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***Calappa granulata* (Linnaeus, 1758) (Crustacea, Decapoda, Brachyura, Calappidae) and *Astioplax aspera* n. gen., n. sp. (Crustacea, Decapoda, Brachyura, Goneplacidae) from the Asti sands Fm. (Late Pliocene) of S. Pietro (Asti, Piedmont, NW Italy)**

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Abstract

Two crabs from the Pliocene sands of S. Pietro (Asti, Piedmont, NW Italy) have been assigned to *Calappa granulata* (Linnaeus, 1758) (Calappidae De Haan, 1833) and to *Astioplax aspera* n. gen., n. sp. (Goneplacidae MacLeay, 1838). Although *C. granulata* has already been reported from the Pliocene of other Italian regions, the Piedmont specimen represents one of the most complete carapaces known to date in the fossil record of this extant species. The discovery of *Astioplax* n. gen., with *A. aspera* n. sp. increases the number of species of Goneplacidae from the Pliocene of Italy, limited to *Goneplax rhomboides* (Linnaeus, 1758) and *G. sacchi* Crema, 1895.

Keywords: Crustacea, Decapoda, Brachyura, Late Pliocene, Italy.

Resumen

Dos cangrejos de las areniscas del Plioceno de S. Pietro (Asti, Piemonte, NO Italia) han sido asignados a *Calappa granulata* (Linnaeus, 1758) (Calappidae De Haan, 1833) y a *Astioplax aspera* n. gen., n. sp. (Goneplacidae MacLeay, 1838). Aunque *C. granulata* ha sido previamente reportada del Plioceno de otras regiones de Italia, el ejemplar de Piemonte representa uno de los más completos caparazones conocidos hasta la fecha en el registro fósil de esa especie viviente. El descubrimiento de *Astioplax* n. gen., con *A. aspera* n. sp., incrementa el número de especies de Goneplacidae del Plioceno de Italia, limitado a *Goneplax rhomboides* (Linnaeus, 1758) y *G. sacchi* Crema, 1895.

Palabras Clave: Crustacea, Decapoda, Brachyura, Plioceno superior, Italia.

1. Introduction

The specimens were discovered in sand blocks crashed by natural erosion along the hills of S. Pietro outcrop located near Asti, Piedmont (NW Italy), in the Astian Pliocene Basin. The yellow sedimentary Asti sands constitute the main body of the surrounding hills, and were deposited in

a coastal environment of the old Padano Gulf. The marine Asti sands Fm. is rich in fossils, mainly in molluscs, indicating an infralittoral environment (Astiana facies), and was dated to the Late Pliocene (Damarco, 2009). Lacking micropaleontological and sedimentological data, we assign the specimens to the Asti sands Fm. (Late Pliocene) in a generic way.

2. Material

The sample includes two specimens: one carapace dorsally preserved as a three-dimensional mould with the original epicuticle partially preserved; one three-dimensional specimen preserving the carapace and the incomplete right cheliped. The specimens have been assigned to *Calappa granulata* (Linnaeus, 1758) (Calappidae De Haan, 1833) and *Astioplax aspera* n. gen., n. sp. (Goneplacidae MacLeay, 1838). The specimens are deposited in the Palaeontological Collections of the Museo di Storia Naturale di Milano (MSNM).

The systematic arrangement used in this paper follows the recent classifications proposed by Castro (2007) and Ng *et al.* (2008).

2.1. Abbreviations

lc: length of carpus; lcxp: length of carapace; lm: length of merus; wcxp: width of carapace.

3. Systematic Palaeontology

Section Eubrachyura de Saint Laurent, 1980

Superfamily Calappoidea De Haan, 1833

Family Calappidae De Haan, 1833

Genus *Calappa* Weber, 1795

Type species: *Cancer granulatus* Linnaeus, 1758, subsequent designation by Latreille (1810).

Calappa granulata (Linnaeus, 1758)

Figure 1

Cancer granulatus Linnaeus, 1758: 627.

Cancer granulatus – Linnaeus, 1767: 533.

Calappa granulata – Garassino and De Angeli, 2004: 38, fig. 4 (1-3). – Garassino *et al.*, 2004: 264, fig. 7 a-c. – De Angeli and Garassino, 2006: 40. – Ng *et al.*, 2008: 48. – De Angeli *et al.*, 2009: 176, 177, 195, 196, fig. 8a, b. – Schweitzer *et al.*, 2010: 82. – Garassino *et al.*, 2012: 51. – Pasini and Garassino, 2013: 320, 321.

