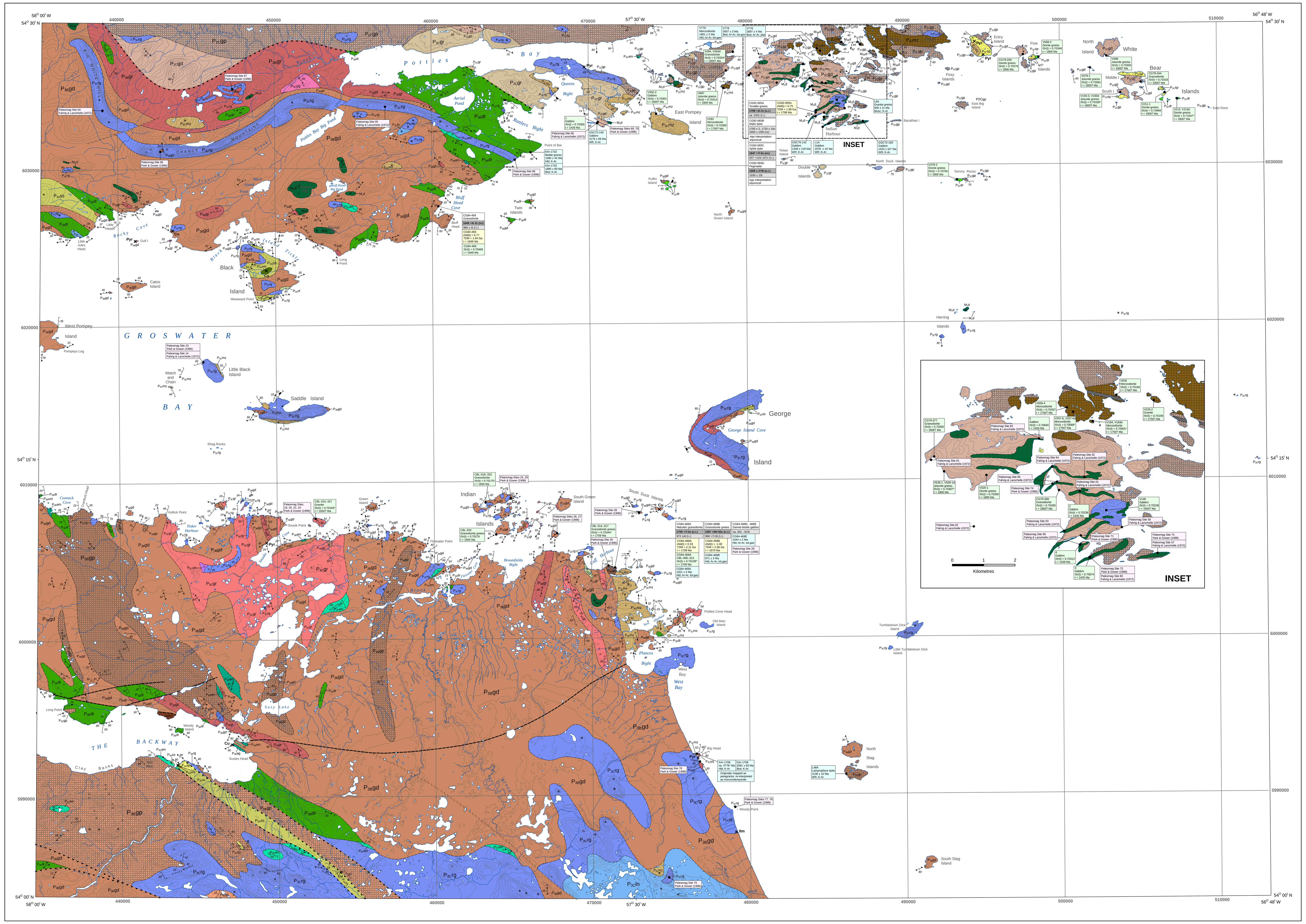
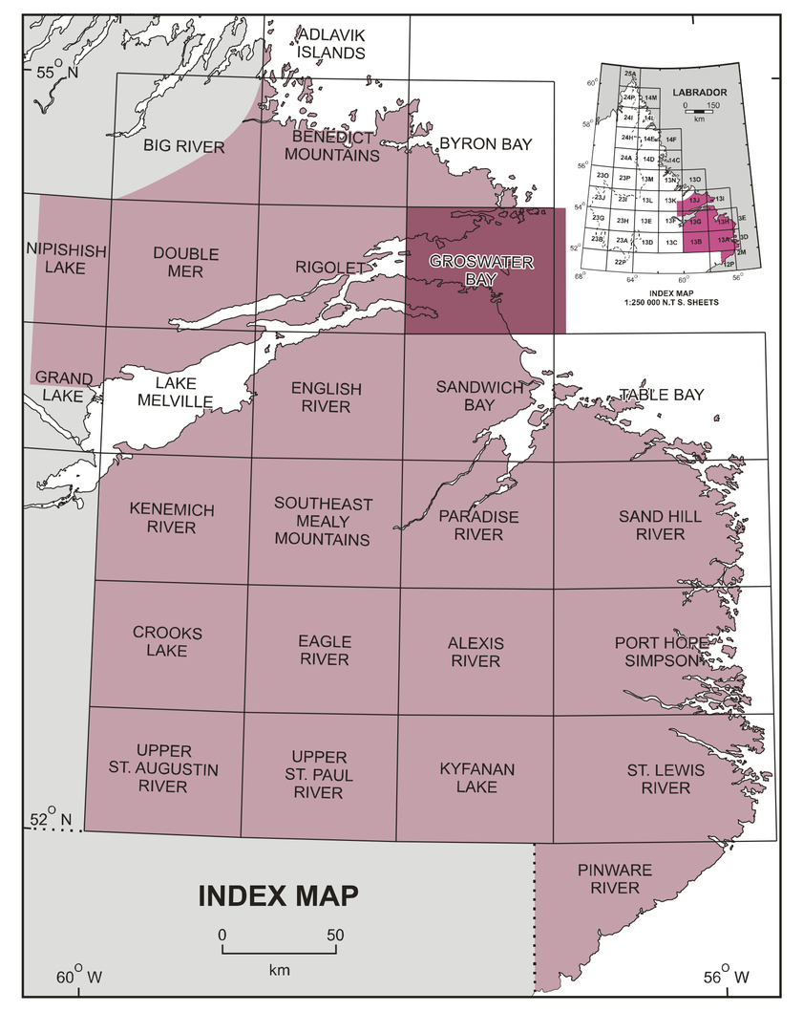
