

PRESENCE OF DORTOKIDAE (CHELONII, PLEURODIRA) IN THE EARLIEST TERTIARY OF THE JIBOU FORMATION, ROMANIA: PALEOBIOGEOGRAPHICAL IMPLICATIONS -

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Abstract. New discoveries of turtle material of *Ronella botanica* in Jibou (Rona Member, Jibou Formation, Romania) allow giving emended diagnosis at the level of the family and the genera and some indications on the specific characters of *Dortoka*. Hypothesis on the phyletic origin of the family are made, owing to its geographic origin and evolutionary stage. Brief comparisons with Cretaceous and Eocene taxa show the endemic nature of the Romanian Dortokidae and the convenient hypothesis of a late Thanetian age for the Rona member.

Keywords: Freshwater turtles. Dortokidae. Diagnosis. Paleocene. Endemism

INTRODUCTION

The discovery of Dortokidae in the lacustrine Rona Limestone ("calcaires de Rona"), of the Jibou Formation, area of Jibou, Sălaj province, Transylvania, Romania, was a surprise: the family was previously known exclusively in the Cretaceous of southern France and northern Iberian Peninsula. The Romanian presence of a dortokid, *Ronella botanica* Lapparent de Broin, 2000, was announced in Gheerbrant et al., 1999-2000 (2000 is the true date of issue). This general work gives all the preliminary paleogeographical, geological, paleoenvironmental and taxonomic data on the Rona Limestone, the importance of which rests on the discovery of a very important new mammal fauna, accompanied with other lacustrine and terrestrial vertebrates, invertebrates and a flora (Codrea et al., 2003), of an old age in the early Tertiary. They are now attributed to the latest Paleocene (Gheerbrant et al., 2003). Firstly found in the two Rona sites, 1 and 2, situated on the right bank of the River Someș below the village of Rona, the fossils were then found on the other bank, in front, in two sites of the Botanic Garden of Jibou, JBA (below) and JBB (upper) (Fig. 1), where the excavations were done with the kind permission and precious help of the Director, Dr. V. Fati. Since 1999-2000, the site JBB is divided in five beds. The Jibou sites are in a slightly lower stratigraphical position than the Rona sites but in an upper altitude, ca 40 meters upper. The exploration (1995) and excavations (1996 to 2002) have begun for turtles by isolated pieces; in 1996 the holotype of *Ronella* (Pl. 1: 1), a plastron from the Jibou site JBB4, was discovered (Fig. 1) as some other pieces. Only few dorsal shell fragments appeared first, the much thicker plastral fragments being more abundant. However, some pieces of the carapace and post-axial skeleton (such as Pl. 1: 3-6

and Pl. 2: 5-7) were found in 2000. In 2002 the bed JBB4 provided two beautiful specimens, a nearly complete carapace and plastron, half a carapace and plastron (Pl. 2: 1 to 4) and other pieces. Only few dorsal shell fragments appeared first, the much thicker plastral fragments being more abundant. However, some pieces of the carapace and post-axial skeleton (such as Pl. 1: 3-6 and Pl. 2: 5-7) were found in 2000. In 2002 the bed JBB4 provided two beautiful specimens, a nearly complete carapace and plastron, half a carapace and plastron (Pl. 2: 1 to 4) and other pieces. The *Ronella* specimens are the most abundant in the bed JBB4, its type site, with the most abundant fauna of micromammals. Some interesting turtle elements, are also found in the other beds, in particular the beds JBB2 (Pl. 1: 2 and 4) and JBB5 as in the JBA site (upper level of the barrage) (Pl. 1: 7). Although all the material is not yet prepared and listed, it is already possible to do better comparisons with *Dortoka*.

Actually, fragments of *Ronella* were known from the nineteenth century without possibility to correctly define a new taxon. Vremir & Codrea (1996) were the first to figure scarce fragments of the Rona turtle and describe the story of its find: all the specimens figured in this work are clearly *Ronella* material. They were provisionally attributed to *Palaeochelys*, a comprehensive genus including forms beginning in the earliest Eocene of Western Europe up to the Lower-Middle Miocene of Eurasia but unknown in the Paleocene (Broin, 1977; Lapparent de Broin, 2001). *Palaeochelys* is now divided in several genera (Hervet, 2003 a,b, 2004; Schleich, 1994). No other taxon from Jibou-Rona has been found in the available collections of the University Babeș-Bolyai.

The new family Dortokidae Lapparent de Broin & Murelaga, 1996 of Pleurodira, constituted a remote new lineage separated from the main modern

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pleurodiran groups (Pelomedusoides and Chelidae) at least from the late Jurassic. Just after its definition, the presence of Dortokidae indet. was testified by one of us (Murelaga-Bereikua, 1998) in another Iberian locality, Vallipón (Teruel province, Spain), but much earlier, *i.e.* in the Early Cretaceous, Early Barremian. More recently, the same (in Company et al., 1999) announced the presence of Dortokidae in the Iberian Peninsula at Chera (Valencia province, Spain), a new Upper Cretaceous locality with a similar fauna to that of the Basque Country and South of France. The presence of the family is unknown elsewhere (Fig. 2).

The two best specimens, found in Jibou help to a National Geographic Society grant, confirm and complete the characters observed on isolated specimens previously found and allow giving preliminary emended diagnosis. When further preparation of the specimens is made, a cladistic study will be given and will better establish the relative polarity of the characters.

This paper is the completed publication of the presentation given to the 4th Romanian Symposium of Paleontologists Association (Lapparent de Broin & Murelaga, 2003).

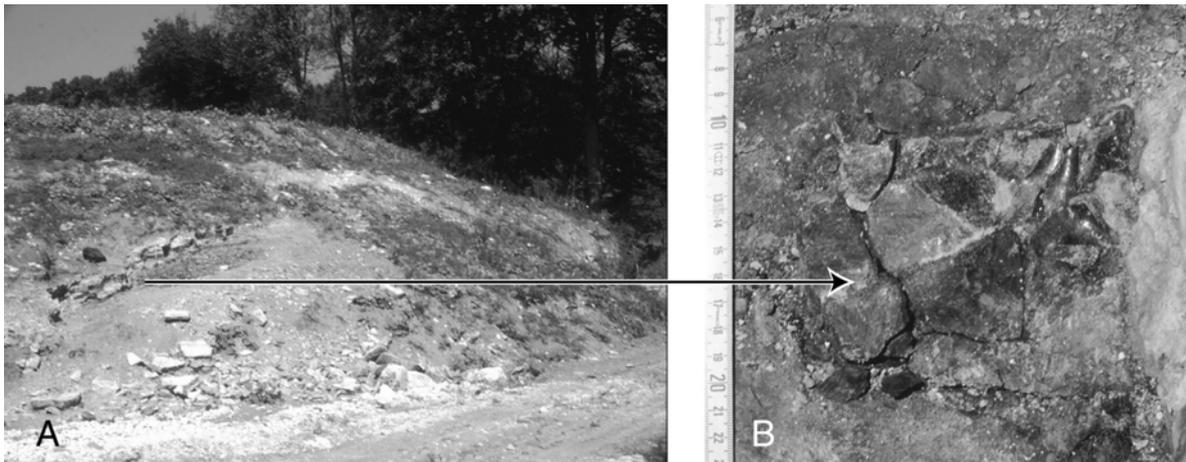


Fig. 1. The type locality of *Ronella botanica* Lapparent de Broin, 2000, in the Botanic Garden of Jibou, Transylvania, Romania, Jibou Formation, Late Paleocene. The front of the hill section constituting the site JBB in 1996 (photos Gheerbrant), with: A, the arrow, from the bed 4 (JBB4), to B, indicates the holotype, plastron JBB-21, dorsal face, *in situ*.

