

Classification of Microbial Growth Forms and Fabric in the Smackover Formation, Southwest Alabama and Implications for Reservoir Quality

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A classification of Smackover microbial buildups according to fabric and growth form aids in understanding the distribution of reservoir quality in the updip basement ridge plays of southwest Alabama. This classification divides the microbial fabrics and growth forms into five 'types', which developed in response to changes in water energy, sedimentation rate and substrate. Type I buildups contain layered thrombolite with characteristic mm/cm-scale crypts. Type II buildups are comprised of reticulate and 'chaotic' thrombolite. In the updip basement ridge plays, the Smackover sea did not flood the Paleozoic basement until the late transgressive systems tract. Layered and reticulate thrombolite buildups (Types I and II) grew directly on Paleozoic basement and formed in response to late transgressive catch-up conditions when sedimentation rates were low and water energies moderate to high. Both Type I and II buildups occur on low and high relief basement structures. Type III buildups are characterized by dendroidal thrombolites. On low relief basement structures, dendroidal thrombolite buildups (Type III) typically overlie Type I and II buildups. Type III buildups are absent on high relief structures. Dendritic thrombolites grew in early highstand keep-up conditions when sedimentation rates were slightly elevated and water energy low. These conditions occurred on the tops of low relief basement structures in the early highstand. Type IV microbialite are composed of isolated stromatolitic crusts that acted as binders to Type V oncoidal packstone/grainstones that grew on soft to firm substrates in high-energy conditions. Typically found in the late highstand deposits, Type IV (isolated crusts) and V (oncoid) microbialite are found in upper Smackover shoal, lagoon and tidal flat facies.

Classification of microbial types is significant to hydrocarbon production in the vicinity of southwest Alabama. Core porosity and well logs indicate a relationship between porosity and the five microbial types. Types I to III buildups are the best fabrics for productive reservoirs. Of these, Types II and III buildups are the highest quality reservoir rocks. Dolomitized reticulate and dendritic fabrics have produced well-connected intercrystalline and vuggy porosity. Type IV and V microbialite are poor reservoir rocks because Type IV are often isolated and the moldic porosity of Type V oncoids are typically not well connected.