

Polyplacophora from the Pleistocene of Kyllini (NW Peloponnese, Greece)

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ABSTRACT - *This paper deals with the chitons (Mollusca: Polyplacophora) from some Pleistocene deposits outcropping near Kyllini (Ileia, NW Peloponnese Greece) and it is the second comprehensive account of the fossil chitons from Greece. Analysed material consists of 198 valves belonging to the following 11 species: Lepidopleurus cajetanus, L. cimicoides, L. scabridus, Ischnochiton rissoi, Callochiton septemvalvis, Lepidochitona cinerea, L. furtiva, Chiton olivaceus, C. corallinus, Acanthochitona fascicularis, Craspedochiton altavillensis. All these species are still living in the Mediterranean Sea with the exception of C. altavillensis, which is here recorded for the first time in a Middle to Upper Pleistocene deposit. The species L. scabridus, for which we suppose a Mediterranean origin, is recorded for the first time from Pleistocene sediments, and the report of L. furtiva represents the first fossil finding of this species which probably originated in the Pleistocene of the Mediterranean area.*

RIASSUNTO - [I Polyplacophora provenienti dal Pleistocene di Kyllini (Peloponneso nord-occidentale, Grecia)] - *L'articolo descrive le associazioni a polioplacofori raccolte da depositi pleistocenici greci affioranti in prossimità di Kyllini, Elea, Peloponneso nord-occidentale. Si tratta della seconda documentazione esaustiva dei chitoni fossili della Grecia dal momento che le uniche segnalazioni allo stato di fossile per tale area erano quelle delle specie Lepidopleurus cajetanus (citata da de Rochebrune per il Pleistocene di Rodi, nel lontano 1883), Chiton olivaceus, Acanthochitona fascicularis, Callochiton septemvalvis (segnalate nei terrazzi marini del Pleistocene superiore caldo di Perachora, nelle vicinanze di Corinto) e Lepidochitona cinerea (riportata nel Pliocene superiore del Peloponneso nord-occidentale).*

Il materiale consiste di 198 valve riferite alle seguenti 11 specie: Lepidopleurus cajetanus, L. cimicoides, L. scabridus, Ischnochiton rissoi, Callochiton septemvalvis, Lepidochitona cinerea, L. furtiva, Chiton olivaceus, C. corallinus, Acanthochitona fascicularis, Craspedochiton altavillensis. Esso proviene da tre livelli stratigrafici (N2, H6 e P3) il cui contenuto paleontologico permette di ipotizzare un ambiente di sedimentazione pertinente alla biocenosi della Posidonia oceanica. Tutte le specie segnalate vivono in Mediterraneo, eccezion fatta per C. altavillensis che viene qui segnalato per la prima volta in sedimenti riferibili all'intervallo Pleistocene medio-superiore. La specie L. scabridus, per la quale ipotizziamo un'origine mediterranea, viene segnalata per la prima volta nel Pleistocene mentre L. furtiva viene citata per la prima volta allo stato di fossile. Il ritrovamento di quest'ultima specie suggerisce che essa si sia originata durante il Pleistocene dell'area Mediterranea.

INTRODUCTION

The Plio-Pleistocene sedimentary successions of Kyllini, belonging to the Vounargon Formation according to Hagemann (1976), are well represented along the cliffed coast between Kyllini and Cape Trypiti (also transliterated from the modern Greek as Kyllene or Killini and Troupito, here cited following the rules of the Greek Standards Organisation (ELOT)), Ileia, north-western Peloponnese, Greece, (Fig. 1). The general geology of the area was described by Christodoulou (1969, 1971), Hagemann (1976), Kowalczyk et al. (1979) and Underhill (1988). More detailed information, with particular regard to the stratigraphy of the Pleistocene outcrops, was given by Garilli et al. (2005). As a whole, the Kyllini-Trypiti sequence consists of sands, sandy clays and clays whose interesting, locally extremely rich malacological content was only recently highlighted (Garilli, 2004; Garilli et al., 2005).

The main purpose of this paper is to give an account of the polyplacophoran assemblage recovered from the northern part of the Kyllini-Trypiti sedimentary sequence and to provide a contribution to the scarcely known fossil chiton fauna from Greece. In effect, at our

knowledge, the first and, for a long time, the only record of fossil Polyplacophora from Greece dates back to de Rochebrune (1883). He reported *Lepidopleurus cajetanus* (Poli, 1791) from the Rhodes Island ("Une valve postérieure un peu fruste, mais parfaitement déterminable, nous a été communiquée par M. le Dr. Fischer"). This record is also quoted by Malatesta (1962) in the distribution of *Lepidopleurus cajetanus* (from Upper Pleistocene of Rhodes). The species *Lepidochitona cinerea* (Linnaeus, 1767) was reported from Pliocene littoral sediments of the Vounargon Formation (W Peloponnese) by Kleinhölter (1994), and *Callochiton septemvalvis* (Montagu, 1803), *Chiton olivaceus* Spengler, 1797, and *Acanthochitona fascicularis* (Linnaeus, 1767) were more recently recorded from the warm Upper Pleistocene marine terraces in the area of Perachora, near Corinth (Vardala-Theodorou, 1998; Dell'Angelo & Vardala-Theodorou, in press).

MATERIAL AND METHODS

Material comes from 3 stratigraphical layers, named N2 (UTM 34S 512072 E 4199458 N), H6 (UTM 34S

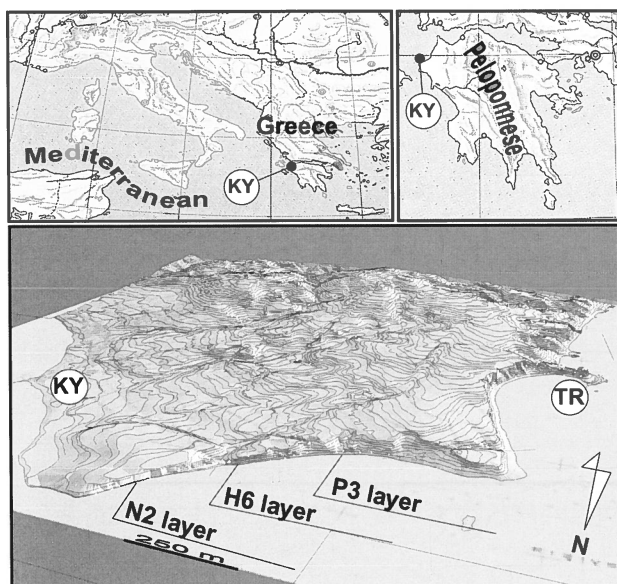


Fig. 1 - Site, H6, N2 and P3 layers locations; KY=Kyllini; TR=Cape Trypiti. Modified from Garilli et al. (2005).

511793E 4199216N), (see Garilli et al., 2005), and P3 (UTM 34S 511567 E 4199084 N) (see Figs. 1-2), outcropping in the northern part of the Kyllini-Trypiti sequence. From all layers, inclined along the cliff plane of about 8° to 12° north to north-eastward, large amounts of bulk sediment were collected by the first author and successively washed on a sieves battery (diameter 0.5, 1, 2 mm). For each bulk samples, fractions between 1 and 2 mm sieves were examined for chiton valves, using a stereomicroscope. A Philips XL 30 ESEM Scanning Electronic Microscope was used for examination of valve sculpture. The examined chiton valves are deposited in the malacological collection of the Dipartimento di Geologia e Geodesia (University of Palermo, Italy, DGUP) and in the B. Dell'Angelo collection (Prato, Italy, BDA).

The N2 and H6 layers mainly consist of a yellowish to greyish muddy sand containing very rich mollusc associations which were related to the modern *Posidonia oceanica* (Linnaeus) Delile, 1813 biocoenosis (HP, *sensu* Pérès & Picard, 1964) by Garilli et al. (2005). As indicated by Garilli et al. (2005), the N2 and H6 beds, overlaying the turritellid-rich blue-greyish muddy level containing the upper Sicilian-early Middle Pleistocene nannofossil association *Gephyrocapsa* sp. 3 and *Crenalithus asanoi* (Sato & Takayama, 1992), are expected to be Middle to Late Pleistocene in age. The P3 bed, consisting of a reddish fine, locally muddy sand, is characterized by having a malacological assemblage very similar to those described by Garilli et al. (2005) for the N2 and H6 layers. The mollusc association recovered from P3 bed mainly consists of gastropod species of which the most, all characteristic of HP biocoenosis, are (after the systematic proposed by Sabelli et al., 1990) tricolids (mainly *Tricolia tenuis* (Michaud, 1829)), cerithiids (mainly *Bittium*

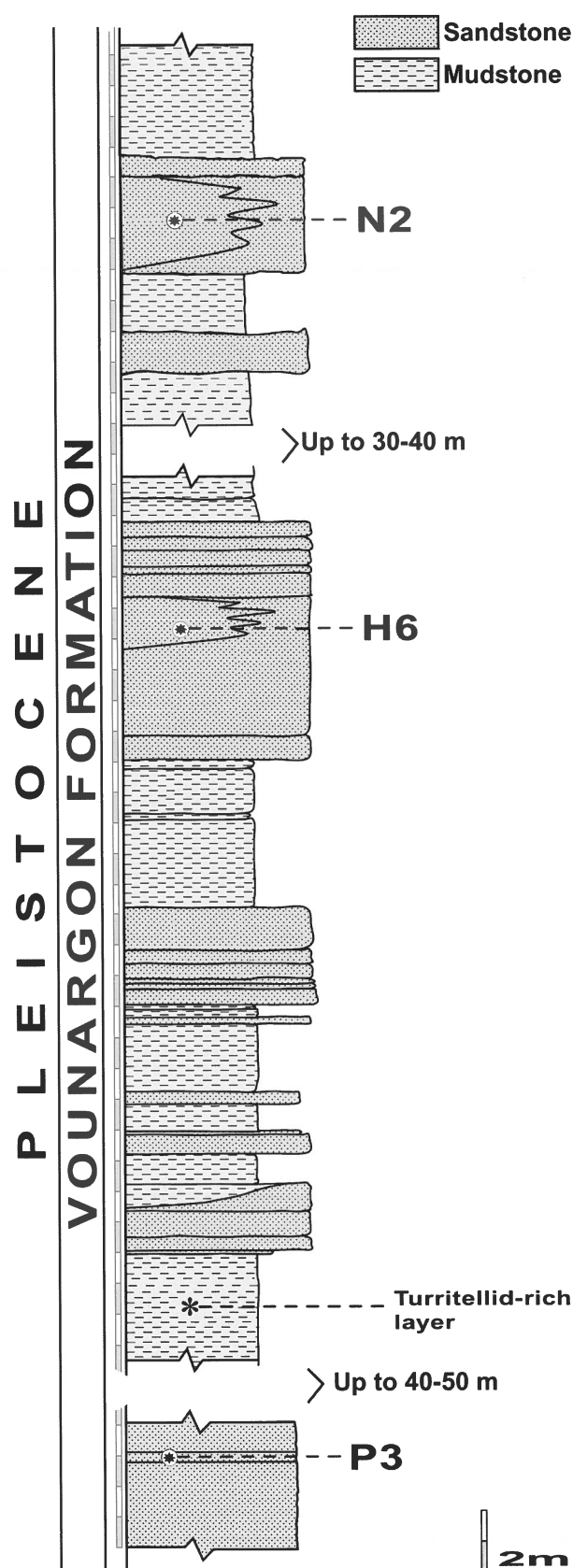


Fig. 2 - Partial columnar section of the northern part of the Kyllini-Trypiti sequence (Kyllini, NW Peloponnese, Greece) illustrating the stratigraphical position of N2, H6 and P3 layers. Modified from Garilli et al. (2005).

reticulatum (Da Costa, 1778)), and rissoids (mainly *Alvania cimex* (Linnaeus, 1758) and *A. discors* (Allan, 1818)). The P3 bed is about 40-50 m underlying the above mentioned turritellid-rich level and its faunistic content is lacking the tropical-subtropical mollusc assemblages (with *Cerithium crenatum* (Brocchi, 1814), *Potamides tricinatus* (Brocchi, 1814), and *Strombus coronatus* DeFrance, 1827) which usually characterizes the Pliocene sediments outcropping in the southernmost part of the Kyllini area. This suggests that an Early to early Middle Pleistocene age could be assigned to the P3 layer.

SYSTEMATIC PALAEONTOLOGY

This chapter includes the essential synonymy and bibliography of each species. Remarkable nomenclatural and taxonomic remarks are also given together with information about stratigraphical and geographical distribution according to selected previous literature.

We follow the systematics proposed by Dell'Angelo & Smriglio (1999), who considered the family Lepidopleuridae Pilsbry, 1892, instead of Leptochitonidae Dall, 1889, for the reasons thoroughly discussed by Dell'Angelo and Palazzi (1991), and, in particular, for the interpretation of art. 40b of the International Commission on Zoological Nomenclature (1999), stating that a family name, also if of posterior date, must have priority on another when it was «generally accepted» before 1961.

