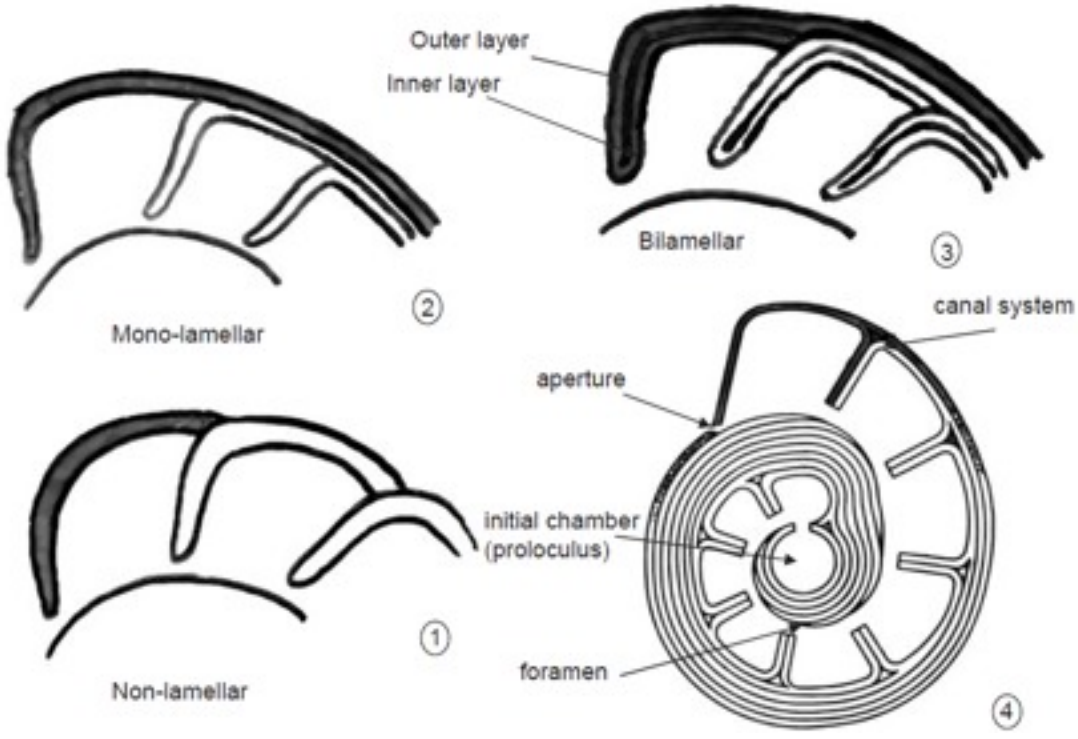
Letter classification of LBF in the field

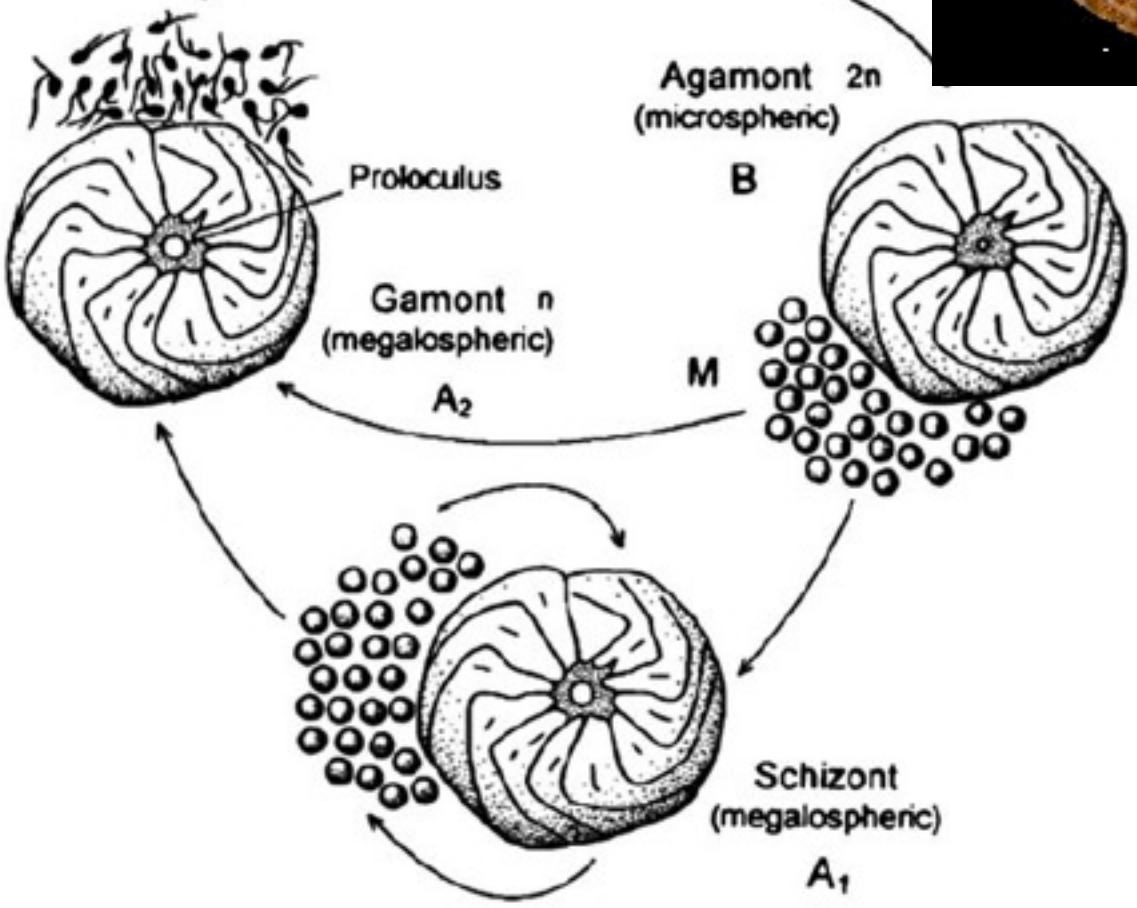
- LBF are the most important age indicators for tropical limestones in the field
- Field identification largely at genus and/or species group level: higher resolution possible when looking at species level
- Convoluted history of application to Indonesian strata

Van der Vlerk & Umbgrove, 1927	Leupold & Van der Vlerk, 1931		Van der Vlerk , 1955		Adams, 1970		Boudagher-Fadel & Banner, 1999		Present study	
Tg	Tg		Tg		Tf	Upper	Tg		Tf	3
Tf	Tf	3	Tf	Upper		Lower	Tf	3		2
		2						2		
		1		Lower				Upper1		1
								Middle1		
								Lower1		
Te	Te	5	Te	Upper	Te	Upper	Te	Upper	Te	5
		4		Lower		Lower		Lower		4
		3								2-3
		2								
		1								1

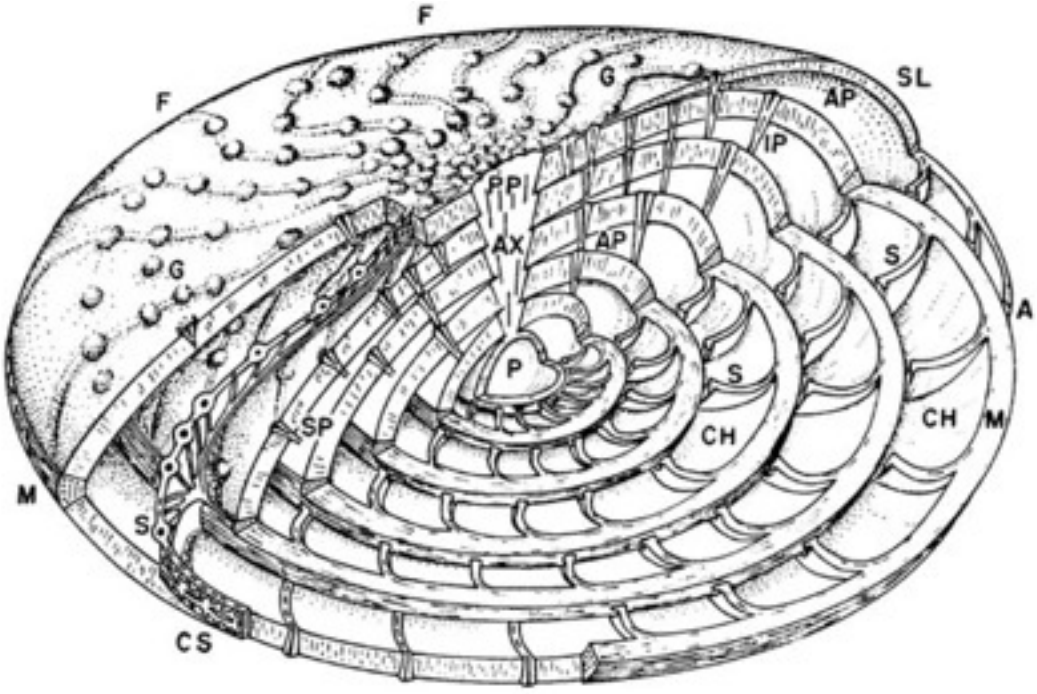
- Test construction: porcellaneous vs laminated perorate

