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MAORICHELYS WIFFENI N. GEN. N. SP., A NEW SEA TURTLE FROM THE EOCENE OF NEW ZEALAND (CHELONII: DERMOCHELYIDAE)

[Maorichelys wiffeni n. gen. n. sp., una nueva tortuga marina del Eoceno de Nueva Zelanda (Testudines: Dermochelyidae)]

Hans-Volker KARL (*)
Gottfried TICHY (**)

(*): Geoscience Centre of the University of Göttingen. Division Geo-Biology. Goldschmidt Str. 3. D-37077 Göttingen, Germany. Correo-e: hvkarl@web.de orhkarl @uni-goettingen.de

(**): Department of Geography and Geology. Division Geology and Evolutionary Research. University of Salzburg. Hellbrunner Straße 34, A-5020 Salzburg, Austria. Correo-e: Gottfried.Tichy@sbg.ac.at

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RESUMEN: Se describe como *Maorichelys wiffeni* n. gen. n. sp., una nueva tortuga marina, procedente del Eoceno de la Isla del Sur de Nueva Zelanda. El holotipo, consistente en un húmero, es descrito y comparado con los húmeros de las especies conocidas de la misma edad.

Palabras clave: Chelonii, Dermochelyidae, *Maorichelys wiffeni* n. gen. n. sp., húmero, taxonomía, Nueva Zelanda, Eoceno.

ABSTRACT: From the South Island of New Zealand a new Eocene genus of a sea turtle *Maorichelys wiffeni* n. gen. n. sp., is erected. The holotype, a fragment of a humerus, is described and compared in its features to the known species of the same age.

Key words: Chelonii, Dermochelyidae, *Maorichelys wiffeni* n. gen. n. sp., humerus, taxonomy, New Zealand, Eocene.

INTRODUCTION

Fossil turtles from New Zealand are described by FORDYCE (1981) from Palaeogene, and by WIFFEN (1981) from the Late Cretaceous, which was correctly determined as Protostegidae/Chelospharginae indet., and FORDYCE (1991) in review.

From the neighbouring Australia KEAR (2003) listed *Notochelone costata* (Owen, 1882) from the Lower Cretaceous (Upper Albian) deposits of Queensland. The holotype specimen (AM F67326) is a partially preserved carapace (OWEN, 1882). KEAR & LEE (2005) described a well preserved large-bodied basal protostegid chelonioid *Bouliachelys suteri*, from the Early Cretaceous (Albian) of Australia. This indicates that early sea turtles were both larger and more diverse than previously thought. GAFFNEY (1981; 1991) reviewed *Notochelone costata* and *Cratochelone berneyi* Longman, 1915 (Albian of Queensland also), which belong to the Desmatochelyidae, but dermochelyids has been hitherto unknown from Australia.

The present humerus OU 22021 from New Zealand was described first by KÖHLER (1994) and was put preliminarily into the genus *Psephophorus*. Although the specimen does not come from the type locality of *Psephophorus terrypretchetti*, it was used for the original description of the type material (KÖHLER, 1995, 1996). Taking into account the geologic age, however, some features of OU 22021 show another relationship. This admits possibilities of a stratigraphic use.

Figure 1 shows the general structure of dermochelyid humeri 1.

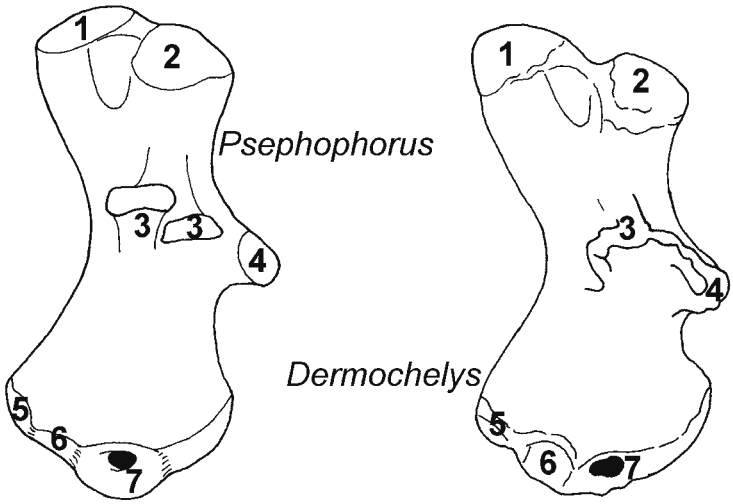


Figure 1. Structure of different dermochelyid humeri of Psephophorus *and* Dermochelys. *1 = processus major (processus ulnaris), 2 = caput humeri, 3 = knob or crista like muscle insertions, 4 = muscle insertion or crista part of processus radialis, 5 = epicondylus ulnaris, 6 = capitulum humeri, 7 = foramen ectepicondylare at epicondylus radialis. Without scale.*

