

## CAMPANIAN PLANKTONIC FORAMINIFERAL ASSEMBLAGES FROM THE CHUGOVITSA FORMATION IN THE AREA OF JELYAVA AND ELESHNITSA VILLAGES, SOFIA DISTRICT

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**ABSTRACT.** The Campanian turbidites of the Chugovitsa Formation, belonging to the Mediterranean type Upper Cretaceous in Bulgaria and cropping out in a narrow strip with west-east direction in the area of the villages of Jelyava and Eleshnitsa, Sofia district, are investigated herein in terms of their planktonic foraminiferal content. The area of study is part of the Panagyurishte Unit of the Srednogorie Zone and the samples were picked up from two sections located along the Jelyavska and Eleshishka rivers' valleys. The lower part of the Chugovitsa Formation in both sections comprises a 60 m package of grey, motley and violet marls referred to the Voden Member. The samples contain poor planktonic foraminiferal fauna including predominantly Early Campanian taxa like *Globotruncanita elevata* (Brotzen), and species with broader stratigraphic range – *Globotruncana arca* (Cushman), *Globotruncana lapparenti* Brotzen, *Globotruncanita stuartiformis* (Dalbiez), *Rugoglobigerina rugosa* (Plummer). The upper levels are composed of about 300 m turbidite deposits containing more diverse and abundant assemblages represented by Early to Late Campanian taxa including, apart from the above mentioned, *Globotruncana ventricosa* White, *Globotruncanita stuarti* (de Lapparent), *Heterohelix globulosa* ((Ehrenberg), *Pseudotextularia elegans* (Rzehak). Two biostratigraphical zones were defined following Premoli Silva and Verga's (2004) zonation – *Globotruncanita elevata* and *Globotruncana ventricosa*.

**Keywords:** planktonic foraminifers, Chugovitsa Fm., Campanian, Srednogorie zone, Sofia District.

## КАМПАНСКИ ПЛАНКТОННИ ФОРАМИНИФЕРНИ АСОЦИАЦИИ ОТ ЧУГОВИШКАТА СВИТА В РАЙОНА НА СЕЛАТА ЖЕЛЯВА И ЕЛЕШНИЦА, СОФИЙСКА ОБЛАСТ

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**РЕЗЮМЕ.** Кампанските турбидити на Чуговишката свита, принадлежащи на Медитеранския тип Горна Креда в България, разкриващи се като тясна ивица с посока запад-изток в района на селата Желява и Елешница, Софийска област, са изследвани от гледна точка на съдържащите се в тях асоциации от планктонни фораминифери. Изучаваният район попада в рамките на Панагорската единица на Средногорската зона. Пробите са взети от два разреза, разположени в долините на реките Желявска и Елешнишка. Долната част на Чуговишката свита, и в двата разреза, е изградена от пачка с дебелина 60 m включваща сиви, пъстри и виолетови мергели, отнесени към Воденския член. Пробите съдържат бедна асоциация предимно от раннокампански таксони като *Globotruncanita elevata* (Brotzen), както и видове с по-широко стратиграфско разпространение – *Globotruncana arca* (Cushman), *Globotruncana lapparenti* Brotzen, *Globotruncanita stuartiformis* (Dalbiez), *Rugoglobigerina rugosa* (Plummer). Горните нива на свитата са представени от турбидитна последователност с дебелина около 300m, съдържаща ранно- и къснокампански асоциации, включващи, освен горните видове, *Globotruncana ventricosa* White, *Globotruncanita stuarti* (de Lapparent), *Heterohelix globulosa* ((Ehrenberg), *Pseudotextularia elegans* (Rzehak). Отделени са две биостратиграфски зони съгласно схемата на Premoli Silva and Verga (2004) – *Globotruncanita elevata* и *Globotruncana ventricosa*.

