



Calibration of the Lower Cretaceous Type Sections and Petroleum Systems of the Atlantic Margin

Grant D. Wach, Graeme E. Wach and Darragh E. O'Connor

Basin and Reservoir Laboratory, Department of Earth Sciences, Dalhousie University

Summary

Exploration of the offshore Central and North Atlantic Ocean is enigmatic. Lengthy exploration efforts are rewarded with success and the “keys” to success, targets, traps, migration pathways, reservoir conduits, are thought to be found. Then there is a dry hole or non-commercial well that is plugged and abandoned. The Rabat Deep 1 (RD-1) well offshore Morocco; the Aspy D-11/D11A, Cheshire L-97/L-97A, and Monterey Jack E-43/E 43A wells on the conjugate margin offshore Nova Scotia were expensive exploration tests. Offshore Newfoundland the Cupids A-33 and Fitzroya A-12Z wells in the Flemish Pass Basin were plugged and abandoned after drilling Cretaceous and Late Jurassic sections, including the Aptian unconformity. What went wrong?

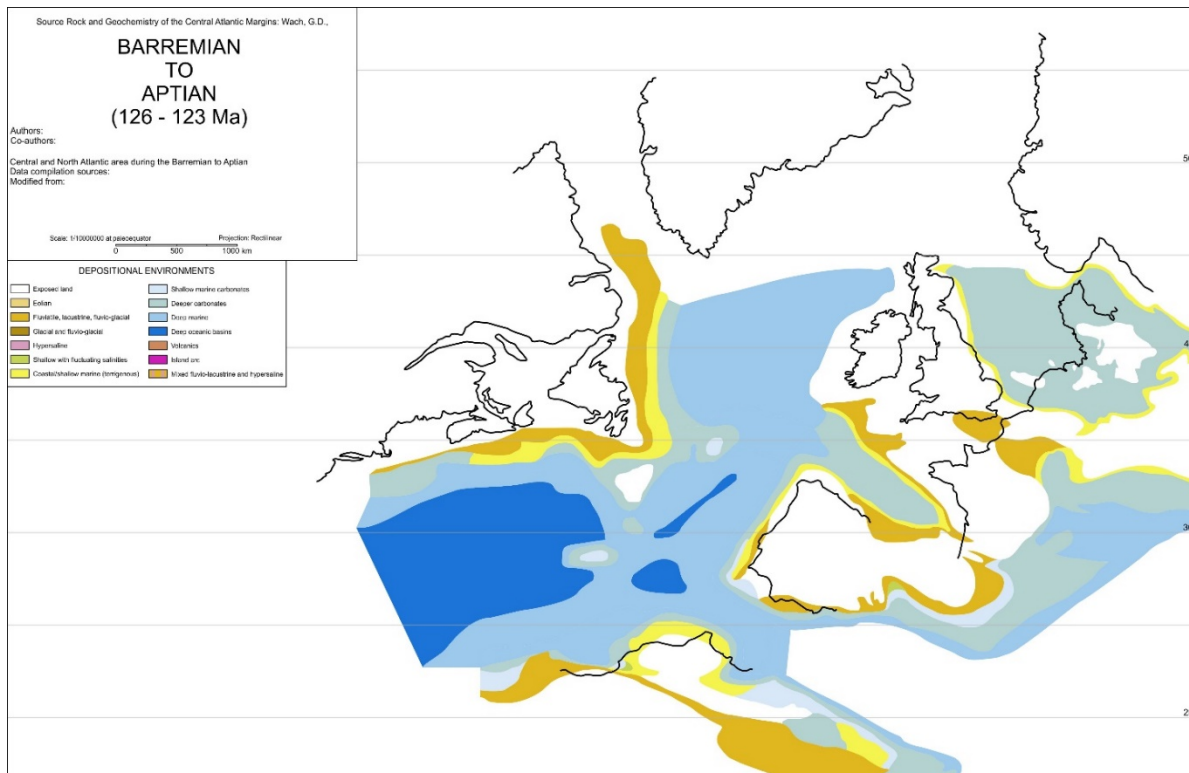


Figure 1. Paleogeographic and gross depositional environment map of Barremian to Aptian (126-123 Ma) interval in the Central and North Atlantic. Darker blue is deep oceanic basins and yellow and orange paralic and fluvial deposits (From Source Rock and Geochemistry of the Central Atlantic Margin study, 2017, G.D. Wach, P.I.).



Regardless of setbacks, exploration and development projects are proceeding from the Central Atlantic up into the North Atlantic on both sides of the margin, within the very prospective Mesozoic succession. The Cretaceous sediments are key elements of the petroleum systems being tested, particularly reservoir and source. For example, the Ben Nevis is a key petroleum reservoir offshore Newfoundland in the Jeanne D'Arc Basin and the Missisauga Formation is a key reservoir formed in deltaic sediments in the Scotian Basin.

