CHAPTER 5

INTRODUCTION TO REGIONAL GEOLOGY

Eastern Laurentia includes the Archean Nain Province and easternmost part of the Superior Province, the Paleoproterozoic Eastern Churchill and Makkovik provinces, and the Paleo- to Mesoproterozoic Grenville Province (Figure 5.1), of which eastern parts of the Makkovik and Grenville provinces are addressed in this report.

The Makkovik Province represents the remnants of a former Paleoproterozoic accretionary orogen that developed on the southern flank of pre-Makkovikian Laurentia, mostly between 1900 and 1790 Ma. The Ketilidian Mobile Belt in southern Greenland is its pre-Labrador Sea continuation to the northeast (Figure 5.2) (Gower and Ryan, 1986, and references therein). The Grenville orogen developed during Mesoproterozoic (1090–985 Ma) continent–continent collisional orogenesis between pre-Grenvillian Laurentia and another cratonic landmass (generally believed to be Amazonia).

Note that a distinction is maintained between 'orogen' and 'province', as the Grenville Province also includes the products of several earlier Proterozoic orogens (*e.g.*, 1710–1600 Ma Labradorian; 1520–1460 Ma Pinwarian). Orogens only exist at the time they are active, after which their remnants are preserved in structural provinces.

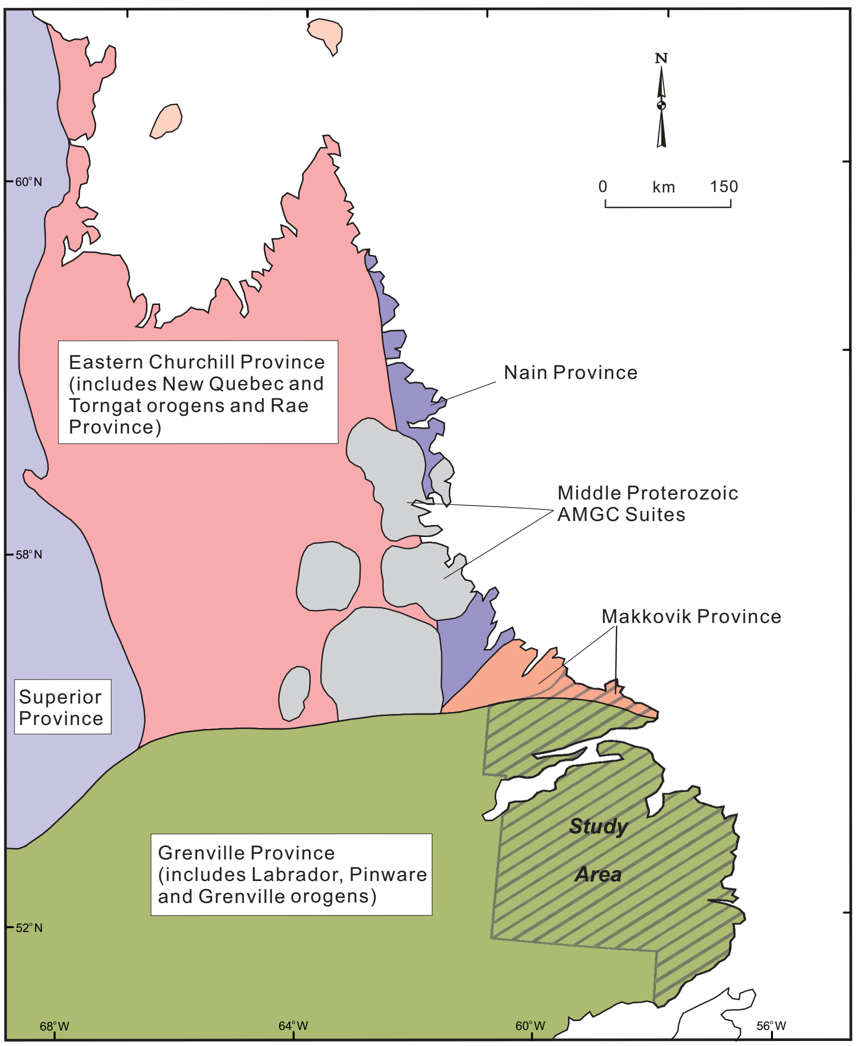

Figure 5.1. *Structural provinces in eastern Laurentia, also showing area addressed in this report.*

To improve readability in the summary text, events are treated as established facts, deferring more nuanced status justification to detailed descriptions of units. Events have also been rounded off to 5-million-year intervals, unless the text demands otherwise.

5.1 MAKKOVIK PROVINCE

The Makkovik Province (Figure 5.3) is divided into three structural domains (Kerr *et al.*, 1996):

i) The Kaipokok domain in the west;
ii) The Aillik domain in the centre; and
iii) The Cape Harrison domain in the east (Chapter 6).

The Kaipokok domain comprises reworked Archean gneiss of the North Atlantic craton and is intruded by Kikkertavak mafic dykes, which are overlain by Paleoproterozoic supracrustal rocks of the Moran Lake Group (undated) and *ca.* 2180–2010 Ma Post Hill Group, and intruded by Paleoproterozoic granitoid rocks, most of which

