

## Revision of the British record of *Tropidemys* (Testudines, Plesiochelyidae) and recognition of its presence in the Late Jurassic of Portugal

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Received: 4 December 2013 / Accepted: 18 December 2014 / Available online: 25 March 2015

### Abstract

The record of coastal marine turtles belonging to Plesiochelyidae is abundant in the Late Jurassic of Portugal. The material analyzed thus far has been attributed to two taxa: *Plesiochelys* and *Craspedochelys*. A specimen is presented here that allows extending the known diversity of Portuguese Jurassic turtles. It is attributed to *Tropidemys*. Although this taxon is relatively well known in the Kimmeridgian record of Switzerland and Germany, no specific allocation performed outside these countries can be, so far, confirmed. The detailed study of the poorly known British taxon "*Pelobatochelys*" *blakii* allows its specific validity to be confirmed here, being recognized as a member of *Tropidemys*. The revision of this species and the analysis of the new Portuguese specimen allow extending the knowledge regarding the genus *Tropidemys*.

**Keywords:** Plesiochelyidae, *Tropidemys*, Late Jurassic, England, Portugal

### Resumen

El registro de tortugas marinas litorales pertenecientes a Plesiochelyidae es abundante en el Jurásico Superior de Portugal. El material analizado hasta ahora ha sido atribuido a dos formas: *Plesiochelys* y *Craspedochelys*. Se presenta aquí un ejemplar que permite ampliar la diversidad de tortugas jurásicas conocida en ese país. Este nuevo espécimen es atribuido a *Tropidemys*. Aunque ese taxón es relativamente bien conocido en el registro Kimmeridgiense de Suiza y de Alemania, no se ha podido confirmar hasta ahora ninguna atribución específica fuera de esos países. El estudio detallado del mal conocido taxón británico "*Pelobatochelys*" *blakii* permite confirmar aquí su validez específica, siendo reconocido como un miembro de *Tropidemys*. La revisión de esa especie y el análisis del ejemplar portugués permiten ampliar el conocimiento sobre el género *Tropidemys*.

**Palabras clave:** Plesiochelyidae, *Tropidemys*, Jurásico Superior, Inglaterra, Portugal

### 1. Introduction

*Tropidemys* Rüttimeyer, 1873, is a taxon belonging to Plesiochelyidae (basal Eucryptodira), a clade of coastal turtles recognized as exclusive of the European Late Jurassic record (Rüttimeyer, 1873; Lapparent de Broin, 2001; Pérez-García,

2014). Its type species, *Tropidemys langii* Rüttimeyer, 1873, was discovered in the uppermost part of the Kimmeridgian of Solothurn (Switzerland). This species has been, until now, only recorded in that country. Only one additional species of this genus is currently recognized as a valid form (Karl *et al.*, 2012; Püntener *et al.*, 2014), *Tropidemys seebachi* Portis,

1878, whose known record is the Kimmeridgian of Hannover (Lower Saxony, Germany). The recent revision of the type material of *T. seebachi* (Karl *et al.*, 2012), together with the study of new materials of *T. langii* from the Kimmeridgian of Porrentruy (Canton Jura, Switzerland) (Püntener *et al.*, 2014), allowed revising the diagnosis of the two species. The presence of *Tropidemys* was notified, more than a century ago, in the Kimmeridgian of England (Lydekker, 1889a) and of France (Sauvage, 1902). This genus has recently been identified in the Tithonian of Spain (Pérez-García *et al.*, 2013), and its presence has been confirmed in the British record (Püntener *et al.*, 2014). However, it was not recognized at the specific level in any of these three countries (Pérez-García *et al.*, 2013; Püntener *et al.*, 2014) (Fig. 1).

“*Pelobatochelys*” *blakii* Seeley, 1875 is a poorly-known taxon from the Late Jurassic of England. The scarce available information is limited to that provided by in the original publication (Seeley, 1875) and by Lydekker (1889a). It was considered as *Chelonii incertae sedis* (Lapparent de Broin, 2001) and, more recently, referred to *Tropidemys*, “*Pelobatochelys*” being designate as a junior subjective synonym of this genus (Püntener *et al.*, 2014). In fact, the absence of a detailed revision of this British taxon led these last authors to remain uncertain regarding its specific identity.

The revision of the British material potentially attributable to *Tropidemys* is performed here. It confirms the specific validity of “*Pelobatochelys*” *blakii*, and defends the new combination *Tropidemys blakii*. In addition, other British specimens with a sagittal keel, which could be attributed to this genus, are also studied here.

Basal eucryptodiran turtles are very abundant in the Kimmeridgian and Tithonian levels of the Lusitanian Basin (central Portugal) (Sauvage, 1898; Antunes *et al.*, 1988; Pérez-García *et al.*, 2008, 2010; Ortega *et al.*, 2009). The Portuguese record includes representatives of *Craspedochelys* and *Plesiochelys*, and a recently described new species of *Hylaeochelys* (i.e., *Hylaeochelys kappa* Pérez-García and Ortega, 2014), which is the only species of this genus identified in the Jurassic (Pérez-García and Ortega, 2014).

A new find, presented here and assigned to *Tropidemys*, expands the known Portuguese Jurassic diversity of Eucryptodira, which also constitutes the most southwestern reference of this genus. It cannot be assigned to any so far identified species, but it is too fragmentary to allow establishing a new taxon.

Institutional abbreviations: CRE, specimens from Creuge-nat (Porrentruy), which belong to the Office de la Culture, République et Canton du Jura, Porrentruy, Switzerland; NHMUK, Natural History Museum, London, UK; NMS, Naturmuseum Solothurn, Switzerland; SHN.LPP, Laboratório de Paleontologia e Paleocologia da Sociedade de História Natural, Torres Vedras, Portugal; VTT, specimens from Vã Tche Tchã (Porrentruy), which belong to the Office de la Culture, République et Canton du Jura, Porrentruy, Switzerland.

