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***Desmatochelys carusianus* (GEINITZ, 1872-1875) n. comb.,
a large Turonian marine turtle from Germany
(Testudines: Chelonioidea)**

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Kurzfassung

***Desmatochelys carusianus* (GEINITZ, 1872-1875) n. comb., eine große marine Schildkröte
aus dem deutschen Turonium (Testudines: Chelonioidea)**

Fossile Belege einer großen desmatochelyiden Schildkröte aus den „Grünsand“ Küstenfazies des Oberen Turoniums von Nordwestdeutschland werden beschrieben und diskutiert. Das neue, hier bearbeitete Material stammt aus Dortmund-Dorstfeld und beinhaltet die bislang größten Knochen, die von dieser Schildkrötengruppe bislang in Deutschland gefunden wurden. Es ergeben sich verwandtschaftliche Beziehungen zu dem juvenilen Typusmaterial von *Chelone Carusiana* GEINITZ, 1872-1875 aus dem Mittleren bis Oberen Turonium Mitteldeutschlands. Die Arbeit gibt außerdem einen Überblick über alle Meeresschildkröten-Fossilfunde aus Plänerkalken in Deutschland.

Abstract

The remains of a large desmatochelyid turtle from the upper Turonian greensand coastal facies of northwestern Germany are described and discussed. The new material comes from Dortmund-Dorstfeld and is the hitherto largest bones of that turtle group found in Germany. It is related to the juvenile type material of *Chelone Carusiana* GEINITZ, 1872-1875 from the Middle to Upper Turonian of Middle Germany. There is also a summary of all hitherto known sea turtle remains from the Plänerkalk group of Germany.

Key words

Desmatochelys carusianus (GEINITZ, 1872-1875) n. comb., giant marine turtle, Late Cretaceous, Turonian, Saxony, North Rhine-Westphalia, Plänerkalk group, Germany

1. Introduction

The new material of a desmatochelyid turtle presented in this article comes from Dortmund-Dorstfeld. It was found during the construction of a new subway track. There are several bones of a forelimb, costals and unidentified parts of the inner skeleton of a

large individual of *Desmatochelys*. The fossils are still not prepared out of a matrix of calcareous sandstone containing glauconite. The sandstones are greensands of a coastal facies from the Upper Turonian of northwestern Germany. After the study of the material, it could now be connected with the type material of *Chelone carusiana* GEINITZ, 1872-1875.

