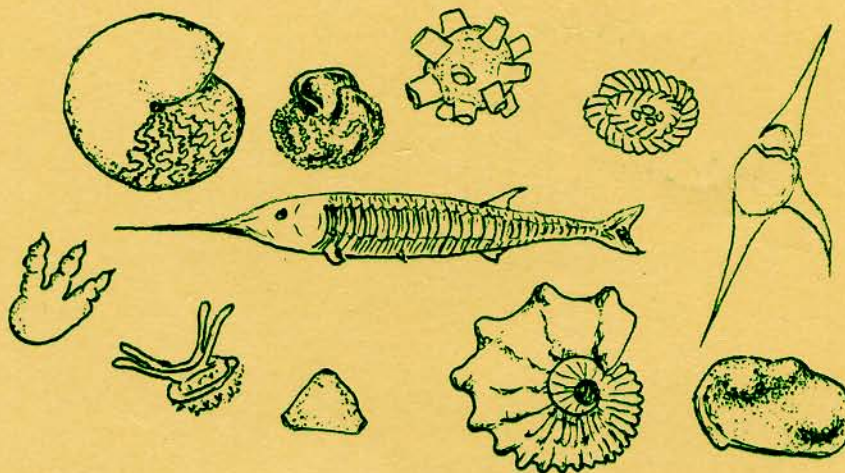


**STRATIGRAPHIC RANGE
OF CRETACEOUS MEGA- AND MICROFOSSILS OF
BRAZIL**

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3.5. The Pernambuco-Paraíba Basin

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F= Foraminifera, I= Invertebrates, P= Palynomorphs,
 PL= Plant remains, TF= Trace fossils, V= Vertebrates

The Pernambuco-Paraíba coastal basin is formed by a narrow coastal strip between Recife and Natal in Northeastern Brazil (Fig. 1).

The sedimentary sequence of the basin comprises the Late Cretaceous Beberibe and Gramame formations, grouped into the Paraíba Group (Fig. 2) (6, 7, 22, 40), which directly overlies the Precambrian basement. The Cretaceous section is overlain by the sediments of the Maria Farinha Formation, mainly built-up of Paleocene carbonates.

Recent studies from adjacent areas provide new data for reinterpretations (17, 20, 38, 39, 42).

The sediments of the Beberibe Formation (Santonian-Campanian ages) reflect a sequence from fluvial, lagoonal and estuarine environments. The lower sediments are coarse to conglomeratic sandstones, with silty fossiliferous beds, which upward grade into quartzose to calcareous sandstone. The fauna of heavy-shelled bivalves, gastropods and echinoids in the upper part of the section indicates a transition to marine environment.

The Beberibe Formation is overlaid by the Gramame Formation (Campanian-Maastrichtian ages) which is composed on carbonates and interbedded gray marls and clays. Three lithofacies may be identified: i) basal fossiliferous calcarenites, deposited in a littoral environment grades laterally into ii) phosphatic carbonates representatives of a supra- to mesolittoral marine facies; small specimens of an invertebrate fauna are preserved as phosphatized internal molds in a phosphatic facies; planktonic foraminifers are rare, whereas the benthonic forms, represented mainly by *Fallotia santosae*, a species of restricted environment, species of *Siphogenerinoides* and agglutinated forms, are abundant; and iii) the carbonate lithofacies of the shelf realm, which is characterized by a diversified invertebrate assemblage with large ammonites, and a rich assemblage of planktonic Foraminifera.

The palynomorph assemblages were studied recently (2, 21). Peridiniid dinoflagellates prevail largely. Important species are *Dinogymnium nelsonense*, *Palaeocystodinium* aff. *P. golzowense* and *Deflandrea striata*. *Zlavisporites blanensis*, *Gabonispores vigo-rouxii*, *Ariadnaesporites spinosus*, *Araucariacites australis* and *Aquillapollenites sergipensis* (= *Tricornites elongatus*) are the biostratigraphic most important spore and pollen species. The assemblage suggest a Late Campanian-Early Maastrichtian age.

TAXONOMIC LIST OF IDENTIFIED SPECIES OF PERNAMBUCO-PARAIBA BASIN

1. Palynomorphs

POLLENITES, SPORITES

- Aquilapollenites sergipensis* Herngreen, 1975 (21)
Aquilapollenites cf. *A. magnus* Regali et alii, 1974 (21)
Araucariacites australis Cookson, 1947 (21)
Araucariacites limbatus (Balme, 1957) Habib, 1969 (21)
Arecipites sp. (21)
Ariadnaesporites spinosus Hills, 1967 (21)
Ariadnaesporites sp. (21)
Banksiaeaidites elongatus Cookson, 1950 (21)
Biretisporites potoniaei Delcourt & Sprumont, 1955 (2)
Cicatrisporites burgli Kedves & Sole de Porta, 1963 (21)
Cicatricosporites cirae Kedves & Sole de Porta, 1963 (21)
Cicatricosporites colombiensis Kedves & Sole de Porta, 1963 (21)
Cicatricosporites cundinamarcensis Kedves & Sole de Porta, 1963 (21)
Cicatricosporites dorogensis subsp. major Kedves, 1961 (2)
Cicatricosporites dorogensis subsp. minor (2)
Cicatricosporites girardotensis Sole de Porta, 1970 (21)
Cicatricosporites grandiosus Kedves & Sole de Porta, 1963 (21)
Cicatricosporites pseudotripartitus (Bolkhovitina, 1961) Dettmann, 1963 (2)
Cicatricosporites radiatus Krutzsch, 1959 (21)
Cicatricosporites tabacensis Kedves & Sole de Porta, 1963 (21)
Cicatricosporites sp. (21)
Classopollis classoides Pflug, 1953 (21)
Concavisporites sp. (21)
Converrucosisporites sp. (21)
Contignisporites cooksonii (Balme, 1961) Dettmann, 1963 (2)
Crassitricolporites brasiliensis Herngreen, 1972 (21)
Cyathidites australis Couper, 1953 (2,21)
Cyathidites minor Couper, 1953 (2,21)
Dictyosporites speciosus Cookson & Dettmann, 1958 (2)
Equisetosporites albertensis Singh, 1964 (21)
Equisetosporites costaliferous (Brenner, 1968) Lima, 1980 (21)
Equisetosporites leptomatus Lima, 1980 (21)
Equisetosporites ovatus (Pierce, 1961) Singh, 1964 (21)
Extratropopollenites arganifer (Pflug in Thomsom & Pflug) Pflug, 1953 (2)
Foveotriletes sp. (21)
Gabonisoris vigourouxii Boltenhagen, 1967 (21)
Ischyosporites sp. (21)
Laevigatosporites ovatus Wilson & Webster, 1946 (2)
Leiotriletes sp. (21)
Lycopodiumsporites eminulus Dettmann, 1963 (2)
Mattesisporites plurituberosus Doring, 1964 (2)
Milfordia homeopunctata (McIntyre, 1965) Partridge, 1973 (21)
Oculopollis cf. *O. tropicus* Boltenhagen, 1976 (21)
Pinuspollenites ruginosa (Stanley, 1965) Oltz, 1969 (2)
Proteacidites sigalii Boltenhagen, 1978 (21)
Psilatricolporites medius (Van der Hammen, 1956) Gonzalez-Gusman, 1966 (21)
Psilatricolpites pannosus Dettmann & Playford, 1968 (21)
Psilamonocolpites sp. (21)
Reticulatisporites sp. (21)

