



A proposal for a new family: Montezumellidae (Crustacea, Decapoda, Brachyura) and description of new genus and species *Moianella cervantesi* from the Priabonian (late Eocene) of Catalonia (NE of Iberian Peninsula)

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Abstract

A new brachyuran family is proposed in order to accommodate *Montezumella* Rathbun, 1930, previously assigned to Cheiragonidae Ortmann, 1893. The establishment of Montezumellidae n. fam. is based on the examination of several samples of both sexes of *Montezumella*, with well-preserved thoracic and abdominal structures. A new genus and species, *Moianella cervantesi* n. gen., n. sp. from the Priabonian (late Eocene) transitional levels of central Catalonia (NE of Iberian Peninsula) is described herein and assigned to the new family. The taxonomic placement of Montezumellidae n. fam. is discussed. Furthermore, "*Atelecyclus*" *gorodiskii* Rémy, 1959 in Gorodiski and Rémy, 1959, considered as atelecyclid, is herein attributed with reserve into the new family.

Keywords: Montezumellidae, Cheiragonidae, Cancroidea, *Montezumella*, *Moianella*, Priabonian, Eocene.

Resumen

Se propone una nueva familia de decápodos braquiuros para acomodar el género *Montezumella* Rathbun, 1930, últimamente asignado a Cheiragonidae Ortmann, 1893, como resultado de las observaciones efectuadas en ejemplares de ambos sexos de ese género, con las estructuras torácicas y abdominales perfectamente conservadas. Se describe también, un nuevo decápodo braquiuro, *Moianella cervantesi* n. gen., n. sp. procedente de los niveles transicionales del Priaboniano (Eoceno tardío) de la Cataluña central (NE de la Península Ibérica) que se asigna a la nueva familia. Además, "*Atelecyclus*" *gorodiskii* Rémy, 1959 in Gorodiski and Rémy, 1959, considerado ateleciclido, es asignado con reservas a la nueva familia.

Palabras Clave: Montezumellidae, Cheiragonidae, Cancroidea, *Montezumella*, *Moianella*, Priaboniano, Eoceno.

1. Introduction

The recent discovery of *Moianella cervantesi* n. gen., n. sp. in the transitional levels of the late Eocene (Priabonian) near the village of Moià, region of Moianès (Bages, Catalonia, NE of Iberian Peninsula) increases the list of decapod taxa known from this area, which was widely studied and described by Via (1932, 1941, 1948a, 1948b, 1959). This species represents one of the youngest decapod of Vic-Igualada area (central Catalonia). Via (1988) pointed out the presence of several specimens of *Portunus catalaunicus* Via, 1941, in the highest marine Eocene levels of several localities of this area and named it “Collbàs residual carcinic fauna”, and reported a probable age of Priabonian for those levels, which has been recently confirmed (Cascella and Dinarès-Turell, 2009).

Moianella cervantesi n. gen., n. sp., represented by two well preserved specimens, is strongly related to *Montezumella* Rathbun, 1930 (1930b), an extinct genus assigned to Cheiragonidae Ortmann, 1893, during the last decade and claimed as the first cheiragonid in the fossil record. This study permits to compare either genera and in particular to revise *Montezumella*. A thorough examination of very well-preserved specimens of different species of *Montezumella*, from Vic and Igualada areas (Catalonia, Iberian Peninsula), from other areas of Ebro foreland basin (Huesca, Aragón, Spain), and also from the Vicenza region (Italy), allows examination of the ventral features of the females. The vulvae are located, as usual in Brachyura, inside of the sterno-abdominal cavity and are completely covered by the abdominal somites, instead of being exposed as in Cheiragonidae; the supra-orbital structure consists of three orbital spines and two fissures, and the posterolateral margin is unarmed. As a result, based on these key characters, in addition to some others, we propose removing definitively *Montezumella* from Cheiragonidae, and suggest its placement together with *Moianella* n.gen. within its own family, Montezumellidae n. fam.

2. Geological setting

The fossil bearing outcrop is located in the Vic area, between the Cadí thrust sheet and the Catalan Coastal Ranges (Serra-Kiel *et al.*, 2003). This is in the north eastern part of the Ebro foreland basin, whose origin is related to flexural subsidence due to the collision between the Eurasian and Iberian plates from the Late Cretaceous to the Miocene. During the Paleogene the basin formed an Atlantic gulf; marine sediments filled the basin until the Late Eocene, after which only non-marine facies deposited (Puigdefàbregas *et al.*, 1992). Many depositional successions during the Paleogene, in this part of the basin, are related to the emplacement of the south Pyrenean thrust sheets which are linked to two major relative sea level rises, in the Lower Ypresian (early Eocene) and Bartonian

(middle-late Eocene). The depositional succession ends in the late Eocene with the closure of Ebro foreland basin to marine influence and its filling with lacustrine and alluvial deposits (Puigdefàbregas *et al.*, 1986; Sanjuán *et al.*, 2012) (Figure 1).

Layers-bearing crabs correspond to the so-called Terminal Complex, at the end of the marine sedimentation in this zone of the basin. This unit, defined by Travé (1992) and Travé *et al.* (1996), is made up of sandstone, anoxic marl, limestone including freshwater stromatoliths, and gypsum, representing the progressive filling of the basin and its final shift to non-marine conditions (Sanjuán *et al.*, 2012) (Figure 2).

According to Travé (1992) and Travé *et al.* (1994, 1996), facies of Terminal Complex cropping out near Moià, consist of three carbonate units that represent successive shallowing carbonate platforms interlayered with prograding sediments in distal areas. Coralline algal build-ups capped by ostreid and echinoid bearing layers are included in the Lower Carbonate Unit, while coralline algal build-ups, oolitic bars, and meadows of branching corals are present in the Middle Carbonate Unit, and laminated microbial intervals composes the Upper Carbonate Unit. Crabs specimens were found in the bioherms formed by the articulated coralline-algae *Corallina* sp. and *Jania* sp., the crustose coralline algae *Lithoporella* sp. and *Lithothamnion* sp. of the Middle Carbonate Unit. Bivalves and echinoids complete the association (Figure 3).

The stratigraphic positions of these units suggest that the Terminal Complex belongs to an intermediate sequence, which has been controversially considered late Bartonian or early Priabonian in age (Serra-Kiel *et al.*, 2003). Recent studies by Cascella and Dinarès-Turell (2009) on calcareous nannofossils have revealed the presence of the lower Priabonian in marine rocks of this part of the basin (Sanjuán *et al.*, 2012).

3. Montezumellidae n. fam.

Type genus: *Montezumella* Rathbun, 1930

Included genera: *Montezumella* Rathbun, 1930, *Moianella* n. gen., *Atelecyclus gorodiskii* Rémy, 1959 in Gorodiski and Rémy, 1959, is attributed with reservation to the family as “*Atelecyclus*” *gorodiskii*.

