JÓZEF PORZYCKI

Instytut Geologiczny

ON THE NATURE OF COAL-BEARING ASSOCIATIONS OF THE LUBLIN COAL BASIN

UKD 551.735.02:551.242.1(438.14)

From the point of view of geological structure, The Lublin Coal Basin in related to a gently asymmetric depression developed in a zone of pericratonic downwarp of the pre-Vendian Platform margin. The basin is situated at the contact of two major geological units: the pre-Vendian East-European Platform and Paleozoic central-European Platform (7). In the south and south-east, it directly contacts the Małopolska Massif, consolidated in result of Baikalian movements. The Lublin Coal Basin originated due movements downwarping marginal part of the East-European Platform, i.e. as a pericratonic depression situated far from the Variscan orogen. A marked differentiation of basement of its Upper Paleozoic cover exorted decisive influence on development of its structure.

Unequal subsidence and strike-slip movements of major geological units, i.e. pre-Vendian and Paleozoic platforms and Małopolska Massif (2), determined evolution of the Carboniferous sedimentary basin, its form and symmetry, migration of axes and rates and magnitude of subsidence. The origin of the Carboniferous sedimentary basin with axis almost parallel to margin of uplifted part of the pre-Vendian Platform was due to the same subsiding movements along its whole length, and Carboniferous sediments infilling the basin accumulated under fairly similar paleotectonic and paleogeographic conditions.

In the Lublin Coal Basin the Carboniferous rests on various members of the Devonian, Lower Paleozoic, and the crystalline basement (at northern periphery of the basin), and is overlain by Permian, Mesozoic, and Cenozoic strata from 360 m thick in eastern part of the basin to over 1200 m thick in the western.

The Carboniferous of the Lublin Coal Basin represents one of members of sedimentary cover of the platform. The thickness of its synthetic section is estimated as up to 3200 m but individual lithostratigraphic units are characterized by small to intermediate thickness, wide distribution and gentle changes in thickness, and co-occurrence of carbonate and phytogenic rocks in lower and middle parts of the section (Fig. 1). The paleontological data show that the Carboniferous is here represented by strata from the Upper Visean to Westphalian D, occurring in sedimentary continuity.

Phytogenic sedimentation was continuing with varying intensity throughout the whole period of formation of the Lublin Coal Basin. Humic coal layers and seams first appear in basal parts of the Visean to disappear completely in the uppermost Westphalian C. The stratigraphic section reflects fairly high changes in intensity of phytogenic sedimentation in time but not in space. Therefore, almost all of its strata display features of the coal-bearing ones. Sedimentary conditions from the Carboniferous time were favourable for development of peatbogs. This is evidenced by cyclic structure of the section, especially the presence of a member typical of peatbog sedimentation (represented by humic coal and either coal shale or claystone – 4) in the majority of cyclothems.

With reference to genetic, lithological-facies and diastrophic criteria, the Carboniferous of the Lublin Coal Basin may be easily divided into three parts. This tripartity is well reflected by differences in lithological composition and predominance of sediments of a specific sedimentary environment (1). Thus three major lithogenetic complexes, named as marine-paralic, paralic, and limnic-fluvial coal-bearing associations, are differentiated in the section (3). The associations are briefly characterized below.