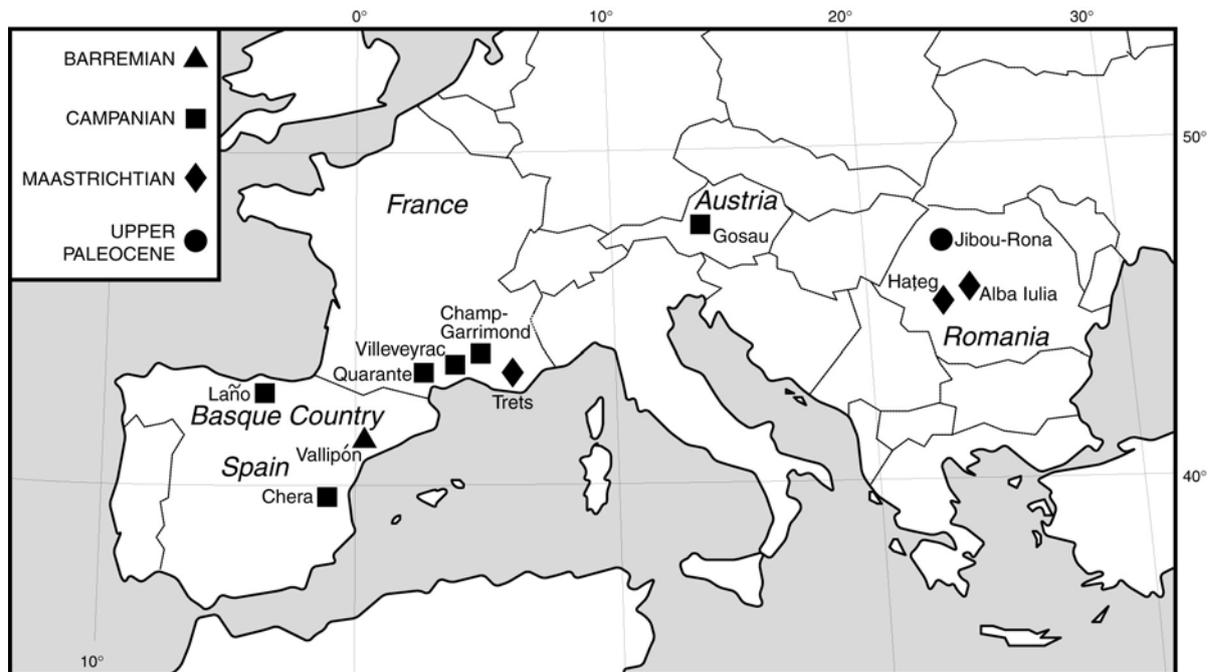


Fig. 2. World geographic distribution of the Dortokidae in France, Iberian Peninsula and Romania at Jibou-Rona. Are also indicated the compared basins from Austria (Gosau) and Romania (Hațeg Basin and Alba Iulia areas) without dortokid record.

COMPARISONS

The family Dortokidae LAPPARENT de BROIN & MURELAGA, 1996.

Type genus and species: *Dortoka vasconica* LAPPARENT de BROIN & MURELAGA, 1996 (Fig. 1, and 1999: Pl. 1 to 3, 1 to 4).

Horizon and known distribution: Late Barremian: Vallipón, Teruel province, Spain (Murelaga-Bereikua, 1998); Campanian and/or Maastrichtian: Trebiño County and Valencia province, northern and western Iberian Peninsula, southern and South-Eastern France (Lapparent de Broin & Murelaga, 1996, 1999; Company et al., 1999); Late Paleocene, Rona and Jibou, Romania (Gheerbrant et al., 1999-2000).

Diagnosis. Autapomorphies: the carapace is well oval, by anterior and posterior elongation, as in various other pleurodire turtles (some chelids, some bothremydids), but the anterior elongation and anterior ovoid shape is particular because it is obtained together by the elongated nuchal and peripherals 2, with the exclusion of the peripherals 1 from the anterior border of the pleurals 1; the peripheral 1, becoming small (half the length or less of the nuchal length) and posteriorly rounded, is intercalated between the external part of the nuchal and the peripheral 2, both anteriorly reduced in width, the nuchal remaining in the border of the shell (contrarily to the cryptodiran *Compsemys* and *Kallokibotia*); the lateral border of the nuchal and the medial border of the peripheral 2, therefore, are roundly notched; presence of a medial strong ornamentation of tubercles and round minute pits and crests and ridges, either on neurals only (*Ronella*) or together on neurals and pleurals medially (*Dortoka* and affinis); on the plastron, longitudinal-oblique fine crests on the hypoplastron at the inguinal border below the femoral scute known in *Dortoka* sp. at Villeveyrac, Champ Garrimond and Quarante (here more marked in fine rounded ridges) and *Ronella* (less marked) or on the hyoplastron at the abdominal lateroanterior border (*Dortoka vasconica* from Laño); the Costal 2 is not normally developed, Costal 1 being at least partly excluded from the pleural 2 (partly laterally in *Dortoka*, completely excluded in *Ronella*); the iliac scar (below the pleural 8) (already excluded from the suprapygal and from the peripheral 11 with respect to the more primitive condition) is still long up to the posterior border of the plate, but only medially in a narrowed tongue shape and laterally widened in a generically characteristic shape (more or less rounded). The presence of some relatively primitive characters but derived in their own way is characteristic; for example, the neurals are alternately long (1st, 3d, 5th) and short (2d, 4th, 6th)

as in more primitive Jurassic pleurodires, but here they have not the same shape: they are narrow, some eventually wider (2nd in *Dortoka*, 7th in *Ronella*), autapomorphically decorated with tubercles and crests and the first one is rectangular instead of primitively hexagonal with lateroposterior short sides.

Numerous homoplastic characters are present, the conjunction of which is also characteristic of Dortokidae, such as (among others): the scute sulci, particularly on the plastron, make a narrow straight line between raised sharp borders (as in some other turtles such as the pleurodire *Pelusios* and many cryptodire terrestrial tortoises); the Vertebrae 2 to 4 are narrowed, the narrowing concerning part of the Vertebrae 1 and 5 (as in many other turtles including pleurodires such as some chelids and some *Pelusios* spp.); the mesoplastra are absent (as in modern cryptodires and, in some pleurodires, the Pelomedusoides *Araripemys* and the Tertiary-extant chelids); the marginals are short on the peripheral external border (as in many turtles); the thoracic rib 1 is much reduced and issued from the medial part of the rib 2; the plastron is narrow-anteriorly rounded (as in many turtles); the pectorals are laterally long towards the epi-hyoplastral suture; the entoplastron is already more or less pyriform or romboid, anteriorly longer than posteriorly or not, but rather primitively long as in Cretaceous chelids; the primitive long anal pleurodiran notch is partly filled resulting in a wide short anal notch but still with the long ischiatic points going inside the xiphoplastral points as in Cretaceous chelids (de la Fuente et al., 2001; Lapparent de Broin & Fuente, 2001); the basic fine microreticulation is particularly strong, visible to the naked eye (as in other turtles such as the cryptodire Testudinidae of the group of "Ptychogasteridae", known as soon as the basal Eocene of Le Quesnoy, France, Nel et al., 1999; Hervet, 2003 and *in prep.*), but the fine crests are apparently rather more linear (Pl. 3: 5-6) and the ornamentation is not finely vermiculoid or punctuated as in many Secondary taxa such as *Kallokibotia*, from the late Cretaceous of Romania and pleurosternids from the late Cretaceous-Paleocene of western Europe and North America; the plates are very thick, particularly the plastral plates; the neural arch of the posterior dorsal vertebrae may be partially free below the posterior pleurals meeting in the midline when the corresponding neural bone is lacking (Gheerbrant et al., 1999, fig. 20) (as in some chelids).

The presence of long ischiatic scars up to inside the xiphoplastral points and the short and wide ilia, pubis and ischia for their height (compared to Pelomedusoides and modern Chelidae in Pleurodira) and the pattern of the intergular which separates the gulars and does not meet the humeropectoral sulcus are primitive (the latter also retained in most

“Eupleurodira”).

