A FRESHWATER SOFTSHELLED TURTLE IN THE ALBEȘTI LIMESTONE

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Abstract. This study focuses on a fragment of a soft-shelled turtle discovered in the Eocene deposits of the Albești Nummulitic Limestone, in Albești Muscel, in the former main open pit (Lutetian). It is the first detailed description of a freshwater turtle from this area. The comparison between the Albești turtle and *Trionyx clavatomarginatus* Lörenthey, 1903 allows for a taxonomic assignation to Trionychinae subfamily. An assignation to a genus and species cannot be done due to the scarcity of the preserved characters. Concerning the host rock, the optic microscopy indicates a granular bioclastic microfacies, caught in a detrital matrix, with terrigenous elements. From a micropaleontological standpoint, one can remark the presence of numerous large benthic foraminifera, as well as the fragments of echinoids and red algae. This micropaleontologic assemblage, along with the presence of fine extraclasts, suggests a depositional environment with high hydrodynamic energies and transport of terrigenous materials. The XRPD analysis shows the dominance of marcasite, followed by pyrite, calcite, quartz and calcopyrite. The presence of pyrite could demonstrate the existence of anoxic tendencies of the environment. Trionychids are indicative for the proximity of emerged areas, with freshwater lakes or slow flowing rivers. However, these turtles can swim along the marine coast, on certain distances. The abrasion marks on the fossil carapace are indicative of effects of hydrotaphonomy, in highly hydrodynamic environments, as well as quite long transport before burial.

Keywords: Trionychinae, turtle, middle Eocene, limestone, Albești, Romania.

Rezumat. O țestoasă cu „carapace moale” din Calcarul de Albești. Acest studiu este focalizat asupra unui fragment de carapace a unei țestoase de tip „carapace-moale” descoperită în depozitele Calcarului Nummulitic de Albești, la Albești Muscel, în fosta carieră principală (Lutetian). Este prima descriere detaliată a unei țestoase de apă dulce din această arie. Comparația dintre țestoasa de la Albești și *Trionyx clavatomarginatus* Lörenthey, 1903, susține încadrarea acestei fosile la sub-familia Trionychinae. Atribuirea generică sau specifică nu poate fi realizată din cauza numărului limitat de caractere păstrate. Privitor la roca gazdă, examinarea microscopică a evidențiat un microfacies bioclastic, cu o matrice detritică cu elemente terigene. Sub aspect micropaleontologic pot fi remarcate numeroasele foraminifere bentonice de talie mare, precum și fragmente de echinoderme și alge roșii. Această asociație micropaleontologică, alături de prezența extraclastelor fine, sugerează un mediu depozițional de mare energie și un transport al materialelor terigene. Analiza XRPD evidențiază dominanța marcasitei, urmată de pirită, calcită și calcopirită. Prezența piritei ar putea demonstra existența unor tendințe anoxice ale mediului depozițional. Trionychidele sunt indicative pentru proximitatea zonelor de uscat cu lacuri cu apă dulce sau râuri având curgere lentă și debite mari. Totuși, aceste țestoase pot înota de-a lungul coastelor marine, pe anumite distanțe. Urmele de abraziune de pe carapacea fosilă indică efecte ale hidrotafonomiei, în medii hidrodinamice cu energie înaltă, precum și un transport relativ îndelungat înaintea îngropării.

Cuvinte cheie: Trionychinae, țestoase, Eocen Mediu, calcar, Albești, România.

INTRODUCTION

The soft-shelled turtles are a distinct family of freshwater turtles, characterized by the lack of horny scutes and peripherals. The shell is covered by a layer of skin rich in ornamentations. Fossil turtles of this family were found all across Europe and their geological ages range from the early Cretaceous (Hauterivian) to Holocene. In Romania they are known since the Eocene. In the past, many species in the family were classified as *Trionyx*, but actually *T. triunguis* (the African or Nile softshell turtle), remains the single extant one still classified as *Trionyx*. The knowledge of the other species still assigned to this genus is exclusively based on fossils (GEORGALIS & JOYCE, 2017). This family probably originated from Asia in the early Cretaceous and then, by the late Cretaceous, they spread firstly into Europe, then into the Americas. In the Eocene they had reached Australia and India, and in the Neogene they were present in Afro-Arabia (GEORGALIS & JOYCE, 2017). In other words, the Trionychidae were found on every continent, excluding South America (although a single fossil Pliocene record was from Venezuela) and Antarctica (LAPPARENT DE BROIN, 2001).

The presence of soft-shelled turtle fossils in Romania is not completely surprising, because trionychids are known quite well in Transylvania from various levels of the middle and late Paleogene and the Miocene, later being extinct in this region. The very first record of an extinct soft-shelled turtle was coined by PETERS (1855), who mentioned it being found in the middle Eocene of Turnu Roșu (= Porcești; Sibiu district). But this material seems to be lost. Later, KOCH (1894) noted the occurrence of the genus *Trionyx* in the Upper Eocene deposits located in the Gilău sedimentary area. At the beginning of the past century LÖRENTHEY (1903) erected the species *T. clavatomarginatus* from Priabonian 'coarse limestone' mined in quarries located close to the city of Cluj, at Mănăștur (now abandoned) and the Pleșca Valley (VREMIR et al., 1997; CODREA & FĂRCAȘ, 2002; VREMIR, 2004).

There was even an isolated early Eocene (Ypresian) trionychid fragmentary carapace found in the limestone mined at Albești (Argeș district). It is stored at the Faculty of Geology and Geophysics in the University of Bucharest. Unfortunately, neither the donor's name, nor the clear location (outcrop, open pit) or the level where the fossil originated from is known. The fragmentary carapace (Fig. 1) preserves just a few costal and neural plates. It has no registration number in the vertebrate collection. In a list of species of the fossil turtles from Romania, VREMIR (2013) assigned this fossil to *Paleotrionyx*. This report lacks both description and illustration. In our opinion, the meagre characters preserved on that carapace are not allowing an assignation to a genus and its relationship to the *Paleotrionyx* genus is speculative, based rather on the geological age of the originating rock.

This paper is focused on a fragmentary carapace found almost half a century ago in the main limestone quarry from Albești and collected by the late Radu Stancu, former manager of the Argeș District Museum.

Figure 1. Trionychidae indet. carapace fragment stored in the paleontological collection of the Geological Department of the University of Bucharest, originating from the Albești Limestone, from Albești (Argeș) - left: inner view of the carapace; right – internal natural mould (photos by courtesy of Dr. Ștefan Vasile).

GEOLOGICAL SETTING

Albești is a village located at 45°18'32" N and 25°00'27" E. This village is part of the Albeștii de Muscel commune, located in the northern area of Argeș district, 6 km NW of Câmpulung-Muscel town, on the District road DJ735.

The commune is situated within the Câmpulung Depression (ILIE, 1969), which is part of a distinct geographic unit in the South of the Southern Carpathians, known as the Getic Depression. The transition from the mountainous area to the plain is generally done by the Sub-Carpathian hills. West from Dâmbovița however, there is a transitory morphology issued from the Cândești Piedmont (PATRULIUS et al., 1968). The river terraces from this region occurred due to erosion-accumulation processes, in the Pleistocene and Holocene. On the left bank of the Argeș River the lowest terrace is exposed between the Mărul Valley and Albești (BOMBIȚĂ et al., 1968).

