

REDESCRIPTION OF *VACCINITES FORTISI* (CATULLO, 1834)

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ABSTRACT

Vaccinites fortisi (Catullo) is a species which has been practically ignored because of the little diffusion of Catullo's works (1827, 1834). Specimens that should have been attributed to this species have been recognized instead as *Vaccinites taburnii* (Guiscardi), *Vaccinites gaudryi* (Munier-Chalmas), *Vaccinites chaperi* (Douvillé), *Vaccinites atheniensis* (Ktenas) and others, all of them species instituted later. Abundant fossil material collected in the south-central Apennines (Italy) has been examined and studied the original specimens of Catullo's collection at Padova, as well as others of other collections. It was concluded that all the hippuritid species that were considered, can be grouped and recognized as *Vaccinites fortisi* (Catullo), as being the species name which has the priority. This species is characteristic of the Santonian.

Key words: Hippuritidae, *Vaccinites fortisi* (Catullo), Santonian, Italian Apennines.

RESUMEN

Vaccinites fortisi (Catullo) es una especie que ha sido prácticamente ignorada por la escasa difusión de los trabajos de Catullo (1827, 1834). Ejemplares que debieron ser atribuidos a esta especie han sido reconocidos como *Vaccinites taburnii* (Guiscardi), *Vaccinites gaudryi* (Munier-Chalmas), *Vaccinites chaperi* (Douvillé), *Vaccinites atheniensis* (Ktenas) y otras, todas ellas especies que se instituyeron después de la de Catullo. Fue examinado abundante material fósil colectado en el sur y centro de los Apeninos de Italia y fueron estudiados los ejemplares originales de la colección de Catullo en Padua, así como otras colecciones. Se llegó a la conclusión de que todas las especies de hipurítidos que han sido consideradas por los autores, pueden ser agrupadas y reconocidas como *Vaccinites fortisi* (Catullo), por ser el nombre de la especie que tiene prioridad. La especie es característica del Santoniano.

Palabras clave: Hippuritidae, *Vaccinites fortisi* (Catullo), Santoniano, Apeninos italianos.

INTRODUCTION

During the field work in south-central Apennines, a considerable amount of rudists was collected, which have been described along several papers (Paradisi and Sirna, 1965; Polsak *et al.*, 1970; Carbone *et al.*, 1971; Praturlon and Sirna, 1975, 1976; Laviano and Sirna, 1979; Carbone *et al.*, 1980; Carbone and Sirna, 1981; Accordi *et al.*, 1982; Matteucci *et al.*, 1982; Sirna, 1982, 1983; Accordi *et al.*, 1987; Cestari and Sirna, 1987; Accordi *et al.*, 1988; Accordi *et al.*, 1990; Sirna, 1990; Pons and Sirna, 1992; Cherchi *et al.*, 1993). Hippuritids, which form a great part of this fossil material, were identified using all those characters that normally are considered by rudist taxonomists—form of the ligamentary crest, form of the pillars, angular measure between the ligamentary crest and the pillars...—except the upper valve, which is rarely found.

As a consequence, the presence of a certain number of hippuritid species in the study area was stated, but, while the observations increased with new sedimentological and palaeoecological data, and the species descriptions and figures made by preceding authors were critically analyzed, it was thought that the specific diversity present in the outcrops could be more apparent than real. In fact, it was considered that

the morphostructural diversity of the main taxonomic features was due to environmental constraints that conditioned several specimens from populations of the same species, originating ecomorphotypes.

Essentially, most of the reported species established in the past by different authors, could be morphotypic modifications of very few, or maybe only one, species. This possibility induced to analyse a group of *Vaccinites* species (see the synonymy list); the result of this study, based on field observations and on bibliographic data, lead to recognize the presence of the same diagnostic features in all of them and to propose *Vaccinites fortisi* (Catullo, 1834) as the species which has the priority. The main species that were studied are the following.

Vaccinites fortisi (Catullo)

(Figure 3)

Probably the fossil reported by Fortis (1802, pl. 6, fig. c), that he attributed to the Orthoceratids, was the first reference of this species.

Catullo (1827) described, figured and named *Hippurites fortisi*, an hippuritid specimen that he considered different from that of Fortis "... quantunque vi si accosti moltissimo nell'aspetto e nella grandezza" (... though it is much similar both in shape and size). Catullo's drawing does not show the inner features but this specimen, preserved in the collections of the Università di Padova, was sectioned by Parona and

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displays the arrangement and shape of pillars and ligamentary crest. In the same paper, Catullo also described and figured *H. fitoloideus* that, for the present authors, is *H. fortisi* itself. Catullo (1834, 1842) referred to both species.

Da Rio (1843-44) reported the finding of *H. cf. fortisi* in marly carbonates (scaglia) of the Euganei Mts. (northern Italy), and Gemmellaro (1848) described a variety of *H. fortisi*.

Parona (1908) figured the transversal section of the right valve of the hippuritids of the Cansiglio area (northern Italy) belonging to Catullo's collection. He attributed to *Hippurites* (*Vaccinites*) *chaperi* Douvillé, a junior species name, the type of *Hippurites fortisi* Catullo, arguing the incomplete description made by Catullo. Other specimens were attributed respectively to *H. (Vaccinites) praecorbaricus* Toucas, *H. (V.) praepetrocoriensis* Toucas, *H. (V.) gaudryi* Munier-Chalmas and *H. (V.) f. ind.*, but the authors of this paper consider that all of them belong to the same species.

Kühn (1948) recognized the validity of *H. (V.) fortisi* Catullo and affirmed that all specimens collected in Istria and in Friuli, assigned by Parona (1908, 1911, 1926, 1932) to *H. (V.) chaperi*, those described by Futterer (1896) as *H. crassicostratus* and all older references to *H. fortisi* have to be attributed to *H. (V.) fortisi* Catullo.

Polšak (1963) described a section of *H. (V.) fortisi* from Pljesevica (Croatia) and suggested a Santonian age for this species.

***Vaccinites taburnii* (Guiscardi)**

(Figure 2, B, D, I; Figure 3, O, Ua, Ub, V, X, Z)

This species was instituted by Guiscardi (1864) on one lower valve collected in Taburno Mt. (southern Italy). In the same paper, *Hippurites baylei*, also based on the description of one lower valve, and *H. arduini*, constituted by an upper valve collected in Abruzzo (central Italy), were proposed.

Douvillé (1891-97) reproduced the figures of *H. taburnii* and *H. baylei* of Guiscardi (1864), concluding that these are two varieties of the same species, differing just in the more or less accentuated convergence of their pillars.

Later on, while *Vaccinites taburnii* has been considered to be the valid species and recognized all along the eastern Mediterranean Province, less consideration have had *H. baylei* and *H. arduini* that were not taken into account by the successive authors.

From the original description of this species, it was generally thought that the apex of the ligamentary crest was rounded. In the figures made by Parona (1901), one of them reproduced by Toucas (1903-04), the apex of the ligamentary crest appears as truncated; this feature was pointed out by Douvillé (1910), who recognized the truncation of the apex of the ligamentary crest in the specimens collected in Algeria.

Douvillé (1913) proposed *H. (V.) jullieni*, based on specimens earlier considered to be *H. (V.) taburnii* (Douvillé, 1910).

This species has been collected in Italy—Taburno Mt., Abruzzo, Campania, S. Polo Matese—Serbia, Istria, Hungary, Turkey, and Algeria.

Guiscardi (1864) did not indicate the age of this species; De Alessandri (1898) considered early Santonian the specimens found in Sirone (northern Italy, Lombard Prealps), age later confirmed by Parona (1901); Toucas (1903-04) dubiously attributed the specimens from Taburno Mt. to the Coniacian, and the same age was accepted by Douvillé (1910). Polšak (1967), who established a reliable and definite stratigraphy of the Cretaceous of Istria, attributed this species to the Santonian-early Campanian, age accepted by all successive authors.

***Vaccinites gaudryi* (Munier-Chalmas in Gaudry, 1862-67)**

(Figure 2, E; Figure 3, P, R, T, Y)

Vaccinites gaudryi was instituted by Munier-Chalmas (Gaudry, 1862-1867), on material from Greece and first figured by Douvillé (1898), who recognized the truncated apex of the ligamentary crest. This species has been considered a variety or subspecies of *Vaccinites cornuvaccinum* Bronn by several authors.

Besides Greece, this species has been reported from Gosau, Dolomites, Carso, Venetian Prealps, Istria, Croatia, Bulgaria.

***Vaccinites chaperi* (Douvillé)**

(Figure 2, G, K)

Douvillé (1891-97) instituted the species *Hippurites chaperi*, based on specimens from Greece, attributing it to the group of *Hippurites cornu-vaccinum* Bronn together with *Hippurites gaudryi* (Munier-Chalmas), *Hippurites alpinus* Douvillé and *Hippurites taburnii* Guiscardi. This group of hippuritids, with polygonal pores in the left valve, was considered typical of the eastern province.

On the other hand, Toucas (1903-04), because of difficulties when recognizing the apex of the ligamentary crest, attributed some specimens collected in France (Corbières and Provence) of *Vaccinites zurcheri* (Douvillé), with reticulate pores in the left valve, to *Vaccinites chaperi* (Douvillé). This fact favoured the taxonomic confusion between both species of hippuritids, specially when only right valves were considered.

As it has been pointed out, Parona (1908) attributed to *H. chaperi* the type specimen of *H. fortisi* (Catullo), not accepting its priority.

Kühn (1948) revised *H. (V.) chaperi*. In this species he included specimens that differ from *H. fortisi* in the thinner external ornamentation, the absence of inner infoldings, and slight differences in the angle between the ligamentary crest and the myocardial apparatus and in the position of the posterior myophore.

