

The Glycymerididae (Mollusca: Bivalvia) of the NE Atlantic and the Mediterranean Sea

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Abstract: In a previous paper, published in *Neptunea*, 12(2), the endemic West African representatives of the genus *Glycymeris* were treated. The new species *Glycymeris rafaelmesai* Nolf & Swinnen, 2013 was introduced, together with the diagnosis of another unknown species from Angola. The present paper will treat the East Atlantic and Mediterranean species of the genus *Glycymeris*. Some of these species also occur along the coasts of NW Africa, Madeira and the Canary Islands.

Abbreviations:

CFN: Private collection of Frank Nolf (Oostende, Belgium).

CFS: Private collection of Frank Swinnen (Lommel, Belgium).

H.: Height.

L: Length.

Introduction: In the NE Atlantic and the Mediterranean Sea the family GLYCYMERIDIDAE is only represented by the genus *Glycymeris* and contains five different species: *Glycymeris bimaculata* (Poli, 1795) restricted to NW Morocco, the Mediterranean Sea from Spain, Italy to Turkey and Israel, *Glycymeris glycymeris* (Linnaeus, 1758) which occurs from Norway to the E Atlantic coasts of the Iberian Peninsula, the western Mediterranean Sea (from Spain to Sicily in the east), the Azores, Madeira, the Canary Islands and Morocco, *Glycymeris nummaria* (Linnaeus, 1758) in the Canaries, Gibraltar, the Alboran Sea, the Marmara Sea, Israel and the NE Atlantic coast of Morocco, *Glycymeris pilosa* (Linnaeus, 1767) throughout the Mediterranean Sea from Spain, Italy to the Aegean Sea, Israel and the Levant Sea, the Atlantic coasts of Morocco and Western Sahara and finally a recently described species *Glycymeris vanhengstumi* Goud & Gulden, 2009, from

Madeira and the Canaries. *Glycymeris arabica* (H. Adams, 1871) is a Lessepsian immigrant from the Red Sea, only known from a few specimens in Israel. In the present paper we will extensively compare and illustrate these species.

Diagnosis:

The family GLYCYMERIDIDAE is a very puzzling family as many “common” species are misunderstood, even those from the Mediterranean Sea and the NE Atlantic.

Most of them have a cancellate microsculpture. The periostracum of European species with fine separated hairs is in contrast with the West African species of *Glycymeris* which all have a distinctly velvety periostracum. The size varies from 30 mm (*Glycymeris vanhengstumi*) to 120 mm (*Glycymeris bimaculata*). They live from subtidal to deep water shallowly burrowed in sandy, gravelly or muddy bottoms. Shells are equivalve, often equilateral, circular or subcircular, occasionally posteriorly angled, usually thick, occasionally rather smooth (*Glycymeris nummaria*) or slightly ribbed with a radial or cancellate microsculpture. Umbones are opisthogyrate and the ligament condition is amphidetic or prosodetic. The hinge plate carries two series of taxodont teeth. There is no pallial sinus. The interior is porcellaneous and the inner ventral margin is strongly crenulated.

The microsculpture of every European *Glycymeris* is unique for each species and is typically not very variable. This offers us a good identification tool when we fail to use the other characteristics which are not constant enough to distinguish the different species. The microstructure is linked to the implantation of the hairs. Smooth shells carry a very fine periostracum or none at all.

The outline is mostly not a good characteristic to distinguish the different species. It partially depends on the kind of substrate in which the specimen is buried. In hard substrates specimens tend to be more oblique as the

mantle gesh damaged during the burrowing process.

Although the umbo in *Glycymeris* is always opisthogyrate, which means that the beaks are turned to the posterior end of the valves, some European species such as *G. bimaculata*, *G. nummaria*, and the Lessepsian immigrant *G. arabica* may have slightly orthogyrate umbones. The height and width of the ligamental area are variable within each species, depending on the growth stage of the individual specimens. The ligamental condition in European species may be amphidetic (*G. arabica*, *G. bimaculata*), slightly prosodetic (*G. nummaria*, *G. glycymeris*, *G. vanhengstumi*) or clearly prosodetic (*G. pilosa*). The ligamental area can be ornamented with grooves. Muscle scars are distinct, the anterior scar (rounded triangular) being different from the posterior scar (rather oval). The anterior muscle scar is narrower than the posterior one. The lower part is obliquely truncated. The posterior muscular scar is nearly circular but the lower part is narrowing below.

Type Family GLYCYMERIDIDAE Newton, 1916
***Glycymeris* da Costa, 1778**

Type species: *Arca glycymeris* Linnaeus, 1758
(by absolute tautonomy: ICZN Opinion 1414 - 1986).

***Glycymeris arabica* (H. Adams, 1871)**
(Pl. I, Figs 1-4)

= *Axinaea* (*Pectunculus*) *arabica* H. Adams, 1871

= *Pectunculus savignyi* P. Fischer, 1871

Geographic distribution: originally in the western Indian Ocean, Red Sea: Gulf of Suez. Introduced in the Mediterranean Sea (Israel) via the Suez Channel. Till 2003 only known from one record in 1977 (Dor, Israel). At present also found at Palmahim lagoon (Israel).

Outline: equivalve, inequilateral, subcircular, with posterior margin subangular. The anterior margin is protruding, giving the shell a somewhat oblique shape. This distortion together with the inflated shell and the small size are diagnostic features for this species. Very slightly opisthogyrate, nearly orthogyrate.

Hinge: Small strongly arched taxodont teeth, with up to 12 teeth anteriorly and up to 14 teeth posteriorly.

Ligamental condition: amphidetic, very narrow and small.

Microsculpture: about 30 low ribs with narrow interspaces. All ribs incised by radial grooves. Inner margin crenulated.

Periostracum: remaining bristles at the margins, but mostly absent.

Colour: Shell externally white with beige, dark brown to reddish brown tessellate markings or with larger coloured areas. Internally usually with a dark brown-black posterior-ventral area.

Measurements: 20-30 mm.

Habitat: It lives in shallow water sandy bottoms. In the Mediterranean dredged at about 50 m depth.

Remarks: In the Red Sea (from Suez to Aden) a second, very similar species occurs: *Glycymeris adenensis* Jousseume in Lamy, 1916.

***Glycymeris bimaculata* (Poli, 1795)**
(Pl. II, Figs 5-6; Pl. III, Figs 7-10;
Pl. IV, Figs 11-12; Pl. V, Figs 13-16)

= *Arca bimaculata* Poli, 1795

= *Pectunculus stellatus* (Gmelin, 1791)

= *Pectunculus siculo* Reeve, 1843

= *Pectunculus pilosus* var. *philippii* Pallary, 1912

= *P. stellatus* var. *mediterranea* de Gregorio, 1892

= *P. stellatus* var. *pervalida* de Gregorio, 1892

= *P. stellatus* var. *umbonata* de Gregorio, 1892

= *Pectunculus bimaculatus* var. *crassa* Koch & Pallary in Pallary, 1900

Geographic distribution: South Portugal, NW Morocco, the Mediterranean Sea, from Spain, Italy to the Bosphorus, Greece, Turkey and Israel.

Shell: very large, heavy and thick, not as globose as *Glycymeris pilosa*.

Outline: almost circular.

Beaks and umbones: raising a little above the ligamental area. Very slightly opisthogyrate, nearly orthogyrate,

Ligamental condition: amphidetic, fairly high and broad. Especially in thick and heavy specimens a number of chevron shaped grooves (about 5) are very clear.

Microsculpture: Many narrow and distinct radiating ribs are separated by very fine grooves. Concentric cords are obsolete and often repressed, resulting in an undulating sculpture of irregular lines.

Periostracum: dark brown, nearly black short bristles follow the concentric ribbing more than the radial striae covering most parts of the valves, especially at the ventral side, the anterior and posterior margins. The bristles are shorter than in *G. glycymeris* and *G. pilosa*.

Colour: yellow, orange to brown. Often with alternating yellow and brown concentric rings. Interior mostly paler than in *G. pilosa*. In fact the name '*bimaculata*' was derived from the white blotch at the beaks. However, this is not a constant characteristic feature: it is not always

present and it can also be discovered in *G. pilosa*. Young specimens are paler than adults.

Measurements: 80-120 mm.

Habitat: In shallow water buried in sand or sandy mud bottoms.

Remarks:

This species is the largest glycymeridid among the European species within this family. It can be differentiated from other European *Glycymeris* by its shell which is even heavier than in *G. pilosa*, the central umbones, the colouration and the broader hinge line. The number of radiating striae and concentric grooves is larger than in *G. pilosa*, resulting in a denser reticulating network.

Pallary (1912) made a mistake in mentioning *Pectunculus pilosus* var. *lineatus* Philippi, 1844 as a variety of *P. pilosus* with depressed and thinner valves with a white interior colour and a lenticular instead of oblique form. However, Pallary changed this name in his 'additions and corrections' to the same work in *P. pilosus* var. *philippii* Pallary, 1912 (= *lineatus* Philippi, 1844, non Reeve, 1843) as the name '*lineatus*' had already been used by Reeve. Moreover, we agree with Crocetta et al. (2013) and others such as Huber (2010) that *Pectunculus pilosus* var. *philippii* is no more than a misidentification of a juvenile specimen of *Glycymeris bimaculata* which becomes evident after studying the figures.

Nordsieck (1969) described *Glycymeris philippii* (Pallary, 1912) without a figure as a possibly eventual distinct species: 'Ähnlich der vorigen, aber mit Radialfurchen. Kreisrund. Möglicherweise eine eigene Art'.

***Glycymeris glycymeris* (Linnaeus, 1758)**

(Pl. VI, Figs 17-22; Pl. VII, Figs 23-28; Pl. VIII, Figs 29-34; Pl. IX, Figs 35-40; Pl. X, Figs 41-46; Pl. XI, Figs 47-52; Pl. XII, Figs 53-64; Pl. XIII, Figs 65-68; Pl. XIV, Figs 69-71, 73-74, 79-80)

- = *Arca glycymeris* Linnaeus, 1758
- = *Arca minima* Turton, 1819 [non Schröter, 1802]
- = *Glycymeris orbicularis* da Costa, 1778
- = *Arca pulchella* Gmelin, 1791
- = *Pectunculus marmoratus* Lamarck, 1819 (juv.)
- = *P. lineatus* Philippi, 1836
- = *P. punctatus* Calcara, 1840
- = *P. glycymeris* var. *globosa* Calcara, 1840
- = *P. glycymeris* var. *bavayi* Bucquoy, Dautzenberg & Dollfus, 1891
- = *P. dautzenbergi* de Gregorio, 1892
- = *P. glycymeris* var. *typica* Monterosato, 1892
- = *P. glycymeris* var. *lineolata* Dautzenberg, 1893
- = *P. glycymeris* var. *zigzag* Dautzenberg, 1893

Geographic distribution: the Hebrides, Faroe Islands, N Norway, North Sea, Scotland, the English Channel, Ireland, E Atlantic, the Bay of Biscay, the Azores, Madeira and the Mediterranean Sea (from the Alboran Sea, Spain, France to Italy). This is in fact a typical NE Atlantic species, only occasionally found in the Mediterranean.

Shape and outline: Valves thick and solid, but thinner and lighter specimens are commonly found depending upon the locality. Shells may be inflated or compressed, with a circular or obliquely subovate outline. Often posteriorly elongated.

Beaks and umbones: very opisthogyrate. Umbones clearly behind the middle of the ligamental area.

Ligamental condition: slightly prosodetic, nearly amphidetic. Rather broad, moderately high, clearly asymmetric. Very adult specimens may have undulating chevron-like areas never cut as grooves. The ligament itself has a chevron structure.

Microsculpture: Fairly strong radiating ribs crossed by equal strong concentric growth lines create a regular reticulated sculpture less pronounced than in *G. pilosa* but more distinct than in *G. bimaculata*.

Periostracum: The hooked fine hairs are short, frequently retained at the margins resulting in concentric bands of bristles.

Colour: light yellow to dark brown with brown or reddish violet V-shaped or zigzag markings all over the surface. The colouration is as variable as the shape varying between nearly completely brown shells and yellowish white shells with zigzag markings, flammules or stripes. Interior off-white, often maculated with concentric brown streaks.

Measurements: 30 to 90 mm.

Habitat: On off-shore sand bottoms or in gravel and mud down to about 75 m or even deeper (1200 m).

Remarks: Because of the high degree of variability, many names without taxonomic value have been attributed to different forms, e.g. by Bucquoy, Dautzenberg & Dollfus (1891) and Lamy (1912). The form *G. glycymeris* var. *bavayi* B.D.D., 1891 refers to equilateral shells, largely maculated with a brown colour.

Comparison:

G. glycymeris is extremely variable in shape, outline and colour. Some specimens may have strong commarginal lines, giving the valves a ribbed impression. Especially large specimens are quite inequilateral and slightly oblique (particularly those from SW England, UK).

The variability is so extreme that some specimens can be confused with typical glycymeridids from West Africa like *G. formosa*, *G. scripta* or *G. concentrica* but never with *G. rafaelmesai* Nolf & Swinnen, 2013, which constantly has a solid, heavy shell and a commarginal structure.

The most remarkable specimens were obtained from Funchal Bay, Madeira (Pl. XIII, Figs 65-68). Four specimens trawled at a depth of 180 m possess a particularly shorter and broader ligamental condition which prevents the beaks from reaching each other, thereby creating a serious gap between the two valves. Moreover, these shells are completely distorted at the posterior end, which results in a central ridge. This feature reminds us of paratype 1 and paratype 2 of *G. rafaelmesai* Nolf & Swinnen (2013) [*Neptunea*, 12(2)] and confirms that using the outline as a unique identification tool can be very confusing and misleading.

Most European authors have considered *G. glycymeris* and *G. pilosa* as two forms of the same species because very heavy and globose forms, typical of the Mediterranean, are also known from the Bay of Biscay, and inequilateral flattened oblique forms are known either from the Mediterranean Sea as from the NE Atlantic.

Originally, Linnaeus used the name '*glycymeris*' for a slightly inequilateral form and '*pilosus*' for an equilateral form, writing the following: "*testa suborbiculata aequilatera, pilosa, simillima A. glycymeris, sed testa perfecte regularis. A. glycymeris vero parum irregularis est.*" Other characteristics mentioned by Linnaeus are not important as they are common to both species. The only useful figure in '*Systema Naturae*' by Lister refers to a *G. glycymeris* as understood by British authors. Moreover, as the locality cited by Linnaeus is the same as used by Lister on his plate "*ad insulam Garnsey*" we have to conclude this is the real *G. glycymeris*. This was confirmed by Turton (1822) and Hanley (1855). As the figures by Bonanni and Gualtieri are rather poor, B.D.D. (1891) photographed a rounded, circular shell (pl. XXXIII, fig. 1) better according to the figure by Chemnitz (1784).

***Glycymeris nummaria* (Linnaeus, 1758)**

(Pl. XV, Figs 81-84; Pl. XVI, Figs 85-88; Pl. XVII, Figs 89-94; Pl. XVIII, Figs 95-100; Pl. XIX, Figs 101-104)

= *Arca nummaria* Linnaeus, 1758
= *Cardium gaditanum* Gmelin, 1791
= *Pectunculus cor* Lamarck, 1805
= *Arca insubrica* Brocchi, 1814
= *Glycymeris insubrica* (Brocchi, 1814)
= *Pectunculus nudicardo* Lamarck, 1819
= *P. transversus* Lamarck, 1819

= *P. violacescens* Lamarck, 1819
= *P. zonalis* Lamarck, 1819
= *P. pilosellus* Risso, 1826
= *P. reticulatus* Risso, 1826
= *P. purpurascens* Mac Andrew, 1854
= *P. obliquatus* de Rayneval & Ponzi, 1854
= *P. violacescens* var. *lactea* Monterosato, 1889
= *P. violacescens* var. *pallida* Bucquoy, Dautzenberg & Dollfus, 1892
= *P. violacescens* var. *solida* Bucquoy, Dautzenberg & Dollfus, 1892
= *P. violacescens* var. *tumida* Monterosato, 1892
= *P. violacescens* var. *typica* Monterosato, 1892
= *P. violacescens* var. *radiata* Pallary, 1900

We follow the arguments of Huber (2010) to select *Arca nummaria* Linnaeus, 1758 as the valid, earliest name for this species.

