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Petrological and facies characteristics of bituminous coal seam No. 111 from the Libiąż layers in the region of Dąb near Chrzanów (USCB)

Introduction

In the years 2009–2012, the Południowy Koncern Węglowy SA drilled over 20 boreholes in the eastern part of the USCB near the village of Dąb between the "Sobieski" and "Janina" mining plants. The new boreholes enabled a detailed exploration of the profile of the Kraków sandstone series consisting of the Łaziska and Libiąż layers and the Kwaczała layers (without coal). The youngest Carboniferous formations in the USCB, including the Libiąż coal-bearing layers, are interesting from the scientific and practical point of view.

The aim of this paper is to expand the knowledge on the structure of bituminous coal seams on the basis of the examination of seam profiles from the Dąb area located in the eastern part of the largest Polish basin – the Upper Silesian Coal Basin. For this purpose, an innovative macroscopic and microscopic approach to the analysis of bituminous coal was

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used. As a result, a very detailed description of the vertical variability of coal seam No. 111 was obtained. This allows both the lithological succession and facies changes to be analyzed. The use of facies indexes also allowed the type of environment in which individual sections of the profile corresponding to lithotypes were formed to be determined.

1. Research area

The research area is located on the border of the Lesser Poland and Silesian provinces. The geological structure of the deposit includes the following stratigraphic units: Quaternary, Tertiary, Triassic (forming overburden) and the Upper Carboniferous productive series. From a geological point of view, the area of the "Dąb" deposit is located in the eastern part of the USCBn (Fig. 1.) in the western wing of the Wilkoszyn basin located in the northern part of the main basin. The Libiąż layers in this region are in the form of thick sandstone and conglomerate layers with mudstones and claystones interbedded with coal seams 111 to 119/2. The minimum thickness of the Libiąż layers is 110 m in the western part of

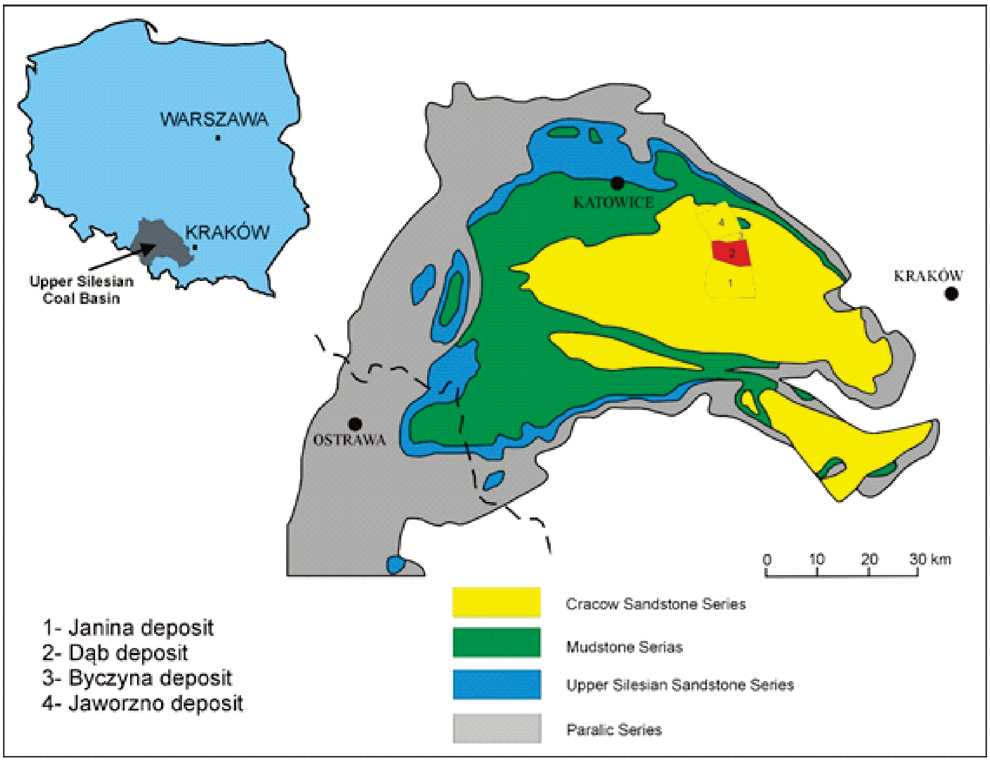

Fig. 1. Location of the research area in the USCB (after Jureczka et al. 1995)

Rys. 1. Lokalizacja rejonu badań na terenie GZW the deposit and increases in a south-eastern direction where it reaches 500 m (Dembowski 1972). The dip angle of the layers does not exceed a few to several degrees. The entire area is cut by numerous faults with throws reaching 280 m.

