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New retroplumid crabs (Crustacea, Brachyura, Retroplumidae Gill, 1894) from the Eocene of Huesca (Aragón, Spain)

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Abstract

Two new brachyurans assignable to the family Retroplumidae Gill, 1894, *Serrablopluma diminuta* n. gen., n. sp., and *Gaudipluma bacamortensis* n. gen., n. sp., from the Eocene of northern Spain (Huesca, Aragón), substantially enlarge our current knowledge of the morphological diversity of the family. The material, with well-preserved ventral surfaces, permits the erection of two new genera that can be referred to the family with confidence on the basis of the general carapace shape, narrow front, a reduced last pair of pereopods and characteristic thoracic sternum (broad, trapezoidal sternites 3, 4, subrectangular sternites 5–7, sternite 8 conspicuously reduced and inclined). *Serrablopluma diminuta* n. gen., n. sp. co-occurs with two other retroplumids in the most diverse fossil assemblage of that family known to date.

Key words: Decapoda, Retroplumidae, *Serrablopluma*, *Gaudipluma*, new taxa

Introduction

Extinct members of the family Retroplumidae Gill, 1894, are comparatively common and diverse in Eocene sedimentary rocks in northern Spain, Eocene and Oligocene strata in northern Italy and Eocene levels in southern France (Via 1959, 1969, 1980; Beschin *et al.* 1996; Larghi 2003; Artal *et al.* 2006). Several fossil taxa from these areas have been assigned to *Retropluma* Gill, 1894, while one species each has been referred to both *Retrocypoda* Via, 1959, and *Loerenthopluma* Beschin, Busulini, De Angeli & Tessier, 1996. Another species of the latter genus has recently been described from the lower Eocene (Ypresian) of northwestern Belgium (Van Bakel *et al.* 2010). The genus *Loerentheyia* Lörenthey in Lörenthey & Beurlen, 1929, from Hungary, which is morphologically close to *Loerenthopluma*, was also recovered from Eocene strata (Glaessner 1969: R531). The two new genera erected herein share important features with all of the above, but also present noteworthy novelties. The two new genera appear to be rather different from extra-European genera currently assigned to Retroplumidae such as *Archaeopus* Rathbun, 1908, and *Costacopluma* Collins & Morris, 1975. These genera constitute the oldest record of Retroplumidae (Beschin *et al.* 1996: 87–88).

One of the features that European genera have in common, inclusive of the two new ones proposed herein, is a carapace that is strongly dorso-ventrally compressed. *Costacopluma*, which is widely distributed both geographically and stratigraphically, with records from America and Africa (Beschin *et al.* 1996) has a more inflated carapace with a convex dorsal surface (Ossó-Morales *et al.* 2010: 220, fig. 7). The other extra-European genus, *Archaeopus*, displays a complex set of dorsal ridges (Rathbun 1908: 347), with swollen regions, *i.e.*, features that differ considerably from those of the two new genera described herein.

The two new forms demonstrate the morphological adaptability of the family, having plesiomorphic characters in common with other members, but also adding new features that merit discussion in the light of the evolutionary

history of the Retroplumidae. In addition, *Serrablopluma diminuta* **n. gen., n. sp.** constitutes the first decapod crustacean to be recovered from uppermost Eocene (Priabonian) strata in Spain.

Material, localities and stratigraphy

Specimens of *Serrablopluma diminuta* **n. gen., n. sp.** were collected from temporary outcrops during road construction works, about 1 km southeast of the village of Fanlillo, in the municipality of Yebra de Basa (Huesca). Only sporadic records of decapod crustaceans are known from this area; none of these records has ever been formally published. Rare, badly weathered individuals of the portunid *Portunus catalaunicus* Via, 1959, have been recovered from time to time from rocks of late Eocene (Bartonian, 41.3–37.0 Ma) age in the Yebra de Basa valley, but none are known from younger strata. New road cuttings furnished a new assemblage of decapod crustaceans from levels straddling the Bartonian-Priabonian boundary several years ago. The beds that have yielded the *Serrablopluma* **n. gen.** were assigned a Priabonian age by Canudo & Molina (1988). It co-occurs with the other retroplumids, *Retropluma eocenica* Via, 1959, and *Retrocypoda almelai* Via, 1959, as well as with abundant, predominantly small-sized gastropods and bivalves, bryozoan thickets and small solitary corals. The white-coloured bivalves usually are well preserved; occasionally they are slightly pyritised. *Serrablopluma diminuta* **n. gen., n. sp.** co-occurs with two other retroplumids, thus constituting most diverse fossil assemblage of this family recorded to date.

