HYDROGEOLOGICAL CONDITIONS OF SMALL BROWN COAL STRATA DEPOSITION

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ABSTRACT

Overall characteristic of hydrogeological conditions of small and shallow brown coal deposition, suitable for small scale mining (for local needs only) is presented in this paper. Lithology of water-bearing strata and of the depth of strata as well as ground water level in the deposits area are analysed.

The term "small brown coal deposits" has been introduced in consequence of the recent investigation concerning the possibility of utilisation of the energy resources that so far have not been of the power engineering industry. Such resources, constituting a rather significant part of overall national resources, occur as numerous shallow deposits and are not extending over great areas. As "small" brown coal deposits we mean the deposits down to 20 m deep under the ground level with the maximal depth of strata to the depth of coal ratio not higher than 4:1, the overall resources of which are lower than the lower limit for industrial deposits, i.e. than 50 mln MG. Most of small deposits of brown coal amount to from several to a dozen or so mln MG. These deposits are subject to shallow mining, performed by local means and serve as a source of energy for local needs only.

Small brown coal deposits occur in boundary regions of coal-bearing Tertiary formations or in the areas of shallow depoci-

tion depending on local uphevals due to older foundation (Fig.1).

Hydrogeological analysis of small brown coal deposits was performed for the deposits in the regions of Opole, Konin, Radom, Bydgoszcz, Olsztyn and Przymorze (more than 30 deposits altogether). Glacitectonically dilluted strata in the parallel band in western Poland (from Lublin - Zgorzelec line in the South to Myślibórz - Dobiegniew line in the north) are treated as a separate group of deposits, hydrogeological conditions of that group being different (Fig. 1). Hydrogeological conditions play an im-

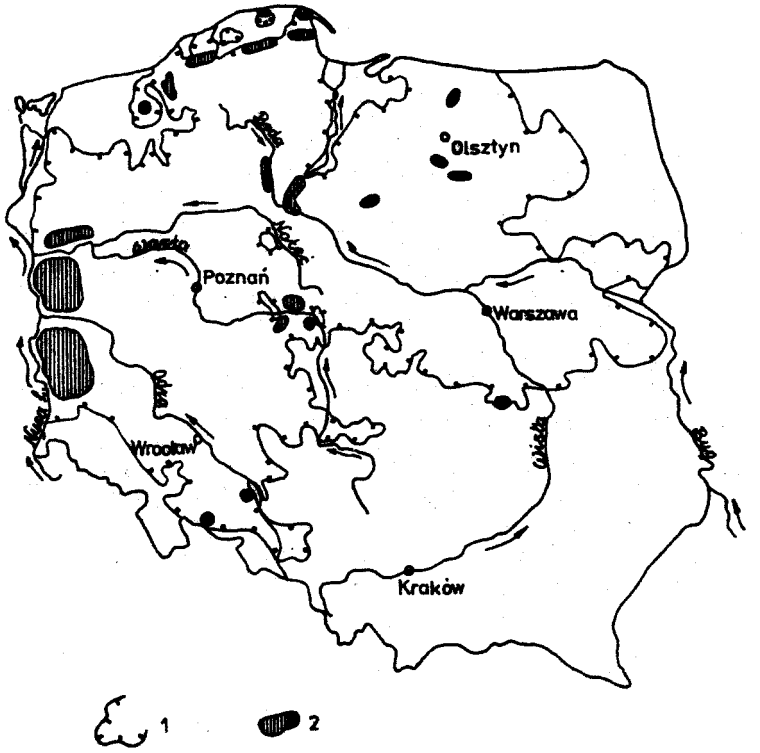

Fig.1. Distribution of shallow brown coal deposits.
1 - Tertiary formation boundary region,
2 - Shallow brown coal deposits area

portant role in the further coal-mining of small deposits, since they are decisive for the intensity of water inflow to the planned strip pits. Thus they will determine the accessibility of the deposits and the mining conditions as well as its worthwileness.

