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***Tasbacka germanica* n. sp., a new Campanian marine turtle from
NW-Germany (Testudines: Chelonioidae)**

HANS-VOLKER KARL, ELKE GRÖNING & CARSTEN BRAUCKMANN

Kurzfassung

***Tasbacka germanica* n. sp., eine neue Meeresschildkröte aus dem Campanium Nordwestdeutschlands
(Testudines: Chelonioidae)**

Basierend auf einem nahezu vollständig erhaltenen Schädel in Dorsalansicht aus der Holtwick-Formation (Untere Osterwick-Bank, Campanium) der Oberkreide von Holtwick-Legden, Nordrhein-Westfalen wird eine neue Meeresschildkröten-Art, *Tasbacka germanica* n. sp. (Testudines: Cryptodira: Cheloniidae) beschrieben. Weitere Exemplare, die sich dieser neuen Art zuordnen lassen, stammen von weiteren Lokalitäten der Oberkreide (Campanium) Nordrhein-Westfalens. Eine Merkmalsanalyse aller bekannten Arten der Gattung *Tasbacka* NESOV, 1987 zeigt, dass die deutschen Exemplare alle zu dieser eigenständigen Art gehören, die ihrerseits den ältesten Vertreter der Gattung repräsentiert. Mit den aktuellen Nachweisen von *Tasbacka* aus dem Campanium erstreckt sich ihre stratigraphische Verbreitung nun auch über die Kreide-Paläogen-Grenze hinweg.

Abstract

Tasbacka germanica n. sp. (Testudines: Cryptodira: Cheloniidae) is a new marine turtle based upon a nearly complete adult skull, preserved in dorsal view, from the Late Cretaceous Holtwick Formation (Lower Osterwick Beds, Campanian) of Holtwick-Legden, North Rhine-Westphalia, Northwest Germany. Additional specimens assigned to the same species originate from different Late Cretaceous (Campanian) localities in North Rhine-Westphalia. A character analysis of all known species of *Tasbacka* NESOV, 1987 shows that the German specimen represents a separate species which is hitherto the most ancient one of the genus. With this Campanian record the stratigraphical range of *Tasbacka* is extended across the Cretaceous-Palaeogene boundary.

Key words

Tasbacka germanica n. sp., marine turtle, Late Cretaceous, Campanian, Holtwick Formation, North Rhine-Westphalia, NW-Germany

1. Introduction

Most of the Late Jurassic (Campanian) specimens mentioned in the present article were housed in the private collection HILPERT (Datteln, North Rhine-Westphalia) which was transferred to the Ruhr Museum Essen in 1998. It includes a large number of turtle fragments which were mainly misinterpreted as mosasaurs. These materials were collected in the area between Coesfeld, Nottuln and Holtwick-Legden, WNW Münster, North Rhine-Westphalia (Fig. 1).

Another complete turtle shell was discovered, but largely destroyed, during road constructions across the Hill called Dielinger Klei W of the Steweder Berg NE Osnabrück. It was saved by Martin RÖPER (Solnhofen) and Dieter SIEBERT (Celle).

The lower part of the Late Campanian is the Coesfeld Formation (Hiss 2007), whereas the upper part of the Early Campanian was formerly named the Osterwick Beds (Fig. 2). The lower part of the latter belongs to the Holtwick Formation. It consists of dark gray, silty and sandy unstratified argillaceous marl which was deposited in a shallow marine environment (shallow to mid-shelf). In the type region, the Asbeck Member and occasionally even the Darfeld Member are rich in fossil sponges (HAUSCHKE 1994, HISS 1997, HAUSCHKE et al. 1999).

The Osterwick Beds and Holtwick Beds are often regarded as synonyms. They crop out within the Westfälische Bucht in Northwest Germany (ARNOLD 1968, HISS 2007, KAPLAN & RÖPER 1997).

The standard Late Cretaceous faunal zones in northern Germany are mainly based upon ammonoids and foraminifers (Hiss 1997, HAUSCHKE et al. 1999, KAPLAN et al. 2005, HISS 2006b).

The Holtwick Formation ranges from the *pilula-senonensis* zone to the *gracilis-senior* zone and thus covers the entire Upper Early Campanian. Its sediments were also deposited in a shallow environment (shallow to moderate shelf). In the type region (survey sheet TK25 3908 Ahaus), there is a gradual transition to the east towards the deep shelf facies with

less sandy components, but with increasing total thickness.

The Coesfeld Formation widely crops out in the Baumberge area between Coesfeld and Münster (Hiss 2006a). In the western part arenitic marl and marly limestone are dominant whereas to the east the facies becomes more fine-grained, with silty and calcareous clays and beds of harder limestone nodules. This suggests a gradual transition towards a facies of deeper water (Ahlen Formation) in the region SE of Münster. Both, the Ahlen and the Coesfeld Formations are clearly distinct by the lack of turbiditic components in the latter.

The Stewede Formation, named after the Steweder Berg between the Dümmer Lake and the Wiehengebirge, NE Osnabrück, completely consists of marine sediments of a shelf environment in moderately deep water. Its rich fossil fauna was described by ARNOLD (1968). Its Haldem Member is characterized by the Opoka facies which is rich in sponge spicules and thus represents a siliceous-carbonate facies (DÖLLING et al. 2006).