Geographic distribution: the E Atlantic (Canary Islands, Morocco) and the Mediterranean Sea (from Gibraltar and the Alboran Sea to the Marmara Sea, Turkey and Israel).

Shape and outline: broader than high. A light shelled species with quadrangular and thinner valves compared to other *Glycymeris* species in the Mediterranean.

Beaks and umbones: very slightly opisthogyrate, nearly orthogyrate. Prominent umbones protruding above the ligamental area, fairly in the middle. In super adult specimens the umbones are placed rather behind the middle of the ligamental area.

Ligamental condition: slightly prosodetic, nearly amphidetic. Distinct chevron grooves, intercalating in the middle, meeting each other as crossed fingers.

Microsculpture: The area around the beaks is characterised by a strongly commarginal rib sculpture. As the shells grow, broad radial ribs appear in the middle and become narrow and sharp near the anterior and posterior margins. Towards the ventral margin the radial ribbing becomes obscure and the undulating commarginal structure is dominating. The shell is smooth and polished in the centre.

Periostracum: olive-brown to dark brown, with many short thin bristles very close to each other giving the whole a velvety appearance.

Colour: The outside is bluish grey to brown. White or pale-brown radiating lines run from the beaks to the ventral margin onwards. Juvenile specimens may have more white flecks. Beaks are provided with a white star. The interior of the valves is off white coloured.

Measurements: 30 to 90 mm.

Habitat: on muddy sand in the infralittoral zone.

Remark:

Some authors used different names for several forms without taxonomic value:

- var. *obliquata* (de Rayneval & Ponzi, 1854) (Pl. XVIII, Figs 95-100): more flattened and oblique than the type; it seems to be more common in the Adriatic Sea;
- var. *pallida* (B.D.D., 1891) (Pl. XIX, Figs 101-102): with small grey blotches and dots on a whitish background;
- var. *zonalis* (Lamarck, 1819) (Pl. XIX, Figs 103-104): more solid and swollen, nearly as high as wide, with concentric dark grey zones and whitish dots on a lighter background.

***Glycymeris pilosa* (Linnaeus, 1767)**

(Pl. XX, Figs 105-108; Pl. XXI, Figs 109-112; Pl. XXII, Figs 113-124; Pl. XXIII, Figs 125-128; Pl. XXIV, Figs 129-132; Pl. XXV, Figs 133-136)

= *Arca pilosa* Linnaeus, 1767
 = *Pectunculus rubens* Lamarck, 1819
 = *Pectunculus tomentosus* Bory de Saint-Vincent, 1827
 = *P. pilosus* var. *neapolitana* Bucquoy, Dautzenberg & Dollfus, 1891
 = *P. pilosus* var. *subtruncata* Bucquoy, Dautzenberg & Dollfus, 1891
 = *P. pilosus* var. *tumida* Bucquoy, Dautzenberg & Dollfus, 1891
 = *P. pilosus* var. *costatuscula* de Gregorio, 1892
 = *P. pilosus* var. *protumida* Monterosato, 1892
 = *P. pilosus* var. *subtransversa* de Gregorio, 1892

Geographic distribution: the E Atlantic (Morocco, Mauritania, Western Sahara) and the Mediterranean (from Cadiz, South Spain to Italy, the Aegean Sea, Israel and the Levant Sea)

Shape and outline: mostly globose, truncated posteriorly. Equivalve, subequilateral. Heavy and solid valves, occasionally lighter and flatter. Circular to elongate, quite large.

Beaks and umbones: Umbones are strongly opisthogyrate. Beaks are strongly elevated behind the ligamental area.

Ligamental condition: Prosodetic ligament, slightly amphidetic. Beaks at approximately 1/3 of the ligamental area, often lower than in *G. bimaculata* and clearly asymmetrical. The surface of the ligamental area is smooth, except for fine horizontal lines. Sometimes, faint wavy chevron-shaped depressions are visible, never grooves. The ligament itself has chevron-like grooves and is very thick.

Microsculpture: Many strong radiating primary ribs – rather broad and more developed than in *G. bimaculata* and *G. glycymeris* - bifurcate into 4-6 secondary ribs per primary rib or internal groove from the beaks to the ventral margin onwards. These ribs are crossed by growth lines

and grooves, less pronounced at the beaks, which means that the primary ribs are more visible.

Periostracum: The dark-brown to black long hairs are hooked and end in a sharp point bent back to the top of the shell. These hairs prefer to follow the radial ribs more than the growth lines. They cover a large part of the ventral area. Even in eroded specimens the valves are still covered with a reddish brown, very thin and smooth epiderm.

Colour: from light brown in juvenile shells to very dark brown nearly black in adults. Interior off-white almost with a large brown blotch at the posterior side.

Measurements: from 50 to 95 mm in length.

Habitat: on mud bottoms below 15 m.

Comparison:

Generally, *G. pilosa* has a more elongated or regularly ovate shape compared with *G. glycymeris*. Its shell is more globose and the umbones are more accentuated. The ligamental area is wider and more developed.

G. pilosa is dark violet or dark brown inside while this is less common in *G. glycymeris*. Some shells may sometimes display intermediate characteristics between the two species. This has inclined authors to consider *G. pilosa* as a form of *G. glycymeris*. A good identification tool is the study of the periostracum: hairs are mostly longer and more hooked in *G. pilosa*. The ligament in *G. pilosa* has a prosodetic condition, very clear in juvenile specimens but certainly still very clear in adults, although this prosodetic condition becomes weaker by age. This characteristic could be used to separate it from *G. glycymeris* and *G. bimaculata*. Although the latter has a very clear amphidetic ligamental condition, *G. glycymeris* is less amphidetic and in fact slightly prosodetic, both in juvenile and even in adult specimens. We do not follow Huber (2010) who uses this characteristic as a good identification key. We fear he was too much influenced by the photos in Poppe & Goto (1993, pl.13, fig. 10d and 12b) which incidentally represent two extremel conditions. Huber admits the two figures are 'rather untypical'. As always we have to use different identification characteristics (microsculpture, condition of ligament and periostracum, shape and outline). Colour and pattern are unreliable, both species may be brownish or whitish inside, nor is the shape, as both species may be compressed or inflated. *G. pilosa* has a smaller number of secondary ribs (4-6) compared with *G. glycymeris* (12-15). *G. pilosa* is predominantly known from the Mediterranean Sea and *G. glycymeris* is a typical NE Atlantic species, sporadically found in the Mediterranean Sea.

Remark:

Glycymeris pilosa is a very variable species and several forms without taxonomic value have been described, especially by B.D.D. (1891), e.g.:

- var. *neapolitana* (Pl. XXII, Figs 123-124; Pl. XXIII, Figs 125-128): slightly inequivalve, posteriorly inflated, flattened valves, rather like *G. glycymeris* except the microsculpture;
- var. *subtruncata* (Pl. XXIV, Figs 129-132): posteriorly truncated;
- var. *tumida* (Pl. XXV, Figs 133-136): more globular, swollen.

***Glycymeris vanhengstumi*
Goud & Gulden, 2009**

(Pl. XIV, Figs 72, 75-78; Pl. XXVI, Figs 137-142;
Pl. XXVII, Figs 143-151)

Geographic distribution: Madeira, the Selvagens, the Canary Islands, Mauritania and Western Sahara.

Shape and outline: Small, rounded or slightly acute shells. Circular to subcircular, barely inequilateral. Thick and relatively globose. Upper posterior shell margin slightly acute, the anterior margin perfectly rounded. Juvenile specimens are mostly oblique and look like small *Limopsis* sp. They completely differ from juvenile *G. glycymeris* which are elongate or subovate in outline.

Beaks and umbones: opisthogyrate. Prominent umbones quite convex and clearly projecting above the hinge line, fairly in the middle.

Ligamental condition: prosodetic, slightly amphidetic.

Microsculpture: The juvenile stage of the shells shows a regular reticulate pattern of equally strong radiating ribs and concentric growth lines. Downwards it changes in a sculpture of dense fine, straight secondary radial ribs towards the margins, 9-12 per primary rib or internal groove, and very fine growth lines.

Periostracum: dense velvety sometimes completely covering the whole surface of the valves, at least the areas around the margins.

Colour: off-white to cream with smaller to larger reddish-brown streaks and blotches.

Occasionally, some specimens show small brown dots in the region of the umbones and the juvenile stage. Interior white but sometimes a brown blotch is present between the posterior and the centre.

Measurements: 20 – 50 mm.

Habitat: From 20 to 110 m on coarse-grained sand and shell gravel, less commonly with mud and clay.

Comparison:

Glycymeris vanhengstumi Goud & Gulden, 2009 shows similar morphological characteristics to *G. glycymeris*. Before the description of the new species, specimens of this species had already been treated as juveniles of *G. glycymeris*, from which they are totally different. Especially very small and juvenile specimens of both species can easily be identified because *G. vanhengstumi* has a '*Limopsis*'-look. This species was already figured as *G. glycymeris* by R. Gómez & J.M. Pérez (1997), as a probably new species by W. Segers et al. (2009) and finally as *G. glycymeris* by R. Gómez & J.M. Pérez (2011) (pl.103, fig.L).

In contrast to *G. glycymeris* and in lesser amount *G. pilosa*, this species lives geographically separated on the Macronesian shelf (Madeira, Selvagens Islands, Canary Islands and occasionally Mauritania or Western Sahara).

We agree with Goud & Gulden (2009) that the larger number of secondary radiating ribs per primary rib or internal groove in *G. glycymeris* is the main characteristic to differentiate *G. vanhengstumi* from *G. glycymeris*, but we consider it a difficult identification tool. We have observed that the juvenile stage of *G. vanhengstumi* already has fewer and broader primary radiating ribs. In *G. glycymeris* primary ribs bifurcate in an earlier stage resulting in a larger total number of secondary ribs. The reticulation in *G. vanhengstumi* is more distinct.

G. vanhengstumi is more globose, inflated and rounded than *G. glycymeris*, similar to some specimens of *G. pilosa*. An important characteristic to make a fast difference is the comparison of the posterior outline: *G. vanhengstumi* is widest at its midline, whereas *G. glycymeris* is widest below midline. Moreover, the acute posterior shell margin reminding us of the upper part of *G. nummaria* and the broader hinge plate, similar to *G. nummaria* and *G. bimaculata*, certainly in the centre of the valves, is certainly the best tool to identify this troubling species. Moreover, its inside is almost totally white.

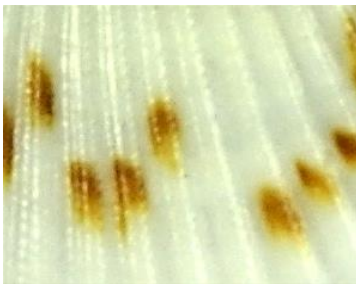
Both *G. vanhengstumi* and *G. pilosa* are prosodetic, nearly amphidetic but *G. pilosa* is a very large shell with a smaller amount of secondary ribs (4-6). Its hinge plate is very narrow in the middle of the valves.

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Identification key to the NE Atlantic and Mediterranean species of *Glycymeris*:

- 1 **Distinctly amphidetic** ligamental condition 7
- **Prosodetic**, slightly amphidetic 2
- 2 **Quadrangular** outline, **distinct concentric cords**, thin valves 6
- **Circular to subovate** outline, globose or flattened valves 3
- 3 **Distinct cancellate network** , **broad hinge plate in the middle**, **upper posterior margins are sharply truncate** 5
- **Obscure reticulated network**, **narrower hinge plate**, upper posterior margins rounded 4
- 4 **Large number of radiating secondary ribs (12-15) per primary rib or internal groove**, large (30 to 90 mm) *Glycymeris glycymeris*
- **Broad radiating ribs, bifurcating in 4-6 secondary ribs per primary rib or internal groove**, **clearly prosodetic**, solid and heavy, inside dark brown posteriorly *Glycymeris pilosa*
- 5 **Small number of secondary ribs (9-12) per primary rib or internal groove**, umbones highly extending above the ligamental area, small (30-50 mm) *Glycymeris vanhengstumi*
- 6 **Commarginal microstructure in the juvenile stage**, **alternating with radial ribs in adults**, light valves, bluish grey mottled with brown zones and flammules *Glycymeris nummaria*
- 7 **Many narrow radiating threads**, obsolete concentric growth lines, circular outline, brown colour over the whole surface of the shell, very large (to 120 mm) *Glycymeris bimaculata*
- **About 30 distinct radiating ribs** separated by deep narrow grooves, very small (less than 30 mm)..... *Glycymeris arabica*

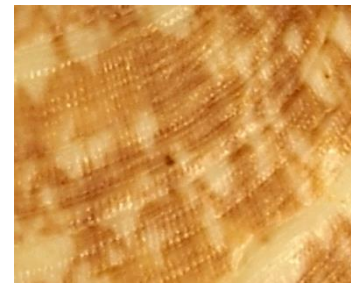
Comparison of the microsculpture



Glycymeris arabica



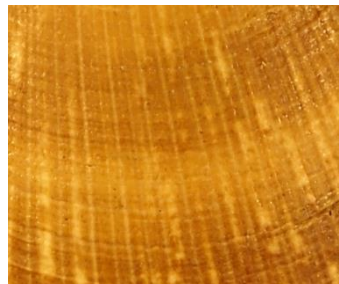
Glycymeris bimaculata



Glycymeris glycymeris



Glycymeris nummaria



Glycymeris pilosa



Glycymeris vanhengstumi

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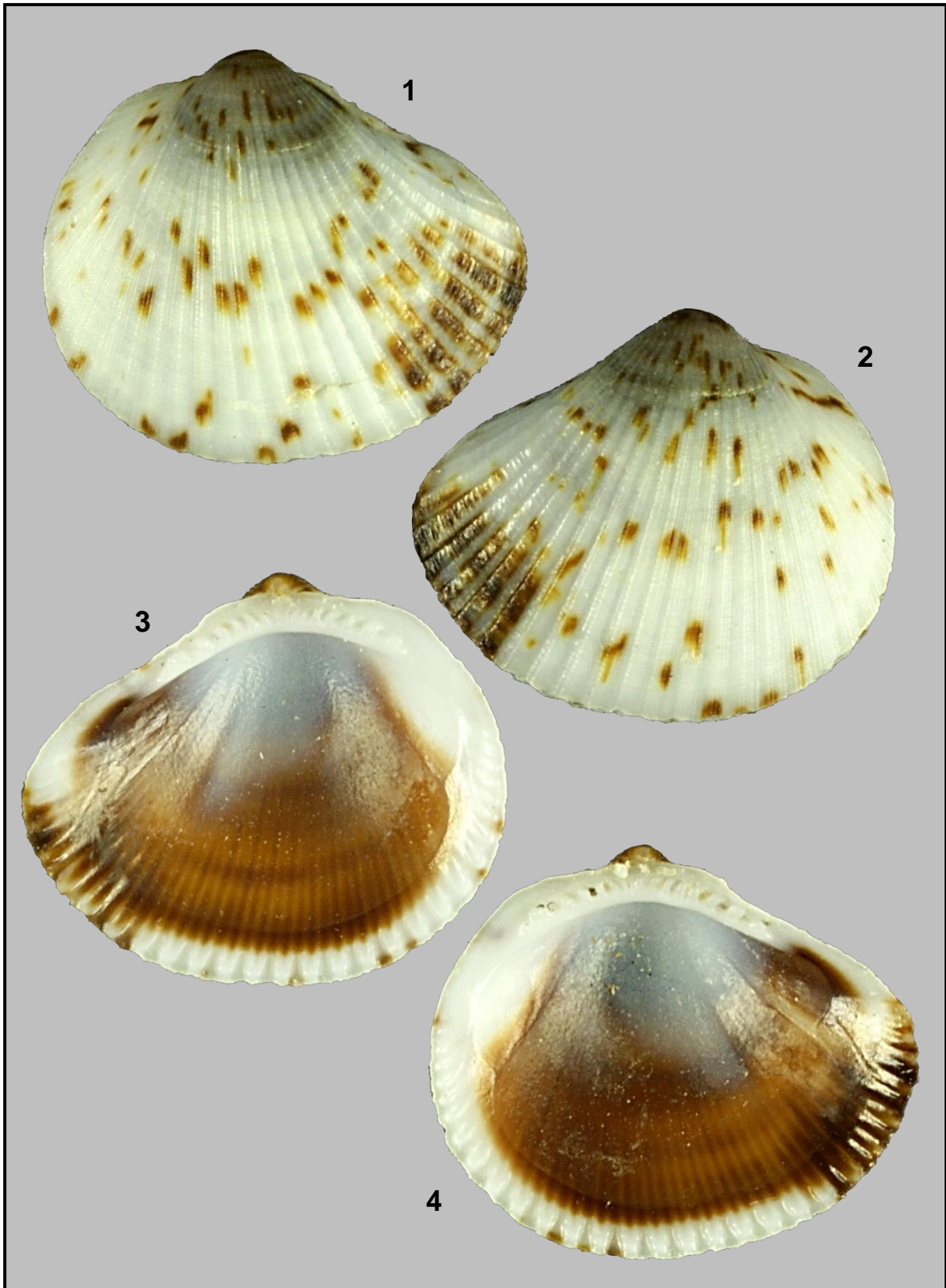


Plate I. Figs 1-4: *Glycymeris arabica* (H. Adams, 1871). Palmahim lagoon, Israel. Dived at a depth of 30 m. August 2011. CFN. H. 9.27 mm L. 10.89 mm; 1: LV; 2: RV; 3: inside of LV; 4: inside of RV.



