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GEOLOGICAL SURVEY OF CANADA | COMMISSION GÉOLOGIQUE DU CANADA

Memorial University of Newfoundland

LEGEND

APPALACHIAN FORELAND

Undeformed, mainly lower Paleozoic carbonates

Upper Neoproterozoic redbeds of Lake Melville Graben

APPALACHIAN OROGEN

POST COLLISIONAL SUCCESSOR BASINS AND GRABENS

Triassic and Jurassic volcanic rocks

Triassic and minor Jurassic terrestrial sedimentary and volcanic rocks with associated mafic dykes and sills

Carboniferous, mainly terrestrial sedimentary rocks

COLLISIONAL SUCCESSOR BELTS

Silurian and Devonian mainly terrestrial volcanic rocks, redbeds and terrigenous sedimentary rocks

Upper Ordovician and Lower Silurian greywackes, conglomerates and marine turbidites

APPALACHIAN MIOGEOCLINE

HUMBER ZONE (EXTERNAL)

Cambrian-Ordovician carbonate sequence, includes Upper Neoproterozoic to Lower Cambrian rift facies volcanic rocks and clastic sedimentary rocks at base, foreland basin flysch at top, and Taconic allochthons

Granitoid intrusions 1.2 - 1.0 Ma of Grenville inliers

Anorthosite, gabbro 1.2 - 1.0 Ma of Grenville inliers

Metamorphic rocks of Pinware Grenville inlier

HUMBER ZONE (INTERNAL)

Upper Neoproterozoic to Lower Cambrian mainly psammites, pelites, metavolcanic rocks and small mafic-ultramafic bodies

TERRANES OF IAPETUS TRACT AND ITS EASTERN MARGIN

DUNNAGE ZONE

Cambrian and Lower Ordovician, mainly mafic volcanic rocks of Notre Dame and Twillingate subzones; granitoids, metasedimentary rocks, and mafic plutons of Dashwoods Subzone

Cambrian and Lower to Middle Ordovician mixed volcanic rocks, shales, greywackes, cherts, limestones and melanges of Exploits Subzone and equivalents

GANDER ZONE

Cambrian and Lower Ordovician quartzose greywackes, slates, and metasedimentary rocks

AVALON ZONE

Middle to Upper Neoproterozoic volcanic and sedimentary rocks and associated intrusions; minor quartzite and marble, Cambrian and Lower Ordovician shales with Atlantic faunas

MEGUMA ZONE

Cambrian and Lower Ordovician greywackes and shales

GRENVILLE OROGEN

EXTERIOR THRUST BELT - PARAUTOCHTHON

Mainly Archean and Paleoproterozoic rocks bounded by Grenville Structural Front (northwest) and leading edge of ETB-allochthon (southeast). Rocks can be correlated with those of adjacent structural provinces outside the Grenville Orogen. Rocks affected by Grenvillian deformation and metamorphism but few (if any) contemporary plutons.

EXTERIOR THRUST BELT - ALLOCHTHON

Triassic volcanic rocks

Upper Paleoproterozoic metamorphic and plutonic rocks bounded by front of Labradorian allochthons (northwest) and 70m line of 1.6 Ga crust (southeast) or limit of numerous Grenvillian intrusions and Pinware boundary (northeast). Rocks emplaced during the Grenvillian Orogeny but already deformed and metamorphosed by the Labradorian Orogeny (1.6 - 1.7 Ga). Little or no correlation with rocks of the External Thrust Belt - Parautochthon. Contains some Grenvillian plutons and many more by the Grenville Province, some of which occur in the ETB - Parautochthon or outside the Grenville Orogen, e.g. Trans Labrador Batholith.

