Sedimentary Architecture and Diagenesis of Modern Carbonate Sands in a Low-Energy Shelf Lagoon, Northern Belize—Modern Analog to Some Ancient Hydrocarbon Reservoirs

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A widespread sheet of modern carbonate sands and muddy sands, deposited unconformably on buried soil and karsted Pleistocene limestone, is present in the shallow, low-energy lagoon (Chetumal Bay) behind Ambergris Caye in northern Belize. Sediment transport and deposition, and overall spatial distribution, are controlled mainly by wind-induced currents in this protected environment. As such, these sediments are a modern analog of some ancient inner-shelf carbonate sands that compose hydrocarbon reservoirs in the Midcontinent. As indicated by ^{14}C dates of buried mangrove peats, deposition was coincident with Holocene transgression in the study area, which began about 6,000 years ago. Surface and inferred buried bedforms include dunes and stacked ripple-forms, overwash lobes, and spits generated as the sands migrate in a southwesterly direction in response to dominant easterly trade winds. Maximum thickness of the sand sheet is 4 inches, and there is control of antecedent bedrock topography and cryptic faulting on facies distribution and thickness variations. Internal facies architecture shallows and coarsens upward in response to decrease in rate of sea-level rise, and has resulted in vertical and lateral heterogeneity in sediment texture and porosity.

Primary porosity in these transgressive-systems-tract deposits includes intraparticle pores within skeletal grains and interparticle pores in sands and muds; effective porosity increases upward in the section. Dolomite cement is present over a wide area in these wholly subtidal deposits, and has precipitated in pore fluids as a likely consequence of bacterial-sulfate reduction or methanogenesis. Partial dolomitization, and secondary pores, similarly are typical in analogous deposits in some upper Paleozoic hydrocarbon reservoirs.

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