Sedimentological and palinological data about young sediments from the Chirpan – Cherna Gora district

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Introduction

The sediments from the hanging wall of the Chirpan fault croppping out in the quarry near the village of Cherna Gora as well as exposed after excavation of the trench Cherna Gora (Vanneste et al., 2006) were submitted to sedimentological and palinological investigations. The present study aims to correlate the Holocene deposits from Cherna Gora Quarry and Cherna Gora Trench according to their pollen spectra and sedimentological features. Need for such correlation appears due to the shortage of reliable absolute dating of the deposits in the trench (Vanneste et al., 2006) whereas for the quarry we have 7 dates obtained by radiocarbon method.

Geological setting

Chirpan fault is a normal fault striking E-W and deeping to the south in the central part of the Upper Thracian Depression. The trench across Chirpan fault was excavated during 2002 (Vanneste et al., 2006). It was located 1 km northern from the village of Cherna Gora (fig. 1). A narrow fault zone separates different type of sediments: typical alluvial (bed flow) deposits of Plio-Pleistocene age referred to the Ahmatovo Formation in the footwall and alluvial (flood plane) deposits of Holocene age at the hanging wall. Deposits of hanging wall are represented by irregular alternation of sandy and sandy-clayey silt with silty and sandy-silty clay, calcareous in various degrees.

Cherna Gora quarry is located about 1 km east from the village of Cherna Gora and 2 km southeastern from the trench Cherna Gora. A typical alluvial sequence of the river Omurovo is exposed in the quarry — an irregular alternation of gravel, sand, silt and clay with 6 paleosol levels representing bed flow and flood plane deposits.

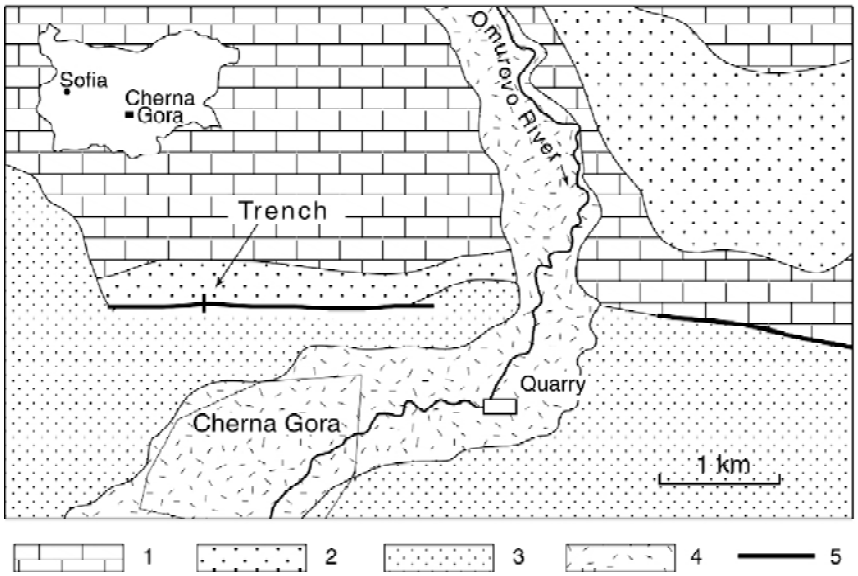

Fig. 1. Geological sketch of the studied region. 1 — Paleogene limestones; 2 — Ahmatovo Formation (N-Q); 3 — Quaternary alluvial and alluvial-fan deposits; 4 — Holocene flood-plane deposits; 5 — fault scarp

