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**“The Subfamily orionininai puri, 1973 (Ostracoda; Hemicytheridae) in the Brazilian Continental Shelf, part II. Sistematic of the Genus Caudites Coryell & Fields, 1973”**

*João Carlos Coimbra, Lilia Pinto de Ornellas*

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Instituto de Geociências, Universidade Federal do Rio Grande do Sul, Porto Alegre, RS, Brasil

# "The Subfamily orionininae puri, 1973 (Ostracoda; Hemicytheridae) in the Brazilian Continental Shelf, part II. Sistematic of the Genus *Caudites* Coryell & Fields, 1973".

João Carlos Coimbra*
Lilia Pinto de Ornellas**

SINOPSE

Compreende o estudo sistemático das espécies do gênero *Caudites* Coryell & Fields, 1937, encontrados na Plataforma Continental Brasileira. É proposta a reformulação da diagnose do gênero *Caudites* com a inclusão de novos e importantes caracteres morfológicos diferenciais. Foram encontradas e descritas quatro novas espécies de *Caudites* para a região estudada: *C. ohmerti*, *C. vandenboldi*, *C. fluminensis* e *C. gnomus*. É redescrita e registrada por primeira vez a ocorrência de *C. nipeensis* Bold, 1946, para a costa brasileira, sendo também proposta uma emenda para sua diagnose.

ABSTRACT

This study deals with the systematic of the species of the genus *Caudites* Coryell & Fields, 1937, found in the Brazilian Continental Shelf. It is proposed the emend of the diagnosis of this genus with the inclusion of new and important differential morphological characters. Four new species of *Caudites* are found and redescribed for the studied region: *C. ohmerti*, *C. vandenboldi*, *C. fluminensis* and *C. gnomus*. For the first time, the occurrence of *C. nipeensis* Bold, 1946 is registered in the Brazilian Coast. This species is redescribed and an emend is proposed for its diagnosis.

## INTRODUCTION

The 720 samples used in the study on the taxonomy of the subfamily Orionininae Puri, 1973 and its distribution in the Brazilian Coast were obtained through the Centro de Estudos de Geologia Costeira e Oceanográfica da Universidade Federal do Rio Grande do Sul (CECO). These samples belong to REMAC Project - Cruzeiro Woods Hole, Águas Rasas - Coordinated by Petróleo Brasileiro S.A. (PETROBRÁS), GEOMAR II/III of the Diretoria de Hidrografia e Navegação da Marinha do Brasil (DHN) and

* Departamento de Biologia
Universidade Federal do Maranhão.
** Departamento de Paleontologia e Estratigrafia da Universidade Federal do Rio Grande do Sul.

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collected by NOc. Austral.

The sampling area comprises all the Brazilian Continental Shelf from latitude 05°N to latitude 35°S. Due to the vast extension of the studied area the work was divided in several stages. The first stage deals with the taxonomical data on this subfamily and on the species of the genus *Orionina* Puri, 1953, found in the Brazilian Coast.The second stage developed in this paper deals with the taxonomical study on the species of the genus *Caudites* Coryell & Fields, 1937. The third stage will be the study of the ecological data and geographical distribution of this subfamily in the Brazilian Continental Shelf.

REPOSITORY The type material is deposited in the collection of the Museu de Paleontologia at the Universidade Federal do Rio Grande do Sul, under numbers M.P., UFRGS, MP-1007 to 1035.

SYSTEMATICS

Phylum ARTHROPODA
Sub Phylum Mandibulata
Classis Crustacea
Sub Classis OSTRACODA Latreille, 1806
Ordo Podocopida Müller, 1894
Sub Ordo Podocopina Sars, 1865
Super Familia Cytheracea Baird, 1850
Familia Hemicytheridae Puri, 1953
Sub Familia Orionininae Puri, 1973

Genus *Caudites* Coryell & Fields, 1937 emend.
Coimbra & Ornellas, 1986.

DIAGNOSIS Orionininae with carapace from subrectangular to subtriangular in lateral view. Surface with variable number of ridges. Intercostal reticulation, when rarely present very weak. Strong ventral and anterior submarginal ridges. Eye tubercles present. Three or four frontal muscle scars, five to eight adductor scars and one dorsal which may be subdivided. Hinge holamphidont.

TYPE SPECIES: *Caudites medialis* Coryell & Fields, 1937, p. 10-11, fig. 12a-d.

REMARKS The genus *Caudites*, when established by Coryell & Fields,(1937), was monotypical. According to Hartmann (1964), Pokorný (1970) and Ohmert (1971), important taxonomical morphological characteristics were

not present in the diagnosis of the genus, since it is based on a single species. For instance, the secondary fusion areas of the inner lamella were not included, although they are very important for the systematic determination of the genus. Coryell & Fields (*op.cit.*), described *Caudites* as á genus with small and subtriangular carapace in lateral view, hinge of the right valve with crenulate socket and groove and triangular posterior tooth. However these characteristics present clear variations in this genus, as follows: the size of *C. sellardsi* Bold, 1946 (0.51 mm), *C. alatus* Ohmert, 1971 (1.08 mm); shape of carapace subrectangular in lateral view - *C. clathratus* (Hartmann, 1962), *C. vandenboldi* sp. nov.; hinge of right valve with smooth socket and groove, as in *C. hipolitoensis* Swain & Gilby, 1974, and with rectangular posteri or tooth in *C. croca* Bate, Whittaker & Mayes, 1981.

Moore (1961) includes *Caudites* in the subfamily Hemicytherinae, and does not register in the diagnosis the presence of secondary fusions in the inner lamella.

Morkoven (1963) registered as characteristics of this genus the complete absence of small posteroventral vestibulum. However, these morphological features present a great changement among several species of *Caudites*.

Yajima (1982) includes *Caudites* in the tribe Orioninae Puri, 1974. He registers in the diagnosis, as constant characteristics, carapace with compressed sides in dorsal view and a strong ridge which runs from the anteroventral angle to the posterodorsal one. Nevertheless, these morphological features present clear variations in the great amount of species of the genus.

For this reason it is proposed a diagnosis for *Caudites*, where it is included the amplitude of morphological variations presented by the inner lamella.

*Caudites nipeensis* Bold, 1946 emend. Coimbra & Ornellas, 1986.

Pl. 1, Fig. 1-24.

Holotypus: collection of the Institute of Geology and Mineralogy of Utrecht University, nº 513040.
Locus Typicus: sample T 1451.
Stratum typicum: Miocene.
Plesiotypi: Carapace, M.P., UFRGS, nº MP-O-1007 to MP-O-1012.
Locus: East/Northern Brazilian Continental Shelf, samples 3690 (Lat. 02°07'S - Long. 41°55'W, prof. 80m), 3699 (Lat. 02°21'S - Long.39°56'W, prof.35m), 3709 (Lat. 02° 53'S - Long.39°28'W - prof.18m) and 3716 (Lat.02°58'S-Long.39°01'W, prof.37mm).

DIAGNOSIS Small carapace. Subtriangular in lateral view. Primary ornamentation constituted by ridges. Secondary ornamentation constituted by residual reticula with small delicate cells, restricted to the small depression areas around the ridges. Ventral and rosal ridges and the ascendent branch of the ventral one presenting each one a node. Discreet caudal process. Carapace laterally compressed in dorsal view, maximum width in the median posterior region. Anterior region prominent and relatively wide. Anterior marginal zone with four areas of secondary fusion in the inner lamella. Some specimens present the pattern of ornamentation of the left valve similar to the one of *Caudites sellardsi* (Howe & Neill), 1935 (in Howe *et alii*, 1935).