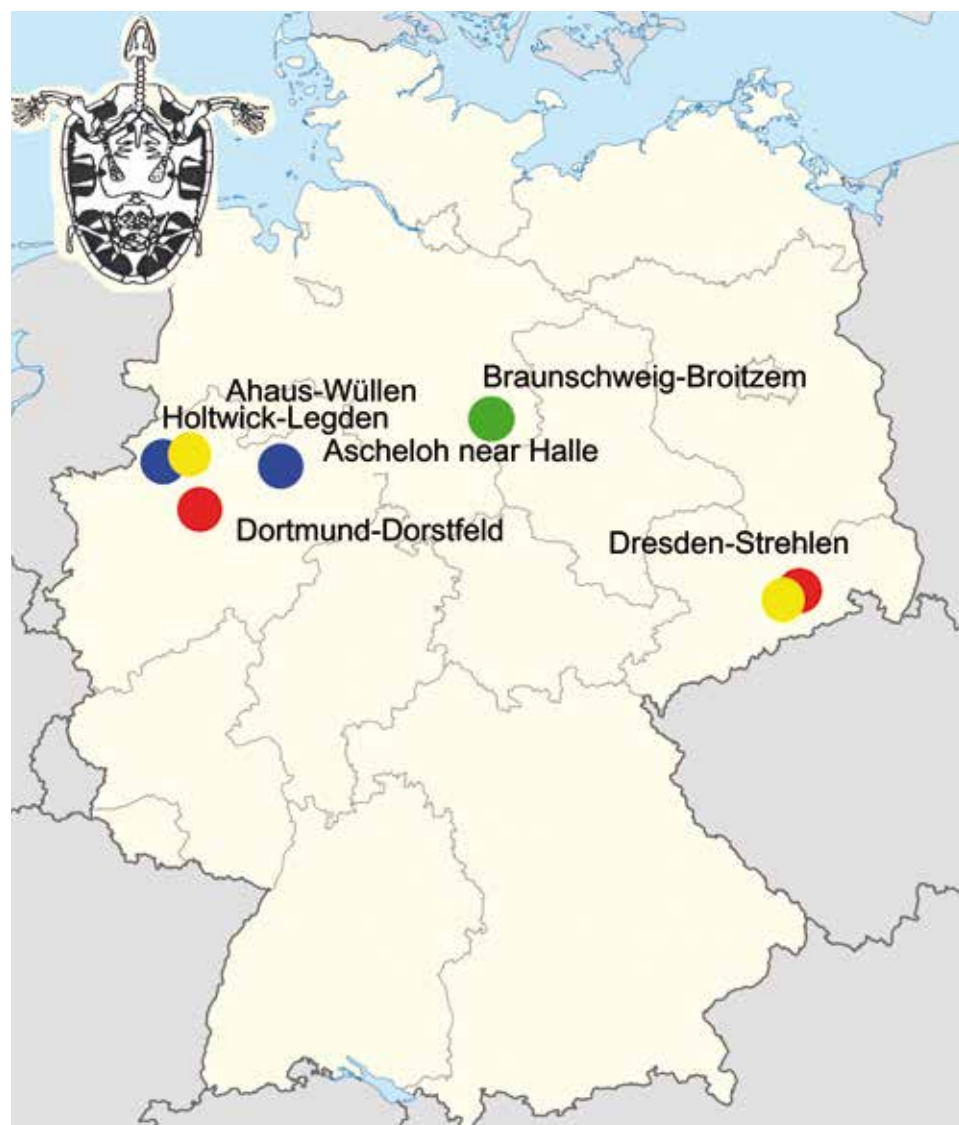


Fig. 1: Geographic distribution of German sea turtle genera and localities of the Plänerkalk group, using an image from HIRAYAMA (1994): red = *Desmatochelys*, blue = *Tasbacka*, green = *Allopleuron*, yellow = *Rhinocelys*.

The remains of the type material come from the unit of the Elbtal group and the Plänerkalk group, which are of the same age as the greensands of Dortmund-Dorstfeld. These units belong to the chronostratigraphic zone of the Cenomanian, Turonian and Lower Coniacian of the Upper Cretaceous and to the zone of the upper Albian from the Lower Cretaceous. The sediments, with a thickness between 100 and 300 m, were formed in an epicontinental sea (NIEBUHR et al. 2007, WILMSEN & HISS 2006).

Up to now, there are three different turtles known from the Plänerkalk group: the protostegid *Rhinocelys pulchriceps* and the chelonids *Allopleuron* cf. *hofmanni* and a new *Tasbacka* species (KARL & NYHUIS 2012, KARL et al. 2012a, b, and KARL et al. in press) (Fig. 1-2). A gypsum cast of a left humerus, which was originally described by DIEDRICH (1999), should be in the WWU-University of Münster, but it could not be found (pers. comm. Markus BERTLING, University Münster). The bone was found in Ascheloh (TK Nr. 3916 Halle (Westphalia), R 3457,7, H 5770,0) near Halle (Westphalia), in the quarry of the Mindener Asphaltmischwerke (MIAMI) in 1989. The remain was found in the horizon of the middle Cenomanian Plänerkalk (Upper Cretaceous), in the biozone of *Acanthoceras rhotomagensis* and *Inoceramus schoendorfi*. According to DIEDRICH (1999) the total length (tl) is 55 mm and the distal width (wd) is 20 mm. From the same horizon KARL et al. (in press) describe *Tasbacka germanica*. In this case, the humerus is not yet known. It could be possible that the humerus from Ascheloh also belongs to it.

2. Abbreviations

FCG-CBP = Fundación Colombiana de Geobiología, Villa de Leyva, Colombia.
KUPV = Kansas University, Museum of Natural History, Vertebrate Paleontology.
NMD = Natural History Museum Dortmund.
SMMG = State Museum for Geology and Mineralogy Dresden.

TUF = Technical University (Bergakademie) Freiberg/Saxony.

UCMP = University of California Museum of Paleontology Berkeley.

3. Systematic Palaeontology

Order Testudines LINNAEUS, 1758
Infraorder Cryptodira COPE, 1868
Superfamily Chelonioidea BAUR, 1893
Family Protostegidae COPE, 1872
Subfamily Desmatochelyinae WEEMS, 1988
Genus *Desmatochelys* WILLISTON, 1894

Type Species: *Desmatochelys lowii* WILLISTON, 1894.