Specimens of *Gaudipluma bacamortensis* **n. gen., n. sp.** came from near the abandoned village of Bacamorta, in the municipality of Foradada del Toscar (Huesca), having been recovered from marls and marly limestones of the Roda Formation (Cuevas-Gozalo *et al.* 1985), of early Eocene (Ypresian) age. In the direct vicinity, about 750 metres east of the village of Bacamorta, are strata that have yielded the majid *Periacanthus ramosus* Artal & Castillo, 2005. The general geology of the area and of the lithology and fossil assemblages are given by Artal & Castillo (2005).

The following abbreviations are used to denote the repositories of material illustrated or referred to in the text: MAB (Oertijdmuseum De Groene Poort, Boxtel, the Netherlands); MGSB (Museo Geológico del Seminario de Barcelona, Barcelona, Spain); MNHN (Muséum national d'Histoire naturelle, Département Histoire de la Terre, and Département Milieux et peuplements aquatiques, Paris, France).

The following abbreviations are used in the descriptions: P1, P2 coxa = pereopod 1, coxa of pereopod 2, etc.; mxp3 = third maxillipeds.

Systematics

Infraorder Brachyura Latreille, 1802

Section Eubrachyura de Saint Laurent, 1980

Superfamily Retroplumoidea Gill, 1894

Family Retroplumidae Gill, 1894

***Serrablopluma* n. gen.**

Type species. *Serrablopluma diminuta* **n. sp.**

Diagnosis. Small size carapace, subtrapezoidal in outline, much wider than long, widest anteriorly, maximum width at position of lateral spines; anterior margin wide, broadly sinuous, terminating in fairly widely projecting lateral spines; front conspicuously reduced, narrow; orbits wide, with sub-orbital spine; lateral margins straight, inclined, converging posteriorly; posterior margin wide, broadly convex; dorsal carapace surface flat in both directions, with 3 strongly marked ridges; anterior ridge continuous, intersecting anterior margin; medium ridge interrupted only by gastric grooves; posterior ridge continuous, straight. Thoracic sternum broad; sternites 3, 4 trapezoidal, sternites 5–7 subrectangular; vulvae large, subcircular, situated below extremity of sutures 5/6; abdomen subtriangular in both sexes; female abdomen much broader than males; thoracic sternites, abdominal

somites notably ridged; thoracic sternite 5, abdominal somite 6 with distinct abdominal holding mechanism; chelipeds equal, robust, relatively large; P2–P4 long, flattened; P5 conspicuously reduced.

Etymology. From Serrablo, the mediaeval name of the area (Pyrenees, Huesca) and the ending *pluma*, which refers to the main character of the family.

Remarks. The new genus differs from all others currently included in the Retroplumidae (see De Grave *et al.* 2009: 41) in having a wide, broadly arched anterior margin, a conspicuously reduced front and an anterior dorsal ridge that intersects the anterior margin at the position of long, fairly projecting lateral spines.

***Serrablopluma diminuta* n. sp.**

(Figs. 1–2)

Diagnosis. As for genus.

Etymology. From the Latin *diminutus*, in allusion to the rather reduced size.

Material examined. MGSB75287, holotype; MGSB75289, MGSB75290a, b, MGSB78334a, b, and MGSB78335a, b, c, paratypes; MAB k. 3279–3281, MAB k. 3293, MAB k. 3295, paratypes, all from Fanlillo, municipality of Yebra de Basa, Huesca, and of late Eocene (Priabonian) age. In the holotype, the maximum carapace width and length (in millimetres) are 12 and 9, respectively.

Description. Carapace small (maximum carapace width 12 mm); subtrapezoidal in outline; wider than long, widest anteriorly at level of lateral spines; dorsal surface flat in both directions. Anterior margin sinuous, broadly arched, with projecting lateral spines. Front conspicuously reduced, narrow, directed forwards; orbits wide, with sub-orbital spine. Lateral margins straight, inclined, converging posteriorly. Posterior margin convex, wide, only slightly shorter than orbitofrontal margin. Dorsal surface with 3 ridges; anteriormost intersecting anterior margins laterally; median ridge defined by epibranchial swellings, interrupted by gastric grooves; posterior ridge straight, continuous, interrupted only by small indentations of subtle branchiocardiac grooves. Dorsal surface smooth except for horizontal ridges, shallow grooves. Mesogastric region defined by 2 faint swellings, bounded by weak posterior grooves. Cardiac region large, gently swollen, sub-rhomboidal in shape. Intestinal region flat.

