

# *Harenacorystes johanjansseni*, a new Pliocene crab (Crustacea, Decapoda) from the Netherlands, and notes on Miocene–Pliocene corystoid crabs from the North Sea Basin

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## Abstract

A new genus and species of corystoid crab, *Harenacorystes johanjansseni*, is recorded from slightly silty, fine-grained and well-sorted, glauconitic quartz sands assigned to the Oosterhout Formation, which are suction dredged at sandpit ‘De Kuilen’ near Langenboom (province of Noord-Brabant, the Netherlands). Although precise provenance data are lacking, the type and sole specimen of this crab known to date is assumed to have come from the lower depositional sequence (Unit B) within this formation, between 12 and 15 metres below the surface. On molluscan and dinoflagellate evidence, Unit B has been dated as early Zanclean to middle Piacenzian (Pliocene, c. 4.9–2.8 Ma). Added are new records of other corystoid crabs; *Corystes cassivelaunus* (Pennant, 1777) and *Micromithrax holsatica* Noetling, 1881, from the Oosterhout Formation (early–middle Pliocene) of Langenboom and of Balgoy (municipality of Wijchen, province of Gelderland, the Netherlands), as well as comments on previous literature records of Neogene corystids from the North Sea Basin.

**Key words:** Crustacea, Decapoda, Crustoidea, Miocene, Pliocene, North Sea Basin, new genus, new species

## Introduction

*Harenacorystes johanjansseni* n. gen., n. sp. is the third fossil corystoid genus on record from the Neogene of the North Sea Basin (Fig. 1). Corystoids have long been known from sandy deposits of Miocene and Pliocene age in this area, and have generally been referred to the genera *Corystes* Bosc, 1802 and *Micromithrax* Noetling, 1881. The latter genus was synonymised with *Corystes* by van Bakel et al. (2004), on the basis of material of *M. holsatica* from the Pliocene (Lillo Formation, Oorderen Member) of the Kallo area (Antwerp, Belgium), correlative with the Oosterhout Formation (see Weerts et al., 1998). Following additional examination and re-evaluation of extant corystoid genera, we prefer to treat *Micromithrax* as a distinct genus. Here we present records of *C. cassivelaunus* and of *M. holsatica* from the lower–middle Pliocene of Langenboom and of Balgoy, respectively; added are comments on previous literature sources.

## Locality and geology

At sandpit ‘De Kuilen’, near the village of Langenboom (municipality

of Mill en Sint Hubert, province of Noord-Brabant, the Netherlands; co-ordinates 51°41'59.53"N–5°44'55.66"E), sand and gravel for road construction are suction dredged and subsequently dumped temporarily. It is from such dumps that private collectors have been obtaining most of their material in recent years, and from where a new genus and species of crab, *Harenacorystes johanjansseni*, has lately been recovered. Divers have now logged the section under water and taken samples for biostratigraphic analyses (Wijnker et al., 2008); data below are taken mostly from that paper.

Unit B, 12–15 metres below surface, has yielded diverse shallow-marine bivalve faunules (for illustrations and pertinent references, see Marquet, 1998, 2002, 2005), the lowest sample (at 15 m depth) generally being dominated by large species such as *Glossus humanus*, *Arctica islandica* and *Pygocardia rustica* forma *tumida*, as well as scaphopods which are known exclusively from this level. Other common bivalve taxa include *Corbula gibba*, *Astarte incerta*, *A. obliquata* as well as the gastropods *Turritella* cf. *incrassata* and *T. vanderfeeni*. *Corbula gibba* is the commonest species at depths of 13 and 14 m, but fragile bivalve taxa such as *Yoldia* (*Yoldia*) *semistriata*, *Abra* aff. *prismatica* and *A. alba* occur commonly, as well as *Digitaria digitaria*, *A. incerta* and *Ensis*