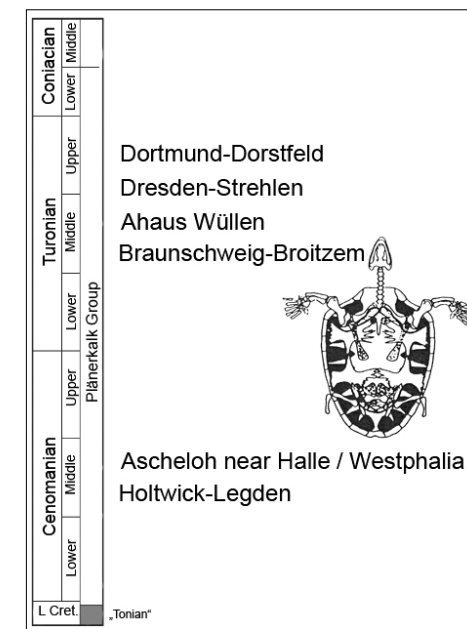


Fig. 2: Compilation of the sub-groups, formations, members, and the benches of the Plänerkalk group according to NIEBUHR et al. (2007) with the stratigraphic distribution of German sea turtle localities: Dortmund-Dorstfeld (*Desmatochelys carusianus*), Dresden-Strehlen (*Desmatochelys carusianus* and *Rhinocelys pulchriceps*), Ahaus-Wüllen (*Rhinocelys pulchriceps*), Braunschweig-Broitzem (*Allopleuron* cf. *hofmanni*), Ascheloh near Halle / Westphalia and Holtwick-Legden (*Tasbacka* sp.). Compiled according to KARL & NYHUIS (2012) and KARL et al. (2012a, b, in press).

Desmatochelys lowii WILLISTON, 1894

Synonyms:

- *Desmatochelys lowii* n. g., n. sp., WILLISTON, 1894: 5.
- *Desmatochelys lowii*, WILLISTON, 1898: 353, pl. 73-78.
- *Desmatochelys lowii* WILLISTON, 1898, HAY, 1908: 185, fig. 238-243.
- *Desmatochelys lowii* WILLISTON, 1898, HAY, 1930: 77.
- *Desmatochelys lowii* WILLISTON, 1898, ZANGERL & SLOAN, 1960: 10, pl. 1-2.
- *Desmatochelys lowii* WILLISTON, 1898, KUHN, 1964: 152.
- *Desmatochelys lowii* WILLISTON, 1898, MŁYNARSKI, 1976: 50-51.

Type Material: KUPV 1200, a complete skull, last reviewed and described by RASELLI (2018). She gave a systematical introduction to the genus *Desmatochelys* based on skull characters.

Type Locality: Fairbury in Jefferson County, Nebraska, USA.

Type Horizon: Fairport Chalk Member, Carlisle Shale, Middle Turonian, Upper Cretaceous.

Differential Diagnosis: In contrast to *Desmatochelys carusianus* with straight radius and ulna, *Desmatochelys lowii* has curved radius and ulna (see Fig. 3).

Desmatochelys carusianus
(GEINITZ, 1872-1875) n. comb.
(Plate 1-3)

Synonyms:

- *Chelone Carusiana* GEINITZ, 1875 in part: 230-231, Tafel 46, fig. 1 (fig. 6-1 here).
- *Dollochelys* cf. *carusiana* (GEINITZ, 1875), KARL, 1991: 236, Tafel 7, fig. 3.
- *Dollochelys atlantica* (ZANGERL, 1953), syn. *Chelone Carusiana* GEINITZ, 1875 in part, KARL, 2002: 192.

Type Material: TUF 193/4, right humerus in ventral view, one type specimen to GEINITZ (1872- 1875) (Plate 1).

Type Locality: Dresden-Strehlen, Saxony, Central Germany.

Type Horizon: Limestone of Dresden-Strehlen, border Middle / Upper Turonian, Upper Cretaceous.

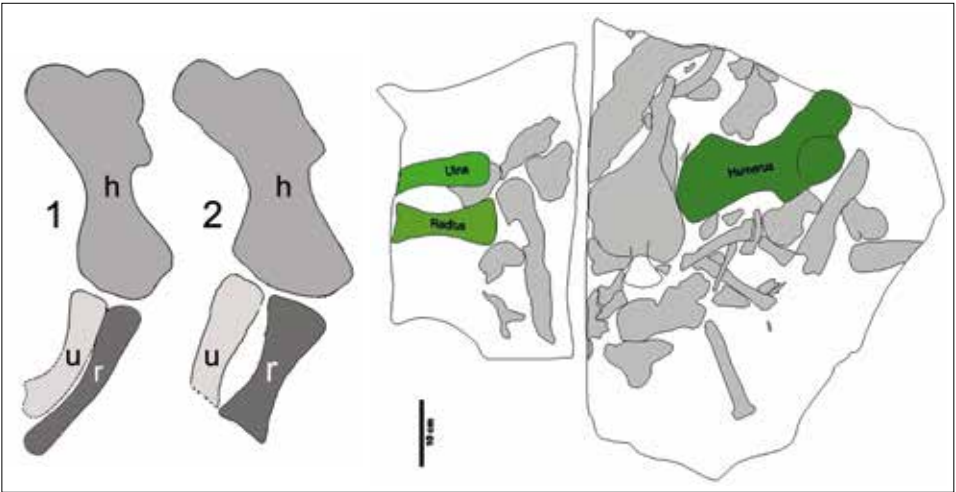


Fig. 3: a.) Comparison of the structure of arms in 1 = *Desmatochelys lowii* = curved radius (r) and ulna (u) and 2 = *Desmatochelys carusianus* = straight radius and ulna, h=humerus. No. 1 by ZANGERL & SLOAN (1960) and No. 2 according to Plates 2 and 3. b.) *Desmatochelys carusianus* from Dortmund-Dorstfeld, North Rhine-Westphalia in situ for comparison with plate 2.