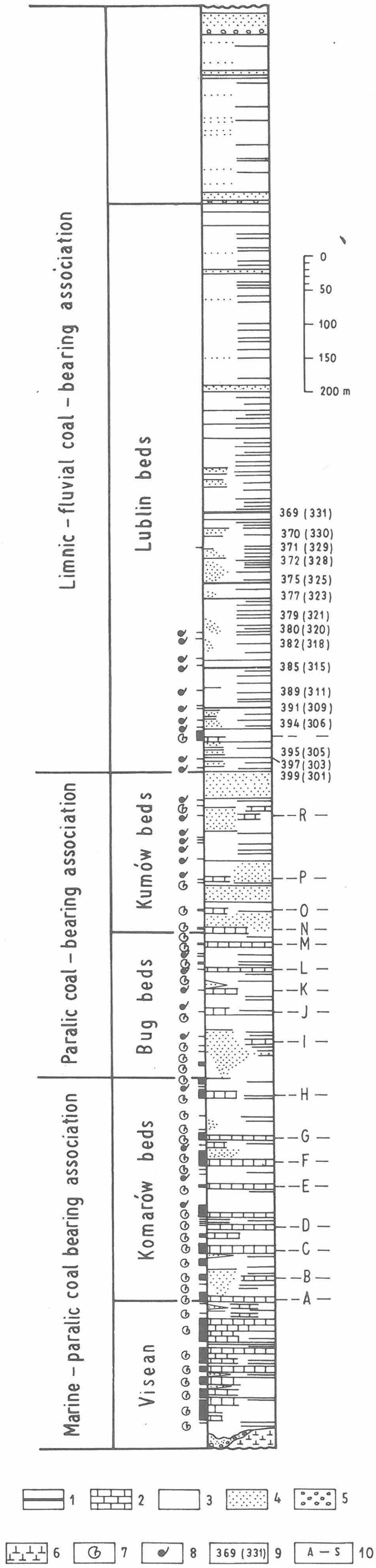
Marine-paralic coal bearing association. The association comprises a part of the section from the base of Visean to the base of the Bug Beds (Figs. 1, 2a), corresponding to the Upper Visean and Namurian A. In the Visean and Early Namurian the sedimentary basin extended from an area west of the Vistula River as far as SE part of the Lvov area and sedimentary conditions were fairly uniform. Sediments formed in these times in the basin mainly comprise marine rocks almost identical in lithology as it is well shown by comparisons of sections from various parts of the basin (1).

Rocks of the marine-paralic association occur throughout the whole area of the coal basin. Their thickness may be usually treated as original so it is possible to trace a general trend to thickening from about a dozen meters in north-eastern, peripheral part of the basin to 650 – 850 m in the south-western. The original extent of this association was much wider, especially to the south and south-west, which is shown by the present pattern of isopachytes.

The section of the marine-paralic association mainly comprises sediments formed in marine environment, the share of which equals 61% at the average, ranging from 23 to 90%. Depending on the part of the basin, the shares are varying from 33.6 to 91.1% (69.5% at the average) for lower part of the section, and from 24 to 93% (50% at the average) for the upper part (Lower Namurian). The sediments mainly include organogenic limestones as well as some marls and calcareous claystones rich in marine fossils. Carbonates predominate in lower part of the section. They become scarcer in the upper part but uniform distribution makes them very useful as correlative horizons (5). A negligible share of sandstones in total thickness of the section is highly specific for this complex.

Continental sediments are represented by decoloured Stigmaria soils, claystones and mudstones with plant remains, coally claystones and thin layers of humic coal. They occur as thin layers separating packets of marine sediments, forming packets up to 20 – 25 m thick in northern par of the basin only.

Rocks of the marine-paralic association are characterized by continuous reappearance of individual lithological types in the section. This reflects repeteability of sedimentary conditions, responsible for origin of characteristic cyclothems. The identified cyclothems may usually be interpreted as "ideal", with appriopriate succession of members and regularly developed transgressive and regressive parts. The majority of them are easily correlated throughout the whole area of their distribution. The uppermost member (i.e. soil member) of each of these



cyclothems was found to be weathered, decoloured and with well marked erosional surface (providing that it is not covered by coal member). Coal members were also found to be usually characterized by erosional surface at the top.

The cyclicity unequivocally shows that the phytogenic sedimentation was continuing through the whole time interval of formation of the association. The recorded plant remains implicate conditions favourable for origin and development of peatbogs. However, it should be noted that this part of the section displays thin coal layers only. The lack of coal seams of economic value may be explained as due to the fact that the time interval from origin of a peatbog to the next marine ingression was too short for accumulation of appropriately thick peat layer. It is highly probable that so thick peat layers were actually formed but failed to escape partial or complete erosion by the transgressing sea. This seems to be supported by presence of erosional surfaces at the top of the Stigmaria horizons not covered by coal layers. Erosional surfaces were also found in the majority of coal layers directly overlain by marine sediments.