2. Abbreviations

GZG = Geoscience Centre,
University of Göttingen.
RE = Ruhr Museum Essen.
SF = Stewede Formation.
CF = Coesfeld Formation.
HF = Holtwick Formation.

3. Systematic Palaeontology

Order Testudines LINNAEUS, 1758
Infraorder Cryptodira COPE, 1868
Superfamily Chelonioidae BAUR, 1893
Family Cheloniidae OPPEL, 1811
Subfamily Cheloniinae OPPEL, 1811
Tribe Cheloniini ZANGERL & TURNBALL, 1955
Genus *Tasbacka* NESSOV, 1987

Paleocene Species: (i) *Tasbacka aldabergeni* NESSOV, 1987 (type species); Zhylga, Kazakhstan; Late Paleocene. (ii) *Tasbacka ouledab-*

dounensis TONG & HIRAYAMA, 2002; Couche 2, Recette 4, Ouled Abdoun phosphate basin, Morocco; Thanetian, Late Paleocene.

Eocene Species: (iii) *Tasbacka salisburgensis* (KARL, 1996); Haunsberg near Sankt Pankraz, Salzburg, Austria; Roterz-Schicht, Early Ypre-

sian, Early Eocene. (iv) *Tasbacka danica* KARL & MADSEN, 2012; Ejerslev Moclaj pit, Isle of Mors, Jutland, Denmark; Fur Formation, late NP 10, Early Eocene. For more details see KARL & MADSEN (2012).

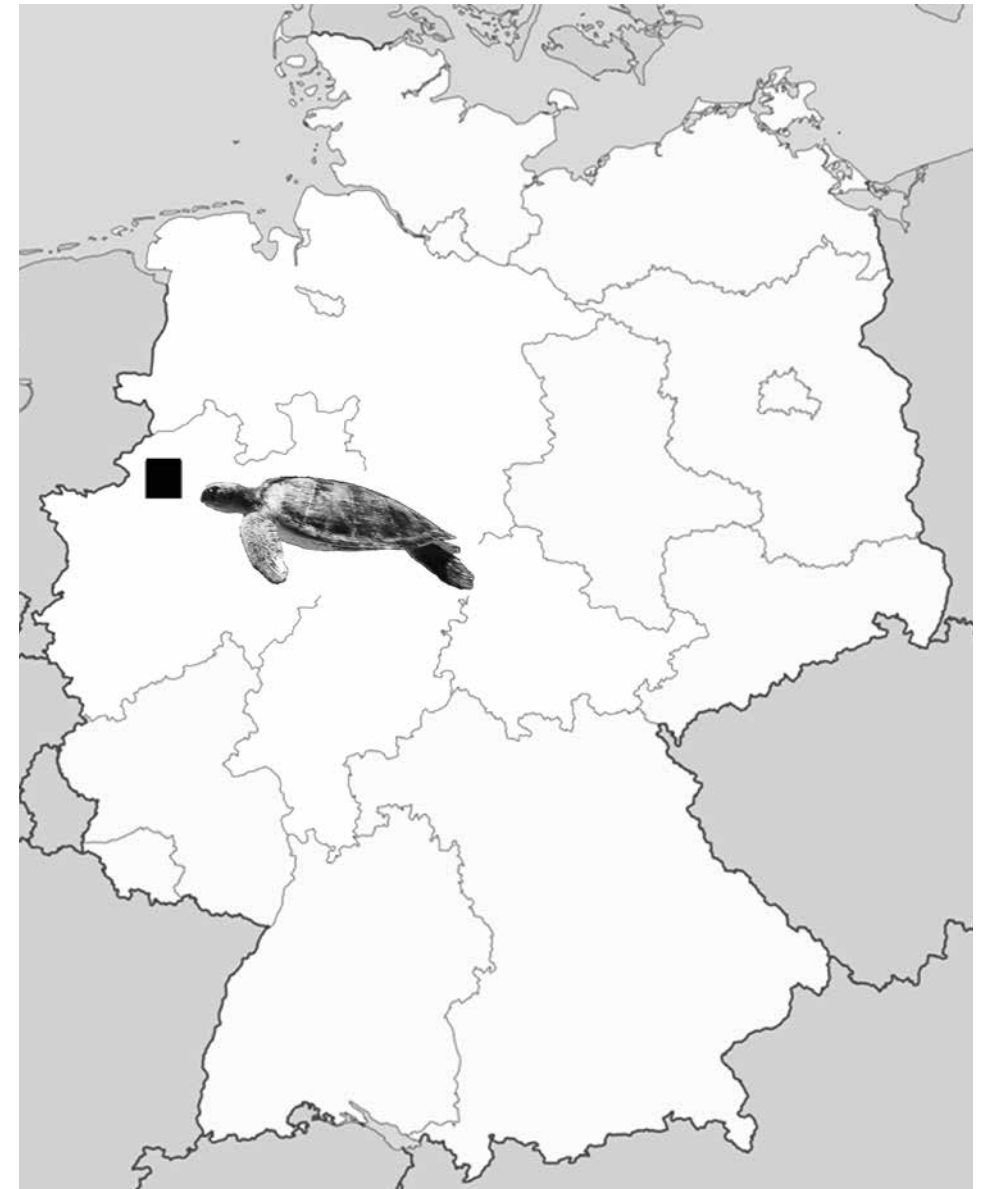


Fig. 1: Geographic position of the type locality of *Tasbacka germanica* n. sp. near Holtwick-Legden.