Dortoka LAPPARENT de BROIN & MURELAGA, 1996

Type species : *Dortoka vasconica* LAPPARENT de BROIN & MURELAGA, 1996,

Horizon and known distribution: type locality of the type genus and species, Laño, Trebiño County in Alava province, Chera in Valencia province, Iberian Peninsula, Late Campanian. Southern and Southeastern France: Champ-Garimond (Fons 0) (Gard) and Villeveyrac (Hérault), Campanian; Quarante (Hérault), Campanian or Maastrichtian? Trets (Bouches-du-Rhône), Maastrichtian.

Emended diagnosis of genus and species (Dortoka group): Autapomorphies are: Ornamentation of sharp, close and more or less parallel crests on neurals and on pleurals medially, also with minute pits on neurals; short oval pubic scars on the xiphoplastron prolonged onto the posterior border of the hypoplastron; strong axillary processes: the scar up to the 2/3 of the pleural 1 (toward the midline) covers the thoracic rib 2 and eventually is turning posteriorly up to the second pleural, or at least the basic elevation of the scar touches the second pleural; more rounded laterally iliac scar than in *Ronella*; the inguinal process crosses the peripheral 7 in its middle and follows under the pleural 5 to turn anteriorly-medially to the pleural 4 at the lateral 2/3; Costal 1 not overlapping the pleural 2 laterally and Costal 3 not overlapping the pleural 5 laterally, because of the laterally elongated Costal 2, as well anteriorly and posteriorly; neural 2 octogon and neural 3 rectanguloid, neurals 5 and 7 with equal anterior and posterior lateral sides. A flattened mark of a wide inguinal fine scute or skin is present.

Homoplastic characters (among others; also found in other taxa) differentiate *Dortoka* from *Ronella*: low ilia indicating a less elevated carapace than *Ronella*; anal notch always short and rectilinear; anals overlapping or not the hypoplastra medially; very short gulars; pectorals medially at the posterior border of the entoplastron or posterior to the entoplastral point although well anterior laterally on the hypoplastron; longer bridge and anterior lobe longer anteriorly than in *Ronella*; regularly and moderately widened posterior lobe up to the anal points; rectangular full shape of the plastron between both sides with well marked angulation of the bridge processes; fused suprapygals 1 + 2; Vertebrae 1 narrower posteriorly, not overlapping the lateroposterior corners of the nuchal, 1 and 5 longer and 2-4 shorter; longer Costals on peripherals (as a whole); Cervical absent or present. Small size in all known localities: carapace ca 15 cm long.

Each time a comparable fragment is preserved, the characters are present in the *Dortoka* lineage. Besides in Laño material: the ornamentation of sharp

crests on pleurals medially is known in Vallipón and Chera (Pl. 1: 8 and 10); the crests on the posterior nuchal border in Champ Garrimond; the possible reduction of the cervical in Champ Garrimond; the pubic scar up to the hypoplastron in Trets, Quarante (Pl. 1: 10) and Champ Garrimond; low ilia and rounded iliac scar in Trets and Vallipón (Murelaga-Bereikua, 1998).

Erroneously (in Lapparent de Broin & Murelaga, 1999), a fragmentary hypoplastron from Villeveyrac has been presented posteroanteriorly as a right piece instead of anteroposteriorly as a left piece, giving the impression that the posterior hypoplastral border has no pubic scar overlapping when, actually, this border is not preserved and the preserved border is the anterior one.

The skull is unknown. The neck vertebrae are not preserved except three fragmentary ones in Laño, indicating the presence of a common pedicel (process) for the postzygapophyses as in the “Eupleurodira” and vertebrae of the chelid type (biconvex fifth and an anterior opisthocelous vertebra). The tail known by many isolated vertebrae in Laño, is constituted of opisthocelous, amphicoelous and procoelous vertebrae as in the stage following the most primitive amphicoelous stage; this stage is represented for example in extant cryptodire chelydrids and in primitive chelids (still represented in some extant *Phrynops*), before the realization of the complete procoely.

Dortoka sp. or spp.

Horizon and known distribution: Chera, Valencia province, Spain, Campanian (Company et al., 1999); Southern and Southeastern France: Champ-Garimond (Fons 0) (Gard) and Villeveyrac (Hérault), Campanian; Quarante (Hérault), Campanian or Maastrichtian? Trets (Bouches-du-Rhône), Maastrichtian.

Characters: Given the few specimens of Dortokidae outside of Laño known from the Late Cretaceous in the same area of the Iberian Peninsula and Southern France (Lapparent de Broin & Murelaga, 1999), it is not possible to distinguish the generic and specific characters. It is however possible to notice some slight significant differences. The pubic scar is more advanced on the hypoplastron in Laño (Pl. 1: 9 and Pl. 2: 10). The marginals are narrower in Laño than in the Chera specimen of peripheral 4 (Pl. 1: 13 and 17). The ridging is more accurate in the hypoplastron border from Quarante than in the other hypoplastra (Laño, Villeveyrac, Champ-Garimond, Trets).

?Dortoka sp.

Horizon and known distribution: Late Barremian: Vallipón, Teruel province, Spain (Murelaga-Bereikua, 1998)

Characters: as in *Dortoka*, the decoration is crested on pleurals (Pl. 1: 10) (apomorphic), the iliac

scar is short (homoplastic); it is rounded (apomorphic) and the ilia are low (maybe primitive) (Murelaga-Bereikua, 1998) as in *Dortoka*.

***Ronella botanica* LAPPARENT de BROIN, 2000, in Gheerbrant et al., 1999, type species of the genus.**

- Freshwater turtles: Koch, 1894: p. 185
- *Emys*: Koch, 1900: p. 538
- *Palaeochelys* s.l. sp.: Vremir & Codrea, 1996: p. 75-81.

Horizon and known distribution: Late Paleocene, Late Thanetian, Rona Limestone in Rona and Jibou (JBA and JBB 1 to 5), Transylvania, Romania (Gheerbrant et al., 1999-2000, Vremir & Codrea, 1996).

Emended diagnosis of genus and species: Autapomorphies: Costals 1 shorter than in *Dortoka*, not overlapping the pleural 2 because of the completely enlarged Costal 2 anteriorly; crests on neurals only, rather rounded and tubercled, rarely sharp on some neurals.

Characters homoplastic (among others) in various other taxa: - More derived than in *Dortoka*: shorter pectorals medially, which overlap the posterior part of the entoplastron; entoplastron wider-more rhomboid (holotype JBB4-21 and JBB5-415) or not (JBB4-416); - Differently derived with respect to *Dortoka*, besides the autapomorphies: longer pubic and ischiatic suture on xiphiplastron, higher ilia (more elevated carapace), widened hypoplastron and xiphiplastron up to the narrow anals which have parallel lateral borders; anal notch shape varying from rectilinear as in *Dortoka* to sinuous and deeper; probably inguinal process crosses the peripheral 6 and follows under the pleural 4 at limit with the fifth, up to the lateral third; relatively longer Vertebrales 2-4; middle size, carapace up to 34 cm long.

More primitive characters with respect to *Dortoka*: shorter Costals on peripherals (as a whole); Cervical present (but only 1 specimen known!); neural 2 not octagonal, neural 4 longer; two suprapyrgals (but derived short suprapygal 2); finer axillary process up to the lateral 1/3 of the plate toward the mid line, on the rib 2 elevated in a round ridge besides the scar; laterally longer and angulous iliac scar below the pleural 8; longer anal notch; Vertebral 1 wider anteriorly, just at the lateroposterior corners of the nuchal. Costal 2 not posterolaterally enlarged.

