

Systematics and Taxonomy of the European Deinotheriidae (Proboscidea, Mammalia)

by Kati HUTTUNEN¹

(With 1 table)

Manuscript submitted on June 12th 2001,
the revised manuscript on December 3rd 2001

Abstract

The study of the original species descriptions showed that many European species were based on a small number of specimens and limited comparisons. Many type specimens mentioned in the original descriptions are no longer available. Currently only two European species are considered valid. The Early to Middle Miocene species *Prodeinotherium bavaricum* and the Middle to Late Miocene *Deinotherium giganteum* can be identified mainly by the cranial and postcranial characters. The interrelationships between the European, African and Asian *Prodeinotherium* and *Deinotherium* species are not known in detail.

Key words: Deinotheriidae, Proboscidea, systematics, taxonomy

Zusammenfassung

Viele europäische Deinotheriidae Arten wurden auf Grund von beschränktem Material oder ohne Vergleiche beschrieben. Viele von den beschriebenen Typusmaterialien existieren nicht mehr. Zwei europäische Arten sind zur Zeit bekannt. Die Früh- bis Mittelmiozäne Art *Prodeinotherium bavaricum* und die Mittel- bis Spätmiozäne Art *Deinotherium giganteum* sind unterschiedlich insbesondere in den cranialen und postcranialen Merkmalen. Die taxonomische Zusammenhänge zwischen den europäischen, afrikanischen und asiatischen *Prodeinotherium* und *Deinotherium* Arten sind noch nicht bekannt.

Introduction

The family Deinotheriidae is characterized by a proboscidean-like skeleton, tapir-like lophodont dentition, and downturned mandibular symphysis with lower incisors. The systematic position of the group was long disputed because the skeletal and cranial characters of Deinotheriidae were unknown (see HARRIS 1978 for a detailed historical overview). Altogether 31 Deinotheriidae species have been described, out of which only six are considered valid today. The type material consists mainly of dental remains from different tooth positions that are of different age and size. At present there are two valid genera: the smaller and older *Prodeinotherium* and the larger and younger *Deinotherium* (HARRIS 1973).

¹ Dr. Kati HUTTUNEN, c/o Geologisch-Paläontologische Abteilung, Naturhistorisches Museum Wien, Postfach 417, A-1014 Wien. – Austria. – e-mail: Kati_jh@yahoo.de

Deinotheres have special cranial and mandibular structures, but otherwise they share most of the typical proboscidean characters. The classical diagnostic characters of the proboscideans are (after LAMBERT & SHOSHANI 1998: 607): 1. Columnar limbs, with proximal elements longer than the distal ones, 2. limb bone shafts lacking medullary cavities, with cancellous bone filling the interior, 3. carpals and tarsals short and broad, 4. skull pneumatized, 5. nasal bones retracted to accommodate a proboscis, 6. premaxilla expanded, 7. I2/i2 enlarged to form tusks, with I1/i1 and I3/i3 absent. 8. canines absent, 9. premolars and molars bunolophodont and composed of plates that form distinct lophs on wear.

Deinotheriidae first appeared in Africa. The earliest *Prodeinotherium* finds from the African Miocene already exhibit the diagnostic characters of the family. Therefore it is assumed that these characters are very primitive and that the earliest evolution of the family took place prior to the Miocene. The dentition and cranium are similar to those of the extinct families Numidotheriidae, Moeritheriidae and Barytheriidae that existed in the Eocene-Oligocene. The similarities are: a flat cranium on its dorsal part, premolars and molars with only two to three ridges with simple cusps, thick enamel (1-5 mm), and vertical tooth replacement. Deinotheres also have the following derived proboscidean characters: slightly elevated skull, pneumatized bones in the cranium, elevated external naris, loss of teeth, long and downturned incisors, tusks in the mandible, a strong medial tubercle on the astragalus, large size and graviportal stance (SHOSHANI et al. 1996: 71).

