

VERTEBRATE PALEONTOLOGY IN ROMANIA¹

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It is always difficult to date precisely the beginning of a new science in a country. If we consider the first written information on fossil vertebrates that were correctly interpreted as remains of animals from the past, then we should place the beginning of Vertebrate Paleontology on the present territory of Romania at the end of the 18th century. Representative for that period, when the description of fossils was included in the geographical notes is **Johan Fichtel**'s paper in 1780 (1). The paper was read by George Cuvier, the renowned French naturalist, the founder of Comparative Anatomy and of modern Vertebrate Paleontology, who corrected Fichtel's misinterpretation of a tusk tip of *Mammuthus primigenius* as the horn of a unicorn. Such descriptions of fossil vertebrates, mostly represented by remains of large mammals from the Late Tertiary and Quaternary deposits of Transylvania, like elephants, mastodons, bison and rhinos, written in German or French, became more frequent in the first half of the next century. But till the middle of the 19th century no detailed study on fossil bones from Romania was published. In the 19th century the center for searches in Natural Sciences among which fossil vertebrates constitute a distinct topic was the town of Sibiu, at that time one of the most flourishing cultural towns, not only for Transylvania but also for the entire Central Europe. To this town were linked the researches of **Eduard Albert Bielz**, **Michael J. Ackner** and **Ludwig J. Neugeboren**, promoters of the **Society of Naturalists in Sibiu**, established in 1849, all of them fossil collectors, researchers and authors of scientific notes, Bielz and Ackner on Late Cenozoic large land mammals, Neugeboren on Paleogene shark teeth.

L.J. Neugeboren is the author of the first extended study on a group of fossil vertebrates from the Romanian territory, namely on the Eocene shark teeth found near Sibiu at Porcesti (Turnu Roşu) (2). The work represents one of the first studies in the world dedicated to fossil fishes; it followed soon after Louis Agassiz's paper of reference *Recherches sur les poissons fossiles* published in 1833–1834.

The studies on fossil vertebrates turned from an occasional subject to a systematic approach during the second part of the 19th century, in close connection with the setting-up of the first modern universities in Romania, in a chronological order, the universities in Iaşi (1862), Bucharest (1864) and Cluj (1872). The

¹ An outline of this paper was presented as an introductory lecture in the opening session of the 7th European Workshop on Vertebrate Paleontology, Sibiu, 2–7 July 2002.

disciplines of Geology, Mineralogy and Paleontology were taught in all the three universities, within the Faculties of Natural Sciences. It should be mentioned that the first professors of Geology in these universities had Paleontology and especially the Vertebrate Paleontology as the main subject of scientific researches.

Grigore Cobălcescu (1831–1892) in Iași, the author of the first geological paper in Romanian: *Calcarul de la Răpidea* (The Limestone from Răpidea) did important researches on the Sarmatian and Pliocene mollusks, but he did not neglect fossil vertebrates when he found their remains. Thus, in the paper mentioned above he described a molar of a rhinoceros within the brackish Middle Miocene (Sarmatian) limestone with mollusks and gastropods, obviously the tooth being carried in the sea from the surrounding land.

Much more devoted to the Paleontology of vertebrates were **Gregoriu Ștefănescu** (1836–1911) and **Anton Koch** (1843–1927), the first professors of Geology at the University of Bucharest and Cluj, respectively.

Gregoriu Ștefănescu's first paper in the field of Vertebrate Paleontology was published in 1872 in *Revista Științifică* (Scientific Magazine) under the title *Oseminte fosile din România* (Fossil bones from Romania) (3). The paper refers to teeth and bones of some large Tertiary and Quaternary mammals, among which mastodons, elephants, deer, horses and rhinos found in the Subcarpathian region and the Romanian Plain. Later on this study was presented at the Geological Society of France where it enjoyed the interest and appreciation of the French paleontologist Albert Gaudry, at that time one of the greatest authorities in the field of Vertebrate Paleontology. But the name of Gregoriu Ștefănescu will always remain associated with the description of two mammals, the elephant-like *Deinotherium gigantissimum* from the Upper Miocene (Meotian) of Mânzați in southern Moldavia and of a new camel species, *Camelus (Paracamelus) alutensis*, from a Lower Pleistocene terrace of the Olt river, near the town of Slatina (4).

The unearthing of the almost complete skeleton of *Deinotherium* that took three years, from the spring of 1890 till the fall of 1893, left interesting memories, significant for the popular beliefs at the end of the 19th century regarding the large fossils. It took time and the involvement of the local police to recover from the villagers the pieces of the skull, the first part of the skeleton that had been unearthed by a landslide. In the spirit of the common belief at that time, the huge bones that had appeared were interpreted as remains of a biblical giant. To have a piece from this "holy relic", the villagers broke the skull in many fragments and hid them in their houses. After the recovery of the skull fragments and the end of the diggings of the site, the restoration of the complete skeleton of *Deinotherium* took 12 years, till it was installed in the "Grigore Antipa" Museum of Natural History in Bucharest, where *Deinotherium gigantissimum* continues to represent one of the most attractive exhibits.



Fig. 1. – Gregoriu Ștefănescu (1836–1911).

To the restoration of the skeleton contributed Louis de Paw, the curator of the Royal Museum of Natural History in Brussels, the same person who, before coming to Bucharest, coordinated the unearthing of the numerous, almost complete skeletons of the ornithopod dinosaur *Iguanodon* from Bernissart, in south Belgium.

Gregoriu Ștefănescu was more than an eminent teacher and an ardent researcher of fossil mammals. He was also the organizer of the first geological

institution in Romania, *Biroul Geologic al României*, founded in 1882 whose main aim was to work out the geological map of the country, at that time without Transylvania. This first geological map of Romania was printed in 1898 at the scale 1:2,000,000, being included in the new edition of the geological map of Europe.