***Tasbacka germanica* n. sp.**
(Plate 1-4)

Holotype: Nearly complete adult skull (Plate 1-3), Ruhr Museum Essen, RE – 551.763.333 A 3752, former coll. HILPERT, old number – 16675.

Etymology: *germanicus*, -a, -um (adjective): the holotype specimen was collected in Germany.

Type Locality: Holtwick-Legden, North Rhine-Westphalia, Germany.

Type Horizon: Holtwick Formation (ID 2008032), Osterwick Beds (ARNOLD 1964), Campanian, Late Cretaceous.

Diagnosis: A species of *Tasbacka* with primary palatinum (plates 2-3). Supraoccipital shorter than in *T. ouledabdounensis* and *T. aldabergeni*, more similar to *T. danica*. Temporal indentations not as deep as in *T. ouledabdounensis* and *T. danica*, but deeper and more distinctly marked than in *T. aldabergeni* (plate 1).

General Remarks: For the general morphology and terminology of the skull of sea turtles and the general shell morphology see for example GAFFNEY (1979) and ZANGERL (1980), respectively. A comparison of the skulls of *Tasbacka* species was presented by TONG & HIRAYAMA (2002) and KARL & MADSEN (2012). Taxonomy and paleozoogeography were discussed by HIRAYAMA (1994), KARL (2002) and MOODY (1993, 1997), furthermore a complete survey of the Russian material is given by DANILOV et al. (2017). LINDGREN et al. (2017) show that the extraordinary preservation of the type of *Tasbacka danica* goes beyond gross morphology to include ultrastructural details and labile molecular components of the once-living animal. Haemoglobin-derived

Specimen	Length	Width	Height	Length/Width Ratio	Width/Height Ratio
<i>Tasbacka germanica</i> n. sp.	123	101	60	1.2	1.7
<i>Tasbacka aldabergeni</i>	97 / 125-147	110	65	1.3	1.7
<i>Tasbacka ouledabdounensis</i> 1	(75)	71	-	1.1	-
<i>Tasbacka ouledabdounensis</i> 2	100	92	-	1.1	-
<i>Tasbacka danica</i> 1	20	-	-	-	-
<i>Tasbacka danica</i> 2	110	70	-	1.6	-

compounds, eumelanin pigments and proteinaceous materials retaining the immunological characteristics of sauropsid-specific β keratin and tropomyosin were detected in tissues containing remnant melanosomes and decayed keratin plates. The preserved organics represent condensed remains of the cornified epidermis and, likely also, deeper anatomical features, and provide direct chemical evidence that adaptive melanism – a biological means used by extant sea turtle hatchlings to elevate metabolic and growth rates – had evolved 54 million years ago.

Comparison of *Tasbacka* Species: In the type species, *Tasbacka aldabergeni*, the cervical scute is absent. As pointed out by NESOV (1987) and TONG & HIRAYAMA (2002), the secondary palatinum is strongly developed in the previously described species. The anterior margin of the apertura narium interna is situated behind the anterior margin of the fossa temporale inferior. The pterygoid takes a substantial part of the palatinum. The post-orbital bone bears a thick transverse ridge at the bottom which extends onto the parietal bone. The lower jaw is narrow with a long symphysis, but does not reach the foramen dentofaciale majus (NESSOV 1987). *T. ouledabdounensis* differs from *T. aldabergeni* (i) in having a more strongly developed secondary palatinum, (ii) the anterior margin of the apertura narium interna being placed at mid-length of the fossa temporale inferior, and (iii) in having deeper temporal indentations. In *T. germanica* n. sp. the temporal indentations are not as deep as in *T. ouledabdounensis* and *T. danica*, but deeper and more distinctly marked than in *Tasbacka aldabergeni*. The main measurements are as follows:

The skull of *T. germanica* n. sp. has the same width/height ratio as *T. aldabergeni*. The length/width ratio of both species is somewhat greater than in *T. ouledabdounensis*, but smaller than in *T. danica*. *T. salisburgensis* differs from *T. aldabergeni*

	Biostratigraphische Gliederung	Lithostratigraphische Gliederung
OBERCAMPAN	Oberes	Baumberge-Schichten
	Unteres	Coesfeld-Schichten
UNTERCAMPAN	Oberes	Osterwick-Schichten
	Unteres	Dülmen-Schichten

Fig. 2: Stratigraphic column of the Northwest German Campanian with the position of the Coesfeld Formation and Osterwick Beds (from HAUSCHKE, 1994). The turtle icon marks the Holtwick Formation, the type horizon of *Tasbacka germanica* n. sp.

in having the proximate marginal sulcus along the middle of the peripheralia. The cervical scute is also absent. *T. danica* differs from *T. ouledabounensis* as well as from the type species (i) in the shorter supraoccipital, and (ii) less deep indentations.

