CHAPTER 4

PREVIOUS OTHER (NON-MAPPING) GEOLOGICAL STUDIES

Generally, non-mapping studies carried out in eastern Labrador have been closely linked with the geological mapping. The foremost three approaches have been: i) regional reviews and 'beyond eastern Labrador' correlations, ii) geochronology, and iii) geophysical studies. Subsidiary topics are, i) igneous petrology, ii) metamorphic petrology, iii) structure, tectonics and geodynamic modelling, iv) post-Grenvillian sedimentary rocks, and v) surficial deposits.

Mineral-exploration-related previous work has been excluded from the above list as a comprehensive review was provided by Gower (2010c).

4.1 REGIONAL REVIEWS AND 'BEYOND EASTERN LABRADOR' CORRELATIONS

A key facet of the 1:100 000-scale mapping program in eastern Labrador has been striving toward understanding of the region in its broader geological context. Gower and Owen (1984) and Gower (1985) first drew attention to the close geological similarities between the Proterozoic rocks of the northern part of the Grenville Province in eastern Labrador (the only part mapped at 1:100 000 scale at that time) with those in the eastern part of the Sveconorwegian Province in southeast Sweden, proposing that they once formed part of a common continental margin during the mid Proterozoic.

Subsequently, and extremely relevant to eastern Labrador, was a symposium entitled 'Middle Proterozoic Evolution of the North American and Baltic Shields' held in St. John's, Newfoundland, in 1988. An outgrowth from the symposium was Geological Association of Canada Special Paper 38 entitled Mid-Proterozoic Laurentia–Baltica (Gower *et al.*, 1990b), which included publications relevant to both the Makkovik and Grenville provinces.

Further co-operation between geoscientists in eastern Laurentia and in Baltica led to IGCP Project 371 (International Geological Correlation Project). The project was entitled 'Correlation of the Precambrian of Northern Europe and North America' (COPENA), which extended from 1994 to 1998. The first major product (based on a conference in Nottingham, England in 1994) was Geological Society Special Publication No. 112 'Precambrian Crustal Evolution in the North Atlantic Region' (Brewer, 1996). This included regional geological reviews of eastern Labrador on the Makkovik Province (Kerr *et al.*, 1996) and Grenville Province (Gower, 1996). In 1996, COPENA held a conference in Goose Bay, Labrador, delivering a volume of abstracts and a series of field guides for various parts of Labrador, including one for the Makkovik Province (Ketchum and Culshaw, 1996) and one for southeast Labrador (Gower *et al.*, 1996). Subsequent meetings of COPENA were held at various venues around the world, but had less relevance to eastern Labrador. The most recent publication directly relevant to eastern Labrador concerning Laurentia–Baltica correlation (but outside COPENA) was by Åhäll and Gower (1997). This addressed Labradorian–Gothian correlations between the eastern Grenville Province and the eastern Sveconorwegian Province.

After COPENA, the Lithoprobe 'Eastern Canadian Shield Onshore–Offshore Transect' (ECSOOT) project dominated regional geological studies in Labrador, culminating (from a publication perspective) in a special issue of the Canadian Journal of Earth Sciences 'Lithoprobe Eastern Canadian Shield Onshore–Offshore transect' (Wardle and Hall, 2002). Regional geological syntheses that addressed eastern Labrador were delivered by Ketchum *et al.* (2002) on the Makkovik Province and by Gower and Krogh (2002) on the eastern Grenville Province.

4.2 GEOCHRONOLOGY

4.2.1 K–Ar AND Ar–Ar

4.2.1.1 K–Ar

The first published radiometric result obtained in eastern Labrador of any kind was a K–Ar date by Lowdon (1961). The sample (a paragneiss) was collected by Y.O. Fortier and C.S. Lord as part of a Geological Survey of Canada program to map, by K–Ar geochronology, various tectonic regions in the Canadian Shield.

