Seismic stratigraphy and architecture of the Jurassic Abenaki margin, and potential for distal organic-rich facies

T. J. CAMPBELL, G. D. WACH, F. W. RICHARDS, AND R. L. SILVA

Basin and Reservoir Lab, Department of Earth Sciences, Dalhousie University, Halifax, NS B3H 4R2, Canada

Well and core data, 3D seismic data, and geologic analogs (Portugal and Morocco) are used to test and extend stratigraphic concepts of a mixed clastic-carbonate depositional setting during the Middle Jurassic to early cretaceous in the Sable Sub-basin, offshore nova Scotia. The study focuses on basinward mapping of third-order depositional sequences in the Abenaki carbonate bank, and addresses: (1) source rock potential in coeval basinal calcareous mudstones; (2) changes in bank margin morphology related to the basement; (3) transition from a dominantly carbonate to fluviodeltaic system extending into the late cretaceous; and (4) the presence of thick fluvio-deltaic sediments adjacent to basinal mudstones outboard of the carbonate bank.

Geological, petrophysical, and geophysical methods are used to interpret the depositional cycles and stratigraphic framework of limestones and calcareous shales deposited in deeper water outboard of the Abenaki margin. This framework formed the basis for a 3D geocellular model populated with lithologies from well data via a seismic inversion. This model was interpreted in terms of environments of deposition and source rock potential.

The third-order sequence stratigraphic framework was modified from a framework established by encana at their Deep Panuke gas field. This third-order chronostratigraphic (Abenaki 1–7) framework incorporates multiple litho-stratigraphically defined formations: the Mohican, Mohawk, Mic Mac, Abenaki, Missisauga, and Verrill canyon. Thick fluvio-deltaic successions adjacent to basinal mudstones, as seen in the Migrant n-20 well, are structurally controlled, with deposition in local depocentres in response to sediment loading and listric faulting above a deeper mobile salt substrate.

Based on published carbonate depositional models, distal condensed sections in the Abenaki 1–4 sequences (Bajocian–Kimmeridgian) have the potential for accumulations of organic-rich sediments. The basinal shales of these sequences are estimated to have been deposited in up to 200 m water depths and have potential as type ii source rocks. A change in seismic signatures and facies occurs between Abenaki 1–4 and Abenaki 5–7 sequences reflecting encroachment of the Sable Delta. Abenaki 5–7 sequences (Kimmeridgian–Berriasian) are interpreted to have potential for a predominantly type iii source, with some potential for type ii sources in intervening calcareous mudstones.

Atlantic Geology, 2018, Volume 54 Conjugate Margins Conference 2018, August 19-22, 2018 doi: 10.4138/atlgeol.2018.014 Copyright © 2019 Atlantic Geology