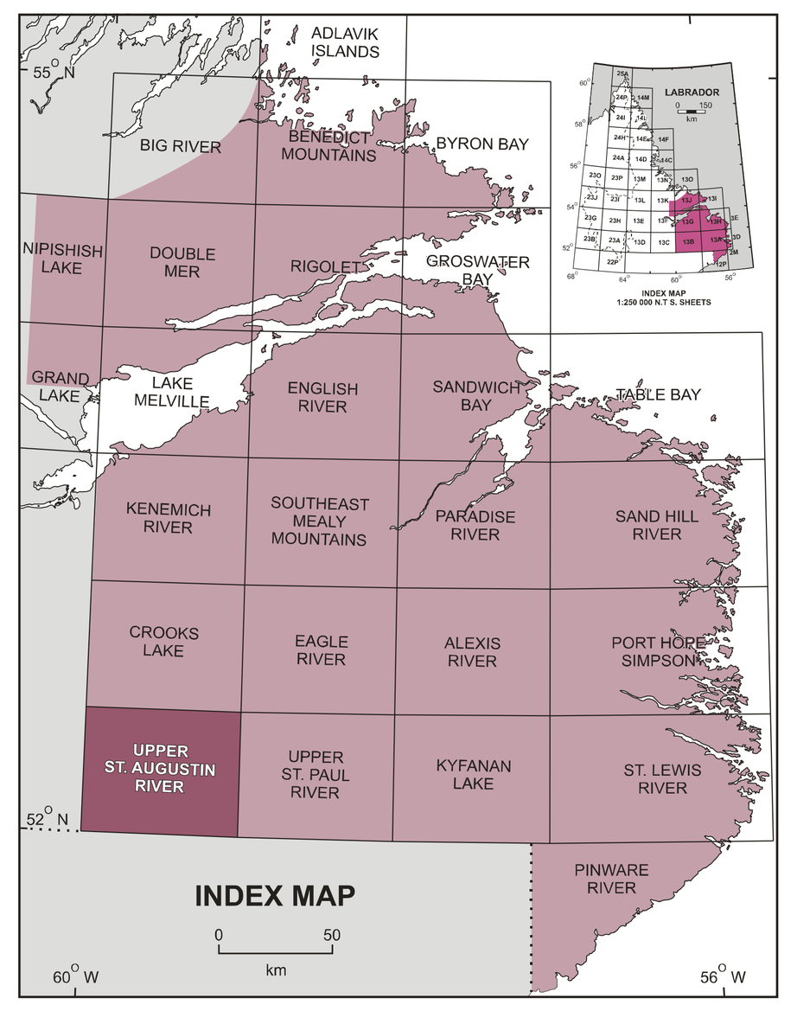

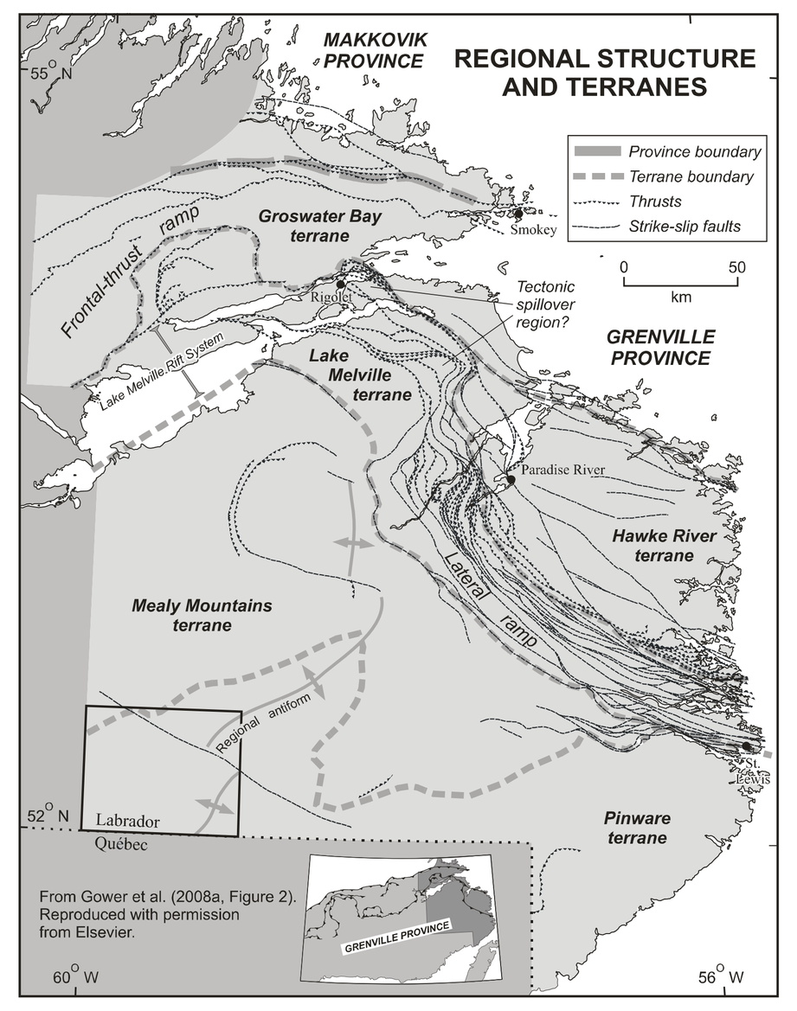

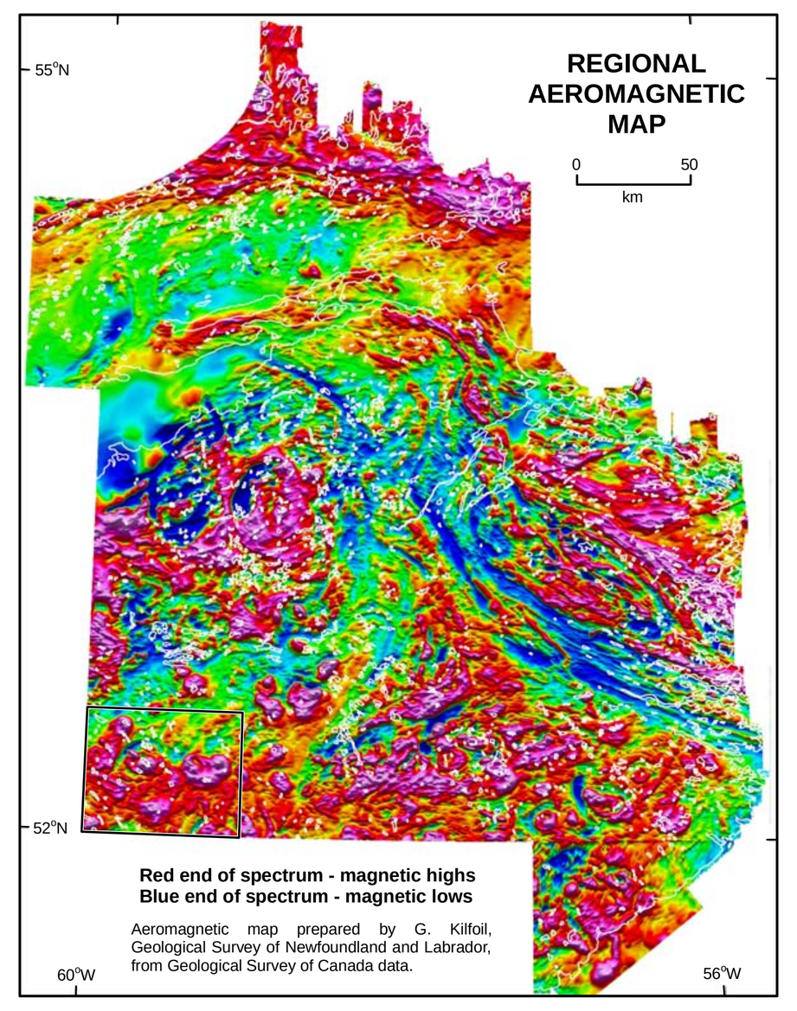

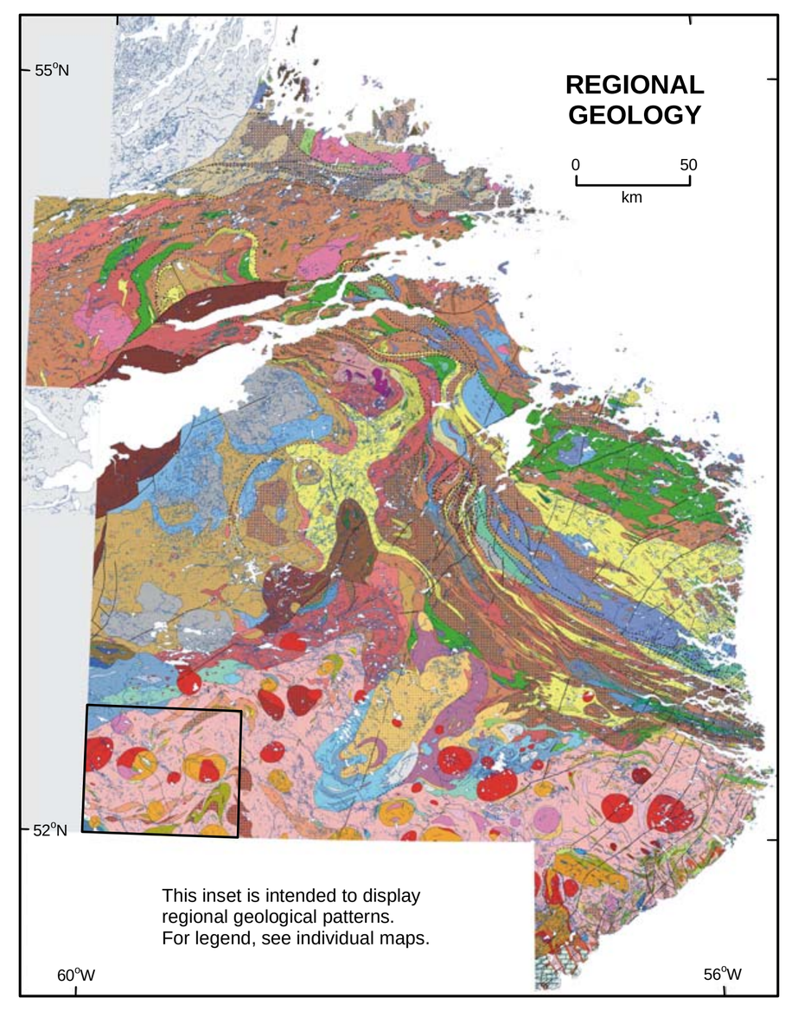

MAP 2010-21

OPEN FILE 013B/0029

GEOLOGY OF THE UPPER ST. AUGUSTIN RIVER AREA (NTS SHEETS 13B/03, 04, 05 & 06) SOUTHEASTERN LABRADOR

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

PMdr — Medium-grained, equigranular, recrystallized weakly to strongly foliated diorite, quartz diorite and to leucoamphibolite

PMgd — Weakly to strongly foliated granite to granodiorite

PMgp — Megacrystic/porphyritic recrystallized granite to quartz monzonite

PMgr — Medium- to coarse-grained, recrystallized weakly to strongly foliated granite and alkali-feldspar granite

