Stratigraphic Compartmentalization Prediction and Ranking in Marginal Marine Systems

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Marginal marine depositional systems exhibit stratigraphic reservoir compartmentalization potential at three hierarchical scales. At each of these scales, stratigraphic compartmentalization potential can be related to the dominant depositional processes & accommodation to coarse sediment supply ratio (A/S) acting at the time of deposition. All three orders of compartmentalization potential must be considered in order to define optimal field development plans & completion strategies. The lowest order of compartmentalization is usually at the inter-parasequence scale. In systems tracts associated with relatively high A/S ratios, vertical compartmentalization potential is relatively high because of the enhanced preservation potential of flooding surface shales under these conditions. In systems tracts associated with relatively low A/S ratios, vertical compartmentalization potential of parasequences is reduced because the potential for erosion of flooding surface shales by overlying deposits is high & hence potential for vertical sand-sand contact between parasequences is enhanced. The second level of compartmentalization hierarchy is the inter sand-body scale. Individual sand bodies are defined within parasequences. The lateral connectivity of these sand bodies is a product of the dominant depositional processes active at the time of their deposition (wave, tidal, fluvial). Wave-dominated systems tend to produce more laterally continuous sand bodies, fluvial-dominated systems more laterally restricted sand bodies & tide-dominated systems both laterally continuous & laterally restricted sand bodies. Vertical compartmentalization potential of these reservoir sand bodies is related to A/S regime. In high A/S regimes, sand bodies are more likely to be disconnected or compartmentalized. In low A/S regimes, erosional amalgamation of sand bodies is more likely thereby leading to lower compartmentalization potential. The third order of potential stratigraphic compartmentalization is the intra sand-body scale. This scale is represented by heterogeneities such as dipping or horizontal shales, carbonaceous-rich laminae, channel abandonment plugs & concretions. In High A/S regimes the preservation potential of these heterogeneities is relatively high leading to an enhanced potential for compartmentalization. Lower A/S regimes result in a greater likelihood of lateral & vertical erosion of these heterogeneities leading to a higher potential for reservoir connectivity.