The Early Miocene species *P. hobleiy* migrated from Africa to the Indian Subcontinent and Europe at ca. 18 Ma ("Proboscidean datum event", TASSY 1989, ANTUNES 1989, RÖGL 1998, 1999, VAN DER MADE 1999), where it supposedly evolved into two different species: *P. bavaricum* (Europe) and *P. pentapotamiae* (Asia). The small genus was replaced by the large genus *Deinotherium* during the Middle Miocene. The origin of *Deinotherium* is still unknown. Three different *Deinotherium* species are currently recognized: *D. bozasi* (Africa), *D. giganteum* (Europe), and *D. indicum* (Asia). Unlike Elephantoidea, Deinotheriidae never migrated to North America. The youngest finds of *Deinotherium* are from the Pliocene of Eurasia (Eastern Europe) and Pleistocene of Africa (HARRIS 1978). The detailed interrelationships between the European, Asian and African *Deinotherium* species have remained unknown.

The latest systematic studies on European Deinotheriidae are those of WEINSHEIMER (1883), OSBORN (1936), GRÄF (1957), BERGOUNIOUX & CROUZEL (1962) and HUTTUNEN (2000). The interpretations have varied between two extremes. Some authors considered nearly all morphological characters to be diagnostic (e.g. GRÄF 1957), while others believed that no constant, diagnostic characters are present in Deinotheriidae dentition (e.g. WEINSHEIMER 1883). No recent publication, however, contains a complete species list with discussions on the validity of the taxa.

The present work summarizes the original descriptions and examines the validity of the taxa. Thus, the history of the European Deinotheriidae research is summarized, new relevant data on deinotheres are presented and a new list of the European Deinotheriidae localities is provided. The synonymy lists are based on the studies of HARRIS (1973, 1978) and HUTTUNEN (2000). HARRIS and HUTTUNEN concluded that there are two genera that can primarily be identified based on their cranial and postcranial morphology.

Spelling of generic names:

The original generic name *Deinotherium* (KAUP 1829) is a combination of the Greek word "deinos" and the Latin word "therium" (in Greek: "thirion"). Several authors have chosen to use the Latin word "dinos" instead of "deinos", but due to priority of the first description the generic name *Deinotherium* remains valid. There is no difference in the pronunciation between *Deinotherium* and *Dinotherium* in Greek (I. GIAOURTSAKIS, pers. comm. 2001).

Systematics and taxonomy

Order: Proboscidea ILLIGER 1811

Family: DEINOTHERIIDAE BONAPARTE 1845

Synonymy: latest synonymy in MCKENNA & BELL 1997: 498-499.

Diagnosis: Large herbivorous graviportal mammals. Dental formula 003/103 for the deciduous teeth and 0023/1023 for the permanent dentition; DP2/2 and P3/3 with well-developed external crest; DP4/4 and M1/1 trilophodont; the remainder of the cheek teeth are bilophodont. Horizontal tooth replacement not developed so that all permanent teeth may be erupted at the same time (cf. elephantoids). Mandibular symphysis and lower tusks curved downwards so that the tusk tips are vertically or nearly vertically aligned. Skull low with deep rostral trough, retracted external nares, low orbit, inclined occiput, high occipital condyles, elongate paroccipital processes, and diplöe (HARRIS 1973).

Genus: *Prodeinotherium* ÉHIK 1930

Synonymy (after HARRIS 1973):

1930 *Prodinotherium* – ÉHIK: 14.

1973 *Prodeinotherium* – HARRIS: 294.

Original diagnosis (ÉHIK 1930: 14)

Revised diagnosis (HARRIS 1973: 293): Small deinotheres. Dental formulae as for the family; M2-3 with well-defined postmetaloph ornamentation. Skull rostrum turned down parallel to the mandibular symphysis; rostral trough and external nares narrow; preorbital swelling close to orbit; external nares anteriorly sited and nasal bones with anterior median projection; skull roof relatively longer and wider than in *Deinotherium*; occiput more vertically inclined; occipital condyles sited more ventrally than in *Deinotherium* and level with the Frankfurt plane; paroccipital processes short. Postcranial skeleton graviportally adapted; scapula with well-defined spine and stout acromion and metacromion; tarsals and carpals narrow but not dolichopodous.