The Geological Survey of Canada continued to deliver K–Ar dates over the next two decades, partly in support of paleomagnetic studies by Fahrig (Wanless *et al.*, 1970, 1972, 1973; Fahrig and Loveridge, 1981), and partly to complement reconnaissance mapping projects by Eade (Wanless *et al.*, 1965), Stevenson (Wanless *et al.*, 1972),

Taylor (Wanless *et al.*, 1973, 1974; Stockwell, 1982), and Bostock (Wanless *et al.*, 1974). One sample dated by the Geological Survey of Canada in this period does not fit into either of the above categories, and the specific reason why it was dated is unknown to this author. It was a 'diorite' submitted by W.R. Sutton from the Makkovik region (Wanless *et al.*, 1970). Four additional K–Ar dates obtained by the Geological Survey of Canada on two samples collected by Stevenson were never formally published, but are included in the author's database. During the same time period, two K–Ar studies dating mafic dykes in eastern Labrador were also carried out by the University of Toronto (Grasty *et al.*, 1969; Gittins, 1972).

In the 1980s, K–Ar dating was carried out on the Mealy dykes (Emslie *et al.*, 1984) and on various mafic rocks from a region north and east of Rigolet (Hunt and Roddick, 1987), both studies completed by the Geological Survey of Canada utilizing samples collected by R.F. Emslie. During the same period, the Geological Survey of Canada also obtained K–Ar dates on some late- to post-Grenvillian granites, utilizing the author's samples (Gower *et al.*, 1991).

Three other K–Ar dates are available for eastern Labrador, all obtained commercially from Krueger Enterprises Inc. on samples collected by the author. The dating was carried out to complement paleomagnetic studies on mafic dykes. Analytical data and the age obtained (in 1985) for a Sandwich Bay mafic dyke sample were reported by Murthy *et al.* (1989a). Analytical data obtained (in 1993) for the other two samples (Gilbert Bay dykes) have not been previously published, although a generalized date for the samples was mentioned by Wasteneys *et al.* (1997). Scanned images of the analytical data and ages are included in the author's database.

The K–Ar data have been used extensively in the construction of thermochron maps for the Grenville Province (Harper, 1967; Bourne, 1971; Baer, 1976; Easton, 1986). All of them show the thermochrons to be more-or-less parallel to Grenville front along the length of the Grenville Province and K–Ar ages decreasing toward the interior of the Grenville Province. All maps also show that, in eastern Labrador, the thermochrons make an almost right-angle bend to the southeast away from the traditionally positioned Grenville Front (*cf.* Section 22.4). The significance of this change in direction in terms of a Grenvillian tectonic indentor model has been addressed by Gower *et al.* (2008a).

4.2.1.2 Ar–Ar

The first Ar–Ar geochronological study in eastern Labrador was by Archibald and Farrar (1979) and involved felsic rocks at the northwest fringe of the region. The study was conducted at Queen's University (Kingston, Ontario).

Other Ar–Ar geochronological data for eastern Labrador have been generated through graduate-student research at Memorial University (St. John's, Newfoundland) by Owen *et al.* (1988) and van Nostrand (1988) in the Smokey and Sandwich Bay areas, respectively. The results reported by Owen *et al.* were obtained by R.D. Dallmeyer (University of Georgia), who, in a subsequent investigation, also dated some of the author's samples. The latter results have not been formally published, but permission was given by Dallmeyer to include the results on the author's 1:100 000-scale geological maps. van Nostrand's data was obtained at Dalhousie University, under the supervision of P. Reynolds, who, in a separate study also delivered Ar–Ar data for the Mealy dykes, utilizing samples collected by Emslie (Reynolds, 1989).

The K–Ar and Ar–Ar data for eastern Labrador have been reviewed by Gower (2003). Its interpretation is an important element in the Grenvillian tectonic indentor model of Gower *et al.* (2008a).

4.2.2 Rb–Sr

Fahrig and Loveridge (1981), in a study on the Michael gabbro, reported the first Rb–Sr data for eastern Labrador. Soon after, Brooks (1982a, b; 1984) investigated various granitoid and mafic rocks from the northern part of eastern Labrador, and, around the same time period, Emslie *et al.* (1983) reported an age for a monzonite–granite from the Mealy Mountains, and Emslie *et al.* (1984) reported an errorchron result for the Mealy dykes. Shortly after, Owen *et al.* (1988) delivered Rb–Sr ages for several granitoid units from the Smokey area (excluding data for a mafic unit that is, however, reported in Owen's (1985) thesis).

