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RECENT BIVALVES (PALAEOTAXODONTA AND
PTERIOMORPHIA) FROM THE BRAZILIAN
CONTINENTAL SHELF

IÊDA REGINA FORTI ESTEVES*

SINOPSE

Pelecípodos recentes das Subclasses Palaeotaxodonta e Pteriomorphia são aqui estudados. O material, coletado durante o Projeto REMAC, abrange amostras ao longo da Plataforma Continental brasileira, coordenadas 34°04'S — 34°31'W a 05°04'N — 52°57'W. Sessenta e seis espécies foram identificadas, sendo cinco descritas como novas. Vinte e duas são características da Província Caribeana, três da Província Argentina e quarenta e uma são formas euritermais de ampla distribuição geográfica. A distribuição batimétrica mostra nove espécies restritas à Plataforma Interna, duas de Plataforma Média, duas de Plataforma Externa; as demais não indicaram profundidade, ocorrendo por toda Plataforma. A distribuição estratigráfica mostrou que 43,44% das espécies surgiram no Terciário (Mioceno ou Plioceno) e 56,35% são de origem Quaternária (Pleistoceno, Holoceno/Recente).

ABSTRACT

Recent pelecypods from the Palaeotaxodonta and Pteriomorphia Subclasses are here studied. The material, collected during the REMAC Project, comprises samples from the Brazilian Continental Shelf between the coordinates 34°04'S — 34°31'W to 05°04'N — 52°57'W. Sixty six species were identified. Five are here described as new. Twenty two are typical from the Caribbean Province, three from the Argentinian Province and forty one are interpreted as eurythermal forms of wider geographic distribution.

The depth distribution showed nine species restricted to the Inner Shelf, two for the intermediate, two for the Outer Shelf and the remaining have not showed characteristics from any depth zone. The geologic range showed that 43,44% of the species are originated on Tertiary (Miocene, Pliocene) and 56,35% are Quaternary (Pleistocene, Holocene/Recent).

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INTRODUCTION

This paper includes the study of microbivalves of the Subclasses Palaeotaxodonta and Pteriomorpha, represented by small forms which are nepionic shells of larger species as well adults of species that attain only a small size (about 10mm in the largest one.).

The material was extracted from 317 sedimentological samples collected during the REMAC Project (1972-73) for the global recognition of the Brazilian Continental Shelf supported by the Petróleo Brasileiro S/A (PETROBRÁS), Departamento de Hidrografia Nacional (DHN) e Divisão Nacional de Produção Mineral (DNPM), together with Wood Hole Oceanographic Institution (WHOI).

Seven dredgings legs were studied:

- leg 1 and 2 — station nº 3001 to 3225 (Rio Grande do Sul to São Paulo State).
- leg 3 — station nº 3226 to 3359 (São Paulo to Bahia State).
- leg 4 — station nº 3360 to 3411 (Bahia to Ceará State).
- leg 5 — station nº 3412 to 3537 (Ceará to Amapá State).
- leg 5 a — station nº 3538 to 3590 (Pará State).
- leg 6 — station nº 3591 to 3757 (Pará to Pernambuco State).
- leg 7 — station nº 3758 to 3964 (Pernambuco to Rio de Janeiro State).

The station numbers plotted on the maps (2, 3, 4, 5) indicate the place where any mollusks were found. The graphs showing the species occurrence (tab. 1, 2, 3, 4, 5) have station numbers only where species of Palaeotaxodonta and/or Pteriomorpha occurred. Table 7 indicates the stratigraphic occurrence for only fifty five classified species, excluding the new ones and the undetermined species listed only as genus.

The material are deposited on the collections of the Departamento de Paleontologia e Estratigrafia do Instituto de Geociências da Universidade Federal do Rio Grande do Sul, beneath the numbers MP-M 6287 to MP-M 6352. The systematic order of the species follow that proposed in Treatise on Invertebrate Paleontology Part N. Bivalvia.

BIOGEOGRAPHICAL DISTRIBUTION

In the study the area of the Brazilian Continental Shelf is divided in to a northern tropical to subtropical province (North Brazilian Subprovince) and a southern temperate to cool water province (South Brazilian Subprovince). The boundaries dividing zoogeographical units based on mollusks and foraminifera (Boltovskoy, 1976) coincide in the main.

According this author, the line between the subprovinces is off Cabo Frio in Rio de Janeiro, approximately at latitude 23°S where occur differences in the water masses on the coast. On the bottom the last remnants of the cold Malvin cur-

rent waters reach up to Cabo Frio. In this area upwellings are observed and the Malvin current waters (certainly mixed with the Brazilian ones) can be found even at the surface.

In this work the northern warm waters fauna are represented in the collections made during legs 3, 4, 5, 5a, 6, 7. In southern cool faunas are represented in the collections made during legs 1, 2 and a small part of 3.

