PLIOCENE/QUATERNARY SEQUENCE STRATIGRAPHY OF THE CASPIAN SEA REGION: INTERPLAY OF DELTAIC SYSTEMS AND CLIMATIC CONTROL ON NON-MARINE DEPOSITIONAL SEQUENCES

Abreu, Vitor S.; Nummedal, Dag; Ware, Paul; Self, Dan; Witmer, Roger; Trevena, Art; Williams, Eileen; and Trybek, Jerzy
Unocal Corporation

The oil industry has been active in Azerbaijan for more than one century and the Apsheron Peninsula, Apsheron Sill, onshore, and shelf-margin of Azerbaijan are considered mature areas for exploration. However, large areas of the offshore Caspian, including the deep-water South Caspian, Turkmenistan shelf, and Central Caspian are still exploration frontiers. An understanding of the distribution of reservoir rocks in these areas could significantly reduce exploration risk. The interplay of the paleo-Volga, paleo-Amu Darya, and paleo-Kura deltas is the most important factor for lithology distribution in the southern Caspian.

The three delta systems exhibit significant differences in depositional style. Strong progradation of the paleo-Amu Darya delta occurred from Pereryva to Surakhany (Lower Pliocene) on the Turkmenistan shelf during an overall rise in the Caspian lake level. During the same time interval, aggradation was the primary depositional pattern in the paleo-Volga delta at the Apsheron sill. In the Central Caspian, the paleo-Volga is marked by the transgressive stratal patterns. In the paleo-Kura system, on the southeast margin of Azerbaijan, a transgressive trend occurred during the deposition of the Lower Productive Series to the mid-Balakhany (uppermost Miocene to Lower Pliocene), with onlap of these units over Miocene and Cretaceous rocks. A major downlap surface developed in the paleo-Kura during mid-Surakhany time. The downlap surface at the base of the paleo-Kura progradation correlates to the upper part of the progradational phase of the paleo-Amu Darya delta. Thus, the paleo-Amu Darya delta could have prograded during rising lake-level, similar to the progradation of the Mississippi delta during the Holocene transgression, controlled primarily by the sediment supply. A paleo-Kura prograding wedge developed during the deposition of the upper Surakhany and Akchagylian (Upper Pliocene) on the Azerbaijan margin. The impact of drainage from the Elburz Mountains in Iran could not be evaluated due to lack of data.

Climatic fluctuations exert a dominant control on the style of sedimentation in the South Caspian basin, along with sediment supply. The entire Productive Series reflects the Pliocene "golden climate" when the earth overall was much warmer than today. On a shorter time scale, the stratification pattern is controlled by high-frequency climatic cycles. Lowstand deposits are dominated by aggradational braided streams and braid deltas. Transgressive and highstand deposits are extensive lake shales interbedded with silts and sands. The transgressive shales can act as pervasive seals and permeability barriers and baffles within the reservoirs.