

METALLOGENIC STUDY OF MID-ORDOVICIAN CHERTS AND SHALES OF CENTRAL NEWFOUNDLAND

by

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INTRODUCTION

In an effort to introduce new metallogenic concepts and encourage mineral exploration in areas that are presently neglected by the exploration industry, the Mineral Deposits Section initiated an assessment of the potential for sedimentary clastic-hosted metal sulphide deposits in the province. The 1981 program focused on the Mid-Ordovician (Caradocian) cherts and argillites of Central Newfoundland. These strata were deposited in a marine starved basin after the cessation of pre-Caradocian island arc activity. Massive banded sulphides are present in many sections and the stratigraphy and sedimentology of the area compares favourably to basins in which known sedimentary-type stratiform deposits occur.

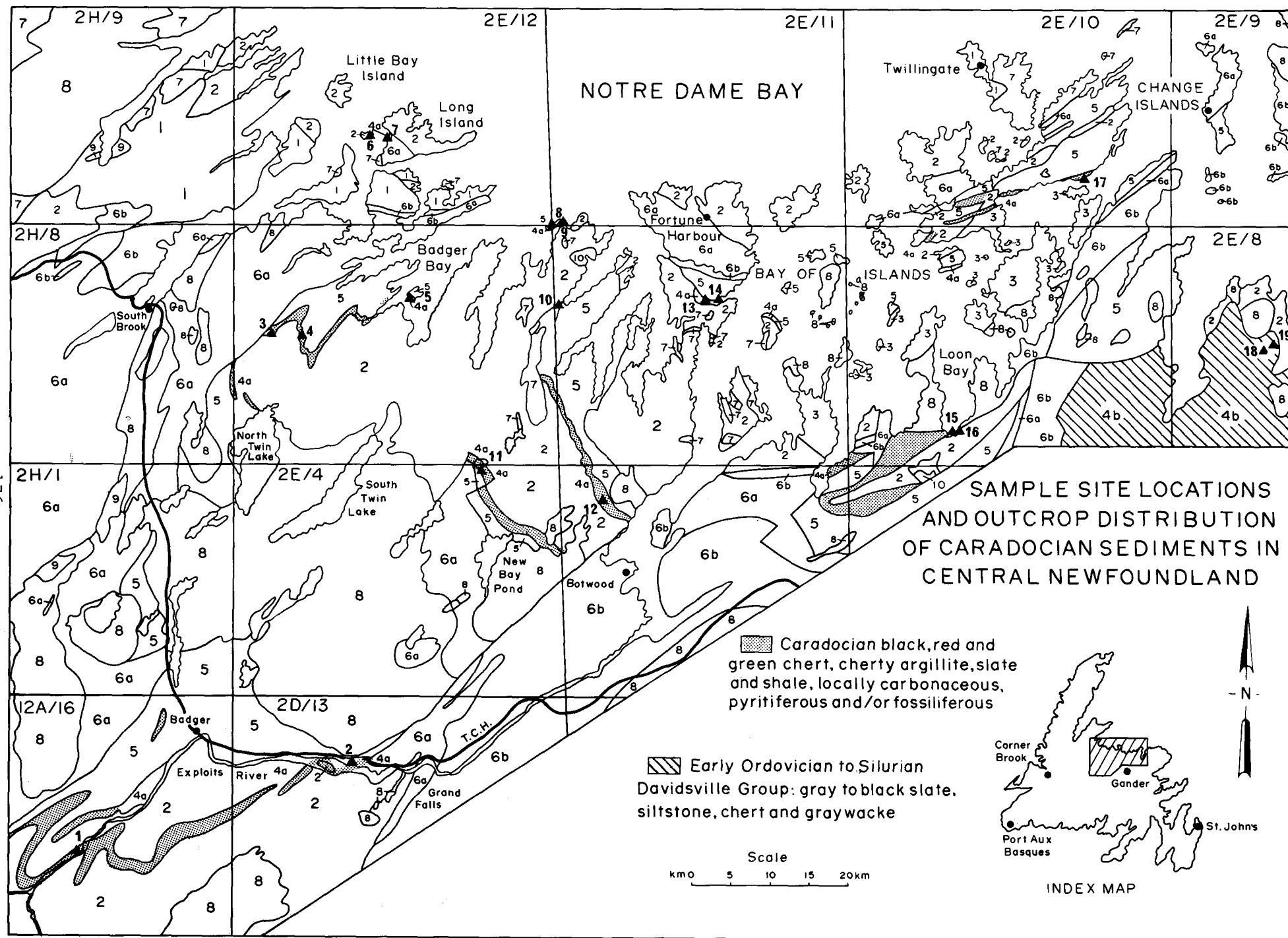
Twenty-four sections were mapped in detail and approximately 1,000 chip samples were collected from 1,500 m of strata. Sample intervals were 3 m in unmineralized sections, 1 m in mineralized sections, and continuous across massive banded sulphides. Sedimentological, structural and paleontological data were collected and rock data sheets were completed to allow entry of all data into computer files. The samples are being analyzed for Cu, Pb, Zn, Ag, Ba, Fe, Mn, C, Ni, Co, As, U and F, as well as major elements. Hopefully, geochemical trends will help delineate sub-basins of metal enrichment within the large Mid-Ordovician basin of Central Newfoundland.