Diagnosis: Carapace from medium size (*Montezumella*) to large size (*Moianella*), from elongate to ovate sub-hexagonal shape, from slightly longer than wide to as wide as long, almost flattened, slightly convex longitudinally, somewhat less convex in transverse section; surface with tubercles and granules, usually in the anterior half of carapace, and rows of granules forming short ridges of squamous aspect in the posterior half. Regions well defined by shallow grooves, usually smooth. Dorsal regions well marked; hepatic region slightly swollen; protogastric lobes inflated, anterior half of lobes both subdivided longitudinally

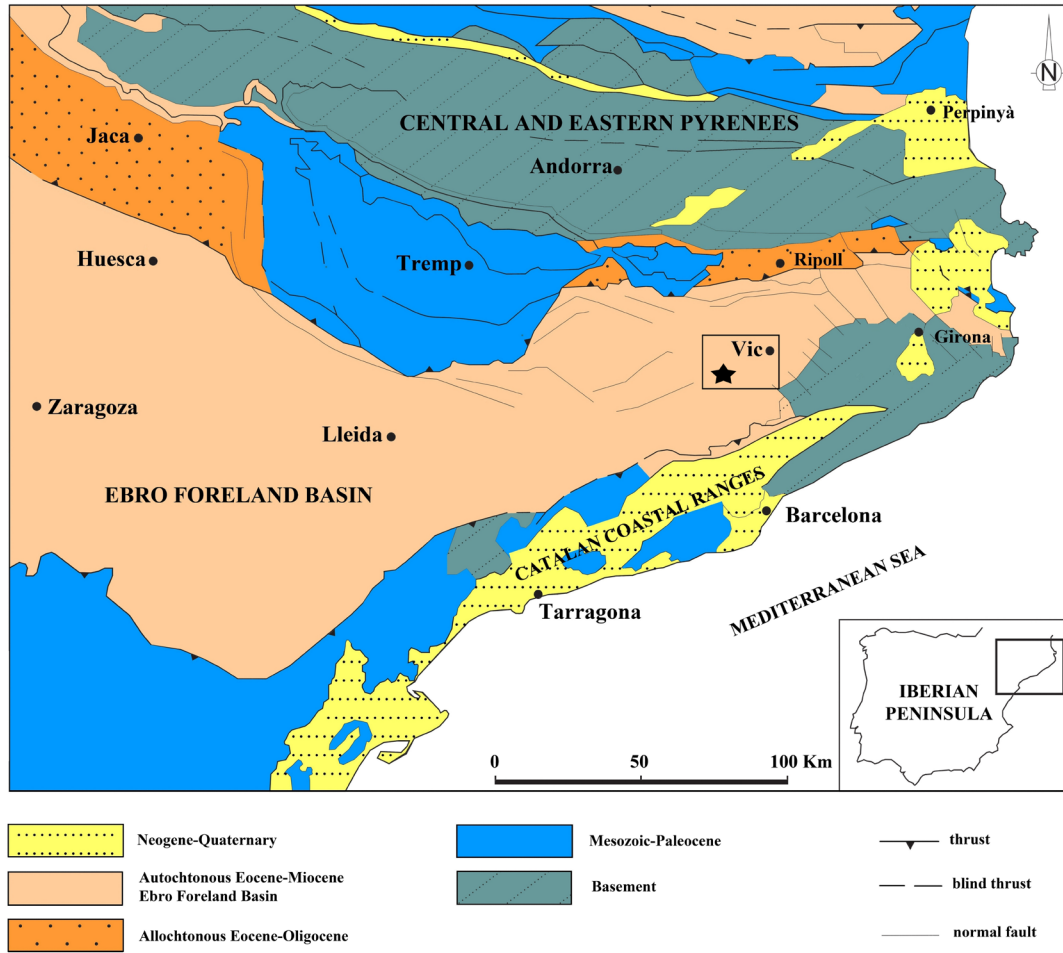


Figure 1. Location map and geological sketch of the eastern part of the Ebro foreland basin showing the location of the outcrop area studied (modified from Sanjuán *et al.*, 2012 and Vergés *et al.*, 1998, in Geological Society, 134 (Special Publications), reproduced with permission of Geologica Acta).

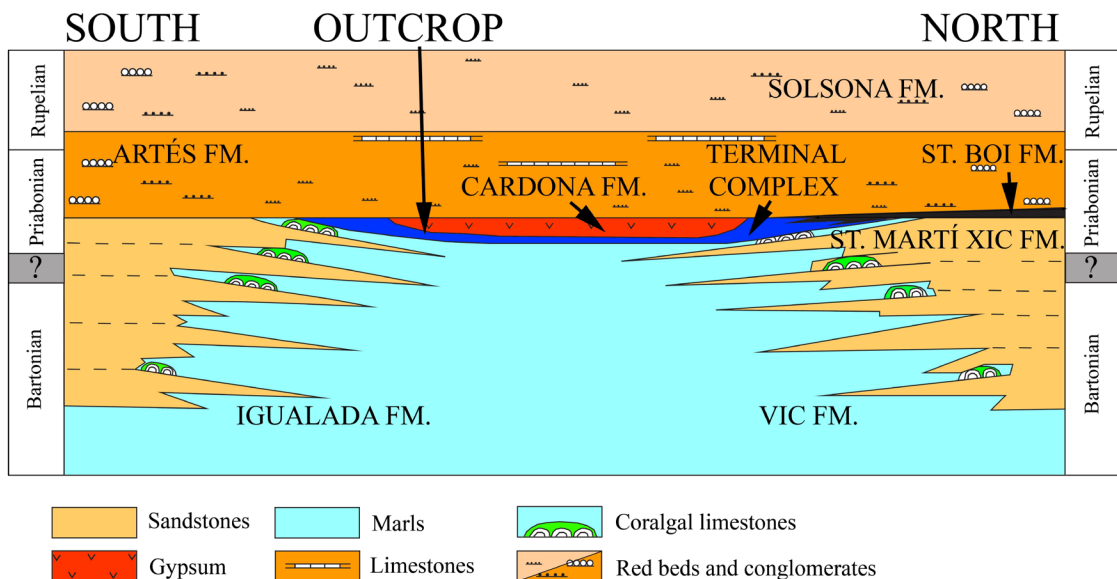


Figure 2. Stratigraphic framework of the Eocene in the outcrop area (modified from Sanjuán *et al.*, 2012 and Vergés *et al.*, 1998, in Geological Society, 134 (Special Publications), reproduced with permission of Geologica Acta).



Figure 3. View of typical aspect of outcrop and close up showing the coralline algae bioherm. Scale bar is 1 m, 10 cm in square close up.

by a median groove forming four short ridges reaching the four frontal lobes or teeth respectively; mesogastric region sharp, reaching the frontal margin; metagastric regions inflated; urogastric region narrow, both well delimited transversally, bounded laterally by a groove connecting the gastro-hepatic and cervical groove to the branchiocardiac groove, forming a characteristic continuous parallel axial line. Cardiac region large. Intestinal region flat. Epibranchial lobes inflated. Mesobranchial and metabranchial region slightly inflated. Front wide, four-lobed or four-toothed, axially divided by a notch. Orbits oblique, oval, complete, supra-orbital margin with three teeth or spines separated by two fissures; inner orbital tooth subtriangular; supra-orbital tooth blunt to sharp; outer orbital tooth sharp, usually sunken; continuous serrated orbital corner and infra-orbital margin bearing a prominent infra orbital tooth. Anterolateral margin short, straight to slightly convex, with four teeth (excluding the outer orbital tooth) forward directed, subequal or decreasing in size, the latter being the smaller. Posterolateral margin straight to convex, unarmed, stepped, edge decorated with tubercles or ridges; a marked re-entrant of fifth pereopod. Posterior margin from straight to slightly concave, short, rimmed. Male thoracic sternum narrow, elongate, entirely metameresed (except for suture 1/2 and suture 3/4 that is only present laterally). Sutures 2/3 and 4/5 to 7/8 complete; episternites well developed, delimited by complete sutures. Sterno-abdominal cavity deep, narrow, V-shaped, reaching the half of sternite 4. Sternites 1 and 2 subtriangular; sternite 3 short, wide, separated laterally from sternite 4 by a notch; sternite 4 elongate; sternites 5, 6, 7 subtrapezoidal; sternite 8 not known. Median line present along the sternite 8 to the half of sternite 4. Press-button on sternite 5 close to suture 5/6. Male abdomen narrow, with all free somites and telson; somites rectangular, somite 6 elongate. Female thoracic sternum larger than in males. Vulvae small, located inside deep sterno-abdominal cavity on somite 6 close to suture 5/6, completely covered by wide, subtrapezoidal somite 6. Ischium of third maxiliped with markedly convex inner margin. Chelipeds strong, slightly heterochelous in males and females. Merus robust, not fused