**Ключови думи:** планктонни фораминифери, Чуговишка свита, Кампан, Средногорска зона, Софийска област.

## Introduction

The sections near the villages of Jelyava and Eleshnitsa, Sofia district, reveal almost complete succession of the Mediterranean type Upper Cretaceous in Western Bulgaria. They comprise Turonian marls, Coniacian glauconitic sandstones, Coniacian–Campanian carbonate and turbidite deposits. Златарски (1910) first described the rocks near the village of Eleshnitsa referring them to the "Campanian substage". Later on Цанков (1965) determined Maastrichtian age for the carbonates in the same section (the village was named Yordankino in the period between the 1960s and the 1980s) and Dimitrova et al. (1981) divided three levels in the section near Jelyava: Coniacian (113 m), Santonian (200 m) and Campanian (677 m). Димитрова et al. (1984) refined this subdivision into Coniacian (totally 113 m including 15 m

glauconitic sandstones in the base and 98 m carbonates), Santonian (200 m carbonate deposits) and Campanian (including 170 m carbonate and 250 m turbidite sequences). The basal terrigenous level and the carbonate one the authors described as "limestone-marl formation" (corresponding to the "first", "second" and "third horizon" of the Maastrichtian of Връблянски et al., 1961) and the turbiditic level – as "flysch formation" ("fourth horizon" of the Maastrichtian of Връблянски et al., 1961). Начев and Начев (1989, 2003) followed this subdivision.

Чунев (1995) referred the rocks of the "limestone-marl formation" to the Mirkovo Formation and these of the "flysch formation" – to the Chugovitsa Formation. The two formal units were introduced and described by Моев and Антонов (1976, 1978) in the Stargel–Chelopech strip. Later on Popov (2005)

united them into the Popintsi Group in Panagyurishte ore region.

Sinnyovsky (Sinnyovsky, 2005; Синьовски, 2007), Дабовски et al. (2009) and Antonov (2010) followed Моев and Антонов's subdivision as the first author recognized the Voden Member of Моев and Антонов (1978) comprising 60 m at the base of the Chugovitsa Formation in the sections near Jelyava and Eleshnitsa. He also noted that "none of the previous investigators reported the presence of large-scale slump structures, resulting in significant augmentation of the thickness".

From micropaleontological point of view, the sections have been investigated by means of planktonic foraminifers and calcareous nannoplankton. Dimitrova (in Dimitrova et al., 1981; Димитрова et al., 1984) examined planktonic foraminifers in thin sections. She gave lists of species representing the most characteristic taxa for every individual package in Jelyava section. Later on Dimitrova and Valchev (2007) summarized these data and indicated the presence of Globotruncanita elevata and Globotruncanita stuartiformis zones. Sinnyovsky, at first indicated three nannofossil zones (Синьовски, 1993), and later on (Sinnyovsky, 2005; Синьовски, 2007) published a detailed Campanian nannofossil zonal scheme concerning the upper levels of the Mirkovo Formation and the entire Chugovitsa Formation.

The present article aims to elucidate in details the taxonomical composition and the structure of the planktonic foraminiferal assemblages on the basis of isolated specimens

recovered from the Chugovitsa Formation and to estimate their biostratigraphical importance.

### Geological Setting

The area of study is part of the Panagyurishte Unit of the Srednogorie Zone (according to Дабовски and Загорчев, 2009, Fig. 1). The outcrops of the Mediterranean type Upper Cretaceous form a narrow strip with west-east direction in the southernmost part of Western Balkan. The samples were picked up from two sections located along the valleys of Jelyavska and Eleshishka rivers in the northern outskirts of Jelyava and Eleshnitsa villages (Fig. 2).

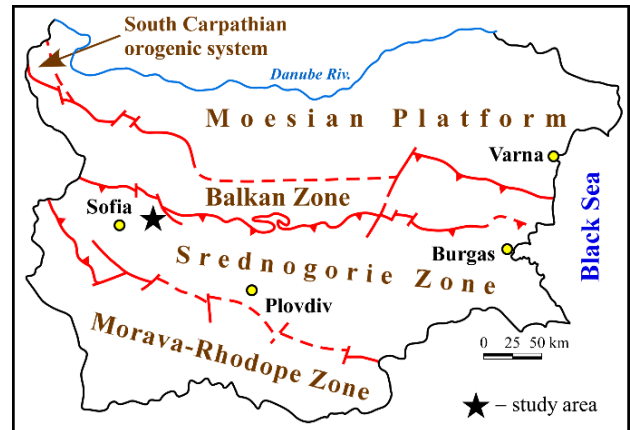


Fig. 1. Tectonic subdivision of Bulgaria (after Дабовски and Загорчев, 2009) with the location of the area of study