GENERAL REMARKS ON EOCENE DERMOCHELYID HUMERI

The following genera of Dermochelyidae hitherto were described. Species with known humeri printed in boldface (see also KARL, 2002):

1. *Arabemys* Tong, Buffetaut, Thomas, Roger, Halawani, Memesch & Lebret, 1999, type species: *Arabemys crassiscutata* Tong *et al.* 1999 (dermal placoids known only).

2. *Cosmochelys* Andrews, 1920, type species: *Cosmochelys dolloi* Andrews, 1920 (only dermalplacoids and ribs known).

3. *Dermochelys* Blainville, 1816, type species: *Dermochelys coriacea* (Linnaeus, 1766) (all bone elements known).

4. *Eosphargis* Lydekker, 1889, type species: *Eosphargis gigas* (Owen, 1880), *Eosphargis breineri* Nielsen, 1959 (skull, trunks, girdles, extremities, dermal elements known).

5. *Mesodermochelys* Hirayama & Chitoku, 1996, type species: *Mesodermochelys undulatus* Hirayama & Chitoku, 1996 (nearly all bone elements known, see also HIRAYAMA & CHITOKU, 1996 and HIRAYAMA & NIKIDA, 1998).

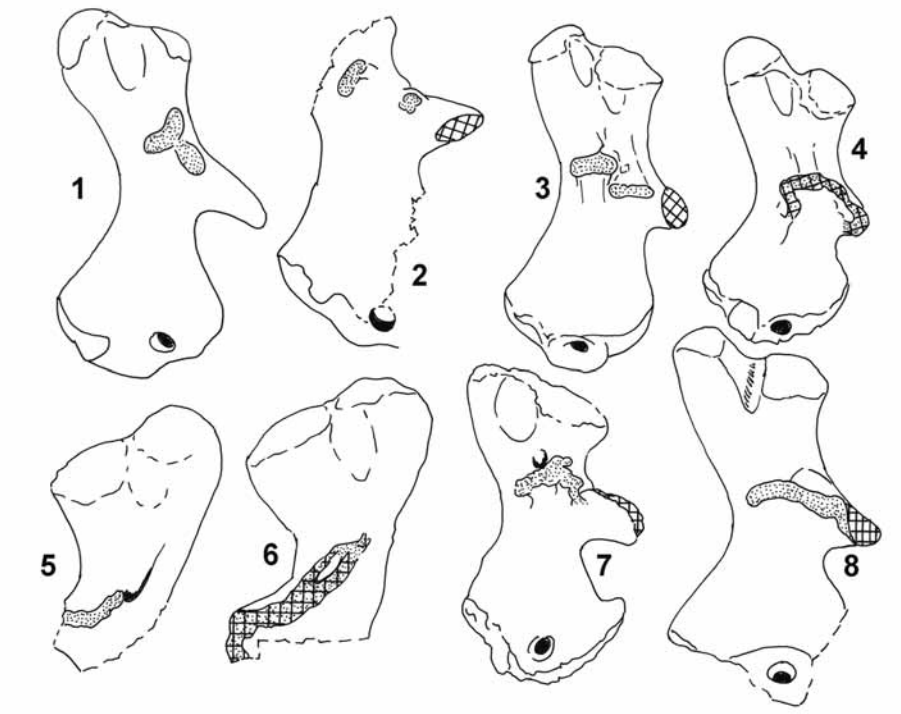


Figure 2. Schematic sketches of known humeri of dermochelyid turtles according to KARL, 1994, KÖHLER, 1994, 1995, 1996 and NIELSEN, 1962-65: 1 = Psephophorus eocaenus, *2* = Psephophorus rupeliensis, *3* = Psephophorus scaldii, *5* = Maorichelys wiffeni *OU 22021, 6* = Eosphargis gigas, *7* = Eospargis breineri, *8* = Dermochelys coriacea. *Without scale.*