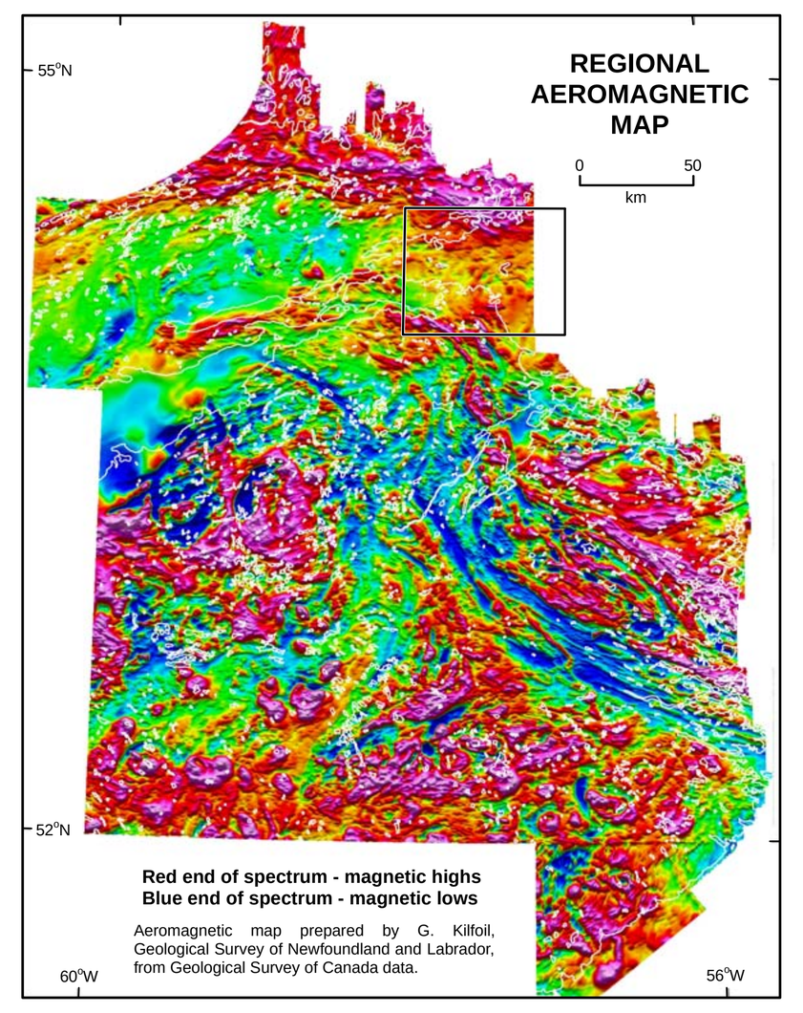
