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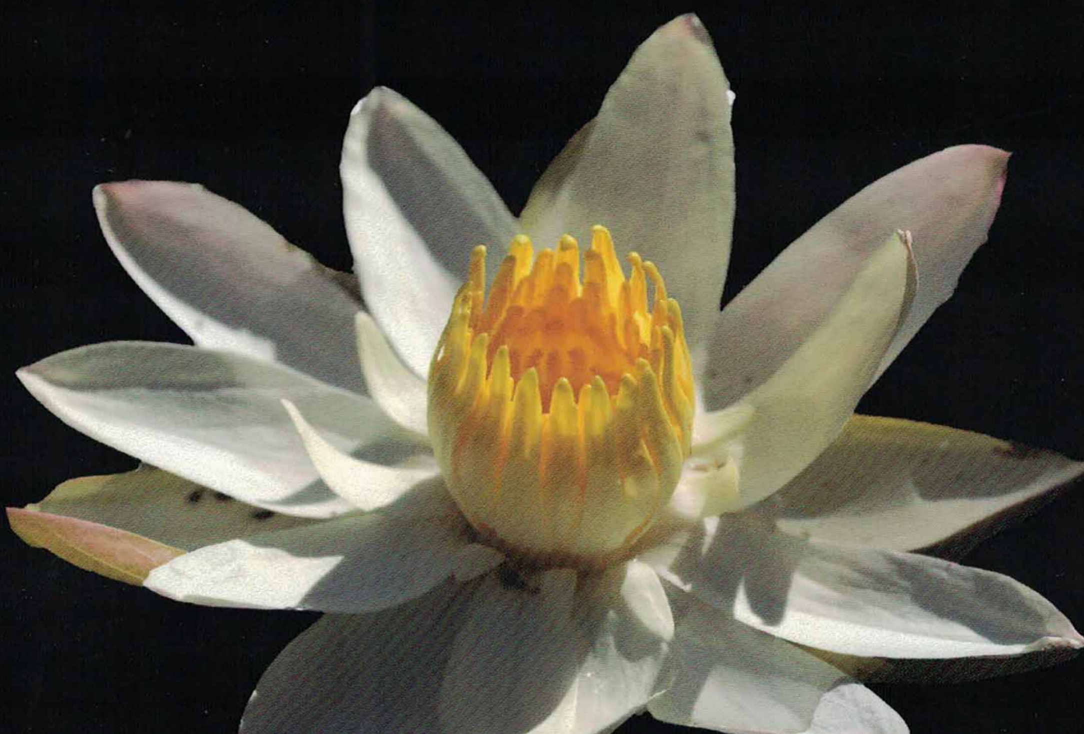

2023

MUZEUL ŢĂRII CRIŞURILOR

NYMPHAEA

FOLIA NATURAE BIHARIAE

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Editura Muzeului Ţării Crişurilor
Oradea 2023

Please send any mail to the following adress:

MUZEUL ŢĂRII CRIŞURILOR
RO-410087 Oradea, Armatei Române nr. 1/A
ROMÂNIA

Founded by
Dr. SEVER DUMITRAŞCU, 1973

ISSN 0253-4649

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New data on the Biharia Horst documented by deep drilling

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Abstract. The geology of the Apuseni Mountains and their related sedimentary basins was an ongoing challenge for the Romanian geological research. Amongst these basins, the Neogene basins Șimleu, Borod, and Beiuș stand out thanks to their geothermal and hydrocarbon potential. The structural evolution of the basement of these subsiding areas, but also of their outlining orogenic rims that shape them, can be reconstructed in a more detailed manner, in order to get a better knowledge of the development and function of the deep hydro-geothermal systems. However, the misinterpretation of data from boreholes drilled in the area throughout time has resulted in a number of errors (*e.g.*, the presence of the Paleogene deposits). This paper concerns a tectonic structure at a southern portion of the boundary between the Borod and Șimleu sedimentary basins, namely the Biharia Horst. The structure in question represents an important area for the hydro-geothermal systems located in the basement of the Neogene basins. Based on geological data from four deep geothermal wells and a petroleum one, we succeeded to outline more precisely the extent of the horst in a northerly direction, and to provide more concrete data on the basement tectonics of the previously mentioned Neogene basins as well as their hydrogeological recharge.

Keywords. Biharia Horst, Borod Basin, Șimleu Basin, Inner Dacides, Romania.

Introduction

At a time of climate fluctuations, human communities have begun to pay attention to the use of alternative energies instead of the use of fossil fuels. Among these types of energy there is obviously geothermal energy. Although its potential began to be reconsidered with the onset of the world energy crisis in 1973 (Țenu 1981), the exploitation of this type of resource for energy purposes in Romania began only in the 1980s, until then it had only been used for recreational purposes. The first project for the industrial use of geothermal water was started by direct use in Sânicolau Mare (Timiș County; engineer Ionel Muțiu, personal communication), then in Oradea (Bihor County) in 1982-1983. The first exploitation project through heat exchangers, specialized pumps and adequate infrastructure started in Oradea only in 1987, and was completed in September 1992. Currently, the exploitation of geothermal energy covers the north-western region as well as parts of the southern region of Romania. For all this to be possible, the most important role was played by the former national enterprises dealing with prospecting and other geological works (*i.e.*, IPEG, IFLGS Bucharest, GFEAG Oradea, etc.). Thanks to the activities of these enterprises, important data related to the deep geological basement of the Romanian territory have been brought to light since the 1960s. This data has outlined or even concretely shaped previously unknown structural aspects. Some of this data was taken over by the Geological Prospecting and Exploration Enterprise Cluj (IPEG Cluj, now TRANSGEX SA). Before the fusion between the Drilling and Special Geological Works Enterprise Bucharest (IFLGS) and Drilling and Exploitation of Geothermal Waters Group Oradea (GFEAG Oradea), all three enterprises have carried out more than 200 deep boreholes in total, that remained classified as geothermal water wells.

Using the record data from four geothermal water boreholes drilled by TRANSGEX SA and data in the literature from a borehole drilled by the Ministry of Petroleum (Țenu 1981), in this paper we aim to: *i.* outline the Biharia Horst on a northern direction along the line of Oradea – Biharia – Satu Nou localities, *ii*. bring new contributions for the southern margin of Șimleu Basin along the line of Biharia – Satu Nou – Tămășeu localities, and *iii*. improve the knowledge on the water supply of the hydro-geothermal systems in the Neogene Șimleu and Borod basins. Although some data have been presented before in the literature (*i.e.*, Istocescu & Ionescu 1970; Țenu 1981 and references therein), all our interpretations will be made by using the internal data from TRANSGEX SA.

Geological setting

The area of interest comprises the north-western sector bordering the Plopiș Mountains as well as the further away neighboring area of the Pannonian Depression. Hence, for the latter, we also refer to its related Borod and Șimleu Neogene sedimentary basins (Paucă 1954, 1967; Nicorici 1981; Popa 2000; Săndulescu 1984). The evolutionary geological context of the Plopiș Mountains is not one with tectono-stratigraphic specificity other than that of the whole Northern Apuseni area, more precisely of the Bihor Unit and the overlying thrusting nappe systems (*i.e.*, Inner Dacides in Săndulescu 1984, Apusenides in Balintoni 1997). The focus of this paper strictly involves the Bihor Unit without the associated thrusting nappes. Its metamorphic bedrock (the Someș Lithogroup, part of the Pre-Apulian terrane, interpreted as an active plate margin, in Balintoni 2019), was considered Precambrian and possibly Cambrian (Săndulescu 1984 and related references). In more recent viewpoints (Balintoni & Balica 2013; Balintoni 2019) these rocks were considered as sequences that recorded two metamorphic events (Ordovician metamorphism followed by Variscan metamorphism). Afterwards, this bedrock was subject to long processes of weathering and erosion before the end of the Paleozoic. In the sedimentary cover of this basement the first sedimentary sequence is Permian, of Verrucano-type clastic deposits, and the last deposits are those accumulated in the post-tectonogenetic elongated grabens (the emplacement of the thrusting nappes in the Bihor Unit occurred in the pre-Gosau tectonic pulse, according to Săndulescu 1984) occurred at the end of the Cretaceous, which also involve Gosau-type, 'Senonian' deposits (Lupu & Lupu 1960, 1983; Săsăran & Săsăran 2007; Schuller et al. 2009) and volcanic inputs. The Mesozoic sedimentary succession was interrupted by the Old and New Cimmerian orogeny and the 'Austrian' tectonic pulse (Ianovici et al. 1976; Bleahu et al. 1994; Săndulescu 1984; Ferry et al. 2022).

Concerning the tectonics of the Bihor Unit, it can be stated that in mid-Cretaceous, the thrusts become incipient, and some folds are formed, these being composed of mostly carbonate rocks (Istocescu & Ionescu 1970; Țenu 1981; Bleahu et al. 1994; Săndulescu 1984). The major thrusts occurred in the pre-Gosau tectonic pulse, when the Inner Dacides and mainly the Bihor Unit were also fractured into tectonic blocks. Finally, fractures and faults were also formed in the Cenozoic, particularly in the New Styrian tectonic pulse and subsequently, mainly related to the outlining of the sedimentary basins west of the Apuseni Mountains, filled in dominance by middle and late Neogene terrigenous deposits (Șimleu, Borod, Beiuș, Zărand) (Nicorici 1972, 1981; Visarion & Săndulescu 1979). It is important to note that among all these sedimentary basins trended NW-SE, located west to the Apuseni Mountains, lower Miocene sedimentary deposits are only in the Borod Basin, in its easternmost area (Popa, 2000). For this paper, only the southern margin of the Șimleu Basin and the northern one of the Borod Basin are of interest.

It is important to note that in this area Paleogene sedimentary deposits are completely missing. Such age mentioned in various technical papers of the above-mentioned enterprises are devoid of any paleontological evidence. One may presume that in Paleogene all the region related now to the Bihor County was emerged.

As far as erosion is concerned, it is clear that the Quaternary has also left its mark (Fig. 1), and it is found in the form of mainly clastic deposits up to 100 m thick. The presence of the Pliocene rocks is not excluded in this pile of clastic rocks, but for instance there are not enough paleontological evidence for this geological age. Unfortunately, the mastodons from Păgaia (Codrea et al. 2005), which we might assume could be Pliocene, do not occur in a broader fossil vertebrate association that is clearly indicative of such an age.

Biharia Horst as seen from deep drilling data

Being located between the Șimleu Basin to the north and the Borod Basin to the south, the Biharia Horst represents the western extension in the form of a submerged step, of the Plopiș Mountains (Țenu 1981), being in fact part of the Bihor Unit (Bleahu et al. 1994).

The four boreholes whose data were used for the descriptions that follow are F-1709H, F-4021H, F-4022H and F-1021H (Fig. 1, Table 1). Three of these were drilled in 1967 and one in 1983, so it can be assumed that the stratigraphic interpretations of that period were not necessarily very accurate. Two very good examples are provided by the data obtained from the drilling of F-4021H and F-4022H, which would have intercepted ‘Paleogene’ blackish marly deposits with ‘*Globigerina* indet. and pyrite’, which are lithologically similar to those of the Late Cretaceous from Băile Felix. A fifth well considered in our descriptions is borehole 501 executed by the Ministry of Petroleum (Fig. 1, Table 1). As far as this well is concerned, the only data we used, by extrapolation, are the depths at which the borehole crossed the stratigraphic intervals of various ages, following Țenu (1981) and Ștefănescu et al. (1988), as we have no other specific data on this borehole. However, it is worth noting that these data are also useful for defining the extent of the horst in question.

The depths at which the boreholes were projected are not the same depths at which they were drilled. Thus, F-1709H was stopped with the sole in the Triassic, F-4021H and F-501MP encountered the first Permo-Werfenian sedimentary sequence, F-4022H was stopped in the ‘Paleogene’ rocks, and F-1021H in the Cretaceous ones. Other detailed data on the lithology of the encountered rocks cannot be made public. What we can say instead is that the lithology does not differ much from one well to another, and that the rocks associated with geological ages, except for the ‘Paleogene’ rocks which are rather Upper Cretaceous, were described with sufficient accuracy by Istocescu & Ionescu (1970).

Table 1. Deep drilling data concerning the thickness of the deposits of various geological ages.

WELL	F-1709H	F-4021H	F-4022H	F-1021H	F-501MP
ELEVATION	132 m	131 m	111 m	111 m	130 m
QUATERNARY	0 – 50 m	0 – 25 m	0 – 25 m	0 – 25 m	0 – 20 m
PANNONIAN	50 – 1059 m	25 – 1600 m	25 – 2150 m	25 – 2070 m	20 – 1200 m
MIOCENE	1059 – 1821 m	1600 – 1840 m	2150 – 2604 m	2070 – 2480 m	1200 – 1600 m
‘PALEOGENE’		1840 – 2016 m	2604 – 2980 m	2480 – 3160 m	
CRETACEOUS	1821 – 2648 m	2016 – 2170 m		3160 – 3453 m	
JURASSIC	2648 – 2796 m				
TRIASSIC	2796 – 3448 m				
BASEMENT		2170 – 2276 m			

The knowledge gaps between the pre-drilling and post-drilling periods can be clearly seen graphically on the various geological cross-sections that have been developed over time. Probably, the last cross-section outlined just before the drilling started is the one shown on the 1:200 000 map, *folio* Oradea, published in

1965 by Giușcă et al. (Fig. 2). In this map it can be seen that the 'Biharea' area would represent a submerged area of the Pannonian Basin, while the Municipality of Oradea would lie over a large horst. Immediately after the drilling of the boreholes in the 1960s, using their acquired borehole data, Istocescu & Ionescu (1970) attempted to elucidate the tectonics and subsurface geology of the northeastern part of the Pannonian Basin, providing an alternative block-diagram sketch of the region (Fig. 3). As can be seen from the drawing, even this representation involves ‘Paleogene’ deposits, which have not been proven with hard bio-stratigraphic arguments. Another remark refers to the Biharia Horst, which is erroneously represented as inverted.

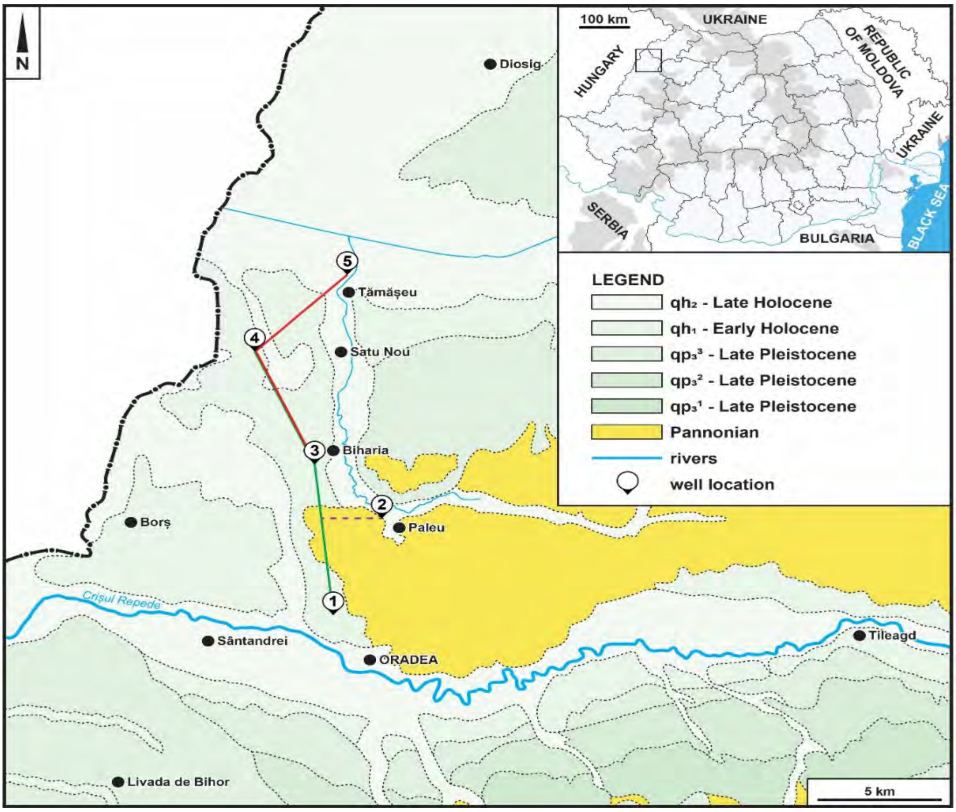

Fig. 1. Geological map of the studied area (modified after Giușcă et al. 1965 and Giușcă et al. 1967), with the direction of the cross sections from Fig. 7. Section A: well points 1 – 2 (projected) – 3 – 4; Section B: well points 3 – 4 – 5.

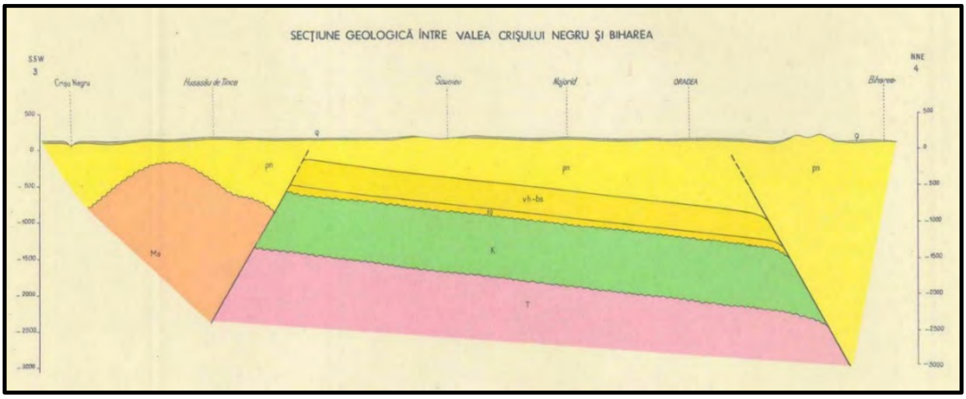

Fig. 2. Geological cross-section between the Crișului Negru Valley and Biharia (by Giușcă et al. 1965). Ma = Precambrian; T = Triassic; K = Cretaceous; to =’Tortonian’ (*i.e.*, Badenian); vh-bs = Volhynian-Bessarabian; pn = Pannonian *s.l.* (including Pontian); Q = Quaternary.

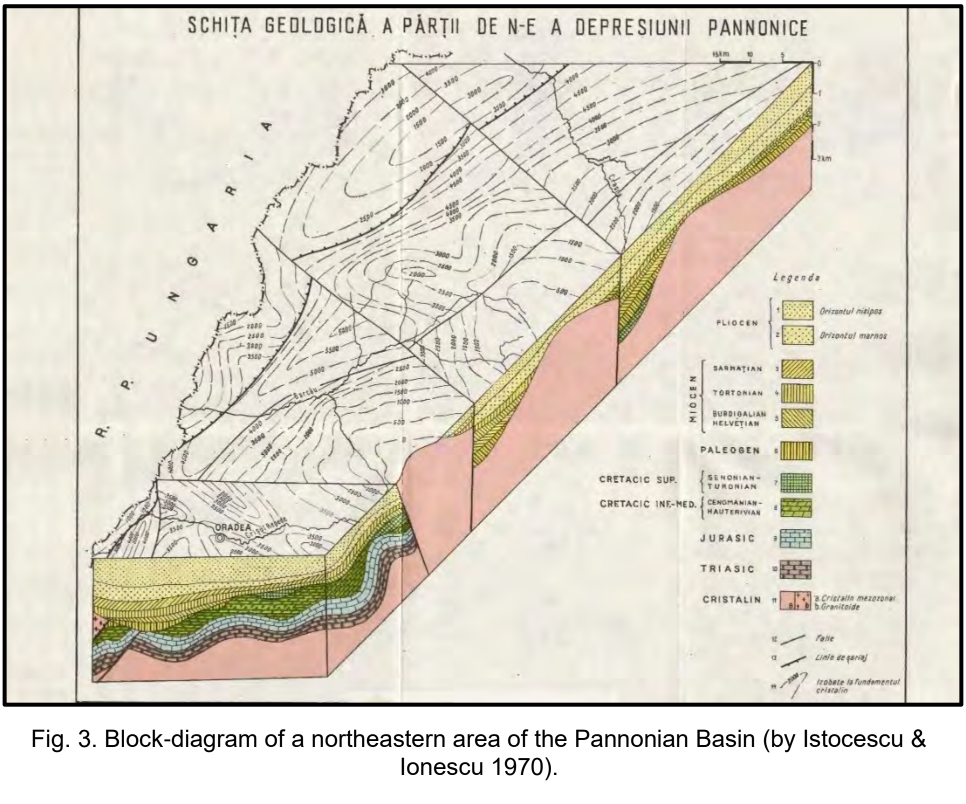

Fig. 3. Block-diagram of a northeastern area of the Pannonian Basin (by Istocescu & Ionescu 1970).

Țenu (1981), in his paper on hyperthermal waters in northwestern Romania, made the most accurate graphical interpretations for that period (Figs. 4, 5), based on a richness of borehole data. However, other borehole data have been collected since then, and with these, new ways of interpreting the structural geology could be brought to light. In contrast, the author is the first to exclude the 'Paleogene' deposits in this region (Fig. 5), even though they appeared in the drilling documentation.

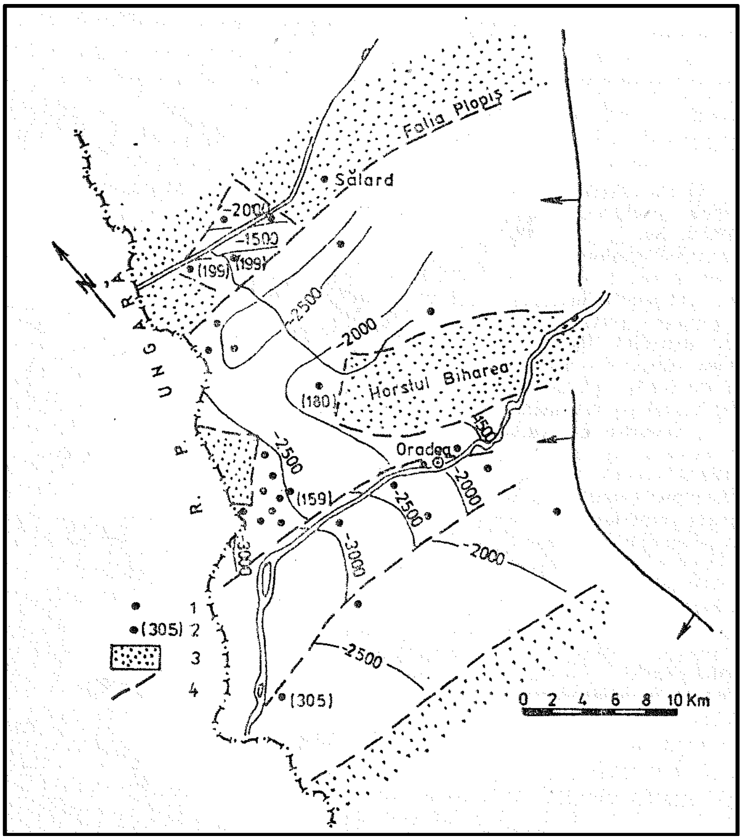

Fig. 4. Structural map depicting the top of the Triassic deposits (by Țenu 1981). The dotted areas refer to areas devoid of Triassic deposits.

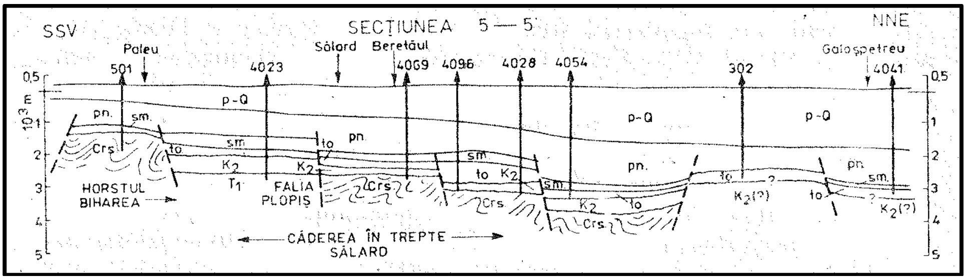

Fig. 5. Longitudinal geological cross-section with deep drilling data between Paleu and Galoșpetreu (by Țenu 1981).

Ștefănescu et al. (1988), while producing a series of geological sections for the whole Romanian territory, used both data from literature (documents and published papers) and maps, supported by boreholes, as well as by geophysical data taken by aeromagnetism, gravimetry and seismometry, and managed to include the Satu Nou - Biharia - Oradea and the Biharia Horst area in the NNW extremity of section 5-B. The representation of the horst is however incorrect, as its outlining faults are considered vertical. Instead, it is noteworthy that the editors excluded, as did Țenu (1981), the 'Paleogene' deposits from the section, relating them either to the Early Cretaceous in F-4022H or to the Middle-Late Miocene in F-4021H (Fig. 6).

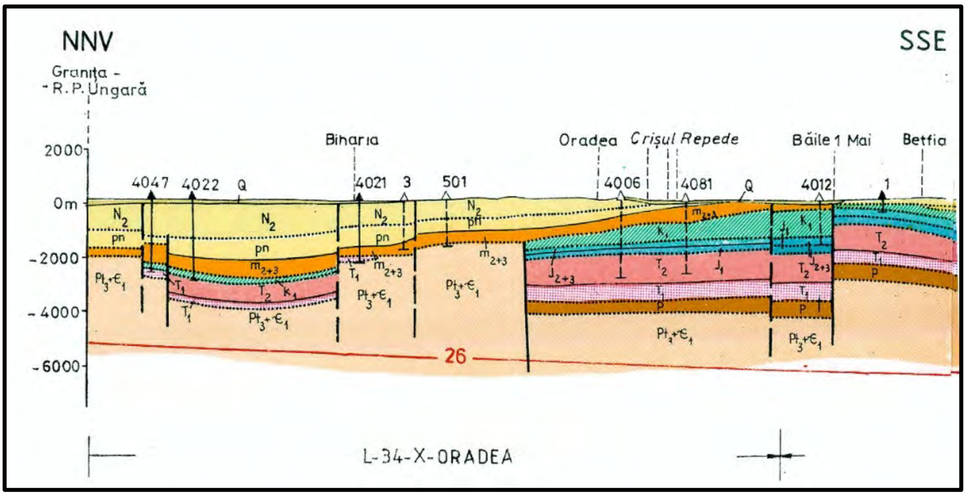

Fig. 6. Geological cross-section between the Romanian-Hungarian border and Betfia (after Ștefănescu et al. 1988).

The Biharia Horst as seen in our perception

A major factor to consider when discussing high depth drilling is keeping track of drilling fluid losses. The only data we have in this regard are the considerable losses that occurred during the drilling of wells F-4021H and F-1709H on the Mesozoic intervals or at the contact with the basement. Using this information, together with the drilling data from the records held by TRANSGEX SA (depth and stratigraphic intervals), we were able to outline the Biharia Horst more precisely (Fig. 7). As for the F-501MP borehole, we used its data as a projection for a distance of ca. 2.5 km to the west. As it is located on the inner margin of the Borod Basin, we can say without difficulty that, since the horst represents a submerged step of the Plopiș Mountains, thus of the Bihor Unit, the stratigraphic intervals in its depth should not differ too much on the basin margins in the east-west direction.

The data provided by the F-1709H well are in accordance with the data held by TRANSGEX SA for the other wells in the Oradea area, and their geological interpretation does not rise any difficulties at the contact level with the Biharia Horst. On the other hand, also from the internal data accumulated from the execution of dozens of boreholes, we could notice a very important aspect that can lead to a much more spatially correct interpretation of the fault structures related to the tectonic steps in the northwestern basins. These refer to the fact that faults have a dip angle between 45° and 60° relative to the horizontal. While in the Beiuș Basin the inclination angle is considerably closer to 60°, in the Borod and Șimleu basins it is smaller. Thus, in our representation (Fig. 7) the tilt angle of the step faults is ca. 45°.

Since the F-4021 well crosses from the Cretaceous directly into the basement, and has faced issues of drilling fluid loss at the contact between these two intervals, with no Jurassic or Triassic intervals encountered, the presence of another step submerged in the south-north direction, just at the entrance to the Șimleu Basin, is justified. Also, regarding the Șimleu Basin, the question of the lack of other Mesozoic deposits (*i.e.*, Triassic and Jurassic) must be raised. Insofar as the thickness of Cretaceous deposits does not differ much between the Borod and Șimleu basins, since in the Borod Basin the whole Mesozoic stratigraphic succession was encountered, while in the Șimleu Basin no Jurassic deposits were crossed, or some very restricted Triassic deposits were encountered (Ștefănescu et al, 1988), the lack of these geological ages could be related either to the fact that the drilling in the latter basin was not deep enough, that the well data collected during drilling were not correctly retrieved or misinterpreted, or that there are other series of submerged Mesozoic steps, which could not be highlighted for interpretation reasons.

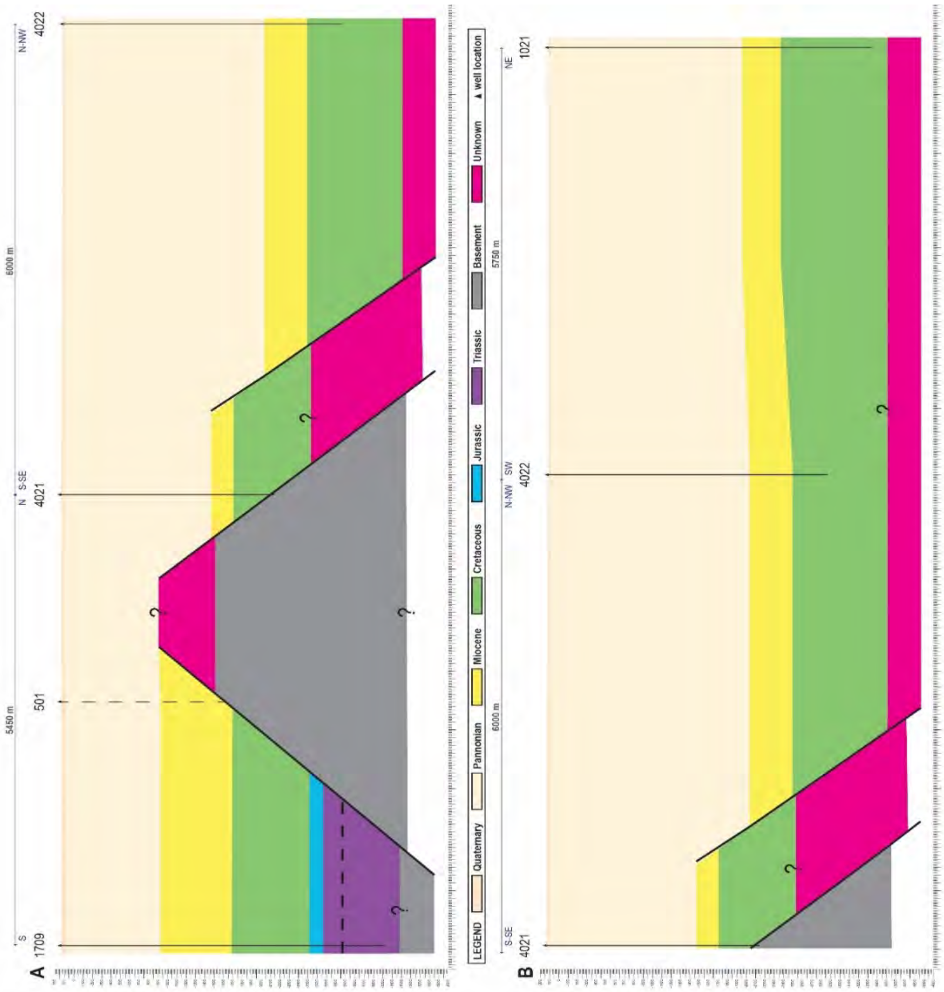

Fig. 7. Geological cross-sections: A = Borod Basin – Biharia Horst – Șimleu Basin (well points 1 – 2 (projected) – 3 – 4); B = Biharia Horst – Șimleu Basin (well points 3 – 4 – 5). ? = unknown. Scale bar in meters.

TRANSGEX SA enterprise data suggests that the water supply to the hydro-geothermal systems in the Neogene basins of northwestern Romania can follows two paths: one from the basin margins towards central areas, and the second from the depth. As far as the Șimleu and Borod basins are concerned, we can say with certainty that the fault areas around the Biharia Horst represent a water migration path from the surface to the underground. At the same time, we do not exclude the fact that the horst in question may harbor a magmatic body beneath it, intruding into the bedrock with remnant heat, or that it may lie just above the mantle. In the former case, only the presence of a batholith would be justifiable for the heat being distributed in the hydro-geothermal systems in the basins, while smaller sill, dyke or laccolith structures are excluded in this context, as they would have cooled faster over time and the heat would have dissipated. In the second case, another problem would be raised, namely that of the Bihor Unit, its thickness at bedrock level, at depth, and the lack of heat remaining towards the surface of the unit’s margins. In this scenario, many unknowns remain to be solved: what is the age of the magmatic body, what was the scenario of its emplacement, which rocks are intruded and what are the thermal contact influences, etc.

Conclusions

Using data from four deep boreholes drilled by TRANSGEX SA and data from a borehole drilled by the Ministry of Petroleum, we were able to outline the approximate shape and size of the Biharia Horst on a south-north section, and the closest contact between this tectonic structure and the Neogene Borod and Șimleu basins. Since the interpretations made over the years on the Mesozoic deposits in the Șimleu basin have sometimes proved erroneous for various reasons, we leave open the option of the existence of a whole suite of Mesozoic sedimentation in this area.

The present paper underlines once more the missing Paleogene deposits in these boreholes. This detail is important for reconstructing the Paleogene paleogeography and bio-events (*e.g.*, Grande Coupure): it is obviously clear that this part of the Apuseni Mountains and the neighboring depressions were a wide terrestrial realm in the Paleogene, allowing the expansion of immigrants of Asian origin towards western Europe (Codrea & Fărcaș 2002; Fărcaș & Codrea 2004, 2005; Tissier et al. 2019; Codrea et al. 2019, 2022).

As far as the recharge of the hydro-geothermal systems of the Borod and Șimleu basins is concerned, we consider that the Biharia Horst is meaning a migration path of surface and meteoric waters towards depth, the horst most probably hosting underneath a batholith with remnant heat, partially intruded into the bedrock. The age, the extension and the heat of this presumed magmatic structure remain to be solved in future, based on geophysical data and more wells drilled for geothermal water and petroleum.

Acknowledgements

The authors' team would like to thank our colleague engineer Ionel Muțiu at TRANSGEX SA for providing data on the history of geothermal water exploitation from deep wells at national level.

Funding. This work was supported by a grant of the Romanian Ministry of Research, Innovation and Digitization, CNCS - UEFISCDI, project number PN-III-P4-PCE-2021-0351, within PNCDI III.

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NYMPHAEA Folia naturae Bihariae	L	23-36	Oradea, 2023

Testate amoebae and their role in the reconstruction of the Holocene palaeoenvironments in Romania

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Abstract. Testate amoebae are unicellular organisms that have been intensely studied in the last century due to their high sensitivity to ecological, hydrological and palaeoenvironmental factors. They are ubiquitous in wet environments, such as lakes or peatlands, being suitable for providing information from these natural archives about the Holocene palaeohydrological conditions. In the present paper we tried to synthetize their applicability in the Romanian peatlands and wetlands based on previous studies and to analyze their potential for future research.

Key words. Testate amoebae, peatlands, palaeoenvironment, palaeohydrology, palaeoecology, Holocene.

Introduction

Testate amoebae (TA), also referred to in the past as thecamoebians (Medioli & Scott 1983), arcellaceans (Patterson et al. 1985) or rhizopods (Harnisch 1948, Tolonen 1986), are unicellular organisms belonging to Subkingdom Protozoa, phylum Sarcomastigophora (Honigberg & Balamuth 1963). In the past 100 years, worldwide, they have been used as indicators of palaeoenvironmental conditions in peatlands (Tolonen et al. 1992, Charman 2001, Lamentowicz et al. 2020) or even in lake sediments (Ellison 1995, Patterson et al. 2002, Marcisz et al. 2020).

As these organisms are ubiquitous in peatlands, the interest in studying the relationship between TA assemblages and environmental factors such as pH, water table fluctuations or surface moisture increased, providing quantitative reconstructions of these variables (Charman & Warner 1997, Lamentowicz et al. 2010).

Although worldwide there are numerous studies of this kind, the number of quantitative reconstructions of the depth to water-table (DWT) (Schnitchen et al. 2006, Feurdean et al. 2015, Diaconu et al. 2017, 2019, Longman et al. 2017, Ruskal et al. 2020) or pH (Diaconu et al. 2017) in Romania are few, even though in 1960 Emil Pop counted and described 436 peatlands in Romania, out of which 171 are eutrophic and 265 oligotrophic (Pop 1960), suggesting therefore that there is great potential for palaeoenvironmental reconstructions lying in these areas.

Testate amoebae and their sensitivity to hydrological changes

The biology of testate amoebae was broadly studied and described by Sleigh (1989) and Patterson & Hedley (1992). The study of fossil TA began over 100 years ago (Lindberg 1899, Steinecke 1927) and has been of great interest ever since.

TA are unicellular protists that live in wet environments (peatlands, soils, lakes, rivers), with their size ranging preponderantly between 20-200 μm. They build their shell from siliceous, calcareous or proteinaceous material, or they agglutinate organic or minerogenic material from their surroundings and form a test. These tests have a wide variety of morphologies and shapes and are a key in identifying the organisms to a species level. TA are well preserved especially in peat sediments (Warner, 1990), and they were mostly studied from Quaternary (especially Holocene) onwards (Mitchell et al., 2008).

The response of the TA assemblages to ecological changes in peatlands has been established for almost a century (Harnisch 1925, Jung 1936) and has been extensively studied ever since. The focus of recent or present studies of fossil amoebae is the relationship between them and peat hydrology, as water availability is controlling the occurrence and abundance of different species, for the living space of TA is the water film on the host substrate (Charman 2007). To quantitatively reconstruct the depth to water-table (DWT) levels in peatlands, in the past decades many studies quantified the TA-water availability relationships (Charman & Warner 1997, Lamentowicz & Mitchell 2016) and several transfer functions were developed (Charman et al. 2007, Amesbury et al. 2016).

One of the most useful natural archives for the reconstruction of water availability, soil moisture or DWT values are ombrotrophic peat bogs. Their importance lies in the fact that their only source of water is from precipitation (rainwater and snowmelt), and their water balance is controlled primarily by precipitation and evapotranspiration (Lindsey 1995). Three main advantages of peat bogs, compared to other archives, identified by Chambers et al. (2012), are: (i) their widespread distribution around the globe and therefore their accessibility; (ii) they almost exclusively contain autochthonous organic matter and can be well-dated, leading to high-resolution chronologies, and (iii) they have a strong atmospheric signal, as they are isolated from groundwater.

Such peat bogs can be found primarily in the mountainous regions of Romania, along the Carpathian Mountains. Some of them have already been included in palaeohydrological studies, with peat accumulation starting from the Late Glacial - Holocene transition (i.e., Ic Ponor, 1050 m a.s.l., (Ruskal et al. 2020), Mohoș peat bog, 1050 m a.s.l. (Longman et al. 2017) and during the Late and Mid-Holocene (i.e., Tăul Muced, 1360 m a.s.l. (Diaconu et al. 2017), Fenyvestető, 1340 m a.s.l. (Schnitchen et al. 2006).

How to use testate amoebae in the reconstruction of Holocene palaeoenvironments: Ic Ponor case study

There are several steps to follow for the analysis of testate amoebae, which include: i. subsampling of the peat cores, laboratory treatment and analyzing each sample to ii. determine the relative abundance of the testate amoebae communities and reconstruct the water table levels, followed by the iii. interpretation of the results and comparison with other proxies from the same area or with other testate amoebae studies and water table depth reconstructions. In the following section, we will describe the points mentioned above by means of a case study from Ic Ponor peat bog (Fig. 1).

The reconstruction of the DWT fluctuations and the palaeohydrological conditions has already been published and described in detail (Ruskal et al. 2020), the aims of that study being (a) the determination of the development phases of the peat using peat physical properties, (b) the interpretation of the ecological trends of fossil TA communities and the quantitative reconstruction of the DWT, (c) the identification of the relationship between local hydrological conditions and vegetation response, and (d) the assessment of the correlation between the past local, regional and European climate conditions. We will focus mainly on aim (b), emphasizing the usefulness of testate amoebae in palaeoenvironmental studies.

Fig. 1. Localization of the Ic Ponor peat bog (NW Romania)

I. Analyzing the testate amoebae samples

Similarly to other proxies used on peat sediments, the testate amoebae analysis starts with the sampling process. For this analysis, 1 cm^3 subsamples are taken from the peat cores and are prepared by the standard protocol (Charman et al. 2000), being boiled for approximately 10 minutes until the samples are disintegrated and then sieved through a 300 µm mesh. The remains are centrifuged for 10 minutes at 3000 rpm and afterwards are stored in glycerol. After the samples' preparation, we analyze them under a biological microscope at 400x magnification, counting at least 150 specimens per sample and identifying them to species level using the available scientific literature (Mazei & Tsyganov 2006, Charman 2007).

At Ic Ponor peat bog a total of 20 TA species were identified in 85 analyzed samples. The most frequent and significant taxa are: *Alabasta militaris*, *Assulina seminulum, Assulina muscorum, Arcella catinus, Archerella flavum, Cyclopyxis arcelloides, Difflugia pulex, Heleopera sylvatica, Hyalosphenia papilio, Nebela tincta,* and *Trigonopyxis arcula* (Fig. 2) (Ruskal et al. 2020).

The chronology of the peat sequence was established by 8 AMS radiocarbon measurements. After converting the C^{14} ages in cal yr. BP (calibrated years before the present) using the Intcal13 database (Reimer et al. 2013), we found that the peat started to accumulate at around 12,700 cal yr. BP. A depositional hiatus occurs after 6220 cal yr. BP, and the recent peat re-began accumulating in the past 100 years (Ruskal et al. 2020).

II. Results: creating the testate amoebae diagram and reconstructing the depth to water table (DWT)

The following step in TA analysis is creating a testate amoebae diagram for the visualization of the results using specific software such as C2 (Juggins 2007). The TA diagram (Fig. 3) helps us observe changes in the testate amoebae communities and percentage fluctuations for each species. TA zones (TAZ) are being statistically determined by a classical clustering analysis, which at the Ic Ponor sequence was conducted using PAST software (Hammer et al. 2001). Based on the ecological preferences of certain species, we could identify time periods described by wetter or drier conditions, but to get a clearer idea about the past hydrological conditions, we quantitatively reconstructed the DWT levels using a pan-European testate amoebae-based transfer function (Amesbury et al. 2016) (Fig. 3).

Throughout the Ic Ponor sequence, the DWT values fluctuated between 11.9 and 25.5 cm, recording an altogether drier phase between 12,000 and 7600 cal yr. BP, and a wetter phase between 7600 and 6200 cal yr. BP. During this timeframe, four TAZ, described below, were delimited, TAZ-2 being divided into two subzones (a, b) (Ruskal et al. 2020).

During TAZ-1 the most abundant species were *Cryptodifflugia oviformis* and *Difflugia pulex,* both species being indicators of relatively drier conditions (Charman 2007, Amesbury 2016). The DWT values were high (23-25 cm), also indicating drier conditions.

TAZ-2a is characterized by the dominance of *Cryptodifflugia oviformis,* while during TAZ-2b *Difflugia pulex* dominates. The reconstructed DWT values were the highest in TAZ-2a (25.5 cm), indicating the driest phase recorded, but had a decreasing trend during TAZ-2b, suggesting a wetting phase.

During TAZ-3 *Difflugia pulex* dominated the TA associations, but *Archerella flavum* and *Hyalosphenia papilio* have notable presence, both being generally associated with wet conditions (Charman 2007, Amesbury 2016). The DWT values decreased significantly, also recording the wettest phase with a water table level of 11.9 cm.

TAZ-4 is still dominated by *Difflugia pulex,* suggesting drier conditions, but *Archerella flavum* also has a significant presence, suggesting short, but wetter phases. The DWT levels are oscillating, being higher in the periods dominated by *Difflugia pulex* and lower in those dominated by *Archerella flavum*.

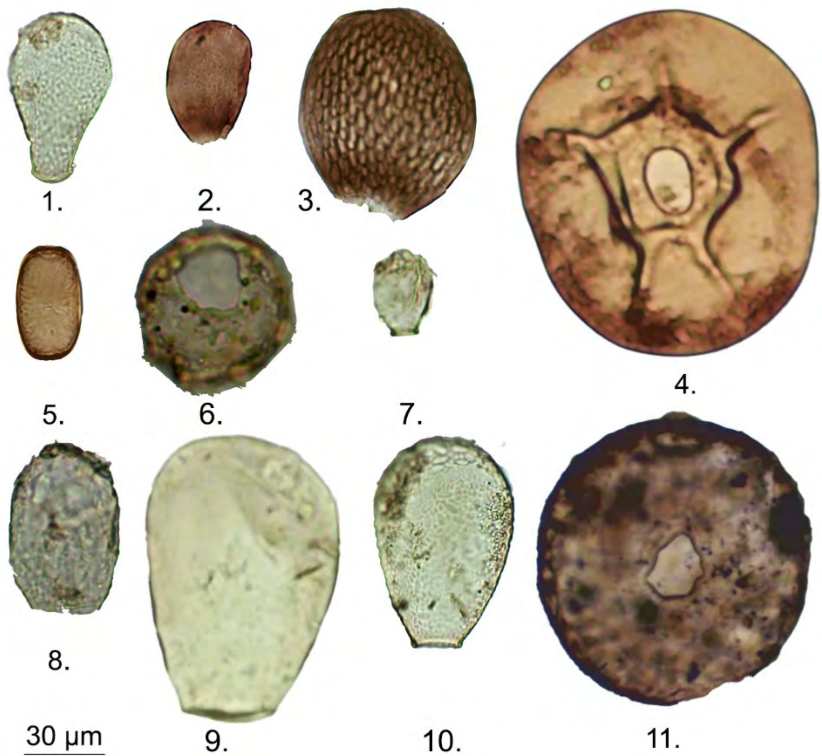

Fig. 2. Most abundant TA species at Ic Ponor sequence: 1. *Alabasta militaris*, 2. *Assulina seminulum*, 3. *Assulina muscorum,* 4. *Arcella catinus,* 5. *Archerella flavum,* 6. *Cyclopyxis arcelloides,* 7. *Difflugia pulex,* 8. *Heleopera sylvatica,* 9. *Hyalosphenia papilio,* 10. *Nebela tincta,* 11. *Trigonopyxis arcula.*

III. Interpretation of the results and correlation with other proxies

By determining the TA relative abundance and by reconstructing the DWT values, we were able to obtain an idea about the past hydrological conditions, thus we divided the sequence into two main phases, a drier one (TAZ-1, TAZ-2a, b) and a wetter one (TAZ-3, TAZ-4).

However, in order to gain a better and broader understanding of the environmental conditions during the Early and Mid-Holocene (12,000-6200 cal yr. BP), we correlated our TA results with other proxies and analyses from the Ic Ponor peat bog (Fig. 4). These include peat physical properties (loss on ignition, magnetic susceptibility), microcharcoal concentration (Ruskal et al. 2020), and pollen analysis (Grindean et al. 2015).