6. *Psephophorus* H. v. Meyer, 1847, type species: *Psephophorus polygonus* H. v. Meyer, 1847, other species: *Psephophorus scaldii* Van Beneden, 1871, *Psephophorus rupeliensis* Van Beneden, 1887, *Psephophorus calvertensis* Palmer, 1909, *Psephophorus eocaenus* Andrews, 1901, [*Psephophorus oregonensis* Packard, 1940, *Psephophorus terrypretchetti* Köhler, 1995, *Psephophorus pseudotracion* Gervais, 1849], syn. *Pseudospbargis* Dames, 1894 (*Pseudospbargis ingens* (Koenen, 1891) (skull, trunks, girdles, extremities, dermal placoids known).

7. *Protospbargis* Capellini, 1884, type species: *Protospbargis veronensis* Capellini, 1884, syn. *Protospbargis capellini* Negri, 1893 (only epithecal shell elements known).

Eocene dermochelyid humeri are only known from *Eospbargis gigas*, *Eospbargis breineri*, *Psephophorus eocaenus* and OU 22021. KÖHLER (1994) compared and discussed with the cast of the holotype in the Egyptian Geological Museum only and excludes the Stuttgart material described by DACQUÉ (1912). That material figured here in plate 1, figure 3-2 shows the correct reconstruction made by DACQUÉ. The present structure of the humerus of *Psephophorus eocaenus* (figure 2-1) is not comparable with OU 22021 (figure 2-5). The humerus of *Eospbargis breineri* (figure 2-7) show a very high development of the crista-like structures of the insertion of musculus teres major which forms a unit crista and the crista deltopectoralis, but neither are not fused together. The humerus of *Eospbargis gigas* (figure 2-6) is relatively closer to OU 22021 because it shows a flat wrinkled crista-like insertion. All other dermochelyid humeri like *Psephophorus rupeliensis* (figure 2-2), *Psephophorus scaldii* (figure 2-3) and *Psephophorus calvertensis* (figure 2-8) present different stages of development from the simple muscle insertions to crista-like structures in progressive connection with the *crista deltopectoralis* (KARL, 1994). The very end of this evolutional process shows *Dermochelys coriacea* (figure 2-4). *Psephophorus calvertensis* possesses its own features of these structures and is a valid species. In the degree status stage of connection between the crista-like structures of insertion of the musculus teres major and the crista deltopectoralis *Psephophorus calvertensis* can be considered as a direct ancestor of *Dermochelys coriacea*. *Psephophorus calvertensis* is known from the Miocene of Calvert Cliffs in Maryland, USA (PALMER, 1909), and is the first occurrence of *Dermochelys* dermal placoids reported from the Pliocene to Early Pleistocene of North Carolina (KÖHLER, 1994).

REDESCRIPTION OF *PSEPHOPHORUS EOCAENUS* ANDREWS, 1901

According KÖHLER (1996) the detailed description by ANDREWS (1901) seems to be quite optimistic, but the original specimen may show some features better than the cast of the holotype (BMNH R 3017). Only the basic features, like the orientation of the deltopectoral crest, can be readily observed and the "… ulnar crest (is) more prominent than in *Psephophorus scaldii* and the radial crest [= lateral process] more oblique". In 1906 he described this further as: "The whole body is strongly compressed dorsi-ventrally. The head so far as preserved, is strongly convex and somewhat triangular in

Plate 1. Original material of Psephophorus eocaenus *in the Stuttgart Museum N.º 11243 a-b described by* DACQUÉ, *1912. Figure 1 = humerus a dorsal, figure 2 = ventral, figure 3 = humerus b ventral, 4 = dorsal. Photographs by H.-V. Karl. Scale bar 1 cm.*

outline. The ulnar crest projects further beyond the head than in *Psephophorus scaldii* or in *Sphargis* [= *Dermochelys*]. Between the anterior thickening, which terminates on the head, and the posterior border the surface of the shaft is concave on the upper and lower faces of the bone, but the ventral concavity is deepest. The part of the bone above the radial process [lateral process] is considerably more elongated in proportion to its width than in *Psephophorus scaldii* and still more than in c. The radial prominence is very strongly developed, but is divided into two or more separate knobs, as in *Psephophorus*, and is continued on the ventral face of the bone obliquely backwards, so that if the line of its direction were continued it would pass through the end of the ulnar process; in both [= *Dermochelys*] and *Psephophorus* the ridge is placed more tranversely" (ANDREWS, 1906).