## 2. The British record of *Tropidemys*

Testudines Batsch, 1788  
Pancryptodira Joyce *et al.*, 2004  
Eucryptodira Gaffney, 1975  
Plesiochelyidae Baur, 1888  
*Tropidemys* Rüttimeyer, 1873

Type species: *Tropidemys langii* Rüttimeyer, 1873

*Emended diagnosis* (modified from Püntener *et al.*, 2014): Plesiochelyid with the following autapomorphies: high carapace with a tectiform posterior part; midline keel present, being more distinct posteriorly; second to last neurals relatively wide and hexagonal; posterior neurals wider than long with no short anterior sides.

*Tropidemys blakii* (Seeley, 1875) comb. nov.  
(Figs. 2A-J, 3A-L)

*Synonyms*: *Pelobatochelys blakii*, Seeley, 1875.

*Lectotype*: NHMUK R2a, several articulated plates corresponding to the fourth to sixth neurals, the nearly complete fourth left costal, and the medial region of the fifth pair of costals (Fig. 2E-G).

*Paralectotypes*: NHMUK R2, several articulated plates corresponding to much of the nuchal plate, the first three neurals, and the medial region of the first to third pairs of costals and of the fourth right costal (Fig. 2A-B); NHMUK 44177a, several articulated plates, probably corresponding to the third to fifth neurals, and to the medial region of the third left, fourth right and fifth left costals (Fig. 2C-D); NHMUK 44177, several articulated plates corresponding to the fourth to seventh neurals, the anterior region of the first suprapygial, the medial region of the fourth right costal, and the medial region of the fifth to eighth pairs of costals (Fig. 2H-J); NHMUK 41235, a peripheral plate (Fig. 3I-J); NHMUK 44177b, a pygal plate (Fig. 3K-L). All of these specimens are from the same locality and horizon as NHMUK R2a.

*Referred material*. NHMUK 44177c, a costal plate (Fig. 3A-B); NHMUK 41234a, a neural (Fig. 3C-D); NHMUK 44178a, a neural (Fig. 3E-G); one of the specimens catalogued as NHMUK R1768, corresponding to a neural (Fig. 3H). All of these specimens are from the same locality and horizon as NHMUK R2a.

*Type locality and horizon*: Weymouth, Dorset, England (Seeley, 1875) (Fig. 1B); Early Kimmeridgian (perhaps late Oxfordian?) of the Kimmeridge Clay (Benton and Spencer, 1995).

*Diagnosis*: Member of *Tropidemys* differing from the other known species of this genus due to the presence of anterior and middle neurals markedly longer than wide, with anterolateral margins much shorter than the posterolaterals; very wide vertebral scutes; presence of fontanelles between the costal and peripheral plates along all or most of their ontog-

