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Palaega pisana n. sp. (Crustacea, Isopoda, Cirolanidae)
from the Pliocene of Orciano Pisano, Pisa
(Toscana, Central Italy)

Abstract - We report a new form of cirolanid ascribed to *Palaega pisana* n. sp. (Crustacea, Isopoda, Cirolanidae) from the Pliocene of Orciano Pisano, Pisa (Toscana, Central Italy). This is the second species of *Palaega* Woodward, 1870, reported from the Pliocene of Tuscany and Italy, increasing the very sparse palaeontological data on presence and distribution of the genus in the Mediterranean Basin during the Late Cenozoic.

Key words: Crustacea, Isopoda, Cirolanidae, Pliocene, Italy.

Riassunto - *Palaega pisana* n. sp. (Crustacea, Isopoda, Cirolanidae) del Pliocene di Orciano Pisano, Pisa (Toscana, Italia Centrale). Viene descritta una nuova forma di isopode cirolanide ascrivita a *Palaega pisana* n. sp. (Crustacea, Isopoda, Cirolanidae) del Pliocene di Orciano Pisano, Pisa (Toscana, Italia). Si tratta della seconda specie di *Palaega* Woodward, 1870 segnalata nel Pliocene toscano e italiano, incrementando le scarsissime conoscenze paleontologiche sulla presenza e distribuzione del genere nel bacino Mediterraneo nel corso del Cenozoico superiore.

Parole chiave: Crustacea, Isopoda, Cirolanidae, Pliocene, Italia.

Introduction and geological setting

The previous report of fossil isopods from the Pliocene of Italy is limited to a single old record by Ristori (1891). The author described briefly a single posterior moult of a cirolanid isopod assigned to *Palaega sismondai* Ristori, 1891, from the Pliocene clays of Mucigliani, Siena (Toscana, Central Italy). In the appendix to this paper, we provided a full translation of the original description of this Italian species.

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The studied specimens were discovered in Pozzavilla locality (Orciano Pisano, Pisa, Toscana, Italy). in an old quarry today reclaimed (Frediani pers. comm., 2010). Orciano Pisano outcrops have been well known since the 18th century for the rich Plio-Pleistocene fossil assemblage including many invertebrates (Pecchioli, 1864), fishes (Lawley, 1875), and above all for the marine mammal remains such as dolphins, whales, and seals (Bianucci & Landini, 2005). The hills around Orciano, where the studied specimens have been discovered, includes the “Formazione delle argille azzurre”, considered to be Pliocene in generic terms on the basis of a fauna of bathyal invertebrates including gastropods (*Ficus*, *Marginella*, *Mitrella*) and barnacles (Menesini, 1968, 1977; Bossio *et al.*, 1999). As reported by De Angeli & Garassino (2006) some brachyuran decapods are also known from the outcrops (*Titanocarcinus*, *Triboloecephalus*, *Calappa*, *Galenopsis*). *Palaega pisana* n. sp. represents the first report of isopods crustaceans from this locality.

Material

Two specimens in dorsal view consisting of a posterior moult slightly crushed dorso ventrally, three-dimensionally preserved on two little slabs of blue-gray clay. The specimens are fixed only with a film of polyvinyl acetate for the study and preservation. The studied specimens are housed in the Paleontological Collections of the Museo of the Gruppo Paleontologico “C. De Giuli”, Castelfiorentino (Firenze) housed in the Biblioteca Comunale Vallesiana (GPDG) and in the Centro Civico “Ofelia Mangini”, seat of the gruppo GAMPS, Badia a Settimo, Scandicci (Firenze) (NM). The systematic paleontology used in this paper follows the recent classification proposed by Brandt and Poore (2003).

Systematic Palaeontology

Order Isopoda Latreille, 1817
Suborder Cymothoida Wägele, 1989
Family Cirolanidae Dana, 1852
Genus *Palaega* Woodward, 1870

Type species: *Palaega carteri* Woodward, 1870, by original designation.

Fossil species: for an updated list see Feldmann & Goolaerts (2005), Feldmann & Rust (2006) and Poltz *et al.* (2006).

