

NEW SPECIES OF THE BIVALVE GENERA *DONAX* AND *CALLISTA* FROM THE LOWER PLIOCENE OF HUELVA, SPAIN

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From the Lower Pliocene (Zanclean) of Lucena del Puerto (Huelva, Spain), two new species of the genus *Donax*, *D. garciai* and *D. triangula*, and one new species of *Callista*, *C. verai*, are described and illustrated.

Key words — Bivalvia, new species, Pliocene, Spain.

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INTRODUCTION

The new taxa described in the present paper were collected from the richly fossiliferous Lower Pliocene (Zanclean) strata which outcrop in the vicinity of the village of Lucena del Puerto, as described by Landau (1984). Two of the new species, *Donax garciai* n. sp. and *Callista verai* n. sp., are restricted to the 'grey sands' at localities 4 and 5 of Landau (1984, p. 137, fig. 2). Landau (1984) commented on the distinction between these fine, grey sands which are known only from boreholes in the Santa Catalina area, and the coarser-grained 'yellow sands', now referred to as the Arenas de Huelva Formation (Civis *et al.*, 1987). Since the original description, the 'grey sands' localities have disappeared, and no new water holes have been constructed, the reason for this being the exceptionally high rainfall in the region over the past few years, and changes in water extraction techniques. The 'yellow sands' near the village of Lucena del Puerto (localities 1-3; see Landau, 1984, p. 137, fig. 2) have continued to produce rich collections of molluscan shells. The rarest amongst the new species here described, *Donax garciai* n. sp., occurs in both deposits. The palaeo-

environment is inferred to be the infralittoral, with waters warmer than those of present-day southwest Spain (Andrés, 1986). The 'grey sands' have not been the subject of subsequent studies. Their correlation with the Arenas de Huelva Formation is still unclear; however, they probably represent a slightly different depositional setting.

SYSTEMATIC PALAEOLOGY

Abbreviations — To denote the repository of specimens the following abbreviation is used: BMNH - Natural History Museum, London (formerly British Museum [Natural History]).

Order	Veneroida H. & A. Adams, 1857
Superfamily	Tellinoidea de Blainville, 1814
Family	Donacidae Fleming, 1828
Genus and subgenus	<i>Donax</i> Linné, 1758

Donax (Donax) triangula n. sp.

Pl. 1, Figs 3-4; Pl. 2, Figs 2, 4-5; Text-fig. 1

Material — Holotype is BMNH LL 41352; umbo-pallial diameter (right valve) 10.7 mm, antero-posterior diameter 13 mm, thickness 4.4 mm; umbo-pallial diameter (left valve) 10.7 mm, antero-posterior diameter 13 mm, thickness 4.4 mm. Paratypes are BMNH LL 41353 (paratype 4), umbo-

pallial diameter (right valve) 10.7 mm, antero-posterior diameter 8.7 mm, thickness 3.7 mm; umbo-pallial diameter (left valve) 10.9 mm, antero-posterior diameter 13.3 mm, thickness 4.5 mm, and eight additional specimens (paratypes 1-3, 5-8) in the B.M. Landau Collection.

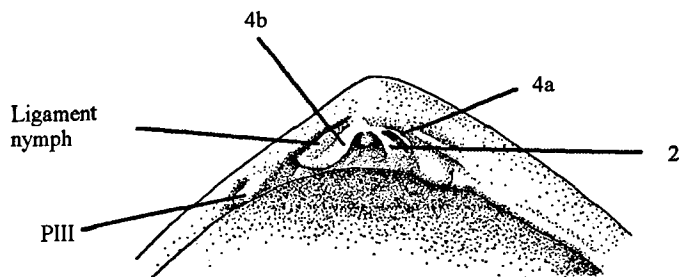


Fig. 1. Hinge of left valve of *Donax (D.) triangula* n. sp.

Derivatio nominis — In reference to the triangular shell shape.

Diagnosis — Inequilateral, solid shell, beak slightly posterior of midline, pointing inwards and slightly posteriorly; shell shape subtrigonal, anterior margin straight two-thirds the distance to ventral margin, sloping posteriorly in a rounded curve; anterior part of ventral margin somewhat produced, ventral margin obtusely angled in a gentle curve with maximum width at a point below halfway along the anterior margin, posteriorly bounded by corselet.

Locus typicus and stratum typicum — Santa Catalina near Lucena del Puerto, Huelva (Spain), locality 4; Lower Pliocene (Zanclean).