2. Research material and methodology

The examined core obtained from the No. 111 seam, with a length of 116.8 cm, was divided into sections with a length of several centimeters. After curing with adhesive, the samples were ground and polished.

A petrographic analysis of the coal was carried out in reflected and blue light using a Zeiss Axioskop polarization microscope. A 50× magnification lens was used for the observation. A qualitative and quantitative petrographic analysis was performed based on the classification of macerals and microlithotypes of bituminous coal (Diessel 1992).

The measurement methodology was adapted to the planned facies analysis based on parallel petrographic studies based on standard methods using the point counter and the microprofiling of the seam (Misiak 2011). A petrographic examination was performed in both reflected white and blue light using a microscope according to the PN-ISO 7404-3:2001 standard. Maceral nomenclature for the vitrinite and inertinite maceral groups is based on the guidelines of the International Committee for Coal and Organic Petrology (ICCP 1998, 2001; Stach et al. 1982). Maceral nomenclature for the liptinite group is based on (Pickel et al. 2017). The maceral group content analysis was performed with the use of 500 equally spaced points on the surface of the polished sections. These studies were supplemented with a “microprofile” or the seam profile made with the use of a microscope (Misiak 2011). For this purpose, the size of the 20-point grid used in a standard microlithotype analysis was increased 10 times to the dimensions of 500 × 500 μm, which corresponds to the diameter of the field of view (FOV) (Hudspith et al. 2012). For these intervals, based on the maceral content, appropriate microlithotypes were assigned. The determined microlithotypes were entered into a computer database according to their location in the profile. This allows the 1:1 scale graphical interpretation based on a microlithotype profile to be developed. A total of 13 associations of macerals were determined, mostly in accordance with the defined microlithotypes (Stach et al. 1982). The selected microlithotypes were differentiated for the purposes of this paper. In the case of vitrain, the structural telo-vitrite and unstructured – detro-gel-vitrite were determined (Table 1). Depending on the vitrinite, inertinite, and liptinite content, the following variants were distinguished in bimaceral microlithotypes: vitrinitic vitrinertite dominated by vitrinite and inertititic vitrinertite dominated by inertinite and respectively: vitrinitic clarite and liptinitic clarite, and inertitic durite and liptinitic durite.

Numerical values, such as: the frequency of macerals and microlithotypes and GI and TPI (Diesel 1982) facies indexes GI and TPI (used for the comparison of coal seams) were also determined.

(Gelification Index) GI = (vitrinite + macrinite)/(fusinite + semifusinite + inertodetrinite)

(Tissue Preservation Index) TPI =
= (telovitrinite + fusinite + semifusinite) / (detrovitrinite + macrinite + inertodetrinite).

3. Research results and discussion

In order to determine the macroscopic variability of the bituminous coal seam, a lithological description based on the separation of lithotypes according to Diessel (1992) has been used. 30 intervals corresponding to the defined lithotypes were separated in the seam No. 111 with a thickness of 116.8 cm. The thickness of lithotypes is in the range from 10 to 89 mm. The share of individual lithotypes (Table 1) in the profile of the coal seam No. 111 is as follows: bright coal (B) – 4.4%, banded bright coal (BB) – 21.0%, banded coal (BC) – 39.3%, banded dull coal (BD) – 17.9%, dull coal (D) – 17.3%.

A microprofile of the examined seam was made using the modified method of determining microlithotypes The microlithotypes identified during microscopic observations are entered into a computer database according to their location in the profile. This allowed for a later graphic interpretation – determining the microlithotype profile (Fig. 2).