with basis-ischium, subtriangular in section, inner surface concave, outer surface granulated and ridged. Carpus strong, massive, densely granulated to tuberculated, upper margin with two forward directed spines on inner and outer angles. Propodus strong, upper margin strongly tuberculated, outer margin convex, with two marked transverse carinae, the second one reaching the tip of fixed finger; dactylus curved, long as propodus length, proximal third of upper margin spiny; both, fixed finger and dactylus almost homodontous, the central tooth being slightly more developed. Ambulatory legs long, robust, sub-oval in section, dactylus long; acute lanceolate.

3.1. Historical account of *Montezumella* Rathbun, 1930 and allied genera.

Montezumella Rathbun, 1930, was erected to accommodate *Montezumella tubulata* Rathbun, 1930 (1930b, p. 4, pl. 2), from the Eocene of Baja California (México), which is therefore the type species. The genus was originally related to *Erimacrus* Benedict, 1892, a genus considered at that time to belong to Atelecyclidae Ortmann, 1893. In addition, Rathbun (1930b, p. 4) included *Cancer fraasi* Lörenthey, 1909 (Lörenthey, 1909, T. 2 f. 3a, 3b) from the Eocene of Egypt in *Montezumella* as *M. fraasi* (Lörenthey, 1909). Successive works describing new species of *Montezumella* retained the genus into Atelecyclidae: *M. ruteni* Van Straelen, 1933, from late Eocene of Netherlands Antilles; *M. lamiensis* Rathbun, 1934, from Neogene of Fiji; *M. casayetensis* Rathbun, 1937, from late Oligocene of Panamá; *M. amenosi*, Via, 1959, from the Eocene of Catalonia; *M. scabra* Quayle and Collins, 1981, from the Eocene of United Kingdom. Also, Quayle and Collins (1981, p. 748) referred *Titanocarcinus elegans* Lörenthey in Lörenthey and Beurlen, 1929, from Eocene of Hungary, to *Montezumella elegans* (Lörenthey in Lörenthey and Beurlen, 1929).

Via (1970, p. 14-15) noted the differences between *Montezumella* and *Erimacrus*, and suggested a phyletic relationship between *Montezumella* and the extant *Atelecyclus* as well as other genera considered at that time as atelecyclids.

More recently, Schweitzer and Salva (2000), based on superficial similarities, reassigned *Montezumella* to the family Cheiragonidae Ortmann, 1893 (= Telmessinae Guinot, 1977) (see Števíć, 1988). Subsequent authors followed this new classification when describing new species referable to *Montezumella*: *M. eichorni* Schweitzer and Salva, 2000, from the Eocene of United States; *M. microporosa* Portell and Collins, 2002, from the late Eocene of United States; *M. pumicosa* Beschin, Busulini, De Angeli and Tessier, 2002, from the middle Eocene of Italy. All authors in successive investigations have considered all species of *Montezumella* as member of Cheiragonidae. Other genera were included in this family: *Karasawaia* Vega, Nyborg, Coutiño and Hernández-Monzón, 2008,

Pirulella Feldmann, Schweitzer and Encinas, 2010, and *Stintonius* Collins, 2002 (see Schweitzer *et al.*, 2010).

3.2. Distinctive characters between Montezumellidae nov. fam. and Cheiragonidae

The establishment of the new family Montezumellidae nov. fam. is justified by a series of characters that are unique and distinguish it from the Cheiragonidae.

The Cheiragonidae (= Telmessinae Guinot, 1977; Števcíć, 1988) consists of two extant taxa, *Telmessus* White, 1846, and *Erimacrus* Benedict, 1892. It was previously included in *Corystoidea* Samouelle, 1819 (Bouvier, 1942) or to *Cancroidea* Latreille, 1802 (Števcíć, 2005; Vega *et al.*, 2008; Schweitzer *et al.*, 2010). A suprafamilial rank, *Cheiragonoidea* Ortmann, 1893, was proposed by Ng, Guinot and Davie (2008, p. 55) and adopted by De Grave *et al.* (2009, p. 31).

The original description by Rathbun (1930b, p. 4) indicates for *Montezumella*: "In shape and ornamentation of carapace resembling *Erimacrus* but differing in the orbit which is broadly tubular viewed from above, concealing the eye. Postero-lateral margins of carapace unarmed." Therefore, with this sentence, Rathbun noted the superficial similarities but also the important differences.

Members of Cheiragonidae possess bi-lobed or four-lobed front (Benedict, 1892; Števcíć, 2005) whereas the front is always four-lobed or four-toothed in Montezumellidae. Other differences in the armature of lateral margin in both families are evident: for example, a number of six or seven antero- and postero-lateral teeth in Cheiragonidae (see Benedict, 1892) instead of four exclusively anterolateral teeth in Montezumellidae, without teeth present on postero-lateral margin. This distinctive character was pointed out by Via (1969, p. 187; 1970, p. 14) and is corroborated by the material examined by us and figured here (Fig. 4).

The pattern of fronto-orbital margin of Montezumellidae and Cheiragonidae would seem identical, mainly regarding the inner orbital tooth which are stout, acute subtriangular and with serrated outer margin. Both families share the same supra-orbital pattern: trilobed with two fissures. Although some authors claim that there are only one fissure and outer and inner orbital spines (Schweitzer and Salva, 2000, p. 286, 287; Karasawa and Schweitzer, 2004), careful observation of figures of Benedict, 1892 (Pl. 15-16-17), descriptions of Števcíć (2005, p. 32) and pers. comm. of Guinot (2012) indicate a trilobed nature of the supra-orbital margin in Cheiragonidae. The supra-orbital margin in Montezumellidae, presents an outer orbital tooth, usually sunken and at lower level than the other teeth, so that it was often not seen or misinterpreted. For example Rathbun (1930b, p. 4) recognized only two teeth when she described *Montezumella tubulata*. According to the description of Via (1959, p. 46), *M. amenosi* Via, 1959, has two teeth and one notch but three teeth have been, however, illustrated (see Via, 1969, p. 184; 1970, p. 13, f. 1). Beschin *et al.* (2002,

p. 16) also pointed out only one fissure when described *M. pumicosa* Beschin, Busulini, De Angeli and Tessier, 2002. Collins and Donovan (2005, p.4) suggested only one supra-orbital notch in *M. rutteni* Van Straelen, 1933. De Angeli (1995, p. 15) observed three teeth and two fissures in *M. elegans* (Lörenthey and Beurlen, 1929) whereas a similar structure was noted by Portell and Collins (2002, p. 597) in *M. microporosa* Portell and Collins, 2002. In contrast to the similarities in the supra-orbital margin, the infra-orbital margin of both families is clearly distinctive. The orbits are not complete and the eyes are not protected either dorsally or ventrally in Cheiragonidae (Benedict, 1892, P. 16, f. 2-5; Števcíć, 2005, p. 32.) whereas the orbits are complete in Montezumellidae (Figure 4: b'- d'; 6: c'). This is an important difference between the two families.

