seminario 25 giugno 2013

I macroforaminiferi del Paleogene:
classificazione, biostratigrafia e paleoecologia

ISPRA
Istituto Superiore per la Protezione e la Ricerca Ambientale
SERVIZIO GEOLOGICO D'ITALIA
Dipartimento Difesa del Suolo

SAPIENZA
UNIVERSITÀ DI ROMA

ORDINE DEI GEOLOGI DEL LAZIO

Paleoecologia dei macroforaminiferi del Paleogene

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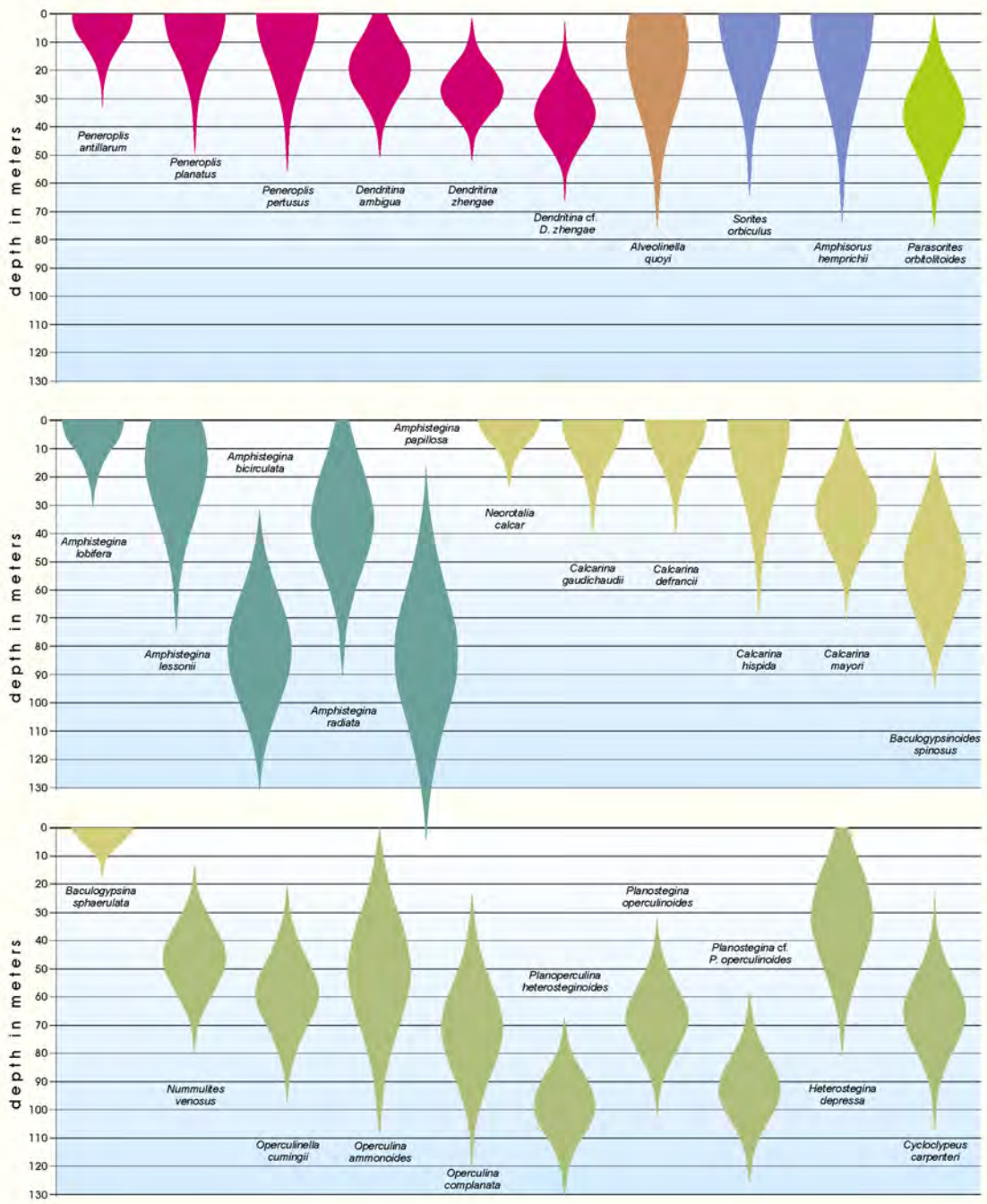
Outline

- Depth distribution in modern seas
- Paleoenvironmental models
- A case history: nummulite banks

