Treb. Mus. Geol. Barcelona, 22 (2016): 7-18

Magyarcarcinidae new family (Crustacea: Decapoda: Goneplacoidea), and description of *Magyarcarcinus yebraensis* new species, from the Bartonian (Middle Eocene) of the Jaca basin, south-central Pyrenees (Aragón, N Spain)

José Luis Domínguez[1] and Àlex Ossó[2,*]

Abstract

Magyarcarcinidae is proposed as a new family to accommodate the genus Magyarcarcinus. A new species, *Magyarcarcinus yebraensis* is erected after specimens from Bartonian levels of the Margas de Arguís Formation at Yebra de Basa (Aragón, N Spain). A detailed comparison with all the Goneplacoidea families and related taxa is presented. Relationship between both Tethyan and British Middle Eocene decapod faunas are herein confirmed, as well as their migration paths.

Key words: Brachyura, Tethys, migration, Paleogene, Margas de Arguís Formation, Yebra de Basa.

Resum

DOMÍNGUEZ, J.L. i OSSÓ, À. Magyarcarcinidae, nova família (Crustacea: Decapoda: Goneplacoidea), i descripció de *Magyarcarcinus yebraensis* nova espècie del Bartonià (Eocè mitjà) de la conca de Jaca, Pirineus centrals (Aragó, N d'Espanya). Es proposa la nova família Magyarcarcinidae per tal d'acomodar-hi el gènere *Magyarcarcinus*. S'erigeix una nova espècie, *Magyarcarcinus yebraensis*, en base a exemplars procedents de nivells del Bartonià de la Formació Margas de Arguís a Yebra de Basa (Aragó, N d'Espanya). Al mateix temps es fa una detallada comparació amb totes les famílies de Goneplacoidea i altres tàxons relacionats. També es confirma la relació entre la fauna de decàpodes de l'Eocè mitjà de les illes britàniques i la del marge occidental del Tetis, així com les possibles vies migratòries.

Paraules clau: Brachyura, Tetis, migració, Paleògen, Formació Margas de Arguís Formation, Yebra de Basa.

Resumen

DOMÍNGUEZ, J.L. y OSSÓ, À. Magyarcarcinidae, nueva familia (Crustacea: Decapoda: Goneplacoidea), y descripción de *Magyarcarcinus yebraensis* n. sp. del Bartoniense (Eoceno medio) de la cuenca de Jaca, Pirineo central (Aragón, N de España). Se propone la nueva familia Magyarcarcinidae, para acomodar el género *Magyarcarcinus*. En base a especímenes de niveles del Bartoniense de la Formación Margas de Arguís en Yebra de Basa (Aragón, N de España), se erige una nueva especie, *Magyarcarcinus yebraensis*. Asimismo, se realiza una detallada comparación con todas las familias de Goneplacoidea así como con otros taxones relacionados. También se confirma la relación entre la fauna de decápodos del Eoceno medio de las islas británicas y la del margen occidental del Tetis, así como las posibles vías migratorias.

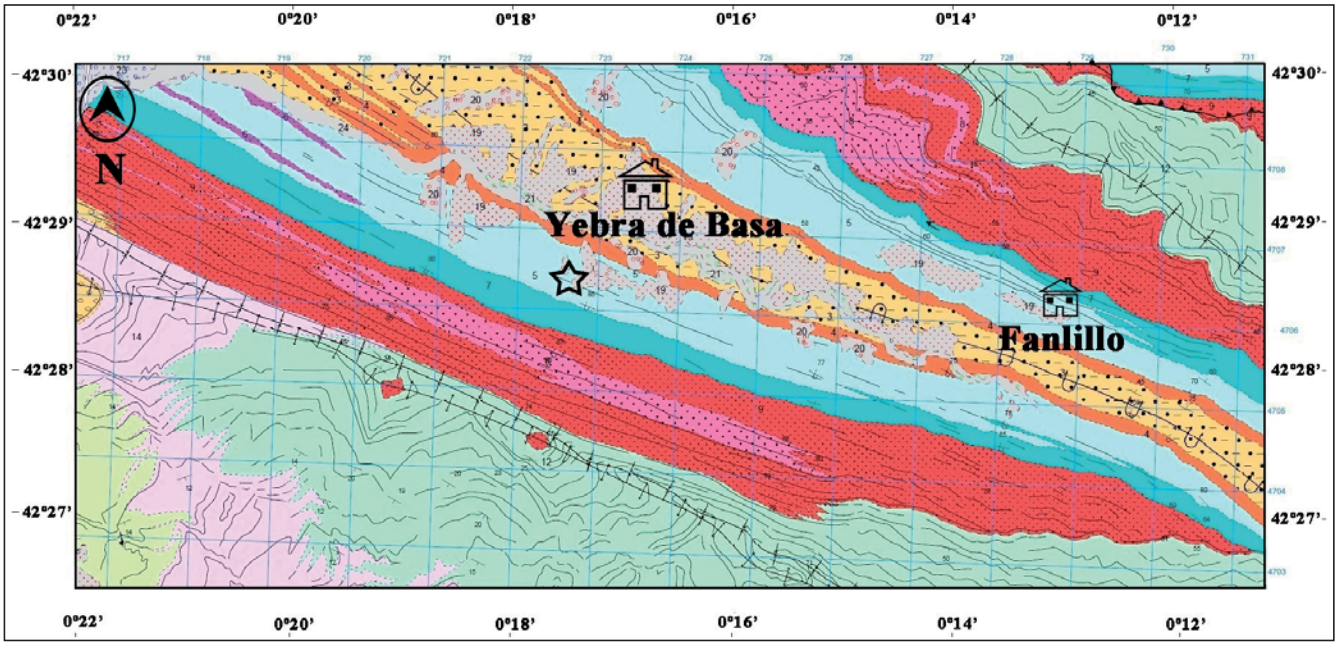
Palabras clave: Brachyura, Tetis, migración, Paleógeno, Formación Margas de Arguís, Yebra de Basa.

INTRODUCTION

The discovery of *Magyarcarcinus yebraensis* n. sp. in Bartonian levels of the Margas de Arguís Formation (Bartonian- early Priabonian) at Yebra de Basa (Aragón, N Spain) within the Jaca basin of the central Pyrenees (Fig. 1), increases the number of described species from this formation (Artal *et al.*, 2013; Ossó *et al.*, 2014). The rich decapod assemblage occurring in these strata displays clear affinities with the Tethyan Eocene faunas from Italy and Hungary, in addition to a relationship with the Upper Eocene faunas from the southern part of the British Isles. *M. yebraensis* n. sp. is congeneric with *M. loczyanus* (Lőrenthey, 1898), originally ascribed by Lőrenthey (1898) as to the genus *Palaeograpsus* Bittner, 1875. More recently, Karasawa & Schweitzer (2004) in their revision of the latter genus, erected the genus *Magyarcarcinus* to accommodate *M. loczyanus*, and included the genus within the family Goneplacidae MacLeay, 1838. The recovered samples of *M. yebraensis* n. sp., both males and females, present well-preserved ventral structures, thus allowing to confirm the adscription of *Magyarcarcinus* to the superfamily Goneplacoidea, but evidencing at the same time the need of a new family where to accommodate this genus, and the need of a revision of its diagnosis. A detailed comparison with each of the Goneplacoidea families, and particularly with some related genera, reinforces the need for the erection of such a new family. The migration patterns of Tethyan fauna to the North Atlantic during the Bartonian transgression through the South-Pyrenean Basin, already suggested by Via (1991), is confirmed by the presence of *Magyarcarcinus* and its associated decapod assemblage in the Bartonian strata of the south-central Pyrenees.

