Natural Resources Canada / Ressources Naturelles Canada

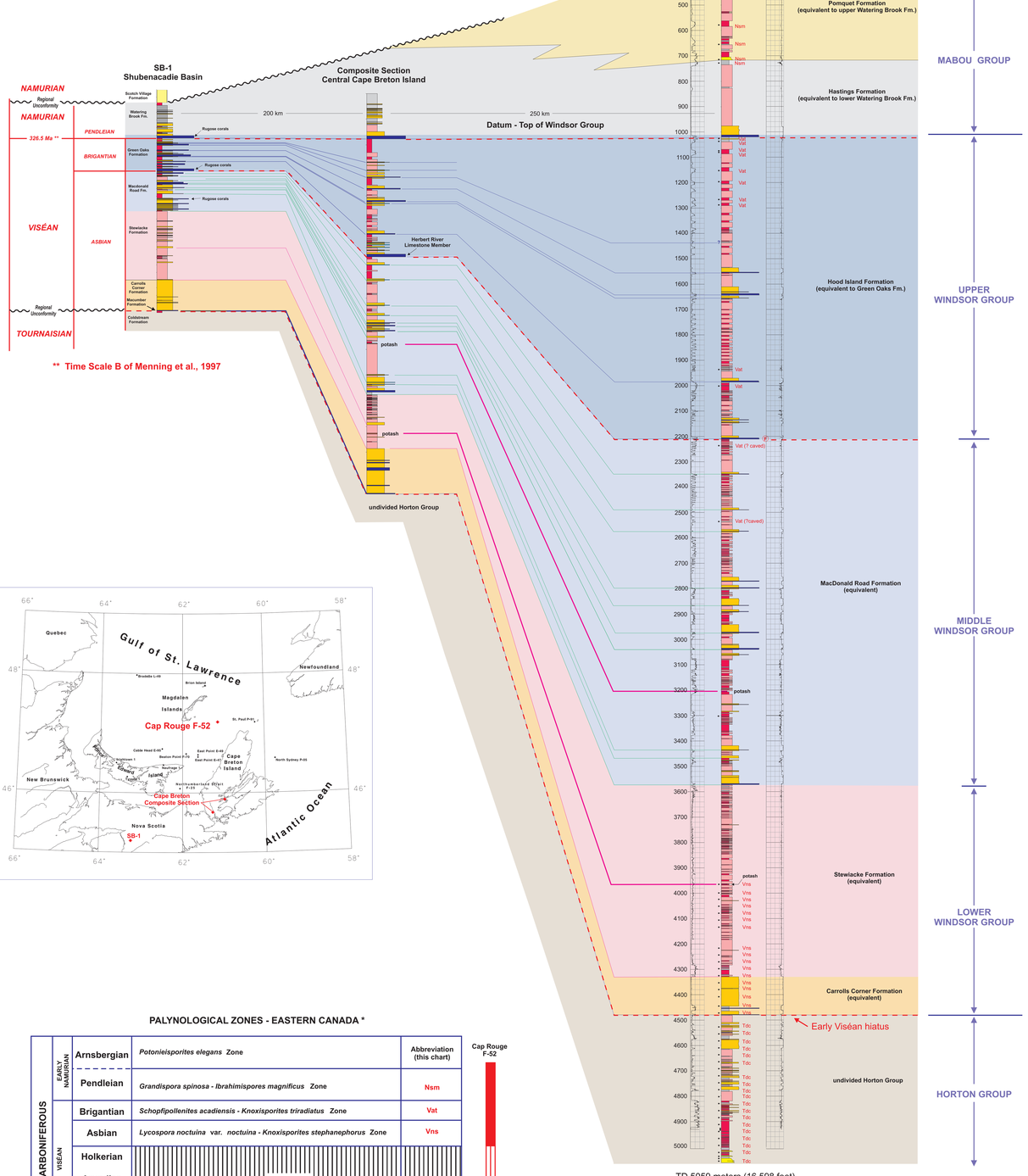
GEOLOGICAL SURVEY OF CANADA — COMMISSION GÉOLOGIQUE DU CANADA

gsc atlantic

SHELL- AMOCO Cap Rouge F-52
Gulf of St. Lawrence, eastern Canada

P.S. Giles[1] and J. Utting[2]