Plate II. Figs 5-6: *Glycymeris bimaculata* (Poli, 1795). Málaga, Spain. Trawled at a depth of 30 m. August 2010. CFN. H. 105.40 mm L. 109.83 mm; 5: LV; 6: RV.

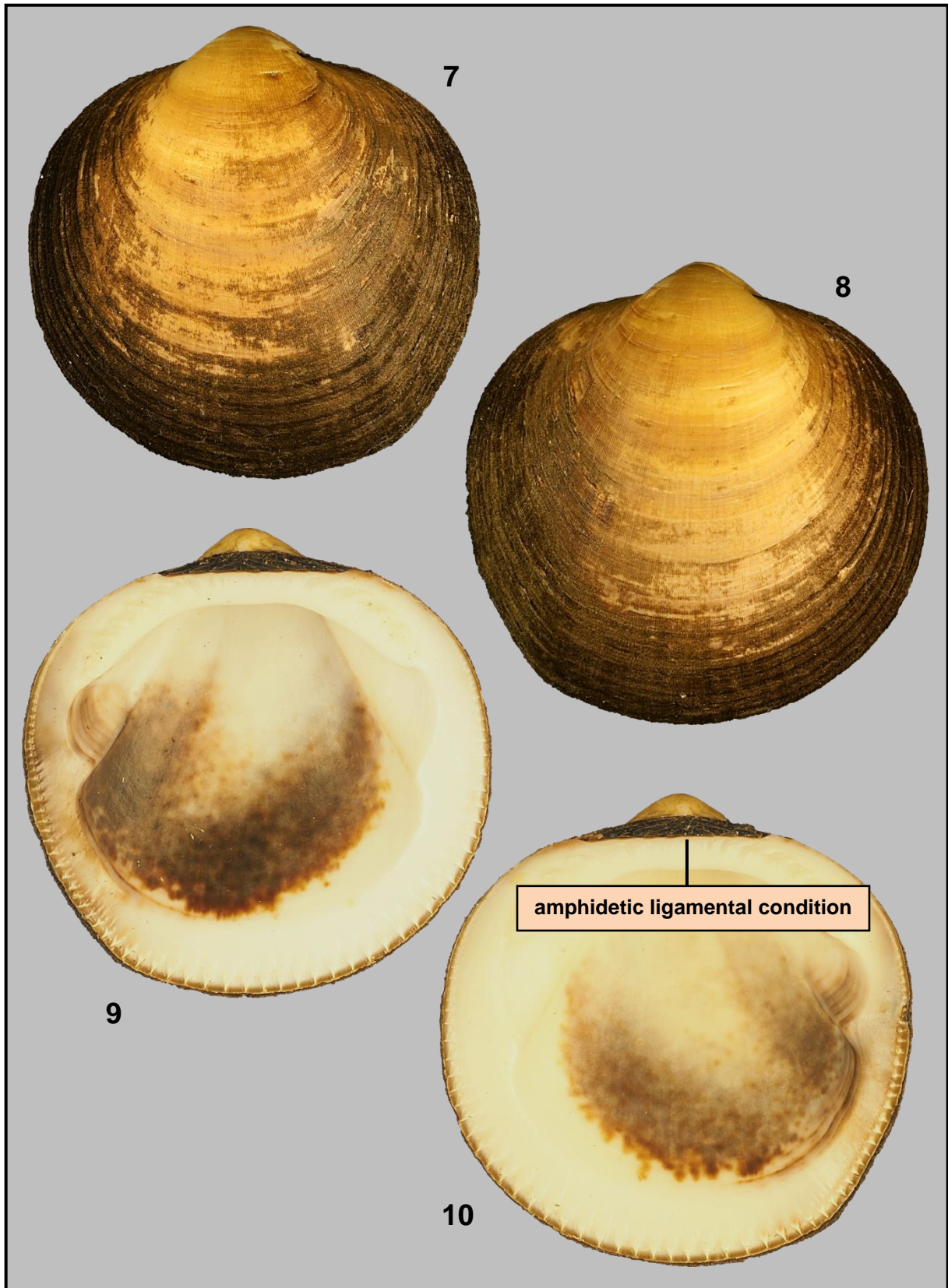


Plate III. Figs 7-10: *Glycymeris bimaculata* (Poli, 1795). Capraia Island, Italy. Dredged at a depth of 65 m. 1989. CFN. H. 72.09 mm L. 71.17 mm; 7: LV; 8: RV; 9: inside of LV; 10: inside of RV.



Plate IV. Figs 11-12: *Glycymeris bimaculata* (Poli, 1795). Dived at a depth of 15 m off Bodrum, Turkey. In sand, among rocks. 1976. CFN. H. 95.96 mm L. 100.08 mm; 11: LV; 12: RV.

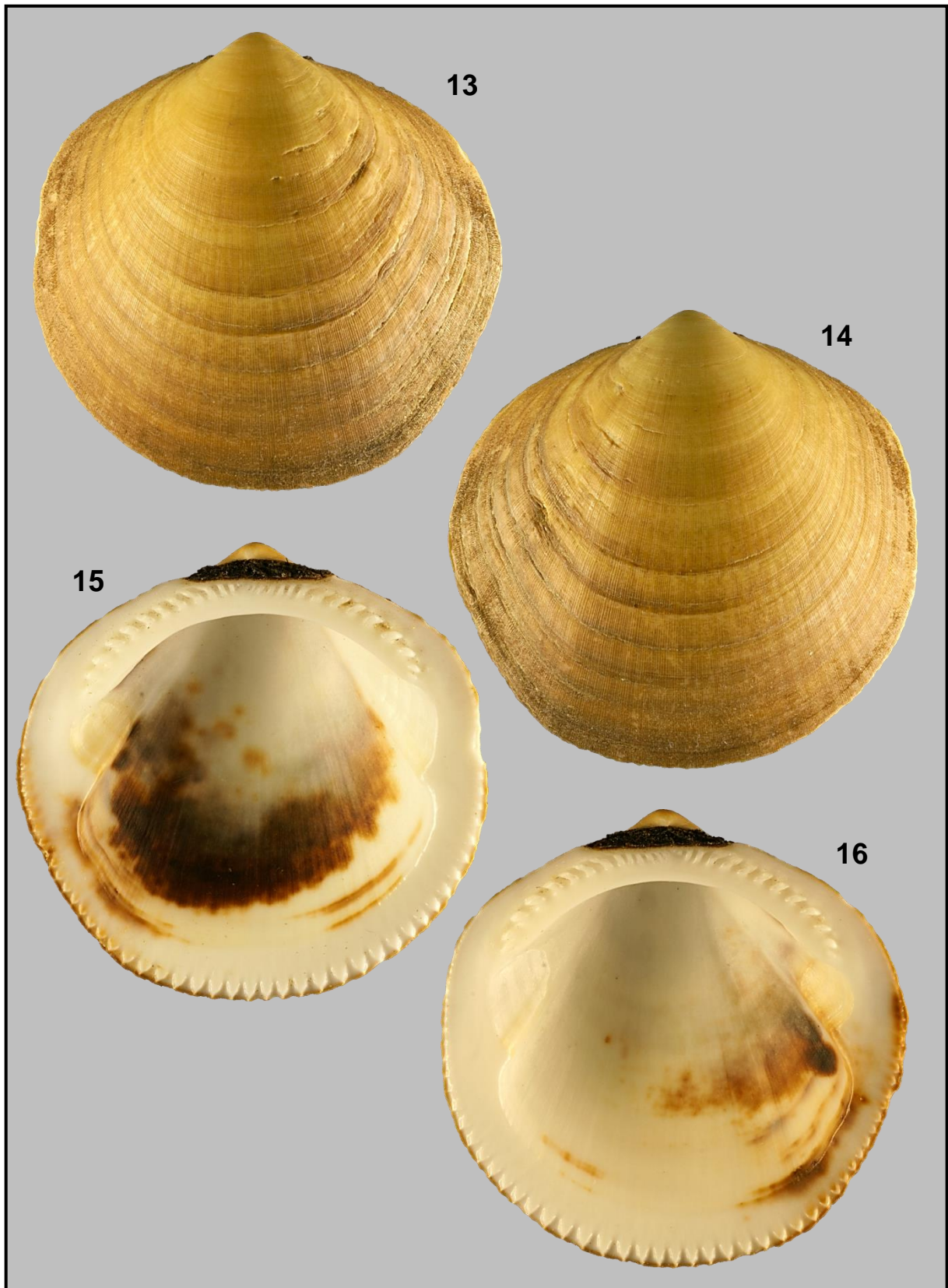


Plate V. Figs 13-16: *Glycymeris bimaculata* (Poli, 1795). Ormideia, Cyprus. Trawled by fishermen. August 1994. CFS. H. 53.67 mm L. 55.06 mm; 13: LV; 14: RV; 15: inside of LV; 16: inside of RV.



Plate VI. Figs 17-22: *Glycymeris glycymeris* (Linnaeus, 1758). CFN; 17-18: Palamos, Gerona, Spain. Trawled by fishermen. September 1978. H. 48.33 mm L. 50.65 mm; 17: LV; 18: RV; 19-20: South of La Rochelle, Bay of Biscay, W France. Trawled by fishermen. 1970. H. 61.36 mm L. 63.77 mm; 19: LV; 20: RV; 21-22: Land's End, SW England, UK. Trawled by Belgian fishermen at a depth of 25 m. In sandy-muddy bottom. 1968. H. 53.78 mm L. 55.86 mm; 21: LV; 22: RV.



Plate VII. Figs 23-28: *Glycymeris glycymeris* (Linnaeus, 1758). Saint-Cast-le-Guildo, Brittany, France. Trawled by local fishermen. 28 August 1992. CFN; 23-24: H. 44.51 mm L. 45.40 mm; 23: LV; 24: RV; 25-26: H. 44.98 mm L. 46.17 mm; 25: LV; 26: RV; 27-28: H. 46.29 mm L. 47.44 mm; 27: LV; 28: RV.

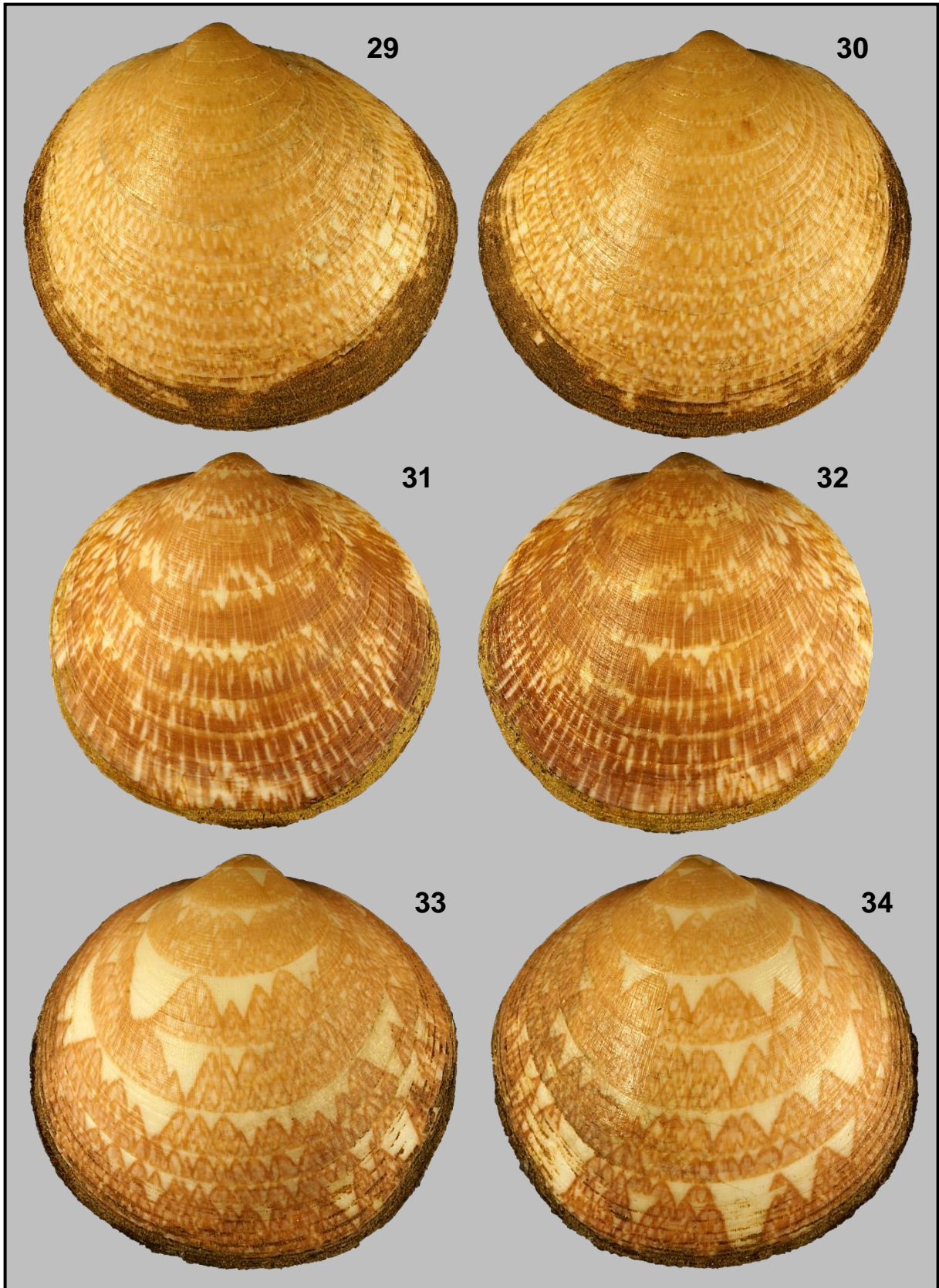


Plate VIII. Figs 29-34: *Glycymeris glycymeris* (Linnaeus, 1758). Saint-Cast-le-Guildo, Brittany, France. Trawled by local fishermen. 28 August 1992. CFN; 29-30: H. 44.56 mm L. 47.92 mm; 29: LV; 30: RV; 31-32: H. 41.21 mm L. 42.99 mm; 31: LV; 32: RV; 33-34: H. 42.13 mm L. 42.16 mm; 33: LV; 34: RV.

