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Artikel: Contribution to the geology and paleontology of the area of the city La Habana, Cuba, and its Surroundings
Autor: Brönnimann, Paul / Rigassi, Danilo
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Eocene, and their occurrence in the outcrop of the Barreras–Vía Blanca road may indicate a Middle Eocene post-Universidad age for the Urría beds.

Punta Brava Formation

For Upper Eocene yellowish to orange hard limestones, chalky limestones, and fine-grained calcarenites we introduce a new lithologic unit, the Punta Brava formation. It is known only from outcrops near Punta Brava, a small village on the Carretera Central toward Pinar del Río in the south-western corner of the Habana area as defined in this paper. The Punta Brava formation differs from both the Upper Eocene Jabaco formation and Jicotea member defined by BERMÚDEZ from outcrops outside the Habana area. Before describing the new formation, the status of these units will be briefly discussed.

The type locality of the Upper Eocene Jabaco formation is at a cut of the road from Guanajay to El Mariel, 4.5 km west-northwest of Guanajay, Pinar del Río Province (BERMÚDEZ, 1950, p. 247). The lithology is a series of yellowish irregularly bedded, marly limestones. Layers of intraformational reworked rock fragments and fossils are a conspicuous element of this formation. In certain beds larger benthonic Foraminifera are abundant. Many perfectly preserved discocyclinas, asterocyclinas and lepidocyclinas were noticed as well as *Dictyoconus cookei* MOBERG and *Fabiania cassis* SILVESTRI of which *F. cubensis* (COLE and BERMÚDEZ) is a junior synonym. As will be seen from the planktonic species cited below, the type samples of the Jabaco beds are from the late Upper Eocene *Globorotalia cerroazulensis* zone, not early Upper Eocene as stated by BERMÚDEZ (1950, p. 247). The following samples listed from bottom to top are from the type locality of the Jabaco formation:

BR station 497 (Base of outcrop)
Lithology: Marl, chalky, grayish yellow.
Washed residue with

Cribrohantkenina bermudezi THALMANN
Hantkenina alabamensis CUSHMAN
Hantkenina suprasuturalis BRÖNNIMANN
Globorotalia cerroazulensis (COLE)
Catapsydrax dissimilis (CUSHMAN and BERMÚDEZ)
Globigerina ampliapertura BOLLI
Globigerina rohri BOLLI group
Globoquadrina venezuelana (HEDBERG) group
Globorotaloides suteri BOLLI
Globigerinatheka barri BRÖNNIMANN
Chiloguembelina cubensis (PALMER) and reworked Universidad forms

BR station 498 (1 m stratigraphically above 497)
Lithology: Marl, chalky, grayish yellow.
Washed residue with

Hantkenina alabamensis CUSHMAN
Hantkenina suprasuturalis BRÖNNIMANN
Globorotaloides suteri BOLLI

Globigerina ampliapertura BOLLI
Globigerina parva BOLLI
Catapsydrax dissimilis (CUSHMAN and BERMÚDEZ)
Pseudohastigerina micra (COLE)
Chiloguembelina cubensis (PALMER) and reworked Universidad forms

BR station 499 (1.5 m stratigraphically above 497)
Lithology: Limestone, hard, orbitoidal, very pale orange to pale yellowish orange.
Texture: Cryptocrystalline groundmass with many discocyclinas, lepidocyclinas, *Operculinoides*, Rupertiidae and algal fragments. Also planktonic Foraminifera.
Assemblage of planktonic microfossils with
Hantkenina alabamensis CUSHMAN-*suprasuturalis* BRÖNNIMANN group
Globorotalia cerroazulensis (COLE)
Globigerina spp.
Chiloguembelina cubensis (PALMER)
Braarudosphaera bigelowi (GRAN and BRAARUD)
Discoaster aster BRAMLETTE and RIEDEL
Discoaster barbadiensis TAN
Discoaster cf. *deflandrei* BRAMLETTE and RIEDEL (rare)
Coccoliths
Tremalithus eopelagicus BRAMLETTE and RIEDEL (large specimens)
Thoracosphaera sp.