This species has been reported from Greece, Italy (Friuli, Dolomites, Venetian Prealps), Serbia, Bosnia-Herzegovina and Slovenia. Douvillé (1891-97) attributed a probable Santonian age to the holotype from Antinitza; this age has been accepted by all successive authors.

***Vaccinites atheniensis* (Ktenas)**

(Figure 2, J, L, M)

Ktenas (1907) erected *Hippurites atheniensis* for specimens from Greece that, because of their large size and relative diversity of internal features—highly pedunculated ligamentary crest and pillars, the second one falciform—were not comparable to any preexisting species.

When Milovanovic (1934) recognized *Hippurites* (*Vaccinites*) *atheniensis* Ktenas in Serbia, he noted that his specimens showed identical features to those of Ktenas, only at a certain ontogenetic stage, while, when examined in different sections, they were very similar to *Hippurites* (*Vaccinites*) *taburnii* Guiscardi. Milovanovic (1956) proposed *Hippurites* (*Vaccinites*) *atheniensis serbicus* for the specimens from Serbia.

Sladic-Trifunovic (1967) revised *Hippurites atheniensis*, distinguishing three subspecies, *H. atheniensis atheniensis*, *H. atheniensis serbicus* and *H. atheniensis grubici*, based on the relative distances among the three inner folds, different in each of them.

The species, besides Greece and Serbia, has been reported in Dalmatia, Istria, Bosnia-Herzegovina, Slovenia, Karintia, Bulgaria, Hungary and Italy by several authors.

Ktenas (1907) hypothesized a late Turonian age for his species. Kühn (1948) attributed a probable late Santonian age. Kaumanns (1962) indicated the early Santonian. Polšak (1967) attributed a Santonian-early Campanian age; this age was confirmed by successive authors.

Other species

(Figure 1, A, H)

Kollman and coworkers (1985) erected *Pseudopironaea hellenica*, collected in Greece, only because the inner margin of her specimens presented undulations (pseudopillars); all the other features correspond to those already described for the aforementioned species. More or less accentuated undulations are common in all large sized *Vaccinites*.

Polšak and Sliskovic (1989) instituted *Vaccinites plenicari*, from Bosnia and Croatia, which is much similar to the species earlier described. Although they affirm that the ligamentary crest is rounded at its apex, it appears as truncated in their figures.

SYSTEMATIC PALAEOLOGY

Family Hippuritidae Gray, 1848

Genus *Vaccinites* Fisher, 1887

Type species—*Hippurites cornu-vaccinum* Bronn, 1831 from Untersberg (Salzbourg, Austria).

***Vaccinites fortisi* (Catullo, 1827)**

(Figure 1; Figure 2, A-N; Figure 3, O-Z)

- ?1802 *Orthoceratites*; Fortis, p. 150, pl. 6, fig. c.
- v*1827 *Hippurites fortisi* Catullo, p. 171, pl. 6, figs. B, b.
- v•1827 *Hippurites fitoloideus* Catullo, p. 173, pl. 7, figs. A, B, C.
- v•1834 *Sphaerulites umbellata* Catullo, p. 14, pl. 1, fig. 2.
- 1834 *Hippurites fortisi* Catullo; Catullo, p. 15.
- 1834 *Hippurites fitoideus* Catullo; Catullo, p. 15.
- 1842 *Hippurites fortisi* Catullo; Catullo, p. 5.
- 1842 *Hippurites fitoideus* Catullo; Catullo, p. 5.
- 1842 *Hippurites maximus* Catullo, p. 5, [fide Parona 1908 = *Hippurites* (*Vaccinites*) *praecorbaricus* Toucas].
- ?1843/44 *Hippurites* cf. *fortisi*; Da Rio, p. 366.
- ?1848 *Hippurites fortisi* Catullo var.; Gemmellaro, p. 35.
- 1864 *Hippurites taburnii* Guiscardi, p. 2, pl. 1, fig. 1.
- 1864 *Hippurites baylei* Guiscardi, p. 3, pl. 1, figs. 2, 3.
- 1864 *Hippurites arduini* Guiscardi, p. 4, pl. 1, fig. 4, a; pl. 2, figs. 4, b, 5-9.
- 1862-67 *Hippurites gaudryi* Munier-Chalmas in Gaudry, p. 390.
- 1891-97 *Hippurites taburnii* Guiscardi; Douvillé, p. 29, text-fig. 18, [cop. Guiscardi 1864].
- 1891-97 *Hippurites baylei* Guiscardi; Douvillé, p. 29, text-fig. 19, [cop. Guiscardi 1864].
- 1891-97 *Hippurites gaudryi* Munier-Chalmas; Douvillé, p. 48, text-fig. 34; pl. 7, figs. 1-3.
- 1896 *Hippurites crassicostatus* Futterer, p. 6, pl. 1, figs. 1, a, b, 2; pl. 2, figs. 1, a, b, 2.
- 1891-97 *Hippurites taburnii?* Guiscardi; Douvillé, p. 205, pl. 30, fig. 8.
- v•1891-97 *Hippurites gaudryi* Munier-Chalmas; Douvillé, p. 213, pl. 31, figs. 5, 6; pl. 34, figs. 1, 2.
- v•1891-97 *Hippurites chaperi* Douvillé, p. 214, pl. 30, figs. 6, 7.
- v•1898 *Hippurites taburnii* Guiscardi; De Alessandri, p. 183, pl. 14, figs. 1, 4.
- v•1901 *Hippurites taburnii* Guiscardi; Parona, p. 212, pl. 1, figs. 13, 14; pl. 3, fig. 12.
- v•1904 *Vaccinites taburnii* (Guiscardi); Toucas, p. 99, text-fig. 155, [same specimen as in Parona 1901].
- ?1904 *Vaccinites gaudryi* Munier-Chalmas; Toucas, p. 100, text-fig. 157.
- 1907 *Hippurites atheniensis* Ktenas, p. 698, text-fig.
- v•1908 *Hippurites* (*Vaccinites*) *praecorbaricus* Toucas; Parona [partim], p. 143, text-fig. 2, [non text-fig. 3 = *Hippurites nanus* Catullo = *Vaccinites gosaviensis* Douvillé].

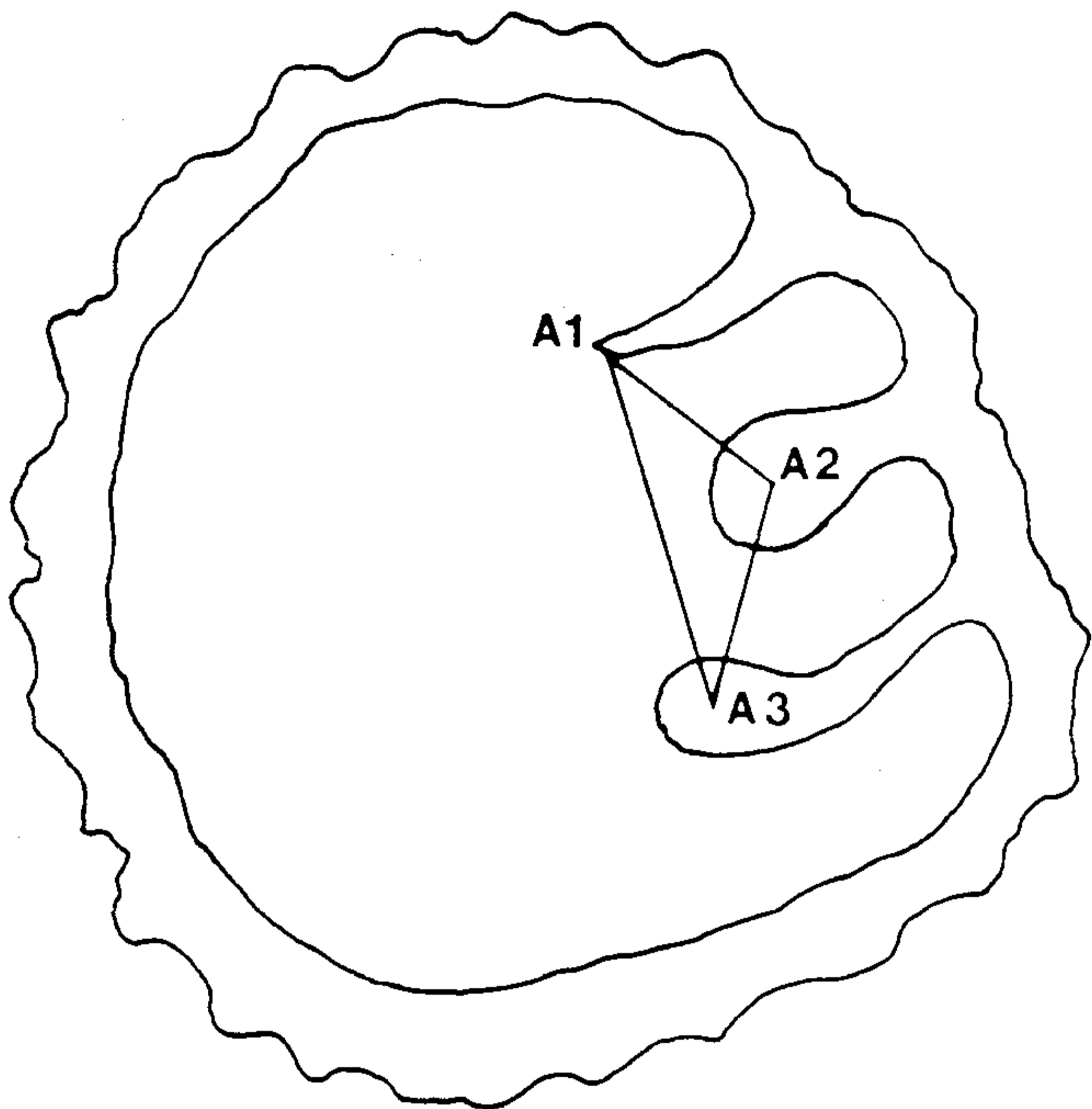


Figure 1. Vertexes of the triangle with the A1, A2, A3 angles on a transverse section of *Vaccinites fortisi* (Catullo) right valve. Matese Mts., central Italy.