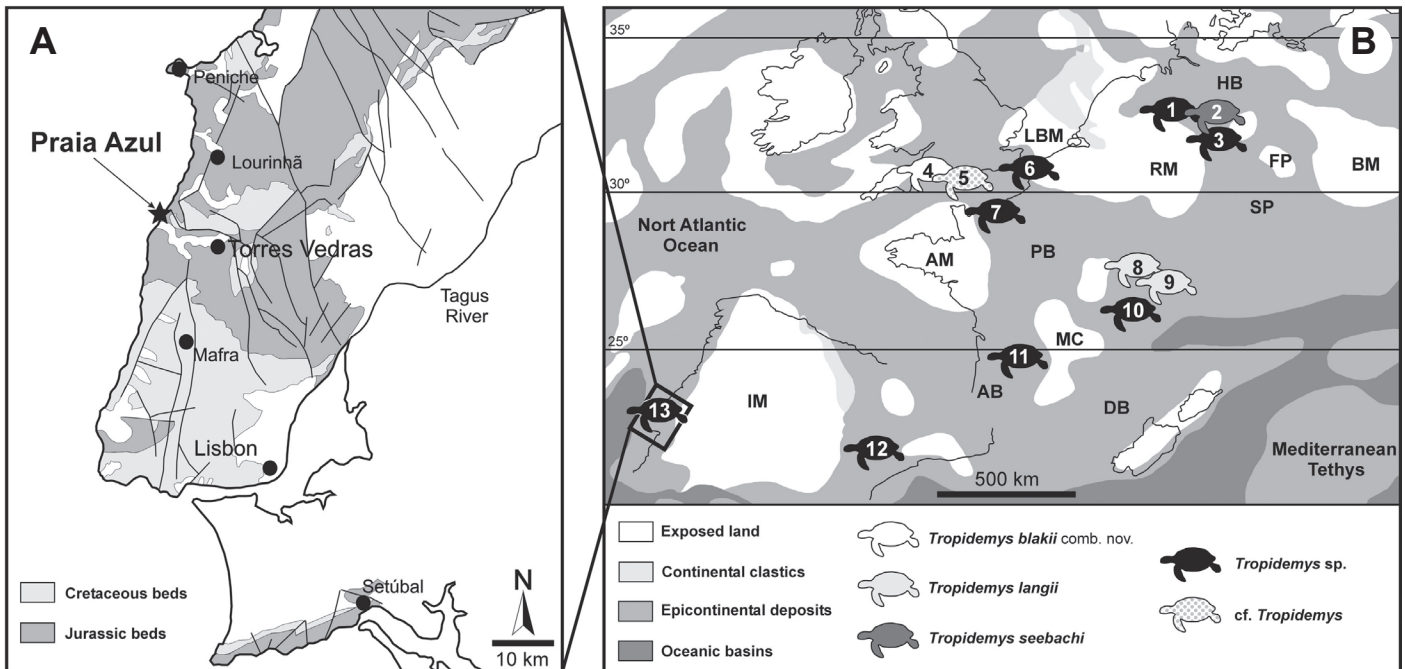


Fig. 1.- A, Map of the central-west region of Portugal showing the location of the Late Jurassic area of Praia Azul (Torres Vedras), where the most southwestern known record of *Tropidemys* has been identified. Modified from Oliveira *et al.* (1992) and Pérez-García and Ortega (2011). B, Map of Western Europe showing all the findings of *Tropidemys* so far reported. Modified from Püntener *et al.* (2014). Numbers: 1, Nettelstedt/Wallücke, Germany. Kimmeridgian; 2, Hannover, Germany. Kimmeridgian; 3, Hildesheim, Germany. earliest Kimmeridgian; 4, Weymouth, England. Late Oxfordian?-Early Kimmeridgian; 5, Isle of Wight, England. Early Aptian?; 6, Boulonnais, France. Kimmeridgian; 7, Le Havre, France. Kimmeridgian; 8, Porrentruy, Switzerland. Kimmeridgian; 9, Solothurn, Switzerland. Late Kimmeridgian; 10, Sainte-Croix, Switzerland. Valanginian?; 11, Fumel, France. Late Kimmeridgian; 12, Galve, Spain. Tithonian; 13, Torres Vedras, Portugal. Late Kimmeridgian-early Tithonian. Abbreviations: AB, Aquitaine Basin; AM, Armorican Massif; BM, Bohemian Massif; DB, Dauphinois Basin; FP, Franconian Platform; HB, Hannover Basin; IM, Iberian Massif; LBM, London Brabant Massif; MC, Massif Central; PB, Paris Basin; RM, Rhenish Massif; SP, Swabian Platform.

eny. It shares with *T. langii*, but not with *T. seebachi*, the presence of five vertebrales.

**Description:** The material analyzed here corresponds to both juvenile (e.g. NHMUK R2 and NHMUK 44177a; Figs. 2A-B, 2C-D) and adult or subadult specimens (e.g. NHMUK R2a and NHMUK 44177; Figs. 2E-G, H-J). The lateral margins of the only preserved nuchal plate are broken. However, it is possible to see that this plate was wider than long (NHMUK R2; Figs. 2A-B). This taxon has eight neural plates. The sixth and seventh neurals of NHMUK 44177 (Figs. 2H-J) are fused, constituting a single element. The first neural is rectangular. The other neurals are hexagonal. The anterior and middle neurals are markedly longer than wide both in the juvenile individuals and in the adults (e.g. the length of the fifth neural of the larger NHMUK R2a and NHMUK 44177, is 1.5 times its maximum width). The anterolateral margins of these neurals are short. A sagittal keel is observed from the second neural to the pygal, being well developed over the middle and posterior neurals (see Figs. 2E-E', 2J, 3G'). It is a rounded keel. The costals are poorly ossified and the free, distal ends of the dorsal ribs are therefore well developed. The poorly ossified area is greater in the adult individuals than in the juveniles. Furthermore, the lateral margins of the costal plates and the medial margins of the peripherals lack a sutured contact. This is related to the presence of fontanelles

between the costal and peripheral plates, probably present along the entire ontogeny. The presence of a hole for the insertion of the distal region of these ribs is recognized in the medial margin of the peripherals. The pygal plate shows the presence of a small posterior notch (Fig. 3K-L).

*Tropidemys blakii* is interpreted as having three cervical scutes (Fig. 2A). They are very short. This taxon has five vertebral scutes. The contact between the first and the second vertebrae is located on the first neural, the contact between the second and third vertebrae on the third neural, that between third and fourth vertebrae on the fifth neural, and the contact between the fourth and fifth vertebrae is placed on the eighth neural (Figs. 2A, C, G, H). The morphology of the sulci between the vertebrae goes from subperpendicular to the axial plane to convex. However, the contact of the fifth vertebral scute with the last pair of marginals is markedly concave, due to the medial wedging of this pair of marginals (Fig. 3K). The vertebral scutes of all analyzed specimens are very wide.

#### Discussion

Seeley (1875) defined *Pelobatochelys blakii* based on several specimens, all of them coming from the same locality. However, he did not identify any of them as the holotype.

