Potential Cretaceous Petroleum Systems of the Northern Onshore and Offshore Basins of Jamaica

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Abstract

Jamaica has been in a unique geological setting since the mid Tertiary, with the opening of the Cayman Trough, the northern portions of Jamaica have become part of the Gonâve microplate. The northern coastal margin and offshore areas can be divided into at least three basins: the Lucea, the Sunderland, and the Windsor basins. Since there are limited exposures and penetrations of the Cretaceous in Jamaica, the Cretaceous substrate is examined in outcrop within the 23 inliers that have been exposed through erosion of the Tertiary cover. There are additional Cretaceous penetrations in three key exploration wells. The Cretaceous section in the Windsor Basin ranges in age from Aptian to the Late Campanian, whereas the Cretaceous strata in the Lucea and Sunderland basins range in age from Late Turonian to Late Maastrichtian and Early Coniacian to Mid/Late Maastrichtian respectively. The analyses of the geochemical data determined two potential source rocks groups: 1) Albian - mid Turonian marine marl or carbonate Type I/II dominated kerogen and 2) Campanian - Maastrichtian marine, shaly, dominated by Type III/IV vitrinite. RockEval analysis of the Windsor-1 found evidence of an organic carbon-rich, algal marine source rock in the Cenomanian to Early Turonian. It is widely accepted that Jamaica was geological initiated as an active island arc system in the early Cretaceous and that the Cretaceous section was deposited in a back-arc basin environment. Sedimentation within an active island arc system can be subdivided into central, dispersal and basinal facies. As seen in outcrop in the Cretaceous sections, the central facies is comprised of variably sorted, coarse volcaniclastics, agglomerates and volcaniclastic breccias; the dispersal facies comprise finer-grained volcaniclastics; and the basinal facies comprise deep water

clastic deposits and pelagic sediments. The sandstones are graded, contain partial Bouma sequences, and have thicknesses ranging from a few centimeters to a few tens of meters. Thicker units of sandstones or amalgamated sandstones are also present. For the deep-water strata, detrital grains are angular to sub-angular, and sorting is generally poor, which is indicative of immature, high energy, gravity-driven deposition. As shown in QFL plots, the main provenance for these sandstones is volcaniclastic material from a volcanic arc complex. Because of the volcaniclastic nature of the detrital grains and the associated compaction and diagenetic issues, the lack of porosity preservation is a major issue for these rocks. In contrast, Maastrichtian sandstones are typically epiclastic in origin, derived from upthrown emergent blocks of older Cretaceous volcanic extrusive flows, sediments and igneous intrusives. There appears to be a general increase in mineralogical and textural maturity of the epiclastics from the Maastrichtian to the middle Eocene potential reservoirs.

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