- 1908 *Hippurites (Vaccinites) praepetrocoriensis* Toucas; Parona, p. 145, text-fig. 4.
- v•1908 *Hippurites (Vaccinites) chaperi* Douvillé; Parona, p. 147, text-fig. 6, [holotype, specimen figured by Catullo 1827].
- v•1908 *Hippurites (Vaccinites) gaudryi* Munier-Chalmas; Parona, p. 148, text-fig. 8.
- v•1908 *Hippurites (Vaccinites)* f.ind. Parona, p. 149.
- v•1910 *Hippurites (Vaccinites) taburnii* Guiscardi; Douvillé, p. 41, pl. 2, figs. 1, 2, 2, a, 3.
- v•1910 *Hippurites (Vaccinites)* sp. Douvillé, p. 42, pl. 2, fig. 4.
- 1911 *Hippurites chaperi* Douvillé; Parona, p. 4, text-fig. 1.
- 1912 *Hippurites gaudryi* Munier-Chalmas; Shubert, p. 2, 61, text-fig. 21.
- v•1913 *Hippurites (Vaccinites) jullieni* Douvillé, p. 242, text-figs. 3, 4; pl. 14, fig. 1, [holotype - Douvillé 1910, pl. 2, fig. 3].
- 1926 *Hippurites (Vaccinites) chaperi* Douvillé; Parona, p. 20, pl. 1, fig. 3; pl. 2, fig. 6.
- 1926 *Hippurites (Vaccinites) gaudryi* Munier-Chalmas; Parona, p. 21, pl. 1, figs. 4, a, b; pl. 2, figs. 5, a, b.
- 1926 *Hippurites (Vaccinites) taburnii* Guiscardi, Parona, p. 22.
- 1932 *Vaccinites taburnii* Guiscardi; Milovanovic, p. 51, pl. 2, fig. 2.
- 1932 *Hippurites (Vaccinites) fitoloideus* Catullo; Kühn, p. 47.
- 1934 *Hippurites atheniensis* Ktenas; Milovanovic, p. 202, text-figs. 6-13.
- 1941 *Hippurites (Vaccinites) gaudryi*; Montagne, p. 61, pl. 4, fig. 4.

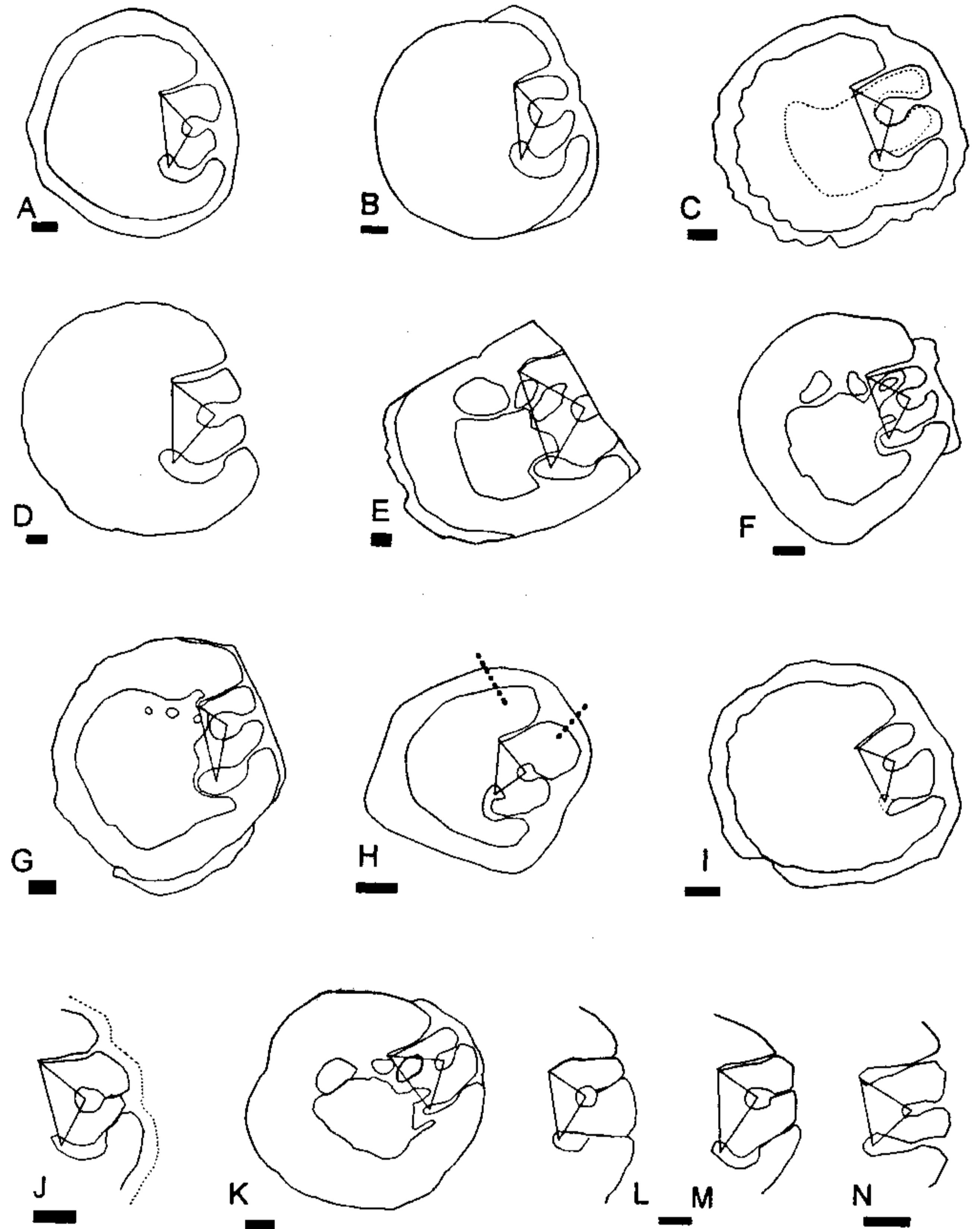


Figure 2. Transverse sections of several right valves of *Vaccinites fortisi* (Catullo) where the position of the considered triangle has been indicated (see list of specimens in Table 1). Scale bar = 10 mm.

- 1942 *Hippurites atheniensis* Ktenas; Van Soest, p. 31, pl. 3.
- 1948 *Hippurites (Vaccinites) atheniensis* Ktenas; Kühn, p. 174, text-figs. 2, 3.
- 1948 *Hippurites (Vaccinites) fortisi* Catullo; Kühn, p. 177, text-fig. 5 (cop. Parona 1908, text-fig. 6).
- 1948 *Hippurites (Vaccinites) chaperi* Douvillé; Kühn, p. 179, text-fig. 6.
- ?1948 *Hippurites (Vaccinites) cornu-vaccinum* Bronn var. *gaudryi* (Munier-Chalmas); Kühn, p. 180, text-figs. 8-11; pl. 27, fig. 1.
- 1951 *Hippurites (Vaccinites) cornu-vaccinum* Bronn; Pejovic, p. 93, pl. 3, fig. 1.
- 1951 *Hippurites chaperi* Douvillé; Pejovic, p. 92, pl. 1, fig. 1.
- 1956 *Hippurites atheniensis* var. *serbicus* Milovanovic.
- 1957 *Hippurites (Vaccinites) atheniensis* Ktenas; Pasic, p. 119, pl. 35, fig. 1; pl. 37, fig. 1.
- 1957 *Hippurites (Vaccinites) taburnii* Guiscardi; Pasic, p. 130, pl. 37, fig. 2.
- 1957 *Hippurites (Vaccinites) atheniensis* Ktenas; Pejovic, p. 95, pl. 34, fig. 1; pl. 35, fig. 1; pl. 36, fig. 1; pl. 37, fig. 1.
- 1957 *Hippurites (Vaccinites) taburnii* Guiscardi; Pejovic, p. 103, text-fig. 46.
- 1958 *Hippurites (Vaccinites) atheniensis* Ktenas; Polšak, p. 2, text-fig. 2.

