

CHAPTER 2

PREVIOUS MAPPING

The accumulation of geological mapping information for any particular area typically results from several information-gathering stages, each one tending to be more detailed than the previous and, at the same time, targeting progressively smaller areas. Eastern Labrador is no exception. Here, earlier mapping is divided into four stages, which are reviewed below, updated from Gower (2011).

2.1 EXPLORER STAGE (1860–1890)

The first geological map (at 1:4 000 000) that includes eastern Labrador, of which the author is aware, is that of Lieber (1860; Figure 2.1A). Oscar M. Lieber was State Geologist for South Carolina and visited Labrador in 1860 as part of the first (of four) U.S. Coast Guard Eclipse Expeditions (Lieber later died at the age of 32 from wounds received in the retreat from Williamsburg during the American Civil War). He divided the whole of Labrador into three geological units, all of eastern Labrador falling into a single gneiss unit, which he termed ‘Domino’ gneiss.

The next geological map of eastern Labrador is a half-page sketch (at roughly 1:6 000 000) by Packard (1891). Alpheus S. Packard was Professor of Zoology and Geology at Brown University, Rhode Island. Packard’s 513-page book is based on two expeditions to Labrador in 1860 and 1864 organized by William Bradford of New York. The preface notes that the book is ‘mainly based on observations and collections made by the author in his early student days’ and that ‘the scientific results, geological and zoological, are reprinted from the *Memoirs of the Boston Society of Natural History for 1867*’, so much of the information substantially predates the book’s 1891 publication year. Packard depicted most of eastern Labrador as being underlain by either ‘Laurentian gneiss’, which he described as typically syenitic and interpreted to be derived from clastic sediments, or ‘Domino gneiss’, which was described as schistose, lighter coloured gneiss with associated trap rocks. Domino gneiss was considered to be the younger of the two. Also shown are: anorthositic rocks, now mapped as the coastal part of the White Bear Arm complex; ‘Cambrian’ sediments in the Strait of Belle Isle area (Bradore and Forteau formations); and basaltic flows at Henley Harbour (Lighthouse Cove Formation).

In 1900, Reginald A. Daly (1902), an instructor in geology at Harvard University, participated in an expedition

along the Labrador coast. Daly’s page-sized geological sketch map of the coast of Labrador does not show any information for southern Labrador, but his text makes reference to biotite and hornblende gneisses, biotite schists and amphibolites, numerous mafic dykes, and quartz and pegmatite veins, as well as massive and gneissoid granites and diorites in the region. Brief discussion is given to interpretation of the Domino gneiss as quartzitic sediments, a view apparently shared by Packard (private communication to Daly), although not clearly stated by Packard in his book.

2.2 GOVERNMENT SURVEY COASTAL MAPPING STAGE (1890–1960)

By the end of the ‘Explorer’ stage of mapping, the Geological Survey of Canada was also active (Bell, 1895; Low, 1896). Bell’s and Low’s reports mention eastern Labrador, but neither is focussed on the region. The first Geological Survey of Canada mapping specifically to address eastern Labrador was by Kindle (1924) in the Lake Melville–Groswater Bay region (Figure 2.1B). Kindle included a page-sized fold-out map (1:1 013 760) of this region in his report, showing, in particular, the distribution of the Double Mer Formation (first described by Low). Kindle noted anorthosite on the south side of Lake Melville, which constitutes the first recognition of the (now termed) Mealy Mountains intrusive suite.

A geological sketch map (at 1:2 534 400) that included parts of eastern Labrador was completed by Kranck (1939), and was the first cartographic product for the region published by the Newfoundland Geological Survey. Kranck carried out his field work in 1937 and 1939 while employed as a lecturer in geology at the University of Helsinki. The most significant, previously unrecognized, feature on his map was separation of the granitoid rocks in (what is now termed) the Makkovik Province from gneisses of (what is now termed) the Grenville Province. Kranck was also the first to recognize the sedimentary protolith of the calc-silicate and quartz-rich clastic rocks on Battle Island and to interpret finely laminated parts of the Domino gneiss as mylonitic in origin. Kranck rejected earlier interpretation claiming age and protolith distinction between Laurentian and Domino gneiss. In fairness to all investigators, although these two gneiss types do not correspond consistently with any units on the author’s 1:100 000-scale maps, this author would argue that some validity exists for all the above-men-

tioned interpretations. Both the Laurentian and Domino gneisses have igneous and sedimentary protoliths and both are mostly Labradorian or older, but the 'Laurentian' gneiss correlates spatially with those rocks most affected by Grenvillian migmatization and magmatism (Lake Melville and more southerly terranes), whereas the 'Domino' gneiss correlates with areas affected more by Grenvillian dynamic metamorphism (Groswater Bay and Hawke River terranes; terranes are depicted in later figures).