PMln — Medium- to coarse-grained, recrystallized leuconorite, leucogabbro

PMmd — Medium- to coarse-grained, recrystallized, weakly to strongly foliated, monzodiorite to monzonite

PMmq — Medium- to coarse-grained, recrystallized, weakly to strongly foliated quartz monzonite

PMrg — Medium- to coarse-grained, gabbro, norite and troctolite

PMtn — Medium- to coarse-grained, recrystallized, weakly to strongly foliated tonalite to granodiorite

PMyq — Medium- to coarse-grained, recrystallized, weakly to strongly foliated syenite, alkali-feldspar syenite and quartz syenite

PMam — Amphibolite; generally thought to be derived from mafic dykes

SUPRACRUSTAL ROCKS PROVISIONALLY ASSIGNED AS PITTS HARBOUR GROUP

Sedimentary protolith

PMsc — Calc-silicate rocks, compositionally layered, medium grained

PMsp — Pelitic schist and gneiss

PMsq — Quartzite, meta-arkose, thin to thick bedded

PMss — Quartz-feldspar psammitic schist and gneiss; medium grained

PMsx — Coarse-grained to pegmatitic-granitic material (diatexite), characteristically associated with psammitic gneiss and quartzite

Volcanic protolith

PMvf — Fine- to medium-grained, banded quartzofeldspathic rocks; locally having lensoid shapes, possibly indicating felsic volcaniclastic protolith

PMvm — Fine- to medium-grained, banded amphibolite containing quartz-feldspar layers and calc-silicate pods; interpreted as mafic volcanic rocks