GEOLOGY

The Caradocian cherts and shales are a widespread, distinct stratigraphic

assemblage representing a period of relative quiescence in the geological development of Central Newfoundland. An "immature" pre-Caradocian island arc sequence of alternating mafic pillow lavas and submarine volcanoclastic-sedimentary strata, subsided and was blanketed with Caradocian chert and shale (Dean, 1978). Initial widespread deposition of bedded, bioturbated chert indicates a quiet, clastic-poor marine environment. The chert is overlain by black carbonaceous graptolitic shales, commonly thinly interbedded with black chert. The stratigraphic thickness of the chert and shale varies from 10 m to 200 m, most probably reflecting the paleotopography of the large Mid-Ordovician basin. Conformably overlying flysch deposits were laid down initially in the west of the basin and progressed eastward during late Caradocian times (Dean, 1978). North of the major Lobster Cove - Chanceport Fault in western Notre Dame Bay, Caradocian argillites are conformably overlain by felsic volcanics.

The dominant lithologies of the Caradocian sediments are black, red, and green chert, cherty argillite, slate and shale, with thin to thick interbeds of tuff, graywacke and carbonate. The cherts and shales are particularly rich in banded massive sulphides, which are present in most sections. The lower chert intervals are often strongly manganiferous. The strata are typically steeply dipping and are undeformed to structurally complex. Dikes of various lithologies and ages intrude the chert and shale, some of which may represent 'feeders' to the overlying post-Caradocian volcanics of Central Newfoundland.



LEGEND

10. JURASSIC INTRUSIVES: Gabbros and lamprophyres.
9. CARBONIFEROUS: Conglomerate, sandstone, siltstone and shale.
8. DEVONIAN INTRUSIVES: Granitoids and gabbros.
7. ORDOVICIAN INTRUSIVES: Granitoids, gabbros and diabase sills.
6. POST-CARADOCIAN VOLCANIC ROCKS: 6a, Intermediate to basic pillow lava, breccias and flows; rhyolite and dacite flows; tuff, chert and graywacke; 6b, associated conglomerate, sandstone and siltstone.
5. POST-CARADOCIAN FLYSCH: Graded graywacke, conglomerate and sandstone.
4. CARADOCIAN ARGILLITES: Chert, argillite, shale + graywacke and tuffs. 4a, Shoal Arm Formation, Luscombe Point Formation, Dark Hole Formation, Lawrence Harbour shale and unnamed cherts and argillites of the Exploits Group; 4b, Davidsville cherts, argillites, shales and slates.
3. DUNNAGE MELANGE: Chaotically mixed argillite and pebbly mudstone with large blocks and boulders of volcanic rocks, gabbro graywacke, limestone, micaceous sandstone and granite.
2. PRE-CARADOCIAN ISLAND ARC ROCKS: Alternating mafic pillow lava units and submarine volcanoclastic-sedimentary units.
1. OCEANIC BASEMENT: Massive to pillow basalt, pillow breccia, aquagene tuff and chert, diabase dikes and gabbro.

SAMPLE SITE LOCATION KEY

<u>SITE NO.</u>	<u>SECTION NAME(S)</u>
1.	RED INDIAN FALLS CHERT AND SHALE
2.	RED CLIFF OVERPASS CHERT AND SHALE
3.	WELLS BROOK CHERT
4.	SOPS LAKE CHERT AND SHALE
5.	GULL ISLAND RED CHERT AND SHALE, BLACK CHERT AND SHALE, AND BIOTURBATED CHERT (3)
6.	OIL ISLAND SHALE AND LIMESTONE
7.	LUSH'S BIGHT CHERT AND SHALE
8.	CULL ISLAND BLACK SHALE
9.	LEADING TICKLES SOUTH SIDE RED CHERT AND SHALE
10.	MILL POND SHALE PIT
11.	CAREY LAKE CHERT
12.	CHARLES BROOK CHERT AND SHALE (2)
13.	LAWRENCE HARBOUR ROAD AND SHALE PIT (2)
14.	LAWRENCE HARBOUR SOUTH AND NORTH (2)
15.	LUSCOMBE POINT
16.	LOON BAY ROAD
17.	JOE WHITES COVE
18.	DAVIDSVILLE CHERT
19.	DAVIDSVILLE SHALE

