Organic Geochemical Characterization of Gondwana Coal Deposits in India: Evaluation of Depositional Environment, Thermal Maturity and Hydrocarbon Generation Potential

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More than 90% of the vast coal reserves in India are located in the Gondwana basins, which support the growing energy requirements of various industries in the country. Detailed organic geochemical characterizations of these Gondwana coal deposits in India, however, have not been extensively conducted in the past, and this is the major goal of the current study.

Two sets of coal samples from two different Gondwana basins have been analyzed – (i) a set of non-coking coals from Kanhan coal field in the Satpura Basin (240-250 Ma) and (ii) another set of coking coals from the Jharia coal field in the Damodar Valley Basin (240-250 Ma). Our preliminary results from Rock-Eval (RE) pyrolysis reveal a wide range of total organic carbon (TOC) variation in the Jharia coals, but not in the Kanhan coals. Overall, S2 and TOC data obtained from RE analyses point towards the presence of mixed type-II/III (oil/gas prone) and type-III (gas prone) kerogens in the samples. Hydrogen index (HI) and T_{max} values indicate that the Jharia coals range in maturity from condensate wet gas window to post-mature dry gas window, while a somewhat wider maturity range is evident for the Kanhan coals – from immature to dry gas window. A high degree of thermal maturity for most of the samples is also alluded to by the ratios of peak intensities (R1) and peak areas (R2) of the graphitic (G) and disordered (D) bands, obtained from Raman spectroscopic analysis.

We are currently in the process of analyzing distribution of organic compounds (n-alkanes and terpenoids) in these sample sets and also intend to perform stable carbon isotope analysis. These analyses will elucidate the nature of vegetational input, depositional environment and will also help confirm the thermal maturity levels of the coal samples, as indicated by the RE and Raman spectroscopic data.