CALCAREOUS NANNOFOSSIL BIOSTRATIGRAPHY OF THE TALARA GROUP (MIDDLE-LATE EOCENE) IN THE NEGRITOS AND CARPITAS FIELDS, TALARA BASIN, PERU

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Abstract: A biostratigraphic study of rock samples from the Talara Group (Talara Basin, Eocene of NW Peru) has allowed the recognition of several calcareous nannofossil biozones. Two wells were investigated from the Negritos and Carpitas oilfields, in the NW region of Peru. Biozones identified in the Talara Group provide dates of Middle to Late Eocene. Calcareous nannoplankton from this stratigraphic unit have not been previously described.

Introduction

The Talara Basin is situated in the westernmost part of Peru in South America. The Talara Group is a stratigraphic unit with widespread distribution, and it is the most representative of the Eocene of NW Peru. The Talara Group comprises mainly the Talara Shales, Talara Sandstone and Pozo Formations. The Talara Shales and Pozo Formations consist of dark brownish to greenish-grey shales, silts and silty clays. The Talara Sandstone is composed of medium- to fine-grained deep-water sandstones. The Talara Shales contain a section composed of synsedimentary breccias. This section is interpreted as a marine-slope facies complex that grades into an inner-shelf transgressive system (Muñoz, 1980).

Biostratigraphic investigations of this stratigraphic unit, based on benthic foraminifers, have been compiled by Gonzales (1976) but calcareous nannoplankton have not been previously described. The lack of detailed studies of calcareous nannofossils in the basin seriously limits attempts to correlate the biozones. Therefore, the main goal of this work was to study the calcareous nannoplankton of the Talara Group sediments and to provide a biozonation for this unit.

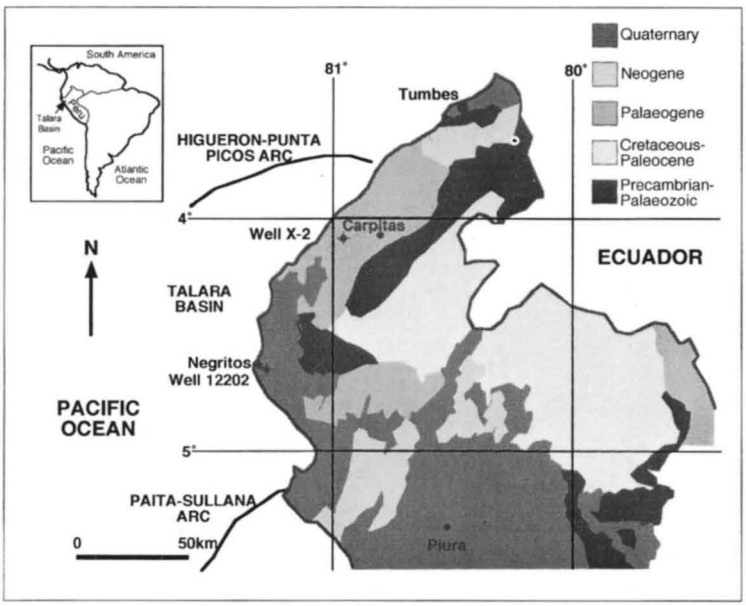

Figure 1: Geological map of the area, showing locations of wells studied (modified from Palacios, 1995).

Material and methods

Two wells were investigated from the NW region of Peru (Figure 1). Well 12202 (24-621m) is from the Negritos oilfield, with a total number of 63 cuttings samples studied, and Well X-2 (1078-1725m) is from the Carpitas field, from which 36 ditch-cuttings samples were collected. Smear-slides were prepared using standard methods and were mounted with Canada balsam. The LM study was undertaken at a magnification of 1280x using a Zeiss Photomicroscope. Some of the observed specimens are illustrated in Plate 1.

A quantitative analysis was attempted, with at least 300 specimens counted from the samples of Well 12202. However, Well X-2 samples had poor nannofossil assemblages, and so fewer than 300 specimens were counted. Around 86% of the smear-slides of both wells yielded datable nannofloras. Because of the ever-present danger of downward contamination, due to caving while holes were being drilled, the highest occurrences (tops) are used for the recognition of zones.