AGE GENERALLY POORLY CONSTRAINED

β — Brittle deformation; cataclastic rocks, pseudotacholite

δ — Ductile deformation; mylonite, straight gneiss

AGE GENERALLY POORLY CONSTRAINED

f — Aplite, microgranite (felsite)

k — Carbonate vein

p — Pegmatite

q — Quartz vein

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

$P_{3C}mq$ — Quartz monzonite, including rare quartz syenite

$P_{3C}mz$ — Monzonite, including minor syenite

$P_{3C}yq$ — Syenite to quartz syenite forming discrete plutons

$P_{3C}d$ — Unnamed mafic dykes

LATE LABRADORIAN ANORTHOSITIC AND MAFIC INTRUSIONS (P_{3C} 1660 – 1600 Ma)
e.g., White Bear Arm complex and Sand Hill Big Pond intrusion

$P_{3C}ag$ — Weakly to markedly foliated mafic granulite, plus leucocratic and melanocratic variants

$P_{3C}am$ — Weakly to markedly foliated amphibolite, plus leucocratic and melanocratic variants

$P_{3C}an$ — Massive to strongly foliated anorthosite and leucogabbronorite

$P_{3C}rg$ — Massive to strongly foliated gabbro and norite, commonly layered; subophitic and locally coronitic

$P_{3C}ln$ — Primary textured to recrystallized leucogabbronorite and leucogabbro; coronitic locally

$P_{3C}lt$ — Primary textured to recrystallized leucotroctolite

$P_{3C}um$ — Massive, weakly or strongly foliated ultramafic rocks, commonly layered and locally showing cumulate textures

EARLY LABRADORIAN MAFIC AND ASSOCIATED ROCKS (P_{3B} 1710 – 1660 Ma)
e.g., Alexis River anorthosite (assigned here although age is uncertain)

$P_{3B}ag$ — Weakly foliated to gneissic amphibolite and mafic granulite, plus leucocratic and melanocratic variants

$P_{3B}an$ — Weakly foliated to gneissic anorthosite and leucogabbronorite

$P_{3B}ln$ — Weakly foliated to gneissic leucogabbronorite and leucogabbro; coronitic locally

$P_{3B}mn$ — Weakly foliated to gneissic monzonorite and monzogabbro

$P_{3B}rg$ — Weakly foliated to gneissic gabbro and norite

$P_{3B}um$ — Massive, weakly or strongly foliated ultramafic rocks, commonly layered and locally showing cumulate textures

EARLY LABRADORIAN GRANITOID AND ASSOCIATED ROCKS (ca. 1678 and 1671 Ma)
e.g., Neveisik Island and Red Island events

$P_{3B}dr$ — Foliated to gneissic diorite to quartz diorite, and compositionally equivalent well-banded gneiss; in part derived from leucogabbronorite

$P_{3B}gd$ — Foliated to gneissic granodiorite and compositionally equivalent well-banded gneiss

$P_{3B}gp$ — Foliated to gneissic megacrystic/porphyritic granitoid rocks, augen gneiss

$P_{3B}gr$ — Foliated to gneissic granite and alkali-feldspar granite, and compositionally equivalent well-banded gneiss

$P_{3B}mq$ — Foliated to gneissic quartz monzonite, grading into diorite or syenite, and compositionally equivalent well-banded gneiss

$P_{3B}mz$ — Foliated to gneissic monzonite and monzodiorite, and compositionally equivalent well-banded gneiss

$P_{3B}ya$ — Foliated to gneissic syenite, alkali-feldspar syenite and alkali-feldspar granite, and compositionally equivalent well-banded gneiss

$P_{3B}am$ — Amphibolite skialiths, lenses and layers (mainly remnants of former dykes)

PRE-LABRADORIAN GRANITOID ROCKS (P_{3A} 1800 – 1710 Ma)

$P_{3A}ag$ — Mafic granulite skialiths, lenses and layers

$P_{3A}dr$ — Foliated to gneissic diorite to quartz diorite, and compositionally equivalent well-banded gneiss

$P_{3A}gd$ — Foliated to gneissic granodiorite and compositionally equivalent well-banded gneiss

$P_{3A}gp$ — Foliated to gneissic megacrystic/porphyritic granitoid rocks, augen gneiss

$P_{3A}gr$ — Foliated to gneissic granite and alkali-feldspar granite, and compositionally equivalent well-banded gneiss

$P_{3A}ln$ — Foliated to gneissic leucogabbronorite, and compositionally equivalent well-banded gneiss

$P_{3A}am$ — Amphibolite skialiths, lenses and layers (mainly remnants of former dykes)

PRE-LABRADORIAN SUPRACRUSTAL ROCKS (P_{3A} 1800 – 1710 Ma)
(Age uncertain; certainly pre-1670 Ma, probably 1800 – 1770 Ma)