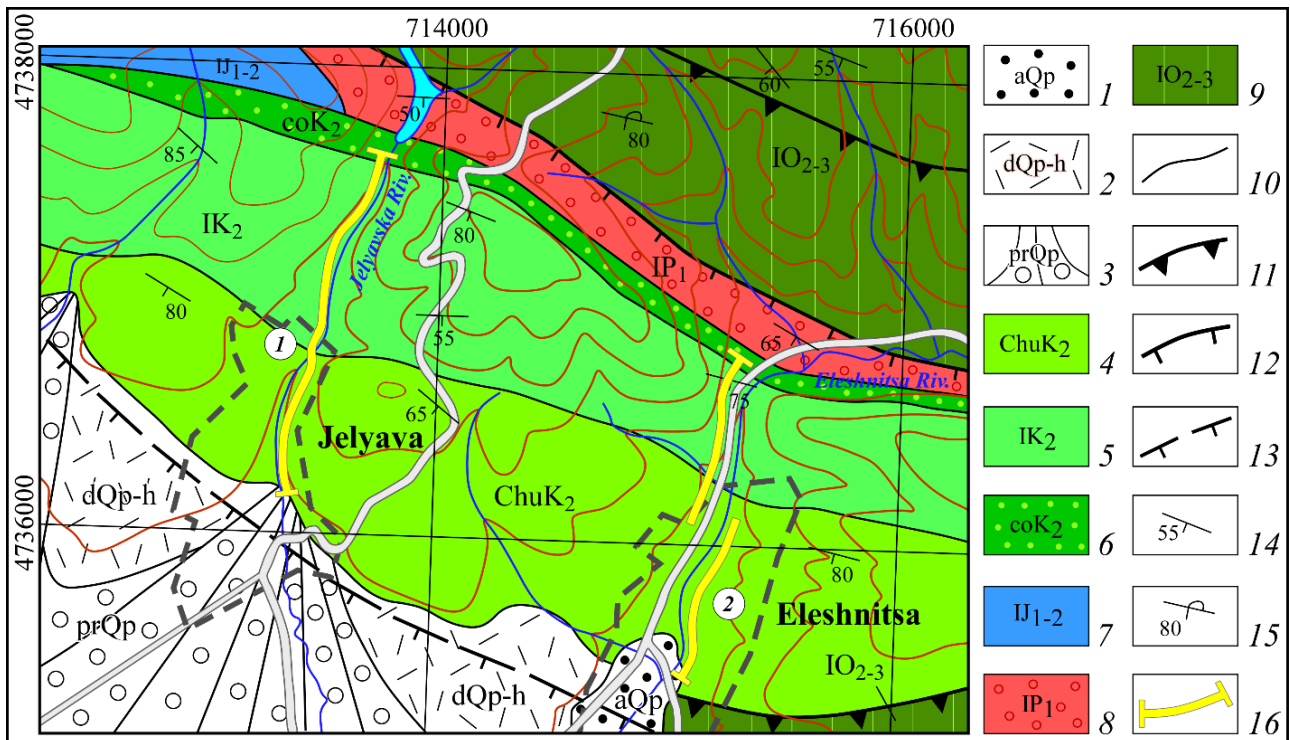


Fig. 2. Geological map of the area of Jelyava and Eleshnitsa villages (after Angelov et al., 2010 with modifications)  
 1-3) Quaternary (1 - alluvium, Holocene; 2 - deluvium, Pleistocene–Holocene; 3 - proluvium, Pleistocene); 4–6) Upper Cretaceous (4 - Chugovitsa Formation: rhythmic alternation of limy sandstones, siltstones, mudstones, marls and clayey limestones, Campanian; 5 - Mirkovo Formation: red to rose and gray-greenish clayey limestones, Santonian-Campanian; limestone-marl formation: gray and motley limestones and marls, Coniacian; sandstone formation: carbonate glauconitic sandstones, Coniacian; 6 - coal formation: conglomerates and breccia-conglomerates, sandstones, siltstones, limy mudstones, marls, clays and coal, Turonian); 7) Lower–Middle Jurassic (Gradets Formation: quartz sandstones, Aalenian-Bajocian; Ozirovo Formation: sandy bioclastic limestones and silty marls, Sinemurian–