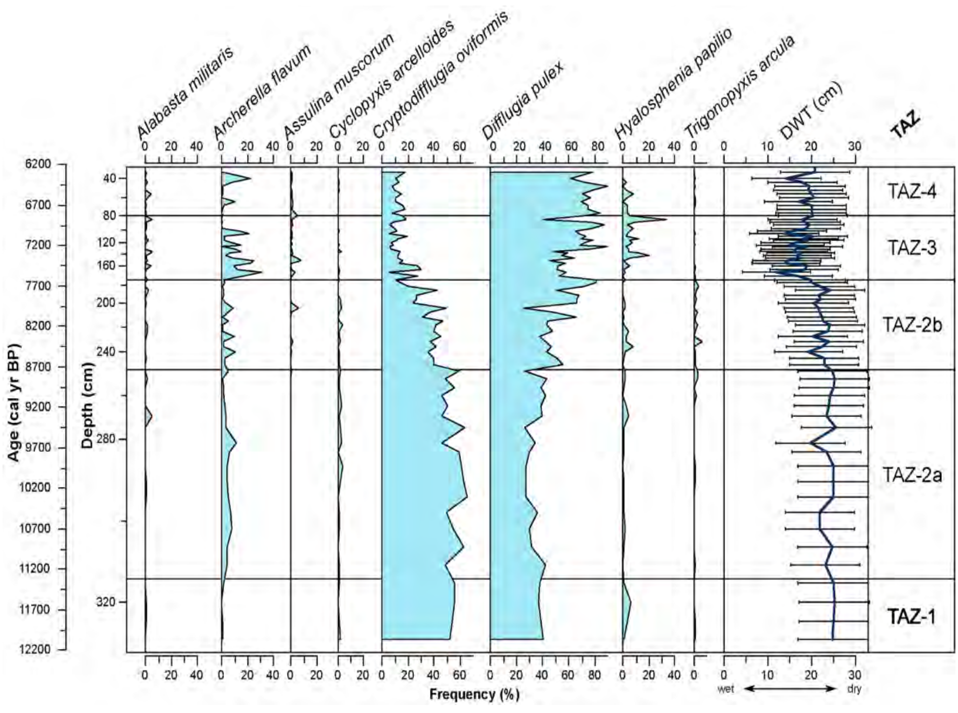

Fig. 3. Relative abundance of the most abundant TA species from the Ic Ponor peat sequence, reconstruction of depth to water table (DWT); TAZ - testate amoebae zones (after Ruskal et al. 2020, modified).

The lithology of the 340 cm long core sequence from Ic Ponor consists of a grey sandy-clayey layer at the bottom part (340-337 cm), followed by a clayey peat layer (337-310 cm). The following 280 cm consists of brown peat, but between 31 and 28 a clayey layer occurs. The top part of the sequence is made up of undecomposed and fresh *Sphagnum* peat (Ruskal et al. 2020). The clayey layer confirms the hiatus that was intercepted by the radiocarbon dating as well.

The loss on ignition and magnetic susceptibility results also confirm the previously described evolution phases of the Ic Ponor sequence (Fig. 4). The minerogenic content (MC) and magnetic susceptibility (MS) values were higher at the bottom part (the sandy-clayey layer), between 12,700 and 12,000 cal yr. BP, when Ic Ponor evolved into an ombrotrophic peat bog from a lacustrine phase. The ombrotrophic peatland phase is confirmed by the high organic matter (OM) and low MS values during the Early and Mid-Holocene (12,000-6220 cal yr. BP) (Ruskal et al. 2020).

The pollen analysis gives us insight on the past vegetation dynamics and thus about palaeoclimate conditions as well. Combined with TA analysis, we can assess how the local hydrological changes are reflected in the regional vegetation dynamics. Throughout most the drier phase of the peat bog development (12,000-7600 cal yr. BP), the surrounding vegetation cover was characterized by open forests of pine, gradually replaced by spruce, and a variety of early successional trees (e.g., birch, hazel) which probably colonized vast areas where other woody species could not develop due to drier soil conditions. Notable abundances of herbaceous species such as *Artemisia* (sagebrush), Poaceae (grass) and chenopods also support the drier palaeohydrological conditions. Wetter conditions, as indicated by higher DWT values (7600-6200 cal yr. BP) coincide with the expansion and development of dense spruce forests in the area, as this tree species prefers moist acidic soils.

The microcharcoal analysis enables us to reconstruct the past regional fire activity (Whitlock & Larsen 2001). At the Ic Ponor peat bog, the high microcharcoal concentrations (associated with large fires of high intensity) correlate with drier phases, as indicated by the high DWT values (Fig. 4).

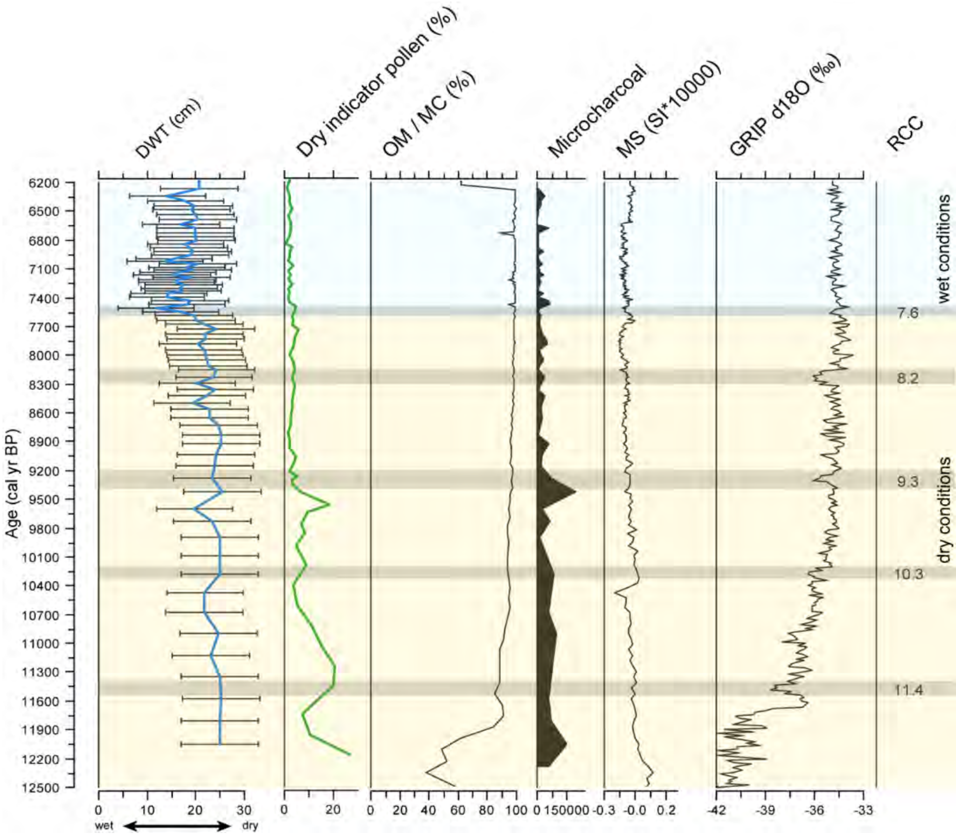

Fig. 4. Correlation of the inferred variables from the Ic Ponor sequence: depth to water table (DWT), dry conditions indicator pollen (Artemisia, Poaceae, chenopods) (Grindean et al. 2015), organic material (OM) and minerogenic content (MC) ratio, microcharcoal concentration and magnetic susceptibility (MS) (Ruskal et al. 2020) and δ^{18}O from the GRIP ice-core record (Vinther et al. 2006); RCC - rapid climate change events (after Ruskal et. 2020, modified).

The local response of several large-scale rapid climate change events (RCC) was also highlighted by our palaeohydrological results (Fig. 4). These include the cooling event between 11,400 and 11,300 cal yr. BP recorded in the Greenland Ice Core (Blockley et al. 2014), a dry event at Ic Ponor with DWT values of 25 cm, the “10.3 ka” cooling event (Bjorck et al. 2001), also dry in the studied area, with DWT values 21-24 cm, and the “9.3 ka”, “8.2 ka” and “7.6 ka” cold events (Magny and Bégeot 2004) with slightly wetter local conditions, with DWT values of 20-23 cm (Ruskal et al. 2020).

Conclusions

As proven by countless studies conducted around the globe, testate amoebae are a very suitable proxy for the reconstructions of the Holocene palaeohydrologic conditions. However, in order to get a broader image about past conditions, the addition of other proxies (i.e., lithology, loss on ignition, humification, pollen, or others) is necessary. Romania is rich in natural archives such as ombrotrophic peatlands which provide a high potential for palaeoclimatic and palaeoenvironmental studies, therefore a high amount of work and research in this field could and should be undertaken.

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NYMPHAEA Folia naturae Bihariae	L	37-65	Oradea, 2023

The Cricetodontini in the middle Miocene of the Pannonian Basin

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Abstract. The members of the tribe Cricetodontini are large sized cricetid-like rodents. They have primary importance in the biochronology of the nonmarine sediments and in the paleoclimatic/paleoecologic reconstructions. This paper presents an overview of the most important morphological characters and the biogeographical, biochronologic and palaeoecological relations of the representatives of the Cricetodontini tribe from the Badenian and Sarmatian stages of the Pannonian Basin.

Key words: Central Paratethys, continental biochronology, rodents.

Introduction

The cricetodontini (Rodentia) are common elements of the Miocene continental fossil record from Europe, Asia, and Africa. The species diversity and the morphological plasticity are indicative of biostratigraphical and palaeoecological changes. The first representatives of the tribe are considered to be immigrants in Anatolia around the Oligocene-Miocene boundary (De Bruijn & Ünay 1996). The diversification and the expansion into Europe start later, at the time of the MN5 Zone.

In France and Spain, the study of Cricetodontini has a long tradition, since the 19th century (e. g., Lartet 1851). In sharp contrast, the study of this tribe in the Pannonian Basin begun only in the 1970's. The first Cricetodontini finds were unearthed in Comăneşti, Romania (Feru et al. 1980) and in Hasznos, Hungary (Kordos 1981, 1986).

New *Cricetodon* populations had been collected in Northern Hungary since the 2000s, at Litke (Hír 2013), Sámsonháza (Hír & Mészáros 2002), Mátraszőlős (Hír & Kókay 2004, 2011), Kozárd (Hír 2015), and Felsőtárkány-Felnémet (Hír 2007). Interesting new materials were found in Romania, at Tăşad (Hír et al. 2002) and Vărciorog (Hír et al. 2019). In Austria, Cricetodontini finds were published from the Badenian localities Mühlbach and Grund (Daxner-Höck 2003) and from the Sarmatian of Gratkorn (Prieto et al. 2010).

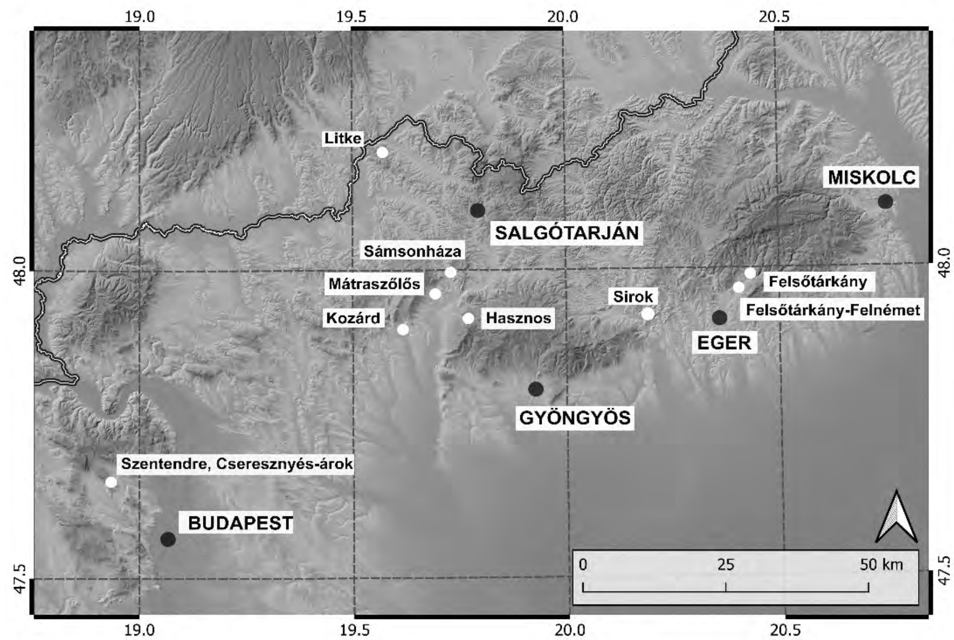

Fig. 1. Geographical position of the studied middle Miocene paleovertebrate localities in Northern Hungary.

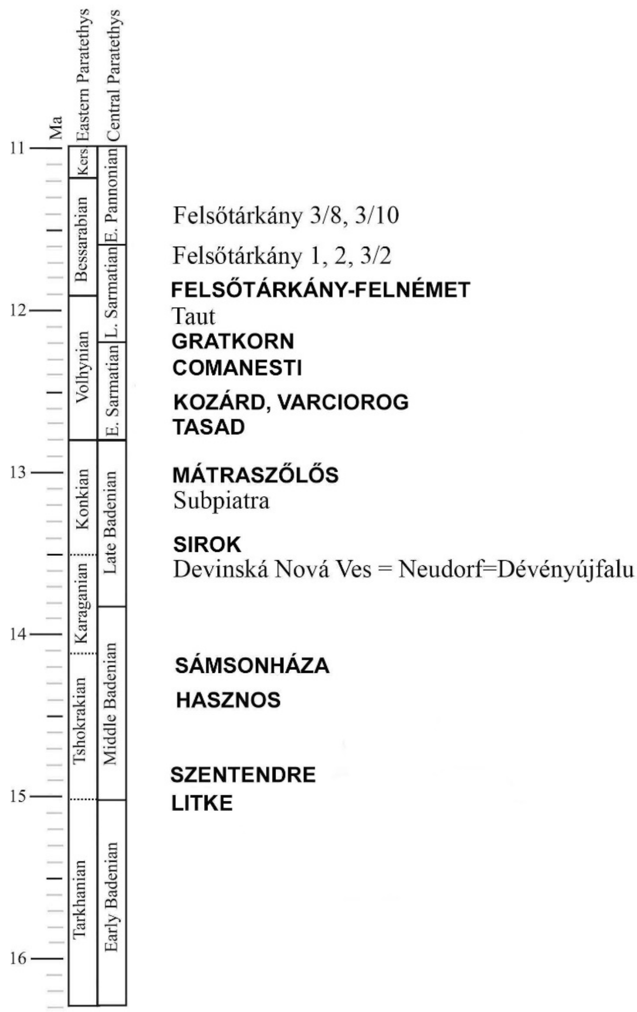

Fig. 2. Chronological position of the Middle Miocene paleovertebrate localities in the Pannonian Basin.

Methods

In the description of the occlusal surface of the molars we used the terminology of Mein & Freudenthal (1971) and Rummel (1998), with some modifications.

Abbreviations in the text:

M1-M2-M3: upper (maxillary) first, second and third molars

m1-m2-m3: lower (mandibular) first, second and third molars

L: maximal antero-posterior length of the occlusal surface (in mm)

W: maximal linguo-labial width of the occlusal surface (in mm)

No.: number of the studied molars

Min.: minimal value

Max.: maximal value

X: arithmetic average

SD: standard deviation

fr: fragment

Li: Litke

Sze: Szentendre

Ha: Hasznos

Sh 3: Sámsonháza 3

Si: Sirok

Msz: Mátraszőlős

Td: Tăşad

Var: Vârciorog

Koz: Kozárd

FF: Felsőtárkány-Felnémet

Systematic description

Family: Cricetidae Fischer, 1817

Subfamily: Cricetodontinae Simpson, 1945

Tribe: Cricetodontini Simpson, 1945

Genus: *Cricetodon* Lartet, 1851

Cricetodon meini Freudenthal, 1963, Litke, Hungary

Measurements (mm) of the *C. meini* molars from Litke 1 and Litke 2:

Li 1.	M1		M2		M3		m1		m2		m3	
	L	W	L	W	L	W	L	W	L	W	L	W
No.	2	3	6	6	3	4	3	3	2	2	3	4
MIN.	2.95	1.87	2.22	1.87	1.85	1.77	2.42	1.50	2.2	1.7	2.25	1.7
MAX.	2.95	2.07	2.43	2.02	1.97	1.95	2.67	1.75	2.35	1.85	2.47	1.87
X.	2.95	1.963	2.31	1.94	1.91	1.86	2.53	1.60	2.27	1.77	2.25	1.82
SD.			0.071	0.055								

Li 2.	M1		M2		M3		m1		m2		m3	
	L	W	L	W	L	W	L	W	L	W	L	W
No.	7	8	14	16	4	4	12	12	12	12	10	10
MIN.	2.6	1.8	2.12	1.8	1.85	1.7	2.17	1.45	2.2	1.77	2.25	1.7
MAX.	3.25	2.15	2.47	2.15	2.02	1.97	2.7	1.85	2.65	2.05	2.72	2
X.	2.95	1.96	2.30	1.95	1.93	1.81	2.49	1.63	2.44	1.93	2.43	1.83
SD.	0.207	0.115	0,086	0.1			0.104	0.069	0.093	0.087	0.098	0.084

The most important morphological characters:

M1. The anterocone is divided. The two units are separated by a shallow notch on the mesial surface. An arched anterior ectoloph is frequent (51%) on the posterior side of the labial anterocone. Lingual quersporn II is developed in 50% of the teeth. Protolophule I is absent. A short posterior ectoloph of the paracone is frequent. The mesoloph, entomesoloph, posteroloph, and posterosinus are absent. Four roots are developed.

m1. Anteroconid is centrally positioned. In lateral view the anteroconid is lower developed than the protoconid. The labial anterolophid is strong, it closes the protosinusid. Anterosinusid is open. Metalophulid I is rare, metalophulid II is more frequent (50%). Detailed description is given by Hír (2013).

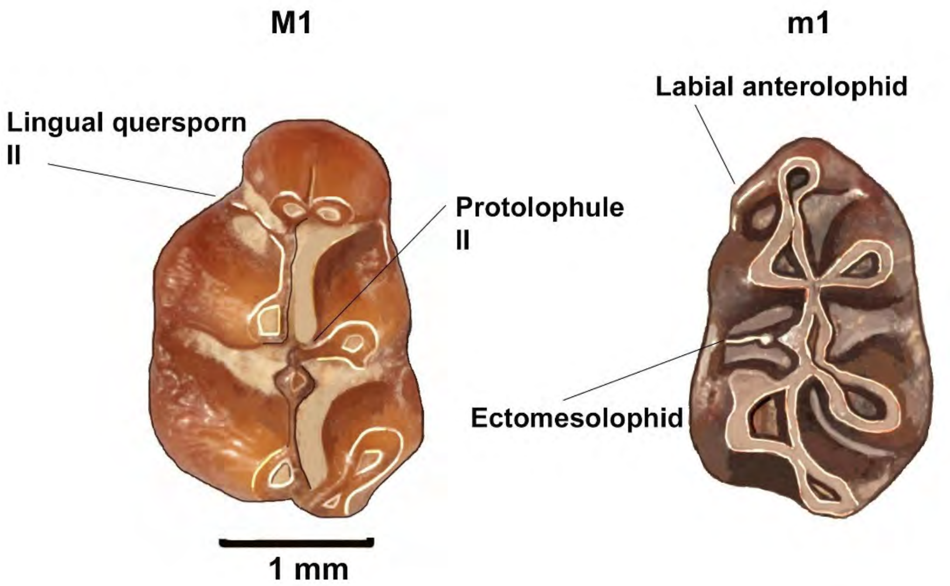

Fig. 3. Occlusal surfaces of *C. meini* M1 and m1 from Litke.

Remarks:

C. meini is the first *Cricetodon* that quickly migrated from Greece up to the Northern slopes of the Pyrenees. This species was reported from the Greek localities Komotini, Antonios, and Thymiana (Koufos 2006), the Serbian localities Paragovo, Bele Vode, Popovac, and Lazarevac (Marković & Milivojević 2010), the Austrian faunas Mühlbach and Grund (Daxner-Höck 2003), and from a series of localities in the Northern Alpine Foreland Basin and in France (Fortelius 2011). Interestingly, it does not reach the Iberian Peninsula. Litke is the first occurrence of the species in the Carpathian Basin. *C. meini* has an important biochronological value in the Northern Alpine Foreland Basin because the occurrences of the species are found directly below the „Brock horizon". The Brock horizon is the result of the Ries asteroid impact, and this is a characteristic marker horizon in that region. This event is dated as 14.9 Ma (Abdul Aziz et al. 2008).

Fig. 4. Geographical position of *C. meini* localities.

Cricetodon aureus Mein & Freudenthal, 1971, Szentendre, Hungary

Measurements (mm) of *C. aureus* molars from Szentendre, Cseresznyés-árok:

Sze	M1		M2		M3		m1		m2		m3	
	L	W	L	W	L	W	L	W	L	W	L	W
No.	68	73	88	88	95	95	66	67	75	76	76	77
MIN.	2.97	1.87	2.25	1.72	1.82	1.69	2.47	1.55	2.35	1.75	2.32	1.75
MAX.	3.6	2.32	2.77	2.17	2.4	2.1	2.9	1.92	2.82	2.12	2.92	2.15
X.	3.23	2.06	2.52	1.99	2.11	1.88	2.68	1.74	2.58	1.95	2.63	1.91
SD.	0.099	0.070	0.091	0.065	0.09	0.059	0.091	0.060	0.083	0.070	0.083	0.064

The most important morphological characters:

M1. The anterocone is mainly divided. The two units are separated by a shallow notch on the mesial surface. An anterocone sporn of the labial anterocone is rare and short. Protolophule II is regular, protolophule I is absent. A lingual quersporn II is frequent (65%). The paracone posterior spur is short. The mesoloph is short or absent. The entomesoloph is mainly absent or short. There is a shallow impression on the anterior surface of the paracone and the metacone.

m1. The anteroconid is unicuspid. The labial anterolophid and the closed protosinusid are well developed. The lingual anterolophid is remnant or absent. The anterosinusid is open. The metalophulid II is regular, the metalophulid I is rare. The mesolophid is mainly absent, but there are some middle-developed specimens. The ectomesolophid is rare. The sinusid is closed by a cingulum. Detailed description is given by Hír & Venczel (2018).

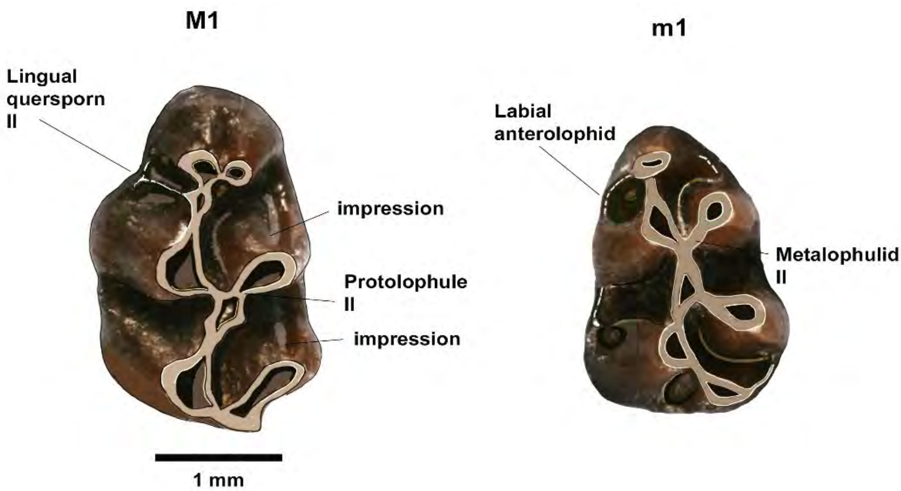

Fig. 5. Occlusal surfaces of *C. aureus* M1 and m1 from Szentendre.

Remarks:

Like *C. meini*, the biochronological value of *C. aureus* is proven in the Northern Alpine Foreland Basin. The occurrences of the species are found between the „Brock horizon” and the main bentonite horizon (Heissig 1997). The age of the bentonite horizon is classified by Abdul-Aziz et al. (2008, 2010) as 14.55±0.19 Ma, but the new results of Rocholl et al. (2017) it is 14,925 ± 0.01 Ma. Szentendre is the Easternmost occurrence of the species. Up to the present *C. aureus* has not been reported from the Balkan and from Anatolia.

Fig. 6. Geographical position of *C. aureus* localities.

Cricetodon hungaricus (Kordos, 1986), Hasznos, Hungary

Measurements (mm) of *C. hungaricus* molars from Hasznos:

Ha	M1		M2		M3		m1		m2		m3	
	L	W	L	W	L	W	L	W	L	W	L	W
No.	28	30	31	30	19	19	19	18	22	22	16	16
MIN.	3.17	2.25	2.32	1.85	2.0	1.87	2.42	1.67	2.37	1.8	2.5	1.75
MAX.	3.77	27	2.95	2.4	2.45	1.30	2.95	2.0	2.87	2.12	2.92	2.07
X.	3.62	2.22	2.65	2.1	2.26	2.02	2.42	1.8	2.72	1.99	2.74	1.91
SD.	0.11	0.054	0.098	0.119	0.099	0.01	0.124	0.062	0.071	0.075	0.107	0.093

The most important morphological characters:

M1. The anterocone is divided. The anterior ectoloph, the lingual quersporn II, the funnel structure, the posterior ectoloph, and the short and narrow entomesoloph are frequent.

m1. The labial anterolophid and the closed protosinusid are well developed. The metalophulids I+II are equally developed in 50% of the m1's. There is only metalophulid II in the other 50% of the m1's. a short or middle developed ectomesolophid is frequent. A short mesolophid is characteristic. Generally, the cusps are better developed than the ridges. The original description is given by Kordos (1986). Detailed description and emended diagnosis are given by Hír (2017).

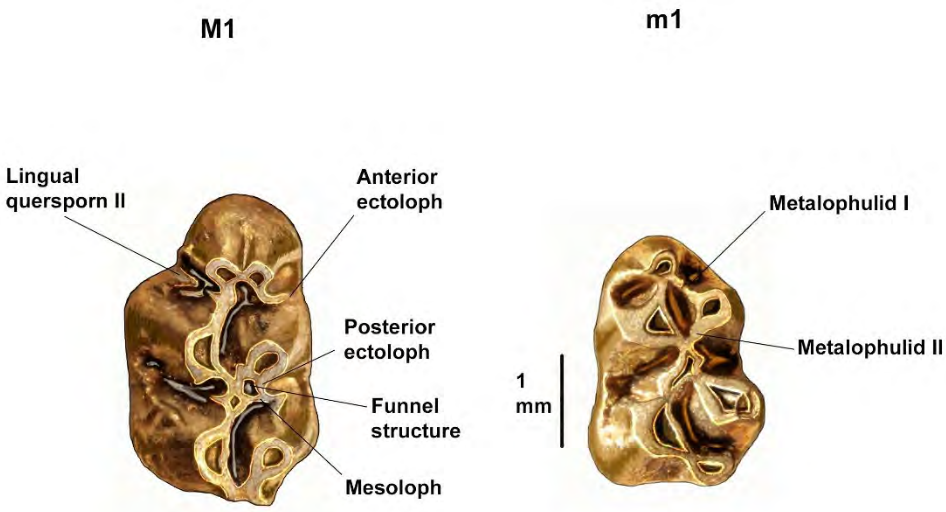

Fig. 7. Occlusal surfaces of *C. hungaricus* M1 and m1 from Hasznos.

Remarks:

The large sized Cricetodontini from Hasznos was first assigned to the species *Deperetomys hagni* (Fahlbusch, 1964) described as *Deperetomys hagni hungaricus* n. ssp. by Kordos (1986). Later De Bruijn et al. (1993) reclassified this taxon as *Cricetodon hungaricus*. These authors recognised that

C. hungaricus strongly resembles *C. candirensis* in size as well as in dental morphology. De Bruijn et al. (1993, 2013) questioned if *C. hungaricus* could be the junior synonym of *C. candirensis*. This assumption was rejected by Prieto et al. (2010) and López-Guerrero et al. (2015). After a detailed comparison, Hír (2017) verified that direct relation or even synonymy is not probable between the two species.

C. hungaricus is reported from Serbia, Brajkovac (Marković & Milivojević 2010) and from Anatolia, Zambal (De Bruijn et al. 2013), but it is not found in the Northern Alpine Foreland Basin and Western Europe.

Fig. 8. Geographical position of *C. hungaricus* localities.

Cricetodon cf. *hungaricus* (Kordos, 1986), Sámsonháza 3, Hungary

Measurements (mm) of *C.* cf. *hungaricus* molars from Sámsonháza 3:

Sh3	M1		M2		M3		m1		m2		m3	
	L	W	L	W	L	W	L	W	L	W	L	W
No.	5	5	1	1	4	4	3	3	6	6	5	5
Min.	3.38	2.12	2.55	1.95	2.17	1.92	2.87	1.75	2.75	1.05	2.55	1.82
Max.	3.77	2.27			2.32	2	3.05	1.9	2.87	2.15	2.87	2.12
X	3.61	2.19			2.26	1.97	2.93	1.84	2.79	1.85	2.71	1.96
SD	0.131	0.058							0.08	0.284	0.074	0.094

The most important morphological characters:

M1. The anterocone is divided. Anterior ectoloph, lingual quersporn II are developed in one specimen. Protolophule I is absent, protolophule II is regular. Paracone posterior spur is regular. The mesoloph is short. Funnell structure is not developed.

m1. The labial anteroloph is well developed, it closes the protosinusid. Lingual anterolophid is found in two specimens. Metalophulid I is absent, metalophulid II is regular. The mesolophid is absent. A short ectomesolophid is characteristic. Detailed description is given by Hír & Mészáros (2002).

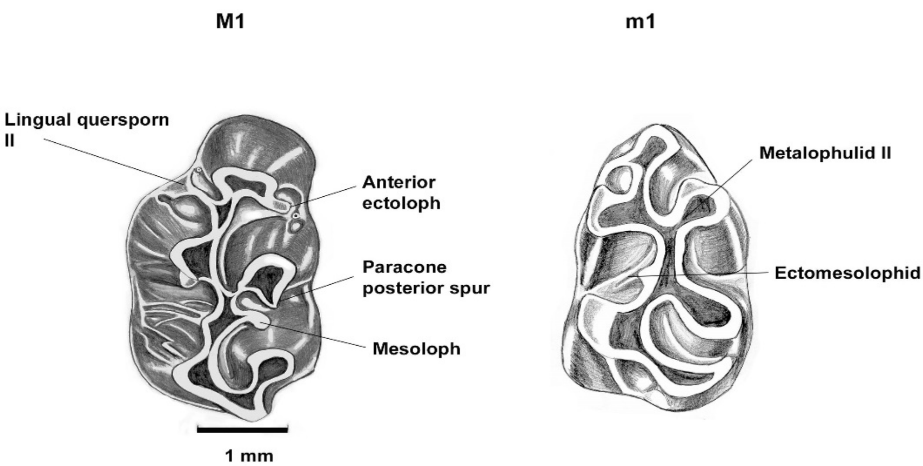

Fig. 9. Occlusal surfaces of *C.* cf. *hungaricus* M1 and m1 from Sámsonháza 3.

Remarks:

The *Cricetodon* population of Sámsonháza is regarded as a local descendant of *C. hungaricus*. The localities Sámsoháza and Hasznos are close to each other in space (10 km) and in time (both are classified as middle Badenian).

Cricetodon sansaniensis LARTET, 1851, Sirok, Hungary

Measurements (mm) of *C. sansaniensis* molars from Sirok:

Si	M1		M2		M3		m1		m2		m3	
	L	W	L	W	L	W	L	W	L	W	L	W
No.	-	-	-	-	-	-	1	1	1	1	1	1
	-	-	-	-	-	-	3.0	2.0	2.8	2.05	2.85	1.87

The most important morphological characters:

m1. The anteroconid is unicuspid. The labial anterolophid is well developed between the anteroconid and the base of the protoconid. It closes the protosinusid. Metalophulid I is present, metalophulid II is absent. The mesolophid and ectomesolophid are not developed. The lingual mesosinusid is open, the labial mesosinusid is closed by a low developed ectostylid. The posterosinusid is closed.

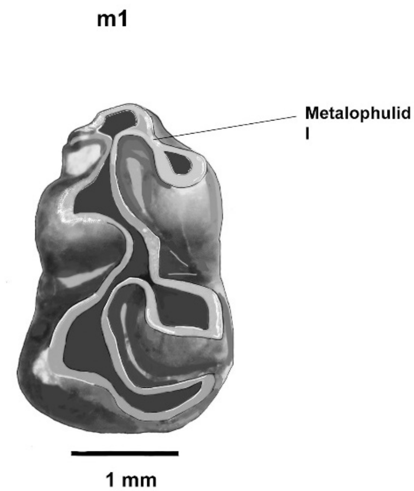

Fig. 10. Occlusal surface of *C. sansaniensis* m1 from Sirok.

Remarks:

The absence of metalophulid II occurs in the lectotype of *C. sansaniensis* (Maridet & Sen 2012: fig. 33). In the Pannonian Basin, the only occurrence of *C. sansaniensis* is in the fissure filling of Neudorf Spalte (= Devinska Nová Ves = Dévényújfalu), close to Bratislava (= Pozsony up to 1919). The species is listed by Sabol et al. (2004), but morphological description or figure are not given. The Late Badenian Studienka Formation is transgressively bedded onto the Mesozoic limestone and the fissure fillings. The numeric age of this latter complex was classified by the $^{86}Sr/^{87}Sr$ method as 13.58 Ma (Hyzny et al. 2012). In the Swiss molasse, *C*. cf. *sansaniensis* was described from the faunas of Öschgraben and Zeglingen (Rummel & Kälin 2003, Kälin & Kempf 2009). These faunas are situated above the 14.2 Ma old Leimbach bentonite. In Spain, in the Calatayud-Daroca Basin, *C. sansaniensis* was published from the faunas of the „F local Zone”. The numeric age of this unit is 13.68 -13.76 Ma after López-Guerrero et al. (2015).

Cricetodon sp. I, Mátraszőlős 1, Hungary

Measurements (mm) of *Cricetodon* sp. I. molars from Mátraszőlős I:

Msz 1	M1		M2		M3		m1		m2		m3	
	L	W	L	W	L	W	L	W	L	W	L	W
No.	-	-	2	2	1	1	-	-	1	1	1	1
Min.	-	-	2.98	2.28	2.28	2.0	-	-	3.0	2.03	2.88	2.0
Max.	-	-	3.05	2.3	-	-	-	-	-	-	-	-

Cricetodon sp. I, Mátraszőlős 2, Hungary:

Measurements (mm) of *Cricetodon* sp. I. molars from Mátraszőlős I:

Msz 2	M1		M2		M3		m1		m2		m3	
	L	W	L	W	L	W	L	W	L	W	L	W
No.	1	1	1	1	1	1	-	-	-	-	-	-
Min.	3.70	1.29	2.85	2.12	2.25	1.90	-	-	-	-	-	-
Max.	-	-	-	-	-	-	-	-	-	-	-	-

The most important morphological characters:

M1. Anterocone is undivided (but it can be the result of the worn out, sub-senile status). There is a long ectoloph on the labial side of the anterocone reaching the anterior basis of the metacone. Lingual quersporn II is remnant.

The funnel structure is well developed. The entomesoloph is absent. Remarks. The material is scarce and is suitable only for modest conclusions. The long anterior ectoloph and the funnel structure are similar to the morphology of *C. hungaricus*, but the remnant lingual quersporn II and the absence of the entomesoloph refer to a difference in species level. Detailed description is given by Hír & Kókay (2004).

Cricetodon sp. II, Mátraszőlős 3, Hungary

Measurements (mm) of *Cricetodon* sp. II. molars from Mátraszőlős 3:

Msz 3	M1		M2		M3		m1		m2		m3	
	L	W	L	W	L	W	L	W	L	W	L	W
No.	-	-	-	-	1	1	-	-	1	1	-	-
Min.	-	-	-	-	2.0	1.72	-	-	2.87	1.90	-	-
Max.	-	-	-	-	-	-	-	-	-	-	-	-

The most important morphological characters:

m2. The lingual anterolophid arm is incipient, the labial arm is weak, and it reaches the basis of the protoconid at a low level. The anterolabial sinusid is very narrow. The mesolophid is medium developed, oblique and reaches the posterior basis of the metaconid. Detailed description is given by Hír & Kókay (2011).

M1

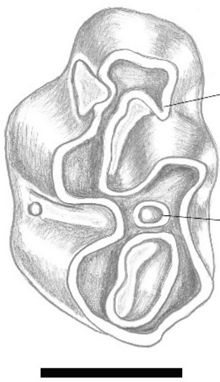

Fig. 11. Occlusal surface of *Cricetodon* sp. M1 from Mátraszőlős 2.

Remarks:

Based on the limited material, the phylogenetical relations of the finds cannot be decided. López-Guerrero et al. (2015: Fig. 6) positioned this material between the Cricetodontini populations with basal morphology and the populations with mosaic morphology.

Cricetodon sp., Tăşad, Romania

Measurements (mm) of *Cricetodon* sp. molars from Tăşad:

Td	M1		M2		M3		m1		m2		m3	
	L	W	L	W	L	W	L	W	L	W	L	W
No.	2	2	2	2	1	1	fr.	fr.	-	-	1	1
Min.	3.27	2.12	2.65	2.10	2.0	1.8	-	-	-	-	2.62	1.72
Max.	3.57	2.12	2.67	1.97	-	-	-	-	-	-	-	-

The most important morphological characters:

M1. The anterocone is well divided. The two units are almost completely separated, only an enamel ridge connects them on the posterior side. The anterolophule doesn’t reach the lingual unit of the anterocone. The labial unit of the anterocone has a long ectoloph, which reaches the anterior surface of the paracone. The labial quersporn II and mesoloph are absent.

m1. The only molar is fragmentary. The anteroconid is unicuspid. Protosinusid and anterosinusid are strongly reduced. Anterior metalophulid is well developed. Mesolophid is middle developed and reaches the posterior basis of the metaconid.

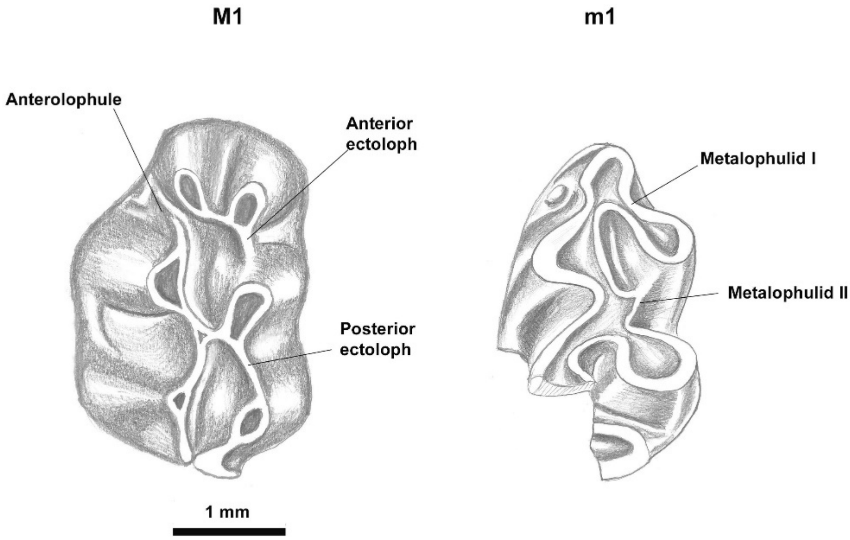

Fig. 12. Occlusal surfaces of *Cricetodon* sp. M1 and m1 fr. from Tăşad.

Remarks:

The material is limited. Only we can conclude that the material has no affinity to *Byzantinia* or *Hispanomys* genera.

„Cricetodon" *venczeli* Hír, Codrea, Prieto, 2019, Vârciorog, Romania

Measurements (mm) of *„C." venczeli* n. sp. molars from Vârciorog:

Var	M1		M2		M3		m1		m2		m3	
	L	W	L	W	L	W	L	W	L	W	L	W
No.	22	23	20	20	9	9	22	22	20	20	9	9
MIN.	3.12	1.87	2.32	1.87	1.97	1.7	2.52	1.65	2.4	1.85	2.25	1.62
MAX.	3.4	2.15	2.75	2.07	2.20	1.9	2.87	1.97	2.7	2.1	2.52	2
X.	3.28	2.03	2.5	1.99	2.06	1.76	2.71	1.78	2.51	1.94	2.44	1.85
SD.	0.070	0.071	0.101	0.055	0.069	0.057	0.083	0.078	0.78	0.078	0.85	0.097

The most important morphological characters:

A middle sized „Cricetodon" species, with modest hypsodonty and flat occlusal surface.

M1. The anterocone is divided. The anterior ectoloph, complete ectoloph, lingual anteroloph, protolophule I and protocone sporn are frequent. The mesoloph is rarely developed and usually short.

m1. The metalophulid II occurs in 61% of the m1s. The co-occurrence of both metalophulids reaches 35%. There is no m1 showing the metalophulid I only. The mesolophid is short or absent.

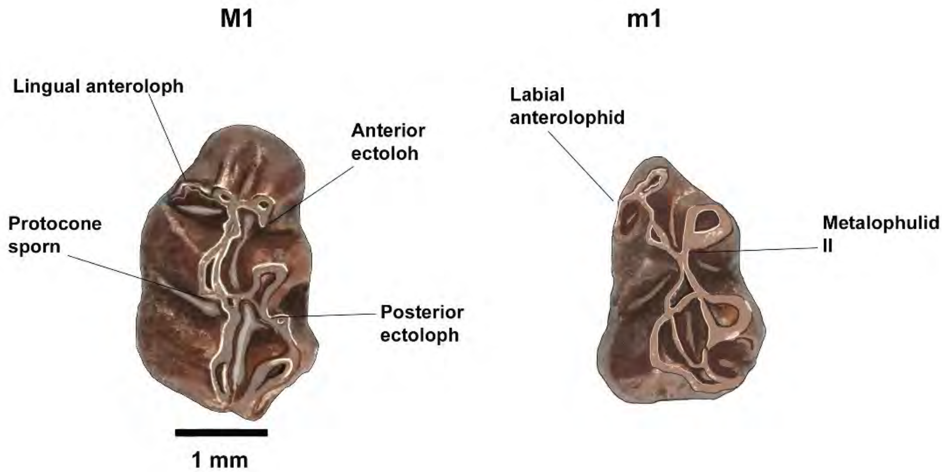

Fig. 13. Occlusal surfaces of *„C."* *venczeli* M1 and m1 from Vârciorog.

„Cricetodon" cf. *klariankae* Hír, 2007, Kozárd, Hungary

Measurements of *„C." cf. klariankae* molars from Kozárd:

Koz	M1		M2		M3		m1		m2		m3	
	L	W	L	W	L	W	L	W	L	W	L	W
No.	22	22	23	23	12	12	18	18	18	18	6	6
MIN.	3.17	2.05	2.4	1.87	1.95	1.7	2.67	1.67	2.57	1.85	2.37	1.75
MAX.	3.75	2.27	2.95	2.03	2.10	2.0	3.0	1.87	2.87	2.10	2.67	2.05
X.	3.45	2.15	2.7	2.2	2.03	1.87	2.82	1.78	2.69	1.98	2.52	1.90
SD.	0.145	0.056	0.118	0.084	0.049	0.082	0.089	0.061	0.072	0.067	0.088	0.091

The most important morphological characters:

M1. The anterocone is divided. The labial unit of the anterocone bears a curved ectoloph. This ectoloph is frequently connected with the anterior spur of the paracone. The lingual conelet has a lingual anteroloph arm. The labial anteroloph is remnant. Complete lingual quersporn II is rare, the protosinus is mainly closed by a protostyle. The protocone sporn is frequent. The mesoloph is absent.

m1. The anteroconid is unicuspid and relatively small. Metalophulid I and II are equally developed. The mesolophid is absent.

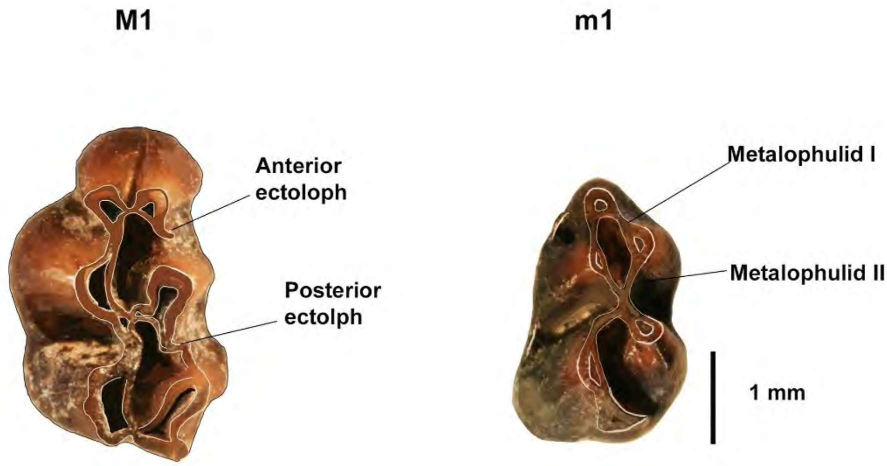

Fig. 14. Occlusal surfaces of „*C.*" cf. *klariankae* M1 and m1 from Kozárd.

„Cricetodon" klariankae HÍR, 2007, Felsőtárkány-Felnémet 2/3, Hungary

Measurements (mm) of „*C. klariankae*" molars from Felsőtárkány-Felnémet:

FF 2/3	M1		M2		M3		m1		m2		m3	
	L	W	L	W	L	W	L	W	L	W	L	W
No.	9	10	11	11	11	11	13	13	16	16	9	9
MIN.	3.3	2.15	2,65	1,85	1,76	1,62	2.65	1.67	2.45	1.75	2.32	1.75
MAX.	3.55	2.27	3,05	2,17	2,05	1,9	2.8	1.95	2.87	2.12	2.5	2
X.	3.39	2.22	2,80	2,03	1.91	1.76	2.74	1.79	2.69	1.93	2,41	1,85
SD.	0.088	0.037	0,07	0,069	0.056	0.064	0.029	0.041	0.069	0.071	0.053	0.053

The most important morphological characters:

M1. The anterocone is divided. The labial unit has a curved ectoloph. It can reach the anterior spur of the paracone. Protolophule II is short. Lingual quersporn II is incomplete. The protocone sporn is regular. The mesoloph is mainly absent. The paracone posterior ectoloph is connected to the anterior ectoloph of the metacone.

m1. The anteroconid is unicuspid and rounded. In the juvenile molars the anteroconid is less developed than the protoconid and the metaconid. The anterolophid arms, the protosinusids and the anterosinusids are reduced. Metalophulid I and II are equally developed. The mesolophid is rare and it is usually short. This configuration corresponds more or less to „Cricetodontini type 4" of De Bruijn & Ünay (1996).

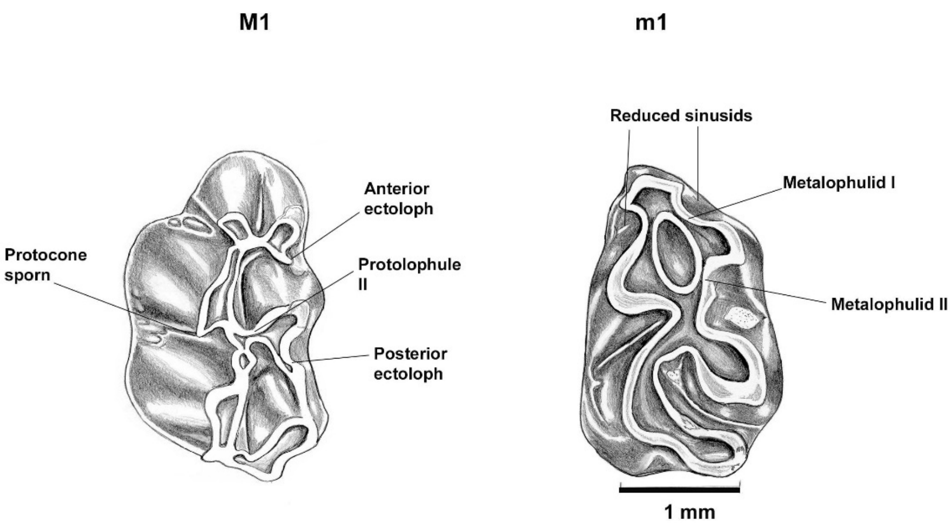

Fig. 15. Occlusal surfaces of *„C." klariankae* M1 and m1 from Felsőtárkány-Felnémet 2/3.