A quantitative determination of maceral composition was performed for each interval corresponding to the separated lithotypes (Table 2). Macerals of the vitrinite group have the largest share in the petrographic composition; their share in individual lithotypes ranges from 5.5 to 96.2%, while in the whole seam it amounts to 69.7%. These macerals have the largest share in bright coal (B), banded bright coal (BB) and banded coal (BC) lithotypes, while their content is smaller in banded dull coal (BD) and dull coal (D) lithotypes. The share of macerals of the inertinite group is lower and ranges from 1.3 to 94.2% in individual lithotypes while is 22.1% in the whole seam. These macerals have the largest share in lithotypes with lower content of vitrinite macerals. Macerals of the liptinite group have the smallest share among individual lithotypes (from 0.3 to 34.7%), and in the whole seam (8.2%). Their share in the seam is very irregular and difficult to assign to specific lithotypes.

In order to determine the coal sedimentation environment in the paleo-peat bog of the No. 111 seam, Diesel's Facies Index (1982), Gelification Index (GI), and Tissue Preservation Index (TPI) were calculated. The obtained values on the diagram (Fig. 3) allow changes in the conditions prevailing in the paleo-peat bog during the formation of the discussed seam to be analyzed (Diessel 1982). The lower section of the profile, including lithotypes 29 to 20 (excluding specimens marked as lithotypes 30 and 28 which were formed under swamp forest conditions) was formed under wet forest swamp conditions – a forest type peat bog with high water level dominated by woody plants (telmatic perennials during the Carboniferous period). The next section of the profile including lithotypes 19 to 2 (except for sections

Table 1. Bituminous coal lithotypes and environments (after Diessel 1992) in the seam No. 111

Tabela 1. Litotypy węgla kamiennego oraz środowiska sedementacji w pokładzie nr 111

Lithotype	Symbol	From (cm)	To [cm]	Thickness [cm]	TPI	GI	Environment
1	D	0	1	1.0	0.2	1.3	RM
2	BC	1	4	3.0	0.8	3.8	SF
3	D	4	5.25	1.25	0.5	1.1	SF
4	BD	5.25	7	1.75	0.5	5.9	SF
5	BB	7	9	2.0	0.9	6.1	SF
6	BD	9	12.3	3.3	0.6	4.0	SF
7	BB	12.3	14.5	2.2	1.5	13.6	WFS
8	D	14.5	16.5	2.0	0.4	2.9	SF
9	BB	16.5	18.5	2.0	1.5	4.2	WFS
10	D	18.5	19.5	1.0	0.7	2.9	SF
11	BD	19.5	24.4	4.9	1.0	4.0	SF
12	BC	24.4	32.3	7.9	1.2	7.0	WFS
13	D	32.3	33.3	1.0	0.7	4.0	SF
14	BC	33.3	41.5	8.2	0.9	4.1	SF
15	D	41.5	46.5	5.0	0.6	1.2	SF
16	BC	46.5	50.5	4.0	0.6	7.4	SF
17	D	50.5	56	5.5	0.6	1.2	SF
18	BB	56	59.2	3.2	1.5	7.9	WFS
19	BC	59.2	63	3.8	0.8	3.5	SF
20	BB	63	66.6	3.6	3.5	10.4	WFS
21	BC	82.6	91.5	8.9	1.7	21.1	WFS
22	BD	91.5	95.7	4.2	0.8	7.3	SF
23	BB	95.7	99.7	4.0	1.2	83.9	WFS
24	B	99.7	101.7	2.0	2.9	89.2	WFS
25	BD	101.7	104.6	2.9	1.4	4.1	WFS
26	D	104.6	106.2	1.6	17.3	0.1	WFS
27	BC	106.2	111.1	4.9	2.4	8.8	WFS
28	BD	111.1	113	1.9	0.9	6.2	SF
29	B	113	115.7	2.7	2.4	7.5	WFS
30	BC	115.7	116.7	1.0	0.5	2.2	SF

B – Bright coal less than 10% dull laminae, BB – Banded bright coal 10–40% dull laminae, BC – Banded coal dull and bright laminae in equal proportions, BD – Banded dull coal 10–40% bright laminae, D – Dull coal less than 10% bright laminae, RM – Reed Moor, SF – Swamp Forest, WFS – Wet Forest Swamp.

marked as lithotypes 12, 9, and 7, which were formed under wet forest swamp conditions) was formed under swamp forest conditions – mixed peat bog overgrown with herbaceous and woody plants with a high water level. The last stage of seam formation (lithotype 1) took part under reed moor-like conditions – peat bog deriving from reeds, usually with deep water cover inhabited and herbaceous plants.