BR station 500 (4 m stratigraphically above 497)
Lithology: Marl, shaley, grayish yellow to pale yellowish orange.
Texture: Cryptocrystalline groundmass with planktonic microfossils and rare orbitoidal Foraminifera (coccolithite).
Assemblage: *Globigerina* spp.
Pseudohastigerina micra (COLE)
Braarudosphaera bigelowi (GRAN and BRAARUD)
Discoaster aster BRAMLETTE and RIEDEL (common)
Coccoliths (abundant)
Tremalithus eopelagicus BRAMLETTE and RIEDEL (large specimens)
Thoracosphaera sp. (common).
Washed residue with
Hantkenina alabamensis CUSHMAN
Hantkenina suprasuturalis BRÖNNIMANN
Globorotalia cerroazulensis (COLE)
Catapsydrax dissimilis (CUSHMAN and BERMÚDEZ)
Globorotaloides suteri BOLLI
Globigerina ampliapertura BOLLI
Globigerina parva BOLLI
Globigerina rohri BOLLI group
Globoquadrina venezuelana (HEDBERG) group
Chiloguembelina cubensis (PALMER).

BR station 501 (6 m stratigraphically above 497)
Lithology: Limestone, hard, grayish yellow to very pale orange.
Texture: Cryptocrystalline groundmass with common planktonic and benthonic Foraminifera. Also mollusk, echinoderm, orbitoidal and algal fragments. Rare igneous grains.

Assemblage: *Globigerina* spp.
Pseudohastigerina micra (COLE)
Chiloguembelina cubensis (PALMER)
Braarudosphaera bigelowi (GRAN and BRAARUD)
Coccoliths
Tremalithus eopelagicus BRAMLETTE and RIEDEL (large specimens)
Thoracosphaera sp.

In the Habana area there are no Upper Eocene rocks of similar lithology. The name Jabaco formation therefore cannot be applied to Upper Eocene beds outcropping at Punta Brava. Under the name Jicotea member of the Jabaco formation, BERMÚDEZ (1950, pp. 249 and 250) described yellowish marls with fine limey sand from a road cut on the Carretera Central, 1 km east of Jicotea, Las Villas Province. From this locality, which was not sampled by us, BERMÚDEZ (1950) listed the following planktonic Foraminifera: *Globigerina mexicana* CUSHMAN [=*Porticulasphaera mexicana* (CUSHMAN)], *Globigerina* cf. *conglobata* H. B. BRADY, *Globorotalia centralis* CUSHMAN and BERMÚDEZ, *Hantkenina alabamensis* CUSHMAN, *Hantkenina longispina* CUSHMAN and *Nonion micrus* COLE [=*Pseudohastigerina micra* (COLE)]. The outcrop is isolated and neither top nor bottom of the Jicotea beds can be seen. Apparently there were never more than a few meters of whitish chalk exposed. An inspection of this locality in the summer of 1958 showed the

