Natural Oil Reservoirs: Computer Simulation of the Sedimentary Architecture

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Sedimentary structures under certain circumstances may serve as hydrocarbon traps. A proper oil-site drilling strategy requires adequate geometric and structural models of these geological objects. Modeling sedimentary architecture in hydrocarbon reservoirs is traditionally approached through purely geostatistical methods or structure imitating object-based methods. Such models are flexible and easy to condition to data from wells, seismic profiles, and outcrop analogs, however the geometry and arrangement of sedimentary bodies often lack realism. More realistic prediction of sediment distribution can be provided by the mathematical simulation of the physical processes, responsible for forming the reservoir structure. Applying process-based approach we aim at reproducing the hierarchy of heterogenous occurrences in sedimentation complexes of the fluvial genesis. Using a mathematical model of the floodplain evolution we developed software to simulate the formation of sedimentary bodies with facial heterogeneities. The model describes the processes of river-bed and -banks erosion, sediment-load transfer and deposition. It also includes the process of oxbow lakes formation characterized by argillaceous deposits. Numerical experiments demonstrate the ability of the model and software to reproduce the geometry of the typical elements of the fluvial sedimentation complexes – large crescent-shaped in plan and wedge-shaped in cross section bodies composed of sand with clay layers