The section of the marine-paralic association comprises up to 28 layers of humic coals. The occurrence of marine sediments directly above a coal layer is here typical. Coal layers do not form groups but are rather farily regularly distributed in individual cyclothems in the section. Layers 0.10–0.25 m thick predominate, those 0.20–0.30 m thick are scarce, and those 0.50–0.60 m thick sporadically found. The mean thickness of the layers equals 0.30 m, and only three of them attain (and locally exceed) 0.80 m in thickness. One layer from lower part of the Visean attains 0.70–1.30 m (and in one place even 2.00 m) in thickness locally in north-eastern part of the basin, and two others, situated at the base of the limestines F and G (Fig. 1), are locally 0.80–1.20 m thick. Thus coals of the marine-paralic association are without economic value (4, 5).

Rocks of the marine-paralic association originated in neritic zone of a shallow and often retreating sea, as it is shown by the presence of horizonts of continental sediments between individual packets. The sedimentation was proceeding under fairly quiet conditions and the rates of subsidence were rather uniform throughout the sedimentary basin (1). The rocks are characterized by minor lateral variability in lithofacies development. However, there may be noted a trend to increase of relative amount of phytogenic sediments towards the north-east, i.e. in direction in which total thickness of the whole complex becomes reduced.

Paralic coal-bearing association. This association comprises middle part of Carboniferous section of the Lublin Coal Basin, from the base of the Bug Beds to the base of the coal seam 394 (306). It comprises the Bug and Kumów

Fig. 1. Synthetic section of the Carboniferous in the Lublin Coal Basin

1 – coals, 2 – limestones, 3 – claystones and mudstones, 4 – sandstones, 5 – conglomerates, 6 – diabases, 7 – marine fauna, 8 – fresh-water fauna, 9 – numbers of coal seams, 10 – indices of limestones

Ryc. 1. Profil syntetyczny karbonu Lubelskiego Zagłębia Węglowego

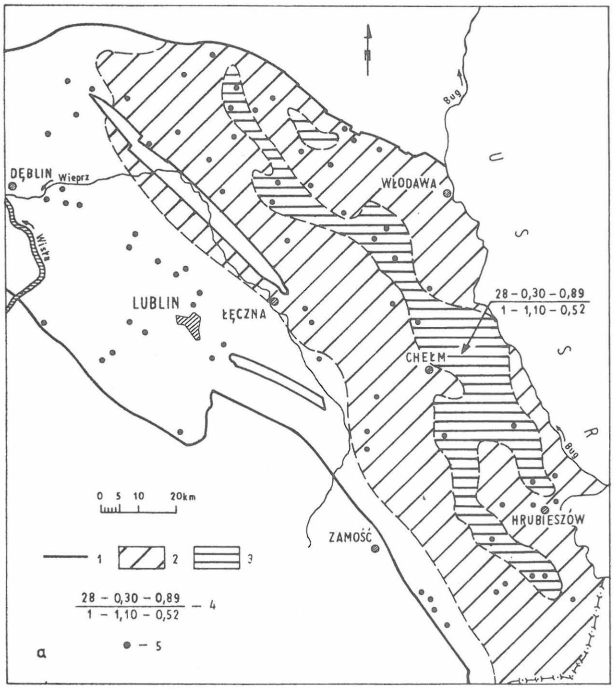
1 – węgle, 2 – wapienie, 3 – iłowce i mułowce, 4 – piaskowce, 5 – zlepieńce, 6 – diabazy, 7 – fauna morska, 8 – fauna słodkowodna, 9 – numeracja pokładów węgla, 10 – indeksy wapieni

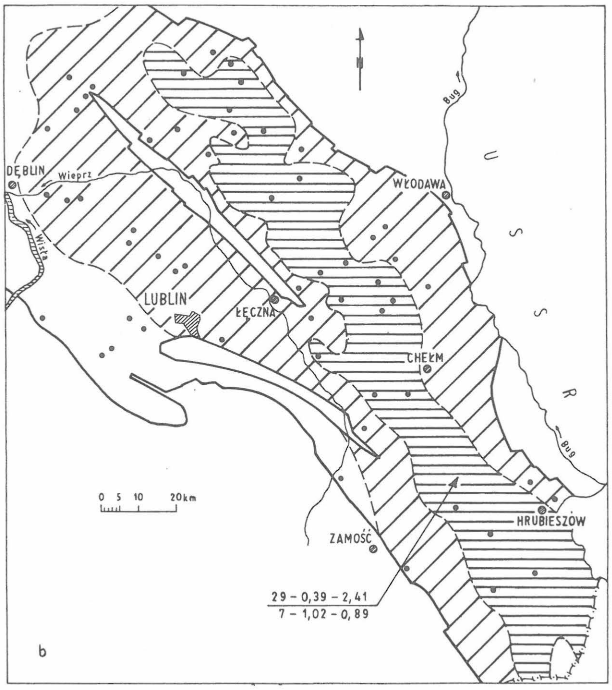
Beds as well as basal part of the Lublin Beds (Fig. 1), i.e. stratigraphic equivalents of the Namurian BC and Westphalian A.

