

Geological and geophysical interpretation of Palaeozoic Strata in Kraków-Cieszyn Area (Western Carpathian)

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Abstract. The geological structure of Polish West Carpathians is very complicated and not quite recognized. The metamorphic Precambrian rocks of Upper Silesian Massive are covered by deposits of Lower Cambrian, Lower, Middle and Upper Devonian, Lower and Upper Carboniferous as well as Jurassic (only in east part), Miocene and Carpathians Flysch sediments. The Palaeozoic basement is determined by complicated fault system (U. Baran, E. Jawor, W. Jawor, 1995, 1996, 1997; Paul, Ryłko, Tomáš, 1996).

The distribution and thickness of the Palaeozoic sediments depends on both vertical tectonic movements and variability of facial development. Cambrian is developed as marine facies and it is represented by three units: *scolithos sandstones*, *bioturbated sandstones* and *siltstones with trilobites*, which are classified to Lower Cambrian (Cebulak, Heflik, Kotas, Ślącza, 1982). Their range and thickness are variable. To the south there is observed gradual pinching out of the upper parts of the sediments (Buła & Jachowicz, 1996). Ordovician and Silurian in the region are not present. Directly on Cambrian the Devonian sediments lie the with erosional contact. Biostratigraphic analyses show that the sediment in the area from Cracow to Cieszyn are represented only by Lower Devonian – Emsian. The age was determined on the basis of psilophites and spores (Turnau, 1974; Konior & Turnau, 1975). It is believed that the Devonian sediments cover Cambrian all over the region and in the west part of the area they overlie Precambrian (Roztropice-3 well). Thickness of Devonian is not big and usually does not exceed several dozen meters.

Key words: Western Carpathians, Palaeozoic sediments, Devonian reservoir rocks, gas accumulations, hydrocarbon accumulations

Introduction

The geological structure of Polish Western Carpathians is very complicated and not quite recognized. The metamorphic Precambrian rocks of Upper Silesian Massive are covered by deposits of Lower Cambrian, Lower, Middle and Upper Devonian, Lower and Upper Carboniferous as well as Jurassic (only in east part), Miocene and Carpathians Flysch sediments. The Palaeozoic basement is determined by complicated fault system (U. Baran, E. Jawor, W. Jawor, 1995, 1996, 1997; Paul, Ryłko, Tomáš, 1996).

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The sediments are represented by very-size grained sandstones, conglomerates and partially by siltstones. In the west and east parts of the region, a sedimentation of Emsian and Middle Devonian is observed. It is characterized by higher carbonate content in sandstones matrix that are covered by dolomitic siltstones, interbedded with sandy dolomites and dolomites. In the middle part of the area (Bielsko – Kęty – Andrychów, fig. 3-6) the Lower Devonian sandstones are overlain by probably Givetian – Frasnian sediments with typical reef structures for them (stromatoporoides and amphipores). It may reflect lack of typical Emsian sediments in the part of Uppersilesian Basin. Furthermore, the Middle Devonian transgression got there only in Givetian. To verify an additional microfaunistic analyses are presently performed there. The problem of the Middle Devonian sea transgression has not been solved yet and because of lack of reliable biostratigraphic data, Eifelian is believed to consist of clastic sediments, mainly claystones with clayey interbeds (Narkiewicz, Racki, 1984), or carbonate sediments, mainly micritic dolomites with clayey interbeds (Tomáš

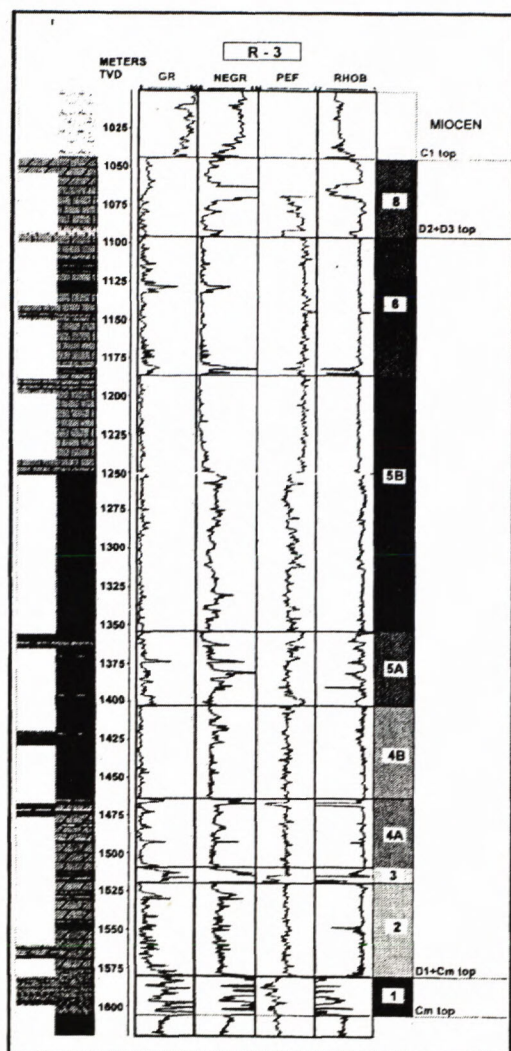


Fig. 1. Geological interpretation of Roczný-3 well (Devonian-Carboniferous formation)

