

**AAPG Annual Meeting
March 10-13, 2002
Houston, Texas**

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Hydrocarbon migration and entrapment at Shah Deniz: A few clues for the South Caspian

Data acquired from the Shah Deniz (SD) gas-condensate discovery suggest that phase and quantity of petroleum in South Caspian Basin (SCB) structures are a consequence of the interplay between structural timing, sand connectivity (allowing depressurisation) and timing of depressurisation events.

SD is located in the SCB within the High Pressure (HP) PaleoVolga playfairway. This play fairway is HP due to compaction disequilibria resulting from rapid Pliocene sedimentation. Hence, in general, water-wet sands at SD are overpressured by up to 5,000 psi.

In contrast, gas-bearing reservoirs are at significantly lower pressures. These lower pressures are interpreted to result from basin margin uplift and erosion of laterally extensive reservoir sandbodies. Less extensive sandbodies remain overpressured. Early oil emplacement is recorded in oil inclusions, which isochore modeling suggests occurred at near-lithostatic pressures, prior to depressurisation.

Maturity indicators from both gases and liquids from DST samples indicate that the upper, Balakhany reservoirs trapped an earlier less mature hydrocarbon charge than the deeper Pereriv reservoirs.

A fill model for the trap is proposed as follows:

- 1) At approximately 2.0 - 3.5 Ma oil migrated through the reservoirs. Because of near lithostatic pressures there was no effective seal.
- 2) Later, uplift of onshore structures resulted in pressure depletion of the Balakhany. This pressure decrease created an extremely effective seal (overlying, overpressured mudstones) and permitted gas entrapment.
- 3) Continued uplift resulted in the pressure depletion of deeper Pereriv reservoirs. Depletion of Pereriv pressures resulted in creation of an effective trap and stopped gas migration to the Balakhany.