Now, KÖHLER (1996) proposes that in "some publications, however, a reconstructed version of the humerus of *P. eocaenus* is figured as showing a crista deltopectoralis separated into distinct knobs (DACQUÉ, 1912; MÜLLER, 1968; KARL, 1994). This reconstruction stands in sharp contrast to the type description given by ANDREWS, with a sketch of the original humerus drawn by Y. Attia (cited by KÖHLER, 1996) from the Egyptian Geological Museum in 1994 [figure 3-1 here], and with my own observations. Despite the damage in this area on the holotype (as examined on cast BMNH R 3017), it appears to me that ANDREW's description is correct".

We can consider that the original type material from ANDREWS is much damaged and eroded (see figure 3-1), but he also described the knob-like muscle insertions. DACQUÉ (1912) founded the diagnosis of that species on much better material (plate 1) and gave the high end reconstruction of its habitus (figure 3-2).

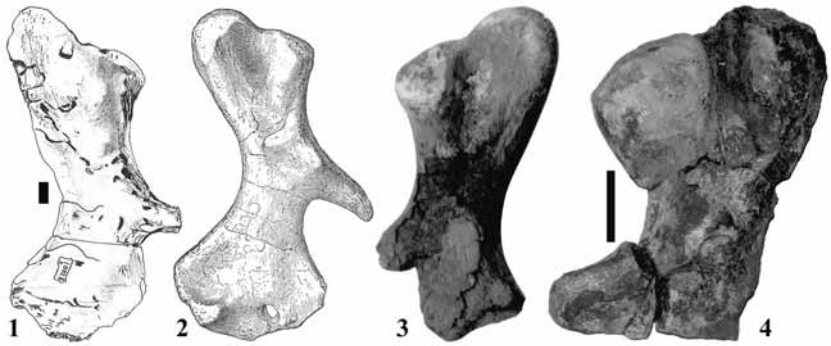


Figure 3. Psephophorus eocaenus *humerus in schematic reconstructions. Figure 3.1 according after a hand sketch of the holotype by Yousry Attia from the Egyptian Geological Museum, Kairo in a letter to Richard Köhler, Dunedin, scale bar 1 cm; figure 3.2 according to DACQUÉ, 1912 based on the Stuttgart material in plate 1, without scale; figure 3.3 SMNS 11243c, the much damaged specimen in the Stuttgart Museum is like the condition of the holotype in the Egyptian Geological Museum N.º 10028; figure 3.4: proximate part of the humerus of* Eosphargis gigas *located in the British Museum BMNH R2717 from the London Clay of Sheppy, photo by G.Tichy, scale bar 5 cm.*

The observations on DACQUÉ's original material in 1994 shows us the accuracy of her reconstruction (figure 3-2). The prominence of the knob-like muscle insertions are clearly demonstreable:

SMNS no (ex coll. Markgr. 1904)	Thickness at corpus	Thickness at knob	Difference
11243 a	16	27,5	11,5
11243 b	18	35	17
11243 c	23	35,5	12,5

According to earlier results (KARL, 1994) *Psephophorus eocaenus* is characterized by a very distinct processus radialis and two separated median tuberculi which are not in connection with a muscle insertion on the processus, and a foramen ectepicondylare which is situated outside the epicondylus. It is the only precise definition of that species.