- Retitricolpites* cf. *R. reticulominutus* Jardiné & Magloire, 1965
(21)
Retitricolpites sp. (21)
Retitricolporites sp. (21)
Rugulatisporites polysculptilis Herngreen, 1975 (21)
Striatopollis paraneus (Norris, 1967) Singh, 1971 (21)
Tricesticillus americanus Stough, 1968 (21)
Zilvisporis blanensis Pacltova, 1961 (21)
Zonallapollenites dampieri Balme, 1957 (21)
Zonallapollenites segmentatus Balme, 1957 (21)

DINOFLAGELLATA

- Cannosphaeropsis filamentosa* Cookson & Eisenack, 1958 (21)
Cordosphaeridium aff. *C. inodes* (Klumpp, 1953) Eisenack, 1963
(21)
Cyclonephelium sp. (21)
Deflandrea cf. *D. echinoidea* Cookson & Eisenack, 1960 (21)
Deflandrea laevigata Malloy, 1972 (21)
Deflandrea striata Drugg, 1967 (21)
Deflandrea sp. (21)
Dinogymnium acuminatum Evitt et alii, 1967 (21)
Dinogymnium aff. *D. curvatum* (Vozzhennikova, 1967) Boltenhagen,
1977 (21)
Dinogymnium euclaensis Cookson & Eisenack, 1970 (21)
Dinogymnium evittii Boltenhagen, 1977 (21)
Dinogymnium nelsonense Cookson, 1956 (21)
Dinogymnium sp. 1 (21)
Dinogymnium sp. 2 (21)
Hystrichosphaera ramosa (Ehremberg, 1838) cf. var. *multibrevis*
Davey & Williams, 1966 (21)
Hystrichosphaera sp. (21)
Hystrichosphaeridium sp. (21)
Leptodinium sp. (21)
Oligosphaeridium sp. (21)
Palaeocystodinium aff. *P. golzowense* Alberti, 1961 (21)
Polysphaeridium cf. *P. pastielsi* Davey & Williams, 1966 (21)
Polysphaeridium sp. 1 (21)
Polysphaeridium sp. 2 (21)
Surculosphaeridium sp. (21)
Tenua sp. (21)

SCYTINASCIAS (CHITINOUS FORAMINIFERS)

- Rhodonascia* sp. (21)
Trochiliascia cuvillieri Deak, 1964 (21)
Trochiliascia majzoni Deak, 1964 (21)

SCOLECODONTA

- Anisocerasites* sp. (21)
Arabellites sp. 1 (21)
Arabellites sp. 2 (21)
Arabellites sp. 3 (21)
Nereigenys sp. (21)
Staurocephalites sp. (21)

INCERTAE SEDIS

Ovoidites parvus (Cookson & Dettmann, 1959) Nakoman, 1966 (21)
Patera tenuis Stough, 1968 (21)

2. Foraminifers

Bolivinopsis clotho (Crzybowski) (13)
Brizalina cf. *B. cretosa* (Cushman, 1946) (13)
Cibicidina sp. (41)
Dentalina cf. *D. consobrina* (d'Orbigny, 1846) (13)
Dentalina gracilis d'Orbigny (13)
Dorothia aff. *D. glabrata* Cushman, 1946 (13)
Dorothia oxycona (Reuss, 1860) (13)
Fallotia santosae Tinoco, 1978 (41)
Gaudryna laevigata (Franke, 1914) (13)
Gavelinella sp. A (41)
Gavelinella sp. B (41)
Globigerinelloides aff. *G. caseyi* (Bolli, Loeblich & Tappan, 1957) (24)
Globigerinelloides cf. *G. mauryae* Petri, 1962 (29)
Globotruncana contusa (Cushman, 1926) (34)
Globotruncana gansseri Bolli, 1951 (34)
Globotruncana cf. *G. rosetta* (Carsey, 1926) (34)
Globotruncana stuarti (de Lapparent, 1918) (34)
Globotruncana tilevi Brönnimann & Brown, 1956 (11)
Globotruncana sp. (41)
Guttulina cf. *G. trigonula* (Reuss) (13)
Guttulina sp. (41)
Haplophragmoides sp. A (41)
Haplophragmoides sp. B (41)
Heterohelix globulosa (Ehrenberg, 1840) (24)
Heterohelix ultimatumida (White, 1929) (24)
Hoeglundina supracretacea (Ten Dam, 1948) (13)
Lenticulina sp. A (41)
Lenticulina sp. B (41)
Lenticulina sp. C (41)
Marginulina sp. (41)
Marginulinopsis sp. A (41)
Marginulinopsis sp. B (41)
Marginulinopsis sp. C (41)
Marginulinopsis sp. D (41)
Neoflabelinella rugosa (d'Orbigny, 1840) (13)
Nodosaria affinis Reuss (13)
Nodosaria pauperkulata Reuss (13)
Nodosaria sp. (41)
Planoglobulina acervulinoides (Egger, 1898) (24)
Planoglobulina carseyae (Plummer, 1931) (24)
Planularia cf. *P. dissona* (Plummer) (13)
Plummerita hantkeninoides (Brönnimann, 1952) (34)
Praebulimina carseyae (Plummer, 1931) (30)
Pseudoguembelina costulata (Cushman, 1938) (12)
Pseudoguembelina excolata (Cushman, 1926) (12)
Pseudonodosaria manifiesta (Reuss, 1851) (13)
Pseudotextularia elegans (Rzehak, 1891) (12)
Pyramidina cf. *P. minima* Brotzen (24)
Quinqueloculina sp. A (41)
Quinqueloculina sp. B (41)