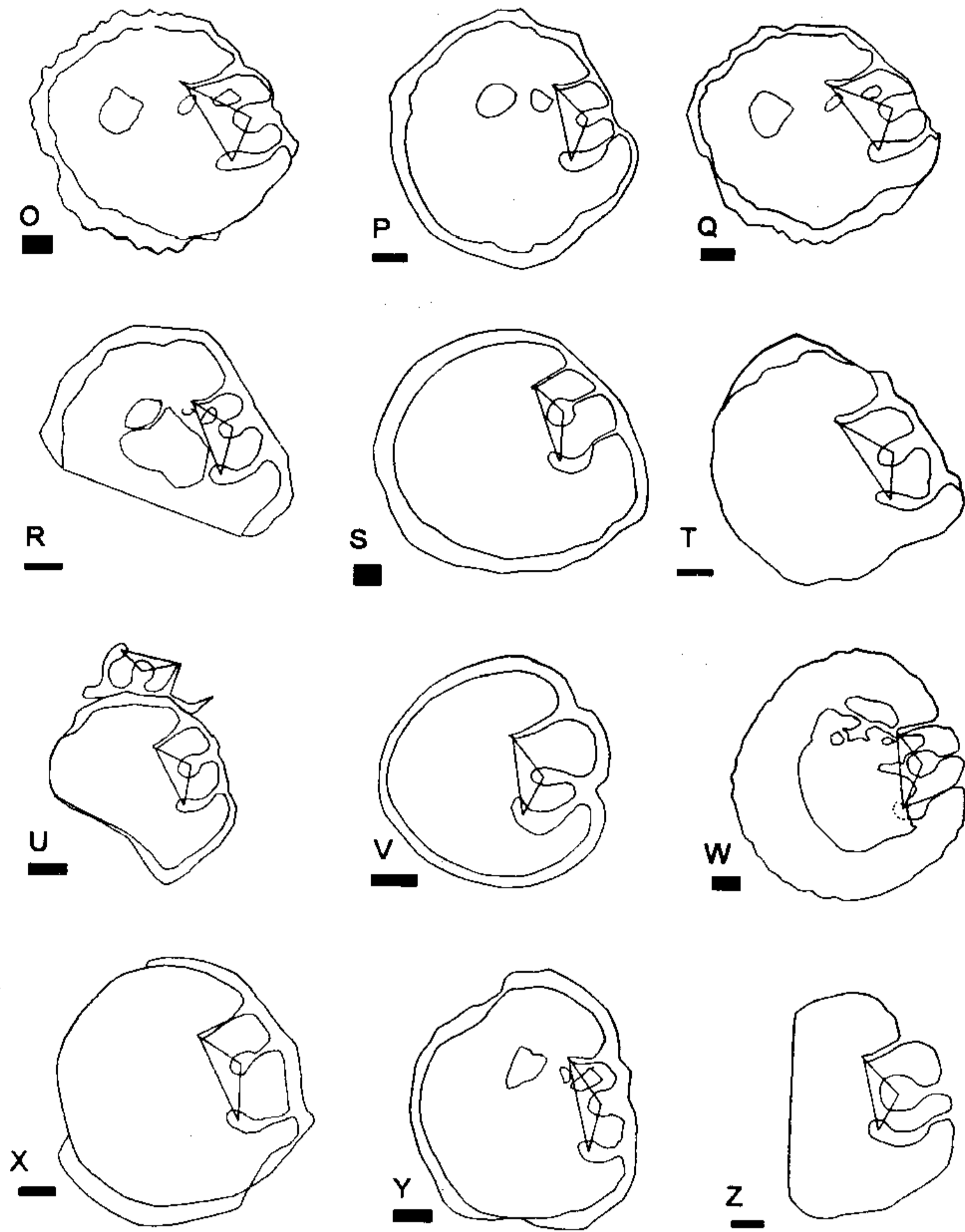


Figure 3. Transverse sections of several right valves of *Vaccinites fortisi* (Catullo) where the position of the considered triangle has been indicated (see list of specimens in Table 1). Scale bar = 10 mm.

- 1959 *Hippurites (Vaccinites) atheniensis* Ktenas; Polšak, p. 58, text-fig. 1; pl. 1, figs. 1-3; pl. 2, figs. 1, 2; pl. 3, fig. 1.
 - 1959 *Hippurites (Vaccinites) cornu-vaccinum gaudryi* (Munier-Chalmas); Polšak, p. 64, text-fig. 2; pl. 5, figs. 1-3; pl. 6, figs. 1, 2.
 - 1960 *Hippurites cornu-vaccinum* Bronn; Pejovic and Kühn, p. 136-138.
 - 1960 *Hippurites chaperi* Douvillé; Pejovic and Kühn, p. 136-138.
 - 1962 *Hippurites atheniensis* Ktenas; Kaumanns, p. 297.
 - 1963 *Hippurites (Vaccinites) cornu-vaccinum gaudryi* (Munier-Chalmas); Polšak, p. 438, pl. 2, fig. 1.
 - 1963 *Hippurites (Vaccinites) fortisi* Catullo; Polšak, p. 441, pl. 3, fig. 1.
 - 1963 *Hippurites (Vaccinites) atheniensis* Ktenas; Sliskovic, p. 8, pl. 1, fig. 1.
 - 1967 *Hippurites (Vaccinites) atheniensis* Ktenas; Polšak, p. 118, text-fig. 39; pl. 73, figs. 1, 2.
 - 1967 *Hippurites (Vaccinites) taburnii* Guiscardi; Polšak, p. 119, text-fig. 40; pl. 74, figs. 1-3.
 - 1967 *Hippurites (Vaccinites) atheniensis* Ktenas; Plenicar and Buser, p. 156, pl. 7, fig. 1.
 - 1967 *Hippurites atheniensis atheniensis* Ktenas; Sladic-Trifunovic, text-figs. 1 [cop. Ktenas 1907], 2 [cop. Milovanovic 1934], 3-15, 16 [cop. Polšak 1967], 17, 18 [cop. Milovanovic 1934], 19 [cop. Polšak 1967], 20, 21.
 - 1967 *Hippurites atheniensis serbicus* Milovanovic; Sladic-Trifunovic, text-fig. 22 [cop. Milovanovic 1934].
 - 1967 *Hippurites atheniensis grubici* Sladic-Trifunovic, text-fig. 23 [cop. Polšak 1959], 24 [cop. De Alessandri 1898?], 25 [cop. Pasic 1957], 26 [cop. Pasic 1957].
 - 1967 *Hippurites (Vaccinites) chaperi* Douvillé; Sliskovic, p. 23, text-figs. 1-5; pl. 1, figs. 1, 2; pl. 2, figs. 1, 2.
 - 1973 *Hippurites (Vaccinites) atheniensis* Ktenas; Sakellariou-Mané, p. 399, pl. 4, fig. 1.
 - 1975 *Hippurites (Vaccinites) chaperi* Douvillé; Plenicar, p. 98, pl. 13, fig. 1; pl. 14, figs. 1, 2.
 - 1981 *Vaccinites atheniensis* (Ktenas); Pamouktchiev, p. 177, pl. 86, fig. 3.
 - 1981 *Vaccinites cornu-vaccinum gaudryi* (Munier-Chalmas); Pamouktchiev, p. 170, pl. 86, figs. 1, 1, a.
 - v•1982 *Vaccinites atheniensis* (Ktenas); Accordi and coworkers, p. 770, pl. 3, fig. c; pl. 4, figs. 2, 6.
 - v•1982 *Vaccinites taburnii* (Guiscardi); Accordi and coworkers, p. 771, pl. 5, fig. 3.
 - v•1982 *Vaccinites giganteus* (d'Hombres-Firmas); Accordi and coworkers, p. 771, pl. 5, figs. 6, 7.
 - 1982 *Vaccinites atheniensis* Ktenas; Czabalay, p. 34, text-fig. 13; pl. 11, fig. 3; pl. 12, fig. 1.
 - 1982 *Vaccinites taburnii* (Guiscardi); Czabalay, p. 36, pl. 11, fig. 1; ?pl. 20, fig. 1.
 - 1982 *Vaccinites fortisi* (Catullo); Czabalay, p. 40, text-fig. 18; pl. 17, fig. 4; pl. 25, fig. 6.
 - v•1985 *Pseudopironaea hellenica* Lupu in Kollmann, Lupu and Velitzelos, p. 129, pl. 5, figs. 23, 24.
 - ?1989 *Vaccinites plenicari* Polšak and Sliskovic, p. 56, pl. 1, figs. 1-3; pl. 2, figs. 1-3.
 - 1989 *Vaccinites taburnii* (Guiscardi); Özer, p. 337, pl. 1, figs. 1-6.
 - v•1990 *Vaccinites taburnii* (Guiscardi); Cestari and Sima, p. 20, pl. 4, figs. 1, 2; pl. 6, figs. 1, 2.
 - v•1990 *Vaccinites taburnii* (Guiscardi); Accordi and coworkers, pl. 1, figs. 7, 8.
 - v•1992 *Vaccinites jullieni* (Douvillé); Chikhi-Aouimeur, p. 174, pl. 5.
 - v•1992 *Vaccinites* aff. *chaperi* (Douvillé); Chikhi-Aouimeur, p. 175, pl. 6.
 - v•1992 *Vaccinites taburnii* (Guiscardi); Chikhi-Aouimeur, p. 175, pl. 7.
 - v•1993 *Vaccinites taburnii* (Guiscardi); Cherchi and coworkers, pl. 5, fig. 4.
- Holotype**—The holotype described by Catullo (1827, p. 171, pl. 6, figs. B, b) and figured in section in Parona (1908, text-fig. 6) as "*Hippurites (Vaccinites) chaperi*", from Monte Piné, Santa Croce, Cansiglio, northern Italy.
- Material**—Although many of the observations were extracted from figures in the literature, the authors examined directly the specimens from Catullo, housed at the Istituto di Geologia, Università di Padova (IGUP); those described by Parona, to-

day housed partly at the aforementioned institution and partly at the Istituto di Geologia, Università di Torino (IGUT); those from the old collection of the École Nationale des Mines studied by Douvillé, housed at the Université de Lyon (EMP); those from De Alessandri, housed at the British Museum (BM); as well as other specimens in the museum of the Servizio Geologico Nazionale, Rome (MSGN) and in the Naturhistorisches Museum Wien (NHMW).

Specimens collected by us in south-central Apennines (Matese and Simbruini-Ernici Mts.) are housed partly at the Dipartimento di Scienze della Terra, Università di Roma (DSTR) and partly in the palaeontological collections at the Universitat Autònoma de Barcelona (PUAB).

