



## Review of the Late Cretaceous erymid lobsters (Crustacea: Decapoda) from the Western Tethys



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### ABSTRACT

The Erymidae Van Straelen, 1925 had a worldwide distribution during the Jurassic and the Cretaceous. Twenty-seven species among four genera were reported in the Late Cretaceous, but confusions in diagnoses have led to wrong generic identifications of many erymid species. In the light of recent clarifications of the diagnoses of erymid genera, the Late Cretaceous species are here reviewed. We recognize thirteen of them including three European species which benefit of new descriptions: *Palaeastacus sussexiensis* (Mantell, 1824), *Enoploclytia leachi* (Mantell, 1822) and *Enoploclytia seitzii* Glaessner, 1932. Furthermore, a comparison of the Late Cretaceous erymid fauna with that from the Early Cretaceous emphasizes some changes. A decrease in diversity on genus and species level is noted with the absence of *Eryma* Meyer, 1840 in the Late Cretaceous and the predominance of *Enoploclytia* M'Coy, 1849 (including almost half of the species). Despite the scarcity of the fossil record, our palaeobiogeographic interpretations led us to propose hypotheses about the provenance of North American populations in the end of Early Cretaceous and in Late Cretaceous: (1) their supposed absence since the Callovian (Jurassic) is due to collecting and/or reporting bias or (2) they were the result of migrations of European populations. Moreover, the report of a chela assigned to *Stenodactylina* cf. *armata* (Secrétan, 1964) in France confirms the existence of migration routes between European and Malagasy faunas during the Late Cretaceous.

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## 1. Introduction

Erymid lobsters are typical Mesozoic decapod crustaceans reported from Europe (e.g., Mantell 1833; Bell 1850, 1863; Oppel 1861, 1862; Lahusen 1894; Van Straelen 1925; Beurlen 1928; Glaessner 1931; Reuss 1854; Bachmayer 1959; Förster and Rieber 1982; Garassino 1996; Jagt and Fraaije 2002; Garassino and Krobicki 2002; Bravi et al. 2014), in the Middle East (Roger, 1946; Förster and Seyed-Emani 1982; Garassino 1994; Charbonnier et al. 2017), in Africa (Beurlen 1933; Joleaud and Hsu 1935; Secrétan 1964, 1984; Charbonnier et al. 2012), in America (Rathbun 1923,

1926; Stenzel 1945; Feldmann and McPherson 1980; Aguirre-Urreta and Ramos 1981; Aguirre-Urreta 1982, 1989; Schweitzer and Feldmann 2001; Feldmann and Titus 2006; Feldmann and Haggart 2007; Vega et al. 2013; J. Luque, pers. com.), in Japan (Karasawa et al. 2008; Kato et al. 2010), in Australia (Woodward 1877; Etheridge 1914; Woods 1957), and in Antarctica (Taylor 1979; Aguirre-Urreta 1989). Despite this worldwide distribution, the fossil record of erymid lobsters remains sparse and fragmentary partially due to the low fossilization potential of decapod crustaceans (scavenging, decortication, disarticulation, carapace fragmentation), and bias related to collection and reporting (Plotnick 1986; Bishop 1986; Plotnick et al. 1988; Tshudy et al. 1989; Müller et al. 2000; Stempien 2005; Mutel et al. 2008; Krause et al. 2011; Hyžný and Klompmaker 2015; Klompmaker et al. 2017). Currently, twenty-seven species are known in the Late Cretaceous. However, until recently, the diagnoses of erymid genera, mainly based on carapace groove pattern and morphology of the chelae of

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the first chelipeds (Van Straelen 1925; Förster 1966; Glaessner 1969), remained confused. Some recent studies tried to clarify the concepts of erymid genera and proposed new diagnoses (Hyžný et al. 2015; Devillez et al. 2016). Thus, considering these revisions, the present contribution aims to give a new look on Late Cretaceous erymid fauna with a focus on European taxa, which benefit of new descriptions, and to compare with Early Cretaceous erymid fauna.

## 2. Material and methods

The studied material includes 272 specimens from the Cretaceous (Table 1). They were mostly studied using a CETI Belgium MEDO binocular microscope. Most of them consist of isolated carapaces and first chelipeds. Almost all European specimens examined in this work are assigned to *Enoploclytia leachi* (Mantell, 1822) or *Palaeastacus sussexiensis* (Mantell, 1824). These species are represented by numerous fossils in the Late Cretaceous chalk formations from southeast United Kingdom and only *E. leachi* is abundantly present in the Bohemian Cretaceous Basin (Czech Republic). In both areas, the fossils are relatively undeformed and few specimens are preserved with some anatomical parts which are uncommonly preserved (pleon, antennulae, antennae, third maxillipeds).