METHODOLOGY

Stratigraphic mapping and sampling of the Caradocian cherts and shales was carried out at 24 well exposed coastal, road, and stream sections throughout Central Newfoundland. Mapping of the sections involved describing sedimentological and structural features, and the types, amount, and mode of visible mineralization. To help accurately date and correlate the strata, graptolites and microfossils were collected wherever possible.

The sections were chip sampled in 1 m and 3 m intervals, according to whether they were mineralized or unmineralized respectively. A mineralized section is defined as one which contains one or more intervals with an estimated 5% or greater sulphide mineralization. Continuous sampling was carried out across massive banded sulphides. The approximately 1000 samples that were collected from 1500 m of strata are being analysed for Cu, Pb, Zn, Ag, Ba, Fe, Mn, C, Ni, Co, As, U and F, as well as major elements. Interpretation will be based on these geochemical analyses, with help from thin and polished sections.

SECTION DESCRIPTIONS

1. RED INDIAN FALLS CHERT AND SHALE
SECTION - NTS 12A/16

This is a 124 m steeply dipping, north facing section on the west side of the rapids at Red Indian Falls on the Exploits River. It is approximately 18 km southwest of Badger, and a 1 km hike from Route 370, the Buchans highway. The base of the section is in fault contact with a broad northeast-southwest striking syncline and the top of the section is covered. The lower half consists of gray chert with minor shale and forms a resistant ridge that strikes northeast, perpendicular to the falls. Recessive black shale of the upper half is exposed below and to the west of the falls, and is present in a 6 m

fault-bound unit within the lower chert.

The thin bedded (3 to 30 cm) argillaceous chert and chert are generally bioturbated. Minor light to dark laminations are present and are associated with fine to medium grained graywacke in beds up to 75 cm thick. Discontinuous black shale horizons averaging 5 cm (but up to 1 m thick) are common. Several light coloured tuffaceous shale horizons were noted. Carbonate nodules, lenses and beds up to 5 cm thick are present throughout. There is a partially exposed, well rounded sphere of clastic carbonate (50 cm in diameter) that is very similar to those at the Lawrence Harbour North Section (14b).

The upper shale section is not as well exposed. Its base is in fault contact with very thinly bedded black carbonaceous chert and shale, which are tightly folded and faulted against the lower argillaceous chert. The shale is thickly laminated (5 - 10 mm), carbonaceous, very graptolitic, and heavily iron stained and/or sulphur stained. It contains rare carbonate lenses and rounded clasts up to 50 cm long, and interbeds of fine grained graywacke up to 1 m thick. The shale is mineralized with massive banded pyrite (1 - 4 cm thick), and disseminated pyrite and was sampled at 1 m intervals. The argillaceous chert contains less sulphide and was sampled at 3 m intervals.

2. RED CLIFF OVERPASS CHERT AND SHALE
SECTION - NTS 2D/13

On the south side of the Trans Canada Highway, adjacent to the Red Cliff overpass 8 km west of Grand Falls, is a structurally complex section of black chert and shale. The 41 m section was sampled from east to west. Both the top and bottom of the section are covered.

Thin regularly interbedded black chert and shale strike 010° - 175°

(average 145°) and dip generally to the west. They are carbonaceous, commonly graptolitic, and have an extremely blocky fracture. Iron staining and yellow to white sulphur staining is present on many horizons. Fine to medium grained, gray to brown sandstone interbeds are 5 - 100 cm thick, and usually iron stained. They are composed of feldspar, chert, volcanic fragments, and disseminated pyrite. These sandy beds often behave as competent units within the cores of folds. Thickly bedded to massive chert and argillaceous chert dominate the west end of the section where bedding is less pronounced. They contain massive bedded pyrite, and heavily disseminated and fracture-controlled pyrite. Banded pyrite 1 - 10 mm thick is present in some shaley intervals, and one horizon contains pyrite nodules 1/2 - 3 cm in diameter. The section is intruded by fine to medium crystalline, porphyritic intermediate dikes 1 - 3 m thick. Sampling was at 1 m intervals and 4 graptolite collections were taken.

