

**ISSUES CONCERNING „THE SEVERIN NAPPE” (SOUTHERN
CARPATHIANS)**

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Abstract

Within the Severin Nappe (as defined by Codarcea, 1940) there have been separated the Firizu Nappe, of Austrian age, at the upper part, and the Obârșia Unit, consisting of an ophiolitic complex, at its lower part. The Austrian Getic Megastructure (the I-st phase Getic Nappe: Codarcea, 1940; without the Obârșia Unit) would consist of several Austrian digitations (scales), some of them of nappes type (Firizu, Borăscu, Godeanu, Pleșiva, Sasca-Gornjac). The thrust plane of the Postaustrrian Getic Megastructure (the II-d phase Getic Nappe: Codarcea, 1940) would be located beneath the Obârșia Unit rocks.

Key words: Tithonic and Berriasian paleontological association, “Severin Nappe”, Getic Nappe, Ophiolitic Obârșia Complex, Southern Carpathians, Firizu Unit (Nappe), Obârșia Unit, Austirian Getic Megastructure, Postaustrrian Getic Megastructure.

Introduction

Murgoci (1905, etc.) has defined the Getic Nappe, formed during the Medium Cretaceous and completed by the end of the Cretaceous. Codarcea (1940) has defined the I-st phase Getic Nappe (Austrian) and the II-d phase Getic Nappe (Laramian). The Laramian Getic Nappe included the Austrian Getic Nappe rocks in its upper part, and the Severin Nappe rocks within its lower part (fig.1); the latter consisted of rocks of the Severin Trench, which was located between the Getic and the Danubian Realms. Stănoiu (1984a) has identified within the Severin “Nappe” (Unit) two distinct, superimposed units: the Obârșia Nappe, in the lower part, consisting of an ophiolitic complex, and the

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Firizu Nappe (inclusive the Balabanu Formation and the Severin Crystalline), consisting of a crystalline basement, of Liassic coal-type rocks and of flysch deposits that include Azuga, Sinaia and Comarnic Beds.

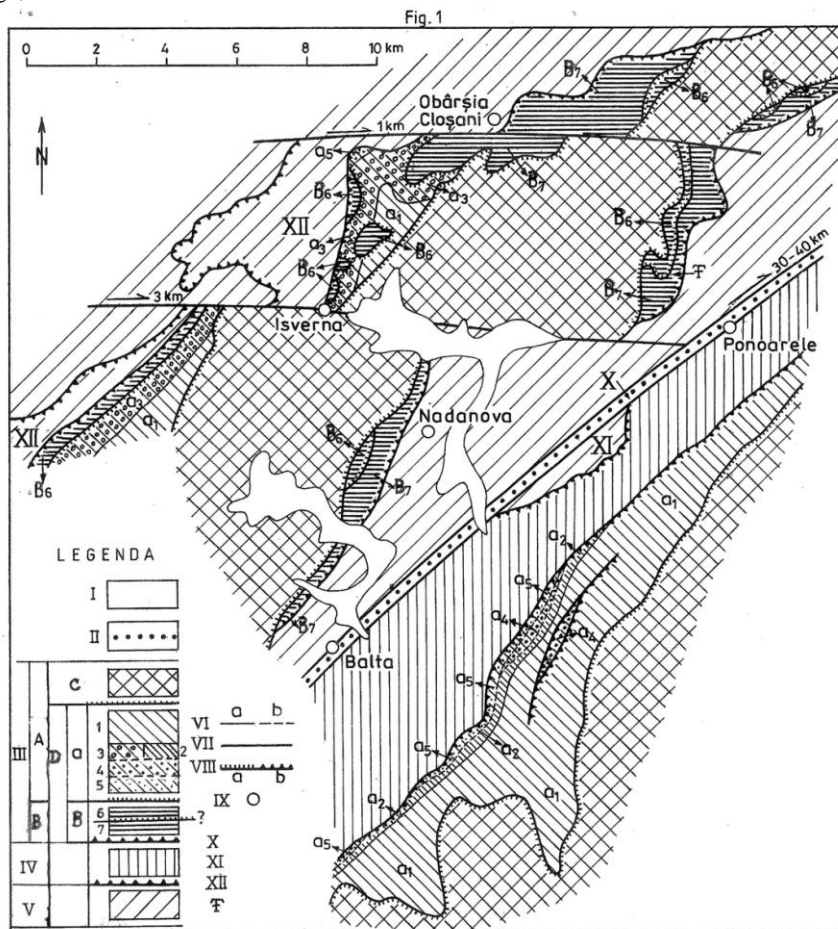


Fig. 1 Geological Sketch - Map of the Obârșia - Isverna - Balta - Ponoarele region (Mehedinți Plateau).