DESCRIPTION External view - Carapace subtriangular in lateral view. Clear posterior and anterior cardinal angles. Maximum height coincident with the eye tubercle region and the anterior cardinal angle. Right valve with the dorsal margin almost straight sloping backwards. Anterior margin strongly rounded, sometimes finely denticulate. Ventral margin sinuous. Posterior margin truncated with concave upper portion. Discreet caudal process.

Surface with ridges and nodes, small and delicate residual reticula restricted to the narrow depression areas, around the ridges. Delicate submarginal ridge parallel to the free margin. From the eye tubercle, a strong ridge runs parallel to the anterior end. Ventral ridge parallel to the correspondent margin with a node just after the mid-length from where the ridge bifurcates. The ascendent main branch presents, near the posterior cardinal angle, a posterodorsal node. Two ridges, one dorsal and the other posterior rise from that node. The posterior one and the ascendent branch of the ventral ridge form deep angular inflection which characterizes the normal ornamental pattern of the species. The small dorsal ridge presents a node before the mid-length. Perpendicular short and incipient ridges rise from the anterior ridge. They form small cells in the anterior end (Pl. 1, Fig. 12, 15 and 17). The left valve is higher and differs from the right by presenting the posterior cardinal angle more prominent. Carapace, laterally compressed in dorsal view, with three pairs of symmetrical prominences by the presence of the nodes. Maximum width, in the median posterior region near the node of the ventral ridge. The posterior edge taperig abruptly to form the caudal process.

Some specimens present the left valve with the ornamentation similar to that of *Caudites sellardsi* (Howe & Neill, 1935) (in Howe *et alii*, 1935) and the right valve with a slight difference from the

normal ornamentation of the species (Pl.1, Fig. 11 and 18). The bifurcation of the ventral ridge occurs, aproximately on the middle of the secondary branch and not directly from the node as in the normal ornamentation.

Teh left valve does not present the deep angular inflection of the ventral ridge in the ventroposterior region. Instead of this, the ridge rises up in an almost parallel line to the posterior edge forming four angles. Internally - Hinge holamphidont. The right valve with stepped anterior tooth; rounded socket; smooth groove and subtriangular posterior tooth. Anterior marginal zone with four areas of secondary fusions in the inner lamella. The dorsal anterior one is oval;followed by other larger subtriangular; the oval anteroventral one is the largest and presents a constriction caused by the presence of normal pore canals; the ventral is smallest and kidney-shaped. They present slight variations in size and shape. Several straight marginal pore canals in all extension of the duplicature. Most of them simple. Line of concrescence coincident with internal margin, except in the anterior and posterior regions. Central muscle scars hardly visible being three frontal in oblique row, followed by a group of six scars. Left valve with hinge elements compementary to the right.

DIMENSIONS

Plesiotypi: Carapace, M.P., UFRGS, nº MP-O-1007; right valve, length: 0.3984 mm; height: 0.1826 mm; left valve, lenght: 0.3984 mm; height: 0.1992 mm.
Carapace, MP-O-1008; length: 0.3984 mm; width: 0.1577 mm.
Carapace, MP-O-1009; right valve, length: 0.3652 mm; height: 0.1826 mm; left valve, length: 0.3652 mm; height: 0.1952 mm.
Carapace, MP-O-1010, right valve, length: 0.3818 mm; height: 0.1826 mm; left valve, length: 0.3818 mm; height: 0.1992 mm.
Carapace, MP-O-1011; length: 0.3818 mm; width: 0.1494 mm.
Carapace, MP-O-1012; right valve, length: 0.3652 mm; height: 0.1826 mm; left valve, length: 0.3652; height: 0.1992 mm.

REMARKS The present species was determined, described and illustrated by Bold (1946). Although the internal characteristics were not described, they were refereed to be as very similar to *Caudites sellardsi* (Howe & Neill),1935 (in Howe *et alii*, 1935).

Nevertheless, it is not possible to compare the internal structures like the secondary fusion areas of the inner lamella between *C. nipeensis* and *C. sallardsi* since they were not described either. Bold

(1963a) illustrates, just for comparison, the right valve of *C. nipeensis* but does not describe it. He represents four secondary fusions of the inner lamella and the muscle scars.

Morkoven (1962, 1963) also illustrates internally the right valve of this species presenting the internal features, but they are not formally described.

As none of all previous consulted papers on *C. nipeensis* presents diagnosis, description and illustrations showing in details their inner and outer structures a diagnosis is proposed ant the species is described and illustrated again.

MATERIAL One hundred ninety carapace and thirty six valves were examined.

OCCURRENCE Miocene of Cuba, Trinidad and Tobago, San Martin, Recent sediments of Trinidad and Tobago, Venezuela, Hatteras Cape, Gulf of Paria and Gulf of Méxco.

In the Brazilian Continental Shelf, Leg 4, sample 3378; Leg 6, samples 3606, 3607, 3608, 3609, 3610, 3615, 3616, 3624, 3636, 3637, 3672, 3679, 3680, 3685, 3686, 3689, 3690, 3698, 3699, 3705, 3706, 3709, 3710, 3711, 3716, 3717, 3721, 3722, 3726, 3743, 3747, 3750, 3823; Leg 7, samples 3765, 3820, 3847, 3863, 3884, 3892, 3904, 3906, 3908, 3922, 3935; GEOMAR III, samples g-148, g-150, g-184, g-185, g-188, g-190, g-200, g-218, g-2467, g-2469, g-2528.

GEOGRAPHICAL DISTRIBUTION in the Brazilian Coast - Lat. $04^{o}26'N$ to $21^{o}02'S$.

STRATIGRAPHIC DISTRIBUTION - Middle Miocene to Recent.

*Caudites ohmerti* Coimbra & Ornellas, sp. nov.

1977 *Caudites* sp. Vicalvi, Kotzian & Forti-Esteves, p.83, pl. IV,fig.1.

Pl. 2, Fig. 1-33

Derivatio nominis: in honor to Dr. Wolf Ohmert.
Holotypus: Female - Carapace, M.P., UFRGS, nº MP-O-1013.
Paratypi: Female - Carapace, nº MP-O-1014 to MP-O-1015.
Male - Carapace, nº MP-O-1016 to MP-O-1018.
Young instars: Right valves, nº MP-O-1019 to MP-O-1021.
Locus typicus: Continental Shelf of Rio de Janeiro, sample 3286 (Lat. $22^{o}24'S$ - Long. $41^{o}19'8$ W, prof. 34 m).
Stratum typicum: Recent.

DIAGNOSIS Carapace subrectangular in lateral view. Surface with ridges. Intercostal reticulation inconspicuous or absent. The ventrolateral ridges with short and ascendent branch in the beginning of the last third.

In the female this ridge presents a weak and sometimes discontinuous connection with the median one in the posterior portion.

In the male, they connect through strong, vertical and arched ridge. Four areas, of secondary fusions in the inner lamella are little clear. Central fusion larger and more conspicuous. Hinge with a horizontal blade sickle-shaped in the inner anterior edge.