Description — Shell solid, inequilateral, beak slightly posterior to midline, pointing inwards and slightly posteriorly, shape subtrigonal, anterior margin straight two-thirds the distance to the ventral margin, then sloping posteriorly in a rounded curve. Anterior part of ventral margin somewhat produced, ventral margin obtusely angled in a gentle curve with maximum width at a point below halfway along the anterior margin. Posteriorly bounded by corselet. Posteroventral angle approximately 80°. Corselet turns inwards at approximately 90°, so that, when valves are articulated, posterior surface would seem to be nearly flat. Anterior quarter of shell surface smooth, polished, middle half ornamented with lightly impressed radial striae, most notable at maximum shell width.

Corselet ornamented with raised, moderately coarse, close-set concentric ridges from the umbo to the margin. Radial striae present on inner third of corselet. Where radial striae cross concentric ridges they form tiny tubercles, the whole ornament being reticulate.

Hinge heterodont; right valve hinge plate with an oblong ligament nymph apposed to the shell surface and concave outwards at its extremity, separated from the dorsal margin by a deep, narrow ligament groove. Two cardinal teeth, posterior one (3b) stout and bifid, lying under the umbo,

separated from anterior one (3a) by a deep socket, 3a is ridge like and convex forward; a deep socket separates 3b from the nymph. Almost obsolete posterior lateral (PI) separated from dorsal margin by a shallow groove.

Left valve hinge plate with elongated, blade-like ligament nymph separated from it by deep ligament groove narrow at the top and widening below. Three cardinal teeth, one posterior (4b), and two anterior (2a, 4a), 4b and 2 separated by wide, deep socket. A very small protuberance in depth of socket. 4b is thin and blade like, confluent with medial margin of nymph; 2 is convex forward, thin at umbo, becoming thicker distally, separated by deep, narrow socket from 4a, which is thin and convex in front. PII runs directly down the distal surface of the ligament groove, is wide and flattened, separated from the corselet by a small socket. The anterior part of hinge plate lying above anterior adductor muscle scar has very slight ridge which represents PI, separated from dorsal margin by shallow groove.

Pallial sinus deep, extending to a point below halfway along anterior margin. Pallial sinus partially confluent with pallial line. Margin sharply serrated, serrations visible from valve exterior.

Discussion — *Donax triangula* is a rare species, known exclusively from the 'grey sands' in the Santa Catalina area. From the European Pliocene no similar species are known. *Donax triangula* differs from *D. garciai* (see below) in being smaller and less angular. The ornament of the corselet has a reticulate pattern nearest the umbo in *D. triangula*, and furthest away from the umbo, near the smooth part in *D. garciai*. The shape of the ligament nymph differs, being confluent with 4b in the former, and separated from the nymph by a groove in *D. garciai*.

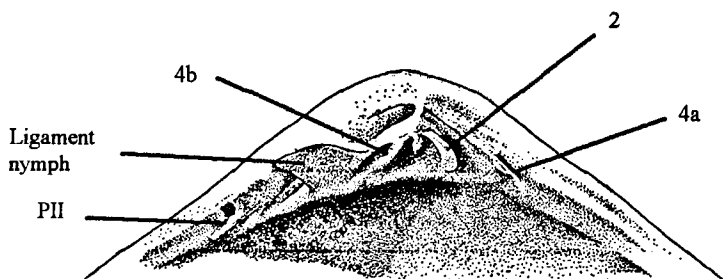


Fig. 2. Hinge of left valve of *Donax (Chion) garciai* n. sp.

Subgenus *Chion* Scopoli, 1777

Donax (Chion) garciai n. sp.

Pl. 1, Figs 5, 6; Pl. 2, Figs 1, 6; Text-fig. 2

1996 *Donax (Chion) affinis* Deshayes — Lozano-Francisco & García, p. 67, pl. 1, figs 1, 2.

Material — Holotype is BMNH LL 41351; umbo-pallial diameter (left valve) 40 mm, antero-posterior diameter 54 mm, thickness 12 mm.

Derivatio nominis — Named after D. Juan José García García, Spanish palaeontologist.

Diagnosis — Inequilateral, solid shell, beak slightly posterior of midline, pointing inwards and slightly posteriorly, shape subtrigonal; anterior margin straight one-third the distance to the ventral margin, sloping posteriorly in a rounded curve. Ventral margin obtusely angled at a point below the beak, posteriorly rounded by corselet from the umbo to the posteroventral margin. Posteroventral angle approximately 70°. Corselet turns inwards at approximately 90°. Anterior portion of the surface smooth, polished, growth lines only becoming slightly raised towards the ventral margin; lightly impressed radial striae, slightly more notable towards the corselet.

Locus typicus and stratum typicum — Santa Catalina near Lucena del Puerto, Huelva (Spain), locality 4; Lower Pliocene (Zanclean).

