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CANADIAN GEOSCIENCE MAP 156

GEOLOGY

KING'S POINT

Newfoundland and Labrador
NTS 12-H/9

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ABSTRACT

Southern Baie Verte Peninsula (Newfoundland and Labrador, NTS 12-H/9) is underlain by the Mesoproterozoic East Pond Metamorphic Suite, Neoproterozoic Birchy Complex, and Neoproterozoic to Ordovician Fleur de Lys Supergroup, which make up the Humber continental margin. East of the Baie Verte Line, the continental margin units are tectonically overlain by Cambrian rocks of the Advocate Complex (Baie Verte Oceanic Tract), and ophiolite cover of the Ordovician Snooks Arm Group and Black Brook group. These are stitched by a continental overlap assemblage including Ordovician-Silurian Burlington plutonic suite, and Silurian Micmac Lake Group, King's Point volcanic complex, and west of the Baie Verte Line, Wild Cove Pond Igneous Suite and late tectonic, Trap Pond granite. Four phases of regional deformation have affected this area including D_1 best documented in the Birchy Complex and related to ophiolite obduction; D_2 regional, penetrative deformation associated with isoclinal folds and shear zones and accompanied by greenschist- to amphibolite-facies metamorphism; D_3 related to asymmetric and chevron folds near the Baie Verte Line; and D_4 related to extensional and dextral faults and reactivation of faults.

RÉSUMÉ

Le sous-sol de la partie sud de la péninsule Baie Verte (Terre-Neuve-et-Labrador, SNRC 12-H/9) est constitué de la Suite métamorphique d'East Pond du Mésoprotérozoïque, du Complexe de Birchy du Néoprotérozoïque et de roches du Néoprotérozoïque à l'Ordovicien du Supergroupe de Fleur de Lys qui composent la marge continentale de Humber. À l'est de la ligne de Baie Verte, les unités de la marge continentale sont surmontées tectoniquement par les roches cambriennes du Complexe d'Advocate (bande océanique de Baie Verte), et de roches de couverture d'ophiolites attribuées au Groupe de Snooks Arm et au groupe de Black Brook de l'Ordovicien. Celles-ci sont soudées par un assemblage continental chevauchant qui comprend la suite plutonique de Burlington de l'Ordovicien-Silurien, ainsi que d'unités du Silurien constituées du Groupe de Micmac Lake, du complexe volcanique de King's Point et, à l'ouest de la ligne de Baie Verte, de la suite ignée de Wild Cove Pond et du granite tarditectonique de Trap Pond. Quatre phases de déformation régionales ont touché la région, dont : D_1, documentée le mieux dans le complexe de Birchy, est reliée à l'obduction des ophiolites; D_2, une déformation régionale et pénétrative associée à des plis isoclinaux, et accompagnée d'un métamorphisme du faciès des schistes verts au faciès des amphibolites; D_3, rapportée à des plis asymétriques et à des plis en chevron près de la ligne de Baie Verte; et D_4, rapportée à la formation de failles d'extension et de failles dextres ainsi qu'à la réactivation de failles.

ABOUT THE MAP

General Information

Authors: T. Skulski, S. Castonguay, W.S.F. Kidd, V.J. McNicoll, and C.R. van Staal

Geological fieldwork by T. Skulski, S. Castonguay, C.R. van Staal, I. Kerr (University of Victoria), S. Hinchey (Memorial University), 2006–2008, and W.S.F. Kidd (University of Cambridge) 1970–1971

Geological compilation and notes by T. Skulski and S. Castonguay, 2008–2012

Geophysical and remotely sensed data processed by G. Kilfoil (Geological Survey of Newfoundland and Labrador), 2007 and T. Skulski, 2008–2013

Compiled structural data digitized by M. Currie and A. Magee

Cartography by N. Côté

Critial review by A. Zagorevski (Geological Survey of Canada) and H.A Sandeman (Geological Survey of Newfoundland and Labrador)

Scientific editing by E. Inglis

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Map projection Universal Transverse Mercator, zone 21.
North American Datum 1983

Base map at the scale of 1:50 000 from Natural Resources Canada, with modifications.
Elevations in metres above mean sea level

Magnetic declination 2015, 19°47'W, decreasing 11.4' annually.

