

SUMMARY

The Słupsk IG 1 borehole, as one of few drilled in the western, deeply sunk part of the Baltic Depression (figs 2, 3) has provided new data about both the old Paleozoic formations and the depth to the crystalline basement along with its composition.

The top of crystalline basement was encountered here at the depth of 5036.0 m i.e. approximately 200 m deeper than it was inferred from seismic data. This is the most westerly site of Paleoproterozoic crystalline rocks of the East European Platform, ever drilled in Poland. The basement is composed of hydrothermally altered, finely laminated quartz-microcline-biotite and quartz-plagioclase-biotite gneisses. Lamination and mineral composition of the gneisses indicate sedimentary nature of the protolith.

The crystalline basement is directly overlain by the first Lower Paleozoic depositional sequence (fig. 4) comprising a continuous succession from the Ediakaran through Middle Cambrian (total thickness 563 m). These are continental and continental-marine deposits (Ediakaran–lowermost Cambrian) represented by sandstones and conglomerates, gradually grading into marine deposits (Lower and Middle Cambrian) composed of sandstones interbedded with sandstone/mudstone heteroliths and mudstones.

The Ordovician section is strongly reduced reaching the thickness of merely 25 m. It consists of the Sasin Claystone Formation of Caradoc age, and the Prabuty Marl and Claystone Formation assigned to the Ashgill.

Numerous fractures and slickensides are observed in the Cambrian/Ordovician and Ordovician/Silurian transition rocks (Modliński, 1975). Uppermost Middle Cambrian, Upper Cambrian, lower Ordovician and (lower?) Llandovery deposits are missing in the section due to tectonic reduction along a fault zone.

Lowermost Silurian – Llandovery deposits are also lacking, or they may be represented only by their uppermost portion, merely 7 m thick (Tomczyk, 1974) or 18 m thick (as interpreted by Jaworowski, 2000c).

The rocks above are represented by an enormously thick series (ca. 3000 m) of the Kociewie Claystones and Mudstones Formation included in the Wenlock and lower Upper Ludlow – Ludfordian (Jaworowski, 2000c; Modliński *et al.*, 2006), and the Puck Calcareous Claystone Formation (330 m thick) corre-

sponding to the lower Upper Ludfordian. Uppermost Ludfordian and Pridoli deposits are absent in the section due to removal by post-Silurian epigenetic erosion. The thickness of the Silurian deposits in the Słupsk IG 1 borehole is 3340 m, being the largest one recorded in the territory of Poland.

The Silurian rocks are directly overlain by a 124 m-thick Permian succession. The Rotliegend is represented by the Darłowo Formation composed of sandstones with thin conglomerate interbeds. The anomalously thin Zechstein section is limited to the stratigraphically lowermost cyclothem of PZ1 overlain by terrigenous Zechstein deposits.

The Mesozoic succession of the Słupsk IG 1 borehole contains numerous stratigraphic gaps. It consists only of Triassic and Upper Cretaceous (Cenomanian through Campanian) deposits.

The Cambrian sandstones, considered the most prospective rocks for hydrocarbon accumulation in the Baltic Depression, exhibit no reservoir properties in the Słupsk region. Petrographical investigations show that these rocks are highly diagenetized due to large burial depth, and the Żarnowiec Formation rocks were those subjected to strongest alterations even under diagenetic/anchimetamorphic conditions. Poor reservoir properties are also proved by hydrogeological tests and measurements of physical properties of rocks.

Thermal maturity of rocks from Słupsk IG 1 varies within a wide range, grading from the early immature phase of hydrocarbon generation (Permian and Mesozoic) through the main phase of oil and gas generation (Silurian – Ludlow) to the post-mature phase (Cambrian, Silurian – Wenlock) when dry, high-methane gas can be generated. It corresponds to the temperature interval of 50–350°C. In general, the Lower Paleozoic deposits contain insignificant amount of organic carbon. An increased content of Corg up to 1.0–1.4% was recorded only in Silurian claystones (Wenlock) showing good source rock properties.

Hydrogeological tests in the borehole revealed brine flows in Lower Permian and Buntsandstein deposits. The brines can be used in medicine for balneological purposes. The analysis of well logs enabled recognition of 2 aquifers in the Mesozoic deposits, filled with mineralized water that can be a potential source of geothermal energy.