

Hydrocarbon potential of ultra deep deposits in the South Caspian Basin

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Introduction

Deep HC accumulations below 5000m have been discovered in the South Caspian basin at the end of XX century (Bulla-deniz, Bahar, Janub-2, Shah-deniz). A unique geological-geophysical data set gained during last decade on the South Caspian basin containing results of studies of superdeep wells, mud volcanic ejects from the depth up to 14 km, deep seismic, and advanced modeling technique allowed us predicting of accumulations below 7 km.

Results

The burial history of the South Caspian basin central part is characterized by continuous sedimentation and stable subsiding from the Upper Jurassic to present. Avalanche sedimentation during Pliocene-Pleistocene (up to 3mm/year) resulted in deposition of 10 km thick Pliocene-Quaternary succession. The total thickness of sedimentary cover in the SCB reaches more than 25 km.

HC Generation

Numerous data testify to a good generation potential of Oligocene-Lower Miocene sediments (Maykop Series), for an example, TOC – is 12,39%, HI – 588 mg HC/gCorg in mud volcanic breccia. Kerogen type of organic matter varies from II to III. Good source rock properties have been revealed in Middle-Upper Miocene sediments (Diatom Suite), and some intervals of middle Jurassic and Lower Cretaceous rocks.

The South Caspian basin is characterized by the abnormally low recorded values of geothermal gradient - 1,30C-1,80C /100 m.

From T and R0 predicted values oil and gas “windows” in the western shelf and continental slope are located in interval 5-12 km; in the deep water zone – 6-14 km. These zones are corresponded to the occurrence of the principal source- rocks in the South Caspian basin- Maykop Series and Diatom Suite.

HC Migration

Isotopic –chemical composition of fluids testifies to a wide temperature -pressure range of HC generation and migration. Subvertical migration of HC fluids in an extremely high scale and with a high rate is a typical feature of the South Caspian basin. Numerous deep faults, mud volcanoes channels and subvertical decompacted bodies traced to the basement might serve as channels of fluid migration from source to trap. Porous and permeable laterally connected sand bodies in some Lower Pliocene intervals (Productive Series-PS) create a fluid conduit network within the basin providing pathways for lateral HC fluid migration.

HC accumulation

Interplay of large river systems, rapid sea level and sediment supply changes in the Early Pliocene played an important role in the accumulation of reservoir rocks. Southward progradation of PaleoVolga system in some PS stages (Pereriva, NKP Suites, possible PK Suite) provides a good reservoir potential for these sediments. Existence of overpressure zones in the studied area enables preservation of reservoir quality in the deeply subsided horizons.

Conclusion

Results of basin modeling showing the vast (up to 8 km on the extent) petroleum source rocks in the

deeply subsided central part of the South Caspian basin and existence besides large anticline structures the numerous lithological traps formed as a result of facial heterogeneity of PS sediments allow prediction of large ultradeep HC accumulations in this part of the basin that is confirmed by fluidflow recorded by geochemical survey. These data allow us to significantly increase the initial potential resources in the basin.