A spiny lobster (Decapoda, Achelata) from the Upper Cretaceous (Cenomanian–Turonian) of Gara Sbaa, southeastern Morocco

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A spiny lobster (Decapoda, Achelata) from the Upper Cretaceous (Cenomanian–Turonian) of Gara Sbaa, southeastern Morocco

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Abstract

A spiny lobster, genus and species undetermined (Palinuridae Latreille, 1802) from the Upper Cretaceous (Cenomanian–Turonian) of Gara Sbaa (southeastern Morocco, NW Africa), is herein described. This is the second fossil record for a palinurid from Africa, enlarging the knowledge on the worldwide distribution of the family.

Keywords: Crustacea, Palinuridae, taxonomy, Konservat Lagerstätte, NW Africa.

1. Introduction

The studied specimen was collected from the Gara Sbaa Member *sensu* Martill et al. (2011) (Kem Kem region, southeastern Morocco). The Member is correlated with the basal horizon of the open shelf carbonate Akraobou Fm that includes laminated dolomitized limestones, deposited within a transgressive fluvio-lagoonal carbonate platform sequence and considered Cenomanian–Turonian (Late Cretaceous) in age. The fossiliferous layers from the Gara Sbaa yielded a rich fossil fauna (mainly fishes) that were the object of several studies (see Cavin et al. 2010; Martill et al. 2011; Murray et al. 2013).

Numerous arthropods (hymenopteran and orthopteran insects; isopods, and decapod crustaceans) have been discovered forming the bulk of the invertebrate biota (Garassino et al. 2008; Martill et al. 2011). The isopods were assigned to the sphaeromatid *Unusuropode castroi* Duarte & Santos, 1962 (Corbacho et al. 2018). Rare xiphosuran limulids were also reported by Garassino et al. (2008) and recently assigned to *Mesolimulus tafraoutensis* Lamsdell, Tashman, Pasini & Garassino, 2019 (Lamsdell et al. 2019). The decapod crustaceans have been studied by several authors (Garassino et al. 2006, 2008; Guinot et al. 2008; Garassino & Pasini 2018) (see Appendix).

The studied specimen was collected from the sublithographic, laminated limestone beds at the top of Gara Sbaa Member (Aaronson, pers. comm. 2020), interpreted to be deposited within a transgressive fluvio-lagoonal carbonate platform sequence and suggesting a possible shallow marine water environment (Murray et al. 2013).

Based upon Schweitzer et al. (2010, 2015) the Palinuridae are known to date in Africa with only one species, *Linuparus africanus* Glaessner, 1932 from the Late Cretaceous (Santonian) of Cameroon (Central Africa).
Hence, the studied specimen represents the second report of a spiny lobster from Africa enlarging the knowledge both of the worldwide distribution of the family and of the crustacean faunal fossil assemblage from Gara Sbaa Member environment. We also provide an updated list of decapod crustaceans known to date from the Gara Sbaa Konservat Lagerstätte (see Appendix).

2. Material

One complete specimen preserved in ventral view on a laminated dolomitized limestone slab, partially covered/encrusted by iron-oxide deposits, is housed in the palaeontological collections of the Museo di Storia Naturale di Milano (MSNM).

We provide natural and UV-light photos of the specimen in order to distinguish better some morphological details of the tiny phosphatized structures.

Abbreviations: lcxp: carapace length; la: antennae length; lb: total body length (excluding antennae); P1–P5: pereiopods 1 to 5; Mxp3: third maxilliped; s1–s6: pleonal somites 1 to 5; wcxp: carapace width.

3. Systematic palaeontology

Infraorder Achelata Schlotz & Richter, 1995

Family Palinuridae Latreille, 1802

Genus and species undetermined
Figs. 1, 2

Material and measurements: One nearly complete specimen in ventral view. MSNM i29337 – lcxp: 14 mm; wcxp: 10 mm; la: 130 mm; lb: 25 mm.