Type species:

1831 *Deinotherium Bavaricum* – VON MEYER (*Dinotherium Bavaricum* 1833, Pl. XXXIV, Fig. 12-15, Pl. XXXVI, Fig. 10-11, 16-17).

Lectotype: right p3 (VON MEYER (1833, Pl. XXXIV, Fig. 12-15) Bayerische Staatssammlung für Paläontologie und historische Geologie, München, Germany, no. AS I 220 (GRÄF 1957: 153).

Type locality: ?Gmünd (now Georgensgmünd), Bavaria, Germany

Remarks: VON MEYER mentioned *D. Bavaricum* for the first time in 1831. A description of the type material followed in 1833. VON MEYER (1833: 508-511) compared the dental remains from Bavaria with the *D. giganteum* (KAUP 1829) teeth from Eppelsheim, Germany and with the *Tapir gigantesque* (CUVIER 1822) teeth from Comminge and Carlat-le-Comte, France. The metric comparisons by VON MEYER showed that the Bavarian and French finds are about one fourth smaller than *D. giganteum* (1833: 511). Therefore VON MEYER recognized a new species *D. Bavaricum*. In addition, VON MEYER considered the shape of the talonid in m3 diagnostic: it is less pronounced in *D. giganteum* than in *D. Bavaricum*. GRÄF (1957) extended the diagnosis for *D. Bavaricum* based on material from the Deinotheriensande (fluvial sands containing both *Prodeinotherium* and *Deinotherium* in Rheinhessen, Germany). Later, HARRIS (1973) identified morphological differences to divide Deinotheriidae into two genera. *P. bavaricum*, being the first description of the small, Early to Middle Miocene Deinotheriidae genus in Europe, became the type species of the genus *Prodeinotherium*.

Synonymy of type species:

1832 *Dinotherium Cuvieri* – KAUP: 14-16.

Syntypic series: Several teeth, originally described as *Tapir gigantesque* by CUVIER (1822, Pl. IV, Fig. 1, 2, 5, Pl. VII, Fig. 2, Pl. VIII Fig. 1, 3, 4)

Lectotype: Left and right mandible fragments from Chevilly, left side with m1-m3, right side with p4, m2-m3. Muséum National d'Histoire Naturelle, Paris, France, no. CHE 13 (MAYET 1908: 200, Pl. VII, Fig. 3).

Type locality: Chevilly, France.

Remarks: KAUP named *T. gigantesque D. Cuvieri* and compared the type material with *D. giganteum* teeth material from Deinotheriensande, Germany (1832: 14-16). Based on a size difference, KAUP described a new species. The size, morphology and stratigraphic distribution of *D. Cuvieri* are similar to those of *P. bavaricum*. Therefore it can be considered synonymous with *P. bavaricum*.

1836 *Dinotherium secundarium* – LARTET: 218.

Paratypic series: several cheek teeth and an incisor from "Department Gers", Simorre and Sansan, France. There is no description available.

Remarks: WEINSHEIMER (1883: 54) notes that LARTET did not mention this species again in his later works. The comparisons by HUTTUNEN (2000) showed that the localities Simorre and Sansan contained only *Prodeinotherium* material. This species is therefore probably synonymous with *P. bavaricum*.

1930 *Prodinotherium hungaricum* – ÉHIK: 14, Pl. 1-4.

Paratypic series: mandible, postcranial elements. In the same work ÉHIK described additional isolated teeth (p3, m2) from the locality Királd. Material not available (destroyed).

Plastotype: Lower mandible with two tusk fragments, left p4-m3, right p4, m2-m3. Natural History Museum, Budapest, Hungary.

Type locality: Kotyháza, Hungary.

Remarks: As an original diagnosis ÉHİK (1930: 14) wrote: "...in p3 the entoconid lays inside of the cingulum and is not in connection with it. Posterior mental foramen falls between the p3 and pm4; the anterior limb is mesatipod opposed to the dolichopod limb of *D. giganteum*". This was also the first description of postcranial material belonging to the small, Early to Middle Miocene Deinotheriidae genus in Europe. The same postcranial morphology (compare diagnosis of *Prodeinotherium*) was later recognized in other European (Franzensbad, Czech Republic; Langenau, Germany) and African localities. HARRIS (1973) demonstrated that this postcranial morphology is diagnostic only at the generic level and considered *P. hungaricum* and *P. bavaricum* synonymous.