I - Quaternary. II - Oligocene - Lower Miocene. III - Postaustrrian Getic Megatstructure (the II-d phase Getic Nappe: Codarcea, 1940). A - Austrain Getic Megatstructure (the I-d phase Getic Nappe: Codarcea, 1940; without the Obârșia Unit). B - Obârșia Unit (Pseudonappe): 1- Paharnicu Subunit; 2 - Măgura Subunit. C - Godeanu Nappe. D - Severin „Unit”? („Severin Nappe“?: Codarcea, 1940). a - Firizu Unit (Nappe): 1 - Sinaia Formation (Beds); 2 - Azuga Formation (Beds); 3 - Valea Verde Formation; 4 - Balabanu Formation; 5 - Severin Crystalline. IV -

Coșuștea Nappe. V – Cerna Unit. VI – lithologic boundary. VII – fault. VIII – overthrust plane: a – Austrain; b – Laramian and Subhercynian. IX – localities: X – Baia de Aramă Graben. XI – Busești Half Window. XII – Cerna Nappe. F – relic of radiolars.

“The Severin” Nappe issue

The Firizu Nappe has been defined (Stănoiu, 1984a) as a result of the separation of a part of the Azuga Beds (within the Severin Nappe) as an independent tectonic unit (the Obârșia a Nappe).

The Firizu Nappe includes a crystalline basement of Getic type (the Severin Crystalline) that consists of micaschists and paragneiss intensely transformed (sheared and retromorphosed), of the stratigraphic series of the Balabanu Basin? (Liassic detritic-clayey, coal-type deposits, with Liassic-Aalenian palynomorphs and ? basinal limestones whose age has been inferred based on *Sacocoma* sp. limestone fragments reworked in the Valea Verde Formation), and of the basinal-turbiditic stratigraphic series of the Severin Basin. The stratigraphic series of the Severin Basin outlines a pre-flysch facies in its lower part (the unconformable deposited Late Tithonic - Early Berriasian Azuga Formation which consists of quartz sandstone, gray-greenish-reddish shales, marly limestones, red and green jaspers, silicoliths, basalts and detritic limestones with many micashists fragments) and a flysch facies in its upper part (the Barremian-Early Aptian Comarnic Formation and the Late Berriasian-Hauterivian Sinaia Formation). There has to be mentioned that the Azuga Formation of the Firizu Nappe is corresponding only to a small part of the Azuga Beds (as defined by Codarcea, 1940) from the Severin Nappe, the largest part of this formation being transferred to the ophiolitic complex of the Obârșia Unit. In the Southern Carpathians, the Sinaia Formation beginning is the Lapusnic Member (Stănoiu, 1978), ascribed to the Early Berriasian (the Calpionella Zone) and whose specific character is given by the occurrence of silicoliths and the abundance of the marly limestones. In quite many instances, the Obârșia Unit rocks directly underlie the Sinaia Formation rocks, without being reworked in the latter.

