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MIHAI ŞTEFĂNESCU

STRATIGRAPHY AND STRUCTURE OF CRETACEOUS AND PALEOGENE FLYSCH DEPOSITS BETWEEN PRAHOVA AND IALOMIŢA VALLEYS

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CONTENTS

STRATIGRAPHY AND STRUCTURE OF CRETACEOUS AND PALEOGENE FLYSCH DEPOSITS BETWEEN PRAHOVA AND IALOMIŢA VALLEYS[1]

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Key words: Cretaceous. Paleogene. Flysch. Olistostromes. Molasse. Stratigraphic units. Tectonic units. Nappes. East Carpathians - Flysch Zone.

Abstract: The convex East Carpathian bend area exhibits a wide range of formations and an extremely complex structure. The author of the present study envisages a solution to the problems raised by a certain perimeter of this area, situated in the western end of the flysch outcropping zone, i.e. between Proviţa Valley in the east and Vulcana Valley in the west. The original results obtained are synthetically presented. The study puts forward the description of Lower Cretaceous-lowermost Miocene formations in flysch facies (Sinaia, Comarnic, Vârfu Rădăcinii and Podu Vârtos Beds, Marly-sandy Rusty Flysch, Fieni Series, Macla Series, Variegated Clays Series, Şotrile Facies, Tarcău Sandstone Facies and Pucioasa Beds with Fusaru Sandstones Facies, Upper Cretaceous hemipelagic and pelagic rocks (Dumbrăvioara Series, Plaiu Marls, Gura Beliei Marls), Upper Cretaceous olistostrome-type rocks (breccias of Dumbrăvioara Series) and Lower Miocene rocks (Slon Facies, breccias related to Sărata Gypsum), molasse formations (Colţii Brăţii Conglomerates, Lower Miocene and Pliocene molasse) and Quaternary deposits. Most of the mentioned formations (less the Pliocene and Quaternary ones) are involved in a complex structure characterized by the co-existence of nappes, the folding of post-nappe covers, the diapirism phenomena and the vertical faults of different trending. Within this structure, it is to note the overthrust units which, starting from inside outside, are the following: Ceahlău Nappe, Teleajen Nappe, Macla Nappe, Variegated Clays Nappe and Tarcău Nappe. The tectonic contacts among the first three cited units are unconformably overlain by a post-nappe cover which includes the whole Upper Senonian-Oligocene interval, also accounting for the moment of emplacement of these units. The Oligocene stage is followed by a new stage of tectonic movements during which over the area corresponding to the Tarcău Nappe slid the Variegated Clays Nappe and then the Ceahlău, Teleajen and Macla Nappes pile as well as their common cover were thrust over. All the tectonic contacts among the nappes of this area are overlain by a new common cover, Lower Miocene in age, subsequently refolded, synchronous with the Tarcău Nappe overthrust. This structure results from long time evolution marked by alternating accumulation and tectogenetic stages, analysed and illustrated by original graphs in the present study.

[1] Paper received on November 4, 1986, accepted for publication on December 4, 1986. Thesis for a doctor's degree held on April 5, 1978 at the University of Bucharest.

Foreword

The present paper is the original version of the thesis for a doctor's degree held in 1978 and elaborated in 1974. Considering the long time lapse between elaboration and publication some specifications are needed with respect to the following pages.

It should be mentioned from the very beginning that no geologic data subsequent to the initial study are presented. Some descriptive or historical details have been restricted, and in order to facilitate the correlation with the adjoining areas the stratigraphic divisions of the Paratethys from the original text have been replaced by those used for drawing up the geological maps of Romania, scale 1:50,000. However, the scientific content of the paper has not been altered by the changes mentioned. For the same purpose, certain local names have been preserved although they have synonyms resulted from direct correlations.

It is also to note that some data or inferences first pointed out in the thesis for a doctor's degree have been subsequently published by the author in several papers or geological maps. Nevertheless, as far as most of the original data are not known yet and no synthesis study concerning this area has been published so far, this paper seems to be worth presenting to the specialists even in this abbreviated form.

Introduction

The bend area is the most complex segment of the Eastern Carpathian Flysch Zone resulting from both the superposition of successive tectonic movements and the joining of tectonic and sedimentary phenomena. If the characteristic zonal development of the Eastern Carpathians appears in the basins of the Teleajen and even the Prahova valleys, starting from the latter westwards it is almost completely effaced and therefore the facies and structural studies are extremely difficult along the strike. The area of interest is located to the west of the Prahova Valley, in a particularly complex zone, marked by all the features mentioned above.

The mapped area is figured as an irregular polygon with its sides meeting in the following geographic points: Salcia peak, confluence of the Crevedia Valley and the Ialomicioara de Jos river, Pietroşiţa, confluence of Bizdidel and Bisericii valleys, the localities of Talea, Valea Târsei, Ursei, Bela, Mălăiştea peak and Salcia peak again.

This perimeter covers an area of approximately 200 km^2 including 6000 observation points. The detailed mapping was required by the high complexity of the region investigated with numerous outcropping formations (37 lithologic units defined) and intense tectonic movements affecting them.

If the age of the formation previously delimited was partially known, their areal extent and the relationships among these formations were far from being stated. We came to understand this from the initial stage of documentation and consequently the field investigations were carried out in order to solve the problems mentioned above. The final results of the researches have shown that the most important contribution to the geological study of this area regarded the areal extent, the stratimetry and the spatial relations among formations.

The data obtained led to the elaboration of a map, substantially changed by comparison with the preexisting ones, which constitutes the reference material for all the descriptions and interpretations presented.

Thanks are due to all those who, in time, contributed to the elaboration of the present paper: to my family, who offered me excellent conditions for study and work, to all my professors at the faculty who introduced me to the wonderful world of geological sciences and made me love and respect this profession, to my colleagues at the Institute of Geology and Geophysics with whom I discussed and elucidated certain problems. I am also grateful to geologist Gr. Popescu who taught me that only tenacious and minute investigation may result in valuable mapping.

My gratitude is due to academician G. Murgeanu who accepted me as candidate for a doctor's degree.

I express my sincere thanks to professor Ion Dumitrescu for his competent help to finalize my study.

1. Previous Works

The first geologic data on the area under discussion were published by the end of the last century. They were obtained by geologic investigations carried out over large areas.

The end of the last century marks the intensification of research studies which become more and more detailed. The investigations were carried out by: Popovici-Hatzeg (1898), Mrazec and Teisseyre (1907), Teisseyre (1908), Popescu-Voiteşti (1910, 1914), Protescu and Murgeanu (1927), Murgeanu (1930 a, b, 1934, 1937), Filipescu (1934), Motaş (1951, 1952), Olteanu (1952), Popescu (1953), Băncilă (1958), Murgeanu, Contescu, Mihăilescu (1962), Ştefănescu, Butnăreanu, Zamfirescu, Matei, Avram (1964), Ştefănescu, Avram, Ştefănescu (1965), Albu, E. Albu, Cucu (1966), Bratu (1966, 1972), Ştefănescu (1969 b, 1970), Boldor, C. Ştefănescu, Iavorschi, Sacerdoţeanu (1969).

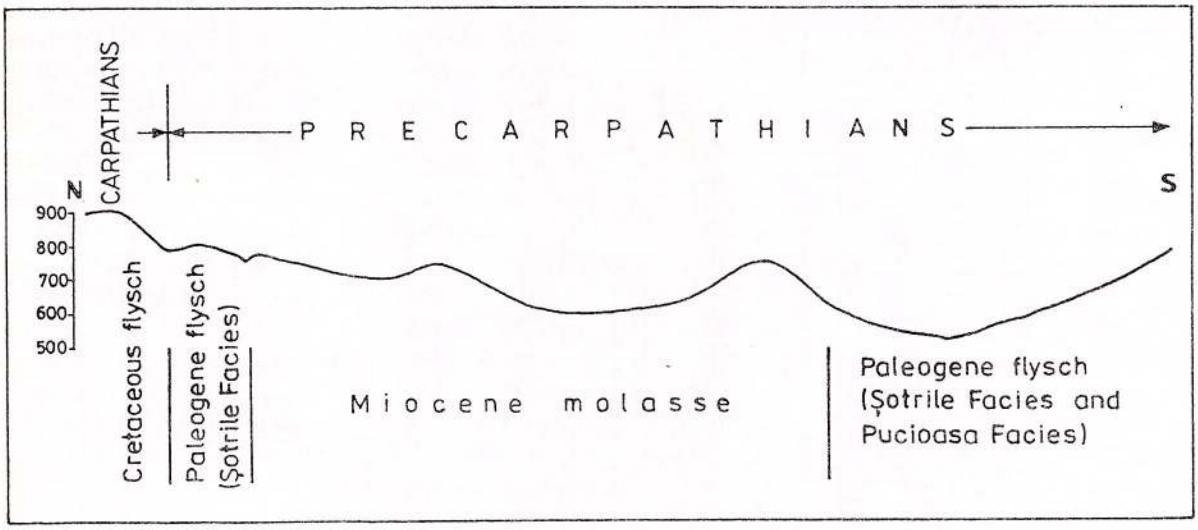

Fig. 1 – Schematic morphologic section of the investigated area along Runcu Bezdeadului peak meridian.

2. Orohydrographic Features of the Investigated Area

The investigated area is geographically assigned to both the Carpathians and the Precarpathians (Mihăilescu, 1963) divided by the Comarnic-Ocina-Dealul Mare line.

The area under discussion appears morphologically as a symmetrical basin (Fig. 1), sunk in the axial area of the Slănic Syncline and exhibiting two thresholds corresponding to its limbs. Both north- and southwards the altitude increases gradually, but not continuously, due to some minor east-west trending depressions, out of which the most characteristic one lies to the south of the Slănic Syncline and corresponds to the breccia occurrences in Slon facies.

The main ridges and the valleys in between generally trend N-S. These valleys are tributaries to the two rivers flowing in the eastern and western areas, namely the Prahova and the Ialomiţa valleys. The hydrographic basins of the two valleys are divided by the ridge linking the peaks Măgura and Sultanu.

3. Stratigraphy

In the area of interest 37 lithologic units have been mapped and assigned to the Hauterivian-Quaternary stratigraphic interval (Pl. I). Their extent, lithologic features and paleontologic content are presented below.

3.1. Hauterivian-Barremian

3.1.1. Sinaia Beds (Teisseyre, 1908)

3.1.1.1. Lamellaptychus angulocostatus Horizon. (Murgeanu, Patrulius, Contescu, 1959). The sandy-calcareous flysch of the Sinaia Beds occurring in the Baiului Mts exhibits several lithological subdivisions (Murgeanu et al., 1959, 1964). Out of them, the investigated perimeter shows only the *Lamellaptychus angulocostatus* level, which is the upper-most one within the Sinaia Beds. In the Prahova Valley, it was first reported by Mrazec (fide Mrazec, Macovei, Popescu-Voiteşti, 1912) as marking the transition from the Sinaia Beds to the Comarnic Beds. In their study regarding the Prahova Valley, Protescu and Murgeanu (1927) assign this level to the Comarnic Beds. As a result of his investigations in the Ialomiţa Valley, Murgeanu (1930 a) reports "the transition beds lying in the Valea Tiţei and the source area of the Coporod Valley" to the Sinaia Beds.

These rocks are well exposed in the Ialomiţa Valley, south of Pietroşiţa. To the east, they are less and less spread and they disappear completely in the Bizdidel Valley. This level occurs as a narrow band in the right slope of the Talea Valley, downstream its confluence with the Belia Valley.

The *Lamellaptychus angulocostatus* horizon (150–200 m thick) consists of the following lithological types (Fig. 2):

– breccias, ranging from a few mm to 25–30 cm thickness, including angular fragments of micaschists

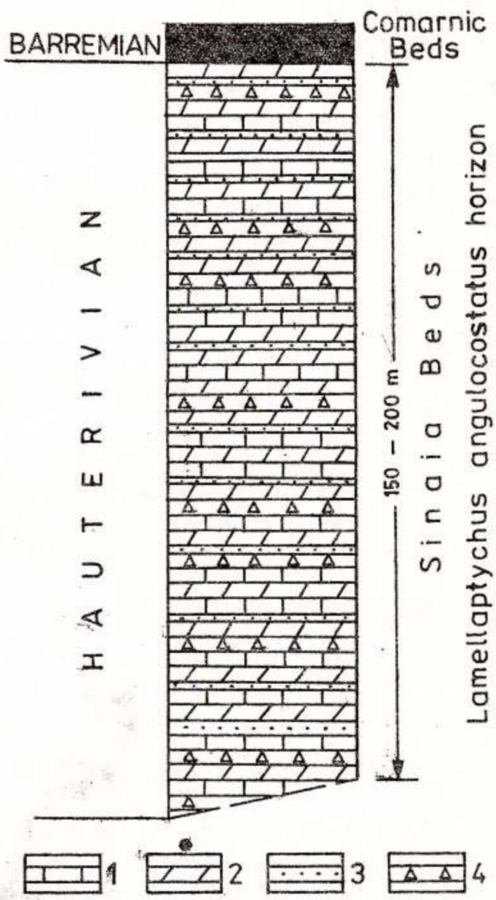

Fig. 2 – Lithologic column of Lamellaptychus angulocostatus horizon of the Sinaia Beds. 1, marly-limestones; 2, marls; 3, sandstones; 4, breccias.

and biotite paragneisses, grey micritic limestones bearing *Calpionella alpina* LORENZ and *Saccocoma* limestones. Grey and white quartz and shale pebbles of green and rarely grey marls. The fresh fracture of these breccias points to the grey colour and when altered they are white;

– grey calcareous sandstones characterized by commonly cross laminar structure, rarely exceeding 5 cm in thickness. Their bottom exhibits both sole markings (flute-casts, load-casts and drag-marks) and bioglyphs. The lower part of sandstones is commonly coarse-grained and consists of angular elements of the same type as those of the above mentioned breccias;

– marls and argillaceous marls of light grey colour, partly siltic and platy;

– deep white marly-limestones, ranging from 1 cm to 30 cm in thickness, with a mean value of 5–10 cm. They frequently show grey fucoids. The marly-limestone layers contain sparse detrital laminae at the base.

Numerous Aptychus and hibolits specimens have been reported by previous researchers from the lower parts of breccias and sandstones. The present author has also found some *Lamellaptychus* specimens, although this was not a main object of investigation: *Lamellaptychus angulocostatus* (PET.) f. typ. TRAUTH (Valea fără Nume, field between Ialomiţa and Ţâţa valleys); *L. angulocostatus* (PET.) var. *atlantica* TRAUTH (field north of Valea Brăţii); *L. angulocostatus* (PET.) var. *longa* TRAUTH (west of the field between Ialomiţa and Ţâţa valleys); *L. diday* COQ. (right tributary of Bizdidel Valley); *L. angulo-didayi* QUENST., *L. angulocostatus* (PET.) (west of the field between Ialomiţa and Ţâţa valleys).

Lamellaptychus angulocostatus COQ is particularly relevant of the age of rocks as it occurs beyond the upper boundary of the Hauterivian (Durand Delga, Gassiorówski, 1970). The other specimens cited also occur in the Barremian.

Taking into account these occurrences, one should agree that the *Lamellaptychus angulocostatus* horizon is assigned to the Hauterivian. This also corresponds to the fact that it is conformably overlain by the Comarnic Beds with their base abunding in Lower Barremian fauna (Patrulius, 1969). However, there are no paleontologic proofs of a perfect superposition between the lithologic boundary between the two formations mentioned above and the time boundary between the Hauterivian and the Barremian. Therefore, part of the latter might be reported to the *Lamellaptychus angulocostatus* horizon.

3.1.2. Comarnic Beds (Mrazec, Popescu-Voiteşti, 1912; emend. Ştefănescu, 1971)

Owing to their lithologic features, the Comarnic Beds had been the object of geologic studies since the first investigations and in 1912 they were defined as independent lithologic unit. The subsequent successive studies (Murgeanu, 1930 a, 1934; Patrulius, 1952; Murgeanu et al., 1958, 1964; Jipa, 1961; Ştefănescu et al., 1964; Ştefănescu, 1971) informed on their age and lithologic characteristics.

The Comarnic Beds, located between the Sinaia Beds at the bottom and the Podu Vârtos Beds at the top crop out all over the area between Ialomiţa and Prahova valleys, but showing different development. They constitute narrow bands between Ţâţa and Bizdidel valleys and from there eastwards they overlie almost the whole area with Hauterivian-Barremian flysch.

This formation is ca 200 m thick and consists of the following rock alternances (Fig. 3):

– rudites, 1.5 m thick, containing Upper Jurassic limestones of Stramberg type, micrite limestones with tintinnids, of Tithonian or Berriasian age, coral or gastropod fragments, marly shale pebbles, white quartz and biotite paragneisses. Depending on the degree of

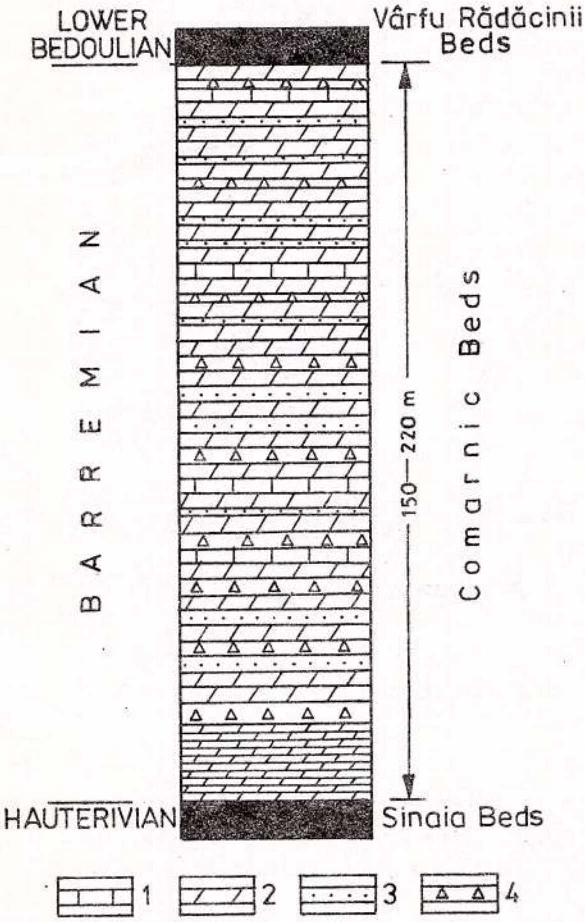

Fig. 3 – Lithologic column of the Comarnic Beds. 1, calcareous marls; 2, marls; 3, sandstones; 4, breccias and calcarenites.

roundness rudites exhibit either breccia features or conglomerate features;

– yellow, hard calcarenites, 2–5 cm thick. Calcarenites consist mainly of yellow or brown micritic limestone fragments, white limestones, oolites, whole organisms or only parts of them, biotite crystalline schists. All of them are contained by a limy-clayey matrix with fine quartz clasts, cemented by crystalline calcite (Jipa, 1961). Calcarenites are marked by cross lamination and simple, normal grading. The calcarenites bottom exhibits sole markings such as load-casts, flute-casts, crescent-casts and drag-marks. Rather often, the upper laminae of calcarenites being very fine are detached by alteration and generate characteristic sound plates;

– grey-yellowish limy sandstones with parallel or cross lamination, 2–5 cm, sometimes 10 cm thick;

– limy marls grey or yellow when weathered. A higher calcium carbonate amount leads to their platy aspect. Marls are the main lithologic component of the Comarnic Beds;

– yellowish marly-limestones usually 3–5 cm thick.

The Comarnic Beds are affected by advanced folding which makes the restoration of their lithologic sequence very difficult. The following sequence of the lithologic constitution has been inferred from the study of several sections (Fig. 3): 1–2 m coarse-grained conglomerate breccia; 5–20 m platy marls which grade into flysch type deposits mainly consisting of grey marls alternating with grey limy sandstones. This characteristic lithologic constitution of the Comarnic Beds is enriched by calcarenites and yellow breccias which are mostly developed (1–1.5 m thick and 5–15 cm in diameter) in the lower half of the sequence. To the top of the Comarnic Beds the breccia interlayerings in marls are scarcer and scarcer and the calcarenites are thinner and scarcer.

The first investigations of the Comarnic Beds pointed out fossil remnants: *Orbitolina lenticularis* d'ORB., *Pentacrinus* sp., *Belemnites* sp. (Mrazec et al., 1912), *Neohibolites duvaliaeformis* STOL., *N.* aff. *clava* STOL., *Orbitolina lenticularis, Ancyloceras* sp. (Murgeanu, 1930 a). Later studies of several outcrops of the Comarnic Beds occurring in areas adjoining to the territory under discussion reported rich faunas of *Phylloceras tethys* d'ORB., *Pachiphylloceras infundibulum* d'ORB., *Lythoceras raricinctum* UHL., *Barremites difficile* d'ORB., *Leptoceras subtile* UHL. (Plaiul Hoţilor – Patrulius, 1952), *Silesites vulpes* COQ. (field on the left of the Florei de Prahova Valley), *Pulchellia prahovensis* AVRAM et ŞTEFĂNESCU, *Hamulina fumisugina* HOH., *Biasaloceras subsequensis* KAR. (Prahova Valley), *Pulchellia schlumbergeri* NICKLES, *Leptoceras beyrichi* KAR. (Păltinoasa Valley – Ştefănescu et al., 1965).

Other fauna specimens recognized during the author's investigations add to the inventory of the Comarnic Beds: *Pseudobelus bipartitus* (d'ORB.) (Ialomiţa Valley downstream Pietroşiţa), *Duvalia lata* BLAINV. (right-side tributary of Valea fără Nume), *Lamellaptychus angulocostatus (Pet.)* var. *atlantica* TRAUTH (ridge west of Bizdidel Valley), *L. angulocostatus (Pet.)* f. typ TRAUTH (right-side tributary of Ţâţa Valley).

From the very beginning, the Comarnic Beds have been assigned to the Barremian-Aptian interval (Mrazec et al., 1912). Then, Murgeanu (1930 a) reported them to the Barremian-Bedoulian interval based on a *Neohibolites* aff. *clava* STOL. specimen; this age has been long time adopted.

Considering the fauna reported – mostly presented above – and their geometric position, the Comarnic Beds *s. str.* with their present meaning have been assigned to the Barremian only.

3.2. Aptian

3.2.1. Vârfu Rădăcinii Beds (Ştefănescu, 1971)

Before their delimitation as independent lithologic unit, these beds has been assigned either to the Comarnic Beds (more often than not) or to the overlying Aptian deposits.

The lithologic description of the Vârfu Rădăcinii Beds defined by Ştefănescu (1971) is presented below:

- hard, well cemented calcareous breccias, consisting almost exclusively of white micritic limestone and sparse fragments of chlorite schists. These are contained by a grey-white calcareous matrix, of siderite character, which altered gets a characteristic red-violaceous colour. Therefore, the prevailing white colour of the fresh break of breccia is replaced by the mottled aspect: red with white spots. The breccias are 5–20 cm thick;
- grey micaceous sandstones, of different hardness, the bottom much more distinct than the upper part which is marked by gradual transition to pelites. They show laminar structure, usually oblique and small hieroglyphs on the bottom due to both low intensity currents and biologic activity. The thickness of sandstones ranges from a few millimeters to 5 cm;
- grey marls, exhibiting fine-grained mica on the bedding planes. They are argillaceous in places and get a greenish colour. The marls are the main lithologic component of the beds under discussion.
- siderite marls, 3–5 cm thick, grey coloured in fresh break, altered to yellow and rusty colour.

These rock alternances (Fig. 4) result in a pile ca 50 m thick.

The only fossil specimens yielded by the Vârfu Rădăcinii Beds have been collected from the type section located outside, east of the studied area (right slope of the Prahova Valley, at Comarnic).

The specimens *Pseudohaploceras liptoviensis* (ZEUSCHNER), *Phylloceras* sp., *Aucellina* sp. are assigned to the middle of the rock pile. Out of these three specimens, only the former can be used for age determination. However, it has been cited from a rather wide time interval, starting with the Barremian (Moore, 1968) and reaching the Lower Gargasian (Thomel, fide Flandrin, 1965). Therefore the age of the Vârfu Rădăcinii Beds is best determined by taking into account other features as well: most of the Barremian occurrences belong to the Comarnic Beds; the rocks overlying the investigated beds yielded (Ştefănescu et al., 1965) a *Macroscaphites yvani* (d'ORB.) specimen which does not exceed the upper boundary of the Bedoulian.

According to the data mentioned above, the Vârfu Rădăcinii Beds might be assigned to the uppermost Barremian and to a part of the Bedoulian. As the available paleontologic proofs are insufficient for the age determination, the Vârfu Rădăcinii Beds have been finally assigned to the Lower Bedoulian.

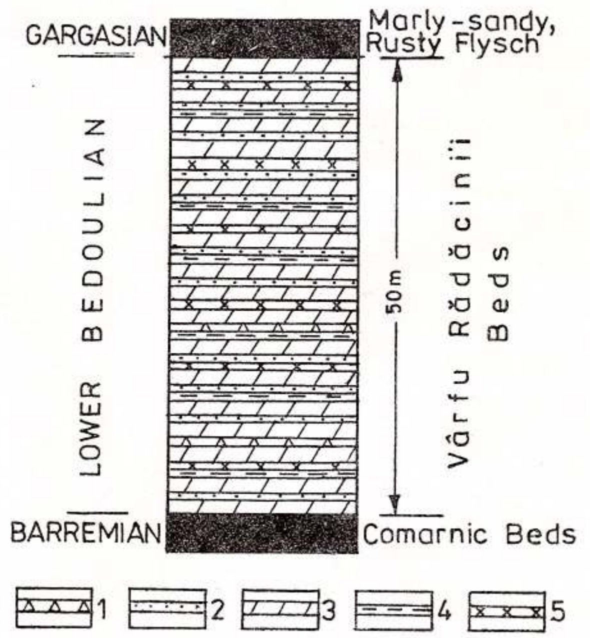

Fig. 4 – Lithologic column of the Vârfu Rădăcinii Beds. 1, breccias; 2, sandstones; 3, grey marls; 4, green marly-clays; 5, sideritic marls.

3.2.2. Marly-sandy Rusty Flysch (Murgeanu, Patrulius, Contescu, 1959)

Owing to the thick sandstones contained, this formation has been mentioned since the first investigations of this area. It was first reported as "Cenomanian" (Popovici-Hatzeg, 1898) and then assigned to the Siriu sandstones (Murgeanu, 1930 a). The flysch deposits were subsequently described under different names: the Aptian middle horizon (Protescu, Murgeanu, 1927), the Vraconian sandy facies (Murgeanu, 1934), the quartz-arenite flysch complex with massive sandstone intercalations (Murgeanu et al., 1958).

The marly-sandy flysch deposits, rusty coloured, occur from west of Colţii Brăţii as far as south of Runcu Bezdeadului peak, in the Măgurii summit, from the Dumbrăvioara Valley to north of Stâlpu peak and in the Ocina Valley springs area.

In these areas the flysch deposits consist of the following:

- hard, smooth sandstones, or blue-greyish colour in fresh break or rusty-yelowish when weathered. They contain white or pink quartz grains, crystalline schists and scarce white limestone fragments within calcareous matrix. The sandstones frequently yield incarbonised plant remnants. On the bottom sole marks such as flute-casts, crescent-casts, prod-casts, drag-marks and bioglyphs represented among others by *Palaeodictyon* specimens do occur. The sandstones structure depends on their thickness. Complete turbidite sequences occur only in thicker sandstones. In some sections appear intercalations of coarser-grained and more calcareous sandstones which yield orbitolines.

- marls and grey argillaceous marls, well bedded. The pelite thickness is approximately the same as that one of arenites in rhythmic sequences; it decreases gradually concomitantly with the sandstone development and in massive sandstones they form simple joints.

- grey or rusty weathered siderite marls.

It is very difficult to reconstruct an accurate lithostratigraphic column due to intense tectonisation and mainly to the outcropping environment. Several sections show that the Marly-sandy Rusty Flysch is marked, on ca 200 m thickness, by a flysch type characterized by rhythmic alternance of the elements mentioned above, with thick and massive sandstone interlayerings (Fig. 5).