1989 *Prodeinotherium petenyii* – VÖRÖS: 101-102, Pl I-V.

Paratypic series: left mandible fragment with p4, m1, m3, no. V.88.5, right mandible fragment with right i2 and left i2, p3-m2, no. V.88.6, Natural History Museum, Budapest, Hungary.

Type locality: Putnok, Hungary.

Diagnosis: VÖRÖS (1989: 101-102): The new species is smaller than the *P. cuvieri-hungaricum* forms. The corpus mandibulae is slender and thin with small tusks and teeth. The mandibular symphysis turns down, does not bend backward. The dimensions of molars comparing to that of the premolars are smaller. The length of m1 and m2 are equivalent. The breadth of m1 equivalent to p4 or somewhat less, the breadth of m2 is slightly wider.

Remarks: The species has a special mandibular symphysis with nearly straight tusks. This symphysis morphology has not been recorded elsewhere. However, GASPARİK (1993) in his description of the Hungarian Deinotheriidae considered this species synonymous with *P. hungaricum*. The tooth morphology and size are, however, similar to the Early Middle Miocene *P. bavaricum* of Europe (measurements of HUTTUNEN 2000).

Other species (Asia):

1876 *Dinotherium pentapotamiae* – FALCONER (1868: 356-372) & LYDEKKER (1876): 54-57.

Synonymy:

1957 *Deinotherium orlovii* – SAHNI & TRIPATHI 27, Pl. 3, Fig. 1-5.

Other species (Africa):

1911 *Dinotherium hobleiy* – ANDREWS: 943-945.

Genus: *Deinotherium* KAUP 1829

Original description by KAUP 1829.

Diagnosis (HARRIS 1973: 292): Large deinotheres. Dental formulae 0023/1023 for the permanent teeth, 003/103 for the deciduous dentition. Tendency for subsidiary styles on

P3-4 and for simplification of the postmetaloph ornamentation of M2-3 when compared to *Prodeinotherium*. Skull rostrum not parallel to the mandibular symphysis and nearly horizontally aligned; rostral trough and external nares wide; preorbital swelling sited anteriorly on the rostrum; skull roof short and narrow at the temporal fossae; occiput slopes gently posteriorly; occipital condyles elevated above the level of the external auditory meatus; paroccipital processes very elongate. Postcranial skeleton with cursorial modifications to graviportal structure; scapular spine with no acromion or metacromion; carpals and tarsals narrow with dolichopodous metapodials exhibiting functional tetradactyly.

Type species:

1829 *Deinotherium giganteum* – KAUP: 401-404, Pl. 1.

Holotype: Hessisches Landesmuseum, Darmstadt, Germany, no. Din 465. Mandible with m2-m3.

Type locality: Eppelsheim, Germany

Remarks: In the original description the lower incisors were reconstructed to point upwards. KAUP gave a correct reconstruction in 1832 (Pl. 1., Fig. 5). In subsequent years (1832-1839) KAUP described several paratypes from the Deinotheriensande localities of Germany, but these descriptions do not give a meaningful diagnosis for the species. GRÄF (1957) divided the same Deinotheriensande material into two species, *D. giganteum* and *D. levius*. The species definitions by GRÄF (1957: 160-162) stressed the importance of size. The morphological characters listed by GRÄF were based on a small number of specimens. The species *D. levius* was later disregarded by HARRIS (1973).

Synonymy of type species:

1833 *Dinotherium medium* – KAUP: 419-420 (1833: 513, Pl. VII, Fig. 2).

Holotype: Left hemimandible with p3-m2.

Type locality: Eppelsheim, Germany.

Remarks: KAUP named a species that is smaller than *D. giganteum*. Later, KAUP himself did not believe that this was a good species (1841a: 45).

1835 *Dinotherii proavi* – EICHWALD: 677-760, Pl. II, Fig. 1-4.