Evidence for the age of the Azuga Formation boundaries as specified in this paper has been provided by Stănoiu (1978, 2004) based on the Calpionellidae remnants. Within the sedimentary rocks of the Firizu Nappe, reworked rocks of oceanic lithosphere type and belonging to the underlying Obârșia Unit do not occur. The transformations (effects of strong tectonic actions, recrystallizations), noticed for the rocks located at the lower part of the Firizu Nappe (at the contact with the Obârșia Unit) are obviously more intense as compared to transformations to which the rocks located at the upper part of the Firizu Nappe (at the contact with the Godeanu Nappe) have been subject. The stratigraphic, paleogeographic and tectonic setting led to the inference (Stănoiu, 1997 a, b) that the internal boundary of the Severin Trench (defined by Codarcea, 1940) laid on the Getic Realm, of continental lithosphere type, while the outer boundary overlaid ? the oceanic lithosphere type Obârșia Realm, defined by Stănoiu (1984a, 1997a). The rocks

of the outer boundary of the Severin Trench (positioned above the Obârșia Realm rocks) have probably been entirely consumed on the plane of incomplete subduction between the Getic and Obârșia realms. It might be possible that the rocks of the Severin Crystalline Formation and of the Balabanu Formation belonged to an independent, Getic paleogeographic unit (basin) of Jurassic - Early Cretaceous age.

The Obârșia Unit (Pseudonappe) consists of an ophiolitic complex (the Obârșia Complex: Stănoiu, in Pop et al, 1975 and in Bercia et al, 1977) that includes a chaotic mixture (tectonic melange: the Obârșia Melange) which consists of lithologic bodies of very different sizes (up to several kilometers in extent), that had been subject to strong tectonic actions (sheared, foliated, micro-folded) and very weakly metamorphosed (the prehnit-pumpellyt facies: Ciulavu, Seghedi, 1997). The largest fraction of Obârșia Unit consists of rocks of oceanic lithosphere type (gabbros, ultrabasites, dolerite-basalts, gray-brown-blackish shales with radiolars, jaspers and radiolarites with Fe and Mn oxides and with radiolars that are characteristic to the Early Oxfordian: Dumitrica and Stănoiu, 1997), accompanied by a quite minor fraction of rocks of the Azuga Formation and the Sinaia Formation type (having been subject to obviously more intense tectonic actions and being more intensely metamorphosed as compared to the corresponding rocks of the Firizu Nappe), as well as crystalline schists of Getic type (micaschists and paragneiss) that are much more transformed (subject to more intense tectonic actions = sheared and retro-morphosed) as compared to the similar rocks of the upper Getic Nappes. Among the researchers that have been involved in the magmatic rocks investigation one should mention: Drăghici (1962, 1965), Drăghici et. Drăghici (1964), Mărunțiu et.al. (1978), Cioflică et.al. (1980, 1981), Popescu et. Al. (1985), Savu (1985, 1986), Savu et.al. (1985, 1987), Mărunțiu (1985, 1987).

The distribution in space of the rocks belonging to the Obârșia Unit indicates (Stănoiu, 1982, 1984a) a reverse succession of the oceanic lithosphere: within the lower part, the Măgura Formation rocks (dolerite-basalts, shales, jaspers, radiolarites), that probably built the Măgura Subunit (Scale ?), are mostly prevalent, while within the upper part, mostly prevalent are the gabbros and ultrabasites that probably built the Paharnicu Subunit (Scale ?). The rocks facies, the detritic rocks absence, the limestones absence, as well as the carbonate skeleton fossils absence suggest (Stănoiu, 1997a) that the sediments that have generated the lithological assemblage of the Măgura Formation had been deposited at large depths (over 5000 m), beneath the calcite compensation depth (CCD) line. There are certain suggestions that the Obârșia Complex has been generated before the Late Cretaceous (probably in the second part of the Early Cretaceous), on the plane of incomplete subduction between the Obârșia and the Getic Realms (to which the rocks of the internal flank of the Severin Trench were also coupled; the outer flank, probably overlying ? the Obârșia Realm, has been possibly entirely consumed): in the Obârșia Complex no Late Cretaceous rocks of the underlying Danubian type have been identified; in the Obârșia Complex, fossiliferous (Calpionellidae and Calcisphaerulidae assemblages) rock bodies occur, that are identical

to those of the Azuga and Sinaia Formations in the Firizu Nappe; in the Obârşia Complex there occur rock bodies (micashists and paragneiss) of the Getic crystalline formations type; the Obârşia Complex rocks appear to have been subject to much more intense tectonic actions and to have been much strongly metamorphosed than the rocks of the Firizu Nappe (above) and the Danubian rocks (below). The rocks of the Firizu Nappe and of the Obârşia Unit could possibly be also interpreted as being the Severinidic Accretionary Pseudo-wedge (Stănoiu, 1984a) associated to the incomplete subduction between the Getic and the Obârşia Realms: In this case, the Severinidic Accretionary Pseudo-wedge (Stănoiu, 1984a) could possibly be considered as consisting of the rocks ascribed by Codarcea (1940) to the Severin Nappe. The Obârşia Complex has been obducted (Stănoiu, 1982, 1984a) over the Danubian, being included in the bottom part of the Postaustralian Getic Megastructure.

