



The first record of a paguroid shield (Decapoda, Anomura, Annuntidiogenidae) from the Miocene of Cyprus

Prva najdba ščitov rakov samotarjev (Decapoda, Anomura, Annuntidiogenidae) iz miocenskih plasti Cipra

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Prejeto / Received 8. 11. 2019; Sprejeto / Accepted 2. 4. 2020; Objavljeno na spletu / Published online 22. 4. 2020

Key words: Paguroidea, Mediterranean, Cenozoic, Miocene, Cyprus, new species

Ključne besede: Paguroidea, sredozemlje, kenozoik, miocen, Ciper, nova vrsta

Abstract

For the first time, a paguroid shield is recorded from upper Miocene reefal strata (Koronia Member, Pakhna Formation) that crop out along the northern margin of the Troodos Massif, north of the village of Mitsero, Cyprus. Described here as *Paguristes joecollinsi* sp. nov., it constitutes the first paguroid shield known from Miocene deposits. The paucity of Cenozoic paguroid shields can probably be linked to a collecting bias in view of their relatively small size; in addition, suitable gastropod shells and internal moulds of such should be screened for 'hidden' hermit crabs.

Izvleček

Predstavljamo prvo najdbo ščita raka samotarja iz zgornjemiocenskih grebenskih apnencev (člen Koronija, formacija Pakhna), ki izdanjajo vzdolž severnega roba masiva Troodos, severno od vasi Mitsero na Cipru. V prispevku predstavljamo novo vrsto *Paguristes joecollinsi* sp. nov., ki je hkrati tudi prva najdba paguroidnega ščita miocenske starosti. Odsotnost kenozojskih paguroidnih ščitov je verjetno povezana z njihovo majhnostjo, saj jih hitro spregledamo. Pri iskanju ostankov rakov samotarjev je treba natančno preveriti tudi lupine in kamena jedra polžev.

Introduction

Up to now, abundant paguroid shield material has been recorded only from Jurassic reefal deposits (e.g., Van Bakel et al., 2008; Fraaije, 2014a; Fraaije et al., 2019) and mid- and Upper Cretaceous strata of comparable lithologies (e.g., Fraaije et al., 2008, 2009, 2012). In stark contrast is the current record of just a single hermit crab shield from Eocene coral-algal limestones in northern Italy as recorded by Beschin et al. (2016, 2017) and of an individual of *Dardanus colosseus*, preserved *in situ* in an internal mould of a gastropod from the Eocene of Austria (Fraaije

& Polkowsky, 2016). Recently, six partially preserved shields have been briefly described and illustrated on the internet by a private collector, who had recovered them from reefal strata of Danian age at a quarry near Vigny (Paris Basin, France) (Buridan.over-blog.com 2018). All of the above constitute the current meagre record of paguroid shields of Paleogene and Neogene age that we are aware of.

Although relatively common in the fossil record, hermit crabs rarely become fossilised within the empty gastropod shells they usually inhabit.

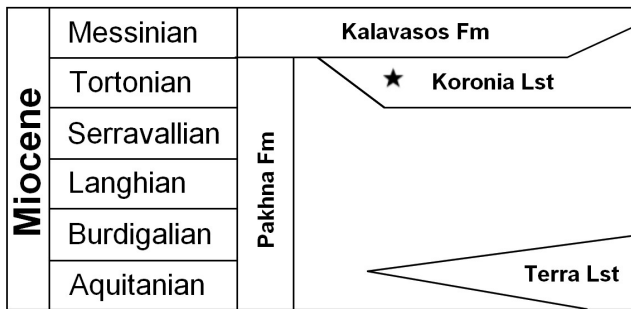


Fig. 1. Stratigraphical position (asterisk) of the holotype and sole specimen of *Paguristes joecollinsi* sp. nov. known to date.

