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Relating microfossil distribution patterns to deep-water depositional processes: A new biofacies model based on Oligocene-Miocene deposits

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Micropaleontologic studies of wells from the Atlantic Basin reveal large-scale variations in microfossil abundance patterns in deep-water mudstones that cannot be adequately explained using traditional paleoenvironmental models (*e.g.*, water depth). Integration of foraminiferal, calcareous nannofossil and palynologic data with e–log and seismic control suggests a relationship between the presence or absence of deep-water slope channel systems and the distribution of these microfossil groups. Depositional processes related to the slope channel systems appear to create different paleoecologic conditions that govern the distribution of major microfossil groups. Recent research on slope channel hydrocarbon reservoirs provides an opportunity to evaluate microfossil distribution patterns relative to deep-water depositional environments.

A new biofacies model is developed that recognizes the important links between paleoecology, sedimentary processes, and Environment of Deposition (EOD). Analyses of ditch cutting samples from wells in the bathyal (slope) environment have identified the following microfossil groups to be significant: planktonic, calcareous benthic and agglutinated benthic foraminifera; calcareous nannofossils; algae, spores, pollen, and kerogen (organic matter types). Five biofacies types are defined in non-reservoir facies based on abundances of these indicator groups. Three biofacies types are defined from intra-reservoir mudrocks. Based on this study the most important environmental factors determining microfossil distribution are:

    1) sedimentation rate;

    2) sediment source (terrestrial versus open marine); and

    3) availability of oxygen on the sea-floor and within the sediment.

This biofacies model has been applied successfully in several deep-water basins and is a potentially useful tool in hydrocarbon systems analysis of risks related to the presence and quality of source, seal and reservoir.