Correlation between pyrolysis data and organic matter occurrence in organo-clay complexes of argillaceous source rock and its significance

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Organic matter (OM) of argillaceous source rock has different occurrence forms, and Rock Eval pyrolysis data are normally used in studies of organic geochemistry, so it is of crucial importance to understand the correlation between pyrolysis data and organic matter occurrence. In this study, we separated the organo-clay complexes (<2μm clay-sized fractions) from argillaceous source rocks, which were buried at 2500-3500 m from the Paleogene Shahejie Formation of the Dongying Sag. The organo-clay complexes were sequentially treated by solvent extraction (dichloromethane, CH2Cl2) and wet chemical oxidation (sodium persulfate, Na2S2O8), and then performed measurements of pyrolysis and infrared spectrophotometry, thus discussing the correlation between pyrolysis data and organic matter occurrence and its significance for studies of hydrocarbon (HC) generation and residual HCs.

Comparing pyrolysis and infrared of sequentially treated organo-clay complexes, it can be found that a) solvent extraction refers to physical extraction, which decreases S1 in large extent and gently decreases other pyrolysis data (TOC, PC, RC, S2) and absorption bands of –CH3 and −CH2−, correlating to the release of physically adsorbed OM (or HCs); b) wet chemical oxidation refers to chemical destruction, which completely decreases pyrolysis data (TOC, PC, RC, S1, S2) and absorption bands of–CH3 and −CH2−, correlating to the release of chemically adsorbed OM (or HCs). These characteristics show that the pyrolysis data is closely related to the OM occurrence forms other than the attributes of OM itself (e.g., kerogen). Therefore, the changes in pyrolysis data of sequentially treated organo-clay complexes, particularly the change after wet chemical oxidation, indicate that the OM chemically adsorbed on clay-sized minerals is the main source of HC generation, and also indicate that the residual HCs in organo-clay complexes have different occurrence states (e.g., physical adsorption and chemical adsorption). Our study is of great significance to reveal the characteristics and evolution of organic-mineral interactions in argillaceous source rock.