

Chemostratigraphy of the Cenozoic succession in Azerbaijan: Implications for petroleum systems in the Caspian Basin

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The Cenozoic succession in Azerbaijan includes largely uniform, fine-grained siliciclastic rocks, with a total thickness of a few thousand meters. Age dating of these often carbonate-free sediments proved to be challenging. Hence, the stratigraphy of the Cenozoic succession is still poorly known. The lack of detailed stratigraphic knowledge is frustrating, as the architecture of the Cenozoic succession in Azerbaijan differs significantly from adjacent areas along the margin of the Greater Caucasus (southern Russia, Georgia). Thus, knowledge of the distribution of sedimentary units will also increase the knowledge on the geological evolution of the Eastern Paratethys significantly. A better understanding of the architecture of the Cenozoic succession is also of great importance for hydrocarbon exploration in the South Caspian Basin, as the number of relevant source rock units, their thickness and stratigraphic distribution is still unknown. The main aims of the present contribution are to provide resilient data on the vertical and lateral variation of stratigraphic units in eastern Azerbaijan, together with information on variations of carbonate contents as well as the amount, type and maturity of organic matter. To reach this goal, apparently continuous key profiles representing Lower Eocene to Middle Miocene (Djengi section) and early to uppermost Miocene units (Siyaki section) have been selected using satellite images and accurate descriptions in Soviet-time papers. Each of the sections represents more than 1,000 m of stratigraphy. Additional short profiles (e.g., Shaibler-Gaibler; Yashma, Nasosny, Adzhively) have been selected to study the lateral extent of key horizons. In total, more than 1,700 samples have been investigated for carbonate, sulphur and organic carbon contents, and Rock-Eval parameters. The study results show that potential source rocks are present in three stratigraphic units: (1) Middle Koun Formation (Middle Eocene); (2) Maikop Group (Oligo-/Miocene); (3) paper shales within the Diatom Formation (upper Miocene). The Middle Eocene Middle Koun Formation is about 100 m thick near the coastline of the Caspian Sea and it contains highly oil-prone sediments (max. TOC 15.6 wt.-%; kerogen type II). The Maikop Formation contains relatively high TOC contents (average TOC: ~1.8 wt.-%), but oil prone layers (max. HI: 450 mgHC/gTOC) are rare. The Diatom Formation contains a paper shale unit with very high TOC contents (max.: 21.8 %) and HI values (max.: 770 mgHC/gTOC). The thickness of the paper shale interval may exceed 50 m near the Caspian Sea. In southern Russia and Georgia, the Middle Eocene to Lower Oligocene succession includes marly sediments (Middle Eocene Kuma Formation; Upper Eocene Belaya Glina Formation). In contrast, time-equivalent rocks in Azerbaijan are largely carbonate-free and carbonate-rich layers are restricted to Middle Eocene event beds. This may indicate that the Middle Eocene to lower Oligocene succession in Azerbaijan was deposited in a deeper marine environment.