Gregoriu Ștefănescu attended all the 10 International Geological Congresses that took place between 1879 and 1909, successively in Paris, Bologna, Berlin, London, Washington, Zurich, St. Petersburg, Vienna, Mexico and Stockholm. His participation in the International Congresses contributed to the opening of the Romanian geology and geologists to the world geological debates. An important follow-up of the personal contacts established on such occasions by Professor G. Ștefănescu was the increase of the paleontological collection of vertebrates at the Faculty in Bucharest, numerous valuable casts and replicas from the greatest museums in Europe and America being added to this collection. Among the obtained pieces there are the copy of the Berlin specimen of *Archaeopteryx* and the complete reconstruction of the North American *Phenacodus* (at that time considered to represent the stem of ungulates radiation) that was offered to him by the famous American paleontologist Edward D. Cope.

The researches involved in field for the elaboration of the first geological map of Romania led to a substantial increase of the paleontological collections in universities and museums. This contributed very much to the rise of the public awareness on the fossils significance for the evolution of life, the fossil vertebrates offering the most convincing arguments in this evolution.

As about two thirds of Romania's surface is covered by Neogene and Quaternary sediments, most of the vertebrates found were mammals, both in marine but especially in nonmarine facies. The largest quantity of bones was found in the Upper Pliocene (Romanian) and Lower Pleistocene–Villafranchian deposits. The collections include mastodons, elephants, rhinos, horses, bovids and various fissiped carnivores. Particularly, the modernization of Bucharest as a country capital favored the discovery of a large number of such fossil mammals in the numerous quarries that were opened around the town in connection with the new buildings.

After Gregoriu Ștefănescu, the studies of the Tertiary and Quaternary mammals from the former Kingdom of Romania, including Moldavia, Valachia and Oltenia were continued by **Sava Athanasiu** (1861–1946) and **Sabba Ștefănescu** (1857–1931).

In 1892 **Sava Athanasiu** succeeded Grigore Cobălcescu at the chair of Geology at the University of Iași and from 1910 till 1936 he was in charge of the chair of Geology at the University of Bucharest, succeeding to Gregoriu Ștefănescu. In 1899 Sava Athanasiu defended his Doctoral thesis on the Geology of the Northern part of the Eastern Carpathians. The searches in field related to this study and especially the later ones, when he extended the area of investigations to

the Subcarpathians of Moldavia and Valachia occasioned the discovery of numerous remains of large mammals which he described in several papers. In 1908 Sava Athanasiu published a large paper on proboscideans from the Tertiary deposits thus trying to correlate the Pliocene deposits from the Dacian, Euxinic and Pannonian basins of the former Paratethys (5). The paper include an inventory of the fossiliferous localities with mammals from the Romanian Kingdom.

Sabba Ștefănescu was the first professor of Paleontology at the new chair, created in 1905 at the University of Bucharest, by the division of the former G. Ștefănescu's chair of Geology into three parts: Geology, Paleontology and Mineralogy. In 1910 Sabba Ștefănescu received the directorship of the chair of Paleontology. At that time he was a senior scientist, known especially through the paleontologic and biostratigraphic studies on the Pliocene mollusks that were the subject of his Doctorate thesis, defended in 1896 at the University of Sorbonne. The study that acknowledged Sabba Ștefănescu as an important scientist on fossil mammals is that on Pliocene and Pleistocene proboscideans, a study that included 30 notes grouped under the title *Sur l'organisation des molaires et sur la phylogénie des éléphants et des mastodontes* (6). The results of this study were presented in the meetings of the French Academy of Science.

In Transylvania, the most prolific researcher in Vertebrate Paleontology in the last decades of the 19th century and the first ones of the 20th was undoubtedly **Anton Koch** (1843–1927), the first professor of Geology at the University of Cluj founded in 1872. A. Koch's special interest was focused on the Tertiary mammals on which he published numerous notes and papers. Among the species described by Koch several are of a special interest, either from a phylogenetic or a paleobiogeographic point of view. Such is *Prohyracodon orientalis* from the Upper Eocene of Radaia, near Cluj, one of the earliest species of rhinocerotids in the entire world. Koch gave special attention to the biostratigraphic succession of the vertebrate fossil, being one of the promoters of the Tertiary biostratigraphy of the continental deposits based on mammals. Anton Koch is the author of two books of reference for the Geology of Transylvania: "The Tertiary formations of Transylvania", in two volumes, the first one, published in 1894, focused on the Paleogene, the second on the Neogene deposits being published in 1900 (7, 8). The mammal remains found in the Paleogene and Neogene of Transylvania were exposed in the Collection of Paleontology of the University of Cluj, whose first organizer was Anton Koch.

From the end of the XIXth century and continuing in the first decades of the XXth, the researches in Vertebrate Paleontology became more specialized and outlined the main groups of fossil vertebrates represented in Romania, namely: **Tertiary and Quaternary mammals; Mesozoic reptiles; Fossil fishes** (teleosts and sharks); **Fossil birds**. In this order we shall refer onwards.

