Composition of the mobile organic matter in Miocene clayey sediments from East Maritsa Basin (Bulgaria)

Състав на подвижното органично вещество в миоценски глинести седименти от Източномаришкия басейн (България)

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Introduction

Studies on organic matter from fresh water lacustrine (Nedjalkov, Kojumdgieva, 1983) overcoal sediments (Middle Miocenian, 11.608–15.97 Ma) from East Maritsa Basin (EMB) were occasionally published. It was concluded that "hydrophilic organic matter" with Ca and Mg ions in the ion-exchange complex determines increased values for porosity, humidity, plasticity and sorption capacity of the gray and black clays (Troyanovo-2 mine), and respectively – lowered values for sealing and relative density (Mamatarkov, Michneva–Shirletova, 1966). The isotropic propagation of the ultrasonic waves in gray-black clays deposited between the second and third coal seams (Troyanovo-2 mine) is due to "hydrophilic organic substance and close coagulation contacts" (Angelov, 1980). On the basis of studies on suitability of the dump materials for soil substrates it was found that many characteristics of EMB clays are very close to the vertisols from the area and that black clays possess high sorption capacity and organic carbon content varying from 4 to 11.50% (Gurbuchev et al., 1975). In the study presented, for first time have been submitted data about composition of the mobile organic matter from overcoal clayey sediments from East Maritsa Basin with an aim to interpret the initial diagenetic processes of organic matter alteration.

Material and methods

Samples of gray and black clays from the overcoal sediments have been studied: 5 samples from borehole B-69, depth interval 62–80 m, and one sample of undercoal clays (Troyanovo-2 mine); 4 samples from borehole B-3, depth interval 34–106 m (Troyanovo-3 mine). Total organic carbon content was determined by modified Turin's method and organic matter composition by the method of Kononova-Belchikova (Kononova, 1966; Filcheva, Tsadilas, 2002).

Results and discussion

Data obtained for organic matter content and composition show tendencies of fairly good expressed trends of differentiation in total organic carbon distribution as well as in his components (Fig. 1). Four samples have high values for total organic carbon (C_{org}) content (8.85–15.08%) (B-3-17, B-69-57, B-69-59A, B-69-68), and they are black clays deposited between the first and second coal seams. The values for total organic carbon in the rest of the samples (light to dark gray and black clays) are much lower (1.21–6.19%). Along the borehole log the total organic carbon distribution is mainly irregular but fairly good trend of increasing with depth could be outlined for the samples from borehole C-69. The values for organic carbon extractable by 0.1M $Na_4P_2O_7$+0.1M NaOH ($C_{руг}$) vary in a broad interval (0.14–3.88%), and just for some samples the maximum values for $C_{руг}$ coincide with maximum values for C_{org}.

The data range for carbon content in humic acids (HA) is broad (0–3.05%) and it could be probably connected to relatively unstable environment in the basin during primary organic matter deposition. The highest values for C_{HA} have been obtained for samples with the highest $C_{руг}$ values. Data for carbon content in fulvic acids (C_{FA}) show irregular trend of distribution. As for borehole C-3 samples, a vague tendency of decreasing with depth could be marked, but for borehole C-69 samples, any regularity could not be found. The tendency of irregular distribution of the values for C_{HA} and C_{FA} has reflected on C_{HA}/C_{FA} ratio. A general tendency of C_{HA}/C_{FA} increasing with total organic carbon increasing is fairly clear. As for the values interval, it is broader for samples from borehole C-3 (0–5.33)

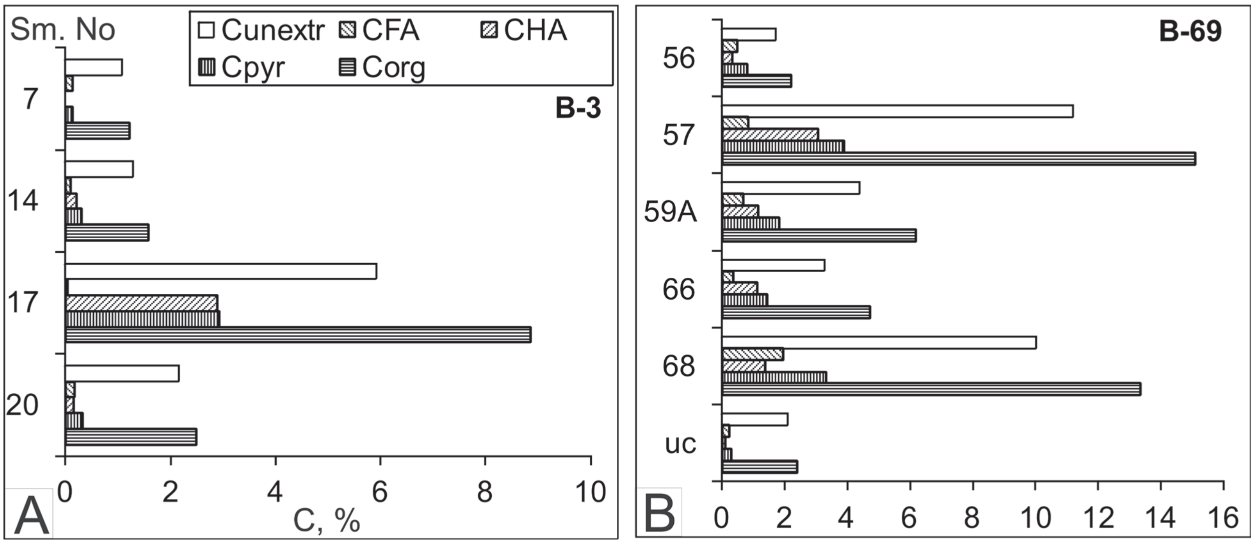

Fig. 1. Total organic carbon (C_{org}) and carbon content in the fractions of the mobile organic matter extracted from EMB sediments: *A*, samples from borehole B-3; *B,* samples from borehole B-69 (C_{pyr} – organic carbon extractable by 0.1M $Na_4P_2O_7$+0.1M NaOH, C_{HA} – organic carbon in humic acids, C_{FA} – organic carbon in fulvic acids, C_{unextr} – unextracted organic carbon)

than those from borehole C-69 (0.43–3.67). The values of C_{HA}/C_{FA} determine organic matter type (Orlov, 1985). In the samples studied the type varies from fulvic (2 samples) and humic-fulvic (3 samples) trough fulvic-humic (1 sample) to humic (4 samples).

Carbon distribution in humic fractions is irregular and varying. HA are predominantly bound to alkaline earth ions which form more stable, hardly soluble complexes. For samples from borehole B-3, any differentiation and tendency of distribution could not be marked. For samples from borehole B-69 the fractions differentiation is distinct. Two samples (C-69-57 and C-69-68, with high values for C_{pyr} and for C_{HA}/C_{FA}) contain HA that are mainly "free" and/or bound to Al and Fe oxides. These HA are more soluble and mobile in the environment.

Organic carbon extracted by 0.1 N H_2SO_4 (the most mobile and low molecular fraction of the organic matter) is presented in negligible values (0.01–0.06%) and could not be able to influence the organic components mobility. In contrast, the values for unextracted organic carbon are very high and mark presence of organic matter components bound very hard to minerals of the clayey sediments.

As a conclusion it would be pointed out that the irregularities and fairly clear trends in the organic matter components above mentioned are rather primary features of the sediments studied but not a result of any diagenetically determined processes. The reasons could be probably traced in the lack of any active tectonic processes, small burial depth and the age of the sediments.

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