ANNOTATED BIBLIOGRAPHY ESQUIMAN CHANNEL, NORTHEASTERN GULF OF ST. LAWRENCE AND WESTERN NEWFOUNDLAND

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This project was funded by the Program on Energy Research and Development, Offshore Geotechnics Subprogram, Task 6A4.

Alam, M. and Piper, D.J.W.
1977: **Pre-Wisconsin stratigraphy and paleoclimates of Atlantic Canada, and its bearing on glaciation in Quebec.** Geographie physique Quaternaire, v.31, n.1-2, p.15-22.

Piston cores (5) from tops of seamounts close to the continental shelf west of the Grand Banks contain sequences of alternating clays and foram nanno ooze back to the Pliocene. The glacial history on the Grand Banks, the Laurentian Channel and further inland is inferred from the cores.

Amos, C.L.
1990: **Modern sedimentary processes.** Chapter 11. in Geology of the Continental Margin of Eastern Canada, eds. M.J. Keen and G.L. Williams, Geological Survey of Canada, n.2, p.611-673: (also Geological Society of America, The Geology of North America, v.I-1).

This chapter describes the characteristics of modern sediments throughout offshore eastern Canada and the processes which control their attributes. They are described in terms of the dynamics of sediment behaviour and are related to the various processes present on the continental margin.

Andrews, J.T.
1973 : **The Wisconsin Laurentide ice sheet: dispersal centers, problems of rates of retreat, and climate implications.** Arctic and Alpine Research, v.5, pt.1, p.185-199.

Andrews, J.T. and Peltier, W.R.
1989: **Quaternary geodynamics in Canada.** Chapter 8. In, Quaternary Geology of Canada and Greenland, ed. R.J. Fulton, Geological Survey of Canada, Geology of Canada, n.1, p.543-572 (also Geological Society of America, The Geology of North America, v.K-1)

This chapter provides an introduction to the extensive Quaternary data base which currently exists and to the geophysical models which have been developed to interpret these data: it is clear that an active interplay between theory and observation is desirable.

Archibald, D.C.
1969: **Intense storm tracks over Hudson Bay, the eastern Nova Scotia coast and the Grand Banks.** In, Proceedings of an Ice Seminar, The Canadian Institute Mining and Metallurgy, Special Volume 10, p.36-44.

The average path of cyclones has been indicated for the Hudson Bay, eastern coast of Nova Scotia, and the Grand Banks areas. Intense storms occurring over a 5 year period have been examined and their trajectories plotted by seasons. Average winds and wave heights are

discussed. Sea-water and mean air temperatures for the Hudson Bay area during the fall season are also plotted.

Ashe, G.W.T. and Ploeg, J.
1971: **Wave climate study, Great Lakes and Gulf of St. Lawrence.** Mechanical Engineering Report MH-107A, National Research Council of Canada, Ottawa, Ontario, v.2.

Banks, R.E.
1966: **The cold layer in the Gulf of St. Lawrence.** Journal of Geophysical Research, v.71, p.1603-1610.

Barss, M.S., Bujak, J.P. and Williams, G.L.
1979: **Palynological zonation and correlation of sixty-seven wells, Eastern Canada.** Geological Survey of Canada, Paper 78-24, 118p.

This paper presents a compilation of palynological data from 67 of the 133 wells drilled in eastern Canada from 1966 to mid-1978. All biostratigraphically significant species are listed.

Bartlett, G.A. and Molinsky, L.
1972: **Foraminifera and the Holocene history of the Gulf of St. Lawrence.** Canadian Journal of Earth Sciences, v.9, p.1204-1215.

Foraminifera have been utilized to interpret the response of waters in the Gulf of St. Lawrence to climatic changes during the Holocene. The Holocene history of the area is one of transition from a rapidly fluctuating brackish water environment, to one which is more consistent with the present environment.

Bell, J.S. and Howie, R.D.
1990: **Paleozoic geology.** Chapter 4. In, Geology of the Continental Margin of Eastern Canada, eds. M.J. Keen and G.L. Williams, Geological Survey of Canada, n.2, p.141-165: (also Geological Society of America, The Geology of North America, v.I-1).

Paleozoic rocks are widely distributed on the seafloor and beneath Mesozoic and Cenozoic rocks on the continental margins of eastern Canada. The Gulf of St. Lawrence is underlain by lower Paleozoic platform sequences (more than 7000 m in the Anticosti Basin) and upper Paleozoic rocks.

Bell, J.S. and Campbell, G.R.
1990: **Petroleum resources.** Chapter 12. In, Geology of the Continental Margin of Eastern Canada, Geology of Canada, eds. M.J. Keen and G.L. Williams, Geological Survey of Canada, n.2, p.674-720: (also Geological Society of America, The Geology of North

America, v.I-1).

The results of exploration to date are reviewed, and recent scientific studies are summarized on source rock characteristics, maturation, hydrocarbon migration and entrapment. Assessment of both the discovered resources and undiscovered hydrocarbon potential is provided.

Belt, E.S.
1968a: **Post-Acadian drifts and related facies, eastern Canada.** In, Studies of Appalachian Geology, Northern and Maritime, eds. E.A. Zen, W.S. White, J.B. Hadley and J.B. Thompson, p.95-117.

This report reviews published data on the eastern Canadian Carboniferous geology, with the addition of unpublished field data collected by the author.

Bolton, T.E.
1972: **Geological map and notes on the Ordovician and Silurian Litho- and Biostratigraphy, Anticosti Island, Quebec.** Geological Survey of Canada, Paper 71-19, 45p.

The six formations detailed on the preliminary geological map of Anticosti Island, Quebec, represent an uninterrupted sequence of nearly flatlying rocks of Upper Ordovician to Middle Silurian ages. Characteristic fossils from each of the six formations are illustrated in a preliminary fashion and grouped by formation.

Bolton, T.E.
1972: **Geology of Anticosti Island.** Geological Survey of Canada, Map 2-1971.

Bostock, H.H.
1983: **Precambrian Rocks of the Strait of Belle Isle area.** In, Geology of the Strait of Belle Isle Area, Northwestern Insular Newfoundland, Southern Labrador, and Adjacent Quebec, Geological Survey of Canada, Memoir 400, p.1-73.

This paper gives an in depth description of the Precambrian geology in the Strait of Belle Isle.

Bradley, D.C.
1982: **Subsidence in late Paleozoic basins in the northern Appalachians.** Tectonics, v.1, n.1, p.107-123.

Between the Devonian continental collision and the Triassic breakup, the northern Appalachians became the site of a wide plate boundary zone of dominantly right-lateral strike slip. Tectonism was both diachronous and rapidly variable along strike through

regimes of 'pure' strike slip, transpressional deformation, and rapid subsidence of extensional basins. Up to 9 km of mainly nonmarine, clastic sediments accumulated in these local depocenters.

Brookes, I.A.
1969: **Late glacial marine overlap in western Newfoundland.** Canadian Journal of Earth Sciences, v.6, p.1397-1404.

Western Newfoundland Quaternary deposits comprise a glacio-marine sequence sandwiched between tills and associated glacial deposits. The upper marine limit was registered when ice of the earlier stage had waned and exposed parts of the present west coastal areas to the sea. In the St. George's and Port au Port Bays this event occurred 13,200-13,700 years ago while in the Bay of Islands area it was delayed by about 1000 years. The diachronous nature of the marine onlap complicates the reconstruction of isobases on raised features.

Brookes, I.A.
1970: **New evidence for an independent Wisconsin-age ice cap over Newfoundland.** Canadian Journal of Earth Sciences, v.7, p.1374-1382.

A reinterpretation of the relative ages of glacial striae in southwestern Newfoundland, and evidence from erratic till-boulder provenances there, support an early view that at the last glacial maximum the island supported its own ice cap and was not affected by ice from Labrador.

Brookes, I.A.
1974: **Late-Wisconsinan glaciation of southwestern Newfoundland (with special reference to the Stephenville map area).** Geological Survey of Canada, Paper 73-40, 31p.

Brookes, I.A.
1977: **Geomorphology and Quaternary geology of Codroy Lowland and adjacent plateaus, southwest Newfoundland.** Canadian Journal of Earth Sciences, v.14, p.2101-2120.

The paper presents an interpretation of preglacial and glacial landforms and Quaternary sediments of approximately 2000 km^2 of southwest Newfoundland. The area comprises lithologically controlled Codroy Lowland, floored by Late Wisconsinan glacial deposits, flanked by Long Range and Anguille Mountain plateaus which bear evidence of multiple Quaternary glaciation. Part of the Long Range Mountains and all of the Anguille Mountains were ice-free at the Late Wisconsinan glacial maximum.

Brookes, I.A.
1977: **Radiocarbon age of Robinson's Head moraine, west Newfoundland, and its significance for postglacial sea level changes.** Canadian Journal of Earth Sciences, v.14, p.2121-2126.

