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INDUSTRIAL-MINERAL STUDIES, 2002

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ABSTRACT

Three limestone and dolostone areas were assessed and sampled for geochemical analysis to determine their suitability as a source of metallurgical-grade material. The Catoche Formation on Table Mountain, north of the community of Port au Port, is dominated by limestone and contains very little dolostone. The Pine Tree Member dolostone, another potential source, on the Port au Port Peninsula does not continue along Table Mountain; however, there may be potential for high-calcium limestone. The Goose Arm area, north of Corner Brook, contains significant areas of dolostone. A recently exposed area was assessed and thick beds of dolostone were sampled. The variable presence of thin siliceous seams detracts from the quality of the dolostone, but it may be possible to obtain significant quantities of metallurgical-grade dolostone. The Catoche Formation, east of Port au Choix, contains an extensive unit of dolostone possibly up to 80 m thick; previously published and new analyses indicate that the dolostone is low in silica. An extensive sampling survey along the northern edge of the formation indicates that silica is a minor component and that the dolostone is of metallurgical grade. A previous survey has estimated that the Catoche Formation dolostone unit is in the billion-tonne range.

INTRODUCTION

The west coast of Newfoundland is richly endowed in limestone and dolostone deposits. Top-quality dolostone and limestone must meet strict chemical parameters before they are used as chemicals in many industries. Dolostone is used as agricultural limestone (dolime), as stone for lining open-hearth furnaces, flux-stone for the steel industry for use in smelting iron ore and steel production, as stone for the production of dead-burned dolomite also used in iron smelting plants, as a raw material for use in glass production and in flue-gas desulphurization. Dolostone is also used for the production of magnesium metal, which has a multitude of uses such as magnesium alloys. Metallurgical-grade dolostone must be low in SiO_2 (< 2 percent), total alkalies (< 0.1 percent $Na_2O + K_2O$), and low in phosphorous (< 0.1 percent) and MgO must be high (> 19 percent).

Metallurgical-grade limestone (high-calcium limestone) is also used in the iron-ore industry, desulphurization processes, lime production in vertical shaft and rotary kilns, and many other chemical and industrial uses such as the paint and paper industries. High-calcium limestone must be high in CaO, and low in SiO_2, MgO, alkalis, alumina (Al_2O_3) and iron. However, in cement production, the presence of SiO_2 and alumina is not a problem as these are added via the shales used in the cement-making process.

Three areas of western Newfoundland were examined during 2002 to determine their potential for metallurgical-grade dolostone and limestone (Figure 1).

THE LOWER ORDOVICIAN CATOCHE FORMATION, PORT AU PORT

The informally termed "Pine Tree Unit" of the Catoche Formation is currently being quarried as a source of dolostone on the Port au Port Peninsula, west of Stephenville, in western Newfoundland, by Atlantic Minerals Inc. Much work has been concentrated on the unit and it is well defined on the peninsula, e.g., Besaw (1974), DeGrace (1974) and Delaney and Howse (1988). Lee (1956), Besaw (1974), and Delaney and Howse (*op. cit.*) also examined the continuation of the unit east of the peninsula where they sampled and analysed dolostones from the area north of Port au Port (Figures 1 and 2). Besaw (*in* DeGrace, 1974, Map No. 3) and Delaney and Howse (1988) indicated that the dolostone continued north of the community of Port au Port along the ridge that forms Table Mountain. Parts of the area studied are included in Reid Lot 201 and in Licence 8884M held by Kevin Brewer.

Palmer (1995) mapped the area between Port au Port Bay and Stephenville and as far north as Fox Island River. This mapping indicated that Table Mountain was underlain by a northwesterly dipping sequence containing the Eocam-