Sedimentary protolith

$P_{3A}sc$ — Calc-silicate rocks, compositionally layered, medium grained

$P_{3A}sp$ — Fine- to medium-grained pelitic schist and gneiss

$P_{3A}sq$ — Quartzite, meta-arkose, thin to thick bedded

$P_{3A}ss$ — Quartz-feldspar psammitic schist and gneiss; medium grained and commonly rusty-weathering

$P_{3A}sx$ — Metasedimentary diatexite; coarse grained to pegmatitic and characteristically white-weathering

Volcanic protolith

$P_{3A}vf$ — Fine- to medium-grained, banded quartzofeldspathic rocks; locally have lensoid shapes, possibly indicating felsic volcanoclastic protolith

$P_{3A}vm$ — Fine- to medium-grained, banded amphibolite containing quartz-feldspar layers and calc-silicate pods; interpreted as mafic volcanic rocks

MID PALEOPROTEROZOIC (P_2 2100 – 1800 Ma)

LATE MID PALEOPROTEROZOIC (P_{2C} 1900 – 1800 Ma)

Granitoid and related intrusive rocks

$P_{2C}dr$ — Foliated to gneissic diorite to quartz diorite, and compositionally equivalent well-banded gneiss

$P_{2C}ga$ — Alkali-feldspar granite, granite and quartz syenite

$P_{2C}gd$ — Foliated to gneissic granodiorite and compositionally equivalent well-banded gneiss

$P_{2C}gp$ — Foliated to gneissic megacrystic/porphyritic granitoid rocks, augen gneiss

$P_{2C}gr$ — Foliated to gneissic granite and alkali-feldspar granite, and compositionally equivalent well-banded gneiss

$P_{2C}mq$ — Foliated to gneissic quartz monzonite, grading into diorite or syenite, and compositionally equivalent well-banded gneiss

$P_{2C}mz$ — Foliated to gneissic monzonite to monzodiorite, and compositionally equivalent well-banded gneiss

$P_{2C}ya$ — Foliated to gneissic syenite to alkali-feldspar syenite, and compositionally equivalent well-banded gneiss

$P_{2C}yq$ — Syenite to quartz syenite

Mafic and associated intrusive rocks

$P_{2C}am$ — Amphibolite skialiths, lenses and layers (mainly remnants of former dykes)

$P_{2C}rg$ — Massive to strongly foliated gabbro and norite, commonly layered; subophitic and locally coronitic

$P_{2C}d$ — Unnamed mafic dykes

Sedimentary protolith

$P_{2C}sc$ — Calc-silicate rocks, compositionally layered, medium grained

$P_{2C}so$ — Conglomerate and agglomerate, partially of volcanic origin

$P_{2C}sp$ — Fine- to medium-grained pelitic schist and gneiss

$P_{2C}sq$ — Quartzite, meta-arkose, thin to thick bedded

$P_{2C}ss$ — Quartz-feldspar psammitic schist and gneiss; medium grained and commonly rusty-weathering

Volcanic protolith

$P_{2C}vb$ — Volcanic breccia, angular clasts, grading into agglomerate

$P_{2C}vf$ — Fine- to medium-grained, banded quartzofeldspathic rocks; locally have lensoid shapes, possibly indicating felsic volcanoclastic protolith

$P_{2C}vi$ — Intermediate volcanic rocks

$P_{2C}vm$ — Fine- to medium-grained, banded amphibolite containing quartz-feldspar layers and calc-silicate pods; interpreted as mafic volcanic rocks

$P_{2C}vp$ — Felsic volcanic porphyry interpreted to be hypabyssal

NOTES

1. Legend is common to all maps (Map 2010-01 to Map 2010-25), but all units do not appear on every map.
2. Uncoloured units do not appear as polygons on maps, but are in unit-designator strings in database.
3. Some mafic dykes also shown as polygons (especially where orientation is unknown).

Scale 1:100 000

0 2 4 6 8 10

Kilometres

UPPER ST. AUGUSTIN RIVER

A preliminary coloured version of this map appeared page-size, together with a report, based on data collected during the 1999 and 2000 field seasons (Gower, 2001). The present map also incorporates field data collected by Eade (1962), making use of original field notes recorded by K.E. Eade and assistants. The map is augmented by follow-up examination of stained slabs, petrographic thin sections and whole-rock geochemical analyses, and inclusion of U-Pb geochronological results (James et al., 2001; Gower et al., 2008b) and Nd-Sm isotopic data (R.A. Creaser, unpublished; see digital database). No mineral occurrences are known in the map area.