Five other studies in eastern Labrador included Rb–Sr data. These are by Prevec (1987; also Prevec *et al.*, 1990) on pelitic gneisses, granitoid and mafic intrusive rocks in the Sand Hill Big Pond area; by Schärer (1991) on various granitoid rocks in the northern part of eastern Labrador; by Emslie *et al.* (1997) on the Michael gabbro; and by Hegner *et al.* (2010) and Bybee and Ashwal (2015) for various rock types in the Mealy Mountains intrusive suite.

Reliance is no longer given to the Rb–Sr isotopic results for age determinations, but the data have petrogenetic value in that model initial Sr ratios (ISr(t)) can be calculated for every analyzed sample where the ages of the rocks are independently known from U–Pb dating. ISr(t) values have been included on the 1:100 000-scale maps of Gower (2010a).

4.2.3 Sm–Nd

The first published Sm–Nd results from eastern Labrador were by Ashwal *et al.* (1986) for two samples of anorthosite from the Mealy Mountains, one orthopyroxene megacryst, and three samples of mafic dykes (Mealy dykes). Earlier Sm–Nd data from eastern Labrador, but never formally published, were obtained by Brooks (1983). Brooks's results were from a granitoid rock east of Cartwright and complemented Rb–Sr isotopic data obtained on the same samples. Other studies that jointly reported Sm–Nd and Rb–Sr data were also completed by Prevec (1987; also Prevec *et al.*, 1990) and Schärer (1991), both of which involved a wide range of rock types; and by Emslie *et al.* (1997) on the Michael gabbro. More recently completed studies are those of Devereaux (2011), Hegner *et al.* (2010), Bybee (2014) and Bybee and Ashwal (2015). Devereaux utilized Sm–Nd data to discriminate between the Michael gabbro and other mafic gabbroic rocks in the northern part of eastern Labrador, whereas the other three studies (which also included Rb–Sr isotopic data) addressed petrogenesis of the Mealy Mountains intrusive suite anorthositic rocks.

The author's database also captures data for several studies partly peripheral with respect to eastern Labrador. These include investigations by Owen *et al.* (1992) and Dickin (2004) in the Long Range Inlier in Newfoundland; by Kerr and Fryer (1994) and Sinclair *et al.* (2002) in the Makkovik region; by Kerr and Wardle (1997) on basement samples obtained during offshore drilling; by Ketchum *et al.* (2002) in the Cape Harrison area; by Parsons and James (2003) on a unit at the boundary between eastern and central Labrador and by Dickin (2000, 2004) in southernmost eastern Labrador, adjacent easternmost Québec, and the Long Range Inlier in western Newfoundland.

Throughout much of eastern Labrador, Sm–Nd isotopic data have been obtained on the author's samples by R.A. Creaser (University of Alberta, Edmonton) and J.S. Daly (University College, Dublin) through contracts with the Geological Survey of Newfoundland and Labrador. The samples chosen were mostly those for which U–Pb geochronological data had already been obtained. The T_{DM} ages and εNd values have been included on the 1:100 000-scale geological maps of the author and in the author's database, but are otherwise formally unpublished. With the analysts' agreement, the analytical data were made available to Hewitson (2010) for incorporation into her M.Sc. thesis on Nd isotopic mapping in southern Labrador. That work has been completed as a Ph.D. investigation (Moumblow, 2014; formerly Hewitson) under the supervision of A. Dickin (McMaster University, Hamilton, Ontario).

4.2.4 U–Pb

Around 1984, the Geological Survey of Newfoundland and Labrador began directing its geochronological resources toward obtaining U–Pb ages, rather than Rb–Sr dates, as had been the approach up to that time. In eastern Labrador, this led to an extraordinarily fruitful co-operation with the Jack Satterly Geochronological Laboratory (formerly at the Royal Ontario Museum, now at the University of Toronto, Ontario). The cooperation was foremost with the late T. E. Krogh (the laboratory's founder and Director until his retirement in 2001), but also involved many of the other geochronologists employed at the laboratory, especially S. Kamo. A particular facet of the investigative approach was to target 'key' localities. The approach, which Krogh was instrumental in initiating, dated several rocks at a single outcrop, where unequivocal field relationships between several units were exposed. Although a seemingly extravagant use of geochronological resources, it resulted in an unprecedented (for the time) rigour in reconstructing the geological history for eastern Labrador.

