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New data on *Eocalcinus eocenicus* Vía Boada, 1959 (Decapoda: Anomura: Calcinidae), from the Middle Eocene of Catalonia

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Abstract

The detailed preparation of remains of the paguroid *Eocalcinus eocenicus* Vía Boada, 1959, from the middle Eocene of Central Catalonia, has revealed for the first time the, hitherto unknown, right chela of this hermit crab. A diagnosis is provided herein. Based on the new data, *Eocalcinus eocenicus* is herein transferred to the family Calcinidae.

Key words: Crustacea, systematic, Paguroidea, Paleogene

Introduction

Vía Boada (1959), described and erected *Eocalcinus eocenicus*, although remains of chelipeds of that paguroid were already known and reported previously by him, for instance as Dromiacea (Vía, 1932, p. 143 [13]) and as Canceridae (Vía, 1941, p. 120 [66], pl. 11, figs. 71–73). *Eocalcinus eocenicus* is relatively common in the marly levels of the middle Eocene of Catalonia (NE of Iberian Peninsula), being also recognized and reported in coeval levels of the Vicentino Region (NE of Italy) and Alicante (SE of Spain) (e.g. Vía Boada, 1991; De Angeli and Caporondo, 2017). In his work, Vía Boada (1959, p. 33) reported at least sixty specimens from diverse localities of the middle Eocene of central and northeastern Catalonia. Later he indicated that remains of more than five hundred specimens were recognized (Vía Boada, 1991: 182). However, all of them belonged to the left chela, and very few of them are preserved with the carpus and/or merus. Careful and detailed preparation work on a specimen from the collections of MGB, embedded in

marly sediment, allows recovery of remains of the right cheliped such as the right propodus, which is described herein for the first time.

The studied specimen was recovered from marly layers cropping out in the surroundings of the village of Folgueroles (Osona, Catalonia). These layers belong to the so-called Coll de Malla Marls Formation (Clavell et al., 1970) commonly considered Lutetian in age (Serra-Kiel et al., 2003), albeit subsequent works indicate a possibly Bartonian age for that formation (e.g. Cascella et al., 2009, fig. 2). The rich decapod crustacean assemblage yielded by the Coll de Malla Marls Formation, has been compiled by several authors, for instance Vía (1941), Vía (1988), Solé and Vía (1989) and Artal et al. (2014).

Institutional abbreviations

MGB: Museu de Geologia de Barcelona-Museu de Ciències Naturals de Barcelona (Catalonia).

Systematics

Order Decapoda Latreille, 1802
 Infraorder Anomura MacLeay, 1838
 Superfamily Paguroidea Latreille, 1802
 Family Calcinidae Fraaije, Van Bakel, and Jagt, 2017

Genus *Eocalcinus* Vía Boada, 1959

Type species: *Eocalcinus eocenicus* Vía Boada, 1959, by original designation.

Included species: *Eocalcinus eocenicus* Vía Boada, 1959; *E. cavus* Beschin, Busulini, De Angeli, and Tessier, 2002; *E. albus* Beschin, Busulini, and Tessier, 2010.

***Eocalcinus eocenicus* Vía Boada, 1959**

(Fig. 1)

Eocalcinus eocenicus Vía Boada, 1959, p. 32, text-fig. 5; Glaessner, 1969, p. R479, fig. 288-2; Vía, 1969, pp. 93–97, pl. 3, figs. 1–3, text-fig. 9; Vía, 1988, p. 350, fig. 341E; Gómez-Alba, 1989, p. 31–32, pl. 3, fig 4; Solé and Vía, 1989, p. 29; Vía Boada, 1991, p. 182; Beschin et al., 1994, p. 164, pl. 1, fig. 2; De Angeli and Beschin, 2001, p. 13; Beschin et al., 2005, p. 13; De Angeli and Garassino, 2006, p. 26; Beschin et al., 2012, p. 21, pl. 4, fig. 4; De Angeli, 2016, p. 21, pl. 1, figs. 1A–C, 2A–B; De Angeli and Caporiondo, 2017, p. 13, text-fig. 4, pl. 1, figs. 1A–C, 2A–B; Ferratges, 2017, p. 38, text-fig. 18, pl. 6, fig. C.

Material examined: MGB 90114 One complete left cheliped preserving complete carpus and partial merus; complete right chela and remains of merus attached to the inner side of left chela; merus of an indeterminate ambulatory leg attached to the outer side of left chela.

Measurements (in mm): Left propodus: length = 47.5; height = 30; thickness = 18.0; Right propodus: length = 19.5; height = 10.5; thickness = 4.5.

