EVALUATING HYDROCARBON RETENSION AND EXPULSION CAPABILITIES OF SHALE USING WHOLE-ROCK AND KEROGEN PYROLYSIS KINETICS

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For evaluating hydrocarbon retension and expulsion capabilities of shale, we proposed a whole-rock grain-based Rock-Eval Pyrolysis method, which shows effectiveness and applicability (Liao et al., 2017). Our previous studies show that whole-rock grain-based Rock-Eval Pyrolysis provides an easy way to evaluate HC generation-expulsion-retention of shale. At laboratory heating rates, the corresponding temperatures to the maximum hydrocarbon generating rate of grains are 3-8℃ higher than powder and kerogen for marine shale and 6-8℃ for lacustrine shale, respectively. Rock grains need higher energy to expel hydrocarbons. Grains of shale exhibit a relatively broader distribution of activation energies than powder and kerogen. At geological heating rate (3℃/my), the corresponding maturity and geological temperature to the maximum hydrocarbon expulsion rate of grains lags powder 0.02 Ro% and 3℃ for marine shale as well as 0.05 Ro% and 6℃ for lacustrine shale, respectively. These results suggest grains enjoy higher expulsion threshold and higher retention ability.

In this study a couple of samples of lacustine and marine shale in China including Maoming shale (MM), Nenjiang shale (NJZ), Shahejie shale (SHJ) and Yanchang (YC) were evaluated using this method. In Figure 1, Yanchang lacustrine shale exhibits stronger retention ability and weaker expulsion ability than Pingliang marine shale due to its relatively lower maturity. Results show hydrocarbon retension ability order is: NJ＞YC＞MM＞SHJ and their hydrocarbon expulsion ability are on the contrary. The temperature and Ro(%) corresponding to hydrocarbon expulsion peak are earlier for MM shale than SHJ, NJ and YC shale. Easy expelled shale shows earlier expulsion of hydrocarbons. The results show that grain-based kinetic parameters provide a novel method for evaluating retension and expulsion capabilities of shale. In this study we also studied the mechanism of the difference of retension and expulsion capabilities for different shale and coal using X-Ray microscope and diffraction.

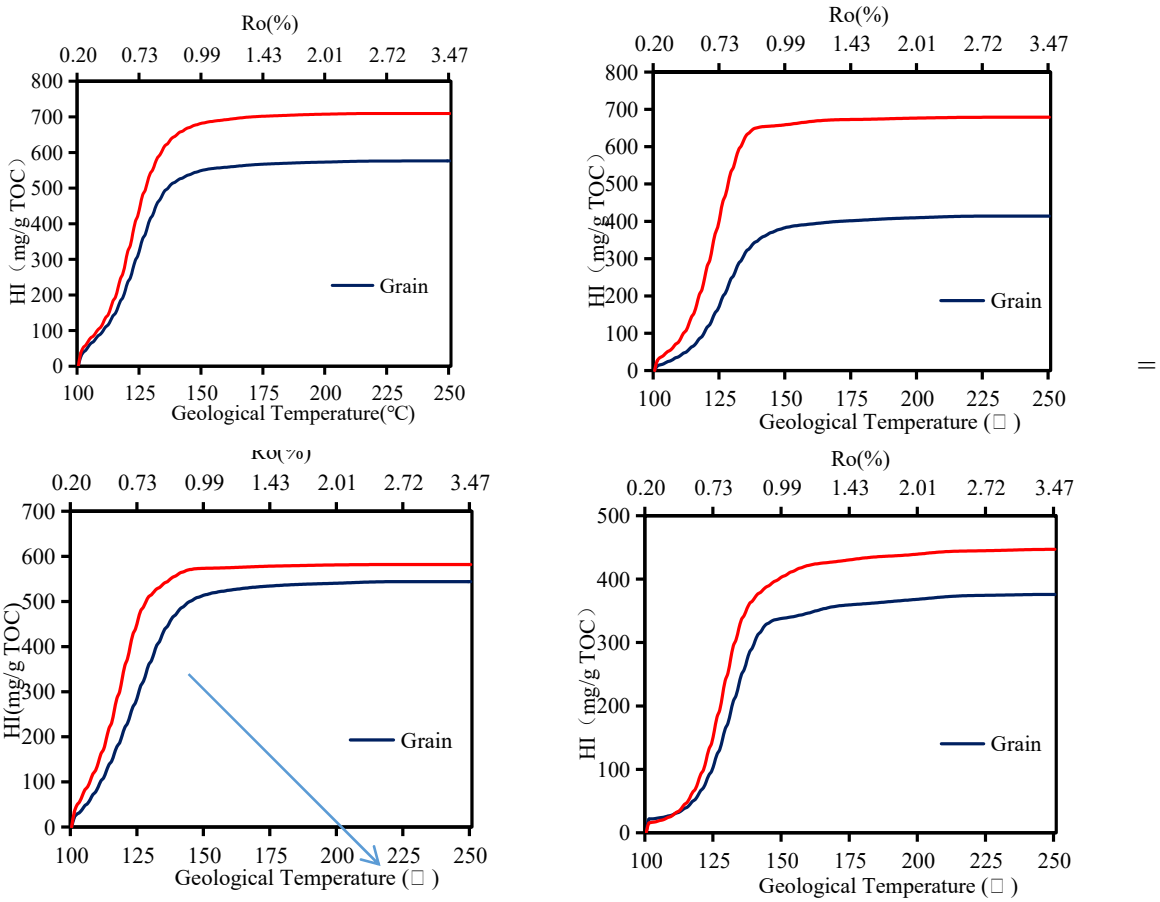

Figure 1 *Comparison of hydrocarbon generation-expulsion amounts of four suits of shale in China at geological conditions(3 ℃/my)*

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References

Liao, L., et al., Kinetic study of marine and lacustrine shale grains using Rock-Eval pyrolysis: Implications to hydrocarbon generation, retention and expulsion, Marine and Petroleum Geology (2017), http://dx.doi.org/10.1016/j.marpetgeo.2017.01.009