Thoracic sternum much broader than long, sternites with subtle ridges; sternites 1,2 fused, small, subtriangular; sternites 3, 4 subtrapezoidal; sternite 4 with pronounced lateral extensions; small, weak indentation between sternites 3, 4; sternites 5–7 subrectangular, with subtle inclined ridges; sternite 8 conspicuously reduced, oblique; vulvae large, subcircular, situated below extremity of suture 5/6. Male abdomen subtriangular, with segments 3–5 fused, all segments with pronounced horizontal ridge; female abdomen much broader, all segments separated, with marked ridges. Abdominal holding mechanism with press-button on sternite 5, and lateral extensions of abdominal segment 6. P1 subequal, robust, relatively large, strong, inner portion of dactyli with numerous denticles. P2–P4 long, flattened. P5 conspicuously reduced.

Remarks. *Serrablopluma diminuta* n. gen., n. sp. shows the plesiomorphic characters of Retroplumidae (de Saint Laurent 1989: 111–112), namely a sinuous anterior margin and a narrow front; a set of dorsal transverse ridges; a thoracic sternum that is much broader than long; subtrapezoidal sternites 3, 4, with pronounced lateral extensions in sternite 4 behind a distinct notch in sternite 3; distinctly wide, sub-rectangular sternites 5–7; a conspicuously reduced, oblique sternite 8; distinct sexual dimorphism for abdomen; P2–P4 long, flattened; P5 conspicuously reduced, sub-dorsal. The thoracic sternum is typical of Retroplumidae (see Guinot & Quenette 2005: fig. 29A).

Genera that resemble *Serrablopluma* n. gen. are *Loerentheyia* (see Glaessner 1969: fig. 338, 5) and *Loerenthopluma*, both of which have a sub-trapezoidal carapace, with the maximum width anteriorly and a wide anterior margin. *Serrablopluma* n. gen., however, shows distinct characters such as the anterior carapace ridge that intersects the anterior margin, a markedly long lateral spine and lateral margins that are uniformly straight.

The extinct genera *Retropluma* and *Retrocypoda* differ (see Beschin *et al.* 1996: figs 4, 5) in having a subrectangular carapace outline, a much narrower anterior margin, lateral margins broadly arched, not diverging posteriorly and an anterior dorsal carapace ridge without lateral spines. The carapace outline is sub-trapezoidal in *Serrablopluma* n. gen., the anterior margin conspicuously wide, clearly broader than the posterior margin; moreover, the anterior margins terminate in a long lateral spine intersecting the first anterior dorsal ridge, while lateral margins are straight and continuous and converge posteriorly.