Description—Externally, the right valve has a cylindrical to conical shape and is ornamented by pronounced costae, although they are often eroded in large-size specimens. Transversal section shows that ligamentary crest and pillars are very close to each other, relative distances among the three inner folds are very variable, and specimens with both pillars emerging from a single peduncle are not rare. The ligamentary crest is long and thin and presents a truncated apex; this feature is not always evident, so that in literature, specimens figured with rounded apex, after careful examination, resulted to be with truncated apex. The first pillar is elongated and pedunculated; the head of the second, also elongated and pedunculated, is reniform to falciform pointing towards the ligamentary crest.

Some specimens may reach considerable size, these and/or specially those which suffered a quick increase in diameter may have a very long and thin ligamentary crest, a first pillar with very thin base and peduncle resulting in a rounded head, and a second pillar with a long and thin peduncle and a highly falciform head; these specimens also display considerable variability in these characters and in the relative distances among the three inner folds and present a still lower angle between the ligamentary crest and the miocardinal apparatus.

The left valve, almost never described in literature, has simple polygonal pores.

Measurements—In order to quantify the variability in the location of the three inner folds, when observed in a transversal section of the right valves, were considered the angular measures (A1, A2 and A3) of the triangle defined by the apex of the ligamentary crest (L) and the center of the head of the first (P1) and second (P2) pillars (Figure 1); as well as the LSE triangle in radiolitids in Cestari (1992).

The present authors consider these three points as representing the position of functional elements, the ligament and the probable ejective structures; instead, the point of insertion of each of the three internal folds to the inner shell margin, considered by most of the preceding authors, depends on ecological factors occurring during the shell-growth processes.

The list of measured specimens is given in Table 1. In the first column, the number given to each specimen is indicated, in order to identify it in tables and graphics of measurements. Those specimens shown in Figures 2 and 3 are indicated with the corresponding capital letter in the second column. In the third column, the original name followed by the bibliographic reference for those specimens already figured and the locality for all of them are indicated, as well as the repository, where it is known. The presence of an acronym and a register number indicates that the original specimen was measured, instead of the original figure.

Values of angles A1, A2 and A3 and ratios A1/A2, A1/A3 and A2/A3 for each measured specimen are given in Table 2. Specimens have been sorted following increasing A1 values; measure error 1°, so A1 + A2 + A3 can be different of 180°.

Measures of the angles and ratios among them are graphically represented respectively in Figures 4 and 5; in abscissa there are the numbers of each specimen and in ordinate respectively the angular values and the ratios among them.

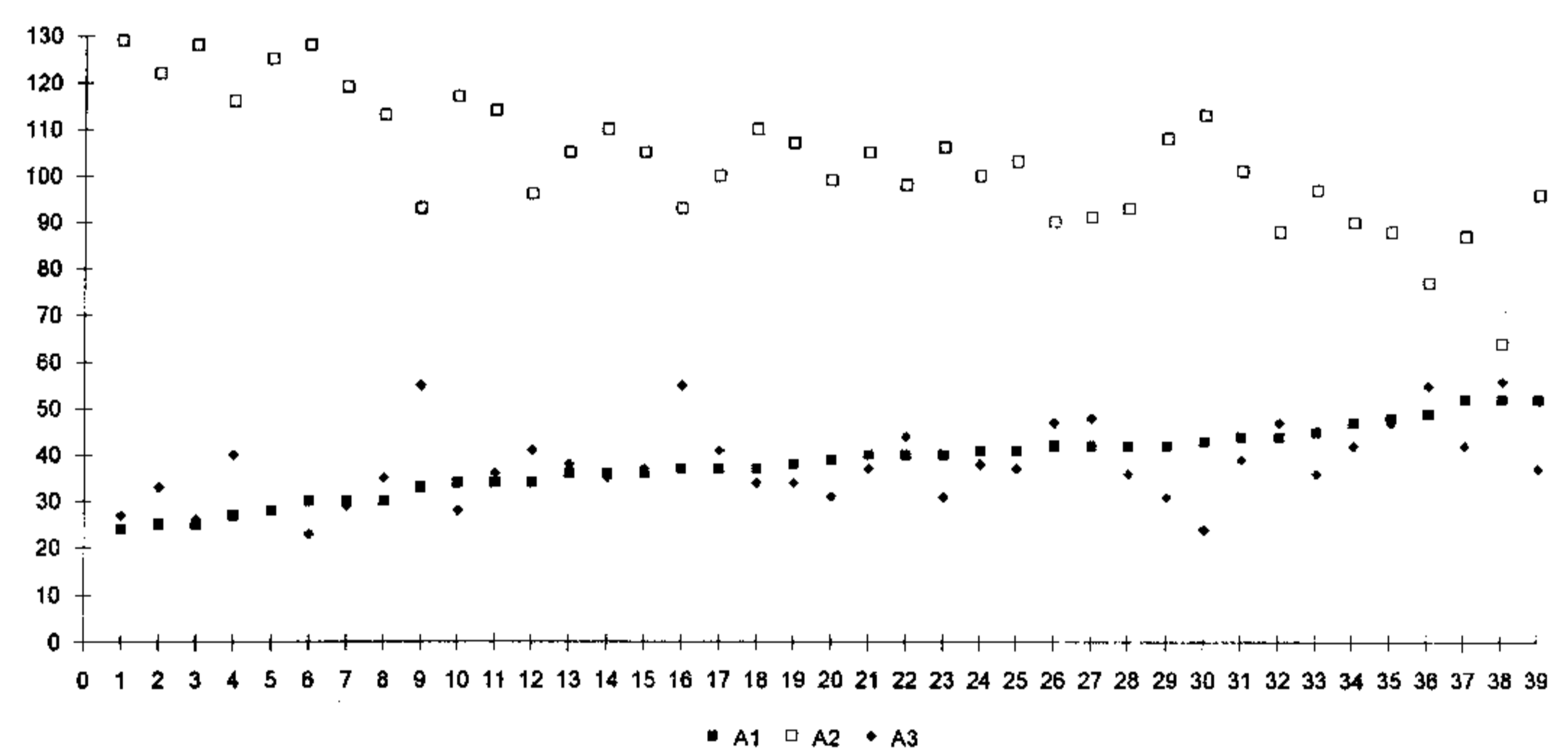


Figure 4. Graphics of A1, A2, A3 values for each of the measured specimens, sorted following increasing A1 values.

DISCUSSION

Specimens attributed in literature to *Vaccinites fortisi*, *V. taburnii*, *V. gaudryi*, *V. chaperi*, *V. atheniensis* and other less used specific names, share, as indicated, diagnostic characters.

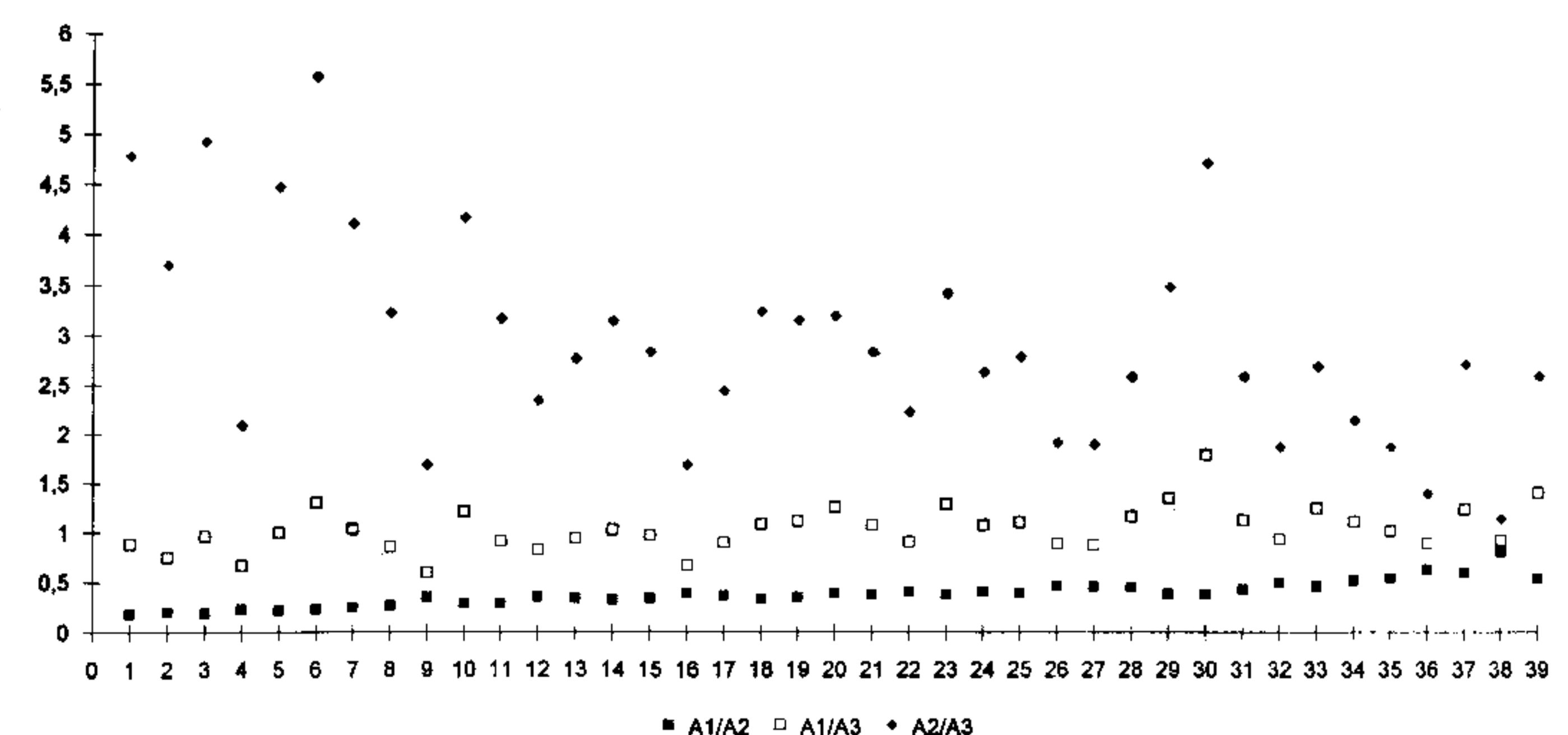


Figure 5. Graphics of A1/A2, A1/A3, A2/A3 ratios for each of the measured specimens, sorted following increasing A1 values.

