

Depositional Facies and Three-Dimensional Architecture of the Goynuk Braid Delta, Gulf of Antalya, SW Turkey

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Although relatively uncommon in the rock record, coarse-grained deltas can be prolific reservoirs when charged with hydrocarbons (e.g., Oseberg Fm, Norwegian North Sea). The general paucity of ancient examples requires, however, that the architecture and depositional facies of modern coarse-grained deltas be used as analogs for their rock-record counterparts. Coarse-grained deltas can be classified as either fan deltas or braid deltas, based on the depositional gradient at the coast and the proximity of the source to the depocenter. The modern Goynuk delta in the Antalya Gulf, Turkey is a coarse-grained braid delta prograding into the Mediterranean Sea. Gravel-sized sediments are sourced from the Antalya Nappes, which are actively controlled by the Antalya fault.

To study the structure of the delta and to define delta foresets, ground-penetrating radar (GPR) was acquired and interpreted to a depth of 60 m. GPR lines reach up to 4 km in length, oriented from the coastline to the Antalya fault. Facies analysis was conducted using outcrops along the channel margin, in order to determine the sedimentary facies of the delta plain and the upper delta front.

As a result of this analysis, ten different facies were defined. The Goynuk delta contains three coarse-grained facies representing longitudinal-bar, transverse-bar and debris-flow deposits. In addition, four sand-dominated facies, associated with minor channel and channel-bar deposits, and two mud-dominated facies, associated with overbank and floodplain deposits have been identified. The sand- and mud-dominated facies are interstratified with and occur laterally adjacent to the coarse-grained facies. Longitudinal-bar deposits, which comprise the dominant facies in the Goynuk delta, are the most characteristic component of braided-river systems and braid deltas. As well, the GPR lines indicate that bedding is horizontal or slightly inclined. This suggests that steep foresets, which are more characteristic of fan deltas rather than braid deltas, are not present. When integrated with one another, the sedimentologically generated depositional facies and the GPR defined architectural elements provide a three-dimensional model of a prograding braid delta that may prove useful as an analog to the rock record.