3. WELLS BROOK SECTION - NTS 2E/5

Wells Brook flows southwest into the north shore of Kippens Pond, approximately 15 km southwest of Roberts Arm. The small 25 m section is poorly exposed 250 m upstream from the lake. The bottom and top of the section are covered. Thinly bedded argillaceous chert (maximum 30 cm) is gray, bioturbated and locally carbonaceous. There is extensive fracturing and moderate quartz veining with several intervals showing dense networks of 0.5 - 1.5 mm dark gray quartz veins which strike perpendicular to bedding. Disseminated pyrite and several finely crystalline masses of pyrite less than 1 cm across are present. The section was sampled in two parts at 1 m intervals.

4. SOPS LAKE ROAD SHALE AND CHERT SECTION - NTS 2E/5

Adjacent to the Sops Lake logging road, 4.5 km east of the Kippens Pond

Junction, is a 21 m exposure of black carbonaceous shale and chert. Bedding is not discernable in the lower half of the section and sampling was carried out perpendicular to cleavage which strikes 020° . The top and bottom of the section are covered.

Lenses of chert averaging 5 x 50 mm are squeezed parallel to cleavage in a sheared shale matrix. Quartz pods or lenses are similar in appearance and present in amounts up to 35%. The top part of the section, separated by a 12 m covered interval, is black graphitic shale with a platy parting (1 - 5 mm) and without chert or quartz lenses. Sampling was at 1 m intervals.

5a. GULL ISLAND RED CHERT AND SHALE SECTION - NTS 2E/5

Distinctly red and manganiferous chert and shale are exposed in a 55 m section on the southwest coast of Gull Island in Badger Bay. The section is in two parts separated by a 150 m interval of partially covered outcrop. The base is to the east at the low tide line. To the west, beyond the top of the section, folding and faulting accompanied by large quartz veins and pods, totally disrupts the bedding which outcrops to the southwest edge of the island. The east-northeast striking beds dip 50° - 60° to the north and have prominent cleavage which forms an angle of 60° - 70° with bedding. Folding is apparent between the two halves of the section.

Red argillaceous chert dominates the lower half of the section and is locally cherty or shaley. The thin beds (5 - 25 cm thick) contain dark wavy, discontinuous lenses or laminations, and noncalcareous manganese stained nodules 2 - 5 mm in diameter. Pyrolusite is common on fracture planes and manganese staining is locally very strong, colouring entire horizons silver-gray. Gray-green to white carbonate horizons range from 1 - 15 cm thick (average 3 cm) and the thinner ones are usually stained with manganese. Green to white

tuffaceous horizons are very similar in appearance except for their distinctly strong cleavage. The upper half of the section is gently folded and displays similar lithologies. Tuffaceous, silty and sandy horizons are more common and manganese staining is slightly heavier. The entire section was sampled at 1 m intervals

5b. GULL ISLAND BLACK SHALE AND CHERT SECTION - NTS 2E/5

Black shale and chert on the south coast of Gull Island are very deformed and cleavage is a much stronger fabric than bedding. The 5 - 10 m cliffs were sampled for 75 m, working west to east along the shoreline. There is a large 75 - 100 m break in the middle of the section to avoid resampling strata on the opposite side of a small point. Bedding, for the most part, is vertical and tight local folds and faults may repeat, or omit, parts of the stratigraphic section.

Black to gray carbonaceous or argillaceous chert, and shale are typically very thinly bedded. The chert often appears lensoid and discontinuous in a sheared shale matrix. Iron staining and sulphur staining are common and minor pyrite is disseminated or banded in some intervals. The top 4 intervals of shale and chert are not as badly deformed and graptolites were collected from them. Sampling was at 3 m intervals in this section.

5c. GULL ISLAND BIOTURBATED CHERT AND SHALE - NTS 2E/5

Bioturbated greenish gray argillaceous chert and shale are exposed to the east of the Black Chert and Shale Section (5b), and separated by 150 m of gravel beach. The 36 m northeast striking section is thinly to thickly bedded (maximum 75 cm) and dips 65° to the northwest. The base of the section is covered and to the east, the top ends in the conspicuous core of an anticline, outlined by strong concordant quartz

veining. Cleavage is strong in the more shaley units adjacent to the anticline. Minor manganese staining and several carbonate nodules and lenses were noted. No sulphides were observed in this section and sampling was at 3 m intervals.

