

The early Vallesian vertebrates of Atzelsdorf (Late Miocene, Austria)

4. Testudines

By Massimo DELFINO^{1,2} & Ursula B. GÖHLICH³

(With 1 plate)

Manuscript submitted on October 14th 2008,
the revised manuscript on November 17th 2008

Abstract

Chelonians are represented in the Late Miocene vertebrate assemblage from Atzelsdorf (Austria) by about 100 remains. Although a considerable number of them is not identifiable with confidence below order level, few well-preserved isolated carapace and plastron elements allow to recognize the presence of the extinct tortoise *Testudo* cf. *burgenlandica* and the pond turtle *Mauremys* sp. On the basis of their ornamentation, three tiny shell fragments are tentatively referred to a softshell turtle (*Trionyx* sensu lato).

Keywords: *Testudo* cf. *burgenlandica*, *Mauremys* sp., *Trionyx* s.l., Lake Pannon, Hollabrunn-Mistelbach Formation

Zusammenfassung

Chelonia sind in der Obermiozänen Wirbeltierfundstelle von Atzelsdorf mit etwa 100 Resten nachgewiesen. Obwohl ein beträchtlicher Anteil davon nicht sicher unterhalb der Ordnung bestimmbar ist, erlauben einige gut erhaltene isolierte Carapax- und Plastron-Elemente den Nachweis der ausgestorbenen Landschildkröten *Testudo* cf. *burgenlandica* und der Wasserschildkröte *Mauremys* sp. Anhand der Ornamentierung sind drei kleine Panzerfragmente vorbehaltlich der aquatischen Weichschildkröte *Trionyx* sensu lato zugewiesen.

Schlüsselwörter: *Testudo* cf. *burgenlandica*, *Mauremys* sp., *Trionyx* s.l., Pannon See, Hollabrunn-Mistelbach Formation

Introduction

The Atzelsdorf site is an abandoned gravel pit located about 35 km NE of Vienna in Lower Austria. It is geologically situated at the western margin of the Vienna Basin. The deposits of the Atzelsdorf site belong to the Hollabrunn-Mistelbach Formation, which

¹ Dipartimento di Scienze della Terra, Università di Firenze, Via La Pira 4, 50121 Firenze, Italy; e-mail: massimo.delfino@unifi.it

² Paläontologisches Institut und Museum, Universität Zürich, Karl Schmid-Strasse 4, 8006 Zürich, Switzerland

³ Naturhistorisches Museum Wien, Geologisch-paläontologische Abteilung, 1010 Wien, Burgring 7, Österreich; e-mail: ursula.goehlich@nhm-wien.ac.at

comprises deltaic deposits that were discharged by the paleo-Danube River into Lake Pannon during the Late Miocene.

Biostratigraphic investigations (HARZHAUSER 2009, this volume) and well-log correlations point to a correspondence of the Aztelsdorf fauna with the Vienna Basin Pannonian Zone C, basal MN9, and an absolute age of about 11.2-11.1 Ma (for more details, see HARZHAUSER 2009, this volume).

The presented material comprises fossils from the Natural History Museum of Vienna (NHMW), as well as of the two private collections (colln) G. PENZ (Vienna) and P. SCHEBECZEK (Pelindorf). Fossils of these private collections are for the most part available as casts at the NHMW.

Taxonomic nomenclature follows FRITZ & HAVAS (2007), whereas anatomical nomenclature follows LAPPARENT DE BROIN (2001).

Systematic Palaeontology

Class Reptilia LAURENTI, 1768

Family Testudinidae BATSCH, 1788

Genus *Testudo* LINNAEUS, 1758

***Testudo* cf. *burgenlandica* BACHMAYER & MLYNARSKI, 1983**

(pl. 1, figs 1-4)

M a t e r i a l : Two nuchals (NHMW 2008z0105/0003, cast of colln SCHEBECZEK S160), (2008z0105/0006, cast of colln PENZ), three nuchal fragments (colln PENZ, no No.); two hypoplastrons: left (2008z0105/0004, cast of colln SCHEBECZEK S161), right (colln PENZ, no No.); one right humerus (2008z0105/0005, cast of colln SCHEBECZEK S159), hyoplastron: one left (2008z0105/0001), three 11th peripheral fragments: left (2008z0105/0002), left (colln PENZ, no No.), right (colln PENZ, no No.); two pygal fragments (colln PENZ, no No.); eight peripheral fragments (colln PENZ, no No.); two left xiphiplastron fragments (colln PENZ, no No.).