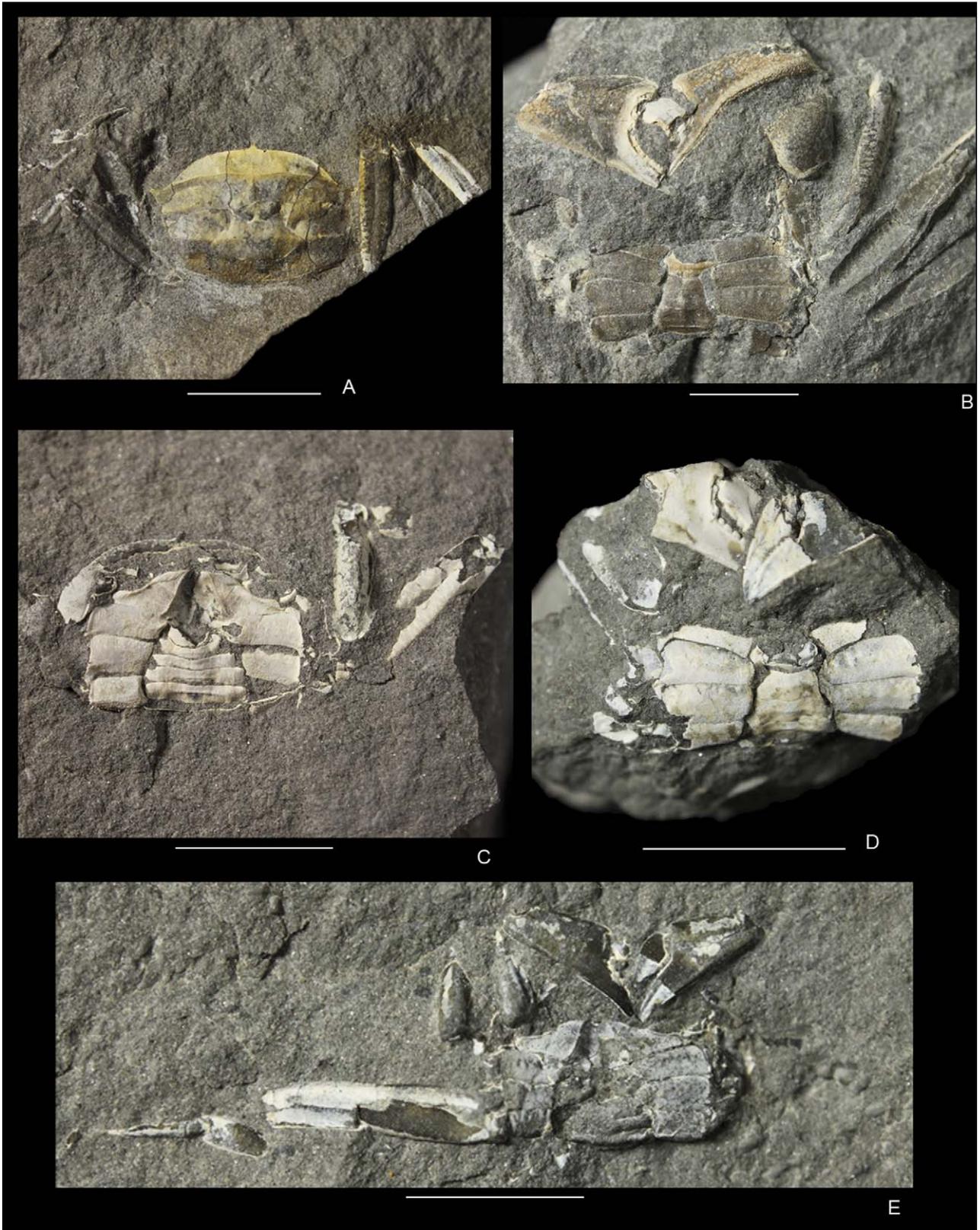


FIGURE 1. *Serrablopluma diminuta* n. gen., n. sp., MGSB75287 (holotype, indeterminate sex); A, dorsal view. MAB k. 3279 (paratype, male); B, ventral view. MGSB75290a (paratype, female); C, ventral view. MGSB75289 (paratype, male); D, ventral view. MGSB75290b (paratype, female); E, ventral view. All from the upper Eocene (Priabonian) of Fanlillo (municipality of Yebra de Basa, Huesca, northeast Spain). Scale bars equal 5 mm.