Because of the derived characters of *Ronella* in another direction than in *Dortoka* and the more primitive characters, both are surely separated from the age of apparition of the oldest, i.e. the Upper Cretaceous. As the form from Vallipón shares at least two derived characters with *Dortoka* and as it is possible that these characters are derived in another direction than the corresponding in *Ronella*, this form can belong to the *Dortoka* line, therefore separated

from the *Ronella* line as soon as the Early Cretaceous. More Vallipón specimens are required to confirm this hypothesis.

POSSIBLE PHYLETIC RELATIONSHIPS OF DORTOKIDAE

The evolutionary grade of the Dortokidae. Phyletic relationships examined with respect to the possible geographical origin of the family Dortokidae (Fig. 3)

The Dortokidae are pleurodire on the basis of the pelvis linked by suture to the carapace and plastron, with the top of the ilia (Pl. 2: 7, 8) here below the pleurals 7 (posterior extremity) and 8 (all along, Pl. 2: 5), and the pubis (Pl. 2: 6) and ischia (Pl. 2: 9) upper the dorsal face of the xiphiplastron (Pl. 1: 1, 9) (see references, phyletic and diagnostic elements of the pleurodira taxa resumed in Lapparent de Broin, 2000b). The presence of the formed joints (cotyles and condyles) in the neck and tail vertebrae indicate a evolutionary grade posterior to the Triassic *Palaeochersis talampayensis* Rougier et al., 1995, still with amphicoelous vertebrae (unretractile neck) as well as the non pleurodiran *Proganochelys* and the primitive Cryptodira. The position of *Palaeochersis* basically in the Pleurodira, is here considered on the presence of the sutured pelvis with the carapace and some other characters considered as derived in common with *Proterochersis*, the oldest recognized pleurodiran, from the Triassic of Germany, such as the shape of the dorsal shell partly rounded, without anterior notch and the posterior semi-rounded notch in place of the pygal. This position implies many convergences between Cryptodira and Pleurodira, of which we have the evidence for many, particularly after a better definition of the characters and the disregarding of the false homologies, and is in favour of the unique and progressive acquisition of the sutured pelvis, a complex structure implying many skeletal modifications and not representing only one character (Lapparent de Broin & de la Fuente, 1996). It is probable that *Proterochersis* had also an unretractile neck. The following grade is that of the acquisition of the formed joints, present in the Jurassic *Platycheilus*, *Notoemys* and the new *Caribemys* de la Fuente & Iturralde-Vinent, 2001, with the possibility to retreat their neck in a horizontal plan. Although all the vertebrae of their neck are not known, their formula appears to be that of the extant Chelidae (2d-4th opisthocoelous, 5th biconvex, 6th procoelous, 7th biconcave and 8th biconvex). The following grade is that of *Dortoka* (and probably that of *Ronella*) and Chelidae with a common process for the postzygapophyses. From this formula, the Pelomedusoides seem to derive by the change in the joints (2d biconvex and the following procoelous): similarly in the tail, the acquisition of joints begins by an intermediary biconvex vertebra with other ones

opisthocoelous anteriorly and procoelous posterior to it, the formula known in *Dortoka* and which is probably the same in *Ronella*, although the passage to the complete procoely is possible inside a family

as it occurs in Chelidae. At this grade in Pleurodira, many other characters are derived with respect to the Triassic and Jurassic taxa.

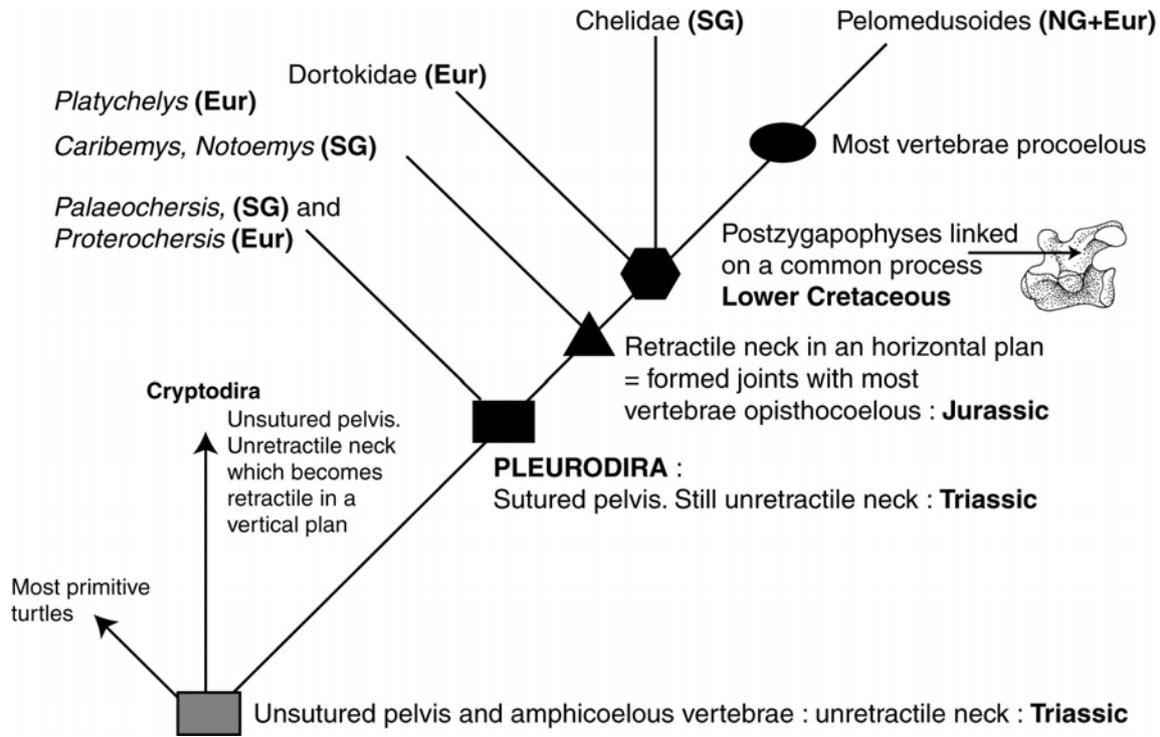


Fig. 3. The evolutionary grade of the Dortokidae. Eur, Europe; NG, northern Gondwana; SG, southern Gondwana; during the Triassic and Jurassic, the taxa were all part of the Pangea and become separated from the early Lower Cretaceous.

The position of the Dortokidae in the phyletic tree of the Pleurodira with respect to the other taxa is not yet established. Besides their autapomorphies, Dortokidae have together: - characters of the known pleurodiran Jurassic taxa; - more derived characters than the oldest Cretaceous Chelidae (Lapparent de Broin & de la Fuente, 2001) (as the Pelomedusoides); - as derived characters as these Chelidae (less than in Pelomedusoides). It shows their own radiation apart from the "Eupleurodira". It has been suggested the possibility (Lapparent de Broin & Murelaga, 1999; Lapparent de Broin, 2000 b) that, being exclusively Laurasiatic and even exclusively European, they were issued from a common ancestor with a Jurassic European taxon, close, for example, to a Platycheilyidae from the Late Jurassic (Kimmeridgian-Tithonic) of Europe (Portugal, Swiss, Germany), in the Northern Pangea, rather than with the common ancestor of the Pelomedusoides and Chelidae hypothesized in Gondwana. Even a common origin, to constitute the "Eupleurodira", of the Chelidae (southern Gondwana) with the Pelomedusoides (northern Gondwana) in the Gondwana (Broin, 1988) is not sure. As the European Dortokidae are known in the Early Cretaceous at the same time as the first Chelidae

and Pelomedusoides (Lapparent de Broin, 2000a, b) this hypothesis is not unlikely. However, it implies many homoplasies and in particular the formation of the common pedicel of the postzygapophyses at least two times... At least we know that pleurodiran turtles have never been found in Asia (except in the Indian Subcontinent and Burma with Gondwanian forms arrived with India from the Gondwana) and the origin of the Dortokidae might be in Europe. In favour of a common origin with a Platycheilyidae such as *Platycheilus*, we can consider the alternative of long and short neurals, shared with *Caribemys* and *Notoemys*, but also the decoration with crest and tubercles (although derived), the narrow oval shape of the carapace moderately elevated as *Dortoka* (although without dentations and while the two other forms share a more cordiform flatter and smooth carapace), the tendency in *Platycheilus* to loss the contact peripheral 1-pleural 1 and the longer pectorals, laterally (see the figure in Fuente & Iturralde-Vinent, 2001). No solution is convincing until new material is found in Jibou (skull, vertebrae) and in the Cretaceous of Romania or in neighbouring countries.

