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Analysis of hydraulic flow parameters in shale gas formations from north Poland

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Shale gas formations in Poland are the exploration targets in terms of unconventional reservoirs [1]. Silurian and Ordovician shale gas reservoirs mainly consist of siltstone and mudstone deposits, rich in organic matter and stretch about 700 km in length along the western margin of the East European Platform [2].

Two main formations are the object of interest: Paślęk Formation, Jantar Member (Silurian) and Sasino Formation (Ordovician) regarding detailed petrophysical, geochemical analysis [3, 4]. Available data set from well L-1 was composed of laboratory measurement results on core samples as total porosity from pycnometer, effective porosity from helium porosimetry, absolute permeability from permeameter, etc.

The concept of hydraulic flow units was detailed described in Amaefule et al. [5]. Hydraulic units are used in determination of fluid flow abilities in porous space. This aspect is especially important in shale gas reservoirs which generally characterized with limited flow abilities. Reservoir quality index (RQI) and flow zone index (FZI) was calculated in order to indicate the intervals with similar filtration abilities.

As a result 74% of analysed samples characterized with FZI from the range of 0-100 μm and 28% in the range of 100-1000 μm . Basing on RQI and FZI parameters six groups with similar flow abilities were established for the Silurian and Ordovician shale gas intervals. Sasino formation revealed the best filtration abilities. Generated groups were also used to estimate the best relation between logarithm of permeability and porosity in shale gas formations.

Research was also concentrated on estimation of the permeability values using "Coates model" (based on NMR experiment results) and "clay bound water influence" in the place of missing data in the whole Silurian and Ordovician interval [6]. Discussion on calculated empirical coefficients C dependent on lithology (used in permeability determination) was conducted. It appeared that lithology coefficients C should not be assumed as 10 values (according to literature) for the shale gas reservoirs because the estimated values closed in the range of 76-4195.

Flow zone indicator together with reservoir quality index and lithology coefficient C divided the shale gas deposits into the groups with similar filtration abilities and lithology characterization.

References:

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