Toarcian; Kostina Formation: sandstones and conglomerates, Sinemurian; trirrigenous-coal formation: quartzites, quartz sandstones, sandy mudstones, Hettangian); 8) Lower Permian (Berimer Formation: breccia-conglomerates, sandstones, siltstones; Lokorsko Formation: conglomerates, breccia-conglomerates, sandstones, siltstones); 9) Middle–Upper Ordovician (Tseretsel Formation: green mudstones, Upper Ordovician; Grohoten Formation: mudstones, silty mudstones, siltstones, quartzites, and quartzitic sandstones, Middle-Upper Ordovician); 10) lithostratigraphic boundary; 11) reverse fault; 12) proven normal fault; 13) supposed normal fault; 14) normal bedding; 15) overturned bedding; 16) section: 1 - Jelyava, 2 - Eleshnitsa

The base of both sections (Fig. 3) is composed of marls referred to the coal formation of Turonian age (Plate 1a). They are overlaid with parallel unconformity by 7–15 m carbonate glauconitic sandstone with inoceramid and rare echinid remains comprising the sandstone formation of Coniacian age (Plate 1a, b). The next level is composed of 220 m gray and motley predominantly thick-bedded to massive limestones and marls belonging to the Mirkovo Formation (Plate 1b, c). In Eleshnitsa section a thin package of tephra layers (190 m

above the base) is observed. In the section near the village of Jelyava this interval is not well exposed and it is characterized by the presence of slump structures. The base of the Chugovitsa Formation is represented by 60 m grey to violet marls referred to the Voden Member (Plate 1d-f). They are overlaid by a 300 m thick turbidite succession with dominance of the marl interbeds and marl packages in its lower levels (Plate 1f-h).