Within the genus *Lepidopleurus* Risso, 1826 we include the subgenera *Lepidopleurus* s.s., *Leptochiton* Gray, 1847, and *Parachiton* Thiele, 1909. The reasons for this choice are clearly discussed by Dell'Angelo and Palazzi (1989), and are mainly based on the fact that juvenile specimens of *Lepidopleurus* have a “leptochitonid” morphology practically indistinguishable by the typical *Lepidopleurus* one.

Class POLYPLACOPHORA Gray, 1821
Order NEOLORICATA Bergenhayn, 1955
Suborder LEPIDOPLEURINA Thiele, 1910
Superfamily LEPIDOPLEUROIDEA Pilsbry, 1892
Family LEPIDOPLEURIDAE Pilsbry, 1892

Genus *Lepidopleurus* Risso, 1826
Subgenus *Lepidopleurus* s.s.

Lepidopleurus (*Lepidopleurus*) *cajetanus* (Poli, 1791)
Pl. 1, figs. 1-2

- 1791 *Chiton cajetanus* POLI, p. 10, Pl. 4, figs. 1-2.
1860 *Chiton decoratus* REUSS, p. 257, Pl. 8, fig. 7.
1883 *Lepidopleurus Cajetanus* POLI - DE ROCHEBRUNE, p. 72.
1934 *Lepidopleurus* (*Lepidopleurus*) *decoratus* RSS. - SULC, p. 3.
1962 *Lepidopleurus* (*L.*) *cajetanus* (POLI) - MALATESTA, p. 146, Figs. 1-2.
1971 *Lepidopleurus decoratus* (Reuss) - BALUK, p. 453, Pl. 1, figs. 1-4.
1977 *Lepidopleurus cajetanus* (POLI) - LAGHI, p. 95, Pl. 1, figs. 13-20.

- 1985a *Lepidopleurus cajetanus* (POLI) - KAAS & VAN BELLE, p. 32, Fig. 12.
1989 *Lepidopleurus* (*L.*) *cajetanus* (POLI) - DELL'ANGELO & PALAZZI, p. 45, Pls. 1-2.
1995 *Lepidopleurus* (*L.*) *cajetanus* (POLI) - DELL'ANGELO & FORLI, p. 223, Fig. 18.
1999 *Lepidopleurus* (*L.*) *cajetanus* (POLI) - DELL'ANGELO, PALAZZI & PAVIA, p. 260, Pl. 1, figs. 2, 4-7.
1999 *Lepidopleurus* (*L.*) *cajetanus* (POLI) - DELL'ANGELO & SMRIGLIO, p. 38, Figs. 10-15 and Pls. 6-7.
2001 *Lepidopleurus* (*L.*) *cajetanus* (POLI) - DELL'ANGELO, FORLI & LOMBARDI, p. 145, Figs. 1, 4.
2004 *Lepidopleurus* (*L.*) *cajetanus* (POLI) - DELL'ANGELO, LANDAU & MARQUET, p. 26, Pl. 7, figs. 4, 8.

Material - N2 layer: 1 tail valve, DGUP coll.; P3 layer: 1 tail valve, DGUP coll.

Remarks - The species is characterized by tegmentum sculptured with some strong, concentric, terraced ribs on head valve, lateral areas of intermediate valves and postmucronal area of tail valve, and with somewhat branching or anastomosing longitudinal chains of granules in central area of intermediate valves and antemucronal area of tail valve. Unlike fully-grown adults, juveniles of this species may show some morphological variability (Laghi, 1977).

Detailed descriptions of *L. cajetanus* are given by Kaas & Van Belle (1985a) and Dell'Angelo & Smriglio (1999). The commonest Recent *Lepidopleurus* is uncommon as a fossil.

Distribution - *L. cajetanus* occurs in the Mediterranean Sea and Atlantic Ocean, from the Iberian Peninsula to Morocco and the Canary Islands. It was reported from the Miocene of central-eastern Europe (under the name of *Chiton decoratus* Reuss, 1860) and North Italy (Tortonian of Montegibbio, Modena and Messinian of Borelli, Torino) (Dell'Angelo et al., 1999). It is frequent in the Plio-Pleistocene of the Mediterranean basin (Italy, France and Spain) and it is the first report of fossil chiton from Greece (de Rochebrune, 1883, a single valve from the Pleistocene of Rhodes Island).

Subgenus *Leptochiton* Gray, 1847

Lepidopleurus (*Leptochiton*) *cimicoides*
(Monterosato, 1879)
Pl. 1, figs. 3-10

- 1878a *Chiton minimus* MONTEROSATO, p. 77 (*nom. nud.*).
1879 *Chiton cimicoides* MONTEROSATO, p. 23 [*nom. nov.* pro *Chiton minimus* Monterosato, 1878 (*non* Gmelin, 1791, *nec* Spengler, 1797)].
1968 *Lepidopleurus intermedius* SALVINI-PLAWEN, p. 251, Pls. 6-8, figs. 44-57.
1985a *Leptochiton* (*Leptochiton*) *intermedius* (von Salvini-Plawen) - KAAS & VAN BELLE, p. 54, Fig. 22.
1987 *Leptochiton* (*L.*) *cimicoides* (Monterosato) - DELL'ANGELO & PALAZZI, p. 95, Figs. 1-15.
1989 *Lepidopleurus* (*Leptochiton*) *cimicoides* (Monterosato) - DELL'ANGELO & PALAZZI, p. 64, Pls. 14-15.
1990 *Leptochiton* (*Leptochiton*) *cimicoides* (Monterosato) - KAAS & VAN BELLE p. 7, Fig. 1.

- 1995 *Lepidopleurus (Leptochiton) cimicoides* (Monterosato) - DELL'ANGELO & FORLI, p. 224.
 1999 *Lepidopleurus (Leptochiton) cimicoides* (Monterosato) - DELL'ANGELO & SMRIGLIO, p. 58, Fig. 24 and Pls. 14-15.
 2001 *Lepidopleurus (Leptochiton) cimicoides* (Monterosato) - DELL'ANGELO, FORLI & LOMBARDI, p. 147, Fig. 6.

Material - N2 layer: 3 valves (2 intermediate and 1 tail), DGUP coll.; 3 intermediate valves, BDA coll.

Remarks - The species is characterized by the tegmentum sculptured with rather thick but distinctly separated granules, arranged randomly (not exactly quincuncially but rather concentric, mutually staggering lines) on head valve, lateral areas of intermediate valves and postmucronal area of tail valve, in longitudinal series in central area of intermediate valves and antemucronal area of tail valve.

Detailed description of *L. cimicoides* is given by Dell'Angelo & Smriglio (1999).

Chiton cimicoides is the least known of the four species described by Monterosato, who in 1878 named it *Chiton minimus*. In 1879 he proposed the new name *Chiton cimicoides* being *C. minimus* pre-occupied by *C. minimus* Gmelin, 1791 (= ? *Chiton albus* Linnaeus, 1767) and *C. minimus* Spengler, 1797 (= *Chiton ruber* Linnaeus, 1767). The species was recently studied by Dell'Angelo & Palazzi (1987), who examined Monterosato's type material and established the synonymy with *Lepidopleurus intermedius* Salvini-Plawen, 1968. *L. cimicoides* is a scarcely recorded species (probably also because of the small size), often confused with other small *Lepidopleurus*, particularly with *L. cancellatus* (Sowerby, 1840), from which it mainly differs by having a different sculpture of the lateral areas, showing randomly arranged granules instead of the radial striae, typical of *L. cancellatus*. Furthermore, *L. cancellatus* bears rounded granules while in *L. cimicoides* these are clearly fungiform.

The six valves found agree well with the characteristics of the species, except for the number of longitudinal series of granules in central areas of intermediate valves, about 50 (in our valves) vs. 30 (as reported by Dell'Angelo & Smriglio, 1999). We think that this difference should be interpreted as intraspecific variation.

Distribution - *L. cimicoides* is scarcely recorded from the Mediterranean Sea (coasts of Italy, France and Croatia), and from the Atlantic Ocean (Western Sahara, between 24° and 25°N, specimens in BDA collection). It occasionally occurs in the Pliocene of Trappeto (NW Sicily, specimens in BDA collection) and the Pleistocene of Riparbella (Pisa), Gallipoli (Lecce), and Pecoraro (Reggio Calabria) (Dell'Angelo & Palazzi, 1989; Dell'Angelo & Forli, 1995).

Lepidopleurus (Leptochiton) scabridus (Jeffreys, 1880)

Pl. 2, figs. 1-4

- 1880 *Chiton scabridus* JEFFREYS, p. 33.
 1894 *Lepidopleurus scabridus* JEFFREYS - SYKES, p. 35, Pl. 3, figs. 4, 7.
 1985a *Leptochiton (L.) scabridus* (Jeffreys) - KAAS & VAN BELLE, p. 49, Fig. 19.
 1986 *Leptochiton (L.) scabridus* (Jeffreys) - DELL'ANGELO & PALAZZI, p. 11, Figs. 11-14, 19-22, 32, 34, 45-48, 54-55, 60.
 1987 *Leptochiton (Leptochiton) scabridus* (Jeffreys) - CESARI, p. 7, Pl. 2, figs. 1-8; Pl. 3, figs. 1-10; Pl. 4, figs. 1-6; Pl. 5, figs. 1-11; Pl. 11, figs. 4-6.
 1989 *Lepidopleurus (Leptochiton) scabridus* (Jeffreys) - DELL'ANGELO & PALAZZI, p. 65, Pls. 16-17.
 1999 *Lepidopleurus (Leptochiton) scabridus* (Jeffreys) - DELL'ANGELO & SMRIGLIO, p. 63, Figs. 25-26 and Pls. 16-17.

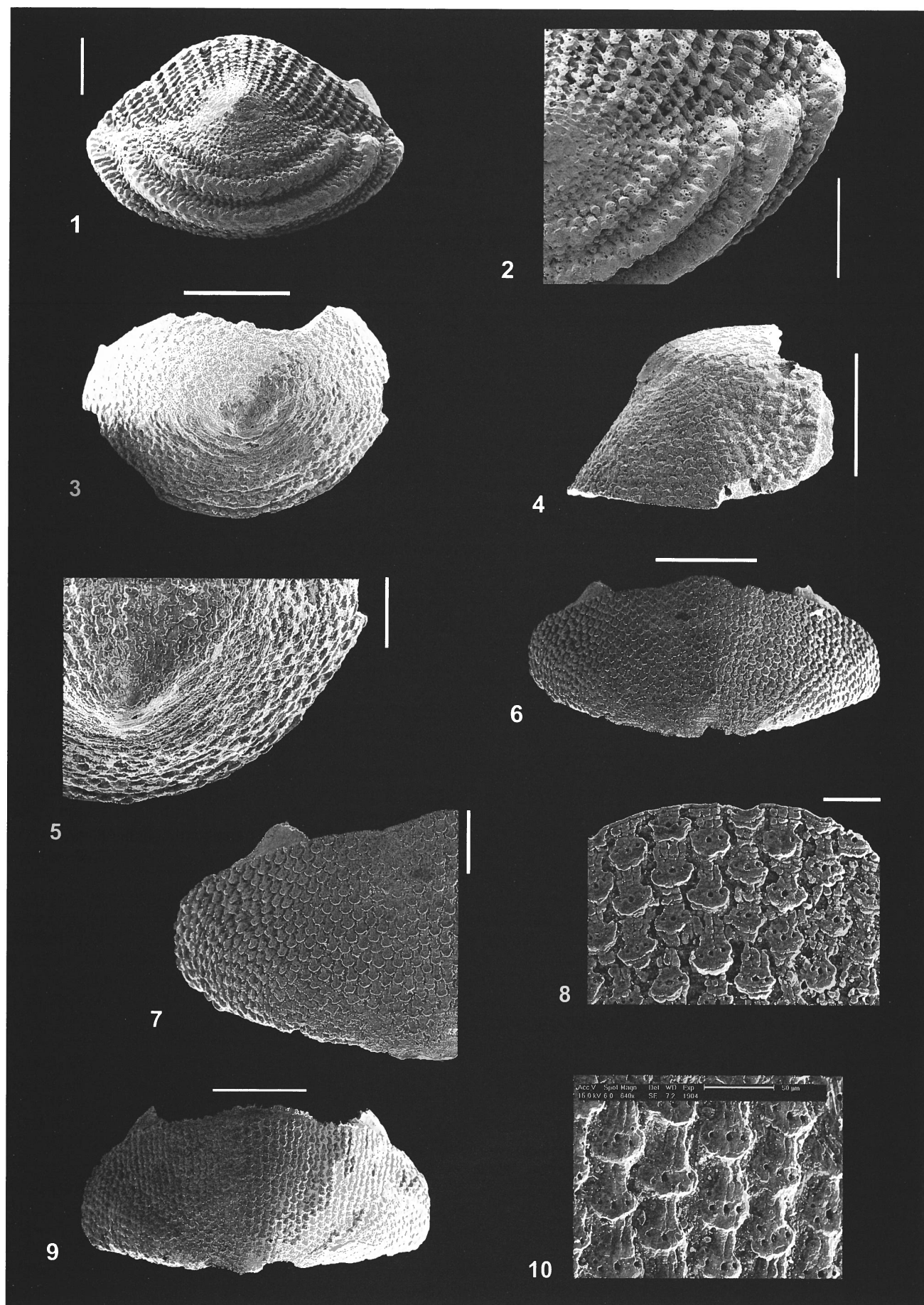
Material - N2 layer: 3 valves (1 head, 1 intermediate, and 1 tail), BDA coll.

