

Review of invertebrate and vertebrate paleontological types in the collection of the Hungarian Natural History Museum

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Abstract – The Hungarian Natural History Museum recently published a catalogue of invertebrate and vertebrate type specimens in its collection. This listing, which contains 2,017 inventory lots and 1,181 fossil species-group taxa, is analyzed here. Ranking of authors and distribution of types by year of description, taxonomic groups, geologic age, geographic and stratigraphic origin are annotated. Most of the observed patterns are correlated with the scientific activities of the most productive authors. Key areas of strengths of the type collection include Paleogene foraminifers, Paleogene and Neogene molluscs and decapod crustaceans, and Quaternary mammals. Taxonomic revisions have been ongoing and more work is needed on some parts of the collection. The catalogue supersedes the relevant part of a previous listing compiled by BODA and published in 1964, and significantly surpasses its information content. With 14 figures.

Key words – Type specimens, catalogue, invertebrate paleontology, vertebrate paleontology, revision.

INTRODUCTION

Type specimens constitute the scientifically most valuable part of any paleontological collection. The International Code of Zoological Nomenclature (ICZN) (INTERNATIONAL COMMISSION ON ZOOLOGICAL NOMENCLATURE 1999) clearly outlines the responsibilities of public collections with regards to primary and secondary type specimens. Every effort should be made to properly curate and store these specimens and make them available to the wider scientific community. The Department of Paleontology and Geology of the Hungarian Natural History Museum

(PG-HNHM) houses a large number of both invertebrate and vertebrate types. Until recently, no up-to-date and publicly accessible type catalogue existed and our in-house inventory system, based on hand-written books, did not facilitate easy listing and retrieval of type specimens. To better serve the research needs of the Hungarian and international paleontological community, both the publishing of a printed catalogue and developing and maintaining a web-based, searchable database were identified as important goals as we entered into the new millenium. An enduring effort by museum curators and staff, aided by scientists of the Research Group for Paleontology of the Hungarian Academy of Sciences–HNHM, led to the recent publication of a printed type catalogue (PÁLFY *et al.* 2008) which is also available on-line from the HNHM website (www.nhmus.hu). This compilation provides a comprehensive listing of invertebrate and vertebrate paleontological types in the HNHM. It includes type specimens preserved in the collection as well as those types, which are known or believed to be lost or missing, but were attributed in the original publications either to our museum or its ancestral mother institution, the Hungarian National Museum (HNM).

The type catalogue itself is largely restricted to presenting the relevant information for each type specimen. The main purpose of the catalogue is to help making our paleontological heritage more accessible. However, a synoptic review and a multi-faceted assessment of the type collection may also be of interest. Hence the main aim of this paper is to summarize the basic facts about the type collection and to highlight its scientific value by presenting various analyses about the distribution of types according to author, year of description, taxonomic group, geologic age, geographic and stratigraphic origin. The content of the type catalogue is compared with the relevant part of its predecessor, the catalogue of BODA (1964). The losses in the type collection and the effect of known revisions are also considered and some interesting miscellaneous aspects are discussed.

Amid growing interest in studies of the history of biodiversity, repositories of paleontological types are increasingly sought to aid taxonomic work. This contribution, through its in-depth analysis and presentation of our type collection, is expected to stimulate ongoing and new descriptive paleontological studies, encourage authors to deposit their type material in the PG-HNHM, and stimulate revisionary taxonomic work on the existing type collection.

HISTORY OF THE COLLECTION AND THE DEVELOPMENT OF THE TYPE CATALOGUE

The eventful history of the paleontological collections of the HNHM from the earliest 19th century beginnings within the HNM through the late 20th century is summarized by KECSKEMÉTI & NAGY (1987). The collections of HNHM survived the World War II with relatively minor losses but during the Hungarian uprising in October 1956, a fire destroyed a major part of the collections and resulted in massive damage. Unfortunately this also led to the destruction of a large number of type specimens. The types believed to be permanently lost at this or other events are included in the type catalogue with the appropriate remark. After 1956, a new inventory of the surviving collections was started. Meanwhile the remaining part of the collections was supplemented by generous donations from other institutions and new acquisitions from a vigorous paleontological research program. Further type specimens were obtained in both ways.

The first modern effort to build a catalogue of type specimens is the work of BODA (1964) that includes types described from Hungary in the paleontological literature up to 1960, housed in either of the two main type repositories of the country, the HNHM and the Geological Institute of Hungary (GIH). No update of the catalogue of BODA (1964) was published in the following 40 years. Developing a card-catalogue of type specimens in the HNHM had been carried out for internal use by former staff member I. Z. NAGY but his project has not been completed. Our recent effort used that card catalogue as a starting point and supplemented it by data culled from the literature. For the first time, a digital catalogue of the paleontological types was compiled and made available to the scientific community through a searchable database on the worldwide web in 2004.