Biostratigraphic remarks

In most of the studied samples of Well 12202, the nannofossils are common and their preservational quality reveals that the majority of specimens were little affected by dissolution. Moderate preservation and common to rare nannofossil abundances were typical of Well X-2 samples. The distribution of nannofossils, as well as their abundances and states of preservation, are shown in Figures 2 and 3. The biozonation used in this study is based on that compiled by Perch-Nielsen (1985) after Martini (1971).

Early Middle Eocene - NP14

This zone is recognised by the last downhole occurrence (LDO) of *Discoaster sublodoensis* and first downhole occurrence (FDO) of *Rhabdosphaera inflata*. It is recorded

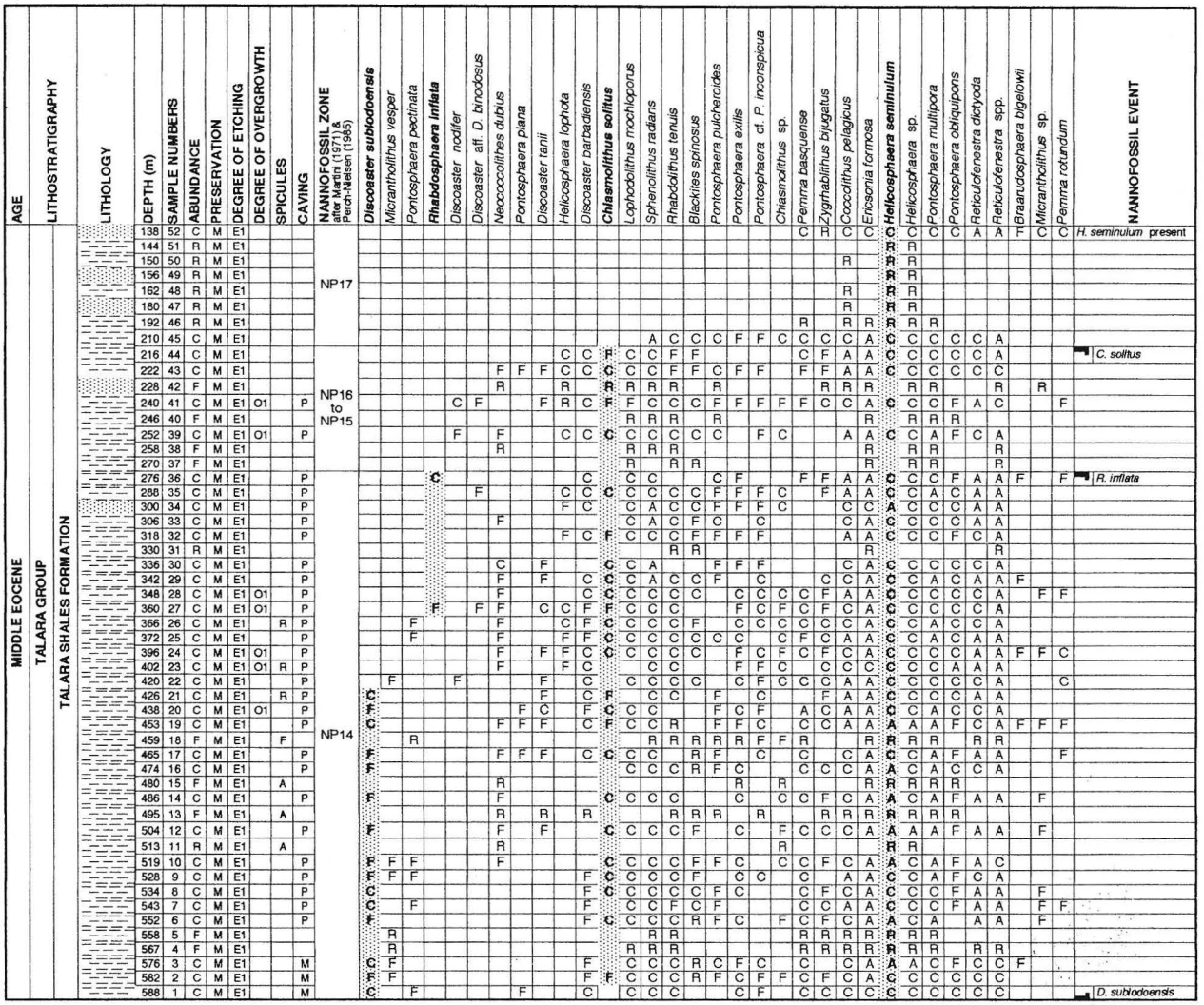

Figure 2: Distribution of calcareous nannofossils in Well 12202, Negritos field. *Abundance*: A = abundant, C = common, F = few, R = rare, VR = very rare; *Preservation*: M = moderate, P = poor; *Degree of etching/overgrowth*: E/O1 = slight, E/O2 = moderate, E/O3 = strong; *Caving*: 1 = slight, 2 = moderate.

recorded from 276m in Well 12202. The most common species in this zone are *Sphenolithus radians, Ericsonia formosa, Discoaster barbadiensis, D. sublodoensis, Neococcolithes dubius* and *Lophodolithus mochloporus.* This zone corresponds to the initial stage of deposition of the Talara Shales Formation. The Talara Group unconformably overlies the Echino stratigraphic unit.

Middle Eocene - NP15 to NP16

