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Charophytes and ostracods from the Berriasian (Purbeckian facies) of Cala d'Inferno (Nurra region, NW Sardinia)

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KEY WORDS — Charophytes, Ostracods, Berriasian, Purbeckian, Sardinia.

ABSTRACT — Charophytes and ostracods from the Berriasian (Purbeckian facies) of Cala d'Inferno (Nurra, NW Sardinia) are described. Some new taxa are erected: the charophyte Musacchiella sardiniae *Feist & Grambast-Fessard n. sp., and the ostracods* Cypridea dorsoinclinata *Colin n. sp.,* C. tumescens meridionalis *Colin n. subsp.,* Theriosynoecum sardum *Colin n. sp.*

RIASSUNTO — [Carofite e Ostracodi del Berriasiano (facies purbeckiana) di Cala d'Inferno (Nurra, Sardegna nord-occidentale] — *Vengono descritte carofite e ostracodi del Berriasiano (facies purbeckiana) di Cala d'Inferno (Nurra, NW Sardegna). Vengono istituiti alcuni nuovi taxa:* Musacchiella sardiniae *Feist & Grambast-Fessard n. sp. (carofita) e* Cypridea dorsoinclinata *Colin n. sp.,* C. tumescens meridionalis *Colin n. subsp.,* Theriosynoecum sardum *Colin n. sp. (ostracodi).*

INTRODUCTION

In NW Sardinia (Nurra region), the transition between the Late Jurassic and the Early Cretaceous is characterized by a lagoonal-lacustrine series of marls and marly limestones showing strong similarities to the Purbeckian facies of Southern England and SE France.

Maxia & Pecorini (1963, p. 7) first described this series from Cala d'Inferno (Capo Caccia peninsula) and indicated the presence of charophytes and ostracods. Pecorini (1965) published a list of macrofossils and microfossils from the succession, which included the molluscs *Planorbis* sp., *Valvata* sp. and Cyrenidae, as well as the ostracods *Cypridea valdensis valdensis* (Sow.), *Cypridea* sp., *Darwinula leguminella* (Eorbes), *Macrodentina mediostricta transfuga* Malz, *Fabanella polita polita* Martin, *Cytheropteron* sp., *Bisulcocypris* sp., and some charophytes: *Clavator grovesi* Harris, *Perimneste horrida* Harris, *Atopochara* n. sp.? (cf. *Clavator thorali* Donze). Larger foraminifera (*Choffatella*?, *Feurtillia*?) and dasycladacean algae (*Clypeina parvula* Carozzi, *Cylindroporella* sp.) first recorded by Pecorini indicate the presence of marine intercalations within this sequence.

In a special paper Pecorini (1969) studied the Clavatoraceae (charophytes) from the Purbeckian of Cala d'Inferno, the most important outcrop of this series, for which he envisaged a Valanginian age. He gave a detailed description of the species *Flabellochara grovesi* (Harris), *Perimneste* cf. *horrida* Harris, *P. micrandra* Grambast and established the new taxon

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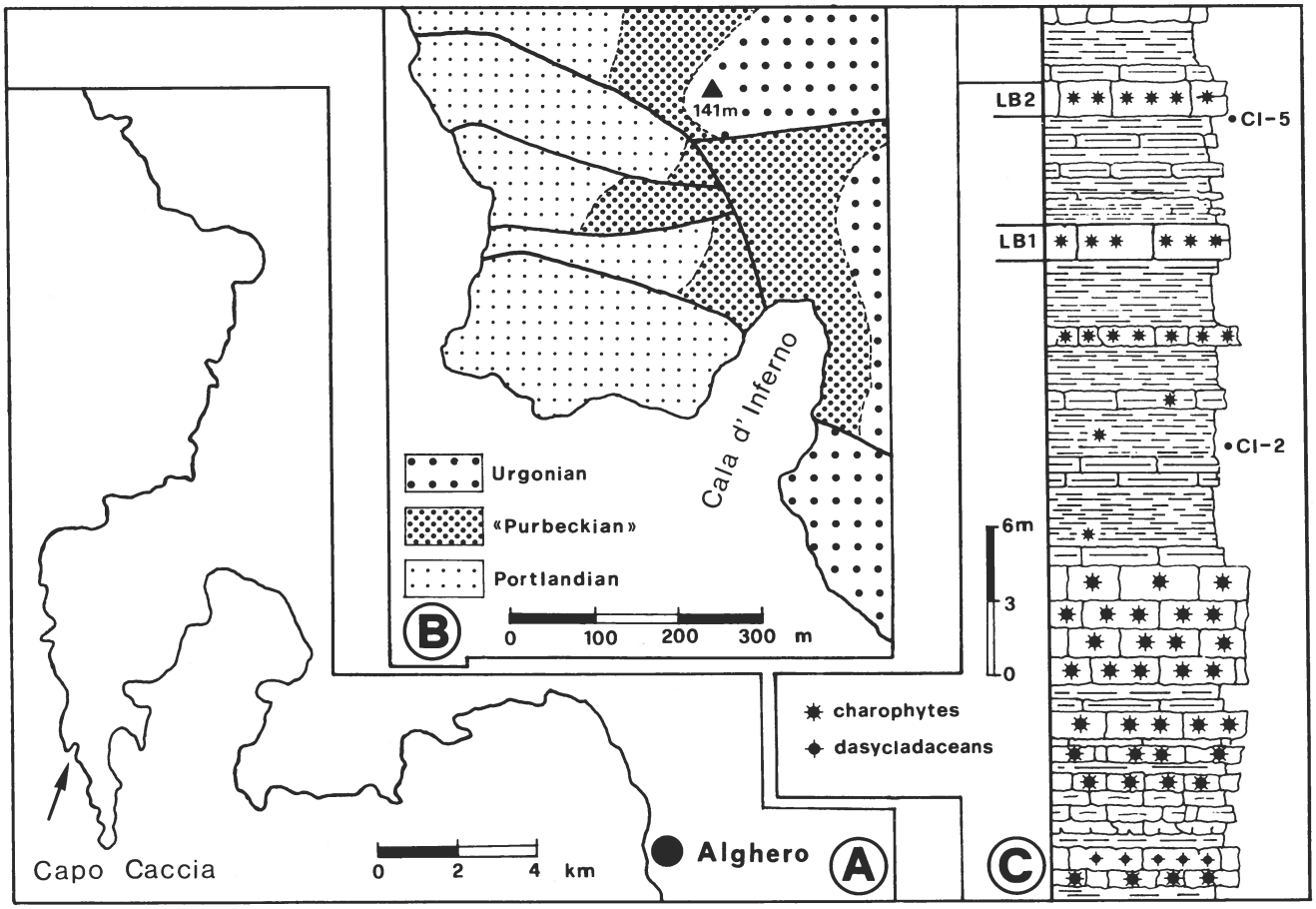