Subsequently, the PG-HNHM collections were moved to temporary premises in 2005 and, shortly afterwards, to the newly renovated home of the department in 2006. Packing, moving, unpacking and rearranging of the entire collection necessitated a quick and rudimentary computerization of our holdings. During this process we discovered that the web-based type catalogue was far from complete and a significant number of type specimens were omitted.

An additional problem arose regarding the different status of types. Numerous taxa, which lack formal holotype designation but have figured member(s) of their type series, were listed in BODA (1964) with holo- and paratypes, but these had to be reinterpreted as syntypes following the ICZN. Significant effort has been made to recognize original type series and many specimens have been added to the list as additional syntypes or paratypes, even if they were previously unlabelled as types but have to be regarded as such according to the ICZN.

Prior to publication of the catalogue (PÁLFY *et al.* 2008) we took several steps towards completeness: 1) we gleaned further data from the primary paleontological literature; 2) we included all types discovered when handling every specimen during the move of our collections; 3) we reprocessed the catalogue of BODA (1964) in search of possible types existing in our collections but unknown at that time; 4) we culled the hand-written inventory books in search of possible hints for the type status of specimens; and 5) we critically reviewed the material donated after 1956 by the GIH and the Eötvös University of

Budapest, as these important historical collections contain previously unrecognized type specimens.

The PG-HNHM collection grew and reached its present state through more than two centuries of hard collecting and scientific work, during an often turbulent history. A multi-year project to build a database culminated in the publication of the comprehensive type catalogue. Although the listing itself is the key product of this effort, the dataset deserves a closer look from different aspects and more complex evaluation, which are attempted here.

ESSENTIAL NUMBERS ABOUT THE TYPE COLLECTION

The type catalogue of PÁLFY *et al.* (2008) records a total of 2,017 inventory lots, which contain primary or secondary type specimens in the collection of PG-HNHM. Types of 1,181 fossil species-group taxa are listed in the catalogue, of them 986 are invertebrates and 195 are vertebrates. Considering their taxonomic rank, 872 are at the species level and 309 are subspecies. A total of 1,132 taxa have or should have name-bearing primary types in our collection (including a replica of a holotype). An additional 49 taxa are represented by their secondary type(s) only. Discounting the specimens that are missing, lost or have been transferred to other institutions, the catalogue includes primary types of 919 taxa available in the collection. When both primary and secondary types are considered, 963 taxa have existing type specimens whereas types of another 218 taxa have been missing or are permanently lost. These essential indicators are shown in Fig. 1.

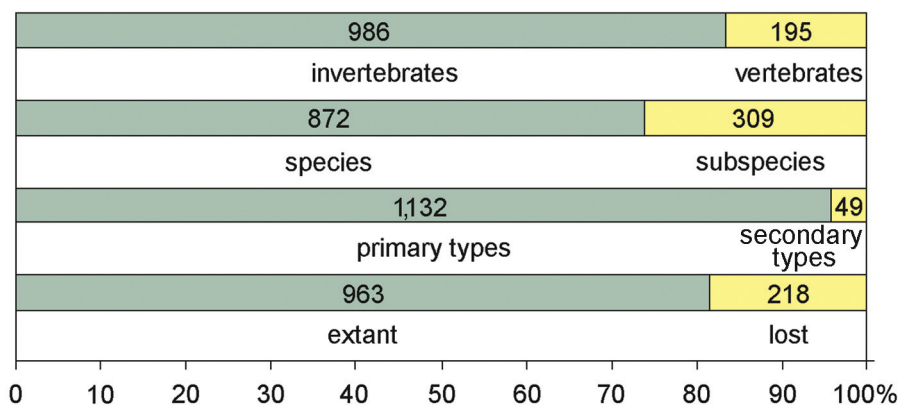


Fig. 1. Essential data of paleontological types in the collection of the Hungarian Natural History Museum

DISTRIBUTION OF TYPES BY AUTHORS AND YEAR OF DESCRIPTION

Specimens became types through the descriptive works of paleontologists who were either connected with the museum through their careers, or whose collections were added to our holdings at some later time. The value of our collections, and that of the type collection in particular, is thus directly related to some outstanding persons. Naturally, their scientific interest determined what they worked on, thereby distributions by most other aspects analyzed in this paper (i.e. by taxonomic groups, geologic age, geographic and lithostratigraphic origin) are correlated to some extent to the significant persons who added types to our collections.

Altogether 101 paleontologists are authors of our types, in 103 different combinations of authorship as individuals or teams. There are 20 authors who registered at least 12 new taxa each. (In the entire dataset analyzed here, the rounded mean number of taxa described by an author happens to be 12, whereas the median is 3.) Together, they are responsible for 83% of all taxa considered here. The contribution of these most prolific authors (in terms of number of new taxa erected) is shown in Fig. 2. The observed pattern in author productivity is discussed later.

