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A new family, genus and species of cyclid (Crustacea, Branchiura, Cyclida) from mid-Cretaceous reefal deposits in northern Spain

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Abstract

We describe the first cyclid, *Alsasuacaris nostradamus* n. gen., n. sp., from reefal limestones of late Albian–early Cenomanian age in the Alsasua area (Navarra, northern Spain). A new family, Alsasuacaridae, is erected to contain two genera, *Alsasuacaris* n. gen. and the late Maastrichtian *Maastrichtiocaris* Fraaije, Schram and Vonk, 2003, from the southeast Netherlands. The late Kimmeridgian (Late Jurassic) genus *Stagmacaris* Schweigert, 2006, is not a cyclid but represents a sixth abdominal somite of a paguroid decapod.

Key words: Crustacea, Branchiura, Cyclida, new family, new genus, new species, Albian–Cenomanian, Spain

Introduction

The Albian–Cenomanian reefal deposits near Alsasua (Navarra, northern Spain) are particularly rich in crustacean remains, mainly anomurans and brachyurans, as recent studies and ongoing work have shown. Klompmaker *et al*. (2010) recorded thirty decapod crustacean taxa from the Aldoirar patch reef. Other crustaceans include an unnamed, large-sized ostracod and a diminutive cyclid, described and named herein. The enigmatic order Cyclida has long been known from Carboniferous to Triassic strata worldwide (see e.g., Schram *et al*., 1997, 2006; Dzik, 2008), but has only recently been recorded from the Jurassic and Cretaceous in northwest and central Europe. The youngest member known to date is *Maastrichtiocaris rostrata* Fraaije, Schram and Vonk, 2003 from the upper Maastrichtian (Maastricht Formation, Meerssen Member), southeast Netherlands. Most recently, two Jurassic taxa have been added: *Stagmacaris quenstedti* Schweigert, 2006, from a sponge-microbial mound (Massenkalk Formation) of late Kimmeridgian age (*Beckeri* Zone, *Ulmense* Subzone) near Ulm, southern Germany and *Juracyclus posidoniae* Schweigert, 2007, from the Posidoniaschiefer Formation of early Toarcian age (*Harpoceras falciferum* Zone) at Gomaringen, southwest Germany. As far as *Stagmacaris* is concerned, recently collected specimens from early late Kimmeridgian reefal deposits at Geisingen (southern Germany), demonstrate that in that genus structures similar to orbits or a rostrum are missing, and that the well-defined axial furrow, combined with a lateral notch on either side, are features which do not occur in cyclids. Those characters are shown by the sixth abdominal somites of paguroids, notably pylochelids. The type specimen of *S. quenstedti* appears to be very similar to the sixth abdominal somite of the pylochelid *Parapylocheles* (compare Forest, 1987, p. 141, fig. 42). Pylochelid paguroids have a Late Jurassic record (Van Bakel *et al*., 2008). The enigmatic early Toarcian genus *Juracyclus* Schweigert, 2007 (see also Schweigert *et al*., 2009) is based on an incomplete carapace whose morphological traits appear and closest to those of representatives of the family Halicynidae Gall and Grauvogel, 1967.

Methods

The type specimen is preserved as a natural mould, with all cuticle dissolved. Thus, the external mould represents the animal's outer geometry. In order to produce a detailed cast tin-cured silicone rubber was poured into the void and to ensure that no air was trapped in the imprint a veneer of silicone rubber was spread across it first by using pressured air. Subsequently, the rubber cast was then coloured using black colour powder of a type commonly used in artwork. Prior to photography, the cast was whitened using ammonium chloride sublimate (NH_4Cl), so as to provide proper contrast on a black background. It proved a real challenge to have

all aspects of the diminutive, three-dimensionally preserved specimen in focus. A stack of twenty images, all with variable plane of focus, were combined (i.e., focus stacked) with Helicon Focus software (http://www.heliconsoft.com/heliconfocus.html). This resulted in a hugely improved depth of field, yielding a more detailed impression of the specimen.

