Processes and Reservoir Architecture of Terminal Sheet Sandstone in a Low-Gradient Fluvial Setting: Integrated Outcrop, Subsurface and Numerical Forward Modeling Approach

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Terminal fluvial systems in low-gradient endorheic basins are characterized by frequently avulsing, small meandering rivers that decrease in width and depth towards the regional base level. Massive flood-out occurs during peak run-off water as sediment cannot be contained within the narrow river cross-sectional area and amalgamated crevasse splays and terminal sheets form by unconfined flow. The sheets are thin (typically less than 1 m thick) but laterally extensive.

Based on core and log analysis thin reservoir sands bordering the Silverpit Desert Lake (South Permian Basin, NW Europe) were interpreted as unconfined terminal sheet sandstone at the end of fluvial channels. Sequence stratigraphy-based log and core correlation provided distribution maps for terminal sheet-prone areas. However, data density was not enough to visualize individual terminal sheet dimensions.

Challenges were to assess the size, shape, spatial distribution and connectivity of the sheet sandstone. To achieve this, process-driven numerical forward modeling experiments were carried out. The input size and shape data sets for the experiments were derived from: (a) analysis of Google Earth images of meandering rivers in a low-gradient coastal plain at the edge of salt lakes in the Andes, and (b) an outcrop analogue study in the distal part of the Huesca Fluvial Fan (Miocene, Spain). Depositional scenarios were performed for two populations of fluvial channels: larger channels representative for the lower floodplain and smaller, distributary channels at the most distal fringes of the fluvial fan. The model results provided insight in terminal sheet depositional thickness, area and volumes and distribution of sand deposited at the mouth of fluvial channels.

The results of this study provide scenarios to assess volume and connectivity potential of thin-bedded fluvial terminal sheet reservoir sandstone bodies.