Remarks - The species is characterized by the sculpture of the tegmentum formed by rather irregular granules with a subquadrangular/subrhomboidal shape, well separated from each other, arranged in radial lines on head valve, lateral areas of intermediate valves and postmucronal area of tail valve, in longitudinal series in central area of intermediate valves and antemucronal area of tail valve, where the granules make a square mesh. In general, the tegmentum presents a rough surface, on which the granules are extended into a body usually formed by two or three longitudinal varices becoming unified or merged along the margin of the valve.

EXPLANATION OF PLATE 1

- Figs. 1-2 - *Lepidopleurus (Lepidopleurus) cajetanus* (Poli, 1791), tail valve, N2 layer, Middle-Upper Pleistocene.
 1 - Dorsal view.
 2 - Sculpture of antemucronal and postmucronal areas, right side of the valve.
 Figs. 3-10 - *Lepidopleurus (Leptochiton) cimicoides* (Monterosato, 1879), N2 layer.
 3-5 - Tail valve, DGUP coll.: 3) Dorsal view; 4) Right lateral view; 5) Sculpture of mucronal and postmucronal areas.
 6-8 - Intermediate valves, DGUP coll.: 6) Dorsal view; 7) Sculpture of central-lateral area; 8) Detail of sculpture, central area.
 9-10 - Intermediate valves, BDA coll.: 9) Dorsal view; 10) Detail of sculpture of central area.

Scale bars: 500 µm in figs. 1-4, 6, 9; 200 µm in figs. 5, 8; 50 µm in figs. 7, 10.



Detailed descriptions of *L. scabridus* are given by Kaas & Van Belle (1985a) and Dell'Angelo & Smriglio (1999).

L. scabridus was described but not figured by Jeffreys (1880) and was quoted by Pilsbry (1894) only in Appendix II («Insufficiently described Chitons, and species of unknown generic position»), where he cited the original description. The species was first figured by Sykes (1894), while Thiele (1909) described the radula and the girdle on a topotype specimen from Jersey (England).

The species was described with a distribution limited to a small zone of the British Channel along the English and French coasts (Jeffreys, 1880). The first record from the Mediterranean (Dell'Angelo & Laghi, 1980) concerns two specimens collected in the Ionian Sea along the coast of Taranto (South Italy), and later several specimens were randomly recorded from various Italian localities.

Distribution - *L. scabridus* is scarcely recorded in the Mediterranean Sea (Adriatic and Eastern Ionian Sea, Tuscany, Sicily, Greece, and Malta). Outside the Mediterranean, the species is recorded from south-western England and northern France (the British Channel), northern Spain (Getaria), the Canary and Cape Verde Islands, and Angola (Dell'Angelo & Smriglio, 1999).

There are a few records from the Miocene (Tortonian) of Rio di Bocca d'Asino (Alessandria, North Italy) and Montegibbio (Modena) (Dell'Angelo & Palazzi, 1989), and a single record from the Tuscan Pliocene of «La Tagliata» (Laghi, 1977, as *L. cancellatus*, see Dell'Angelo & Palazzi, 1989). Not recorded up to now from the Pleistocene. At our knowledge this species was never recorded as fossil outside the Mediterranean area.

Suborder ISCHNOCHITONINA Bergenhayn, 1930

Family ISCHNOCHITONIDAE Dall, 1889

Subfamily ISCHNOCHITONINAE Dall, 1889

Genus *Ischnochiton* Gray, 1847

Subgenus *Ischnochiton* s.s.

Ischnochiton (Ischnochiton) rissoi (Payraudeau, 1826)
Pl. 2, figs. 5-6

- 1826 *Chiton rissoi* PAYRAUDEAU, p. 87, Pl. 3, figs. 4-5.
- 1847 *Chiton mediterraneus* GRAY MS, REEVE, Pl. 23, fig. 157.
- 1934 *Ischnochiton rudolticensis* SULC, p. 23, Pl. 2, figs. 41-43.
- 1962 *Ischnochiton (I.) rissoi* (Payraudeau) - MALATESTA, p. 160, Figs. 16-17.
- 1971 *Ischnochiton rudolticensis* Sulc - BALUK, p. 458, Pl. 3, figs. 5-8.
- 1977 *Ischnochiton (Simplischnochiton) rissoi* (Payraudeau) - LAGHI, p. 104, Pl. 1, figs. 4-9.
- 1984 *Ischnochiton rissoi* (Payraudeau) - BALUK, p. 287, Pl. 6, figs. 2a-b.
- 1990 *Ischnochiton (I.) rissoi* (Payraudeau) - KAAS & VAN BELLE, p. 78, Fig. 32.
- 1995 *Ischnochiton (I.) rissoi* (Payraudeau) - DELL'ANGELO & FORLI, p. 230, Fig. 15.
- 1999 *Ischnochiton (Simplischnochiton) rissoi* (Payraudeau) - DELL'ANGELO, PALAZZI & PAVIA, p. 265, Pl. 3, figs. 3, 5.
- 1999 *Ischnochiton (Ischnochiton) rissoi* (Payraudeau) - DELL'ANGELO & SMRIGLIO, p. 100, Figs. 40-48 and Pls. 29-31.
- 2001 *Ischnochiton rissoi* (Payraudeau) - DELL'ANGELO, FORLI & LOMBARDI, p. 150, Figs. 20, 23.
- 2004 *Ischnochiton (Ischnochiton) rissoi* (Payraudeau) - DELL'ANGELO, LANDAU & MARQUET, p. 34, Pl. 4, figs. 3-4.

Material - N2 layer: 5 valves (4 intermediate and 1 tail), DGUP coll.; H6 layer: 1 tail valve, DGUP coll. and 2 valves (1 head and 1 intermediate), BDA coll.; P3 layer: 1 intermediate valve, DGUP coll.

Remarks - The species is characterized by tegmental sculpture consisting of concentric vermicular ribs, often intersected by fine radial furrows, on the head valve, the lateral areas of the intermediate valves, and the postmucronal area of the tail valve. The ribs continue longitudinally on the central areas of the intermediate valves and on the antemucronal area of the tail valve.

The material presented herein matches the characteristics of this highly variable species, falling within the infraspecific range of variation. Taxonomic status is rather complex.

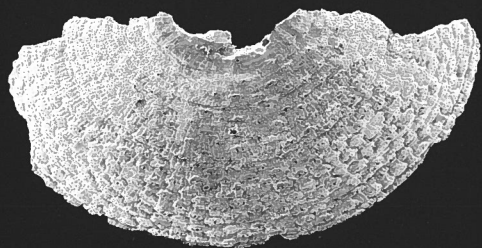
Comprehensive descriptions of *I. rissoi* are given by Kaas & Van Belle (1990) and Dell'Angelo & Smriglio (1999).

EXPLANATION OF PLATE 2

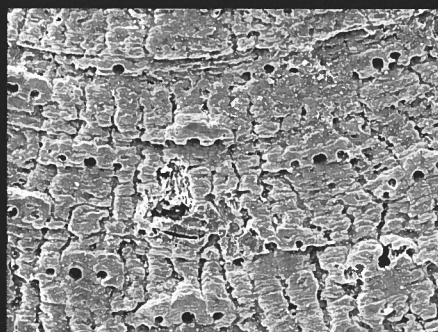
- Figs. 1-4 - *Lepidopleurus (Leptochiton) scabridus* (Jeffreys, 1880), N2 layers, Middle-Upper Pleistocene, DGUP coll.
 - 1-2 - Dorsal view (1) and sculpture (2) of head valve.
 - 3-4 - Dorsal view (3) and sculpture of intermediate valve (4).
- Figs. 5-6 - *Ischnochiton (Ischnochiton) rissoi* (Payraudeau, 1826), intermediate valve, N2 layer, DGUP coll.
 - 5 - Dorsal view.
 - 6 - Sculpture of lateral-pleural area.
- Figs. 7-10 - *Callochiton septemvalvis* (Montagu, 1803), intermediate valve, N2 layer, DGUP coll.
 - 7 - Dorsal view.
 - 8 - The characteristic scars in the pleural area.
 - 9-10 - Sculpture of lateral (9) and jugal area (10).

Scale bars: 1 mm in fig. 5; 500 µm in figs. 1, 3, 7; 200 µm in fig. 6; 100 µm in fig. 4; 50 µm in figs. 2, 8-10.

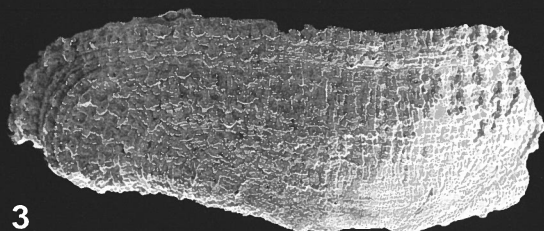
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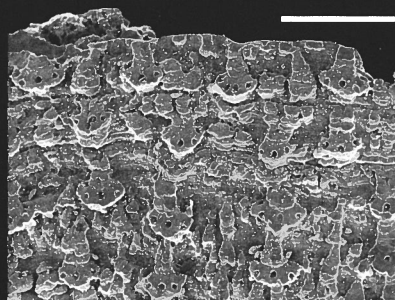
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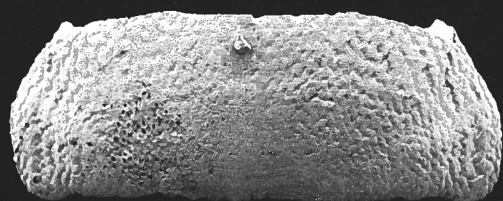
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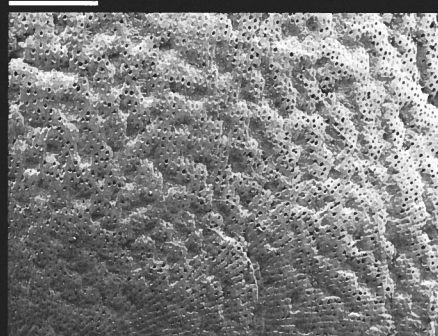
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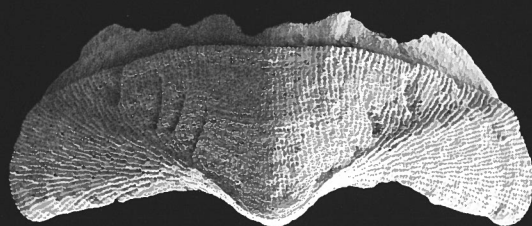
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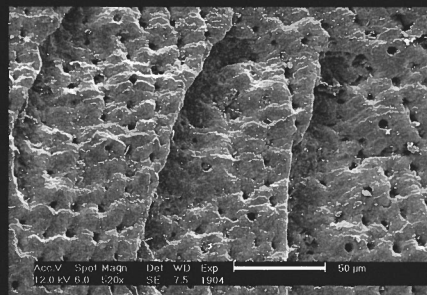
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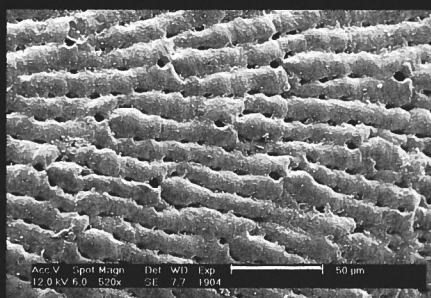
7



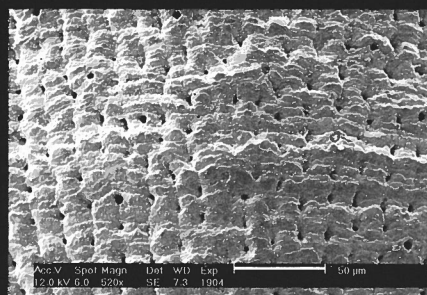
8



9



10



Laghi (1977) considered the Miocene (Badenian) valves from Korytnica (Poland) (identified by Baluk (1971) as *Ischnochiton rudolticensis* (Sulc, 1934)) to be conspecific with *I. rissoi*, a decision accepted by Baluk (1984) and subsequent authors.