Description: The humerus is not slightly “s”-shaped in the sense of ZANGERL (1953), but flat and wide. The visceral side shows the characteristic constriction between the caput humeri and the trochanteric area and the shaft surface. The radial process (trochanter minor) is distal to the caput humeri. The distal joint surface (condylus, epicondylus) is convex, extends to ventral face (see HIRAYAMA 1994).

Measurements: tl = total length, ccl = caput-condylus-length, wp = width proximally, wd = width distally, sts = smallest thickness of shaft (in mm), see Fig. 4. Collected by Birgit GAITZSCH and Daniel FALK (TUF).

Inv. No. TUF 193/4	tl	ccl	wp	wd	sts
Humerus	63	59	32	22	9

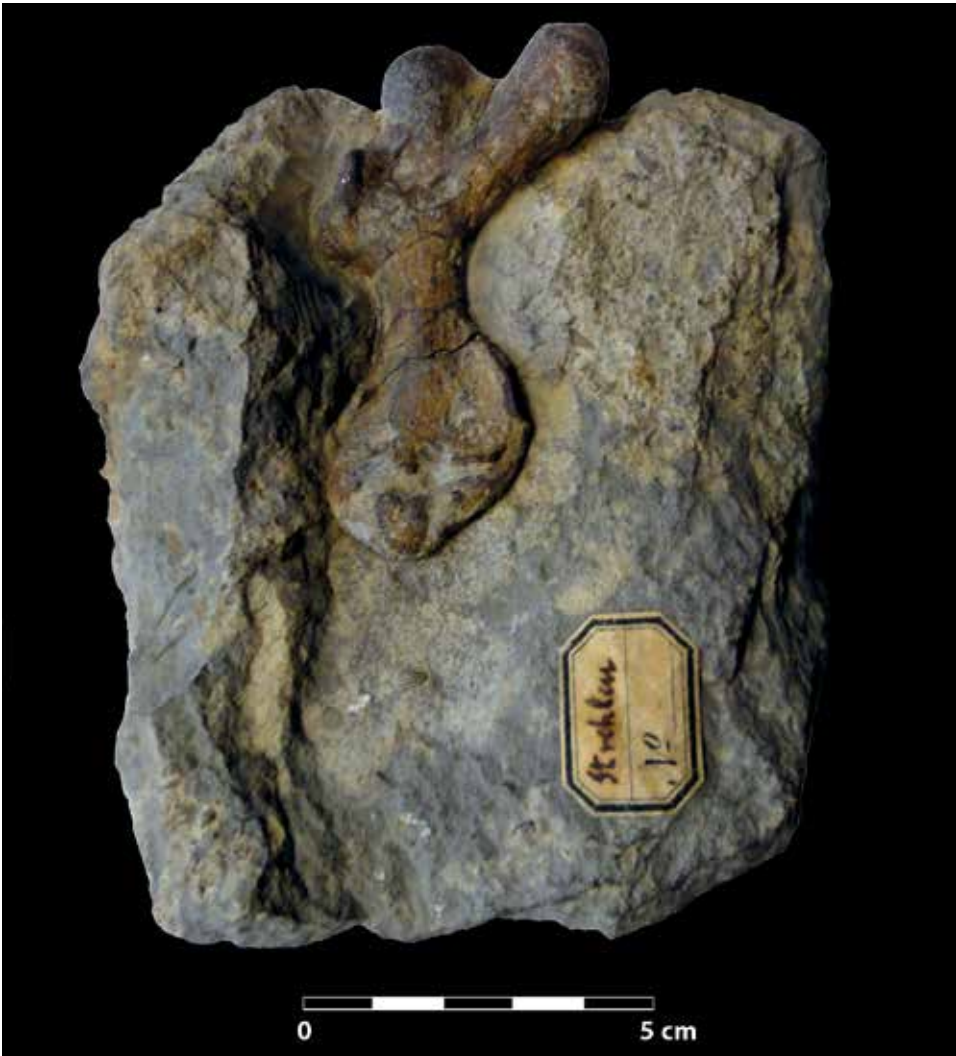


Plate 1: *Desmatochelys carusianus*, TUF 193/4, humerus in ventral view, one type specimen to GEINITZ (1847). Scale 5 cm. Photo taken by Birgit GAITZSCH (Bergakademie Freiberg).