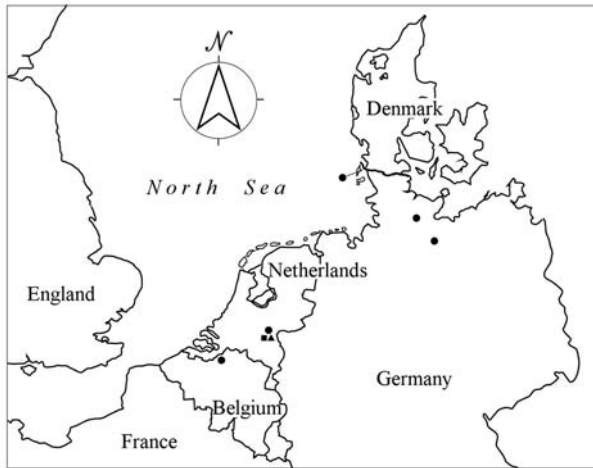


Fig. 1. Map of the North Sea Basin (the Netherlands, Belgium, southeast England, northern Germany and Denmark) showing localities which have yielded corystoid crabs of Miocene and Pliocene age: ▲ = *Harenacorystes johanjansseni* n. gen., n. sp.; ● = *Micromithrax holsatica* Noetling, 1881; ■ = *Corystes cassivelaumus* (Pennant, 1777).

cf. *hausmanni*. *Digitaria* is a good indicator of water depth, because in modern settings the upper depth range is 15 m below sea level (Marquet, 2005). Typical bivalve species at the 12.5 m level are *D. digitaria*, *C. gibba*, *E. cf. hausmanni*, *A. incerta* and *Cyclocardia scalaris*, while at 12 m *A. incerta* is the commonest form. Throughout Unit B, rajid teeth occur, which suggests fairly shallow sandy sea bottoms with rich vegetation for egg attachment.

The age of Unit B relies on molluscan evidence as well as on dinoflagellate analysis. A sample taken at 15 m below the surface is of early Zanclean age as based on the last occurrence datum (LOD) of *Reticulatosphaera actinocoronata*, which according to Louwey et al. (2004) falls within the Kattendijk Formation of the Antwerp area. Molluscan taxa from the 15 m level also comprise species known from the Kattendijk Formation (Zanclean; age estimate 4.86–4.37/4.00 Ma; see De Schepper, 2006) and Coralline Crag Formation of eastern England (age estimate 4.4–3.8 Ma; see Head and Norris, 2003). Situated within the 13–14 m interval are the LODs of *Selenopemphix armageddonensis* and *Operculodinium tegillatum* (the latter dated at c. 3.5 Ma, near the Zanclean–Piacenzian boundary), and the first occurrence datum (FOD) of *Achomosphaera andalusiensis suttonensis*. This part of the sequence is thus of middle to late Zanclean age, and the absence of *R. actinocoronata* suggests a post-early Zanclean date. Sample 12 m yields long-ranging and undiagnostic dinoflagellate taxa only, but based on superposition the age is assumed to be middle Zanclean to (early) Piacenzian. Molluscan faunules from samples 12 and 12.5 m depth have numerous elements in common with the latest Zanclean–middle Piacenzian Luchtbal and Oorderen members (Lillo Formation; age estimate: 3.8–2.76 Ma, see Laga et al., 2002; De Schepper, 2006; Kuhlmann et al., 2006) in the Antwerp area.

The Balgoy faunal assemblages are of the same age (late Zanclean–early Piacenzian, c. 4–3 Ma) as the bulk of material from Langenboom, but document a more nearshore facies. On the basis of the preservational state of molluscs, found in association with *Micromithrax holsatica*,

this fauna appears to represent a single one. Only a few, strongly abraded, Miocene forms occur, but these are fewer in number than assemblages known from the basal conglomerate at Langenboom. Amongst them are some genuine nearshore indicator species of which in particular a new form of *Lentidium complanatum* and *Ptychopotamides tricinctus* are striking. The large number of articulated bivalves and the faunal composition in boulders demonstrate quiet marine, rather shallow settings, between fair weather and storm wave base. Typical stratigraphically important indicators are: immigrants from the Pacific (the bivalves *Mytilus antiquorum*, *Macoma obliqua*, *Mya arenaria* and *Mya truncata*; younger than c. 4.1 Ma) and typical early Pliocene species include the bivalves *Pygocardia rustica* forma *solida*, *Cerastoderma hoistei* (tall form), *Carinastarte trigonata*, *Palliolium gerardi* and the gastropod *Turritella vanderfeeni* (F. P. Wesselingh, pers. comm., May 2008).