DESCRIPTION External view - Carapace subrectangular in lateral view. Anterior cardinal angle, prominent than posterior. Right valve presents a slight sinuous dorsal margin with a bland concavity at the limit of the anterior edge; anterior margin rounded, ventral one sinuous, posterior margin concave in the dorsal half and posteroventral conspicuous caudal process. Surface with ridges. Intercostal area with slight and unconspicuous reticulation or smooth. Submarginal ridge parallel to the free margin and more developed in the anterior end. From the anteroventral portion of this ridge rises another bifurcated one. Its upper branch forms the ventrolateral ridge and the lower the ventral one.This branch extends subparallelly to the correspondent margin. After the mid-length it fusionates again with the ventrolateral ridge to form an anteroventral elongate cell. The ventrolateral ridge presents in the last third a short and ascendent vertical branching. From the submarginal ridge arise three very short anterodorsal ridges which converge and fusionate to form the median one. The median ridge overpasses the upper part of the subcentral tubercle, reaches the posterior cardinal angle, connects with weak and ascendent posterior ridge. This one joined with the dorsal ridge which bifurcates just before the mid-lenght. The left valve differs from the right by being higher, the cardinal angles more clear and the edge of the caudal process in some specimens slightly crenulate. Dorsal view - Maximum width in the last third of the lenght. Posterior end tapering in a caudal process with sinuous dorsal commissure.

Internal view - Hinge holamphidont. Right valve with anterior tooth simple and prominent, socket, smooth groove, and rectangular lobate posterior tooth. The inner anterior edge of the hinge presents a laminar, horizontal projection sickle-shaped (Pl. 2, Fig. 6, 9, 14, 19 and 29). The four areas of secondary fusion not easily seen. The dorsal one approximately oval; the next and the largest clearly heart-shaped;

the third with an irregular outline; the ventral very small and approximately kidney-shaped.

Numerous marginal pore canals straight, most of them simple and concentrated in the anterior and posterior extremities.

Anterior vestibulum narrow and the posterior vestigial. Central muscle scars not clear being three frontal in oblique line and seven scars in a double row. The caudal process presents a distal slight concavity marginated internally by the selvage (Pl. 2; Fig. 8 and 15). Left valve with complementary hinge elements of the right. Secondary fusions of the inner lamella with slight variations in shape. The male differs from the female by the relatively longer and narrower carapace with shorter caudal process; by presenting a strong, neat, continuous and arched posterior vertical ridge, joined to the ventral, median and dorsal ones and by presenting the anterior tooth of the right hinge sharper.

DIMENSIONS

Holotypus: Female - Carapace, M.P., UFRGS nº MP-O-1013; right valve, length: 0.6474 mm; height: 0.2988 mm; left valve, lenght: 0.6474 mm; height: 0.3154 mm.
Paratypi: Female - Carapace, MP-O-1014; lenght: 0.6474 mm; width: 0.2822 mm.
Female - Carapace, MP-O-1015; right valve, length: 0.5644 mm; height: 0.2739 mm; left valve, length: 0.5644 mm; height: 0.2822 mm.
Male - Carapace, MP-O-1016; right valve, lenth: 0.7138 mm; height: 0.3154 mm; left valve, length: 0.7138 mm; height: 0.3320 mm.
Male - Carapace, MP-O-1017; length: 0.6972 mm, width: 0.2573 mm.
Male - Carapace, MP-O-1018; right valve, length: 0.6142 mm; height: 0.2822 mm; left valve, length: 0.6142 mm; height: 0.2988 mm.
Juvenile instars: right valve, MP-O-1019; length: 0.4814 mm; height: 0.2573 mm.
Juvenile instars: right valve, MP-O-1020; length: 0.4482 mm; height: 0.2490 mm.
Juvenile instars: right valve, MP-O-1021; length: 0.3818 mm; height: 0.1992 mm.

REMARKS This species is greatly related to *Caudites jacksonvillensis* Swain, 1951, and *Caudites gnomus* sp. nov. It resembles, also, *Caudites diagonalis* Sanguinetti, 1979, and *Caudites posdiagonalis* Ornellas, 1981 (unpublished). All these species, present similarities in the ridge patterns what makes them a characteristic group in the genus. However they have well-defined specific characteristics easely recognizable.

*C. ohmerti* differs from *C. jacksonvillensis* by presenting clear differences in the relation length-height; by the presence of posterior vertical ridge arched connecting the dorsal, the median, the ventrolateral ones, stronger in the male carapace; by presenting the vertical ridge in the last third of the ventrolateral one and the lower branch of the dorsal ridge longer. It was not possible to compare morphological inner structures because, according to Swain (1951), his material was badly preserved, making the identification of these structures impossible.

*C. ohmerti* differs from *C. gnomus* mainly by presenting larger size; strong and clear ornamentation; sinuous ridges; vertical posterior ridge arched connecting the dorsal, ventrolateral and median ridges, incipient in the female and conspicuous in the male; sickle-like blade in the inner anterior edge of the hinge. Anterior tooth of the right hinge sharper and the posterior rectangular and lobate. *C. gnomus* is more rectangular and presents the area between the ventral ridge and the correspondent margin as well as the posterior region clearly lowered.

*C. ohmerti* differs from *C. diagonalis* by being larger and by presenting the median ridge horizontal rather than diagonal. The median and the ventrolateral ridges are approximately parallel being H-shaped in the anterior portion instead of V-shaped what is characteristic of *C. diagonalis*. *C. ohmerti* still differs by the subrectangular shape of the carapace in lateral view; by the rectangular and lobate posterior tooth of the right valve; by the number and shape of the secondary fusions of the inner lamella; and by the sickle-like blade in the inner anterior edge of the hinge.

*C. ohmerti* differs from *C. posdiagonalis* by presenting a larger caudal process; less developed intercostal reticulation; outline of the anteroventral margin bland and continuous without angle; subcentral tubercle without posterior sulcus; marginal pore canals not bulbous; central muscle scars more numerous; and by presenting the pattern of secondary fusions of the inner lamella. It differs, yet, by the presence of a sickle-like blade in the inner anterior edge of the hinge.

Vicalvi *et alii* (1977), when studying the Quaternarian microfauna of the São Paulo Continental Shelf, registered the occurence of *Caudites* sp. The comparison between males of *Caudites ohmerti* and the illustration presented by those authors shows an identical ornamentation, indicating that they belong to the same species.

MATERIAL Among the species belonging to the subfamily Orioniniae this one is the most abundant in the Brazilian Continental Shelf. Is is rep resented in the samples by one hundred and fifty-one carapaces, and six hundred and eight-nine isolate valves, including males, females and young instars.

OCCURRENCE Brazilian Continental Shelf, Leg. 1, samples 3002, 3003, 3004, 3006, 3008, 3010, 3011, 3020, 3026, 3028, 3030, 3031, 3060, 3096; Leg 2, samples 3154, 3163, 3171, 3194, 3203, 3205, 3206, 3209, 3221; Leg 3, samples 3227, 3228, 3229, 3231, 3234, 3236, 3243, 3244, 3246, 3250, 3251, 3254, 3257, 3264, 3273, 3283, 3286, 3293, 3316; Leg 7, samples 3923, 3928, 3929, 3240, 3945, 3947, 3949, 3950, 3955, 3957,3963; GEOMAR VI, samples g-326, g-333, g-346, g-349, g-362, g-370; El Austral, samples A-6702, A-6704, A-6705, A-6714, A-6726, A-6738.

GEOGRAPHICAL DISTRIBUTION On the Brazilian and Uruguaian Coast. Lat. 19°32' to 35°06'S.

STRATIGRAPHIC DISTRIBUTION - Recent.

*Caudites gnomus* Coimbra & Ornellas, sp. nov.

1975 *Caudites* sp. Bertels, p. 335, pl. 5, fig. 6.

Pl. 1, Fig. 25-44.

Derivatio nominis: due to the small size of the specimens.
Holotypus: Female - Carapace, M.P., UFRGS, nº MP-O-1022.
Paratypi: Female - Carapace, nº MP-O-1023 and MP-O-1024.
Male - Carapace, nº MP-O-1025 and MP-O--1026.
Locus typicus: Continental Shelf of the Rio de Janeiro State, sample 3945, Lat. 22°18'S - Long. 40°57'W, depth 44 m.
Stratum typicum: Recent.

