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**PLIO-PLEISTOCENE PALEONTOLOGICAL
RESERVES FROM OLTENIA**

Summary

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PLIO-PLEISTOCENE PALEONTOLOGICAL RESERVES FROM OLTENIA

Key words: Oltenia, protected areas, paleontology, fossil forms, bivalves, gastropods, micro-mammals, geological structure, Dacian Basin, Moesian Platform

Every geological structure generates a natural equilibrium in which the different implied factors are in accordance with the laws of nature. For a long period, even billion of years, the planet evolved freely, evolved naturally. However, this equilibrium broke with the apparition of the modern civilization. The human being modified the spontaneous evolution to satisfy his needs, activity that contradicts many times the laws of nature.

At the midpoint of the 19th century, the naturalists sense the danger, the gravity of this threat for the nature and understood that the nature has to be protected; it has to be granted with a special protection. Thus, the natural reserves and monuments appeared.

The first Romanian study that describes a fossiliferous place that afterwards has become a protected area is the study of Grigore Cobălcescu (1862) referring to “*Calcarul de la Răpidea*” (*Răpidea limestone*). At present, Repedea Hill from Bârnova, Iasi County is a national protected area.

The natural reserves are those natural protected areas that aim the protection and preservation of some natural habitats and species that are important under floristic, faunistic, silvan, hydrological, geological, speleological, paleontological, pedological aspects.

The protected areas of paleontological interest form perimeters containing important fossiliferous resources that are representative from scientific point of view by the abundance or even by the rarity of the contained species. In many cases, the same perimeter among the fossiliferous outcrop can have important geological structures (folds, remarkable beds etc.) or rare plants or it can present a remarkable landscape. In this case, the protected area becomes a complex protected area.

1. THE HISTORIC OF THE NATURAL AREAS PROTECTION IN ROMANIA

The first step concerning natural preservation and the initiation of protected areas in Romania has made in the year 1928 when, in Cluj, the first naturalists' congress from Romania took place, where there was adopted a decision, proposed by Emil Racoviță, regarding the elaboration of a law referring to the nature protection in Romania. Therefore, in 1930 the Law no. 213 concerning the protection of natural monuments in Romania appeared. On behalf of this law, The Natural Monuments Commission was established, followed by the first natural monuments statements by law (The Council of Ministers Journal from 1935): the edelweiss and the thermal lotus and by the first national park: Retezat National Park.

In the year 1950, the Decree no. 237 was emitted and was referring to the natural monuments' protection, followed by the Council of Ministers Decision no. 114/1954 in which the functional zoning of the forests was accomplished. Through this legislative act, it was established that in the areas that represent permanent or temporary scientific reserves and in the protection areas of Natural Monuments there will be executed only workings with sanitation and pest control character only with the approval of the Natural Monuments Commission.

Subsequently, the territorial subcommittees have emerged and they have continued the knowledge, promotion and protection activity of some habitats, places or rare or scientifically

important species. Therefore, in 1955 the Cluj Sub-Commission, in 1956, Iasi Sub-Commission, in 1960, Timișoara Sub-Commission and in 1968, Craiova Sub-Commission were constituted.

In the period 1944-1989, the nature protection measures were based on institutional efforts made before the war by well-known scientists as Al. Borza or Emil Racoviță.

In 1972 the number of protected areas increased to 190 objectives totaling almost 100,000 hectares. However, the protected area in 1972 represented only 0.0042% of the country's territory, a percentage that did not cover by far the entire specific and ecological diversity of the country.

From the legal point of view, it was adopted in 1973, the Environmental Law where there are included some provisions for the protection of nature reserves and monuments. In this period, the first international recognition of the value of the Romanian protected areas occurs, when in 1979, Retezat and Pietrosul Rodnei were recognized as Biosphere Reserves under the auspices of UNESCO program - Man and Biosphere (MAB).

Another international recognition of the value and the great importance and uniqueness of the Danube Delta was represented by its designation as a Ramsar site in 1991 and as a World Natural Heritage Site for 50% of its surface and subsequently in 1992 was recognized as a Biosphere Reserve. Thus, exceptionally, Government Decision 248/1994 has recognized the Danube Delta as a Biosphere Reserve.

In 1995, the Environmental Law no. 137 was adopted; containing provisions related to nature conservation and protected areas. The law was amended and completed by Law no. 5 of 2000 concerning the organizational plan of the national territory, Section III-protected areas. The law defines the protected areas as natural or constructed areas, bounded geographically and/or topographically, which include natural and/or cultural heritage values and declared as such to achieve the specific conservation objectives of heritage values.

In 2001, the Law no. 462, concerning the protected natural areas regime, natural habitats and wild fauna and flora preservation, and subsequently the GD 230/2003 concerning the delimitation of biosphere reserves, national and natural parks and the establishment of their management appeared.

1.1. Dates from the Historic of Nature Protection in Oltenia

The Bucovat fossiliferous place was known since the end of last century, mentioned by Ed. Bielz (1864), Roger Porumbaru (1881), Sabba Stefanescu (1889 - Bucovat). The Bahna fossiliferous place was also known, mentioned by Ș. Macovei (1890).

The beginning of Oltenia's natural protection can be considered the early 20th century when there were founded several societies and institutions that took into account issues about rare plants and animals, protection of the forests, or have described a number of fossiliferous points as those of Bucovat and Bahna.

On June the 9th, 1913, in Craiova was founded a section of the society "Friends of science", where were held several conferences with regard to the knowledge of nature's rarities.

Over 10 years, on October the 2nd, 1923, there was inaugurated the Museum of Oltenia, due to the endeavours of professors Stefan Ciuceanu and Marin Demetrescu. The institution had from the beginning concerns about nature protection issues. The emergence of the magazine "Oltenia's archives" in 1922, founded by Ch. Laugier and C.F. Fortunescu, provided the possibility of publication of numerous articles by the naturalists in the area. I. Ionescu Argetoiaia, Anton Opreșcu, Raul Calinescu, Alexandru Borza have published here. The magazine appeared until 1943, followed by the new series in 1981.

The "Association of Oltenia Naturalists" and "Students Society of Geographical and Touristic Oltenia" emerged in 1928 in Craiova, both identifying a number of elements of flora and fauna that subsequently became natural monuments.

"Oltenia Regional Commission" appeared in 1936, led by Prof. Marin Demetrescu and with members among others: CS Plopsor Nicolaescu, Aurel Metzulescu, Eugen Nicolaescu, C.F. Fortunescu, Al Bărcăcilă.

The first natural monuments were declared in Oltenia at NMC proposal by CMD 1625/aug 1955 the following: Closani Cave, Gura Plaiului Cave and Bahna fossiliferous point.

Oltenia Museum where I. Firu held his activity carried out under the auspices of the Scientific Commission on Natural Monuments, the first electrification of a cave in Oltenia-The Women's Cave. The electrification opening took place on August 9, 1959.

Since 1960, Oltenia was scientifically paternalized in terms of nature protection by Timisoara Sub-Commission for Natural Monuments Protection where there were a number of Oltenian naturalists: Al. Buia, I. Safta and I. Firu.

In 1960 there were proposed by NMC as natural monuments: The Danube Basins and Cozia Mountain.

On March 22, 1968, the office of the Presidium of the Academy approves the foundation of the Sub-Commission for Natural Monuments Protection whose chairman was appointed C.S. Nicolaescu Plopșor. The Sub-Commission worked until 1971 and was reorganised in 1979, when the Academy presidium office confirmed a new component.

In 1979, exhibits with "Nature Protection" profile were organised in Craiova, Turnu Severin and Ramnicu Valcea.

At 3 to 4 June 1979, the Communications Session "Nature Protection in Oltenia" was held in Slatina.

The seventh session of the scientific session of Nature Conservation on Ecological Outlines took place between 30th of September and 5th of October 1980 in Drobeta-Turnu Severin.

The Dolj County Council Resolution no. 26/1994 established a protected area regime for a number of objectives including Bucovăț and Drănic geological-paleontological areas.

Later those areas became national interest by publication of Law no. 5/2000 Section III Protected Areas. In this law, in Oltenia there are 12 protected paleontological areas, of which seven of them are Pliocene.

In the year 2004, the Sub-Commission was reorganized, being approved by the presidium of the Academy no. 1529/28.10 2005.

2. THE RELIEF OF OLTENIA

The Pliocene paleontological places from Oltenia are located in the following morphological units: Getic Subcarpathians, Getic Piedmont and Oltenia Plain.

2.1. The Getic Subcarpathians

The Getic Subcarpathians are formed of three subdivisions: Gorj Subcarpathians, Vâlcea Subcarpathians and Argeș Hillocks, the first two ones being located in Oltenia.

Gorj Subcarpathians, extending from Motru Valley to Olteț Valley, developed on Miocene and Pliocene formations, are formed by depressions and hills arranged in two continuous rows parallel to the mountains. The general descent of relief from the east to the west due to the geological structures immersion makes the altitude to decrease from 615 m near the Olteț River, to 500 m near Gilort River and to 450-350 m in the hills bordering the Jiu Valley.

Vâlcea Subcarpathians have the characteristic arrangement of the hills and the depressions in the network. They have relief energy lower than Argeș Hillocks from the east, but they are higher and less gentle than Gorj hills. The monoclinic hills from the east between Luncavăț and Olteț and between Cucești - Cernișoara - Berbești - Alunu are constructed by Pliocene deposits.

2.2. The Getic Piedmont

The Getic Piedmont is located in the territory between the Getic Subcarpathians and the Romania Plain. The whole relief of this piedmont is modeled in Pliocene and Pleistocene deposits. The Oltenian part of this piedmont is divided regarding the geomorphologic characteristics into seven major subunits: Motru Piedmont, Jiu Knobs, Bălăcița Piedmont, Olteț Piedmont, Cotmeana Piedmont, Argeș Knobs and Căndești Piedmont. From those, only the first four geomorphologic elements are part of Oltenia.

Motru Piedmont. It extends from the limit of the Mehedinți Plateau to the Jiu corridor, to the southern part being bounded by the Balota-Butoiești alignment where the Gârnița Valley, Huștița Valley and Motru Valley are located (between Strehaia and the river mouth).

On the western boundary, in contact with Mehedinți Plateau it is individualized the depression corridor where the following depressions range: Drobeta Turnu Severin, Malovăț, Crăguiești, Ilovita, Șovarna, Bala and Bratovoiești.

Bălăcița Piedmont is located between Motru Piedmont and Oltenia Plain, having a tabular relief slightly inclined to the south-east in accordance with the dip of the Pliocene deposits.

In the northern side, the hydrological network is tributary to the Jiu, as in the southern one to the Danube.

Jiu Knobs. They represent the hill groups between Jiu and Gilort, having a triangular shape with the head pointing down and the base on Cioiana Valley. They appear like knob shape – long shaped hills, with altitudes that drop from the north to the south-east. The most important valleys are: Sterpoaia, Purcarul Valley și Groșera, which revolve to the south-east and flow into the Gilort River.

Olteț Piedmont. It represents a large step between the Subcarpathians and the Romanian Plane.

Even if it is a fairly unitary piedmont unit, there are two units: the piedmont hills in the northern part and hilly plateaus in the southern one.

The southern step is also divided into two subunits: Teslui Plateau in the west and Beica Plateau in the east.

2.3. The Oltenia Plane

The Oltenia Plane is situated in the western side of the Olt River and it represents the oldest part of the Romanian Plane judging by the most complete series of fluvial terraces found on the Danube and Jiu River. It is made of the following morphologic units: Blahnița Plane, Băilești Plane and Romanați Plane.

The Oltenia Plane is crossed by the Jiu, Olt, Olteț, Drincea and Desnățui rivers.

Blahnița Plane occupies the western part of the Oltenia Plane, being bounded to the north and north-east by the Getic Plateau through 80-120 m dislevelments. The Blahnița Plane is composed of the Danube's terraces, modeled afterwards by Blahnița and Drincea.

Băilești Plane presents the most typical display of relief steps, as a result of the fact that the whole system of the Danube's eight terraces expands here. It is divided into four relief subunits. The Băilești Plane is presented as an accumulation and erosion plane, if it is reported to the action of the Danube in the past and as an accumulation plane if the reference is the actual and older main action of the wind.

Romanați Plane extends south of the line Leu-Slatina-Stoenești to the Danube. The altitude of the relief descends downhill to the Vădăstrița-Tia Mare line, then in steps on the Danube's terraces, facts that confer a sunny southern exposition to this plane.

2.4. The Current Modelling of the Relief as a Forming Factor for the Pliocene and Quaternary Fossiliferous Openings

The current evolution stage of the Oltenia territory relief reflects the adaptation to the structure, lithology and neo-tectonics.

The most frequent forms of the Subcarpathian sector, developed on Miocene-Pliocene folded structures, are the ones represented by a relief in accordance with the structure, which are the hills developed on the anticlines (Săcelu, Ciocadia, Mâța, Seciul) and the two depressions developed on the synclinals (lithologically conditioned or in sinking areas). There are also some relief inversions that diversify the variety of the relief: anticline and anticline valleys (Câlnic, Giovria) and suspended synclinals (Călugăreasa, Hârnea-Prunești).

In the piedmont sector, the quasi-horizontal structure in the south and the one with weak undulations in the north, prove light tectonic disturbance caused by the mobility of the substrate and by the folds grafted onto it.

Here, the monocline structure influence is emphasized by the network of subsequent valleys that led to the relief of *cuestas*, fact that binds to the major landslides. Contact between the Subcarpathian area and the piedmont area (Motru Hill, Bran Hill, etc) has made the mass movement and ravening processes occur on the head of the *cuestas*' layer or subsequently on the springs of the torrential valleys tributary to the valleys with north-south direction. Most of the relief in the Subcarpathian sector is carved in Neogene sediments (Miocene and Pliocene). The slopes with mass movement predominance appear in the relief, especially profound landslides and landslides due to the rapid sinking of the valleys.

The conditions for the emergence of fossil nests were pursuant to the relief fragmentation, the increased erosion, the landslides and collapses. As an example, in the right side of the Jiu River between Gura Motrului and Craiova, there was unveiled Romanian sand with "carved uniodidae" that sit over clays placed on the river bed level. The landslides uncovered sliding sandy ravines with rich Romanian mollusks' fauna in Drănic, Podari, Bâlta, Leamna, Bucovăț and Buicești.

River bank erosion on the wide meadow rivers also unveils the substrate where fossil nests sometimes occur as in Erghevița Valley, Gilort Valley to Cărbunești in sandy clays.

The human intervention degree has already made its mark on the landscapes of hydrographic basins: Motru Jilț, Gilort, Amaradia. Secular forests deforestation has led to land degradation and increasing relief fragmentation.

Also, most sites with mollusk and mammal remains were discovered through human activities, excavations for various utilities, mineral aggregates quarries (New Bucovăț Podari, Scorușu, Leu, Aninoasa etc).

3. THE NEOGENE AND THE QUATERNARY FROM OLTENIA

3.1. The Neogene

The Neogene stratigraphic division was made after the International Commission on Stratigraphy (International Stratigraphic Chart). For the Pliocene-Pleistocene stratigraphy in Romania, this new stratigraphic division was presented by I. Andreescu, V. Codrea, Victoria Lubenescu, A. Petculescu, E. Știucă in "Abstract volume 2010 annual meeting INQUA-SEQS".