[1] Geological Survey of Canada (Atlantic)
[2] Geological Survey of Canada (Calgary)



PALYNOLOGICAL ZONES - EASTERN CANADA *

				Abbreviation (this chart)
CARBONIFEROUS	EARLY NAMURIAN	Arnsbergian	*Potonieisporites elegans* Zone	
		Pendleian	*Grandispora spinosa - Ibrahimispores magnificus* Zone	Nsm
	VISÉAN	Brigantian	*Schopfipollenites acadiensis - Knoxisporites triradiatus* Zone	Vat
		Asbian	*Lycospora noctuina* var. *noctuina - Knoxisporites stephanephorus* Zone	Vns
		Holkerian	HIATUS	
		Arundian		
		Chadian		
	LATE TOURNAISIAN	Courceyan	*Colatisporites decorus - Schopfites claviger* Zone	Tdc

Cap Rouge F-52

* Modified from Lenz et al, 1993: Paleoscene 15. Paleozoic Biostratigraphy, *in* Geoscience Canada , v.20, Number 2, pp.41- 73

NATMAP
CARTNAT
Canada's National Geoscience Mapping Program
Le Programme national de cartographie géoscientifique du Canada

Recommended Citation:

Giles, P.S. and Utting, J., 2001; SHELL - AMOCO Cap Rouge F-52,
Gulf of St. Lawrence, eastern Canada. Geological Survey of Canada, Open File 3204

Explanatory Notes

Introduction:

In the western portion of the Maritimes Basin of eastern Canada, underlying much of the Gulf of St. Lawrence, only eight hydrocarbon exploration wells have been drilled from marine platforms in a period extending more than twenty-five years. The SHELL - AMOCO Cap Rouge F-52 well was drilled in the central Gulf of St. Lawrence and to date is the single well to penetrate the Maritimes Basin succession within the so-called salt-diapir province. The well was drilled in 1973 to a total depth of 5059 metres and intersected strata of the lower Mabou Group, the entire Windsor Group and the upper portion of the Horton Group. No hydrocarbon shows were encountered and the well was classified as dry and abandoned upon shut-in. Although unsuccessful as a hydrocarbon exploration venture, the well nevertheless provides valuable insight into the stratigraphy of the Maritimes Basin. We suggest correlation of the Cap Rouge stratigraphic record with key onshore sections from central Cape Breton Island and from the Shubenacadie Basin in southern Nova Scotia, in order to place the Cap Rouge succession in a regional stratigraphic context. Correlation of the Windsor Group as represented in these three areas illustrates the remarkable regional extent of that rock unit, and is the key to understanding the Cap Rouge succession.

Lithostratigraphy:

No record exists for the highest 305 metre interval of the succession drilled in the Cap Rouge well. We surmise that the strata intersected were most probably fine-grained red siltstones and sandstones of the Pomquet Formation, the highest lithostratigraphic unit in the well for which data are available. This premise is based mainly on the absence of any biostratigraphic indication of post-Pomquet Formation strata which might have contributed to cuttings samples lower in the well as caved material. The implied thickness of the Pomquet Formation dictated by this interpretation is totally compatible with known thicknesses of the Pomquet Formation and equivalent strata in onshore areas of western Cape Breton Island, but our supposition is admittedly otherwise unconstrained. Description of cutting samples and side-wall cores, and a single conventional core, are available from 305m to TD. We have used these descriptions, supplemented with available mechanical logs and by our own examination of cuttings from selected intervals, to interpret the stratigraphy of the well.

Mabou Group

Pomquet Formation: (305-717.0m; possibly sea floor to 717.0m)

The Pomquet Formation (Belt, 1965) comprises interstratified red siltstones, shales and sandstones where typically developed in onshore portions of eastern Nova Scotia and Cape Breton Island. In the Cap Rouge F-52 well, one can add to this lithologic assemblage a significant proportion of halite, apparently interstratified with fine-grained siliciclastic rocks typical of the Pomquet Formation. Evaporites in the Pomquet Formation are regionally uncommon except for sparse scattered anhydrite nodules which have been noted in the deep subsurface at a few onshore localities, making the Cap Rouge succession highly anomolous. The lower boundary of the formation is transitional with the underlying Hastings Formation regionally, and is marked by a 60m thick interval of interstratified red and grey shales with rare channel sandstone bodies, and with abundant interstratified halite in the Cap Rouge well. The Pomquet-Hastings Formation contact is placed at the base of a channel sandstone body, overlain by significant red shale intervals, and underlain by mainly halite with associated grey shales.

