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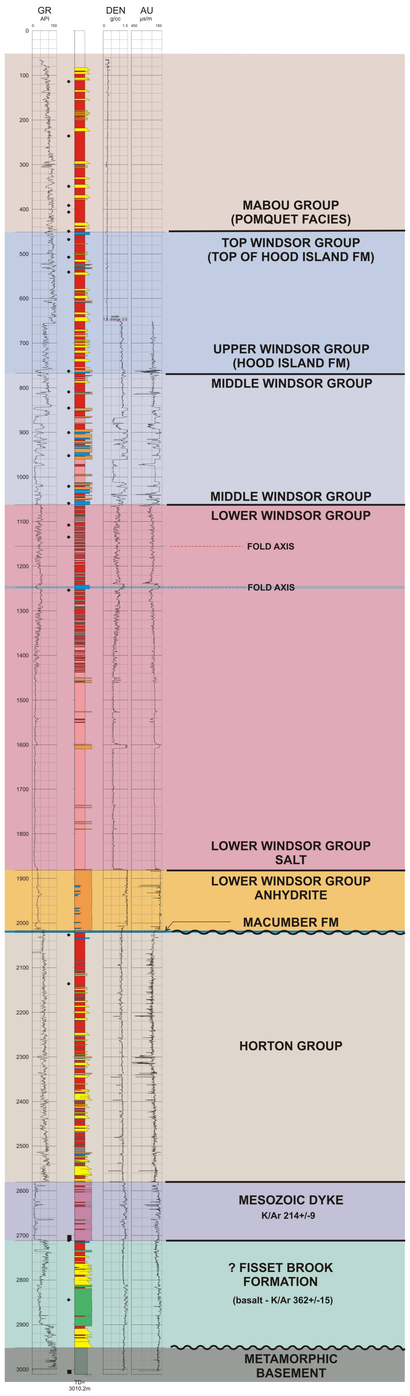
Prince Edward Island CANADA

Stratigraphic and structural interpretation of the HB Fina Northumberland Strait F-25 well, western Maritimes Basin, eastern Canada

P.S. Giles

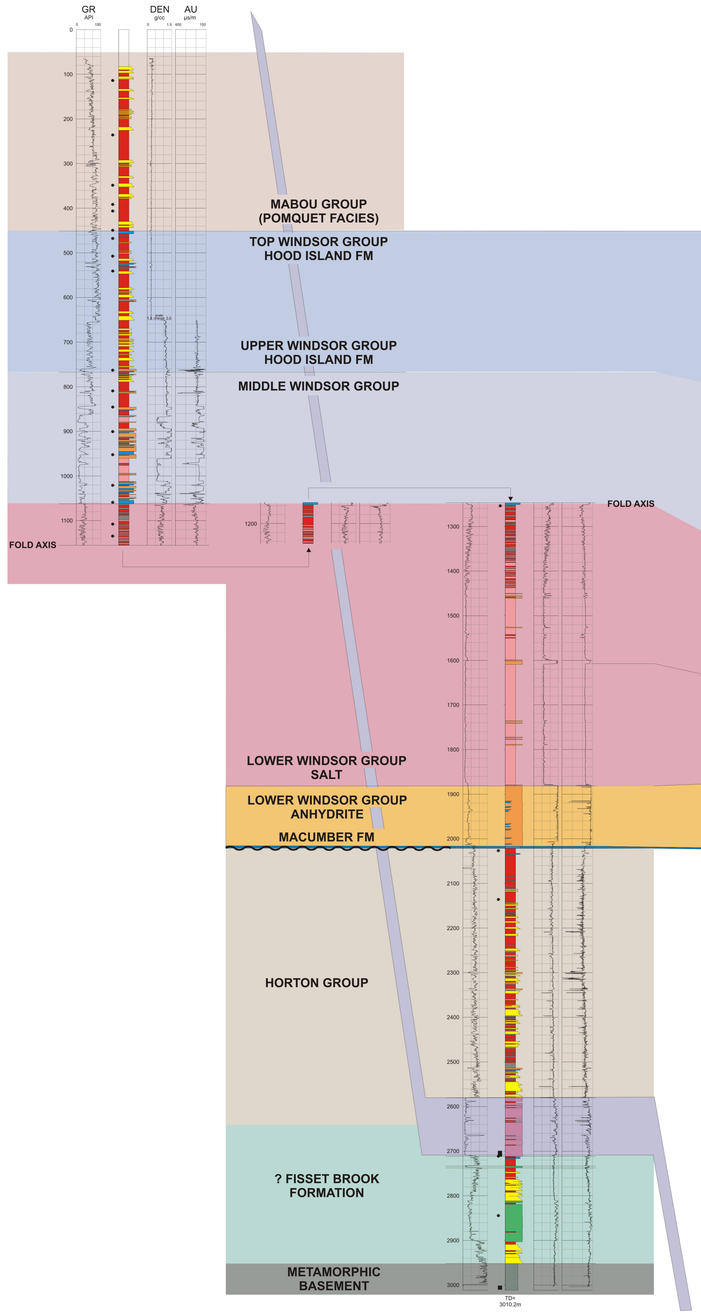
Northumberland Strait F-25 (as drilled) (1970)