This map is not to be used for navigational purposes.

Title photograph: F_3 folded pelite and psammite, Birchy Complex, north of Kidney Pond, Newfoundland and Labrador.
Photograph by T. Skulski. 2014-109

The Geological Survey of Canada welcomes corrections or additional information from users.

Data may include additional observations not portrayed on this map. See documentation accompanying the data.

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Map Viewing Files

The published map is distributed as a Portable Document File (PDF), and may contain a subset of the overall geological data for legibility reasons at the publication scale.

ABOUT THE GEOLOGY

Descriptive Notes

The King's Point map area (southwest Baie Verte Peninsula, Newfoundland and Labrador) is one of three new 1:50 000 scale maps in this area that are based on new and compiled bedrock geological and remotely sensed data (*see also* Skulski et al., 2015a, b). This area is underlain by Mesoproterozoic basement rocks (East Pond Metamorphic Suite), Neoproterozoic to Ordovician rocks of the Humber continental margin (Fleur de Lys Supergroup), dismembered Cambrian ophiolite (Advocate Complex), Lower to Middle Ordovician ophiolite cover (Snooks Arm Group), and Upper Ordovician to Silurian continental, volcano-plutonic rocks (Burlington plutonic suite), Micmac Lake Group, King's Point volcanic complex, and Wild Cove Pond Igneous Suite (IUGS Time Scale of Cohen et al. (2013) is utilized herein).

TECTONOSTRATIGRAPHY AND SETTING

The East Pond Metamorphic Suite constitutes Mesoproterozoic basement (de Wit, 1980; de Wit and Armstrong, 2014) to the Fleur de Lys Supergroup and consists of grey psammitic and semipelitic gneiss, biotite quartzite, epidosite, amphibolite, migmatitic gneiss, and granitic gneiss (unit mPEPm). The overlying Fleur de Lys Supergroup represents the east-facing continental margin that is subdivided (van Staal et al., 2013) into the ocean-continent transition (558 Ma Birchy complex), an extensional allochthon (Rattling Brook Group), and para-autochthonous continental margin (Old House Cove Group on this map). The Birchy complex includes psammite and pelite (unit nPBq) overlain by tholeiitic metabasalt and mafic metatuff (unit nPBm), and interbedded psammite, semipelite, and metabasalt cut by metagabbro (unit nPBc). The Rattling Brook Group comprises unseparated semipelitic, pelitic, and psammitic schist; and minor greenschist, marble, and graphitic schist (unit nPORB). Rocks of the para-autochthonous Humber margin include rift facies (Ediacaran mafic volcanic and fining-upward clastic metasedimentary rocks) and overlying drift-facies metasedimentary rocks (Cambrian to Early Ordovician carbonate and clastic sedimentary rocks). These are represented locally by tectonized, feldspar porphyroblastic, mica schist of the Old House Cove Group (unit nPOOHt) that are cut by amphibolite dykes, sills, and pods (unit nPOa).