A radiocarbon date of 12,600 years BP is reported on marine shells from sands within the Robinson's Head kame moraine at Stephenville, Newfoundland. The date refers to the time of moraine and delta-kame construction and confirms an earlier estimation. Other radiocarbon dates from the area are used with a hypothetical isostatic uplift curve and a published eustatic sea level curve, to produce a first approximation to postglacial changes of local sea level in the St. George's Bay region.

Brookes, I.A.
1987: **Late Quaternary glaciation and sea-level change southwest Newfoundland, Canada.** Geological Society of America, Centennial Field Guide-Northeastern Section, v.5, p.445-450.

Sites along the southwest coast of Newfoundland in the St George's and Port au Port areas are described in terms of the Quaternary Geology and sea-level change.

Brookes, I.A., Scott, D.B. and McAndrews, J.H.
1985: **Postglacial relative sea-level change, Port au Port area, west Newfoundland.** Canadian Journal of Earth Sciences, v.22, p.1039-1047.

Reported foraminifera analysis and radiocarbon dates in the Port au Port-northern St. George's Bay area closely constrain a curve of postglacial relative sea level change. The form of the curve supports a recent model predicting sea-level response to wastage of a limited late Wisconsinan ice load in the wider region.

Canadian Hydrographic Service
1980: **Sailing directions. Gulf and River St. Lawrence.** Canada Dept. of Fisheries and Oceans.

Canadian Hydrographic Service
1983a: **Canadian tide and current tables, volume 2, Gulf of St. Lawrence.** Canada Dept. of Fisheries and Oceans.

Cawood, P.A. and Williams, H.
1988: **Acadian basement thrusting, crustal delamination and structural styles in and around the Humber Arm Allochthon, western Newfoundland.** Geology, v.16, p.370-373.

The leading edge of the Humber Arm allochthon in western Newfoundland coincides with the western limit of the Taconian and

Acadian deformed zones. Taconian deformation is west-directed and confined to rocks of the allochthon. Acadian deformation extends to deeper crustal levels and affects underlying shelf carbonates and Grenville basement. The authors offer explanations for conflicting styles and polarities.

Cawood, P.A., Shaw, B.R., Etemadi, M. and Stevens, R.K.
1991: **Comment on "Structure of the Appalachian deformation front in western Newfoundland: Implications of multichannel seismic reflection data."** Geology, v.19, n.9, p.951-952.

The authors comment on Stockmal and Waldron's (1990) interpretation of petroleum-industry seismic data. Criticisms include (1) quality of the seismic data is poor with numerous multiplies, (2) the upper detachment of the triangle-zone is merely "differential movement" (4) the Humber Arm allochthon is too incompetent to occupy the interior of a triangle and (4) there is a shallow autochthonous crystalline basement in the near offshore.

Chevron Canada Resources Limited
1983: **Emergency Contingency Plan. Gulf of St. Lawrence - Cablehead.** Chevron Canada Resources Limited, Calgary, Alberta.

Conolly, J.R., Needham, H.D. and Heezen, B.C.
1967: **Late Pleistocene and Holocene sedimentation in the Laurentian channel.** The Journal of Geology, v.75, n.2, p.131-147.

Conolly et al. describe 11 cores collected in the Laurentian channel during the 1960 and 1961 cruises "R/V Vema". Reddish-brown glacial-marine sediment was deposited in the Laurentian Channel during the late Pleistocene. Two 10-23 cm. thick brick-red tills, 70-350 cm. apart lie within the glacial marine sediment.

Cumming, L.M.
1983: **Lower Paleozoic Autochthonous Strata of the Strait of Belle Isle.** In, Geology of the Strait of Belle Isle Area, Northwestern Insular Newfoundland, Southern Labrador, and Adjacent Quebec, Geological Survey of Canada, Memoir 400, p.75-108.

Hadrynian, Cambrian, and Ordovician autochthonous strata of the Strait of Belle Isle area are part of a wedge of strata extending to the southwest and underlying most of the Gulf of St. Lawrence. The strata were deposited on a shelf that gave way easterly to a shelf edge and then to a turbiditic facies which formed along the former continental slope and rise.

Dainty, A.M., Keen, C.E., Keen, M.J. and Blanchard, J.E.
1966: **Review of geophysical evidence on crust and upper mantle structure on the eastern seabroad of Canada.** In, The Earth Beneath

the Continents, eds. J.S. Steinhart and J.J. Smith, American Geophysical Union, Monograph 10, p.349-369.

Geophysical experiments (started in 1962) on the eastern Seabroad of Canada show that the structure of the crust is complicated with a close relationship between the surface geology and the deeper crustal structure. The crust is approximately 40-45 km beneath the Carboniferous Basin of the Gulf of St. Lawrence.

Department of Mines and Energy, Government of Newfoundland and Labrador.
1989: **Hydrocarbon potential of the western Newfoundland area.** Department of Mines and Energy, Government of Newfoundland and Labrador, 20p.

Dickie, L.M. and Trites, R.W.
1983: **The Gulf of St. Lawrence.** In, Estuaries and Enclosed Seas, ed. B.H. Ketchum,

This paper summarizes several aspects of the Gulf of St. Lawrence including: (1) geology and morphology, (2) temperature and salinity distributions, (3) circulation patterns, (4) the biological production and (5) the impact of human activity.

Dunbar, M.J
1970: **The Gulf of St. Lawrence: Past and Future.** 2nd Gulf of St. Lawrence Workshop, Bedford Institute of Oceanography, 31p.

Dunbar, M.J. Maclellan, Filion A. and Moore, D.
1980: **The biogeographic structure of the Gulf of St. Lawrence.** Prepared by Marine Sciences Center, McGill University, Montreal, for Parks Canada, Ottawa, Ontario, 143p.

Durling, P.W. and Marillier, F.
1989: **Marine multichannel deep seismic reflection data from the Gulf of St. Lawrence.** Geological Survey of Canada, Open File 01990, 50p.

Durling, P.W. and Marillier, F.
1990: **Basement rock subdivisions in the western Gulf of St. Lawrence and their relationship to northern appalachian terranes.** in Programs with Abstracts of the Quebec - Maine - New Brunswick Appalachian Workshop, Geological Survey of Canada, Open File 02235, p.36-39.

El-Sabh, M.I.
1975: **Transport and currents in the Gulf of St. Lawrence.** Bedford

Institute of Oceanography, Report Series, BI-R-75-9, 180p.

Emory-Moore, M., Barrie, J.V. and Solomon, S.
1988: **Modelling of two heavy mineral placer deposits on the Canadian continental shelf.** In, Geological Association of Canada, Canadian Society of Petroleum Geologists, Joint Annual Meeting, St. John's, Program with Abstracts, v.13, p.A37.

Environment Canada
1972: **An interdisciplinary study of the Gulf of St. Lawrence area.** Steering Committe, Gulf of St Lawrence Project, Bedford Institute of Oceanography, Dartmouth Nova Scotia, 69p.

Environment Protection Services
1979: **Environment Atlas of southern Gulf of St. Lawrence.** Environment Canada, Marine Environment Branch.

Ewing, G.N., Dainty, A.M., Blanchard, J.E. and Keen, M.J.
1966: **Seismic studies on the eastern seaboard of Canada: The Appalachian system.** Canadian Journal of Earth Sciences, v.3, p.89-95.

The results of seismic refraction profiles in the Gulf of St. Lawrence and on the northwest and northeast coasts of Newfoundland are presented. The thickness of the crust is about 45 km in the region of the Gulf of St. Lawrence southwest of the Cabot Strait Trough, and off the northeast coast of Newfoundland east of the Long Range Mountains.

Farquharson, W.I.
1970: **Tides, tidal streams, and currents in the Gulf of St. Lawrence.** 2nd ed. Atlantic Oceanography Lab, Dartmouth, N.S., Unpublished Manuscript, 145p.

Flint, R.F.
1940: **Late Quaternary changes of level in western and southern Newfoundland.** Bulletin of the Geological Society of America, v.51, p.1757-1780.

Quaternary marine features are numerous along the west coast of Newfoundland. They include wave-cut benches and cliffs, localized forms such as beach ridges, bars and deltas, and a discontinuous blanket of fossil-bearing marine sediments. Evidence in two areas indicates that at least part of the post-glacial eustatic rise of sea level occurred while glacier ice was still actively present, and prior to at least part of the crustal warping.

Forbes, D.L.
1984: **Coastal geomorphology and sediments of Newfoundland.** In, Current Research, Geological Survey of Canada, Paper 84-1B, p.11-24.

Coastal surveys initiated in 1981 have yielded a large data set for analysis of geomorphological features and sediments in the coastal zone. The data collected include bathymetric, sidescan, and seismic surveys, and bottom-grab, piston-core, and vibracore sampling. In addition detailed studies have been undertaken at 74 representative sites. This report presents a general outline and preliminary results of this coastal survey project.

Forbes, D.L.
1988: **Cruise report 88-018.** Geological Survey of Canada, Open File 2041, 15p.