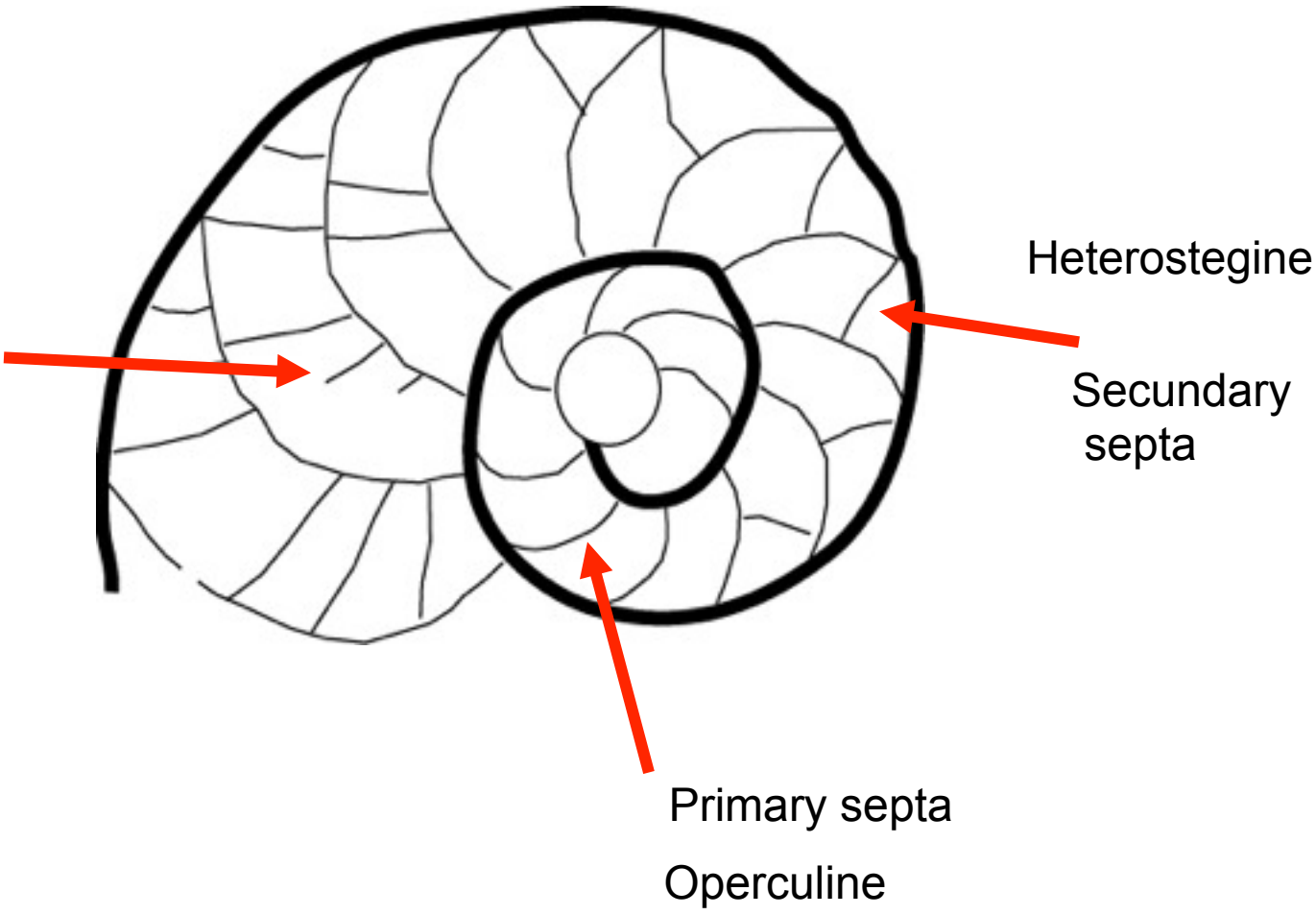


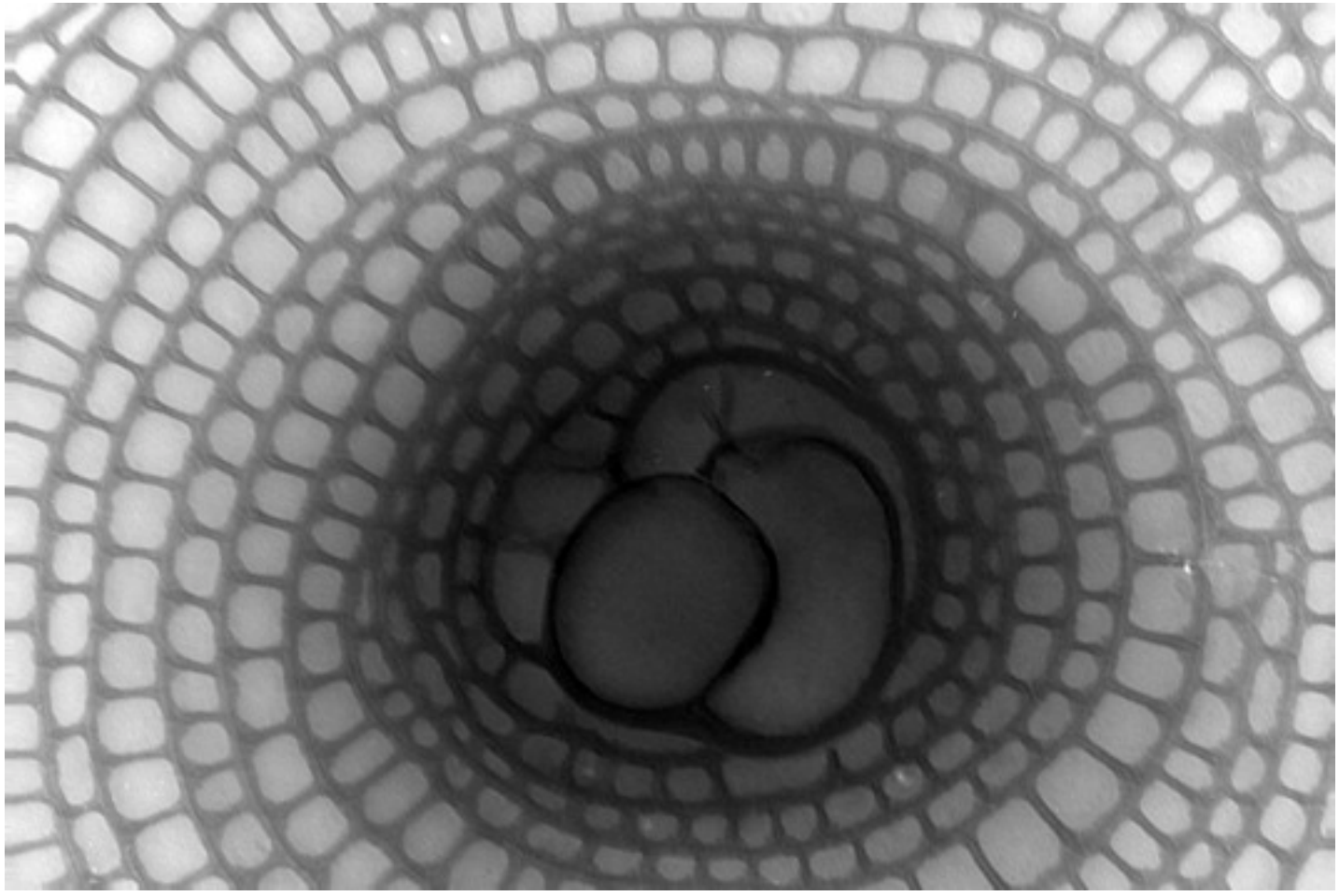
Haynes, 1985


Zygote
Agamont 2n
(microspheric)
B
Proloculus
Gamont n
(megalospheric)
A2
M
Schizont
(megalospheric)
A1

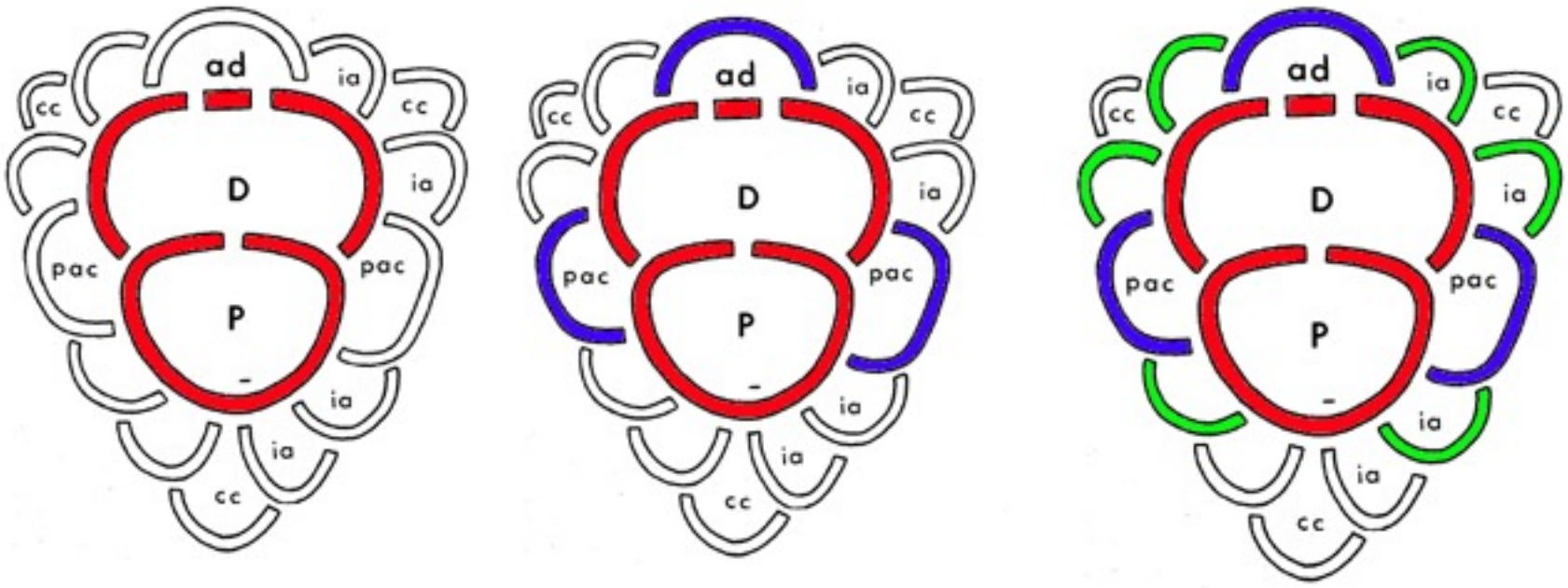
- Start is to understand the morphology of LBF
  - Spiral
  - Orbitoidal
  - Spindles




Incomplete
Secundary
septa
Heterostegine
Secundary
septa
Primary septa
Operculine



orbitoidal


ad
ia
cc
cc
D
ia
pac
pac
P
ia
ia
cc
ad
ia
cc
cc
D
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ad
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pac
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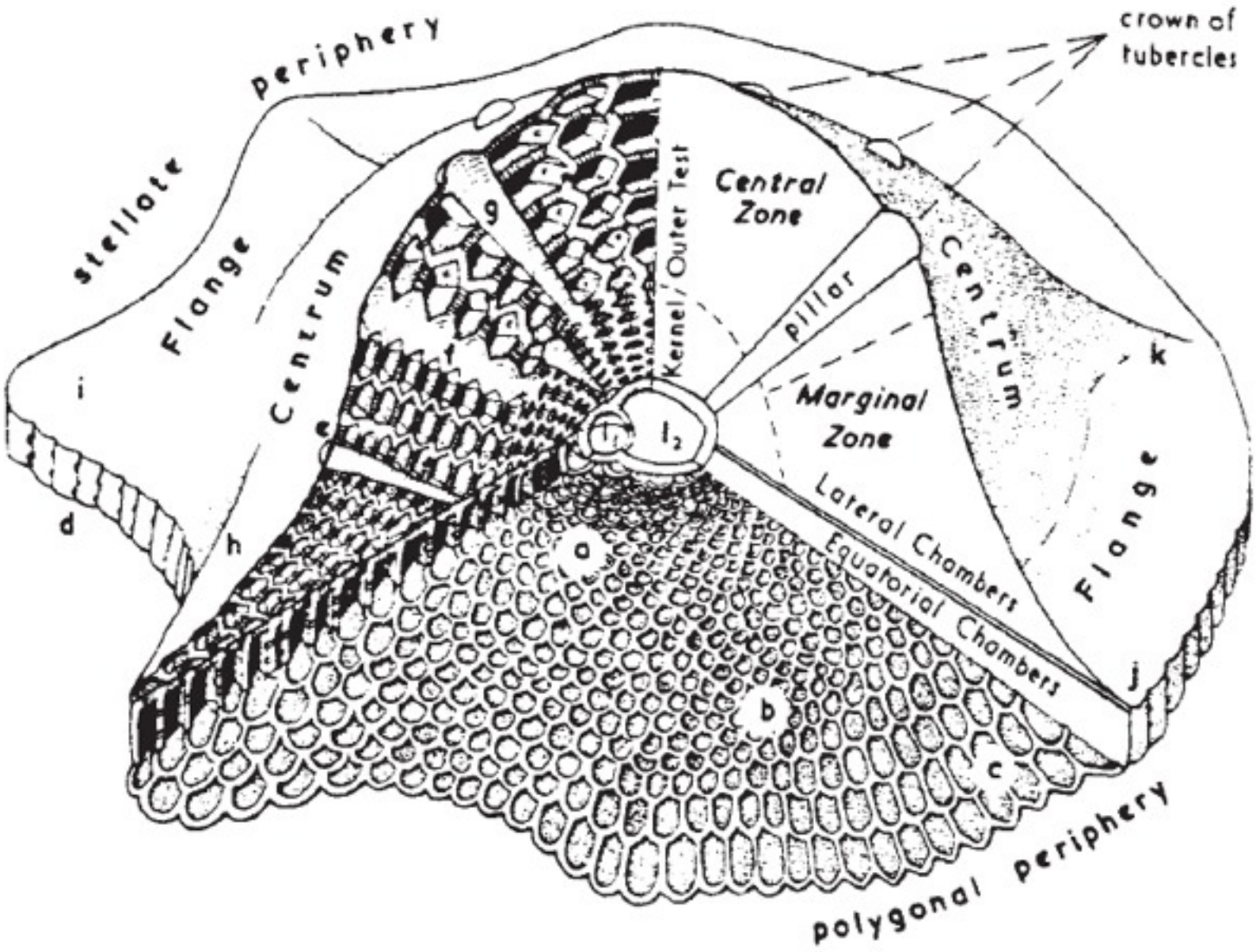
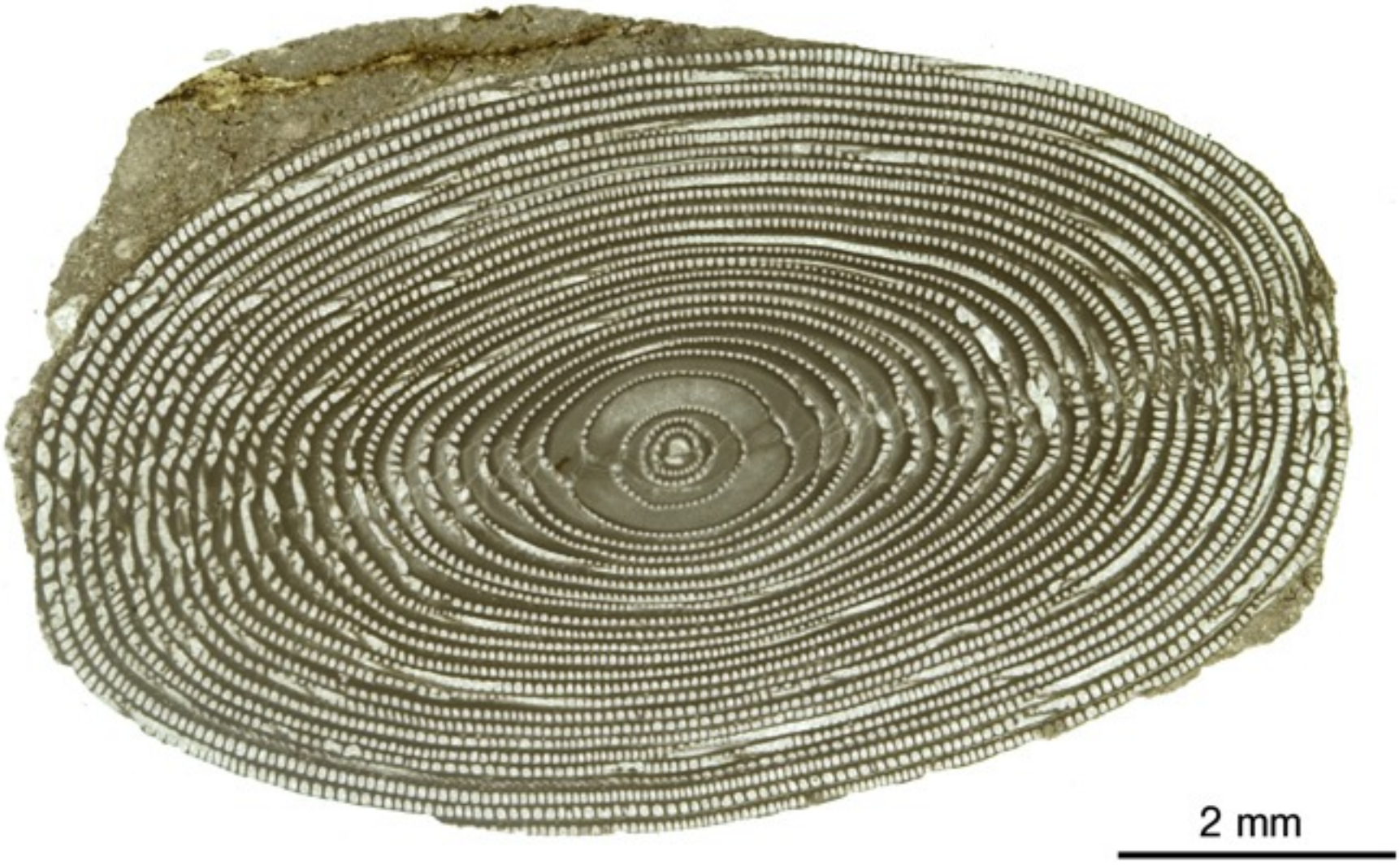
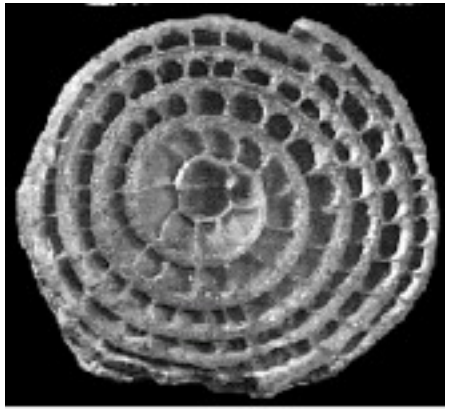
P
ia
ia
cc