The following 22 species are characteristic of the northern tropical to subtropical province: *Nucula (Nucula) brasiliana* n. sp., *Nucula (Nucula)* aff. *N. crenulata*, *Nucula (Leionucula)* sp. b, *Nuculana (Saccella) acuta*, *Nuculana (Saccella)* sp. cf. *N. acuta*, *Nuculana (Saccella) concentrica*, *Arca (Arca) zebra*, *Barbatia (Barbatia) cancellaria*, *Arcopsis adamsi*, *Limopsis (Pectunculina) antillensis*, *Glycymeris (Glycymeris) tellinaeformis*, *Glycymeris (Glycymerella) decussata*, *Nucinella serrei*, *Cosa caribaea*, *Dacrydium vitreum*, *Propeamussium* sp., *Chlamys (Chlamys) benedicti*, ? *Hinnites* sp., *Dimya* cf. *D. argentea*, *Dimya acuminata*, *Anomia simplex*, *Ctenoides (Ctenoides) floridiana*. Only three species are restricted to the southern province: *Nucula (Leionucula)* sp. a, *Nuculana (Propeleda) fortiana* n. sp., *Yoldia (yoldia) riograndensis* n. sp. Forty-one species have a wide geographic distribution and for this reason representing eurythermal forms. They are: *Nucula (Nucula) semiornata*, *Nucula (Leionucula) puelcha*, *Nuculana (Saccella) larranagai*, *Adrana patagonica*, *Arca (Arca) imbricata*, *Barbatia (Barbatia) candida*, *Barbatia (Acar) domingensis*, *Anadara (Lunarca) ovalis*, *Anadara (Caloosarca) notabilis*, *Scapharca (Cunearca) chemnitzii*, *Noetia (Eontia) bisulcata*, *Limopsis (Limopsis) janeiroensis*, *Limopsis (Pectunculina) davinae* n. sp., *Glycymeris (Glycymeris) longior*, *Glycymeris (Tucetona) pectinata*, *Cosa brasiliensis*, *Brachidontes (Hormomya) domingensis*, *Crenella divaricata*, *Gregariella coralliophaga*, *Lioberus castaneus*, *Musculus (Ryenella) lateralis*, *Modiolus* sp., *Atrina (Servatrina) seminuda*, *Pteria colymbus*, *Propeamussium pourtalesianum*, *Cyclopecten (Cyclopecten) nanus*, *Palliolum reticulum*, *Chlamys (Chlamys) tehuelchus*, *Argopecten gibbus*, *Leptopecten bavayi*, *Lyropecten (Nodipecten) nodosus*, *Pecten (Euvola) ziczac*, *Plicatula gibbosa*, *Lima (Lima) cf. L. caribaea*, *Lima (Limaria) pellucida*, *Lima (Limaria) cf. L. thrypica*, *Limatula cf. L. hendersoni*, *Limea bronniana*, *Crassostrea rhizophorae*, *Ostrea puelchana*, *Ostrea equestris*.

BATHYMETRICAL DISTRIBUTION

To give a more precise idea of the bathymetric distribution of the organisms three depth zones are arbitrarily delimited.

- 1 — Species restricted to the inner shallow water depth zone (0-50 meters).
- 2 — Species restricted to intermediate depth (51-100 meters).
- 3 — Species restricted to the outer depth zone (101 to more than 150 meters).

The bathymetric distribution of the species, here given, is supplemented by data provided by Rios (1975), table 6.

Since the majority of specimens are represented by dead organisms with separated valves, their probable transportation from the original site of deposition must be recognized; for this reason ecological inferences are given in general sense.

Of the 22 species present in warm waters (Northern tropical to subtropical Province), listed in the chapter of Zoogeographical Distribution, six are restricted to the inner depth zone. These are: *Nucula (Nucula) brasiliana* n. sp., *Nuculana (Saccella)* sp. cf. *acuta*, *Cosa caribaea*, *Propeamussium* sp., ? *Hinnites* sp., *Anomia simplex*. Seven occur in the inner and intermediate depth zones: *Nucula (Nucula)* aff., *N. crenulata*, *Nuculana (Saccella) concentrica*, *Arcopsis adamsi*, *Glycymeris (Glycymeris) tellinaeformis*, *Glycymeris (Glycymerella) decussata*, *Nucinella serrei*, *Chlamys (Chlamys) benedicti*. Two are restricted to the intermediate zone: *Nucula (Leionucula)* sp. b, *Dimya acuminata* n. sp. One occurs only in the intermediate and outer depth zones: *Dimya* cf. *D. argentea*. Six presented a widely bathymetric distribution: *Nuculana (Saccella) acuta (Area) zebra*, *Barbatia (Barbatia) cancelaria*, *Limopsis (Pectunculina) antillensis*, *Dacrydium vitreum*, *Ctenoides (Ctenoides) floridana*.

Of the three species present only in cool waters, two are restricted to the depth zone: *Nucula (Leionucula)* sp. a, *Yoldia (Yoldia) riograndensis* n. sp. One is restricted to the intermediate and outer depth zones: *Nuculana (Propeleda) fortiana* n. sp.

