Atlantic Geology

Structural Evolution of North—East Newfoundland: comparison with that of the British Caledonides

W. R. Church

Volume 1, Number 3, July 1965

URI: https://id.erudit.org/iderudit/ageo1_3art04

See table of contents

Publisher(s)

Maritime Sediments Editorial Board

ISSN

0843—5561 (print)
0843—5561 (digital)

Explore this journal

Cite this article

Church, W. R. (1965). Structural Evolution of North—East Newfoundland: comparison with that of the British Caledonides. *Atlantic Geology*, *1*(3), 10–15.

follows.

Structural Evolution of North-East Newfoundland: comparison with that of the British Caledonides

by W.R. CHURCH

University of Western Ontario,
London, Ontario

The British Caledonides and the Newfoundland Appalachian systems have in common: a northwestern foreland region composed of pre-Cambrian gneisses, overlain by Cambro-Ordovician carbonate rocks containing a typical North American fauna; a north-central orthotectonic belt of intensely deformed garnet-grade metamorphic rocks; a south-central belt of Ordovician and Silurian clastic and volcanic rocks; and a south-eastern foreland region composed dominantly of pre-Cambrian volcanics overlain by Upper Proterozoic rocks followed by Cambro-Ordovician clastic rocks bearing a typical European fossil fauna. An important point of similarity between North-East Newfoundland and the West of Ireland is the occurrence, immediately to the south-east of the north-central metamogphic belts of both regions, of Lower Ordovician spilitic lavas unconformably overlain by Silurian red-bed clastics and volcanics. Opinion in Britain as to the age of the Caledonide orthotectonic metamorphic belt is divided, and ages as varied as pre-Cambrian, Middle Cambrian - Lower Ordovician, and post-Lower Ordovician have been postulated for the belt. However in the west of Ireland the earliest phase of deformation recognizable in the metamorphic rocks occurred prior to, or within Lower Ordovician times. The metamorphic rocks are also deformed by a late phase of post-Silurian deformation. Deformation that might be attributable to the Taconic orogeny was much less intense in comparison with the early and late orogenic phases, and produced structures that are essentially paratectonic in style.

The rocks of the Burlington Peninsula, North-East Newfoundland, belong to four groups: the Fleur de Lys Group of clastic metasediments and the Baie Verte Group of spilitic lavas of the metamorphic belt; the Snooks Arm Group of spilitic lavas; and the Cape St. John Group of conglomerates, sandstones, and silicic and mafic lavas. The Fleur de Lys and Baie Verte Groups are unfossiliferous, but are considered by Neale and Nash (1963) to be Ordovician on the basis of the lithologic similarity of the Baie Verte Group to the Lower Ordovician Snooks Arm Group. The Cape St. John Group appears to unconformably overlie the folded Snooks Arm Group, and is therefore considered to be Silurian in age. A comparison of minor structures in the Fleur de Lys, Baie Verte, and Cape St. John Groups along the north shore of the Burlington Peninsula indicates that they have a common structural history, involving at least three phases of deformation. This suggests

that either the main phase of deformation of the Appalachian system in North-East Newfoundland was post-Silurian in age, or that the volcanic rocks considered to be part of the Cape St. John Group in the northern part of the Burlington Peninsula belong to the metamorphic belt and are unrelated to the undoubted group of post-Ordovician clastics and volcanics at Tilt Cove, Betts Cove and Mic-Mac Lake.

The Taconic folds affecting the Lower Ordovician Snooks Arm volcanic rocks are paratectonic in style. In contrast, the folds in the metamorphic belt are complex flow structures. Pillow lavas of the Baie Verte Group are highly deformed and are converted to actinolite schists. The simple style of the Taconic folds affecting the Snooks Arm Group and the absence of structural effects attributable to the Taconic orogeny within the Ordovician-Silurian succession of the Notre Dame Bay suggests that the metamorphic belt is not Taconic in age, since it is unacceptable, at least to some geologists, that a metamorphic event accompanied by recumbent folding on a large scale could be restricted to the metamorphic belt, leaving areas only thirty miles away virtually unaffected. The paratectonic folding of the Snooks Arm Group may be interpreted as marginal folding formed during epeirogenic uplift of the metamorphic belt along a zone extending South-West from Baie Verte. Epeirogeny rather than orogeny is compatible with the 'klippe hypothesis' advanced by Rodgers and Neale (1963) for the origin of the Humber Arm Group of Western Newfoundland.

However, near Mic-Mac Lake, virtually undeformed lavas, including pillow lavas, grade over a very short distance into chlorite schists in contact with garnetiferous quartzo-feldspathic schists and gneisses. If these lavas are part of the Baie Verte Group (assuming the Baie Verte Group to be Lower Ordovician in age) then there is no reason to doubt the Taconic age of the metamorphic belt. A Taconic age for the orthotectonic metamorphic belt would constitute an important difference between the North-East Newfoundland Appalachians and the Caledonides of the west of Ireland, the orthotectonic belt of which is pre-Lower Ordovician in age.