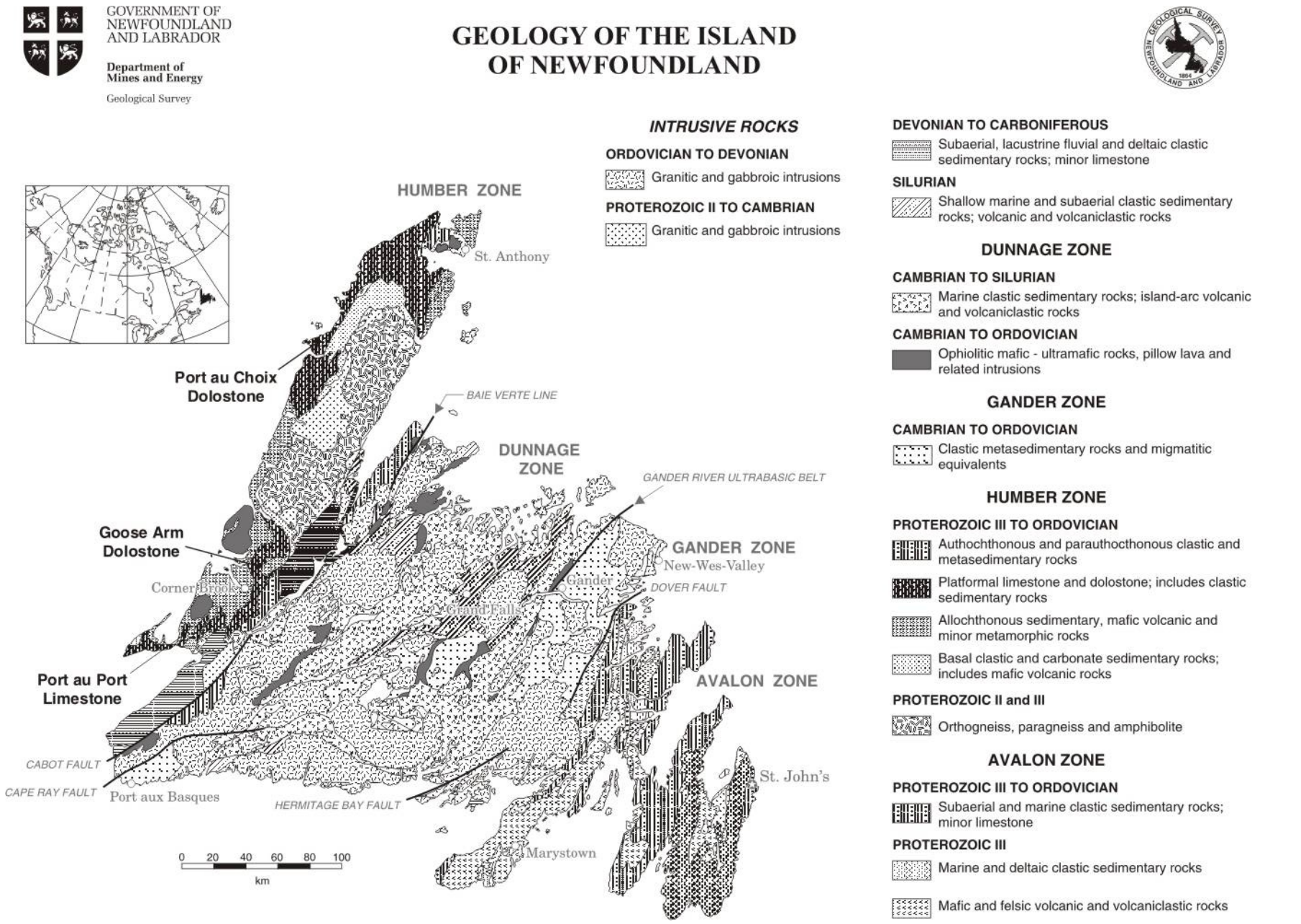


Figure 1. *Location of industrial mineral surveys in 2002.*

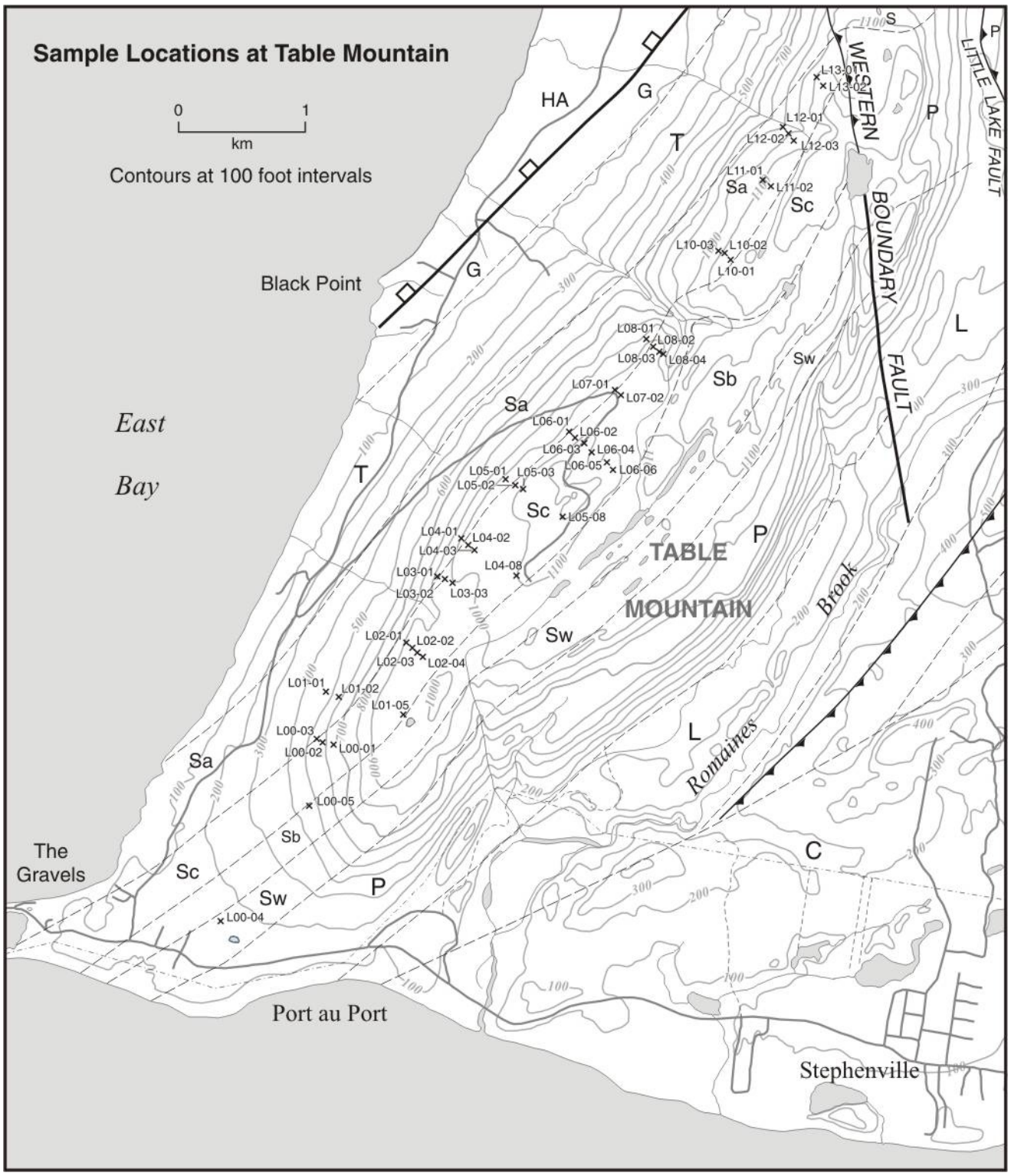


Figure 2. *Geology of the Table Mountain area, Port au Port (from Palmer, 1995). (L) Labrador Group; (P) Port au Port Group; (S) St. George Group; (G) Goose Tickle Group; (T) Table Head Group; (HA) Humber Arm Allochthon; (C) Carboniferous.*

brian Labrador Group, through the Cambrian Port au Port Group, the Early Ordovician St. George Group and into the Middle Ordovician Table Head Group and the Goose Tickle Group at the top (Figure 2). The dolomite unit of interest lies within the St. George Group and is described by Delaney and Howse (1988) as a 10-m-thick, vuggy, burrowed

sequence containing dolomitized burrows in a calcium limestone matrix and the vugs were also commonly lined with calcite (Plate 1). Chert occurred as nodules, lenses and locally as layers.

The dolomitized burrowed unit is interpreted to be part of the Catoche Formation of the St. George Group (Knight and James, 1988). The Catoche Formation forms the crest of the ridge at Table Mountain (Figure 2) and is exposed from the Pine Tree ski hill, for about 8 km, where it is terminated by the Western Boundary Fault of Palmer (1995). Initial mapping during this study showed that the burrowed unit was thicker than that reported by Delaney and Howse (1988). The formation generally trends at 045° and dips at 10 to 25° to the northwest. The unit was sampled and mapped along 12 gridlines oriented at 315°, spaced about 500 m apart, and sampled at 100 m intervals, where in-place bedrock was exposed and there was sufficient exposure to allow line-sampling (Figure 2). The sequence was sampled from the its base, where it overlies thin-bedded, grey, flaggy limestone of the Boat Harbour Formation, to the top of the formation below thick-bedded, massive, grey limestones of the Aguathuna Formation. At the southern end of the ridge, exposure is very poor and occurs only in areas cleared for the ski hill and along old woods trails. A total of 45 samples were collected from a potential 55 sites.

The top of the Catoche Formation lies about 4 m stratigraphically above a 20- to 30-cm-thick, highly porous, chert-replaced algal layer. The lower part of the Catoche Formation is dominated by thin- to medium-bedded, pale grey to grey, fossiliferous, bioturbated limestone (Plates 2 and 3) commonly containing conspicuous gastropods. This sequence is exposed across strike, for up to 300 m, indicating an approximate maximum true thickness of 125 m. Overlying the thin-bedded limestones is a sequence of light-grey-weathering, grey, thick-bedded, massive, burrowed limestone commonly containing prominent dolomitized, randomly oriented burrows (Plate 1). Locally, the burrowed beds are capped by uniform to variegated, buff, fine-grained dolostone that is up to 20 cm thick. The burrowed limestone sequence was found to be exposed across strike for up to 250 m indicating an approximate maximum true thickness of 100 m; all of the ridge is considered to be a variably dolomitized limestone. Siliceous knobs and patches occur in varying concentrations throughout the burrowed limestone and have their highest concentrations near the top of the unit in the vicinity of the porous chert horizon. The only outcrops of completely dolomitized limestone were found on the southwestern slope of the ridge, near the base of southernmost ski run. The outcrops contain beige, thick-bedded, sucrosic, burrowed dolostone and the lower outcrop also contains spongy chert nodules and patches; there is no trace of calcite in these dolostones.