In the Namurian B, structure of the Carboniferous sedimentary basin became somewhat changed, which resulted in development slightly different than in Visean and Early Namurian. The structural change is reflected by some differences in patterns of isopachytes of the Bug and Kumów Beds, drastic increase in share of coarse-clastic as well as lacustrine, fluvial and phytogenic sediments, and reduction and lateral changes of horizons of marine sediments. The axis of the sedimentary basin became shifted to the north-east and symmetry of the basin and position of the zone of maximum subsidence also changed.

Paralic sediments are widely distributed in the basin. The original thickness of these sediments is usually preserved (Fig. 2b) as erosion resulted in their partial or complete removal in the zones of outcrops and areas of horsts and anticlines only (Fig. 2b). There is a steady trend to increase of thickness to the south and the pattern of isopachytes differs from that of the marine-paralic sediments. Total thickness of paralic sediments equals 120–160 m in NE zone of the basin, increasing to 280–320 m in the central and 450–470 m in the western. The sediments rest on marine-paralic ones with sedimentary continuity throughout the major part of the basin, overstepping the latter in the north-western part only. In the latter area an intraformational erosion resulted in removal up to 35 m of top part of the marine-paralic sediments (4, 5).

The complex of paralic rocks markedly differs in development from the underlaying ones. It is characterized by high share of coarse-clastic sediments which form three thick packets separated by claystone-mudstone rocks with intercalations of limestones and coals (Fig. 1). Sandstones from basal part of thick complex are usually of the graywacke type, as a rule monofractional, and useful





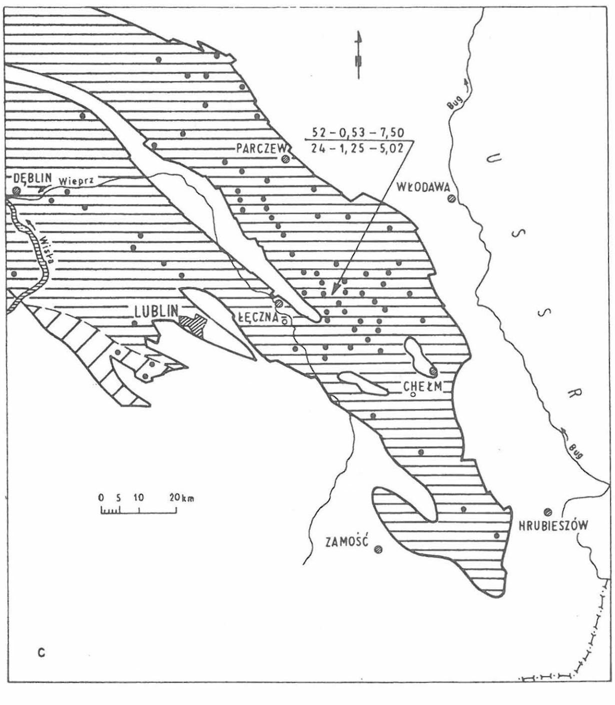


Fig. 2. Distribution of coal-bearing associations

a – marine-paralic, b – paralic, c – limnic-fluvial; 1 – boundary of association, 2 – area of occurrence of coal-bearing continental sediments, 3 – area of occurrence of economic coal seams, 4 – pattern shown in maps: in numerator the total number of coal seams, average thickness of seams, and ratio of coal-bearing are successively shown, and in denominator the number of economic seams, average thickness of economic seams, and ratio of coal reserves are shown, 5 – important boreholes