- Quinqueloculina* sp. A (41)
Quinqueloculina sp. B (41)
Racemiguembelina fructicosa (Egger, 1899) (12)
Ramulina arkadelphia Cushman, 1938 (13)
Ramulina navarroana Cushman (13)
Rudoglobigerina macrocephala Brönnimann, 1852 (34)
Rugoglobigerina rugosa (Plummer, 1927) (34)
Rugoglobigerina scotti (Brönnimann, 1952) (34)
Saracenaria triangularis (d'Orbigny, 1840) (13)
Siphogenerinoides bramletti Cushman forma *pernambucaensis* Tinoco, 1978 (41)
Siphogenerinoides cretacea Cushman, 1929 (13)
Siphogenerinoides parva Cushman, 1929 (13)
Siphogenerinoides plummerae Cushman, 1929 (13)
Stilostomella alexanderi (Cushman) var. *impesia* Tinoco, 1978 (13)
Stilostomella horridens (Cushman) (13)
Tritaxia capitosa (Cushman) (13)
Tritaxia colombiana (Cushman & Hedberg) (13)
Tritaxia sp. (41)
Vaginulina cf. *V. cretacea* Plummer (13)
Vaginulina taylorana Cushman, 1938 (13)
Vitriwebbina sp. (41)

3. Invertebrates

COELENTERATA (SCLERACTINIA)

Caryophyllidae sp. (14)

GASTROPODA

- Anchura roxoi* Oliveira, 1951 (27)
Cerithium (Campanile) *brasiliense* Maury, 1930 (25)
Cypraea azevedoi Oliveira, 1957 (28)
Cypraea parahybensis Maury, 1930 (25)
Ficus sp. (28)
Natica parahybensis Maury, 1930 (25)
Turritella antigona Maury, 1930 (25)
Turritella arethusa Maury, 1930 (25)
Turritella brunnhilda Maury, 1930 (25)
Turritella toctiumsantorum Maury, 1930 (25)
Tylostoma cf. *T. materinum* White, 1887 (25)
Volutomorpha brasiliensis Maury, 1930 (25)
Xenophora vasconcellosi Oliveira, 1957 (28)

BIVALVIA

- Cardium riogramamense* Maury, 1930 (25)
Corbula lyra Maury, 1930 (25)
Cucullaea erda Maury, 1930 (25)
Cucullaea freia Maury, 1930 (25)
Cucullaea isolda Maury, 1930 (25)
Inoceramus dominguesi Maury, 1930 (25)
Pecten gramamensis Maury, 1930 (25)
Lopatinia (*Pseudocucullaea*) *stantoni* (Maury, 1930) (25,26)
Lucina ? sp. (28)

Pholadomya parahybensis Maury, 1930 (25)
Pinna reginamaris Maury, 1930 (25)
Plicatula parahybensis Maury, 1930 (25)
Protocardia (Pachycardium) sp. (28)
Trigonarca jessupae Maury, 1930 (25)
Venericardia linoi Oliveira, 1957 (28)
Venericardia marisaustralis Maury, 1930 (28)
Veniella brasiliensis (Maury, 1930) (25,35)

CEPHALOPODA

Baculites kegei Oliveira, 1957 (28)
Canadoceras andromeda Maury, 1930 (25)
Canadoceras riogramamense Maury, 1930 (25)
Glyptoxoceras brasiliense Maury, 1930 (25)
Glyptoxoceras parahybense Maury, 1930 (25)
Pachydiscus albuquerqui (Maury, 1930) (25)
Pachydiscus arionis (Maury, 1930) (25)
Pachydiscus athena (Maury, 1930) (25)
Pachydiscus brasiliensis (Maury, 1930) (25)
Pachydiscus bruneti (Maury, 1930) (25)
Pachydiscus dossantosi (Maury, 1930) (25)
Pachydiscus endymion (Maury, 1930) (25)
Pachydiscus eurydice (Maury, 1930) (25)
Pachydiscus euzebioi (Maury, 1930) (25)
Pachydiscus gettyi (Maury, 1930) (25)
Pachydiscus hera (Maury, 1930) (25)
Pachydiscus hermes (Maury, 1930) (25)
Pachydiscus oceanus (Maury, 1930) (25)
Pachydiscus orpheus (Maury, 1930) (25)
Pachydiscus parahybensis (Maury, 1930) (25)
Pachydiscus perseus (Maury, 1930) (25)
Pachydiscus poseidon (Maury, 1930) (25)
Pachydiscus psyche (Maury, 1930) (25)
Pachydiscus reedsi (Maury, 1930) (25)
Pachydiscus sumneri (Maury, 1930) (25)
Pachydiscus williamsoni (Maury, 1930) (25)
Pseudophyllites amphitrite Maury, 1930 (25)
Pseudophyllites nereidideditus Maury, 1930 (25)
Sphenodiscus brasiliensis Maury, 1930 (25)
Sphenodiscus parahybensis Maury, 1930 (25)

POLYCHAETA

Hamulus cf. H. onyx Morton, 1834 (28)

CRUSTACEA (MALACOSTRACA)

Callianassa beberibae Beurlen, 1962 (5)
Callianassa massarandubae Beurlen, 1962 (5)
Callianassa mottai Beurlen, 1962 (5)
Ophthalmoplax brasiliana (Maury, 1930) (4)
Palaeoxanthopsis cretacea (Rathbun, 1902) (4)