Of the forty — one species common to both northern and southern subprovince, three are restricted to the inner depth zone: *Brachidontes (Hormomya) domingensis*, *Lioberus castaneus*, *Crassostrea rhizophorae*. Ten occur in the inner and intermediate depth zones: *Arca (Arca) imbricata*, *Anadara (Lunarca) ovalis*, *Scapharca (Cunearca) chemnitzii*, *Noetia (Eontia) bisulcata*, *Musculus (Ryenella) lateralis*, *Atrina (Servatrina) seminuda*, *Argopecten gibbus*, *Pecten (Euvola) ziczac*, *Lima (Limaria) pellucida*, *Plicatula gibbosa*. One is restricted to the intermediate and outer depth zones: *Modiolus* sp. Twenty-eight are widely distributed: *Nucula (Nucula) semiornata*, *Nucula (Leionucula) puelcha*, *Nuculana (Saccella) larranagai*, *Adrana patagonica*, *Barbatia (Barbatia) candida*, *Barbatia (Acar) domingensis*, *Anadara (Caloosarca) notabilis*, *Limopsis (Limopsis) janeiroensis*, *Limopsis (Pectunculina) davinae* n. sp., *Glycymeris (Glycymeris) longior*, *Glycymeris (Tucetona) pectinata*, *Cosa brasiliensis*, *Crenella divaricata*, *Gregariella coralliophaga*, *Pteria colymbus*, *Propeamussium pourtalesianum*, *Cyclopecten (Cyclopecten) nanus*, *Palliolum reticulum*, *Chlamys (Chlamys) tehuelchus*, *Leptopecten bavayi*, *Lyropecten (Nodipecten) nodosus*, *Plicatula gibbosa*, *Lima (Lima)* cf. *L. caribaea*, *Lima (Limaria)* cf. *L. thryptica*, *Limatula* cf. *L. hendersoni*, *Limea bronniana*, *Ostrea puelchana*, *Ostrea equestris*.

ECOLOGICAL INFERENCES

The great majority of the Palaeotaxodonta and Pteriomorphia specimens were found as disarticulated valves with a few articulated and other fragmented. They

belong to a life assemblage of organisms that were disarticulated after death by transport of currents. Although the transport action was not far for the majority of specimens, as evidenced by the approximately equal number of right and left valves found for each species, nevertheless it should be said that for a few species the presence of only single valves or fragments indicates a longer transport, not representing the real substrate and depth in which the species concerned lived. These are: *Nucula* sp. a, *Nucula* sp. b, *Cosa caribaea*, *Modiolous* sp., *Propeamussium pourtalesianum*, *Propeamussium* sp., *Chlamys* (*Chlamys*) *tehuelchus*, *Argopecten gibbus*, *Lyropecten* (*Nodipecten*) *nodosus*, *Hinnites* sp., *Pecten* (*Euvola*) *ziczac*, *Plicatula gibbosa*, *Dimya* cf. *D. argentea*, *Dimya acuminata* n. sp., *Anomia simplex*.

Comparative study of sediment type where the majority of the present valves occur, with that of the same species by Stanley (1970) and by Rios (1975), confirms the similarity of substrates. Species of warm water (tropical, subtropical) and some eurythermal forms are associated with biodetritic and calcareous organic sediments, composed of broken corals, calcareous algae and sand. These are: *Arca* (*Arca*) *zebra*, *Arca* (*Arca*) *impricata*, *Barbatia* (*Barbatia*) *candida*, *Barbatia* (*Acar*) *domingensis*, *Noetia* (*Eontia*) *bisulcata*, *Arcopsis adamsi*, *Limopsis* (*Pectunculina*) *antillensis*, *Limopsis* (*Pectunculina*) *davinae* n. sp., *Glycymeris* (*Glycymeris*) *tellinaeformis*, *Glycymeris* (*Tucetona*) *pectinata*, *Cosa brasiliensis*, *Crenella divaricata*, *Gregariella coralliophaga*, *Musculus* (*Ryenella*) *lateralis*, *Dacrydium vitreum*, *Cyclopecten* (*Cyclopecten*) *nanus*, *Chlamys* (*Chlamys*) *benedicti*, *Lima* (*Lima*) cf. *L. caribaea*, *Lima* (*Limaria*) *pellucida*, *Lima* (*Limaria*) cf. *L. thryptica*, *Ctenoides* (*Ctenoides*) *floridana*, *Limatula* cf. *L. hendersoni*, *Limea bronniana*, *Crassostrea rhizophorae*.

The species of temperate waters require sand or muddy sand, with fragments of shells: *Nucula* (*Nucula*) *brasiliensis* n. sp., *Nucula* (*Nucula*) *semiornata*, *Nucula* (*Nucula*) aff. *N. crenulata*, *Nucula* (*Leionucula*) *puelcha*, *Nuculana* (*Sacculina*) *larranaçai*, *Nuculana* (*Sacculina*) *acuta*, *Nuculana* (*Sacculina*) sp. cf. *N. acuta*, *Nuculana* (*Sacculina*) *concentrica*, *Nuculana* (*Propeleda*) *fortiana* n. sp., *Adrana patagonica*, *Yoldia* (*Yoldia*) *riograndensis* n. sp., *Barbatia* (*Barbatia*) *cancellaria*, *Anadara* (*Caloosarca*) *notabilis*, *Scapharca* (*Cunearca*) *chemnitzii*, *Limopsis* (*Limopsis*) *janei-roensis*, *Glycymeris* (*Glycymeris*) *longior*, *Glycymeris* (*Glycymerella*) *decussata*, *Nucinella serrei*, *Brachiodontes* (*Hormomya*) *domingensis*, *Lioberus castaneus*, *Atrina* (*Servatrina*) *seminuda*, *Pteria colymbus*, *Palliolium reticulum*, *Leptopecten barayi*, *Ostrea* (*Ostrea*) *puelchana*, *Ostrea equestris*.

