Deep-Water Sequences in Static and Dynamic Basin Margin Accommodation

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ABSTRACT

Sedimentary sequences deposited in deep-water basins contain a variety of reservoir-prone units separated by fine-grained intervals. We have compared deep-water sequences from a post-rift passive margin Paleogene of the West of Shetlands, syn-deformational Miocene of the NW Borneo fold-thrust belt, and intra-cratonic Cretaceous clinoforms of the West Siberian basin to examine distribution of reservoirs and seals in the environments of different tectonic settings. On passive margins, transition to post-rift thermal subsidence is often associated with increased sand supply and smoothing of rift topography. An overall progradational trend is reflected by superposition of channels over lobes. There are commonly persistent point source feeder systems, controlled by the underlying structure. Due to efficient sand transport, the drape development may be limited and the effective seal is typically only developed at significant sea-level rise episodes, or due to changes in tectonic subsidence pattern. Sequences deposited in toe-set portions of clinoforms prograding into relatively shallow intra-cratonic basins experience limited lateral and downdip confinement, resulting in an overall progradation within and between sequences. The shelf edge often develops multiple feeder systems, which tend to alternate in supplying sand into deep water. As a result, autocyclic drapes related to lateral shift of deposition define more localized sequences, which partly overlap to stack into linear belts. In compressional settings, folding is initially subtle, mainly providing lateral confinement in tortuous corridors. Progradation and draping of the systems are commonly linked to sea-level change controlling sediment supply. Progressive linkage of structures creates more disconnected slope accommodation. The confining structures often grow near equilibrium with sedimentation rate, and a switch from ponding to bypass may happen repeatedly and in random order. Bypass and updip trapping of sediment is the key control in a development of drapes. Geometry and vertical stacking of deep-water sequences depends on whether the receiving accommodation is static or dynamically changing due to substrate deformation. The slope gradient variation controls relative proportion of channelized and sheet-like deposits. The drapes may result from autocyclic lateral shifts or from an allocyclic supply switch-offs, either due to rejuvenation of updip topographic sills or a eustatic sea level rise.