All material is deposited in the collections of the Oertijdmuseum De Groene Poort, Boxtel (the Netherlands; abbreviation MAB).

### Systematic palaeontology

Infraorder Brachyura Linnaeus, 1758

Superfamily Corystoidea Samouelle, 1819

Family Corystidae Samouelle, 1819

**Remarks:** The Corystidae comprises three extant genera, *Corystes* Bosc, 1802, *Gomezia* Gray, 1831, and *Jonas* Hombron and Jacquinot, 1846 (see Ng et al., 2008, p. 56). Until now four genera are known from the fossil record:

*Corystites* Müller, 1984 (*nom. nov.* pro *Microcorystes* Lörenthey in Lörenthey and Beurlen, 1929, *non* Fritsch, 1893; type species: *C. latifrons*) is from the middle Miocene ('Badenian') of the Budapest area (Hungary). Unfortunately, the type specimen of *Corystites latifrons* is lost and no additional specimens have ever been collected (P. Müller, pers. comm., 2002);

*Gomezinus* Collins in Collins et al., 2003 (type species: *G. tuberculatus*) from the Miocene Miri Formation of Sarawak;

*Micromithrax* Noetling, 1881 (type species: *M. holsatica*) from the lower Miocene to middle Pliocene of northern Germany, northeast Belgium and the Netherlands (see below), and;

*Hebertides* Guinot, De Angeli & Garassino, 2007b (type species: *H. jurassica*) from the upper Bathonian (Middle Jurassic) of Calvados, Normandie (northwest France; see also Guinot et al., 2007a). The stratigraphic age of this genus is in doubt; currently, bryozoans isolated from the matrix are being analysed and a Late Cretaceous (Campanian or Maastrichtian) age seems more likely (D. Guinot and G. Breton, pers. comm., May 2008).

### Genus *Harenacorystes* n. gen.

**Type species:** *Harenacorystes johanjansseni* n. sp.

**Derivation of name:** From Latin *harena*, meaning sand or sandy coast, in reference to the habitat and burying mode of corystoid crabs, and to the sediment from which the type specimen was collected, suction dredged at sandpit 'De Kuilen' near Langenboom.

**Diagnosis:** Carapace subcircular in outline, tumid, slightly longer

than wide, front weakly produced; orbitofrontal margin fifty per cent of maximum carapace width; orbits large, oval; anterolateral margins convex, with a sharp edge. Only central-posterior carapace regions well defined; large branchiocardiac grooves, tubercles on branchial areas flattened and anteriorly directed; subhepatic area with a single node, *linea brachyura* raised; pterygostome tumid; buccal cavity rectangular, wide, with a distinct lateral rim; antennules positioned between orbits, directly under front; antennar fossae slightly lower, bounded by antennular and orbital socket.

***Harenacorystes johanjansseni* n. sp.**

(Figs. 2.A–C)

**Material:** Holotype, and single specimen known, is MAB k.2540, from late Zanclean–early Piacenzian strata at sandpit ‘De Kuilen’, near the village of Langenboom.

**Derivation of name:** In honour of Johan S. Janssen (Asperen, the Netherlands), who collected the specimen, brought it to our attention and kindly allowed it to be deposited in the collections of the Oertijdmuseum De Groene Poort, Boxtel.

**Diagnosis:** As for genus.

**Description:** Carapace subcircular in outline, length slightly exceeding width, greatest carapace width at a third from anterior, gently convex in longitudinal and convex in transverse cross-sections. Orbitofrontal margin equalling half the maximum carapace width. Front slightly produced, width equal to orbit, downturned in continuous curve of carapace cross-section, anterior margin poorly preserved. Orbital margin arched, raised with central dip. Orbital cavities elliptical, laterally downturned.