The fundamental depth distributions in clear tropical seas



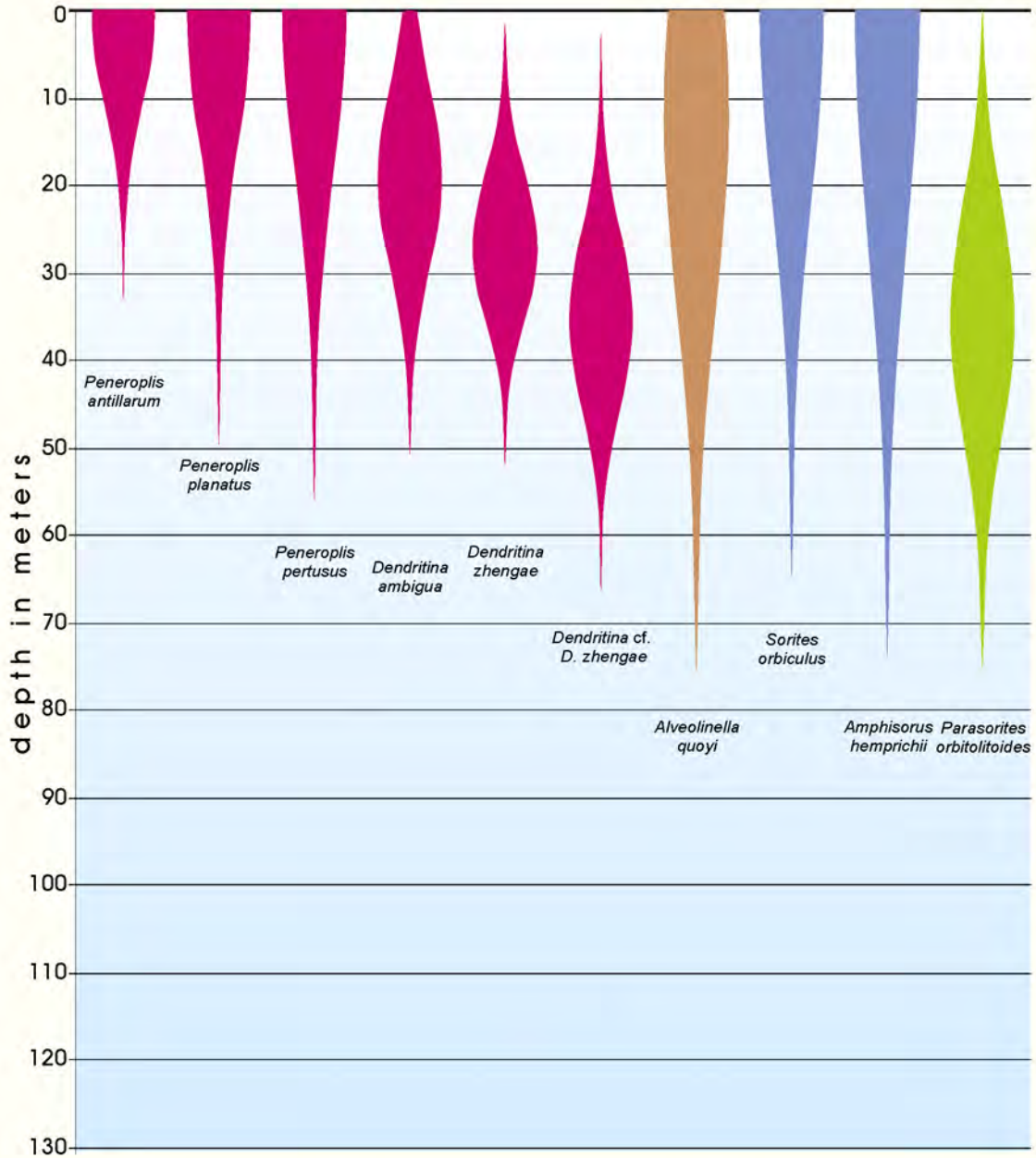
Peneroplis antillarum

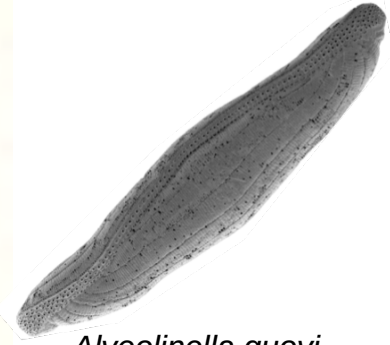
Peneroplis planatus

Peneroplis pertusus

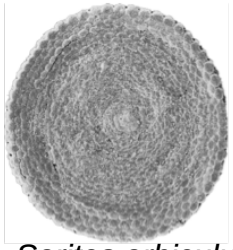
Dendritina ambigua

Dendritina zhengae

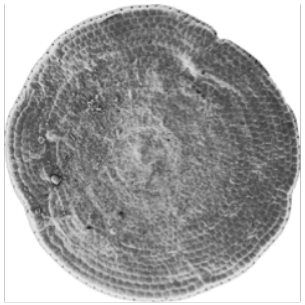




Alveolinella quoyi



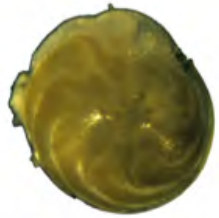
Sorites orbiculus



Amphisorus hemprichii

Parasorites orbitolitoides