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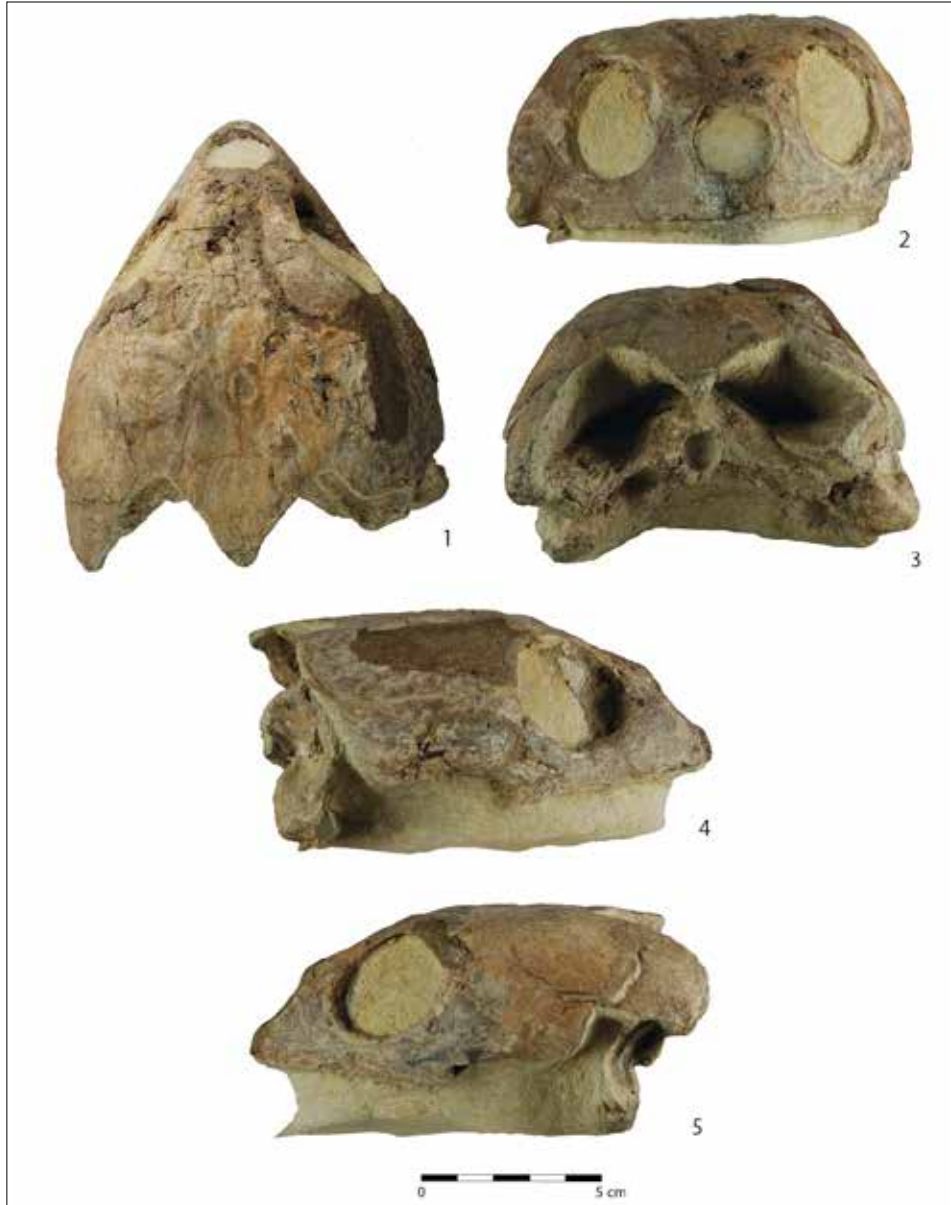


Plate 1: *Tasbacka germanica* n. sp., holotype, skull; Late Cretaceous: Campanian: Holtwick Formation; Holtwick-Legden, North Rhine-Westphalia, Northwest Germany. Figure 1 = dorsal view, 2 = frontal view, 3 = occipital view, 4 = right lateral view, 5 = left lateral view. Scale bar = 5 cm. Dark areas are reconstructed.



Plate 2: *Tasbacka germanica* n. sp., holotype, skull; Late Cretaceous: Campanian: Holtwick Formation; Holtwick-Legden, North Rhine-Westphalia, Northwest Germany. Figure 1 = occipital view of CT, 2 = dorsal view of CT, no = nasal opening, + = position of the internal choanae, bc = brain cavity.