Distribution - *I. rissoi* is currently confirmed only in the Mediterranean Sea. Some Atlantic records (Canary, Selvagens and Azores Islands) (Bergenhayn, 1931) need confirmation (Dell'Angelo & Smriglio, 1999). It has been reported from the Middle Miocene (Badenian) of central eastern European basins, the Tortonian of northern Apennines, the Messinian of Borelli (Torino) and many Italian and Spanish Pliocene localities (Dell'Angelo et al., 1999; Dell'Angelo et al., 2004). It is more frequent in the Pleistocene of South Italy (Apulia, Calabria, and Sicily), and scarcely recorded from other Italian localities, for instance the Lower Pleistocene of Torrente Stirone (Sabelli & Taviani, 1979) and Riparbella (Dell'Angelo & Forli, 1995).

Subfamily CALLOCHITONINAE Plate, 1901

Genus *Callochiton* Gray, 1847

Callochiton septemvalvis (Montagu, 1803)
Pl. 2, figs. 7-10

- 1803 *Chiton septemvalvis* MONTAGU, p. 3.
- 1823 *Chiton achatinus* BROWN, p. 402.
- 1829 *Chiton euplaeae* O.G. COSTA, pp. i, iv, Pl. 1, fig. 3.
- 1859 *Chiton doriae* CAPELLINI, p. 325, Pl. 12, fig. 2.
- 1860 *Chiton rariplicatus* REUSS, p. 258, Pl. 8, figs. 9-11.
- 1934 "*Chiton*" *rariplicatus* Rss. - SULC, p. 27, Pl. 2, fig. 55.
- 1962 *Callochiton* (C.) *achatinus* (Brown) - MALATESTA, p. 158, Fig. 15.
- 1971 *Callochiton rariplicatus* (Reuss) - BALUK, p. 461, Pl. 5, figs. 1-5.
- 1977 *Callochiton laevis* (Montagu) - LAGHI, p. 108, Pl. 2, figs. 14-18.
- 1985b *Callochiton septemvalvis* (Montagu) - KAAS & VAN BELLE, p. 11, Fig. 2.
- 1995 *Callochiton septemvalvis* (Montagu) - DELL'ANGELO & FORLI, p. 226, figs. 10, 17.
- 1999 *Callochiton septemvalvis* (Montagu) - DELL'ANGELO & SMRIGLIO, p. 125, Figs. 55-63 and Pls. 40-41.
- 2004 *Callochiton septemvalvis* (Montagu) - DELL'ANGELO, LANDAU & MARQUET, p. 34, Pl. 3, figs. 2, 5.

Material - N2 layer: 1 intermediate valve, DGUP coll.; 14 valves (10 intermediate and 4 tail), BDA coll.; H6 layer: 1 tail valve, DGUP coll.

Remarks - This species has long been known under the names *C. laevis* (Montagu, 1803) (*non* Pennant, 1777), *C. achatinus* (Brown, 1823), and *C. doriae* (Capellini, 1859). Kaas (1978) proposed the name *Callochiton septemvalvis* (Montagu, 1803) for this species, and separated at subspecific level the typical Atlantic form, *C. septemvalvis septemvalvis*, from the Mediterranean one, *C. septemvalvis euplaeae* (O.G. Costa, 1829). The latter taxon is characterized by its smaller size and by the presence of 3-5 longitudinal scars on the pleural areas. We agree with Dell'Angelo & Palazzi (1994), who, adopting the taxon *Callochiton septemvalvis*, suggested to designate this species as a whole, since *Chiton euplaeae* was clearly described by O.G. Costa (1829) as having a smooth surface, without any trace of scars. Carmona Zalvide et al. (2002) gave specific validity to the two taxa *Chiton euplaeae* and *C. septemvalvis*, but they did not seem to know the work of Dell'Angelo & Palazzi (1994) where the same subjects was already discussed, reaching different conclusions (and in any case, *C. euplaeae* cannot be used for the Mediterranean form of *C. septemvalvis* which is characterized by the presence of longitudinal scars!).

The valves reported herein have the same tegmental sculpture as living specimens, i.e. a dense and uniform set of cords, barely visible with the naked eyes, with 3-6 longitudinal scars in the pleural area.

Detailed description of *C. septemvalvis* are given by Kaas & Van Belle (1985b) and Dell'Angelo & Smriglio (1999).

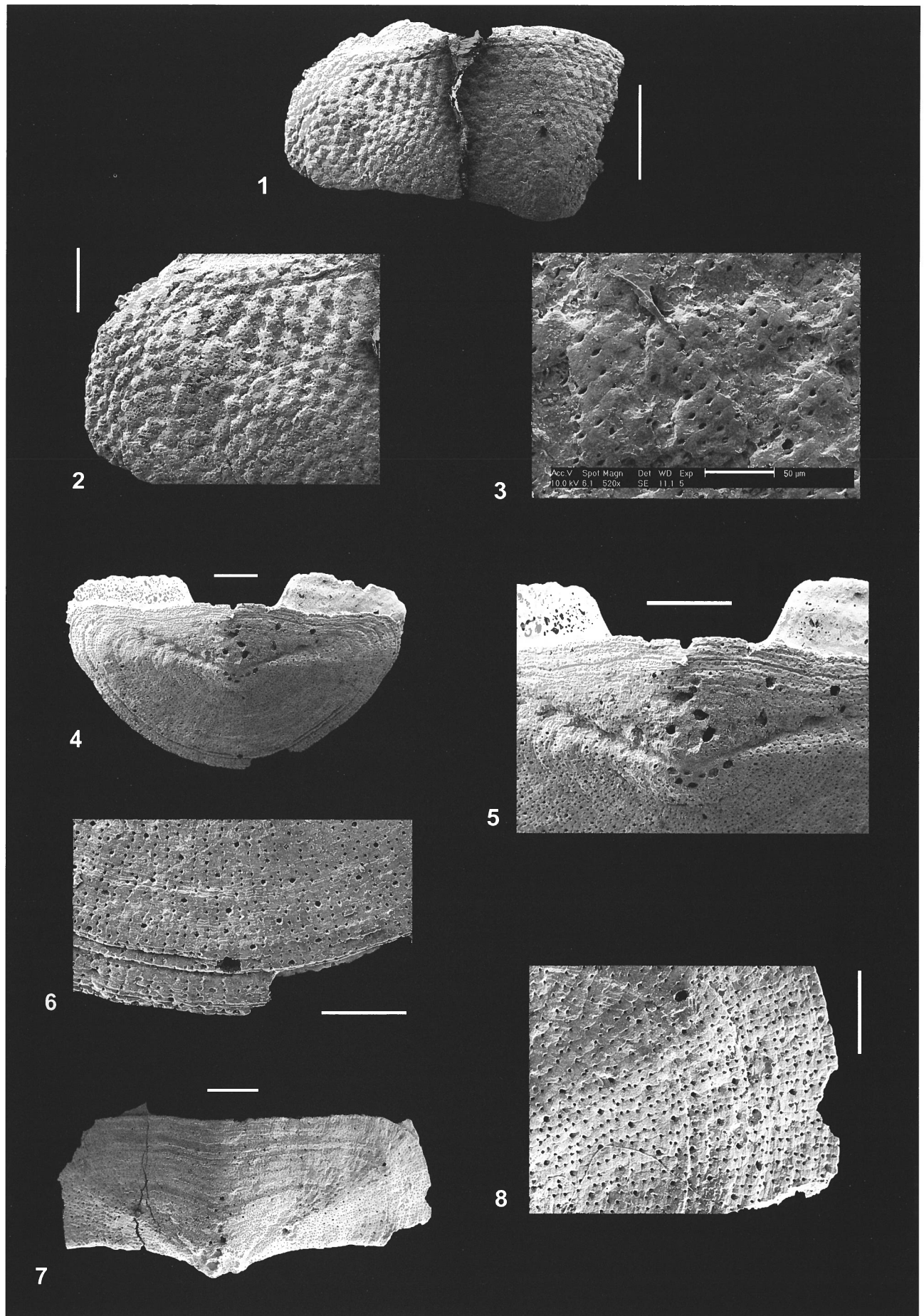
Laghi (1977) considered the Miocene (Badenian) specimens from Korytnica (Poland), identified by Baluk (1971) as *Callochiton rariplicatus* (Reuss, 1860), as well as those from the Miocene of the Vienna Basin illustrated by Reuss (1860) and Sulc (1934), to be conspecific with *Callochiton septemvalvis*, a decision accepted by Baluk (1984) and subsequent authors.

Distribution - *Callochiton septemvalvis* is widely distributed in the north-eastern Atlantic Ocean, from Norway to the Canary Islands and the Mediterranean Sea. It has been reported from the Miocene of central-

EXPLANATION OF PLATE 3

- Figs. 1-3 - *Lepidochitona* (L.) *cinerea* (Linnaeus, 1767), intermediate valve, P3 layer, Lower-lower Middle Pleistocene, DGUP coll.
 - 1 - Dorsal view.
 - 2-3 - Lateral-pleural area (2) and detail of sculpture of the pleural area (3).
- Figs. 4-8 - *Lepidochitona* (L.) *furtiva* (Monterosato, 1879), tail and intermediate valves, N2 layer, Middle-Upper Pleistocene, DGUP coll.
 - 4-6 - Tail valve: dorsal view (4), close-up of jugal area (5) and detail of sculpture in the postmucronal area (6).
 - 7-8 - Intermediate valve: dorsal view (7) and sculpture of lateral-pleural area (8).

Scale bars: 500 µm in fig. 1; 200 µm in figs. 2, 4, 5, 7; 100 µm in figs. 6, 8; 50 µm in fig. 3.



eastern Europe (as *Chiton rariplicatus* Reuss, 1860) and the Miocene of Montegibbio (Modena) (Dell'Angelo & Smriglio, 1999). *Callochiton septemvalvis* is common in the Italian Plio-Pleistocene, and is also recorded from the Portuguese (Dell'Angelo & da Silva, 2003) and Spanish (Dell'Angelo et al., 2004) Pliocene. It is mentioned also (Vardala-Theodorou, 1998, Dell'Angelo & Vardala-Theodorou, in press) from the Upper Pleistocene of Greece.

Subfamily LEPIDochitoninae Iredale, 1914

Genus *Lepidochitona* Gray, 1821

Subgenus *Lepidochitona* s.s.

Lepidochitona (*Lepidochitona*) *cinerea* (Linnaeus, 1767)

Pl. 3, figs. 1-3

- 1767 *Chiton cinereus* LINNAEUS, p. 1107.
 1777 *Chiton marginatus* PENNANT, p. 71, Pl. 36, fig. 2.
 1962 *Lepidochitona* (*L.*) *cinereus* (Linné) - MALATESTA, p. 155, Figs. 11-12.
 1977 *Lepidochitona cinerea* (Linneo) - LAGHI, p. 105, Pl. 3, figs. 1-4.
 1985b *Lepidochitona* (*L.*) *cinerea* (Linnaeus) - KAAS & VAN BELLE, p. 84, Fig. 39.
 1995 *Lepidochitona* (*L.*) *cinerea* (Linneo) - DELL'ANGELO & FORLI, p. 227, Fig. 14.
 1999 *Lepidochitona* (*Lepidochitona*) *cinerea* (Linnaeus) - DELL'ANGELO, PALAZZI & PAVIA, p. 264, Pl. 2, figs. 1-3.
 1999 *Lepidochitona* (*L.*) *cinerea* (Linneo) - DELL'ANGELO & SMRIGLIO, p. 138, Figs. 67-72 and Pls. 44-45.
 2001 *Lepidochitona cinerea* (Linneo) - DELL'ANGELO, FORLI & LOMBARDI, p. 148, Figs. 12, 15.
 2004 *Lepidochitona* (*L.*) *cinerea* (Linnaeus) - DELL'ANGELO, LANDAU & MARQUET, p. 36, Pl. 3, fig. 6.

Material - N2 layer: 1 head valve, DGUP coll.; P3 layer: 2 intermediate valves, DGUP coll.

Remarks - This species had a complicated taxonomical history. Early authors mistook

Lepidopleurus (*Leptochiton*) *asellus* (Gmelin, 1791) for *Chiton cinereus* Linnaeus, 1767, adopting the younger name *Ch. marginatus* Pennant, 1777. The species is characterized by tegmentum sculptured all over with fine diamond-shaped granules, arranged in a somewhat irregular quincunx pattern.

Comprehensive descriptions of *L. cinerea* are given by Kaas & Van Belle (1985b) and Dell'Angelo & Smriglio (1999).