Diagnosis: Left cheliped — from Vía Boada, 1959 — highly developed, planoconvex, and semicircular outline. Cuticle thick. Surface covered by tight blunt granules somewhat squamous. Propodus strong, elongate, outer side strongly vaulted, covered by homogenous fine granulation at the lower half and posterior third, heterogeneous at the upper half with scattered strong granules. Upper margin short, blunt, slightly arched, two longitudinal rows of tight gran-

ules. Lower margin sharp, long, strongly sinuous on the posterior part. Inner side weakly convex, almost flat, granulated marginally, smoother centrally, shortened by the carpo-propodial articulation. Dactyli very robust, triangular cross-section somewhat compressed, maximum width at the functional edge, where both contact. Occlusal edges smooth. Carpus with granulate edges, obliquely placed. Merus smooth, with lower edge sharp and granulated, upper margin blunt.

Right propodus — herein — elongated, thin, small, about 0.40 of maximum length of left propodus and about 0.35 of maximum height of left propodus. Palm subtrapezoidal, about half total length of propodus. Outer side weakly convex, row of granules paralleling the upper margin. Inner side smooth, weakly concave. Upper margin short, slightly convex, armed with about four or five transverse blunt teeth. Lower margin almost straight, sharp, continuous with index. Dactylus long, rounded section. Index subtriangular in outline and in section. Both dactyli bearing scattered granules and coarse subcircular setal pits.

Merus of an ambulatory leg robust, long, ovate in section, surface smooth, upper margin scarcely granulated, with subcircular setal pits.

Remarks: Vía (1969, p. 97), placed the genus *Eocalcinus* within Paguridae Latreille, 1802, whereas Glaessner (1969, p. R479) included the genus in the subfamily Diogeninae Ortmann, 1892, within Diogenidae (MacDonald et al., 1957), which is currently accepted (McLaughlin, 1983; Martin and Davis, 2001). In spite of the former familial placement, Vía Boada (1959), rightly, paid attention and compared *Eocalcinus* to two typical hermit crabs, *Diogenes* Dana, 1851 (Diogenidae Latreille, 1802) and *Calcinus* Dana, 1851 (Calcinidae), in particular to the latter, considered as diogenid at that time, given the strong morphological similarity of the left chelae (e.g. Poupin and Lemaitre, 2003; Poupin and Bouchard, 2006). However, Vía Boada (1959) erected a new genus on basis of the differences in the carpo-propodial articulation between *Calcinus* and *Eocalcinus*.

In this sense, the placement of *Eocalcinus* within Calcinidae is appropriate. Although the former keys for the Paguroidea families proposed by McLaughlin