The data collected on this cruise included bathymetry, side scan sonar imagery, shallow seismic reflection data, magnetometer data, 66 Van Veen grab samples, 8 gravity cores. The areas surveyed were Port au Port bay, St. George's Bay and the southwest coast.

Forbes, D.L. and Frobel, D.
1986: **Cruise report 85-300; Coastal air video and ground survey, west Newfoundland and southern Labrador.** Bedford Institute of Oceanography, 13p.

Forbes, D.L. and Frobel, D.
1986: **Coastal video survey of western Newfoundland.** (Gros Morne National Park), Geological Survey of Canada, Open File 1230, (2 1 hour tapes).

Forbes, D.L., Taylor, R.B. and Shaw, J.
1989: **Shorelines and rising sea levels in eastern Canada.** Episodes, v.12, n.1, p.23-28.

This article summarizes respectively recent work along Canada's low-lying eastern coast and its more rugged western one, which provides part of the scientific background required in order to understand and cope with changes in the coastal zone. The authors show here the importance of variations, not only in sea level, but also in conditions of sediment supply.

Forrester, W.D.
1964: **A quantitative temperature-salinity study of the Gulf of St. Lawrence.** Bedford Institute of Oceanography, Report Series, BI-R-64-11, 11p.

Geological Survey of Canada
1988: **Gravity anomaly map of the continental margin of eastern Canada (bouger on land; free-air at sea).** Geological Survey of Canada, "A" Series Map 01708a.

Geological Survey of Canada
1988: **Magnetic anomaly map of the continental margin of eastern Canada.** Geological Survey of Canada, "A" Series Map 01709a.

Goodacre, A.K., Brule, B.G. and Cooper, R.V.
1969: **Results of regional underwater gravity surveys in the Gulf of St. Lawrence.** Dominion Observatory, Gravity Map Series, n. 86, 24p.

Grant, A.C.
1975: **Canada's continential margins and offshore petroleum exploraton.** In, Canada's Continental Margins and Offshore Petroleum Exploration, eds. C.J. Yorath, Parker E.R. and Glass D.J., Canadian Society of Petroleum Geologists, Memoir 4, Abstracts, p.45-57.

Grant, A.C., Josenhans, H.W., MacLean, B., Vilks, G. and Zevenhuizen, J.
1991: **H-1:Application of high resolution seismic techniques in offshore "Hard Bottom" regions.** In, Program & Abstracts, CSEG National Convention Centre, Calgary, Alberta, May 14-16, p.87.

The predominance of carbonate rocks in the Lower Paleozoic basins, underlying the Gulf of St. Lawrence results in "hard bottom" conditions that make it difficult to recover good multichannel reflection seismic data. Cruises by the Geological Survey of Canada have acquired seismic data using high frequencies (120-6000 hz) generated by small energy sources (e.g. 40 cu. in. sleeve gun, HUNTEC "Boomer") to attain maximum resolution within the depth interval to the first water bottom multiple.

Grant, A.C.
1988: **Depth to basement of the continental margin of eastern Canada.** Geological Survey of Canada, "A" Series Map 01707a.

Grant, D.R.
1969: **Late Pleistocene re-advance of piedmont glaciers in western Newfoundland.** Maritime Sediments, v.5, n.3, p.126-128.

Detailed air-photo interpretation of the southern half of the peninsula, reveals that Long Range ice had expanded also westward through troughs between nunataks, and spread out into the sea over the western lowlands as several piedmont glaciers which produced a whole series of interlobate and recessional moraines. The author

presents 4 possible interpretations for this event.

Grant, D.R.
1969: **Surficial deposits, geomorphic features and late Quaternary history of the terminus of the Northern Peninsula of Newfoundland and adjacent Quebec-Labrador.** Maritime Sediments, v.5, n.3, p.123-125.

Surficial deposits, geomorphic and Late Quaternary history of the terminus of the Northern Peninsula of Newfoundland and adjacent Quebec and Labrador are presented.

Grant, D.R.
1972: **Postglacial emergence of northern Newfoundland.** Geological Survey of Canada, Report of Activities, Paper 72-1, Part B, p.100-102.

Surficial geological mapping of the Northern Peninsula has included documenting postglacial changes in the relative level of land and sea. This report complements previous accounts of the surficial deposits and geomorphology of the area.

Grant, D.R.
1975: **The contrasting styles of Late-Wisconsinan Laurentide and Appalachian glaciation: New England and the Atlantic Provinces.** The Geological Society of America, Northeastern Section, Abstracts with programs, v.10, n.1, p.66.

Two themes are developed - a concept of local glaciation of the Appalachians and a sequence of recessional ice margins. The glacial model devolves from field evidence in key areas, and is the basis for inferred deglacial positions that account for glacial features throughout the region.

Grant, D.R.
1977: **Glacial style and ice limits, the Quaternary stratigraphic record, and changes of land and ocean level in the Atlantic provinces, Canada.** Geographie physique Quaternaire, v.31, n.3-4, p.247-260.

This paper summarizes the author's work in the region over the last 10 years. Evidence from various sources indicates that the late Wisconsinan glaciers spread weakly toward, and in many areas not beyond, the present coast. The limiting factor was the deep submarine channels that transect the region.

Grant, D.R.
1977a: **Altitudinal weathering zones and glacial limits in Western**

Newfoundland, with particular reference to Gros Morne National Park. Geological Survey of Canada, Paper 77-1A, p.455-463.

Grant, D.R.
1980a: **Quaternary sea-level change in Atlantic Canada as an indication of crustal delevelling.** In, Earth Rheology, Isostasy and Eustasy, ed. N-A. Morner, John Wiley and Sons Ltd., New York, p.201-214.

This marginal segment of the continental plate has been sinking at 5-10 cm/1000 y by means of a spasmodic titling interrupted by wide swings of sea level, recorded by Mesozoic-Cenozoic shelf strata. However, recent glacio-isostatic perturbations dominate.

Grant, D.R.
1987: **Quaternary Geology of Nova Scotia and Newfoundland.** International Union for Quaternary Research, 12th INQUA Congress Field Excursion Guide Book A-3/C-3, 62p.

The field trip ranges over a large area of the Atlantic Provinces and is designed to traverse a variety of landscapes, to visit outstanding exposures, and to demonstrate the major aspects of Late Cenozoic geological evolution.

Grant, D.R.
1989: **Quaternary Geology of the Atlantic Appalachian region of Canada.** Chapter 5. In, Quaternary Geology of Canada and Greenland, ed. R.J. Fulton, Geological Survey of Canada, Geology of Canada, n.1, p.339-440 (also Geological Society of America, The Geology of North America, v.K-1).

This chapter reviews the Quaternary geology of the Atlantic Appalachian region. Interpretations of glacial events and limits are presented.

Grant, D.R. and King, L.H.
1984: **A stratigraphic framework for the Quaternary history of the Atlantic Provinces, Canada.** In, Quaternary Stratigraphy of Canada - A Canadian Contribution to IGCP Project 24, ed. Fulton R.J., Geological Survey of Canada, Paper 84-10, p.173-191.

Lithostratigraphic correlation of sedimentary sequences reveals a broadly parallel series of four glacial advances of varying provenance and vigour. Quaternary deposits are divided into three broad groups according to whether they underlie or overlie horizons assigned to the last interglacial stage.

Grant, D.R.
1973: **Surficial Geology, NTS 12G/8.** Scale 1:50,000. Geological Survey of Canada, Open File 244.

1986: **Surficial Geology, Port Sanders, Newfoundland.** Scale 1:250,000. Geological Survey of Canada, Map 1622A.

1989: **Surficial Geology, Sandy Lake, Newfoundland.** Scale 1:250,000. Geological Survey of Canada, Map 1664A.

In press: **Surficial Geology, Stephenville-Port aux Basques, Newfoundland.** Scale 1:250,000. Geological Survey of Canada Map.

Guilbault, J-P.
1984: **Late glacial foraminifera localities in raised marine sediments in western Newfoundland.** Geological Survey of Canada, Open File 01003, 97 p.

Hacquebard, P.A.
1986: **The Gulf of St. Lawrence Carboniferous Basin; the largest coalfield of eastern Canada.** Bulletin of the Canadian Institute of Mining and Metallurgy, v.79, n.891, p.67-78.

Two continuous coal zones occurring in a 2500 ft. thick section of the Upper Carboniferous Pictou Group have been encountered in five offshore wells drilled for oil and gas in the Gulf of St. Lawrence. They correlate, by means of fossil spores, with thick coals of the Mabou and Inverness coalfields situated at the eastern edge of the basin indicating the presence of a large submarine coalfield of at least 18,000 sq. mi.

Hacquebard, P.A.
1987: **Estuary and Gulf of St. Lawrence.** Geological Survey of Canada, Open File 01721, 264 p.