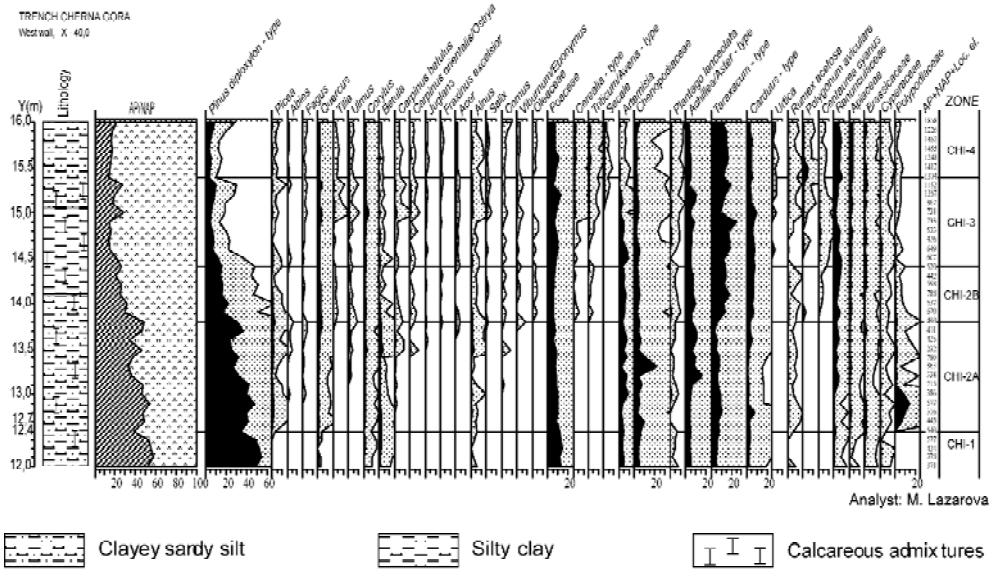

Fig. 2. Percentage pollen diagram for Cherna gora trench (Yaneva, Lazarova, 2004)

Material and method

Deposits from the hanging wall of the trench and those from the quarry were sampled for pollen analysis (Yaneva, Lazarova, 2004). Results from palynological study are shown as simplified percentage pollen diagram on which the reconstruction of vegetation was based. Statistical data processing and plotting of the pollen diagram were made with the help of TILIA and TILIA-GRAPH programs (Grimm, 1991). Results from pollen analyses were submitted to cluster analysis using Ward's method and Euclidean distance. Sedimentological analyses include macroscopic and microscopic observations on texture, structure, mineralogical and grain size composition. Color of deposits was defined by Munsell color chart and the index of melanization as a tool for evaluation of the degree of soil development was calculated (Birkeland, 1999; Harden, 1982).

Results and discussion

The studied deposits from the hanging wall of Cherna Gora trench could be referred to clayey-silty sediments, sandy and calcareous in various degrees (fig. 2). Particles of silt size predominate over clay and sand sized. The later pedogenic processes has altered these deposits and blurred the layers' boundaries. (Yaneva, Lazarova, 2004). In the lower part of the section clay minerals predominate over terrigeneous ones, whereas in the upper part terrigenous minerals are dominant. Deposits from the hanging wall represent well developed soil profile with high indexes of melanization (table 1)

Gravels and pebbles, sand, silty sand and silty clays build the alluvial section of the river Omurovo in the quarry (fig. 3). The shifting of the river bed during the latest 5 ky had formed 6 flood planes

Table 1. Color indexes of dry and moist material and indexes of melanization

Trench	Period	Color/dry	Color/moist	Melanisation
w-40-15,8	Subatlantic	10YR3/1	7,5YR3/1	70
w-40-15,5	Subatlantic	10YR3/2	7,5YR2,5/1	75
w-40-15,2	Subboreal	10YR5/3	10YR4/4	40
w-40-14,5	Atlantic	10YR5/4	7,5YR5/4	30
w-40-13,5	Atlantic	10YR4/4	7,5YR4/3	50
w-40-12.5	Boreal	10YR3/2	7,5YR3/2	70
Quarry				
paleosol A	Subatlantic	10YR5.5/3.5	10YR4/3	5
paleosol A	Subatlantic	10YR6/4	10YR5/4	20
paleosol B	Subatlantic	2.5Y5.5/3	10YR4/3	20
paleosol C	Subboreal	2.5Y5.5/3	10YR5/3	15
paleosol E	Subboreal	2.5Y4/2	10YR4/2	15

capped with soil horizons. Gravels and pebbles are exposed at the lowermost part of the section forming lens-like beds. The particle size is ranging from 1 to 10 mm, dominantly 3-4 mm and the matrix is from silty and sandy material. Silty and sandy clays are composed of equal amounts clay minerals and silty-sandy sized mineral grains. The sand from the lower parts of the section is poorly sorted, more enriched in silt and clay, whereas upper sand is purer end better sorted. Main minerals are quartz, feldspars and muscovite, and larger particles represent rock fragments.