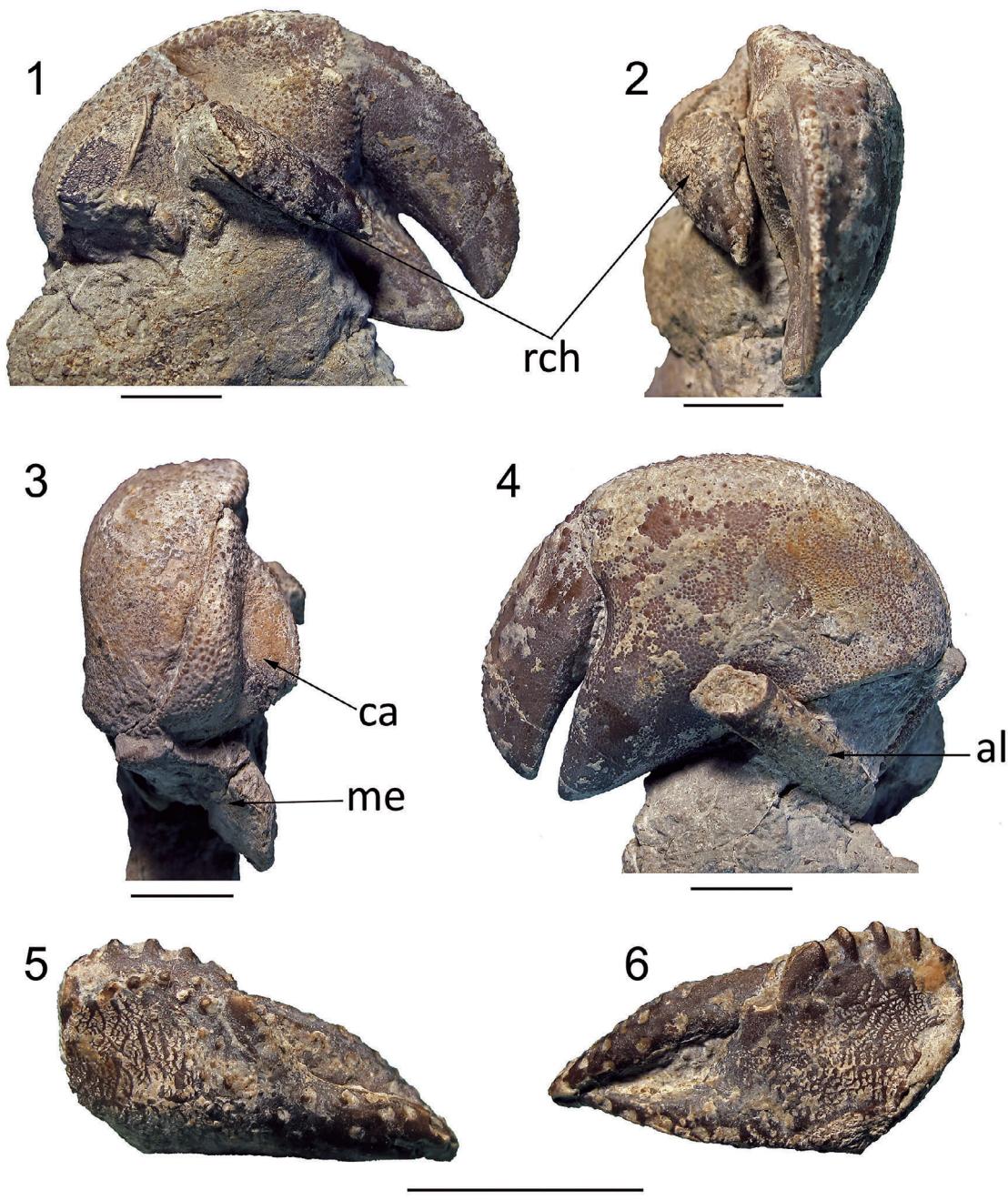


Fig. 1. 1–6. *Eocalcinus eocenicus* Vía Boada, 1959. MGB 90114. 1, lateral view of inner side of left chela with attached right chela; 2, frontal view of left chela with right chela attached; 3, posterior view of left chela, carpus and merus; 4, lateral view of outer side of left chela with attached merus of an indeterminate ambulatory leg; 5, lateral view of outer side of right chela; 6, lateral view of inner side of right chela. **Abbreviations:** al = ambulatory leg; ca = carpus; me = merus; rch = right chela. Scale bar equal to 10 mm.

(2003) for Diogenidae s.l. are based mainly on elements not preserved usually in fossil paguroids, such as shield, maxillipeds, and tergites, among others. However, in the case of the new specimen of *Eocalcinus eocenicus*, it can be observed that it

matches well with some of the keys for Diogenidae there listed, for instance: “Chelipeds unequal, left appreciable larger...” (McLaughlin, 2003, p. 114).

However, Fraaije et al., 2017, based on the shield morphology, splitted the Diogenidae in three fami-

lies: Annuntidiogenidae Fraaije, 2014, Calcinidae and Diogenidae Latreille, 1802 *s.s.* Shields of *Eocalcinus eocenicus* have never been found or reported, and its morphology remains unknown, yet, given the evident morphological similarity of its chelae with that of species of *Calcinus*, the type genus of the family, *Eocalcinus* is transferred herein to Calcinidae. The find of the right chela, very reduced, confirms that placement.

Isolated remains of left chelae of *Eocalcinus eocenicus* are relatively common and abundant in middle Eocene outcrops of the central and north-eastern Catalonia, as it was detailed by Vía (1969, p. 93–96), Vía Boada (1991, p. 182). However, no remains of the right chela have been reported so far. It may be due, in view of the evidences presented herein, such as the very small size of the right chela, that if present, could not have been interpreted as such, but as remains of ambulatory legs or other disarticulated elements and consequently neglected. As well, as seen in some occasions, when the major chela is attached or embedded to the rock, the remains of the right chela has been destroyed in an attempt to bring out the remarkable and powerful left chela.

In view of the fossil record, *Eocalcinus eocenicus* originated and lived in warm waters of the westernmost Tethys Sea during the middle Eocene. Similar extant taxa, such as *Calcinus laevimanus* Poupin, 1997 and *C. seurati* Forest, 1951, inhabit tropical and subtropical waters, in particular in the Indo-Pacific (e.g. Malay and Paulay, 2010).

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