Description — Shell solid, inequilateral, beak slightly posterior to midline, pointing inwards and slightly posteriorly, shape subtrigonal. Anterior margin straight one-third the distance to the ventral margin, then sloping posteriorly in a rounded curve. Ventral margin obtusely angled at a point below the beak, posteriorly rounded by corselet from the umbo to the posteroventral margin. Posteroventral angle approximately 70°. Corselet turns inwards at approximately 90°, so that in articulated valves the posterior surface would seem to be nearly flat. Anterior portion of the surface smooth, polished, growth lines becoming slightly raised only towards the ventral margin. Lightly impressed radial striae, slightly more notable towards the corselet.

Corselet with raised, sharp, extremely close-set, fine concentric ornament with an eccentric component superimposed. Where they cross the radial striae they form elongated tubercles, the whole ornament resembling a fine file. Radial ridges present only on the outer half of the corselet.

Hinge plate has a short, robust ligament nymph, which is thorn like in lateral view, with a curved, concave upper surface, separated from the corselet by a deep ligament groove which is narrow at the top, and widens below. Hinge heterodont, three cardinal teeth, two of which are prominent and lie below the umbo (4b and 2), separated by a broad, deep socket. There is a very small pro-tubercle in the depth of the socket. Upper part of 4b and 2 is truncated, possibly resorbed. Growth lines at this point indicate an area of attachment of the anterior ligament; 2 is of medium thickness and gently convex forward; 4b is thinner and more blade like, 4a diminutive and separated from 2 by a small, shallow groove. PII runs directly down the distal surface of the ligament groove, and is small but prominently separated from the corselet by a small socket. Anterior part of hinge plate lying above the anterior adductor muscle scar has a very slight ridge which represents PI separated from the dorsal margin by a shallow groove.

Pallial sinus deep, extending to a point below the anterior tip of PI, its lower margin partially confluent with the pallial

line. Margin fairly coarsely serrated; serrations not visible in external view.

Discussion — *Donax garciai* appears to be a very rare species in the type stratum, and just a single additional specimen is known to date, a left valve from the 'Autovía de Niebla' outcrop (González Delgado, 1987); in Vera-Lozano personal collection, with an umbo-pallial diameter of 39 mm, antero-posterior diameter of 53 mm, and a thickness of 11.2 mm.

A similar species from the European Neogene is *Donax (Chion) affinis* Deshayes, 1843 (see Pl. 3, Figs 1, 2), but this differs from the present species in being smaller, more robust, and with a more regularly curved ventral margin. The hinges of the two also are quite different, with the central cardinal larger and thinner in *D. affinis* than in *D. garciai* and bifid, and the lateral teeth larger and thinner in the former as well.

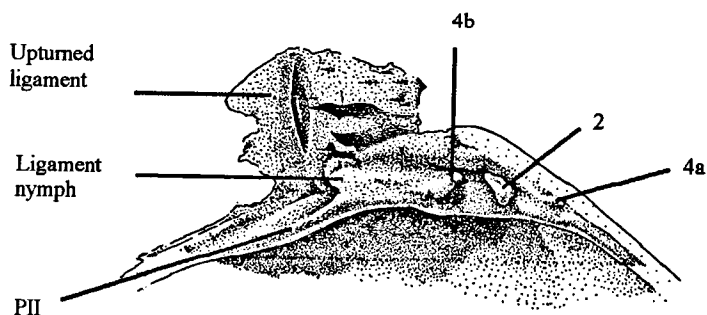


Fig. 3. Hinge of left valve of *Donax serra* Röding, 1798.

The extant South African *Donax serra* Röding, 1798 (see Pl. 2, Figs 3, 7) closely resembles *D. garciai* in being a large subtrigonal species with a similar ligament slit and nymph. It is, however, larger, somewhat more elongated, with the ventral margin more obtusely angled, and the ornament on posterior portion coarser; the nymph is straight and blade like, confluent with 4b.

Other extant species of *Donax* with similar characteristics are *D. punctatostriatus* Hanley, 1843 from the coast of California (USA), which differs in that the anterior striations on the shell surface are composed of small punctae, and *D. deltoides* Lamarck, 1818 from Australia, which has a smooth corselet, and an unserrated ventral margin.

Order Veneroida H. & A. Adams, 1857
 Superfamily Veneroidea Rafinesque, 1815
 Family Veneridae Rafinesque, 1815
 Subfamily Pitarinae Stewart, 1930
 Genus and subgenus *Callista* Poli, 1791

Callista (Callista) verae n. sp.
 Pl. 3, Fig. 3; Pls 4, 5

1997 *Tapes* sp. — Ruiz Muñoz *et al.*, p. 105, pl. 26, figs 8, 9.

