. The nearest communities are Terrenceville and Grand Le Pierre, located about 15 km to the southwest.

The Ackley Granite in this area is a light-pink, massive, very coarse-grained, plagioclase–microcline-porphyritic, biotite granite (Dickson, 1983; O'Driscoll and Hussey, 1978). The phenocrysts are equant and about 2 cm across and are present in equal proportions, forming about 50 percent of the rock (Plate 1). The matrix comprises quartz, biotite, plagioclase and microcline and the average crystal size is about 7 mm. Some of the microcline is mantled with white albite. Accessory minerals include hornblende, allanite and magnetite. The allanite occurs as rare, 3 mm diameter crystals that are altered, and are commonly surrounded by radial fractures up to 2 cm from the allanite core; the biotite and the feldspars are fresh. The granite contains several variably sized, generally rounded, light-grey inclusions. These occur throughout the outcrop but are widely scattered. They range in size from a few centimetres to about 75 cm. Some are mafic clots rich in biotite and hornblende; others are fine-grained grey diabasic rocks containing pink feldspar porphyroblasts, up to 2 cm in length.

The quarry has been developed about 300 m west of the contact and an access road was constructed. The quarry is on the northeast side of a low, elongate, glacially streamlined ridge of exposed granite that has been further exposed by clearing off the sandy overburden, which has been left on-site (Plate 2). The whalebacks are oriented at about 160° and the newly exposed surfaces have been glacially polished and

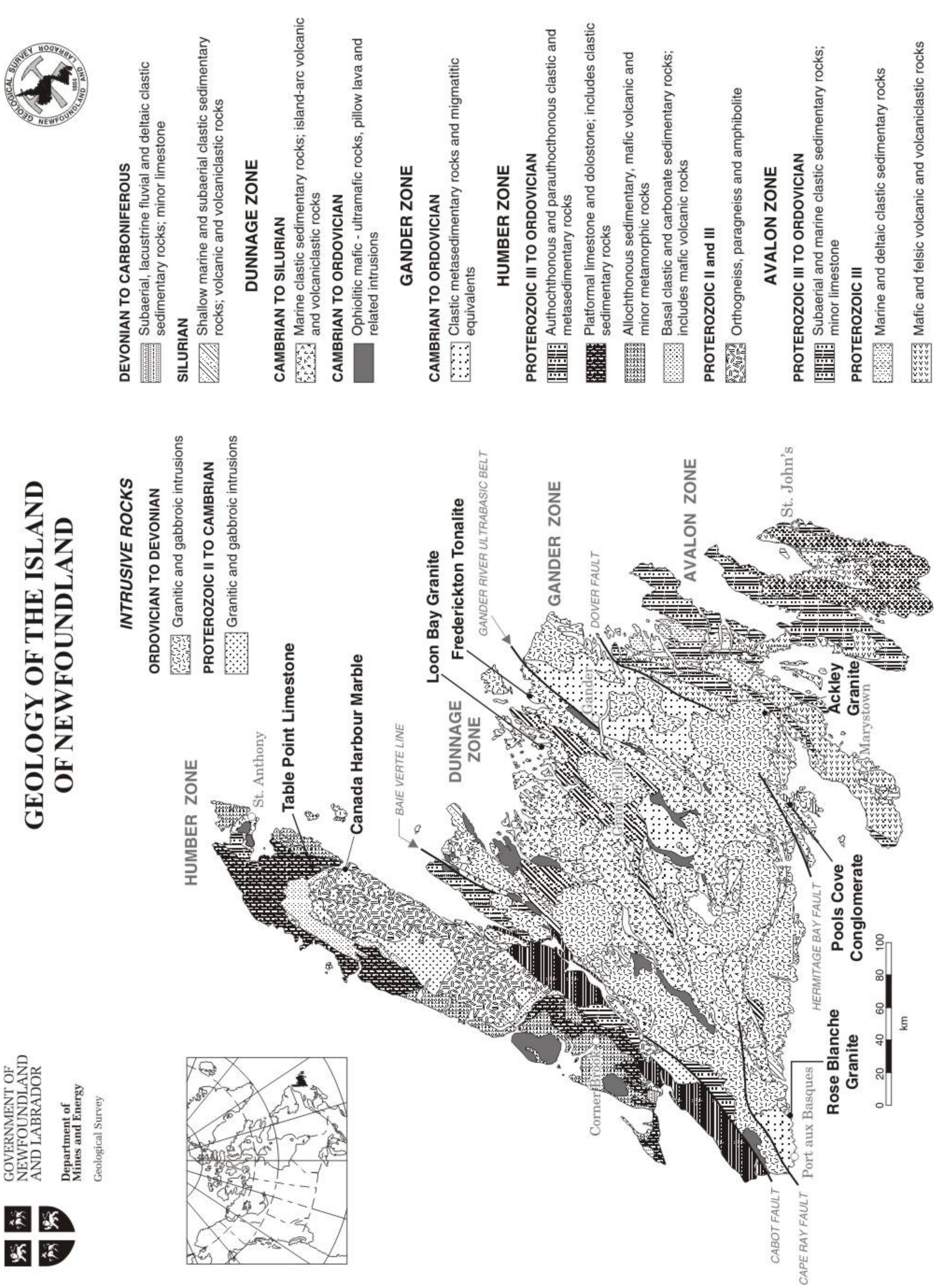

Figure 1. *Location of dimension-stone sites studied.*

Plate 1. *Close up of the very coarse-grained Ackley Granite in the dimension-stone quarry.*

Plate 2. *View of the granite quarry in the Ackley Granite. Notebook on quarried block is 17.5 cm high.*

contain striae orientated parallel to the long axis of the ridge. Drainage ditches have also been constructed to lead water away from the outcrop. The ridge is now about 10 m higher than the surrounding area.

