



<http://www.biltek.tubitak.gov.tr/bilgipaket/jeolojik/index.htm>

Paleontology

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Department of Geology

Lecture 5



ANKARA UNIVERSITY



Rotaliina

1. Cretaceous rotaliids

Larger ones

Orbitoides sp.

Omphalocyclus sp.

Lepidorbitoides sp.

Siderolites sp.

Relatively smaller

Hellenocyclus sp.

2. Cretaceous to Paleocene rotaliids

Neoflabellina sp.

Bolivinooides sp.

Laffitteina sp.

3. Paleogene rotaliids

Larger ones

Nummulites sp.

Assilina sp.

Discocyclus sp.

Actinocyclus sp.

Relatively smaller

Chapmanina sp.

3. Paleogene-Miocene rotaliids

Larger ones

Miogypsina sp.

Miogypsinoides sp.

Miolepidocyclus sp.

Operculina sp.

Lepidocyclus sp.

4. Others

5. Age and paleoenvironmental interpretations by foraminifera in time and space

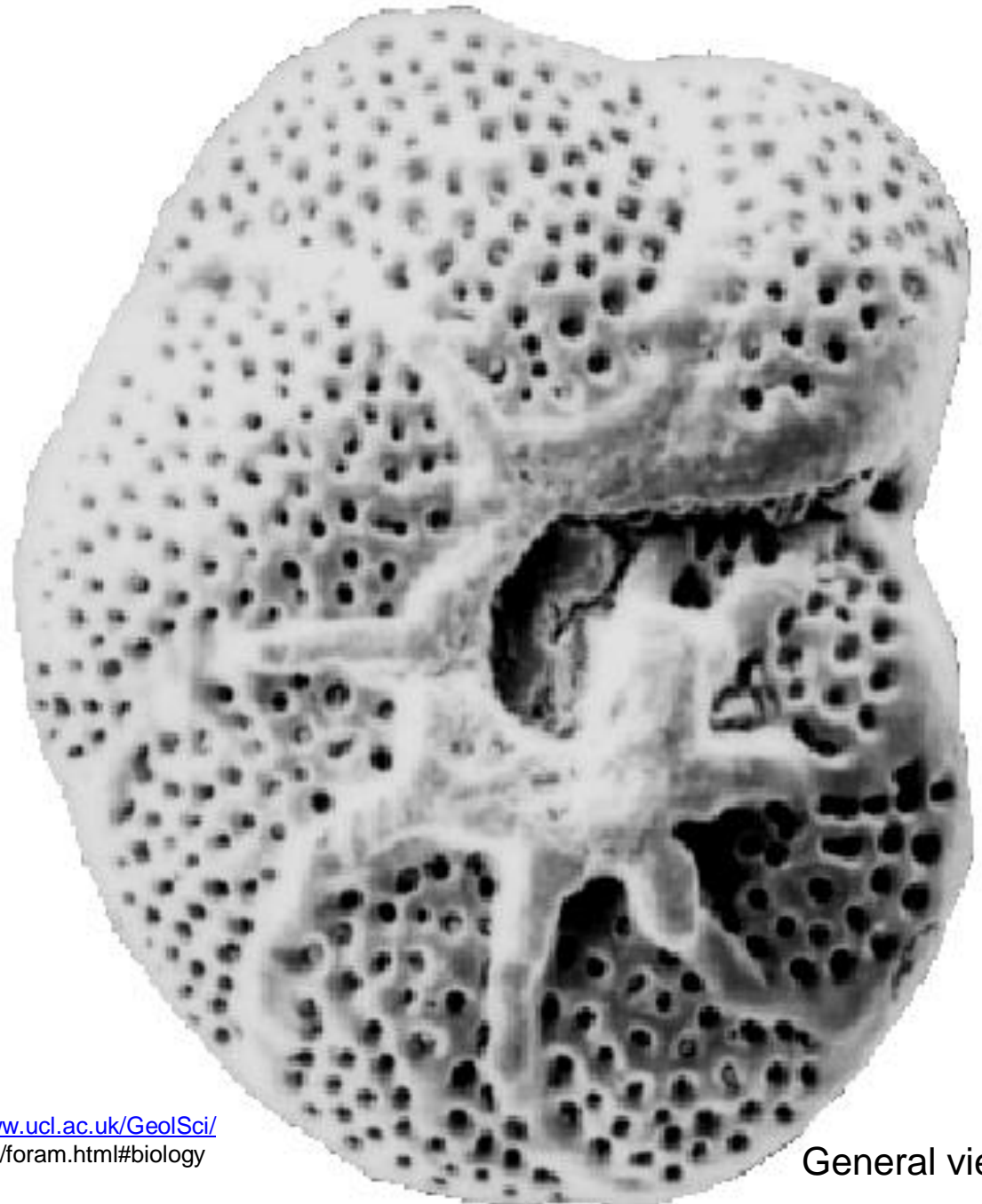
Topics

Main rotaliid selected genera with their stratigraphical ranges

Genus	J	Kr	pa	e	ol	mi	pli	ple	h
<i>Orbitoides</i> sp.		█							
<i>Omphalocyclus</i> sp.		█							
<i>Lepidorbitoides</i> sp.		█							
<i>Siderolites</i> sp.		█							
<i>Hellenocyclina</i> sp.		█							
<i>Neoflabellina</i> sp.		█	█						
<i>Bolivinooides</i> sp.		█	█						
<i>Laffitteina</i> sp.		█	█						
<i>Nummulites</i> sp.			█	█	█	█			
<i>Assilina</i> sp.			█	█	█				
<i>Discocyclina</i> sp.			█	█	█				
<i>Actinocyclina</i> sp.				█	█				
<i>Chapmanina</i> sp.				█	█				
<i>Miogypsina</i> sp.						█	█		
<i>Miogypsinooides</i> sp.					█	█	█		
<i>Miolepidocyclina</i> sp.						█	█		
<i>Operculina</i> sp.			█	█	█	█	█		
<i>Lepidocyclina</i> sp.					█	█	█		



Suborder Rotaliina



General views

http://hoopermuseum.earthsci.carleton.ca/2001_benthicforams_jk/cont.html

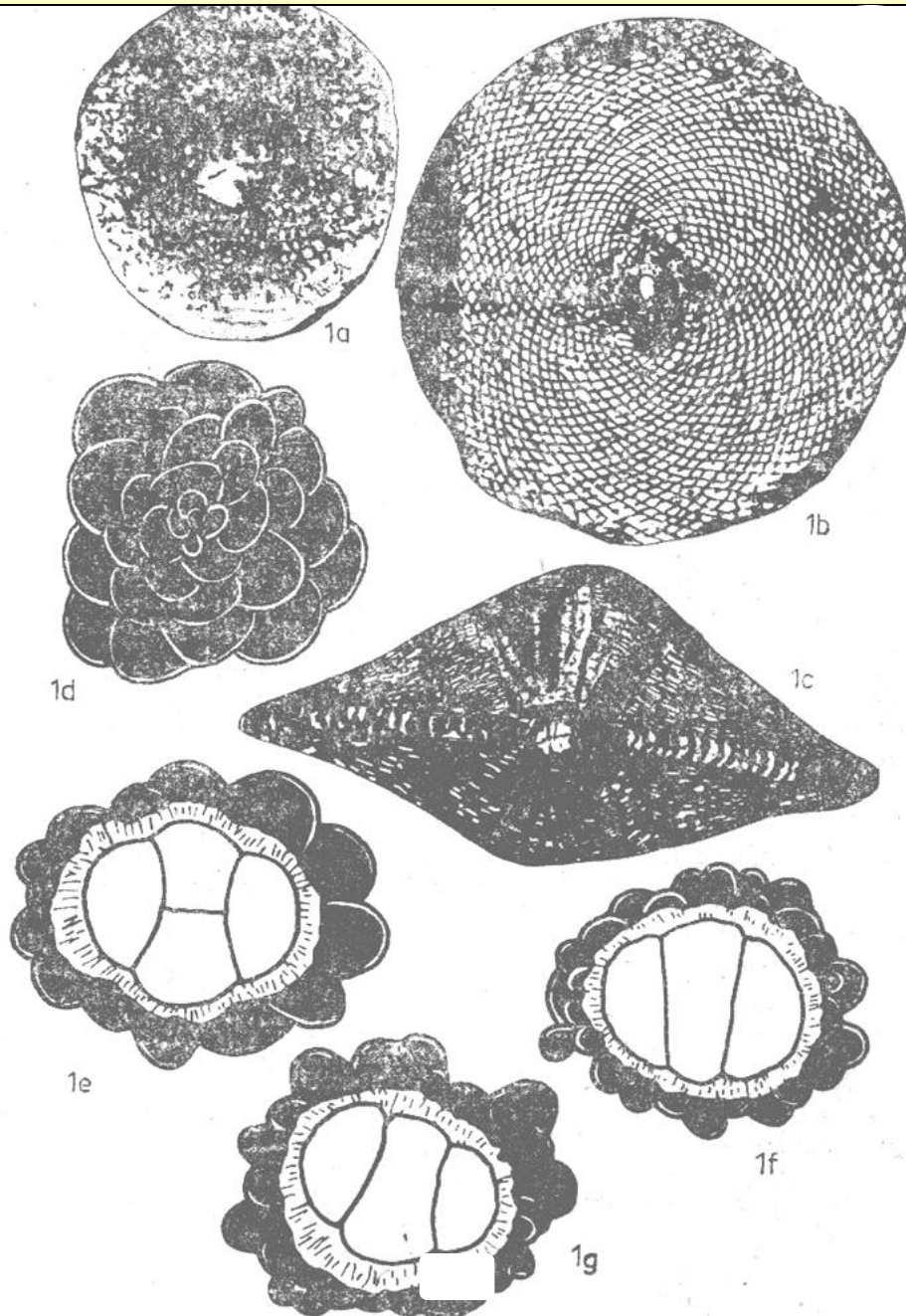
<http://www.ucl.ac.uk/GeolSci/micropal/foram.html#biology>

Characteristic features: test wall (hyaline), lenticular shape embryonic view including protoconch, deutoroconch and lateral embryonic chambers

Late Cretaceous

Suborder Rotaliina

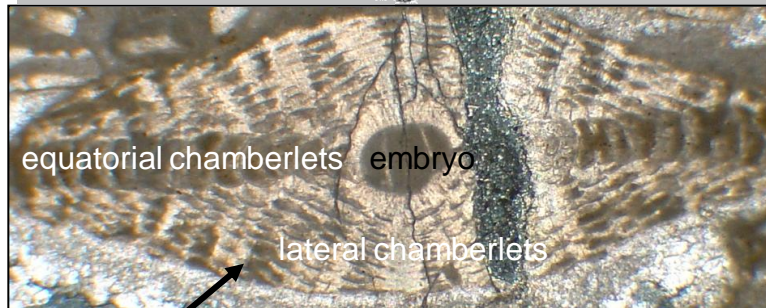
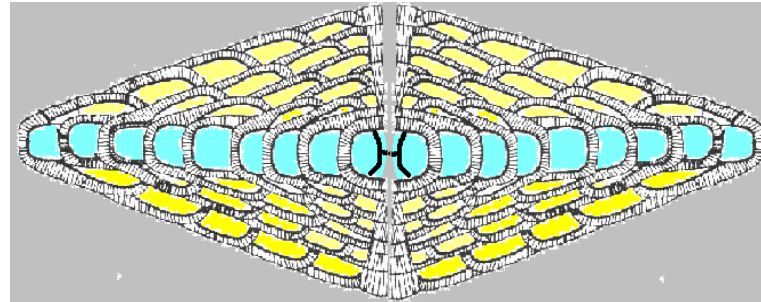
larger benthic, dimorphic



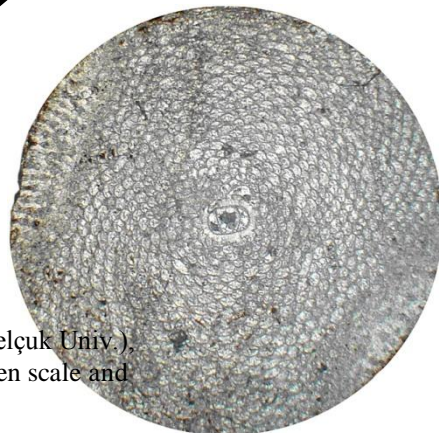
Orbitoides sp.

- Lenticular test, thin edged lens-shaped
- Mainly 2mm to 15 mm in size
- Lateral and equatorial many chamberlets
- Embryo view

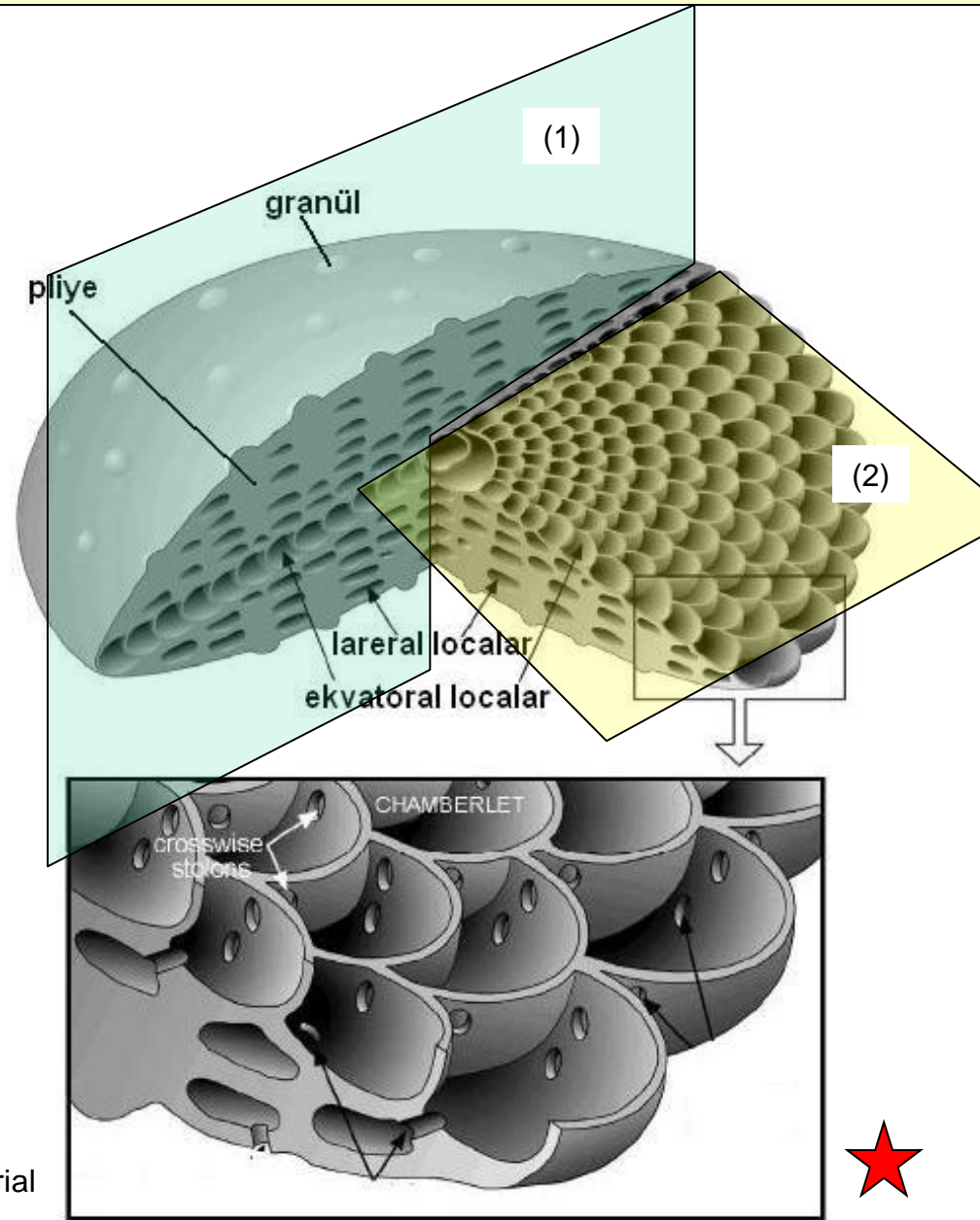
(1) axial sections



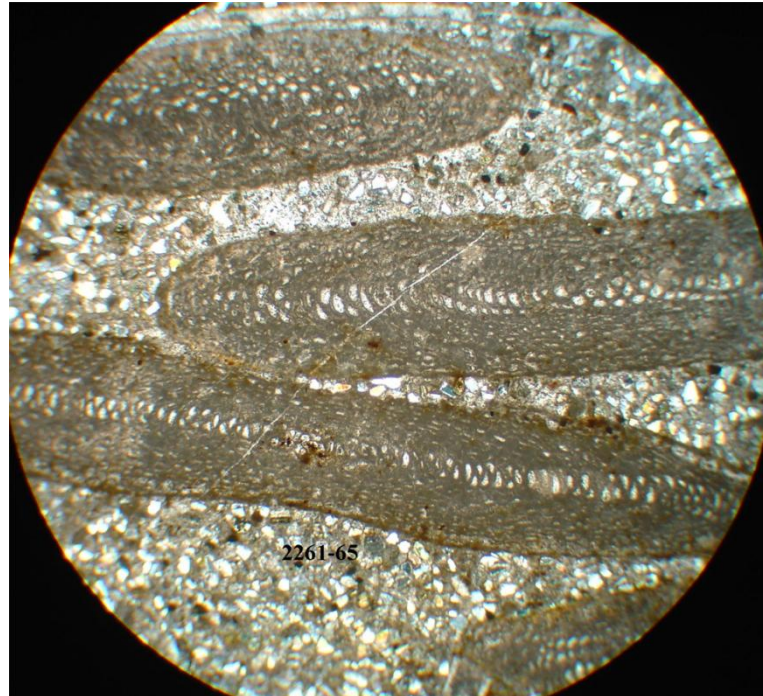
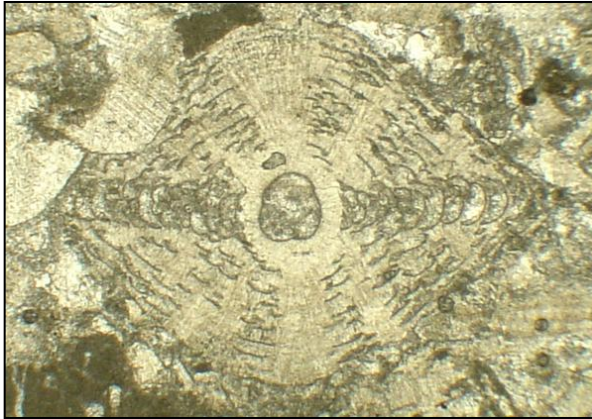
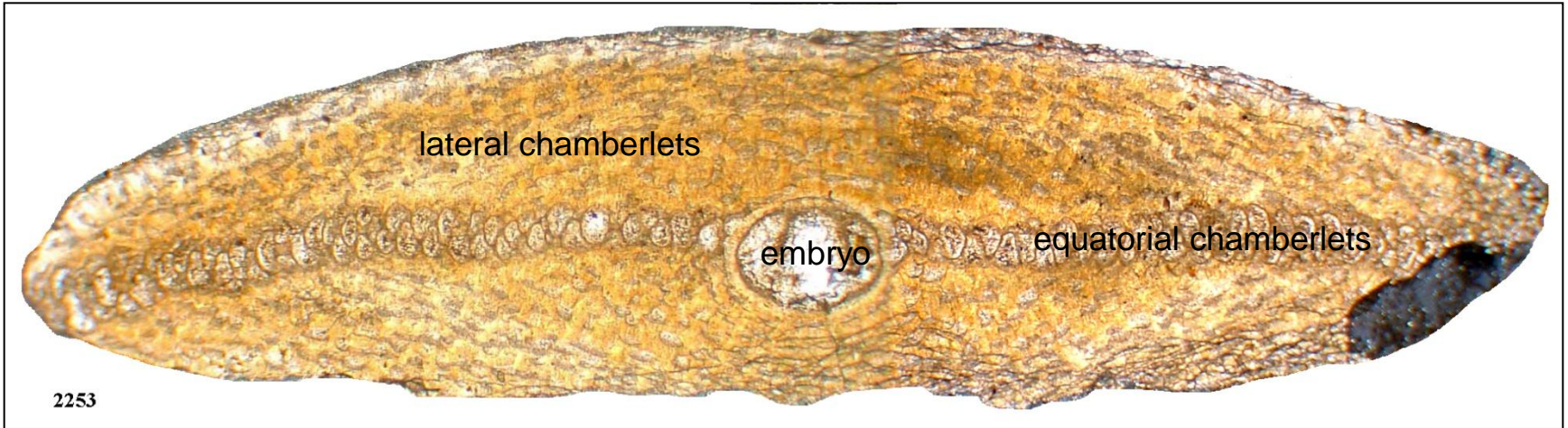
pillars



(2) equatorial section



Orbitoides sp.

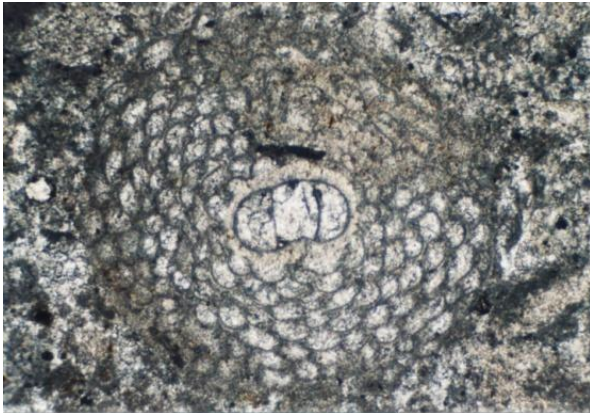
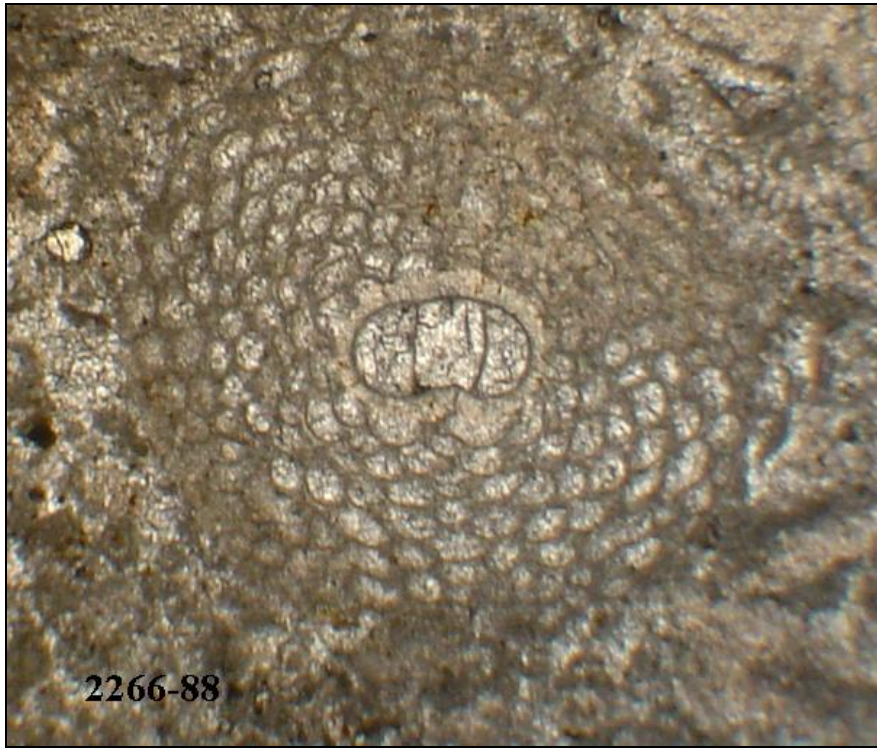


axial
sections

Pictures from Alkaya (Selçuk Univ.),
lecture notes, by forgotten scale and
reference



Orbitoides sp.



equatorial
sections

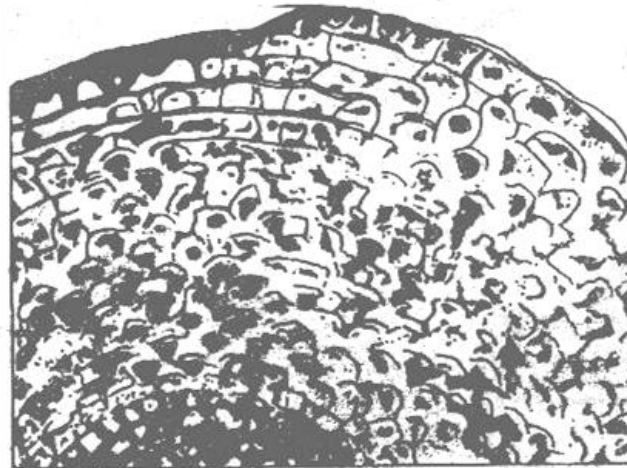
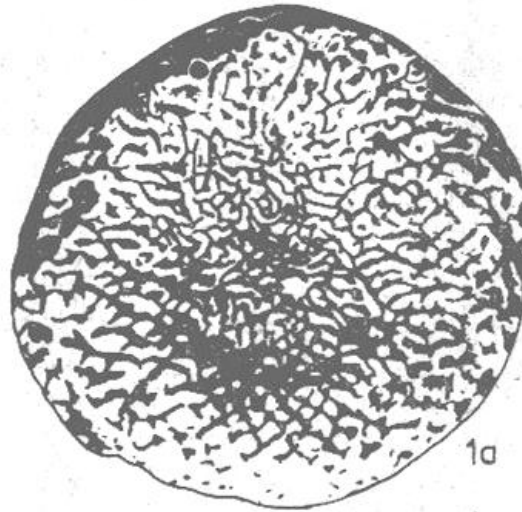


Omphalocyclus sp.