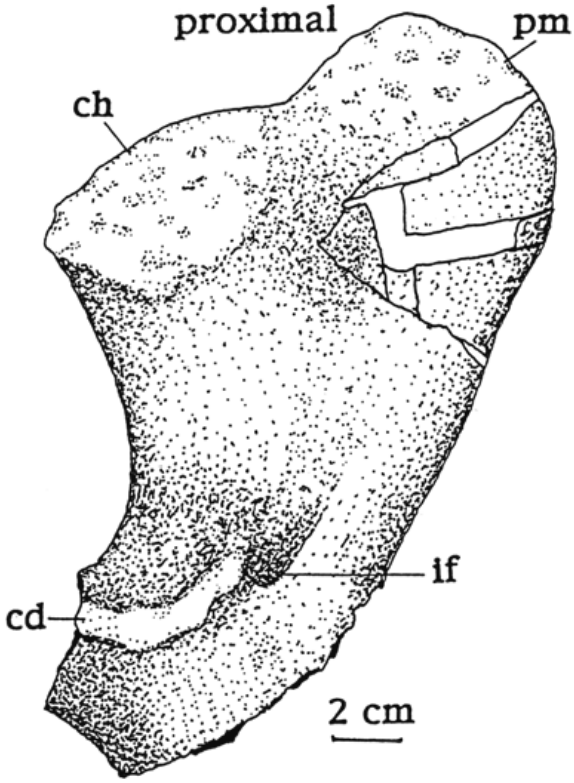


Figure 4. Schematic sketch of the proximate part of humerus OU 22021 in ventral view from KÖHLER, 1996. cd = crista deltopectoralis, ch = caput numeri, if = intertubercular fossa, pm = processus major. Scale bar 2 cm.

SYSTEMATIC PALAEONTOLOGY

Order Chelonii Brongniart, 1800 (Latreille, 1800)

Gigaorder Casichelydia Gaffney, 1975

Megaorder Cryptodira Gray, 1825

Parvorder Eucryptodira Gaffney, 1975

Suborder Polycryptodira Gaffney, 1984

Superfamily Chelonioidea Aggasiz, 1857

Family Dermochelyidae Gray, 1825

Maorichelys n. gen.

TYPE SPECIES: *Maorichelys wiffeni*, new species.

DISTRIBUTION: Eocene of South Pacific.

DIAGNOSIS: Processus minor nearly completely reduced, forming a knob; insertion of the musculus teres major forms an intertubercular hole; insertion of the musculus teres major forms a unit fused crista deltapectoralis which is fused with the crista lateralis.

Maorichelys wiffeni n. sp.

TYPE SPECIMEN: University of Otago-Dunedin, Paleontological collection, N.º OU 22021 (figure 2-5, figure 3, plate 3).

LOCALITY: Boulder Hill near Dunedin (Otago): NZMS [New Zealand Mapping Series] 260 metric sheet 144 (1987): Grid reference: 054873: South Island of New Zealand (KÖHLER, 1995).

HORIZON: Eocene, middle Bartonian (*Wetzeliella hampdenensis* Wilson, 1967), Burnside Formation, according to KÖHLER, 1995.

ETYMOLOGY: Maori = with respect to the native people of New Zealand, chelys = Greek-a turtle; *wiffeni* = in honour of Joan Wiffen, affectionately known as "the Dragon Lady", who fervently maintains her passion and zeal for New Zealand's prehistoric flora and fauna, especially reptiles.

DIAGNOSIS: Same as the genus.

Plate 2. Holotype of Maorichelys wiffeni *n. gen. n. sp., N.º OU 22021. Figure 1 = humerus proximate ventral, figure 2 = humerus proximate dorsal, 3 = humerus proximate anterior, 4 = humerus proximate posterior. Photographs by Ewan Fordyce, Dunedin. Scale bar 1 cm.*

CHARACTER ANALYSIS

1. Processus minor well developed and contacts the caput humeri, present = 0, absent = 1;

2. processus minor nearly completely reduced and forms a knob, absent = 0, present = 1;

3. processus minor transformed to a processus radialis / lateralis, absent = 0, present = 1;

4. processus major higher than the caput numeri, present = 0, absent = 1;

5. insertion of the musculus teres major forms a rough fossa, absent = 0, present = 1;

6. insertion of the musculus teres major forms an intertubercular hole, absent = 0, present = 1;

7. insertion of the musculus teres major forms two tubercles or knobs, absent = 0, present = 1;

8. insertion of the musculus teres major forms two fused tubercles to cristae, absent = 0, present = 1;

9. insertion of the musculus teres major forms a unit fused crista deltapectoralis, absent = 0, present = 1;

10. crista deltopectoralis fused with crista lateralis, absent = 0, present = 1.