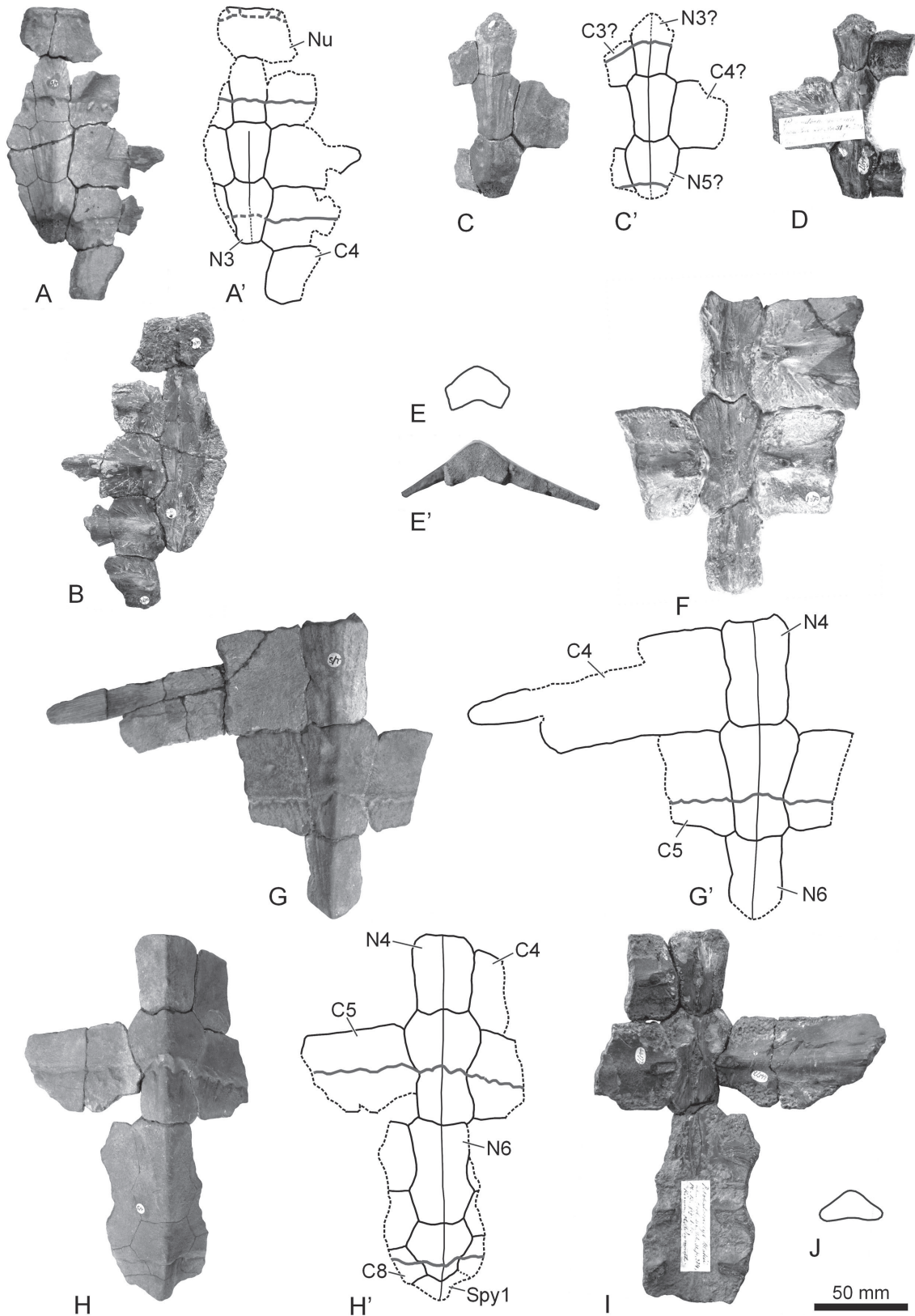


Fig. 2.- A-V, *Tropidemys blakii* (Seeley, 1875) comb. nov., from the late Oxfordian?-early Kimmeridgian of the Kimmeridge Clay of Weymouth (Dorset, England). A-B, NHMUK R2 (paralectotype), articulated nuchal, neurals and costals, in dorsal (A) and ventral (B) views; C-D, NHMUK 44177a (paralectotype), articulated neurals and costals, in dorsal (C) and ventral (D) views; E-G, NHMUK R2a (lectotype), articulated neurals and costals, in anterior (E), ventral (F), and dorsal (G) views; H-J, NHMUK 44177 (paralectotype), articulated neurals, costals, and first suprapygals, in dorsal (H), ventral (I) and anterior (J) views. The thicker black lines represent the sutures between plates, the narrower black lines indicate the position of the sagittal keel, and the grey lines correspond to the border of the scutes. Abbreviations: C, costal; N, neural; Nu, nuchal; Spy1, suprapygals.