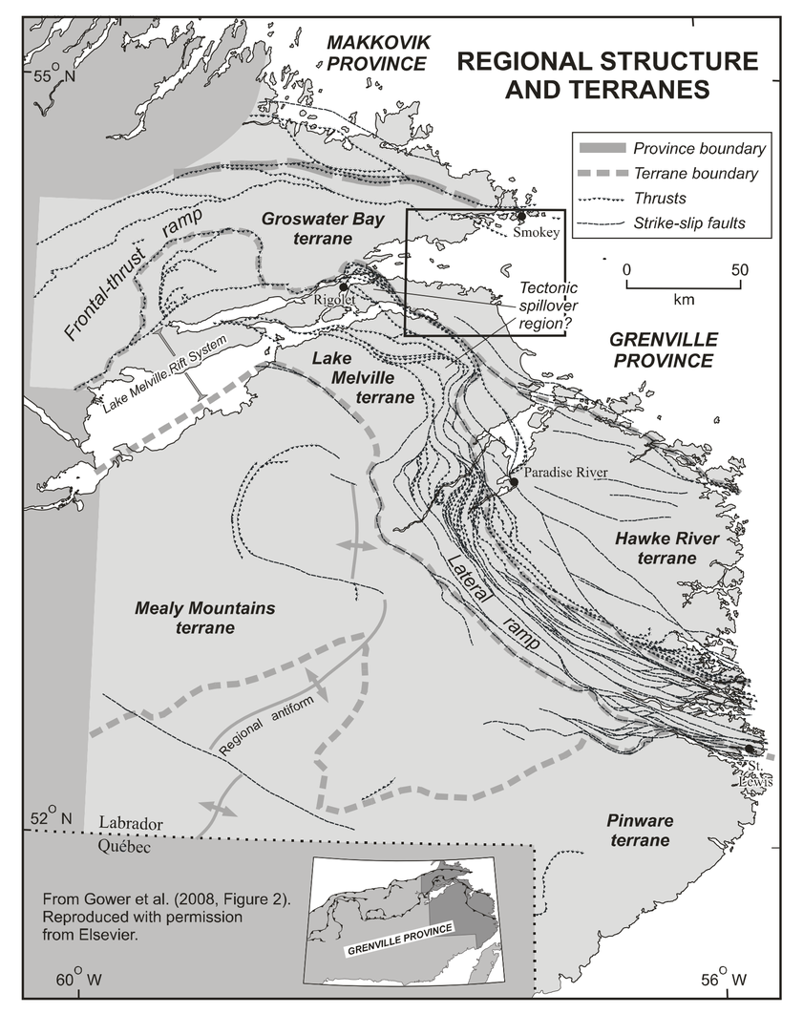
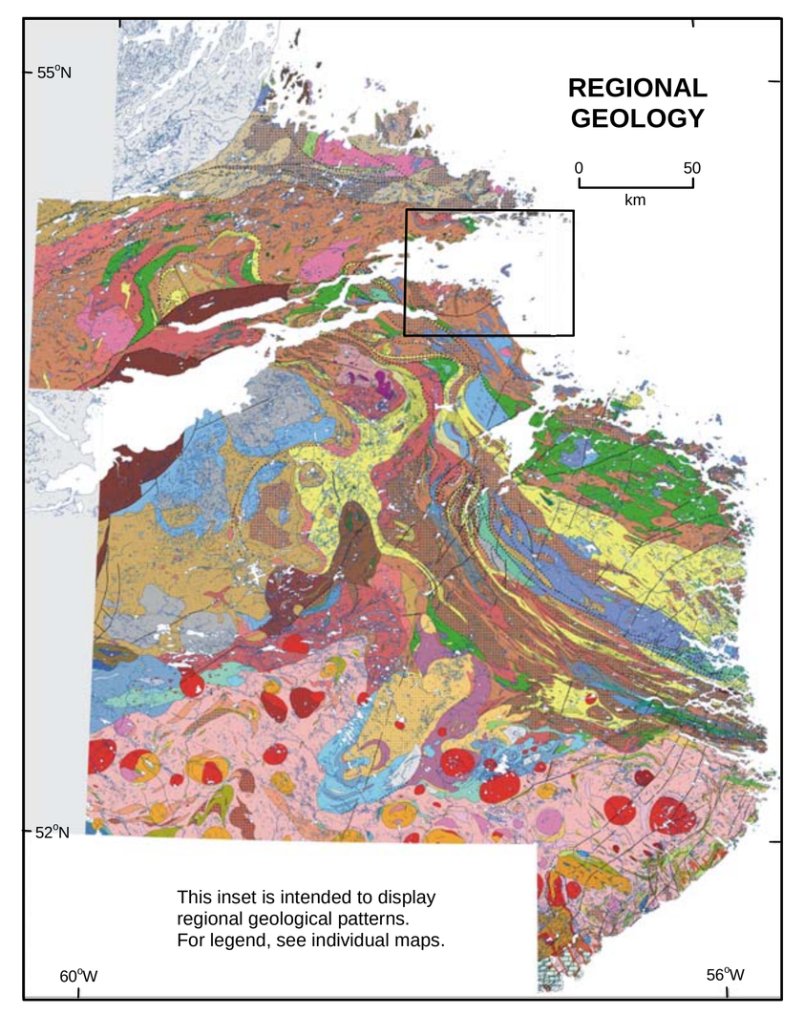