Material — Holotype is IRScNB 6395; umbo-pallial diameter 68.5 mm, antero-posterior diameter 103.75 mm; paratype 1 (right valve), IRScNB 6396, umbo-pallial diameter 61.4 mm, antero-posterior diameter 92.45 mm; paratype 2 (left valve), IRScNB 6397, umbo-pallial diameter (left valve) 69 mm, antero-posterior diameter 95.2 mm, and eight additional specimens (all paratypes) in the B.M. Landau Collection.

Derivatio nominis — Named after Dr José Luis Vera Peláez, a dedicated and enthusiastic researcher of molluscan palaeontology in Spain.

Diagnosis — Medium-sized to large, thick and robust shell; outline triangular, antero-posteriorly elongated, with a curved pallial margin, approximately equivalve, with left valve slightly more convex, inequilateral. Umbo small, prosogyrate, and hinge heterodont.

Locus typicus and stratum typicum — Santa Catalina near Lucena del Puerto, Huelva (Spain), locality 4; Lower Pliocene (Zanclean).

Description — Anterior dorsal margin elongated, slightly concave for the first quarter of its length, then regularly convex. Anterior margin short and strongly convex, dorsal posterior margin gently convex. Posterior margin strongly convex and somewhat truncate. Ventral margin regularly curved.

Outer surface of shell polished, with fine concentric growth lines, becoming flattened lamellae, rectangular in cross section, increasing in strength towards the ventral margin. Lunule short oval, widest at its anterior margin; escutcheon wide, about twice the length of the lunule. External ligament narrow and elongated. Both lunule and escutcheon ornamented with fine growth lines.

Interior of valve irregular. Adductor muscle scars large, deep and isomyarian. Accessory muscle scars run from the anterior adductor scar to umbo, the largest of which, situated just above the anterior adductor scar, deep and bluntly triangular, becoming smaller and punctiform towards the umbo. The pallial line runs more or less parallel to the ventral margin although somewhat flatter. Shallow, v-shaped pallial sinus, situated below the posterior adductor scar, extending to approximately one quarter of the antero-posterior diameter.

Hinge heterodont, right valve with three cardinal teeth. Cardinal 1a situated directly below umbo, large, triangular and bifid, the anterior half wider than posterior. Cardinal 3a large, thin and elongated, sloping towards umbo. Cardinal 3b smaller and narrower, also sloping towards umbo and bifid. Elongated triangular grooves separate cardinal teeth. Between the two lateral cardinal teeth and the dorsal margin lie two triangular fossae, narrow and arched above 3a and wider above 3b. AI small, situated halfway along anterior dorsal margin.

Left valve with three cardinal teeth; cardinal 2, situated above and slightly anterior to umbo, thin and deeply bifid. Cardinal 2a thick and flattened; 2b thinner and laminar. Cardinal teeth separated by elongated triangular grooves, anterior being wider than posterior. Above 2a is a narrow,

triangular, superficial fossa. All small, situated below the distal end of the lunule.

Discussion — Although the preservation of our material is excellent, the prodissoconch is worn and broken in all specimens available. Even in extant representatives of the genus it is unusual to find prodissoconchs intact in such large shells. Specimens before us show a considerable variation in umbo-pallial diameter, but are otherwise constant in other characteristics.

Two other species have been recorded from the Arenas de Huelva Formation, viz. *C. (C.) chione* (Linné, 1758) and *C. (C.) italica* (DeFrance, 1818) (see Andrés Galache, 1982a, b; Landau, 1984), and from other Spanish Pliocene outcrops (Almera, 1907; Cuenca Anaya, 1981; de Porta & Martinell, 1981; Domenèch, 1983, 1984; González Delgado *et al.*, 1984; Castaño *et al.*, 1988; Ruiz Muñoz *et al.*, 1997; Lozano-Francisco, 1997, 1998). These species are also found in the Piemonte-Liguria basin (Italy; see Brocchi, 1814; Sacco, 1897-1898) and in northern Africa (Lecointre, 1952).

Callista chione differs from the present species in having a more regular, triangular outline, less elongated in its antero-posterior axis and an equivalve, more fragile shell. The anterior and posterior muscle scars are approximately equal in size, but of different shape; the anterior one elongated, the posterior rounded, whereas in *C. verai* both are semicircular. The escutcheon in *C. chione* is short and narrow, almost limited to the ligamentary area, whereas in *C. verai* it is longer. Hinges are quite different: in *C. chione*, the right valve cardinal 3a is cylindrical, pointed and deeply bifid, 3b is also bifid, but narrower and longer. Lateral AI is triangular and broad with an extra tooth AIII and a lateral PI, not present in *C. verai*. The left valve cardinal 2a is thin and laminar, and 2a broad and triangular; the opposite configuration occurs in the new species.