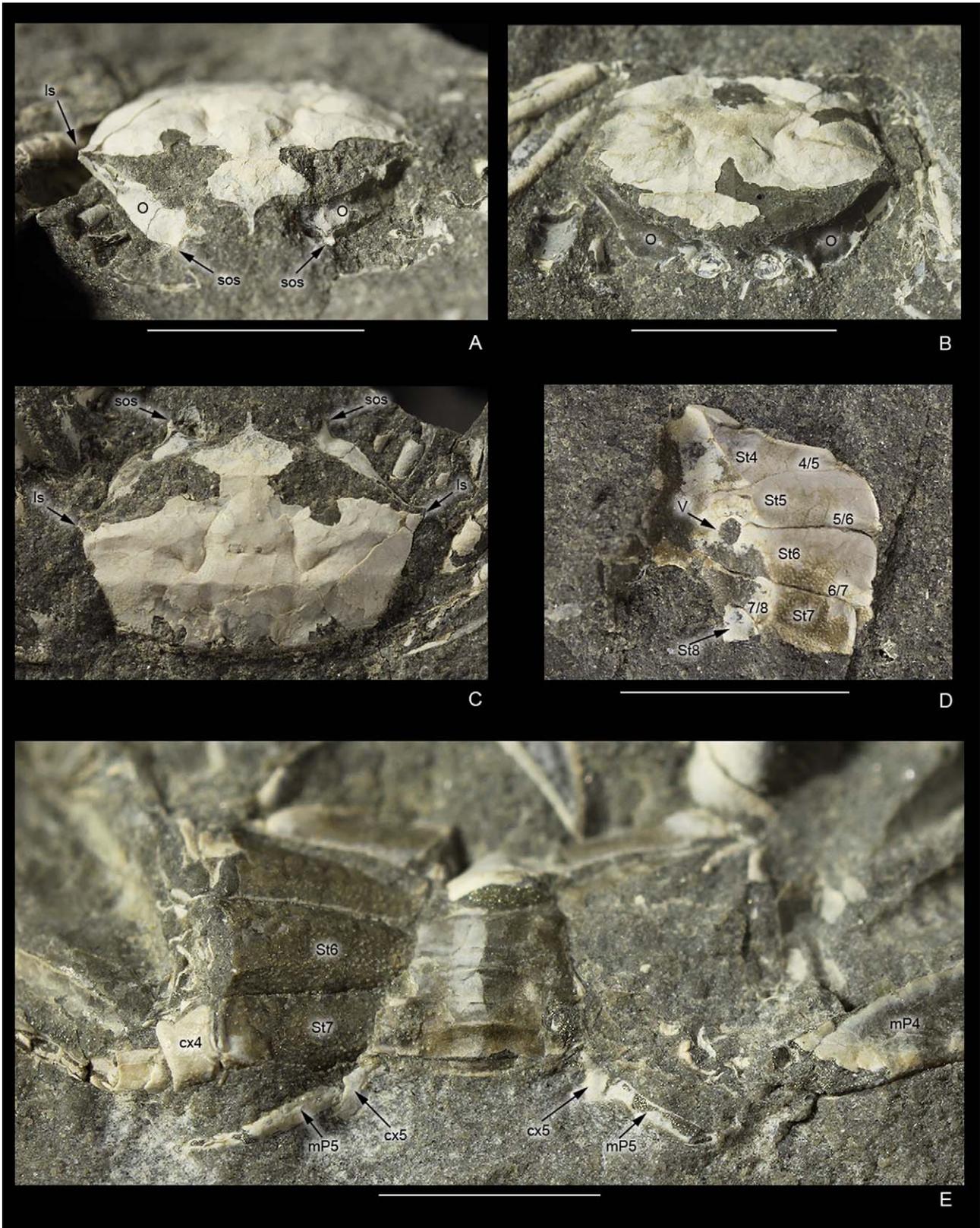


FIGURE 2. *Serrablopluma diminuta* n. gen., n. sp., MGSB78335a (paratype, indeterminate sex; anterior carapace margin damaged); A, oblique frontal view, showing orbits; C, dorsal view. MGSB78334a (paratype, indeterminate sex; anterior carapace margin damaged); B, oblique frontal view, showing orbits. MGSB78334b (paratype, female partial thoracic sternum); D, ventral view showing vulva and reduced sternite 8. MGSB78335c (paratype, male); E, posteroventral view, showing reduced P5. All from the upper Eocene (Priabonian) of Fanlillo (municipality of Yebra de Basa, Huesca, northeast Spain). Scale bars equal 5 mm (A–D), 2 mm (E). **O**, orbit; **sos**, sub-orbital spine; **ls**, lateral spine; **V**, vulva; **4/5**, **5/6**, **6/7**, **7/8**, thoracic sternal suture 4/5, 5/6, 6/7, 7/8; **St4**, **St5**, **St6**, **St7**, **St8**, thoracic sternites 4, 5, 6, 7, 8; **cx4**, **cx5**, P4, P5 coxae; **mP4**, **mP5**, P4, P5 merus.

Species of *Costacopluma* and *Archaeopus*, which were included in the Retroplumidae by De Grave *et al.* (2009: 41), exhibit much more inflated carapaces, with markedly convex dorsal surfaces. The dorsal surface in *Archaeopus* has in addition swollen regions (Rathbun 1908: pl. 47, fig. 5), rather than the thin ridges that define *Serrablopluma* **n. gen.**

***Gaudipluma* n. gen.**

Type species. *Gaudipluma bacamortensis* **n. gen., n. sp.**

Diagnosis. Carapace large; subrectangular, wider than long, maximum width posteriorly; carapace strongly compressed dorso-ventrally; orbits large, supraorbital margins markedly sinuous; front narrow, relatively long; lateral margins arched, with 2 marked raised lateral nodes; posterior margin convex, wider than orbitofrontal margin; dorsal surface flat in both directions, with 3 subtle, low ridges; thoracic sternum with sternites 3, 4 trapezoidal, sternites 5–7 subrectangular, sternites 6, 7 with prominent median line; sternite 8 inclined, reduced; vulvae subcircular, at extremities of sutures 5/6; male, female abdomens weakly differentiated, narrow; chelipeds subequal; P2–P4 long, with numerous spines; P5 conspicuously reduced; dorsal surface with numerous large pits.

Etymology. In honour of the Catalan architect Antoni Gaudí (1852–1926), in allusion to the shape and ornament of the new taxon which is defined by sinuous lines, reminiscent of his works, plus the ending *-pluma*, which refers to the main character of the family.

Remarks. The new genus can be differentiated from all others genera in the family Retroplumidae (see De Grave *et al.* 2009: 44) by a few unique dorsal and ventral characters. The dorsal ridges are fairly attenuated, lateral margins have two conspicuous lateral nodes, male and female abdomens are particularly narrow, the male abdominal segment 6 is long, sternite 7 is unusually large for the family, and distinctly long. Distinguishing features also include a dorsal surface which is densely covered by large pits and P2–P4 with numerous spines, characters never seen in any other retroplumid genera.

***Gaudipluma bacamortensis* n. sp.**

(Figs. 3–4)

Diagnosis. As for genus.

Etymology. From Bacamorta, the name of the village from where the material originates.

Material examined. MGSB75283, holotype; MGSB75284, 75285a, b and 75286a, b, paratypes; MAB k. 3282–3283, paratypes, all from the vicinity of Bacamorta (Huesca), of early Eocene (Ypresian) age. In the holotype, the maximum carapace width and length (in millimetres) are 39 and 30, respectively.

