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PS Microbial Carbonates as Hydrocarbon Reservoirs*

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Abstract

Microbial carbonates occur in rocks of Precambrian to Recent age in virtually any depositional environment. Microbial reservoir rocks fall into 3 main structural categories: 1) stromatolites, 2) thrombolites, and 3) leiolites; the first two being most common. If preserved, microfabrics within microbialites can help to subdivide macrostructural forms and pinpoint environmentally-related depositional fabrics. Reservoirs in microbialites must be large enough to contain commercial hydrocarbon accumulations, thus eliminating buildups smaller than hundreds of acres and several feet in thickness.

Porosity and permeability in microbialites may be depositional, diagenetic, or fractured. Jurassic examples in Alabama have diagenetically altered depositional and purely diagenetic porosity; Mississippian examples usually have altered separate-vuggy porosity with fracture-enhanced permeability. Depositional pores in stromatolites include interlaminar voids, constructed vugs, and fenestrae. Depositional pores in thrombolites include constructed vugs or sub-millimeter sized matrix pores with moderate to good inter-body connectivity. Micritic leiolites and mud-mounds do not typically exhibit effective depositional porosity, but diagenesis and fracturing can transform them into prolific producers.

Stromatolites, thrombolites, and leiolites/mud-mounds are more abundant in Paleozoic rocks than younger ones but recent discoveries in Cretaceous microbialites off Brazil reveal the global scale and economic importance of microbial carbonates. Developing these microbial reservoirs will require defining flow units and petrophysical rock types by their depositional macrostructures, internal microfabrics, poroperm-altering diagenesis or fractures, and the inter-relationships of those attributes with reservoir performance.

Selected References

Adachi, N., Y. Ezaki, J.W. Pickett, 2006, Marked accumulation patterns characteristic of Lower Devonian stromatoporoid bindstone; palaeoecological interactions between skeletal organisms and microbes: Palaeogeography Palaeoclimatology Palaeoecology, v. 231/3-4, p. 331-346.

Ahr, W.M., 1971, Long-lived pollutants as sedimentological tracers (correlators) in south Texas coastal-zone environments: Abstracts with Programs, GSAmerica, v. 3/7, p. 488.

Ahr, W.M., 1971, Paleoenvironment, algal structures, and fossil algae in the upper Cambrian of central Texas: Journal of Sedimentary Petrology, v. 41/1, p. 205-216.

Aitken, J. D., 1967, Classification and environmental significance of cryptalgal limestones and dolomites, with illustrations from the Cambrian and Ordovician of southwestern Alberta: Journal of Sedimentary Petrology, v. 37/4, p. 1163-1178.

Virgil, E. and L.P. Dixon, 1959, Insoluble residues of Ellenburger subsurface rocks: Barnes Publication, University of Texas Bureau of Economic Geology, v. 5924, p.191-198.

Buczynski, C. and H.S. Chafetz, 1990, Habit of bacterially induced precipitates of calcium carbonate; examples from laboratory experiments and Recent sediments *in* Carbonate microfabrics symposium and workshop, 20 p.

Buczynski, C. and H.S. Chafetz, 1990, Habit of bacterially induced precipitates of calcium carbonate and the influence of medium viscosity on mineralogy: International Sedimentological Congress, v. 13, p. 81-82.

Burne, R.V. and L.S. Moore, 1987, Microbialites: organosedimentary deposits of benthic microbial communities: Palaios, v. 2/3, p. 241-254.

Chafetz, H.S. and S.A. Guidry, 1999, Bacterial shrubs, crystal shrubs, and ray-crystal shrubs: bacterial vs. abiotic precipitation: Sedimentary Geology, v. 126/1-4, p. 57-74.

Chafetz, H.S., 1986, Marine peloids: a product of bacterially induced precipitation of calcite: Journal of Sedimentary Petrology, v. 56/6, p. 812-817.

Kopaska-Merkel, D.C. and D.U. Schmid, 1999, New (?) bioherm-building tubular organism in Jurassic Smackover Formation, Alabama: Transactions Gulf Coast Association of Geological Societies, v. 49, p. 300-309.

Mancini, E.A., W.C. Parcell, W.M. Ahr, V.O. Ramirez, J.C. Llinas, and M. Cameron, 2008, Upper Jurassic updip stratigraphic trap and associated Smackover microbial and nearshore carbonate facies, eastern Gulf Coastal Plain, USA: AAPG Bulletin, v. 92, p. 409-434.

Mancini, E.A. T.A. Blasingame, R. Archer, B.J. Panetta, C.D. Haynes, and D.J. Benson, 2004, Improving hydrocarbon recovery from mature oil fields producing from carbonate facies through integrated geoscientific and engineering reservoir characterization and modeling studies, Upper Jurassic Smackover Formation, Womack Hill Field (Eastern Gulf Coast, USA): AAPG Bulletin, v. 88, p. 1629-1651.

Montgomery, S.L., J. Worrall, and D. Hamilton, 1999, Delaware Mountain Group, West Texas and Southeastern New Mexico, A Case of Refound Opportunity: Part 1--Brushy Canyon: AAPG Bulletin, v. 83/12, p. 1901-1926.

Morgan, D., 2003, Mapping and ranking flow units in reef and shoal reservoirs associated with paleohighs: Upper Jurassic (Oxfordian) Smackover Formation, Appleton and Vocation fields, Escambia and Monroe County, Alabama: M.S. thesis, Texas A&M University, 157 p.