Late Cretaceous

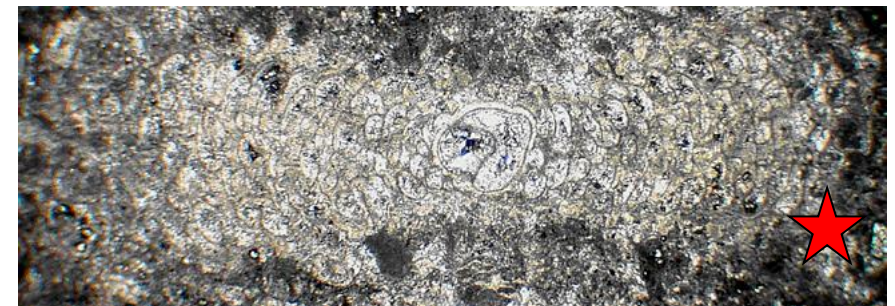
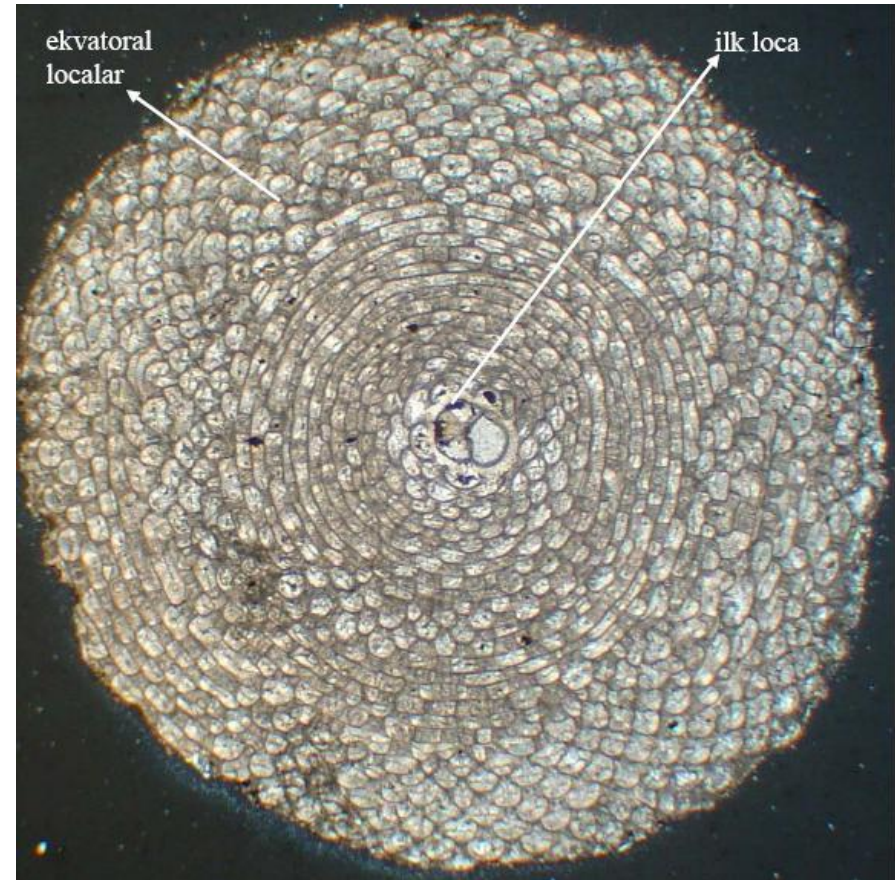
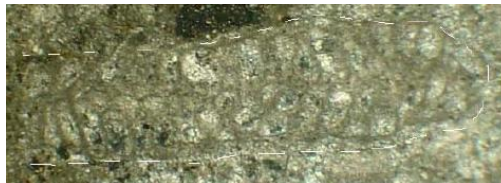
Suborder Rotaliina

Characteristic features: test wall (hyaline), lenticular shape embryonic view bow-tie axial view, rectangular equatorial chamberlets



Omphalocyclus sp.

- concave lens-shaped
- many chamberlets
- embryo view

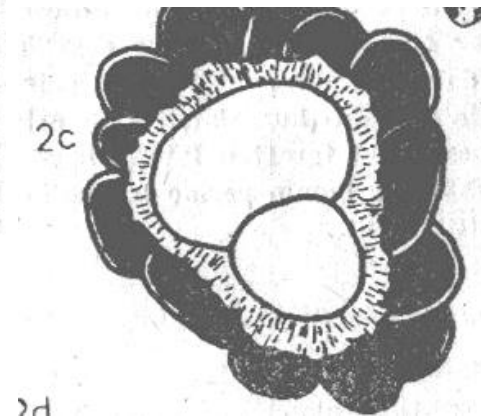
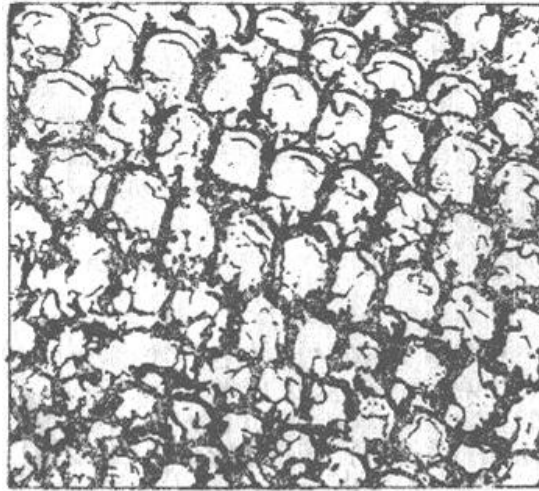
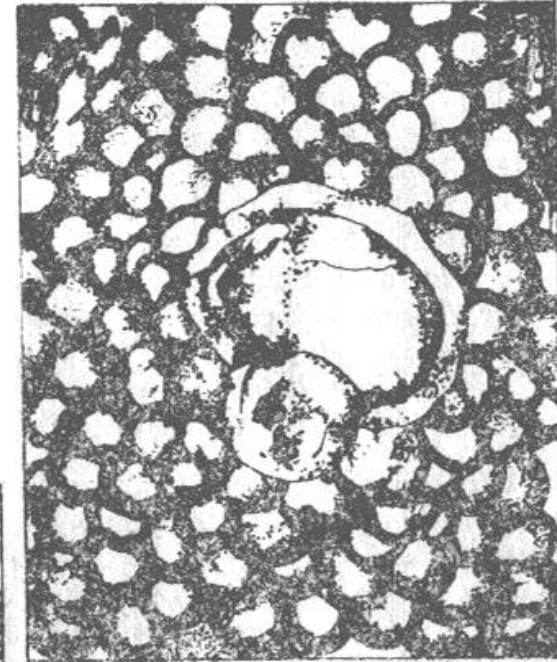
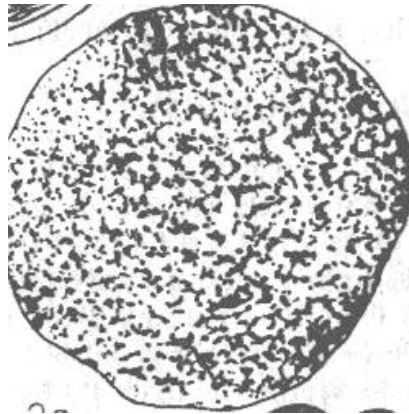


Lepidorbitoides sp.

Late Cretaceous

Suborder Rotaliina

Characteristic features: test wall (hyaline), lenticular shape embryonic view (two), shape of equatorial chamberlets



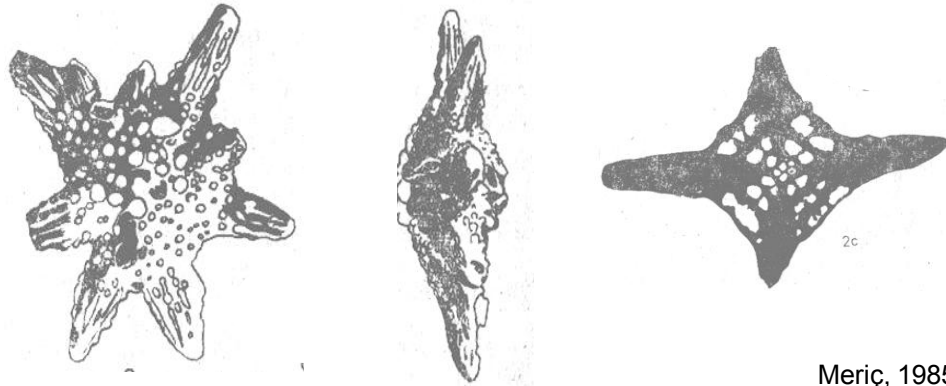
Characteristic features: test wall (hyaline), coarse spines from the center of the test

Suborder Rotaliina

Late Cretaceous

Picture from Alkaya (Selçuk Univ.), lecture notes, by forgotten scale and reference

Siderolites sp.



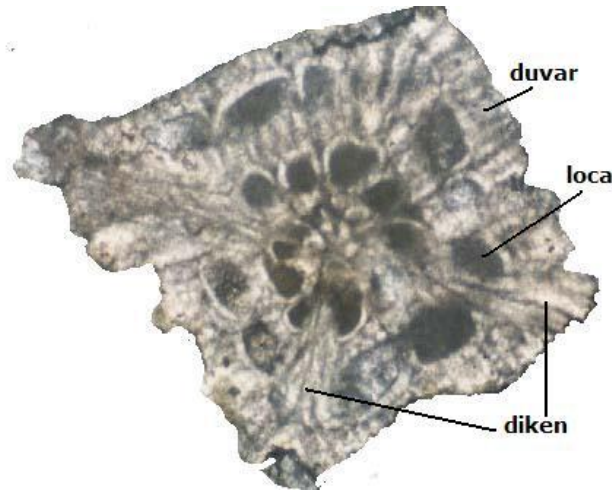
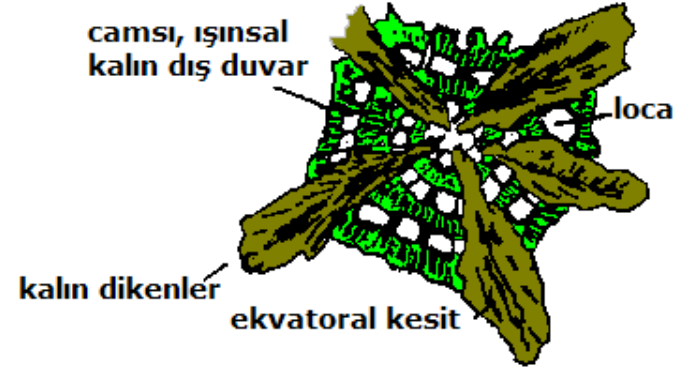
Meriç, 1985



Siderolites sp.

Late Cretaceous

Suborder Rotaliina

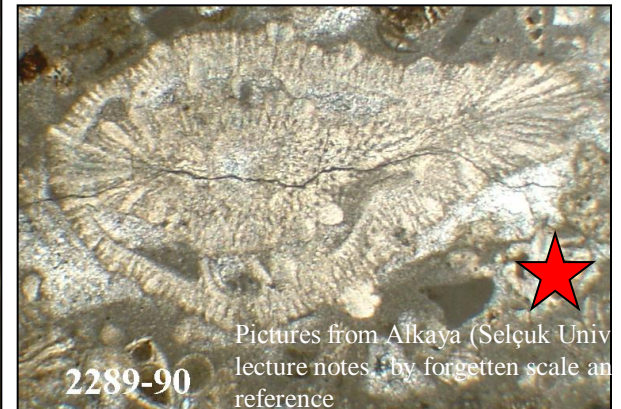
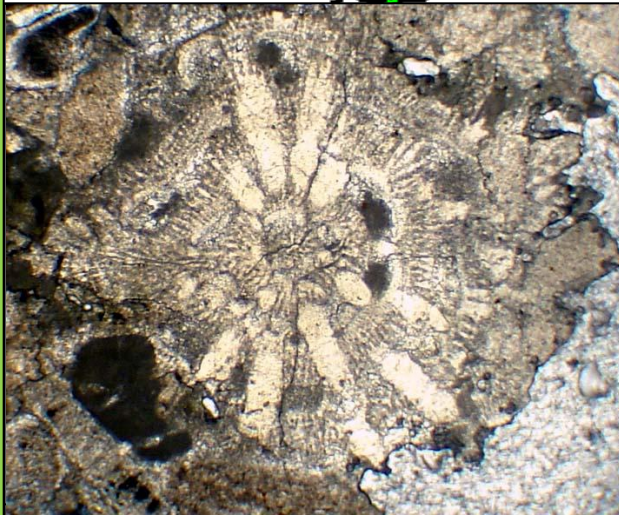
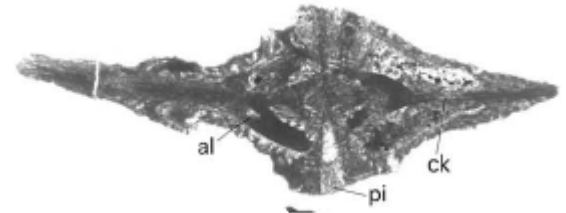
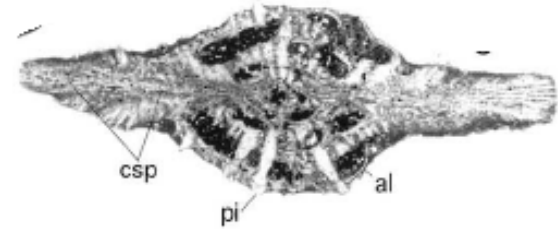


Pictures from Alkaya (Selçuk Univ.),
lecture notes, by forgotten scale and
reference

Siderolites sp.

Late Cretaceous

Suborder
Rotaliina

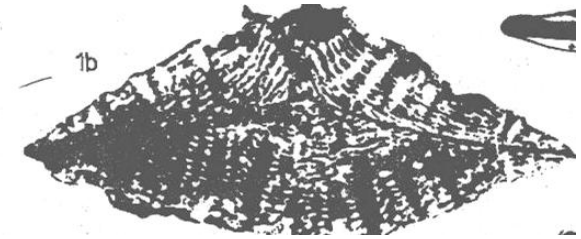
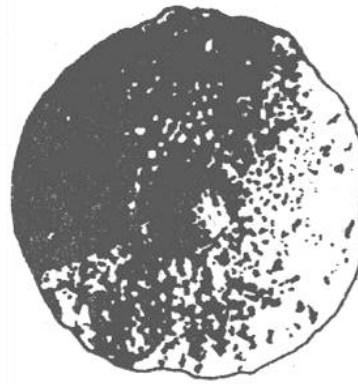


Pictures from Alkaya (Selçuk Univ
lecture notes, by forgotten scale and
reference

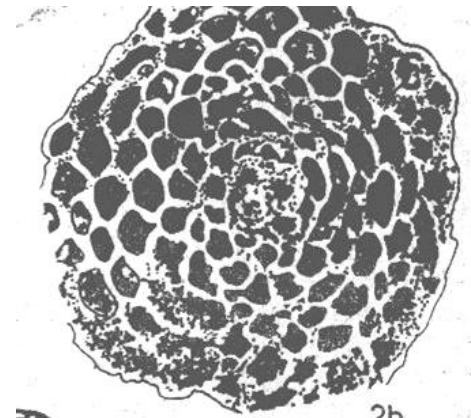
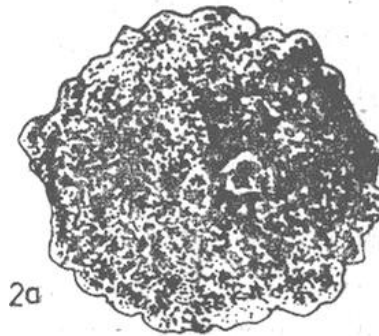
Suborder Rotaliina

Characteristic features: small test, calcite accumulation on both sides of equatorial chambers

Clypeorbis sp.



Hellenocyclina sp.

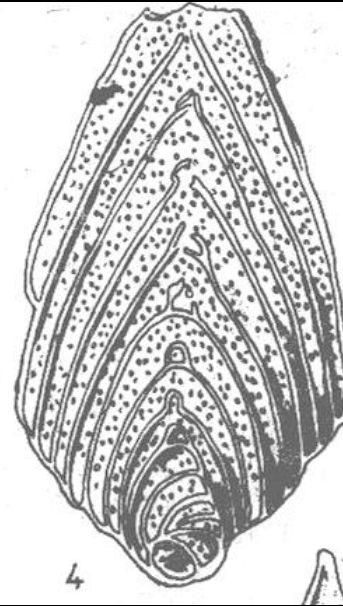


Characteristic features: two serial narrow, elongated chambers,

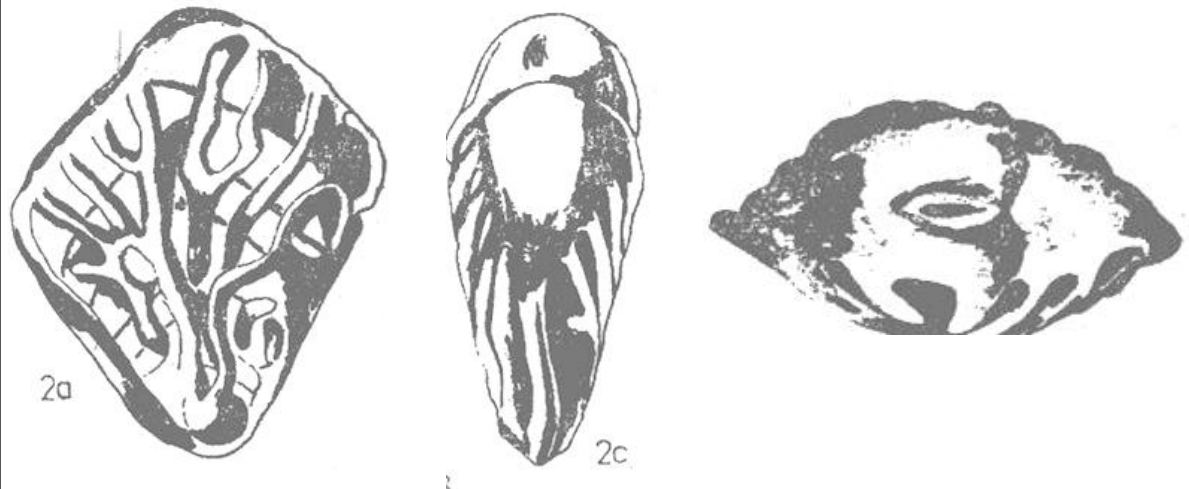
Suborder Rotaliina

Characteristic features: two serial narrow, elongated chambers, ornament

Neoflabellina sp.



Bolivinooides sp.



Laffitteina sp.

Late Cretaceous to Paleocene

Suborder Rotaliina

Characteristic features: radial, hyaline test wall, different axial view



Meriç, 1985



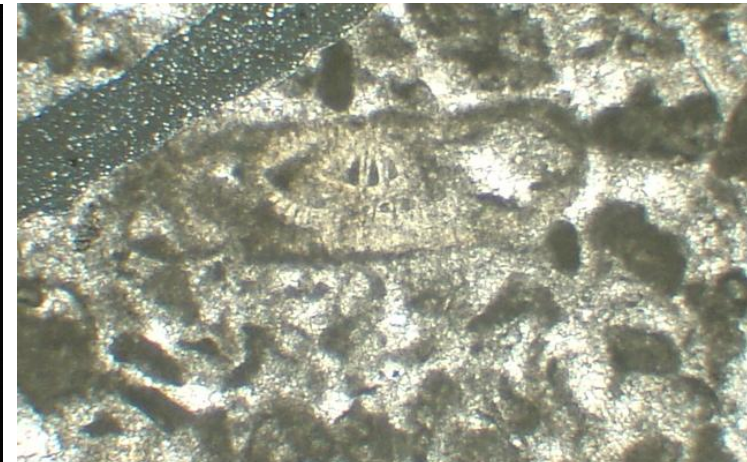
ekvatorial kesit



aksiyal kesit

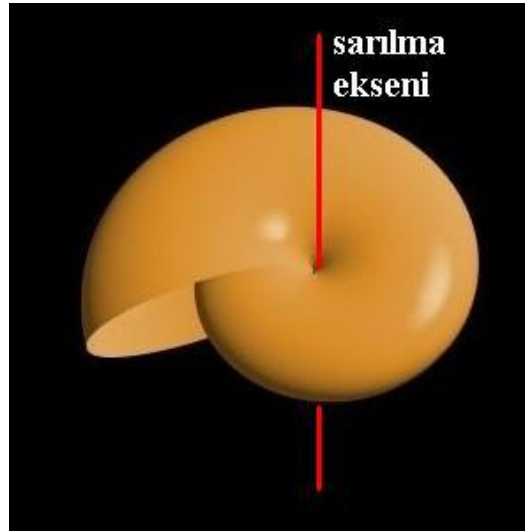


Pictures from Alkaya (Selçuk Univ.),
lecture notes, by forgotten scale and
reference



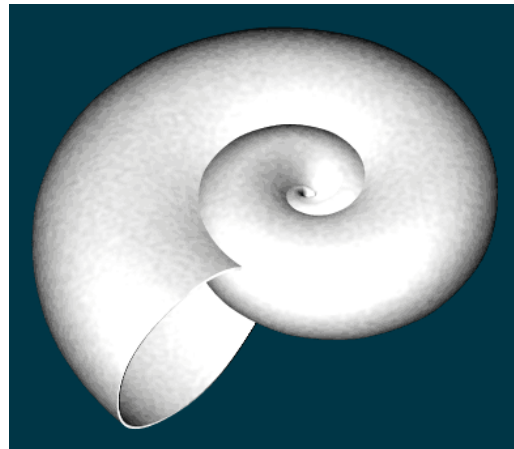
Comparison of coiling

Paleogene



*Nummulites
Operculina*

planispiral involute



Assilina

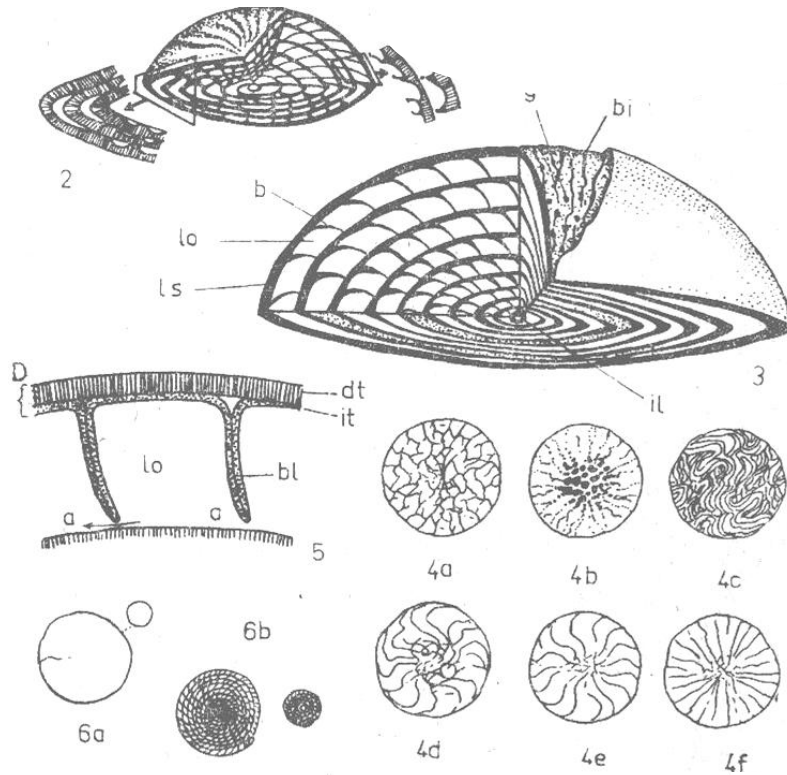
planispiral evolute

Pictures from Alkaya (Selçuk Univ.),
lecture notes, by forgotten scale and
reference

Nummulites sp.