46° 04´ 25.140´´ 62° 03´ 45.640´´

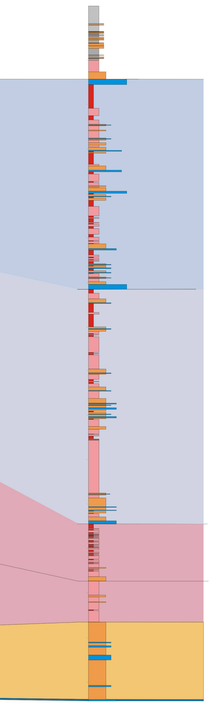


Northumberland Strait F-25 (minor fold removed/ section shortened accordingly) (1970)

46° 04´ 25.140´´ 62° 03´ 45.640´´



Composite section Windsor Group central Cape Breton Island



LITHOLOGY AND SYMBOLS

- channel sandstone
- siltstone, shale, mudstone - red
- siltstone, shale, mudstone - grey
- bedded limestone(major and minor units)
- halite
- anhydrite
- basalt
- diabase dyke, Triassic
- palynology sample location
- core location

NOTES IN EXPLANATION

Lithostratigraphy:

The Northumberland Strait F-25 well provides an overview of the Windsor Group in apparently complete section, and a partial section of the overlying Mabou Group. In its lower part the well offers insight into the early portion of the fill of the Maritimes Basin, and in addition, records a unique Triassic diabase dyke (Pe-Piper and Jansa, 1986) which must, by virtue of its age, cut the entire Carboniferous succession in the Maritimes Basin. The stratigraphic interpretation presented here also suggests that folds can be recognized within the Windsor Group succession penetrated by the Northumberland Strait F-25 well, as indicated by repetition of key beds with reversal in facing direction.

The well collared in red fine-grained strata of the Mabou Group and continued in these strata to a depth of approximately 450m where the first (highest) limestone of the Windsor Group marks the Windsor-Mabou Group contact. The red colours of Mabou Group rocks immediately above the Windsor Group is in contrast with more typical gray lower Mabou Group beds in much of southern Nova Scotia and on Cape Breton Island. Sandstone bodies of significant thickness were also intersected in the Northumberland Strait F-25 well above the Windsor Group, interbedded with red siltstones. These sandstones also represent a departure from the normal lithologic assemblage seen at this stratigraphic level in southern and eastern Nova Scotia.

The upper part of the Windsor Group, termed the Hood Island Formation in western Cape Breton Island, is typified by intercalated marine limestones with associated anhydrite and red siltstones. The latter dominate the upper Windsor Group in most areas of Nova Scotia. In the Northumberland Strait F-25 well, the upper Windsor Group is likewise dominated by fine-grained red strata, and contains both interstratified limestones and anhydrite in relatively thin beds. In addition, however, sandstones were intersected in the upper Windsor Group beds in the well.

At an approximate depth of 764m, the well passed through a limestone correlated here with the Herbert River limestone at the base of the upper Windsor Group, and continued downwards through a succession of interbedded anhydrite, limestone, siltstone and halite thought to represent the middle part of the Windsor Group. At approximately 1060m, the well passed through a significant carbonate bed marking the base of the middle Windsor Group and continued in halite and siltstone in interstratified beds marking the characteristic upper beds of the main lower Windsor Group halite. One hundred metres below the base of the middle Windsor Group, the facing reversed across a fold axis and the hole passed up-section until the same carbonate rock unit was intersected for a second time. At this depth, the hole again crossed a fold axis and drilled a repeated section of the upper beds of the main Windsor Group halite for the third time. The fold repetitions are indicated not only by lithology, but by symmetry reversals in the Gamma Ray log. As a result of these folds, the thickness penetrated by the drill at this level within the Windsor Group is exaggerated by almost 200 meters, as shown in the chart.