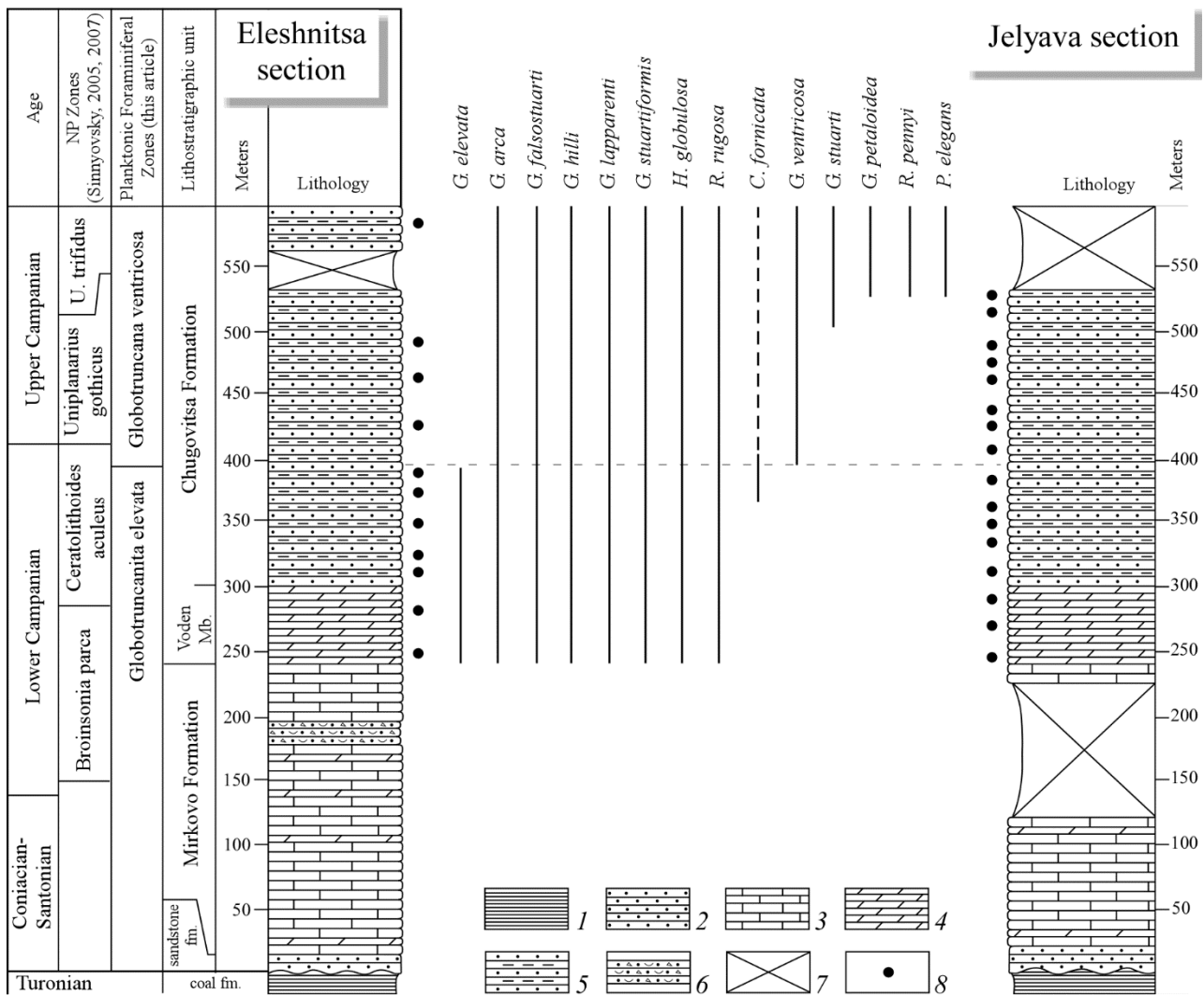


Fig. 3. Stratigraphical columns of Eleshnitsa and Jelyava sections (after Sinnyovsky, 2005, Синьовски, 2007, with modifications) with the distribution of the planktonic foraminiferal taxa

1, marls; 2, sandstones; 3, limestones; 4, limy marls; 5, turbidites; 6, tephra layers; 7, interval without outcrops; 8, sample

### Planktonic foraminiferal assemblages and zones

The samples from the Voden Member contain poor planktonic foraminiferal fauna including predominantly Early Campanian taxa like *Globotruncanita elevata* (Brotzen), and species with broader stratigraphic range – *Globotruncana arca* (Cushman), *Globotruncana lapparenti* Brotzen,

*Globotruncanita stuartiformis* (Dalbiez), *Rugoglobigerina rugosa* (Plummer). The samples from the typical Chugovitsa Formation contain more diverse and abundant assemblages represented by Early to Late Campanian taxa including apart from the above mentioned *Globotruncana ventricosa* White, *Globotruncanita stuarti* (de Lapparent), *Heterohelix globulosa* ((Ehrenberg), *Pseudotextularia elegans* (Rzehak).

Two biostratigraphical zones were defined following Premoli Silva and Verga's (2004) zonation – *Globotruncanita elevata* and *Globotruncana ventricosa*.

#### **Globotruncanita elevata Partial Range Zone**

*Author.* Postuma (1971). In Bulgaria it was introduced by Ванцарова (1975) as “*Globotruncana elevata*” Zone.

*Definition.* Interval, with *Globotruncanita elevata* (Brotzen), from last occurrence of *Dicarinella asymetrica* (Sigal) to first occurrence of *Globotruncana ventricosa* White.

*Common taxa.* In the lower levels (the lowermost 50 m) of the zone, despite the zonal marker *Globotruncanita elevata* (Brotzen), *Globotruncana arca* (Cushman), *G. lapparenti* Brotzen, *Globotruncanita stuartiformis* (Dalbiez) were recorded as rare specimens, while taxa like *Globotruncana falsostuarti* Sigal, *G. hilli* Pessagno, *Heterohelix globulosa* (Ehrenberg), and *Rugoglobigerina rugosa* (Plummer) occur as single specimens only. The middle and upper levels reveal the same taxonomical composition, but with higher specimen abundance.