The contact with the hornfelsed sandstone country rocks is exposed along the highway and the granite is coarse grained along the contact, but is intensely jointed. A few hundred metres within the granite, the joints are widely spaced. In the quarry, the horizontal joints, apart from the remnant of the cap rock, are spaced at up to 3 m. They are oriented at approximately 085°/10°S. The near-vertical joints are similarly widely spaced and there are three main orientations. These are 085°, 126° and 140°. These joints coincide along the southern part of the outcrop. There is only minor alteration along the joints and it does not penetrate the rock for more than a centimetre.

Quarrying has been carried out over a distance of about 15 m along the eastern side of the outcrop, which is also the steepest side and initial quarrying removed the narrow wedges of granite cap rock above a horizontal joint. Further quarrying has produced several blocks of granite, one of which has been left on site and this cubic block has dimensions of about 1.5 m in length or about 3 m^3 or 8 tonnes (assuming a density of 2.6 tonnes per cubic metre). The bedrock adjacent to the quarry faces had been drilled off and would have produced similar-sized blocks. A seized drill rod and bit remain in one drillhole. The blocks were probably extracted by the plug-and-feather method.

The quarry has the potential to produce very large blocks of at least 25 tonnes, and many smaller but sizeable blocks, could also be produced. Further clearing would provide access to a huge deposit of similar granite.

LOON BAY GRANITE (TONALITE) DIMENSION-STONE QUARRY, NEAR CAMPBELLTON

An exploration licence was issued to International Granite Corporation, Gander, Mineral Licence No. 7546M to determine the potential of the tonalite. The claim block is located west of the highway to Newstead (Route 343) north-east of Campbellton (Figure 1). The claims are underlain by the Loon Bay Granite, a medium-grained, massive, equigranular, light grey, biotite–hornblende tonalite containing about 5 to 10 percent mafic minerals (Plate 3). Approximately, 1.5 km to the north, this pluton has intruded cleaved mafic volcanic rocks, gabbro, sandstone and siltstone of the Dunnage Mélange (Currie and Williams, 1995). The granite contains about 5 percent pale-grey to dark-grey, ovoid, mafic xenoliths ranging in length from a few cm to about 15 cm. Widely distributed, small pyrite stringers and blebs are found in the tonalite and these could lead to rusty discolouration, if used as an outdoor stone.

The main area of activity is a knob of tonalite located at 653430E, 5467820N, (NAD 27) and an altitude of 15 m. The working face is about 20 m north of the access road from Route 343 (Plate 4). Jointing is vertical and horizontal, very widely spaced to moderately spaced (5 to 1 m). The main horizontal joint is about 4 m below the top of the quarry face and the widely spaced jointing has resulted in the production of very large joint blocks. There is some alteration along the joints for up to 2 cm on either side of the joints. A loose block in the quarry contains an alteration band not associated with a joint. The natural joint blocks are estimated to be 2 to 5 m wide, 4 m high and possibly over 2 m thick or about 16 to 40 m^3. Therefore, these natural blocks would weigh between 45 to over 100 tonnes each (assuming a density of 2.8 tonnes per cubic metre). It is estimated that

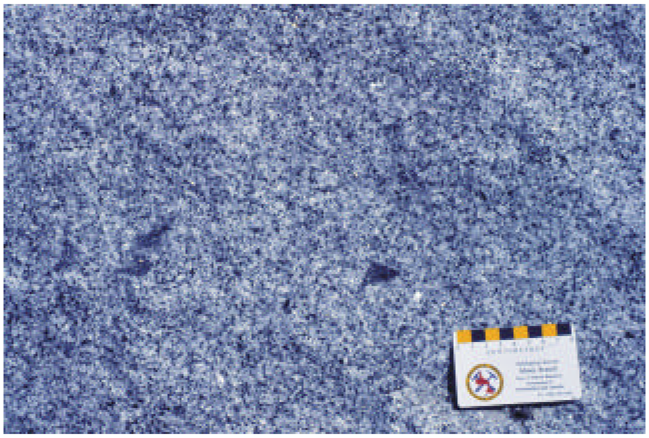

Plate 3. *Close up of the medium-grained Loon Bay tonalite in the dimension-stone quarry.*

Plate 4. *View of the granite quarry in the Loon Bay tonalite. Quarry face is about 3 m high.*

over 200 tonnes has been quarried and removed from the site. There are a few irregularly shaped quarried blocks, up to about 5 tonnes, left on site. It is estimated that about 30 percent of the knob remains. Further development would require the development of a new level that would start downslope, to the south of the road.

The tonalite blocks have been cut and used by International Granite for headstone bases. The cut rock observed at the Jumpers Brook processing plant contains dark-grey xenoliths, possibly as much as 5 percent, by area. These xenoliths are quite prominent and make the rock unattractive for use as a monument base, because xenolith-free rocks are preferred.

POTENTIAL DIMENSION-STONE SITES

DIMENSION-STONE POTENTIAL OF THE FREDERICKTON TONALITE

The Frederickton tonalite is a small, granitic intrusion located to the west and south of the small communities of Frederickton and Noggin Cove, about 2 km west of Carmanville, in northeastern Newfoundland (Figure 1). The pluton was assessed following an enquiry from International Granite Limited about occurrences of grey equigranular granite suitable for use as bases for monuments and headstones. From previous work by Strong *et al.* (1974), the Frederickton Pluton is known to be a grey granitic rock.

The Frederickton Pluton, which is exposed mainly to the northwest of Frederickton, is well-exposed along the shoreline and on inland ridges and plateaus and on the adjacent peninsula and islands. It has intruded a variety of Ordovician slates and an olistostromal sequence (*see* e.g., Currie, 1997). Shoreline exposures are weathered to a buff colour and inland the rock weathers to dark grey. The closest accessible inland outcrops are exposed about 100 m and about 500 m to the northwest of Frederickton (Site 1, Figure 2). Several outcrops of the pluton were examined in this area. The rock is a grey to buff-grey, medium-grained, equigranular, massive to weakly foliated, hornblende–biotite tonalite. The rock is cut by numerous granitic and diabase dykes and veins. Jointing is generally closely spaced and in several orientations. Shoreline outcrops to the east of Site 1 indicate that natural loose blocks are small and the natural block size in the inland outcrops would also be small (< 2 tonnes) and would commonly contain veins. This area, although the closest to road access, has little potential.