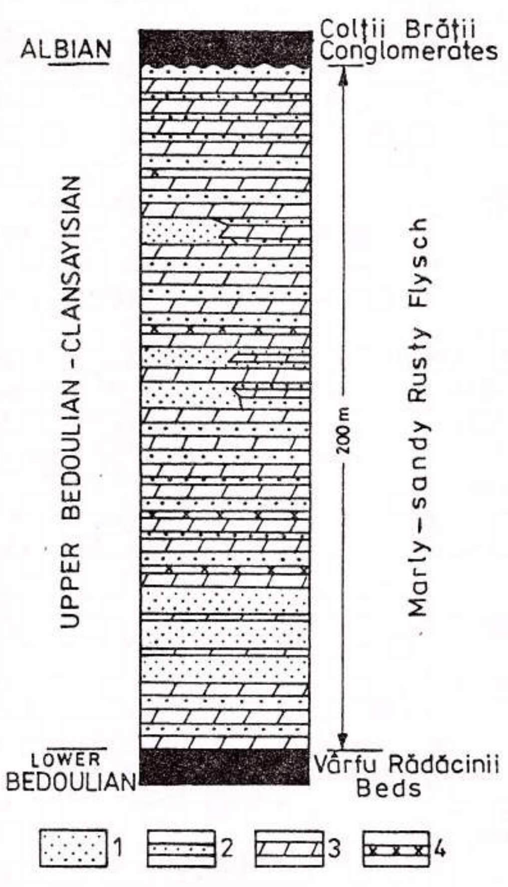

Fig. 5 – Lithologic column of the Marly-sandy Rusty Flysch. 1, massive sandstones; 2, thin and medium sandstones; 3, marls and marly-clays; 4, siderite marls.

The Marly-sandy Rusty Flysch yielded only two ammonite imprints which could be assigned to no genus. *Orbitoloina conoidea* and *O. dicoidea* specimens have been collected from several places and they account only for the Aptian as age for the investigated flysch deposits.

Therefore, the Bedoulian-Clansayesian age of the Marly-sandy Rusty Flysch has been argued by taking into account the fossil specimens cited from adjoining areas.

3.2.3. *Podu Vârtos Beds* (Ştefănescu, Avram, Ştefănescu, 1965)

North of the inner slope of the Buciumeni Syncline, the Upper Cretaceous overlies a sequence with specific lithologic features differently named according to the various denominations used for the Aptian formations occurring in the outer slope of the "Baiu anticlinorium"; these names have already been presented at the chapter regarding the Marly-sandy Rusty Flysch. Ştefănescu et al. (1965) described this sequence as an independent lithologic unit first remarked in the Prahova Valley section along 1 km upstream the bridge to Ghioşeşti (Comarnic).

The Podu Vârtos Beds are well developed at the two ends of the investigated area: from the Ialomiţa Valley to the west and from the springs of the Târsa Valley to the east. Between these two valleys they are exposed on reduced areas, commonly discontinuous.

All over the 450–500 m thickness, the Podu Vârtos Beds consist of the following lithologic components (Fig. 6):

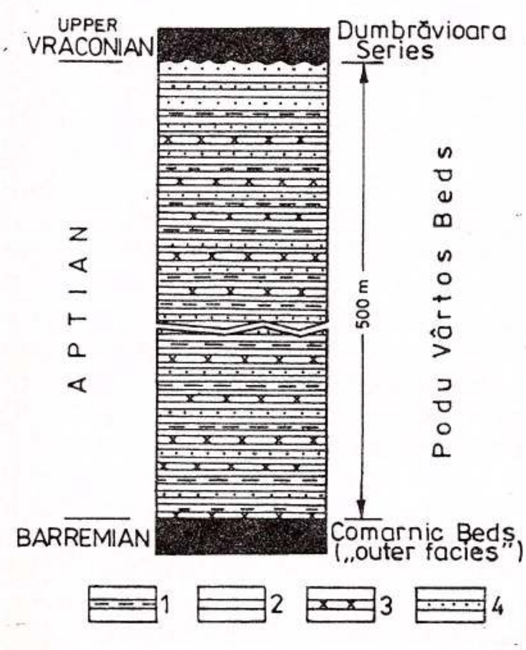

Fig. 6 – Lithologic column of the Podu Vârtos Beds. 1, green pelites; 2, grey pelites; 3, siderite marls; 4, sandstones.

– grey or green sandstones, seldom over 5 cm thick, the average value being of 1–1.5 cm. The sandstones are generally slightly lithified, finely micaceous and show cross or/and convolute lamination. The bottom exhibits less prominent hieroglyphs which are usually the product of biologic activity;

– grey, siltic marls with irregular break and green marls. The marls show sparse muscovite and biotite spangles and shell fragments;

– grey-black clays interlayered with other pelites resulting in characteristic striped aspect;

– calcareous, siderite marls, grey-coloured in fresh break, weathered to rusty colour.

Although the Podu Vârtos Beds are lithologically uniform and also different from the other formations in this area, they are difficult to identify at both the upper and the lower part. Thus, at the base they grade into the Comarnic Beds and the boundary in between is marked by the first calcarenite interlayerings. It is to note that this feature is obvious only in the slopes of the Ţâţa Valley where the normal substratum of the Podu Vârtos Beds is exposed. With respect to the upper boundary of these beds, one should note their disturbed morphology. Below the Dumbrăvioara Series, the Podu Vârtos Beds are usually contorted or even breccia-like in places, due to pre-Vraconian submarine sliding.

The Podu Vârtos Beds have yielded a relatively large amount of fossil specimens from almost all outcrops. The first ones are reported by Vinogradov (Murgeanu et al., 1963) from the Prahova Valley section. They were redetermined by Patrulius (1969) and are represented by: *Tetragonites* cf. *heterosulcatus* ANTH., *Acanthohoplites* cf. *aschiltaensis* (ANTH.), *A.* sp. (aff. *A. lorioli* SINZ.), *A.* sp. (ex. gr. *A. bergeroni*), *A.* sp. (aff. *A. laticostatus* SINZ.), *Hypacanthoplites* sp. (gr. *H. jacobi* COLLET), *Callizoniceras (Wollemaniceras)* sp., *Neosilesites* sp. From the same section of the Prahova Valley, Ştefănescu et al. (1965) cite the following fauna: *Acanthohoplites nolani* SEUNES, *An. nolani crasa* SINZ., *A.* sp. aff. *A. laticostatus* SINZ.

The quoted specimens were collected from outside the area under discussion. Several outcrops of the Podu Vârtos Beds located in the investigated area have yielded ill preserved ammonites; only a few could have been assigned to a genus or a species: *Costidiscus* sp. (left tributary of Ţâţa Valley), *Acanthohoplites nolani nolani* SEUNES (Ţâţa Valley), *Acanthohoplites aschiltaensis* ANTH. (tributary to the Ţâţa Valley, on the northern border of Dealul Mare village), *A. trauscholdi* SIM., BUC., SOR. (right tributary of Ţâţa Valley), *A.* sp. (right slope of Valea fără Nume), *Parahoplites* sp. (second left tributary of Ţâţa Valley) and ? *Nodosohoplites* sp. (Ialomiţa Valley section ca 1.5 km upstream its confluence with Ţâţa Valley).

Most of the fossil specimens previously cited as well as the fauna specimens recognized by the author in the investigated area account for Clansaysian occurrences in the Podu Vârtos Beds. *Costidiscus* sp. cited above is an exception to this rule. It was collected from the lowermost part of the Podu Vârtos Beds, at ca 8–10 m thickness above the first calcarenite of the Comarnic Beds. This genus is considered not to exceed the upper boundary of the Lower Aptian (Moore, 1968). Due to this fact it should be admitted that the age of the Podu Vârtos Beds begins in the Bedoulian and consequently they cover the whole Aptian interval.

3.3. Albian

3.3.1. Colţii Brăţii Conglomerates (Ştefănescu, 1971)

All the descriptions of the Aptian occurrences west of the Prahova Valley point out conglomerates of different development and lithologic constitution. To this type were also assigned the conglomerates in the southern slope of the "Baiu anticlinorium", which had been mentioned by Murgeanu since 1930 a. Later, Murgeanu et al. (1958) cited within the "flysch complex with hard sandstone and conglomerate interlayerings" some rudite occurrences, described as "conglomerates of Colţii Brăţii type", name to be adopted by Patrulius (1969), too. The mentioned authors considered that these conglomerates represented some secondary varieties of Aptian sandstones. Ştefănescu (1971) defined them as an independent lithostratigraphic unit, mapped as the Colţii Brăţii Conglomerates.

The Colţii Brăţii Conglomerates occur as thin, discontinuous stripes in the following zones: Colţii Brăţii-left slope of Coporod Valley, left slope of Bizdidel Valley, starting from Dumbrăvioara Valley through the Stâlpu peak to the Târsa Valley.

This lithologic sequence (up to 25 m thick) consists of polymictic conglomerates and hard sandstones (Fig. 7):

– the polymictic conglomerates contain black (Triassic ?) limestone fragments, yellow and grey (Jurassic) limestones, white-yellow or rosy (Urgonian) limestones, hard quartzitic microconglomerates, quartzites and gneissic granites. The pebbles are well rounded and their size ranges from 2–3 cm to 80–100 cm. They are disorderly arranges within a yellowish gritty matrix, usually consolidated;

– grey-yellowish hard sandstone piles 1–2 m thick, with calcareous matrix. Isolated pebbles similar to those of conglomerates occur in places. An increased number of these pebbles results in graded, lateral or vertical transition to conglomerates.

The Colţii Brăţii Conglomerates have not yielded *in*

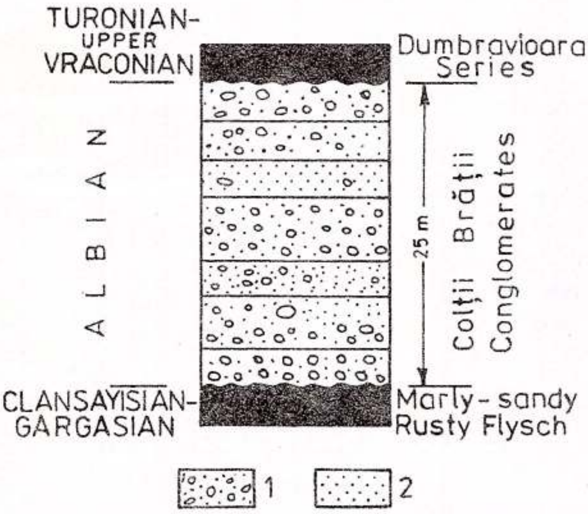

Fig. 7 – Lithologic column of the Colţii Brăţii conglomerates. 1, conglomerates with gritty matrix; 2, massive sandstones.

situ organic remnants. Therefore the age assigned to them ranged within large time limits: Cenomanian (Popovici-Hatzeg, 1898), Aptian (Protescu, Murgeanu, 1927), Vraconian sandy facies (Murgeanu, 1934), Albian-Vraconian (Popescu, 1954) and then Aptian (Murgeanu et al., 1958).

Ştefănescu (1971) assigned these conglomerates to the Albian by taking into account the following:

- the conglomerates rework different pebbles, the youngest being represented by white or rosy limestones the Urgonian age of which is proved *Chaetetopsis zonata* PATRULIUS (Patrulius, 1969);
- the geometric position of conglomerates is well marked, unconformably overlying the marly-sandy flysch of rusty colour (Bedoulian-Clansayesian) and overlain unconformably by the Dumbrăvioara Series (Upper Vraconian-Turonian).

According to these data, the Colţii Brăţii Conglomerates should be younger than the Aptian and older than the Upper Vraconian and be thus assigned to the Albian, without any specific mention of a certain stage.

3.4. Vraconian-Turonian

3.4.1. Dumbrăvioara Series (Popescu, 1954)

From below the inner slope of the Buciumeni Syncline are exposed rocks characterized by different lithologic features. Some of them, previously assigned to the most different Cretaceous formations, were grouped by Popescu (1954) as the Dumbrăvioara Series.

Two of the rock types assigned by Popescu (1954) to the Dumbrăvioara Series, namely the "sandy, hard, unbedded marl" and the "breccias with components of the Sinaia and Comarnic Beds" are worth considering as they correspond to the older and respectively the youngest members of this series.

The Dumbrăvioara Series, delimited between the two marker rock type mentioned above, is developed between Ţâţa and Talea valleys, the most outstanding exposures being situated between Ialomiţa and Coporod valleys, as well as between Dumbrăvioara and Talea valleys.

In the investigated area, the Dumbrăvioara Series consists of the following rock piles (Fig. 8):

a) A basal pile of marls and grey, micaceous siltstones, unbedded, containing sideritic marly-limestone lenses at the lower part. Between Ialomiţa and Leurza valleys and on the slopes of the Ocina valley the grey siltstones associate with conglomerates and/or fine breccias which grade into sandstones, mainly built of white, Urgonian limestones and subordinate crystalline schists, within grey-yellowish sandy matrix. The diameter of pebbles averages 0.5–1 cm.

b) Grey, green calcareous marls, exhibiting chonchoidal cracks. The grey marls show green spots and the green ones show black spots. The weathered marls are whitish.

c) The preceding piles are invaded in places by sedimentary breccias, differently developed both vertically and laterally. The breccias consist of a marly, micaceous matrix, usually of grey colour. This matrix contains fragments of the rusty-coloured marly-sandy flysch of the Vârfu Rădăcinii Beds and of the Comarnic Beds. The size of pebbles ranges from 2–3 cm to 30–50 cm.

d) Grey-whitish marls, white marls or even marly-limestones. They usually show green or grey-black spots, similarly to the rocks of level (b).

e) Marls (argillaceous in places) and red-cherry coloured marly-limestones which are a very good mapping marker.

f) White-greenish, hard, well bedded calcareous marls.

g) Marls and grey, black clays with sparse green interlayerings. These rocks are weathered to yellow or rusty coloured in places and show sulphur efflorescences. Rather frequently piles (f) and (g) and seldom pile (e) show disturbance of initial bedding due to submarine sliding. Sometimes this led to the generation of sedimentary breccias with grey, marly matrix containing white, green, grey and black marl fragments.

h) Green platy muscovitic sandstones interlayered with soft marls of characteristic deep green colour. The sandstones frequently rework soft pebbles of green marls.

i) Another sedimentary breccia episode, characterized by grey argillaceous matrix containing fragments

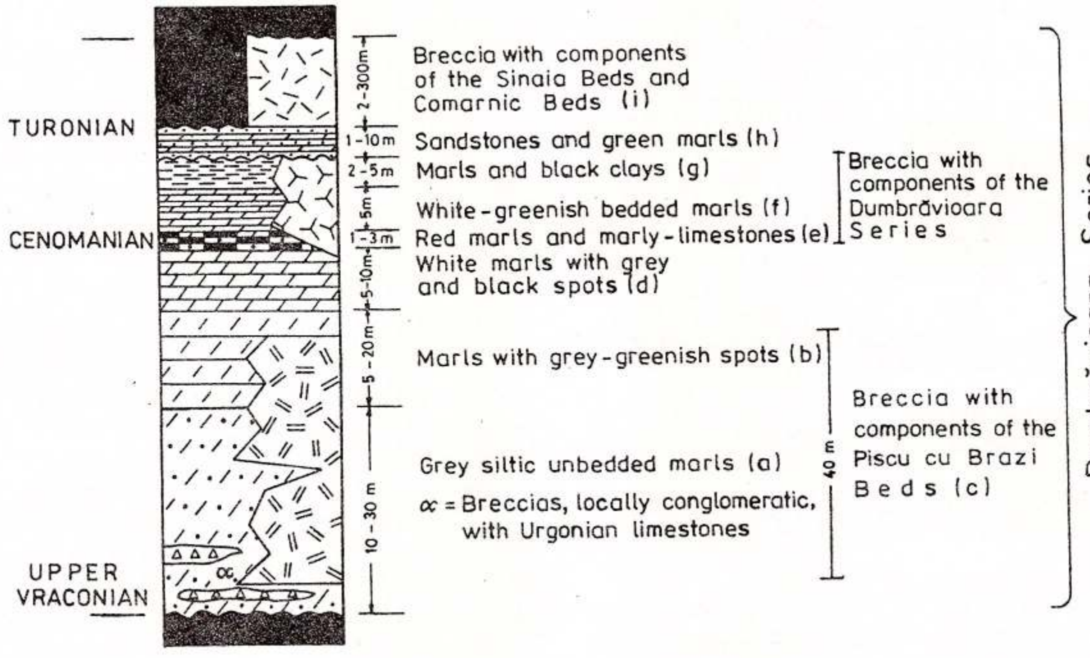

Fig. 8 – Lithologic column of the Dumbrăvioara Series.

of breccias with crystalline schists, calcirudites, calcarenites, sandstones and marly-limestones yielded by the Sinaia and Comarnic Beds. The size of elements ranges from 3–5 cm to 10–30 cm.

The fresh outcrops in the Belia Valley and at the springs of the Ocina Valley show, besides Lower Cretaceous flysch, green and white-greyish marls from the older piles of the Dumbrăvioara Series. The breccia is lens-shaped and may lack from some sections.

This rock sequence belonging to the Dumbrăvioara Series differs from the initial description (Popescu,1954, 1958) because of the following features: some of the conglomerates initially assigned to this series have been delimited as Colţii Brăţii Conglomerates; there are several sedimentary breccia layers; finally, the relation between the sandstone and green marl pile (h) and its substratum: this pile overlies different members of the Dumbrăvicioara Series, accounting for a possible stratigraphic disconformity. This view is also supported by the presence of submarine slidings and by the sedimentary breccia occurrences in the substratum of the sandstone and green marl pile (h).

This disconformity divides the rocks of the Dumbrăvicioara Series in two: a lower pile consisting of (a) to (g) levels and an upper pile consisting of levels (h) and (i). However, considering the initial definition of this series which also envisages the breccia with Lower Cretaceous flysch pebbles (i) as well as the map scale which hindered the attempt to delimit the two rock piles, the rocks below the disconformity and those above it are still assigned to the Dumbrăvioara Series.

The thickness of the Dumbrăvioara Series usually ranges round 100 m. It may even exceed 400 m where the breccia deposits containing rocks of the Sinaia and Comarnic Beds are headed up due to diapiric phenomena.

The age of the Dumbrăvioara Series was differently determined: Albian-Vraconian (Popescu, 1954), Vraconian-Cenomanian (Popescu, 1958), Vraconian-Turonian (Murgeanu et al., 1958). Later, Ştefănescu, Zamfirescu (1964) showed that the sedimentation of the Dumbrăvioara Series had started with the Upper Vraconian, so that its age was assigned to the Upper Vraconian-Turonian interval.

Out of the numerous fossil specimens yielded by the Dumbrăvioara Series from almost all its outcrops, we are going to quote only those determined from the investigated area: *Globotruncana appenninica* RENZ (light green marls in the left bank of the Dumbrăvioara Valley; white and bluish-grey calcareous marls, Târsa Valley; whitish, sandy marly- limestones, Valea Beliei), *Aucellina gryphaeoides* SOW. (from several places), *Scaphites meriani meriani* PICT. et CAMP. (sandy marl, Valea Beliei, 1300 m downstream its confluence with Talea Valley) (Popescu, 1954); Hedbergella-Rotalipora-Praeglobotruncana assemblage and *Prae-*

globotruncana helvetica (pile (h) in Valea Beliei; Patrulius et al., 1967).

Besides the above quoted microfauna, it is to add some macrofossil specimens discovered by the author: *Ostlingoceras puzosianum* (d'ORB.), *Lechites gaudini* PICT et CAMP., *Hamites* sp. (yielded by the siltic marls exposed in the Ialomiţa Valley, ca 750 m upstream the confluence with Ţâţa Valley); *Puzosia* sp. (several specimens yielded by grey siltic marls exposed in the right tributary of the Dumbrăvioara Valley); *Parahibolites tourtiae* WEIGN. (collected from yellow weathered marls occurring in the interfluve between Ialomiţa and Leurza valleys); *Aucellina gryphaeoides* SOW. (present in all the cited outcrops).

Out of the cited specimens, *Ostlingoceras puzosianum* is the most important as it is a zone ammonite, characteristic of the Upper Vraconian. Its presence in the basal layer of the Dumbrăvioara Series accounts for its deposition concomitantly with the Upper Vraconian.

The lithologic correlation of marls and cherry-red marly-limestones (e) occurring in the investigated area and of those present in the Dâmboviţa and Teleajen valleys, also marked by the occurrence of macro- and microfossil specimens characteristic of the Cenomanian (Murgeanu et al., 1963; Patrulius et al., 1967; Popescu, 1958), shows that the Cenomanian may be accepted at least at this level.

The assemblages of fossil microorganism cited by Patrulius et al. (1967) from Valea Beliei support the Turonian occurrences at the top of this series.

Thus, taking into account the specimens recognized at the base of this series and the literature data concerning their middle and upper parts, the Dumbrăvioara Series is assigned the Upper Vraconian-Turonian age.

3.4.2. Fieni Series (Ştefănescu et al., 1964; emend.)

This name is given to a rock pile which had been differently defined: the Aptian sandy horizon (Murgeanu,1930 b); the sandy Vraconian facies (Murgeanu, 1934); the sandstone-bearing grey marl complex (Popescu, 1953), the Fieni Series (also including the top of the Macla Series; Ştefănescu et al., 1964), the Teleajen Series (Patrulius et al., 1967).

The Fieni Series mapped and described here consists only of the outcrops inwards the Macla Series and outwards the Gura Beliei Marls in the southern limb of the Buciumeni Syncline.

The Fieni Series occurs on a limited area, between the springs of the Vulcaniţa Valley and the left slope of the Bizdidel Valley. It consists of the following:

- grey marls, the bedding of which is marked by different shades of colour as well as by some grey-greenish interlayerings; they are finely micaceous in places;
- grey, calcareous, sideritic marls, weathered to rusty colour;
- grey sandstones with micaceous sides, exhibiting parallel, cross, frequently convulute lamination. Their mean thickness is of 3–5 cm. The bottom shows both sole markings (flute-casts, crescent-casts and drag-marks) and bioglyphs;
- grey-yellowish calcareous sandstones forming piles 1–2 m thick; they show parallel, rarely convulute, lamination;
- sedimentary breccias consisting of pebbles from grey marls, white calcareous marls and green, glauconitic marls;
- calcareous breccias (Murgeanu, 1934) almost exclusively consisting of Urgonian limestone pebbles, white and rosy in colour. The size of pebbles usually ranges from 3–5 cm to 30 cm. The pebbles of both types of breccias are supplied by an outer source the constitution of which is similar to certain parts of the Moesian Platform.

The Fieni Series approximates 600 m thickness. Its lower part consists of rhythmic alternance of prevailing marls (shaly flysch) and thin sandstones. At the top of this series (Fig. 9) thick sandstone interlayerings replace almost completely (sandy flysch) the preceding rhythmic sequence. Both the breccias with marly pebbles and the calcareous breccia occur at the top of the Fieni Series associated with or even within the massive sandstone layers.

The Fieni Series is, due to the reworked marls, the first formation yielding Albian fauna (Vraconian; Murgeanu, 1934) in the Eastern Carpathian bend area. The fossil specimens collected from the marls contained by breccias have been partly determined by Patrulius (Murgeanu et al., 1963; Patrulius et al., 1968). Taking into account the quoted fauna, the pebbles of breccias are assigned (Patrulius et al., 1968) either to the Middle or to the Upper Albian.

To the rich fauna discovered by previous researchers we add some specimens not cited yet or collected from new fossiliferous sites, such as: *Kossmatella muhlenbecki* (FALLOT), *K.* cf. *romana* WIED., *Pseudohelicoceras* sp., *Hamites* sp. (from grey-whitish marls; right slope of Ialomiţa Valley, opposite the dam at Fieni); *Lechites gaudini* PICT. et CAMP., *Puzosia* sp. and *Perna* cf. *lanceolata* GEINTZ. (grey-whitish marls; the road from Fieni to the quarry "Lutu Roşu").

Among these specimens only *Kossmatella muhlenbecki* has an accurat stratigraphic meaning, being quoted in geological literature only from the Vraconian deposits. It is thus proved that the rock reworked in breccias may be assigned to a stratigraphic interval wider than the one delimited by Patrulius et al.(1968).

The fossil specimens collected from the marls of sedimentary breccias have been the only paleontologic

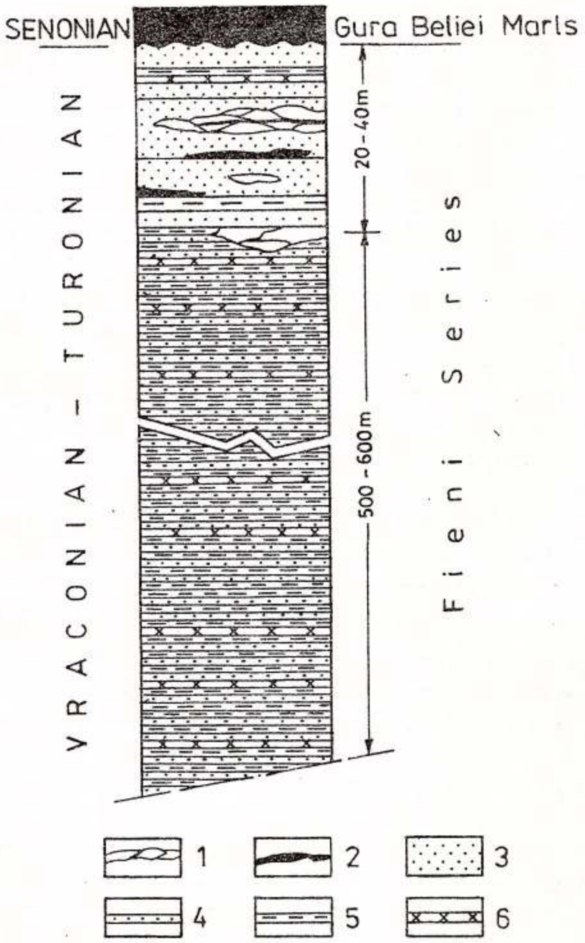

Fig. 9 – Lithologic column of the Fieni Series. 1, reworked marl slices; 2, calcareous breccias; 3, massive sandstones; 4, thin sandstones; 5, marls and clays; 6, sideritic calcareous marls.

proofs of the age of the Fieni Series, which had been differently considered in time: Cenomanian (Popovici-Hatzeg, 1898), Aptian (Murgeanu, 1930 b), Vraconian (Murgeanu, 1934), Upper Aptian-Albian (Popescu, 1953), Albian (?)-Lower Vraconian (Ştefănescu et al., 1964), Albian-Vraconian (Patrulius et al., 1968)

Unfortunately, as all the specimens discovered are reworked, they inform indirectly on the age of the Fieni Series. However, *in situ* fossil specimens have been collected by the author from the siltic pelites of the flysch layer underlying the massive sandstones exposed in the left slope of the Ialomiţa Valley. All the specimens belong to *Inoceramus labiatus opalensis* BOSE (f. *longa* SEITZ.). This species is cited (Tröger, 1967) as a characteristic of the Lower Turonian. Therefore, the Turonian is proved to occur in the Fieni Series.

Considering that outside the perimeter the Fieni Series interfingering with the top of the Teleajen Series, it has been assigned to a stratigraphic interval wider than the one shown by the *in situ* fossils, namely to the Vraconian-Turonian interval.

3.4.3. Macla Series (Popescu, 1959)

The name of Macla Series was used by Popescu to define "a repeated sequence of marls and grey, light green clays.....and frequent interlayerings of thin convulute sandstones" present in the Teleajen Valley. The author also mentions some red clay interlayerings.

Rocks showing similar lithologic features occur in the studied area, between the Bizdidel Valley and the brook Vulcana, where they form a continuous strip ca 11 km long and of 800 m maximum width.

The formations recognized were divided by previous researchers in two groups, independently assigned to the surrounding rocks. The inner part (upper levels) was usually enclosed in the Fieni Series, while the outer part (lower level) with red pelite interlayerings was described together with the Senonian deposits or with the "red clay complex" (Motaş, 1952; Popescu, 1953).

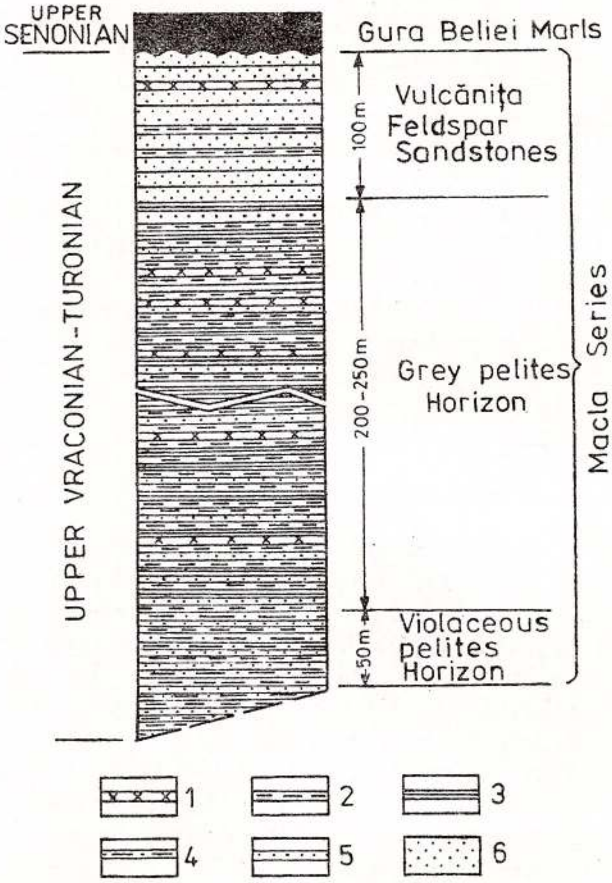

Fig. 10 – Lithologic column of the Macla Series. 1, sideritic pelites; 2, grey pelites; 3, grey and black pelites; 4, red and violaceous pelites; 5, thin sandstones; 6, massive sandstones.