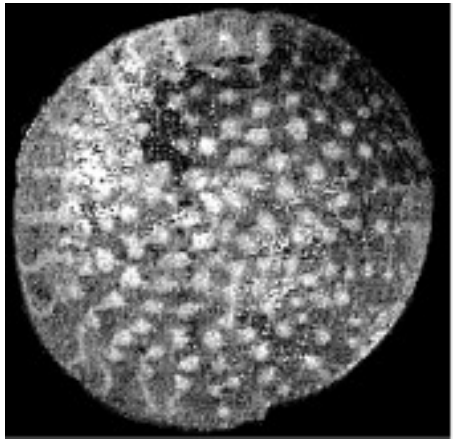

crown of tubercles
stellate periphery
Flange
Centrum
Kernel / Outer Test
Central Zone
pillar
Marginal Zone
Centrum
Flange
Lateral Chambers
Equatorial Chambers
polygonal periphery
a
b
c
d
e
f
g
h
i
j
k


2 mm

Nummulites



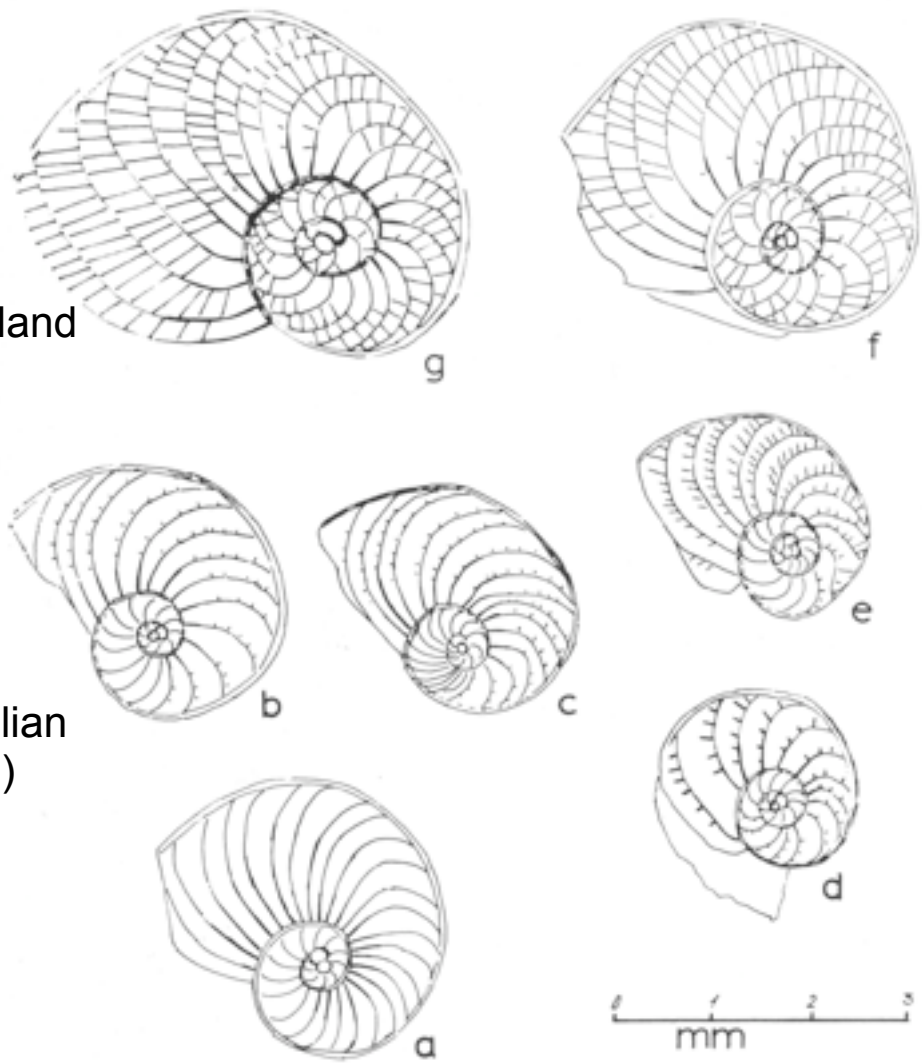
binnenkant



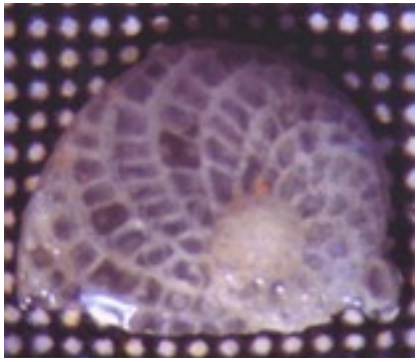
buitenkant

Middle
Serravallian
(Austria, Poland

Burdigalian
(France)



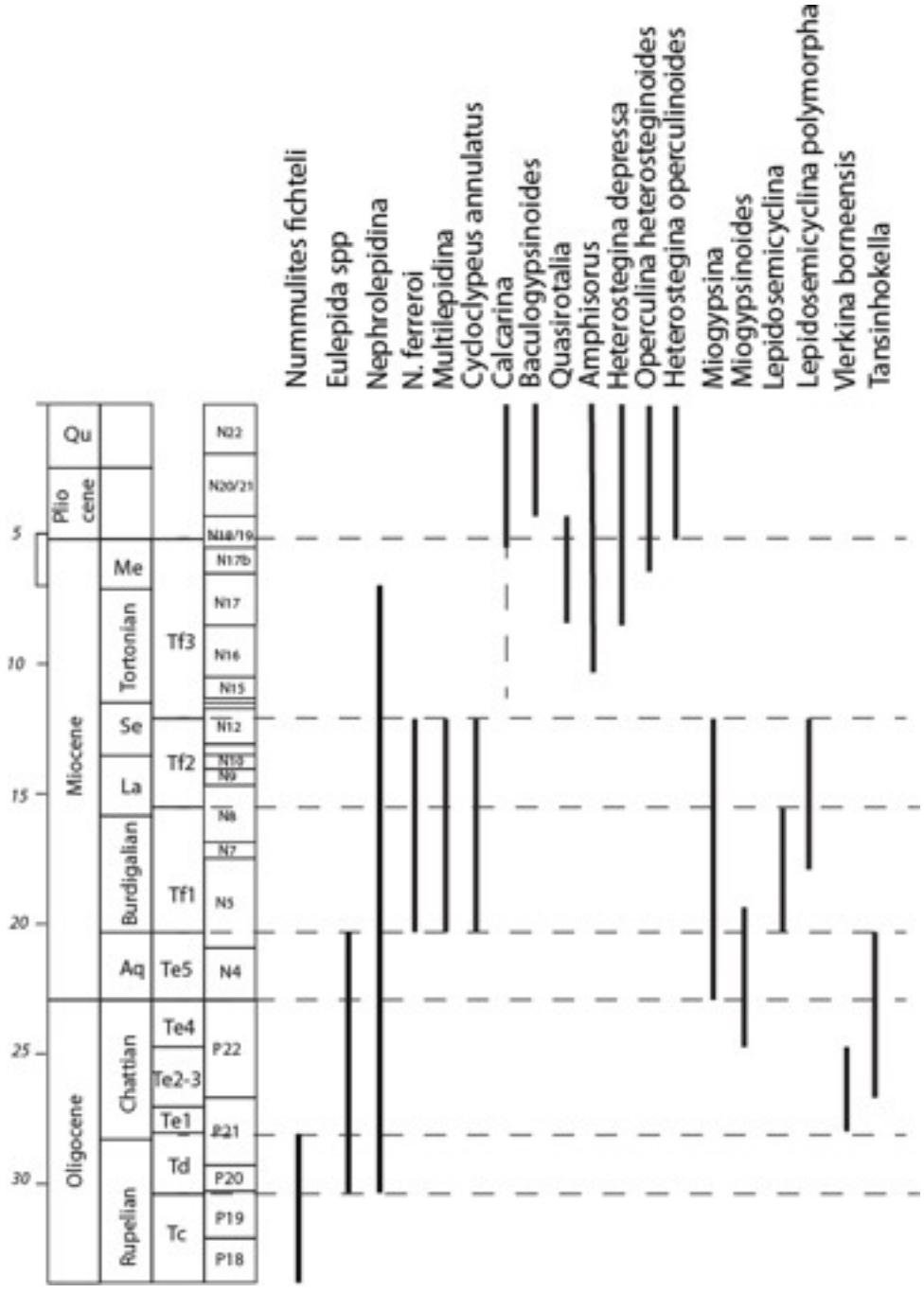
Papp, 1963



N10-N11 Java

Similar to f

If the same species: one of the latest examples of trans Middle East migration


Nummulites fichteli
Eulepida spp
Nephrolepidina
N. ferreroi
Multilepidina
Cycloclypeus annulatus
Calcarina
Baculogypsinoides
Quasirotalia
Amphisorus
Heterostegina depressa
Operculina heterosteginoides
Heterostegina operculinoides
Miogypsina
Miogypsinoides
Lepidosemicyclina
Lepidosemicyclina polymorpha
Vlerkina borneensis
Tansinhokella
Qu
Plio cene
Miocene
Oligocene
Me
Tortonian
Se
La
Burdigalian
Aq
Chattian
Rupelian
Tf3
Tf2
Tf1
Te5
Te4
Te2-3
Te1
Td
Tc
N22
N20/21
N18/19
N17b
N17
N16
N15
N12
N10
N9
N8
N7
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P22
P21
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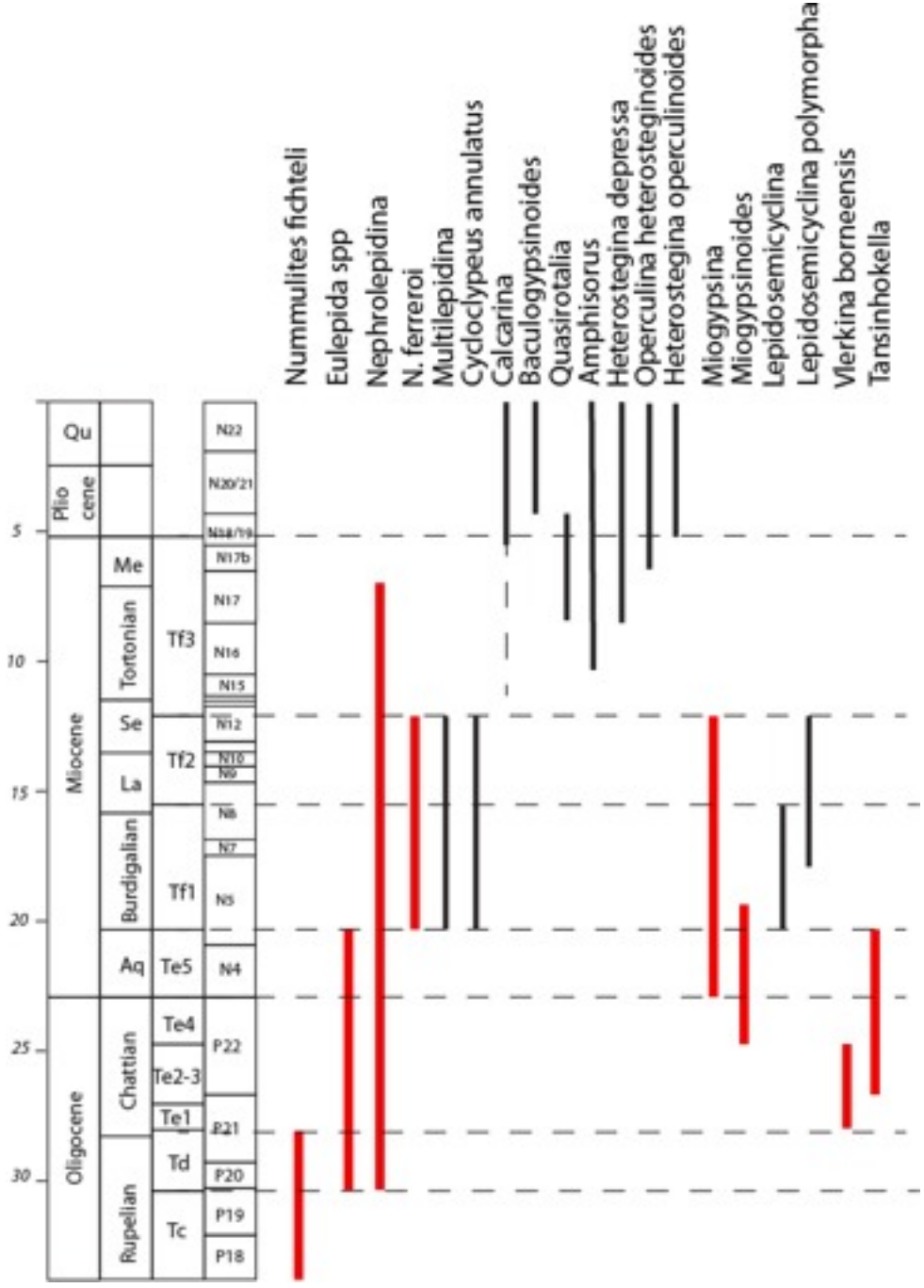
25
30