Zones NP15 and NP16 have been combined due to the absence of the appropriate distinguishing marker-species (*Rhabdolithus gladius*, *Reticulofenestra umbilica*). These zones are recognised by the LDO of *Chiasmolithus solitus.* The event was recorded at 216m in Well 12202. The interval is characterised by *Ericsonia formosa, Coccolithus pelagicus, Discoaster barbadiensis* and *C. solitus.* These zones comprise part of the Talara Shales Formation. NP16 is also recorded from 1212m in Well X-2. The absence of markers for the base of NP16 in these sections may be attributable to biogeographic restrictions.

Late Middle Eocene - NP17

The base of NP17 is identified by the FDO of *Chiasmolithus solitus.* The base of NP18 could not be recognised because of the absence of *Chiasmolithus oamaruensis.* However, Martini (1990) described the last occurrence of *Helicosphaera seminulum* towards the top of NP17. This species was recorded at 138m in Well 12202, and so the top of the studied interval is believed to lie in NP17. This interval is characterised by *Discoaster barbadiensis, C. solitus* and *H. seminulum. H. seminulum*, however, does not occur in Well X-2, and so the base of NP18 could not be recognised here.

Late Middle Eocene to Late Eocene - NP17 to NP20

These zones are indistinguishable in Well X-2 because of the absence of the appropriate marker-taxa (Perch-Nielsen (1985) commented that *Chiasmolithus* and *Isthmolithus* are absent or rare in low-latitude sections). The LDO of *Chiasmolithus solitus* can be used to determine the base of NP17, and *Discoaster barbadiensis*, the FDO of which