The largest fold structure in the Burlington Peninsula and Notre Dame Bay regions is the Notre Dame Bay oroclinal fold. It is a late structure superposed on all earlier structures. Minor folds associated with it are open with a z-shaped asymmetry, and axial planes striking approximately North-South. The orocline deforms North-East-South-West trending post-Silurian folds in the Notre Dame Bay region and is therefore post-Silurian in age: an Acadian age would be indicated if it can be correlated with similar folds affecting Devonian rocks in Gaspé and New Brunswick. Identical late stage oroclinal structures occur in the west and north-west of Ireland. Their exact age is also unknown but they are post-Silurian in age, and may be Acadian. However in Britain the Acadian orogenic phase is generally considered to be a paratectonic phase producing only faults, thrusts, and minor folding. In the absence of Devonian rocks in both north-east Newfoundland and in the west and north-west of Ireland, an upper limit to the age of the oroclinal folding cannot be determined with certainty.

Selected References Concerning the Structural Geology of North-East Newfoundland and the West and North-West of Ireland

ANDERSON, J.G.C., 1948, The occurrence of Moinian rocks in Ireland: Quart. Jour. Geol. Soc. Lond., v. 103, p. 171-188

_____ 1954, The pre-Carboniferous rocks of the Slieve League promonotory, Co. Donegal: Quart. Jour. Geol. Soc. Lond., v. 109, p. 399-419

_____ 1960, The Wenlock strata of South Mayo: Geol. Mag., v. 117, p. 265-275

BAIRD, D.M., 1951, The geology of the Burlington Peninsula, Newfoundland: Geol. Surv. Canada Paper 51-21, 71 p.

_____ and NEALE, E.R.W., 1959, Nippers Harbour, Newfoundland: Geol. Surv. Canada Map No. 22-1958

CHURCH, W.R., 1963, Minor structures in the Moine Series (Eo-Cambrian) of Co. Donegal, Eire: Symposium on Structures in Rocks, University of Ottawa Publication

_____ 1964, The structural evolution of North-East Newfoundland: comparison with that of the British Caledonides: Can. Min. Met. Bull., v. 58, p. 219

DEWEY, J.F., 1963, The Lower Palaeozoic stratigraphy of central Murrisk, County Mayo, Ireland, and the evolution of the South Mayo trough: Quart. Jour. Geol. Soc. Lond., v. 119, p. 313-344

_____ and McMANUS, J., 1964, Superposed folding in the Silurian rocks of County Mayo, Eire: Liverpool and Manchester Geol. Jour., v. 4, p. 61-76

_____ and PHILLIPS, W.E.A., 1963, A tectonic profile across the Caledonides of South Mayo: Liverpool and Manchester Geol. Jour., v. 3, p. 237-246

FITCH, F.J., MILLER, J.A., and BROWN, P.E., 1964, Age of Caledonian orogeny and metamorphism in Britain: Nature, v. 203, p. 275-278

FULLER, J.O., WATSON, K. de P., and NEALE, E.R.W., 1959, Fleur de Lys, Newfoundland: Geol. Surv. Canada Map 16-1959

JENNESS, S.E., 1963, Terra Nova and Bonavista map-area, Newfoundland: Geol. Surv. Canada Memoir No. 327, 184 p.

JOHNSON, M.R.W., and STEWART, F.H., editors, The British Caledonides, 1963, 280 p., Oliver and Boyd, Edinburgh

KALIOKOWSKI, J., 1953, Springdale, Newfoundland: Geol. Surv. Canada Paper No. 53-5, 4 p.

KAY, M., and COLBERT, E.H., 1964, Stratigraphy and life history, 736 p., John Wiley and Sons, New York

McKERROW, W.S., 1962, The chronology of Caledonian folding in the British Isles: Proc. U.S. Nat. Acad. Sci., v. 48, p. 1905-1913

_____ and CAMPBELL, C.J., 1960, The stratigraphy and structure of the Lower Paleozoic rocks of North-West Galway: Sci. Proc. Roy. Dublin Soc., v. 1, p 27

NEALE, E.R.W., 1957, Ambiguous Intrusive relationships of the Betts Cove - Tile Cove Serpentinite Belt, Newfoundland: Proc. Geol. Assoc. Canada, v. 9, p. 95-106

_____ 1959, Relationship of the Baie Verte group to Gneissic groups of Burlington Peninsula, Newfoundland: Geol. Soc. Am., Bull., v. 70, p. 1650-1651

_____, BELAND, J., POTTER, R.R., and POOLE, W.H., 1961, A preliminary tectonic map of the Canadian Appalachian Region based on age of folding: Can. Min. Met. Bull., v. 54, p. 687-694

_____ and NASH, W.A., 1963, Sandy Lake (East Half) Newfoundland: Geol. Surv. Canada Paper No. 62-28, 40 p.

PHILLIPS, W.E.A., 1963, p. 339 in Dewey, J.F., Lower Palaeozoic stratigraphy of central Murrisk, County Mayo, Ireland, and the evolution of the South Mayo trough: Quart. Jour. Geol. Soc. Lond., v. 119, p. 313-344