The Baia de Aramă Lineament (Graben) in the Mehedinţi Plateau separates two compartments of different stratigraphic series and nappes. In the eastern compartment, the Firizu Nappe rocks and the Coşuştea Nappe rocks are developed to a large extent, while the Obârşia Unit rocks are absent. In the western compartment, the Coşuştea Nappe rocks are absent, the Firizu Nappe rocks are present to a small extent, while the Obârşia Unit rocks occur to a very large extent. One can also notice that the lithostratigraphic entities and the nappes in the compartment located eastward of the Baia de Aramă Lineament are identical to those that occur on the Vâlcan-Parâng Mountains southern slope. The indicated facts outline a transcurrent dextral character, with horizontal displacements of the order of 30-40 km that are similar to those identified (Stănoiu, 1973, 1978, 1999) in the case of the Cerna Lineament.

The Firizu Nappe has different stratigraphic series in the two compartments of the Baia de Aramă Lineament from the Mehedinţi Plateau, which probably belong to different Austrian scales: the Dealul Mare Scale located east of the Baia de Aramă Lineament and the Prejna Scale located to the west of this lineament. In the bottom part of the Sinaia Formation from the eastern compartment there occur rocks of the Lăpuşnic Member, that had not been identified in the western compartment. The correspondent of the Azuga Formation of the eastern compartment (that unconformably covers the occurrences of crystalline schists and Liassic rocks) is in the western compartment the Valea Verde Formation (Stănoiu, 1984a), which is synchronous, yet it has a somehow different lithology.

The Valea Verde Formation occurs beneath the Sinaia Formation (with *Calpionella alpina* Lorenz) very weakly metamorphosed and having undergone feeble tectonic actions, and above the rocks of the Obârşia Unit, in the region between Valea Verde streambed to the north and Ciolanu Mare Peak to the south. Between the Valea Verde Formation and the Obârşia Unit, lens-like bodies of micashists and paragneiss (retromorphosed and having undergone strong tectonic actions, sheared), that may belong to the Getic Crystalline Formations, protrude from below.

The Valea Verde Formation is about 50-100 m thick and displays effects of transformation processes (very weak metamorphism and tectonic action traces: foliation, micro-folding, lamination). This lithostratigraphic unit consists of gray quartz-feldspath, highly micaferous sandstones (resembling the Liassic ones), of breccia with crystalline schists clasts; of gray, greenish or reddish marly limestones, frequently re-crystallized; of siltites, shales and shaly marls; there are no basalts.

The Valea Verde Formation (that probably occurs unconformably with respect to the Severin Crystalline) has been ascribed (Stănoiu, 1999, 2004) to Late Tithonic and Early Berriasian, by considering several indications: it occurs beneath the Sinaia Formation, that started being deposited in the Early Berriasian; it is obviously the equivalent of the Azuga Formation (with Calpionellidae that indicate the Late Tithonic and the Early Berriasian) in the territories located to the east of the Baia de Aramă Lineament, it includes a paleontological assemblage (that indicates the Late Tithonic and the Early Berriasian) with *Globochate alpina* Lombard, *Clypeina jurassica* (Favre), *C.sp.C.cf. nigra* Conrad (the species determined by Prof. O. Dragastan), *Cylindroporella arabica* Eliot (the species determined by Prof. O. Dragastan), *Crassicollaria brevis* Remane, *C. parvula* Remane, *C.cf. masutiniana* (Colom), *Calpionella alpina* Lorenz, *Sacoccoma* sp. (obviously reworked) (pl. I, pl. II).

