

Etisus evamuelleræ, a new xanthid crab (Decapoda, Brachyura) from the Middle Miocene of Austria and Hungary

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On the basis of several carapaces, a new species of xanthid crab, *Etisus evamuelleræ*, is described from the Middle Miocene of the Vienna (Austria) and Great Hungarian basins. It differs from the coeval xanthids, *Xantho moldavicus* and *Pilodius vulgaris*, in having a distinctly protruding front and comparatively longer carapace. Contrary to those two species, the new one makes up for just a small percentage in the decapod crustacean assemblages studied.

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Introduction

Decapod crustacean assemblages in reef habitats worldwide often are dominated by xanthid crabs. This pattern can also be traced into the geological past, as xanthids have been shown to predominate in many Neogene decapod faunas (Müller, 1984, 1993, 1996, 2004).

Although the specific identification of extinct xanthids is comparatively straightforward, assignment to genera and subfamilies is far less so. A recent phylogenetic analysis of the Xanthidae *sensu stricto* (Lai *et al.*, 2011) has shown that the use of only 'dorsal' features (*e.g.*, carapace outline, nature of chelipeds and legs) may lead to paraphyletic and even polyphyletic groupings. Naturally, this makes interpretation of the xanthid fossil record much more difficult than discussed to date (Karasawa & Schweitzer, 2006). However, 'unnamed' often is synonymous with 'does not exist'; therefore, we describe and name a new xanthid crab below.

Geological setting

The material studied comes from the following localities:

1. Eisenstadt-Sopron Basin (a satellite of the Vienna Basin): Fenk quarry at Gross Höflein (Burgenland), the type locality of the Leitha Limestone (Steininger & Papp, 1978). Here, two major facies, a deep-water and a coral one, are exposed (Riegl & Piller, 2000); both are of late Langhian/early Serravallian age ('middle Badenian'), corresponding to nannoplankton zone NN5 (*sensu* Martini, 1971; Young, 1998; see also Wiedl *et al.*, 2013). For sedimentological details and a palaeoecological interpretation reference is made to Dullo (1983), Riegl & Piller (2000) and Wiedl *et al.* (2013). Riegl & Piller (2000) considered the palaeoenvironment to have consisted of coral carpets. The decapod crustacean fauna has been described and illustrated, albeit in part, by Bachmayer & Tollmann (1953), Müller (1984, 1998) and Hyžný (2012).
2. Great Hungarian Basin: quarry at Zebegény (northern Hungary). Here red algal marly limestone is exposed, intercalated with two 2-m-thick layers of micritic calcarenite (Müller, 1984; Dulai *et al.*, 2010). Decapod crustaceans from these coral-rich layers were described by Müller (1984). The age of the strata exposed is Langhian ('early Badenian'; see Dulai *et al.*, 2010). For sedimentological details and a palaeoecological interpretation reference is made to Strausz (1924), Müller (1984) and Dulai *et al.* (2010).

Material and methods

Specimens of the new species described below (Pl. 1, figs. 1-3) were compared with other co-occurring xanthids, in particular with the type and additional material of *Pilodius vulgaris* (Glaessner, 1928) and *Xantho moldavicus* Yanakevich, 1977. Of the latter, only an illustration of the type, here refigured as Pl. 1, fig. 6, was available. The carapace region terminology follows that of Dana (1852; see also Serène, 1984).

The newly described material is deposited in the collections of the Naturhistorisches Museum Wien, Vienna, Austria (NHMW) and the Natural History Museum at Budapest, Hungary (M).

Systematic palaeontology

Order Decapoda Latreille, 1802
Infraorder Brachyura Latreille, 1802
Section Eubrachyura de Saint Laurent, 1980
Subsection Heterotremata Guinot, 1977
Superfamily Xanthoidea MacLeay, 1838
Family Xanthidae MacLeay, 1838