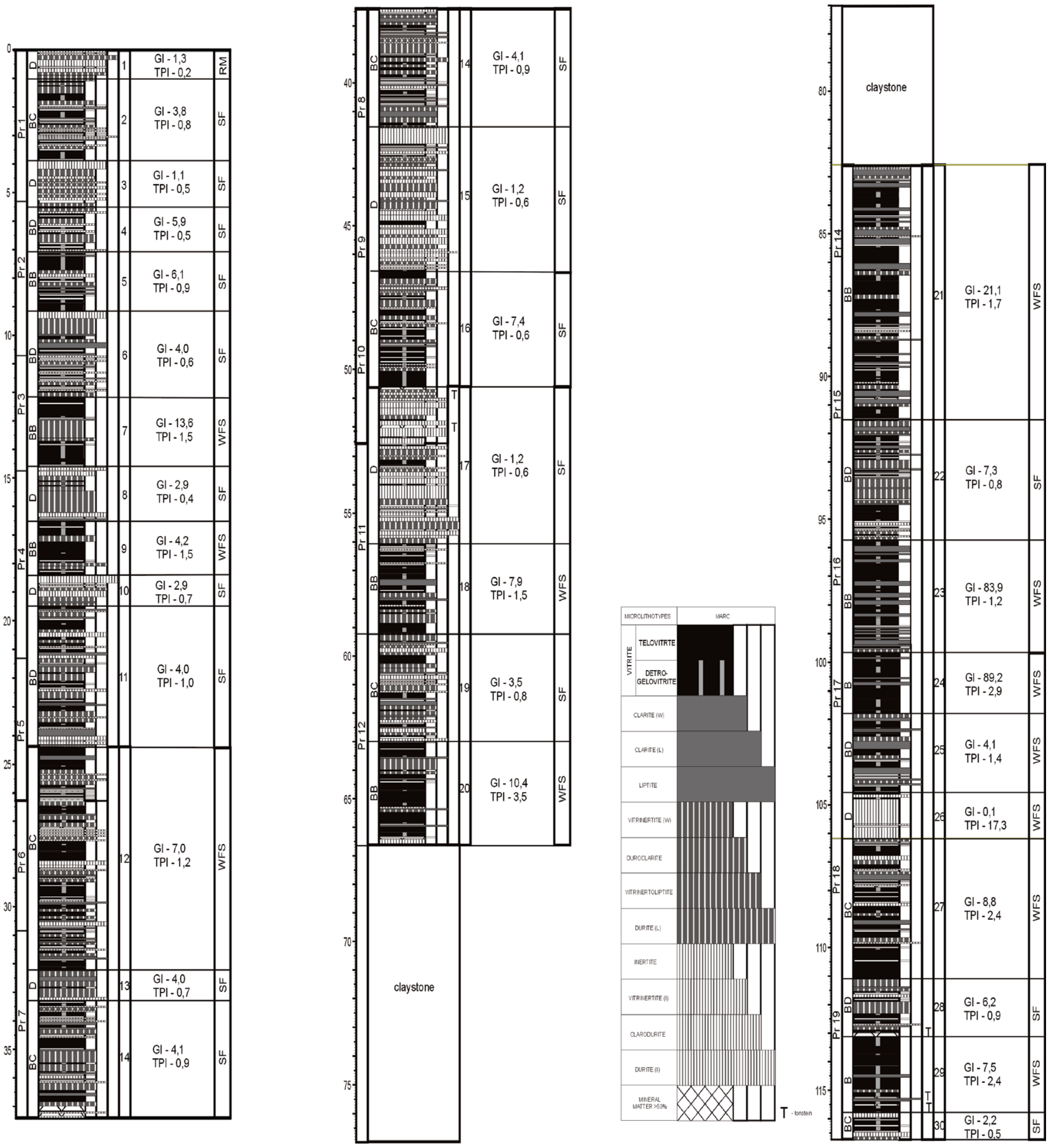

Fig. 2. Lithological profile and microprofile of the No. 111 coal seam with facies interpretation

Rys. 2. Profil litologiczny i mikroprofil pokładu węgla 111 z interpretacją facjalną

Table 2. Petrographic characteristics of bituminous coal lithotypes in the seam No. 111