A similar species, *L. subgranosa* Baluk, 1971 was recorded from the Miocene (Badenian) of Poland, and considered by Laghi (1977) to be a junior synonym of *L. cinerea*. This statement was not accepted by Baluk (1984), who regarded the ornamentation of *L. subgranosa* more similar to that of *L. canariensis* (Thiele, 1909) than to that of *L. cinerea*. A revision of fossil *Lepidochitona*, including the study of type material, is necessary in order to provide a clear opinion about this question.

Distribution - Today, *Lepidochitona* (*L.*) *cinerea* is widely distributed along the European Atlantic coasts, from Norway to the Iberian Peninsula, and into the Mediterranean and Black Sea; it also occurs along the north-western Atlantic coast of Morocco (Dell'Angelo & Smriglio, 1999). A doubtful record exists from the Badenian of Poland, from the Miocene of North Italy (Tortonian of Montegibbio, Modena and Messinian of Borelli, Torino) (Dell'Angelo et al., 1999), with a few records from some Italian, Spanish (Dell'Angelo et al., 2004), Portuguese (Dell'Angelo & da Silva, 2003), and Greek (Kleinhölter, 1994) Pliocene localities, and the Pleistocene of Italy and Norway (Antevs, 1928).

Lepidochitona (*L.*) *furtiva* (Monterosato, 1879)

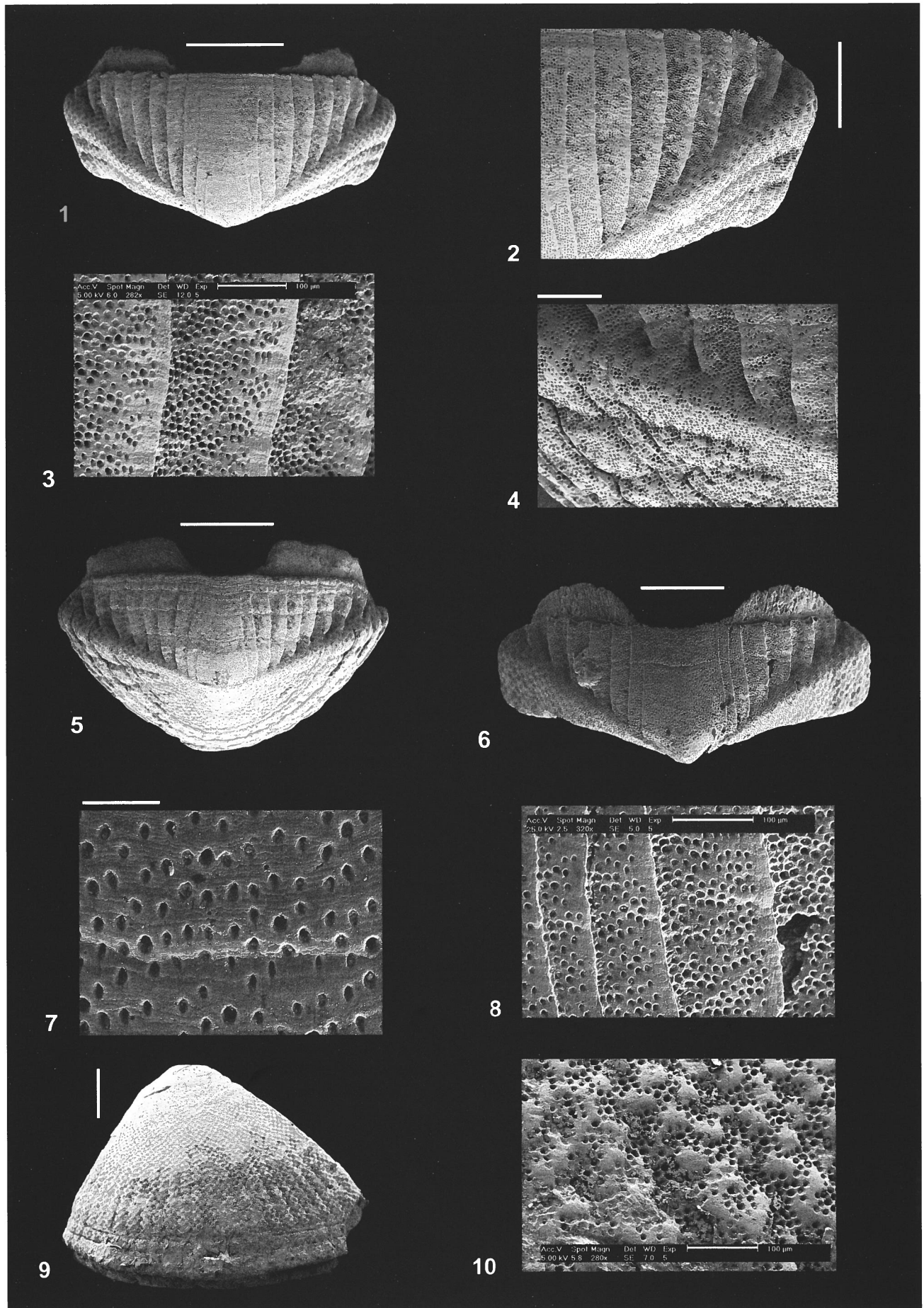
Pl. 3, figs. 4-8

- 1872 *Chiton ruber* (L.) Lowe. Var. = *C. furtivus* mihi MS - MONTEROSATO, p. 29 (*nom. nud.*).
 1875 *Chiton furtivus* MONTEROSATO, p. 21 [= ? *C. ruber*, (Lin.) Loowe var. L.] (*nom. nud.*).

EXPLANATION OF PLATE 4

- Figs. 1-5 - *Chiton* (*Rhyssoplax*) *olivaceus* Spengler, 1797, intermediate (1-3) and tail (4-5) valves, N2 layer, Middle-Upper Pleistocene, DGUP coll.
 1 - Dorsal view.
 2 - Sculpture of lateral-pleural area.
 3 - Detail of sculpture in the pleural area.
 4 - Sculpture of the contact between antemucronal and postmucronal areas.
 5 - Dorsal view.
- Figs. 6-10 - *Chiton* (*Rhyssoplax*) *corallinus* (Risso, 1826), intermediate (6-8) and head (9-10) valves, N2 layer, Middle-Upper Pleistocene, DGUP coll.
 6 - Dorsal view.
 7 - Sculpture of jugal area.
 8 - Sculpture of pleural area.
 9 - Antero-lateral view.
 10 - Detail of sculpture.

Scale bars: 1 mm in fig. 1; 500 µm in figs. 4, 6, 9; 200 µm in figs. 2, 5; 100 µm in figs. 3, 8, 10; 50 µm in fig. 7.



- 1878b *Chiton furtivus* MONTEROSATO, p. 147 (*nom. nud.*).
 1879 *Chiton furtivus* MONTEROSATO, p. 19.
 1909 *Trachydermon furtivus* (Monterosato) - THIELE, p. 15, Pl. 2, figs. 6-13.
 1985b *Lepidochitona* (L.) *furtiva* (di Monterosato) - KAAS & VAN BELLE, p. 91, fig. 42.
 1999 *Lepidochitona* (L.) *furtiva* (Monterosato) - DELL'ANGELO & SMRIGLIO, p. 150, Fig. 77 and Pls. 49-50.

Material - N2 layer: 4 valves (2 intermediate and 2 tail), DGUP coll.; 24 valves (20 intermediate and 4 tail), BDA coll.

Remarks - The tegmentum is nearly smooth, with only weak radial striae on the anterior valve, the lateral areas of the intermediate valves, and the postmucronal area of the tail valve; in Recent material, it shows a very variable and noticeable coloration, usually red-brown with large irregular white spots on the central part of the valves.

Detailed descriptions of *L. furtiva* are given by Kaas & Van Belle (1985b) and Dell'Angelo & Smriglio (1999).

Chiton furtivus was established by Monterosato, who collected about fifty specimens near Palermo (north-western Sicily), at a depth of 20-30 meters, «...obtained with the dredge the fishermen use, together with plants and shells of the laminar zone ...». Later, the species was not found again, and was frequently put in synonymy with *Tonicella rubra* (Linnaeus, 1767). (Sabelli, 1974, p.74)

Thiele (1909) described the species, particularly the radula, and the elements of the girdle, on the basis of some specimens sent to him by Monterosato. Recent findings and the study of specimens of Monterosato's original lots (housed in the Locard collection at the Muséum National d'Histoire Naturelle of Paris and in the Zoologisches Museum der Humboldt Universität, Berlin) have brought Kaas & Van Belle (1981) to accept *L. furtiva* as a valid species.

Recently, several specimens were reported by Kaas & Van Belle (1987, p. 29) from the beach of Cap d'Antibes (France), on thalli of *Posidonia oceanica* (Linnaeus) Delile beached after violent storms, and at Zannone, one of the Pontine Islands (Italy), in two stations respectively at 20 and 30 meters (Gravina et al., 1992): «*Lepidochitona furtiva* is dominant in these two stations, where it clings to the coarsest elements of the sediment. The species proves therefore related to the SGCF biocenosis». It is noteworthy that the herein presented material comes from the N2 layer (where it is one of the most abundant species), which contains a large amount of *Posidonia* remains (leaves and rhizomes) (Garilli et al., 2005). From the Tuscan Pliocene Dell'Angelo & Forli (1996) described a *Lepidochitona verrucosa* showing some analogies with *L. furtiva* but characterized by a tegmentum covered with large irregular scales similar to warts. *L. verrucosa* could be phylogenetically connected to *L. furtiva*, but the scarcity of fossil material of both species does not permit reaching satisfactory conclusions.

Distribution - Random records from north-western Sicily (Palermo), Isle of Lampedusa, the Pontine

Islands (Zannone), France (Cap d'Antibes), Corsica (Calvi), Malta, Algeria (Oran) (Dell'Angelo & Smriglio, 1999), Tunisia (Djerba, Bou Grara) (Kaas, 1989). *L. furtiva* is a very rare species and no fossil occurrence was known so far. The herein presented record therefore suggests that this species originated in the Pleistocene Mediterranean area.

Family CHITONIDAE Rafinesque, 1815
 Subfamily CHITONINAE Rafinesque, 1815

Genus *Chiton* Linnaeus, 1758
 Subgenus *Rhyssoplax* Thiele, 1893

Chiton (*Rhyssoplax*) *olivaceus* Spengler, 1797
 Pl. 4, figs. 1-5

- 1797 *Chiton olivaceus* SPENGLER, p. 73, Pl. 6, fig. 8.
 1828 *Chiton siculus* GRAY, p. 5.
 1883 *Gymnoplax Bohemicus* DE ROCHEBRUNE, p. 63.
 1934 *Chiton bohemicus* (Rochebrune) - SULC, p. 25, Pl. 2, figs. 48, 50-54.
 1962 *Chiton* (*Chiton*) *olivaceus* Spengler - MALATESTA, p. 161, Figs. 18-19.
 1977 *Chiton olivaceus* Spengler - LAGHI, p. 109, Pl. 2, figs. 5-8, 13.
 1995 *Chiton* (*Rhyssoplax*) *olivaceus* Spengler - DELL'ANGELO & FORLI, p. 231.
 1999 *Chiton* (*Rhyssoplax*) *olivaceus* Spengler - DELL'ANGELO, PALAZZI & PAVIA, p. 270, Pl. 4, figs. 1-8.
 1999 *Chiton* (*Rhyssoplax*) *olivaceus* Spengler - DELL'ANGELO & SMRIGLIO, p. 169, Figs. 86-96 and Pls. 56-57.
 2001 *Chiton olivaceus* Spengler - DELL'ANGELO, FORLI & LOMBARDI, p. 152, Fig. 28.

Material - N2 layer: 37 valves (3 head, 28 intermediate, and 6 tail), DGUP coll.; 3 valves (2 intermediate and 1 tail), BDA coll.; P3 layer: 11 valves (3 head, 6 intermediate and 2 tail), DGUP coll.

Remarks - *Chiton olivaceus* is one of the more common and best known Mediterranean species, easily recognizable for its characteristic sculpture of rather coarse but very variable radial grooves on the head valve, the lateral areas of the intermediate valves and the postmucronal area of the tail valve, and longitudinal grooves on pleural areas of intermediate valves and antemucronal area of tail valve.

A comprehensive description of *C. olivaceus* is given by Dell'Angelo & Smriglio (1999).

In many of the reported valves the longitudinal grooves are converging towards the jugum, the width of the jugal area is variable, and it is the same for the number of radial and longitudinal grooves. The variability of the fossil forms is so vast that former authors established various specific taxa, for instance *Chiton bohemicus* (de Rochebrune, 1883) from the Vienna basin, and the same was made by the 19th century authors who attributed specific validity to many colour variations, giving a rather extensive synonymy.