it, probably because the animals abandon these when under stress (Dunbar & Nyborg, 2003). Alternative hypotheses are that the hard parts fall out of the gastropod shell upon decay of the hermit crab and not all Mesozoic hermit crabs inhabited gastropods (e.g., Fraaije, 2003). A recent study by Klompmaker et al. (2017) has revealed that the decay of complete paguroid animals is a rapid process, in comparison to other decapod crustaceans such as lobsters and crabs. They also demonstrated that, in addition to paguroid claws, anterior carapaces (shields) also have a relatively high preservational potential compared to the less calcified posterior shield. This result suggests that the paucity of extinct paguroid carapaces/shields might be a matter having been overlooked by collectors in the field on account of their small to diminutive size in comparison to other associated decapod crustaceans. Additionally, extensive checking of the content of gastropod shells or their internal moulds is likely to yield more paguroid specimens.

The new specimen described here was collected in May 2017 by one of us (RHBF) while doing fieldwork together with the fourth author (AAK) in upper Miocene reefal deposits at Mitsero, Cyprus (Figs. 1, 2). Following the record of a new, shallow-water munidopsid anomuran by Fraaije (2014b), this is only the second study on decapod crustaceans from the Miocene of Cyprus. More material from various localities in Cyprus is now contained in the collections of the Oertijdmuseum at Boxtel (the Netherlands). Below we adopt the morphological terminology of paguroid carapaces as described by Fraaije et al. (2019).

Institutional abbreviation: MAB, Oertijdmuseum, Boxtel, the Netherlands.

Systematic palaeontology

Order Decapoda Latreille, 1802

Infraorder Anomura MacLeay, 1838

Superfamily Paguroidea Latreille, 1802

Family Annuntidiogenidae Fraaije, 2014a

Genus *Paguristes* Dana, 1851

Type species: *Paguristes hirtus* Dana, 1851, by the subsequent designation of Stimpson (1858).

Included species: For fossil taxa, reference is made to Gagnaison (2012), Fraaije et al. (2015, table 1), Karasawa & Fudouji (2018, p. 23) and Beschin et al. (2018). For extant species, see Lemaitre & McLaughlin (2019).



Fig. 2. Location of a number of basins with Miocene strata, with the type locality of *Paguristes joecollinsi* sp. nov. marked by a large asterisk; the provenance of the only other anomuran recorded to date from the Miocene of Cyprus, *Palmunidopsis muelleri* Fraaije, 2014b, is marked by a small asterisk. Image modified from Fraaije (2014b, fig. 1)