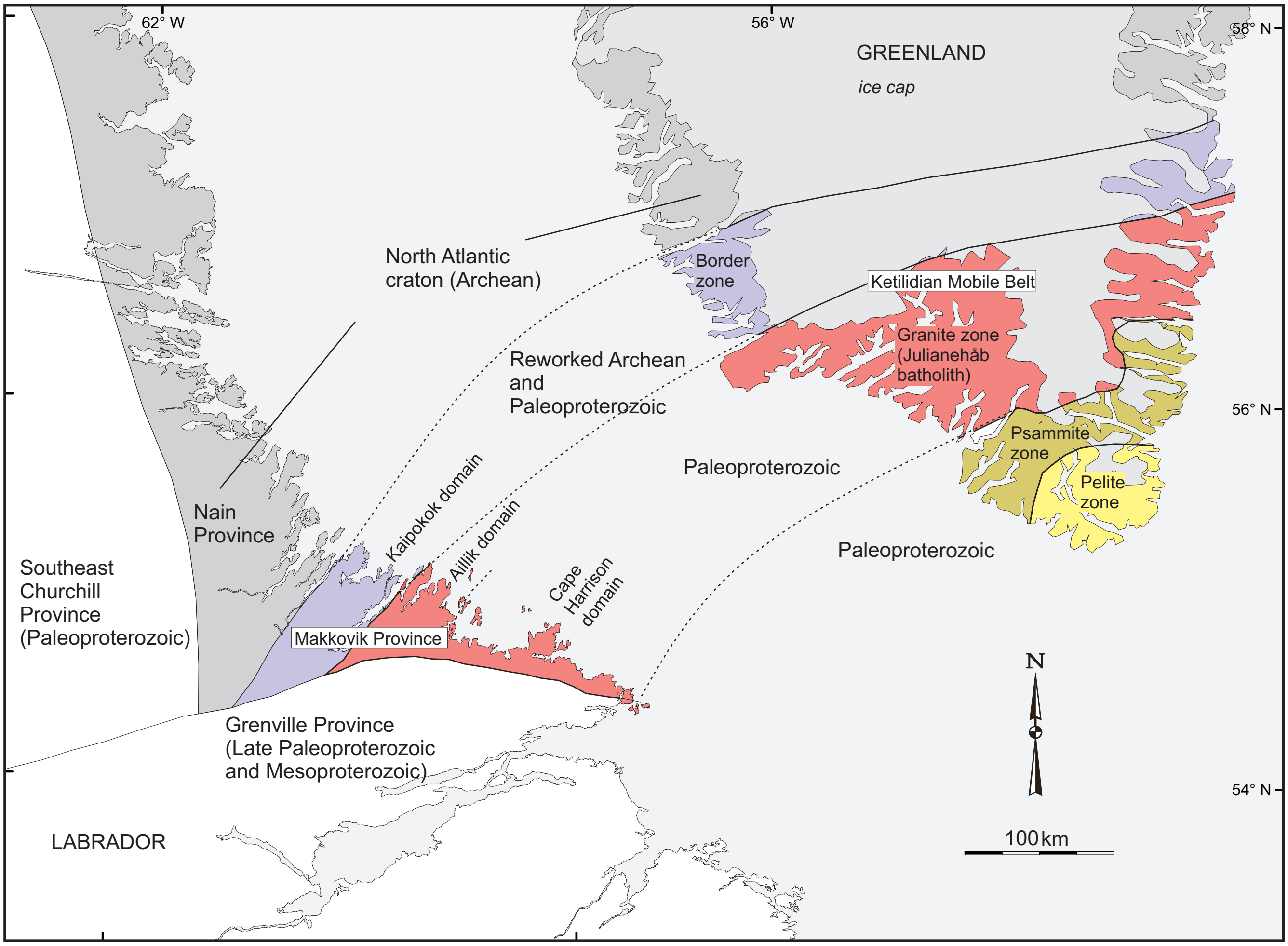

Figure 5.2. *Pre-Labrador Sea reconstruction of relationship between Makkovik Province and Ketilidian Mobile Belt.*

have been traditionally assigned to the 1890–1870 Ma Island Harbour Bay intrusive suite. It is separated from the Archean Nain Province by the Kanairiktok shear zone.

The Aillik domain is underlain by Paleoproterozoic felsic volcanic rocks of the 1885–1850 Ma Aillik Group, associated granitoid intrusive units, tectonic slices of Archean gneiss, and some late Paleoproterozoic (Labradorian) plutons. The terms 'Post Hill' and 'Aillik' groups follow the redefined usage proposed by Ketchum *et al.* (2002; *cf.* Aillik Group nomenclature Section 6.1). The Aillik domain is separated from the Kaipokok domain by the Kaipokok Bay shear zone.

The Cape Harrison domain comprises mostly Paleoproterozoic granitoid and gneissic rocks dated to be 1840 Ma and 1820–1790 Ma (Numok and related intrusive suites), but includes some remnants of Aillik Group 1855 Ma felsic volcanic rocks and late Paleoproterozoic (Labradorian) plutons. The Numok Intrusive Suite is also found in the Kaipokok and Aillik domains, as is the younger Strawberry Intrusive Suite (*ca.* 1720 Ma). No obvious structural boundary separating the Cape Harrison domain from the Aillik domain has been identified, but the Big River fault could be considered boundary-defining in part.

The Kaipokok domain correlates with the Border Zone of the Ketilidian Mobile Belt; and the Aillik and Cape Harrison domains with the Granite Zone (Julianehåb batholith). Pelitic gneiss in the area south of the easternmost Makkovik Province may be correlative with the supracrustal gneiss in the southernmost Ketilidian Mobile Belt, but metasedimentary gneiss in the Grenville Province is a more substantive potential correlative (*cf. see* next section).

The starting time adopted for this report and the 1:100 000-scale maps of Gower (2010a) is 1900 Ma, which therefore excludes more than passing reference to Archean rocks, the Kikkertavak mafic dykes and the Post Hill and Moran Lake groups. Tectonically, it excludes the rift–drift

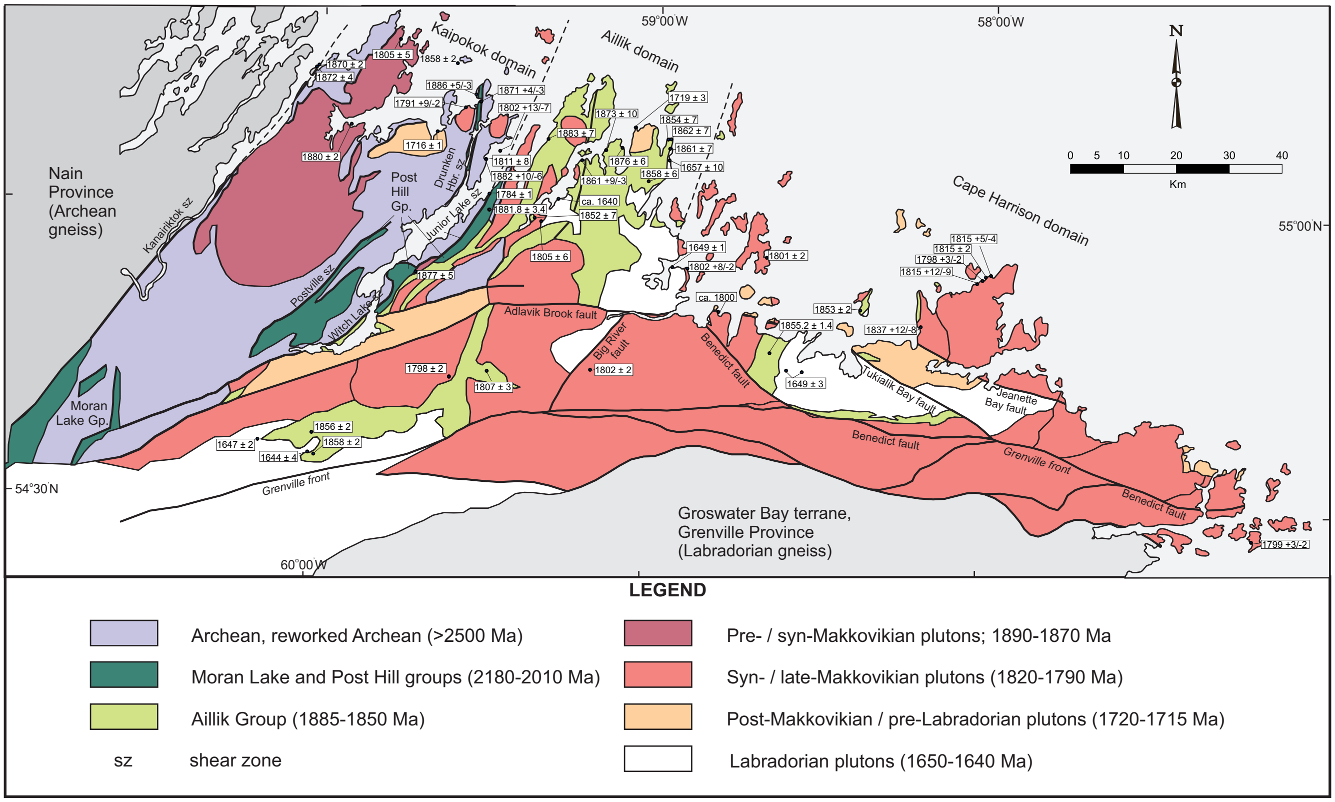

Figure 5.3. *Simplified geological map of the Makkovik Province, showing domain classification, major structures and U–Pb emplacement ages.*

extensional phase for which those rocks constitute evidence, commencing instead with the convergent arc-related regimes that followed.

