Classifications of Bioturbate Textures and Paleobiologically-Influenced Dolomites: Hydrocarbon Potential

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ABSTRACT

Most detrital carbonate rocks show effects of bioturbation in textural characteristics, including discrete trace fossils visible in outcrops and drill cores and indiscrete fabrics in petrographic analyses. Studies on carbonate sedimentology and diagenesis have documented biogenically-derived textures in general terms such as “bioturbated,” “burrowed,” “burrow-mottled,” and “nodular,” or have ignored such ichnologic aspects altogether. Furthermore, these works utilize standard classification schemes erected for depositional textures, in descriptions of fabrics derived through bioturbation. Such contradictions and oversights in carbonate research stem from disregard of a fundamental tenet: skeletal accumulations represent essentially paleobiological buildups, where biotic processes provide intrinsic controls on both sedimentary dynamics and diagenesis. Hence, a paleobiological approach is useful in characterizations of textural heterogeneities, particularly dolomites and hydrocarbon potential.

Petrographic classification schemes for bioturbate textures and paleobiologically-influenced dolomites are proposed. First, a binomial scheme for classification of bioturbate textures includes (1) identification of burrow fabrics on the basis of grain-size selection, and morphologic characteristics of skeletal alignments in carbonate detritus, and (2) burrow-to-burrow relationships. Two types of burrow fabrics, distinct and indistinct have been described on the basis of genetically-significant criteria. These classes are erected on the basis of the relative distinctiveness of burrow wall structures, which reflect in part the contrast between the fills and host substrates. Distinct burrow fabrics consist of three classes including microfills, mesofills, and megafills. These grain-size classes represent burrow fills that are smaller than the host, the same size as the host, and larger than the host sediments, respectively. Classes of indistinct burrow fabrics include tangentially-, planar-, and concentrically-aligned skeletal arrangements, which define morphologic aspects of local textural heterogeneities. Secondly, classes of burrow-to-burrow relationships are defined on the basis of abundance patterns and cross-cutting relationships, which reflect biogenically-worked and progressively reworked sediments, including fabrics such as isolated, clustered non-interpenetrating, clustered-interpenetrating, and homogenized textures. This approach to classification provides a genetic foundation for understanding distribution patterns in paleobiologically-influenced diagenetic fabrics, such as burrow-fabric selective dolomites and bioturbate texture-enhanced dolomites. Such dolomites show hydrocarbon potential ranging from permeable conduit systems to reservoirs or traps, respectively.