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Original article

Intraspecific variation and taphonomy of a new erymid lobster (Crustacea: Decapoda) from the Middle Jurassic of Belmont (Beaujolais, France)☆

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ABSTRACT

Erymid lobsters are relatively common in Jurassic rocks, but usually only occur as isolated carapaces or chelae. As a consequence, intraspecific variation, possible sexual dimorphism and heterochely remain poorly known in this group. New material from the Middle Jurassic (Aalenian) of Belmont, France, consists of specimens belonging to approximately 20 individuals with well-preserved carapaces retaining both chelipeds. A re-evaluation of selected taxa of the Erymidae is presented, in which *Eryma*, *Palaeastacus* and *Erymastacus* are considered valid genera. However, *Stenodactylina* is interpreted to be a junior subjective synonym of *Erymastacus*. Intraspecific variation in the length and curvature of fingers in *Erymastacus lagardettei* nov. sp., is highlighted, raising doubts as to the relevance of isolated chelae as the basis for new species designation. Interestingly, carapaces from Belmont often exhibit damaged posterior parts, which are here tentatively interpreted as cephalopod scavenging marks.

1. Introduction

Reptantian decapods and particularly lobsters underwent a major diversification during the Jurassic (Wahle et al., 2012; Bracken-Grissom et al., 2014; Schweitzer and Feldmann, 2014). The fossil record of decapod crustaceans is relatively sparse when compared to hard-shelled animals such as molluscs or brachiopods; nevertheless, erymid lobsters are relatively common in Jurassic deposits (Förster, 1966). Usually, only isolated carapaces or chelae are found; more complete specimens are known almost exclusively from Konservat-Lagerstätten (Garassino, 1994, 1996; Schweigert et al., 2000; Garassino and Schweigert, 2006; Charbonnier, 2009; Charbonnier et al., 2012b). As a consequence, intraspecific variation, possible sexual dimorphism and heterochely remain poorly known for this group of lobsters (Charbonnier et al., 2012b), allowing only a few taxa to be eligible for whole-body reconstructions. Slight heterochely is known for several Late Jurassic members of the family (Förster, 1966; Schweigert et al., 2000; Charbonnier et al., 2012b); this phenomenon, however, is difficult to study across different genera because of the scarcity of specimens retaining both chelae.

The early Middle Jurassic (Aalenian) material from France described herein offers an insight into the cheliped asymmetry in some members of this family. It also helps in elucidating the true nature of the enigmatic genus *Stenodactylina* Beurlen, 1928, previously known only from two specimens (Schweigert, 2013), and leads to reconsider the independent generic status of *Erymastacus* Beurlen, 1928, which has been regarded as a junior subjective synonym of *Eryma* von Meyer, 1840 for some time (Förster, 1966; Glaessner, 1969). Middle Jurassic decapod crustaceans of France have been the subject of systematic studies since the 19th Century. Erymid lobsters from this age and area were discussed by Étallon (1861), Oppel (1861, 1862), Méchin (1901), Lissajous (1907), Van Straelen (1925), Förster (1966), Crônier and Courville (2004), and Charbonnier et al. (2010, 2014). The present

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contribution adds new data on the Middle Jurassic marine lobsters of France.

2. Geological and stratigraphical setting

All of the studied specimens were collected in a quarry situated between the villages of Charnay-d'Azergues, Belmont-d'Azergues and Saint-Jean-des-Vignes, in the southern Beaujolais area (Rhône Department, east-central France; Fig. 1). The quarry is exploited by Lafarge Company for a local cement factory, and is renowned for its richness in mainly Toarcian fossil vertebrates and invertebrates. Toarcian to Bajocian strata are well exposed in this quarry. The succession (Fig. 2) begins with alternating plastic dark marl-bioclastic limestones of early toarcian age (''Calcaires à Ammonitella'' *sensu* Elmi and Rulleau, 1993). These marls are of yellowish color when weathered (Suan et al., 2013). They are overlain by dark-grey laminated shales that are very poor in macrofossils. In turn, these shales are overlain by more or less oolite-rich, purple to greenish marls with oolitic limestone concretions of middle and late toarcian age, based on an extremely rich ammonite fauna (e.g., Elmi and Rulleau, 1993; Rulleau, 2006). Apart from ammonites, numerous belemnites, bivalves, gastropods, scarce brachiopods and vertebrate remains were described from this part of the succession (Vincent et al., 2013), including one of the largest ichthyosaurs ever found (Martin et al., 2012). A discontinuity marks the end of the Toarcian deposition. The marly Toarcian succession is capped by yellow to reddish, calcareous sandy limestones called the ''*Cancellophycus* limestones'' (Elmi and Rulleau, 1993) due to an abundance of the trace fossil *Zoophycos* (syn. *Cancellophycus*) and belonging to the early Aalenian *Opalinum* Zone. These sandy limestones represent the base of the Aalenian part of the succession, which can reach up to 60–80 m locally. The Aalenian succession starts with a 20–35 cm thick bed of heavily bioturbated, pinkish, bioclastic limestone extremely rich in partially phosphatised ammonites dominated by leioceratids (''*Leioceras* Bed''), dated to the *Opalinum* Subzone. The next two intervals are characterized by abundant *Zoophycos*. The first of these two intervals consists of an irregular, 0–50 cm thick layer of yellow and pinkish limestone rich in ammonites indicating the *Comptum* Subzone, accompanied by common bivalves and rare decapod crustaceans. The second interval consists of up to 65 cm of purple limestone containing ammonites, belemnites, bivalves and brachiopods, dated to the *Haugi* Subzone (base of the *Murchisonae* Zone).