Table 1. List of measured and figured specimens.

No.	Fig.	Measured and figured specimens
1	Y	<i>H. gaudry</i> (in Douvillé, 1892; pl. 7, fig. 3); Caprena (Greece); EMP R666
2	Ua	<i>H. (V.) taburnii</i> (in Douvillé, 1910; pl. 2, fig. 2a); Constantine (Algeria); EMP R373
3		<i>H. taburnii</i> (in De Alessandri, 1898; pl. 14; figs. 1, 4); Sirone (Italy); BM L 62326
4	T	<i>H. gaudry</i> (in Douvillé, 1897; pl. 34, fig. 1); Santa Croce (Italy); EMP R644
5		<i>V. fortisi</i> ; Matese Mt. (S. Polo)
6	C	<i>V. fortisi</i> ; Matese Mt. (Piano di Corte)
7	X	<i>H. (V.) jullieni</i> ; Khenchela (Algeria); EMP R501/R374
8	B	<i>H. taburnii</i> (in Guiscardi, 1864; pl. 1, fig. 1); Taburno Mt. (Italy); Guiscardi Coll. Napoli?
9	S	<i>V. fortisi</i> ; Matese Mt. (Piano di Corte)
10	W	<i>H. Fortisi</i> ; holotype of Catullo; Colli Euganei (Italy); IGUP
11	P	<i>H. gaudry</i> (in Douvillé, 1897; pl. 31, fig. 6); Antinitza (Greece); EMP R648/629
12	Z	<i>H. taburnii</i> (in Parona, 1901; pl. 1, fig. 14); Taburno Mt? (Italy); Salmojrighi Coll. Torino?
13		<i>V. fortisi</i> ; Simbruini Mts. (Italy); DSTR 872
14	R	<i>H. gaudry</i> (in Douvillé, 1897; pl. 31, fig. 5); Delphos (Greece); EMP R649
15	Ub	<i>H. (V.) taburnii</i> (in Douvillé, 1910; pl. 2, fig. 2a); Constantine (Algeria); EMP R373
16	Q	<i>H. (V.) praecorbaricus</i> (in Parona, 1908; text-fig. 2); Cansiglio (Italy); IGUP 7250
17	J	<i>H. atheniensis grubici</i> (in Sladic, 1967; text-fig. 23); Vrpolje, Dalmatia; Zagreb?
18		<i>H. taburnii</i> (in Parona 1901; pl. 3, fig. 12); Benevento (Italy); IGUP w/n (without number)
19	A	<i>Pseudopironaea hellenica</i> ; Macedonia (Greece); NHMW w/n
20	V	<i>H. baylei</i> (in Guiscardi, 1864; pl. 1, fig. 2); Italy; Guiscardi Coll. Napoli?
21	O	<i>V. taburnii</i> (in Accordi <i>et al.</i> , 1990; pl. 1, fig. 8); Matese Mt. (Italy); DSTR GF66
22		<i>H. taburnii</i> (in Parona, 1901; text fig. 13); Taburno Mt. (Italy); Salmojrighi Coll. Torino?
23		<i>V. fortisi</i> ; Matese Mt. (Piano di Corte)
24		<i>H. gaudry</i> (in Douvillé, 1897; pl. 34, fig. 2); Sessana (Slovenia); EMP R643
25		<i>Sphaerulites umbellatus</i> (in Catullo, 1834; pl. 1, fig. 2; upper valve); Cansiglio (Italy); IGUP w/n
26	E	<i>H. (V.) gaudry</i> (in Parona, 1926; pl. 2, fig. 5b); Lesece (Slovenia); Trieste?
27	F	<i>H. chaperi</i> (in Douvillé, 1897; pl. 30, fig. 6); Antinitza (Greece); EMP R650
28		<i>V. taburnii</i> (in Accordi <i>et al.</i> , 1982; pl. 5, fig. 3); Matese Mt. (Italy)
29		<i>H. (V.) praepetrocoriensis</i> (in Parona, 1908; text-fig. 4); Cansiglio (Italy); IGUP w/n
30	G	<i>H. (V.) chaperi</i> (in Parona, 1926; pl. 2, fig. 6); Opicina (Italy); Trieste?
31		<i>V. taburnii</i> (in Cestari and Sirna, 1990, pl. 4, fig. 1); Vitulano (Italy); MSGN
32	H	<i>V. pleniacari</i> (in Polšak and Sliskovic, 1989; pl. 1m, fig. 1); Zagreb (Croatia); DGPZ 1319
33	I	<i>V. taburnii</i> (in Cherchi <i>et al.</i> , 1993; pl. 5, fig. 4); Matese Mt. (Italy)
34	L	<i>H. atheniensis serbicus</i> (in Sladic, 1967; text-fig. 22); Ribarica (Serbia); Beograd?
35		<i>V. fortisi</i> ; Matese Mt. (Piano di Corte)
36	K	<i>H. chaperi</i> (in Douvillé, 1897; pl. 30, fig. 7); Antinitza (Greece); EMP R627
37	D	<i>V. taburnii</i> (in Cestari and Sirna, 1990; pl. 6, fig. 1); Vitulano (Italy); MSGN
38	N	<i>H. crassicostatus</i> (in Futterer, 1896; pl. 1, fig. 2); Barcis (Italy)
39	M	<i>H. atheniensis</i> (in Ktenas, 1907; text-fig. w/n) Athens (Greece)

In the transversal sections represented in Figures 2 and 3, which include the types and representatives of all these species, the pattern of the three inner folds, conformed by the elongation of the ligamentary crest, the pedunculation of both pillars and the form (from reniform to falciform) of the head of the second pillar, form a continuous variation series.

Angle A1 has revealed as being the most representative in order to indicate the relative position of the two pillars with respect to the ligamentary crest. In the graphic of Figure 4, with the specimens sorted following increasing A1 values, it can be observed a continuous variation of values from 22 to 52°, without any steps among them.

When comparing the graphics of Figures 4 and 5 with the list in Table 1, it can be observed that the different specific attributions can not be clustered; they are completely mixed, although *V. chaperi* and *V. atheniensis* tend to be located with the higher values.

It is concluded that, as stated in the synonymy list, all these species can be included in *Vaccinites fortisi* (Catullo).

STRATIGRAPHIC DISTRIBUTION

Although there is some uncertainty about the age in many of the reported data on *Vaccinites fortisi*, and the former species here considered as synonyms, most authors indicate the Santonian.

In the central Apennines, this species occurs in a micro-facies characterized by the presence of *Cuneolina* gr. *pavonia* Henson, *Moncharmontia apenninica* De Castro, *Accordiella conica* Farinacci, *Rotorbinella scarsellai* Torre, *Aeolisaccus kotori* Radoicic, *Scandonea samnitica* De Castro, *Sgrossoella parthenopeia*, large Dicyclinids, rare *Keramosphaerina tergestina* and others, indicating a Santonian-?earliest Campanian age.

ACKNOWLEDGMENTS

Most of this research was carried out during the tenure by the first author of a grant from the Italian Government (Ministero della Pubblica Istruzione) at the Department de Geologia, Universitat Autònoma de Barcelona. This paper is a contribution to the Spanish-Italian Joint Research Program (1992) HI-053. I. Dieni and L. Altichieri (Padova), F. Campanino (Torino) and A. Prieur and M. Sirvent (Lyon) helped us during the revision of the collections in their care and A. Belloni (Vittorio Veneto) gave us every facility to study his collection from Lago di Santa Croce. All these institutions and persons are highly thanked.

BIBLIOGRAPHICAL REFERENCES

- Accordi, Giovanni; Carbone, Federico; Cestari, Riccardo; Reali, S.; and Sirna, Giuseppe, 1990, Cretaceous rudist colonization in north-eastern Matese, in Accordi, Giovanni; Carbone, Federico; and Sirna, Giuseppe, eds., Rudist communities and substratum in the Matese Mounts, Molise, Italy:

Table 2. Values of the angular measures A1, A2, A3 and of the ratios A1/A2, A1/A3, A2/A3 for each one of the considered specimens.