TAXONOMIC DIVERSITY AND GEOLOGICAL DISTRIBUTION

Comparing the species from the Brazilian coast with the faunas of the Southeast Australia (Cotton, 1961), and New Zealand (Fleming, 1966; Dell, 1955) there is no similarity at the species level. A few specimens represented by *Arca* (*Arca*) *imbricata*, *Arcopsis adamsi* and *Pteria colymbus* are common to the Eastern and

Western Atlantic, i.e., Africa and Brazil (Ihering, 1907). All three species are known since the Miocene in the Florida and Caribbean zone, migrating to eastern South America and West Africa in that time. Other that occur along the eastern Pacific and Western Atlantic (Weisbord, 1964) are: *Crenella divaricata*, *Gregariella coralliphaga*, *Chlamys (Chlamys) tehuelchus*. The first two species are known in the Tertiary of the Northern hemisphere from the Atlantic coast of North America, migrating to the east Pacific before the close of the Panama Isthmus near the end of the Tertiary, and also to the Southern hemisphere along the Brazilian coast. *Chlamys (C.) tehuelchus* first occurs in the Pleistocene of Argentina (Camacho, 1966). As species of colder waters it only reaches the southern part of Brazil. All the others species mentioned in the present study are restricted of the west Atlantic coast, representing species of Tertiary, Quaternary/Recent origin (table 7).

SISTEMATICS OF THE NEW SPECIES

Class PELECYPODA
Subclass PALAETAXODONTA
Order NUCULOIDA
Superfamily NUCULACEA
Family NUCULIDAE
Genus *Nucula* Gray, 1824
Subgenus *Nucula* s.s.

Nucula (Nucula) brasiliiana n.sp.

Plate 1, figs. 1-3

Description: Shell very small, ovately triangular in outline with length and height approximately equal, anterior and posterior margins rounded; exterior ivory in color, smooth except for the exceedingly fine radial threads that are more strongly developed toward the ventral margin; interior slightly nacreous with crenulated margins; hinge with well developed semicircular resilifer between four posterior and seven anterior, chevron shaped teeth.

Dimensions of Holotype: right valve — length 1.5mm;
height 1.4mm;
Station 3359; MP-M 6287a

Paratype: left valve — length 1.6mm;
height 1.5mm;
Station 3359; MP-M 6287b

Remarks: *Nucula (Nucula) brasiliiana* n.sp., is referred to *Nucula* s.s. because of its radial ornament and internally crenulated margin; its ovately triangular shape, small size and absence of concentric ribs differentiate it from the known forms *Nucula (Nucula) semiornata* d'Orbigny and *Nucula (Nucula) crenulata* A. Adams.

Substratum: soft mud with biodebris

Depth: 20-46 meters; restricted to the inner depth zone of the Continental Shelf.

Geographical Distribution: Brazilian coast — Sergipe and Bahia States.
Stations: 3351 (20m), 3358 (55m) and 3374 (36-46m).
Number of valves: six right and four left.

Superfamily NUCULANACEA

Family NUCULANIDAE

Genus *Nuculana* Link, 1807

Subgenus *Propeleda* Iredale, 1924

Nuculana (Propeleda) fortiana n.sp.

Plate 3, figs.23-26

Description: Shell elongate, with anteriorly located umbo marked only by fine irregular growth lines, which are more visible ventrally; periostracum yellow-brownish; the short anterior margin regularly rounded, the posterior margin elongate, dorsally concave and rostrate; posterior end truncated. Hinge marked by an elongate resilifer with 13 anterior and 30 posterior small teeth. The posterior rostrum reflected internally by elongate rib.

Dimensions of Holotype: right valve — length 13.3mm;
height 5.0mm;
Station 3121; MP-M 6297a
Paratype: left valve — length 12.6mm;
height 5.2mm;
Station 3154; MP-M 6297b

Remarks: This species represents the first record of the occurrence of the subgenus *Propeleda* from the southern Brazil. Rios (1974) considers it as a genus and listed *Propeleda platessa* Dall as occurring in Amapá State. *Nuculana (Propeleda) fortiana* differs from *platessa* by its longer size and more elongate posterior end with the dorsal margin concave. The name *fortiana* is in honor of my father Aglimério Souza Forti.

Substratum: muddy sand with biotritus; biotrititic mud; hemipelagic silt.

Depth: 52-158 meters; intermediate and outer depth zone of the Continental Shelf.

Geographic Distribution: Brazilian Coast — Rio Grande do Sul to Rio de Janeiro State.

Stations: 3120 (135m), 3121 (138m), 3122 (131m), 3123 (120m), 3132 (121m), 3154 (114m), 3193 (98m), 3232 (152m), 3237 (84m), 3242 (106m), 3251 (11m), 3293 (95m).