Anterolateral margin convex, sharp edged and weakly flanged, posterior half incompletely preserved but a weak indentation could have led to a marginal tooth. Posterolateral margin longer than anterolateral margin, weakly arched, edge blunt. Only lateral corner of posterior margin preserved, its width equal to orbitofrontal margin.

Carapace regions weakly defined, especially those in anterior half. Slightly raised epigastric regions emerge besides anterior mesogastric process. Protogastric and hepatic areas barely separated. Strong crescent-shaped branchiocardiac grooves define a large cardiac region, diamond shaped with its apex positioned posteriorly, and bearing two symmetrical crests. Epibranchial region with two strong downwardly curved elevations, the inner with a posterior extension axially towards midpoint of branchiocardiac furrows. An obscure notch with a sharp elevation close to the posterolateral margin, about halfway.

Subhepatic, suborbital and pterygostomian areas domed, very tumid. Subhepatic dome bearing an anteriorly elongated tubercle. A raised rim separates pterygostomian area from subhepatic, raised rim lining buccal cavern being more distinct.

Dorsal carapace surface near posterior and lateral margins, at branchial regions, inner orbital margin and rostrum, with flat, anteriorly directed tubercles. Muscle scars in branchiocardiac furrows and towards posterior margin, as well as in epibranchial depressions.

**Discussion:** We place the new genus and species in the Corystidae based on the areolation of the dorsal carapace; the construction

of the orbits and epistome; and nature of subdorsal carapace and pterygostomian plate.

Within the Corystidae, *Corystes cassivelaunus* shows an overall similarity to the new genus; carapace areolation, especially the central area, is remarkably close, as are the anteriorly directed tubercles on the posterior carapace surface. The frontal construction is of the same concept, with clearly defined oval orbital sockets. The subhepatic and pterygostomian areas are similar in *Corystes* and *Harenacorystes* n. gen., but in the latter the anterior margin is sharp, while it is rounded in the former. Moreover, the carapace in *Harenacorystes* n. gen. is relatively much shorter.

In carapace outline, and dorsal view of the orbital margin, the genus *Pseudocorystes* H. Milne Edwards, 1837, currently included in Atelecyclidae Ortmann, 1893 (see Ng et al., 2008), shows similarities. We know of no previous fossil record for this extant genus, which is confined to the west coast of South America. In comparison to *Harenacorystes johanjansseni* n. gen., n. sp., *Pseudocorystes* has a narrower posterior margin, and the orbits are closer together, giving the carapace a more oval appearance than the Pliocene North Sea Basin form. The ocular peduncles in *Pseudocorystes* are not protected by a complete orbital socket as in the new genus; instead, the socket is open laterally and the orbital cornea is protected by strong outer orbital and suborbital, spiniform teeth. In addition, the subhepatic area and pterygostomian plate are distinctly more tumid in the new genus, which is why it cannot be included in *Pseudocorystes*. Atelecyclids are characterised by a (sub)circular carapace outline, which better fits the diagnosis of the new genus. However, their body is relatively thin, with the pterygostomian plate not nearly as tumid as in corystoids. For this reason, we place the new genus in the Corystidae, and note that many characters on which extant members of these families are assigned taxonomically, such as the length and nature of the antennae, the fusion of the abdominal segments as well as male and female sexual features such as the gonopod, cannot be examined.

Superficially, the new species recalls representatives of the enigmatic genus *Camarocarcinus* Holland and Cvancara, 1958. This has recently been assigned to its own family, Camarocarcinidae, together with a newly described genus, *Cretacocarcinus* (Feldmann et al., 2008). The new species described herein cannot be assigned to *Camarocarcinus* or the Camarocarcinidae, because its orbits are much larger, the orbitofrontal width occupies 51% in the new genus and species vs 37 % in *Camarocarcinus*. In addition, the subhepatic and pterygostomian areas are much more tumid. In *Harenacorystes johanjansseni*, the frontal construction is that of an advanced (eubranchyuran) crab, thus the orbital fossae are placed laterally to the front which overhangs the antennular and antennar fossae. In *Camarocarcinus*, the orbital construction is primitive, with the orbital fossae being central, and partly underneath the front, typical of the Podotremata.