Kranck was appointed a visiting professor at McGill University in Montreal in 1948, and permanently joined the faculty in 1951. He returned to Labrador to carry out field work in 1949 between Domino and Hopedale. The results of this work (Kranck, 1953) (Figure 2.1B) included a geological map (1:760 320) of the coast between Domino and Hopedale (on which, curiously, much of the area that he formerly separated as Makkovik granite is now re-assigned as Domino gneiss). His report gives more detailed descriptions of the various rock types present.

Other government-funded projects were conducted during the same period. Douglas (1953) visited the coast of Labrador in 1946 and 1947 on behalf of the Government of Newfoundland, and Christie (1951) mapped the coast from Forteau to Cape Porcupine in 1950 for the Geological Survey of Canada. Douglas's objective was to report on economic mineral potential, rather than carry out geological mapping, but he included geological sketch maps of specific localities. Christie (1951) included a geological map at 1:253 440 scale of the coastal areas (Figure 2.1B). The maps of Kranck (1953; field work 1949) and Christie (1951; field work 1950) were both published by the Geological Survey of Canada. They overlap between Domino and Cape Porcupine, but appear to be entirely independent of each other.

The next addition to the geological map of eastern Labrador was by Christie *et al.* (1953). The map (1:506 880) in the report covers much of Labrador, extending from south of Goose Bay in the south, to north of Nain in the north, and from the coast westward to Lake Michikamau (Figure 2.1B; Nain and Lake Michikamau outside area of figure). The map is compilation in nature, rather than the result of additional field work, and the report notes that the eastern part of the map includes information supplied by Dome Exploration Limited, American Metals Exploration Company and Frobisher Exploration Company. The map includes the area covered by Kranck (1953), but there is no indication that Kranck's work was utilized, despite Christie *et al.* (1953) citing Kranck's (1953) report. For the first time, the extent of the anorthositic rocks of the Mealy Mountains intrusive suite is mapped. The distribution of some distinctive syenitic rocks in the Makkovik Province is shown, some of which were also depicted by Kranck.

From 1945 onward mineral exploration companies were active in the region, especially Brinex, and contributed much to the geological knowledge of eastern Labrador, including the preparation of regional geological maps. A review of the history of mineral exploration activity in eastern Labrador is given by Gower (2010c).

2.3 GEOLOGICAL SURVEY OF CANADA MAPPING STAGE (1960–1975)

The 1960s heralded a new era in geological mapping in eastern Labrador, facilitated by the use of aircraft, thus removing reliance on water-borne transportation and also enabling previously inaccessible interior areas to be mapped. All the mapping during this stage was conducted by the Geological Survey of Canada (Figure 2.2A).

The first airborne project was carried out in 1961 for NTS map areas 3D, 3E, 13A, 13B, 13G and 13H (Eade, 1962). Eade (*op. cit.*) gained access to lakes using fixed-winged aircraft. Foot traverses were then made to nearby outcrops (lakeshore outcrop being generally sparse in the region). Mapping coverage was uneven, being controlled by lakes suitable for float-plane landings. Eade's map (1:506 880) was the first published map to discriminate between metasedimentary gneiss and orthogneiss and to show approximately the distribution of the (now termed) White Bear Arm complex, and some other mafic intrusive bodies. Eade utilized reconnaissance geological mapping by Brinex (*cf.* Gower, 2010c for details) and relied on previous work in coastal regions.

Farther north, in 1968, Stevenson (1970) mapped NTS map areas 13J and 13I at 1:250 000 scale using helicopter access for inland regions and an inflatable boat for coastline mapping. Stevenson's map was the first in eastern Labrador to include geochronological ages (K–Ar). Armed with these, and mapping that demonstrated a contrast between granitoid rocks in the Makkovik Province and quartzofeldspathic gneiss in the Grenville Province, he was able to locate approximately the Grenville Front in the area (the existence of the Grenville Province as a distinct entity elsewhere within the Canadian Shield was already known). Stevenson also mapped out granulite facies rocks in the Double Mer White Hills (although these had been previously recognized by Halet, 1946), and mapped the inland distribution of various mafic intrusive rocks, including the (now termed) Michael gabbro.