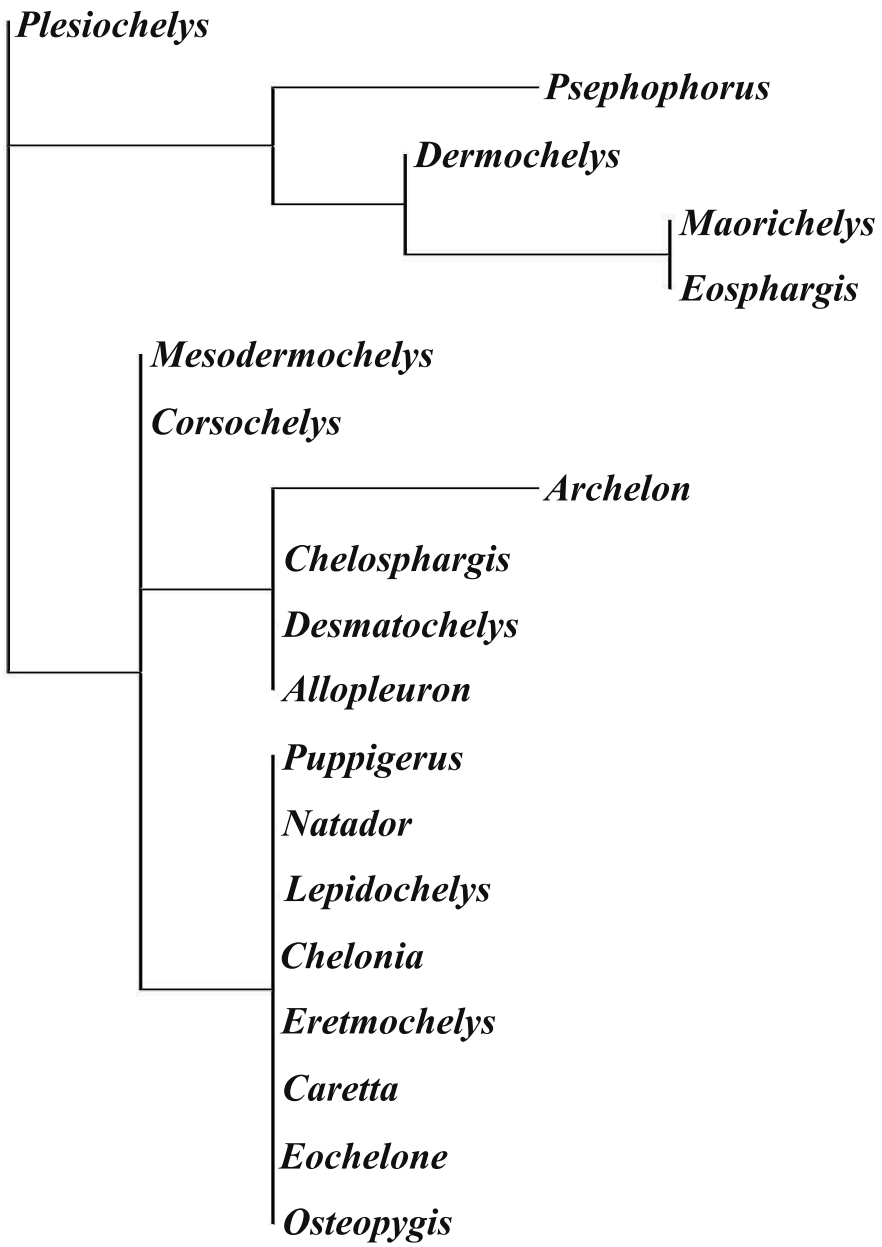
DATAMATRIX

Plesiochelys 0000000000; *Osteopygis* 1000100000; *Allopleuron* 1000010000; *Gigantatypus* 0000????00; *Eochelone* 1000100000; *Caretta* 1000100000; *Eretmochelys* 1000100000; *Chelonia* 1000100000; *Lepidochelys* 1000100000; *Natador* 1000100000; *Puppigerus* 1000100000; *Desmatochelys* 1000010000; *Chelosphargis* 1000010000; *Archelon* 0100010000; *Corsochelys* 1000000000; Mesodermochelys 1000000000; *Psephophorus* 0010001110; *Eosphargis* 0011010011; *Maorichelys* 0011010011; *Dermochelys* 0010000011

OUTTREE BY DOLMOVE- Interactive Dollo and Polymorphism Parsimony (Joseph FELSENSTEIN)

