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# SOURCE-ROCK POTENTIAL AND ORIGIN OF HYDROCARBONS IN THE CRETACEOUS AND JURASSIC SEDIMENTS OF THE PUNJAB PLATFORM (INDUS BASIN, PAKISTAN)

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## ABSTRACT

A better understanding of the petroleum systems, including source rock characterization, is needed to enhance the success rate of exploration in the Punjab Platform of Pakistan. Bulk geochemical data and biomarker composition are used here to characterize the environment of deposition and the source rock potential of the strata, drilled in the Ali Sahib and Amir Wali wells. Rock-Eval pyrolysis data classify the organic matter in Jurassic to Eocene strata as Type-III kerogen with transition to Type-II. A few samples from the Chichali (Cretaceous) and the Datta Formation (Jurassic) have a fair generative potential for oil and gas.

An algal/microbial origin is proposed for the organic matter present in the samples from the Cretaceous Chichali Fm, whereas a mixed algal/bacterial and land plant origin is proposed for the organic matter of the Cretaceous Lumshiwai, as well as the Samana Suk and Datta Fms (both Jurassic). An anoxic/reducing marine environment during deposition of the Chichali and the Lumshiwai Fms. (Cretaceous) is indicated, whereas the Samana Suk and Datta/Kingriali Fm (Jurassic to Triassic) were deposited under oxic to dysoxic conditions. Urs-12-ene, a biomarker for angiosperms, was identified in the Chichali Fm of the Ali Sahib well. All samples are immature to marginally mature. An average vitrinite reflectance ( $R_r$ ) between 0.5 and 0.6 is estimated from  $T_{max}$  and the isomerisation of  $17\alpha,21\beta$  (H)  $C_{31}$  hopanes.

A condensate sample from the Sarai Sidhu well indicates elevated biodegradation of light hydrocarbons that were derived from the cracking of petroleum. Based on the presence of rearranged drimanes in the condensate, probably originating from pentacyclic triterpenoids originating in angiosperms, and of urs-12-ene in the Chichali Fm, an origin of the condensate in this Fm is proposed. Oil and condensate must have been formed deeper in the Basin, most probably from mature sediments of the Chichali or Datta Fm. The investigated condensate may represent the degraded residue of methanogenic biodegradation responsible for the gas accumulations in the study area.