GEOLOGY OF THE NIPPERS HARBOUR MAP-SHEET (2 E/13)*

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Introduction

During 1974, the project was confined to a re-mapping and metallogenic evaluation of the Nipper's Harbour map sheet, Burlington Peninsula. Most of the work was confined to the area south and east of the Cape Brule Porphyry (unit 10, fig. 1).

The area was included in maps by Baird (1951) and Neale (1958). More recent work by Church (1969), Dewey and Bird (1971), Kennedy (1973) and others has, however, thrown into dispute the ages of the rocks and their tectonic history. Before any metallogenic assessment of the area could be made, it was necessary that questions regarding the age, structure and chemistry of the rocks be resolved. Accordingly, we directed most of our efforts to mapping the area, and supplemented our work by radiometric age-dating studies (in cooperation with K. Bell and J. Blenkinsop of Carleton University) and a rock-geochemistry survey.

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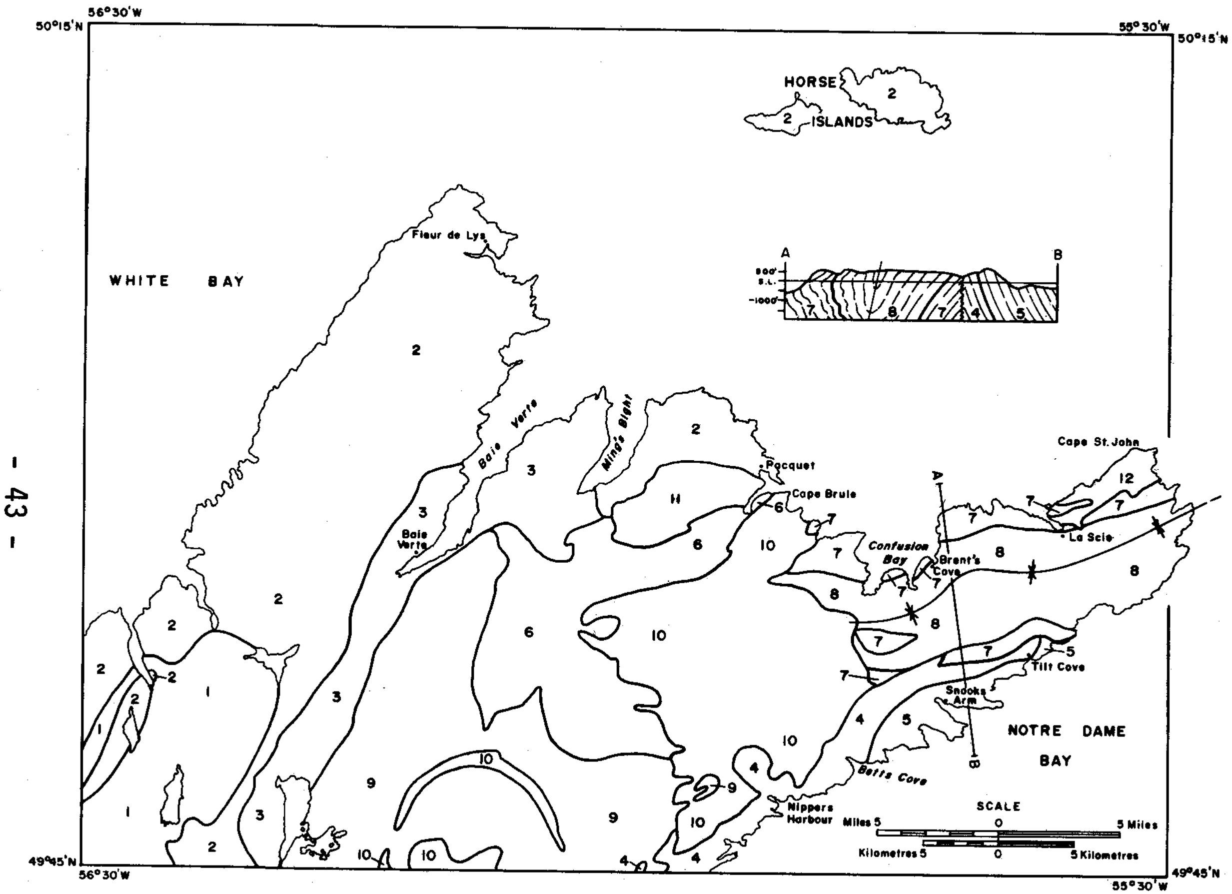