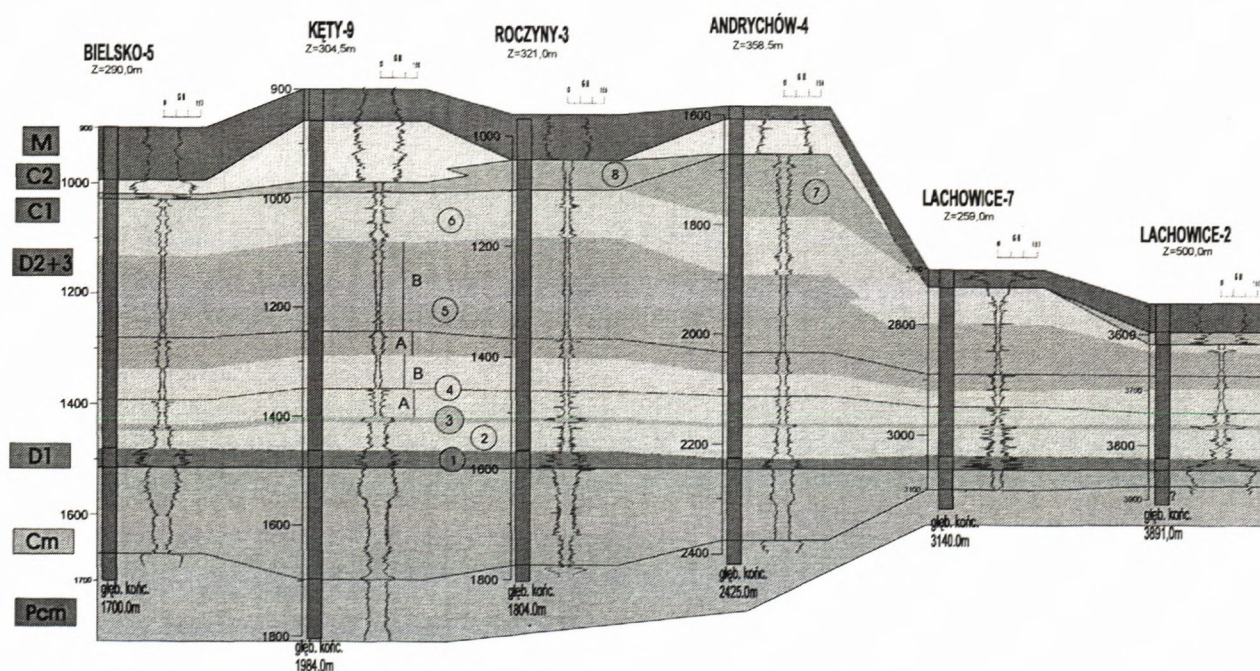
& Zajac, 1996). Givetian and Frasnian are represented by thick-bedded carbonate sediments made of organodetritic, amphipores and stromatoporoides, partially micritic and dolomitic limestones. In Frasnian there are also present crumbly limestones and carbonate breccias. Fammenian is built by micritic limestones interbedded with grainstones containing oncoides, peloides, and intraclasts, and with organodetritic limestones containing snails, brachiopods, foraminiferas and corals fossils. In the Fammenian sediments palaeosoils are observed. Lower Carboniferous is represented by Upper Tournai or Visean and may be developed as both carbonate and clastic facies. Upper Carboniferous is made of sandy, silty and clayey sediments.

In more wells in Bielsko-Biała, Kęty, Andrychów, Wysoka area a gas and oil have been observed in dolomites, and limestones of Middle and Upper Devonian and in sandstones of Lower Devonian-Cambrian (fig. 1). The first gas accumulations were discovered in the Lachowice block by Lachowice-1 well. After perforation and acidizing in Middle Devonian 3450-4060 m. depth interval, the gas and condensate flow of $V_p-115 \text{ m}^3/\text{min}$ was observed from microfractured, microcavernous limestones and dolomites of very poor reservoir properties, $P_d-50.84 \text{ MPa}$ (Jawor 1992, Baran, E. Jawor, W. Jawor 1995, 1996, 1997).

The discovery of Lachowice gas field gave a type to penetrate the neighbouring Stryżawa block with Lachowice-7 well. In Lachowice-7 gas production was commenced through perforating and acidizing in the 2821-2768 m depth interval from Upper Devonians dolomites and limestones; $V_p = 179 \text{ m}^3/\text{min}$ and reservoir pressure is equal to 26.77 MPa (Baran, E. Jawor, W. Jawor 1995, 1996, 1997).