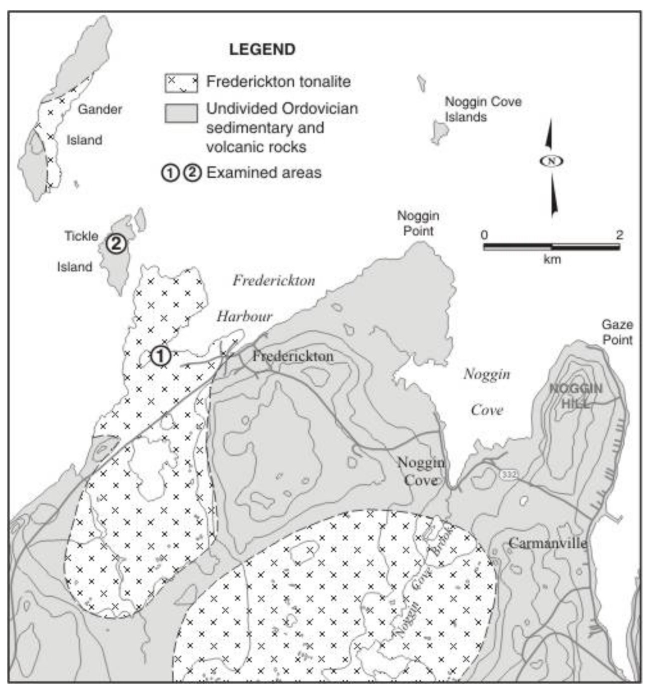

Figure 2. *Geology of the Frederickton tonalite and locations of sites examined.*

An area of tonalite to the northwest of Frederickton underlies Tickle Island, which is about 1.5 km long and about 600 m wide (Site 2, Figure 2). A very shallow, boulder-filled channel about 1 km west of Frederickton and about 200 m across, separates the island from the mainland. The island has significant relief and has an altitude of over 30 m (over 100 feet). Glacially streamlined outcrops are abundant and these form knobs that are up to 50 m in length and up to 10 m high (Plate 5).

The rock on Tickle Island (Site 2, Figure 2) is a medium-grained, grey to grey-buff, moderately foliated, hornblende–biotite tonalite (Plate 6). It is a more biotite-rich version of that found around Site 1. Biotite forms abundant rounded books, about 4 mm in diameter, and forms about 20 percent of the rock. Shoreline outcrops reveal that dykes and veins of diabase, tonalite and white granite are common, and these dykes vary in thickness from a few centimetres to over 1 m. Jointing along the shore is generally very widely spaced and large blocks could be extracted. Xenoliths are apparently rare to absent. Away from the shore, the outcrops are lichen and moss covered and the degree of dyking is hard to assess but several diabase and white-granite dykes were found. However, it is possible that grey dykes of similar composition to the tonalite are masked by the lichens. Jointing is in several orientations and is moderately (about 1 m) to widely (over 1.5 m) spaced and large loosened blocks are found adjacent to their source.

It may be possible to find areas that could be quarried and do not contain dykes or veins. The limited tonnage required for monument bases could possibly be found in this area. However, the problems with access, and the need for construction of an access road and a causeway to the island, may prove to be too costly.

Plate 5. *View of the Frederickton tonalite terrain on Tickle Island.*

Plate 6. *Close up of a block of medium-grained Frederickton tonalite, Tickle Island.*

DIMENSION-STONE POTENTIAL OF PART OF THE POOLS COVE CONGLOMERATE

The property of Greg Hoskins (Licence number 8060M, NTS 1M/11 and 1M/12) was visited with Greg Hoskins on July 23, 2002. Outcrops of conglomerate of the Devonian Pools Cove Formation and also the Precambrian Simmons Brook Intrusive Suite in the vicinity of Route 362 to English Harbour West, Fortune Bay, south coast of Newfoundland were visited (Figure 1).

At Site 116 (Figure 3; UTM 611920E 5276690N, NAD 27), there is abundant outcrop of very thick-bedded conglomerate in the area on both sides of the highway. These rocks have been assigned to the Devonian Pools Cove Formation (O'Brien, 1998). The area examined is treeless and adjacent to the highway and a power line runs along the east side of the road. The conglomerate is a mixed coarse-grained sandstone to boulder conglomerate that forms thick beds, possibly several metres thick but no clearly separate beds were noticed. The bedding planes are not usually apparent but layers and lenses with different grain sizes are commonly seen. From the orientation of the layers and lenses bedding is about 052°/70°E. The rock is weathered to a depth of only a few millimetres.

The layers vary from 1 to 50 cm thick and contain thin, 1-cm-thick or less, elongate lenses of black siltstone. Graded layering is common within a bed along with scoured bases and lenses and changes in grainsize, texture and composition are commonly gradual over 2 to 5 cm. The conglomerate is clearly a fluvial deposit. The rock is extremely hard and tough and has a green-grey colour. The larger clasts include rounded pebbles (2 to 8 cm in diameter) and cobbles (up to 20 cm in diameter) of pink, medium-grained granite, medium-grained gabbro, fine-grained mafic and felsic vol-