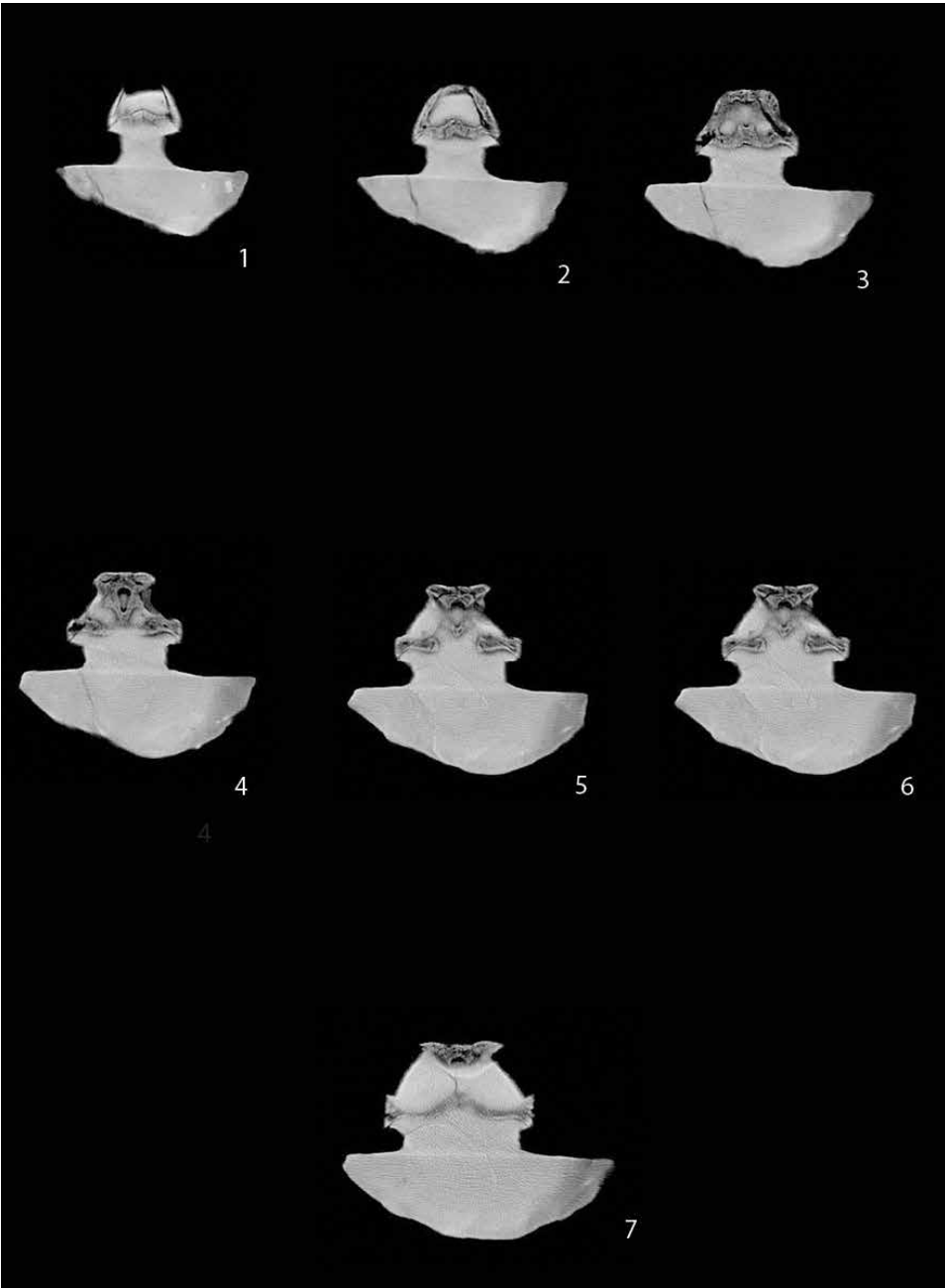


Plate 3: *Tasbacka germanica* n. sp., holotype, skull; Late Cretaceous: Campanian: Holtwick Formation; Holtwick-Legden, North Rhine-Westphalia, Northwest Germany. CT cuts of nasal opening (apertura narium externa) and choans (apertura narium interna). 1 = cut through snout with praemaxillae and nasal opening, 2 = cut immediately behind the nasal opening, 3-6 = cut through primary palatine with choanal openings, 7 = cut through primary Palatinum behind the choanae.

In *T. danica* the supraoccipital is shorter than in *T. ouledabdownensis* and *T. aldabergeni*, but more similar to *T. danica*. The metacarpal 1 of *T. danica* is thick and inflated. In adults, its skull is relatively smaller and more elongate than in the other species.
The sea turtle *Itilochelys rasstrigin* DANILOV, AVERIANOV & YARKOV, 2010 from the Lower Paleocene of Russia is generally similar, but its supraoccipital process is much longer than in the *Tasbacka* species.

Additional material assigned to *Tasbacka germanica* n. sp.: Many fragments of shells and skeletons have been collected from different localities of similar stratigraphical (Campanian) age (plate 4). It probably includes parts of a single individual which were scattered by trucks over a larger area. There assignment to *Tasbacka* is mainly based upon the very wide peripheralia. The localities, all situated in North Rhine-Westphalia, are as follows:

- 1) Dielinger Klei, a hill S of the Dümmer Lake and W of the Steweder Berg, close to the boundary between North Rhine-Westphalia and Lower Saxony (NE Osnabrück).
- 2) Nottuln-Darup, Daruper Mark, new road construction of the L 656, between Münster and Coesfeld.
- 3) Coesfelder Berg, excavation of water-retaining basins.
- 4) Rosendahl-Holtwick.
- 5) Holtwick-Legden, dump at the Federal Highway B 474, close to the southern border of Legden. The material probably originates from Coesfeld.