Genus *Corystes* Bosc, 1802

*Type species:* *Cancer cassivelaunus* Pennant, 1777, by monotypy.

***Corystes cassivelaunus* (Pennant, 1777)**

(Fig. 2. E)

**Material:** A single specimen, preserved as an external mould, MAB k.2541. A silicone rubber cast produced of this specimen exposes only the ventral surface, with all sternites, the pterygostome and epistome, but also features which are rarely preserved in the fossil record such as ocular peduncles, and proximal portions of first and second maxillipeds. There is no vulva on sternite 6, which means that this specimen represents a male.

**Discussion:** Holthuis (1949) listed Pliocene and younger decapod crustacean species recognised on the basis of cheliped material collected from boreholes throughout the Netherlands. Although most of the common extant species of the North Sea are represented, that author did not record any material which was assignable to *C. cassivelaunus*.

#### Genus *Micromithrax* Noetling, 1881

**Type species:** *Micromithrax holsatica* Noetling, 1881, by monotypy.

**Emended diagnosis:** Carapace oval in outline, strongly arched both longitudinally and transversely; surface areolated with a central tubercle on each region, medially forming a tubercular axis; groove system shallow but branchiocardiac grooves distinct; orbitofrontal margin two-thirds of maximum carapace width; front wide, produced, bifid with flattened triangular teeth; orbital margin with two fissures, outer orbital tooth prominent; orbits subcircular, deep; lateral margins rounded, anterolateral margin spinose, with three anteriorly curved teeth, an additional tooth on the subhepatic area being visible in dorsal view; posterolateral margin arched with a single tooth near the straight, rimmed posterior margin.

#### *Micromithrax holsatica* Noetling, 1881

(Figs. 2, D, F–H)

1881 *Micromithrax holsatica* Noetling, p. 363, pl. 20, fig. 2.

1964 *Corystes bernhardi* Gripp, p. 123, pl. 21, fig. 8.

1987 *Corystes* cf. *holsaticus* (Noetling, 1881); Montag, p. 78.

2004 *Corystes holsaticus* (Noetling, 1881); van Bakel et al., p. 102, text-fig. 3, pl. 4, figs. 1, 2, 6–8.

2005 *Corystes holsaticus* (Noetling, 1881); Moths, p. 84, fig. 4.

**Material:** Two partial, but otherwise well-preserved, carapaces (MAB k.2542, k.2543) from a former sandpit at Balgoy (municipality of Wijchen, province of Gelderland). Their age, as based on associated molluscan assemblages (see above), is late Zanclean to early Piacenzian.

**Discussion:** These specimens constitute the first record of the species from the Netherlands, and are identical in areolation and ornament to specimens from coeval strata (Lillo Formation, Oorderen Member) at Kallo, Antwerp area (Belgium; see van Bakel et al., 2004, p. 102).

Material from northern Germany, of early–middle Miocene age, tends to be smaller (up to 10 mm carapace length; compare Moths, 2005, p. 84) and has slightly deeper carapace grooves than Pliocene individuals from Belgium and the Netherlands.

The type specimen is from Segeberg, Schleswig-Holstein (northern Germany), where it was found in a boulder of fossiliferous sandstone, now referred to as ‘Holsteiner Gestein’. On planktonic molluscan evidence, this type of rock has recently been shown to be of early Miocene age (Gürs and Janssen, 2002; Janssen and Gürs, 2002).

