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Geochemical, Mineralogical and Pore structure of Shales from Auranga basin, Jharkhand, India

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The dramatic impact of shale gas resource has changed global energy landscape. The shales of Auranga basin in Damodar valley is a part of Gondwana sedimentation of lower Permian. Here authors have carried geochemical, mineralogical and pore structural studies through Rock Eval pyrolysis (REP), total organic carbon (TOC), vitrinite reflectance in oil (Ro), Fourier Transform infrared spectroscopy (FTIR), Pore surface area characterization through N_2 adsorption isotherm from various depths of Barakar Formation (Early Sakmarian to Kungurian). The Auranga shales have TOC, Hydrogen Index (HI), Oxygen Index (OI) and T_{max} varying between 1.35-63.46 wt%, 14-298 mg HC/g TOC, 3.53-35.00 mg HC/g TOC, 409-468 ˚C respectively. The analyzed samples have mean vitrinite reflectance in oil (R_{omv}) ranging from 0.41-0.72%. These technological results imply that the studied samples are immature to early mature in nature. The variation of genetic potential (S1+S2) values (0.55-131.46 mg HC/g rock) under REP of the samples indicates poor to excellent hydrocarbon generation potential. The relationship between HI and OI exhibits that samples are enriched in type III and admixed type (II/III) kerogen. Although, organo-petrographic constituents elucidate that the studied samples may appear to be more gas prone (Fig. 1). FTIR provides information about dominance of quartz, kaolinite and feldspar as major minerals whereas sepiolite, smectite, illite and calcite are also observed within the studied samples. The variable TOC content and mineral composition displayed reasonable difference in pore structure. These pores may help in storage of hydrocarbon. Organic matter and clay mineral appear to affect the mesopore structure. The heterogeneity of mesopore is dependent to clay mineral content [1]. Both the mineral matrix and organic matter pores are well distributed in the samples as ink bottle shaped pores in high TOC samples and mineral matrix silt shaped pores in low TOC (Fig. 2).

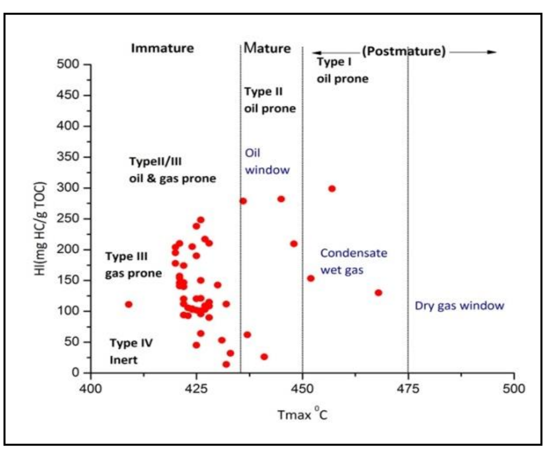

Figure 1: Plot of Tmax and HI showing maturity and kerogen type following [2, 3]

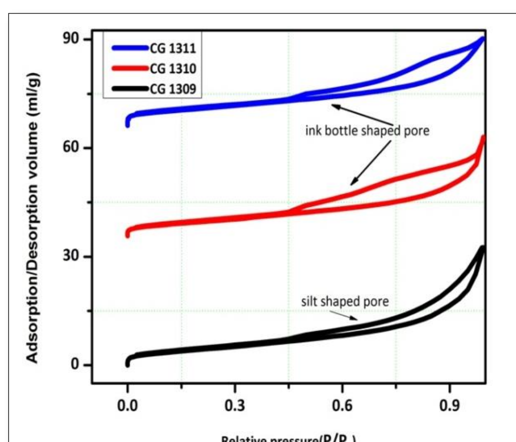

Figure 2: Pore structure of samples with N_2 adsorption/desorption isotherm at low temperature for shale samples.

References:
[1] Tang X et al. (2015) Journal of Natural Gas and Engineering (23), 464-473
[2] Varma et al. (2015) Int J Coal Geol, 51-62
[3] Varma et al. (2014) ICCP Symposium, 40–41