Numbers of valves: nine right and twelve left valves.

Genus *Yoldia* Möller, 1842

Subgenus *Yoldia* s.s.

Yoldia (Yoldia) riograndensis n.sp.

Plate 3, figs.28-31

Description: Shell elongate, posterior end pointed, the anterior rounded; umbo prominent near the anterior end; exterior yellowish in color, smooth dorsally and concentrically ribbed ventrally; the ribs narrow and separated by interspaces of twice

their width, becoming progressively narrow in the ventral border as the shell grows; internally the resilifer is triangular separating 10 to 11 anterior and 14 to 17 posterior chevronshaped teeth; pallial sinus V-shaped

Dimensions of Holotype: right valve — length 4.0mm;
height 2.5mm;
Station 3132; MP-M 6299a

Paratype: left valve — length 3.4mm;
height 2.2mm;
Station 3134; MP-M 6299b

Remarks: This new species differs from the two species previously reported (Rios, 1975) occurring off the Brazilian coast, *Y. scapania* Dall and *Y. crosbyana* (Guppy), by its small size and acute posterior end. The name *riograndensis* reference to its occurrence in the southern region of Brazil.

Substratum: muddy sand with biodetritus; silty clay with biodetritus.

Depth: 111-153 meters; restricted to the outer depth zone of the Continental Shelf.

Geographic Distribution: Brazilian Coast — Rio Grande do Sul to São Paulo State.

Stations: 3122 (131m), 3132 (121m), 3134 (153m), 3231 (130m), 3238 (137m), 325 (111m).

Numbers of valves: eleven right and ten left valves.

Subclass PTERIOMORPHIA
Order ARCOIDA
Superfamily LIMOPSACEA
Family LIMOPSIDAE
Genus *Limopsis* Sassi, 1827
Subgenus *Pectunculina* d'Orbigny, 1843
Limopsis (Pectunculina) davinae n.sp.
Plate 5, figs.50-53

Description: Shell small, higher than long; umbo prosogyrous; periostracum yellowish giving an ivory color to the shell; externaly ornamented with regular fine concentric ribs, crossed by fine radial ribs separated by narrow, linear interspaces giving a crenulate appearance to the shell; posterior side straight dorsally and a little convex ventrally, anterior side rostrate; internally the hinge with a triangular resilifer surrounded by three anterior and three posterior teeth; valve internally striated with two or three stronger internal ribs in the rostrum position and with crenulated ventral margin.

Dimensions of Holotype: right valve — length 2.92mm;
height 3.24mm;
Station 3261; MP-M 6312a

Paratype: left valve — length 2.40mm;
height 2.72mm;
Station 3233; MP-M 6312b

Remarks: This new species is distinguished by the less inflated appearance of the shell; by its regularly distributed concentric and radial ribs, with the radial ones abundant and closely adjacent to each other; by its relatively straight posterior margin and greater relative height, differing in these aspects from *L. antillensis* Dall which is more globose, with fewer and more widely separated radial ribs. The protoconch is pink in color in the young specimens and whitish in the adult ones. The name is in honour of a friend called Davina.

Substratum: calcareous sand; hemipelagic sand and mud.

Depth: 64-158 meters; common in the outer depth zone of the Continental Shelf.

Geographical Distribution: Brazilian coast — Rio de Janeiro, São Paulo and Rio Grande do Sul States.

Stations: 3121 (138m), 3145 (158m), 3195 (116m), 3233 (126m), 3239 (150m), 3240 (155m), 3241 (115m), 3290 (80m), 3261 (91m), 3262 (130m), 3263 (101m), 3266 (124m), 3291 (140m), 3295 (64m).

Number of valves: fifty four right and fifty eight left valves.

Superfamily PECTINACEA

Family DIMYIDAE

Genus *Dimya* Rouault, 1850

Dimya acuminata n.sp.

Plate 9, figs.99-100

Description: Left valve elongate; angulate above the resilial pit, becoming enlarged ventrally; hinge line not auriculate, with an internal alivincular resilifer; inner margin bordered by small radial grooves outside the pallial line a low narrow ridge developing as two crurae bordering the resilifer. Interior of valve porcellaneous; anterior muscle scar small and oval in shape, posterior scar larger and bilobate. Surface irregular reflecting the attached life habitat.

Dimensions of Holotype: right valve — length 17.6mm;
height 21.3mm;
Station 3877; MP-M 6342a

Paratype: left valve — length 10.5mm;
height 21.3mm;
Station 3339; MP-M 6342b

Remarks: This new species differs from *D. argentea* Dall, by its larger size and acuminate shape.

Substratum: calcareous algae; calcareous sand and gravel.

Depth: 54-79 meters; intermediate depth zone of the Continental Shelf.

Geographical Distribution: Brazilian coast — Bahia and Espírito Santo States.

Stations: 3339 (54m), 3877 (79m).

Number of valves: two left valves.