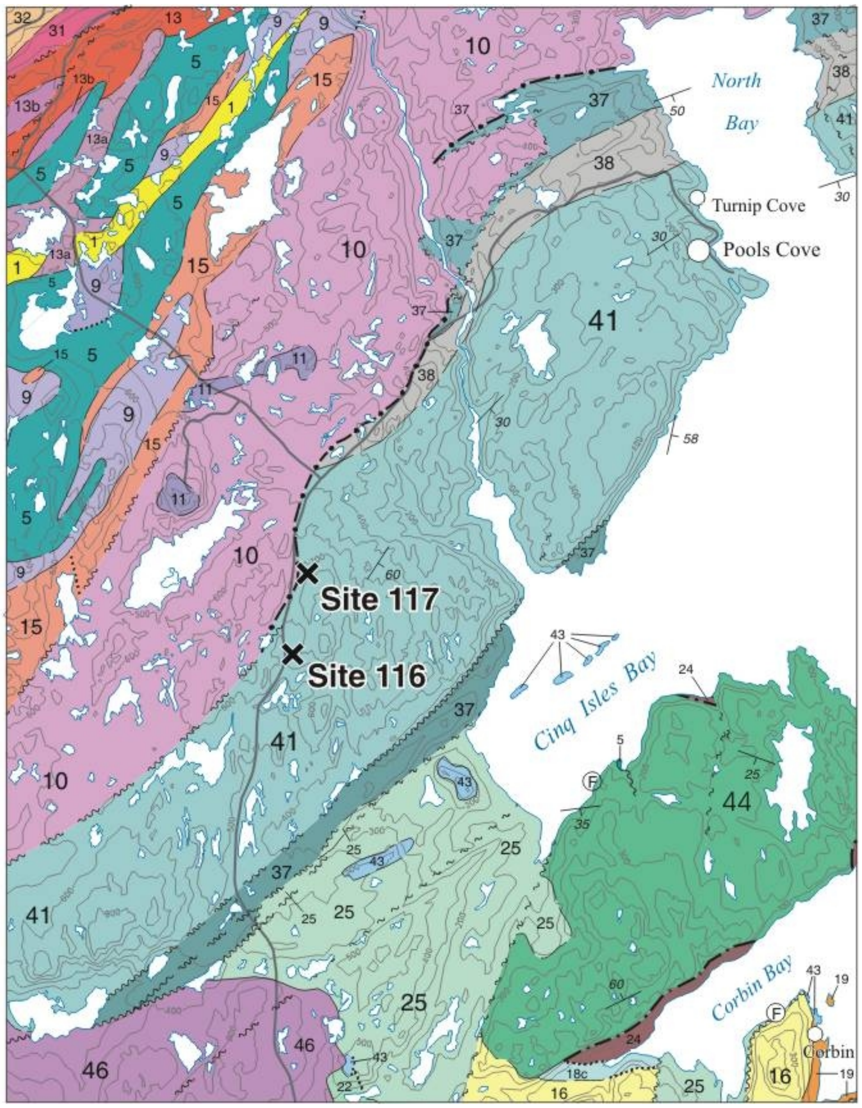

Figure 3. *Geology of the Pools Cove area and locations of conglomerate sites examined.*

canic rocks, chert, and fine-grained sandstone and siltstone set in a medium- to coarse-sand matrix containing similar rock types and quartz and feldspar clasts. The clasts are generally matrix supported and the various larger clasts produce circular spots of a prominent colour including pink, black and grey in the green to grey matrix.

Jointing is well developed in the conglomerate and the dominant vertical joints trend southward, parallel to the road. These joints are spaced at 30 cm to over 1 m and cross-vertical joints are also well developed and are commonly spaced at 1 to 3 m and trend 012°, 045° and 140°. Subhorizontal joints are also well developed and produce layers up to 1 m thick. Bedding planes are not the site of joints. The jointing is such that triangular blocks are the most common shape and are commonly up to 3 m^3 or about 8 tonnes (assuming a density of 2.7 tonnes per cubic metre), with a horizontal long axis about 3 m long, and up to 1.5 m wide. Thick blocks (> 1 m thick) in the 15 to 25 tonne range were not seen. It could be possible to produce slabs 2.5 m long and 80 to 100 cm wide and a thickness up to 50 cm. Shorter slabs could also be produced because of the triangular to elongate polygonal shape of the blocks. Two-feet-square (61 by 61 cm) tiles could also be produced.

Blocks having a more rectangular shape are rare and blocks of 15 to 25 tonnes are very rare in the area examined. The conglomerate is exposed along the gently sloping hillside and the block sizes and jointing patterns do not change. A large bluff about 500 m to the south displays a rectangular joint pattern on the vertical cliff face. These are spaced about 1 to 2 m apart. However the northeast-trending joints are closely spaced and would produce small blocks. Site 116 (Figure 3) is the location of the polished conglomerate block now on display in the Johnson GEO CENTRE in St. John's.

LEGEND (Figure 3)

MIDDLE PALEOZOIC
DEVONIAN

OLD WOMAN STOCK

46 Pink, medium- and coarse-grained, porphyritic biotite granite; minor aplite

GREAT BAY DE L'EAU FORMATION

43 Dark-green, locally brown-weathering pyroxenite and gabbro

POOLS COVE FORMATION

41 Boulder conglomerate: buff to pale orange in the northeast and dark-weathering, deep red to grey in the southwest part of the area

38 Red arkosic sandstone, containing thin beds of pebble conglomerate; red conglomerate, extensively developed in the lower half of the unit in the northwest part of the area

CINQ ISLES FORMATION

37 Red micaceous sandstone, red and grey quartz-pebble conglomerate, red shale, red and grey limestone

SILURIAN AND/OR DEVONIAN

NORTHWEST BROOK COMPLEX AND ASSOCIATED INTRUSIONS

32 Foliated, medium-grained, equigranular, biotite- and muscovite-biotite granite; includes unseparated, foliated, pink muscovite granite of the Northwest Cove Granite

SILURIAN

GAULTOIS GRANITE

31 Foliated, biotite-rich, pink-K-feldspar megacrystic granite

EARLY CAMBRIAN

Random Formation

Chapel Island Formation

25 Grey, micaceous siltstone and thin-bedded siliceous sandstone; also contains minor red siltstone, pink quartzitic arkose, grey micaceous sandstone, shale-pebble conglomerate and shale, and rare, grey limestone lenses

LATE NEOPROTEROZOIC

LONG HARBOUR GROUP (Units 16 to 24)

Rencontre Formation (Units 19 to 24)

24 Red micaceous siltstone and interbedded, buff-weathering, quartzitic arkose and pebble conglomerate

22 Red and grey, thin-bedded siltstone, and fine-grained sandstone and interbedded buff, coarse-grained, cross bedded quartzitic arkose; minor bright-red shale and green-grey and black-grey and black siltstone