Discussion. Fossil isopods are commonly known only from posterior parts of their exuviae as a result of the typical biphasic moulting (George, 1972), while many important characters are present on the cephalic area and on the ventral remains of the body. The attribution to the different families and genera is very difficult if not impossible when based only on incomplete partial parts as in the fossil specimens. Wilson (1998), however, remarked that in isopods a single cephalothorax or pleoatelson is character sufficient for a specific assignation. The studied specimens show general major affinities with Cirolanidae and particularly with *Palaega* Woodward, 1870. This genus is still the subject of discussion; for example, Bowman (1971) considered *Palaega* simply as group-assemblage; in any case, according to Wägele (1989), the placement of *Palaega* within Cymothoida is unclear and its position requires a reexamination of the type samples (Feldmann & Rust, 2006).

The type specimen *Palaega carteri* was erected by Woodward (1870: 496) based on a posterior part, “Thoracic segments divided transversally in two parts by a line, the anterior being smooth; epimeres pointed and curved backwards; telson semicircular somewhat broader than long, posterior margin dentate; presence of a slightly raised medial ridge terminating with a small spine and lateral margin border with a series of raised plicae.” Other early diagnose enlarged these features (Von Ammon, 1882; Van Straelen, 1928), so that several recent attributions are based on descriptions not strictly consistent with the type species. Recently Feldmann & Goolaerst (2005) doubted that a number of species could be attributed to the genus *s. str.* Brandt & Poore (2003) have recently revised the suborder dividing Flabellifera Sars, 1882, into the Cymothoidea Leach, 1814, and the Cymothoidea Wägele, 1989 including the single family Cirolanidae within which is *Palaega*. Among the Cirolanidae, *Palaega* and the “supergiants group” (Lowry & Dempsey, 2006) represented by *Bathynomus* A. Milne Edwards, 1879 have “remarkably similar posterior exuviae” . . . so great that the species have often been considered synonymous; however, a ruling of the International Commission on Zoological Nomenclature (1992) concluded that, when cases of synonymy are considered, *Bathynomus* shall take precedence.” (Feldmann & Rust, 2006). Instead, as suggested also by Feldmann (pers. comm., 2009), the studied specimens have general features of *Palaega*, as the arrangement of pleonites, distal points of the epimeres with medial keel directed posteriorly, broad pleotelson with smooth partial medial keel, sub-trapezoidal in shape and rounded posteriorly; presence of spines on the posterior margin. The ornamentation is granulate to pustulose on all the body. The relative small size of the specimen GPDG0091 for the genus following the features emphasized by Van Straelen (1928) is, in our opinion, a minor feature in assigning to a genus because it is impossible to know the exact growth stage and if the moult represents a juvenile, subadult, or mature specimen.

On the basis of all these remarks, and waiting revision clarifying the problematics of the genus or discovery at new, more complete material, we place confidently our new species within *Palaega* as it is now constituted (Feldmann & Goolaerts, 2005).

Palaega pisana n. sp.

Figs. 1-3

Diagnosis: pleurae of pleonites short directed laterally, terminate as medium-sized triangular lateral spines pointed posteriorly. Pleotelson subtrapezoidal rounded posteriorly, broader than long; inflated centrally with central keel on the midline more developed on the posterior part, ending with a spine. Four pairs of short triangular robust similar spines on posterior margin.

Etymology: the trivial name alludes to Pisa Province where the specimens have been discovered.

Holotype: NM50.

Paratype: GPDG0091.

Geological age: Pliocene (Argille azzure Formation).

Type locality: Pozzavilla (Orciano Pisano, Pisa), Toscana, Central Italy.

Occurrence and measurements: two incomplete specimens from Orciano Pisano, Pisa (Toscana, Italy).



Fig. 1 - *Palaega pisana* n. sp. Holotype/Olotipo, NM50 (x 2).

NM50 – total length: 80 mm; maximum width: 50 mm.

GPDG0091 – total length: 28.5 mm; maximum width: 25 mm.