Description. Carapace large (maximum carapace width about 40 mm); subrectangular in outline; wider than long, widest posteriorly, at level of metabranchial region. Dorsal surface flat in both directions, densely covered by large pits. Orbits large, supraorbital margins sinuous, median sinus projected anteriorly; supraorbital margins terminating in long outer-orbital spines. Front slender, directed anteriorly, relatively long. Lateral carapace margins broadly arched, with 2 conspicuously raised nodes, the first at level of epibranchial region, the second at metabranchial region; posterior margin convex, wider than orbitofrontal margin. Dorsal carapace surface crossed by 3 subtle ridges; anterior ridge continuous, sinuous; median ridge inclined (oblique), interrupted by gastric grooves; posterior ridge continuous. Mesobranchial region subcircular, bounded by subtle grooves. Epibranchial regions slightly swollen, inclined (oblique), interrupted by shallow gastric grooves. Cardiac region weakly defined, slightly raised, forming continuous faint ridge with swollen metabranchial region. Intestinal region depressed. Buccal frame large, subrectangular, mpx3 with large, robust endopodite, narrow exopodite. Thoracic sternum wider than long, sternites 1, 2 subtriangular, small, sternites 3, 4 subtrapezoidal; strong, notable notch between sternites 3, 4; sternite 4 with conspicuous lateral projection; sternites 5–7 subrectangular, wide; sternite 7 longer than 5, 6; sternites 6, 7 with prominent median line; sternite 8 inclined, conspicuously reduced; vulvae subcircular, at extremities of sutures 5/6. Male, female abdomens narrow, sexual dimorphism weak, telson short, small in both sexes; female abdomen subelliptical to subtriangular, with rounded lateral margins, all segments separated; male abdomen subtriangular, with straight, inclined lateral margins; abdominal segment 6 conspicuously long, with clear