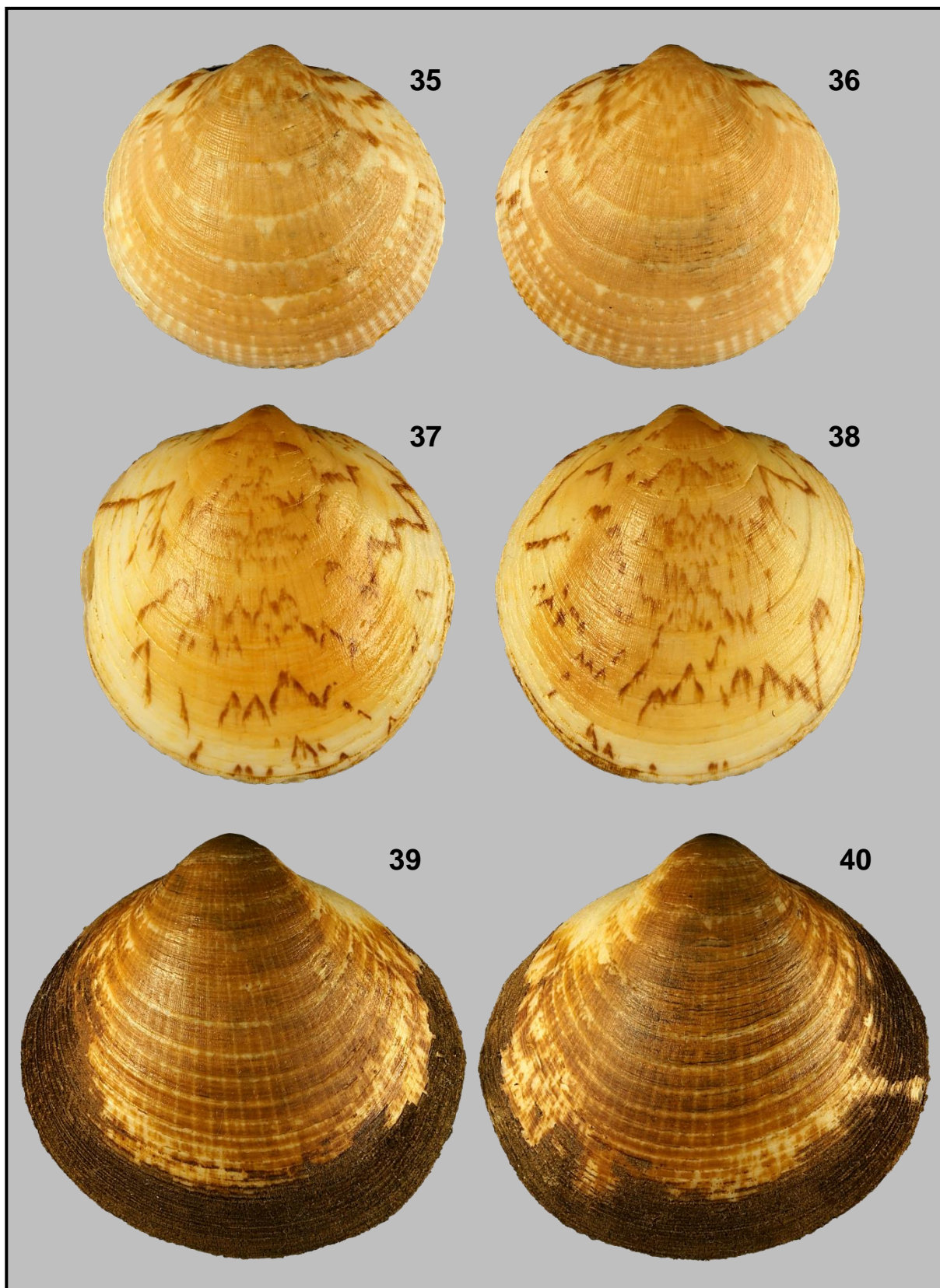


Plate IX. Figs 35-40: *Glycymeris glycymeris* (Linnaeus, 1758). Saint-Cast-le-Guildo, Brittany, France. Trawled by local fishermen. 28 August 1992. CFN; 35-36: H. 37.49 mm L. 39.77 mm; 35: LV; 36: RV; 37-38: H. 41.85 mm L. 40.97 mm; 37: LV; 38: RV; 39-40: H. 69.41 mm L. 72.11 mm; 39: LV; 40: RV.

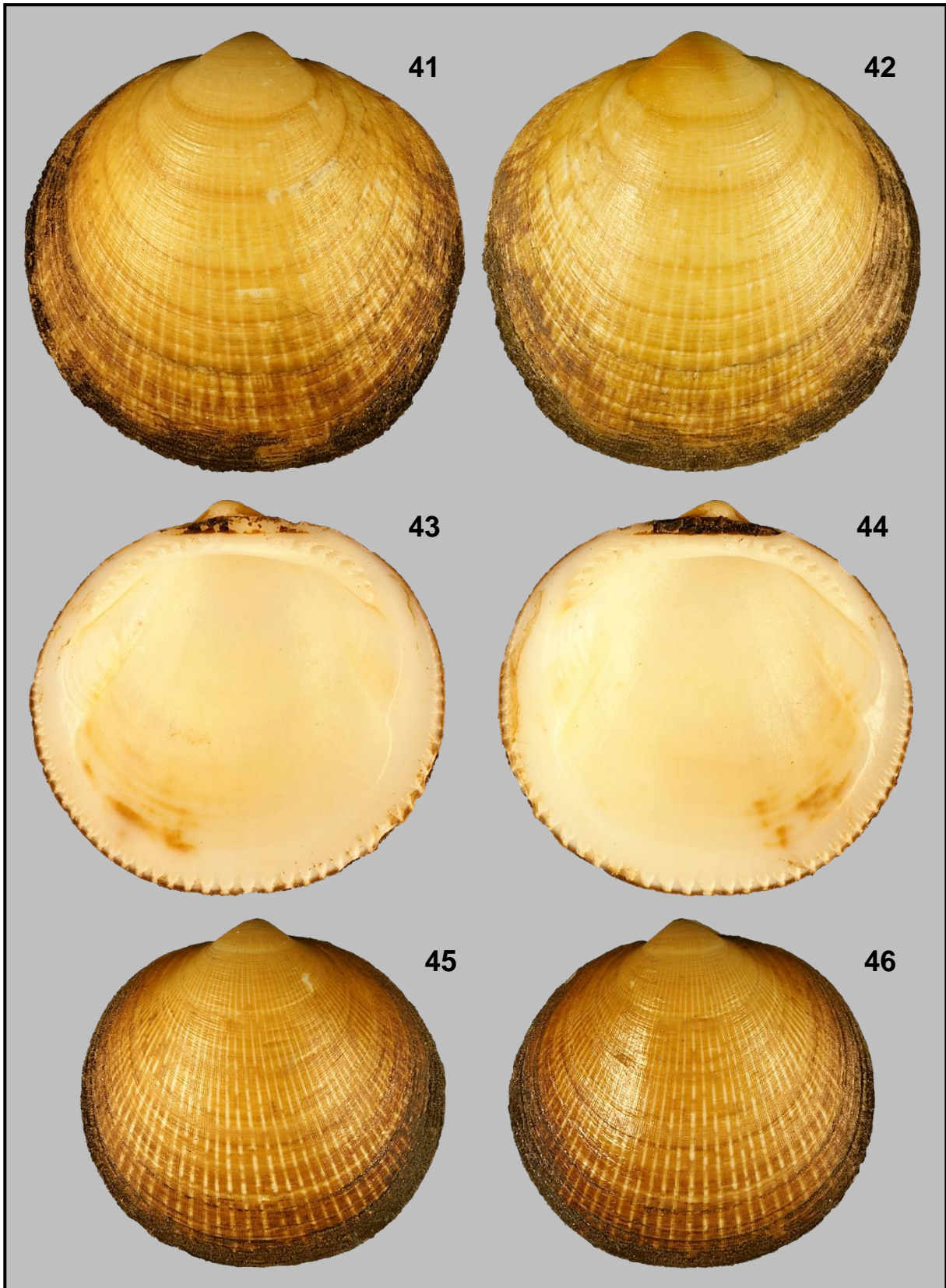


Plate X. Figs 41-46: *Glycymeris glycymeris* (Linnaeus, 1758). Saint-Cast-le-Guildo, Brittany, France. Trawled by local fishermen. 28 August 1992. CFN; 41-42: H. 51.81 mm L. 51.17 mm; 41: LV; 42: RV; 43-44: H. 45.05 mm L. 45.02 mm; 43: inside of LV; 44: inside of RV; 45-46: H. 41.03 mm L. 42.91 mm; 45: LV; 46: RV.

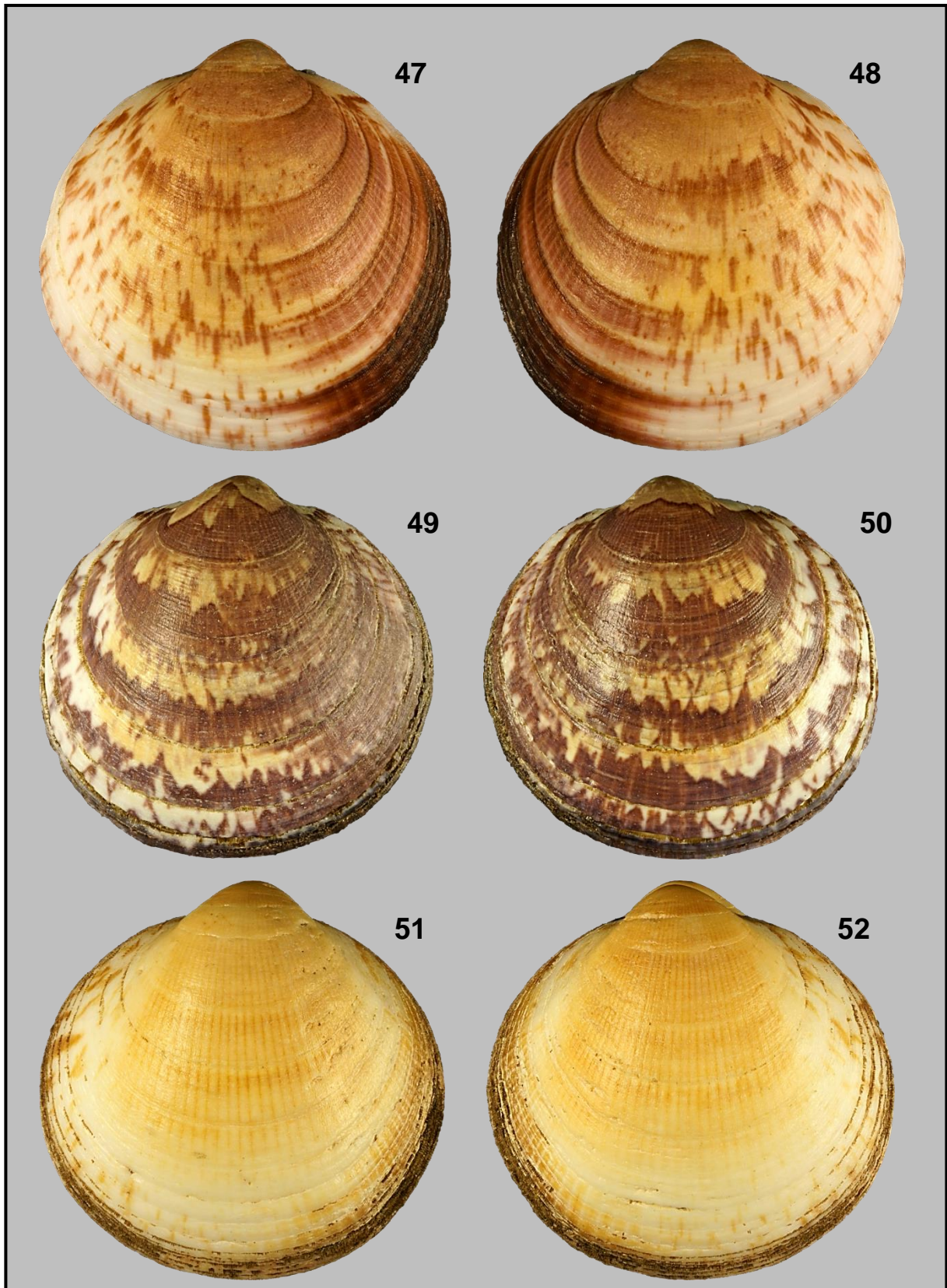


Plate XI. Figs 47-52: *Glycymeris glycymeris* (Linnaeus, 1758). CFN; 47-48: Le Verdelet, Le Val-André, Brittany, France. In sand at extreme low tide. H. 40.08 mm L. 40.05 mm; 47: LV; 48: RV; 49-52: Saint-Enogat, Dinard, Brittany, France. In sand at extreme low tide. April 2012; 49-50: H. 33.58 mm L. 34.36 mm; 49: LV; 50: RV; 51-52: H. 38.34 mm L. 39.02 mm; 51: LV; 52: RV.

