

Biomarker geochemistry of bituminous shale sequence and crude oil in the Ereğli-Bor Basin (Konya-Niğde), Central Anatolia, Turkey

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In the Ereğli-Bor Basin (Konya-Niğde), Central Anatolia, bituminous shale sequence with thickness ranging between 72 and 160 m occurs in lacustrine deposits of Upper Miocene-Pliocene age. The live oil has also been observed in this bituminous shale sequence. Rock-Eval/TOC, GC and GC-MS analyses were conducted on selected bituminous shale samples from four borehole (key-12/1, key-12/2, key-12/3 key-12/4) and one crude oil sample from a borehole (key-12/2) in the basin. In this study, organic matter type, maturity and depositional environment of bituminous shale are evaluated and the origin of crude oil is determined by the bituminous shale-crude oil correlation.

The total organic carbon (TOC) values of the bituminous shale samples range from 1.21-13.98 wt% with an average TOC value of 4.75wt%. The bituminous shale sequence is characterized by high HI (127-662 mg HC/g TOC) and low OI (7-50 mgCO₂/TOC). Tmax varies from 332-419 [U+1D52]C. Very low Pr/Ph ratios of bituminous shale (0.09–0.22) are indicative of anoxic depositional conditions.

C27 is dominate sterane for bituminous shale and crude oil samples with C27>C29>C28. Normal steranes are more dominant compare to iso- and diasteranes. Quite high sterane/hopane ratios (1.14-2.70) indicate dominant algal organic matter input for bituminous shale and source rock of crude oil. C31R/hopane ratio for bituminous shale and crude oil samples are very low (0.09-0.13) and these ratio show a lacustrine depositional environment for bituminous shale and source rock of crude oil. Sterane and terpane distributions of bituminous shale and crude oil are very similar. A very good correlation in terms of biomarker between bituminous shale and crude oil samples indicate that source rock of crude oil is bituminous shale.

The 22S/(22R + 22S) C32 homohopane ratios of bituminous shale and crude oil samples are found to be 0.56 and 0.61, indicating that homohopane isomerization has attained equilibrium and bituminous shale and crude oil are of an early mature character for oil generation. 20S/(20S + 20R) and sterane ratios are calculated in the range of 0.22-0.42 and 0.27-0.41, respectively. Moretane/hopane ratio for bituminous shale and crude oil samples are very low (0.06-0.07). Generally, these biomarker data indicate that bituminous shale and crude oil are early mature-mature stage. Despite the early mature-mature feature, quite low Tmax value (332-419 [U+1D52]C) are resulted from the contribution of the heavy components of the high oil content of bituminous shale to S2.