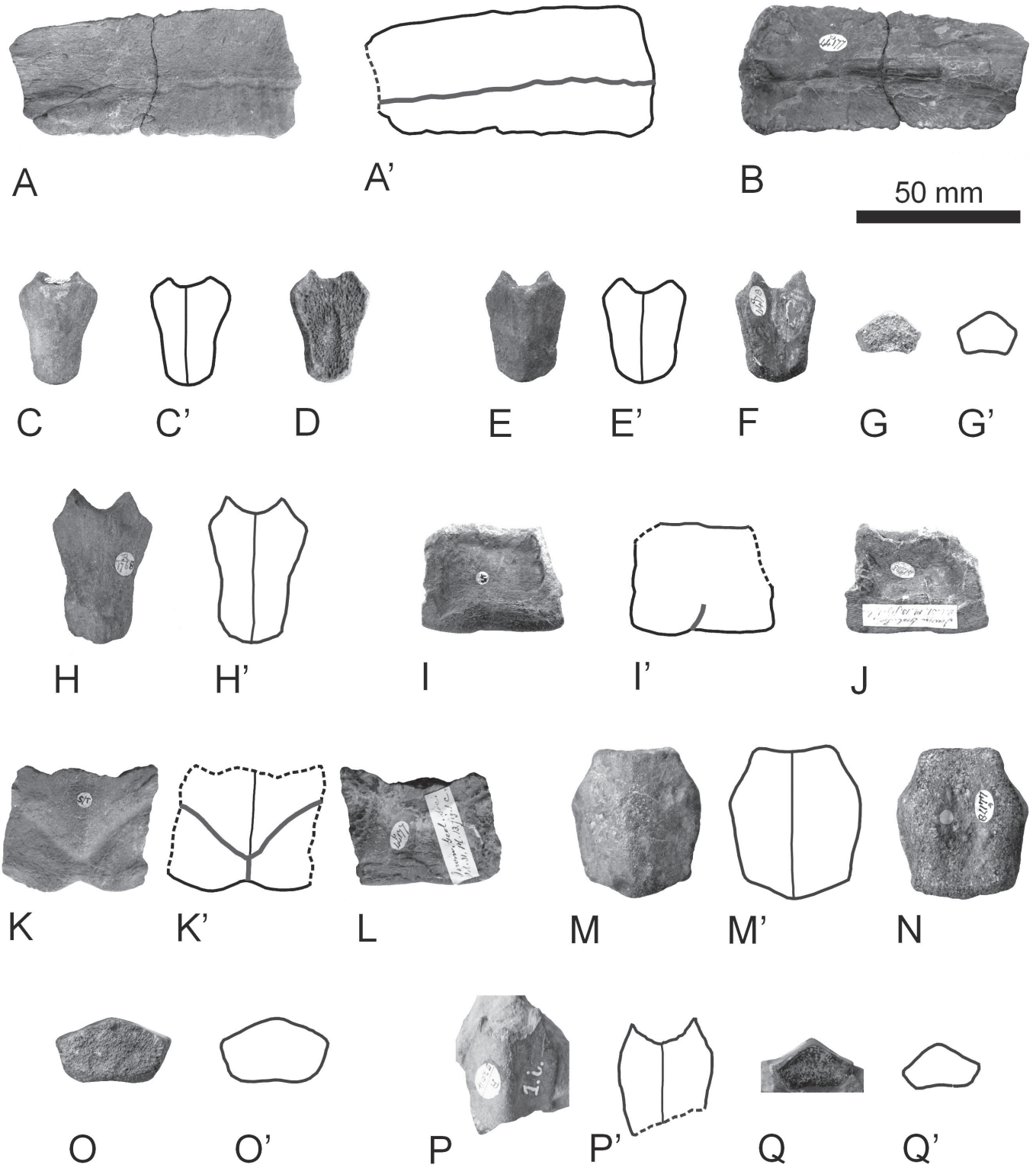


Fig. 3.- A-L, *Tropidemys blakii* (Seeley, 1875) comb. nov., from the late Oxfordian?-early Kimmeridgian of the Kimmeridge Clay of Weymouth (Dorset, England). A-B, NHMUK 44177c, costal, in dorsal (A) and ventral (B) views; C-D, NHMUK 41234a, neural, in dorsal (C) and ventral (D) views; E-G, NHMUK 44178a, neural, in dorsal (E), ventral (F) and posterior (G) views; H, NHMUK R1768, neural, in dorsal view; I-J, NHMUK 41235 (paralectotype), peripheral, in dorsal (I) and ventral (J) views; K-L, NHMUK 44177b (paralectotype), pygal, in dorsal (K) and ventral (L) views. M-O, NHMUK 44178b, neural of *Tropidemys* sp., from the late Oxfordian?-early Kimmeridgian of the Kimmeridge Clay of Weymouth (Dorset, England), in dorsal (M), ventral (N) and posterior (O) views. P-Q, NHMUK R5204, neural of cf. *Tropidemys* whose origin (earliest Aptian of the Isle of Wight) cannot be confirmed, in dorsal (P) and posterior (Q) views. The thicker black lines represent the sutures between plates, the narrower black lines indicate the position of the sagittal keel, and the grey lines correspond to the border of the scutes.

The specimens analyzed by Seeley (1875) have been recognized in the Paleontology Collection at the Natural History Museum (London). Due to this so far problematic taxon revised here, and a diagnosis proposed for the first time, I identify a lectotype and several paralectotypes. I choose specimen NHMUK R2a as the lectotype. The other specimens cited by Seeley (1875) are recognized as paralectotypes: NHMUK R2, NHMUK 41235, NHMUK 44177b, NHMUK 44177, NHMUK 44177a.

The presence of three cervical scutes is shared with the European clade Plesiochelyidae (Lapparent de Broin *et al.*, 1996), being also present in a member of Eurysternidae (i.e. *Eurysternum wagleri*; Walter G. Joyce, pers. comm.). “*Pelobatochelys*” *blakii* is attributed to *Tropidemys* because it shares exclusively with this plesiochelyid the presence of a sagittal keel, its carapace being high and tectiform, and wider than long posterior neurals, with no short anterior sides.

The length of the shell of the specimen NHMUK R2 is inferred to have been similar to that of the relatively complete carapace of *T. langii* CRE985-1 (see fig. 6 in Püntener *et al.*, 2014), identified as a juvenile specimen. However, the length of the neural and costal plates of NHMUK R2a and NHMUK 44177 are compatible with those of adult specimens of *T. langii* (e.g. VTT006-176 and VTT006-563; figs. 4 and 5 of Püntener *et al.*, 2014). The absence of nuchal notch has been recognized in some specimens of *T. langii*, but others have a shallow notch. The presence of an eighth neural is shared with all the known specimens of *Tropidemys*. The morphology of the first neural of all the specimens of this genus is rectangular, but the other neurals are hexagonal. None of the known Swiss and German specimens of *Tropidemys* has the middle neurals markedly longer than wide, nor the anterolateral margins noticeably shorter than the posterolateral ones. In this regard, it has been recently indicated that the fourth and fifth neurals of the previously-cited juvenile specimen of *T. langii* (CRE985-1) are about as long as wide, the fifth neural of VTT006-176 and of VTT006-563 being slightly wider than long (Püntener *et al.*, 2014). All neurals from the second to the last one are wider than long in the almost complete carapace from Solothurn NMS 8648 (see fig. 1 in plate 8 of Bräm, 1965). In fact, all known neurals in the holotype of this taxon (NMS 8554), neurals six to eight, are also wider than long. The morphology and the angle of the sagittal keel of the British taxon fall within the range of variability previously known in *Tropidemys*. The length of the preserved neurals and costals of NHMUK R2 is very similar to that of CRE985-1. However, the width of the second pair of costals of CRE985-1 is close to three times its length, whereas in NHMUK R2 this width is less than 1.5 times its length. Therefore, although the costals of CRE985-1 were sutured to the peripherals, or separated by very narrow fontanelles, the fontanelles of NHMUK R2 were highly developed. The comparison between NHMUK R2a and several specimens of *T. langii* with a similar size allows observing that, unlike the condition present in *T. langii*, the adult or subadult specimens

of *T. blakii* preserve fontanelles between the costal and peripheral plates.