Obviously, the number of new taxa can be a misleading indicator of the true value of someone's scientific contribution, therefore a few comments are warranted here. The three most prolific authors indeed made seminal contributions to Hungarian paleontology. In his monographs of Oligocene molluscs, NOSZKY (1936, 1939, 1940) employed a somewhat narrow species concept, therefore subsequent taxonomic revisions of BÁLDI (1973, 1986) synonymized several of his subspecies or species.

CSEPREGHY-MEZNERICS, a former head of the department, published a suite of monographs and shorter papers on Neogene molluscs from Hungary. MÜLLER, although never employed by the HNHM, donated to our department the Eocene and Miocene decapod crustacean material, including types of numerous taxa introduced in his monograph and a series of papers. SZÖTS is ranked fourth in our list but his type material is split between the GIH and HNHM. In fact the more valuable figured material of his monograph is mostly kept at the GIH, but the institute donated parts of the type series (which invariably lack designated holotypes) to the HNHM after 1956. Mostly Triassic radiolarian types of species described by KOZUR and coworkers represent the currently most dynamically growing part of the type collection. BÁLDI continued the monographic work on the rich Tertiary mollusc fauna, previously studied by NOSZKY and a few other workers, with impressive and lasting results. Much more controversial is the legacy of KOLOSVÁRY, who erected new species of corals, balanids and other groups on often dubiously preserved material in a series of papers. The validity of many of his taxa has been debated. Unfortunately, types of as many as 21 of his taxa can no longer be found in the collection. The Coquand Collection has a more complicated history than his collector, the eminent 19th century French paleontologist H. COQUAND, hoped for and set out in his will. Purchased by a donation of A. SEMSEY for the GIH, a large part of the collection, including many types, were transferred to the HNHM to alleviate the losses of 1956 (BÁCSKAY 1994). HANTKEN is considered the founding father of Hungarian micropaleontology, hence his type material

is of great historical and scientific value. Although types of seven of his species are lost, the preserved material, including the original nummulite preparations of his award-winning collection in unmistakable green cells, represents unique value. The fate of the somewhat younger and less significant foraminifer collection of FRANZENAU is much less fortunate, with only three types remaining and 28 lost. The work of three outstanding figures of 20th century Hungarian vertebrate paleontology – KORMOS, KRETZOI and JÁNOSSY – is nearly equally well represented in the type collection. Together they form the most sought after and frequently consulted part of our vertebrate collection. An emblematic figure of Hungarian geology, L. LŐCZY described an interesting suite of Paleozoic fossils from China, collected during a pioneer expedition of Count B. SZÉCHENYI in East Asia (LŐCZY 1899). Although this material was supposedly deposited in the HNM, currently nothing is known of its fate and whereabouts, thus presumed lost. The opposite is true for the classical shark tooth collection of NEUGEBOREN (1850, 1851) from Transylvania, which was assumed to have vanished but a significant part turned up in the HNHM when we scrutinized the little known parts of the collection in search of types. The monographs of GÉCZY, devoted to the diverse Jurassic ammonoid faunas from the Bakony Mts., report 10 primary types deposited in the HNHM. In fact these are now in the GIH collection, together with the other holotypes from his works. Our museum only possesses paratypes of two of these and eight other taxa. SZALAI is one of only three paleontologists (beside GAÁL and KRETZOI), who described both new vertebrate and invertebrate taxa from our collection. Apart from his better known turtles, he also named some Tertiary molluscs and crinoids. Our list of “top 20” authors also includes two recently retired colleagues from the HNHM; during their long career TOPÁL described several new fossil bat taxa, whereas KECSKEMÉTI’s work focused on Eocene larger foraminifers. A dozen new taxa of Triassic megalodontid bivalve are the legacy of E. VÉGH-NEUBRANDT (deceased in 2008), former professor of the Eötvös University, who generously donated her entire fossil collection to HNHM.

The paleontological literature, in which the invertebrate and vertebrate taxa represented by types originally or subsequently deposited in the HNHM collection were introduced, consists of more than 250 items and spans 167 years. The oldest work dates back to 1841 in which COQUAND describes new Cretaceous aptychus species from the French Alps. The latest publication considered in the catalogue appeared in February 2008. Of course the type collection continues to grow; already several new taxa with types in our collection have been published since the catalogue was completed.

The temporal distribution of types according to the year of description is analyzed using a histogram with decadal bins (Fig. 3). During the peak period of classical monographic works in the late 19th century and at the turn of the century, most of the paleontological material from the historical Hungarian territories was deposited in the geological surveys, the GIH in Budapest and the Geologische Reichsanstalt in Vienna. The HNHM’s role was relatively subordinate at that time. The largest peak in our collection occurs in the middle part of the 20th century, from the 1930’s through the 1960’s. The leading figures of these activities are NOSZKY and CSEPREGHY-MEZNERICS. From the 1970’s, research directions have diversified and the emphasis has partly shifted away from descriptive work to biostratigraphy, paleoecology, and paleobiogeography. Currently there is again a renewed interest in taxonomic paleontology and monographic works, partly explained by the focus on understanding the diversity history of important clades of fossil organisms.