Remarks – With more than 600 species, this family is the most speciose group within the infraorder Brachyura (Ng *et al.*, 2008). The taxonomy and systematics of the family are markedly complex (Guinot, 1978; Serène, 1984; Karasawa & Schweitzer, 2006; Clark, 2007; Lai *et al.*, 2011) and are far from stable (Lai *et al.*, 2011, p. 408). Members of the

family have traditionally been classified on the basis of carapace shape and the nature of lateral dentition, chelipeds and walking legs. However, these features are considered to have been subject to convergence (see *e.g.*, Guinot, 1977a, b, 1978, 1979); the most recent phylogenetic analysis supports this view (Lai *et al.*, 2011). In this respect, characters of the thoracic sternum and male gonopods, position of genital openings and morphology of the first zoea are more informative in elucidating phylogenetic relationships among the Xanthidae (Guinot, 1978, 1979; Lai *et al.*, 2011; Guinot *et al.*, 2013). The family is in need of more detailed studies, both of extant and fossil members, in order to arrive at consensus.

Subfamily Etisinae Ortmann, 1893

Diagnosis – Carapace with dorsal surface finely granular or smooth; regions more or less delineated and projecting, but always indicated. Four to eight acute or subacute anterolateral teeth behind exorbital angles. Front more or less projecting; bilobed or quadrilobed, with noticeable median fissure, and lateral sinus separating supra-orbital angles; breadth less than one-third maximum width of carapace. Antennules fold transversely. Basal antennal article with outer anterolateral lobule (sometimes weak) occupying orbital hiatus; antennal flagellum excluded from orbit. Chelipeds with extremities of fingers rounded and spoon-shaped. Walking legs typically with dactyl-propodal articulation formed by rounded prolongation of propodal lateral margin sliding against and beneath projecting button situated proximally on lateral margin of dactylus (if not clearly differentiated, dactylus apically bifid) (from Davie, 2002, p. 529).

Remarks – Members of this subfamily, which comprises *Etisus* and the monospecific *Paretisus* Ward, 1933, have spoon-tipped fingers. However, this feature also characterises other subfamilies such as Chlorodiellinae Ng & Holthuis, 2007, Cymoinae Alcock, 1898, Liomerinae Sakai, 1976, and Xanthinae MacLeay, 1838. The fossil record of the Etisinae Ortmann, 1893 is rather poor; several species of *Etisus* H. Milne Edwards, 1834 has been described (Schweitzer *et al.*, 2010; see also below).

Genus *Etisus* H. Milne Edwards, 1834

Type species – *Cancer dentatus* Herbst, 1785, by the subsequent designation of Glaessner (1929).

Diagnosis – The carapace is feebly convex, both longitudinally and transversely. The frontal margin is usually feebly developed in front of the supraorbital angles. The antennules are transversely folded. The buccal cavity is hardly elongated (from Serène, 1984, p. 218; see also Poore, 2004, p. 468).

Remarks – A few species of *Etisus* are known only as fossils. Van Straelen (1938) described *Cancer javanicus* from the Pliocene of Java. Nations (1975) opined that it fits the diagnosis of *Cancer* Linnaeus, 1758; Schweitzer *et al.* (2010) listed the taxon under *Etisus* without further explanation, and we are not aware of any other published discussion on the species. Hu & Tao (2000) erected *Etisus pleistocenicus* for the fragmentary material

from the Pleistocene of Taiwan. Beschin *et al.* (2007) described *Etisus ardunoi* Beschin, Busulini, De Angeli & Tessier, 2007 from the Lower Eocene of Italy. In none of these occurrences a detailed discussion on referring the material to the respective genus is provided. For instance, Beschin *et al.* (2007, p. 59) based their assignment on the general shape of the carapace, characteristics of the anterolateral margins and the presence of distinct front. In fact, the diagnoses of Etisinae and *Etisus* presented above mention only few characters that can be used by palaeontologists. As a consequence for the fossil taxa the assignment to *Etisus* is largely based on the similarities with particular species. Indeed, Beschin *et al.* (2007) referred their material as morphologically closest to extant *Etisus laevimanus* Randall, 1840. Similarly, our Middle Miocene material is close to *Etisus electra* (Herbst, 1801), which has comparable general outline and pronounced frontal lobes (compare Guinot, 1964, p. 49, text-figs. 21, 22; pl. 5, fig. 1).

The genus *Etisus*, as recognised by Ng *et al.* (2008), has recently been shown to be polyphyletic (Lai *et al.*, 2011, p. 422). For this reason, the generic assignment of the new species described below, on the basis of carapace morphology alone, is preliminary. Unfortunately, no ventral parts or chelipeds are preserved.

