Effect of Water on Pore Size Distribution and Methane Adsorption Capacity of Shale Clay: A Case Study of Shanxi Shale in Northeastern Ordos Basin, China

Zhengfu Zhao[1]
[1]College of Geoscience, China University of Petroleum-Beijing, Petroleum, Beijing, China
zhao_zhf@163.com

ABSTRACT

Clay in shale is rich in nano-pores, but these pores are likely to be blocked by water because of hydrophilcity of clay, especially in moist conditions, in which methane adsorption capacity of shale would reduce 40%-90% compared with dry conditions. However, the research of the effect of water on clay pore size distribution and relative methane adsorption contribution of clay to bulk shale remains unclear. Upper Permian Shanxi shale in northeastern Ordos Basin is characterized by high total organic carbon (average 5.01%), high water saturation (~85%), large proportion of clay minerals (~ 59%) and low gas adsorption amount (average 1.9m3/t). In this project, methane adsorption amounts of bulk Shanxi shales and their clay content will be investigated via methane adsorption method and X-ray diffraction, respectively. Then, moisture equilibrium experiment was performed on the single standard dry clay minerals (montmorillonite, illite, kaolinite) to obtain samples with relative humidity (RH) from 0% to 98%. Subsequently, nitrogen and methane adsorption were conducted to analyze the change pattern of pore size, and calculate methane adsorption amount of per gram clay at different RH. We observed that the nano-pores (＜5nm) gradually disappeared in pore size curve, attributing to capillary condensation gradually emerging in larger pores when RH rose. Finally, together with the proportions of three types of clays in shale samples, the adsorption contribution of single clay to bulk shale can be predicted. This project will not only enrich theoretical studies of the effect of water on pore distribution, but also will provide guidance in objective understanding the methane adsorption behavior of clay at different RH and its relative adsorption contributions to bulk shales.

AAPG Search and Discovery Article #90321 2018 Grants-in-Aid Projects