The cervical scutes of *T. blakii* are interpreted as being significantly shorter than those present in *T. langii*. These scutes are not known in *T. seebachi*. The number of vertebral scutes in *T. blakii* is shared with *T. langii* and they are smaller than that of *T. seebachi*. The overlapping of the sulci between the vertebral scutes on the first, third, fifth and eighth neurals is the condition usually present in *T. langii*, but, as in many taxa, specimens that show some modifications are recognized (Pérez-García, 2012; Püntener *et al.*, 2014). The vertebral scutes of *T. langii* and *T. seebachi* are relatively narrow, in contrast to the wide vertebrales in *T. blakii*.

Therefore, “*Pelobatochelys*” *blakii* is attributed to the *Tropidemys*, but recognized as a taxon distinct to both *T. langii* and *T. seebachi*.

*Tropidemys* sp.  
(Figs. 3M-O)

*Material*: NHMUK 44178b, a neural plate.

*Locality and horizon*: The type locality and horizon of *Tropidemys blakii* (i.e. Weymouth, Dorset, England. Kimmeridge Clay).

*Description*: NHMUK 44178b is a neural plate. It is relatively wide, its length about 12% greater than its width. The length of the posterolateral margins is less than 25% greater than anterolaterally. This plate has a rounded sagittal keel, whose angle is about 130°.

*Discussion*: The presence of a sagittal keel, together with the morphology of this neural plate, relatively wide and with relatively short anterolateral margins, is exclusive to *Tropidemys*. In fact, these last two characters are only present in the more posterior neurals of *T. blakii*, but are shared with all the neural plates (except the first one) of *T. langii* and *T. seebachi*. The obtuse angle recognized in the keel of this plate, of more than 120°, has not been recognized in neurals farther behind the fifth neural in any specimen of this genus (see table 2 of Püntener *et al.*, 2014). This is consistent with the interpretation by Lydekker (1889a), who considered NHMUK 44178b a second neural plate. The absence of overlapping of a sulcus delimiting the vertebral scutes makes possible that interpretation, but its allocation to a fourth neural cannot be determined for certain. Therefore, the morphology of this plate is consistent with those of *T. langii* and *T. seebachi*, differing from the neurals of *T. blakii*. The absence of a sulcus corresponding to the limit between two vertebrales allows excluding its attribution to *T. seebachi*. The available information is not sufficient to attribute it to *T. langii* and therefore it is only possible to recognize the presence of an indeterminate second member of *Tropidemys* in the British record.

Although Lydekker (1889a) attributed to *T. langii* other specimens from the cited British locality (NHMUK 45920, three articulated anterior right costals; NHMUK 45921, a first left costal; and NHMUK 42372, a hyoplastron), their

