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Jurassic Coal is Not the Source Rock of Jurassic Oil in Tu-Ha Basin, Northwest China—Insights from New Organic Geochemical Data

Jurassic coals have been regarded as the source rock for Jurassic oils in the petroliferous Tu-Ha Basin, NW China, mainly because of the close stratigraphic proximity of Jurassic coals and reservoirs. Our organic geochemical results of eight representative source rock and oil samples and thermal maturation study suggest that the Permian lacustrine shales are the major source rock. The rock and oil samples are from outcrop, subsurface, and oil-bearing sandstone concretions. GCMS analysis of Permian shale and crude oil, and Triassic cannel coal indicates that they contain abundant C₃₀ hopane, gammacerane, β -carotane, but little terpanes, suggesting kerogen macerals derived from aquatic biota. Jurassic humic coals, however, contains abundant sesqui-terpane and tricyclic terpane, suggesting macerals derived from land plants. GC analysis of saturated hydrocarbons in Permian shale and Triassic cannel coal shows a bimodal distribution of both low- and high-carbon-number compounds, suggesting a mixed origin of kerogens derived from aquatic biota and land plants. Jurassic humic coals, however, contain little light hydrocarbons and a trace amount of alkanes, suggesting low hydrocarbon-producing potential. The GCMS and GC characteristics of three Jurassic oil samples are similar to those of Permian shales and Triassic cannel coals, but different from those of Jurassic humic coals. In addition, the R_o of most Jurassic coals is <0.4% and above the oil window. Our results strongly suggest that the Jurassic oils were generated from Permian lacustrine shales and sapropelic coals, not from Jurassic humic coals in Tu-Ha Basin.