Syntype: Left m1, p4.

Remarks: The m1 specimen from Podolia, Russia, is not necessarily a *Deinotherium*, as noted by KAUP (1841a: 18). EICHWALD proved later (1837) that *D. proavum* is larger than *D. giganteum* from Deinotheriensande. In a description of a Russian *Deinotherium*, BELOKRYSS (1960) did not consider *D. proavum* valid.

1835 *Dinotherii Uralensis* – EICHWALD: 677-760.

Remarks: OSBORN (1935) listed this species with the citation mentioned above. EICHWALD mentioned the species *D. Uralensis* from Ural Mountains, Russia, in connection with a description of *D. proavum*, but considered it synonymous with *D. proavum*.

1837 *Mastodon podolicum* – EICHWALD: 43-44.

Remarks: OSBORN (1935) listed this species from Podolia, Russia, with the above citation. In fact, the citation does not refer to a species description, but to a later comparison between *D. proavum* and *D. giganteum* by EICHWALD (as described above). EICHWALD mentioned the species *Mastodontis Podolici* in 1835, but did not consider it a separate species. In a description of a Russian *Deinotherium*, BELOKRYSS (1960) no longer mentioned this species anymore.

1841 *D. Königii* – KAUP: 19.

Remarks: KAUP described small teeth from the Deinotheriensande, Germany. In a later correspondence (1841: 241) KAUP mentioned that he considers only the species *D. giganteum* and *D. Königii* valid because the size differences between all other species are too small and gradual for species identification. According to WEINSHEIMER (1883:54, Pl. I) the *D. Königii* teeth were deciduous teeth of *D. giganteum* (based on the notes attached to specimens at Hessisches Landesmuseum, Darmstadt, Germany).

1841 *Dinotherium minutum* – VON MEYER: 459.

Holotype: left M1 and a lower tooth fragment.

Type locality: Mösskirch, Germany.

Diagnosis: M1 maximum width 49 mm.

Remarks: According to WEINSHEIMER (1883: 55), only one other author (ZITTEL & VOGELSANG 1867) used this species definition. The tooth size corresponds to *D. giganteum*.

1845 *Dinotherium giganteum* var *majus*, *Dinotherium giganteum* var *medium*, *Dinotherium giganteum* var *minus* – DE BLAINVILLE: 3.

Remarks: DE BLAINVILLE distinguished between different-sized *D. giganteum* individuals. This classification was not used by other authors.

1845 *Dinotherium maximum* – KAUP ?

Remarks: According to WEINSHEIMER (1883: 48) this species was never described by KAUP and DE BLAINVILLE may only have confused the words *maximum* and *giganteum*. There is a citation in DE BLAINVILLE (1845: 18): "*D. maximum* KAUP 1831, (= *D. très-grand*) synonymous with *D. giganteum*?"

1845 *Dinotherium intermedium* – DE BLAINVILLE: Pl. I, III.

Holotype: right hemimandible with p3-m3.

Type locality: Eppelsheim, Germany.

Remarks: DE BLAINVILLE stressed the importance of size in species identification. *D. intermedium* is a name for *D. giganteum* individuals of intermediate size (like *D. medium* KAUP 1833). The taxon is synonymous with *D. giganteum*, if the tooth size variability for *D. giganteum* is considered.

1861 *Dinotherium levius* – JOURDAN: 1011 (DEPÉRET 1887: 86, 115, 190, 192, 192, 195, Pl. 15-16, 18-22).

Remarks: There is no designated holotype in the original description by JOURDAN for the material from La Grive St. Alban, France. DEPÉRET described later a syntypic series of this species from the same locality. Several authors (e.g. GRÄF 1957) considered the species smaller than *D. giganteum* and a transitional species in the lineage between *D. bavaricum* and *D. giganteum*. The same *D. levius* tooth morphology and size are also present in the original *D. giganteum* material from the Deinotheriensande, Germany. The species has been considered synonymous with *D. giganteum* by HARRIS (1973), and by HUTTUNEN (2000).