3. Material and methods

The material studied consists of lobster specimens belonging to approximately 20 individuals. Some specimens are preserved as carapaces associated with both chelipeds, which is not common in the lobster fossil record (not taking into account cases of exceptional preservation). The recrystallized cuticle is usually whitish in color. Most of the specimens have been prepared using an air scribe. In some cases, the preparation proved difficult because of the fragility of the preserved cuticle. Specimens were photographed in two ways: uncoated and/or coated with ammonium chloride prior to photography (see figure captions for details). For specimens deposited in private collections, casts were made using the silicone impression material Stomaflex® Putty and epoxide resin painted in black. All measurements are in millimeters.

Abbreviations: **KGP-MH**, Department of Geology and Paleontology, Faculty of Natural Sciences, Comenius University, Bratislava, Slovakia; **MNHL**, Musée des Confluences, Lyon, France; **PF**, Musée Pierres Folles, Saint-Jean-des-Vignes, Rhône Department, France; **SMNS**, Staatliches Museum für Naturkunde Stuttgart, Germany; **P1**, first pereiopods.

4. Systematic palaeontology

DECAPODA Latreille, 1802
ERYMIDA Van Straelen, 1925
Superfamily ERYMOIDEA Van Straelen, 1925
Family ERYMIDAE Van Straelen, 1925

Remarks: The Erymidae embrace extinct marine clawed lobsters constituting rather common elements of the Mesozoic benthic decapod faunas. Numerous species have been described (for the most comprehensive list, see Schweitzer et al., 2010), but many of them are based only on fragmentary material. For systematic identification at generic and specific levels, carapace

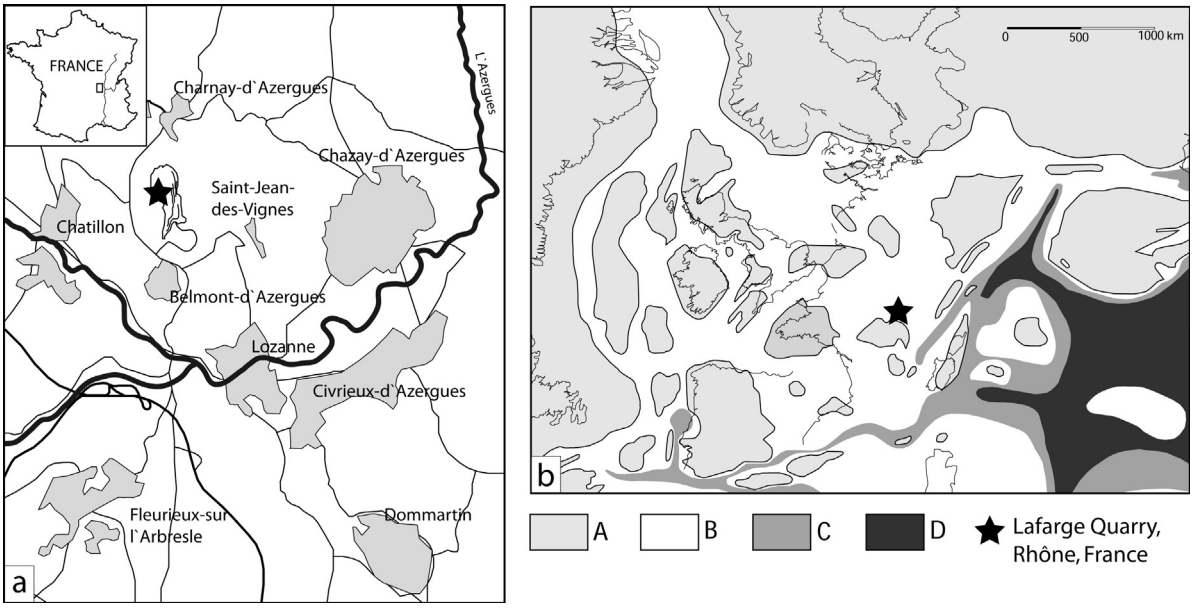

Fig. 1. a: geographical location of the Lafarge quarry, just north of Belmont-d Azergues; **b**: palaeogeographical scheme of the western margin of the Tethys (modified after Thierry et al., 2000 and Dera et al., 2010). A: emerged land; B: shallow epicontinental seas; C: deep epicontinental seas; D: deep oceanic basin.