[PS]Petroleum Geological Exploration Technology - Innovation Strategies, Upper Rotliegend, Polish Permian Basin*

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Abstract

The Rotliegend series of clastic sediments in the area of the Polish Permian Basin have been very important gas-bearing formation for the last decades. Until now gas deposits in the Polish Rotliegend Basin have been discovered only in structural traps in the top parts of these sediments. Most often traps are sealed with Zechstein Sea evaporates (salt and anhydrite) and they were found in aeolian sandstones or less often in fluvial sandstones, which in most cases having good reservoir properties. In recent years, exploratory works and research north of Wolsztyn-Pogorzela Paleo-High (near Poznań) has shown repeatedly, that hydrocarbons accumulations in multilevel traps are probable. Geological data clearly indicate the presence of such traps in terms of new approaching and searching techniques of exploration areas which were considered as non-gas bearing. In fact, a lot of well-drilled geological data, gathered for the last decades is excellent quality material to prove an innovative concept aiming to discover the new type of gas deposits. The reservoir rocks of these intraformational lithological traps in the Rotliegend sediments are composed of porous aeolian or fluvial sandstones. The innovative idea is trying to specify the definition of sealing rock as alluvial conglomerates within Rotliegend strata. The main component of conglomerates is clasts of volcanic rocks having a diverse mineralogical composition and clasts of Carboniferous sedimentary rocks with diverse lithology. Especially noteworthy is the significant amount of clay minerals (varies from 30 to 50%) present in conglomerates, formed during diagenetic processes. Successful results of Drill Steam Tester carried out within perspective Rotliegend strata with the non-commercial flow of gas provides the clear evidence of huge potential of gas accumulations/saturation in these series. Further evidence is given by the significant mudlogging data noted gas manifestations in lower part of Rotliegend strata below conglomerate layers combined with well logging gas indicating interpretation. In the light of borehole data and in particular VSP it turns out that the top of intraformational traps in Rotliegend can be also tracked on seismic data (low amplitude gas traps), therefore it is possibly to determine spatial range of this kind of sandy bodies.

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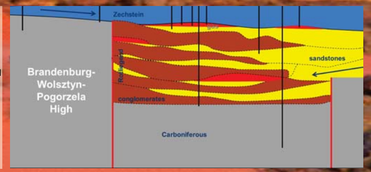
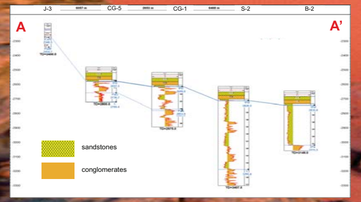
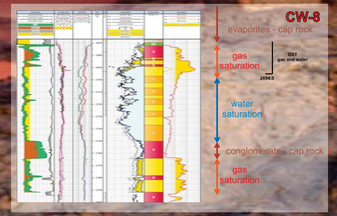
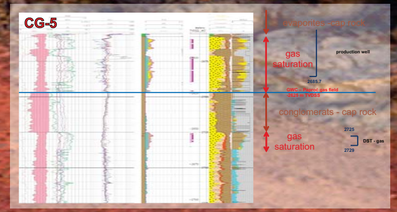
Kiersnowski H., 2013, Late Permian aeolian seas from the Polish Upper Rotliegend basin in the context of palaeoclimatic periodicity. In: Palaeozoic climate cycles: their evolutionary and sedimentological impact,Gasiewicz A. & Słowakiewicz M. Eds. Geological Society, London, Special Publications, No 376, p.431-456

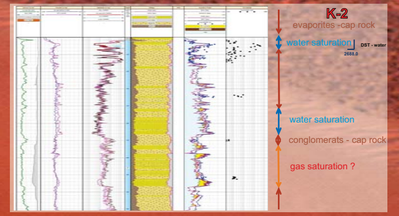
Schematic model of structural gas traps in the top part of Permian sediments (aeolian sandstones sealed with Zechstein Sea evaporates) (a), multilevel traps (porous aeolian or fluvial sandstones and alluvial conglomerates as a sealing rock within Rotliegend strata) (b)

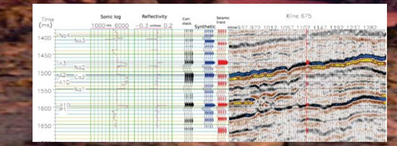






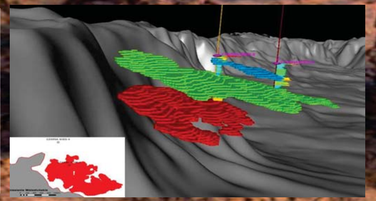


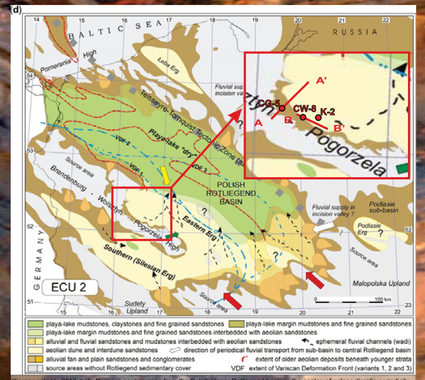




Analysis of the seismic record with the support of synthetic seismograms shows that reflections can be tracked inside the Rotliegend sediments, associated with the occurrence of aeolian sandstones inside fluvial sediments.

The analysis of seismic attributes in the Petrel (Schlumberger) software allowed for the isolation of geobodies showing the position of sandstone bodies inside fluvial deposits in 3D.
As a result of this analysis, it was possible to determine their volume and potential resources.





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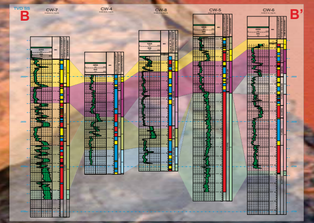
Chemostratigraphic correlation – Czarna Wieś Gas Field
The sedimentary succession is composed of siltstones, argillaceous sandstones and sandstones which can be assigned to one of the three main depositional settings: alluvial fans facies, fluvial facies or aeolian facies. These facies can be relatively easily recognised also by geochemistry using Si/Zr ratio.
The differences in the thickness of the Packages as well as occurrence of uncorrelatable packages within studied field suggest the high complexity of facies architecture.
It is impossible to determine relationship between Packages P2, P3 and P5, P6. They may represent different time slices or different depositional sub-environments.
The key correlatable horizon is Package P7



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Geological data clearly indicate the presence of such traps in terms of new approaching and searching techniques of exploration areas which were considered as non-gas bearing.
In fact, a lot of well-drilled geological data, gathered for the last decades is excellent quality material to prove an innovative concept aiming to discover the new type of gas deposits.
The reservoir rocks of these intraformational lithological traps in the Rotliegend sediments are composed of porous aeolian or fluvial sandstones.
The innovative idea is trying to specify the definition of sealing rock as alluvial conglomerates within Rotliegend strata.
The main component of conglomerates is clasts of volcanic rocks having a diverse mineralogical composition and clasts of Carboniferous sedimentary rocks with diverse lithology.
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Successful results of Drill Steam Tester carried out within perspective Rotliegend strata with the non-commercial flow of gas provides the clear evidence of huge potential of gas accumulations/saturation in these series.
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