

An overview of shale gas exploration efforts in Poland: a template for the circum-Black Sea region?

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Two Paleozoic source rock formations in Poland were analyzed for their gas shale potential. The first one is the Upper Ordovician-Silurian shale at the western East European Craton, and the other is the Lower Carboniferous shale in the SW Poland. Lower Paleozoic shales are spread across large area, partly characterized by quiet structural setting. These sediments deposited in a foredeep basin of the Caledonian orogen. Up to few hundred meters thick organic rich formation is recognized in lower part of the section (mainly Lower Silurian). Average TOC for a few tens to a few hundreds meters thick interval varies laterally from less than 0.5 % to 3.5 %, while maximum measured TOC is 17 %. Thermal maturity is laterally changeable from immature in the east to overmature in the west, thus in the matured zones primary (pre-maturation) TOC might be considerably higher than the measured one. The same direction depth to the organic rich shale increases, from less than 1000 m in the east to more than 4000 m in the west. Shales are siliceous, consolidated and brittle. Presence of gas shale is indirectly confirmed by gas shows, however some of gas composition analysis indicate locally considerable contents of Nitrogen. The other analyzed source rock formation is a few tens to a few hundreds meters thick Lower Carboniferous shale intervals within Wielkopolska Kulm facies complex in the SW Poland. Tectonic setting is more complex here as the Wielkopolska Carboniferous presumably represents outer part of Variscan collision zone. Depth to the Carboniferous shales increases towards NE from less than 1000 m to more than 4000 m. High thermal maturity is characteristic for this zone, being equivalent of dry gas widow to overmature. In some parts of the zone maturity exceeds 3-4 % Ro, indicating CO₂ risk. The Lower Carboniferous shale contains mixed II and III type of kerogen. Irrespective of advanced maturation TOC is locally relatively high, with averages values for a few tens to few hundred meters thick intervals being up to 2.3 %, and the highest measured value being 9.1 %. The rock is highly consolidated, siliceous and brittle. Gas in Carboniferous complex is locally observed as shows and DST. Gas composition analysis indicates laterally changeable, but locally considerable contents of Nitrogen. Both regions until recent time were explored only for conventional HC, however recent unconventional HC exploration efforts will be able to verify the gas shale concepts postulated for both basins.