**CONCLUSION: ENDEMISM OF RONELLA,
IMPLICATION IN STRATIGRAPHY**

**Absence of Dortokidae from Cretaceous
Romanian localities and neighbouring areas.**

Two Cretaceous continental basins are known inside Romania and not much far from Romania, which are currently compared with the Upper Cretaceous continental localities from the Iberian Peninsula and South of France that provided *Dortoka*.

From the Late Cretaceous of Gosau (Austria), Seeley (1881) mentions *Pleuropeltus Suessii* (including a part of a dinosaurian bone) and 4 species of "Emys", only one being named: "*Emys Neumayri*" Seeley 1881: no one figured is dortokid. As the other "Emys" species are not described and figured, the possibility of a dortokid presence is not completely rechecked. Both named and unnamed species from Gosau are *Chelonii incertae sedis* (Lapparent de Broin, 2001).

The Hațeg Basin, Transylvania, southern to Jibou and Sălaj province, provided the famous *Kallokibotion bajazidi* Nopcsa, 1923a,b, a cryptodiran primitive taxon. The type material preserved in London has been more recently revised (Gaffney & Meylan, 1992) but the decoration is not examined, the carapace is not well preserved and analysed (in particular the anterior dorsal part) and it is not easy to recognize the genus on isolated specimens; no recent material found and preserved in Romania has been examined for this work. Only *Kallokibotion* is mentioned in the material more recently found in the Sânpetru Formation, in the Sânpetru Valley (material exposed as casts in the Țării Crișurilor Museum of Oradea) as well as in the Alba County (Codrea & Vremir, 1997; Jianu et al., 1997) although a new examination of the material is in view so that to define the differences between dortokids (pleurodiran) and *Kallokibotion* (cryptodiran) on isolated pieces not showing pleurodiran particular elements. A specimen from Nălaț-Vad recently found (Smith et al., 2002) in preparation in Paris (MNHN) could be also from *Kallokibotion*, surely not from a dortokid.

Therefore, given the known distribution of the Dortokidae (Fig. 2) it is impossible to see how the Ibero-French and the Romanian dortokids have been in geographical relation and where was refugied the lineage of *Ronella* between its origin and the time of Jibou-Rona.

Absence of Dortokidae in the Paleocene and Eocene other localities

No dortokid has been found in the rare Paleocene localities of northern Spain such as those of the Tremp-Graus basin at Campo and in southern France in the Petites Pyrénées (Gheerbrant et al., 1997a, 1997b); other Provence localities such as

those of the Vitrollian beds are nearly azoic as far as turtles are concerned. Moreover, the Dortokidae are absent from the other west European Paleocene continental localities, of the northern Franco-Belgian basin such as Mons, Hainin, Vinalmont, Cernay-Mont Berru which have yielded abundant other turtles, and they are not present either at the Paleocene of Menat (Center of France): *Dortoka* disappears after the Cretaceous and on the other hand the Dortokidae are neither present in the Eocene of Europe (Groessens-Van Dyck, 1982, 1983; Hervet, 2003a,b, 2004; Broin, 1977; Lapparent de Broin, 2001 and others). In Romania, in the "Upper Red Beds" of the Jibou Formation ("couches moyennes bariolées", in Gheerbrant et al. 1999), at Giurtelecu Șimleului, there is (at least) a modern pleurodire, cf. *Neochelys* (a Pelomedusoides Podocnemididae) and an aquatic Testudinidae indet. ("Emydidae" or "Bataguridae" of the authors), cryptodire. These taxa are only known from the beginning of the Eocene (MP7) and never with a dortokid.

In conclusion, the presence of the dortokid *Ronella botanica* in the Rona Member of the Jibou Formation, firstly attributed to the Paleocene/Eocene boundary possibly including the earliest Eocene, and now attributed to the Late Paleocene, possibly the latest, is therefore surprising after such a long geological time without any other attestation. It manifests an endemism as far as the turtles are concerned, which could also affect the Crocodyliidae (two procoelous forms, apparently no more known from Cretaceous than from Tertiary) and the origin of these endemic forms is unknown. The age of the Rona Limestone at the end of the Thanetian and before the Eocene is convenient, even if it does not explain the endemism of *Ronella*.