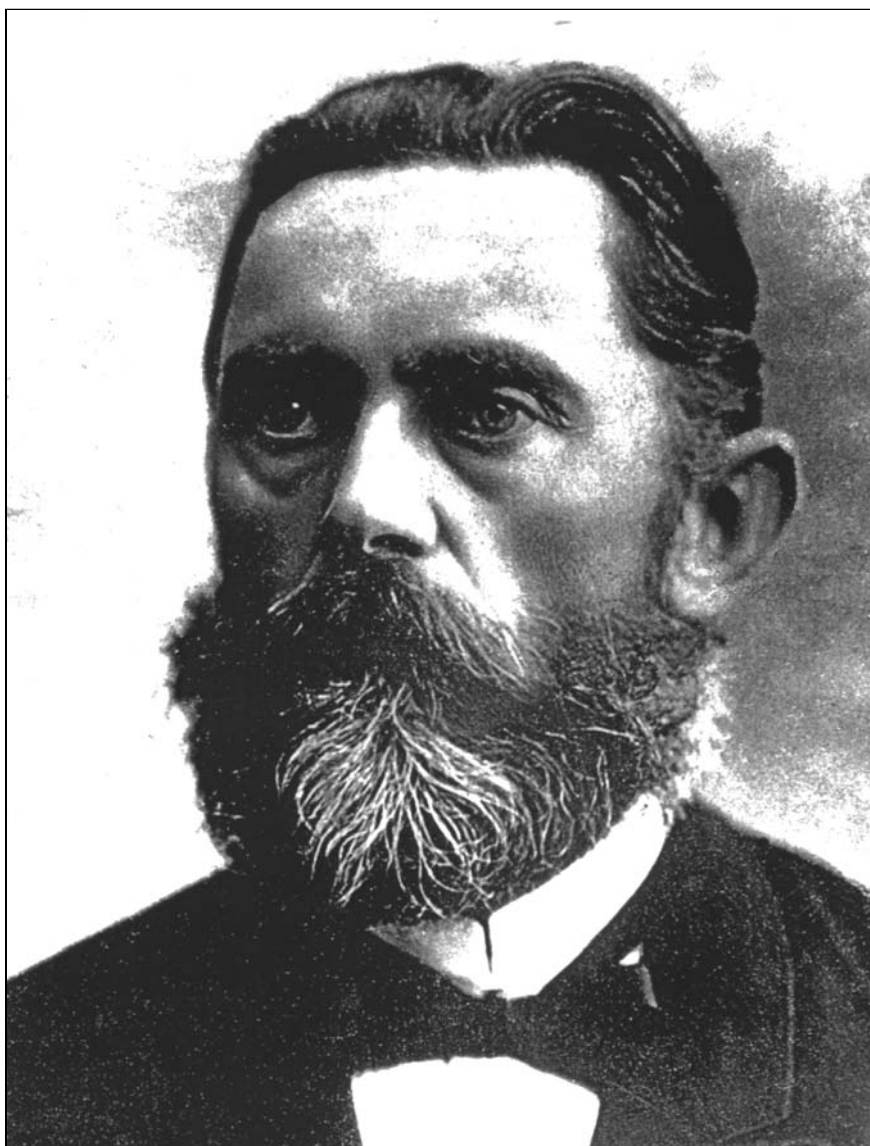


Fig. 2. – Anton Koch (1843–1927).

TERTIARY AND QUATERNARY MAMMALS

A continuer of the forerunners in the study of the Tertiary and Quaternary mammals in Romania, that started to become a traditional subject in the Romanian Vertebrate Paleontology was **Ion Simionescu** (1873–1944), though his wide paleontological work include many other groups of animals.

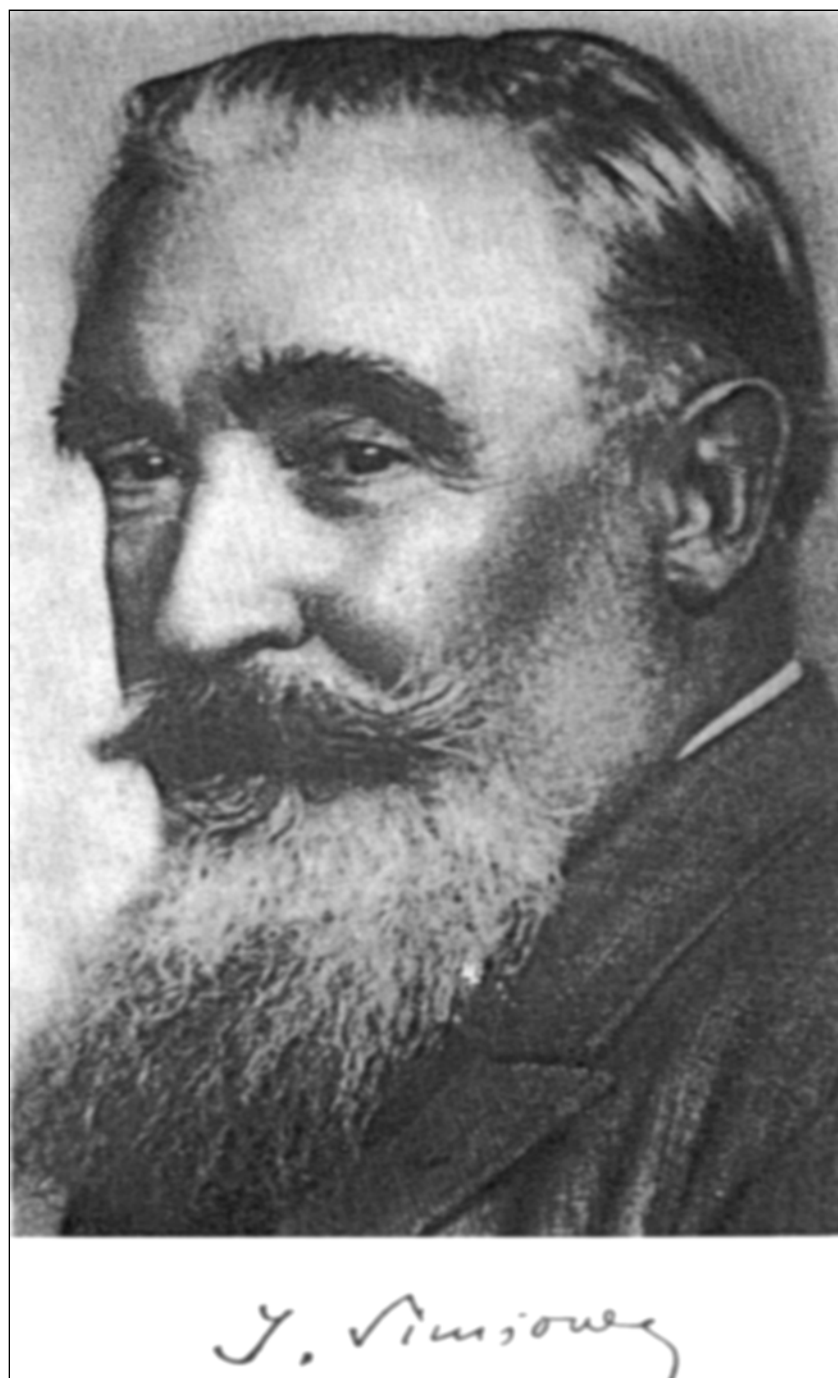


Fig. 3. – Ion Simionescu (1873–1944).