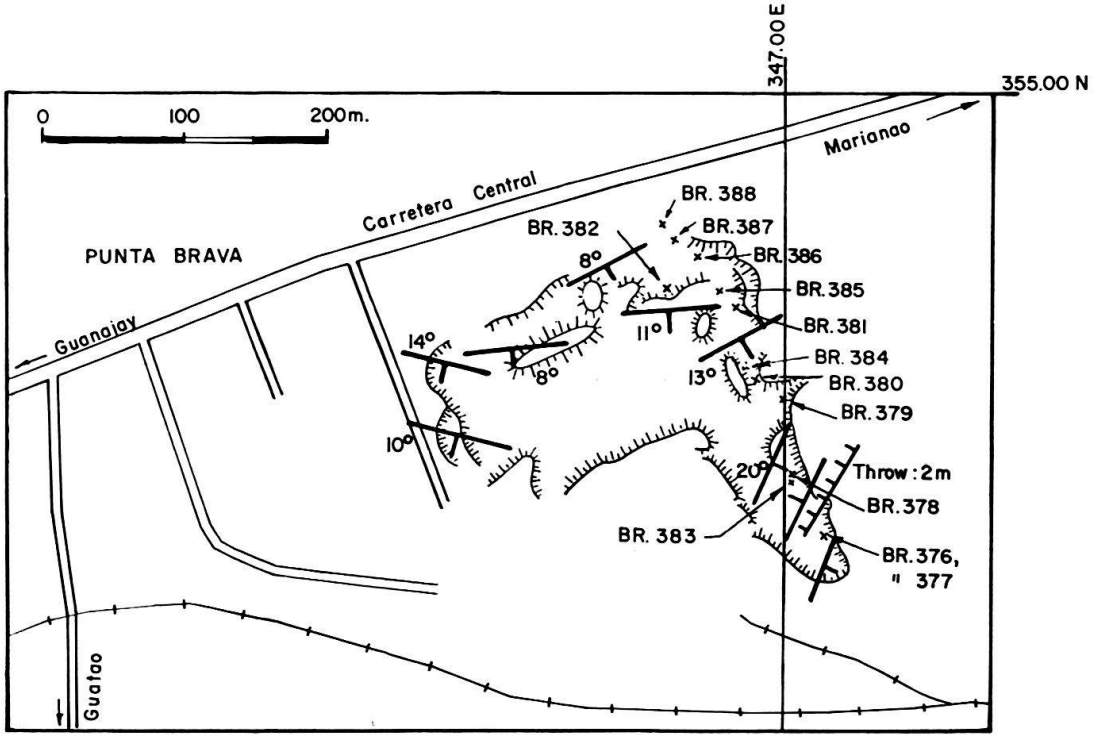

Fig. 64. Index map of the quarry east of Punta Brava.

Jicotea beds to be under heavy grass and soil cover, and lithologies reminiscent of the Punta Brava formation could not be found. In view of these observations it is our opinion that also the name Jicotea should not be used for Upper Eocene beds in the Habana area.

Description of the type locality of the Punta Brava formation

The type locality of the Punta Brava formation was completely exposed in the summer of 1958 in the abandoned quarry east of Punta Brava, a village on the Carretera Central about 3 km southwest of the Plaza del Mediodía. The coordinates of the quarry area are 354.80 N and 347.00 E (index map, fig. 64). The Punta Brava formation consists of about 23 m of well-bedded, hard, whitish to yellowish orange limestones and chalky limestones and orange to grayish more or less shaley, very fine-grained, graded-bedded calcarenites with dark igneous grains. As shown in the columnar section, fig. 65, each sedimentary cycle is closed by shaley beds. Toward the top of the formation, the bedding is less distinct and in the uppermost 5 m there are no more clastic beds. An irregular surface, probably corresponding to a local intraformational disconformity, was observed about 6 m above the base of the formation. The formation rests unconformably on much steeper dipping brownish sandy

