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Ven Kolla[1], Hanry Posamentier[2], Jasim Imran[3] (1) Consultant, Houston, TX (2) Anadarko Corporation, Calgary (3) University of South Carolina, Columbia, SC

Deepwater Sinuous Channels and Reservoir Architectures

Turbidity currents versus debris flows, and velocities, frequencies, volumes and sediment caliber of catastrophic versus steady turbidity flows, seafloor gradients and topography (including faults), width/depth ratios of channels, bank cohesiveness, and persistence of point- versus line- sediment source, broadly control the sinuosity evolution of deepwater channels. Slumping and channel blocking may also affect the channel sinuosity. We present here several types of deepwater sinuous channels from recent seafloor, and from shallow- and deep- subsurface from several offshore areas of the world, based on analyses of 3D seismic grids and side-scan imagery. The deepwater sinuous channels may be moderately to highly sinuous. Significant levee build-up and aggradations are unique to deepwater sinuous channels. In the deep-water setting, there may be solitary sinuous channels or clusters of them, each individual channel, one or two seismic cycles thick, or there may be amalgamated and intersecting channel complexes within a stratigraphic interval. These sinuous channels, especially the “amalgamated” complexes exhibit neck or chute cutoffs, avulsions and migrations or only vertical stacking. Deepwater channel migrations are either continuous or discrete with varying magnitudes of down-stream versus lateral components. In some cases, the downstream component of migration (sweep) is quite significant whereas in other cases, the lateral component of migration (swing) appears to be more significant. Channel migrations do not always result in increased sinuosity. These various characteristics of deepwater sinuous channels and the consequent reservoir architectures are explained in terms of various controlling factors and in terms of newly evolving concepts on secondary circulation patterns within turbidity currents.