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Properties of Silurian shales from the Barrandian Basin, Czech Republic

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Although shale gas-bearing deposits have a markedly lower gas content than coal deposits, great attention has recently been paid to shale gas as a new potential source of fossil energy. Shale gas extraction is considered to be quite economical, despite the lower sorption capacity of shales, which is only about 10% of coal sorption capacities The selection of a suitable locality for extracting shale gas requires the sorption capacity of the shale to be determined. The sorption capacity is determined in the laboratory by measuring the amount of methane absorbed in a shale specimen at a pressure and a temperature corresponding to in situ conditions, using high pressure sorption. According to the principles of reversibility of adsorption/desorption, this amount should be roughly related to the amount of gas released by forced degassing.

High pressure methane sorption isotherms were measured on seven representative samples of Silurian shales from the Barrandian Basin, Czech Republic. Excess sorption measurements were performed at a temperature of 45oC and at pressures up to 15 MPa on dry samples, using a manometric method. Experimental methane high-pressure isotherms were fitted to a modified Langmuir equation. The maximum measured excess sorption parameter and the Langmuir sorption capacity parameter were used to study the effect of TOC content, organic maturity, inorganic components and porosity on the methane sorption capacity. The studied shale samples with random reflectance of graptolite 0.56 to 1.76% had a very low TOC content and dominant mineral fractions. Illite was the prevailing clay mineral. The sample porosity ranged from 4.6 to 18.8%. In most samples, the micropore volumes were markedly lower than the meso- and macropore volumes. In the Silurian black shales, the occurrence of fractures parallel with the original sedimentary bending was highly significant. A greater proportion of fragments of carbonaceous particles of graptolites and bitumens in the Barrandian Silurian shales had a smooth surface without pores. No relation has been proven between TOC-normalized excess sorption capacities or the TOC-normalized Langmuir sorption capacities and thermal maturation of the shales. The methane sorption capacities of shale samples show a positive correlation with TOC and a positive correlation with the clay content. The highest sorption capacity was observed in shale samples with the highest percentage of micropores, indicating that the micropore volume in the organic matter and clay minerals is a principal factor affecting the sorption capacity of the shale samples.