Haworth, R.T.
1975: **Paleozoic continental collision in the northern Appalachians in light of gravity and magnetic data in the Gulf of St. Lawrence.** In, Offshore Geology of Eastern Canada, eds. W.J.M. van der Linden and J.A. Wade, Geological Survey of Canada, Paper 74-30, v.2, p.1-10.

Regional features depicted on new 1:1,000,000 Bouger gravity anomaly and magnetic anomaly maps covering the Gulf of St. Lawrence are interpreted in terms of Paleozoic continental collision following the closing of a proto-Atlantic ocean.

Haworth, R.T.
1975: **The development of Atlantic Canada as a result of**

continental collision-evidence from offshore gravity and magnetic data. In, Canada's Continental Margins and Offshore Petroleum Exploration, eds. C.J. Yorath, E.P. Parker and D.J. Glass, Canadian Society of Petroleum Geologists, Memoir 4, p.59-77.

The extensive physiographic feature of the Laurentian Channel, in apparent continuation of the sharp offset in the continental shelf along the southern Grand Banks, has long suggested the presence of a major fault zone that extends from the Gulf of St. Lawrence into the North Atlantic. The zone of Appalachian thrust faults along the St. Lawrence valley is flexed within the Gulf of St. Lawrence and reappears in Newfoundland having been offset 400 km to the southeast.

Haworth, R.T.
1978: **Interpretation of geophysical data in the northern Gulf of St. Lawrence and its relevance to lower Paleozic geology.** Geological Society of America Bulletin, v. 89, p.1091-1110.

With the aid of seismic data magnetic and gravity anolomies overlying typical Grenville crust are examined. The source of the Banc Beauge Low anomaly in particular is examined. Possible sources for this anomaly may be a low-density intrusion or a sedimentary basin. The interpretations are then summarized in a tectonic synthesis for the region.

Haworth, R.T. and Watts, A.B.
1971: **Gravity measurements in the Gulf of St. Lawrence.** In, Earth Science Symposium on Offshore Eastern Canada, eds. P.J. Hood, N.J. McMillan and B.R. Pelletier, Geological Survey of Canada, Paper 71-23, p.337-338.

During 1968 and 1969 bathymetry, magnetic and gravity data were obtained along ship tracks totalling approximately 55,000 km. The surface ship gravity survey covers much of the eastern Gulf of St Lawrence previously surveyed with underwater gravimeters. A notable exception from the underwater data set is a series of gravity "lows" interpreted as being caused by evaporite bodies within the Carboniferous sequence causing the main Magdalen low centered over the Cabot Strait.

Haworth, R.T. and MacIntyre, J.B.
1976: **Gravity and magnetic fields of the Gulf of St. Lawrence.** Geological Survey of Canada, Paper 75-42, 11p.

Gravity and magnetic field data collected along approximately 55,000 km of closely spaced ship's tracks in the Gulf of St. Lawrence, Canada, have been compiled at a scale of 1:1,000,000 and set against a background of data collected on a more regional scale.

Haworth, R.T. and Sanford, B.V.
1976: **Paleozoic geology of northeast Gulf of St. Lawrence.** Geological Survey of Canada, Paper 76-1A, p.1-6.

The Paleozoic geology of the northeast of the Gulf of St. Lawrence is mapped using seismic data collected by the authors and Shearer (1973) and core samples collected with the BIO electric rock-core drill.

Hill, P.A. and Ruest, A.E.
1981: **Heavy minerals and metals in Port au Port Bay, Newfoundland: a reconnaissance.** Economic Geology, v.76, p.961-970.

Within Port au Port Bay, well-stratified, well-sorted heavy minerals-predominately chromite-are visible in the 2 to 5 ft marine terrace between Fox Island River and Port au Port. The lighter minerals (of the original till) have been winnowed out to form southerly pointing spits of relatively clean immature sands.

Hobson, G.D. and Overton, A.
1973: **Sedimentary refraction seismic surveys, Gulf of St. Lawrence.** In, Earth Science Symposium on Offshore Eastern Canada, eds. P.J.Hood, N.J.McMillan and B.R.Pelletier. Geological Survey of Canada, Paper 71-23, p.325-336.

From a two-ship seismic refraction program, begun in 1964, 94 profiles were obtained from which some aspects of the underlying geology were interpreted. The seismic refraction results of previous workers, Sheridan and Drake (1968), Willmore and Scheidegger (1956), MacPherson (1962), and Ewing and Hobson (1966) have been incorporated.

Hobson, G.D. and Overton, A.
1970: **Marine seismic program, Gulf of St. Lawrence (12b,c,f,g,i,j,k,o,p).** In, Report of Activities Part a, Geological Survey of Canada, Paper 70-1A, p.76.

Howie, R.D. and Barss, M.S.
1975: **Upper Paleozoic rocks of the Atlantic provinces, Gulf of St. Lawrence, and adjacent continental shelf.** In, Offshore Geology of Eastern Canada, eds. W.J.M. van der Linden and J.A. Wade, Geological Survey of Canada, Paper 74-30, v.2, p.35-50.

The Paleozoic folded belt in the Atlantic region of Canada forms the northeastern part of the Appalachian region of North America. The earliest phase of Paleozoic folding was the Taconic Orogeny (Ordovician). A succeeding phase of tectonism, the Acadian Orogeny (Early to late Devonian) was characterized by folding, faulting, metamorphism, and granitic intrusion that gradually stabilized the Appalachian Geosyncline.

Howie, R.D. and Barss, M.S.
1975: **Paleogeography and sedimentation in the upper Paleozoic, eastern Canada.** In, Canada's Continental Margins and Offshore Petroleum Exploration, eds. C.J. Yorath, E.R. Parker and D.J. Glass, Canadian Society of Petroleum Geologists, Memoir 4, p.45-57.

The upper Paleozoic of eastern Canada once occupied an area from the southern part of the Gapse Peninsula to the Bay of Fundy, to the continental shelf north and east of Newfoundland. These sediments deposited on the Acadian orogen range in age from middle Devonian to early Permian. The Carboniferous Period accounts for most of these rocks.

Hudson Bay Oil and Gas Company Ltd. (HBOG)
1980: **Contingency Plan, Prince Edward Island operations. Vol.1 Response plan.** Hudson's Bay Oil and Gas Co. Ltd., Calgary Alberta.

Hudson Bay Oil and Gas Company Ltd. (HBOG)
1980: **Contingency Plan, Prince Edward Island operations. Vol.2 Reference data.** Hudson's Bay Oil and Gas Co. Ltd., Calgary Alberta.

Ives, J.D.
1978: **The maximum extent of the Laurentide ice sheet along the east coast of North America during the last glaciation.** Arctic, v.31, p.24-35.

Between 1860 and 1940 it was assumed that ice extent of the Laurentide Ice Sheet along the eastern seaboard was limited. However after 1940 this interpretation was replaced by one contending that all high coastal mountains were inundated. After reviewing opposing interpretations it is suggested that the earlier viewpoint was the more accurate.

Josenhans, H., Sanford, B.V., Sparkes, R., Johnston, B.L., Boyce, A., Nielsen, J. and Belliveau, M.
1989: **Cruise report 89-008.** Geological Survey of Canada, Open File 2115, 68p.

The survey was intended to provide regional seismic coverage of the Gulf of St. Lawrence to gain an understanding of the regional surficial and bedrock geology. Data collected includes 5111 km. airgun seismics, 4732 km. Huntec DTS, 2823 BIO Sidescan, 2049 km. Klein Sidescan, 615 km. Huntec Sidescan, 4522 km. magnetometer, and 5182 km. 3.5 Khz.

Josenhans, H., Johnston, K., Jarrett, K., Smith, D. and Zevenhuizen, J.
1990: **Surficial geological investigations of the Gulf of St.**

Lawrence - Cruise Report 90-028. Geological Survey of Canada, Open File, 108p.

The cruise was designed to obtain representative samples of the regional seismic units and to define the sedimentary environments proximal and distal to former ice margins. Geophysical and sampling data were compiled. The sampling included box, LCF and Leheigh cores, water, Van Veen and IKU grab samples.

Josenhans, H., Zevenhuizen, J. and MacLean, B.
1990: **Preliminary seismostratigraphic interpretations from the Gulf of St Lawrence.** In, Current Research, Part B, Geological Survey of Canada, Paper 90-1B, p.59-75.

The results of two seismic and sampling surveys in the Gulf of St. Lawrence are illustrated and discussed. Regional coverage of the surficial and bedrock geology of the entire gulf was obtained and the major features of the surficial geology and geomorphology of the region is presented.

Jordon, F.
1973: **The St. Lawrence system run-off estimate 1960-1970.** Bedford Institute of Oceanography, Data Series BI-D-73-10.

Kalkreuth, W. and Macauley, G.
1989: **Organic petrology and Rock-Eval studies on oil shales from the Lower Carboniferous Rocky Brook Formation, Western Newfoundland.** Bulletin of Canadian Petroleum Geology, v.37, n.1, p.31-42.