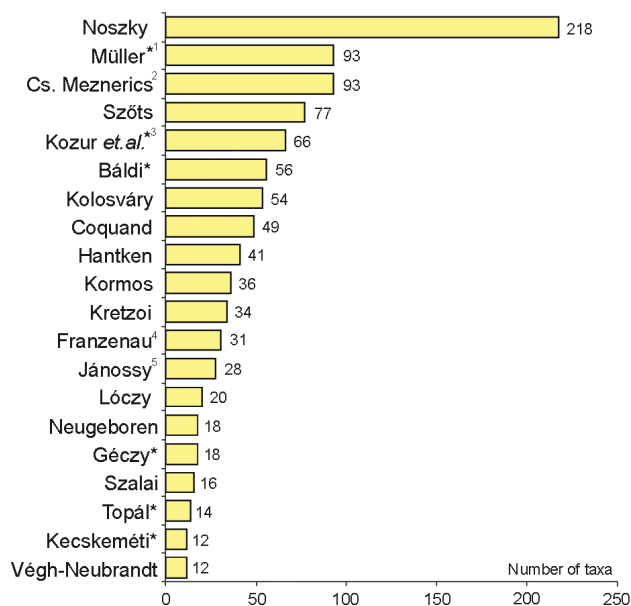


Fig. 2. Number of taxa, whose types are or previously were in the type collection, erected by different authors. Chart shows the contribution of the 20 most prolific authors. ¹ includes taxa authored by MÜLLER and MÜLLER & COLLINS; ² author's name varies (CS. MEZNERICS, CSEPREGHY-MEZNERICS, MEZNERICS); ³ includes taxa authored by KOZUR, MOIX & MOSTLER, and KOZUR, MOIX & OZSVÁRT, and KOZUR & MOSTLER; ⁴ includes two species authored by FRANZENAU & MAJZON; ⁵ includes three species authored by JÁNOSSY & VAN DER MEULEN. Still active workers are marked with an asterisk

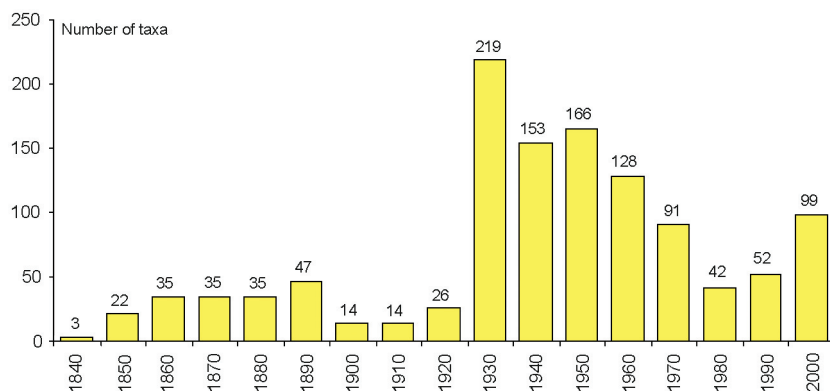


Fig. 3. Distribution of number of taxa, whose type is or previously was in the type collection, by year of description, arranged in decades

DISTRIBUTION OF TYPES BY TAXONOMIC GROUPS

The department's holdings are divided into two main parts: the collection of invertebrates and vertebrates. In total there are more than 72,000 invertebrate and close to 19,000 vertebrate inventory lots. Type specimens thus represent approximately 1.4% of the registered invertebrate and 1% of the vertebrate specimen lots.

The invertebrate part of the type catalogue, within primary chapters by geologic age, is arranged secondarily by taxonomic subdivisions. We use the following, well-known and well-represented groups, arbitrarily taken from higher taxa at the phylum, class, or order level: Radiolaria, Foraminiferida, Anthozoa, Polyplacophora, Bivalvia, Scaphopoda, Gastropoda, Cephalopoda, Annelida, Brachiopoda, Trilobita, Ostracoda, Cirripedia, Decapoda, Crinoidea, Ophiuroidea, Echinoidea. The catalogue of vertebrate types is arranged by higher taxa only, containing subdivisions for "Pisces", Reptilia, Aves, and Mammalia. The obsolete category of Pisces is used here for historical reasons to include taxa from Chondrichthyes and Actinopterygii.

Fig. 4 shows the distribution of types (in terms of number of species represented) among the different higher taxonomic groups. They are arranged in sequence from protists to mammals. Clearly, the main strength of the invertebrate collection is the molluscs, in particular the gastropods and bivalves. (This may explain the tradition that the prefix of our invertebrate inventory numbers is M, for molluscs, rather than I, to match the V prefix in the vertebrate collection.) Four out of the six most prolific taxon authors devoted their careers to malacology. The vertebrate collection is dominated by mammals, and the majority of the 141 mammal taxa in the type collection bear the legacy of three great Quaternary vertebrate paleontologists of the 20th century, KORMOS, KRETZOI and JÁNOSSY.