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REFERENCES

- Broin F. de 1977, Contribution à l'étude des Chéloniens. Chéloniens continentaux du Crétacé et du Tertiaire de France. *Mémoires du Muséum national d'Histoire naturelle, Paris*, C, 38, p.I-IX, 1-366.
- Broin F. de 1988, Les Tortues et le Gondwana. Examen des rapports entre le fractionnement du Gondwana et la dispersion géographique des Tortues pleurodires à partir du Crétacé. *Studia Geologica Salmanticensis, Studia Palaeocheloniologica* II/5, p. 103-142, Salamanca.
- Codrea, V., Petrescu, I., Gheerbrant, E., Baciuc, C., Petrescu, R.M., Dica, P., Sasaran, E., Farcas, C., Sasaran, L., Barbu, O. & Fati, V. 2003, Paleocenul din Gr[dina Botanic] Jibou - o raritate în patrimoniul geologic al României. *Environment & Progress*, p. 105-114, Cluj-Napoca.
- Codrea, V. & Vremir, M. 1997, Kalkokibotion bajadizi Nopcsa (Testudines, Kalkokibotidae) in the Red Strata of Râpa Rosie - Sebes (Alba County). *Sargetia, Series Scientia Naturae*, 17, p. 233-238, Deva.
- Company, J., Murelaga, X., Pereda-Suberbiola, X. & Ruiz-Omeñaca, J.I. 1999, The vertebrate fauna from the new Late Cretaceous Chera locality (Valencia province, Spain). IV European Workshop on Vertebrate Paleontology, Albarracin (Teruel, Spain), Abstracts, Universidad de Zaragoza Ed., p. 37-38, Zaragoza.
- Fuente, M. S. de la & Iturralde-Vinent, M. 2001, A new pleurodiran turtle from Jagua Formation (Oxfordian) of Western Cuba. *Journal of Paleontology*, 75/4, p. 860-869, Lawrence, Kansas.
- Fuente M. de la, Lapparent de Broin, F. de and Manera de Bianco, T. 2001, The oldest and first nearly complete skeleton of a chelid, of the *Hydromedusa* sub-group (Chelidae, Pleurodira), from the Upper Cretaceous of Patagonia. *Bulletin de la Société géologique de France*, 172/2, p.105-112.
- Gaffney, E. S. & Meylan P.A. 1992, The Transylvanian Turtle, *Kalkokibotion*, A Primitive Cryptodire of Cretaceous Age. *American Museum Novitates*, 3040, p. 1-37, New York.
- Gheerbrant, E., Abrial, C. & Cuenca, G. 1997a, Nouveau mammifère condylarthre du Paléocène supérieur de Campo (Pyrénées aragonaises, Espagne). *Comptes Rendus de l'Académie des Sciences, Paris*, II a, 324, p. 599-606.
- Gheerbrant, E., Abrial, C. & Cappetta, H., 1997b, Nouveaux sites à Microvertébrés continentaux du Crétacé terminal des petites Pyrénées (Haute-Garonne et Ariège, France). *Geobios*, 20, p. 257-269, Lyon.
- Gheerbrant, E., Codrea, V., Hosu, A., Sen, S., Guernet, C., Lapparent de Broin, F. de, & Riveline, J. 1999-2000, Découverte en Transylvanie (Roumanie) de gisements à vertébrés dans les calcaires de Rona (Thanétien ou Sparnacien) : les plus anciens mammifères cénozoïques d'Europe Orientale. *Eclogae Geologicae Helvetiae*, 1999, 92/ 3, p. 517-535, Basel.
- Gheerbrant, E., Codrea, V., Lapparent de Broin, F. de, Petrescu, I., Dica, P., & Farcas, C., 2003, Earliest Tertiary vertebrate fauna including mammals from eastern Europe (Jibou Fm, NW Transylvania, Romania), The fourth Romanian symposium on Paleontology, 2003, September 5-7, Cluj-Napoca, Romania, Abstracts, p. 21-22.
- Groessens-Van Dyck, M.C. 1982, Note sur les Chéloniens et les Crocodiles du gisement paléocène de Vinalmont (province de Liège, Belgique). *Bulletin de la Société belge de Géologie*, 91/3, p. 163-185, Bruxelles.
- Groessens-Van Dyck, M.C. 1983, Etude des Chéloniens du Montien continental de Hainin (Hainaut, Belgique). *Bulletin de la Société belge de Géologie*, 92/2, p. 67-76, Bruxelles.
- Hervet, S. 2003a, Paris, 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. Doctorat du Muséum national d'Histoire naturelle, 1er Juillet 2003, 406 p.
- Hervet, S., 2003b, Deux nouvelles tortues de l'Eocène inférieur de Saint-Papoul (Aude) France. *Comptes Rendus-Palevol*, 2, 617-624, Paris.
- Hervet, S. 2004, Systématique du groupe "*Palaeochelys* sensu lato - *Mauremys*" (Chelonii, Testudinoidea) du Tertiaire d'Europe occidentale: principaux résultats. *Annales de Paléontologie*, 90/1, 13-78, Paris.
- Jianu, C-M., Mészáros, N. & Codrea, V. 1997, A new collection of Hateg and Râpa Rosie material (Dinosauria, Crocodilia, Chelonia) in the Cluj Napoca University. *Sargetia, Series Scientia Naturae*, 17, p. 218-232, Deva.
- Koch, A., 1894, Az Erdélyési medencze harmadkori képződményei. I. Paleogén csoport. *Földtani Intezet Évkönyve.*, X: 161-356, Budapest.
- Koch, A., 1900: Systematische Übersicht der fossilen Wirbeltierreste der Lander der Ungarischen Krone. *A Magyar Orvosi és Természettudományi Vizsgálatok Vándorgyűlésének Munkálatai*, 30: 526-560, Budapest.
- Lapparent de Broin F. de. 2000a, African chelonians from the Jurassic to the Present. A preliminary catalog of the African fossil chelonians. *Palaeontologia Africana*, 36 p. 43-82, Johannesburg.
- Lapparent de Broin F. de, 2000b, The oldest pre-Podocnemidid turtle (Chelonii, Pleurodira), from the early Cretaceous, Ceará state, Brasil, and its environment. *Treballs del Museu de Geologia de Barcelona*, 9, p. 43-95.
- Lapparent de Broin F. de, 2001. The European turtle fauna from the Triassic to the Present. *Dumerilia*. 4/3, p. 155-216, Paris.
- Lapparent de Broin, F. de & de la Fuente, M. 1996, The analysis of the character "fused pelvis". Abstracts of papers, 56 Ann. Meeting, SVP, American Museum of Natural History, New York, oct. 16-19, 1996, *Journal of Vertebrate Paleontology*, 16, suppl. N° 3: 47A. Lawrence, Kansas.
- Lapparent de Broin F. de & Fuente M. S. de la. 2001, Oldest world Chelidae (Chelonii, Pleurodira), from the Cretaceous of Patagonia, Argentina. *Comptes Rendus de l'Académie des Sciences, Paris*, II, 333: 463-470.
- Lapparent de Broin, F. de & Murelaga, X. 1996, Une nouvelle faune de Chéloniens dans le Crétacé supérieur européen. *Comptes Rendus de l'Académie des Sciences, Paris*, Ila, 323, p. 729-735.
- Lapparent de Broin F. de & Murelaga X. 1999, Turtles from the Upper Cretaceous of Laño (Iberian Peninsula). In : Geology and palaeontology of the Upper Cretaceous vertebrate-bearing beds of the Laño Quarry (Basque-Cantabrian Region, Iberian Peninsula), H. Astibia et al. coords. *Estudios del Museo de Ciencias Naturales*

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PALEOBIOGEOGRAPHICAL IMPLICATIONS -

- de Alava, 14 (Num. Esp. 1), p. 135-211, Vitoria-Gasteiz.
- Lapparent de Broin, F. de & Murelaga Bereikua, 2003, Presence of Dortokidae (Chelonii, Pleurodira) in the earliest Tertiary of the Jibou Formation, Romania: paleobiogeographical implications. The fourth Romanian symposium on Paleontology, 2003, September 5-7, Cluj-Napoca, Romania, Abstracts, p. 34.
- Murelaga Bereikua, X. 1998, Primeros restos de tortugas del Cretácico inferior (Barremiense superior) de Vallipón (Castellote, Teruel). *Mas de las Matas*, 17, p. 189-200. Mas de las Matas.
- Nel, A., de Plöeg, G., Dejax, J., Dutheil, D., De Franceschi, D., Gheerbrant, E., Godinot, M., Hervet, S., Menier, J., Augé, M., Bignot, G., Duffaud, S., Gaudant, J., Hua, S., Jossang, A., Lapparent de Broin, F. de, Pozzi, J.P., Paicheler, J.C., Beuchet, F. & Rage, J.-C. 1999, Un gisement sparnacien exceptionnel à plantes, arthropodes et vertébrés (Eocène basal, MP7) : Le Quesnoy (Oise, France). *Comptes Rendus de l'Académie des Sciences, Paris*, II, 329, p. 65 1999, 65-72.
- Nopcsa, F. 1923a, The geological importance of the primitive reptilian fauna in the uppermost Cretaceous of Hungary; with a description of a new tortoise (*Kallokibotium*). *Quarterly Journal of the geological Society of London*, 89, p. 100-116.
- Nopcsa, F. 1923b, *Kallokibotium* A Primitive Amphichelydian Tortoise from the Uppermost Cretaceous of Hungary. *Palaeontologia Hungarica*, 1, p. 1-34. Budapest.
- Rougier, G. W., de la Fuente, M.S. & Arcucci, A.B. 1995, Late Triassic Turtles from South America. *Science*, 268/5212, p.855-858.
- Schleich, H.H. 1994, Neue Reptilienfunde aus dem Tertiär Deutschlands. 13. Schildkröten- und Krokodilreste aus der eozänen braunkohle des Untertagebaues Stolzenbach bei Borken (Hessen). (Reptilia: Crocodylia, Testudines). *Courier Forschungsinstitut Senckenberg*, 173, p. 79-101.
- Seeley, H.G. 1881, The Reptile Fauna of the Gosau Formation preserved in the Geological Museum of the University of Vienna. *Quarterly Journal of the Geological Society of London*, 37, p. 620-706. London.
- Smith, T., Codrea, V. A., Sasaran, E., Van Itterbeeck, J., Bultynck, P., Csiki, Z., Dica, P., Farcas, C., Folie, A., Garcia, G. & Godefroit, P. 2002, A new exceptional vertebrate site from the Late Cretaceous of the Hateg Basin, Romania. *Studia Universitatis Babeş-Bolyai, Geologia*, Special Issue, 1, p. 321-330, Cluj-Napoca.
- Vremir, M. & Codrea, V. 1996, *Palaeochelys* sp. (s.l.) (Testudines; Emydidae) from the Paleocene of the Transylvanian depression: outcrops from Rona and Jibou (Salaj County, Romania). *Studii si Cercetari (St Naturii)*, 2, p. 75-81, Bistrița.