Until the end of June 2009, the lower limit of the Quaternary has been defined by GSSP (Global Boundary Stratotype Section and Point) Vrica being dated at 1.806 Ma. This timing has been inaccurately viewed as representing the first degradation of the climate in the Italian Plio-Pleistocene. For example, the ostracod *Cytheropteron*, an immigrant from the north, regarded as having special significance for identifying Vrica GSSP was discovered in Monte San Nicola, being 2.4 million years old (AIELLO et al., 1996). Therefore, GSSP Vrica had a potential weak correlation and provided a more arbitrary than descriptive measure for the subdivision of geological time.

3.1.1. The Stratigraphy of the Neogene

The Neogene from Oltenia is different depending on the geotectonic structure from which it was described. The depression area has a more complete structure than the one of the Moesian Platform (Intra-Carpathian-Balkan Platform), where Middle and Upper Miocene is missing.

Ma	STAGES/ SUBSTAGES	MOLLUSCS ZONATION (ANDREESCU, 1979, 1981, 1983 etc. Revised)		EPOCH
		ZONES	Subzones/Fm./Type Localities	
0.13	OLFOVIAN			PLEISTOCENE
0.5	MUSAIAN	QM9- <i>U. pictorum-U. bonidus</i>	Mostiștea Sand (=T5-Prut)	
		QM8- <i>D. pontocaspia-A. plicata</i>	Barboși-Babele Fm. (=T5-T4-Prut)	
0.8	NETINDAVIAN	QM7- <i>D. orassa-M. pontica</i>	Vanatori Fm. (=T6-T5-Danube)	
1.0		QM6- <i>Pseudosturta caudata</i>	Copaceni Beds	
	UZUNIAN	QM5- <i>Bogatschevia scutum</i>	Lower Căceni Fm. (=T8-Prut)	
		QM4- <i>Bogatschevia sturi</i>	Uzunu Beds	
1.6			Izvoru Beds (=T9-Danube)	
2.0	MILCOVIAN	QM3- <i>Unio apacheronicus</i>	Slatina 3	
		QM2- <i>Bogatschevia tamanensis</i>	Slatina 2 (=T10-Prut)	
2.6		QM1- <i>Unio kujalnicensis</i>	Slatina 1	
3.0	VALAHIAN	NSM12- <i>Sphaerostoma milcovensis</i>	12a- <i>E. milcovensis</i> -Valah. orientalis	PLIOCENE
		<i>Bogatschevia pretamanensis</i>	12b- <i>Halautio iconianus</i>	
3.2			12c- <i>Stenocardium elzeviri-E. motzei</i>	
	PELENDAV.	NSM11- <i>Moldavunia lenticularis</i>	11c- <i>Peledunio bica</i>	
			11b- <i>Pristinaria pristina</i>	
			11a- <i>Rytia brandei</i>	
3.7				
4.0	SIENSIAN	NSM10- <i>Malvinsina psilodonta</i>	10b- <i>Bittneriella marzoci</i>	
		<i>Viviparus bifurcatus</i>	10c- <i>Malvinsina psilodonta</i> - <i>Viviparus</i>	
4.2				
4.7	PARSCOVIAN	NSM9- <i>Horodacna rumana</i>	9b- <i>Prozodacnomya sturi</i>	PLIOCENE
		<i>Euxinocardium limanicum</i>	9c- <i>Bittneriella bittneri</i>	
			9a- <i>Pachyprionolaura haueri</i>	
			<i>Prozodacnomya stenopleura</i>	
5.0	GETIAN		8d- <i>Zamphridacna orientalis</i>	
5.25			<i>Prozodacnomya sabbai</i>	PLIOCENE
5.5			8c- <i>Pachydaena rufabilis</i>	
5.5	BOSPHELIAN	NSM8- <i>Prozodacnomya sabbai</i>	8b- <i>Phyllocardium planum</i>	PLIOCENE
6.0				

Fig. no 1 The Stratigraphic scheme of the Pliocene-Pleistocene in the Dacian Basin (Andreescu, Codrea, Lubenescu, Petculescu, Știucă. 2010)

3.1.1.1. The Getic Depression

In the Getic Depression, the Neogene is represented by Miocene and Pliocene. The Miocene begins with Aquitanian-Burdigalian formations constituted from high sea or shoreline formations. In top of these formations, there are Badenian limestone marl and the Sarmatian represented by detrital cemented or uncemented rocks, marly limestone and rarely lumachelle limestone interspersed between gravel.

The Upper Miocene is formed by Meotian and Pontian. The Meotian is developed in sandy and marly sand facies, rarely with marly limestone intercalations. The Pontian is discordantly placed over the Meotian, being constituted from a marly clay facies with rare sand and gravel intercalations. The Pontian formations have no coal beds.

The Pliocene from the Dacian Basin is represented by the Dacian and the Romanian.

The Pontian/Dacian limit is identified in Erghevița area on the western boundary of the basin, where over the Pontian bluish-gray colored marl, there are clay sands with Pontian/Dacian fauna.

The Dacian is formed by sand, clay sand, and clay with coal. It has 12 beds of coal (A-D and I-VIII beds), some of them being exploitable. The Dacian starts with the clay sands of Erghevița Valley. Over them, there is disposed a massive bed of sand which contains quartz in the north-western area of the Dacian Basin. Over this, there is a succession of clay, sandy clay and sand with coal.

The Romanian is disposed in sedimentation continuity being composed by the same types of rocks. It has in its composition, the IX-XVII coal beds, X and XII being the only exploitable ones.

The Romanian is found all over the Dacian basin, being from lithologic point of view, the same as Dacian. It is comprised of a characteristic fauna which, in some places, formed genuine “fossiliferous deposits”, some of them being constituted in paleontological reserves.

3.1.1.2. The Moesian Platform

In the platform area, the bedding of the Pliocene deposits is formed of Pontian deposits.

The Pontian outcrops on the left bank of the Danube and near the confluence on the valleys that flow into the Danube. It consists of marl clay and paper marl which contain a rich flora in the Batoți area.

The Pliocene consists of Dacian and Romanian, both composed of the same types of rocks, which in Băilești, Negoii, Giubega, Predești sectors, contain coal beds.

3.2. The Quaternary

The Quaternary is formed of new rocks from the rivers’ terraces, diluvium and landslides. It rarely contains thin coal beds.

3.2.1. The Stratigraphy of the Quaternary

It contains Pleistocene and Holocene formations by lacustrine or continental nature.

3.2.1.1. The Getic Depression

The Quaternary outcrops on the broadest areas in Oltenia. It is formed of sands and gravels of alluvial nature where, there were found, in many places, mammals remains (Stoina, Răcari, Irimești, Tetoiu).

3.2.1.2. The Moesian Platform

Due to the less rugged relief of the Bălăcița Piedmont and terraces plain, which form the Oltenian sector of the Wallachian Platform, the Quaternary blanket covers most of its surface. In the fluvial, lacustrine and eolian formations there were discovered mammals remains (Orodel, Corlățel, Țuglui, Padea, Drănic, Leu, Dîlga, Moțăței, Plenița, Măceșu de Sus, etc)

4. THE TECTONICS

From geo-tectonic point of view, Oltenia has two major structures: the Getic Depression (Carpathian Foredeep) and the Moesian Platform (Intra-Carpathian-Balkan).

The structural edifice of the depression has two flanks: internal (epeirogenic) and external separated by the Peri-Carpathian fault. Its route is more or less north of Drăgășani-Urdarii de Sus-Ciovârnavăni-Șimian.

The separation line among the two structures is represented through a flexure that follows the general lines of the alignment Dobra-Călinești-nord Melinești-Vânju Mare –Gruia (Țicleanu, Pătruțoiu 1978).

The tectonic alignment of the Getic Depression was mainly built during the Moldavian movements in Lower and Middle Sarmatian. These movements also involved the bedding, fact proved by the existence of some major faults amongst them being the Peri-Carpathian fault.

In the north-east of Oltenia, where the Neogene deposits are on the surface, those are caught in a folded structure that forms the Ocnele Mari anticline and the Olănești syncline.

The Attic movements completed the diapir structures from Olănești - Călimănești - Râmnicu Vâlcea - Ocnele Mari - Țicleni.

The sedimentation cycle was recommenced in Pliocene, in the Romanian-Lower Pleistocene stage, in the Wallachian phase.

In the western limit of the Getic Depression, the Colibași anticline is highlighted, being divided by several faults.

Another obvious tectonic element is the Vișenilor Valley fault situated on the Danube-Motru interfluvium and who continues to the south.

North of Tg. Jiu it is shaped a syncline structure continued south with an anticline on the Tg. Jiu – Săcelu line (Huică, Turculeț 1962).

In the area between Motru and Jiu there were highlighted a series of tectonic elements, the most important being, from west to east: Rovinari anticline, Vlădueni syncline, followed by Peșteana anticline (Enache 1976).

Between Jiu and Olteț, the Albeni-Seciuri anticline is highlighted (Enache 1976).

The Getic Piedmont represents the biggest piedmont unit from our country, kept in the actual relief. It was completed as a piedmont plane in the Lower Quaternary (considered as Lower Pleistocene). It was then raised and transformed into a plateau, fragmented by valleys and divided into a series of subunits.

To decipher the Quaternary evolution of this piedmont, one must first take account of the neo-tectonic movements of the Wallachian phase started in the Upper Pliocene and pursued in Lower Pleistocene and of their effects on the piedmont.

West of Gilort, these movements shaped, at the end of the Pliocene, two rows of anticline vaults (Roșița - Strâmba - Rovinari - Tâlvești și Strehaia - Negomir - Peșteana) and the synclines between them Vlădueni și Plopșoru), corresponding to some subsidence areas.

The tectonic map of the Pliocene coal deposits between Filiași and Băilești, with isobaths at the level of the main lignite bed, marks the constant orientation of the major faults on northwest-southeast or west-east direction: Motru fault, Raznic fault and Desnățui fault. It is to be remarked the molding of Neogene, even Pliocene sediments over the post-Cretaceous relief.

In the Inferior Pleistocene, as a result of the continuous elevation of the Meridional Carpathians and of the stress generated by this elevation over the northern side of the Getic Depression, the folding continued between Bistrița (Vâlcea) and Gilort, emphasizing the structure into two parallel anticlines, determining the elevation with a large bulge in Slătioara anticline, fact that brought to the concentration of the anticline folds and the disappearance of the synclines between them.

In the meantime, a piedmont plane was formed, gradually covered by the detrital products of the rivers flowing from the mountains.

The main water flows that came from the Meridional Carpathians: Olt, Olteț, Jiu and Motru forced their way at their feet where it deposited gravel and sand forming piedmont glacis.

The movements from Pasadena phase are highlighted by the bulging of the old, high and superior terraces of the Jiu at Rovinari, highly developed on the left side of this river (Feru and al, 1963). The bulging axis of the three terraces corresponds to the axis of the Rovinari anticline, which restarted his elevation in this neo-tectonic phase.

South of the marginal sector of the External Flank and in the platform's structure, the covering Miocene-Pliocene deposits are more monotonous, with wide undulations, with mild inclined flanks of 2-7°. These are, generally speaking, false structures, of different compaction and represent the effects of the pre-Neogene recession effects.

The Neogene deposits on the External Flank and Platform are affected by low amplitude and reduced frequency faults.

In the Middle Pleistocene, the Pasadena phase movements produced a reactivation of the Balș-Leu-Dioști elevation, which forced the Olt River to move to the east and the Jiu River to move to the west. Therefore, the Jiu River has a system of terraces only on the eastern versant starting with the confluence with Amaradia, while the Olt River has terraces only on the western versant. In the same time, there was a change in the flow direction of the Jiu River, from northwest-southeast to the south and the Danube's movement to the south, west side of the Jiu.

The movement to the southwest of the Danube's flow starting with Middle Pleistocene is attributed to the elevation movements that affected the whole plane territory, with mild tilting movements to the south.

5. PROTECTED NATURAL PALEONTOLOGICAL PLACES FROM THE PLIOCENE OF OLTENIA

Among the paleontological reserves from Oltenia, the most spectacular are the ones from Pliocene formations, as for the size, but mostly because of the abundance of species and individuals. These reserves are developed in weakly consistent rocks which, in relatively short time, change their morphology due to natural factors, but in most cases due to human activity. The human interventions can concur to the disappearance of the paleontological sites, but there were many cases when, because of the mineral resources exploitation, there were identified new sites which subsequently have become protected places.

5.1. Bucovăț fossiliferous place

Placement

Bucovăț is situated 6 km from the city of Craiova, on the county road DJ522 Craiova - Cetate.

The protected area is situated in the village Bucovăț, on DC 97 going to the Cârligiei village, about 200 m from the intersection with DJ 552, on the property of Viorel Cerneanu.

The outcrop is a vertical opening of about 40 m in height, predominantly sandy, on the western side of Cârligiei Hill.

Dates from the history of the place

The fossiliferous deposit from Bucovăț was reported for the first time by the naturalists from Sibiu, L. Bielz and D. Czekelius in the year 1849.

The research over the fauna and its position in the stratigraphic scale was made subsequently by one of the pioneers of Romanian paleontology, Radu Porumbaru.

In the year 1880, R. Porumbaru reported in Bucovăț a rich fossiliferous deposit of lamellibranchiate and gastropods which he attributed to the Levantine (the anterior name of the Romanian) and from which he delivered for examination the determined fossils to the great paleontologist Tournouër. This one published in the same year, the study "*Conchyliorum fluviatillium fossilium, in stratis tertiariis superioribus Rumaniae colectorum, nove species*" making a remark over the new species found in Bucovăț. We can mention *Unio craiovensis* Tourn.

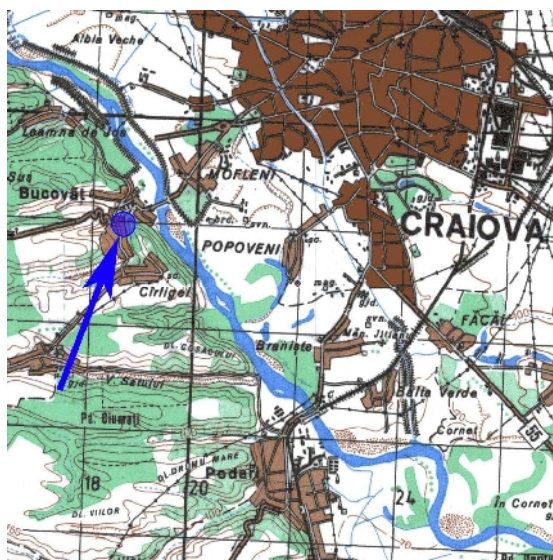


Fig. no. 2 The location of Bucovăț fossiliferous place

In 1881, R. Porumbaru published in Paris, "*Etude géologique des environs de Craiova, parcours Bucovatzu-Creztesci*", where he described in detail, the profile found in the right bank

of Jiu River at about 200 m downstream of Bucovăț bridge. This profile became a classic for the Romanian fauna of the Dacian Basin.

Sabba Ștefănescu (1881) in „*Studiu geologic asupra împrejurimilor Craiovei*” proposed the fossiliferous opening from Bucovăț as the stratotype for the Romanian.

The same author published in 1889 in the Romanian Geological Bureau Yearbook “Memoriu relativ la geologia județului Dolju”, which shows that the Bucovăț profile extends to Leamna-Crețești describing mollusks fauna of these outcrops.