Tabela 2. Charakterystyka petrograficzna litotypów węgla kamiennego w pokładzie nr 111

Lithotype No.	Vitrinite						Liptinite					Inertinite							Total		
	telinite	colotelinite	colodetrinite	vitrodetrinite	corpogelinite	gelinite	microsporinite	macrosporinite	cutinite	resinite	liptodetrinite	fusinite	semifusinite	macrinite	micrinite	funginite	secretinite	inertodetrinite	vitrinite	liptinite	inertinite
1	0.0	1.5	23.3	0.0	0.0	0.9	2.0	32.7	0.0	0.0	0.0	0.3	9.5	10.0	0.1	1.7	0.2	18.0	25.7	34.7	39.7
2	0.0	26.3	44.1	0.0	0.0	0.0	1.1	6.0	0.0	0.1	0.0	7.3	5.5	1.4	0.1	2.1	0.1	6.1	70.4	7.2	22.5
3	0.0	1.2	37.1	0.0	0.0	0.0	2.2	17.6	0.0	0.0	0.0	13.3	10.3	1.4	0.4	2.4	0.2	13.8	38.3	19.8	41.9
4	2.9	19.2	54.6	0.0	0.0	0.0	0.1	7.4	0.4	0.0	0.0	3.7	3.6	0.0	0.1	2.2	0.0	5.7	76.7	8.0	15.3
5	0.0	34.6	43.4	0.0	0.0	0.0	1.1	5.8	0.0	0.0	0.0	3.6	5.7	0.5	0.1	1.6	0.0	3.6	78.0	6.9	15.1
6	0.0	20.0	50.5	0.1	0.0	0.0	1.0	8.1	0.1	0.0	0.0	4.9	6.9	0.4	0.1	2.1	0.1	5.9	70.6	9.1	20.3
7	0.7	51.7	33.5	0.0	0.1	0.0	0.9	4.9	0.0	0.0	0.0	0.7	2.9	0.1	0.0	1.7	0.0	2.7	86.0	5.8	8.2
8	0.0	12.8	52.6	0.0	0.0	0.3	0.2	7.7	0.0	0.0	0.0	5.1	9.7	1.1	0.3	1.5	0.2	8.6	65.7	7.9	26.4
9	0.0	42.5	26.8	0.0	0.0	0.8	0.9	9.2	0.0	0.0	0.0	2.0	7.9	1.2	0.1	1.5	0.0	7.1	70.2	10.2	19.7
10	0.0	21.9	39.1	0.0	0.0	0.0	1.5	13.3	0.0	0.0	0.0	5.5	7.3	0.9	0.4	1.5	0.1	8.7	61.0	14.8	24.3
11	2.0	31.4	39.5	0.0	0.1	0.1	1.2	5.3	0.0	0.0	0.0	5.9	7.3	0.3	0.1	1.5	0.1	5.3	73.1	6.5	20.4
12	1.4	40.5	38.0	0.0	0.0	0.1	1.0	6.0	0.0	0.0	0.0	4.7	2.5	0.2	0.1	1.1	0.0	4.3	80.0	7.0	13.0
13	0.0	26.0	46.0	0.0	0.0	0.0	0.6	6.4	0.0	0.0	0.0	5.6	5.6	0.0	0.0	3.2	0.0	6.8	72.0	7.0	21.1