Distribution - Presently, *C. olivaceus* occurs in the whole Mediterranean, the Marmara Sea and Atlantic (from the southern coast of Portugal and Tangier,

Morocco) (Dell'Angelo & Smriglio, 1999). From the Miocene it was reported from the Tortonian of the Northern Apennines (Montegibbio, Rio di Bocca d'Asino) and the Messinian of Borelli (Torino) (Dell'Angelo et al., 1999). From the Pliocene the species is recorded, less frequently, from various Italian and French localities. From the Pleistocene it is present, with greater frequency, in many Italian and Spanish localities (Dell'Angelo et al., 2004). It is also mentioned from the Greek Upper Pleistocene (Vardala-Theodorou 1998, Dell'Angelo & Vardala-Theodorou, in press).

Chiton (Rhyssoplax) corallinus (Risso, 1826)
Pl. 4, figs. 6-10

- 1826 *Lepidopleurus corallinus* RISSO, p. 268.
1844 *Chiton pulchellus* PHILIPPI, p. 83, Pl. 19, fig. 14 (non Gray, 1828).
1860 *Chiton denudatus* REUSS, p. 259, Pl. 8, figs. 14-15.
1870 *Chiton philippii* ISSEL, p. 5 (nom. nov. pro *Chiton pulchellus* Philippi, 1844).
1934 *Chiton (Clathropleura) corallinus denudatus* Rss. - SULC, p. 24, Pl. 2, figs. 44-45.
1962 *Chiton (Chiton) corallinus* (Risso) - MALATESTA, p. 163, Figs. 20-21.
1971 *Chiton denudatus* Reuss - BALUK, p. 462, Pl. 5, figs. 9-11.
1977 *Chiton corallinus* (Risso) - LAGHI, p. 109, Pl. 2, figs. 9-12.
1999 *Chiton (Rhyssoplax) corallinus* (Risso) - DELL'ANGELO & SMRIGLIO, p. 174, Figs. 97-107 and Pls. 58-59.
2001 *Chiton corallinus* (Risso) - DELL'ANGELO, FORLI & LOMBARDI, p. 152, Fig. 25.
2004 *Chiton (Rhyssoplax) corallinus* (Risso) - DELL'ANGELO, LANDAU & MARQUET, p. 39, Pl. 3, figs. 4, 7.

Material - N2 layer: 2 valves (1 head and 1 tail), DGUP coll.; 18 valves (1 head, 11 intermediate, and 6 tail), BDA coll.

Remarks - The species is characterized by smooth head valve, lateral areas of intermediate valves and postmucronal area of tail valve. The pleural areas of intermediate valves and antemucronal area of tail valve have 7-10 longitudinal grooves that are actually small outward-leaning folds of the tegmentum. The material reported herein matches well the characteristics of the species.

A detailed description of *C. corallinus* is given by Dell'Angelo & Smriglio (1999).

Laghi (1977) considered *Chiton denudatus* Reuss, 1860, a species from the Miocene of Steinabrunn (Vienna Basin), Rudoltice (Bohemia) and Korytnica (Central Poland), to be a junior synonym of *Chiton corallinus*, a decision accepted by Baluk (1984) and subsequent authors.

Distribution -Today, *Chiton corallinus* occurs only in the Mediterranean Sea. It has been reported from the Miocene of central-eastern Europe (under the name of *Chiton denudatus* Reuss, 1860) and of Montegibbio (Modena, Tortonian) (Dell'Angelo & Smriglio, 1999). It is more common in Italian Pliocene (locally very frequent) and Pleistocene deposits, and is also reported from the Pliocene of Portugal (Dell'Angelo & da Silva, 2003).

Suborder ACANTHOCHITONINA Bergenhayn, 1930
Family ACANTHOCHITONIDAE Simroth, 1894
Subfamily ACANTHOCHITONINAE Simroth, 1894

Genus *Acanthochitona* Gray, 1821

Acanthochitona fascicularis (Linnaeus, 1767)
Pl. 5, figs. 1-3

- 1767 *Chiton fascicularis* LINNAEUS, p. 1106.
1826 *Acanthochites communis* RISSO, p. 268.
1883 *Acanthochites faluniensis* DE ROCHEBRUNE, p. 60.
1934 *Acanthochiton faluniensis* Rochebrune - SULC, p. 17, Pl. 1, fig. 29; Pl. 2, figs. 30-32; Text-Fig. 2.
1962 *Acanthochitona communis* (Risso) - MALATESTA, p. 166, Figs. 24-25.
1971 *Acanthochitona faluniensis* (Rochebrune) - BALUK, p. 463, Pl. 2, figs. 10-15.
1977 *Acanthochitona communis* (Risso) - LAGHI, p. 110, Pl. 3, figs. 13-19.
1977 *Craspedochiton (Pseudoacanthochitona) ambiguus* - LAGHI, p. 113, Pl. 4, figs 9-12.
1985 *Acanthochitona fascicularis* (Linnaeus) - KAAS, p. 585, Figs. 1-6.
1995 *Acanthochitona fascicularis* (Linneo) - DELL'ANGELO & FORLI, p. 235, Figs. 8, 11.
1999 *Acanthochitona fascicularis* (Linnaeus) - DELL'ANGELO, PALAZZI & PAVIA, p. 273, Pl. 5, figs. 1, 3-5; Pl. 6, figs. 3-4, 6.
1999 *Acanthochitona fascicularis* (Linneo) - DELL'ANGELO & SMRIGLIO, p. 192, Figs. 113-123, Pls. 64-65.
2001 *Acanthochitona fascicularis* (Linneo) - DELL'ANGELO, FORLI & LOMBARDI, p. 153, Figs. 30, 33.
2004 *Acanthochitona fascicularis* (Linnaeus) - DELL'ANGELO, LANDAU & MARQUET, p. 40, Pl. 3, fig. 8; Pl. 4, fig. 1.

Material - N2 layer: 31 valves (1 head, 25 intermediate, and 5 tail); 24 valves (20 intermediate and 4 tail), BDA coll.; H6 layer: 2 intermediate valves, DGUP coll.; P3 layer: 1 head valve.

Remarks - *A. fascicularis* is an extremely variable species, characterized by a tegmentum covered with small roundish granules arranged along orderly arched lines on the valves, except for the jugal area, and by its flat or slightly concave surface. The material here presented matches the characteristics shown by Recent specimens of this species.

A comprehensive description of *A. fascicularis* is given by Dell'Angelo & Smriglio (1999).

A. faluniensis de Rochebrune, 1883 (from the Miocene of central-eastern Europe), differing from *A. fascicularis* only by having a proportionally less number of slightly larger granules, was, in our opinion rightly, considered as a junior synonym of *A. fascicularis* by Laghi (1977) and Dell'Angelo et al. (1999). This statement was not accepted by Baluk (1984).

One tail valve from N2 layer shows some supplementary incisions in the insertion lamina, in addition to the two usual ones. This feature has caused many problems in the determination of fossil valves, as several species has been described as new only on the basis of this character (e.g. *Craspedochiton ambiguus* Laghi, 1977). This distinction does not seem justifiable, as all the other characters are identical.

Distribution - *A. fascicularis* occurs throughout the Mediterranean and in the Atlantic, from the British Channel and Bretagne to the Azores and the Canary Islands (Dell'Angelo & Smriglio, 1999). It is reported from the Miocene (Badenian) of central-eastern Europe, Tortonian of Montegibbio (Modena) and Messinian of Borelli (Torino) (Dell'Angelo et al., 1999). It is recorded from the Spanish Pliocene (Dell'Angelo et al., 2004), and from many Italian Plio-Pleistocene localities, where it is locally very frequent. It is also reported from the Upper Pleistocene of Greece (Vardala-Theodorou, 1998; Dell'Angelo & Vardala-Theodorou, in press).

Genus *Craspedochiton* Shuttleworth, 1853

Craspedochiton altavillensis (SEGUEZZA, 1876)

Pl. 5, figs. 4-10

- 1876 *Chiton altavillensis* SEGUEZZA, p. 264.
 1883 *Gymnoplax Deslongchampsii* DE ROCHEBRUNE, p. 69, Pl. 3, fig. 6.
 1905 *Acanthochites profascicularis* BOETTGER, p. 208.
 1934 *Cryptoconchus (Craspedoplax) profascicularis* (Boettger) - SULC, p. 13.
 1971 *Craspedochiton schafferi* Sulc - BALUK, p. 465, Pl. 4, figs. 13-14.
 1977 *Craspedochiton deslongchampsii* (Rochebrune) - LAGHI, p. 112, Pl. 4, figs. 4-8.
 1979 *Craspedochiton deslongchampsii* (Rochebrune) - SABELLI & TAVIANI, p. 158, Pl. 1, fig. 16.
 1984 *Craspedochiton profascicularis* (Boettger) - BALUK, p. 292, Pl. 12, figs. 1-2.
 1988 *Craspedochiton altavillensis* (Seguenza) - DELL'ANGELO & PALAZZI, p. 174, Fig. 1.
 1999 *Craspedochiton altavillensis* (Seguenza) - DELL'ANGELO, PALAZZI & PAVIA, p. 276, Pl. 6, figs. 1-2, 5.
 2001 *Craspedochiton altavillensis* (Seguenza) - DELL'ANGELO, FORLI & LOMBARDI, p. 153, Fig. 31.
 2004 *Craspedochiton altavillensis* (Seguenza) - DELL'ANGELO, LANDAU & MARQUET, p. 40, Pl. 2, figs. 4, 7.

Material - N2 layer: 2 intermediate valves, BDA coll.; P3 layer: 3 valves (1 intermediate and 2 tail), DGUP coll.

Remarks - The species is characterized by having the tegmentum covered with large elevated granules of irregular shape, except for the jugal area. The shape of the granules is highly variable, from single granules, regularly ellipsoidal, to coalescing granules fused to form irregular cords; also the elevation and density of granules on the tegmentum is variable. Another characteristic is the large raised rib separating the lateral and lateropleural areas in intermediate valves.

A complete description of *C. altavillensis* is given by Dell'Angelo et al. (1999).

The herein presented material matches well the characteristics of the species. The synonymy between *altavillensis* and *deslongchampsii* was discussed by Dell'Angelo & Palazzi (1988), who also designated neotypes.

Distribution - With regard to the Miocene, the species has been reported from the Burdigalian of Torino hills, Badenian of central-eastern Europe, Tortonian of Montegibbio and Messinian of Borelli (Dell'Angelo et al., 1999). There are a few records from some Italian and Spanish Pliocene localities (Laghi, 1977; Dell'Angelo et al., 2001; Dell'Angelo et al., 2003; Dell'Angelo et al., 2004) and two reports from the Lower Pleistocene (Santernian Substage of Torrente Stirone, Parma, N Italy (Sabelli & Taviani, 1979), and from the upper Emilian Substage of Dattilo, Trapani, NW Sicily (Garilli, 1998)).