Ion Simionescu started his university career in Iași where, in 1900, he became professor and Chief of the Chair of Paleontology, created after Grigore Cobălcescu's death in 1892. In 1929 Ion Simionescu was appointed titular of the Chair of Paleontology in Bucharest, a position he occupied till 1943 when he retired. That same year Ion Simionescu was elected President of the Romanian Academy, unfortunately he died a few months later, on 7 January 1944.

The groups of organisms Ion Simionescu dealt with are numerous, including algae, corals, ammonites, pelecypods, sea-urchins and various vertebrates. In the domain of paleovertebrates he wrote papers on the Oligocene fishes from Piatra Neamț, on the Triassic ichthyosaurs from North Dobrogea, on a *Megalosaurus* (theropod dinosaur) tooth from the Lower Cretaceous limestone in South Dobrogea. However the study of mammals remains Ion Simionescu's main subject. Following a few notes on Tertiary mammals found in Moldavia (9) he published several monograph studies on fossil mammal faunas, like those on the *Pliocene faunas from Mălușteni*² (10) in south Moldavia and *Cimislia* in Bessarabia, the last one in five parts: I – Carnivores, II – *Helladotherium duvernoyi* (in collaboration with Dr. **Elena Dobrescu**), III – Proboscideans (in collaboration with Dr. **Virginia Barbu**), IV – Rhinocerotids, V – Ruminants (with Dr. **Elena Dobrescu**). Other monographs refer to some species of fossil mammals: *Rhinoceros (Dicerorhinus) mercki*, *Elephas (Parelephas) trogontherii*, *Ursus spaeleus* from the Cioclovina cave, etc. Together with **Franz Reiner**, the well-known Austrian anatomist and anthropologist, Ion Simionescu described the earliest *Homo sapiens* skull from Romania that was found in the cave of Cioclovina³ (11). Ion Simionescu studied also the fossil marine mammals from the Sarmatian deposits: the seals and dolphins from Chișinău, the cetaceans from Balcic, in south Dobrogea.

A few students of Ion Simionescu's studied in their turn the fossil mammals: Elena Dobrescu and Virginia Barbu, already mentioned as Simionescu's co-workers in the study of some groups of mammals from the Pliocene fauna of Cimislia. Virginia Barbu (1905–1997) who was for thirty years professor of Paleontology at the Institute of Petrol, Gas and Geology in Bucharest searched the distribution of the genus *Hypparion* in Romania and Eastern Europe (12). Another student of Ion Simionescu's, Ion Z. Barbu (1903–1988), whose fields of scientific research were not the mammals or other class of vertebrates, but Paleobotany and Micropaleontology that he taught for many years as a professor at the University of Bucharest, left a useful Catalogue of fossil vertebrates from Romania, published in 1930 (13).

Among Ion Simionescu's students, the one who entirely devoted his scientific career to the Tertiary and Quaternary mammals, mostly from the Moldavian Platform was **Neculai Macarovici** (1900–1979), for more than 40 years, professor at the

² The age of the fauna from Mălușteni-Berești was proved to be Lower Pleistocene (Samson P. & Rădulescu C., 1963).

³ The skull was dated recently by radio-carbon that indicates an age of 29,000 years.

University of Iași. He published numerous papers on the mammals of different ages, from Sarmatian to Upper Pleistocene, dealing especially with the taxonomic and biostratigraphic aspects of the mammalian faunas from different fossiliferous localities in Moldavia and Bessarabia. His scientific work also included a synthesis on the evolution of the fossil horses (14) and of the Pliocene and Pleistocene faunas as a whole from Romania (15). Like I. Simionescu, N. Macarovici also studied the marine mammals (seals and dolphins) from the Sarmatian of Chișinau.



Fig. 4. – Neculai Macarovici (1900–1979).

Among the researchers who constantly studied the large fossil mammals, especially the Quaternary elephants and bovids from the Romanian Plain, we should include **Dr. Leonid Apostol**, graduate in 1937 from the Faculty of Geography at the University of Iași and who worked till 1980, when he retired, at the “Grigore Antipa” Museum of Natural History in Bucharest.

The most prolific workers on fossil mammals from Romania in the last four decades were, undoubtedly, **Petre Samson** (1930–2001) and **Constantin (Costin) Rădulescu** (1932–2002). Both were attached, from the beginning of their scientific carrier till the end, to the “Emil Racoviță” Institute of Speleology in Bucharest.



Fig. 5. – Petre-Mihai Samson (1930–2001).

C. Rădulescu took his Ph.D. degree with a comparative anatomical study of the extinct and modern Artiodactyles from Romania, while P. Samson’s doctoral thesis dealt with the fossil horses from the Pliocene and Pleistocene of Romania (**16**), the study

being honored in 1976 with the Prize of the Romanian Academy for paleontologic researches. Most of Costin Rădulescu and Petru Samson's studies were done together in field, digging for large mammals or washing and screening for micromammals. The areas of their researches extends on a large part of the country, including localities in the Romanian Plain and South Dobrogea, Subcarpathian hills of Muntenia and Oltenia, internal depressions from the southern part of the Eastern Carpathians (Brasov, Baraolt, Câmpeni), caves from Central Dobrogea