19 Purple conglomerate; minor sandstone and siltstone (forms the base of the Rencontre Formation in the northern Fortune Bay area, where it lies conformably on the Mooring Cove Formation and disconformably on the Belle Bay Formation);

Mooring Cove Formation

18c 18c purple and red sandstone; grey slate and sandstone

Belle Bay Formation

16 Pink-to purple, massive, banded and autobrecciated rhyolite, and locally, unseparated grey to green mafic tuffs and agglomerate

HARBOUR BRETON GRANITE

15 Taylor Brook Stock of Harbour Breton Granite: pink, medium- to coarse-grained, mainly equigranular, biotite granite

HARDY'S COVE GRANITE

13, 13a, 13b Pink-to orange, medium-grained, equigranular granite; 13a buff to grey granodiorite and minor unseparated felsite; 13b grey to green, medium-grained diorite

GROLE INTRUSIVE SUITE (Unit 12)

11 Dark-grey, green, black and black-and-white, medium- to coarse-grained and pegmatitic gabbro

SIMMONS BROOK INTRUSIVE SUITE (Units 9 and 10)

10 Grey, medium-grained, equigranular, hornblende-biotite granodiorite and tonalite; minor gabbro

9 Dark-grey to green, fine- to medium-grained diorite

CONNAIGRE BAY GROUP

Units 4 and 5 may include rocks that pre-date the Connaigre Bay Group

CONNAIGRE BAY GROUP ? (Units 5 and 6)

5 Unnamed volcanic-clastic sequence: unseparated dark-grey and green, massive to layered mafic tuffs and grey and green tuffaceous sandstone; minor basalt

TICKLE POINT FORMATION

1 Buff- to brown-weathering, pink to purple and green, felsic volcanic rocks, including massive and banded rhyolite flows and crystal- and crystal-lithic felsic tuffs; minor basalt and andesite flows and interlayered, tuffaceous sedimentary rocks; locally contains unseparated diorite sills and plugs

The conglomerate at Site 117 (Figure 3; UTM 612110E, 5277370N, NAD27) lies about 700 m to the north-northeast of Site 116. On the west and east sides of the road, the outcrops are of variably sheared gabbroic and minor granitic rocks of the Simmons Brook Intrusive Suite. The conglomerate occurs farther up hill, about 100 m to the east. A fault and an unconformity are shown on the compilation map of O'Brien (1998) to separate the Precambrian Simmons Brook Intrusive Suite from the conglomerate. However, the shearing does not affect the conglomerate and the contact is interpreted here to be the unconformity. The Simmons Brook Intrusive Suite is highly jointed and along the road side has produced a talus slope composed of large, highly jointed blocks of gabbro and granite in the range of 1 to 5 tonnes.

Plate 7. *View of the jointed Pools Cove conglomerate.*

Plate 8. *Outcrop showing the jointing in the Pools Cove conglomerate. Barry Wheaton (foreground) and Greg Hoskins.*

The conglomerate is similar to that seen at Site 116. Bedding is 040°/70°E. The colour is more grey than at Site 116. Jointing in the conglomerate is dominated by subhorizontal joints that are up to 1 m apart (Plates 7 and 8). Vertical joints are more abundant that at Site 116. The largest blocks would be in the order of 1 m^3 (about 1.5 m long, 1.2 m wide and 60 cm thick (deep). Therefore, the block sizes are much smaller than that at Site 116 and would be only in the range of 2 to 4 tonnes.

The conglomerates in both areas are similar in composition and texture. The nature of the rock would produce tiles each of which was unique and are variations of the same pattern. The blocks could be cut in any direction due to the lack of cleavage and bedding-plane weakness. Tiles cut parallel to the bedding would generally have a uniform pattern across the tile; those cut at an angle to the bedding would have a banded appearance. This could result in a variety of patterns being produced from the same rock. Colour variations are subtle varying from a green-grey to grey having pink tones being produced from the matrix and the granite clasts.

An examination of some petrographic thin sections of the conglomerate, provided by Greg Hoskins, showed that the matrix of the conglomerate is uniformly composed of very fine-grained intergrown sericite and silica. The silica and sericite have completely replaced any shaly laminae and bedding plane partings, which would allow the rock to split along these planes and this probably accounts for the extreme toughness of the rock

In summary, tiles up to 2 by 2 feet (61 by 61 cm) could be produced with various patterns depending on the cut orientation. Slabs up to 2 m long could also be produced by cutting the blocks at right angles to the bedding. The long axis of the blocks is generally close to perpendicular to bedding, and therefore the most economic orientation in terms of wastage in tile production would be subparallel to bedding. The triangular to elongate polygonal shape of many surface blocks would result in limited production of 61 by 61 cm slabs from a block. The ends of the block could be used for making smaller tiles. Cutting parallel to bedding would produce tiles having distinctly different patterns ranging mainly from coarse sandstone and pebbly sandstone to cobble conglomerate.

Conglomerate blocks in the 15 to 25 tonne range and having squarish cross-sections of 1 m^2 or more along the full length of the block were not seen on surface in the two areas examined. Blocks with this cross-sectional area would have to be 6 to 9 m long. Greg Hoskins has indicated that farther to the east, in an area examined by Mike Regular and himself but not seen by the author, larger blocks are exposed on surface that are in the 15 tonne range.

THE ROSE BLANCHE GRANITE

The Rose Blanche lighthouse is located about 40 km east of Port aux Basques, on the south coast of Newfoundland (Figure 1). When reconstruction of the Rose Blanche lighthouse was started in 1992, only the light tower was standing but ready to collapse and the attached lighthouse building lay in ruins (Plate 9); it was completed in 1999 (Plate 10). The interior of the lighthouse was also reconstructed and is now a museum containing many artifacts. A new light was installed and relit in August 2002 and is now an official navigation aid. The lighthouse and surrounding grounds are a popular tourist attraction. Some exceptional pictures of the lighthouse may be found at *http://www.geocities.com/rblighthouse/lighthousepics.html*.