AGE	LITHOSTRATIGRAPHY	LITHOLOGY	DEPTH (m)	SAMPLE NUMBER	ABUNDANCE	PRESERVATION	DEGREE OF ETCHING	DEGREE OF OVERGROWTH	SPICULES	CAVING	NANNOFOSSIL ZONE after Martini (1971) & Perch-Nielsen (1985)	*Pontosphaera pulcheroides*	*Rhabdolithus tenuis*	*Braarudosphaera bigelowii*	*Discoaster tanii*	*Zygrhablithus bijugatus*	*Pontosphaera obliquipons*	***Chiasmolithus solitus***	*Chiasmolithus* sp.	*Micrantholithus* sp.	***Discoaster barbadiensis***	*Micrantholithus vesper*	*Pemma basquense*	*Coccolithus pelagicus*	*Ericsonia formosa*	*Helicosphaera* sp.	*Pontosphaera multipora*	*Reticulofenestra dictyoda*	*Reticulofenestra* spp.	NANNOFOSSIL EVENT
LATE EOCENE	TALARA GROUP		1122	34	F	M	E1	O2			NP20 to NP17										R	R	R	R	R	R	R	R	C	*D. barbadiensis* present
			1167	33	F	P	E1	O3													R	R	R		R	R	R	R	C	
			1197	32	F	M	E1	O1												R	R	R	R	F	F	R			C	
MIDDLE EOCENE			1212	31	F	M	E1	O1										R	R	R	R	R	R	F	F	F			C	*C. solitus*
			1221	30	F	M	E1		F									R	R	R	R	R	R	F	F	R	R	R	C	
			1227	29	F	M	E1		R									R	R	R	R	R	R	R	R		R	R	C	
			1233	28	R	P	E3											R	R	R	R	R	R				R	R	R	
			1257	27	F	M	E2											R	R	R	R	R	R	R	R				F	
			1278	26	R	P	E2											R	R	R	R	R	R				R		R	
			1302	25	R	M	E2										R	R	R	R	R	R	R			R	R		F	
			1317	24	R	P	E2										R	R	R	R	R	R					R		F	
			1347	23	R	P	E1	O3								R		VR			VR	VR	VR	R	R	F	R		F	
			1362	22	F	M	E2									R		VR			VR	VR	VR	F	R	R			F	
			1377	21	F	M	E1	O2	R	1			R	R	R	R	R	VR	R	R	VR	VR	VR	F	R	F	F	R	C	
			1380	20	R	P	E2						R	R	R			VR	VR		VR	VR	VR					R	R	
			1407	19	C	M	E1	O1		1			R					VR	VR		VR	VR	VR	F	F	R			C	
			1419	18	C	M	E1			1			R			R	R	VR	VR	R	VR	VR	R	F	F	R	F	F	C	
			1422	17	F	M	E2			1			R			R	R	VR	VR	VR	VR	VR		F		F			F	
			1437	16	C	M	E1			1	NP16		R		R	R	R	VR	VR	VR		R	F	F	R	F	R	F	C	
			1452	15	C	M	E1	O2		1			R		R	F		VR	R	VR			F	F	C	C		R	C	
			1467	14	C	M	E1			1		R					R	VR	R	VR	R		C	C	C	F	F	F	C	
			1476	13	C	M	E2			1		R						VR	VR	VR	VR	R	F		F	R	R	R	F	
			1497	12	C	M	E2	O1		1		R			R	F		VR	VR	VR	VR		F	F	C	C	F	F	C	
			1518	11	R	M	E2	O2							R			R	VR	VR	VR					R			R	
			1527	10	C	M	E1	O2		1					R	R	R	R	VR	VR	R			F	C	C	F	F	C	
			1542	9	F	M	E1	O1		1					R	R	VR		R	R			F	F	F	F	R	F	C	
			1587	8	F	M	E1	O1		1						R	VR		R	VR			F	R	F	R	VR	F	C	
			1599	7	R	P	E2									R	VR			VR			F	VR	F	VR	VR	VR	R	
			1617	6	R	P	E2										VR			VR			VR	VR	VR	VR	VR	VR	R	
			1644	5	R	P	E2										VR			VR			VR	VR	VR	VR	VR	VR	R	
			1662	4	R	P	E2	O1		1							VR			VR			VR	R	R	VR	VR	VR	R	
			1686	3	R	P	E2													VR			VR	VR	VR	VR	VR	VR	R	
			1707	2	R	P	E1	O2		2							R			R			R	R		R	VR	VR	R	
			1722	1	R	P	E2										VR			VR			VR	VR		VR	VR	VR	R	
			1725	BARREN							INDET.	BARREN																		INDETERMINATE

Figure 3: Distribution of calcareous nannofossils in Well X-2, Carpitas field. Key as for Figure 2.

marks the base of NP21, is still present at the top of the studied interval (1122m). The most common species in this interval in Well X-2 are *Coccolithus pelagicus, Ericsonia formosa, Reticulofenestra dictyoda* and *D. barbadiensis.*

Conclusions

Biozones NP14 to NP17 have been identified in Well 12202 (Negritos oilfield). In Well X-2 (Carpitas oilfield), NP16 to NP20 have been distinguished. Zones NP17 to NP20, and NP15 to NP16 cannot be distinguished due to the absence of marker-taxa. The Middle Eocene succession is generally thicker than the Late Eocene interval (Narváez, 1998). The base of NP17 (Middle Eocene) can be correlated between the two wells. The Talara Group in well 12202 does not contain nannofossil biozones of Late Eocene age.

