

EASTERN SOUTH CASPIAN BASIN PETROLEUM SYSTEM: THE GOGRANDAG - OKAREM PETROLIFEROUS PROVINCE, TURKMENISTAN

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In the Late Neogene, collisional orogenies occurred in the surrounding thrust belts of the South Caspian basin intracontinental depression (Paleocene back-arc). Combined flexure loading and thermal cooling resulted in high subsidence rates overprinted by third order (?) eustatic cycles, evidenced by high frequency depositional sequences. A large westwards prograding deltaic wedge from the paleoAmu-Darya river deposited a thick clastic section of near 6000 meters in an area of over 60,000 sq. km, known as the Red Color Fm (Middle Pliocene). The sedimentary wedge was initially deposited possibly during a relative lowstand (3.0 ma?) that progressed from backstepping, aggradational to progradational during the late Pliocene and Quaternary. This unit is thought to be roughly equivalent to the Productive Series in Azerbaijan.

Maturity studies indicate immature indigenous source rocks and present depth of the oil window top is approximately at 4000 meters in the producing areas. Since no wells penetrated the source rock interval in the region, the postulated source rock is interpreted as the Miakop Series (Miocene-Oligocene), according to studies in Azerbaijan (Abrams, 1997; Wavrek, 1998). Mud volcanoes, thrust and accommodation faulting are effective migration pathways.

Late Pliocene detachment tectonics resulted in a series of parallel, N-S to NE-SW passive fold trends where hydrocarbons were trapped by four-way dip anticlines in the onshore area. In the early eighties, the exploration activity focused on the Gograndag-Okarem region resulting in important discoveries such as Korphedze (100 MMbo), Keimir (85 MMbo), Akpatlauk (66 MMbo) and other fields. Commercial accumulations were found only in the first of the three known closure trends with modest discoveries in the second trend. Field sizes in the region range between 86 to 1 MMbo with a mean size of 50 MMbo.

Multi-stacked gas and oil reservoirs with vertically varying hydrocarbon properties reveal a complex multiphase migration history. Reprocessed seismic interpretation and development drilling showed important reservoir compartmentalisation as the result of transcurrent and extensional faulting in the folded cover.

Each reservoir presents a structurally controlled independent fluid contact and the drive mechanism is predominantly water drive. The reservoirs are fine-grained lithic arkosic sandstones that range in thickness from 2 to 15 meters, deposited in coastal to upper delta plain environments. Geometrically, reservoirs are laterally continuous (high accommodation), cyclic, stacked and overpressurized. Intergranular effective porosity vary from 16 to 24%, permeabilities from 50 to 1,000 mD and overpressures range from 10.5 to 16.5 ppg. Typical producing depths range from 1500 to 3600 meters.

Wells produce an average of 300 bopd from a single reservoir. Gor's range from 6090 to 5500 bbls/cfg in undersaturated and saturated systems respectively. Oil is sweet with 15 to 34 API and paraffinic (13-20%). Field development is location and completion selective and oriented to oil bearing reservoirs due to a lack of gas market. Commingling is rare, as soviet development method required one well per reservoir. Development of deeper reservoirs (NK9 and deeper) has been limited by drilling difficulties and overpressure.

Large areas of the Gograndag - Okarem region remains unexplored, particularly the offshore, where several prospects were identified near the Iranian border. In the onshore further potential is thought to be related to strat traps basinward of the known accumulations and to Red Color Fm deeper horizons. Exploration potential in the second and third structural trends is limited due to westward diminishing reservoir quality and trap timing.