Foraminifera is fourth in the ranking, owing to a long tradition of research in the museum, starting with HANTKEN in the late 19th century, through contemporary work of KECSKEMÉTI, followed most recently by OZSVÁRT. The more than 100 decapod taxa originate largely from the lifetime contribution of MÜLLER, complemented by a few taxa by his early 20th century predecessors. By contrast, radiolarian studies had no precursors in the HNHM prior to the collaborative work of KOZUR, OZSVÁRT and colleagues, which results in a dynamically growing number of new types in this microfossil group.

Another four groups are represented by 20 to 50 taxa in the type collection: corals, cephalopods, brachiopods, and bony and cartilaginous fish combined.

DISTRIBUTION OF TYPES BY GEOLOGIC PERIODS

The breakdown of taxa by age in the type collection (Fig. 5) to some extent reflects the areal distribution of fossiliferous bedrock in Hungary. Thus the overwhelming majority of taxa are Cenozoic in age, followed by a more modest number of Mesozoic taxa, whereas the entire Paleozoic is underrepresented. The predominance of the Oligocene within the Cenozoic is explained by the "monograph effect", mainly of NOSZKY's work. The Pliocene and Pleistocene comprise mainly vertebrate taxa. Should the Pliocene/Pleistocene boundary be lowered by a pending decision of the International Stratigraphic

Commission, a significant part of the material that we now regard as Late Pliocene in age will be transferred to the Pleistocene.

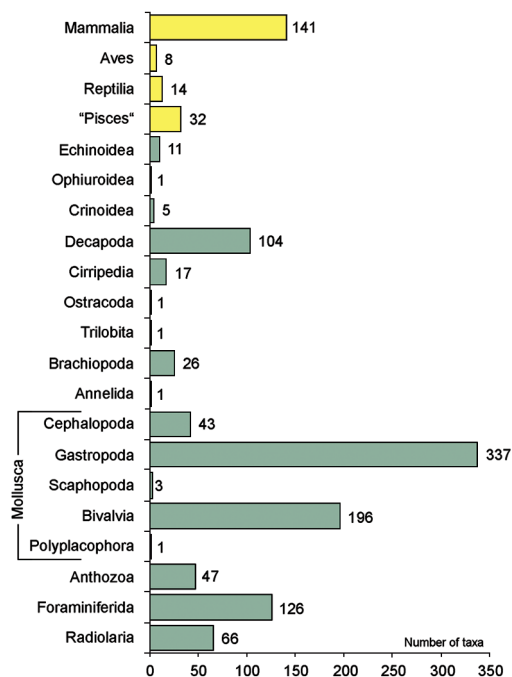


Fig. 4. Distribution of number of taxa, whose type is or previously was in the type collection, by taxonomic groups

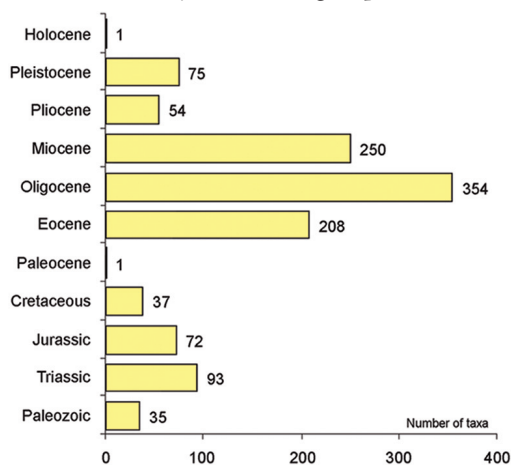


Fig. 5. Distribution of number of taxa, whose type is or previously was in the type collection, by chronostratigraphic units

DISTRIBUTION OF TYPES BY GEOGRAPHIC LOCALITIES AND LITHOSTRATIGRAPHIC UNITS

Not surprisingly for a national natural history museum, almost four-fifths of the taxa are from type localities in Hungary. A significant number of types originate from neighboring countries, mostly from territories which at the time of description of taxa formed part of historic Hungary or the Austro-Hungarian Monarchy: Transylvanian part of Rumania, Slovakia, Croatia, Austria and Serbia (Fig. 6). That the number of taxa described from Turkey surpasses all other foreign countries is due to the recent acquisition of types from an exceptionally rich Triassic radiolarian fauna, published by KOZUR, OZSVÁRT and colleagues. The large number of types from Algeria and France are part of the Coquand Collection. The only other country, which provided a significant number of types, is China, but unfortunately these specimens originating from the late 19th century expedition of Count B. SZÉCHENYI appear to be lost. Ten additional countries furnished types in our collection, albeit each is represented by not more than five taxa.