Other Material: NMD 9332; 12/B1, two slabs with right arm bones, carapace and other inner skeletal remains (Plate 2, Fig. 3a-b).

Locality: Dortmund-Dorstfeld, North Rhine-Westphalia, Germany.

Horizon: Calcareous sandstone containing glauconite, Upper Turonian, Upper Cretaceous.

Description: The humerus is not slightly “s”-shaped in the sense of ZANGERL (1953), but flat and wide. The angle of head to shaft approximately 140° and the axis of shaft is 25° off plane of movement. The radial process (trochanter minor) is distal to the caput humeri. The distal joint surface (condylus, epicondylus) is convex, extends to ventral face. No contact rugosities between radius and ulna are present. Radius and ulna are straight (Fig. 4).

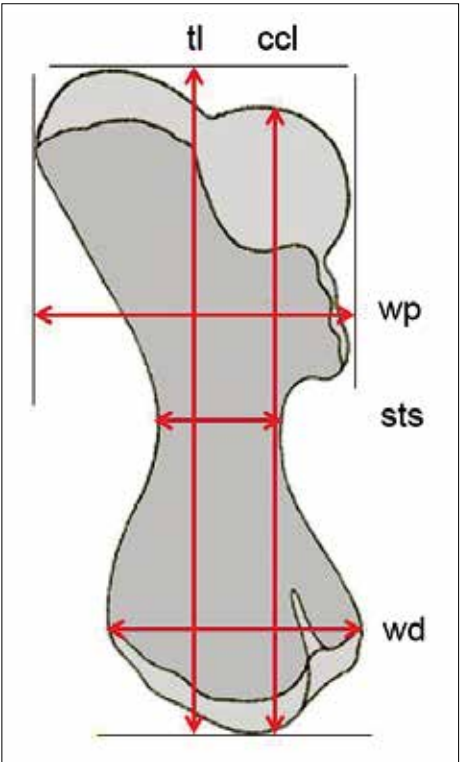


Fig. 4: Measuring sections of humeri used in this study.

Measurements: tl = total length, ccl = caput-condylus-length, wp = width proximally, wd = width distally, sts = smallest thickness of shaft (in mm), see Fig. 3. Collected by Stefanie BIERMANN.

Inv. No. 9332; 12/ B1	tl	ccl	wp	wd	sts
Humerus	278	262	129	106	64
Radius	-	-	69	-	32
Ulna	-	-	-	-	30

Desmatochelys padillai CADENA & PARHAM, 2015 (Fig. 5)

Synonyms:

- 1989 *Desmatochelys lowi* WILLISTON; SMITH, 1989: 158, figs. 7.6-7.8, pls. 7.11-7.15.
- 1992 *Desmatochelys lowi* WILLISTON; NICHOLLS, 1992: 379 (fide SMITH).
- 1997 *Desmatochelys* WILLISTON; ELLIOT, IRBY & HUTCHISON, 1997: 246 (fide SMITH).
- 2015 *Desmatochelys padillai* n. sp., CADENA & PARHAM, 2015: 3, figs. 2-5.

Type Material: FCG-CBP 01 According to CADENA & PARHAM (2015) complete skull, lower jaw, partial right hyoid, cervical vertebrae (3-8), right and left forelimbs (missing most phalanges), nearly complete carapace, left scapula and coracoid, partial hyoplastron and hypoplastron.

Type Locality: According to CADENA & PARHAM (2015) Loma La Catalina and Loma La Cabrera, near Villa de Leyva in Boyacá, Colombia, South America.

Type Horizon: According to CADENA & PARHAM (2015) Paja Formation, Late Cretaceous, Upper Barremian – Lower Aptian (~120 Ma).

Description: According to CADENA & PARHAM (2015) the humerus of *Desmatochelys padillai* is robust with the processus medialis almost at the same level of the caput humeri. The processus lateralis is located anteriorly very close

to the caput humeri, and the foramen ectepicondylaris is deep and particularly visible on the left front paddle. The radius is longer than the ulna, slightly convex anteriorly as in all

other protostegids. The humerus of *Desmatochelys padillai* is more robust than in *lowii* or *carusianus* (Fig. 5).