Van Bakel et al. (2004, p. 101) accepted synonymy of *Micromithrax* with *Corystes*, first proposed by Gripp (1967), on the basis of close similarity in carapace outline with *Corystes cassivelaunus*. This opinion was shared by Moths (2005, p. 85). The more areolated carapace regions, each with a central spinose tubercle, resemble more closely the condition found in *Gomezinus* from the Miocene of Sarawak and in the extant genus *Jonas*, which is represented by six species (see Ng et al., 2008). Thus, we reinstate *Micromithrax* as a distinct genus, for now comprising only the early Miocene–middle Pliocene *M. holsatica* from the North Sea Basin.

Two additional species have previously been assigned to the present genus. *Micromithrax? grippi* Müller, 1974 (p. 279, pl. 2, figs. 1, 2) from the middle Miocene of the Budapest area (Hungary) was later transferred to the pirimelid genus *Trachypirimela* Müller, 1984 and considered a senior synonym of *T. radula* Müller, 1974 (see Müller, 1984, p. 79), while *Micromithrax? minusculus* Feldmann and Wilson, 1988 (p. 486, fig. 16), from the Eocene (La Meseta Formation) of Seymour Island Antarctica, probably is a majid, and thus cannot be accommodated in the corystid genus, *Micromithrax*.

**Occurrence:** Montag (1987, p. 78) noted that in Schleswig-Holstein (northern Germany), *Corystes* cf. *holsaticus* was widely distributed, apparently having favoured sandy bottoms because the species is rarely encountered in clayey sediments, e.g. the late Miocene ‘Glimmertown’ at Morsumkliff (Sylt, northern Germany) has only yielded five remains (see also Bossau and Klockenhoff, 1977). Current data suggest that *Micromithrax holsatica* ranged from the early Miocene to the middle Pliocene of northern Germany, northwest Belgium and the Netherlands, i.e. the North Sea Basin. In view of this distribution, the species can also be expected in the Craggs of southeast England (Norfolk and Suffolk).

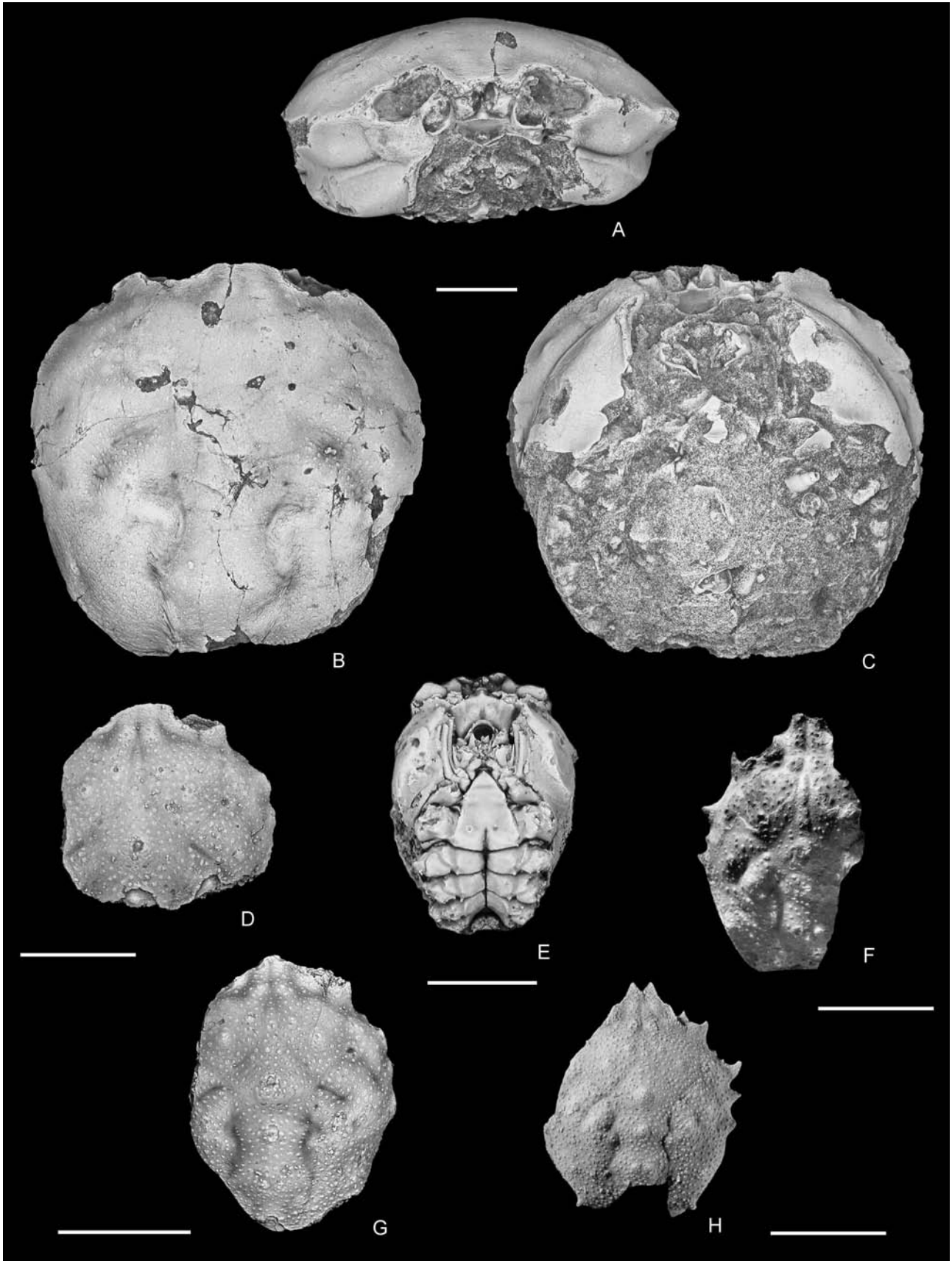
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#### →Fig. 2.