Hastings Formation: (717.0-1011.0m)

Belt (1965) first formally defined the Hastings Formation as a succession of grey and dark grey shales, typically with thinly interbedded dolomitic siltstone, separating the Windsor Group below from the Pomquet Formation. Both the upper and lower contacts are conformable. Lower intervals of the formation are known to be evaporite rich in several sub-basins, with both anhydrite and halite in beds reaching 10's of metres in thickness. In the Cap Rouge well, the Hastings Formation equivalent is dominated by halite, with lesser interbeds of grey shale, and with interbeds of red shale and siltstone in its upper transition into the overlying Pomquet Formation.

Windsor Group

"Upper Windsor Group": (1011.0-2210.0m)

The top of the Windsor Group in the Cap Rouge well is placed at the top of the highest intersected marine carbonate rock, here correlated with the E1 or Kennetcook Limestone of the type Windsor Group. In its type area, the upper part of the Windsor Group is dominated by red siltstone, with minor associated gypsum or anhydrite, and contains up to eight marine carbonate marker intervals which characterize the group (Moore, 1967). In the Cap Rouge well, halite is volumetrically dominant in the upper Windsor Group, although in all other aspects, the Cap Rouge succession can be closely compared with the type Windsor Group. The base of the Upper Windsor Group is placed at the base of the carbonate interval which we believe to represent the equivalent of the Herbert River Limestone Member of Moore (1967). Our identification of this stratigraphic marker is based on the close similarity of the Cap Rouge succession with that documented in diamond-drill cores from central Cape Breton Island where the Herbert River limestone is well known and typical. Biostratigraphic data are compatible with this interpretation (see below).

"Middle Windsor Group" (2210.0-3572.5m)

The middle Windsor Group is here defined as that portion of the group bounded at the top by the Herbert River limestone member and at the base by siltstone and halite of the highest beds of the thick evaporite cycle which represents regionally the beginning of Windsor Group sedimentation (Cycle 1 of Giles, 1981). As many as twenty marine carbonate intervals occur within the middle Windsor Group, each typically overlain by thick anhydrite beds and in turn by thick halite deposits in some basins. Siliciclastic rocks are subordinate volumetrically to evaporites, but become increasingly abundant towards the top of the middle Windsor. In the Cap Rouge succession, as in overlying formations, rock salt is abundant, dominating the middle Windsor succession. Potash salts were noted in a side-wall core at a depth of 3203.4m, low in the middle Windsor, suggesting correlation with a similarly located potash horizon in the central Cape Breton Island composite section. Additional similarity with the central Cape Breton Island succession is shown by the concentration of marine carbonates with associated thick anhydrite beds at two principal levels, near the base and near the mid-point of the middle Windsor Group. Correlations of individual marine carbonate bands which we suggest here, are speculative, since the Cap Rouge carbonate rock intervals are thin and their description based entirely upon cuttings.

"Lower Windsor Group" (3572.5-4480.0m)

A major sedimentary cycle dominated by halite and anhydrite, with carbonate rock at the base is assigned to the lower Windsor Group. With the exception of the initial carbonate at the base of the lower Windsor, and a few thin laminated carbonate beds within the thick anhydrite near the base of the cycle, the lower Windsor Group is regionally characterized by the absence of rhythmically interstratified marine bands which are so typical of the middle and upper Windsor Group. The base of the lower Windsor Group is most commonly placed at the base of the Macumber Formation (Nova Scotia) or its correlative, the Ship Cove limestone (Newfoundland). In New Brunswick, the Macumber Formation is underlain by conglomerates of the Hillsborough Formation which have been included in the Windsor Group in that area (St. Peter, 1993). In the Cap Rouge well, typical Macumber Formation, characterized by millimetre- to centimetre-banded pelloidal carbonate rocks, cannot be confirmed. Dolomitic rocks are recorded at the level where the Macumber Formation should occur. Moreover, not one but two significant carbonate intervals are found near the base of the lower Windsor cycle, separated by anhydrite and minor siltstone. The lower of these two carbonate intervals has been selected as the base of the lower Windsor Group, based on a comparison of the central Cape Breton Island succession and with the section cored in its entirety in hole SB-1 (Shubenacadie Basin).