LEGEND

CARBONIFEROUS AND OLDER

12	La Scie Intrusive Complex: gabbro, granite

LOWER SILURIAN AND OLDER

11	Dunamagon Granite
10	Cape Brule Porphyry
9	Burlington Granodiorite
7 8	Cape St. John Group: 7 - predominantly basic to intermediate flows and tuffs, interbedded with sediments and quartz-feldspar crystal tuffs near Tilt Cove; 8 - predominantly acid flows and tuffs
6	Pacquet Harbour Group: basic to acid volcanics

LOWER ORDOVICIAN

5	Snooks Arm Group: predominantly intermediate volcanics and minor sediments
4	Snooks Arm Group: Betts Cove and Nippers Harbour ophiolites
3	Baie Verte Group: ophiolite and overlying sediments and volcanics

EOCAMBRIAN

2	Fleur de Lys Supergroup: predominantly psammites and semi-pelites, metaconglomerate at base

PRECAMBRIAN

1	Remobilized basement to Fleur de Lys Supergroup

SYMBOLS

axial plane trace of F_2 fold

Geological sketch map of Burlington Peninsula, showing regional setting of Cape St. John Group and related intrusive rocks.

Principal Results

1. Lithology and Age of the Cape St. John Group and Related Rocks.

Rocks presumed to belong to the Cape St. John Group rest in observed unconformity on ophiolites northwest of Nippers Harbour. At Beaver Cove, rocks of the basal part of the Cape St. John Group rest disconformably on volcanics of the Snooks Arm Group, which is Lower Ordovician in age on the basis of fossil graptolites (Snelgrove, 1931). There is considerable scouring of the underlying beds at the contact resulting in local angular discordances between the units.

Coarse calcareous sandstone units near the base of the Cape St. John Group contain conglomerates in places. The sandstones are light to purple-grey and thin-bedded, and show large scale cross-bedding. Paleocurrent directions on the sandstones are generally from north to south. The sandstones contain clasts of quartz, feldspar, green and red ultramafic rocks, rhyolite and chromite with lesser amounts of carbonate and chlorite. The conglomeratic beds occur sporadically throughout the unit and consist essentially of the same rock fragments in a sandy matrix. Conglomerate beds near the basal disconformity contain rounded boulders of volcanics resembling those of the Snooks Arm Group, red ultramafic fragments, rhyolite, chert and minor quartz in a mixed sandy and andesitic sediment matrix. Basic volcanic flows which are interbedded with these sediments are dark-green, and highly vesicular and amygdaloidal; they are commonly oxidized to a maroon colour.

Basic volcanic rocks (fig. 1, unit 7) in the north part of the Cape St. John outcrop area are probably in part correlative with rocks of the Pacquet Harbour Group (6).

Acid volcanic rocks (8) of the Cape St. John Group exhibit a complex volcanic stratigraphy and are mostly subaerial lapilli tuffs, ash-flow tuffs and welded crystal tuffs. Flow-banded rhyolite and trachyte flows are common, and are pink to maroon in colour, aphanitic, and commonly feldspar porphyritic.

The Cape St. John Group is probably Lower Silurian in age on the basis of field relations and regional considerations. An attempt at obtaining a whole-rock Rb/Sr age date for the Cape St. John gave ambiguous results (Bell and Blenkinsop, 1975, pers. comm.).

The "Burlington Granodiorite" (9) is a medium to coarse-grained complex pluton in which massive hornblende and biotite granite, granodiorite and quartz diorite have all been recognized. The intrusion is probably gnetically related to the Cape Brule Porphyry (10) and, ultimately, to the Cape St. John Group. It is uppermost Ordovician in age on the basis of a Rb/Sr age-date on biotite of 440 m.y. (I. Pringle, 1974, pers. comm.).

The Cape Brule quartz-feldspar Porphyry is a very high-level complex pluton which intrudes both the Burlington Granodiorite, the Cape St. John Group and the Nippers Harbour Groups. It contains abundant inclusions of ultramafic rocks and of coarse and fine-grained mafic rocks, presumed to have been derived from an ophiolite. The inclusions vary in size from pebbles to very large boulders (which may in fact be roof pendants) and show varying degrees of metasomatism by the enclosing porphyry. The finer-grained phases of the porphyry are very similar in appearance to silicic rocks (8) of the Cape St. John Group, and much of the Cape St. John is considered to be the extrusive equivalent of the porphyry. I. Pringle (1974, pers. comm.) has reported a whole-rock Rb/Sr isochron age-date of 430 m.y. for the Cape Brule Porphyry. Bell and Blenkinsop (1975, pers. comm.) have reported a date of 325 $\pm$ 14 m.y. for the porphyry.

