Diagenetic variability of the Zechstein Limestone (Ca1) strata from the Wolsztyn Ridge region in the scope of basin's bathymetry

The Wolsztyn Ridge located in western Poland, is an uplifted pre-Zechstein horst structure created due to a major tectonic activity. Its presence allowed for the creation of a relatively shallow environment, thus promoting a growth of the bryozoan reefs in the middle of a deep-water zone of the Zechstein sedimentation. Currently, the reefs, together with their slopes and the strata deposited at greater depths, are represented by the rocks of so called Zechstein Limestone (Ca1). The development of the reefs has ceased due to the appearance of anhydrite and halite sediments, having flattened the basin's substrate. Subsequently, the Main Dolomite (Ca2) sediments have been deposited. It is thus widely accepted that the sedimentation conditions under which the Wolsztyn Ridge Ca1 was deposited differed significantly from those corresponding to the formation of Main Dolomite (Ca2) strata. Hence, a distinct sedimentological character of the Ca1 reefs seems to reflect the variability of the diagenetic processes of this division, as well – referred to any physical and chemical changes of the sediment taking place between sedimentation and metamorphism.

While the characteristic sedimentological zones connected with the Ca2 strata – i.e. a carbonate platform, its slope and basinal area – have so far been carefully studied, the Wolsztyn Ridge Ca1 carbonate reefs are still not fully described. A vast majority of researchers was focused chiefly on pure sedimentology of the region, rather than on diagenesis, hence constricting the development of Zechstein Limestone's diagenetic characteristics. Not surprising is that a thourough investigation of the diagenetic processes is a key to a proper interpretation of the Wolsztyn Ridge Ca1 hydrocarbon storing capability. Consequently, the prerequisite of this project is to bridge a gap between sedimentology and diagenesis due to finding a relation between sedimentation conditions and corresponding diagenetic alterations. A spacial facies analysis will significantly enhance the ability to predict the lateral dispersion of the potential hydrocarbon deposits in this region.

A valid part of the project is moreover connected with the methodology proposed to be launched in the studied case. Since the effectiveness of the research is intended to be maximized, the traditional methods will be accompanied by the precise and modern solutions, such as Computed Tomography (CT) and Nuclear Magnetic Resonance (NMR). First of all, however, a standard core description will be undertaken to enable the selection highly modified zones related to the reef, slope and basinal sediments. The samples withdrawn from these zones will then be subjected to the cement polarizing microscopy in a transmitted light, supported by the cathodoluminesce studies. The latter will be particularly useful in an investigation of dolomitization. Whether greater accumulations of dolomite are present, they will be associated with an appropriate dolomitization model, possible to deduce by applying the stable isotopic studies. Any chemical composition uncertainties will be resolved using both X-Ray Diffraction (XRD) and electron microprobe (SEM-EDS) methods. Finally, the selected samples will be subjected to both CT and NMR experiments. The CT is expected to yield the porosity type and connectivity data. Thus, the forms such as cavernous *(vuggy)* and fracture porosity can be carefully studied, including the estimation of their connectivity and apertures. The CT research will be supplemented by the innovative, low-field NMR experiments. The NMR studies not only allow for the performance of porosity calculation but also enable the possibility to identify fractures, the zones of reduced porosity or even pressure dissolution structures connected with the process of chemical compaction.

It is worth adding moreover, that any previously published papers and research projects concerning the Wolsztyn Ridge Ca1 strata were concentrated on the investigation of strictly limited set of alterations, using basic equipment only. Consequently a combination of both innovative technical solutions and proposition of tying the diagenetic alterations with corresponding morphology of the basin, seems to be very desirable. Thus, the application of the presented approach will surely result in an amelioration of petroleum prospection tasks performed within the Ca1 sediments of the described region.