Etisus evamuelleriae n. sp.

Pl. 1, figs. 1-3; Pl. 2.

?1953 *Titanocarcinus vulgaris*; Bachmayer & Tollmann, p. 314 (*partim*).

?1993 *Etisus?* sp.; Müller, p. 21, fig. 10G, I.

Diagnosis – Transversely ovate carapace with protruding, bilobed front; anterolateral margin with four distinct teeth; anterior parts of epigastric (1M) and protogastric (2M) regions forming transverse ridges; branchial regions 1R and 2R fused into elongated area with strongly concave anterior margin.

Type – The holotype is a complete dorsal carapace (NHMW 2011/0167/0065) from the Fenk quarry at Gross Höflein, Lower Austria (Pl. 1, fig. 1).

Other material – In addition to a near-complete dorsal carapace (NHMW 2013/0608/0001; Pl. 1, fig. 2) from the type locality, there is a near-complete dorsal carapace (M INV 2014.74; Pl. 1, fig. 3) from Zebegény.

Etymology – The specific epithet honours Éva Müller, wife of Pál Müller, who was the first to recognise this new form.

Table 1. Measurements (in mm) of sufficiently well-preserved dorsal carapaces of *Etisus evamuelleriae* n. sp. Abbreviations: ML = maximum length; LP = length of posterolateral margin; MW = maximum width; FW = width of frontal margin (front + orbits); RW = width of front; PW = width of posterior margin.

specimen	ML	LP	MW	FW	RW	PW
NHMW 2011/0167/0065	22.7	11.2	27.4	14.0	6.2	12.5
NHMW 2013/0608/0001	14.2	5.8	17.7	8.0	4.0	7.0
M INV 2014.74	–	–	–	11.5	5.7	–

Description – Carapace transversely ovate; front protruding, bilobed, frontal width approximately one quarter of carapace width; orbits deeply incised; anterolateral margin convex, adorned with four distinct teeth pointing forwards; posterolateral margin slightly convex; posterior margin rimmed, approximately twice wider than front; carapace regions well delineated, markedly in anterior half except for frontal lobes 1F and 2F, surface sparsely scabrous, ornamented with rough tubercles on “anterior” regions, i.e., 1M, 2M, 1L, 2L, 3L and 4L; 2M partially divided longitudinally, narrower inner branch confluent with adjacent 1M (epigastric region), anterior parts of 1M and 2M form transverse ridges; 1M square; 3M (mesogastric region) well defined, very narrow anteriorly and moderately widening posteriorly; 4M (urogastric region) short and wide; branchial regions 1R and 2R fused into elongated area with strongly concave anterior margin; 3R (metabranial) relatively large; 1P (cardiac region) not clearly delineated and not separated from intestinal region 2P. Ventral aspects of carapace and appendages unknown.

Occurrence – Middle Miocene (‘Badenian’) of Austria (type material) and Hungary and questionably also Middle Miocene of Catalonia (Müller, 1993, fig. 10E, G, I).

Remarks – Glaessner (1928) described a new species, *Titanocarcinus vulgaris*, on the basis of a single near-complete carapace (see Pl. 1, fig. 4) from Middle Miocene coral limestone at Rauchstallbrunngraben (Austria); some dissociated cheliped fragments from different facies at several other nearby localities were included. Müller (1984) opined that *T. vulgaris*, as originally defined, was in fact an admixture of various taxa; he considered the holotype of *T. vulgaris* to be fairly close to *Pilodius* Dana, 1851, and transferred it to that genus. However, it should be noted that Müller (1984, p. 91) was aware of the unresolved taxonomic issues surrounding that genus and that he used *Pilodius* as a collective taxon. Following the revision of extant members of *Pilodius* (Clark & Galil, 1993), *Titanocarcinus vulgaris* remained in *Pilodius* (Müller, 1998; Schweitzer *et al.*, 2007, 2010), not having been evaluated or revised since Müller (1984).