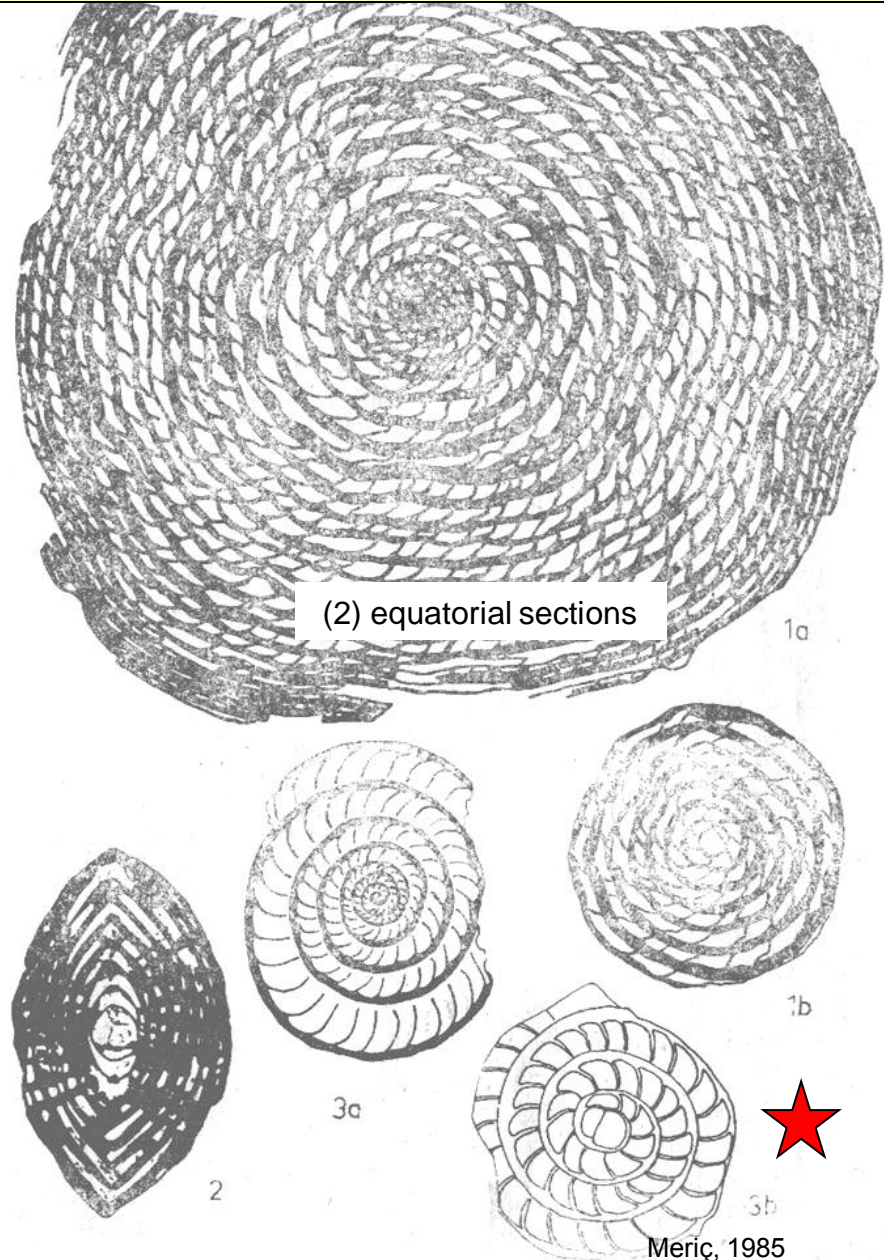
Paleogene

schematic block diagram



external views

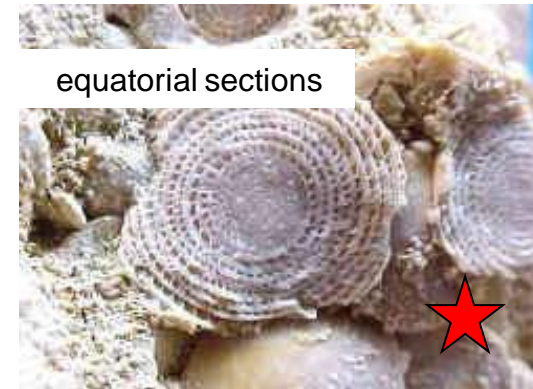
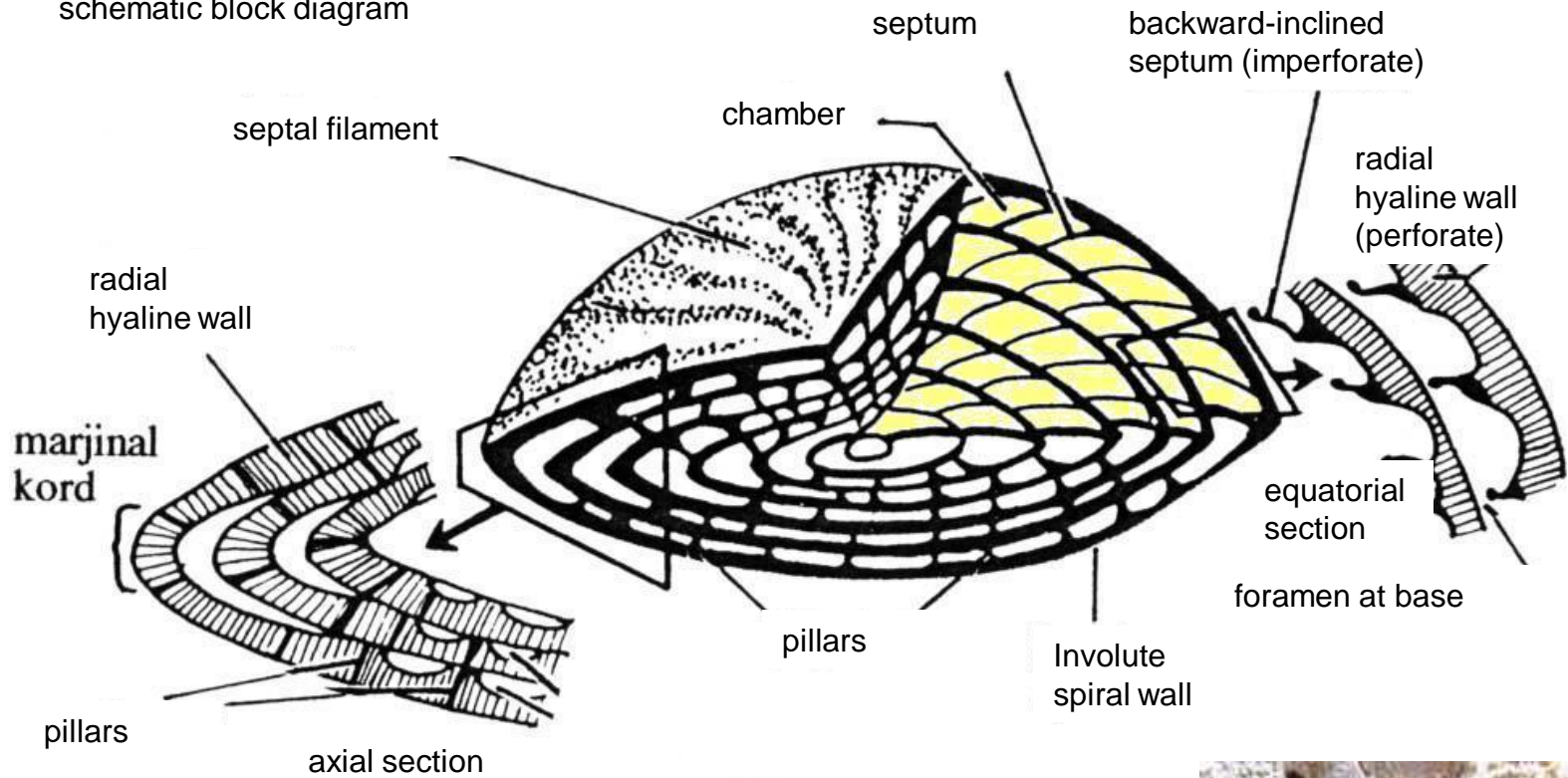
(1) axial section



Characteristic features: external septal views, V shaped whorls, lameller test, pillars

Nummulites sp.

schematic block diagram



ekvatorial

Paleogene

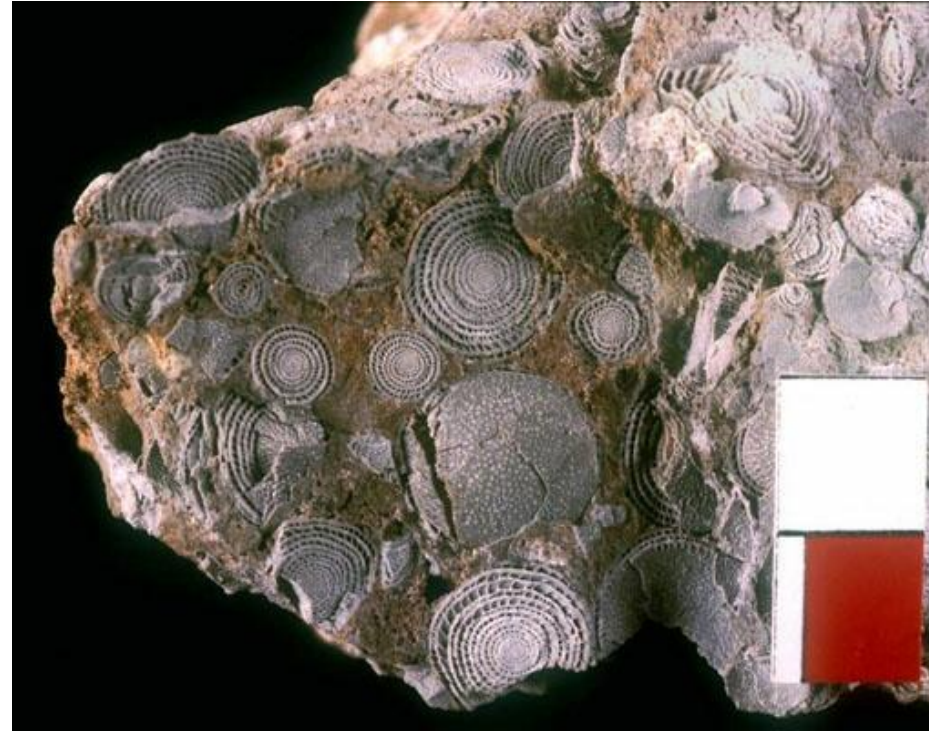
Nummulites sp.

Paleogene



external view

equatorial sections



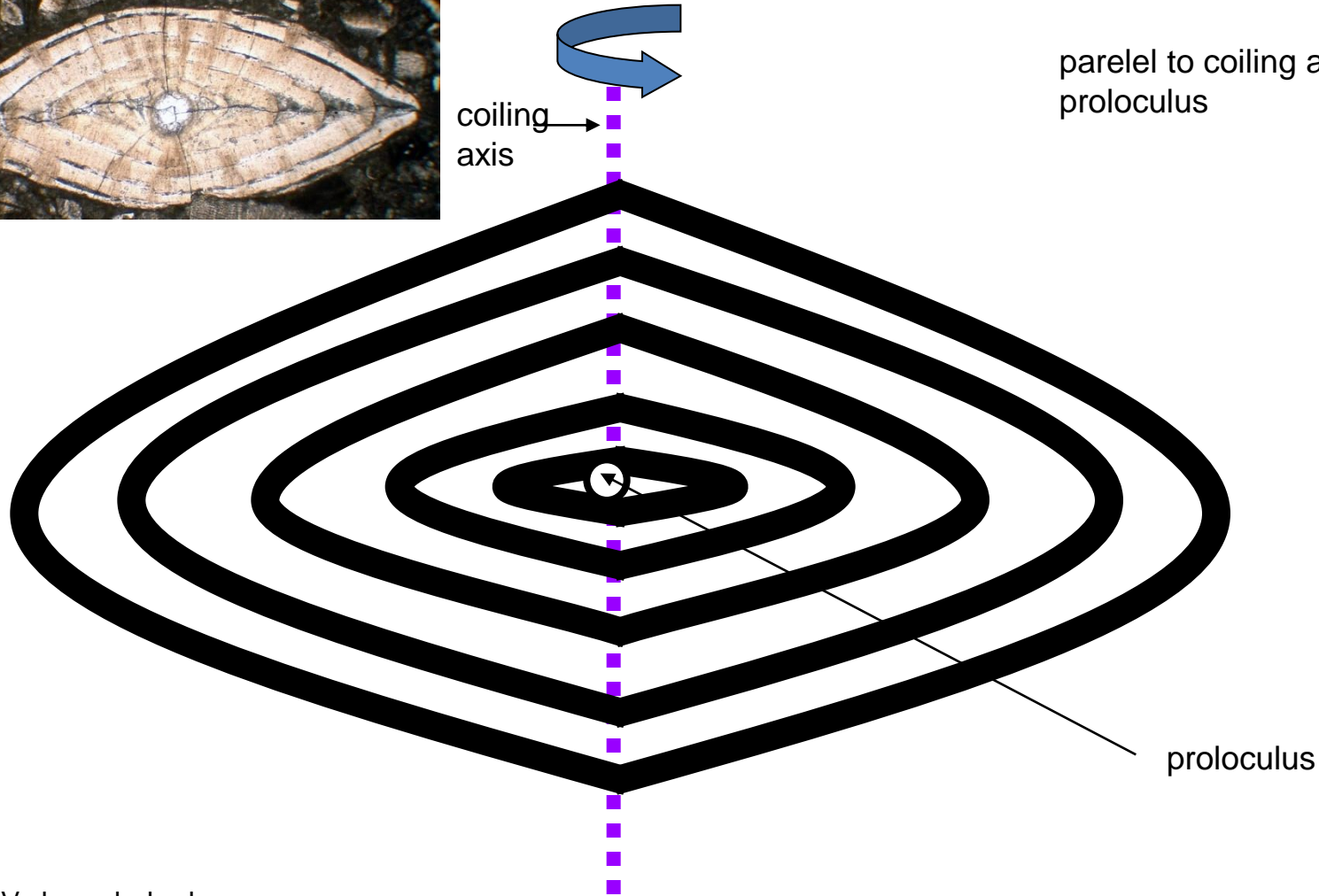
axial section



Pictures from Alkaya (Selçuk Univ.),
lecture notes, by forgotten scale and
reference

Nummulites sp.

Paleogene



parallel to coiling axis seeing proloculus

proloculus

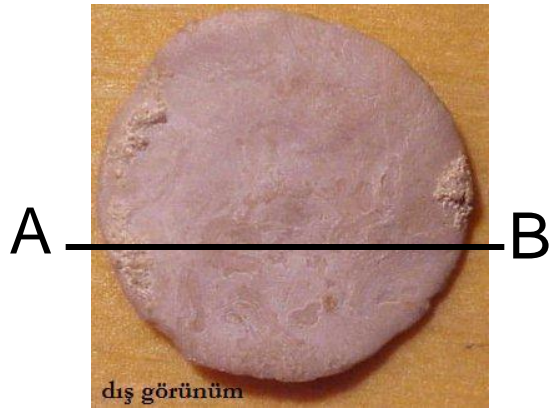
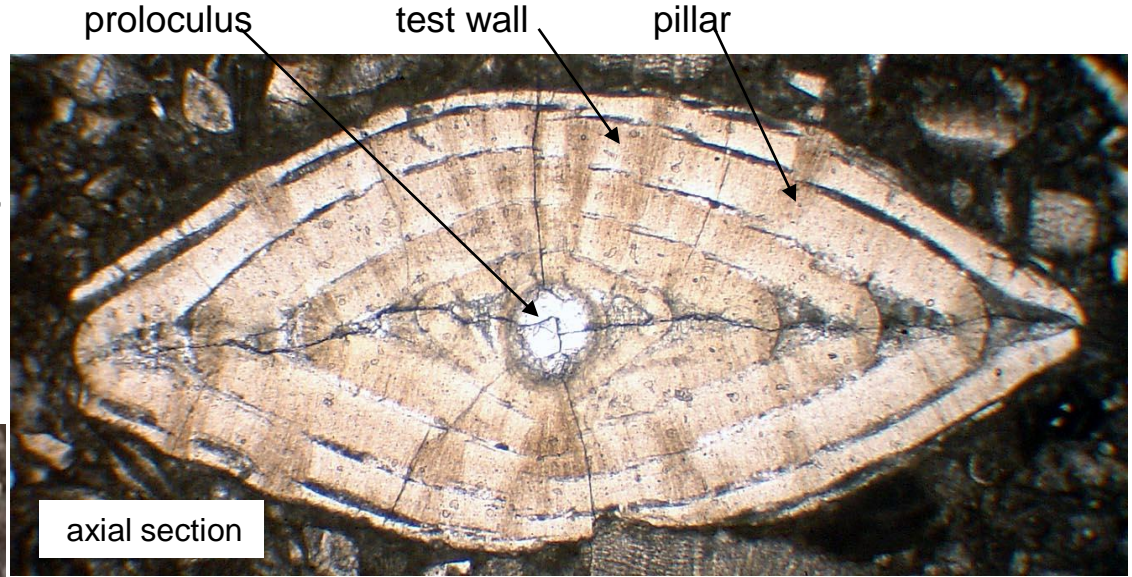
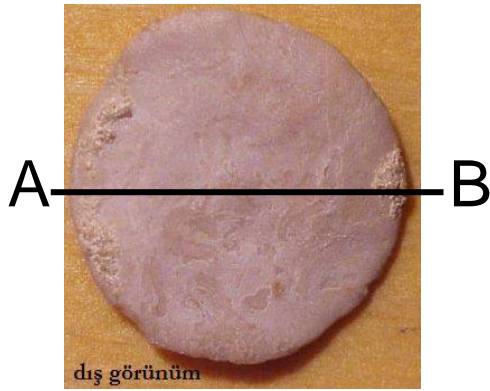
V shaped whorls
axial section



Pictures and drawing from Alkaya (Selçuk Univ.),
lecture notes, by forgotten scale and reference

Nummulites sp.

Paleogene

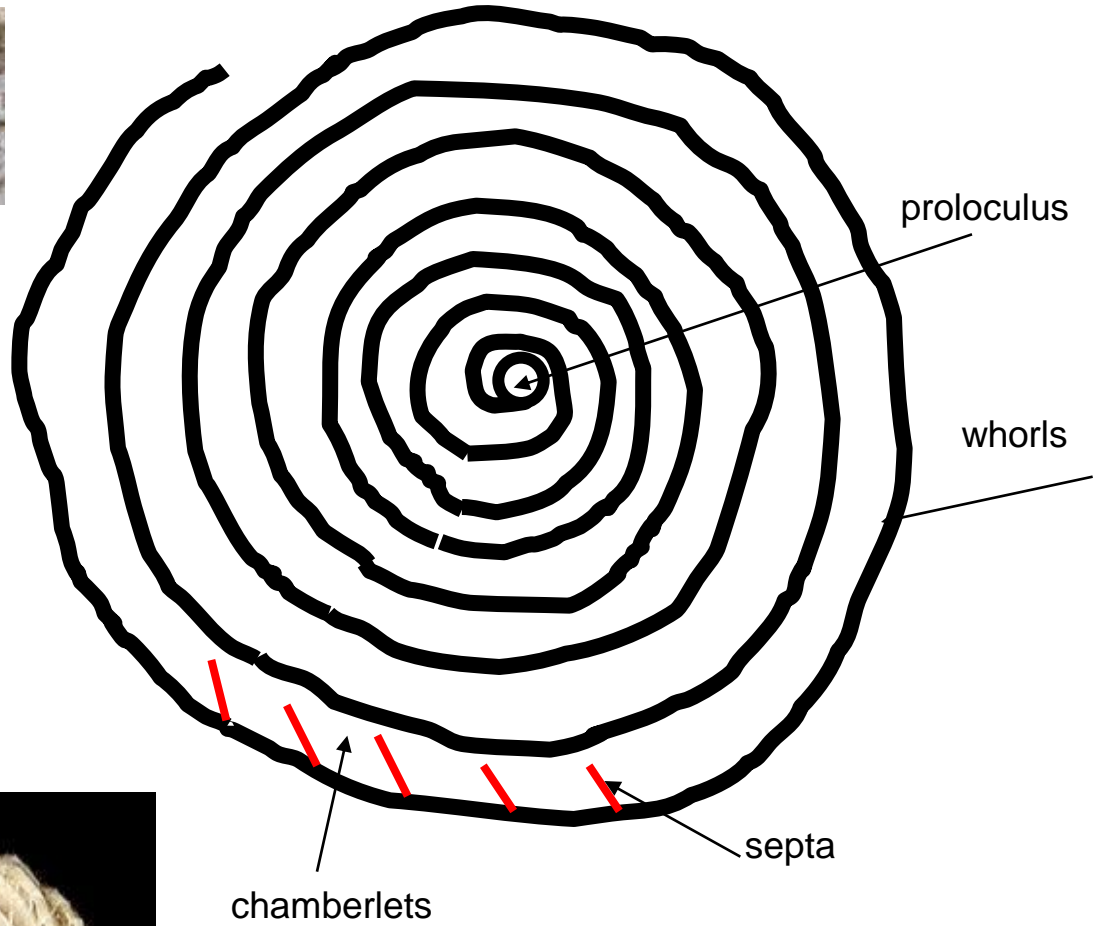


parallel section to axial section

Pictures from Alkaya (Selçuk Univ.),
lecture notes, by forgotten scale and
reference

Nummulites sp.