Nummulites fichteli
Eulepida spp
Nephrolepidina
N. ferreroi
Multilepidina
Cycloclypeus annulatus
Calcarina
Baculogypsinoides
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Amphisorus
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Lepidosemicyclina
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Tf3
Tf2
Tf1
Te5
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Te1
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Tc
N22
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N17b
N17
N16
N15
N12
N10
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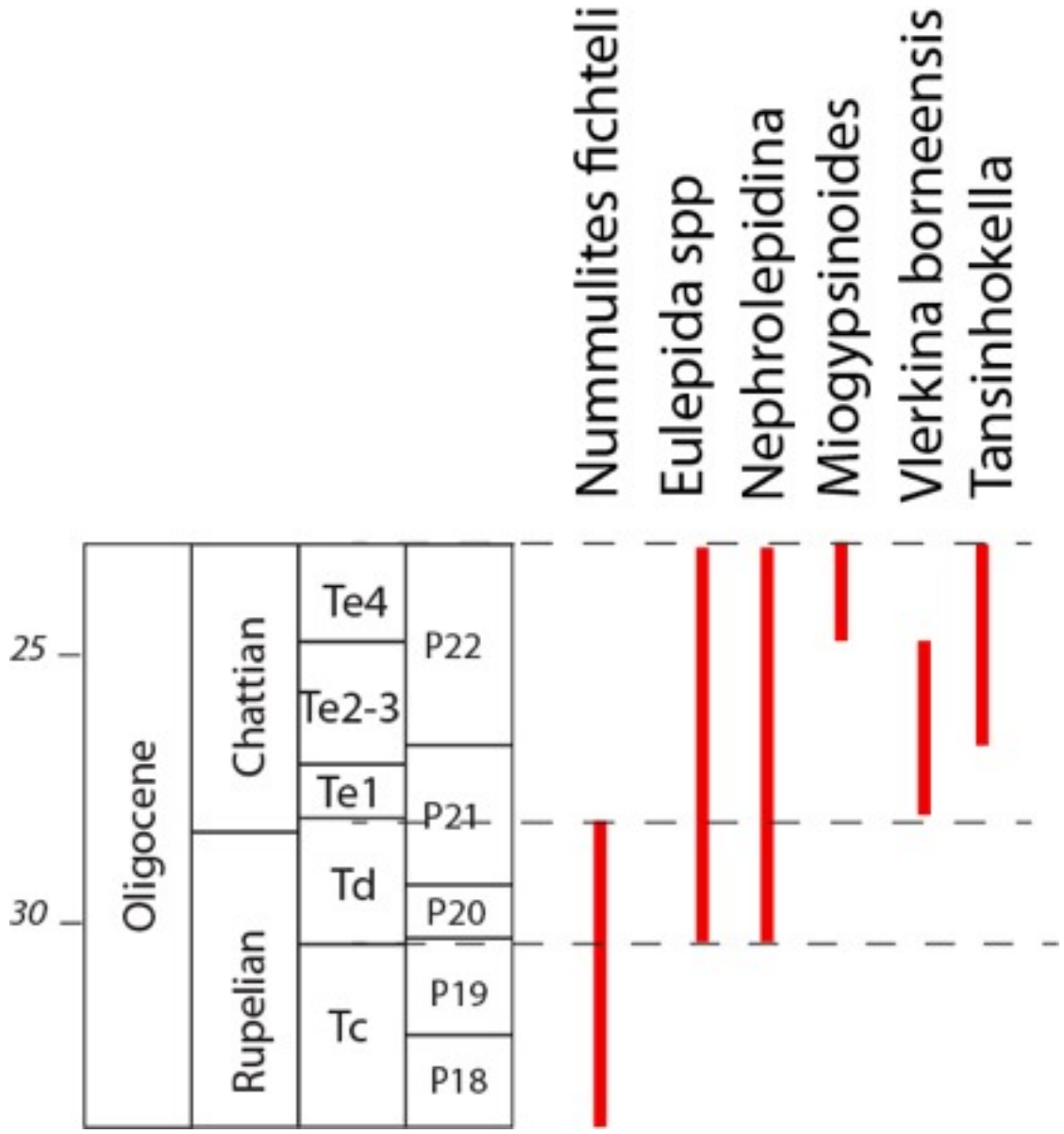
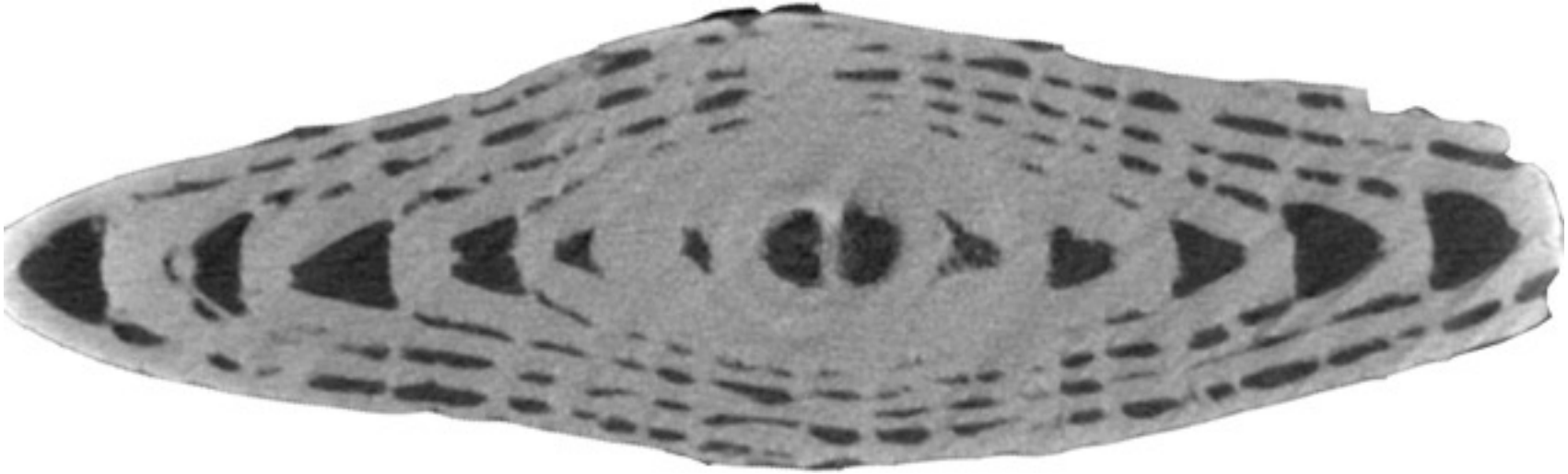
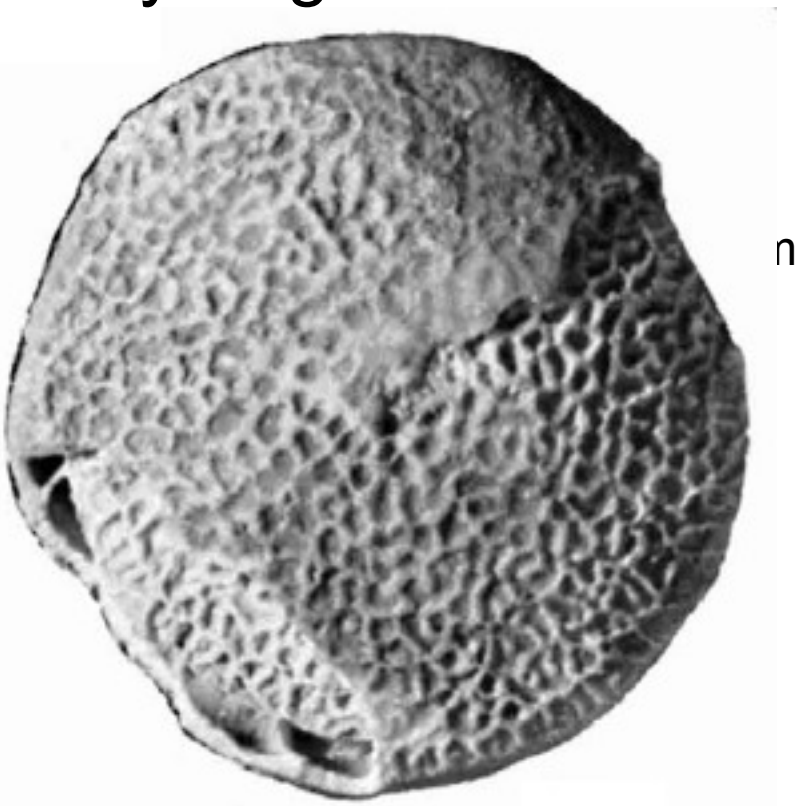
25
30

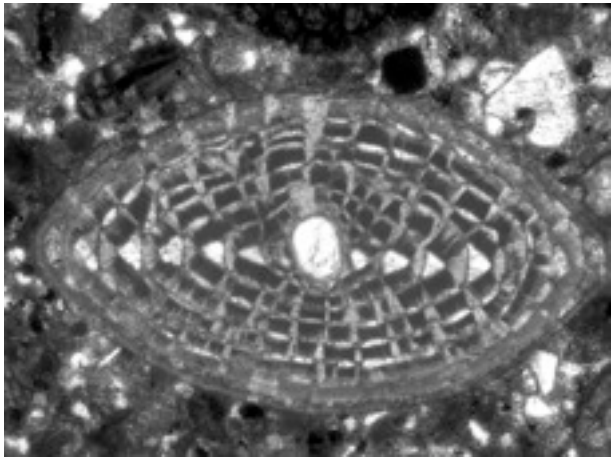

Nummulites fichteli
Eulepida spp
Nephrolepidina
Miogypsinoides
Vlerkina borneensis
Tansinhokella
25
30
Oligocene
Chattian
Rupelian
Te4
Te2-3
Te1
Td
Tc
P22
P21
P20
P19
P18



Early Oligocene: *Nummulites fichteli*



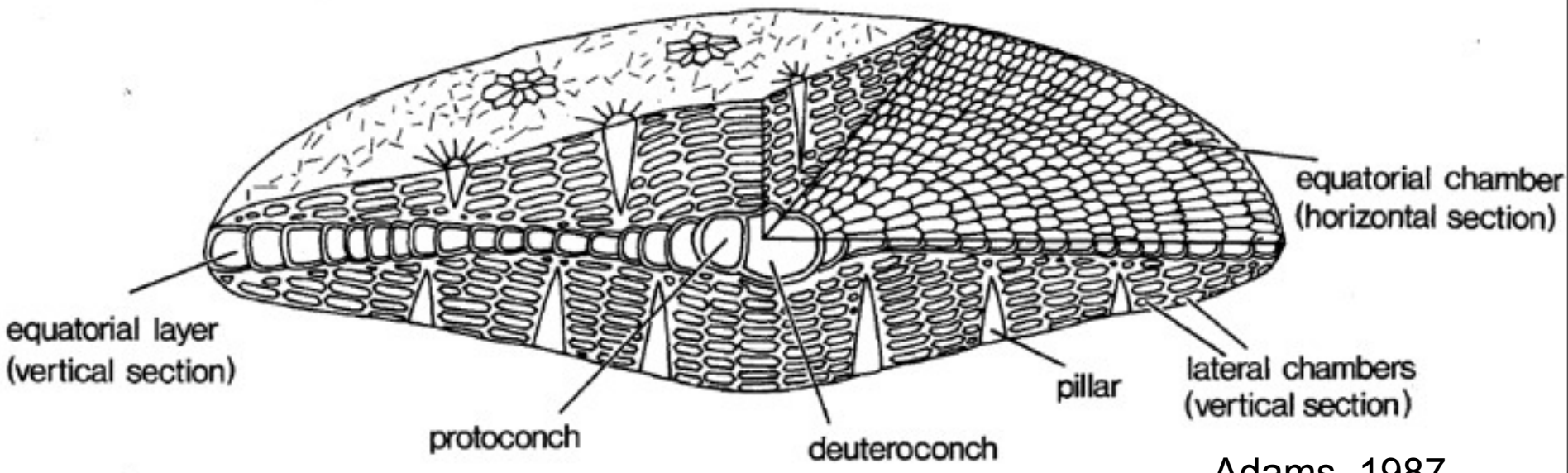
n



Additional species:
Cycloclypeus bantamensis

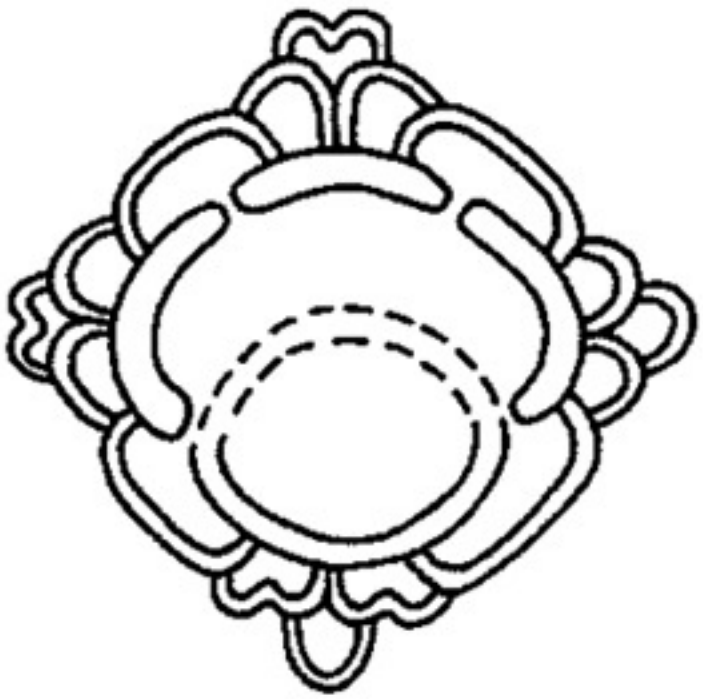
- Orbitoidal
- often confused
- B-form sometimes indicated as ‘ Lepidocyclina’

Differentiated by their median layer.