The mollusks species known until then are presented and described by W. Wenz in the paleontological album “*Die Mollucken des Pliozäns der rumänischen Erdöl-Gebiete*”, published in Frankfurt am Main in the year 1942.

In the year 1967, when there were excavations for the sand that was used to the building of the central stadium in Craiova, the opening extended and it was arranged as a natural monument. This opening was covered in time by material resulted from successive landslides and in part by vegetation.

Subsequently a number of researchers have developed studies on the Bucovăț fossiliferous place. Among these we include: Ana Malos (1969), I. Firu (1971).

In the year 1976 in the study “**Rezervații naturale geologice din România**”, published in Editura Tehnică signed by M. Bleahu, V. Brădescu and Fl. Marinescu, the Bucovăț fossiliferous point is reported.

In the study „Rezervații și monumente ale naturii din Oltenia”, B. Bobîrnac, M. Popescu and D. Cîrțu described the Bucovăț fossiliferous site as a “**famous and known place for the wealth of bivalve fossils**”.

In the year 2000, about 600 m south of the opening on the eastern slope of the road that leads to Calafat through Cetate, a new excavation for the construction of a dwelling owned by Viorel Cerneanu revealed again the characteristic lumachelle bed. The new opening was researched by a collective from the Oltenia Museum Enache, Popescu, Diaconu 2001) who inventoried the local fauna from this outcrop.

The Bucovăț fossiliferous place became protected area of local interest only in the year 1994 by Dolj Council Decision No 26/04.11.1994.

It became a fossiliferous place of national importance by Law 5/2000-annex III, published in the Official Gazette no. 152/12.04.2000.

The stratigraphic succession

The classic outcrop from Bucovăț, as described by I. Ionescu Argetoia (1918) presents the following stratigraphic succession:

- blue marls;
- weakly fossilized sands with 1 m thickness, with a rich fossil sandy lumachelle, made of bivalves and gastropods shells;
- alternance of fossiliferous sands and gravels, interlayer of sandstones and two fossil soils of at most 10 cm thickness;
- a thin lignite bed of 15-20 m thick;
- yellow marls 2-4 m thick, rich in fossils especially in melanopsides and *Cuneopsidea porumbarui*, *C. sculpta*, *C. iconomianus* și *Rytia bielzi*;
- Quaternary deposits formed by gravels over which there is a loess bed with limestone nodules.

The paleontological content

The paleontological inventory contains 62 species from which 34 are lamellibranchiate and 28 are gastropods.

The scientific importance

The Bucovăț fauna with “carved unionidae”, served to separate the top stage of the Neogene, Romanian stage of Oltenia, because of its great wealth and extraordinary content. For this reason, the opening from Bucovat constitutes the paleontological stratotype of this stage.

The protected area has 4.00 hectares.

5.2. Drănic fossiliferous place

Placement

The Drănic settlement is located at about 32 km south of city of Craiova.

The Drănic fossiliferous place is located on the right side of the Jiu Valley. The access is made by DJ 561 road to Drănic settlement and then by a local road to the left that descends in the Jiu meadow. There are three successive openings (Drănic 1, 2, 3), north of the settlement, where the Jiu River meanders near Buzduganu and Rojișteștea puddles.

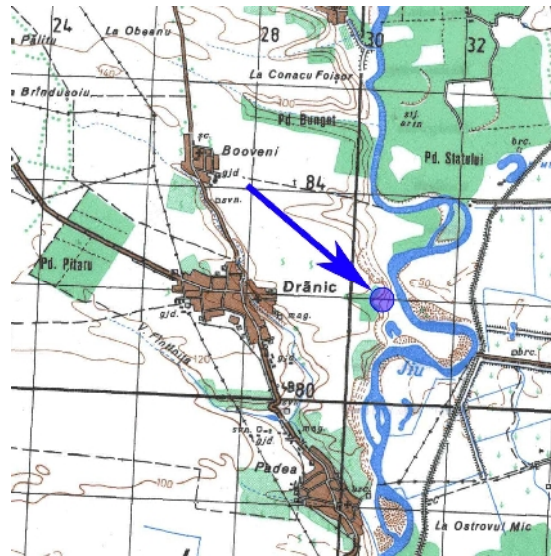


Fig. no. 3 The location of Drănic fossiliferous place

Dates from the history of the place

The steep from the right side of the Jiu near Drănic where the fossiliferous site is placed, was first mentioned in 1971 by T. Bandrabur in his doctoral dissertation.

The description of the mollusks fauna from Drănic was analyzed in 1990 by Enciu and Andreescu and in 1999, Rădulescu and others, who researched in this paleontological place, the micro-mammals fauna, published the micro-mammals fauna set from beds: Drănic 0, Drănic 1, Drănic 2 and Drănic 3. In 2000, Enache, analyzing the gastropods set resulted from the sifting effectuated for the micro-mammals, published the results materialized in the identification of 17 species of small gastropods.

The Drănic fossiliferous place became protected area of local interest in the year 1994 by Dolj County Council Decision no. 26/04.11.1994.

It became fossiliferous place of national interest by Law 5/2000-annex III, published in the Official Gazette no. 152/12.04.2000.

The stratigraphic succession

Over the sandy deposits formed by Dacian clays and Dacian sandy clays, there are fossiliferous yellow sands (three mollusks lumachelle bed) belonging to the Romanian that ends with a fossil soil bed. The stratigraphic column ends with Pleistocene deposits made from white sands with fine gravels over which there are placed clay loess yellow sands, with limestone concretions.

The paleontological content

There are four fossiliferous beds (Drănic 0, 1, 2, 3) situated in the high bank of the Jiu River. These have the following composition: Drănic 0 - 10 species of micro-mammals, Drănic 1 - 46 species of which 23 bivalve species, 14 gastropods and 9 micro-mammals, Drănic 2 - 54 species of which 14 bivalve species, 26 gastropods and 14 micro-mammals and Drănic 3 with 44 species of which 18 species of bivalves, 19 gastropods and 7 micro-mammals.

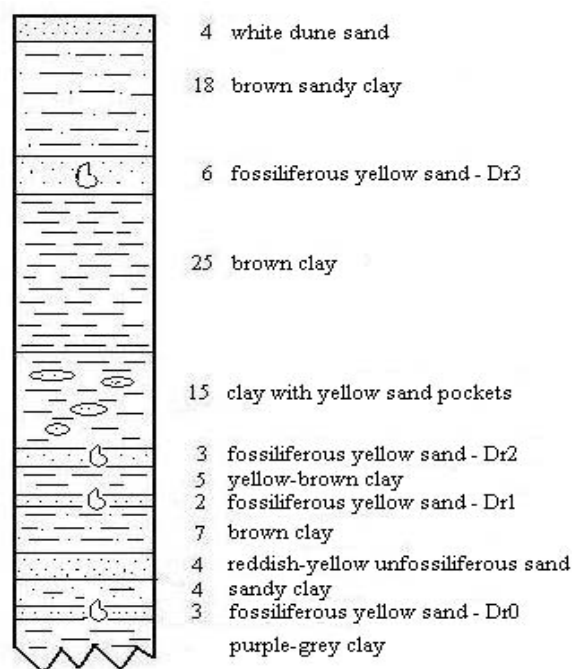


Fig. no. 4 The synthetic litho-stratigraphic column of Drănic fossiliferous place

The scientific importance

The protected paleontological area from Drănic constitutes the most southern point with Romanian fauna from Oltenia, concentrated in very rich lumachelles, as for mollusks fauna, but also for micro-mammals.

The protected area is 6.00 ha.

5.3. Groșerea-Aninoasa fossiliferous place

Placement

The Groșerea fossiliferous place is located in Aninoasa, Gorj County.

In the area of Aninoasa there are two fossiliferous points: one that is declared protected area and it is located in Groșerea village and one that is located in Aninoasa village that is not declared as protected area.

The access to the Groșerea site is made by the road DJ 662 Aninoasa-Capu Dealului and then by the local road to Sterpoia village. After about 1.5 km from the intersection one reaches the village church, the point being located behind this one in an opening of about 30 m in height.

The relief of the area is dominated by the hills between the Gilort River and its right affluent, the Groșerea Brook, from which a main saddle, Grăjdana Hill, oriented northwest-southeast, descends gently to the confluence of these flows. Streaks depart from the main saddle, formed by the torrential valleys and torrents that gravitate towards Aninoasa, respectively towards the county road from the Gilort Valley, like Văcăroia Hill or Poncea Hill and others towards the Groșerea Brook, like Cornului Hill or Rușchiului Hill.

The paleontological content

From the two fossiliferous points, we have collected 15 species from which 8 were bivalves, 6 gastropods and 1 mammal.

In the Aninoasa area, there were cited in different stages a series of mammal remains.

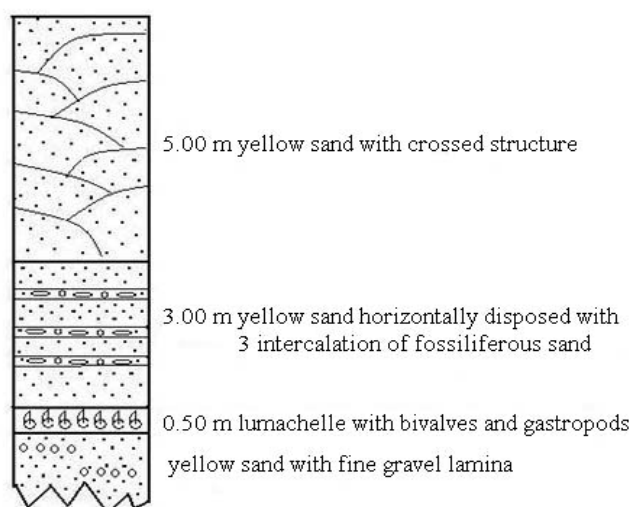


Fig. no. 8 Profile through the outcrop of Aninoasa

The fossiliferous bed in Aninoasa is formed by grit reddish sand, with frequent elements of gravel and intercalations of weakly consolidated sandstones.

The deposits that form the positive relief over the Gilort Valley are of Romanian stage, made largely from yellow, white or gray sands, with thin beds or laminae of fine gravels, with mollusks fossiliferous beds that alternate especially in the lower side with clays or sandy clays with rusty stripes.

The scientific importance

Bearing in mind that the new fossiliferous place from Aninoasa found at about 2 km distance from the protected area, that in Groșerea there were found fossiliferous remains of mammals and that in the new location, the fossiliferous bed is thicker and has higher species richness, we consider that the importance for the Romanian of the fossiliferous place is maintained and keeping it as a protected area is recommended if both outcrops are included.

The area of protection is 1 ha for each outcrop.

5.4. Săulești fossiliferous place

Location

The Săulești fossiliferous place is located in Săulești, Purcaru village, Gorj County. From geomorphologic point of view, the locality is situated in the southeastern area of Jiu Hills, on the right side of Gilort River.

To the fossiliferous place, one can arrive by the road DJ 661 Filiași-Târgu Cărbunești to Săulești and then by the road DC 46 to Purcaru by the church, where one can follow a torrential valley to the spring.

The fossiliferous outcrops are one after another on the narrow torrential valley that flows into Purcaru Brook, near the church. The valley is between two parallel heights which gradually descend from Bibeștilor Hill to the brook.

The stratigraphic succession

The deposits that arise over the base bed represented by the Gilort's water, belong to the Jiu-Motru formation, in its superior side, made of clays and sandy gray clays, over which there are placed reddish sands, then yellow and white, with intercalations of clay sands with a fossiliferous mollusks bed, Romanian stage, over which lay sandy clays with a thin intercalation of coal of 10-30 cm thickness. The respective deposits are covered by Quaternary loess deposits and, on the slopes, by proluvial deposits and lots of landslides in majority stabilized.



Fig. no. 9 The location of Săulești fossiliferous place

The scientific importance

The fossiliferous place has a reduced importance because of the fact that the existent forms are common and weakly preserved. The fossiliferous bed is thin, of 3-5 cm and discontinuous. The paleontological content is of only two species of the same genus, common to all the outcrops that contain that fossiliferous bed. It is unrepresentative and unimportant.

The protected area has 1 ha.

5.5. Valea Deșului fossiliferous place

Location

Valea Deșului fossiliferous place is located in Vladimir, Valea Deșului village, Gorj County. From geomorphologic point of view, the locality is located on the left side of Gilort River in the southwestern area of Olteț Piedmont.

One can arrive to the fossiliferous place, by the road DJ 661 Filiași-Târgu Cărbunești to the intersection with Vladimir, then by the road DJ 661A that passes through Andreești, Vladimir, Valea Deșului to road to Totea de Hurezani. After about 1.2 km, in the left side of the road the fossiliferous bed can be seen.

The historic of the research

Valea Deșului fossiliferous place, known initially as Vladimiru outcrop, was identified by the geologist Gheorghe Enache and mentioned for the first time in 1981 in the study "Fauna de moluște a depozitelor cu ligniți din Oltenia" by Pană, Enache and Andreescu.

From geomorphologic point of view, Vladimir locality is located in the area of the Olteț Piedmont Hills.

The paleontological content was described by Pană, Enache and Andreescu in 1981. It has 12 species from which 6 are bivalves and 6 gastropods.

In the time being, the outcrop presented in the year 1981 is partially closed. Only the superior bed is opened in the slope of the road to Totea de Amaradia. From this bed we have collected 4 forms of bivalves and 3 of gastropods.

The scientific importance

The fauna from Valea Deșului is representative for the Romanian formations. It brings a series of information about the spreading of the Romanian in the Getic Depression and about the evolution of the Pliocene lake.

The area of protection is 1 ha.

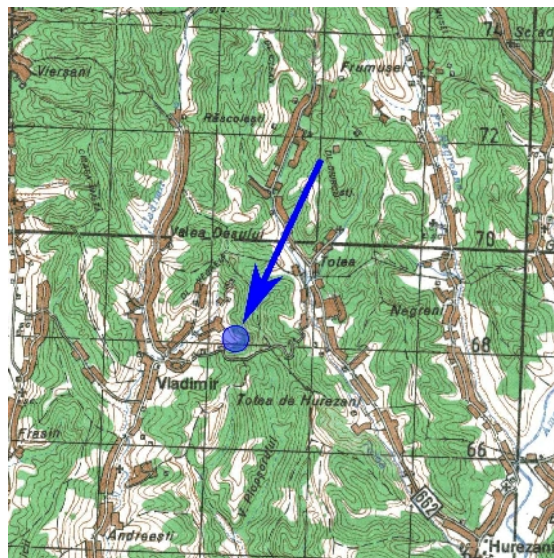


Fig. no. 10 The location of Valea Deșului fossiliferous place

The stratigraphic succession (after Pană, Enache, Andreescu 1981)

In the area of Vladimiru locality, on Valea Deșului, on Surdumoale Torrent and on Cerului Brook there is known in geological literature the following succession:

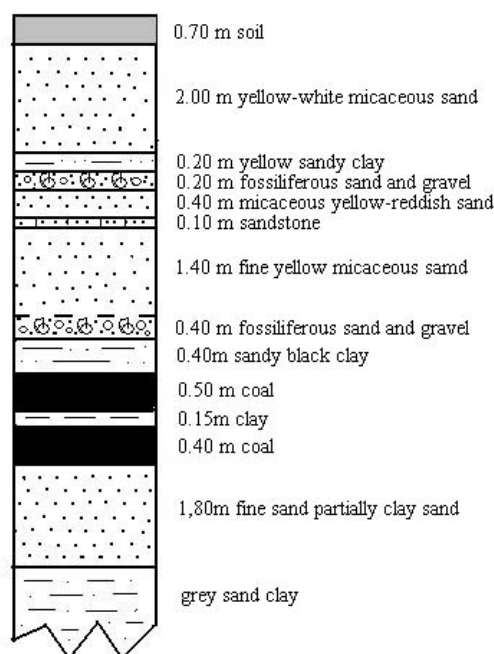


Fig. no. 11 The litho-stratigraphic column of Valea Deșului place

5.6. Gârbovu fossiliferous place

Location and access

The fossiliferous place is located in the territory of the Gârbovu locality, village that belongs to the city of Turceni, Gorj County.