Ryc. 2. Zasięgi występowania asocjacji węglonośnych

a – morsko-paralicznej, b – paralicznej, c – limniczno-fluwialnej. 1 – granice asocjacji, 2 – obszary, w których obrębie występują utwory lądowe z pokładami węgla, 3 – obszary, w których obrębie występują bilansowe pokłady węgla, 4 –

ogólna liczba pokładów węgla	średnia miąższość pokładów	współczynnik węglonośności
liczba pokładów bilansowych	średnia miąższość pokładów bilansowych	współczynnik węglozasobności

Objaśnienia „wzorów" zaznaczonych na mapkach $\frac{52-0{,}53-7{,}50}{24-1{,}25-5{,}02}$

5 – ważniejsze otwory badawcze

as important reference and correlative horizon in the basin. Higher parts of the complex comprise quartz to quartz-feldspar thick-bedded sandstones, usually various-grained and with intercalations of gravelstones. A gradual reduction in share of marine sediments and a radical increase in share of phytogenic sediments in relation to marine-paralic ones is highly typical for this part of the section. Phytogenic deposits form here coal layers varying in thickness. Seven of these layers may be of economic value. The rocks may be interpreted as typical productive series and coal seams occurring between the limestones I and L are exploited in the Lvov – Volhynia Basin.

The section of the paralic coal-bearing association displays a tripartity from the point of view of lithogenetic composition, cyclicity, and share of phytogenic sediments. The tripartity is used in lithostratigraphic subdivision (Fig. 1). Lower part of the section is assigned to the so-called Bug Beds, varying from 40 to 220 m in thickness. Its development is typical of paralic productive formations, and the cyclicity classical. Individual cyclothems are uniform in thickness and characterized by vast distribution of transgressive parts. This makes them highly important as correlative horizons. The cyclothems with the limestones K, L, and M, are especially reliable correlative horizons.

The shares of marine sediments (limestones and claystones with marine fauna) range from 4 to 26% (12% at the average), decreasing five times in comparison with the section of marine-paralic sediments. The shares of phytogenic sediments range from 0.30 to 5.50% (2.47% at the average). The section of these sediments comprises 15 layers of humic coals, ranging from 0.05 do 1.20 m in thickness (most often 0.20 to 0.40 m and sometimes – 0.50 to 1.20 m). In northern and south-eastern parts of the basin, four layers locally attain 0.70 – 1.20 m in thickness. Therefore, it follows that conditions predominating in times of sedimentation of these rocks were advantageous for development of peatbogs and the erosion of the peatbog deposits not so intense as during sedimentation of the underlaying rocks. Moreover, erosional surfaces are not so common at the top of coal layers and Stigmaria soils. Coal layers are directly overlain by either marine sediments or (which is also common) claystones with fresh water fauna and those with plant remains (3).

The above discussed rocks are overlain by those of the Kumów Beds – a characteristic and easily identifiable complex mainly comprising coarse clastic rocks, 80 to 360 m in thickness (Fig. 1). The share of sandstones in total thickness of that complex reaches 46%, varying from one part of the basin to another from 14 to 73% (but most often from 35 to 55%). They are concentrated in two packets: lower and upper, separated by a series of mudstone-claystone rocks.

The share of marine rocks (carbonates and claystones with marine fauna) equals merely 2.5% of the total thickness, ranging from 0.60 to 3.60%. A part of sandstones of the lower sandstone packet probably originated in the nearshore environment as they display some features of beach sediments.

The type of cyclicity displayed by the Kumów Beds differs from those of underlaying complexes. Individual cyclothems are characterized by much better development of sandstone member which rests directly on members representing marine or lacustrine environment. The whole original transgressive part of cyclothems is here often eroded and replaced by sandstone member. Cyclothems of the model: coal – lacustrine claystone – mudstone – sandstone – Stigmaria soil and without transgressive marine member predominate in middle part of this complex. However it was stated that lacustrine member of such cyclothem often laterally passes into marine member. Erosional surfaces are also found at the top of Stigmaria soils when coal layer is missing, or at the top of coal layer.

The share of phytogenic deposits is varying from 0.30 to 3.70%, being equal 2.26% at the average. In upper part of the paralic association there occur up to 14 coal layers highly variable in thickness. The layers are 0.05 to 1.50 m thick, most often 0.20 to 0.40 m or 0.50 to 0.70 m thick. Three layers attain 0.80 to 1.50 m in thickness in a limited areas in northern and eastern parts of the basin. The latter are fairly widely distributed but, unfortunately, rich in ash and sulfur.