The first studies resulting from the co-operation were published by Schärer *et al.* (1986) and Schärer and Gower (1988), mostly utilizing samples collected by the author and T. Krogh in 1984. The U–Pb isotopic data were later integrated with Pb–Pb, Sm–Nd and Rb–Sr results in a petrogenetic synthesis by Schärer (1991). Investigations using the author's samples are those of Kamo *et al.* (1989), Gower *et al.* (1991, 1992), Kamo and Gower (1994), Tucker and Gower (1994), Kamo *et al.* (1996), Gower and Kamo (1997), Wasteneys *et al.* (1997), Krogh *et al.* (2002), Heaman *et al.* (2004), Kamo and Hamilton (2007), Gower *et al.* (2008b), Kamo *et al.* (2011) and Kamo (2011, 2012). Other studies at the Jack Satterly Geochronological Laboratory relevant to eastern Labrador, but not using author-collected samples, have been reported by Kerr *et al.* (1992) and James *et al.* (2001).

Additional U–Pb isotopic projects comprising samples from eastern Labrador at other geochronological laboratories have been carried out at the Geological Survey of Canada (Gower and Loveridge, 1987; Emslie and Hunt, 1990; Hamilton and Emslie, 1997), at Memorial University, St. John's, Newfoundland (Corrigan *et al.*, 1996, 2000; Ketchum *et al.*, 2002), at University of Québec, Montreal (Scott *et al.*, 1993), and at the University of Texas at Austin (Loewy *et al.*, 2003; Pb–Pb whole-rock analyses).

A synthesis of the geological history of eastern Labrador based on U–Pb geochronological data available at time of publication has been delivered in two parts by Gower and Krogh (2002, 2003). The 2003 publication,

which was the earlier of the two to be written, reviews events prior to 1600 Ma, whereas the 2002 publication, although providing a synopsis of pre-1600 Ma events, is focussed on post-1600 Ma history.

4.3 GEOPHYSICS

4.3.1 MAGNETIC

Regional aeromagnetic data acquired by the Geological Survey of Canada are available for all of eastern Labrador. The airborne surveys were carried out between 1969 and 1971 at an altitude of 1000 feet (305 m) and at a flight-line spacing of 0.5 mile (800 m). All the surveys were flown along north–south flight lines with the exception of those south of latitude 52°N (corresponding with the Labrador–Québec border), which were flown along east–west flight lines. Magnetic 'discontinuities' at the border between NTS map areas 12P and 13A can be related to the differing flight-line directions. Aeromagnetic coverage was also acquired across part of the Strait of Belle Isle, along northwest–southeast flight lines. The data were collected as analog profiles and compiled as uncoloured contour maps, and levelled to adjacent surveys. The maps were published at 1:63 360 and 1:250 000 scales between 1969 and 1976. Reference to individual maps is given on a map-region basis in the author's Current Research articles published by the Geological Survey of Newfoundland and Labrador.

In 1985, the Geological Survey of Canada (1985) released total-field magnetic anomaly maps, in colour, at 1:1 000 000 scale based on the earlier acquired aeromagnetic data. Most of eastern Labrador is covered by map NN-21-M (Cartwright), but areas to the west of longitude 60°W are covered by map NN-20-M (Churchill Falls) and areas to the south of latitude 52°N by map NM-21/22-M (Corner Brook).

Marine magnetic data for the Labrador Sea adjacent to eastern Labrador has also been obtained. A compilation at 1:5 000 000 scale was published by the Geological Survey of Canada (1988) as map 1709A. Interpolation between the aeromagnetic and marine data on this map disguises a gap that separates the two that varies between roughly 10 and 50 km wide. The gap is shown, however, on a page-size compilation included by Hall *et al.* (2002) and on a Geological Survey of Canada 1: 3 000 000-scale magnetic anomaly map of Atlantic Canada (Oakey and Dehler, 2004).