Description: *Carapace*. Carapace poorly preserved, subrectangular, longer than wide, with concave posterior margin; frontal margin poorly preserved, rostrum indistinct; pterygostomian regions with irregular coarse granulations; epistome smooth, with a median frontal triangular projection. *Pleon*. Pleonal somites s1-s6 subrectangular; pleurae not visible; s1-s6 decreasing posteriorly (s1 = 9 mm; s6 = 6 mm); telson poorly preserved, downturned posteriorly under the body. *Thoracic*

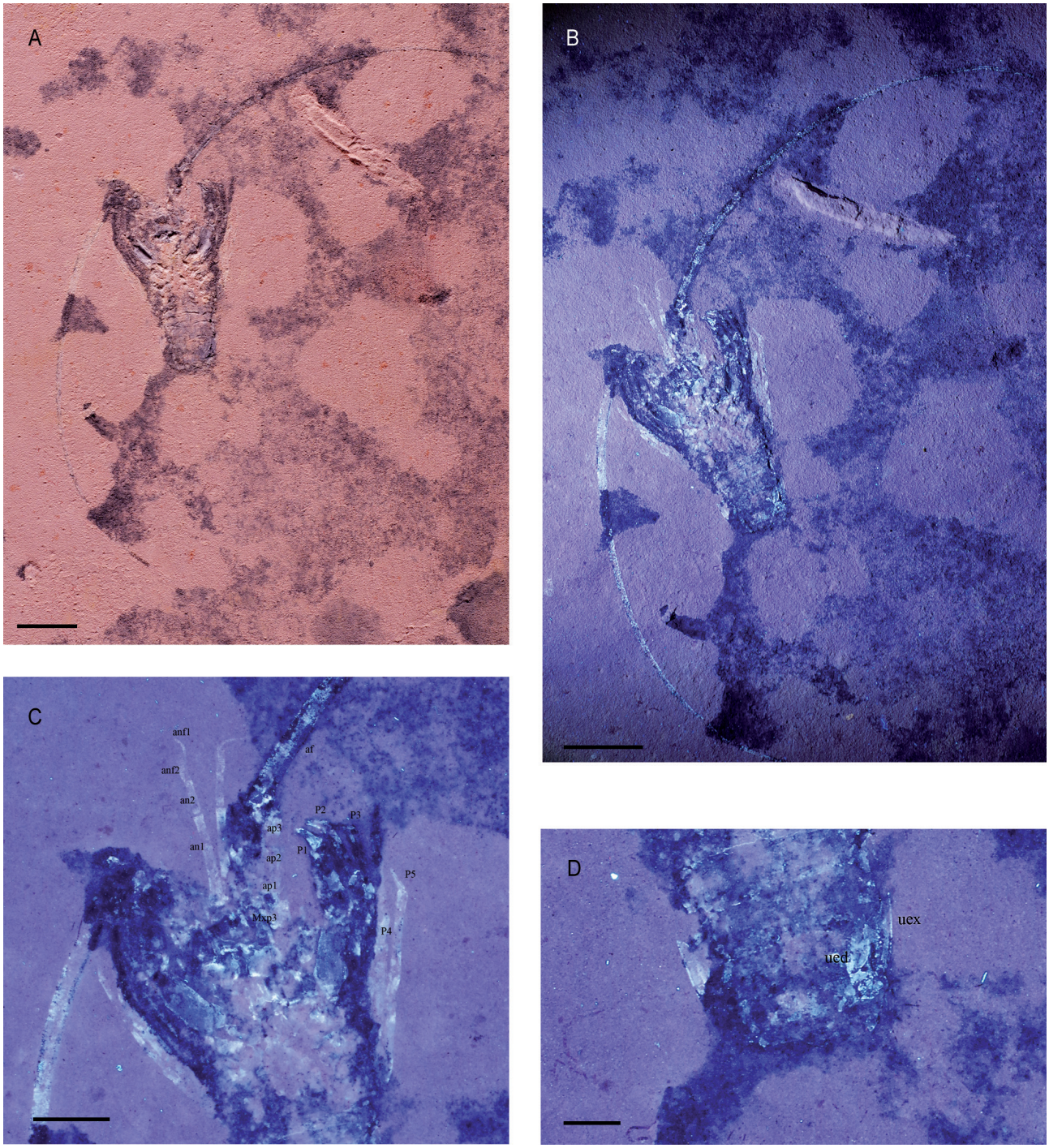

Fig. 1. Palinuridae, genus and species undetermined, MSNM i29337. (A) General view by natural light. Scale bar equals 8.3 mm. (B) General view by UV light. Scale bar equals 12.5 mm. (C) Close-up of the cephalic appendages by UV light. Scale bar equals 5 mm. (D) Close-up of the tail fan by UV light. Scale bar equals 2.2 mm. Abbreviations: an1, an2: antennular peduncles 1 and 2; anf1, anf2: antennular flagellum 1 and 2; ap1–ap3: antennal peduncles 1–3; af: antennal flagellum; Mxp3: third maxilliped; P1–P5: pereiopods 1–5; uex: uropodal exopod; ued: uropodal endopod.

sternum. Smooth sternum flattened, triangular-shaped, isosceles, decreasing in size distally. *Cephalic appendages*. Thick antennae, with very elongate flagellum, decreasing in size distally; strong peduncle with 3 well-developed spinose articles; antennae about 4.3 times longer than body; antennulae slender, elongate (12 mm total length), 11 times shorter than antennae; proximal elongate slender peduncle 3 times longer than the distal one, with smooth lateral margins; distal short slender peduncle, with smooth lateral margins; two unequal flagellae shorter than the peduncle; outer flagellum short and wide, subtruncate; inner flagellum elongate and thin, decreasing in size distally; scaphocerite absent; Mxp3 elongate with distal triangular dactylus. *Thoracic appendages*. P1–P5 well exposed, covered by granulate, coarse ornamentation; P1–P3 having same length; P1 with strong merus, carpus, and globular elongate propodus; strong triangular P1 dactylus slightly downturned, with a medial longitudinal