The relatively low nannoplankton diversity, and the absence of certain marker-taxa, from Well X-2, is possibly the result of greater dissolution at deeper water-depths than in Well 12202, in which nannoflora are moderately well-preserved, suggesting that deposition may have taken place in depths well above the carbonate compensation depth. However, it is also possible that certain marker-taxa are missing as a result of biogeographic distributions.

Acknowledgements

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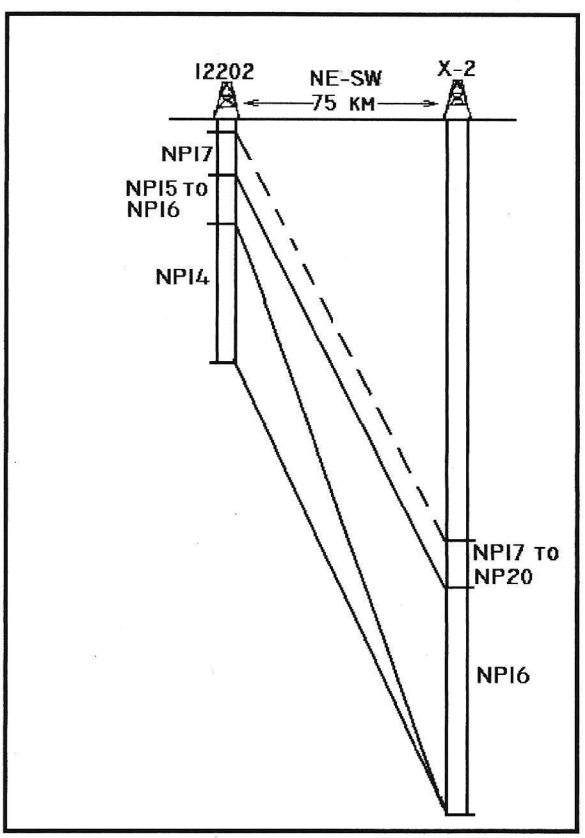

Figure 4: Correlation between Wells 12202 and X-2.

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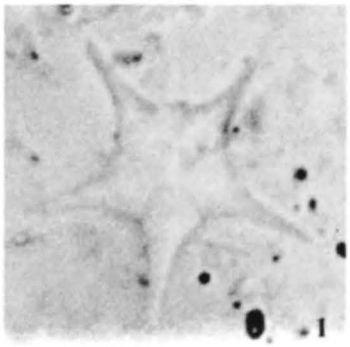
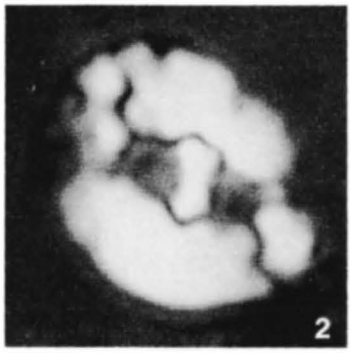
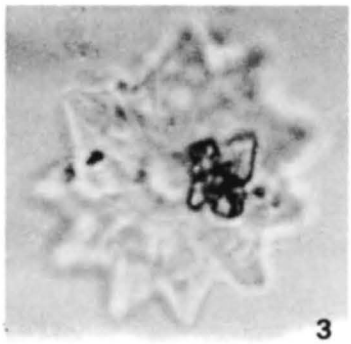
PLATE 1