From a geological viewpoint, the Getic Depression (in fact, a geographical name) is part of the Southern Carpathians Foredeep, occurred after the upper Cretaceous 'Laramian' tectonic phase. The Getic Depression sector acted as a sedimentary basin since late Cretaceous to the end of Miocene (SĂNDULESCU, 1984). Like the whole Foredeep, it is filled by molasse structures, with obvious transgression events and stratigraphic gaps (BOMBIȚĂ et al., 1968). The 'Depression' includes important geological structures, which occurred in the Cenozoic (POPOVICI, 1898; BOMBIȚĂ, 1963; BOMBIȚĂ et al., 1968). The general layout of the shallow sedimentary strata is a monocline, but in this region, there are also deeper folded structures (BOMBIȚĂ et al. 1968). These structures are caused by the effects of convergence and collision processes within the Southern Carpathians and the Moesian Platform consequence of the clockwise rotation of the plates that supported these structures (PLĂCINTĂ et al., 2016). In the last decade the knowledge of these structures has been refined, due to the seismic interpretations targeting to locate hydrocarbon deep traps (DIACONESCU, 2017).

The physiographic features of the area around the town of Câmpulung Muscel refer to what is known as the Câmpulung Depression, part of the Getic Depression, surrounded by high relief. This depression is limited to the N by the Brătila and Dâmbovița valleys, as well as by the Păpușa metamorphic structures. The eastern limit is marked by the Leaota metamorphic rocks, overlaid by Jurassic limestone and Upper Cretaceous deposits. In the southern part the vaulting of the shale with Oligocene fishes separates the depression from the Getic hills, and to the W it connects with the Loviștea Depression and the hillock (in Romanian meaning 'muscel') area (ILIE, 1969).

The Câmpulung 'Depression' is not an erosional one, but a tectonic graben. The sudden interruption of the Leaota Crystalline demonstrates the existence of an important fault. The Mățău Anticline, which lies in the southern part of the Câmpulung 'Depression', is crossed by a multitude of transversal and longitudinal faults, already observed by DRAGOȘ (1954), and form an entire system which caused and controlled the tectonic subsidence (ILIE, 1969). The proof of the depression's current tectonic activities is evidenced by local earthquakes. ȘTEFĂNESCU (1872) described a 600 m long and 28 m deep submerging area close to the town of Câmpulung, occurred after a series of earthquakes.

The Albești Nummulitic Limestone is exposed on the area of Albești commune, extending 1.5 ha. In 1954, the northern part of the Albești quarry was declared a Natural Monument (BLEAHU et al., 1976) and it is now a protected area of national interest, according to Law Nr. 5 from March 6 2000, as reserve type: Geological and paleontological natural reserve, category III IUCN (GRIGORESCU, 2017). This reserve includes both the Nummulitic Limestone and the Albeşti Granite. The latter contains 80 blocks of pink coloured granite, composed by quartz, pearlitic microclines, as well as fine biotite and sericite (Fig. 2).

Because the limestone has high building qualities, it was largely used in monumental buildings since the 13th Century: Curtea de Argeş and Câmpulung monasteries, the Cernavodă Bridge, the Casino in Constanța, the Triumphant Arch from Bucharest are a few examples. Such stone was used in smaller amount for the Roman camp from Jidova, in the Argeş district, part of *Limes Transalutanus*, erected by the soldiers of *Cohors Prima Flavia Commagenorum.*

The 'Rock of Albeşti' is a grey, somewhat bluish limestone originating in biotic accumulation. The fossils caught in its matrix are difficult to be extracted (BOMBIŢĂ, 1963). This limestone overlies either the metamorphic rocks of the Southern Carpathians, or Upper Cretaceous marls of marine origin (Fig. 2; POPOVICI, 1898; GRIGORESCU, 2017).

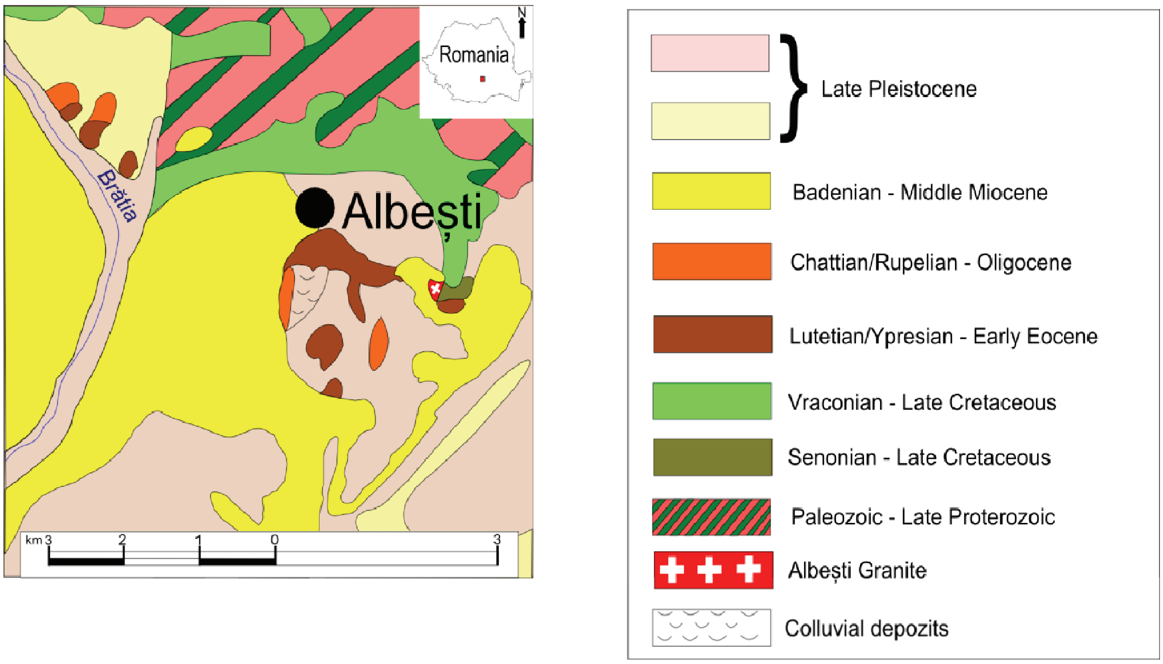

Figure 2. Simplified geologic map of Albeşti area (modified and redrawn from MURGEANU et al. 1968).

The oldest rocks of this region are metamorphic, belonging to the Timiş-Boia unit and the upper Getic and Argeş nappes, in dominance with paragneisses, gneisses and amphibolite of the Sebeş-Lotru Lithogroup, where the Granite of Albeşti could represent elements caught in the basal portion of a pre-Alpine tectonic nappe. The geological age of the Sebeş-Lotru Lithogroup could be Greenvillian, although the radiometric data are still rather unclear (BALINTONI, 1997).