The above described rocks originated in fluvial-limnic environment of vast coastal plains affected five times by short-lasting marine ingressions.

A packet of mudstone-claystone sediments with sandstone intercalations and humic coal layers forms top part of the paralic association. The uppermost part of that packet displays the latest marine horizon in the Carboniferous section of the Lublin Coal Basin. The horizon, comprising the limestone S (Fig. 1), is called as the Dunbarella marine horizon and used as fully reliable correlative level. The packet comprises five coal layers, including one 0.80 to 1.30 m thick.

Rocks of the paralic coal-bearing association originated in sedimentary basin the evolution of which was stimulated by movements of the Erzgebirge phase. A high lateral variability of lithogenetic types and predominance of coarse clastic sediments (especially in higher parts of the section) indicate that uplifting movements were affecting areas situated west, south and south-east of the sedimentary basin and, therefore, gradually breaking connections and finally, isolating the basin from open sea (8). The areas, built of rock complexes varying in lithology, acted as sources of various types of coarse-clastic material.

Limnic-fluvial coal-bearing association. Rocks of that association rest on paralic ones with sedimentary continuity. The association comprises the Lublin Beds with the maximum recorded thickness equal 900 m, and higher parts of the Westphalian (corresponding to Westphalian BC), up to 600 m thick (Fig. 1).

Structural rebuilding related to the Erzgebirge movements resulted in complete isolation of the sedimentary basin from open sea and subsequent subsiding Westphalian movements, dispite of marked amplitude in further gradual and quiet subsidence. A thick sedimentary series formed under such conditions highly differs from older parts of the Carboniferous section in the basin (1). At present the limnic-fluvial strata are markedly varying in thickness in the basin but this is not related to sedimentary conditions but subsequent tectonic and erosional processes. The strata are the thickest in tectonic depressions, being deeply or even completely eroded in areas of horsts and anticlines (Fig. 2c). It appears impossible to reconstruct original distribution of thickness of the strata as the correlation comparative parts of the section throughout the area remains difficult and not much reliable, and erosion was strong. Therefore, the course of axis of the sedimentary basin remains unknown. It may be, nevertheless, stated that the basin was asymmetrical, with a trend to maximum plunging to NW.

The limnic-fluvial strata are mainly characterized by predominance of aleuritic-pelitic rocks in the section, minor share of coarse-clastic and the lack of marine ones, very numerous coal layers, and the wealth of plant remains.

The lithological development of the strata is apparently monotonous as their section a few lithological varieties only. The varieties continuously reappear in the section, reflecting cyclicity of sedimentary conditions (3). The cyclicity markedly differs from that of the underlaying strata, being characteristic of limnic-fluvial coal-bearing associations. The section displays two principal types of cyclothems, differing in origin of transgressive part only. The first type, with the succession coal – lacustrine claystone with fauna – mudstone – sandstone – Stigmaria soil, is characteristic and predominating in lower part of this complex, i.e. from the base to the coal seam 320 (380), being only sporadically found in upper part. The type with succession coal – claystone with flora – mudstone – sandstone – Stigmaria soil, predominates above the coal seam 320 (380). Cyclothems of the latter type are varying and of limited value for correlation. Sandstone member is often missing in both types of cyclothems whereas the coal member was recorded in 90%, and the soil member – everywhere. The lithogenetic composition of the complex is also highly characteristic. The share of mudstones equals about 42% of total thickness of the complex, varying from 35 to 46%, that of claystones – 34% (from 32 to 35%), and that of sandstones – only 16% (from 13 to 19%). The data reflect very small or even negligible variability in shares of individual lithological types.

The above discussed composition and character of cyclicity of the limnic-fluvial complex show that the strata were originating in vast plains with lakes, swamps and river channels, under conditions of low-rate subsidence of the area (1, 8).

The data on phytogenic sediments, given below, concern only those of a lower, 450 m part of the limnic-fluvial coal-bearing association, the knowledge of which may be treated as sufficient and the reported indices as reliable. The share of phytogenic sediments in that part of the section equals 7.5% (varying from 6.8 to 8.5%), and the frequency of occurrence of coal layers and seams clearly higher than in the remaining parts of the Carboniferous of the Lublin Coal Basin.