Description. In the holotype (NM50) pereonite 5, 6, and 7 preserved, equals in length (10 mm); pereonite 5 twisted dorsally and disarticulated. All five free pleonites, well preserved and articulated, complete pleotelson and left exopodite of the uropod. Body moderately convex. Epicuticle partially preserved on all parts of the body. Right epimere of pereonite 6 and 7 large, triangular, with a smooth medial keel, pointed posteriorly and partially overlapped to one another. Pereonite 6 (length 10 mm) slightly rounded dorsally, laterally directed toward posterior part, wider than pleonites, acute coxa with smooth median keel. Five free pleonites about $\frac{1}{2}$ length than the pereonites (total length 45 mm, width 11 mm) well exposed dorsally, more complete on the right border, sub-parallel to one another straight medially, the epimeres seem more laterally pointed than anterior ones. Pleonites 1 and 5 (width about 5 mm) are shorter or more compressed than 2-4 (width 3 mm); pleonites 4 and 5 tapering slightly posteriorly in width, with lateral epimeres having a possible median keel on distal part but not distinctly separate from the pleurae and terminate as medium-sized lateral spines



Fig. 2 - *Palaega pisana* n. sp. Paratype/Paratipo, GPDG0091 (x 3.5).

directed posteriorly, not completely exposed distally. Pleotelson crushed (length 30 mm, width 44 mm) sub-trapezoidal in outline but rounded posteriorly, broader than long, longer than the total 5 pleonites. Convex in section, with an expanded moderately inflated central bulge, following the form of the outline of the margin flattened along the borders. Posterior margin bearing four pairs of triangular and broadened spines. A long medial keel crosses on the midline of the pleotelson, partially deformed due to the compression of the exuvia and more evident in the posterior part. Left elongated uropodal ?endopod partially exposed, curved laterally; truncated pointed margin tip shorter than the pleotelson, and with a possible tiny spinose external margin. Epicuticle nearly complete, preserved on pleonite and pleon, ornamented by micro-granulate punctae, irregular small, sparse tubercles.

The paratype (GPDG0091) is smaller and less preserved, lacking the diagnostic ornamentation of the pleotelson; moreover the specimen shows the same general characters, arrangement of the pleon and ornamentation of the holotype. The posterior margin of the pleonites is slightly convex medially and the short medial keel in the epimeres is more evident. Right elongate uropodal ?exopod partially exposed.

Discussion. *Palaega pisana* n. sp. has been compared with the type species, *Palaega carteri* Woodward, 1870, and the other two species of the genus from the Pliocene, *Palaega sismondai* Ristori, 1891, from Toscana, Italy and *Palaega kakatahi* Feldmann & Rust, 2006, from New Zealand. *Palaega carteri* differs from *P. pisana* n. sp. in having the transversal line dividing the pleonites into two parts with smooth anterior part; in the medial keel of the pleotelson terminating posteriorly in a small spine; in having the raised plicae along the lateral margin. *Palaega sismondai* differs from *P. pisana* n. sp. in having longer epimeres, pleonites decre-

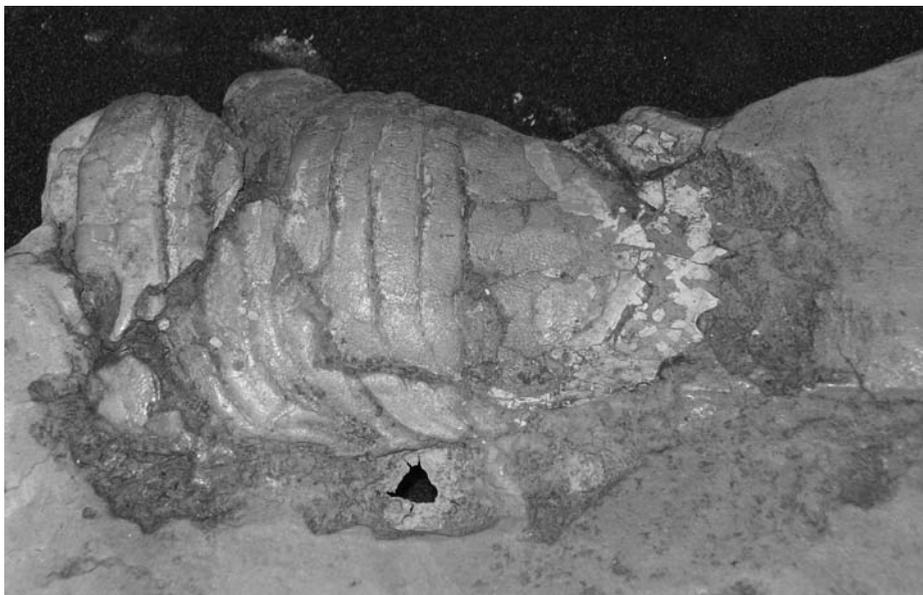


Fig. 3 - *Palaega sismondai* Ristori, 1891. Holotype/Olotipo, MUSNAF 4609 (x 2.5).