[1] Padre Manjón, 12. 50010 Zaragoza, Spain. jl.domin@hotmail.com
[2] Josep Vicenç Foix, 12-H, 1r 1a. 43007 Tarragona, Catalonia. aosso@comt.cat
* Corresponding author.

Fig. 1. Location map of the Huesca province (Aragón) in northern Spain and of the fossil locality (star).
Fig. 1. Localització de la província d'Osca (Aragó) i del jaciment (estel) en un mapa del nord-est d'Espanya.



MARINE LUTETIAN-BARTONIAN

Gray marls
(Margas de Larrés Fm.)

Glauconitic sandstones
(Arenas de Sabiñánigo Fm.)

MARINE BARTONIAN-PRIABONIAN

Gray marls
(Margas de Pamplona-Arguís Fm.)

Gray sandstones and marls
(Areniscas y margas de Belsué-Atarés Fm.)

CONTINENTAL BARTONIAN- PRIABONIAN

Massive conglomerates
(Santa Orosia conglomerates)

Red shales, sandstones and conglomerates

QUATERARY

Alluvium-colluvium

Poligenic gravels and sands
River terrace deposits

Fig. 2. Geological sketch of the outcrop area. Modified from Mapa Geológico de España 1:50.000, sheet 210 Yebra de Basa (Montes, 1992).
Fig. 2. Esquema geològic de l'àrea del jaciment. Modificat del Mapa Geológico de España 1:50.000, full 210 Yebra de Basa (Montes, 1992).

Material. Type specimens of *Magyarcarcinus yebraensis* n. sp. are housed at Museo de Ciencias Naturales de la Universidad de Zaragoza (Spain) under the acronym MPZ. Other specimens figured for comparison are kept in the A. Ossó collection, under the acronym AO.

Geological setting. The study area is located in the Basa anticline, within the so-called Jaca basin. This basin developed an E–W orientation in a time when the Pyrenees were subjected to a S–N compression. The basin infilling began during Lutetian times, and the general depositional sequence, named "Secuencia de Jaca" (Remacha & Picart, 1991), comprises several different formations (see also Puigdefábregas, 1975). The decapod-bearing layers of this study correspond to the Margas de Arguís Formation, also known as Margas de Pamplona-Arguís Formation (Puigdefábregas, 1975). In this area, it consists of a sequence, approximately 700 meters thick, of blue-grey marls interbedded with sandstone intervals (Figs. 2, 3).

The base is defined by large scale sandstone deposits of offshore shelf facies marked by several episodes of shallowing and deepening. These deposits culminated in a relatively long transgressive episode that filled the basin. The general marine conditions of the Margas de Arguís Fm. correspond to a tectonic transgressive-regressive cycle (Toledo, 1992). It is also worth noting that these layers were affected by deltaic contributions, with important terrigenous inputs, that become totally dominant in the upper levels (see Ossó *et al*., 2014).

The crab remains were recovered from the lower levels of the section. According to Canudo *et al.* (1991), the outer shelf sediments where such decapods occur are included the Bartonian age depositional sequence, SD5, as indicated by the presence of planktonic foraminifera of the Pomeroli Biozone. Biostratigraphic and magnetostratigraphic data (Pueyo *et al*., 2002) establish the lower and upper limits of the Margas de Pamplona-Arguís Formation from 40.32 to 37.17 Ma, which, according the ICS ICC 2015, correspond to a Bartonian-early Priabonian age. The level where *M. yebraensis* has appeared consists of blue-gray marls with small associated fauna composed only of scarce nummulites, ostreids, scaphopods, and small branching bryozoans; no other decapod remains occur. However, in the underlying levels, a concentration of *Portunus catalaunicus* Via, 1941 and *Harpactocarcinus punctulatus* A. Milne-Edwards, 1862 is observed. The overlying levels have also provided abundant specimens of *P. catalaunicus*; both species typically occur in the Bartonian of the western Tethys sea margin.

Fig. 3. General landscape of the outcrops near Yebra de Basa (Huesca Province, Aragón, Spain)
Fig. 3. Panorama general dels afloraments prop de Yebra de Basa (província d'Osca, Aragó, Espanya).

SYSTEMATIC PALAEONTOLOGY

Order DECAPODA Latreille, 1802
Infraorder BRACHYURA Latreille, 1802
Superfamily GONEPLACOIDEA MacLeay, 1838
Family MAGYARCARCINIDAE n. fam.
Genera included. *Magyarcarcinus* Schweitzer & Karasawa, 2004.

Diagnosis. Carapace small to medium in size, rounded in shape, slightly wider than long; dorsal surface convex in both senses, mainly anteriorly; surface almost smooth; dorsal regions weakly defined; front straight, bimarginate, weak medial notch; orbits broad; medial closed fissure in supraorbital margin; acute outer orbital spine. Anterolateral margins entire, convex, sharp edged; posterolateral margin convex; posterior margin slightly convex. Thoracic sternum relatively broad, ovate to subrectangular; sternites 1-2 forming a subtriangular plate much wider than long; sternite 3 broad; sternite 4 broad, swollen, prominent, laterals borders convex; sternite 4 wider than sternite 3; sternites 3 and 4 crossed by a deep median longitudinal groove; sternites 5 and 6 subtrapezoidal, narrower transversely, laterally expanded; sternite 7 subtrapezoidal, broader laterally, shorter than sternites 5-6; sternite 8 not visible; episternites 4-7 downward directed; episternite 7 covering anterior edge of coxa of P5. Sternal suture 1/2 distinct; suture 2/3 complete; suture 3/4 complete in male, almost complete in female; sutures 4/5 and 5/6 appears interrupted medially; suture 6/7 complete. Male abdomen broad, subtriangular, all somites free, narrowing anteriorly from somite 3 to telson and posteriorly to somite 1; male somite 3 the larger, filling space between coxa of P5. Third maxillipeds arcuate, convex axially; merus subquadrate; ischium subrectangular elongate, with median sulcus; exopod large. Chelipeds long, heterochelous; merus long, smooth carpus robust, smooth, inner angle with strong spine. Dactylus and pollex shorter than palm. Ischium, merus and basis not fused.