This metamorphic sole is overlaid with no uniformity, by transgressing Upper Cretaceous deposits as patches of sandstones, marls and clay of Vraconian-Cenomanian age (BOMBIŢĂ et al., 1968). The 'Senonian' deposits include breccias reworking metamorphic rocks and grey whitish marls with *Inoceramus* (POPOVICI, 1898, BOMBIŢĂ, 1963; DESSILA-CODARCEA et al., 1968). The Eocene (Ypresian-Lutetian) from the Getic Depression is represented by basal conglomerates, red marls and marl sandstones (DESSILA-CODARCEA et al., 1968; BOMBIŢĂ et al., 1968; ANDRONACHE et al., 2019). The Oligocene bears shale, clay and sandstone. Next come Aquitanian lagoon deposits. The Miocene in the Burdigalian age refers to weakly cemented conglomerates, sands, gravel and sands, grey marls. In Quaternary two horizons may be outlined: a basal clayish one and an upper sandy one. The old terrace deposits of the Olt and Argeş rivers are including gravels with reworked mica schist, gneisses, quartzite and chlorite schist (DESSILA-CODARCEA et al., 1968; PATRULIUS et al., 1968; BOMBIŢĂ et al., 1968).

Locally, one may consider that the Câmpulung Embayment began its sedimentary evolution in the Cenomanian by sandstone and conglomerate deposits (ILIE, 1969). Next there are the 'Senonian' ones with marls and clayish marls in dominance. The Eocene rocks are discordant compared to the older ones, with sandstones, conglomerates, oncolytic limestones and sandstone/limestones with calcareous algae (*Lithothamnium)* and nummulites. The Oligocene is scattered spread, represented by fine shale rich in fish skeletons. The Badenian deposits illustrate a strong transgression event and refer to sandstones, sands and altered red or violet marls. Next is the Pontian (clay dominated sediments) – Dacian (littoral sedimentation) – Romanian (continental fluvial-lacustrine sedimentation) sedimentary suit (JIPA & OLARIU, 2009). The youngest sediments in the Câmpulung embayment are Quaternary fluvial terrace deposits, ungraded gravel devoid of any stratification (ILIE, 1969).

The Albești Nummulitic Limestone is the largest patch in the region. The boroughs of Upper Bughea, Albești and Cândești are built upon the layers of these rocks. In Albești, the limestone is laying directly on the metamorphic schist (POPOVICI, 1898; BOMBIȚĂ, 1963; GRIGORESCU, 1967, 2017) cropping out on the last ramifications of the Iezer Massive, and on Upper Cretaceous marls of marine origin. At Albești there are some abandoned open pits and quarry-holes, mentioned even in older works by POPOVICI (1898) or POPESCU-VOITEȘTI (1909; e.g. the Strigoi or Faur valleys). The succession of the Eocene (Ypresian and Lutetian; POPOVICI, 1898; BOMBIȚĂ 1963, BOMBIȚĂ et al., 1980; GRIGORESCU, 1967) limestones (Fig. 3) can be better observed in the quarry located in the centre of the Albești commune, where 3 levels ('horizons') can be outlined: the lower of 10-15 m in thickness, the middle of 5-6 m and the upper of 6-7 m (BOMBIȚĂ et al., 1980).

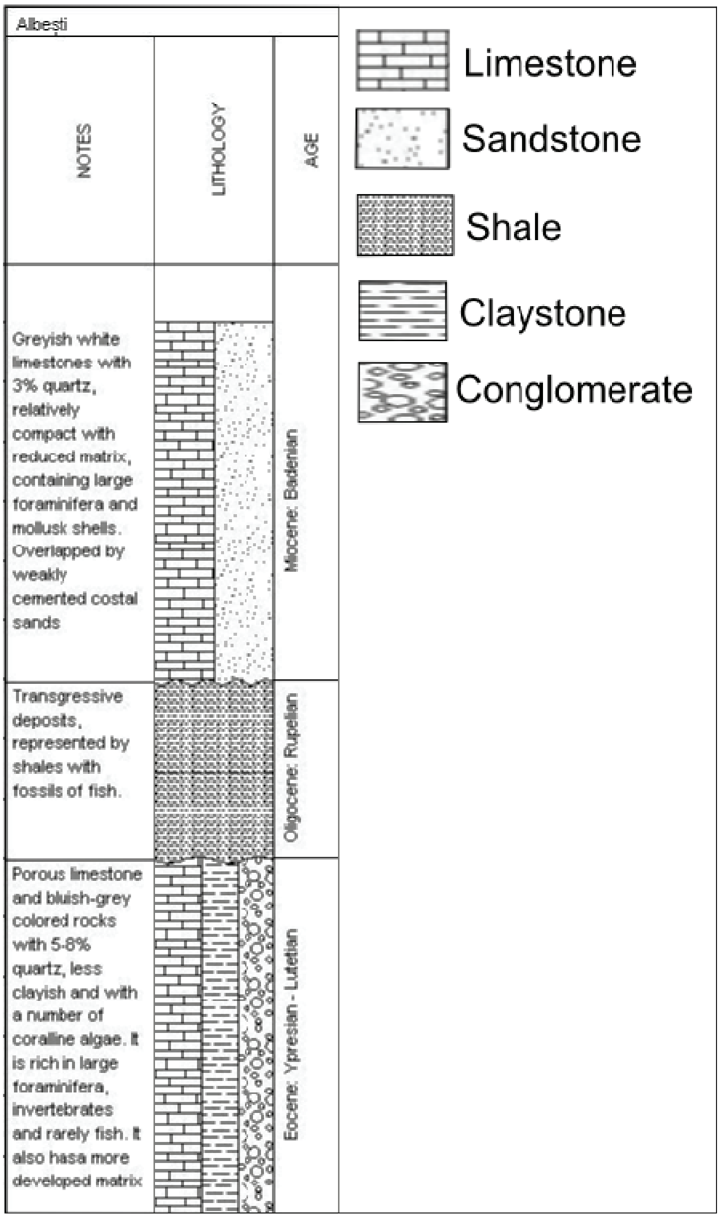

Figure 3. The stratigraphic log of Albești Eocene locality
(simplified, redrawn from DESSILA-CODARCEA et al. (1968), ILIE (1969) and BOMBIȚĂ et al. (1963, 1980).

The lower levels refer to bluish-grey coloured rocks, more porous and softer than the rocks from the upper horizon and with a higher content of quartz (5-6%), corallinae algae and a more developed matrix (BOMBIȚĂ et al., 1980).

The mid-level is the richest in fossils, dominated by calcirudites in the basal portion and biocalcarenites at the upper one. It also contains a rich assemblage of large foraminifera (*Nummulites, Assilina, Operculina)*, along with numerous, various invertebrates: brachiopods *(Terebratula grandis)*, bryozoans, molluscs, crustaceans *(Ranina reussi, R. marestiana)*, crinoids and echinoids *(Conoclypeus conoidens)*. Even rarely, fish remains can be found, especially shark teeth *('Lamna elegans, Charcharodon angustidens, Myliobatis'*; POPOVICI, 1898; BOMBIȚĂ, 1963, BOMBIȚĂ et al., 1980; GRIGORESCU, 1967, 2017; TRIF & CODREA, 2018; ANDRONACHE et al., 2019). The rock is coloured grey and light yellow, weak rust-coloured with some parts being burgundy. It is a porous limestone, with 5-8% quartz, richer in matrix than in the lower level horizon, is less clayish and with a number of corallinae algae fragments (GRIGORESCU 1967, 2017; BOMBIȚĂ et al., 1980). At the top there are siliceous concretions, which were dubbed by the local stone cutters as 'ciulini'.

The upper level is made up of greyish white limestone with 3% quartz, relatively compact with reduced matrix. It contains large foraminifera and mollusc shell fragments. This pure limestone is overlapped by a costal level bearing sands with iron oxides, weakly cemented, devoid of any Priabonian microfossils. It is in this level where a fragmented sirenian rib originated from (GRIGORESCU 1967, 2017).