1892 *Dinotherium gigantissimum* – STEFANESCU: 82 (1894: 176-199).

Remarks: There is no type material description by STEFANESCU from the type locality Gaiceana, Tecuciu, Romania. STEFANESCU described syntypic series from Manzati, Romania, in 1894, including the first postcranial element descriptions belonging to one *Deinotherium* individual. HARRIS (1973, 1978) demonstrated convincingly that the same postcranial morphology and dimensions were also present in the African *D. bozasi*. HARRIS (1973, 1978) considered the postcranial morphology diagnostic for the genus only. As no other diagnostic characters are known for *D. gigantissimum*, HARRIS (1973) believed that this species is a large variety of *D. giganteum*.

1914 *Dinotherium styriacum* – HILBER: 111-132, Pl. 1, Fig. 1.

Holotype: right P3, not available.

Type locality: Oberdorf bei Weiz, Austria.

Diagnosis: Triangular labial wall, no metaloph present. Size as in *D. giganteum* male specimens. Anterior paracone continues to the cingulum. Size P3: length labial 84 mm, lingual 68 mm, width anterior 78 mm, posterior 81 mm.

Remarks: This species has not been described elsewhere. The species is similar to other *D. giganteum* material of Europe (comparisons by MOTTI 1958, HUTTUNEN 2000).

Other species (Asia):

1845 *Dinotherium indicum* – FALCONER: 361, Pl. XIV, Fig. I.

Synonymy (after HARRIS: 1973):

1845 *Dinotherium angustidens* – KOCH: 41.

1868 *Dinotherium perimense* – FALCONER: 415.

1868 *Antogetherium* – FALCONER: 416, Pl. 34, Fig. 1-2.

1880 *Dinotherium sindiense* – LYDEKKER: 196, Pl. 31, Fig. 4.

1908 *Dinotherium náricum* – PILGRIM: 156.

Not a proboscidean:

1843 *Dinotherium Australe* – OWEN: 7.

Other species (Africa):

1934 *Dinotherium bozasi* – ARAMBOURG: 309 (1947: 240-252, Pl. 1, Fig. 1-3).

Synonymy (after HARRIS: 1973):

1935 *Dinotherium hopwoodi* – OSBORN: 117.

Differential diagnoses *Prodeinotherium* vs. *Deinotherium*

Cranial characters: *Prodeinotherium* is characterized by a smaller cranium with rostrum turned down parallel to the mandibular symphysis; the skull roof is relatively longer and wider than in *Deinotherium*. The occipital condyles are sited more ventrally than in *Deinotherium*. In *Deinotherium* the occiput slopes gently posteriorly and occipital condyles are elevated (HARRIS 1973, 1978).

Dental characters: The *Prodeinotherium* type specimen (p3) has parallel proto- and metaconids anteriorly. In the *Deinotherium* p3 the anterior conids are fused to form a single anterior conid.

Postcranial characters: The postcranial skeleton of *Prodeinotherium* is graviportally adapted. The scapula has a well-defined spine and stout acromion and metacromion. The tarsals and carpals are narrow and aserially organized. In *Deinotherium* the postcranial skeleton has cursorial modifications to graviportal structure, the scapular spine has no acromion or metacromion, the narrow carpals and tarsals have an enhanced aserial structure, and the metapodials exhibit functional tetradactyly (MC1 and MT1 are reduced).

Discussion

The above summary of the European Deinotheriidae species shows that most of the original descriptions were based on a small number of specimens, few comparisons and limited stratigraphic calibrations of the type localities. For most species, no holotype was described and the mere size of the dentition was taken as a diagnostic character. For some early authors both the systematic position and the correct number of tooth positions in Deinotheriidae were completely unknown. The validity of the European species has been discussed in several works. The most recent taxonomic revision (HARRIS 1973), including division into two genera, states mainly generic characters for European, African and Asian species. The species diagnoses for the European species have remained poorly defined, and therefore only the first descriptions for the smaller Early to Middle Miocene *Prodeinotherium* and large Middle to Late Miocene *Deinotherium* have remained valid. The current type material of the European species (teeth, mandible fragments) does not provide a sufficient number of constant characters to allow distinct species diagnoses.