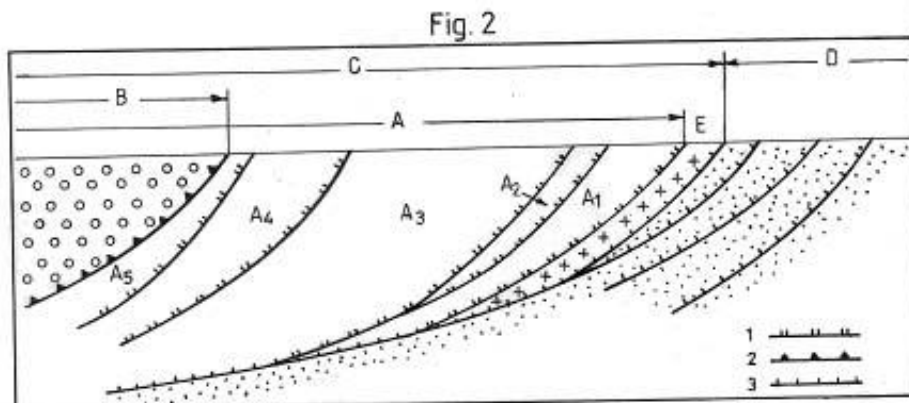


Fig.2 – Regional tectonic section of the Southern Carpathians.

A – Austrian Getic Megatructure. A₁ – Firizu Unit (Nappe). A₂ – Borăscu Nappe. A₃ – Godeanu Nappe. A₄ – Pleșiva Scale. A₅ – Sasca Gornjak Nappe (Scale). B – Supragetic Megatructure. C – Postaustrian Getic Megatructure. D – Danubian. E – Obârșia Unit. 1 – Austrian overthrust plane. 2 – Laramian, Subhercynian and Mediteranean overthrust planes. 3 – Laramian and Subhercynian overthrust plane.

On the northern slope of Vâlcan and Parâng Mountains, under the crystalline schists of the Godeanu Nappe and above the Danubian rocks, there occur entities which correspond, although the more intensely transformed (subject to strong tectonic actions

and weakly metamorphosed), to the Obârșia Unit rocks (green schists with meta-basites and lens that include: serpentinites; meta-radiolarites; red and green meta-shales; rocks of the Sinaia and the Azuga Formations type) and to the Firizu Nappe (the Azuga and the Sinaia Formations), that have been provisionally categorized as “the Puru Nappe” (Stănoiu 1984b; Stănoiu et al., 1996-1997), a unit which Voitești (1923) had inferred to exist.

The Danubian Nappes are thrust of the Danubian Unit, controlled by the Postaustrrian Getic Megastructure thrusting.