Water — bearing formation occurence in geological structure of particular strata and the form of its existance vary even within the same deposit. Thus they are characteristic of particular deposit being connected with the course of the local sedimentation and erosion proceses in Tertiary and Quartenary strata.

Water-bearing formations occur as regular, lenticular or isolated tabular strata. They may be located on the levels of various depth above the deposit in Quartenary overlay (water-bearing levels of the overlay), in Tertiary formations (the levels above the deposit) as well as under the deposit in vertical profile of the deposit (Fig. 2).

There are no water-bearing levels in the vicinity of some deposits (Fig. 3).

The lithology of the strata near the deposit (i.e., occurring in the deposit overlay and its nearest neighbourhood) plays the main role in formation of hydrogeological conditions. It is a decisive factor of water-bearing capacity of the strata, i.e. of their ability to accumulate and conduct water as well as of their filtration capacity, i.e. the quality of being water-permeable and easily filtrated off.

Loose and cohesive formations participate in geological structure of small brown coal deposits while water-bearing solid rocks exist in the deeper strata of coal-bearing formation foundation (Fig. 2 and 4).

Permeable and often water-bearing sands of various grain size distribution as well as impermeable and semipermeable boulder clays prevail in Quatenary overlay (Fig. 2, 4 and 5).

Water-bearing gravels (Fig. 4), dusts and poorly permeable silts and impermeable clays are found in the formations in smaller amounts.

Filtration coefficient for Quartenary formations varies significantly and ranges from $5 \cdot 10^{-7}$ m/s in some dust sands to 10^{-7}

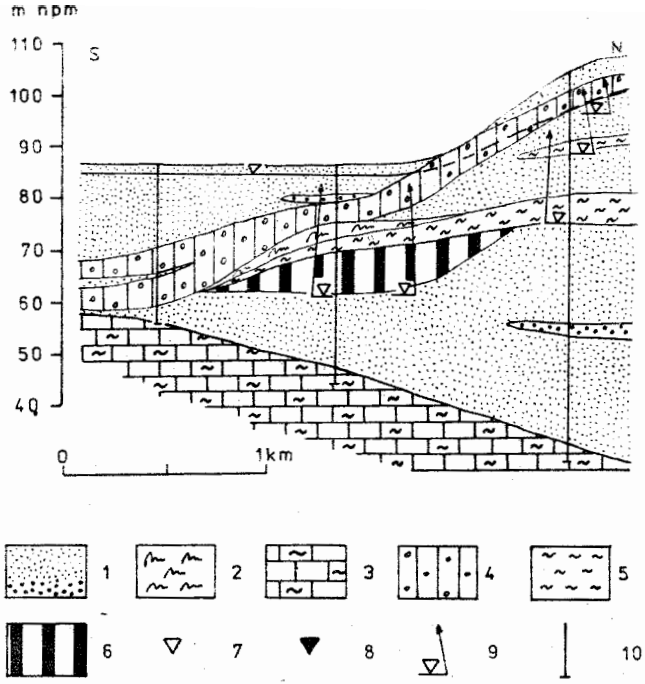

Fig. 2. Hydrogeological profile of the Drzewce deposit.
Water-bearing formations : 1 - sands and gravels, 2 - dusts, 3 - older strata of foundation ;
Impermeable formations : 4 - boulder clays, 5 - clays, 6 - brown coal, 7 - drilled water level, 8 - stabilized water level, 9 - drilled water level of unknown stabilization level, 10 - drill holes.

for gravels and averages to 10^{-1}m/s. The value of that coefficient for Tertiary sands (which are very often dust sands) averages to 10^{-5}m/s. (Nałęcki, Wilk, 83, 85). The thicknesses of water-bearing beds around small brown coal deposits are also small, mainly due to not a very deep strata deposition. They usually range from less than 1 meter within the overlay formations up to several meters (Fig. 5, 6) and are not thicker than a dozen or so (it is so for both : Quaternary and Tertiary formations). Mo-