The last aeromagnetic data acquired by the Federal Government in eastern Labrador was over 40 years ago, but some more recent data have been obtained by exploration companies. Many of the surveys were done during the 1995–1996 post-Voisey's Bay Ni–Cu–Co mineral exploration boom, with additional coverage gained during the more recent (2009–2011) surge in exploration for U and REE. Most of the surveys cover small, irregular areas, but the data are high-resolution and give an indication of the huge interpretational refinements that would be possible if continuous coverage was available.

Geological Survey of Canada magnetic data, in various forms (*e.g.*, total field, vertical gradient) are available, free-of-charge, from Natural Resources Canada (www.NRCan.gc.ca). Shaded-relief, colour aeromagnetic maps that integrate Geological Survey of Canada regional data with higher resolution exploration company data may be obtained from the Geological Survey of Newfoundland and Labrador.

For more information regarding the history of aeromagnetic surveying in Canada the reader is referred to Hood (2007).

4.3.2 GRAVITY

Gravity surveys covering the eastern Grenville Province and adjacent parts of the Superior, Churchill, Nain and Makkovik provinces, were carried out between 1954 and 1968 by the Gravity Division of the Dominion Observatory (now included within the Geodetic Survey Division of Natural Resources Canada). Bouguer anomaly maps, at 1:500 000 scale, and an interpretation of the data were provided by Thomas (1974). During these surveys, 3009 gravity stations were occupied at a spacing of 10–15 km, with control stations roughly 90 km apart. Density determinations were also made on 377 rock samples collected at outcrops close to gravity stations.

Marine free-air gravity surveys were acquired between 1964 and 1985 and integrated with land-based Bouguer anomaly data in a 1:5 000 000-scale compilation map for the continental margin of eastern Canada (Geological Survey of Canada, 1988). Further gravity information compilation is available in the Canadian Geophysical Atlas, which includes free-air, Bouguer anomaly, and isostatic anomaly gravity maps at 1:10 000 000 scale for Canada (Goodacre *et al.*, 1987a, b, c), and a more recent isostatic residual gravity anomaly map at 1:750 000 scale is available from www.NRCan.gc.ca (Miles *et al.*, 2001).

4.3.3 SEISMIC

As a result of the Lithoprobe ECSOOT project (Wardle and Hall, 2002) both seismic reflection and refraction data relevant to eastern Labrador are available. A seismic reflection transect (ECS-92) off the coast of southern Labrador provided a wealth of data relevant to the deep crustal structure for the region. This 730-km-long transect extended from the Nain Province then, southwards, across the full

width of the Makkovik and Grenville provinces off the coast of Labrador. A preliminary interpretation of the data was provided by Hall *et al.* (1995). Further interpretation of the data, after interfacing with onshore surface geological information and onshore/offshore magnetic and gravity data, was delivered by Gower *et al.* (1997a) and a geodynamic model for the region formulated. After additional processing of the seismic reflection data and incorporation with the results of seismic refraction studies, a refined interpretation of the data was provided by Hall *et al.* (2002).

The seismic refraction data were collected in two stages. In 1992, reconnaissance seismic wide-angle reflection–refraction data were recorded on land during the ECS-92 reflection profiling transect (Louden and Fan, 1998). In 1996, data were collected along two transects offshore eastern Labrador. On line 2, shots were fired along a 247-km-long, northwest-oriented section and data recorded by 6 ocean-bottom seismographs along this line, plus five land stations deployed in a line that partly overlapped the marine section and partly extended it to the northwest. On line 3, shots were fired along a 115-km-long segment of a north-oriented line and data collected by 7 ocean-bottom seismographs along this line, plus 20 land stations that extended the line to the south (Funck *et al.*, 2001).

4.3.4 PALEOMAGNETIC

Paleomagnetic studies in eastern Labrador commenced with an investigation of the Michael gabbro by Fahrig and Larochelle (1972) based on samples collected by Fahrig during the reconnaissance mapping project of Stevenson (1970). This was followed by a study by Fahrig *et al.* (1974) on anorthositic rocks in the Mealy Mountains. Another study in the Mealy Mountains was carried out by Park and Emslie (1983) on the Mealy dykes based on samples collected by Emslie during his 1975 mapping project in the region.