In 1969, Bostock (1983) started a mapping project that included both the Labrador and Newfoundland sides of the Strait of Belle Isle. Mapping on the Labrador side (NTS map areas 12P and 2M) was done in 1971, using an inflatable boat for coastal work and a helicopter inland. Bostock's map

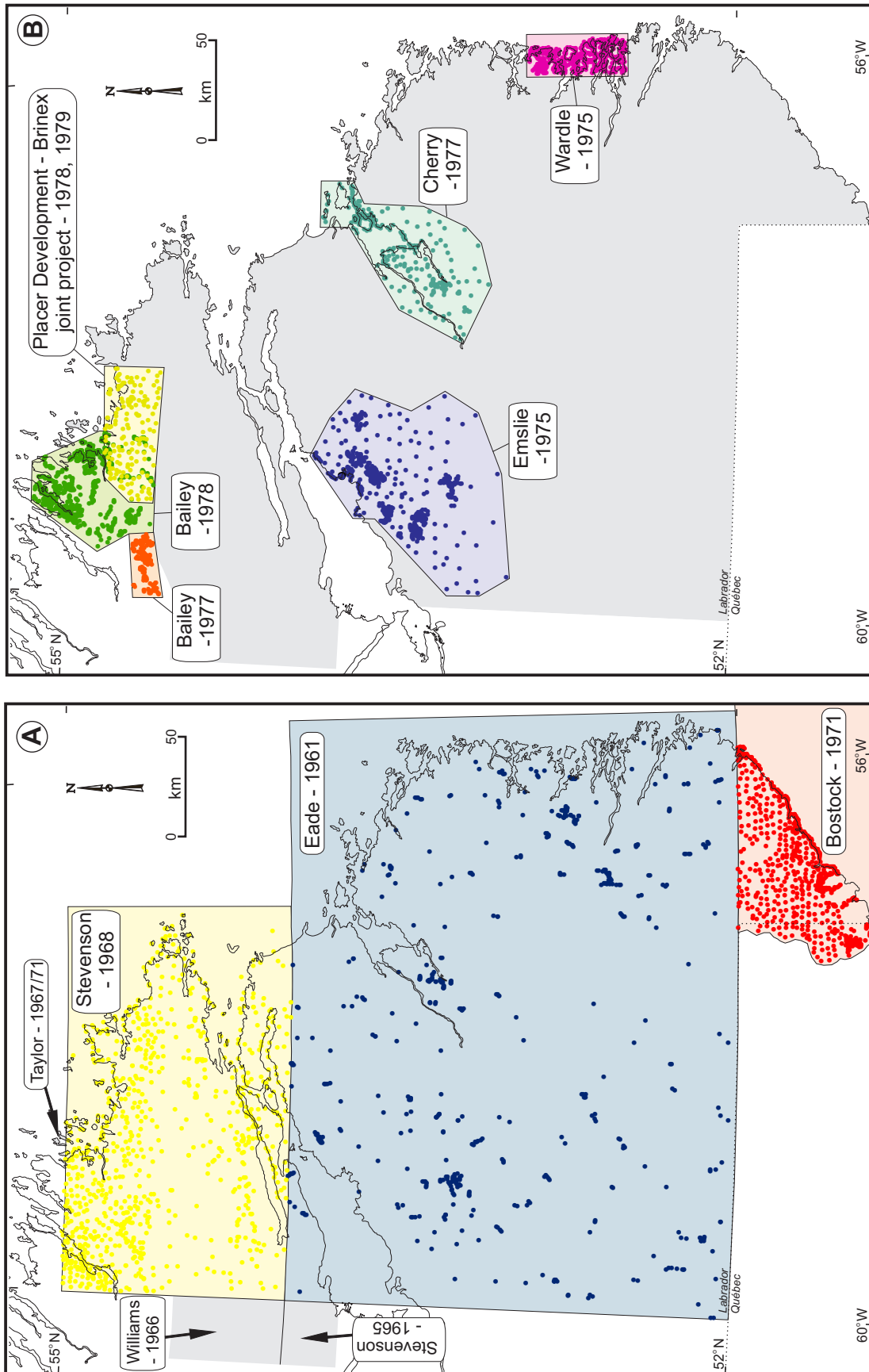


Figure 2.2. Geological mapping in eastern Labrador between 1960 and 1979. A. Geological Survey of Canada mapping (1960–1975), B. ‘Targeted’ geological mapping of specific areas (1975–1979). Note that year of mapping indicated, rather than year of publication.