Blocks of granite for the reconstruction of the facility were obtained by recycling blocks salvaged from the ruins

Plate 9. *View of lighthouse ruins prior to reconstruction.*

Plate 10. *View of lighthouse after reconstruction (from http://www.geocities.com/rblighthouse/ light3.html).*

of the former lighthouse and new replacement blocks were produced from the original quarry site on the shoreline about 200 m east of the lighthouse. The local people were trained in rock quarrying and produced the blocks under the guidance of a quarry master. The outside wall of the lighthouse is constructed with shaped blocks that are up to 1 m by 50 cm by 30 cm. The blocks used on the inside wall are miscellaneous-sized but mainly smaller rectangular shaped blocks of granite (Plate 11) and also scraps of other rock types such as schist. All the blocks, both inside and outside, are cemented together. The spiral staircase is constructed from blocks about 1.2 m long tapering from about 50 to 25 cm. The steps are integrated into the tower walls. The roof of the lighthouse is covered in "pink Trinity slate" tiles which have also been recycled from the original roofing slate with new tiles probably from the slate plant at Burgoynes Cove, near Clarenville.

Plate 11. *View of the interior of the lighthouse showing the use of various shapes and sizes of blocks (from http://www.geocities.com/rblighthouse/light4.html).*

The lighthouse granite quarry site is located on the upper part of a storm platform adjacent to the open ocean (Plate 12). The rock is a fresh, light grey, slightly porphyritic, medium- to medium-coarse-grained, moderately foliated, biotite–muscovite granite containing about 5 percent of 1-cm-long plagioclase phenocrysts and about equal amounts, possibly 2 percent of 1 to 2 mm muscovite and biotite throughout the rock. The granite contains a few elongate, mafic amphibolite xenoliths, some of which weather rusty. A small patch of granite pegmatite was found in the granite. The foliation is defined by elongated quartz and feldspar. The lineation trends towards 220° at 10° and the poorly developed foliation is steeply dipping.

In the quarry site, the granite is well jointed and the important joint set is gently dipping toward the sea at about 10° and these joints produce slabs that are 30 to 75 cm thick (Plate 13). Vertical to subvertical jointing varies greatly from widely spaced to intense zones up to 2 m wide containing parallel joints only a few centimetres apart. The ver-

Plate 12. *View of the Rose Blanche Granite along the shoreline east of the lighthouse. The subhorizontal jointing has produced the large granite sheets used in block production.*

Plate 13. *Left-over block of quarried Rose Blanche Granite at the quarry site. Notebook is 17.5 cm high.*

tical to near vertical joints trend 010°, 052° and 110°–052° is the most common orientation.

At the quarry site, it is possible to get blocks up to 5 m by 10 m by 75 cm thick. The possible reserve of similar material at the site is 30 by 25 by 3 m vertically. Blocks used in lighthouse construction were cut from the horizontal slabs by plug-and-feather method using drillholes spaced about 10 cm apart and drilled to within 5 cm of the base of the block. Rock was drilled using a 2.5-cm-diameter drill bit, and the rock was split mainly along the foliation to facilitate splitting. However, some blocks were also cut across foliation and gave a clean cut. Blocks were probably trimmed on site and then transported to the lighthouse site. A “wishing well” and benches were also constructed using leftover blocks and thin slabs of granite. Near the exit from the trail system, a few blocks were used in constructing steps on a small but steeper part of the trail. Several unused finished blocks have been left near the lighthouse.

To the east of the quarry site, the granite is cut by thin, long, 1-cm-thick granitic veins in a few places; these are composed of fine-grained granite and are orientated at 150°/90°. In the same area, there is also a thin sheet of granite pegmatite and it is orientated 030°/20°S.

Another possible source of grey granite similar to that quarried near the lighthouse is found near the start of the tourist trail to the lighthouse and at the cove immediately to the east of the trail. There appear to be no other readily accessible sources of stone. The rock-cut made during construction of the road to the lighthouse complex shows that the granite is highly jointed and would produce only irregularly sized and shaped, generally smallish blocks well less than 1 m^3 but a few blocks possibly up to 3 m^3 could be obtained. These blocks would not be easily shaped into blocks without the use of rock saws and heavy machinery. Away from the lighthouse complex, the granite is locally cut by medium-grained, pink granite dykes up to 1 m thick. In and to the west of the community of Rose Blanche, jointing in the Rose Blanche Granite, where exposed along the roads and adjacent mounds, is intense and irregular in orientation. It is not a potential source of economic, commercial-size blocks suitable for cut slabs, monuments or monument bases.

DIMENSION-STONE POTENTIAL OF THE TABLE POINT FORMATION

A unit of the Table Point Formation of the Middle Ordovician Table Head Group has been suggested as possibly having some potential for dimension stone and that further assessment should be carried out. This unit is designated MOTP-2 in Knight (1986) and is described as a light-grey to white, dominantly fenestral limestone and dark-grey limestone (Knight, 1987, page 356). This unit occurs in several areas north of Roddickton but only the most westerly area, located about 14 km northwest of Roddickton was considered to have some potential (Figure 1). The other areas of the unit are considered to be too fractured due to normal and thrust faulting for use as a dimension stone.

The area of Unit MOTP-2 considered to have some potential is exposed along an abandoned forest-access road and its branches south of Route 432 about 1.5 km west of the junction with Route 433. Part of the area is held by Kevin Brewer under Licence 8887M. The area is very gently undulating and relief is low. Outcrops are found mainly in the roadbed and only rarely in the forest adjacent to the roads; till cover is thin but extensive.

The exposures of limestone had been cleared off during forest-access road construction and display the tops of the nearly flat-lying beds. The main rock type of Unit MOTP-2 is light-grey weathering, fine-grained, friable limestone and less abundant dark-grey weathering, fine-grained, hard limestone containing prominent calcite crystals. Only in the few outcrops, away from the road, was bedding apparent and the beds are seen to be medium to thin bedded (30 to 5 cm) and to dip gently to the west. Coiled gastropod fossils were apparent in some outcrops. Visible jointing in the unit varies from widely spaced to intense. The widely spaced vertical jointing is commonly up to 2 m apart, and usually in at least two directions.