Callista italica is much larger, with an even more robust and thicker shell, more triangular in shape and less convex. Muscle scars of similar size but elongate, rather than semicircular, with posterior scar more deeply impressed than anterior one, and not equally marked as in *C. verai*. The escutcheon in *C. italica* is as in *C. chione*, limited to ligamentary area, whereas it is much larger in *C. verai*. Hinge also clearly different; cardinal 3a of right valve bifid, with also an extra tooth AIII not present in the new form.

The overall aspect of these three species is so different that confusion appears impossible.

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PLATE 1

Figs. 1, 2. *Donax serra* Röding, 1798, BMNH LL 41350, left valve, Recent, South Africa, x 1.

Figs. 3, 4. *Donax (D.) triangula* n. sp., BMNH LL 41352 (holotype), left valve, Pliocene, Lucena del Puerto (Huelva, Spain), x 3.5.

Figs. 5, 6. *Donax (Chion) garciai* n. sp., BMNH LL 41351 (holotype), left valve, Pliocene, Lucena del Puerto (Huelva, Spain), x 1.

PLATE 1

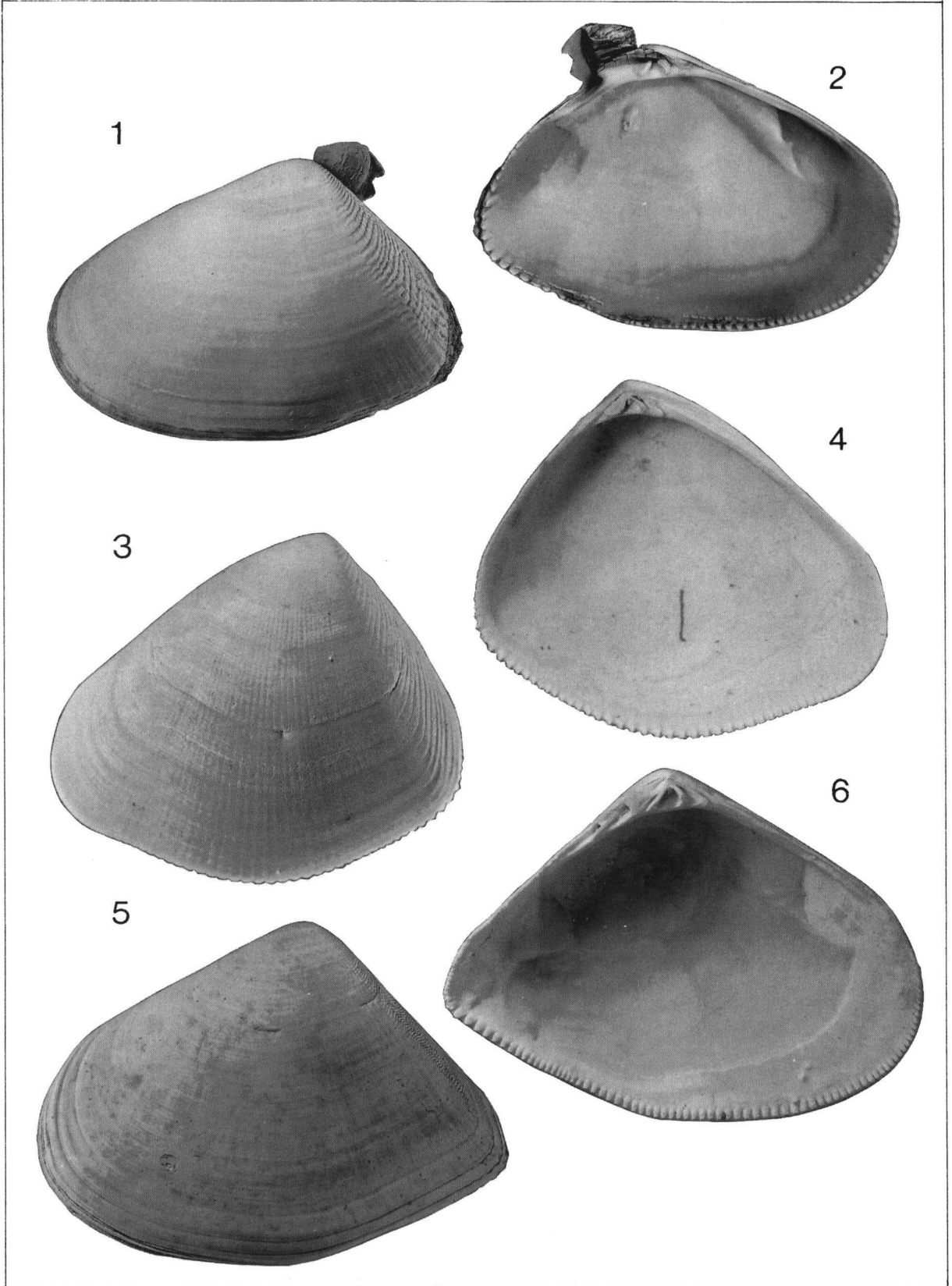


PLATE 2

- Figs 1, 6. *Donax (Chion) garciai* n. sp., BMNH LL 41351 (holotype), view of corselet and hinge, respectively, Pliocene, Lucena del Puerto (Huelva, Spain).
- Figs 2, 4, 5. *Donax (D.) triangula* n. sp., BMNH LL 41352 (holotype), view of corselet, hinge of right and left valves, respectively, Pliocene, Lucena del Puerto (Huelva, Spain).
- Figs 3, 7. *Donax serra* Röding, 1798, BMNH LL 41350, view of corselet and hinge with upturned ligament of attached left valve, respectively, Recent, South Africa.