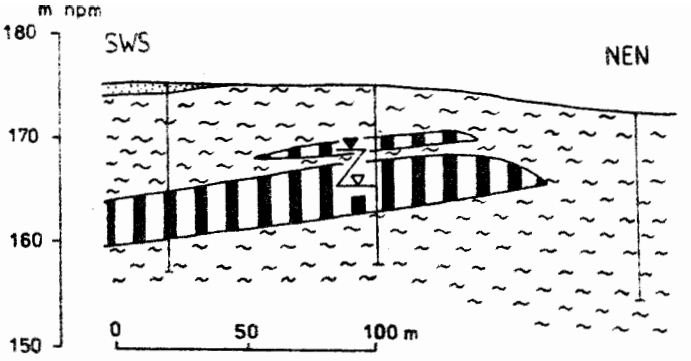

Fig. 3 . Hydrogeological profile of the Polska Nowa Wieś deposit segment
Legends as for Fig. 2.

reover, they may differ significantly from each other within the same deposit (Fig. 2 and 4).

Within Tertiary coal-bearing series poorly permeable dust sands and dusts as well as impermeable sitls and clays can be found (Fig. 2 and 6).

Ground water stabilisation levels in small brown coal deposits range from less than 1 meter in the areas of river valleys mostly to several meters (Fig. 2 and 3) and sometimes to a dozen or so under the ground level. The deepest (up to several dozens meters) ground water levels were found in some glacitectonically dilluted strata (Fig. 6).

The main reason of this is due to significant hypsometric differences between the hilltops formed by glacitectonic coal upheavals and the river valleys and water reservoirs around the hills, being a basis for natural drainage.

Water-bearing strata under deposits in the nearest vicinity of the coal bed may play an important role in formation of hydrogeological conditions around small brown coal deposits (Fig. 2

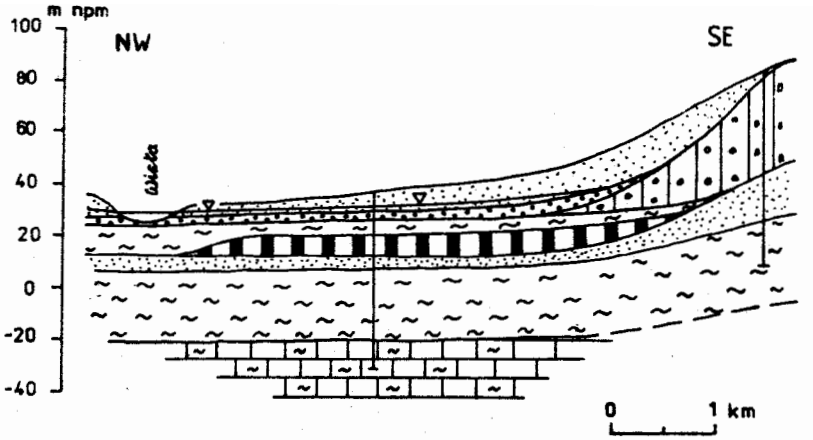

Fig. 4. Hydrogeological profile of the Słoncz-Czarze deposit. Legends as for Fig. 2.

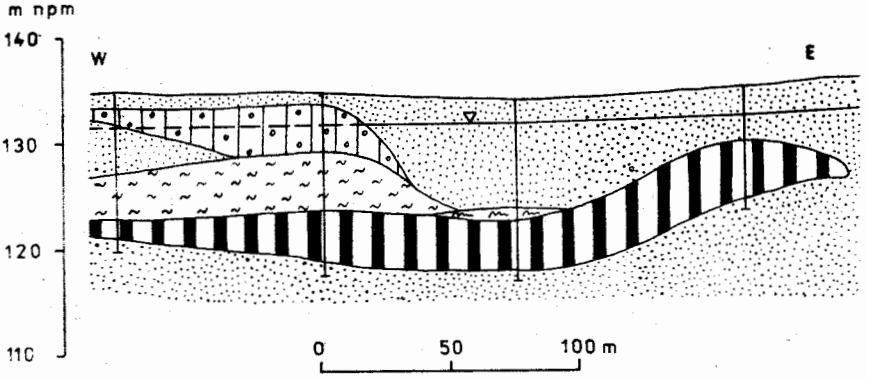

Fig. 5. Hydrogeological profile of eastern part of the Wola Owadowska deposit segment.
Legends as for Fig. 2