Intrusive rocks of unit 12 belong to a single intrusive complex. The Reddits Cove gabbro, exposed in the north part of the complex, is a fine to medium-grained equigranular intrusion in which igneous layering is present in places as 1-5 cm. alternate mafic and feldspar-rich bands. The Seal Island Bight Syenite in the west part of the complex is fine-to-medium-grained, very homogeneous, and riebeckite-bearing. It is Carboniferous in age (315 $\pm$ 25 m.y.) on the basis of a whole-rock Rb/Sr age-date (Bell and Blenkinsop, 1975, pers. comm.). The La Scie Granite is a heterogeneous fine-to-medium-grained pink biotite and hornblende granite which is feldspar porphyritic in places and which intrudes the Seal Island Bight Granite. It is in turn intruded by massive quartz veins, the youngest rocks in the map-area.

2. Structure and Metamorphism of the Cape St. John Group and Closely Related Rocks.

The earliest structure in the Cape St. John Group is an inhomogeneously developed, bedding plane schistosity (S_1) which was recognized only in a few places where it is transposed by S_2, the regionally developed fabric. Field relations give no indication as to whether S_1 predates or postdates the emplacement of the intrusive rocks in the area. Both the Cape Brule Porphyry and the La Scie Intrusive Complex were, however, affected by two subsequent deformations. The major structure is a tight upright syncline (F_2) with a penetrative axial planar mineral orientation schistosity (S_2). Asymmetrical F_2 minor folds were noted in several places and, together with stratigraphic tops determinations and the regional distribution of Cape St. John rock units, served to define the axial plane trace of the major fold. The major F_2 structure was in turn inhomogeneously deformed by vertical shortening with an associated mineral-orientation and fracture-cleavage fabric (S_3). Thus, in the north part of the map-area, the beds are deformed into south-facing recumbent folds. These, however, are simply the deformed northern limb of an earlier upward-facing syncline. S_3 gradually dies out to the south and is generally not seen south of the La Scie Highway. The related southward facing folds (F_3) have amplitudes of up to 600 m. near Brents Cove Head and perhaps a meter near Brents Cove. F_3 is a flat-lying crenulation of S_2 in places further south.

North of Brents Cove and on the west side of Confusion Bay, MS_2, MP_2 and

MS_3 acicular hornblende crystals in mafic volcanics define a L-S fabric with the L-component aligned roughly perpendicular to the F_2 and F_3 fold axes.

All of the rocks in the map-area are metamorphosed. Basic volcanic rocks are generally altered to greenschist or subgreenschist facies in the south, with the grade increasing to amphibolite and garnet-amphibolite facies to the north where S_3 is more evident. Acid pyroclastic rocks of the Cape St. John Group are generally slightly altered to quartz-sericite schists, with the extent of metamorphism increasing to the north. In most places, however, recrystallization has been slight, and original features in the rocks are readily discernable.

Minor metamorphism accompanying deformation is evident around the margins of the La Scie Intrusive Complex and is rare towards the center. The Cape Brule Porphyry shows progressively more intense metamorphism to the north, as is the case with acid rocks of the Cape St. John Group.

3. Economic Geology of the Cape St. John Group and Related Rocks.

In the Cape St. John Group, small pyrite occurrences seem to be confined for the most part to acid pyroclastic rocks of unit 8 where they are closely interbedded with mafic volcanic rocks of unit 7. Traces of pyrite are ubiquitous in volcaniclastic rocks of unit 8, and it is perhaps to be expected that these sulphides would tend to be disseminated rather than highly localized in the subaerial environment of deposition. Parts of the Cape St. John Group may be submarine in origin, however, and the probable correlation of parts of the Cape St. John Group with the Pacquet Harbour Group of proven economic potential (Rambler Mines and Ming Mine) should encourage continued interest in the economic possibilities of the rocks.

Small cross-fibre chrysotile asbestos deposits are present in xenoliths of ultramafic rock in the Cape Brule Porphyry northwest of Nippers Harbour. These probably have no great economic potential.

The Reddits Cove Gabbro of the La Scie Intrusive Complex (12) contains up to 6% TiO_2 in thickly-disseminated ilmenite making it of some economic interest. Quartz veins intruding the granite near La Scie average over 98.5% SiO_2 (Butler, this volume).

The results of lake and stream sediment geochemistry studies on the Burlington Peninsula (Davenport and others, this volume) may generate further interest in the economic potential of the area.

Future Plans

The results of field mapping will be issued as a preliminary map with marginal notes early in 1975. Further structural and stratigraphic data will be published separately at the earliest opportunity. The "Nippers Harbour Map Sheet" will be completed in the 1975 field season, and work will be extended to the west into the Pacquet Harbour Group.

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