No. Fig.	1 Y	2 Ua	3	4 T	5	6 O	7 X	8 B	9 S	10 W	11 P	12 Z	13	14 R	15 Ub	16 Q	17 J	18	19 A	20 V
A1	24	25	25	27	28	30	30	30	33	34	34	34	36	36	36	37	37	37	38	39
A2	129	122	128	116	125	128	119	113	93	117	114	96	105	110	105	93	100	110	107	99
A3	27	33	26	40	28	23	29	35	55	28	36	41	38	35	37	55	41	34	34	31
A1/A2	0.186	0.21	0.20	0.23	0.22	0.23	0.252	0.265	0.36	0.290	0.29	0.35	0.343	0.327	0.34	0.4	0.37	0.34	0.36	0.394
A1/A3	0.888	0.76	0.96	0.68	1.00	1.30	1.034	0.857	0.60	1.214	0.92	0.83	0.947	1.029	0.97	0.67	0.9	1.09	1.12	1.258
A2/A3	4.777	3.70	4.92	2.09	4.46	5.56	4.103	3.228	1.69	4.158	3.17	2.34	2.763	3.143	2.84	1.69	2.44	3.24	3.15	3.193
No. Fig.	21 C	22	23	24	25	26 E	27 F	28	29	30	31	32 H	33 I	34 L	35	36 K	37 D	38 N	39 M	
A1	40	40	40	41	41	42	42	42	42	43	44	44	45	47	48	49	52	52	52	
A2	105	98	106	100	103	90	91	93	108	113	101	88	97	90	88	77	87	64	96	
A3	37	44	31	38	37	47	48	36	31	24	39	47	36	42	47	55	42	56	37	
A1/A2	0.381	0.41	0.377	0.41	0.40	0.466	0.461	0.45	0.39	0.38	0.44	0.50	0.464	0.522	0.55	0.636	0.60	0.81	0.540	
A1/A3	1.081	0.91	1.290	1.08	1.11	0.894	0.875	1.17	1.36	1.79	1.13	0.94	1.250	1.119	1.02	0.891	1.24	0.93	1.406	
A2/A3	2.838	2.23	3.420	2.63	2.78	1.915	1.896	2.58	3.48	4.71	2.59	1.87	2.694	2.143	1.87	1.400	2.71	1.14	2.594	

Rome, Università "La Sapienza", Centro di Studio per la Geologia dell'Italia Centrale, Consiglio Nazionale della Ricerca and Dipartimento di Scienze della Terra, International Conference on Rudists, 2, Roma-Bari, Field trip, p. 19-30, 6 pls.

Accordi, Giovanni; Carbone, Federico; and Sirna, Giuseppe, 1982, Relationships among tectonic setting, substratum and benthonic communities in the Upper Cretaceous of northeastern Matese (Molise, Italy): *Geologica Romana*, v. 21, p. 755-793, 5 pls.

—1987, Presenza di Senoniano a rudiste lungo il margine Aquilano del Gran Sasso: *Rendiconti della Società Geologica Italiana*, v. 10, p. 79-82.

Accordi, Giovanni; Carbone, Federico; Sirna, Giuseppe; Catalano, G.; and Reali, S., 1988, Sedimentary events and rudist assemblages of Maiella Mt. (central Italy)—Paleobiogeographic implications: *Geologica Romana*, v. 26, p. 135-147, 1 pl.

Alessandri, G. De, 1898, Fossili cretacei della Lombardia: *Palaeontographia Italica*, v. 4, p. 169-202.

Bronn, H.G., 1831, Hippurites, in Ersch, J.S., and Gruber, J.G., eds., *Allgemeine Encyclopaedie der Wissenschaften und Künste*, Section 2, Part 8: Brockhaus, p. 371-376.

Carbone, Federico; Praturlon, Antonio; and Sirna, Giuseppe, 1971, The Cenomanian shelf-edge facies of Rocca di Cave (Preneestini Mts., Latium): *Geologica Romana*, v. 10, p. 131-198, 53 figs., 1 tab.

Carbone, Federico; Russo, A.; and Sirna, Giuseppe, 1980, Comunità a coralli e rudiste del Cretacico superiore di Rocca di Cave (Monti Preneestini, Lazio): *Annali dell'Università di Ferrara, Scienze Geologiche e Paleontologiche*, v. 6, supplemento, p. 199-217, 5 pls.

Carbone, Federico, and Sirna, Giuseppe, 1981, Upper Cretaceous reef models from Rocca di Cave and adjacent areas in Latium, central Italy: *Society of Economic Paleontologists and Mineralogists, Special Publication 30*, p. 427-445.

Catullo, T.A., 1827, *Saggio di Zoologia fossile delle provincie austro-venete*: Padova, Italy.

—1834, Memoria geognostico-zoologica sopra alcune conchiglie fossili del calcare juresse che si eleva presso il Lago di Santa-Croce nel territorio di

Belluno: Padova, Italy, *Nuovi Saggi dell'Accademia di Scienze, Lettere, Arti di Padova*, v. 4, p. 1-20, 2 pls.

—1842, *Catalogo delle specie organiche fossili raccolte nelle Alpi Venete*: Padova, 31 p.

Cestari, Riccardo, 1992, Biometrical analysis on gorjanovicias and on other radiolitids (Radiolitidae, Hippuritoida): *Geologica Romana*, v. 28, p. 1-25, 2 pls.

Cestari, Riccardo, and Sirna, Giuseppe, 1987, Rudist fauna in the Maastrichtian deposits of southern Salento (southern Italy): *Società Geologica Italiana, Memorie*, v. 40, p. 133-147.

Cestari, Riccardo, and Sirna, Maurizio, 1990, Giacimenti fossiliferi a Hippuritidae e Radiolitidae (Hippuritacea) in Italia centro-meridionale: *Memorie descrittive della Carta Geologica d'Italia*, v. 41, p. 7-24, 13 pls.

Cherchi, Antonietta; Ruberti, Daniella; and Sirna, Giuseppe, 1993, Osservazioni biostratigrafiche sul Cretaceo del Matese centro-settentrionale (Italia centrale): *Bolletino del Servizio Geologico d'Italia*, v. 110, p. 91-110, 6 pls.

Chikhi-Aouimeur, Fettuoma, 1992, Les rudistes de la formation carbonatée bréchique du Santonien de Khenchela (Algérie): *Geologica Romana*, v. 28, p. 173-193, 8 pls.

Czabaly, L., 1982, La faune des rudistes des environs de Sümeg (Hongrie): *Geologica Hungarica, Series Palaeontologica*, v. 41, 100 p., 60 pls., (in Hungarian with French translation).

Da Rio, N., 1843-44, Nota intorno ad una Ippurite ritrovata nella scaglia dei Monte Euganei: *Atti delle adunanze I.R. Istituto Veneto di Scienze, Lettere ed Arti*, v. 3, p. 366-370.

Douvillé, Henry, 1891-97, Études sur les Rudistes. Revision des principales espèces d'Hippurites: *Mémoires de la Société géologique de France, Paléontologie*, v. 1-6, (Mémoire 6), 230 p., 34 pls.

—1908, Sur un nouveau genre de Rudistes (*Roussellia guilhati*): *Bulletin Société Géologique de France*, 3rd ser., v. 26, p. 140-151.

—1910, Études sur les Rudistes. Rudistes de Sicile, d'Algérie, d'Égypte, du Liban et de la Perse: *Mémoires de la Société Géologique de France, Paléontologie*, v. 18, no. 1, (Mémoire 41), 84 p., 7 pls.