undivided Horton Group: (4480.0m-TD at 5059m)

From the base of the Windsor Group to TD, the Cap Rouge well penetrated a succession dominated by rock salt, interstratified with thick anhydrite beds and lesser grey and red shale. Carbonate rocks are notably absent. In their apparent position beneath a typical basal cycle of the Windsor Group, these rocks are best assigned to the Horton Group. The abundant evaporites including rock salt do not preclude this assignment, since similar rocks of supposed lacustrine origin are well documented in southeastern New Brunswick in the middle part of the Horton Group, and are also present below the Windsor Group in the Wellington No.1 well in western Prince Edward Island (Howie, 1988; Giles and Utting, 1999). Our palynological data suggest that the Horton Group salts intersected in the Cap Rouge F-52 well are younger than other known Horton Group salt deposits, albeit still of Tournaisian age (see Biostratigraphy).

It is appropriate to address reported volcanic rocks in the lowest portion of the Cap Rouge well (Monjo and Powell, 1973) since their identification is of considerable stratigraphic significance to regional stratigraphic correlation. Examination of cuttings from the identified interval confirmed the presence of rhyolite fragments. However, these were associated with other cuttings of granitoid rocks and high-grade metamorphic rocks, in samples dominated by red sandstone and siltstone. Unless the latter sedimentary cuttings are totally caved, we favour the interpretation of the volcanic and other extra-basinal material as polymictic clasts in conglomeratic rocks. Unfortunately, mechanical logs were not run in the bottom 127m interval of the Cap Rouge well where the supposed volcanic rocks were encountered, and we were not able to further test our interpretation. Biostratigraphic data suggest that the basal strata in the well do not represent the older portion of the Horton Group, nor the underlying Fisset Brook Formation of latest Devonian age, both stratigraphic intervals in which volcanic rocks are known to occur in the early sedimentary fill of the Maritimes Basin. It is therefore suggested that the well bottomed in coarse-grained continental facies high in the upper Tournaisian Horton Group.

Biostratigraphy

Calcareous foraminiferans have been reported from limestone cuttings at depths of 2194.6-2209.8m and 2225.0-2240.3m (Lesky, 1973 *in* Monjo and Powell, 1973). The higher of these sample intervals yielded *Archaediscus* of the Group Krestovnikovi, *Archaediscus* sp., *Cornuspira* sp. and *Endothyra bowmani*, an assemblage which, although limited in numbers and diversity, clearly indicates a Viséan age (Lesky, 1973). Mamet (1970) reported that *Archaediscus* of the Group Krestovnikovi appears for the first time regionally in the upper Windsor Group. The associated species appear first in the middle Windsor Group (the B subzone of Bell, 1929) and range into the upper part of the Windsor Group. Thus, these foraminiferans justify assignment of their host limestone to the upper Windsor Group. This assignment is in close agreement with our pick for the base of the upper Windsor Group at 2210.0m. The lower sample yielded *Biseriammina ?* sp., *Planospirodiscus* sp. and *Endothyra bowmani*. *Planospirodiscus* indicates possible upper Windsor Group affinities according to Mamet (1970) but the two associated species are not diagnostic for differentiating the middle versus the upper Windsor Group. In the absence of any *in situ* carbonate rocks within the lower sample interval, we suggest that the limestone cuttings may have caved from a higher stratigraphic level, perhaps near the position of the higher of the two samples at 2194.6-2209.8 metres.

Palynological samples (56 in number) representing the interval between 375.2m and 5047.5m provided data to independently assess the biostratigraphic age of the Cap Rouge F-52 succession by comparing the Cap Rouge assemblages with those described in earlier work in the Maritimes Basin (Utting, 1987; Utting et al., 1989; Martel et al., 1993 and Lenz et al., 1993). Sabry (1973) reported biostratigraphic ages based on palynomorphs ranging from early Viséan at TD to possible Namurian A in the topmost recovered sample interval in the well at a reported depth of 323.1m.