The Albești Nummulitic Limestone rocks directly support the transgressing deposits of the Oligocene (PATRULIUS et al., 1968) represented by shale with Rupelian fossils (Fig 3). Further, there are weakly consolidated detrital rocks belonging to the mid-Miocene molasse. These last ones contain frequent reworked Cretaceous and Eocene foraminifera (BOMBIȚĂ et al., 1980).

MATERIAL AND METHODS

In the Natural Sciences collection of the Argeş District Museum of Pitești (abbreviated as ADPNS, hereinafter) there were three limestone blocks originating from the Albești central quarry, collected by the late Radu Stancu in 1970. The main aim of this study was focused on the assignation of the turtle carapace. In this respect, comparisons were done with fossils of this kind from Romanian collections, and to specimens described and illustrated in various foreign references.

The fossil preparation was done by removing the limestone matrix using a pneumatic air brush connected to an AIRBAG HP1 compressor and chemically through differentiated attack in 20% acetic acid. In order to prevent the destruction of the fossil remains they were doused by mowillite. The fragments were cleaned afterwards using acetone and reassembled using cyanoacrylate etil2 adhesive.

After preparation, two of the turtle carapace portions were completely relieved from their matrix and the counter-block with its imprint was also prepared by mowillite. These materials are stored in the ADPNS collections, registered as: 2573 - Trionychinae indet., carapace and 2574 - Trionychinae indet., inner imprint of the carapace (Fig. 4).

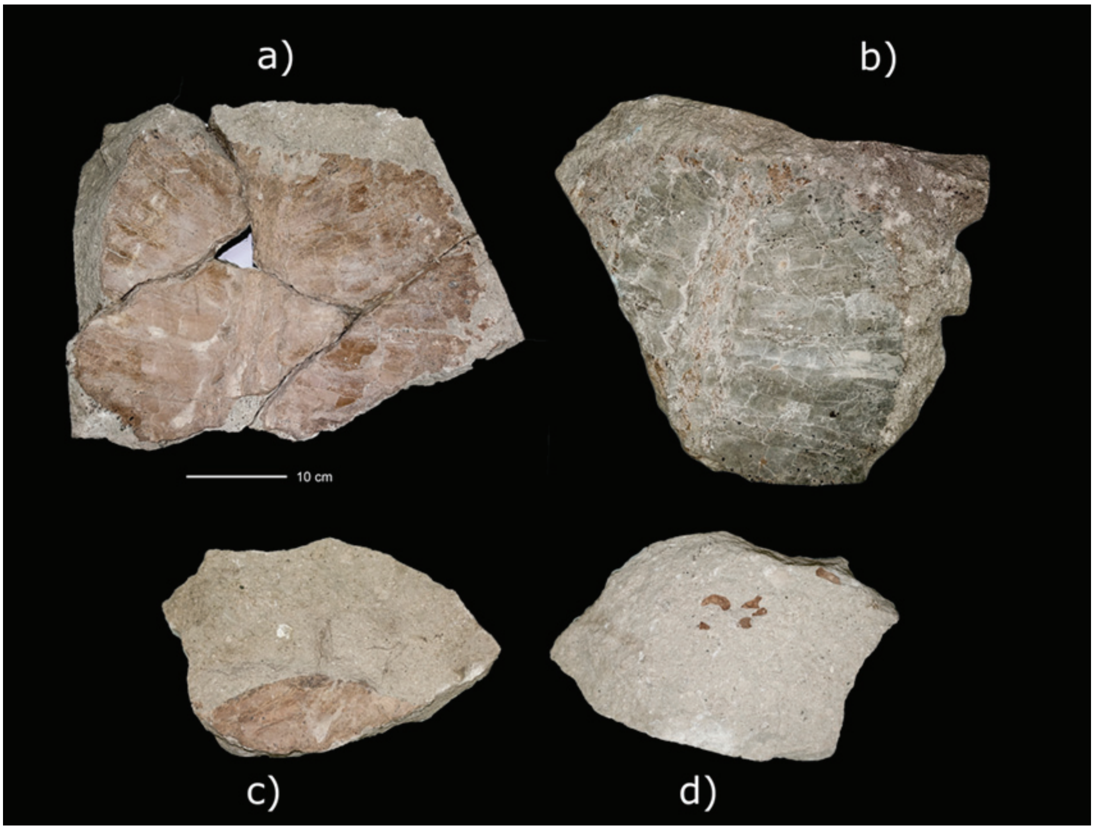

Figure 4. Image of the Albești Limestone blocks before preparation works: (a) the Trionychinae carapace into the limestone, inner view; (b) limestone counter-block with inner imprint of the carapace; (c) additional piece of the carapace, its position in the carapace was unknown at the time; (d) opposite side of the additional carapace piece (photo by Nicolae Trif).

Additionally, we studied the limestone in classical thin sections for microscopy, in order to interpret the microfacies. A slice of a few millimetres thick was cut across the rock sample with a diamond saw in order to prepare a thin section for OM and polished thin sections for polarized light optical microscopy. After cutting, the slice was cleaned with distilled water. Optical microscopy was carried out at the Department of Geology (Babeş-Bolyai University Cluj-Napoca) with an Axio Imager. A 2 m Zeiss transmitted light polarizing microscope equipped with a Zen 2011 Axio high resolution digital video camera.

Last but not least, the mineral content of the rock was analysed, revealing that sulphides occurred as results of diagenesis. In order to determine the mineral content of the rock a few grams of material from the limestone were hand-milled in an agate mortar and analysed by X-ray powder diffraction (XRPD) with a Bruker D8 Advance diffractometer in the Department of Geology from the Babeş-Bolyai University from Cluj-Napoca. The diffractometer has a Bragg-Brentano geometry and operates at 40 kV and 40 mA with a Cu anode. Other technical characteristics include CuKα1 radiation (λ = 1.5418 Å), Ni 0.0125 mm filter and a one-dimensional LynxEye detector. The diffraction was recorded from 5° to 64° (2T) with 0.02° (2θ) step and 1s/step. The identification of the minerals is based on the Bruker's Diffrac.Eva 2.1 software and the ICDD PDF 2016 database.

Photographs were captured with a Sony DSC-RX100M5 camera mounted on a professional tripod, as well as a Nikon d90 with 18-55 mm objective. The morphometric data for macrofossils were established with the help of a measuring tape. The illustrations and maps from the text were made using Adobe Photoshop CS5, Inkscape.Ink and GIMP2.Ink programs.

All measurements are in millimetres, taken with a professional calliper. The anatomical terminology and systematics follow LOVERIDGE & WILLIAMS (1957) and LAPPARENT DE BROIN (1977, 2001).