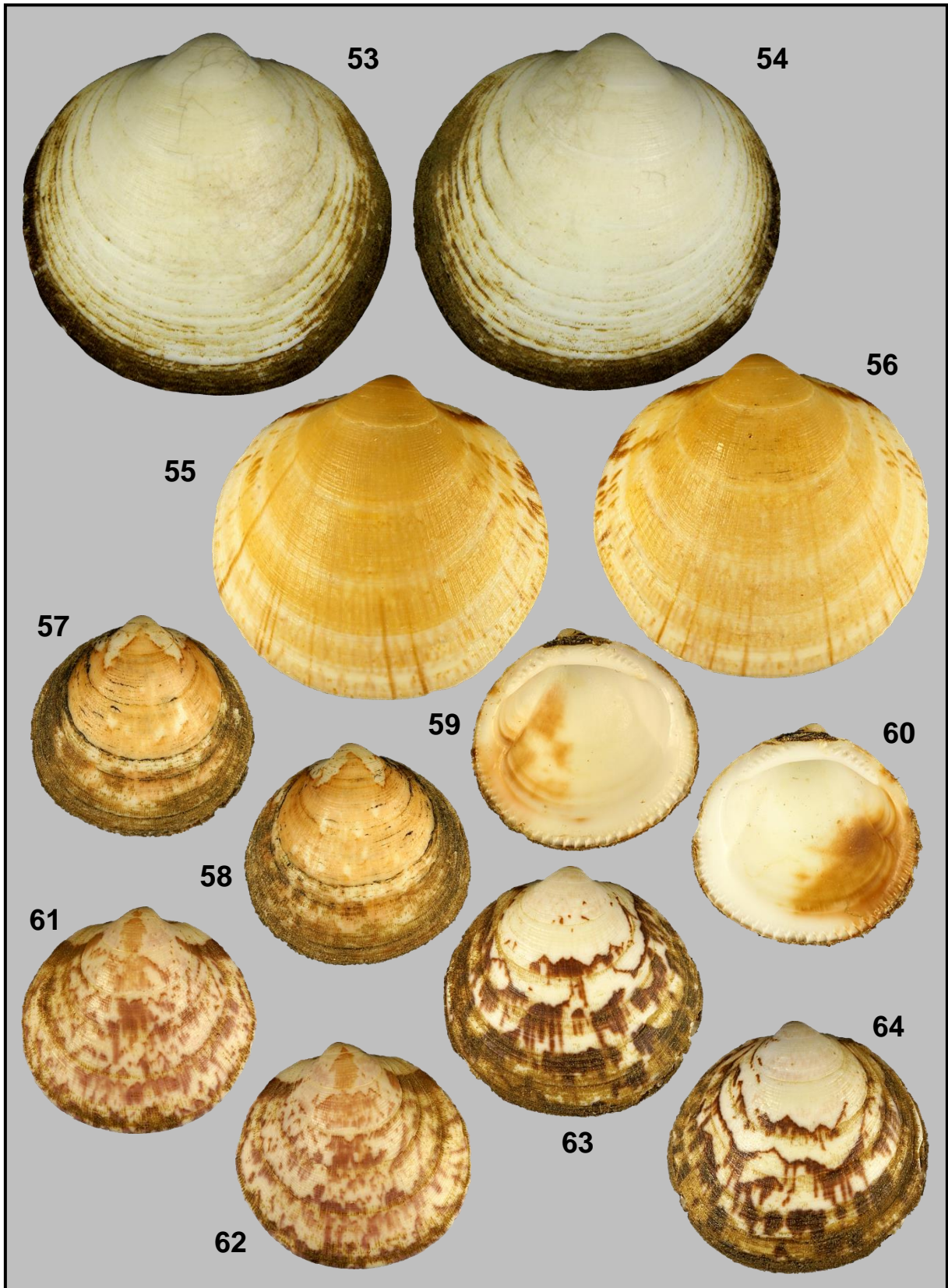


Plate XII. Figs 53-64: *Glycymeris glycymeris* (Linnaeus, 1758). CFN; 53-54: Erquy, Brittany, France. Trawled by local fishermen. July 1968. H. 41.44 mm L. 42.18 mm; 53: LV; 54: RV; 55-56: Ile Callot, off Roscoff, Brittany, France. In sand at extreme low tide. 9 August 1998. H. 35.81 mm L. 37.24 mm; 55: LV; 56: RV; 57-64: Granville, Normandy, France. In sand at low tide. April 2012; 57-60: H. 20.88 mm L. 21.42 mm; 57: LV; 58: RV; 59: inside of LV; 60: inside of RV; 61-62: H. 21.69 L. 22.54 mm; 61: LV; 62: RV; 63-64: H. 26.20 mm H. 27.19 mm; 63: LV; 64: RV.

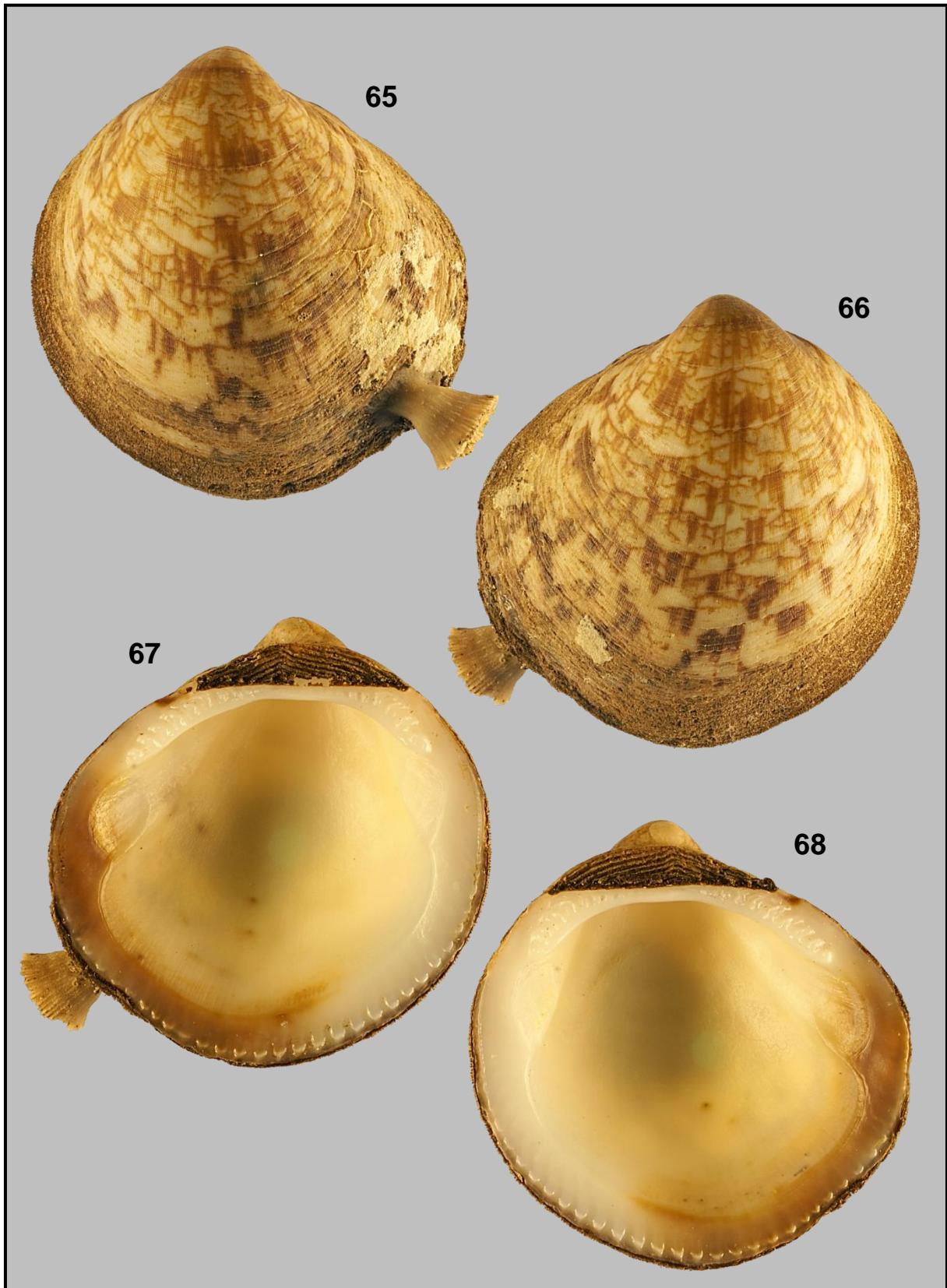


Plate XIII. Figs 65-68: *Glycymeris glycymeris* (Linnaeus, 1758). Funchal Bay, Madeira. Trawled by fishermen at a depth of 180 m. CFS. H. 46.95 mm L. 45.16 mm; 65: LV; 66: RV; 67: inside of LV; 68: inside of RV.

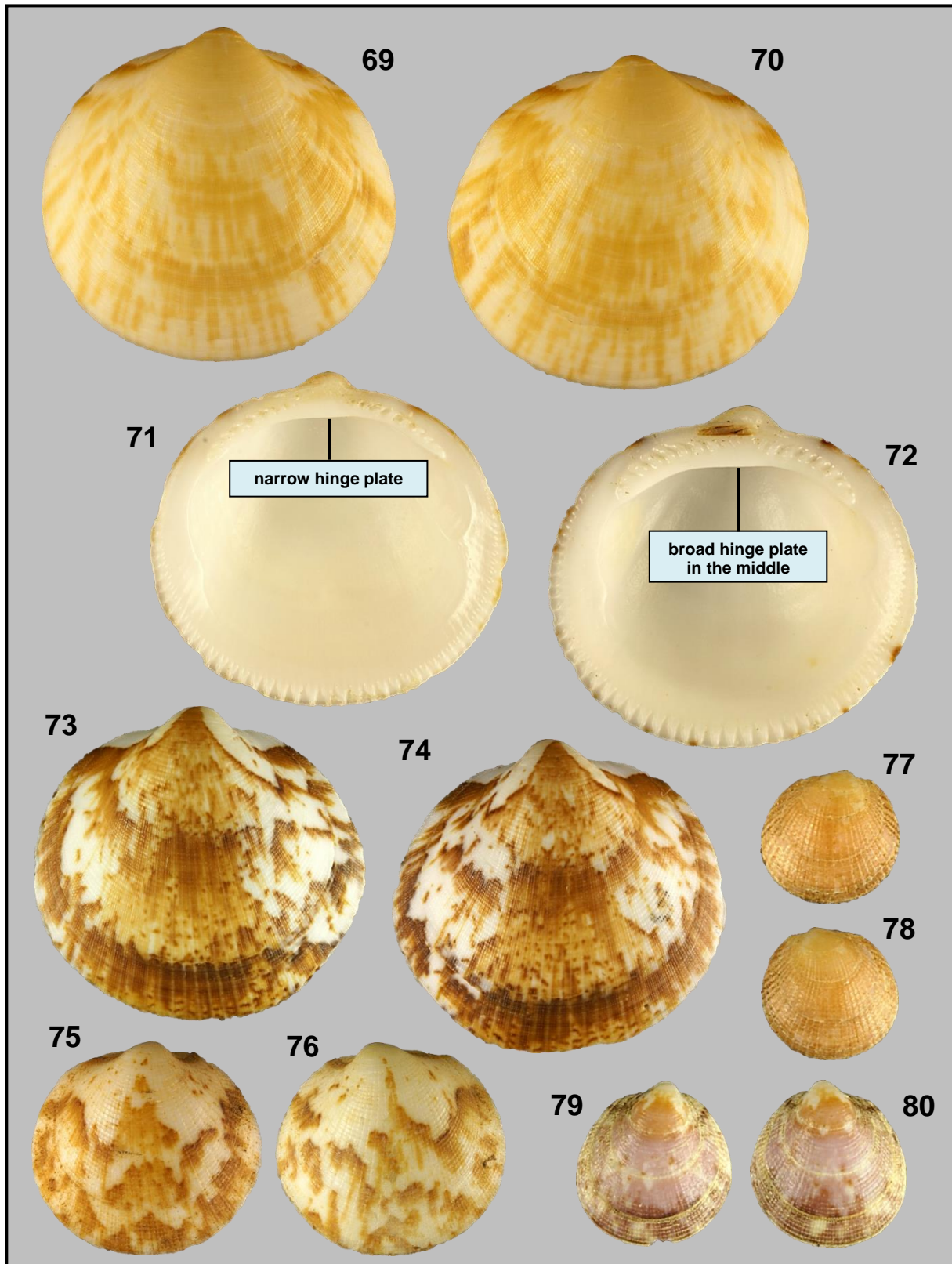


Plate XIV. Figs 69-71: *Glycymeris glycymeris* (Linnaeus, 1758). Sardina, Gran Canaria, Canary Islands. June 1987. CFS. H. 25.02 mm L. 26.71 mm; 69: LV; 70: RV; 71: inside of RV; 72: *Glycymeris vanhengstumi* Goud & Gulden, 2009. 10 km north of Agadir, between Anza and Aourir. On the beach at low tide. August 1989. CFS. H. 22.13 mm L. 23.81 mm. Inside of RV; 73-74: *Glycymeris glycymeris* (Linnaeus, 1758). Ilhéu de Fora, Selvagens Islands, Madeira. Dived at a depth of 14-20 m. CFS. H. 20.65 mm L. 21.96 mm; 73: LV; 74: RV; 75-78: *Glycymeris vanhengstumi* Goud & Gulden, 2009. Garajau, Madeira. Dredged at a depth of 80 m. June 2000. CFS; 75-76: H. 11.80 mm L. 12.66 mm; 75: LV; 76: RV; 77-78: H. 5.26 mm L. 5.34 mm (juvenile specimen); 79-80: *Glycymeris glycymeris* (Linnaeus, 1758). Granville, Normandy, France. In sand at low tide. April 2012. CFN. H. 7.17 mm L. 6.87 mm (juvenile specimen); 79: LV; 80: RV.

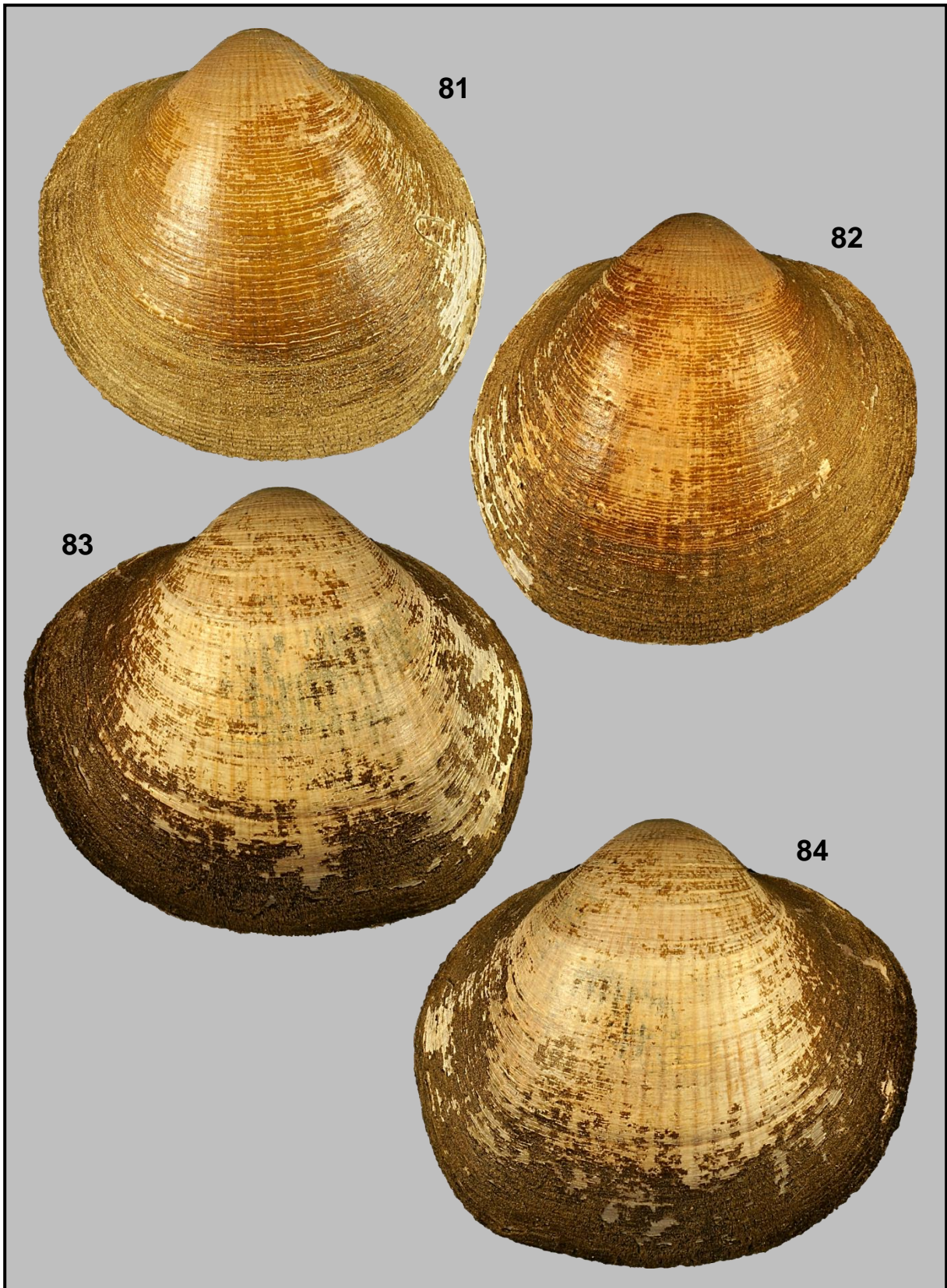


Plate XV. Figs 81-84: *Glycymeris nummaria* (Linnaeus, 1758). Gibraltar area. South Spain. Trawled by fishermen at a depth of 35 m. 1997. CFN. H. 63.50 mm L. 66.21 mm; 81: LV; 82: RV; 83-84: H. 71.87 mm L. 80.56 mm; 83: LV; 84: RV.