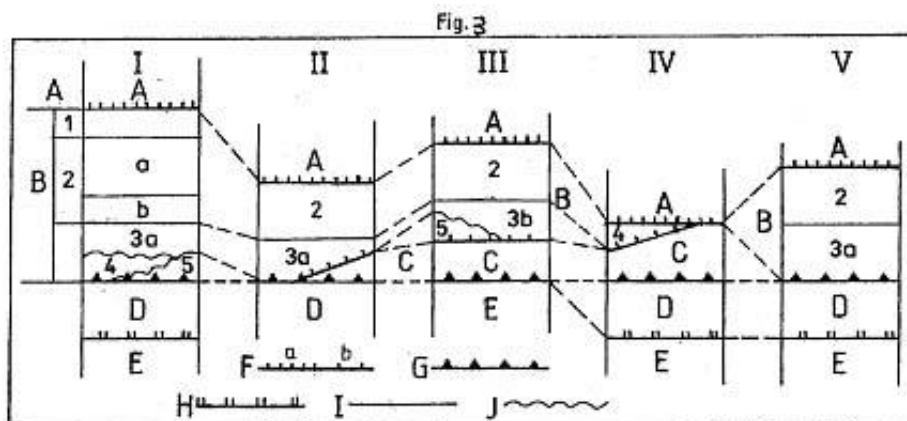


Fig.3 – The correlation of the sections in “the Severin Nappe” of the South Carpathians.
 I. Coșuștea Valley (cerna Vârf - Dâlbocița). II – Vârciorova. III - Ciolanu Mare Peak. IV – Vâlari. V – Polovragi. A.Godeanu Nappe. B-Firizu Unit (Nappe): 1 – Comarnic Formation; 2 – Sinaia s.l. Formation (a- Sinaia s.s. Member; b – Lăpușnic Member); 3a – Azuga Formation; 3b – Valea Verde Formation; 4 – Balabanu Formation ; 5 – Severin Cristollyne. C – Obârșia Unit. D – Coșuștea Nappe. E – Cerna Unit. F – Austrian overthrust plane (a-overthrust of the Godeanu Nappe ; b – overthrust of the Austrian Getic Megastructure). G + H = Laramian and Subhercynian overthrust plane (G – overthrust plane of the Postaustrrian Getic Nappe; H – overthrust plane of the Coșuștea Nappe). I – lithologic boundary. J- unconformity boundary. A + B + C - Postaustrrian Getic Megastructure. A + B – Austrian Getic Megastructure. B + C – “Severin Unit (Nappe)”: Codarcea (1940).

Conclusions

Existing information suggests (fig. 2) that the designation “I-st phase Getic Nappe” may still be used in order to define the Austrian Getic Megastructure (Nappe) made of several Austrian scales (nappes) which deformed the Getic Realm territories: the Firizu Nappe (Stănoiu, 1984), the Borăscu Nappe (Gherasi et.al., 1986), the Godeanu Nappe (Conovici and Sabău, 1994), the Pleșiva Scale, the Sasca-Gornjac Nappe (Săndulescu,

1975), etc. The Firizu Nappe may be viewed as a thrust slice of the Austrian Getic Megastructure. The Austrian Getic Megastructure may be the result of the overthrusting of the Getic Realm as a whole over the Obarsia Realm, during the Early Austrian Tectogenetic Phase, with possible effects on the Eastern Carpathians tectonics and the paleogeography. The Laramic Getic Megastructure (Nappe) thrust plane in the Southern Carpathians is positioned beneath the Obârșia Unit that has been overthrust (together with the entire Getic Realm, the Sub-Hercynian Megastructure ? = Supragetic Nappe included) on the Danubian Realm, during the Early Laramic Tectogenetic Phase. There are certain pieces of evidence indicating (Stănoiu, 1997a) a Sub-Hercynian Tectogenesis in the Southern Carpathians, and implicitly a Sub-Hercynian age of the Supragetic Megastructure.

The position of the Liassic fossiliferous rocks (siltites and coal-bearing black sandstones) of the Balabanu Formation at Valari (beneath the crystalline schists of the Godeanu nappe and above the shales with basaltic rocks of the Obarsia Unit, which at their turn overlie the Cosustea Nappe rocks, which overlie the Cerna Unit rocks), and on Cosustea Valley (overlying the Cosustea Nappe rocks positioned at the overlant the Cerna Unit rocks and underlying the Azuga Beds (Formation) rocks positioned at the base of the Sinaia Beds) has provided the crucial evidence (Stanoiu, 1984a, 1996, 1997b) in what concerns the Cosustea Nappe position (over the Cerna Units rocks), as well as for separating two tectonic and tectonic-stratigraphic units, completely distinct from one another (the Obarsia Unit =? Pseudonappe and the Firizu Unit = Nappe) within “the Severin Nappe” (Codarcea, 1940). (fig.3) The position of the shales with basaltic rocks of the Obarsia Complex at Valari (overlying the Cosustea Nappe rocks and underlying the Balabanu Formation of the Firizu Nappe, that are at their turn covered by the crystalline schists of the Godeanu Nappe), as well as the position of the Obarsia Complex serpentinites at Varciorova (beneath the Sinaia and the Azuga Beds of the Firizu Nappe, and above the Cosustea Nappe limestones) have provided the crucial evidence for assessing the position and the significance (geodynamic, tectonic, paleogeographic, litho-stratigraphic) of the Obarsia Unit and of the Firizu Nappe within the tectonic setting of the Southern Carpathians (fig. 3).