D e s c r i p t i o n : The nuchal bones are hexagonal, with anterior and posterior sides markedly asymmetrical, being the posterior side, in contact with the first neural, the shortest. The sulci left by the cervical scute are generally visible both on the dorsal and ventral surfaces; despite some variability (compare pl. 1, figs 1 and 2), the external surface covered by the cervical can be rather large, but much smaller than the area covered by the cervical on the ventral side of the nuchal. Both the neural bones are rectangular in shape and bear a transversal sulcus left by the vertebral scutes. All the peripherals are characterized by the absence of a transversal sulcus, which approximately corresponds to the pleural-peripheral suture (only a longitudinal sulcus is present). The 11th peripherals (pl. 1, fig. 3), have a relatively acute ventromedial angle. The fragmentary pygals do not have any sulcus both externally and internally. The best preserved hypoplastron (pl.

1, fig. 4) has a moderately arched abdominal-femoral sulcus, whose medial end does not correspond to the hypo-xiphiplastral suture. The best preserved xiphiplastron has a rather roundish external outline and preserves a nearly straight femoral-anal sulcus; the anterior edge of the bone is characterised by a well-developed suture indicating the absence of a hinge. The humeri have an arched, thick, and robust shaft surmounted, in the only case in which the proximal epiphysis is preserved, by a robust and large articular surface and by tall trochanters, relatively close to each another, delimiting a long intertrochanteric fossa.

D i s c u s s i o n : The tortoise remains are referred to *Testudo* cf. *burgenlandica* BACHMAYER & MLYNARSKY, 1983, on the basis of congruent variability of the cervical scute and congruent morphology of the pygal, as well as on the common absence of hypo-xiphiplastral hinge and congruent shape of the posterior plastral lobe.

According to LAPPARENT DE BROIN et al. (2006), *T. burgenlandica* is devoid of cervical scute, but direct examination of all the chelonian collection from the type locality, Kohfidisch (Late Miocene), revealed that the cervical development is actually variable in this species, being rarely completely absent, sometimes present only on the ventral surface of the nuchal, and sometimes present on both sides; the cervical is usually larger on the ventral surface than on the dorsal one, and tends to narrow in anterior direction. The morphology shown by the nuchals from Atzelsdorf matches with the variability observed in the specimens of *T. burgenlandica* from the type locality. Both in the abundant material from Kohfidisch and in the two fragmentary pygals from Atzelsdorf, the absence of a sagittal sulcus indicates that the 12th marginals were fused in a single scute covering the pygal. The shape of the external profile of the xiphiplastron of *T. burgenlandica* is variable but tends to be rather rounded in some specimens from Kohfidisch (i.e. type specimen NHMW 1981/0024/0015) as in the only well-preserved xiphiplastron from Atzelsdorf. The absence of hypo-xiphiplastral hinge in the material from Atzelsdorf fits with the condition shown by *T. burgenlandica* from Kohfidisch.

The tortoises of Kohfidisch are here referred to *Testudo burgenlandica* as originally suggested by BACHMAYER & MLYNARSKI (1983). Worth noting is that the taxonomy of the tortoises traditionally referred to genus *Testudo* has been revised in recent years. According to LAPPARENT DE BROIN et al. (2006, and literature therein) the following three genera should be recognized within the *Testudo* sensu lato lineage: *Agrionemys* KHOZATSKY & MLYNARSKI, 1966, *Eurotestudo* LAPPARENT DE BROIN, BOUR, PARHAM & PERÄLÄ, 2006, and *Testudo* sensu stricto. As for *T. burgenlandica*, the above mentioned authors accept its validity and indicate possible relationships with *Eurotestudo*. Conversely BÖHME & ILG (2008, see reference therein) refer the Kohfidisch tortoises to a different genus, *Protestudo* CHKHIKVADZE, 1970, and, because of priority reasons, to *P. csakvarensis* (SZALAI, 1934), a species known from the Late Miocene of Hungary. There are contrasting opinions on the validity of the latter species: considered valid by some authors (see CHKHIKVADZE 1983; KHOSATZKY & REDKOZUBOV 1989), it was recently defined by LAPPARENT DE BROIN et al. (2006: 345) as a taxon incertae sedis based on material “too poor to diagnose the species”. Regardless of these contrasts, it seems that the taxon here described differs from *P. csakvarensis* for the presence of cervical scute on the dorsal surface of the nuchal, as well as for the absence of a nuchal notch (I. DANILOV, pers. comm.).