RESULTS

Systematic palaeontology

Order **Chelonii** Brongniart, 1800 (Latreille, 1800)
Infraorder **Cryptodira** Cope, 1868
Superfamily **Trionychoidea** Fitzinger, 1826 (Gray, 1825)
Family **Trionychidae** Fitzinger, 1826 (Gray, 1825)
Subfamily **Trionychinae** Fitzinger, 1826

Trionychinae indet.
Plate I, 4 a-b

Description. In the fragmentary carapace ADPNS 2473, the nuchal plate is missing, as well as the free ribs. The edges are broken and deformed by the sediment overburden. In the external face of the carapace pitted sculpturing can be observed dotting the neural- and costal plates, specific to the Trionychidae. Most of the pits close to the edges of the carapace are filled with marcasite grains of different sizes. Only the sutures of the third costal plate can be distinguished on the right side of the carapace. On the left side there is a bone which remained fixed on the carapace in the same rock matrix. Judging by its shape, it might be an epiplastron fragment. Out of the eight ribs specific to the Trionychidae, only six pairs can be observed in this specimen, and it is most likely that the first and eight pairs are missing. The right half of the carapace is better preserved and one can notice the fourth rib being perpendicular to the midline. The second and third ribs are obliquely trended towards the frontal part of the shell and the ribs five, six and seven are backwards curved. Every rib is convex and thick all the way towards the fourth one, and beginning with the fifth the ribs start to become thinner. On the right side only half of the second rib can be seen, while the remaining are complete; however, ribs four, five and six are cut obliquely. At ribs three, four and seven the inner margins are rounded and broken. On the left side of the carapace only the sixth rib is complete. Because the free ribs are missing one cannot observe the fontanelles. The middle portion of the carapace is compressed and mostly deformed. Only the flattened vertebrae which connect ribs three and four can still be distinguished.

The imprint of the carapace ADPNS 2474 shows an incomplete image of what the shell looks like. The right anterolateral part of the imprint is broken off. On the left side the imprints of ribs two-six can be seen clearly. The outline of the imprint is lightly scalloped and the free ends of the ribs are missing. Ribs two-four are rounded and prominent. Beginning with the fifth rib they curve towards the caudal part of the imprint and enlarge and the ends. The first and eight ribs unfortunately are not preserved. The imprint of the thoracic vertebrae is clearly preserved. All of these aspects fit with the ones of the fossil carapace, doubtless both blocks refer to same specimen (Table 1).

Table 1. Comparison between *T. clavatomarginatus* Lörenthey, 1903 and Trionychinae. indet. from Albeşti (shell imprint and fossil), showing their age, body size in millimeters, the size or lack of a nuchal and the length and width of their costal plates (data after LÖRENTHEY, 1903). Abbreviations: ant = anterior length; post = posterior length; pro = proximal width; dis = distal width.

	T. clavatomarginatus Lörenthey, 1903 Shell				**T. clavatomarginatus Lörenthey, 1903 Shell imprint**				**T. indet. Shell**				**T. indet. Shell imprint**			
Age	Priabonian				Priabonian				Ypresian – Lutetian				Ypresian – Lutetian			
Length	380				380				273				270			
Width	350				355				300				260			
Nuchal	L=51		W=207		L=51		W=207		-				-			
Length and Width of each carapace																
	Length		Width		Length		Width		Length		Width		Length		Width	
	ant	post	pro	dis	ant	post	pro	dis	ant	post	pro	dis	ant	post	pro	dis
C I	97	114	46	39	100	130	43	41	-	-	-	-	-	-	-	-
C II	114	145	44	69	130	157	37	59	55	100	25	23	155	160	35	25
C III	145	152	40	53	157	177	44	50	100	123	40	56	160	167	31	30
C IV	152	148	38	54	177	170	37	48	100	115	30	40	167	158	28	37
C V	148	136	36	56	170	173	35	41	115	120	30	28	158	153	30	31
C VI	136	121	38	60	173	143	29	51	95	105	25	30	153	125	35	40
C VII	121	95	37	56	143	94	25	34	110	100	25	34	125	90	25	35
C VIII	-	-	-	78	94	55	30		-	-	-	-	90	68	30	

Dimensions. In the following Table 1, there is a brief comparison between the Albeşti turtle and *T. clavatomarginatus* Lörenthey, 1903, which is a well-preserved fossil, held in the collection of the Palaeontology and Stratigraphy Museum of the Babeş-Bolyai University in Cluj-Napoca. The first column shows the data on the turtle's shell, measured by Lörenthey, the second column shows the data on the imprint of the turtle's shell with the measurements done by us, and the last column shows the data on the shell imprint of the Albeşti turtle. The measurements of the rib lengths of *T. clavatomarginatus* Lörenthey, 1903 were done by Lörenthey along the suture line of the ribs and so we measured our specimen the same way.

Discussion. The history regarding the nomenclature of soft-shelled turtles is rather complex and has been subjected to changes (MEYLAN, 1987). The present nomenclature of turtles follows two trends: the current one based on ranks governed by the ICZN (International Commission on Zoological Nomenclature) through the ICZN (International Code of Zoological Nomenclature; 1999) and the rank-free phylogenetic direction through the PhyloCode (International Code of Phylogenetic Nomenclature; 2003) based on the phylogenetically defined clade names (JOYCE et al., 2004).

French palaeontologist CUVIER (1812) provided the first description of Old World fossil soft-shelled turtles, based on research of fragmentary remains found in France. Soon afterwards fossil trionychids were discovered in almost every country in Europe. However, a problem arose, when during the second half of the 19th century and at the beginning of the 20th century every new fossil soft-shelled turtle discovery was treated as a new taxon, mostly in Italy (JOYCE et al., 2004; VITEK & JOYCE, 2015). HUMMEL (1929, 1932) provided the first complete list of fossil soft-shelled turtles named at the time, and through his work he was the first to indicate that the names of many species that were based on fragmentary remains should be considered dubious. During the second half of the 20th century, the fossil record of European trionychids was partially summarized, beginning with LOVERIDGE & WILLIAMS (1957), who wrote a revision concerning the African tortoises and turtles for the Harvard College. Next came other notable researchers, such as Młynarski, Meylan, Iverson, Lapparent de Broin, Danilov, etc (JOYCE et al., 2004; JOYCE & LYSON 2010).

The person who provided the first phylogenetic analysis of trionychids was MEYLAN (1987), but his research was restricted only to extant species. After the publication of Meylan's research, extinct species were reanalysed and revised by a new generation of palaeontologists (ex: Joyce, Vitek, Lyson, Georgalis, etc.) who wanted to revolutionize the nomenclature of turtles. They based their research on the PhyloCode (2003), such as Joyce who, in 2004, published his work, under the title 'Developing a Protocol for the Conversion of rank-based Taxon Names to Phylogenetically Defined Clade Names, as Exemplified by Turtles' (VITEK, 2012). This contribution follows ICZN (1999) systematically.

The presence of early Eocene soft shelled turtles in Eastern Europe is still devoid of enough studies, because few fossils have been discovered so far, even ones that are poorly preserved. In Bulgaria a late Eocene Trionychidae indet. was discovered, in Hungary a *Trionychidae* indet. from the mid- and late Eocene, in Romania two Trionychidae indet. from the late Eocene (Ypresian – Lutetian) – one mid-Eocene Trionychidae indet. from Sibiu and three late Eocene Trionychidae indet. from Cluj (GEORGALIS & JOYCE, 2017), and in Ukraine form the mid-Eocene a *T. ikoviensis* (DANILOV et al., 2011). By comparison, Western Europe is abundant in fossil soft-shelled turtles that are known especially from the Eocene. The genera known from the early Eocene were endemic to Europe, even though they showed similar characteristics with the ones from North America and Asia. However, no common origin for these genera was demonstrated yet. As the endemic European species were progressively disappearing, new ones appeared at the beginning of the Eocene. What we know today is that the Lower Cretaceous species from Asia and the Upper Cretaceous species from North America were coeval with the last Mesozoic species from Europe (LAPPARENT DE BROIN, 2000, 2001; VITEK & DANILOV, 2010).