Discussion. *Magyarcarcinus loczyanus* (Lőrenthey, 1898) (=*Palaegrapsus loczyanus*) (Figs. 4 and 6H-J) from the Eocene of Hungary and Italy, the type species of the new family, was originally included within the genus *Palaeograpsus* Bittner, 1875. *Palaeograpsus* was erected to accommodate two species: *P. inflatus* (its type species) and *P. attenuatus* (=*Bittneria attenuatus* after Schweitzer & Karasawa, 2004, Panopeidae) and placed within Grapsidae MacLeay, 1838. Lőrenthey (*in* Lőrenthey & Beurlen, 1929: 257) expressed some doubts regarding the placement of *P. loczyanus* in Grapsidae, and suggested a possible relationship with *Carcinoplax* H. Milne-Edwards, 1852 (Goneplacidae), but kept it in Grapsidae. Via (1969: 320) pointed out the differences between *P. loczyanus* and *P. inflatus* (the type species). Subsequent authors including Beschin *et al.* (1994), Beschin *et al.* (1996) and De Angeli & Beschin (2001) retained this placement. Schweitzer & Karasawa (2004: 76-77, figs. 1, 3-5) revised the genus *Palaeograpsus* and their associated species, erecting the genus *Magyarcarcinus* for *P. loczyanus*, and moving it from Grapsidae to Goneplacidae MacLeay, 1838, based mainly on dorsal characters. This new systematic placement has been followed by subsequent authors (e.g., De Angeli & Garassino, 2006; Busulini & Beschin, 2009; De Angeli & Caporiondo, 2009; Beschin *et al.*, 2010; Busulini *et al.*, 2012).

The well preserved remains of *Magyarcarcinus yebraensis* n. sp., recovered in the south-central Pyrenees, permit us to enlarge the knowledge of the genus *Magyarcarcinus*, especially regarding the sterno-abdominal features not present, or only partially preserved, in the holotype of *M. loczyanus*.

The inclusion of the genus in the superfamily Goneplacoidea seems well supported by many features such as the rounded and smooth carapace with not clearly defined regions; the straight front and broad fronto-orbital margin; the sternite 7 expanded and sternite 8 not visible; the sternal sutures 2/3 complete, 4/5 and 5/6 interrupted medially, and 6/7 appearing complete; all the male abdominal somites free, somites 1-2 slightly narrower than somite 3, and with somite 3 covering the space between the coxa of P5. This array of characters seems to match perfectly with the diagnosis of Goneplacoidea (Karasawa & Schweitzer, 2006; Ng & Manuel-Santos, 2007; Castro *et al.*, 2010).

Nevertheless, the unique combination of characters that *Magyarcarcinus* exhibits such as: a smooth and rounded carapace, the frontal and fronto-orbital ratios, a sternum relatively broad and not clearly ovate, the sternite 4 broad and vaulted, and suture 3/4 complete, among others, is not seen in any of the current Goneplacoidea families. Nevertheless, several of these characters are shared by many Goneplacoidea members. For instance, the deep and narrow median longitudinal groove through sternites 3/4 reaching the suture 2/3, is present in Sotoplacidae Castro, Guinot & Ng, 2010 (see Castro *et al.*, 2010). Also, the distinct sternal suture 1/2 is present in Acidopsidae Števčić, 2005 (see Castro *et al.*, 2010); the well-marked and complete suture 3/4 is present in several members of Progeryonidae Števčić, 2005, or Conleyidae Števčić, 2005 (see Castro & Ng, 2008; Castro *et al.*, 2010); and the markedly triangular abdomen narrowing gradually from sternite 3 to the telson is also seen in Conleyidae and in members of Goneplacidae such as *Thyraplax* Castro, 2007, *Neogoneplax* Castro, 2007 or *Guinoplax* Castro & Ng, 2010, among others. Despite this, the particular combination of characters seen in *Magyarcarcinus* suggests the need to place this genus in his own family Magyarcarcinidae within Goneplacoidea.

We examine the characteristics of *Magyarcarcinus,* the sole member of the new family Magyarcarcinidae, with an emphasis on the ventral features in comparison to extant and extinct Goneplacoidea families (including two *incertae sedis* genera) and considering recent works with refined diagnosis.

Members of Progeryonidae share significant similarities with *Magyarcarcinus* like a well-marked male suture 3/4 (Castro & Ng, 2008), defined as “deep, laterally only” in Castro *et al.* (2010), and a broad triangular male abdomen with distinct sutures, being somite 3 the larger and filling the space between the coxa of P5. However, they differ from Magyarcarcinidae in having a transversally ovate carapace with at least one anterolateral tooth, a shorter fronto-orbital margin, smaller orbits with an entire supra-

orbital margin, a broader thoracic sternum, the 3rd sternite with a shallower longitudinal groove, without reaching the suture 2/3, a narrower sternite 7, and abdominal somites 3 and 4 fused or with sutures visible whereas they are completely free in Magyarcarcinidae (Crosnier, 1976; Ng & Manuel-Santos, 2007; Ng & Guinot, 1999; Ng *et al*., 2008; Guinot & Richer de Forges, 1981; Castro & Ng, 2008; Castro *et al*., 2010).

Members of family Mathildellidae Karasawa & Kato, 2003 differ from Magyarcarcinidae because, even exhibiting a smooth surface of the carapace, the regions are still distinguishable. In addition, the fronto-orbital width is narrower, despite of having a bimarginate front as in Magyarcarcinidae; the anterolateral margins are usually toothed, being entire in Magyarcarcinidae; the thoracic sternum is more ovate; the sterno-abdominal cavity reaches only the median part of sternite 4 while in Magyarcarcinidae it reaches the suture 2/3; the suture 3/4 is not well marked as in Magyarcarcinidae; the somite 3 do not fills the space between the coxa of P5 as in Magyarcarcinidae; the male abdomen is also more rectangular elongate and with sutures distinct, or somites 3 and 4 fused, whereas it is triangular and somites are completely free in the new family (Guinot & Richer de Forges, 1981; Karasawa & Kato, 2003a; Ng & Manuel-Santos, 2007; Ng *et al*., 2008; Castro *et al*., 2010).

Conleyidae Števčić, 2005 shares with the new family the poorly distinct dorsal carapace regions; the complete sternal suture 3/4, the longitudinal median groove present in sternite 4, an episternite 7 expanded laterally forming plate which covers the anterior edge of P5 coxa; a broad sternite 7, and the male abdomen with all somites free. Nevertheless, they differ from Magyarcarcinidae in having narrower fronto-orbital margin; a toothed anterolateral margin; a broader thoracic sternum; a ridge in suture 1/2, deeper suture 4/5, and absence of longitudinal median groove in sternite 3. None of these features exhibited by Conleyidae are present in Magyarcarcinidae (Ng & Ng, 2003; Ng & Manuel-Santos, 2007; Ng *et al*., 2008; Castro *et al*., 2010).