6. OIL ISLAND SHALE AND LIMESTONE SECTION - NTS 2E/12

On the northeast corner of the Oil Islands, directly west of Lushs Bight, a 48 m section of calcareous shale and clastic limestone of the Parsons Point Formation is conformably overlain by felsic volcanics of the Long Tickle Formation. This shale has been correlated with other Caradocian shales around Notre Dame Bay (Dean, 1978), and represents the one known visible conformable upper contact with post-Caradocian volcanic rocks. The base of the Oil Island section is covered.

At the exposed base, on the northeast edge of a wave-cut bench, are thinly bedded (maximum 10 cm) calcareous shale and minor chert. They are folded and irregularly interbedded with medium to coarse grained clastic limestone which contains cobbles up to 15 cm in diameter. This is partially eroded by a 10-15 m thick massive unit of fine to coarse grained limestone containing blocks of shale up to 50 cm across. The remainder of the section is gray calcareous shale and limestone breccia which are massive to thinly interbedded. Pyrite is present in most intervals, usually in fine to coarse disseminations but also as euhedral crystals (1 - 3 mm) on fracture planes. Sampling was at 3 m intervals in this section.

7. LUSH'S BIGHT CHERT AND SHALE SECTION - NTS 2E/12

On the west side of Long Island at Lush's Bight, Caradocian argillaceous chert and shale of the Parsons Point Formation are exposed in 6 - 10 m cliffs and on a wave-cut bench on the south side of the harbour. The base of the 9 m

section is covered, and the top is capped by a 2 m porphyritic dacite sill. The Parsons Point Formation is overlain by the Long Tickle volcanics on the Oil Islands (Dean, 1978), but the contact is not exposed here.

Very thinly interbedded argillaceous chert and shale are 1 - 4 cm thick and less than 5 mm thick, respectively. Several 1 - 2 cm thick sandy interbeds, and 4 gray calcareous nodules up to 15 cm across were noted. Fracturing is moderate and carbonate veining is common. Disseminated pyrite is only minor in the small section and sampling was at 3 m intervals.

8. CULL ISLAND BLACK SHALE SECTION - NTS 2E/11

The section is on the south shore of Cull Island, 500 m west of the Leading Ticks causeway. It is a cliff exposure of steeply dipping to vertical black shale and chert. The top and bottom of the 102 m section are covered, as is a 5 m saddle-shaped depression that continues well back from the shoreline and may represent a large fault. Several small faults are evident and a gently dipping, very continuous 1 1/2 m lamprophyre dike cuts across half of the section. The dike has a heavy yellow sulphur precipitate along its edges.

At the base of the section, 18 m of steeply north-dipping bioturbated gray chert and interbedded green tuffaceous shale are faulted against the black carbonaceous shale and chert. The latter are very thinly interbedded, but fracturing and shearing often obliterate bedding. The chert is commonly sheared into pods or lenses up to 40 cm long. The thickly laminated shale is iron stained and often coated with a yellow sulphur precipitate. Disseminated pyrite is present in the chert and one graptolite locality was noted. The sampling was at 3 m intervals.

9. LEADING TICKLES SOUTH SIDE RED CHERT AND SHALE SECTION - NTS 2E/11

This coastal cliff exposure is located east of the south side of the Leading Ticks causeway and continues southeast around the point. The 102 m section consists of upright red and green chert and cherty shale which strike east-northeast. The section is repeated south of the base by folding and faulting. There are tight local folds within the section and much small and large scale faulting. The top of the section is adjacent to the tickle.

Argillaceous chert and cherty shale are in beds averaging 10 - 20 cm thick, with regularly spaced shale laminations up to 1 cm thick. Coarse to fine grained tuffaceous graywacke beds and lenses up to 40 cm thick appear throughout the section. Manganese staining is common and probably derived from the thin carbonate lenses and nodules which are similar in appearance to those at the Luscombe Point Section (15). Sampling was at 3 m intervals and pyrite was observed in two of these.

10. MILL POND SHALE PIT - NTS 2E/6

The 102 m section is in the base of a roadfill shale pit on the east side of Route 350, approximately 16 km north of Point Leamington. Bedding is quite irregular due to the extreme shearing of the very thinly bedded black carbonaceous shale. Three non-parallel 30 m sections were sampled at 3 m intervals across the pit floor. Discontinuous quartz lenses and pods added to the difficulty in sampling the mechanically smoothed surfaces. Disseminated pyrite is common and banded pyrite was observed in the float.

