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3D geocellular facies modeling of the braided-to-meandering fluvial Castissent Formation (late Ypresian, Tremp-Graus Basin, Spain)

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ABSTRACT

The fluvial deposits of the Castissent Formation (Late Ypresian) crop out in the Tremp-Graus piggy-back Basin, located in the central part of the South Pyrenean Foreland Basin. The currently accepted architectural subdivision involves three different multi-lateral and multi-story sheet sandstone complexes, named A, B, and C, which are separated by brackish marls. The lower sheet sandstone of Castissent Formation known as Complex A has been divided systematically into three architectural units: A1, A2 and A3.

This work aims to construct a 3D geocellular facies model of the fluvial sheet sandstone Complex A of the Castissent Formation that reflects the transition from braided to meandering systems in both vertical and lateral directions and captures the sedimentary heterogeneity at a regional scale and displays progressive shifts of the direction of the fluvial system.

The methodology mainly consisted of a) datasets compilation from outcrops of the area described in previous studies, b) Estimation of facies proportions and measurements of the sandy bodies dimensions of different stratigraphic correlations in the area such as widths, thicknesses, amplitudes and, c) 3D modeling using the MultiPoint Statistics method (MPS) which combines the Gaussian indicator simulation with object modeling.

The 3D model could reflect the sedimentary heterogeneity at a regional scale and displayed variations in both vertical and lateral directions. Three of the four facies proposed for modeling (Facies 0: Floodplain, Facies 1: Sandy and conglomeratic channel-fill, and Facies 3: Muddy channel-fill), could be captured in the model. Its distribution replicates an accurate approximation of the different fluvial styles that acted during the deposition of the fluvial sandstone Complex A, a sandy dominated braided river for the A1 and A2 units, and a meandering dominated fluvial style for the A3 unit.

Keywords: 3D modeling, channel fill, facies, heterogeneity, analogue outcrops, multipoint statistics method, regions, training image, object modeling.