Remarks:

Hír et al. (2019) proposed that the „*Cricetodon*" populations of Vârciorog, Kozárd and Felsőtárkány-Felnémet 2/3 form an evolutionary lineage. The evolutionary trends in *„C." venczeli – „C." klariankae* line are:

- the increasing dimensions of the molars,
- the increasing hypsodonty,
- increasing of the relative length of the M2 and m2 (but in less degree than is *Byzantinia* species),
- the disappearance of the anterior protolophule in M1,
- the strengthening of anterior ectoloph of the paracone in M1,
- the disappearance of the short mesoloph in M1,
- the disappearance of the lingual arm of anteroloph in M1,
- the involution of labial anterolophid and protosinusid in m1,
- the strengthening of metalophulid I in m1.

During the late phase of the Middle Miocene, substantial changes occurred in the morphology of the Cricetodontini tribe throughout in Europe. In SW Europe, the transition from *Cricetodon* to *Hispanomys* took place (López-Guerrero et al. 2008, López-Antoñanzas & Mein 2009). In SE Europe and in Anatolia, this is the time period of the *Cricetodon-Byzantinia* transition (De Bruijn & Ünay 1996). According to López-Guerrero et al. (2015), in the Cricetodontini populations of Western and Central Europe the change from the „basal morphology” to the „mosaic morphology” occurred. This means the strengthening of the ectolophs in the upper molars and the reduction of the mesolophids in the lower molars. The reduction of the metalophulid II can be seen in the m1s of the Western European species. This latter element is regular in the Cricetodontini populations of the Pannonian Basin.

cf. *Byzantinia* sp. or div. sp., Comăneşti 1, Romania

Measurements (mm) of cf. *Byzantinia* sp. molars from Comăneşti:

Com	M1		M2		M3		m1		m2		m3	
	L	W	L	W	L	W	L	W	L	W	L	W
No.	-	-	1	1	1	1	2	2	-	-	2	2
MIN.	-	-	2.92	2.0	2.12	1.77	1.65	1.7	-	-	2.67	1.75
MAX.							2.7	1.75			2.67	1.77

The most important morphological characters:

M2. The anterior width (across the protocone-paracone) is wider than the posterior width (across the hypocone-metacone). The lingual anteroloph is incipient and the labial anteroloph is a well-developed cusp. The protocone is disconnected from the endoloph. The protolophule is directed forwards and it is ending free, in the anterosinus. The mesoloph is not developed. M3. Anterior with is wider than the posterior width. The anterocone is widely confluent width the protocone. The lingual anteroloph arm is incipient, the labial anteroloph arm is well developed and its terminal part forms a small cusp. The mesoloph is not developed. m1. The anterolophids, anterosinusid, and protosinusid are incipient. The anterior metalophulid is well developed, the posterior metalophulid is weak and found only one of the two molars. The mesolophid is absent.

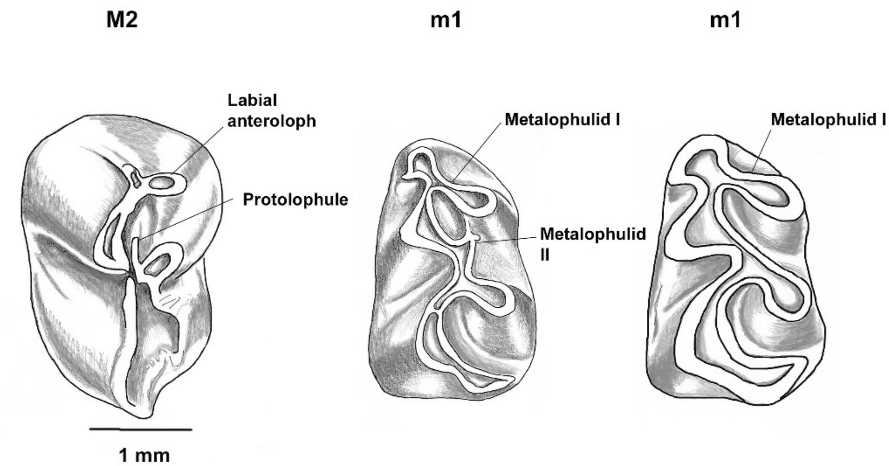

Fig. 16. Occlusal surfaces of. *Byzantinia* cf. *Byzantinia* sp. M2 and m1 from Comăneşti.

Remarks:

In their original publication, Feru et al. (1980) described two Cricetodontini taxa from the material: *Hispanomys* cf. *lavocati* and *Hispanomys* cf. *bijugatus*. Hír et al. (2011) revised the teeth and considered that the differences observed between the two m1 are linked to intraspecific variability. They considered this sample as monospecific, in the absence of a confident generic assignment. However, the molars from Comăneşti share similarities with *Byzantinia*.

Conclusions

New important Cricetodontini populations have been unearthed in Hungary and in Romania during the last three decades.

The *C. meini* populations of Litke 1 and 2 have a relation with the first great dispersion of the Cricetodontini tribe in Europe. The species bears a substantial biochronological importance because it is possible to correlate it to 15.2 -15.0 Ma. The composition of the Litke faunas refers to a relatively arid environment (Venczel & Hír 2015).

C. aureus is a characteristic element of the early MN6 faunas of France, Germany, and Switzerland. It is related with a younger biochronological horizon: 14.55 -14.9 Ma. The species rich fauna of Szentendre points to a humid climate.

C. hungaricus or *C.* cf. *hungaricus* of Hasznos and Sámsonháza has a clear Anatolian affinity. It is known from the Balkans, but it has no occurrence in Western Europe and in the Northen Alpine Foreland Basin. The localities have no independent chronological control and the exact numerical age is not given. The faunas represent humid, but not very moist environment (Prieto et al. 2015). The faunas of Litke, Szentendre, Hasznos, Sámsonháza are relatable to the environmental conditions of the „Middle Miocene Climatic Optimum" (Böhme 2003).

C. sansaniensis is known from a series of European localities from Spain up to Devinska Nová Ves, Slovakia. Its chronological range is approximately 13.58 -13.76 Ma. This age is relatable to the Late Badenian in the Central Paratethys.

The faunas of Mátraszőlős, Tăşad, Kozárd, and Vârciorog are simultaneous with the „Middle Miocene Climatic Transition", although the latest diplocynodontid occurrences are found in Tăşad and Vârciorog.

The evolutionary line of „*C.*" *venczeli* – „*C.*" *klariankae* is endemic for the Pannonian Basin. The morphological changes are partly similar to the tendencies observed in the Cricetodontini populations of the Mediterranean, but there are some special characters.

In the Pannonian Basin and in the Northern Alpine Foreland Basin (Switzerland and Southern Germany), Cricetodontini went extinct at the border of the Middle and Late Miocene (in the Central Paratethys it is relatable to the Sarmatian-Pannonian transition). In the Mediterranean they survived. In the Eastern Mediterranean and in Anatolia they occurred up to the Late Miocene. In Southern France the genus *Ruscinomys* survived up to the Pliocene. We assume that the early extinction of the Cricetodontini in Central Europe can be related to the increasing humidity of the climate at the terminal period of the Middle Miocene. It was the „washhouse climate" after the sense of Böhme et al. (2008).

López-Guerrero et al. (2014a, 2014b) introduced a three-phase model for the description of the morphological evolution of European Cricetodontini.

I. Basal morphology is characterised by the brachyodont molars, straight buccal contour in occlusal view, poorly developed or absent ectolophs in the upper molars, the presence of solely metalophulid II in the m1, and frequent presence of mesolophs and mesolophids. Among the Cricetodontini species of the Pannonian Region, *C. meini*, *C. aureus, C. hungaricus* are undoubtedly referable to this group.
II. Mosaic morphological pattern. The main characters are the semi-hypsodont molars, the frequently present, but rarely complete ectolophs, the straight contour of the occlusal surface in upper molars, the short or absent mesolophids, and the absence of metalophulid II. in the lower molars. In the Pannonian Basin, *C. sansaniensis*, „*C.*" *venczeli* and „*C.*" *klariankae* belong to this group.
III. In the third phase these hypsodont Cricetodontini species were frequent in the Late Miocene and Pliocene of the Mediterranean. The complete ectolophs, the absence of mesolophs and trilobate outline of the labial margin on the occlusal surface of M1 are characteristic in the upper molars. This phase has no representative in the Carpathian Region.

Acknowledgements

The author would like to express his sincere thanks for the financial help of the Hungarian Scientific Fund OTKA T046719, T115472, K131894 projects, and the SYNTHESIS Projects (NL -TAF -619 (2010), AT-TAF -2187 (2012), ES-TAF -2742 (2013), http://www.synthesis.info/, which is financed by the European Community Research Infrastructure Action under the FP6 and FP7 B Capacities Programs. We express our thanks for the kind efforts of our colleagues Chiara Angelone, Jerome Prieto, Lars Van Den Hoek Ostende, Uwe Kirscher, Vlad Codrea, Jenő Kessler, the late József Kókay, and Emanoil Ştiucă. At last, but not least, we would like to express our gratitude to the management of the Ţării Crişurilor Museum, Oradea.

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Abstract. A museum collection represents an assemblage of cultural and natural goods which can be accessible for both the wider public as well as researchers. The sources which represent the origins of the objects that make up a collection can originate from donations, acquisitions or discoveries resulting from systematic studies in the field. The discovery of a new collection which resides in a museum's depository represents a momentous occasion. The Fuchs Herman Collection, while of a smaller size, contains several sirenian fossil remains discovered in areas inside and around Cluj-Napoca by the respective paleontologist, a former teacher at the “Babeș-Bolyai” University. The collection itself is of great importance, because it is a part of the “Bethlen Gábor” College school museum’s patrimony, from Aiud. To this extent, the collection can help in ensuring the use of new, alternative teaching methods, the consolidation of knowledge and offers the possibility for the development of the students’ desire to learn. The sirenians from this collection are documented by fragmentary ribs and vertebrae, therefore an assignation from systematic viewpoint below the order level is not possible. The target of this paper is the inventory of the sirenian fossils from the Fuchs Herman Collection, thereby contributing to the development of the scholar museum.

Key words: Paleogene, paleontological collection, “Bethlen Gábor” College Aiud, Sirenia, museum, Romania.

Introduction

The museum collection means, according to the law of museums and public collections from Romania, ‘the assemblage of cultural and natural goods, constituted systematically and coherently by physical entities and legal entities under public or private law’ (Law nr. 311). The sources from which these objects originate can be donations, acquisitions or discoveries resulting from field research. Their evidence is performed with the help of the Registry for the analytical evidence of cultural goods (Methodological Norms, 2000). Researchers’ consultation of these registries is a difficult procedure, almost impossible in the case of museums which house dozens upon thousands of objects. While in the European countries there is a permanent preoccupation to facilitate access for the public, as well as researchers in the digital culture, in Romania however such a national systematic program for digitalizing of the museum patronage does not exist yet (Collection management).

In the XVII century Comenius (Jan Amos Komenský, 1592-1670) has shown in his work ‘*Orbis Sensualium Pictus*’ the didactic importance of a space for collecting in schools, named ‘museum’, so that students can obtain knowledge, not just from books (Nagrineac, 2019). Later John Dewey (1854-1952) underlined the importance of the existence of a museum in each school, in which along with a library, a laboratory and the workshops the students will be prepared for their futures (Koltai 2012, Veress & Codrea 2021).

Figure 1. The “Bethlen Gábor” College in Aiud, Romania.
Source: https://reformatus.ro/iskolak/nagyenyedi-kollegium

Recognizing such aspects, the discovery of a new collection in the museums’ storages is a particular event. Herein, we present the Fuchs Collection, which belongs to the Bethlen Gábor College’s scholar museum from Aiud (Romania), which we have discovered by chance, thanks to an article from a newspaper and which we were able to inventory (Kerekes 2022).

The Aiud Museum of Natural Sciences

It is the oldest museum of natural sciences opened for the public in Romania. It subordinates to the Aiud town hall, and it is located in the same building with the “Bethlen Gábor” College (Fig. 1) since 1622. The oldest evidence for a fossil and mineral collection can be found in the manuscript of ‘*Catalogus Raritatum et Benefactorum*’, courtesy of professor Benkő Ferenc and Nagy László

(Veress & Codrea, 2021). Also, from this source we find the year in which the museum was officially founded, namely 1796, by the name of ‘Raritarum et Rerum Naturalium Museum’ (Codrea & Morărescu 2008). Throughout its long history, the museum’s collections, aside from the scientific contributions, have offered support not only to the didactic activities of the College’s students, but also to the activities of the geology students of the “Babeș-Bolyai” University, who have paid many scientific visits there (Veress & Codrea 2021).

Figure 2. The Small Museum at the „Bethlen Gábor” College in Aiud, Romania.
Photo by Veress László.

Among the most important contributors to the establishment and development of the museum’s collection, we mention (aside from Benkő Ferenc and Nagy László) Herepei Károly and Zeyk Miklós, who have assured the development of the museum through their efforts, including donations of personal collections (Codrea & Mărgineanu 2007). After the passing over of the museum to the suborder of the Aiud town hall, a few of the “Bethlen Gábor” College’s professors have initiated the establishment of the so-called ‘Small Museum’ (Fig. 2). These professors are: Józsa Miklós, a professor of Hungarian literature and speech, Kónya Mária and Krizbai Jenő, professors of history, and Dvorácsek Ágoston, a professor of biology. With the support of the then-director of the college, Simon János, they were able to organize a small museum in the college’s boarding house building (Fig. 2), as an exhibition of a few objects of unique value which are in the possession of the College: documents and photographs, instruments and old devices, as well as a small collection of minerals and fossils. In the year 2006 the College received a rich donation, which is the collection of the late paleontologist and university lecturer, Fuchs Hermann (1915-1996) (Bakó 2006, Kerekes 2022). This is made up of fossils discovered in the areas around Cluj-Napoca (Leghia, Jebuc, Mera, Cheile Baciului, Someș-dig). First, professor Dvorácsek, professor Wanek Ferenc and the student Karsai Noémi have conducted an inventory of this collection and have also placed some of these fossils in the small museum, as well as write about them briefly in an article for the school’s magazine.

Fuchs Hermann (18th of February 1915 – 8th of April 1996)

He was born in Brașov into a numerous and highly religious family. He was orphaned by a father at a young age, which is why he grew up in rough material conditions. He studied at Brașov and at Odorheiul Secuiesc, obtaining his high school diploma at Brașov (Wanek 2001). His passion for Earth sciences began through his grandfather’s collection of minerals, who oversaw the mine from Baia de Arieș, and was prompted by his gymnasium professor, Abrecht József (Ajtai 1993).

He began his university studies at Cluj, at the "Ferdinand I" University (presently "Babeș-Bolyai" University), in 1932. He obtained his graduation diplomas in 1936 at the College of Nature Sciences' geology section, in 1940 at the College of Pedagogics' primarily natural history and secondarily physics-chemistry. In 1941 he graduated from the Unitarian Pedagogic Seminar and in 1942 he received an *absolutorium* in geography at the "Ferenc József" University in Cluj (presently "Babeș-Bolyai" University). Here he began his didactic and research carrier at the geology-paleontology department in 1941, as an assistant of professor Balogh Ernő, remaining almost uninterrupted until his retirement in 1976 (Ajtai 1993, Wanek 2001, 2022). His main preoccupation was the development of the didactic collections for better student teaching.

He published several articles in the magazine of that time, signing towards the end of his life as 'Brassói Fuchs Herman'. His main field of research was vertebrate paleontology, mainly Paleogene sirenians from Transylvania, but he did work in the field of micropaleontology starting from 1955, being the first Transylvanian researcher who adapted biometrics and statistics into the study of foraminifera populations in certain strata (Ajtai 1996).

After his death, his family decided to donate his personal collection, as well as a part of his professional library, to the "Bethlen Gábor" College in Aiud, because he campaigned his entire life for the popularization of paleontology and geology through numerous articles in the press, lectures, and clubs for students (Bakó 2006).

From a geological viewpoint, the fossils were collected by Fuchs himself from classical Upper Eocene and Lower Oligocene outcrops located in the basin of Transylvania, in Cluj-Napoca or in localities from the Cluj District. The deposits the sirenian fossils originated from belong to the Cluj Limestone Formation (Priabonian; Hofmann 1879) and Mera Formation (Rupelian, Merian; Koch 1880, emended by Mészáros et al. 1989). The first one is marine, while the second illustrates a transition from marine environments to terrestrial ones as transition to the terrestrial Moigrad Formation (Rusu 1970).

Figure 3. Study of the materials
Photo by Dvoracsek Ágoston.

Materials and methods

The following section is the inventory and description of each sirenian fossil from the college’s collection. Because Fuchs’ collection contained five boxes with sirenian fossils, five separate tables were used to inventory the pieces contained in them. In the other boxes there were no sirenian fossils. The inventory of each piece includes: the family to which the fossils belong to, the newly designated inventory number, the location where they were discovered, as well as the age of the location, and lastly the measurements done on each piece; however, certain fossil pieces (e.g., mollusk shells, rock fragments, and bone shards) were not measured. The measurements of a couple of pieces, which were measured in greater detail, were based on the methodologies employed by Zalmout & Gingerich (2012).

The Mera Formation (= Mera Beds) (Box V)

Taxon	New inventory number	Fossil	Location/Age/ Formation	Measurements
Sirenia	BCA-PC ME-1	Bone fragments	Mera, Early Oligocene (Rupelian, Merian), Mera Fm.	-
Sirenia	BCA-PC ME-2	Rib fragment	Mera, Early Oligocene (Rupelian, Merian), Mera Fm.	Length = 34.04 mm Width = 35.89 mm
Sirenia	BCA-PC ME-3	Humerus fragment in matrix	Mera, Early Oligocene (Rupelian, Merian), Mera Fm.	Length = 66.78 mm Width = 42.76 mm
Sirenia	BCA-PC ME-4	Rib distal end	Mera, Early Oligocene (Rupelian, Merian), Mera Fm.	Length = 34.30 mm Width =14.53 mm
Sirenia	BCA-PC ME-5	Rib proximal end	Mera, Early Oligocene (Rupelian, Merian), Mera Fm.	Length = 70.54 mm Width = 36.68 mm
Sirenia	BCA-PC ME-6	Rib distal end	Mera, Early Oligocene (Rupelian, Merian), Mera Fm.	Length = 34.78 mm Width = 20.02 mm
Sirenia	BCA-PC ME-7	Rib distal end	Mera, Early Oligocene (Rupelian, Merian), Mera Fm.	Length = 66.67 mm Width = 46.37 mm
Sirenia	BCA-PC ME-8	Rib distal end	Mera, Early Oligocene (Rupelian, Merian), Mera Fm.	Length = 60.43 mm Width = 28.79 mm
Sirenia	BCA-PC ME-9	Rib fragments	Mera, Early Oligocene (Rupelian, Merian), Mera Fm.	-
Sirenia	BCA-PC ME-10	Bone fragments in matrix	Mera, Early Oligocene (Rupelian, Merian), Mera Fm.	-
Sirenia	BCA-PC ME-11	Bone fragments	Mera, Early Oligocene (Rupelian, Merian), Mera Fm.	-

Sirenia	BCA-PC ME-12	Rib fragment in matrix	Mera, Early Oligocene (Rupelian, Merian), Mera Fm.	Length = 126.64 mm Width = 30.18 mm
Sirenia	BCA-PC ME-13	Bone fragments in matrix	Mera, Early Oligocene (Rupelian, Merian), Mera Fm.	-
Sirenia	BCA-PC ME-14	Rib distal end	Mera, Early Oligocene (Rupelian, Merian), Mera Fm.	Length = 46.51 mm Width = 140.75 mm

Cheile Baciului, Cluj-Napoca, Cluj Limestone Formation (Box II)

Taxon	New inventory number	Fossil	Location/Age/ Formation	Measurements
Sirenia	BCA-PC BA-1	Rib fragment	Cheile Baciului, sirenian level, Late Eocene (Late Priabonian), Cluj Limestone Fm.	Length = 53.89 mm Width = 24.35 mm
Sirenia	BCA-PC BA-2	Vertebra fragment	Cheile Baciului, sirenian level, Late Eocene (Late Priabonian), Cluj Limestone Fm.	Length = 59.50 mm Width = 33.68 mm
Sirenia	BCA-PC BA-3	Indeterminate bone fragment	Cheile Baciului, sirenian level, Late Eocene (Late Priabonian), Cluj Limestone Fm.	-
Sirenia	BCA-PC BA-4 (Fig. 5)	Rib fragment (distal end is missing)	Cheile Baciului, sirenian level, Late Eocene (Late Priabonian), Cluj Limestone Fm.	Length (incomplete) = 350 mm Inner arch length (incomplete) = 393 mm Outer arch length (incomplete) = 473 mm

				Capitulum to tubercle length = 52.32 mm Neck width = 34.62 mm Maximum mediolateral width = 34.27 mm Maximum anteroposterior width = 45.28 mm
Sirenia	BCA-PC BA-5	Rib distal fragment	Cheile Baciului, sirenian level, Late Eocene (Late Priabonian), Cluj Limestone Fm.	Length = 174 mm Width = 35.34 mm
Sirenia	BCA-PC BA-6	Rib fragment	Cheile Baciului, sirenian level, Late Eocene (Late Priabonian), Cluj Limestone Fm.	Length = 87.34 mm Width = 30.49 mm
Sirenia	BCA-PC BA-7	Vertebra fragment	Cheile Baciului, sirenian level, Late Eocene (Late Priabonian), Cluj Limestone Fm.	Length = 47.96 mm Width = 18.30 mm
Sirenia	BCA-PC BA-8 (Fig. 5)	Left scapula glenoid	Cheile Baciului, sirenian level, Late Eocene (Late Priabonian), Cluj Limestone Fm.	Length = 92.31 mm Glenoid process width = 54.67 mm Neck width = 40.62 mm
Sirenia	BCA-PC BA-9	Rib distal end	Cheile Baciului, sirenian level, Late Eocene (Late Priabonian), Cluj Limestone Fm.	Length = 136.05 mm Width = 30.09 mm
Sirenia	BCA-PC BA-10	Bone fragments	Cheile Baciului, sirenian level, Late Eocene (Late	-

			Priabonian), Cluj Limestone Fm.	
Rocks	BCA-RF BA-1	Rock fragments	Cheile Baciului, sirenian level, Late Eocene (Late Priabonian), Cluj Limestone Fm.	-
Sirenia	BCA-PC BA-11	Rib fragment	Cheile Baciului, sirenian level, Late Eocene (Late Priabonian), Cluj Limestone Fm.	Length = 26.50 mm Width = 40.21 mm
Sirenia	BCA-PC BA-12	Rib fragment	Cheile Baciului, sirenian level, Late Eocene (Late Priabonian), Cluj Limestone Fm.	Length = 55.36 mm Width = 21.73 mm
Sirenia	BCA-PC BA-13	Vertebra fragment	Cheile Baciului, sirenian level, Late Eocene (Late Priabonian), Cluj Limestone Fm.	Length = 39.03 mm Width = 31.84 mm
Sirenia	BCA-PC BA-14	Rib fragment	Cheile Baciului, sirenian level, Late Eocene (Late Priabonian), Cluj Limestone Fm.	Length = 48.88 mm Width = 15.61 mm
Sirenia	BCA-PC BA-15	Bone fragments	Cheile Baciului, sirenian level, Late Eocene (Late Priabonian), Cluj Limestone Fm.	-
Sirenia	BCA-PC BA-16	Rib fragments	Cheile Baciului, sirenian level, Late Eocene (Late Priabonian), Cluj Limestone Fm.	Length = 89.41 mm Width = 38.92 mm
Sirenia	BCA-PC BA-17	Bone fragments	Cheile Baciului, sirenian level, Late	

			Eocene (Late Priabonian), Cluj Limestone Fm.	-
Sirenia	BCA-PC BA-18	Bone fragments	Cheile Baciului, sirenian level, Late Eocene (Late Priabonian), Cluj Limestone Fm.	-
Sirenia	BCA-PC BA-19	Rib fragments	Cheile Baciului, sirenian level, Late Eocene (Late Priabonian), Cluj Limestone Fm.	Length = 46.51 mm Width = 140.75 mm
Sirenia	BCA-PC BA-20 (Fig. 5)	Bone fragment (sternum?)	Cheile Baciului, sirenian level, Late Eocene (Late Priabonian), Cluj Limestone Fm.	Length = 91.93 mm Width = 75.38 mm
Sirenia	BCA-PC BA-21	Rib fragment	Cheile Baciului, sirenian level, Late Eocene (Late Priabonian), Cluj Limestone Fm.	Length = 69.55 mm Width = 37.04 mm
Sirenia	BCA-PC BA-22	Rib fragment	Cheile Baciului, sirenian level, Late Eocene (Late Priabonian), Cluj Limestone Fm	Length = 16.50 mm Width = 35.74 mm
Sirenia	BCA-PC BA-23	Bone fragments	Cheile Baciului, sirenian level, Late Eocene (Late Priabonian), Cluj Limestone Fm.	-
Sirenia	BCA-PC BA-24	Bone fragment (proximal?)	Cheile Baciului, sirenian level, Late Eocene (Late Priabonian), Cluj Limestone Fm.	Length = 260 mm Width = 27.37 mm

Bucium (Țara Chioarului), Maramureș, Cluj Limestone Formation (Box III)

Taxon	New inventory number	Fossil	Location/Age/ Formation	Measurements
Sirenia	BCA-PC BUGR-1	Rib fragments	Bucium (= Gaura), Late Eocene (Priabonian), Cluj Limestone Fm	-
Sirenia	BCA-PC BU-1	Rib fragment	Bucium (= Gaura), Late Eocene (Priabonian), Cluj Limestone Fm.	Length = 77.27 mm Width = 18.10 mm
Sirenia	BCA-PC BU-2	Rib fragment	Bucium (= Gaura), Late Eocene (Priabonian), Cluj Limestone Fm.	Length = 22.7 mm Width = 42.02 mm
Sirenia	BCA-PC BU-3	Rib distal end	Bucium (= Gaura), Late Eocene (Priabonian), Cluj Limestone Fm.	Length = 240 mm Width = 42.96 mm
Sirenia	BCA-PC BU-4	Rib fragments	Bucium (= Gaura), Late Eocene (Priabonian), Cluj Limestone Fm.	-

Box I (various items)

Taxon	New inventory number	Fossil	Location/Age/ Formation	Measurements
Sirenia	BCA-PC SD-1	Indeterminate bone fragment in matrix	Cluj-Napoca, Someș riverbed, Late Eocene (Late Priabonian), Cluj Limestone Fm.	-
Sirenia	BCA-PC SD-2	Various indeterminate bone fragments	Cluj-Napoca, Someș riverbed, Late Eocene (Late Priabonian), Cluj Limestone Fm.	-
Bivalvia	BCA-BV BA-1	*Progymnodus* in matrix	Cheile Baciului, Late Eocene (Late Priabonian), Cluj Limestone Fm.	-
Sirenia	BCA-C DO-1	Right squamosal	Cluj-Napoca, Donath quarry, Late Eocene (Late Priabonian), Cluj Limestone Fm.	Length = 92.91 mm Width = 30.85 mm
Sirenia	BCA-PC-1	Bone fragments	-	-
Sirenia	BCA-PC SD-3	Bone fragments	Cluj-Napoca, Someș riverbed, Late Eocene (Late Priabonian), Cluj Limestone Fm.	-
Sirenia	BCA-PC ME-15	Bone fragments	Mera, Early Oligocene (Rupelian, Merian), Mera Fm.	-
Sirenia	BCA-PC SD-4 (Fig. 5)	Rib	Cluj-Napoca, Someș riverbed, Late Eocene (Late Priabonian), Cluj Limestone Fm.	Length = 334 mm Inner arch length = 398 mm Outer arch length = 36.9 mm

				Capitulum to tubercule length = 30.36 mm Neck width = 30.36 mm Maximum mediolateral width = 21.07 mm Maximum anteroposterior width = 33.63 mm
Bivalvia	BCA-BV BA-2	*Progymnodus* in matrix	Cheile Baciului, Late Eocene (Late Priabonian), Cluj Limestone Fm.	-
Sirenia	BCA-PC LE-1	Bone fragment	Leghia, Cluj Limestone Fm.	-
Sirenia	BCA-PC SD-5	Bone fragment	Cluj-Napoca, Someș riverbed, Late Eocene (Late Priabonian), Cluj Limestone Fm.	-
Sirenia	BCA-PC SD-6	Vertebra fragment	Cluj-Napoca, Someș riverbed, Late Eocene (Late Priabonian), Cluj Limestone Fm.	-
Sirenia	BCA-PC SD-7	Thoracic vertebra in matrix	Cluj-Napoca, Someș riverbed, Late Eocene (Late Priabonian), Cluj Limestone Fm.	Centrum-height = 26.39mm -length = 22.55 mm -width = 36.69 mm Vertebral arch (fragmentary) = 26.43 mm Upper vertebral surface = 20.49 mm

Box VIII (various items)

Taxon/ Rock	New inventory number	Fossil	Location/Age/ Formation	Measurements
Rocks	BCA-1	Rock fragments	-	-
Rocks	BCA-2	Coal fragments	Căliman mountains coal mine	-
Sirenia	BCA-PC BA-24	Rib fragment	Cheile Baciului, Late Eocene (Late Priabonian), Cluj Limestone Fm.	-
Rocks	BCA-BV-1	Limestone pieces	Brașov, top of the Tâmpa mountain	-
Rocks	BCA-3	Flint shards	Warnwmünde, shores of the Baltic sea	-
Rocks	BCA-4	Ichnofossils (worm tunnel)	-	-
-	BCA-GP	Tooth cast model (sirenia?)	-	-
Rocks	BCA-5	Limestone pieces	-	-
Sirenia	BCA-C SD-1 (Fig. 5)	Skull fragment (palate?)	Cluj-Napoca, Someș riverbed, Late Eocene (Late Priabonian), Cluj Limestone Fm.	Length = 86.53 mm Width = 57.34 mm
Sirenia	BCA-PC A-1	Rib fragment	Aghireș, Oligocene	-
Sirenia	BCA-PC ME-16	Rib fragment in matrix	Mera, Early Oligocene (Rupelian, Merian), Mera Fm.	-
Sirenia	BCA-PC-2	Bone fragments in matrix	-	-

Sirenia	BCA-PC SD-8	Rib distal end	Cluj-Napoca, Someș riverbed, Late Eocene (Late Priabonian), Cluj Limestone Fm.	-
Sirenia	BCA-PC-3	Rib fragment in matrix + smaller fragments	-	-
Rocks	BCA-6	Limestone with Bivalvia	-	-
Rocks	BCA-7	Limestone with bone fragments	-	-
Sirenia	BCA-PC BU-5	Rib fragment	Bucium (= Gaura), Late Eocene (Priabonian), Cluj Limestone Fm.	Length = 35.10 mm Width = 33.44 mm

Concluding remarks

The school museum represents not just an extension of the educational space for the consolidation of the scholarly materials, but also offers the possibility of developing creativity and independence, as well as the students' desire to know new worlds, socializing and communication. Thanks to the lessons held in the museum, the students can cultivate their initiative spirit, the desire to realize research and to complete museum displays.

The development of the school museum collections should become a priority for the community; however, this is not enough. These collections must be inventoried to serve the education of multiple generations. We think that the great local, regional, and national museums could contribute through their researchers and curators to the organization of the scholar collections, as well as to their development through donations.

An example in this context would be Fuchs Herman himself, who, like many other great professors at universities in Cluj, placed a particular emphasis on the enrichment of scholar collections (Wanek 2001), as well as attracting the youth to the field of paleontology through the founding of the Science Club 'The Debate School' at the ȚBethlen GáborȚ College in Aiud, where he presented to the participants the 'Prehistoric World' (Bakó 2006).

However, the examination of his collection donated to the museum in Aiud leads us to assume that a significant number of Sirenian fossils were not part of this donation, presumably having ended up in other collections. Of course, part of the fossils collected by him appear in the records of the Museum of Paleontology-Stratigraphy at the "Babeș-Bolyai" University, but others are supposed to have ended up in other collections, whose inventory remains unknown to specialists.

For instance, the Paleogene sirenians from Transylvania continue to remain poorly known from the systematic viewpoint, mainly due to the scarceness and fragmentary status of the fossils collected until now. The majority of remains refer to ribs and vertebrae, easy to assign to these marine mammals due their pachyostosis, an adaptation for the longer time spent underwater by the sea-cows, to facilitate eating the sea grass. Other post cranial bones are by far rarer, and skulls are exceptional finds in Transylvania (Fuchs 1970, Șuraru & Codrea 1988). The Fuchs's collection in Aiud does not break this rule. The largest part of this collection refers mainly to fragmentary ribs and vertebrae. Therefore, our tentative to assign these bones to a systematic level below order was unsuccessful. More complete and diagnostic fossils are needed for such a target.

Today, when technology is more and more developed, pseudoscience permeates through the internet very easily in every house, because the media news tends to superficially persecute scientific information, often wrongly. Future generations will be faced with real challenges when it comes to distinguishing between valuable scientific information and false scientific information.

The human of the future will have to be a very well-informed one, and this is only possible if the desire to learn develops, beginning from the learning time at school.

Acknowledgements

We especially thank prof. Szőcs Ildikó, the school principal of the “Bethlen Gábor” College in Aiud, as well as professor Dvoracsek Ágoston for allowing our access and their support in studying the fossils of the Herman Fuchs Collection. The authors thank two anonymous reviewers for their work that improved this paper.

Funding. This work was supported by a grant from the Ministry of Research, Innovation and Digitization, CNCS - UEFISCDI, project number PN-III-P4-PCE-2021-0351, within PNCDI III. The research of one of as (LV) was supported by a doctoral grant of the Romanian Government trough the Ministry of Education.

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Figure 4. Sirenian fossil ribs from the Fuchs Herman Collection:
BCA-PC BA-4 (a); BCA-PC SD-4 (b).

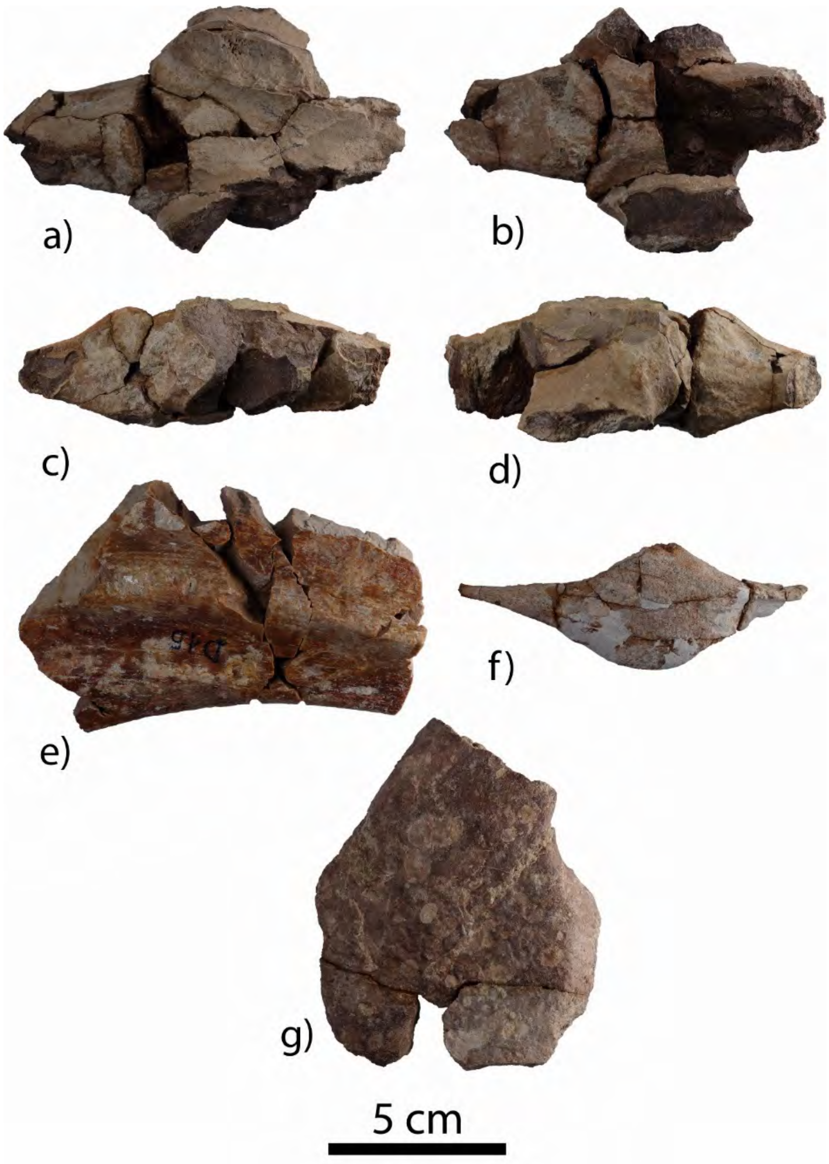

Figure 5. Various fossil sirenian bone fragments from the Fuchs Herman Collection: BCA-C SD-1 (skull fragment (palate?) (a – dorsal view; b – ventral view; c – lateral left view; d – lateral right view); BCA-PC BA-8 (left scapula glenoid) (e); BCA-C DO-1 (right squamosal) (f); BCA-PC BA-20 (sternum(?) fragment) (g).

NYMPHAEA Folia naturae Bihariae	L	89-100	Oradea, 2023

Microscopic and phytochemical study of *Lonicera caprifolium* L.

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Abstract. *Lonicera caprifolium* L. is part of *Magnoliophyta* class, prefers northern temperate areas and is cultivated in Romania as an ornamental plant, but also for honey production, in parks and gardens. Its main curative qualities are antispasmodic, emollient, expectorant, mild sedative, diuretic, laxative, and antimicrobial. The plant parts that produce these effects are mainly the flowers and leaves, but sometimes the fruits are also used. Specimens of *Lonicera caprifolium* L. were harvested in June-July 2020 and 2021 from cultivated flora in Cluj County, Negreni locality. Cross sections were conducted through the anatomical structures of the vegetative organs which were then observed under the light microscope at 10X, 20X and 40X objectives. For phytochemical characterization the preparation of plant material consisted in harvesting and drying mature flowers and were determined total polyphenol content, total flavonoid content, and antioxidant capacity.

Introduction

Lonicera caprifolium L. is part of *Caprifoliaceae* family, *Dipsacales* order, *Asteridae* subclass, *Magnoliophyta* class. It is a shrub with voluble stems, up to 4 m high, with glabrous branches. The leaves are leathery, deciduous, short petiolate, elliptic or obovate, with entire margins, dark green on the front, glabrous on the back, 4-10 cm long and 3-6 cm wide and the leaves at the upper nodes are conate, shaped like elliptic or circular discs (Săvulescu et al. 1965). The flowers are strongly scented, usually in sixes at the subtending the uppermost pair of leaves, sometimes even the first pair. The calyx is persistent, with obtuse teeth, white or yellowish corolla, about 4-5 cm long, externally glandular, internally glabrous, bilabiate, with the tube equal to its blade (Săvulescu et al. 1965). The stamens are also equal to the leaf blade of the corolla, and the styles are glabrous. The fruit is berry-like, free, ellipsoidal, about 8 mm long, reddish-orange and presents ellipsoidal seeds, about 4 mm long, wrinkled (Săvulescu et al. 1965).

In terms of habitat, the plant prefers northern temperate areas, up to northern edges of the subtropics (Smith & Donoghue 2010, Theis et al. 2008). It prefers any type of soil, both in terms of moisture and pH. Grows in semi-shaded and unshaded areas (Smith & Donoghue 2010, Theis et al. 2008). This species is cultivated in Romania as an ornamental plant, but also for honey production, in parks and gardens. It is sub-spontaneous in the Banat region through the forests of the Danube Delta. In terms of general distribution around the world, it is found in Europe, Western Asia and South-West Asia, North Africa (Săvulescu et al. 1965).

Its main curative qualities are antispasmodic, emollient, expectorant, mild sedative, diuretic, laxative, and antimicrobial (Passalacqua et al. 2007). The plant parts that produce these effects are mainly the flowers and leaves, but sometimes the fruits are also used.

It is also said to be the plant that cleanses the blood in internal use and has anti-inflammatory properties (Turgut et al. 2016), can also be used for headache relief, in gargle for various ENT disorders (Shang et al. 2011, Mahmoudian-Sani et al. 2017, Passalacqua et al. 2007), can also slow blood clotting and keeps heart disease at bay, commonly used to heal wounds, abscesses, acne and scars.

Material and methods

Specimens of *Lonicera caprifolium* L. were harvested in June-July 2020 and 2021 from cultivated flora in Cluj County, Negreni locality. We conducted cross sections through the anatomical structures of the vegetative organs which were then observed under the light microscope at 10X, 20X and 40X objectives.

For phytochemical characterization the preparation of plant material consisted in harvesting (Figure 1) and drying mature flowers of *Lonicera caprifolium* L. at room temperature (Figures 2, 3).

Fig. 1. *Lonicera caprifolium* L. - fresh plant material.

After drying it out, 10% ethanol solutions were made and subjected to spectrophotometric analyses, by which we determined the total polyphenol content, the total flavonoids and antioxidant capacity.

Fig. 2. Flowers of *Lonicera caprifolium* L., 2020 - *Lonicerae flos.*

Fig. 3. Flowers of *Lonicera caprifolium* L., 2021 - *Lonicerae flos*.

To determine the content of total polyphenolic compounds we used the Folin-Ciocâlteu method, the results being expressed in GAE gallic acid equivalents (mg/ml).

The antioxidant activity of *Lonicerae caprifoliaceae flos* extracts we evaluated using the FRAP method, expressed in Trolox equivalents/ml.

Results and discussions

Anatomical structure of the stem

In figure 4 there are highlighted the epidermis with cells tightly joined together. The shape of the section through the stem is round, the stem being cylindrical. On the epidermis, numerous long, unbranched, multicellular perithecia are observed.

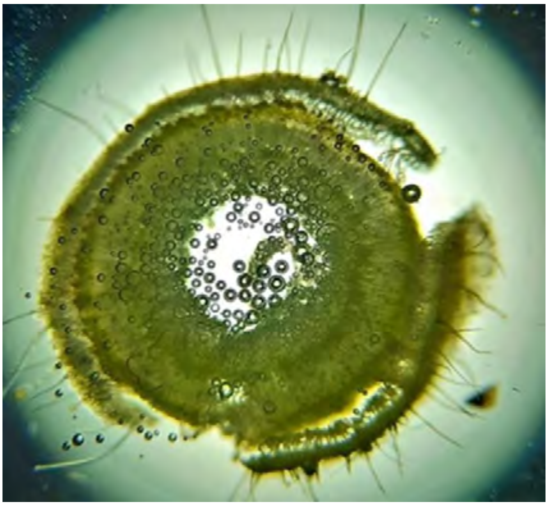


Fig. 4. *Lonicera caprifolium* L. - cross section through young stem (200X).

The epidermis is the single stratified defensive tissue made up of small, tightly packed cells. observed with the optical microscope in cross-section. The outer walls of the cells that come into contact with the external environment are thickened, cutinized, to fulfil the defense function.

Underneath the single stratified epidermis there is the multilayered crust of parenchymal cells. The assimilating parenchyma, the chlorenchymas, located under the epidermis, is a parenchymal tissue forming several layers of cells, the cells are rounded in cross-section, has intercellular spaces and numerous chloroplasts in the cytoplasm, necessary for photosynthesis.

The bark continues with the central cylinder, which is well represented in the species studied, comprising a well-developed medullary parenchyma, libero-ligneous conducting vessels, and medullary rays. In the middle there is a medullary lacuna due to resorption of medullary tissue.

Anatomical leaf narrowing

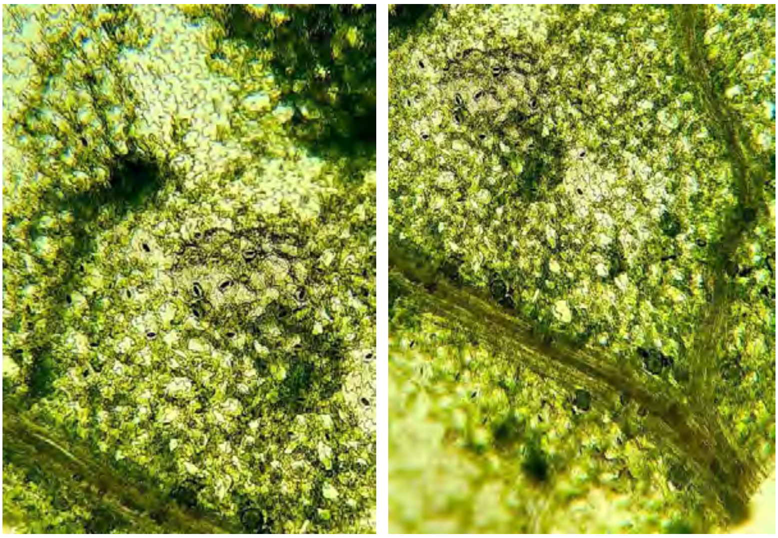
By cross-section through the leaf, the two single stratified epidermis, namely the upper and lower epidermis, can be seen. Both the upper and lower epidermis have a small number of multicellular perithecia.

Beneath the upper epidermis there is the palisading assimilatory tissue, consisting of two layers of cells, made up of elongated cells, perpendicular on the epidermis and closely united, in which a large number of chloroplasts accumulate.

Figs. 5-6. *Lonicera caprifolium* L. - cross section through leaf (100X).

Beneath the lower epidermis there is lacunar assimilative tissue made up of rounded, parenchyma cells between which large intercellular spaces are observed. In the cells the number of chloroplasts is reduced, with less photosynthesis taking place at this level.

At the level of the cross-section through the main rib (Figs. 5-6), the libero-ligneous beam is observed, with the free facing the lower epidermis and the wood facing the upper epidermis. Around the libero-ligneous bundle there is a ring of collenchyma with a protective role.



Figs. 7-8. *Lonicera caprifolium* L. - longitudinal section through leaf (200X).

The longitudinal section shows the structure of the leaf epidermis (Figs. 7-8). The cells are tightly packed together, without intercellular spaces. Branched veins, characteristic of dicotyledons, are observed. Anomocytic stomata are also observed (Fig. 9), with the attached cells around the stomatal cells not differentiated into special cells, but identical in shape to the epidermal cells.

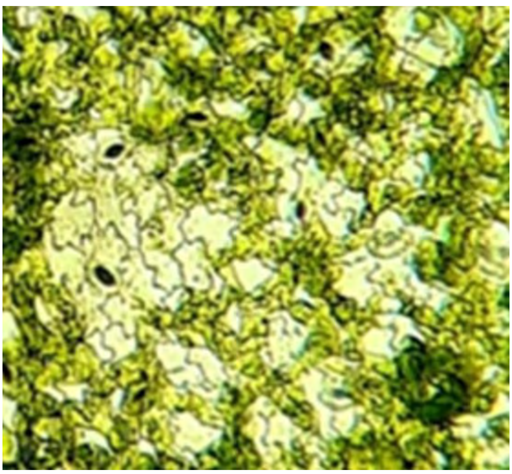


Fig. 9. *Lonicera caprifolium* L. - evidence of stomata on leaf epidermis (400X).

Phytochemical characterisation of the species *L. caprifolium* L.

Determination of total polyphenol content

The determination of the total polyphenol content was carried out using the Folin-Ciocâlteu method.