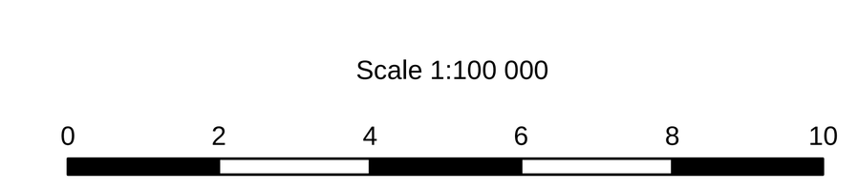




From Gower et al. (2008, Figure 2). Reproduced with permission from Elsevier.



This inset is intended to display regional geological patterns. For legend, see individual maps.



MAP 2010-08

OPEN FILE 013I/0028

GEOLOGY OF THE GROSWATER BAY AREA (NTS SHEETS 13I/03, 04, 05 & 06) EASTERN LABRADOR

GROSWATER BAY

A preliminary version of this map was originally published uncoloured (Gower et al., 1983) and a brief description of rock types in the area was given previously by Gower et al. (1981). Most of the map is based on investigations carried out in 1979 and 1980, but additional field data were collected in subsequent visits. The present map incorporates field data collected by Stevenson (1970) and Owen (1985), making use of original field notes recorded by I.M. Stevenson and assistants and thesis material of J.V. Owen.

The map is augmented by follow-up examination of stained slabs, petrographic thin sections, and whole-rock geochemical analyses. U-Pb geochronological results (Schärer et al., 1986; Schärer and Gower, 1988; Schärer, 1991; Kamo et al., 1996; Krogh et al., 2002, Nd-Sm isotopic data (Schärer, 1991; R.A. Creaser, unpublished - see digital database), Rb-Sr isotopic data (Fahrig and Loveridge, 1981; Brooks, 1982; Owen, 1985; Owen et al., 1988; Schärer, 1991), K-Ar isotopic data (Geological Survey of Canada, unpublished; Grasty et al., 1969; Wanless et al., 1972, 1973), Ar-Ar isotopic data (Owen et al., 1988; R. D. Dallmeyer, unpublished, see digital database), and paleomagnetic sites (Fahrig and Larochelle, 1972; Park and Gower, 1996) are shown. Localities designated as mineral occurrences are based partly on observations made during the 1979 and 1980 field seasons, but include earlier and later reported discoveries (see Mineral Occurrence Table; current to 2009).

Since the preliminary map was published, interpretation for the region has evolved, so there are some differences between the current and preliminary versions of this map, particularly in the northeast part of the map, where the mapping of Owen (1985) has been integrated, but also regarding the depiction of thrusts in the southwest part, most of which are yet to be confirmed. Unit modification is partly related to a compilation approach applied to the whole of eastern Labrador, but border regions of the map have been revised as a result of data integration with adjacent map areas. Geological boundaries are poorly controlled, especially away from shorelines, and have been extrapolated inland using structural observations, regional aeromagnetic data and topographic trends. Data station sites have been digitized from where originally located on aerial photographs or (rarely) on topographic maps, so reliability of location is likely mostly dependent on initial plotting accuracy.

As is characteristic of metamorphic and plutonic terranes, individual outcrops are typically very complex, and commonly embody several different rock types. Generally, the unit polygon depicted is based on what was judged to be the dominant rock type present, but this approach was not universally followed, due to the exigencies of specific situations, such as the need to emphasize minor rock types deemed to have high significance. All rock types recorded from any individual outcrop may be determined by consulting the 'Unit designator' string for that locality given in the digital database. The user is alerted to the fact that, in the digital database, no attempt has been made to reconcile rock names applied to field outcrops, versus those applied to stained slabs, or petrographic thin sections. Differences may be due to subsequent, more refined identifications, but other reasons may apply, such the sample (or thin section) not being representative of its source material. Unit designator and polygon labels applied are based on an awareness of such factors.

Recommended citation
Gower, C.F., 2010: Geology of the Groswater Bay area (NTS sheets 13I/03, 04, 05 and 06), eastern Labrador. Geological Survey, Mines Branch, Department of Natural Resources, Government of Newfoundland and Labrador, Map 2010-08, Open File 013I/0028.

Geological cartography by T. Paltanavage, Cartographic Unit, Geological Survey, Department of Natural Resources.

Digital NTS base maps (NTS 13I/03, 04, 05, and 06) used for this map are available from Surveys and Mapping Branch, Natural Resources Canada.
Magnetic declination at 54° 00' N, 58° 00' W at the start of 2010 was 23° 12' W.
Elevations are in feet above sea level. Contour interval is 60 feet.
UTM (Universal Transverse Mercator) Grid Zone 21, NAD (North American Datum) 27.

