

Mapping: Field and laboratory studies were completed by C. Buchanan, E. Burden and T. Calon between 2000 and 2004.

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Digital NTS base maps (12B/15, 12B/16, and 12G/1) used for this map are available from Surveys and Mapping Branch, Natural Resources, Ottawa, Canada.

The 2005 Magnetic North bearing is 20° 44' West of Grid North; Grid North is 1° 01' West of True North for centre of map.

Elevations are in metres above sea level. Contour interval is 20 m, except for the map area 12B/15 where the interval varies but is approximately 20 m.

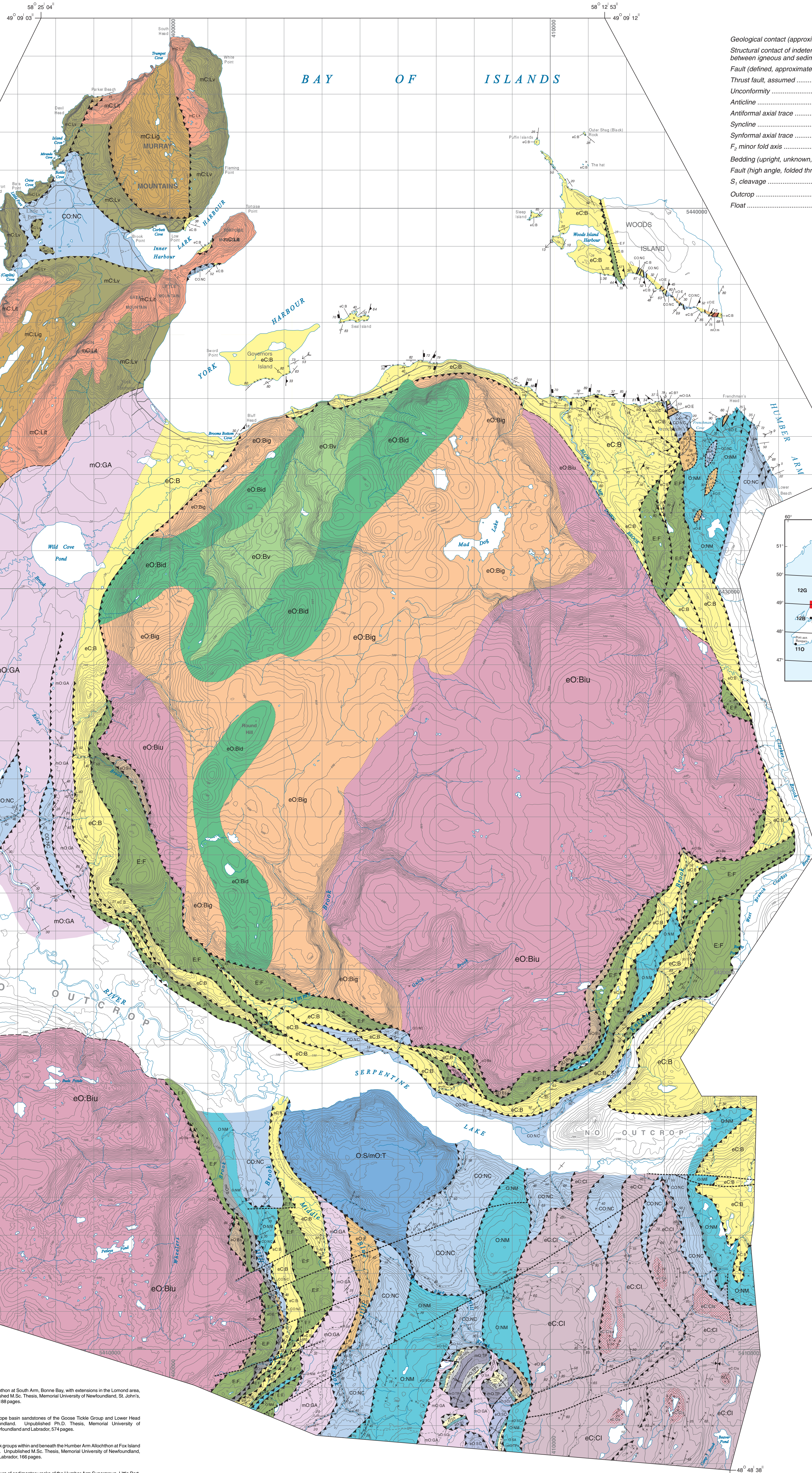
Universal Transverse Mercator (UTM) Grid Zone 21.