Character Analysis: Because of the different preservation of the materials, only a few characters are comparable: 1 = secondary palatinum absent (0) or present (1); 2 = skull broad (0) or elongate (1); 3 = temporal notches flat (0) or deep (1); 4 = marginal sulcus along the middle (0) or at the proximate edge of the peripheralia (1). The following data matrix was used: *Tasbacka germanica* 0011/ *Tasbacka aldabergeni* 1011/ *Tasbacka ouledabdownensis* 101?/ *Tasbacka danica* 1101/ *Tasbacka salisburgensis* ???0. Discrete character parsimony algorithm, PARS version 3.6a3©Joseph Felsenstein 1986b found two most parsimonious trees: (i) = (*Tasbacka ouledabdownensis*: 0.00, (*Tasbacka salisburgensis*: 1.00, *Tasbacka danica*: 1.00, *Tasbacka aldabergeni*: 0.00):1.00, *Tasbacka germanica*: 1.00)[0.5000], see Fig. 3; (ii) = (*Tasbacka salisburgensis*: 1.00, *Tasbacka ouledabdownensis*: 0.00, (*Tasbacka danica*: 1.00, *Tasbacka aldabergeni*: 0.00):1.00, *Tasbacka germanica*: 1.00)[0.5000], see fig. 4.

Tree 1 requires a total of 4.000 (Fig. 3)

between	and	Length
1	<i>Tasbacka ouledabdownensis</i>	0.00
1	3	1.00
2	<i>Tasbacka salisburgensis</i>	1.00
2	<i>Tasbacka danica</i>	1.00
2	<i>Tasbacka aldabergeni</i>	0.00
1	<i>Tasbacka germanica</i>	1.00

Tree 2 requires also a total of 4.000 (Fig. 4)

between	and	Length
1	<i>Tasbacka salisburgensis</i>	1.00
1	<i>Tasbacka ouledabdownensis</i>	0.00
1	2	1.00
2	<i>Tasbacka danica</i>	1.00
2	<i>Tasbacka aldabergeni</i>	0.00
1	<i>Tasbacka germanica</i>	1.00

The cladograms were created with TreeView ©Roderic Page (Fig. 3).

Locality	Horizon	Collection	Inventory number	
Dielinger Klei	SF	GZG (ex coll. RÖPER)	GZG.V.25743	
		Coll. SIEBERT	single specimen	
Nottuln-Darup, L 565	CF	RE	RE 551.763.333 A 3756/01-26	
			RE 551.763.333 A 6836/1-7	
Coesfelder Berg	CF		RE 551.763.333 A 3759-67 single specimen	
Rosendahl-Holtwick	HF		RE 551.763.333 A 4945	
Holtwick-Legden, B 474	HF/CF		RE 551.763.333 A 3752	