In many ways the current state of the Deinotheriidae research in Europe suffers from the same problems as already one hundred years ago: a considerable amount of material has been discovered, but a systematic framework to allow a precise identification of Deinotheriidae material is not available. The works by WEINSHEIMER (1883), OSBORN (1936), GRÄF (1957), BERGOUNIOUX & CROUZEL (1962a), ANTOINE (1994) and HUTTUNEN (2000) have recorded variability at selected European localities. Their results show clearly that the size of the Deinotheriidae dental and skeletal elements increases continuously throughout the Miocene, but the taxonomic interpretations of the authors vary. The most recent comparisons by HUTTUNEN (2000) support the genus diagnoses by HARRIS (1973), but the results do not provide new diagnoses for the European species.

**Country *Prodeinotherium bavaricum* localities
(Early to Middle Miocene) *Deinotherium giganteum* localities**

Country	<i>Prodeinotherium bavaricum</i> localities (Early to Middle Miocene)	<i>Deinotherium giganteum</i> localities (Middle Miocene to Pliocene)
Austria: Vienna Basin and Molasse Zone	Grund, Wilfersdorf, Thallern	Brunn-Vösendorf, Gaiselberg bei Zistersdorf, Kettlasbrunn, Prottes, Wolkersdorf, Bruck an der Leitha, Mannersdorf, Hollabrunn, Türkenschanze, Paasdorf bei Mistelbach, Mistelbach, Hof am Leithagebirge
Austria: Burgenland		Kohfidisch, Wolfau, Breitenbrunn
Austria: Styrian Basin	Seegraben bei Leoben, Hörgas bei Rein, Rosental bei Köflach, St. Oswald, Ilz, Eibiswald, Buchelberg bei Lassnitzhöhe, Breitenfeld bei Reigersburg	Fehring, Fohnsdorf NW, Lichtenberg bei Rauning, Höllgraben (Kornberg bei Feldbach), Hartmannsdorfsberg, Pöllau bei Gniebing, St. Oswald, Buchelberg bei Graz, Schottergrube O von Nestelbach, Pickelsdorf-Hirnsdorf, Woldra/St. Anna, Obergieü bei Feldbach, Edelsbach bei Feldbach, Kapellen bei Radkersburg, St. Georgen, <i>Oberdorf bei Weiz</i>
Bulgaria	Ausakovo, Novo Selo, Sovoljanovo	<u>Eserovo</u> , Luboviste, Nessebar, Temelkovo, Rogosen, Noevci, Mestitzscha, Galata, Kutina, Ijarebichna, Izgrev
France	Beaugency, <i>Chevilly</i> , La Grive, <u>Montreal de Gers</u> , Orleanais, <i>Sansan</i> , Tavers, Pontlevoy, Castelnau d'Arbieu, Fabas, Pépieux, Tournan, Valentine, Le Foussoret, Toulouse, Peyrissas, <i>Simorre</i> , St. Gaudens/Les Pujaments, Castelnau-Magnoac, Carla-Bayle, Valentine	<i>La Grive</i> , Montredon, Valentine, Castelnau-Magnoac, Pimossan, St. Frajou, Vienne, Lombez, Boulogne-sur-Gesse, Escarnecrabe
Germany: Bavaria	Derching bei Augsburg, <u>Untierzolling</u> , Thannhausen, Aultzhausen, Osselthausen, Oberdornbach, Pfaffenzell bei Derching, Oberlauterbach, Rinnenthal, Eidenried, Wulfertshausen, Stätzing bei Augsburg, Oberhausen, Steinkirchen bei Pfaffenhofen, Wachelhofen, Unter-Wohlbach, Junkenhofen, Reichertshausen/Ilm, Ergoldsbach, Rampoldstetten, Uttenhofen, Hoisberg bei Heidenburg, Schachach bei Geroldsberg, <i>Georgensgmünd</i>	Stätzing bei Augsburg, Landshut, Massenhäuser, Hinterauerbach bei Erding, N-Ebing Inn, Stätzing, Fraunberg, Hirschhorn/Eggenfelden, Osselthausen, Rinnenthal, Derching, Wulfertshausen
Germany	<u>Langenau</u> , Deinotheriensande (Alzey/Gaglenberg, Esselborn, Gauweinheim, Wiesberg bei Gauweinheim, Wissberg, Wolfshiem, <i>Eppelshiem</i> , Wahlheim)	<u>Höwenegg</u> , Deinotheriensande (<i>Eppelsheim</i> , Esselborn, Gauweinheim, Wiesberg bei Gauweinheim, Westhofen, Sprendlingen, Wissberg, Dintesheim, Kettenheim), Dorn-Dürkheim
Hungary	Salgotarjan Coalbasin (Etes, Királd, <i>Kotyháza</i> , Szuhakállò, Zagyvapálfalva), <i>Putnok</i> , Salgotarjan (Meszesalja Sandpit), Szurdokpüspöki, Tinnye, Edelény	Baltavar, Edelény, Pannonhalma, Martonvasar-Tarnok, Kemendollar, Sopron-Boor Sandpit, Bötöfa