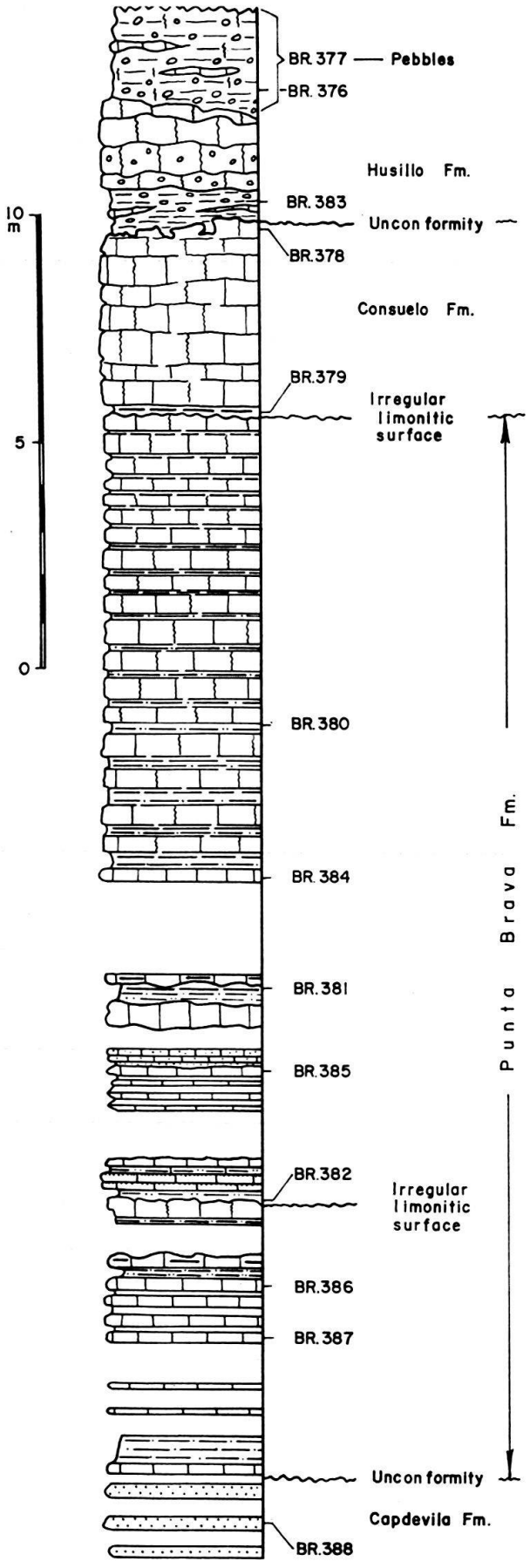

Fig. 65. Columnar section of the Punta Brava, Consuelo and Husillo formations, quarry east of Punta Brava.

Lower Eocene Capdevila beds, represented by BR station 388, described under Capdevila formation. The white to yellowish massive chalks of the Oligocene Consuelo formation overlie disconformably or with slight angular unconformity the Punta Brava formation. This disconformity or unconformity is marked by an irregular, limonitic surface suggesting emersion. The overlying Consuelo beds of the *Globigerina ciperoensis–Globorotalia opima* zone contain re-deposited Upper Eocene and Lower to Middle Eocene planktonic Foraminifera. Unconformably on top of the Consuelo beds follow conglomeratic chalks and chalky limestones with