(*Dermochelys*, (*Maorichelys*, (*Eosphargis*, (*Psephophorus*, (*Mesodermochelys*, (*Corsochelys*, (*Archelon*, (*Chelosphargis*, (*Desmatochelys*, (*Puppigerus*, (*Natador*, (*Lepidochelys*, (*Chelonia*, (*Eretmochelys*, (*Caretta*, (*Eochelone*, (*Gigantatypus*, (*Allopleuron*, (*Osteopygis*, *Plesiochelys*))))))))))))))))))

OUTTREE BY PARS-Discrete character parsimony algorithm, version 3.6a3, shows 5 trees in all found (Joseph FELSENSTEIN)


Plesiochelys
Psephophorus
Dermochelys
Maorichelys
Eosphargis
Mesodermochelys
Corsochelys
Archelon
Chelosphargis
Desmatochelys
Allopleuron
Puppigerus
Natador
Lepidochelys
Chelonia
Eretmochelys
Caretta
Eochelone
Osteopygis

(((*Dermochelys*: 0.00, (*Maorichelys*: 0.00, *Eosphargis*: 0.00): 2.00): 1.00, *Psephophorus*: 2.00): 2.00, *Gigantatypus*: 0.00, (*Archelon*: 1.00, (*Chelosphargis*: 0.00, *Desmatochelys*: 0.00, *Allopleuron*: 0.00): 1.00): 1.00, (*Mesodermochelys*: 0.00, *Corsochelys*: 0.00, (*Puppigerus*: 0.00, *Natador*: 0.00, *Lepidochelys*: 0.00, *Chelonia*: 0.00, *Eretmochelys*: 0.00, *Caretta*: 0.00, *Eochelone*: 0.00, *Osteopygis*: 0.00): 1.00): 1.00, *Plesiochelys*: 0.00) [0.2000]

(((*Dermochelys*: 0.00, (*Maorichelys*: 0.00, *Eosphargis*: 0.00): 2.00): 1.00, *Psephophorus*: 2.00): 2.00, (*Archelon*: 1.00, *Gigantatypus*: 0.00, (*Chelosphargis*: 0.00, *Desmatochelys*: 0.00, *Allopleuron*: 0.00): 1.00): 1.00, (*Mesodermochelys*: 0.00, *Corsochelys*: 0.00, (*Puppigerus*: 0.00, *Natador*: 0.00, *Lepidochelys*: 0.00, *Chelonia*: 0.00, *Eretmochelys*: 0.00, *Caretta*: 0.00, *Eochelone*: 0.00, *Osteopygis*: 0.00): 1.00): 1.00, *Plesiochelys*: 0.00) [0.2000]

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TREE BY TREEVIEW (Roderic Page) based on Outtree 2 by DOLMOVE (Joseph Felsenstein) without *Gigantotypus*.

DISCUSSION

In all five trees *Maorichelys* stands closer to the genus *Eosphargis* than the genus *Psephophorus* or *Dermochelys*. *Plesiochelys* is a sister taxon for all taxa used. Other closely related groups are the Cheloniidae (*Puppigerus*, *Natador*, *Lepidochelys*, *Chelonia*, *Eretmochelys*, *Caretta*, *Eochelone*) and *Osteopygis*, *Mesodermochelys* and *Corsochelys* as well as the Protostegidae (*Archelon*, *Chelosphargis*, *Desmatochelys*) and *Allopleuron*. General remarks on phylogeny of chelonioidea see HIRAYAMA (1994). The position of

Gigantatypus (type species *G. salahi* Kaddumi, 2006) in this tree is still unclear because the ventral side of the gigantic humerus (length 67 cm, greatest width 30 cm) is unknown, since it is hidden under sediment (KADDUMI, 2006).

The main result of this analysis is OU 22021, a member of its own genus and species, described here as *Maorichelys wiffeni* n. sp. The comparative character analysis of this specimen shows a clear relation to the genus *Eosphargis*, but not to *Psephophorus*, and therefore it cannot be included into the type specimen of *Psephophorus terrypretchetti* Köhler, 1995. Furthermore, the type location of OU 22021 is not identical with that of the aforementioned specimen. On this basis *Psephophorus terrypretchetti* Köhler, 1995 shows no more different features to other *Psephophorus*-species founded on dermal placoids.

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