5.2 GRENVILLE PROVINCE

A distinction is made throughout this report between the eastern Grenville Province, by which is meant the eastern third of the whole of the Grenville Province (Figure 5.4) and the Grenville Province in eastern Labrador (Figure 5.5).

The Grenville Province in eastern Labrador comprises late Paleoproterozoic and Mesoproterozoic rocks that formed during multiple orogenic events between *ca.* 1810 and 950 Ma (Figure 5.6). Six stages of geological development can be identified (Gower and Krogh, 2002, 2003), namely:

i) 'Eagle River' (late Makkovikian correlative) orogenesis (1810–1775 Ma) (Chapters 7 and 8);
ii) Labradorian orogenesis (1710–1600 Ma) (Chapters 9, 10, 11 and 12);
iii) Pinwarian orogenesis (1520–1460 Ma) (Chapter 13);
iv) Post-Pinwarian–Pre-Grenvillian events (1460–1090 Ma) (Chapters 14, 15 and 16);
v) Grenvillian orogenesis; and late- to post-Grenvillian events (1090–985 Ma; 985–920 Ma) (Chapter 17);
vi) Neoproterozoic and Phanerozoic events (Chapters 18 and 19).

The Eagle River (late Makkovikian), Labradorian, Pinwarian and Grenvillian orogenies were active-margin accretionary events, whereas the Grenvillian orogeny represents a continent–continent collision that terminated active Proterozoic accretionary tectonism in this region.

The Grenville Province in eastern Labrador is subdivided into five terranes, which are, from north to south, Groswater Bay terrane, Hawke River terrane, Lake Melville terrane, Mealy Mountains terrane, and Pinware terrane (Figure 5.7). These have most geological significance in a Grenvillian context, but are referenced in a geographical sense when referring to earlier rocks. The regional magnetic map for eastern Labrador (Figure 5.8) has been included here to allow some appreciation of the basis for the interpretation depicted in Figure 5.7. Periodic reference to it is made in the subsequent text.

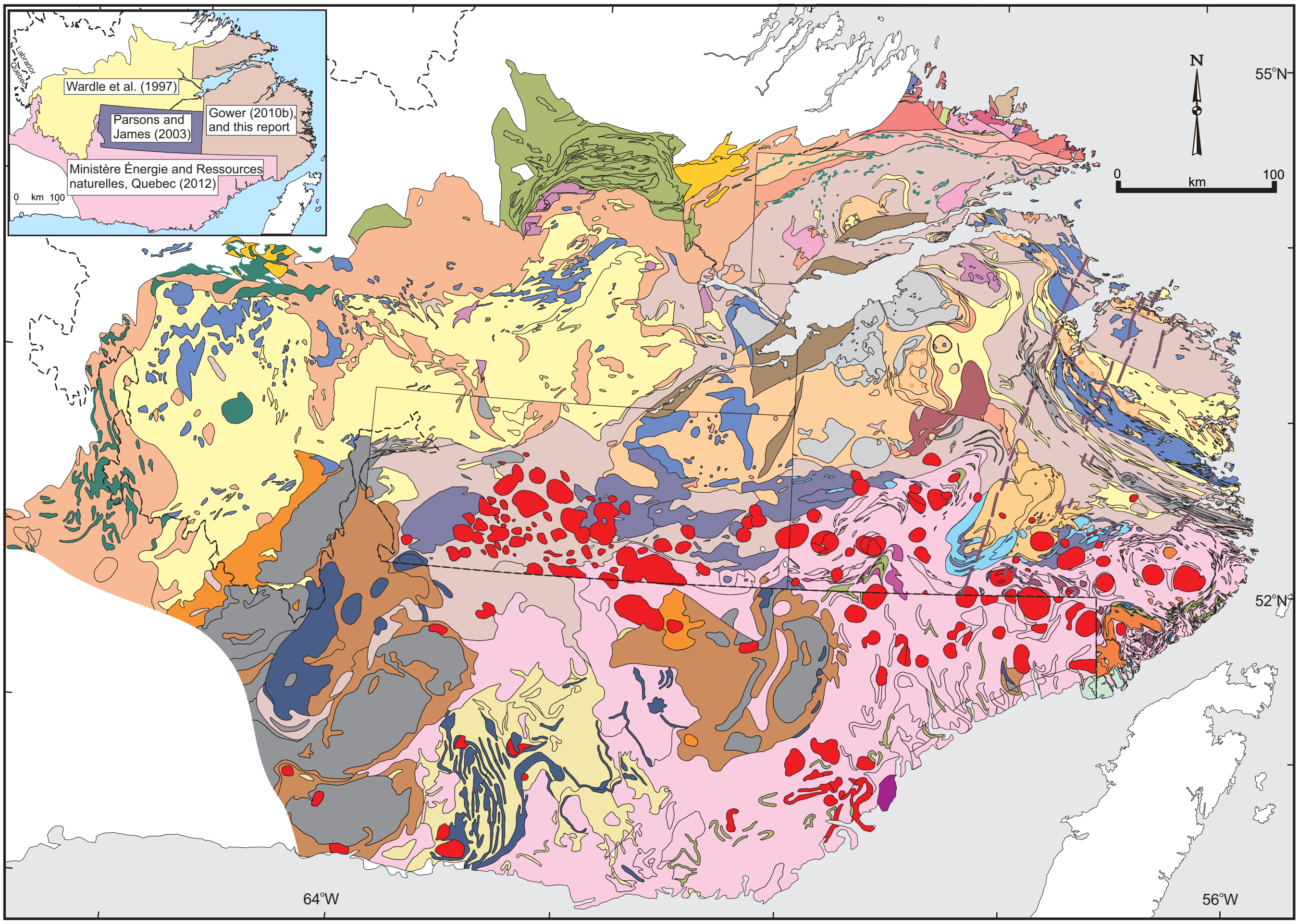

Figure 5.4. *Compilation geological map of the eastern Grenville Province (legend on page 29).*

5.2.1 'EAGLE RIVER' (LATE MAKKOVIKIAN) OROGENESIS (1810–1775 Ma)

Rocks formed during this period can be divided into two groups, namely granitoid units and metasedimentary gneiss. The granitoid rocks having 1810–1775 Ma ages clearly establish the existence of a magmatic event (Eagle River orogeny) in the Grenville Province in eastern Labrador well before Labradorian orogenesis (Gower *et al.*, 2008b), and coeval with, or partially slightly younger than, the Numok intrusive event in the eastern Makkovik Province.