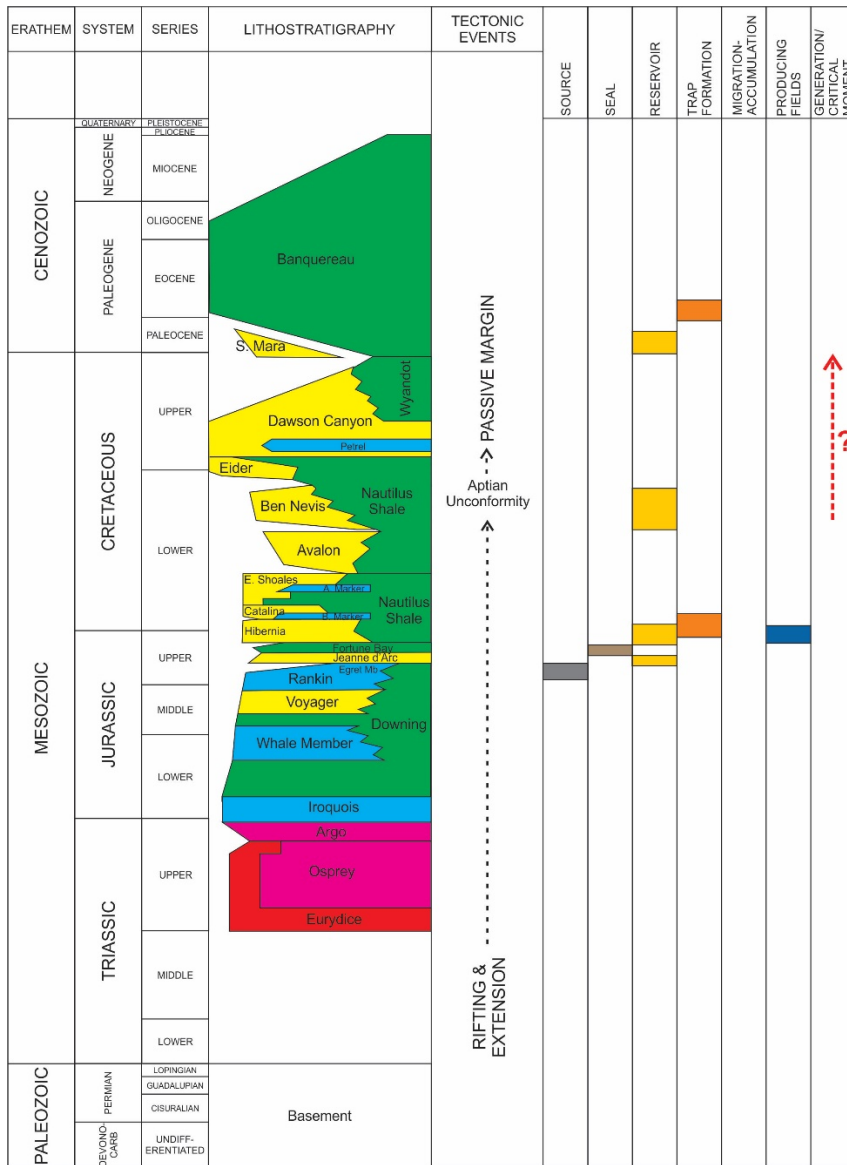


Figure 2. Petroleum systems chart of the Grand Banks- Jeanne d'Arc Basin. Note the Aptian Unconformity (based on Grant and McAlpine, 1990; Sinclair et al., 1994 and Enachescu, 2006).



Type sections as designated by the International Union of Geological Sciences (IUGS). Outcrops of the Valanginian to Hauterivian and the Aptian to Albian of Provenance in southeastern France are examined and compared to the Lower Cretaceous successions of the Aquitaine and Wessex basins on the eastern side of the Atlantic margin, and the Scotian and Jeanne D'Arc basins on the western side of the margin. These detailed analyses of outcrop and subsurface data can help to calibrate our examination of opportunities as exploration continues along the Atlantic margins.

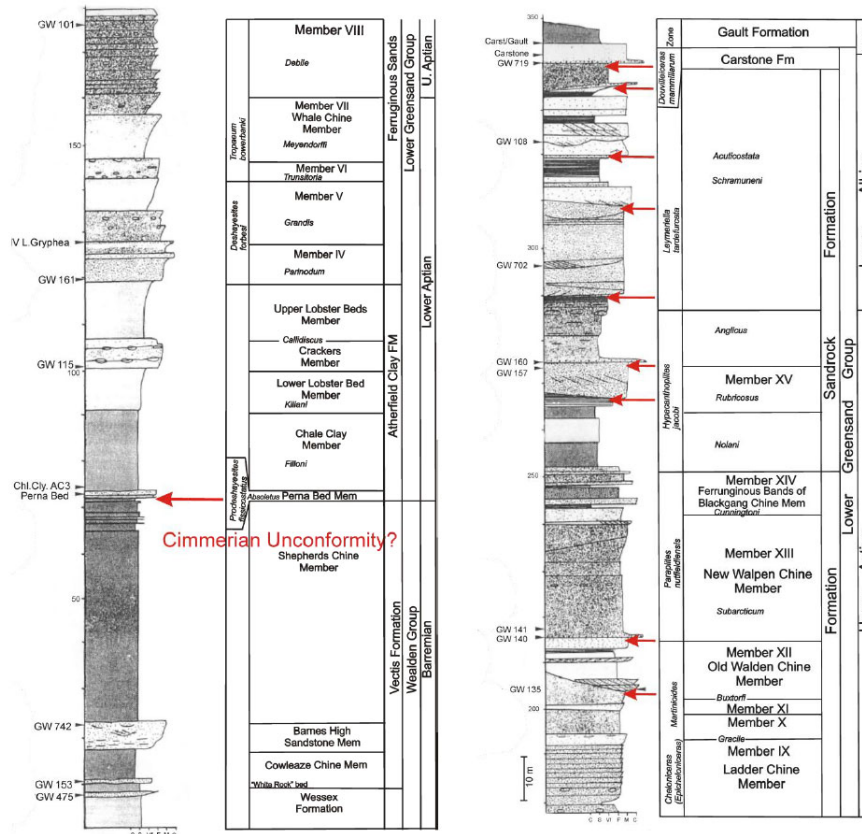


Figure 3. Lithostratigraphic chart for Barremian through Albian for the Channel Subbasin of the Wessex Basin on the Eastern Atlantic margin. Unconformities (red arrows) are marked within the Lower Cretaceous succession (Aptian and Albian) visible in outcrop. The roles of eustasy and tectonism on the development of these unconformities can be readily examined and their potential impact on petroleum systems.