In conclusion, taking into consideration that recent genetic analyses of extant tortoises (FRITZ & BININDA-EMONDS 2007) obtained a monophyletic arrangement of the extant members of *Testudo* sensu lato, a conservative approach will be adopted here and the extant members of the clade, as well as their close relatives, will be referred to a single genus *Testudo*. Following the indications of LAPPARENT DE BROIN and co-authors (2006) and waiting for the revision of “*Testudo*” *csakvarensis*, *T. burgenlandica* is considered provisionally valid and belonging to genus *Testudo* in its wide sense.

Family Geoemydidae THEOBALD, 1868

Genus *Mauremys* GRAY, 1869

***Mauremys* sp.**

(pl. 1, figs 5-9)

M a t e r i a l : pleural (NHMW 2008z0106/0001); right hypoplastron (2008z0106/0002); left xiphiplastron (2008z0106/0003); pleural (2008z0106/0004 cast of colln PENZ); peripheral (2008z0106/0005, cast of colln PENZ); right hyoplastron (2008z0106/0005, cast of colln PENZ), left hyoplastron (2008z0106/0008, cast of colln Penz); right hypoplastron (2008z0106/0009, cast of colln PENZ).

D e s c r i p t i o n : All the remains described in this section are lightly built if compared to those referred to genus *Testudo*. The pleural element (2008z0106/0001), possibly a 6th right element, is moderately widened in distal direction; it bears the vertebral-costal sulcus and the intercostals one. The peripherals (pl. 1, fig. 5) are characterised by a costal-marginal sulcus located proportionally far from the suture with the pleural (as well as by the presence of the intermarginal sulcus). Two hyoplastra are nearly completely preserved (pl. 1, figs 6, 7). They host the humeral-pectoral and pectoral-abdominal sulci. The position of the humeral-pectoral sulcus clearly indicates that it crossed also the entoplastron; the position of the pectoral-abdominal sulcus is relatively far from the hyoplastron-hypoplastron suture. The abdominal-femoral sulcus reaches the external rim of the hypoplastron (pl. 1, fig. 8) at the level of the inguinal notch. The xiphiplastron fragment (pl. 1, fig. 9) corresponds to the posterior most tip of the element, which is rather acute and partly delimits a wide anal notch.

D i s c u s s i o n : All the described characters indicate the presence of member of the family Geoemydidae. The shape of the epi-hyoplastral suture as well as the depth of anal notch (see HERVET 2003) support the referral of the remains from Atzelsdorf to the genus *Mauremys*. According to BACHMAYER & MLYNARSKI (1983), the genus *Mauremys* is present at Kohfidish with remains referred to *Mauremys* aff. *gaudryi* (DÉPÉRET, 1885). Even if the morphology of the few remains available at Atzelsdorf does not significantly differ from that of the remains from Kohfidish (see for example specimen NHMW 1981/24/18 and its reconstruction in fig. 1 by BACHMAYER & MLYNARSKI 1983), it is here preferred not to identify them at species level because of the absence of significant diagnostic characters.

Family Trionychidae FITZINGER, 1826

Genus *Trionyx* GEOFFROY, 1809***Trionyx sensu lato***

(pl. 1, figs 10, 11)

M a t e r i a l : three shell fragments (NHMW2008z0107/0001 to 2008z0107/0003, casts of colln PENZ)

D e s c r i p t i o n : Few fragmentary shell remains are characterized by having the external surface completely ornate by small pits. The pits of the specimen figured in pl. 1, fig. 10 are much more evident and deep than those visible on the other specimens, as the one figured in pl. 1, fig. 11. There are no signs of scute sulci (but their presence on larger portions of shell cannot be excluded a priori). Due to the small size of the fragments it is not possible to refer them to any precise shell element.

D i s c u s s i o n : The ornamentation of these remains (including the apparent absence of scute sulci) is similar to that of softshell turtles which were rather common in Europe during the Miocene. It is not clear if the difference in terms of ornamentation shown by these remains reflects a difference in term of taxonomy. On the basis of geographic provenance and age, the material is tentatively referred to *Trionyx sensu lato* (LAPPARENT DE BROIN 2001).

Testudines indet.