The studied section of the limnic-fluvial sediments from northern part of the basin displays up to 52 coal layers and seams varying from 0.5 to 3.90 m in thickness. The majority of these layers (55%) are less than 0.80 m thick, most often varying from 0.30 to 0.50 m (3). Twenty four of all the layers attain or exceed 0.80 m in thickness and are assigned to economic. The latter are usually 0.90 to 1.30 m thick. Seams 1.30–1.70 m thick are much scarcer, and only four seams locally attain 1.60–2.20 m in thickness. The mean statistical thickness of economic coal seams from individual parts of the basin equals 1.21, 1.23 and 1.25 m, respectively. Taking into account thickness, structure, lateral distribution and quality, the coal seams were subdivided into stable, relatively stable, varying, and highly varying. Of the 24 economic seams, three may be treated as stable, 5 as relatively stable, 7 as varying, and 9 as highly varying.

The coal seams are usually overlain by claystones with plant remains or, sometimes, lacustrine claystones with fresh-water fauna. Mudstones and sandstones occasionally rest directly on coals but it should be noted that top surface of the latter is usually erosional. Horizons of Stigmaria soils are recorded at the base of all the coal seams. They are represented by claystones or, sometimes, mudstones with typical soil structure.

Upper part of the limnic-fluvial complex still remains poorly known but it may be already stated that its index of relative coal content is much lower than for the Lublin Beds. Up to a dozen of coal layers less than 0.60 m thick were found in single points.

The following table shows statistical treatment of the major indices for phytogenic sediments of the whole section of the Carboniferous in the Lublin Coal Basin.

The table clearly illustrates increases and oscillations in shares of phytogenic sediments upwards the section along with freshening of the basin.

The mean relatively coal content is even below 1% for marine-paralic complex, and three economic coal seams locally found in that complex are practically without economic value because of complex structure, lateral variability and depth of occurrence. The indices appear more advantageous in the case of the paralic complex, especially its lower part with the mean relative coal content index attaining 1.26%. However, economic layers of that complex are limited in distribution (mainly to northern and south-eastern parts of the basin) and also characterized by complex structure, which makes them still without any economic value. The coal content indices decrease again in upper part of the paralic complex, and three economic seams locally present in that part of the section are practically without economic value because of variability in structure and low quality parameters.

It floows that the major coal resources of the Lublin Coal Basin are related to a lower part of the limnic-fluvial complex, with mean relative indices of coal-bearing and coal resources up to 7.50 and 5.02%, respectively. The

Coal-bearing association	Lithostratigraphic units	Total number of coal seams	Thickness of seams in m		Ratio of relative coal-bearing in %	Number of economic seams	Thickness of economic seams		Ratio of relative coal reserves in %
			from-to	average			from-to	average	
Limnic-fluvial		12	0,10–0,59	0,31	–	–	–	–	–
	lubelskie Lublin	52	0,10–3,90	0,53	6,80–8,54 7,50	24	0,80–3,90	1,25	4,18–6,28 5,02
Paralic	kumowskie Kumów	14	0,05–1,50	0,37	0,30–3,70 2,26	3	0,80–1,50	1,07	0,42–1,42 0,74
	bużańskie Bug	15	0,05–1,30	0,40	0,30–5,50 2,47	4	0,80–1,30	0,93	0,40–1,72 1,26
Marine-paralic	komarowskie Komarów	18	0,05–1,20	0,30	0,10–2,30 0,92	2	0,80–1,20	1,10	0,25–1,05 0,46
	karbon dolny Lower Carboniferous	10	0,05–2,00	0,28	0,10–3,90 0,65	1	0,80–2,00	1,11	0,53–1,80 0,88

Lublin Beds comprise a large coal deposit built of numerous coal seams and subdivided by tectonic and erosional boundaries, and the idea of mining management of the basin is based on use of these resources only. In the total geological resources of the basin the share of coals of the limnic-fluvial complex equals 91%, and that of coals of the paralic complex – 9% only, whereas the resources of the marine-paralic complex are neglected in the calculations.