The Baie Verte Oceanic Tract includes the largely intact ophiolite of the Betts Cove Complex and correlative, but dismembered ophiolite rocks that include the Advocate, Point Rousse, and Pacquet complexes. The Advocate Complex includes kilometre-scale tracts of serpentinized oceanic mantle (unit ЄMs), locally with talc-carbonate (unit ЄBHl) and quartz-carbonate-fuchsite alteration. The ophiolite intrusive section includes layered ultramafic cumulate rocks (unit ЄBHu) in fault contact with layered melagabbro, pyroxenite, and gabbro (unit ЄBHg). The Lower to Middle Ordovician Snooks Arm Group overlies the Baie Verte Oceanic Tract on Baie Verte Peninsula (Skulski et al., 2010). The local contact with the underlying Advocate Complex, although not exposed, is interpreted to be an angular unconformity (Skulski et al., 2010). The overlying Scrape Point Formation comprises megaconglomerate with decimetre-scale clasts of ophiolite-derived gabbro in a black shale matrix (unit OSPx) overlain by the Kidney Pond conglomerate (unit OSPc) with clasts of ophiolite-derived gabbro, serpentinite, boninite, and continental margin–derived marble, quartzite, and granitoid clasts in a mixed sand and shale matrix. A granitoid clast has an age of 479 ± 4 Ma (location 18, Table 1) and provides a maximum age for deposition. An overlying felsic to intermediate volcanic unit is dated north of the map area at 476.5 ± 4 Ma (location 17, *see* Skukski et al., 2015a, Table 1; unit OSPf). The upper reaches of the Scrape Point Formation include pillowed, tholeiitic basalt (unit OSPm) and high TiO_2 (>2%) tholeiitic basalt units (unit OSPe) and mafic volcaniclastic and or epiclastic rocks (unit OSPv). The Bobby Cove Formation includes the Prairie Hat member consisting of clinopyroxene-phyric, mafic crystal and lapilli tuff (dated at 470 ± 4 Ma overlying the Betts Cove Complex; location 16, *see* Skulski et al., 2015b, Table 1) and is overlain by mafic tuff (unit OBCv). The Venams Bight Formation consists of pillowed tholeiitic basalt units (unit OVBm). Tholeiitic gabbro sills and dykes (unit OSAg) cut the Snooks Arm Group. The Black Brook group represents the final phase of submarine volcanism and sedimentation on the continental margin. It comprises quartzite, jasper iron-formation,

felsic tuff, and pillow basalt (unit uOBBu; cf. Hibbard, 1983). The quartzite is dominated by detrital zircon crystals with a mean age of 457 ± 4 Ma (location 12, Table 1), which may date contemporaneous volcanism and yield a maximum age of deposition.

The Burlington plutonic suite marks a major tectonomagmatic transition in the Notre Dame Subzone in the late Ordovician to Silurian (Llandovery-Wenlock) with the widespread intrusion of felsic plutons and coeval subaerial volcanism accompanied by episodic regional uplift and emergence of the older continental margin sequences, and by Wenlock time, onset of the Salinic Orogeny (Skulski et al., 2010). The Burlington plutonic suite comprises an early phase of calc-alkaline, hornblende+biotite granodiorite (unit OBgdh) dated at 445 ± 4 Ma (location 11, *see* Skukski et al., 2015a, Table 1; to the north), hornblende-biotite leuco-quartz diorite, biotite-hornblende quartz diorite and biotite-hornblende tonalite (unit SBqd), and an intermediate, synvolcanic phase of biotite±hornblende granodiorite (unit SBgd) dated at 441 ± 1.2 Ma (location 9, *see* Skukski et al., 2015a, Table 1; to the north). The Micmac Lake Group comprises two unconformity-bound, Silurian formations (redbeds and metamorphic equivalents). The Strugglers Pond formation unconformably overlies the Burlington plutonic suite (unit OBgdh) where it was deposited on a rugged paleotopography (Kidd, 1974). It contains a basal pebble to boulder conglomerate with clasts of granodiorite, aphyric rhyolite, quartz-feldspar porphyry, and basalt (unit SMSc), overlain by porphyritic eutaxitic ignimbrite (unit SMSp), basalt (unit SMSb) and aphyric rhyolitic eutaxitic ignimbrite (unit SMSi) dated at 442 ± 4 Ma (location 10, Table 1). These are overlain by massive flow-banded, aphyric rhyolite (unit SMSr), and quartz-K-feldspar–phyric eutaxitic ignimbrite (unit SMSip). The Fox Pond formation (dated at <430 ± 4 Ma; location 7, *see* Skukski et al., 2015a, Table 1; to the north) lies unconformably on the Strugglers Pond formation and on the Burlington plutonic suite (433 Ma unit SBgdb; location 8, *see* Skukski et al., 2015a, Table 1; to the north) and contains volcanic rock–derived pebble to boulder conglomerate (unit SMFc), overlain by massive basalt, basanite, and hawaiite (unit SMFb), trachytic alkaline basalt (unit SMFt), arkose (unit SMFs), eutaxitic ignimbrite (high-K rhyolitic and dacitic; unit SMFi), and aphyric, mainly intrusive, comendite dykes, sills or rare flows (unit SMFh). The King's Point volcanic complex comprises Lower volcanic rocks of aphyric to quartz-feldspar porphyritic ash-flow tuff and tuff breccia (unit SKLax), and a Middle felsic volcanic unit of sparsely porphyritic and lithophysae-bearing ash-flow lapilli tuff and breccia (unit SKmv), sparsely quartz-feldspar phyric (unit SKsqfw), to aphyric (unit SKsqfa) ash-flow tuff units, quartz-feldspar–phyric comenditic ash-flow tuff and breccia units. The Middle felsic volcanic unit includes hypabyssal intrusive equivalents forming ring dykes (unit SKqfa). The Upper volcanic unit comprises amphibole-phyric comenditic ash-flow tuffs and ignimbrite (unit SKama; Miller and Abdel-Rahman, 1994). These are cut by synvolcanic intrusive rocks including feldspar±quartz–phyric syenite and granite (unit SKsg), fine- to medium-grained granite and quartz syenite (unit SKgqs) dated at 427 ± 2 Ma (Coyle, 1990), and the satellite Gull Pond Ridge pluton comprising sodic amphibole-biotite peralkaline monzogranite (unit SGPR). The Wild Cove Pond igneous suite is contemporaneous with the King's Point and Cape St. John volcanic complexes and intrudes basement and cover of the Humber margin. It comprises contact migmatite, hybrid gneiss units and agmatite (unit SWCm), massive to foliated