groove; P1 twice times wider in transverse section (2 mm) than P2–P3; P2–P3 elongate and more slender (1 mm) than P1, ending in a pointed triangular dactylus; P4–P5 much thinner (0.5 mm) and shorter than P2–P3, with triangular pointed dactylus and decreasing in length posteriorly; P1–P3 covered by coarse irregular granulations on merus, carpus, and propodus; P4-P5 smooth. *Pleonal appendages*. Pleopods poorly preserved; uropodal exopod only partially exposed; petal-like exopod with a longitudinal thin medial ridge and subtruncate posterior margin; uropodal endopod poorly preserved, seems to have a thin longitudinal medial ridge.

D i s c u s s i o n : Despite the small body, we can confidently exclude that the studied specimen could represent a pre-adult or an "intermediate transitional development stage" *sensu* Haug & Haug (2016) due to the presence of a well-sclerotized hardened and developed pleon and the absence of the typical biramous elongate pleopods with plumose natatory setae on the pereiopods. Indeed, it's almost impossible to recognize in fossil spiny lobsters the intermediate development stages simply based upon the size or the generic body morphologic characters only (see for example the case of "*Palinurina*" *tenera* in Haug & Haug 2016) and when lacking an enough number of comparable specimens. Indeed, palinurid *puerulus* transitional stage (= benthic juvenile development) usually resembles the adult body plan.

Based upon Schweitzer et al. (2015) the diagnostic characters of the studied specimen fit those of the Palinuridae in having subcylindrical or semirectangular carapace; epistome in broad contact with carapace; broad, triangular sternum; very large antennae, thick antennal bases usually with spines; scaphocerite absent; P1 almost always same length or only slightly longer than other pereiopods.

According to Schweitzer et al. (2015), the Palinuridae includes 15 fossil and extant genera. The best-preserved characters of the studied specimen have been compared with those of the genera having more affinities in the body arrangement and P1 structure and shape.