In addition, the most important and definitive differences between Cheiragonidae and Montezumellidae are the sternal and abdominal features. In the two genera of Cheiragonidae (*Telmessus* White, 1846, and *Erimacrus* Benedict, 1892) the females have the vulvae located laterally on the sternite 6 that are not covered by the abdomen, and thus exposed (Benedict, 1892, p. 223, Pl. 16, f. 3-6; Guinot, 1979, p. 178, Pl. 25, f. 1-2-3; Števcíć, 1988, p. 32, 2005, p. 32; Schweitzer and Salva, 2000, p. 285; Karasawa and Schweitzer, 2004, p. 114). In *Telmessus*, the vulvae are even located in a strong notch that cuts the external margin of abdominal somite 6 (Guinot, 1979, p. 25, f. 3). This character is almost unique amongst the Brachyura (Guinot, 1979, p. 178). In contrast, the vulvae of Montezumellidae are located inside the sterno-abdominal cavity and completely covered by the abdomen, as usual in Brachyura (Figure 5: b-b'-c-d-e).

Other differences between Cheiragonidae and Montezumellidae are clear when features of the thoracic sternum are considered. The pattern of the sternal sutures is different. In Cheiragonidae, the sutures 4/5 and 5/6 are incomplete, with extremities that are close to each other, and sutures 6/7 and 7/8 are complete (Guinot, 1979, p. 99). In Montezumellidae sutures 4/5 to 7/8 are complete (Figure 5: a). In addition, males of Cheiragonidae have a large, triangular abdomen, with abdominal somites 3-5 fused (Števcíć, 2005, p. 32) while in Montezumellidae the abdomen is narrow, with all somites free in Montezumellidae (Via, 1969, p.13, f. 2a; 1970, f. 2).

These characteristics seem to be sufficient to remove *Montezumella* from Cheiragonidae Ortmann, 1893, and are evidence of a separate family, justifying the establishment of Montezumellidae n. fam.

Another genus, *Moianella* n. gen. that offers the same diagnostic familial characters as *Montezumella* is assigned here to Montezumellidae n. fam. (see below).

When the diagnosis of Cheiragonidae Ortmann, 1893, was expanded in order to include a different range of characters (Schweitzer and Salva, 2000, p. 287; Karasawa and Schweitzer, 2004, p. 144-145), a number of fossil genera from Eocene were moved or added to this family. *Karasawia* Vega, Nyborg, Coutiño and Hernández-Monzón,

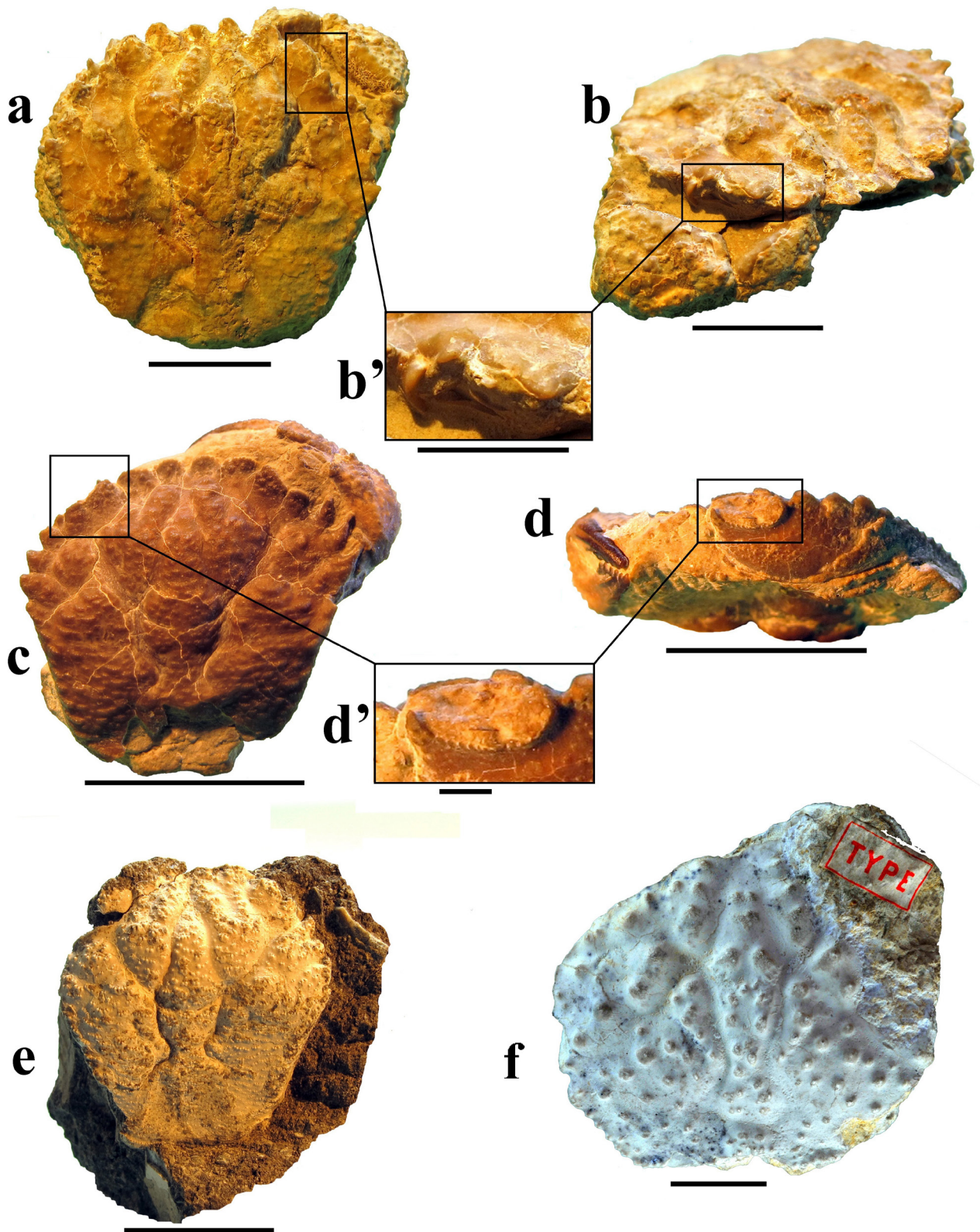


Figure 4. a: *Montezumella amenosi* Via, 1959, AO C-022-1 dorsal view, Collbàs Fm., Bartonian (late Eocene), La Pobla de Claramunt, Anoia (Catalonia); b: same sample fronto-lateral view; b': close-up of right orbit of the same sample; c: *Montezumella* sp. MGB 59628, dorsal view, Lutetian (middle Eocene), Vic zone, Osona (Catalonia) ex Alfons Onetti coll.; d: same sample infra-orbital view; d': close up of the left orbit; e: *Montezumella scabra* Quayle and Collins, 1981, AO C-230-1, Lutetian (middle Eocene), Arzignano, Vicentino (Italy); f: "*Atelecyclus*" *gorodiskii* Rémy, 1959 in Gorodiski and Rémy, 1959, holotype MNHN R03847, dorsal view, Lutetian (middle Eocene), Pognar (Senegal). Scale bar = 10 mm (except for b' = 5 mm; d' = 1 mm).