Correspondence
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Copies of this map may be obtained from the Geoscience Publications and Information Section, Geological Survey, Mines Branch, Department of Natural Resources, Government of Newfoundland and Labrador, P.O. Box 8700, St. John's, NL, A1B 4J6, Canada. Email: pub@gov.nl.ca.

NOTE: Map 2010-08 is one of twenty-five maps on the geology of the Grenville Province in eastern Labrador and adjacent eastern Makkovik Province produced by the Geological Survey, Mines Branch, Department of Natural Resources, Government of Newfoundland and Labrador.

Mines Branch website: http://www.nr.gov.nl.ca/nr/mines/index.html.

REFERENCES

Beavan, A.P.
1980: Report on assessment work, 1980, claim block 1173, Licence No. 1408. Sen Lac Resources Inc. Newfoundland and Labrador Geological Survey, Assessment File 013/04/0018, 12 pages plus appendices.

Brooks, C.
1982: Supplement to the third report on the geochronology of Labrador. Newfoundland Department of Mines and Energy, 23 pages.

Corbeil, R. and Villeneuve, D.H.
1995: Report on a preliminary prospecting and sampling program on 38 properties located in Labrador, Province of Newfoundland. Hebron Fjord Resources Inc. Newfoundland and Labrador Geological Survey. Assessment File LAB/1334, 31 pages plus appendices.

Emory-Moore, M. and Meyer, J.
1992: Geology of the Porcupine Strand beach placers, eastern Labrador. In Current Research. Department of Mines and Energy, Geological Survey Branch, Report 92-1, pages 221-230.

Fahrig, W.F. and Larochelle, A.
1972: Paleomagnetism of the Michael Gabbro and possible evidence of the rotation of the Makkovik Subprovince. Canadian Journal of Earth Sciences, Volume 9, pages 1287-1296.

Fahrig, W.F. and Loveridge, W.D.
1981: Rb-Sr study of the Michael Gabbro, Labrador. In Current Research, Part C. Geological Survey of Canada, Paper 81-1C, pages 99-103.

Gower, C.F.
1980: Geology of the Benedict Mountains and surrounding areas. In Current Research. Newfoundland Department of Mines and Energy, Mineral Development Division, Report 80-1, pages 182-191.

Gower, C.F., Kamo, S. and Krogh, T.E.
2008: Indentor tectonism in the eastern Grenville Province. Precambrian Research, Volume 167, pages 201-212.

Gower, C.F., Noel, N. and Gillespie, R.T.
1981: The geology of the Rigolet region. In Current Research. Newfoundland Department of Mines and Energy, Mineral Development Division, Report 81-1, pages 121-129.

Gower, C.F., Noel, N. and Gillespie, R.T.
1983: Groswater Bay map region. Newfoundland Department of Mines and Energy, Mineral Development Division, Map 83-43.

Grasty, R.L., Rucklidge, J.C. and Elders, W.A.
1969: New K-Ar age determinations on rocks from the east coast of Labrador. Canadian Journal of Earth Sciences, Volume 6, pages 340-344.

Halet, R.A.
1946: Geological reconnaissance of the Naskaupi Mountains and adjoining coastal region – Nfld. Labrador. Dome Exploration Co. Ltd. Newfoundland and Labrador Geological Survey, Assessment report LAB/0009, 25 pages.

Kamo, S.L., Wasteneys, H., Gower, C.F. and Krogh, T.E.
1996: Refinements to the timing of Labradorian and later events in the Grenville Province, eastern Labrador, based on new U-Pb data. Precambrian Research, Volume 80, pages 239-260.

Kirwan, L.D.
1960: Rocky Cove sulphide show, Nipishish – Pottles Bay, Labrador concession. Newfoundland and Labrador Geological Survey, Assessment File 013I/12/0003, 2 pages.

Krogh, T.E., Kamo, S., Gower, C.F. and Owen, J.V.
2002: Augmented and reassessed geochronological data from the Labradorian-Grenvillian front in the Smokey Archipelago, eastern Labrador. Canadian Journal of Earth Sciences, Volume 39, 831-843.

Owen, J.V.
1985: Tectono-metamorphic evolution of the Grenville front zone, Smokey Archipelago, Labrador. Ph.D. thesis, Memorial University of Newfoundland, St. John's, 382 pages.

Owen, J.V., Dallmeyer, R.D., Gower, C.F. and Rivers, T.
1988: Metamorphic conditions and 40Ar/39Ar geochronologic contrasts across the Grenville front zone, coastal Labrador, Canada. Lithos, Volume 21, pages 13-35.

Park, J.K. and Gower, C.F.
1996: Paleomagnetism of pre-Grenvillian mafic rocks from the northeast Grenville Province, Labrador: implications for the Grenville track. Canadian Journal of Earth Sciences, Volume 33, pages 746-756.