LAPPARENT DE BROIN (2001) used the name *Trionyx s. l.* only for the European taxa, so as to establish a line that separates them from the other soft-shelled turtles of the world. She distinguished species with small shells from the Palaeocene and the lower Eocene from Belgium and France, as well as midsized species from France and Austria: *T. michauxi* Broin, 1977, *T. styriacus* Peters, 1855, *T. ikoviensis* Danilov, 2011. She also considers the presence of *Rafetus* as a possibility in Eastern Europe, based on discoveries from Turkey (LAPPARENT DE BROIN, 2001).

After reviewing the fossil *Trionychidae* from France, DE BROIN (1977) recognized two groups of soft-shelled turtles in Europe: *Paleotrionyx* (large sized), represented in France in early Eocene (*P. vittatus)*, and in Belgium in the Paleocene and early Eocene *(T. erquelinnensis = P. vittatus, T. levalensis = P. aff. vittatus)* and in England *(Eurycephalochelys fowleri)*, as well as the *T. triunguis s.l.* line beginning with the late Miocene. Eastern Europe was not mentioned.

When GEORGALIS & JOYCE (2017) reviewed the European fossils, they recognized two valid taxa for the European Oligocene: *T. boulengeri* north of the Alps and *T. capellinii* south of the Alps, differentiated by a few nuanced characteristics of the carapace. They refer to the fact that *T. capellinii* seems restricted to the Eocene – Oligocene of Italy and to the fact that *T. clavatomarginatus* of Romania's Late Eocene or Oligocene is more likely *T. boulengeri*, even though the diagnose was done without the existence of the plastron (GEORGALIS & JOYCE, 2017). The geologic time gap between *T. clavatomarginatus* and the Albești Trionychidae indet. is confirmed even by BOMBIȚĂ (1963), who argued that the Eocene marine deposits from Albești and Porcești (Ypresian and early Lutetian) are not coeval with the ones from Alba-Iulia, Cluj and Jibou (late Lutetian and Priabonian).

Trionyx clavatomarginatus has a complicated nomenclatural history. In 1903 Lörenthey published a comprehensive material regarding multiple fossil turtle fragments discovered in different sites within the limits of Cluj, from different geological t times (Eocene or Oligocene). He named the specimen *clavatomarginatus* due to the etymology of the name (LÖRENTHEY, 1903; FARKAS, 1995). He even compared it to *T. austriacus*. In 1995 though Farkas did a review on these fossils, in which he compared *T. clavatomarginatus* with other soft-shelled turtles: *T. austriacus* Peters, 1859, *T. scutumantiquum* Cope, 1873, *T. barbarae* Owen, 1849. After reanalyzing the fossils, he accepted *T. clavatomarginatus* as *bona species*, although he stated that it, along with *T. boulengeri* of the Oligocene, is synonymous with the Miocene *T. gergensi*. GEORGALIS & JOYCE (2017) declared *T. clavatomarginatus* a *nomen invalidum* and a synonym for *T. boulengeri*, due to their similarities. They consider it highly undesirable to have a taxon based on non-synchronous materials.

We compared the Albești turtle to *T. clavatomarginatus*, according to their sizes and shell ornamentations, since both of them are midsized, even if they hail from different geologic periods. When Koch observed the ornamentations specific to soft-shelled turtles (LÖRENTHEY, 1903), Lörenthey specified that the ornamentation in *T. clavatomarginatus* is regularly aligned towards the margins and is non-uniformly scattered in the middle of the carapace. On the Albești specimen, the presence of ornamentations can be noted along the shell margins in the form of depressions filled with marcasite, as well as small, faint bulges scattered in the middle.

In the past, the systematization of fossils based on the carapace ornamentations was attempted, the characteristics of the carapaces of extinct Trionychids being differentiated even through colour (LOVERIDGE & WILLIAMS, 1957). It is still unclear whether these ornamentations had a peculiar role in the turtle's life (DE BROIN, 1977; LAPPARENT DE BROIN, 2001; DANILOV, 2011; VITEK & JOYCE, 2015; GEORGALIS & JOYCE, 2017) and the utility of the ornamentation structures is still unclear in the taxonomic identification of the Trionychids. Though for a long time these ornamentation characteristics were diagnostically considered due to the lack of other characteristics, today it is known and unanimously accepted that ornamentation variations are found not just between species, but also between individuals of the same species, between individuals of the same species and of different ages, between the carapace and plastron of the same individual and between the different areas of the same carapace (VITEK & JOYCE, 2015). This is why the ornamentation is not a criterion in the taxonomic identification of the species, but it is enough diagnostic to identify the subfamily Trionychinae (DE BROIN, 1977). The size of the ribs and their narrow forms towards the vertebrae and widened towards the exterior margins, offer the same taxonomic assignation.

Rock mineralogy. The microscopic analysis and the geochemical XRPD analysis have yielded the mineralogical composition of the rock in which the Albești turtle was discovered. The marcasite, pyrite and calcite could be diagenetic and the quartz and chalcopyrite could probably originate by rework from the neighbouring metamorphic terrains. As it is well known, marcasite forms pseudo-morphic structures, most of the time in association with fossils (SZAKÁLL, 2005). In the depressions of the Albești carapace we were able to identify such structures, which upon analysis proved to be marcasites. The presence of pyrite shows the probability of an anoxic environment about 50-100 m deep. The tropical and subtropical climate of the Eocene from the Albești area led to the warming of the waters. This determined the rise in the number of foraminifera, in turn contributing to the anoxicity of deeper waters.

Microfacies. The carbonate deposits from which the turtle shell originates are characterized by granular bioclastic facies caught in a detritic matrix with terrigenous elements (quartz granules). In accordance with the terminologies proposed by DUNHAM (1962) and EMBRY & KLOVAN (1971), the analysed limestones can be classified as coarse grainstones and bioclastic rudstones.

About the micropaleontological contents, it is worth mentioning the presence of numerous large benthic foraminifera (*Nummulites, Discocyclina, Assilina*) (Pl. II). Along with these, the following biotic forms can also be mentioned: isolated pieces of echinoids (small plates and spike fragments), red algae thallus fragments, or some rotaliid foraminifera which are unidentifiable to the generic level.

The clasts represent weak sorting towards the environment and a relatively condensed configuration, most likely due to the compacting processes which occurred during the post-burial diagenesis (FLÜGEL, 2010). The morphology of the compositional elements (deformed/truncated bioclasts and prevalent subangular detritic fragments) demonstrates an abrasion phenomenon and transportation on relatively short distances, effects of accentuated hidrodynamic energy. The micropaleontological assemblages and the presence of fine extraclasts (quarts granules) suggest a depositional environment with shallow waters and with frequent terrigenous sedimentary inputs (Fig. 5).