biotite±hornblende quartz diorite, monzodiorite and comagmatic alkaline gabbro (theralite; unit SWCd), and massive to foliated K-feldspar megacrystic monzogranite, biotite±hornblende granodiorite and biotite-muscovite±garnet monzogranite. Small plutons of syntectonic, peraluminous, biotite-muscovite granite and granodiorite (unit SWC) are locally dated at 427.8 ± 2.5 Ma (to the south *in* NTS 12-H/7). The late-tectonic Trap Pond pluton (unit STPg) is a biotite granite dated at 423 ± 1.7 Ma (location 34, Table 1).

TECTONOMETAMORPHIC EVOLUTION

Rocks of the southern Baie Verte Peninsula have been affected by at least four phases of deformation (de Wit, 1972; Kidd, 1974; Hibbard, 1983; Skulski et al., 2010 and references therein). Structural correlations across the Baie Verte Line are rendered difficult due to intense and long-lived strain along the complex fault zone, which has juxtaposed rock units of different origins and structural levels.

Structures and metamorphic imprint related to D_1 (D_e of Hibbard, 1983) are best preserved in the Birchy complex. A relict S_1 fabric is deduced in local, less transposed hinges of F_2 folds. Strongly overprinted D_1 fault zones are northwest-directed thrust faults that are commonly decorated with serpentinite or mélange in the Fleur de Lys Supergroup (Hibbard, 1983 and references therein). The D_1 phase is interpreted as related to obduction of ophiolite and partial underthrusting of the Humber margin during the Taconic Orogeny (Waldron et al., 1998; van Staal et al., 2007, 2013).