The Macla Series outcrop includes three independent lithologic piles (Fig. 10):

a) The Violaceous Pelite Horizon. The deepest zone of the Macla Series exposed in this area – ca 100 m thick – consists of alternating grey, green, violaceous-cherry-coloured or red clays and fine sandstones with cross or convolute lamination, usually of green or grey-green colour.

b) The Grey Pelite Horizon. This pile, 200–250 m thick, mainly consists of grey (prevailing), black and green pelites which alternate with grey micaceous sandstones showing cross or convolute lamination. Against this lithologic background interlayer white marly limestones weathered to rusty-colour. Due to alteration, this pile and mainly the dark-coloured pelites are rusty-coloured and their schistosity makes them resemble the Pucioasa Beds.

c) The Vulcaniţa Feldspar Sandstone. It is represented by a pile ca 50 m thick consisting of grey-(dark)green massive arenites. The sandstones show an argillaceous matrix with numerous feldspars and sparse limestones, marly-limestones and older Cretaceous marl elements. The massive beds are interbedded with black and grey, fine micaceous pelites weathered to white.

So far, in the investigated area the Macla Series has yielded only microfossil specimens: *Rotalipora turonica* BROTZEN and "several *Praeglobotruncana* specimens" (Patrulius et al., 1968) present in the grey clay layer (left slope of the Ialomiţa Valley). Outside the area under discussion, the Macla Series contains ammonites and neohibolites of certain stratigraphic value (Popescu, 1958; Ştefănescu et al., 1964).

The study of published fauna shows that the cherry-red pelite horizon begins in the Upper Vraconian, the grey pelite horizon belongs to the Cenomanian and at least to a part of the Turonian. Considering the geometric position of the Vulcaniţa sandstone which overlies normally the grey pelite sequence, one may assign it to the Turonian too. Therefore, the whole flysch pile of the Macla Series is Vraconian-Turonian in age.

3.5. Vraconian-Senonian

3.5.1. Variegated Clay Series (Ştefănescu, 1970)

This name has been adopted for a very typical pile present outside the Macla Series, previously assigned in turn to Senonian formations (Popovici-Hatzeg, 1898; Murgeanu, 1930 a), the Upper Aptian-Albian (Popescu, 1953) or the Upper Cretaceous (Popescu, 1958; sheet Cheia).

The Variegated Clay Series forms a stripe 1.2 km wide between the Cretaceous flysch area and the Paleogene flysch zone.

The lithologic composition of this sequence is as follows:

- red, grey and green clays, 1–2 cm to 10 cm thick, forming piles 0.5–1 m thick;
- grey, rarely green marls, calcareous and tuffaceous in places, 1–5 cm thick, which, when highly weathered show a siderite or manganese crust of rusty or dark colour. The outcrops of variegated pelites also contain some baryte concretions (diameter of 3–4 cm);
- grey or green, fine micaceous sandstones, slightly lithified, exhibiting cross or convolute lamination. Their thickness ranges from 1–2 cm to 10 cm;
- grey massive sandstones (Mălăiştea), weathered to white, poorly cemented, thick bedded (1–2 m) and forming piles 10–20 m thick. Sometimes these sandstones display spheroidal weathering. These sandstones are characterized by the biotite content besides the muscovite one;
- grey-whitish sandstones with calcareous matrix, showing parallel lamination and thickness ranging from 20 to 80 cm. Granodiorite fragments reaching 1 cm in diameter occur all over the bed or only in its basal part;
- lens-like sands and gravels consisting almost exclusively of granodiorite fragments up to 10 cm in diameter. Crystalline and sedimentary rock fragments occur in reduced amounts.

Almost each large outcrop shows the inner structure of this sequence, which is extremely complicated, of "argile scagliose" type (Ogniben, 1963) impeding the assignment of the normal geometric sequence of the lithologic components mentioned above. The detailed field investigation pointed out the following sequence of the variegated clay series (Fig. 11):

- the lower part begins with an alternation of grey and green pelites, green convolute sandstones, which support a pile of red, green pelites and gravel lenses both bearing granodiorites;
- the upper part contains mainly grey massive sandstones associated with grey and green pelites (Mălăiştea sandstone). The section in the Cheia Valley exhibits green pelites both at the base and at the top of sandstones.

Although these two piles are lithologically distinct, due to the extremely complicated detail structure, their delimitation on the map is only lithological, lacking in structural meaning.

Most of the micropaleontologic samples collected from the red pelites and studied by M. Tocorjescu have yielded few agglutinate specimens, stratigraphically irrelevant. Nevertheless, the green pelites occurring at the top of the Mălăiştea sandstone contain numerous microfauna specimens: *Globotruncana lapparenti* BROTZEN, *Bathysiphon filiformis* SARS, *Gaudrynella pseudosserata* CUSH., *Gaudryna bentonensis* (CARMAN), *Tritaxia macfadyeni* CUSH., *Dendrophyra excelsa* GRZYB.

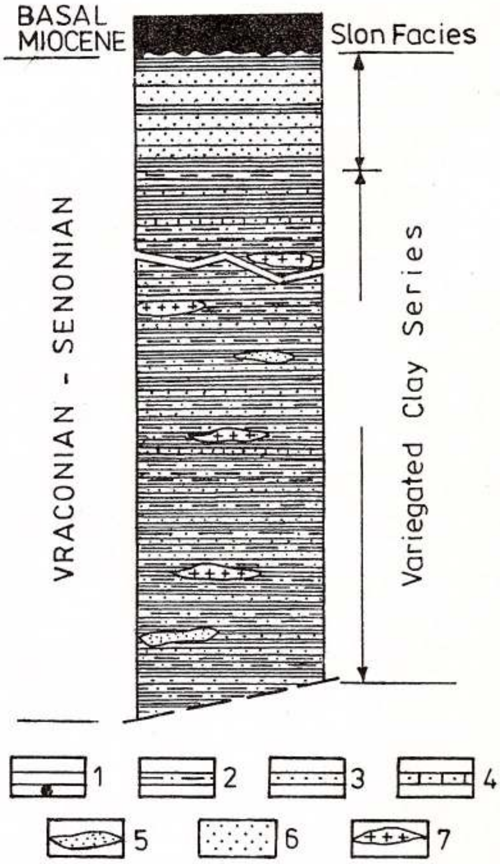

Fig. 11 – Lithologic column of the Variegated Clay Series. 1, green and grey pelites; 2, red pelites; 3, fine clayey sandstones; 4, calcareous sandstones; 5, fine lenticular sandstones; 6, massive sandstones; 7, granodiorite pebbles.

This assemblage points to the Maestrichtian age of the rocks which represent the youngest part of the variegated clay series. As regards the age of the lower part, which consists of red clays (containing sandstones with granodiorites), it has been considered that they are at least partly synchronous with the rocks from the Buzău Valley which had yielded *Parahibolites tourtziae* WEIGN. specimens (Marinescu, 1962). Considering that these specimens belong to the Vraconian, the Variegated Clay Series first appeared during the Vraconian and reached at least the Senonian[2].

3.6. Upper Senonian

3.6.1. Massive Sandstones in the Bizdidel Valley (Murgeanu, 1930 a; emend., Ştefănescu, 1970)

In the left slope of the Bizdidel Valley, ca 3.5 km northwards from the centre of the locality Bezdead, there are some outcrops of massive sandstones mentioned by Murgeanu since 1930 a.

In this place one may see the best sections through the mentioned formation which show the following lithostratigraphic sequence (Fig. 12):

a) Both the Dumbrăvioara Series and the Colţii Brăţii Conglomerates are unconformably overlain by a pile, ca 5 m thick, consisting of: brick-red marls, finely micaceous with green marl interlayerings of 1–2 cm; green, soft marls, with a middle zone, 3–4 cm thick, with pyrite concretions; brick-red marls along 1–5 cm; green marls 20 cm thick; green platy sandstone less than 20 cm thick and green marls of tuffaceous type along the last 50 cm.

b) The rocks previously described are conformably overlain by massive sandstones 30 m thick. They consist of yellow-whitish or greenish sandstones, highly muscovitic, 30–80 cm thick, with coarser microconglomerate zones often reworking green marls, grey low siltic marls and white, calcareous marls.

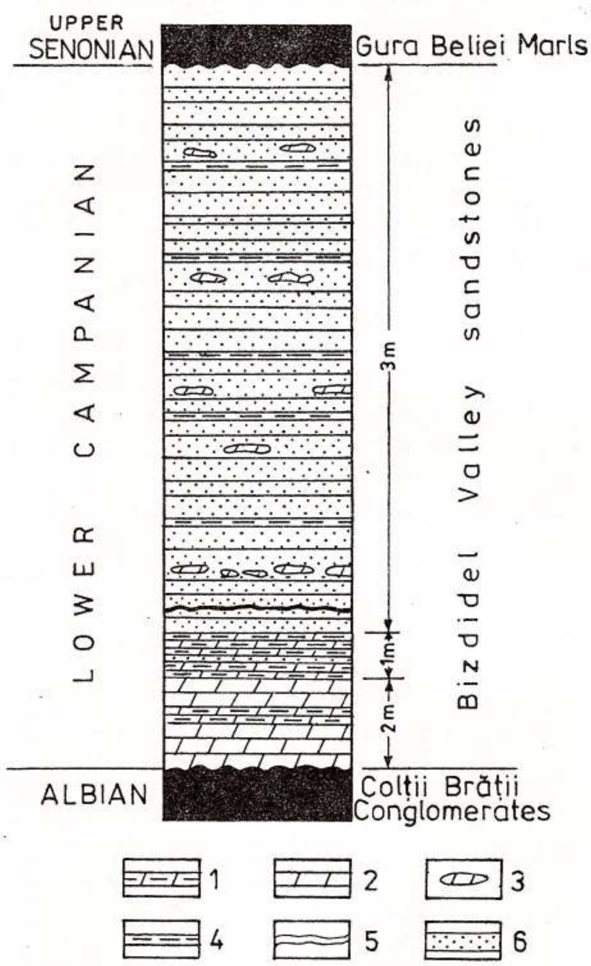

Fig. 12 – Lithologic column of sandstone occurrences in the Bizdidel Valley. 1, green marls; 2, red micaceous marls; 3, marl pebbles; 4, grey clays; 5, coals; 6, micaceous sandstones.

The micropaleontologic samples collected from the

[2] According to recent data this sequence occurs as late as the Paleocene.

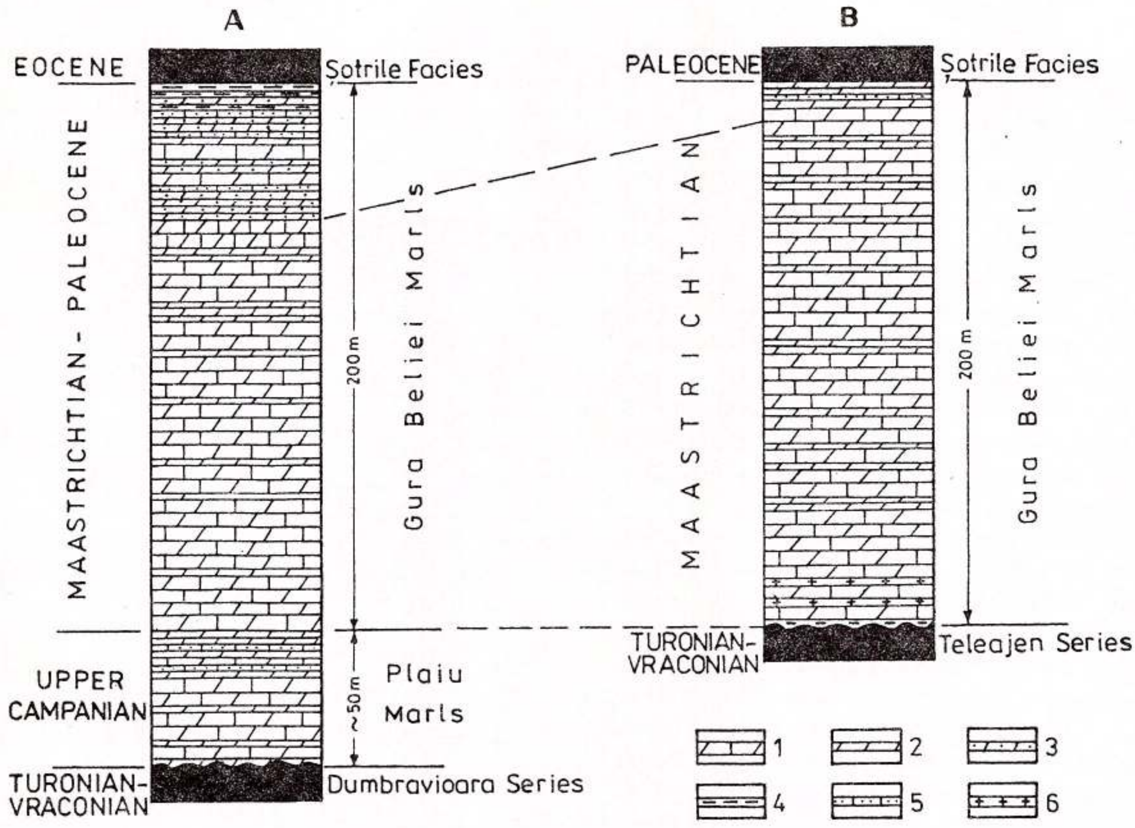

Fig. 13 – Lithologic columns of Plaiu (A) and Gura Beliei (B) Marls next to Talea (A) and Fieni (B) localities. 1, red and white calcareous marls; 2, red and white marls; 3, red micaceous marls; 4, grey and red clays; 5, whitish and greenish sandstones; 6, tuffs and bentonites.

marls overlain by the massive sandstones, studied by J. Ion, yielded a rather rich, but less characteristic, content. Thus, the age proved by the microfauna assemblage is not defined obviously enough: Lower Senonian (?)-(lowermost) Campanian. As the Lower Senonian is proved by a single specimen, which also reaches the Lower Campanian, the sandstones and the marls occurring in the Bizdidel Valley are assigned to the Lower Campanian.

3.6.2. Plaiu Marls (Ştefănescu, 1970)

To the east of the perimeter, large areas are covered by white marls which owing to their colour obviously contrast to the Gura Beliei red marls. Till 1970, when they were mapped independently, the white marls had been assigned either to the Senonian in Gura Beliei facies or to the Dumbrăvioara Series.

The Plaiu Marls, overlying older rocks, crop out between Ocina and Târsa valleys and exhibit the following lithologic components (Fig. 13A):

-grey-greenish, white marls with green or grey spots;

-grey-whitish calcareous marls with green or grey spots;

-grey, calcareous, low micaceous sandstones, 1–5 cm thick, rather sparse.

The study (carried out by J. Ion) of some samples collected from Valea Beliei has pointed out a micropaleontologic content which accounts for the Upper Campanian-Maestrichtian age. However, as to the last sub-stage are assigned the Gura Beliei Marls and as there are no data to prove the correspondence between the lithologic boundary of Plaiu Marls/ Gura Beliei Marls and the stratigraphic boundary Campanian/Maestrichtian, the Plaiu Marls have been arbitrarily assigned to the Upper Campanian.

3.6.3. Gura Beliei Marls (Ştefănescu, 1970)

Owing to their bright red colour, these marls are easily recognized in the field. As these red marls were assigned to the Senonian from the very beginning, they had been usually described under this name (Popovici-Hatzeg, 1898; Protescu, Murgeanu, 1927; Murgeanu, 1930 a, 1937). This lithologic unit has also been named: Breaza Beds (Teisseyre, 1908), Senonian red marls, (Protescu, 1915) red marly-limestone complex (Popescu, 1953), Gura Beliei Beds (Băncilă, 1958), "couches rouges" (Murgeanu et al., 1963).

The Gura Beliei Marls occur all over the area being represented by strips trending east-westwards.

In these bands show outcrop marls and red calcareous marls with white or green spots associated with white or green calcareous marls containing pyrite concretions. Green micaceous sandstone interlayerings with parallel structure are sparse. In the Ialomiţa Valley the red marls are preceded by green bentonitic marls with ellipsoidal calcareous concretions.

The quarry of the cement factory at Fieni exposes the basal part of the Gura Beliei Marls (Fig. 13B). One may see here three interlayerings of white, grey tuffs, partly bentonitic, 0.2–1.5 m thick.

The thickness of the Gura Beliei Marls ranges from 80 to 100 m between the Ocina Valley and the right slope of the Ţâţa Valley. In the other zones, their thickness increases reaching 200 m between Valea Beliei and Târşa Valley, as well as west of Bizdidel Valley.

In 1898 Popovici-Hatzeg assigned the red marls to the Senonian by taking into account the specimens of *Belemnitella hoeferi* SCHL. present at Gura Beliei, Lăicăi and Coteneşti. Later micropaleontologic studies proved that they do not cover the whole Senonian interval, but only its upper part represented by Campanian and Maestrichtian (Murgeanu et al., 1963).

The samples collected by us from the investigated area and analysed by M. Tocorjescu have pointed to the Maestrichtian age. According to the results of these analyses, the Gura Beliei Marls are mostly of Maestrichtian age.

3.7. Paleocene-Eocene

3.7.1. Şotrile Facies (Protescu, 1915)

Since 1906, when Mrazec distinguished these rocks for the first time, they have been described as "Bartonian" (Botez, 1909). This stratigraphic name is used by Protescu (1918) himself, who in 1915 introduced the notion of Şotrile Facies.

As these rocks exceed downwards the stratigraphic boundaries of the Eocene, the name of Şotrile Facies is used to define the inner equivalent of the Tarcău Sandstone Facies.

Subsequent studies have brought the following specifications regarding the Şotrile Facies: the delimitation of five lithologic levels within the "Eocene Series" (Olteanu, 1952), from the Valea Cheii section (Vulcana de Sus); the map delimitation (Motaş, 1952) as independent lithologic unit of the lower level of Globigerina marls bearing the name of "calcareous Crevedia marls"; the delimitation and description of the upper level of Globigerina marls as "the level of Buciumeni Marls" (Ştefănescu, 1970); the mapping, for the first time, of all the horizons of the Şotrile Facies occurring between the Prahova Valley and the Vulcana Valley basin (Ştefănescu, 1970, 1971), horizons (Fig. 14) described below:

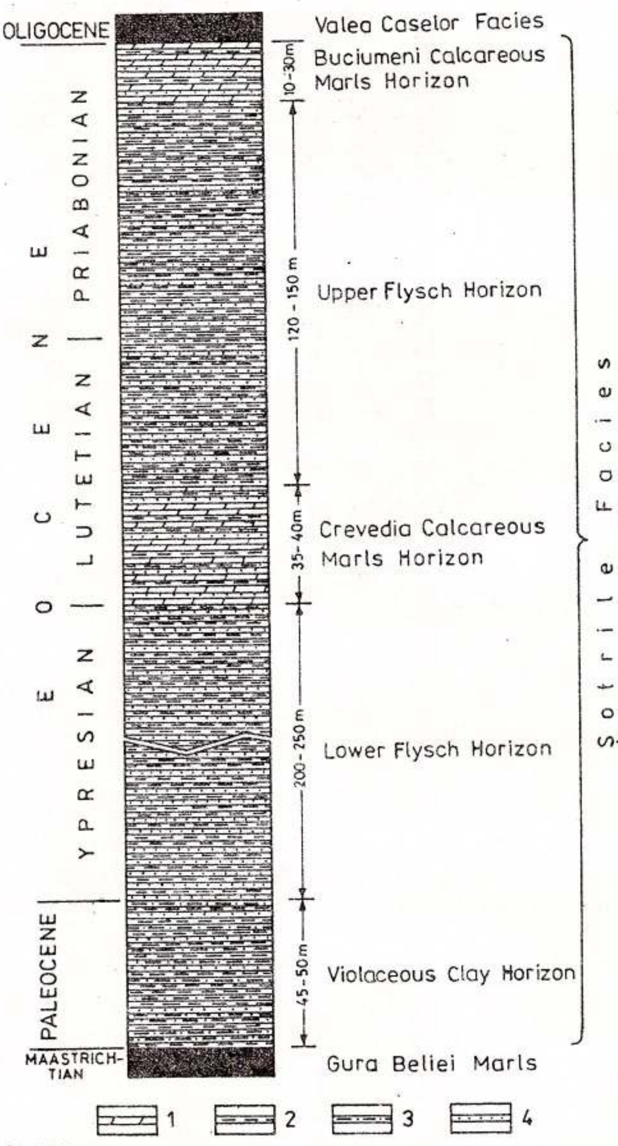

Fig. 14 – Lithostratigraphic column of the deposits in Şotrile Facies. 1, calcareous marls; 2, grey marls and clays; 3, red and violaceous clays; 4, sandstones.

a) The Violaceous Clay Horizon. The pelagic Gura Beliei Marls grade at the top into a flysch sequence. It begins with violaceous or cherry-red clays. Their thickness is of a few centimeters and they are interbedded with more and more frequent grey and green clays alternating with green, micaceous sandstones, showing parallel or cross lamination and hieroglyphs; the tickness of sandstones ranges from 1 to 5 cm. The whole horizon amounts to 35–50 m thickness along the line between Valea Beliei and Ţâţa Valley and to 80–100 m along the line between Ialomiţa and Vulcana valleys[3].

b) The Lower Flysch Horizon. It is marked by the most obvious flysch characteristics all over the sequence in Şotrile Facies. It consists of a rhythmic alternance of sandstones 5–20 cm thick, grey, whitish in colour, of calcareous, micaceous character, showing parallel, cross or convolute lamination, with numerous sole markings and bioglyphs on the bottom (with nummulites in places) and grey or green pelites, the beddings of which is obvious due to alternating colours. The thickness of this horizon approximates 250 m.

c) The Crevedia Calcareous Marls Horizon. To the top of the previous level pelites are more and more calcareous and form a distinct pile, mainly consisting of white calcareous marls, 5–10 cm thick, with light green shade, hard, showing green tracks of biologic activity. The marls (35–40 m thick) are usually interspersed with green or grey clays and grey calcareous, micaceous sandstones. The marls yield Globigerinas.

d) The Upper Flysch Horizon. It consists of an alternating sequence (120–150 m thick) of grey marls, grey and green clays, grey calcareous sandstones bearing frequent hieroglyphs and being 3–10 cm thick. These rocks are interlayered with clays of sparse red and cherry-red marls, usually grouped at the base of this level. However there are exceptions to this sequence, red pelites also occurring at other levels.

e) The Buciumeni Calcareous Marls Horizon. It consists mainly of white, rarely greenish, hard calcareous marls with traces of biologic activity. Rather numerous Globigerinas are noticeable under the magnifying glass. The marls are interlayered with grey clays and grey-whitish calcareous sandstones 3–10 cm thick. Some sections show associated low bentonized tuffaceous pelites of olive-green colour. The thickness ranges from 10 to 30 m, and sometimes it may amount only to 5 m.

The Şotrile Facies has been considered of different ages: Bartonian (Mrazec, 1906), Upper Lutetian-Middle Oligocene (Popescu-Voiteşti, 1909), Middle and Upper Eocene (Mrazec, Popescu-Voiteşti, 1914) and Eocene (Murgeanu, 1930 a, 1934). Moreover, according, to Murgeanu (1930 b) "the base of this complex" (Şotrile respectively) "should be assigned to the Paleocene", as proved by later micropaleontologic studies (Bratu, 1966) from which it is inferred that the violaceous clay horizon a corresponds to the Paleocene and the Paleocene-Eocene age of the Şotrile Facies should be unanimously accepted. The age of each horizon (Fig. 14) is also inferred from biozone study of Bratu (1966, 1972; Bratu, Gheţa, 1972).

3.7.2. Tarcău Sandstone Facies (Athanasiu, 1907)

The south-eastern part of the investigated area consists of rocks usually reported to the Eocene. Olteanu (1952) is the first who delimits them appropiately and assigns them to the Tarcău Sandstone.

The rocks assigned to this facies are developed on a reduced area, only between Ocina and Ursei valley. They can be separated in two piles showing different lithologic features (Fig. 15):

a) The Upper Horizon of the Tarcău Sandstone (Săndulescu, J. Săndulescu, 1963). This level is exposed on only 50 m thickness, due to tectonic break and contains: pelites in different shades of grey; grey calcareous sandstones, 10–20 cm thick; grey massive, micaceous sandstones, 30–100 cm thick, microconglomeratic in places. The microconglomerate pebbles are commonly well rounded.

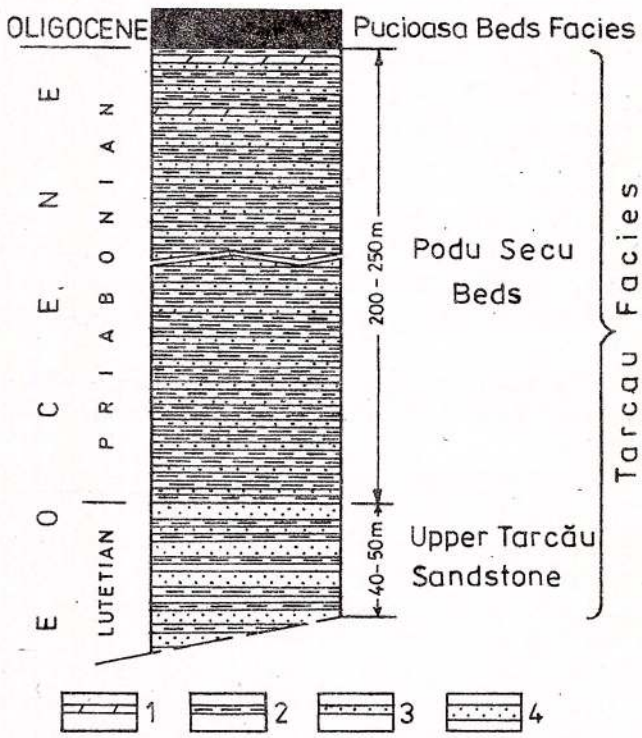

Fig. 15 – Lithostratigraphic column of the deposits in the Tarcău Sandstone Facies. 1, calcareous marls; 2, marls and clays; 3, thin and medium sandstones; 4, thick sandstones and microconglomerates.

b) Podu Secu Beds (Băncilă, 1955). On 200–250 m thickness they consist of a rhythmic alternance of grey or white pelites and grey or green calcareous, micaceous sandstones showing hieroglyphs on the lower face. Some sections, at the top of the pile, contain white, calcareous Globigerina marls 5–20 cm thick. Due to discontinuous occurrences, they have not been separated as an independent level.

[3]Later the author discovered in this horizon a few centimetric intercalations of bioturbated bentonites.

As regards the age of these rocks, one should mention that they have been usually assigned to the Eocene in "Fusaru-Tarcău Facies". It is also to mention that the Eocene-Oligocene boundary is marked by the Globigerina marls occurring at the top of the Podu Secu Beds, which, like the Buciumeni Marls, close to Eocene sedimentation. The age details adopted (Fig. 15) have been inferred from the correlation with the levels recognized in the Central East Carpathian area by Săndulescu, J. Săndulescu (1963).

3.8. Oligocene-Lowermost Miocene

3.8.1. Valea Caselor Facies

According to Popovici-Hatzeg (1898) the Eocene flysch facies includes the dyssodile rock occurrences in Valea Caselor, already reported to the Oligocene by Toula in 1897 (fide Murgeanu, 1930 a). The same rocks are considered Oligocene again by Murgeanu in 1930 a. Between Ursei and Ialomiţa these rocks are investigated by Popescu (1953) who delimits on the map the menilite occurrences at the base of the Oligocene, and by Albu et al. (1966) who discover the "upper dyssodiles" north of Fieni.

Our investigations in this area informed on the occurrence of a peculiar facies of the Oligocene-Lower Miocene stratigraphic interval, the reason for which it was named differently with respect to the equivalent rocks.

The mapping of the Valea Caselor Facies points to three different lithologic horizons presented below (Fig. 16 A):

a) The Lower Horizon of the Dysodile Shales with menilites (30–50 m thick). It consists of brown argillaceous shales, weathered to rusty-yellow, exhibiting shaly structure, abunding in fossile fish remnants. They are interlayered with black or brown hard menilites and silicified calcareous shales.

b) The Shaly Horizon with Marly-limestone (75–80 m thick). It is represented by alternating black and green shaly clays weathered to brown yellow. They are intermingled with stratiform dolomitic marly-limestones, 5-20 cm thick, white or light green in colour. Thin (1–3 cm), micaceous sandstones of grey colour and white calcareous schists occur in places.

c) The Upper Horizon of the Dysodile Shales (15–20 m thick). It consists of a uniform pile of brown of brown or grey shaly clays weathered to yellow or rusty-colour. The lithologic characteristic is represented by two layers (ca 20 cm thick) of yellow, almost completely bentonized tuff intercalated at the base of the horizon.