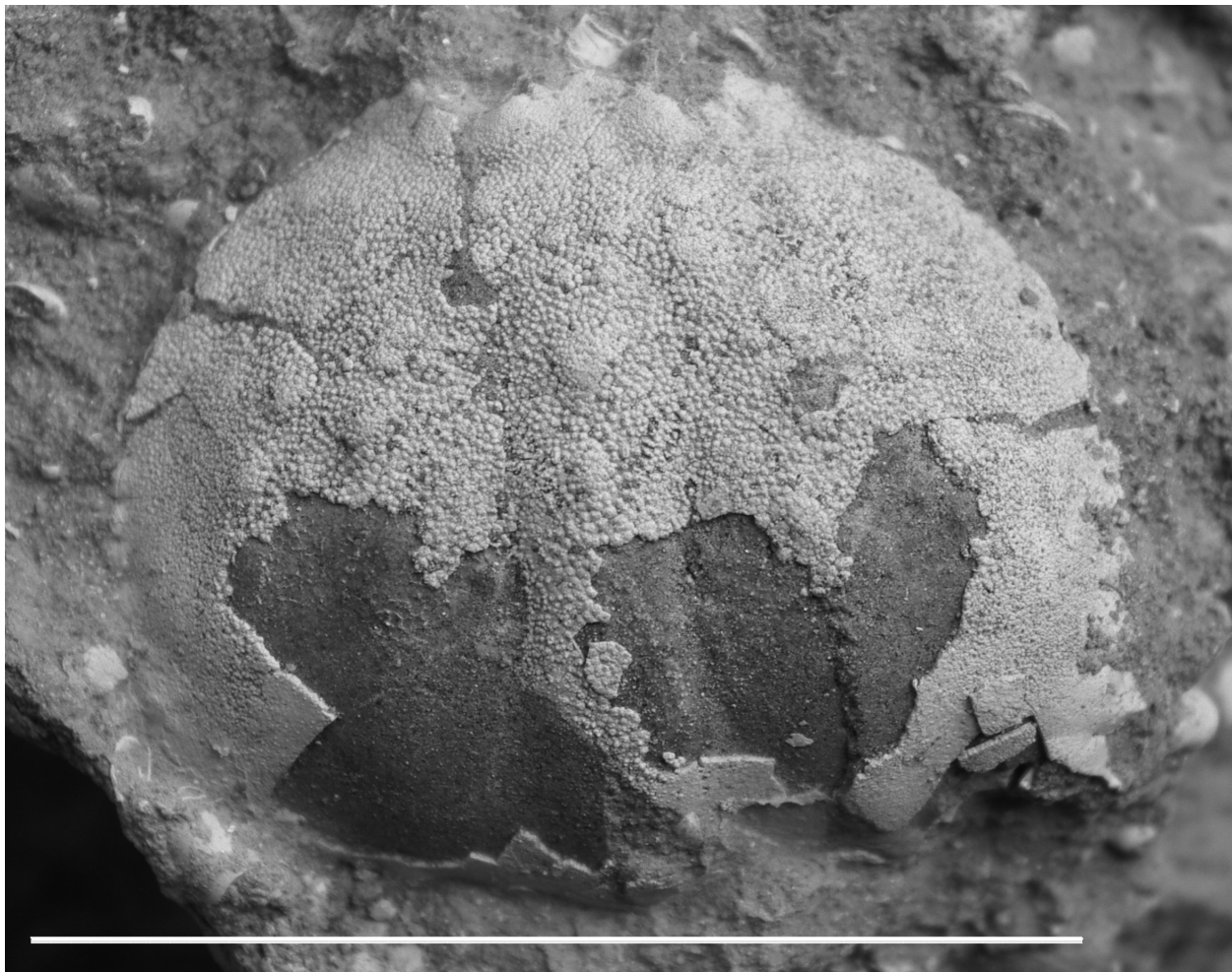


Figure 1. *Calappa granulata* (Linnaeus, 1758), MSNM i27827, dorsal view. Scale bar: 40 mm.

Material and measurements: one carapace in dorsal view (MSNM i27827 – lcxp: 33 mm; wcxp: 40 mm).

Discussion. The specimen has been compared with the extant species of *Calappa* Weber, 1795, from the Indo-West Pacific region from which it differs notably in the general shape and ornamentation of the carapace and distribution of the posterolateral teeth (Ng *et al.*, 2008); and with the extant and fossil *C. granulata*, widespread in the Mediterranean Sea.