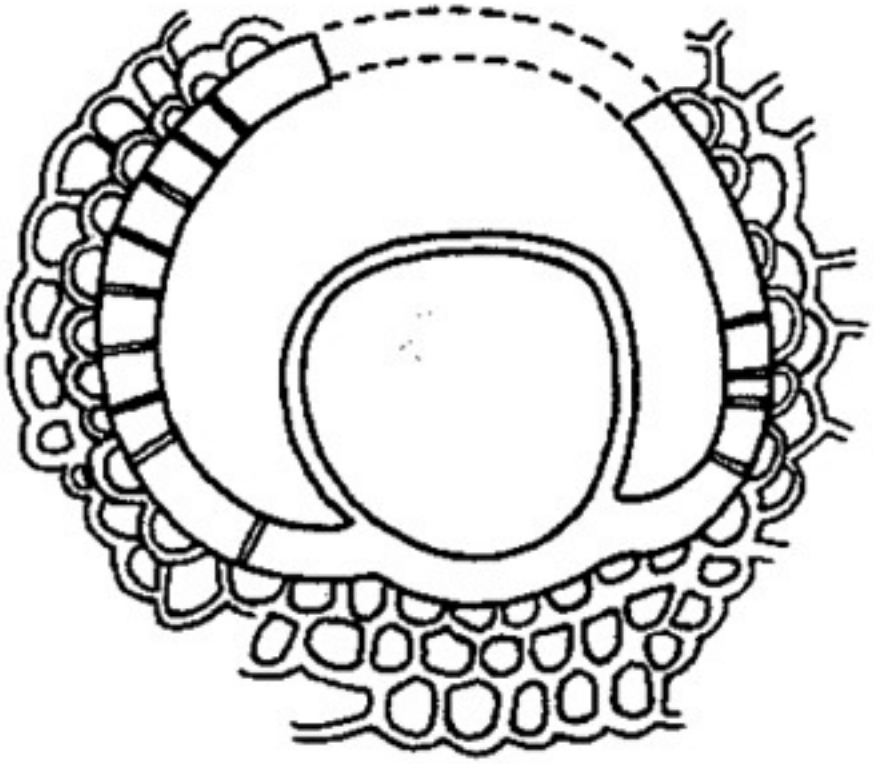


Adams, 1987

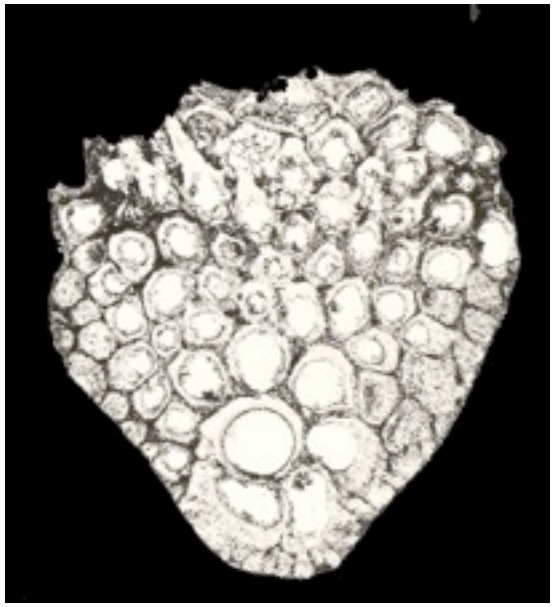
Nephrolepidina



Eulepidina

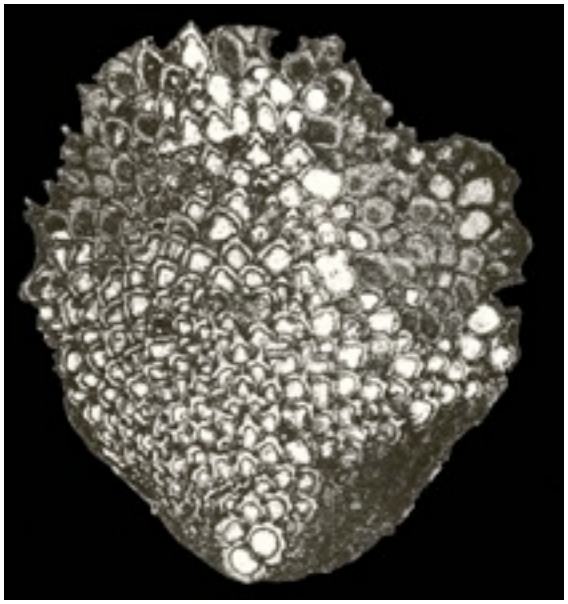


In random thin section: equatorial layer in Nephrolepidina thickens towards the margin and is thinner (than in Eulepidina)

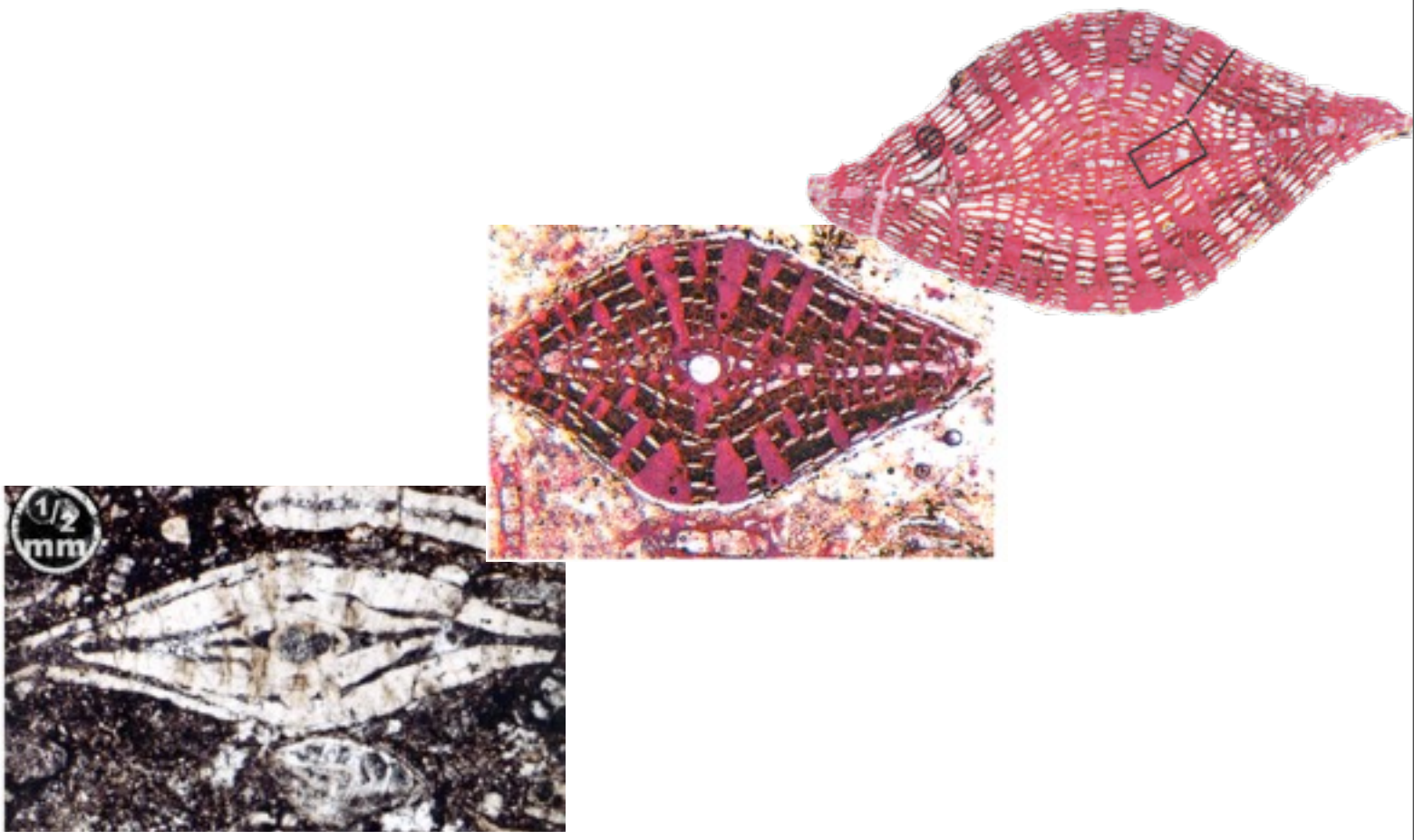


Miogypsina

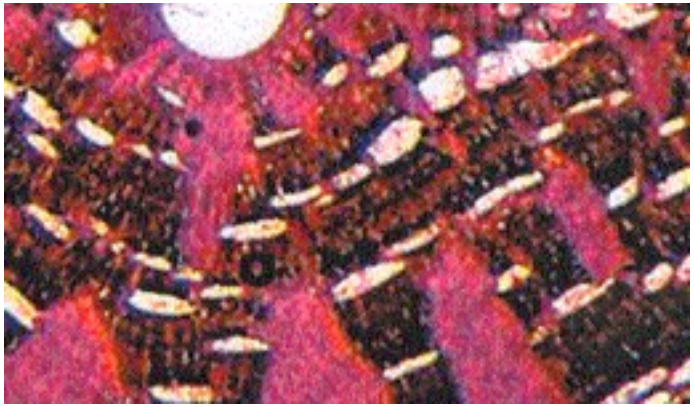
Miogypsinoides

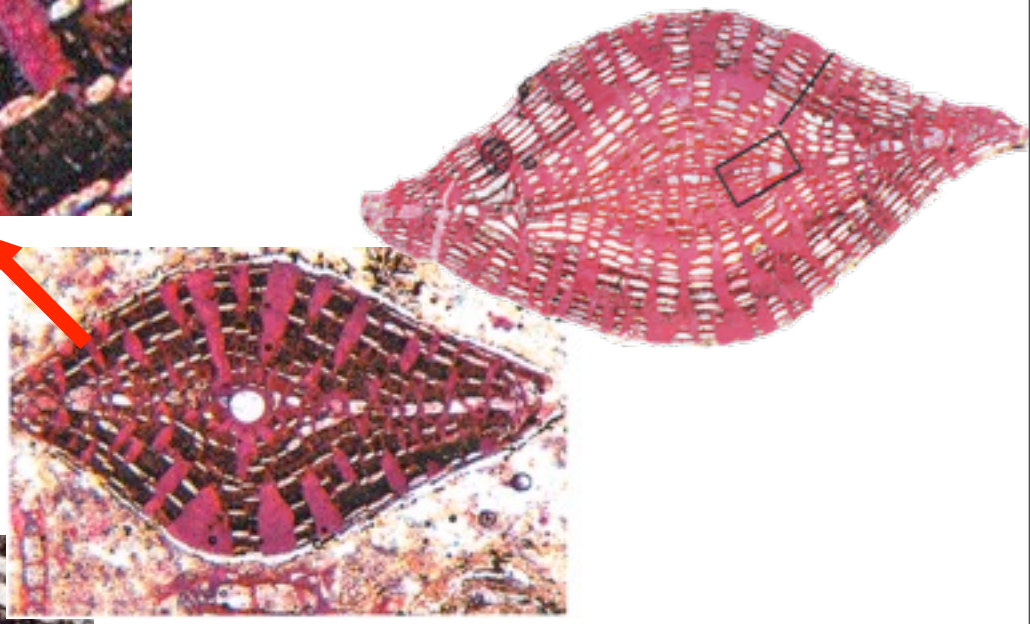


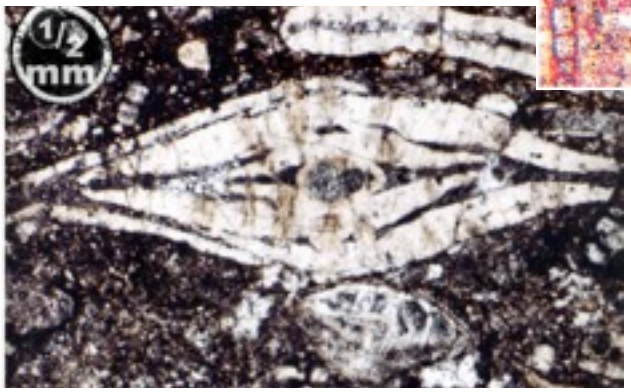
Vlerkina and Tansinhokella



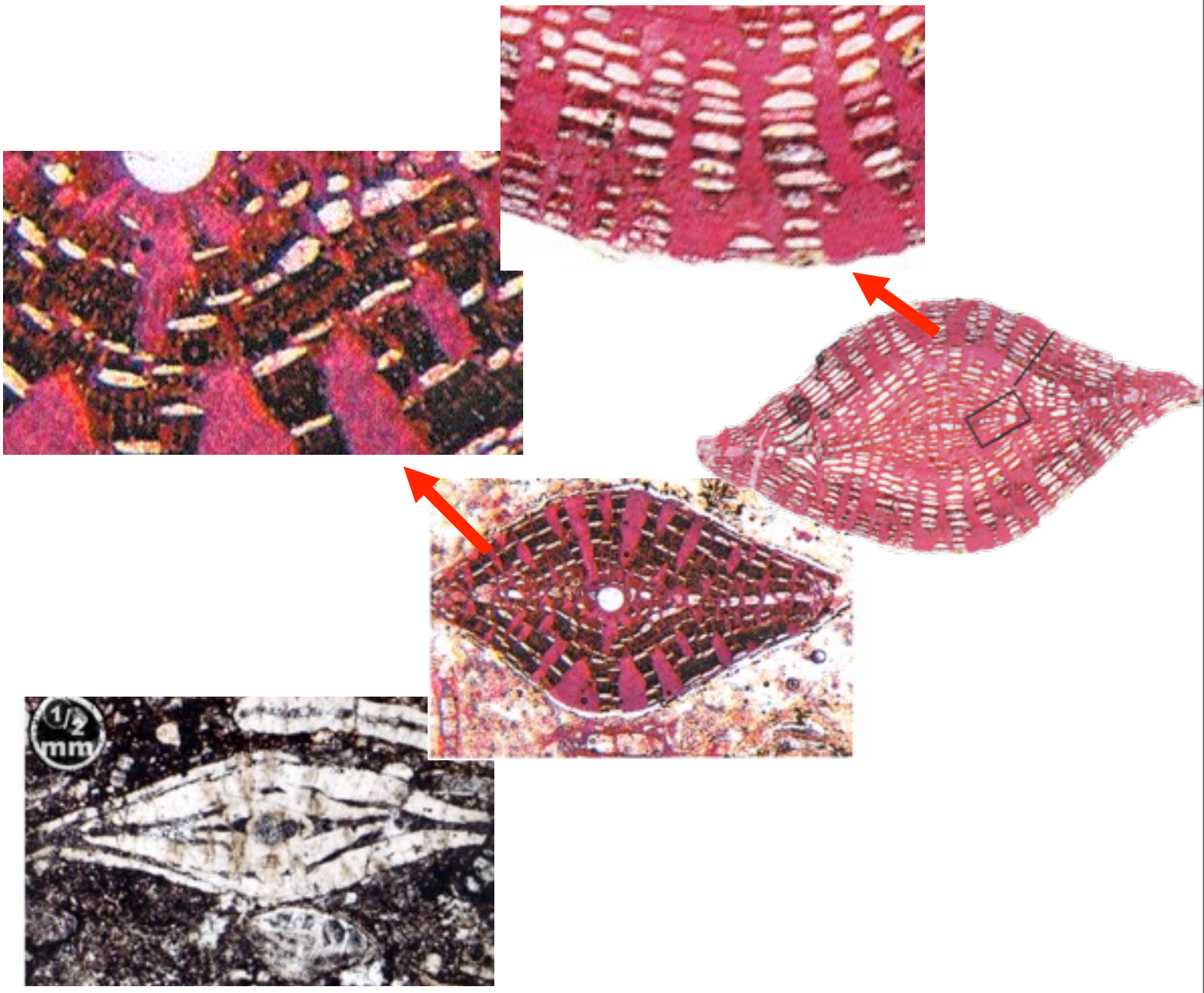
Renema and Lunt (in prep)