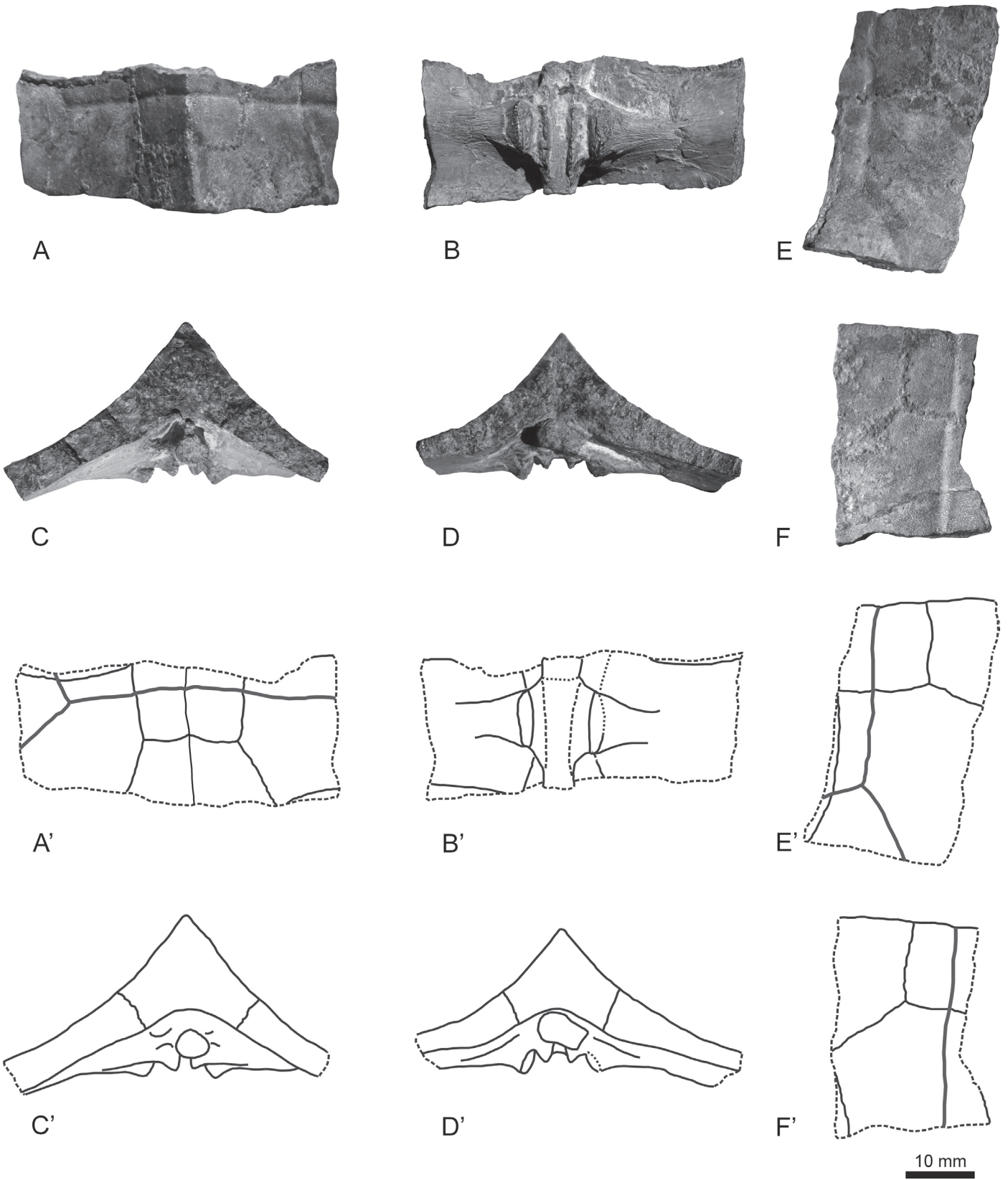


Fig. 4.- SHN.LPP 173, *Tropidemys* sp. from the late Kimmeridgian-early Tithonian of Praia Azul (Torres Vedras, Portugal), in dorsal (A), ventral (B), posterior (C), anterior (D), left lateral (E), and right lateral (F) views. The black lines represent the osseous elements and the grey lines correspond to the border of the scutes.

attribution to *Tropidemys* based on availability of characters prevents their assignment to a single taxon. Characters such as the presence of relatively narrow vertebral scutes, and relatively well-ossified costal plates, confirms that these costal plates are not compatible with *T. blakii*.

cf. *Tropidemys*  
(Figs. 3P-Q)

**Material:** NHMUK R5204, a neural plate lacking its posterior region.

**Locality and horizon:** This specimen is identified, on its label, as coming from an indeterminate locality of the Isle of Wight, within the Perna Beds of the Lower Greensand. The age of the Lower Greensand is Aptian-Albian, the Perna Beds corresponding to lowest Aptian levels (Ruffell, 1988).

**Description:** The length of the neural NHMUK R5204 is not known, since this plate is broken. However, the preserved region indicates that it corresponded to a longer than wide plate, with the anterolateral margins shorter than the posterolateral ones. Its anterior margin is strongly concave. It has a rounded sagittal keel, with an angle close to 110°.

#### Discussion

As previously indicated, the presence of a well-developed sagittal keel is shared with the members of *Tropidemys*, but not with other Late Jurassic European taxa. The elongated morphology of this plate, with the anterolateral margins significantly shorter than the posterolateral ones, is compatible with *T. blakii*. Furthermore, the concavity of the anterior margin of some neural plates of this species is recognized as more developed than that commonly present in the other species. Therefore, it is likely that this specimen corresponds to a member of this group but, given their limited availability of characters, I prefer to refer its attribution to cf. *Tropidemys*.

“*Chelone*” *valanginiensis* Pictet in Pictet and Campiche (1858-1860), a taxon from Sainte-Croix (Switzerland) recently reassigned to *Tropidemys* sp. (Püntener *et al.*, 2014), was erected on material from the Early Cretaceous. However, several authors have indicated that it is possible that the material attributed to it comes from Jurassic levels, its collection site being unknown. Kimmeridgian levels are exposed in that region (see Pérez-García *et al.*, 2013; Püntener *et al.*, 2014).

The recent refutation of the identification of “*Plesiochelys*” *valdensis* Lydekker, 1889b and “*Plesiochelys*” *vectensis* Hooley, 1900 as members of Plesiochelyidae, and the identification of *Hylaeochelys* Lydekker, 1889c as a taxon outside that clade, indicate the known distribution of Plesiochelyidae is restricted to the Jurassic (Bardet, 1994; Pérez-García, 2012; Pérez-García *et al.*, 2013).

NHMUK R5204 corresponded to a specimen of the collection of R. W. Hooley. After his death, this specimen was added to the collection of the Natural History Museum (London) in 1924, along with more than a hundred reptile specimens

(Getty and Crane, 1975). The oldest label accompanying the specimen was written after this acquisition. It does not contain the precise location of the area of the Isle of Wight where it was found. Since many specimens of the collection of Hooley came from the Isle of Wight, it is possible that NHMUK R5204 was recognized, by mistake, as coming from that place and, more specifically, from the Perna Beds. Therefore, the limited available historical and systematic information is not sufficiently strong to propose that *Tropidemys* could have survived beyond the Jurassic.

### 3. Presence of *Tropidemys* in the Portuguese record

Testudines Batsch, 1788  
Pancryptodira Joyce *et al.*, 2004  
Eucryptodira Gaffney, 1975  
Plesiochelyidae Baur, 1888  
*Tropidemys* Rüttimeyer, 1873

Type species: *Tropidemys langii* Rüttimeyer, 1873

*Tropidemys* sp.  
(Fig. 4)

**Material:** SHN.LPP 173, a fragment of the medial area of a carapace.

**Locality and horizon:** Praia Azul, Torres Vedras; Sobral Formation (Manupella *et al.* 1999; Pereda Suberbiola *et al.*, 2005); Late Kimmeridgian - Early Tithonian (Fürsich, 1981) (Fig. 1).

**Description:** SHN.LPP 173 corresponds to the posterior region of a neural plate, the anterior region of another, and the medial region of a pair of costal plates, in addition to the posteromedial edge of the left costal plate anterior to that pair, and the anteromedial edge of the right costal plate posterior to that pair.