From geomorphologic point of view, Turceni is located in the southern area of Jiu Hills, at the confluence of Jiu with Jițul Mare Brook.

The access to Turceni is made by the road DJ 674 Turceni-Strâmba de Jiu to the Gârbovu village. From there to the fossiliferous place one can go to the road DC 72B.

The place has only one fossiliferous bed identified in fine sands with rare elements of fine gravel that follows the Manaful Valley located between Manafu Height to the north and Piatra Hill to the south.

The bed is discontinuous and can be followed after the last houses from the village, in the proximity of the left slope of the valley.

Lamellibranchiate and fragments of weekly preserved shells appear in landslide areas, in a higher number in the spring area of the valley.

The stratigraphic succession

The geological deposits located over the erosion base belong to the Upper Pliocene, Romanian and Quaternary stages.

The yellow-white sand deposits of the Romanian are found little over the running waters Jiu and Jilț, with the fossiliferous regional bed known under the name of “carved unionidae” bed and they sit over clays and sandy clays. A ravine of landslide which opened the fossiliferous outcrop was covered by landslides and vegetation so that the parts of fossils are only found in the landslide area. This is located in the terminal part of the Manaful Valley. The valley is seasonal being most of the time dry. Fragments of fossil shells appear in the sandy thalweg.

The paleontological content

We have collected and determined 2 species of bivalves and one gastropod, every one of them being common.



Fig. no. 12 The location of Gârbovu fossiliferous place

The scientific importance

The place has a reduced scientific importance due to the closing of the protected fossiliferous outcrop by the deluvial material. Because of this, the preservation as a protected area is not possible also due to the fact that on the opposed slope of the hill, in Scorșu, there is an outcrop with the same fossiliferous bed, but much thicker and rich in species situated in a less vulnerable place to weather and landslides.

The protected area has 1 ha.

5.7. Pietrele Roșii fossiliferous place

Location

The Pietrele Roșii fossiliferous place is located in Husnicioara locality, Mehedinți County. There are two outcrops from which the Romanian fauna was described. One is placed in an opening over the ex-mine Husnicioara II, while the second is placed in the vicinity of the road that leads to West Husnicioara quarry.

The access is done by the road DJ 607A Cerneți-Husnicioara. The first outcrop was placed at about 300 m from the intersection with the quarry road in the right slope of the road in the vicinity of Copcii Valley and the second was placed in a landslide located at the edge of the forest on the left side of the quarry road after about 100 m from the intersection with DJ607A.

The outcrop from DJ607A is the only one included in the Law 5/2000.

From geomorphologic point of view, Husnicioara locality is located in the central area of Coșuștea Hills, unit of the Getic Piedmont. The protected area was found at the western limit of the Coșuștea Hills with the Severin Depression, dominated by the Oprănești-Cernata Height from which towards the Severin Depression it was formed a net of valleys among which Copcii Valley is found on the right slope of it.

The fossiliferous place was described for the first time in 1987 by Victoria Georgescu and published in the study „*Punctul fosilifer Pietrele Roșii din bazinul minier Husnicioara*“.

In 1994, C. Meilescu presented the stratigraphy of this fossiliferous place and in the year 2000, I Pătruțoiu identified the outcrop from the road to the quarry from which he cited new species of mollusks found in that period of time.

The fossiliferous bed from DJ 607A outcrop was included in a fine and medium sand bed with numerous areas with weakly consolidated sandstones.

The bed from the quarry road was disposed just under the soil cover and it was 3.0-3.5 m thick. The shells of squashed, twisted, flattened *Viviparus* and very rare whole well preserved specimens were predominant. The lamellibranchiate were very rare and with fragmented shells.



Fig. no. 13 The location of Pietrele Roșii fossiliferous place

The geology of the area

The deposits that form the Coșuștea Hills are made of Upper Miocene deposits in the base, over which the Pliocene and Quaternary deposits lay.

The Upper Miocene, made of Upper Pontian deposits is represented by green and purple sandy clays that outcrop at the bottom of Copcii Valley in the vicinity of Șimian locality.

Next, there are Dacian deposits made of white quartz sand without fossils, yellow sands with lignite intercalations. The superior lignite beds (I-IV) are exploited in the Husnicioara quarry. The IV bed was exploited in the past in Copcii Valley mine. Next, the Romanian is made of clays and yellow sandy clays then by fossiliferous sands and fine gravels, that outcrop in Copcii Valley. The succession ends with Quaternary heterogeneous sands and loess deposits.

The actual situation

From the two outcrops, none is identifiable.

The point from the road's slope DJ 607A was closed by a wall of support due to landslides that affected the road.

The point from the quarry road disappeared due to successive landslides. The area was covered with grassy vegetation, making it impossible to identify the fossil bed.

6. THE ANALYSIS OF THE PROTECTED PLIOCENE PALEONTOLOGICAL AREAS

In order to set up a protected area, a proposal is necessary in this regard. This may be done by the authorities of the central and local administration, various institutions and, very importantly, by non-governmental organizations and natural entities. In order to create a natural protected area, a scientific documentation endorsed by the Romanian Academy must be submitted to the County or Local Council.

A first observation imposed refers to the age of the deposits from these fossiliferous locations. All of them are quartered into deposits belonging to the last stage of Pliocene, the Romanian and they belong to the paleontological area NSM11, to the same fauna level with lamellibranchiate and gastropods known under the name of the horizon with “carved unionidae”, a reason why the paleontological associations are similar.

The thickness and number of the fossiliferous levels vary greatly from one fossiliferous location to another. The most important fossiliferous levels are in Podari and Drănic, the others being generally thinner, and at Gârbovu, Săulești and Pietrele Roșii there is one thin fossiliferous level.

The species discovered in each of the aforementioned fossiliferous locations (see the attached drawings), indicate that only at Bucovăț, Drănic and Groșerea the fauna associations include a richer fauna from the one known at that respective fauna level, in Săulești and Gârbovu the association being formed only by two or three species.

The formation of the Pliocene and Quaternary deposits of soft rocks and some unconsolidated (sands and gravels) is characteristic, a situation that makes the natural fossiliferous openings to be very vulnerable to external agents. Thusly, the outcrops opened by the watercourses may be destroyed by them during floods and if the course of the river deviates on that bank.

Another category of Pliocene or Quaternary fossiliferous outcrops are the result of anthropic activities: sand or gravel pits and in the last decades, due to day exploitation of lignite in large pits.

In many cases, the exploitation continues passing over the fossiliferous levels, which are not identified. In the case of mammal remnants, the probability of identifying them is even smaller.

A less important category consists in the openings performed for the so-called adopted holes made near the constructions works.

This vulnerability which is more emphasized in external agents of the Pliocene or Quaternary fossiliferous outcrops leads to a need in periodically analyzing on site the paleontological areas protected by law, located in such deposits.

In the Pliocene fossiliferous places from Oltenia, which are protected the law; the fauna content has been analyzed in the following situation:

Fossiliferous place	Number of species			
	Total	Bivalves	Gastropods	Mammals or Micro-mammals
2390 Bucovăț	62	34	28	-
2391 Drănic	133	35	58	40
2447 Groșerea*	21	9	6	6
2448 Gârbovu	3	3	-	-
2450 Săulești	2	2	-	-
2451 Valea Deșului	12	6	6	-

* for Groșerea fossiliferous place there were also inventoried the species of mammals cited in the area

Fossiliferous place	Species percent			
	Total (%)	Bivalves (%)	Gastropods (%)	Mammals or Micro-mammals (%)
2390 Bucovăț	100	54,84	45,16	-
2391 Drănic	100	26,31	43,61	30,08
2447 Groșerea*	100	42,86	28,57	28,57
2448 Gârbovu	100	100	-	-
2450 Săulești	100	100	-	-
2451 Valea Deșului	100	50	50	-

Hereinafter, the graphical representations of the fossiliferous fauna percent content from the main protected fossiliferous places from Oltenia are given.

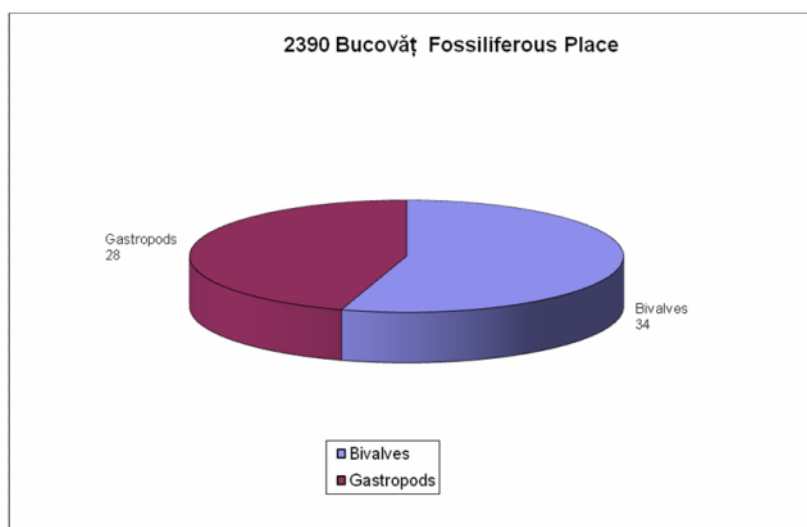


Fig. no. 14 The fauna content from Bucovăț fossiliferous place

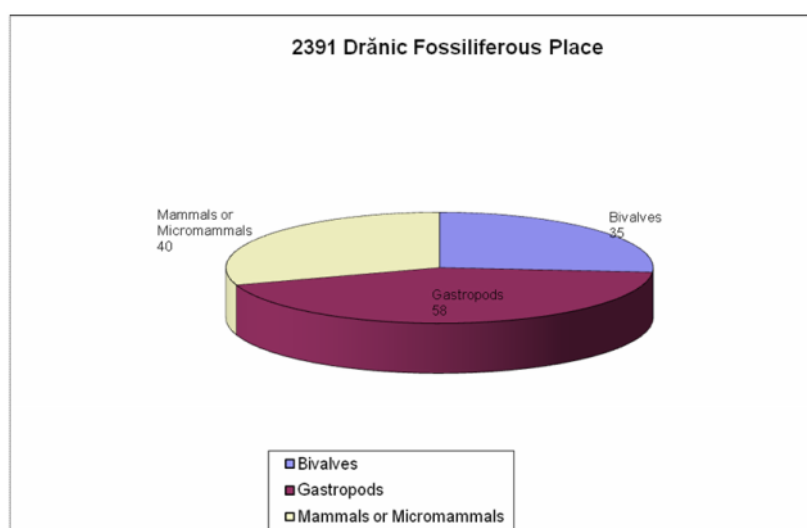


Fig. no. 15 The fauna content from Drănic fossiliferous place

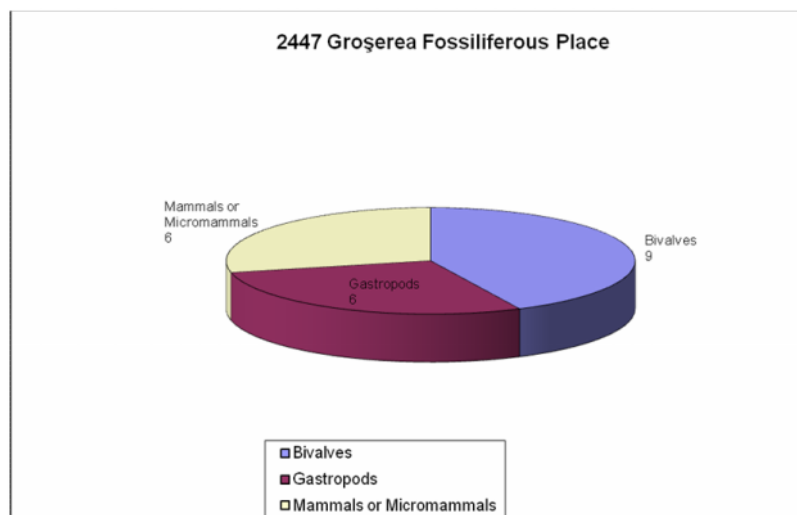


Fig. no. 16 The fauna content from Groșerea fossiliferous place

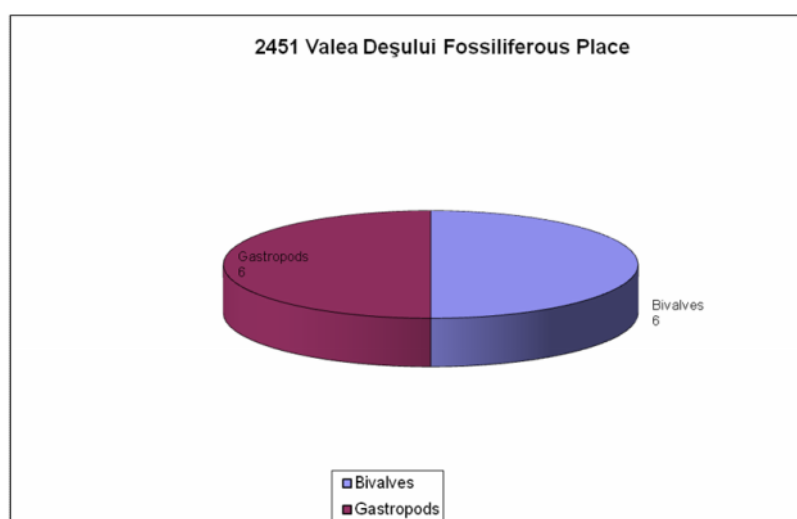


Fig. no. 17 The fauna content from Valea Deșului fossiliferous place

The thorough analysis of each Pliocene fossiliferous location in Oltenia protected by law allows the following findings:

The fossiliferous location of Bucovăț, which is very important from a scientific point of view, it has been inaccessible for a few decades due to the collapse of material and its becoming overgrown with grass, covering the faunistic level. In 1967, upon excavations for sand, the opening was enlarged, the fossiliferous outcrop was again brought to the light on a larger front, and after just 20 years, it became non-visitable again, being covered once more by slope material. In 2000, when a new excavation was done nearby for the construction of a building, the very thick and faunistically rich fossiliferous level returned again to the surface.

The fossiliferous location of Drănic on the right versant of the Jiul River, which has been ignored for a very long time as it had no access routes, was discovered in 1971 by T. Bandrabur and paleontologically analysed much later (Enciu, Andreescu, 1990, Rădulescu and al.1999).