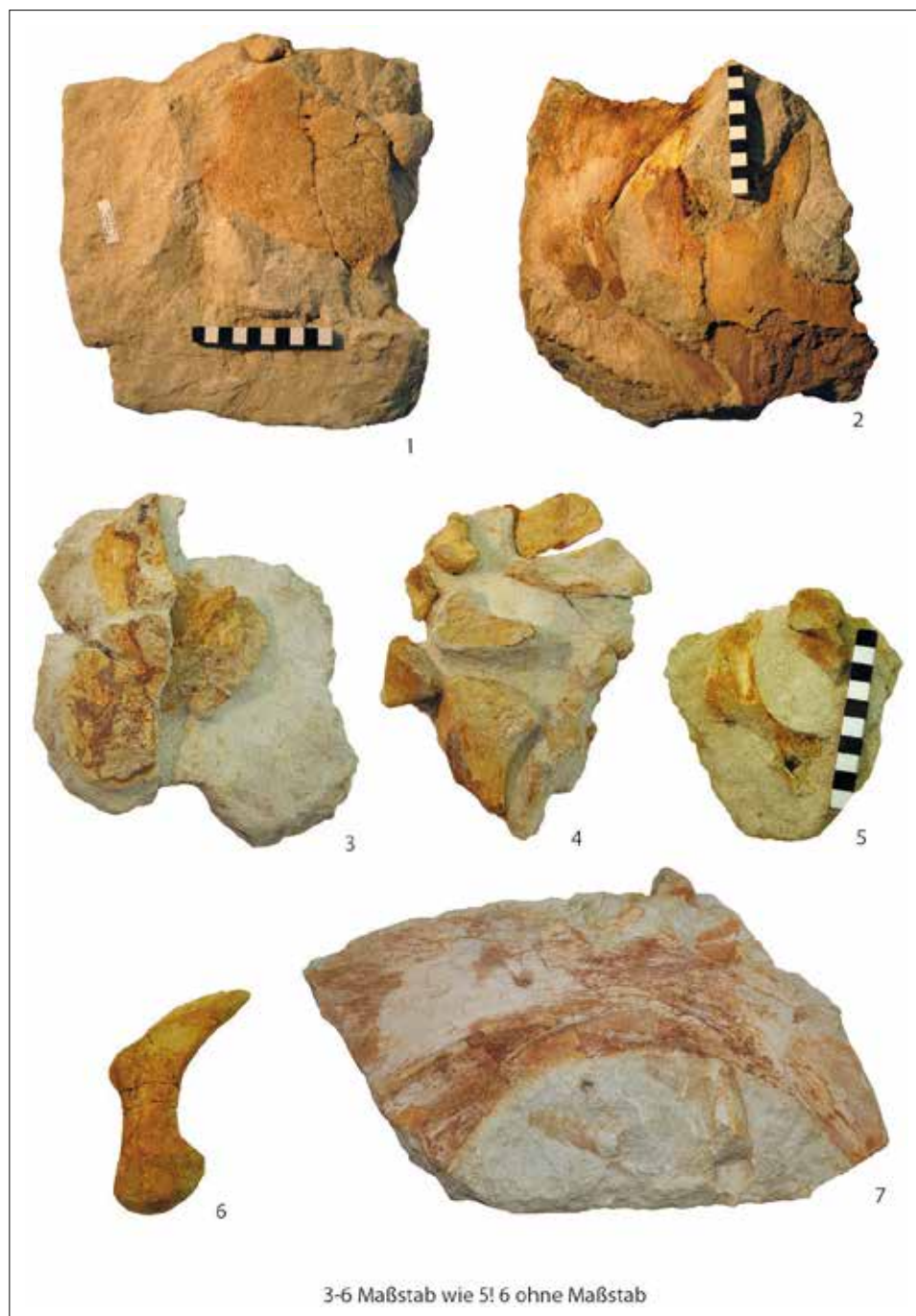


Plate 4: *Tasbacka germanica* n. sp., fragments of turtle shell (Figs 1, 2, 7), girdles and extremities (Figs 3-6). 1-2 = A 3756-1, 3 = A 3764, 4 = A 3765, 5 = A 3761-1a, 6 = A 3761-1b, 7 = GZG.V.25743.

Another tree based on DOLMOVE (Interactive Dollo and Polymorphism Parsimony by Joseph Felsenstein, 1986a) was also created with TreeView©Roderic Page (Fig. 4).

4. Discussion

Related Cretaceous remains of Cheloniidae are already known from NW Germany. KARL & NYHUIS (2012) described turtle fragments of the subfamily Lophochelyinae from the (Late Santonian to) Early Campanian Lägerdorf Formation of Itzehoe (Schleswig-Holstein, North Germany) which have to be compared with the specimens from North Rhine-Westphalia. The genus *Lophochelys* has been previously reported only from the Coniacian-Campanian Niobrara Chalk of Kansas and the Campanian Mooreville Chalk of Alabama, USA (NICHOLLS et al. 1990). Specimen TMP 89.47.1 in the article mentioned extends the geographic distribution of the genus from

Kansas and Alabama towards southern Alberta, Canada. *Ctenochelys stenoporus* (HAY, 1905) was previously only known from the Late Cretaceous of North America. The specimens described by KARL & NYHUIS (2012) enlarge its geographic range to Central Europe. The serrated keel along the midline of the carapace is diagnostic of the Lophochelyinae as defined by ZANGERL (1953). In this character the materials from the Stenweder Berg are different from those specimens described by NICHOLLS et al. (1990), but essentially show the characters pointed out by NESSOV (1987) for *Tasbacka*, especially in the plastron. In particular the central fontanella of the plastron of *Lophochelys* is less distinctly marked in *Tasbacka* and in the specimens from the Stenweder Berg. Furthermore, the broader peripheralia of the lateral and posterior margins have only smooth edges.

The small Late Cretaceous protostegid turtle *Rhinochelys* SEELEY, 1869 (Protostegidae) also differs distinctly from *Tasbacka* and its Cam-