ECHINOIDEA

- Codiopsis castroi* (Maury, 1930) (8)
Coenholectypus subcrassus (Peron & Gauthiers (9, 43)
Gomphechinus aff. *selim* (Peron & Gauthiers (8, 43)
Hemiaster ? *delawarensis* Clark (10, 43)
Linthia variabilis (Slocum) (10, 43)

4. Vertebrates

PISCES

- Enchodus elegans* Dartevelle & Casier, 1949 (33)
Enchodus lybicus (Quaas, 1902) (33)
Enchodus oliveirai Maury, 1930 (25)
Gyrodus sp. (16) —
Lamna serrata (Agassiz, 1838) (33)
Notidamus microdon Agassiz, 1835 (33)
Odontaspis tingitana Arambourg, 1952 (33)
Paleobalistum dossantosi Maury, 1930 (25)
Phacodus sp. (16)
Rhombodus binkhorsti Dames, 1881 (33)
Saurocephalus aff. *S. lanciformis* Harlan, 1824 (36)
Scapanorhynchus rapax (Quaas, 1902) (33)
Squalicorax kaupi (Agassiz, 1843) (33)
Squalicorax pristodontus (Agassiz, 1843) (33)

REPTILIA

- Globidens* cf. *G. fraasi* Dollo, 1913 (32)
Nyctosaurus lamegoi Price, 1953 (31)
Mosasaurus cf. *M. anceps* (Owen, 1851) (32)
Mossaurus cf. *M. beaugei* Arambourg, 1952 (32)

5. Plantae

- Palmocarpus luisi* Maury, 1930 (25)

6. Trace Fossils

- Coprolites* (18,19)
Gastrochaenolites sp. (15)

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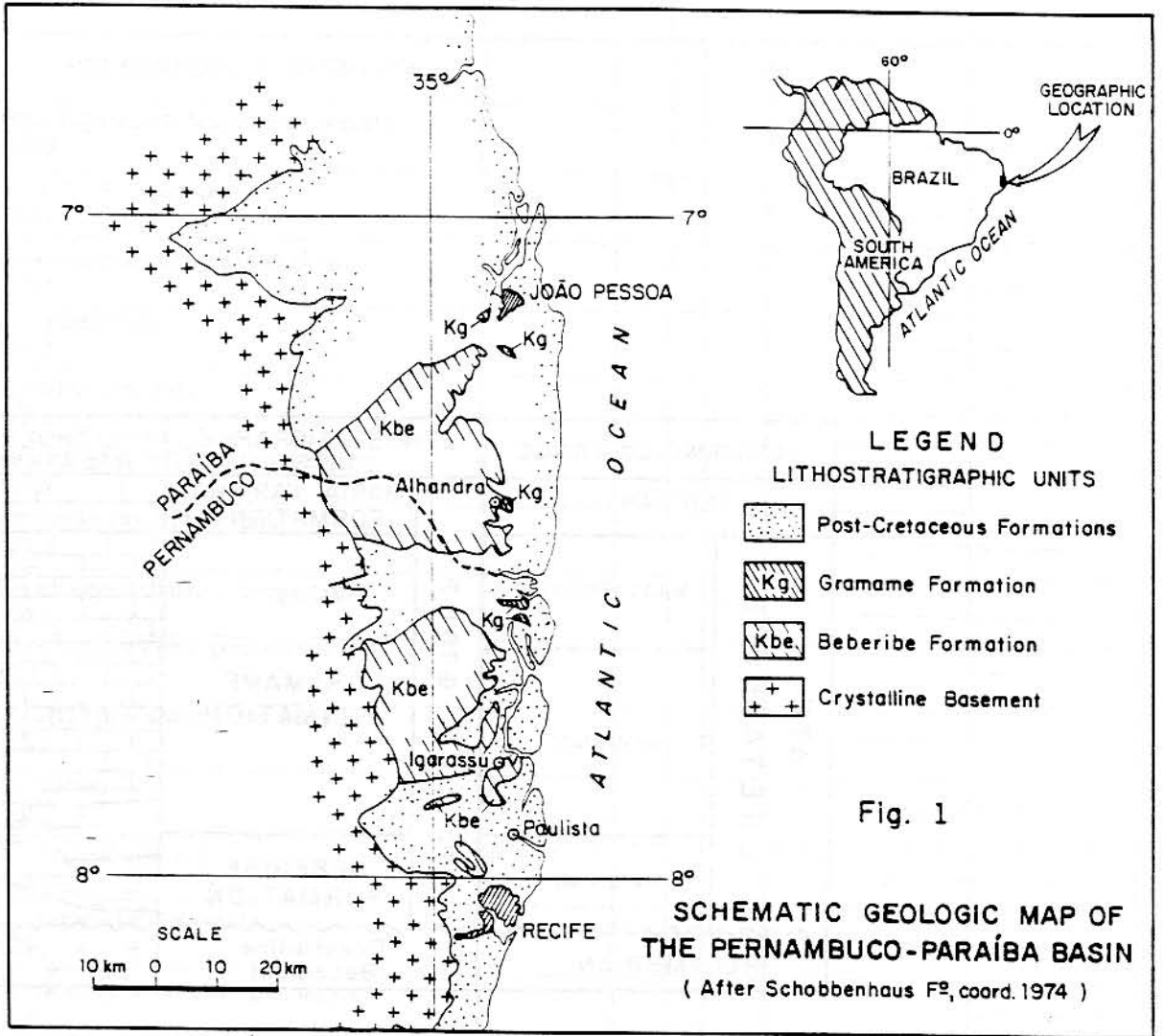


Figure 1

| GEOCHRONOLOGIC SCALE | | LITHOSTRATIGRAPHIC UNITS | | LITHOLOGIC RELATIONSHIP |
|----------------------|-------------------------|--------------------------|-------------------------|---------------------------|
| TERTIARY | | PARAÍBA GROUP | MARIA FARINHA FORMATION | |
| LATE CRETACEOUS | MAASTRICHTIAN L E | | GRAMAME FORMATION | |
| | CAMPANIAN L E | | | |
| | SANTONIAN L E | | BEBERIBE FORMATION | |
| PRECAMBRIAN | | Crystalline Basement | | + -+ + + + + + + + + + |