Due to the height of the slope (around 50m) separating the piedmont from the Jiul Meadow and also due to the location of the fossiliferous levels on its upper part, this fossiliferous place that is also important for the faunistic content of molluscs and micromammals is less vulnerable to bad weather, the landslides created affecting only the lower part of the versant.

The fossiliferous location of Groserea-Aninoasa, located in the gully opening a landslide, which was subsequently used as a place for sampling the sand for various human

activities, represents one fossiliferous level of small thickness, located on the lower part of the opening.

Due to sand sampling by locals, the fossiliferous location indicates great vulnerability for maintaining the integrity of this outcrop.

It is also worth highlighting that this thin fossiliferous level, with few species and remnants of fossils poorly preserved is not of the same scientific importance as it was initially.

On our movement on site, we however found out a new opening in **Aninoasa** near the county road across the church, and it was much richer from a fossiliferous point of view and with especially easy access. We also discovered the remnants of a cervid's horn in this outcrop, which makes us that other remnants may also appear in time. Without accurately establishing the instances, remnants of mammals are cited in the area of Aninoasa.

Being located in the very neighbourhood of the county road, it can be kept under observation by the local authorities.

The remnants of mammals from Aninoasa and the fact that the area is not thoroughly researched recommend that the fossiliferous location is maintained as an area protected by law, but also including the fossiliferous location with molluscs near the church in Aninoasa.

The fossiliferous location of Gârbovu is currently listed as inexistent, the opening being clogged by landslides. Fossile remnants could be collected only from the slid material. This fossiliferous point is represented by few species of molluscs, so that its keeping into the category of protected areas is not sustained from a scientific point of view. Concurrently, it must be stated that the same fossiliferous level with a thickness of a few meters and rich in species is located on the other slope of the hill, at Scorusu.

The fossiliferous location of Saulesti does not currently exist anymore, being entirely covered by diluvium and vegetation deposits. It is still partially visible only on the bed of the valley. Other fossils have not been found, except from one kind: *Pristinunio*, a form very widely spread into all Romanian fossiliferous outcrops with "sculptured unionidae".

The fossiliferous location of Valea Desului It is currently deteriorated, by processing the land for placing buildings, and the outcrops are currently visible only on the side of the road going from Valea Desului to Totea de Hurezeni. We deem that the current situation of the place is not compatible anymore with the status of protected area.

The fossiliferous location of Pietrele Roșii from the upper basin of Husnicioara stream cannot be identified anymore due to the landslides and some anthropic activities. We deem it is not necessary anymore to have the status of a protected area.

7. PROPOSALS OF NEW PROTECTED PALEONTOLOGICAL AREAS

Oltenia has a large paleontological inventory, especially in the Pliocene formations. A series of classic or new openings unveiled with different occasions offer important "fossiliferous deposits", real open air paleontological museums. Spectacular openings like the ones in Valea Mare-Bengești, Podari or Bâlta came into notice of the researchers who carefully analyzed them and published complete fauna inventories especially of mollusks but micro-mammals too.

A special place is taken by the fossiliferous places from Valea Ergheviței and Leu, the first one for the passing fauna from Pontian to Dacian, the second one for the Quaternary mammal fauna.

The richness in genera and individuals from these outcrops, their stratigraphic succession of Pliocene and Quaternary, entitled us to consider that these sites can become protected areas of national interest.

Below, we will describe a series of 7 fossiliferous places from Mehedinți, Gorj and Dolj Counties which we propose as paleontological protected places by various laws.

7.1. Valea Ergheviței fossiliferous place

Location and access

It is located in Șimian locality, Erghevița village, Mehedinți County. Valea Ergheviței is a seasonal valley that crosses from east to west the village with the same name and flows into the Danube close to Bistrița village from Hinova locality. After about 800 m from the exit of the village, there is an opening of 6-7 m where the Lower Dacian fauna is quartered.

The access is done by the road DN 6 Drobeta Tr. Severin-Strehaia. At about 5 km from the exit from Șimian, a road to the right leads to Erghevița village. The road crosses the locality and then goes parallel with the valley. At about 1500 m from the intersection with DN 6 on the left side, the outcrop with fossiliferous clay sand is identified with some difficulty because of the vegetation.

The research history of the Valea Erghevița fossiliferous place

Valea Erghevița point was identified in the year 1998 by I. Pătruțoiu, in a pack of fine grey-green clay sands that sit directly over grey marls of Bosphorian stage (that outcrops in the thalweg of Erghevița Valley). In these sands it was identified a rich fauna from the bedding of the Getian (Pătruțoiu I. 2000). Subsequently, the materials were determined and published in the study „Date noi privind stabilirea limitei Pontian-Dacian în vestul Bazinului Dacic”.

The Erghevița village is located in the western area of Coșuștea Hills close to the Danube meadow.

The characteristics of the relief are the Erghevița Hills and the valley with the same name that gather the waters in a small bassinette where the locality is placed. The hills are in most part formed by white quartz sand from the Dacian bedding. For this reason there are lots of ravines and abrupt gulches of tens meter in height that open the Dacian formations to the Pontian limit.

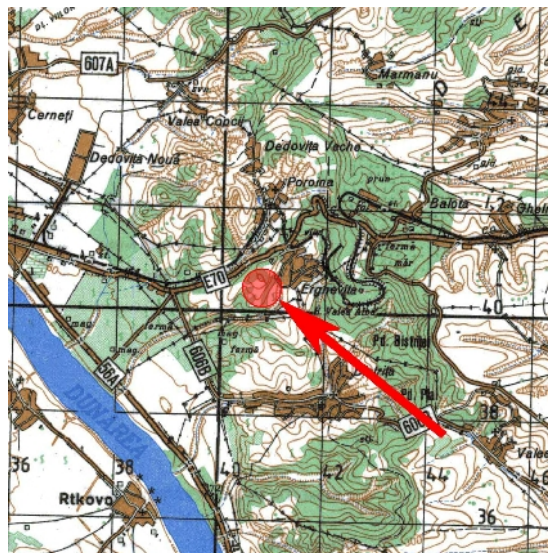


Fig. no. 18 The location of Valea Erghevița fossiliferous place

The stratigraphic succession

At about 800 m, on the Erghevița Valley, downstream of the village with the same name, on the left side of the brook a pack of fine gray-yellow clay sands is found. It lays over the grey-bluish marls of Bosphorian stage, that outcrop also, south of the Bistrița village, from where Ioana Pană, C. Enache and I. Andreescu (1981), described a fauna with *Dreissnomya aperta* (DESH.), *Phyllocardium planum planum* (DESH.), *Plagiodacna arcaiformis* (WENZ), *Pontalmyra subcarinata* (DESH.), regularly found in Bosphorian.

We consider that the sands pack from Erghevița Valley cited and investigated by us it synchronous with the “Cocorova sands”.

In Erghevița area, these sands also contain a transition fauna with numerous Dacian elements: *Prosodacna longiuscula obliqua* EBERZIN, *Prososthenia radmanesti* (FUCHS), *Prosodacnomya cf stenopleura* (SABBA), *Viviparus argesiensis* SABBA, *Viviparus achatinoides glogovensis* (SABBA), etc. among other existent forms from the Upper Pontian: *Plagiodacna tohanensis* PAPAIANOPOL, *Plagiodacna auingeri* (FUCH), *Pontalmyra otiosa* ANDREESCU, *Pontalmyra extensa* PAPAIANOPOL, etc. and common forms: *Dreissena rostriformis* (DESH), *Phylocardium planum planum* (DESH), *Pontalmira subcarinata* (DESH), *Prosodacnomya stenopleura* (SABBA), etc.

It is to mention the total absence of *Dreissenomya aperta* (DESH.), abundant form in the clay bluish sands from the bedding.

In these conditions, we consider that the Pontian-Dacian limit is found over the grey bluish marls of Bosphorian stage and under the “Erghevița sands” synchronous with the “Cocorova sands”. The argument for the position of the limit is the arrival of new Dacian fauna elements.

Teisseyre (1907), Fl. Marinescu (1995) shows that in Dacian, in the Dacian Basin “we assist at the synchronous development of two types of fauna: a brackish water fauna (dominated by limnocardium and congeria) and a fresh water fauna (dominated by viviparus and unionidae)”.

In the brackish water fauna of the Dacian, there are:

- **species found only in Dacian** (*Horiocardna*, *Euxinocardium*, *Pachidacna*);
- **species with maximum propagation in Dacian** (*Parapachydacna*, *Zamphiridacna*, *Stylodacna*, *Psilodon* și *Dacicardium*);
- **specii found in Pontian and also in Dacian** (*Phyllocardium*, *Tauricardium*, *Euxinocardium*, *Plagiodacna*, *Pontalmyra*, *Pseudocatillus*, *Chartoconcha*, *Prosodacnomya*).

As for the fresh water mollusks, the most frequent are the unionidae and viviparus, with an important frequency for *Psilunio* and *Rumanunio*.

In the Upper Dacian, it is to be remarked the first arrival of the genus *Pristinunio* (Fl. Marinescu 1995).

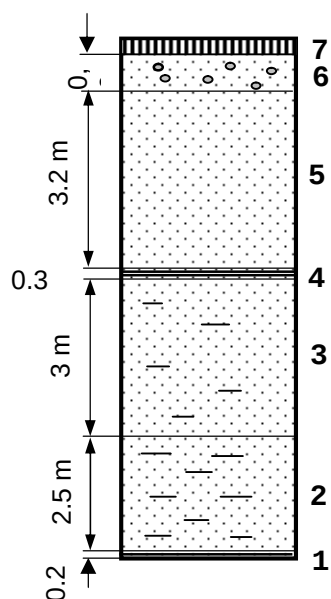


Fig. no. 19 The outcrop with Dacian fauna from Valea Ergheviței

1. 0.2 m Bosphorian sandy grey-bluish marl
2. 2.5 m white-yellowish clay sand with rare fossils
3. 3 m yellow clay sand rich in fossils
4. 0.3 m reddish sandy clay
5. 3.2 m fine white-yellow sand with brown areas
6. 0.6 m white-yellow sand with gravel elements
7. 0.4 m vegetal soil

Having in mind that the fauna from Danube-Motru-Jiu area, we did not split the Dacian in their two sub-stages Getian and Parscovian, because us and the other researchers state that in that sector there is not a section where the fauna to be continuous form the lower limit to the upper one for this stage, lots of stratigraphic intervals being free of fauna. We may also add the

alternance of brackish water deposits with cardicea with limmnic, deltaic and marsh deposits with unionidae and viviparus, especially in the upper part of the Dacian where these deposits alternate more often.

The paleontological content

From paleontological point of view, the Valea Erghevița outcrop has 22 species form which 18 are bivalves and 4 gastropods.

The scientific importance

The importance of this fossiliferous place is the fact that it is the only site where the Pontian/Dacian limit from the western Dacian Basin can be found (Pătruțoiu, Enache 2000). The fossiliferous place has the advantage of a location hidden by vegetation and relatively hard accessible.

The fauna from Valea Erghevița completes the paleontological inventory that has Pontian robust forms, full-grown that indicates a long evolution in brackish water along new Dacian elements of fresh water.

7.2. Valea Mare-Bengești fossiliferous place

Location and access

Valea Mare place is located in Bengești Ciocadia, Gorj County. Valea Mare is a left affluent of Gilort with the confluence in Bengești village.

From geomorphological point of view, the Bengești Ciocadia locality is located in the southwestern area of the Oltenian Sub-Carpathian Depression.

The access is done by the road DN 67 Tg.Jiu-Rm.Vâlcea to Bengești, then by the road DJ 675B to the bridge from the limit of Bengești village and then left on a local road to the Valea Mare area. After about 500 m from the road there is a ravine where the fossiliferous bed are found.



Fig. no. 20 The location of Valea Mare-Bengești fossiliferous place

The Gilort Valley is bordered to the east on the right of the river, by Priloaselor Hill medium-sized, largely forested (Bengești Forest) where Valea Mare is found.

The research history of the Valea Mare-Bengești fossiliferous place

The openings from Valea Mare-Bengești were first mentioned by Ionescu-Argetoia (1918). Afterwards, a large number of researchers studied this region among them being D. Ilie (1952), Motaș (1955) and Popescu-Voitești (1935). In 1995, I. Papaianopol proposed the profile from Valea Mare-Bengești as the parastratotype for the Getian because it is the most complet and most rich fossiliferous profile for this sub-stage.

The geology of the area

The formations that appear belong to the Upper Miocene represented by the Upper Pontian (Bosphorian) over which the Pliocene deposits lay (Dacian and Romanian), then Quaternary deposits. The Portaferian deposits are made of marls and clays, sometimes sand clay and sands.

Over these sands, there are sands and sandy marls, with intercalations of Dacian fine gravels. Over these, there is a bed of lamellar lignite, about 2 m thick sometimes intercalated with clay pockets. These deposits appear well opened in Bengești and Valea Mare and Greci torrent.

The Romanian deposits are missing.

The Lower Pleistocene is represented by sand and intercalations of fine gravels, with crossed structure and the Upper Pleistocene by sandy deposits with limestone concretions and terrace deposits. The Holocene is represented by the alluvial deposits from Gilort meadow.

The paleontological content

It has 52 species of mollusks with 42 bivalves and 10 gastropods, and 11 ostracods.

In the year 1995, Papaianopol, Marinescu, Macaleș realize analysis of spores and pollen identifying over 50 species.

The scientific importance

The extraordinary importance of national interest of the Valea Mare-Bengești paleontological place is that it represents the Getian parastratotype.

7.3. Podari fossiliferous place

Location and access

The Podari locality is located in the central Dolj County, on both sides of the road DN 56 Craiova-Calafat and of the railroad Craiova-Calafat, at 5 km from city of Craiova and 19 km from Segarcea.

The section of Podari is about 7 km downstream of the bridge over Jiu, on the right side of the river, on Solomon Hill on the slope facing Hoțului Valley.

The access is easy, on the road E76 Craiova-Calafat, right after the bridge over Jiu, on a road to the right that continues with Hoțului Road.

Before about 300 m of the forester road in the right side of it, the Podari fossiliferous place appears.

Podari locality is located in the terminal southeastern area of Bălăcița Piedmont, in the closeness of Jiu meadow.

The research history

The first mention of Podari fossiliferous place has realized by Bandrabur, in 1971, who mentioned the presents of mollusks in this outcrop.

In 1979, Feru mentioned the presence of micro-mammals in the same point.

The first description of the mollusks in Podari (bivalves and gastropods) was made by Pană, Enache and Andreescu in 1981. It is the most complete study referring to the paleontological inventory of the mollusks in Podari fossiliferous place published in the volume "*Fauna de moluște din depozitele de cărbuni din Oltenia*".

Between the years 1993-1997, with intermittence, the specialists from the Speology Institute "Emil Racoviță" București and Oltenia Museum Craiova, coordinated by C. Rădulescu and P. Samson made a series of research in the Podari opening for micro-mammals, publishing the results in 1999.

The geology of the area

At the bedding of the profile there are grey-bluish clays, followed by coarse sands, by sand with oblique lamination and by sands with parallel lamination. The first three contain limestone or ferric concretions. In the upper part of the profile there are thin covers and concretions of ferric oxides, associated with gypsum crystals and green clays with a band of coal clay over with the soil cover lays.