Members of Chasmocarcinidae Serène, 1964, share only some features with Magyarcarcinidae such as a straight front, or entire anterolateral margins. However, many characteristics differentiate them from *Magyarcarcinus*: a carapace rectangular or trapezoidal; a broader sternum; a male abdomen not entirely filling space between coxae of P5; a large portion of sternite 8 visible in ventral view with a characteristic coxo-sternal supplementary plate; and the fused male abdominal somites 3-5 (Karasawa & Schweitzer, 2006; Ng *et al*, 2008; Castro *et al*., 2010).

Beyond some shared characters as entire and sharp edged anterolateral margin or sternites 1-2 fused, forming a triangular plate, Scalopidiidae Števčić, 2005, clearly

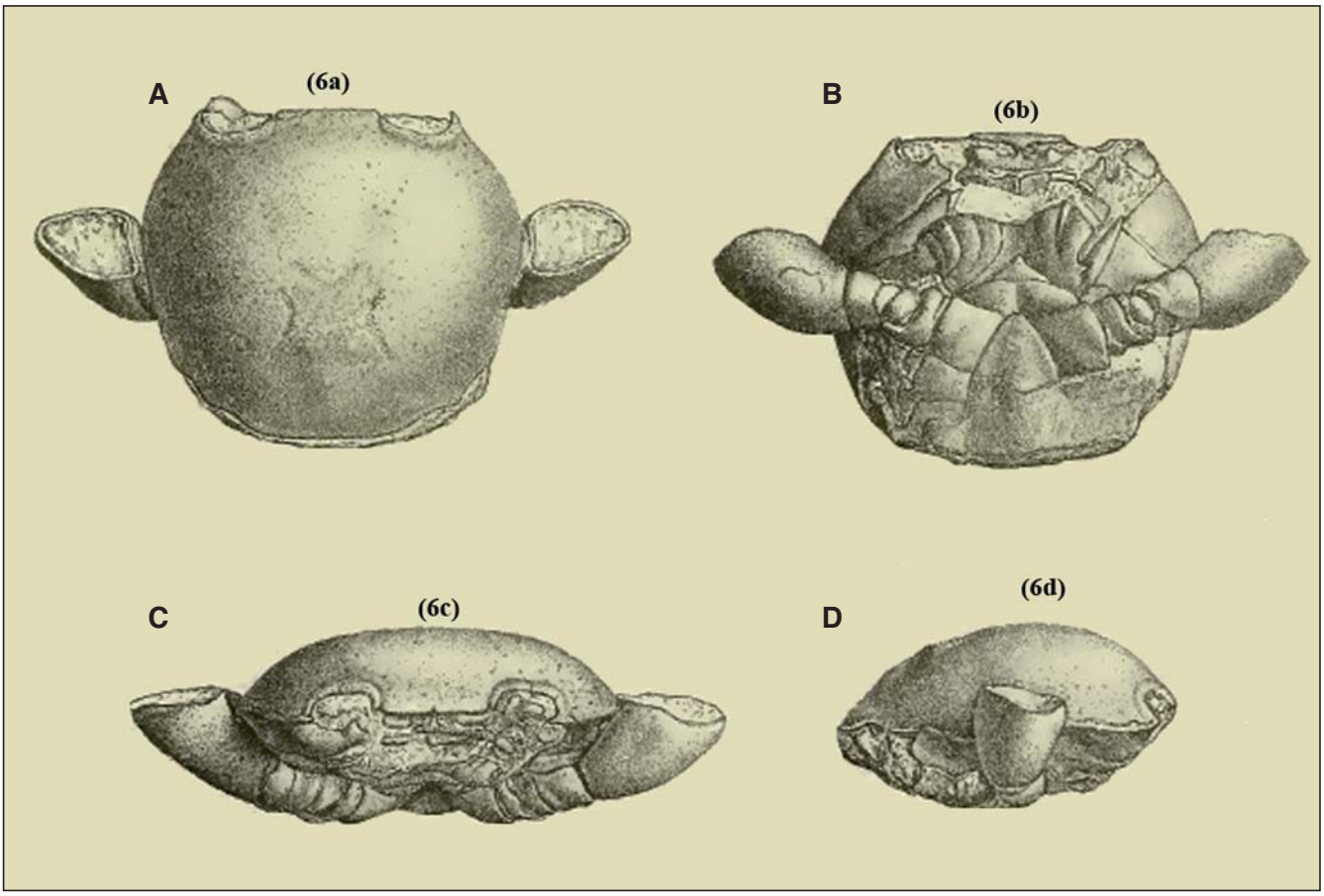


Fig. 4. A-D, *Magyarcarcinus loczyanus* (Lőrenthey, 1898). Holotype, digital image from the original publication, plate 4, figs. 6a-d: A, dorsal view; B, ventral view; C, frontal view; D, right lateral view.
Fig. 4. A-D, *Magyarcarcinus loczyanus* (Lőrenthey, 1898). Holotip, imatge digital de la publicació original, làmina 4, figs. 6a-d: A, vista dorsal; B, vista ventral; C, vista frontal; D, vista lateral dreta.

differs from Magyarcarcinidae in the very smaller orbits, a broader thoracic sternum in males, a longitudinal median groove not present in sternites 3 and 4, a narrower T-shaped male abdomen, or abdominal somite 2 much shorter than the somites 1 and 3 (Števčić, 2005; Ng & Castro, 2008; Ng *et al.*, 2008 and Ng & Castro, 2013).

Sotoplacidae Castro, Guinot & Ng, 2010, share only a few characters with Magyarcarcinidae such as: a smooth carapace surface, a longitudinal median groove trough sternites 3 and 4, or all male abdominal somites free. Sotoplacidae, clearly differ from the new family in having broader orbits, spiny anterolateral margins, a wider thoracic sternum, a deeper sterno-abdominal cavity; the suture between sternites 3/4 only visible laterally, a large portion of sternite 8 exposed and a notably narrower male abdomen (Števčić 2005; Ng & Castro, 2008; Ng *et al.*, 2008; Castro *et al.*, 2010).

Members of Acidopsidae Števčić, 2005 exhibit a few characters in common with Magyarcarcinidae such as: relatively broad orbits, relatively narrow sternum, and several species of this family have a deep and narrow longitudinal groove through sternites 3 and 4 as in Magyarcarcinidae. But they can be easily differentiated from the new family in having characters such as different general carapace shape, the suture 3/4 is only visible laterally, a small or large portion of male sternite 8 not covered by the abdomen, the male abdomen narrower with the abdominal somites 3-5 fused and very different width and shape of somites 1-2-3, which preclude any relationship with Magyarcarcinidae (Ng, 2002; Ng *et al.*, 2008; Castro *et al.*, 2010; Ng & Rahayu, 2014).

Litocheiridae Števčić, 2005 exhibit a smooth dorsal surface and similar fronto-orbital margin, a broad male abdomen with all somites free, narrowing gradually from sternite 3 to telson, and somite 3 only slightly broader than sternites 1-2, characters shared with the new family. However, they clearly differ from Magyarcarcinidae in having a subquadrate carapace, the sternal suture 3/4 only visible laterally with longitudinal median groove absent and a small portion of sternite 8 exposed when male abdomen is closed, among others differences (Türkay, 1975; Castro *et al.*, 2010; Ng *et al.*, 2008).