11. CAREY LAKE CHERT SECTION - NTS 2E/5

Carey Lake is 6 to 7 km northeast of Frozen Ocean Lake, downstream along West Arm Brook. The 168 m section is on the southeast side of the lake, and the base is approximately 55°35'0" west

longitude, 49°15'14" north latitude (UTM 603100E and 545660N). It is accessible by logging roads leading north of the Trans Canada Highway to the New Bay Pond area. The base of the section conformably overlies interbedded volcanic flows and chert of the Wild Bight Group. The top of the section is covered, and over 100 m of section in between are covered. The strata are south facing, steeply south dipping, and generally strike 120°.

Red and gray tuffs, mudstones, siltstones and graywacke at the base grade quickly into red and green chert. The chert is thinly bedded to massive and may be intercalated with shale averaging 5 mm in thickness. The upper third of the section is white weathering gray chert that is strongly bioturbated, and still contains shale laminations, many of which are tuffaceous. Moderate manganese staining is present through much of the section and there is disseminated pyrite in several of the 3 m intervals.

12a. CHARLES BROOK SHALE SECTION - NTS
2E/3

Low outcrop is visible discontinuously for 150 m on the west side of Route 350 just north of Charles Brook, approximately 5 km north of Northern Arm. Exposure is poor and rubbly with bedding often parallel to the road. Both ends of the outcrop are covered. The small 5 m section is at the north end of the exposure and consists of gray to black laminated shale which is somewhat carbonaceous, and interbedded with gray medium grained sandstone units 4 - 20 cm thick. Sulphide mineralization is limited to a few 1 - 3 mm bands and disseminations of pyrite. Several species of graptolites were collected from the shale in one of the two sample intervals.

12b. CHARLES BROOK CHERT SECTION - NTS
2E/3

This road exposure is on the east

side of Route 350, 1/2 km north of Charles Brook. Bedding is 135/85 northeast throughout the 60 m section. White weathering gray and black banded chert, in beds average 25 cm thick, is intercalated with laminations of black shale or argillaceous chert up to 1 cm thick. Bioturbation is conspicuous through most of the section with black 'burrow-like' features stretching up to 4 or 5 cm across bedding, but appearing more regularly as 1 - 2 cm wide irregular lenses. Mineralization consists of minor disseminated pyrite and pyrrhotite. The chert was sampled in 3 m intervals.

13a. LAWRENCE HARBOUR ROAD SECTION - NTS
2E/6

On the northeast side of Route 352, about 9 1/2 km south of Cottrells Cove, is a 36 m roadcut section of light to dark green bioturbated chert. The south facing sequence strikes 100° and dips very steeply towards the north end where it conformably overlies small pillowed lavas. The chert beds average 25 cm in thickness and contain fine discontinuous light and dark wavy laminations. There are several thin interbeds of green tuffaceous shale and sandstone. Manganese staining is intermittent and veining is essentially absent. Sulphides were not observed in any of the 3 m intervals.

13b. LAWRENCE HARBOUR SHALE PIT SECTION
- NTS 2E/6

The 22 m shale section is located in the south end of a shale pit on the east side of Route 352, 1/2 km north of the Lawrence Harbour Road Section (13a). The base of the section is covered and beyond the top, the strata are deformed, fractured and heavily veined with quartz. Throughout the section, bedding is a consistent 075° with a vertical dip.

Uniformly black, carbonaceous, graptolitic chert and shale average 3 cm and 1 cm thick, respectively. The shale

has a platy parting (1 - 5 mm), iron staining, and is regularly interbedded with the chert. The black chert is often argillaceous and contains disseminated pyrite. Massive banded pyrite up to 1/2 cm thick, and pyrite nodules (1 - 2 cm across) are present in one interval. Sampling was at 1 m intervals, and graptolites were collected in two of these.

14a. LAWRENCE HARBOUR SOUTH SECTION -
NTS 2E/6

Lawrence Harbour is halfway up the east side of the Fortune Harbour Peninsula and it is accessible by a logging road from the Lawrence Harbour Shale Pit Section (13b). The 52 m section is exposed on a northeast facing cliff and includes several intervals on a wave-cut bench accessible only at low tide. The strata are generally north to northeast facing and dip steeply to the south. Underlying volcanic flows are present 15 m south of the base, across a covered interval. Several folds, faults and covered intervals break the continuity of the section, the top of which is covered.

The lower 10 intervals are light gray laminated and bioturbated chert and shale which contain interbeds of tuffaceous shale and graywacke. There are carbonate nodules and 75 cm long carbonate lenses (up to 3 cm thick) which are slightly stained with manganese. The lower beds grade up into black chert, argillaceous chert, and graptolitic shale. The chert is in beds 1 - 4 cm thick, often squeezed into lenses with long pointed terminations. The black carbonaceous shale averages 1 cm in thickness (maximum 8 cm) and is iron stained. Pyrite lenses (up to 30 cm long) are present in 5 intervals and disseminated pyrite was noted in half of the 1 m intervals. One graptolite locality was sampled and 12 others noted.