Text-fig. 1 - A: Geographic position of Cala d'Inferno (arrow). B: Geological map of Cala d'Inferno region. C: Purbeckian (lower unit) section of Capo Caccia region showing the position of samples CI-2 and CI-5.

Globator maillardi (Saporta) *nurrensis*. Another paper by the same author documented the dasycladacean algae from this locality (Pecorini 1972).

Chabrier & Fourcade (1975) correlated the entire Purbeckian of Cala d'Inferno to the Berriasian and Valanginian (*pro parte*), and cited from the lower part of this series the ostracods *Fabanella* gr. *polita* Jones and *Cypridea* gr. *bispinosa* Martin (det. R. Damotte). In the middle part of the series they mentioned *Protocythere* cf. *divisa* Oertli and *Macrodentina* cf. *mediostricta transfuga* Malz as well as the lituolid foraminifer *Everticyclammina* sp. and the dasycladacean alga *Macroporella embergeri* Bouroullec & Deloffre. The same assemblage is also reported by Azéma *et al.* (1977, p. 129).

During the preparation of the 19th European Micropaleontological Colloquium (Sardinia, 1985) a series of samples was taken from the lower part of the Cala d'Inferno section. Two of the samples (CI-2 and CI-5) being particularly rich in charophytes (studied by M. Feist & N. Grambast-Fessard) and ostracods (studied by J.P. Colin), will be presented at this congress and are the subject of this paper. A detailed paleontological study of all the material collected is planned.

STRATIGRAPHIC POSITION AND AGE OF THE SAMPLES

Cala d'Inferno, the locality from where the two studied samples were taken, is a small bay on the west side of the Capo Caccia peninsula, which is situated approx. 7 kms to the west of Alghero [sheet 192 IV S.E. (Capo Caccia) of the Carta d'Italia 1:25.000; see also text-fig. 1-A]. This bay owes its origin to the erosion of the marly Purbeckian series, which is situated between the hard and well-bedded Portlandian limestones forming the cliff to the west (altitude 125 m) and the escarpment of the massive Urgonian limestones (Punta Malrepos, 141 m) to the east (text-fig. 1B).

The lithostratigraphy of the Purbeckian sequence from this locality was studied in detail by Haehnel

(1983). He has subdivided the Purbeckian (total thickness: approx. 80 m) into two units:

— a lower unit (approx. 35 m thick), predominantly lacustrine;
— an upper unit (approx. 45 m thick), characterized by numerous relatively short marine intercalations.

The lower unit of the Purbeckian is well exposed on the steep northern coast of Cala d'Inferno. At this locality, the contact with the underlying Portlandian limestones is a nearly vertical fault, so that the transition between these two formations cannot be observed. These transitional beds (approx. 5 m thick) have been studied immediately to the south of Punta Malrepos, where they consist of grey-brownish marls and marly limestones containing not only gyrogonites of charophytes and ostracods, but also dasycladacean algae and marine foraminifera. These associations indicate the transition between the marine environment of the underlying Portlandian and the lacustrine character of the lower Purbeckian unit.