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PLATE I

- Fig. 1 — 3 *Nucula (Nucula) brasiliana*, n.sp. — left valve (1, 2), ext. view. X 27; int. view. X 22; right valve (3), ext. view. X 31 — MP-M 6287
- 4 — 5 *Nucula (Nucula) semiornata* — right valve, ext. view. X 10; int. view. X 11.5 — MP-M 6288
- 6 — 9 *Nucula (Nucula) aff. N. crenulata* — right (6,9) and left valve (7,8), ext. and int. view. X 10 — MP-M 6289
- 10 — 11 *Nucula (Leionucula) puelcha* — right valve, ext. and int. view. X 7 — MP-M 6290

PLATE 2

- Fig. 12 — 13 *Nucula (Leionucula) sp.a* — right valve (12), ext. view. X 23.5; left valve (13), ext. view. X 18.5 — MP-M 6291

- 14 *Nucula (Leionucula) sp.b* — right valve, ext. view.X 25 — MP-M 6292
- 15 — 16 *Nucula (Saccella) larranagai* — left (15) and right valve (16), ext. viewX 8.5 — MP-M 6293
- 17 — 18 *Nuculana (Saccella) acuta* — left valve, ext. and int. view.X 9 — MP-M 6294
- 19 — 21 *Nuculana (Saccella) sp.cf. N. acuta* — right valve (19,20), ext. and int. view.X 6.5; left valve (21), ext. view.X 6.5 — MP-M 6295
- 22 *Nuculana (Saccella) concentrica* — right valve, ext. view.X 8 — MP-M 6296

PLATE 3

- Fig. 23 — 26 *Nuculana (Propeleda) fortiana* n.sp. — right valve (23,24), ext. viewX 5; int. view.X 4; left valve (25,26), ext. and int. view.X 4 — MP-M 6297
- 27 *Adrana patagonica* — right valve, ext. view.X 10 — MP-M 6298
- 28 — 31 *Yoldia (Yoldia) riograndensis* n.sp. — right valve (28,29), ext. and int. view.X 13; left valve (30,31), ext. and int. view.X 12 — MP-M 6299

PLATE 4

- Fig. 32 *Arca (Arca) zebra* — right valve, ext. view.X 15 — MP-M 6300
- 33 — 34 *Arca (Arca) imbricata* — right valve, ext. and int. view.X 8.5 — MP-M 6301
- 35 — 36 *Barbatia (Barbatia) cancellaria* — right valve, ext. and int. view.X 7.5 — MP-M 6302
- 37 — 38 *Barbatia (Barbatia) candida* — left valve, ext. view.X 5; int. view.X 6 — MP-M 6303
- 39 *Barbatia (Acar) domingensis* — left valve, ext. view.X 18 — MP-M 6304
- 40 *Anadara (Lunurca) ovalis* — left valve, ext. view.X 12 — MP-M 6305
- 41 *Anadara (Caloosarca) notabilis* — left valve, ext. view.X 15 — MP-M 6306
- 42 — 43 *Scapharca (Cunearca) chemnitzii* — right valve, ext. and int. view.X 1 — MP-M 6307

PLATE 5

- Fig. 44 *Noentia (Eontia) bisulcata* — left valve, ext. view.X 8 — MP-M 6308
- 45 *Arcopsis adamsi* — left valve, ext. view.X 7 — MP-M 6309
- 46 — 47 *Limopsis (Limopsis) janeiroensis* — left valve, ext. view.X 2; int. view.X 2.5 — MP-M 6310
- 48 — 49 *Limopsis (Pectunculina) antillensis* — right valve, ext. view.X 18; int. view.X 17 — MP-M 6311
- 50 — 53 *Limopsis (Pectunculina) davinae* n.sp. — right valve (50,51), ext. and int. view.X 14; left valve (52,53), ext. and int. view.X 15.5 — MP-M 6312
- 54 — 55 *Glycymeris (Glycymeris) longior* — right valve (54), ext. view.X 4.5; left valve (55), ext. view.X 6 — MP-M 6313

PLATE 6

- Fig. 56 — 57 *Glycymeris (Glycymerella) decussata* — left valve, ext. view.X 13; int. view.X 8.5 — MP-M 6314
- 58 — 62 *Glycymeris (Glycymeris) tellinaeformis* — left valve (58,59), ext. and int. view.X 17; right valve (60), ext. view.X 14 — MP-M 6315; fragmented valve (61,62), ext. and int. view.X 6 MP-M 6316
- 63 — 64 *Glycymeris (Tucetona) pectinata* — right valve, ext and int. view.X 8 — MP-M 6317
- 65 — 66 *Nucinella serrei* — left valve, ext. view.X 23; int. view.X 20 — MP-M 6318

PLATE 7

- Fig. 67 *Cosa brasiliensis* — left valve, ext. view.X 22 — MP-M 6319
- 68 *Cosa caribaea* — left valve, ext. view.X 31 — MP-M 6320
- 69 *Brachidontes (Hormomya) domingensis* — left valve, ext view.X 20 — MP-M 6321
- 70 *Crenella divaricata* — left valve, ext. view.X 36 — MP-M 6322
- 71 *Gregariella coralliophaga* — left valve, ext. view.X 40 — MP-M 6323
- 72 *Lioberus castaneus* — right valve, ext. view.X 29 — MP-M 6324
- 73 *Musculus (Tyenella) lateralis* — left valve.X 25 — MP-M 6325
- 74 — 75 *Dacrydium vitreum* — right valve (74), ext. view.X 21; left valve (75), ext. view.X 21 — MP-M 6326