*Age.* Early Campanian.

*Correlation.* The zone is cosmopolitan. Its taxonomical composition is the same as in the zones described by Wonders (1980), Robaszynski et al. (1984), Caron (1985), Abdel-Kireem et al. (1995), Salaj (1980). In Bulgaria it was established by Vaptzarova (1976, 1980) in the western and central north parts of the country.

*Remarks.* Premoli Silva and Verga (2004) limited the range of the zone in the Lowermost Campanian only.

*Boundaries.* The lower boundary was not fixed in the present study. The upper one was established at 400 m above the base of the sections.

*Thickness.* At least 150 m.

#### **Globotruncana ventricosa Interval Zone**

*Author.* Dalbiez (1955).

*Definition.* Interval from first occurrence of *Globotruncana ventricosa* White to first occurrence of *Radotruncana calcarata* (Cushman).

*Common taxa.* In the lower levels the zonal marker *Globotruncana ventricosa* White occurs predominantly as single to rare specimens and it increases gradually its abundance in the middle and upper levels. Common taxon throughout the entire interval is *Globotruncanita stuartiformis* (Dalbiez). Species like *Globotruncana falsostuarti* Sigal, *G. hilli* Pessagno, *Heterohelix globulosa* (Ehrenberg), and *Rugoglobigerina rugosa* (Plummer) are additional elements to the assemblages. In the uppermost levels *Globotruncanita stuarti* (de Lapparent), *Pseudotextularia elegans* (Rzehak), *Globotruncanella havanensis* (Voorwijk), and *Rugoglobigerina penyi* Broennimann were recorded as single or rare specimens.

*Age.* Latest Early Campanian–Late Campanian.

*Correlation.* The zone corresponds entirely to the zone of the same name of Abdel-Kireem et al. (1995), partly to *ventricosa* zone of Caron (1985), Robaszynski et al. (1984), and Wonders (1980), *arca* and *rugosa* zones of Salaj (1980). In Bulgaria it could be correlated to *Globotruncanita stuartiformis* zone of Dimitrova and Valchev (2007) and *Globotruncana rugosa* zone of Vaptzarova (1976).

*Remarks.* In the sections near the villages of Jelyava and Eleshnitsa the zonal marker *Radotruncana calcarata*

(Cushman) was not found and therefore the upper boundary of this zone was not defined. Thus, the entire interval above *Globotruncanita elevata* zone is referred to *Globotruncana ventricosa* zone.

*Boundaries.* The lower boundary was established at 400 m above the base of the sections.

*Thickness.* 200 m.

## **Conclusion**

The turbidite deposits of the Chugovitsa Formation are well exposed in the northern outskirts of the villages of Jelyava and Eleshnitsa and they provide a good opportunity for a biostratigraphical study of the Campanian interval – four nannofossil zones have been previously defined. In terms of planktonic foraminifers the investigated assemblages are low to moderately diverse and with low abundance of specimens. On the other hand, the assemblages are dominated by species of broad stratigraphical range. This fact is an obstacle to find biostratigraphical markers (FAD and LAD) for a detailed zonation – only the FAD of *Globotruncana ventricosa* White was recorded in the sections and therefore only two zones were defined.