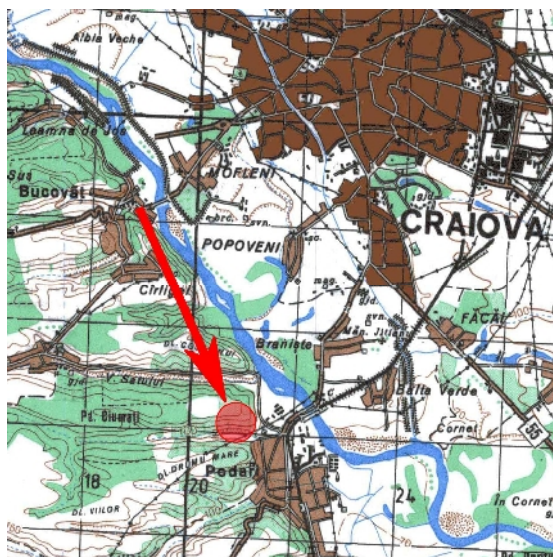


Fig. no. 21 The location of Podari fossiliferous place

The paleontological content

In the Podari fossiliferous point there was discovered an association of invertebrates and vertebrates, unique due to an important number and stratigraphic value: 75 species from which 36 are bivalves, 19 are gastropods and 20 species of micro-mammals.

The scientific importance

Podari fossiliferous place is a continuation to the east of the Bucovăț one, both being located in the same sand pack from Cârlichei Hill.

The harvesting of numerous micro-mammals from this fossiliferous point makes its paleontological importance to grow. The presence near a European road, 8 km south of Craiova makes the access to be easy.

The Podari fossiliferous point represents like Bucovăț one, a national importance concerning the evolution of aquatic and coastal life from the Upper Pliocene of the Dacian Basin.

There were found here, in this fossiliferous point, 13 new species. Most of the identified species are identified as biomarkers.

This site is also important because it has a great informational potential that was not yet been highlighted because in the upper pack of clays and coal clays, the vegetation fossil remains were not studied: fossil plants, association of pollen and spores but also ostracods, fishes, reptiles etc.

7.4. Bâltă fossiliferous place

Location and access

It is located in Bâltă village belonging to Filiași city. The fossiliferous place is found on the eastern slope of the Budică torrent, from where there is a valley that flows into Cornetului Valley found at about 300 m downstream. The place is known by the locals as the “shell spring” because at the bedding of the fossiliferous sands there is a spring.

The access is easy, on the DN 6 road to Filiași, and then on DC 121 that binds the city with Bâltă village. Afterward, one may pass the village on the Valea Mare Street to Cornetului Valley and Budică torrent where the “shell spring” is located at the bottom of a splendid sand wall of over 20 m in height, rich in fossils.

The research history

It was first cited by I. Ionescu Argetoia without the fossil fauna determination.

The relief of the area

The area’s relief is represented by the Gura Motrului Hill that is cut by Bâltă Valley, 7.5 km long, orientated west-east, that springs from Gura Motrului Forrest and flows into Jiu in

Bâlta. This brook is bounded by Gura Motrului Hill to the north with heights that descend from 280 m to 240 m towards the Jiu River and to the south by a line of crests that descend gradually from 280 m to 235 m: Ursoaia Hill, Racovița Hill and Stroie Hill.

To Bâlta Valley there are some torrential valleys like Cornetului Valley with Budilă torrent where the fossiliferous site is found. That valley is located between Martalogul Hill and Pietrișului Hill, the latter one being affected by old stabilized landslides.

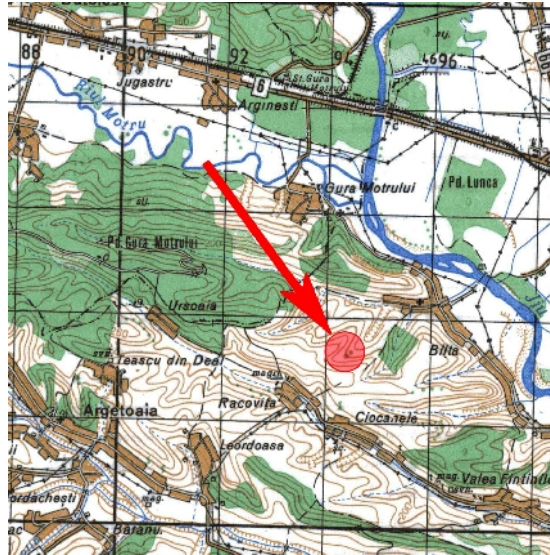


Fig. no. 22 The location of Bâlta fossiliferous place

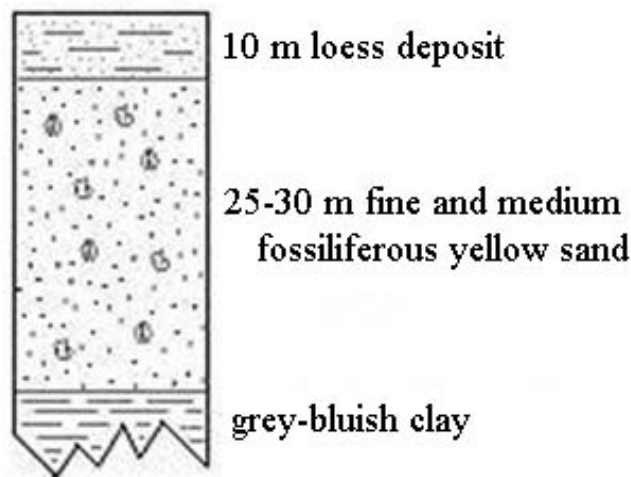


Fig. no. 23 The stratigraphic column of Bâlta fossiliferous place

The geology of the area

The area of Gura Motrului Hill is dominated by sandy Romanian deposits. The same lithology is found in the Martalogu Hill in the fossiliferous place area.

The stratigraphic column was the following succession:

- the lower horizon with bluish marls *Rytia slavonica*, *Cuneopsidea magna*, *Unio clivosus acutus*;
- the middle horizon with fossiliferous sand (bivalves și gastropods);
- the upper marly horizon.

The marly horizon with sandy marls intercalated between laminated marls has also beds and pockets of sands with heterogeneous gravels partly fossiliferous.

The paleontological content

It has 23 species from which 14 are bivalves and 9 gastropods.

The scientific importance

It is a splendid opening over 20 m in height where the bivalves and the gastropods are littered over the whole height and does not form lumachelle bands, being the only place in Oltenia where the fossil remains from the "carved unionidae" bed are in their dwelling place and not heaped on foreshores.

7.5. Scoruşu fossiliferous place

Location and access

It is located in Scoruşu village in Borăscu locality, Gorj County. From geomorphologic point of view, the locality is placed in the southeastern area of Jiu Hills, on the banks of Jilţu Mare Brook.

The fossiliferous place is found on the western slope of the road from the middle of Scoruşu village.

The access is done on the road DJ 673 Turceni-Mătăşari to Calapăru village from where one follows the road DC 68 to Scoruşu village. The road passes the Jilţu Mare brook and the railroad and reaches the opening found at the bottom of Croitoru Hill after about 1.8 km from the intersection with the county road.

The village is crossed from the northeast to the southwest by the Scoruşu Brook.

The research history

The place was firstly identified by I. Pătruţoiu in the year 1980, in a sand exploitation, but the fauna has not been identified since.

The identified and described by us forms are the first determinations from this outcrop.

These were determined with the help of Dr. geol. Constantin Enache.

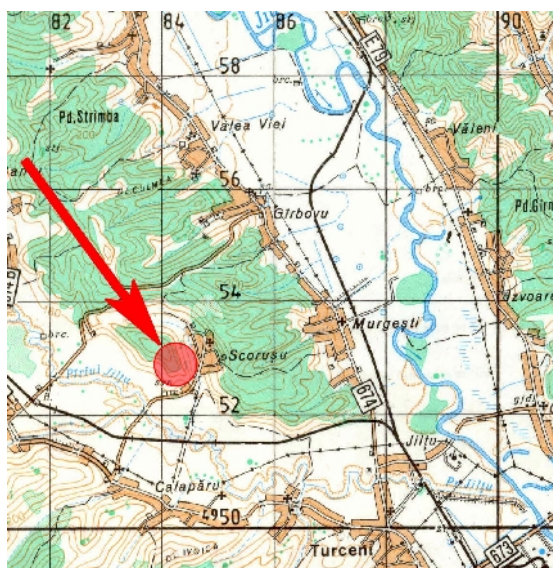


Fig. no. 24 The location of Scoruşu fossiliferous place

The geology of the area

Borăscu locality is located in the southern area of Getic Depression. The geological formations are a part of the last sedimentation cycle constituted by Pliocene and Quaternary deposits that assure the bedding of the actual relief.

From the Pliocene deposits, only the Romanian ones are above-ground, formed by clays, sandy clays, which lay under sands with fine thin sand intercalations and reddish laminas of ferrous oxides, followed by an alternation of sands, clays, sandy clays and thin beds of lignite.

The middle sands contain a fossiliferous bed, opened in Scoruşu, known in geological literature as "carved unionidae" bed.

The Quaternary deposits are represented by green or black clays and sandy loess clays that cover the superior part of the hills, the proluvial deposits on the slopes and the diluvial deposits with sands and heterogeneous gravels from the Jiu meadow.

The paleontological content

There were determined 22 species from which 8 are bivalves and 14 gastropods.

The scientific importance

It presents importance being the only fossiliferous place from the north of Getic Piedmont that is rich in mollusks species, with two lumachelles of 1,5-1,8 m thick, with easy access and a reduced geomorphologic vulnerability. The paleontological inventory is very rich, well preserved. There are many lamellibranchiate with both valves, found in the dwelling position. The adductor was preserved and fossilized at many of these shells.

7.6. Buicești fossiliferous place

Location and access

The fossiliferous place is in Butoiești, Buicești village, Mehedinți County in the spring area of Florii Valley in a place called “the ravine with shells”.

The access is done on the road DN6 from Butoiești, then on the road DJ 606D that crosses the Jiu River and then Buicești village. From the limit of the village before the climbing to Tântăru village, one may leave the road and follows a path that crosses the hill, descending then in the Florii Valley, with an approximate southwest-northeast direction. One may follow the valley with tightens to the spring area, where the in right slope the fossiliferous place is found in a clay sand.

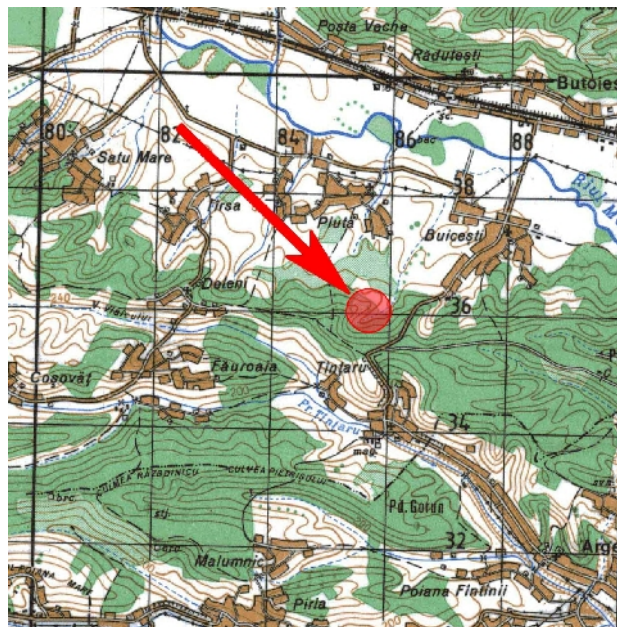


Fig. no. 25 The location of Buicești fossiliferous place

The research history

The first research referring to the Buicești fossiliferous place were made by I. Pătruțoiu, Fl Stamate, C. Meilescu who in 1998 publish the study ” Fauna romanian medie de la Buicești Mehedinți”.

The main fossiliferous bed has a large number of species, but it is also very rich in individuals.

Predominant are *Pristinus* at which *Rytia* exemplars are added, rare *Cyclopotomida* and very rare *Viviparus*.

Many unionidae individuals have both valves and the adductor fossilized.

The paleontological content

There were determined 8 forms from which 7 bivalves and 1 gastropod.

The scientific importance

The fossiliferous place has very robust, very well preserved forms. A series of lamellibranchiate have the adductor fossilized. This is very rare and this fact can make a basis for further genetic studies.

7.7. Leu fossiliferous place

Location and access

The fossiliferous place is located west-southwest of the Leu locality, on the Frasinului Valley, where the access is made from the locality on the road that leads to the sand quarries from this valley.

The fossiliferous place is located at about 4 km from the locality and has an opening of 10 m height and about 150 m in length.

The Leu locality is located from geomorphologic point of view in the central area of the Romanați Plane, and from geo-structural point of view it is in the Moesian Platform.

The area is part of the high plane Leu-Rotunda, with tabular relief, crossed by a large number of shallow but very large valleys. More important than Frasinului Valley is Leului Valley, with a depression of about 37 m from the high plane, where there was constructed a retention lake for agricultural needs.

The stratigraphic succession

The bedding of the high plane is made in the shallow area of Pleistocene deposits formed by fine sands and gravels, of fluvial origin, from which on the Frasinului Valley there were collected a large number of mammals remains, from which a mammoth skeleton almost intact.

The Pleistocene deposits lay over Romanian yellow sands with grey or yellow clays intercalations that form a pack of about 100 m thick.

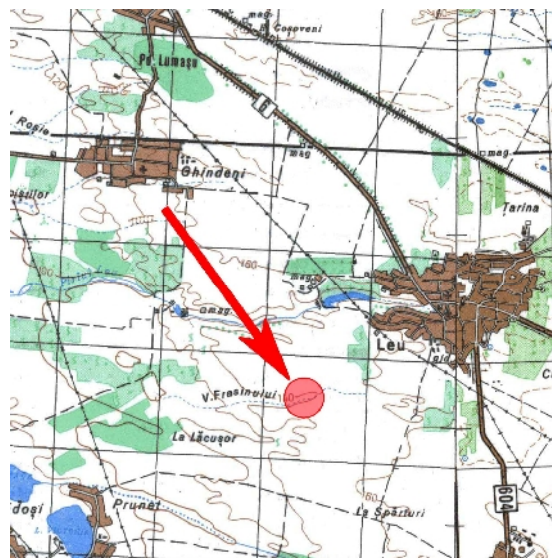


Fig. no. 26 The location of Leu fossiliferous place

The paleontological content

There were discovered 11 fossil forms of mammals.

The scientific importance

This place is important for the Pleistocene mammal fauna, being the only place where an almost whole mammoth, unique in Romania, was found, but also for the fact that the fossils deposit is not yet exhausted.

8. THE TAPHONOMIC ANALYSIS

For several protected areas, existing or proposed, with fossil levels over 1 m thick, we have conducted research to taphonomic analysis (geological discipline studying the conditions of fossilization of creatures) of the fossiliferous deposits with gastropods and bivalve from the Pliocene sediments of Oltenia.

The freshwater bivalves from the Romanian deposits have different ways of life. The *Dreissena* are adapted for digging in the substrate in which they are buried so that in their lifetime they are orientated in a vertical position with the umbone facing down in the sand on the bottom.

The *Unionidae*, which live in fresh water in rivers and lakes, rarely in brackish waters, are dragging on the bottom and are adapted to move relatively quickly.

