

Petroleum Systems of South Caspian Basin: Integrated Approach to Understanding Reservoirs and Hydrocarbon Entrapment

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Understanding the distribution of regionally extensive reservoir sands within the Pliocene Productive Series (PS) of the South Caspian Basin (SCB) is crucial for petroleum systems analysis. Laterally extensive reservoirs influenced charge and migration history as well as sealing capacity of the large SCB structural traps. Conditions that allowed for deposition of the laterally extensive fluvio-lacustrine PS reservoir facies, were initiated in Late Miocene (Messinian), when isolation of the marine basin led to large-scale base level fall. This base level fall resulted in incision of the Paleo-Volga canyon, integration of the major river systems and focus of large volumes of sediment to the SCB. The regionally extensive sands within PS now act as the main reservoirs for oil and gas offshore and the extensive lacustrine shales, interbedded with the sands form intraformational seals. In the Late Pliocene a major regional flooding event resulted in the deposition of deepwater marine shales throughout the South Caspian. This regional flooding event was followed by a period of compression, which led to the uplift and erosion of late Miocene-early Pliocene Productive Series reservoirs in onshore Azerbaijan. This phase of uplift and erosion resulted in rapid basin-scale dewatering and pressure regression in the laterally continuous reservoir carrier beds which was crucial in the formation of hydrodynamic seals. This compression also resulted in the initiation and renewal of fold growth, which generated many of the present-day structural traps in the basin. Hydrocarbons migrated into traps after the pressure regression were able to form extremely large columns due to enhanced seal capacity as a result of hydrodynamic effects. Regional mapping of reservoir and seals shows the extent of connected sands and is key to understanding the complex interactions of these petroleum system.