The main part of the lower unit (approx. 30 m thick) consists at Cala d'Inferno of green-greyish or light grey marls and limestones or marly limestones being in part unfossiliferous, but frequently being very rich in charophytes and ostracods. The upper boundary of this unit is marked by a 1.5 m thick yellowish marly limestone (horizon LB 2 *in* Haehnel 1983; see also text-fig. 1C). A second key horizon is a hard and dark grey-brownish limestone ledge (1.5 m thick), which is situated approx. 7 m below the top of the unit and is characterized by abundant charophyte remains (horizon LB 1 *in* Haehnel 1983).

Sample CI-2 is situated approx. 17 m below the top of the lower unit and contains:

Charophytes:

Musacchiella sardiniae Feist & Grambast-Fessard n. sp.

Ostracods:

Fabanella boloniensis (Jones)

Sample CI-5, situated immediately at the base of the key horizon LB 2 (see text-fig. 1C), contains:

Charophytes:

Musacchiella maxima (Donze) n. comb.
Flabellochara aff. *grovesi* (Harris)
Perimneste micrandra Grambast
Globator nurrensis (Pecorini) Grambast n. comb.

Ostracods:

Cypridea tumescens meridionalis Colin n. ssp.
Cypridea cf. *vidrana* Wolburg
Cypridea cf. *protogranulosa* Anderson
Cypridea dorsoinclinata Colin n. sp.
Theriosynoecum sardum Colin n. sp.
Dictyocythere gr. *mediostricta* Sylvester-Bradley
Protocythere cf. *divisa* Oertli

Concerning the charophyte flora, the new species found in sample CI-2 is of any stratigraphic interest. The association found in the sample CI-5 indicates a Late Berriasian - Early Valanginian age.

The age of the two samples can be specified by the ostracod fauna. *Fabanella boloniensis* (sample CI-2) initially appears in the Berriasian and ranges up to the Aptian. The ostracod fauna of sample CI-5 is of Berriasian age.

These results agree well with those produced by previous authors. Haehnel (1983) found near Punta Cristallo (4.5 kms north of Cala d'Inferno) in the transitional beds between the marine Portlandian and the lacustrine Purbeckian (corresponding to the lowermost 5 meters of text-fig. 1 C) the dasycladacean algae *Salpingoporella annulata* Carozzi and *Heteroporella lemmensis* (Bernier) (det. Dr. M.A. Conrad, Genève). The latter species ranges from the Kimmeridgian to the Jurassic/Cretaceous boundary.

The upper unit of the Purbeckian from Cala d'Inferno is overlain by marine Lower Valanginian of Urgonian facies containing « *Valdanchella* » *miliani* (Schroeder) (Azéma *et al.* 1977, p. 129).

On the basis of the above evidence, a Berriasian age can be envisaged for the Lower Purbeckian unit of Cala d'Inferno (with exception of the basal, partly marine, beds).

Charophytes (M. Feist & N.Grambast-Fessard)

Several levels from Cala d'Inferno yielded charophytes but only isolated specimens extracted from the marls have been studied here (specially levels CI-2 and CI-5 belonging to the Lower Unit of the series).

The charophyte flora is similar to that described by Pecorini (1969) from the same outcrop. Only *Perimneste* cf. *horrida* was not found in the collected material. On the other hand, two species of *Musacchiella* are now to be added to the previously known assemblage.

The lowest sample CI-2 contains only one species which is new, *Musacchiella sardiniae*. The genus *Musacchiella* extends from the Middle Jurassic to the Lower Cretaceous.

Four species are present in the upper sample CI-5:

— *Musacchiella maxima* (Donze) n. comb., a species which has been reported from the Berriasian (Purbeckian facies) of the Jura and Subalpine Massifs (Donze 1955, 1958; Häfeli 1966) as well as from NE Spain (Brenner 1976). It is also present in the Berriasian of SE France where it is associated with the flora quoted by Babinot *et al.* (1971), as confirmed by new findings from the same localities (pers. observ.).

— *Globator nurrensis* (Pecorini) Grambast n. comb. has been first described from Cala d'Inferno, originally dated as Valanginian. In a sequence of the same age from Southern Jura, Donze (1969, p. 8) quoted « *Globator maillardi...* dont les cellules utriculaires sont fortement tordues en spirale, avec une forte réduction des cellules basales ». This description corresponds to that of *G. nurrensis,* which at that time was still not erected. In the Lower Cretaceous charophyte zonation proposed by Grambast (1974, p. 476), the « Nurra zone » with *G. nurrensis* is stated to be Valanginian. Moreover, this species also occurs associated with *M. maxima* in NE Spain and SE France, and aged as Berriasian. Among the specimens from the latter region we have recently examined, « *Globator maillardi...* P44 » (Babinot *et al.* 1971, p. 195) may be identified as *G. nurrensis.*

— *Perimneste micrandra* Grambast, first described from the Hauterivian, extends in fact from the Upper Berriasian to the Lower Barremian (Grambast 1974).