The currently available information points to the fact that the Firizu Nappe and the Obarsia Unit (Pseudo-nappe) never constituted together an independent tectonic unit (structure) (The Severin Nappe). Additionally, there isn't available any piece of information which would suggest an independent tectonic displacement of the Obarsia Unit (Pseudo-nappe), the latter being displaced together with the Austrian and Post-Austrian Getic Megastructure, during the Sub-Hercynic and Laramic Tectogeneses, at the bottom part of the Getic Nappe.

The Postaustralian Getic Megastructure thrust plane importance is also highlighted by the occurrence of certain tectonic “fingerings” (imbrications) and of severely tectonically disturbed zones (Coșuștea Valley, Turcului Valley etc), frequently several hundreds of meters thick, between the Postaustralian Getic Megastructure rocks (especially the Sinaia

and the Azuga Layers rocks and the Obarsia Complex rocks) and the underlying rocks of the Danubian Unit (especially the flysch and olistostroma facies Late Cretaceous rocks of the Danubian Trench Basin).

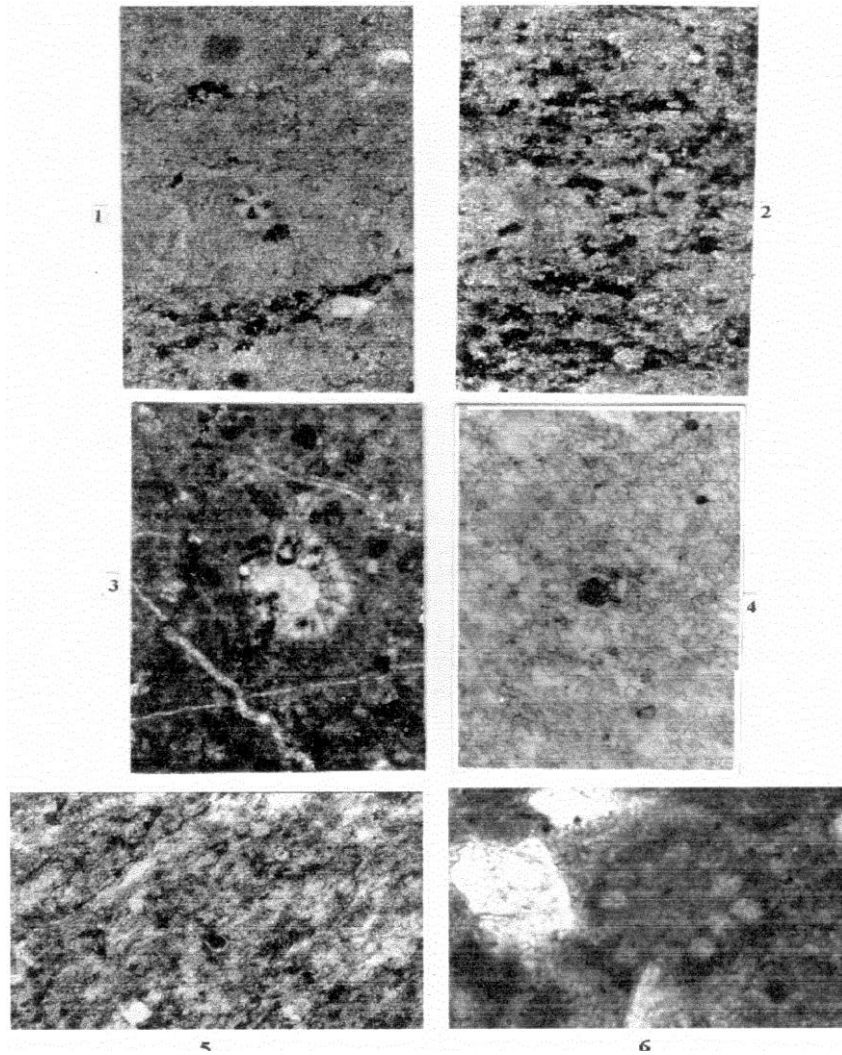
The very complex issue of the Supra-Getic Megastructure (Nappes) is not yet properly elucidated. At the boundary between the “Getic Unit” and the “Supra-Getic Unit”, in the Olt Valley, there occur several Mediterranean (Post-Cenomanian and Ante-Campanian), Sub-Hercynic (Post-Santonian and Ante-Campanian), Laramic (Post-Maastrichtian) and possibly even older tectonic thrust units. The Supra-Getic Megastructure (Nappes) in the Poiana Rusca Mountains is inferred by Strutinski et.al. (1983) to be of Sub-Hercynic (Ante-Maastrichtian and Post-Santonian) age, while Krautner et.al.(1972) assumes it to be of Laramic (Post-Maastrichtian) age.

