A NEW PROVISIONAL GEOLOGICAL MAP OF THE ISLAND OF NEWFOUNDLAND

by

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Introduction

Since Jukes first undertook a geological survey of Newfoundland in 1839, the major objective of the Newfoundland Department of Mines and Energy has remained ".... to know what are the different earthy or mineral masses of which the country is composed, and what are their relative and actual positions" (Jukes, 1842a). A new 1:500,000 scale geological map of the island of Newfoundland, compiled during the first half of 1983, represents the most recent stage in the fulfillment of this objective.

The new map was compiled mainly to serve as a base map for a forthcoming metallogenic map of the island. However, it has been printed in color at 1:1,000,000 scale and placed on open file to serve as a provisional new geological map of the island (Hibbard, 1983). The long range prospect for the map includes revision by the Newfoundland Mapping Section over the next few years and, hopefully, publication at 1:500,000 scale.

More than fifteen years of intensive geological mapping have been undertaken since the last map of the island of Newfoundland was produced. Most of the new mapping has been done by government surveys. During the 1960's and early 1970's, the task was largely the responsibility of the Geological Survey of Canada, but since the mid-1970's, a revitalized Newfoundland Department of Mines and Energy has developed an extensive 1:50,000 scale mapping program on the island. This mapping has largely been the result of agreements jointly funded by the governments of Newfoundland and Canada, and some of it has been done jointly with the Geological Survey of Canada. In addition, the results of work by industry and academia have been used in the compilation of the new map. Government-financed mapping of the island is continuing, so this new map will be progressively updated.

History

The new map is heir to a succession of geological maps of the island that date back to 1842 (Jukes, 1842b). Baird (1954a) summarized more than one hundred years of development of Newfoundland mapping when he published a geological map of the island (Baird, 1954b); his review included short discussions of a geological map of the island by Howley (circa 1905), a sketch map of the island by Snelgrove (1937), and an unpublished map by E.R. Rose (circa 1947), as well as a description of his own map. The present map is a direct descendant of Williams' 1967 map, which succeeded Baird's contribution.

The New Map

This new map of Newfoundland partly reflects its predecessors, yet has features that give it a distinctive character. Its close relationship to Williams' 1967 map is most apparent in the overall layout of the legend. The legends of both are divided into three major parts, including western, central and eastern Newfoundland. These divisions are based mainly on geography; however, they also reflect, roughly, the major Ordovician and older lithostratigraphic divisions of the island as first presented by Williams (1964, 1967). The three divisions are linked by mere lithostratigraphic shreds; the western and central areas share anorthosite bodies (along the Cabot Fault) and ophiolitic suites of similar ages, whereas the central and eastern areas are linked by Devonian granite. Carboniferous rocks overlap both the western and central areas and occur in small patches in the eastern area.

The distinctive character of the new map is evident in the division of rock units within each area. The philosophy of the new legend is based on distinguishing major depositional and intrusive packages through time for each of the three parts of the island. This compilation scheme contrasts with that of the 1967 version, which was based on a 'lumping solely by age' style of legend. The new refinement is possible mainly because of the finer scale of geological maps now available. The finer scale maps have also allowed for major changes in the boundaries between units, especially in southern and central Newfoundland. Stratigraphic nomenclature plays a minor role on the new map, and is keyed to numerical subscripts. For example in the central area, a major depositional package of mainly basinal clastic rocks includes

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the Davidsville, Baie d'Espoir, and Bay du Nord Groups; the package is labelled **Ocs** for Ordovician clastic sedimentary rocks, and the individual groups listed are given numerical subscripts 1, 2 and 3, respectively.

The following is a summary of the legend. The divisions discussed below have been distilled from the work of numerous geologists; for the sake of brevity, references are not included.