Euryplacidae Stimpson, 1871 present only some dorsal similarities with Magyarcarcinidae, such as a dorsal surface smooth with regions not clearly defined. Nevertheless, differences between them are strong, for instance: a not so rounded carapace, the anterolateral margins usually toothed, the suture 3/4 is not well-marked or interrupted, the male sterno-abdominal cavity reaches only to anterior margin of sternite 4 whereas in Magyarcarcinidae it reaches the posterior margin of sternite 3, a T-shaped male abdomen remarkably narrow with somites 4-6 narrowing steeply from somite 3 to telson, and very long somite 6. The aforementioned differences discard a close relationship with Magyarcarcinidae (Castro & Ng, 2010; Ng *et al.*, 2008; Castro *et al.*, 2010).

Vultocinidae Ng & Manuel-Santos, 2007 present a longitudinal median groove through sternites 3 and 4 that, although shallower, is also visible in Magyarcarcinidae. But many other features of Vultocinidae, as the sculpted and subquadrate carapace with regions defined by swollen ridges and deep grooves, the ovate thoracic sternum, the broad sternite 4 with straight grooves parallel to the lateral margin, a narrower sternite 7, and a not triangular male abdomen, discard the relationship between the two families (see Ng & Manuel-Santos, 2007; Ng *et al.*, 2008; Ng & Richer de Forges, 2009; Castro *et al.*, 2010; Ossó *et al.*, 2014).

Members of the fossil family Carinocarcinoididae Karasawa & Kato, 2003 also share several characters with Magyarcarcinidae, such as: a dorsal surface of carapace smooth, the front nearly straight and/or the supraorbital margin without well-marked fissures. However they display features clearly different from those of Magyarcarcinidae, which rule out the relationship between those two families, such as the relatively distinct dorsal regions, the anterolateral margins toothed, a broader thoracic sternum, the sternites 1-2 fused as equilateral triangle, more flattened sternite 4, absence of longitudinal median groove in sternite 3 which is present in Magyarcarcinidae, the suture 3/4 is only distinct by a shallow depression; as well, the male abdomen is narrower and with the abdominal somites 3-5 fused, and a portion of sternite 8 visible ventrally, which is not the case in Magyarcarcinidae (Karasawa & Fudouji, 2000; Karasawa & Kato, 2003a; Karasawa & Schweitzer, 2006).

The fossil family Martinocarcinidae Schweitzer, Feldmann & Bonadío, 2009, only shares with Magyarcarcinidae the longitudinal median groove through sternites 3 and 4, suture 3/4 distinct or all male somites free. But clearly differs in having carapace with well-defined regions; smaller orbits; spiny margins; ovate thoracic sternum; flattened sternite 4 and narrower male abdomen (see Schweitzer *et al.*, 2009).

Agostella Ossó, 2011 (Goneplacoidea, *incertae sedis*) from the Eocene of Spain, shares several features with *Magyarcarcinus* such as a convex anterior half of thoracic sternum, a swollen sternite 4 with convex lateral margins, and all male somites free. Nevertheless, it differs from *Magyarcarcinus* in its dorsal regions of carapace distinct and swollen, the anterolateral margins with three spines, the relatively broader thoracic sternum, the shallower longitudinal median groove through sternites 3 and 4, the suture 3/4 defined by a groove but only visible laterally, and a male abdomen not triangular (Ossó, 2011).

Tehuacana Stenzel, 1944 (Goneplacoidea, *incertae sedis*) from the Palaeocene of Texas and Lower Eocene of Mexico, clearly differs from Magyarcarcinidae in its carapace with regions well-defined by strong swellings, a narrower fronto-orbital margin, the lobed anterolateral margins, a narrower ovate thoracic abdomen, a shallower longitudinal median groove trough sternites 3 and 4, a suture 3/4 only visible laterally, and the male abdomen not remarkably subtriangular as in *Magyarcarcinus* (Stenzel, 1944, Armstrong *et al.*, 2009; Ossó, 2011).

Magyarcarcinus Schweitzer & Karasawa, 2004

Type species. *Palaeograpsus loczyanus* Lőrenthey, 1898.

Included species. Magyarcarcinus loczyanus (Lőrenthey, 1898) and *Magyarcarcinus yebraensis* n. sp.