Beneath the major salt interval, additional lower Windsor Group strata are represented by a thick basal anhydrite, and the underlying Macumber Formation (limestone), the base of which defines the regional base of the Windsor Group. A composite section of the Windsor Group in central and southern Cape Breton Island, based on the writer's personal research, is shown on the chart for comparison with the Windsor Group in the Northumberland Strait F-25 well.

Beneath the Windsor Group, the hole penetrated more than 500 meters of sandstones and shales of the Horton Group until at a depth of ~2580 metres, it intersected the Triassic diabase dyke documented by Pe-Piper and Jansa (1986). K/Ar dating of the dyke rock yielded ages of 214 +/- 9ma and 239 +/- 10ma. Beneath this dyke rock, the hole continued in a succession of interbedded thin basalts and fine-grained redbeds, an underlying interval of conglomerate and sandstone, and finally through almost 100 meters of basaltic lava. Beneath this basalt, the hole continued in fine-grained red strata with interbedded sandstone and conglomerate, and passed into argillites at approximately 2950m. These argillites are here interpreted to represent the pre-Acadian basement to the fill of the Maritimes Basin.

Pe-Piper and Jansa reported a K/AR age of 362 +/- 15ma for the lower thick basalt interval. They believed that the basalts represented "basement" and that the Late Devonian age was due to thermal resetting by Acadian Orogeny events. Here their reported radiometric date is accepted as the true age of the basalt. The higher thin basalts intersected a short distance below the Triassic diabase suggest that volcanic rocks characterize the entire succession bounded by the dyke at the top and the pre-Acadian unconformity at the base. Because of its Late Devonian age, with admitted large error limits, this volcanic-bearing rock unit is provisionally assigned to the Fisset Brook Formation. This interpretation suggests that the Triassic diabase dyke has injected the contact zone between the Fisset Brook Formation and the overlying Horton Group, thus obscuring the original nature of the contact. With this uncertainty admitted, the Northumberland Strait F-25 well records a relatively complete succession of Maritimes Basin fill ranging in age from Late Devonian to early Namurian.

In a regional context, the Windsor and Mabou Group successions in this well are of interest for their intercalated sandstones which become progressively more common in the upper parts of Northumberland Strait F-25. Sandstones and shales dominate successions in southeastern New Brunswick where biostratigraphic data point to equivalence with beds of the upper Windsor group, and where marine beds of upper Windsor age are conspicuously absent. Perhaps the Northumberland Strait well records the beginnings of that regional facies transition which is poorly understood in onshore areas of northern Nova Scotia due to lack of exposures and deep well records.

Biostratigraphy:

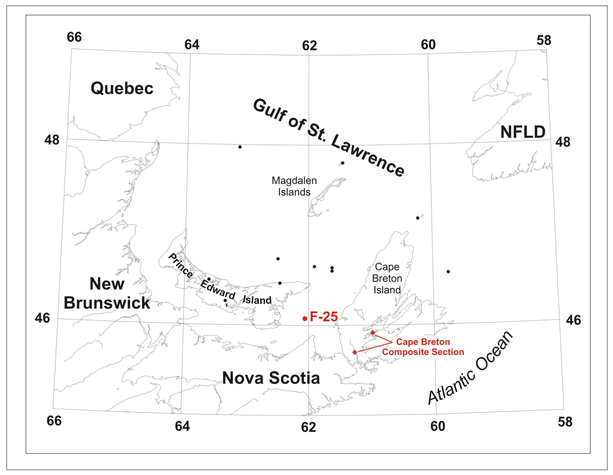
Barss et al. (1979) assessed the palynomorph assemblages for the Northumberland Strait F-25 well, reporting Viséan to Namurian spores from the top of the well to a depth of approximately 2010 metres. Despite the use of only well cuttings with consequent risk of caving of sampled material, these results are consistent with the lithostratigraphic interpretation presented here.

Below the Windsor Group, Barss et al. (1979) reported no productive samples. No biostratigraphic data are therefore available to constrain the lithostratigraphic interpretation.

References Cited:

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.

Pe-Piper, G. And Jansa, L.F., 1986. Triassic olivine-normative diabase from Northumberland Strait, eastern Canada: implications for continental rifting. Canadian Journal of Earth Sciences, **23**, pp.1013-1021



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