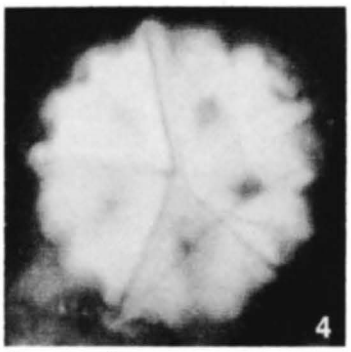
Discoaster sublodoensis
426m, Negritos field; 12μm diameter; Early Middle Eocene; Neg.# 07-40



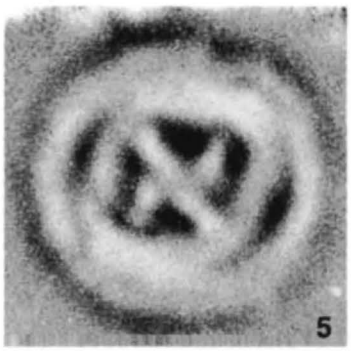
Helicosphaera seminulum
216m, Negritos field; 13μm length; Middle Eocene; Neg.# 07-15



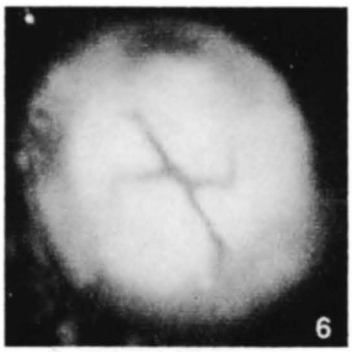
Discoaster barbadiensis
240m, Negritos field; 13μm diameter; Middle Eocene, Neg.# 09-5



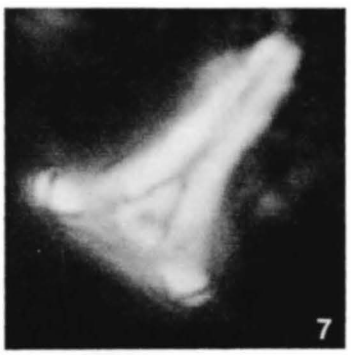
Pemma basquense
138m, Negritos field; 10μm diameter; Late Middle Eocene; Neg.# 04-15



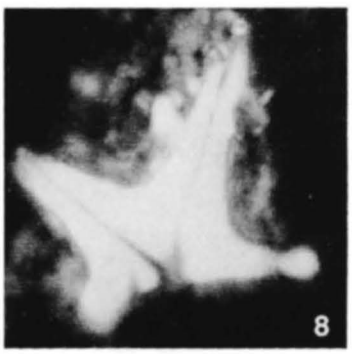
Chiasmolithus solitus
240m, Negritos field; 12.5μm length; Middle Eocene; Neg.# 01-21



Coccolithus pelagicus
222m, Negritos field; 12μm length; Middle Eocene; Neg.# 04-3

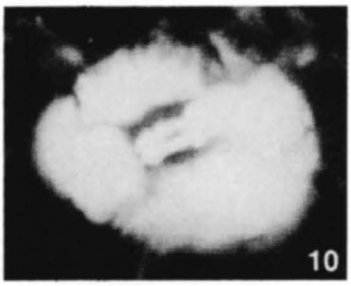


Zygrhablithus bijugatus
342m, Negritos field; 10μm length; Early Middle Eocene, Neg.# 04-19

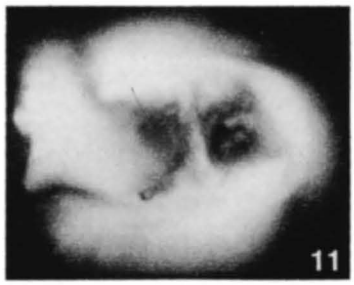


Micrantholitus vesper
420m, Negritos field; 15μm diameter; Early Middle Eocene; Neg.# 08-14

Rhabdolithus inflata 276m, Negritos field; 18μm length; Middle Eocene; Neg.# 08-27



Helicosphaera lophota
228m, Negritos field; 12μm length; Middle Eocene; Neg.# 08-3



Lophodolithus mochloporus
465m, Negritos field; 17.5μm length; Early Middle Eocene; Neg.# 04-35