It is practically impossible to determine the age of the whole Valea Caselor Facies based on fossil remnants contained, as the fossil fish specimens (Popovici-Hatzeg, 1898) are of reduced stratigraphic value. The correlation of lithologic levels assigned to the Valea Caselor Facies and of those in the Pucioasa Beds Facies with Fusaru Sandstones (Fig. 16) points to the synchronous character of these two facies. The age of these facies will be treated further on.

3.8.2. Pucioasa Beds (Mrazec, Popescu-Voiteşti, 1914) *with Fusaru Sandstones* (Popescu-Voiteşti, 1910) *Facies*

This name much used in literature with respect to the Paleogene flysch includes two terms marked by different evolution prior to their union as a single notion.

East of the Bizdidel Valley and immediately south of the investigated area lies the Fusaru peak, the name of which was used by Popescu-Voiteşti (1909) in order to describe a thick sandstone and microconglomerate pile. Then, it was considered to be synchronous with the Tarcău sandstone and therefore the name of "Fusaru-Tarcău Sandstone" was used (Filipescu, 1934; Noth, Pătruţ, 1951 etc.). After 1950 (Noth, Pătruţ, 1951; Popescu, 1952, 1953; Olteanu, 1952) the sandstones which are similar to those occurring in the Fusaru mountain are proved to be interlayered in the Oligocene rocks. Discussing the data presented by Grigoraş (1951), I. Atanasiu proposed the name of Tarcău Sandstone only for the Eocene sandstones and the name of Fusaru Sandstone for the arenites interbedded within the Oligocene rocks. This opinion will be adopted by all the scientists.

According to Mrazec and Popescu-Voiteşti (1914), the Pucioasa Beds represent the entire rock sequence exposed on both slopes of the Ialomiţa Valley, north of Pucioasa. However, in this area, besides the proper Pucioasa Beds there are also other deposits - The Vineţişu Beds and the upper horizon of dyssodile schists belonging to the same facies. The accurate delimitation and mapping (Olteanu, 1952; Popescu, 1953) of all the horizons of the Pucioasa Beds with Fusaru Sandstones Facies was followed by the restriction of term Pucioasa Beds only to the interval between the lower horizon of dysodiles and the Vineţişu Beds. Popescu (1952) and Olteanu (1952) use almost concomitantly a term combined of the classical ones: the facies of Pucioasa Beds with Fusaru Sandstones.

This brief description of the evolution of the lithostratigraphic names related to the discussed facies is supplemented by the description of its constituent lithologic levels (Fig. 16C):

a) The Lower Horizon of Dysodile Shales (ca 200 m thick) consists of brown and grey shaly clays, ankeritic marly-limestones, 3-10 cm thick, sparse millimetric yellow benthonite interlayerings and thin menilitic interlayers in places.

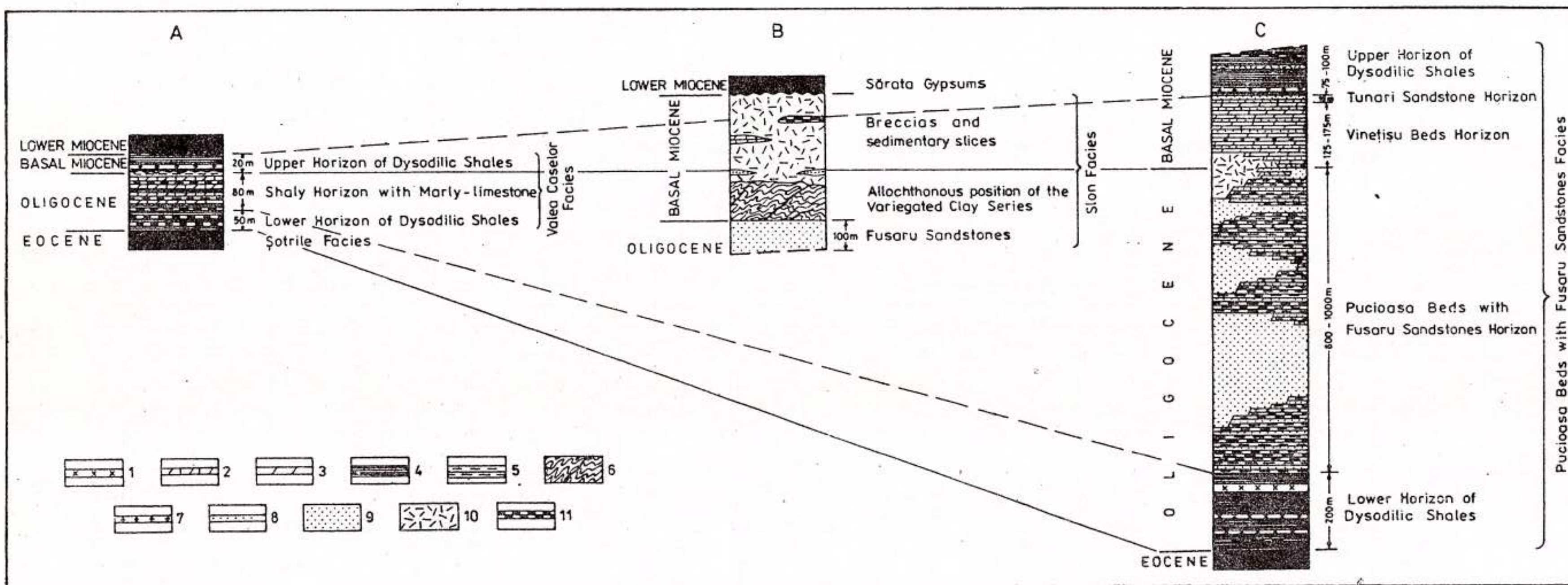

Fig. 16 – Lithostratigraphic column of Oligocene-Miocene basal deposits. 1, sideritic calcareous marls; 2, greenish calcareous marls; 3, marls; 4, dysodilic clay shales; 5, grey clays; 6, variegated clays; 7, tuffs and bentonites; 8, thin sandstones; 9, massive thick sandstones; 10, sedimentary breccias; 11, sedimentary slices.

b) The Pucioasa Beds with Fusaru Sandstones Horizon (800–900 m thick) is represented by more or less rhythmic alternances of grey pelites and grey laminar or cross lamination sandstones associated with white marly-limestones 1–3 cm thick (Pucioasa Beds); yellow massive sandstones, with massive or graded structure, either with coaly lenses or forming weathering boulders (Fusaru Sandstones). The ratio of rhythmic piles and massive sandstones differs from one section to another. It is to mention that between the Fusaru peak and Bela this level is represented by massive sandstones as it corresponds to the axial zone of a submarine alluvial fan.

c) The Vineţişu Beds Horizon (Grigoraş, 1955). On 125–175 m thickness the lithologic composition is constant: light grey marls weathered to white, interlayered, mostly in the lower half, with grey calcareous sandstones, more or less lithified, the sandstones 1–2 cm thick showing diagonal lamination and the thicker ones (10 cm) showing convolute lamination. The bottom exhibits both sole markings and bioglyphs. Within the lower half of the Vineţişu Beds appear white dacite tuff interlayerings (two or three levels), benthonized in places, their thickness ranging from 10 to 60 cm.

The boundary between the Pucioasa Beds with Fusaru Sandstones and the Vineţişu Beds is usually marked by the occurrence of rocks genetically different, namely sedimentary breccias belonging to the Slon Facies, which will be described further on. However, it is to mention here that the breccias occur in lower geometric position than mentioned above, being also interlayered with the top of the Pucioasa Beds with Fusaru Sandstones. The thickness of the breccia interlayerings varies from one section to another, tending to increase both northwards and westwards.

d) The Tunari Sandstone Horizon (5–10 m thick). At first, it was described as "upper Fusaru sandstone" (Ştefănescu, 1970). This level includes grey sandstone layers (weathered to yellow) with argillaceous matrix, soft, micaceous, 0.20–1.5 m thick. The sandstones are separated by argilaceous joints or beds, of black colour weathered to brown.

e) The Upper Horizon of Dysodilic Shales (75–100 m thick). It starts with shaly, argillaceous pelites grey-brown in fresh break or weathered to rusty yellow. The pelites are interlayered with two or three benthonized tuff beds or only yellow benthonites, 20–60 cm or even 1 m thick. These are followed by brown argillaceous shales more or less calcareous in places and of white colour. Silicified argillaceous shales of different thickness or even menilites occur in places.

As the facies of the Pucioasa Beds with Fusaru Sandstones shows an inward parasitic facies -Slon facies - the age of these deposits will be studied considering the both facies, but after the description of the latter.

3.8.3. Slon Facies (Popescu, 1958)

The boundary between the Crętaceous flysch area and the Paleogene flysch area is marked by a characteristic rock sequence present along the whole perimeter, between Ocina and Vulcana valleys.This sequence exhibits the close imbrication of some rock piles of different ages (Upper Cretaceous, Eocene and Oligocene). A similar sequence occurs in the Teleajen Valley basin and it was considered by Filipescu (1936) as "a scale zone". The "scale zone" of the perimeter under discussion was also studied by Popescu and Olteanu (Olteanu, 1952) who drew the conclusion that it was in fact an area of sedimentary breccia development.

The name of Slon Facies was introduced in literature by Popescu (1958) to define a specific facies, equivalent to a part of the facies of Pucioasa Beds with Fusaru Sandstones, suddenly replacing the latter inwards. In the area under discussion it is not limitted only to the Tarcău Nappe, but it occurs northwards covering the inner nappes and being almost exclusively represented by an accumulation of gravitationally slided slices lacking in matrix or with a small amount of it between the slices.

Between Ocina and Vulcana valleys there are two large categories of breccias, each one showing certain varieties as follows:

– polymictic breccias usually consisting of grey or black argillaceous matrix, siltic in places including: white marly-limestones with Globigerinas (Eocene) which are prevailing; brown, black argillaceous shales (of Oligocene type); menilite fragments; green micaceous sandstones (Eocene); red marly-limestones of Gura Beliei type (Maestrichtian); sparse red and cherry-red clays (Paleocene and/or Priabonian).

The size of pebbles ranges from 4–5 mm to 2–5 cm. However, they usually exceed the upper limit and the dark matrix also includes olistoliths consisting of layers longer than 100 m.

If similar occurrences are sparse in the breccia strip at the boundary between the Pucioasa Beds with Fusaru Sandstones and the Vineţişu Beds, inwards they are more and more abundant and the olitoliths of entire layers prevail over proper breccias. These are present in the northern tributaries of the Valea Ursei, being marked by successive menilite piles in alternance with Buciumeni Marls. The well exposed sections show that these undissociated piles are separated by breccia layers the thickness of which ranges from a few meters to half a meter or even less. Although rather thin in places, solely the occurrences of breccias is relevant to the geological environment, accounting for gravitational accumulations and not for tectonic repetition.

– oligomictic breccias, which are a particular and rare instance of polymictic breccias, exhibiting both the matrix and the components made up of the same material. In fact, these are breccias consisting exclusively of red calcareous marls, more or less rounded, surrounded by a red matrix. Both the components and the matrix are supplied by the Gura Beliei Marls. Unlike the polymictic breccias, the ones under discussion have a subordinate matrix which usually fills the cavities among the component elements, the latter contacting each other. The inner structure of these beccias proves the destruction and rapid transport of their component material.

Among the breccias described above and mainly accompanying the polymictic breccias, there are grey micaceous sandstones, 1.5 m thick at the most, commonly showing parallel lamination and reworking soft pebbles. The sandstones are lens-shaped and therefore difficult to delimit and to map. They seem to represent common sediments deposited in the area of breccia formation during the relatively quiet tectonic stages in the source areas.

In spite of difficult conditions, the depostion sequence in the Slon Facies area has been reconstructed and the following data have been obtained:

– the base of the sequence (Fig. 16) consists of a rather thick (ca 100 m) pile of grey-yellow, massive Fusaru Sandstone showing numerous microconglomerate episodes with well rounded quartz fragments. The thick sandstones are in places finer-grained, more micaceous and show parallel or largely convolute lamination;

– these are almost always followed by a pile, of different thickness, of the "variegated clay sequence", marked by extremely complicated inner structure;

– the sedimentary breccias overlie the preceding rocks. They are finer-grained outside and coarser inside the area, leading to the resedimentation of entire layers. It should be also noted that the resedimentation sequence corresponds to the stratigraphic sequence, starting with the Upper Cretaceous rocks to the Oligocene ones.

Considering the geometric sequences of the rocks in the facies of Pucioasa Beds with Fusaru Sandstones and in the Slon Facies, and taking into account the available data, the stratigraphic interval of these rocks will be defined.

As the present study is not intended to be a historical account of the investigation of this area, only the data of real interest to elucidating our problems will be revised.

If the lower lithologic limit of the facies of Pucioasa Beds with Fusaru Sandstones is admitted to correspond to the Eocene-Oligocene stratigraphic limit, the age of the upper part of the former is still a problem.

Miogypsina specimens were collected by Olteanu (1952, 1973) from the top of the Pucioasa Beds with Fusaru Sandstones exposed on the southern border of the area under discussion (Bizdidel Valley basin). As they were poorly preserved, their species assignment was not achieved (Olteanu, 1973). However, both Van der Vlerk and Olteanu consider the fossil specimens of Miocene age. Gastropods and lamellibranches with Miocene features are discovered by Motaş (1948 a) in the Fusaru Sandstone occurrence west of Pucioasa. It is worth remembering that although the sparse paleontologic proofs do not offer accurate stratigraphic information, they seem to mark the fauna changes which correspond to the beginning of the Miocene. However, this raises two main problems to be solved.

First, it is to mention the problem of the Oligocene-Miocene boundary. Practically, there is no accurate paleontologic solution. The only proofs are obtained by the nannoplankton study (Gheţa, 1974) of some samples collected from the Vineţişu Beds exposed in the Bizdidel Valley. Some samples situated approximately at the same level as a green tuff bed yielded an assemblage which, according to Gheţa[4], "exceeds by all means the upper limit of the Oligocene". Starting from this, we considered that the Oligocene-Miocene boundary might correspond to the lithologic boundary between the horizon of Pucioasa Beds with Fusaru Sandstones and the Vineţişu Beds Facies Horizon, also envisaging their possible occurrence at the top of the Pucioasa Beds with Fusaru Sandstones.

Secondly, it is to determine how much of the rocks under discussion is to be assigned to the Miocene.

In order to solve this problem, suppositions should be made till fossil remnants are found *in situ*. Outside the perimeter, to the east, in the basin of the Teleajen Valley, the Facies of the Pucioasa Beds with Fusaru Sandstones is overlain by the Cornu Beds (Mrazec, Popescu-Voiteşti, 1914), which yielded Burdigalian pecten fauna (Popa, 1960). These beds usually start with a gypsum pile similar to the Sărata Gypsum unconformably overlying the Slon Facies in the area investigated. Therefore, the rock occurrences between the base of the Vineţişu Beds and the gypsum layer (as well as their equivalents) should include both the Aquitanian and a part of the Burdigalian. As no more detailed specifications are possible at present, these rocks are assigned to the lowermost Miocene, as one may see from Figure 16.

Finally, it is appropriate to end the discussion of the age of the rocks occurring between the uppermost Eocene and the Miocene molasse, by assigning each of the lithologic entities described to a certain stratigraphic interval:

– Oligocene = lower horizon of dysodile shales with

[4] N. Gheţa - personal communication

(Valea Caselor Facies) or without menilites (Pucioasa Beds with Fusaru Sandstones Facies); shaly horizon with marly-limestones (Valea Caselor Facies); Pucioasa Beds with Fusaru Sandstones Horizon (including the Fusaru Sandstone overlain by Slon breccias) and lower levels of the Slon breccias.

– Lowermost Miocene = Vineţişu Beds, Tunari sandstone horizon, upper horizon of dysodile shales (assigned to both the Valea Caselor Facies and to the Pucioasa Beds with Fusaru Sandstone Facies) and most of the breccias in the Slon Facies.

3.9. Lower Miocene

3.9.1. Sărata Gypsum

This name is used here for the chemical precipitation rocks recognized by Popescu-Voiteşti (1914) in the area of the springs of Sărata Valley (left-side tributary of Bizdidel Valley). For simplifying the presentation, the thin normal cover of the gypsum will be described in this subchapter, too.

According to Olteanu (1952) the "Aquitanian gypsum is unconformably transgressive" over older deposits. The rock sequence included in the Sărata Gypsum can be divided, lithologically, as follows (Fig. 17 A):

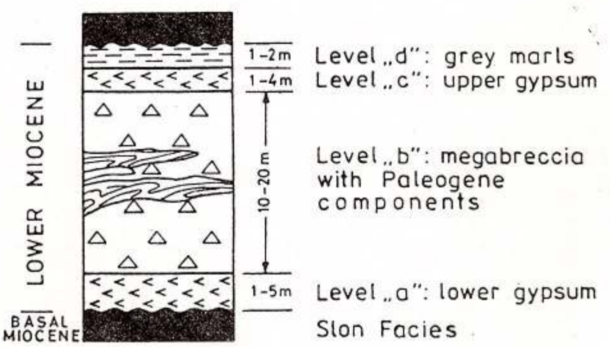

Fig. 17 – Lithologic column of Sărata Gypsum.

a) – at the base, a gypsum level 1–5 m, at the most 20 m, thick, consisting of thin, grey-white gypsum layers separated by argillaceous or fine sandy laminae;

b) – the next level is commonly 10–20 m thick and includes white Globicerina marls (probably Buciumeni marls), dysodile shales with or without menilites and brown shales with yellow marly-limestone interlayerings (Valea Caselor Facies). The chaotic arrangement of these rocks shows that they constitute a sedimentary megabreccia, the components of which have been supplied by the top of the Şotrile Facies and mostly by the Valea Caselor Facies;

c) – the breccia is overlain by a grey gypsum level 1–4 m thick; owing to the detrital laminae interlayered with the gypsum, the latter shows the same striped feature as level **a**.

In a single section the Sărata Gypsum is overlain by younger deposits. Here along 1-2 m thickness the second gypsum level supports grey pelites slightly weathered to yellow, low micaceous along bedding planes.

The rocks described are associated with the salty springs in the upper course of Sărata Valley. However, the salts deposits are difficult to locate with respect to the mentioned sequence, as they are not cropping out and their occurrence is proved only by springs.

The Sărata Gypsum is Lower Miocene (Burdigalian) in age.

The discussion of the deposits assigned to the "Aquitanian" by previous researchers should also include the "Valea Leurzei Beds" (Popescu, Motaş, 1959), mainly because their type section is in the area under discussion.

As a result of the investigations carried out we consider that the "Valea Leurzei Beds" are not an independent lithologic sequence, but they stand for rocks of different age (Vraconian to Oligocene) showing a common feature: both anomalous violaceous pelite interlayerings (even in menilites) and violaceous diaclases. Thus, it has been inferred that the colour is a secondary effect of highly oxidizing waters which circulated through rocks before the deposition of the Lower Miocene molasse.

Considering these data, the "Valea Leurzei Beds" are no longer interpreted as an independent lithostratigraphic unit. However, the name of Valea Leurzei may be used to define the characteristic weathering type which sometimes informs on the structure.

3.9.2. Lower Miocene Molasse

All the formations described so far are overlain by a thick rock sequence of different lithologic constitution.

East of the Ialomiţa Valley the Lower Miocene molasse covers a large area in the middle of the perimeter, dividing it into two parts. West of this valley, the molasse occurs on small areas as outliers.

These deposits start with polymictic conglomerates, known as the Brebu Conglomerates (Mrazec, fide Grujinschi, 1971). They consist of a grey sandy matrix with well rounded Mesozoic limestones and crystalline schists. Along some sections, the component elements are also represented by well rounded gypsum fragments. Conglomerates are not constantly present. They vary both vertically (10–30 m thick) and horizontally. West of the Coporod Valley, at the base of the Lower Miocene molasse there are chaotic breccias with grey, siltic matrix commonly containing pelitic rock fragments, some of red-violaceous colour, characteristic of the Valea Leurzei weathering type.

Most of the rocks recognized within the Lower

Miocene molasse are represented by alternating soft micaceous sandstones, of grey, yellow or red colour, ranging in thickness from 5 cm to 1 cm or even more. Their bottoms show current marks and traces of biologic activity. The detrital material from the sandstone base often fills the mud-cracks of subjacent pelites.

The sandstones are interlayered with pelites, siltic in places, of grey, yellow, red or even cherry-red colour, ca 10 cm or only 1–5 mm thick.

From the Ocina Valley westwards, there are some white or olive-green dacitic tuff interlayerings, partly benthonized and less than 1 m thick. It is also to mention here white or grey, laminar gypsum layers, ranging in thickness from 20 cm to 1 m. The younger part of the Lower Miocene molasse sequence exposed both in the Ocina-Proviţa interfluve and east of it, exhibits a gypsum layer 2–4 m thick associated with laminar, calcareous shales which are an outstanding lithologic marker of this sequence.

Special mention should be made of the gypsum exposed in the slopes of the Vulcăniţa Valley. In the interfluve between this valley and the Vulcana Valley, there is a Lower Miocene molasse outlier which starts with a gypsum pile 4–5 m thick. Besides their unusual position, these gypsum deposits are of a peculiar colour, usually pink or white and pink. The gypsum is also interlayered with breccias which rework pelite fragments affected by weathering of Valea Leurzei type. The reworked violaceous pelite occurrences show that the mentioned gypsum deposits are younger than the Sărata ones (preceding the alteration of Valea Leurzei type) with which they could be confounded due to similar geometric position. The same is valid for the gypsum outcrops in the Vulcăniţa-Ialomiţa interfluve, which are more than 10 m thick.

Several well preserved reworked nummulites have been collected from the Lower Miocene molasse. Moreover, Cervideae footprints are reported for the first time.

As the quoted fossil specimens are not relevant of the age of these deposits, the latter are considered Lower Miocene due only to their geometric position.

3.10. Pliocene

In the western end of the investigated area, over a very reduced surface there are some rock occurrences represented by sands and gravels, usually low consolidated. The reworked pebbles of gravels are supplied by the flysch area and probably by the Leaota crystalline massif. They are contained by a yellow gritty matrix with lamellibranch and gastropod fragments. The deposits have been assigned to the Dacian, considering the age determined by Motaş in 1952.

3.11. Quaternary

Quaternary deposits occur all over the investigated area. Morphologically, it can be considered that they usually follow the main water flow.

The Quaternary deposits have been generated either by fluvial activity - lower and upper terraces, alluvial fans and recent alluvia - or by combined action of water and gravitation force - land slidings.

Land slidings will be briefly treated here. Their relatively large areal extent might be due to three factors which independently or together brought about these phenomena: the lithologic composition of deposits, their genetic features and the tectonisation degree.

Taking into account the mainly pelitic character, one may interpret the slidings which usually affect the Comarnic Beds (right slope of Brăţii Valley), the variegated clay series (Berevoieşti, springs of Vulcăniţa Valley, Cucuteni), top of the Şotrile Facies (Ialomiţa-Ialomicioara de Jos interfluve), Dumbrăvioara Series (mainly its sedimentary breccias) and the breccias in Slon Facies.

The tectonisation degree of formations was decisive to the generation of slidings. Thus, the slidings in the springs area of Leurda and Coporod valleys or in the right slope of Ocina Valley, north of Bezdead, could be mainly due to the high tectonisation of rocks. It is also worth mentioning that the land slidings are mainly due to the coexistence of two or of even all three factors mentioned above.

4. Tectonics

With respect to the area between Prahova and Ialomiţa valleys there are two different tectonic views: one concerning a nappe structure and another one supposing a normal structure of deposits.

One should mention from the very beginning that till 1962, excepting the structural interpretation of Murgeanu (1934), the nappe existence in this area was theoretically supposed more as a necessity of the prolongation of the large structural units described all over the East Carpathian flysch area, starting from the northern border of the country to the Teleajen meridian, than as the result of a well documented study.

In our opinion, the nappes play one of the important parts in the tectonic environment of the investigated area; however, post-nappe vertical faults have equally contributed to the present structure (Pl. II, III).

This view generally supports the idea of nappe occurrence (Mrazec, Popescu-Voiteşti, 1914; Murgeanu, 1934; Băncilă, 1958), but it also differs from preceding ones, as the structural units recognized are only partly and mainly south of the Slănic syncline concordant with those delimited by previous researchers.

4.1. Major Structures

4.1.1. Ceahlău Nappe

The Ceahlău Nappe occurs along the whole area between Belia and Ţâţa valleys. It exhibits a highly composite structure. The present structural image of the Sinaia Beds was preceded by several other interpretations.

In 1914 Mrazec and Popescu-Voiteşti recognized three big tectonic units: the Siriu sandstone nappe, the Senonian red marls nappe and the Fusaru Sandstone nappe. The first unit quoted corresponds mainly to the present Ceahlău Nappe, more specifically to its rusty marly-sandy flysch and the Colţii Brăţii Conglomerates.

Murgeanu (1934) considered, like the other two, that the largest amount of the Sinaia Beds represents the autochthon from which the outer nappes had been detached. The "inner nappe" has two digitations: Comarnic and Teşila. In the area which coincides with the perimeter under discussion Murgeanu reports the deposits either to the inner nappe autochthon or to the Comarnic digitation.

These two structural divisions partly correspond to the Măgura and Comarnic digitations of the Ceahlău Nappe. The front line of the former seems to correspond to Lutu Roşu line described by Băncilă (1958) and adopted by Hristescu et al. (1967). According to Ştefănescu (1969), in the Ialomiţa valley basin the frontal line of the tectonic units assigned to the Sinaia Beds lies below the Slănic syncline.

In 1970, we obtained a different image, including two digitations of the Ceahlău Nappe, which are exposed between Belia and Ţâţa valleys. They are obvious due to facies differences within Aptian and Upper Vraconian-Turonian deposits.

4.1.1.1. Măgura Digitation.[5] It includes a rock sequence (Fig. 18A) which starts with the Hauterivian and reaches the Turonian. The deposits which strictly form the Măgura digitation are followed stratigrafically by some formations belonging to the Senonian-Oligocene refolded post-tectonic cover.

Along the southern border of this digitation are mainly exposed the younger rocks of the sequence, the older ones occurring inwards. There are also some stratigraphic differences within this digitation as follows:

– the occurrence of Colţii Brăţii Conglomerates in the front area, where this sequence associates with the whole Dumbrăvioara Series;

– the lack of conglomerates and even of the Dumbrăvioara Series from the inner zones of the digitation, where the Marly-sandy Rusty Flysch is directly overlain by the Upper Senonian.

The inner structure of the Măgura Digitation consists of very tight scales, rendered obvious by the fact that no section exhibits a complete rock sequence, but sequences of two, three or four members are most frequent.

Between the Coporod Valley and the left slope of Ialomiţa Valley, there are also some rudimentary anticlinal or synclinal folds. However, even they are affected in places by axial faults, as it is the case with the Colţii Brăţii anticline or the syncline in the left slope of the Dumbrăvioara Valley.

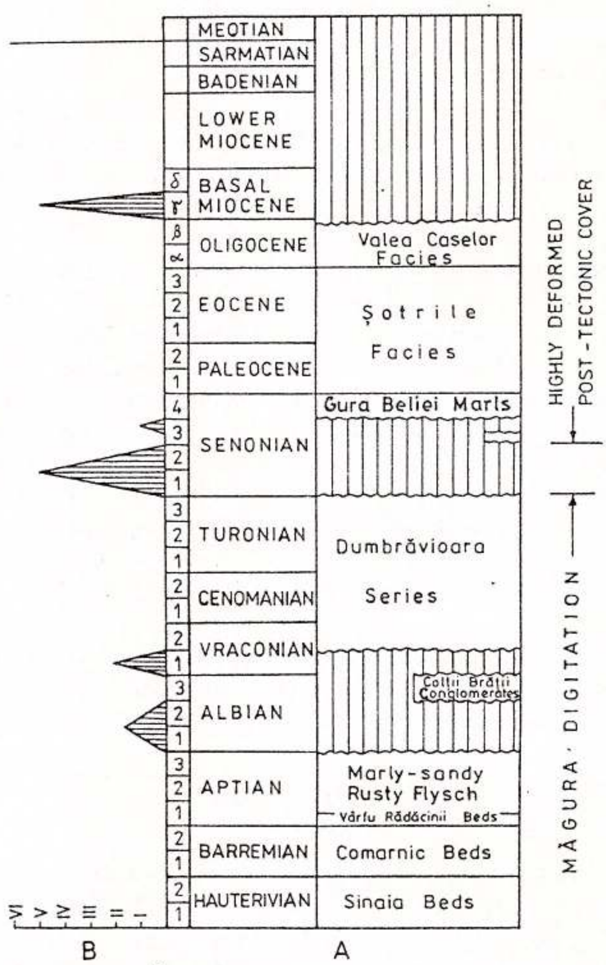

Fig. 18 – Lithostratigraphic constitution (A) of the Măgura Digitation and types of movements which had affected it (B). I, uplifts without deformation; II, folds, faulted folds; III, imbricated structure, longitudinal faults; IV, overthrusts; V, thrusts; VI, transverse faults.