PLATE 2

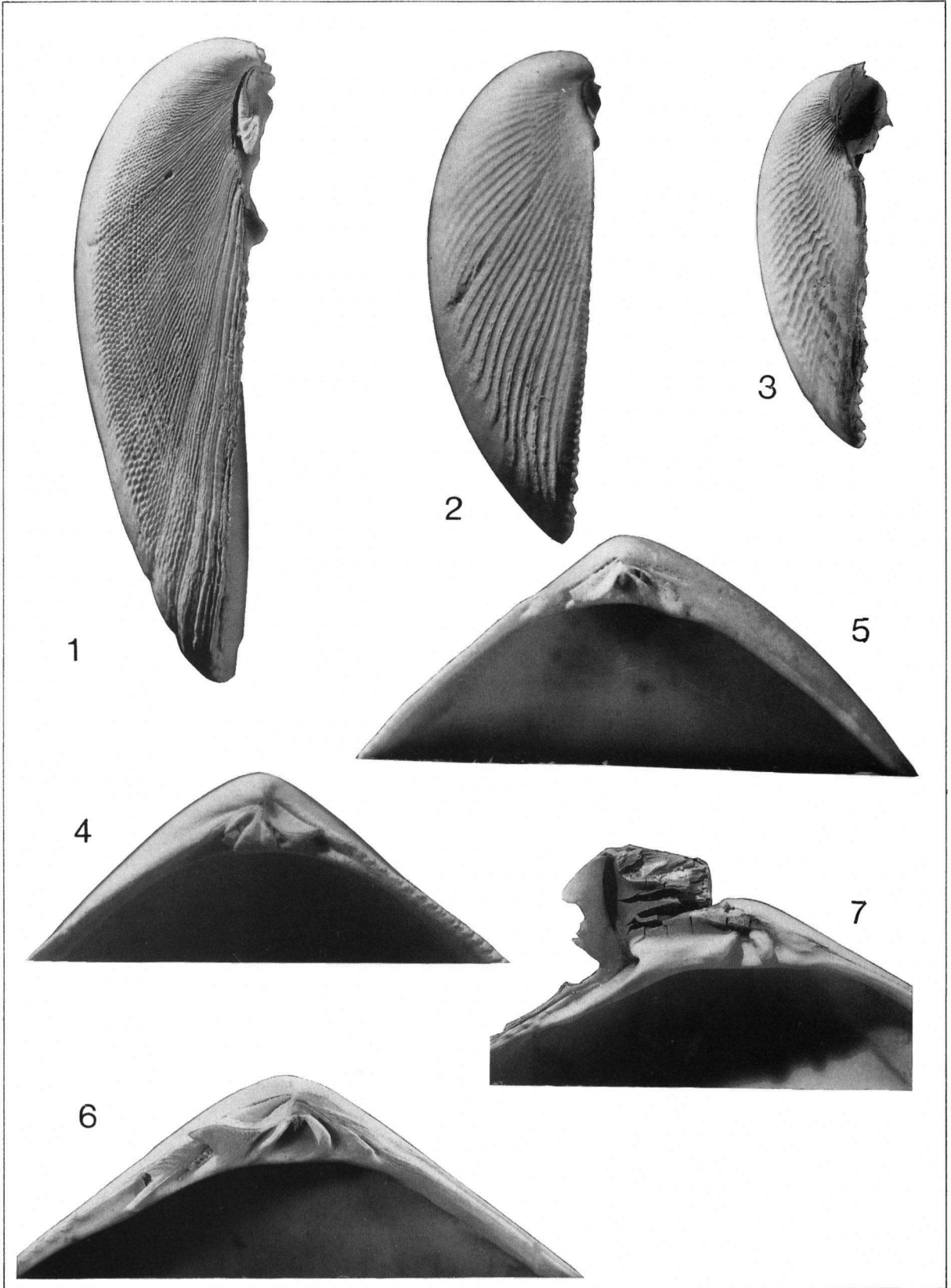


PLATE 3

- Figs 1, 2. *Donax affinis* Deshayes, 1843, Collection D. Ledon, dorsal and ventral views of left valve, respectively, Late Burdigalian (Miocene), Saucats (France), x 2.5.
- Fig. 3. *Callista (Callista) verai* n. sp., IRScNB 