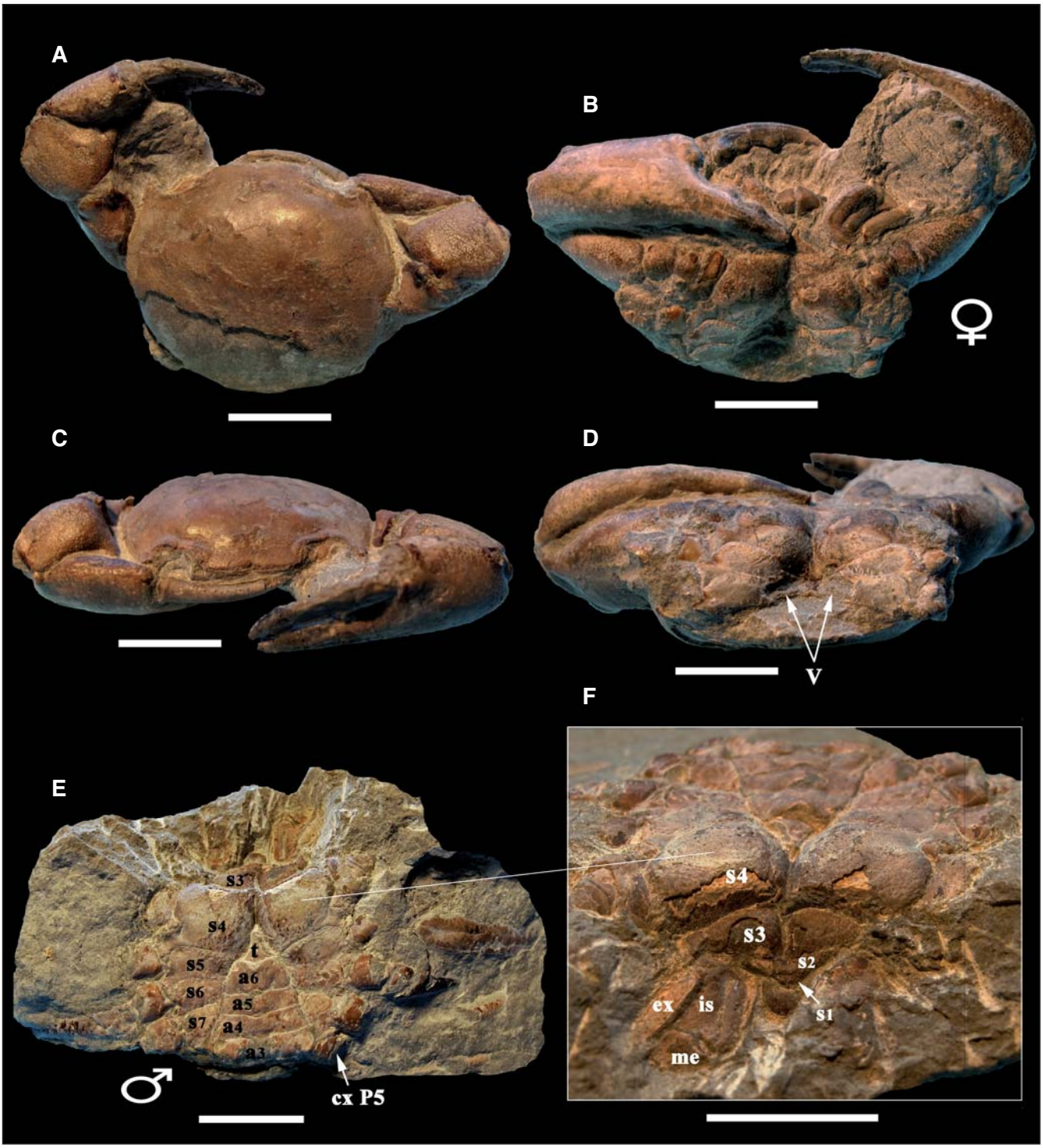


Fig. 5. A-F, *Magyarcarcinus yebraensis* n. sp. from the Priabonian (late Eocene) of Yebra de Basa (Huesca, Aragón, N Spain). A-D, holotype MPZ 2016/72, female: A, dorsal view; B, ventral view; C, frontal view; D, posterior view, arrows showing the vulvae. E-F, paratype MPZ 2016/73, male: E, ventral view; F, close up of the anterior part of thoracic sternum and maxillipeds. Abbreviations: is = ischium of third maxilliped; me = merus of third maxilliped; ex = exognath of third maxilliped; s = thoracic sternites; a = abdominal somites; t = telson; v = vulvae. Scale bar = 1 cm.
Fig. 5. A-F, *Magyarcarcinus yebraensis* n. sp. del Priabonià (Eocè superior) de Yebra de Basa (Osca, Aragó, N Espanya). A-D, holotip MPZ 2016/72, femella: A, vista dorsal; B, vista ventral; C, vista frontal; D, vista posterior, les fletxes assenyalen les vulves. E-F, paratip MPZ 2016/73, mascle: E, vista ventral; F, detall de la part anterior de plastró i maxil·lípede. Abreviacions: is = isqui del tercer maxil·lípede; me = meros del tercer maxil·lípede; ex = exopodi del tercer maxil·lípede; s = esternites toràciques; a = somites abdominals; t = tèlson; v = vulves. Escala = 1 cm.

Emended diagnosis. Carapace small to medium sized, rounded in shape, slightly wider than long, moderately convex in both directions, dorsal surface finely granulated, dorsal regions weakly discernible; front straight, bimarginate, weak medial notch; orbits broad, slightly oblique, supraorbital margin with medial closed fissure; acute outer orbital spine; anterolateral margin entire, convex, sharp edged; posterolateral margin convex; posterior margin slightly convex. Thoracic sternum relatively broad, ovate to subrectangular; sternites 1-2 forming a plate subtriangular much wider than long; sternite 3 broad; sternite 4 broader than sternite 3, wider than long, vaulted,

prominent, lateral borders convex; sternites 3 and 4 crossed by a deep median longitudinal groove; sternites 5 and 6 subtrapezoidal, transversely narrow, laterally expanded; sternite 7 subtrapezoidal, broader laterally, shorter than sternites 5-6; sternite 8 not visible; episternites 4-7 downward directed; episternite 7 expanded laterally forming plate covering anterior edge of coxa of P5. Suture 1/2 distinct as shallow groove, suture 2/3 complete, suture 3/4 complete in male, almost complete in female; sutures 4/5 and 5/6 interrupted medially, suture 6/7 appears complete; portion of sternite 8 not visible. Male abdomen broadly triangular, narrowing gradually from somite 3 to telson; all somites free; male somite 3 fairly expanded laterally, filling space between coxae P5; male somite 2 almost as broad transversely as somite 3, somite 1 somewhat narrower. Third maxilliped arcuate, convex axially; merus subquadrate; ischium subrectangular elongate, with median sulcus; exopod large. Chelipeds long, heterochelous; merus long, smooth; carpus robust, smooth, inner angle with strong tooth. Dactylus and pollex shorter than palm. Ischium, merus and basis not fused.

Discussion. Lőrenthey (*in* Lőrenthey & Beurlen, 1929: 257) suggested a possible relationship among *Magyarcarcinus loczyanus* (Lőrenthey, 1898) and the fossil and extant genus *Carcinoplax* Milne-Edwards, 1852 (Goneplacidae), most probably based on its rounded carapace with poorly defined regions, the anterolateral margins almost entire, and the straight front with a weak medial notch. Furthermore, characters as the broad thoracic sternite 7 with a posterior prolongation, all male abdominal somites free and a large vulvae in females, are shared by both genera. However, very clear differences exist: the orbits are broader in *Magyarcarcinus* and the anterolateral margins are usually armed in *Carcinoplax* while they are entire in Magyarcarcinidae; the thoracic sternum is narrower in *Magyarcarcinus*, with deep a median longitudinal groove across sternites 3 and 4, which is absent in *Carcinoplax*; the suture 3/4 is complete in *Magyarcarcinus* but interrupted in *Carcinoplax*; the male abdomen of *Magyarcarcinus* presents the lateral margins straight, covering the space between coxa P5, and the sternite 8 is not visible, whereas *Carcinoplax* presents a male abdomen with the lateral margins concave and a small portion of sternite 8 is visible (Guinot, 1969, 1989; Ng & Manuel-Santos, 2007; Castro, 2007; Ng *et al.*, 2008; Castro *et al.*, 2010).

Amydrocarcinus Schweitzer, Feldmann, Gonzales-Barba & Vega, 2002 (Goneplacidae) from the Eocene of Baja California (Mexico) presents a similar carapace aspect, moderately vaulted in both senses, smooth, with the regions poorly defined; a front straight and the anterolateral margins entire as in *Magyarcarcinus*; also presents a male abdomen with all the abdominal somites free and filling space between coxa P5. But it clearly differs from *Magyarcarcinus* by its entire supra-orbital margin, whereas in Magryarcarcinidae a close supraorbital fissure is present. Also differs in having a broader thoracic sternum, and because the medial longitudinal groove across sternites 3 and 4, present in Magyarcarcinus is absent in *Amydrocarcinus*; the male abdomen is more rectangular and with concave lateral margins of abdominal somites, instead of the straight margins of *Magyarcarcinus* (Schweitzer *et al.*, 2002: 17-18, fig. 19; Schweitzer & Karasawa, 2004: 73-76, fig.1, 1-2).