This composite structure is due to successive tectonic movements (Fig. 18B) which had started later

[5]Later we proved this subunit to represent in fact the westward prolongation of the Bratocea digitation of the Ceahlău Nappe.

than the Aptian, reached their maximum intensity prior to the Upper Senonian and took place till after the deposition of the Lower Miocene molasse.

The study of the line contour marking the Măgura Digitation points out some mapping features characteristic of overthrusts: the front line cross-cuts the lower unit below; the presence of a tectonic window in Valea fără Nume area; an important tectonic half island between Dumbrăvioara and Belia valleys, along ca 5 km length and ca 1 km width. These account for an important thrusting of the Măgura Digitation deposits over those of the Comarnic Digitation.

The outcrop data show a minimum width of thrusting of 3–5 km, which is however far from proving the real amplitude of the displacement of the Măgura Digitation.

4.1.1.2. Comarnic Digitation. This digitation was delimited by Ştefănescu (1970) who named it by taking into account the denomination used by Murgeanu (1934) to define the tectonic compartment including "the mixed Vraconian" in the Prahova Valley. Along this section, "the mixed Vraconian" is similar to the Podu Vârtos Beds reported by us, which are assigned to the Comarnic Digitation. The Comarnic Digitation also consists of Comarnic Beds and Dumbrăvioara Series.

These rocks are overlain by a thick post-tectonic cover starting in the Upper Senonian and reaching the Lower Miocene (Fig. 19A).

The inner structure of the Comarnic Digitation is generally represented by closely repeated scales. This structure is characteristic for the whole area between Prahova and Ialomiţa valleys lying next to the northern limb of the Buciumeni Syncline. North of this area, axially faulted folds (Leurda Valley) and folds with intact axial zones (Târsa springs) occur successively.

All these folds and scales which also affect the post-tectonic rocks are due to the successive deformations (Fig. 19B) which had started before the Upper Vraconian and lasted till the Lower Miocene.

One of the most important results of the tectonic movements which affected the deposits of the Comarnic Digitation is their thrusting over the rocks in front of them (Teleajen Nappe).

4.1.2. Teleajen Nappe

The deposits assigned to this structural unit occur on a limited area between the Bizdidel Valley and the left slope of Cheia Valley.

They were initially reported (Mrazec, Popescu-Voiteşti, 1914) to the nappe of Senonian red marls. Later, Murgeanu (1930 a, b) considered that the sandy complex and the limestone klippen outcropping at Fieni belonged to the tectonic unit called "Slănic syncline". Băncilă (1958) is the first who recognized

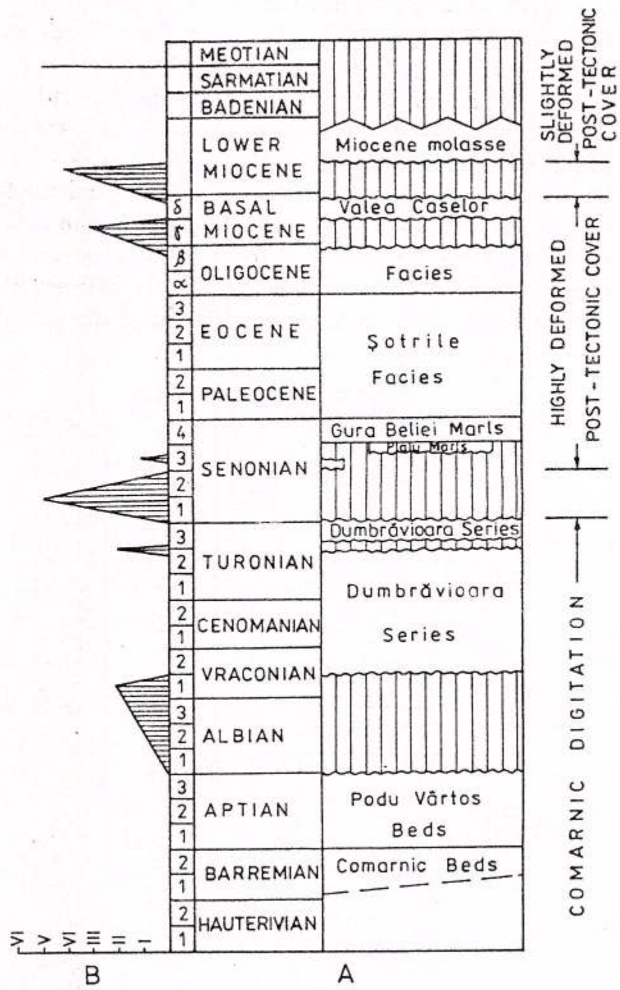

Fig. 19 – Lithostratigraphic constitution (A) of the Comarnic Digitation and types of movements which had affected it (B). I, uplifts without deformation; II, folds, faulted folds; III, imbricated structure, longitudinal faults; IV, overthrusts; V, thrusts; VI, transverse faults.

the east-inner unit (= Teleajen Nappe) west of the Prahova Valley, as far as the Ialomiţa Valley. He also assigned to this unit the whole Buciumeni syncline its northern limb included. This hypothesis is inaccurate as the northern limb of this syncline overlies unconformably the deposits of the Comarnic Digitation.

The Teleajen Nappe exposed in the area under discussion consists of flysch deposits (Fieni Series) assigned to the Vraconian-Turonian interval, unconformably overlain by the post-tectonic cover of the Buciumeni Syncline (Fig. 20A).

The inner structure of the Fieni Series is obviously different from the one of the post-tectonic cover, being marked by tight folding noticeable in the outcrops of the Ialomiţa Valley at Fieni, where even the competent rocks (sandstones) of this sequence exhibit folds several meters wide.

The folding is due to the movements which had preceded (Fig. 20B) the deposition of Upper Senonian rocks. These movements have also generated the thrusting relationships between the Fieni Series and the neighbouring inward and outward sequences.

The boundary between the Fieni Series and the rocks of the Comarnic Digitation is not exposed because of the overlying post-tectonic deposits of the Buciumeni Syncline. Nevertheless, the age and the facies of pre-Senonian deposits cropping out from below the Buciumeni Syncline lead to the conclusion that at present there is an overthrusting contact between the former Sinaia Beds and the "black shales" domains.

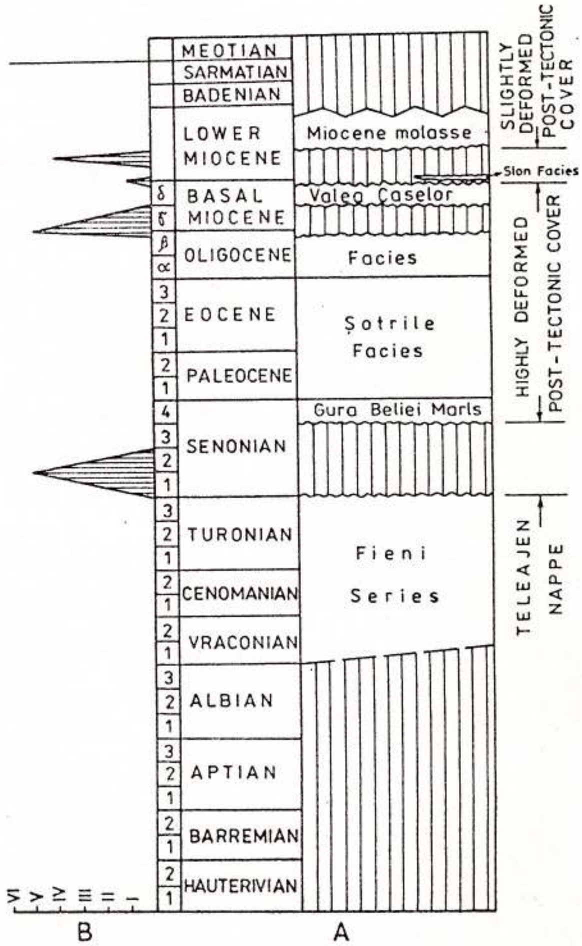

Fig. 20 – Lithostatigraphic constitution (A) of the Teleajen Nappe and types of movements which had affected it (B). I, uplifts, without deformations; II, folds, faulted folds; III, imbricated structure, longitudinal faults; IV, overthrusts; V, thrusts; VI, transverse faults.

The outer boundary of the Teleajen Nappe is exposed along ca 7 km. The youngest member of the Macla Series (Vulcăniţa feldspar sandstone) is overthrust by the Fieni Series, accounting for this important thrusting also proved by drillings in Teleajen, Doftana and Bizdidel valleys.

Taking into account certain regional aspects one should consider that the thrusting of the Teleajen Nappe over the Macla Series had preceded the deposition of the Gura Beliei Marls.

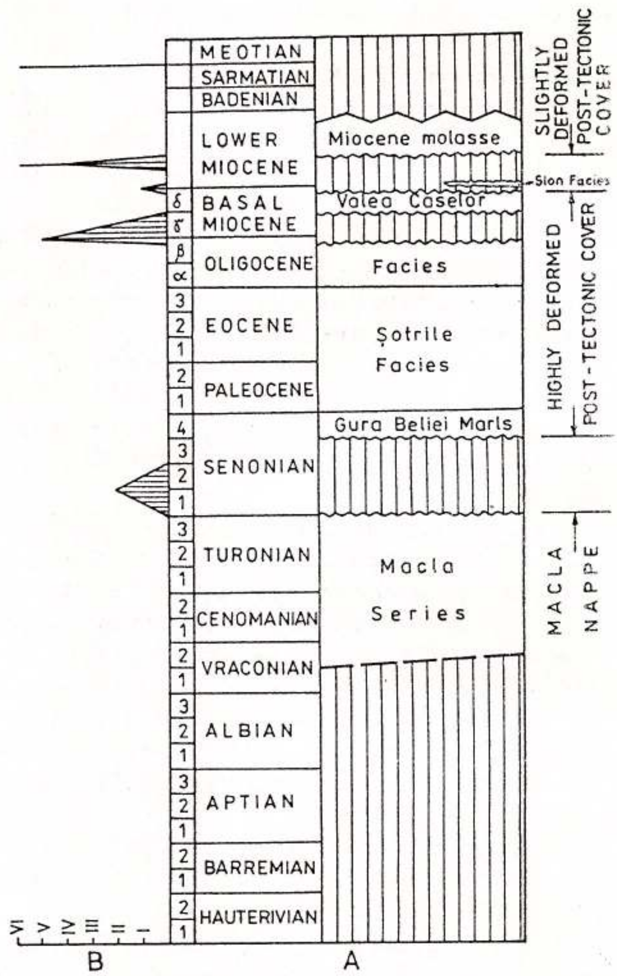

Fig. 21 – Lithostratigraphic constitution (A) of the Macla Nappe and types of movements which had affected it (B). I, uplifts without deformations; II, folds, faulted folds; III, imbricated structure, longitudinal faults; IV, overthrusts; V, thrusts; VI, transverse faults.

4.1.3. Macla Nappe

It occurs as a thin strip external to the Teleajen Nappe, between Bizdidel and Vulcana valleys.

The rocks now assigned to the Macla Nappe were initially considered by Mrazec and Popescu-Voiteşti (1914) as Senonian red marls. In 1953 Popescu reported these rocks to the "Cretaceous and Paleogene flysch" tectonic area which also contained the Fieni Series and the Variegated Clay Series. According to Ştefănescu et al. (1964) the Macla Series occurs from the Crasna Valley westwards to the Ialomiţa Valley basin. Nevertheless, the Macla Nappe was correctly delimited by Ştefănescu (1970) who divided the Macla Series from the Variegated Clay Series.

The Macla Nappe consists of the three horizons of the series bearing the same name as the unit, and of the Gura Beliei Marls, the Şotrile Facies and the Valea Caselor Facies (Fig. 21A).

The inner structure of the Macla Nappe usually resembles a monocline constantly sinking northwards. Some sections show repeated scales (right slope of Ialomiţa Valley, Cheia Valley basin), or tight folds (Cheia Valley, left slope of Ialomiţa Valley) which cause an artificial widening of the outcropping areas of the grey pelite horizon.

The deposits of the Macla Nappe had been affected by two important movement phases (Fig. 21B). The first phase preceded the deposition of the Gura Beliei Marls, when the thrusting of the Teleajen Nappe took place concomitantly with the folding of the Macla Series. The second phase started later, during the deposition of the upper part of the Pucioasa Beds with Fusaru sandstones and reached its climax subsequently to the deposition of the latter, when the Macla Nappe, like all the inner flysch nappes, overthrust its adjoining external realm.

4.1.4. Variegated Clays Nappe

Before their delineation as independent tectonic unit (Ştefănescu, 1970), the variegated clays had been assigned to other structural units as follows: Senonian red marls nappe (Mrazec, Popescu-Voiteşti, 1914), Slănic Nappe (Olteanu, 1952), Cretaceous and Paleogene flysch zone (Popescu, 1953), Audia Nappe (Băncilă, 1958), Macla Nappe (Ştefănescu et al., 1964).

The Variegated Clays Nappe of almost constant constitution (Fig. 22A) occurs along the almost entire length of the area from the Ocina Valley in the east to the Mălăiştea peak in the west.

All over the outcropping length the Variegated Clays Nappe shows a much complicated inner structure marked by intense microfolding and disorderly repetition of the two rock piles which form the variegated clays sequence. Moreover, there are also some clay piles marked by different microfolding styles and a rather sudden thinning out of sandstones interlayered with clays, the sandstones often occurring as isolated ellipsoidal bodies. These data prove that the inner structure of this nappe is not due to centripetal tangential tectonic forces, but it has resulted from possibly submarine gravitational movements caused by centrifugal tangential forces. The rock types which constitute the variegated clays sequence and mainly their present structure account for the assignement of this series to the "argile scagliose" type (Ogniben, 1962, 1963).

The submarine slidings which had generated the inner structure of the Variegated Clays Nappe are in fact parts of an important gravitational displacement, that is the emplacement of the nappe itself. The nappe emplacement was followed by a new tectonic event (Fig.

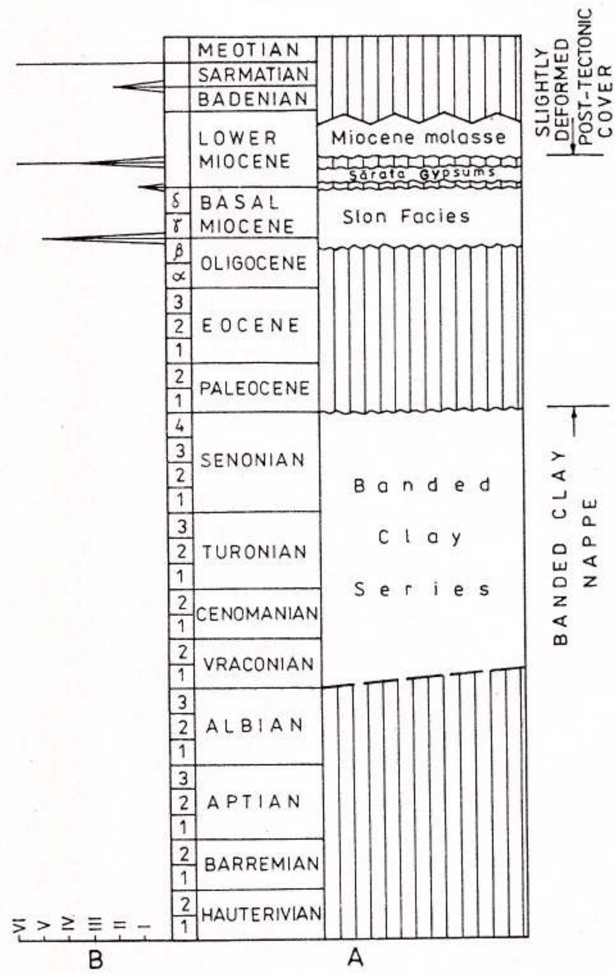

Fig. 22 – Lithostratigraphic constitution (A) of Variegated Clay Nappe and types of movements which had affected it (B). I, uplifts without deformations; II, folds, faulted folds; III, imbricated structure, longitudinal faults; IV, overthrusts; V, thrusts; VI, transverse faults.

22B) which led to its coeval folding with both the overthrust deposits of the Tarcău Nappe and the rocks subsequently deposited (sedimentary breccias and Sărata Gypsum). To this stage are assigned: the Cheia Valley syncline, the Sărata Valley syncline and the anticline in the left slope of the Ursei Valley spring. The unfolding of the Variegated Clays Nappe leads to an approximation of the nappe sliding of at least 4–5 km.

4.1.5. Tarcău Nappe

The Paleogene deposits exposed southward of the variegated clays series have been structurally delimited from the other rock occurrences since the first geologic investigations in this area. According to Popescu-Voiteşti (1911) the present-day Tarcău Nappe contained the Eocene-Oligocene rocks occurring externally to the Cretaceous ones. Mrazec and Popescu-Voiteşti (1914) considered these rocks to form an independent nappe – the Fusaru sandstone nappe – which

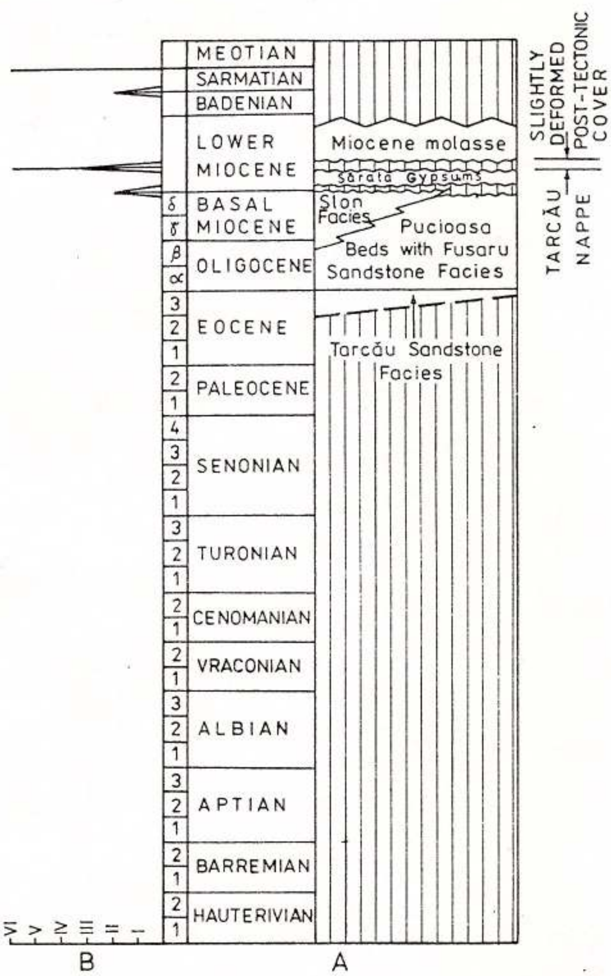

Fig. 23 – Lithostratigraphic constitution (A) of the Tarcău Nappe and types of movements which had affected it (B). I, uplifts without deformations; II, folds, faulted folds; III, imbricated structure, longitudinal faults; IV, overthrusts; V, thrusts; VI, transverse faults.

was "the lowermost of the inner nappes". This structural unit has been subsequently named: the Homorâciu Nappe (Olteanu, 1952), the Eocene-Oligocene flysch zone (Popescu, 1953), the middle subunit of the middle-marginal unit (Băncilă, 1958) and finally, the Tarcău Nappe (Dumitrescu et al., 1962) as used by Dumitrescu (1951).

The Tarcău Nappe occurs along the whole area between Proviţa and Vulcana valleys. Here, it consists of Eocene rocks in Tarcău Sandstone Facies, Oligocene-Miocene rocks in both Pucioasa Beds with Fusaru Sandstones Facies and Slon Facies, as well as Lower Miocene rocks such as the Sărata Gypsum deposits (Fig. 23A).

The reduced area of the Tarcău Nappe figured on the present map is in fact the northern limb and partly the axial zone of a single positive structure of the Tarcău Nappe, namely the Stârmini-Fricoasa anticline, with subsidiary tectonic complication, such as the reverse faults west of the Bizdidel Valley which occurs as far as the Ursei-Coclanda confluence. Inward the Stârmini-Fricoasa anticline were delimited other structures also belonging to the Tarcău Nappe (the Cheia Valley syncline, the Cucuteni anticline and the Sărata syncline), but in which deposits in Slon Facies are mainly involved.

All the structural components of the Tarcău Nappe had started forming prior to the deposition of the Sărata Gypsum deposits and became final due to several subsequent movements (Fig. 23B).

4.1.6. Buciumeni Syncline

The rocks of this important structure in the investigated area have been considered to belong to a nappe slid from inside, from the autochthonous realm built of Sinaia Beds. This downsliding nappe was differently named: Red Marl Nappe (Popescu-Voiteşti, 1910; Mrazec, Popescu-Voiteşti, 1914); Comarnic Digitation (Murgeanu, 1934) and Slănic Nappe (Olteanu, 1952). In his studies regarding the area between Bizdidel and Bărbuleţ valleys, Murgeanu (1930 a, b) reports all the Senonian-Miocene formations to the "Slănic syncline". Considering the lack of Oligocene rocks from the Ialomicioara Valley section, the quoted author (1930 b) divides this syncline in two parts with the meridian of this valley in between. The eastern part is called the "Slănic syncline" (proper) and the western part the "Gura Bărbuleţului syncline". Popescu (1953) describes a "large syncline" – the Slănic syncline. Finally, it is to mention the opinion of Băncilă (1958) who considers that the initial unitary structure "consists in fact of two basins, accidentally linked by the outward advancement of the inner-east unit". According to him, the "Breaza syncline" represents the structure developed from Doftana Valley, in the west, and reaching the area under discussion.

The author's field investigations have proved that the Slănic syncline really includes several structures: two with Paleogene-Lower Miocene deposits (the Buciumeni Syncline and the Tarcău Nappe) on which the Miocene molasse is superimposed. Therefore, it is necessary to use (Ştefănescu, 1971) a name only for the syncline lowerer than that formed of the Miocene molasse and developed on the Cretaceous pile nappes. The name comes from Buciumeni village, in the neighbourhood of which this structure exhibits its most complete sequence and its both limbs are well developed.

The Buciumeni Syncline consists of rocks which start with the Upper Senonian and end with the lowermost Miocene. The first member (Gura Beliei Marls) lies unconformably over several structural units: in the northern limb, over the Comarnic Digitation and the Măgura Digitation, and in the southern limb, over

Teleajen Nappe. This obviously shows that the Buciumeni Syncline does not belong to a single unit, but to all the quoted ones. Thus, it has the position of a post-tectonic cover (subsequent to a former superposition of nappes) which, during younger tectonic stages, had been folded or even removed together with the units which it overlies unconformably.

Although the rocks which constitute the Buciumeni Syncline occur all over the investigated area, its entire structure with the two limbs is present only between Ialomicioara de Jos Valley and the left slope of the Ialomiţa Valley. It is to mention that in some areas the synclinal limbs are affected by longitudinal faults.

The present structural features of the Buciumeni Syncline are due to successive tectonic movements. The first movement took place subsequently to the deposition of the second level of the Valea Caselor Facies. Then, followed a release period characterized by the deposition of the upper level dysodiles of the mentioned facies, succeeded by an important stage of movements (Figs. 20B, 21B) when the Buciumeni Syncline formed as structural unit. Later, it was also affected by the movements which had generated the folding of the Lower Miocene molasse.

4.1.7. Slănic Syncline

The investigated area is approximately divided into two parts by the Lower Miocene rocks which form a well developed, large syncline.

This structure has been differently described by various authors who gave it different names and different stratigraphic description. As far as the discussion on the Slănic Syncline also regards the Buciumeni Syncline, it is not resumed here.

The author's data (1971) show that the Lower Miocene molasse rocks constitute an independent structure with respect to all the tectonic complications affecting the older rocks, and according to Popescu (1953) and Olteanu (1952) to the Slănic Syncline should be assigned only the rock sequence which starts with the Brebu Conglomerates.

The Slănic Syncline is slightly asymmetric, the inner limb being more dipping than the outer one. The asymmetry is also proved by its axis which between Ialomiţa and Coporod Valleys is closer to the northern border. The Coporod Valley basin contains some secondary folds due to which the main axis of the Slănic Syncline is shifted to its southern border. The axis is centrally located only in the area between Ocina and Târsa valleys.

The present-day shape of the Slănic Syncline is due to at least two stages of tectonic movements (Figs. 22B, 23B), which can be noticed in the investigated area. During the first stage, the Lower Miocene molasse deposits were slightly folded into a syncline. During the subsequent stage this unit was cross-fractured by faults the amplitude of which increased from west to east.

In the investigated area, the accurate timing of these movements is difficult as they had affected only a single young formation – the Lower Miocene molasse. The available data show that the first folding of the Slănic Syncline preceded the Sarmatian, while the transverse faults which affected the latter had acted before the Meotian.

4.2. Faults

4.2.1. Longitudinal Faults

Several longitudinal faults have been recognized in the area under discussion. Some (the front lines of overthrusting compartments – nappes or scales) had formed during the emplacement of different nappes and have been described together with them. Others are subsequent to the overthrusts and equally affect the overthrusting and thrust compartments.

4.2.2. Transverse Faults

All over the investigated area there is a fault system which crosses orthogonally the structural elements previously described, these faults being prevailing in the central area. Their trending is N–S in the Ialomiţa Valley and almost NW–SE to the Ocina Valley, thus resulting in the radial arrangement of this system. The two extreme fracturing trends intersect in places and generate the "y"-shaped (Ursei fault) or "x"-shaped (Dumbrăvioara fault) faults.

In the case of some faults it is difficult to determine the general shifting of a compartment with respect to the eastward or westward neighbouring one, as the lithologic or tectonic boundaries had been affected by opposite movements in two adjoining compartments.

Therefore, a genetic solution is needed to account for the inferred data. One could consider that these transverse faults had resulted from the tendency to equilibrate the tectonic forces according to the lithologic features of the different areas affected by tangential forces. Hence, the name proposed for these faults, i.e. "equilibration faults". The equilibration faults represent in fact a plane which delimits two compartments differently folded and faulted longitudinally during the same tangential effort.

The youngest deposits on which act the transverse faults belong to the Lower Miocene molasse. The important effects of these faults on the rocks older than the Lower Miocene molasse cannot be accounted for due to the slight displacement from the Lower Miocene molasse level. Therefore, the fracturing of Lower Miocene rocks is considered to result from the reactivation of older faults, preexistent to the molasse deposits.

The southward extension of the Ursei fault is blocked south of Vişineşti by Moesian deposits. Eastwards, between Prahova and Aluniş valleys, the Slănic Syncline is also overlain by Sarmatian rocks affected by several transverse faults which seem to belong to the same system as the ones occurring in the area under discussion. According to these data, the reiteration of reverse faults is assigned to the Sarmatian-Meotian time interval.

4.3. Diapirism Phenomena

In the investigated area, diapirism phenomana were first noticed in the flysch zone with respect to sedimentary breccias. We cite the breccias of the Dumbrăvioara Series, with Sinaia Beds and Comarnic Beds elements, exposed in places due to diapiric piercing of their hangingwall usually consisting of Gura Beliei Marls and Şotrile Flysch. The same plastic shifting accounts for the highly varying thickness of breccias.

It is obvious that in this area the accumulation by shifting to certain areas or even by diapiric piercing by the breccias of the normal hangingwall is due to the same tangential tectonic forces which brought about the folding and faulting of the other rocks. These are some diapirism phenomena which correspond, even from the point of view of their genetic mechanism, to those defined by Mrazec (1907) for the folds with salt core.

5. Geologic Evolution of the Investigated Area

The area between Prahova and Ialomiţa valleys covers the western end of the flysch outcropping area.

According to the paleogeographic characteristics, the flysch zone corresponds to a large geosyncline (Dumitrescu et al., 1962; Dumitrescu, Săndulescu, 1968) longitudinally divided in two parts (eu- and miogeosyncline) with peculiar sedimentation environment. Owing to their different constitution and tectonic evolution, the two parts of the depositional basin generated different major structures. The inner part generated the Ceahlău Nappe with its digitations (Măgura and Comarnic). The outer part generated the Teleajen Nappe, the Macla Nappe, the Variegated Clays Nappe and the Tarcău Nappe.

In order to obtain an accurate image of the geologic evolution of this area, several diagrams have been drawn up.