6395 (holotype), right valve, Pliocene, Lucena del Puerto (Huelva, Spain), x 0.85.

PLATE 3

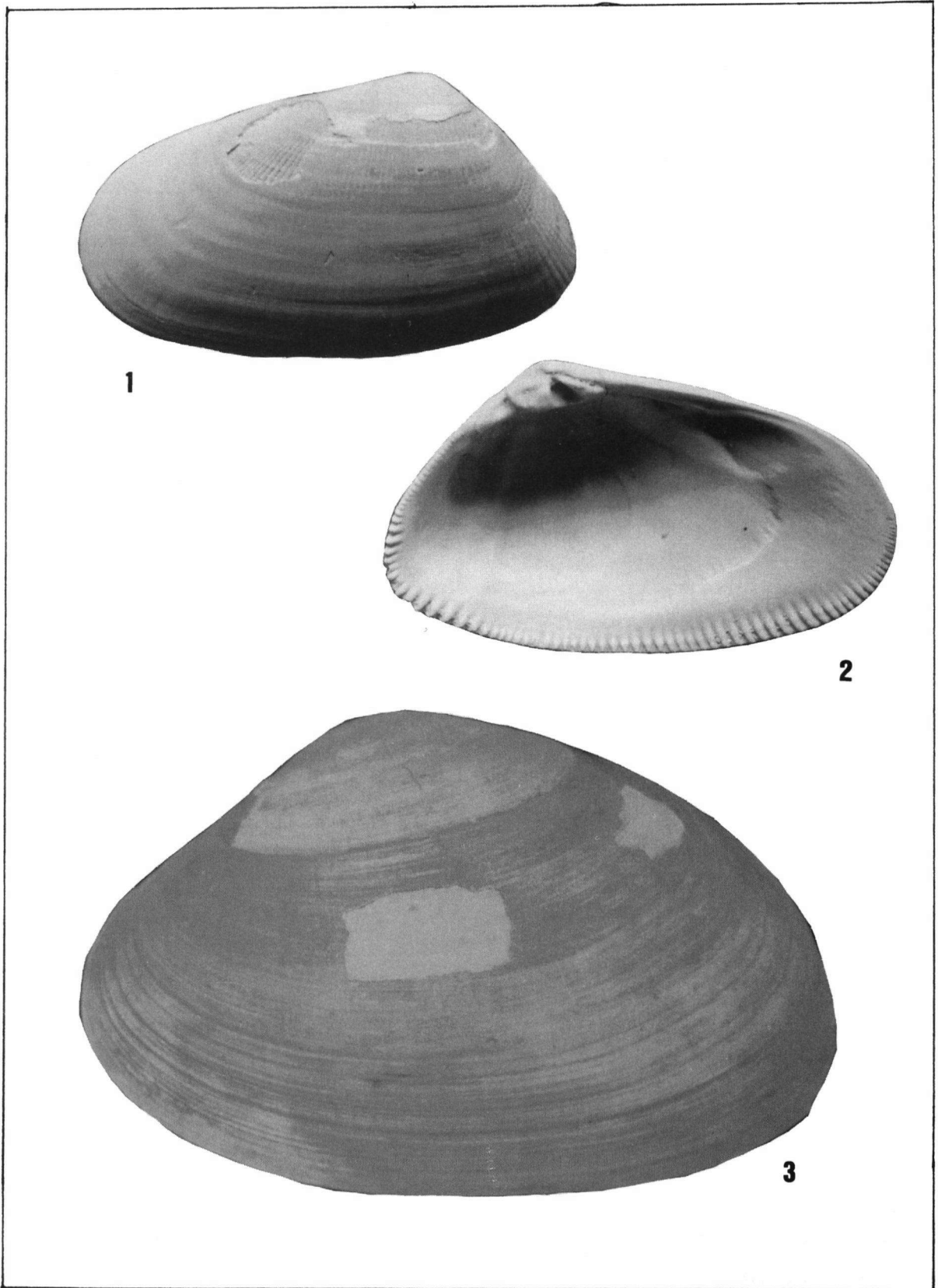


PLATE 4

Callista (Callista) verai n. sp., Pliocene, Lucena del Puerto (Huelva, Spain)

Fig. 1. IRScNB 6395 (holotype), left valve, x 0.85.