Amphistegina lobifera

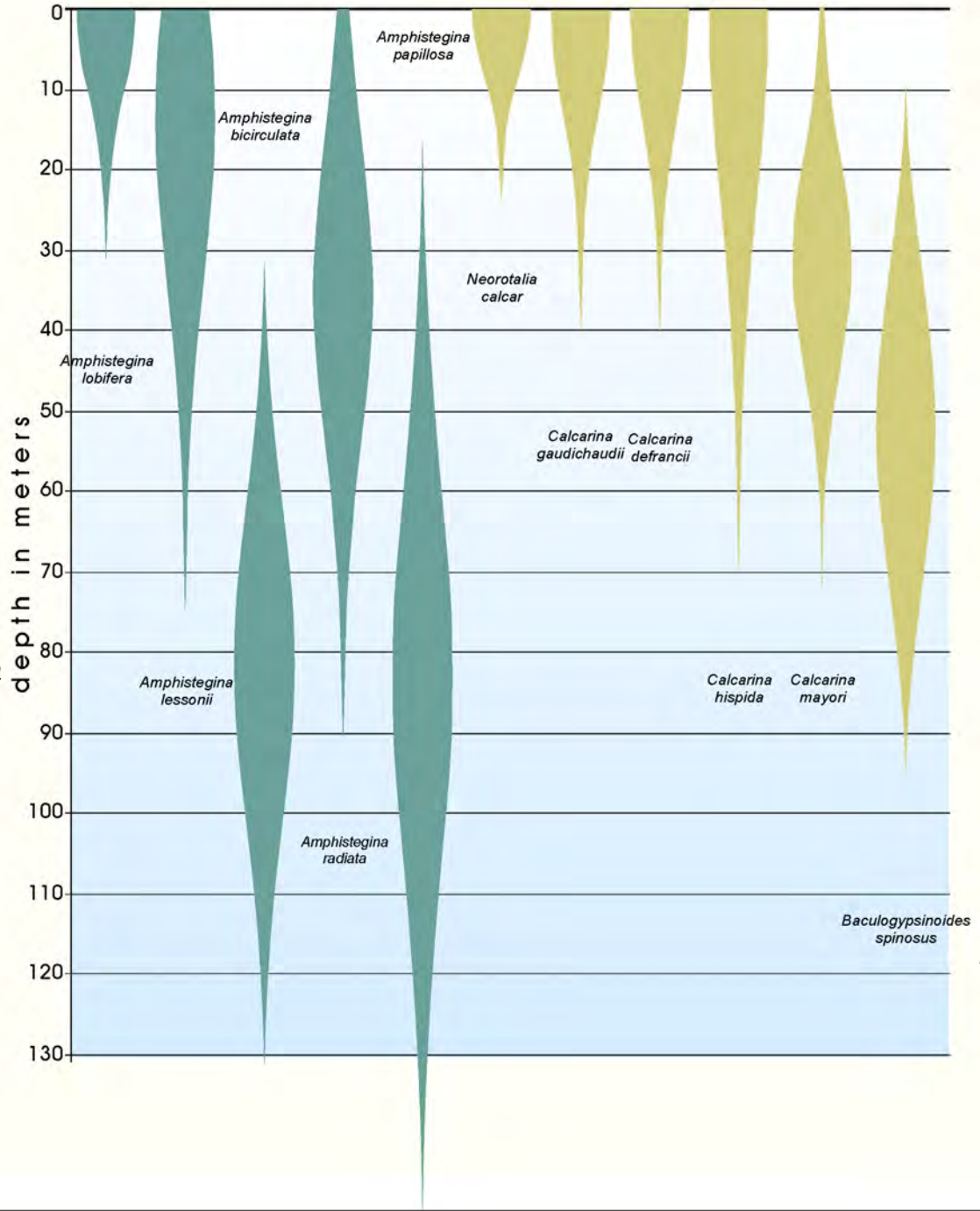


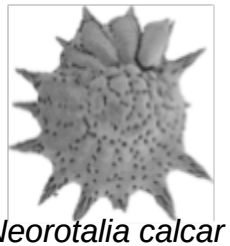
Amphistegina lessonii

Amphistegina bicirculata

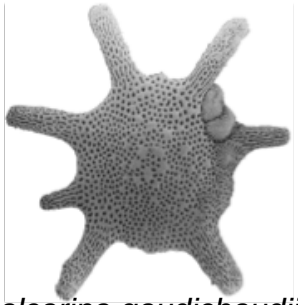
Amphistegina radiata

Amphistegina papillosa





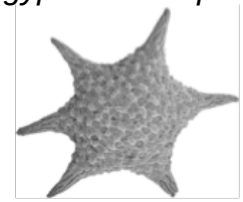
Neorotalia calcar



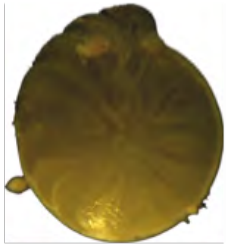
Calcarina gaudichaudii

Calcarina hispida

Baculogypsinoides spinosus



Baculogypsina sphaerulata

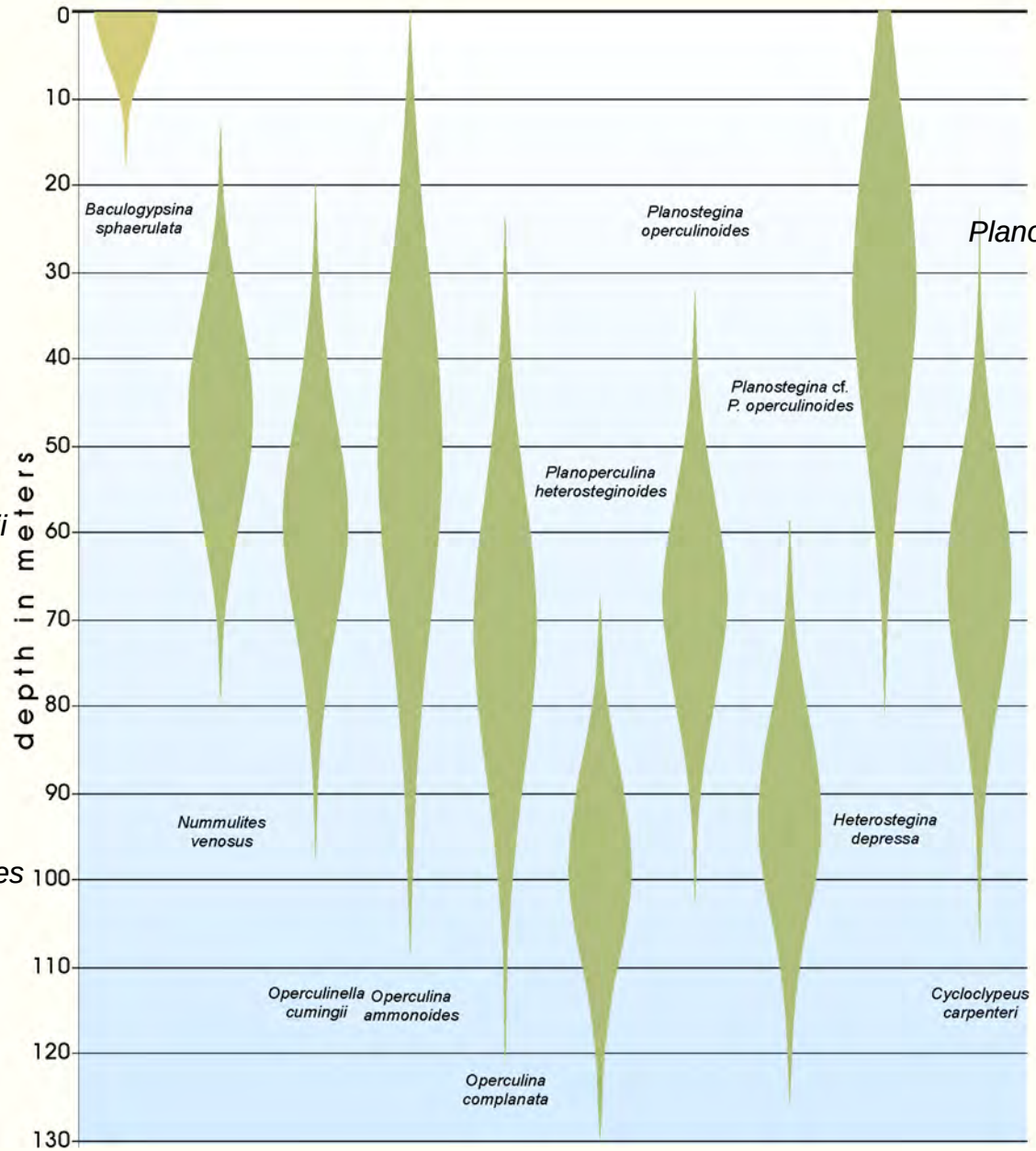