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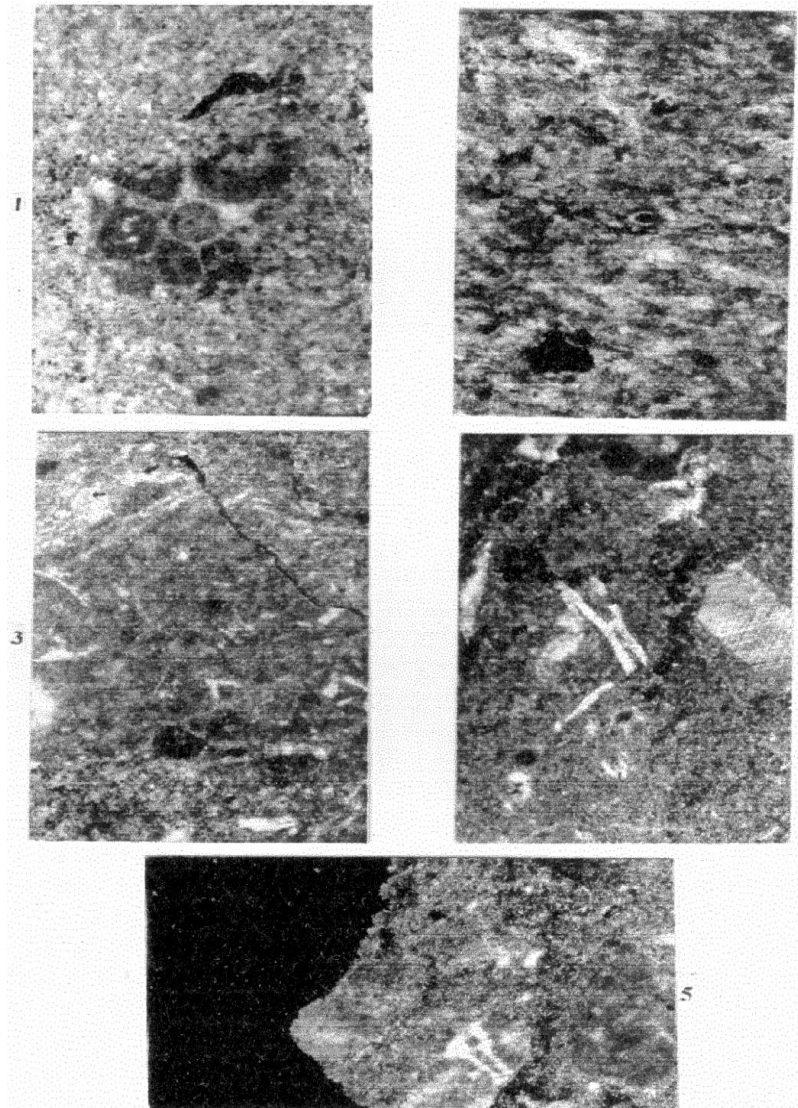
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Plate I



Pl.I: fig.1-Globochaete alpina Lombard, x150; fig.2-Globochaete alpina Lombard, x200; fig.3-Clypeina jurasica (Favre), x25; fig.4-Calpionella alpina Lorenz, x125; fig.5-Calpionella alpina Lorenz, x100; fig.6 Clypeina sp.C.cf.nigra Conrad.

Plate II



Pl.II:fig.1-Cylindroporella sp. C.cf.arabica Elliott; fig.2-Crassicollaria brevis Remane, x120; fig.3,4,5 pieces of Sacoccoma sp, x5