North American Datum 1927.

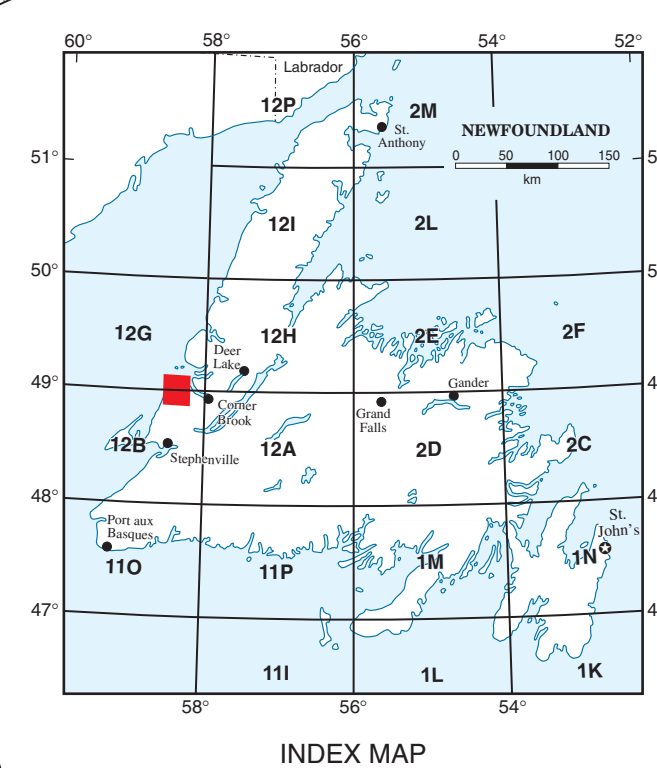
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SYMBOLS		LEGEND	
Geological contact (approximate, assumed)	IGNEOUS ROCKS OF THE BAY OF ISLANDS OPHIOLITE COMPLEX (after Williams and Caywood, 1989)	
Structural contact of indeterminate nature between igneous and sedimentary rocks	.....	eO.Dv	Pillow basalt, volcanic breccia, minor jasper and clastic sedimentary rocks
Fault (defined, approximate, assumed)	.....	eO.Bid	Altered mafic dykes and brecciated dykes, local gabbro screens
Thrust fault, assumed	.....	eO.Big	Layered to massive gabbro, diorite, and minor trondhjemite. Abundant dykes
Unconformity	.....	eO.Bu	Serpentinized harzburgite, dunite, pyroxenite, and hornblende
Anticline	.....	eO.Ba	Metamorphic aureole
Antiformal axial trace	.....	COM	Mount Barron Complex
Syncline	.....	IGNEOUS ROCKS OF THE LITTLE PORT COMPLEX (after Williams and Caywood, 1989)	
Synformal axial trace	.....	mC1.v	Pillow basalt with sheeted dykes, and locally volcanic breccia
F ₂ minor fold axis	.....	mC1.lid	Sheeted to brecciated altered mafic dykes
Bedding (upright, unknown, overturned, vertical)	.....	mC1.liq	Massive to foliated quartz diorite and trondhjemite
Fault (high angle, folded thrust, thrust)	.....	mC1.g	Massive and foliated gabbro
S ₁ cleavage	.....	STRATIGRAPHY OF THE HUMBER ARM SUPERGROUP	
Outcrop	.....	NORTHERN HEAD GROUP	
Floot	.....	mO.NM	Middle Arm Point Formation
		mO.CO	Cooks Brook Formation
		CURLING GROUP	
		mO.CI	Irishtown Formation (shale member)
		mO.Ci	Irishtown Formation (sandstone member)
		UNDEFINED ASSOCIATION	
		eO.B	Blow Me Down Brook Formation
		FOX ISLAND GROUP	
		eO.F	Fox Island Group (undifferentiated)
		mO.m	Mélange (sheared shale matrix with exotic igneous blocks)
		mO.z	Zone of intensely imbricated, broken formations (undifferentiated)
		PARAUTOCHTHONOUS UNITS	
		GOOSE TICKLE GROUP	
		mO.GA	American Tickle Formation
		eO.E	Eagle Island Formation
		TABLE HEAD AND ST. GEORGE GROUPS	
		O-SmO-T	Table Head and St. George Groups (undifferentiated)
		GEOLOGY OF THE SPRUCE HILLS ANTIFORM (after Knight and Boyes, 2002)	
		TABLE HEAD GROUP	
		mO.TR	Table Point Formation
		mO.TPs	Spring Inlet Member
		ST. GEORGE GROUP	
		mO.SA	Agathana Formation
		eO.SC	Catoche Formation
		eO.SC	Costa Bay Member



DESCRIPTIVE NOTES

Goose Tickle Group
American Tickle Formation
mO.GA Massive, graded grey-green siltstone and mudstone in beds up to about 1 m thick, interbedded with dark grey to black, laminated shale and siltstone in beds up to about 1 m thick.