Nummulites venosus

Operculinella cumingii

Operculina ammonoides

Operculina complanata



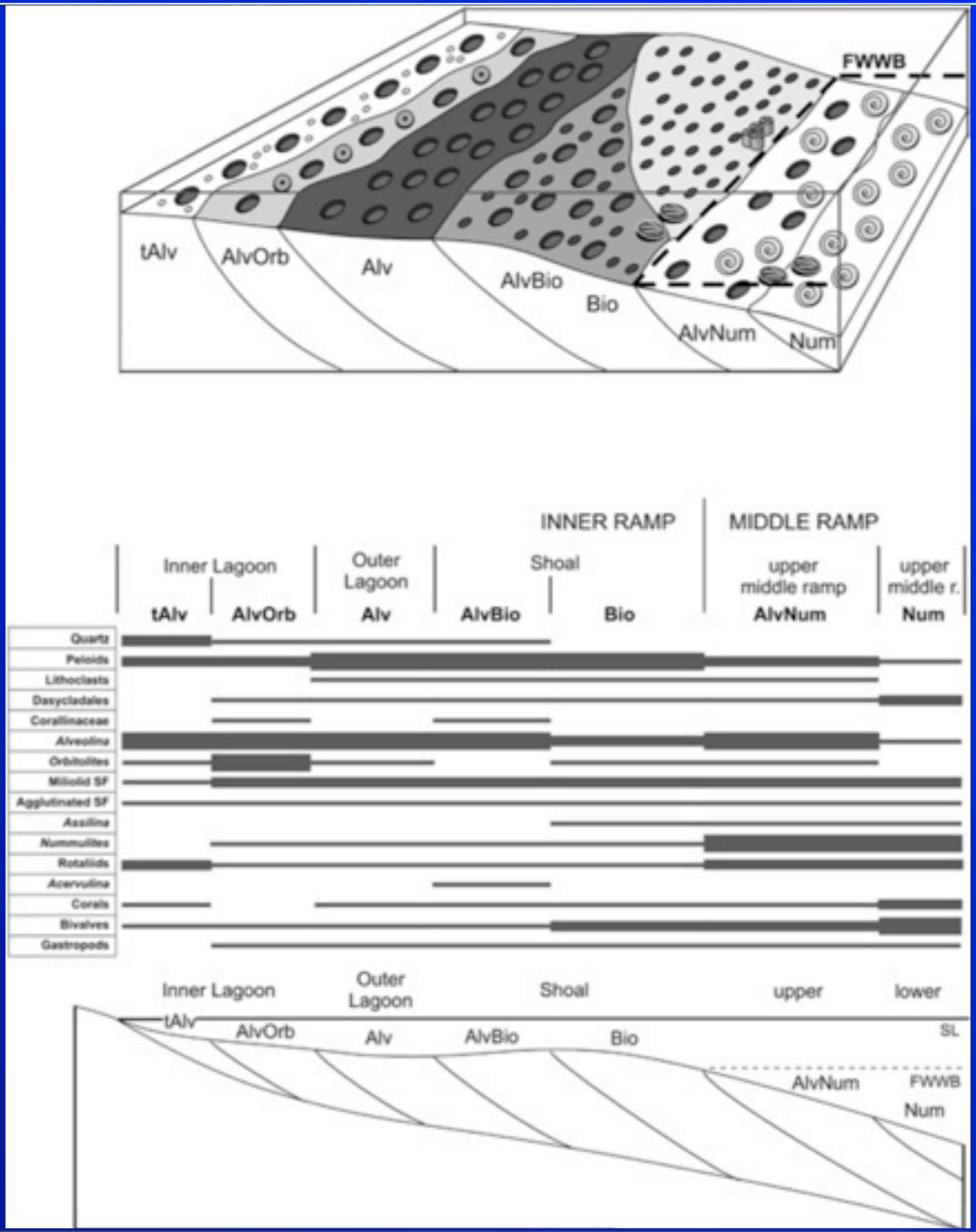
Planoperculina heterosteginoides

Planostegina operculinoides

Heterostegina depressa

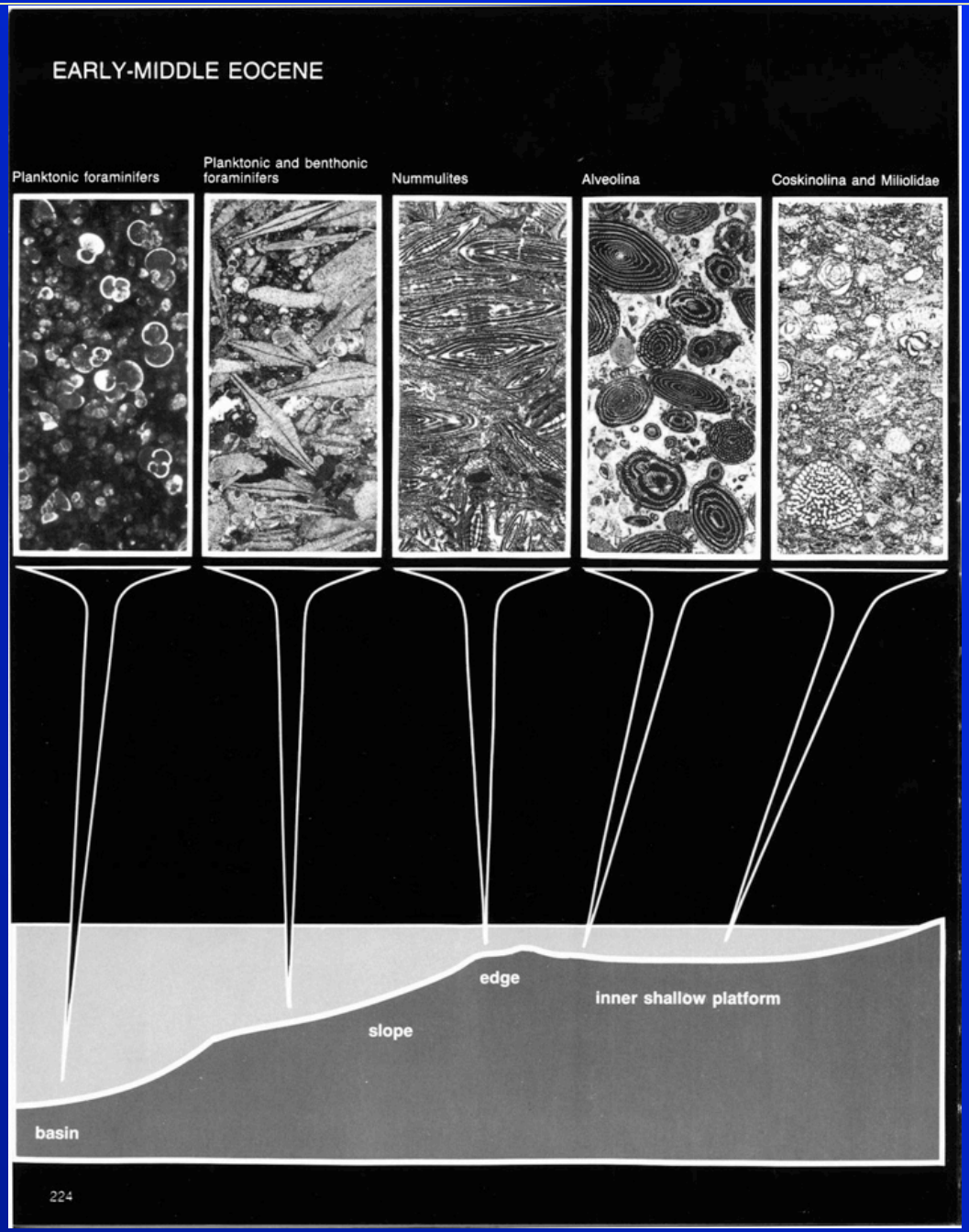
Cycloclypeus carpenteri

Paleoenvironmental models



Rasser et al. (2005)

Paleoenvironmental models



Sartorio & Venturini (1988)

Paleoenvironmental models

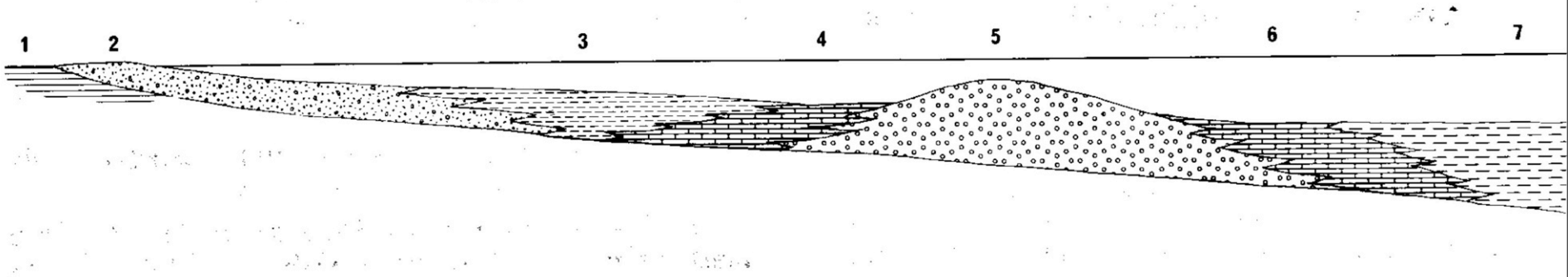
