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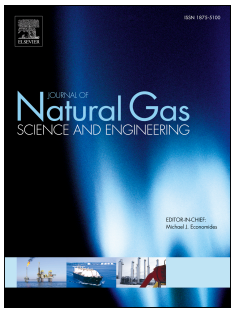

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Pore structure characterization of tight sandstone from Sbaa Basin, Algeria: investigations using multiple fluid invasion methods

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Abstract: The pore structure characteristics, such as porosity, pore size distribution, and pore connectivity, of tight gas sandstone are crucial for evaluating its reservoir capacity. However, due to multiscale pore size and various pore types in tight sandstone, the characterization of the pore structure can be optimized by combining the multiple fluid invasion methods. In this paper, optical microscopy (OM), gas injection porosimetry (GIP), helium pycnometry, low-pressure N_2 adsorption (LPN_2A) and mercury intrusion porosimetry (MIP) were applied to investigate the pore structure characterization of tight sandstone from Sbaa Basin, Algeria. The results of OM observation suggest that the pores are composed of dissolution pores, intergranular pores, intragranular pores and microcracks. The porosity obtained by GIP and helium pycnometry is consistent, demonstrating the efficiency of GIP in measuring the porosity. Furthermore, after the small-sized pores (nanometer scale) and large-size pores (micrometer scale) of tight sandstone were investigated by using LPN_2A and MIP respectively, it is noteworthy that the combination of the two methods is more appropriate to characterize the full scale of pore size distribution (PSD). The key point is to accurately integrate the measurements obtained from LPN_2A and MIP for the estimation of the PSD from the *dV/dlog(D)* curves. The full scale of PSD proves that the pores are primary macropores if the IUPAC classification is adopted, which seems insufficient to reveal the storage capacity of the tight sandstone reservoir. Accordingly, the pores are more proposed to be classified into nanopores (1 nm - 1 µm), micropores (1 - 62.5 µm) and mesopores (62.5 µm - 4 mm), which is recommended by Loucks et al. (Loucks et al., 2012). Additionally, by comparing the permeability predicted from the inflectional pore throat and/or porosity with the measured permeability, it was found that the effect of the inflectional pore throat on the permeability is more remarkable than that of porosity.

Keywords: Tight sandstone; Pore structure characterization; Low-pressure N_2 adsorption; Mercury intrusion porosimetry; Pore throat

Acronyms

GIP gas injection porosimetry

WIP water immersion porosimetry