Implications of Tectonostratigraphic and Depositional Setting in Identifying Successful Resource Plays in The Middle East

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ABSTRACT

There are multiple stratigraphic intervals in the Middle East composed of organic-rich sediments deposited in localized basins. Thickness, maturity, organic-richness and present-day depth make some of these rock units potential resource plays, but successful exploitation requires the presence of brittle interbeds that are either naturally fractured or within which fractures can be induced. Prediction of geomechanical "sweet spots," requires an unconventional screening workflow that utilizes an understanding of gross depositional setting within a sequence stratigraphic framework to predict the distribution and location of carbonate brittle units. Complicating factors such as the asymmetry of the basin, competing sediment sources and mineralogical composition also need to be considered. This workflow is applied to the Kazhdumi, Shilaif, and Pabdeh formations, which represent a range of lithological and depositional settings. The Shilaif Formation represents deposition in a carbonate intrashelf basin, punctuated by grainstones shed from surrounding bioherms, especially during lowstand periods. These interbeds can thus be predicted stratigraphically, but their areal distribution requires an understanding of an array of complex factors including, for example, windward versus leeward position. The Kazhdumi Formation, deposited on a mixed carbonate-siliciclastic differentially subsiding platform, demonstrates a degree of asymmetry with respect to its sedimentological organization. The south-west side of the basin is dominated by clastic input from the Burgan Delta, whereas the eastern portion is carbonate dominated with interbeds shed from the adjacent platform. To determine the location and distribution of brittle units in this formation, the identification of sediment input points into the basin is crucial. The Pabdeh Formation, deposited in a foredeep setting, has a degree of asymmetry similar to the Kazhdumi Formation. Flysch derived from the south-west propagating Zagros mountain belt may generate more ductile interbeds, but lowstand carbonate interbeds are also documented derived from the adjacent platforms. Gross depositional environment mapping, tied to a detailed sequence stratigraphic framework and understanding of local tectonics, enables informed predictions of the stratigraphic and areal distribution of brittle interbeds. Combined with classic resource play screening techniques, this enables the "sweet-spots" for exploration to be identified.