Structural Controls on Deepwater Architecture and Facies in the Eocene Ainsa Basin, Spanish Pyrenees

Clark, Julian [1]; Pyles, David [2]; Bouroullec, Renaud [2]; Amerman, Robert [2]; Hoffman, Matthew [2]; Moody, Jeremiah D.[2]; Moss-Russell, Amy [2]; Setiawan, Prianto [2]; Silalahi, Henri [2]; Heard, Thomas [3]; Guzofski, Chris [3]; Fildani, Andrea [1]; Drinkwater, Nicholas [4]; Pyrcz, Michael [3] (1) ETC, Chevron, San Ramon, CA. (2) Department of Geology and Geological Engineering, Colorado School of Mines, Golden, CO. (3) ETC, Chevron, Houston, TX. (4) CALAEP, Chevron, Houston, TX.

Eocene strata of the Ainsa Basin record both clastic and carbonate sedimentation in the structurally active south-central Pyrenean foreland basin. The basin fill comprises slope mudstones, sandstone, and reworked carbonate material, in the form of deepwater channels, slumps and debris flow deposits. The carbonate detritus was sourced from basin-margin highs associated with growing structures, and these strata interdigitate with clastics focused in the basin axis.

Significant stratigraphic thickness variations relate to irregular three-dimensional slope bathymetry formed by syn-depositional growth structures. Evolving structure and basin bathymetry had a primary control on the style of turbidite system architecture and facies distribution. Our studies in the Arro, Ainsa and Morillo turbidite systems show that in the depocenter of local syn-depositional minibasins, weakly confined channel complexes developed, characterized by relatively broad channel belts of-sand-rich channelized facies. In contrast, on the adjacent flanking highs, incisional and relatively narrow slope valleys developed, with increased evidence of multiple channel occupation and bypass.

Towards the end of deepwater deposition in the basin, the ratio of structural growth to sedimentation rate decreased, resulting in smoother slope profiles, and contrasting turbidite architecture (the Guaso System). This trend continued in the final stages of marine deposition, when sediment supply exceeded accommodation, allowing progradation of a graded delta-slope-toe-set fan system (Sobarbe Fm.).

The Ainsa Basin outcrops show relationships between stratigraphic style and evolving basin physiography and provide insights on the processes and controls on deepwater architecture and facies. These relationships between structure and stratigraphy enable predictive trends and stratigraphic data to be applied in predicting and modeling reservoir distribution in subsurface analogs.