Deposition of the sediments in eastern Labrador was at the same time as, or shortly after, the emplacement of granitoid magmatic rocks (Gower *et al.*, 2008b). Metasedimentary gneiss in eastern Labrador is overwhelmingly pelitic, but associated rocks include psammitic gneiss, quartzite/metachert, mafic volcanic rocks, and rocks derived from calcareous protoliths. The depositional age of the metasedimentary gneiss still remains uncertain, but has been argued to have been between 1810 and 1770 Ma (Wasteneys *et al.*, 1997; Gower and Krogh, 2003; Gower *et al.*, 2008b).

5.2.2 LABRADORIAN OROGENESIS (1710–1600 Ma)

Labradorian orogenesis in the eastern Grenville Province was reviewed by Gower and Krogh (2002, 2003), who suggested an evolving series of events reflecting accretion of an outboard arc. The key dictate of the outboard accretionary model was (and still is) lack of evidence for early Labradorian magmatism and metamorphism (prior to arc accretion) within pre-Labradorian Laurentia. Had early Labradorian rocks formed in a continental margin setting then such magmatism and metamorphism would be expected to be commonplace.

Early Labradorian activity is traditionally defined to include events between *ca.* 1710 and 1680 Ma. The only rock within this time period from eastern Labrador dated by

LEGEND

Phanerozoic (<540 Ma) (Chapter 19 equivalents)

- Bradore and Forteau formations

Neoproterozoic (900–540 Ma) (Chapter 18 equivalents)

- Baie des Moutons complex
- Double Mer Formation and correlative rocks

Late Mesoproterozoic (1200–900 Ma) (Chapter 17 equivalents)

- Syn- to post-Grenvillian (1040–950 Ma) monzonite, syenite and granite plutons
- Syn- Grenvillian (*ca.* 1040 Ma); Fold test K-fs megacrystic granitoid intrusions
- Pre- to early post-Grenvillian (1140–975 Ma) AMCG-related granitic rocks
- Pre- to early post-Grenvillian (1140–975 Ma) AMCG-related monzonitic rocks
- Pre- to early post-Grenvillian (1140–975 Ma) AMCG-related anorthositic rocks
- Pre- to early post-Grenvillian (1140–975 Ma) AMCG-related mafic rocks

Late Middle Mesoproterozoic (1350–1200 Ma) (Chapter 16 equivalents)

- Seal Lake Group (*ca.* 1250 Ma) basaltic flows, clastic sediments and mafic sills
- Red Wine intrusive suite (*ca.* 1337 Ma) and Letitia Lake Group (*ca.* 1327 Ma) peralkaline felsic rocks

Early Middle Mesoproterozoic (1460–1350 Ma) (Chapter 15 equivalents)

- Michael and Shabogamo gabbros

Late Paleoproterozoic and Early Mesoproterozoic (1810–1350 Ma) (Chapters 13-14 equivalents)

- Pinware terrane granitoid rocks; mainly granite, syenite common
- Gabbronorite, ultramafic rocks, and metamorphic derivatives
- Wakeham Group (*ca.* 1550–1500 Ma) arenites, conglomerate, marble, mafic and felsic volcanic rocks
- Pinware terrane supracrustal rocks (1650–1500 Ma?) felsic volcanoclastites, psammites and pelites)

Late Paleoproterozoic Labradorian (Chapters 9-12 equivalents)

- Late Labradorian felsic volcanic rocks (1650 Ma), *e.g.*, Bruce River and Blueberry Lake groups
- Late Labradorian Trans-Labrador granitoid batholith and related rocks (1655–1650 Ma)
- Late Labradorian AMCG-related monzonitic and granitic rocks (1645–1635 Ma)
- Late Labradorian anorthositic rocks (1660–1600 Ma); Leucogabbronorite, leucotroctolite, anorthosite
- Late Labradorian mafic rocks (1660–1600 Ma); Gabbronorite and metamorphic derivatives
- Early Labradorian granitoid rocks (1710–1660 Ma)
- Early Labradorian anorthositic/mafic rocks (1710–1660 Ma)

Paleoproterozoic pre-Labradorian (Chapter 7 equivalents)

- Pre-Labradorian supracrustal rocks (*ca.* 1810–1770 Ma); Mostly pelitic gneiss; some psammitic gneiss, quartzite, calc-silicate rocks and mafic volcanic rocks