The first group of diagrams (Figs. 24–28) is intended to illustrate the subsidence movements in the initial areas corresponding to each unit. On this diagram, the subsidence value, at one time, is marked by the rock thickness and the deposition depth of each type of deposit. Time is also marked by the rock thickness. Although the thickness of rocks is a real value, measured in outcrops, it does not correspond to the thickness of sediments during the time intervals plotted on diagrams due to the settlement processes subsequent to their deposition. As regards the second value – the sedimentation depth –, excepting the Lower Miocene molasse deposits, it is uncertain and depends on the features of the formation considered and on the biologic activity that took place during sedimentation.

Certain facies recurrences are accounted by the following: in a deposition basin and during the same sedimentation cycle, the rock piles characterized by similar petrographic features had deposited in similar bathimetric conditions. These have been considered for the graphic representation of the deposition depth of the Globigerina marls layers od the Şotrile Facies or of the dysodile layers. This principle has also applied in extension to different sedimentation cycles of those rocks with very similar lithologic features.

Besides subsidence, on a parallel diagram are plotted the percentages of arenites and rudites of sediments in view of a comparison with the relations between negative movements in deposition areas and positive ones in the source areas. These graphs may also be used to individualize the different paleogeographic areas correesponding to the present major tectonic units.

The second group of graphs (Figs. 29–30) is meant to show on a single diagram the variation of intensity and sense of tectonic movements, compared to the morphologic consequences. The approximate subsidence value and the relief heights are given in meters, while the duration and amplitude of positive tectonic movements is given in conventional units.

The data presented so far and the diagrams show that starting from the initial stage of deposition basin to the present orogen stage, the flysch zone underwent a long time complex evolution, which will be described further on.

In the Ceahlău Nappe area, the sedimentation of rocks in flysch facies had started in the late Jurassic and continued till the Aptian, included. During the Austrian stage, large folding and cessation of sedimentation took place in this area (Figs. 24, 25).

Sedimentation has ceased (with some local exceptions, i.e. Colţii Braţii Conglomerates) till the beginning of the Upper Vraconian, when the thallatogenic movements generated in the Ceahlău Nappe area the sinking of the relief to the depth appropriate for pelagic sediment deposition. If in this area the almost complete stopping of subsidence had favoured the pelagic deposition, in the outer areas corresponding to Teleajen (Fig. 26), Macla (Fig. 27) and Variegated Clays

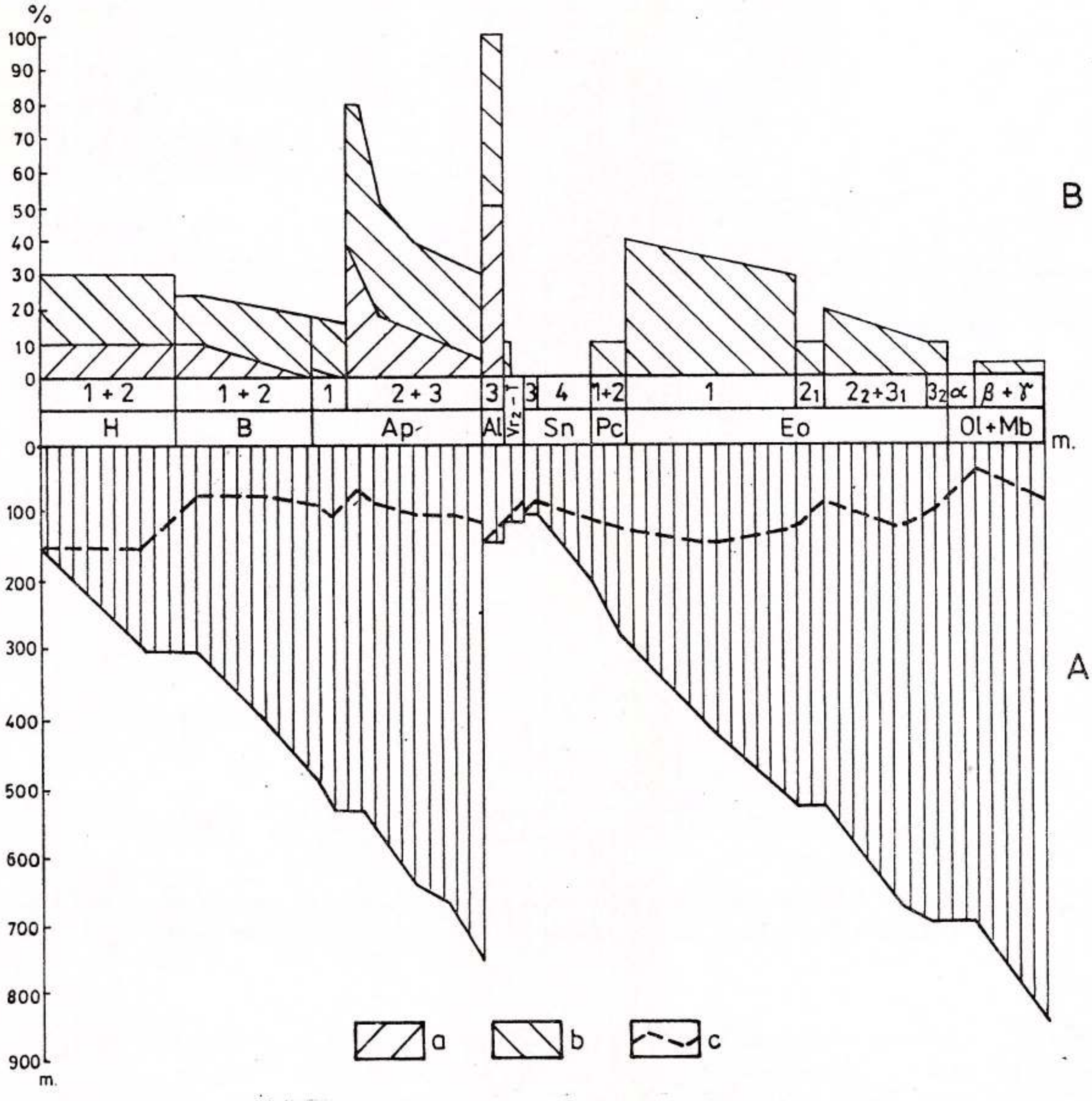

Fig. 24 – Diagram of subsidence in the Măgura Digitation area (A) and graph of detrital supply variation (B). a, rudites; b, arenites; c, variation curve of supposed deposition depth.

Nappes the subsidence continued since the Lower Cretaceous and determined the accumulation of rocks in flysch facies.

The next, Mediterranean stage of movements preceded the Upper Turonian. It is characterized by the initiation of fracture planes between Măgura and Comarnic Digitations as well as between the whole Ceahlău Nappe and the units in front of it. At the same time was generated the relief from which the components of the sedimentary breccia occurrences at the top of the Dumbrăvioara Series detached. The Mediterranean movements were present in the source areas of the rocks external to the Ceahlău Nappe and generated in the deposition areas a high amount of coarse-grained detrital material: the breccias and sandstones of the Fieni Series, the Vulcaniţa feldspar sandstones of the Macla Series.

The sedimentation process was stopped again by Subhercynian movements which had important structural results: the Măgura Digitation thrust the Comarnic Digitation, the whole Ceahlău Nappe (Fig. 29) overthrust the Teleajen Nappe and the latter overthrust the Macla Nappe.

The intense tectonic activity during the Subhercynian stage was followed by a long subsidence period of the whole area which started in the Upper Senonian

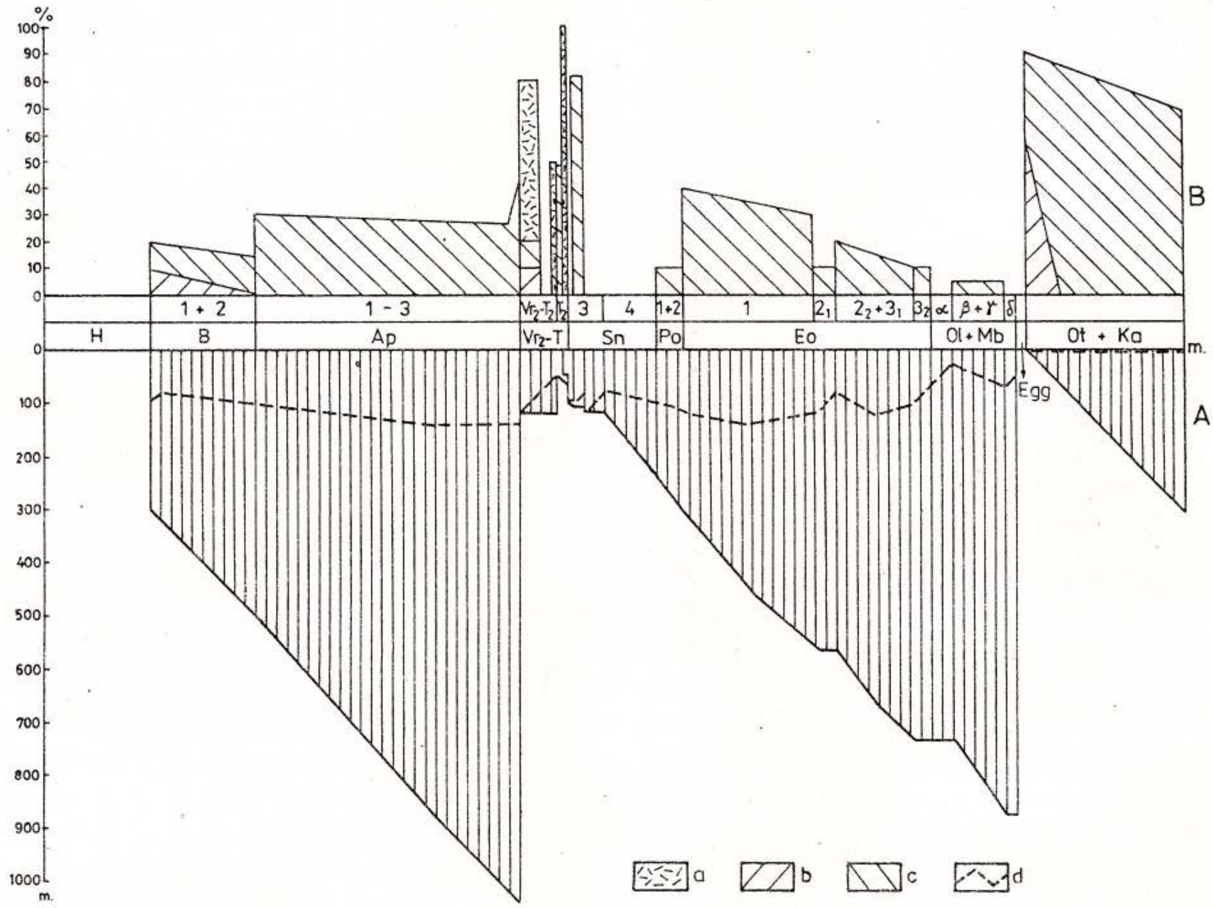

Fig. 25 – Diagram of subsidence in the Comarnic Digitation area (A) and graph (B) of detrital supply variation. a, sedimentary breccias; b, rudites; c, arenites; d, variation curve of deposition depth.

and lasted till the lowermost Miocene. During this period mainly accumulated the deposits in flysch facies: Şotrile Facies, Tarcău Sandstone Facies and Pucioasa Beds with Fusaru Sandstones Facies. Exceptions to this rule are the thin deposits represented by the Plaiu Marls, the Gura Beliei Marls, the Valea Caselor Facies and the levels of dysodile shales in the Pucioasa Beds with Fusaru Sandstones Facies (Fig. 28, 30).

The sedimentation of these rocks preceded the Savic stage of movements which led to: the emplacement of variegated clays nappe and an initial thrust of Cretaceous flysch nappes over the Paleogene Flysch Zone. The displacement of these nappes was accompanied by relief uplifting which supplied the component material of sedimentary breccias in Slon Facies.

The tectonic activity was interrupted during the deposition of the upper level of dysodile shales, then it was resumed till the deposition of the Sărata Gypsum due to old Styrian movements.

The structogenetic results of this stage are worth considering as far as the present constitution of Lower Miocene pre-molasse deposits and their relations with the inner flysch are concerned.

The erosion stage which seemed to alter the morphologic features due to old Styrian movements was followed by the sinking of relief and its immediate invasion by water. In this basin only a few meters deep, the thick pile of Lower Miocene molasse deposits accumulated owing to continuous slight subsidence, almost equal to the accumulation rate.

The subsidence stage was followed by the action of tectonic forces during the Moldavian stage which resulted in the slight folding of the Lower Miocene molasse and the constitution of the Slănic Syncline.

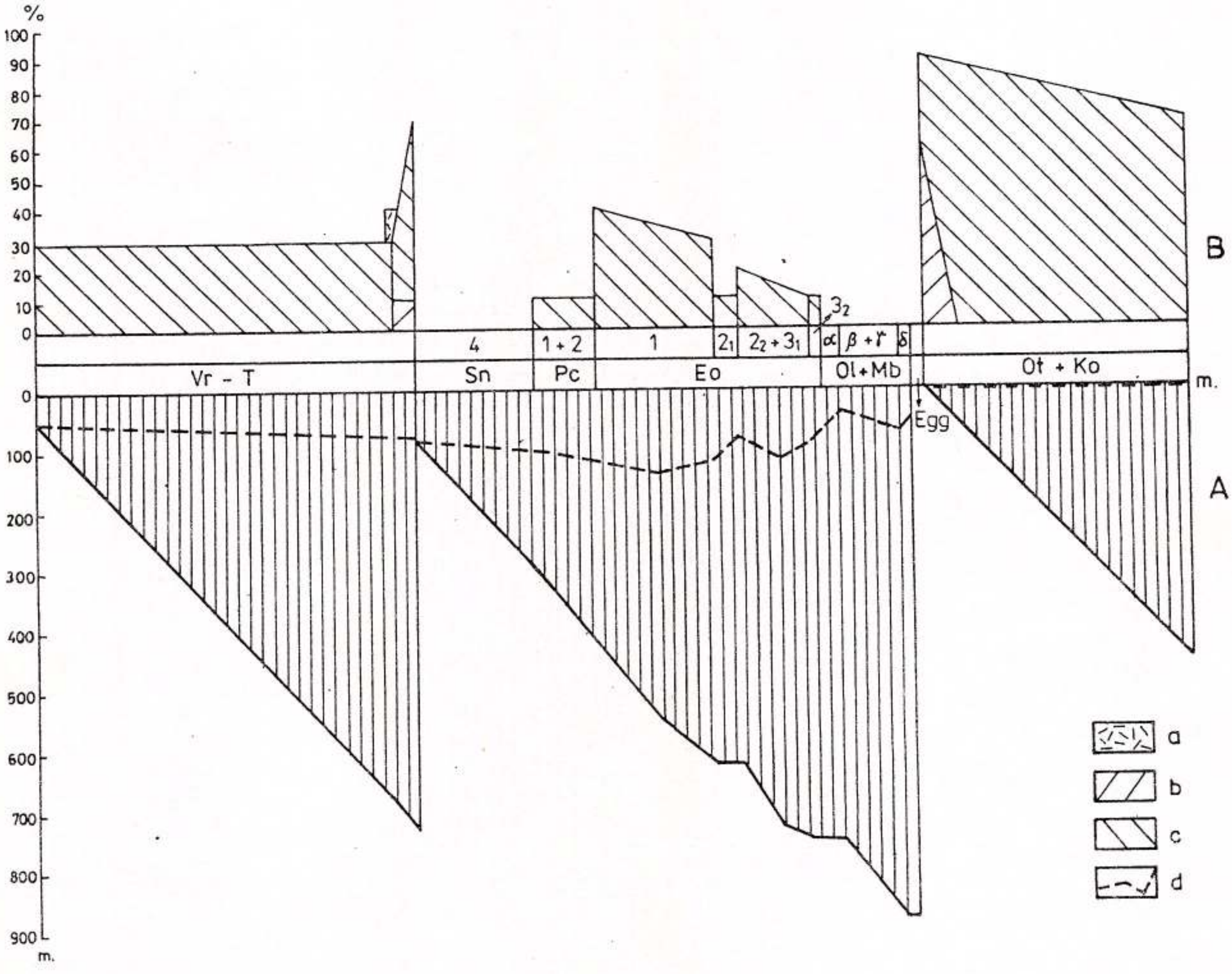

Fig. 26 – Diagram of subsidence in the Teleajen Nappe area (A) and graph of detrital supply variation (B).
a, sedimentary breccias; b, rudites; c, arenites; d, variation curve of deposition depth.

Conclusions

The detailed investigation of the area of interest supplied new data regarding both the lithostratigraphy and the structure of rocks. They are summarized as follows:

– the delimitation of Vârfu Rădăcinii Beds and the strict definition of the Comarnic Beds at the top;

– the delimitation of Podu Vârtos Beds in the Ialomiţa Valley basin;

– the identification and map representation of Colţii Brăţii Conglomerates;

– the establishment of the stratigraphic sequence of rocks within the Dumbrăvioara Series. Although the levels recognized have proved constant along the strike, all over the investigated area, they are not mapped due to the very reduced scale;

– the identification and map representation of Plaiu Marls;

– in the contact area between the Cretaceous flysch nappes and the Tarcău Nappe there is a Variegated Clay Series (Upper Cretaceous) with different lithologic features and sequence with respect to the other Creaceous formations in this area;

– the Oligocene–Lower Miocene stratigraphic level contains the Valea Caselor Facies, more internal than the synchronous Pucioasa Beds with Fusaru Sandstones;

– the regional investigation of the Şotrile Facies levels;

– the identification of the position and areal extent of the Slon Facies;

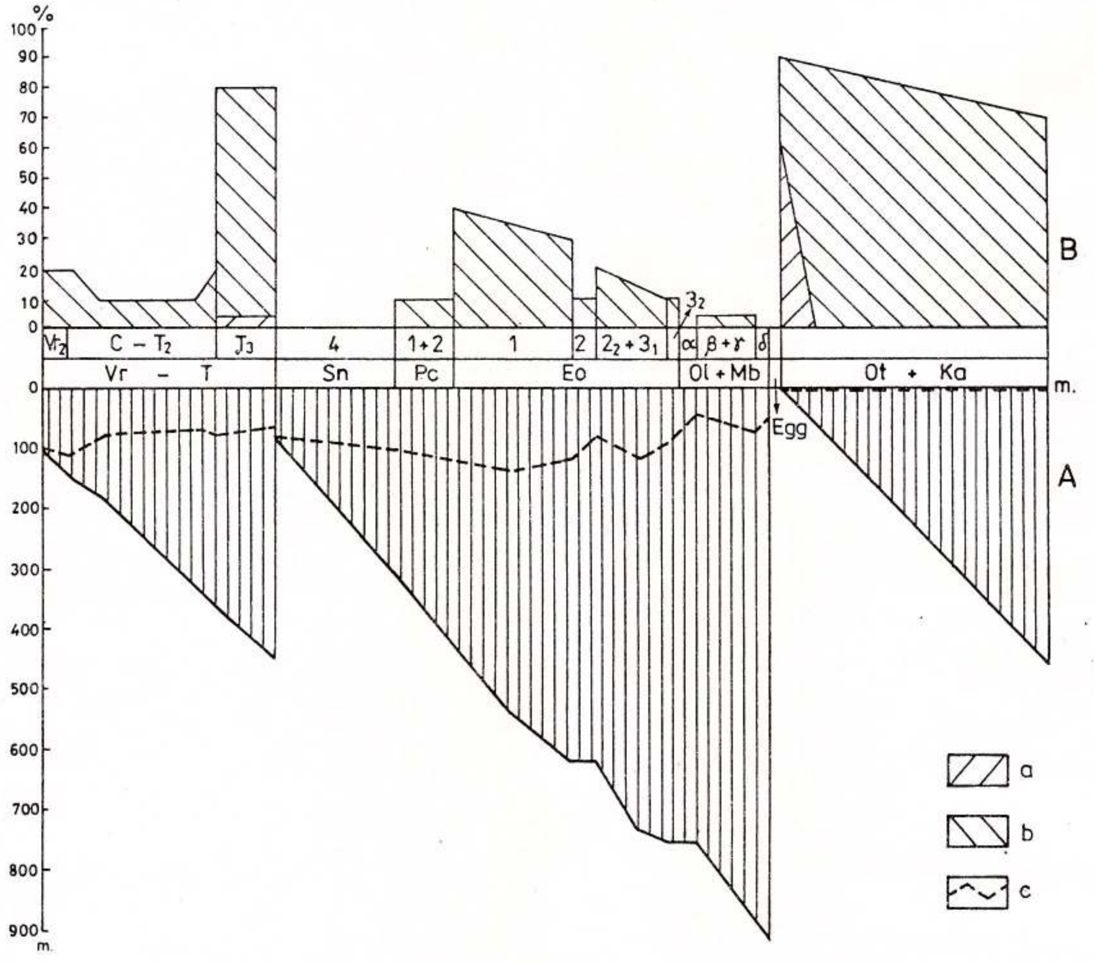

Fig. 27 – Diagram of subsidence in the Macla Nappe area (A) and graph (B) of detrital supply variation. a, rudites; b, arenites; c, variation curve of deposition depth.

– the delimitation, south of the Slănic Syncline, of three types of massive sandstones (Fusaru in the Slon Facies area, Mălăiştea and Vulcăniţa), which allowed the structural description of this area.

The lithostratigraphic data presented favoured an accurate structural interpretation, different from previous ones due to the following:

– the presence of two tectonic compartments of digitation type within the Ceahlău Nappe;

– the assignment of the relations between the Ceahlău Nappe and the Buciumeni Syncline;

– the delimitation of three tectonic units south of the Buciumeni Syncline compared to the two ones previously known;

– the recognition of a cross fault system affecting all the terrains, starting from Lower Cretaceous ones to the Miocene rocks.

The new lithostratigraphic and structural data resulted in an original map representation, obviously different from previous maps.

Finally, it is to assume that the investigation of the area between Prahova and Ialomiţa valley led to several new data which thoroughly prove the efficiency of the geologic study of this area. However, this investigation should be continued in view of improving the knowledge of an accurate practical application of geologic data obtained from this complex region.

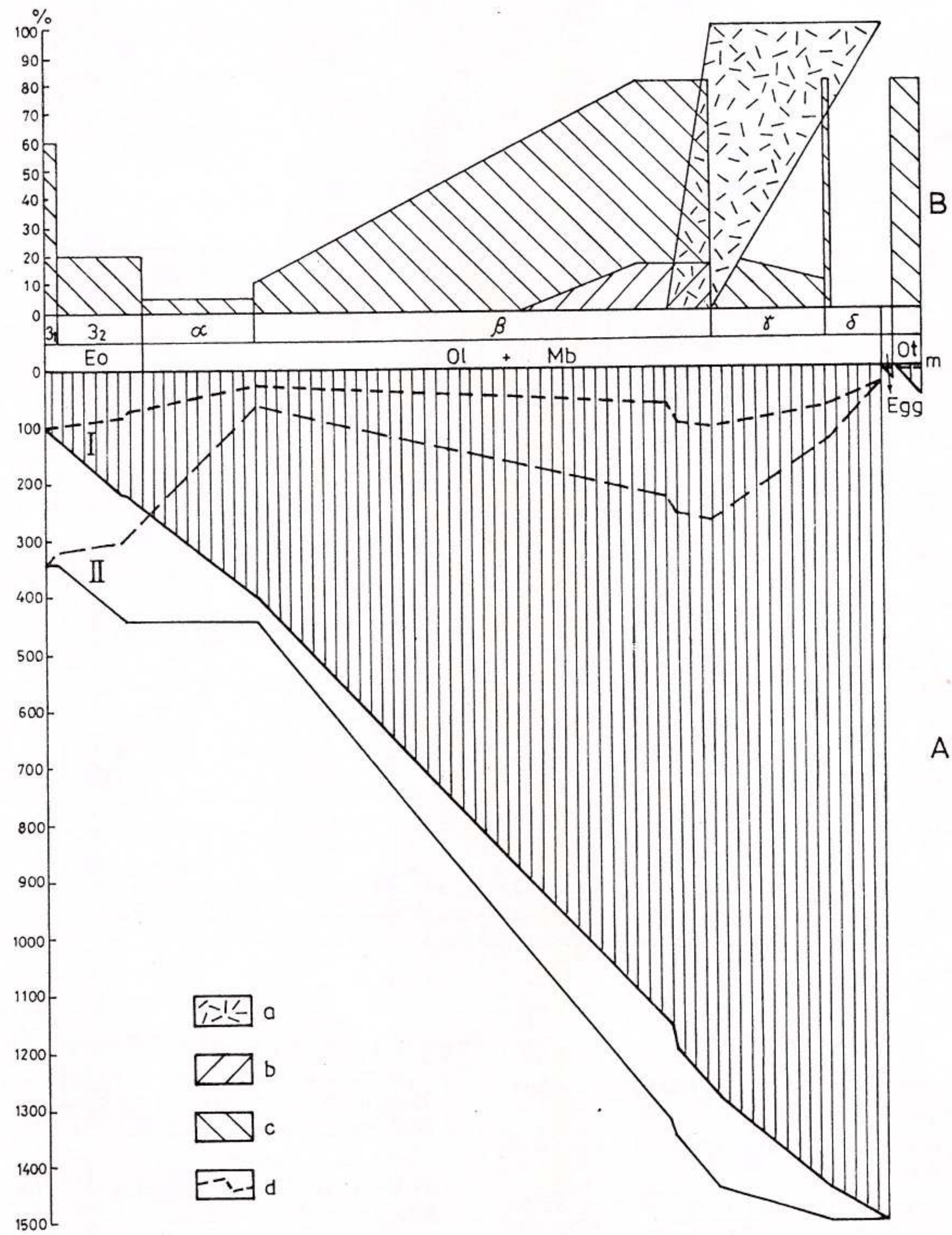

Fig. 28 – Diagram of subsidence in the Tarcău Nappe area (A) and graph (B) of detrital supply variation. a, sedimentary breccias; b, rudites; c, arenites; d, variation curve of deposition depth.

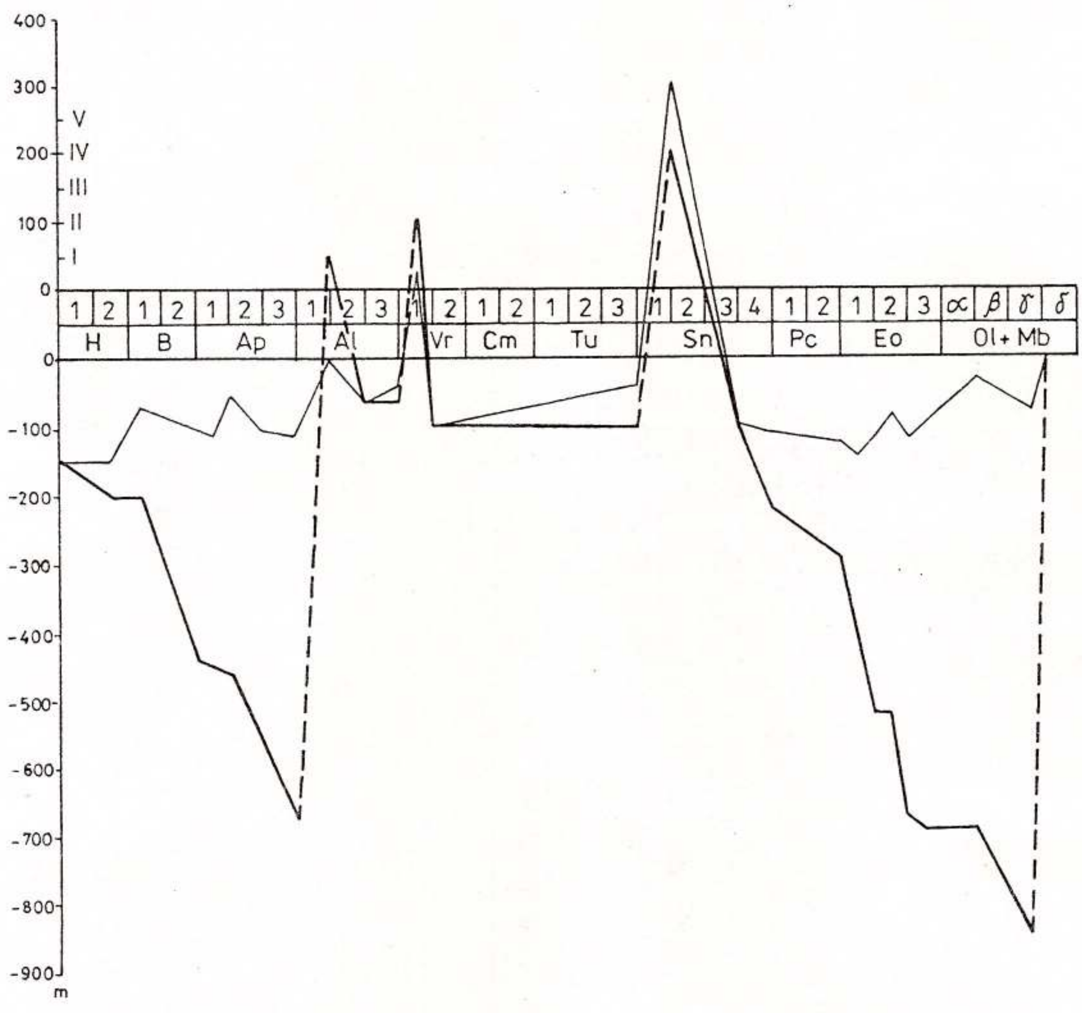

Fig. 29 – Diagram of tectonic movements (a, thallatogenic; b, structogenetic) within the Măgura Digitation and their morphologic effects (c). I, uplifts without deformations; II, folds, faulted folds; III, imbricated structure, longitudinal faults; IV, thrusts; V, overthrusts.