— *Flabellochara* aff.*grovesi* (Harris) Grambast. The type-locality of this species belongs to the British Purbeck (Harris 1939) considered to be equivalent to the Berriasian. The species extends up to the Valanginian. In certain cases, specimens referred to *F. grovesi* may correspond to several species.

From a stratigraphical point of view, the present assemblage could suggest either a Late Berriasian or an Early Valanginian age. The fact that sample CI-5 might belong to the Early Valanginian cannot be absolutely excluded and this age would be in agreement with the Grambast's charophyte zonation.

On the other hand, the ostracod fauna associated with the charophytes indicates a Berriasian age. This latter age implies that the « Nurra zone » is older than suggested by Grambast. The CI-5 assemblage lacks of elements of the Early Berriasian flora, characterized by *Globator maillardi maillardi* (the ancestor of *G. nurrensis*), *Perimneste horrida, Dictyoclavator fieri* and *Clavator reidi.* Elements of this flora have been found in the Purbeckian of England (Harris 1939), Jura (Donze 1955) and NE Germany (M.F., work in progress).

Therefore it seems more appropriate to attribute the « Nurra assemblage » to the Late Berriasian.

TAXONOMY

Division CHAROPHYTA
Ordo CHARALES
Family POROCHARACEAE Grambast, 1962
Subfamily POROCHAROIDEAE
Genus MUSACCHIELLA
Feist & Grambast-Fessard, 1984
MUSACCHIELLA SARDINIAE n. sp.

Pl. 1, figs. 6-13

Derivatio nominis — From Sardinia.

Types — Holotype CF 2736-1 (pl. 1, fig. 7); paratypes CF. 2736-2 to 4 (pl. 1, figs. 8, 9, 10). - Coll. M. Feist, Université des Sciences et Techniques du Languedoc, Montpellier, France.

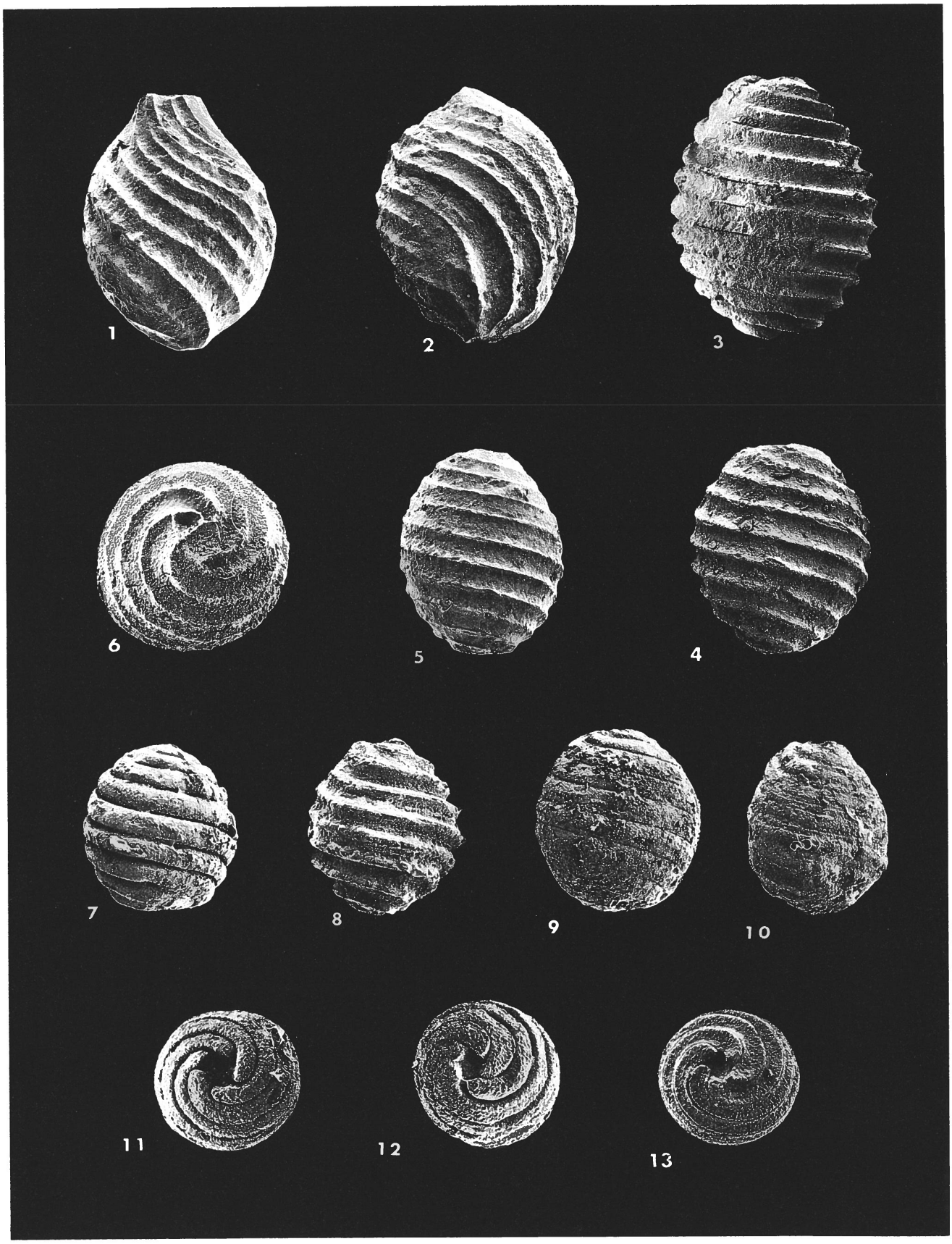
Type horizon and locality — Marls of the Lower unit of the Purbeckian (sample CI-2), Berriasian. Cala d'Inferno, Capo Caccia peninsula, Sardinia.