The angle of divergence between the lateral margins of the posterior region of one of the neurals is smaller than that of the anterior region of the other neural. Therefore, these neurals were longer than wide, with their anterolateral margins shorter than the posterolateral ones. The contact between both neurals is subperpendicular to the axial plane, with a slight convexity in the central area.

A well-developed sagittal keel is present in this specimen. It is very sharp and its angle is about 80° in the most anterior preserved region, and about 75° in the most posterior one.

An almost complete dorsal vertebra and the posterior region of another, both articulated, are preserved in ventral view. The proximal end of the dorsal ribs is short but very robust.

The presence of a sulcus that delimits two vertebral scutes is recognized in dorsal view. This sulcus crosses the posterior half of the most anterior neural. The most medial region of a pleural scute is laterally recognized. The length of the sulcus delimiting the two vertebrals is, on the neural plate, twice its length from the contact with the pleural scute to the contact with this neural.



## Discussion

No turtle with a sagittal keel has so far been recognized from the Portuguese fossil record. Plesiochelyid material is very abundant and diverse in the Late Jurassic of the Lusitanian Basin, where other basal eucryptodiran taxa (i.e. *Hylaeochelys*) has also been recognized (Pérez-García and Ortega, 2014). SHN.LPP 173 can be attributed to the plesiochelyid *Tropidemys* due to the presence of a sagittal keel. The great development of this keel does not support the identification of the preserved elements as belonging to the anterior region of the carapace. The presence of a sulcus delimiting two vertebral scutes on the anteriorly-preserved neural implies that, removal of its assignment to the third neural for the above reason, it probably corresponds to the fifth neural. Therefore, the preserved vertebral scutes are interpreted as the third and fourth vertebrae, and the pleural as the third one. As indicated, the morphology of the lateral margins of the neural plates allows interpreting that they were longer than wide, with their anterolateral margins shorter than the posterolateral ones. This is consistent with the species of *Tropidemys* recognized from the British fossil record. However, given that these proportions are not known, it is also possible that these could be close to the maximum ratios recognized in the fifth neural of some specimens of *T. langii*, this neural has not been recognized in *T. seebachi*. The presence of short sulci between the vertebral scutes differs from the condition recorded in *T. langii*. The keel of SHN.LPP 173 is not rounded, but is formed into a markedly sharp keel, its angle more acute than that present in the hitherto known specimens of *Tropidemys*. The discovery of new specimens is necessary to know if the Portuguese taxon of *Tropidemys* presented here corresponds to a new species, or if it belongs to any of the described species, expanding its range of variability.

## 4. Conclusions

“*Pelobatochelys*” *blakii* is a taxon named in the nineteenth century. However, it has not been revised so far, usually ignored in the literature due to limited information that does not allow its validity to be confirmed. Its detailed study, performed here, provides for its recognition as a valid species of *Tropidemys*. The diversity of this genus is therefore increased. Three species are identified, each of them being recognized from only individual countries: the type species, *Tropidemys langii*, in Switzerland; *Tropidemys seebachi* in Germany; and *Tropidemys blakii* in England.

The record of Eucryptodira from the Early Cretaceous of the Iberian Peninsula has been recognized as the most diverse in Europe (Pérez-García and Murelaga, 2012). One of the better-represented clades is that of the basal members of Eucryptodira (stem Cryptodira), represented by several taxa of Xinjiangchelyidae (Pérez-García and Murelaga 2012, 2013; Pérez-García *et al.*, 2014). Although the information on the basal members of Eucryptodira from the Late Jurassic

of the Iberian Peninsula was, until recently, very limited, recent studies have shown that this clade was also very diverse, represented by members of several lineages exclusively from the Jurassic record (i.e., Plesiochelyidae), and also for others not recorded in the Iberian Early Cretaceous (i.e., *Hylaeochelys*) (Pérez-García and Ortega, 2014).

The known diversity of turtles from the Late Jurassic of Portugal increases with the recognition of the presence of *Tropidemys*. This find is farthest from the generic type locality (Solothurn, Switzerland) and also the first identification of this genus in the western coast of the Iberian Massif. Despite the abundant record of turtles from the Late Jurassic of Portugal, the presence of any member of Eurysternidae, another basal clade of basal Eucryptodira very abundant and diverse in other European regions (France, Germany, and Switzerland; see Lapparent de Broin, 2001) has not been recognized there. The find of *Tropidemys* in Portugal confirms that the range of distribution of several genera of Plesiochelyidae (*Tropidemys*, *Plesiochelys* and *Craspedochelys*) was much higher than that of the synchronous clade Eurysternidae, both recognized as inhabitants of coastal environments. This is consistent with the interpretation of Eurysternidae as turtles inhabiting brackish subenvironments and Plesiochelyidae interpreted as inhabiting saltwater subenvironments (see Pérez-García and Ortega, 2014 and references therein), since this probably facilitated their dispersion.

## Acknowledgements

The author thanks Sandra Chapman (NHMUK) and Bruno Silva (SHN.LPP) for access to material; Sandra Chapman, Walter Joyce (Université de Fribourg), Pedro Mocho (Universidad Autónoma de Madrid/SHN.LPP), Francisco Ortega (UNED) and Christian Püntener (Section d'Archéologie et Paléontologie) for information, comments and suggestions; and Jose Joaquin dos Santos for the location of the Portuguese specimen studied here. This study has been supported by the SYNTHESYS Project <http://www.synthesys.info/>, financed by the European Community Research Infrastructure Action under the FP7 Integrating Activities Programme, and by the Fundação para a Ciência e a Tecnologia (Grant SFRH/BPD/97806/2013).

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