Paleogene



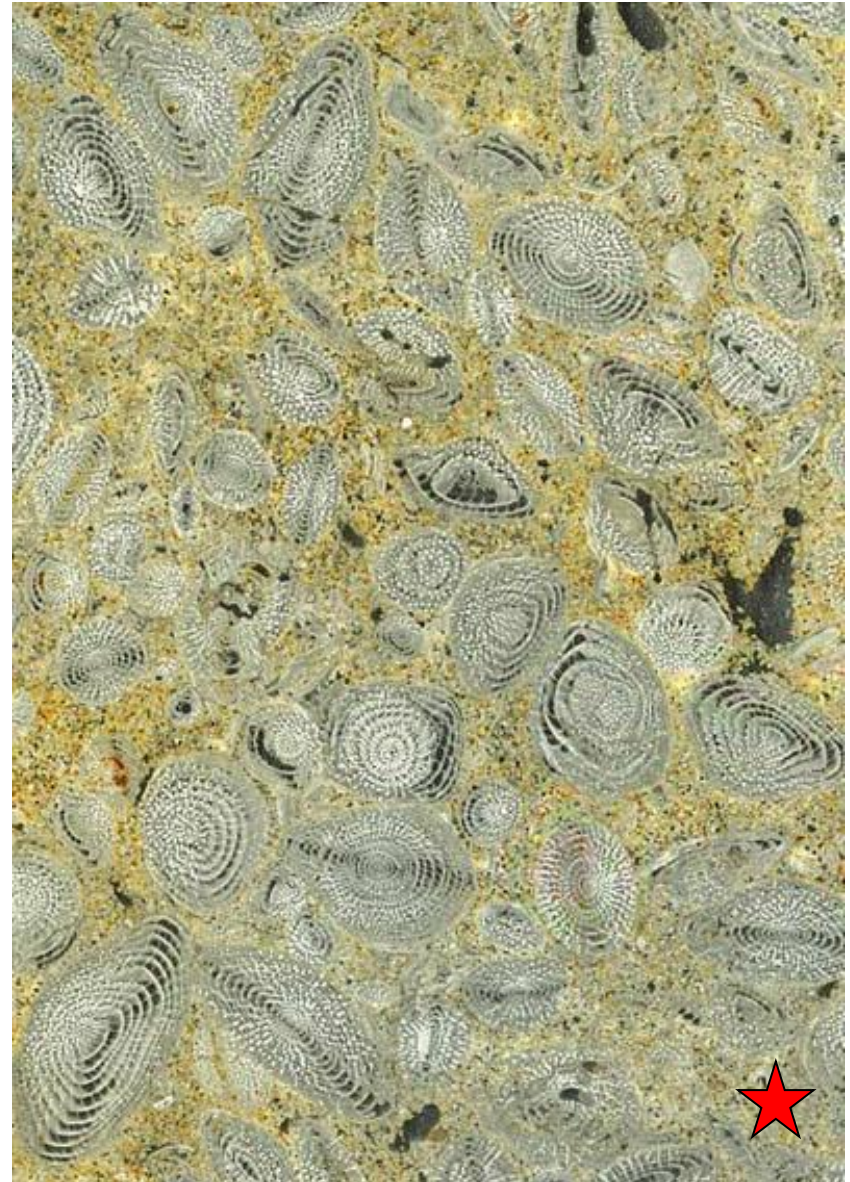
Pictures and drawing from Alkaya (Selçuk Univ.),
lecture notes, by forgotten scale and reference

Nummulites sp.

Paleogene

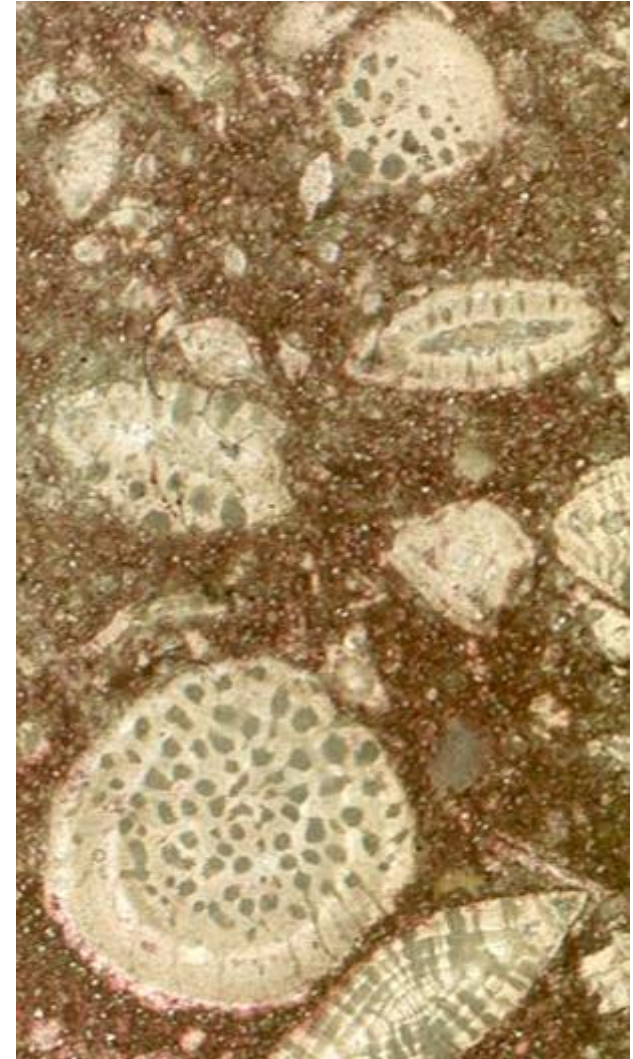
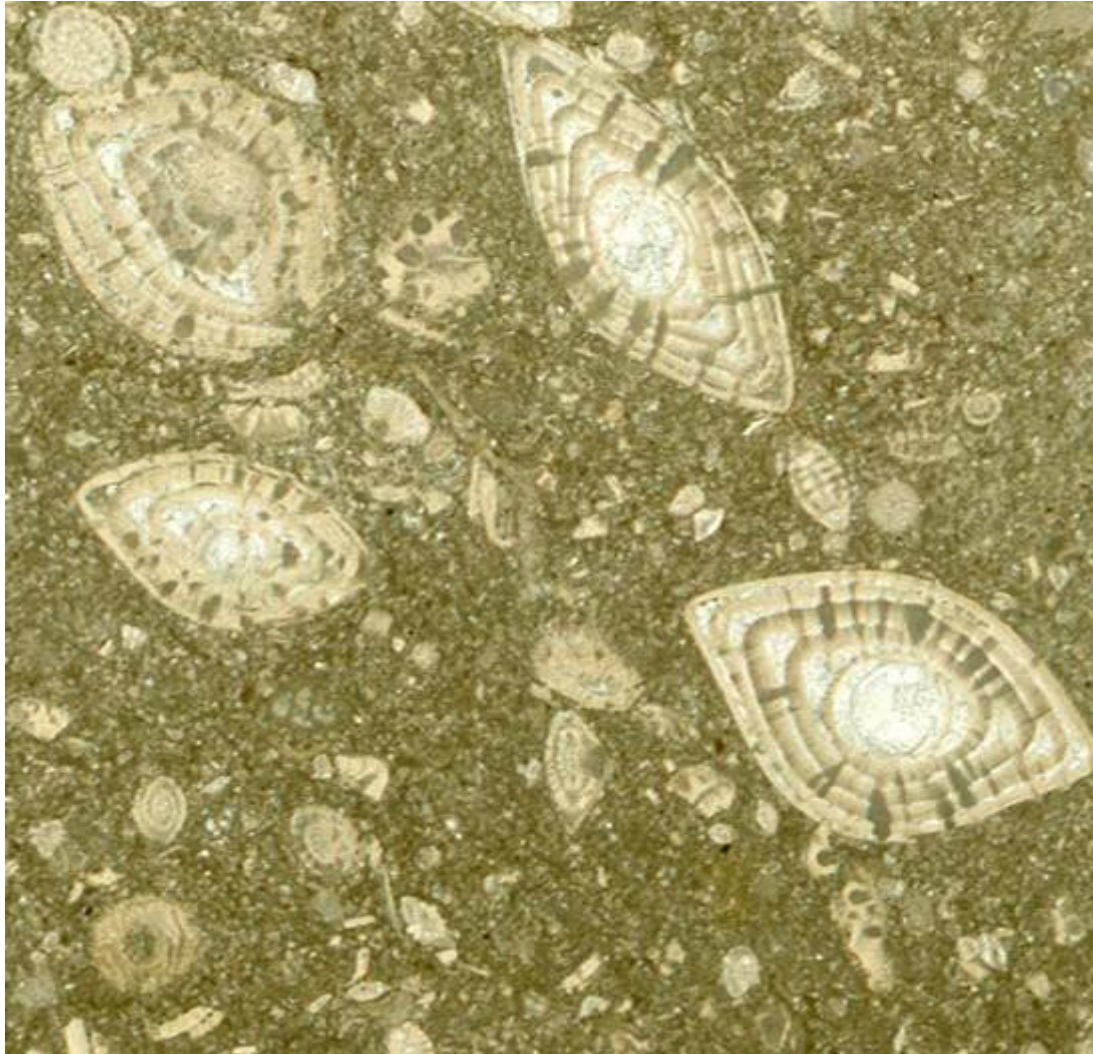


Pictures from Alkaya (Selçuk Univ.),
lecture notes, by forgotten scale and
reference



Nummulites sp.

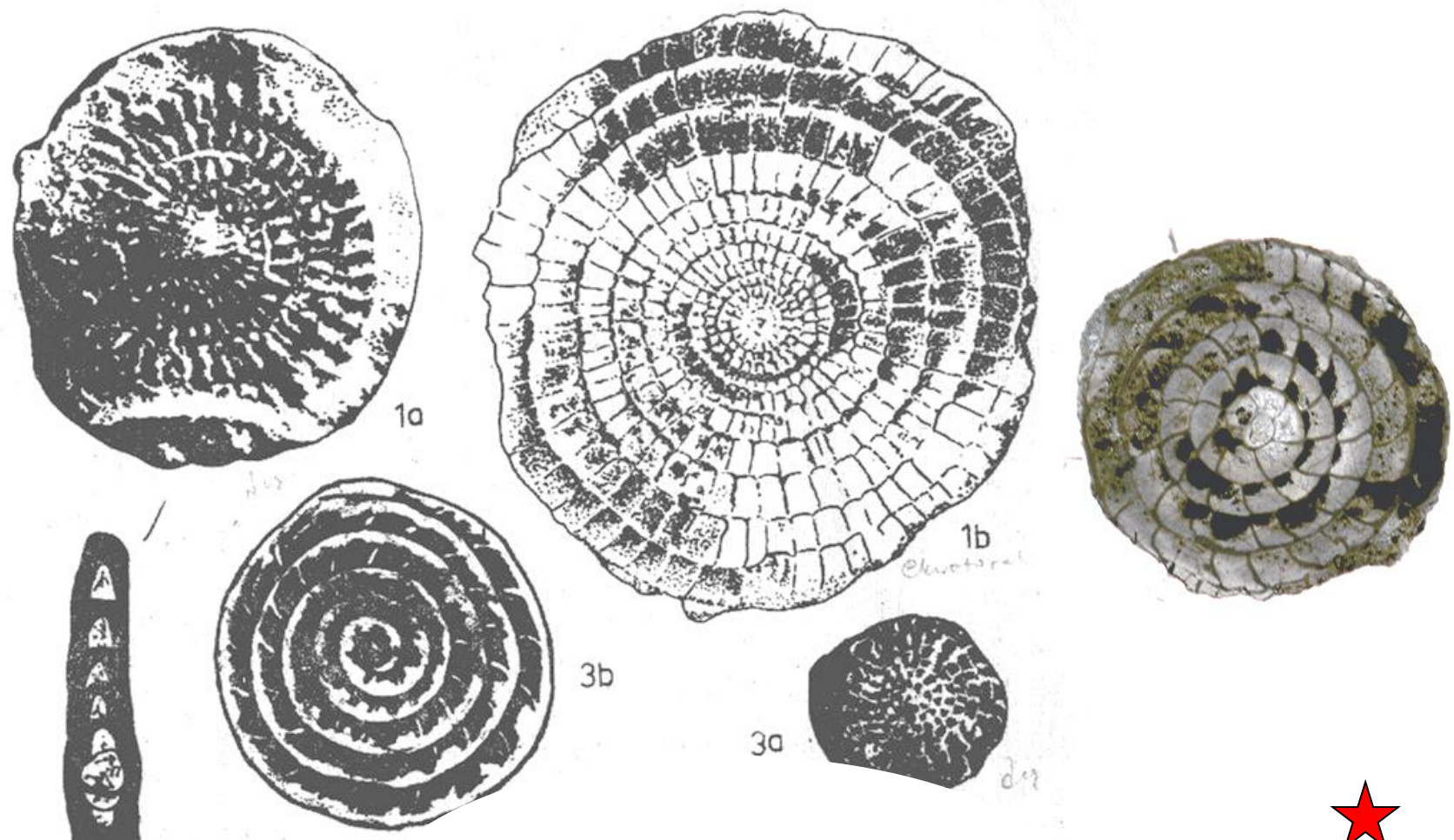
Paleogene



Pictures from Alkaya (Selçuk Univ.),
lecture notes, by forgotten scale and
reference

Assilina sp.

Paleogene



Meriç, 1985

2 **Characteristic features:** clear external septal traces, U shaped whorls

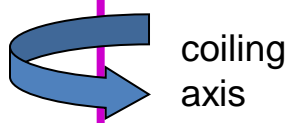


Picture from Alkaya (Selçuk Univ.), lecture notes, by forgotten scale and reference

Assilina sp.

Late Paleocene to Eocene

Paleogene



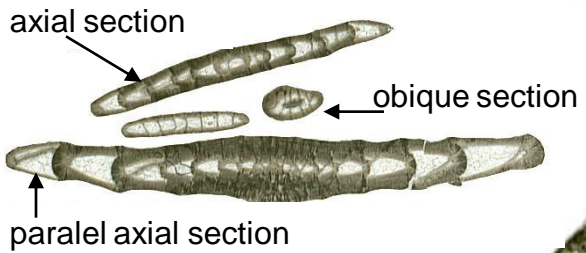
planispiral evolute, U shaped whorls

Pictures and drawing from Alkaya (Selçuk Univ.),
lecture notes, by forgotten scale and reference

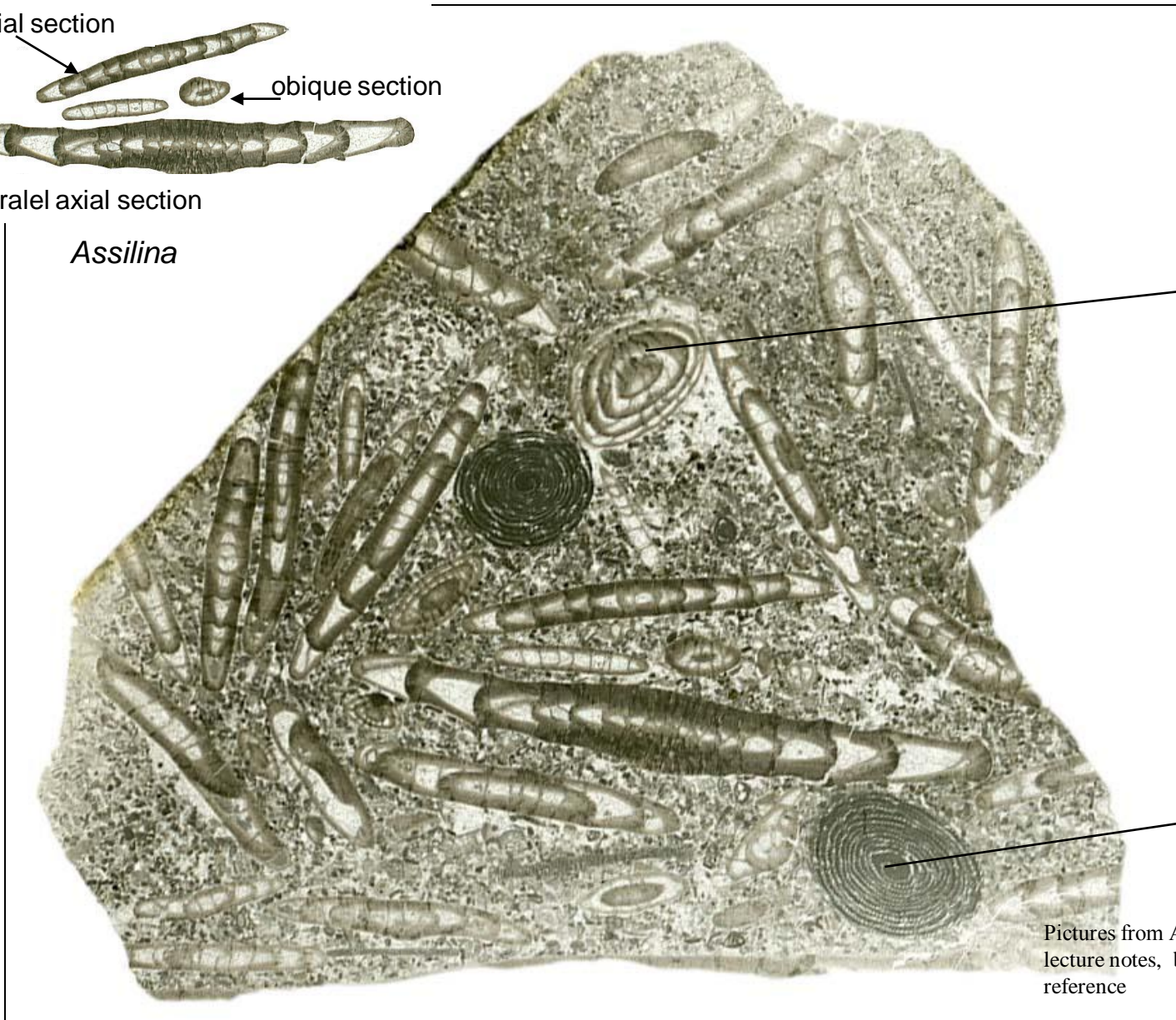
Assilina sp.

Late Paleocene to Eocene

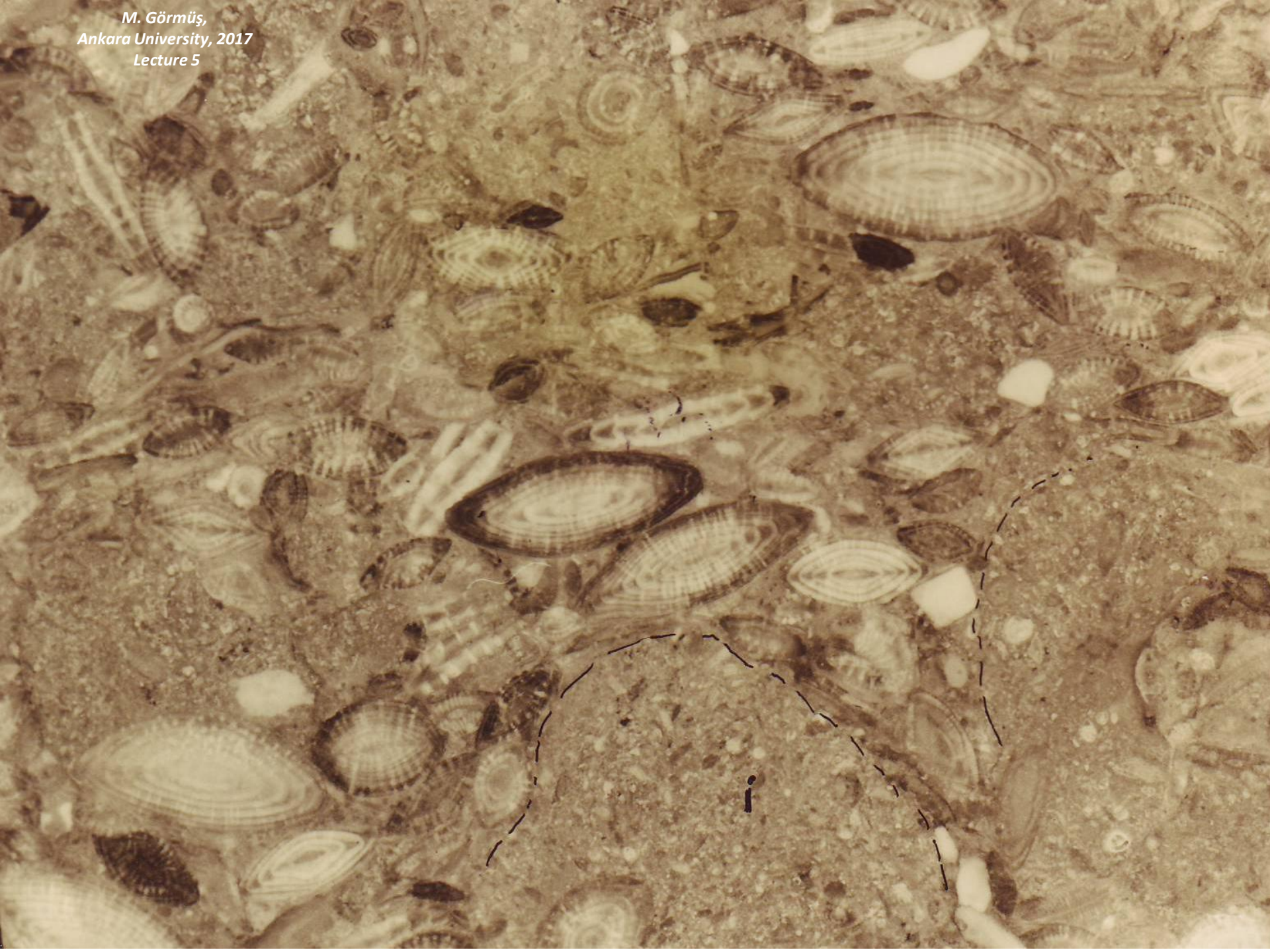
Paleogene



Assilina



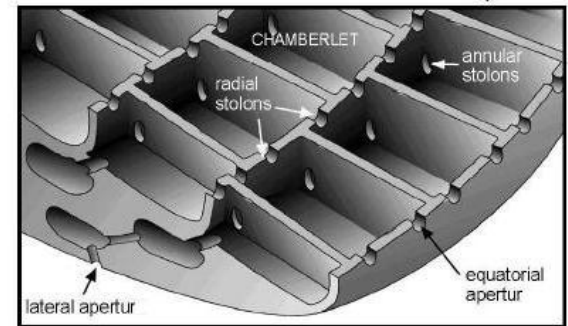
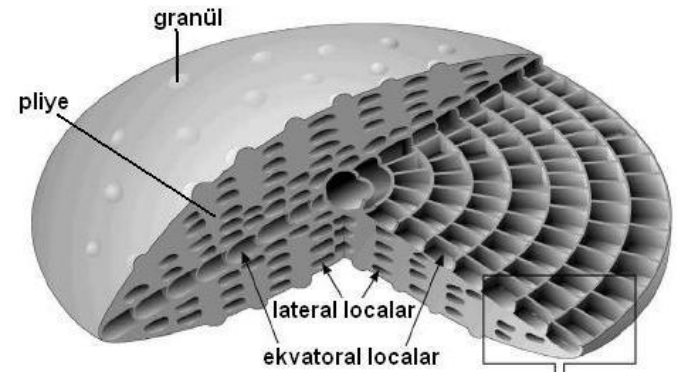
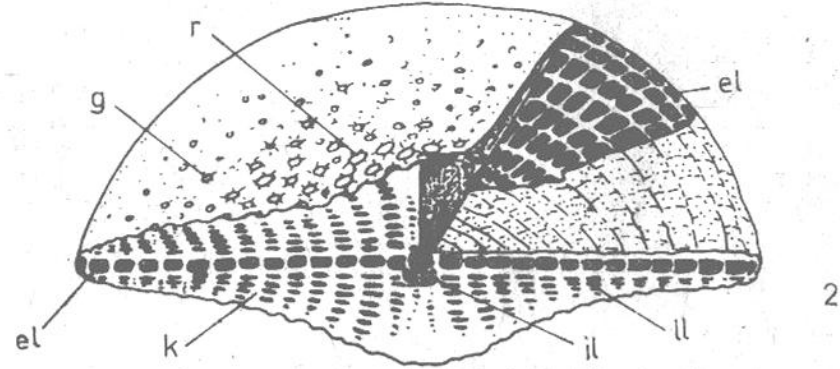
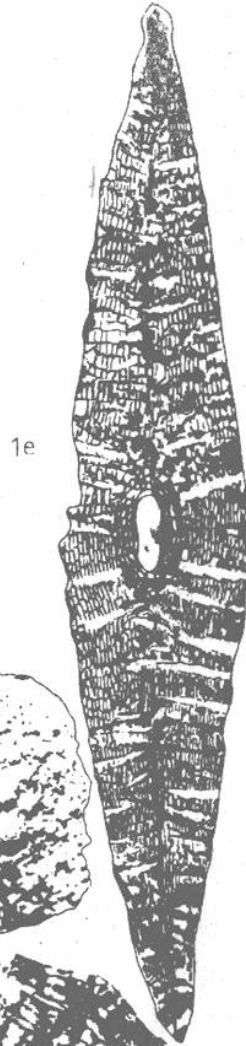
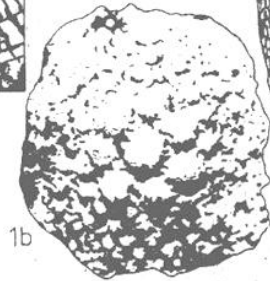
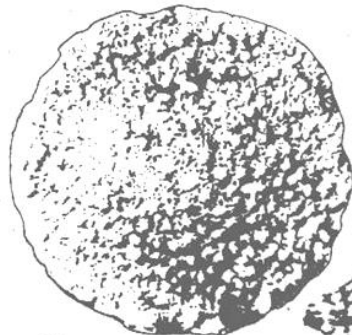
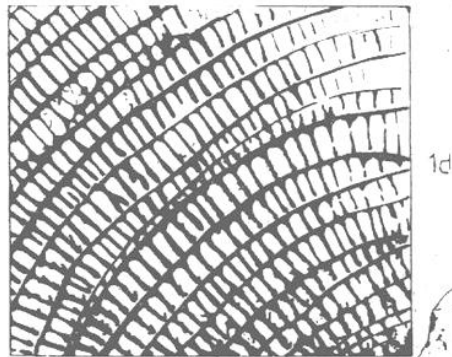
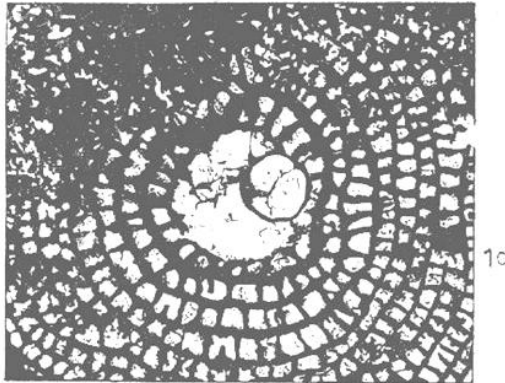
Pictures from Alkaya (Selçuk Univ.),
lecture notes, by forgotten scale and
reference



Discocyclina sp.

