Channel-Belt Clusters as an Exploration Target in Alluvial Basins

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Amalgamated channel-belt bodies are exploration targets in alluvial basins. In most cases dense zones of channel bodies are interpreted as resulting from external factors (e.g. base-level, subsidence rates or discharge). In contrast we suggest that stratigraphically significant, but localized, zones of high-density channel bodies may form by autogenic processes. Channel-belt clusters (henceforth clusters) are small groups of closely-spaced channel-belt deposits separated from each other by extensive overbank intervals. Examples come from the Ferris and Lance formations (Maastrichtian/Paleocene, Wyoming).

Clusters in the Ferris Formation in the Hanna Basin are composed of >10 individual channel bodies that are each about 5 m thick, containing 2 to 3 stories, and have aspect ratios that average 32:1. Preserved barforms suggest paleorivers were on average 0.6 m deep. Clusters range up to a few tens of meters vertically and a few hundred meters horizontally and are separated from each other by mudstone-dominated intervals. Channel bodies in the contemporaneous Lance Formation in the Bighorn Basin are much larger, typically 10 m thick with 3 to 4 stories. Aspect ratios are about 50:1. Paleorivers were large, typically 2.5 m deep. Apparent clusters are large as well, up to 100 m in thickness.

In both basins, clusters show no evidence of incision and valley filling (they lack large-scale unconformities and extensive interfluve paleosols), and were formed at a time when shorelines were far away. The lateral scale of these units is too limited to be easily reconciled with overall changes in stacking pattern driven by changes in accommodation or sediment supply. Instead such features may represent relatively long time-scale self-organization of channel avulsion in which fluvial depocenters migrate filling the basins.

Comparison between the formations studied suggest that the size and extent of clusters may scale directly with paleoflow depth of formative rivers. Flow depths of Lance rivers, as well as thickness and width of channel bodies, are about five times larger than those in the Ferris Formation. Consistent scaling is compatible with an autogenic origin for cluster formation.

Autogenic clustering of channel bodies by avulsion provides an alternative depositional model for high net:gross intervals. As such, subsurface correlations of amalgamated channel bodies assuming extrinsic controls on deposition may over estimate reservoir continuity and connectivity.