Figure 2

| <p style="text-align: center;">LATE CRETACEOUS TAXA</p> <p style="text-align: center;">— PALYNOMORPHS PERNAMBUCO-PARAIBA BASIN</p> | CENOMANIAN | TURONIAN | CONIACIAN | SANTONIAN | CAMPANIAN | MAASTRICHTIAN |
|--|------------|----------|-----------|-----------|-----------|---------------|
| POLLENITES ? SPORITES | | | | | | |
| <i>Aquilapollenites sergipensis</i> (21) | | | | | | |
| <i>A. cf. A. magnus</i> (21) | | | | | | |
| <i>Araucariacites australis</i> (21) | | | | | | |
| <i>A. limbatus</i> (21) | | | | | | |
| <i>Arecipites</i> sp. (21) | | | | | | |
| <i>Ariadnaesporites spinosus</i> (21) | | | | | | |
| <i>Ariadnaesporites</i> sp. (21) | | | | | | |
| <i>Banksiaeidites elongatus</i> (21) | | | | | | |
| <i>Biretisporites potoniaei</i> (2) | | | | | | |
| <i>Cicatrisporites burgli</i> (21) | | | | | | |
| <i>C. cirae</i> (21) | | | | | | |
| <i>C. colombiensis</i> (21) | | | | | | |
| <i>C. cundinamarcensis</i> (21) | | | | | | |
| <i>C. dorogensis</i> subsp. major (2) | | | | | | |
| <i>C. dorogensis</i> subsp. minor (2) | | | | | | |
| <i>C. girardotensis</i> (21) | | | | | | |
| <i>C. grandiosus</i> (21) | | | | | | |
| <i>C. pseudotripartitus</i> (2) | | | | | | |
| <i>C. radiatus</i> (21) | | | | | | |
| <p style="text-align: center;"> ————— rare (less than 10 specimens)</p> <p style="text-align: center;"> ————— common (between 10 and 30 specimens)</p> | | | | | | |

| <p style="text-align: center;">LATE CRETACEOUS TAXA</p> <p style="text-align: center;">PALYNOMORPHS PERNAMBUCO-PARAIBA BASIN</p> | CENOMANIAN | TURONIAN | CONIACIAN | SANTONIAN | CAMPANIAN | MAASTRICHTIAN |
|---|------------|----------|-----------|-----------|-----------|---------------|
| Cicatricosisporites tabacensis (21) | | | | | — | — |
| Cicatricosisporites sp. (21) | | | | | — | — |
| Classopollis classoides (21) | | | | | — | — |
| Concavisporites sp. (21) | | | | | — | — |
| Converrucosisporites sp. (21) | | | | | — | — |
| Contignisporites cooksonii (2) | | | | | | — |
| Crassitricolporites brasiliensis (21) | | | | | — | — |
| Cyathidites australis (2,21) | | | | | — | — |
| C. minor (2,21) | | | | | — | — |
| Dictyotosporites speciosus (2) | | | | | | — |
| Equisetosporites albertensis (21) | | | | | — | — |
| E. costaliferous (21) | | | | | — | — |
| E. leptomatus (21) | | | | | — | — |
| E. ovatus (21) | | | | | — | — |
| Extratripoporollenites arganifer (2) | | | | | | — |
| Foveotriletes sp. (21) | | | | | — | — |
| Gabonisporis vigourouxii (21) | | | | | == | == |
| Ischyosporites sp. (21) | | | | | — | — |
| Laevigatosporites ovatus (2) | | | | | — | — |
| Leiotriletes sp. (21) | | | | | — | — |
| <p>———— rare (less than 10 specimens)</p> <p>===== common (between 10 and 30 specimens)</p> | | | | | | |

| <p style="text-align: center;">LATE CRETACEOUS TAXA</p> <p style="text-align: center;">PALYNOMORPHS PERNAMBUCO-PARAIBA BASIN</p> | CENOMANIAN | TURONIAN | CONIACIAN | SANTONIAN | CAMPANIAN | MAASTRICHTIAN |
|---|------------|----------|-----------|-----------|-----------|---------------|
| Lycopodiumsporites emirulus (2) | | | | | | |
| Mattesisporites plurituberosus (2) | | | | | | |
| Milfordia homeopunctata (21) | | | | | — | — |
| Oculopollis cf. O. tropicus (21) | | | | | — | — |
| Pinuspollenites ruginosa (2) | | | | | | |
| Proteacidites sigalli (21) | | | | | — | — |
| Psilatricolporites medius (21) | | | | | — | — |
| P. pannosus (21) | | | | | — | — |
| Psilamonocolpites sp. (21) | — | | | | — | — |
| Reticulatisporites sp. (21) | | | | | — | — |
| Retitricolpites cf. R. reticulomir- nutus (21) | | | | | — | — |
| Retitricolpites sp. (21) | | | | | — | — |
| Retitricolporites sp. (21) | | | | — | — | — |
| Rugulatisporites polysculptilis (21) | | | | | — | — |
| Striatopollis paraneus (21) | | | | | — | — |
| Tricesticillus americanus (21) | | | | | — | — |
| Zlivisporites blanensis (21) | | | | | — | — |
| Zonallapollenites dampieri (21) | | | | | — | — |
| Z. segmentatus (21) | | | | | — | — |
| | | | | | | |
| <p>————— rare (less than 10 specimens)</p> | | | | | | |