PITCHER, W.S., ELWELL, R.W.D., TOZER, C.F., and CAMBRAY, F.W., 1964, The Leannan Fault: Quart. Jour. Geol. Soc. Lond., v. 120, p. 241-274

_____ and READ, H.H., 1960, The aureole of the Main Donegal Granite: Quart. Jour. Geol. Soc. London, v. 116, p. 1-16

READ, H.H., 1961, Aspects of Caledonian magmatism in Britian: Liverpool and Manchester Jour. Geol., v. 2, p. 653-683

TREMLETT, W.E., 1963, Stress chronology of the Mid-Palaeozoic orogeny of the British Isles: Jour. Geol., v. 71, p. 793-800

TRENDALL, A.F., and ELWELL, R.W.D., 1963, The metamorphic rocks of North-West Mayo: Proc. Roy. Irish Acad., v. 62, sect. B., p. 217-247

WATSON, J., 1963, Some problems concerning the evolution of the Caledonides of the Scottish Highlands: Proc. Geol. Assoc., v. 74, p. 213-258

WILLIAMS, H., 1962, Bottwood, (West Half) map-area, Newfoundland: Geol. Surv. Canada Paper No. 62-9, 16 p.

WILLIAMS, H., 1963, Twillingate map-area, Newfoundland: Geol. Surv. Canada Paper No. 63-36, 30 p.

_____ 1964a, The Appalachians in north-eastern Newfoundland-a two-sided symmetrical system: Am. Jour. Sci., v. 262, p. 1137-1158

_____ 1964b, Notes on the orogenic history and isotopic ages of Bottwood map-area, north-east Newfoundland, p. 22-25 in Stockwell, C.H., Age determinations and geologic studies: Geol. Surv. Canada Paper No. 63-17 (Part II), 29 p.

DOUGLAS W. LEWIS has completed recently at McGILL a Ph.D. dissertation entitled "Cambrian (Pre-Beekmantown) sedimentation in southwestern Quebec with especial reference to three deep wells near Montreal". The study of Potsdam sandstones confirmed their subdivision into a lower feldspathic Covey Hill Formation and an upper Chateauguay Formation subdivided into an orthoquartzitic Cairnside Member and an upper carbonate-rich Theresa Member. Roundness of grains and stability of heavy minerals suggest that sands are mature and have undergone extensive predepositional abrasion in a semi-arid to temperature climate. Textural inversions, omnipresent sorted laminations, and sedimentary structures indicate shallow shelf deposition with variable energy conditions imparted predominantly by strong tides.

Diagenesis attained the early phyllomorphic stage after early reorganization of detrital clays in Covey Hill beds produced an illite-serecite-chlorite assemblage. Alteration of detrital micas was general in hematitic-flake coloured portions of the Covey Hill Formation. Important pressure solution modified original grain roundness. Overgrowths of quartz and feldspar are ubiquitous; some replacement by chert of clays occurred. Sphene developed after diagenetic alteration of ilmenite to leucoxene. Pyrite authigenesis appears related to Monteregian igneous activity.

JOHN H. JOHNSEN, Chairman of the Department of Geology and Geography at VASSAR COLLEGE, New York reports that his research on Ordovician limestones will be published soon. The study, entitled "The limestones of Jefferson County, New York", involves carbonates of the Black River and Trenton groups. It includes an economic survey complete with chemical analyses of the units and an updated version of the stratigraphy based on an extensive drilling program. Many stratigraphic sections are described from drill core and from natural sections.

The following is a partial list of papers dealing with stratigraphy and paleontology presented at the AMERICAN ASSOCIATION OF PETROLEUM GEOLOGISTS - SOCIETY OF ECONOMIC PALEONTOLOGISTS AND MINERALOGISTS, Annual Meeting in New Orleans, Louisiana on April 26-

29, 1965. The abstracts of these and other paper presented are published in the March 1965 Bulletin of the American Association of Petroleum Geologists, p. 332-365:

BUTTNER, P.J.R., Response model design for a rhythmic delta-platform domain, Devonian Catskill complex of New York, p. 336

FERM, J.C., and EHRLICH, R., Tectonic chronology of Pennsylvanian borderlands, p. 340

FRAKES, L.A., Landslide facies and the paleoslope in the Catskill Delta, p. 340

GLAESSNER, M.F., The Cambrian frontier, p. 341

GOULD, D.F., and DE MILLE, G., Piercement structures in Canadian Arctic islands, p. 342

MCLEAN, J.D., Jr., An application of electronic data processing techniques to paleontology and stratigraphy, p. 349

OLSSON, R.K., Planktonic foraminifera, paleoecology, paleogeography, and correlation, p. 355

SHAW, W.S., Salt deposits and structure of the Maritime Provinces of Canada, p. 358

TRETTIN, H.P., Silurian and Devonian arenites of the Franklinian eugeosyncline, p. 361

VAN HOUTEN, F.B., Origin of sodium-rich Triassic lacustrine deposits, New Jersey and Pennsylvania, p. 361

WOLFF, M.P., Sedimentologic design of deltaic sequences, Devonian Catskill complex of New York, p. 364

WOODS, R.D., Modern role of paleontology in basin geology, p. 364