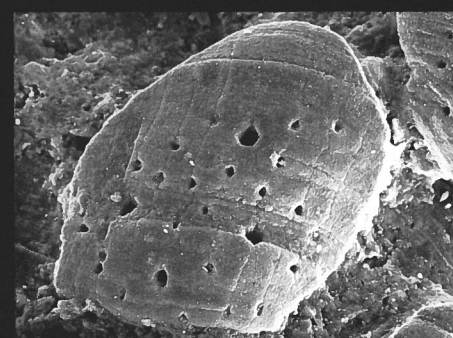
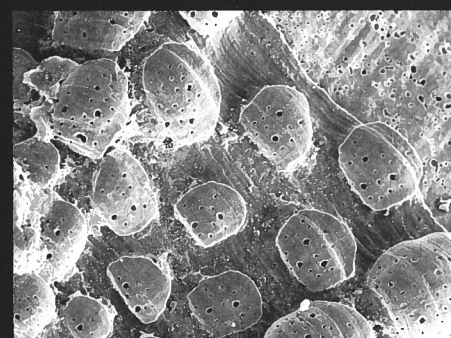
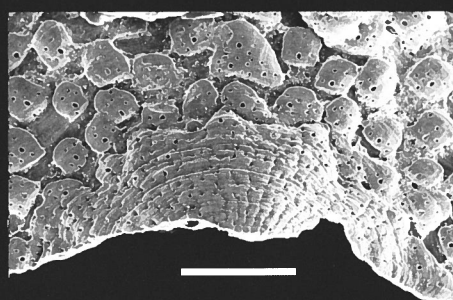
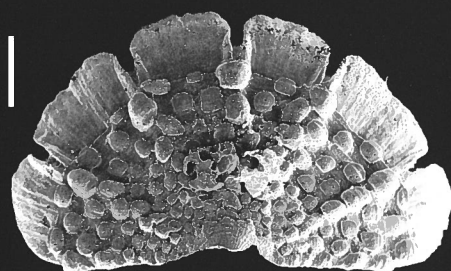
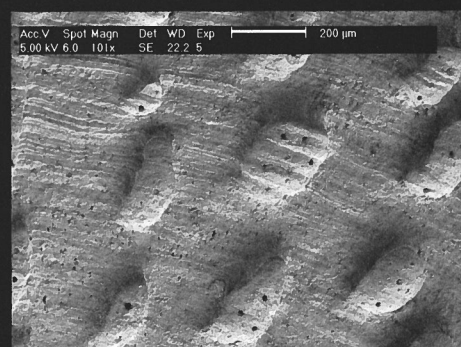
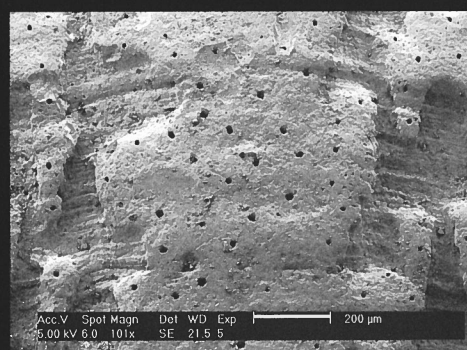
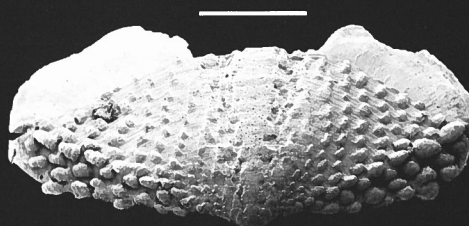
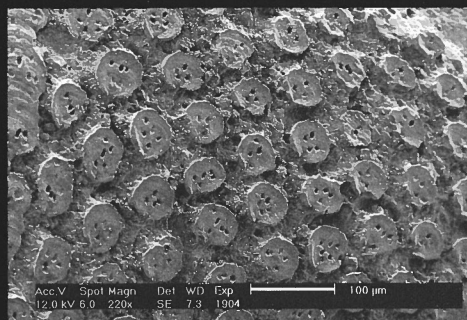
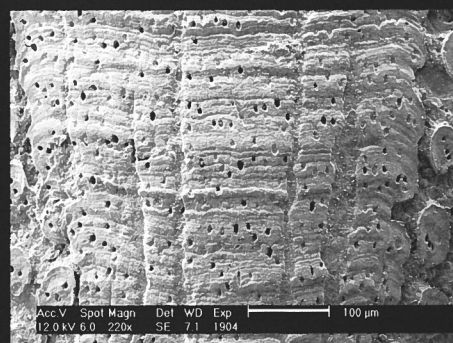
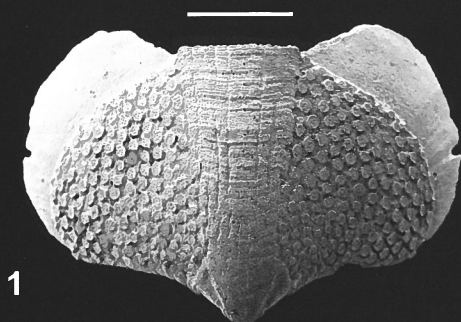
CONCLUDING REMARKS

After Vardala-Theodorou (1998) and Dell'Angelo & Vardala-Theodorou (in press), who provided a list from the Corinth area (Perachora), this paper is the second comprehensive and illustrated account of fossil Polyplacophora from Greece. The rich chiton assemblage sourced from the Pleistocene sites of Kyllini includes 11 species represented by 198 valves (Tab. 1). As a whole, about half of the valves (53,5%) belong to the species *Chiton olivaceus* (51 valves) and

EXPLANATION OF PLATE 5

- Figs. 1-3 - *Acanthochitona fascicularis* (Linnaeus, 1767), intermediate valve, N2 layer, Middle-Upper Pleistocene, DGUP coll.
 1 - Dorsal view.
 2 - Sculpture of jugal area.
 3 - Sculpture of lateropleural area.
- Figs. 4-10 - *Craspedochiton altavillensis* (Seguenza, 1876), intermediate (4-6) and head valves (7-10), P3 layer, Lower-lower Middle Pleistocene, DGUP coll.
 4 - Dorsal view.
 5 - Sculpture of jugal area.
 6 - Sculpture of lateropleural area.
 7 - Dorsal view.
 8 - Sculpture near the apex.
 9 - Arrangement of granules.
 10 - Detail of a granule showing the arrangement of aesthetes.

Scale bars: 2 mm in fig. 4; 500 µm in figs. 1, 7; 200 µm in figs. 5, 6, 8, 9; 100 µm in figs. 2, 3, 10.



Species	N2 layer	H6 layer	P3 layer	Total
<i>Lepidopleurus cajetanus</i>	1		1	2
<i>Lepidopleurus cimicoides</i>	6			6
<i>Lepidopleurus scabridus</i>	3			3
<i>Ischnochiton rissoi</i>	7	1	1	9
<i>Callochiton septemvalvis</i>	15	1		16
<i>Lepidochitona cinerea</i>	1		2	3
<i>Lepidochitona furtiva</i>	28			28
<i>Chiton olivaceus</i>	39	1	11	51
<i>Chiton corallinus</i>	20			20
<i>Acanthochitona fascicularis</i>	44	10	1	55
<i>Craspedochiton altavillensis</i>	2		3	5
Total	166	13	19	198

Tab. 1- Number of chiton valves found by layers/species.

Acanthochitona fascicularis (55 valves). *Ischnochiton rissoi*, *Callochiton septemvalvis*, *Lepidochitona furtiva*, and *Chiton corallinus* are represented by a fair number of valves. The remaining five species (*Lepidopleurus cajetanus*, *L. cimicoides*, *L. scabridus*, *Lepidochitona cinerea*, and *Craspedochiton altavillensis*) are represented by six or fewer valves. In particular the most abundant association comes from the N2 layer where all the recovered taxa were found; four and six species, usually with fewer valves, are present in the H6 and P3 layers respectively (Tab. 1).

All the species found are still living in the Mediterranean Sea (of them 7 also occur in the eastern Atlantic) with the exception of *C. altavillensis* which can also be considered to be a rare species in the Plio-Pleistocene. In effect, few citations are known for the Pliocene (mainly from Italy) and only two records exist for this species from the Selinuntian (*sensu* Ruggieri et al., 1984) of North Italy and Sicily, so that the material

presented herein is to be considered the first for the post Lower Pleistocene chronostratigraphic range. With regard to the stratigraphical distribution of the discussed taxa (Tab. 2), nine of them have a Miocene to Pleistocene range, including *Lepidopleurus scabridus* which was never recorded till now from Pleistocene. Regarding to this species, for which we suppose a Mediterranean origin, it is noteworthy to remark that the herein presented material represents the missing link between Recent and fossil findings. *L. cimicoides* is known to have a Plio-Pleistocene paleodistribution while the Mediterranean species *Lepidochitona furtiva* (found only in the younger N2 layer) is here recorded for the first time as fossil. Further, fossil occurrences of this very rare species could be helpful in verifying its Mediterranean Pleistocene origin suggested by our record.

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REFERENCES

- Antevs E. (1928). Shell Beds in the Skagerack. *Geologiska Föreningens i Stockholm Förhandlingar*, 50 (4): 479-749.
 Baluk W. (1971). Lower Tortonian chitons from the Korytnica clays, southern slopes of the Holy Cross Mts. *Acta Geologica Polonica*, 21: 449-472.
 Baluk W. (1984). Additional data on chitons and cuttlefish from the Korytnica clays (Middle Miocene; Holy Cross Mountains, Central Poland). *Acta Geologica Polonica*, 34: 281-297.

Species	Miocene	Pliocene	Pleistocene	Living	
				Medit.	Atlantic
<i>Lepidopleurus cajetanus</i>	x	x	x	x	x
<i>Lepidopleurus cimicoides</i>		x	x	x	x
<i>Lepidopleurus scabridus</i>	x	x	x	x	x
<i>Ischnochiton rissoi</i>	x	x	x	x	
<i>Callochiton septemvalvis</i>	x	x	x	x	x
<i>Lepidochitona cinerea</i>	x	x	x	x	x
<i>Lepidochitona furtiva</i>			x	x	
<i>Chiton olivaceus</i>	x	x	x	x	x
<i>Chiton corallinus</i>	x	x	x	x	
<i>Acanthochitona fascicularis</i>	x	x	x	x	x
<i>Craspedochiton altavillensis</i>	x	x	x		
Total	9	10	11	10	7

Tab. 2 - Stratigraphic and Recent distribution of the discussed species.

