

Development of Geologic Models to Facilitate the Exploration for Microbial Carbonate Buildups and Potential Reservoir Facies in Mixed Depositional Systems

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Formulation of strategies for the exploration and development of microbial carbonate reservoirs requires clear understanding of basin architecture, depositional setting, and degree to which depositional, diagenetic, and/or fracture processes influence reservoir characteristics. Five geologic models for microbial carbonate formation are developed for basins characterized by mixed carbonate, siliciclastic, and/or evaporite depositional systems. These include: (1) inner to outer carbonate ramp environments; (2) subtidal to deeper water environments of isolated platforms bounded by steep, high relief slopes; (3) subtidal to downdip from the shelf-slope break environments on rimmed shelves; (4) deep water, low energy distal ramp or outer shelf to basinal environments; and (5) non-marine (lacustrine) environments. Microbial carbonates occur in inner to outer ramp settings with subsurface examples including the post-salt Upper Jurassic (Oxfordian) thrombolite buildups of the eastern Gulf Coastal Plain of the United States, the Upper Jurassic (Kimmeridgian to Tithonian) microbial buildups of northeast Texas, the Lower Cretaceous (Berriasian-Aptian) thrombolites from west central Louisiana, and the Precambrian-Cambrian stromatolite buildups of south Oman. Carboniferous (Visean-Bashkirian) microbial carbonate buildups in the pre-Caspian Basin of Kazakhstan developed on isolated platforms in subtidal shelf to steep, high relief slope environments. Jurassic microbialites on the Scotian Shelf formed downdip from the shelf-slope break on a rimmed shelf. Lower Carboniferous Waulsortian and Waulsortian-type carbonate mud mounds typically developed in deep water, low energy environments associated with distal ramp or outer shelf to basinal depositional settings. Subsurface examples in North America include Mississippian microbial buildups in the Paradox Basin of Utah and Colorado, in the Hardeman and Fort Worth basins of Texas, and in the Williston Basin of North Dakota. The microbial carbonates discovered in rift basins in pre-salt Lower Cretaceous strata off Brazil and West Africa are interpreted to have formed in non-marine (lacustrine) environments.