DIAGNOSIS In lateral view subrectangular carapace. Weak ornamentation, with ridges without intercostal reticulation. Median and ventrolateral ridges connected in the posterior region by a vertical and straight ridge, present in the female as well as in the male. Ventral ridges relatively strong. Lowered area limited by the ventral and posterior ridges. In dorsal view the pattern of dorsal ridges forms an isosceles triangle in the posterior half of the carapace. Anterior marginal zone with four areas of secondary fusions in the inner lamella.

DESCRIPTION External view - Female carapace subrectangular in lateral view. Cardinal angles clear. Maximum height coincident with the anteri-

or cardinal angle, and the incipient eye tubercle. Right valve with the dorsal edge slightly convex sloping down towards the posterior cardinal angle. Anterior margin rounded. Ventral margin sinuous.Posterior margin concave in the upper portion and truncate in the lower, forming a conspicuous quadrangular caudal process. Surface of the carapace ornamented with ridges, without intercostal reticulation. Submarginal ridge parallel to the free margin more developed in the anterior end. From this ridge arise, in the anterior region, two lateral ridges, one ventral and the other, median. The ventrolateral bifurcates in its begining. The lower branch forms the strong ventral ridge. The upper branch follows in ascendent, oblique line until the incipient subcentral tubercle from which it inflects downwards fusionating again with the ventral ridge. It forms, in the anterior region, a cell similar to a scalene triangle and continues sinuosly backwards in a slight ascension. Before reaching the caudal process it bifurcates the weak branch ending in the inferior angle of the caudal process. The other one forms, abruptely, the clear vertical posterior ridge and connectes with the terminal portion of the median ridge. The peripheral posterior and vertical area is lowered and limited by the correspondent riges. The median ridge, reaches the subcentral tubercle and runs in ascendent sinuous line until the posterior dorsal region. The dorsal ridge rises, in the posterior cardinal angle and runs parallel to the correspondent edge until the third fifth of the length, where bifurcates. The lower branch slopes and reaches the median ridge in the first fifth of the length. The upper branch ends in the median region of the dorsal margin. The left valve differs from the right by being higher; the limit of the anterior and dorsal edges convex, and by the more conspicuous anterior cardinal angle. In dorsal view presents straight and almost parallel sides. The posterior portion tapers abruptely forming the caudal process. The group of dorsal ridges form an isosceles triangle in the posterior dorsal half. Maximum width in the last third of the carapace. Internal view - Hinge holamphidont. The right valve with anterior tooth simple, socket rounded, groove and the posterior tooth smooth. Anterior marginal zone with four areas of secondary fusion in the inner lamella. The dorsal fusion is approximately oval, and the second is the largest, both present irregular outline due to the location of normal pore canals; the third fusion is partially eroded; the ventral and kidney-shaped one is the smallest. Marginal pore canals more numerous in the anterior portion, being straight and most of them simple. The caudal process presents a distal slight concavity, limited internally

by the selvage. Anterior vestibulum narrow and the posterior very reduced. Central muscle scars, little clear, presenting three anterior scars almost in vertical line followed by a group of seven scars. The left valve with the complementary hinge elements of the right, being the anterior median tooth shorter and rounded, the bar sinuous. Posterior socket with a central hole in a drop-like shape. The left valve does not present the anterior vestibulum. The secondary fusions shows a variation in shape. Sexual dimorphism present. In dorsal view the male differs from the female by the longer and narrower carapace with the sides converging backwards. Shorter caudal process. Stronger ornamentation. Internally the male shows the anterior tooth of the right hinge longer and narrower; slight variations in the outline of the secondary fusions of the inner lamella; and the valves do not present the posterior vestibulum.

DIMENSIONS

Holotypus: Female - Carapace, M.P., UFRGS, nº MP-O-1022, right valve, length: 0.5478 mm; height: 0.2822 mm; left valve, length: 0.5478 mm; height: 0.2905 mm.
Paratypi: Female - Carapace, MP-O-1023; length: 0.5644 mm; width: 0.2324 mm.
Female - Carapace, MP-O-1024; right valve, length: 0.5644 mm; height: 0.2739 mm; left valve, lenght: 0.5644 mm; height: 0.2822 mm.
Male - Carapace, MP-O-1025; length: 0.5810 mm; width: 0.1992 mm.
Male - Carapace, MP-O-1026; right valve, length: 0.5810 mm; height: 0.2490 mm; left valve, length: 0.5810 mm; height: 0.2573 mm.

REMARKS *C. gnomus* sp. nov. is compared with the topotype material of *Caudites* sp. Bertels, 1975 from the Pleistocene of Argentina, kindly sent us for study by Dr. Alwine Bertels. The comparison of the Brazilian and Argentinian specimens shows that they present identic internal and external morphologic characteristics.

*C. gnomus* resembles *Caudites ohmerti* sp. nov., from which it differs by presenting a small size; little clear ornamentation; less sinuous ridges; posterior ridge straight and vertical, both in male and female; it does not present a short and ascendent branch in the beginning of the last third of the ventrolateral ridge; the area between the ventral ridge and the correspondent margin as well as the posterior region are clearly lowered; anterior tooth of the right valve more rounded and the posterior smooth.

MATERIAL Twenty-eight carapaces and six valves, most of them females.

OCCURRENCE Pleistocene of Argentina.
Brazilian Continental Shelf, Leg. 2, sample 3133; Leg. 3, samples 3215, 3281, 3296, 3297, 3311, 3312; Leg. 7, samples 3928, 3945; GEOMAR VI, sample g-362.

GEOGRAPHICAL DISTRIBUTION on the Brazilian Coast - Lat. 19°30'S to 31°06'S.

STRATIGRAPHIC DISTRIBUTION Pleistocene to Recent.

*Caudites fluminensis* Coimbra & Ornellas, sp. nov.
Pl. 3, Fig. 1-16.

Derivatio nominis: from the occurrence in the coast of the Rio de Janeiro State.
Holotypus: Male - Carapace, M.P., UFRGS, nº MP-O-1027.
Paratypi: Male - Carapace, nº MP-O-1028 and MP-O-1029.
Female - Carapace nº MP-O-1030.
Locus typicus: Continental Shelf of the Rio de Janeiro State, sample 3929 (Lat. 22°01'S - Long. 40°35'W, Depth 42 m).
Stratum typicum: Recent.

DIAGNOSIS Large carapace. In lateral view rectangular and elongate. Surface punctate and with delicate reticulum just visible in eletronic microscope. Subcentral tubercle very weak. Four incipient longitudinal ridges. In the posteroventral region presents an independent node.Four areas of secondary fusions in the inner lamella, being the central one the largest. The internal anterior margin of the hinge presents very developed horizontal laminar projection sickle-shaped.

DESCRIPTION External view - Male carapace rectangular in lateral view. Cardinal angles very clear. Maximum height coincident with the anterior cardinal angle and with the eye tubercle. Right valve with dorsal margin slightly sinuous and concave in the limit of the anterior margin. Anterior margin strong and evenly rounded. Ventral margin sinuous.

Posterior margin concave in the dorsal half and truncate in the ventral, with caudal process. Weak sucentral tubercle. Surface with incipient longitudinal ridges ending in nodes in the last third of the length. Submarginal ridge parallel to the free margin more developed in the anterodorsal and posterodorsal portions. Two ridges, rise from the anterior portion of this ridge, one ventrolateral and the other, median. Both converging towards the weak and incipient subcentral tuberle. Just after this, the median ridge bifurcates. The upper branch upwards obliquely and presents a node before reaching the posterior

cardinal angle. The lower branch is very weak and almost reaches the posteroventral independent node. The ventrolateral ridge bifurcates immediately after its origin and forms a stronger ventral ridge subparallel to the correspondent margin. After the mid-length it fusionates again with the ventrolateral ridge to form in the anteroventral half a cell like a scalene triangle and ends by a ventrolateral node. This is more developed and prominent than the other nodes. The weak dorsal ridge runs from the correspondent node forward.