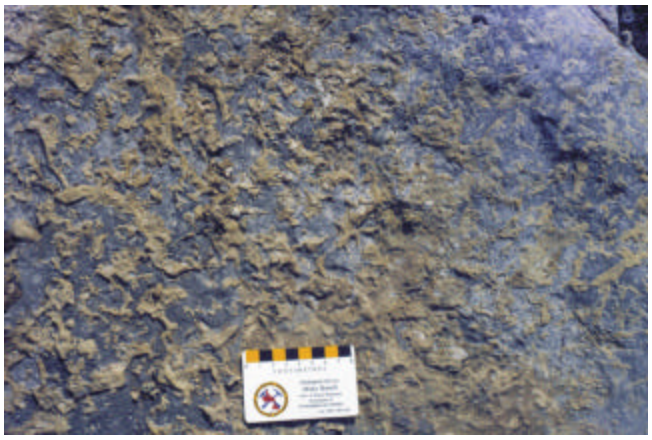


Plate 1. *Thick-bedded limestone of the Catoche Formation at Port au Port containing burrows replaced by brown-weathering dolomite (Site L00-01, Figure 2).*

Plate 2. *Thick-bedded grey limestone from near the base of the Catoche Formation. Notebook is 17.5 cm tall (Site L08-03, Figure 2).*

Plate 3. *View of the Catoche Formation looking southwest toward the Port au Port Peninsula. The photograph shows the medium- to thick-bedded limestones along the cliff face. The Aguathuna Formation lies to the west of the line of dwarf spruce to the right of the view.*

The Catoche Formation on Table Mountain is not a potential extension of the Pine Tree unit dolostone found on the Port au Port Peninsula. Complete dolomitization ends at the ski hill and only the fine-grained caps of the burrowed limestone beds and the burrows are completely dolomitized.

The distribution of the Catoche Formation in the northern part of the area (Figure 2) appears to lie further west than shown by Palmer. Correlation of strata along strike using aerial photographs suggests that the eastern part of the Aguathuna Formation of Palmer (1995) should be included in the Catoche Formation. Similarly, it appears that most of the Catoche Formation in the northern area lies along strike from the Boat Harbour Formation.

Geochemistry

Values for selected elements for the samples collected from the Table Mountain area are shown in Appendix 1. The data indicate that only the only sites containing metallurgical-grade dolostone (>19 percent MgO) are near the southern end of the Catoche Formation (samples L0.2 and L0.3) and from near the top of the Catoche Formation (sample L4.1; see Appendix 1 and Figure 2). Analyses of samples L2.1, L3.1 - L3.3 and L4.2 have enhanced magnesium but it is significantly lower than the high-magnesium samples. Most of the other samples could be classed as magnesian limestone and only one sample (L7.1) is chemically a high-calcium limestone (>55 percent CaO). The silica values are generally higher than required for metallurgical grade limestone and dolostone being commonly over 1.5 percent SiO_2. In summary, the chemistry does not indicate that the samples from the Catoche Formation could be a source of high-quality limestone or dolostone. The full analyses of the samples from the Table Mountain area will be published in 2003.

THE DOLOSTONE IN THE PETIT JARDIN FORMATION, GOOSE ARM AREA

Delaney and Howse (1988) reported on various dolostone prospects in the Goose Arm area, of the Bay of Islands, in western Newfoundland. An area of dolostone, located about 1 km east of the head of Goose Arm and 20 km north of Corner Brook (Figure 1), has subsequently become more accessible following logging and woods-road construction in the area. Knight (1994a) has assigned the dolostone mainly to the Petit Jardin Formation of the Late Cambrian Port au Port Group. Descriptions of the stratigraphy and structure in the area are given in Knight and Boyce (1991) and Knight (1994b). Knight (1994a) has shown that with the overlying limestone of the Berry Head Formation and the underlying limestone of the March Point Formation, and arenite, sandstone and phyllite of the Reluctant Head Formation and the Petit Jardin Formation form part of a west-directed slice thrust over another area of the Petit Jardin Formation. The Petit Jardin Formation in the study area forms an east-southeast-dipping sequence that generally dips at about 40° (Figure 3). The northern end of the thrust slice is faulted against cleaved, medium-bedded, burrowed, grey limestones of the Berry Head Formation; the burrows have been dolomitized.

The dolostones are well exposed along a relatively new system of woods-roads to the west of the main woods-road north of Old Mans Pond, which leads to the head of Goose Arm. The area has been logged and is free of commercial forest. The dolostone outcrops along a series of northeast-trending ridges that have been traversed at an acute angle by the new woods-roads. Outcrop was sufficient for sampling at intervals of around 200 m (Figure 3), and additional samples collected where the rock was different from the norm. Twenty-nine samples were collected. The location of the samples, when plotted on the 1:50 000-scale map of Knight (1994a), indicates they were collected from the upper portion of the March Point Formation, the full thickness of the Petit Jardin Formation and lower portion of the Berry Head Formation.

The Petit Jardin Formation is dominated by thick- to very thick-bedded, buff-weathering, pale grey, sucrosic, massive dolostone (Plate 4). In the central part of the succession, black to dark grey, medium- to very thick-bedded dolostone is interbedded with the pale-grey dolostone. Near the bottom and top of the examined sequence, some dolostone beds are conglomerates composed of rounded dolostone pebbles and cobbles in a dolostone matrix. Near the top of the succession, a few dolostone beds contain conspicuous clastic quartz granules. The dolostones, which are coarsely recrystallized, variously display burrows, parallel- and crosslamination, and vugs commonly lined or filled with dolomite crystals or silica (Plate 5). Reddish patches, of unknown material, are found in the dolostones within the lower part of the sequence; stylolite partings are found locally. The dolostones are jointed with joint spacing varying from 30 cm to 2 cm, however, the dolostone locally displays wider spaced joints. Rarely the dolostone displays a steeply northeast-dipping cleavage.

An unusual bed of highly altered, rusty, silty material is preserved in the central part of the succession (Site 4, Figure 3); clearly a soluble mineral has been removed from this bed. A 2-m-thick bed of grey chert (Site 18, Figure 3) also occurs in the central part of the succession. Thin veinlets of a rusty metallic mineral, possibly near hematite, locally cut the dolostone.