Nine samples of oil shale from the Carboniferous Rocky Brook Formation in western Newfoundland were studied by incident microscopy and geochemical analysis. These oil shale beds are Type 1 lacustrine lamosites dominated by the maceral lamalginite. Optical properties indicate low to moderate thermal maturation and geochemical analysis indicate the beds are immature.

Keen, C.E., Keen, M.J., Nichols, B., Reid, I., Stockmal, G.S., Colman-Sadd, S.P., O'Brien, S.J., Miller, H., Quinlan, G., Williams, H. and Wright, J.
1986: **A deep seismic reflection profile across the Northern Appalachians.** Geology, v.14, p.141-145.

Marine deep seismic reflection data were collected across the Appalachian orogen, northeast of Newfoundland, with the aim of relating deep crustal structure to near-surface geology. This experiment indicates major tectonic differences compared to results for the southern Appalachians.

Keen, M.J. and Cameron, G.D.M.
1988: **Tectonic element map of the continental margin of eastern Canada.** Geological Survey of Canada, "A" Series Map 01706a.

Keen, C.E., Loncarevic, B.D., Reid, I., Woodside, J., Haworth, R.T. and Williams, H.
1990: **Tectonic and geophysical overview.** Chapter 2. In, Geology of the Continental Margin of Eastern Canada, eds. M.J. Keen and G.L. Williams, Geological Survey of Canada, n.2, p.33-75: (also Geological Society of America, The Geology of North America, v.I-1).

The tectonic history of offshore eastern Canada is reviewed.

Kirkham, R.V.
1985: **Base metal in Upper Windsor (Codroy) Group oolitic and stromatolitic limestones in the Atlantic provinces.** In, Current Research, Part A, Geological Survey of Canada, Paper 85-1A, p.573-585.

This is a preliminary report on base metal occurrences in Late Visean upper Windsor Group limestones in the Atlantic Provinces. Chalcopyrite, sphalerite, galena and at one locality, tetrahedrite are dispersed in upper Windsor Group brown, grey and black oolitic and stromatolitic limestones interlayered with red clastics, grey and green limy shales and pale evaporates.

Laroche, P.J.
1975: **The geological setting of the Gulf of St. Lawrence.** In, Canada's Continental Margins and Offshore Petroleum Exploration, eds. C.J. Yorath, E.R. Parker and D.J. Glass, Canadian Society of Petroleum Geologists, Abstracts, Memoir 4, p.892.

Extensive geological field work, supported by detailed sample laboratory studies and nearly 6,000 miles of marine seismic reflection data, in addition to published previous work, have lead to a better understanding of the geological setting of the Gulf of St. Lawrence.

Lauzier, L.M., Trites, R.W. and Hachey, H.B.
1957: **Some features of the surface layer of the Gulf of St. Lawrence.** Bulletin of the Fisheries Resources Board of Canada, v. 3, p.195-212.

Lilly, H.D.
1966: **Late Precambrian and Appalachian tectonics in the light of submarine exploration on the Grand Banks and in the Gulf of St. Lawrence: preliminary views.** American Journal of Science, v.264, p.569-574.

Submarine bedrock has been directly examined both east and west of the island of Newfoundland in an attempt to locate both sides of the Appalachian fold belt.

Liverman, D. and Taylor, D.
1990: **Surficial geology map of Insular Newfoundland.** In, Current Research Newfoundland Department of Mines and Energy, Geological Survey Branch, Report 90-1, p.39-48.

A 1:500,000 scale surficial geology map of insular Newfoundland has been compiled, using existing 1:50,000 and 1:250,000 mapping and original aerial photograph interpretation.

Loring, D.H.
1971: **Marine geology of the Gulf of St. Lawrence.** In, Earth Science Symposium on Offshore Eastern Canada, eds. P.J.Hood, N.J.McMillan and B.R.Pelletier, Geological Survey of Canada, Paper 71-23, p.305-324.

Data obtained from seismic profiles, echograms, oblique sonagrams, underwater photographs, grab and core samples indicate that the major geomorphological features are not related to the present environmental conditions. Instead the submarine troughs and the shelves are preglacial erosional features developed in bedrock of differing structures, origins and ages.

Loring, D.H.
1975: **Surficial geology of the Gulf of St. Lawrence.** In, Offshore Geology of Eastern Canada, eds. W.J.M. van der Linden and J.A. Wade, Geological Survey of Canada, Paper 74-30, v.2, p.11-34.

This article is mainly a synopsis of the bedrock and surficial geology of the Gulf of St. Lawrence as presented in detail by Loring and Nota, 1973. Acoustical and sampling data indicate that the underlying bedrock is covered by uneven glacial and postglacial sediments. The main stages in the development of the Gulf are: (1) establishment of a preglacial valley system, (2) modifications by repeated Pleistocene glaciations, (3) late Wisconsin ice readvances and retreats, and (4) modifications by postglacial changes in sea level and present conditions.

Loring, D.H. and Nota, D.J.G.
1969: **Mineral dispersal patterns in the Gulf of St. Lawrence.** Revue de geographie de Montreal, v.23, p.289-305.

Loring, D.H. and Nota, D.J.G.
1973: **Morphology and sediments in the Gulf of St. Lawrence.** Environment Canada, Fisheries and Marine Service, Fisheries

Research Board of Canada, Bulletin 182, p.147.

This report describes and assesses the submarine morphology and the characteristics of the sediments (lithology, grain size, mineralogy, and chemistry) of the Gulf of St. Lawrence and the St. Lawrence Estuary. The data indicates that the main stages in the development of the Gulf included (1) formation of preglacial landscape, (2) modification of the landscape by Pleistocene glaciations, (3) late- glacial ice advances and retreats and (4) modification by postglacial changes in sea level and present depositional conditions. The enclosed charts indicate grab and core (about 1500) locations and seismic lines.

McClintock, P. and Twenhofel, W.H.
1977: **Wisconsin glaciation of Newfoundland.** Geological Society of America Bulletin, v.51, p.1729-1756.

From the presence of fresh erratic stones and ice-scoured topography it is concluded that Newfoundland was completely glaciated during the Wisconsin stage of the Pleistocene. The glaciation had three recognizable episodes: (1) the maximum episode, (2) the Bay St. George episode, and (3) the cirque-forming and local moraine episode.

Marillier, F., Keen, C.E., Stockmal, G.S., Quinlan, G., Williams, H., Colman-Sadd, S.P. and O'Brien, S.J.
1989: **Crustal structure and surface zonation of the Canadian Appalachians: implications of deep seismic data.** Canadian Journal of Earth Sciences, v.26, p.305-321.

Two marine seismic reflection transect reveal the regional three-dimensional geometry of the Canadian Appalachian orogen. Three lower crustal blocks referred to as the Grenville, Central, and Avalon are distinguished. In general, Carboniferous and Mesozoic basins crossed by the seismic profiles overlie thinner crust. However, a deep Moho is found at some places beneath the Carboniferous Magdalen Basin.

Marillier, F. and Verhoef, J.
1989: **Crustal thickness under the Gulf of St.Lawrence, northern Appalachians, from gravity and deep seismic data.** Canadian Journal of Earth Sciences, v.26, p.1517-1532.

Deep seismic data and gravity data sets were interpreted to determine crustal thickness in the Gulf of St Lawrence. Gravity data provide a means of linking the seismic lines and extending their interpretation to a larger area. The most prominent feature in the gravity data over the Appalachians is a strong gradient in the Bouguer anomaly along the entire orogen. It is suggested that this feature is related to mantle underplating of the crust as a result of the Carboniferous-age formation of the Magdalen Basin.

Marillier, F., Dentith, M., Michel, K., Reid, I., Roberts, B., Hall, J., London, K., Morel-a-l'Huissier, P., Spencer, C. and Wright, J.
1990: **Coincident seismic wave velocity and reflectivity properities of the Lower Crust beneath the Appalachian front, west of Newfoundland.** For C.G.E.S. as a short communication, 16p.

McCutcheon, S.R. and Robinson, P.T.
1987: **Geological constraints on the genesis of the Maritime Basin, Atlantic Canada.** In, Sedimentary Basins and Basin-Forming Mechanisms, eds. C.Beaumont and A.J.Tankard, Canadian Society of Petroleum Geologists, Memoir 12, p.287-297.

This paper outlines, with the aid of geological and magnetic data, some constraints that can be placed on the genesis of the Maritimes Basin. The faulting histories of the Belleisle and Cobequid-Chedabucto faults are incompatible with a strike-slip, pull-apart origin for the Maritimes Basin. The faulting history, as well as the distribution and composition of Upper Devonian to Lower Carboniferous granitic and volcanic rocks suggests a passive subsidence origin.

McGrath, P.H., Hood, P.J. and Cameron, G.W.
1973: **Magnetic surveys of the Gulf of St. Lawrence and the Scotian Shelf.** In, Earth Science Symposium on Offshore Eastern Canada, eds. P.J. Hood, N.J. McMillan and B.R. Pelletier, Geological Survey of Canada, Paper 71-23, p.339-358.