M a t e r i a l : nuchal (NHMW 2008z0104/0001); three pleural fragments (2008z0104/0002-4); 17 shell fragments: (2008z0104/0005-10); plastron fragment (2008z0104/0011); 16 pleural fragments (colln PENZ, no No.); seven peripheral fragments (colln PENZ, no No.); 14 shell fragments (colln PENZ, no No.).

R e m a r k s : Several remains whose preservation does not allow any precise identification are simply referred at order rank, despite their thickness could indicate that in several cases they belong to tortoises and not to pond turtles.

Acknowledgements

M. DELFINO is grateful to G. DAXNER-HÖCK (Vienna) for the opportunity to study the chelonian remains of Atzelsdorf. F. CHESI (Firenze) critically commented an earlier version of the manuscript. I. DANILOV (Saint Petersburg) and S. HERVET (Paris) revised the manuscript; the latter kindly discussed the identification of the *Mauremys* remains. We thank G. PENZ (Vienna) and P. SCHEBECZEK (Pellendorf) for placing their Atzelsdorf fossils at our disposal.

References

- BACHMAYER, F. & MLYNARSKI, M. (1983): Die Fauna der pontischen Höhlen- und Spaltenfüllungen bei Kohfidisch, Burgenland (Österreich). Schildkröten (Emydidae und Testudinidae). – *Annalen des Naturhistorischen Museums in Wien, Serie A*, **85**: 107-128.
- BÖHME, M. & ILG, A. (2008): fosFARbase, www.wahre-staerke.com/ (accessed 05 May 2008)

- CHKHIKVADZE, V.M. (1983): The fossil turtles of Caucasus and Northern Black Seaside region. –149 pp., Tbilisi (Metsniereba). [in Russian]
- FRITZ, U. & BININDA-EMONDS, O.R.P. (2007): When genes meet nomenclature: tortoise phylogeny and the shifting generic concepts of *Testudo* and *Geochelone*. – *Zoology*, **110**/4: 298-307.
- & HAVAS, P. (2007): Checklist of chelonians of the world. – *Vertebrate Zoology (Zoologische Abhandlungen)*, **57**/2:149-368.
- HARZHAUSER, M. (2009): The early Vallesian vertebrates of Atzelsdorf (Late Miocene, Austria). 2. Geology. – *Annalen des Naturhistorischen Museums in Wien, Serie A*, **111**: 479-488.
- HERVET, S. (2003): Le groupe *Palaeochelys* sensu lato – *Mauremys* dans le contexte systématique des Testudinoidea aquatiques du Tertiaire d'Europe occidentale. Apports à la biostratigraphie et à la paléobiogéographie. – 406 pp., unpublished Ph.D. dissertation, Muséum National d'Histoire Naturelle, Paris.
- KHOZATSKY, L.I. & REDKOZUBOV, O.I. (1989): Neogene chelonians of Moldavia. – 94 pp., Kichinev (Shtiinca). [in Russian]
- LAPPARENT DE BROIN, F. DE (2001): The European turtle fauna from the Triassic to the present. – *Dumerilia*, **4**/3: 155-217.
- , BOUR, R. & PERĀLĀ, J. (2006): Morphological definition of *Eurotestudo* (Testudinidae, Chelonii): second part. – *Annales de Paléontologie*, **92**: 325-357.

Plate 1***Testudo cf. burgenlandica* BACHMAYER & MLYNARSKI, 1983**

Figs 1a, b. nuchal in dorsal and ventral view (NHMW NHMW 2008z0105/0003).

Fig. 2. fragmentary nuchal in dorsal view (NHMW 2008z0105/0006) (note the sulci left by the large cervical scute).

Fig. 3. left 11th peripheral in external view (NHMW 2008z0105/0002).

Fig. 4. left hypoplastron in ventral view (NHMW 2008z0105/0001).

***Mauremys* sp.**

Fig. 5. undetermined peripheral in external view (NHMW 2008z0106/0005).

Figs 6, 7. left and right hyoplastra in ventral view (NHMW 2008z0106/0006-7).

Fig. 8. right hypoplastron in ventral view (NHMW 2008z0106/0008).

Fig. 9. fragmentary left xiphiplastron in dorsal view (NHMW 2008z0106/0003).

Trionyx sensu lato

Figs 10, 11. shell fragments in external view (NHMW 2008z0107/0001-2).

All specimens from the Lower Vallesian of Atzelsdorf, Lower Austria.

Scale bars equal 10 mm.