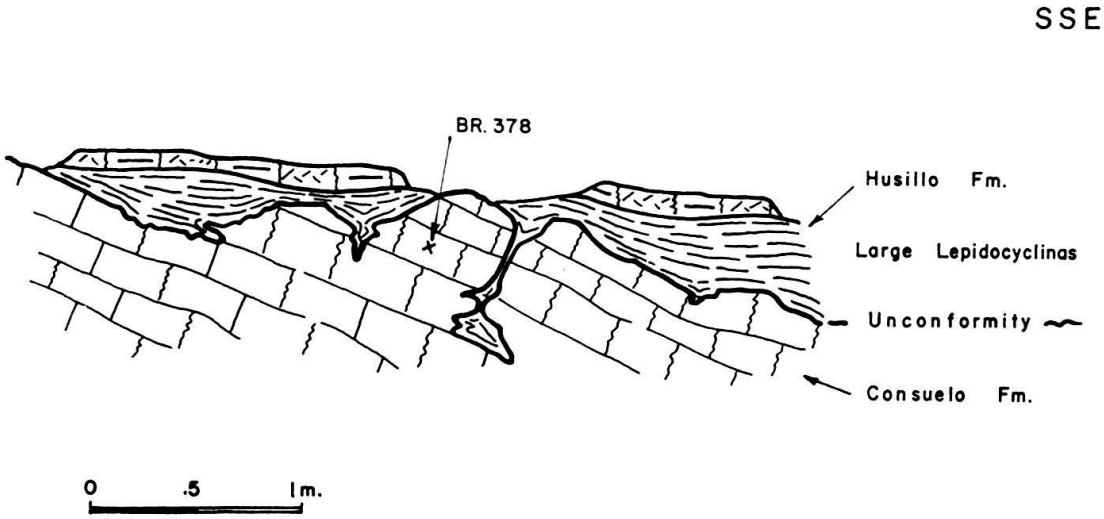

Fig. 66. Detail of the unconformable contact between the Consuelo and Husillo formations, quarry east of Punta Brava.

numerous lepidocyclinas and *Operculinoides* which we tentatively assigned to the Husillo formation. Although the unconformity is distinctly angular and irregular as expressed by the sketch of the contact zone, fig. 66, there is practically no time break between the Consuelo and the Husillo beds, both of which seem to form part of the *Globigerina ciperoensis–Globorotalia opima* zone.

W. M. VAN DEN BOLD (letter March 21, 1963) identified in BR station 383 the following ostracodes:

Aurila deformis (REUSS) ?
Bairdia sp.
Cytherella sp.

and in BR 376, which is stratigraphically about 2.8 m higher,

Aurila deformis (REUSS)
Bairdia sp.
Jugosocythereis vicksburgensis (HOWE)
Krithe sp.

At a later visit, in December 1958, the quarry in which the type section was measured was found to be filled up and levelled. However, at the remaining eastern cliff, the Punta Brava beds and adjoining formations were still accessible.

The stratigraphic position of the Punta Brava type samples is shown in the columnar section (fig. 65). They are from bottom to top:

BR station 387
Lithology: Limestone, hard, whitish to very pale orange.
Texture: Microcrystalline groundmass with planktonic microfossils. Recrystallization destroyed most of the discoasterids and coccoliths.

Assemblage:
Discoaster barbadiensis TAN (common)
Discoaster cf. *woodringi* BRAMLETTE and RIEDEL (rare)
Braarudosphaera bigelowi (GRAN and BRAARUD)
Braarudosphaera discula BRAMLETTE and RIEDEL (common)
Coccoliths (rare)
Tremalithus eopelagicus BRAMLETTE and RIEDEL (large specimens)
Thoracosphaera spp. (ellipsoid and spherical bodies).

BR station 386
Lithology: Limestone, chalky, very pale orange.
Texture: Microcrystalline groundmass with planktonic microfossils.

Assemblage:
Globigerina spp. with coarse perforations
Discoaster aster BRAMLETTE and RIEDEL (rare)
Discoaster barbadiensis TAN (rare)
Braarudosphaera bigelowi (GRAN and BRAARUD) (common)
Braarudosphaera discula BRAMLETTE and RIEDEL
Coccoliths (rare)
Tremalithus eopelagicus BRAMLETTE and RIEDEL (large specimens)
Thoracosphaera spp. (ellipsoid and spherical bodies).

BR station 382
Lithology: Calcarenite, very fine-grained, friable, with a few igneous grains, dark yellowish orange.

Washed residue with
Hantkenina alabamensis CUSHMAN
Hantkenina thalmanni BRÖNNIMANN
Globorotalia centralis CUSHMAN and BERMÚDEZ
Globigerapsis index (FINLAY)
Globigerapsis semiinvoluta (KEIJZER)
Globoquadrina venezuelana (HEDBERG) group
Globigerina aff. *rohri* BOLLI group
Globigerina ampliapertura BOLLI
Globigerina linaperta FINLAY
Chiloguembelina cubensis (PALMER).

BR station 385
Lithology: Limestone, grayish orange.
Texture: Microcrystalline groundmass with planktonic microfossils.