14	2.5	26.7	38.7	0.0	0.0	0.3	2.6	9.1	0.0	0.1	0.0	6.2	5.6	0.4	0.1	2.3	0.0	5.0	68.3	11.9	19.8
15	0.0	3.8	39.0	0.0	0.0	1.2	0.0	8.0	0.0	0.0	0.0	15.1	12.3	3.1	0.2	4.6	0.2	12.7	44.0	8.0	48.0
16	0.0	29.7	49.1	0.0	0.8	0.2	0.4	4.6	0.0	0.0	0.0	2.6	2.5	0.6	0.1	3.5	0.1	5.8	79.9	5.0	15.1
17	0.0	9.9	25.1	0.0	0.3	0.7	0.2	19.3	0.0	0.0	0.0	3.8	14.0	5.8	0.1	2.4	0.1	18.3	36.0	19.6	44.5
18	6.7	43.2	33.7	0.0	0.0	0.0	1.1	4.0	0.0	0.0	0.0	3.3	3.8	0.1	0.1	0.6	0.0	3.5	83.6	5.1	11.3
19	1.3	25.2	43.1	0.1	0.1	0.1	1.3	5.5	0.1	0.0	0.0	10.6	4.1	0.7	0.2	2.3	0.1	5.4	69.8	6.8	23.3
20	0.0	68.3	19.9	0.0	0.0	0.0	0.1	2.5	0.0	0.0	0.0	6.4	0.7	0.0	0.0	0.6	0.1	1.4	88.1	2.6	9.2
21	8.2	48.4	34.6	0.0	0.1	0.0	0.3	3.0	0.2	0.0	0.0	2.4	0.8	0.1	0.1	0.7	0.0	1.2	91.3	3.5	5.2
22	3.6	29.2	46.6	0.5	0.0	0.1	0.4	7.4	0.0	0.0	0.0	4.5	2.6	0.1	0.2	1.0	0.0	3.8	79.9	7.8	12.3
23	6.8	45.1	42.1	0.0	0.1	0.0	1.0	3.5	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.1	0.0	0.9	94.1	4.6	1.3
24	0.0	72.2	24.0	0.0	0.0	0.0	0.2	2.2	0.1	0.0	0.0	0.3	0.0	0.0	0.0	0.2	0.0	0.8	96.2	2.5	1.3
25	0.0	38.0	36.7	0.0	0.7	0.0	2.3	2.8	0.2	0.0	0.0	16.7	0.4	0.1	0.1	0.4	0.0	1.4	75.4	5.4	19.2
26	0.0	0.0	5.5	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	83.1	11.2	0.0	0.0	0.0	0.0	0.0	5.5	0.3	94.2
27	9.6	49.9	23.4	0.9	0.5	0.0	0.2	4.8	0.1	0.0	0.0	3.5	3.1	0.0	0.1	0.8	0.0	2.9	84.3	5.2	10.5
28	6.7	24.9	36.4	3.3	6.3	0.0	0.0	9.1	0.1	0.1	0.0	5.0	2.5	0.0	0.0	0.7	0.0	5.0	77.6	9.3	13.1
29	5.9	49.2	20.9	6.7	4.2	0.0	1.0	0.4	0.0	0.0	0.0	7.5	3.7	0.0	0.0	0.1	0.0	0.3	86.9	1.4	11.7
30	0.0	6.1	40.6	6.7	9.8	0.0	1.2	0.6	0.2	0.0	0.0	8.2	12.0	0.0	0.0	5.9	0.0	8.6	63.3	2.0	34.7