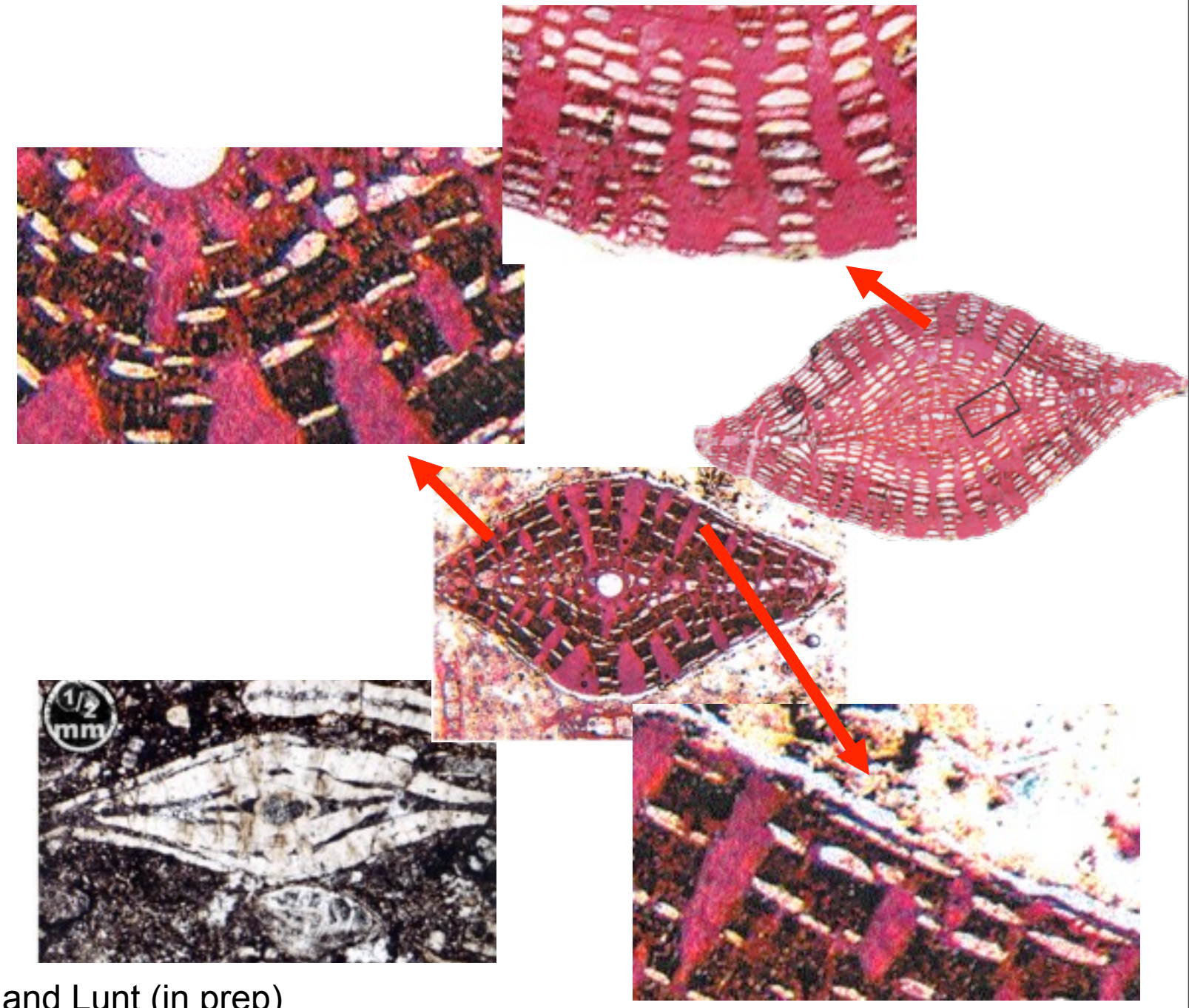




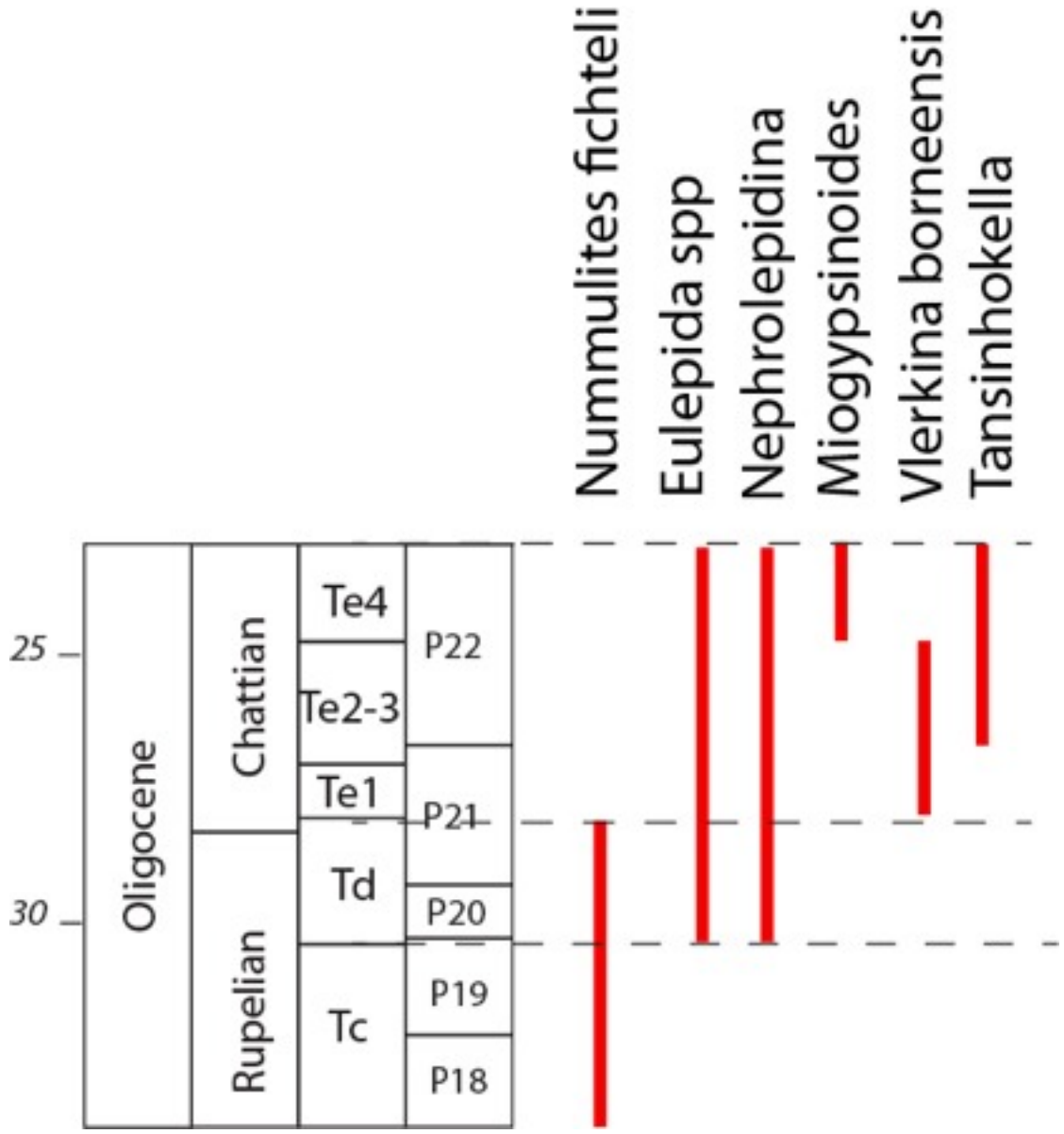
Renema and Lunt (in prep)

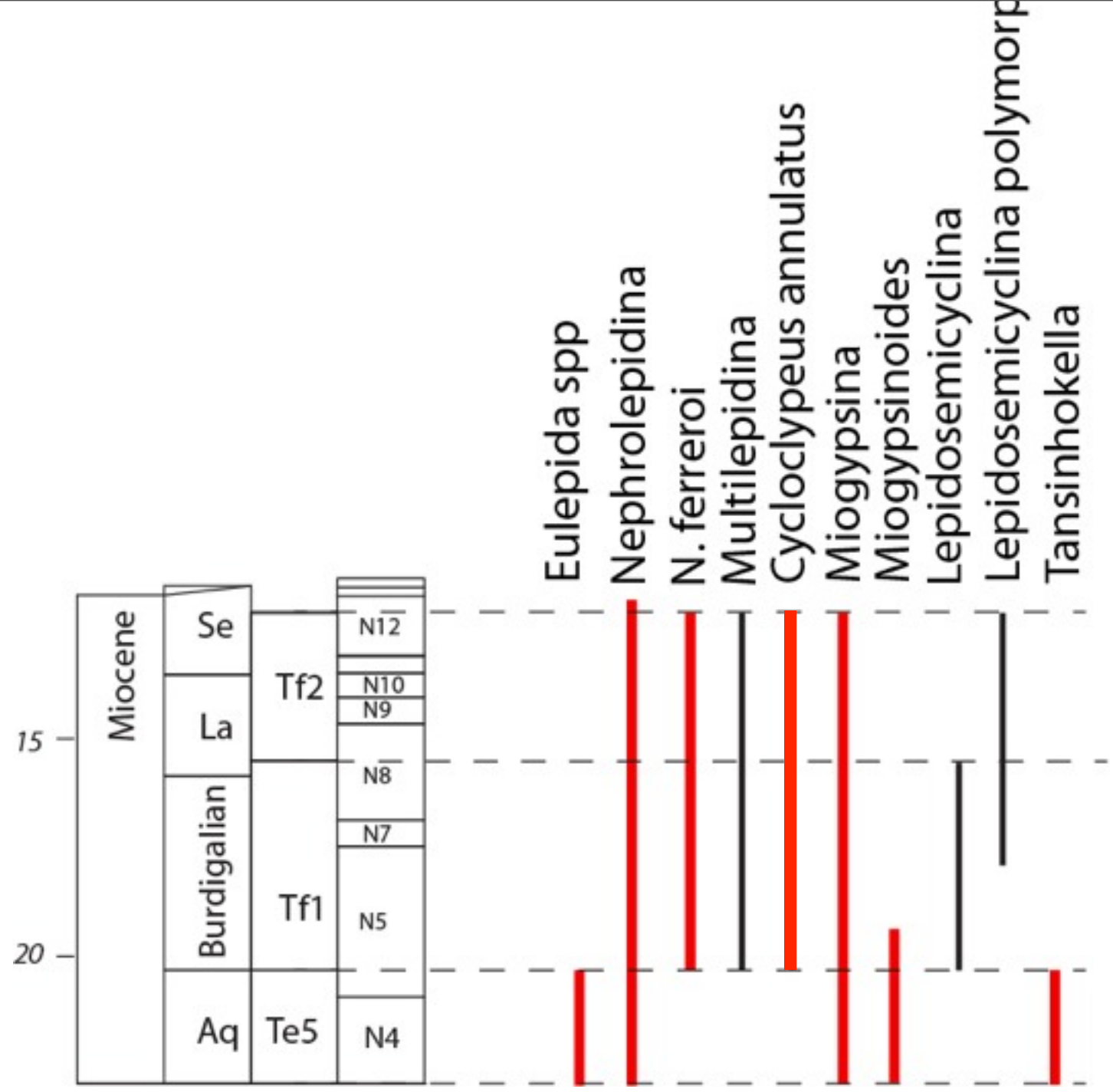


Renema and Lunt (in prep)



Renema and Lunt (in prep)


Nummulites fichteli
Eulepida spp
Nephrolepidina
Miogypsinoides
Vlerkina borneensis
Tansinhokella
25
30
Oligocene
Chattian
Rupelian
Te4
Te2-3
Te1
Td
Tc
P22
P21
P20
P19
P18