Most aquatic gastropods lead a benthic lifestyle and are adapted to drag to the bottom. They are predators, who dug into the mud after lamellibranchiate perforating their shell. The *Planorbis* genus, for example, lives in small lakes. The *Viviparus* genus includes vegetarian gastropods, which are attached to the stems of aquatic plants and feed on their leaves.

Many Romanian bivalves and gastropods living in the sediment, feed on suspension vegetal plankton. Most of the Romanian bivalves are buried in the water substrate, feeding on small animals and organic particles in suspension in water, being microphages.

Given the above, we established the following, in the taphonomic analysis:

- For the Bucovăț, Drănic, Aninoasa, Valea Deșului, Scorușu fossiliferous places, for 1-2 m wide, we have established a relatively flat surface where we counted how many bivalves there are, by position (the ones that are whole) and for the separated valves, how many of them are in vertical position, how many have the umbone up or down, which are in horizontal position and which in any other oblique position. For the Bâlta fossiliferous place, where the fossil sand wall is over 20 m in height and the arrangement of individuals is relatively uniform throughout the rock mass, we used the study of photography and binocular with 10 times magnification.

The resulting composition as a percentage of total counted valves reveals the following situation:

Fossiliferous place	Total valves (%)	Vertical valves (%)	Oblique valves (%)	Shells with both valves (%)	Horizontal valves	
					With the internal part downwards (%)	With the internal part upwards (%)
Bucovăț	100	13,6	9,4	11,3	37,5	28,2
Drănic	100	16,2	22,6	14,5	27,4	19,3
Groșerea-Aninoasa	100	29,3	20,7	5,2	10,3	34,5
Valea Deșului	100	13,8	34,5	17,3	8,6	25,8
Bâlta	100	73,0	11,0	12,8	3,2	
Scorușu	100	14,0	33,3	18,4	23,2	11,1

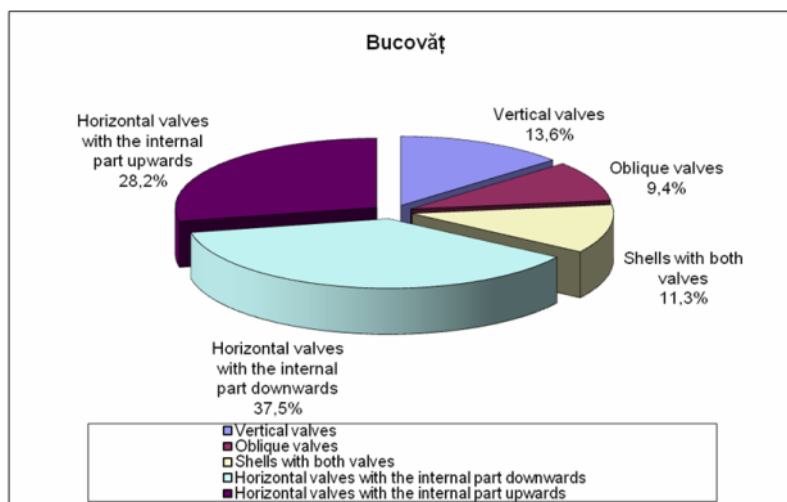


Fig. no. 27 The taphonomic analysis of the Bucovăț fauna

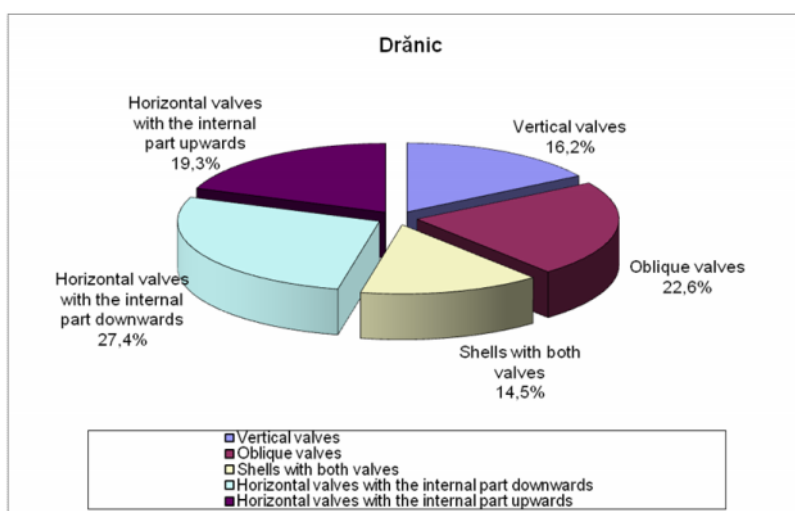


Fig. no. 28 The taphonomic analysis of the Drănic fauna

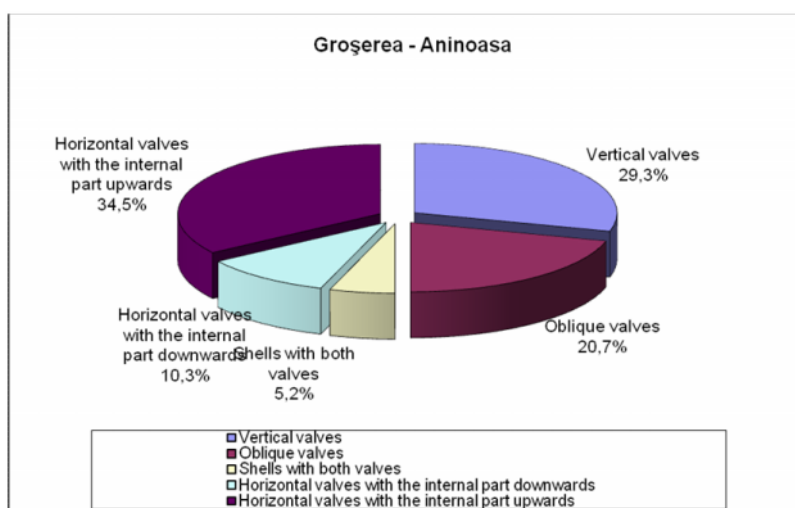


Fig. no. 29 The taphonomic analysis of the Groșerea-Aninoasa fauna

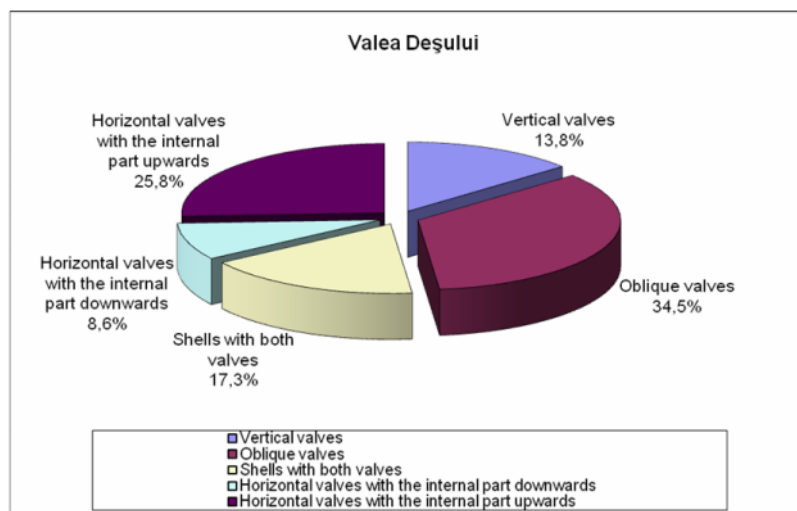


Fig. no. 30 The taphonomic analysis of the Valea Deșului fauna

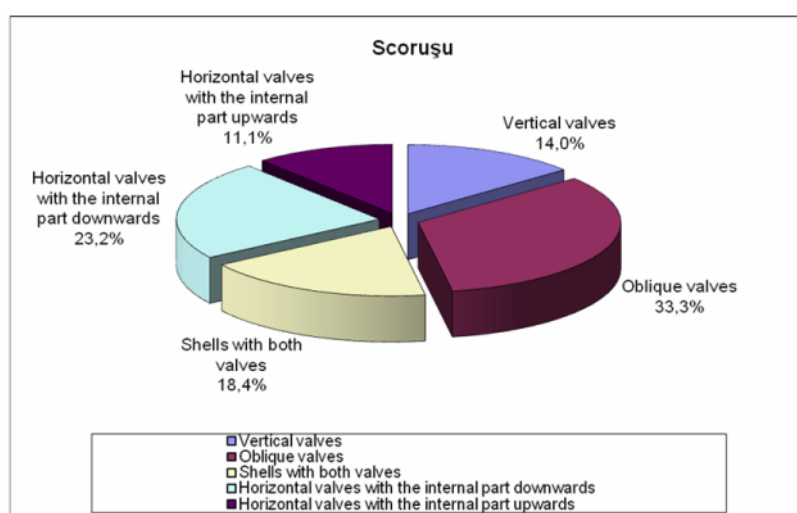


Fig. no. 31 The taphonomic analysis of the Scorușu fauna

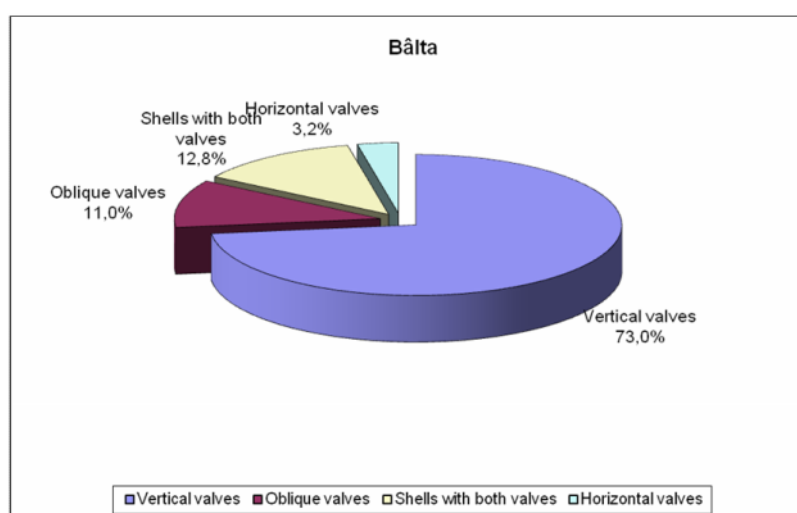


Fig. no. 32 The taphonomic analysis of the Bâlta fauna

9. PALEONTOLOGY

The Pliocene fossiliferous places from Oltenia that are protected by Law 5/2000 contain only bivalves and gastropods fauna. The newly proposed fossiliferous sites, with the exception of Leu one, contain the same type of fauna.

The collected species were determined in order to characterize the fossil sites protected by law and the proposed ones,.

The species of mollusks identified by us in the 12 sites from which they were collected are described in the paleontology chapter.

There are described 63 species of mollusks, of which 39 are bivalves and 26 are gastropods.

All these forms are presented in 26 plates.

The chapter is completed with a plate in which the deer antler fragment identified by us in the Aninoasa site is presented.

10. THE MANAGEMENT OF A PROTECTED AREA – SCORUȘU CASE STUDY

10.1. The protected area concept

The problem of the areas worldwide is introduced by IUCN – The World Conservation Union, which tries to influence, encourage and assist the worldwide organizations in the domain in order to preserve the integrity and diversity of nature, but also to ensure the use of natural resources in an equitable and sustainable manner. The result of this process consisted in elaborating a system for defining and classifying the protected areas. Currently, the Strict Nature Reserve is included among the management categories of IUCN

Within this classification system, the protected paleontological areas are enclosed into the category of Strict Nature Reserve, defined as a terrestrial and/or aquatic area representing ecosystems, geological or representative features, available primarily for the scientific research and/or monitoring.

The organizational responsibilities stipulate: the ownership and control must be done at a national level or at another governmental level, by a professionally qualified agency or by private foundations, universities or institutions having research or preservation functions or by owners working in cooperation with any of the governmental organizations or the aforementioned institutions.

10.2. The main provisions of the Romanian legislation concerning the paleontological reserves

The paleontological reserves are enclosed into the general provisions regarding the protection of the natural sites needing protection.

In order to provide special measures for protecting and preserving the goods of the natural patrimony in situ, a differential regime of protection, preservation and use is formed in the areas with important bio-geographical resources under a biogenetic, ecological, scientific and recreational aspect.

- the proposals for setting up the regime of natural protected area can be done on the initiative of:

- a) the chairmen of the county councils or town halls;
- b) territorial authorities for environmental protection;
- c) scientific and local education institutions and museums;
- d) local non-governmental organizations and natural entities;
- e) land owners

Natural reserves are those natural protected areas the aim of which is to protect and preserve certain habitats and important natural species under a floristic, faunistic, forestry, hydrologic, geologic, spelean, **paleontological**, pedological aspect. Their size is determined by the habitat necessary to provide the integrity of the protected elements.

The management of natural reserves is done differentially, according to their features, by active measures of management in order to provide the keeping of habitats and/or in order to protect certain species, groups of species or biotic communities.

Uses of lands or exploitation of resources harming the assigned objectives are prohibited. According to the aim which they have been designated for, natural reserves may have a predominant feature: botanical, zoological, forestry, geological, **paleontological**, landscape, spelean, of humid, marine area, of genetic resources and others.

In order to monitor certain natural protected areas and goods of the natural patrimony that are under a special regime of protection and preservation belonging to the public domain and do not need special administration structures, the quality of custody is set up.

The custodians may be natural or legal entities, museums, schools, universities, local authorities, non-governmental organizations, spelean clubs, and tourism clubs and alike, which have the qualification, training and means needed to apply the measures for protecting and preserving the goods entrusted.

10.3. The Custody of a protected paleontological area

It is stipulated in the Romanian legislation that those natural or legal entities meeting certain requirements may be custodians of protected areas, including those of paleontological kind.

Those natural or legal, public or private entities are eligible for this, if they meet the following requirements:

- a) they have technical capacity (of transportation to the location of the protected area);
- b) they have scientific capacity, assessed according to the studies, training, experience, skills of those people involved into administrating the natural protected areas;
- c) they have financial capacity, which is assessed according to the possibility of providing the financial resources needed equipping and operational expenses and other categories of expenses needed for the smooth course of the activity.

The natural/legal entity that has received the custody of a natural protected area has the right to:

- a) ensure the protection and promotion of the image of the natural protected area, by registering a self brand of it and monitor the compliance with the legal regime, applicable to the brand;
- b) inform upon those rights regarding the brand, by cession or permit, at any time during the brand protection duration;
- c) to establish and use the uniform and specific signs for custodians, in order to promote the image;
- d) to represent the natural protected area within the meetings at an international and national level;
- e) as member with full rights, to be part of the networks or international and national organizations such as Europarc, IUCN, the Paleontology Society, etc.);
- f) present in mass-media the natural protected area, own activity and any event running or issue occurred in the natural protected area;
- g) request the support of the responsible authorities, including in order to get funds for the natural protected area;
- h) make and implement projects aiming the preservation of the natural protected area;
- i) contract or participate in contracts aiming the preservation of the natural protected area;
- j) establish taxes for completing the financial resources necessary for good administration of the natural protected area, according to the management plan and regulations.

10.4. The elaboration process of a plan of management for paleontological areas

The aim of the elaboration is an affirmation of an ideal future state for the protected area on a long term, as result of the management plan. The word vision is sometimes used. This is similar to a purpose, but it can be an even broader concept, integrating not just a future state, but also attitudes and experiences connected to the future.