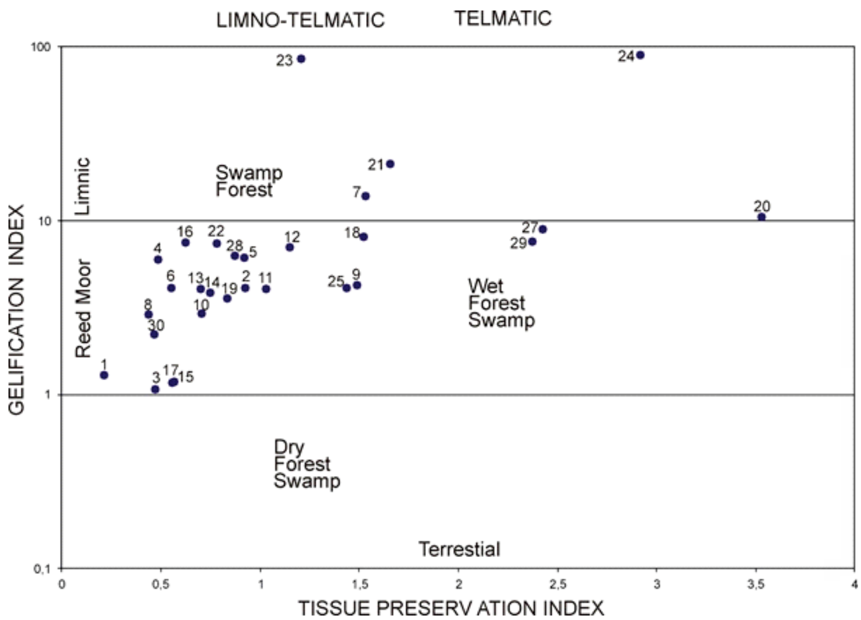

Fig. 3. Facies diagram (Diessel 1986) of the seam No. 111

Fig. 3. Diagram facjalny pokładu 111

Conclusions

The research methodology presented above enables a detailed description of petrographic variability in the profile of the coal seam. In particular, it allows the variability of dull coal (durain) can be described, the sections of which occurring in the seam, although macroscopically similar or almost identical, can have a very different petrographic composition (Misiak 2017). The sequence of consecutive microfacies illustrates both the petrographic and facies variability. Its lower part is dominated by lithotypes with a large share of bright coal – vitrain. This section of the profile was formed under conditions of a strongly flooded wet forest swamp. In the upper section of the seam, a higher macroscopic share of dull coal – durain has been observed. The microscopic analysis has shown that the conditions dominant during the formation of this section were typical for swamp forest peats.

Currently, a number of coal-based technologies, taking the situation on the fuel market and environmental protection into account, are being developed. Examples include: the underground gasification of coal, production of liquid fuels from coal, extraction of methane from coal seams and surrounding rocks, and CO_2 storage in unexploited coal seams (combined with methane extraction) (Dubiński and Koteras 2014). New technologies also require expanding knowledge about the structure of coal seams. This is only possible with a detailed profiling of the coal seam on a macro scale combined with micro-profiling and a detailed petrographic description of the isolated lithotypes. This methodology is also useful in the facies analysis of bituminous coal seams.

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REFERENCES

Dembowski, Z. 1972. Cracow sandstone series of the Upper Silesian Coal Basin (*Krakowska seria piaskowcowa Górnośląskiego Zagłębia Węglowego*). *Prace Instytutu Geologicznego* 61, pp. 509–534 (*in Polish*).

Diessel, C.F.K. 1982. An appraisal of coal facies based upon maceral characteristicks. *Symp. proc., Geol. Soc. Australia Inc., Coal Group*. 4, pp. 474–483.

Diessel, C.F.K. 1992. *Coal-Bearing Depossitional Systems*. Berlin: Springer-Verlag, 721 pp.

Dubiński, J. and Koteras, A. 2014. Current status and development trends of underground coal gasification technology in a global context (*Obecny stan i kierunki rozwoju technologii podziemnego zgazowania węgla w świecie*). *Przegląd górniczy* 11(70), pp. 5–12 (*in Polish*).

Hudspith et al. 2012 – Hudspith, V., Scott, A.C., ME Collinson, M.E., Pronina, N. and Beeley, T. 2012. Evaluating the extent to which wildfire history can be interpreted from inertinite distribution in coal pillars: An example from the Late Permian, Kuznetsk Basin, Russia. *International Journal of Coal Geology* 89, pp. 13–25.

ICCP 1998. The new vitrinite classification (ICCP System 1994). *Fuel* 77, pp. 349–358.

ICCP 2001. The new inertinite classification (ICCP System 1994). *Fuel* 80, pp. 459–471

Jureczka et al. 1995 – Jureczka, J., Aust, J., Buła, Z., Dopita, M. and Zdanowski, A. 1995. *Mapa Geologiczna Górnośląskiego Zagłębia Węglowego (odkryta po karbon),* skala 1:200000, Warszawa: PIG.

Misiak, J. 2011. Microlithotype profile of the coal seam no. 116/2 (Libiąż Beds) with facial interpretation – ZG Janina (USCB) (*Mikrolitotypowy profil pokładu węgla kamiennego 116/2 (warstwy libiąskie) oraz jego interpretacja facjalna – ZG„Janina" (GZW)*). *Gospodarka Surowcami Mineralnymi – Mineral Resources Management* 27(2), pp. 5–15 (*in Polish*).

Misiak, J. 2017. Petrographic composition and forms of bituminous coal lithotypes in the Upper Carboniferous Formations of the Upper Silesian Coal Basin (*Skład petrograficzny i formy litotypów węgla kamiennego w utworach karbonu górnego Górnośląskiego Zagłębia Węglowego*). *Gospodarka Surowcami Mineralnymi – Mineral Resources Management* 33(3), pp. 109–120 (*in Polish*).