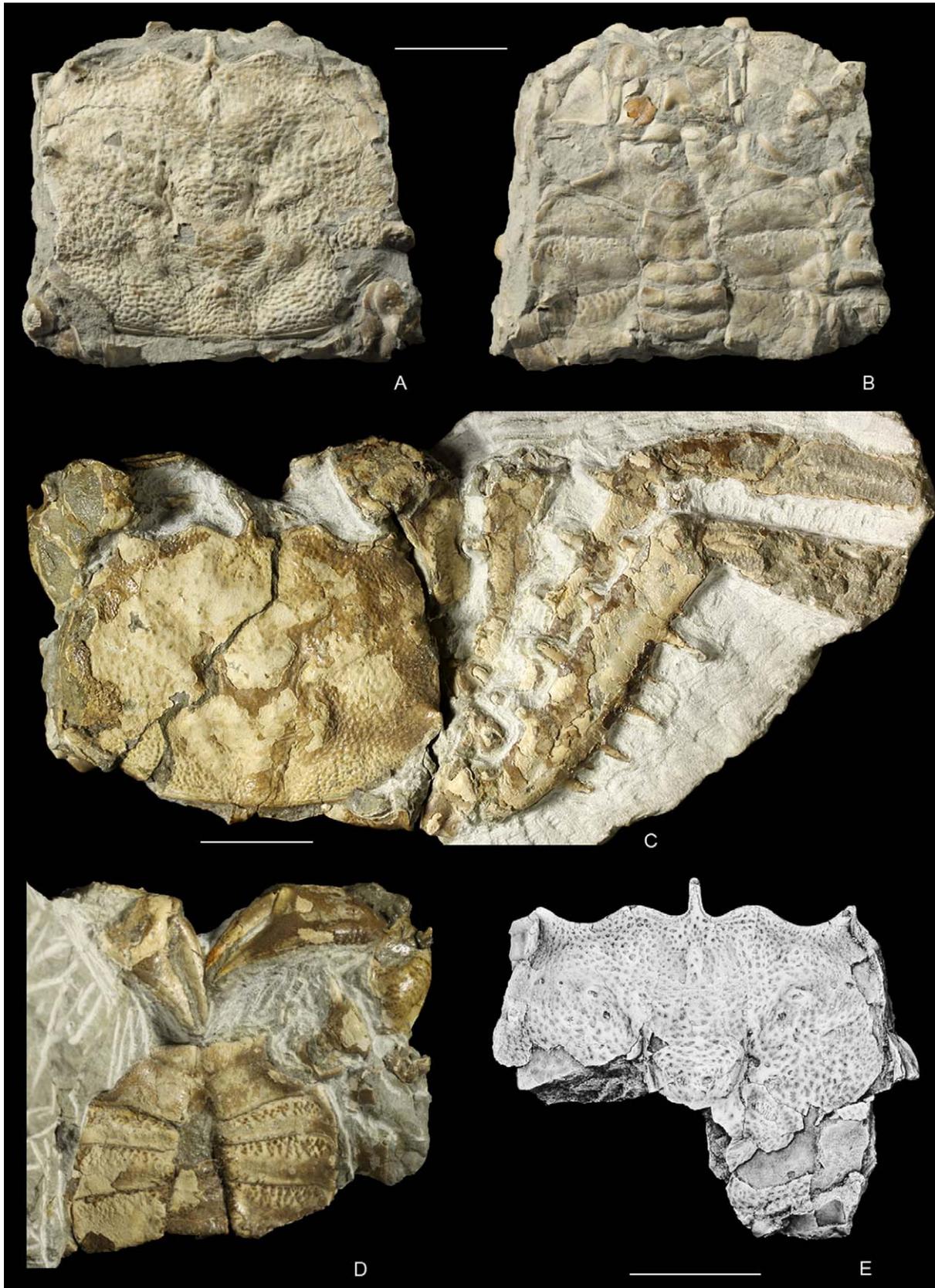


FIGURE 3. *Gaudipluma bacamortensis* n. gen., n. sp., MGSB75284 (paratype, female); A, dorsal view; B, ventral view. MGSB75283 (holotype, male); C, dorsal view (note spines of P2–P4); D, ventral view. MAB k. 3282 (paratype, female); E, dorsal view (note the long, narrow front). All are from the lower Eocene (Ypresian) of the vicinity of Bacamorta (Huesca, northeast Spain). Scale bars equal 10 mm.