The total polyphenol content of the samples, i.e., approximately 100 ml, is mixed with 1750 ml of distilled water, 200 ml of Folin-Ciocâlteu reagent (diluted 1:10 v/v) and 1000 ml of 15% Na_2CO_3 solution, and then incubated at room temperature, in the dark, for two hours. The absorbance is then measured at a wavelength of 765 nm using a UV-Vis spectrophotometer. The calibration curve was linear for the range of concentration range of 0.1-0.5 mg/ml for gallic acid. The content of total polyphenols in extracts is expressed as mg gallic acid gram equivalent (GAE)/ml extract. The calibration curve used is (Fig. 10): y = 1.973x + 0.0261 (R^2 = 0.9928), where x is the absorbance and y is the gallic acid gram equivalent [3].

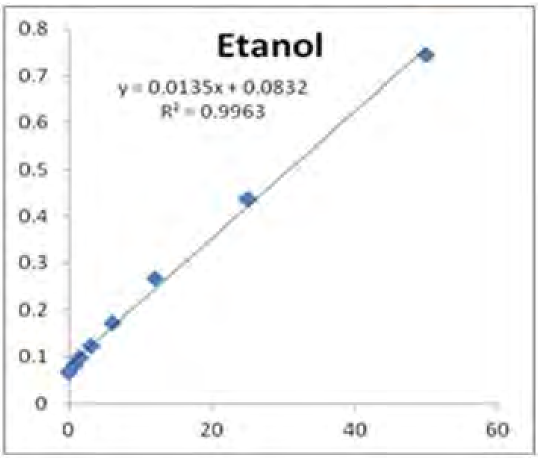


Fig.10. Calibration line performed with gallic acid for the Folin-Ciocâlteu method in alcoholic medium.

For this method 0.1 ml of fresh extract is mixed with 1.7 ml of deionized water and 0.2 ml of Folin-Ciocâlteu reagent (Merck). After shaking, 1 ml of 20%

Na_2CO_3 solution is added. Absorbance is recorded after 90 minutes, during which time the samples are kept in the dark at 765 nm (Brand-Williams et al. 1995).

Determination of total flavonoid content

The colorimetric method is used for this determination. We took 1 ml sample (containing 0,1 mg/ml dried plant product), mixed it with 4 ml of distilled water and placed it in a 10 ml volumetric flask. Then we added 3 ml of $NaNO_2$ 5% solution and after 5 minutes 0.3 ml $AlCl_3$ 10% solution. After 6 minutes, 2 ml of 1M NaOH is added. We filled the volumetric flask to the mark with distilled water and read the absorbance at 510 nm (Singleton & Rossi 1995).

The calibration line (Fig. 11) is drawn using standard quercetin (QE).

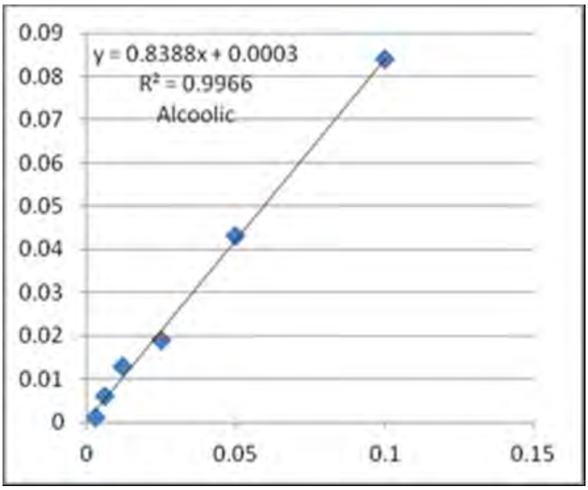


Fig. 11. Calibration line performed with quercetin in alcoholic medium.

Determination of antioxidant capacity

The antioxidant capacity of honeysuckle flower extracts was determined by the Cuprac method, which is based on changes in the absorption characteristics of the neocuproine (Nc) copper (II) complex when reduced with an antioxidant. The reduction potential of the sample or standard effectively converts Cu^{2+} to Cu^{+}, thus changing the absorbance maximum. This copper reduction complex shows an absorption maximum at 450 nm. The calibration curve is generated using a known concentration of Trolox, with the data being expressed as µmol Trolox equivalents/ml (Apak et al. 2006).

Year	Total polyphenols mgGAE/ gDW	Total flavonoid mgQE/ gDW
2020	273.31 ± 1.12	46.27 ± 1.08
2021	164.22 ± 0.06	27.78 ± 2.06

Table 1. Total amount of polyphenols and flavonoids.

Year	Cuprac µmol Trolox equivalent / mL
2020	27.43 ± 3.17
2021	19.22 ± 2.23

Table 2. Comparison of the antioxidant capacity, determined from the extracts in 2020 and 2021.

Analyzing the results obtained, a close correlation is observed between the content of flavonoids and polyphenols and the antioxidant capacity of the studied plant.

Conclusions

Among the species of the genus *Lonicera*, the species *Lonicera caprifolium* L., cultivated in our country as an ornamental plant, is the least studied worldwide.

For this study, the flowers (*Lonicerae flos*), harvested and dried at room temperature for two consecutive years, were subjected to phytochemical analysis to determine their therapeutic potential.

As shown in the paper, *Lonicerae caprifoliaceae flos*, freshly harvested and dried at room temperature, was subjected to chemical processes, resulting in the alcoholic extract on which spectrophotometric determinations were performed. Following the analyses, it can be stated that the plant has a high content of polyphenols, expressed as gallic acid-type phenolic acids and flavonoids expressed as quercetin, as active principles.

The content of phenolic acids in the plant product, expressed as gallic acid, was determined by the Folin-Ciocâlteu method, after which the sample was determined spectrophotometrically by plotting the calibration curve. The content of flavonoids, expressed as quercetin, was also determined by the colorimetric method. In addition to the determination of these active principles, the antioxidant properties of the plant product were also determined by the Cuprac method.

Following the results obtained, the correlation between the content of active principles expressed in phenolic acids and flavonoids and the antioxidant capacity of the product represented by the flowers (*Lonicerae flos*) can be observed. It was also found that there may be large differences in the amount of active principles from one year to another, probably due to pedo-climatic factors. Therefore, the species studied is a rich source of polyphenols and flavonoids with antioxidant effect, and further studies are needed to determine a potential therapeutic effect.

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NYMPHAEA Folia naturae Bihariae	L	101-122	Oradea, 2023

Supporting in time of need: The Crustacean Collection of Professor Ruiyu Liu from China Seas in the collections of the ”Grigore Antipa” Museum

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Abstract. We present a catalogue of the generous donation made by Professor Ruiyu Liu (J. Y. Liu), esteemed carcinologist, representing 163 crustacean specimens from different groups: Cirripedia, Hoplocarida, Eumalacostraca (Mysidacea), and Decapoda (Penaeidae, Alpheidae, Anomura-Paguroidea, Brachyura) from all the seas around China (Yellow Sea, South China Sea, East China Sea). The specimens were collected between 1929 and 1983 and represent a small part of a larger donation made by the Oceanographic Institute of Academia Sinica and the National Museum in Beijing as an effort to reconstruct the collections lost in the tragic earthquake in Romania in 1977.

Keywords: crustacean collection, Brachyura, China seas, Ruiyu Liu, China donation.

Introduction

The ”Grigore Antipa” National Museum of Natural History in Bucharest had to face big unfortunate events during its long history: World War II, bombings, and three earthquakes, namely in 1940, 1977 and 1986 (Petrescu 2004a). On March 4th, 1977, Romania was hit by the most terrible earthquake known from the history of modern registrations. A lot of important buildings collapsed, mainly in Bucharest. The “Grigore Antipa” National Museum of Natural History also suffered a lot. Many important pieces were very damaged or even irremediably destroyed, including the most valuable fossil skeletons of *Deinotherium gigantissimum* and *Mastodon americanus*, which had collapsed. After important efforts by the museum’s staff, most of the specimens with minor damages were recovered, with some of them being replaced, but still a great loss in the patrimony of the museum remained (Papadopol 1979). In those troubled times, it was late Academician Mihai Băcescu, the famous director of the museum at that time, who had the saving initiative to call for help to the great and extremely generous specialists he knew from all around the world (Petrescu 2004b). Many important donations from different museums of natural history on different continents arrived to Bucharest: from the Australian Museum, a collection of Indo-Pacific molluscs (Petrescu 2004c), from the Smithsonian Institution, U.S.A., and from many others (Andrei 2010). The museum’s collections continued increasing thanks to the material Academician Mihai Băcescu had brought from expeditions in the Indian Ocean (Persian Gulf, with the R/V “Thalassa”, in 1977), and from Indo-Pacific (expedition of the museum to the Indonesian Archipelago, in 1991).

Prof. Ruiyu Liu (used name J. Y. Liu) (1922-2012) was a renowned marine biologist and carcinologist, a pioneer of carcinology in China and a dedicated professor at the Institute of Oceanology, Chinese Academy of Sciences (I.OC.A.S.), and later, since 1997, a member of the Chinese Academy (Liu et al. 2020). He focused on numerous groups in the field of marine benthic ecology, on Mysidacea and Cirripedia (Ren & Liu 1978), Stomatopoda and Decapoda (Xiang & Li 2013). One of the magisterial works of his career was the “Checklist of Marine

Biota of China Seas" (Liu 2008), the basis of The Chinese Register of Marine Species (ChaRMS) (Xu et al. 2023).

I.O.C.A.S. conducted a series of surveys starting from 1957 with the R/V *Jinxing* (Venus), named the Comprehensive Oceanographic Survey in the Bohai Sea and northern Yellow Sea (1957-1958), followed by the National Comprehensive Oceanographic Survey (NCOS) to Beibu Gulf (1959-1960, 1962), in which more than 60 different institutes and laboratories from all over China participated. The surveys were carried out in Bohai Gulf (Wade-Giles), Huanghai (Yellow Sea), Tonghai (East China Sea) and Nanhai (South China Sea). Other Sino-Russian Marine Biodiversity Survey (1957-1960) to Hainan Island, and the Sino-Vietnam Joint Comprehensive Oceanographic Survey of Beibu Gulf (Beibuwan Gulf, Gulf of Tonkin) (1959-1962) took place. These were followed by the Xisha (Chen 1975, Chen & Lan 1978, Chen 1980, Huanting 1996) and Nansha expeditions between 1975 and 1986, by the Chinese Academy of Sciences. The marine fishes and invertebrates were deposited in the Marine Biological Museum of the Chinese Academy of Sciences in Qingdao (Liu 2013). Other large-scale ocean and marine living resource surveys include the 1981–1987 National Coastal Zone and Beach Resources Comprehensive Survey, the 1981-1988 Shandong Province Coastal Zone Resources Comprehensive Survey, and the 1991-1999 Sino-Korean Joint Research on Yellow Sea Oceanography.

As an homage to him, an issue of *Crustaceana* Monographs was dedicated to the memory of Prof. Ruiyu Liu, and numerous species and genera had been described in his memory (Liu et al. 2021).

This is the first publication of a catalogue of specimens donated from China to the museum in Bucharest. We hereby present the catalogue of the crustacean collection donated by Professor Ruiyu Liu (J. Y. Liu) to the museum in Bucharest as an utmost help after the tragic loss of part of its collections.

Material and methods

The present catalogue was completed by checking the hard-copy registers and the hand-written registers made by the custodian of the collections (at that time Mrs. Gabriela Andrei, an esteemed malacologist at the museum) and comparing the data with the original labels accompanying the specimens in the invertebrate collection. All this was done as an effort to complete or correct the available information.

The species were catalogued by their taxonomical classification, according to the present nomenclature. General classification follows the one by Martin & Davis 2001 and Sakai (1976). For barnacles updated classification we have followed Chan et al. 2021.

Results and discussions

On 26 December 1978, the “Grigore Antipa” Natural History Museum received a large donation from the National Museum from Beijing (NMB), containing a collection of mammals, birds, reptiles, molluscs and crustaceans. That donation was the subject of a temporary exhibition specially organized by our museum (Guțu 1978, Marinescu 1979). Our museum received also a second donation from China, from the Oceanographic Institute of Academia Sinica (OIAS), consisting of a collection of crustaceans, molluscs and echinoderms (Marinescu & Ionescu 1985). A final lot of invertebrates was donated by the same Prof. J. Y. Liu in 1983. Several specimens from both donations were part of the permanent exhibition until 1996, when consolidation work has started at the museum building.

In recent decades, an effort was made to catalogue invertebrate specimens, the majority of which are preserved in the wet collections, in 70% ethanol or formalin 4%.

Part of the material was fixed in alcohol. The specimens originating from the National Museum in Beijing (NMB) are as originally placed in cylindrical glass jars with a heavy base and covered by a circular glass plate attached to the rim of the jar with a sealing compound (Fransen et al. 1997), while other pieces are mounted on glass plates in cylindrical jars and fixed with nylon threads. The specimens were exhibited until 2008 in the marine fauna sector (Crustacea) in the permanent exhibition of the museum.

All the specimens have the original label. The specimens from the I.O.C.A.S. hold a significant header with their origin written in Chinese, have a type-written label with the original collection number placed in the left corner, the name of the specimen and data regarding the locality and collecting area written in Latin letters (Fig. 1A). The specimens from the Museum in Beijing present a supplementary label hand-written in India ink, where only the name of the specimen is written in Latin letters (Fig. 1B).

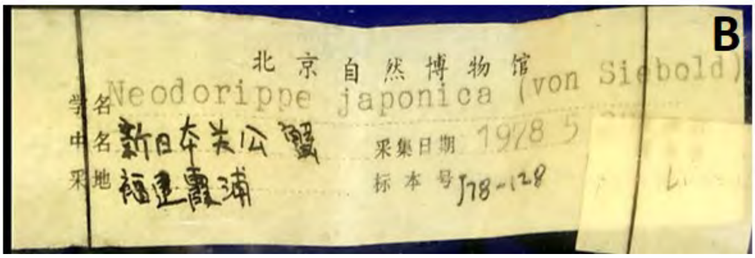

Fig. 1 A. Original type-written label, initial collection number (donation IOCAS).
1 B. Hand-written label, with initial collection number (don. National Museum from Beijing).

The collection is preserved in the invertebrate wet specimen deposit of the crustacean collection at the “Grigore Antipa” National Museum of Natural History.

The crustacean collection consists of 162 crustacean specimens, preserved in 66 jars. In this collection we could identify 20 specimens from the Beijing Museum and 141 specimens from I.O.C.A.S. Numerous taxa (62 species) are included in major groups such as: Cirripedia, Hoplocarida, Eumalacostraca (Mysidacea), Decapoda (Penaeidae, Alpheidae), Anomura (Paguroidea), and Brachyura (Dorippidae, Calappidae, Matutidae, Leucosiidae, Orithyiidae, Epialtidae, Parthenopidae, Portunidae, Xanthidae, Camptandriidae, Dotillidae, Macrophthalmidae, Mictyridae, Ocypodidae, Gecarcinidae, Varunidae, Carpiliidae, Dairidae, Eriphiidae, Euryplacidae, and Goneplacidae).

The specimens were collected between 1929 and 1983, but a vast majority of the specimens belong to the period 1950, 1955-1983. According to Liu (2013), prior to 1950 there was no research vessel for marine or fishery science, and only after the foundation of the Marine Biological Laboratory (now the Institute of Oceanology) of the Chinese Academy of Sciences (I.O.C.A.S.) the marine research in China really commenced. Before 1950 the collecting campaigns were realized only with limited resources, namely fishing boats, intertidal surveys, and in fish markets (Liu 2013).

Important donors from the Institute of Oceanology of the Chinese Academy of Sciences

In the collection we were able to identify on the handwritten register and also on the original label that some of the specimens were provided by the most esteemed students of Professor Liu and later on by renowned specialists who collected and donated numerous crustaceans.

Professor Chen Huilian, an esteemed Chinese carcinologist, donated ten species of crabs, a collection of remarkable and beautifully preserved specimens, mostly collected from Xisha Islands. She was a student of Prof. J. Y. Liu who had also worked in the Qingdao Institute of Marine Biology, where she had taken part in numerous national surveys between 1958 and 1992 (Ng & Jiang 2013). In 1957, Professor Chen Huilian, who recently graduated at the Xiamen University, was chosen by the Chinese Academy of Sciences to work at the Qingdao Institute of Marine Biology (the predecessor of I.O.C.A.S.), where she studied crustacean systematics under the direct coordination of Professor J. Y. Liu (Ng & Jiang 2013).

Part of the specimens originate from the Xisha and Nansha islands comprehensive expeditions in the 1970s (Chen 1980, Huanting 1996).

Professor Liu's longtime collaborator **Prof. Yongliang Wang** had also donated crustacean specimens, hermit crabs and shrimps from 1957, 1959 and 1982, collected in the Yellow Sea and from the Paracel Islands (Liu & Wang 1978).

Prof. Qi Zhongyan, a renowned Chinese malacologist and marine biologist (Zhang et al. 2014), who has also donated an important part of the conchological collection of Chinese molluscs (Andrei G. pers. comm.), provided two species of mysids.

Abbreviations: IOCAS = The Institute of Oceanology, Chinese Academy of Sciences; **NMB =** National Museum from Beijing; **MGA** = Museum Grigore Antipa; **inv. no**. = inventory number; **specs** = specimens; **ovig.** = ovigerous; **don** = donation.

Class THECOSTRACA

Subclass CIRRIPEDIA

Ord. Balanomorpha

Superfam. Balanoidea Leach, 1817

Fam. Balanidae Leach, 1817

Subfam. Amphibalaninae Pitombo, 2004

Balanus albicostatus (Pilsbry, 1916), syn. *Fistulobalanus albicostatus* (Pilsbry, 1916), 30778 (old. col. no. 036), East China Sea, 24.04.1982; 4 specs; don. IOCAS.

Subfam. Megabalaninae Leach, 1817

Megabalanus tintinnabulum (Linnaeus, 1758), 30777, East China Sea, 15.12.1980; 8 specs; don. IOCAS.

Superfam. Coronuloidea Leach, 1817

Fam. Tetraclitidae Gruvel, 1903

Tetraclita squamosa (Bruguière, 1789), 30779 (old. col. no. CRP037), East China Sea, 24.12.1980; 2 specs; don. IOCAS.

Ord. Pollicipedomorpha

Fam. Pollicipedidae Leach, 1817

Pollicipes mitella (Linnaeus, 1758), syn. *Capitulum mitella* (Linnaeus, 1758), 30793 (old col. no. CRP 039), East China Sea, 24.12.1980; 3 specs.; don. IOCAS.

Ord. Scalpellomorpha

Superfam. Lepadoidea Chan, Dreyer, Gale, Glenner, Ewers-Saucedo, Pérez-Losada, Kolbasov, Crandall & Høeg, 2021

Fam. Lepadidae Darwin, 1852

Lepas anserifera Linnaeus, 1758, 30780 (old col. no. CRP 038), East China Sea, 19.05.1980; 2 spec.; don. IOCAS.

Class Malacostraca Latreille, 1802

Subclass Hoplocarida Calman, 1904

Order Stomatopoda Latreille, 1817

Suborder Unipeltata Latreille, 1825

Superfamily Gonodactyloidea Giesbrecht, 1910

Family Gonodactylidae Giesbrecht, 1910

Gonodactylus chiragra (Fabricius, 1781), 29990, South China Sea, Hainan Island, China, 23.05.1955, 2 specs (1 ♂, 1 ♀); don. IOCAS.

Superfam. Squilloidea Latreille, 1802

Fam. Squillidae Latreille, 1802

Dictyosquilla foveolata (Wood-Mason, 1895), 29991, South China Sea, Guangdong; 26.03.1956; 2 specs (1 ♂, 1 ♀); don. IOCAS.

Oratosquilla oratoria (De Haan, 1844), 29993, Est China Sea, Quingdao; 3.04.1957; 2 specs (1 ♂, 1 ♀); don. IOCAS (Fig. 2).

Oratosquillina interrupta (Kemp, 1911), 29988, South China Sea, Guangdong; 19.03.1956; 2 specs (1 ♂, 1 ♀); don. IOCAS.

Quollastria gonypetes (Kemp, 1911) syn. *Oratosquilla gonypetes* (Kemp, 1911), 29984, South China Sea; 10.1959; 2 specs (1 ♂, 1 ♀); don. NMB.

Vossquilla kempi (Schmitt, 1931), 29992, South China Sea, Guangdong; 19.3.1956; 2 specs (1 ♂, 1 ♀); don. IOCAS.

Fig. 2. *Oratosquilla oratoria* (De Haan, 1844), Japanese squillid mantis shrimp, (♂, ♀) (commercial species, MGA inv. no. 29993).

Subclass Eumalacostraca Grobben, 1892

Superord. Peracarida Calman, 1904

Order Mysida Haworth, 1825

Fam. Mysidae Haworth, 1825

Neomysis orientalis Ii, 1964, 30773, brought by Prof. Qi Zhong Yan, 09.1983, don. Prof. J. Y. Liu, 4 specs, don. IOCAS.

Hyperacanthomysis longirostris (Ii, 1936), syn. *Acanthomysis longirostris,* 02.1936, 30774, brought by Prof. Qi Zhong Yan, 09.1983, don. Prof. J. Y. Liu, 4 specs, don. IOCAS.

Superord. EUCARIDA Calman, 1904

Order DECAPODA Latreille, 1802

Suborder Dendrobranchiata Bate, 1888

Superfam. Penaeoidea Rafinesque, 1815

Fam. Penaeidae Rafinesque, 1815

Penaeus chinensis (Osbeck, 1765), 29987, East China Sea, Quingdao, J. Y. Liu, China; 20.10.1978; 1 ♂, 1 ♀; don IOCAS.

Penaeus japonicus Bate, 1888*,* 30782, Yellow Sea, Guandong, China, leg. Chen, 04.1959, 2 specs; *don. IOCAS.*

Suborder Pleocyemata Burkenroad, 1963

Infraorder Caridea Dana, 1852

Superfamily Alpheoidea Rafinesque, 1815

Fam. Alpheidae Rafinesque, 1815

Alpheus japonicus Miers, 1879, 30781, China, Quingdao, Y. L. Wang, China, 08.1982, 2 specs; don. IOCAS.

Infraord. Anomura MacLeay, 1838

Superfam. Paguroidea Latreille, 1802

Fam. Paguridae Latreille, 1802

Pagurus pectinatus (Stimpson, 1858), 30775, in sponge, Yellow Sea, leg. J. L. Wang; 11.1957; 2 specs; don. IOCAS.

Fam. Coenobitidae Dana, 1851

Coenobita perlatus H. Milne-Edwards, 1837, 30776 (without shell); South China Sea, Xisha Island, China, leg. J. L. Wang; 04.1957; 3 specs; don. IOCAS.

Infraord. BRACHYURA Latreille, 1802

Heterotremata Guinot, 1977

Superfam. Dorippoidea MacLeay, 1838

Fam. Dorippidae MacLeay, 1838

Dorippe fachinno (Herbst, 1785), syn. *Dorippoides facchino* (Herbst, 1785), 9383 (orig. no.3), South China Sea, Shanwei (Kwangtung) China, 25.02.1956, 3 specs, don. IOCAS; 30789, Yellow Sea, Guangdong, China, leg. Chen, 04.1959; 1 spec.; don. IOCAS.

Dorippe frascone (Herbst, 1785), 9378, South China Sea, Shanwei (Kwangtung), China; 25.02.1956; 2 specs (1 ♂, 1 ♀); don. IOCAS.

Neodorippe japonica (von Siebold, 1824), syn. *Heikeopsis japonica* (von Siebold, 1824), 29881 (orig. no. 1, J78-128), East China Sea, Xiapu, Prov. Fujian, China, 29.05.1978, 2 specs (1 ♂, 1 ♀); don. NMB; 9385, Yellow Sea, Shantung, Tsingtao, 4 specs, don. IOCAS (Fig. 3).

Dorippe polita Alcock & Anderson, 1894, syn. *Paradorippe polita* (Alcock & Anderson, 1894), 9372 (orig. no. 4), Bohai Sea, Yellow Sea, Chingwangtao (Qinhuangdao), China, 21.07.1930, 4 specs (2 ♂♂, 2 ♀♀); don. IOCAS.

Fig. 3. *Neodorippe japonica* (von Siebold, 1824), Heikegani, samurai crab (♂, ♀) (MGA inv. no. 29993).

Superfam.Calappoidea De Haan, 1833

Fam. Calappidae De Haan, 1833

Calappa hepatica (Linnaeus, 1758), 30785, Xisha Island, China, leg. Chen; 05.1975; 1 spec.; don. IOCAS.

Calappa philargius (Linnaeus, 1758), 29871 (orig. no. 12, 778-127), East China Sea, Fujian, Chimen, China; 06.1978; 1 spec. 1 ♂; don NMB.; 9388 (orig. no. 5), South China Sea, Shanwei (Kwangtung), 2 specs (1 ♂, 1 ♀), don. IOCAS.

Fam. Matutidae De Haan, 1835

Matuta planipes Fabricius, 1798, 9364 (orig. no.7), China, East China Sea, Yanghokou (Gulf of Chihli); 17.06.1930; 2 specs (1 ♂, 1 ♀); don IOCAS.

Superfam.Leucosioidea Samouelle, 1819

Fam. Leucosiidae Samouelle, 1819

Pyrhila pisum (De Haan, 1841), 9363 (orig. no. 8), Bohai Sea, Chinwangtao (Gulf of Chihli), China; 27.07.1930; 3 specs (2 ♂♂, 1 ♀); don. IOCAS.

Superfam. Orithyioidea Dana, 1852

Fam. Orithyiidae Dana, 1852

Orithyia sinica (Linnaeus, 1771), 9391 (orig. no. 6) Yellow Sea, Shantung Peninsula, Hsingtsun, 23.05.1931, 2 specs (1 ♂, 1 ♀); don. IOCAS (Fig. 4).

Fig. 4. *Orithyia sinica* (Linnaeus, 1771), the tiger face crab (♂, ♀) (MGA inv. no.9391).

Superfam. Majoidea Samouelle, 1819

Fam. Epialtidae MacLeay, 1838

Pugettia quadridens (de Haan, 1839) syn*. Scyra quadridens* (De Haan, 1839), 9367 (orig. no. 9), South China Sea, Yangmatao, (Shantung Pen.); 9.07.1929; 3 specs (1 ♂, 2 ♀♀); don. IOCAS.

Superfam. Parthenopoidea MacLeay, 1838

Fam. Parthenopidae MacLeay, 1838

Subfam. Parthenopinae MacLeay, 1838

Parthenope (Platylambrus) validus (de Haan, 1839), syn*. Enoplolambrus validus* (De Haan, 1837), 29877 (orig. no.3; 998-182), East China Sea, Fukuyama, China;

24.04.1978; 1 spec.; don. NMB; 9386 (orig. no. 10), Peihai (Kwangtung) China, 16.06.1957, 1 spec., don. IOCAS.

Superfam. Portunoidea Rafinesque, 1815

Fam. Portunidae Rafinesque, 1815

Subfam. Portuninae Rafinesque, 1815

Portunus hastatoides (Fabricius, 1798), syn. *Eodemus hastatoides* (Fabricius, 1798), 29878, East China Sea, Fujian,China, 24.04.1978; 2 specs (1 ♂, 1 ♀ ovig.); don. NMB.

Portunus sanguinolentus (Herbst, 1783), 9376 (orig. no. 13), Shantung, Hainan Isl., China; 02.12.1955; 1 spec.; don. IOCAS.

Portunus trituberculatus (Miers, 1876), 9379 (orig. no.12), Cheroo San, Shantung, Hainan Isl., China, 01.05.1930; 2 specs (1 ♂, 1 ♀); don. IOCAS.

Subfam. Thalamitinae Paulson, 1875

Charybdis (*Gonioneptunus*) *bimaculata* (Miers, 1886), 29879 (orig. no.5; 778-054), South China Sea, Fujian, Dongshan, Chinese territorial waters; 24.04.1978; 2 specs (1 ♂, 1 ♀); don. NMB.

Charybdis (Charybdis) japonica (A. Milne-Edwards, 1861), 9377 (orig. no. 14), Bohai Sea (Yellow Sea), Shantung, Peitaiho (Gulf of Chihli), China; 21.06.1930, 2 specs (1 ♂, 1 ♀); don. IOCAS.

Charybdis cruciata (Herbst, 1794) syn. *Charybdis (Charybdis) feriata* (Linnaeus, 1758), East China Sea, Shanwei (Guangdong), 17.04.1960, 1 spec. (1 ♀), don. IOCAS.

Thalamita coeruleipes Hombron & Jacquinot, 1846, 30783, South China Sea, Xisha Island, China, leg. Chen; 05.1975; 2 specs; don. IOCAS.

Subfam. Necronectinae Glaessner, 1928

Scylla serrata Forskal, 1775, 9392 (orig. no. 11), Yellow Sea, Kwanghai (Kwangtung), China, 12.02.1957, 2 specs (1 ♂, 1 ♀), don. IOCAS (Fig. 6).

Fig. 6. *Scylla serrata* Forskal, 1775 , Giant mud crab, (♂, ♀) (MGA inv. no. 9392).

Superfam. Xanthoidea MacLeay, 1838

Fam. Xanthidae MacLeay, 1838

Subfam. Etisinae Ortmann, 1893

Etisus dentatus (Herbst, 1785), 30792, South China Sea, Xisha Island, China, leg. Chen; 05.1975; 1 spec.; don. IOCAS.

Subfam. Xanthinae MacLeay, 1838

Leptodius sanguineus (H. Milne Edwards, 1834), 29876 (orig. no. 6; J77-050), Xisha Island, Chinese territorial waters, South China Sea; 21.03.1976; 1 spec.; don. NMB.

Xantho distinguendus (de Haan), syn. *Macromedaeus distinguendus* (De Haan, 1835). 9374 (orig. no. 17), Petaiho - Qinhuangdao, Petaiho (Beidaihe) (Gulf of

Chihli), China; 25.05.1931; 3 specs (2 ♂♂, 1 ♀); don. IOCAS; 29874 (orig. no. 7), Sehngdi, Fujian (Pingyun), Chinese territorial waters, East China Sea, China; 7.05.1978; 2 specs (1 ♂, 1 ♀); don. NMB.

Subfam. Zosiminae Alcock, 1898

Atergatis floridus (Linnaeus, 1767), 9382, South China Sea, Hainan Island, China, 21.07.1955, 3 specs, don. IOCAS.
Zosimus aeneas (Linnaeus, 1758), 30788, South China Sea, Xisha Island, China, leg. Chen; 05.1975, 1 spec.; don. IOCAS.

Superfam. Ocypodoidea Rafinesque, 1815

Fam. Camptandriidae Stimpson, 1858

Cleistostoma dilatatum de Haan, 1835, 9365 (orig. no. 24), Yellow Sea, Tangku (Gulf of Chihli), China; 13.07.1930; 4 specs (2 ♂♂, 2 ♀♀); don. IOCAS.

Fam. Dotillidae Stimpson, 1858

Scopimera bitympana Shen, 1930, 9381 (orig. no. 21), Yellow Sea, Rushankou, Rushan, Shandong (Shantung), 3 specs; don. IOCAS.

Fam. Macrophthalmidae Dana, 1851

Macrophthalmus (Mareotis) japonicus (De Haan, 1835), 9373 (orig. no. 23), Bohai Sea, Tengchow (Penglai) (Shentung Pen.), China, 24.05.1930; 3 specs (2 ♂♂, 1 ♀); don. IOCAS; 29872 (orig. no. 10; 999-151), Qingdao, Shangdong, East China Sea, Chinese territorial waters, China, 06.1977; 2 specs (1 ♂, 1 ♀), don. NMB.

Fam. Mictyridae Dana, 1851

Mictyris longicarpus Latreille, 1806, 9370 (orig. no. 19), South China Sea, Hainan Isl., China, 21.12.1950; 3 specs (1 ♂, 2 ♀♀: 1 ♀ ovig.), don. IOCAS; 29882 (orig. no.9), South China Sea, Fujian, Fuqing, Chinese territorial waters; 14.04.1978; 2 specs (1 ♂, 1 ♀); don. NMB.

Fam. Ocypodidae Rafinesque, 1815

Subfam. Gelasiminae Miers, 1886

Austruca lactea (De Haan, 1835), syn. *Uca lacteus* (de Haan, 1835), 9369 (orig. no. 22), East China Sea, Wenchow (Wenzhou, Chekiang), 2.07.1962, 3 specs (3 ♂♂); don. IOCAS.

Subfam. Ocypodinae Rafinesque, 1815

Ocypode ceratophthalmus (Pallas, 1772), 30786, South China Sea, Xisha Island, China, leg. Chen; 05.1975; 1 spec.; don. IOCAS.

Ocypode stimpsoni Ortman, 1897, DCP560, Bohai Sea, Chefoo (Yantai) (Shantung), China; 30.05.1930; 3 specs (2 ♀♀, 1 ♂); don. IOCAS.

Tubuca arcuata (De Haan, 1835), 9366 (orig. no.21), Shatsukou (Shantung Pen.), China; 9.05.1931; 3 specs (2 ♂♂, 1 ♀); don. IOCAS.

Superfam.Grapsoidea MacLeay, 1838

Fam. Gecarcinidae MacLeay, 1838

Gecarcoidea lalandii H. Milne Edwards, 1837, 30790, Xisha Island, China, leg. Y. L. Wang; 04.1957; 1 spec.; don. IOCAS.

Fam. Varunidae H. Milne Edwards, 1853

Subfam. Gaeticinae Davie & Ng, 2007

Gaetice depressus (de Haan, 1835), 9375 (orig. no. 29), Yellow Sea, Yangmagtao Island, Shantung Peninsula, China, 15.07.1930; 4 specs (2 ♂♂, 2 ♀♀); don. IOCAS; 29875 (orig. no.12; 998-098), Fujian, East China Sea, China; 7.05.1978; 2 specs (1 ♂, 1 ♀ ovig.); don. NMB.

Subfam. Varuninae H. Milne Edwards, 1853

Eriocheir sinensis H. Milne Edwards, 1853, 9380 (orig. no. 28), Bohai Sea (Yellow Sea), Hopei (Hebei), East China Sea, China; 29.09.1957; 2 specs (1 ♂, 1 ♀); don. IOCAS (Fig. 5).

Hemigrapsus penicillatus (de Haan, 1835), 9371 (orig. no. 26), Yellow Sea, Chefoo (Yantai), Shantung, Bohai Gulf, China, 06.05.1930; 4 specs (2 ♂♂, 2 ♀♀: 1♀ ovig.); don. IOCAS.

Hemigrapsus sanguineus (De Haan, 1835), 9368, Bohai Sea, Chinwangtao (Qinhuangdao, Gulf of Chihli), China; 16.06.1929; 3 specs (2 ♂♂, 1 ♀); don. IOCAS; 29873 (orig. no. 7; 998-93), Dongshan, Fujian, South China Sea, China; 24.05.1978; 2 specs (1 ♂, 1 ♀ ovig.); don. NMB.

Fig. 5. *Eriocheir sinensis* H. Milne Edwards, 1853, Chinese mitten crab, (♂) (MGA inv. no.9380).

Subfam. Cyclograpsinae H. Milne Edwards, 1853

Helice tridens tientsinensis Rathbun, 1929, syn. *Helice tientsinensis* Rathbun, 1931, 9387 (orig. no. 30), Yellow Sea, Tangku (Gulf of Chihli), China, 08.05.1929; 2 specs (1 ♂, 1 ♀); don. IOCAS.

Superfam.Carpilioidea Ortmann, 1893

Fam. Carpiliidae Ortmann, 1893

Carpilius convexus (Forskål, 1775), 30791, South China Sea, Xisha Island, Chen, China, leg. Ren; 05.1975; 2 specs; don. IOCAS.

Superfam.Dairoidea Serène, 1965

Fam. Dairidae Ng & Rodríguez, 1986

Daira perlata (Herbst, 1790), 30784, Xisha Island, China, leg. Chen; 05.1975; 2 specs; don. IOCAS.

Superfam.Eriphioidea MacLeay, 1838

Fam. Eriphiidae MacLeay, 1838

Eriphia sebana (Shaw & Nodder, 1803), 30787, South China Sea, Xisha Island, China, leg. Chen; 05.1975; 1 spec.; don. IOCAS.

Superfam.Goneplacoidea MacLeay, 1838

Fam. Euryplacidae Stimpson, 1871

Eucrate crenata (de Haan, 1835), 9384 (orig. no. 18), South China Sea, Shanwei, Guangdong, China, 29.02.1956, 2 specs (1 ♂, 1 ♀), don. IOCAS.

Fam. Goneplacidae MacLeay, 1838

Carcinoplax longimanus (De Haan, 1833), 29880 (orig. coll. no. J78-0100), East China Sea, Fujian, Pingyu, China, 14.05.1974, 1 spec.; don. NMB.

Other invertebrates

In the invertebrate collection (dried specimens) there were other specimens donated by J.Y.Liu, from I.O.C.A.S. Among the class Asteroidea, fam. Archasteridae, we note the sand star *Archaster typicus* Müller & Troschel, 1840 (2 specs, MGA inv. no. 30750, Hainan Island), or the brittle star *Ophiolepis cincta* Müller & Troschel, 1842 (Ophiuroidea; 2 specs, MGA inv. no.30749, Xisha Island), along with the cake sand dollar *Arachnoides placenta* (Linnaeus, 1758) (Echinoidea, Clypeasteridae; 3 specs, MGA inv. no. 30751), and the rock burrowing urchin *Echinometra mathaei* (Blainville, 1825) (Echinometridae; 1 spec., MGA inv. no. 30752, Hainan Island).

Conclusions

Professor Ruiyu Liu (J. Y. Liu) donated an entire ”Noah's ark” specimens from seas all around China, male and females of each kind, different life stages, different shapes, with peculiar behaviour, important for aquaculture, or species that became invasive, all specimens ready to be exhibited to the public. The rare and beautifully conserved crustacean specimens donated by Prof. J. Y. Liu and his colleagues stand witness to their dedication and great care, a true demonstration of professionalism, friendship beyond the borders, and dedication to education and museology, nonetheless.

Placed at the heart-center of the capital, the ”Grigore Antipa” Museum always impressed its visitors, by educating the students, through the museology aspects and even more, through the vivid example of a regenerating organism, all due to the care and dedication of all of its great donors and benefactors, to whom we are forever thankful.

Acknowledgements

We are deeply thankful to our anonymous reviewers and to our colleagues: to Dr. Angela Petrescu for the most useful suggestions in writing the manuscript, to Mrs. Gabriela Andrei, senior museographer and curator of the invertebrate collection (between 1976 and until retirement), for the information regarding the malacological collection, and to Mariana Iancu for the archive documents.

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Giant amphipods from Lake Baikal in the collections of the “Grigore Antipa” National Museum of Natural History

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Abstract. A small collection of giant amphipods from Lake Baikal was presented. It was collected and donated by researchers from the Royal Institute of Natural Sciences from Bruxelles who took part of the BAIK95 expedition in 1995. It’s one of the most valuable collections of Peracarida from the "Grigore Antipa” National Museum of Natural History.

Keywords: Lake Baikal, Amphipoda, giant specimens, endemite, museal collection

Introduction

Lake Baikal is in southern Siberia (Russia), in a rift zone in the Yenisei River Basin. It is a freshwater lake, with the largest freshwater reserve in the world, 23000 km^3, 22-23% of the world's drinking water reserves (excluding glaciers). It is the oldest (20–25 million years) and deepest lake on the globe (1637 m) (Kozhov 1963) and has a diverse endemic fauna (Takhteev 2019).

It is fed by more than 300 watercourses, among which the Selenga, in the Buryat Republic, located in the SE of the lake and forming small delta, is the most important, and from this lake only one river rises, the Angara, separating the eastern and southern regions (Touchart 2014).

On the eastern side of the lake the average temperature ranges from a winter low of -19 °C to a summer high of 14 °C. UNESCO declared Baikal a World Heritage Site in 1996.

Lake Baikal is known to be one of the most important regions of the planet with high number of endemic species, along with the Ponto-Caspian region, South of Europe, South of Australia, and the karst regions of eastern U.S. (Vaïnölä et al. 2008). The geographical isolation determined an accentuated speciation (Gurkov et al. 2019), while a most rigorous study combined the morphological and molecular data proved that the Baikal amphipod fauna resulted from two independent invasions in the lake from nearby waters (Macdonald et al. 2005).

So far 354 species and subspecies of amphipods are known from Lake Baikal, most of them being endemic (Takhteev et al. 2015, Takhteev 2019). The total number of Amphipod taxa, superfamily Gammaroidea, from the Lake Baikal is now around 7 families, 3 subfamilies, 51 genera, and 354 species and subspecies (Takhteev 2019).

They were systematically studied by many specialists, starting with Dybowsky in the 19th century and ending with Bazikalova, Kamaltynov, Mechanikova, Chapelle and others in our time. The amphipod fauna of Lake Baikal is extremely diverse morphologically, ranging from the classical form of freshwater *Gammarus* to the most armoured and processiform carapace of the Acanthogammaridae. In some situation the higher concentration of oxygen in the water leads to larger body sizes in amphipods (Chappelle & Peck 2004).

A collection of amphipods of Lake Baikal is quite an exquisite part of any crustacean collection. In the zoological collections held at various natural history museums in the world we could not find many catalogues or mentions. The vast majority of these endemic species are held in Russia (Baikal Limnological

Museum of Irkutsk Scientific Center of the Russian Academy of Science, Zoological Institute of the Russian Academy of Sciences, St. Petersburg, the State Darwin Museum, Moscow), some in Finland (the Finnish Museum of Natural History, University of Helsinki, 26 samples of Amphipoda from Lake Baikal, according to Albrecht et al. 2012), Royal Belgian Museum, Naturalis Biodiversity Center, Copenhagen Museum (Stebbing 1899), Zoological Museum, Moscow State University, Moscow; the amphipod type collection of Benedict Dybowski from the Museum and Institute of Zoology of the Polish Academy of Sciences in Warsaw and Krakow, the Natural History Museum Vienna, the Zoological Museum of Lviv University, the Museum of Natural History in Berlin, the Zoological Institute and Museum of Hamburg University, the Senckenberg Natural History Collections Dresden; the Natural History Museum in London, and the Lake Biwa Museum (exhibited live in Aquarium in Oroshimo, Kusatsu, Japan, as part of a collaboration between the Lake Biwa Museum and the Baikal Limnological Museum).

The "Grigore Antipa" National Museum of Natural History is among the very few natural history museums in the world that possess such valuable pieces.

Material and methods

The material is represented by 43 specimens of endemic amphipods, some of them being the largest of the known amphipod species, which were obtained by the late Alexandru Marinescu, former head of the Public Relations Department, a television personality, passionate oceanologist and consummate researcher of the history of science, known for his connections with Jacques Yves Cousteau, famous for all the research and actions undertaken related to Romania's great biologists (starting with Grigore Antipa and continuing with Emil Racoviță and others). Following the visits and discussions undertaken in 1995 at the Institut Royal des Sciences Naturelles de Belgique in Brussels, especially with the illustrious Belgian amphipodologist Claude de Broyer, he received as a gift a small collection of amphipods collected by him and his colleague, Gauthier Chapelle, during the BAIK95 Campaign in August 1995 in Lake Baikal.

The collected material was identified by the great Russian specialists Ravil Masalimovich Kamaltynov and Irina Mechanikova from the Limnological Institute of the Siberian Branch of the Russian Academy of Sciences, Irkutsk, Russia.

This material was mainly collected during the joint Russian-Belgian expeditions on Lake Baikal in 1995 on the board of R.V. '*Vereschagin*' (Martin et al. 1995).

The specimens were collected using an ‘autonomous trap system' developed at the Royal Belgian Institute of Natural Science beam trawl, with an acoustic trap, during 18-29.08.1995, at 20-1000 m deep, especially on the Eastern shore (as described by Mekhanikova et al. 2001). The specimens were collected from Frolikha Bay, Chivyrkui Gulf, Olkhon Island (Irkutsk), Cape Ireksokon, Selenga Delta, Cape Krestovy, and Kharauz Creek (Selenga Delta).

For the taxonomic update we used five bibliographic sources: Barnard & Barnard 1983, Bousfield 1977, Bazikalova 1945, Kamaltynov 2009, Takhteev 2019.

Results

The Amphipoda collection of the “Grigore Antipa” National Museum of Natural History in Bucharest holds more than 38,000 specimens and is one of the largest in the country. Most of them were collected from Romania, while others were donated from several remoted areas, from different expeditions, from the Indo-Pacific Ocean, Indonesia (1991), and from Tanzania (1973-1974). Among these we have identified a small collection of amphipods from Lake Baikal.

Seven endemic families are known in Lake Baikal: Acanthogammaridae, Baikologammaridae, Eulimnogammaridae, Macrohectopidae, Micruropodidae, Pachyschesidae and Pallaseidae (Vaïnölä et al. 2008).

In our collection we have identified 43 amphipod specimens belonging to 3 families, Gammaridae, Acanthogammaridae and Pallaseidae, 10 genera and 14 species.

Many of them present exuberant spines and crests on the carapace or very long antennae. Specimen length varied from 10 mm up to almost 63 mm, for *Acanthogammarus (Ancyracanthus) maculosus.*

Gammaridae Leach, 1914

***Odontogammarus calcaratus* (Dybowsky, 1874)**

Lake Baikal, station 37, Frolikha Bay, 55°31’N 109°51’E, 100 m, trap, 24.08.1995, leg. Claude de Broyer & G. Chapelle, BAIK95, det. R. Kamaltynov & I. Mechanikova, 3 specimens (AMP 10). Size: 23-25 mm (max. body length-35 mm, Chapelle 2002).

***Ommatogammarus albinus* (Dybowsky, 1874)**

Lake Baikal, station 21, Cape Ireksokon, 55°31’N 109°51’E, 92 m, acoustic trap, 22.08.1995, leg. Claude de Broyer & G. Chapelle, BAIK95, det. R. Kamaltynov & I. Mechanikova, 3 specimens (AMP 11). Size: 25-27 mm.

Acanthogammaridae Garjajew, 1901

Acanthogammarinae Garjajew, 1901

***Acanthogammarus (Ancyracanthus) maculosus* Dorogostaisky, 1930**

Lake Baikal, Mys Kharantsy (Cape Kharantsi), Olkhon Island, station 11, 53°10’N 107°11’E, 50 m, beam trawl, 19.08.1995, leg. Claude de Broyer & G. Chapelle, BAIK95, det. R. Kamaltynov & I. Mechanikova, 3 specimens (AMP 3). Size: 60- 62.8 mm, (Fig. 1) (max. body length 56 mm, Takhteev 2019).

Fig. 1 *Acanthogammarus maculosus* Dorogostaisky, 1930 (scale 2 cm).

***Brachyuropus grewingkii* (Dybowsky, 1874)**

Lake Baikal, station 52, Chivyrkui Gulf, 760 m., beam trawl, 27.08.1995, leg. Claude de Broyer & G. Chapelle, BAIK95, det. R. Kamaltynov & I.

Mechanikova, 2 specimens (1 specimen damaged) (AMP 1). Size: 45.7 mm (max. body length 90 mm - Chapelle 2002) (Fig. 2).

Fig. 2 *Brachyuropus grewingkii* (Dybowsky, 1874) (scale 2 cm).

Lake Baikal, station 52, Chivyrkui Gulf, 750 m beam trawl, 27.08.1995, leg. Claude de Broyer & G. Chapelle, BAIK95, det. R. Kamaltynov & I. Mechanikova, 1 specimen (AMP 2). Exhibited in the museum hall in a glass cylinder.

***Brachyuropus reichertii* (Dybowsky, 1874)**

Lake Baikal, station 58, Selenga Delta, 52°19'N 106°07'E, 150 m, beam trawl, 28.08.1995, leg. Claude de Broyer & G. Chapelle, BAIK95, det. R. Kamaltynov & I. Mechanikova, 6 specimens (AMP 4). Size; 10.2- 44.3 mm, (Fig. 3). It can reach a body length up to 70 mm.