We attempted to allocate type strata into modern lithostratigraphic units. A total of 70 formations were identified as the provenance of 935 taxa, whereas no unambiguous lithostratigraphic assignment was possible for the remaining 246 taxa. There are 15 formations, which yielded 10 or more taxa with types in the HNHM collection (Fig. 7). Here again the “monograph effect” dominates the observed distribution, pulling the Oligocene Kiscell Clay Formation to the top of the list, followed by the Miocene “Leithakalk” equivalents (Sámsonháza and Rákossziget Formations) and the late Oligocene Eger Formation.

REVISIONARY TAXONOMIC WORK: RESULTS AND FURTHER OPPORTUNITIES

Taxonomy is a scientific discipline, where advances are often made through revision of previously established taxa. During the compilation of the type catalogue such revisions were noted in every case where we became aware of them. An effort was made to search for and consider published revisions. However, the expertise of the catalogue’s authors falls short of covering all ages and taxonomic groups represented in the type collection, hence it is almost certain that we overlooked some existing revisions. With this caveat, revised names are now assigned to 170 taxa, or nearly 15% of the total. More than half of these revisions, involving 90 taxa, are purely nomenclatural in nature, i.e. restricted to changing the generic assignment of species-group taxa through recombination of names. We found 61 cases where the validity of taxa was questioned by the revisers who treated them as subjective junior synonyms of other species. For 17 subspecies there are published opinions, which reject the basis to erect and maintain subspecies, and for 15 of these cases, a new generic assignment is also suggested.

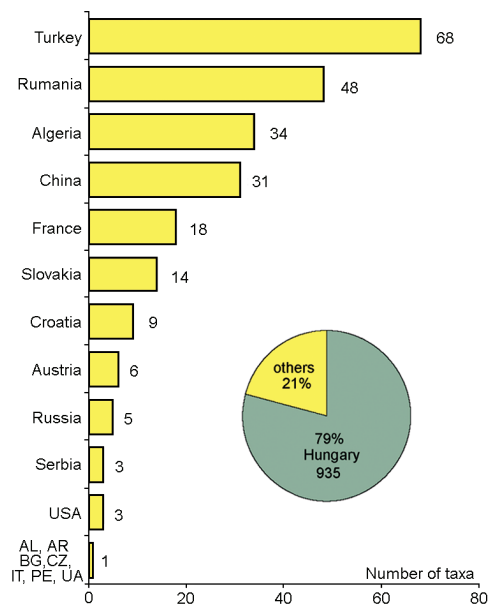


Fig. 6. Distribution of number of taxa, whose type is or previously was in the type collection, by countries of type locality. Abbreviation of countries: AL = Albania, AR = Argentina, BG = Bulgaria, CZ = Czech Republic, IT = Italy, PE = Peru, UA = Ukraine

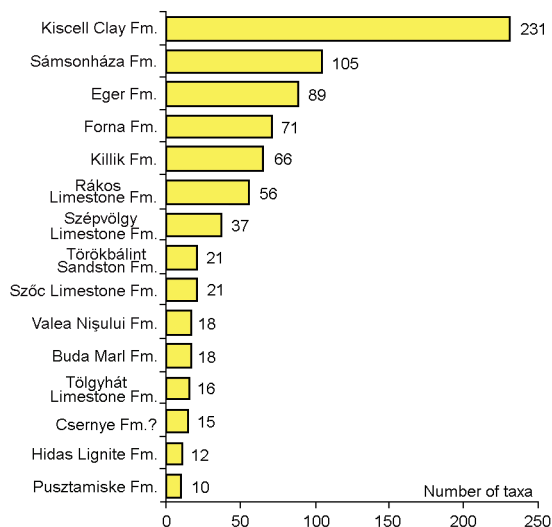


Fig. 7. Distribution of number of taxa, whose type is or previously was in the type collection, by lithostratigraphic units. Only 15 formations are shown, out of a total of 70, which furnished types of at least 10 taxa. Abbreviation: Fm. = Formation

Our in-house scientific staff has been engaged in revisionary work; the example of BÁLDI's revision of NOSZKY's work was already mentioned above. More recent is the revision of Neogene proboscideans by GÁSPARIK (2001) and the as yet unpublished revision of HANTKEN's nummulite collection by KECSKEMÉTI. External experts also take part in these activities, e.g. HANTKEN's smaller foraminifers were revised by HORVÁTH (2002, 2003). The significance of an almost forgotten assemblage of Middle Jurassic cephalopods and bivalves from the Eastern Caucasus (Daghestan, Russia) was recognized during the type catalogue project. The historic collection contains types of PAPP (1907), originating from the pioneer expeditions led to the Caucasus by DÉCHY. The material, once treasured in the GIH, was transferred to HNHM after 1956 and it has now been taxonomically revised by GALÁCZ & SZENTE (2008). International interest is exemplified by ongoing revision of the Neogene pectinid bivalves of CSEPREGHY-MEZNERICS (1960) by O. MANDIC (Vienna), and numerous research visits by foreign taxonomists through SYNTHESYS, an EU-funded project that facilitates collection access.