Eulepida spp
Nephrolepidina
N. ferreroi
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Miogypsinoides
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Lepidosemicyclina polymorp
Tansinhokella
Miocene
Se
La
Burdigalian
Aq
Tf2
Tf1
Te5
N12
N10
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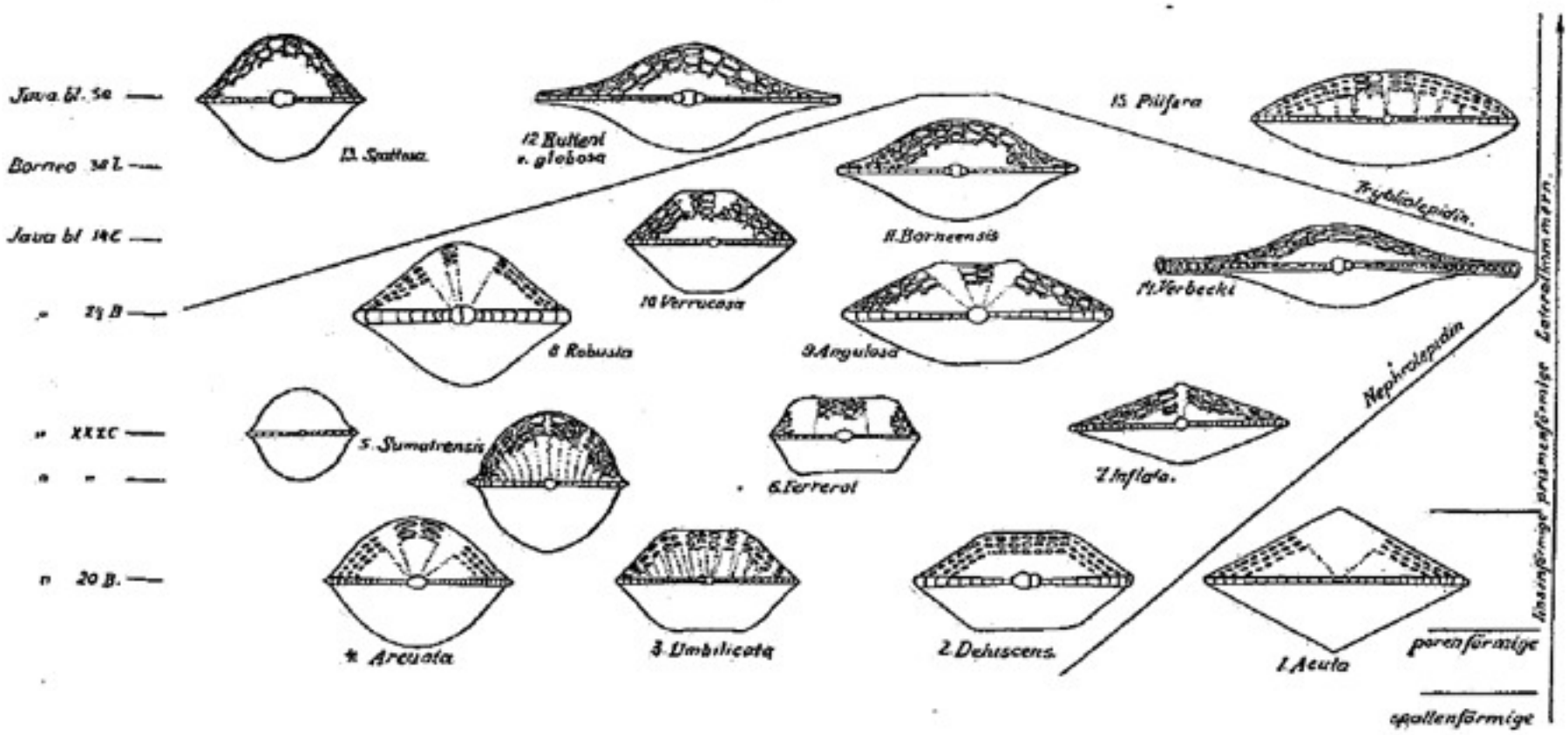
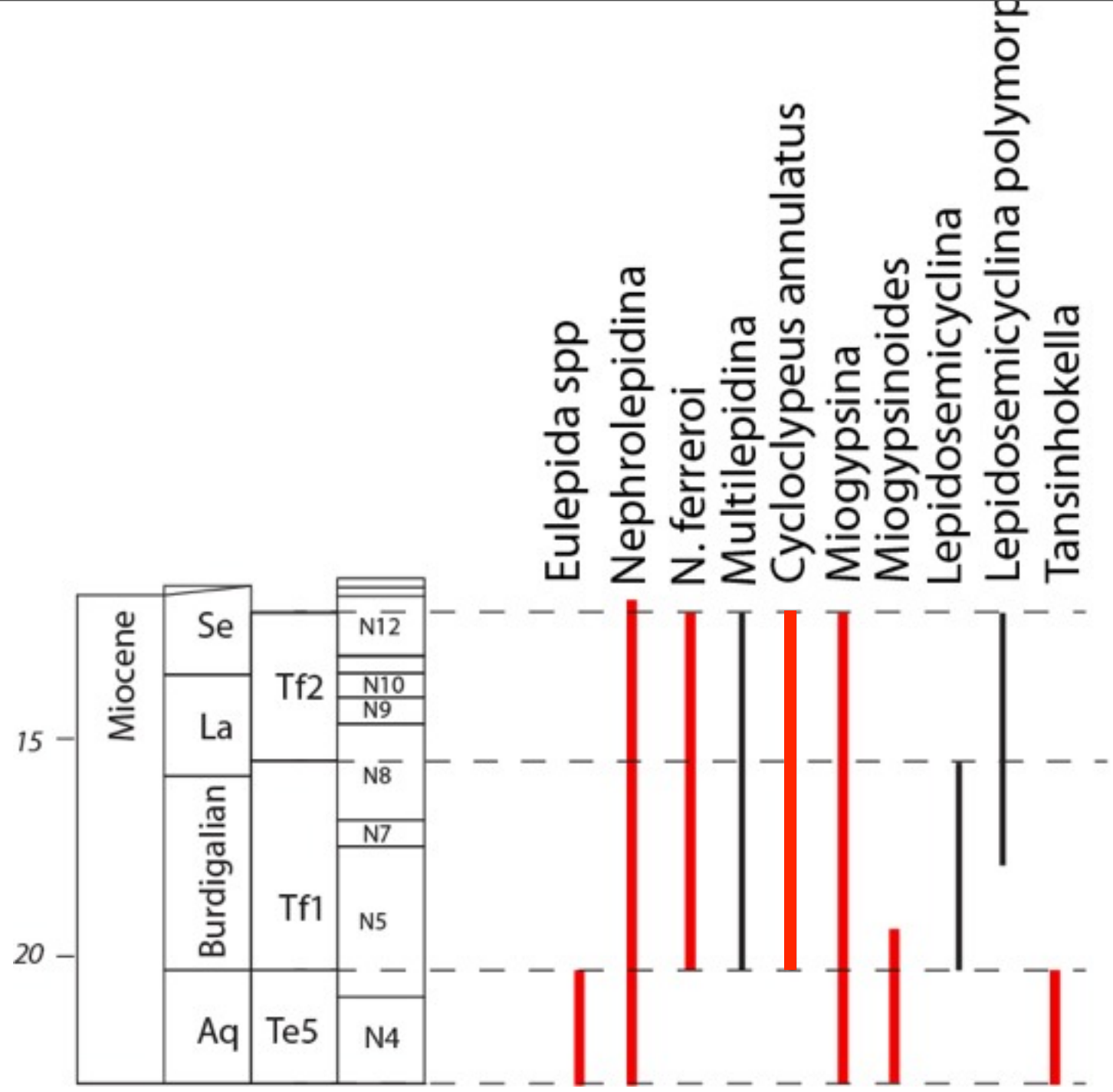
N8
N7
N5
N4
15
20


Java bl. 5a
Borneo 34 L.
Java bl 14C
" 24 B
" XXXC
" "
" 20 B.
13. Spatiosa
12 Rutteni
v. globosa
15. Pilifera
Trybliolepidin.
11. Borneensis
10 Verrucosa
14. Verbeeki
8 Robusta
9. Angulosa
Nephrolepidin
5. Sumatrensis
6. Ferrerai
7. Inflata.
4. Arcuata
3. Umbilicata
2. Dehiscens.
1. Acuta
Lateralsummetrn.
prismenförmige
linsenförmige
parenförmige
apfelförmige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Tf2
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N12
N10
N9
N8
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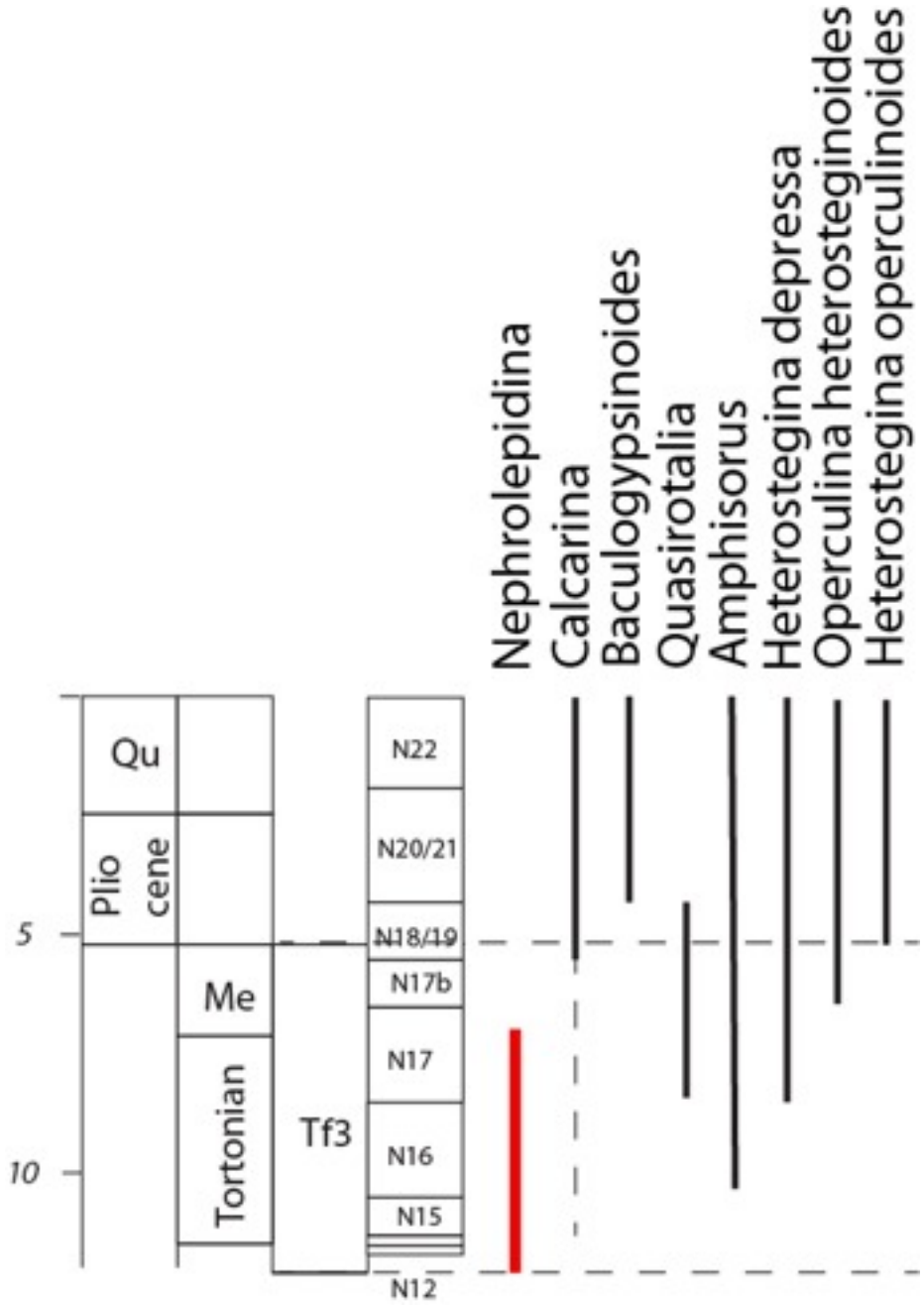
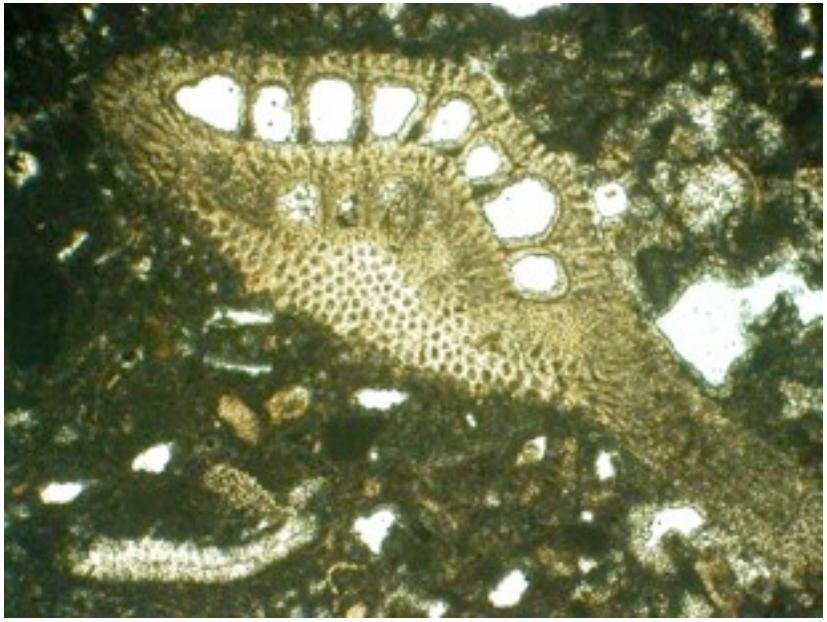
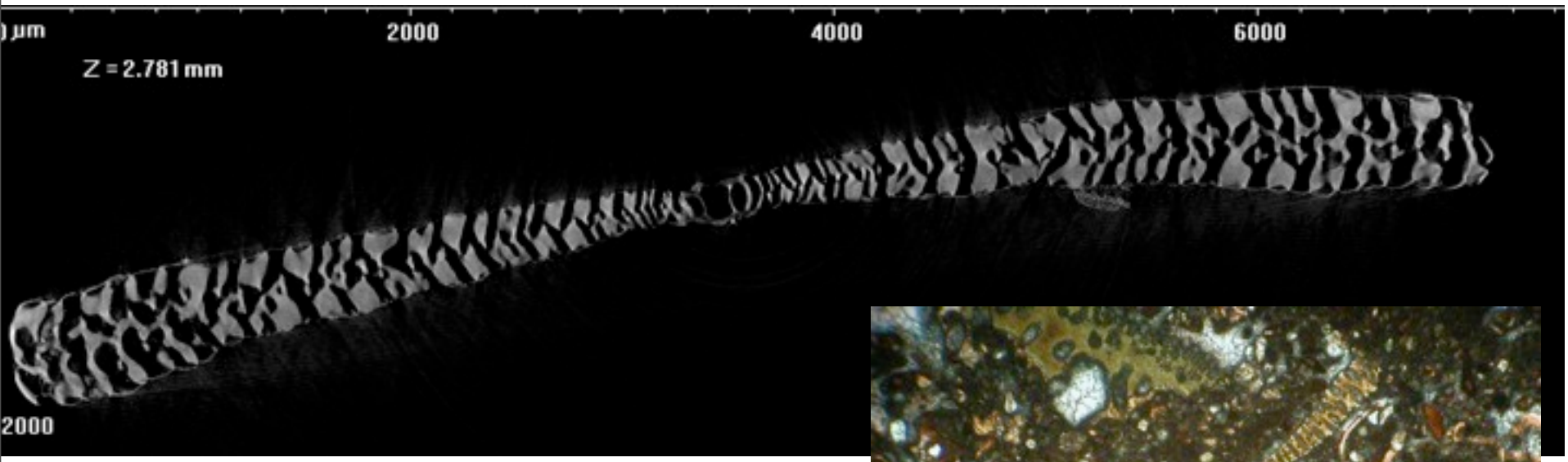
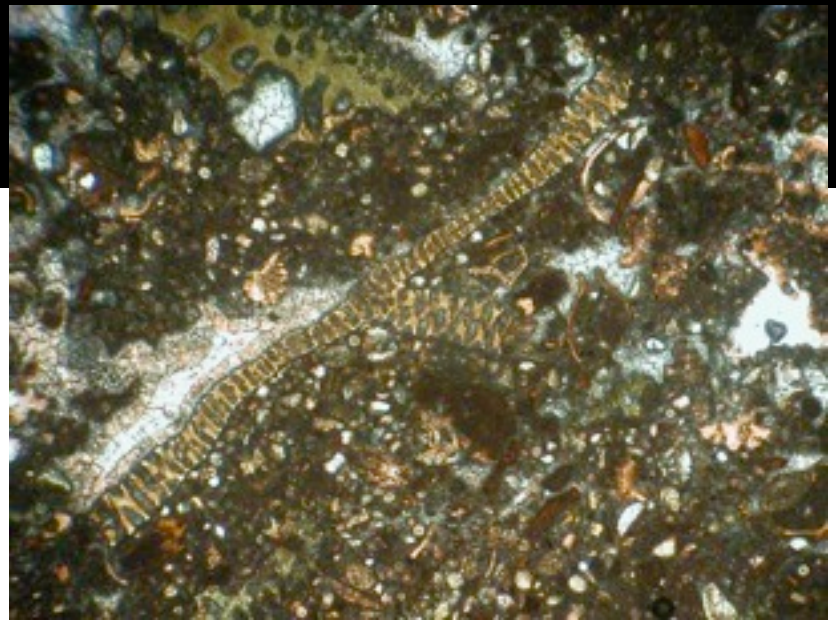
N5
N4
15
20