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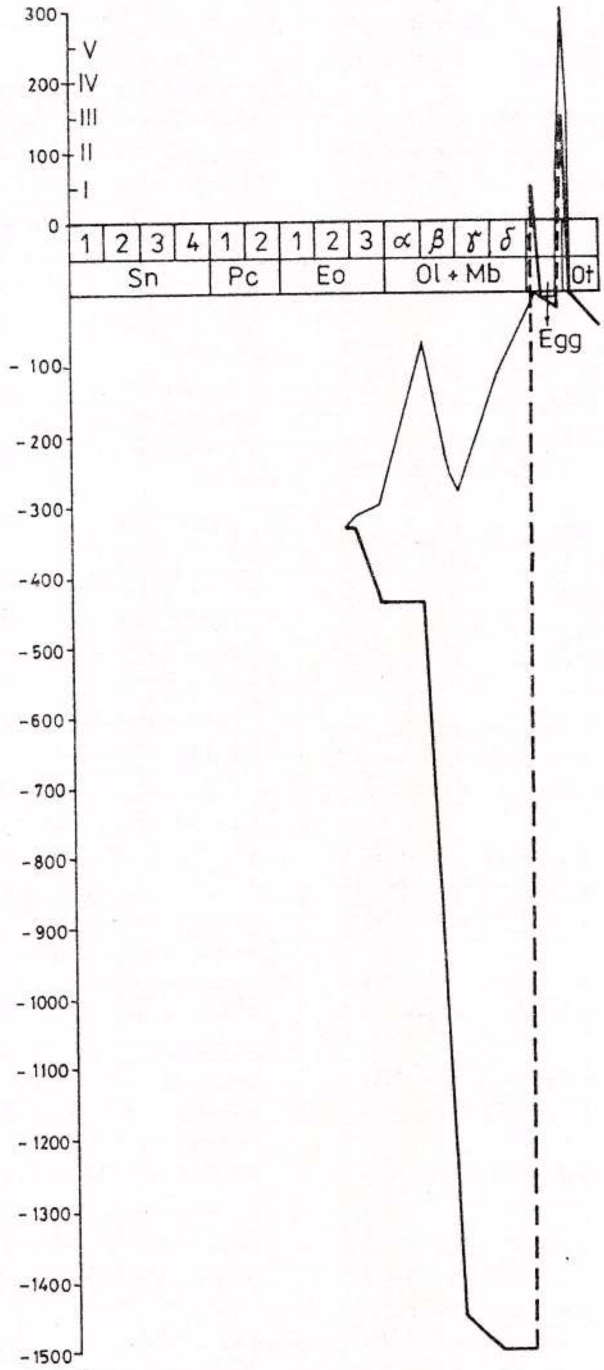

Fig. 30 – Diagram of tectonic movements (a, thallatogenic; b, structogenetic) within the Tarcău Nappe and their morphologic effects (c). I, uplifts without deformations; II, folds, faulted folds; III, imbricated structure, longitudinal faults; IV, thrusts; V, overthrusts.

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STRATIGRAFIA ŞI STRUCTURA FLIŞULUI CRETACIC ŞI PALEOGEN DINTRE VALEA PRAHOVEI ŞI VALEA IALOMIŢEI

(Rezumat)

INTRODUCERE

Cercetările efectuate în regiunea dintre valea Prahovei şi valea Ialomiţei constituie precizarea stratigrafiei şi descifrarea structurii depozitelor ce apar la zi de sub flancurile sinclinalului de Slănic. Pentru realizarea acestor obiective a fost necesară efectuarea unei cartări cu grad ridicat de detaliu (30 de puncte pe kilometru pătrat), pe o suprafaţă de aproximativ 200 Km^2. Datele obţinute prin lucrările de cartare au condus, în final, la realizarea unei hărţi substanţial modificate în raport cu cele preexistente, hartă ce constituie documentul de bază pentru toate descrierile şi interpretările din această lucrare.

Cercetările efectuate, timp de peste zece ani, atît pe teren, cât şi în laborator, au condus la precizarea conţinutului litologic al unor strate deja cunoscute, separarea unor entităţi lito-stratigrafice încă neremarcate, precizarea naturii raporturilor dintre diferitele formaţiuni, stabilindu-se astfel cu destulă certitudine existenţa a numeroase accidente tectonice cu o gamă largă de intensităţi, de la simple falii verticale, până la încălecări de valoarea şariajelor.

I. ISTORICUL CERCETĂRILOR

Odată cu începutul secolului XX gradul de cunoaştere al regiunii creşte treptat, fiecare nou pas fiind marcat de câte o nouă lucrare publicată şi apărută sub semnăturile următorilor autori: V. Popovici-Hatzeg (1898), W. Teisseyre (1905), L. Mrazec şi W. Teisseyre (1907), I. Popescu-Voiteşti (1912, 1914), O. Protescu şi G. Murgeanu (1927), G. Murgeanu (1933, 1934, 1937), Al. Codarcea (1937), Gr. Popescu (1946, 1953), R. North şi I. Pătruţ (1951), I. Motaş (1951, 1952), Fl. Olteanu (1952), I. Băncilă (1958), I. Dumitrescu, M. Săndulescu, V. Lăzărescu, O. Mirăuţă, S. Pauliuc, C. Georgescu (1962), M. Ştefănescu, C. Butnăreanu, M. Zamfirescu, V. Matei, E. Avram (1964), M. Ştefănescu, E. Avram (1965), St. Albu, P. Cucu (1966), E. Bratu (1966, 1972), M. Ştefănescu (1967, 1970), I. Dumitrescu, M. Săndulescu (1968), D. Patrulius, C. Ghenea, A. Ghenea, N. Gherasi (1968) şi M. Săndulescu, M. Ştefănescu, Gr. Alexandrescu, J. Săndulescu, E. Bratu (1973).

II. CARACTERIZAREA OROHIDROGRAFICĂ A REGIUNII CERCETATE

Din punct de vedere geografic, regiunea studiată se suprapune atât peste Carpaţi, cât şi peste Precarpaţi, cele două zone fiind separate de o linie ce trece prin localităţile Comarnic, Ocina şi Ţâţa.

Morfologic, perimetrul cercetat se prezintă sub forma unei chiuvete destul de simetrice, cu partea cea mai coborâtă în zona axială a sinclinalului de Slănic şi complicată de apariţia a două praguri ce corespund flancurilor aceluiaşi sinclinal. Atât spre nord, cât şi spre sud, altitudinile cresc treptat, dar nu continuu, ci complicate de unele depresiuni secundare, orientate est-vest, dintre care o remarcăm pe cea caracteristică, situată la sudul sinclinalului de Slănic, depresiune ce corespunde ariei de dezvoltare a breciilor din faciesul de Slon.

III. STRATIGRAFIE

A. Hauterivian–Barremian

1. Strate de Sinaia. (Orizontul cu *Lamellaptychus angulocostatus* – G. Murgeanu, D. Patrulius, L. Contescu, 1959) (Hauterivian).

Dintre toate separaţiile litologice ale stratelor de Sinaia în cadrul perimetrului cercetat nu am întîlnit decât una singură şi anume orizontul cu *Lamellaptychus angulocostatus*. Acesta este un fliş grezo-calcaros, alcătuit dintr-o alternanţă de gresii cenuşii, calcaroase, cu textură laminară, în general cu grosimi sub 5 cm, marne sau marne argiloase de culoare cenuşie şi marno-calcare. Intre acestea se intercalează, destul de frecvent, strate de brecii ce ating uneori 30 cm grosime şi care sunt constituite din elemente angulare de micaşisturi, paragnaise cu biotit, calcare micritice, cenuşii şi galeţi moi de marne verzui sau cenuşii. Succesiunea aparţine Hauterivianului.

2. Strate de Comarnic (L. Mrazec, I. Popescu-Voiteşti, 1912; emend. M. Ştefănescu, 1971) (Barremian).

Ele reprezintă unul din pachetele litologice cele mai caracteristice ale acestei regiuni. Ele debutează printr-o brecie grosieră, uneori conglomeratică, polimictică, groasă de 1–2 m, alcătuită din elemente de şisturi metamorfice, dintre care, datorită frecvenţei, se remarcă paragnaisele cu biotit, precum şi din elemente de roci sedimentare, între care se evidenţiază calcarele de tip Stramberg. Urmează, în succesiune, un pachet de 5–20 m grosime de marne gălbui-cafenii, în plăci, care la rândul lor, sunt succedate de un fliş marno-grezos constituit din: gresii calcaroase, cenuşii-gălbui cu structură laminară şi oblică, marne calcaroase, cenuşii-albicioase şi marno-calcare gălbui. Între aceste roci se intercalează şi calcarenite gălbui, în strate de 2–5 cm sau chiar mai groase. În acest ultim caz, ele devin şi mai grosiere. Calcarenitele sunt alcătuite din acelaşi tip de elemente ca şi cele din brecia bazală. Grosimea stratelor de Comarnic variază între 150–200 m.

B. Apţian

1. Strate de Vârfu Rădăcinii (M. Ştefănescu, 1971) (Bedoulian inferior)

Depozitele descrise sub acest titlu, reprezintă de fapt un fliş marno-grezos, alcătuit dintr-o alternanţă de: gresii cenuşii, micacee, cu structură laminară, în general oblică şi grosimi cuprinse între 3–5 cm; marne cenuşii cu muscovit pe feţele de statificaţie, uneori mai argiloase şi cu o culoare verzuie; marne sideritice în strate de 3–5 cm, cenuşii în spărtură proaspătă sau ruginii când sunt alterate. Acestui fond litologic i se adaugă intercalaţii de 5–20 cm de brecii calcaroase, dure, alcătuite aproape exclusiv din calcare albe, dar care mai conţin şi rare fragmente de şisturi cristaline, în general cloritoase. Elementele sunt prinse într-un ciment calcaros, sideritic, care la alteraţie capătă o culoare roşietică, ce este caracteristică acestor brecii. Grosimea stratelor în discuţie variază în jurul cifrei de 50 m.

2. Fliş marno-grezos, ruginiu (G. Murgeanu, D. Patrulius, L. Contescu, 1959) (Bedoulian superior–Clansayesian)

În cadrul regiunii cercetate, flişul marno-grezos, ruginiu are următoarea alcătuire litologică: gresii dure, calcaroase, cu feţe nete, cenuşii-albăstrui în spărtură proaspătă sau ruginii-gălbui când sunt alterate, cu o textură ce variază în funcţie de grosimea stratului – oblică, la stratele de 10–15 cm, şi paralelă, la cele ce depăşesc această grosime (ele putând atinge chiar 1–1,25 m) –; marne şi marne argiloase, cenuşii, bine stratificate; marne sideritice, cenuşii, ce devin ruginii la alteraţie.

3. Strate de Podu Vârtos (M. Ştefănescu, E. Avram, Marina Ştefănescu, 1965) (Bedoulian–Clansayesian)

Ca şi toate celelalte depozite apţiene din regiune şi cele atribuite stratelor de Podu Vârtos îmbracă un facies de fliş. Ele sunt constituite dintr-o alternanţă de gresii cenuşii sau verzi, cu grosimi ce depăşesc rar 5 cm; marne cenuşii, siltice, cu spărtură neregulată; marne verzi; argile negre; marne calcaroase sideritice, cenuşii, ce devin ruginii la alteraţie.

C. Albian

1. Conglomerate de Colţii Brăţii (M. Ştefănescu, 1971)

Întâlnit numai pe anumite suprafeţe, pachetul de roci descris sub acest titlu este alcătuit din conglomerate şi gresii masive. Conglomeratele sunt polimictice şi conţin elemente de calcare negre, triasice, calcare gălbui sau cenuşii, jurasice, calcare albe-gălbui, neocomiene sau roz, urgoniene, cuarţite, gnaise şi granite gnaisice. Elementele sunt prinse într-o matrice grezoasă. .

D. Vraconian–Turonian

1. Seria de Dumbrăvioara (Gr. Popescu, 1954) (Vraconian superior–Turonian)

În cadrul depozitelor descrise sub această denumire au fost recunoscute mai multe pachete litologice distincte care se succed, în ordine stratigafică, după cum urmează: marne siltice, cenuşii, fără stratificaţie; marne cenuşii, verzui, frecvent calcaroase şi pătate; marne cenuşii-albicioase, marne sau chiar marno-calcare albe pătate cu negru; marne şi marno-calcare roşii şi vişinii; marne albe, verzui, calcaroase, litate; marne şi argile cenuşii, negre, cu rare intercalaţii verzi; gresii verzi, în plăci, micacee, ce alternează cu marne verzi; brecii sedimentare cu matrice negricioasă, în care sunt prinse elemente provenind din stratele de Sinaia şi stratele de Comarnic. În afara acestor brecii, în seria de Dumbrăvioara, autorul mai descrie încă două nivele, la care apar formaţiuni similare. Primul dintre acestea se află aproximativ spre partea bazală a seriei şi conţine elemente provenind din flişul marno-grezos, ruginiu. Cel de-al doilea nivel de brecie se situează deasupra marno-calcarelor vişinii şi reprezintă de fapt distrugerea prin alunecări submarine, chiar a pachetelor seriei de Dumbrăvioara. Grosimea totală a seriei variază în jurul a 100 m.

2. Seria de Fieni (M. Ştefănescu et al., 1964, emend.) (Vraconian–Turonian)

Seria de Fieni este reprezentată de un fliş slab litificat, la a cărui alcătuire participă: gresii cenuşii-gălbui, calcaroase, în bancuri de 1–2 m, cu structură în general paralelă, gresii cenuşii cu structură curbicorticală sau oblică, groase de 3–7 cm; marne cenuşii sau verzi şi marne calcaroase, sideritice, cenuşii sau ruginii când sunt alterate. Deosebit de important este faptul că, în special alături de gresiile masive, apar brecii sedimentare cu dezvoltare lenticulară, ce sunt alcătuite fie din elemente de calcare urgoniene, fie de marne cenuşii, calcaroase, fosilifere, descoperite de G. Murgeanu (1934).

3. Seria de Macla (Gr. Popescu, 1959) (Vraconian-Turonian)

În cadrul zonei de aflorare a seriei de Macla s-au putut separa trei pachete litologice, care în ordine stratigrafică, se succed după cum urmează:

- *Orizontul pelitelor violacee.* El este alcătuit dintr-o alternanţă de gresii verzui, fine, cu structură laminară, oblică sau curbicorticală, marne cenuşii, mai rar verzui şi argile vişinii sau roşii.

- *Orizontul pelitelor cenuşii.* Ca şi orizontul anterior şi cel al pelitelor cenuşii este reprezentat tot de un fliş marno-grezos, compus din gresii cenuşii micacee cu structură oblică sau curbicorticală şi pelite negre sau verzi, care la alteraţie capătă un aspect asemănător şisturilor disodilice.

- *Orizontul gresiei feldspatice de Vulcăniţa.* El este constituit din gresii masive, cenuşii-murdar sau verzui, separate de pachete de pelite negre şi cenuşii care, la alteraţie, devin albicioase.

În regiunea cercetată, grosimea seriei de Macla se situează în jurul cifrei de 350–400 m.

4. Seria argilelor rubanate (M. Ştefănescu, 1970) (Vraconian–Senonian)

La alcătuirea acestei serii participă diferite elemente litologice, ce au fost grupate în două orizonturi distincte:

- în bază, un pachet de argile roşii, cenuşii, verzi, marne cenuşii-verzui, gresii fine, cenuşii sau verzui, micacee, gresii cenuşii-albicioase, cu ciment calcaros ce conţin fragmente de granodiorite. Aceleaşi elemente de granodiorite (G. Murgeanu, 1937) se găsesc însă aglomerate şi ca pietrişuri cu dezvoltare lenticulară.

- la partea superioară, un pachet de gresii masive (denumite de autor "gresiile de Mălăiştea"), moi, albicioase, ce conţin atât muscovit, cât şi biotit şi care sunt similare cu unele pachete din gresia de Siriu.

E. Senonian

1. Gresiile din valea Bizdidelului (G. Murgeanu, 1930; emend. M. Ştefănescu, 1970) (Campanian inferior)

În versantul stâng al văii Bizdidel, la aproximativ 3,5 km amonte de centrul localităţii Bezdead, aflorează următoarea succesiune: 5 m de marne roşii, cărămizii, micacee; 1–2 m marne verzi, micacee, calcaroase, cu concreţiuni de pirită şi o gresie de 20 cm la partea superioară; 30 m gresii masive, foarte micacee, cenuşii-gălbui sau albicioase.

2. Marne de Plaiu (M. Ştefănescu, 1970) (Campanian superior)

Suprafeţe importante de teren, din partea de est a perimetrului, sunt ocupate de un pachet de marne cenuşii-verzui şi marne calcaroase, cenuşii-albicioase, între care se intercalează rare gresii calcaroase, cenuşii, fin micacee. Grosimea acestui pachet de marne variază între 4–5 m şi 60 m.

3. Marne de Gura Beliei (V. Popovici-Hatzeg, 1898; emend. M. Ştefănescu, 1970) (Maestrichtian)

Sub această denumire, autorul include o stivă de depozite redusă în comparaţie cu cea descrisă de antecercetători ca "marne roşii senoniene". Astfel, el include în cadrul acestei separaţii marnele şi marnocalcarele de culoare roşie, precum şi intercalaţiile lor de marne albe, albe-verzui şi tufurile bentonitice albe din baza marnelor roşii din zona Fieni.

F. Paleocen–Eocen

1. Faciesul de Şotrile (O. Protescu, 1915)

În cadrul perimetrului cercetat au fost separate cartografic cinci orizonturi litologice distincte, dintre care unele fuseseră deja recunoscute local (Fl. Olteanu, 1952) sau chiar cartografiate parţial (I. Motaş, 1952).

- *Orizontul cu argile violacee (Paleocen).* El face trecerea de la faciesul pelagic al marnelor de Gura Beliei la cel tipic de fliş al "faciesului de Şotrile", prezentând el însuşi caractere de fliş datorită alternanţei de argile-marne-gresii, cenuşii şi verzi, cărora li se asociază argile violacee şi strate subţiri de tufuri dacitice bentonitizate, albe. Grosimea acestui orizont variază între 35–100 m.

- *Orizontul inferior de fliş (Ypresian).* Pe grosimi ce variază în jurul cifrei de 250 m, el prezintă o alternanţă ritmică de gresii cu grosimi între 5–20 cm, cenuşii sau albicioase când sunt calcaroase, micacee, cu structură paralelă sau diagonală; marne cenuşii; argile cenuşii şi verzi.

- *Orizontul marnelor calcaroase de Crevedia (Luteţian inferior).* El reprezintă, de fapt, o invazie de marne calcaroase, albe, cu globigerine, pe o grosime de 35–40 m a leit-motivului litologic de fliş al faciesului de Şotrile.

- *Orizontul superior de fliş (Luteţian superior–Priabonian inferior).* Acest orizont prezintă, în general, aceleaşi caractere litologice ca şi orizontul inferior de fliş, dar spre deosebire de acesta din urmă, el conţine gresii mai subţiri şi unele intercalaţii de pelite roşii, dintre care cel mai constant este nivelul situat deasupra marnelor calcaroase de Crevedia.

- *Orizontul marnelor calcaroase de Buciumeni (Priabonian superior).* El este rezultatul unei noi invadări a fondului litologic de fliş de către strate de marne calcaroase, albe, cu globigerina. Grosimea orizóntului este de aproximativ 10–20 m.

2. Faciesul gresiei de Tarcău (S. Athanasiu, 1901)

Dintre toate orizonturile litologice din cadrul acestui facies, pe suprafaţa perimetrului cercetat nu aflorează decât două:

– *Orizontul superior al gresiei de Tarcău* (M. Săndulescu, J. Săndulescu, 1963) (Luteţian). El este constituit din gresii cenuşii, uneori microconglomeratice, în strate de 30–100 cm, gresii calcaroase de 10–20 cm şi marne cenuşii.

– *Strate de Podu Secu* (I. Băncilă, 1955) (Priabonian). Sunt reprezentate de o alternanţă tipică de fliş cu gresii cenuşii sau verzui, calcaroase, micacee şi pelite cenuşii sau albicioase. Pe unele profile, spre partea superioară a orizontului în discuţie, apar strate de marne albe cu globigerine. Grosimea stratelor de Podu Secu variază între 200 şi 250 m.

G. Oligocen–Miocen bazal

1. Faciesul de Valea Caselor (M. Ştefănescu, 1970).

Autorul separă trei orizonturi în cadrul acestui facies, orizonturi care, în ordine stratigrafică, se succed după cum urmează:

– *Orizontul inferior al şisturilor disodilice cu menilite.*

– *Orizontul şistos cu marno-calcare.* Fondul lui litologic este constituit dintr-o alternanţă de argile şistoase, negre şi verzi între care se intercalează marnocalcare dolomitice, albe cu tentă verzuie.

– *Orizontul superior al şisturilor disodilice.* Acesta conţine argile şistoase cafenii sau cenuşii ce au spre partea bazală intercalaţii decimetrice de tufuri bentonitizate, gălbui.

Grosimea totală a depozitelor acestui facies atinge 150 m.

2. Faciesul stratelor de Pucioasa (L. Mrazec, I. Popescu-Voiteşti, 1914) cu gresii de Fusaru (I. Popescu-Voiteşti, 1911).

Orizontarea depozitelor acestui facies se datoreşte următorilor autori: R. Noth, I. Pătruţ (1951), Gr. Popescu (1952, 1953), N. Grigoraş (1955). Faţă de orizonturile separate de geologii citaţi mai sus, autorul mai deosebeşte unul în plus, respectiv, gresia de Tunari.

– *Orizontul inferior al şisturilor disodilice.* Este compus din şisturi argiloase, cafenii sau negricioase cu intercalaţii sporadice de menilite şi lentile de ankerit. Grosimea lui este de 200 m.

– *Orizontul stratelor de Pucioasa cu gresii de Fusaru.* El este reprezentat de un fliş mai mult sau mai puţin grezos, ale cărui pelite sunt de culoare cenuşie închisă pînă la neagră sau verzi ce alternează cu gresii subţiri cenuşii şi cu structură oblică sau curbicorticală. Acest fond litologic este invadat uneori de pachete de gresii masive cu dezvoltare lenticulară şi care conţin fragmente de gasteropode şi lamellibranchiate. Grosimea acestui orizont este cuprinsă între 800 şi 1000 m.

– *Orizontul stratelor de Vineţişu.* Acest orizont este alcătuit dintr-o alternanţă ritmică de fliş, la care participă: marne cenuşii şi gresii cenuşii, calcaroase, cu structură curbicorticală, mai numeroase în jumătatea inferioară a orizontului, unde au fost întâlnite şi intercalaţii de tufuri dacitice, verzi, uneori bentonitizate. Stratele de Vineţişu au o grosime cuprinsă între 125–175 m.

– *Orizontul gresiei de Tunari.* De fapt acest orizont este alcătuit numai din gresii cenuşii, moi, micacee, în strate de 0,2–1,5 m.

– *Orizontul superior al şisturilor disodilice.* El este constituit din pelite şistoase, cenuşii, cafenii, cu intercalaţii de tufuri bentonitizate, galbene (2–3 strate de 0,2–0,6 m), în bază şi strate subţiri (1–2 cm) de menilite, spre partea superioară.

3. Faciesul de Slon (Gr. Popescu, 1958)

În regiunea cercetată, breciile sedimentare ce constituie marea majoritate a depozitelor acestui facies au fost recunoscute pentru prima dată de către Gr. Popescu şi Fl. Olteanu (fide Fl. Olteanu, 1952).

Breciile în discuţie reprezintă de fapt un facies parazitar care înlocuieşte violent, spre interior, pe cel al stratelor de Pucioasa cu gresii de Fusaru, dar a cărui zonă de apariţie nu se limitează numai la pânza de Tarcău, ci se extinde spre interior, până pe pânza de Teleajen.

Faciesul de Slon este reprezentat de brecii polimictice şi oligomictice provenind din cuvertura posttectonică a pânzelor cu tectogeneză cretacic superioară, respectiv, din marnele de Gura Beliei, din faciesul de Şotrile şi din faciesul de Valea Caselor. Dimensiunile elementelor variază de la câţiva milimetri până la pachete lungi de câţiva zeci de metri. Matricea este marnoasă-argiloasă şi de culoare neagră sau cenuşie.

Cea mai veche intercalaţie de brecie din faciesul stratelor de Pucioasa cu gresii de Fusaru a fost intîlnită în partea terminală a orizontului stratelor de Pucioasa cu gresii de Fusaru, iar cea mai nouă în orizontul superior al şisturilor disodilice. Aceste situaţii au făcut pe autor să considere că faciesul de Slon este echivalent cu întregul interval corespunzător părţii superioare a orizontului stratelor de Pucioasa cu gresii de Fusaru, a stratelor de Vineţişu şi a orizontului superior al şisturilor disodilice.

H. Miocen inferior-mediu

Gipsurile de Sărata.

Sub această denumire, autorul a inclus un complex de roci, alcătuit din două pachete de gips groase de 1–4 m, separate de un nivel de brecie sedimentară, groasă de 10–20 m şi formată din elemente provenind, în special, din faciesul de Valea Caselor. Pe un singur profil, peste cel de-al doilea nivel de gips, pe 1–2 m, au fost descoperite marne cenuşii, slab micacee şi cu o alteraţie gălbuie.

Molasa de Doftana.

În cadrul acestui interval stratigrafic se dezvoltă o stivă groasă (peste 300 m) de depozite, cu o alcătuire litologică complexă: conglomerate polimictice (conglomerate de Brebu) cu dezvoltare lenticulară, gresii micacee, moi, cenuşii sau roz, cu structură paralelă, când depăşesc 30 cm grosime, sau oblică sub această grosime, marne de obicei siltice, cenuşii, gălbui, roşii şi argile violacee. Între aceste elemente se intercalează tufuri dacitice albe sau oliv, în parte bentonitizate, groase de 0,1–1 m, precum şi gipsuri albe, roz sau cenuşii, cu grosimi cuprinse între 1 şi 4 m, unul dintre ele având asociate şi şisturi calcaroase.

I. Pliocen

Pe o suprafaţă foarte restrânsă, în vestul perimetrului, au fost întîlnite depozite constituite din nisipuri şi pietrişuri care au fost atribuite Pliocenului.

J. Cuaternar

Depozitele atribuite acestei vârste sunt dezvoltate de obicei în lungul principalelor cursuri de apă şi s-au format fie ca rezultatul unei activităţi fluviatile – terase (două nivele mai importante), conuri de dejecţie şi aluviuni recente – , fie sub acţiunea apei şi forţei gravitaţionale – alunecări de teren.

V. TECTONICA

În regiunea dintre valea Prahovei şi valea Ialomiţei au existat două opinii tectonice diametral opuse: cea a unei structuri în pânze de şariaj şi aceea a unei structuri, în general, normale a depozitelor. Datele detaliate obţinute au condus pe autor la o interpretare în sprijinul primei ipoteze amintite, dar care, în acelaşi timp au modificat sensibil imaginile tectonice anterioare.

A. Structuri majore

1. Pânza de Ceahlău

Ea aflorează numai în partea de nord a perimetrului, unde este reprezentată de două dintre digitaţiile sale.

Digitaţia de Măgura

Sub această denumire structurală este inclusă o succesiune de depozite ce începe din Hauterivian şi urcă până în Turonian (orizontul cu *Lamellaptychus angulocostatus* al stratelor de Sinaia, strate de Comarnic, strate de Vârfu Rădăcinii, fliş marno-grezos, ruginiu, conglomerate de Colţii Brăţii, seria de Dumbrăvioara). Depozitele ce aparţin strict digitaţiei de Măgura sunt completate cu formaţiuni ce constituie cuvertura post-tectonică, intens cutată a unităţilor cu tectogeneză cretacic superioară şi care s-a depus în intervalul Senonian-Oligocen (marne de Gura Beliei, facies de Şotrile, facies de Valea Caselor).