Systematic palaeontology

Remarks: Here we follow the classification recently proposed by Dzik (2008). To denote the repositories of specimens illustrated or referred to in the text the following abbreviations are used: IGT, Institut für Geowissenschaften der Universität Tübingen [Quenstedt Collection], Tübingen; MAB, Oertijdmuseum De Groene Poort, Boxtel; MGSB, Museo Geológico del Seminario de Barcelona, Barcelona; NCB-RGM, Nederlands Centrum voor Biodiversiteit (RGM, Naturalis), Leiden; SMNS, Staatliches Museum für Naturkunde, Stuttgart.

Class Crustacea Pennant, 1777

Subclass Branchiura Thorell, 1864

Order Cyclida Schram, Vonk and Hof, 1997

Family Alsasuacaridae n. fam.

Type genus: *Alsasuacaris* n. gen.

Included genera: In addition to the type genus, only *Maastrichtiocaris* Fraaije, Schram and Vonk, 2003.

Diagnosis: Carapace small, oval, longer than wide; large orbits; rostrum very large, fan-shaped; prominent upraised outer orbital tooth, orbital margin raised; front anteriorly widened, with central depression; posterior margin rounded, with distinct shelf; carapace surface areolated with swellings, granular.

Discussion: Other families that are referable to the order Cyclida, i.e. Cyclidae Packard, 1885, Schraminidae Dzik, 2008, Americlidae Dzik, 2008 and Halicynidae Gall and Grauvogel, 1967, have been diagnosed only on the number and morphology of appendages and carapace ornament. Appendages or remains of the ventral surfaces of *Maastrichtiocaris* and *Alsasuacaris* n. gen. have not been preserved. However, the large, ornamented orbits, the pronounced and grooved rostrum, the post-rostral depression, the anterior carapace lobation and the rimmed posterior carapace of the family Alsasuacaridae n. fam. differ from those of other known cyclid families.

Genus *Alsasuacaris* n. gen.

Type species: *Alsasuacaris nostradamus* n. sp.

Diagnosis: Carapace small, oval; orbits large, directed outwards, orbital margin thickened, outer orbital tooth very strong; very large, fan-shaped rostrum; with raised crest and central depression; posterior margin rounded, with sloping shelf; carapace surface areolated, posterior portion covered with multiple subcircular, parallel ridges; cuticle granular.

Derivation of name: From Alsasua, the area of provenance.

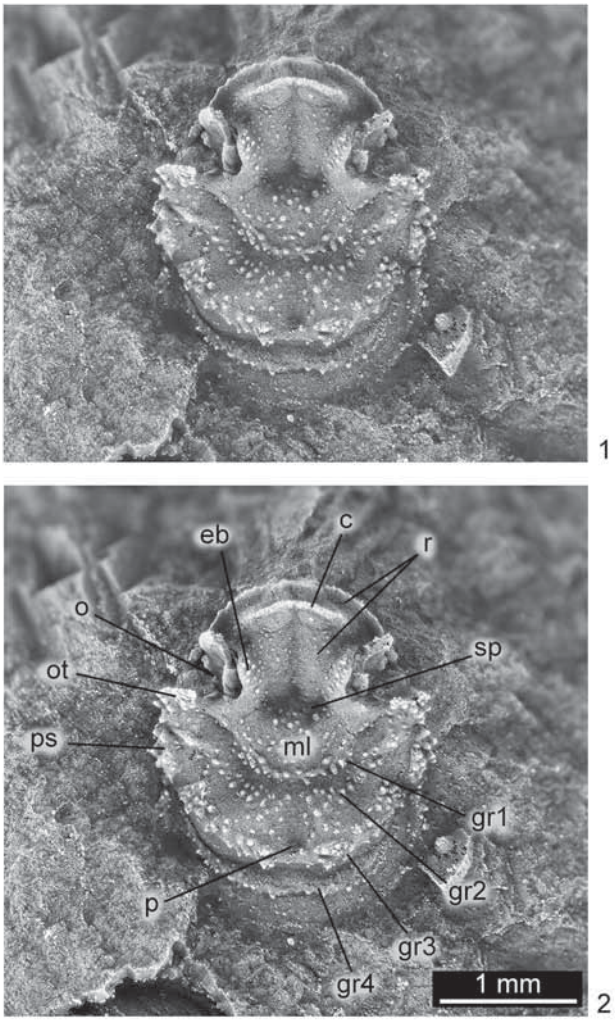

Fig. 1. *Alsasuacaris nostradamus* n. gen., n. sp., silicone rubber cast (MAB k. 3143) of the holotype (MGSB 75.424) from Albian-Cenomanian reefal limestones at the disused Koskobilo quarry, Olazti near Alsasua, Navarra (northern Spain).