The light-grey limestones are the most frequently exposed. An extensive outcrop of this rock type is exposed about 200 m south of Route 432. This rock weathers a light grey and is darker grey on fresh surfaces. Some mottling is present. Jointing is closely spaced but large samples may be obtained in the float. However, the limestone is extremely friable and shatters easily when struck with a hammer or dropped on a hard surface. The fragility of this limestone and the apparent closely spaced jointing would probably be a problem when attempting to obtain larger samples or blocks.

The dark-grey limestone exposed along the forest-access road generally contains widely spaced, vertical joints. However, in these outcrops the thickness of the beds could not be determined but is at least 30 cm where there is some vertical exposure. Three areas were found along the woods road between UTM 553919E, 5648858N and 553925E, 5647775N, where the rock is very tough and does not shatter. Jointing varies greatly in intensity but locally spacings are sufficient to produce small blocks with an exposed surface area of around 1 m^2 (Plate 14). The flatness of the outcrop prevented the collection of large samples. Small, 1-cm-diameter vugs and locally transparent calcite crystals up to 3 mm in diameter are found in this limestone. The areal extent of the dark limestone is uncertain and its thickness can only be determined by drilling. This unit could provide small blocks but the lack of relief in the area would hinder quarry development.

Samples from the more widely jointed outcrops were collected for cutting and polishing. The samples polish well and the textures are displayed as shades of brown, grey and white patches or layers (Plate 15). The textures represent calcite-filled fenestra, burrows, fossils, and also laminae and stylolites. The original grey colour of the samples may be seen along the edges of the samples. Thin seams of pelite (beige colour) and very fine fractures become apparent in the polished samples. The limestones may be useful for small-scale craft manufacturing but it is doubtful if there is any potential for large-scale development.

Plate 14. *Flat outcrop of limestone containing widely spaced joints; Unit MOTP-2 of the Table Point Formation, northwest of Roddickton. Hammer is 32 cm long.*

Plate 15. *Collage of the larger polished limestone from Unit MOTP-2 of the Table Point Formation, northwest of Roddickton.*

DIMENSION-STONE POTENTIAL OF THE CANADA HARBOUR MARBLE PROSPECT

The Canada Harbour marble prospect is located on a hillside overlooking the resettled community of Canada Harbour, on the south side of Canada Bay, 6 km south of Englee (Figure 1). The prospect forms one of a string of marble occurrences that extend from 5 km south of Canada Harbour (Figure 4) northwards to Croque, a distance of 50 km (A. Howse, personal communication, 2001). The marble prospects are associated with Taconic allochthon.

The Canada Harbour prospect was first quarried between 1912 and 1915, and the marble is reported to have been intended for use as dimension stone (Martin, 1983, cited in Howse, 1989). Two small quarries were developed and the material was transported to Canada Harbour for shipment. Many tonnes of material were quarried but how much was shipped is unknown. Remnants of this operation are scattered along the trail to the two abandoned quarries. This includes a rusted-out steam plant, tram lines and pulley system set up for hauling ore carts up and down the hillside.

Several investigations were carried out by the Geological Survey of Newfoundland during the 1930s to determine the suitability of the deposit. These include reports by Muir (1935), Howse (1936), Bain (1937) and Betz (1939). Betz concluded that the marble was unsuitable for development because of its lack of distinctive colour or patterns, the presence of micaceous seams, and the high degree of fracturing in the rock. No further work was carried out following these reports.

Subsequent work on the prospect has concentrated on the chemistry of the marble. Barron (1967) reported on a detailed mapping, exploration and bulk sampling program. Lines were cut trending about 330° and trenches dug. Howse (1989) reported that the trenches had been filled in. Discussions with Christopher Dempsey (oral communication, 2002) of Englee and a former resident of Canada Harbour indicated that drilling was also carried out, and that a variety of coloured marbles were obtained including blue and streaky blue-white, as well as the common creamy-white marble. Mr. Dempsey also reported that the bulk samples were stored in steel drums but were not shipped out and the drums rusted and stained the marble samples. A complete history of the marble prospects is found in DeGrace (1974).

DeGrace (1974) reported on work on the chemistry of the marbles carried out by McKillop (1955) and Besaw (1973). These works showed that the marble contains both calcitic and dolomitic types. Howse (1986, 1989) carried out detailed sampling of the largest quarry, which lies 15 m to