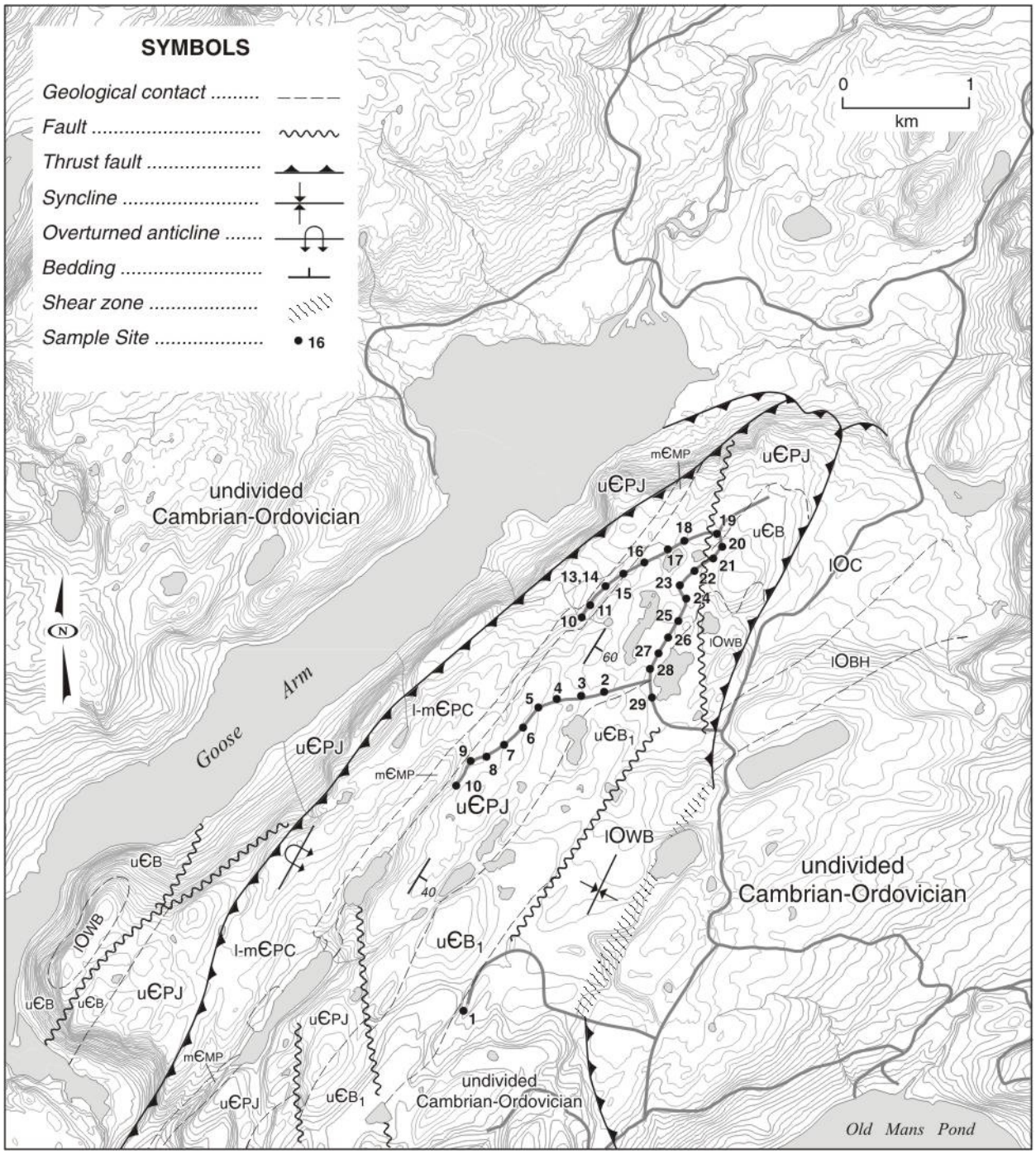


Figure 3. *Geology of the Goose Arm area, western Newfoundland (from Knight, 1994a) and sample locations.*

Silica occurs within the dolostones most commonly as 2- to 4-mm-thick, fine-grained joint and fracture fillings and locally as replacement chert. The abundance of silica varies greatly and forms up to 5 percent of the rock. Small 1 to 2 mm specks of silica and patches of quartz and fine-grained silica up to 2 cm in diameter, commonly occur within the dolostone beds but are generally a minor constituent. In the vicinity of Site 28, Figure 3, the dolostone contains sand-size clasts of quartz. A significant tonnage of dolostone is available in this area.

Geochemistry

Values for selected elements for the samples collected from the Goose Arm area are shown in Appendix 2. The analyses show that all of the samples are highly dolomitised

Legend for Figure 3

LOWER ORDOVICIAN TO LOWEST MIDDLE ORDOVICIAN

St. George Group

lOc Catoche Formation: grey bioturbated dolomitic limestone

lOBH Boat Harbour Formation: grey bioturbated limestone

lOWB Wild Bight Formation: dark grey, cherty, burrow-mottled moundstone commonly replaced by bituminous dolostone near the base of the unit

MIDDLE TO UPPER CAMBRIAN

Port au Port Group

uЄB Berry Head Formation: thick-bedded, light-grey to cream dolostone and minor chert

uЄPJ Petit Jardin Formation: buff-weathering, light-grey, microcrystalline massive dolostone and minor dark grey dolostone; locally displays crosslamination; minor replacement chert and quartz veins; rare thick chert units

mЄMP March Point Formation: grey, oolitic, oncolitic and bioturbated limestone dolomitized in the upper parts

LOWER TO MIDDLE CAMBRIAN

l-mЄPC Penguin Cove Formation: interbedded, thin- and thick-bedded quartz arenite, sandstone shale and phyllite; minor limestone and dolostone

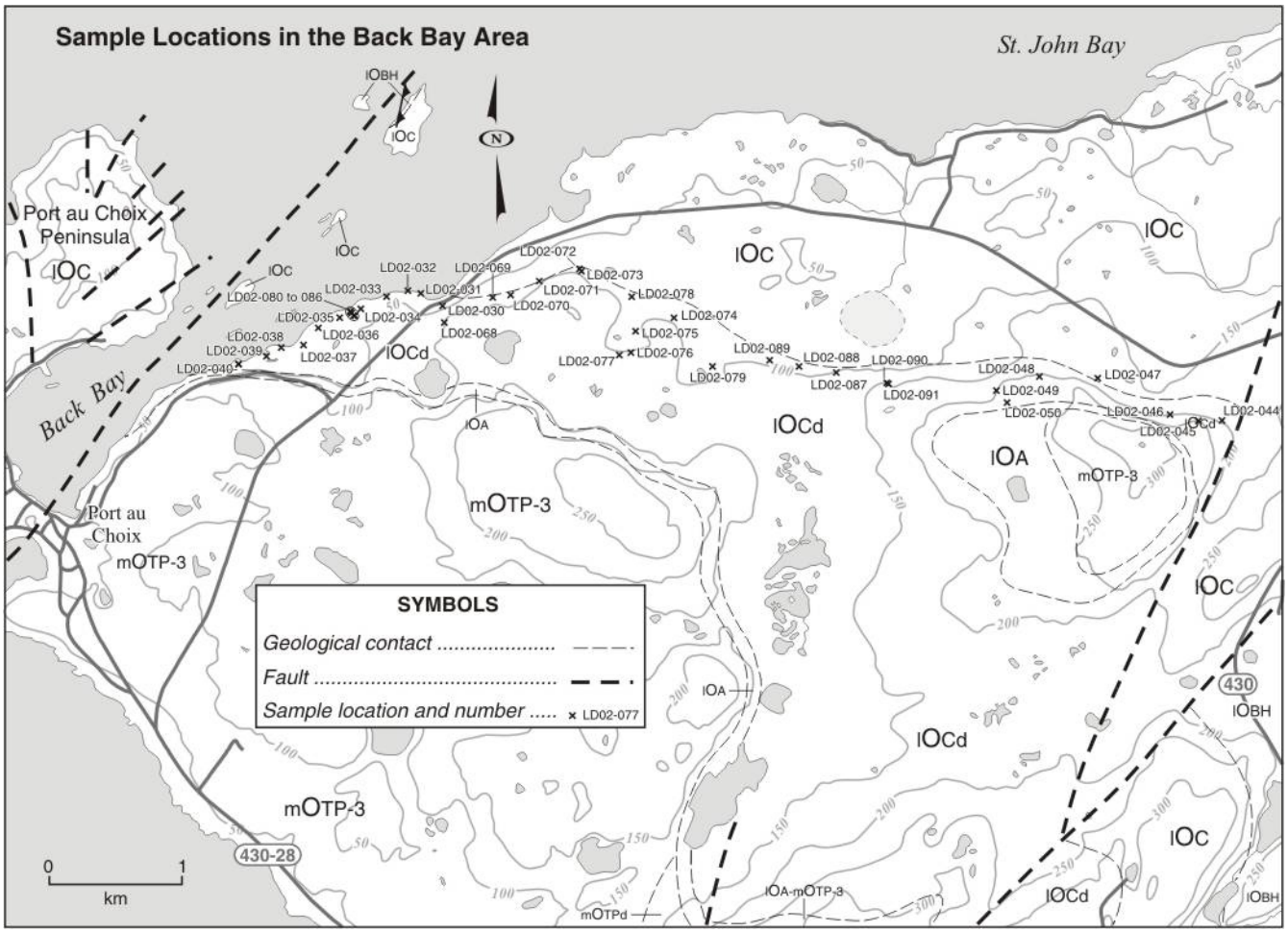
Plate 4. *Laminated dolostone of the Petit Jardin Formation in the Goose Arm area. (Site 26, Figure 3).*