PLATES

PLATE I

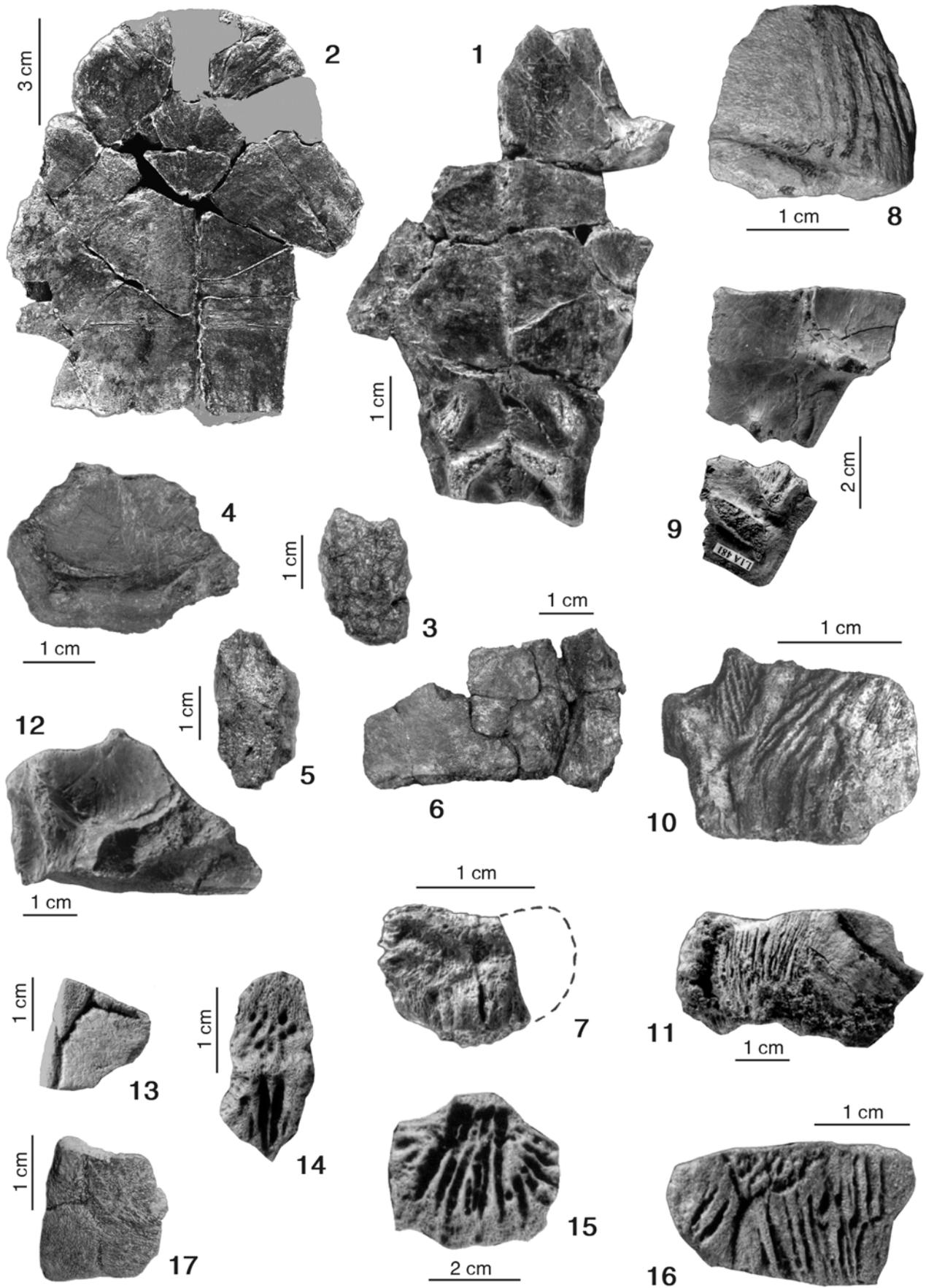
Ronella botanica Lapparent de Broin, 2000, late Paleocene, Jibou, Botanic Garden, Transylvania, Romania, coll. University Babeş-Bolyai, Catedra de Geologie-Paleontologie; 1, holotype, plastron, JBB-21, dorsal face; 2, mid-anterior plastron, JBB-134 (bed 2), ventral face; 3, JBB-404 (bed 4), tuberculate neural 4, dorsal face; 4, JBB-132 (bed 2), left pleural one, ventral face, showing the axillary process and the elevated thoracic rib 2 and reduced rib 1; 5, JBB-405 (bed 4), tuberculate neural 1, dorsal face; 6, JBB-406 (bed 4), left pleural 5, dorsal face, showing the absence of medial ridging; 7, JBA-7, crested neural 7, dorsal view. *Dortoka* sp., 8 and 17, coll. Universidad de Valencia, Late Campanian, Chera, Valencia province, Spain; 8, right pleural 6, medial fragment, dorsal face, showing the crests; 17, left peripheral 4, dorsal face. *Dortoka vasconica* Lapparent de Broin & Murelaga, 1996, 9 and 11 to 16, coll. Museo de Ciencias Naturales de Alava, MCNA, Late Campanian, Laño, Trebiño County, Iberian Peninsula; 9, right hyoplastron 6332 and xiphoplastron 6708, dorsal view; 11, 6687, right pleural 5, dorsal face; 12, 6704, left pleural 1, ventral face; 13, 6623, left peripheral 4, dorsal face; 14, 6731, neural 1, dorsal face; 15, 6747, neural 2, dorsal face; 16, 6643, right pleural 2, dorsal face. ?*Dortoka* sp., coll. Museo Paleontologico de Zaragoza, 10, V 9326, Late Barremian, Vallipón, Spain, right posterior pleural, dorsal face.