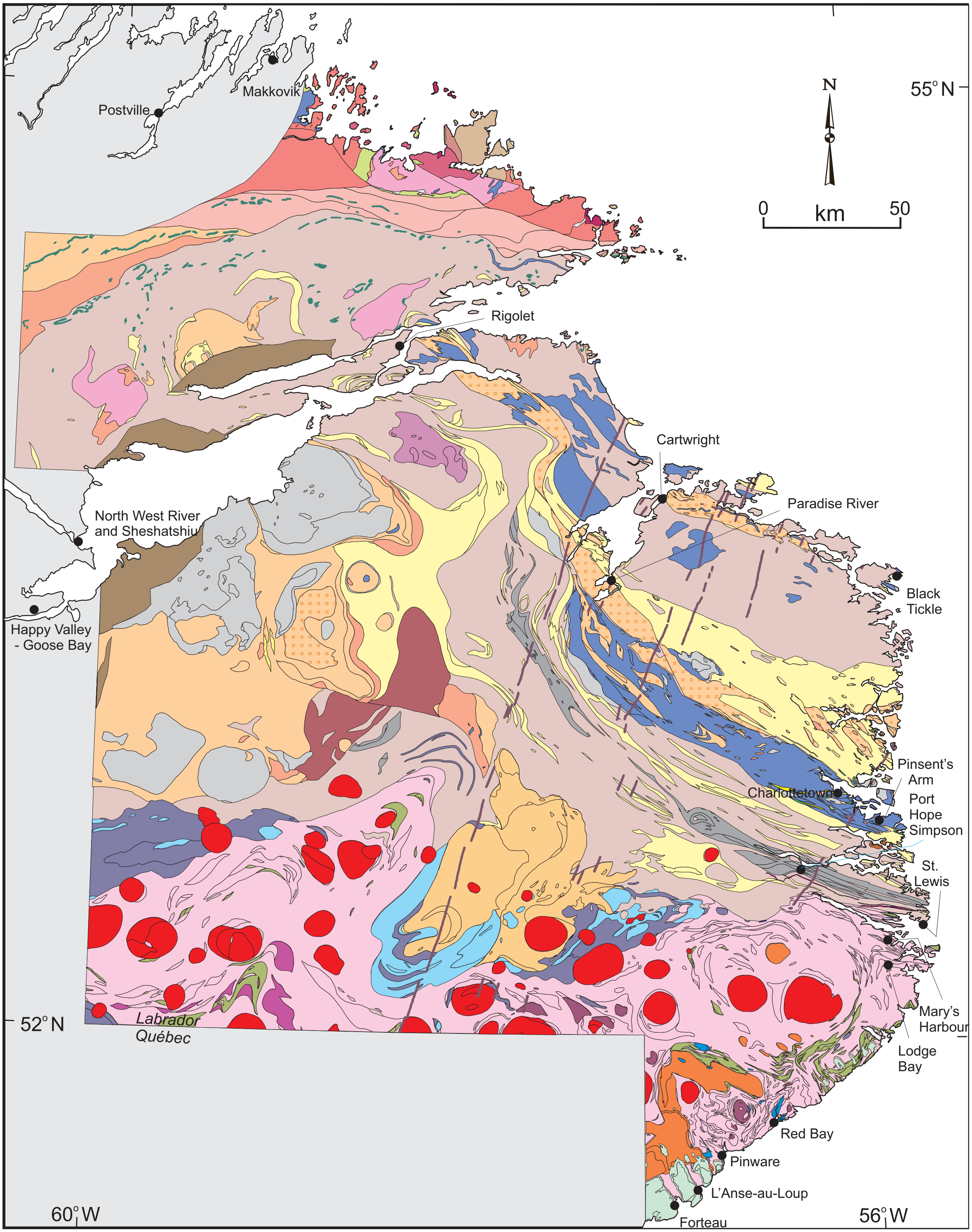

Figure 5.5. *Simplified geological map of eastern Labrador (legend on page 31).*

LEGEND

	Phanerozoic (<540 Ma)	CHAPTER 19
	Bradore and Forteau formations	Figure 19.1
	Neoproterozoic (900–540 Ma)	CHAPTER 18
	Long Range dykes	Figure 18.2
	Double Mer Formation and correlative rocks	Figure 18.1
	Late Mesoproterozoic (1200–900 Ma)	CHAPTER 17
Grenvillian orogeny	Late post-Grenvillian (975–950 Ma); Monzonite, syenite and granite plutons	Figure 17.10
Grenvillian orogeny	Early post-Grenvillian (985–975) Ma; Monzonite to granite intrusions	Figure 17.5
Grenvillian orogeny	Early post-Grenvillian (985–975 Ma); Gabbronorite and leucogabbronorite intrusions	Figure 17.5
Grenvillian orogeny	Late syn- to Early (1015–975 Ma) post-Grenvillian; Alkalic felsic intrusions	Figure 17.5
Grenvillian orogeny	Syn- Grenvillian (*ca.* 1040 Ma); Fold test K-fs megacrystic granitoid intrusions	Figure 17.4
	Pre-Grenvillian (1200–1090 Ma); Gilbert Bay granite	Figure 17.1
	Late Middle Mesoproterozoic (1350–1200 Ma)	CHAPTER 16
	Upper North River intrusion; granite and syenite	Figure 16.2
	Fox Harbour volcanic belt: mostly alkalic felsic volcanic rocks, minor mafic volcanic rocks	Figure 16.1
	Early Middle Mesoproterozoic (1460–1350 Ma)	CHAPTER 15
	Michael gabbro	Figure 15.1
	Early and Middle Mesoproterozoic (1600–1350 Ma)	CHAPTER 14
Pinwarian orogeny	Monzonite, syenite and granite (Pinware - Mealy Mountains terrane boundary mafic and felsic rocks)	Figures 14.2
Pinwarian orogeny	Leucogabbronorite, anorthosite (Pinware - Mealy Mountains terrane boundary mafic and felsic rocks)	Figures 14.1
Pinwarian orogeny	Gabbronorite, ultramafic rocks, and metamorphic derivatives (Pinware - Mealy Mountains terrane boundary mafic and felsic rocks)	Figures 14.1
	Late Paleoproterozoic and Early Mesoproterozoic (1810–1350 Ma)	CHAPTER 13
Pinwarian orogeny	Pinware terrane granitoid rocks; mainly granite, syenite common	Figure 13.7
Pinwarian orogeny	Pinware terrane supracrustal rocks (felsic volcanoclastites, psammitic rocks, pelitic rocks)	Figures 13.1-3
	Late Paleoproterozoic Labradorian	CHAPTERS 9-12
Labradorian orogeny	Late Labradorian granitoid rocks (1660–1600 Ma); Syenite, quartz syenite	Figure 12.1
Labradorian orogeny	Late Labradorian granitoid rocks (1660–1600 Ma); Granite, alkali-feldspar granite	Figure 12.1
Labradorian orogeny	Late Labradorian granitoid rocks (1660–1600 Ma); K-fs megacrystic quartz monzonite to granite	Figure 12.1
Labradorian orogeny	Late Labradorian granitoid rocks (1660–1600 Ma); Monzonite to quartz monzonite	Figure 12.1
Labradorian orogeny	Late Labradorian anorthositic rocks (1660–1600 Ma); Leucogabbronorite, leucotroctolite, anorthosite	Figure 11.1
Labradorian orogeny	Late Labradorian mafic rocks (1660–1600 Ma); Gabbronorite and metamorphic derivatives	Figure 11.1
Labradorian orogeny	Early Labradorian granitoid rocks (1710–1660 Ma); Granitoid gneiss (compositions include quartz diorite, granodiorite, monzonite, granite, alkali-feldspar granite and megacrystic variants)	Figure 10.1
Labradorian orogeny	Early Labradorian anorthositic/mafic rocks (1710–1660 Ma); Alexis River and Upper Eagle River intrusions	Figure 9.1
	Paleoproterozoic pre-Labradorian	CHAPTER 8
Eagle R. orogeny	Pre-Labradorian granitoid rocks (*ca.* 1810–1770 Ma); Eagle River complex; Quartz diorite to granite	Figure 8.1
	Paleoproterozoic pre-Labradorian (Grenville Province from here up)	CHAPTER 7
Eagle R. orogeny	Pre-Labradorian supracrustal rocks (*ca.* 1810-1770 Ma); Mostly pelitic gneiss; some psammitic gneiss, quartzite, calc-silicate rocks and mafic volcanic rocks	Figure 7.1
	Paleoproterozoic (Makkovik Province – Cape Harrison domain)	CHAPTER 6
Makkovikian orogeny	Post-Makkovikian (*ca.* 1720 Ma); Granite and alkali-feldspar granite	Figure 6.5
Makkovikian orogeny	Post-Makkovikian (*ca.* 1720 Ma); Alkali-feldspar syenite	Figure 6.5
Makkovikian orogeny	Late- to Post-Makkovikian (1800–1790 Ma); Possibly correlative rocks in northernmost Grenville Province	Figure 6.4
Makkovikian orogeny	Late- to Post-Makkovikian (1800–1790 Ma); Monzonite, quartz monzonite, syenite and granite plutons	Figure 6.4
Makkovikian orogeny	Late-Makkovikian (1840–1820 Ma); Cape Harrison metamorphic suite and correlatives	Figure 6.3
Makkovikian orogeny	Syn- to Late-Makkovikian (1840–1820 Ma); Deus Cape K-fs megacrystic granodiorite	Figure 6.3
Makkovikian orogeny	Syn-Makkovikian (1870–1840 Ma); Aillik Group correlative felsic volcanic and volcanoclastic rocks	Figures 6.1-2