Four pollen assemblage zones (PAZ) are detached in the Cherna Gora trench (fig. 2). Moreover, zone 2 is subdivided into two subzones (CHI-1, CHI-2 (2A, 2B), CHI-3, CHI-4) (Yaneva, Lazarova, 2004). Each pollen assemblage zone, recognized on the basis of changes in the ratio between basic components of pollen spectra, reflects the main stages of the development of the vegetation communities. The oldest zone CHI-1 is separated on the basis of pollen characteristic for the Boreal climate period with abun-

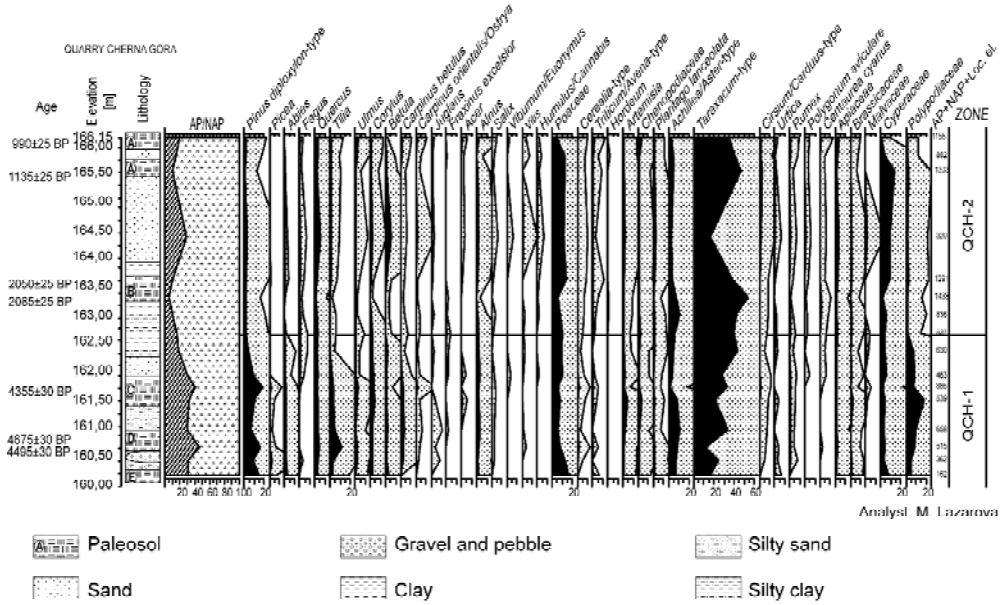

Fig. 3. Percentage pollen diagram for Cherna Gora quarry

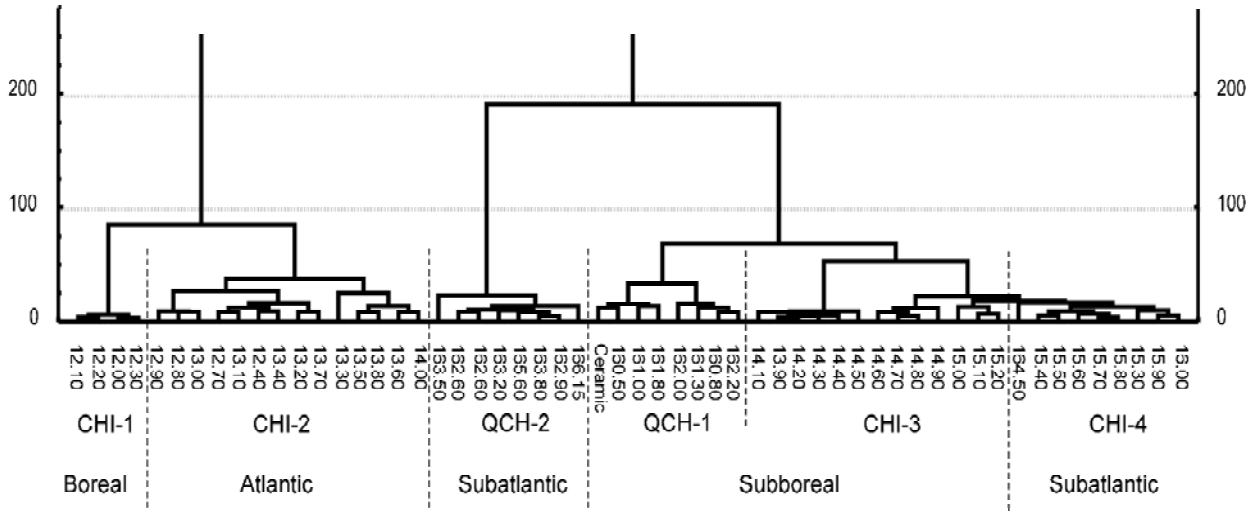

Fig. 4. Tree diagram for samples taken from the trench and quarry

dance of arboreal pollen (AP) (*Pinus* is dominant). The next zone CHI-2 coincides with the Atlantic period, when optimal ratio of temperature and humidity existed. In this zone the maximum values for AP (trees and shrubs) was registered. Zone CHI-3 is determined according to the vegetation characteristic for Sub-Boreal period and CHI-4 is referred to the Sub-Atlantic. Both zones are characteristic with an increase of all anthropogenic indicators at the expense of sharp forest degradation.