- 76 *Atrina (Servatrina) seminuda* — fragments, ext. view.X 1 — MP-M 6327
 77 *Pteria colymbus* — right valve, ext. view.X 10 — MP-M 6328

PLATE 8

- Fig. 78 — 79 *Propeamussium pourtalesianum* — left valve, ext. and int. view.X 4 — MP-M 6329
 80 *Propeamussium* sp. — fragment, ext. view.X 22 — MP-M 6330
 81 — 82 *Cyclopecten (Cyclopecten) nanus* — right valve, ext. view.X 18.5; int. view.X 21 — MP-M 6331
 83 — 84 *Palliolum reticulum* — left valve (83), ext. view.X 6.5; right valve (84), int. view.X 15 — MP-M 6332
 85 *Chlamys (Chlamys) tehuelchus* — fragment, ext. view.X 1.5 — MP-M 6333
 86 *Chlamys (Chlamys) benedicti* — left valve, ext. view.X 4 — MP-M 6334
 87 *Argopecten gibbus* — fragment, ext. view.X 4 — MP-M 6335
 88 *Leptopecten bavayi* — left valve, ext. view.X 9 — MP-M 6336

PLATE 9

- Fig. 89 *Lyropecten (Nodipecten) nodosus* — fragments, ext. view.X 4 — MP-M 6337
 90 ? *Hinnites* sp. — left valve, ext. view.X 8 — MP-M 6338
 91 — 92 *Pecten (Euvola) ziczac* — right valve (91), ext. view.X 3.5; left valve (fragment), ext. view.X 4 — MP-M 6339
 93 — 94 *Plicatula gibbosa* — right valve (93) and left valve (94), ext. and int. view.X 2 — MP-M 6340
 95 — 98 *Dimya* cf. *D. argentea* — two left valves, ext. and int. view.X 8.5 and X 16 — MP-M 6341.
 99 — 100 *Dimya acuminata* n.sp — two left valves, int. view.X 2 and X 2.5 — MP-M 6342

PLATE 10

- Fig. 101 *Anomia simplex* — left valve, ext. view.X 8.5 — MP-M 6343
 102 *Lima (Lima) cf. L. caribaea* — right valve, ext. view.X 18 — MP-M 6344
 103 *Lima (Limaria) pellucida* — left valve, ext. view.X 5.5 — MP-M 6345

- 104 *Lima (Limaria) cf. L. thryptica* — left valve, ext. view.X 12,5 — MP-M 6346
- 105 *Ctenoides (Ctenoides) floridana* — right valve, ext. view.X 7 — MP-M 6347
- 106 *Limatula cf. L. hendersoni* — right valve, ext. view.X 25 — MP-M 6348
- 107 *Limea bronniana* — right valve, ext. view.X 24,5 — MP-M 6349
- 108 *Crassostrea rhizophorae* — left valve, ext. and int. view.X 3 — MP-M 6350
- 109 *Ostrea (Ostrea) puelchana* — left valve, ext. view.X 1,8 — MP-M 6351
- 110 *Ostrea equestris* — right valve, int. view.X 2,5 — MP-M 6352

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TABLE 3	OCCURRENCE	TABLE
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[illegible]