Penetrative D_2 deformation (D_m of Hibbard, 1983) and metamorphism affects all rock units of the Baie Verte Peninsula. Although locally folded, the S_2 foliation is generally steep, trending to the south-southwest. D_2 is associated with tight folds and bivergent fault zones (i.e. southeast- and northwest-directed). D_2 fabrics are locally overprinted by asymmetric and upright chevron F_3 folds, associated with an axial-planar S_3 strain-slip cleavage (D_L of Hibbard, 1983) and causing local deflection of the main structural grain. D_2 and D_3 are interpreted as part of an overall transpressional regime during the Salinic Orogeny (Waldron et al., 1998; Skulski et al., 2010). Age of Salinic deformation and metamorphism is locally constrained to be between ca. 423 Ma (location 34, Table 1; U-Pb titanite age of a late tectonic granite) and ca. 417 Ma (location 1, Table 1; U-Pb zircon age on a post-tectonic dyke).

The fourth deformation phase (D_L of Hibbard, 1983) is mainly documented along the Baie Verte Line, where a series of major, but relatively narrow and steep dextral, compressional or extensional fault zones overprint earlier structural fabrics, such as the Baie Verte Road Fault of Neale and Kennedy (1967). The D_4 phase is interpreted to have initiated during progressive dextral strike-slip (transpressional to transtensional) faulting along the Baie Verte Line and other shear zones during the Middle to Upper Devonian (Waldron et al., 1998; Anderson et al., 2001).