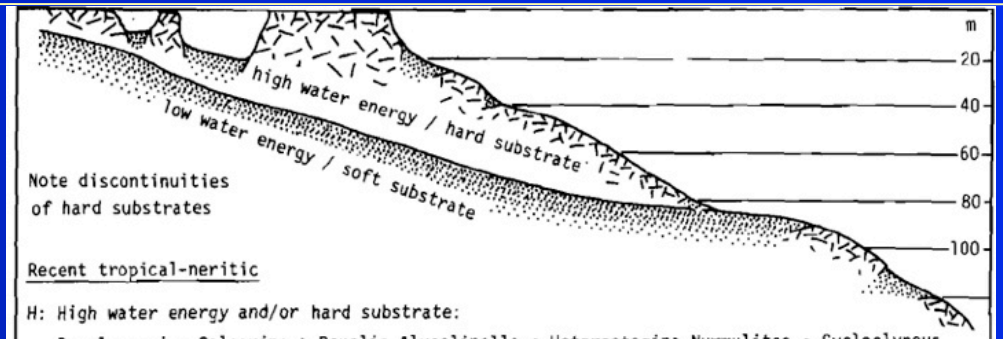


FIGURE 2

Relationship between the facies in the Collbàs Fm. : (1) lagoon facies; (2) fore-shore facies; (3) shore-face facies; (4) back-bank facies; (5) bank of large *Nummulites*; (6) fore-bank facies; (7) internal shelf facies

Serra-Kiel & Reguant (1984)

Paleoenvironmental models



Recent tropical-neritic

H: High water energy and/or hard substrate:
Baculogypsina,Calcarina → Borelis,Alveolinella → Heterostegina,Nummulites → Cycloclypeus