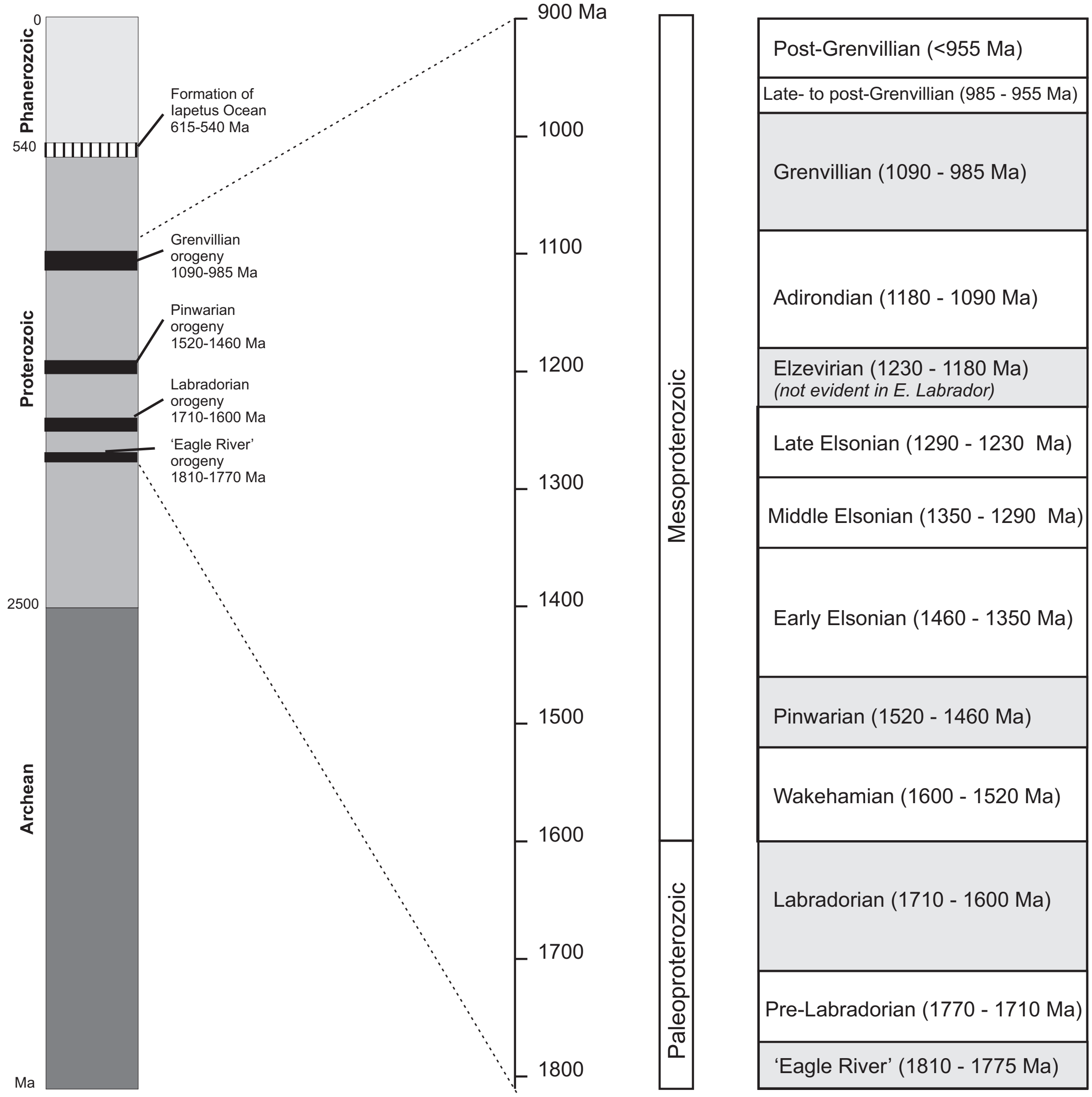

Figure 5.6. *Geological time and eastern Labrador. Right-hand column modified from Gower and Krogh (2002).*

U–Pb methods is a nebulitic granodiorite from the Groswater Bay terrane having a zircon age of 1709 Ma (Schärer *et al.*, 1986). Other dates between 1740 and 1700 Ma from the Groswater Bay terrane and the 1705 to 1680 Ma hiatus may mean that the 1740–1700 Ma activity has greater affinity with the Strawberry Intrusive Suite in the Makkovik Province than with Labradorian orogenesis.

Early to mid-Labradorian calc-alkaline magmatism related to Labradorian orogenesis occurred between 1680 and 1655 Ma. The rocks are dominated by biotite- and hornblende-bearing quartz diorite to biotite granodiorite, but also include some tonalite, large quantities of K-feldspar megacrystic hornblende biotite granodiorite to quartz monzonite, and lesser granite.

Deformation and metamorphism were concentrated between 1665 and 1655 Ma, after which a change in tectonic conditions took place, heralding the start of Trans-Labradorian magmatism (Gower and Krogh, 2002, 2003). This magmatism included i) the emplacement of the Trans-Labrador batholith, ii) creation of coeval supracrustal units, and iii) formation of similar-aged felsic rocks in the Pinware terrane. The Trans-Labrador batholith (term introduced by Wardle and staff, 1982) was emplaced between 1655 and 1645 Ma as a linear belt at least 600 km long and less than