Piloski, M.J.
1955: Appendix II. Geological report on area 'E' Labrador concession. In Exploration in Labrador and Newfoundland, 1954, Brinco Ltd. Newfoundland and Labrador Geological Survey, Assessment File NFLD/0121, 21 pages plus additional material.

Schärer, U.
1991: Rapid continental crust formation at 1.7 Ga from a reservoir with chondritic isotope signatures, eastern Labrador. Earth and Planetary Science Letters, Volume 102, pages 110-133.

Schärer, U. and Gower, C.F.
1988: Crustal evolution in eastern Labrador; constraints from precise U-Pb ages. Precambrian Research, Volume 38, pages 405-421.

Schärer, U., Krogh, T.E. and Gower, C.F.
1986: Age and evolution of the Grenville Province in eastern Labrador from U-Pb systematics in accessory minerals. Contributions to Mineralogy and Petrology, Volume 94, pages 438-451.

Stevenson, I.M.
1970: Rigolet and Groswater Bay map areas, Newfoundland (Labrador) (13J, 13I). Geological Survey of Canada, Paper 69-48, 24 pages.

Wanless, R.K., Stevens, R.D., Lachance G.R. and Delabio, R.N.
1972: Age determinations and geological studies, K-Ar isotopic ages, Report 10. Geological Survey of Canada, Paper 71-2, 96 pages.

Wanless, R.K., Stevens, R.D., Lachance G.R. and Delabio, R.N.
1973: Age determinations and geological studies, K-Ar isotopic ages, Report 11. Geological Survey of Canada, Paper 73-2, 139 pages.

MINERAL OCCURRENCE DATA SOURCES

Inventory No.	Map label	Status	Easting	Northing	Reference
013I/03/Cu 001	Cu	Indication	474332	6008150	GSNL (field notes; CG80-696)
013I/03/Pyr001	Pyr	Indication	476690	5992310	Stevenson (1970; map; SG68-110)
013I/03/Ti 001	Ilm	Prospect	479100	5987600	Emory-Moore and Meyer (1992)
013I/04/Cu 001	Cu	Indication	464890	6008915	GSNL (field notes; CG80-338)
013I/04/Cu 002	Cu	Indication	453893	5985195	GSNL (field notes; CG80-758)
013I/04/Cu 003	Cu	Indication	447030	5993358	GSNL (field notes; RG80-107)
013I/04/Pyr001	Pyr	Indication	443560	5992100	Beavan (1980); GSNL (field notes; CG84-196A,B; RG80-114A,C)
013I/04/Pyr002	Pyr	Indication	449318	6006174	GSNL (field notes; CG880-271)
013I/04/U 001	U	Indication	435714	5996640	Piloski (1955 Area E, p. vi); Beavan (1980)
013I/05/Au 001	Au	Indication	447330	6035096	Corbeil and Villeneuve (1995)
013I/05/Cu 001	Cu	Showing	443458	6026089	Kirwan (1960); Sketch map
013I/05/Cu 002	Cu	Indication	448630	6025179	GSNL (field notes; CG79-795)
013I/05/Cu 003	Cu	Indication	449420	6023510	Halet (1946, p.22); GSNL (field notes; CG84-197)
013I/05/Cu 004	Cu	Indication	449651	6021756	GSNL (field notes; CG79-800)
013I/05/Pyr001	Pyr	Indication	441082	6025444	GSNL (field notes; CG79-902)
013I/06/Pyr001	Pyr	Indication	469741	6036341	Stevenson (1970; map; SGJ68-108)
013I/06/Pyr002	Pyr	Indication	494595	6037816	Stevenson (1970; map; SG68-181)
013I/06/Pyr003	Pyr	Indication	495140	6036962	GSNL (field notes; CG79-337)

GSNL (Geological Survey of Newfoundland and Labrador)

GEOLOGICAL DATA SOURCES

Personnel	Stations	Year(s) data collected	Project name	Mapping references
C.F. Gower (project geologist)	532	1979, -80, -81, -82, -84, -92	Rigolet & Cartwright regions & other visits	Gower (1980), Gower et al. (1981, 1983); additional data
J.V. Owen (graduate geologist)	86	1982	Ph.D investigation	Owen (1985)
R.T. Gillespie (assistant geologist)	80	1980	Rigolet region	Gower et al. (1981, 1983)
J.H. Bourne (assistant geologist)	29	1968	Rigolet - Groswater Bay	Stevenson (1970)
I. M. Stevenson (project geologist)	28	1968	Rigolet - Groswater Bay	Stevenson (1970)
N. Noel (assistant geologist)	23	1980	Rigolet region	Gower et al. (1981, 1983)
W. Nesbitt (assistant geologist)	12	1968	Rigolet - Groswater Bay	Stevenson (1970)
R.A. Doherty (assistant geologist)	6	1979	Benedict Mtns. region	Gower (1980), Gower et al. (1981, 1983)