L: Low water energy and/or soft substrate. In the deepest section, the H/L difference may be inconspicuous or irrelevant.
Sorites,Amphisorus,Marginopora → Borelis,Alveolinella → Operculina → Heterocyclina

Miocene

H: Baculogypsina → Heterostegina (inv.) → Flosculinella → Nummulites → Cycloclypeus

L: "Archaias",Sorites → Borelis,Flosculinella → Operculina,Planoperculina

Oligocene

H: "Pararotalia" viennoti → Borelis → Nummulites → Heterostegina (inv.) → Spiroclypeus

L: Praerhapydionina → Borelis,Bullalveolina → Nummulites → Heterostegina (ev.) → Operculina

Late Eocene

H: Baculogypsinoides,Fabiania → Borelis → Nummulites,Heterostegina (inv.) → Spiroclypeus
Pellatispira (inv.)

L: Fallotella?,Orbitolites → Borelis → Nummulites → Operculina gr. gomezi & gr. alpina
Biplanispira,Pellatispira(ev.) → Bullalveolina

(inv.)=involute
(ev.) =evolute

Middle Eocene

H: Calcarina?,Fabiania,Dictyoconoides → Alveolina → Nummulites

L: Coskinolina,Dictyoconus → Orbitolites,Fabularia → Alveolina → Nummulites → Operculina s.l.

Early Eocene

H: Lockhartia,Dictyoconoides → Alveolina → Nummulites

L: Coskinolina,Dictyoconus → Orbitolites,Somalina,Fabularia → Alveolina → Nummulites → Operc.

Middle-Late Paleocene

H: Miscellanea, Daviesina (ornate),Kathina → Alveolina → Nummulites

L: Fallotella,Coskinon,Glomalveolina → Alveolina → Nummulites,Ranikothalia → Operculina
Broeckinella,Saudia Daviesina (compressed)

Upper Cretaceous

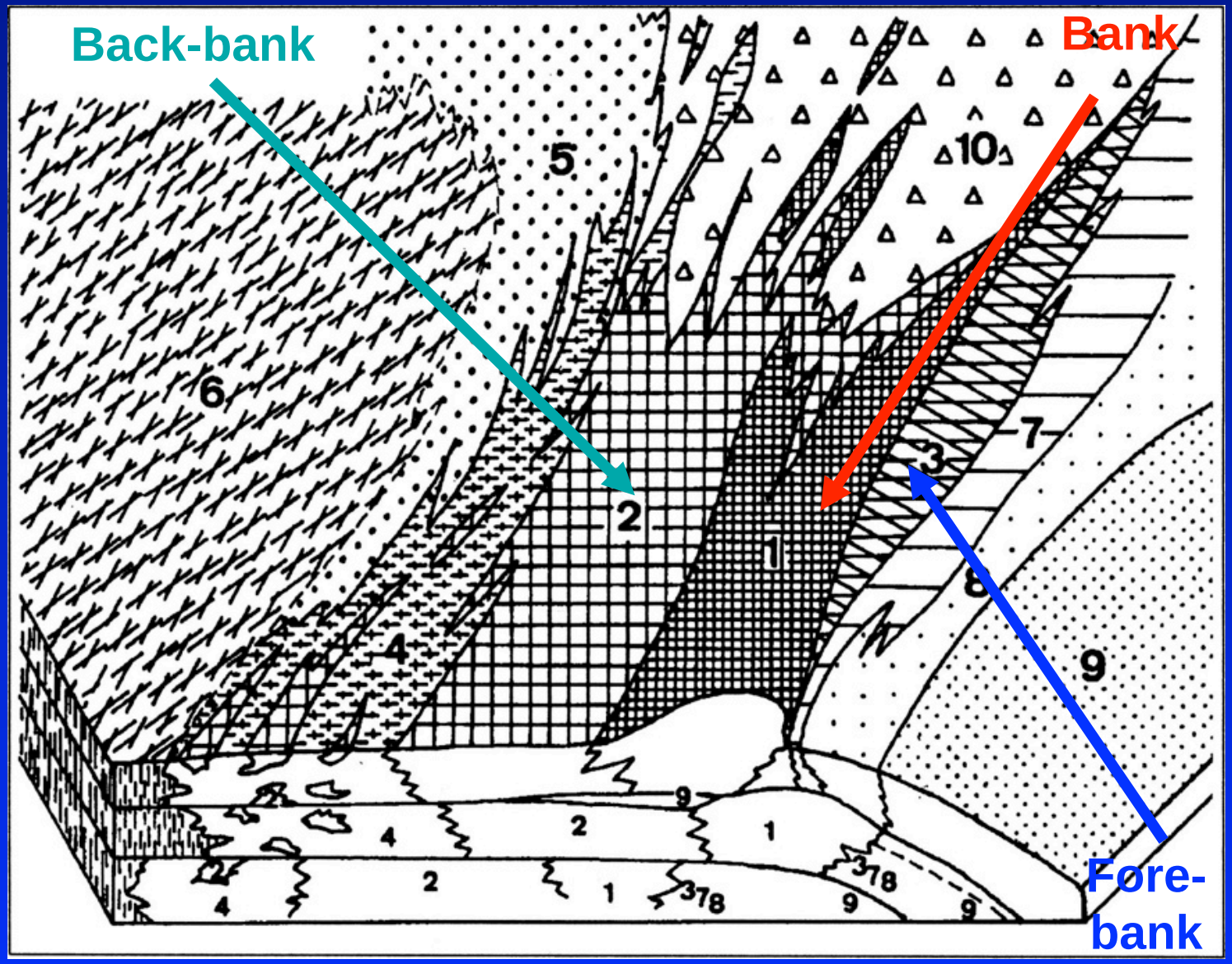
H: Siderolites,Daviesina,Sulcoperculina → Lacazina compressa → Pseudosiderolites

L: Calveziconus,Montsechiana → Periloculina,Subalveolina → Lacazina elongata - Meandropsinids
Ilerdorbis,Dicyclina

Fig. 1 Succession according to depth and substrate of selected genera of larger foraminifera. Ranges are largely overlapping. Amphisteginid and orbitoid species form similar parallel successions.