According to Sabry (1973), a sidewall core from 323.1m, no longer available for additional study, yielded *Florinites*, a genus which has its earliest occurrence in western Europe in the Namurian A (Clayton et al., 1979). Our present assessment of this genus is that it appears in the Maritimes Basin succession in the *Potonieisporites elegans* Zone (Lenz et al., 1993), within but not at the base of the local early Namurian succession. In the regional lithostratigraphic framework which we have applied here, this genus appears typically for the first time in rocks of the Pomquet Formation.

The interval from 375.2m-731.5m in the Cap Rouge well is assigned to the *Grandispora spinosa - Ibrahimispores magnificus* Zone, based on the occurrence of rare *Raistrickia nigra* which has its first occurrence in this zone (Utting, 1987). In the regional lithostratigraphic framework, the lowest occurrence of this zone has previously been placed at or near the base of the Hastings Formation, immediately above the Windsor Group. Research in progress (JU - 2000) suggests that the first appearance of species typical of this Zone is slightly lower in the succession, within or near the base of the highest marine carbonate member of the Windsor Group, and that the *Grandispora spinosa - Ibrahimispore magnificus* Zone is earliest Namurian in age (see discussion below).

The interval between depths of 1028.1m and 2535.9m is assigned to the *Schopfipollenites acadiensis - Knoxisporites triradiatus* Zone of Utting (1987) based on the association of *K. triradiatus* with common *Rugospora minuta* and *Crassispora trychera*. In the regional lithostratigraphic framework, the base of this zone approximates the base of the upper Windsor Group. In the Cap Rouge well, however, assemblages typical of this zone were recovered in two samples which underlie (up to 300 metres lower) the lithostratigraphic base of the upper Windsor Group. This suggests that the zonal boundary is significantly lower in the Cap Rouge succession or alternatively, that cavings may have contributed upper Windsor Group material to these two samples. Because the samples represent well cuttings, cavings cannot be ruled out. The zonal boundary might therefore be more appropriately placed at its regionally predicted level at or near the base of the upper Windsor Group.

The interval from 3301.6-4520.2m yielded palynomorphs characteristic of the *Lycospora noctuina* var. *noctuina - Knoxisporites stephanephorus* Zone of Utting (1987). This assignment is based on the association of common *Crassispora trychera* and *Rugospora minuta*, along with *Lycospora pusilla*, *Spelaeotriletes pretiosus* var. *windsorensis* and *Knoxisporites stephanephorus*. A single questionable specimen of *Knoxisporites triradiatus* recovered from a depth of 4401.3 m is probably derived from cavings. In the regional lithostratigraphic framework, this zone extends from the base of the upper Windsor Group to the base of the Windsor Group, thus including strata assigned to both the middle and lower Windsor Group.

Between depths of 4547.6m and 5047.5m, the association of *Crassispora trychera*, *Colatisporites decorus*, *Raistrickia clavata* and a single specimen of *Vallatisporites verrucosus* (at 4547.6m) suggests tentative assignment to the *Colatisporites decorus - Schopfites claviger* Zone of Utting et al. (1989) and Martel et al. (1993). In the regional lithostratigraphic framework, this zone is typical of the youngest (Tournaisian) strata of the Horton Group. This interpretation differs from that of Sabry (1973) who suggested a Viséan age at T.D.