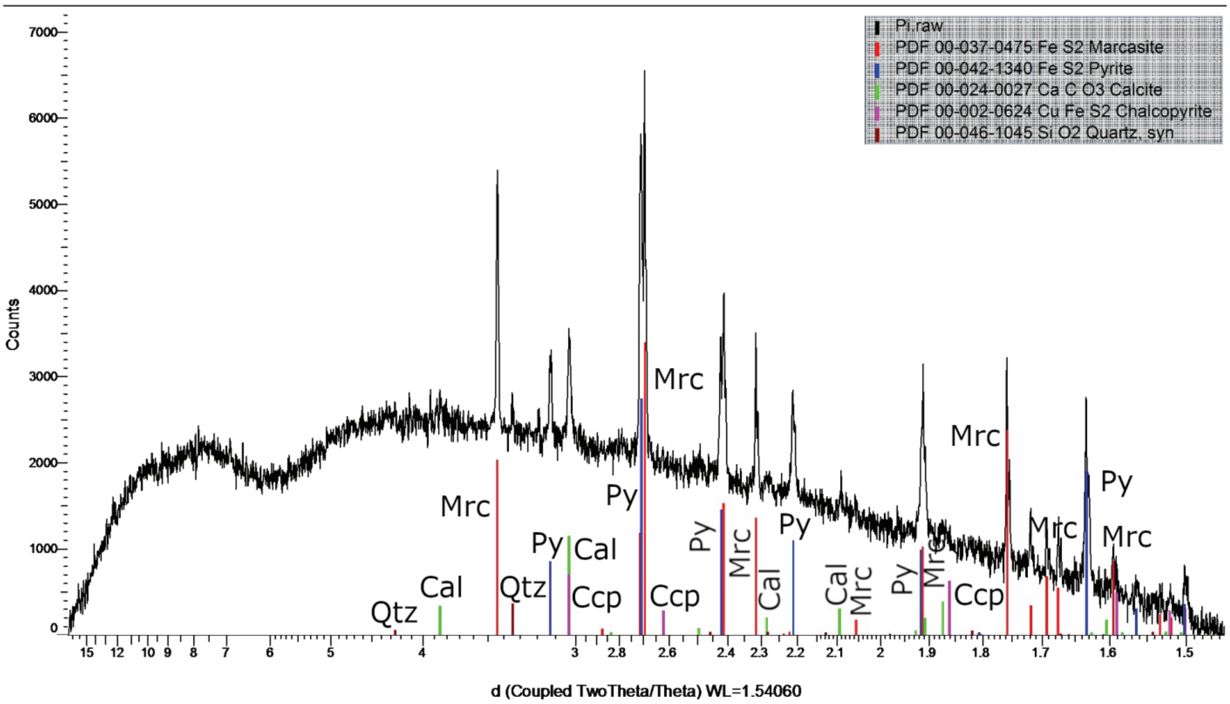

Figure 5. X-ray diffractogram illustrating the mineralogical composition of the sample: Marcasite (Mrc), Pyrite (Py), Calcite (Cal), Chalcopyrite (Ccp), Quartz (Qtz)

Paleogeography. Even if the migratory direction of the soft-shelled turtles is unclear (VREMIR, 2013), it is more and more widely accepted that these migrations could take place both on land and in the sea. Trionychoidea are freshwater turtles with paddled limbs and they are able to cross a short seaway or to follow a coastline (LAPPARENT DE BROIN, 2000). Recent studies have shown that examples of *Trionyx triunguis* Forskål, 1775 from the southern coast of Turkey could occasionally swim for short distances even in the open sea. The presence of these species in some of the Greek islands in 1992 determined their pursuit, concluding with this migration (CORSINI-FOKA & MASSETI, 2008).

Paleoecology. Trionychids are indicative of the proximity of land zones. The turtles of the *Trionyx* genus are indicatives for both fresh water lakes and slow flowing rivers (CODREA & FĂRCAȘ, 2002). The analysis of the fossil skulls and comparing them with extinct species enables the identification of the diet of the fossil soft-shelled turtles: fish and molluscs for large species; however, it is presumed that herbivorous species existed as well, although the skulls more likely support the idea that these were durophagous (VITEK & JOYCE, 2015).

Taphonomy. The discovery of this fossil fresh water soft-shelled turtle in the sedimentary marine strata makes many think that this specimen was post-mortem carried from neighbouring emerging areas, washed by river flows, into the marine basin, where the hydrotaphonomy was continued by waves and currents. The water transport for the carapace is documented by its razed margins, the erased ornamentation, and the absence of plastron (although a small plastron fragment could be however present in the limestone block ADPNS 2474) as well as the limb bones. In other words, it represents allochthonous participants in the taphocenosis (CODREA & FĂRCAȘ, 2002).

CONCLUDING REMARKS

The studied fossil, discovered in the Albești Nummulitic Limestone from Argeș District in the Foredeep of the Southern Carpathians, is the carapace of a freshwater soft-shelled turtle. As this discovery happened half a century ago, it is difficult to know now from which level of the quarry it originated from, but one may presume that it was the middle one. Therefore, the geological age is middle Eocene (Lutetian). The poor preservation of this material obstructs an assignation to a species or even a genus, since such assignations can be based only on skull characters, of which this specimen is devoid. Therefore, it may be noticed as belonging to Trionychinae indet., based on the peculiar characters of this subfamily: ornamentation on the surface of the shell, which includes small bulges and depressions, absence of peripherals as well as the presence of lateral extremities through which the rib ends come out of (though the rib ends are also not preserved in our specimen), seven or eight pairs of pleurals from which the first and last pairs are not preserved as well.

The microscopic analysis revealed the presence of micropaleontological assemblages specific to the Eocene environment (*Nummulites, Assilina, Discocyclina)*. The diffractogram shows the principal presence of marcasite, followed by pyrite and calcite, which could be diagenetic, while the quartz and chalcopyrite probably were carried into the marine basin by river streams, from the neighbouring metamorphic terrains. A characteristic of this carapace is represented by the marcasite pseudo-morphic structures, which formed into the shell's pits.

In terms of microfacies, the analysed limestone, which belongs to the carbonate deposits the carapace was extracted from, could be characterized as being coarse grainstones or bioclastic rudstones.

Regarding the local paleoecology, the micropaleontological assemblies and the transport of terrigenous materials suggest shallow waters (50-100 m deep), but with high hydrodynamic energies at the surface. On deeper waters, anoxic tendencies were present. This soft-shell turtle carapace is indicative for the proximity of emerged areas, where freshwater lakes and slow flowing rivers were present.

The taphonomy indicates that this specimen was carried *post mortem* from the neighbouring emerged zone. The morphology of the rock composing elements (e.g. deformed bioclasts) as well as the erased ornamentations in some portions of the carapace demonstrates the abrasion processes and transport before definitive burial.