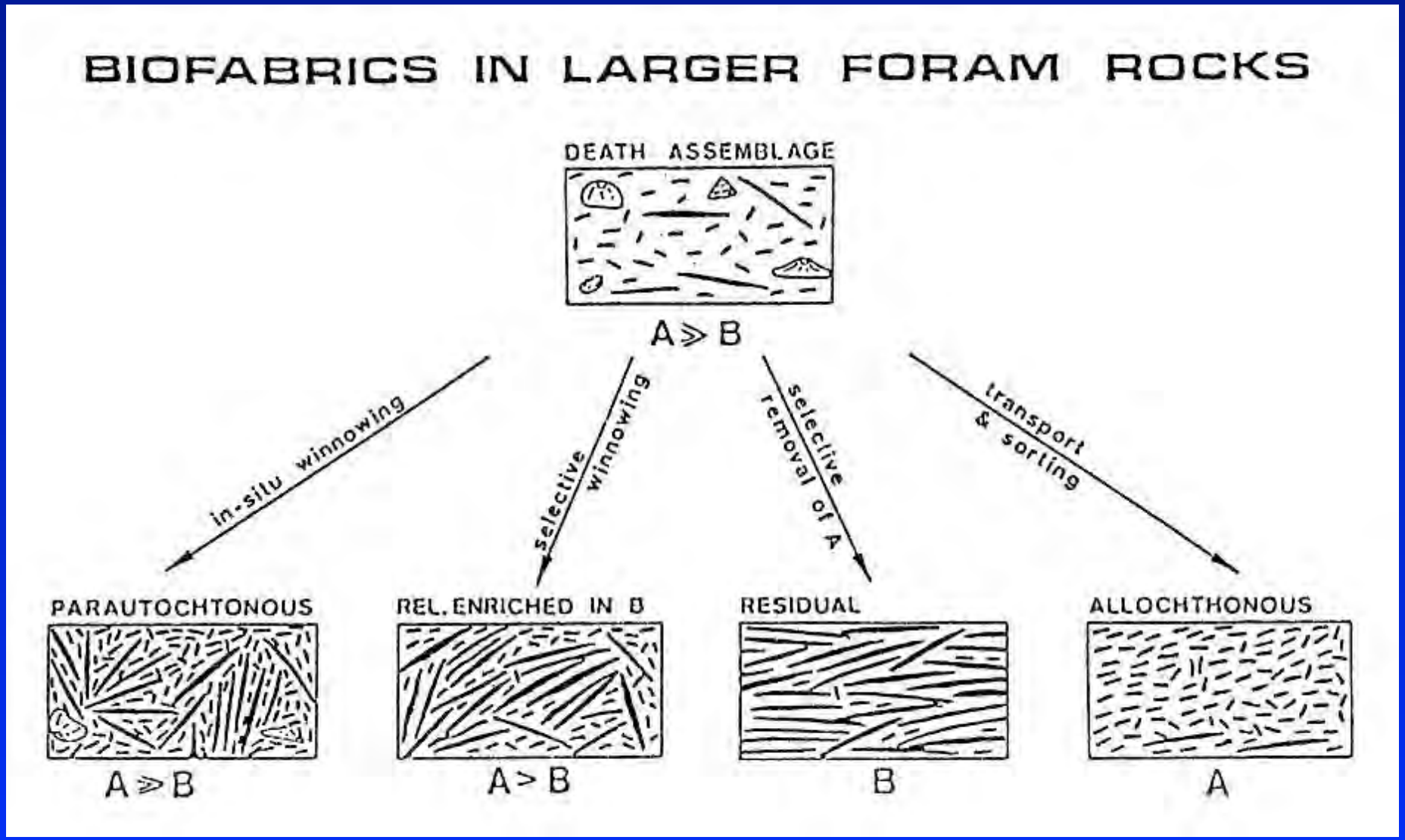
Hottinger (1983)

A case history: nummulite banks



Nummulite bank model according to Arni (1965)

A case history: nummulite banks



Nummulite ‘tell’ model according to Aigner (1985)

A case history: nummulite banks

In the original definition (Arni, 1965), a nummulite bank is a bio-sedimentary body characterized by:

a) an **unusual abundance of B form** (= a relatively **low A/B ratio**) of the genus *Nummulites*;

b) the overwhelming **dominance of one (or two) species** of *Nummulites*, always a large one (e.g. *N. gizehensis*, *N. perforatus*, etc.);

c) a **slightly positive relief** over the sea bottom, stretching more or less parallel to the ancient coastline.

The relative depth of the bank is not specified, and it has been interpreted in different ways by different authors.

Jorry et al. (2006)