(at 1:125 000 scale) depicted much of the region as underlain by leucocratic to melanocratic gneiss, but shows remnants of metasedimentary gneiss within it. Metagabbro, mangerite and granite bodies intruding the gneiss were mapped.

For completeness, three other projects are mentioned, although only small segments are included in the present map (Figure 2.2A), and, in contrast to the above-mentioned Geological Survey of Canada projects, field data from these projects have not been captured in the author's database. In 1966, Williams (1970) mapped the eastern half of NTS map area 13K, of which NTS areas 13K/01 and 13K/08 are included in the author's geological maps of eastern Labrador. The project was done by canoe and foot traverses, and serviced by fixed-wing aircraft. Only brief examination was made of the part that is included in the 1:100 000-scale map of eastern Labrador. Granite gneiss, granite and amphibolite were the main rock types reported. In 1965, Stevenson (1967a) carried out a helicopter-assisted mapping project in NTS map area 13F, of which only the northeast corner (13F/16) is included here. Between 1967 and 1971, Taylor (1977) carried out Operation Torngat (helicopter and fixed-wing-assisted), which covered much of the Ungava Peninsula. Only NTS areas 13O/02 and 13O/03 are part of the present map.

2.4 TARGETED GEOLOGICAL MAPPING STAGE (1975–1979)

After the completion of Geological Survey of Canada geological mapping, there was a brief transitional period when specific areas were targeted (Figure 2.2B), before adopting 1:100 000-scale systematic mapping in 1979.

Two of these targeted projects were carried out in 1975. One was by Emslie (1976) in the Mealy Mountains intrusive suite (MMIS). Emslie distinguished between the leucocratic Kenemich massif in the west and the leucogabbro-bronoritic Etagelet massif in the east, as well as mapping associated monzonitic rocks (mostly in the south) and the northeast-trending Mealy dyke swarm. Emslie's map (at 1:250 000 scale) was never formally published, although

made available to the author and used by Emslie in page-size sketch form in journal publications.

The other project in 1975 was carried out by Wardle (1976, 1977) in the Alexis Bay–Snug Harbour area in south-east Labrador. Wardle mapped migmatitic granitoid rocks and gneisses; mapped and named the White Bear Arm complex; identified and mapped the Gilbert Bay granite; and mapped both metamorphosed and unmetamorphosed mafic dykes, including a Long Range dyke that transects the area. Wardle's (1977) map marked the start of bedrock mapping at 1:100 000 scale in eastern Labrador by the Geological Survey of Newfoundland and Labrador (called the Mineral Development Division at the time).

The Sandwich Bay area was targeted in 1977 (Cherry, 1978a, b). Cherry mapped the bedrock as granitoid gneisses of various types, together with anorthositic and gabbroic bodies and mafic dykes, including recognizing a Long Range dyke on Earl Island.

The final targeted-area projects in eastern Labrador were in the Makkovik Province, and were carried out by Bailey in 1977 and 1978. The areas mapped largely fall outside the limits of the present study, but are mentioned here as they provide continuity with the author's own mapping. In 1977, Bailey (1979) mapped the Walker Lake–MacLean Lake area, which is underlain by felsic volcanic rocks and associated sedimentary rocks of the Aillik Group (adopting the redefined usage of Ketchum *et al.*, 2002) and intruded by 1.85 Ga Makkovikian and 1.65 Ga Labradorian granitoid rocks. This was followed by mapping of similar rocks in the Makkovik area in 1978 by Bailey *et al.* (1979). Following the resignation of Bailey from the Geological Survey of Newfoundland and Labrador, the author was assigned responsibility for completion of a report and a 1:100 000-scale map for the project (Gower *et al.*, 1982a).

One other project included in this section was carried out as a Placer Development–Brinex joint-venture exploration project (Davidson and Kowalczyk, 1979). The report from this project is an all-too-rare industry example having sufficient geological information for material to be entered into a mapping database.

