Architecture of Deep-Water Channel Complex Deposits, Tres Pasos Formation, Chile: Insights into Reservoir Compartmentalization in Channel-Lobe Transition Strata

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Deep-water deposits represent important hydrocarbon reservoirs along continental margins globally. The architecture of deep-water units has been studied extensively using seismic reflection data, providing insight into depositional system evolution and gross facies distributions. Bed-scale sedimentological detail is irresolvable in seismic data and is a key component in understanding deep-water reservoir architecture. A reservoir analog from the outcropping Cretaceous Tres Pasos Formation, Chile, represents an important means for acquiring the facies and architectural data necessary for building realistic reservoir models. This study attempts to capture the stratigraphic complexity of clastic units deposited at the base of slope, in proximity to the channel-lobe transition.

The architectural analysis of an outcrop 3.5 km long and ~350 m thick forms the basis for the study. It is characterized by 2D and 3D exposures of numerous channel elements, complexes and complex sets. The database consists of > 2000 m of measured stratigraphic section, photomosaics, and 3000 high-resolution GPS measurements used to map stratigraphic surfaces in 3D. Large channelform bodies 8-20 m thick dominate the stratigraphy, with bases commonly draped by siltstone-dominated bypass deposits. These channel bodies are composite features, made up of stacked, smaller channelform elements, with axial portions consisting of amalgamated sandstone sedimentation units 0.2-2 m thick. These units are typically structureless, high-concentration turbidity current deposits with common mudstone clast, or coarse sandstone to pebble, lags. Channel fills are characterized by a rapid transition from axial facies, with 90-100% sandstone, to thinly interbedded marginal facies with < 30% sandstone. This facies transition typically takes place over < 20 m, a shorter distance than is commonly expected, thus having important implications on reservoir prediction from stratigraphic profiles in 1D well penetrations. Channel bodies are stacked vertically and despite the fact that the average net:gross over the outcrop transect is 0.8, fluid flow pathways would be highly tortuous due to the common preservation of fine-grained drape facies on the bases of the channel bodies. The spatial arrangement of low-permeability margin and drape facies mapped in the Tres Pasos Formation provides insight into compartmentalization in deep-water channel dominated strata, and particularly that of the channel-lobe transition.