



Studies of the coal facies in Western Ukraine (the Lvov-Volyn basin)

Ariadna Ivanova, Lyudmila Zaitseva*

O. Gonchar str., 55b, Kiev 01054, Ukraine

Received 1 January 2003; accepted 2 August 2003

Abstract

The authors reviewed shortly the recent state of knowledge in the field of petrographic compositions and origins of the Carboniferous age coals in the Lvov-Volyn coal basin (LVB) as well as make the proper conclusions about the conditions of peat-accumulation, according to the results of former investigations performed by themselves and other researchers.

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Keywords: Coal; Carboniferous; Genesis; Swamp

This article is a review of literature devoted to the studies concerning the petrography and origin of coals in the Lvov-Volyn coal basin.

The Lvov-Volynian coal basin (LVB) is situated on the margin of Lvov Paleozoic trough at the north-west edge of the East European platform. The Novovolynsk, Chervonograd and Southwest coal-bearing districts are recognized within LVB from north to south and southwest. A coal-bearing sequence (thickness up to 1400 m) was deposited on sedimentary and volcanogenic-sedimentary formations of the Upper Paleozoic and is covered by

Jurassic, Cretaceous and Neogene sediments. The coals are related to Visean, Serpukhovian and Bashkirian sediments.

Petrologic investigations of LVB coals have been carried out since the 1950s. Detailed studies of petrographic composition of these coals were initially conducted for the Novovolynsk and Chervonograd mining districts. Data on primary plant material of the coals were obtained as results of floristic and palynological studies carried out by [Brazhnikova et al. \(1956\)](#). A number of papers were devoted to peculiarities of matter composition and genesis of coals ([Boldyreva, 1958, 1959, 1960](#); [Boldyreva and Slivko, 1959](#); [Savchuk, 1958](#); [Savchuk et al., 1960](#)). Rich field evidence from numerous prospecting boreholes, new coal fields, including Southwest district, became the basis for new generalizations.

* Corresponding author. Fax: +38-044-216-93-34.

E-mail address: zaitseva_l@mail.ru (L. Zaitseva).

Studies in the 1970–1980s made a significant contribution to investigations of petrography, chemical, technological and physical properties of coals, facies conditions of formation of the coal beds of the basin (Struev, 1963; Kushniruk and Bartoshinskaya, 1971; Fedushchak et al., 1974; Yershov and Vyrvich, 1975; Vyrvich and Lapo, 1979; Vyrvich et al., 1978; Bartoshinskaya and Byk, 1979; Bartoshinskaya et al., 1980, 1983a,b; Struev et al., 1984; Fedushchak and Radchenko, 1988; Byk et al., 1990) and others. Regularities in variations of petrographic and quantitative parameters were recognized not only for humic coal but also for sapropelic coals of Early Carboniferous (Mississippian) age in coal beds and coal fields.

To elucidate peat-accumulation processes and to determine plants–coal formers, the phyteral analysis method was used. Structural and chemical features of phytolaims of some coal-forming plants were studied (Uziyuk, 1989, 1992).

In a mutual Polish–Ukrainian project, a comparative analysis of facies conditions and corresponding petrographic types of coal was made for some coal-bearing basins of Ukraine and the Lublin Basin, Poland (Ivanina et al., 1997; Ivanova and Zaitseva, 1997; Ivanova et al., 1999a,b, 2000, 2001; Savchuk et al., 2000, 2001).

Basing on the former investigations carried-out by themselves as well as another researchers, the condition of peat-accumulation were established.

Reconstruction of conditions of Carboniferous peat-accumulation demonstrated that, during formation of coal-bearing sequences in the Early Carboniferous (Late Visean–Early Serpukhovian stage of peat-accumulation), the original coal matter accumulated in conditions of flooded forest and mire swamps on the open or lagoon-flooded shore of shallow sea with frequently changing facies conditions. It is confirmed by data on calculation of gelification index (GI) and tissue index (TPI) coefficients after Dissel (1982, 1986) for Upper Visean–Lower Serpukhovian coals (Fig. 1A,B). Most variation of petrographic composition observed in the Visean coals is explained by segregation of peat mires where

