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NOTES ON THE TERTIARY STRATIGRAPHY OF MARGARITA ISLAND

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ABSTRACT

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Micropalaeontological evidence is presented for a further refinement of the Tertiary stratigraphy of Margarita Island, Venezuela. The writer supports Bermudez & Gamez (1966) and Butterlin (1970) in determining the uppermost beds of the Punta Mosquito Formation as no younger than the *Truncorotaloides rohri* zone of the Middle Eocene. Caudri's (1974) evidence for possible deposition of Upper Eocene sediments is challenged. Micropalaeontological studies and field observations indicate the La Guica Formation to be a middle clay member of the Mio-Pliocene Cubagua Formation. Rich planktonic foraminiferal faunas from this horizon are identified as representing the Late Miocene *Neogloboquadrina dutertrei* zone of Bolli & Bermudez (1965). The Los Bagres limestone is interpreted as allochthonous blocks of Paleocene or Early Eocene age within the conglomeratic facies of the Lower Eocene Las Bermudez Formation. The time gap represented by the Miocene-Eocene unconformity on the island can be demonstrated to extend through Late Eocene to Late Miocene time.

INTRODUCTION

Margarita Island has been under continuous geological study since WALL (1860) first defined the geology in terms of his 'Older' (metamorphic) and 'Newer' (Miocene) 'Parian Systems'. He also mentioned an intermediate sedimentary section of unknown age exposed between Porlamar and Pampatar, which RUTTEN (1940) much later identified as Eocene. WOODRING (1928) had earlier confirmed the presence of definite Miocene faunas in Wall's 'Newer Parian' but it was LIDDLE (1946) who first clearly documented the major unconformity which exists between the Miocene and Eocene sedimentary sections of the island. In order to more exactly define the magnitude of this unconformity field and micropalaeontological studies were undertaken of those stratigraphic units directly associated with that stratigraphic break. These included the uppermost horizons of the Eocene Punta Carnero Group, the basal beds of the unconformably overlying Cubagua Formation, and isolated units such as the La Guica Formation and Los Bagres limestone, which have been considered at one time or another as mid-Tertiary in age.

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PUNTA MOSQUITO FORMATION

The upper part of the Punta Carnero Group, defined as the Punta Mosquito Formation by DE RIVERO (1956), begins with orbitoidal limestones at the base (the 'Upper orbitoidal beds' of Kugler's Punta Carnero Formation) whose fauna of larger foraminifera was interpreted as Late Eocene in age (ANISGARD, 1956, DE RIVERO, 1956, KUGLER, 1957). Species identified at that time included:

Eorupertia sp.
Lepidocyclina (Pliolepidina) pustulosa (Douvillé)
Lepidocyclina cf. yurnagunensis Cushman
Eoannularia eocenica Cole and Bermudez
Discocyclina (Asterocyclina) cf. D. (A) asterisca (Guppy)
Operculinoides trinitatensis (Nuttall)
Gypsina globulus (Reuss)
Gypsina vesicularis (Parker and Jones)
Fabiania cubensis (Cushman and Bermudez)
Schlumbergerina

However, Brönnimann, Renz. and Blow (KUGLER, 1957) all suggested that the smaller foraminifera were more indicative of a Middle Eocene age. This was later confirmed by BERMUDEZ & GAMEZ (1966) who, in basing their conclusions on the