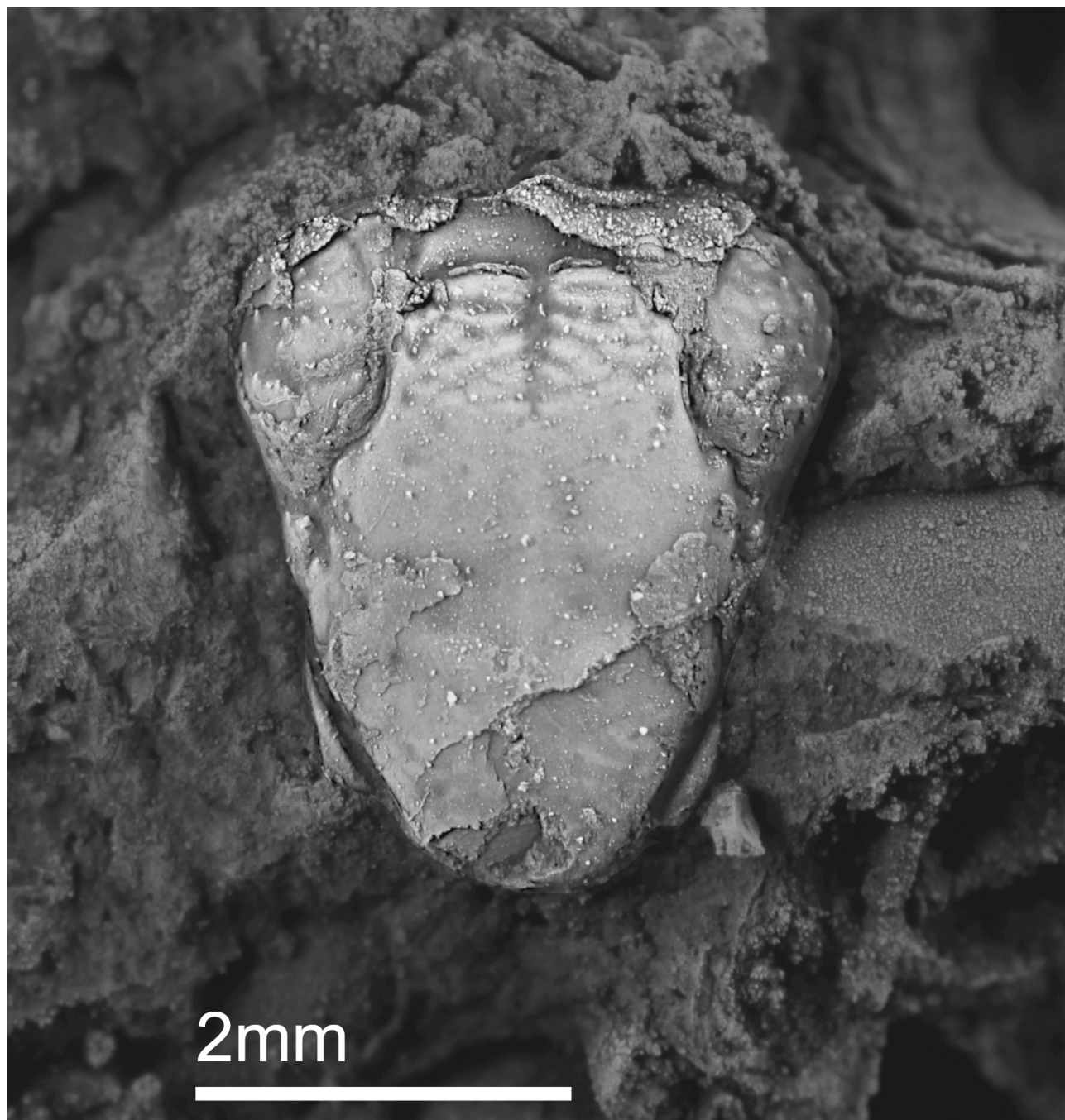


Fig. 3. Dorsal view of the shield of the holotype of *Paguristes joecollinsi* sp. nov. (MAB 10456a) as described here. No image of the lateral side is provided because the specimen sits in a depression, making further preparation too risky.

***Paguristes joecollinsi* sp. nov.**

Diagnosis: Shield elongated (length/width ratio c. 1.15); broad, rimmed and shallow orbital cavity; convex postrostral ridges indented medially by central gastric furrow; pronounced, globose and spinose massetic region; reniform keraial region; narrow and spinose lateral branchial area. Anterior gastric region with transversely crenulated muscle scar; V-shaped cervical groove.

Material: The holotype and sole known specimen to date (MAB 10456a,b: part and counter-

part) is an anterior part of the carapace with a maximum length of 3.8 mm and a maximum width of 3.3 mm.

Etymology: The species is named after our recently departed friend and colleague, Joseph ('Joe') S.H. Collins of London (England), who did so much to stimulate decapod crustacean studies by three of us (RHBF, BWMvB and JWMJ). We owe him a great deal.

Locality and stratigraphy: To the west of Kreatos Hill, about one kilometre to the north-north-west of the village of Mitsero, in coral-reef

talus of the upper Miocene (Tortonian, 11.6–7.2 Ma) Koronia Member (Pakhna Formation; see Fig. 1). The shield was recovered from a block of bioclastic rock measuring about one square metre. The sedimentology and stratigraphy of this region have been described in detail by Robertson et al. (1991) and Follows (1992).