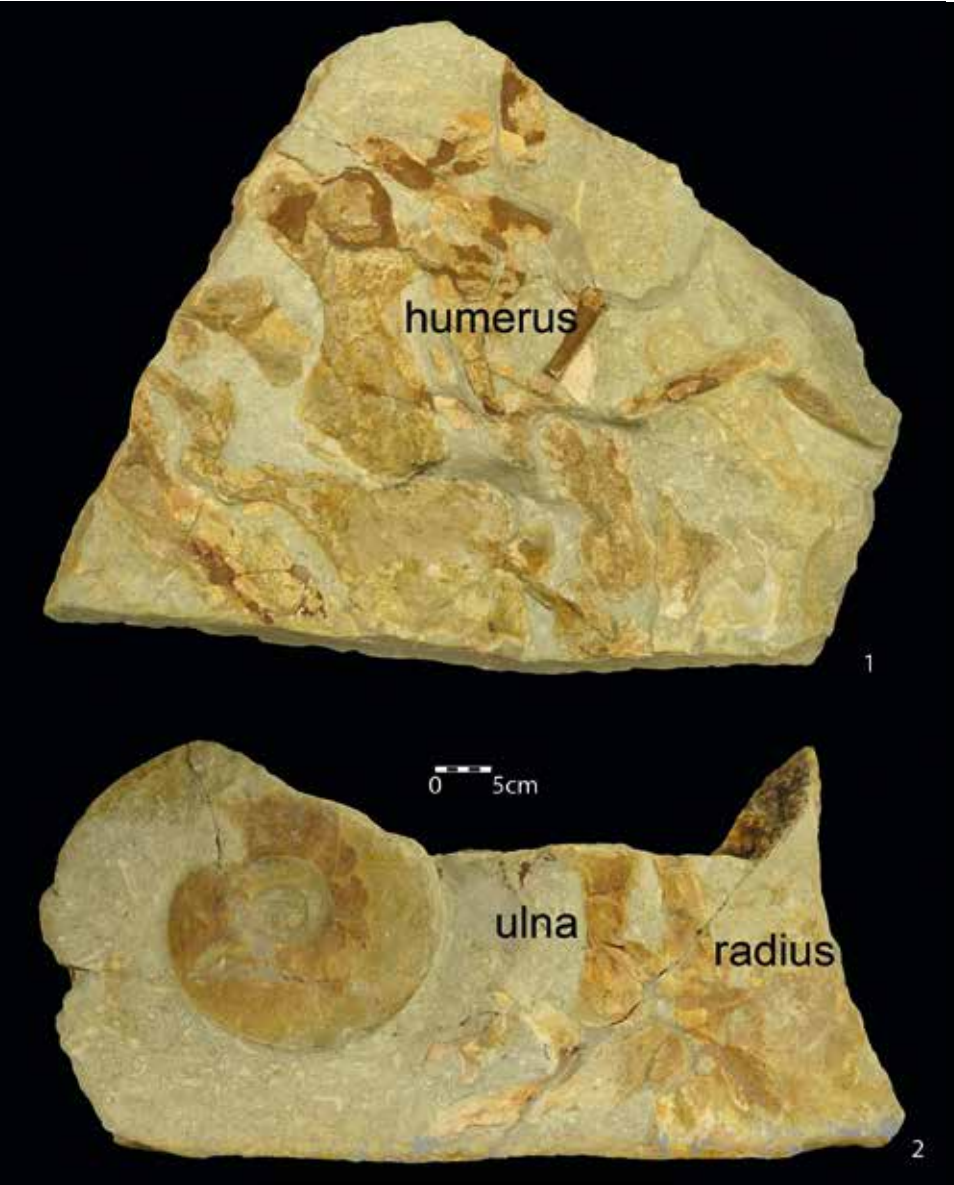


Plate 2: No. 1: *Desmatochelys carusianus*, NMD 9332; 12/B1, slab 1 with humerus in dorsal view. Scale 5 cm. Photo taken by Heike FISCHER (Museum für Naturkunde Dortmund). No. 2: *Desmatochelys carusianus*, NMD 9332; 12/B1, slab 2 with radius and ulna in dorsal view with *Lewisiceras peramplum* Stbr. F. Foerth. Scale 5 cm. Photo taken by Heike FISCHER (Museum für Naturkunde Dortmund).

4. Discussion

The two species of *Desmatochelys* are clearly different in the structure of radius and ulna (Fig. 4). At Mike EVERHART's website <http://www.oceansofkansas.com/turtledig2008.html> new humerus material is presented from the Fairport Chalk, Mitchell County, Kansas. He shows two views of a right humerus (ventral and dorsal views), compared with a figure of the right humerus of the type specimen of *Desmatochelys lowii* published by WILLISTON (1894). Initially, he thought that they were of the same species (the type specimen is about 50 % larger, 26 cm vs. 17 cm), but the more he looked at it, the more he thought it must be different. Furthermore a comparison between the South Dakota, the Kansas and the Nebraska specimens shows that the South Dakota and Kansas specimens are nearly identical in the length with 17 cm. Our new material from Dortmund-Dorstfeld is related to the larger specimen.