ISOTOPIC DATA

U/Pb Geochronology

Sample number
Rock type
Inherited/detrital age
Emplacement age
Metamorphism/closure/cooling/undefined Pb loss age

Mineral abbreviations:
a - allanite
b - baddeleyite
m - monazite
r - rutile
t - titanite
x - xenotime
z - zircon

Concordia abbreviations:
c - concordant
nc - near-concordant
l.i. - lower intercept
u.i. - upper intercept

Nd/Sm Geochronology

Sample number
Rock type
Epsilon value
Depleted mantle age
Age of rock
(? age inferred)

Rb/Sr Geochronology

Sample number
Rock type
Initial Sr ratio calculated from time t
Age of rock
(? age inferred)
(* one of two or more analyses)

K/Ar Geochronology

Sample number
Rock type
Age
Mineral; Method
(* average of two or more analyses)

Biot - biotite
Hbl - hornblende
Musc - muscovite
WR - whole rock
plat - plateau age
tot. gas - total gas age

ISOTOPIC DATA SOURCES

Method	Reference(s)	Samples
U-Pb	Kamo et al. (1996)	CG92-065C
U-Pb	Krogh et al. (2002)	CG92-065A; CG92-065B; CG92-065D
U-Pb	Scharer and Gower (1988)	CG84-469
U-Pb	Schärer et al. (1986)	CG84-468A; CG84-468B; CG84-468D, CG84-468E
Nd-Sm	Creaser (unpublished)	CG92-065A
Nd-Sm	Scharer (1991)	CG84-468A; CG84-468B; CG84-469
Rb-Sr	Brooks (1982)	CBL-308; CBL-309; CBL-310; CBL-311; CBL-312; CBL-313; CBL-314; CBL-315; CBL-316; CBL-317; CBL-318; CBL-319; CBL-320; CBL-321; CBL-322; CBL-323; CBL-324; CBL-325; CBL-326; CBL-327; CBL-333;
Rb-Sr	Fahrig & Loveridge (1981)	1; 2; 3; 4; 5
Rb-Sr	Owen (1985)	V149; V302-2
Rb-Sr	Owen et al. (1988)	CG79-339; CG79-344; CG79-366; CG79-377; V009-4; V032; V164; V164d; V193; V193-3; V193d; V211-1; V213; V213d; V225-2; V257-6; V257-6d; V264; V264d; V293; V325-1; V379-2; V526-1; V526-1d; V579-1; V586; V588-2; V687
Rb-Sr	Schärer (1991)	CG84-468A; CG84-469
K-Ar	Geol. Surv. Can. (unpublished)	KAr-1708; KAr-1709; KAr-1732
K-Ar	Grasty et al. (1969)	L1A; L48A; L6A
K-Ar	Wanless et al. (1972)	GSC70-142
K-Ar	Wanless et al. (1973)	GSC72-140; GSC72-150
Ar-Ar	Dallmeyer (unpublished)	CG84-468A; CG84-468B; CG84-468E
Ar-Ar	Owen et al. (1988)	V-776

LEGEND

DEVONIAN (?)

Dd — Sandwich Bay and Battle Harbour dykes

EARLY CAMBRIAN

CFo — Forteau Formation

CBr — Bradore Formation (subdivided into L'Anse-au-Clair, Crow Head and Blanc-Sablon members)

NEOPROTEROZOIC – EARLY CAMBRIAN

NCLc — Lighthouse Cove Formation

NCBa — Bateau Formation

NEOPROTEROZOIC

NDm — Double Mer Formation

NGi — Gilbert arkose

NSb — Sandwich Bay conglomerate

Nc — Clastic dykes

Nd — Long Range dykes

Nq — Quartz veins

LATE MESOPROTEROZOIC (M_3 1200 – 900 Ma)

LATE POST-GRENVILLIAN INTRUSIONS (M_{3D} ca. 975 – 955 Ma) e.g., Chateau Pond granite

$M_{3D}gp$ — Massive to weakly foliated megacrystic/porphyritic granite to quartz monzonite

$M_{3D}gr$ — Massive to weakly foliated granite to alkali-feldspar granite

$M_{3D}ln$ — Massive to weakly foliated leucogabbro to leuconorite

$M_{3D}mn$ — Massive to weakly foliated monzogabbro and monzonorite

$M_{3D}mq$ — Massive to weakly foliated quartz monzonite; mantled feldspar textures

$M_{3D}mz$ — Massive to weakly foliated monzonite to monzodiorite

$M_{3D}yq$ — Massive to weakly foliated syenite, quartz syenite and alkali-feldspar quartz syenite