Fig. 3 *Brachyuropus reichertii* (Dybowsky, 1874) (scale 1 cm).

Garjajewiinae Tachteew, 2000

Garjajewia cabanisii **(Dybowsky, 1874)**

Lake Baikal, station 58, Selenga Delta, 52°19’N 106°06’E, 150 m, beam trawl, 28.08.1995, leg. Claude de Broyer & G. Chapelle, BAIK95, det. R. Kamaltynov & I. Mechanikova, 4 specimens (AMP 8). Size: 24.6- 43.3 mm (max. body length 80 mm, Takhteev 2019) (Fig. 4).

Fig. 4 *Garjajewia cabanisii* (Dybowsky, 1874) (scale 1 cm).

Garjajewia sarsi **Sowinsky, 1915**

Lake Baikal, station 4, Cape Krestovy, 52°34’N 106°26’E, 1000 m, beam trawl, 18.08.1995, leg. Claude de Broyer & G. Chapelle, BAIK95, det. R. Kamaltynov & I. Mechanikova, 3 specimens (AMP 9). Size: 38.2-54.7 mm (Fig. 5).

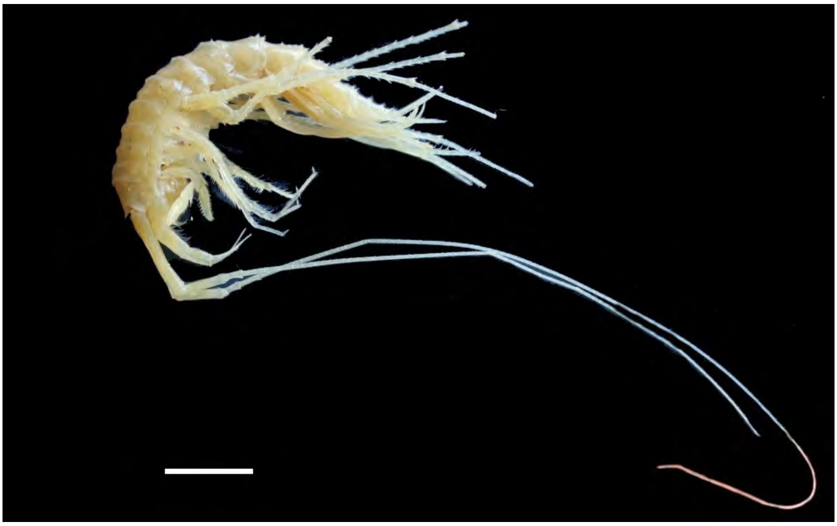

Fig. 5 *Garjajewia sarsi* Sowinsky, 1915 (scale 1 cm).

Hyalellopsinae Kamaltynov, 1999

Hyalellopsis (Boeckaxelia) potanini **(Dorogostaisky, 1922)**

Lake Baikal, station 62, Selenga Delta, 52°18’N 106°09’E, 50 m, beam trawl, 28.08.1995, leg. Claude de Broyer & G. Chapelle, BAIK95, det. R. Kamaltynov & I. Mechanikova, 3 specimens (AMP 5). Size: 46.8- 57.1 mm, (Fig. 6).

Fig. 6 *Boeckaxelia potanini* (Dorogostaisky, 1922) (scale 0.5 cm).

Pallaseidae Tachteew, 2000

Pallaseinae Tachteew, 2000

***Poekilogammarus pictus* (Dybowsky, 1874)**

Lake Baikal, station 62, Kharauz Creek (Selenga Delta), 52°18’N 106°09’E, 50 m, fish trawl, 28.08.1995 leg. Claude de Broyer & G. Chapelle, BAIK95, det. R. Kamaltynov & I. Mechanikova, 3 specimens (AMP 15). Size: 26-29 mm.

***Propachygammarus dryshenkoi* (Garjajew, 1901)**

Lake Baikal, station 66, Selenga Delta, 52°20’N 106°01’E, 450 m, beam trawl, 29.08.1995, leg. Claude de Broyer & G. Chapelle, BAIK95, det. R. Kamaltynov & I. Mechanikova, 2 specimens (AMP 12). Size: 22-25 mm.

Parapallaseinae Kamaltynow, 1999

***Parapallasea borowskii* (Dybowsky, 1874)**

Lake Baikal, station 59, Selenga Delta, 52°19’N 106°04’E, 210 m, beam trawl, 28.08.1995, leg. Claude de Broyer & G. Chapelle, BAIK95, det. R. Kamaltynov & I. Mechanikova, 2 specimens (AMP 13). Size: 28.5-32.2 mm.

***Parapallasea lagowskii* (Dybowsky, 1874)**

Lake Baikal, station 4, Cape Krestovy, 52°34’N 106°26’E, 1000 m, beam trawl, 18.08.1995, leg. Claude de Broyer & G. Chapelle, BAIK95, det. R. Kamaltynov & I. Mechanikova, 2 specimens (AMP 14). Size: 35-40 mm.

***Ceratogammarus cornutus* (Sowinsky, 1915)**

Lake Baikal, station 59, Selenga Delta, 52°19’N 106°04’E, 210 m, beam trawl, 28.08.1995, leg. Claude de Broyer & G. Chapelle, BAIK95, det. R. Kamaltynov & I. Mechanikova, 3 specimens (AMP 6). Size: 30.8- 36.2 mm (Fig. 7).

Fig. 7 *Ceratogammarus cornutus* (Sowinsky, 1915) (scale 0.5 cm).

Ceratogammarus dybowskii **Sowinsky, 1915**

Lake Baikal, station 52, Chivyrkui Gulf, 53°58’N 109°03’E, 760 m, beam trawl, 27.08.1995, leg. Claude de Broyer & G. Chapelle, BAIK95, det. R. Kamaltynov & I. Mechanikova, 3 specimens (AMP 7). Size: 37.8- 45.2 mm (Fig. 8).

Fig. 8 *Ceratogammarus dybowskii* Sowinsky, 1915 (scale 1 cm).

Conclusions

Museum collections are part of the national patrimony and with the rigorous documentation and identification (which can simplify the digitization process of the collections and therefore they become more available to the scientific community and the public), they create a bridge between natural science communicators and other scientists. The Baikal amphipod collection is one of utmost beauty and uniqueness within the crustacean collections of the Natural History Museum in Bucharest.

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NYMPHAEA Folia naturae Bihariae	L	135-165	Oradea, 2023

The giant butterfly-moths (Lepidoptera: Castniidae) of the "Grigore Antipa" National Museum of Natural History, Bucharest

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Abstract. The 21 specimens belonging to the family Castniidae (Lepidoptera) in the collections of the "Grigore Antipa" National Museum of Natural History were studied and catalogued. Concise data on the distribution and biology for each one of the species treated herein are presented. The presentation of this material gives the occasion for a brief consideration regarding the historical background of the foundation and development of this part of the museum's collection as well as a short presentation of the entomologist's career of Francisc (Franz) Salay, the one who brought the specimens of Castniidae presented in this catalogue to the museum collection.

Key words: biodiversity, neotropical fauna, entomological collection, illustrated catalogue, collection history.

Introduction

The family Castniidae was established in 1828 by the French entomologist Jean-Baptiste Alphonse Dechauffour de Boisduval. Currently it groups about 150 peculiar diurnal moths species (Moraes & Duarte 2014) of medium to large size (the wingspan is 20 to 155 mm). A few species fly for a short time, in the dusk – within this family, adults are usually active during daytime, in warm, sunny conditions. Generally, Castniidae are robust body moths, and like the butterflies they have clubbed antennae. Most of the species have the dorsal face of the forewings with various dull and cryptically patterns, sometimes with broad transparent or coloured bands. On the other hand, the hindwings are generally more colourful and some have contrasting colours in the central area or broad concentric bands along the margin. Only few species are dimorphic, with the females occasionally having wider bands on the forewings in addition to the transparent ones, but in most cases both sexes are generally similar in appearance.

The monophyly of the group is well supported also by the molecular data, but the systematic position of this family is still undetermined (Kallies & al. 2016). It is highly probable that this family has established its current range prior to the breakup of the bygone southern continent Gondwana, because today the species within it are distributed almost exclusively across South and Central America and Australia (Miller 1986, Holloway 1998). Only *Tascina* Westwood, 1877, a genus with 4 currently known species and for which the subfamily Tascininae was established, is found in south-east Asia (Edwards & al. 1999). The rest of the species in the Castniidae are currently grouped in the subfamily Castniinae. Up to now, all the Australian species are classified together within the genus *Synemon* Doubleday, 1846, commonly known as the sun-moths due to the habit of the adults to be active during the daytime, in warm to hot weather. Considering that the tribe Gazerini was found paraphyletic, the significantly larger number of neotropical species is includes in a single tribe, Castniini, an arrangement that follows Moraes & Duarte (2014).

Despite the efforts made in the last few decades to increase the amount of published data regarding the specimens of Castniidae preserved in different collections all around the world (González & Stünning 2007, González & al. 2010, González & al. 2013, Domagała & al. 2017a, Domagała & al. 2017b, González & Domagała 2019, Rodríguez-Ramírez & al. 2020, González & Domagała 2021), this family remains a poorly known one, also because the existing specimens from different collections are not at all or insufficiently studied and known. With only few notable exceptions, Castniidae are rarely found in collections and the destruction of the natural habitats throughout the Neotropical realm decrease the possibility of finding and collecting species/specimens of this group. However, the importance of these specimens is gradually increasing, since they are more often used (for example) as the basis for systematic studies regarding the Castniidae (Moraes & Duarte 2014), this being just one of the reasons that justify the intensification of the efforts for studying the specimens from this systematic group that are found in different collections all around the world.

As a primary goal, the current paper aims to join the effort to list the specimens of Castniidae, particularly rarely found in various museum collections, and to make available the faunistic data provided by this material. At the same time, this is a relevant part of the old entomological collection of the “Grigore Antipa” National Museum of Natural History in Bucharest, important not only for the diversity of this collection, but also from a historic perspective.

The Catalogue of the Castniidae in the collections of the “Grigore Antipa” National Museum of Natural History

Following a reorganisation of the oldest Lepidoptera collection curated at the “Grigore Antipa” National Museum of Natural History and built up by Francisc (Franz) Salay (1861-1946), the specimens belonging to the family Castniidae were identified, revised, and recorded in a collection database. All the specimens were photographed, and images of the labels found on the pin of each one of them were also taken. The names of the species and the systematic arrangement follow

Moraes & Duarte (2014), with the changes and additions proposed by Worthy & al. (2022). However, since the systematics of this family still suffers revisions, within genera, the species are listed alphabetically. Concise data on the distribution and biology for each of the species treated herein are presented, as well as brief considerations regarding the history of this collection based on the information provided on the original labels of the specimens.

Castniidae Blanchard, 1840

Castniinae Blanchard, 1840

Castniini Blanchard, 1840

Athis clitarcha (Westwood, 1877)

Colombia: Cartago, Valle del Cauca (600 m altitude), 1 ♂ (Fig. 1, 2); the specimen holds a printed label with the mention "Cartago, Caucatal, Columbien (alt.) 600 m" and a determination label handwritten by Aristide Caradja (1861-1955) with the mention "*Castnia clitarcha* Ww.".

Remarks: Native in Central America, this species is distributed from Guatemala, Honduras and Nicaragua to Costa Rica and Panama (Rothschild 1919, Miller 1986, González & Hernández-Baz 2012, Maes & González 2022). Ruling out a (still possible) labelling error, the data found on the label of this specimen suggest that this species was (and might still be) also distributed further south, in the northernmost part of South America. In this respect, new distribution data are needed to confirm that this species is found also in Colombia.

Castnia invaria penelope Schaufuss, 1870

Paraguay: 1 ♂ (Fig. 3, 4); the specimen holds a printed label with the only mention "Paraguay" and a determination label handwritten by Aristide Caradja with the mention "*Castnia endelechiae*" (sic!).

Remarks: A species native to South America; subspecies *penelope* Schaufuss, 1870 can be found from Venezuela and the Guianas to Paraguay, northern Chile, and northern Argentina, notably in the Amazon and Orinoco basins.

The larvae feed inside different Bromeliaceae species. Besides the wild species, it is found also on *Ananas sp.* (including *Ananas comosus*), where they dig large tunnels in the centre of the pineapple plants; occasionally, they also feed on flowers or young fruits. As a result of the above mentioned, it is considered a pest of pineapples.

Castnia invaria volitans Lamas, 1995

French Guiana: 1 ♀ (Fig. 5, 6); the specimen holds a printed label with the mention "Franz.(ösisch) Guyana" and a determination label handwritten by Aristide Caradja with the mention "*Castnia icarus*".

Remarks: The subspecies *volitans* Lamas, 1995 is only found in the South America north to the Amazon basin, from the Guianas to Venezuela and eastern Colombia. Like the other subspecies, its larvae feed on different Bromeliaceae species, being also a pest of pineapples (*Ananas comosus*).

Castnia papilionaris papilionaris Walker, [1865]

Colombia: Villavicencio, 1 ♂ (Fig. 7, 8); the specimen holds a printed label with the mention "Villavicencia (sic!), Columbia" and a determination label handwritten by Aristide Caradja.

Remarks: A species distributed from Panama, Colombia, Venezuela and Ecuador to Peru and north-western Bolivia (Zongo – Rothschild 1919); the nominate subspecies is considered to be confined to Colombia (Worthy & al. 2022). Little if nothing is known regarding the biology of this species.

Ceretes marcelserres (Godart, [1824])

Brazil: Rio de Janeiro, 1 ♂ (Fig. 9, 10) and 1 ♀ (Fig. 11, 12); each specimen is holding a printed label with the mention "Rio Janeiro" and a determination label handwritten by Aristide Caradja with the mention "*marcelserres* Godt.".

Remarks: A species much less common in collections, its distribution area being confined to Bolivia, Paraguay, and south-eastern Brazil. Males have androconia on the dorsal side of the hindwing. The larvae are developing on *Miltonia flavescens* (Ríos & González 2011).

Eupalamides cyparissias (Fabricius, 1776)

1 ♂ (Fig. 13, 14); this specimen holds only the determination label handwritten by Aristide Caradja with the mention "*Castnia daedalus* (sic!) Cr.".

Remarks: A species distributed from Panama to Peru, Bolivia, and Brazil, recorded also in Trinidad. The larvae have been reported on several palm species (*Elaeis guineensis*, *Cocos nucifera*, *Mauritia carana*, *Mauritiella peruviana*, *Astrocaryum murumuru* and *A. javarense*) and are a well-known pest for oil palms, coconut trees and murumuru palms. The life history of this species has been extensively studied (Korytkowski & Ruiz 1979a, Korytkowski & Ruiz 1979b, Ruiz & Korytowsky 1980).

Imara pallasia (Eschscholtz, 1821)

Brazil: Rio de Janeiro, 1 ♀ (Fig. 15, 16); the specimen holds a printed label with the mention "Janeiro, Brasil" and a determination label handwritten by Aristide Caradja with the mention "*Castnia pallasia* Esch.".

Remarks: A species with limited distribution, found in the Serra do Mar primary coastal cloud forests from south-eastern Brazil (Miller 1986, González & Stüning 2007, González & al. 2010, González & Domagała 2019, González & Domagała 2021). Although the adults have been spotted hill topping with several *Morpho sp.* and other Nymphalidae, nothing else is known about the biology and ecology of this species (Miller 1986).

Imara satrapes satrapes (Kollar, 1839)

Brazil: Rio Grande do Sul, 1 ♀ (Fig. 17, 18); the specimen holds a printed label with the mention " R.(io) Gr.(ande) d.(o) Sul, Brasil" and a determination label handwritten by Aristide Caradja with the mention "*Castnia satrapes*".

Remarks: A species distributed in southern Brazil, Paraguay, and Uruguay. Adults have been spotted flying high (over 10 m above ground), normally at mid-day (11:00–15:00) (Bieżanko 1961, Miller 1986). The larvae have been reported feeding on different wild Bromeliaceae (Miller 1986, Ríos & González 2011).

Prometheus cochrus (Fabricius, 1787)

1 ♂ (Fig. 19, 20); the specimen holds a printed label with the mention "Palmar, Guatemala" (an obvious mislabelling error; other mislabelled specimens of Castniidae in museum collections were reported also by González & al. 2010 and González & al. 2013) and a determination label handwritten by Aristide Caradja with the mention "*Castnia garbei* Foett.".

Remarks: A highly variable species, distributed in south-eastern Brazil and Paraguay (Jörgensen 1930, Miller 1986). Adults have been spotted in Brazil flying at mid-day (11:00-15:00) in clear areas close to creeks (Bieżanko 1961) Larvae are feeding on different Bromeliaceae, including pineapple (Bieżanko 1961, Ríos & González, 2011).

Prometheus heliconioides dodona (Druce, 1896)

Peru: Iquitos, Omaguas (150 m altitude), 1 ♂ and 1 ♀ (Fig. 21, 22); each specimen is holding a printed label with the mention "Jquitos, Omaguas, 150 m" and a determination label handwritten by Aristide Caradja with the mention "*Castnia heliconioides*".

Remarks: Native in South America, this species was so far recorded from in the Guianas, Brazil, Ecuador, Peru, Bolivia, and Paraguay; the subspecies *dodona* (Druce, 1896) is distributed in Peru and Ecuador (Lamas 1995). It is a typical example of a mimetic sun-moth, with adults of this species resembling more or less different models of the mimetic ring which includes *Athesis sp.* (Nymphalidae: Danainae), *Callithomia lenea* (Cramer, [1779]) (Nymphalidae: Danainae), *Dircenna sp.* (Nymphalidae: Danainae), *Epithyches sp.* (Nymphalidae: Danainae), *Euthresis sp.* (Nymphalidae: Danainae), *Lycorea ilione* (Cramer, 1775) (Nymphalidae: Danainae), *Methona sp.* (Nymphalidae: Danainae), *Notophyson sp.* (Erebidae: Arctiinae), *Paititia neglecta* Lamas, 1979 (Nymphalidae: Danainae), *Parides chabrias* (Hewitson, [1852]) (Papilionidae: Papilioninae), *Patia orise* (Boisduval, 1836) (Pieridae: Dismorphiinae), *Thyridia psidii* (Linnaeus, 1758) (Nymphalidae: Danainae), etc (Miller 1986, Ríos & González 2011, González & Domagała 2019).

Prometheus heliconioides obidona (Rothschild, 1919)

French Guiana: Saint-Laurent-du-Maroni, 1 ♂ (Fig. 23, 24); the specimen holds a printed label with the mention "St. Laurent, Guyana" and a determination label handwritten by Aristide Caradja with the mention "*Castnia heliconioides*".

Remarks: The subspecies *obidona* (Rothschild, 1919) is distributed in northern Brazil (Pará), Guyana and French Guiana (Lamas 1995).

Prometheus simulans songata (Strand, 1913)

Bolivia: Provincia La Paz, 1000 m altitude, 1 ♀ (Fig. 25, 26); the specimen holds a printed label with the mention "La Paz Prov., (alt.) 1000 m, Bolivia" and a determination label handwritten by Aristide Caradja with the mention "*Castnia melessus* Druce".

Remarks: Originally described after a female specimen collected in Colombia, this species is largely distributed in South America, from Colombia, Ecuador and Venezuela to Peru, Bolivia, and western Amazonas in Brazil (Miller 1986, González & Fernández Yépez 1993, González 1997, Hernández-Baz & al. 2012); the subspecies *songata* (Strand, 1913) is distributed in the southern part of this vast distribution area, in Bolivia. It is one of the several species of Castniidae that are part of the mimetic rings that include as models poisonous Nymphalidae butterflies (Miller 1986).

Telchin cacica procera (Boisduval, [1875])

Panama: Chiriquí (Province), 1 ♂ (Fig. 27, 28) and 1 ♀ (Fig. 29, 30); each specimen is holding a printed label with the mention "Chiriquí, Panama" and a determination label. The female specimen's determination label is handwritten by Aristide Caradja with the mention "*Castnia cacica*".

Remarks: A species distributed from Mexico (however, according to Worthy & al. 2022, the exact type locality is in doubt and there are no recent, reliable records from Guatemala) south to Costa Rica and Panama. The larvae of this moth are a known pest in plantain and sugar-cane plantations, where they can produce moderate damages.

Telchin diva chiriquiensis (Strand, 1913)

Panama: Chiriquí (Province), 1 ♂ (Fig. 31, 32); the specimen holds a printed label with the mention "Chiriquí, Panama" and a determination label handwritten by Aristide Caradja with the mention "*Castnia diva* Bt.".

Remarks: A species distributed from Mexico right to Central America south to Colombia and Ecuador (Lamas 1995, Miller 1995, Salazar 1999, González & al. 2010, Vinciguerra 2010, González & al. 2013). Little if nothing is known regarding the biology of this species.

Telchin evalthe cuyabensis (Lathy, 1922)

Brazil: Rio Farinha, 1 ♀ (Fig. 33, 34); the specimen holds a handwritten label with the mention "Castnia dardanus, Farinas" and a determination label handwritten by Aristide Caradja with the mention "*Castnia evalthe* F.".

Remarks: By treating this species within the genus *Telchin* Hübner, [1825] we follow Moraes & Duarte (2014). *Telchin evalthe* (Fabricius, 1775) is a species widespread in the Neotropical realm, recorded from southern Mexico to Peru, Bolivia, and southern Brazil (Mato Grosso); the subspecies *euphrosyne* (Perty 1833) was described from “River System, Cuyaba Corumba, Matto Grosso” (Lathy 1922). In this species, the larvae develop on different species of *Bromelia sp.* and *Heliconia sp.* (González & Cock 2004).

Telchin evalthe vicina (Houlbert, 1917)

Ecuador: 1 ♂ (Fig. 35, 36); the specimen holds a printed label with the only mention "Ecuador" and a determination label handwritten by Aristide Caradja with the mention "*Castnia evalthe* F.".

Remarks: A subspecies described by Constant Vincent Houlbert (1857-1947) based on 4 specimens collected about 20 years before, in 1893, at “La Chima” by M. de Mathan. According to Houlbert, if compared with the subspecies *viryi* (Boisduval, [1845]), it shows differences in wing pattern. However, a definitive systematic status for this taxon can only be achieved after a revision following both morphological and molecular data.

Telchin licus licus (Drury, 1773)

Brazil: Manaus, 1 ♀ (Fig. 37, 38), coll. Anton Fassl; the specimen holds a handwritten label with the mention "Castnia licus ♀, Coll. Fassl" and a determination label handwritten by Aristide Caradja.

Remarks: A species native to Central and South America, the nominate subspecies being largely distributed from Nicaragua to Peru, Bolivia, and Brazil. The larvae are tunnelling in the stems of *Saccharum officinarum*, *Musa sp.*, *Heliconia sp.* and *Ichnosiphon sp.*, being considered a pest species.

Specimen collected by Anton Heinrich Hermann Fassl (1876-1822) during his last voyage in South America.

Synpalamides fabricii (Swainson, 1823)

Brazil: Rio Grande do Sul, 1 ♂ (Fig. 39, 40); the specimen holds a printed label with the mention " R.(io) Gr.(ande) d.(o) Sul, Brasil" and a determination label handwritten by Aristide Caradja with the mention "*Castnia besckei* Mén.".

Remarks: A species almost endemic to the Atlantic Forest (“Mata Atlântica”) found in the southern and southeastern parts of Brazil (Moraes & al. 2010, Penco 2011). Although there are some records of larvae of this species foraging in *Tillandsia aeranthos*, the food plant is still unknown.

Historical consideration on the first Lepidoptera collection of the “Grigore Antipa” National Museum of Natural History and its maker, Francisc (Franz) Salay

All the Castniidae specimens found in the collections of the “Grigore Antipa” National Museum of Natural History were collected and purchased for the museum more than a century ago. Without exception, these specimens where part of the first, oldest scientific Lepidoptera collection of the museum. Although the exact moment when the Castniidae specimens presented herein entered the museum collection is not known, the one who was in charge with the Lepidoptera collections at the time when these specimens might have entered the museum possession was

Francisc (Franz) Salay (1861-1946; fig. 41). One of the first curators of the museum after it was moved in the current building, a friend and close collaborator of Dr. Grigore Antipa, Salay was responsible for the foundation and development of the museum’s first Lepidoptera collection, and all achievements regarding this collection in the first decades of the 20th century are entirely due to his discrete and patient, but at the same time persevering and passionate efforts.

Despite that Francisc Salay worked at the museum for several full decades and distinguished himself during this time by his constant, tireless and persistent efforts dedicated to the building up of a reference entomological collection for a national museum, little is known about him and his scientific and curatorial activity, with only a few exceptions (Iuga 1966, Székely 2014). Moreover, the published materials previously mentioned are based almost exclusively on the recollections and accounts of several people who knew Salay in person and are not based on researching the archive documents. The following brief account of Salay’s career both as an entomologist and museum curator attempts to fill an unwanted hiatus in the knowledge of the history and evolution of the “Grigore Antipa” National Museum of Natural History entomological collections.

Francisc (Franz) Salay was born on April 28, 1861. His father, Stephan, was of Austrian descent, and settled in Bucharest in the middle of the 19th century, where he earned his living as an upholsterer and decorator.

Little Francisc was drawn to nature from his early age. However, the sudden death of his mother, Ana, when he was only 10 years old, and then the premature blindness of his father because of a rapidly progressing cataract prevented him from completing his studies, forcing him to get a job early on. Soon, the state of his father's health steadily worsened, so young Francis was forced for a time to permanently accompany and to take care of him, as it appears from the certificate of dispense issued on February 20, 1883, by the Recruitment Review Board, through which he was exempt from active military duty (Fig. 42). All these hardships hindered the young Salay from giving time to his passion for nature and developing it during his adolescence and early youth.

However, in the spring of 1880 things began to change when he met the Liebrecht brothers, who at the time were catching butterflies for their father's collection. From Carol Liebrecht, a passionate collector, Francisc Salay acquired his first information and skills on collecting, preparing, labelling, and preserving entomological material. Shortly after meeting Carol Liebrecht, Salay began to collect lepidoptera with dedication and passion, spending more and more time in nature or working on his own collection. As a result, in the last decade of the 19th century he entirely devoted himself to building a remarkable entomological collection, in which specimens received, exchanged, or bought from different collectors and insect traders of that time quickly began to add up, along with the specimens he collected personally. Encouraged and supported also by his wife Emma, née Roth, whom he married in 1889, Salay became a hard-working, diligent, but also skilled, meticulous, and passionate collector who managed to enrich his collection rapidly, in a relatively short time.

Franz Salay started volunteering at the museum after his butterfly collection, one of the most impressive in Romania at the beginning of the 20th century, was exhibited at the Royal Jubilee Exhibition organized in Carol Park of Bucharest (June-November 1906). At that exhibition, Salay's collection received the Carol I jubilee gold medal (Fig. 43), and as a result, on February 20, 1907, he received the Order of the Crown of Romania in the rank of knight (Fig. 44). Unfortunately, this brought only a trifling comfort after the immense loss he suffered in 1907, when he was deeply shaken by the sudden death of his wife, succumbed to a pulmonary congestion.

During the award ceremony in which he received the Order of the Crown of Romania in the rank of knight, Salay met Dr. Grigore Antipa, who invited him to join the new team of the natural sciences museum of Bucharest, which was to open soon in a new building, the first one in Romania specially designed and built to house a museum. Although he was no longer young, Salay enthusiastically accepted and as a result he was appointed curator of the museum's entomological collections, a position he held for more than 20 years. At first, Salay took the charge of reorganizing and conserving Eduard Fleck's collection after it came into the museum's possession. At the same time, through intense and diligent work, Salay managed to obtain for the museum’s collection many remarkable specimens from various butterfly collectors and insect traders, such as Hans Fruhstorfer, Max Korb, Max Bartel, Max Fürbringer, Eduard Leinwather, Otto Habich (whom he had personally met through his mentor Carol Liebrecht), Josef Schernhammer, Max Wiskott, Antal Schmidt, Hermann Stauder and Jacob Doll. The goal of this tenacious work was to create a collection as diverse as possible, comprising best preserved specimens of as many species as possible, worthy of a national museum. For this long and remarkable activity, Salay was rewarded by King Carol II with the Order of Cultural Merit with medal, class II, on June 23, 1933 (decree no. 1891; Fig. 45).

Close to the end of his career (Fig. 46), Salay donated his collection of Lepidoptera, numbering 8,630 specimens arranged in 50 high quality drawers, to the museum. His collection was brought to the museum in October 1934 and after that Salay, at that time assistant within the museum, received an official letter of confirmation from the Ministry of Education, Cults and Arts (Fig. 47). On that occasion, he was appointed by Dr. Grigore Antipa "honorary curator", a title he proudly retained until the end of his life. In fact, Salay continued to work at the museum until shortly before his death, even though he was suffering from a cataract that was slowly but steadily progressing past retirement age. For this activity, carried out at such an advanced age, but especially for his outstanding contribution to the foundation and development of the first collection of Lepidoptera owned by the museum, Franz Salay was awarded on March 24, 1944, with the honorary patent "Reward for 25 years worked in the service of the State" (Fig. 48) Remarkably, this was the only known official act in which Salay was referred to as an "entomologist". He died on May 23, 1946, shortly after Prince Aristide Caradja's famous Lepidoptera collection was brought to the museum, after it had been acquired for it by the Ministry of National Culture and Cults.

Although Salay was a keen, self-taught lepidopterist, he understood he lacked a thorough training in entomology. Because of this, he used to send any specimen which he could not properly identify for determination or checking of the determination to renown Romanian entomologists at that time, such as Constantin

Nikolaus Freiherr von Hormuzaki (1862-1937) or Aristide Caradja (1861-1955), a fact remembered and mentioned by Iuga (1966). Finally, that might explain why almost all the specimens of Castniidae presented in this catalogue are accompanied by characteristic, easy to recognise determination labels handwritten by Aristide Caradja.

Acknowledgements

I am deeply indebted to Alexandru Mihai, who took the photographs of the specimens presented in this paper, and also, to the anonymous referees who, through constructive discussions, emendations, and suggestions, have helped to improve this paper.

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Images

Figure 1. *Athis clitarcha* (Westwood, 1877), dorsal view.

Figure 2. *Athis clitarcha* (Westwood, 1877), ventral view.

Figure 3. *Castnia invaria penelope* Schaufuss, 1870, dorsal view.

Figure 4. *Castnia invaria penelope* Schaufuss, 1870, ventral view.

Figure 5. *Castnia invaria volitans* Lamas, 1995, dorsal view.

Figure 6. *Castnia invaria volitans* Lamas, 1995, ventral view.

Figure 7. *Castnia papilionaris papilionaris* Walker, [1865], dorsal view.

Figure 8. *Castnia papilionaris papilionaris* Walker, [1865], ventral view.

Figure 9. *Ceretes marcelserres* (Godart, [1824]), ♂, dorsal view.

Figure 10. *Ceretes marcelserres* (Godart, [1824]), ♂, ventral view.

Figure 11. *Ceretes marcelserres* (Godart, [1824]), ♀, dorsal view.

Figure 12. *Ceretes marcelserres* (Godart, [1824]), ♀, ventral view.

Figure 13. *Eupalamides cyparissias* (Fabricius, 1776), dorsal view.

Figure 14. *Eupalamides cyparissias* (Fabricius, 1776), ventral view.

Figure 15. *Imara pallasia* (Eschscholtz, 1821), dorsal view.

Figure 16. *Imara pallasia* (Eschscholtz, 1821), ventral view.

Figure 17. *Imara satrapes satrapes* (Kollar, 1839), dorsal view.

Figure 18. *Imara satrapes satrapes* (Kollar, 1839), ventral view.

Figure 19. *Prometheus cochrus* (Fabricius, 1787), dorsal view.

Figure 20. *Prometheus cochrus* (Fabricius, 1787), ventral view.

Figure 21. *Prometheus heliconioides dodona* (Druce, 1896), dorsal view.

Figure 22. *Prometheus heliconioides dodona* (Druce, 1896), ventral view.

Figure 23. *Prometheus heliconioides obidona* (Rothschild, 1919), dorsal view.

Figure 24. *Prometheus heliconioides obidona* (Rothschild, 1919), ventral view.

Figure 25. *Prometheus simulans songata* (Strand, 1913), dorsal view.

Figure 26. *Prometheus simulans songata* (Strand, 1913), ventral view.

Figure 27. *Telchin cacica procera* (Boisduval, [1875]), ♂, dorsal view.

Figure 28. *Telchin cacica procera* (Boisduval, [1875]), ♂, ventral view.

Figure 29. *Telchin cacica procera* (Boisduval, [1875]), ♀, dorsal view.

Figure 30. *Telchin cacica procera* (Boisduval, [1875]), ♀, ventral view.

Figure 31. *Telchin diva chiriquiensis* (Strand, 1913), dorsal view.

Figure 32. *Telchin diva chiriquiensis* (Strand, 1913), ventral view.

Figure 33. *Telchin evalthe cuyabensis* (Lathy, 1922), dorsal view.

Figure 34. *Telchin evalthe cuyabensis* (Lathy, 1922), ventral view.

Figure 35. *Telchin evalthe vicina* (Houlbert, 1917), dorsal view.

Figure 36. *Telchin evalthe vicina* (Houlbert, 1917), ventral view.

Figure 37. *Telchin licus licus* (Drury, 1773), dorsal view.

Figure 38. *Telchin licus licus* (Drury, 1773), ventral view.

Figure 39. *Synpalamides fabricii* (Swainson, 1823), dorsal view.

Figure 40. *Synpalamides fabricii* (Swainson, 1823), ventral view.

Figure 41. Francisc (Franz) Salay (1861-1946) at the age of 55.


Judeţul Ilfov

Plasa

Comuna Bucuresci

Model Nr. 2

9

Clasa anului 1883.

CERTIFICAT DE DISPENSĂ

Consiliul de revisie al Recrutarei

Avênd în vedere Art. 18, alin. ...... din legea de recrutare, care dispensă de serviciul armateĭ active în timp de pace pe tinerii aflaţi[1]) având Tată Orb

Avênd în vedere actele presentate de tênĕrul Salay Frantz fiul luĭ Stefan şi al Ana (moartă) născut la anul 1861 în comuna Bucuresci plasa ...... judeţul Ilfov şi actualmente domiciliat în comuna Bucuresci plasa ...... judeţul Ilfov avênd pĕrul ...... sprâncenile ...... ochiĭ ...... fruntea ...... nasul ...... gura ...... bărbia ...... obradul ...... talia ...... semne particulare ...... de profesie ...... şi înscris pe tabelele de recensemênt la Nr. 101 prin care se constată că el este[1]) Dispensat având tată orb.

Consiliul, în unanimitate de voturĭ, dispenseadă pe tênĕrul Salay Frantz de serviciul armateĭ active, numaĭ în timp de pace, rĕmâind însă a fi chemat în timp de resbel cu clasa căria aparţine.

Dat astă-dĭ la 20 Februar la 1883 in Bucuresci

Membrii consiliului

REGATUL ROMANIEI — COMISSAR SECTIUNEA

Vĕdut şi trecut în Registrul matricul la Nr. 101

Şeful depositului de recrutare

DEPOSITUL DE RECRUTARE

[1]) Ca cel maĭ în vêrstă dintre orfanĭ; Unicul fiŭ la părinţi infirmi, etc. etc. etc.

Typ. Mod. Gr. Luis

Figure 42. Certificate of dispense issued on February 20, 1883, by the Recruitment Review Board, through which Francisc Salay was exempt from military active duty.

Seria litera ....

No. 287

1906, Maiu 10.

MINISTERUL AFACERILOR STRĂINE

CANCELARIA ORDINELOR

BREVET

PENTRU

„MEDALIA JUBILARĂ CAROL I“

Medalia Jubilară Carol I s'a conferit Domnului Franz Salay Proprietar din Bucureşti

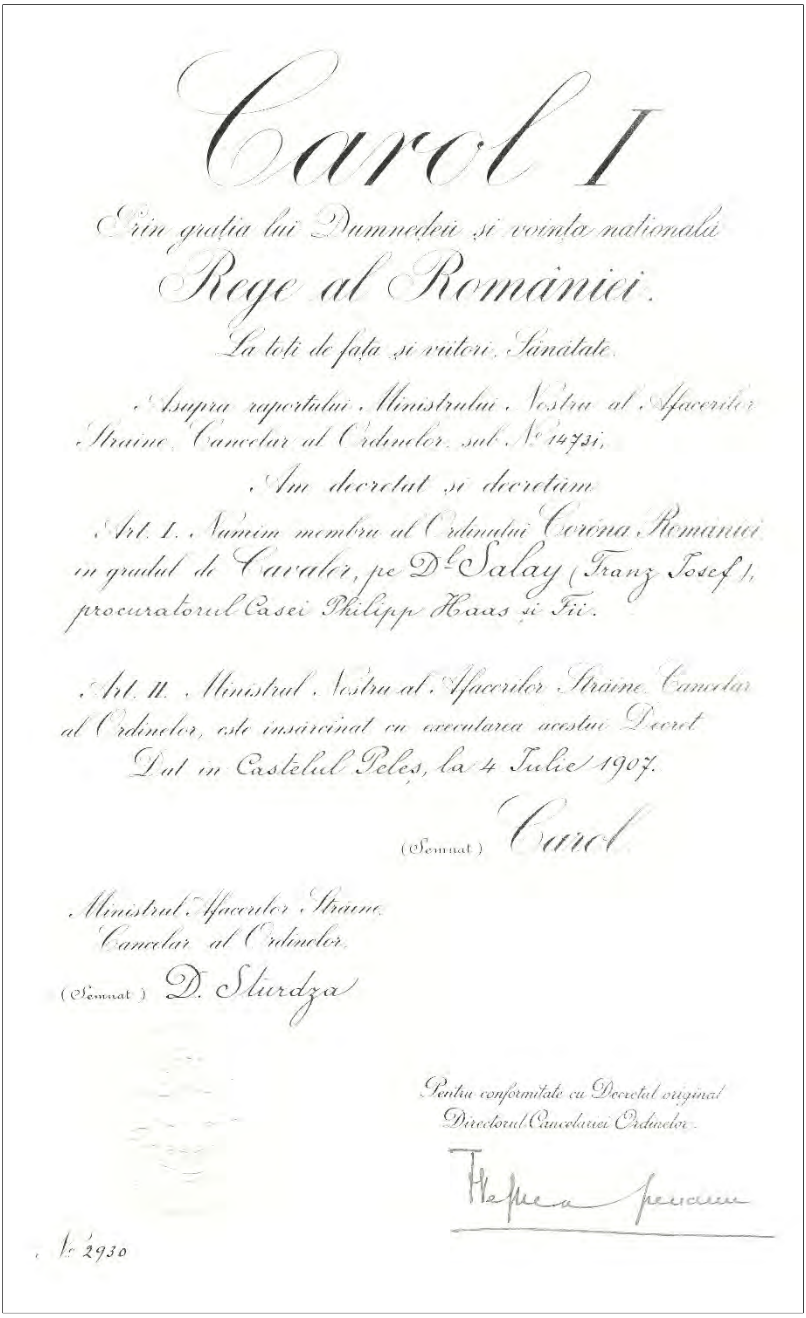
I s'a dat acest Brevet, conform Decretului Regal No. 5.384 din 28 Decemvrie 1905, publicat în «Monitorul Oficial» No. 218 din 1 Ianuarie 1906.

În numele Ministrului Afacerilor Străine
Cancelar al Ordinelor
DIRECTOR,

Prezentul Brevet s'a încredinţat titularului de COMISARUL GENERAL

MINISTERUL AFACERILOR STRĂINE CANCELARIA ORDINELOR

Figure 43. The patent that accompanied the Carol I jubilee gold medal granted to Francisc Salay (May 10, 1906).



Carol I

Prin gratia lui Dumnedeu și vointa natională

Rege al României.

La toți de fața și viitori, Sănătate.

Asupra raportului Ministrului Nostru al Afacerilor Straine, Cancelar al Ordinelor, sub No 14731,

Am decretat și decretăm:

Art. I. Numim membru al Ordinului Coróna României în gradul de Cavaler, pe Dr Salay (Franz Josef), procuratorul Casei Philipp Haas și Fii.

Art. II. Ministrul Nostru al Afacerilor Străine, Cancelar al Ordinelor, este însărcinat cu executarea acestui Decret.

Dat în Castelul Peleș, la 4 Iulie 1907.

(Semnat) Carol

Ministrul Afacerilor Străine, Cancelar al Ordinelor.

(Semnat) D. Sturdza

Pentru conformitate cu Decretul original
Directorul Cancelariei Ordinelor.

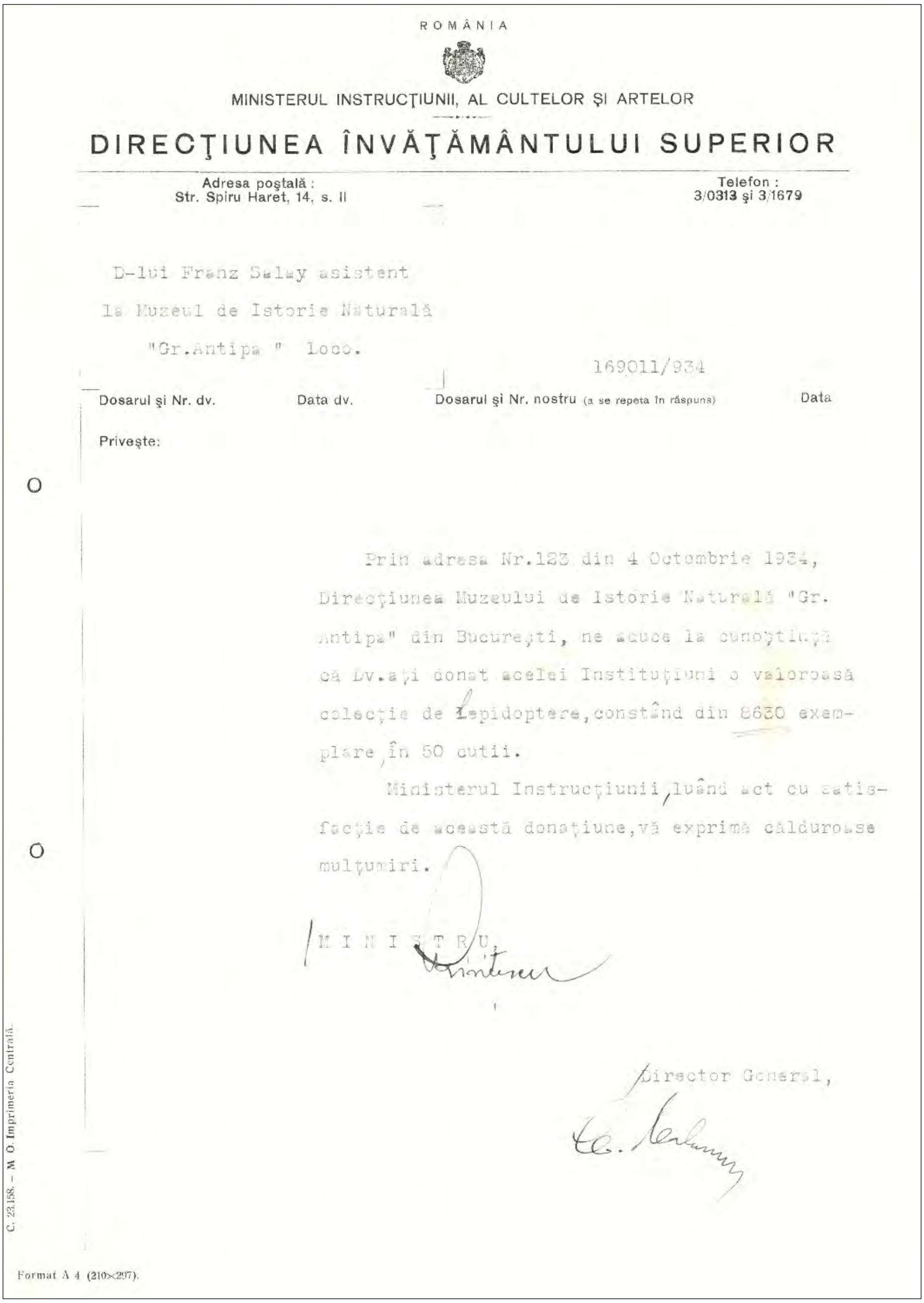
No 2930

Figure 44. The diploma of the Order of the Crown of Romania in the rank of knight received by Francis Salay on February 20, 1907.


Carol al II-lea
Prin grația lui Dumnezeu și voința Națională
Rege al României
La toți de față și viitori Sănătate.
Dorind a da o probă de a Noastră bunăvoință
Domnului Fr. Salay
Muzeul de Șt. Naturale
pentru servicii aduse școalei, bisericii, precum și pe tărâm literar, artistic, științific și social
Noi îi conferim ordinul „Meritul Cultural"
pentru „Cultură și anume
Medalie cl. I-a
Drept care îi dăm acest brevet subscris de Noi și investit cu regescul Nostru sigiliu
Dat în București la 23 Iunie 1933
Ministrul Secretar de Stat
la Departamentul Instrucțiunii,
al Cultelor și Artelor
No. DECRETULUI 1891/1933
BREVETULUI 503

Figure 45. The decree 1891 from June 23, 1933, by which Francisc Salay is granted the Order of Cultural Merit with medal, 2nd class.

Figure 46. Francisc (Franz) Salay at the age of 74, assistant at the “Grigore Antipa” National Museum of Natural History.



ROMÂNIA

MINISTERUL INSTRUCŢIUNII, AL CULTELOR ŞI ARTELOR

DIRECŢIUNEA ÎNVĂŢĂMÂNTULUI SUPERIOR

Adresa poştală :
Str. Spiru Haret, 14, s. II

Telefon :
3/0313 şi 3/1679

D-lui Franz Salay asistent
la Muzeul de Istorie Naturală
"Gr.Antipa " Loco.

169011/934

Dosarul şi Nr. dv. | Data dv. | Dosarul şi Nr. nostru (a se repeta în răspuns) | Data

Priveşte:

Prin adresa Nr.123 din 4 Octombrie 1934, Direcţiunea Muzeului de Istorie Naturală "Gr. Antipa" din Bucureşti, ne aduce la cunoştinţă că Dv.aţi donat acelei Instituţiuni o valoroasă colecţie de Lepidoptere, constând din 8630 exemplare, în 50 cutii.

Ministerul Instrucţiunii, luând act cu satisfacţie de această donaţiune, vă exprimă călduroase mulţumiri.

MINISTRU,

Director General,

C. 23.158. – M. O. Imprimeria Centrală.

Format A 4 (210×297).

Figure 47. Letter confirming the donation of the Lepidoptera collection to the "Grigore Antipa" National Museum of Natural History, received by Francisc Salay from the Ministry of Education, Cults and Arts (November 1934).

REGATUL ROMÂNIEI

Președinția Consiliului de Miniștri

Secretariatul General

BREVET

Noi, Secretarul General al Președinției Consiliului de Miniștri, adeverim că prin Înaltul Decret Regal Nr. 630 din 24 Martie 1944, Majestatea Sa Regele a binevoit a conferi semnul onorific „Răsplata Muncii pentru 25 ani în serviciul Statului",

D omnul Salay Francisc

Entomolog, Muzeul Gr. Antipa București.-

Dat în Bucuresti la 24 Martie 1944

Secretar General al
Președinției Consiliului de Miniștri,

Director,

Nr. 21.469.-

C. 73.982.

Figure 48. The diploma of the honorary patent "Reward for 25 years worked in the service of the State", received by Francisc Salay on March 24, 1944.