### 2.1. Institutional abbreviations

BAS	British Antarctic Survey, Cambridge (United Kingdom).
BGR	Bundesanstalt für Geowissenschaften und Rohstoffe, Berlin (Germany).
BM	Booth Museum of Natural History, Brighton (United Kingdom).
MNHN	Muséum national d'Histoire naturelle, Paris (France).
MUZ	Museo de Múzquiz, Coahuila (Mexico).
NHMUK	Natural History Museum, London (United Kingdom).
NM	Národní Muzeum, Prague (Czech Republic).
STI	Steinmann Institut für Geologie, Mineralogie und Paläontologie, Bonn (Germany).
SM	Sedgwick Museum of Earth Sciences, Cambridge (United Kingdom).
NPL	Non-Vertebrate Paleontology Laboratory, Jackson School of Geosciences, University of Texas, Austin (United States).
USNM	United States National Museum of Natural History, Smithsonian Institution, Washington, D.C. (United States).

### 2.2. Anatomical abbreviations

a1	Antennulae.
a2	Antennae.
CL	Carapace length (excluding rostrum).
CH	Carapace height.
Mxp3	Third maxilliped.
ω	Attachment site of mandibular muscle.
χ	Attachment site of adductor testis muscle.
P1–P5	Pereiopods 1–5.
s1–s6	Pleonal somites 1–6.

## 3. Systematic Palaeontology

MALACOSTRACA Latreille, 1802

DECAPODA Latreille, 1802

ERYMIDA *sensu* Schram and Dixon, 2004

Superfamily ERYMOIDEA Van Straelen, 1925

Family ERYMIDAE Van Straelen, 1925

INCLUDED GENERA. — *Enoploclytia* M'Coy, 1849; *Eryma* Meyer, 1840; *Palaeastacus* Bell, 1850; *Pustulina* Quenstedt, 1857; *Stenodactylina* Beurlen, 1928; *Tethysastacus* Devillez et al., 2016.

PRELIMINARY REMARKS. — Currently, the phylogenetic position of Erymidae is debated. Indeed, many authors have included this family within the Astacidea Latreille, 1802 (Van Straelen 1925; Glaessner 1969; Aguirre-Urreta 1989; Schweigert et al. 2000; Garassino and Krobicki 2002; Crônier and Courville 2004; Garassino and Schweigert 2006; Feldmann and Titus 2006; Schweigert 2013; Charbonnier et al. 2013) while recent contributions recognized this family to belong to Glypheidea Zittel, 1885 (De Grave et al. 2009; Schweitzer et al. 2010; Wahle et al. 2012; Karasawa et al. 2013; Feldmann et al. 2015). However, results of phylogenetic analysis by Charbonnier et al. (2015) suggest to remove Erymidae from Glypheidea. So, following Hyžný et al. (2015), we consider the systematic position of the Erymidae as uncertain. Then, according to Schram and Dixon (2004), we include the Erymidae in the separate clade Erymida, without listing taxonomic rank beyond superfamily.

Genus *Eryma* Meyer, 1840

TYPE SPECIES. — *Macrourites modestiformis* Schlothheim, 1822, by subsequent designation of Glaessner (1929).

DIAGNOSIS. — An emended diagnosis was proposed by Devillez et al. (2016: 518) and does not need to be repeated here.

REMARKS. — Among the numerous species of *Eryma* listed by Schweitzer et al. (2010), four are known in the Late Cretaceous. Three of them are from the United States: *Eryma americanum* Rathbun, 1923, *Eryma flectum* Rathbun, 1926, and *Eryma stantoni* Rathbun, 1935. These species are based on fragments of P1 chelae and carapaces and, after careful examination of figures presented by Rathbun (1923, 1926, 1935), we follow Förster (1966: 125) and Devillez et al. (2016: 520) who consider that *E. americanum*, *E. flectum* and *E. stantoni* do not belong to Erymidae. The last listed species is *Eryma cretaceum* Roger, 1946 from the Cenomanian of Lebanon. Based on the carapace groove pattern and the morphology of the P1 chelae, Charbonnier et al. (2017) transferred this species to *Pustulina* Quenstedt, 1857. We concur with this transfer.

In conclusion, to our current knowledge, there is no representative of *Eryma* in the Late Cretaceous and the last occurrence of this genus is *Eryma vocontii* Devillez et al., 2016 from the Albian (Early Cretaceous) of southeast France.

Genus *Stenodactylina* Beurlen, 1928

TYPE SPECIES. — *Stenodactylina liasina* Beurlen, 1928, by monotypy.

DIAGNOSIS. — An emended diagnosis was proposed by Devillez et al. (2016: 522) and does not need to be repeated here.

REMARKS.— *Stenodactylina* includes thirteen species mostly from the Jurassic (Devillez et al. 2016). Only two species are reported from the Late Cretaceous: *Stenodactylina triglypta* (Stenzel, 1945) (Coniacian, Texas, United States) and *S. armata* (Secrétan, 1964) (Campanian, Madagascar). These species are known from only a few fossils. *Stenodactylina armata* is known from four incomplete P1 chelae initially assigned to *Enoploclytia* M'Coy, 1849 (Secrétan 1964; Förster 1966; Schweitzer et al. 2010; Charbonnier et al. 2012). These P1 chelae exhibit a strong, rectangular propodus, slightly compressed dorso-ventrally, with a slight concavity of the outer margin at the basis of the index and with a strongly inflated dactylar bulge (Fig. 1A, B). As pointed out by Devillez et al. (2016), these characteristics fit the general morphology of the P1 chelae of

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