Plate XVI. Figs 85-88: *Glycymeris nummaria* (Linnaeus, 1758). Fiumicino, Lazio, Italy. Trawled by fishermen. June 2003. CFN. H. 57.62 mm L. 65.08 mm; 85: LV; 86: RV; 87: inside of LV; 88: inside of RV.

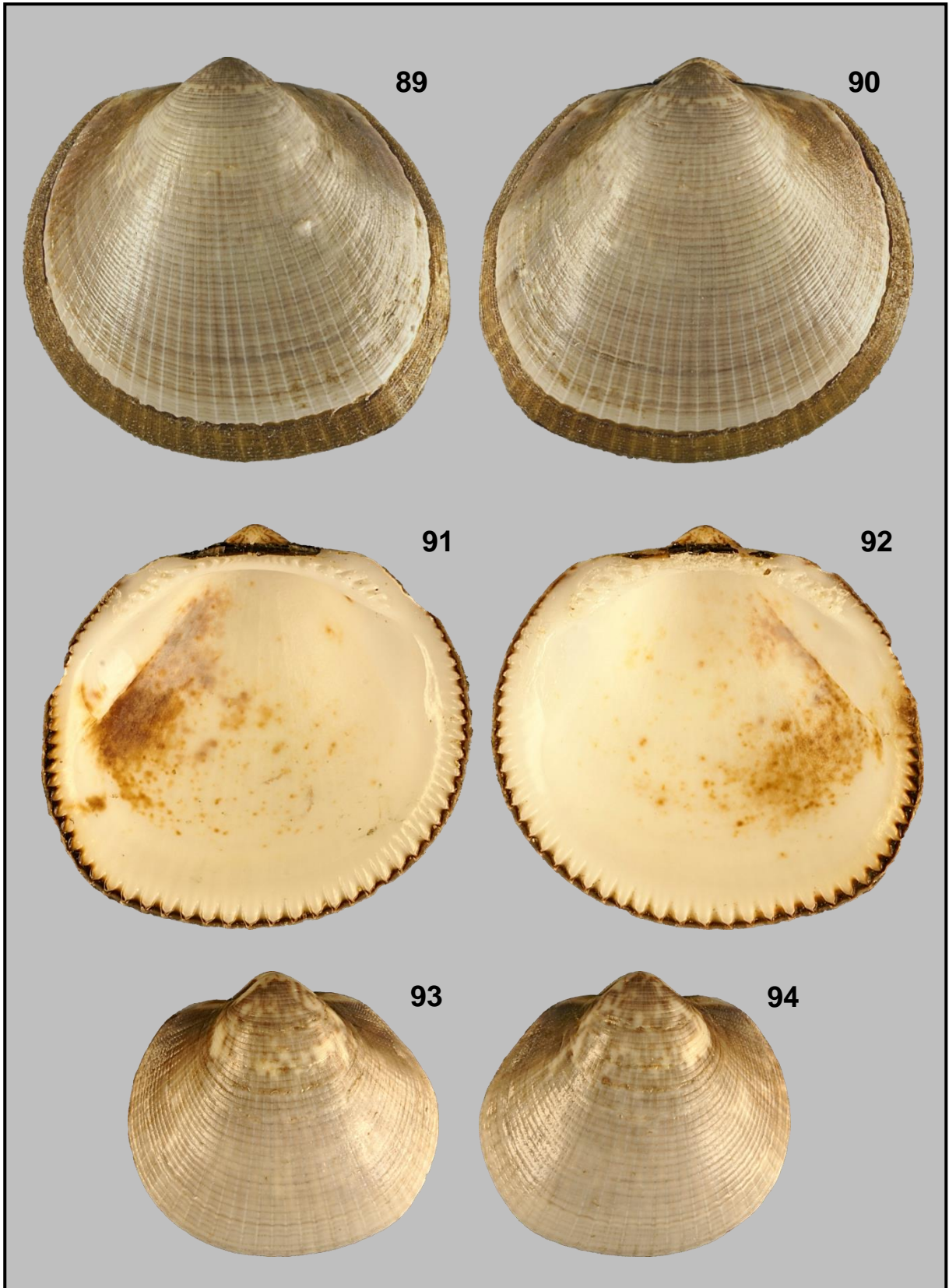


Plate XVII. Figs 89-94: *Glycymeris nummaria* (Linnaeus, 1758); 89-92: Panormos Bay, Skopelos Island, Greece. Dived at a depth of 5 m. On mud. June 2006. CFN. H. 33.52 mm L. 36.39 mm; 89: LV; 90: RV; 91: inside of LV; 92: inside of RV; 93-94: Sardina, Gran Canaria, Canary Islands. Dredged at a depth of 17 m. July 1984. CFS. H. 17.3 mm L. 18.90 mm; 93: LV; 94: RV.

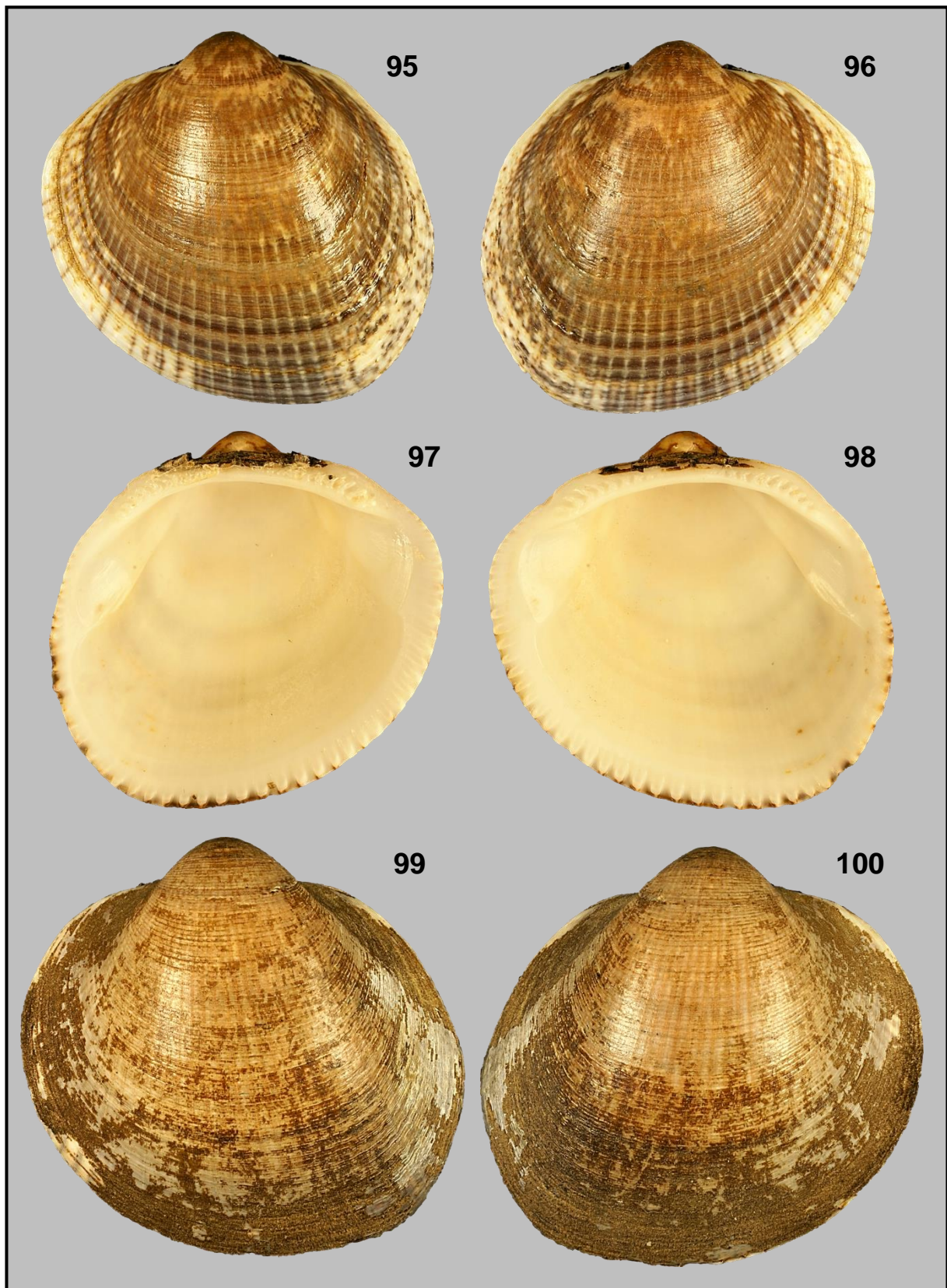


Plate XVIII. Figs 95-100: *Glycymeris nummaria* var. *obliquata* (de Rayneval & Ponzi, 1854). CFN; 95-98: Gulf of Gabès, Tunisia. Trawled by fishermen. August 1975. H. 43.54 mm L. 49.60 mm; 95: LV; 96: RV; 97: inside of LV; 98: inside of RV; 99-100: Barcelona, Spain. Trawled by fishermen. 1961. H. 55.96 mm L. 60.41 mm; 99: LV; 100: RV.

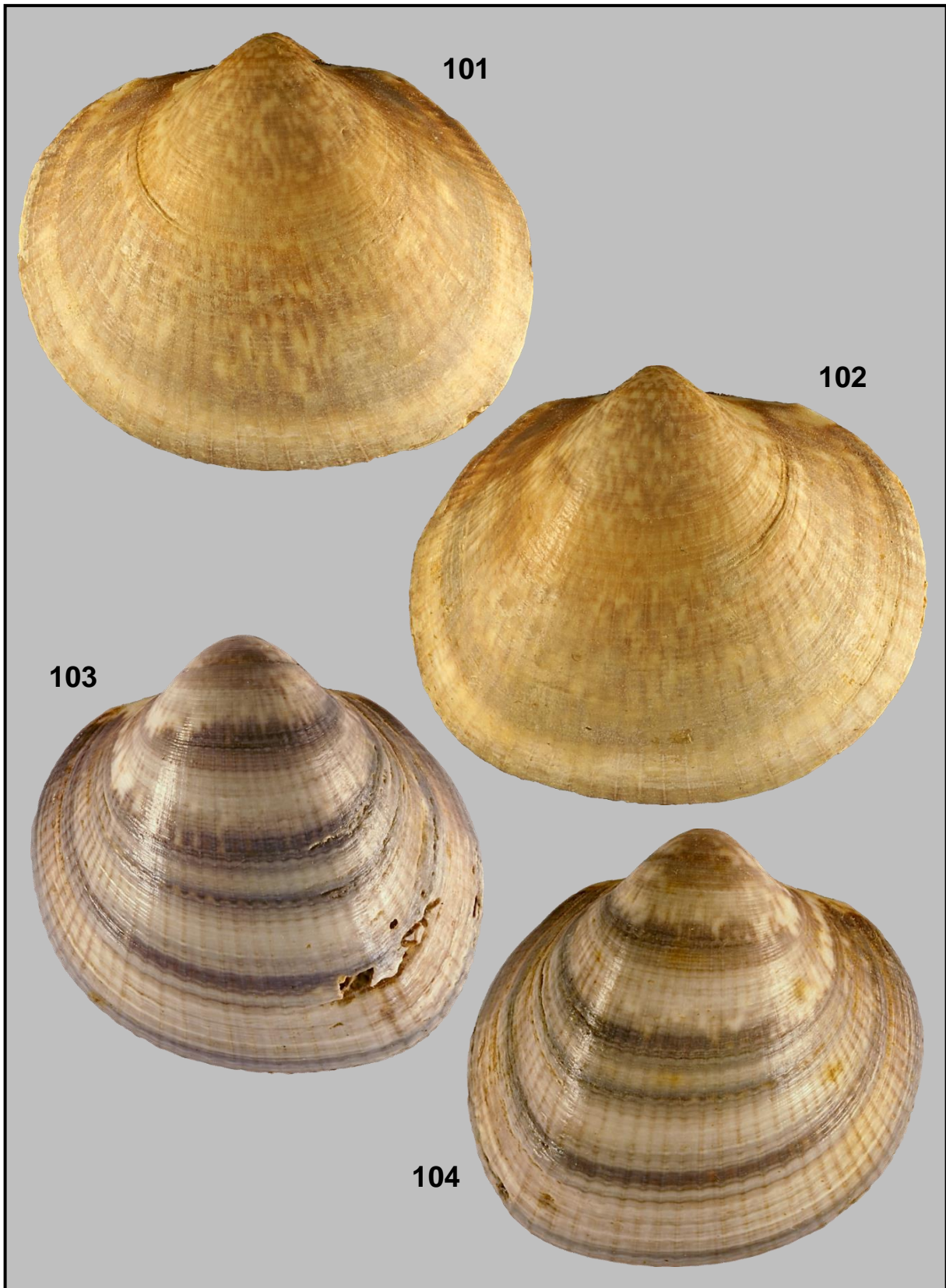


Plate XIX. Figs 101-102. *Glycymeris nummaria* var. *pallida* (B.D.D., 1891). Barcelona, Spain. Trawled by fishermen. 1961. CFN. H. 42.44 mm L. 49.26 mm; 101: LV; 102: RV; 103-104: *Glycymeris nummaria* var. *zonalis* (Lamarck, 1819). El Arenal, Spain. Trawled by fishermen. 9 March 1973. CFN. H. 35.21 mm L. 35.26 mm; 103: LV; 104: RV.

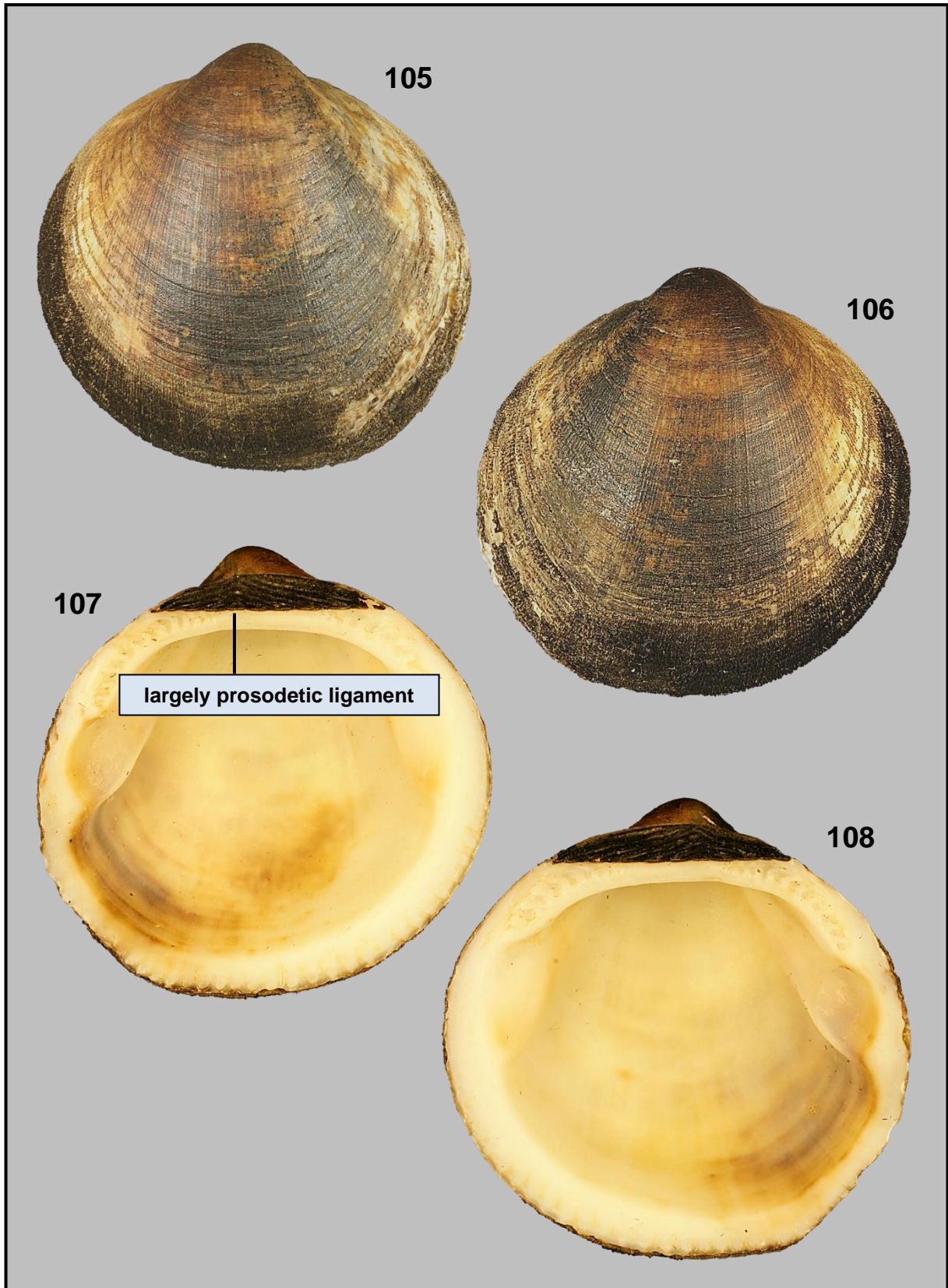


Plate XX. Figs 105-108: *Glycymeris pilosa* (Linnaeus, 1767). Trawled by fishermen off Barcelona, Spain. CFN. H. 64.27 mm L. 65.21 mm; 105: LV; 106: RV; 107: inside of LV; 108: inside of RV.