Surface presents, in eletronic microscope, numerous puncta and a very slight reticula with small irregular cells specially clear in the anterodorsal region. The left valve differs from the right by being higher, anterodorsal region more convex, the sinuosity of dorsal margin more stressed, the posterior cardinal angle heart-shaped, the lower branch of the median rib weaker. Carapace is compressed in dorsal view, with three prominences in each side corresponding to the nodes and with the posterior portion steppe-shaped. Maximum width coincident with the prominent node of ventrolateral ridge. Posterior extremity tapering in a caudal process. Internal view - Hinge holamphidont.The right valve of the male presents the anterior tooth stepped, with the anterior portion lower, rounded socket, smooth groove,posterior tooth lobate and less prominent than the anterior. Hinge inner margin presents a laminar well-developed projection sickle-shaped. Four secondary fusion areas in the inner lamella. The dorsal one oval; the median largest, rounded and with two strong reentrances by the presence of normal pore canals; the anteroventral one not clear and often eroded; the ventral elongate is the smallest one. Marginal pore canals straight, mostly simple and more abundant in the anterior extremity. Anteroventral and vestigial vestibulum. The distal portion of the caudal process presents a concavity internally marginated by the selvage. Central muscle scars not visible in the male, but clear in some females. Left hinge with the complementary elements of the right.Through the eletronic microscope it shows a small central drop-shaped hole inside of the posterior socket (Pl. 3, Fig. 8). The secondary fusions of the inner lamella with small variation in shape.Sexual dimorphism present. The only three female carapaces found were not externally illustrated because they were accidentally damaged. However, it was possibel to observe that the female differs from the male externally by presenting a more inflate carapace,the node of the ventrolateral ridge forms an alar process. Internally - Three frontal muscle scars in oblique row, followed by a group of eight scars: five large, three small and one supracentral large.

DIMENSIONS

Holotypus: Male - Carapace, M.P., UFRGS, nº MP-O-1027; right valve, length:0.7636 mm; height: 0.3486 mm; left valve,length: 0.7636 mm; height: 0.3569 mm.
Paratypi: Male - Carapace, MP-O-1028; length: 0.7802 mm; width: 0.3652 mm.
Male - Carapace, MP-O-1029; right valve, length: 0.7802; height: 0.3403 mm; left valve, length: 0.7802 mm; height: 0.3569 mm.
Female - Carapace, MP-O-1030; right valve length: 0.7553 mm; height: 0.3237 mm,left valve, length: 0.7553 mm; height: 0.3403 mm.

REMARKS The present species resembles to *C. vandenboldi* sp. nov., but differs by being larger, alar process less prominent, posterior portion in dorsal view steppe-shaped; less developed caudal process; presence of an indenpendent posteroventral node; surface of the carapace punctate and with a delicate reticula; very developed horizontal laminar projection sickle-shaped in the internal anterior margin of the hinge. Central muscle scars more numerous.

MATERIAL The specimens of this species are very scarce.There were found only six carapace and five isolate valves, most of them males.

OCCURRENCE Brazilian Continental Shelf, Leg 7, samples 3920 and 3945.

GEOGRAPHICAL DISTRIBUTION on the Brazilian Coast - Lat. 22°01'S to 22°18'S.

STRATIGRAPHIC DISTRIBUTION - Recent.

*Caudites vandenboldi* Coimbra & Ornellas, sp. nov.
Pl. 3, Fig. 17-31.

Derivatio nominis: in honor of Dr. William van den Bold.
Holotypus: Carapace, M.P., UFRGS, nº MP--O-1031.
Paratypi: Carapace, nº MP-O-1032 to MP-O--1033.
Juvenils instars: Right valves, nº MP-O--1034 to MP-O-1035.
Locus typicus: Southernmost of the Continental Shelf of the Espítito Santo State, sample 3301.
Stratum typicum: Recent.
Juvenile instars: Right valves nº MP-O-1034 and MP-O-1035.

DIAGNOSIS Subrectangular carapace in lateral view. In dorsal view sagitate with elongate and prominent caudal process. Two alar process,the ventral one inflate. Surface with very weak ornamentation and incipient ventrolateral and median ridges. Four secondary fusion areas in the inner lamella, being the median the largest and the most irregular in shape. Laminar process sickle-shaped in the anterior inner margin of the hinge little developed.

DESCRIPTION External view - Subrectangular carapace in lateral view. Clear cardinal angles. Maximus height coincident with the eye tubercle and the anterior cardinal angle region. Right valve presents the dorsal margin straight, anterior margin strongly rounded, almost straight in the limit with the dorsal one; ventral margin sinuous; posterior margin strongly concave in the upper portion and truncate in the lower region with conspicuous caudal process.

Surface with two strong alar processes, a wide ridge little prominent in all free margin and two weak ridges: one vetrolateral; the other median. Intercostal reticulation absent. The ventrolateral and the median ridges rise in the anterior submarginal region. Both converge to the weak subcentral tubercle, after diverge again and end in the apex of the correspondente alar process. The median ridge bifurcate after the mid-length, the weak and lower branch ends in the apex of the ventral alar process. The ventrolateral ridge has the anterior half arched, forming with the ventral ridge a cell scalene shape. There is also a ventral ridge which fusionates anteriorly with the ventrolateral ridge and posteriorly with the correspondent alar process.

The left valve differs from the right by being higher; by presenting a slighter concavity of the posteroventral region; and the posterior cardinal angle less conspicuous. In dorsal view,carapace arrow-shaped and posterioly inflate. It tapers strongly after its last third, forming a well-developed caudal process. Maximum width in the beginning of the last third, coincident with the greater expansion of the ventral alar process and the most inflate region. Internal view - Hinge holamphidont. Right valve with smooth and high anterior tooth; socket stepped shape; smooth groove and lobate posterior tooth. In the anterior inner margin of the hinge there is a small laminar and horizontal projection sickle-shaped. Four areas of secondary fusions in the inner lamella. The dorsal fusion oval; the median larger and with irregular outline by the presence of the normal pore canals, the anteroventral slightly heart-shaped and the ventral one smaller and kidney-shaped. Straight marginal pore canals simple and more numerous in the

anterior region. Line of concrescens and inner margin coincident, except in the anteroventral portion where forms a vestibulum. In the distal portion of the caudal process the selvage separates from the edge, forming a concave region. Central muscle scars hardly seen constituted of three frontal scars followed by a group of seven scars. Left hinge with complementary elements of the right. Secondary fusion areas present variations in size and shape. The median one with more irregular outline. Some specimens present four or five small denticles in the anterodorsal edge, coincident with the area of the anterior elements of the hinge (Pl. 3, Fig. 28). Sexual dimorphism not present.

DIMENSIONS

Holotypus: Carapace, M.P., UFRGS, nº MP-O-1031; right valve, length: 0.6474 mm; height: 0.3320 mm; left valve, length: 0.6474 mm; height: 0.3486 mm.
Paratypi: Carapace, nº MP-O-1032; length: 0.6972 mm, width: 0.2573 mm.
Carapace, nº MP-O-1033; right valve, lenght: 0.5976 mm; height: 0.2905 mm; left valve, length: 0.5976 mm; height: 0.3071 mm.
Juvenile instar: MP-O-1034; right valve, length: 0.4897 mm; height: 0.2490 mm.
Juvenile instar: MP-O-1035; right valve, length: 0.3486 mm; height: 0.1826 mm.