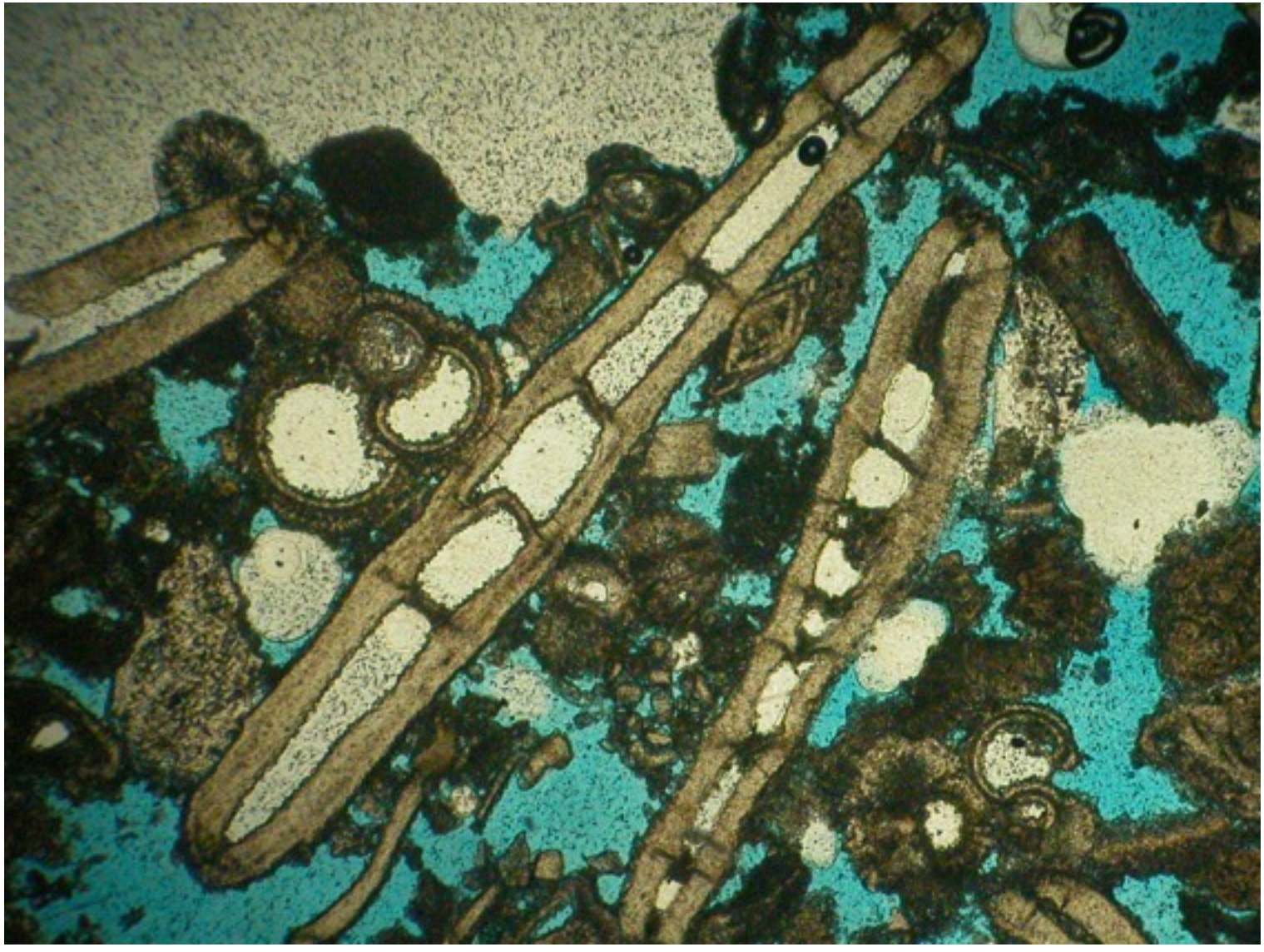

Qu
Plio
cene
Me
Tortonian
Tf3
N22
N20/21
N18/19
N17b
N17
N16
N15
N12
5
10
Nephrolepidina
Calcarina
Baculogypsinoides
Quasirotalia
Amphisorus
Heterostegina depressa
Operculina heterosteginoides
Heterostegina operculinoides

- Quasirotalia: latest Miocene- earliest Pliocene
- Flosculinella – Alveolinella transition

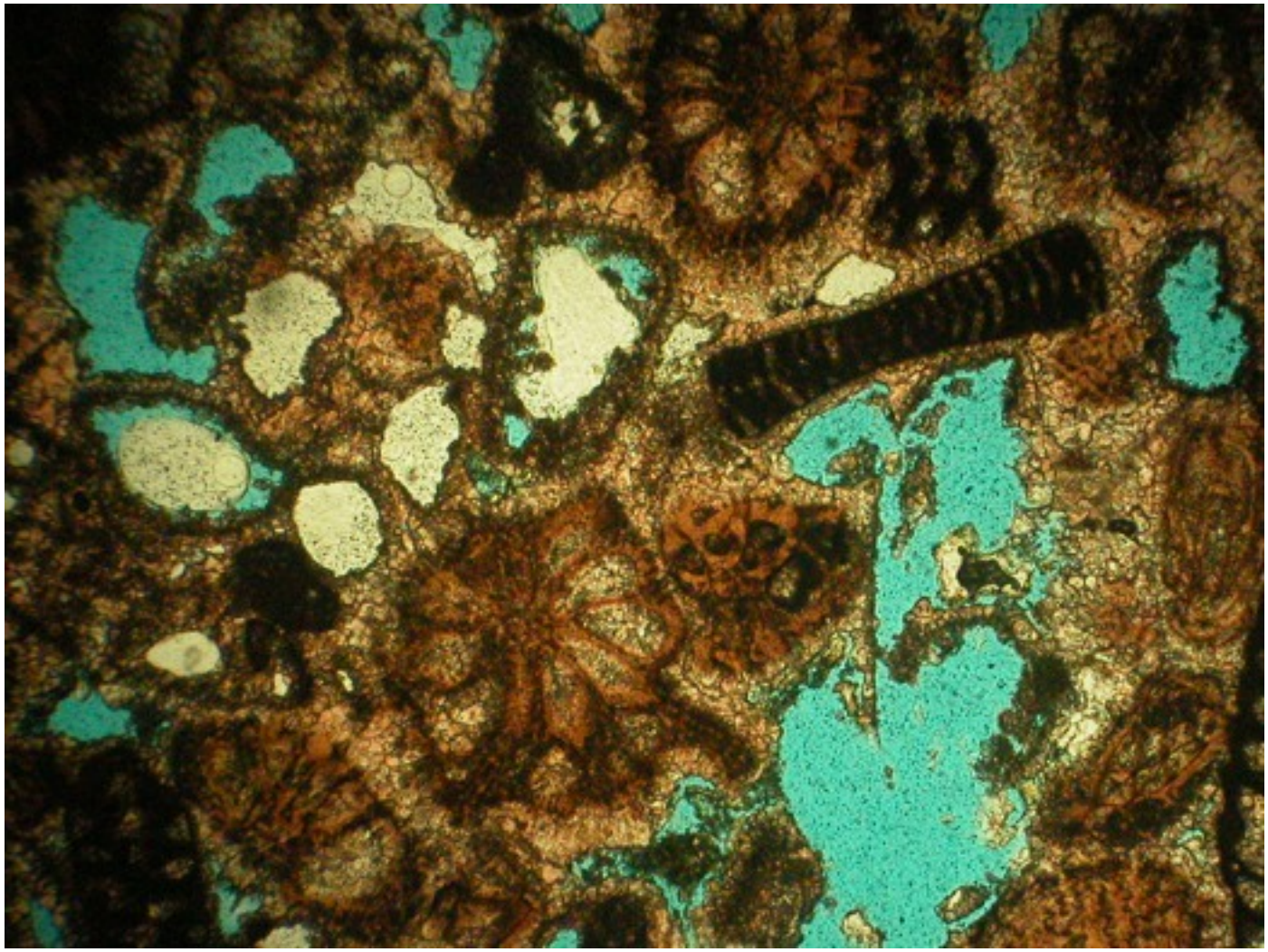



µm
2000
4000
6000
Z = 2.781 mm
2000

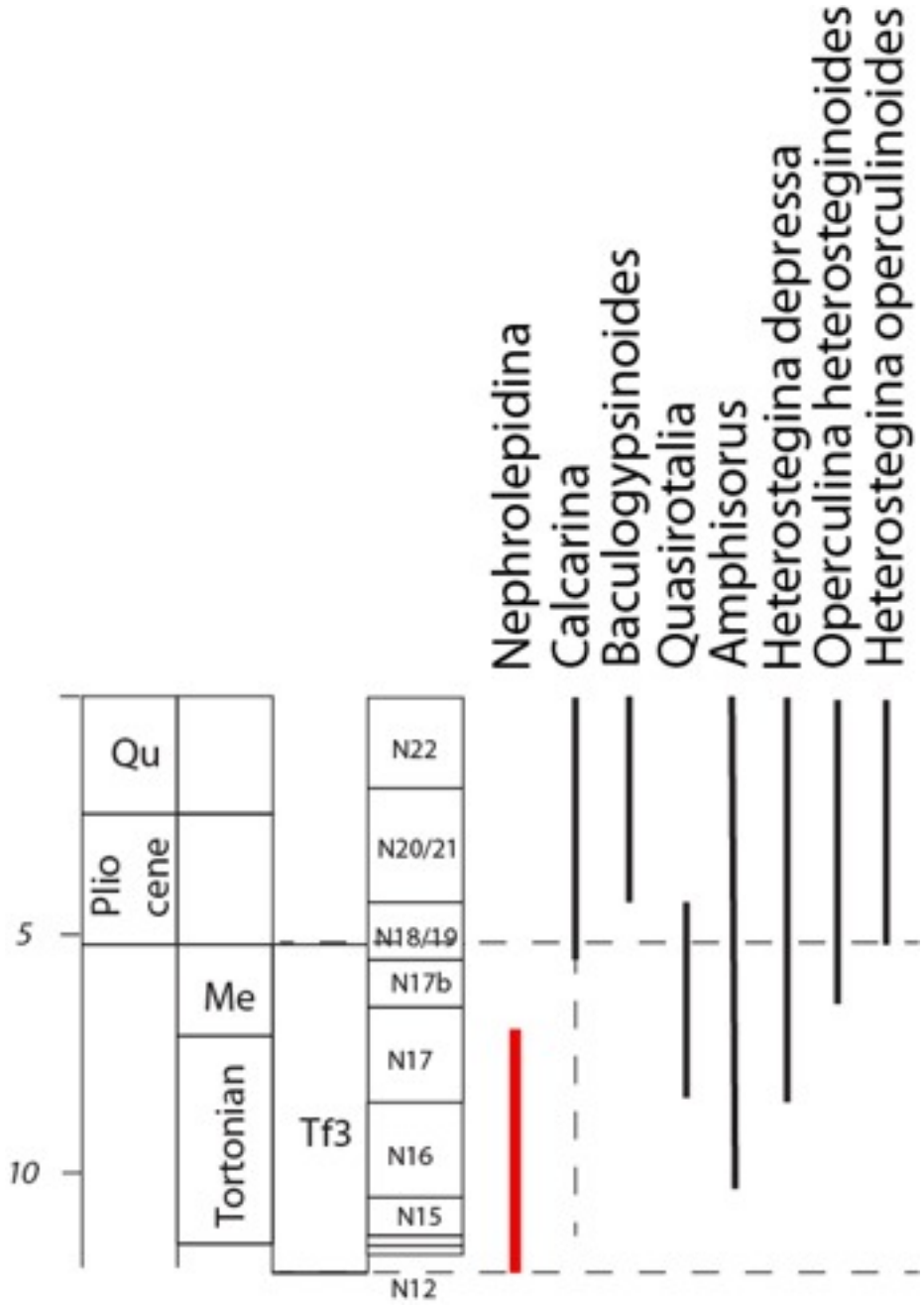




Heterostegina



Planostegina


Qu
Plio
cene
Me
Tortonian
Tf3
N22
N20/21
N18/19
N17b
N17
N16
N15
N12
5
10
Nephrolepidina
Calcarina
Baculogypsinoides
Quasirotalia
Amphisorus
Heterostegina depressa
Operculina heterosteginoides
Heterostegina operculinoides

Issues

- Convergent evolution
  - Heterostegina 3*
  - Planostegina 3*
  - Spiroclypeus 2*

- Calibration to GTS
  - Based on assemblages, hardly on occurrences in sections
  - Increasing correlation to other zonal schemes
    - Plankton
    - Nanno plankton
    - Sr isotopes

- Future work
  - Measure long sections covering time
    - Integrate disciplines
  - attempt basin margin – basin correlation