Aeromagnetic surveys have been flown in the southern half of the Gulf of St. Lawrence. Several large wave-length anomalies in the central part of the Gulf have been interpreted using a curve-matching technique.

Miller, H.G.
1990: **A synthesis of the geophysical characteristics of terranes in eastern Canada.** Tectonophysics, v.177, p.171-191.

Geological identification of terranes in the Canadian Appalachians has led, in general, to the proposing of terranes which have recognizably distinct geophysical signatures indicative of fundamental differences in crustal structure between the terranes. The rapidly expanding body of geophysical data has enabled an integrated approach to geophysical terrane analysis.

Miller, H.G. and Wright, J.A.
1984: **Gravity and magnetic interpretation of the Deer Lake Basin, Newfoundland.** Canadian Journal of Earth Sciences, v.21, p.10-18.

The gravity and magnetic studies used to delineate the geological

history of the Carboniferous Deer Lake basin of west-central Newfoundland are reported. Modelling of gravity and magnetic data indicates that the Humber syncline contains approximately 1.2 km of sediment. Digitized aeromagnetic data and preliminary reflection and refraction seismic data are also discussed.

Miller, H.G., Kilfoil, G.J. and Peavy, S.T.
1990: **An integrated geophysical interpretation of the Carboniferous Bay St. George subbasin, western Newfoundland.** Bulletin of Canadian Petroleum Geology, v.38, n.3, p.320-331.

Gravity, magnetic and reflection seismic data were complied and interpreted to determine the basement configuration and internal structure in the Carboniferous Bay St. George Subbasin of western Newfoundland and to ascertain the relationship of the known petroleum and coal occurrences to the geophysically determined structure.

Mott, R.J. and Grant, D.R.
1985: **Pre-Late Wisconsinan paleoenvironments in Atlantic Canada.** Geographie physique Quaternaire, v.39, n.3, p.239-254.

Palynological and macrofossil studies from numerous Quaternary organic deposits of various lithologies reveal a variety of environments from forests dominated by hardwood to mixed temperate forests to coniferous forests to forest tundra. Three intervals of organic accumulation indicate a trend in climate from warmer to colder.

Murty, T.S. and Taylor, J.D.
1970: **A numerical calculation of the wind-driven circulation in the Gulf of St. Lawrence.** Journal of Oceanography Society of Japan, v.26, p.203-204.

Nota, D.J.G. and Loring, D.H.
1964: **Recent depositional conditions in the St. Lawrence River and Gulf-a reconnaissance survey.** Marine Geology, v.2, p.198-235.

The results of a sedimentological reconnaissance in the area of the River and Gulf of St. Lawrence are discussed. The study is concerned mainly with the relationship between submarine topography, surface sediments, sediment sources and present processes of deposition.

Nowlan, G.S. and Barnes, C.R.
1987: **Thermal maturation of Paleozoic strata in eastern canada from conodonts colour alteration index (CAI) data with implications for burial history, tectonic evolution, hotspot tracks and mineral and hydrocarbon exploration.** Geological Survey of Canada, Bulletin

367, 47p.

Thermal histories of basins preserved in the Appalachian orogen, foreland basins and St. Lawrence Platform are interpreted based on colour alteration indices (CAI) for conodonts from over 160 localities. These data are plotted on five base maps for divisions of the Ordovician and Silurian.

Petryk, A.A.
1981: **Carte Geologique de L'ile D'Anticosti.** Ministere de L'Energie et des Ressources, Direction Generale des Energies Conventionnelles, DPV-823, 14p.

Petryk, A.A.
1981: **Lithostratigraphie, Paleogeographie et Potentiel en Hydrocarbures de L'ile D'Anticosti.** Ministere de L'Energie et des Ressources, Direction Generale des Energies Conventionnelles, DPV-817, 129p.

Piper, D.J.W., Cameron, G. and Best, M.A.
1988: **Quaternary geology of the continental margin of eastern Canada.** Geological Survey of Canada, "A" Series Map 01711a.

Piper, D.J.W., Mudie, P.J., Fader, G.B., Josenhans, H.W., MacLean, B. and Vilks, G.
1990: **Quaternary Geology.** Chapter 10. In, Geology of the Continental Margin of Eastern Canada, eds. M.J. Keen and G.L. Williams, Geological Survey of Canada, n.2, p.475-607: (also Geological Society of America, The Geology of North America, v.I-1).

This chapter describes the physiography, lithostratigraphy, chronology of Quaternary sediments throughout the offshore eastern Canada. The glacial history, palaeoenvironment and paleoceanography of the Quaternary are also described. Methods used in marine Quaternary research are introduced.

Pirazzoli, P.A., Grant, D.R. and Woodworth, P.
1989: **Trends of relative sea-level change: past, present and future.** Quaternary International, v.2, p.63-71.

This paper presents a short review of the status of knowledge of past, present and future sea-level trends, a multidisciplinary approach in order to provide a sounder basis for the prediction of future sea-level changes and their consequences is proposed.

Ploeg, J.
1971: **Wave climate study, Great Lakes and Gulf of St. Lawrence.**

Mechanical Engineering Report MH-107A, National Research Council of Canada, Ottawa, Ontario, v.1, 139p.

Prest, V.K.
1969: **Retreat of the last ice sheet from the Maritime Provinces-Gulf of St. Lawrence region.** Geological Survey of Canada, Paper 69-23, 14p.

The authors have used field observations and air photo interpretations to draw conclusions regarding the extent and movement of the last ice-sheet complex, both at its maximum and during subsequent recessional stages. The pattern of ice-flow features and end moraines is shown to relate to a rising sea level over the period from about 18,000 to 11,000 years BP. It is concluded that Laurentide ice was not as active over the Maritimes Provinces as has generally been believed.

Prest, V.K., Grant, D.R. and Rampton, V.N.
1967: **Glacial map of Canada.** Geological Survey of Canada, Map 1253A.

Quinlan, G. and Beaumont, C.
1981: **A comparison of observed and theoretical postglacial relative sea level in Atlantic Canada.** The Canadian Journal of Earth Sciences, v.18, p.1146-1163.

Two extreme models (maximum versus minimum ice loads) of late Wisconsinan ice cover in Atlantic Canada and the northeastern U.S.A. are shown to produce postglacial relative sea level (RSL) curves that bracket existing field observations at six sites throughout the region. Both ice models predict the existence of four sea level zones relative to the centre of glaciation: an innermost zone with RSL falling since deglaciation; an outermost zone with RSL rise; and two transitional zones with early RSL fall followed by RSL rise.

Quinlan, G. and Beaumont, C.
1982: **The deglaciation of Atlantic Canada as reconstructed from the postglacial relative sea-level record.** The Canadian Journal of Earth Sciences, v.19, p.2232-2246.

The post-Wisconsinan relative sea-level (RSL) record from Atlantic Canada is used in a numerical model to reconstruct the morphology of the late Wisconsinan age cover during its retreat from the Atlantic region. The proposed reconstruction has little or no grounded ice in the southern Gulf of St. Lawrence, an ice dome over the north shore of the St. Lawrence, and thin ice, often less than 1 km thick, over much of the area.

Rashid, M.A., Vilks, G. and Leonard, D.J.
1975: **Geological environment of a methane-rich recent sedimentary basin in the Gulf of St. Lawrence.** Chemical Geology, v.15, p.83-96.

Two sediment cores collected in Chaleur Trough, Gulf of St. Lawrence are compared in terms of geochemistry, sediment texture and foraminifera. Results tend to suggest a relatively fast rate of sedimentation in depressions resulting in the preservation of organic compounds and development of anaerobic subsurface conditions. This results in the formation of methane.

Reid, S.J.
1975: **Density structure in the Gulf of St. Lawrence, July 1972.** Bedford Institute of Oceanography Report Series BI-R-75-20.

Riley, G.C.
1962: **Stephenville map-area, Newfoundland.** Geological Survey of Canada, Memoir 323, 72p.

The Stephenville map-area is underlain by rocks ranging in age from Precambrian to Lower Pennsylvanian. The structure is complex, but the main structural trend is northeasterly. Aeromagnetic anomalies correspond fairly closely to areas underlain by basic and ultrabasic rocks.

Rodrigues, C.G.
1980: **Holocene microfauna and paleoceanography of the Gulf of St. Lawrence.** Unpubl. Ph.D. Thesis, Carleton University, Ottawa, 352p.

Rodrigues, C.G. and Hooper, K.
1982: **Recent benthonic foraminiferal association from offshore environments in the Gulf of St. Lawrence.** Journal of Foraminiferal Research, v.12, n.4, p.327-352.

One hundred and seventy-nine taxa of the total benthonic foraminiferal population were identified in 84 bottom samples from the Gulf of St. Lawrence. Sampling depths range from 55 to 520 m. Seven Recent benthonic foraminiferal associations which are primarily water mass related and one fossil or relict association are recognized from cluster analysis of the 84 samples based on the abundance of the 179 taxa.