REMARKS The species which present the most similar morphological characteristics to *C. vandenboldi* sp. nov. are *C. alatus* Ohmerti, 1971 and *C. fluminensis* sp. nov. The present species differs from the first mainly by presenting smaller size; little clear ridges, absence of intercostal reticulation; hinge with smooth groove and little number of secondary fusions in the inner lamella. From *C. fluminensis* it differs specially by presenting smaller size; more developed alar process; surface of the valves without puncta or reticula; more elongate caudal process; horizontal laminar projection sickle-shaped in the inner anterior margin of the hinge less developed; and by little number of central muscle scars.

MATERIAL Twenty-one carapace and fifty valves, including juvenile instars.

OCCURRENCE Brazilain Continental Shelf, Leg. 1, sample 3004; Leg. 2, sample 3133; Leg. 3, samples 3215, 3281, 3301, 3311, 3312, 3325, 3352; Leg. 7, samples 3807, 3808, 3811, 3812, 3834, 3906, 3909, 3910, 3912, 3917, 3921, 3923, 3928, 3929, 3939, 3945; GEOMAR VI, sample g-362.

GEOGRAPHICAL DISTRITUTION on the Brazilian Coast - Lat. 15°01'S to 31°06'S.

STRATIGRAPHIC DISTRIBUTION - Recent.

## CONCLUSION

The systematic study of *Caudites* Coryell & Fields, 1937 in the Brazilian Continental Shelf lead to the following coments and conclusions:

- Proposition of a new diagnosis for the genus *Caudites*. Structures presented by all species of the genus, important for its determination like: secondary fusion areas of inner lamella and variation of carapace in size and in shape are included. Some variables characteres, which may or may not present in the species of the genus like: crenulation of the hinge elements, posteroventral vestibulum, carapace with compressed side in lateral view and the strong ridge which runs from the anteroventral angle to the posterodorsal one are excluded.
- A diagnosis to *Caudites nipeensis* Bold, 1946 is proposed. The species is described and illustrated again, because none of all previous consulted papers presents diagnosis, complete description and illustration in detail of their inner and outer structures.
- In the Brazilian Continental Shelf five species of *Caudites* occur: *C. nipeensis* Bold, 1946 and four new species, here described: *C. ohmerti* sp. nov., *C. gnomus* sp. nov., *C. fluminensis* sp. nov. and *C. vandenboldi* sp. nov.
- By the identity of internal and external morphologic characteristics, *Caudites* sp. Bertels,1975 is a synonymous of *Caudites gnomus* sp. nov. and *Caudites* sp. Vicalvi, Kotzian et Forti-Esteves, 1977 is a synonymous of *Caudites ohmerti* sp. nov.

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PLATE 1

Figures 1-24. *Caudites nipeensis* Bold, 1946.

Plesiotypus nº MP-O-1007: 1.LV, lateral view; 2.RV, lateral view.
Plesiotypus nº MP-O-1008: 3. Carapace, dorsal view.
Plesiotypus nº MP-O-1009: 4. LV hinge, dorsal view (approx. 96X); 5. RV, hinge, dorsal view (approx. 95X); 6. LV, posterior marginal pore canals (approx. 84X); 7. LV, anterior marginal pore canals and secondary fusions in the inner lamella (approx. 84X); 8. RV, anterior marginal pore canals and secondary fusions in the inner lamella (approx. 82X); 9. RV, posterior marginal pore canals (146.3X); 10. LV, muscle scars (approx. 82X).
Plesiotypus nº MP-O-1010: 11. RV, in lateral view; 12. RV, ornamentation of anterior portion.
Plesiotypus nº MP-O-1012: 13. LV, hinge, dorsal view (approx. 88X); 14. RV, hinge, dorsal view (approx. 88X).
Plesiotypus nº MP-O-1011: 15. Carapace, anterior end; 16. Carapace, dorsal view.
Plesiotypus nº MP-O-1010: 17. LV, ornamentation of anterior portion; 18. LV, lateral view.
Plesiotypus nº MP-O-1011: 19. Normal pore canal.
Plesiotypus nº MP-O-1010: 20. Muscle scars.
Plesiotypus nº MP-O-1012: 21. RV, anterior marginal pore canals and secondary fusions in the inner lamella (approx. 84X); 22. RV, posterior marginal pore canals (approx. 84X); 23. LV, posterior marginal pore canals (approx. 82X); 24. LV, anterior marginal pore canals and secondary fusion in the inner lamella(approx.82X).

Figures 25-44. *Caudites gnomus* Coimbra et Ornellas, sp. nov.

Holotypus nº MP-O-1022: 25. Female LV, lateral view; 26, Female RV, lateral view.
Paratypus nº MP-O-1023: 27. Female carapace, dorsal view.
Paratypus nº MP-O-1024: 28. Female LV hinge, dorsal view (approx. 84X); 29. Female RV, hinge, dorsal view (approx. 84X).
Holotypus nº MP-O-1022: 30. Female LV, hinge detail.
Paratypus nº MP-O-1024: 31. Female LV, muscle scars (approx. 84X).
Holotypus nº MP-O-1022: 32. Female LV, hinge details.
Paratypus nº MP-O-1026: 33. Male RV, muscle scars.
Paratypus nº MP-O-1024: 34. Female LV, posterior marginal pore canals (approx. 84X); 35. Female LV, anterior marginal pore canals and secondary fusions in the inner lamella (approx. 84X).
Paratypus nº MP-O-1026: 36. Male RV, anterior marginal pore canals and secondary fusions in the inner lamella (approx. 84X); 37. Male RV, posterior marginal pore canals (approx. 84X).
Paratypus nº MP-O-1025: 38. Male, normal pore canal; 39. Male LV, lateral view; 40. Male carapace, dorsal view.
Paratypus nº MP-O-1024: 41. Female RV, anterior marginal pore canals and secondary fusions in the inner lamella (approx. 83X); 42. Female RV, posterior marginal pore canals (approx. 83X).
Paratypus nº MP-O-1026: 43. Male LV, hinge, dorsal view (approx. 93X); 44. Male RV, hinge, dorsal view (approx. 93X).

PLATE 2

Figures 1-33. *Caudites ohmerti* Coimbra et Ornellas sp. nov.

Holotypus nº MP-O-1013: 1. Female LV, lateral view; 2. Female RV, lateral view.
Paratypus nº MP-O-1014: 3. Female carapace, dorsal view.
Paratypus nº MP-O-1015: 4. Female LV hinge, dorsal view (approx. 96X); 5. Female RV, hinge, dorsal view (approx. 96X).
Holotypus nº MP-O-1013: 6. Female RV, hinge detail; 7. Female LV, hinge detail.

