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Effects of Composition on Canister Desorption Behavior of Upper Paleozoic Shales in the Ordos Basin, NW China

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A series of canister desorption tests were carried out on 31 deep (over 3000 m) over-mature Lower Permian-Upper Carboniferous shale cores under atmospheric pressure and at reservoir temperatures of 75 and 80 ℃, as well as a higher temperature of 95℃. Organic chemistry and X-ray diffraction were combined to investigate the impact of composition on canister desorption behavior. In order to better understand sorption and emission processes of shale gas, high-pressure methane sorption experiments were conducted at the reservoir temperature and pressures up to 18 MPa . Geochemical measurements show that the total organic carbon (TOC) content ranges from 0.488 wt % to 4.310 wt %. The depositional setting is lagoon and delta. The type of organic matter is mainly Type III. The dominant minerals of the shale samples are clay (25.4-97.0 wt %, average 58.8 wt %) and quartz (1-62.1 wt %, average 33.3 wt %). The content of clay minerals shows a significant negatively correlation with that of quartz with a coefficient of determination, R2, of 0.7260. The results show that an increase from the reservoir temperature to a higher value results in an average of 31% enhancement in desorbed gas volume. The desorbed gas volumes at both temperatures are linearly correlated with total organic carbon (TOC) content, which support the positive relationship with TOC found by the high-pressure methane sorption isotherms. The coefficients of determination, R2, at reservoir temperature and 95℃, are 0.6584 and 0.6444, respectively. The desorbed gas volumes at both temperatures show a slight correlation with clay minerals, indicating that adsorption sites on clay may have an impact on canister desorption testing. In addition, a slight negative correlation between quartz and desorbed gas volume was observed. The shale samples with a lower content of quartz and a higher desorbed gas volume generally have a higher content of clay minerals and TOC, which may indicate that clay minerals and TOC are the dominant contributors to the sorbed gas capacity, even after spontaneous imbibition.

References

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