14b. LAWRENCE HARBOUR NORTH SECTION -
NTS 2E/6

On the north shore of Lawrence Harbour are sets of broad folds and parasitic folds on a wave-cut bench which is exposed at low tide. The base of the section is at the core of a syncline which plunges very steeply to the south-southwest and the top of the 30 m section is covered. The northwest limb of the fold was sampled at 3 m intervals.

Black weathering, gray to brown, laminated (possibly graded), silty shale occurs in beds up to 25 cm thick. Cleavage is moderate and fracturing slight, despite the degree of folding. Disseminated pyrite was observed in one interval and graptolites in two others. Several horizons contain rounded to elongated limestone spheres up to 2 m in diameter. They are light to medium brown with fine clastic laminations emphasized by differential weathering. The spheres are usually coated with sheared carbonaceous and calcareous mudshale, possibly indicating transport down a paleoslope into the basin.

15. LUSCOMBE POINT SECTION - NTS 2E/7

Thinly to thickly bedded chert, argillaceous chert and shale of the Luscombe Point Formation conformably overlie the pre-Caradocian Loon Harbour volcanics at Luscombe Point in Loon Harbour. The contact is gradational over 10 - 12 m with interbedded light gray chert and gray to green volcanoclastics containing chert fragments up to 5 cm across. The last appearance of the volcanoclastics marks the base of the Luscombe Point section. There are 125 m of strata exposed in the continuous coastal section. It is the best exposed section of Caradocian chert and shale that was sampled. The top of the Luscombe Point Formation is not exposed at this locality.

Dark gray to black chert and argillaceous chert dominate the section. Thin dark coloured laminations are common and bioturbation is present in 10 - 15% of the intervals. Intercalations up to 2 cm thick of light yellowish brown to white, very thinly laminated chert + carbonate, are conspicuous throughout the lower half of the section. The irregularly spaced bands thicken and thin along strike, often in sinuous fashion, and may envelope ellipsoid nodules and lenses which have carbonate cores. These typically weather out leaving black coated cavities. As many as 10 - 15% of the bands are pink and manganiferous, composed of rhodonite and rhodochrosite (Kay, 1975). The upper half of the section contains sets of closely spaced 1/2 - 1 cm resistant white chert laminations which are laterally discontinuous.

Black shale appears as partings or beds up to 8 cm thick (average 1 - 2 cm). They are usually rhythmic in occurrence between thicker argillaceous chert. Rounded to rectangular recrystallized carbonate blocks (up to 20 x 40 cm) are present in the upper shale beds. Several well cleaved green shale horizons, which appear to be tuffaceous, occur in beds up to 17 cm thick, but average 2 - 3 cm. Pyrrhotite + pyrite is disseminated through 80 - 90% of the section. Manganese staining is moderate and there are several groupings of magnetite bands with maximum thickness 1.5 cm. All strata were sampled at 1 m intervals.

16. LOON BAY ROAD SECTION - NTS 2E/7

The section consists of both sides of an extensive roadcut on Route 340, 1.5 km north of the turnoff for Luscombe Point, on the east side of Loon Bay. Chert and argillaceous chert are exposed on cliffs up to 10 m high. The 44 m section on the west side begins 30 m north of the south end at the core of an anticline which plunges 40° to the northeast. The north end is covered. The east section begins 20 m from the south

end where the strata correlate with the top of the west section with a 5 - 10 m overlap. The east section is 113 m, not including two large covered intervals and 3 dikes, 1 - 4 m thick. The top is covered but several small exposures are present north along the road. The Loon Bay Batholith is exposed less than 2 km north of the top of the section. This section is thought to be approximately continuous with the top of the Luscombe Point Section (15). It contains the best exposures of sulphide mineralization of all sections sampled.

The west side consists of thinly to thickly bedded gray chert and argillaceous chert, commonly with sets of resistant white laminations up to 1 cm thick. The chert contains disseminated pyrrhotite and pyrite throughout and is stained with manganese. Upper intervals on the west side display massive well banded pyrrhotite and pyrite + magnetite, across intervals 10 - 40 cm thick.