NYMPHAEA Folia naturae Bihariae	**L**	**167-188**	**Oradea, 2023**

Assesment of the checkered beetles (Coleoptera: Cleroidea: Cleridae) from eleven Romanian collections: biodiversity, distribution, and museology

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Abstract. Over the last 19 years, more entomological collections containing Cleridae material have been investigated by the author. This work presents data concerning 499 specimens belonging to 29 species, as parts of 11 entomological collections. The collections include 29 Western Palaearctic species belonging to 12 genera (out of a total of 13 genera and 27 species recorded in Romania to date). The collecting interval ranges from 1883 (The "Iosif Màllasz" Collection) until 2019 (The "Grigore Antipa" National Museum of Natural History's Coleoptera study collection). Even if some of the material was collected abroad and, in many cases, the specimen data is incomplete or missing, the material's good conservation status and the data pertaining to it are essential as museological patrimony and, in the case of the Romanian specimens, as biodiversity vouchers.

Key words: Cleridae, Romania, museology, collections.

Introduction

In the 11 collections investigated, most of the pieces are Romanian species, *T. apiarius* being the most collected, other Western palaearctic taxa being less represented. Most of the pieces bear complete identification and collecting data, but some of them lack most if not all the data concerning them, because, at the time that the collections from which they were part of were used mostly as comparison material. In some cases (unacceptable according to the current standards) the specimens bore only a catalogue number – which, as many authors underlined – is not a good practice, because if the catalogue is lost, all the data concerning those specimens will be also irremediably lost.

Also, a case of overcollecting is reported hereby, to be considered as a warning against local biodiversity loss by unethically population sampling, even in the case of well-known and common species.

Material and methods

The material was examined, and the morphological, nomenclatural, and zoogeographical data were compared to the literature (Gerstmeier 1998, Corporaal 1950, Löbl et al. 2007). In the case of old collections, additional data were provided by the collection's curators and by colleagues. The data were compiled, compared to the literature (where available) (Manolache 1930) and catalogued, its' analysis being more or less accurate due to the lack of completeness of the archived information – in some cases, only a catalogue number associated with the specimen or even any information at all is available. The taxa were ordered according to the Opitz's classification system (Opitz 2010), the specimens' data being ordered chronologically, and the examined collection being ordered in alphabetical order. The spatio-temporal distribution of the examined specimens was plotted on a UTM distribution map, according to the appropriate source (Lehrer & Lehrer 1990). The hungarian and saxon toponyms (where necessary) were translated and cross-checked with the appropriate sources (Suciu 1967, 1968).

Abbreviations:

Leg(it) = collected (by)
sic! = right so (lat.)
spec(s) = specimen(s)
s.d. (sine data) = without data
sub nom. (sub nomen) = named / identified as (used for synonims)

BZ = Buzău; CJ = Cluj; CL = Călăraşi; CS = Caraş-Severin; CT = Constanţa; CV = Covasna; GR = Giurgiu; HD = Hunedoara; HR = Harghita; IL = Ialomiţa; IF = Ilfov; MH = Mehedinţi; NT = Neamţ; PH = Prahova; SB = Sibiu; SM = Satu Mare; SV = Suceava; VN = Vrancea; VS = Vaslui; TL = Tulcea; TM = Timişoara; VS = Vaslui.

A.G. = Adrian Gagiu; A.-L.M. = Arnold-Lucien Montandon; A.P. = Alexandra Popa; A.P.-B. = Andrei Popvici-Bâznoşanu; A.R. = Atena Roşca; A.T. = Adalbert Tokàcs; Ar.-P. = Arion-Panin (George Arion & Sergius Panin); B. = Birthler; C.A. = Costică Adam; C.C. = Cristina Constantinescu; C.S. = Cătălin Stanciu; D.K. = Deszö (Dénes) Kenderessy; D.N.S. = Dr. Nicolae Săvulescu; E.E. = Eduard Eppelsheim; E.F. = Eduard Fleck; E.I. = Elena Iorgu; E.R. = Edmund Reitter. F.D. = Friedrich Deubel; F.E.P. = Franz Ernest Pipitz; F.T. = Florentina Togănel; G.C. = Gabriel Chişamera; G.P. = Gheorghe Paina; I.C. = Igor Ceianu; I.F. = Imre Frivaldzsky; I.I. = Ionuţ Iorgu; I.K. = Istvan Konya; I.M. = Iosif Màllasz; K.S. = Kàroly Sajó; L. = Lăzărescu; L.G. = Ludwig Ganglbauer; L.O.P. = Luis Ovidiu Popa; M.-A.I. = Mircea-Alexandru Ieniştea; M.B. = Mihai Brădescu; M.S. = Mihai Stănescu; M.V. de B. = Marcel Vauloger de Beaupré; P.I. = P. Istrate; R.C. = Richard Canisius; R.S. = Rodica Serafim; S = Solovăstru; T. = Thalhammer; V.G. = Viorel Gavril; V.V. = V. Vicol;

DMNS = Deva Museum of the Dacian and Roman Civilisations, The Natural Sciences Department
DZLC = The Descriptive Zoology Laboratory of the Bucharest Faculty of Biology Collection

GAHC = “Grigore Antipa” National Museum of Natural History – The Historical collection containing material from the collections:

GAHC - ALM = “Arnold-Lucien Montandon”

GAHC – DK = “Dionys Kenderessy”

GAHC – EF = “Eduard Fleck”

GAHC – GA/RC = “Grigore Antipa” and / or “Richard Canisius”

GAIC = “Grigore Antipa” National Museum of Natural History – The “Igor Ceianu” collection

GASC = “Grigore Antipa” National Museum of Natural History – The Coleoptera study collection

MAIC = Mircea Alexandru Ieniştea Collection

PMNS = Argeş Departmental Museum of Piteşti, Natural Sciences Section

SZSC = Sinaia Zoological Stationary Entomological Collection

TCMO = “Ţării Crişurilor” Museum in Oradea

TMNS = Tîrgu Mureş Natural Sciences Museum

TNSM = Tulcea Natural Sciences Museum

Results

Class: Insecta

Order: Coleoptera

Suborder: Polyphaga

Suprafamily: Cleroidea

Family: Cleridae Latreille, 1802

Subfamily: Clerinae Latreille, 1802

Genus: *Clerus* Geoffrey, 1762

Species: *C. mutillarius* Fabricius, 1775

DMNS: 1 spec., Banat, 1885, leg. B., 1 spec., Kalocsa (sic!), 1891, leg. T., 1 spec., 1891, leg. B., 1 spec., Râu de Mori (HD), 30.VI.1928, leg. I.M., 1 spec. s.d.; **DZLC:** 1 spec., Cotroceni (Bucharest)(IF); **GAHC-ALM:** 2 specs, Comana (GR), leg. A.-L.M.; 3 specs, Bucharest, leg. A.-L. M., 1 spec., Besançon (France), leg. A.-L.M.; **GAHC-DK:** 2 specs, Transsylvania, leg. D.K.; **GAHC-EF:** 1 spec., Germany, leg. E.F. [2561] / (84937); **GAHC-GA/RC**: 1 spec., V., Periş (IF); **GAIC:** 1 spec., Snagov (IF), 21.V.1950; 1 spec., Timişoara, Verde forest (TM), 3.V.1960; 1 spec., Huşi, Voloşeni (VS) (sic!), 10.V.1967; 1 spec. s.d.; **GASC:** 2 specs, Canaraua Fetii (CT), 10.VI.2015, leg. M.S.; 3 specs, Hagieni (CT), 14.VI.2013, leg. I.I.; 2 specs, Runcu (Eolian Park) (CT), 26.VI.2018, leg. C.S.; 1 spec., Ivrinezu Mare (CT), 24.VI.2017, leg. V.G.;1 spec., Podeni (MH), 10.VI.2015, leg. G. C.; 1 spec., Cocoş Monastery (TL), 15.V.1985, leg. D.N.S. ; 3 specs (from a mixed *Tilia* sp. – *Quercus* sp. forest), Slava Rusă (TL), 7.VII.2018, leg. C.S.; **MAIC:** 1 spec., Boys Lyceum yard, Târgovişte (DB), 1 spec. s.d.; **TMNS:** Meseş Mts. (HR), 3 specs, VI.1967, leg. A.T.; **TNSM:** 2 specs., leg. D.N.S.

Genus: *Opilo* Latreille, 1802

Species: *O. domesticus* (Sturm, 1837)

DMNS: 1 spec., Tavarnok (Tovarníky, Slovakia), 1893. leg. Kelecs. (sic!), 2 specs, Tavarnok (Tovarníky, Slovakia); **GAHC-ALM:** 1 spec., Alsace (France), leg. A.-L.M. [2557] / (84933); 1 spec., Besançon (France), A.-L.M.

Species: *O. mollis* (Linnaeus, 1758)

DMNS: 1 spec., Turnu Roşu (SB), 26.V.1884; 1 spec., Remetea, 1887; 1 spec. Turnu Roşu (SB), 1891; 1 spec., Turnu Roşu (SB); **GAHC-ALM:** 1 spec., Alsace (France), leg. A.-L.M. [2558] / (84934); **GAIC:** 1 spec., Nana (CL), 18.V.1991, leg. I.C.; **MAIC**: 1 spec., Baia Sprie (MM), 25-30. V. 1939; **TMNS:** 1 spec., Zălan (CV) leg. A.T.; 3 specs s.d.; **TNSM:** 2 specs., Băile Herculane (CS), 27.V.1978, leg. D.N.S.;

Species: *O. pallidus* (Olivier, 1795)

DMNS: 1 spec. Carinthia (Austria); 1 spec. Carinthia (Austria), 1891, leg. T.; **MAIC:** 1 spec., 14. VII. 1933, Valea Cerbului (Băile Herculane) (CS), leg. M.-Al.I.;

Species: *O. taeniatus* (Klug, 1842)

DMNS: 1 spec. Kalocsa sic!, 1888, leg. T.; 1 spec., Kalocsa (sic!), 1892, leg. T.; 1 spec., Kalocsa (sic!), 1894, leg. T.; 1 spec., Kalocsa (sic!), leg. T.; **GAHC-EF:** 1 spec., Lăculeşti, leg. E.F.; [2560] / (84936) 1 spec., Haţeg (CT), leg. E.F.

Genus: *Thanasimus* Latreille, 1806

Species: *T. femoralis* (Zetterstedt, 1828)

DMNS: 1 spec., Mecklenburg (Germany); 1 spec., Mecklenburg (Germany), 1889, leg. E.E.;1 spec., Wechsel Mts. (Austria), 1888, leg. L.G.; **GAHC-EF**: 1 spec., Azuga (PH), leg. E.F. [2562] / (84938).

Species: *T. formicarius* (Linnaeus, 1758)

DMNS: 1 spec., VIII.1886, Bistra; 4 specs, s.d.; [2563] / (84939) ; **DZLC:** 1 spec., Cotroceni (Bucharest) (IF) (sub. nom. *Clerus*); **GAHC-ALM**: 2 specs, Carpathian Mts., Northern Ialomiţa; 2 specs, Bârlad river valley; 2 specs, Comana (GR); 1 spec., Besançon (France); **GAHC-DK:** 3 specs, leg. D.K.; **GAHC GAHC-EF:** 4 specs, Azuga (PH), leg. E.F.; **GAHC-GA/RC**: 2 specs, Bucharest (IF), leg. R.C.; 1 spec., Periş (IF), V ; **MAIC:** 3 specs, Bolvaşniţa (CS), 4. VII. 1932; 5 specs, Parâng Mts., 10. VII. 1933; 1 spec., Bolvaşniţa (CS), 15. VIII. 1933, 1 spec. s.d.; **PMNS:** 1 spec., Retezat Mts., 14.VI.1955, leg. D.N.S.; 2 specs, Şaua Apei, 14.VIII. 1955, leg. D.N.S.;

Genus: *Trichodes* Herbst, 1792

Species: *T. alvearius* (Fabricius, 1792)

DMNS: 1 spec., Austria; 1 spec. Stettin, 1889; 2 specs s.d.; **GAHC-ALM**: 1 spec., Besançon (Jura) (France), 28.6.80, leg. A.-L.M.; [2567] / (84943); **GAHC-DK**: 1 spec., leg. D.K.; **GAHC-EF:** 1 spec., Limburg (Netherlands), 27.VII., leg. E.F.

Species: *T. ammios* (Fabricius, 1787)

DMNS: 1 spec., Italia, 1889, *leg.* F.E.P.; **GAHC-ALM:** 2 specs, Oued Riou, Oran (Algeria), leg. M.V. de B.; 1 spec., Algeria, leg. A.-L.M. [2571] / (84947); **GAHC-DK:** 2 specs, leg. D.K. [2568] / (84944);.

Species: *T. apiarius* (Linnaeus, 1758)

DMNS: 1 spec., VI.1885, Sibiu (SB); 1 spec. 1886; 1 spec., Monsta, 1905; 1 spec., Arad (AR), 1905; 1 spec., Pacs (Hungary), 20.IV.1905; 1 spec., Eger (Hungary), 1905, leg. I.M.; 1 spec., Deva (HD), 1910-1913, leg. I.M.; 1 spec., Râu de Mori (HD), 30.VI.1928, leg. I.M.; 1 ex. Tismana (GJ), 1929, leg. I.M.; 4 ex., Deva (HD), Col. Mallasz; 2 specs without other data, Col. Mallasz.; 1 spec. s.d.; **DZLC:** 1 spec., Bucureşti (IF); **GAHC-ALM:** 2 specs, Măcin (TL), leg. A.-L.M.; 1 spec., Duernstein a/Donau, Nieder-Oesterreich (Austria); 1 spec., Besançon (France); 1 spec. s.d.; [2565] / (84941); **GAHC-DK:** 1 spec., Transilvania; 2 specs, Haţeg (CT); **GAHC-EF**: 1 spec., Piteşti (AG); 1 spec., Drobeta Turnu Severin (MH); 1 spec. Azuga (PH); **GAHC-GA/RC**: 1 spec., VII, S. Grâuşor (sic !); 1 spec., IV., S. Brassov (Braşov) (BV); 1 spec., VI, S. Ferestrau (sic!) (Herăstrău / Mihai I park); 1 spec., S. Novaci (sic !); 2 specs., leg. R.C., VII, Torzburg [Bran Castle]; **GAIC:** 1 spec., Fundu Aţei (NT), 14.VII.1949; 1 spec., Câmpulung Moldovenesc, Carasu (SV), 22.VII.1952; 1 spec., Broşteni, Drăgoiasa (SV), 26.VII.1958; 1 spec., Baba Novac (SM), 26.VII.1960; 2 specs, Câmpulung Moldovenesc, Poiana Boba (SV), 17.VII.1962; 1 spec., Câmpulung Moldovenesc, Carasu (SV), 20.VIII.1962; 1 spec. Bogdana (Voloşeni) (VS), 16 – 20 (sic!).V.1968; 2 specs s.d.; **GASC:** 2 specs, Pasărea (IF), 28.IV.1951, leg. D.N.S.; 1 spec., Băile Herculane (CS), 10.VI.1951, leg. D.N.S.; 1 spec., Timişoara (Pădurea Verde) (TM), 13-15.VI.1951, leg. D.N.S.; 2 specs, Băile Herculane (CS), 26.VI.1970, leg. A. R.; 1 spec., Argineşti Forest (Gura Motrului) (MH), 23.VI.1983, leg. D.N.S.; 1 spec., Cheile Râmeţului (AB), 02.VI.2012, leg. I.I.; 1 spec., Soveja, Cremeneţ river valley (VN) 12.VI.2014, leg. C.C.; 2 specs, Ungureanca river (Cremeneţ river tributary) (VN), 20.VI.2014, leg. C.C.; 1 spec., Munţii Măcin (Vf. Moroianu, Greci) (TL) 23.VI.2014, leg. E.I.; 1 spec., Tălmaciu, Şuvara Saşilor (SB), 2.VII.2014, leg. C.C.; 2 specs, Soveja (VN), 25.VII.2014, leg. C.C.; 2 specs, Soveja (Pârâul Ungureanca) (VN), 26.VII.2014, leg. C.C.;1 spec. ROSCI Frumoasa, Dobra river valley (SB), 16.VIII.2014, leg. C.C.; 1 spec., Valea Dobrei (SB), 16.VIII.2014, leg. C.A.; 2 specs, Cheile Şugăului - Munticelu (NT), 27.VI.2015, leg. C.A.; 1 spec., Retezat Mts. (Gemenele Scientific Reserve) (HD), 03.VII.2015, leg. C.A.; 1 spec., Cheile Şugăului - Munticelu (NT), 08.VIII.2015, leg. V.G.; 1 spec., Dăbâca (CJ), 13.VI.2017, leg. A.P.; 19 specs (sic!), Ivrinezu Mare (CT), 24.VI.2017, leg. V.G.; 8 specs, Ivrinezu Mare (CT), 05.VII.2017, leg. V.G.; 2 specs, Brebu (BZ), 19.VI.2018, leg. L.O.P.; 1 spec, Brebu Mănăstirii (PH), 18.VII.2019, leg. R.S.; 2 specs, Băile Herculane (CS), leg. D.N.S.; **MAIC:** 1 spec., Bucureşti, Lic. Cantemir; 1 spec., Lic. Băieţi Blaj; 4 specs, Valea Răstoliţei, 12. VII. 1931; 1 spec., Ocna Sibiului (SB); 1 spec., Braşov (BV), 15. VII. 1930; **PMNS:** 1 spec., Băile Herculane (CS), 12.VII.1960, leg. D.N.S.; 1 spec., Băile Herculane (CS), 7.VIII.1960, leg. D.N.S.; 1 spec., Băile Herculane (CS), 15.VI.1965, leg. D.N.S.; **SZSC:** 1 spec., Borsec (HR), 24.VI.1932, leg. A.P.-B. (?); **TCMO:** 1 spec., Salonta (BH) (from the field), 15.VI.1960; 1 spec., Salonta (BH) (str. Cloşca nr. 10, on *Rosa* sp.), 10.V.1962; 1 spec., Oradea, Pály-Erdõ [Paleu forest] (BH), 4.V.1965; 2 specs, Răbăgani (BH), 2.VI.1973, leg. G.P.; 2 specs, Păd. Săldăbagiu (BH) (on flowers, on the hill), 22.V.1966; 1 spec., Băile 1 Mai (Băile Peţa) (BH), (on *Fagus* spp. leaves), 19.VI.1958; 1 spec., Băile 1 Mai (BH), 25.VI.2003, leg. A.G.; **TMNS:** 1 spec., Zălan (CV), V.1958, leg. A.T.; 1 spec., Târgu Mureş, Hipodrom (MS), 1.VI.1965, leg. I.K.; 1 spec., Tîrgu Mureş (MS), IV.1967, leg. V.V.; 1 spec., Sovata (MS), 23.VII.1982, leg. V.V.; 3 specs, Răstoliţa (MS), 8.VI.1993, leg. F.T.; Băile Herculane (CS), 1 spec., Sântana (MS), 8.VII.1994, leg. V.V.; 1 spec., Stânceni (MS), 26.VI.1999, leg. F.T.; 1 spec., 4.VI.1995, leg. F.T.; 1 spec., 30.VI.1995, leg. F.T.; 2 specs, Vaidacuta (Suplac) (MS), 8.VII.1995, leg. F.T.; 1 spec., Târnăveni (MS), VI.1997, leg. V.V.; 1 spec., 28.VI.1998, leg. F.T.; 1 spec., Reghin (MS), 20.V.2000, leg. P.I. at 500 m; 1 spec., 11.VII.2001, leg. S.; **TNSM:** 4 specs., Letea (TL), 25.VI.1962, leg. D.N.S., 1 spec., Letea (TL), 28.VI.1962, leg. D.N.S., 3 specs., C.A. Rosetti (TL), 11.VII.1980, leg. M.B., 2 specs., C.A. Rosetti (TL), 12.VII.1980, leg. M.B., 2 specs., C.A. Rosetti (TL), 17.VII.1980, leg. M.B., 2 specs., C.A. Rosetti (TL), 18.VII.1980, leg. M.B., 3 specs., C.A. Rosetti (TL), 19.VII.1980, leg. M.B.

Species: *T. crabroniformis* (Fabricius, 1787)

DMNS: 2 specs s.d., Turkey.

Species: *T. favarius* (Illiger, 1802)

DMNS: 1 spec., Hungary, 1886, leg. K.S.,1 spec. s.d.; **GAHC-ALM:** 1 spec., Turpine (Italy) [2566] / (84942); **GAIC:** 1 spec., Cerhat (SM), 21-24.IV.1964 (sic!); 2 specs., Cernica (IF), 25.VI.1987; 1 spec. s.d.; **GASC:** 1 spec., Cheile Şugăului (Munticelu) (NT), 12.VII.2015, leg. C.A.; 3 specs, Argineşti forest (Gura Motrului) (MH), 23.VI.1983, leg. R.S.; 5 specs, Băile Herculane (CS), leg. D.N.S.; 4 specs, Hagieni forest (CT), leg. D.N.S.; **TNSM:** 5 specs., Băile Herculane (CS), 5.VII.1970, leg. D.N.S.

Species: *T. octopunctatus* (Fabricius, 1787)

GAHC-DK: 1. spec., leg. D.K. [2570] / (84946);

Species: *T. punctatus* Fischer von Waldheim, 1829

Aberration: *T. punctatus* ab. *viridifasciatus* Chevrolat, 1843

GASC: 1 spec., Argineşti forest (Gura Motrului) (MH), 23.VI.1983, leg. R.S.; **TMNS:** 1 spec., Răcătău, VII.1969, leg. L. (sub nom. *T. apiarius*).

Species: *T. quadriguttatus* Adams, 1817

GAHC-ALM: 1 spec., Măcin (TL), leg. A.-L.M. [2572] / (84948); **GAHC-EF:** 1 spec., Dobroudja; **GAIC:** 1 spec., Hagieni (CT), 21.VI.1964; **GASC:** 3 specs, Hagieni (CT), 14.VI.2013, leg. I.I.; 2 specs, Canaraua Fetii (CT), 10.VI.2015, leg. M.S.; 1 spec., Ivrinezu Mare (CT), 24.VI.2017, leg. V.G.; 2 specs, Runcu Aeolian Park (CT), 26.VI.2018, leg. C.S.; **MAIC:** 2 specs, Ecrene (Bulgaria), 19. VII. 1935, leg. Ar.-P.; **PMNS:** 5 specs, Hagieni (CT), 18.VI.1967, leg. D.N.S.; **TNSM:** 2 specs., Hagieni (CT), 12.VI.1961, leg. D.N.S.; 4 specs., Hagieni (CT), 15.VI.1961, leg. D.N.S.; 1 spec., Hagieni (CT), 4.VI.1962, leg. D.N.S.

Species: *T. umbellatarum* (Olivier, 1795)

GAHC-ALM: 1 spec., Algeria (Philippeville), leg. A.-L.M.; 1 spec., Algeria (Atlas Mts.), leg. A.-L.M. [2569] / (84945); **GAHC-DK:** 2 specs s.d.

Subfamily: Korynetinae Laporte De Castelnau, 1836

Genus: *Korynetes* Herbst, 1792

Species: *K. caeruleus* (DeGeer, 1775)

DMNS: 1 spec., Austria, 1884, leg. F.E.P.; (sub. nom. *Corynetes*) [2573] / (84949); **DZLC:** 1 spec., Sinaia (PH) (sub. nom. *Corynetes*); **GAHC-ALM:** 1 spec., Măcin (TL), leg. A.-L.M.; 1 spec., leg. A.-L.M.; **GAHC-DK:** 1 spec., Dalmatia, leg. D.K.; 5 specs, Haţeg (CT), leg. D.K.; **GAHC-EF:** 4 specs, Azuga (PH), leg. Fleck ; 1 spec., Cormarnic (PH), leg. E.F.; **GAHC-GA/RC:** 5 specs, Prague (Czech Republic); 19 specs., leg. R.C.

Species: *K. ruficornis* Sturm, 1837

DMNS: 2 specs, Schaffhausen (sic!), 1 spec. s.d.

Genus: *Necrobia* Olivier, 1795

Species: *N. ruficollis* (Fabricius, 1775)

DMNS: 1 spec. Austria, 1884, *leg.* K.S., 1 spec. Austria, 3 specs s.d.; **MAIC:** 1 spec., 13. IX. 1932, Bucharest (IF), 1 spec., s.d.;

Species: *N. rufipes* (DeGeer, 1775)

DMNS: 1 spec., 1889, Someşeni, Cluj (CJ); 1 spec., Styria (Austria), 1884, leg. F.E.P.; [2575] / (84951); **GAHC-ALM:** 1 spec., Bucharest (IF), leg. A.-L.M.; **GAHC-DK:** 1 spec., Oran (Algeria), leg. D.K.; **GAHC-EF:** 2 specs, leg. E.F.;

Species: *N. violacea* (Linnaeus, 1758)

DMNS: 3 specs, Sibiu (SB), 8.III.1885; 1 spec., Szeged (Hungary), 1905, leg. I.M., 1 spec., Deva (HD), 1910, leg. I.M.; 6 specs, Deva (HD), 1913, leg. I.M.; 1 ex. Câmpuşel, Retezat, 29-31.07.1928, leg. I.M.; 16 specs, Deva, leg. I.M.; 11 specs, Kassa, 1905/ Comloşu Mare, 1905 / Mohok, 1905 (sic!), leg. I.M.; 1 spec. 10.V.1890; 1 spec., 17.07.1928, leg. I.M.; 20 specs s.d., col. Mallasz; **DZLC:** 1 spec., Cotroceni (Bucharest) (IF); 1 spec., Sinaia (PH); **GAHC-GA/RC**: 3 specs. Kronstadter Gebirge [Braşov Mts.] (BV), leg. F.D. [2574] / (84950); **MAIC:** 1 spec., 20. V. 934, Chişinău (Republic of Moldavia); 1 spec., VII 1935, Chişinău (Republic of Moldavia); 1 spec., 1.VI. 1935, Bucureşti (IF); 1 spec., 16. IX. 27, Bucureşti (IF); 1 spec., 16. IX. 1927, Bucureşti (IF); 1 spec., 10. V. 1947, Valea Cerbului (Băile Herculane) (CS); 2 specs s.d.;

Genus: *Opetiopalpus* Spinola, 1844

Species: *O. sabulosus* (Motschoulsky, 1840)

GAHC-EF: 1 spec., Bârlad (sic!), leg. E.F., [2577] / (84953).

Species: *O. scutellaris* (Panzer, 1797)

DMNS: 1 spec., 1889, Someşeni, Cluj (CJ); 1 spec. Kalocsa (sic!), 1888, *leg*. T.; 1 spec. s.d.; [2576] / (84952) **GAHC-ALM:** 1 spec., leg. A.-L.M.; **GAHC-DK:** 1 spec., Haţeg (CT), leg. D.K.; **GAHC-EF:** 1 spec., leg. E.F.

Subfamily: Neorthopleurinae Opitz, 2009

Genus: *Dermestoides* Schaffer, 1771

Species: *D. sanguinicollis* (Fabricius, 1782)

DMNS: 1 spec., Sibiu (SB), 1883; 1 spec., 30.V.1889.

Subfamily: Tarsosteninae Jacquelin Du Val, 1862

Genus: *Tarsostenus* Spinola, 1844

Species: *T. univittattus* (Rossi, 1792)

DMNS: 1 spec., Mehadia (CS), 1888, leg. I.F.

Subfamily: Tillinae Leach, 1815

Genus: *Tillus* Olivier, 1829

Species: *T. elongatus* (Linnaeus, 1758)

DMNS: 1. spec., Sibiu (SB), 1885; 1 spec, Sibiu (SB), 1886; 1 spec., Sibiu (SB), V.1889; **GAHC-EF:** 2 specs., Azuga (PH), leg. E.F.; 1 spec., 26.VIII., Azuga (PH), leg. E.F. [2554] / (84930); **MAIC:** 1 spec., Buşca (SM), 18. V. 1932; 1 spec., Băile Herculane (CS), 15. VII. 1933; 1 spec., Buşca (SM), 1-10.V.1939;

Genus: *Tilloidea* Laporte De Castelnau, 1832

Species: *T. transversalis* (Charpentier, 1825)

DMNS: 3 specs, Greece, 2x leg. P.; 1 spec. Greece, 1889; **GAHC-ALM:** *Tilloidea* (sub nom. *Tillus*) *transversalis* Charp. [2555] / (84931): 1 spec., Ain Sefra (Hénon) (Algeria), leg. et Coll. M.V. de B.; 2 specs, Algeria, leg. M.V. de B.; **GAHC-DK:** 1 spec. Hispania [Spain]; 1 spec. s.d.; **GAIC:** 3 specs, Jegălia (CL), 1955; 1 spec., Jegălia (CL), 22.VI.1955; 1 spec., Jegălia (CL), 16.V.1956; 1 spec., Jegălia (CL), 18.V.1956; 1 spec., Jegălia (CL), 20.V.1956; 1 spec., Cotul Ciorii (BZ), 27.V.1963; 2 specs s.d.;

Species: *T. unifasciata* (Fabricius, 1787)

DMNS: 1 spec., 1883; 1 spec. 2.IV.1889; 1 spec. 1890; 1 spec. s.d.; **DZLC:** 1 spec., Bucharest (IF) (sub nom. *Tillus*); **GAHC-ALM:** (sub nom. *Tillus unifasciatus* Charp.) [2556] / (84932); 3 specs, Alsace (France), leg. A.-L.M.; **GAHC-DK:** 1 spec., Transilvannya, leg. D.K.; 3 specs, leg. D.K.; **GAHC-EF:** 1 spec., Babadag (TL), 6.VI, leg. E.F.; **MAIC**: 1 spec., Buşca (SM),18. V. 1932; 1 spec., Băile Herculane (CS), 15. VII. 1933; 1 spec., Buşca (SM), 1-10.V.1939;

Subfamily: Enopliinae Gistel, 1856

Genus: *Enoplium* Latreille,1802

Species: *E. serraticorne* (Olivier, 1790)

DMNS: 1 spec., Kies. (sic!), Italy, *leg.* E.R.

Discussions

In terms of biodiversity, the investigated material contains 29 Western Palaearctic species belonging to 12 genera (out of a total of 13 genera and 27 species recorded in Romania until now (Table 1).

Table 1. The number of collected specimens (the Western Palaearctic species which are non-native to to the Romanian fauna are marked by an asterisk *).

Nr.	Taxa	Romania	Abroad	Unknown	Total
1	*Clerus mutillarius*	33	3	4	40
2	*Opilo domesticus*	-	4	-	4
3	*O. mollis*	9	1	3	13
4	*O. pallidus*	1	2	-	3
5	*O. taeniatus*	4	1	-	5
6	*Thanasimus femoralis*	3	1	-	4
7	*T. formicarius*	27	-	2	29
8	*T. alvearius*	-	4	3	7
9	*Trichodes ammios**	-	4	2	6
10	*T. apiarius*	134	5	11	150
11	*T. crabroniformis**	-	2	-	2
12	*T. favarius*	21	2	2	25
13	*T. octopunctatus**	-	-	1	1
14	*T. punctatus* ab. *viridifasciatus*	2	-	-	2

15	*T. quadriguttatus*	23	2	-	25
16	*T. umbellatarum**	-	2	2	4
17	*Korynetes caeruleus*	12	7	20	39
18	*K. ruficornis*	-	2	1	3
19	*Necrobia ruficollis*	2	2	4	8
20	*N. rufipes*	2	2	2	6
21	*N. violacea*	37	3	13	53
22	*Opetiopalpus sabulosus*	1	-	-	1
23	*O. scutellaris*	2	1	3	6
24	*Dermestoides sanguinicollis*	1	-	1	2
25	*Tarsostenus univittatus*	1	-	-	1
26	*Tillus elongatus*	9	-	-	9
27	*Tilloidea transversalis*	8	8	3	19
28	*T. unifasciata*	6	3	7	16
29	*Enoplium serraticorne**	-	1	-	1
Total number of specimens		**338**	**62**	**84**	**484**

The examined material is very heterogenous in terms of collecting range (Table 2), period and completeness of specimen's data. From the oldest collected material (DMNS, first collecting date: 1883) to the newest (GASC, latest collecting date: 2019), a great variation in terms of collecting periods (Table 3 and Fig. 2) and number of records for Romania and abroad (Fig. 1) is shown.

In terms of geographic coverage, most of the collected specimens with complete (or almost complete) data cover almost all the Romanian historical provinces (Table. 3).

Table 2. Collecting periods of the investigated material with collecting date.

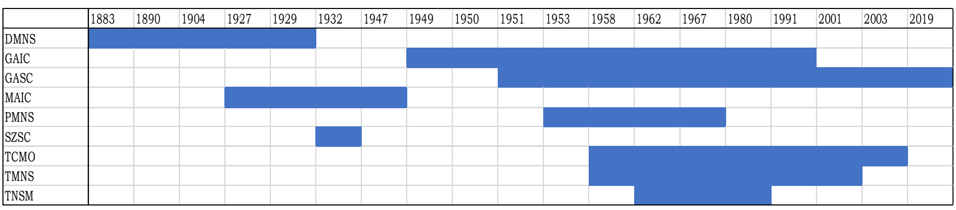

Table 3. The collecting range per entomological collection of the investigated specimens (the collecting period is indicaten in brackets, where no data was available, the date is replaced by a question mark).

Collection / Collecting range	**1850-1900**	**1901-1950**	**1951-1990**	**1990-2023**	**s.d.**	**Total specimens per collection**
DMNS (1883-1929)	39	29	-	-	73	141
DZLC (?-?)	-	-	-	-	7	7
GAHC-GA/RC (?-?)	-	-	-	-	37	37
GAHC-ALM (?-?)	-	-	-	-	34	34
GAHC-DK (?-?)	-	-	-	-	27	27
GAHC-EF (?-?)	-	-	-	-	25	25
GAIC (1949-1991)	-	6	15	1	6	28
GASC (1951-2019)	-	1	10	69	11	91
MAIC (1927-1947)	-	28	-	-	8	36
PMNS (1953-1967)	-	-	6	-	-	6
SZSC (?-1932-?)	-	1	-	-	-	1
TCMO (1958-2003)	-	-	8	1	-	9
TMNS (1962-1980)	-	-	7	13	4	24
TNSM (1958-2001)	-	-	30	-	3	33
Total specimens per collecting range	**39**	**65**	**76**	**84**	**235**	**499**

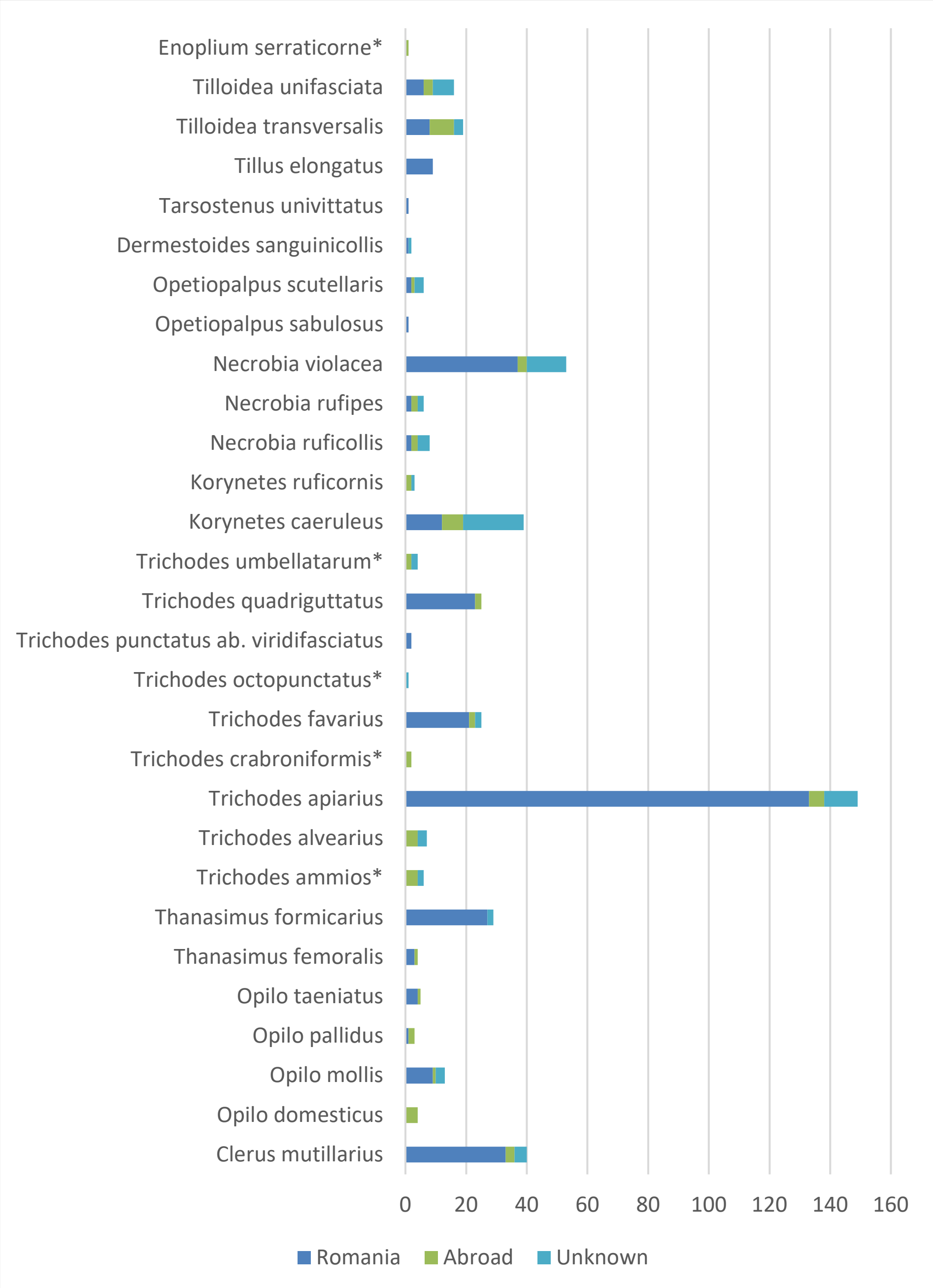

Figure 1. The number of the collected specimens per country.

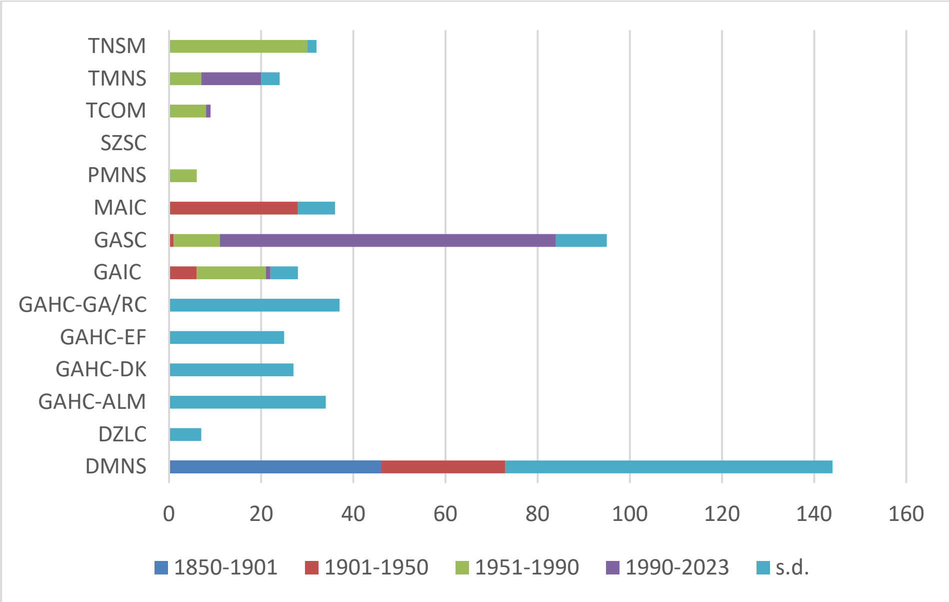

Figure 2. The total number of investigated specimens collected over time.

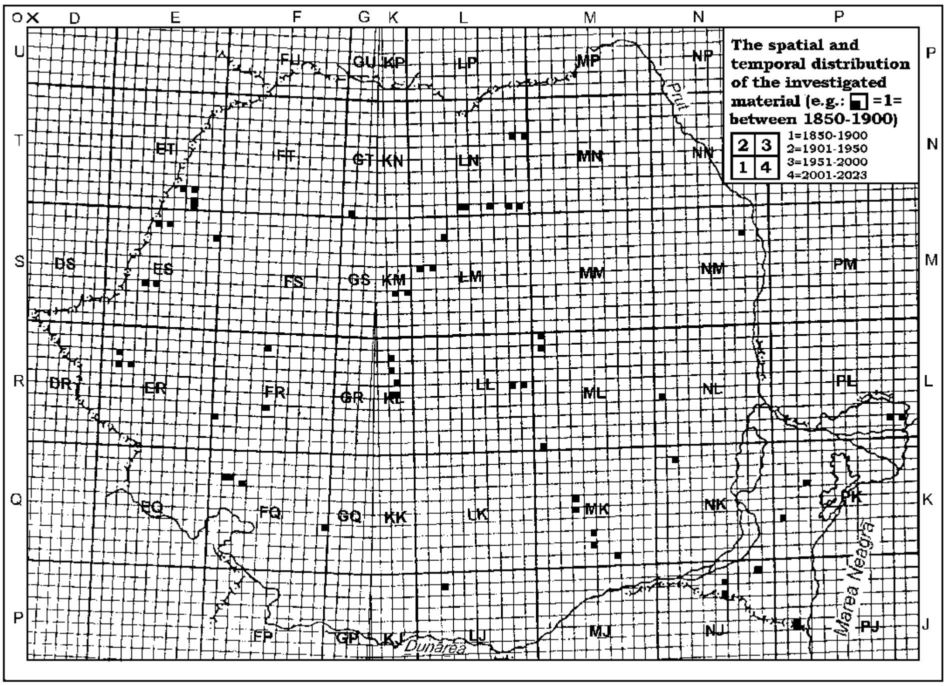

Figure 3. The spatio-temporal distribution of the specimens bearing complete collecting data.

The most diverse (in terms of biodiversity) is the Màllasz collection (DMNS), followed by the collections now part of the GAHC. As distribution, the collecting localities are local (GAHC-EF, TMNS, TNSM, TCMO), national (GAIC, GASC, MAIC) or western Palaearctic (DMNS, GAHC-ALM, GAHC-DK). In terms of completeness of the specimens' associated data (*locum, datum, legit*), the GASC ones are the most complete, while in the case of older collections, they can lack at all (GAHC), mostly (DMNS) or less (DZLC, MAIC, GAIC, TCOM, TMNS). The locality written as Kalocsa mentioned as such in the text may refer to Călacea (Dej county, Romania) or to Kalocsa (Bács-Kiskun county, Hungaria) (Suciu, 1967). Also, in the case of the 11 specimens of *N. violacea* from the DMNS collection collected in 1905, the locality could not be identified, the toponyms being written as they were found in the entomological collections written inventory.

An explanation for the lack of data associated to te specimens from older collections is the fact that at the time those collections were gathered, one of the scopes of a collection was rather to be used as a comparison material, in order to identify faster the collected specimens than a biodiversity database, as they are today. So, the zoogeographical value can be considered as low, in contrast to the specimens' age, which constitutes a value which increases by its' age. In the case of some specimens from the investigated collections, there are no indications concerning the collector, so, it can be presumed that the respective specimens have been collected by the owner of the collection itself even if it's not mentioned as such on the specimens' labels.

The examined material is contained in wooden entomological boxes, kept on shelves (DMNS, GAIC, GASC, PMNS, TCMO, TMNS, TNSM) or in entomological cabinets (DZLC, GAHC, MAIC). Even if now the conservant used is naphthalene, in some cases creosote was used – as its' characteristic smell remained associated with the material (GAHC).

The material is pinned on classical, black enameled entomological pins with sizes varying from 0 to 2 (most of them), only a small portion being glued on carton boards, which are pinned directly on the bottom of the entomological boxes (which can be covered or not with a cork layer), or, in the case of newer collections in polystyrene foam. The labels are original, partially printed and / or hand-written in black China ink, or, in some cases in pencil and contain different amounts of data associated with the specimens. In some cases, a collection catalogue was gathered (DMNH), containing all the specimens' data.

The material is arranged in vertical columns (DZLC, GAHC, MAIC, PMNS, TCMO, TMNS, TNSM) or in horizontal rows (DMNS, GAIC, GASC). The disposition of the material in the boxes is the original one, except for the GAHC, where the material from the older collections (ALM, DK, EF, GA/RC) was gathered in one entomological box a long time ago.

The number of obstacles between the exterior and the material (the entomological box and the entomological cabinet not included) varies from 4 (GAHC, GAIC, GASC), 3 (DMNS, MAIC, PMNS, TCMO, TMNS, TNSM) to 2 (DZLC, SZSC).

Even so, there are more factors contributing to the conservation status of the examined collections, as in the case of TCMO, where even if there are three obstacles, the door of the collection room is doubled by a anti-fire metal door which closes hermetically, or, as in the case of other collections, the extensive use of the naphthalene and its' replacement as soon as necessary, or, the tightness of the entomological boxes' lids and of the entomological cabinet *per se* contribute to a superior conservation status of the material.

Conclusions

The examined material presented here is important, both as historic and museological patrimony, as its' general conservation status is a good one. The specimens are important as biodiversity vouchers, distribution data and for the history of the Romanian zoology. This catalogue contributes to a better knowledge concerning the Romanian Cleridae taxa biodiversity, distribution, and museology.

Acknowledgements

To all of the staff from the investigated collections (directors, researchers, curators, museographers and technicians) who helped in this research: Nae Lotrean (Piteşti Museum of Natural Sciences), Adina Radu (Tulcea Eco-Museal Research Institute), Adriana Ardeu, Dorin Cărăbeţ (the Deva Museum of the Dacian and Roman Civilisation), Zoltán Soós, Zoltán Szombath, Mihaela Niculina Sămărghiţan (Tîrgu Mureş Museum of Natural History), Constantin Ciubuc (The Sinaia Zoological Station), Adrian Gagiu, Dorina Golban („Ţării Crişurilor” Museum of Oradea), Melanya Stan, Marieana Foaltin (the „Grigore Antipa” National Museum of Natural History), and last, but not least, to Eugen Niţu (the „Emil Racoviţă” Institute of Speleology, under the Romanian Academy), the author expresses here his sincere thanks. Also, many thanks to the „Nymphaea” reviewers and editors for their patience and kindness.

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NYMPHAEA Folia naturae Bihariae	L	189-200	Oradea, 2023

The catalogue of the ant collection (Hymenoptera: Formicidae) from the entomological collection of Țării Crișurilor Museum, Oradea

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Abstract. The small ant collection of the Țării Crișurilor Museum in Oradea was revised, yielding a total of 82 individuals (9 males, 25 females and 48 workers), belonging to 12 species. The myrmecological material was collected mainly from the Western part of Romania between 1954 and 1990.

Key words: ants, museum collections, western Romania.

Introduction

Museum collections are of a great importance by preserving valuable and historical data (Miller et al. 2020). Natural history museums hold preserved biodiversity collections and associated specimen and ecological data that have long been recognized as an invaluable and irreplaceable resource for biodiversity research and society (Johnson et al. 2011, Funk 2018, Nelson & Ellis 2019, Watanabe 2019, Lendemer et al. 2020).

Up to date the ant collections preserved in Romanian museums are to be found in Sibiu (Markó & Csõsz 2002, Csõsz & Markó, 2005), Bucharest (Paraschivescu 1975), Bacău (Goagă & Paraschivescu 1991), Cluj-Napoca and Oradea (Markó et al. 2006). It is very likely that within the entomological collections there is also myrmecological material preserved in other Romanian museums. The ant collections from Cluj-Napoca and Oradea are unpublished, whereas the other were revised or partially revised in the last decades.

The Natural Sciences department of Țării Crișurilor Museum was established formally in 1971, housing collections of geology, palaeontology and biology based on collecting started in 1950 by its first head of department, the palaeontologist Tibor Jurcsák, and his collaborators in the department. The entomological collection is made up of more than 4,600 specimens (the oldest was collected in 1952), and includes over 500 species from Europe, the Americas, Africa, Asia, and Australia.