The biostratigraphic ages currently assigned to these zones are shown in table form in this chart, and are modified from previously published interpretations (see Utting, 1987; Utting et al., 1989; Martel et al., 1993; Lenz et al., 1993). These modifications deal primarily with the biostratigraphic age of the *Grandispora spinosa - Ibrahimispores magnificus* Zone which has been interpreted as the youngest Viséan zone in earlier work. We have re-assigned this zone to the earliest Namurian, based on recent recognition of Namurian rugose coral assemblages in the youngest Windsor Group limestone member (E. Poty, personal communication 1999). Since the base of the *Grandispora spinosa - Ibrahimispores magnificus* Zone lies at the approximate level of the coral occurrence, this zone is more probably earliest Namurian in age. A revised age for the *Grandispora spinosa - Ibrahimispores magnificus* Zone has led to a revision of the *Schopfipollenites acadiensis - Knoxisporites triradiatus* Zone to the Brigantian, the youngest stage of the western European Dinantian (George et al., 1976) or the upper portion of VI3 in Belgium. This is also supported by foraminiferal evidence (Mamet, 1970) and by rugose coral assemblages in the Herbert River limestone at the base of the zone, most recently reported (E. Poty, 1999 and personal communication 2000) to be typical of the Brigantian of western Europe. If the *Schopfipollenites acadiensis - Knoxisporites triradiatus* Zone is correctly assigned to the latest Viséan age, then one should reconsider the biostratigraphic age of the underlying *Lycospora noctuina* var. *noctuina - Knoxisporites stephanephorus* Zone. Rugose corals recovered from the lower portion of the middle Windsor Group tentatively suggest a mid-Asbian age (E. Poty, personal communication 2000), i.e. one stage below the Brigantian. It has previously been argued that the oldest beds of the Windsor Group were not older than the Arundian of George et al. (1976), but that they could be younger (Giles, 1981; Utting, 1987). If one considers the potential very rapid rate of sedimentation for the evaporite-dominated lower Windsor Group, it is quite possible that the entire *Lycospora noctuina* var. *noctuina - Knoxisporites stephanephorus* Zone could be reasonably assigned to the Asbian stage alone, given the evidence provided by the rugose corals. This interpretation is significant to the assessment of the biostratigraphic gap between the Windsor and Horton Groups, in that the Chadian, Arundian and Holkerian stages of George et al. (1976) are apparently absent from the rock record for the Viséan of the Maritimes Basin of eastern Canada.

The *Colatisporites decorus - Schopfites claviger* Zone is assigned to the Courceyan Stage of George et al. (1976), and is latest Tournaisian in age.

Structural setting:

The Cap Rouge F-52 well was located to test hydrocarbon potential adjacent to a major salt structure imaged on seismic reflection data. The preponderance of halite from the base to the top of the well, suggested to Monjo and Powell (1973) that it was drilled through stratigraphically and structurally complex strata typical of a major salt diapir. Our assessment differs. Throughout the Windsor Group, repetitive small-scale cycles of sedimentation result in a systematic order of sedimentation, with marine carbonate rocks typically overlain in turn by anhydrite, halite and red continental siliciclastic rocks. In some instances, the transgressive phase of these cycles passes first through anhydrite before the marine carbonate appears in the succession, but halite is rarely preserved except in the regressive portion of each cycle. Using this simple pattern of deposition, facing direction can be determined in drilled well profiles, and in the Cap Rouge F - 52 well, there is no evidence for overturning. Similarly, biostratigraphic data show no indication of inverted stratigraphic relationships. Estimates of true stratigraphic thickness remain uncertain. Dipmeter survey data provided in the well history report are definitive for only a short interval at the level of the Carrolls Corner Formation anhydrite, where dips of approximately 25 degrees were recorded. No reliable estimate of true stratigraphic thickness for the entire succession is therefore possible.

References Cited:

Belt, E.A., 1965: Stratigraphy and paleogeography of Mabou Group and related Middle Carboniferous facies, Nova Scotia, Canada. Geological Society of America Bulletin, v.76, pp.777-802

Bell, W.A., 1929: Horton-Windsor District, Nova Scotia. Geological Survey of Canada, Memoir 155, 268p.

Clayton, G., Coquel, R., Doubinger, J., Gueinn, K.J., Loboziak, S., Owens, B. and Streel, M., 1977: Carboniferous miospores of western Europe. Illustration and zonation. Report of Commission internationale de microflore du paleozoïque, Working Group on Carboniferous Stratigraphical Palynology, v.29, 71p.

George, T.N., Johnson, G.A.L., Mitchell, M., Prentice, J.E., Ramsbottom, W.H.C., Sevastopulo, G.D. and Wilson, R.B., 1976: Dinantian (L. Carboniferous) - a correlation of Dinantian rocks in the British Isles. Geological Society of London, Special Report No. 7, 87p.

Giles, P.S., 1981: Major transgressive-regressive cycles in Middle to Late Viséan rocks of Nova Scotia. Nova Scotia Department of Mines and Energy, Mineral Development Division, Paper 81-2, 27p.

Giles, P.S. and Utting, J., 1999: Maritimes Basin Stratigraphy -Prince Edward Island and adjacent Gulf of St. Lawrence. Geological Survey of Canada, Open File 3732

Howie, R.D., 1988: Upper Paleozoic evaporites of southeastern Canada. Geological Survey of Canada, Bulletin 380, 120p.