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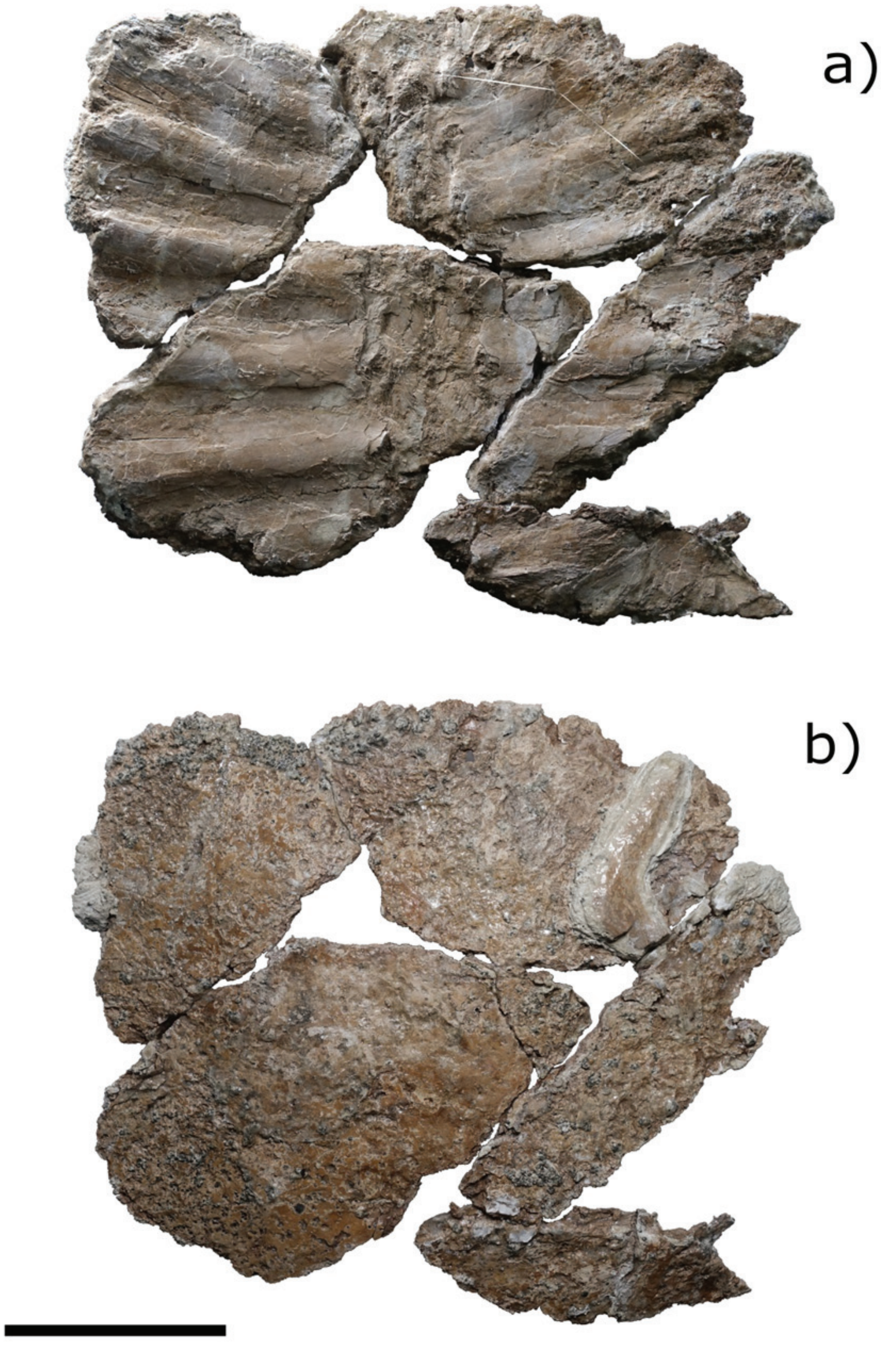
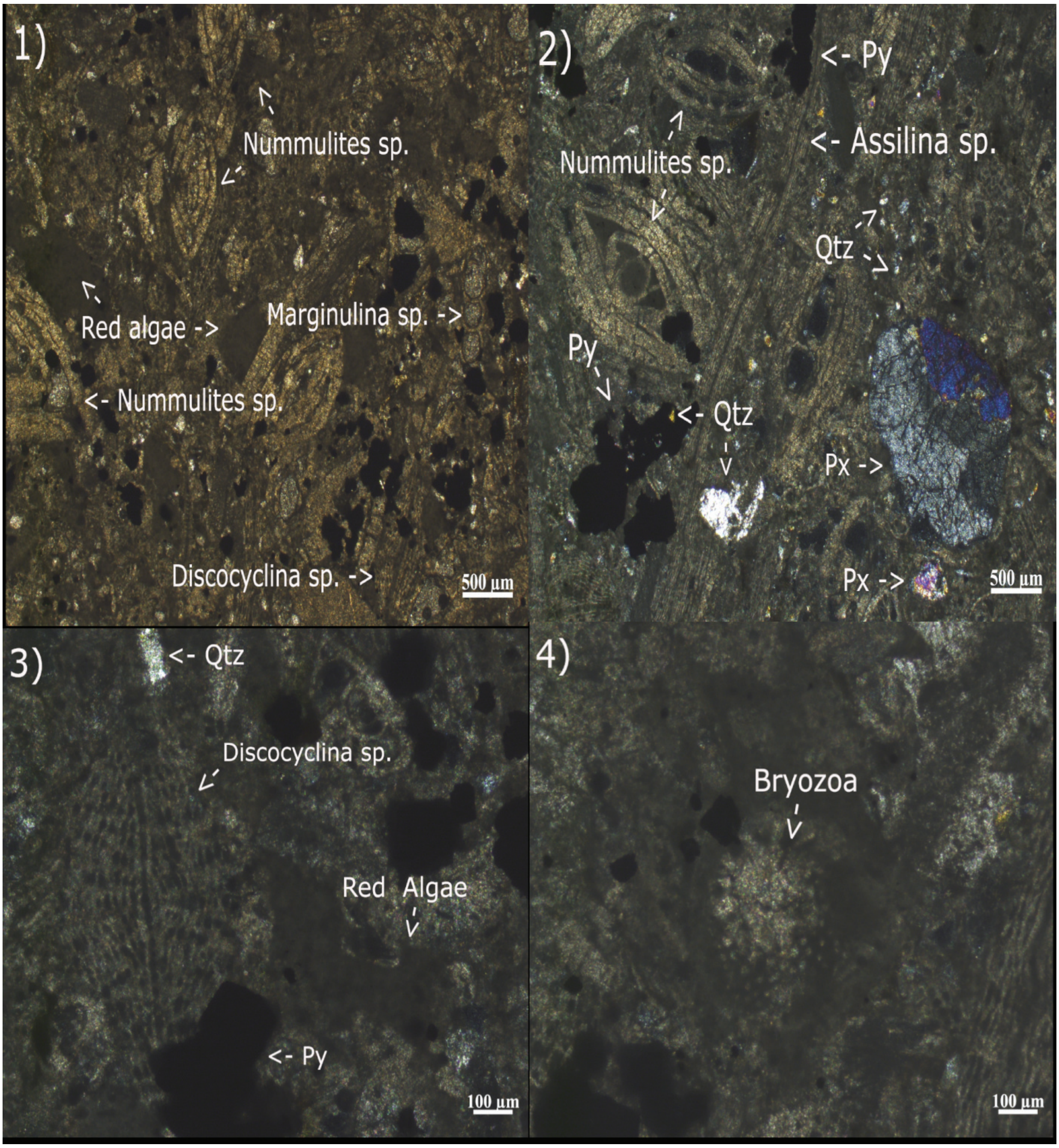
Plate I.



Fragmentary carapace of the Trionychinae turtle of Albești, Eocene (Lutetian): a. inner view; b. outer view (photo by Marian Bordeianu). Scale bar: 5 cm.

Plate II



Thin section in the limestone bearing the Trionichinae carapace. (1) Embedment of *Nummulites* sp., as well as red algae, *Discocyclina* sp. and *Marginulina* sp.; (2) *Nummulites* sp. and *Assilina* sp., pieces of pyroxene (Px) and more prominent, several pieces of quartz (Qtz), chunks of pyrite (Py); (3) A piece of quartz (Qtz), red algae, chunks of pyrite (Py), *Discocyclina* sp.; (4) A possible ?Bryozoa.