| LATE CRETACEOUS TAXA PALYNOMORPHS PERNAMBUCO-PARAIBA BASIN | CENOMANIAN | TURONIAN | CONIACIAN | SANTONIAN | CAMPANIAN | MAASTRICHTIAN |
|---|------------|----------|-----------|-----------|-----------|---------------|
| | | | | | | |
| DINOFLAGELLATA | | | | | | |
| <i>Cannosphaeropsis filamentosa</i> (21) | | | | | ===== | ===== |
| <i>Cordosphaeridium</i> aff. <i>C. inodes</i> (21) | | | | | ===== | ===== |
| <i>Cyclonephelium</i> sp. (21) | | | | | ===== | ===== |
| <i>Deflandrea</i> cf. <i>D. echinoidea</i> (21) | | | | | ===== | ===== |
| <i>D. laevigata</i> (21) | | | | | ===== | ===== |
| <i>D. striata</i> (21) | | | | | ===== | ===== |
| <i>Deflandrea</i> sp. (21) | | | | | ===== | ===== |
| <i>Dinogymnium acuminatum</i> (21) | | | | | ===== | ===== |
| <i>D.</i> aff. <i>D. curvatum</i> (21) | | | | | ===== | ===== |
| <i>D. euclaensis</i> (21) | | | | | ===== | ===== |
| <i>D. evittii</i> (21) | | | | | ===== | ===== |
| <i>D. nelsonense</i> (21) | | | | | ===== | ===== |
| <i>Dinogymnium</i> sp. 1 (21) | | | | | ===== | ===== |
| <i>Dinogymnium</i> sp. 2 (21) | | | | | ===== | ===== |
| <i>Hystrichosphaera ramosa</i> cf. var. <i>multibrevis</i> (21) | | | | | ===== | ===== |
| <i>Hystrichosphaera</i> sp. (21) | | | | | ===== | ===== |
| <i>Hystrichosphaeridium</i> sp. (21) | | | | | ===== | ===== |
| <i>Leptodinium</i> sp. (21) | | | | | ===== | ===== |
| <i>Oligosphaeridium</i> sp. (21) | | | | | ===== | ===== |
| <p>----- rare (less than 10 specimens)</p> <p>===== common (between 10 and 30 specimens)</p> <p>===== frequent (more than 30 specimens)</p> | | | | | | |

| <p style="text-align: center;">LATE CRETACEOUS TAXA</p> <p style="text-align: center;">PALYNOMORPHS PERNAMBUCO-PARAIBA BASIN</p> | CENOMANIAN | TURONIAN | CONIACIAN | SANTONIAN | CAMPANIAN | MAASTRICHTIAN |
|---|------------|----------|-----------|-----------|-----------|---------------|
| Palaeocystodinium aff. <i>P. golzowense</i> (21) | | | | | — | |
| Polysphaeridium cf. <i>P. pastielsi</i> (21) | | | | | — | |
| Polysphaeridium sp. 1 (21) | | | | | — | |
| Polysphaeridium sp. 2 (21) | | | | | — | |
| Surculosphaeridium sp. (21) | | | | | — | |
| Terua sp. (21) | | | | | — | |
| SCYTINASCIAS (CHITINOUS FORAMINIFERS) | | | | | | |
| Rhodonascia sp. (21) | | | | | — | |
| Trochiliascia <i>cuvilleri</i> (21) | | | | | — | |
| T. <i>majzoni</i> (21) | | | | | — | |
| SCOLECODONTA | | | | | | |
| Anisoceratites sp. (21) | | | | | — | |
| Arbellites sp. 1 (21) | | | | | — | |
| Arbellites sp. 2 (21) | | | | | — | |
| Arbellites sp. 3 (21) | | | | | — | |
| Nereigenys sp. (21) | | | | | — | |
| Staurocephalites sp. (21) | | | | | — | |
| INCERTAE SEDIS | | | | | | |
| Ovoidites <i>parvus</i> (21) | | | | | — | |
| Patera <i>tenuis</i> (21) | | | | | — | |
| <p style="text-align: center;">— rare (less than 10 specimens)</p> <p style="text-align: center;">— frequent (more than 30 specimens)</p> | | | | | | |

| LATE CRETACEOUS TAXA FORAMINIFERA PERNAMBUCO-PARAIBA BASIN | CENOMANIAN | TURONIAN | CONIACIAN | SANTONIAN | CAMPANIAN | MAASTRICHTIAN |
|---|------------|----------|-----------|-----------|-----------|---------------|
| | | | | | | |
| <i>Bolivinopsis clotho</i> (13) | | | | | | — — |
| <i>Brizalina</i> cf. <i>B. cretosa</i> (13) | | | | | | — — |
| <i>Cibicidina</i> sp. (41) | | | | | | — — — |
| <i>Dentalina</i> cf. <i>D. consobrina</i> (13) | | | | | | ————— |
| <i>Dentalina gracilis</i> (13) | | | | | | — — — |
| <i>Dorothia</i> aff. <i>D. glabrata</i> (13) | | | | | | — — — |
| <i>Dorothia oxycona</i> (13) | | | | | | — — — |
| <i>Fallotia santosae</i> (41) | | | | | | ————— |
| <i>Gaudryna laevigata</i> (13) | | | | | | — — — |
| <i>Gavelinella</i> sp. A (41) | | | | | | — ————— |
| <i>Gavelinella</i> sp. B (41) | | | | | | — — — |
| <i>Globigerinelloides</i> aff. <i>G. caseyi</i> (24) | | | | | | — — — |
| <i>Globigerinelloides</i> cf. <i>G. mauryae</i> (29) | | | | | | — — — |
| <i>Globotruncana contusa</i> (34) | | | | | | ————— |
| <i>Globotruncana gansseri</i> (34) | | | | | | — — — |
| <i>Globotruncana</i> cf. <i>G. rosetta</i> (34) | | | | | | — — — — |
| <i>Globotruncana stuarti</i> (34) | | | | | | ————— |
| <i>Globotruncana tilevi</i> (11) | | | | | | — — — |
| <i>Globotruncana</i> sp. (41) | | | | | | — — — |
| <i>Guttulina</i> cf. <i>G. trigonula</i> (13) | | | | | | — — |
| ————— rare (less than 10 specimens) | | | | | | |

