

Geochemical characterization from the South Caspian Basin, eastern Azerbaijan

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Fine-grained Paleocene-Miocene strata of eastern Azerbaijan record the evolution of the South Caspian Basin from an open marine system, which was well-connected to the Tethys Sea, to an isolated epicontinental sea. Additionally, these strata form the main source interval for the major hydrocarbon accumulations locally and throughout the Caspian region. Due to the extreme thickness of the Jurassic-Quaternary sedimentary fill within the South Caspian Basin (up to 25 km), source rock penetrations within the offshore oil province are rare, making onshore outcrop sampling the only practical means of directly characterizing the source kerogens for this petroleum system. Four hundred Paleocene-Miocene samples collected within eastern Azerbaijan demonstrate spatial and temporal geochemical heterogeneity within the predominately mudstone succession. TOC values range from 0.3 to 6.3%, with Oligocene-Miocene samples showing average values of 1.4%, compared to lower TOC values found in Paleocene-Eocene strata (average = 0.3%). Rock-Eval pyrolysis of 79 samples shows that the majority of strata are organic lean, immature, and mixed oil/gas to gas prone, with a smaller group of latest Eocene-Early Miocene samples having better oil prone source potential. While the majority of strata are not classic Type II oil-prone source rocks, the large volume of this organic-lean, Type II/III to Type III source rock facies makes it a potentially significant gas source. Gas-prone contributions may be especially important from the older, more thermally mature Paleocene-Eocene interval. Gas chromatography and biomarker analysis of 24 samples reinforces the immaturity of most samples, shows varying levels of terrestrial input in all samples, suggests well-oxygenated waters prevailed with periodic suboxic to dysoxic/anoxic events, highlights gross differences between the Paleocene-Eocene and Oligocene-Miocene stratigraphic intervals, and shows generally good lateral correlation between samples. Organic geochemical methods highlight the spatial differences between the western-most Angeheran locality and all others studied, suggesting a different sub-basinal history for this area. These interpretations reinforce what is seen through inorganic geochemical evaluation of trace metals, bulk composition, and stable isotopic ratios.