

Litho-Tectonic Features of the Early Mesozoic Grand Manan Basin, New Brunswick and Maine

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The island of Grand Manan in the southwestern Bay of Fundy has the only exposures of strata and basalt of the Grand Manan Basin, an Early Mesozoic rift basin about 30 km wide by 70 km long that is mostly submerged near the border of New Brunswick and Maine. On the eastern side of Grand Manan, the fault-bound White Head Horst exposes Ediacaran and Cambrian basement rocks between this small basin and the much larger Fundy Basin to the east, both of which have a similar Triassic litho-stratigraphy. The eastern border fault of the Grand Manan basin is well exposed at Red Point. End-Triassic (201.3 Ma) Dark Harbour Basalt covers western Grand Manan with a total thickness around 240 m, but it is probably removed by erosion from most of the submerged basin. Up to 12 m of sub-horizontal lacustrine grey mudstone and fluvial red sandstone of the Late Triassic Dwellys Cove Formation are exposed along the western shoreline beneath the basalt, and the sediment probably forms most of the seafloor bedrock of the basin. These strata and overlying basalt represent the top of tectono-stratigraphic unit TS-III and lower part of TS-IV. A few meters of conglomeratic fluvial red sandstone (Late Permian? TS-I), named the Miller Pond Road Formation, rests on a basement of Cambrian argillite immediately east of the basin.

Several unusual features of the Grand Manan Basin set it apart from most Early Mesozoic rift basins in eastern North America. The basin is bound on opposite sides by normal faults with similar vertical displacements, so that strata at Grand Manan are not tilted as in a half-graben. Despite a similar depositional history, basalt and strata of the Grand Manan Basin are nearly 2 km higher (shallower) than in the adjacent Fundy Basin, indicating a separate tectonic history. The Miller Pond Road arkose is probably a remnant of the base of basin strata now perched on the White Head Horst, and juxtaposed by the Red Point border fault to nearly the same level as the top of Dwellys Cove mudstone to the west. Thus by amazing coincidence, the vertical offset of the border fault must nearly match the thickness of Permian/Triassic sub-basalt formations of the Grand Manan Basin, estimated at 3 km.