| <p style="text-align: center;">LATE CRETACEOUS TAXA</p> <p style="text-align: center;">FORAMINIFERA</p> <p style="text-align: center;">PERNAMBUCO-PARAIBA BASIN</p> | CENOMANIAN | TURONIAN | CONIACIAN | SANTONIAN | CAMPANIAN | MAASTRICHTIAN |
|--|------------|----------|-----------|-----------|-----------|---------------|
| Guttulina sp. (41) | | | | | | — — — |
| Haplophragmoides sp. A (41) | | | | | | — — — — — |
| Haplophragmoides sp. B (41) | | | | | | — — — — — |
| Heterohelix globulosa (24) | | | | | | — — — — — |
| Heterohelix ultimatimida (24) | | | | | | — — — — — |
| Hoeglundina supracretacea (13) | | | | | | — — — — — |
| Lenticulina sp. A (41) | | | | | | — — — — — |
| Lenticulina sp. B (41) | | | | | | — — — — — |
| Lenticulina sp. C (41) | | | | | | — — — — — |
| Marginulina sp. (41) | | | | | | — — — — — |
| Marginulinopsis sp. A (41) | | | | | | — — — — — |
| Marginulinopsis sp. B (41) | | | | | | — — — — — |
| Marginulinopsis sp. C (41) | | | | | | — — — — — |
| Marginulinopsis sp. D (41) | | | | | | — — — — — |
| Neoflabelinella rugosa (13) | | | | | | — — — — — |
| Nodosaria affinis (13) | | | | | | — — — — — |
| Nodosaria pauperkulata (13) | | | | | | — — — — — |
| Nodosaria sp. (41) | | | | | | — — — — — |
| Planoglobulina acervulinoides (24) | | | | | | — — — — — |
| Planoglobulina carseyae (24) | | | | | | — — — — — |
| <p>————— rare (less than 10 specimens)</p> | | | | | | |

| LATE CRETACEOUS TAXA FORAMINIFERA PERNAMBUCO-PARAIBA BASIN | CENOMANIAN | TURONIAN | CONIACIAN | SANTONIAN | CAMPANIAN | MAASTRICHTIAN |
|---|------------|----------|-----------|-----------|-----------|---------------|
| | | | | | | |
| <i>Planularia</i> cf. <i>P. dissona</i> (13) | | | | | | — — — — |
| <i>Plummerita hantkeninoides</i> (34) | | | | | | — — — — |
| <i>Praebulimina carseyae</i> (30) | | | | | | — — — — |
| <i>Pseudoguembelina costulata</i> (12) | | | | | | — — — — |
| <i>Pseudoguembelina excolata</i> (12) | | | | | | — — — — |
| <i>Pseudonodosaria manifiesta</i> (13) | | | | | | — — — — |
| <i>Pseudotextularia elegans</i> (12) | | | | | | — — — — |
| <i>Pyramidina</i> cf. <i>P. minima</i> (24) | | | | | | — — — — |
| <i>Quinqueloculina</i> sp. A (41) | | | | | | — — — — |
| <i>Quinqueloculina</i> sp. B (41) | | | | | | — — — — |
| <i>Racemiguembelina fructicosa</i> (12) | | | | | | — — — — |
| <i>Ramulina arkadelphia</i> (13) | | | | | | — — — — |
| <i>Ramulina navarroana</i> (13) | | | | | | — — — — |
| <i>Rugoglobigerina macrocephala</i> (34) | | | | | | — — — — |
| <i>Rugoglobigerina rugosa</i> (34) | | | | | | — — — — |
| <i>Rugoglobigerina scotti</i> (34) | | | | | | — — — — |
| <i>Saracenaria triangularis</i> (13) | | | | | | — — — — |
| <i>Siphogenerinoides bramletti</i> forma <i>pernambucaensis</i> (41) | | | | | | — — — — |
| <i>Siphogenerinoides cretacea</i> (13) | | | | | | — — — — |
| <i>Siphogenerinoides parva</i> (13) | | | | | | — — — — |
| ————— rare (less than 10 specimens) | | | | | | |

| LATE CRETACEOUS TAXA FORAMINIFERA PERNAMBUCO-PARAIBA BASIN | CENOMANIAN | TURONIAN | CONIACIAN | SANTONIAN | CAMPANIAN | MAASTRICHTIAN |
|---|------------|----------|-----------|-----------|-----------|---------------|
| | | | | | | |
| <i>Siphogenerinoides plummerae</i> (13) | | | | | | — — — — |
| <i>Stillostomella alexanderi</i> var. <i>impesia</i> (13) | | | | | | — — — — |
| <i>Stillostomella horridens</i> (13) | | | | | | — — — — |
| <i>Tritaxia capitosa</i> (13) | | | | | | — — — — |
| <i>Tritaxia colombiana</i> (13) | | | | | | — — — — |
| <i>Tritaxia</i> sp. (41) | | | | | | — — — — |
| <i>Vaginulina</i> cf. <i>V. cretacea</i> (13) | | | | | | — — — — |
| <i>Vaginulina taylorana</i> (13) | | | | | | — — — — |
| <i>Vitriwebbina</i> sp. (41) | | | | | | — — — — |
| | | | | | | |
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| | | | | | | |
| | | | | | | |

———— rare (less than 10 specimens)

| LATE CRETACEOUS TAXA INVERTEBRATES PERNAMBUCO-PARAIBA BASIN | CENOMANIAN | TURONIAN | CONIACIAN | SANTONIAN | CAMPANIAN | MAASTRICHTIAN |
|--|------------|----------|-----------|-----------|-----------|---------------|
| | | | | | | |
| COELENTERATA (SCLERACTINIA) | | | | | | |
| Caryophilidae (14) | | | | | | |
| GASTROPODA | | | | | | |
| Anchura roxoi (27) | | | | | | |
| Cerithium (Campanile) brasiliense (25) | | | | | | |
| Cypraea azevedoi (28) | | | | | | |
| C. parahybensis (25) | | | | | | |
| Ficus sp. (28) | | | | | | |
| Natica parahybensis (25) | | | | | | |
| Turritella antigona (25) | | | | | | |
| T. arethusa (25) | | | | | | |
| T. brunnhilda (25) | | | | | | |
| T. toctiunsanctorum (25) | | | | | | |
| Tylostoma cf. T. materinum (25) | | | | | | |
| Volutomorpha brasiliensis (25) | | | | | | |
| Xenophora vasconcellosi (28) | | | | | | |
| BIVALVIA | | | | | | |
| Cardium riogrammense (25) | | | | | | |
| Corbula lyra (25) | | | | | | |
| Cucullaea erda (25) | | | | | | |
| ——— rare (less than 10 specimens) | | | | | | |