A–C. *Harenacorystes johanjansseni* n. gen., n. sp. Holotype (MAB k.2540), sandpit ‘De Kuilen’, Langenboom (Noord-Brabant, the Netherlands), Unit B, Oosterhout Formation (Pliocene, late Zanclean or early Piacenzian), A, frontal; B, dorsal; C, ventral views. Scale bar equals 10 mm. D, F–H. *Micromithrax holsatica* Noetling, 1881. D (MAB k.2542), anterior portion of large carapace. G (k.2543), partial carapace. Balgoy (municipality of Wijchen, Gelderland, the Netherlands), Oosterhout Formation (Pliocene, late Zanclean to early Piacenzian). Scale bars equal 10 mm. H. MAB k.2381, Kallo (Antwerp area, Belgium), Lillo Formation, Oorderen Member, Piacenzian (van Bakel et al., 2004, pl. 4, figs. 1, 2). Scale bar equals 10 mm. F. Type specimen (unregistered; collections of Museum für Naturkunde, Humboldt-Universität Berlin). Scale bar equals 5 mm. E. *Corystes cassivelaunus* (Pennant, 1777). MAB k.2541, sandpit ‘De Kuilen’, Langenboom (Noord-Brabant, the Netherlands), Oosterhout Formation (Pliocene, late Zanclean or early Piacenzian), ventral view. Scale bar equals 5 mm.





*Harenacorystes johanjansseni* n. gen., n. sp., thus enabling it to be described and formally named, Werner Peters (Balgoy) for allowing the two Dutch specimens of *Micromithrax holsatica* to be placed in the Oertijdmuseum De Groene Poort collections, Frank P. Wesselingh (Nationaal Natuurhistorisch Museum [Naturalis], Leiden) and Erik Wijnker (Genetisch Laboratorium, Wageningen University) for providing data on stratigraphy of the Balgoy and Langenboom occurrences, respectively, Charles H. J. M. Fransen (Nationaal Natuurhistorisch Museum [Naturalis], Leiden) and Danièle Guinot (Muséum national d'Histoire naturelle, Laboratoire de Zoologie [Arthropodes], Paris) for providing items of literature, and the journal reviewers for commenting on an earlier typescript.

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