Paratypus nº MP-O-1015:8.Female LV, posterior marginal pore canals (approx. 90X); 9. Female LV, anterior marginal pore canals and secondary fusions of the inner lamella (approx. 90X).
Holotypus nº MP-O-1013: 10. Female RV, median posterio vertical branch of t e ventrolateral ridge; 11. Female RV, normal pore canal of the median posterior vertical branch of the ventrolateral ridge; 12. Female RV, hinge detail; 13. Female RV, hinge detail.
Paratypus nº MP-O-1016: 14. Female RV, anterior marginal pore canals and secondary fusions of the inner lamella (approx. 95X); 15. Female RV, posterior marginal pore canals (approx. 95X).
Paratypus nº MP-O-1018; 16. Male RV, muscle scars (approx. 163X).
Paratypus nº MP-O-1016: 17. Male RV, detail of the ventrolateral ridge.
Paratypus nº MP-O-1018: 18. Male LV, posterior marginal pore canals (approx.163X); 19. Male LV, anterior marginal pore canals and secondary fusions of the inner lamella (approx. 88X).
Paratypus nº MP-O-1016: 20. Male LV, lateral view; 21. Male RV, lateral view.
Paratypus nº MP-O-1017: 22. Male carapace, dorsal view.
Paratypus nº MP-O-1018: 23. Male LV, hinge, dorsal view (approx. 103X); 24. Male RV, hinge, dorsal view (approx. 103X); 25. RV, anterior marginal pore canals and secondary fusions of the inner lamella (approx. 81X); 26. Male RV, posterior marginal pore canals (approx. 81X).
Paratypus nº MP-O-1016: 27. Male LV, hinge detail; 28. Male LV, hinge detail; 29. Male RV, hinge detail; 30. Male RV, hinge detail.
Paratypus nº MP-O-1019: 31. Imature instar, RV lateral view.
Paratypus nº MP-O-1020: 32. Imature instar, RV lateral view.
Paratypus nº MP-O-1021: 33. Imature instar, RV lateral view.

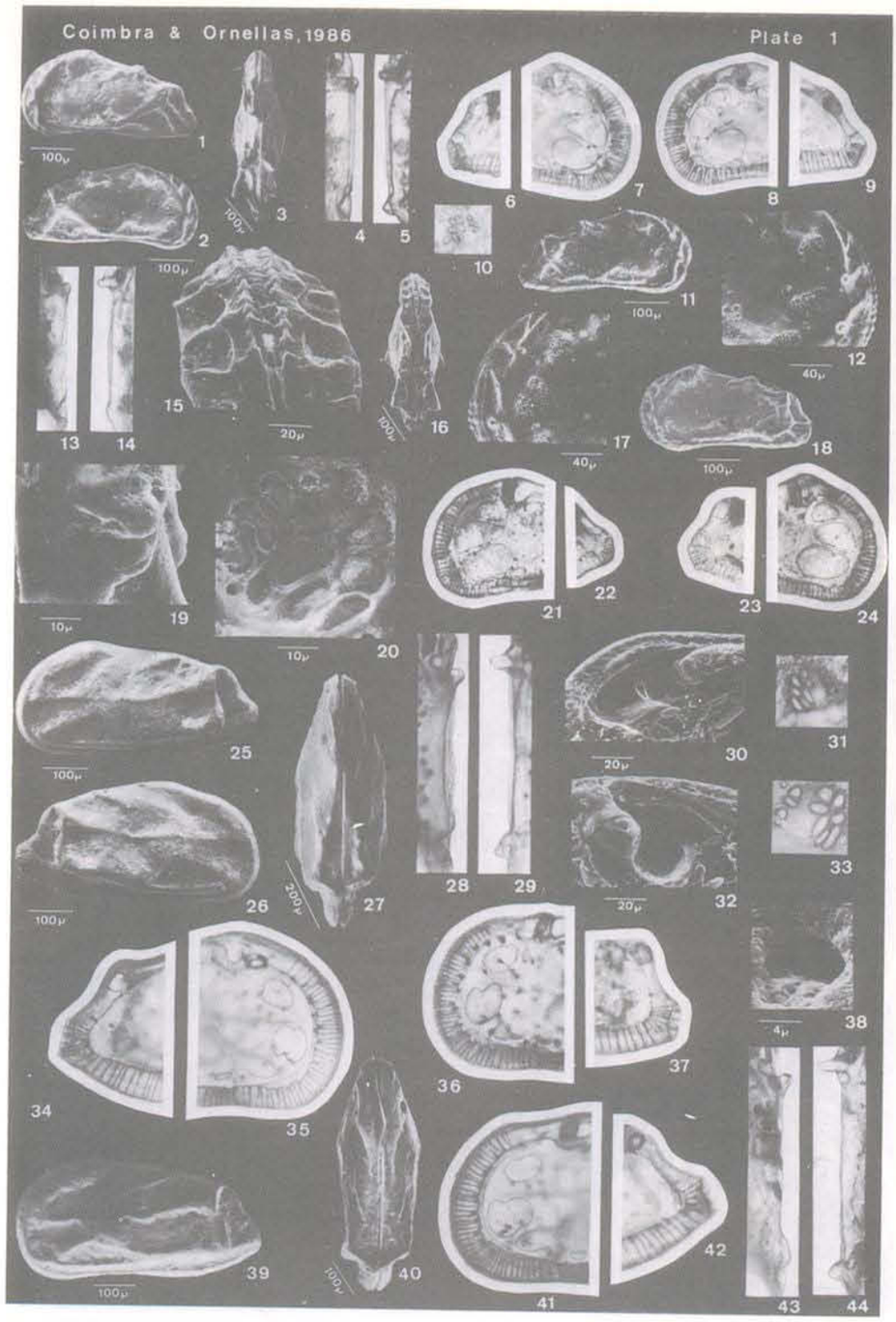
PLATE 3

Figures 1-16. *Caudites fluminensis* Coimbra et Ornellas, sp. nov.

Holotypus nº MP-O-1027: 1. Male LV, lateral view; 2. Male RV, lateral view.
Paratypus nº MP-O-1028: 3. Male carapace, dorsal view.
Paratypus nº MP-O-1029: 4. Male LV, hinge, dorsal view (approx. 98X); 5. Male RV, hinge, dorsal view (approx. 98X).
Holotypus nº MP-O-1027: 6. Male RV, hinge detail; 7. Male RV, hinge detail; 8.Male LV, hinge detail; 9. Male LV, ornamentation of the anterior dorsal region; 10. Male LV, normal pore canals; 11. Male LV, normal pore canal, detail; 12. Male LV, secondary fusions of the inner lamella.
Paratypus nº MP-O-1030: 13. Female LV, muscle scars (approx. 81X).
Paratypus nº MP-O-1029: 14. Male LV, hinge (approx. 97X); 15. Male RV, anterior marginal pore canals and secondary fusions fo the inner lamella (approx. 81X); 16. Male RV, posterior marginal pore canals (approx. 81X).

Figures 17-31. *Caudites vandenboldi* Coimbra et Ornellas, nov. sp.