Eagle Island Formation
eO.E Light brown to pale green, poorly sorted, medium- to coarse-grained quartzose and arkosic sandstone in ribbon-like beds up to about 2 m thick, interbedded with grey, black, and occasionally red shale and micaceous siltstone beds up to about 1 m thick. Sedimentary structures include, scored bases, flutes, load structures, convolute bedding, desiccation structures, homogeneous beds, planar laminations, and cross-beds. Lenses of polyhedral pebble conglomerate composed of granitic and shale clasts are common at the base of some of the thicker sandstone beds. Shale beds are massive or laminated. Sandstone beds typically have some calcite cement and may also contain spherical concretions. Trace fossils often occur on contacts between sandstone and shale.

Northern Head Group
Middle Arm Point Formation
mO.NM Thick successions (> 10 m) of interbedded, dark grey to black (pyritiferous), green (partly dolomitic) and red shale, interbedded with minor chert, intraformational granule and pebble conglomerate, grey calcarenite, yellow weathering, silty, central dolostone, and rarely, thin beds of grey, fine- to medium-grained sandstone, in beds up to about 0.5 m thick. Coarser grained strata may be deposited as thin ribbons or rarely, as thick amalgamated beds formed as large, probably lensoid shaped units that may be tens of metres thick. Conglomerate clasts tend to be quartzose; a significant quantity of fossiliferous platform carbonate pebbles and cobbles can usually be found in conglomerate beds. Sedimentary structures in sandstones include, scored bases, load structures, homogeneous beds, planar laminations, cross-beds, and desiccation structures; shales may be laminated and bioturbated. Some sandstones contain intraformational clay chip breccias. In long sections, the lower part of the formation tends to contain more and thicker sandstone and conglomerate beds than the top of the formation. The top of the formation may contain thin, fine-grained and silty calcarenite beds less than 0.1 m thick.

Cooks Brook Formation
mO.CO Dark grey to black (occasionally pyritiferous) and green (partly dolomitic) shale, in beds typically less than 0.1 m thick and less commonly up to about 10 m thick, interbedded with grey, fine- to coarse-grained calcarenite and intraformational conglomerate up to about 5 m thick. Strata may be deposited as thin ribbon limestones and shale or as thick amalgamated limestone beds separated by thin to thick shale. Sedimentary structures in calcarenite beds include, scored bases, load structures, convolute bedding, homogeneous beds, planar laminations, and cross-beds. Conglomerate beds are both clast and grain supported, and may be massive or imbricated and graded. Shale beds are massive or laminated. Trace fossils often occur on contacts between calcarenite and shale.

Curling Group
Irishtown Formation
eO.CI & eO.Ci Dark grey to black (rusty-weathering) shale in bedded successions up to tens of metres thick, interbedded with grey, pale grey to white weathering, pebbly, granular, very coarse- to fine-grained graded, orthoquartzitic, micaceous and feldspathic sandstone and polymict conglomerate consisting of individual beds that are typically up to 3 m thick and amalgamated beds formed as large, probably lensoid shaped units that may be tens of metres thick. Conglomerate clasts tend to be quartzose; a significant quantity of fossiliferous platform carbonate pebbles and cobbles can usually be found in conglomerate beds. Sedimentary structures in sandstones include, scored bases, load structures, homogeneous beds, planar laminations, cross-beds, and desiccation structures; shales may be laminated and bioturbated. Some sandstones contain intraformational clay chip breccias. In long sections, the lower part of the formation tends to contain more and thicker sandstone and conglomerate beds than the top of the formation. The top of the formation may contain thin, fine-grained and silty calcarenite beds less than 0.1 m thick.