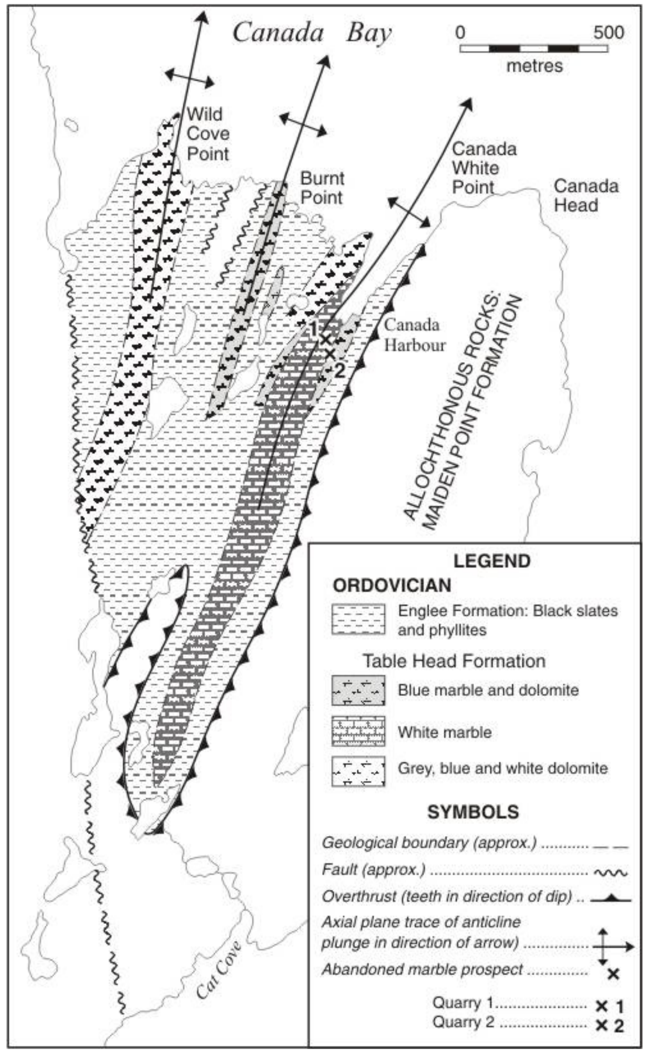

Figure 4. *Geology of the Canada Harbour area.*

the west of the trail to Canada Harbour. The smaller quarry, 50 m farther south and 10 m east of the trail was not geochemically analysed. Howse (1989) obtained results similar to the previous geochemical surveys and also reported that the marble had an average dry brightness value of 95.83 percent. Howse (*op. cit.*) considered the marble suitable for use as a high-quality filler but that further purification would be required to remove impurities, such as sericite.

The Canada Harbour marble belt is probably equivalent to the marbles at Englee, which Knight (1986) has assigned to the Early to Middle Ordovician St. George Group. The marble prospects are reported to occur in the core of a tight, upright anticline flanked by slate and phyllite, which have been overthrust to the east by clastic rocks of the late Precambrian to Early Ordovician Maiden Point Formation (Knight, 1986). Marbles along the shore at Canada Harbour are strongly sheared. A few outcrops are found in the stream at Canada Harbour and along the trails and cut lines. All outcrops contained whitish, strongly cleaved marble containing a well-developed parting, forming thin slabs about 2 cm thick.

The former two marble quarries at Canada Harbour were assessed for their dimension-stone potential. The quarries lie about 400 m south of the head of Canada Harbour. The trails, cut lines and trenches are partly overgrown. The quarries face north. The larger quarry (here termed Quarry 1), lies just to the west of the trail from Canada Harbour, and is the closest to Canada Harbour. It has three worked faces forming an S-shape. Much of the material taken from the quarry is strewn around the quarry slope to the north. The quarry comprises highly fractured and space-cleaved, fine-grained, white marble. Some shears are seen in loose blocks. A narrow, 5-cm-wide band of pelitic marble may represent bedding. The orientation of this layer is 044/50E and it is also strongly cleaved 032/65E; sericite is found along the cleavage in the regular marble. Howse (1989) reported that the marble is dominantly calcitic but contains a few layers of dolomitic marble.

The blocks, visible in the quarry faces and strewn around are all small with the largest block of fractured marble being less than 1 m in length. The average length is less than 30 cm. The outcrop is about 35 wide and 10 m high; the quarried site is about 10 m wide and 6 m high and 10 m long; no good marble for dimension stone could be obtained from this site. As thick a sample as possible was taken from about 4 m east of this quarry. However, it still contains prominent parallel fractures, which reflect the cleavage in the marble. It is unlikely that any marble suitable for dimension stone was ever taken from this site.

Quarry 2 is located about 30 m to the southeast of Quarry 1, on the east side of the trail adjacent to the large pulley wheel, left behind from the first attempt at development. The quarry face is about 15 m long and up to 4 m high and two 1.5 m-long drillholes are visible in the face of the quarry. The holes are widely spaced at about 4 m (intervening holes are not apparent). The marble in the quarry is fine grained and internally uniform. However, there is a strong cleavage and spaced cleavage variably developed throughout the marble oriented 040/30E; sericite occurs along the spaced cleavage. The main quarry face contains a large lens of massive unjointed and uncleaved marble (Plate 16). It is about 10 m long and up to one metre thick and dips to the east at shallow angle along the face of the quarry. The depth of the lens is not able to be determined from the flat quarry face. This lens may be the source of the historically reported blocks of marble said to have been left on the shore at Canada Harbour but which are now missing. The marble lens could not be sampled due to the flat and unjointed nature of the lens. This site has much better potential for dimension-stone marble compared to the other quarry but is still not suitable for modern large dimension block sizes. Only the lens would be usable but it probably has a very limited extent and therefore tonnage would be small.

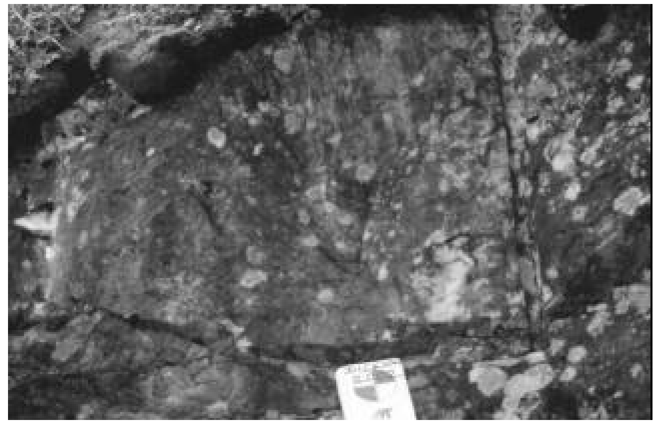

Plate 16. *View of marble lens in Quarry 2, south of Canada Harbour. Notebook is 10 cm wide.*

Samples obtained from both quarries were cut and polished. The marble has a creamy-white colour and contains abundant 1- to 3-mm-thick (< 5 percent), curved and linear olive green and beige streaks (Plates 17 and 18). These streaks are the stylolitic seams and the sericitic cleavage in the marble. The rock polishes well and if larger, uncleaved blocks could be obtained it would make an attractive marble.

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Plate 17. *Slab of polished Canada Bay marble from Quarry 1, south of Canada Harbour. The sides of the block are shear surfaces.*

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Plate 18. *Slab of polished Canada Bay marble from Quarry 2, south of Canada Harbour. The sides of the block are shear surfaces.*

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