The genera *Gollincarcinus* Beschin & De Angeli, 2004 and *Lessinioplax* Beschin & De Angeli, 2004 (both Litocheiridae), from the Middle Eocene of Vicenza area (N Italy), also present a smooth carapace with entire anterolateral margins, but they are more elongate and not as much subcircular as in *Magyarcarcinus* and their anterolateral margins are usually rimmed instead of smooth as in the latter genus; their front is larger and the orbits, with an entire supra-orbital margin, are placed more laterally (Beschin & De Angeli, 2004).

Magyarcarcinus yebraensis n. sp.
Fig. 5.A-F; Fig. 6.A-G

Etymology. From Yebra de Basa, the closest village to the type locality.

Stratigraphic horizon. Margas de Arguís Formation, Bartonian, Middle Eocene.

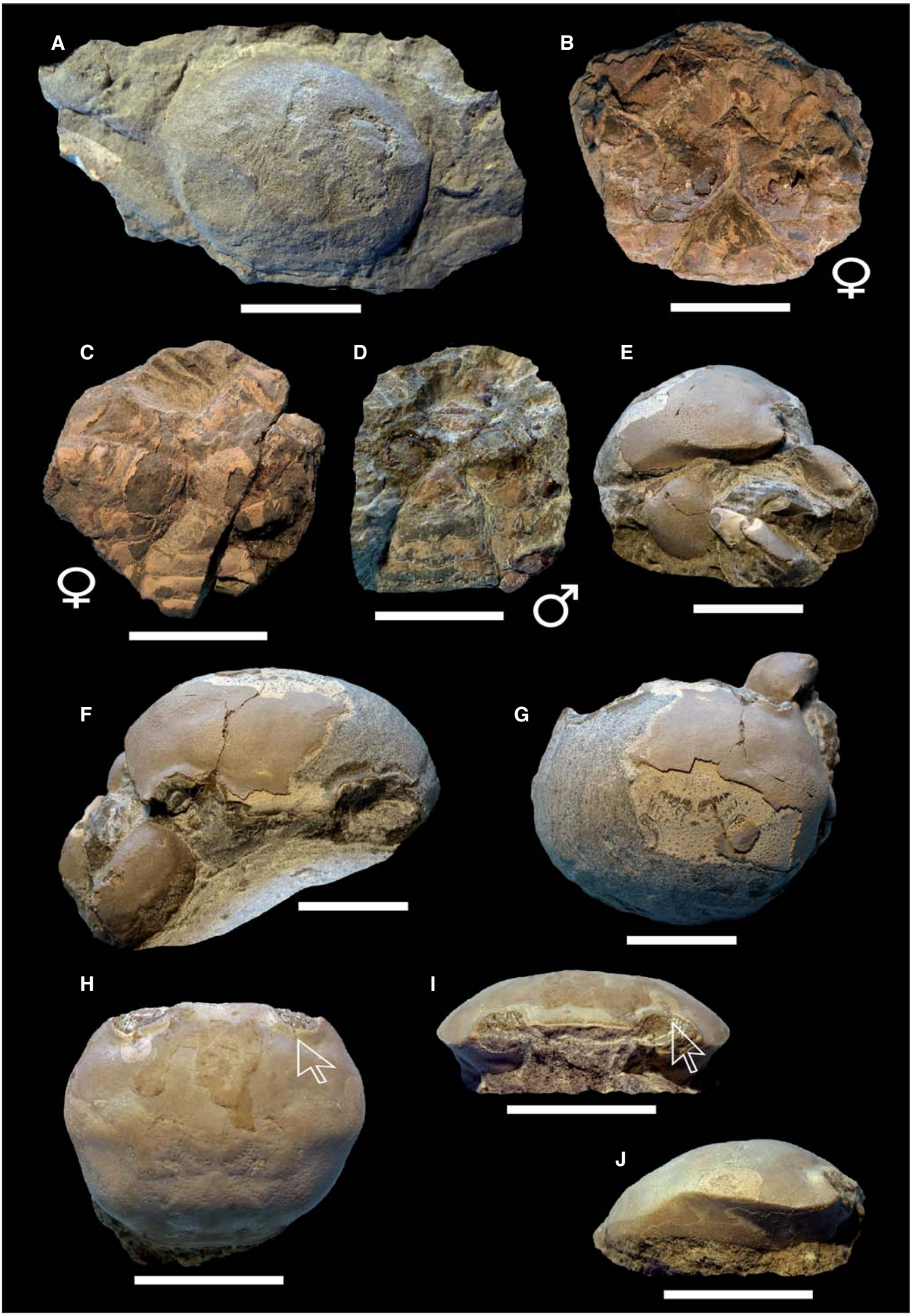
Type locality. Yebra de Basa, (Serrablo county, Huesca province, Aragón autonomous community, northern Spain).

Material and measurements (in mm). Holotype, the specimen MPZ 2016/72 (length = 23; width = 27; fow = 22). Paratypes MPZ 2016/73, MPZ 2016/74, MPZ 2016/75, MPZ 2016/76 and MPZ 2016/77 (length = 24; width = 28; fow = 22). Rest of paratypes, fragmentary.

Diagnosis. As for the genus.

Description. Carapace small to medium in size, rounded in shape, slightly wider than long, moderately convex in both senses, widest about two thirds from the posterior margin; dorsal surface apparently smooth but finely granulated; dorsal regions weakly discernible, defined by very shallow grooves. Front straight, bilobed

Fig. 6. A-G, *Magyarcarcinus yebraensis* n. sp. from the Priabonian of Yebra de Basa (Huesca, Aragón, N Spain). Paratype MPZ 2016/74, male: A, dorsal view; D, ventral view. Paratype MPZ 2016/75, female: B, ventral view. Paratype MPZ 2016/76, female: C, ventral view. Paratype MPZ 2016/77: E, lateral view; F, frontal view; G, dorsal view. H-J, AO C-220/1 *M. loczyanus* (Lőrenthey, 1898) from the Middle Eocene of Chiampo valley (Vicenza region, N Italy): H, dorsal view; I, frontal view; J, lateral view. White arrow indicates the supraorbital fissure. Scale bar = 1 cm.
Fig. 6. A-G, *Magyarcarcinus yebraensis* n. sp. del Priabonià de Yebra de Basa (Osca, Aragó, N d'Espanya). Paratip MPZ 2016/74, mascle: A, vista dorsal; D, vista ventral. Paratip MPZ 2016/75, femella: B, vista ventral. Paratip MPZ 2016/76, femella: C, vista ventral. Paratip MPZ 2016/77: E, vista lateral; F, vista frontal; G, vista dorsal. H-J, AO C-220/1 *M. loczyanus* (Lőrenthey, 1898) de l'Eocè mitjà de la vall de Chiampo (regió de Vicenza, N d'Itàlia): H, vista dorsal; I, vista frontal; J, vista lateral. La fletxa blanca assenyala la fissura supra-orbital. Escala = 1 cm.