Fig. 2. *Alsasuacaris nostradamus* n. gen., n. sp.; same specimen as in Fig. 1, with abbreviations for morphological terms used in the text. Scale bar in millimetres.

Alsasuacaris nostradamus n. sp.

(Figs. 1–2)

Diagnosis: As for genus.

Derivation of name: Nostradamus, Latinised name of Michel de Nostredame (1503–1566), French seer, well known for his prophecies published in his book 'Les Propheties'. His name, used here as a noun in apposition, has been chosen because the presence of cyclids in the Alsasua area was predicted by one of us (RHBF) one year prior to the discovery of the holotype of the new taxon.

Material: Holotype, and sole specimen known to date, is MGSB 75.424, a natural external mould of a complete carapace, of which MAB k. 3143 and NCB-RGM 344000 are silicone rubber casts.

Type locality and stratigraphic level: The disused Koskobilo quarry, north of Olazti, two kilometres southwest of Alsasua (co-ordinates: + 42° 52' 55.17"; - 2° 11' 59.52"), from Albian–Cenomanian reefal limestones of the Aldoirar patch reef.

Dimensions: Length 2,6 mm, width 2,1 mm.

Description [for abbreviations in brackets, see Fig. 2]: Carapace very small, longitudinally oval in outline, maximum width at mid-length, 80 per cent of maximum length; dorsal surface coarsely areolated but generally as a plateau with vertical lateral walls, posterior and frontal slopes; fan-shaped rostrum (r) very large, wide; anterior margin inflated, sharp; dorsal surface anteromedially with small, paired swellings and prominent, sharp, arched crest (c); shallow axial groove extends centrally over rostrum up to large axial sunken pit (sp) between orbits; orbits (o) very large, at a quarter of total carapace length from front; outer orbital tooth (ot) prominent and upraised, inner (medial) margin sinuous, vaulted, as an eyebrow (eb); anterior margin strongly inflated; outer orbital corners with granular lateral sides, extending towards posterior in post-orbital swellings (ps); dorsal carapace surface with vaulted medial lobe (ml), of which posterior margin forms convex granular ridge (gr1); second concentric granular ridge (gr2) weakly elevated, extending up to outer orbital corners; medially, a wide depression extends posteriorly towards small circular pit (p); third granular ridge (gr3) prominent, forming convex posterior border of dorsal 'plateau', anterolaterally separated from post-orbital swellings by deep groove; below a vertical shelf the acute fourth granular ridge (gr4) is slightly constricted medially; a gentle slope leads towards the strongly convex posterior carapace margin, which appears to be smooth, but details may be absent in the artificial cast.

Discussion

The Alsasuacaridae n. fam. comprises the youngest members of the order Cyclida of mid- and Late Cretaceous age. This enigmatic group of crustaceans witnessed maximum diversity during the Carboniferous (e.g. Schram *et al*., 1997, 2006) and there was another acme during the Triassic (Dzik, 2008); the Cretaceous members are remarkably small sized and may have been commonly overlooked – in fact, they may even have been more abundant than currently known. Cyclids inhabited mainly shallow-marine environments, and during the Triassic at least one group also invaded continental waters (Dzik, 2008). Schram *et al*. (1997) suggested that cyclids might have occupied niches equivalent to those inhabited by modern crabs. Such an interpretation might be correct for stratigraphically older cyclid representatives, but members of the new family are found to co-occur in mid- and Late Cretaceous shallow-marine reefal settings with highly diverse decapod crustacean faunas, mainly anomurans and brachyurans. For this group of cyclids a parasitic lifestyle, as suggested previously by Müller (1955), seems much more likely.

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