Zariquiey-Álvarez (1968) pointed out the main characters of this species, such as the convex and wider than long carapace; rounded anterolateral margins; straight posterior margin; poorly produced, bidentate straight front; small well-marked orbits, inferior margin with two small separate teeth; anterolateral margins with small poorly developed teeth wider at the base, followed on the posterior third by four larger teeth pointed medially; posterior margin straight lacking teeth on the median portion; mesogastric and cardiointestinal regions appear fused, forming a prominent longitudinal ridge delimited laterally by two marked longitudinal grooves; at each side of these two grooves, generally four longitudinal grooves not reaching the posterior margin and delimiting other ridges; all the ridges bear longitudinally nodules of decreasing size, with the larger sizes in the mesogastric region; a small nodule is present in the anterior cardiac region; the other regions are covered by granules.

The specimen, although poorly preserved, shows close affinities with *C. granulata* as follows: suboval convex carapace wider than long; straight front and small rounded orbits; raised convex anterolateral margins, with posterior triangular and pointed teeth and nearly straight posterior margin; regions well marked by two longitudinal grooves that divide the carapace in three parts; tuberculate longitudinal ridges and a dense granulation covering the regions, mainly the central dorsal part of the carapace. The specimen is also very similar in shape and ornamentation to the only carapace from the Italian Pliocene of Tuscany reported by De Angeli *et al.* (2009; 177, fig. 8). Based on these data we attest that the previous reports from the Pliocene of Piedmont, Emilia Romagna, and Sicily and from the Pleistocene of Monte Pellegrino (Sicily) can be assigned to the extant and fossil *C. granulata* (Ristori, 1891; Gemmellaro, 1914; Garassino and De Angeli, 2004; Garassino *et al.*, 2004; De Angeli *et al.*, 2009; Pasini and Garassino, 2013).

Superfamily Goneplacoidea MacLeay, 1838

Family Goneplacidae MacLeay, 1838

Subfamily Goneplacinae MacLeay, 1838

Genus *Astioplax* n. gen.

Diagnosis: carapace transversely rectangular, much wider than long; front slightly turned downwards, not

marked by slight median notch or projection; inner edge of supraorbital margin distinct; wide orbits 1.3 longer than front; outer orbital angle without teeth or spines; supraorbital margins strongly sinuous; suborbital margins sinuous, toothless; anterolateral margins slightly convex, toothless; posterolateral margins straight, converging posteriorly; posterior margin long, slightly convex; dorsal surface of carapace conspicuously granular, with slight horizontal ridges, moderately convex, without clear indication of regions; produced lateral knock under the postorbital angles; stout and heavy chelipeds, strongly granulose.

Etymology: from Asti, city located close to the outcrop where the specimen was discovered.

Type species: *Astioplax aspera* n. gen., n. sp. (gender feminine).

Description: as for the type species.

Discussion. The family Goneplacidae, as reported by Castro (2007), has the following diagnostic characters: carapace transversely rectangular, subquadrate, or trapezoidal; front narrow to wide, typically lamellar, straight; dorsal surface smooth; varying number of anterolateral spines posterior to outer orbital angle (sometimes none but typically one or two); orbits moderately to conspicuously wide, long; fissure in supraorbital margin absent; dorsal surface of carapace typically smooth or with slight horizontal ridges, moderately convex, without clear indication of regions. Most of these characters are present in the specimen, here, assigned to Goneplacidae. Moreover, we justify the erection of the new genus *Astioplax* based on some supplementary morphological observations. The outer orbital angle and the anterolateral margin of carapace spineless of *Astioplax* n. gen. are two characters shared with the extant *Notonyx* Milne Edwards, 1873. The carapace, however, is distinctively quadrate and the typically smooth dorsal surface of *Notonyx* exclude *Astioplax* n. gen. from belonging to this genus. The dorsal surface of the carapace of the *Astioplax* n. gen., with slight horizontal ridges, moderately convex, without clear indication of regions, is a character shared with some species of the extant genera: *Carcinoplax* H. Milne Edwards, 1852, *Pycnoplax* Castro, 2007, *Goneplax* Leach, 1814, *Neogoneplax* Castro, 2007, *Paragoneplax* Castro, 2007, and *Ommatocarcinus* White, 1852 (see Castro, 2007). The dorsal surface of the carapace, however, conspicuously granular in *Astioplax* n. gen., excludes it from belonging to *Pycnoplax*, *Goneplax*, *Neogoneplax*, and *Paragoneplax* where the dorsal surface of the carapace is typically smooth. We also exclude it from belonging to *Carcinoplax*, although slight horizontal ridges and granules along the antero- and posterolateral margins are present in two species, *C. cracens* Castro, 2007, and *C. tuberosa* Castro, 2007; as reported by Castro (2007) these are not considered as generic characters. Finally, although the carapace of *Ommatocarcinus* has slight horizontal ridges, a smooth or conspicuously granular dorsal surface and the anterolateral margin toothless, the outer orbital angles, each with a conspicuous acute tooth, exclude *Astioplax* n. gen.

from belonging to this genus.

