Caspian Night

The South Caspian Basin Petroleum Systems: Original Concepts and Modifications Based on New Information

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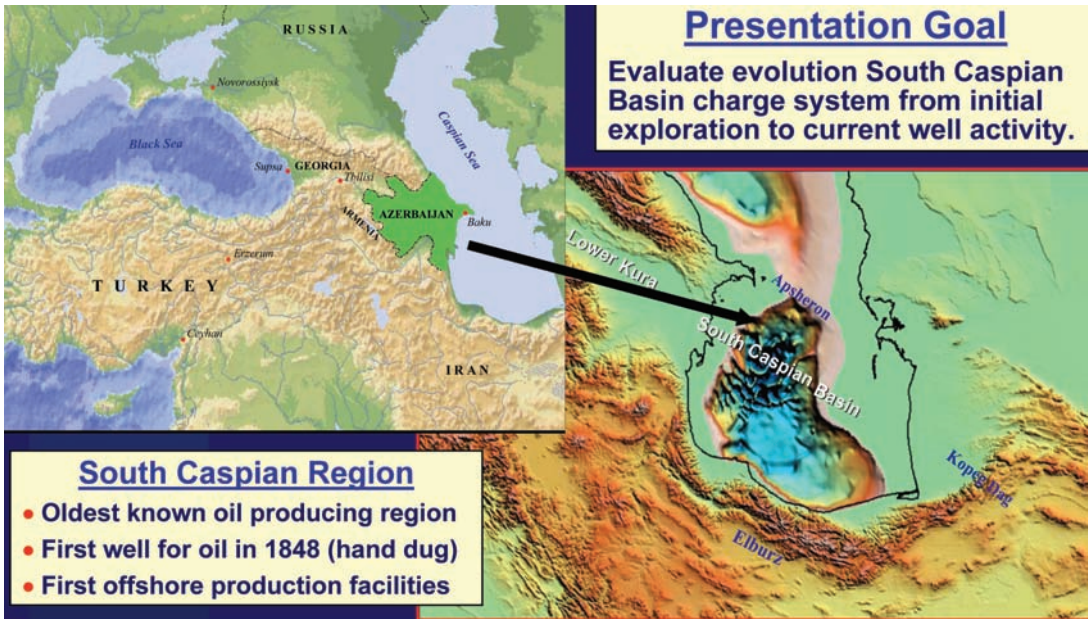
The South Caspian Basin (SCB) contains significant accumulations of both oil and gas-condensate within onshore and near-shore structures related to a unique set of paleogeographic and tectonic events. Rapid Pliocene subsidence resulted in significant continuous hydrocarbon charge from different age source rocks and compaction disequilibrium (elevated pore pressure). Recent drilling activity has not been as successful as in the offshore tests, indicating that a more complex petroleum system exists.

Abrams and Narimanov (1997) document the SCB reservoir crude oils belong to a single genetic oil group based on conventional molecular characteristics. The reservoir oils also display a systematic isotopic shift from onshore to offshore fields. A similar isotopic separation is noted in Lower Maikopian to Diatomaceous rock extracts, indicating that offshore oils (Pliocene reservoirs) are primarily derived from Upper Maikopian and Diatomaceous rocks whereas onshore oils (Miocene and older reservoirs) are derived from Lower and Middle Maikopian rocks. The SCB reservoir gases are sourced from a mixed terrestrial-marine source facies with varying contributions of biogenic gas, indicating that the gases are not derived from the same source rock as the oils.

Source rocks capable of generating significant volumes of both oil and gas can be found in onshore outcrops and cores from the Eocene to Middle Miocene. Offshore seabed geochemical studies have collected oil and gas from macroseeps having similar molecular characteristics as onshore and near-shore fields, indicating that the source rock facies present in onshore Azerbaijan extend to the unexplored offshore Azerbaijan (van Graas, 2000). Pre-drill assessment for traps with access to mature oil- and gas-generating source rocks, high-quality Paleo-Volga sands and regional topseals (Akchagel marine flood) were very favorable. The gas versus oil distribution is believed to be controlled by a combination of factors: differential entrapment (preferential leakage), fill and spill, and pressure-temperature conditions.

A reassessment of the SCB petroleum system based on recent drilling activity indicates that the previous SCB petroleum systems concepts are essentially correct but that pressure disequilibrium plays a far more important role (Piggott et al., 2002). Reservoir continuity, expressed as pressure regression, appears to control the ability to charge and retain migrating hydrocarbons. Well-connected sands result in lower



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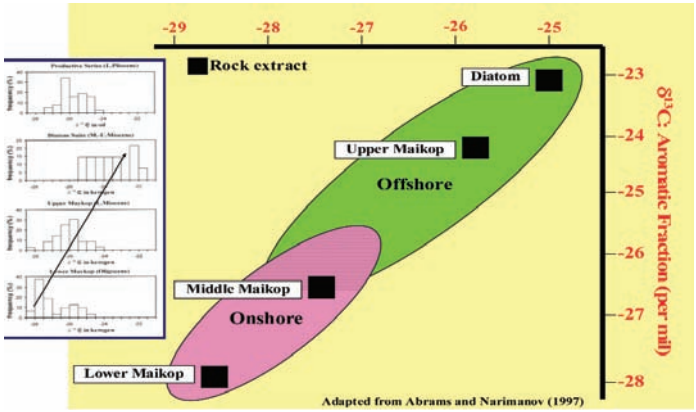
pore pressure, good seal capacity and a greater chance to contain hydrocarbons. Poorly connected sands result in higher pore pressure, poor seal capacity and a greater chance to be wet. The development of new SCB prospects will need to consider not only access to charge and reservoir fairways but also evaluate regional and stratigraphic pressure regimes using multi-dimensional basin modeling and pore pressure prediction tools. ■



Biographical Sketch

Dr. Michael Abrams is currently Manager Petroleum Geochemistry with Apache Corporation. Prior to working with Apache, he was Manager Petroleum Geochemistry and Senior Research Scientist for the University of Utah's Energy & Geoscience Institute (EGI) and Senior Research Geochemist with Exxon Production Research Company. Dr. Abrams has over 25 years' experience in petroleum exploration, production and research providing integrated geochemical services. His research interests include surface geochemistry, petroleum systems evaluation, reservoir geochemistry, bacterial gas prediction and migration pathway analysis. He has a BS in geology from George Washington University, MS in geology from the University of Southern California and PhD from Imperial College in London.