Since the preliminary report, there has been some re-interpretation and redefinition of geological boundaries and units. The changes result from a compilation approach applied to the whole of eastern Labrador, and from integration with data from adjacent map areas. Data station locations are based on GPS-supported readings. Geological boundaries are poorly controlled, being positioned from outcrop data and extrapolated using structural observations, regional aeromagnetic data and topographic trends.

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 Upper St. Augustin River area (NTS sheets 13B/03, 04, 05 and 06), southeastern Labrador. Geological Survey, Mines Branch, Department of Natural Resources, Government of Newfoundland and Labrador, Map 2010-21, Open File 013B/0029.

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

Digital NTS base maps (NTS 13B/03, 04, 05 and 06) used for this map are available from Surveys and Mapping Branch, Natural Resources Canada.
Magnetic declination at the centre of the map at the start of 2010 was 22° 04' W.
Elevations are in metres above sea level. Contour interval is 20 metres.
UTM (Universal Transverse Mercator) Grid Zone 21, NAD (North American Datum) 27.

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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 2010-21 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.

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MINERAL OCCURRENCE DATA SOURCES

Inventory No.	Map label	Status	Easting	Northing	Reference
					No mineral occurrences

GEOLOGICAL DATA SOURCES

Personnel	Stations	Year(s) data collected	Project name	Mapping references
C.F. Gower (project geologist)	379	1999; 2000	Upper St. Augustin River & other visits	Gower (2001)
?. Reynolds (assistant geologist)	11	1961	Battle Harbour - Cartwright	Eade (1962)
D. Mahaffy (assistant geologist)	9	1961	Battle Harbour - Cartwright	Eade (1962)
K.E. Eade (project geologist)	8	1961	Battle Harbour - Cartwright	Eade (1962)
S. Lowey (supporting geologist)	3	1999	Upper St. Paul River	Gower (2001)
D.T. James (project geologist)	1	1999	Minipi Lake	James and Nadeau (2000)

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	Gower et al. (2008b)	CG00-135; CG00-154A; CG00-154B; CG00-154C; CG00-169; CG00-319A; CG00-319B; CG00-319C; GC00-221
U-Pb	James et al. (2001)	DJ99-015
Nd-Sm	Creaser (unpublished)	CG00-135; CG00-154A; CG00-319A
Rb-Sr	no data	
K, Ar	no data	

MINERAL OCCURRENCE ABBREVIATIONS

Amz	Amazonite
Au	Gold
Bt	Biotite
Cly	Clay
Cr	Chromium
Cu	Copper
Fe	Iron
Fel	Feldspar
Fl	Fluorite
Gnt	Garnet
Ilm	Ilmenite
Lst	Limestone
Mgt	Magnetite
Mo	Molybdenite
Ms	Muscovite
Neph	Nepheline
Ni	Nickel
Pb	Lead
Pd	Paladium
Po	Pyrrhotite
Pt	Platinum
Pyr	Pyrite
Saph	Sapphire
Si	Silica
Stn	Dimension stone
Th	Thorium
Tourm	Tourmaline
Tpz	Topaz
U	Uranium
V	Vanadium
Zn	Zinc
Zr	Zirconium
(?)	Occurrence reported but validity suspect

NOTE:
All mineral occurrence and structural symbols do not appear on each map.

Vertical structures use 90° dip value.

* Generation of structure only applicable at observation site.

SYMBOLS

Geological contact
Normal fault
Strike-slip fault
Thrust fault
Normal fault reactivating thrust
*Fold axial plane (1st, 2nd, 3rd generation)**
S-fold axis (1st generation)
Z-fold axis (1st generation)
Dyke (affinity unspecified)
Fault (sense of movement unknown, dextral, sinistral, normal)
Joint
*Linear fabric (1st, 2nd, 3rd generation)**
*Fold axis (1st, 2nd, 3rd generation)**
Slickenside
Geological data station
Geological data station (no fabric measured)
Bedding (tops known, unknown)
Enclave
*Foliation (1st, 2nd, 3rd generation)**
*Gneissosity (1st, 2nd generation)**
Igneous layering (tops known, unknown)
Vein
Shear zone (sense of movement unknown, dextral, sinistral, reverse)
Mineral occurrence
Geochronology location