Figs 2, 3. IRScNB 6396 (paratype 1), dorsal view of right valve and hinge, respectively, x 0.85.

PLATE 4

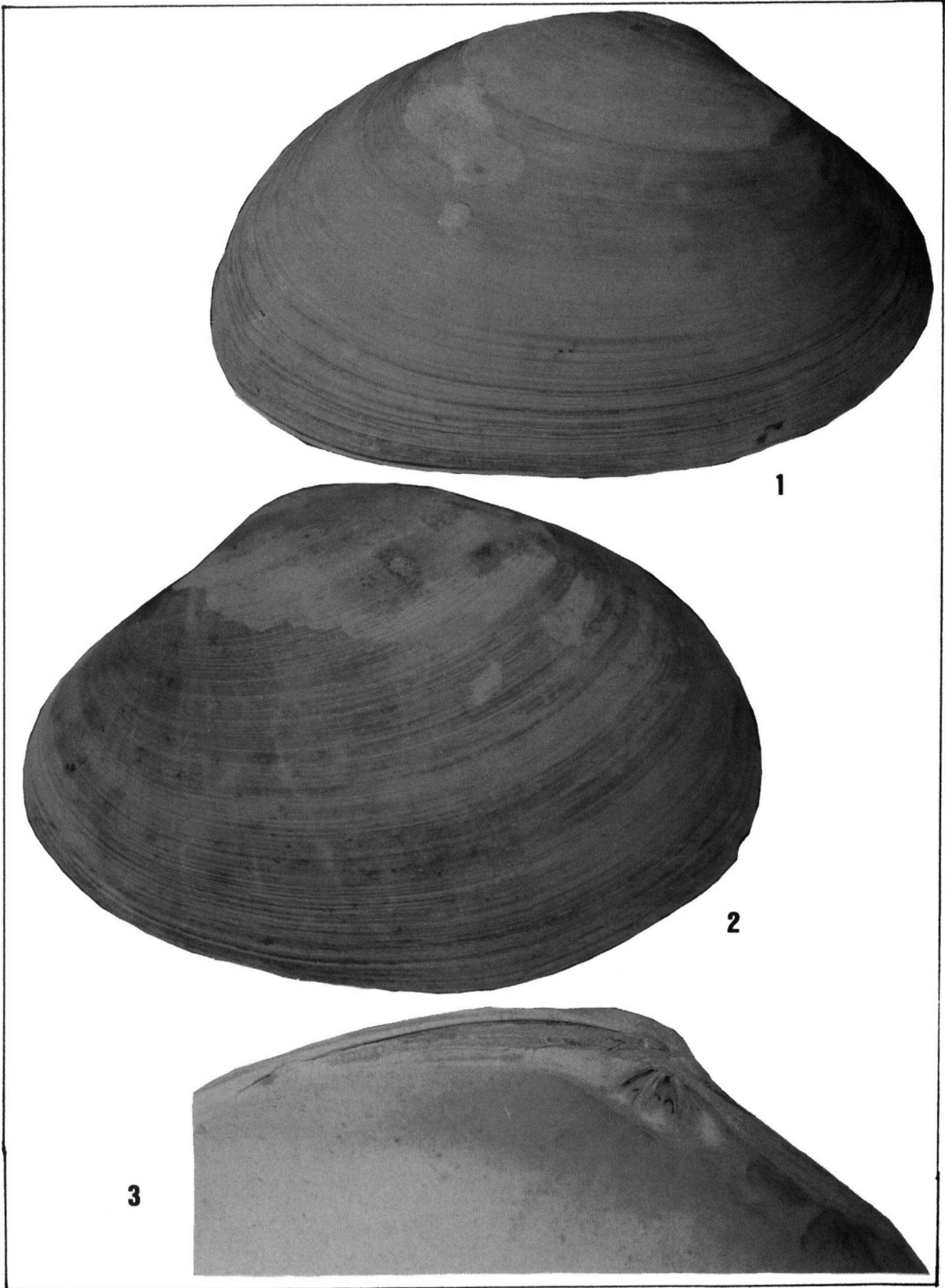


PLATE 5

Callista (Callista) verai n. sp., Pliocene, Lucena del Puerto (Huelva, Spain)

Fig. 1. IRScNB 6396 (paratype 1), ventral view of right valve, x 0.85.

Figs 2, 3. IRScNB 6397 (paratype 2), ventral view of left valve (x 0.85) and hinge, respectively.

PLATE 5