Translated by W. Brochwicz-Lewiński

REFERENCES

1. Bojkowski K. – Carboniferous palaeogeographic environments in the Lublin and Silesia-Cracow area. Pr. Inst. Geol. 1978 vol. 86.
2. Brochwicz-Lewiński W., Pożaryski W., Tomczyk H. – Large-scale strike-slip movements along SW margin of the East-European Platform in the Early Paleozoic. Prz. Geol. 1981 nr 8.
3. Kotas A., Porzycki J. – Major features of Carboniferous coal basins in Poland. Ibidem 1984 nr 5.
4. Porzycki J. – Fundamental proprieties of the geological structure and evaluation of the deposits of the Lublin Coal Basin. Biul. Inst. Geol. 1980 nr 328, Geology of Poland vol. III.
5. Porzycki J. – Structure geologique du basin houiller de Lublin. Dixiéme Congr. Intern. Strat. Géol. Carbonifére. Madrid 1983 vol. 3.
6. Pożaryski W., Kotański Z. – The tectonic development of the Polish part of East-European Platform forefield in the Bajkalian and Caldono-Variscan epochs. Kwart. Geol. 1979 nr 1.
7. Znosko J. – Tectonic units of Poland against the background of the tectonics of Europe. Biul. Inst. Geol. 1975 nr 252.
8. Żelichowski A.M. – Lithological associations in the Carboniferous in Poland. Prz. Geol. 1983 nr 6.

STRESZCZENIE

Nierównomierna substancja i ruchy przesuwcze wielkich jednostek geologicznych stymulowały ewolucję lubelskiej karbońskiej niecki sedymentologicznej, w której osadziło się 3200 m karbonu, w całości o znamionach utworów produktywnych. Profil ten w sposób naturalny dzieli się na trzy duże kompleksy litogenetyczne. Są to asocjacje węglonośne: morsko-paraliczna, paraliczna i limniczno-fluwialna.

Morsko-paraliczną asocjację węglonośną tworzą głównie osady morskie porozdzielane cienkimi pakietami utworów lądowych, wśród których występuje do 28 warstewek węgla humusowego, z których 3 lokalnie osiągają 0,80–1,20 m miąższości.

Paraliczna asocjacja węglonośna to kompleks w przewadze utworów lądowych z cienkimi wkładkami osadów morskich i dużym udziałem utworów gruboklastycznych. W jej profilu występuje do 29 warstewek węgla, z których 7 lokalnie osiąga 0,80–1,50 m miąższości.

Limniczno-fluwialna asocjacja to wyłącznie utwory jezior, zastoisk, torfowisk i rzek. Zawiera ona do 52 pokładów węgla, z których 24 osiąga 0,80–3,90 m miąższości i stanowi podstawowe utwory produktywne zagłębia. 91% zasobów zagłębia przypada na pokłady węgla utworów limniczno-fluwialnych, a 9% na pokłady utworów paralicznych.

РЕЗЮМЕ

Неравномерная субсиденция и перемещающие движения больших геологических единиц стимулировали эволюцию люблинской карбонской седиментационной мульды, в которой карбонские осадки имеющие признаки продуктивных отложений, имеют мощность 3200 м. Разрез этих отложений разделивается естественно на 3 больших литогенных комплекса: морско-паралическую, паралическую и лимнически-паралическую угленосные ассоциации.

Морско-паралическую угленосную ассоциацию слагают главным образом морские осадки, разделенные тонкими прослойками континентальных отложений. среди которых находится до 28 прослоек гумусового угля; три из них местно достигают мощности 0,8—1,2 м.

Паралическая угленосная ассоциация это комплекс с преимуществом континентальных отложений с тонкими прослойками морских осадков и многими крупнокластическими отложениями. В её разрезе находится до 29 прослоек угля, 7 из них местно достигает мощности 0,8—1,5 м.

Лимнически-флювиальная ассоциация это исключительно осадки озер, застойных бассейнов, торфяников и рек. Они содержат до 52 угольных пластов, 24 из них достигает мощности 0,8—3,9 м. Эта ассоциация составляет собой основные продуктивные отложения угольного бассейна. 91% ресурсов угольного бассейна это угольные пласты лимнически-флювиальных отложений, 9% это пласты паралических отложений.