In the quarry two zones could be divided (fig. 3): QCH-1 and QCH-2. The oldest zone QCH-1 (160.80 — 162.50 m) is recognized on the basis of almost equal presence of nonarboreal pollen (NAP) and AP with domination of *Pinus*, *Quercus*, *Tilia*, *Corylus*, *Carpinus betulus*, and *Alnus*. It is dated as Sub-Boreal (4675±30 — 4495±30 years BP for paleosol D, and 4355±30 years BP for paleosol C) and is successfully correlated to CHI-3 LPZ from the Cherna Gora trench. The younger zone QCH-2 (162.50-166.20 m) is characteristic with sharp decrease of all AP parallel to the increase of the anthropogene indicators: *Taraxacum*-type, *Poaceae*, *Achillea/Aster*-type, etc. This zone is dated as Subatlantic (2085±25 — 2050±30 years BP for paleosol B, and for paleosol A — 1135±25 — 990 ±25 years BP). The lower part of the second one QCH-2 is correlated with the zone CHI-4 from Sub-Atlantic period in the trench Cherna Gora. During the Sub-Boreal and Sub-Atlantic climate periods, the human impact on the vegetation communities is much higher than the influence of climatic changes.

Cluster analysis was applied to interpret vegetational and environmental trends over the last few millennia at both sites. Using cluster analysis of pollen data, we identified characteristic species groupings. The results from cluster analysis are in good correlation with the results from pollen analysis of the samples from the trench. Pollen zones and subzones coincide with main clusters on the tree diagram (fig. 4). Thus, the deposits from Boreal and Atlantic periods are distinctly separated from those of Sub-Boreal and Sub-Atlantic. Clear subdivision into two main clusters of Sub-Boreal and Sub-Atlantic age is obvious on the tree diagram from the quarry. They reflect the two LPZ — QCH-1 and QCH-2.

On the united tree diagram the samples from CHI-3 and CHI-4 are closer to QCH-1 (Sub-Boreal) than to QCH-2 (Sub-Atlantic). The separation of depostis from QCH-1 could be explained by prolonged sedimentation in the river Omurovo after the end of sedimentation in the area of the trench Cherna Gora.

The color indexes for melanisation, calculated for the deposits from the quarry, show very low degree of pedogenesis there — indexes are between 5 and 20, whereas in the trench they are 50-70. That means that the time for formation of the soil profile in the flood planes have been much shorter that in the trench. This is another proof that sedimentation in the trench area had stopped earlier than in the quarry area.

Conclusion

The results from pollen analyses and cluster analyses allow us to attribute the age obtained from samples in the quarry to the samples from the trench with similar pollen assemblages. The similarity between the pollen assemblages confirms the Sub-Atlantic and Sub-Boreal period of the deposits from the upper 2 m in the trench. Thus deposits from the interval 14.80 — 15.30 m could be dated 4675±35 — 4355±30 years BP, and those above 15.30 — 2085±25 — 2050±30 years BP and younger. These data are useful for more exact dating of the seismic events along this part of the Chirpan fault.

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Седиментоложки и палиноложки данни за младите седименти от райна на Чирпан – Черна гора

Марлена Янева, Мария Лазарова

Резюме. Целта на настоящето изследване е корелация на холоценските седименти от кариерата при с. Черна гора и от канавата в района на същото село (фиг. 1). Необходимостта от подобна корелация се поражда от липсата на датировка на седиментите от канавата, което затруднява по-точното датиране на сеизмичните събития, описани там (Vanneste et. al., 2006). За отложенията от кариерата разполагаме със 7 C^{14} дати, получени по радиовъглероден метод. След поленовия анализ бяха отделени 4 локални поленови зони в канавата при с. Черна гора (фиг. 2), отразяващи главните етапи от развитието на растителните съобщества (CHI-1, CHI-2 (2A, 2B), CHI-3, CHI-4) (Yaneva, Lazarova, 2004) в обхвата от Бореалния до Субатлантическия климатични периоди. В кариерата при с. Черна гора са отделени две поленови зони QCH-1 и QCH-2, които много добре се корелират със зоните CHI-3 и CHI-4. Резултатите от клъстер анализа показват също така добра корелация между тези зони (фиг. 4). Тази висока степен на сходство позволява да потвърдим Суббореалната възраст на CHI-3 и да я конкретизираме около 4300—4700 години преди настоящето (за интервала 14,80—15,30 m), а за зона CHI-4 — Субатлантическата възраст около 2000—2100 години преди настоящето (и по-млада) за интервала над 15,30 m.