Material — About 500 gyrogonites.

EXPLANATION OF PLATE 1

Figs. 1-2, 5-13 - Charophytes from the Berriasian (Purbeckian facies) of Cala d'Inferno (Nurra, NW Sardinia).
Figs. 3-4 - Charophytes from the Berriasian (Purbeckian facies) of the French Jura.

Figs. 1-2 - *Globator nurrensis* (Pecorini) Grambast n. comb. - Lateral view. - CF.2736/CI-5/1 and 2. x 40.
Figs. 3-4 - *Musacchiella maxima* (Donze) Feist & Grambast-Fessard n. comb. - Lateral view. x 50.
Fig. 5 - *Musacchiella maxima* (Donze) Feist & Grambast-Fessard n. comb. - Lateral view. - CF.2736/CI-5/3. x 50.
Fig. 6 - *Musacchiella sardiniae* n. sp. - Internal cast showing the impression of the segmented basal plate. - CF.2736/CI-2/8. x 120.
Figs. 7-13 - *Musacchiella sardiniae* n. sp. x 50.
7. Holotype, lateral view. - CF.2736/CI-2/1.
8. Paratype, lateral view. - CF.2736/CI-2/2.
9. Paratype, lateral view. - CF.2736/CI-2/3.
10. Paratype, lateral view. - CF.2736/CI-2/4.
11. Apical view. - CF.2736/CI-2/5.
12. Basal view. - CF.2736/CI-2/6.
13. Basal view. - CF.2736/CI-2/7.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Diagnosis — Gyrogonite of *Musacchiella* characterized by its medium size and its broadly ellipsoidal or nearly subglobular outline, with rounded base, rounded summit, very slightly truncated; apical pore small and sunken.

Dimensions — 500-575 (625) µ long, 425-525 µ wide, 7-8 (9) convolutions, L/W ratio 1.05-1.22 (1.27).

Remarks — This species has been assigned to the genus *Musacchiella* because of the presence of a segmented basal plate. This feature is conspicuous in particular as an impression on the internal cast (pl. 1, fig. 6).

Among the other species of *Musacchiella, M. palmeri* Feist & Grambast-Fessard from the Bathonian of England includes specimens of the same size, but with a much more distinctly truncated summit. Among the species from the Berriasian of the French Jura, *P.* cf. *hildesiensis* Mädler described by Donze (1958) has a more elongated outline (L/W ratio ranging about 1.27, measured on original material).

MUSACCHIELLA MAXIMA (Donze)
Feist & Grambast-Fessard n. comb.
Pl. 1, fig. 5

1955 *Aclistochara maxima* n. sp. - DONZE, p. 289, pl. 13, figs. 6-7.
1958 *Porochara maxima* - DONZE, p. 180.

The Sardinian specimens have the same outline, ellipsoidal with a truncated summit, as those of *P. maxima* Donze. They differ from the Jura specimens (pl. 1, fig. 3) in their smaller size, in having the spiral cells often flattened instead of strongly concave, and finally in having slightly pronounced sutures. It is worth mentioning that specimens similar to the largest ones from Sardinia (up to 800-850 µ long) are also present in the French Jura assemblage (Grambast collection; pl. 1, fig. 4). For this reason both assemblages are assigned to the same species.

In the material coming from South Jura we have been able to observe a segmented basal plate, allowing us to assign *P. maxima* Donze to the genus *Musacchiella.* But on the Sardinian specimens, it has not been possible to detect the plate and to confirm the existence of this character.

M. maxima differs from *M. douzensis* Feist & Grambast-Fessard which possesses a gyrogonite wider in its equatorial part.