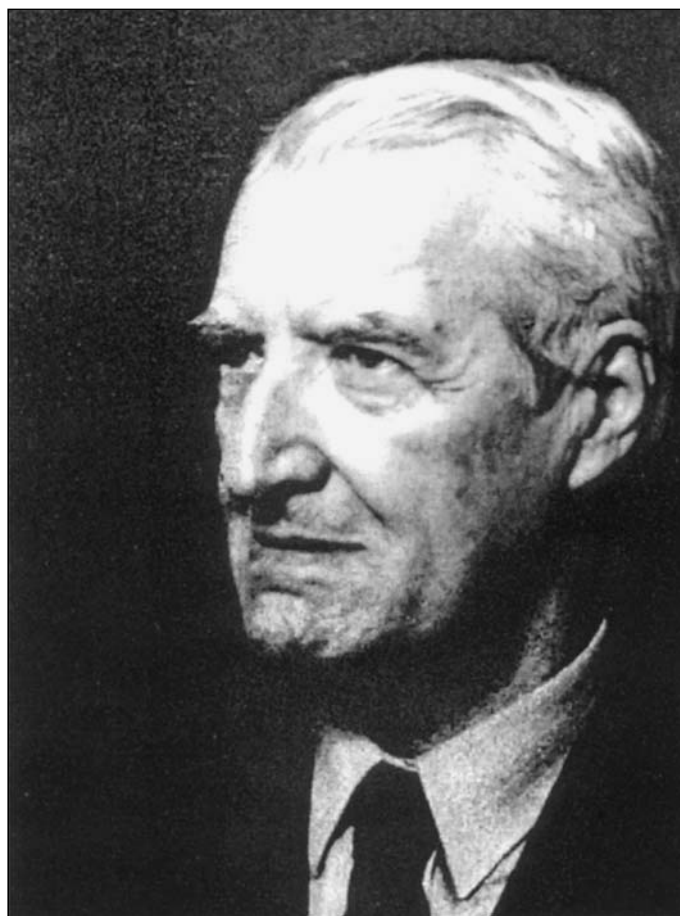


Fig. 6. – Constantin (Costin) Rădulescu (1932–2002).

(La Adam, Cheia, Gura Dobrogei), southern part of the Moldavian platform, localities in the Western Carpathians and Transylvania. As regards the categories of mammals studied by the two authors, these include many orders from the multituberculates to rodents and insectivores, artiodactyles and perissodactyles, embrithopods, proboscideans and primates. The aspects treated in their studies are

the taxonomy and systematic of the groups, phylogeny, biogeography and origin of taxa or faunas (17, 18) Numerous new species and genera (some 60 in total), as well as a new family of multituberculates were described either individually or together by the two authors and it is worth mentioning that all the taxa above the species level were validated internationally.

Among the significant contributions of C. Rădulescu and P. Samson to the knowledge of the mammalian faunas from Romania we should also mention the description made together with Dr. J. Soudre from Montpellier of a new embrithopod, *Crivadiatherium*⁴, from the Upper Eocene/Lower Oligocene deposits of the Hateg Basin. It proved that the embrithopods were not an endemic group for North Africa as thought before. Another important study is that on several well preserved skulls of a cercopithecoid monkey (*Paradolochopithecus geticus* n.sp.) found independently by two scientific teams, one led by Dr. C. Nicolaescu-Plopșor, another by Prof. Olga Necrasova from Iași, to this team were also associated C. Rădulescu and P. Samson. The study was finalized in collaboration with Eric Delson from the American Museum of Natural History in New York.

A major part in P. Samson and C. Rădulescu's work is represented by the researches on the biostratigraphy of the Neogene and Pleistocene terrestrial deposits based on micromammal species zonation, especially rodents, a field in which the two authors should be regarded as forerunners in Romania.

Among the contributions of C. Rădulescu and P. Samson to the development of studies on fossil mammals from Romania one should also include their close collaboration with paleontologists and curators of the collections in the Museums of Natural Sciences. **Mircea Feru** from the Museum in Craiova and **Alexandru Kovacs** from Sfântu Gheorghe-Covasna Museum are among those who benefited from this collaboration materialized in joint publications on Neogene and Pleistocene mammals.

Colleague with C. Rădulescu and P. Samson at the "Emil Racoviță" Institute of Speleology in Bucharest was **Dr. Elena Terzea** who studied large mammals (carnivores, ruminants, elephants, primates) but especially micromammals (rodents and insectivores). For many years she worked on the micromammals from Betfia caves, near Oradea, trying to clarify the biostratigraphy of the Biharian international stage of Lower Pleistocene, whose stratotype was located here by Milos Kretzoi. Elena Terzea published also a synthesis on the evolution of the Pliocene and Pleistocene mammal faunas in Romania (19).

Studies on Tertiary and Quaternary mammals are currently undertaken by Drs. Vlad Codrea from the University of Cluj and Emanoil Stiuca from the "Emil Racoviță" Institute of Speology in Bucharest. Vlad Codrea published several works and a book (20) on the ceratomorph perissodactyles (rhinocerotids and tapirs) from

⁴ The first remains of the new embrithopod were found by Gheorghe and Maria Iliescu during the field mapping in the Hateg region in late 1960s.

Romania and conducted systematic researches in the field on the Paleocene (Paleocene and Lower Eocene) continental deposits from north-western Transylvania with micromammals and other associated vertebrates. Emanoil Știucă studies the Pliocene and Pleistocene Fissipeds which represent the subject of his PhD.

As regards the *marine mammals*, except the already mentioned works of Ion Simionescu and Neculai Macarovici on Sarmatian seals and dolphins, more recent studies were done by **Herman Fuchs** from the University of Cluj on the Eocene sirenians from Transylvania and **Dan Grigorescu** from the University of Bucharest on the Sarmatian seals from South Dobrogea and other regions of the Paratethys sea (21).

MESOZOIC REPTILES

The Mesozoic reptiles in Romania are represented by the Triassic marine forms and Cretaceous terrestrial ones. There is an important discrepancy between the two groups with respect to the frequency of the remains in Romania and, correspondingly, the state of knowledge: the Triassic marine reptiles are very scarce and poorly known taxonomically while the Cretaceous reptiles are quite abundant at both extremities of the Cretaceous period: the Lowermost (Berriasian) and the Uppermost (Maastrichtian), both assemblages including several genera of dinosaurs and flying reptiles (pterosaurs).