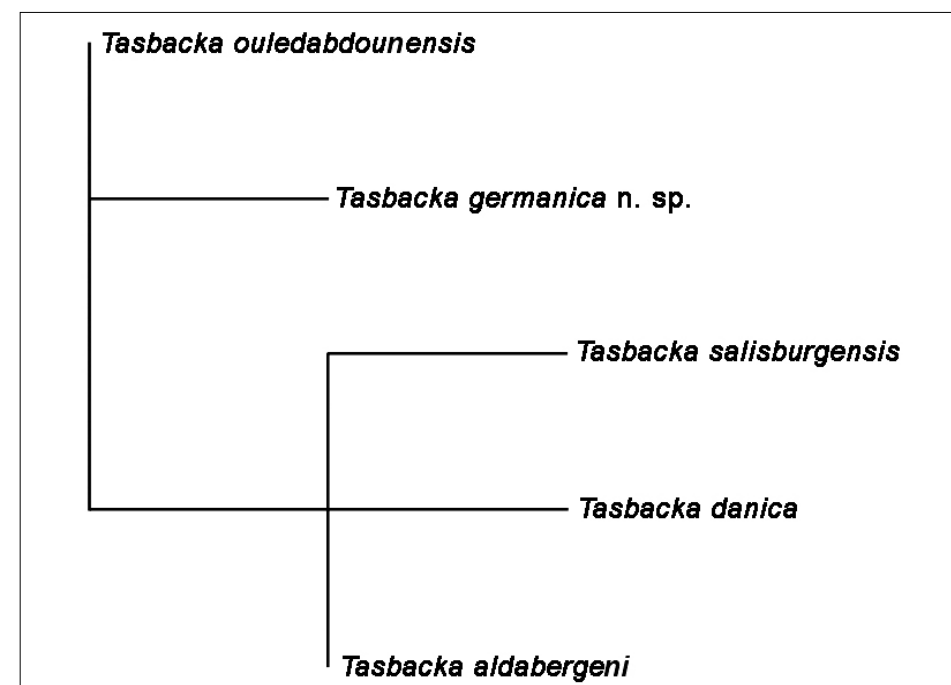


Fig. 3: Cladogram of the character analysis with PARS-Discrete character parsimony © Copyright 1986-2000 by the University of Washington. Written by Joseph FELSENSTEIN. Created with TreeView©Roderic Page.

panian records from Germany (DIEDRICH & HIRAYAMA 2003, KARL et al. 2012). Also the hitherto known turtle remains from the Campanian of Hanover area of the large genus *Allopleuron* BAUR, 1888 (Allopleuroninae) are not comparable. The actual study for phylogenetic aspects of marine adaption in turtles by EVERS & BENSON (2018) show that members of all marine clades that were present at the end of the Cretaceous (i. e. bothremydids, pleurodires, angolachelonians and chelonoids) survived into the Cenozoic. The genus *Tasbacka* is one example of these.

Stratigraphical Range of *Tasbacka* species: Previously *Tasbacka* species were only known from the Palaeogene Period. The youngest species is *T. salisburgensis* from the Early Eocene (Fig. 5): Early Ypresian 55.8-48.6 (formerly Cuisian “Roterzschicht”). Slightly older is *T. danica* from the Early Eocene Fur Formation (56-54.5 my). *T. aldabergeni* and *T. ouledabdounensis* are of Late Paleocene origin: Thanetian age (58.7-55.8 my). The hitherto most ancient species is *T. germanica* n. sp. from the Late Cretaceous (Campanian) Lower Osterwick Beds (83.5-71.3 my). It is the first evidence of *Tasbacka* in the Late Cretaceous, and thus in the Mesozoic era, characterized by a primary palatinum. All Cenozoic species of the genus have secondary palatina.

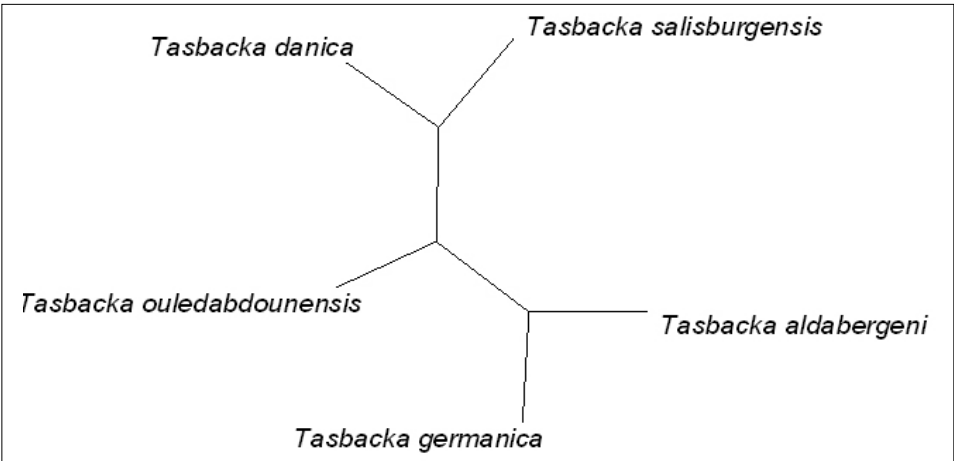


Fig. 4: Cladogram of DOLMOVE-Interactive Dollo and Polymorphism Parsimony © Copyright 1986-2002 by the University of Washington. Written by Joseph FELSENSTEIN.

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System	Series	Stage	Taxon
Palaeogene	Oligocene	Chattian	
		Rupelian	
	Eocene	Priabonian	
		Bartonian	
		Lutetian	
		Ypresian	<i>Tasbacka danica</i> <i>Tasbacka salisburgensis</i> <i>Tasbacka aldabergeni</i> <i>Tasbacka ouledabdounensis</i>
	Palaeocene	Thanetian	
		Seelandian	
		Danian	
	Cretaceous	Upper Cretaceous	Maastrichtian
Campanian			<i>Tasbacka germanica</i>
Santonian			
Coniacian			
Turonian			
Cenomanian			

Fig. 5: Stratigraphical distribution of the *Tasbacka* species from the Campanian to the Early Eocene.

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