Paleocene to Eocene

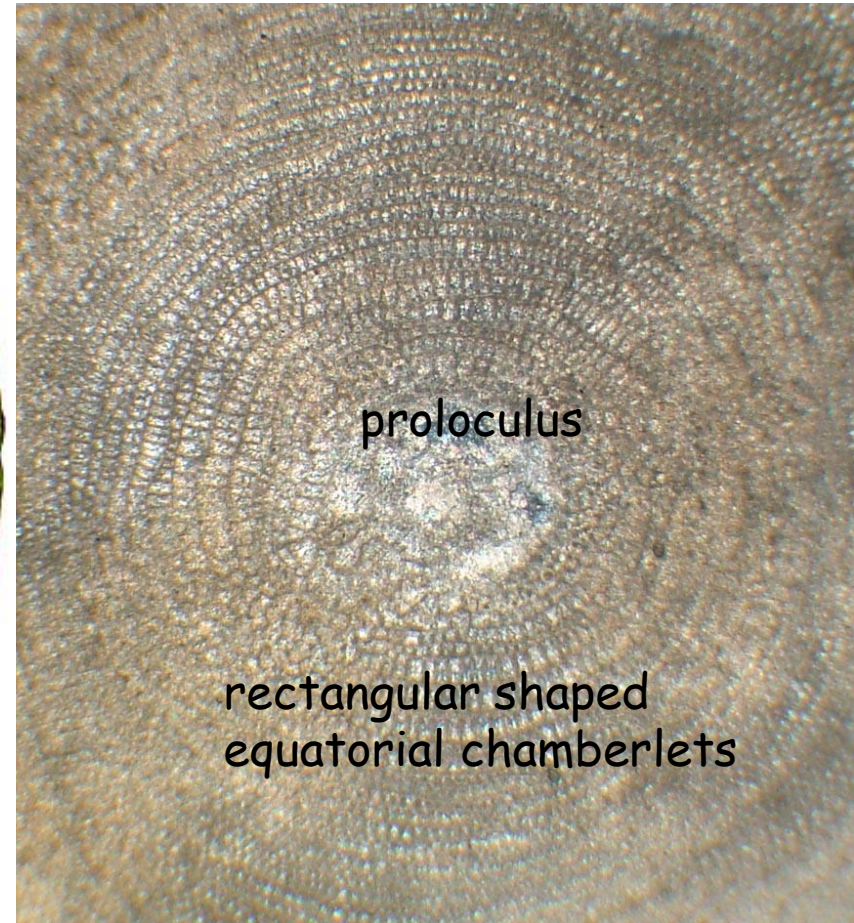
Paleogene



Discocyclina sp.

Paleocene to Eocene

Paleogene



Characteristic features: numerous rectangular shaped chamberlets, proloculus

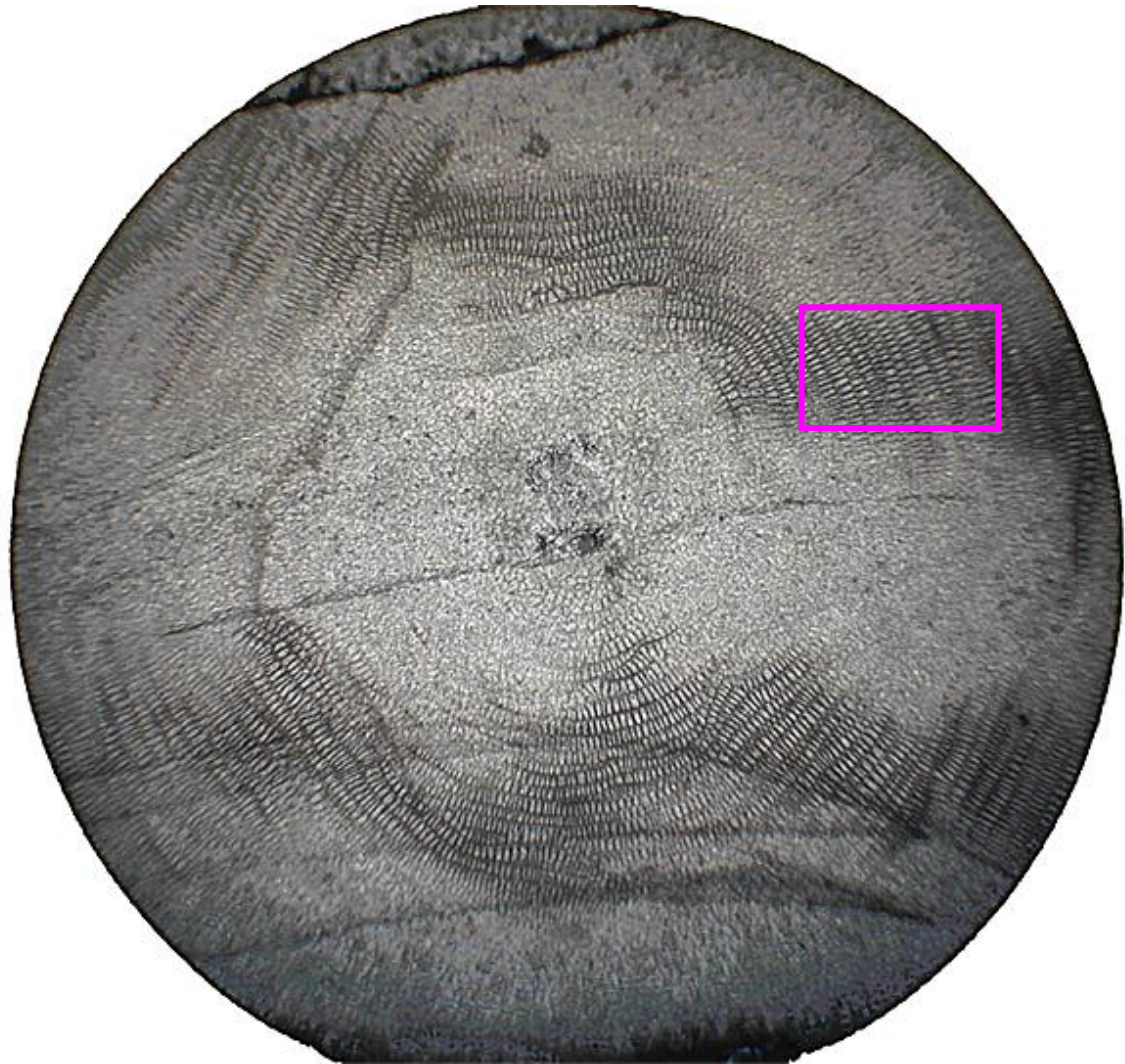
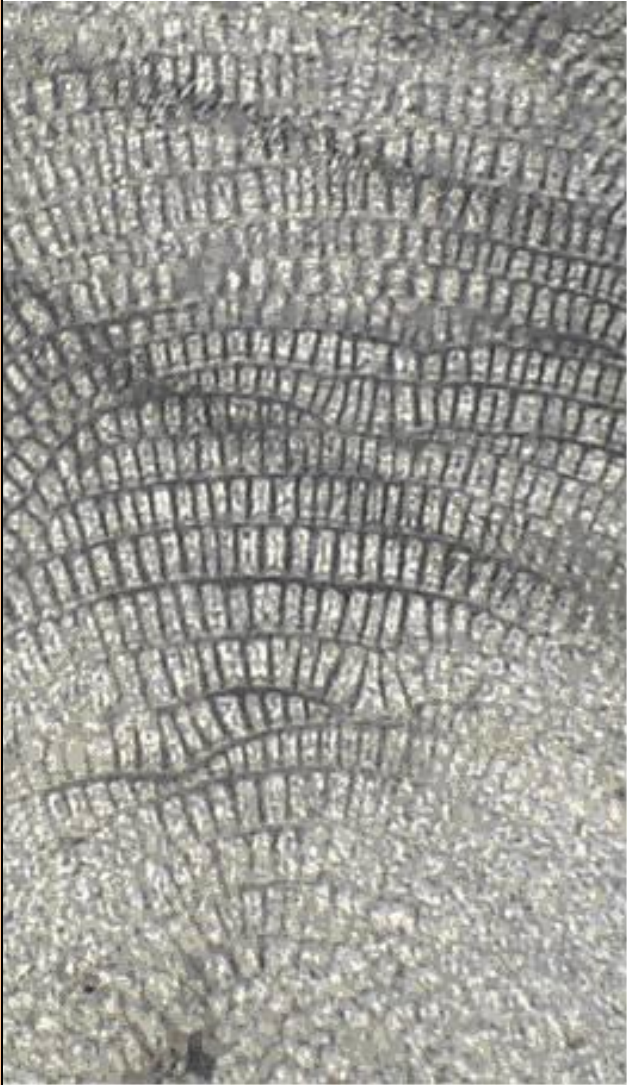


Pictures from Alkaya (Selçuk Univ.),
lecture notes, by forgotten scale and
reference

Discocyclina sp.

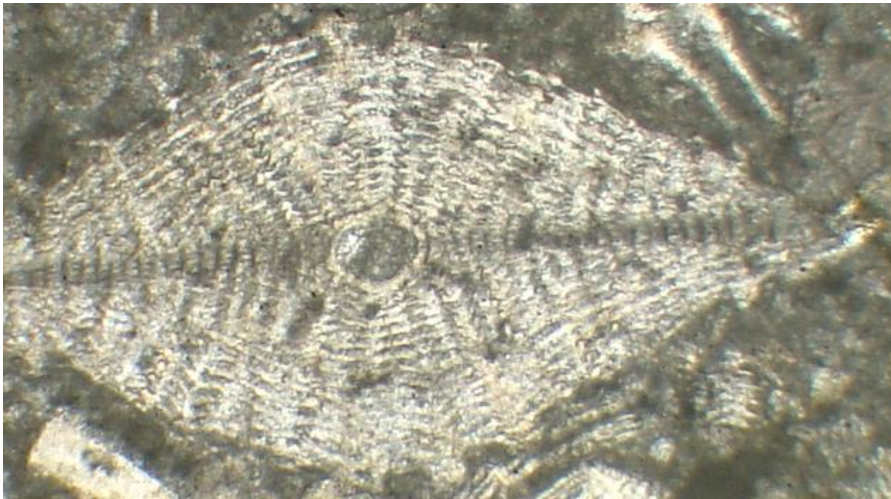
Paleocene to Eocene

Paleogene



Discocyclina sp. Paleocene to Eocene

Paleogene

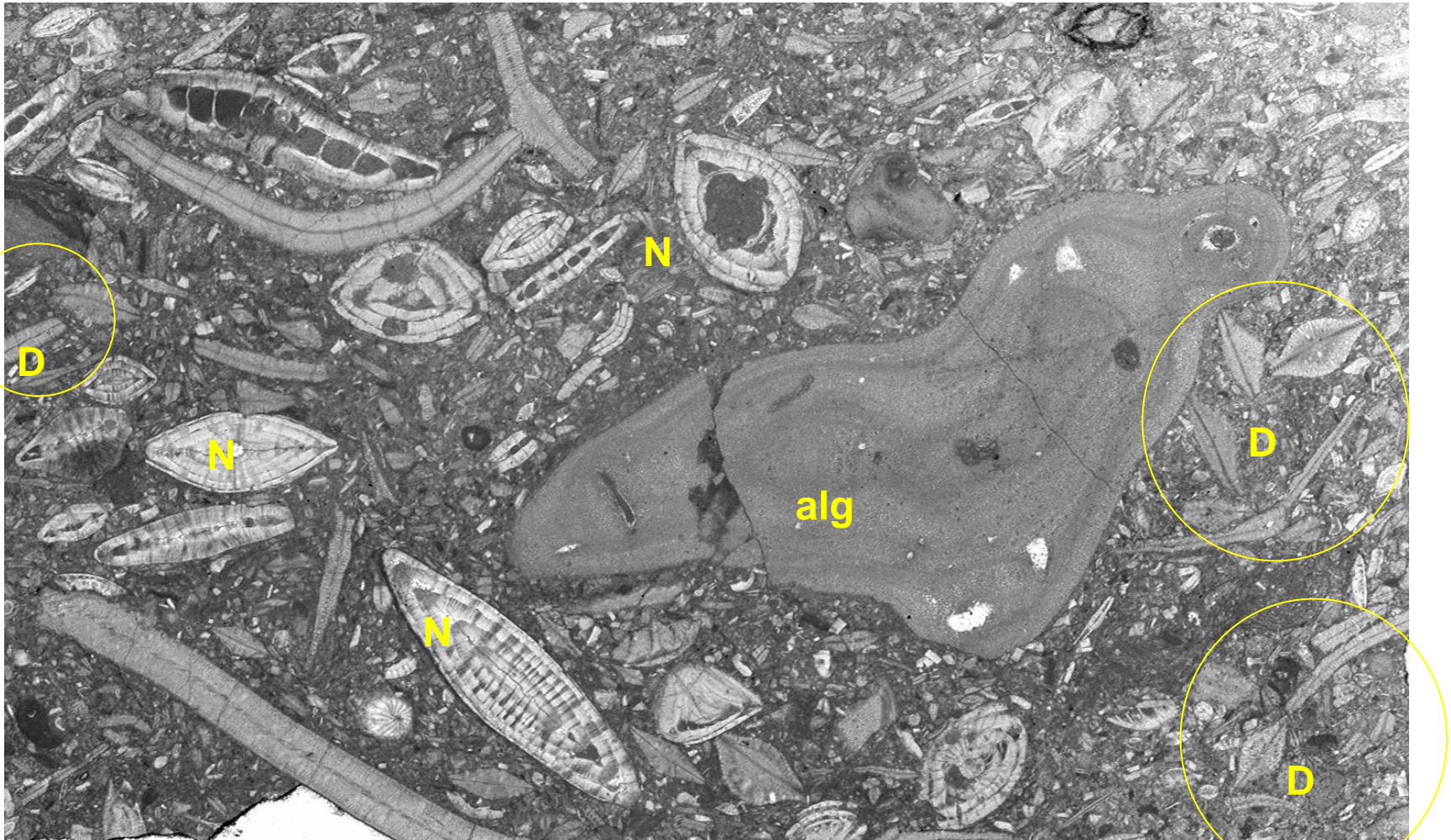


Pictures from Alkaya (Selçuk Univ.),
lecture notes, by forgotten scale and
reference

Discocyclina sp.

Paleocene to Eocene

Paleogene



D: *Discocyclina*, **N:** *Nummulites*

Picture from Alkaya (Selçuk Univ.),
lecture notes, by forgotten scale and
reference

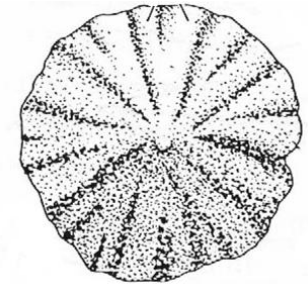
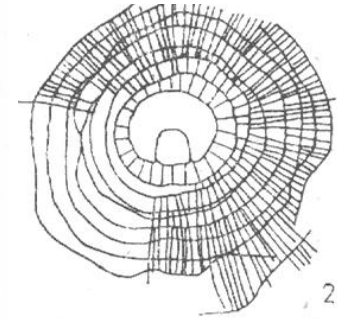
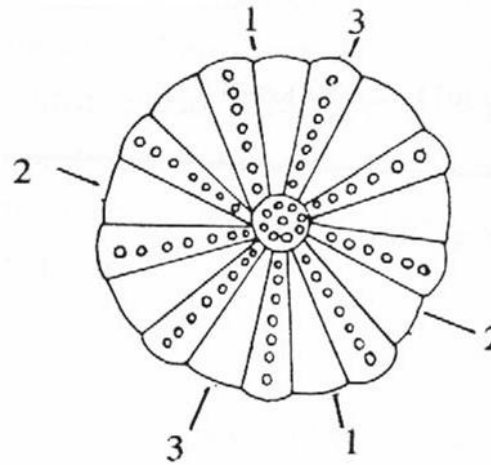
Actinocyclus sp.

Eocene

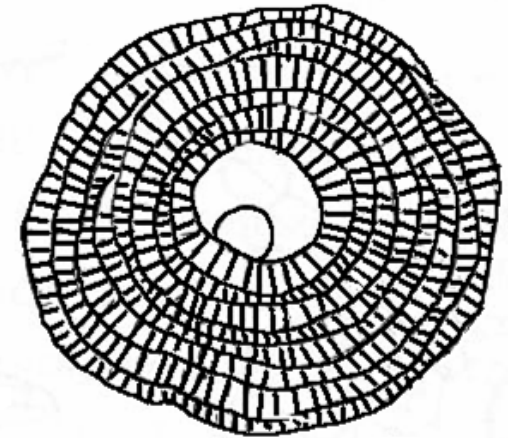
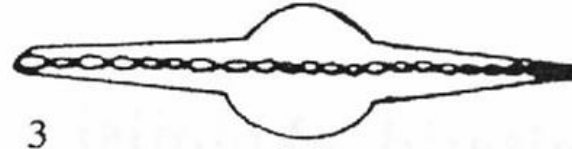
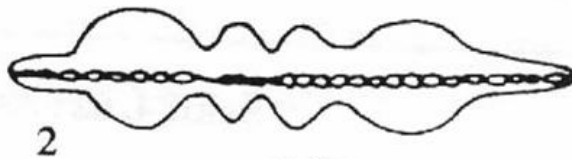
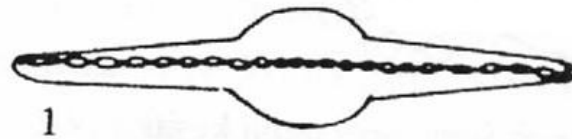
Paleogene

Suborder
Rotaliina

Characteristic
features: different
axial views



Meriç, 1985



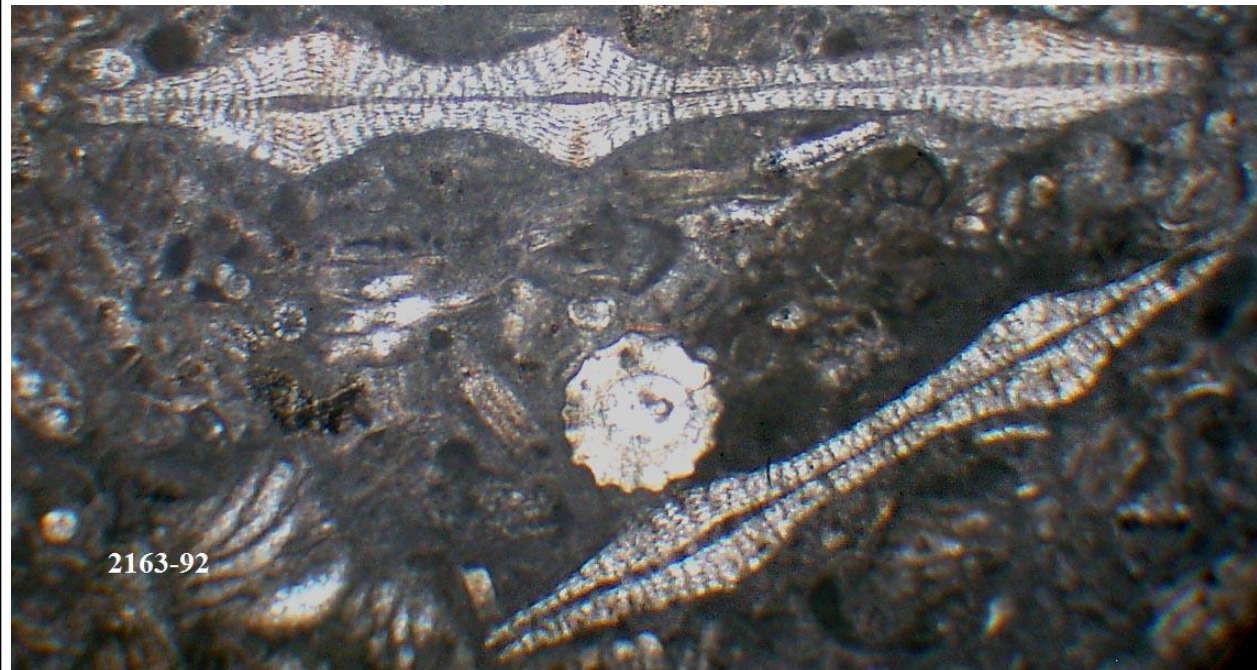
Drawings from Alkaya (Selçuk Univ.),
lecture notes, by forgotten scale and
reference

Actinocyclus sp.