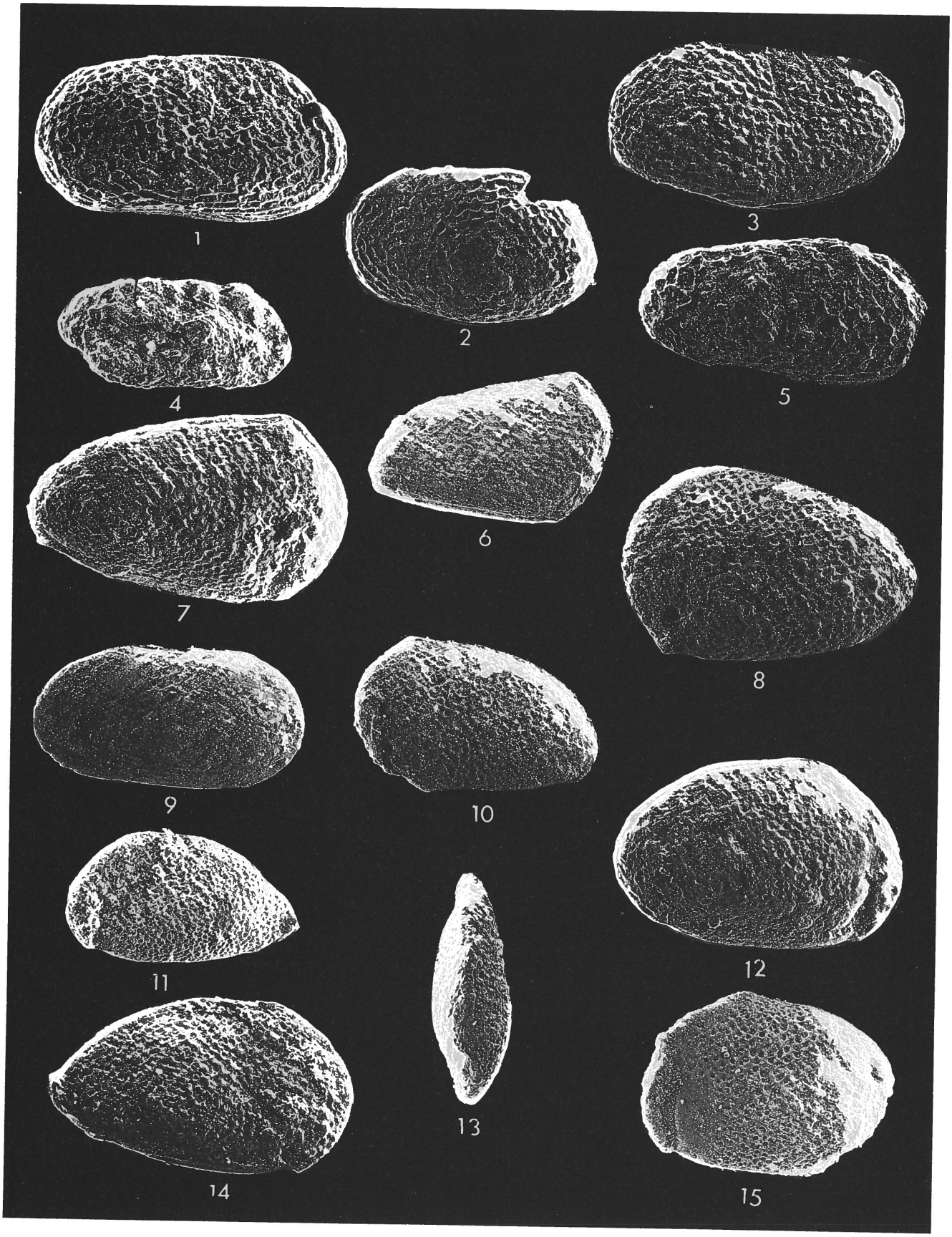
Family CLAVATORACEAE PIA, 1927
Subfamily CLAVATOROIDEAE
Genus GLOBATOR Grambast, 1966
GLOBATOR NURRENSIS (Pecorini) Grambast n. comb.
Pl. 1, figs. 1-2

1969 *Globator maillardi* (Saporta, 1891) var. *nurrensis* - PECORINI, p. 7.
1974 *Globator nurrensis* (Pecorini) Grambast - GRAMBAST, p. 472.

The variety established by Pecorini was raised to specific rank by Grambast who considered it as representing a more advanced evolutionary stage than the type *Globator maillardi* (Saporta) Grambast (= *Clavator thorali* Donze). However, the new combination