Plate 5. *Massive, parallel and crosslaminated dolostone on the Petit Jardin Formation, in the Goose Arm area (Site 2, Figure 3).*

and most of the samples are metallurgical-grade dolostone containing >19 percent MgO with the highest MgO values being obtained from lower units of the Petit Jardin Formation. The samples collected from near the top of the unit have about 1 percent less MgO containing generally less than 19 percent MgO and CaO is correspondingly higher being over 30 percent. The change in chemistry is also shown by the Sr values which in the lower units are well less than 100 ppm and well over 130 ppm in the upper part of the unit. Silica values are variable in the dolostones with the lower values generally found in the lower sections and most of the high values being found near the top on the unit. Generally, the silica values are below the generally accepted maximum value of 2 percent although several samples contain significantly higher silica reflecting the presence of siliceous seams that occur within some of the dolostone horizons. The full analyses of the samples from the Goose Arm area will be published in 2003.

THE EARLY ORDOVICIAN CATOCHE FORMATION, BACK ARM AREA

The Early Ordovician Catoche Formation in the Back Arm area, east of Port au Choix (Figure 1), comprises a lower unit of thin- to medium-bedded, grey limestone, to the north, and an upper sequence of thick-bedded dolostone, to the south, which has replaced the limestone. The Catoche Formation is conformably overlain to the south by limestones and dolostones of the Early Ordovician Aguathuna and Middle Ordovician Table Point formations (Knight, 1991; Figure 4). Knight (1991) has estimated that the average thickness of the Catoche Formation dolostone is about 40 m. The northern edge of the dolostone unit is accessible from a disused gravel road that links Port au Choix to the Viking Highway (Route 430).



Legend

MIDDLE ORDOVICIAN
TABLE HEAD GROUP

TABLE POINT FORMATION: **mOTP-1** - Cyclic limestone and dolomitic limestone or dolostone; **mOTP-3** - Well-bedded, dark grey, fossiliferous limestone with characteristic dolomitic–argillaceous seams; **mOTPd** - Dolomitized equivalents of mOTP-1 and mOTP

EARLY TO MIDDLE ORDOVICIAN
ST. GEORGE GROUP

AGUATHUNA FORMATION: **l-mOA** - Light grey to grey dolostone having interbedded green-grey and grey shale

CATOCHE FORMATION: **lOC** - Well-bedded, grey, fossiliferous and bioturbated limestone associated with characteristic dolomite mottling, locally microbial mounds; **lOCd** - Diagenetic and epigenetic dolostone replacing Catoche Formation limestone

BOAT HARBOUR FORMATION: **lOBH** - Interbedded, dark to light grey, dolomitic limestone and buff dolostone; dolomitization common throughout; widely preserved chert and matrix breccia bodies especially at the base

WATTS BIGHT FORMATION: **lOWB** - Dark grey to black, thick-bedded, fine- to medium-crystalline dolostone

MIDDLE TO LATE CAMBRIAN
PORT AU PORT GROUP

PETIT JARDIN FORMATION: **uCPJ -3** - Upper dolostone member - thick- to thin-bedded, light grey dolostone

Figure 4. *Geology of the Back Arm area, Port au Choix, western Newfoundland (from Knight, 1991) and sample locations.*

The industrial-mineral potential of the Catoche Formation dolostone was part of a reconnaissance survey by Delaney and Howse (1988) who sampled the dolostones on the eastern shoreline of Back Arm (Plate 6), 1 km east of Port au Choix, and along the northern shoreline of the Pointe Riche Peninsula, immediately west of the town of Port au Choix. Knight (1991, page 86-89) also carried out some geochemical sampling of the dolostones of the Catoche Formation and the overlying Table Point Formation. The dolostones in the town of Port au Choix and the Pointe Riche Peninsula can probably not be exploited as they lie within a developed part of the town and the Port au Choix Natural Historic Park.

To the southeast of Back Arm, the dolostone forms a 6-km-long inland cliff located adjacent to the contact between the underlying limestone and the dolostone and probably represents a former sea cliff (Plate 7) at the edge of a very gently undulating, raised, wave-cut platform. The cliffs are up to 25 m high and are between 300 m and 1 km south of a disused road. The top of the cliffs in the east is at an altitude of about 75 m descending gently westward to near sea level at Back Arm. At the eastern and western ends of the cliffs the dolostone is overlain by limestone. The shoreline exposures at Back Arm form a gently south-dipping series of terraces that start within the dolostone sequence and extend southward to the inland limestone cliffs.

Along the north-facing dolostone scarp face, a 30- to 100-m-wide fringe of conifers and birch occurs on the large, soil- and moss-covered dolostone blocks at the base of the cliffs. The higher parts of the limestone terrace in front of the cliffs are variably covered by conifers that are harvested for both domestic firewood and saw logs. Much of the gently undulating lower ground is underlain by Catoche Formation limestone and is a wet peat bog that supports scrub spruce, shrubs and sparse, small larch ("juniper") trees; there are also a few small ponds. The top of the dolostone sequence is usually covered by small stands of conifers, scrub spruce and shrubs, and to the south, by extensive peat bog and swampy ground.

To further determine the potential of the dolostone east of Port au Choix, a geochemical sampling program was carried out along the inland dolostone cliffs south of a disused road east of Port au Choix, and also along the shoreline at Back Arm. Sampling was carried out at different altitudes along the cliff to assess any vertical variations in lithology and chemistry. A total of 42 samples were collected including 7 stratigraphic chip-samples collected over 1 m intervals for a total sampling thickness of 7 m. Sampling along the cliff was spaced at intervals of about 250 m and at varying heights up the cliff (Figure 3).

Plate 6. *Massive, thick-bedded dolostone of the Catoche Formation in the Back Arm area, east of Port au Choix (Site LD02-032, Figure 4).*

Plate 7. *Massive, thick-bedded dolostone of the Catoche Formation in the Back Arm area, east of Port au Choix forms the edge of the dolostone plateau (Site LD02-091, Figure 4).*

The dolostone unit is a continuous sequence that is thick- to very thick-bedded, medium-grained, sucrosic, buff-weathering, and mottled pale buff and dark brown or dark grey on fresh surfaces. The mottling reflects dolomitized burrows and bioturbation. Traces of parallel and convolute lamination are also found. Along the shoreline at Back Arm, several successive beds contain round thrombolite mounds up to 3 m in diameter. Scalloped surfaces are commonly associated with the thrombolite mounds along the shoreline and these are also found on the weathered cliff exposures. Commonly, the mottled medium-grained, dolostone beds are capped by a slightly mottled to uniform, fine-grained dolostone. These caps vary in thickness from 20 to 50 cm. Fossils are rarely seen in the weathered inland outcrops but along the shoreline at Back Arm, fossils including gastropods are apparent on the smooth, intertidal exposures. Vugs are common and these vary in abundance from less

than 1 percent to about 2 percent. The vugs are generally about 1 cm in diameter and are usually lined or filled with dolomite crystals. In several areas, a dark brown to black material was also found in the vugs and may be a remnant of bitumen. In a few areas, similar bituminous material was found as disseminations in highly porous dolostone.

Nearly all beds contain minor, 1- to 2-cm-long, irregularly shaped to round knots of fine-grained silica that may represent silicified organic material. Rarely, some beds contain abundant knots of silica that vary in abundance up to about 10 percent (Plate 8). Bedded chert was not found.