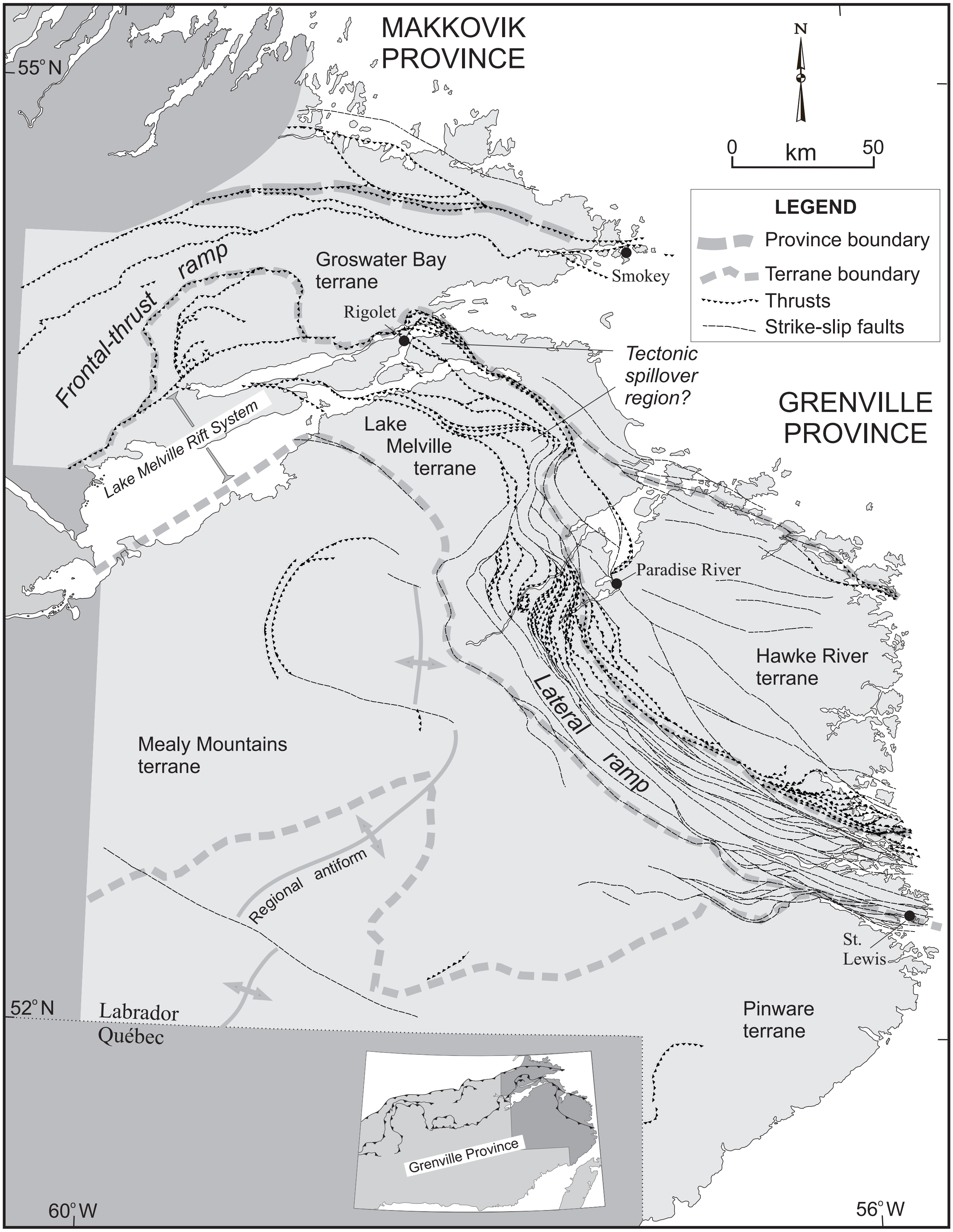

Figure 5.7. *Terranes and major geological structures in eastern Labrador (Gower* et al.*, 2008a).*

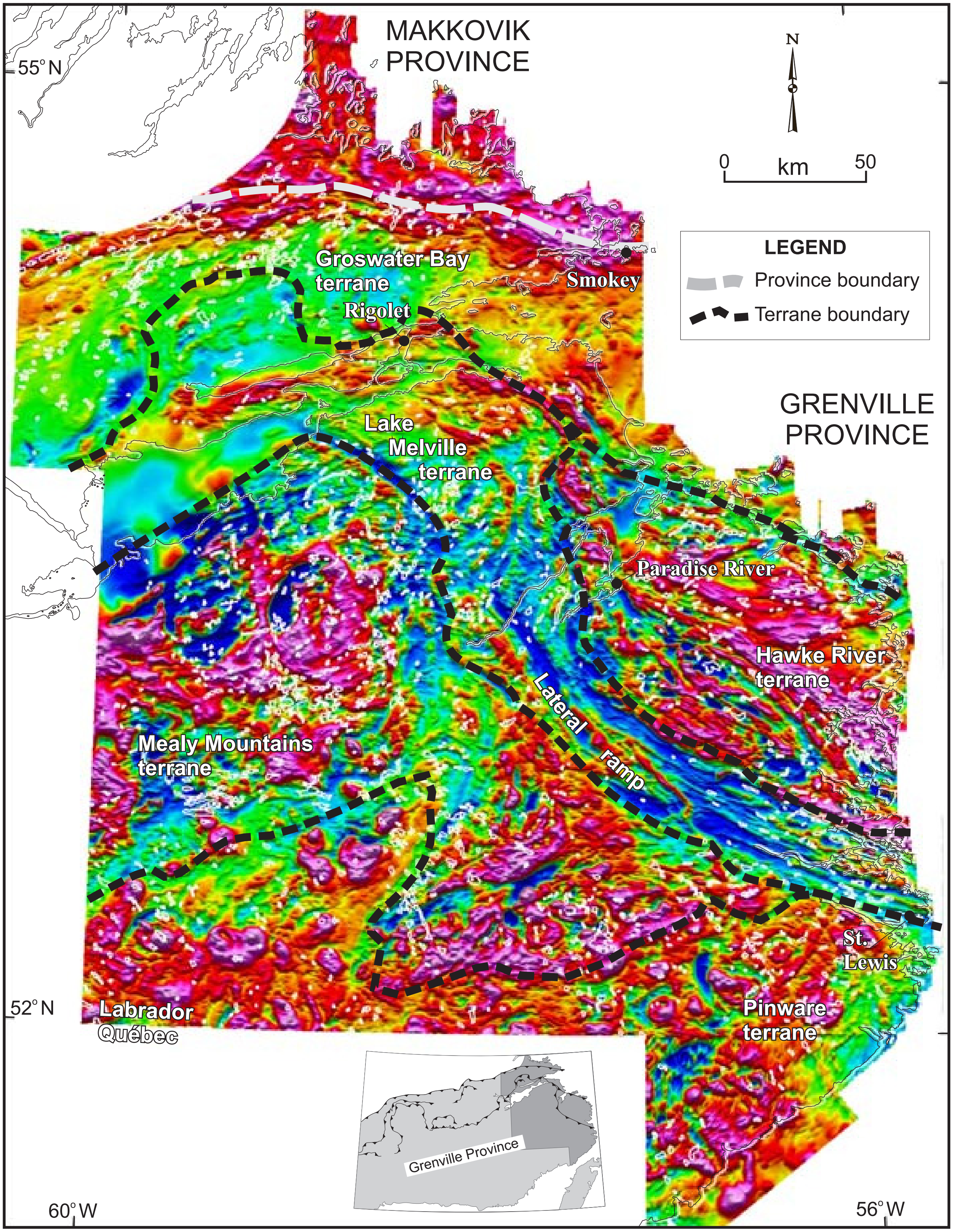

Figure 5.8. *Regional aeromagnetic map for eastern Labrador.*

100 km wide along the northern margin of the Labrador orogen. It has a trend that is slightly oblique to the Grenville front, some plutons emplaced 50 km north of the Grenville front in eastern Labrador, but having its northern limit about 50 km south of the Grenville front in western Labrador. The coeval supracrustal sequences, dominated by felsic volcanic rocks, are situated along the northern fringe of the batholith, and have been interpreted as its extrusive carapace, but preserved only on the northern side because of progressively deeper exhumation from north to south linked to Grenvillian thrusting. These supracrustal packages are all situated west of eastern Labrador, with the possible exception of felsic volcanic rocks south of the Benedict Mountains (which, however, are assumed in this report to be correlative with the Aillik Group), and minor supracrustal remnants scattered throughout the Groswater Bay terrane that probably have felsic volcanic/volcanoclastic protoliths (Gower and Owen, 1984). Their age affiliations are unknown, and could equally be correlative with the Aillik Group. The similar-aged felsic rocks in the Pinware terrane include both supracrustal rocks (Pitts Harbour Group), interpreted to have been derived from a felsic volcanic/volcaniclastic protolith, and granitoid plutonic rocks.