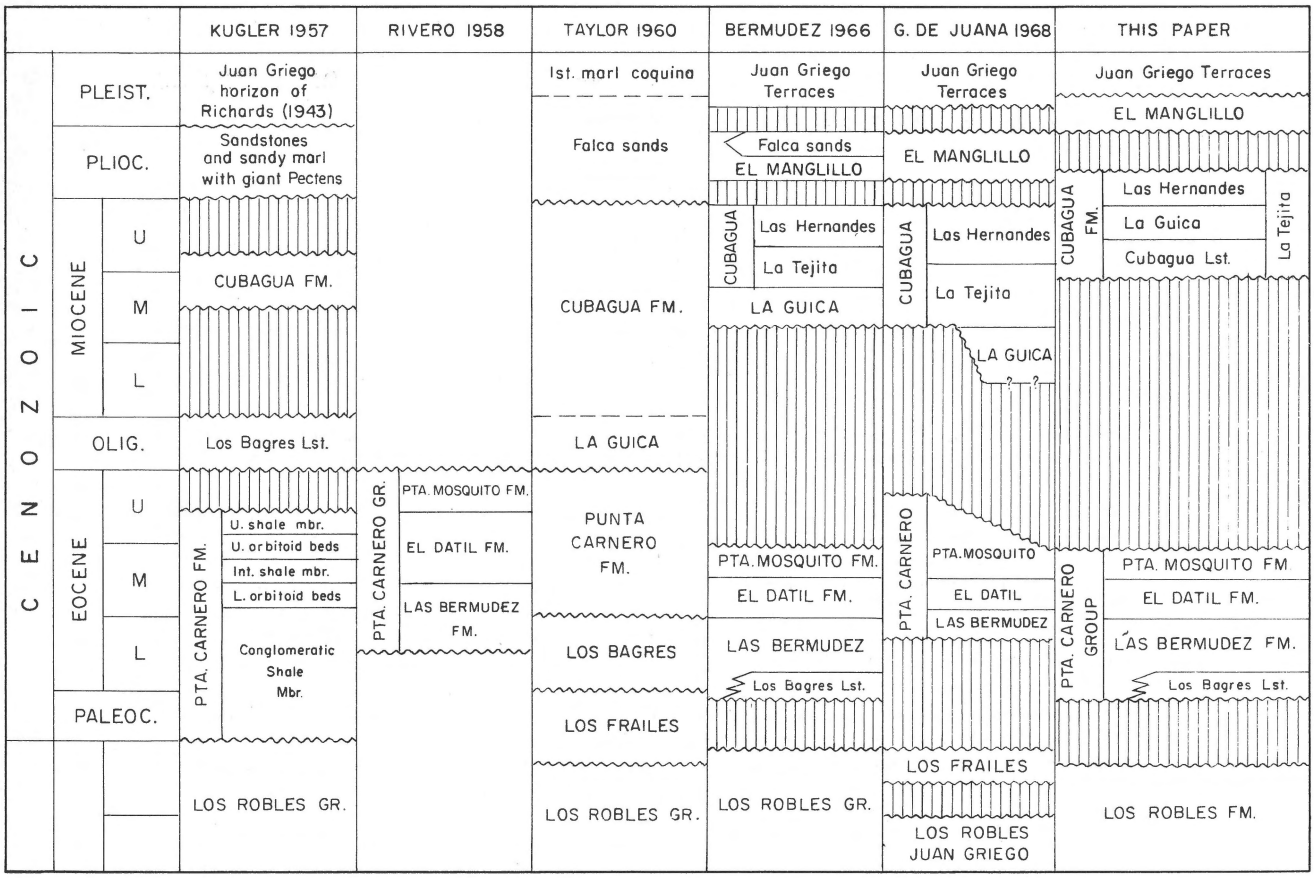

Fig. 1
Lithostratigraphy of Margarita Island, according to various authors.

rich microfaunas of the overlying shale interval (Kugler's 'upper shale member'), concluded that the basal orbitoidal limestone unit of the Punta Mosquito Formation must essentially represent the Middle Eocene *Porticulosphaera mexicana (Orbulinoides beckmanni)* zone of BOLLI (1957, 1966). A planktonic assemblage was not described from the orbitoidal level but the richer faunas of the overlying shale unit indicated an uppermost Middle Eocene *Truncorotaloides rohri* zone age. The writer, together with M.A. Furrer (personal communication), and M. Tourmakine (in CAUDRI, 1974) have since identified the index marker *Orbulinoides beckmanni* within the orbitoidal limestone sequence.

The larger foraminifera have also been restudied by BUTTERLIN (1970) who also concluded a Middle Eocene age in identifying the following species:
Lepidocyclina (Pliolepidina) ariana Cole and Ponton
Asterocyclina habanensis (Cole and Bermudez)
Asterocyclina monticellensis (Cole and Ponton)
Asterocyclina penonensis (Cole and Gravell)

All these species are considered by Butterlin not to range up into the Upper Eocene.

