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Similar Sequence Geometry and Hierarchy in River-dominated Deltaic Systems of the Syn-rift Hibernia Formation (Offshore Newfoundland) and the Breathitt Group Foreland Basin Succession of Eastern Kentucky

The 'fit' of outcrop analogues to subsurface reservoirs is commonly evaluated in terms of age, tectonic setting, climate, etc. and relative importance of different allocyclic controls on sequence development is debated. Comparative analysis of the Cretaceous syn-rift Hibernia Lower Zone in Hibernia oilfield, with part of the Pennsylvanian foreland basin succession, Eastern Kentucky reveals similar architecture, interpreted in terms of similar accommodation history, despite different tectonic settings. In both basins 3-D subsidence variations, convolved with eustatic sea level cycles produced predictable sequence hierarchy, despite differences in subsidence mechanism and climate. This suggests that the 4-D accommodation/sediment supply balance is the fundamental control on reservoir architecture. In a Hibernia, third order sequence, basal amalgamated fluvial channel-fills of Layer 3 represent the late lowstand/early transgressive systems tract, the lower Medial Shale is a maximum flooding zone and the upper Medial Shale through Layer 1 represents a highstand systems tract. Four superimposed 4th order sequences contain incised valleys that show different geometries, depending on their position in the 3rd order sequence. Third order Breathitt sequences contain 4th order sequences; their positions in the longer duration sequences also control vertical connectivity between valley-fills. In areas of long term low accommodation, shale-dominated intervals are partly to completely eroded at subsequent incision surfaces, leading to vertical connectivity between successive incised fluvial complexes. This architecture is interpreted in Hibernia to explain pressure equilibration between certain reservoir units. During long-term base level rise, 4th order sequences are more completely preserved, with marine/nonmarine flooding surfaces producing vertical fluid compartmentalisation.