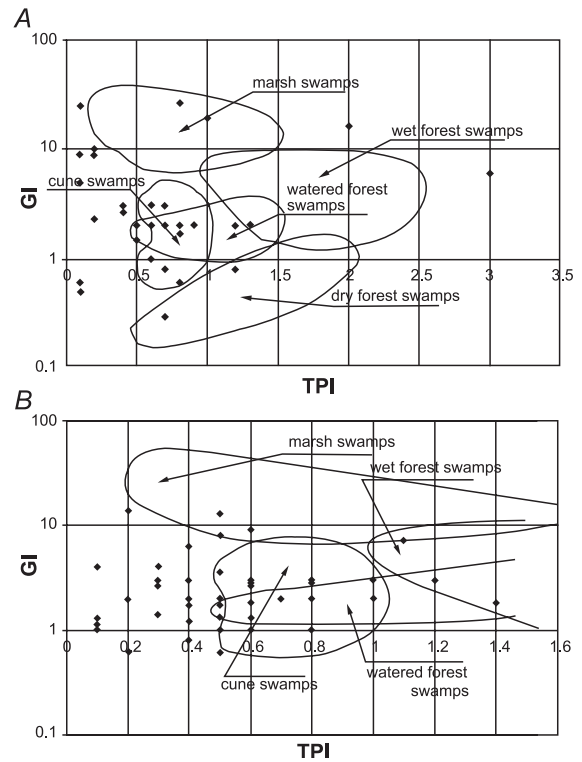


Fig. 1. Diagram of correlation between microcomponent composition of Visean (A) and Early Serpukhovian (B) coals and conditions of their formation.

various conditions of flooding existed, from low to high water level, and insignificant water current rate. But, as the graph indicates (Fig. 1A), the main volume of coals formed in conditions of flooded swamps of cane-like type and forest swamps.

Peat-accumulation in the Early Serpukhovian time took place both in flooded forest and swamps of cane-like type and dying lakes (Fig. 1B). Such conditions, as the maceral composition of coal beds testifies, persisted in Late Serpukhovian time. It explains the presence of numerous beds and members of sapropelic coals.

Plant material of the Early Bashkirian peat fields accumulated in vast flooded and periodically drained forest swamps with weak currents (Table 1).

Table 1
Carboniferous coal basin, the Western Ukrainian, LVB

Author	Method	Depositional environment other commeris	Age/area	ASTM rank
Savchuk S. (1958)	petrology, sedimentology	marine	Lower Carboniferous (Mississippian)	hvb-lvb
Boldyreva (1958, 1959, 1960)	petrology, organic geochemistry, sedimentology	marine	Lower Carboniferous (Mississippian)/ Volynsk, Zabugsk, Sokal, Mezhrechensk deposits	hvb-lvb
Boldyreva and Slivko (1959)	sedimentology	marine	Lower Carboniferous (Mississippian)	hvb-mvb
Savchuk et al. (1960)	petrology, organic geochemistry		Lower Carboniferous (Mississippian)	hvb-mvb
Fedushchak et al. (1967)	petrology		Lower Carboniferous (Mississippian)/ Mezhrechensk, Zabugsk deposits	mvb
Bartoshinskaya et al. (1969)	petrology, organic geochemistry	marine, tectonic control	Lower Carboniferous (Mississippian)/ Mezhrtchensk deposit	mvb
Stasiv and Bartoshinskaya (1969, 1972)	sedimentology	marine, fluvial	Lower Carboniferous (Mississippian)	hvb-lvb
Bartoshinskaya (1971)	petrology		Lower Carboniferous (Mississippian)	hvb-lvb
Fedushchak et al. (1972a,b)	petrology	black and quaking bog	Lower Carboniferous (Mississippian)/ Volyn deposit	hvb
Fedushchak et al. (1972a,b)	organic geochemistry	marine, fluvial	Lower Carboniferous (Mississippian)/ Zabugsk, Mezhrechensk, Tyaglov deposits	mvb
Fedushchak et al. (1974)	petrology, organic geochemistry		Lower Carboniferous (Mississippian)	hvb-lvb
Terentiev (1975)	petrology, sedimentology	marine	Lower Carboniferous (Mississippian)/ Volyn, Tyaglov, Karov deposits	hvb-lvb
Bartoshinskaya and Byk (1979)	sedimentology	marine, limnic	Lower Carboniferous (Mississippian)	hvb-lvb
Byk et al. (1979)	petrology, sedimentology, organic geochemistry	marine, limnic	Lower Carboniferous (Mississippian)	hvb-lvb
Bartoshinskaya et al. (1980)	organic geochemistry		Lower Carboniferous (Mississippian)	hvb-lvb
Bartoshinskaya et al. (1983a)	petrology		Lower Carboniferous (Mississippian)/ Lyubel deposit	mvb-lvb
Fedushchak and Radchenko (1988)	petrology, organic geochemistry	marine, fluvial	Lower Carboniferous (Mississippian)	hvb-lvb
Uziyuk (1989, 1992)	petrology, paleobotany, organic geochemistry		Lower Carboniferous (Mississippian)	hvb-lvb
Ivanina et al. (1997)	palynology		Lower Carboniferous (Mississippian)	hvb-lvb
Brazhnikova et al. (1956)	paleobotany, palinology		Lower–Middle Carboniferous (Mississippian–Pennsylvanian)	
Bobrovnik et al. (1962)	petrology, sedimentology	marine, fluvial, limnic	Lower–Middle Carboniferous (Mississippian–Pennsylvanian)	hvb-mvb
Struev (1963)	sedimentology, petrology	marine, fluvial, limnic	Lower–Middle Carboniferous (Mississippian–Pennsylvanian)/ Zabugsk, Sokal, Mezhrechensk, Tyaglov deposits	hvb-mvb
Shpakova (1969)	sedimentology	marine, fluvial, limnic	Lower–Middle Carboniferous (Mississippian–Pennsylvanian)/ Novolynsk, Mezhrechensk, Zabugsk, Tyaglov deposits	hvb-mvb