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PLATE I

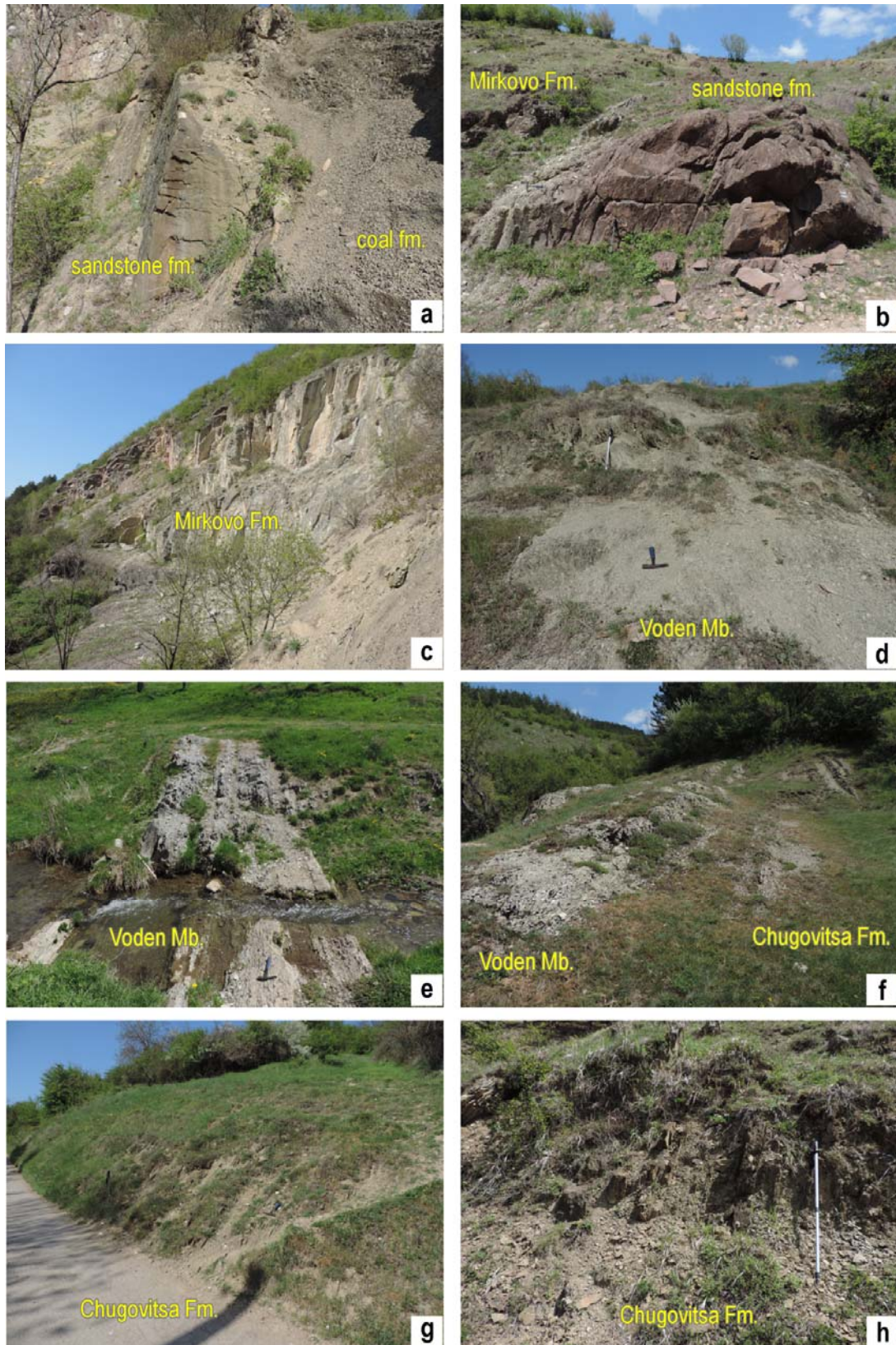


PLATE I

a) the base of the Mediterranean type Upper Cretaceous 1 km north of the village of Eleshnitsa representing the coal and the sandstone formations; b) the sandstone formation and the base of the Mirkovo Formation 1.5 km north of the village of Jelyava; c) the Mirkovo Formation in the Eleshnitsa River valley 800 m north of the village of Eleshnitsa; d) the Voden Member of the Chugovitsa Formation in the northern outskirts of the village of Eleshnitsa; e) the Voden Member in the valley of Jelyavska River 1 km north of the village of Jelyava; f) the uppermost levels of the Voden Member and the base of the typical Chugovitsa Formation on the left riverside of Jelyavska River; g, h) the lower levels of the Chugovitsa Formation in the northern outskirts of the village of Eleshnitsa (g) and on the left riverside of Jelyavska River (h).