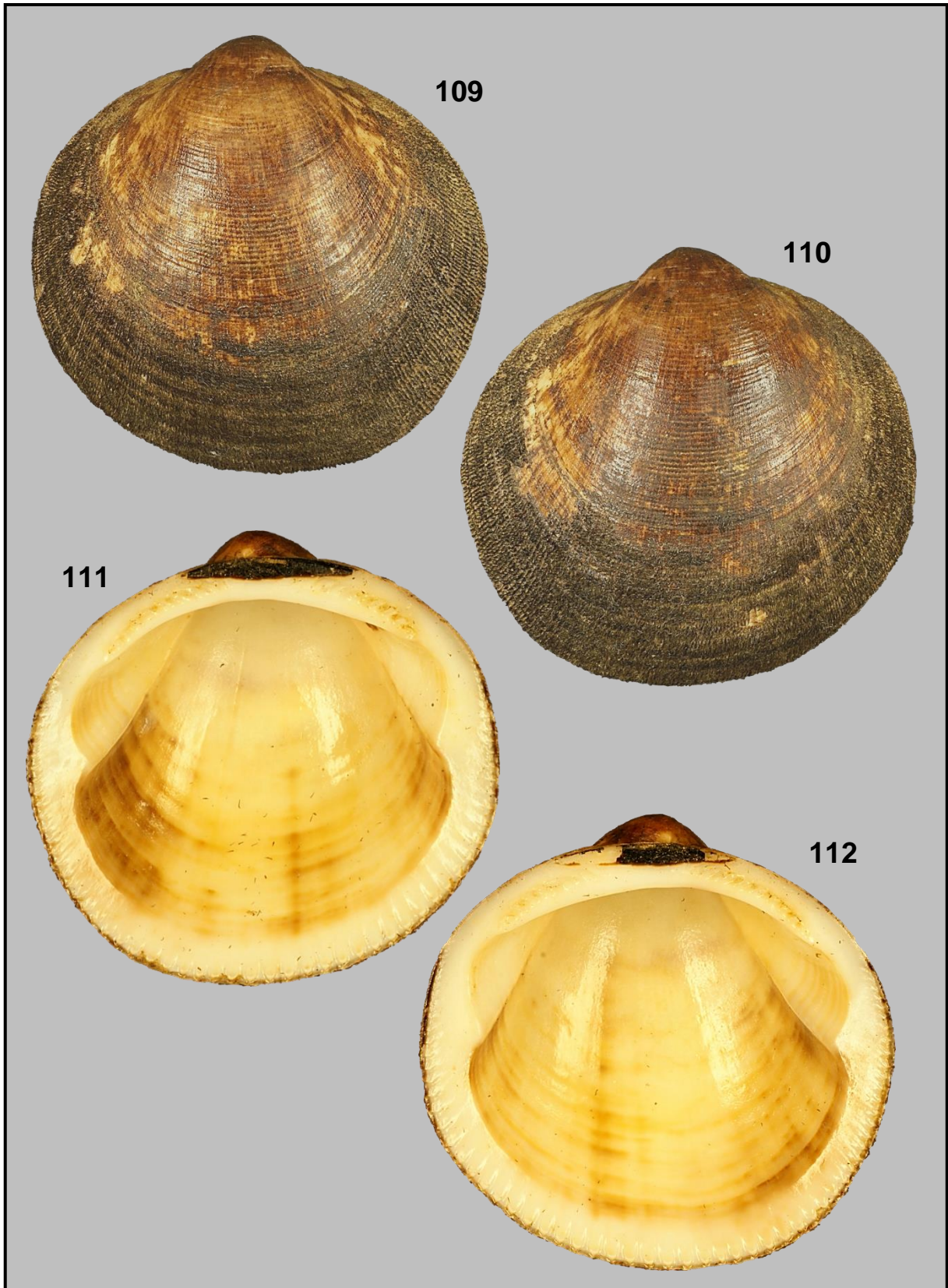


Plate XXI. Figs 109-112: *Glycymeris pilosa* (Linnaeus, 1767). Trawled by fishermen off Barcelona, Spain. CFN. H. 60.79 mm L. 63.47 mm; 109: LV; 110: RV; 111: inside of LV; 112: inside of RV.

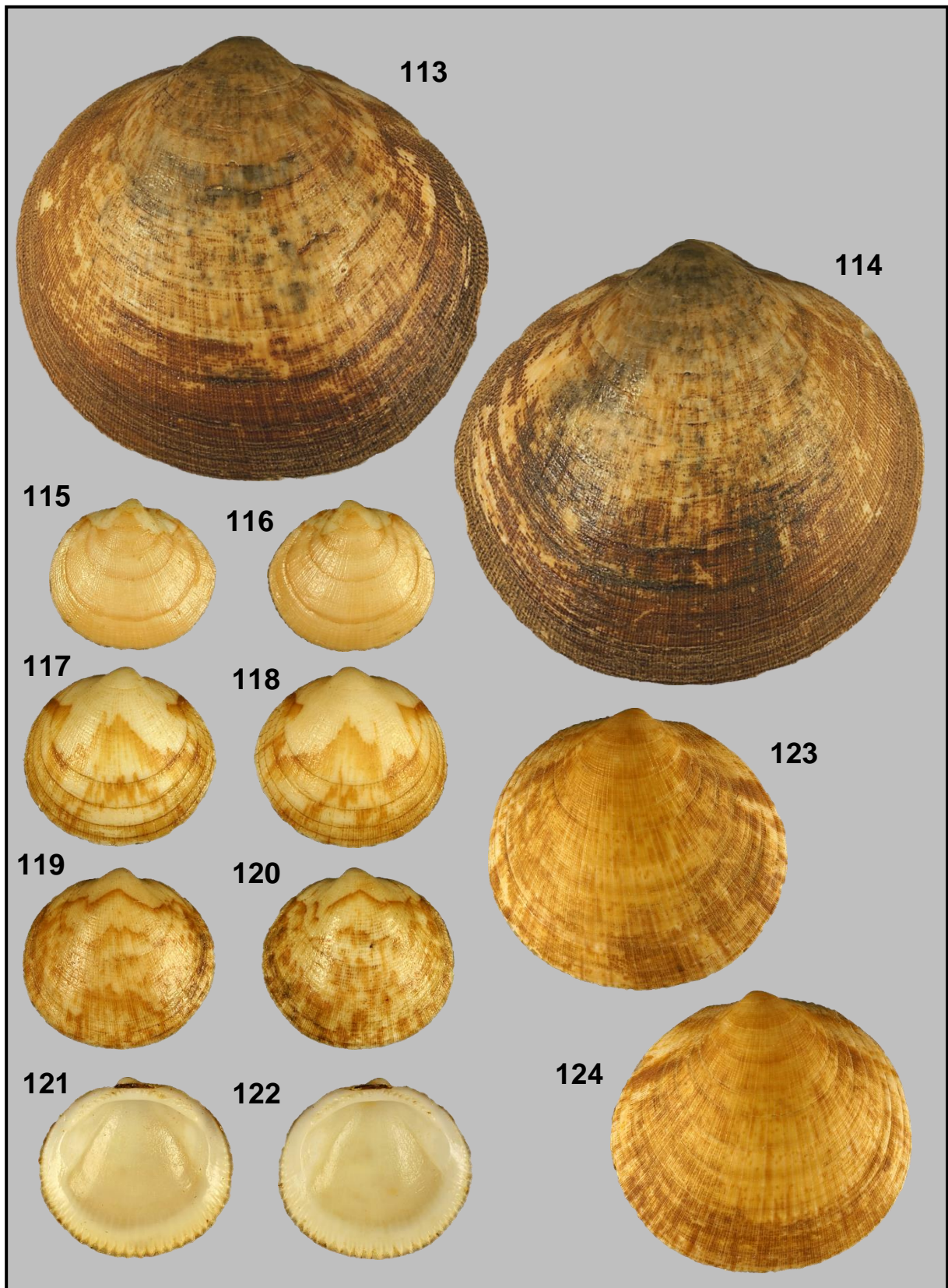


Plate XXII. Figs 113-122: *Glycymeris pilosa* (Linnaeus, 1767). CFN; 113-114: Porto Cesareo, Italy. Dredged at a depth of 14 m. In sand. July 1994. H. 57.18 mm L. 60.15 mm; 113: LV; 114: RV; 115-122: Cabo Blanco, Mauritania. Trawled by fishermen. September 1972; 115-116: H. 15.02 mm L. 16.84 mm; 115: LV; 116: RV; 117-118: H. 18.76 mm L. 20.13 mm; 117: LV; 118: RV; 119-122: H. 19.98 mm L. 20.98 mm; 119: LV; 120: RV; 121: inside of LV; 122: inside of RV; 123-124: *Glycymeris pilosa* var. *neapolitana* (B.D.D., 1891). Cadiz, South Spain. Trawled by fishermen. August 1989. CFS. H. 33.20 mm L. 35.28 mm; 123: LV; 124: RV.

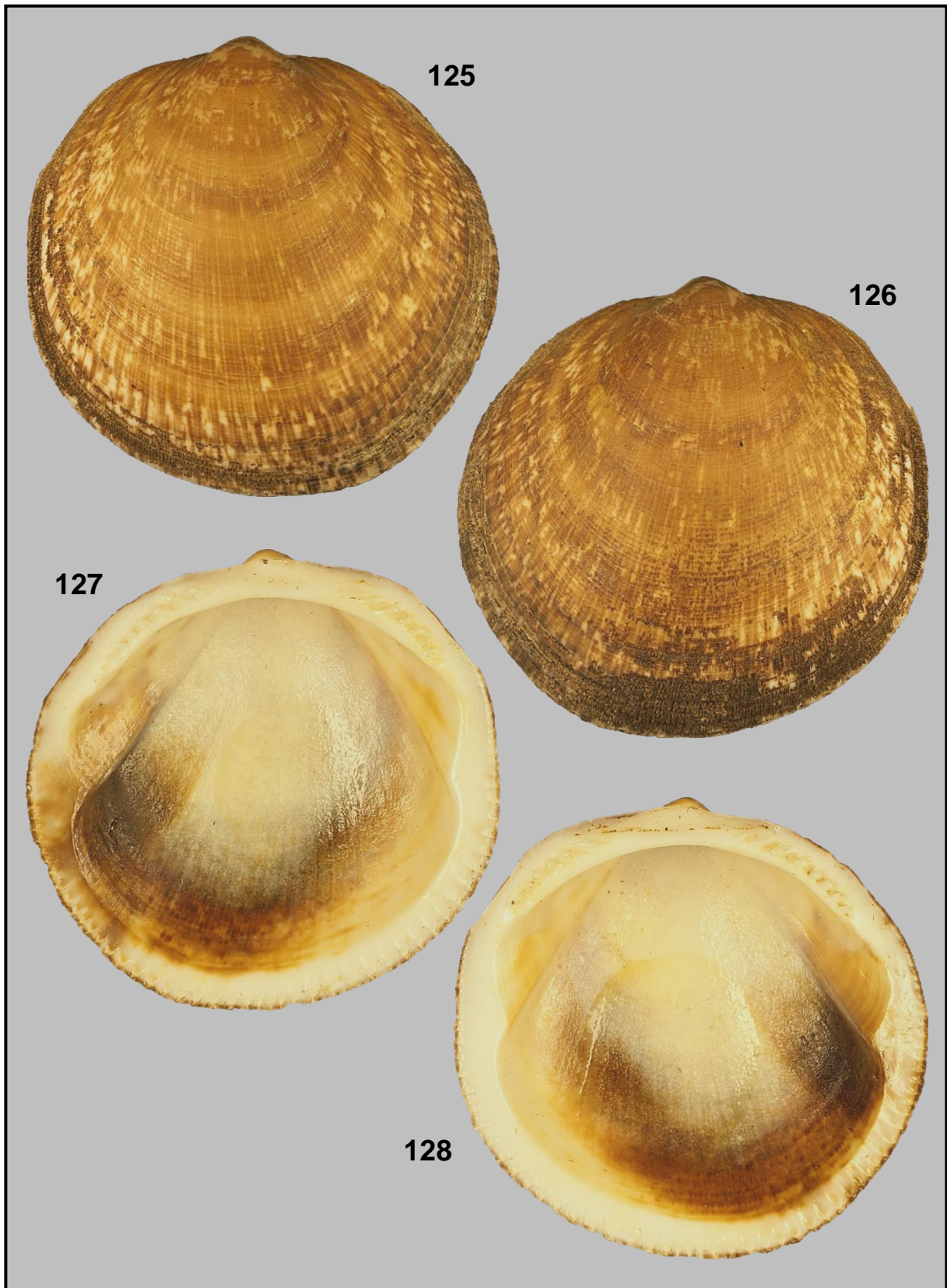


Plate XXIII. Figs 125-128: *Glycymeris pilosa* var. *neapolitana* (B.D.D., 1891). Sicily, Italy. Trawled by fishermen. CFN. H. 77.33 mm L. 79.95 mm; 125: LV; 126: RV; 127: inside of LV; 128: inside of RV.