asing in width posteriorly and overlapping one another; shorter pleotelson and one shorter medial ridge, that is $\frac{2}{3}$ of the total length of the pleotelson. We made also a direct comparison with this old species, housed in the Museo di Storia Naturale dell'Accademia dei Fisiocritici (Siena) originally poorly described and figured by Ristori (1891, see Appendix). Unfortunately, due the poorly preservation and the incomplete margin of the pleotelson, it was impossible to make a more detailed description of this species and above all to clarify the exact number (3, 4 or more) of the paired marginal spines of the pleotelson (Fig. 3). Finally, *P. kakatahi* differs from *P. pisana* n. sp. in having a different outline; the form of the spines of pleopods is more elongated and pointed; the number and form of the spines on the slender pleotelson (3 pairs).

Environmental notes

It is interesting to note that both cirrolanid isopods from Toscana (*P. sismondai* and *P. pisana* n. sp.) come from deep-water deposits as testified by the mollusk associations and the abundance of marine mammal remains. A “whale fall community” like that of Orciano Pisano, represents a rich source of food for many groups of different predators and benthic scavengers, like the isopods of the fossil *Palaega* and extant *Bathynomus*. This particular environment may be more adapted to the life style and behavior of these specimens, unknown to date in other Pliocene sediments of shallower waters that are more extensive in the Italian peninsula. More specific research in this direction and new fossil material is necessary to enlarge the record of this isopod family.

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Appendix

The purpose of this appendix is to provide a literal translation of the description of *Palaega sismondai* Ristori, 1891; written originally in ancient Italian language and never translated into English, as an aid to the worldwide researchers. Notes are in square brackets [].

- Ristori G., 1891 - Contributo alla fauna carcinologia del Pliocene italiano. *Atti della Società Toscana di Scienze Naturali*, Pisa: 17-18; (Tavola I, fig. 13): “... Anyhow here is an outline description of my new specie: General form very lengthened, body moderately convex. Thorax segments [pereonites] very arched, fairly narrow, imbricate, and arranged in perfect parallelism. Epimeres very lengthened in form of flat spines, acute, and crossed in the middle by a little raised carena. Abdominal segments [pleonites], that are complete in my specimen, are as always five,- excluding the last [telson], that deserves a special mention- a little shorter than the anterior segments [pereonites] and ranged always parallel one to other; moreover them edges don't drawing an arc of a circle, like the thoracic segments, but fold abruptly laterally, and in the middle are nearly straight, trending to become throughout more concave, going towards the last segment [pleotelson]. The epimeres are very lengthened, flat and pointed; spiniforms and imbricate like those of the thorax, in way that the upper cover almost totally the lower. The last abdominal segment or sixth (telson) is very big, measuring 25 mm [0.98 inch] in width and 21 mm [0.82 inch] in length. This is crossed in the middle length by a keel or costa originate from the upper side running down just to $\frac{2}{3}$ of the length; the margin of this segment [pleotelson], although not complete in the studied specimen, has flat pointed denticles with wide base and well distinct edges. This set of teeth seems push forward just to touch the epimeres of the fifth segment [pleonite 5], so is very possible to think of an analogy between these spines and the epimeres, with which ends all the thoracic and abdominal segments. These points are less acute, more flat and larger at the basis of the equivalents of the others fossil species of *Palaega* known to date [1891]. Locality: Mucigliani [near the railroad tunnel], Siena (Tuscany, Central Italy), Pliocene clays [Museo dei Fisiocritici, Siena; repository: Museo di Storia Naturale dell'Accademia dei Fisiocritici (MUSNAF)], only one specimen [catalog number: 4609]”.

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