EXPLANATION OF PLATE 2

Ostracods from the Berriasian (Purbeckian facies) of Cala d'Inferno (Nurra, NW Sardinia).
Figs. 1-8, 11-15 - Sample CI-5; fig. 9: sample CI-2.
Figs. 1-3, - *Theriosynoecum sardum* n. sp.
1. Carapace, male (holotype), right view. Xe 13237. x 67.5.
2. Left valve, female (postero-dorsal angle broken). x 67.5.
3. Right valve, female (dorsal margin slightly damaged). x 67.5.
Fig. 4 - *Protocythere* cf. *divisa* Oertli, 1966. - Right valve. x 67.5.
Fig. 5 - *Dictyocythere* gr. *mediostricta* Sylvester-Bradley, 1956. - Right valve. x 67.5.
Figs. 6-8, 10 - *Cypridea dorsoinclinata* n. sp.
6. Carapace, right view. x 67.5.
7. Carapace, right view (holotype). Xe 13235. x 67.5.
8. Carapace, left view. x 67.5.
10. Carapace, right view. x 67.5.
Fig. 9 - *Fabanella boloniensis* (Jones, 1882). - Carapace, female, left view. x 67.5.
Figs. 11, 13-14 - *Cypridea tumescens meridionalis* n. subsp.
11. Carapace, left view (holotype). Xe 13236. x 34.
13. Carapace, dorsal view. x 34.
14. Carapace, right view. x 67.5.
Fig. 12 - *Cypridea* cf. *protogranulosa* Anderson, 1971. - Carapace, right view. x 67.5.
Fig. 15 - *Cypridea* cf. *vidrana* Wolburg, 1959. - Left valve (posterior end damaged). x 67.5.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was not validated yet. The fundamental structure, made of three units each of them composed of eight cells (Grambast 1974, fig. 6), is the same in both forms but the median basal cell tends to be somewhat reduced in *G. nurrensis*. *G. nurrensis,* moreover, presents thinner and more strongly coiled spiral elements, and its apical part is often passing into a neck. The shape variability was well illustrated by Pecorini (1969, text-fig. 8).

Remarks — About the two other species identified in sample CI-5, *Perimneste micrandra* Grambast, 1967 and *Flabellochara* aff. *grovesi* (Harris, 1939) Grambast, 1959, we refer to the good illustrations in Pecorini (1969, text-figs. 9-11), being the new specimens only few and not very well preserved.

Ostracods (J.P. Colin)

The Purbeckian of Cala d'Inferno has yielded rich non-marine ostracod faunas, allowing correlations with the Purbeckian of Spain, SE France, and to a lesser degree with the type-Purbeckian from S England.

Two samples (CI-2 and CI-3) have provided numerous specimens of the brackish to hyperhaline species *Fabanella boloniensis* (Jones) which is well known in Europe from the Portlandian to the Aptian.

A more interesting sample (CI-5) is characterized by a rich and diversified ostracod fauna dominated by various species of the genus *Cypridea*. Stratigraphically, the microfauna presents strong affinities with the Middle Purbeckian faunas of S England (Anderson & Bazley 1971; Anderson 1973; Kilenyi & Neale 1978) and equivalent horizons in SE France (Babinot *et al.* 1972; Colin & Oertli 1985), and Spain (Kneuper-Haack 1966; Brenner 1976).

The following species have been found:

— *Cypridea tumescens meridionalis* n. ssp.: this subspecies has already been reported from the « Marnes vertes infracrétacées » of SE France (Babinot *et al.* 1972; Colin & Oertli 1985) and from the Purbeckian of N. Spain (Kneuper-Haack 1966). In NW Europe, the various sub-species of *Cypridea tumescens* (Anderson) are restricted to the Middle and Lower Purbeckian (ostracod zones 1 to 3 of Anderson 1973) of Berriasian age.

— *Cypridea* cf. *vidrana* Wolburg: this species is very rare in the studied samples. It is known to be restricted to the Middle Purbeckian of Germany and England (Wolburg 1959; Anderson & Bazly 1971; Kilenyi & Neale 1978).

— *Cypridea dorsoinclinata* n. sp.: new species only known from the type locality.

— *Cypridea* cf. *protogranulosa* Anderson: few specimens bearing strong affinities with the Middle Purbeckian species *Cypridea protogranulosa* have been found. They differ from the English species only by having fewer turbercles. It has also been reported from the Purbeckian of SE France (Babinot *et al.* 1972; Colin & Oertli 1985).

— *Theriosynoecum sardum* n. sp.: new species also known from the Berriasian of SW France (Colin & Oertli 1985) strongly related to the Purbeckian species *Theriosynoecum forbesii* (Jones).

— *Dictyocythere* gr. *mediostricta* Sylvester-Bradley: only one specimen of this brackish-marine genus has been found. Although badly preserved, it belongs certainly to the *Dictyocythere mediostricta* group known from the Berriasian and Valanginian deposits of Germany (Malz 1958), England, Spain (Malz 1958; Brenner 1976) and SE France (*Dictyocythere* sp. in Colin & Oertli 1985). The subspecies *Dictyocythere mediostricta transfuga* Malz has been reported from the Nurra series of Capo Caccia by Chabrier & Fourcade (1975) and by Azéma *et al.* (1977).

— *Protocythere* cf. *divisa* Oertli: only one badly preserved specimen has been found. Although originally described from the Valanginian of the Jura Mountains (Oertli 1966), this species has also been reported in the Late Berriasian of SE France (Babinot *et al.* 1972). It has already been mentioned in Sardinia at Cala d'Inferno by Chabrier & Fourcade (1975) and Azéma *et al.* (1977).

Despite the presence of two valves of marine ostracods belonging to the genera *Dictyocythere* and *Protocythere,* the entire ostracod fauna clearly indicates a fresh-water to at most an oligohaline environment.