Assemblage:
Hantkenina alabamensis CUSHMAN
Globorotalia centralis CUSHMAN and BERMÚDEZ
Globoquadrina venezuelana (HEDBERG) group

Globigerina cf. *ampliapertura* BOLLI
Globigerina rohri BOLLI group
Globigerapsis semiinvoluta (KEIJZER)
Discoaster barbadiensis TAN
Braarudosphaera bigelowi (GRAN and BRAARUD)
Coccoliths
Tremalithus eopelagicus BRAMLETTE and RIEDEL (large specimen)
Thoracosphaera sp. (globular bodies).

BR station 381
Lithology: Calcarenite, very fine-grained, friable, with a few igneous grains, grayish orange to dark yellowish.
Washed residue with

Globorotalia centralis CUSHMAN and BERMÚDEZ
Globoquadrina venezuelana (HEDBERG) group
Globigerina ampliapertura BOLLI
Globigerina rohri BOLLI group
Globigerina aff. *senni* (BECKMANN)
Globigerapsis index (FINLAY).

BR station 384
Lithology: Limestone, very pale orange.
Texture: Microcrystalline to cryptocrystalline groundmass with abundant planktonic microfossils and few angular igneous grains in layers.
Assemblage:

Globigerapsis index (FINLAY)
Globigerapsis semiinvoluta (KEIJZER)
Globorotalia centralis CUSHMAN and BERMÚDEZ
Braarudosphaera bigelowi (GRAN and BRAARUD)
Discoaster barbadiensis TAN
Coccoliths (rare)
Tremalithus eopelagicus BRAMLETTE and RIEDEL (large specimen)
Thoracosphaera sp. (globular bodies).

BR station 380
Lithology: Calcarenite, very fine-grained, friable, with a few igneous grains, dark yellowish orange.
Washed residue with

Hantkenina alabamensis CUSHMAN
Globorotalia centralis CUSHMAN and BERMÚDEZ
Globoquadrina venezuelana (HEDBERG) group
Globigerina aff. *ampliapertura* BOLLI
Globigerina rohri BOLLI group
Catapsydrax dissimilis (CUSHMAN and BERMÚDEZ)
Globigerapsis semiinvoluta (KEIJZER)
Chiloguembelina cubensis (PALMER).

The samples from BR stations 378 and 379 are from the Oligocene Consuelo formation and those from BR stations 383, 376, 377 and 1013 from beds tentatively

referred to the Oligo-Miocene Husillo formation. Their stratigraphic position is indicated in the columnar section, fig. 65. They will be described under Consuelo formation.

Environment and age

The type section of the Punta Brava formation consists in its lower half of clastic, dark orange, very fine-grained calcarenites or calcareous siltstones with dark igneous fragments, and in its upper half of whitish to orange hard limestones and chalky limestones of cryptocrystalline texture with interbedded shales. The upper beds contain abundant microfossils of which some groups such as coccoliths and discoasterids may occur in rock-forming quantities. From a rough estimate of the ratio of planktonic and benthonic Foraminifera it can be inferred that the type beds were formed under basinal conditions, similar to those under which the limestones and chalks of the Universidad formation were laid down (GRIMSDALE and VAN MORKHOVEN, 1955). The associated fine-grained clastics also yield abundant planktonic Foraminifera indicating that they too were deposited under deep-water conditions. Larger benthonic Foraminifera, in particular discocyclinas, asterocyclinas and lepidocyclinas, conspicuous in the type beds of the Jabaco formation, are absent. Minute clastic fragments, usually angular dark igneous grains, were noticed to be arranged in microlaminae in otherwise non-clastic deeper water limestones, suggesting that the source of the clastic material was probably not too close to the Punta Brava locality. The recurrence of clastic sedimentation in the Upper Eocene and the fore-reefal faunal association of the Jabaco beds are suggestive of a post-Universidad pre-Consuelo period of apparently minor uplift movements in the Habana area. This would explain the flysch-type graded-bedding of the Punta Brava clastics reflecting rapid influx and settling of the detrital material in a trough in front of an unstable area. Late Middle Eocene rocks were only rarely encountered in the Habana area and Upper Eocene beds are missing, excepting in Punta Brava and perhaps at Tejar Consuelo (slumped beds). The late Middle and Upper Eocene planktonic Foraminifera in the basal slumped zone at Tejar Consuelo may however imply that late Middle to Upper Eocene basinal sediments were originally laid down over all or part of the Habana area, but were then removed prior to Consuelo time as a sequel to the mentioned uplift movements.