The studied specimen clearly differs from *Jasus* Parker, 1883 in having shorter antennae, longer antennulae, and developed pleonal somites with spiny pleurae; *Justitia* Holthuis, 1946 in having carapace with imbricate scales and longer P1 subchelate, not distinctly wider than others; *Panulirus* White, 1847 in having antennular flagellum longer than peduncle, smooth P1 not enlarged, and spiny pleurae margin (Holthuis 1991; Schweitzer et al. 2015).

The studied specimen shows instead closer similarities with the extant and fossil genera *Palinurus* Weber, 1795 (Upper Cretaceous–Recent), *Palinurellus* von Martens, 1878 (late Eocene–Recent), and with the fossil *Palinurina* Münster, 1839 (Lower–Upper Jurassic). However, *Palinurus* has a carapace and P1-P5 ornamentation nearly smooth and notably spiny pleurae margin, whereas *Palinurellus* has a larger body, P1 shorter than the others, uniformly covered by small tubercles, and shorter antennae (Schweitzer et al. 2015).

The studied specimen shares some diagnostic characters with *Palinurina* in having antennae with strong articles; absence of scaphocerite; and P2–P5 long and slender (Schweitzer et al. 2015: 6). However, the studied specimen differs from the type species, *Palinurina longipes* Münster, 1839, in several specific characters, such as the ornamentation with coarse irregular granulations of the pterygostomian region; P4–P5 smooth, distinctly much thinner and shorter than P2–P3; P1–P3 with fine irregular granulations not ranged in rims. We consider these substantial differences (beyond the different geological age), enough to exclude the assignment of the studied specimen to *Palinurina*.

In conclusion, we prefer to leave the studied specimen in open nomenclature due to the impossibility to check the main morphological characters of the carapace. This new report is remarkable, representing the second record of a representative of a spiny lobster in Africa, enlarging our knowledge on the decapod crustacean assemblage from the Late Cretaceous Gara Sbaa fossiliferous beds.

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Appendix

Updated general list including the decapod crustaceans reported to date from the Cenomanian–Turonanian (Upper Cretaceous) of Gara Sbaa *Konservat Lagerstätte* (after Garassino et al. 2006, 2008, 2014; Guinot et al. 2008; Garassino & Pasini 2018; and this study).

Family Penaeidae Rafinesque, 1815

Genus *Cretapenaeus* Garassino, Pasini & Dutheil, 2006

Cretapenaeus berberus Garassino, Pasini & Dutheil, 2006

Family Palinuridae Latreille, 1802

Genus and species undetermined (this paper)

Family Amazighopsidae Garassino & Pasini, 2018

Genus *Amazighopsis* Garassino & Pasini, 2018

Amazighopsis cretacica Garassino & Pasini, 2018

Family Glypheidae Zittel 1885

Genus *Glyphea* v. Meyer, 1835

?*Glyphea garasbaaensis* Garassino, De Angeli & Pasini, 2008

Family Galatheidae Samouelle, 1819

Genus *Galathea* Fabricius, 1793

Galathea sahariana Garassino, De Angeli & Pasini, 2008

Genus *Cretagalathea* Garassino, De Angeli & Pasini, 2008

Cretagalathea exigua Garassino, De Angeli & Pasini, 2008

Family Porcellanidae Haworth, 1825

Genus *Muelleristhes* Garassino, De Angeli & Pasini, 2014

Muelleristhes africanus (Garassino, De Angeli & Pasini, 2008)

Family uncertain

Genus *Corazzatocarcinus* Larghi, 2004

Corazzatocarcinus cf. *C. hadjoulae* Larghi, 2004

Family Dorippidae MacLeay, 1838

Genus *Telamonocarcinus* Larghi, 2004

Telamonocarcinus cf. *T. gambalatus* Larghi, 2004

Family Marocarcinidae Guinot, De Angeli & Garassino, 2008

Genus *Marocarcinus* Guinot, De Angeli & Garassino, 2008

Marocarcinus pasinii Guinot, De Angeli & Garassino, 2008