Western Newfoundland

The legend for the western part of Newfoundland reflects the well established tectonic history of the area; its divisions record the evolution and destruction of an Early Paleozoic continental margin. The major stratified rock packages (including ophiolites) include the following:

(1) a Precambrian infrastructure of mainly undivided gneisses;

(2) an Eocambrian-Cambrian mixed siliciclastic and carbonate sequence that overlies (1), and is in part related to the rift formation of the continental margin;

(3) three divisions of a Cambro-Ordovician carbonate bank (based on age and depositional environment) that were deposited on (2);

(4) a Middle Ordovician flysch sequence that covers part of (3);

(5) allochthonous Cambro-Ordovician sedimentary, volcanic, ophiolitic igneous and metamorphic rocks that were derived from an area at the eastern edge of the continental margin;

(6) Middle Ordovician parallochthonous sedimentary rocks that were deposited upon the allochthonous rocks as the latter were emplaced;

(7) Ordovician to Silurian neoautochthonous sedimentary rocks deposited upon the emplaced allochthons; to the east, these include felsic volcanic rocks;

(8) deformed and metamorphosed Lower Paleozoic rocks equivalent to those listed above;

(9) Devonian to Carboniferous fluviatile, lacustrine and shallow marine sedimentary rocks.

The major plutonic divisions in the western area include the following:

(1) a variety of Precambrian intrusions in the crystalline infrastructure;

(2) a Precambrian to Cambrian diabase dike swarm that intrudes the crystalline infrastructure and lower parts of the mixed siliciclastic and carbonate sequence;

(3) Silurian to Devonian granitoid rocks along the eastern margin of the area.

Central Newfoundland

As for the western area, the legend for central Newfoundland reflects an established tectonic history; the divisions document the evolution of a Lower Paleozoic volcanic arc system and associated sedimentary basins that were apparently in large part initiated on oceanic crust. The major stratified units (including ophiolites) include the following:

(1) a Cambrian(?)-Ordovician ophiolitic basement equivalent to allochthonous ophiolites of western Newfoundland;

(2) paragneisses that may be related to Precambrian rocks of the western part of the island;

(3) Lower Ordovician "early" volcanic arc sequence with associated sedimentary rocks;

(4) a southeastern basinal clastic facies that appears to be in part coeval with the "early" arc;

(5) a distinct Middle Ordovician black shale and siliceous argillite unit;

(6) an Upper Ordovician to Devonian "late" volcanic arc sequence with associated sedimentary rocks;

(7) a sequence of apparently Ordovician quartz-rich clastic rocks that may have been derived from either more silicic parts of the "early" arc or an undiscovered continental source;

(8) undivided, mainly metamorphic rocks that may, in large part, be equivalent to facies listed above;

(9) Devonian to Carboniferous volcanic rocks and fluviatile to lacustrine sedimentary rocks.

The plutonic divisions used for the central area of the new map are not fully established, but relate in part to the vol-

canic arc but probably more to syn- and post-arc tectonics. The following divisions are tentative, because diagnostic data used in separating intrusions are generally of an analytical nature, such as radiometric dates, petrochemistry, and isotopic ratios, and because work has been carried out only on a cursory regional scale. The plutonic divisions are as follows:

(1) Precambrian anorthosite and possible Precambrian granitoid rocks, probably related to similar age rocks of western Newfoundland;

(2) Ordovician granitoid rocks, including extensive areas of tonalitic to granodioritic rocks;

(3) Ordovician to Silurian granitoids and minor related mafic phases;

(4) a variety of divisions of Ordovician to Carboniferous granitoids and mafic intrusions that are separated on the basis of mineralogy, petrochemistry, physical features, and age constraints (mainly radiometric);

(5) Jurassic, mainly mafic stocks.

Eastern Newfoundland

The eastern Newfoundland legend is composed of well established depositional and plutonic packages; however, the unified tectonic theme of the belt is not totally clear. In recent years, the rocks of the area have been considered to represent an episode of Early Hadrynian rifting with subsequent abortion, foundering and infilling of the rift basin. The major stratified divisions of the new map include the following:

(1) Early to Middle Hadrynian mafic volcanic rocks and associated sedimentary rocks;

(2) Hadrynian basinal sedimentary sequences, one of which includes a distinctive mixtite unit;

(3) Late Hadrynian bimodal volcanic sequences;

(4) Late Hadrynian shallow marine to fluviatile sequences;

(5) Eocambrian to Lower Ordovician shallow marine clastic and carbonate rocks;

(6) Devonian to Carboniferous alluvial, fluvial, and lacustrine clastic rocks and mainly felsic, subaerial volcanic rocks.