Eocene

Paleogene

Suborder
Rotaliina

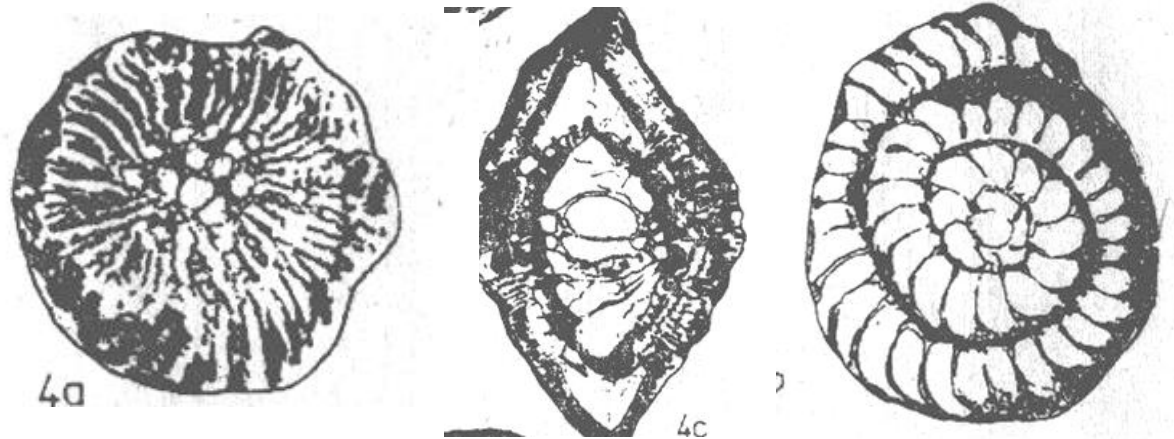


Pictures from Alkaya (Selçuk Univ.),
lecture notes, by forgotten scale and
reference

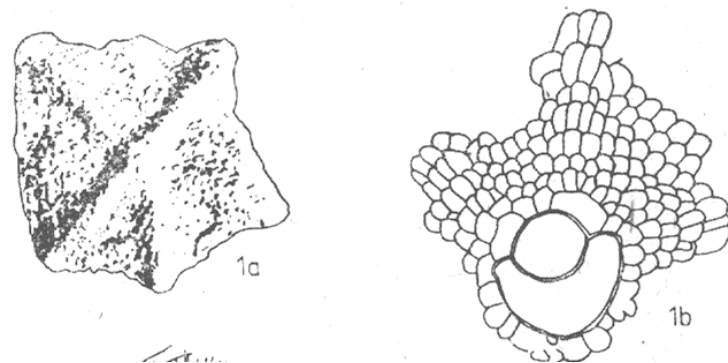
Suborder Rotaliina

Paleogene

Miscellanea sp. Late Paleocene

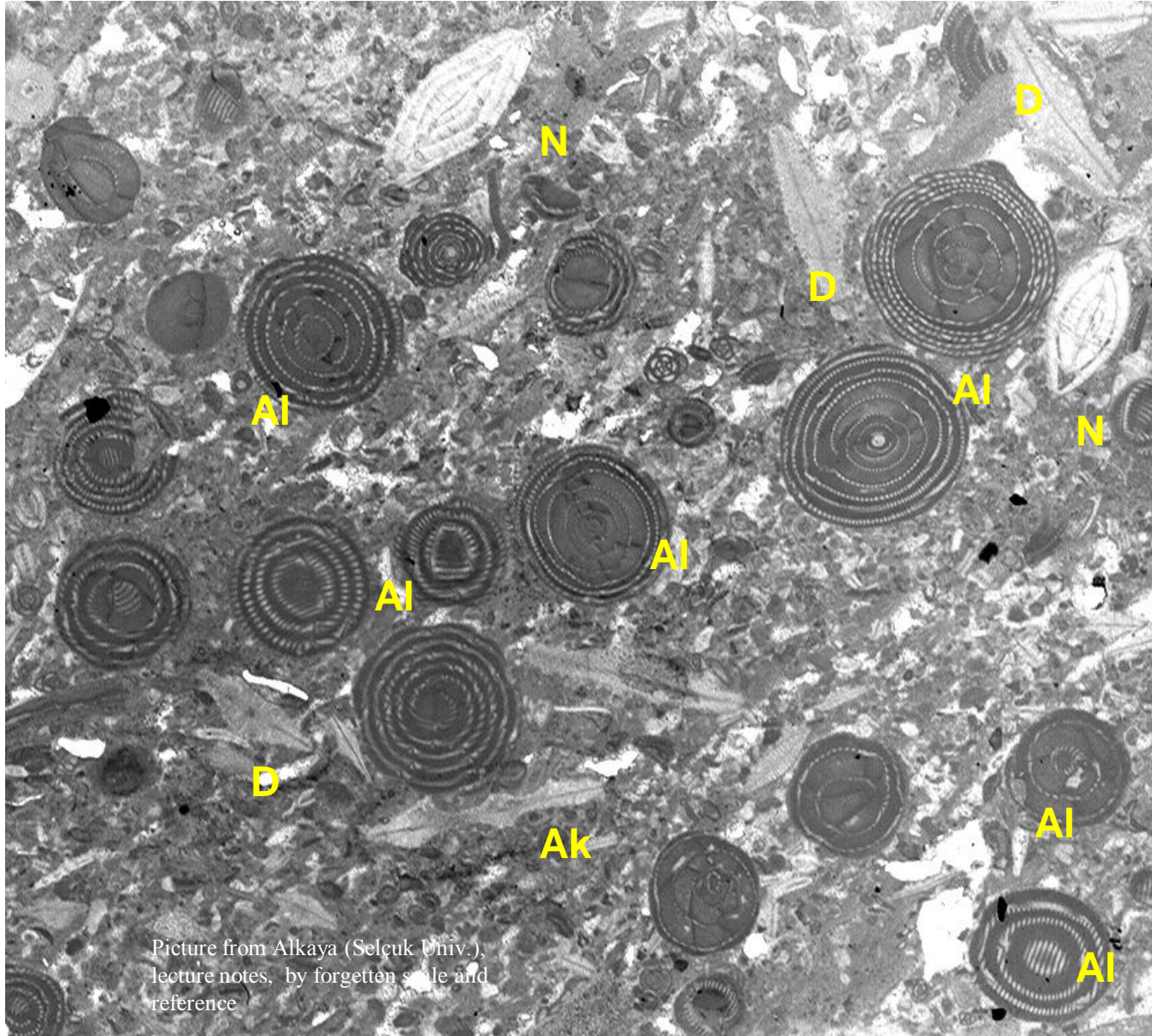


Asterocyclina sp. Eocene



Thin section view

Paleogene

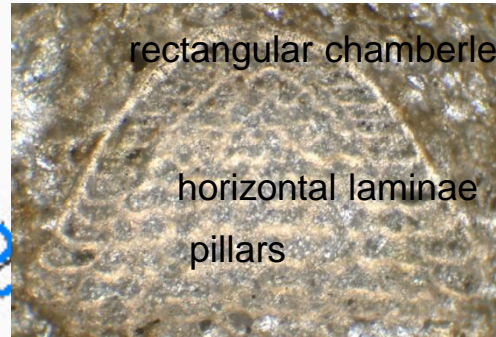
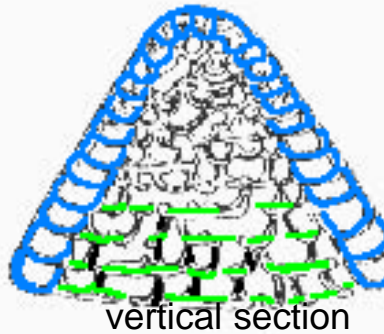


Picture from Alkaya (Selçuk Univ.),
lecture notes, by forgotten scale and
reference

D: *Discocyclina*
A: *Aktinocyclus*
N: *Nummulites*
A: *Alveolina*

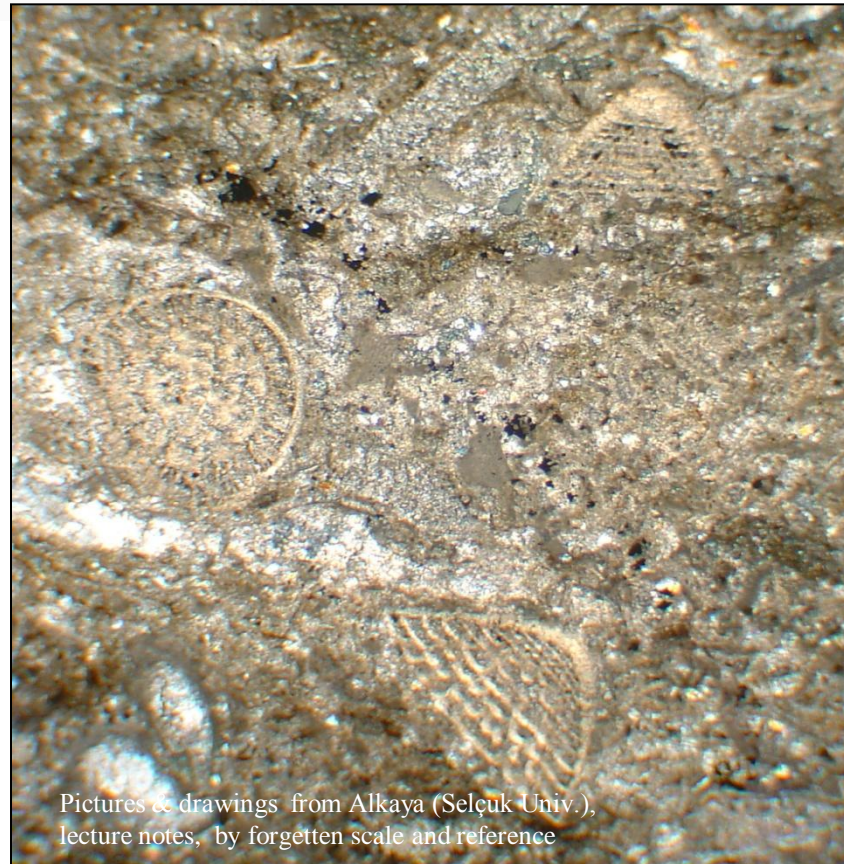
Chapmanina sp.

Eocene



Suborder Rotaliina

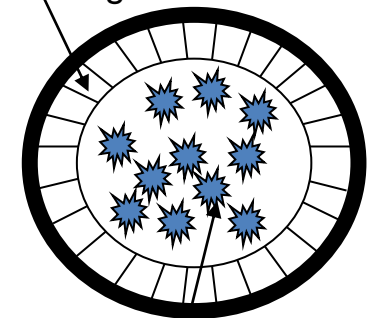
Characteristic features: vertical section views



Pictures & drawings from Alkaya (Selçuk Univ.),
lecture notes, by forgotten scale and reference

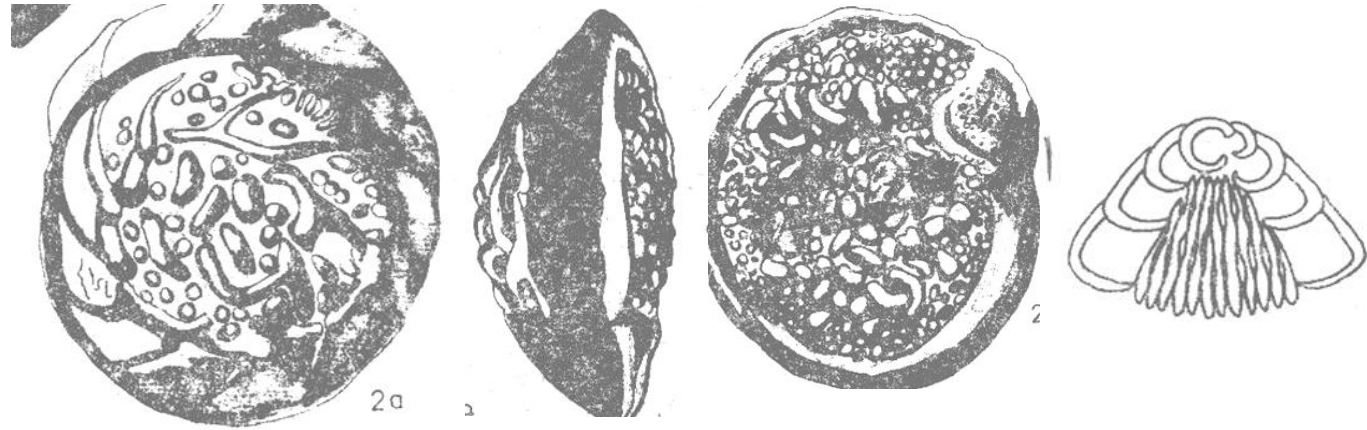


rectangular chamberlets



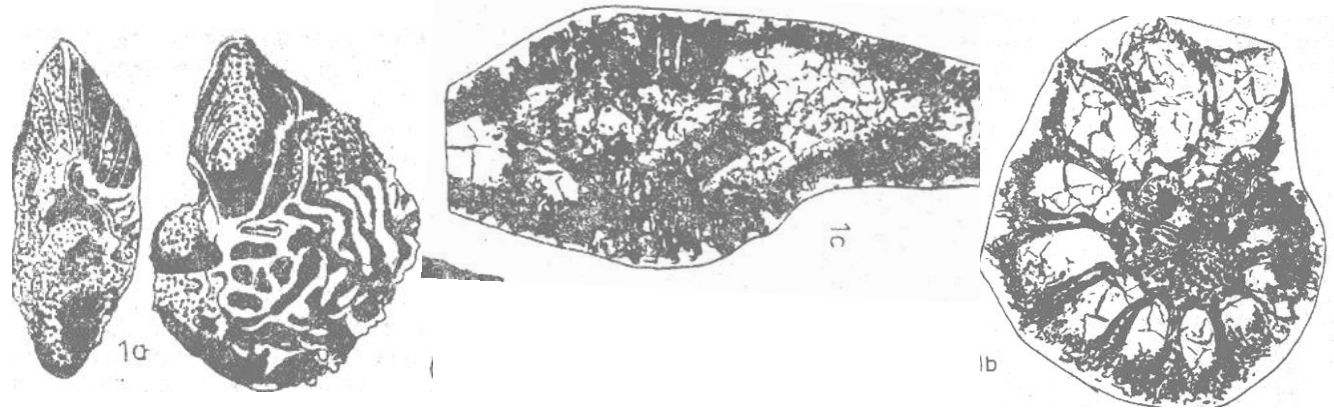
pillars' extensions

***Lockhartia* sp.**
Paleocene to Middle Eocene



**Suborder
Rotaliina**

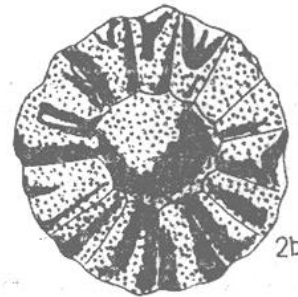
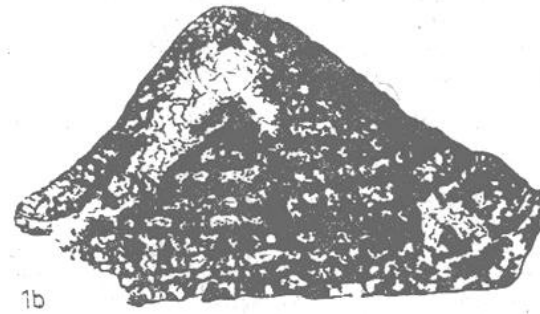
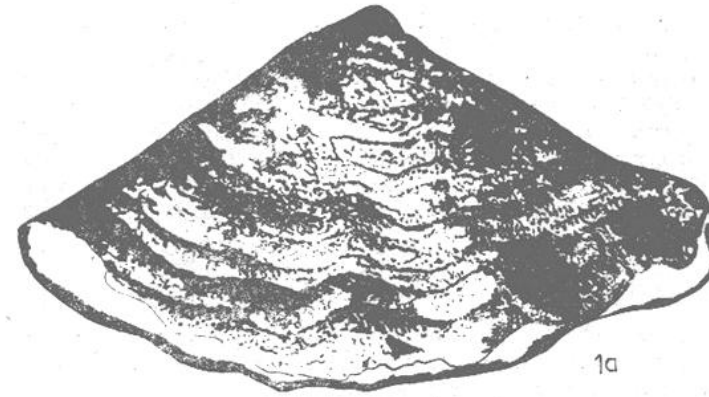
***Cuvillierina* sp**
Eocene



Suborder Rotaliina

Paleogene

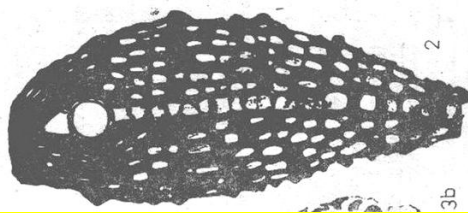
Fabiania sp.
Eocene



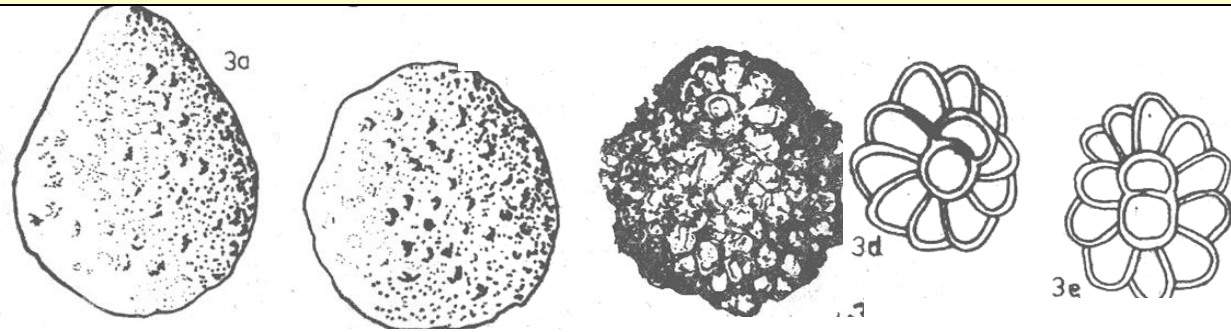
Şek. 77 — Cymbaloporidae (1 — *Fabiania*, 2 — *Halkyardia*).

Oligocene to Miocene

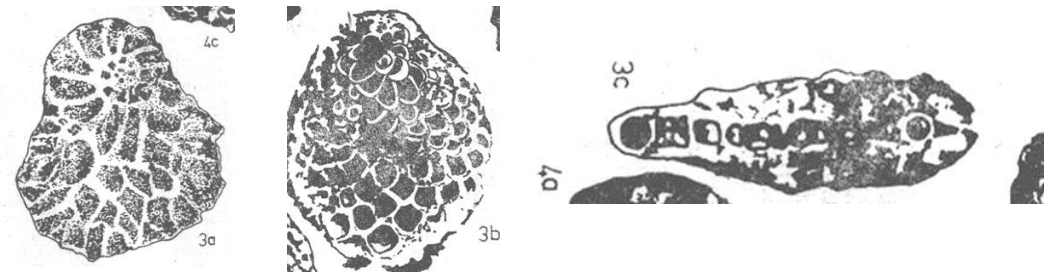
Suborder
Rotaliina



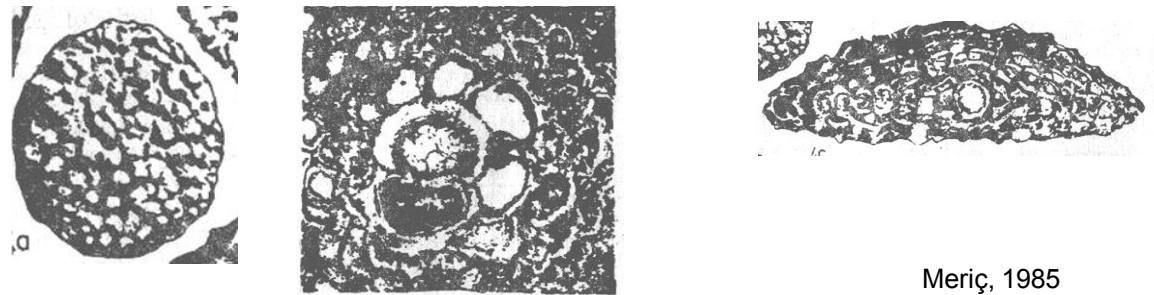
Miogypsina sp.
Late Oligocene to Early Miocene



Miogypsinoides sp.
Oligocene to Early Miocene

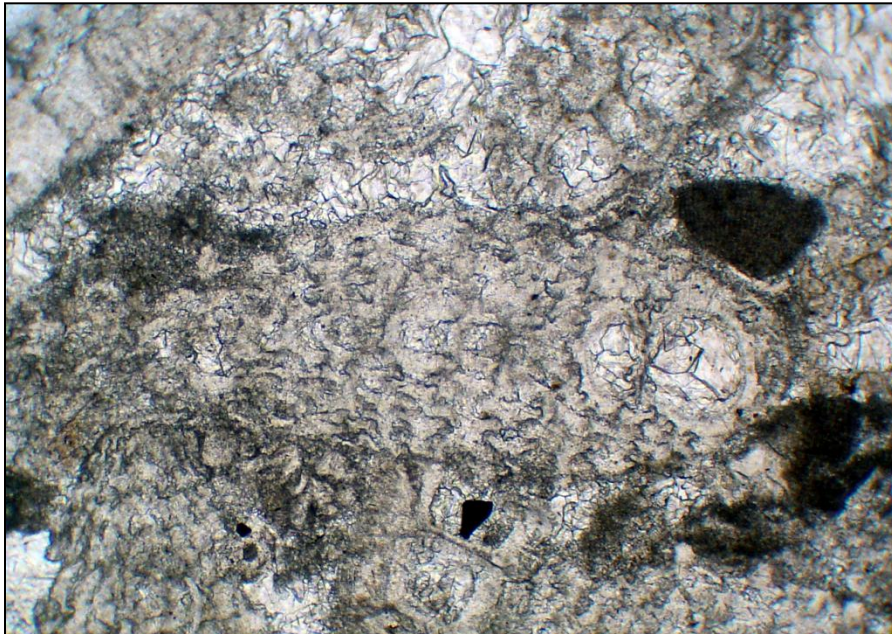
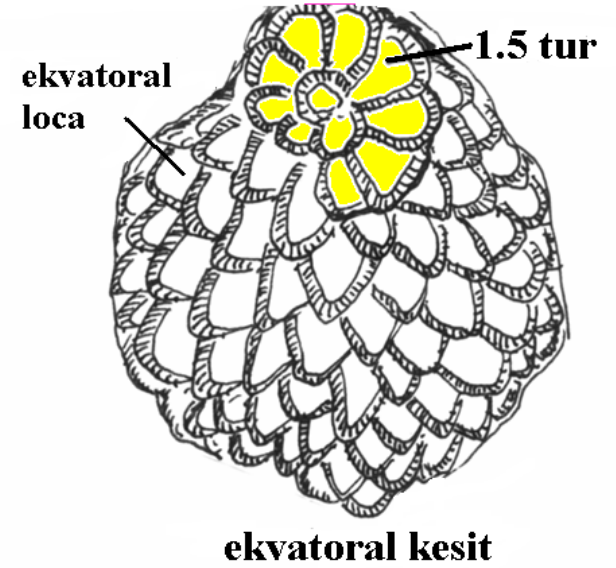
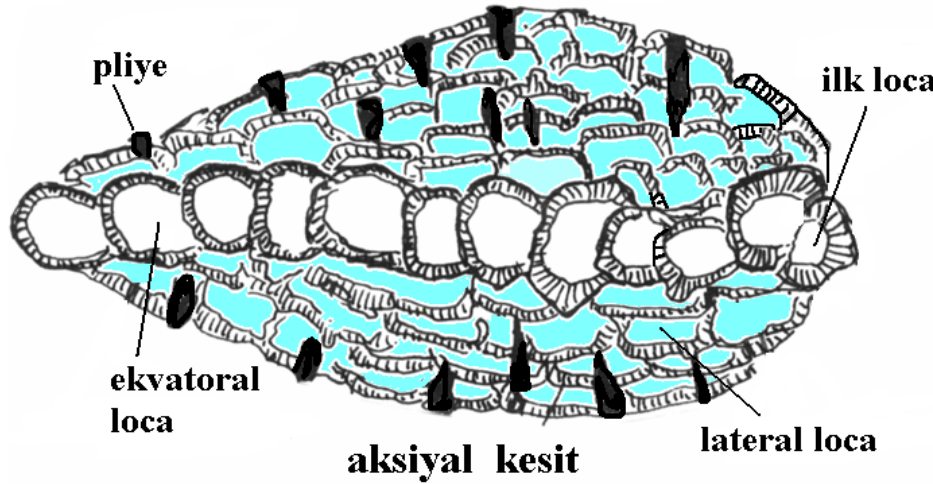


Miolepidocyclina sp.
Late Oligocene to Early Miocene



Miogypsina sp.