As part of the 1:100 000-scale mapping projects by the author, numerous mafic dykes were mapped and classified into various suites. A collaborative paleomagnetic project was established between the Geological Survey of Newfoundland and Labrador and G. Murthy (Memorial University, St. John's, NL). Mafic dykes discovered during mapping were revisited and oriented samples collected by M. Tubrett and R. Patzold, staff at the paleomagnetic laboratory at Memorial University at the time. Three publications resulted; on the Sandwich Bay dykes, Long Range dykes and on pre-Grenvillian dykes (Murthy *et al.*, 1989a, b; 1992). About 15% of the paleomagnetic data collected during the project remains unpublished, and is included in the author's database.

The only other published paleomagnetic study carried out in eastern Labrador was delivered by Park and Gower (1996). This study targeted the Michael gabbro, the sampling for which was done in 1982 in conjunction with a geochemical/petrological investigation of the Michael gabbro by Emslie and others (Emslie *et al.*, 1997).

An 'in-progress' study on the Gilbert Bay dykes by McCausland *et al.* (2007), is delayed because, i) not all the dykes necessarily belong to a single suite as was originally thought, and ii) work is in progress to obtain more geochronological data.

4.4 IGNEOUS PETROLOGY

Studies of igneous rocks in eastern Labrador can be subdivided according to their geological province. Those in the Makkovik Province (excluding the Makkovik region, which is outside the scope of this report) have addressed both intrusive and extrusive felsic rocks (Kerr, 1986, 1987, 1989a, b; Gower and Ryan, 1987).

Igneous studies conducted in the Grenville Province in eastern Labrador have been mostly on mafic rocks, commencing with Taylor (1951), who completed a largely petrographic appraisal of mafic rocks in the Groswater Bay terrane. Several different ages of mafic rock are now known in Taylor's field area, including a Labradorian 1645 Ma layered mafic body that was the focus of a mostly field-based study by O'Flaherty (1986). Similar-aged mafic rocks (*ca.* 1640 Ma) in the Hawke River terrane form part of a geochemical–isotopic study (along with granitoid rocks and metasedimentary gneisses) by Prevec (1987) and Prevec *et al.* (1990). The geochemical signature of Labradorian mafic rocks, *vs.* that of the Michael gabbro has been addressed by Devereaux (2011). The 1426 Ma Michael gabbro itself has been the target of research by Emslie (1983) and Emslie *et al.* (1997), and the 1250 Ma Mealy dykes by Emslie *et al.* (1984). Both the Michael gabbro and Mealy dykes were included in Gower *et al.*'s (1990a) geochemical comparison of Mesoproterozoic mafic suites in Labrador.

Anorthositic rocks have also been given some petrological attention, particularly the Mealy Mountains intrusive suite, which has been included in studies by Ashwal *et al.* (1986), Hegner *et al.* (2010), Bybee *et al.* (2014, 2015) and Bybee and Ashwal (2015).

A study of gneissic rocks and granitoid intrusions in the Pinware area by Chubbs (1988), and a petrographic study that outlined criteria to enable recognition of metamorphosed felsic volcanic rocks from the same region, were completed by Gower (2007).

4.5 METAMORPHIC PETROLOGY

Although cursory mention regarding metamorphism is given in the author's GSNL Current Research articles on a region-by-region basis, few investigations specifically directed toward metamorphism have been completed in eastern Labrador. The earliest was by Bourne (1978) as part of creating the first metamorphic map of the Canadian Shield (Fraser *et al.*, 1978). Bourne relied on petrographic thin sections from Geological Survey of Canada mapping by Eade (1962), Stevenson (1970) and Bostock (1983) and the project was at reconnaissance level.