- 1913, Description des Rudistes de l'Égypte. Mémoires présentées à l'Institut Egyptien: Le Caire, v. 6, p. 237-256.
- Fisher, P., 1887, Manuel de Conchyliologie et de Paléontologie conchyliologique, p. 1041.
- Fortis, A., 1802, Mémoires pour servir à l'Histoire Naturelle et principalement à l'Oryctographie de l'Italie et des pays adjacents: Paris.
- Futterer, K., 1896, Über einige Versteinerungen aus der Kreideformation der Karnischen Voralpen: Palaeontologische Abhandlungen N. F., v. 2, no. 6, p. 241-266, pl. 33-39.
- Gaudry, A., 1862-67, Animaux fossiles et géologie de l'Attique: 476 p.
- Gemmellaro, C., 1848, Sopra una varietà della Hippurites Fortisii Catullo: Atti Accademia Gioenia Scienze Naturali di Catania, v. 5, p. 35-53.
- Gray, J.E., 1848, On the afrangement of the Brachiopoda: Magazine Natural History, Annals, v. 2, p. 435-440.
- Guiscardi, G., 1864, Studii sulla famiglia delle Rudiste: Atti della Reggia Accademia di Scienze di Napoli, v. 2, no. 5, p. 1-8, 2 pls.
- Kaumanns, M., 1962, Zur stratigraphie und tektonik der Gosauschichten. II. Die Gosauschichten des Kainachbeckens: Sitzungsberichten der Österreichischen Akademie der Wissenschaften, Mathematisch-naturwissenschaftlichen Klasse, Abteilung I, v. 171, nos. 8-10, p. 289-314, 3 pls.
- Kollman, H.A.; Lupu, D.; and Veltzelos, E., 1985, Rudisten aus der oberen Kreide von Agios Christophoros, östlich Ptolemais (Mazedonien, Griechenland): Annalen Naturhistorischen Museums in Wien, ser. A, Mineralogie und Petrographie, Geologie und Palaeontologie, Anthropologie, Præhistoire, v. 87 A, p. 121-134, 6 pls.
- Ktenas, A., 1907, Sur l'âge des terrains calcaires des environs d'Athènes: Comptes rendus des séances de l'Académie des Sciences, Paris, v. 144, p. 697-699.
- Kühn, O., 1932, Fossilium catalogus. I. Animalia. Rudistae: Berlin, W. Quenstedt, 202 p.
- 1948, Stratigraphie und Paläogeographie der Rudisten. IV. Rudisten aus Griechenland: Neues Jahrbuch für Mineralogie, Geologie und Paläontologie, B. Geologie-Paläontologie, v. 89, p. 167-194, pl. 27.
- Laviano, Angela, and Sirna, Giuseppe, 1979, Preliminary comparison between rudist-bearing Cretaceous of southern-central Apennine and Apulia: Rendiconti della Società Geologica Italiana, v. 2, p. 69-70.
- Matteucci, Ruggero; Schiavinotto, F.; Sirna, Giuseppe; and Russo, Antonio, 1982, Palaeoenvironmental significance of Maastrichtian biological communities in the Pachino area (Sicily) and preliminary data on their distribution in the Mediterranean Upper Cretaceous, in Montanaro-Gallitelli, Eugenia, ed., Paleontology essential of historical geology: Modena, Italy, Università Modena, Ist. Paleontol., International Meeting, 1, Venice-Modena, Italy, June 2-4, 1981, Proceedings, p. 77-96.
- Milovanovic, B., 1932, Contribution à la connaissance des rudistes de la Serbie: Annales Géologiques de la Péninsule Balkanique, v. 11, no. 1, p. 20-73, 8 pls., (in Serbo-Croatian with French abstract).
- 1934, Les rudistes de la Yougoslavie. I. Serbie orientale, occidentale et ancienne Raska: Annales Géologiques de la Péninsule Balkanique, v. 11, no. 1, p. 178-254, (in Serbo-Croatian with French abstract).
- 1956 (1953-54), Evolution und stratigraphie der Rudisten: Zbornik radova Geoloskog i Rudarskog fakulteta, Beograd, p. 163-187, (in Serbo-Croatian with German abstract).
- Montagne, D.G., 1941, Geologie und Palaeontologie der Umgebung von Sestovac (Dalmatien): Geographische en geologische Mededeelingen, Physiographisch-geologische Reeks, Utrecht, v. 2, no. 1, p. 1-93, 8 pls.
- Özer, S., 1989, Sur une faune d'hippuritides des calcaires du Crétacé Supérieur de la zone d'Izmir-Ankara (Anatolie occidentale)—Intérêt paléontologique et stratigraphique: Revue de Paléobiologie, v. 8, no. 2, p. 335-343, 1 pl.
- Pamouktchiev, A., 1981, Bivalvia II, in Tzankov, V.; Pamouktchiev, A.; Tchech-medjieva, V.; and Motekova, N., eds., Les fossiles de Bulgarie. V. Crétacé Supérieur: Académie Bulgare des Sciences, Sofia, p. 152-206, pls. 72-98, (in Bulgarian).
- Paradisi, A., and Sirna, Giuseppe, 1965, Osservazioni geologiche e paleontologiche sulla struttura compresa tra la Vallenga e la Valle del Sangro (Marsica occidentale): Geologica Romana, v. 4, p. 145-160, 2 pls.
- Parona, C.F., 1901, Le rudiste e le camacee di S. Polo Matese raccolte da Francesco Bassani: Memorie della Reale Accademia delle Scienze di Torino, v. 2, no. 50, p. 197-214, 3 pls.
- 1908, Sopra alcune rudiste del Cretaceo Superiore del Cansiglio nelle Prealpi Venete: Memorie della Reale Accademia delle Scienze di Torino, v. 59, p. 139-156, 1 pl.
- 1911, Nota per lo studio del Neocretaceo nel Friuli occidentale: Atti della Reale Accademia delle Scienze di Torino, v. 46, p. 213-218.
- 1926, Ricerche sulle rudiste e su altri fossili del Cretaceo Superiore del Carso goriziano e dell'Istria: Istituto Geologico della Regia Università di Padova, Memorie, v. 7, 56 p., 6 pls.
- 1932, Fauna cretacea di Aurisina (Trieste), Collezione del Museo di Bologna: Giornale di Geologia, Annali del Regio Museo Geologico di Bologna, v. 7, p. 3-16.
- Pasic, M., 1957, Biostratigraphische verhältnisse und tektonik der oberkreide in den weiteren umgebung von Kosjeric (Westserbien): Geol. Inst. "Jovan Zujovic", v. 7, p. 1-176, 38 pls., (in Serbo-Croatian with German abstract).
- Pejovic, D., 1951, Several rudists from the Senonian sediments in the surroundings of Pirot: Bull. Inst. geol. Univ. Beograd, v. 2, p. 91-97, 3 pls., (in Serbo-Croatian with English abstract).
- 1957, Geologie und tektonik der weiteren umgebung von Pocuta (Westserbien) mit besonderer Berücksichtigung der biostratigraphie der oberkreidischen bildungen: Geol. Inst. "Jovan Zujovic", v. 8, p. 1-147, 45 pls. (in Serbo-Croatian with German abstract).
- Pejovic, D., and Kühn, O., 1960, Das Alter der Rudistenkalke von Pirot. Sonderabdruck aus dem Anzeiger der mathematisch-naturwissenschaftlichen Klasse der Österreichischen Akademie der Wissenschaften, Jahrgang 1960, v. 7, p. 136-138.
- Plenicar, Mario, 1975, Hippuritidae of Nanos and the Trieste-Komen Plain: Razprave Disertationes, v. 18, p. 81-117, 23 pls.
- Plenicar, Mario, and Buser, S., 1967, The Cretaceous macrofauna in the western part of the Trnovski Gozd: Geologija, v. 10, p. 147-159, 8 pls.
- Polšak, Ante, 1958, Recherches géologiques des couches Crétacée Supérieur du sud de l'Istrie: Bull. sci. Cons. Acad. Yougosl., v. 4, no. 2, p. 1-2.
- 1959, Les rudistes et quelques autres fossiles des environs de Vrpolje et de Perkovic en Dalmatie: Geoloski Vjesnik, Zagreb, v. 12, p. 53-76, 7 pls., (in Serbo-Croatian with French abstract).
- 1963, Les rudistes du Sénonien des Lacs de Plitvice et de la Licka Pljesevica en Croatie: Geoloski Vjesnik, Zagreb, v. 15, no. 2, p. 435-454, 3 pls., (in Serbo-Croatian with French abstract).
- 1967, Macrofaune Crétacée de l'Istrie méridionale (Yougoslavie): Palaeontologia Jugoslavica, v. 8, 219 p., 85 pls., (in Serbo-Croatian with French translation).
- Polšak, Ante; Praturlon, Antonio; and Sirna, Giuseppe, 1970, Contribution à la corrélation des couches cénomaniennes à facies néritique carbonatée dans les Dinarides externes et l'Apennin central: Kongres geologa SFR Jugoslavije, 7, v. 1, p. 263-274.
- Polšak, Ante, and Sliskovic, Teofil, 1989, *Vaccinites pleniacari* n. sp., a rudist from the Senonian deposits of Donje Oresje near Zagreb and the surroundings of Visegrad in eastern Bosnia: Glasnik Zemaljskog muzeja Bosne i Hercegovine, Prirodne nauke, Nova serija, v. 28, p. 55-64, 2 pls.
- Pons, J.M., and Sirna, Giuseppe, 1992, Upper Cretaceous rudists distribution in the Mediterranean Tethys—Comparison between platforms from Spain and south-central Italy: Geologica Romana, v. 28, p. 341-349.
- Praturlon, Antonio, and Sirna, Giuseppe, 1975, The stratigraphy and paleontology of the Cretaceous in Italy, in Squyres, C., ed., Geology of Italy: The Earth Sciences Society of the Libyan Arab Republic, Tripoli, v. 2, p. 1-47.
- 1976, Ulteriori dati sul margine cenomaniano della piattaforma carbonatica laziale-abruzzese: Geologica Romana, v. 15, p. 427-445.
- Sakellariou-Mané, H., 1973, Quelques espèces des rudistes provenant de la région du village Spiléou près de la ville Grévéna (Macédoine occidentale): Sci. Annals Fac. Phys. Mathem., Univ. Thessaloniki, v. 13, p. 395-402, 4 pls.
- Shubert, R., 1912, Geologischer Führer durch die nördliche Adria: Bornträgers Sammlung geol. Führer, v. 17.
- Sirna, Giuseppe, 1982, Quelques rudistes cénomaniens du Monte Pellegrino (Palermo, Sicile): Geologica Romana, v. 21, p. 79-87, 1 pl.

- 1983, Sur la position systematique de *Sauvagesia villei* Toucas (Radioliti-
dae, Hippuritoida): *Geologica Romana*, v. 22, p. 297-298.
- 1990, A new Senonian species of Hippuritid in the Matese and Maiella
Mts. (central Italy): *Bolletino della Società Paleontologica Italiana*, v. 29,
no. 1, p. 25-28.
- Sladic-Trifunovic, M., 1967, Les caractères paléontologiques de l'espèce *Hippu-
rites atheniensis* Ktenas: *Zbornik Rudarsko-geoloskog fakulteta*, v. 9-10,
p. 267-282, (in Serbo-Croatian with French abstract).
- Sliskovic, Teofil, 1963, Aperçu sur les rudistes de Bosnie-Herzegovine avec un
compte rendu sur les recherches effectués jusqu'au présent: *Glasnika
Zemaljskog muzeja Bosne i Hercegovine, Prirodne nauke, Nova serija*, p.
5-28, 6 pls., (in Serbo-Croatian with French abstract).
- 1967, *Hippurites (Vaccinites) chaperi* Douvillé dans les couches
Senoniennes des environs de Imotski: *Glasnika Zemaljskog muzeja Bosne
i Hercegovine, Prirodne nauke, Nova serija*, v. 6, p. 23-33, 2 pls., (in
Serbo-Croatian with French abstract).
- Toucas, A., 1903-1904, Études sur la classification et l'évolution des Hippurites:
Mémoires de la Société géologique de France, Paléontologie, v. 11-12,
Mémoire 30, 128 p., 17 pls.
- van Soest, J., 1942, Geologie und Paläontologie des zentralen Biokovo (Dalma-
tien): *Utrecht, Geographische en geologische Mededeelingen, Physiog-
raphisch-geologische reeks*, v. 3, no. 2, p. 31, pl. 3.

Manuscript received: February 1, 1995.

Corrected manuscript received: May 31, 1995.

Manuscript accepted: June 15, 1995