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Table 1 (continued)

Author	Method	Depositional environment other commeris	Age/area	ASTM rank
Kushniruk and Bartoshinskaya (1971)	sedimentology, petrology, organic geochemistry	limnic, marine influences	Lower–Middle Carboniferous (Mississippian–Pennsylvanian)	hvb-lvb
Tikhonova et al. (1973)	organic geochemistry	marine, fluvial	Lower–Middle Carboniferous (Mississippian–Pennsylvanian)/ Novovolynsk, Mezhrechensk, Zbugsk deposits	hvb-mvb
Yershov and Vyrvich (1975)	petrology	marine influences	Lower–Middle Carboniferous (Mississippian–Pennsylvanian)	hvb-lvb
Fedushchak (1977)	sedimentology	marine, fluvial, limnic	Lower–Middle Carboniferous (Mississippian–Pennsylvanian)	
Vyrvich et al. (1978)	petrology, organic geochemistry sedimentology	marine, fluvial	Lower–Middle Carboniferous (Mississippian–Pennsylvanian)/ Karov, Mezhrechensk, Tyaglov, Volyn, Zbugsk deposits	hvb-lvb
Bartoshinskaya et al. (1979)	petrology, organic geochemistry		Lower–Middle Carboniferous (Mississippian–Pennsylvanian)	hvb-lvb
Vyrvich and Lapo (1979)	petrology, palynology, organic geochemistry	limnic, marine influences	Lower–Middle Carboniferous (Mississippian–Pennsylvanian)/ Novovolyn, Tchervonograd, Tyaglov coal fields	hvb-mvb
Bartoshinskaya et al. (1983b)	petrology, sedimentology, organic geochemistry	marine, limnic, fluvial, tectonic control	Lower–Middle Carboniferous (Mississippian–Pennsylvanian)	hvb-lvb
Fedushchak (1984, 1986)	sedimentology, petrology	limnic	Lower–Middle Carboniferous (Mississippian–Pennsylvanian)	hvb-lvb
Struev et al. (1984)	petrology, sedimentology	marine, fluvial, limnic	Lower–Middle Carboniferous (Mississippian–Pennsylvanian)/ Novovolyn, Tchervonograd coal fields	hvb-mvb
Byk et al. (1990)	organic geochemistry, sedimentology	marine, fluvial	Lower–Middle Carboniferous (Mississippian–Pennsylvanian)/ Tyaglov coal field	mvb-lvb
Shulga et al. (1992)	sedimentology	marine, fluvial	Lower–Middle Carboniferous (Mississippian–Pennsylvanian)	
Ivanova and Zaitseva (1997)	petrology		Lower–Middle Carboniferous (Mississippian–Pennsylvanian)	hvb-lvb
Ivanova et al. (1999a,b, 2000)	petrology, organic geochemistry, sedimentology	marine, fluvial	Lower–Middle Carboniferous (Mississippian–Pennsylvanian)	hvb-lvb
Savchuk et al. (2000, 2001)	petrology, sedimentology, organic geochemistry	marine, fluvial	Lower–Middle Carboniferous (Mississippian–Pennsylvanian)	hvb-lvb
Ivanova et al. (2001)	petrology, sedimentology	marine, limnic	Lower–Middle Carboniferous (Mississippian–Pennsylvanian)	hvb-lvb

Acknowledgements

The authors are grateful to Dr. M. Hamor-Vido for her valuable assistance in preparing this report to its publication.

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