Effects of tectonism on the organic matter of coal from Sikkim, India: Insights from petrography and geochemical proxies

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The authors had collected seven coal samples from the road cut sections of South and West Sikkim to investigate the tectonic effects on the physico-chemical properties of the organic matter in the coal beds. The samples are brittle, pulverised, flaky nature due to intense tectonic activities of the two main thrust system: Main Boundary Thrust (MBT) and Main Central Thrust (MCT) traversing this area. The Gondwana lithology along with the coal seams is exposed in Rangit window zone at the core of Sikkim domal structure. The Petrographic study exhibits intense fusinitization of the liptinite and vitrinite group of macerals had been taken place in the samples. The formation of micrinites in reasonable amount as well as their association with the degraded liptinites in the samples might be explained as the residue remained after the migration of hydrocarbons had been occurred from the labile liptinites due to tectonism. The preservation of alginites in sufficient amount in the samples may imply that the tectonic movements would have forced the organic matter to mature at a rate that was much greater than that of expected during gradual coalification preserving the alginites from getting reworked by microbes. The characteristic small values of hydrogen index (HI-average value 1.14 mg/g), S1&S2 (0.04 & 0.25 mg/gTOC) parameters may illustrate that the expulsion of hydrocarbons had already been taken place enriching residual carbon (RC) in expense of pyrolizable carbon (PC) in the samples due to intense tectonic disturbances. The Fourier Transform Infrared Spectroscopy reveals the dominance of aromatic functional groups over aliphatics and presence of aromatic C=C stretching in the samples may infer the high rank of the coal, may be semi-anthracite. The anisotropic tectonic stress coupled with heat derived by tectonic activities might have increased the rate of change in chemical composition and structural parameters of the organic matter and this change was sudden instead of gradual in geological context.