The management plan must have as aim:

- the protection and management of the paleontological content of the fossiliferous;
- to inform the public in the area about the paleontological site and the importance of protecting it;

In order to identify the main priorities in the administration of the protected area and its management, it is very useful to run a SWOT analyses (Strengths, Weaknesses, Opportunities, Threats) identifying the strong points, weaknesses, opportunities and threats.

10.5. The management plan for the Scorusu, Gorj County protected paleontological area

The paleontological site of Scorusu, proposed for being included into the list of reserves protected by law represents immediate dangers of degradation. Due to its particularity, the potential dangers of degradation are the excavations into the fossiliferous sand for economical needs, which may damage that respective outcrops.

The aim and categories of protected areas. The protected area proposed is one of national interest, being from the category of scientific reserves important for science by enriching the fossil mollusc species, being suggested as protected area, administered especially for protection.

Legal basis of the plan. The stipulations of Ord. 1533/2008 concerning the approval of the Methodology for assigning the natural protected areas that do not need administration structures.

Process of managerial planning. The elaboration of the management plan started from the realities noticed on the land, problems and opportunities we identified at the time when we drafted this plan. The plan must be approved by the National Authority governing the environmental issues, as well as the Romanian Academy.

The procedure of modifying the plan. Depending on the needs and problems arising in the direction of protecting the reserve, new objectives and duties may also be added, which must be approved by all custodians of the reserve, with a simple majority of votes, subsequently the changes in the plan being approved by the national authority governing the environmental issue and by the Romanian Academy.

Description. Geographical position: the reserve is located next to the communal road, connecting Turceni to Scorusu, at the entrance into this village.

The access is then on the county road DJ 573 and then on the communal road DC 68, to the place proposed for founding the paleontological reserve, at the entrance into Scorusu.

The right to using and managing the land of the proposed reserve consists in an area of 200 x 50 m = 1ha.

The reserve is created on an opening with a length of 100m of the fossiliferous sands, located nearby at about 200m from the first houses in Scorusu.

Physical environment: the annual average temperature is 18.5 ° C, the frost interval lasting around 120 days, the average temperature rising at about -1° C, and that of July is 27 °C, the annual rainfalls amounting 700 mm. Western winds are frequently reported.

The protected area belongs to the middle basin of Jiu River, the sub-basin of Jilt stream.

The reserve indicates sandy Romanian deposits with small, fossiliferous gravels, alternating with clay sands and sandy clays.

The soil is part of the group of brown podsol and brown acid soils, laid by clay formations.

Past use of the land Currently, the natural opening with sandy fossiliferous deposits is sometimes used for obtaining material locally for various household management needs.

10.6. The SWOT Analysis (Strengths, Weaknesses, Opportunities, Threats)

STRENGTHS

New fossiliferous outcrop for science

The richness of taxa, fossil species and specimens

The easy access to the protected area

OPPORTUNITIES

Restricting the access from the communal road to the protected area.

Indicating the importance and contents of that respective fossiliferous location and restrictions imposed by a warning sign.

WEAKNESSES

The weak consistency (sands) of the fossiliferous deposit which makes it vulnerable to collapses or landslides.

THREATS

What factors endanger the effective and efficient management of the reserve in the future.

Locating the fossiliferous site near the communal road transferring people and animals daily that can damage the fossiliferous deposit.

The sandy feature of the fossiliferous deposit tempting to be used for household or construction needs.

10.7. The monitoring plan

The monitoring plan must include the following:

- Evaluating the evolution of laying out the reserve boundary, on field.
- Monitoring the establishment and maintenance of the indicator plates.
- Observing the changes in the locals' and tourists' behaviour to the issue of the reserve.
- Noting down as reports of the patrols in the reserve area,

10.8. The administration plan for the Scorusu, Gorj County protected paleontological area

The elaboration of the administration and management plan for the protected paleontological area of Scorusu started from the realities noticed on the land and opportunities identified at the time when we drafted this plan.

Depending on the needs and problems arising toward protecting the paleontological area of Scorusu, new duties may be added or those stipulated previously in this plan may be changed.

The aim of the plan is to ensure that the paleontological location with a fauna of Romanian molluscs from Scorusu is assigned under the protection by law, given its importance as fossiliferous point that is new for science, as well as its richness in species identified, as it results from the presentation made in chapter 7.

Because the fossiliferous point of Scorușu is on the territory of the village having the same name, which belongs to Borăscu village, which has qualified human potential (geography and science teachers) as well as an economic potential, according to the requirements of aforementioned legal provisions regarding the custody, it is suggested that the Local Public Authority, represented by the Town Hall of Borăscu, to take over the custody of this area we proposed eventually in partnership with other scientific or economic public or private units that will show their interest.

The purpose of the suggested plan tries to protect and valorise that fossiliferous location, given its scientific importance. However, also given the location of the outcrop in

an easily accessible place in the immediate vicinity of the road connecting the Scorusu village to the county road, it also represents a point of tourist interest, as well as for training students.

In order to achieve this purpose, it is necessary to inform widely through sustained written and visual mass-media.

Duties

- To delimit the reserve and buffer zone on land and enclose it on the boundary with the communal road. In order to stop the material sampling from the fossiliferous sandy deposit.
- Making a panel on the side of the protected area, which would indicate its kind and name, as well as its importance for science and which would also indicate the norms and regulations that are to be followed for protecting that respective paleontological location.
- Providing a regular patrol in the area.
- The custodian should inform about all integrity prejudices brought to the fossiliferous location, the protection fence or presentation panel found out by the patrol provided by the Town Hall of Borascu.
- The access into the reserve is only permitted to the specialised personnel, for paleontological research reasons or to organised groups of students accompanied by the specialised personnel (geography or science teachers), having on them the endorsement of the Town Hall of Borascu.
- Rearranging the front of the fossiliferous front of the deposit in case of collapses or landslides, by removing the dislocated material.

11. CONCLUSIONS

The study of the protected paleontological areas of Pliocene age in Oltenia have highlighted a series of important fossiliferous locations from the Pliocene formations in Oltenia, as well as a series of shortcomings of the manner which they were established in and proposed for enactment, as well as on how they are protected.

The paleontological areas in Oltenia have been examined on field, and are included into annex III to Law 5/2000:

The research consisted in verifying on field all aforementioned fossiliferous sites, by their location, current physical state, as well as litho-stratigraphic sequence and paleontological content.

The thorough analysis of each Pliocene fossiliferous location in Oltenia that is protected by law allows the following general estimations:

The fossiliferous location of Bucovăț, which is very important from a scientific point of view, it has been inaccessible for a few decades due to the collapse of material and its becoming overgrown with grass. In 2000, when a new excavation was done nearby for the construction of a building, the very thick and faunistically rich fossiliferous level returned again to the surface.

The fossiliferous location of Drănic on the right versant of the Jiu River, which has been ignored for a very long time as it had no access routes, was discovered in 1971.

Due to the height of the slope (around 50m) separating the piedmont from the Jiul Meadow and also due to the location of the fossiliferous levels on its upper part, this fossiliferous place that is also important for the faunistic content of mollusks and micro-mammals is less vulnerable to bad weather, the landslides created affecting only the lower part of the versant.

The fossiliferous location of Groserea, located in the gully opening a landslide, which was subsequently used as a place for sampling the sand for various human activities, represents one fossiliferous level of small thickness, located on the lower part of the opening.

Due to sand sampling by locals, the fossiliferous location indicates great vulnerability for maintaining the integrity of this outcrop.

It is also worth highlighting that this thin fossiliferous level, with few species and remains of fossils poorly preserved is not of the importance as it was assigned.

On our movement on land, we however found a new opening in **Aninoasa**, near the county road across the church, that is fossiliferously much richer and are particularly easy to be accessed. Being located in the very neighborhood of the county road, it can be kept under observation by local authorities.

The remnants of mammals from Groserea, recalled at the Museum of Oltenia, without being located, recommend that the fossiliferous location is also maintained for Romanian mammals as an area protected by law, but also including the fossiliferous location with mollusks near the church in Aninoasa.

The fossiliferous location of Gârbovu is currently listed as inexistent, the opening being clogged by landslides. Fossil remnants could be collected only from the slid material. This fossiliferous point is represented by few species of mollusks, so that its keeping into the category of protected areas is not sustained, from this point of view.

The fossiliferous location of Saulesti does not currently exist anymore, being entirely covered by diluvium and vegetation deposits. It is still partially visible only on the bed of the valley. Other fossils have not been found, except from one kind: *Pristinunio*, a form very widely spread into all Romanian fossiliferous outcrops with “sculptured unionidaes”.

The fossiliferous location of Valea Desului It is currently deteriorated, by processing the land, the outcrops are currently visible only on the side of the road going from Valea Desului to Totea de Hurazeni.

The fossiliferous location of Pietrele Roșii from the upper basin of Husnicioara still has, ever since it was discovered, few species that are spread in all fossiliferous locations in the same faunistic level, so that its enclosure into the category of protected area does not justify the necessary importance. Moreover, it is currently covered by a supporting wall on the county road DJ607A and grassy landslides.

From the analysis of the physical state of the current Pliocene fossiliferous locations protected by law and their fossiliferous contents, there results the need to remove the following locations from list of protected areas, which is attached to law 5/2000:

2448 The fossiliferous location of Gârbovu, Turceni town;

2450 The fossiliferous location of Saulesti, Saulesti commune;

2626 The fossiliferous location of Pietrele Rosii, Husnicioara commune, Mehedinti County.

Therefore, Gârbovu, Săulești, Pietrele Roșii have been included into the list of Pliocene fossiliferous locations of Oltenia, that are weakly fossiliferous and unknown in specialised works of wide circulation, ignoring instead very important fossiliferous locations such as: Podari, Scorușu, Bâta (unique as presentation for the level with „ sculptured unionidaes”), Buicești, Scorușu, etc.

Another conclusion that may be drawn from the analysis of the protected Pliocene fossiliferous locations is that there is no Dacian fossiliferous location to be protected, although there are various important outcrops at Ilovăț, Sisești, Scoarța, Hârnea, Genuneni and especially the fossiliferous location of Valea Mare from Bengești where Papaianopol has established the Getzian parastratotype for the Western side of the Dacian Basin, or Erghevița Valley where the Dacian/Pontzian limit was established on the same side of the Dacian Basin.

For this reason, I have started researching fossiliferous locations, that are much more important as uncovered surface, faunistic richness of mollusks, which the fossils micro-mammal fauna also adds to it, such as: Drănic, Bâta, Scorușu, Buicești as well as some fossiliferous locations with Dacian fauna, which have not been protected so far; in Erghevița and Valea Mare-Bengești, and another mammal Quaternary fossiliferous location of Leu, which we suggest for being included into the list of those protected by law.

A sheet has been arranged for each fossiliferous location, accompanied by photos of the outcrops and the regional plan where it was stated: the location, access routes, history, landscape, geological description, and known fauna content.

For the taphonomic analysis, taking into account the indications from the paleontology treaties regarding the position of the lamellibranchiate wrappers as indicators of the feature of the fossiliferous deposit (that is on the living place, carried by waves and settled on the side of the waters sorted depending on the specific size and weight of the shells inside the running water or the lake). Where it was possible, the position was inventoried, especially that of the lamellibranchiate wrappers.

In the fossiliferous locations of Gârbovu and Săulești, the fossils form either one level where the lamellibranchiates and gastropods' shells are lined discontinuously: either congestions formed in a ratio of 75 - 80% of the lumachelic deposit, demonstrating that that respective deposit represents a Falun formed on the side of lake bank, where waves at the bank represent the constructor of the deposit. An exception is the fossiliferous location of Groserea-Aninoasa, where above a lumachel, there are a few meters of sands where the fossil wrappers are even fewer and generally on a vertical or inclined position and even more rarely in horizontal positions, suggesting the increase of the water level and successive movement of the shore.

A special mention must be stated for the fossiliferous location of Balta, which besides the grandness of the opening, it also presents a sandy wall which is over 10m high, it is interlaced with wrappers or even whole shells of bi-valves, most of them in vertical position, not tight as in a Falun, which can only be explained by death of the habitat where they lived, in an obviously lake environment, whose level has increased continuously.

For gastropods, and analysis could only be done in Bucovăț (the current opening where at the base of the outcrops there is a lumachel where the vivipari represented by the species *rudis rudis* and *rudis strossmaierianus*, *turgitus turgitus* și *turgidus pilari*, oriented almost exclusively into the position with the protoconc upwards, into the rest of the outcrops, the vivipari are laid irregularly between the bivalved, which predominate.

In the fossiliferous location of Podari that is proposed for protection no classification or special orientation of the fossils into layers is noticed. Many fragments, as well as almost whole specimens of molluscs are found, that are in a good preservation state. For the gastropods, the last cycle of the spiral has not been maintained generally.

At Balta, the development of a great number of kinds and species, with individuals in all stages of ontogenetic development indicates to us the norms of development of the fauna at the side of a lake settlement basin, with waves. Most of the shells of lamellibranchiate are open, which certifies that the sediment belongs to some wrappers detached from the living location of those molluscs. It is also found out that most of the wrappers are quasi-vertical, because of the sediment into a peaceful environment whereas the bivalved ones have died in their habitat. Within the lumachel, gastropods are of average size or many are of small size and fragile, so it is difficult to find out their position in situ.

At Buicesti, the shapes described are well preserved, some having both shells and adductor muscle fossilised.. This means they have not been transported, fossilising inside the habitat.

By taking into account that although Oltenia has many locations where Pleistocene mammal remnants have been found, there is no place protected by law, so I suggested the fossiliferous location with fossil mammals of Leu for protection, where a rich fauna was discovered, which marks the passing from Pliocene to Pleistocene (of which *Mammuthus (Archidiskodon) meridionalis* almost whole) and because the deposit is not yet worn-out.

The analysis of the protected fossiliferous locations has highlighted the fact that the Romanian fossiliferous outcrops are quartered generally into soft rocks, mainly in sands that are vulnerable to the action of the external agents, with a high geomorphologic risk, as well as with the risk of being destroyed due to excavations for that respective material, sands and small gravels, useful in construction activities and for roads. Recent geomorphologic phenomena: collapses, landslides or vegetative invasion or anthropic interventions have seriously affected the fossiliferous locations of Saulesti, Garbovu, Pietrele Rosii.

Regarding the legal stipulations concerning the marking of the protected fossiliferous locations, except for some (Bucovat, Valea Desului), they are no longer signalled and they sometimes slip the attention of the local administration.

Besides the contributions to the scientific research of the existing or proposed protected Pliocene and Quaternary fossiliferous locations and taphonic study, due to the need to evaluate and from a share point of view and position of the shapes included into these fossiliferous locations, we collected as many species as possible, which have been determined and presented in the chapter Paleontology, accompanied by 27 drawings with their images. The presentation of the taxa determined in the attached drawings was done for each fossiliferous location separately, in order to highlight their paleontological contents.

The evolution of the protected areas is a dynamic and continuous process. For this reason, the researches started in order to characterise the Pliocene protected areas in Oltenia and for valorising new paleontological sites initiate a research stage which must go on.

We deem that our work here is a starting point for further researches, in order to valorise the Romanian paleontological patrimony.

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