The type species of *Desmatochelys* is *Desmatochelys lowii*, named by WILLISTON (1894). It is based on the type specimen KUV 1200, collected near Fairbury, Nebraska. ZANGERL & SLOAN (1960) described a further specimen of *Desmatochelys lowii* as a primitive cheloniid sea

turtle from the Cretaceous of South Dakota. An incomplete specimen of *Desmatochelys* cf. *lowii* from the Trent River Formation (Santonian – Campanian) of the Comox Basin of eastern Vancouver Island was the first documented account of a Cretaceous marine vertebrate from the Pacific coast of Canada. It represents according to NICHOLLS (1992) both stratigraphic and geographic range extensions for the genus *Desmatochelys*. That genus was assigned to Cheloniidae by CARROLL (1988), to Desmatochelyinae by WEEMS (1988), to Desmatochelyidae by NICHOLLS (1992) and to *Chelonia* by SEPKOSKI (2002). WEEMS (1988) groups the Desmatochelyinae with *Desmatochelys* and *Corsochelys* ZANGERL, 1960 to the Dermochelyidae. Further information concerning morphology, distribution and systematics was given by ZANGERL (1953, 1980), ZANGERL & SLOAN (1960), HIRAYAMA (1994), ELLIOTT et al. (1997), KARL (2002), EVERHART & PEARSON (2008) and ALBRIGHT et al. (2013). MOODY (1993, 1997), HIRAYAMA (1997) and KARL (2002) gave further information concerning the biogeography.

Mike EVERHART shows the skull of a possibly *Desmatochelys*-like turtle (UCMP 38346) collected from the Early Cretaceous near Bogota, Columbia, South America. GAFFNEY et al.

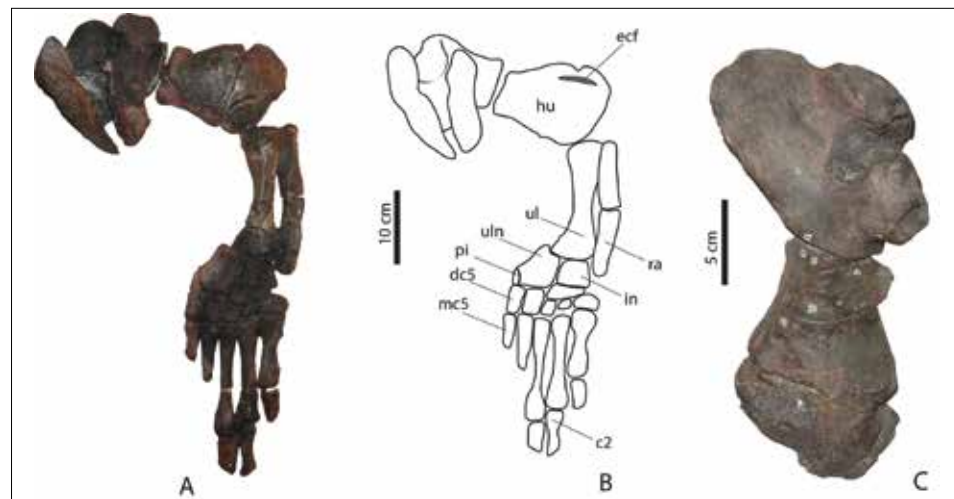


Fig. 5: *Desmatochelys padillai*. Left paddle, holotype FCG-CBP 01. A, B, dorsal view. C, left humerus isolated in ventral view. Abbreviations: c2: carpal 2, ecf: foramen ectepicondylaris, dc5: distal carpal 5, hu: humerus, in: intermedium, mc5: metacarpal 5, pi: pisiform, ra: radius, ul: ulna, uln: ulnare. From CADENA & PARHAM (2015) with permission.