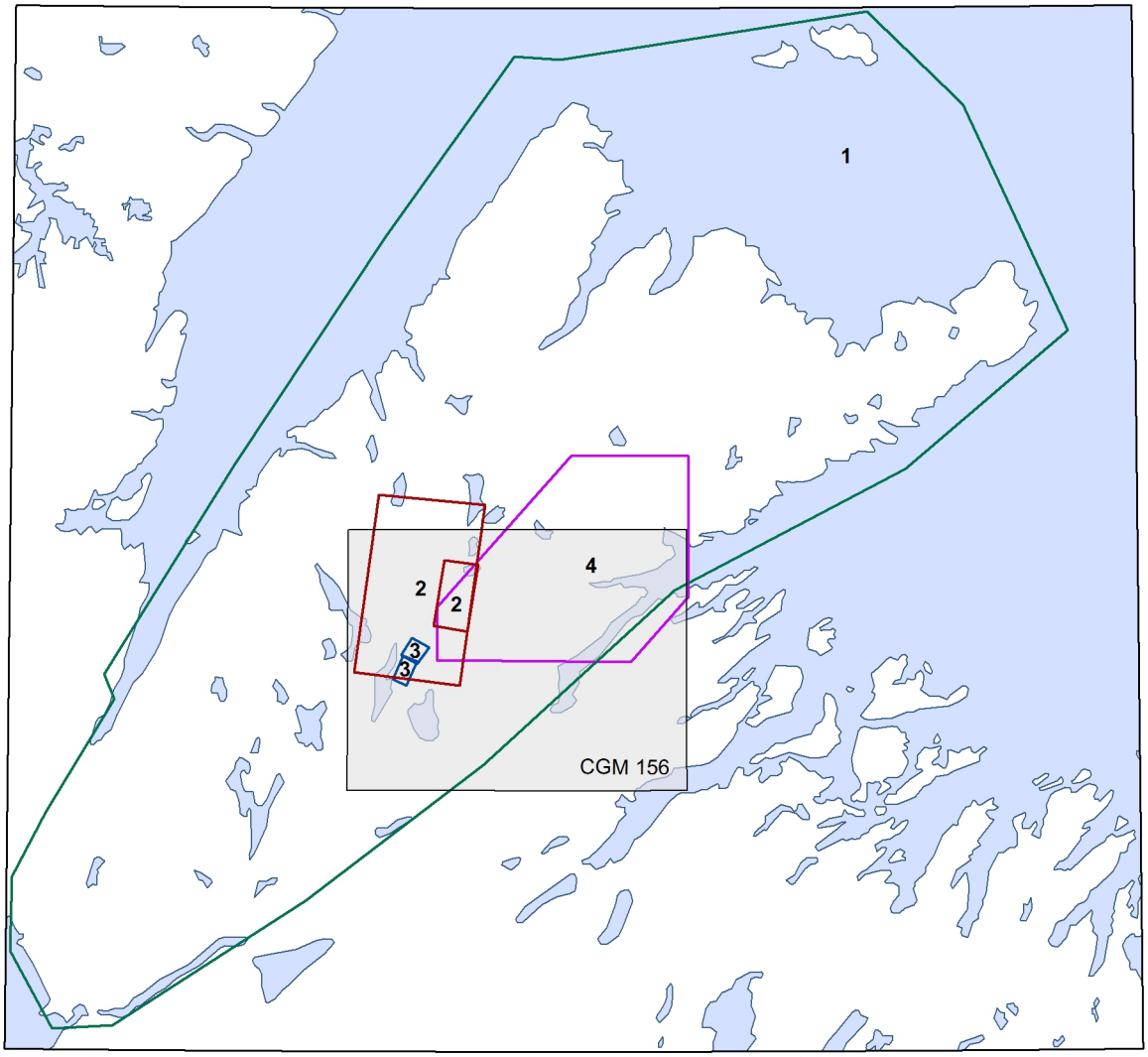

Figure 1. Map sources: 1 = Hibbard, 1983; 2 = Kidd, 1974; 3 = MacDougall et al., 1989; 4 = Miller and Abdel-Rahman, 1994.