The forerunner in the searches of Mesozoic reptiles in our country is **Franz Nopcsa** (1877–1933) who for more than 20 years studied the dinosaur remains found on his family estate from the Hățeg Basin. In 1899, while still being a student in geology at the University of Vienna, Franz Nopcsa presented a paper on a new genus of the “duck-billed” dinosaurs (or hadrosaurs) – *Limnosaurus transsylvanicus*, the genus being renamed two years later as *Telmatosaurus* (22). After graduating in Vienna, Franz Nopcsa started searching intensively the fluvio-lacustrine deposits from the Hățeg Basin of a Danian age, at that time regarded as the final stage of the Cretaceous. From Hățeg he extended the researches to other regions of Transylvania where the continental deposits from the end of the Cretaceous outcrop, among these Vurpar and “Râpa roșie” (“Red Precipice”) near the town of Sebeș. From Hățeg and other regions of Transylvania Nopcsa described five dinosaur species (a titanosaurid sauropod – *Magyarosaurus dacus*, a theropod – *Megalosaurus hungaricus*, two ornithomimids – *Rhabdodon priscus* and the hadrosaur – *Telmatosaurus transsylvanicus*, an ankylosaur – *Struthiosaurus transsylvanicus*) as well as a turtle (*Kallokibotion bajazidi*), a crocodilian (*Allodaposuchus precedens*) and a pterosaur (cf. *Ornithodesmus*). In his studies, F. Nopcsa paid special attention to evolutionary aspects of the individual taxa from the assemblage but also to the whole Transylvanian reptilian fauna from the end of the Cretaceous. He recognized the primitiveness of most of the dinosaur taxa from Transylvania, in spite of their chronostratigraphic position at the end of the Cretaceous (23). Also, the small size of the

adult dinosaurs in this fauna was considered as a biologic response through generations to the limited space on islands. Cases such as dwarfing of the species living on isolated islands with limited areas are well known today, especially within the mammals (pigmy elephants, rhinos or hippopotamus). It should also be mentioned that Nopcsa was a sustainer of the birds' origin from the small running dinosaurs, an idea that is now widely accepted, but it was not so a century ago.

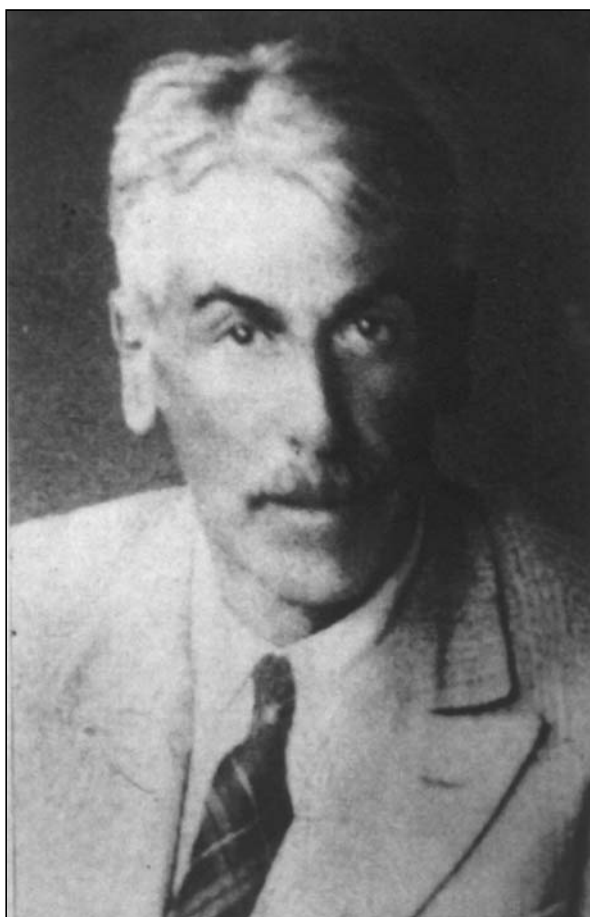


Fig. 7. – Frany Nopcsa (1877–1933).

After Franz Nopcsa, who left Transylvania during the First World War and sold most of his large collection of dinosaurs and other fossil reptiles to the British Museum of Natural History in London, the Latest Cretaceous continental deposits from Hațeg were not searched systematically in the field for more than 60 years,⁵

⁵ Some dinosaur bones were found and given to the Laboratory of Paleontology in Bucharest by Alfred Mamulea who searched for his doctoral thesis the geology of the Hațeg Basin, the results being published in two papers issued in 1953 .

till the late 1970s when the author of the present paper resumed the studies on this fauna and its paleoenvironment (24). Since then the searches continued uninterruptedly till now, each summer students in geology joining the researchers in the field. At the beginning of the new searches in Hațeg, **Ioan Groza** from the Deva Museum also joined the digging team from the University of Bucharest; afterwards he also did individual researches in the field between two consecutive summer campaigns of the University of Bucharest. Thus was made the important paleontologic collection of the Deva Museum whose curator is now **C. Jianu**, who also published together with Dr. David Weishampel from Baltimore notes and papers on individual taxa or on the faunal assemblage.

The new researches, after 1977 added many taxa to the Nopcsa's list of fauna, including several small carnivorous dinosaurs (theropods) and many non-dinosaur taxa: fishes, amphibians, lizards and especially multituberculate mammals, not known before in Hațeg, but also in the entire Upper Cretaceous of Europe. Among the new discoveries of a special interest are the nests with dinosaur eggs and hatchlings remains as well as the giant pterosaur *Hatzegopteryx*, one of the largest flying animal ever known.