Geochemistry

The geochemical data for the dolostones sampled by Knight in 1982 and Delaney and Howse in 1987 are given in Appendix 3. It shows that the Catoche Formation dolostone is low in silica at generally less than 1 percent and high in magnesia at over 21 percent. Combined "total iron" as Fe, alumina and alkalis is low at less than 0.5 percent.

Values for selected elements for the samples collected in 2002 from the Back Arm area are shown in Appendix 4. The analyses show that all of the samples are highly dolomitised and all samples are metallurgical-grade dolostone containing >19 percent MgO and most of the samples contain over 21 percent MgO. Apart from one sample (LD02-050; see Figure 4) all silica contents lie well below the maximum acceptable values. The one high-silica sample contains 4.33 percent SiO_2 and was noted in the field to contain conspicuous quartz concentrations. This sample occurs near the top of the dolostone unit near the contact with the Aguathuna Formation. It is perhaps noteworthy that one sample (LD02-086) contains an anomalous Zn value of 2463 ppm Zn. No mineralization was observed in the field. The analyses are similar to the analyses obtained by Knight (1991) and Delaney and Howse (1988). The uniform high quality of the dolostones indicates that there is significant potential for metallurgical-grade dolostone in this area. The full analyses of the samples from the Back Arm area will be published in 2003.

Potential Reserves

Knight (1991, pages 87-89) reports that dolomitization has also occurred in the lower part of the Table Point Formation and the Aguathuna Formation that overlie the Catoche Formation at Back Arm. The chemical analyses are similar to the dolostones of the Catoche Formation. Knight (*op. cit.*) also reports that the dolostone sequence at Back Arm may have a possible thickness of up to 80 m based on drilling by Brinex for Pb–Zn exploration. Based on a stratigraphic interval of 40 m, Knight (1991) has estimated reserves of 290 million tonnes immediately east of Back Arm and a further 820 million tonnes of reserves underlie the area to the east. The potential of the area for metallurgical-grade dolostone is good. Samples will be analysed for major and trace elements including gold and the results published in 2003.

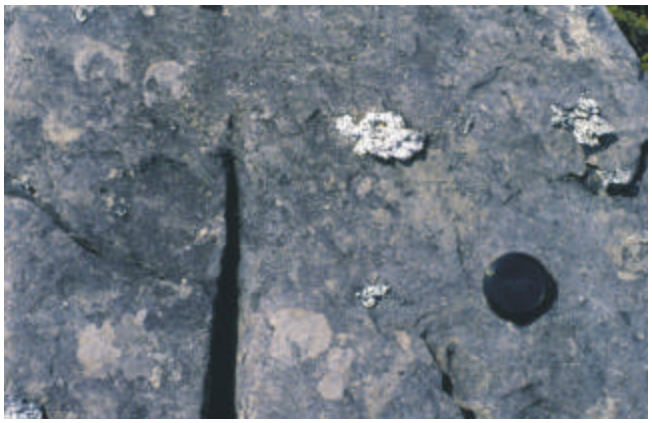


Plate 8. *Massive, thick-bedded dolostone of the Catoche Formation in the Back Arm area, east of Port au Choix. The sample shows large quartz knots in the dolostone.(Site LD02-077, Figure 4). Lens cap is 6 cm in diameter.*

East of Back Arm, the raised sea cliffs are natural quarry faces, and ready access is provided from the disused road. Two shallow ponds about 250 m in diameter are found on the western end of the dolostone terrace and these could easily be avoided in a quarrying operation.

ACKNOWLEDGMENTS

Field assistance was provided by Barry Wheaton. The report benefited from a review by Paul Moore.

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APPENDIX 1

Chemistry of selected elements for carbonate samples collected from the Table Mountain area, Port au Port.

Field Number	CaO wt. %	MgO wt. %	SiO_2 wt. %	Fe_2O_3 (tot) wt. %	Al_2O_3 wt. %	Na_2O wt. %	K_2O wt. %	P_2O_5 wt. %	Total wt. %	Sr ppm	Zn ppm	Pb ppm	Ba ppm	Au ppb
L0.1	46.52	4.54	4.61	0.54	1.13	0.02	0.76	ND	41.05	316	10	1	32	ND
L0.2	29.90	19.86	2.46	0.12	0.38	0.05	0.22	0.01	45.77	33	7	ND	11	ND
L0.3	31.00	18.87	2.53	0.03	0.14	0.06	0.11	ND	45.60	99	5	ND	105	ND
L0.4	53.17	0.62	3.06	0.19	0.56	0.02	0.39	ND	41.77	429	5	ND	15	ND
L0.5	54.66	0.62	1.36	0.05	0.23	0.01	0.16	ND	43.07	356	8	ND	8	ND
L1.1	50.24	3.83	2.54	ND	0.08	0.02	0.09	ND	42.98	193	5	ND	6	ND
L1.2	47.09	5.84	2.63	0.07	0.31	0.03	0.23	ND	43.35	162	138	ND	12	ND
L1.5	53.69	0.72	2.27	0.18	0.56	0.03	0.40	ND	42.30	298	17	3	16	2
L2.1	42.51	9.86	1.92	0.06	0.29	0.03	0.23	ND	44.31	169	10	ND	14	ND
L2.2	49.45	3.97	2.39	0.06	0.27	0.02	0.23	ND	44.17	128	23	ND	11	ND
L2.3	51.21	2.28	2.47	0.28	0.68	ND	0.46	ND	43.01	178	6	ND	11	ND
L2.4	52.60	0.61	2.98	0.18	0.55	0.02	0.39	ND	42.38	363	39	9	17	ND
L3.1	37.97	13.17	2.22	0.10	0.34	0.05	0.27	ND	46.17	117	18	ND	5	ND
L3.2	37.98	13.24	2.24	0.11	0.34	0.05	0.27	ND	44.53	139	6	ND	13	ND
L3.3	38.97	12.17	2.46	0.13	0.37	0.05	0.29	ND	44.22	157	7	2	18	ND
L4.1	30.73	19.71	1.86	0.08	0.22	0.05	0.18	ND	45.89	45	16	ND	8	ND
L4.2	40.65	10.50	2.30	0.11	0.29	0.03	0.25	ND	44.07	120	25	1	13	1
L4.3	52.96	0.58	2.91	0.27	0.72	0.03	0.53	ND	41.76	364	31	2	21	ND
L4.8	55.48	0.42	1.31	0.11	0.34	0.02	0.27	ND	42.92	263	4	ND	30	ND
L5.1	51.75	3.51	1.30	ND	0.14	0.02	0.14	ND	43.51	157	5	ND	22	ND
L5.2	43.31	9.36	1.41	0.02	0.10	0.03	0.11	ND	44.65	127	6	ND	5	ND
L5.3	42.44	10.49	1.55	0.13	0.27	0.03	0.22	ND	44.51	114	8	ND	11	ND
L5.8	46.22	4.79	5.37	0.46	1.15	0.03	0.83	ND	40.46	266	17	5	40	ND
L6.1	52.05	0.16	9.70	ND	0.03	0.02	0.07	ND	38.43	143	4	ND	5	ND
L6.2	49.93	4.13	1.04	0.01	0.18	ND	0.11	ND	43.75	157	9	ND	6	ND
L6.3	54.61	1.06	1.31	0.05	0.15	0.01	0.15	ND	42.96	188	7	ND	21	ND
L6.4	48.05	2.98	3.68	0.43	1.02	ND	0.63	0.01	41.45	340	18	2	27	ND
L6.5	34.16	16.40	2.34	0.12	0.48	0.03	0.33	ND	44.90	173	13	1	17	ND
L6.6	43.75	5.19	5.41	0.66	1.54	ND	0.98	0.01	40.47	274	8	1	42	1
L7.1	55.76	0.55	0.70	ND	0.06	0.02	0.09	ND	43.31	217	6	ND	3	ND
L7.2	47.75	6.79	1.19	0.01	0.12	0.01	0.12	ND	44.28	120	7	ND	5	ND
L8.1	36.39	14.96	2.24	0.03	0.07	0.03	0.09	ND	45.07	85	7	ND	4	ND
L8.2	52.79	2.06	0.82	ND	0.07	0.01	0.10	ND	43.73	123	4	ND	3	ND
L8.3	53.91	0.60	1.26	0.06	0.20	ND	0.18	ND	43.16	231	11	ND	8	ND
L8.4	50.66	2.44	3.21	0.23	0.40	0.02	0.33	ND	42.22	344	18	2	25	ND
L10.1	48.97	4.59	1.15	0.07	0.22	0.02	0.19	ND	43.81	180	6	ND	10	ND
L10.2	37.89	13.94	1.14	0.05	0.20	0.02	0.17	ND	45.32	62	5	ND	8	ND
L10.3	53.52	1.86	0.86	ND	0.06	0.01	0.10	ND	43.53	185	4	ND	4	ND
L11.1	53.98	2.19	0.61	ND	0.06	0.01	0.08	ND	43.93	163	8	5	2	ND
L11.2	50.17	4.22	1.23	0.01	0.22	ND	0.20	ND	43.78	229	7	ND	11	ND
L12.1	53.52	1.93	1.07	ND	0.09	0.02	0.11	ND	43.61	230	14	ND	4	ND
L12.2	51.31	3.13	1.34	0.03	0.26	0.02	0.20	ND	43.43	177	7	1	10	ND
L12.3	51.92	2.01	2.36	0.20	0.36	0.02	0.30	ND	42.58	251	21	3	12	ND
L13.1	42.69	10.25	1.09	0.08	0.21	0.02	0.17	ND	44.88	130	14	ND	9	ND
L13.2	53.62	1.22	1.67	0.12	0.33	0.02	0.27	ND	43.03	203	7	1	15	ND
Mean	47.06	6.05	2.26	0.12	0.35	0.02	0.27	0.001	43.42	195.6	13.8	0.9	15.5	0.1
Maximum	55.76	19.86	9.70	0.66	1.54	0.06	0.98	0.01	46.17	429	138	9	105	2
Minimum	29.90	0.16	0.61	ND	0.03	ND	0.07	ND	38.43	33	4	ND	2	ND
Samples	45	45	45	45	45	45	45	45	45	45	45	45	45	45