Thus, with Butterlin's publication, it appeared that workers in both the larger benthonic and the planktonic foraminifera were in agreement on a Middle Eocene age for the Punta Mosquito Formation. However, CAUDRI (1974) has since identified three species which she considers as indicative of a Late Eocene age. These are *Helicostegina soldadensis,* 'a very large-chambered Lepidocyclina we have called *'spatiosa'*, and perhaps *Asterocyclina asterisca'*. However, the latter species has been described from other Venezuelan stratigraphic units now considered to belong to the Middle Eocene. These include the Churuguarita Formation of northeast Zulia, the Cerro Campana Formation of Falcón, the Peñas Blancas Formation of Guárico, and the Tinajitas Member of the Caratas Formation of Anzoátegui (see HUNTER, 1974). *Helicostegina soldadensis* has also been recorded from the Peñas Blancas Formation and from the San Jacinto Formation of northwestern Colombia which, in its type locality, is directly overlain by Middle Eocene marls.

Although Caudri is prepared to interpret the presence of these species as contaminants from overlying alluvial material there is no further supporting evidence to suggest that Upper Eocene and Oligocene sediments have ever been deposited

within the area of the Venezuelan northern offshore island complex. Caudri's principal sample (PJB-145) was the same as that studied by BUTTERLIN (1970) who concluded a Middle Eocene age. BERMUDEZ & GAMEZ (1966) describe the sample as coming from the Punta Mosquito coast, correlating it with the top of the upper shale member of the Punta Mosquito Formation in its type locality at Las Marites. By so doing they indicate a *Truncorotaloides rohri* zone age for the sample. A Middle Eocene age is further supported by the identification of *Orbulinoides beckmanni* by Tourmakine in the sample studied bu Caudri and Butterlin. All micropalaeontological evidence therefore indicates that the uppermost horizons of the Eocene Punta Carnero Group are no younger than the uppermost Middle Eocene *Truncorotaloides rohri* zone.

LA GUICA FORMATION

The La Guica Formation was originally described by TAYLOR (1960) as a silt/clay unit sandwiched, supposedly with unconformable contacts, between the Punta Carnero and Cubagua Formations considered Middle-Upper Eocene and Middle-Upper Miocene, respectively. In his map legend Taylor indicates the La Guica Formation as '?Oligocene', while in the stratigraphic chart it is shown as Miocene.

The clays of the type area contain an extremely rich foraminiferal fauna with planktonic species indicating an uppermost Miocene (*Neogloboquadrina dutertrei* zone) age based on the following identifications by the writer.
Neogloboquadrina dutertrei (d'Orb)
Spaeroidinellopsis subdehiscens (Blow)
Globoquadrina altispira (Cushman and Jarvis)
Globigerinoides obliquus extremus Bolli and Bermudez
Globigerinoides trilobus (Brady) s. 1.
Globorotalia acostaensis Blow
Globorotalia menardii (Parker, Jones, and Brady)
Globorotalia pseudomiocenica Bolli
Orbulina universa d'Orb
Globigerinella siphonifera (d'Orb)

The conspicuous absence of such planktonic species as *Globorotalia margaritae* (Bolli and Bermudez), *Globorotalia crassaformis* (Galloway and Wissler), *Globigerinoides conglobatus* (Brady) and species of *Pulleniatina* further indicates a Late Miocene age for the La Guica Formation.

This faunal data is supported by field evidence for placing the La Guica Formation as a middle clay member of the Upper Miocene-Pliocene Cubagua Formation. This stratigraphic revision is further supported by the presence of Early Pliocene microfaunas, including *Globorotalia margaritae*, in the Las Hernandez beds of the same area, which appear to represent an upper sandy facies of the same Cubagua Formation. The La Guica Member can be directly correlated with the Cerro Verde Member of the Cubagua Formation of the Venezuelan mainland (Araya Península), the Huso Clay Member of the Pozón Formation of Falcón, Venezuela, and the Las Perdices Formation in its type area of northwestern Colombia.