Outstanding Problems

This new provisional map reflects the major tripartite division of the island; however, several previously unrecognized second-order patterns of undetermined significance can also be recognized. Three such patterns may be particularly significant and are discussed below.

(1) Tonalitic to granodioritic gneisses and migmatites of apparently pre-Devonian age cradle the central area on three sides. These units include the informal Southwest Brook Complex and southwesterly equivalents, the Cinq Cerf Complex, tonalitic migmatite at Grey River, tonalitic rocks of the Little Passage gneisses and the Hare Bay Gneiss. It is uncertain whether these compositionally similar units are related to distinct pre-Devonian magmatic events or to a single progressive event that affected all of the central belt. Resolution of this problem would help to show if the central belt was a mosaic of 'terranes' or a unified arc system prior to the Devonian.

(2) Quartz-rich clastic rocks occur along strike from each other all along the Hermitage Flexure. These rocks appear to be Ordovician in age, but have been interpreted to have had different sources. Some siliciclastics appear related to the felsic volcanic-rich La Poile Group, whereas others, such as the Gander Group, have been traditionally interpreted to be of continental derivation. Still others, such as the informal Spruce Brook group, appear to have been overthrust by ophiolites of the central belt and are of uncertain origin. Further work on all these units should determine their origin, whether they are related, and the nature of the eastern side of the central belt.

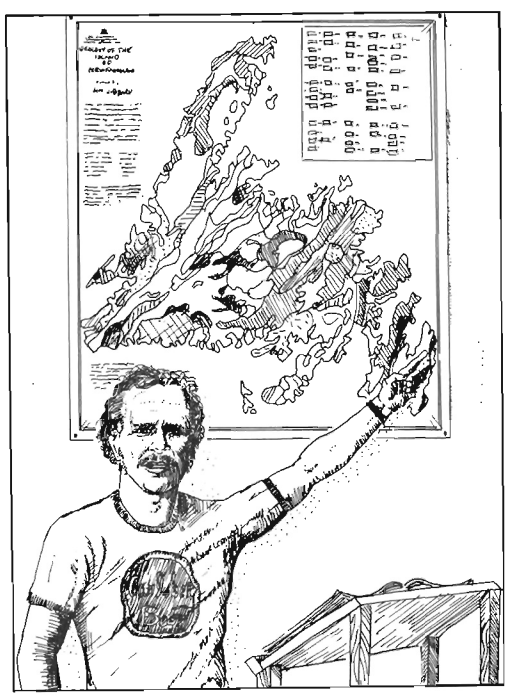
(3) The Baie Verte Flexure has been interpreted as representing the original morphology of the ancient North American continent. Eocambrian dikes related to rifting and the formation of Iapetus Ocean trend southward, through Grenville gneisses of the northern Long Range Mountains, as far as the latitude of the flexure, where they appear to deflect westward. At the same latitude and slightly to the west, the northward striking Cow Head carbonate breccias abruptly terminate. It has been suggested recently that the Cow Head rocks may be autochthonous, rather than allochthonous as previously thought (R.K. Stevens and S. Stouge, personal communications, 1983), on the basis of the state of preservation of conodonts. The problem is to determine whether or not these features are related to the morphology of the ancient margin, and whether rocks formerly interpreted as allochthonous are actually autochthonous.

Closing Remark

My feelings about this map are best expressed in a quotation with which Baird (1954a) also ended his report on the 1954 geological map:

"With regard to the distribution of the geological formations, it will be clear to anyone at all conversant with the difficulties attendant upon drawing in boundary lines with accuracy, especially in wild unknown or unfrequented regions, that many alterations and modifications will hereafter be necessary before the map can be considered by any means complete; nevertheless, I feel tolerably sure that the approximation is such as to be of considerable service for present purposes, and will be a useful guide for future and more minute investigation of details."

Alexander Murray (1881)



.... and here, on the last leg of our field trip, we will come to taverns 131 - 198 located just east of the prodelta and frontal delta deposits of the St. John's Group.

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