As reported by Karasawa and Kato (2003) and Schweitzer *et al.* (2010) the Goneplacidae includes eight fossil genera: *Amydrocarcinus* Schweitzer, Feldmann, González-Barba and Vega, 2002; *Carcinoplax* H. Milne Edwards, 1852; *Goneplax* Leach, 1814; *Icriocarcinus* Bishop, 1988; *Kowaicarcinus* Feldmann, Schweitzer, Maxwell and Kelley, 2008; *Magyarcarcinus* Schweitzer and Karasawa, 2004; *Ommatocarcinus* White, 1852; *Psopheticus* Wood-Mason, 1892. *Carcinoplax*, *Goneplax*, and *Ommatocarcinus* are extant genera from which *Astiplax* n. gen. is excluded. *Amydrocarcinus* was described from the Eocene Tepetate Fm. (Mexico) (Schweitzer *et al.*, 2002; Schweitzer and Karasawa, 2004), *Icriocarcinus* from the Late Cretaceous (late Campanian or early Maastrichtian) of San Diego County (California, USA) (Bishop, 1988), *Kowaicarcinus* from the Pliocene of New Zealand (Feldmann *et al.*, 2008), *Magyarcarcinus* from the Late Eocene of Hungary (Schweitzer and Karasawa, 2004), and *Psopheticus* from the Oligocene of Taiwan (Hu and Tao, 1996; Karasawa and Kato, 2003) and the Pliocene of Japan (Karasawa, 1997). We exclude *Astiplax* n. gen. from these genera not only for geological and paleogeographic implications, but also for the ovoid carapace, small and squared orbits, and the dorsal surface of the carapace typically smooth in *Amydrocarcinus*; the pentagonal carapace, anterolateral margins with three acute spines, and the dorsal surface of the carapace strongly ridged of *Icriocarcinus*; the hexagonal carapace, small and ovoid orbits, and tri-lobed anterolateral margin of *Kowaicarcinus*; the circular carapace, small and ovoid orbits, and smooth dorsal surface of the carapace of *Magyarcarcinus*; the subquadrate carapace, the outer orbital angle with acute tooth, anterolateral margin with one acute spine, and the dorsal surface of the carapace typically smooth of *Psopheticus*.

Astiplax aspera n. sp.

Figures 2-4

Etymology: from the Latin *asper*, *aspera*, *asperum* = rough, alluding to the strong granular ornamentation of carapace and cheliped.

Holotype: MSNM i27828 – specimen, lacking left cheliped, chela of right cheliped, and ambulatory legs (lcxp: 22 mm (excluding front); wxcp: 32 mm; lm: 20 mm; lc: 8 mm).

Type locality: S. Pietro (Asti, Piedmont, NW Italy).

Geological age: Asti sands Fm., Late Pliocene.

Description. Carapace transversely rectangular, much wider than long; widest at junction between antero- and posterolateral margins; front slightly turned downwards, not marked by slight median notch or projection; inner edge of supraorbital margin distinct; wide orbits 1.3 longer than front, with granular eye-stalk; orbits greatly expanded distally with outer orbital angle toothless; supraorbital margins strongly sinuous, without fissures; sinuous,

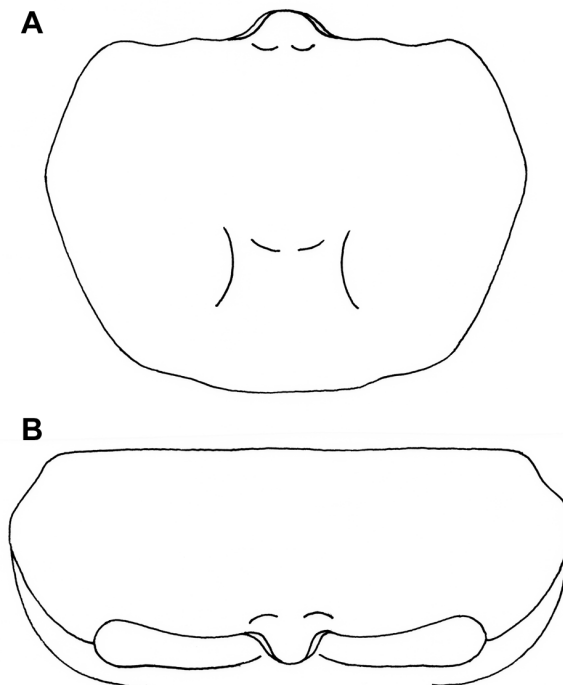


Figure 2. *Astiplax aspera* n. gen., n. sp. A) reconstruction of carapace in dorsal view. B) reconstruction of the carapace in orbito-frontal of the view.