Late Oligocene to Early Miocene

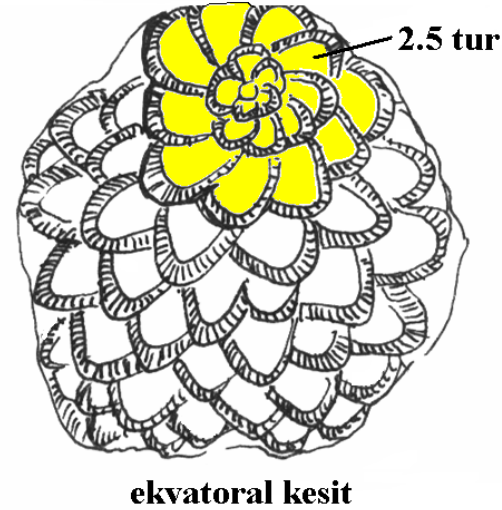
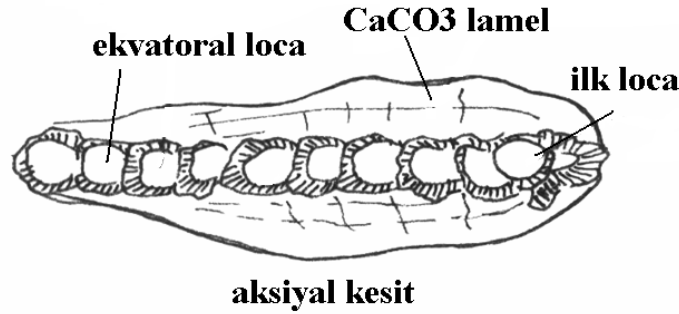


Characteristic features: lateral and equatorial chamberlets views

Picture & drawings from Alkaya (Selçuk Univ.), lecture notes, by forgotten scale and reference

Miogypsinoides sp.

Oligocene to Early Miocene

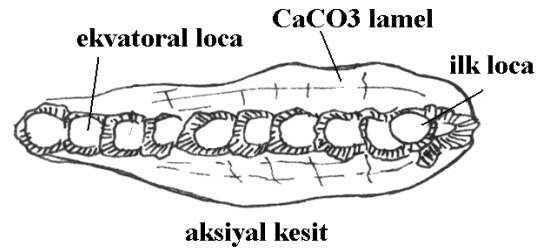


Characteristic features: lateral and equatorial chamberlets views, calcite accumulation on both side of equatorial chamberlets

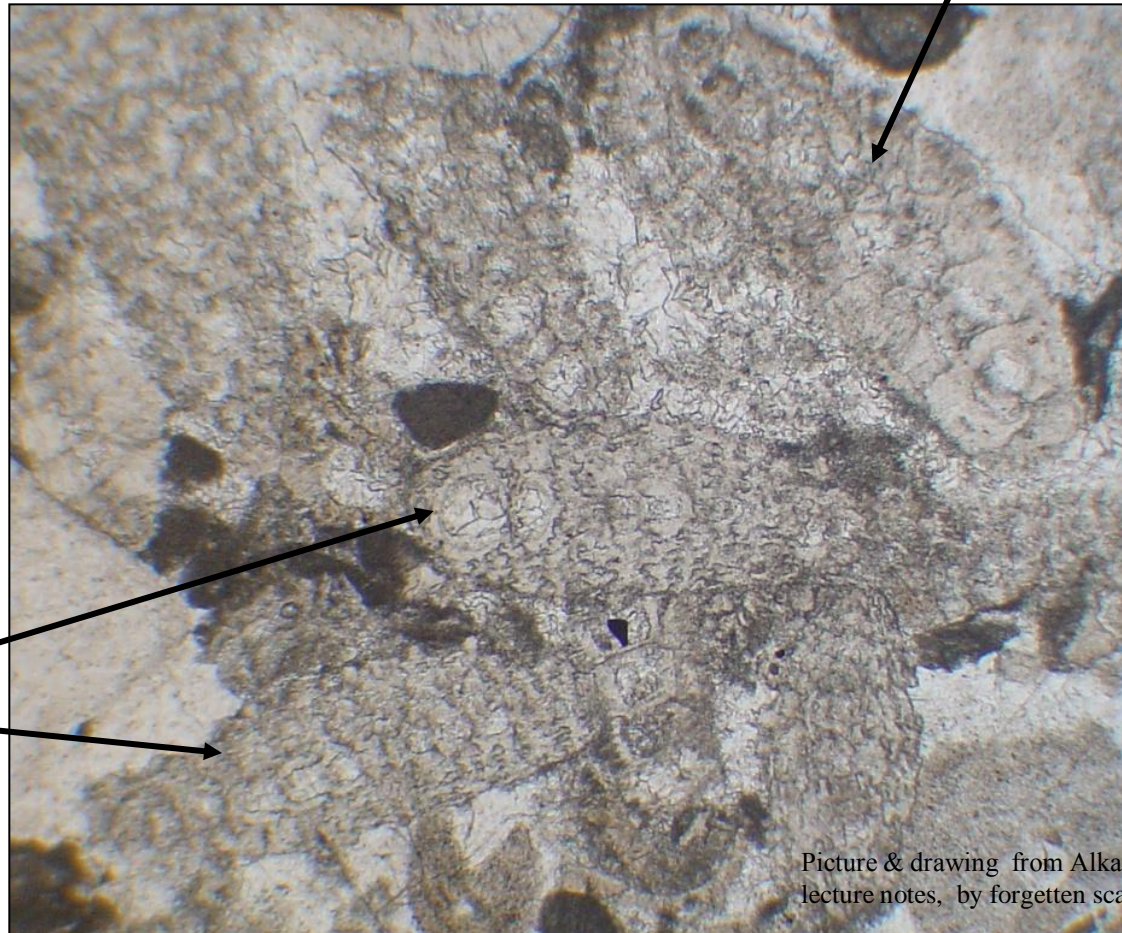
Picture & drawings from Alkaya (Selçuk Univ.), lecture notes, by forgotten scale and reference

Miogypsina sp. & Miogypsinoidea sp.

Oligocene to Early Miocene



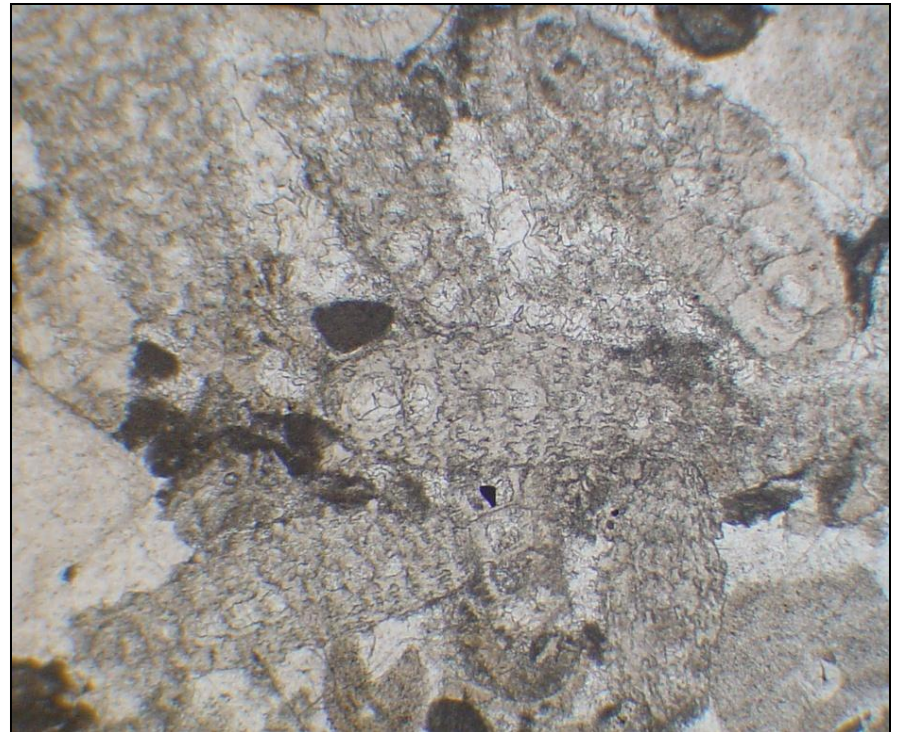
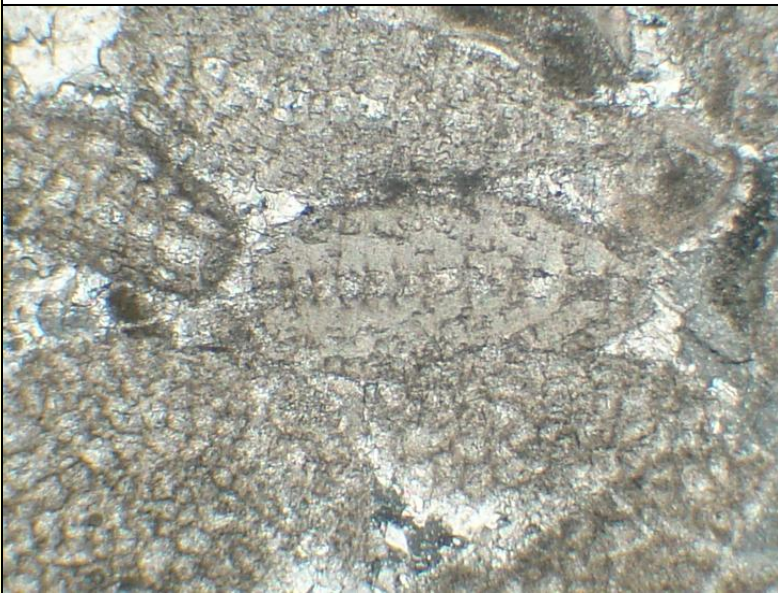
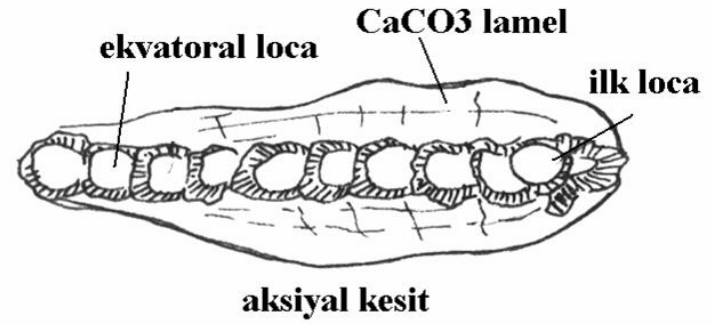
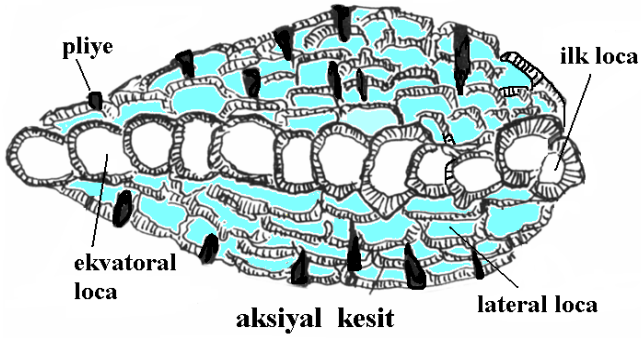
Miogypsinoidea



Miogypsina

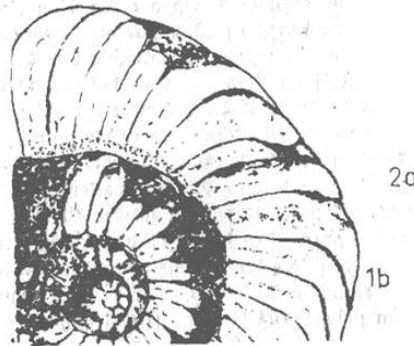
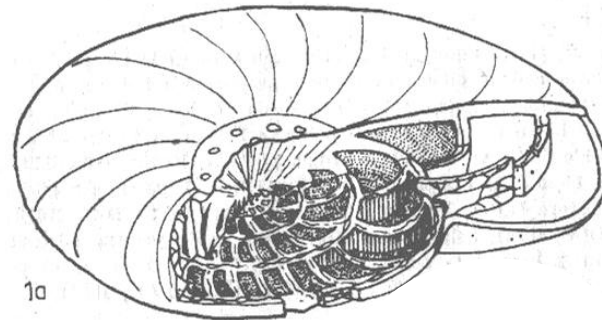
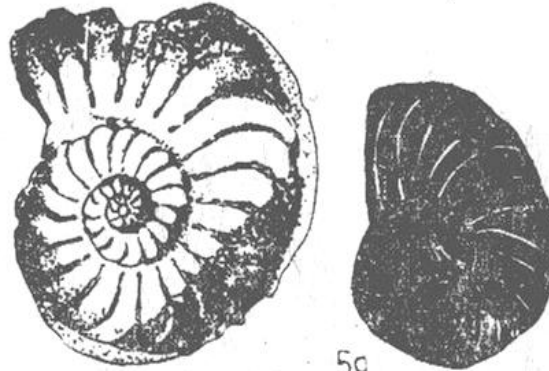
Miogypsina sp. & Miogypsinoides sp.

Oligocene to Early Miocene



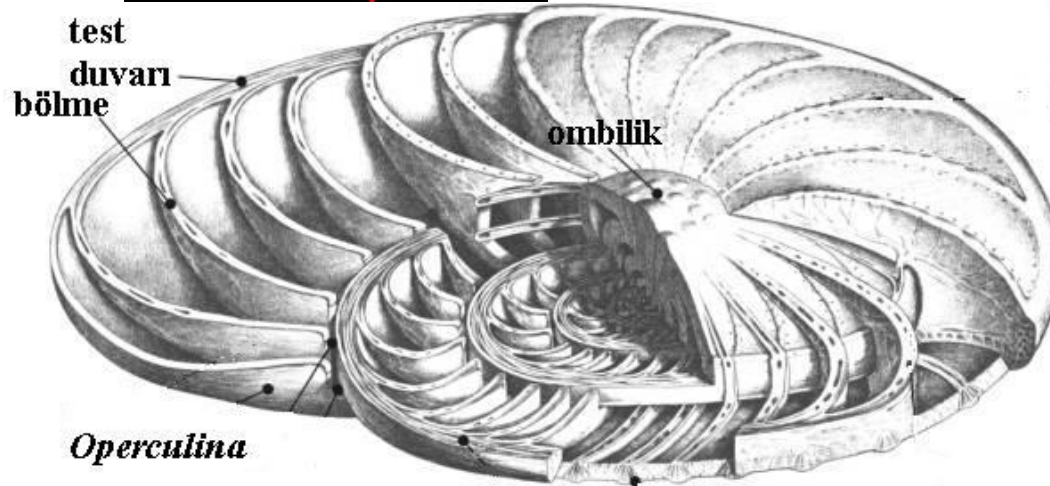
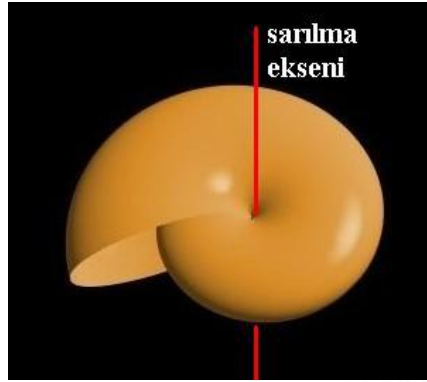
Operculina sp.

Characteristic features: last whorling view



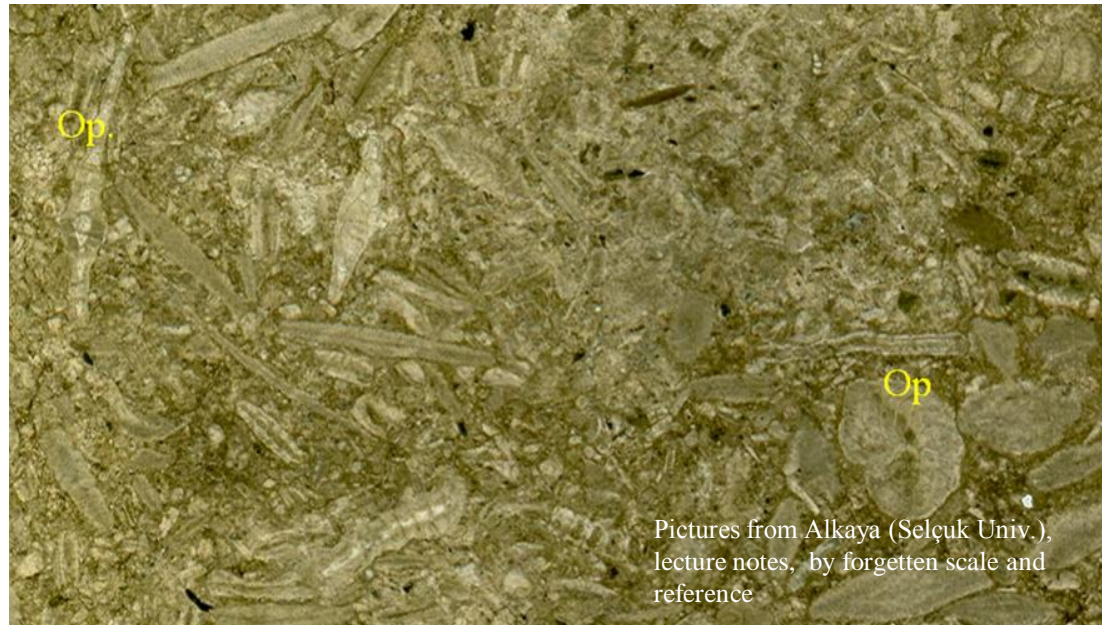
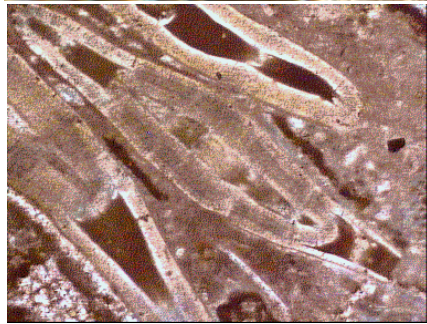
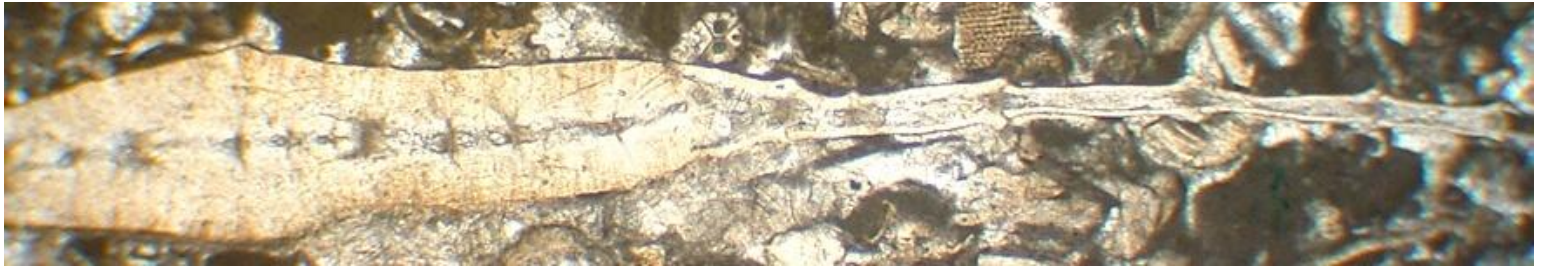
Operculina sp.

Oligocene to Miocene



Operculina sp.

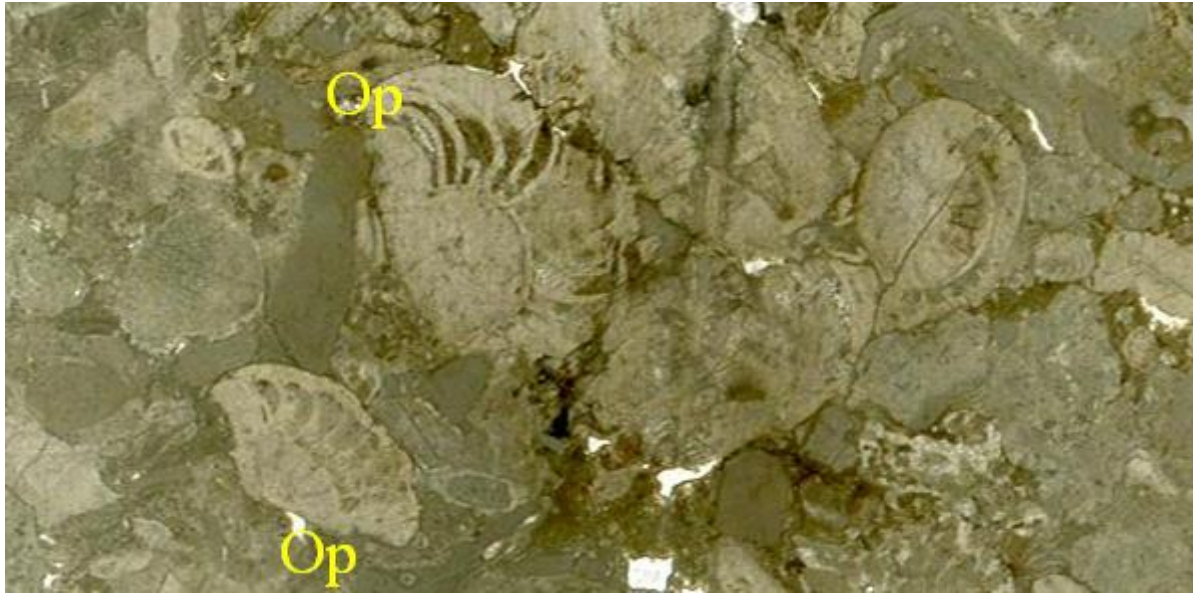
Oligocene to Miocene



Pictures from Alkaya (Selçuk Univ.),
lecture notes, by forgotten scale and
reference

Operculina sp.

Oligocene to Miocene

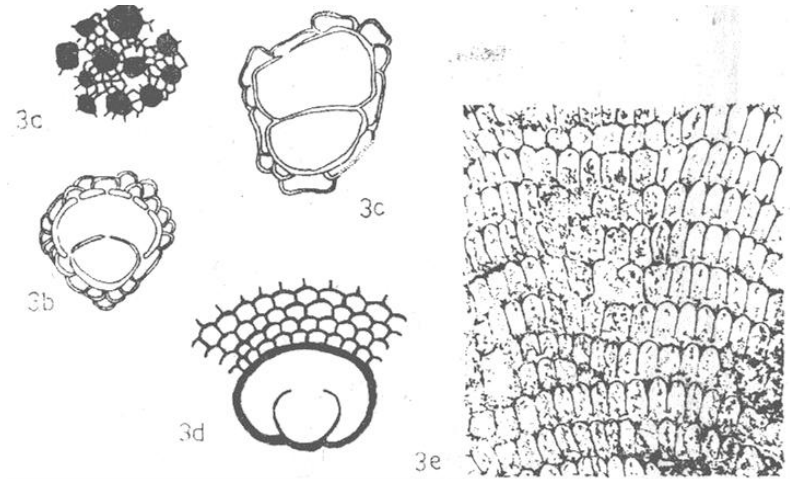
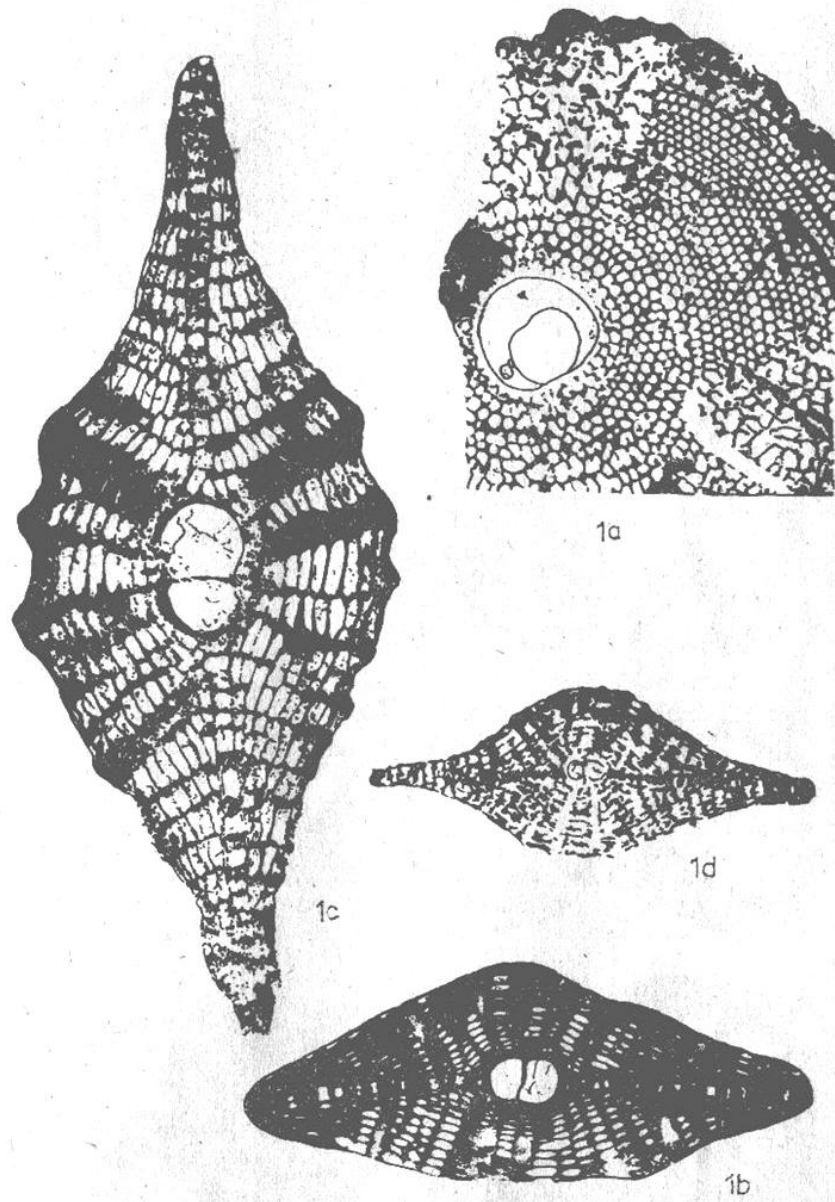


Pictures from Alkaya (Selçuk Univ.),
lecture notes, by forgotten scale and
reference



Lepidocyclina sp.