The most spectacular discovery of the last years in the Hațeg Basin is represented by the original nests with dinosaur eggs, some of them containing remains of embryos and hatchlings. First discovered at Tuștea in 1988 the number of nests increased very much, from two in 1988 to more than 25 at present, new fossiliferous localities being added to the original Tuștea nesting site on the Râul Mare valley at Totești and Nalațvad by researches done by a Belgian-Romanian team. It is worth mentioning that the very rare known connection of dinosaur eggs and hatchling remains allowed the assignment of the eggs from Tuștea to the hadrosaur dinosaur *Telmatosaurus transsylvanicus* in spite of the morphology of the eggs and eggshell microstructure of a *Megaloolithid* type that seem to characterize the sauropod dinosaurs.

The fauna with dinosaurs from Hațeg – one of the latest in the world before the dinosaurs extinction – attracts through its particular paleobiological implications the scientific interest of researchers not only from Romania but also from abroad. A consistent study on the sauropod dinosaurs and the multituberculate micromammals from the Hațeg assemblage is under preparation by **Zoltan Csiki** from the University of Bucharest. He also studied, alone or jointly, other groups of dinosaurs, especially the small theropods (25) and the microvertebrates from the assemblage. The amphibians and lizards from the micropaleontologic assemblage of Hațeg were studied by Dr. **Marton Wenczel** from the Museum of Oradea, whose main subjects of researches are the Quaternary herpetofaunas.

The other large assemblage with dinosaurs and pterosaurs from Romania was discovered accidentally by two miners while working in an underground mine of bauxite at Cornet, from the Pădurea Craiului Mountains in Western Carpathians, almost at the same time as the resumed researches in the Hațeg Basin in 1977.

The bauxite deposit enclosed disarticulated bones of dinosaurs and pterosaurs – more than ten thousands bones or bone fragments were extracted from the hard matrix⁶ representing the weathering products of the Uppermost Jurassic (Tithonian) limestone during an uplifting episode, dated presumably as Beriasian. The fossils were studied and published in several articles by **Tiberiu Jurcsak** (1926–1992) and his colleagues from the Museum of Oradea, **Elisabeta Popa** and **Eugen Kessler**; fossils from the same deposit were also searched and published by **Dan Patrulius** and **Florian Marinescu**, both from the Institute of Geology in Bucharest. The bone assemblage from Cornet is dominated, like in other Wealden type of faunas in the world, by the remains of the ornithopod dinosaurs. At Cornet they are represented by a small species of a camptosaurid, still unnamed, and a dryosaurid – *Valdosaurus*; possibly the ornithopod assemblage also includes a species of an iguanodontid (26). These ornithopods are the subject of the PhD thesis of **Erika Pozmosanu** from the Museum of Oradea, under preparation; together with E. Cook from Bristol, she studied also the taphonomy and identified some pathological aspects on the bones (27). The dinosaur assemblage from Cornet also includes a nodosaurid ankylosaur and a small, undetermined, theropod. The second, most frequent group in the bauxite from Cornet, after the ornithopods, is that of the pterosaurs. The “flying reptiles” seem to be represented by several taxa, but till now only two forms could be assigned to the genus level: *Dsungaripterus*, also known from China and *Gallodactylus* (28). The fossil assemblage from the bauxite of Cornet also seems to include a few species of birds which, taken into account the exceptional rarity of the Lower Cretaceous birds in the fossil record, would increase very much the scientific interest of this fauna. These birds will be presented in the section dedicated to them in this article.

As regards the *Triassic marine reptiles* from Romania, they are known by a few vertebrae from the Middle Triassic of Hagighiol in North Dobrogea that were assigned to a small ichthyosaur by Ion Simionescu in 1913 and by much more remains found in the Middle Triassic (Anisian) marine deposits of the Western Carpathians, at Lugaşu de sus and Pestiş, near Aleşd town in the Bihor County. The fossil remains were found by **D. Istocescu** in 1968 and studied by **Tiberiu Jurcsak**, **Radu Huza** and **Erika Tallodi-Pozmosanu**, all from the Museum of Oradea (29). They identified in the assemblage skeletal fragments of an ichthyosaurid, a turtle, three species of placodonts, four sauropterygians among which two nothosaurid species, two species of thecodonts and a cervical vertebra considered to belong to the bizarre long-neck lizard-like *Tanystropheus*.

FOSSIL FISHES

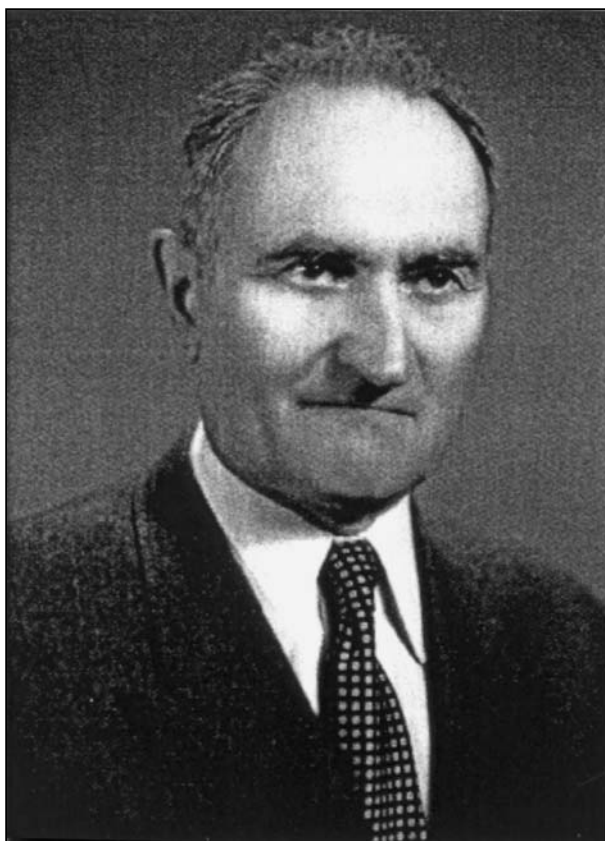
The fossil fishes are represented in Romania mostly by Oligocene teleost fishes and Eocene shark teeth, much more rarely being reported ganoid

⁶ The preparation of the thousands of bone fragments embedded in the hard matrix of bauxite, took several years, being done together by T. Jurcsak and Elisabeta Popa from the Museum of Oradea.

paleonisciform fishes in the Permian of Banat or Upper Cretaceous teleosteans from the Babadag Basin in North Dobrogea.