INTERIOR MAGMATIC BELT

Granitoid intrusions 1.2 - 1.0 Ma

Anorthosite, gabbro 1.2 - 1.0 Ma

Middle Mesoproterozoic volcanic and sedimentary rocks of Wakeham Supergroup and equivalents

Mesoproterozoic metamorphic rocks and associated plutons

ATLANTIC CONTINENTAL MARGIN
depth to pre-Mesozoic basement
0 km 4 8 12 16 20

CARBONIFEROUS SUCCESSOR BASINS
depth to pre-Carboniferous basement
0 km 4 8 12
evaporites

APPALACHIAN FORELAND
depth to pre-Paleozoic basement
0 km 4 8
buried depth contours

KEY TO STRUCTURAL LINES

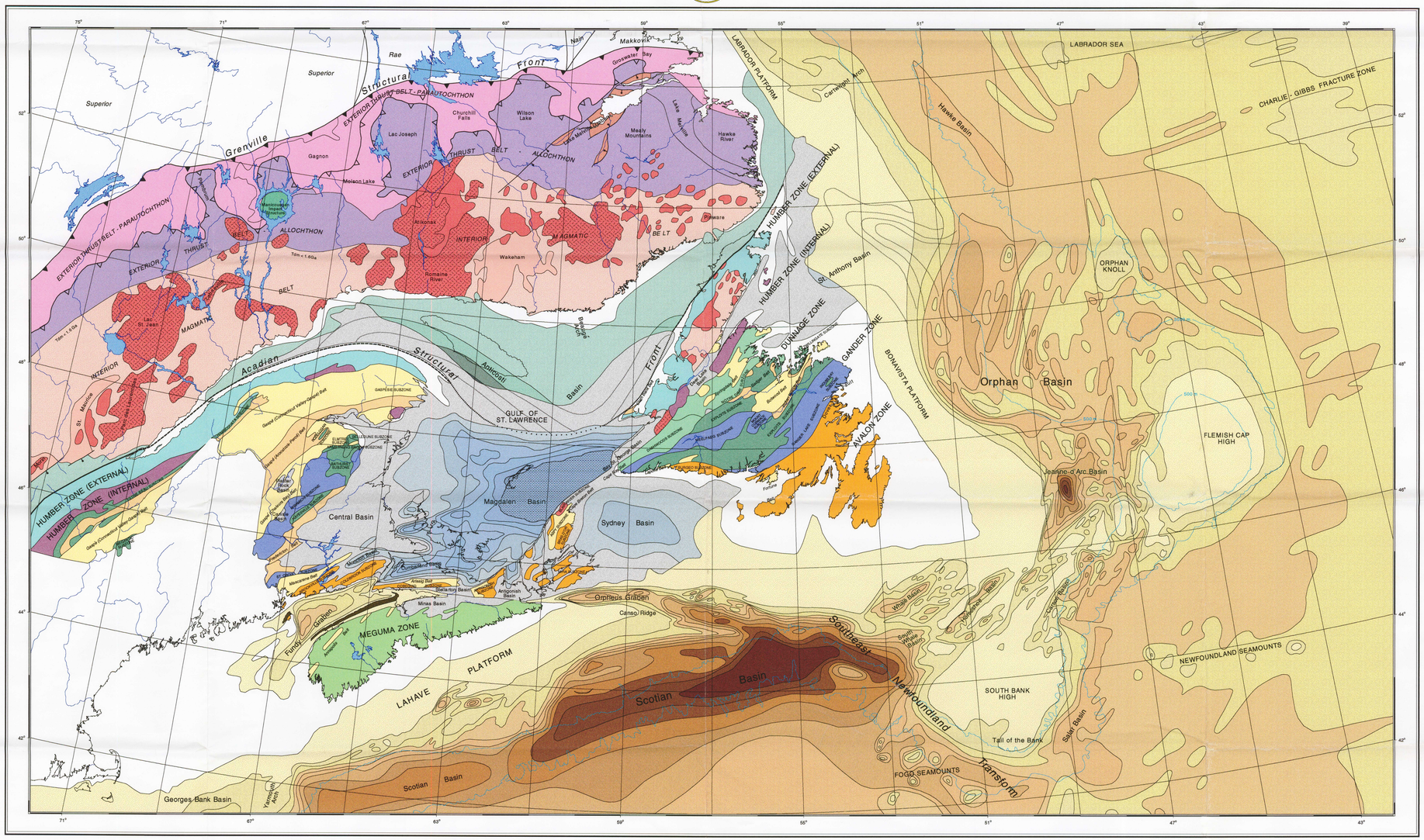
Grenville Structural Front

Front of Labradorian allochthons

Acadian Structural Front : onland, submarine, sub-Carboniferous, presumed

Normal Faults

500m, 3000m bathymetric contours



TECTONIC ASSEMBLAGES

ATLANTIC REGION

CANADA

Scale 1:3 000 000 - Échelle 1:3 000 000

LOCATION MAP - LOCALISATION DE LA CARTE

TECTONIC ASSEMBLAGES

The prominent tectonic features of Atlantic Canada are the Precambrian Grenville Orogen, the Paleozoic Appalachian Orogen, and the modern Atlantic continental margin. All three features are parallel for more than 3000 km southwestward of Newfoundland and they are parallel to the spreading centre of the Atlantic Ocean. Northeast of Newfoundland, a bifurcation in the Atlantic spreading centre opened the Labrador Sea and isolated Greenland from North America so that the modern Atlantic margin there crosses the Appalachian Orogen, the Grenville Orogen, and older provinces of the Canadian Shield farther north. This circumstance provides superb exposures across the entire Appalachian and Grenville orogens.

The Grenville Orogen has orogen-parallel belts, similar to most Phanerozoic orogens, with external thrust-dominated belts and an internal belt of intrusions. The orogen seems to have built up by successively younger outboard accretionary events, and in a general way, rocks are younger from northwest to southeast. Most of its rocks were involved in earlier orogenies. Metamorphic grade increases away from the Grenville Structural Front but there is no systematic arrangement of metamorphic isograds across the orogen, reflecting different ages of metamorphism in different belts and differential uplift and erosion of some areas with respect to others. Deep seismic data confirm surface observations that the orogen is an imbricate stack of crustal scale lenses inclined to the south and southeast and riding on a basal crust-penetrating thrust expressed at the surface as the Grenville Structural Front (Davidson, 1995). The orogen is one-sided, asymmetric with structures directed toward the craton. There is no preserved record of the continental margins and oceanic tract that preceded Grenvillian collisional tectonics.

