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Seismic Geomorphology of High-Sinuosity Fluvial Systems Integrating 2D and 3D Seismic Data

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Seismic data can reveal significant detail regarding stratigraphic architecture, depositional styles, and areal distribution of fluvial systems. These insights can be leveraged to identify stratigraphic compartments as well as fluvial depositional style, with implications for both exploration as well as development. Examples from the Gulf of Thailand using conventional 3D seismic data integrated with high-resolution 2D sparker seismic data yield images that integrate seismic geomorphology (from 3D data) with seismic stratigraphy (from 2D data). Integration of stratigraphy and geomorphology can reduce risk associated with reservoir prediction and production performance. High-resolution 2D sparker seismic data provide useful stratigraphic information from the water bottom down to approximately 150m with resolution less than 1m. These lines are integrated with high-resolution map-view images afforded by exploration 3D seismic data to characterize depositional elements. Models developed within these shallow sections subsequently can be exported to exploration depths so as to better understand uncertainties regarding reservoir distribution and compartmentalization.

Seismic analysis of the near-seafloor of the Gulf of Thailand reveals the presence of numerous high-sinuosity fluvial systems, some suggestive of the presence of incised valleys, others unincised and flowing across an unconfined floodplain. Channels commonly are less than 400 m wide though channel belts can be multiple kilometers wide. Numerous fluvial geomorphic features are imaged and stratigraphic architecture can be either directly observed or inferred. Such features as point bars, neck cutoffs, chute cutoffs, abandonment channels (with associated mud plugs), and tributary valleys are described both in plan view as well as in section view. Criteria for recognition of incised valleys as well as indications of tidal influence close to the coastline are shown. Examples of incised valley stratigraphy as well as evidence for point-bar related reservoir compartmentalization will be presented.

Direct imaging of abandonment channel patterns and fill suggest the existence of reservoir compartments separated by mud-prone fill of abandoned channels. Abandoned channels, which tend to swing from one side of a channel belt to the other, appear to be largely mud-filled and commonly can serve as flow barriers or baffles. Where these channels swing from one side of a channel belt to another, a "V"-shaped pattern can be observed in plan view. Thus, a "rule of V's" can be invoked to predict the location of reservoir compartment boundaries.