APPENDIX 2

Chemistry of selected elements from dolostones of the Petit Jardin Formation in the Goose Arm area.

Field Number	CaO wt. %	MgO wt. %	SiO_2 wt. %	Fe_2O_3 (tot) wt. %	Al_2O_3 wt. %	Na_2O wt. %	K_2O wt. %	P_2O_5 wt. %	L.O.I. wt. %	Sr ppm	Zn ppm	Pb ppm	Ba ppm	Au ppb
LD02-002	30.51	21.11	0.69	0.14	0.13	0.02	0.16	ND	46.86	60	9	1	10	ND
LD02-003	30.17	20.82	1.51	0.28	0.42	0.02	0.35	ND	45.83	61	13	2	11	ND
LD02-004	30.46	21.33	1.33	0.14	0.26	0.02	0.26	ND	46.20	56	13	2	25	1
LD02-005	28.61	20.63	2.17	0.28	0.54	0.02	0.38	ND	45.38	64	26	5	20	ND
LD02-006	29.73	20.87	1.97	0.21	0.36	0.02	0.31	ND	45.49	60	6	2	50	ND
LD02-007	29.16	20.79	1.70	0.28	0.33	ND	0.21	ND	46.08	70	7	3	23	ND
LD02-008	29.45	20.10	2.19	0.27	0.23	ND	0.13	ND	45.83	68	23	5	15	ND
LD02-009	30.23	20.45	0.81	0.22	0.18	ND	0.13	ND	46.77	69	65	4	23	ND
LD02-010	29.93	20.27	1.15	0.26	0.35	ND	0.19	ND	46.37	66	10	3	21	ND
LD02-011	29.89	20.60	0.44	0.29	0.16	ND	0.11	0.01	47.08	47	6	2	9	ND
LD02-012	30.24	20.71	0.56	0.30	0.09	ND	0.08	ND	47.01	50	6	1	9	ND
LD02-013	30.83	21.27	1.09	0.14	0.14	ND	0.11	ND	46.67	65	9	1	9	ND
LD02-014	30.64	21.06	0.62	0.11	0.05	ND	0.07	ND	47.03	67	4	1	5	ND
LD02-015	30.49	20.91	1.00	0.15	0.20	ND	0.16	0.01	46.61	64	6	1	17	ND
LD02-016	29.20	20.34	2.66	0.30	0.51	ND	0.43	0.03	45.02	84	11	2	59	ND
LD02-017	28.66	19.75	5.25	0.38	0.67	ND	0.46	0.01	43.74	83	8	4	55	ND
LD02-018	28.85	19.65	3.48	0.34	0.69	ND	0.57	0.01	44.53	94	18	2	63	ND
LD02-019	30.48	19.47	2.38	0.14	0.34	ND	0.33	0.01	45.82	157	8	1	44	1
LD02-020	30.20	18.12	4.89	0.38	0.66	ND	0.48	0.01	43.57	148	15	2	52	ND
LD02-021	31.80	18.86	1.19	0.14	0.32	ND	0.23	0.01	46.03	163	6	1	19	ND
LD02-022	30.16	18.37	4.60	0.23	0.46	ND	0.37	0.01	43.94	199	10	2	47	ND
LD02-023	32.04	18.99	1.23	0.18	0.31	ND	0.24	0.02	45.91	198	14	2	11	ND
LD02-024	31.99	18.82	1.05	0.12	0.32	ND	0.27	0.01	46.20	167	8	ND	23	ND
LD02-025	30.83	19.43	1.60	0.16	0.35	ND	0.30	0.02	45.81	136	8	2	34	ND
LD02-026	30.74	16.89	8.22	0.30	0.66	0.01	0.35	0.01	41.81	225	9	1	20	ND
LD02-027	31.89	18.23	2.70	0.21	0.34	ND	0.24	ND	45.05	232	8	1	12	ND
LD02-028	32.27	18.84	1.32	0.12	0.28	ND	0.25	0.02	45.96	178	7	2	11	ND
LD02-029	31.41	19.00	1.72	0.13	0.44	ND	0.34	0.01	45.84	148	6	1	13	ND
Mean	30.39	19.85	2.13	0.22	0.35	0.0	0.269	0.01	45.66	110.0	12.1	2.0	25.3	0.07
Maximum	32.27	21.33	8.22	0.38	0.69	0.02	0.57	0.03	47.08	232	65	5	63	1.0
Minimum	28.61	16.89	0.44	0.11	0.05	ND	0.07	ND	41.81	47	4	ND	5	ND
Samples	28	28	28	28	28	28	28	28	28	28	28	28	28	28

APPENDIX 3

Chemical analyses of chip samples from the Catoche Formation dolostone in the Back Arm area (from Knight, 1991, and A. Howse, personal communication, 2001). Results presented in weight percent.