Contrary to such very rare occurrences, the **Oligocene teleosteans** are commonly found as impressions of some parts of the skeleton, sometimes of the entire skeleton, throughout the Paleogene flysch zone of the Eastern Carpathians, in the Getic Depression and in Transylvania. The common facies in which the remains are found is that of black schists (“dyssodilic schists”) generated under reducing geochemical condition. Such remains were found during the field excursions and deposited, without taxonomic identification in the paleontologic collections of the universities and museums. Only few papers, written by N. Cosmovici and I. Simionescu were devoted before 1930 to the Oligocene teleosts, from the Piatra Neamț region, one of the richest in fossil teleosts.

Fig. 8. – Mircea Paucă
(1903–1988).



The systematic study of these fossil fishes from Romania was initiated and continued for many decades by **Mircea Paucă** (1903–1988). In his doctoral thesis on the Oligocene fishes from Suslănești-Muscel, elaborated under the scientific

guidance of the well-known Austrian paleobiologist Othenio Abel and defeated in Vienna in 1930 (30). Mircea Paucă described several new species and drew some conclusions on the origin and ecology of the Carpathian Oligocene ichthyofauna. He sustained the dominance of the tropical forms within this ichthyofauna and the mixture of autochthonous (Carpathian) elements with allochthonous ones originating in the Indian and Atlantic Oceans (31).

More recently, the teleost fishes from the Oligocene bituminous facies of the Eastern Carpathians were the subject of three doctoral theses presented by **Mircea Ciobanu** in 1975 (32) and **Sorin Baci** (in 2001), both from the Museum of Natural Science in Piatra Neamț and by **Paul Constantin** (in 2000) from the Institute of Geology and Geophysics in Bucharest. A young and promising researcher on fossil fishes is **Paul Dica** from the University of Cluj, who is preparing a PhD study on the Paleogene fishes from Transylvania. Occasionally, papers and notes on teleost fishes, mainly from the Oligocene but also of other ages (Cretaceous, Pliocene), were presented by **Natalia Paghida-Trelea**, **Dan Grigorescu**, **Titus Brustur**, **Iulian Huica**.

Another large category of fishes, **the sharks**, known in the fossil record mostly by their bony elements (the teeth), are commonly found in Romania, especially in the Eocene deposits of the shelf zones, well represented in the Getic Depression and the Transylvanian Basin. In spite of their abundance, no detailed study was made on fossil sharks from Romania since Neugeboren's paper in 1850, except **Rodica Ciobanu's** study from Sibiu, linked with her PhD thesis "Paleogene sharks from Romania", defended in Cluj in 1998 (33).

FOSSIL BIRDS

The record of fossil birds in Romania extends in age from the Lowermost Cretaceous (almost the age of the oldest fossil birds known in the world) to the Holocene. However the Cretaceous birds from Romania are still controversial, two species of pretended owls and a pelecaniform, all from the Maastrichtian fauna with dinosaurs from the Hațeg Basin being already rejected as small theropod dinosaurs. As regards the Lowermost Cretaceous birds, they were mentioned from the bauxite deposits of Cornet in the Western Carpathians within the fossil assemblage dominated by the ornithomimid dinosaurs. Three species of birds were identified by Drs. **Eugen Kessler** and **Tiberiu Jurcsak**, on the basis of limb bone fragments: *Archaeopteryx* sp., *Palaeocursornis biharicus*, a flightless bird from the Ratite group and *Eurolimnornis corneti*, a grebe-like bird (34). The dispute among the avian paleontologists still continues around the validity of these taxa and even on their avian origin. If the identification of taxa is correct, then in the Beriasian bauxite from Cornet are present together the oldest paleognath (*Palaeocursornis*) and the oldest neognath (*Eurolimnornis*).

The record of the Paleogene birds from Romania is very scarce, including only two species, a pelican-like *Eostega* from the Upper Eocene of Mănăştur-Cluj and a corncrake-*Rallierex* from Cetăţuie-Cluj, both described by Karl Lambrecht in 1929.

The Miocene birds are known both from ichnofossils (footprints) and bone remains. The first ones include feet impressions preserved in the peritidal and lagoonal mudstones from the Subcarpathian regions of Moldavia and Muntenia. Such footprints of periaquatic birds were described by **Mircea Paucă** in the early 1940s and two decades later by **Nicolae Panin** and **Emil Avram**. A rich association of aquatic and periaquatic birds, including at least 9 species was described on the basis of skeletal fragments by **Dan Grigorescu** and **Eugen Kessler** from the Sarmatian littoral sands of Credinţa and Ciobăniţa localities in South Dobrogea (35). The association includes species of sulids, cranes, storks, albatrosses and various wild-ducks and geese. A few birds are also known from the Pliocene deposits of Derna-Tătăruş in Bihor county and Măluşteni in Vaslui county. The last locality, that includes also the Lower Pleistocene, yielded a steppe association with bustard (*Otis*), *Palaeortyx* and *Corvus*, identified by **Dr. Eugen Kessler** from the University of Cluj. He also studied especially the Pleistocene avifaunas from Romania (36), the best preserved, with the largest number of known species, found both in outcrops and cave deposits. In her PhD thesis dedicated to the Pleistocene avifaunas of Romania (2002), **Erika Gall** from Cluj inventoried 120 species in the Lower Pleistocene (all of them represented in Betfia – the richest known assemblage of fossil birds from Romania) and 111 species in the Upper Pleistocene.

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