(2007) noted concerning that specimen, that the University of California has a skull and partial skeleton material (UCMP 38346) of an undescribed chelonoid from the vicinity of Bogota, Colombia (V 4538), that may be Aptian – Barremian in age, but this material has never been described and its age is not substantiated. According to the phylogenetic analysis by CADENA & PARHAM (2015) the stem chelonoid *Toxochelys latiremis* is considered the sister taxon to a clade formed by Cheloniidae, Protostegidae and Pan-*Dermochelys*. Within the Chelonioidea s.l., protostegids are placed as the sister taxon to Pan-*Dermochelys*. Within the protostegids, *Santanachelys gaffneyi* is the most basal taxon, whereas *Desmatochelys padillai* is placed as the sister taxon to *Desmatochelys lowii* consistent with its earlier referral to that species (NICHOLLS 1992, ELLIOTT et al. 1997). The *Desmatochelys lowii* and *Desmatochelys padillai* clade is placed as the sister taxon to a Late Cretaceous clade that includes *Rhinochelys nammourensis*, *Archelon ischyros*, and *Protostega gigas*. Similar forelimb remains are described from the Upper Albian of Annopol in Poland (KAPUŚCISKA & MACHALSKI 2015) and the Upper Cretaceous – Lower Eocene Scaglia Rossa Formation from the Venetian Prealps of north-eastern Italy (AMALFITANO et al. 2016). The small Late Cretaceous protostegid turtle *Rhinochelys* also differs distinctly from *Desmatochelys* and its Campanian records from Germany (DIEDRICH & HIRAYAMA 2003, KARL et al. 2012a). The provisional assignment of the humerus to *Dollochelys* was carried out by KARL (1991) due to the great similarity and correspondence to the cretaceous *Dollochelys atlantica* ZANGERL, 1953 and also the very similar humeri of *Dollochelys casieri* ZANGERL, 1972 from the Middle Oligocene of the Weiße Jura Basin (see comments by LAPPARENT DE BROIN 2001). According to KARL (2007) the Oligocene material belongs to *Glariichelys knorri* (OWEN, 1837). The two type specimens to *Chelone carusiana* GEINITZ 1872-75 are systematically assigned as follows:

- The Freiberg specimen BAF 193/4 (fig. 6-1) is the type specimen of *Desmatochelys carusianus* (GEINITZ, 1872-1875) n. comb.

- The Dresden specimen of SMMG (without no.) (fig. 6-2) belongs in the synonymy of *Rhinochelys pulchriceps* (OWEN, 1842) according to KARL et al. (2012a).

5. Acknowledgements

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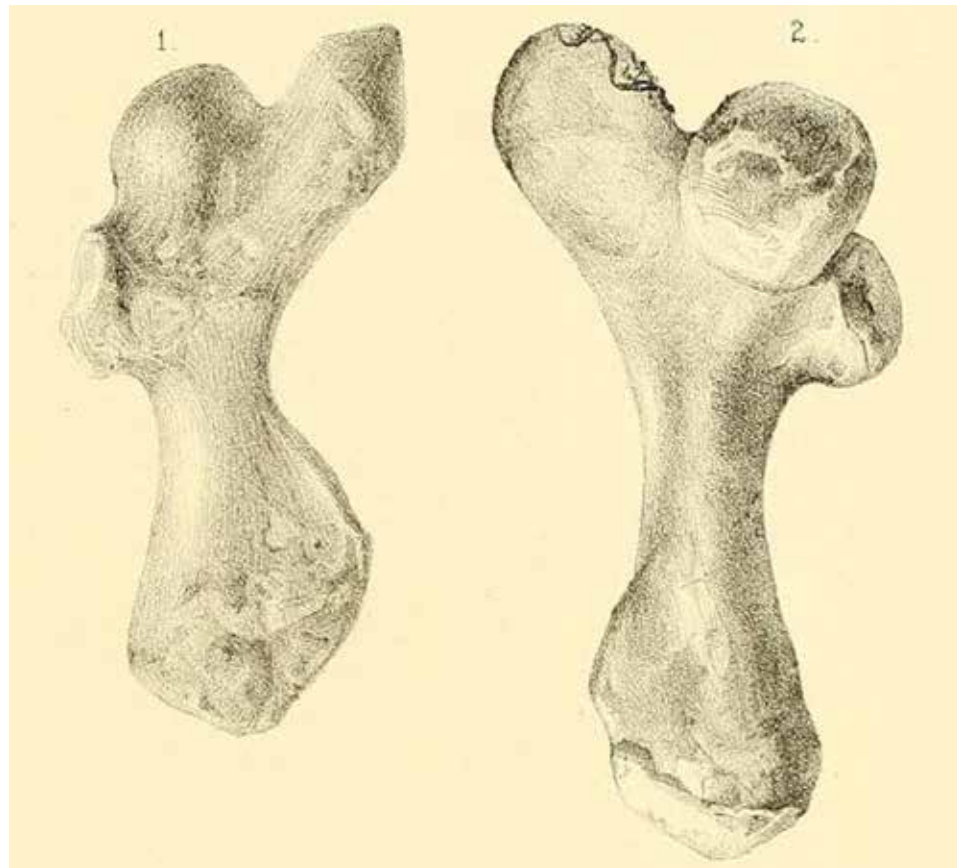


Fig. 6: Original figures legends by GEINITZ: 1 = Right humerus from the Plänerkalk of Strehlen in the collection of Technical University (Bergakademie) Freiberg/Saxony. Drawing by M. KRANTZ; 2 = left humerus in the State Museum for Geology and Mineralogy Dresden. Drawing by M. STEINLA.

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