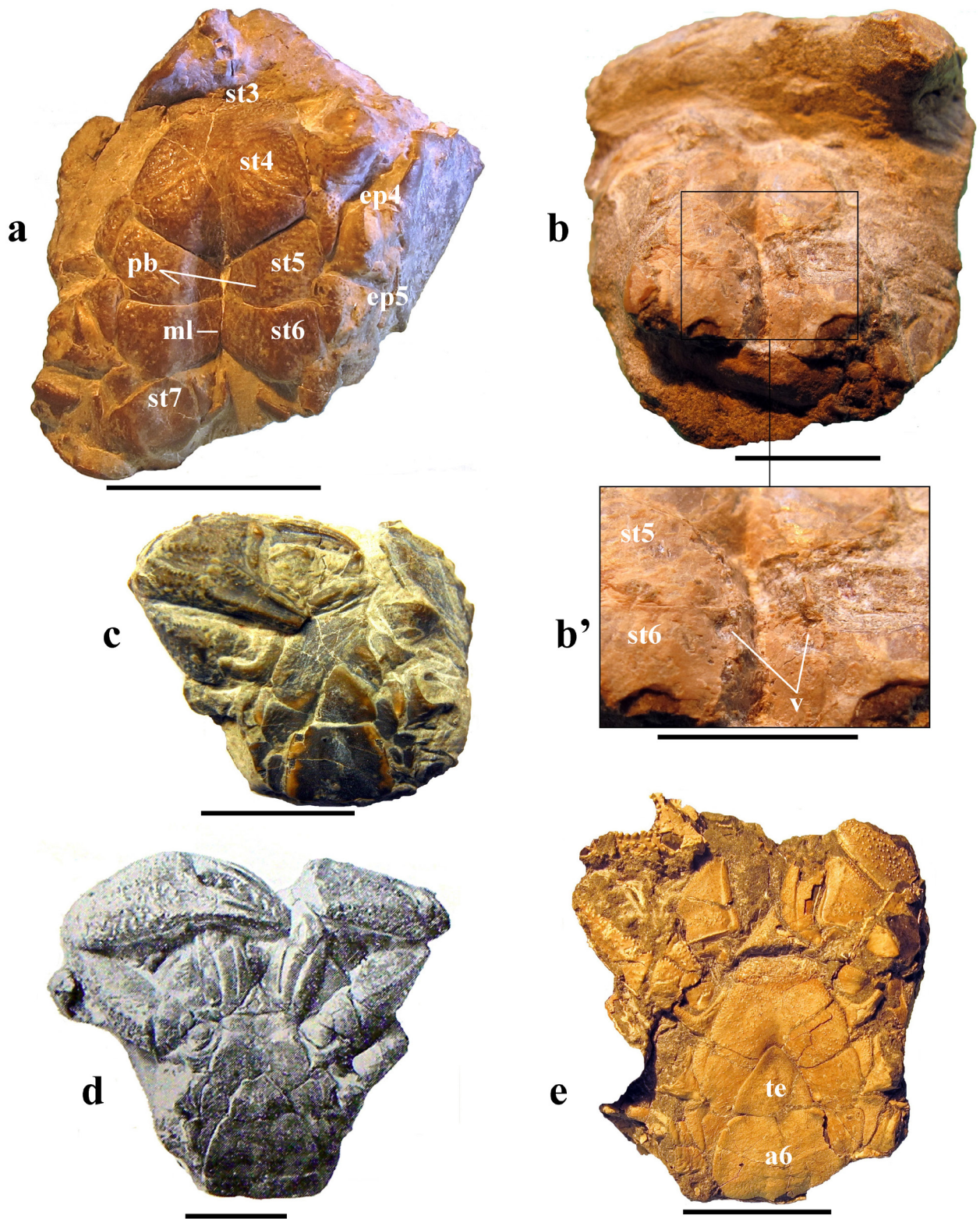


Figure 5. a: *Montezumella* sp. MGB 59626, male ventral view, Lutetian (middle Eocene), Vic zone, Osona (Catalonia); b: *Montezumella* sp. MGB 59627, female ventral view, Lutetian (middle Eocene), Vic zone, Osona (Catalonia) ex Alfons Onetti coll.; b': close up of sternum of same sample; c: *Montezumella* sp., private collection, female ventral view, Lutetian (middle Eocene), Vic zone, Osona (Catalonia); d: *Montezumella amensosi* Via, 1959, female ventral view, Collbàs Fm., Bartonian (late Eocene), La Pobla de Claramunt, Anoia (Catalonia), figured by Via in 1969 (reproduced with permission of *Pirineos*); e: *Montezumella* sp. MGB 59629, female ventral view, Bartonian (late Eocene), Huesca, Aragón (Spain). Abbreviations: a = abdominal somite, ep = episternites, ml = median line, pb = press button, st = thoracic sternites, te = telson. Scale bar 10 mm (except for b' = 5 mm).

2008, that was erected as new combination for *Stintonius* (= *Plagiolophus*) *markgrafi* Lörenthey, 1907, previously placed into Eucratopsinae (Panopeidae) as *Glyphithyreus* (= *Plagiolophus*) *markgrafi* (Karasawa and Kato, 2003, p. 144) was posteriorly moved to Cheiragonidae (Karasawa and Schweitzer, 2004, p. 144-146, f. 1.7; Vega *et al.*, 2008, p. 56, f. 3, pl. 2, f. 13; De Grave *et al.*, 2009, p. 31; Feldmann *et al.*, 2011, p. 335-336, f. 7).

Stintonius Collins, 2002, erected to accommodate *Portunites subovata* (Quayle and Collins, 1981) and placed in Portunidae, was questionably transferred by Collins (2002, p. 86) to Cheiragonidae (Quayle and Collins, 1981, p. 749-750, p. 105, f. 2; Schweitzer and Feldmann, 2000, p. 637; De Grave *et al.*, 2009, p. 31). *Pirulella* Feldmann, Schweitzer and Encinas, 2010, was also included in Cheiragonidae on the basis of similarities with *Montezumella* and *Erimacrus* (Feldmann *et al.*, 2010, p. 346-347, f. 7).

Although none of these genera preserve ventral structures or appendages, we disagree with these inclusions, being convinced that only *Telmessus* White, 1846, and *Erimacrus* Benedict, 1892, belong to the family Cheiragonidae. In particular, absence of females of the above-mentioned fossil species that could show the diagnostic sternal and abdominal cheiragonid structures, does not allow identification with confidence. Thus, assignment of these fossil genera to Cheiragonidae is not accepted here. A possible inclusion in Montezumellidae n. fam. is neither adopted.

Atelecyclus gorodiskii Rémy, 1959 in Gorodiski and Rémy, 1959 (Plate 1) from Eocene of Senegal, treated as Atelecyclidae (Rémy, 1959 in Gorodiski and Rémy, 1959, p. 318, p. 19a, f.2), deserves attention. The species was re-examined by Schweitzer and Feldmann (2010, p.402-404, f. 1 B) and tentatively assigned to genus *Calappilia* A. Milne-Edwards in De Bouillé, 1873 (Calappidae De Haan, 1833). *Atelecyclus gorodiskii* presents a carapace “*légèrement arquée dans ses deux dimensions*” (slightly arched in its two dimensions) which, although the frontal margin is absent, is suspected to be as wide as long. Other characters are: well-marked mesogastric region defined by grooves; apparently well-developed protogastric lobes with an oblique ridge, possibly formed by a median protogastric groove; metagastric and urogastric regions distinct, well defined, narrowing backwards until the cardiac region, which is large, and both bounded by grooves forming a continuous axial line; dorsal surface covered by granules; and posterolateral margin decorated with a row of tubercles. This combination of features excludes its belonging to Calappidae and suggests that *A. gorodiskii* could be related to Montezumellidae n. fam., where it is questionably placed herein. On the other hand *A. gorodiskii*, represented only by a fragmentary carapace, does not match with the diagnosis of genus *Atelecyclus* (Salva and Feldmann, 2001, p. 47-49; Števcíć, 2005, p. 32; Tavares and Cleva, 2010, T. 1). Consequently, until new material is available, we retain tentatively this taxon as “*Atelecyclus*” *gorodiskii*.