| <p style="text-align: center;">LATE CRETACEOUS TAXA</p> <p style="text-align: center;">INVERTEBRATES PERNAMBUCO-PARAIBA BASIN</p> | CENOMANIAN | TURONIAN | CONIACIAN | SANTONIAN | CAMPANIAN | MAASTRICHTIAN |
|--|------------|----------|-----------|-----------|-----------|---------------|
| Cucullaea freia (25) | | | | | | |
| C. isolda (25) | | | | | | |
| Inoceramus dominguesi (25) | | | | | | |
| Pecten gramamensis (25) | | | | | | |
| Lopatinia (Pseudocucullaea) stan- toni (25,26) | | | | | | |
| Lucina ? sp. (28) | | | | | | |
| Pholadomya parahybensis (25) | | | | | | |
| Pinna reginamaris (25) | | | | | | |
| Plicatula parahybensis (25) | | | | | | |
| Protocardia (Pachycardium) sp. (28) | | | | | | |
| Trigonarca jessupae (25) | | | | | | |
| Venericardia linoi (28) | | | | | | |
| V. marisaustralis (28) | | | | | | |
| Veniella brasiliensis (25,35) | | | | | | |
| CEPHALOPODA | | | | | | |
| Baculites kegei (28) | | | | | | |
| Canadoceras andromeda (25) | | | | | | |
| C. riogramamense (25) | | | | | | |
| Glyptoxoceras brasiliense (25) | | | | | | |
| G. parahybense (25) | | | | | | |
| <p>————— rare (less than 10 specimens)</p> | | | | | | |

| <p style="text-align: center;">LATE CRETACEOUS TAXA</p> <p style="text-align: center;">INVERTEBRATES PERNAMBUCO-PARAIBA BASIN</p> | CENOMANIAN | TURONIAN | CONIACIAN | SANTONIAN | CAMPANIAN | MAASTRICHTIAN |
|--|------------|----------|-----------|-----------|-----------|---------------|
| Pachydiscus albuquerquei (25) | | | | | | |
| P. arionis (25) | | | | | | |
| P. athena (25) | | | | | | |
| P. brasiliensis (25) | | | | | | |
| P. bruneti (25) | | | | | | |
| P. dossantosi (25) | | | | | | |
| P. endymion (25) | | | | | | |
| P. eurydice (25) | | | | | | |
| P. euzebioi (25) | | | | | | |
| P. gettyi (25) | | | | | | |
| P. hera (25) | | | | | | |
| P. hermes (25) | | | | | | |
| P. oceanus (25) | | | | | | |
| P. orpheus (25) | | | | | | |
| P. parahybensis (25) | | | | | | |
| P. perseus (25) | | | | | | |
| P. poseidon (25) | | | | | | |
| P. psyche (25) | | | | | | |
| P. reedsi (25) | | | | | | |
| P. sumneri (25) | | | | | | |
| <p>————— rare (less than 10 specimens)</p> | | | | | | |

| <p style="text-align: center;">LATE CRETACEOUS TAXA</p> <p style="text-align: center;">—INVERTEBRATES PERNAMBUCO-PARAIBA BASIN</p> | CENOMANIAN | TURONIAN | CONIACIAN | SANTONIAN | CAMPANIAN | MAASTRICHTIAN |
|---|------------|----------|-----------|-----------|-----------|---------------|
| Pachydiscus williamsoni (25) | | | | | | |
| Pseudophyllites amphitrite (25) | | | | | | |
| P. nereidideditus (25) | | | | | | |
| Sphenodiscus brasiliensis (25) | | | | | | |
| S. parahybensis (25) | | | | | | |
| POLYCHAETA | | | | | | |
| Hamulus cf. H. oryx (28) | | | | | | |
| CRUSTACEA (MALACOSTRACA) | | | | | | |
| Callianassa beberibae (5) | | | | | | |
| C. massarandubae (5) | | | | | | |
| C. mottai (5) | | | | | | |
| Ophthalmoplax brasiliana (4) | | | | | | |
| Palaeoxanthopsis cretacea (4) | | | | | | |
| ECHINOIDEA | | | | | | |
| Codiopsis castroi (8) | | | | | | |
| Coenholectypus subcrassus (9,43) | | | | | | |
| Gomphechinus aff. selim (8,43) | | | | | | |
| Hemiaster ? delawarensis (10,43) | | | | | | |
| Linthia variabilis (10,43) | | | | | | |
| | | | | | | |
| <p>————— rare (less than 10 specimens)</p> | | | | | | |

| <p style="text-align: center;">LATE CRETACEOUS TAXA</p> <p style="text-align: center;">VERTEBRATES PERNAMBUCO-PARAIBA BASIN</p> | CENOMANIAN | TURONIAN | CONIACIAN | SANTONIAN | CAMPANIAN | MAASTRICHTIAN |
|--|------------|----------|-----------|-----------|-----------|---------------|
| PISCES | | | | | | |
| Enchodus elegans (33) | | | | | | |
| E. lybicus (33) | | | | | | |
| E. oliveirai (25) | | | | | | |
| Gyrodus sp. (16) | | | | | | |
| Lamna serrata (33) | | | | | | |
| Notidamus microdon (33) | | | | | | |
| Odontaspis tingitana (33) | | | | | | |
| Paleobalistum dossantosi (25) | | | | | | |
| Phacodus sp. (16) | | | | | | |
| Rhombodus binkhorsti (33) | | | | | | |
| Saurocephalus aff. S. anciformis (36) | | | | | | |
| Scapanorhynchus rapax (33) | | | | | | |
| Squalicorax kaupi (33) | | | | | | |
| S. pristodontus (33) | | | | | | |
| REPTILIA | | | | | | |
| Globidens cf. G. fraasi (32) | | | | | | |
| Nyctosaurus lanegoi (31) | | | | | | |
| Mosasaurus cf. M. anceps (32) | | | | | | |
| M. cf. M. beaugei (32) | | | | | | |
| <p>————— rare (less than 10 specimens)</p> | | | | | | |