$M_{3D}d$ — Unnamed mafic dykes

EARLY POST-GRENVILLIAN INTRUSIONS (M_{3C} ca. 985 – 975 Ma) e.g., Beaver Brook and Picton Pond plutons

$M_{3C}gr$ — Weakly to moderately foliated granite to alkali-feldspar granite

$M_{3C}ln$ — Weakly to moderately foliated leucogabbro to leuconorite

$M_{3C}mn$ — Weakly to moderately foliated monzogabbro to monzonorite

$M_{3C}mq$ — Weakly to moderately foliated monzonite to quartz monzonite

$M_{3C}rg$ — Weakly to moderately foliated gabbro, norite and troctolite

$M_{3C}yq$ — Weakly to moderately foliated syenite, quartz syenite and alkali-feldspar syenite

$M_{3C}d$ — L'Anse-au-Diable, York Point, Gilbert Bay mafic dykes

SYN-GRENVILLIAN INTRUSIONS (M_{3B} ca. 1085 – 985 Ma)

$M_{3B}gd$ — Moderately to strongly foliated granodiorite to quartz diorite

$M_{3B}gp$ — Moderately to strongly foliated megacrystic/porphyritic granodiorite to quartz diorite

$M_{3B}gr$ — Moderately to strongly foliated granite to alkali-feldspar granite

$M_{3B}yn$ — Moderately to strongly foliated aegerine- or nepheline-bearing syenite

$M_{3B}d$ — Unnamed mafic dykes (Makkovik Province and adjacent Grenville Province)

PRE-GRENVILLIAN INTRUSIONS (M_{3A} ca. 1200 – 1085 Ma) e.g., Gilbert Bay pluton

$M_{3A}gr$ — Weakly to strongly foliated granite

$M_{3A}mn$ — Weakly to strongly foliated monzonite to monzonorite

MIDDLE MESOPROTEROZOIC (M_2 1350 – 1200 Ma) e.g., Upper North River intrusion

M_2gr — Weakly to strongly foliated granite and alkali-feldspar granite

M_2rg — Weakly to strongly foliated gabbronorite (in database only - Lourdes-de-Blanc-Sablon intrusion, Quebec)

M_2yq — Weakly to strongly foliated syenite, quartz syenite and alkali-feldspar syenite

M_2d — Mealy dykes

EARLY MESOPROTEROZOIC (M_1 1600 – 1350 Ma) e.g., Upper Paradise River, Kyfanan Lake and 13B/12 intrusions, and Michael Gabbro

M_1an — Massive or weakly foliated anorthosite to leucogabbronorite, indistinctly layered in places

M_1am — Weakly to markedly foliated amphibolite, plus leucocratic and melanocratic variants; granulite facies equivalents

M_1dr — Massive, weakly or strongly foliated diorite to amphibolite, may be metamorphic derivative of monzodiorite or leucogabbronorite

M_1gp — Moderately to strongly foliated megacrystic/porphyritic granitoid rocks

M_1gr — Massive, weakly or strongly foliated granite to quartz monzonite

M_1ln — Massive, weakly or strongly foliated leucogabbronorite and anorthositic gabbro, locally grading into gabbronorite, locally coronitic

M_1mn — Moderately to strongly foliated monzonorite

M_1mq — Moderately to strongly foliated monzonite to quartz monzonite

M_1mz — Moderately to strongly foliated monzonite to monzodiorite

M_1rg — Massive to strongly foliated gabbro, norite and troctolite, commonly layered; subophitic and locally coronitic; includes recrystallized derivatives retaining igneous textures

M_1um — Massive, weakly or strongly foliated ultramafic rocks, commonly layered and locally showing cumulate textures

M_1yq — Moderately to strongly foliated syenite and quartz syenite

M_1d — Mafic dykes; includes Michael Gabbro

LATE PALEOPROTEROZOIC AND EARLY MESOPROTEROZOIC (PM 1800 – 1350 Ma) (Ages generally unknown, but ca. 1650 Ma and 1500 – 1470 Ma rocks identified)

RECRYSTALLIZED IGNEOUS ROCKS

LATE PALEOPROTEROZOIC (P_3 1800 – 1600 Ma)

LATE LABRADORIAN GRANITOID INTRUSIONS (P_{3C} 1660 – 1600 Ma) e.g., Paradise Arm intrusion and Hawke Bay intrusive suite

$P_{3C}dr$ — Diorite, quartz diorite and tonalite; locally grading into leucogabbronorite

$P_{3C}ga$ — Alkali-feldspar granite, granite and quartz syenite forming discrete plutons

$P_{3C}gd$ — Granite to granodiorite forming discrete unmigmatized plutons

$P_{3C}gp$ — Megacrystic/porphyritic granite to granodiorite

$P_{3C}gr$ — Granite and minor alkali-feldspar granite

$P_{3C}mn$ — Monzonorite and monzogabbro