3.3. Comparisons of Montezumellidae n. fam. with other eubrachyuran families

Montezumellidae n. fam. is compared with families that have similar thoracic structures and similar dorsal characters. Montezumellidae n. fam. cannot be accommodated in Trichopeltarioidea Tavares and Cleva, 2010, whose front is cut into three teeth (versus four teeth in Montezumellidae), epibranchial teeth are very prominent (versus small or subequal in Montezumellidae) and sternal sutures 4/5 and 5/6 are incomplete (versus 4/5 and 5/6 complete in Montezumellidae), pattern of dorsal features is distinct, the carapace being subpentagonal and inflated (versus subhexagonal and flattened in Montezumellidae) (Tavares and Cleva, 2010, T. 1).

Guinot (1979) who interpreted the sutures of thoracic sternites as a key character at higher level in Brachyura, proposed a division into four groups, the first embracing the genera with uninterrupted transverse sternal sutures 4/5 to 7/8. Several families were listed in this group, for example Atelecyclidae Ortmann, 1893, Corystidae Samouelle, 1819 and Cancridae Latreille, 1802 (Guinot, 1979, p. 81-86, T. 1). Montezumellidae n. fam. offers this precise pattern. In contrast, *Telmessus* and *Cheiragonus* were diagnosed by Guinot (1979, p. 88) by sutures 4/5 and 5/6 that are “*presque jointives*” (almost joined) and sutures 6/7 and 7/8 that are complete.

The presence of complete or almost complete sternal sutures was regarded as plesiomorphic (Guinot, 1979). Although sharing a similar pattern of narrow sternum and thoracic sternal sutures, Corystoidea Samouelle, 1819 (type genus: *Corystes* Bosc, 1802) differs from Montezumellidae in the absence of a sterno-abdominal cavity (well-marked in Montezumellidae) and the absence of abdominal locking (presence of a press- button in Montezumellidae). In addition, *Corystes* has lateral margins that are armed along its entire length, a very different bifid frontal margin, carapace inflated and regions not well-marked, incomplete orbits and male abdominal somites 3-5 fused (Guinot, 1979, p. 132, Pl. 9, f. 1, Števcíć, 2005; Guinot, De Angeli and Garassino, 2007, fig. 1).

Kraussinae Ng, 1993 (Xanthidae MacLeay, 1838) has also uninterrupted sternal sutures 4/5-7/8. Although it presents superficial similarities with Montezumellidae notably in dorsal ornamentation, and frontal as well as lateral margins, it differs in many characters, such as the suture 3/4 that is complete (incomplete in Montezumellidae), and in any case, its current status as Xanthidae is confirmed (Ng, 1993, Števcíć, 2005, Ng *et al.*, 2008).

Pilumnoides Lucas, 1844 in H. Milne Edwards and Lucas, 1844 (Pilumninoididae Guinot and Macpherson, 1987) possesses a narrow thoracic sternum and complete sutures 4/5 to 7/8; squamous appearance of carapace, well-marked axial line of grooves along the well-defined protogastric, metagastric and urogastric lobes, well defined mesogastric region, and tuberculated chelipeds with keeled

propodus. But *Pilumnoides* differs from Montezumellidae in having an incomplete suture 2/3 which is complete in Montezumellidae; episternites fairly developed and without sutures, instead of well-developed with marked sutures of Montezumellidae; a lower fronto-orbital ratio than Montezumellidae; ischium-merus fused instead of a free articulation in Montezumellidae; press button placed at mid length of sternite 5 in *Pilumnoides*, which is placed near the suture 5/6 in Montezumellidae; and shorter dactylus of first ambulatory leg compared to that of Montezumellidae. Moreover, the current status of *Pilumnoides* Lucas, 1844 (Pilumninoididae Guinot and Macpherson, 1987) in Pseudozioidea (Ng *et al.*, 2008) discards the relationship with Montezumellidae. In our opinion, except for members of Cancroidea Latreille, 1802, the same would be said for other genera included by Guinot (1979, p. 83-86) into this first group of taxa with uninterrupted transverse sternal sutures 4/5 to 7/8. The current status of *Thia* Leach, 1815 (Thiidae Dana, 1852), *Carpilius* Desmarest, 1823 (Carpiliidae Ortmann, 1893), *Daira* De Haan, 1833 (Dairidae Serène, 1965) and *Paraxanthus* Lucas, in H. Milne Edwards and Lucas, 1844 (Xanthidae MacLeay, 1838), discards also any relationship with Montezumellidae.

Two primitive families, Marocarcinidae Guinot, De Angeli and Garassino, 2008, and Componocarcinidae Feldmann, Schweitzer and Green, 2008, neither of them can accommodate Montezumellidae. Both families differ in having interrupted sternal suture 5/6, and different angle of sternites 4/5 to 7/8 than in Montezumellidae; other important differences are the very dissimilar dorsal pattern without well-defined regions which in contrast are well-marked in Montezumellidae (Guinot *et al.*, 2008; Feldmann *et al.*, 2007; Feldmann *et al.*, 2008).

In conclusion, Montezumellidae possesses a primitive thoracic sternal pattern, and without going in to previous works relating *Montezumella* with Atelecyclidae (Rathbun, 1930b, Via, 1969, 1970, Quayle and Collins, 1981), we compare Montezumellidae n. fam. with Cancroidea Latreille, 1802 (*sensu* Guinot *et al.*, 2008; Schubart and Reuschel, 2009); this is Atelecyclidae Ortmann, 1893, and Cancridae Latreille, 1802, which are considered as primitive families (Guinot, 1979, p. 81, 137; Štević, 2005, p. 8, 12, 136). Atelecyclidae, which was attributed to Crystoidea, was transferred to Cancroidea by Guinot *et al.* (2008, p. 25-30).

Montezumellidae n. fam. shares with families of Cancroidea several characters; for instance, a more or less narrow, elongate and metamerised thoracic sternum, a median line present from sternite 4 to 8, a trilobed supraorbital margin, a similar continuous axial line of grooves along lobes from protogastric to cardiac regions, and keeled propodus of first pereopod. Nevertheless, cancrioid families differs from Montezumellidae in having sternal suture 2/3 that are laterally marked in Atelecyclidae and absent in Cancridae, (complete in Montezumellidae); in males, fused abdominal somites 3 to 5 (free in Montezumellidae);

a different pattern of carapace, usually wider than long in Cancridae, and smooth in both families Cancridae and Atelecyclidae, (as wide as long and profusely ornate with strong granules, tubercles and ridges in Montezumellidae); a front usually trilobed in Cancroidea (four-lobed to four toothed in Montezumellidae); a lower fronto-orbital ratio in Cancroidea than in Montezumellidae; chelipeds isochelous (Cancridae) or homochelous (Atelecyclidae), (conspicuously heterochelous in Montezumellidae) (see Rathbun, 1930a, p. 85, f., 2-3-4-5; Tavares and Cleva, 2010, T. 1; Schram and Ng, 2012, f. 3).