Pickel et al. 2017 – Pickel, W., Kus, J., Flores, D., Kalaitzidis, S., Christanis, K., Cardott, B.J., Misz-Kennan, M., Rodrigues, S., Hentschel, A., Hamor-Vido, A., Crosdale, P. and Wagner, N. 2017. Classification of liptinite – ICCP System 1994. *International Journal of Coal Geology* 169, pp. 40–61.

Stach et al. 1982 – Stach, E., Mackowsky, M.Th., Teichmüller, M., Taylor, G.H., Chandra, D. and Teichmüller, R. 1982. *Stach's Textbook of Coal Petrology*. Stuttgart: GebrüderBorntraeger, 428 pp.

PETROLOGICAL AND FACIES CHARACTERISTICS OF BITUMINOUS COAL SEAM NO. 111 FROM THE LIBIĄŻ LAYERS IN THE REGION OF DĄB NEAR CHRZANÓW (USCB)

K e y w o r d s

bituminous coal, lithology, petrology, facies, depositional environment

A b s t r a c t

The new boreholes drilled between 2009 and 2012 enabled a detailed exploration of the profile of the Kraków sandstone series in the Dąb area between the "Sobieski" and "Janina" mining plants, USCB (Upper Silesian Coal Basin). The core from the No. 111. bituminous coal seam was selected for further analysis. 30 intervals corresponding to the defined lithotypes were separated in the seam with a thickness of 116.8 cm. The thickness of lithotypes ranges from 10 mm to 89 mm. A microprofile of the examined seam was made using the modified method of determining microlithotypes. A quantitative determination of the maceral composition was performed for each interval corresponding to the separated lithotypes. This allowed petrographic and facies characteristics of the seam to be determined. Its lower part is dominated by lithotypes with a large share of bright coal – vitrain coal. This section of the profile was formed under conditions of a strongly flooded wet forest swamp. In the upper section of the seam, a higher macroscopic share of dull coal – durain was observed. The microscopic analysis has shown that the conditions dominant during the formation of this section were typical for swamp forest peats. New technologies also require expanding knowledge about the structure of coal seams. This is only possible with a detailed profiling of the coal seam on a macro scale combined with micro-profiling and a detailed petrographic description of the isolated lithotypes. This methodology is also useful in the facies analysis of bituminous coal seams.

CHARAKTERYSTYKA PETROLOGICZNA I FACJALNA POKŁADU WĘGLA KAMIENNEGO 111 Z WARSTW LIBIĄSKICH W REJONIE DĘBU KOŁO CHRZANOWA (GZW)

S ł o w a k l u c z o w e

węgiel bitumiczny, litologia, petrologia, fasety, środowisko osadzania

S t r e s z c z e n i e

Nowe odwierty w latach 2009–2012 rozpoznały szczegółowo profil utworów krakowskiej serii piaskowcowej w rejonie miejscowość Dąb pomiędzy granicami zakładów górniczych Sobieski i Janina, GZW. Z nawierconych pokładów węgla do dalszych badań pobrano rdzeń pokładu węgla Kamiennego 111. W pokładzie o miąższości 116,8 cm wydzielono 30 interwałów odpowiadających zdefiniowanym litotypom. Miąższość litotypów waha się w przedziale od 10 do 89 mm. Za pomocą zmodyfikowanej metody wydzielania mikrolitotypów wykonano mikroprofil badanego pokładu pokładu. Dla każdego interwału odpowiadającego wydzielonym litotypom wykonano oznaczenie ilościowe składu macerałowego. Pozwoliło to na charakterystykę petrograficzną, jak i facjalną pokładu.

Dolna jego część zdominowana jest przez litotypy mające duży udział węgla błyszczącego – witrynu. Ten odcinek profilu tworzył się w warunkach torfowiska silnie podtopionego typu Wet Foret Swamp. W odcinku górnym pokładu zaobserwowano makroskopowo większy udział węgla matowego – durynu. Badania mikroskopowe wskazują, że podczas tworzenia się tego odcinka dominowały warunki wskazujące na torfowisko typu *Swamp Forest*. Nowe technologie przetwarzania węgla wymagają również poszerzenia wiedzy na temat budowy pokładów węgla. Jest to możliwe tylko dzięki szczegółowemu profilowaniu pokładu węgla w skali makro w połączeniu z mikroprofilowaniem i szczegółowym petrograficznym opisem wydzielonych litotypów.