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From seismic geomorphology to hydrostratigraphic units: spatial and temporal variations of deltaic to fluvial architecture, Pannonian Basin, Hungary

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This study focuses on the stratigraphic architecture of deltaic and fluvial sand lithologies within the Late Neogene Pannonian basin-fill succession in Hungary, identified from seismic and well data, in order to develop a quantitative hydrostratigraphic classification of the sequence. Hydrostratigraphic divisions are based on the hydraulic conductivity of the rock bodies, which depends on their extent, i.e. the thickness and the spatial distribution, as well as the lateral and vertical connectivity of sand bodies embedded in various muddy lithologies. Thus, we are going to build a simplified 3D lithological model for the uppermost 1500 m of the basin fill succession, that can later be transformed into hydrostratigraphic units and hydraulic conductivity values applied in a numerical flow model. The depositional environments change from deltaic to fluvial and within the fluvial system, the environment alternates between meandering and anastomosing. These intervals will appear as different hydrostratigraphic units in the model.

In our work-flow, a merged three-dimensional seismic cube covering an area of approximately 50 x 40 km^2 was analyzed: 7 master horizons and several proportional slices were delineated in different attribute maps (e.g. amplitude, Root Mean Square amplitude, symmetry, similarity). These maps were generated to investigate the seismic geomorphological features and their associated depositional environments. Rock bodies were defined on the planform geometry of seismic attributes. Basic wireline logs (gamma, spontaneous potential, and resistivity) from 237 wells were interpreted simply in terms of sand, mud, and heterolithic muddy-sand, and finally were tied to the seismic cube. Lithology of rock bodies was determined with the help of well data. With this method, sandy deltaic lobes, sandy fluvial channel belts, and the muddy flood plains were identified. Based on the extension and density of sand bodies, percentages of sand vs clay (net-to-gross; N/G) as well as sand connectivity percentages were determined.

Above the deltaic succession, the fluvial depositional setting can be divided into three minor units. These units start with a meandering system, with 500-3600 m wide channel belts and a relatively high N/G. For an interval in the Pliocene about 350 m thick, a transition into an anastomosing river system is observed. This unit is characterized by channels about 100-200 m wide, with significantly lower N/G ratios and less connectedness. In the uppermost part of the succession, large

meandering channel belts returned to the area. These changes in river style and paleo-hydrography affect the sand and clay ratio and their connectivity; therefore, definition of previous hydrostratigraphic units must be reconsidered.

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