Despite these areas of progress, several parts of the type collection remain in need of modern revision. An example is the Jurassic fossils described by COQUAND, which furnish several available names that undeservedly fell into disuse simply because of the obscurity of their type material. A similar study on the Cretaceous cephalopod types of COQUAND, housed in the GIH collection, is underway by SZIVES. Also warranted is a comprehensive revision of the coral species erected by KOLOSVÁRY, many of them based on inadequately preserved type material, nevertheless occasionally used by other taxonomists.

Another avenue of research, which has not yet been pursued extensively, is the morphometric characterization of various species based on their type material. Traditionally, most of the diagnoses and original descriptions rely on expert opinions. Modern methods such as geometric morphometrics, landmark analysis, and Fourier shape analysis applied to selected taxa within the type collection could complement and enhance the original descriptions, and help characterize and distinguish taxa on a more quantitative basis.

COMPARISON WITH DATA IN THE TYPE CATALOGUE OF BODA (1964)

The first comprehensive paleontological type catalogue in Hungary was compiled by BODA (1964), with a cut-off date of included information set to 1960. However, merely a few years after the destruction at HNHM, it was not yet possible to locate all specimens or confirm their loss, hence the listing is replete with types of unknown whereabouts. The HNHM received and/or catalogued significant donations from other institutions (notably the GIH and the Eötvös University) after 1960, thus many types entered into our collection after publication of BODA (1964). Moreover, that catalogue is restricted to species described from the territory of present-day Hungary, thereby disregarding a significant number of types from either those parts of historical Hungary, which now belong to neighbor states or countries farther afield. Naturally, a large number of new species has been described from Hungary or by Hungarian paleontologists since 1960.

A comparison of the new HNHM type catalogue (PÁLFY *et al.* 2008) with that of BODA (1964) is summarized in Table 1. Less than half of the 1181 taxa listed in the new catalogue, only 539 appear also in BODA (1964). There is a net growth of 397 taxa that were introduced after 1960. An additional 174 taxa, erected before 1,960, are from type localities outside present-day Hungary, therefore they fell outside the scope of the BODA catalogue. Besides, there are 71 taxa that appear to have been omitted through oversight. Of those previously listed without known repository, types of 129 species are now found in the HNHM collection, whereas 117 remain missing or known to have been lost.

Eighty-three species or subspecies have types listed from other collections that are now deposited in the HNHM, mostly as a result of post-1956 transfers. Eleven taxa had types correctly reported from the HNHM in BODA (1964) that have since become missing. For a large number of species, the status of their type specimens (i.e. holo-, syn-, lecto- or neo-types as primary types and para- or paralectotypes as secondary types) have been updated.

Clearly, much new and updated information is now available. There are only 277 species with complete agreement between the information content of the two type catalogues.

Table 1. Taxa with types in the HNHM collection: Comparison of catalogues of PÁLFY *et al.* (2008) vs. BODA (1964)

According to BODA (1964)		According to PÁLFY <i>et al.</i> (2008)		Invert. ¹	Vert. ²	I+V ³	Total	
Not listed in Boda 1964	Outside the scope	Outside Hungary before 1960		108	66	174		
		Described after 1960	From Hungary	263	62	325		
			Outside Hungary	71	1	72	571	
	By omission			62	9	71	71	
Listed in Boda 1964	As repository unknown	Exists at HNHM	Status of type: same	48	10	58		
			Status of type: different	64	7	71		
		Missing but originally at HNHM	Status of type: same	82	8	90		
			Status of type: different	26	1	27		
	As at HNHM	Exists at HNHM	Status of type: same	169	18	187		
			Status of type: different	8	4	12		
		Missing but originally at HNHM	Status of type: same	7	4	11		
			Status of type: different	0	0	0		
			As elsewhere	Exists at HNHM	Status of type: same	32	1	33
		Status of type: different			46	4	50	539
				986	195	1181	1181	

¹ Invertebrates

² Vertebrates

³ Invertebrates and vertebrates together

Grey-shaded highlight indicates items with complete agreement in both catalogues

MISCELLANEOUS POINTS OF INTEREST

The compilation of the type catalogue revealed the existence of several forgotten type specimens, many of them of historical significance. The birth of Hungarian vertebrate paleontology dates back to the first collecting trip of S. J. PETÉNYI to the limestone quarry of Beremend in 1847. Pliocene and Quaternary vertebrate remains recovered from the remarkably fossiliferous karst fissures have supplied material for several subsequent generations of vertebrate paleontologists. Part of the original material from 1847 survived in the collection and contains several types of different authors (PETÉNYI, NEHRING, MÉHELY, SCHAUB), some of which were previously unlabelled as types or not even registered in the inventory (Fig. 8).