Bachmayer & Tollmann (1953) identified *Titanocarcinus vulgaris* also at the Fenk quarry in the vicinity of Gross Höflein. They, however, did not figure the studied specimens and only noted the presence of the species. Indeed, among the material of Bachmayer’s collection from the Fenk quarry deposited at NHMW recently studied by one of us (MH), also some specimens attributable to that taxon have been found. In addition, one carapace has been identified, which together with the newly collected material from the same locality, forms the basis for the description of *Etisus evamuelleræ* n. sp. The new species accounts for just a small percentage in the Fenk quarry assemblage. In fact, out of > 2,000 crabs, only four carapaces belong to the new species. In this respect it has to be noted that the decapod assemblage at the Fenk quarry consisting of approximately 30 taxa is strongly dominated by two species, *Chlorodiella mediterranea* Lörenthey in Lörenthey & Beurlen, 1929 and *Petrolisthes haydni* Müller, 1984. More than a half of all identified species at the locality are known only from a handful of specimens, thus, the scarcity of *Etisus evamuelleræ* n. sp. should not be surprising. The same can be postulated also for the Hungarian locality Zebegény, where the studied assemblage has virtually the same composition (Müller, 1984, p. 44).

From the Miocene of Catalonia, Müller (1993) recorded *Etisus?* sp. on the basis of two specimens. We tentatively assign the material to *E. evamuelleræ* n. sp.

Etisus evamuelleræ n. sp. is morphologically close to extant *E. electra*, but the furrow separating regions 1M and 2M is comparatively longer in the latter taxon (Guinot, 1964, pl. 5, fig. 1). *Etisus evamuelleræ* n. sp. differs from co-occurring xanthids mainly in having a distinctly protruding front. In *Pilodius* the front hardly projects, if at all (Poore, 2004, p. 466; compare Pl. 1, fig. 4), whereas one of the most widespread Miocene xanthids *Xantho moldavicus* has a typically straight frontal margin (Pl. 1, fig. 6). *Xantho moldavicus* and *Pilodius vulgaris* have moderately to strongly areolated dorsal carapaces (Müller, 1984), whereas the new species has only weak carapace ornament, although this may be a preservational artifact. The holotype of *Xantho moldavicus* has an elliptical carapace outline (Pl. 1, fig. 6). Although various carapace length/width ratios have been noted for this species (see Radwański *et al.*, 2006, fig. 8), no closer examination of this range of variation has so far been conducted. The type carapace of *Pilodius vulgaris* is less wide (Pl. 1, fig. 4) than that of *X. moldavicus*. In this respect, *Etisus evamuelleræ* n. sp. has the proportionally longest (or narrowest) carapace (Pl. 1, figs. 1-2; Pl. 2).

The co-occurrence of *Etisus* and *Pilodius* at the studied localities Fenk quarry and Zebegény has its analogue in recent conditions. Galil & Vannini (1990) reported two *Etisus* species (including *Etisus electra*) co-occurring with two *Pilodius* species at the same locality at the coast of Somalia. Similarly, Guinot (1964) noted the presence of both genera in studied areas of the Red Sea and Aldabra.

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Plate 1

Etisus evamuelleræ n. sp. (Figs. 1–3) and co-occurring Middle Miocene xanthids (Figs. 4–6).

Fig. 1. *Etisus evamuelleræ*, holotype, NHMW 2011/0167/0065, Fenk quarry, Austria.

Fig. 2. *Etisus evamuelleræ*, NHMW 2013/0608/0001, Fenk quarry.

Fig. 3. *Etisus evamuelleræ*, M INV 2014.74; Zebegény, Hungary.

Fig. 4. *Pilodius vulgaris* (Glaessner, 1928), holotype (NHMW 1927/0001/0002); Rauchstallbrunngraben, Austria.

Fig. 5. *Pilodius vulgaris*, NHMW 2011/0167/0176, Fenk quarry.

Fig. 6. *Xantho moldavicus* Yanakewitch, 1977, holotype (digitalised copy of Yanakewich, 1969, pl., fig. 6).

Specimens in Figs. 1, 2, 4 and 5 were coated with ammonium chloride prior to photography. Scale bar equals 5 mm.

Plate 2

Etisus evamuelleræ n. sp.

Fig. 1. Reconstruction of dorsal carapace based on the holotype, NHMW 2011/0167/0065.

Fig. 2. Scheme of dorsal carapace regions.