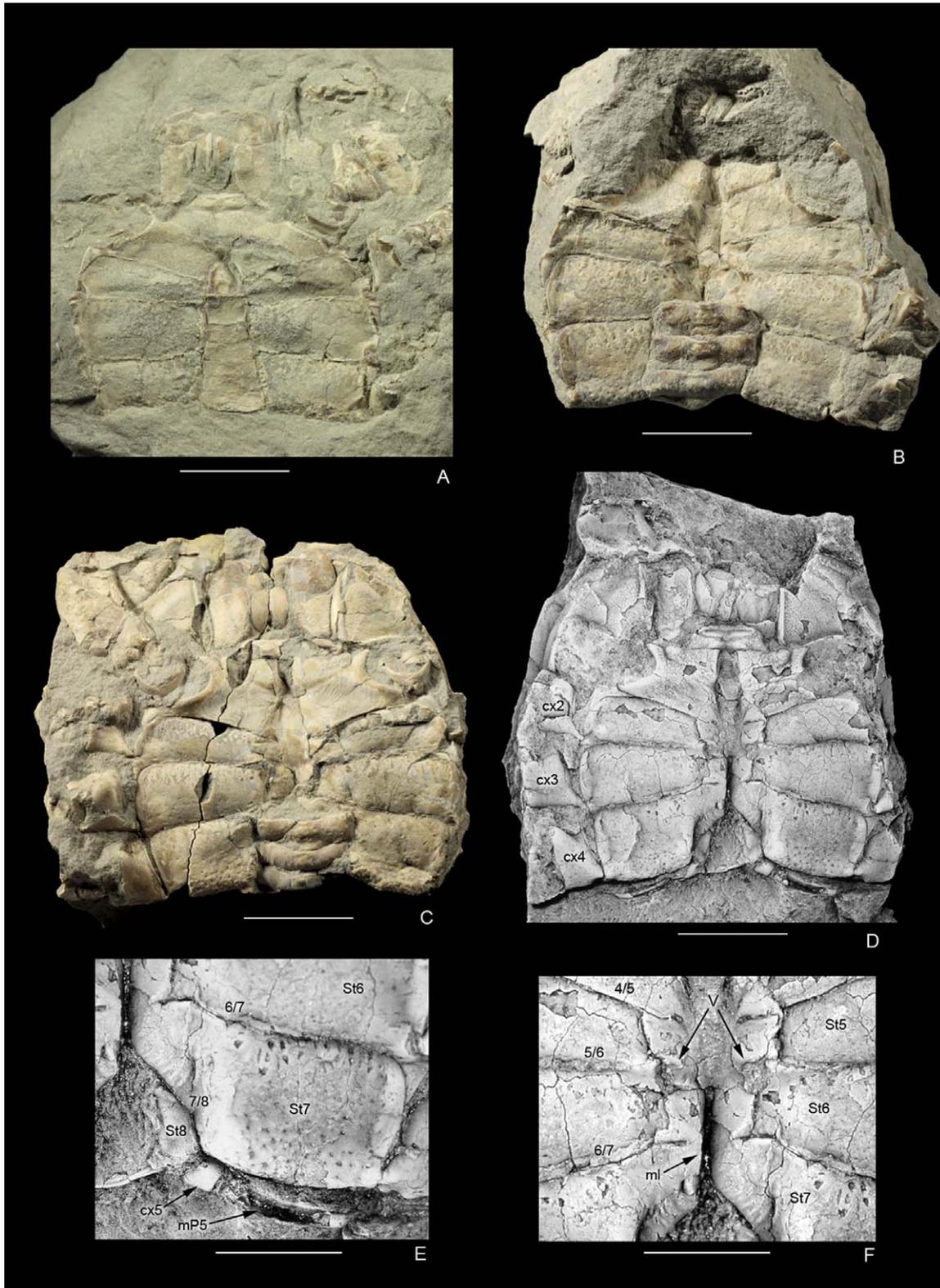


FIGURE 4. *Gaudipluma bacamortensis* n. gen., n. sp., MGS75285a (paratype, male); A, ventral view. MGSB75285b (paratype, female); B, ventral view, detail of vulvae. MAB k. 3283 (paratype, female); C, ventral view. MGSB75286a (paratype, female); D, ventral view; E, details of large sternite 7, reduced sternite 8, reduced P5 coxa, and P5 merus; F, details of vulvae at extremities of sutures 5/6. All are from the lower Eocene (Ypresian) of the vicinity of Bacamorta (Huesca, northeast Spain). Scale bars equal 10 mm (A–D), 5 mm (E–F). **V**, vulva; **ml**, median line; **4/5**, **5/6**, **6/7**, **7/8**, thoracic sternal suture 4/5, 5/6, 6/7, 7/8; **St4**, **St5**, **St6**, **St7**, **St8**, thoracic sternites 4, 5, 6, 7, 8; **cx2**, **cx3**, **cx4**, **cx5**, P2, P3, P4, P5 coxae; **mP5**, P5 merus.

lateral extensions; male abdominal segments 3–5 fused. Abdominal holding mechanism clearly indicated by lateral projections in sternite 5, lateral extensions of abdominal segment 6. Female vulvae at extremity of suture 5/6 (Fig. 4F). P5 subequal, dactyli with numerous small denticles. P2–P4 long, flattened dorso-ventrally, lateral sides with numerous spines. P5 conspicuously reduced (Fig. 34D, E). Dorsal carapace surface densely covered by large pits.

Remarks. The main features of *Gaudipluma bacamortensis* **n. gen., n. sp.** match those attributed to other retroplumids (de Saint Laurent 1989: 111–112). Diagnostic features of the new taxon include the general shape of the carapace, large orbits with sinuous margins, narrow front, general shape of the thoracic sternum, with subtrapezoidal sternites 3, 4, rectangular sternites 5–7, an inclined and reduced sternite 8, female vulvae at the extremity of sutures 5/6, P2–P4 long and flattened; P5 conspicuously reduced (Fig. 4D, E).

The similarly sized *Retrocypoda almelai* has a different dorsal surface, with more numerous and better defined dorsal ridges, much wider abdomens, with marked sexual dimorphism, a shorter abdominal segment 6 and longer telson (Via 1969: fig. 41). The female abdomen in *Retrocypoda* is conspicuously large, occupying a large portion of the ventral surface (Via 1969: pl. 38, fig. 4b). Similar features are seen in *Retropluma* (see Beschin *et al.* 1996) as far as male and female abdomens are concerned. The dorsal carapace surface in *Retropluma* has more strongly marked, acute ridges.

The male and female abdomens of *Gaudipluma* **n. gen.** are markedly narrow, and sexual dimorphism is weak. The male abdominal segment 6 is unusually long. The male and female telsons are short in the new genus. *Serrablopluma* **n. gen.**, *Loerentheyia* and *Loerenthopluma* all differ mainly in carapace size (smaller), general outline, the construction of the orbits, and all the specific features indicated in the discussion of *Serrablopluma* **n. gen.** The female abdomen in *Serrablopluma* **n. gen.**, *Loerenthopluma* and *Retrocypoda* is fairly broad, with distinct sexual dimorphism (see Beschin *et al.* 1996).

Costacopluma is characterised by a wide geographical distribution (America, Africa) and a long stratigraphic range (Coniacian–Eocene; see Beschin *et al.* 1996; Schweitzer *et al.* 2010). The ten species currently assigned to this genus exhibit a wide range of morphological features, with variable carapace sizes and shapes (subcircular to subelliptical to widely sub-rectangular or elongate). The main distinguishing features of *Costacopluma* are the stronger dorsal carapace areolation, shorter orbitofrontal margins, wider abdomens and more accentuated sexual dimorphism. The dorsal surfaces of the carapace are more convex and marginal angles are more rounded. The dorsal carapace regions are clearly separated; moreover, the front is much wider and the orbitofrontal margins much shorter (Schweitzer *et al.* 2003: fig. 16).

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