Table 1: Selected European faunas which include Deinotheriidae species. Generic determination by HUTTUNEN (2000). Underlined localities contain important cranial and postcranial material. Localities in *italics* are type localities.

Geographic and stratigraphic distribution in Europe – a preliminary list

Deinotheriidae remains have been recorded from various European countries. The genus *P. bavaricum* is known from Austria (e.g. HUTTUNEN 2000), Bulgaria (BAKALOV & NIKOLOV 1962), Czech Republic (e.g. HUTTUNEN 2000), France (ANTOINE et al. 1997), Germany (e.g. GRÄF 1957), Hungary (GASPARIK 1993), Portugal (e.g. ANTUNES 1989), Serbia (LASKAREV 1944) and Spain (BERGOUNIOUX & CROUZEL 1962).

D. giganteum has been recorded from Austria (e.g. MOTTL 1969, HUTTUNEN 2000), Bulgaria (BAKALOV & NIKOLOV 1962), Czech Republic (MUSIL 1956, 1959), France (ANTOINE et al. 1997), Germany (e.g. GRÄF 1957), Greece (SYMEONIDIS 1970, TSOUKALA & MELENTIS 1994) Hungary (GASPARIK 1993), Romania (STEFANESCU 1892, MOROSAN 1936), Russia (BELOKRYSS 1960), Serbia (LASKAREV 1944) and Spain (BERGOUNIOUX & CROUZEL 1962).

An updated distribution list for Deinotheriidae in Georgia, Greece, Moldova, Spain, Switzerland, Turkey and Ukraine is available in the online database NOW - Neogene of the Old World of the University of Helsinki, Finland (current web address: <http://www.helsinki.fi/science/now>).

The following locality list is based on the variation studies by HUTTUNEN (2000) that followed the genus diagnosis by HARRIS (1973). The studies were based on tooth size and morphology comparisons between selected European localities.

Conclusions

The synonymy list provided in this contribution completes the works of WEINSHEIMER (1883), OSBORN (1936) and GRÄF (1957), which already discussed the validity of European species based on original type descriptions. The valid European Deinotheriidae species are the older and smaller *P. bavaricum* and the younger and larger *D. giganteum*. The same generic characters are present both in Eurasia and Africa. The most recent variation study on the European Deinotheriidae by HUTTUNEN (2000) supports the diagnosis by HARRIS (1973). In the absence of a species diagnosis for the European species, *P. bavaricum* and *D. giganteum* can only be identified by the generic characters which distinguish *Prodeinotherium* and *Deinotherium*.

Acknowledgments

I thank Mr. I. GIAOURTSAKIS (Bayerische Staatssammlung für Paläontologie und historische Geologie, München) for helpful comments on this manuscript and Dr. W. SANDERS (University of Michigan, Ann Arbor) for reviewing the manuscript. The preparation of this manuscript was supported by the Austrian Theodor-KÖRNER-Award (2001, German project title "Die Systematik der Familie Deinotheriidae [Proboscidea, Mammalia] in Europa").

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