In spite of these differences, we consider that the similar thoracic features suggest a certain degree of relationship between Montezumellidae and Cancroidea. We propose to place the new family tentatively in Cancroidea.

4. Systematic palaeontology

Order Decapoda Latreille, 1802
 Infraorder Brachyura Latreille, 1802
 Superfamily ?Cancroidea Latreille, 1802
 Family Montezumellidae n. fam.
 Genus *Moianella* new genus

Etimology. From Moia, village of Bages (Catalonia, NE of Iberian Peninsula).

Diagnosis. Carapace subhexagonal, ovate, slightly longer than wide, flattened in both longitudinally and transversally; maximum width at mid-length of carapace; regions well defined; dorsal surface ornamented with tubercles, large granules and rows of various granules forming short squamous ridges. Dorsal regions well defined, hepatic region slightly swollen; protogastric lobes inflated, anterior half of both lobes sub-divided longitudinally by a median groove forming four short ridges that reaches the four frontal teeth respectively; mesogastric region slender, reaching the frontal margin; metogastric regions inflated, urogastric region narrow, both well delimited and bounded laterally by a groove that connect the cervical groove with the branchiocardiac groove, forming an axial continuous line. Cardiac region large. Epibranchial lobes inflated. Front relatively large, four-toothed with four acute spiny teeth. Orbits oval, oblique, complete, supra-orbital margin with two fissures; prominent acute sub-triangular inner orbital tooth with serrated outer margin, acute and prominent supraorbital tooth and finely laterally serrated outer tooth; continuous serrated orbital corner and infra-orbital margin bearing a prominent inner infra-orbital tooth. Anterolateral margin slightly convex, short, armed with four strong and acute teeth. Posterolateral margin straight, stepped, converging backwards, ornamented with a row of prominent tubercles with re-entrant of fifth pereopod. Posterior margin short, rimmed, convex. Mesobranchial and metabranchial regions slightly inflated. Toracic sternum narrow, granulated. Sternites 1-2 triangular; sternite 3 flat,

well developed laterally; sternite 4 big, vaulted, laterally rimmed, deep sterno-abdominal cavity reaching two thirds of its length. Sternite 5 subtrapezoidal. Sternites 4-5 with well-developed episternites with suture complete. Suture 2/3 complete, suture 3/4 visible only laterally; sutures 4/5 and 5/6 complete, sutures 6/7 and 7/8 unknown but supposedly complete. Press button on sternite 5 near suture 5/6. Median line present at the sterno-abdominal cavity reaching sternite 4. Pterygostome subtrapezoidal, granulated; buccal collar of pterygostome rimmed at inner margin and finely serrated at outer margin. Abdominal somite 6 sub-rectangular with central socket in distal margin. Right cheliped: merus robust, subtriangular in section, inner surface concave, outer surface granulated and ridged; carpus strong, massive, three acute and spiny distal teeth, forward directed at the inner, upper and lateral outer angle, outer surface strongly convex coarse granulated; manus strong, upper margin with unknown spines or tubercles (scars), outer surface almost smooth except for a few scattered tiny granules; two transversal carinae: a medial one from the proximal margin to the mid-length of the manus and the second one parallel to the lower margin reaching the fixed finger; fixed finger with five teeth, outer surface with two carinae; movable finger with five teeth, as long as manus, upper margin with two rows of spines extend half distance to tip of finger. First ambulatory leg slender, sub-rectangular in section, long as propodus, dactylus acute.

Discussion. *Moianella* n. gen. shares with *Montezumella* Rathbun, 1930b similar carapace pattern that is almost flattened, ovate elongate, the same ornamentation with more or less strong granules or tubercles at the anterior half of carapace and ridges of tubercles at the posterior part giving a squamous aspect to the carapace; large and strongly four toothed front with median notch, trilobed supraorbital margin with two fissures, orbits closed; short and four toothed anterolateral margin, almost straight and unarmed posterolateral margin; well defined gastric process with anteriorly subdivided protogastric lobes by a groove; sharp mesogastric region reaching the frontal median notch; metogastric region inflated and urogastric region narrower, both distinct, and large cardiac region, all of them bounded by the characteristic sub parallel axial line of grooves; narrow and elongate sternum with median line reaching the sternite 4, metamerised, sutures 2/3 and 4/5 to 7/8 complete, and also the long, downward directed episternites. Despite the holotype of *Moianella* is not completely preserved in its ventral part, we assume that it follows the same pattern than in *Montezumella*.

Nevertheless, *Moianella* can be clearly distinguished from *Montezumella* for the big size (2 to 3 times) of the new genus when compared with *Montezumella*. In addition, the sharp and long spiny frontal teeth are usually blunt in the latter (even if *M. tubulata* Rathbun, 1930b has spiny and longer frontal teeth than other species of *Montezumella*). Also the anterolateral margin is armed with four subequal conical tooth in *Moianella*, while in *Montezumella* they

decrease in size, being the last anterolateral tooth the smallest ones. Chelipeds are somewhat different between the two species: whereas in *Moianella* the carpus has strong tubercles, in *Montezumella* it is finely granulated and also the propodus is strongly tuberculated in its upper margin and slightly granulated between the carinae of the outer margin in *Moianella*, being usually profusely granulated in *Montezumella*. The differences are sufficient to propose a new genus for this new taxon.

Moianella cervantesi new species

Figure 6: a, b, c, d

Etymology. Dedicated to Manuel and Antonio Cervantes, who found and donated the holotype.

Diagnosis. as for the genus

Description. Carapace subhexagonal, elongate, ovate, slightly longer than wide. Slightly convex longitudinally, mainly at posterior part of carapace; flattened transversally. Regions well defined by shallow grooves and inflations. Dorsal surface ornamented with large granules or tubercles at the median areas of carapace, granules with spiny tip forward directed in the anterior areas of carapace and rows with various granules forming short irregular, squamous ridges at the posterior third of carapace. Hepatic region slightly inflated. Protogastric lobes inflated, well defined and bounded by the hepatogastric and cervical grooves, anterior half of both, subdivided longitudinally by an oblique median groove that reaches the frontal margin between the median and submedian frontal teeth, resulting four ridges that reaches the four frontal teeth respectively; mesogastric region narrow, sharp at the end when reaching the median frontal notch; metogastric region subtrapezoidal inverted, urogastric region short, narrow, bounded by two swellings, both regions well delimited and bounded laterally by grooves that form a continuous characteristic axial line connecting cervical groove with the branchiocardiac groove. Epibranchial lobes slightly inflated. Mesobranchial and metabranchial regions slightly swollen. Cardiac region subhexagonal, flat. Intestinal region flat. Front large, with four long, acute and sharp spiny teeth forward projected, divided by a U-shaped median notch. Orbits small, oblique, with two fissures on the supraorbital margin; prominent long, acute subtriangular inner orbital tooth, with serrated outer margin; long, sharp supraorbital tooth; outer orbital tooth sharp, finely serrated laterally, continuous serrated orbital corner and infra-orbital margin bearing a prominent inner infra-orbital tooth. Anterolateral margin short, slightly convex armed with four strong sub-equal, conical, sharp teeth, forward directed; last anterolateral tooth bifid, outer tip shorter than the inner tip. Posterolateral margin straight converging backwards, stepped, ornamented with a row of prominent tubercles and short ridges, with marked re-entrant of fifth pereopod. Posterior margin convex, shorter than frontal margin. Pterygostome subtrapezoidal, granulated; buccal collar of pterygostome rimmed at inner margin and