Also found among old, unregistered material are syntypes of a fossil beaver, *Castor ebeczkyi* (Fig. 9) from another famous vertebrate locality, Ajnácskő (now Hajnáčka in Slovakia). The species was erected by KRENNER (1867), who is best known as eminent mineralogist and became the head of the Department of Mineralogy and Paleontology of HNM in 1870. *Mesocetus hungaricus* (Fig. 10), a rare cetacean find described by KADIC (1907), exemplifies the turbulent history of many of the types. Found in 1899 in Borbolya (now in Burgenland, Austria), it was donated to the Royal Hungarian Geological Institute (now known as GIH), where the prepared and mounted skeleton was on display for more than 40 years. After World War II, the GIH no longer wanted to keep the specimen because it was collected outside the present-day borders and thus deemed outside the scope for the GIH. Thus it was transferred to the HNHM, where it was severely damaged in the fire of 1956. Fortunately, the skull and some other bones survived the ordeal.

The Royal Hungarian Geological Institute's collection was also the original repository of some of the famous Late Cretaceous dinosaur and other vertebrate remains from Transylvania, subject of a series of classical papers and monographs by NOPCSA. (However, most of his material is housed in the Natural History Museum in London.) At some time a sauropod limb bone was transferred from the GIH into the HNHM collection. This specimen is regarded a syntype of two nominal species, *Titanosaurus dacus* NOPCSA, 1915 and *Magyarosaurus transsylvanicus* HUENE, 1932 (Fig. 11). A modern revision (LE LOEUFF 1993) treats the two species synonymous and accepts the genus that was erected by HUENE (1932), hence the valid name – and a rather startling combination – is *Magyarosaurus dacus*.

Perumys gyulavarii KRETZOI et VÖRÖS, 1989 (Figs 12–13) is the only type that was collected in South America but this is not the only curiosity of this specimen. Unregistered fossil material from the bequest of KRETZOI, the doyen of Hungarian vertebrate paleontology who deceased in 2005, was received from the HNM. When searching it for possible types, a molar fragment was found, labeled as *Perumys gyulavarii*. Much to our surprise, the fragment fit together perfectly with the figured holotype already in our collection, thus the two fragments complement each other into a nearly complete tooth.

Similarly surprising was the rediscovery of the type of *Rhabdocidaris posthumus* (Fig. 14). The specimen was collected in 1853, during the construction of the tunnel under Castle Hill in Buda, from the Eocene Buda Marl. Although originally described by PÁVAY (1874) as a large, fan-shaped spine of an echinoid, it was consigned to the vertebrate collection during the post-1956 recataloguing effort. Apparently mistaken for a caudal fin of a

fish, part and counterpart was placed in two different drawers within the Tertiary fish collection. There may be one more twist awaiting in the story of this specimen: a revision might prove it to be neither an echinoid spine, nor part of a fish, as some curators now suggest.



Figs 8–14. Photographs of type specimens mentioned in the text. 8 = *Beremendia fissidens* (PETÉNYI in KUBINYI, 1856), syntype, maxilla, V.61.1585, scale bar 0.5 cm. 9 = *Castor ebeczkyi* KRENNER, 1867, syntype, right M^2 , 2007.304.2., scale bar 0.5 cm. 10 = *Mesocetus hungaricus* KADIC, 1907, holotype, skull, V.79.118, scale bar 20 cm. 11 = *Magyarosaurus dacus* (NOPCSA, 1915), syntype (also syntype of *Magyarosaurus transsylvanicus* HUENE, 1932), left fibula, V.60.1709, scale bar 3 cm. 12 = *Perumys gyulavarii* KRETZOI et VÖRÖS, 1989, holotype, left M_2 , V.88.1, occlusal view and 13 = buccal view, note that only the upper part above the fracture was figured in the original description, scale bar 1 cm. 14 = *Rhabdocidaris posthumus* PÁVAY, 1874, holotype, V.61.893, scale bar 2 cm

Apart from such anecdotal curiosities of individual taxa and their type specimens, a synoptic analysis of empirical distribution patterns is also of interest. As noted above, the individual contribution of authors is highly unequal. The distribution of authorship follows the Pareto law, well known from economics and also observed in other social sciences (REED 2001). It is also known as the 80–20 rule, applied to observations where roughly 80% of the effects come from 20% of the cases, such as in the original formulation which reports an observation that 80% of wealth belongs to 20% of the population. In our case, approximately 20% of the authors erected 80% of the taxa. I argue that such distribution of authorship is the master parameter that controls the other analyzed distributions, i.e. by the taxonomic group, age, geographic and stratigraphic origin, where the Pareto distribution also appear to hold (see Figs 2, 4–7) and that may also be termed the “monograph effect”. Similar power law behavior is also noted for many natural phenomena, including biological and paleontological examples such as the body size distribution of animals (MAY 1988) and the frequency and severity of mass extinctions (SOLÉ *et al.* 1997). In the type collection, the Pareto principle acts upon paleontologists whose “wealth” can be regarded in terms of the species described. Although fossils as natural objects could also take part in phenomena exhibiting power law behavior, our observations are explained by social rather than natural scientific factors.

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