Description: Shield elongated (L/W ratio c. 1.15), convex transversely, almost straight longitudinally, divided into distinct regions by grooves (as shown in Fig. 3); broad, rimmed and shallow orbital cavity, broad, slightly convex postrostral ridges centrally indented by central gastric furrow, extending posteriorly in faint central line; pronounced, very globose and spinose massetic region, posteriorly covered with finely spinose ridges; tiny reniform but clear keraial region; narrow and spinose lateral branchial area; anterior gastric region alongside central furrow with transversely crenulated ornament; V-shaped cervical groove; shield irregularly covered with large (setal) pores.

Remarks: The new species is assigned to *Paguristes* because the shape of the anterior shield, the grooves such as a central gastric groove, and the regional definition conform well with those of many modern species (e.g., Forest et al., 2000). Numerous representatives of *Paguristes* have been described from the fossil record, from the Albian (late Early Cretaceous) onwards (see Fraaije et al., 2015, table 1), but nearly all of these are based exclusively on chelae, with the exception of two, namely a partial shield from the upper Pleistocene of southern Italy, referred to *Paguristes* cf. *syrtensis* de Saint Laurent, 1971, by Garassino et al. (2014) and a specifically indeterminate form, *Paguristes* sp., from the lower Eocene of northern Italy (Beschin et al., 2016). A comparison with this specimen is not made here, because this species will be placed in a different genus (Fraaije et al., 2020). *Paguristes joecollinsi* sp. nov. differs from *P.* cf. *syrtensis* in having less convex orbital cavities, a much more globose massetic region, less convex upper orbital margins and substantially fewer (setal) pores across the shield, although the cuticle is less well preserved. We have also compared the species to extant representatives from the same geographical region, the Mediterranean, which was a nearly enclosed basin during the Tortonian (e.g., Rögl, 1999). After all, decapods crustaceans with stratigraphical ranges of 10 million years or more have been reported occasionally (Klomp maker et al., 2012, p. 792–793; Hyžný, 2016, table 1). This region may also harbour one or more descend-

ants of the species in the present study. However, the shields of extant Mediterranean species of *Paguristes* are not morphologically identical or very close to the new species. *Paguristes joecollinsi* sp. nov. differs from *P. eremita* (Linnaeus, 1767) [= *P. oculatus* (Fabricius, 1775) and *P. maculatus* (Risso, 1827)] (see Pipitone, 1998; Koçak et al. 2005, for drawings and images), *P. streaensis* Pastore, 1984 and *P. syrtensis* in that the general shape is more triangular and the massetic region is more pronounced in the new species. The shield appears to show impressions of the anterior gastric muscles (sensu Klomp maker et al., 2019, fig. 14F) in the anterior portion.

The assemblage from Mitsero also contains paguroid appendage fragments, but more research is needed to check whether one or more specimens might be ascribed to *P. joecollinsi* sp. nov. Ascribing disarticulated paguroid elements to one species is difficult, but it is essential to evaluate the true diversity of paguroids within assemblages. For example, Fraaije et al. (2013) have attempted to link sixth abdominal tergites to shield-based species based on the relative abundance of these isolated elements. None of the propodi within the Mitsero assemblage known to date is comparable to another Miocene *Paguristes*, *P. cserhatensis* Müller, 1984, from the middle Miocene of Hungary, or with *Paguristes gagnaisoni* from the middle Miocene of France (Gagnaisson, 2012).

Acknowledgements

We thank Thea van Boom-Fraaije for her company and assistance during fieldwork campaigns over recent years, the late Pál Müller for showing other Miocene localities and inspiring future research, and the journal reviewers, Francisco J. Vega and Ewa Krzemińska, for pertinent comments on an earlier draft of the typescript. This research was supported, in part, by a 2017 Paleontological Society Arthur J. Boucot research grant to one of us (AAK).

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