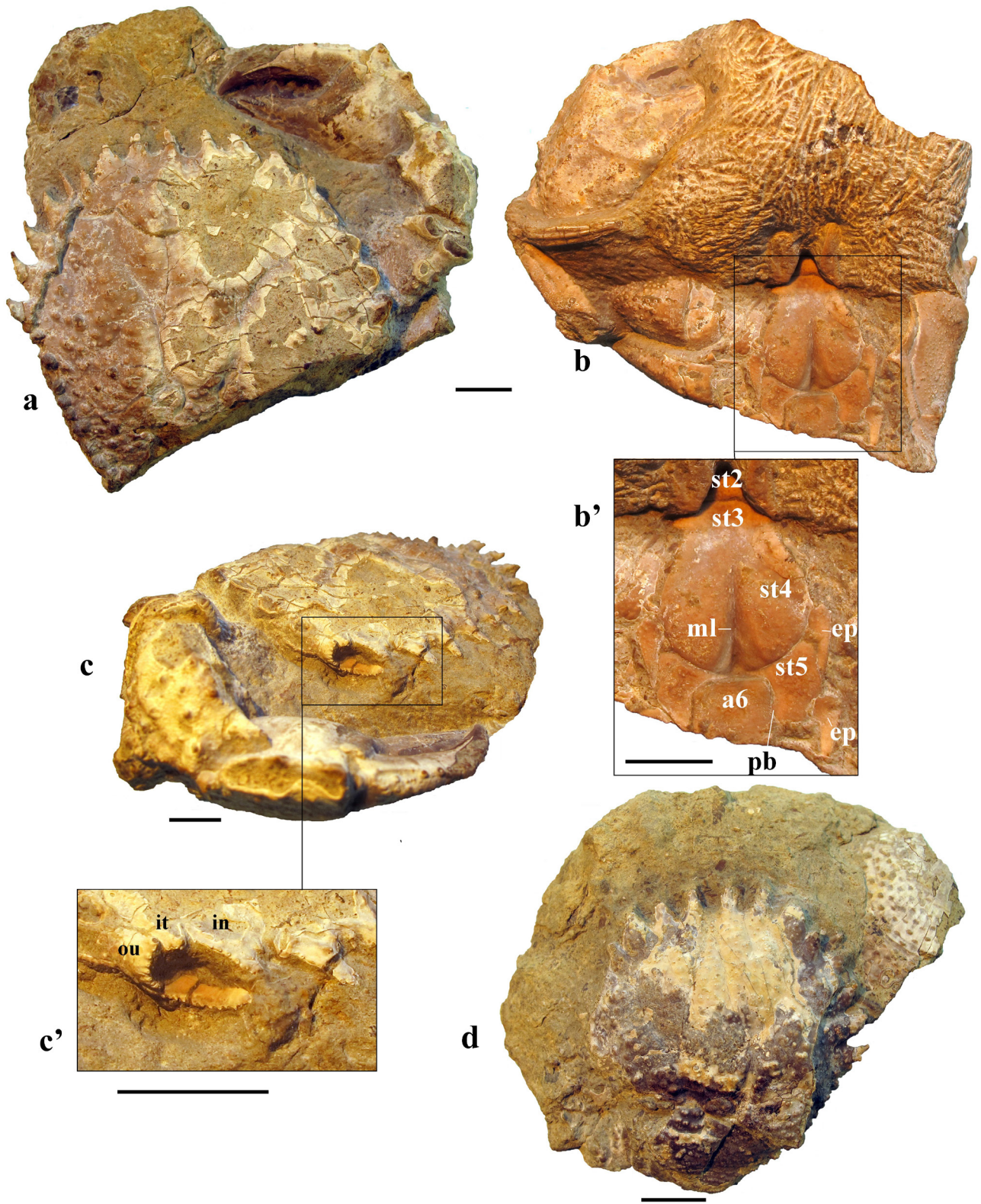


Figure 6. a: *Moianella cervantesi* n. gen., n. sp. Holotype MGB 59624 dorsal view, Priabonian (late Eocene), Moià, Bages (Catalonia); b: same sample ventral view; b': close up of sternum of same sample; c: fronto-orbital view of the same sample; c': close up right orbit of same sample; d: *Moianella cervantesi* n. gen., n. sp. paratype MGB 59625 dorsal view, Priabonian (late Eocene), Moià, Bages (Catalonia). Abbreviations: a = abdominal somite, ep = episternites, in = inner-orbital tooth, it = intra-orbital tooth, ou = outer-orbital tooth, ml = median line, pb = press button, st = thoracic sternites. Scale bar: 10 mm.

finely serrated at outer margin. Thoracic sternum narrow, elongate, slightly granulated. Sternites 1-2 subtriangular, flat; sterno-abdominal cavity deep, reaching almost the anterior portion of sternite 4, median line present. Sternite 3 flat, well developed laterally. Sternite 4 vaulted, elongate, more than three times longer than sternite 3, lateral margins longitudinally rimmed. Sternite 5 subtrapezoidal, forming an angle of 65° with the sternite 4 and an angle of 50° with the sternite 6. Episternites 4 and 5 narrow, long and downwards directed, suture with sternites 4-5 complete. Suture 2/3 complete; suture 3/4 visible only laterally in the notch that divides both; suture 4/5 complete. Press button visible on sternite 5 near suture 5/6. Abdominal somite 6 subrectangular, pocket on the upper margin. Right cheliped: merus robust, subtriangular in section, inner surface concave, outer surface granulated and ridged; carpus strong, massive, three acute and spiny distal teeth, forward directed at the inner, upper and lateral outer angle, outer surface strongly convex coarse granulated; manus strong, upper margin with unknown spines or tubercles (scars), outer surface almost smooth except for a few scattered tiny granules; two transversal spiny carinae: a medial one from the proximal margin to the mid length of the manus and the second one parallel to the lower margin reaching the fixed finger; fixed finger with five teeth, outer surface with two carinae; movable finger with five teeth, as long as manus, upper margin with two rows of spines extend half distance to tip of finger. First ambulatory leg slender, sub-rectangular in section, long as propodus, dactylus acute.

Material. Holotype MGB 59624 and paratype MGB 59625.

Measurements (in mm). Holotype MGB 59624, carapace length = 56 (uncomplete), width = 57, orbito-frontal width = 42, frontal width = 30. Paratype MGB 59625 Carapace length = 40, width = 37, orbito-frontal width = 32, frontal width = 23.

5. Conclusions

The main objective of this paper is to describe the new taxon *Moianella cervantesi* n. gen., n. sp. and not a revision of the different species of *Montezumella*, for this is beyond the scope of this study. The need of placing the new taxon within a family and considering its similarities with *Montezumella* have inevitably led us to review the previous familial placement of this genus and to propose the erection of a new family that include both genera.

There is no evidence yet, as it was claimed for *Montezumella*, of Cheiragonidae members in the fossil record. Montezumellidae has been revealed as a homogeneous basal eubranchyuran family, appearing in warm waters of the Mediterranean area during the middle Eocene. It would not be surprising to find new specimens in lowermost levels, and being widely dispersed westward

during the late Eocene and Oligocene, reaching the Pacific Ocean via the Caribbean and Straits of Panamá, as the fossil record indicates.

7. Acronyms

MGB: Museu de Geologia de Barcelona. MNHN: Muséum national d'Histoire naturelle (Paris). AO: À. Ossó collection.

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