The present paper aims to document the Formicidae specimens housed in the entomological collection of Țării Crișurilor Museum.

Material and methods

The habitus of the specimens was examined visually, with the help of a magnifying glass and of a Delta Optical binocular microscope, model SZ-450/SZ-430, and the identification and distribution data were checked using several ant-keys (Agosti & Collingwood 1987, Czechowski et al. 2012, Czekes et al. 2012, Markó et al. 2009, Seifert 2018).

Abbreviations: leg. = *legit* („collected by”, Latin); det. = determined by; spec(s). = specimen(s).

Results

Class Insecta

Order Hymenoptera

Infraorder Aculeata

Superfamily Formicoidea

Family Formicidae Latreille, 1809

Subfamily Formicinae Lepeletier, 1836

Camponotus herculeanus (Linnaeus, 1758)

5518/1-10 ♀♀, 15 May 1966, Paleu (forest), det. D. Paraschivescu, 10 specs. (one on bark).
5518/11 [= ep 5192] ♀, 19 July 1969, Apuseni Mountains, Padiș, Glăvoi (”La grajduri” = at the stables), leg. I. M. Paina, 1 spec.
5518/12 [= no number] ♀, 16 Aug. 1954, Apuseni Mountains, Padiș, leg. T. Jurcsák, det. D. Paraschivescu, 1 spec.
5518/13-22 [= ep 3810, ic 3976] workers, 4 June 1965, Paleu (forest, on oak), det. D. Paraschivescu, 10 specs.
5518/23-24 [= ep 5239] workers, 28 Sept. 1969, Apuseni Mountains, Padiș, leg. I. M. Paina, 2 specs (one det. D. Paraschivescu).
5518/25-27 [= ep 6187] workers, 12 Aug. 1973, Apuseni Mountains, Drăganului Valley, Ciripa, leg. I. M. Paina, det. D. Paraschivescu, 3 specs.
5518/28 [= ep 4114] worker, 21 July 1966, Nucet (Negru Hill), leg. I. M. Paina, det. D. Paraschivescu, 1 spec.
5518/29 [= no number], *C. herculeanus* (Linnaeus, 1758) worker, 13 Oct. 1977, Apuseni Mountains, Vărășoaia, leg. I. M. Paina, det. D. Paraschivescu, 1 spec.

Formica cunicularia Latreille, 1798

5518/30 [= ep 6186] (labeled ”*cinerea*”), worker, 11 Aug. 1973, Apuseni Mountains, Bohodei, leg. I. M. Paina, det. D. Paraschivescu, 1 spec.

5518/31 [= ep 6367] (labeled ”*cinerea*”), worker, 6 Aug. 1975, Băile 1 Mai, leg. I. M. Paina, det. D. Paraschivescu, 1 spec.
5518/32 [= ep 6174] (labeled ”*rufibarbis*”), worker, 6 July 1973, Apuseni Mountains, Bulz Valley (”la canton”), leg. I. M. Paina, det. D. Paraschivescu, 1 spec.

F. fusca Linnaeus, 1758

5518/33 [= ep 6174] (labeled ”*cinerea*”), worker, 6 July 1973, Apuseni Mountains, Bulz Valley (”la canton”), leg. I. M. Paina, det. D. Paraschivescu, 1 spec.

F. sanguinea Latreille, 1798

5518/34 [= ep 3536/2, ic 3579], worker, 13 April 1964, Paleu (forest, on oak), leg. T. Jurcsák (?), det. D. Paraschivescu, 1 spec.

F. pratensis Retzius, 1783

5518/35-39, workers, 2 May 1966, Săldăbagiu (Paleu commune) (forest), leg. T. Jurcsák (?), det. D. Paraschivescu, 5 specs.
5518/40-43, workers, 8 May 1966, Băile 1 May (on the ground), leg. T. Jurcsák (?), det. D. Paraschivescu, 4 specs.

F. rufibarbis Fabricius, 1793

5518/44-45 [= no number], workers, 8 Apr. 1990, no locality, leg. I. M. Paina, det. A. Gagiu, 2 specs.

Lasius fuliginosus (Latreille, 1798)

5518/46-52 [= ep 6485], workers, 17 Apr. 1976, Răbăgani, leg. I. M. Paina, det. D. Paraschivescu, 7 specs.

Lasius flavus (Fabricius, 1782)

5518/53-54, worker, 15 Apr. 1966, Oradea (on the Criș riverbank), leg. T. Jurcsák (?), det. D. Paraschivescu, 2 specs.
5518/55 [= ep 6187] *Lasius sp*. (labeled ”flavus”), ♀, 12 Aug. 1973, Apuseni Mountains, Drăganului Valley (Ciripa), leg. I. M. Paina, det. D. Paraschivescu, 1 spec.
5518/56 [= ep 5222] *Lasius sp*. (labeled ”flavus”), ♀, 13 Aug. 1969, Apuseni Mountains, Râtu Florilor, leg. I. M. Paina, det. D. Paraschivescu, 1 spec.
5518/57 [= ep 6174] *Lasius sp*. (labeled ”niger”), ♂, 6 July 1973, Apuseni Mountains, Bulz Valley (”la canton”), leg. I. M. Paina, det. D. Paraschivescu, 1 spec.

5518/58-63 [= ep 7331] *Tetramorium sp*., ♂♂, 17 Apr. 1983, Oradea (house), leg. I. M. Paina, 6 specs.

Subfamily Myrmicinae Lepeletier, 1835

Myrmica schencki Viereck, 1903

5518/63-69 [= ep 7331], ♀♀, 12 Sept. 1983, Oradea, leg. I. M. Paina, 6 specs.
5518/70 [= ep 7331] ♀ ?, 12 Sept. 1983, Oradea, leg. I. M. Paina, 1 spec.

Myrmica ruginodis Nylander, 1846

5518/71-75 [= ep 6253] (labeled ”*Leptothorax unifasciatus*” = *Temnothorax unifasciatus*), 3 ♀♀, 2 workers, 27 Aug. 1974, Apuseni Mountains, Padiș, leg. I. M. Paina, det. D. Paraschivescu, 5 specs.

5518/76 [= ep 7331] *Myrmica sp., ♂,* 12 Sept. 1983, Oradea, leg. I. M. Paina, 1 spec.

Manica rubida (Latreille, 1802)

5540/1, ♂, 20-21 Aug. 1970, Apuseni Mountains, Mt. Bihor, leg. I. M. Paina, 1 spec.
5540/2 [= ep 5239], ♀, 28 Sept. 1969, Apuseni Mountains, Padiș, leg. I. M. Paina, det. D. Paraschivescu, 1 spec.

Subfamily Dolichoderinae Forel, 1878

Liometopum microcephalum (Panzer, 1798)

5518/77-80, workers, 11 Apr. 1960, Tinca (museum yard), leg. T. Jurcsák (?), 4 specs.

Discussions

The specimens are well conserved and placed in horizontal rows in the entomological box. The genus, species and caste were typed, probably by the entomologist Ion Mircea Paina, a former head of the Natural Sciences Department, on larger labels at the lower side of the series of specimens. Most of the specimens are fixed on mounting boards and the others are pinned on standard entomological pins. The individual labels are handwritten and virtually all of them present the necessary identification data (Fig. 1). In a few cases, the collector was identified based on handwriting and his active period. Most of the specimens (45) were collected by I. M. Paina and the remainder were collected by the renowned Romanian myrmecologist Dinu Paraschivescu (20) and by T. Jurcsák (17), respectively.

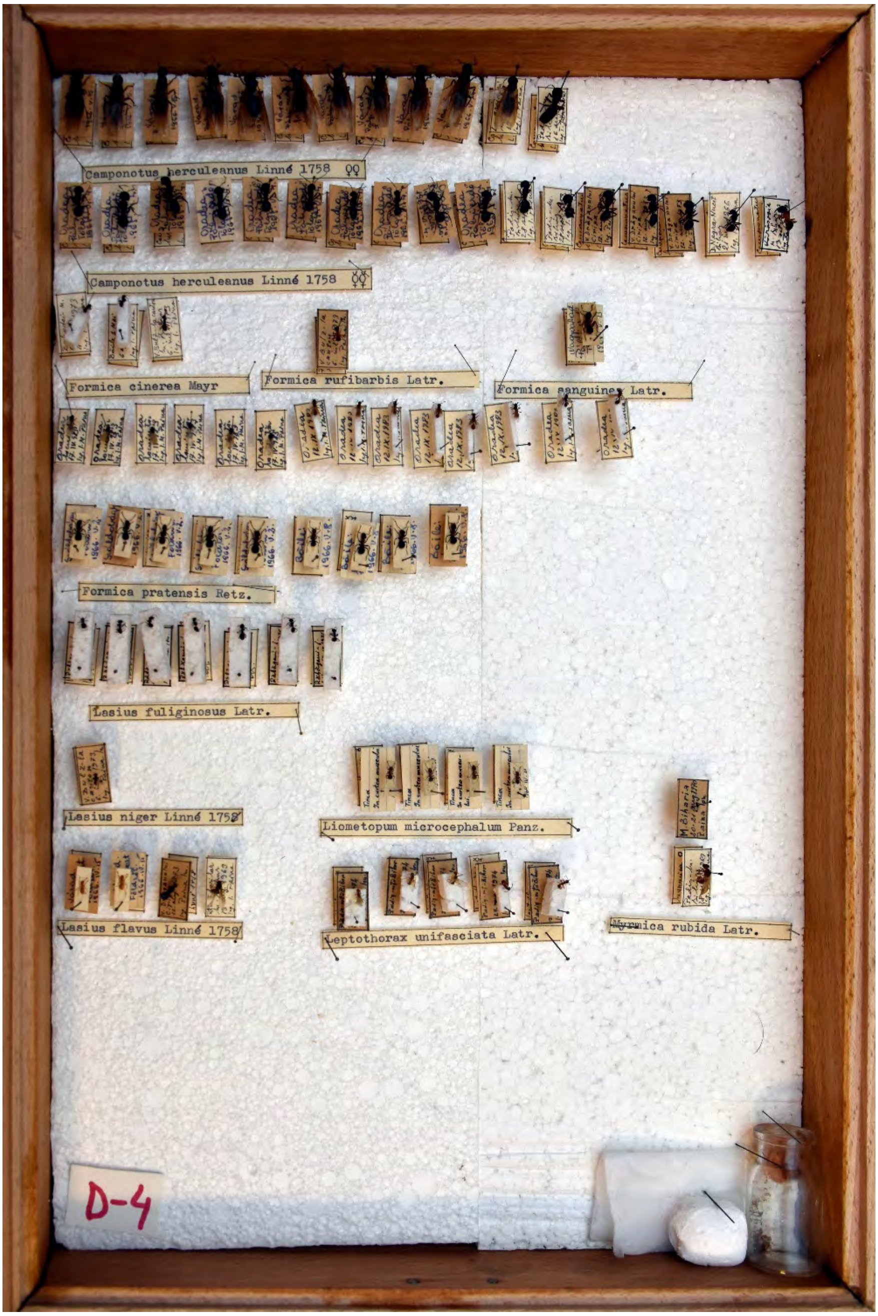

Fig. 1. The Formicidae specimens housed in the entomological collection of Țării Crișurilor Museum (box D4).

The collecting localities (all in Bihor County, northern-western Romania, and in Apuseni Mountains) are listed below. The most abundant locality (with 26 specs.) is Paleu, a commune near Oradea, followed by Apuseni Mountains and Oradea (Fig. 2).

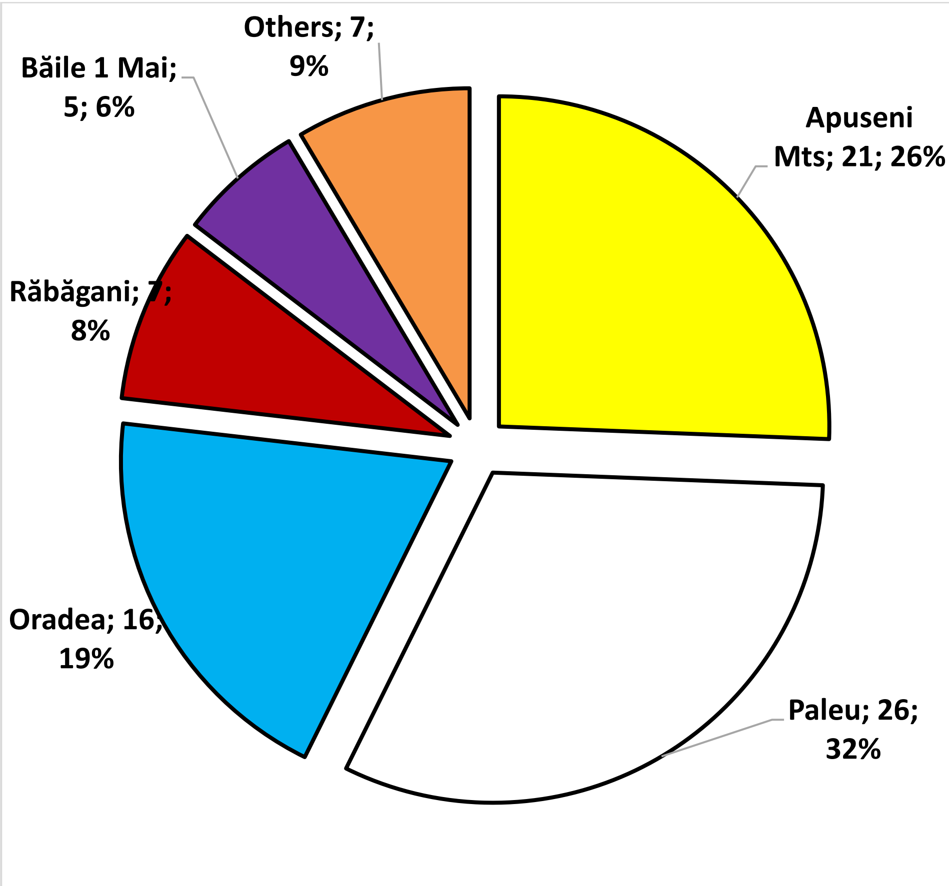

Fig. 2. The collecting frequency according to the sampling sites

The monthly distribution of the collecting records is illustrated in Fig. 3, even though the non-continuous collecting over the respective time and in the localities does not allow for a representative rendition of the ants' activity in Bihor County.

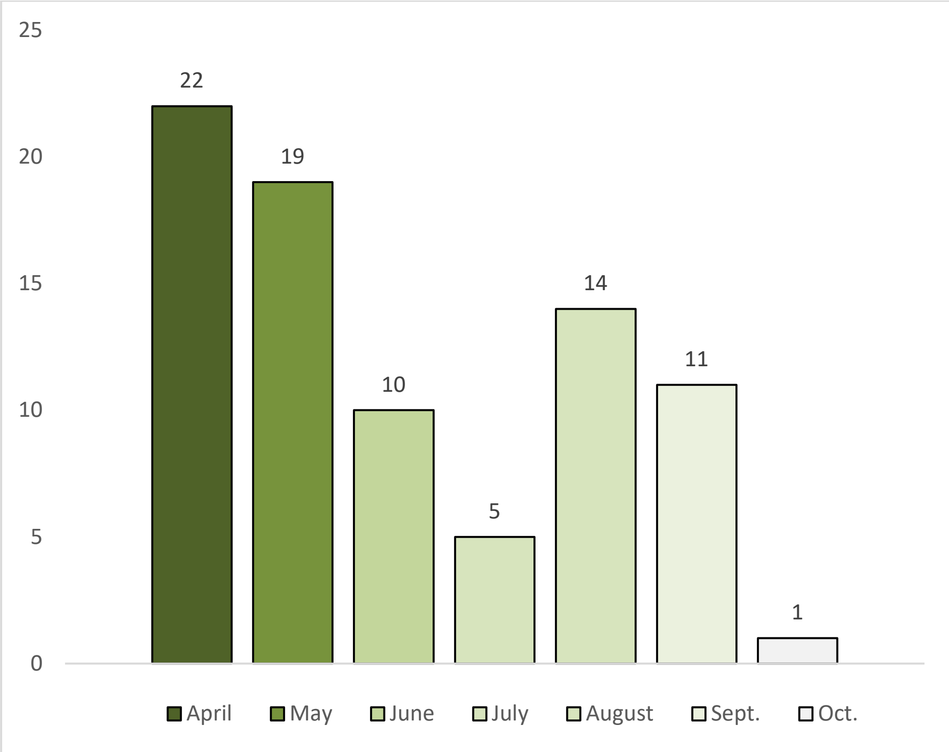

Fig. 3. Monthly phenogram for the number of ant individuals sampled which are preserved in the entomological collection of Țării Crișurilor Museum, Oradea.

The collecting period spans non-continuously over 36 years (1954-1990), with a peak in 1966 (Fig. 4). The low number of individuals collected in each case did not pose a threat to the respective populations. Of the 82 ant species known in Romania, 12 are included in the present collection, belonging to 3 subfamilies and 7 genera, and the best represented is the genus *Formica*, with 5 species. Among the more interesting species in the collection there are *Liometopum microcephalum*, an arboreal, xerophilous species, therefore an indicator for conservation (Csõsz 2000), and *Myrmica schencki*, a xerophilous, Palearctic species important to nature conservation because it is a host for the larvae of the vulnerable Lycaenids (blue butterflies) *Phengaris rebeli and P. arion*.

Compared to other Romanian museum collections, this collection is rather small. Probably the most valuable collection is found in Brukenthal National

Museum in Sibiu, followed by the Bacău Museum Collection and the collection housed at the “Grigore Antipa” National Museum of Natural History in Bucharest. However, ant collections in Romania are quite rare. Thus, the small collections add value to the knowledge of the Romanian myrmecofauna.

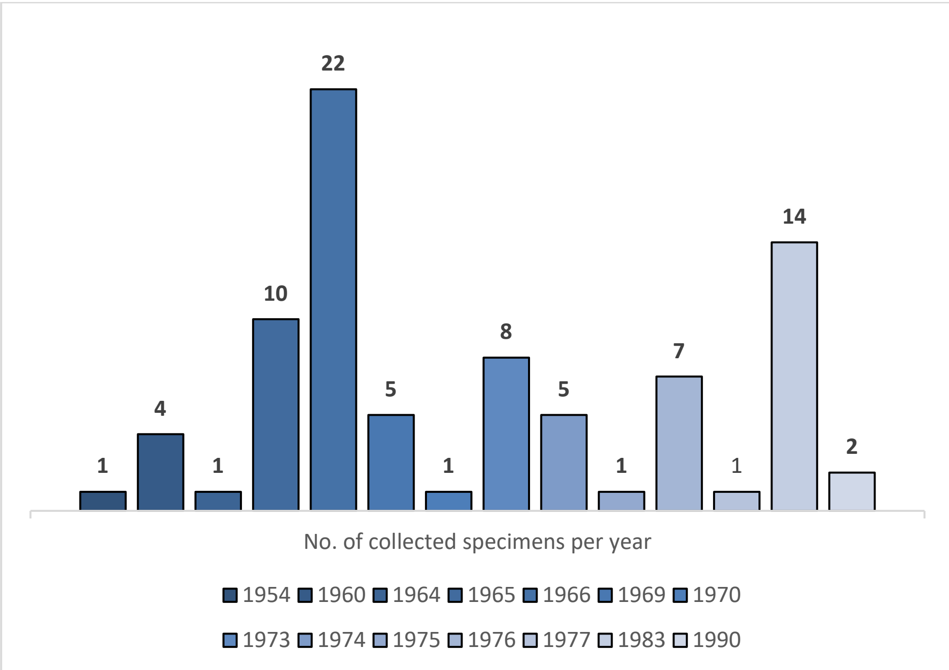

Fig. 4. Collecting data abundance per year for the Formicidae in the entomological collection of Țării Crișurilor Museum, Oradea.

Acknowledgements

The authors are thankful to all the former collectors (Ioan Mircea Paina, Dinu Paraschivescu and Tiberiu Jurcsák), who made this ant collection possible.

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NYMPHAEA Folia naturae Bihariae	L	201-230	Oradea, 2023

The Heinz Neumann egg collection from the patrimony of the "Grigore Antipa" National Museum of Natural History, Bucharest, Romania

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Abstract. The Heinz Neumann collection entered the heritage of the "Grigore Antipa" Museum in Bucharest from 2021 through the donation and goodwill of his son, forest engineer Horst Neumann, which completes and enriches the egg collection of the museum in Bucharest. It contains 620 eggs from 168 clutches, from 84 species and 33 families. These are common species in various habitats. The collection does not contain pieces from endangered or vulnerable bird species. Through our study we want to make this collection known, and the publication of the catalog to be a tribute to Heinz Neumann, musician, teacher, ornithologist and lepidopterologist, refined intellectual, romantic who loved the beauty of nature.

Keywords: collection, eggs, donation, "Grigore Antipa" Museum, Heinz Neumann.

Introduction

Collecting bird eggs has been an activity of people since ancient times, especially to supplement food. Then they began to be used as art objects (painted eggs, ostrich eggs for chandeliers, Fabergé eggs). Their use as objects of collection for their special shape and colors appears after 1800. This concern took a particular extent until 1930, when the collection of nests was considered harmful to birds and was tempered by laws specific to each country.

Avian museum collections are important elements in studies regarding environmental changes as their data is easily available through digitization and open to further analysis (georeferencing, chemical analysis or molecular studies) (Norris et al. 2023). New classification studies were obtained by egg white analysis (Sibley & Ahlquist 1972), proving that eggs and eggshells represent an important source of valuable information for phylogenetic and taxonomic studies. These analyses need to take into consideration protocols of careful sampling of the eggs from the museum collections, because as they age, they become more delicate and brittle (Stewart et al. 2015). New information regarding the temporal and geographical differences or the drifting habitats and climate changes can be brought from analyzing the nest collections (Russell et al. 2013).

The largest scientific collections are now stored in several museums of natural sciences in the world: The Natural History Museum of London, BMNH/NHM, Tring, UK – 450,000 clutches; Western Foundation of Vertebrate Zoology, WFVZ, Camarillo, CA, USA - 275,000 clutches; National Museum of Natural History (NMNH) - Smithsonian/USA - 47,500 clutches; Zoologisches Forschungsinstitut und Museum “Alexander Koenig”, ZFMK, Bonn, Germany - 60,000 clutches; Museum für Naturkunde, ZMB or ISZ, Berlin, Germany - 50,000 clutches; National Museums Scotland, NMS, Edinburgh, UK - 45,000 clutches; Naturalis, Nationaal Natuurhistorisch Museum, RMNH, Leiden, The Netherlands - 39,459 clutches; Hungarian egg collections at the Hungarian Natural History Museum, Hungary - 23,945 clutches (Pereszlényi et al. 2019, Marini et al. 2020, Norris et al. 2023, Roselaar 2003).

Collections of eggs at museums in Romania

Some egg collections are stored in museums in Romania, but they have remained unknown. The egg collection of the Țării Crișurilor Museum (Museum of the Criș Rivers Region) in Oradea is the largest egg collection in Romania. It includes 13,812 eggs, 3,573 clutches and 659 species. The catalog of the collection was published by Béczy (1971). This collection consists of three parts: the Ladislau Dobay collection, with material collected from the Târnăveni area, where Dobay worked as a public official, known through the works of Tamás Béczy (1964, 1966); collection of Ernő Andrássy (1894-1968), who was a physician, ornithologist and archaeologist; and the third part represents the collection established after 1950 by the museum specialists, the ornithologists Tamás Béczy, Ludovic Kováts and Rozalia Poliș (Béczy 1971).

From our personal data we add that the Zoological Museum in Cluj-Napoca has one of the largest egg collections; it is in second place after the one in Oradea, and it is made up of 4392 eggs from 850 clutches, of which 514 eggs are on public display, 1141 are considered reserve eggs, a collection established between 1853-1920. The Banat Museum in Timișoara has a collection consisting of 2184 eggs, 537 clutches from 198 species, with a catalog published by Andrei Kiss (1997).

The Mureș County Museum has a collection of 1879 eggs, 382 clutches, from 82 species, published by Zoltan Szombath (2012). The "Răsvan Angheluță" Museum Complex of Natural Sciences in Galați has a collection of 1670 eggs, 592 clutches, 101 species. The collection comes from the materials collected by Ion I. Cătuneanu (Patrichi & Manci 2006). The Vrancea Museum in Focșani, Natural Sciences Section, has an oological collection of 432 eggs from 107 species (Szombath 2012). The Oltenia Museum in Craiova has 352 eggs, 158 species, from the Licherdopol collection, with a catalog published by Ridiche (2003). The Sibiu Museum of Natural Sciences has an egg collection made up of approximately 1900 eggs from 207 species (Stein-von Spiess et al. 2005). The Eco-Museum Research Institute in Tulcea, the Eco-Tourist Museum Center, has a collection of eggs that contains 291 eggs from the Danube Delta and some eggs from Australia and Africa; the data are taken from the Museum's official website, because the collection of eggs was not published.

The Ion I. Cătuneanu collection was established between 1925-1970, part of which is at the Museum of Natural Sciences in Bacău since 1974 (432 eggs and 63 nests, from 107 species and 36 families) and the other part has entered the heritage of the "Răsvan Angheluță" Museum Complex of Natural Sciences Galati (Patrichi & Manci 2006). The egg collection of the Natural History Museum in Iași (“Al. I. Cuza” University) contains 890 eggs and 217 clutches (Mândru 1985).

Ladislau Kalaber in Reghin (a private collection) has 116 species, 413 broods, 2009 eggs and has the published catalog from 1976 (Kalaber 1976). Zoltán Szombath (2012) mentions in his work the catalog of the egg collection at the Târgu-Mureș Museum, about the private collection of Dorin Lupean from Sibiu, which contains 400 eggs from 100 species. These data have also been verified from articles published in the press.

Brief history of the Egg Collection of the “Grigore Antipa” Museum

The collection of the "Grigore Antipa" Museum now contains 2455 eggs from 566 clutches. The first eggs were collected by Carol Walstein and Carlo Ferrerati in the period 1854-1868, and then by Ion I. Licherdopol, who has been hired in 1877 as an assistant at the Museum of Zoology in Bucharest by Gregoriu Ștefănescu, the director of the museum. Over time, he chose mollusks as his field of study and began an intense activity to collect and publish. Along with mollusk shells, Licherdopol also collected bird eggs. This collection was acquired by the museum twice, in 1904 and 1911, by Grigore Antipa, while the ornithologist Robert Ritter von Dombrowski was employed at the museum. Until 1916, when he left Romania, the latter added other items to this small collection. In the period 1916-1950 the collection stagnated, very few eggs were purchased from individuals, donated by various people, or collected by the museum staff. A better period for the collection was after 1950-1970, when the two ornithologists of the museum, Aurel Papadopol and Matei Tălpeanu, as well as other specialists of the museum, collected during field expeditions especially destroyed and abandoned nests. A private collection of eggs from Apoldul de Sus, Sibiu, established in the period 1840-1960, unfortunately without data, was also purchased. In 1990, the Museum acquired a collection of eggs from the Romanian ornithologist Dimitrie Radu, which consisted of eggs collected from the species he raised in captivity while he was the director of the Bucharest Zoo. The most recent donation is the egg collection of Heinz Neumann, which arrived because of the purchase made by the "Grigore Antipa" Museum in 2019, when it bought his collection of Lepidoptera. His son, the forestry engineer Horst Neumann, donated the egg collection to the museum on this occasion.

The Heinz Neumann Collection

Neumann Enric-Alivin (Heinz) (3 Oct. 1938 – 7 July 2013) was born in Timişoara. He graduated from the "Lenau" High School in Timișoara in German, and in parallel studied the piano as his main instrument at the Music High School in Timișoara. He continued his studies at the "Gheorghe Dima" Academy of Music in Cluj, at the Faculty of Composition, majoring in composition, conducting and pedagogy. He graduated in 1965 and then taught piano, music theory and music history at the Popular Art School in Timișoara. During the period 1965-1975 he had an intense concert activity, with numerous concerts for which he prepared with passion. After 1975 he continued his teaching activity at the "Ion Vidu" Music High School in Timișoara, where he taught piano, theory and solfege. He retired from this school in 1998. In addition to Heinz Neumann's passion for music, he also had a great love for nature. Since childhood, he has been passionate about trips, fishing, and observing nature, and his grandfather also initiated him into beekeeping. Beekeeping was a passion that started for him in childhood when he procured himself a swarm of bees from the forest. During his life, he became a beekeeper with extensive experience, an occupation that allowed him to supplement his modest income as a music teacher (Rákosy 2014). The observations accumulated over time on bees and the species that feed on bees culminated in the publication of a well-documented and extremely important work on the biology, ecology, and behavior of the species *Merops apiaster*, a unique study at that time in Romania (Neumann 1983).

Throughout his life, such activity was carried out on two levels, musical-artistic and scientific research. The latter first started in the field of ornithology in his youth and continued with the study of Lepidoptera from 1975 until the end of his life. His collection of Lepidoptera, today in the patrimony of the “Grigore Antipa” Museum, contains 34,336 specimens from over 2,000 species. The collection was completed between 1970-2013 and is accompanied by 12 published studies on butterflies from the Banat area, Romania (Neumann 1993, 1995, 1997b, 1998, 1999, 2000a, 2000b, Neumann & Varga 1995, Rákosy & Neumann 1990, Rákosy & Neumann 1997).

Starting from 1956, around the age of 18 and thanks to the observations on the behavior of birds, which he started at the bird's nests, he laid the foundations of a collection of eggs on which he worked until 1976, then sporadically until 1980, when the last observations appear in the notes. Scientific research in the field of ornithology was based on hundreds of observations collected and carefully recorded in notebooks. An excellent self-taught naturalist, he managed to publish 12 scientific articles with lepidopterological content and 10 with ornithological content. In his studies of ornithology, he mainly pursued new aspects regarding the situation of waterfowl in Timiş County (Neumann 1982). He wrote about bird colonies in wetlands, about Ardeidae and Anatidae, and the heron colony at the Murani dam, Timiș County (Neumann & Kiss 1983, Kiss & Neumann 1985); the study of the dynamics of gray heron (*Ardea cinarea*) populations in Banat, and of its trophic behavior (Neumann 1996); the dynamics of some populations of Anatidae in the Banat plain (Neumann 1991a); the cormorant (*Phalacrocorax carbo sinensis*) in the western plain of Romania (Neumann 1991b); the ornitofauna of the Sacoșu Turcesc fish farm, Timiș County (Neumann 1997a); avifaunistic novelties, etc.

The collection was established between 1955 and 1971, and he added sporadically a few pieces until 2011, when the last collection date appears. The clutches collected in 1955 are without complete collection data and without localities due to the lack of experience and the absence of the necessary knowledge for such an activity. Probably at the beginning, as an artist, he was attracted by the beauty of the shapes, colors, and designs specific to each bird species. Over time, he managed to cover this gap and today we see a real scientific collection, even though the person who created it was an autodidact.

We note that the eggs in the collection are grouped by species, with labels, in wooden drawers covered with glass, to avoid contact with dust, which has meant that for over 60 years the eggs are protected and look impeccable. For each species he noted the scientific name and the vernacular name in German (Heinz's mother tongue). All the pieces were collected and processed by him. Emptying the contents is a laborious activity, easier to do if the egg is fresh. Eggs hatched in the first stages are difficult to empty because their shell becomes fragile and breaks easily. Of the total of 620 eggs, 14 specimens are cracked, of which 7 are broken, fragmented and could not be measured.

Collecting eggs is a special action, which involves an active search in the research area, distributive attention, and knowledge of the behavior of the tracked species, but also of the nesting periods. The collection includes clutches from various habitats (aquatic, riparian, terrestrial, arboreal) (Fig. 1).

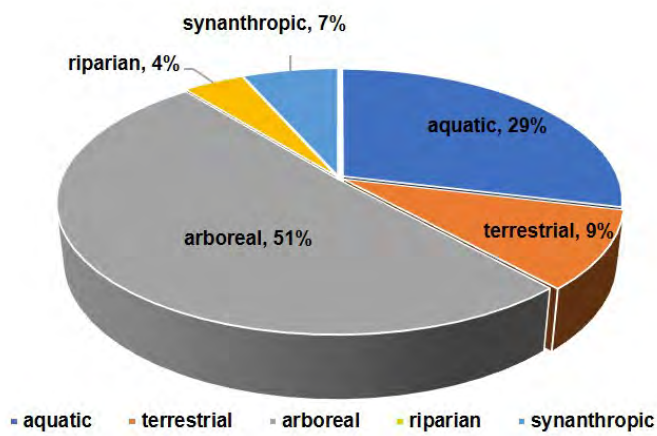

Fig. 1. Clutches from various habitats

In the collection, 51% of the eggs are from species that live and nest in forests, parks, and bushes and whose life is linked to the arboreal environment. Fig. 2 shows the families, the species, the number of clutches and the number of eggs, and among the arboreal species, the fringillids, the sylvins, the accipitrids, the falconids, the corvids, the picids, the muscicapids, etc.

29% of the species are from the aquatic environment. The large number of eggs collected from this environment is also related to the research done by Heinz Neumann in the wetlands of Banat, as he published several studies related to the avifauna of fish farms or wetlands, such as Murani or Satchinez in Timiș County. In addition to these two categories, there are also synanthropic species (7%), those that live in dense environments, near people (*Ciconia ciconia*, *Hirundo rustica*, *Passer domesticus, Passer montanus*); *Hirundo* and *Passer* are easy to collect, but *Ciconia ciconia* involves a high degree of difficulty, therefore there is only one type in the collection.

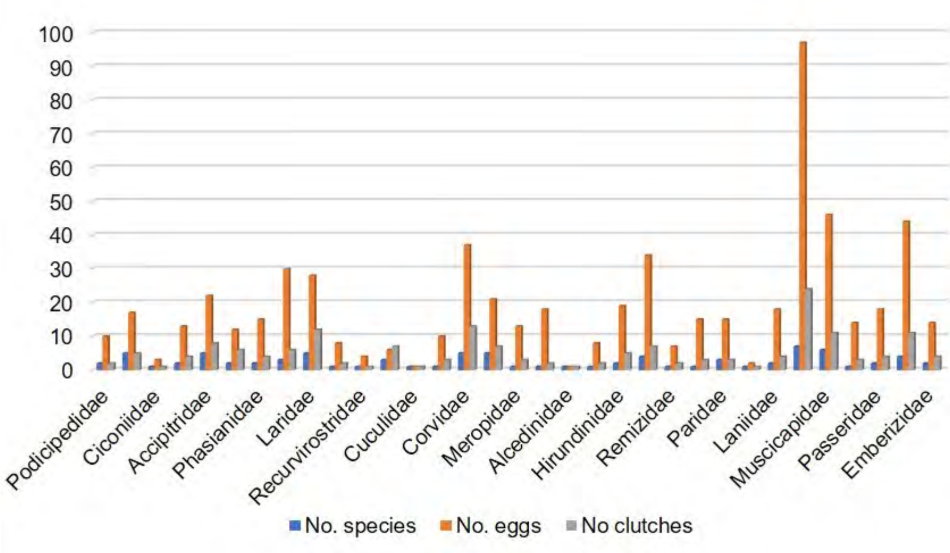

Fig. 2. The number of eggs and clutches by species and families.

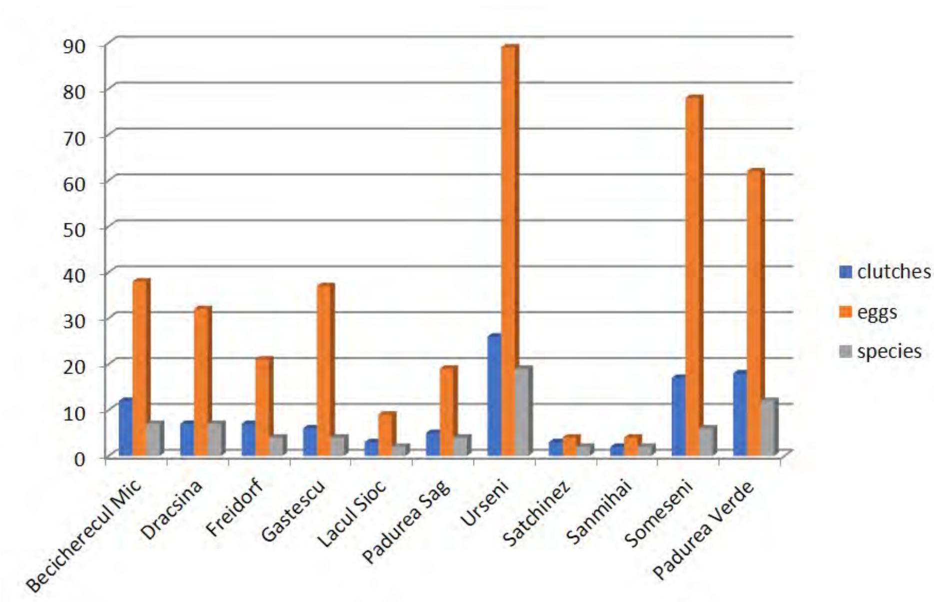

Fig.3. Number of species, eggs, and clutches per locality where they were collected.

Terrestrial species account for 1.9%. This category includes Phasianidae (*Coturnix coturnix* and *Phasianus colchicus*), alaudids (*Galerida cristata*), motacilides, namely all those species that prefer to nest on the ground.

The clutches were collected over time from 34 localities spread over five counties (Timiș, Cluj, Arad, Dolj and Tulcea). Most of the towns are from Timiș County. Urseni, Someșeni, Becicherecul Mic, and Pădurea Verde from Timișoara are the localities where the most specimens were collected. There are 7 collection points from Timișoara, where eggs from 22 species were collected. These data are particularly important in a current study on urban biodiversity in Timișoara and can show us the evolution of avifauna over the past 60 years (Fig. 3).

In conclusion, the collection contains 620 eggs from 168 clutches, from 84 species and 33 families (Tab. 1). They are common species in various habitats (Figs. 4-7). The collection does not contain pieces from endangered or vulnerable bird species. In the collection there is a cuckoo egg (*Cuculus canorus*) in a clutch with two *Acrocephalus palustris* eggs. In the patrimony of the "Grigore Antipa"

Museum, we have a specimen from Apoldul de Sus and a specimen from the collection of the ornithologist Dimitrie Radu. This particular collection, the Heinz Neumann one, which has entered the heritage of the "Grigore Antipa" Museum through the donation and the goodwill of his son, forestry engineer Horst Neumann, completes and enriches the egg collection of the Bucharest Museum, which is otherwise quite poor.

We want our study to make this collection known, to be researched, and the data to be used in various future studies. We also want our study and the publication of this catalog to be a tribute to Heinz Neumann, a musician, teacher, ornithologist and lepidopterist, refined intellectual, and a romantic person who loved the beauty of nature.

***Table* 1. The Heinz Neumann egg collection in the patrimony of the "Grigore Antipa" National Museum of Natural History, Bucharest (Romania)**

No. col.	Species	Collection data	No. eggs	Dimensions (Height X diameter, mm)
	PODICIPEDIDAE			
17609	*Podiceps cristatus* (Linnaeus, 1758)	6.06.1964 Lake Șioc Timișoara, Timiș	3	1-54.87x34.45; 2-53.26x35.62; 3-53.62x35.39;
17610	*Tachybaptus ruficollis* (Pallas, 1764)	29.05.1956 Freidorf, Timișoara, Timiș	7	1-37.06x26.17; 2-38.02x26.66; 3-36.8x26.09; 4-37.91x26.22; 5-37.78x26.08; 6-35.76x25.26; 7-37.83x26.55
	ARDEIDAE			
17611	*Ardea purpurea* Linnaeus, 1766	05.1971 Becicherecul Mic, Timiș	5	1-57.99x41.58; 2-61.07x39.68; 3-58.73x41.65; 4-59.02x41.91; 5-57.86x40.79
17612	*Ardea cinerea* Linnaeus, 1758	4.04.1981 Dracșina, Timiș	3	1-61.97x42.76; 2-58.94x43.51; 3-61.17x42.63;

17613	*Botaurus stellaris* (Linnaeus, 1758)	05.1971 Becicherecul Mic, Timiș	1	1-46.45x38.72;
17614	*Nycticorax nycticorax* Linnaeus, 1758	3.05.1966 Satchinez, Timiș	2	1-46.39x32.37; 2-47.5x32.79;
17615	*Nycticorax nycticorax* Linnaeus, 1758	06.1994 Satchinez, Timiș	1	1-45.75x32.09
17616	*Ixobrychus minutus* (Linnaeus, 1766)	28.05.1966 Covaci, Timiș	5	1-34.45x25.45; 2-34.51x25.59; 3-34.75x25.44; 4-34x25.36; 5-34.77x25.69
	CICONIIDAE			
17617	*Ciconia ciconia* (Linnaeus, 1758)	2.06.1966 Becicherecul Mic, Timiș	3	1-73.03x51.77; 2-74.83x50.22; 3-71.47x52.14;
	ANATIDAE			
17618	*Anas platyrhynchos* Linnaeus, 1758	20.04.1958 Freidorf, Timișoara, Timiș	9	1-58.49x41.26; 2-59.06x40.67; 3-57.52x41.29; 4-60.7x41.11; 5-59.8x41.06; 6-60.13x41.37; 7-58.01x41.33; 8-58.32x41.62
17619	*Anas platyrhynchos* Linnaeus, 1758	No date Freidorf, Timișoara, Timiș	1	1-58.88x41.49;
17620	*Anas platyrhynchos* Linnaeus, 1758	5.04.1957 Freidorf, Timișoara, Timiș	2	1-57.06x41.01; 2-58.12x41.13
17621	*Aythya sp.*	No data	1	1-60.41x39.37
	ACCIPITRIDAE			
17622	*Accipiter gentilis* (Linnaeus, 1758)	4.05.1958 Urseni, Timiș	2	1-56.17x44.84; 2-55.82x45.1;
17623	*Accipiter gentilis* (Linnaeus, 1758)	No data	3	1-58.79x43.62; 2-57.41x44.07; 3-55.65x44.26;
17624	*Accipiter nisus* (Linnaeus, 1758)	6.05.1956 Pădurea Verde, Timișoara, Timiș	2	1-40.78x29.76; 2-39.16x30.52
17625	*Buteo buteo* (Linnaeus, 1758)	7.04.1966 Urseni, Timiș	3	1-55.16x45.83; 2-55.41x45.68; 3-53.53x43.44

17626	*Buteo buteo* (Linnaeus, 1758)	27.04.1958 Urseni, Timiș	1	1-53.37x43.03
17627	*Milvus migrans* (Linnaeus, 1758)	25.04.1958 Urseni forest, Timiș	2	1-52.36x43.32; 2-52.99x43.51;
17628	*Circus aeruginosus* (Linnaeus, 1758)	6.06.1964 Lake Sioc	4	1-51.69x36.47; 2-50.35x37.14; 3-49.77x37.96; 4-52.62x38.64
17629	*Circus aeruginosus* (Linnaeus, 1758)	2.05.1964 Lake Sioc	5	1-47.95x38.64; 2-49.23x37.8; 3-47.94x37.71; 4-50.27x37.11; 5-47.98x38.69
	FALCONIDAE			
17630	*Falco tinnunculus* Linnaeus, 1758	06. 1958 Urseni forest, Timiș	2	1-38.66x30.69; 2-40.4x29.88
17631	*Falco tinnunculus* Linnaeus, 1758	06. 1958 Pădurea Verde, Timișoara,	1	1-37.91x29.74;
17632	*Falco tinnunculus* Linnaeus, 1758	24.04.1956 Faunne Park	2	1-36.95x31.06; 2-37.6x31.33;
17633	*Falco tinnunculus* Linnaeus, 1758	16.05.1965 Dracșina	3	1-36.96x30.37; 2-36.84x30.75; 3-36.96x29.85
17634	*Falco vespertinus* Linnaeus, 1766	4.06.1957 Bega River, Sânmihaiu, Timiș	3	1-36.39x29.02; 2-37.53x28; 3-36.36x28.37;
17635	*Falco vespertinus* Linnaeus, 1766	4.06.1957 Bega River, Sanmihaiu, Timiș	1	1-35.93x28.92;
	PHASIANIDAE			
17636	*Phasianus colchicus* Linnaeus, 1758	No date Satchinez, Timiș	1	1-42.72x34.01;
17637	*Phasianus colchicus* Linnaeus, 1758	05.1965 Dracșina, Timiș	11	1-44.54x34.24; 2-45.56x33.68; 3-43.93x33.64; 4-44.71x33.8; 5-44.01x33.69; 6-43.68x32.63; 7-45.34x34.14; 8-45.29x33.46; 9-45.58x33.77; 10-44.85x33.19; 11-43.9x33.61;
17638	*Coturnix coturnix* (Linnaeus, 1758)	No data	1	1-29.57x22.33;

17639	*Coturnix coturnix* (Linnaeus, 1758)	31.08.1988 Giulvăz, Timiș	1	1-29.53x22.19;
	RALLIDAE			
17640	*Rallus aquaticus* Linnaeus, 1758	1.06.1964 Someșeni, Cluj	1	1-33.54x24.32;
17641	*Rallus aquaticus* Linnaeus, 1758	5.06.1964 Someșeni, Cluj	7	1-33.25x24.04; 2-33.14x23.39; 3-31.09x22.23; 4-33.18x24.46; 5-32.84x25.03; 6-32.21x23.13; 7-32.46x23.53
17642	*Gallinula chloropus* (Linnaeus, 1758)	5.07.1957 Urseni, Timiș	4	1-41.47x29.86; 2-43.91x28.36; 3-44.17x28.87; 4-38.2x27.45
17643	*Gallinula chloropus* (Linnaeus, 1758)	12.05.1957 Urseni, Timiș	7	1-42.4x28.21; 2-39.55x27.89; 3-41.29x26.78; 4-40.67x29.31; 5-41.31x28.35; 6-41.37x28.69; 7-43.27x29.81;
17644	*Gallinula chloropus* (Linnaeus, 1758)	5.06.1956 Berecsău, Timiș	4	1-43.17x31.23; 2-42.77x31.22; 3-42.55x31.79; 4-41.54x32.14
17645	*Fulica atra* Linnaeus, 1758	11.05.1958 Urseni, Timiș	7	1-55.06x37.46; 2-54.31x37.8; 3-53.9x37.77; 4-52.77x38.15; 5-53.4x37.72; 6-56.42x37.8; 7-55.37x36.56
	LARIDAE			
17646	*Chroicocephalus ridibundus* (Linnaeus, 1766)	5.07.1957 No data	2	1-51.79x35.9; 2-52.47x35.5;
17647	*Chroicocephalus ridibundus* (Linnaeus, 1766)	8.05.2011 No data	1	1-51.93x37.56
17648	*Chroicocephalus ridibundus* (Linnaeus, 1766)	No data	1	1-45.64x33.01
17649	*Thalasseus sandvicensis* (Latham, 1787)	9.07.1971 No data	1	1-29.56x22.35;