LOS BAGRES LIMESTONE

This 'basal limestone of Los Vagres' (Los Bagres), first mentioned by HESS & MAXWELL (1949), has been variously interpreted as a separate limestone unit unconformably located beneath the Punta Carnero Group (TAYLOR, 1960); as a lenticular reefal limestone within the base of the Las Bermudez Formation (GONZÁLEZ DE JUANA, 1968); and as allochthonous elements within the 'wildflysch' sediments of the Las Bermudez Formation (MUÑOZ, 1973).

This limestone was at one stage thought to be Cretaceous in age. BUCHER (1952) wrote: 'It is definitely of Cretaceous age; more precise dating is, however, not possible. It is hoped that the study of the fauna by J. W. Wells will yield evidence that will decide whether or not this limestone is post-Turonian like the coral limestones of Bonaire, Curaçao, and La Goajira which lie unconformably on older Cretaceous formations'. However, Wells' results were quite contrary to expectations when he concluded that, on the basis of its coral faunas, the age was 'definitely Oligocene' (KUGLER, 1957), listing the following species:
Stylophora imperatoris Vaughan
N. gen., n. sp. (astrocoeniid)
Acropora n. sp. (*A. echinata* gr.)
Leptoseris n. sp. (same as form from San Luis formation of Venezuela)
Actinacis sp. indeterm.
Agathiphyllia (?) *tenuis* (Duncan).

Further identifications by Wells are listed in Muñoz (1973) and include:
Astreopora sp.
Leptoria cf. L. spenceri Vaughan
Montastraea cf. M. altissima (Duncan)

Finally, a new genus, *Atopocoenia kugleri,* is described by WELLS (1973) from the Los Bagres limestone. In this latest publication Wells still favours an Oligocene age based purely on the coral faunas but the situation is best summarized in his communication to M. A. Furrer (in MUÑOZ, 1973) that 'the data from the corals suggest an Oligocene age but not definitely, and an Eocene age is not impossible. The real trouble is that Eocene reefal forms (corals) are not at all well known in the West Indian area, the only one being that of St. Bartholomew which has nothing in common with the Margarita fauna . . .'.

Palaeontologists working with the larger foraminifera have always preferred a Paleocene or Eocene age for the Los Bagres limestone. DE RIVERO (1956) lists:
Discocyclina (Discocyclina) anconensis Barker
Operculinoides trinitatensis Nuttall

Eoconuloides sp., and
Athecocyclina sp., suggesting a Middle or Early Eocene age.

KUGLER (1957) mentions further species identified by D. O. Nelson which include *Discocyclina cf. barkeri* Vaughan and Cole, and *Athecocyclina cf. cookei* Vaughan together with the planktonic species *Globorotalia aff. velascoensis.* From this fauna he concludes a possible Lower Eocene age and remarks that 'the presence of *Athecocyclina* would indicate Paleocene to Lower Eocene while the other forms indicate Lower to Middle Eocene . . .'.

The Los Bagres limestone and the Las Bermudez Formation carry little in the way of planktonic foraminifera but the rich faunas from the overlying El Datil Formation indicate that the Los Bagres limestone cannot be younger than Lower Eocene.

Based on the field evidence, the fauna of larger foraminifera, and the rich Middle Eocene microfaunas of the overlying El Datil Formation, the writer prefers to interpret the Los Bagres limestone as allochthonous blocks of Paleocene or Early Eocene age within the Lower Eocene conglomerates of the Las Bermudez Formation. MAURY (1925) described the presence of the Paleocene mollusc *'Venericardia planicosta*, smooth variety' on the island and, although its presence has never since been confirmed, it is quite possible that Maury's specimens could have come from blocks of the Los Bagres limestone.

CONCLUSIONS

It can be concluded from the above studies and discussions of published data that the Eocene-Miocene unconformity of Margarita Island spans Late Eocene through Middle Miocene time and there is no conclusive evidence that mid-Tertiary (Upper Eocene through Aquitanian) marine sediments were ever deposited in the island area. In clearly dating the Punta Mosquito Formation as Middle Eocene and the La Guica formation as the middle member of an Upper Miocene-Pliocene Cubagua Formation the coral faunas of the los Bagres Limestone remain the only slim evidence that mid-Tertiary time is represented in the Tertiary sedimentary record of the island.

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