The Appalachian miogeocline developed on Grenville basement. Initial rifting affected a wide zone extending cratonward to the Lake Melville Graben. The Laurentian passive margin existed for at least 100 m.y. and its stratigraphic analysis of rifting, passive margin development, and destruction by ophiolite obduction is as sophisticated as that for any continental margin. The orogen built up by Ordovician and Silurian accretionary events. Early Paleozoic oceanic vestiges are well preserved in interior parts of the orogen on both sides of the Iapetus tract. Final collision came in the Devonian with dextral transcurrent movements in the Carboniferous. The Appalachian Orogen is two-sided with Paleozoic structures directed toward the Laurentian and Gondwanan margins of Iapetus (Williams, 1995).

The Mesozoic Atlantic margin developed along Gondwanan terranes of the Appalachian Orogen, except north of Newfoundland where it crosses older North American elements. Many features of the Atlantic continental margin mimic those of the Appalachian miogeocline, or Paleozoic Iapetus margin. For example, the Tail of the Bank is a modern Atlantic promontory that mimics the Paleozoic St. Lawrence Promontory, now expressed in the sinuous Acadian Structural Front in the Gulf of St. Lawrence. Triassic rift graben related to Atlantic opening, such as the Fundy Graben, occur well inland from the Atlantic continental margin, just as Late Neoproterozoic rift graben related to Iapetus opening, such as the Lake Melville Graben, occur well inland from the Iapetus continental margin. Offshore, the Charlie Gibbs Fracture Zone is concurrent with the Dover Fault, a possible collisional boundary between Paleozoic lower crustal blocks. Other examples of ancestral controls abound.

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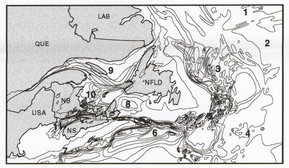
BASEMENT STRUCTURES



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Copies of this map can be obtained from the Geological Survey of Canada (Atlantic)
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ATLANTIC CANADA MAP SERIES
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