Rodrigues, C.G. and Hooper, K.
1982: **The ecological significance of Elphidium clavatum in the Gulf of St. Lawrence, Canada.** Journal of Paleontology, v.56, n.2, p.410-422.

The benthonic foraminiferal species Elphidium clavatum Cushman, not E. excavatum (Terquem), occurs abundantly in bottom sediment

samples from shallow and deep waters in the Gulf of St. Lawrence down to 520 m. At intermediate depths the species is rare. Much confusion has surrounded the taxon making it difficult to use as an ecological and paleoecological indicator. In this paper Elphidium clavatum is related to environmental factors such as water mass temperature, salinity, oxygen content and depth.

Roksandic, M.M. and Granger, B.
1981: **Structural styles of Anticosti Island, Gaspe passage and eastern Gaspe peninsula inferred from reflection seismic data.** In, Field meeting, Anticosti-Gaspe, Quebec, 1981, Volume 2: Stratigraphy and Paleontology, ed. P.J.Lesperance, International Union of Geological Sciences (IUGS) Submission on Silurian Stratigraphy and Ordovician-Silurian Boundary Group, p.211-221.

Ruffman, A. and Woodside, J.
1970: **The odd-twin magnetic anomaly and its possible relationship to the Humber Arm Klippe of western Newfoundland, Canada.** Canadian Journal of Earth Sciences, v.7, p.326-335.

A distinctive twin-peaked magnetic anomaly has been traced for 65 km parallel to the coast of western Newfoundland about 10 km offshore. It is interpreted as having been produced by two dikes (or sills) dipping $30\text{-}40^0$ W.

Sanford, B.V.
1975: **Paleogeography and sedimentation in the lower and middle Paleozoic, eastern Canada.** In, Canada's Continental Margins and Offshore Petroleum Exploration, eds. C.J. Yorath, Parker E.R. and Glass D.J., Canadian Society of Petroleum Geologists, Memoir 4, Abstracts, p.893.

Sanford, B.V. and Grant, A.C.
1990: **Bedrock geological mapping and basin studies in the Gulf of St. Lawrence.** In, Current Research, Part B, Geological Survey of Canada, Paper 90-1B, p.33-42.

High resolution reflection data have been used to produce a revised, preliminary bedrock geological map of the Gulf of St. Lawrence region. Results indicate that the Carboniferous strata extend farther northward onto the lower Paleozoic terraine of the Anticosti Basin.

Seaconsult Marine Research Ltd.
1983: **Environmental data criteria for offshore drilling, Cablehead project.** Prepared for Chevron Canada Resources Ltd., 44p.

Schenk, P.E.
1978: **Synthesis of the Canadian Appalachians.** Geological Survey of Canada, Paper 78-13, p.111-136.

The geological evolution of the Canadian Appalachian Orogen, which encompasses an area of 10^6 km^2, is outlined. The Canadian Appalachians are divisible into a number of tectono-stratigraphic zones including the Humber zone, Dunnage zone, Gander zone, Avalon zone, Meguma zone, the Siluro-Devonian zones, and the Carboniferous-Permian zones.

Shaw, B.R. and Etemadi, M.
1989: **Acadian deformation in the Anticosti Basin, west Newfoundland.** American Association of Petroleum Geologists Bulletin v.75, n.3, p.671.

It has been traditionally assumed that the limit of the Acadian deformation of the Anticosti basin corresponded with the western limit of the on land exposures in western Newfoundland. Recent reprocessing of old marine seismic data reveals that Acadia thrust deformation extends about 80-100 km to the west of Newfoundland. New interpretations indicates structurally focused petroleum potential in the offshore.

Shaw, J. and Forbes, D.L.
1987: **Coastal barrier and beach-ridge sedimentation in Newfoundland.** In, Proceedings Canadian Coastal Conference, ed. Y. Ouellet, National Research Council of Canada, Associate Committee for Research on Shoreline Erosion and Sedimentation, p.437-454.

Coastal development in Newfoundland has been strongly influenced by the distribution and character of glacigenic sediment sources and regional variability in relative sea-level behaviour. A number of sites on the island illustrate the interactions between these factors, local physiographic setting and coastal processes, leading to a variety beach-ridge accumulations.

Shaw, J. and Forbes, D.L.
1990: **Late Quaternary sedimentation in St. George's Bay, southwest Newfoundland: acoustic stratigraphy and seabed deposits.** Canadian Journal of Earth Sciences, v.27, p.964-983.

The authors present results pertaining to the Quaternary acoustic stratigraphy and surficial sediments of inner St. George's Bay. Interpretations were made using shallow seismic reflection profiles, side scan imagery, echo sounder data, and a limited number of bottom sediment and core samples. The seismic data reveal that there is a complex pattern of subsurface topography and acoustic facies. Two basins in the inner bay are underlain by

glacially overdeepened valleys that extend to depths in excess of 180 m.

Shearer, J.M.
1970: **Detailed grain size analysis of recent marine sediments and post-glacial history of Port au Port Bay, Newfoundland.** Unplished M.Sc. dissertation, Memorial University of Newfoundland, St. John's, 234p.

Shearer, J.M.
1973: **Bedrock and surficial geology of the northern Gulf of St. Lawrence as interpreted from continuous seismic reflection Profiles.** In, Earth Science Symposium on Offshore Eastern Canada, eds. P.J.Hood, N.J.McMillan and B.R.Pelletier, Geological Survey of Canada, Paper 71-23, p.285-303.

Approximately 1850 km. of airgun reflection profiles and refraction data were interpreted to construct the bedrock and surficial geology of the Northern Gulf of St. Lawrence.

Shih, K.G., Kay, W., Woodside, J., Jackson, R., Adams, J., Drysdale, J., Bell, J.S. and Podrouzek, A.J.
1988: **Crustal thickness, seismicity, and stress orientations of the continental margin of eastern Canada.** Geological survey of Canada, "A" series map 01710a.

Shih, K.G., Williams, H.L. and MacNab, R.
In Press: **Magnetic anomalies and major structural features of southeastern Canada and the Atlantic Continental Margin.** Geological Survey of Canada.

SOQUIP (Societe Quebequoise d'Initiatives Petrolieres).
1987: **Estuary and Gulf of St. Lawrence, geological-geophysical-geochemical data integration.** Geological Survey of Canada, Open File 1721, 75p.

SOQUIP was mandated by the Geological Survey of Canada, to provide an up-to-date geological, geophysical and geochemical interpretation of the Estuary and Gulf of St. Lawrence. From the Estuary and the Northern part of the Gulf 21 major base maps have been prepared for the Anticosti Basin and from the central and southern part of the Gulf 22 major base maps have been prepared.

SOUQAR
1973: **Workshop of the physical sciences in the Gulf and Estuary of the St. Lawrence.** In, Proceedings of Workshop of Physical Sciences in the Gulf of St. Lawrence, Universite du Quebec a Rimouski, 248p.

This volume presents the collection of papers given at the workshop. The aims of the workshop were to; (1) review the present state of knowledge of various aspects of the physical sciences and (2) develop and coordinate future plans.

Stevens, R.K.
1970: **Cambro-Ordovician flysch sedimentation and tectonics in west Newfoundland and their possible bearing on a Proto-Atlantic Ocean.** In, Flysch Sedimentology in North America, ed. J. Lajoie, The Geological Association of Canada, Special Paper Number 7, p.165-177.

A succession of Ordovician flysch derived from the east overlies Cambro-Ordovician carbonate rocks in west Newfoundland. The flysch is overridden by two allochthons mainly made up of flysch sequences also of Cambro-Ordovician age. The tectonic activity associated with the emplacement of the allochthons also led to the deposition of the allochthonous flysch which transgressed westward onto the carton.

Stockmal, G.S. and Waldron, J.W.F.
1990: **Structure of the Appalachian deformation front in western Newfoundland: implications of multichannel seismic reflection data.** Geology, v.18, p.765-768.

Petroleum-industry multichannel marine seismic data in the public domain do not support the traditional interpretation of the Acadian deformation front in the Appalachians of Western Newfoundland. The Long Point Group has been interpretated to lie above the upper detachment of a triangle zone implying that the Humber Arm allochthon lies entirely within the package thrust westward in the Acadian orogeny.

Stockmal, G.S. and Waldron, J.W.F.
1991: **Reply to comment on "Structure of the Appalachian deformation front in western Newfoundland.: Implications of multichannel seismic reflection data".** Geology, v. , p.952-953.

Replying to comments by Cawood et al., 1991 Stockmal and Waldron argue that (1) although numerous multiplies occur only strong primary reflectors were selected, (2) geologic boundaries proposed by Cawood et al. cross primary reflectors, (3) there in not at present a full understanding of triangle-zone mechanics and (4) depth to basement proposed by Cawood et al. does not include gravity data.