TABLE 6 BATHYMETRIC DISTRIBUTION TABLE			
SPECIES	INNER DEPTH ZONE (0 — 50 m.)	INTERMEDIATE DEPTH ZONE (50 — 100 m.)	OUTER DEPTH ZONE (more than 100 meters)
SUBCLASS: PALAEOTAXODONTA			
Nucula (Nucula) brasiliiana n.sp.	X		
Nucula (Nucula) semiornata d'Orbigny	X	X	X
Nucula (Nucula) aff. N. crenulata A. Adams	X	X	
Nucula (Leionucula) puelcha d'Orbigny	X	X	X
Nucula (Leionucula) sp. g.			X
Nucula (Leionucula) sp. b.		X	
Nuculana (Saccella) larranagai Klapp & Scarab	X	X	X
Nuculana (Saccella) acuta (Conrad)	X	X	X
Nuculana (Saccella) sp. cf. N. acuta (Conrad)	X		
Nuculana (Saccella) concentrica (Say)	X	X	
Nuculana (Propeleda) fortiana n. sp.		X	X
Adrana patagonica (d'Orbigny)	X	X	X
Yoldia (Yoldia) sulista n. sp.			X
SUBCLASS: PTERIOMORPHIA			
Arca (Arca) zebra (Swain)	X	X	X
Arca (Arca) imbricata Brug.	X	X	
Barbatia (Barbatia) cancellaria (Lam.)	X	X	X
Barbatia (Barbatia) candida (Helbling)	X	X	X
Barbatia (Acar) domingensis (Lam.)	X	X	X
Anadara (Lunarca) ovalis (Brug.)	X	X	
Anadara (Caloosarca) notabilis (Röding)	X	X	X
Scapharca (Cunearca) chemnitzii (Phil.)	X	X	
Noelia (Eontia) bisulcata (Lam.)	X	X	
Arcopsis adamsi (Dall)	X	X	
Limopsis (Limopsis) janeiroensis E. A. Smith	X	X	X
Limopsis (Pectunculina) antillensis Dall	X	X	X
Limopsis (Pectunculina) davisae n. sp.	X	X	X
Glycymeris longior (Sow)	X	X	X
Glycymeris (Glycymerella) decussata (Linne)	X	X	
Glycymeris (G.) tellinaeformis (Reeve)	X	X	
Glycymeris (Tucetana) pectinata (Gme.)	X	X	X
Nucinella serrei Lamy	X	X	
Cosa brasiliensis Klapp	X	X	X
Cosa caribaea Abbott	X		
Brachidontes (Hormomya) domingensis (Lam.)	X		
Crenella divaricata (d'Orbigny)	X	X	X
Gregariella coralliophaga (Gme.)	X	X	X
Lioberus castaneus (Say)	X		
Musculus (Ryenella) lateralis (Say)	X	X	
Dacrydium vitreum (Holböll)	X	X	X
Modiolus sp.		X	X
Atrina (Servatrina) seminuda (Lam.)	X	X	X
Pteria colymbus (Röding)	X	X	X
Propeamussium pourtalesianum (Dall)	X	X	X
Propeamussium sp.	X		
Cyclopecten (Cyclopecten) nanus Verrill & Bush	X	X	X
Palliolum reticulatum (Dall)	X	X	X
Chlamys (Chlamys) tehuelchus d'Orbigny	X	X	X
Chlamys (Chlamys) benedicti Verrill & Bush	X	X	
Argopecten gibbus (Linne)	X	X	
Leptopecten bavayi (Dautz)	X	X	X
Lyropecten (Nodipecten) nodosus (Linne)	X	X	X
Hinnites ? sp.	X		
Pecten (Euvola) zic zac (Linne)	X	X	
Plicatula gibbosa Lam.	X	X	X
Dimya cf. D. argentea Dall.		X	X
Dimya acuminata n. sp.		X	
Anomia simplex d'Orbigny	X		
Lima (Lima) cf. L. caribaea d'Orbigny	X	X	X
Lima (Limaria) pellucida C.B. Adams	X	X	
Lima (Limaria) cf. L. thryptica Penna	X	X	X
Ctenoides (Ctenoides) floridana (Olsson & Harbison)	X	X	X
Limatula cf. L. hendersoni Olsson & McGinty	X	X	X
Limea bronniiana Dall	X	X	X
Crassostrea rhizophorae (Guilding)	X		
Ostrea puelchana d'Orbigny	X	X	X
Ostrea equestris Say	X	X	X

EPOCHS	SPECIES	
RECENT		
PLEISTOCENE		
PLIOCENE		
MIOCENE		
	Nucula (Nucula) semmarata	
	Nucula (Nucula) aff. N. crenulata	
	Nucula (Leanucula) puelicha	
	Nuculana (Saccella) laronagoi	
	Nuculana (Saccella) acuta	
	Nuculana (Saccella) concentrica	
	Adrana patagonica	
	Arca (Arca) zebra	
	Arca (Arca) imbricata	
	Barbatia (Barbatia) cancellaria	
	Barbatia (Barbatia) candida	
	Barbatia (Acor) domingensis	
	Anodora (Lunarca) ovalis	
	Anodora (Calosarca) notabilis	
	Scapharca (Cunearca) chemnitzii	
	Ngata (Eonta) bauricata	
	Arcopecten adamsi	
	Limopsis (Limopsis) jonesensis	
	Limopsis (Pectunculus) antillensis	
	Glycymeris (Glycymeris) longior	
	Glycymeris (Glycymeris) telliniformis	
	Glycymeris (Glycymeris) decussata	
	Glycymeris (Tucetana) pectinata	
	Nacella serrei	
	Cosa brasiliensis	
	Cosa caribaea	
	Brachidontes (Harmomya) domingensis	
	Crenella divaricata	
	Gregariella ceratophaga	
	Licobius costaneus	
	Musculus (Ryenella) lateralis	
	Dactyldium vitreum	
	Atrina (Serratina) seminuda	
	Pteria colymbus	
	Propeamussium portalesium	
	Cyclopecten (Cyclopecten) nonus	
	Pallium reticulatum	
	Chlamys (Chlamys) talichius	
	Chlamys (Chlamys) benedicti	
	Argopecten gibbus	
	Leptopecten boyayi	
	Lyropecten (Nodopecten) nodosus	
	Pecten (Euvola) ziczac	
	Piscatula globosa	
	Onys cf. O. argentea	
	Anomia simplex	
	Lima (Lima) cf. L. caribaea	
	Lima (Lima) pellucida	
	Lima (Lima) cf. L. thryptis	
	Ctenoides (Ctenoides) floridana	
	Limatula cf. L. hendersoni	
	Limea brenniana	
	Crassostrea rhizophorae	
	Ostrea puelichana	
	Ostrea equestris

SOUTH AMERICA :
Approximate location of 150meter contour
Fig 1