Paratypus nº MP-O-1032: 17. Carapace, dorsal view.
Holotypus nº MP-O-1031: 18. LV, lateral view; 19. RV, lateral view.
Paratypus nº MP-O-1033: 20. LV, posterior marginal pore canals (approx. 86X); 21. LV, anterior marginal pore canals and secondary fusion in the inner lamella (approx. 86X); 22. RV, anterior marginal pore canals and secondary fusion in the inner lamella (approx. 82X); 23. RV, posterior marginal pore canals; 24. LV,muscle scars (approx. 82X); 25. LV, hinge, dorsal view (approx. 90X); 26. RV, hinge, dorsal view (approx. 90X).
Holotypus nº MP-O-1031; 27. RV, hinge detail; 28. LV, hinge detail; 29. RV, hinge detail. Paratypus nº MP-O-1034; 30. RV, imature instar.
Paratypus nº MP-O-1035: 31. RV, imature instar.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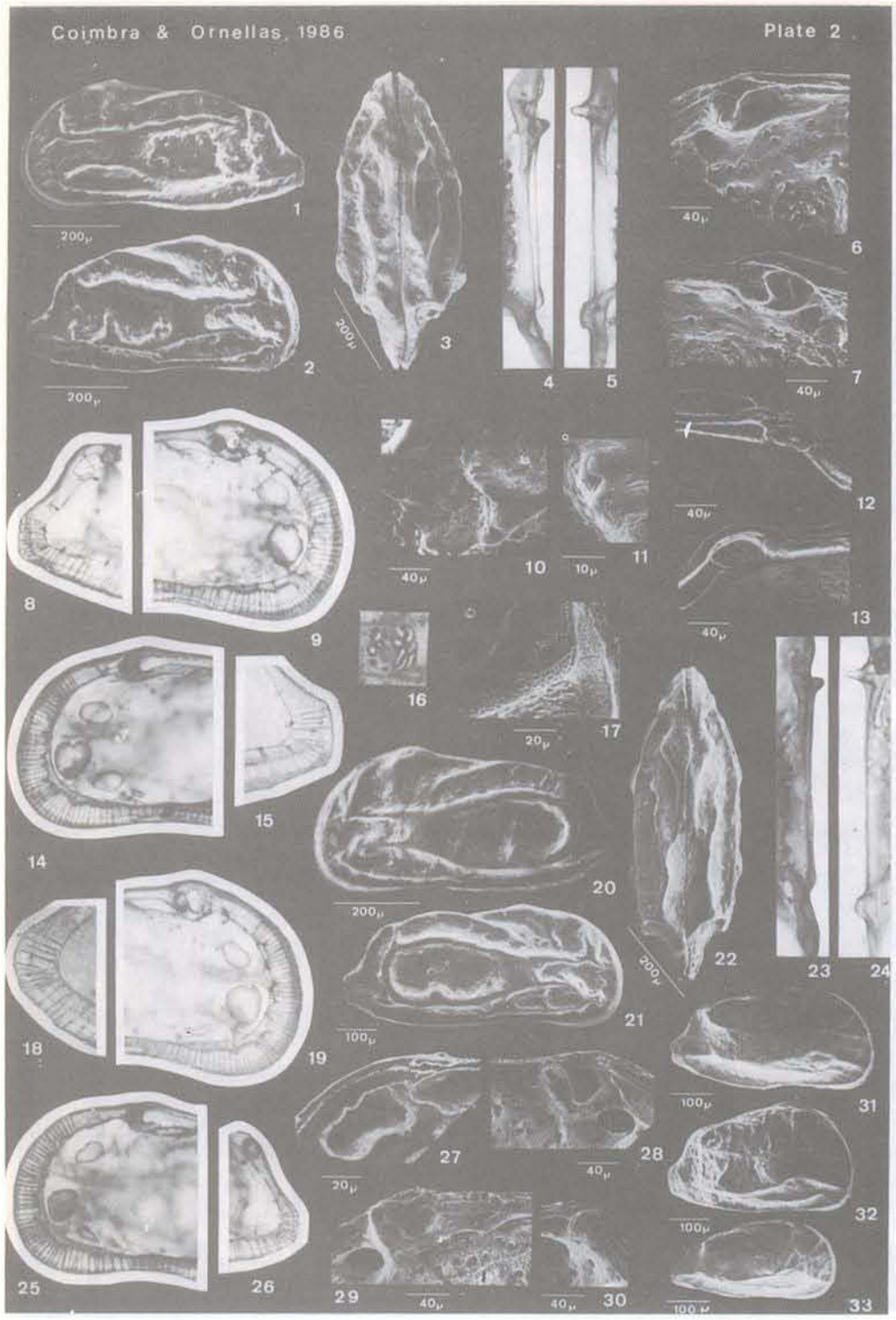
Coimbra & Ornellas, 1986
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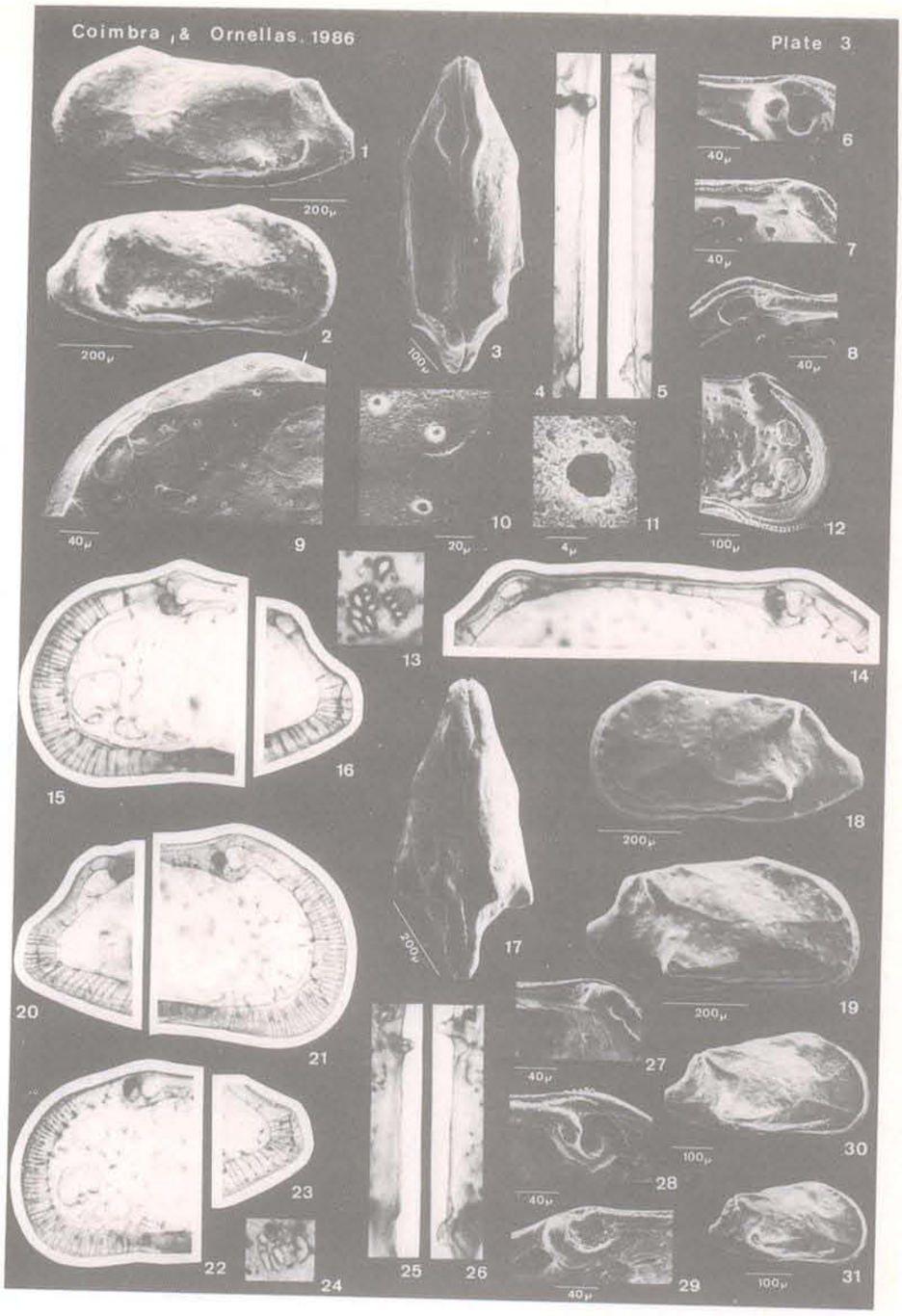
Coimbra & Ornellas, 1986
Plate 3
1
200µ
2
200µ
3
100µ
4
5
6
40µ
7
40µ
8
40µ
9
40µ
10
20µ
11
4µ
12
100µ
13
14
15
16
17
200µ
18
200µ
19
200µ
20
21
22
23
24
25
26
27
40µ
28
40µ
29
40µ
30
100µ
31
100µ