Stratigraphic Reservoir Characterization for Petroleum Geologists, Geophysicists, and Engineers: Chapter 7. Fluvial Deposits and Reservoirs (Developments in Petroleum Science)

Roger M. Slatt

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There are different types of fluvial deposits and reservoirs. The two end-member depositional types are braided-river and fluvial-river deposits. A third type, incised valley fill, can contain either or both of these end members within the confines of the valley. In addition, fluvial deposits near the mouths of the valleys may become reworked by estuarine and tidal processes, which ultimately produce a different set of reservoir properties. The geometry, size, and reservoir characteristics of each fluvial type depend upon transportational, depositional, and postdepositional (diagenetic) processes that are controlled by several external variables, including geographic location, sediment source areas (provenance), climate, and degree of tectonic activity. Braided-river deposits tend to be relatively coarse-grained and consist of gravel and sand, with little to no mud. Because of this, the beds tend to be laterally continuous over much or all of the width of the braidplain, although the presence of some shale beds may disrupt the continuity locally. By contrast, meandering-river deposits tend to be finer-grained, more lenticular, and partially or completely encased in floodplain shales. Depending upon the deposit's degree and type of postdepositional compaction and cementation, its porosity and permeability can be quite variable. However, in general, braided-river facies are more porous and more permeable than are meandering-river facies. A typical sequence stratigraphic stacking pattern for fluvial deposits consists of a basal erosion surface, formed during a falling stage of relative sea level, upon which sits, from the base upward, a lower braided-river deposit (deposited during early turnaround in relative sea level), a floodplain–meandering-river system, and then lacustrine and/or estuarine/floodplain deposits of a transgressive systems tract, capped by highstand floodplain/meandering-river deposits. As a result of differences in properties, fluvial reservoirs can be expected to have quite varied performances. Any reservoir-management plan should include an evaluation of the type of fluvial reservoir and its characteristics. For example, waterflood sweep efficiency will be higher in a braided-river reservoir than in a meandering-river reservoir. Also, horizontal wells may be more efficient in a set of discontinuous meandering-river sandstones than in a more continuous and interconnected set of braided-river deposits. Seismic-reflection techniques, as well as well-log, core, and well-test analyses, all can be used to adequately define the type of fluvial reservoir and predict the recovery performance and efficiency of that reservoir.

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