The discoasterids of the Punta Brava beds are poorer in species than those of the Lower to Middle Eocene Universidad formation. The following species were recorded in the type samples:

Braarudosphaera bigelowi (GRAN and BRAARUD) (rare)
Braarudosphaera discula BRAMLETTE and RIEDEL (common)
Discoaster aster BRAMLETTE and RIEDEL (rare)
Discoaster barbadiensis TAN (common)
Discoaster cf. *woodringi* BRAMLETTE and RIEDEL (rare).

The other nannofossils associated with the discoasterids continue as in the Lower to Middle Eocene beds:

Coccoliths, with large specimens of *Tremalithus eopelagicus* BRAMLETTE and RIEDEL
Thoracosphaera spp. (globular and ellipsoid bodies).

Discoasterids, coccoliths and *Thoracosphaera* occur in all the thin sections studied, but their number often appeared reduced through recrystallization. Radiolaria are virtually absent in the Punta Brava beds.

The following diagnostic Universidad discoasterids do not extend into or perhaps occur only rarely in the Punta Brava formation:

Discoaster lodoensis BRAMLETTE and RIEDEL
Marthasterites tribrachiatus (BRAMLETTE and RIEDEL)
Marthasterites sp.

The extinction of *D. lodoensis* and of *M. tribrachiatus*, the two most characteristic Universidad forms, creates a distinct faunal break between the Universidad and the Punta Brava beds. The latter are here referred to the *Discoaster barbadiensis* zone.

The planktonic Foraminifera of the Punta Brava formation are diagnostic for Upper Eocene, but not for the late Upper Eocene *Globorotalia cerroazulensis* zone, as represented at Jabaco. A lithologic gap, indicated in the field by an irregular, limonitic disconformity separates the Punta Brava formation and the *Globigerina ciperoensis–Globorotalia opima* zone of the Oligocene Consuelo formation. At Tejar Consuelo the Consuelo formation extends from the *Globigerina ampliapertura* zone into the *Globigerina ciperoensis–Globorotalia opima* zone. Based on the absence of *Globorotalia cerroazulensis* and on the occurrence of highly evolved representatives of *Globorotalia centralis* and *Globigerapsis semiinvoluta*, the Punta Brava beds are here placed at the top of the early Upper Eocene *Globigerapsis semiinvoluta* zone.

Consuelo Formation

Chalky beds of the older part of the Marianao group assigned by R. H. PALMER and later by BERMÚDEZ to formations of Upper Eocene age, turned out later to be either older or younger than Upper Eocene. The Consuelo formation proposed by BERMÚDEZ (1950) is a case in point, and a review appears indicated to explain the present nomenclatorial usage and age assignment of the beds erroneously regarded at one time or another as Upper Eocene.

PALMER (1934, p. 125, table I, pp. 132 and 133) included in his supposedly Upper Eocene Príncipe formation, or "upper phase of the Eocene", the soft whitish sediments above the Capdevila formation or "lower phase of the Eocene", and below the Oligo–Miocene overlap. In 1937, BERMÚDEZ (pp. 153–169) sampled the typical exposures of the Príncipe formation along the road cuts across Loma del Príncipe and on the campus of the University of Habana, and found certain but not all of the faunas to be Lower Eocene (index map, fig. 49). Based on this he believed to deal with an older lithologic unit different from PALMER's Príncipe formation which he called Universidad formation. But in fact BERMÚDEZ did not find a new formation. What he showed was simply that part of PALMER's Príncipe formation is of Lower Eocene age. PALMER in his paper of 1945 (table I on p. 6)