WATER-BEARING CAPACITY OF THE ŚWIERKLANIEC BEDS IN BYTOM SYNCLINE AREA

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ABSTRACT

Water-bearing sands in Swierklaniec lower Triassic beds are deposited on Carboniferous foundation over the whole area of the Bytom syncline. Those strata have been a source of water hazards for coal mining in the vicinity of Carboniferous stratus. Water level in these formations lowered by several dozens meters due to longlasting mining drainage. At present only the lower parts of Świerklaniec beds possess water-bearing capacity. The area of water-bearing capacity includes the central part of the Bytom syncline, extending from the Bytom area to the Brynica river meridian.

The Bytom syncline is formed by syncline-shaped Carboniferous strata coated with also syncline-shaped Triassic strata (Drewniak, 1980, Pałys, Zajączkowski, 1964), lying in the western part of Upper Silesian Coal Basin. Triassic Bytom syncline constitute a separate hydrogeological structure (Rozkowski, Wilk, 1980). The syncline is about 40 km long. It extends from Gliwice in the west to Sosnowiec in the east and is on the average about 8 km wide (Fig. 1).

Carboniferous and Triassic Bytom syncline boundaries differ a little, nevertheless, owing to hydraulic connection of water-bearing formations in lower Triassic and Carboniferous strata, we can assume the same boundaries for both structures.

Triassic formations constitute the eastern and nort-eastern

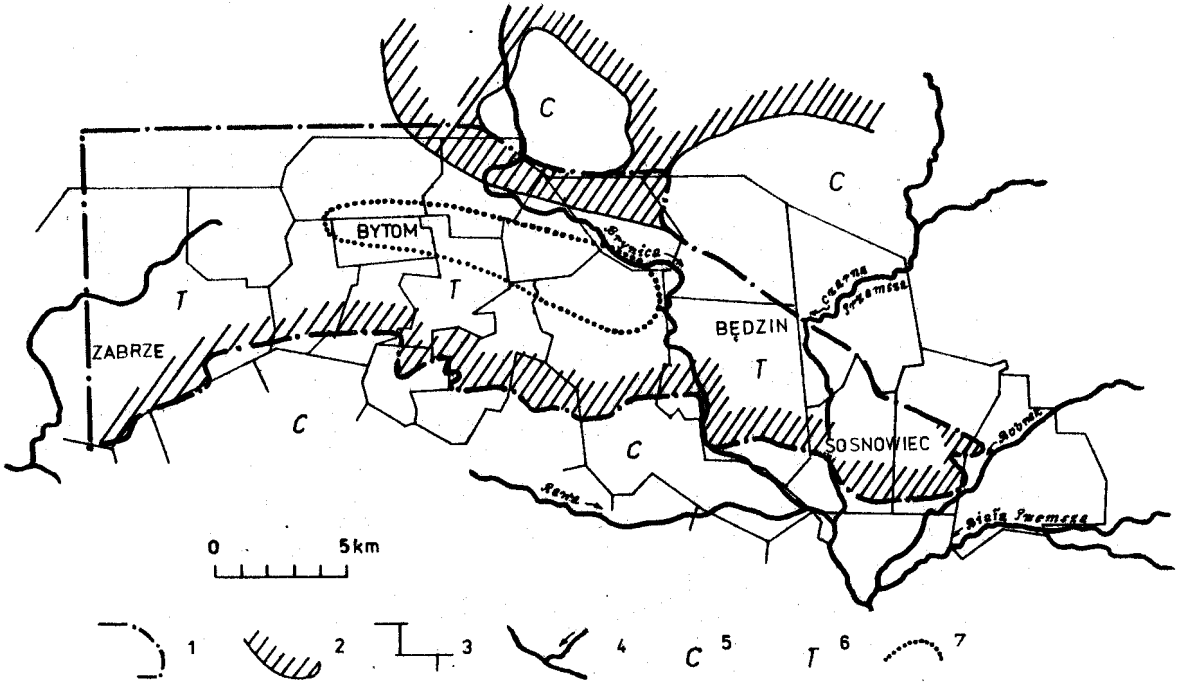

Fig. 1. Schematic map of the Bytom syncline
1 - Bytom syncline boundaries, 2 - the outcrop range of Świerklaniec beds, 3 - boundaries of mining areas of hard coal mines, 4 - rivers, 5 - Carboniferous formations, 6 - Triassic formations, 7 - the supposed range of water-bearing capacity of Świerklaniec beds

boundaries of the syncline, while the other boundaries are assumed by convention. Triassic Gliwice culmination is the western boundary, while the northern boundary runs along the Pyskowice parallel overcoming the northern boundaries of the coal mining area (Fig. 1).

Within the Bytom Triassic strata three distinct water-bearing levels can be separated : in Muschelkalk, in Röt and in lower variegated sandstone of the Świerklaniec beds. Stratygraphic location of the Świerklaniec beds is not clear due to the lack of faunistical documentation (Aleksandrowicz, Siedlecki, 1960). Probably this is a redeposited drift of degraded older foundation rocks (Lydka, 1956). Taking into account sedimentary gap between Carboniferous and Triassic in that area it can be assumed, that those formations are very likely to be of the lower Triassic.