Lenz, A.C., Jin, J., McCracken, A.D., Utting, J. and Westrop, S.R., 1993: PALEOSCENE 15. Paleozoic Biostratigraphy. *in* Geoscience Canada, v.20, Number 2, pp.41-73

Lesky, M.J., 1973: Micropaleontology *in* Monjo, R.G. and Powell, E.R., 1973: Well History Report, SHELL - AMOCO Cap Rouge F - 52, unpublished report submitted by Shell Canada Limited; released September, 1975

Mamet, B.L., 1970: Carbonate microfacies of the Windsor Group (Carboniferous), Nova Scotia and New Brunswick. Geological Survey of Canada, Paper 70-21, 121p.

Martel, A.T., McGregor, D.C. and Utting, J., 1993: Stratigraphic significance of Upper Devonian and Lower Carboniferous miospores from the type area of the Horton Group, Nova Scotia. Canadian Journal of Earth Sciences, v.30, pp.1091-1098

Menning, M., Weyer, D., Drozdzewski, G. and van Amerom, H.W.J., 1997: Carboniferous Time Scales Revised: Time Scale A (mim. ages) and Time Scale B (max. ages); use of geological time indicators. Carboniferous Newsletter, v.15, pp.26-28

Moore, R.G., 1967: Lithostratigraphic units in the upper part of the Windsor Group, Minas Sub-basin, Nova Scotia, pp.245-266 *in* E.R.W. Neale and H. Williams (eds.), Collected Papers on Geology of the Atlantic Region - Hugh Lilly Memorial Volume; Geological Association of Canada, Special Paper 4, 292p.

Monjo, R.G. and Powell, E.R., 1973: Well History Report, SHELL - AMOCO Cap Rouge F - 52, unpublished report submitted by Shell Canada Limited; released September, 1975

Poty, E., 1999: Stratigraphy and paleobiogeography of Carboniferous rugose corals of Nova Scotia. XIV International Congress on the Carboniferous - Permian, August, 1999, Calgary, Alberta, Canada. Programme Abstracts, p.115

Sabry, H., 1973: Palynology, *in* Monjo, R.G. and Powell, E.R., 1973: Well History Report, SHELL - AMOCO Cap Rouge F - 52, unpublished report submitted by Shell Canada Limited; released September, 1975

St. Peter, C., 1993: Maritimes Basin evolution: key geologic and seismic evidence from the Moncton Subbasin of New Brunswick. Atlantic Geology, v.29, pp.233-270

Utting, J., 1987: Palynology of the Lower Carboniferous Windsor Group and Windsor-Canso boundary beds of Nova Scotia, and their equivalents in Quebec, New Brunswick and Newfoundland. Geological Survey of Canada, Bulletin 374, 93p.

Utting, J., Keppie, J.D. and Giles, P.S., 1989: Palynology and age of the Lower Carboniferous Horton Group, Nova Scotia *in* Contributions to Canadian Paleontology, Geological Survey of Canada, Bulletin 396, pp.117-143

Utting, J., 1994: Palynological study of 56 samples from the Shell - Amoco Cap Rouge F-52 well, submitted by P.S. Giles, Atlantic Geoscience Centre, Dartmouth, Nova Scotia; unpublished report, Geological Survey of Canada (Calgary), 3p.

Acknowledgements:

André Comeau assisted in the graphic presentation of data for the Cap Rouge F-52 well, as did Claudia Currie. One of us (PSG) has benefitted from discussions of the well and its implications for regional stratigraphy and the interpretation of seismic reflection data with Paul Durling, formerly with GSC (Atlantic) and now with Corridor Resources. We are grateful to Ramakant Kalyatker and Brenda Davies of GSC (Calgary) who processed the palynology samples. Al Grant and David Piper offered critical suggestions which significantly improved this chart. To each of these persons, we express our appreciation.

LITHOLOGY AND SYMBOLS

- channel sandstone
- siltstone, shale, mudstone - red
- siltstone, shale, mudstone - grey
- bedded limestone(major and minor units)
- halite
- anhydrite
- ● palynology sample location
- ■ core location
- Ⓕ foraminiferans reported

OPEN FILE
DOSSIER PUBLIC
3204
GEOLOGICAL SURVEY OF CANADA
COMMISSION GÉOLOGIQUE DU CANADA
OTTAWA
02/2001