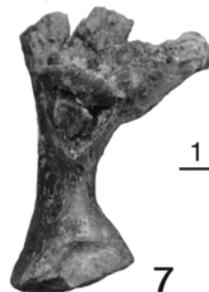
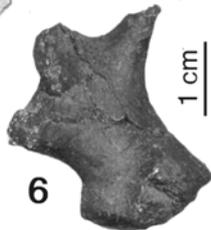
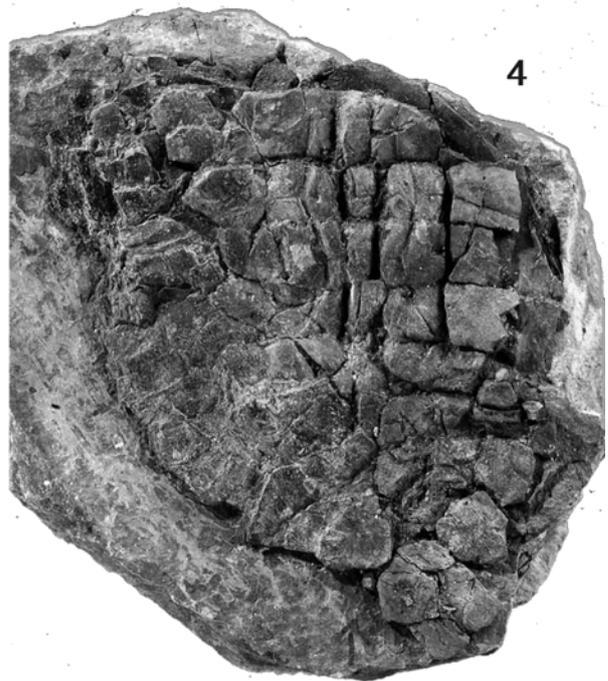
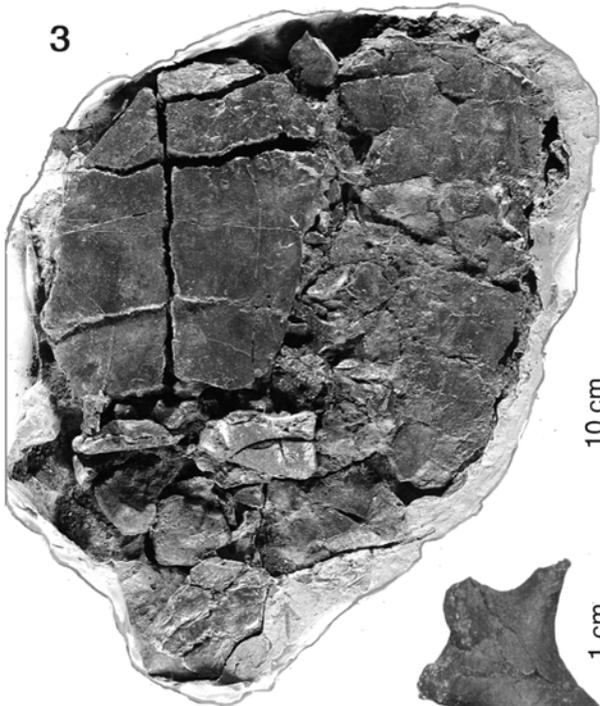
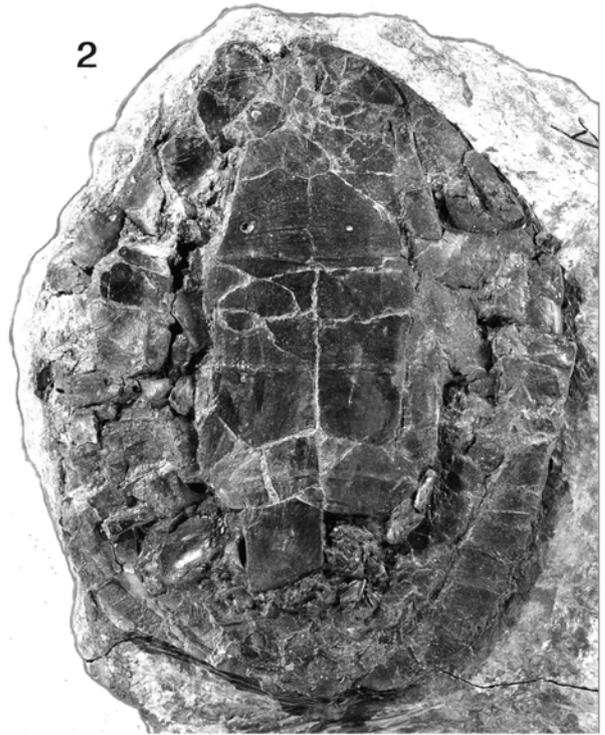
PLATE II

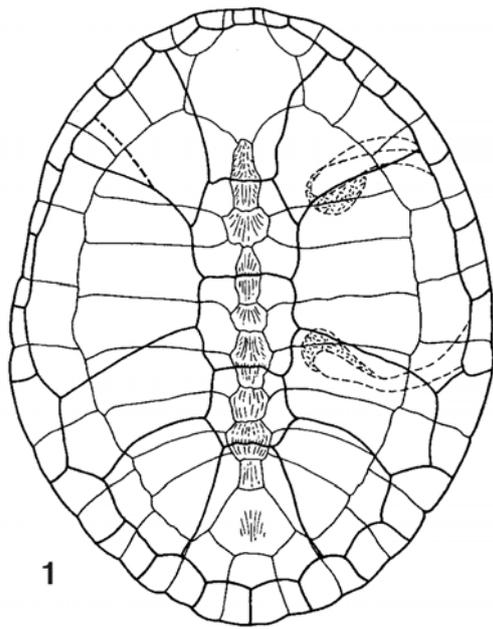
Ronella botanica Lapparent de Broin, 2000, Late Paleocene, Jibou, Botanic Garden, Transylvania, Romania, coll. University Babeş-Bolyai, Catedra de Geologie-Paleontologie, 1 to 7; 1, 2, JBB-408 (bed 4), carapace, dorsal and ventral faces; 3, 4, JBB-409 (bed 4), half posterior carapace, ventral and dorsal faces; 5, JBB-407 (bed 4), pleural 8, ventral view on the iliac scar; 6, JBB-400, left pubis, inner medial view; 7, JBB-403, left ilium, external lateral view. *Dortoka vasconica* Lapparent de Broin & Murelaga, 1996, coll. Museo de Ciencias Naturales de Alava, MCNA, late Campanian, Laño, Trebiño County, Iberian peninsula; 8, 6609, right ilium, external view; 9, 6723, left pubis, inner view. *Dortoka* sp., Campanian or Maastrichtian? Quarante, Hérault, France, MNHN, P, right partial hypoplastron, dorsal view.

PLATE III

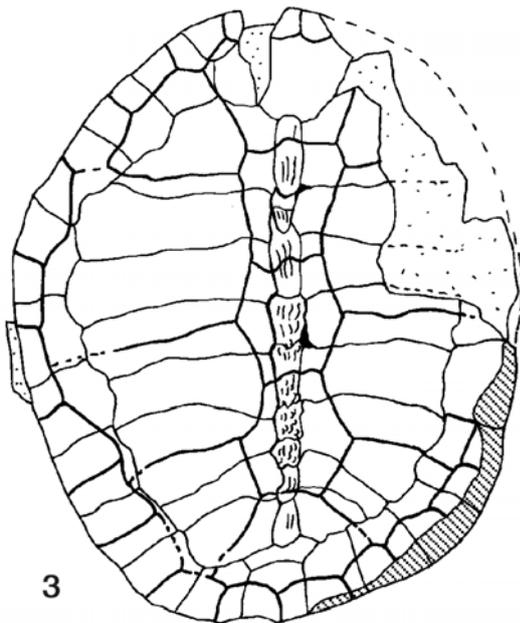
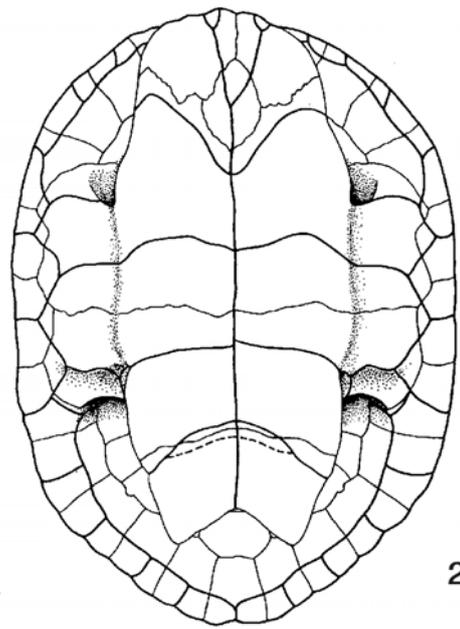
Ronella botanica Lapparent de Broin, 2000, Late Paleocene, Jibou, Botanic Garden, Transylvania, Romania, coll. University Babeş-Bolyai, Catedra de Geologie-Paleontologie, 3, 4, 5: 3, 4 JBB-408 (bed 4), carapace, dorsal and ventral faces; 5, detail of the hypoplastron JBB-25 (bed 4), showing the microreticulate decoration. *Dortoka vasconica* Lapparent de Broin & Murelaga, 1996, Late Campanian, Laño, Trebiño County, Iberian Peninsula, coll. Museo de Ciencias Naturales de Alava, 1, 2, 6: 1, 2, reconstruction of the carapace, dorsal and ventral view, 6, MCNA 6607, left peripheral 3, dorsal view, showing the microreticulate decoration and the short marginals. *Dortoka* sp., Champ-Garimond (Fons 0), Gard, France, coll. Université des Sciences et Techniques du Languedoc, 7, nuchal, dorsal view, showing the superposed cervical and meeting marginals 1 (regression of the cervical in progress) and the fine short crests on the posterior border.







2 cm



4 cm