Figure 3. *Astiplax aspera* n. gen., n. sp., holotype/olotipo, MSNM i27828. A) dorsal view. Scale bar: 35 mm. B) orbito-frontal view. Scale bar = 30 mm.

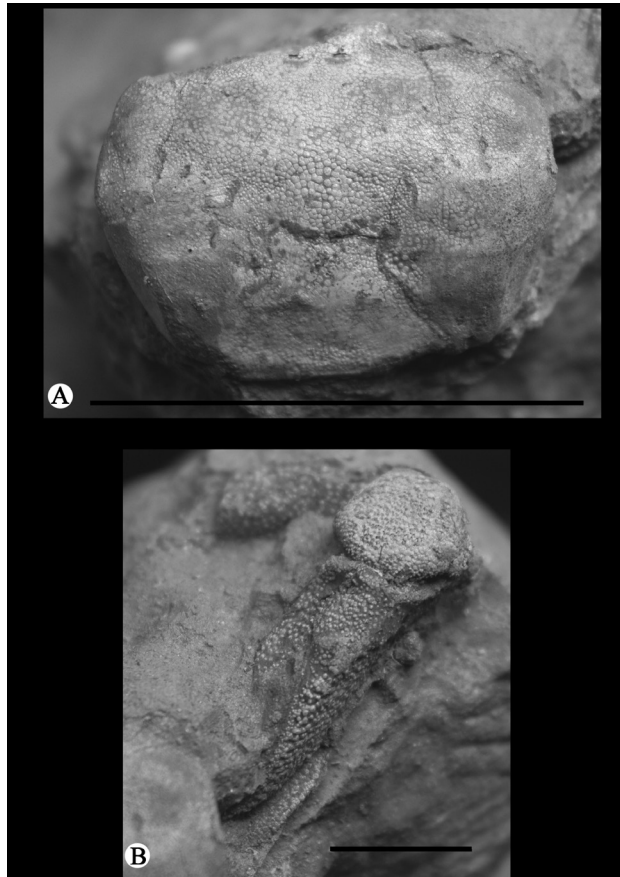


Figure 4. *Astioplax aspera* n. gen., n. sp., MSNM i27828. A) dorsal surface of the carapace conspicuously granular. Scale bar: 35 mm. B) incomplete right cheliped with granular ornamentation. Scale bar = 10 mm.

toothless suborbital margins; toothless anterolateral margins slightly convex; long, straight posterolateral margins, converging posteriorly; long posterior margin slightly convex; deep gastric pits; branchiocardiac grooves slightly distinct in cardiac region; dorsal surface of the carapace strongly granular, with bigger granules in the metagastric region; slight horizontal ridges, moderately convex, without clear indication of regions; an elevated notch under both postorbital angles, produced forwardly. Stout, heavy cheliped, with moderately long merus, subtriangular in section; carpus subsquare in section, dorsolaterally convex and toothless; merus and carpus surface strongly granular; granules of cheliped bigger than those of the carapace.

Discussion. Among the fossil crabs from the Pliocene of Italy, only *Simonellia quiricensis* Vinassa de Regny, 1897 (Euryplacidae Stimpson, 1871) from S. Quirico d'Orcia (Tuscany) could be compared with the new genus (Vinassa de Regny, 1897). As reported by De Angeli and Garassino (2006), however, the holotype of this species is lost, making difficult a comparison between the two species based on the published description and the line drawing (Vinassa de Regny, 1897: Pl. 2, figs. 1, 1a). Moreover,

this specimen was reported from the clays of S. Quirico d'Orcia (middle Pliocene), younger than the Asti sands Fm. (Late Pliocene) from where the specimen was discovered. *Simonellia quiricensis* is therefore considered a *nomen dubium* for not having other specimens of the same species and from the same locality in order to be able to confirm its description. Some characters, reported by Vinassa de Regny, however, distinguish *Simonellia* from *Astioplax* n. gen.: the compressed, ovoid carapace, with sharp margins; the small, ovoid orbits; the anterolateral margin with one spine. Finally it is difficult to compare the ornamentation of the dorsal surface of the carapace. Indeed the author described a "scabrous" surface, a term that does not explain if the surface is granular, tubercular or uneven.

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