The Świerklaniec beds are Triassic sea deposits basis and are deposited directly on Carboniferous roof.

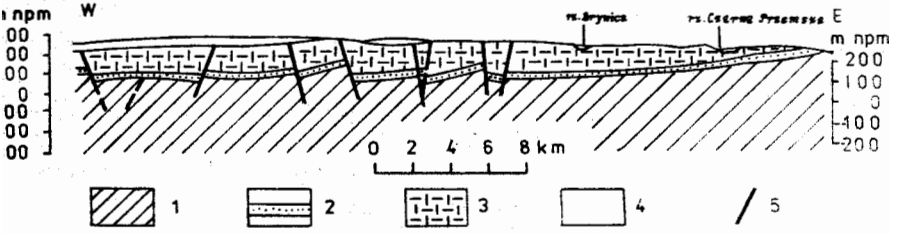

Fig. 2. Schematic geological longitudal section of the Bytom syncline
1 - Carboniferous formations, 2 - Świerklaniec beds, 3 - upper Triassic strata, 4 - Quaternary formations, 5 - faults

These strata exist under the form of sands and sometimes easily crumbling sandstones as well as variegated, red and green clays. The sands are usually fine sands and very often dust sands and tend to turn into quicksand due to the pressure of water accumulated in them. Water-bearing sands in Świerklaniec beds form a continous cover of the Bytom syncline area. Its thickness is fairly regular and amounts to several meters, very rarely reaching several dozens meters. The sands are deposited mostly on the

Carboniferous formation roof and together with it they constitute one common water-bearing level.

The clays, mentioned above, occur within the Świerklaniec beds and in cross-section they can be found in sand beds and in their floor under the form of lenses and patches of a small area. Mostly, however, those clays occur on the roof of water-bearing sands and together with the upper marl formations of the variegated sandstone form one common impermeable bed, insulating the level from the water-bearing Röt level above (Aleksandrowicz, Siedlecki, 1960).

Due to such a shape and due to syncline deposition of Świerklaniec beds in the Bytom trough, these strata formed in the past a pressure water reservoir with the pressures reaching 1.5 MPa in the central part of the syncline.

In the past, that level under natural conditions was supplied with precipitation water in the outcrop area. The surplus water flew out of that level directly to the Brynica and Przemsza rivers (including their tributaries), that at that time were of a draining character, or indirectly, through Quaternary overlay permeable formations. Since the changes of water characteristic on that level, resulting from the hard coal mining drainage, took place it has been also supplied with water from the rivers mentioned, infiltrating the outcrop area.

Hard coal mining in the Bytom syncline area started in the end of the previous century and from its very beginning water-bearing sands in Świerklaniec beds were subject to intensive drainage. In the beginning of the century, vanishing of water in wells, located in the outcrops of those beds was the first symptom of that process.

The main sources of the drainage were at first the mine shafts and headings of the mines located in the vicinity of Carboniferous roof and then the drill holes and probably also some of ground water intakes.

The drainage resulted from the infiltration through the permeable Carboniferous outcrops and fault areas as well as from direct quicksand and water penetration from the Świerklaniec beds into the mining headings.

After the world war IInd, in the course of the Bytom syncline coal mining exploatation, more than 20 penetrations (mainly by quicksand) have been observed. The intensity of those penetrations varied from 0.5 m^3/min. To about 15 m^3/min. The duration varied as well, being not lower, however than several months. The intensive water and quicksand inflows to the mines, from the underground investigation and drainage drill holes (from the workings to the Carboniferous roof), with the intensity on the average about 1 - 1.5 m^3/min have been also more numerous.

The hazard due to the quicksand from the water-bearing Świerklaniec beds penetration into mine headings depends on piezometric position of the water pressure surface on the level and the water-bearing capacity area in relation to the mine workings. In the years 1975 - 1977 several measurments have been made of the water stabilization level in the Świerklaniec beds (Nałęcki, 1986) in connection with the undertaken mining of coal deposited in the direct vicinity of Carboniferous roof in the bed 405. The analysis of the measurements shows, that he stabilization level is above + 110 m a.s.l., i.e. that it has not changed since the mid-sixties. It may prove, that the drainage of that level and its supply have reached the state of equilibrium.

As a result it can be seen, that owing to intensive and several dozens years continuing drainage of the Świerklaniec beds the water level of that horizon has lowered and it remains now more or less stable, including the lower parts of the beds.

As a result of significant unevenness of the floor of Świerklaniec beds local underground water reservoirs can be found locally within the beds, usually under low pressures. They are connected with each other or separated by the areasalready completely drained out.

Thus the horizontal water-bearing capacity area of the Świerklaniec beds includes nowadays only some sectors of the Bytom syncline, forming a narrow and irregular band from the area in the west of Bytom to the Brynica river meridian (Fig. 1). However, owing to the fact, that the water pressures in those beds are lo-

cally formed, depending on the local mining drainage intensity and of the precipitation and surface inflows supplies that area may differ a little from the one presented above. The explanation of that would require more numerous mesurements of the water level position in that bed on the whole area of the Bytom trough.

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