Post Trans-Labradorian magmatism, between 1655 and 1625 Ma, emplaced trimodal mafic–anorthositic–monzogranitic rocks (AMCG suites). Both time range and composition of magmatic products overlap with those of the preceding Trans-Labradorian magmatism. Trimodal magmatism was accompanied by post-Trans-Labradorian deformation and metamorphism between 1645 and 1625 Ma. Late Labradorian events, between 1625 and 1600 Ma, involved the emplacement of minor granitic intrusions and sporadic, diverse, and mostly minor, metamorphism/deformational activity.

5.2.3 PINWARIAN OROGENESIS (1520–1460 Ma)

The key feature of dated Pinwarian magmatism is an overwhelmingly granitic (*sensu stricto*) character. Its duration is well constrained as many intrusions have been dated in southern Labrador, adjacent eastern Québec and in the Long Range Inlier in western Newfoundland (summarized by Gower and Krogh, 2002, with more recent results reported by Heaman *et al.*, 2004 and Gower *et al.*, 2008b). Large bodies are confined to the southern part of the eastern Grenville Province, with only minor Pinwarian felsic magmatism farther north (Gower, 1996). In addition to widespread granitic magmatism, Pinwarian activity also involved metamorphism and deformation. The Pinwarian event was interpreted as reflecting a continental-margin arc over a north-dipping subduction zone (Gower, 1996).

5.2.4 POST-PINWARIAN–PRE-GRENVILLIAN EVENTS (1460–1090 Ma)

Most early post-Pinwarian–pre-Grenvillian activity (1460–1350 Ma) occurred north of the Grenville front and comprised emplacement of huge AMCG suites, namely the Michikamau, Harp Lake and Mistastin complexes. Emplacement of these intrusions began at about 1460 Ma, coincident with the termination of Pinwarian magmatism.

In eastern Labrador, similar-aged activity is represented by the Michael gabbro (1450–1425 Ma), which is a swarm of roughly east-northeast-trending, sheet-like bodies, with which the Shabogamo gabbro in western Labrador is correlative. Collectively, the two suites form a belt about 700 km long and roughly 50 km wide that is situated close to the Grenville front. Slightly later, the 1417 Ma Mokami Hill quartz monzonite was emplaced in the Groswater Bay terrane (Gower and Kamo, 1997).

The next phase, from 1350 to 1290 Ma, also mostly concentrated north of the Grenville front. The main representative was the Nain Plutonic Suite, the emplacement of which spanned the whole of this period. In the Grenville Province in eastern Labrador, the only intrusion known to belong to this time period is the 1296 Ma Upper North River granite in the Lake Melville terrane, but coeval felsic volcanism was recognized in the southern part of the Lake Melville terrane in 2010, in rocks termed the Fox Harbour Belt (http://www.searchminerals.ca/; Haley, 2014).

The next stage (1290 to 1230 Ma) of this period in eastern Laurentia was spatially generalized by Gower and Krogh (2002) as comprising felsic magmatism north and south of a central region of mafic magmatism, all occurring more-or-less concurrently. In eastern Labrador, the 1250 Ma Mealy dykes are one example of the central region of mafic magmatism.

In contrast to the western and central parts of the Grenville Province, the lead-up to the start of Grenvillian orogenesis in eastern Laurentia was largely a period of inactivity, represented in eastern Labrador by the deposition of the Battle Island supracrustal rocks and the emplacement of the Gilbert Bay granite.

5.2.5 GRENVILLIAN OROGENESIS (1090–985 Ma) AND LATE- TO POST-GRENVILLIAN EVENTS (985–920 Ma)

Grenvillian orogenesis in the eastern Grenville Province extended from 1090 to 985 Ma (Gower, 1996;

Gower and Krogh, 2002). Peak deformation, metamorphism and magmatism occurred at different times in different areas in eastern Labrador.

In the Groswater Bay and Hawke River terranes, Grenvillian orogenesis was mild and unaccompanied by magmatism (except for minor granitoid intrusions, perhaps, close to terrane boundaries with the Lake Melville terrane). Pre-Grenvillian titanite ages are commonly preserved.

The Lake Melville terrane was the scene of major Grenvillian activity, being characterized by northwest-verging thrusting north of Lake Melville and dextral strike-slip transposition from Lake Melville to the southern Labrador coast. Deformation and metamorphism was associated with emplacement of minor granitoid intrusions – at least, during the early stages of activity. Orogenesis started in the Lake Melville terrane at 1090 Ma, much earlier than in the other terranes (*ca.* 1050 Ma). Late Grenvillian activity in the Lake Melville terrane was marked by the emplacement of alkalic mafic dykes (Gilbert Bay dykes), which are spatially associated with the Gilbert River fault.

The Mealy Mountains terrane also experienced mild Grenvillian orogenesis. Magmatism was very minor, except in southern parts of the terrane, which were affected by late- to post-Grenvillian granitoid pluton emplacement.

In contrast to the other terranes, the Pinware terrane was characterized by extensive pluton emplacement that was accompanied by moderate- to high-grade metamorphism. Granitoid pluton emplacement commenced at *ca.* 1040 Ma, which also marked the start of Grenvillian orogenesis in the terrane. Magmatism, metamorphism and deformation were continuous until 985 Ma, at which time metamorphism and deformation declined significantly. Later Grenvillian events are divided here into two groups. The older event (985 to 975 Ma) involved alkalic mafic dyking (L'Anse-au-Diable dykes) and anorthositic/mafic/alkalic magmatism, whereas the younger event (975 to 955 Ma) was one of monzonitic, syenitic and granitic magmatism. The first clearly developed into the second without any hiatus, but there are sufficient time–compositional contrasts to distinguish them.

5.2.6 NEOPROTEROZOIC AND PHANEROZOIC EVENTS

For 300 million years following the end of the Grenvillian orogeny, there is no record of geological activity in the region. The next events are related to the rifting and drifting phases of the opening of Iapetus Ocean during the late Neoproterozoic. Rifting was marked in the region by the emplacement of the 615 Ma Long Range dykes, huge quartz veins, deposition of the Double Mer Formation in the Lake Melville Rift System and Sandwich Bay graben, deposition of the Bateau Formation and extrusion of the Lighthouse Cove mafic volcanic rocks. The start of the drifting phase in the early Phanerozoic is marked by flooding of the ancient Laurentian margin, as indicated by the deposition of ferruginous clastic and mixed clastic–carbonate of the Bradore and Forteau formations. At least two, and possibly three, mafic dyke emplacement events of uncertain specific age followed (one likely Devonian–Carboniferous, and the other probably later).