17650	*Sterna hirundo* Linnaeus, 1758	11.07.1971 Sahalin, Tulcea	3	1-45.94x32.15; 2-41.54x30.58; 3-43.46x31.58;
17651	*Chlidonias leucopterus* Temminck, 1815	10.07.1970 Becicherecul Mic, Timiș	2	1-31.83x23.96; 2-33.22x24.14;
17652	*Chlidonias leucopterus* Temminck, 1815	11.05.2008 Becicherecul Mic, Timiș	2	1-43.39x31.06; 2-43.48x31.94; 3- 42.73x31.89; 4- 43.92x30.84;
17653	*Chlidonias hybrida* Pallas, 1811	10.6.1970 Becicherecul Mic, Timiș	3	1-36.67x28.35; 2-39.08x27.14; 3-39.95x27.7
17654	*Chlidonias hybrida* Pallas, 1811	10.06.1970 Becicherecul Mic, Timiș	3	1-38.73x27.35; 2-40.29x28.96; 3-40.56x28.53;
17655	*Chlidonias hybrida* Pallas, 1811	10.06.1970 Becicherecul Mic, Timiș	3	1-40.1x29.1; 2-38.44x20.11; 3-38.96x28.28;
17656	*Chlidoniashybrida* Pallas, 1811	10.06.1970 Becicherecul Mic, Timiș	3	1-42.78x30.23; 2-42.25x30.64; 3-41.34x29.64
17657	*Chlidonias hybrida* Pallas, 1811	10.06.1970 Becicherecul Mic, Timiș	3	1-41.02x29.31; 2-37.41x28.88; 3-39.78x29.8;
	CHARADRIIDAE			
17658	*Vanellus vanellus* (Linnaeus, 1758)	7.04.1965 Someșeni, Cluj	4	1-47.9x34.45; 2-46.06x34.07; 3-47.76x33.69; 4-47.04x33.91;
17659	*Vanellus vanellus* (Linnaeus, 1758)	6.04.1965 Someșeni, Cluj	4	1-45.64x34.11; 2-46.92x33.21; 3-47.92x33.36; 4-44.42x31.74
	RECURVIROSTRIDAE			
17660	*Himantopus himantopus* (Linnaeus, 1758)	11.05.2008 Ghilad,Timiș	4	1-43.39x31.06; 2-43.48x31.94; 3-42.73x31.89; 4-43.92x30.84
	Columbidae			
17661	*Streptopelia decaocto* (Frivaldszky, 1838)	No data	1	1-30.78x23.58;

17662	*Streptopelia decaocto* (Frivaldszky, 1838)	27.05.1956 Șag forest	2	1-31.09x24.19; 2-31.91x24.97;
17663	*Streptopelia turtur* (Linnaeus, 1758)	7.05.1956 Pădurea Verde, Timișoara, Timiș	2	1-30.65x21.99; 2-28.8x21.74;
17664	*Columba palumbus* Linnaeus, 1758	5.06.2009 Toagheș, Timiș	1	1-45.31x30.07;
	STRIGIDAE			
17665	*Asio otus* (Linnaeus, 1758)	4.1956 Padurea Verde, Timișoara, Timiș	3	1-40.02x31.92; 2-39.82x32.18; 3-39.87x31.93
17666	*Asio otus* (Linnaeus, 1758)	6.1958 Urseni, Timiș	2	1-38.87x32.16; 2-39.28x31,51
17667	*Asio otus* (Linnaeus, 1758)	15.4.1967 Pădurea Verde, Timișoara, Timiș	5	1-40.05x31.72; 2-41.59x32.01; 3-40.21x32.57; 4-39.96x32.56; 5-40.84x32.55;
	CORVIDAE			
17668	*Corvus corone cornix* Linnaeus, 1758	No data	1	1-41.25x30.49;
17669	*Corvus corone cornix* Linnaeus, 1758	24.04.1966 Dracșina, Timiș	5	1-37.24x27.96; 2-40.48x29.37; 3-39.51x29.48; 4-35.68x27.84; 5-42.33x28.36;
17670	*Corvus corone cornix* Linnaeus, 1758	29.04.1956 Urseni, Timiș	3	1-44.2x30.79; 2-43.22x29.75; 3- spart
17671	*Corvus corone cornix* Linnaeus, 1758	11.04.1958 Giroc, Timiș	2	1-47.15x31.03; 2-47.36x31.05;
17672	*Corvus corone cornix* Linnaeus, 1758	No data	1	1-43.65x35.12;
17673	*Corvus frugilegus* Linnaeus, 1758	12.04.1964 Bonțida, Cluj	4	1-35.28x26.78; 2-37.55x26.74; 3-34.8x26.42; 4-36.44x26.66;
17674	*Pica pica* (Linnaeus, 1758)	No data	1	35.76x26.33;
17775	*Pica pica* (Linnaeus, 1758)	No data	4	1-36.71x23.08; 2-32.03x23.39; 3-32.79x23.64; 4-32.74x23.52;

17675	*Coleus monedula* (Linnaeus, 1758)	25.04.1958 Padurea Verde, Timișoara	2	1-29.79x23.42; 2-30.54x23.37;
17676	*Coleus monedula* (Linnaeus, 1758)	25.04.1958	1	1-30.54x23.37;
17776	*Coleus monedula* (Linnaeus, 1758)	24.04.1966 Dracșina, Timiș	5	1-34.87x24.98; 2-33.64x24.42; 3-35.95x24.85; 4-34.44x24.81; 5-37.09x24;
17677	*Garrulus glandarius* (Linnaeus, 1758)	26.04.1959 Urseni, Timiș	2	1-29.41x20.18; 2-29.15x21.23;
17678	*Garrulus glandarius* (Linnaeus, 1758)	2.05.1957 Șag forest	6	1-30.23x22.61; 2-30.91x21.8; 3-31.02x22.9; 4-30.78x22.64; 5-30.56x22.78; 6-31.6x22.73;
	PICIDAE			
17679	*Dendrocopos major* (Linnaeus, 1758)	2.05.1958 Pădurea Verde, Timișoara	2	1-25.97x20.2; 2-26.4x19.79;
17680	*Dendrocopos syriacus* (Hemprich & Ehrenberg, 1833)	1955 No data	2	1-24.13x19.98; 2-24.57x19.75;
17681	*Dendrocopos medius* (Linnaeus, 1758)	27.04.1958 Urseni forest, Timiș	1	1-24.15x18.58;
17682	*Dendrocopos medius* (Linnaeus, 1758)	8.05.1957 Urseni, Timiș	3	1-23.58x19.7; 2-24.32x19.56; 3-23.97x19.67;
17683	*Dendrocopos medius* (Linnaeus, 1758)	24.04.1959 Urseni, Timiș	7	1-23.94x18.14; 2-24.15x18.15; 3-24.52x18.01; 4-24.55x17.27; 5-23.36x18.29; 6-24.05x17.43; 7-24.31x18.41;
17684	*Dendrocopos minor* (Linnaeus, 1758)	No data	1	1-24.06x18.61;
17685	*Jynx torquilla* (Linnaeus, 1758)	1955 No data	5	1-20.11x15.52; 2-20.5x15.07; 3- 19.54x15.49; 4-20.92x14.97; 5-20.14x15.46;

	MEROPIDAE			
17686	*Merops apiaster* Linnaeus, 1758	10.06.2011 Uliuc, Timiș	6	1-26.98x22.63; 2-26.38x22.7; 3-25.99x22.91; 4-25.88x22.23; 5-27.2x22.54; 6-27.16x22.77;
17687	*Merops apiaster* Linnaeus, 1758	27.05.1956 Șag, Timiș	2	1-30.39x22.64; 2-30.18x23.01;
17688	*Merops apiaster* Linnaeus, 1758	4.06.1973 Timiș riverbank	5	1-26.8x22.01; 2-24.39x21.3; 3-24.81x21.86; 4-26.52x22.1; 5-25.77x20.38;
	UPUPIDAE			
17689	*Upupa epops* Linnaeus, 1758	10.05.1964 Gâștescu, Cluj	8	1-27.05x17.7; 2-27.46x17.58; 3-26.49x17.52; 4-26.33x17.86; 5-27.52x17.33; 6-26.79x17.46; 7-26.22x17.49; 8-27.19x17.83;
17690	*Upupa epops* Linnaeus, 1758	9.05.1964 Gâștescu, Cluj	10	1-24.15x15.82; 2-25.54x16.99; 3-26.72x16.42; 4-26.03x17.72; 5-27.41x17.01; 6-26.13x17.57; 7-25.6x17.7; 8-26.43x17.73; 9-24.89x18.12; 10-26.71x17.5;
	ALCEDINIDAE			
17691	*Alcedo atthis* (Linnaeus, 1758)	7.07.1980	1	1-22.48x18.88;
	ALAUDIDAE			
17692	*Galerida cristata* (Linnaeus, 1758)	10.04.1966 Freidorf, Timișoara, Timiș	4	1-22.2x16.59; 2-22.14x16.83; 3- 22.21x16.65; 4-22.09x16.39;
17693	*Galerida cristata* (Linnaeus, 1758)	6.04.1966 Freidorf, Timișoara, Timiș	4	1-23.05x17.26; 2-21.63x17.08; 3-22.54x17.26; 4-22.94x17.46;

	HIRUDINIDAE			
17694	*Hirundo rustica* Linnaeus, 1758	18.05.1966 Becicherecul Mic, Timiș	5	1-19.55x12.99; 2-19.43x13.8; 3-19.12x13.12; 4-19.57x13.66; 5-20.06x13.4;
17695	*Hirundo rustica* Linnaeus, 1758	21.06.1964 Fundătură	5	1-20.21x12.95; 2-19.8x12.88; 3-19.1x12.92; 4-19.76x13.03; 5-19.27x13.29;
17696	*Riparia riparia* (Linnaeus, 1758)	06.1958 Urseni, Timiș	4	1-17.92x12.9; 2-16.38x12.66; 3-16.9x12.89; 4-17.17x12.66;
17697	*Riparia riparia* (Linnaeus, 1758)	06.1958 Urseni, Timiș	4	1-17.33x12.84; 2-17.82x12.68; 3-17.93x12.36; 4-17.99x12.98;
17698	*Riparia riparia*(Linnaeus, 1758)	10.06.2011 Uliuc, Timiș	1	1-17.49x11.37;
	MOTACILLIDAE			
17699	*Motacilla flava dombrowskii/a* (Tschusi zu Schmidhoffen, 1903)	5.06.1964. Someșeni, Cluj	6	1-18.74x14.18; 2-18.54x14.28; 3-19.96x14.32; 4-19.18x14.16; 5-18.44x13.73; 6-18.61x14.06;
17700	*Motacilla flava dombrowskii/b* (Tschusi zu Schmidhoffen, 1903)	7.06.1964. Someșeni, Cluj	7	1-18.7x14.41; 2-19.8x14.29; 3-19.33x14.9; 4-18.34x14.76; 5-20.02x14.73; 6-18.82x14.73; 7-18.59x14.5;
17701	*Motacilla flava dombrowskii/c* (Tschusi zu Schmidhoffen, 1903)	7.06.1964. Someșeni, Cluj	4	1-19.1x14.56; 2-18.61x14.54; 3-18.33x14.72; 4-19.53x14.45;
17702	*Motacilla flava dombrowskii/d* (Tschusi zu Schmidhoffen, 1903)	7.06.1964. Someșeni, Cluj	6	1-19.3x14.61; 2-18.54x14.3; 3-19.51x14.71; 4-19.6x14.37; 5- 19.27x14.4; 6-19.43x14.56;

17703	*Motacilla flava feldegg* Michahelles, 1830	No data	3	1-20.28x14.86; 2-20.08x14.66; 3-20.17x14.18;
17704	*Motacilla cinerea* Tunstall,1771	No data	4	1-19.51x14.3; 2-19.71x14.48; 3-19.92x14.56; 4-19.75x14.52;
17705	*Motacilla alba* Linnaeus, 1758	No data	4	1-19.08x14.6; 2-19.13x14.22; 3-19.19x14.35; 4- 19.46x14.52;
	REMIZIDAE			
17706	*Remiz pendulinus* (Linnaeus, 1758)	No data	2	1-17.71x10.48; 2-17.8x10.4;
17707	*Remiz pendulinus* (Linnaeus, 1758)	4.08.1971 Becicherecul Mic, Timiș	5	1-16.12x11.06; 2- 16.3x11.48; 3-16.23x11.29; 4-16.31x10.81; 5-15.97x11.05;
	AEGITHALIDAE			
17708	*Aegithalos caudatus* (Linnaeus, 1758)	16.04.1958 Pădurea Verde	6	1-13.88x11.14; 2-13.74x10.9; 3-13.83x10.92; 4-14.19x10.65; 5-13.52x10.79; 6-13.89x10.96;
17709	*Aegithalos caudatus* (Linnaeus, 1758)	16.04.1956 Pădurea Verde	6	1-14.56x11.26; 2-14.15x10.99; 3-14.11x11.82; 4-14.27x11.16; 5-14.15x10.84; 6-13.44x11.02;
17710	*Parus major* Linnaeus, 1758	07.1958 Bega riverbank, Electrica public pool, Timiș	3	1-17.58x13.78; 2- 18.44x14.08; 3-18.65x13.62;
17711	*Cyanistes caeruleus* (Linnaeus, 1758)	27.04.1958 Urseni forest, Timiș	6	1-15.49x12.01; 2- 14.19x12.04; 3-14.98x11.91; 4- 15.4x12.11; 5-15.29x11.98; 6-15.61x11.94;
17712	*Poecile palustris* (Linnaeus, 1758)	4.05.1958 Urseni forest, Timiș	4 (1)	1-15.9x11.86; 2-15.87x11.96; 3-16.37x11.96; 4-15.97x11.05;

	ORIOLIDAE			
17713	*Oriolus oriolus* (Linnaeus, 1758)	06.1956 Urseni, Timiș	2	1-28.46x21.15; 2-32.89x21.87;
	LANIIDAE			
17714	*Lanius minor* Gmelin, 1788	3.06.1956 Freidorf, Timișoara, Timiș	3	1-24.82x17.81; 2- 25.22x17.46; 3-23.89x17.61;
17715	*Lanius collurio* Linnaeus, 1758	27.05.1956 Pădurea Șag, Timiș	4	1-21.69x16.82; 2-21.82x16.54; 3-21.18x15.99; 4- 21.13x16.17;
17716	*Lanius collurio* Linnaeus, 1758	27.05.1956 Pădurea Șag, Timiș	5	1-20.86x15.45; 2-21.96x16.44; 3-20.91x15.84; 4-20.87x16.11; 5-21.1x16.51;
17717	*Lanius collurio* Linnaeus, 1758	1955 No data	6	1-21.27x16.53; 2-22.16x16.27; 3-23.19x15.86; 4-21.01x16.36; 5-21.76x15.85; 6-22.31x16.4;
	SILVIIDAE			
17718	*Acrocephalus arundinaceus* (Linnaeus, 1758)	29.05.1956 Freidorf, Timișoara	1	1-21.95x17.22;
17719	*Acrocephalus arundinaceus* (Linnaeus, 1758)	07.1958 Bega, Timiș	5	1-23.78x16.53; 2-23.83x16.56; 3-23.87x16.24; 4-23.34x16.1; 5-24.08x16.18;
17720	*Acrocephalus palustris* with *Cuculus canorus* egg	No data	3	1-22.1x16.99; 2-18.61x13.56; 3-18.36x13.45;
17721	*Acrocephalus palustris* (Bechstein, 1798)	No data	8	1-18.19x13.23; 2-18.42x13.03; 3-19.1x13.97; 4-18.9x13.88; 5-18.77x13.36; 6-18.49x13.53; 7-19.19x13.14; 8-18.66x13.3;
17722	*Acrocephalus palustris* (Bechstein, 1798)	7.06.1964 Someșeni, Cluj-Napoca	4	1-17.66x13.21; 2-18.03x13.77; 3-18.48x13.44; 4-17.49x13.45;

17723	*Acrocephalus palustris* (Bechstein, 1798)	7.06.1964 Someșeni, Cluj-Napoca	5	1-17.78x13.46; 2-18.99x13.49; 3-18.61x13.51; 4-17.76x13.36; 5-17.79x13.35;
17724	*Acrocephalus palustris* (Bechstein, 1798)	5.06.1964 Someșeni, Cluj-Napoca	4	1-18.81x13.67; 2-17.89x13.61; 3-18.34x14.07; 4-18.63x13.49;
17725	*Acrocephalus palustris* (Bechstein, 1798)	21.05.1956 Amenhaus	5	1-18.48x14.14; 2-16.97x13.2; 3-17.45x14.07; 4-17.62x13.58; 5-16.8x13.72;
17726	*Acrocephalus schoenobaenus* Linnaeus, 1758	12.06.2010 Dumbrăvița, Timiș	2	1-18.26x13.84; 2-18.56x14.38;
17727	*Acrocephalus schoenobaenus* Linnaeus, 1758	1.06.1964 Someșeni, Cluj-Napoca	5	1-17.55x13.67; 2-17.37x13.86; 3-18.18x13.84; 4-17.68x13.69; 5-17.66x13.31;
17728	*Acrocephalus schoenobaenus* Linnaeus, 1758	1.06.1964 Someșeni, Cluj-Napoca	2(2)	1-16.89x13.2; 2-17.43x13.03;
17729	*Acrocephalus schoenobaenus* Linnaeus, 1758	1.06.1964 Someșeni, Cluj-Napoca	5	1-16.9x13.52; 2-16.77x13.71; 3-16.66x13.51; 4- 17.03x13.64; 5-16.58x13.38;
17730	*Acrocephalus schoenobaenus* Linnaeus, 1758	7.06.1964 Someșeni, Cluj-Napoca	4	1-17.22x13.3; 2-18.02x14.05; 3-17.37x13.8; 4-17.2x13.92;
17731	*Sylvia nisoria* (Bechstein, 1792)	19.05.1968 Pădurea Verde, Timișoara, Timiș	3	1-20.11x15.08; 2-18.86x13.84; 3-19.01x14.22;
17732	*Sylvia atricapilla* (Linnaeus, 1758)	1955 No data	5	1-19.05x14.66; 2- 19.15x14.48; 3-18.56x14.91; 4-18.15x14.49; 5-18.82x14.61;
17733	*Sylvia atricapilla* (Linnaeus, 1758)	11.05.1965 Giroda forest	4	1-18.46x13.87; 2-19.15x14.12; 3-19.23x14.37; 4-18.7x14.07;

17734	*Sylvia atricapilla/b* (Linnaeus, 1758)	17.05.1958 Pădurea Verde, Timișoara, Timiș	4	1-18.76x14.64; 2-20.31x14.99; 3-19.09x14.53; 4-19.5x14.8;
17735	*Sylvia atricapilla/a* (Linnaeus, 1758)	17.05.1958 Pădurea Verde, Timișoara, Timiș	5	1-19.32x14.52; 2-19.19x14.33; 3-18.41x14.38; 4-19.17x14.6; 5-19.49x14.54;
17736	*Sylvia atricapilla* (Linnaeus, 1758)	No data	3	1-20.57x14.76; 2-18.82x14.57; 3-20.25x14.74;
17737	*Curruca communis* (Latham, 1787)	05.1964 Gâșteni, Cluj	5	1-18.22x13.6; 2- 18.02x13.62; 3-19.01x13.65; 4-18.78x13.98; 5-18.29x13.64;
17738	*Curruca communis* (Latham, 1787)	1955	3	1-18.16x14.12; 2-17.63x14.2; 3-18.05x14.12;
17739	*Curruca curruca* (Linnaeus, 1758)	06.1958 Urseni, Timiș	4	1-16.33x12.97; 2-16.73x12.88; 3-16.47x12.76; 4-16.38x12.67;
17740	*Curruca curruca* (Linnaeus, 1758)	12.05.1964 Gâșteni, Cluj	3	1-17.41x12.87; 2-17.29x12.97; 3-17.01x12.94;
17741	*Curruca curruca* (Linnaeus, 1758)	1955 No data	3	1-16.04x12.73; 2-15.96x13.14; 3-16.87x12.36;
	MUSCICAPIDAE			
17742	*Muscicapa striata* (Pallas, 1764)	3.06.1999 Ciupercenii Noi, Dolj	3	1-18.31x13.32; 2-18.32x13.39; 3-17.97x13.23;
17743	*Muscicapa albicollis* (Temminck, 1765)	25.05.1967 Pădurea Verde, Timișoara, Timiș	4	1-17.89x13.3; 2-18.9x13.21; 3-17.87x13.22; 4-17.57x13.33;
17744	*Turdus merula* Linnaeus, 1758	No data	4	1-30.85x21.62; 2-30.45x20.9; 3-30.36x20.57; 4- 27.3x21.69;
17745	*Turdus merula* Linnaeus, 1758	No data	4	1-29.8x21.7;

				2- 30.11x21.57; 3-29.96x21.7; 4-29.11x21.94;
17746	*Turdus philomelos* Brehm, 1831	No data	3	1-26.4x20.18; 2-25.93x20.3; 3-29.01x20.55;
17747	*Turdus philomelos* Brehm, 1831	No data	3	1-24.99x20.18; 2-25.51x20.4; 3-26.72x20.19;
17748	*Turdus philomelos* Brehm, 1831	No data	5	1-27.21x20.62; 2-28.14x20.3; 3-27.13x20.89; 4-26.95x20.28; 5-26.32x20.32;
17749	*Phoenicurus phoenicurus* (Linnaeus, 1758)	10.05.1964 Gâștescu, Cluj	7	1-18.66x14.45; 2-18.27x14.42; 3-18.08x14.27; 4-18.95x14.53; 5-18.6x14.71; 6-18.72x14.44; 7-17.63x14.11;
17750	*Phoenicurus phoenicurus* (Linnaeus, 1758)	1960 No data	6(7)	1-18.18x13.62; 2-19.49x13.47; 3-19.55x13.42; 4-19.25x13.62; 5-19.49x13.68; 6- 18.93x13.46;
17751	*Phoenicurus phoenicurus* (Linnaeus, 1758)	10.05.1964 Gâștescu, Cluj	4	1-17.69x14.19; 2-17.67x13.75; 3-17.36x13.17; 4-17.91x14.22;
17752	*Erithacus rubecula* (Linnaeus, 1758)	6.05.1981 Dracșina	2	1-18.99x14.61; 2-17.38x13.82;
	STURNIDAE			
17753	*Sturnus vulgaris* Linnaeus, 1758	27.04.1958 Urseni forest, Timiș	3	1-29.65x20.79; 2-30.74x20.79; 3-30.35x20.74;
17754	*Sturnus vulgaris* Linnaeus, 1758	24.04.1959 Urseni forest, Timiș	6	1-30.86x20.96; 2-30.58x20.58; 3-32.28x20.88; 4-32.74x21.31; 5-29.84x21.56; 6- 28.85x21.93;

17755	*Sturnus vulgaris* Linnaeus, 1758	24.04.1959 Urseni forest, Timiș	5	1-28.76x21.3; 2-30.99x21.79; 3-28.84x21.61; 4-29.42x21.99; 5-29.13x21.87;
	PASSERIDAE			
17756	*Passer domesticus* (Linnaeus, 1758)	No data	4	1-22.05x15.22; 2- 22.09x15.92; 3-23.92x16.09; 4-19.11x13.89;
17757	*Passer domesticus* (Linnaeus, 1758)	No data	6	1-21.93x16.2; 2-22.28x15.92; 3-23.39x16.24; 4- 22.43x16.25; 5-20.57x16.07; 6- 22.77x15.75;
17758	*Passer montanus* (Linnaeus, 1758)	No data	3	1-17.84x13.97; 2-18.28x14.27; 3-18.55x13.84;
17759	*Passer montanus* (Linnaeus, 1758)	No data	5	1-19.42x13.91; 2- 19.31x14.04; 3-18.31x13.79; 4-18.64x14.17; 5-18.03x13.92;
	FRINGILLIDAE			
17760	*Fringilla coelebs* Linnaeus, 1758	6.05.1956 Pădurea Verde, Timișoara, Timiș	3	1-18.47x14.39; 2-18.17x15.02; 3-18.17x15.02;
17761	*Fringilla coelebs* Linnaeus, 1758	1955 No data	4	1-20.7x15.13; 2-19.8x15.38; 3-20.24x15.26; 4-19.51x15.09;
17762	*Fringilla coelebs* Linnaeus, 1758	7.05.1956 Pădurea Verde Timișoara, Timiș	4	1-19.2x15.64; 2-19.16x14.67; 3-18.42x15.25; 4-19.2x15.57;
17763	*Fringilla coelebs* Linnaeus, 1758	23.04.1956 Pădurea Verde, Timișoara, Timiș	4	1-18.91x14.67; 2- 19.04x14.78; 3-19.11x14.74; 4-18.52x14.63;
17764	*Coccothraustes coccothraustes* (Linnaeus, 1758)	8.05.1958 No data	3	1-23.14x17.45; 2-23.6x18.14; 3-22.99x17.92;

17765	*Coccothraustes coccothraustes* (Linnaeus, 1758)	24.05.1964 No data	3	1-22.36x18.11; 2-23.02x18.21; 3-22.81x18.04;
17766	*Coccothraustes coccothraustes* (Linnaeus, 1758)	22.04.1959 Pădurea Verde Timișoara, Timiș	5	1-22.3x17; 2-23.61x16.73; 3-23.61x16.9; 4-22.26x16.44; 5-23.39x16.32;
17767	*Chloris chloris* (Linnaeus, 1758)	19.05.1964 Students' Park, Timișoara, Timiș	6	1-21.61x15.57; 2-22.04x15.92; 3-22.26x15.53; 4-22.64x15.86; 5-21.98x15.77; 6-22.07x15.64;
17768	*Chloris chloris* (Linnaeus, 1758)	26.04.1959 Urseni forest, Timiș	3	1-20.51x14.04; 2-20.46x13.69; 3-20.35x13.68;
17769	*Carduelis carduelis* (Linnaeus, 1758)	No data	4	1-16.93x12.92; 2-17.96x13.62; 3-17.92x13.9; 4-18.1x13.5;
17770	*Carduelis carduelis* (Linnaeus, 1758)	19.05.1964 Agronomy Park, Timișoara, Timiș	5	1-16.52x12.68; 2-17.78x13.35; 3-16.91x12.93; 4-16.6x12.55; 5-16.64x13.34;
	EMBERIZIDAE			
17771	*Emberiza citrinella* Linnaeus, 1758	1977 No data	1	1-17.93x14.51;
17772	*Emberiza citrinella* Linnaeus, 1758	06.1958 Urseni, Timiș	5	1-21.02x16.81; 2-21.18x16.84; 3-21.39x16.87; 4-20.81x16.66; 5-21.83x16.76;
17773	*Emberiza calandra* Linnaeus, 1758	17.05.2002 Dracșina, Timiș	3	1-22.87x17.63; 2-22.92x17.52; 3-22.8x17.78;
17774	*Emberiza calandra* Linnaeus, 1758	14.06.2004 Căpâlnaș, Arad	5	1-24.69x18.32; 2-23.89x17.75; 3-24.81x18.04; 4-24.55x17.88; 5-24.13x17.81;

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Fig. 4. The Neumann egg collection - general aspect.

Fig. 5. Various eggs of water birds (*Vanellus*, *Chlidonias*, *Himantopus* etc.).

Fig. 6. Various eggs of birds (*Anas, Chroicocephalus, Gallinula, Phasianus* etc.).

Fig. 7. Various eggs (*Upupa, Merops, Asio* etc.).

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Restoration of a woolly mammoth skeleton and its conservation in the permanent exhibition of the Țării Crișurilor Museum, Oradea

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Abstract. The Țării Crișurilor Museum owns the most complete woolly mammoth skeleton from Romania, 1/3 of the bones of a single individual, which were discovered in Oradea. After in situ conservation in 1972 and ex situ restoration, the *Mammuthus primigenius* skeleton was displayed in the permanent exhibition for almost four decades. Due to the ageing of the old adhesives, the tusks and ribs needed restoration several times. In 2006 the exhibition was closed, the skeleton was packed and relocated to the new museum building in 2018. The repeated moving of the packed skeleton, until it was displayed in the new permanent exhibition, resulted in the fracturing of the bones along the areas of former restorations. The skeleton was restored again and displayed in the new permanent exhibition in 2020. The heating system with air convectors of the new location led to a severe decrease in relative humidity (RH). Therefore, a humidifier is operating, and the microclimate values are permanently monitored.

Keywords: restoration, conservation, *Mammuthus primigenius*, relative humidity, temperature

Abbreviation: MTCO – Țării Crișurilor Museum Oradea.

Introduction

Proboscideans are well represented in the Țării Crișurilor Museum's paleontological collection. The following species are present: *Deinotherium giganteum* (Derna), *D. proavum* (Derșida), *Tetralophodon longirostris* (Dijir, Derșida), *Anancus arvernensis* (Huta, Oradea – Viilor Hill), *Mammut praetypicum* (Păgaia), *Mammuthus meridionalis* (Subpiatră, Oradea – Viilor Hill, Brusturi, Drăgești, Balc, Groși), *Mammuthus trogontherii* (Betfia) and *Mammuthus primigenius* (Oradea, Galoșpetreu, Râpa, Sălard, Sîntion, Batăr, Șicula), which cover a timeframe from Late Miocene to Late Pleistocene (Jurcsák 1983, Jurcsák & Moisi 1983, Codrea et al. 2005). The most outstanding specimen of proboscideans in our museum is an almost complete skeleton of *Mammuthus primigenius,* discovered in Oradea in February 1972, during construction work at the former Beer Factory. This location is well known today as the Lotus Center.

The fieldwork at the Beer Factory, conducted by Tiberiu Jurcsák, was extremely well documented for 1972, all taphonomical information being recorded. The skeletal remains were found dispersed but in recognizable association, at 5 m depth in an area measuring 19.5 m x 16 m. The bone bearing sediment consisted of loess, laid on gravel, deposited within the former terraces of the Criș River. Anatomically adjacent elements articulated when brought together were consistent in size and ontogenetic age (Jurcsák & Moisi 1983). It was therefore evident that all these bones pertained to a single young wholly mammoth individual, which is the best-preserved specimen in Romania. A total number of 136 skeletal elements and bone fragments were initially recovered and marked on the field map, comprising 31 skull fragments, 16 vertebrae and fragments of neural spines and arches, 36 ribs and rib fragments, 10 bones of the right forelimb, 11 bones of the left forelimb, 10 bones of the right hindlimb and 7 bones of the left hindlimb (Jurcsák & Moisi 1983). Due to weathering and subsequent compaction of the sediment, the bones were mechanically weak and vulnerable once excavated due to the low temperature in February. The excavated skeletal remains were very friable and wet, saturated in water, and the large bones were deformed due to the weight of the overlaying sediments (Jurcsák & Moisi 1983).

According to Jurcsák & Moisi (1983), the bone surfaces were cleaned by brushing and covered with wet sheets of cellophane to block the rapid evaporation of the water. The cellophane sheets were covered with wet cheesecloth and the bones were plastered to protect them from freezing. The jackets of larger bones, such as the tusks, pelvic bones, femora, and humeri, were strengthened with iron bars, bolted around the plastered specimens. The plaster jackets also maintained the mechanical integrity of the bones (Fig. 1) during lifting and transportation and allowed the bones physical protection until they could be opened in the museum's building under a more controlled microclimate. A four-week period followed, to offer stability to the enclosed bones to dry up and acclimatize to the new conditions before the jackets were removed and restoration begun (Jurcsák & Moisi 1983).

The plastered bones were deposited up-side down at floor level (14-16^{o}C) and left to dry up for four weeks. After drying up all exposed bone surfaces were impregnated with a weak solution of nitrocellulose lacquer dissolved in acetone (4-10%). To consolidate the porous interior of large bones, their surfaces were perforated and consolidant was poured through the holes in the interior of the bones. The plaster jackets were gradually removed, and the bones were gradually impregnated with 4-10% solution of nitrocellulose lacquer dissolved in acetone. The corresponding bone fragments were glued together with undiluted nitrocellulose lacquer (Jurcsák & Moisi 1983).

Only 74 determinable bones out of 136 fragments could be restored, representing 1/3 of the skeleton of a single individual. The missing bones, such as tibia, bones of the pes and manus, were completed as artificial copies. The *Mammuthus primmigenius* skeleton was reconstructed and displayed for almost four decades in the permanent exhibition of the Natural Sciences Department hosted in the Baroque Palace. In 2006 the exhibition was closed, the skeleton was packed and prepared for relocation to the new museum building. The repeated moving of the packed skeleton, until it was finally moved to the new museum building in 2018, resulted in the fracturing of the bones along the areas of former restorations, due to the ageing of the consolidant.

Figure 1. In-situ conservation of the wholly mammoth skeleton at the Beer Factory in 1972 (MTCO archive).

Material and method

As information about preparation and conservation of paleontological specimens is extremeley important (Fitzgerald 1988), the examination of formerly used consolidant started with the information regarding preparation tehniques and adhesives used after the discovery of the *Mammuthus primigenius* partial skeleton and during its restoration (Jurcsak & Moisi 1983). In the first restoration process, solution of nitrocellulose lacquer dissolved in acetone (4-10%) was used.

All the subsequent restorations were performed by Elisabeta Popa, who recorded all the processes in the Restoration Data sheet and the Preparation Register. E. Popa used a solution of 3-10% of nitrocellulose dissolved in acetone, to consolidate the exfoliated bone surfaces.

To avoid ageing, two types of consolidants are recently used in the Paleontology Lab, respectively Paraloid B72, supplied as solid pellets, and Mowillith, supplied as powder. Paraloid B-72 is an extremely stable methyl-acrylate copolymer, has a long shelf life, is soluble, removable, and re-workable over time, is resistant to degradation under normal conditions of exposure, and is soluble in acetone, ethyl alcohol, or a combination of those two solvents, as well as in toluene (Davison & Brown 2012). Polyvinyl-acetate copolymer Mowillith has a moderate reversibility, is soluble in acetone and ethanol (Elder et al. 1997), it is less glossy than Paraloid B72 and is easier to dissolve, given its powdery appearance.

Given the large surfaces of the mammoth bones and the short period of time for the restoration process, Mowillith was used as consolidant, dissolved in acetone.

The microclimate of the Paleontology Lab and the Exhibition Room was monitored by measuring and recording the temperature and relative humidity (RH) by spot checks, using an electronic thermohydrometer.

The ageing of the old consolidant

Due to the ageing process of the nitrocellulose lacquer used in restoration of the wholly mammoth skeleton, the joins became brittle and cracked, resulting in the splitting of joins along the former restoration areas. The most affected skeletal parts were the most fragile ones, especially the tusks, ribs, and pelvic bones, which were subjected to stress due to their weight and position on the display and in the wooden boxes, where the bones were packed and stored.

The ageing of consolidants used in paleontological collections, especially in the preparation and restoration of Quaternary vertebrates or sub-fossil bones, caused problems all over the world. Although nitrocellulose was easy to use, easily reversible and offered good joins, was not very stable and became brittle with age (Keene 1987). Elder et al. (1997) provided a Wall Chart for the Society for the Preservation of Natural History Collections on Adhesives and Consolidants in Geological and Paleotological Conservation, including chemical composition, glass-transition temperature T_g, reversibility and solvents. According to this Wall Chart, cellulose nitrates, such as the nitrocellulose lacquer, tends to yellow and deteriorate, and migration or volatilization of plasticizers results in severe shrinkage, potentially damaging the objects (Elder et al. 1997).

The skeleton was constantly restored over time by Elisabeta Popa, and the last restoration of the tusks, ribs, and pelvis dates to 2002. According to the restoration documentation, E. Popa impregnated the bones with a solution of 3 g of nitrocellulose lacquer dissolved in 100 ml of acetone and the fractures were joined with undiluted nitrocellulose lacquer. The join areas and deeper cracks were filled with gypsum. Over time, nitrocellulose used as consolidant showed considerable ageing.

Restoration of the skeleton

In 2007 the skeleton was packed and prepared to be moved to the new location of the museum. The relocation of the collections and the opening of the museum itself were delayed for almost a decade. The packed large mammoth bones were repeatedly moved from time to time, which implied fluctuations in the microclimate and caused damage to the bones. In 2018 the relocation was finalized, but due to the lack of space in the Paleontology Lab, the effective restoration of the skeleton began only in 2020.

The examination of the conservational state of the bones showed that the following elements were the most affected skeletal parts: left tusk (MTCO 10975/3), right tusk (MTCO 10975/11), parietal fragment (MTCO 10975/62), ribs (MTCO 10975/27, 37, 41, 46, 61, 73, 85, 94, 95, 104, 122), left fibula (MTCO 10975/109), dorsal vertebra (MTCO 10975/124), fragment of the left pelvis (MTCO 10975/124) and the left scapula (MTCO 10975/80), being fractured along the formerly restored areas. This was due mainly to the ageing of the formerly used consolidant, nitrocellulose (Fig. 2), which yellowed, became brittle and showed evident signs of cracking and flaking (Fig. 3). The type of formerly used consolidant was examined, and all the needed information was available in the preparation register and Restoration data Sheet, as well as in the description given by Jurcsak and Moisi (1983).

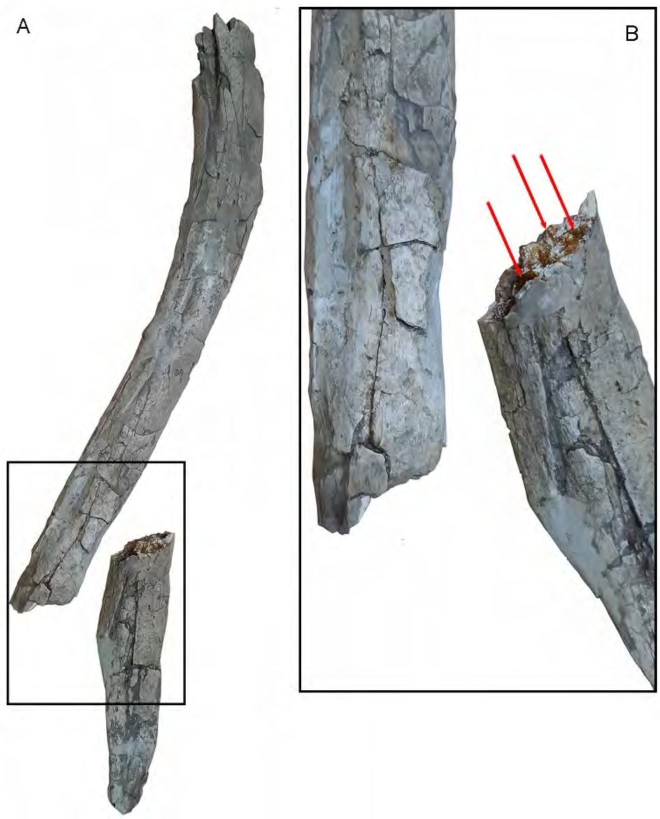

Figure 2. (A) The right dorsal rib (MTCO 10975/122) fractured along the formerly restored area. (B) Detail of the fractured area, arrows indicate the aged consolidant.

Figure 3. (A) Flacking of the left tusk (MTCO 10975/3) due to the ageing of the nitrocellulose. (B) Detail of the fractured area of the left rib (MTCO 10975/37), arrows indicate the brittled consolidant.

After evaluation, the first step was to remove the aged nitrocellulose from the surface of the bones and from the glued fractures. When repairing old fractures, it is important to ensure that all old glues are removed from the joined areas, as they may alter the setting of modern adhesives. Thus, the old nitrocellulose was removed by dissolving it with acetone. This process was time-consuming, nitrocellulose had to be removed from the bone surfaces as well as the fractured areas by gently swabbing with cotton swabs soaked in acetone.

The second step of the restoration was to consolidate the cleaned bone surfaces and the fractured areas, using a solution of Mowilith 3-10% dissolved in acetone. Next, the restorer cemented together the fractured parts by using a highly viscous mixture of Mowilith and acetone (17-50%), in accordance with the weight of the specimen.

The gaps were filled with gypsum, using the same material as the one formerly used in the restoration process (Fig. 4). At the end of restoration, a final consolidation was performed by impregnating the bone and filled surfaces with weak Mowilith (3%) solution dissolved in acetone (Fig. 4).

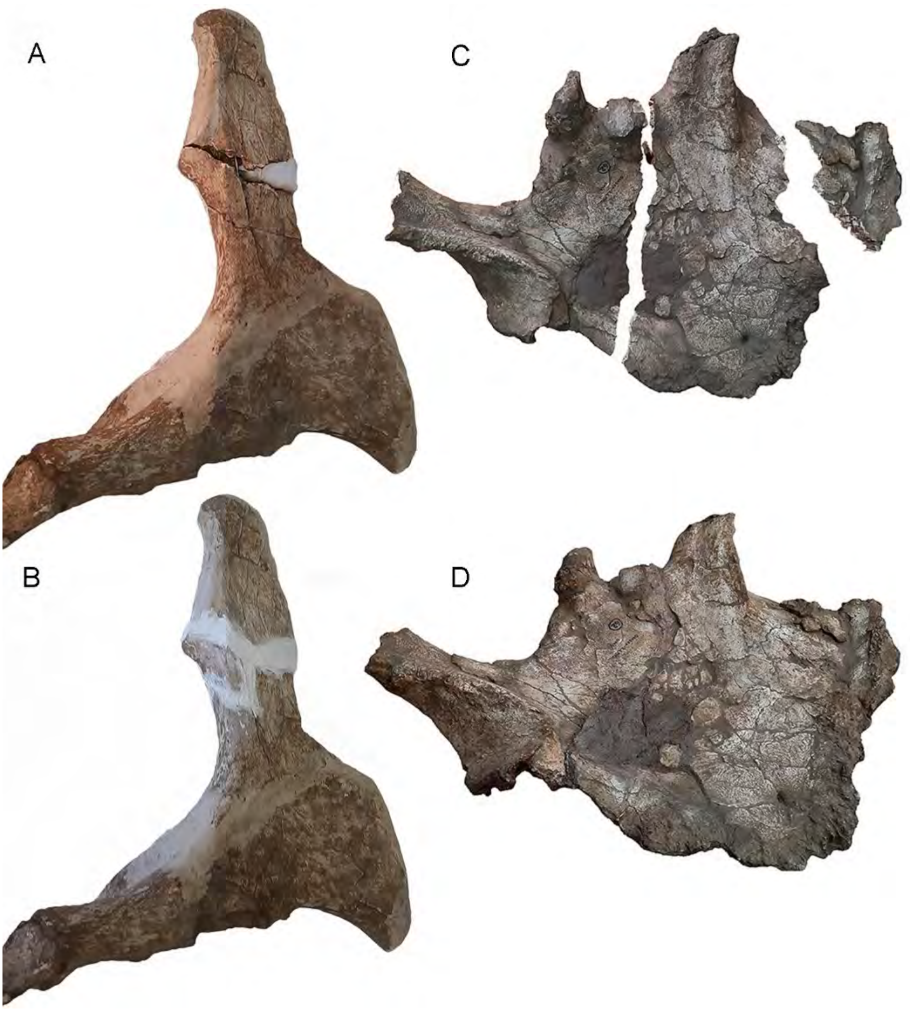

Figure 4. (A-B) Fragment of the left pelvic bone (MTCO 10975/54), before and during restoration. (C-D) Parietal fragment (MTCO 10975/62) before and after restoration.

After restoration, the woolly mammoth skeleton was displayed in the permanent exhibition of the Natural Sciences department of the museum (Fig. 5).

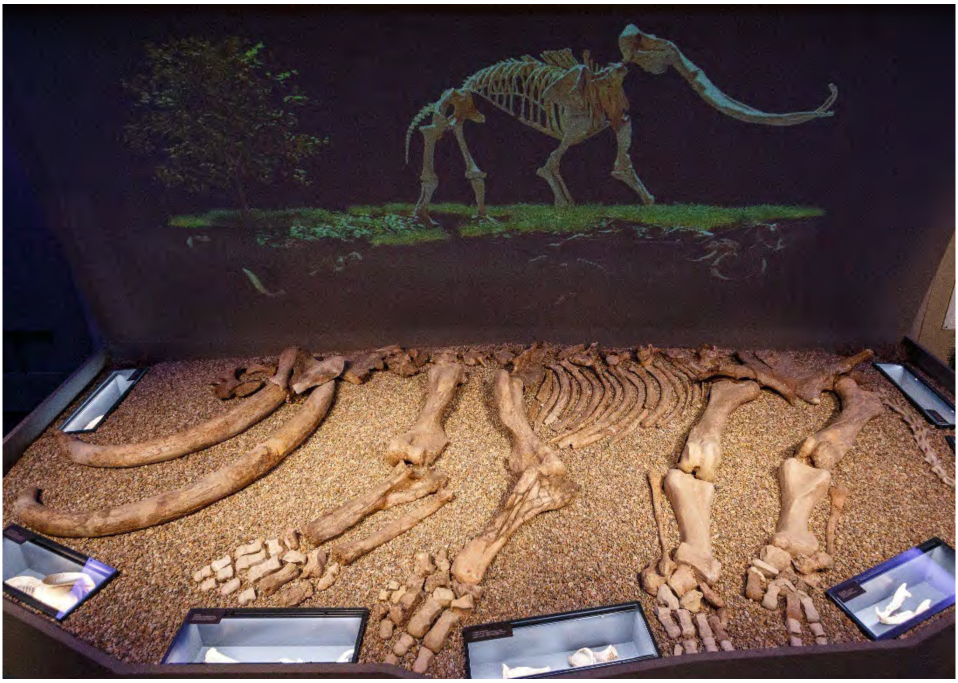

Figure 5: *Mammuthus primigenius* skeleton in the permanent exhibition

Conservation measures in the Quaternary Hall of the Natural Sciences permanent exhibition

Fossils that retain original organic constituents, particularly those from Pleistocene, may be sensitive to ultraviolet lights and high or low relative humidity values. The general rules for curatorial care for geological and paleontological collections recommend humidity levels at 45-55% and the elimination of ultraviolet lights (Cato 1994, Stainley 2004, NPS 2005).

The mammoth skeleton was displayed in the new exhibition, where the microclimate was permanently monitored, knowing that Pleistocene vertebrate fossils are very sensitive to low RH values. The RH values were monitored in the exhibition by daily spot-checks with a hand electronic thermohydrometer. The exhibition room was designed without any source of natural light, to limit UV damage.

The heating system, consisting of air convectors, started to operate in November and reached its maximum capacity in January 2021, leading to a severe drop of the relative humidity (23-28%). Material shrinks and stiffens at low RH, which may be accompanied by fracture sensitivity and embrittlement (Erhardt & Mecklenburg 1994, Erhardt et al. 2007). Low RH values in the exhibition room might affect the old consolidant, namely nitrocellulose, which was used in the former restoration of the mammoth partial skeleton. Long term low RH values might even affect the more stable new consolidant as well, respectively Mowillith, which we recently used in the restoration of bones affected by breakage and exfoliation.

To avoid the consolidant's ageing and to obtain the relative humidity close to 45-55%, a humidifier was installed at the beginning of February 2021. According to the Standard in the Museum Care of Geological Collection, revised by Stanley (2004), controlling humidity by installing humidifiers is efficient and cost-effective, because if relative humidity is held at the required levels, the temperature can be allowed to fluctuate. Our RH controlling system consists of a simple, portable humidifier, which needs maintenance by the museum staff (i.e. filling the empty reservoirs).

The museum uses a central heating system with air-convective heaters and humidifiers, a situation defined by Martens (2012) as Control of Level No. 3: Temperature and simple RH control.

During the operation of the central heating system, the mean RH values without humidifiers was between 23-28%. The conservator monitored the temperature and RH values and the daily operation of the humidifiers for three years. There is a significant improvement of the mean RH values when the heating system is operating. Mean values of RH varies between 38-43% during the winter months, which is closer to the optimal values of 45-55% for paleontological collections (Cato 1994, Stanley 2004). Although the microclimate is not the best in the exhibition, since the operation of the humidifiers there were no severe RH value drops like those recorded before.

Conclusions

Pleistocene vertebrates might show a high degree of degradation in time, due to their porous structure and weak fossilization, as well as the ageing of the consolidants used in their preparation. Any restoration work must start with the identification of the formerly used consolidant, its removal and restoration with more stable consolidants.

The most affected bones of the wholly mammoth skeleton were the ribs, tusks, shoulder blade and pelvis bones.

Microclimate monitoring is very important in any museum collection. Low RH values and fluctuation of the temperature can affect the specimens in the paleontological collections, leading to an accelerated ageing process of the consolidants. The continuous operation of the humidifiers significantly improved the microenvironment of the exhibition room and the conservational status of the wholly mammoth skeleton in the permanent exhibition of the Țării Crișurilor Museum.

Acknowledgements

We would like to express our deepest appreciation to Elisabeta Popa, former restorer at the Natural Sciences Department, who closely supervised the restoration process, even after she retired.

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*** NPS Museum Handbook, Part I, 2005 – Appendix U: Curatorial Care of Paleontological and Geological Collections, U: 1-54.

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