Most of the subsequent metamorphic studies have focussed on the Groswater Bay terrane. Emslie (1983) addressed progressive metamorphism in the Michael gabbro southward across the terrane, with particular reference to the coronitic assemblages. Gower (1986) and Gower and Erdmer (1988) examined progressive metamorphism in both the Michael gabbro and the host gneisses across the Groswater Bay terrane and into the northern Lake Melville terrane. Reports by Emslie (1983), Erdmer (1984) and Gower (1986) all include mineral chemistry, which provided the basis for quantitative P–T estimates reported by Gower and Erdmer (1988). Other studies addressing metamorphism in the northern part of the Groswater Bay terrane (Smokey area) were by Owen (1985), Owen *et al.* (1988) and Owen (1991). Petrographic and geothermobarometric studies of mafic rocks in the Rigolet area were carried out by Tulk (1996), and an evaluation of metamorphic conditions in the southeast Groswater Bay terrane extending into parts of the Hawke River and Lake Melville terranes (Sandwich Bay region) formed part of a study by van Nostrand (1988). The only other metamorphic investigation to date carried out in eastern Labrador was by Arima and Gower (1991) on osumilite-bearing assemblages in part of the Hawke River terrane.

4.6 STRUCTURAL, TECTONIC AND GEODYNAMIC STUDIES

Perhaps the earliest contribution to structural geology in eastern Labrador was the recognition of differing geological features north and south of what is now termed the Grenville front, the credit for which goes to Kranck (1939). Many attempts have been made (on the basis of a range of criteria) to define the position of the Grenville front more precisely since Kranck's work. The various proposals were reviewed by Gower *et al.* (1980), but exactly what the Grenville front represents and where it should be located continues to be an issue (*cf.* Gower *et al.*, 2008a).

During the course of 1:100 000-scale mapping, almost 25 000 structural measurements were taken and are included in the author's database. These have been used in a generalized fashion to interpret major structures, brief mention of which is given in GSNL Current Research articles written by the author. Although valuable as an adjunct to geological mapping, the usefulness of the information in the database in the context of detailed structural analysis is somewhat limited because of uncertainties in assigning generational significance to individual observations.

The only specifically structural studies carried out in eastern Labrador are those of Hanmer and Scott (1990) and Gower (2005). The study of Hanmer and Scott was a kinematic analysis across the southeast end of the Lake Melville terrane. The data collected during this investigation are included in the author's database. The article by Gower (2005) extended the analysis inland, data being obtained from numerous roadcuts along the then newly created Trans-Labrador Highway in the region.

Indirectly relevant to structural studies in Labrador is a brief note on 'syn-tectonic' intrusions (Gower, 1993). Information relevant to the tectonics and geodynamics in eastern Labrador forms part of regional interpretations published by Gower *et al.* (1997a, 2008a), and Hall *et al.* (2002).

4.7 POST-GRENVILLIAN SUPRACRUSTAL ROCKS

Post-Grenvillian supracrustal rocks in eastern Labrador fall into two groups, namely: i) the Double Mer Formation in the Lake Melville region, and ii) the Labrador Group in the Strait of Belle Isle area.

The Double Mer Formation has been described by Kindle (1924), and more detailed description, plus its context within the Lake Melville rift system by Gower *et al*. (1986a) and Gower (1988).

Although the Labrador Group in the Strait of Belle Isle area is included on the maps of Gower (2010a), very little of it was examined by him during 1:100 000-scale mapping. That responsibility was assigned to his colleague I. Knight, who provided a review of the Labrador Group in field excursion guides for the region (Gower *et al.*, 1997b, 2001). Included in the later publication is an updated interpretation of the Labrador Group and comprehensive access to its earlier literature.

4.8 SURFICIAL DEPOSITS

The purpose of this report is to address the bedrock geology rather than surficial deposits, but a brief review is given here to facilitate entry into relevant literature for the region. Surficial geological mapping at 1:50 000 scale for the region was carried out by Fulton *et al.* (1975), based mostly on aerial photographic interpretation. The work was compiled at 1:250 000 scale by Fulton *et al.* (1979) and at 1:500 000 scale by Fulton (1986). A more focused investigation for southeasternmost Labrador was completed by Grant (1986, 1992). Regional topical Quaternary studies were carried out by Fulton and Hodgson (1979) and Klassen *et al.* (1992), and studies targeted toward specific areas within southeast Labrador were carried out by McCuaig (2002a, b, c) and Smith *et al.* (2003). Granular-aggregate mapping in southeast Labrador was completed by Ricketts (1987, 2004, 2005 and 2011).