Thomas, R.H.
1977: **Calving bay dynamics and ice sheet retreat up the St. Lawrence valley system.** Geogr. phys. Quat., v.31, n.3-4, p.347-356.

Geological evidence suggests that a calving bay formed in the Laurentian Channel and the St. Lawrence valley after the late-Wisconsin maximum. Retreat rates in this calving bay are calculated for a variety of possible models assuming that locally the late-Wisconsin Laurentide ice sheet extended to the edge of the continental shelf.

Trites, R.W.
1968: **Gulf of St. Lawrence workshop.** In, Gulf of St. Lawrence Workshop held at the Bedford Institute, Dartmouth, N.S., 81p.

The purpose of the workshop was to bring together persons interested primarily in physical or environmental oceanography and biological oceanography in the Gulf, in order to review present knowledge on the Gulf.

Trites, R.W. and Walton, A.
1975: **A Canadian coastal sea-the Gulf of St. Lawrence.** Bedford Institute of Oceanography, Report Series BI-R-75-15, 61p.

The authors present a summary of the physical, chemical and biological aspects of the Gulf of St. Lawrence in the hope that it will serve as a useful background resource document.

Thibaudeau, S. and Currie, R.
1990: **CSS Hudson cruise report 90-031.** Geological Survey of Canada, Open File 02426, 153p.

The cruise was designed to collect data and material for studies of the late glacial/postglacial sedimentary and oceanographic history in the Gulf of St. Lawrence. Data collected included Vanveen Gab samples (2), AGC Long cores (20), CTD stations (15), bottle casts (15), boxcores (15), Huntec DTS (518 km), 3.5 KHz Bathymetry (3100 km), and sleevegun seismics (1053 km).

Twenhofel, W.H. and Conine, W.H.
1921: **The post-glacial terraces of Anticosti Island.** American Journal of Science, v.1, p.268-278.

The terraces on Anticosti Island are impressive and begin at or below sea level to measured heights of 400 ft. Terraces may exceed 1 mile wide but may also narrow to disappearance. The places of greatest width are about the indentations of the coast: the places of least width are on the salients.

Vanderveer, D.G.
1977b: **Surficial and glacial geology: and gravel Resource inventory, Burin Peninsula, Newfoundland.** Scale 1:50,000, Newfoundland Department of Mines and Energy, Minerals Division,

Open File NFLD (959).

1987a: **Landform classification maps for the Deer Lake-Hampden area (NTS 12H/3, 6, 10, 11).** Scale 1:50,000, Newfoundland Department of Mines and Energy, Mineral Development Division, Open File 12H (945).

1987b: **Landform classification maps covering NTS 12B/7, 9, 10, 11, 12A/13.** Scale 1:50,000, Newfoundland Department of Mines and Energy, Mineral Development Division, Open File NFLD (1576).

Vilks, G. and Rodrigues, C.
1989: **Cruise report 89-007, Gulf of St. Lawrence.** Geological Survey of Canada, Open File 2119, 114p.

The cruise was designed to study the glacial and post-glacial sedimentary sequences in Esquiman, Anticosti and parts of the Laurentian Channel. Work completed included 1) 2000 line km of Huntec and airgun surveys, 2) piston and box core and water samples were recovered at 13 sites, 3) 39 Van Veen grab samples were collected and 4) 21 rock cores (total length of 32.29 m).

Vilks, G., MacLean, B. and Rodrigues, C.
1990: **Late Quaternary high resolution seismic and foraminiferal stratigraphy in the Gulf of St. Lawrence.** In, Current Research, Part B, Geological Survey of Canada, Paper 90-1B, p.49-58.

Glacial to post glacial marine environments are described in the Gulf of St. Lawrence on the basis of 1300 km of high resolution seismic profiles and foraminiferal assemblages from eight piston cores.

von Bitter, P.H., Scott, S.D. and Schenk, P.E.
1990: **Early Carboniferous low-temperature hydrothermal vent communities from Newfoundland.** Nature, v.344, p.145-147.

Fossil tubes, an abundant low-diversity fauna and sulphide mineralization occur in Carboniferous carbonate mounds in western Newfoundland. These features together with evidence for microbial activity, point to the existence of a chemosynthetic community clustered around low-temperature vents. The degree of preservation allows for comparisons to modern vent communities.

Waldron, J.W.F. and Milne, J.V.
1991: **Tectonic history of the central Humber Zone, western Newfoundland Appalachians.** Canadian Journal of Earth Sciences.

Wade, J.A., Grant, A.C., Sandford, B.V. and Barss, M.S.

1977: **Basement structure of eastern Canada and adjacent areas.** Geological Survey of Canada, Map 1400A (4 sheets, 1:2,000,000).

Williams, E.P.
1967: **Oil and gas possibilities in Prince Edward Island.** Bulletin of the Canadian Institute of Mining and Metallurgy, v.60, pt.2, p.1429-1434.

Prince Edward Island is more or less centrally located in the Maritimes Basin, a large intermontane basin within the Appalachian orogenic belt. The Maritimes Basin is subdivided into sub-basins and uplifts which exhibit two dominant structural trends; east and northeast. The Basin is known to be petroliferous because of the seeps, shows, oil shales and oil produced from the Stony Creek field near Moncton, New Brunswick.

Williams, E.P.
1974: **Geology and petroleum possibilities in and around Gulf of St. Lawrence.** The American Association of Petroleum Geologists Bulletin, v.58, n.6, pt. 2, p.1137-1155.

Beds having possibilities for oil and gas production are present in early Paleozoic beds overlying Taconic basement in the Gaspe fold belt, and in late Paleozoic formations overlying Acadian basement in the Maritimes basin.

Williams, E P.
1973: **St. Lawrence lowlands, Gaspe, and Gulf of St. Lawrence areas.** In, Future Petroleum Provinces of Canada, ed. R.G. Crossan, Canadian Society of Petroleum Geologists, Memoir 1, p.561-587.

The structural geology, stratigraphy, and economic geology relative to oil and gas are summarized separately for each of the five geological provinces within the Gulf of St. Lawrence Lowlands, Gaspe and the Gulf of St. Lawrence areas.

Williams, G.L., Ascoli, P., Barss, M.S., Bujak, J.P., Davies, E.H., Fensome, R.A. and Willimson, M.A.
1990: **Biostratigraphy and related studies.** Chapter 3. In, Geology of the Continental Margin of Eastern Canada, eds. M.J. Keen and G.L. Williams, Geological Survey of Canada, n.2, p.89-137: (also Geological Society of America, The Geology of North America, v. I-1).

The biostratigraphy of offshore eastern Canada has been tabulated from a study of exploratory wells. The sedimentary rocks represent most periods of the Phanerozoic and were deposited in a wide range of paleoenvironments ranging from continental to abyssal.

Williams, H.
1975: **Structural succession, nomenclature, and interpretation of transported rocks in western Newfoundland.** Canadian Journal of Earth Sciences, v.12, p.1874-1894.

The Humber Arm and Hare Bay Allochthons of Western Newfoundland are made up of a variety of sedimentary rocks and volcanic and plutonic rocks that originated toward the east and record the evolution and destruction of the ancient continental margin of Eastern North America. Five contrasting rock assemblages that constitute different structural slices are defined and delineated in the Humber Arm Allochthon while six contrasting rock assemblages constitute the Hare Bay Allochthon.

Williams, H. and Smyth, W.R.
1983: **Geology of the Hare Bay Allochthon.** In, Geology of the Strait of Belle Isle Area, Northwestern Insular Newfoundland, Southern Labrador, and Adjacent Quebec. Geological Survey of Canada, Memoir 400, p.109-141.

The Allochthon consists of a variety of sedimentary and volcanic and plutonic rocks including greywacke, polymicitic conglomerate, quartz-pebble conglomerate, siltstone, shale, mafic pillow lava, peridotite, harzburgite, dunite, gabbro, and diorite. The rocks record a part of the development and destruction of the ancient continental margin of eastern North America.

Williams, H., James, N.P. and Stevens, R.K.
1985: **Humber Arm Allochthon and nearby groups between Bonne Bay and Portland Creek, western Newfoundland.** In, Current Research, Part B, Geological Survey of Canada, Paper 85-1A, p.399-406.

The Humber Arm allochthonous rocks occupy the coastal lowland between Bonne Bay and Portland Creek. The Humber Arm Allochthon, and autochthonous to parautochthonous rocks of the Paleozoic carbonate sequence and its underlying basement were mapped across the Gros Morne area.

Willmore, P.L. and Scheidegger, A.E.
1956: **Seismic observations in the Gulf of St. Lawrence.** Transactions of the Royal Society of Canada, Series 3, v.50, p.93-100.

Zen, E.A., White, W.S., Hadley, J.B. and Thompson, J.B.
1968: **Studies of Appalachian Geology, Northern and Maritime.** Interscience Publishers, New York, p.95-117.

A series of papers which examine northern and Maritime Appalachian geology.