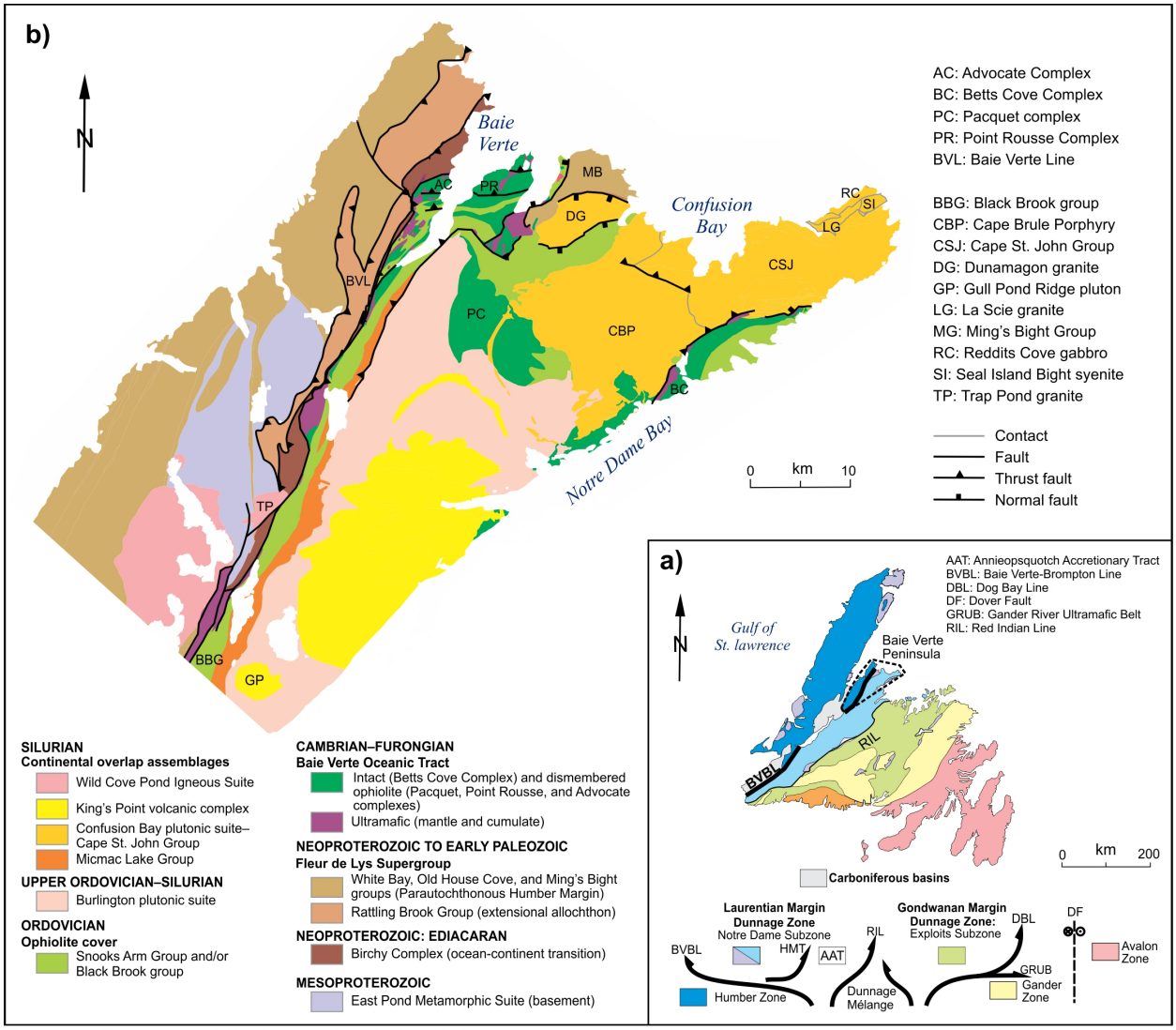

Figure 2. **a)** Tectonic map of Newfoundland and **b)** simplified geological map of the Baie Verte Peninsula (*modified from* Hibbard, 1983; Skulski et al., 2010; van Staal et al., 2013).

Location	Method	Mineral	Rock type	Code	Age (Ma)	Interpretation	Note	Reference
1	U/Pb SHRIMP	Zircon	Aphyric post-tectonic dyke	nPBc	417 ± 6	Approximate age		Castonguay et al., 2010
10	U/Pb SHRIMP	Zircon	Welded ash-flow tuff	SMSi	442 ± 4	Crystallization age		Skulski et al., 2012
12	U/Pb SHRIMP	Zircon	Quartzite	uOBBu	<457 ± 4	Maximum detrital age		Skulski et al., 2010
18	U/Pb SHRIMP	Zircon	Conglomerate	OSPc	<479 ± 4	Detrital maximum age		Skulski et al., 2010
34	U/Pb-TIMS	Titanite	Late tectonic biotite granite	STPg	423 ± 1.7	Minimum crystallization age		Skulski et al., 2012
53	$^{40}Ar/^{30}Ar$ laser step-heating	Amphibole	Amphibolite	mPEPm	440.1 ± 3.4	Metamorphic cooling age	Plateau, 100% gas released	Castonguay et al., 2014

Table 1. Geochronological data.

Location	Name	Commodity	Secondary commodity
4	Rocky Bottom Trend; RB Landing	Gold	
5	Tornado	Gold	
9	Crow Hill North	Gold	
11	Arrowhead South	Gold	
15	Crow Hill South	Gold	
17	Mardi Gras	Gold	
18	White Face Hill	Gold	
24	Arrowhead	Gold	
25	Crooked Creek	Gold	
28	Triple N	Gold	
35	Gold Pit	Gold	Copper, molybdenum, zinc, uranium
36	Mic Mac Lake North	Asbestos	
42	Raven	Gold	

Table 2. Drilled prospects.

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Author Contact

Questions, suggestions, and comments regarding the geological information contained in the data sets should be addressed to:

Tom Skulski
Geological Survey of Canada
601 Booth Street
Ottawa Ontario
K1A 0E8
Tom.Skulski@canada.ca

Coordinate System

Projection: Universal Transverse Mercator
Units: metres
Zone: 21
Horizontal Datum: NAD83
Vertical Datum: mean sea level

Bounding Coordinates

Western longitude: 56°30’00”W
Eastern longitude: 56°00’00”W
Northern latitude: 49°45’00”N
Southern latitude: 49°30’00”N

Data Model Information

This Canadian Geoscience Map does not conform to either the Bedrock or Surficial Mapping Geodatabase Data Models. The author may have included a complete description of the feature classes and attributes in the Data\Data Model Info folder.

LICENCE AGREEMENT

ACCORD DE LICENCE