The east side of the road section begins with similar thinly to thickly bedded chert intercalated with shaley 1 cm bands or thinner partings which occur regularly spaced up to 20 cm apart. These shaley bands are slightly metamorphosed with white mica present on bedding surfaces. Pyrrhotite is often preferentially located in these horizons and also occurs with or without pyrite throughout the east side. There are several tight local folds and faults in the upper half of this side.

Massive banded pyrrhotite and pyrite + magnetite occur throughout a dozen or more intervals on the east side, mostly in the lower half. The bands vary in size from several mm to several cm and are often closely spaced through entire 1 m intervals. Blebs of chalcopyrite up to 5 mm across were present in 2 intervals. Iron and manganese staining is extremely abundant in the sulphide intervals, completely masking the banded nature of the sulphides on weathered surfaces.

Sampling was at 1 m intervals, and 38 of these were selectively resampled at intervals less than 1 m.

17. JOE WHITES COVE - NTS 2E/10

This faulted and folded section is exposed in 5 - 10 m cliffs on the south side of Joe Whites Cove. The cove is on the north coast of Dildo Run, 5 or 6 km northwest of Virgin Arm. The base of the section is on a point at the east end of the cove. Similar rocks are exposed on a wave-cut bench to the east of the point but are structurally repeated strata from the section. The top of the 78 m section is covered at the west end of the cove. Slightly metamorphosed Sansom graywacke is exposed to the north of this covered interval.

Bioturbated gray chert forms the resistant north limb of an anticline which plunges very steeply to the west. The beds are 10 - 25 cm thick with 1 - 2 cm black bands that are increasingly bioturbated to the west. In the nose of the anticline are recrystallized limestone blocks (maximum size 20 x 50 cm). The chert grades west into cherty shale with interbeds of fine to medium grained graywacke. Black carbonaceous, graptolitic shale is exposed at the west end of the cove. It occurs in beds 1 - 3 cm thick, and is extensively sheared and faulted. The shale is coated with a yellow sulphur precipitate and contains disseminated pyrite. Sampling was at 3 m intervals and 2 graptolite localities were sampled.

18. DAVIDSVILLE CHERT SECTION - NTS 2E/8

The section encompasses both sides of a 150 - 200 m roadcut approximately 6 km southwest of Carmanville on Route 330. Bedding is perpendicular to the road, averaging 160/65 east, but the strike folds around to the east at the east end of the south side. The section is within 750 m of the Frederickton Pluton (Currie *et al.*, 1981) and both top and bottom are covered.

Black to gray argillaceous chert (argillite?) occurs in beds up to 1 m thick (averaging 30 cm). Intercalations of shale (1 - 3 cm) are present at regular intervals, but do not always control parting. Coarse metamorphic muscovite (1 - 3 mm) is present on many bedding planes. Quartz veining is slight to heavy, in 1 - 4 mm discordant veins and thicker recrystallized pods. Fine to coarse pyrite appears on fracture and bedding planes, and in lenses up to 10 cm in length and 3 cm across. Pyritized graptolites were noted in one interval. Pyrrhotite is less common, and chalcopryrite is present within 1 or 2 small sulphide aggregations. Sampling was at 1 m intervals in this section.

19. DAVIDSVILLE SHALE SECTION - NTS 2E/8

The section is at the south edge of a shale pit on the south side of Route 330, approximately 4.5 km southwest of Carmanville. The 36 m shale section is vertically dipping and strikes 035°. Exposure is rubbly and limited. The shale is black and gray, commonly carbonaceous and in laminations and beds 1 mm to 4 cm thick. Iron staining is common, sulphur staining less common, and slight to moderate quartz veining is present. Graptolites were collected from one interval and noted in the rubble at the northwest side of the shale pit. The shale is mineralized throughout with pyrite + pyrrhotite. The sulphides are usually disseminated but also occur on fractures and in laminations less than 1 cm and lenses up to 4 cm thick. The section was sampled in 1 m intervals.

MINERAL POTENTIAL

The detailed field studies of twenty-four sections of Caradocian cherts and shales substantiated the original hypothesis by Dean (1977) that these strata were deposited in a marine starved basin. The presence of massive banded sulphides in several sections indicate that conditions necessary for

sulphide precipitation existed at various times in various localities in sub-basins, within the major oceanic basin. Preliminary geochemical analyses from several sections indicate considerable relief in contents of Mn, Ba and base metals within the cherts and shales. Careful analysis of the complete geochemical data will hopefully indicate horizons or sub-basins of metal enriched strata and lead to further detailed exploration in these areas.

The raw geochemical data together with stratigraphic sections will be placed on open file after all the analyses are complete.

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