- Bergenhayn J.R.M. (1931). Beiträge zur Malakozoologie der Kanarischen Inseln. *Arkiv für Zoology*, 23A (13): 1-38.
- Boettger O. (1905). Zur Kenntnis der Fauna der mittelmioanen Schichten von Kostež im Krasso-Szörenyer Komitat. Gasteropoden und Anneliden. *Verhandlungen und Mittheilungen des Siebenburgischen Vereins für Naturwissenschaften in Hermannstadt*, 55: 101-244.
- Brown T. (1823). Conchology. I, Multivalves. 1, Chiton. In Enc. Brit., Edinburgh, ed. 6, 6 (2): 401-402.
- Capellini J. (1859). Catalogue des Ostracibrions de la Méditerranée suivi de la description de quelques espèces nouvelles. *Journal de Conchyliologie*, 7: 321-328.
- Carmona Zalvide P., García F.J. & Urgorri V. (2002). Consideraciones taxonómicas y zoogeográficas del género *Callochiton* Gray 1847 en la península ibérica. *Archiv für Molluskenkunde*, 131 (1/2): 185-199.
- Cesari P. (1987). Note sistematiche e geonemiche su alcune specie mediterranee del genere *Leptochiton* Gray, 1847 (Polyplacophora, Leptochitonidae). *Lavori Società Veneziana di Scienze Naturali*, 12: 3-34.
- Christodoulou G. (1969). Geological map of Greece, Vartholomion Sheet. Institute for Geology and Subsurface Research. Athens, 1969.
- Christodoulou G. (1971). The Neogene sediments near Kyllene, NW Peloponnisos. *Edikai Meletai epi tes Geologias tes Ellados*, 11: 1-60.
- Costa O.G. (1829). Catalogo sistematico e ragionato de'testacei delle Due Sicilie. Napoli, Tip. Minerva: 8 + cxxxii pp.
- Dell'Angelo B. & Forli M. (1995). I Polyplacophora del Pleistocene inferiore di Riparbella (Pisa), con elenco dei molluschi rinvenuti. *Bollettino Malacologico*, 30 (10-12) [1994]: 221-252.
- Dell'Angelo B. & Forli M. (1996). Due nuove specie di Polyplacophora del Pliocene toscano. *La Conchiglia*, 28 (279 suppl.): 42-49.
- Dell'Angelo B., Forli M. & Lombardi C. (2001). I Polyplacophora plio-pleistocenici della Toscana. *Bollettino Malacologico*, 36 (9-12): 143-154.
- Dell'Angelo B. & Laghi G.F. (1980). *Hippopodinella lata* (Busk, 1856) (Bryozoa, Cheilostomata) epizoica su *Chiton olivaceus* Spengler, 1797. *Oebalia, Rivista dell'Istituto Sperimentale Talassografico "A. Cerruti"*, 6: 25-30.
- Dell'Angelo B., Gallorini H. & Taviani M. (2003). First Neogene record of an articulated polyplacophoran. *Journal of Paleontology*, 77 (6): 1193-1194.
- Dell'Angelo B., Landau B. & Marquet R. (2004). Polyplacophora from the Early Pliocene of Estepona (Málaga, southwest Spain). *Bollettino Malacologico*, suppl. 5: 25-44.
- Dell'Angelo B. & Palazzi S. (1986). Considerazioni sulla famiglia Leptochitonidae Dall, 1889 (Mollusca: Polyplacophora) con descrizione di due nuovi taxa. *Bollettino Malacologico*, 22 (1-4): 1-36.
- Dell'Angelo B. & Palazzi S. (1987). Considerazioni sulla famiglia Leptochitonidae Dall, 1889 (Mollusca: Polyplacophora). II. Ridescrizione di *Leptochiton cimicoides* (Monterosato, 1879). *Bollettino Malacologico*, 23 (1-4): 95-105.
- Dell'Angelo B. & Palazzi S. (1988). *Gymnoplax deslongchampsii* de Rochebrune, 1883, sinonimo di *Chiton altavillensis* G. Seguenza, 1876 (Mollusca, Polyplacophora). *Il Naturalista Siciliano*, 12: 174-175.
- Dell'Angelo B. & Palazzi S. (1989). Considerazioni sulla famiglia Leptochitonidae Dall, 1889 (Mollusca: Polyplacophora). III. Le specie terziarie e quaternarie europee, con note sistematiche e filogenetiche. *Atti I Giornata di Studi Malacologici CISMA*: 19-140.
- Dell'Angelo B. & Palazzi S. (1994). *Callochiton calcatus* n. sp. con note su *Callochiton septemvalvis* (Montagu, 1803). *La Conchiglia*, 26 (273): 15-23.
- Dell'Angelo B., Palazzi S. & Pavia G. (1999). I Molluschi del Messiniano inferiore di Borelli (Torino). 4. Polyplacophora. *Bollettino del Museo Regionale di Scienze Naturali*, 16 (1-2): 257-302.
- Dell'Angelo B. & da Silva C.M. (2003). Polyplacophora from the Pliocene of Vale de Freixo: Central-West Portugal. *Bollettino Malacologico*, 39 (1-4): 7-16.
- Dell'Angelo B. & Smriglio C. (1999). Chitoni viventi del Mediterraneo. Edizioni Evolver, Roma, 256 pp. (English ed., 2001, Living Chitons from the Mediterranean Sea).
- Dell'Angelo B. & Vardala-Theodorou E. (in press). Pleistocene Polyplacophoran species from Perachora Peninsula (Corinth, Greece). *Annales Goulondris Natural History Museum*, Vol. 11. Athens.
- Garilli V. (1998). Paleocomunità a molluschi bentonici nel Pleistocene inferiore di Dattilo (Trapani). Brevi considerazioni ecologiche e cronologiche. In Lo Cicero G. (ed.), La Sicilia un laboratorio naturale nel Mediterraneo. Atti del 79° Congresso nazionale della Società Geologica Italiana. Offset, Palermo. B: 471-474.
- Garilli V. (2004). A new species of *Ersilia* (Caenogastropoda, Eulimidae) from the Plio-Pleistocene of the Central Mediterranean area. *Bollettino Malacologico*, 39 (5-8): 91-94.
- Garilli V., Crisci M. & Messina R. (2005). A new species of *Gibbula* (Gastropoda: Trochidae) from the Pleistocene of Kyllini (north-western Peloponnesus, Greece). *Bollettino della Società Paleontologica Italiana*, 44 (1): 47-53.
- Gravina M.F., Smriglio C. & Ardizzone G.D. (1992). Benthos di fondo mobile delle isole Pontine: 1. Molluschi. Atti XIII Congr. SIBM. *Oebalia, International Journal of Marine Biology and Oceanography*, 17 (suppl.): 355-357.
- Gray J.E. (1828). Spicilegium Zoologicum; or original figures and short systematic descriptions of new and unfigured animals. Family Chitonidae. London, 1: 5-6.
- Hagemann J. (1976). Stratigraphy and sedimentary history of the Upper Cenozoic of the Pyrgos Area (Western Peloponnesus), Greece. *Annales Géologiques des Pays Helléniques*, 28 (2^{ème} Série): 299-333.
- International Commission on Zoological Nomenclature (1999). International Code of Zoological Nomenclature. Fourth Edition. The International Trust for Zoological Nomenclature, c/o The Natural History Museum, London, pp. xxx + 306.
- Issel A. (1870). Intorno ai Chiton del mare di Genova. *Bollettino Malacologico Italiano*, 3: 5-9.
- Jeffreys J.G. (1880). On a new species of chiton lately found on the British Coasts. *Annals and Magazine of Natural History*, (5) 6: 33-35.
- Kaas P. (1978). Notes on Loricata, 10. On the European Callochiton species. *Basteria*, 42: 73-75.
- Kaas P. (1985). The genus *Acanthochitona* Gray, 1821 (Mollusca, Polyplacophora) in the north-eastern Atlantic Ocean and in the Mediterranean Sea, with designation of neotypes of *A. fascicularis* (L., 1767) and of *A. crinita* Pennant, 1777). *Bulletin du Muséum National d'Histoire Naturelle*, (4) 7 (A3): 579-609.
- Kaas P. (1989). Notes on Loricata, 16. Chitons from the Gulf of Gabes, Tunisia. *Basteria*, 53: 91-92.
- Kaas P. & Van Belle R.A. (1981). The genus *Lepidochitona* Gray, 1821 (Mollusca: Polyplacophora) in the northeastern Atlantic Ocean, the Mediterranean Sea and the Black Sea. *Zoologische Verhandelingen*, 185: 3-43.
- Kaas P. & Van Belle R.A. (1985a). Monograph of Living Chitons (Mollusca: Polyplacophora). Vol. 1. Order Neoloricata: Lepidopleurina. 240 pp. Leiden-London-Köln-Kopenhagen, E.J. Brill/ W. Backhuys.
- Kaas P. & Van Belle R.A. (1985b). Monograph of Living Chitons (Mollusca: Polyplacophora). Volume 2. Suborder Ischnochitonina, Ischnochitonidae: Schizoplacinae, Callochitoninae & Lepidochitoninae. 198 pp. Leiden-London-Köln-Kopenhagen, E.J. Brill/W. Backhuys.
- Kaas P. & Van Belle R.A. (1987). Monograph of Living Chitons (Mollusca: Polyplacophora). Volume 3. Suborder Ischnochitonina: Ischnochitonidae: Chaetopleurinae & Ischnochitoninae (pars). Additions to Vols. 1 & 2. 302 pp. Leiden-New York-Köln-Kopenhagen, E.J. Brill/W. Backhuys.

- Kaas P. & Van Belle R.A. (1990). Monograph of Living Chitons (Mollusca: Polyplacophora). Volume 4. Suborder Ischnochitonina: Ischnochitonidae: Ischnochitoninae (continued). Additions to Vols 1, 2 and 3. 298 pp. Leiden-New York-Kobenhavn-Köln, E.J. Brill.
- Kleinholter K. (1994). Ein Nachweis von *Lepidochitona cinerea* (Linne) aus dem Oberpliozän der W-Peloponnes Griechenland. *Münster Forschungsschwerpunkte geologisches paläontologisches Zeitschrift*, 76 (6 S): 91-96.
- Kowalczyk G., Winter K.P. & Reisch L. (1979). Die geologische Entwicklung der Kyllini-Halbinsel im Neogen und Quartär (West-Peloponnes, Griechenland). *Zeitschrift der deutschen geologischen Gesellschaft*, 130: 323-346.
- Laghi G.F. (1977). Polyplacophora (Mollusca) neogenici dell'Appennino settentrionale. *Bollettino della Società Paleontologica Italiana*, 16: 87-115.
- Linnaeus C. (1767). Systema Naturae. Editio duodecima, reformata. "Vermes Testacea". Holmiae, L. Salvii, 1 (2): 533-1327.
- Malatesta A. (1962). Mediterranean Polyplacophora Cenozoic and Recent. *Geologica Romana*, 1: 145-171.
- Montagu G. (1803). Testacea Britannica or natural history of British shells, marine, land and freshwater, including the most minute, systematically arranged and embellished with figures. London, White, 1: i-xxxvii, 1-291; 2: 292-606.
- Monterosato (di Maria) T. (1872). Notizie intorno alle conchiglie mediterranee. 61 pp. Palermo, Ufficio Tipografico di Michele Amenta.
- Monterosato (di Maria) T. (1875). Nuova rivista delle conchiglie mediterranee. *Atti dell'Accademia di Scienze, Lettere e Belle Arti*, 5: 1-50.
- Monterosato (di Maria) T. (1878a). Enumerazione e sinonimia delle Conchiglie mediterranee. *Giornale di Scienze Naturali ed Economiche*, 13: 61-115.
- Monterosato (di Maria) T. (1878b). Notes sur quelques coquilles draguées dans les eaux de Palerme. *Journal de Conchyliologie*, 26: 143-160.
- Monterosato (di Maria) T. (1879). Enumerazione e sinonimia delle Conchiglie mediterranee. Monografia dei Chitonidi del Mediterraneo. *Giornale di Scienze Naturali ed Economiche*, 14: 9-31.
- Payraudeau B.C. (1826). Catalogue descriptif et méthodique des annélides et des mollusques de l'île de Corse. Paris, 218 pp.
- Pennant T. (1777). British Zoology, ed. 4, vol. 4. Crustacea, Mollusca, Testacea. London: i-viii, 1-154.
- Pérès J.M. & Picard J. (1964). Nouveau manuel de bionomie benthique de la mer Méditerranée. *Recueil des Travaux de la Station Marine d'Endoume, Faculté des Sciences de Marseille*, 31: 1-137.
- Philippi R.A. (1844). Fauna Molluscorum viventium et in tellure tertiaria fossilium regni utriusque Siciliae. Volumen secundum. Halis Saxonum, Sumptibus Eduardi Anton: 1-304.
- Pilsbry H.A. (1892-94). Monograph of Polyplacophora. In G.W. Tryon (ed.), Manual of Conchology. *Academy of Natural Sciences*, Philadelphia, 14: 1-128 (1892); i-xxxiv, 129-350, (1893); 15: 1-64 (1893); 65-133 (1894).
- Poli G.S. (1791-95). Testacea utriusque Siciliae eorumque historia et anatome. Parma, Bodoni ed., Tomus primus: 257 pp.; Tomus secundus: 234 pp.
- Reeve L. (1847-48). Conchologia iconica, or illustrations of the shells of molluscos animals. 4, Monograph of the genus Chitonellus: Pl.1; Monograph of the genus Chiton: Pls.1-27 (1847), Pl. 28 (1848).
- Reuss A.E. (1860). Die marinen Tertiärschichten Böhmens und ihre Versteinerungen. *Sitzungsberichte Akademie (K.) der Wissenschaften*, 39: 250-270.
- Risso J.A. (1826). Histoire naturelle des principales productions de l'Europe méridionale et particulièrement de celles des environs de Nice et des Alpes maritimes. Paris, Libraire F.G. Levrault, vol. 4: vii + 439 pp.
- Rochebrune A.T. de (1883). Monographie des espèces fossiles appartenant à la classe des Polyplacophores. *Annales des Sciences Géologiques*, 14: 1-74.
- Ruggieri G., Rio D. & Sprovieri R. (1984). Remarks on the chronostratigraphic classification of Lower Pleistocene. *Bollettino della Società Geologica Italiana*, 103: 251-259.
- Sabelli B. (1974). Origine e distribuzione dei Polyplacophora viventi in Mediterraneo. *Quaderni della Civica Stazione di Idrobiologia di Milano*, 5: 71-78.
- Sabelli B. & Taviani M. (1979). I Polyplacophora del Pleistocene inferiore del T. Stirone (Preappennino Parmense, Italia). *Bollettino della Società Paleontologica Italiana*, 18: 157-161.
- Sabelli B., Giannuzzi-Savelli R. & Bedulli D. (1990). Annotated check-list of Mediterranean marine mollusks. Vol. 1, Edizioni Libreria Naturalistica Bolognese, 348 pp.
- Salvini-Plawen L. (1968). Neue Formen in marinen Mesopsammon: Kamptozoa und Aculifera (nebst der für die Adria neuen Sandfauna). *Annalen des Naturhistorischen Museums in Wien*, 72: 231-272.
- Seguenza G. (1873-77). Studii stratigrafici sulla formazione pliocenica dell'Italia meridionale. *Bollettino del Regio Comitato Geologico Italiano*, 4: 29-45, 84-103, 131-153, 213-230, 280-301, 345-357 (1873); 5: 4-15, 68-85, 146-152, 271-283, 332-347 (1874); 6: 18-31, 82-89, 145-153, 203-211, 275-283, 339-345 (1875); 7: 7-15, 91-103, 179-189, 259-271, 355-359 (1876); 8: 7-17, 91-99, 359-367 (1877).
- Spengler L. (1797). Udförlig beskrivelse over det mangeskallede konkylie-slaegt, af Linnaeus kaldet Chiton; met endeel nye Arter og Varieteter. *Skrivter af Naturhistorie Selskabet*, 4: 62-103.
- Sulc J. (1934). Studien über die fossilen Chitoniden. I. Die fossilen Chitoniden im Neogen des Wiener Beckens und der angrenzenden Gebiete. *Annalen des Naturhistorischen Museums in Wien*, 47: 1-31.
- Sykes E.R. (1894). Notes on the British Chitons. *Proceedings of the Malacological Society*, 1: 35-37.
- Thiele J. (1909). Revision des Systems der Chitoniden. *Zoologica*, 22: 1-132.
- Underhill J.R. (1988). Triassic evaporites and Plio-Quaternary diapirism in western Greece. *Journal of Geological Society*, 145: 269-282.
- Vardala-Theodorou E. (1998). Study of recent and fossil (Quaternary) benthic mollusca of Vouliagmeni lake at Perachora Corinth Greece. Ph. D. Thesis, University of Athens. 480 pp.

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