Next well Stryżawa-2k on the Stryżawa block discovered new gas field in the Lower Devonians-Cambrian sandstones (well in the test). The Lower Devonian Cam-

Fig. 2 Cross-Section of Bielsko-Lachowice line (West Carpathian)



The map displays a complex geological structure with various colored regions representing different geological units. Topographic contour lines are overlaid on the geological features. A prominent fault line, labeled 'Klamath Fault', runs diagonally across the map. Other features include 'Klamath Crater' and 'Klamath Lake'. The map is framed by a coordinate grid with elevations ranging from 5,000 to 10,000 feet. A legend in the bottom right corner provides information about the map's scale and data sources.

Legend:

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The exploration results of the Lachowice-1, Lachowice-7, Stryszawa-2k have increased perspective of this area and indicate chances of next hydrocarbon accumulations in the dolomites, and limestones of Middle and Upper Devonian or sandstones of Lower Devonian-Cambrian.

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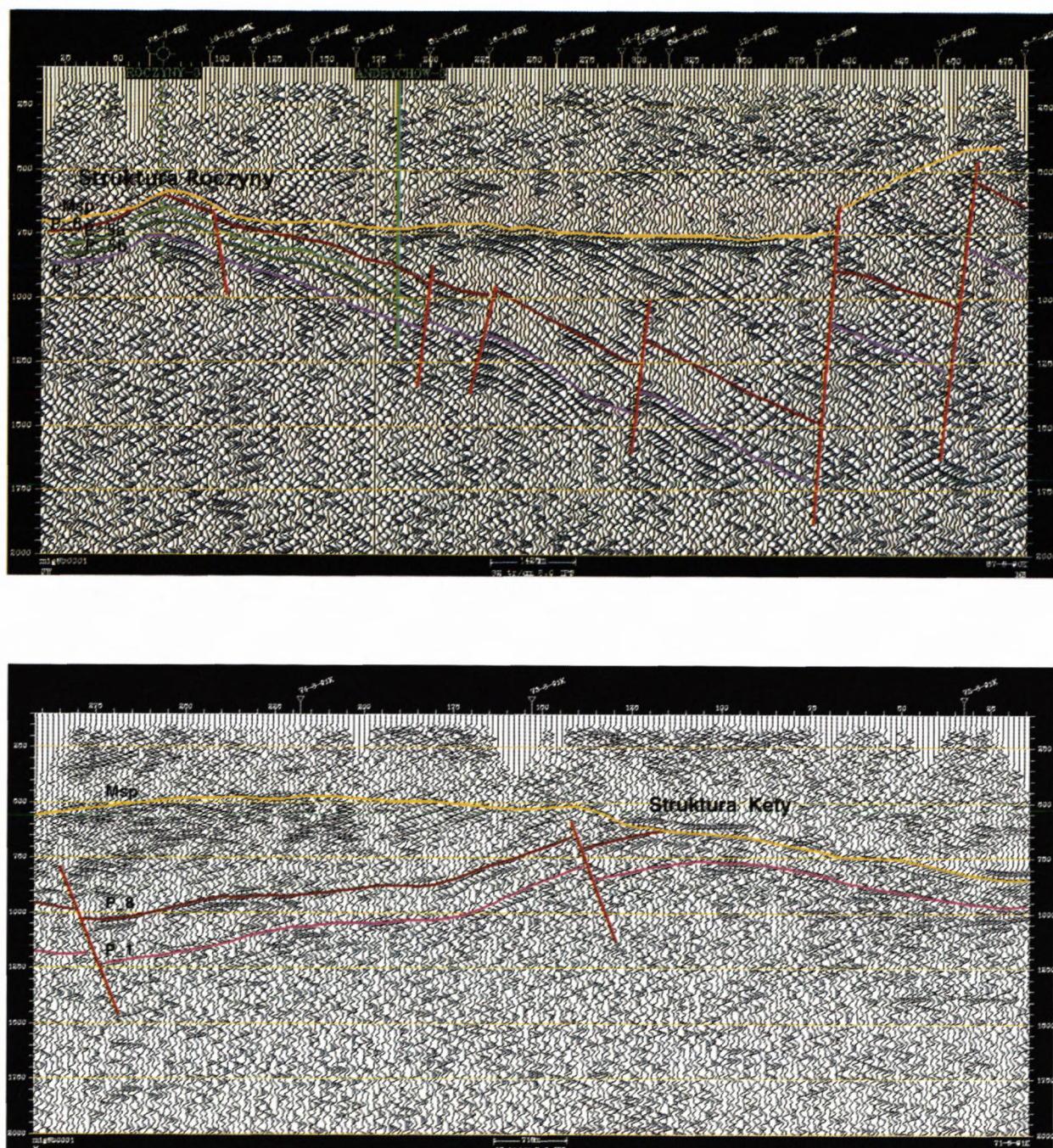


Fig. 6. Seismic line 71-8-9k (Kęty area)

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