Organic matter preservation mechanisms lead to a difference in the depth of hydrocarbon generation

QIAN CHAO, JINGONG CAI*

State Key Laboratory of Marine Geology, Tongji University, Shanghai, China(*correspondence: jgcai@tongji.edu.cn)

Organic matter(OM) preservation mechanisms control the extent to which OM and mineral surfaces are contacted. Here we explore the influence of this contact on the depth of hydrocarbon generation in a geologic record. Source rock samples are collected from Shahejie Formation, Dongying Depression, China. A sequential fractionation is performed to quantify and characterize the evolution of bitumen, mineral-associated OM(MOM) and particulate OM(POM). MOM and POM represent organic molecules preserved through adsorption and condensation mechanism, respectively. Over the studied interval 2900 to 3500m, the percentage contribution of MOM decreases with burial depth, contributing to increasing amount of bitumen. By contrast, the percentage contribution of POM doesn't undergo a systematic variation within the studied burial depth. Thermo-XRD confirms the intercalation of MOM into the interlayer space of smectite, within which Brønsted acid sites significantly promote its hydrocarbon generation. We interpret the early onset of hydrocarbon generation of MOM as a response to the catalytic organo-mineral interaction and conclude that OM preservation mechanisms should be additionally considered in hydrocarbon generation besides temperature and residence time. In addition, Rock-Eval pyrolysis reveals that POM even has a better hydrocarbon potential compared to MOM but a higher Tmax. We predict POM will contribute to another hydrocarbon generation peak in the late stage of thermal evolution.

The result of this work reveals a difference in the depth of hydrocarbon generation result from a contrast in OM preservation mechanisms. MOM and POM potentially play key roles in different stages of hydrocarbon generation.

Acknowledgment: This work was financed by the National Natural Science Foundation of China (Grant Nos. 41672115)