Sample No.	SiO_2	Al_2O_3	Fe total*	MgO	CaO	Na_2O	K_2O	MnO	L.O.I.**
9269	0.30	0.12	0.13	21.86	30.37	0.04	0.06	0.02	47.52
9271	0.57	0.19	0.14	21.71	30.06	0.03	0.08	0.02	47.24
9272	0.81	0.31	0.21	21.12	29.67	0.05	0.13	0.02	47.25
9273	0.91	0.19	0.13	21.52	29.95	0.04	0.09	0.01	46.93
9274	0.38	0.10	0.15	21.72	30.19	0.03	0.05	0.02	47.32
9275	0.62	0.13	0.12	21.57	29.83	0.03	0.07	0.01	47.21
9276	0.39	0.11	0.13	21.64	30.08	0.04	0.05	0.02	47.38
9277	3.41	0.24	0.17	21.95	29.20	0.04	0.11	0.02	45.71
K-82-60A	0.27	0.11	0.12	21.51	30.20	0.04	0.04	0.02	47.20
K-82-60B	0.71	0.19	0.14	21.61	30.03	0.05	0.09	0.02	46.88
K-82-122	1.01	0.24	0.14	21.50	29.31	0.03	0.14	0.02	46.58

* Total iron as Fe_2O_3 ** L.O.I. = Loss on ignition

APPENDIX 4

Chemistry of selected elements from dolostones of the Catoche Formation in the Back Arm area, Port au Choix.

Field Number	CaO wt. %	MgO wt. %	SiO_2 wt. %	Fe_2O_3 (tot) wt. %	Al_2O_3 wt. %	Na_2O wt. %	K_2O wt. %	P_2O_5 wt. %	L.O.I. wt. %	Sr ppm	Zn ppm	Pb ppm	Ba ppm	Au ppb
LD02-030	30.03	21.42	0.60	0.12	0.20	ND	0.16	0.02	47.04	27	23	ND	3	ND
LD02-031	29.91	21.00	0.85	0.14	0.28	ND	0.22	0.01	46.77	32	6	2	11	ND
LD02-032	29.84	21.01	0.75	0.12	0.28	0.05	0.17	ND	46.76	27	11	ND	5	ND
LD02-033	29.95	20.98	0.35	0.09	0.10	0.02	0.07	ND	47.12	25	5	ND	2	1
LD02-034	30.01	21.38	0.50	0.14	0.09	ND	0.11	ND	47.12	25	6	ND	2	ND
LD02-035	29.90	21.26	0.42	0.12	0.10	ND	0.10	0.01	47.09	25	8	1	2	ND
LD02-036	29.58	20.81	0.82	0.12	0.07	0.02	0.06	ND	47.20	24	7	1	2	ND
LD02-037	29.73	21.03	1.18	0.11	0.26	ND	0.22	0.01	46.40	28	5	ND	8	ND
LD02-038	29.38	21.04	0.94	0.16	0.24	ND	0.19	0.01	46.75	29	5	2	6	ND
LD02-039	29.82	21.07	0.41	0.18	0.15	ND	0.15	0.02	47.12	28	5	ND	3	ND
LD02-040	30.30	21.01	0.54	0.18	0.18	0.02	0.13	0.01	46.86	27	5	1	3	1
LD02-044	29.91	21.15	0.68	0.10	0.27	ND	0.21	0.02	47.23	27	5	ND	4	ND
LD02-045	30.17	20.99	0.38	0.17	0.15	ND	0.14	0.02	47.00	27	9	ND	2	ND
LD02-046	30.27	21.05	0.55	0.14	0.19	ND	0.17	0.01	46.76	39	4	ND	3	ND
LD02-047	30.34	20.85	0.77	0.16	0.27	ND	0.22	0.02	46.81	36	5	1	4	1
LD02-048	30.00	21.15	0.60	0.11	0.22	ND	0.17	0.01	46.82	28	5	ND	3	ND
LD02-049	30.45	21.66	0.26	0.08	0.07	ND	0.10	0.01	47.39	23	4	ND	2	ND
LD02-050	28.91	19.99	4.33	0.13	0.22	0.02	0.15	ND	44.57	28	4	ND	6	ND
LD02-068	30.13	21.38	0.87	0.18	0.16	ND	0.16	0.02	46.77	27	8	ND	4	ND
LD02-069	30.41	21.49	0.73	0.07	0.09	0.05	0.08	0.01	47.12	25	5	ND	3	1
LD02-070	30.48	22.01	0.30	0.11	0.10	ND	0.09	ND	47.25	26	6	ND	2	1
LD02-071	30.53	21.15	0.76	0.12	0.27	0.02	0.17	0.01	47.00	29	8	ND	5	ND
LD02-072	30.45	21.47	0.46	0.10	0.16	0.03	0.09	0.01	47.08	28	8	ND	3	ND
LD02-073	30.02	21.01	1.57	0.14	0.27	0.02	0.20	0.01	46.28	26	14	ND	7	ND
LD02-074	30.23	22.09	1.12	0.16	0.28	ND	0.24	ND	46.46	30	5	1	8	ND
LD02-075	30.52	22.34	0.20	0.09	0.07	ND	0.10	0.01	47.15	26	4	ND	2	ND
LD02-076	30.67	22.36	0.50	0.15	0.18	ND	0.15	0.01	46.95	27	8	ND	3	ND
LD02-077	29.75	21.41	2.17	0.20	0.20	ND	0.15	0.01	45.79	27	4	1	5	ND
LD02-078	30.34	21.42	0.94	0.14	0.23	0.02	0.12	ND	46.51	24	10	ND	6	ND
LD02-079	29.59	21.04	1.52	0.11	0.33	ND	0.21	ND	46.14	25	11	1	10	ND
LD02-080	30.08	21.28	0.65	0.09	0.15	0.02	0.07	ND	47.01	24	5	ND	2	1
LD02-081	30.11	21.51	0.86	0.11	0.19	0.01	0.11	ND	46.66	25	7	1	4	ND
LD02-082	29.87	21.34	0.63	0.09	0.08	0.01	0.04	ND	47.10	26	6	ND	2	ND
LD02-083	29.92	21.28	0.93	0.12	0.10	0.01	0.05	ND	46.74	25	6	1	3	ND
LD02-084	29.94	21.40	0.99	0.11	0.08	ND	0.05	ND	46.74	24	10	ND	2	ND
LD02-085	30.01	21.61	0.65	0.10	0.14	ND	0.09	ND	47.03	25	7	ND	4	ND
LD02-086	30.32	21.87	0.36	0.12	0.10	0.01	0.07	ND	47.08	28	2463	1	2	ND
LD02-087	29.96	21.21	1.13	0.12	0.30	0.02	0.20	ND	46.50	28	5	ND	9	ND
LD02-088	29.94	21.41	1.09	0.13	0.29	ND	0.21	ND	46.56	26	18	1	8	ND
LD02-089	30.01	21.40	0.87	0.12	0.21	0.01	0.15	ND	46.55	29	11	ND	5	ND
LD02-090	30.16	21.14	1.32	0.19	0.42	0.01	0.23	ND	46.24	32	13	1	6	ND
LD02-091	29.97	21.35	0.23	0.09	0.08	ND	0.06	ND	46.90	28	5	ND	2	ND
Mean	30.05	21.31	0.85	0.13	0.19	0.01	0.14	0.01	46.77	27.3	66.0	0.4	4.3	0.0
Maximum	30.67	22.36	4.33	0.20	0.42	0.05	0.24	0.0	47.39	39	2463	2	11	1
Minimum	28.91	19.99	0.20	0.07	0.07	ND	0.04	ND	44.57	23	4	ND	1.8	ND
Samples	42	42	42	42	42	42	42	42	42	42	42	42	42	42