Evolution of sedimentary organic matter in a closed system at high pressure and temperature

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Abstract

Evolution of organic matter was discussed based on the experimental data of lignite-water in a closed system under the conditions of 373-973 K and 1-3GPa. Geochemical parameters of saturated, aromatic hydrocarbons and carbon isotope ratios of individual n-alkanes for the original lignite and pyrolysates were determined. The experimental data indicated that high pressure significantly retarded maturation of organic matter, especially at lower temperature (<773 K), but favored cyclization, polymerization and aromatization of decomposed organic compounds and preservation of biomarkers and carbon isotopic records. Temperature effect on evolution of organic matter became more evident when temperature was higher than 873 K at high pressures. The biomarkers, petroleum compounds and carbon isotopic records were retained at the experimental conditions. The results indicate that gases and relative abundance of high molecular weight hydrocarbons and aromatic hydrocarbon may exist under the conditions of the lower lithosphere in the subduction zone, and also are significant for understanding the accumulation, preservation of petroleum in deep reservoirs and identifying early and extraterrestrial life.