These correlations together with close comparisons with the type-Purbeckian of S. England, allow to confirm the Berriasian age already proposed for the « couches à Charophytes et Ostracodes » by Chabrier &Fourcade (1975) and Azéma *et al.* (1977).

TAXONOMY (DESCRIPTION OF NEW TAXA)

Subclass Ostracoda Latreille, 1806

Order Podocopida Müller, 1894

Suborder Podocopina Sars, 1866

Family Ilyocyprididae Kaufmann, 1900

Family Cyprideinae Martin, 1940

Genus Cypridea Bosquet, 1852

Cypridea dorsoinclinata n. sp.

Pl. 2, figs. 6-8, 10

Derivatio nominis — From the strongly inclined dorsal margin.

Holotype — One carapace deposited in the collections of the Senckenberg Museum, Frankfurt am Main, Germany, Xe 13235.

Paratypes — 10 carapaces in the author's collection.

Type-locality — Purbeckian of Cala d'Inferno, Sardinia.

Diagnosis — Species of the genus *Cypridea* of medium size, characterized by a dorsal margin strongly inclined toward the posterior end. Highest point of the carapace situated in an anterior position. Rostrum and alveolus very small; cyathus small. Surface of the valves coarsely punctate with in some cases few small scattered tubercles. Left valve is larger but weakly overlapping.

Remarks — By its strongly inclined and straight dorsal margin and the highest point of the carapace situated in a strongly anterior position, this species is easily differentiated from all the other *Cypridea* species. The obliquity of the dorsal margin is rather variable and the antero-dorsal angle can be comprised between 125° and 135°. In extreme cases, the antero-dorsal angle is located in a more anterior position than the rostrum (pl. 2, fig. 6).

Size — L = 0.67-0.87 mm
h = 0.41-0.55 mm
L/h = 1.4-1.68.

Distribution — This species is only known from the Purbeckian of the type-locality.

CYPRIDEA TUMESCENS MERIDIONALIS n. subsp.

Pl. 2, figs. 11, 13-14

1966 *Cypridea* (*Cyamocypris*) *tumescens* (Anderson, 1939) - KNEUPER-HAACK, pl. 46, fig. 24.
1985 *Cypridea* gr. *tumescens* (Anderson, 1939) - COLIN & OERTLI, p. 38, figs. 1-3.

Derivatio nominis — From the southern geographical distribution of this species.

Holotype — One carapace, deposited in the collections of the Senckenberg Museum, Frankfurt am Main, Germany, Xe 13236.

Paratypes — 10 carapaces in the author's collection.

Type-locality — Purbeckian of Cala d'Inferno, Sardinia.

Diagnosis — Subspecies of *Cypridea tumescens* (Anderson) characterized by its large size and anterior and posterior swellings. Rostrum large; long and deep alveolus. Posterior caudal process bearing a well developped spine on the left valve. Surface of the valves coarsely punctate. Left valve larger.

Remarks — This subspecies differs from the other subspecies *Cypridea tumescens tumescens* (Anderson), *Cypridea tumescens acrobeles* Anderson, and *Cypridea tumescens praecursor* Oertli, from the Early and Middle Purbeckian of NW Europe, mainly by the presence of a posterior spine on the left valve.

In dorsal view, the carapace is narrow and shows the strong anterior and posterior swellings of the left valve.

Size — L = 1.2-1.26 mm.

Distribution — This species is known from the Purbeckian of Sardinia, of SE France (Babinot *et al.* 1972) and Spain (Sierra de los Cameros: Kneuper-Haack 1966; Maestrazgo: Babinot *et al.* 1972).

Family LIMNOCYTHERIDAE Sars, 1925
Subfamily TIMIRIASEVIINAE Mandelstam, 1960
Genus THERIOSYNOECUM Branson, 1935

THERIOSYNOECUM SARDUM n. sp.

Pl. 2, figs. 1-3

1985 *Theriosynoecum* gr. *forbesii* (Jones 1885) - COLIN & OERTLI, pl. 39, fig. 11.

Derivatio nominis — From Sardinia.

Holotype — One carapace deposited in the collections of the Senckenberg Museum, Frankfurt am Main, Germany, Xe 13237.

Paratypes — 5 carapaces in the author's collection.

Type-locality — Purbeckian of Cala d'Inferno, Sardinia.

Diagnosis — Species belonging to the genus *Theriosynoecum* Branson, characterized by its medium size, the absence of tubercles, the weakness of the antero-dorsal sulci. Surface of the valves regularly reticulate.

Remarks — By its medium size, the weakness of the antero-dorsal sulci and the general morphology, this species is closely related to the Purbeckian species *Theriosynoecum forbesii* (Jones), from which it differs essentially by the well defined reticulation and by the total absence of tubercles on the male dimorphs (see discussion on *Theriosynoecum forbesii* in Anderson & Bazley 1971).

Strong sexual dimorphism, females being posteriorly inflated by the development of a brood-pouch.

Size — L = 0.69-0.84 mm.

Distribution — Purbeckian of Sardinia and Berriasian of SE France (Colin & Oertli 1985).

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