Undefined Association
Blow Me Down Brook Formation
eO.B Grey-green and tan-weathering, pebbly, granular, very coarse- to medium grained, graded, arkosic through orthoquartzitic sandstone and polymict conglomerate consisting of individual beds that are typically 0.5 to 3 m thick and amalgamated beds formed as large, probably lensoid shaped units that may be tens of metres thick, interbedded with dark grey, black (rusty weathering), green and red shale and micaceous siltstone beds in successions up to 4 m thick. Sedimentary structures in sandstones include, scored bases, load structures, homogeneous beds, planar laminations, cross-beds, and desiccation structures; shales and siltstones may be laminated and bioturbated. Some sandstones contain intraformational clay chip breccias. Conglomerates are predominantly formed as large fragments of feldspar, with quartz, and weathered metamorphic and igneous rocks.

LEGEND NOTES

The indicated map distribution patterns and rock types for platform rocks of the Serpentine Lake Block and the Spruce Hills Antiform, and the igneous rocks of the Bay of Islands Ophiolite Complex and the Little Port Complex are mostly after Comeau (1972), Godfrey (1982), Williams and Caywood (1989), and Knight and Boyes (2002). Allochthonous strata mapped under this GSC-NLGIS NATMAP project are described according to our own observations from more than 2,500 stations collected from traverses along the coast, along roads and old logging trails, and in many of the books and notes that draw the area, nearly all of the areas formerly mapped as mélanges are redefined.

The repeated and persistent association of the Fox Island volcanics with Blow Me Down Brook Formation has been noted by other workers in the area (Schillerf, 1980; Quinn, 1985). Our own work supports this assessment, indicating that many of the rocks mapped as the Fox Island strata could be a suite of rift volcanics interbedded with and, perhaps also, underlying those strata deposited as turbidites in grabens.

Inasmuch as strata from the Blow Me Down Brook Formation are mostly unfossiliferous sandstones and conglomerates, shale samples commonly contain abundant and diverse acritarch assemblages of the lower Cambrian Skelliga sp. complex. Good to excellent preservation, and red to dark brown colouration indicate relatively shallow burial, near the bottom of the oil window (Palmer et al., 2001).

The Curling Group is composed of the Summerdale and Irishtown formations. Summerdale strata, thought to be laterally equivalent to the Blow Me Down Brook Formation (Quinn, 1985; Waldron et al., 1998), are not exposed in this area.

The Irishtown Formation is crudely divided into a lower quartzose sandstone and conglomerate interval and an upper more shale dominated succession (Palmer et al., 2001). The thickness of the sandstone and shale is largely conjecture; faulting and folding have resulted in substantial thickness thinning. Shaly Irishtown strata may contain blackened carbonized debris, and sparse, poorly preserved Cambrian acritarchs (Palmer et al., 2001). All Irishtown strata sampled for this work are outside the oil window, and point to a different tectonostratigraphic history from the Blow Me Down Brook strata.

Northern Head Group strata tend to be weak and rapidly deformed into complex and related recumbent folds, stacked thrusts and duplexes, in many places east of the Lewis Hills Massif, rocks of the Northern Head Group are plastically cleaved.

Palynology residues from Northern Head Group strata lying east of the Little Port Complex are normally blackened organic detritus with sparse, poorly preserved Cambrian acritarchs. Northern Head Group rocks lying beneath, and west of, the Little Port Complex are much better preserved than those containing light grey and yellow coloured acritarchs indicating strata in the oil window.

Goose Tickle Group strata can be difficult to identify in the field; the rocks can share many features in common with older strata. In some places, stratigraphic position and biostratigraphy are clear diagnostic indicators (Bostford, 1988; Lindholm and Casey, 1990). Elsewhere, and where present, characteristic detrital minerals and provenience determinations can be useful aids for defining strata (Quinn, 1985; 1992). When substantive mineralogy, lithostratigraphy, and biostratigraphy are lacking, tectonostratigraphic position becomes a key defining element for determining the Goose Tickle strata.

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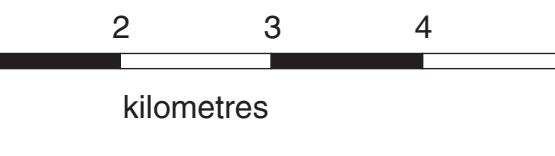
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Map 2006-03

GEOLOGY OF THE HUMBER ARM ALLOCHTHON, LARK HARBOUR - SERPENTINE LAKE AREA, NEWFOUNDLAND

Scale 1:50 000



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