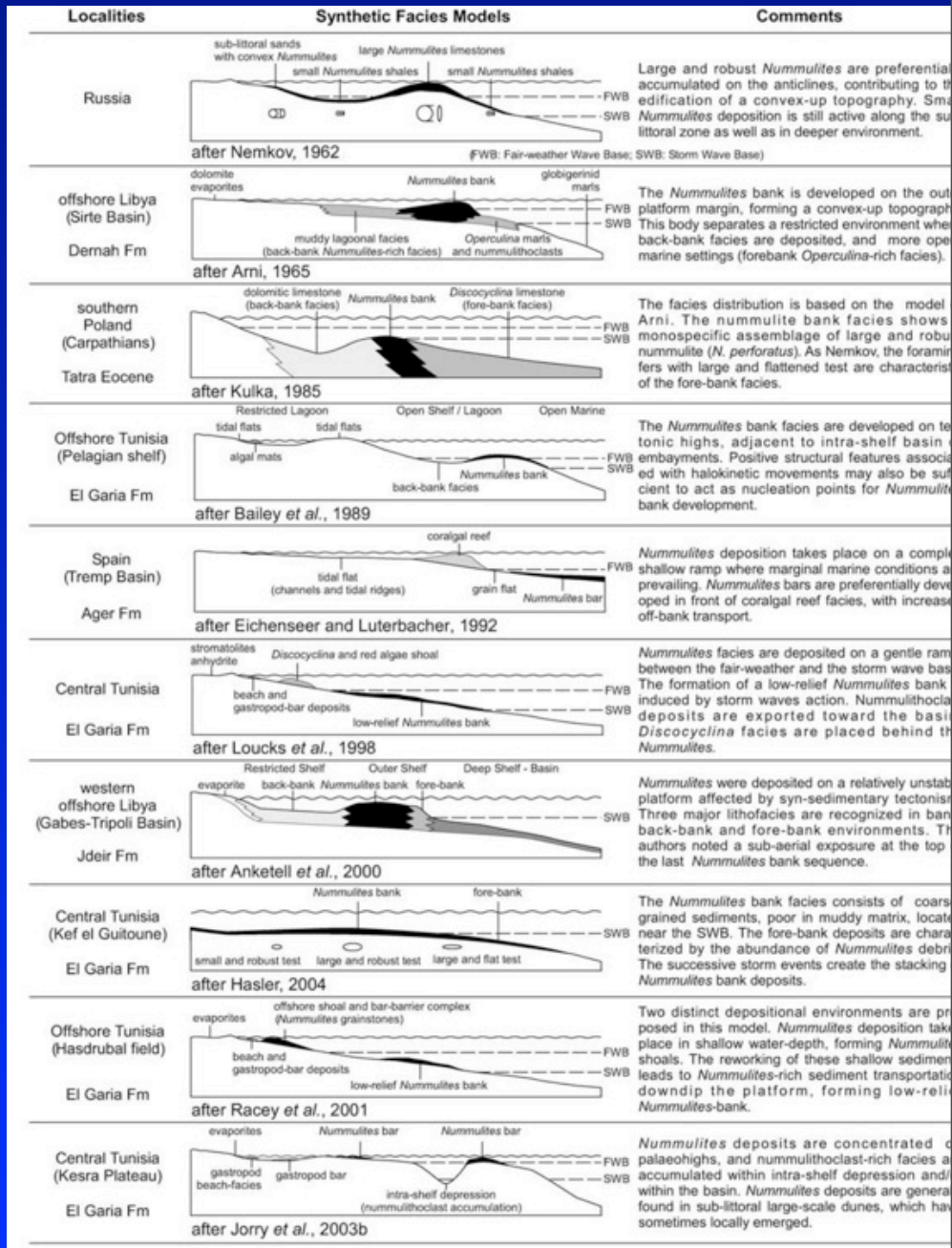


Fig. 2 Comparison between different facies models proposed for interpreting the *Nummulites* accumulations

A case history: nummulite banks

QUANTITATIVE MEASUREMENTS

a) Percentage composition of the fossil assemblage, at the species level.

b) A/B ratio in *Nummulites.*

A case history: nummulite banks

METHODOLOGY

a) Washed samples: counting a large number of specimens (around 1,000) to determine both the percentages for each species and the number of A and B forms.

b) Polished slabs: squares with constant area were traced on a polished surface and the A and B specimens were counted. The counting was repeated on different areas to obtain a significant number of B-forms.

A case history: nummulite banks

CASE STUDIES

- Italy (Veneto) - 3 localities

- Spain (Ebro basin) - 3 localities

- Romania (Transylvanian basin) - 7 localities

- Germany (Bavaria) - 1 locality

A case history: nummulite banks

A case history: nummulite banks

Tavertet *N. tavertetensis* bank

A case history: nummulite banks

Leghìa *N. perforatus* bank

A case history: nummulite banks

A case history: nummulite banks

Synthesis 1: Abundance

Locations		Sample	Dominant species	Percentage	A/B ratio	Bank/Non Bank
Veneto		San Germano dei Berici	*N. fabianii*	85.3	28-28.8	Bank
		Pederiva	*N. lyelli*	76.6	35	Bank
		Mossano			348	Non Bank
		Pederiva 2			236	Non Bank
		Pederiva 3			86	Non Bank
		Pederiva 4			117	Non Bank
Spain	Tavertet section	Vic 1201	*N. tavertetensis*	90	16.6	Bank
		Vic 1202	*N. tavertetensis*	100	43.2	Bank
	Igualada section	IG 1202	*N. perforatus* (A-forms)	55.7	151	Non Bank
	Saint Marti Xic	Vic 1203	*N. biedai*	75.4	42	Bank
Romania	Cheile Baciului area	ROM 1111,1112	*N. fabianii*	100	19.2-51.6	Bank
	N. perforatus beds	ROM 1101, 1101B, 1101C, 1109, 1114,1115, 1116	*N. perforatus*	100	17-47.8	Bank
		ROM 1110, 1119	*N. perforatus*	90-91	12.3-16	Bank
		ROM 1113	*N. perforatus* (A-forms)	100	92.5	Non Bank
Adelholzen		Adel1: *Assilina* bed	*Assilina cuvillieri*	77.5	7.8	*Assilina* Bank
		Adel2: *Nummulites* bed	*N. polygyratus*	57.66	63.1	Non Bank

Dominant species (quantitative works)	
nummulite banks	>75%

A case history: nummulite banks

Synthesis 2: A/B ratio

Locations		Sample	Dominant species	Percentage	A/B ratio	Bank/Non Bank
Veneto		San Germano dei Berici	*N. fabianii*	85.3	28-28.8	Bank
		Pederiva	*N. lyelli*	76.6	35	Bank
		Mossano			348	Non Bank
		Pederiva 2			236	Non Bank
		Pederiva 3			86	Non Bank
		Pederiva 4			117	Non Bank
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		Adel2: *Nummulites* bed	*N. polygyratus*	57.66	63.1	Non Bank

A/B ratio (quantitative works)	
nummulite banks	7–50 (Low)
"normal" nummulite limestone	60–350(high)