

Lacustrine Carbonate Facies of a Mixed System: Lake Turkana Rift, Kenya

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Mixed siliciclastic and carbonate lacustrine deposits are important hydrocarbon sources and reservoirs in extensional basins worldwide. However, these deposits exhibit considerable variability on account of 1) the complex water chemistry of lake basins, 2) the influence of faunal endemism in long-lived lakes, and 3) rapid deformation in active rifts. Lake Turkana, northern Kenya, provides an opportunity to develop a depositional framework and facies model in a volcanically-mediated, mixed clastic and carbonate system. The lake is approximately 250 km long with maximum and mean depths of 90 m and 35 m, respectively. This study focuses on the eastern margin of the central and southern basins of the lake, where modern and ancient carbonate deposits are readily observed. This research integrates new and legacy Lake Turkana geophysical data with new stratigraphic, petrologic, and petrophysical observations of onshore lacustrine carbonate facies.

An intensive field campaign along the southeastern margin of Lake Turkana was undertaken in 2009, and observed facies include diatomite, micrite, burrowed wackestone and packstone, ostracod packstone and grainstone, gastropod packstone, bivalve packstone, algal mounds and balls, oolite, biolitharenite, calcareous litharenite, and tephra. Preliminary porosity values of the ostracod packstone facies are as high as 28.7% with a permeability of 5.73 mD. The new mapping effort defines the eastern extent of these deposits, and places them into a stratigraphic hierarchy. Paleoecological analyses indicate patchy algal bioherms and biostroms with various isolated shoals built from differing monospecific taxa. Carbonate and diatomite deposits are directly suprajacent to pillow basalt with the former locally accreting onto volcanic bombs, forming algal balls. Carbonate cements are present in most of the facies, except the diatomite, which may indicate sedimentation during intervals of higher lake level.