A
B
♀
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D
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H
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J

with weak medial notch, bimarginate, about one third of maximum width. Orbits broad, rounded, slightly oblique, supraorbital margin with closed medial fissure; acute outer orbital spine; eyestalks relatively short. Fronto-orbital margin about 80% of maximum width. Lateral margins unarmed, joining at the point of maximum width of the carapace; anterolateral margins entire, convex, sharp edged; posterolateral margins convex, posteriorly convergent; posterior margin slightly convex; slight re-entrant between posterolateral and posterior margin. Cervical groove fairly discernible medially by V-shapped scar; branchiocardiac grooves defined by scars.

Thoracic sternum relatively broad, ovate to subrectangular, anterior half swollen, posterior half flattened; sternoabdominal cavity reaching to median part of sternite 4; sternites 1-2 forming a subtriangular plate much wider than long, lateral margins granulated; sternite 3 broadly inverted subtriangular divided by a median longitudinal groove, narrower in males; sternite 4 broader than sternite 3, wider than long, vaulted and prominent, laterals borders convex with strong posterior indentation; sternites 3 and 4 crossed by a deep and narrow median longitudinal groove, broader and shallower in females; sternites 5 and 6 subtrapezoidal, transversely narrow, laterally expanded; sternite 7 subtrapezoidal, broader laterally, shorter than sternites 5-6; sternite 8 not visible; episternites 4-7 downward directed; episternite 7 expanded laterally forming plate covering anterior edge of coxa of P5. Suture 1/2 distinct as shallow groove; suture 2/3 complete, suture 3/4 complete in male, V-sapped, shallow and medially interrupted in female; sutures 4/5 and 5/6 interrupted medially; suture 6/7 appears complete. Female press button of abdominal locking mechanism on anterior edge of sternite 5, close to suture 4/5. Vulvae moderately large on sternite 6 of females. Male abdomen broad, subtriangular, slightly folded medially, narrowing gradually and uniformly from somite 3 to telson; all abdominal somites free; male somite 2 almost as broad transversely as somite 3, somite 1 something narrower than somite 2; male somite 3 the largest, fairly expanded laterally but filling space between coxae of P5; somites 4-5 subtrapezoidal, transversally narrow, lateral margins straight, equal length as somite 3; somite 6 subtrapezoidal, length twice of somite 5; third maxilliped axially arcuate, inner margins convex, outer margins concave; merus subquadrate; ischium subrectangular elongate, with median sulcus; exopod large.

Chelipeds long, heterochelous; merus long, smooth, strong tooth at inner distal angle; carpus robust, smooth, inner angle with strong tooth. Dactylus and pollex shorter than palm; dactylus with proximal tooth molariform and two blunt teeth, slightly eccentric; pollex with proximal tooth submolariform and two blunt distal teeth. Ischium, merus and basis not fused.

Discussion. Although differences among *Magyarcarcinus yebraensis* n. sp. and *M. loczyanus* are not remarkable, in our opinion they are sufficient to establish a new species. For instance, the orbits in *M. yebraensis* n. sp. are broad and slightly oblique, whereas in *M. loczyanus* they are smaller and forward directed, and the closed supraorbital fissure is more easily discernible in *M. yebraensis* than in *M. loczyanus*. Also, the frontal margin in *M. yebraensis* n. sp. is clearly bilobed with a well-marked medial notch, while it is straighter in *M. loczyanus* and the medial notch is not so marked. In addition, the frontal/width and fronto-orbital/width ratios are clearly different between both species. *Magyarcarcinus yebraensis* n. sp. has a frontal/width ratio about 0.32 and a fronto-orbital/width ratio about 0.77, whereas in *M. loczyanus*, those ratios are 0.25 and 0.65, respectively. Regarding sternal features, the difference in width of the basis of sternite 2 is evident as well and, while in *M. yebraensis* n. sp. the ratio of the basis of the triangle formed by sternites 1-2 with the height is about triple, in *M. loczyanus* this ratio is about twice (check Lőrenthey, 1898, plate IV, fig. 6a-d; Schweitzer & Karasawa, 2004, fig. 1; this work, Figs. 4 and 6, H-J).

FINAL REMARKS

The unique combination of significant characters displayed by *Magyarcarcinus*, justifies the erection of a new family within the superfamily Goneplacoidea, to accommodate the new genus. Probably, the most outstanding/relevant features distinguishing Magyarcarcinidae new family from other goneplacoids are the relatively broad male thoracic sternum, the distinct sternal suture 1/2, the sternal suture 3/4 complete, and the longitudinal median groove crossing sternites 3 and 4, which together suggest a clear basal condition of Magyarcarcinidae within Goneplacoidea, thus contributing to a better understanding of this superfamily.

The great relationship between the decapod faunas of the Late Eocene levels of the south-central Pyrenees of Spain and the coeval ones from Italy and Hungary, also confirmed by the presence of *Magyarcarcinus* in both areas, is noteworthy. The hypothesis proposed by Via (1991: 185, fig. 3) suggested how the Middle-Late Eocene Tethyan carcinofaunas from Hungary and Italy could have reached the southern part of the British Islands via the southern margin of the Iberian Peninsula, or through the northern way represented by the lasting South-Pyrenean Basin. Current knowledge confirms that the latter path, this is, a migration via the northern margin of the Iberian Peninsula, is the most parsimonious alternative (Domínguez & Ossó, 2016).

The Tethyan Eocene decapod fauna described by Quayle & Collins (1981) from the Hampshire basin (Great Britain) formed by *Montezumella* sp. (Montezumellidae), *Chasmocarcinus* sp. (Chasmocarcinidae), *Ethusa*? sp. (Ethusidae), *Micromaia* sp. (Majiidae), *Calappilia* sp. (Calappidae), Parthenopidae or Portunidae, among other taxa, is also well represented in the uppermost Eocene levels of the Margas de Arguís Formation at the Yebra de Basa outcrops (forthcoming works). Furthermore, common Eocene Tethyan species from Italy or Hungary as *Eopalicus* sp. (Palicidae), *Eopilumnus* sp. (Pilumnidae), *Retrocypoda almelai* Via, 1959 (Retroplumidae) and *Daragrapsus trispinosus* Müller & Collins, 1991 (Grapsidae),

among others, are also present in the uppermost levels of the Margas de Arguís Formation. These two evidences strongly suggest that the migration path followed by these faunas, from the Tethys sea to reach the North Atlantic ocean, was, at least, through the South-Pyrenean Basin and the Bay of Biscay, when the second Eocene relative sea level rise during the Bartonian, connected the open North Atlantic waters with the westernmost Tethyan ones (Domínguez & Ossó, 2016).

ACKNOWLEDGEMENTS

We gratefully thank Jesús García Valero (Zaragoza, Spain) who kindly donated a specimen that has become paratype MPZ 2016/77. We are grateful to Javier Luque (Alberta University, Canada / Smithsonian Tropical Research Institute, Panama) and Sylvain Charbonnier (Muséum National d'Histoire Naturelle, Paris, France) whose accurate and constructive reviews helped to improve the present work.

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