Structura internă a digitaţiei de Măgura se prezintă sub forma unor solzi foarte strânşi sau, în cazuri mai rare, ca sinclinale şi anticlinale cu lăţime redusă.

Gradul ridicat de tectonizare la care au ajuns depozitele digitaţiei de Măgura este rezultatul unei suite de mişcări tectonice ce au început după Apţian şi au continuat până după depunerea molasei miocene, atingând un maximum de intensitate înaintea Senonianului superior.

Digitaţia de Comarnic

La alcătuirea acestei digitaţii participă depozite ce aparţin intervalului stratigrafic Barrenian-Turonian (strate de Comarnic, strate de Podu Vârtos, seria de Dumbrăvioara), cărora li se adaugă şi cele ale cuverturii post-tectonice intens deformate (marne de Plaiu, marne de Gura Beliei, facies de Şotrile, facies de Valea Caselor).

Structura internă a digitaţiei de Comarnic se prezintă, în marea majoritate a cazurilor, sub forma unei repetări dese de solzi. Excepţie face o porţiune din partea de est a perimetrului, unde au fost conservate două cute sinclinale.

Toate cutele şi solzii în care sunt implicate atât depozitele proprii digitaţiei, cât şi cele ale cuverturii post-tectonice, intens deformate, reprezintă rezultatul unor deformări succesive ce au început să se manifeste înainte de Vraconianul superior şi au continuat până în Miocen.

Contactul dintre întreaga pânză de Ceahlău şi unitatea imediat exterioară, respectiv, pânza de Teleajen, nu poate fi observat la suprafaţă, întrucât el este acoperit discordant de către depozitele post-tectonice intens deformate, ce participă la alcătuirea sinclinalului de Buciumeni.

2. Pânza de Teleajen

Depozitele pânzei de Teleajen, ce aflorează în regiunea studiată, sunt reprezentate printr-o formaţiune cu caracter de fliş (seria de Fieni) ce s-a depus în intervalul Vraconian-Turonian. Acestea sunt acoperite discordant de depozitele cuverturii post-tectonice, intens deformate (marne de Gura Beliei, facies de Şotrile şi facies de Valea Caselor).

Seria de Fieni prezintă o structură internă net diferită de cea a cuverturii post-tectonice, senonian-oligocene, ea caracterizându-se printr-o cutare strânsă în care este implicată chiar şi partea superioară a seriei, parte ce conţine gresii masive.

Această cutare se datoreşte unor mişcări ce s-au produs înaintea Senonianului superior şi care, în plus, au condus la punerea în loc a pânzei de Ceahlău peste cea de Teleajen, precum şi a acesteia din urmă peste pânza de Macla.

3. Pânza de Macla

Aşa cum este separată de către autor, pânza de Macla cuprinde ca elemente litostratigrafice proprii numai cele trei orizonturi ale seriei cu acelaşi nume, depuse în intervalul stratigrafic Vraconian-Turonian. Acestora li se adaugă depozitele cuverturii post-tectoni-ce, senonian superioare-oligocene (marnele de Gura Beliei, faciesul de Şotrile şi faciesul de Valea Caselor), comune tuturor pânzelor cu tectogeneză cretacic superioară.

Structura internă a pânzei de Macla este relativ simplă, ea prezentându-se, pe cea mai mare parte a zonei de aflorare a unităţii sub forma unui homoclin.

Pânza de Macla a suferit două faze tectonice mai importante. Prima fază s-a produs înaintea depunerii marnelor de Gura Beliei când pânza de Teleajen a şariat peste cea de Macla, producându-se totodată şi cutarea depozitelor acesteia din urmă. Cea de-a doua fază a început mult mai târziu, în timpul depunerii statelor de Pucioasa cu gresii de Fusaru şi a atins un punct de maximă intensitate aproximativ la limita dintre acestea şi stratele de Vineţişu, moment în care pânza de Macla, solidară cu cea de Teleajen, a încălecat peste domeniul de la exterior.

4. Pânza argilelor rubanate

Ea este constituită numai din cele două orizonturi ale seriei cu acelaşi nume, serie ce a fost considerată ca fiind de vârstă vraconian-senoniană.

Pânza argilelor rubanate prezintă o structură internă foarte complicată ce se manifestă atât printr-o cutare destul de intensă a pachetelor predominant argiloase, cât şi printr-o repetare fără nici o ordine a celor două pachete ce constituie seria argilelor rubanate. Aceste fapte constituie probe care dovedesc că structura internă a unităţii în discuţie nu s-a format ca urmare a forţelor tangenţiale centripete, ci că reprezintă rezultatul unor deplasări gravitaţionale, foarte probabil submarine, datorate forţelor tangenţiale centrifuge. Alunecările gravitaţionale ce au dus la formarea structurii interne a pânzei argilelor rubanate nu reprezintă elementele componente. ale unei deplasări gravitaţionale mai importante şi anume aceea a punerii în loc a întregii pânze, care capătă, astfel, caracterul unei pânze gravitaţionale.

5. Pânza de Tarcău

La alcătuirea pânzei de Tarcău participă: depozite eocene în faciesul gresiei de Tarcău, depozite oligocen-miocene ce îmbracă atât faciesul stratelor de Pucioasa cu gresii de Fusaru, cât şi pe cel de Slon, precum şi din depozite eggenburgiene, reprezentate prin gipsurile de Sărata.

Mica parte a pânzei de Tarcău ce a fost întâlnită în perimetrul studiat reprezintă, în mare măsură, numai flancul nordic şi, într-o măsură mai redusă, zona axială a unei singure structuri pozitive şi anume anticlinalul Stârmini-Fricoasa, structură pe care s-au grefat câteva complicaţii de mai mică amploare.

Elementele structurale aparţinând pânzei de Tarcău au început să se formeze înainte de depunerea gipsurilor de Sărata, s-au accentuat după depunerea acestora şi s-au definitivat mult mai târziu, probabil înaintea Sarmaţianului.

6. Sinclinalul de Buciumeni

Sinclinalul de Buciumeni este alcătuit din depozite a căror vârstă începe din Senonianul superior (marnele de Gura Beliei), urcă în Paleogen (faciesul de Valea Caselor şi faciesul de Şotrile) şi se încheie în Miocenul bazal (orizontul superior al şisturilor disodilice din faciesul de Valea Caselor). Primul termen – marnele de Gura Beliei – al acestei stive de depozite repauzează discordant peste toate unităţile tectonice compuse în principal din fliş cretacic. Ulterior depunerii, formaţiunile ce participă la alcătuirea acestui sinclinal au fost recutate şi fracturate împreună cu cele ale pânzelor peste care stau discordant. Prima mişcare suferită de ele s-a manifestat după depunerea celui de-al doilea orizont al faciesului de Valea Caselor, la limita de timp Oligocen-Miocen.

7. Sinclinalul de Slănic

Suprafaţa perimetrului cercetat este împărţită aproximativ în două de depozitele molasei miocen inferioare ce formează un sinclinal larg, bine individualizat. El reprezintă una şi aceeaşi structură cu cea din regiunea Slănic, fapt dovedit direct, prin urmărire cartografică. Autorul susţine însă că denumirea de sinclinal de Slănic nu trebuie utilizată decât pentru structura alcătuită de molasa de Doftana întrucât sinclinalele de depozite mai vechi peste care ea se suprapune accidental în bazinele văilor Ialomiţei şi Slănicului aparţin unor unităţi tectonice complet diferite, respectiv, pânzelor flişului cretacic şi pânzei de Tarcău.

După datele existente în cadrul perimetrului, forma actuală a sinclinalului de Slănic se datoreşte activităţii a cel puţin două faze de mişcări tectonice. În prima fază, depozitele sale au fost slab cutate, luând forma de sinclinal. În cea de-a doua fază el a fost afectat de fracturi transversale.

B. Falii

1. Falii longitudinale

Regiunea cercetată este brăzdată de numeroase falii longitudinale. O parte dintre ele (liniile frontale ale compartimentelor încălecătoare – pânze sau solzi) s-au format în timpul punerii în loc a diferitelor pânze. O altă parte dintre faliile longitudinale sunt posterioare şariajelor, ele afectând în măsură egală atât depozitele încălecătoare, cât şi pe cele încălecate.

2. Falii transversale

Întreaga suprafaţă a regiunii studiate este traversată de un sistem de falii ce intersectează ortogonal elementele structurale mai vechi şi a căror amploare creşte de la vest către est.

Unei părţi dintre faliile detectate prin cartare este foarte greu să se stabilească un sens general de deplasare al unui compartiment luat în totalitate faţă de compartimentul vecin, întrucât limitele litologice sau tectonice suferă adesea deplasări cu sensuri contrare în două compartimente alăturate. Pentru a explica satisfăcător această situaţie, autorul a imaginat o soluţie genetică particulară conform căreia, tipul de falii în discuţie au luat naştere în urma necesităţii de echilibrare a efectelor unei forţe tectonice, în funcţie de particularităţile litologice locale ale diferitelor sectoare supuse eforturilor tangenţiale. El denumeşte aceste fracturi "falii de echilibrare". Faliile de echilibrare reprezintă de fapt un plan de discontinuitate între două compartimente, care s-au cutat şi faliat longitudinal diferit unul faţă de celălalt.

C. Fenomene de diapirism

Autorul descrie, pentru prima dată în zona flişului cretacic, fenomene de diapirism suferite de breciile sedimentare cu elemente de strate de Sinaia şi strate de Comarnic din cadrul seriei de Dumbrăvioara. Aceste brecii au ajuns la zi prin străpungerea diapiră a acoperişului lor normal, constituit din marnele de Gura Beliei şi din depozitele faciesului de Şotrile.

VI. EVOLUŢIA GEOLOGICĂ A REGIUNII STUDIATE

Regiunea dintre valea Prahovei şi valea Ialomiţei se situează pe terminaţia vestică de aflorare a zonei flişului.

Din punct de vedere paleogeografic zona flişului a corespuns unui larg geosinclinal divizat (Dumitrescu et al., 1962; Dumitrescu, Săndulescu, 1968) longitudinal în două părţi (eu- şi mio-) ce ofereau condiţii diferite de sedimentare. Diferite ca evoluţie şi alcătuire, cele două părţi ale bazinului au dat naştere şi la structuri majore independente. Astfel, din partea internă, au luat naştere pânza de Ceahlău împreună cu digitaţiile sale, în cazul nostru cu cele de Măgura şi Comarnic. Din partea externă s-au format pânzele de Teleajen, Macla, a argilelor rubanate şi pânza de Tarcău.

Dar, pentru a ajunge de la faza iniţială de bazin depoziţional la cea actuală de orogen, zona flişului a avut o lungă şi complicată evoluţie, din care vor fi subliniate aici numai etapele cele mai importante.

Pe domeniul corespunzător pânzei de Ceahlău, sedimentarea depozitelor în facies de fliş începută încă din Jurasicul superior se continuă neîntreruptă pînă în Apţian, inclusiv. Intervenţia mişcărilor din timpul fazei austrice produce o cutare largă şi o întrerupere a sedimentării în această zonă.

Întreruperea sedimentării, cu unele excepţii locale (cazul conglomeratelor de Colţii Brăţii), este prezentă până la începutul Vraconianului superior, moment în care acţiunea unor mişcări thalatogenetice conduce la coborârea reliefului, în zona corespunzătoare pânzei de Ceahlău, până la adâncimea corespunzătoare depunerii unor depozite pelagice. Dacă, după atingerea acestui nivel, subsidenţa, practic nulă, a condiţionat depunerea de depozite pelagice, în schimb, în zonele mai externe, corespunzătoare pânzelor de Teleajen, Macla şi argilelor rubanate, subsidenţa activă, începută din timpul cretacicului inferior, a favorizat acumularea unor depozite în facies de fliş.

Următoarea fază de mişcări, mediteraneană, s-a făcut simţită înaintea Turonianului superior. În timpul acestei faze se produce amorsarea planelor de ruptură dintre digitaţia de Măgura şi cea de Comarnic, precum şi dintre întreaga pânză de Ceahlău şi pânza de Teleajen. Simultan ia naştere şi relieful din care s-au desprins elementele componente ale breciei sedimentare de la partea superioară a seriei de Dumbrăvioara. Mişcările mediteraneene s-au făcut simţite şi în ariile sursă ale depozitelor de la exteriorul pânzei de Ceahlău, având drept rezultat, în zonele depoziţionale, un aport masiv de material detritic grosier: breciile şi gresiile din seria de Fieni, gresiile feldspatice de Vulcăniţa.

Sedimentarea este din nou întreruptă, de data aceasta de faza mişcărilor subhercinice, fază ale cărei efecte structurale sunt deosebit de importante: încălecarea digitaţiei de Măgura peste cea de Comarnic, a întregii pânze de Ceahlău peste cea de Teleajen, precum şi a acesteia din urmă peste pânza de Macla. Punerea în loc a pânzelor amintite şi cutarea postşariaj ce le-a afectat a avut drept urmare şi o importantă modificare a reliefului, care de data aceasta s-a ridicat, cel puţin cu câteva sute de metri deasupra nivelului mării.

După agitaţia tectonică din timpul fazei subhercinice întreaga regiune intră într-o lungă perioadă subsidentă, ce începe în Senonianul superior şi se continuă până în baza Miocenului.

După sedimentarea acestor formaţiuni intervine o nouă fază de mişcări, cea savică. Rezultatele principale ale acestor mişcări sunt următoarele: punerea în loc a pânzei argilelor rubanate, încălecarea, într-o primă etapă, a pânzelor flişului cretacic peste zonele flişului paleogen. Deplasarea acestui pachet de pânze a fost însoţită şi de o ridicare a reliefului în partea frontală a încălecării, ridicare ce a furnizat materialul constituent al breciilor sedimentare din faciesul de Slon.

Activitatea tectonică este întreruptă pe o perioadă corespunzătoare timpului de depunere al orizontului superior al şisturilor disodilice, după ea se face din nou simţită, înaintea depunerii gipsurilor de Sărata, datorită mişcărilor stirice vechi.

După o etapă de eroziune care a tins să niveleze morfologia formată de mişcările stirice vechi, relieful începe să coboare, fiind imediat invadat de ape. În bazinul astfel format, începe să se depună stiva destul de groasă a molasei miocene.

După această etapă de subsidenţă, regiunea este afectată de forţele tectonice ale fazei moldavice, forţe ce au produs cutarea slabă a molasei miocene şi, deci, şi a sinclinalului de Slănic.

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Se va adăuga o filă separată cu un colontitlu de maximum 60 semne şi un sumar, în care se va indica ierarhia titlurilor din text în clasificarea zecimală (1; 1.1; 1.1.1), care nu trebuie să depăşească patru categorii.

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Cuvintele cheie (maximum 10) trebuie să fie în limba engleză sau franceză, corespunzător limbii în care este lucrarea (sau abstractul, dacă textul este în română), prezentate în succesiune de la general la specific şi dactilografiate pe pagina cu abstractul.

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Citations in the text should include the name of the author and the publication year. Example: Ionescu (1970) or (Ionescu, 1970). For two authors: Ionescu, Popescu (1969) or (Ionescu, Popescu, 1969). For more than two authors: Ionescu et al. (1980) or (Ionescu et al., 1980). For papers which are in course of print the publication year will be replaced by "in press". Unpublished papers or reports will be cited in the text like the published ones.

Abstract, of maximum 20 lines (on separate sheet), must be in English, summarizing the main results and conclusions (not a simple listing of topics).

Key words (max. 10 items), in English or French, following the language used in the text (or the Resumé if the text is in Romanian), given in succession from general to specific, should be typed on the abstract page.

References should be typed in double-line spacing, listed in alphabetical order and chronological order for authors with more than one reference. Abbreviations of journals or publishing houses should be in accordance with the recommendations of the respective publications or with the international practice.

Examples:

a) journals:

Giuşcă, D. (1952) Contributions à l'étude cristallochimique des niobates. *An. Com. Geol.*, XXIII, p. 259–268, Bucureşti.

– , Pavelescu, L. (1954) Contribuţii la studiul mineralogic al zăcămîntului de la Muşca. *Comm. Acad. Rom.*, IV, 11–12, p. 658–991, Bucureşti.

b) special issues:

Strand, T. (1972) The Norwegian Caledonides. p. 1–20. In: Kulling, O., Strand, T. (eds.) Scandinavian Caledonides, 560 p., Interscience Publishers.

c) books:

Bălan, M. (1976) Zăcămintele manganifere de la Iacobeni. Ed. Acad. Rom., 132 p., Bucureşti.

d) maps:

Ionescu, I., Popescu, P., Georgescu, G. (1990) Geological Map of Romania, scale 1:50,000, sheet Cîmpulung. Inst. Geol. Geofiz., Bucureşti.

e) unpublished papers or reports:

Dumitrescu, D., Ionescu, I., Moldoveanu, M. (1987) Report. Arch. Inst. Geol. Geofiz., Bucureşti.

Papers or books published in Russian, Bulgarian or Serbian etc. should be mentioned in the references transliterating the name and titles. Example:

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Illustrations (figures and plates) must be numbered and submitted as originals on separate sheets (tracing papers), ready for reproduction. The thickness of the lines, lettering and symbols on figures should be large enough to be easily read after size-reduction. The original size should not extend beyond the print area of the page: column width 8 cm, page width 16.5 cm, page length 23 cm for figures; the width of line drawings should not extend over a single (16.5/23) or double (23/33 cm) page area and must be selfexplanatory (including title, authors, legend etc.). The graphic scale is obligatory.

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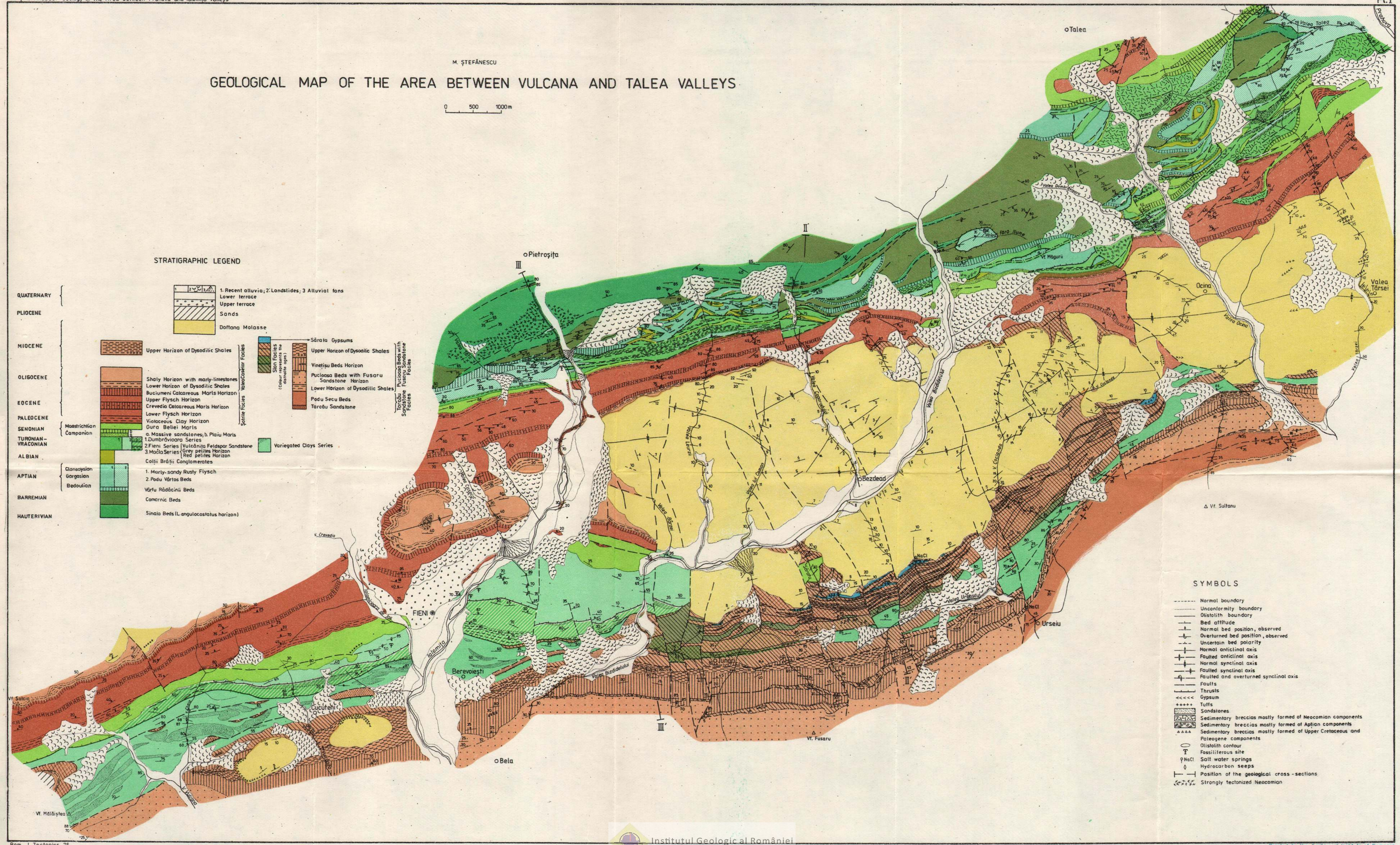

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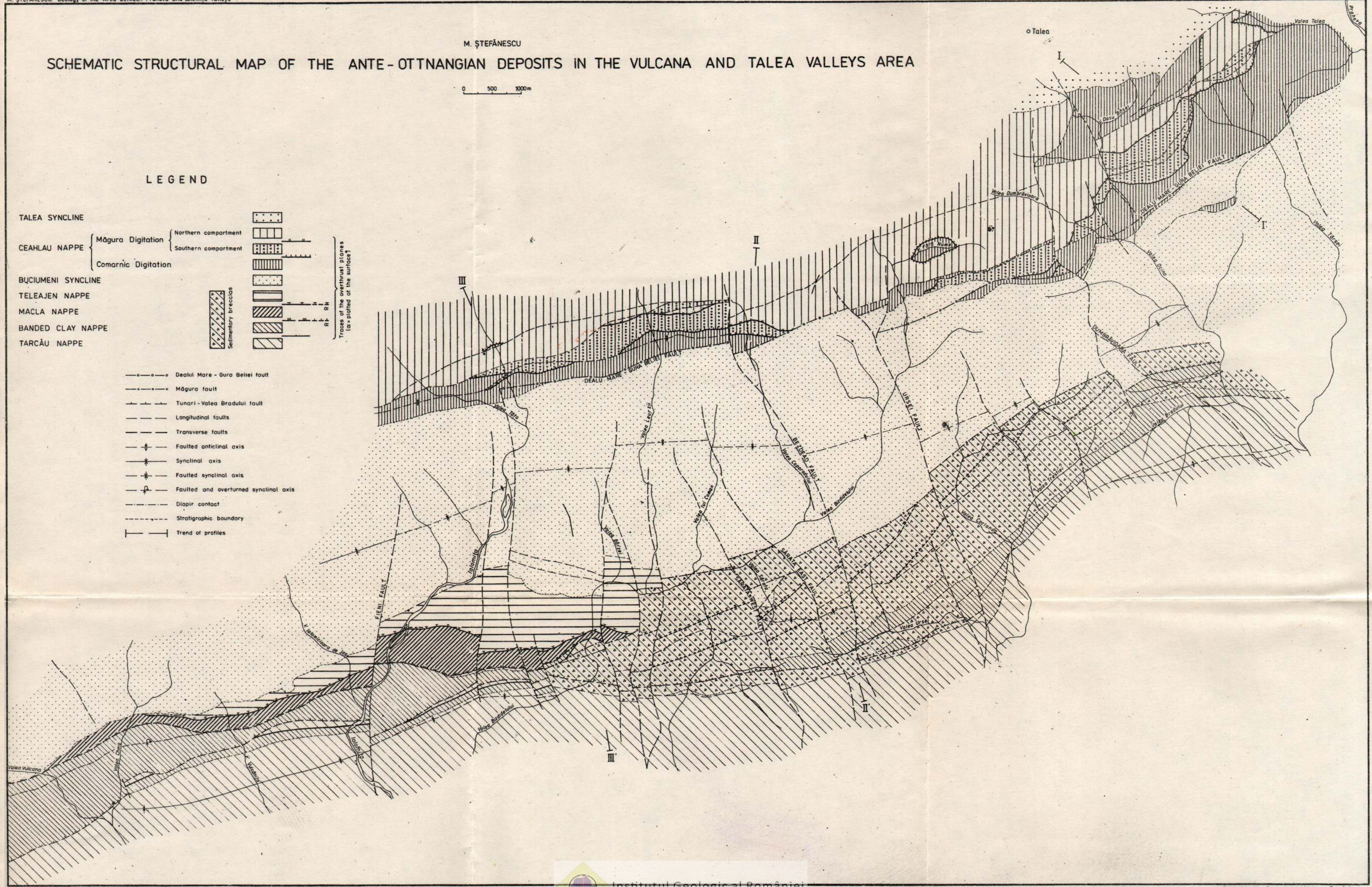

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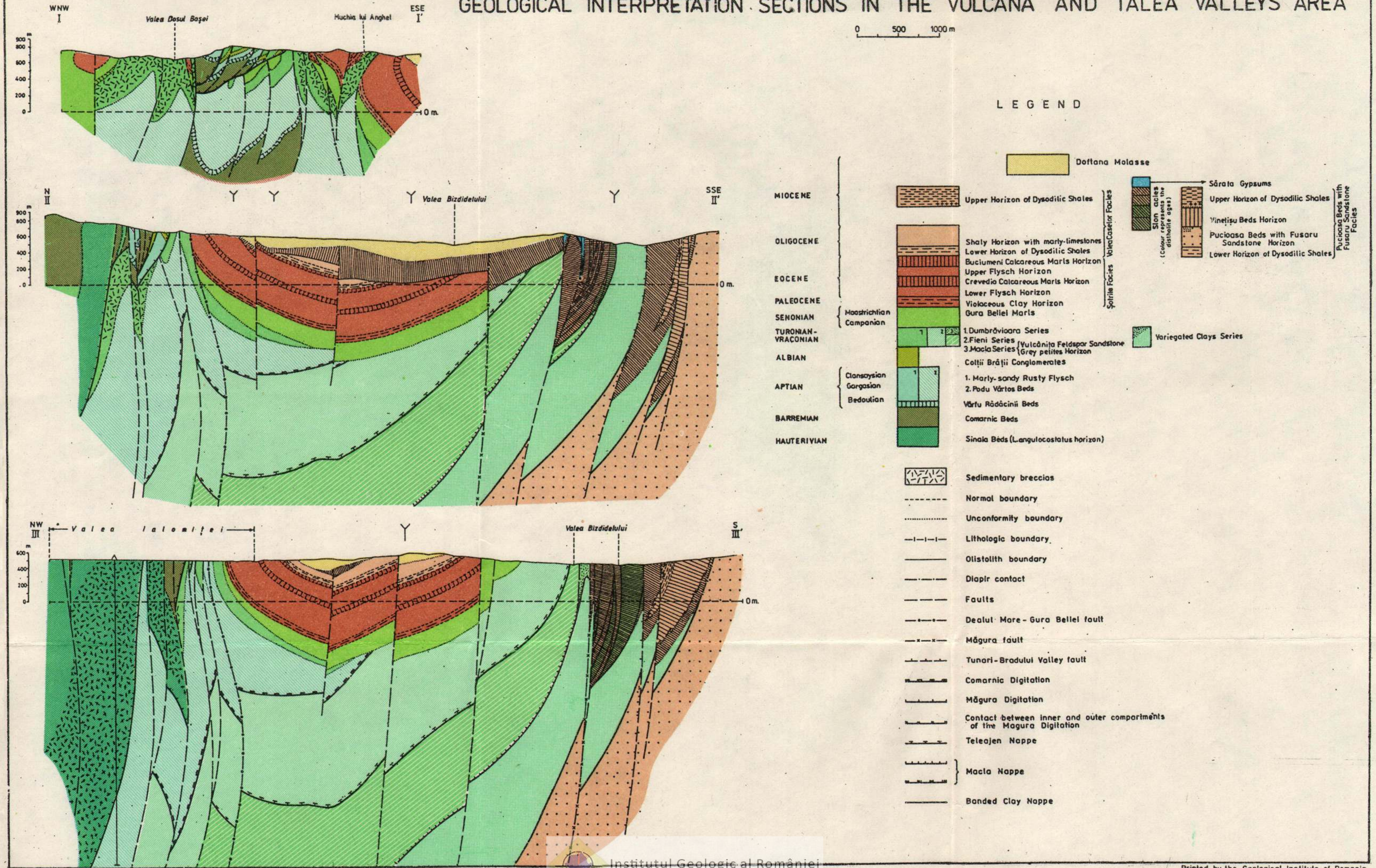

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