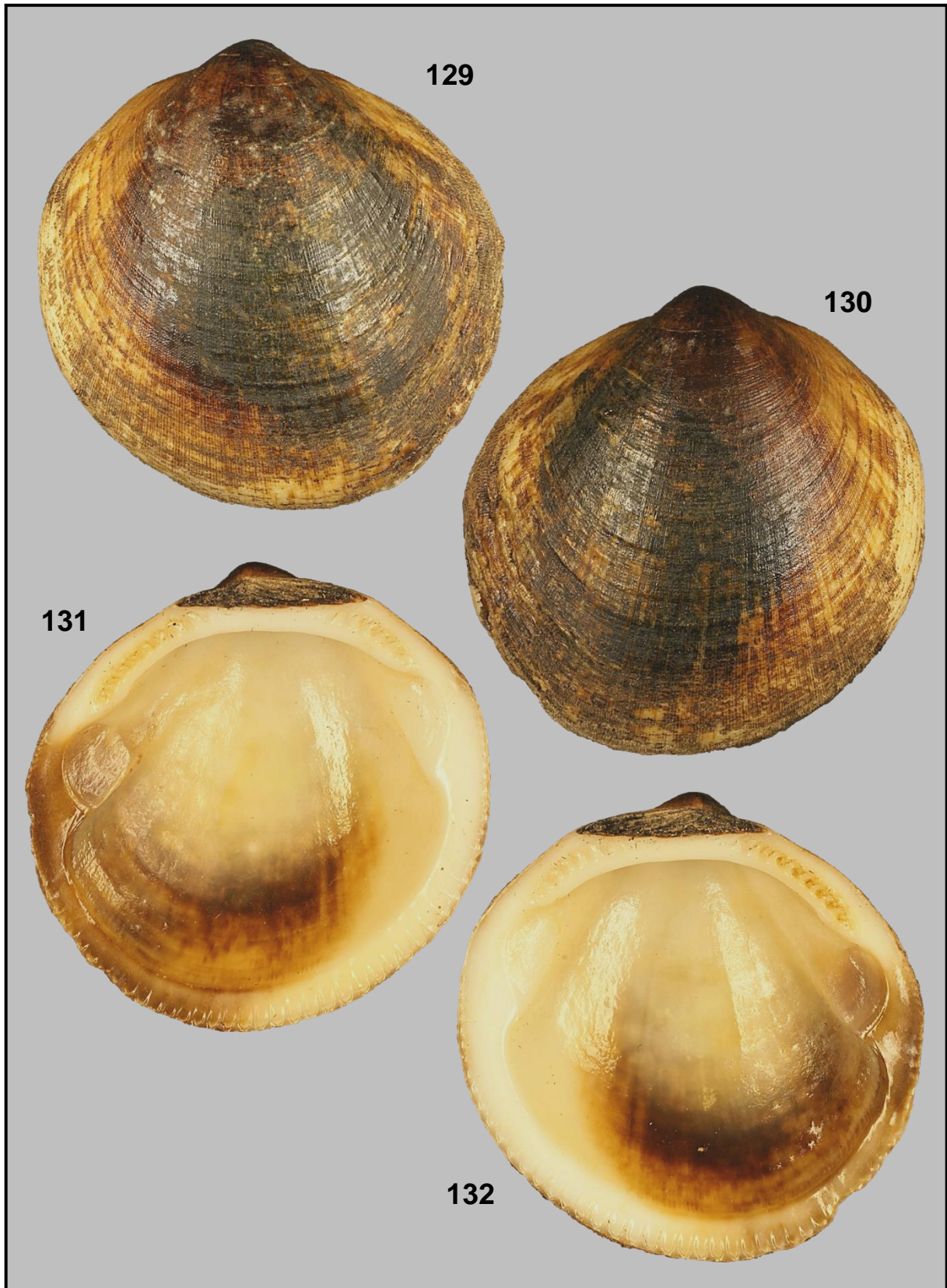


Plate XXIV. Figs 129-132: *Glycymeris pilosa* var. *subtruncata* (B.D.D., 1891). Sicily, Italy. Trawled by fishermen. CFN. H. 68.80 L. 68.64 mm; 129: LV; 130: RV; 131: inside of LV; 132: inside of RV.

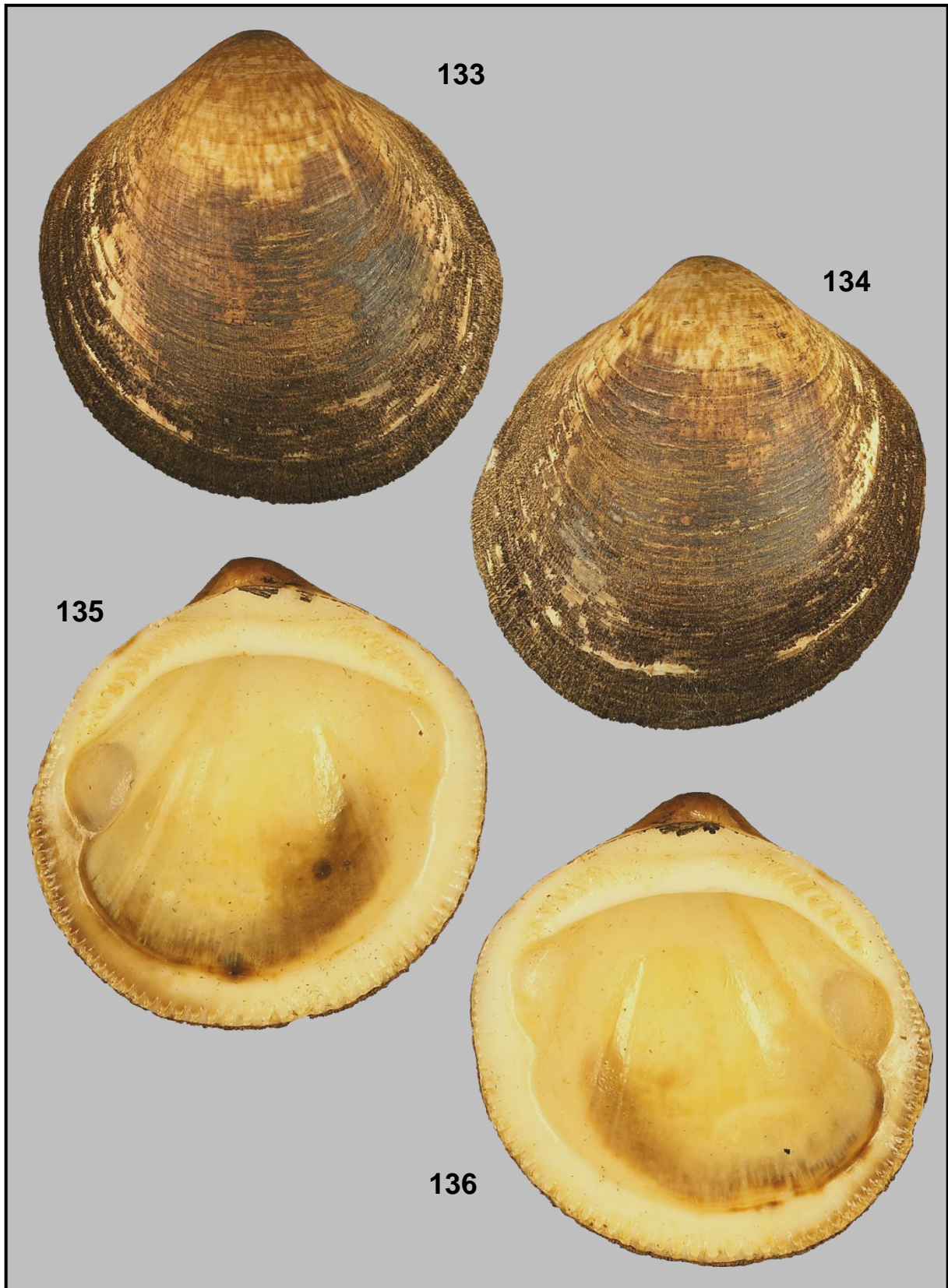


Plate XXV. Figs 133-136: *Glycymeris pilosa* var. *tumida* (B.D.D., 1891). Barcelona, Spain. Trawled by fishermen. December 1971. CFN. H. 74.47 L. 74.55 mm; 133: LV; 134: RV; 135: inside of LV; 136: inside of RV.

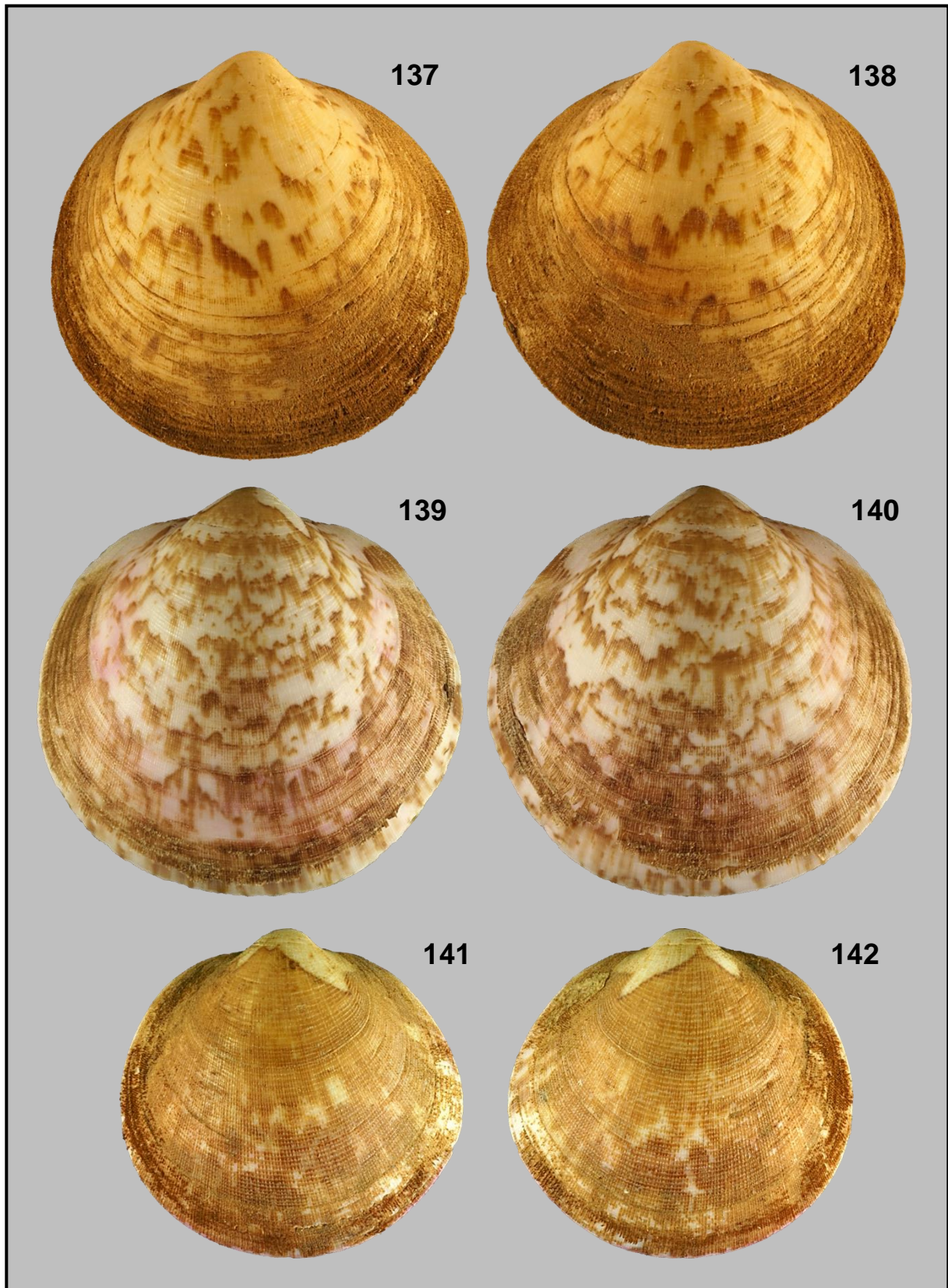


Plate XXVI. Figs 137-142: *Glycymeris vanhengstumi* Goud & Gulden, 2009. Funchal Bay, Madeira. Trawled by fishermen at a depth of 100 m. 5 June 2000. CFS; 137-138: H. 28.17 mm L. 28.63 mm; 137: LV; 138: RV; 139-140: H. 30.34 mm L. 31.47 mm; 139: LV; 140: RV; 141-142: H. 20.29 mm L. 21.14 mm; 141: LV; 142: RV.

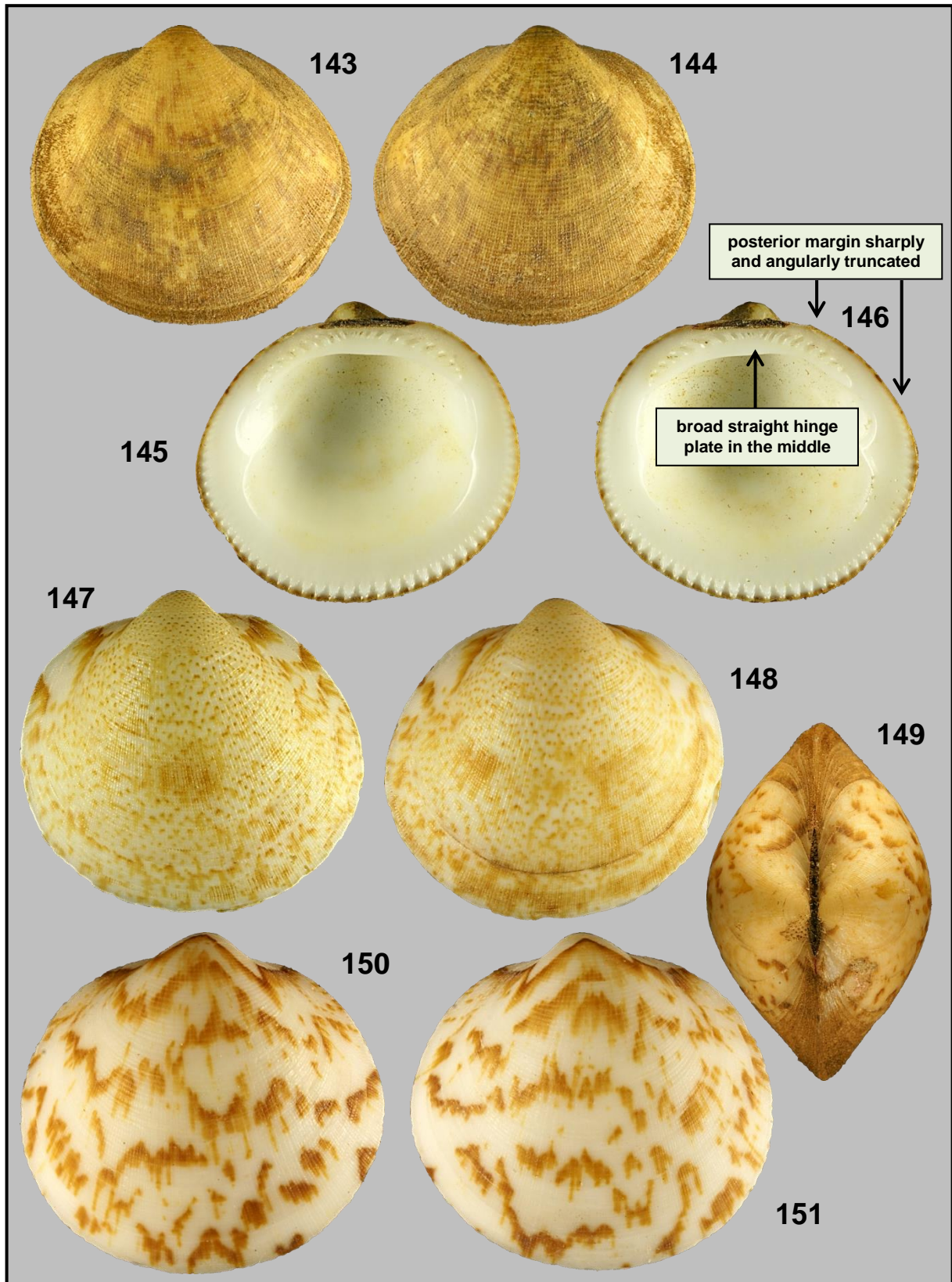


Plate XXVII. Figs 143-151: *Glycymeris vanhengstumi* Goud & Gulden, 2009. CFS; 143-149: Funchal Bay, Madeira. Trawled at a depth of 100 m. 5 June 2000; 143-146: H. 20.73 mm L. 22.45 mm; 143: LV; 144: RV; 145: inside of LV; 146: inside of RV; 147-148: H. 20.90 mm L. 22.64 mm; 147: LV; 148: RV; 149: top view; 150-151: 10 km north of Agadir, between Anza and Aourir, Morocco. On beach at low tide. H. 22.13 mm L. 23.81 mm; 150: LV; 151: RV.