and 5). They are mainly of pressure character and the pressures of water accumulated in them are sometimes significantly high and may be a cause of water and quicksand hazards to open pit through its bottom. The levels under deposit, remaining in hydraulic contact with water-bearing and sometimes very rich in coal level of older formation are especially hazardous (Fig. 2).

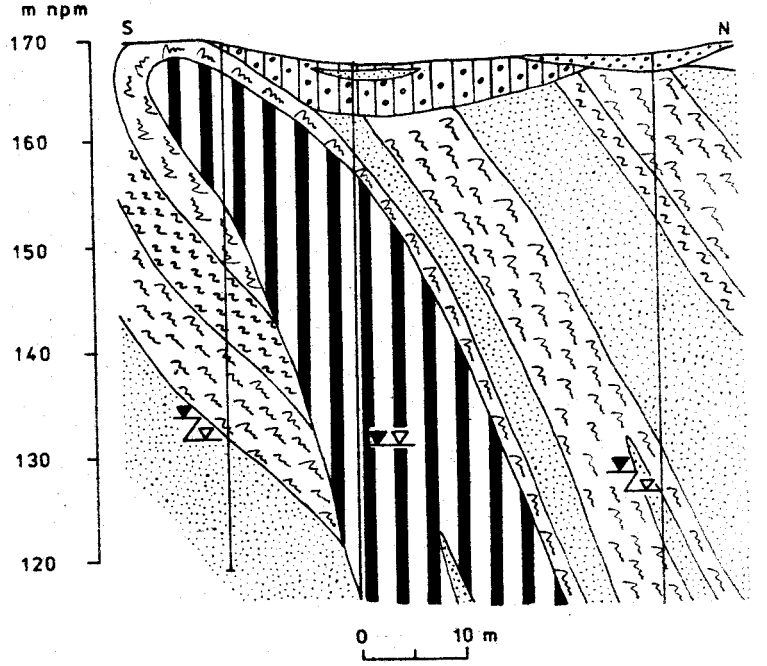

Fig. 6. Hydrogeological profile of a saddle in the west of the Sieniawa deposit.
Legends as for Fig. 2.

Water-bearing levels are supplied with water infiltrating from the rainfalls and surface waters, which is leading to the dynamic resources renovation and water pressure stabilisation in the level (Fig. 2, 4 and 5). The levels under the deposit may be al-

so supplied by infiltration (in the bed outcrops) and sometimes by ascending water form the lower water-bearing strata (Fig. 2).

As we can see from the analysis presented, hydrogeological conditions of small brown coal deposits occurence vary significantly sometimes even within the deposit given. Thus the hydrogeological conditions of small brown coal deposition are characteristic of the deposit and should be taken into account as a specific factor in the planned mining of the deposits, especially as the continuous drainage of the mined headings will be needed.

REFERENCES

Ciuk E., Piwocki M., 1983, Geological and mining aspects of the exploitation of small and shallow brown coal deposits for local needs, (in polish), Mat. III Konf. KGSM PAN, Kraków.

Nałęcki T., Wilk Z., 1983, The influence of hydrogeological conditions on mining of small brown coal deposits (in polish), Mat. III Konf. KGSM PAN, Kraków.

Nałęcki T., Wilk Z., 1985, Hydrogeological conditions of small lignite deposits in Poland (in polish), III Ogólnop. Symp. - Aktualne Problemy Geologii, Kraków.