Oligocene to Miocene



Characteristic features: embryon view, rectangular lateral chamberlets

Eulepidina – bigger protoconch

Nephrolepidina – small protoconch

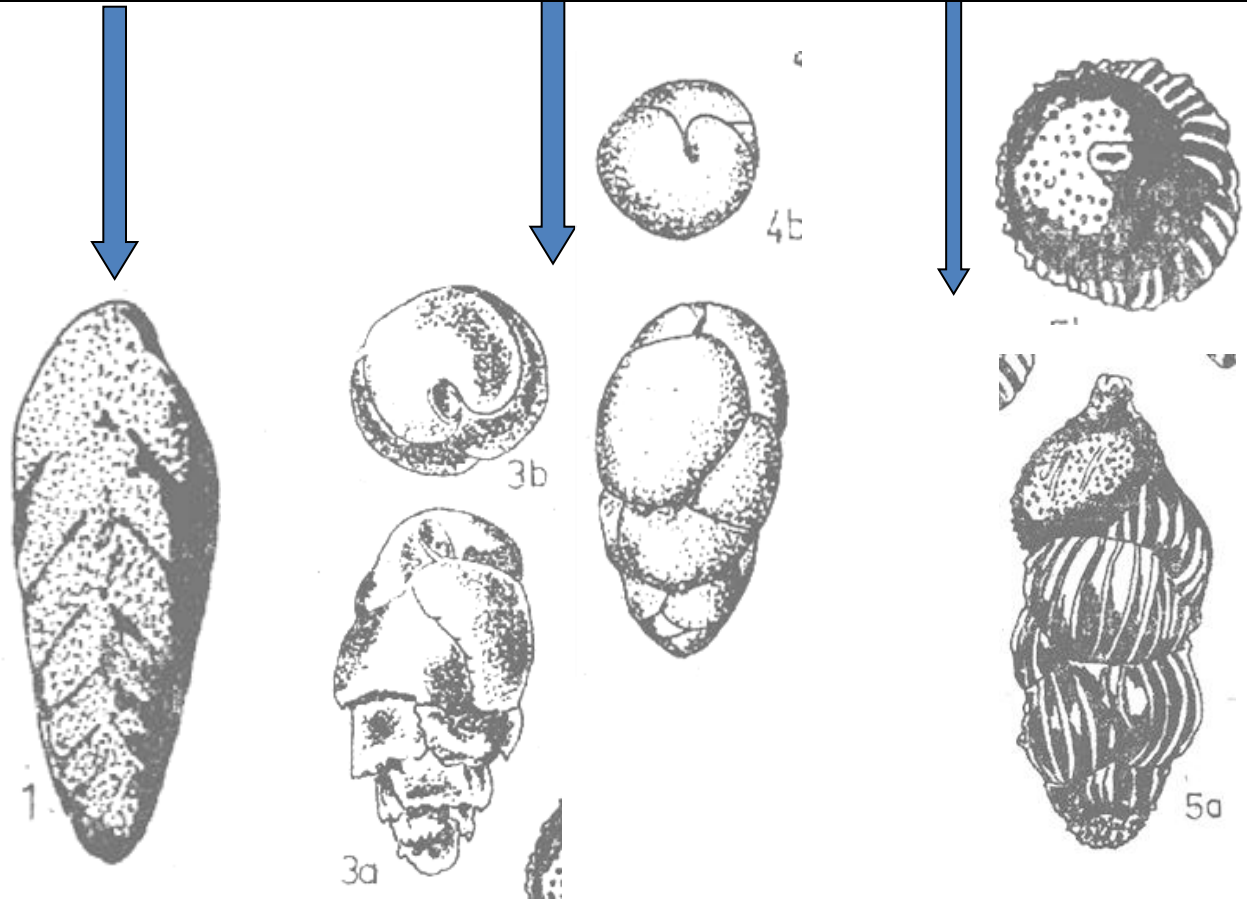
Isolepidina – equal

Bolivina sp. *Bulimina* sp. *Uvagerina* sp.

Late Cret. to Rec.

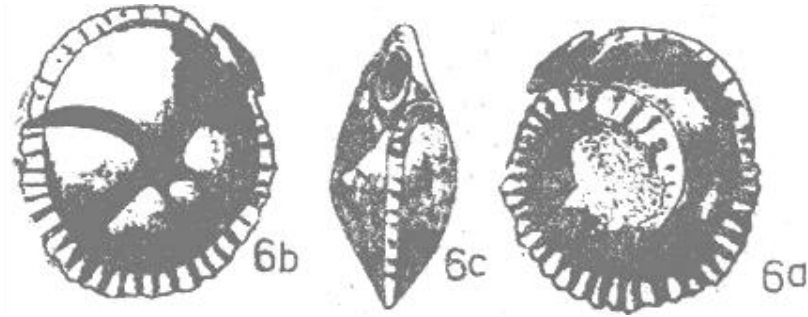
Eocene to Rec

Suborder
Rotaliina

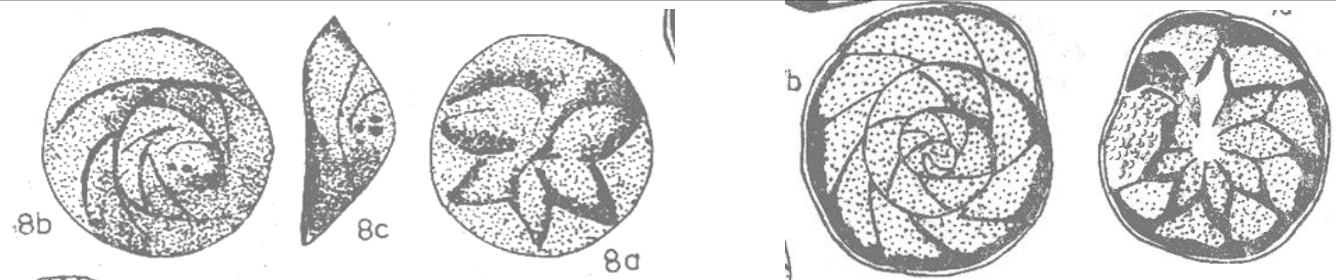


Suborder
Rotaliina

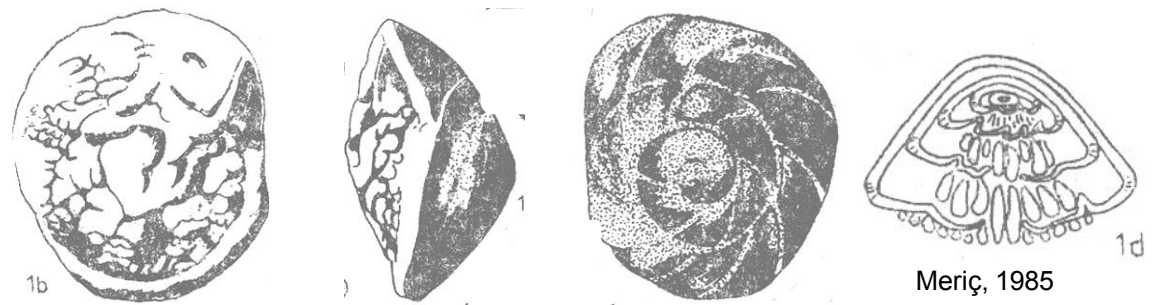
Siphonina sp.
Eocene to Rec.



Asterigerina sp.
Cretaceous to Rec.

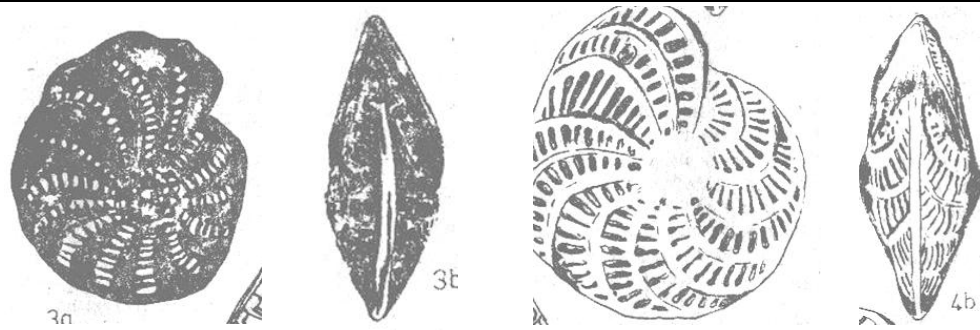


Rotalia sp.
Cretaceous to Rec.

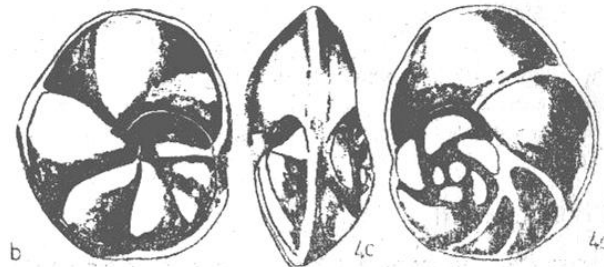


Suborder
Rotaliina

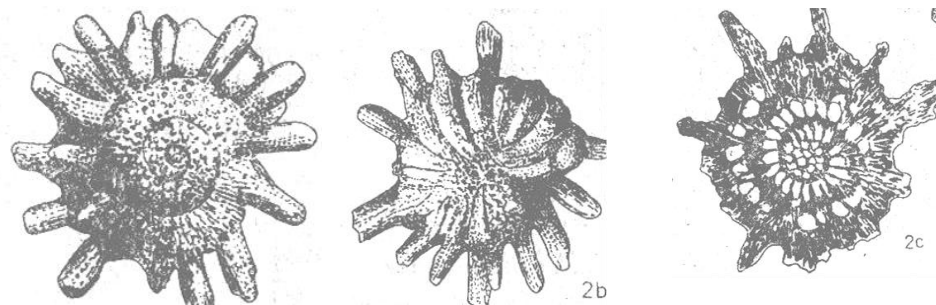
Elphidium sp.
Eocene to Rec.



Eponides sp.
Cretaceous to Rec.

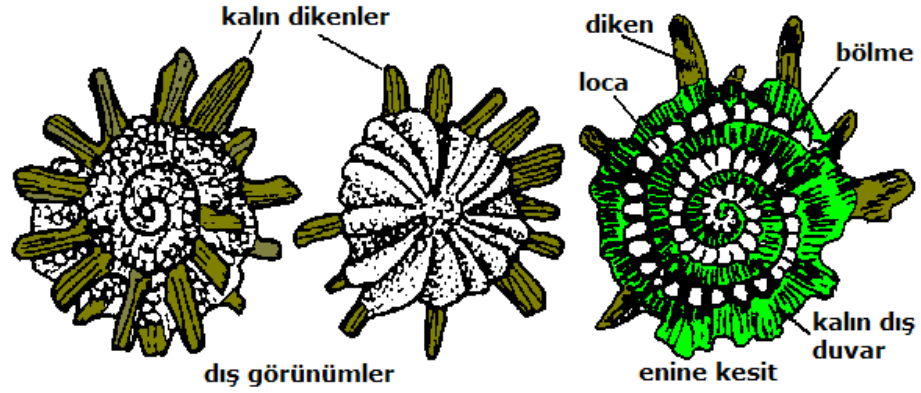


Calcarina sp.
Late Cretaceous to Rec.

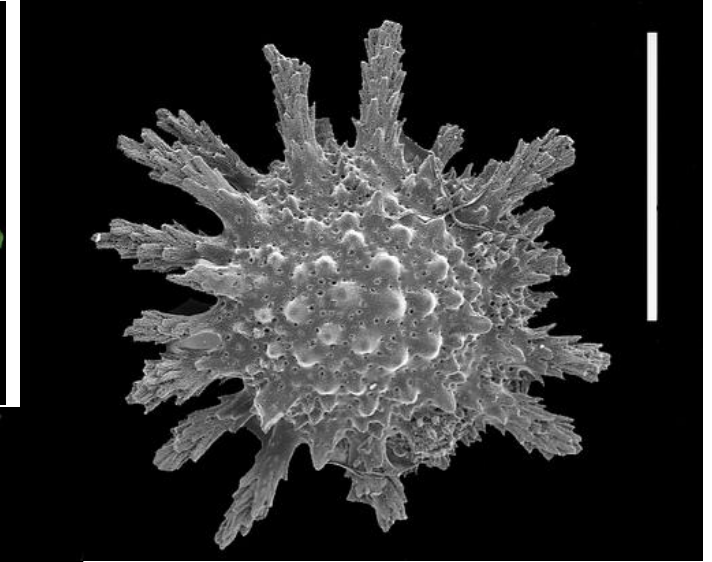
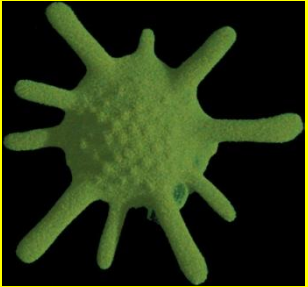


Calcarina sp.

Late Cretaceous to Rec.



Suborder Rotaliina

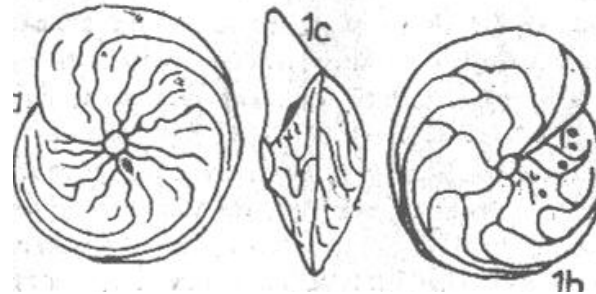


<http://flickr.com/photos/melissa>

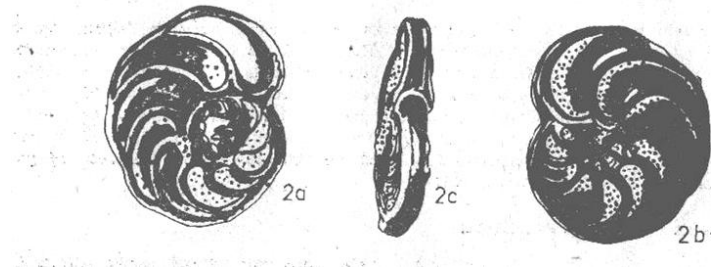
Pictures & drawings from Alkaya (Selçuk Univ.),
lecture notes, by forgotten scale and reference

Suborder
Rotaliina

Amphistegina sp.
Late Cretaceous to Rec.



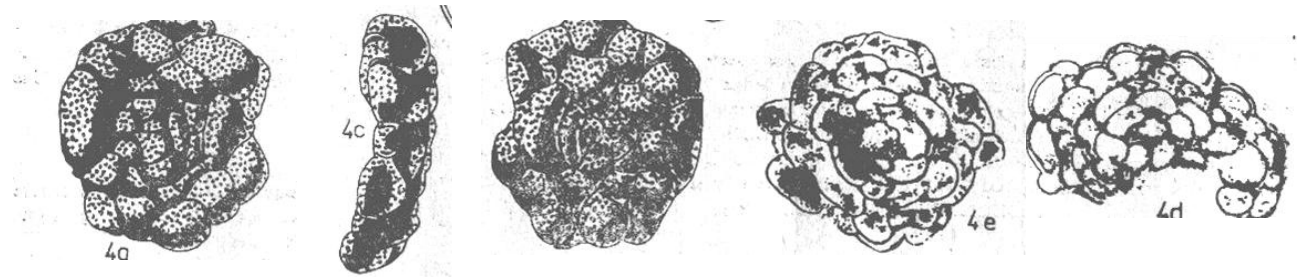
Planulina sp.
Late Cretaceous to Rec.



Cibicides sp.
Cretaceous to Rec.



***Planorbulina* sp.**
Late Cretaceous to Rec.

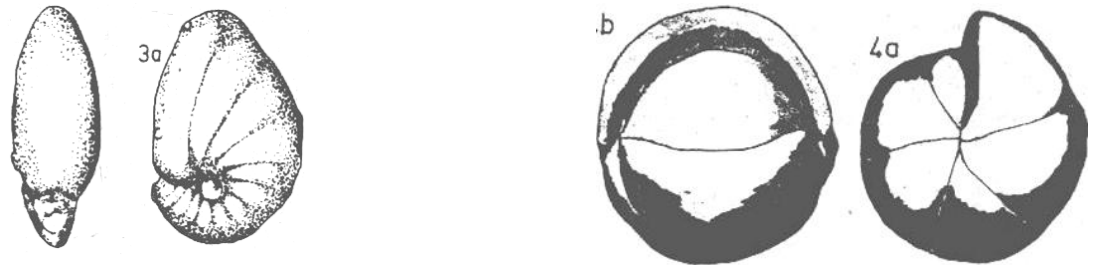


***Nonion* sp.**

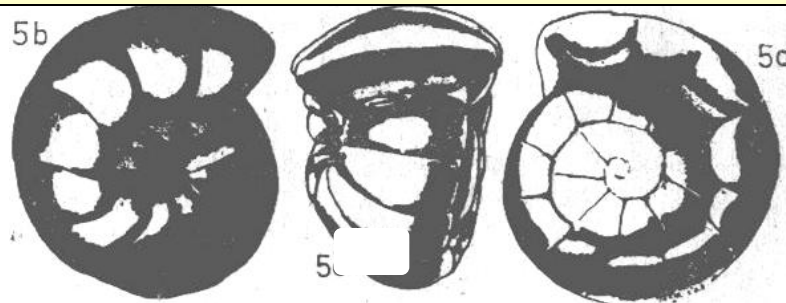
***Pullenia* sp.**

Cretaceous to Rec.

Suborder
Rotaliina

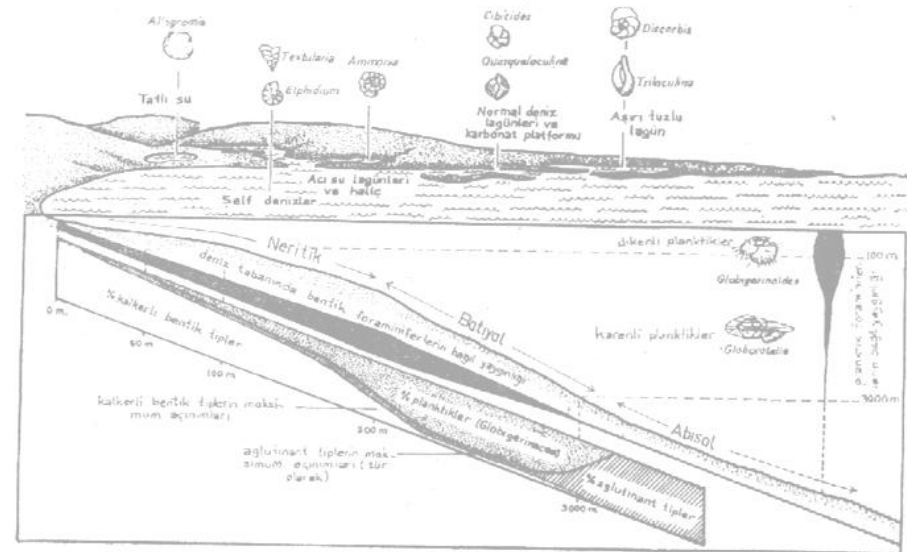


***Gyroidina* sp.**
Eocene to Rec.



for aging

- . index foraminifera species
- . other supporting fossil data
- . other supporting dating data
- . rock type
- . transportation, reworking
- sufficient literature



Brasier, 1980

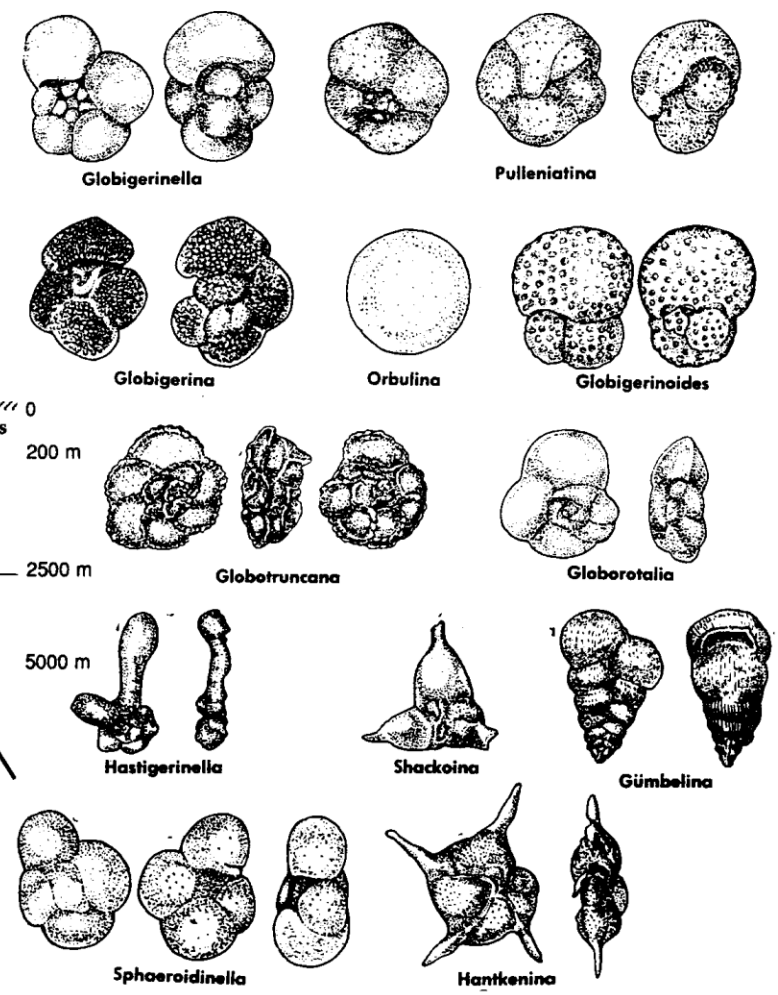
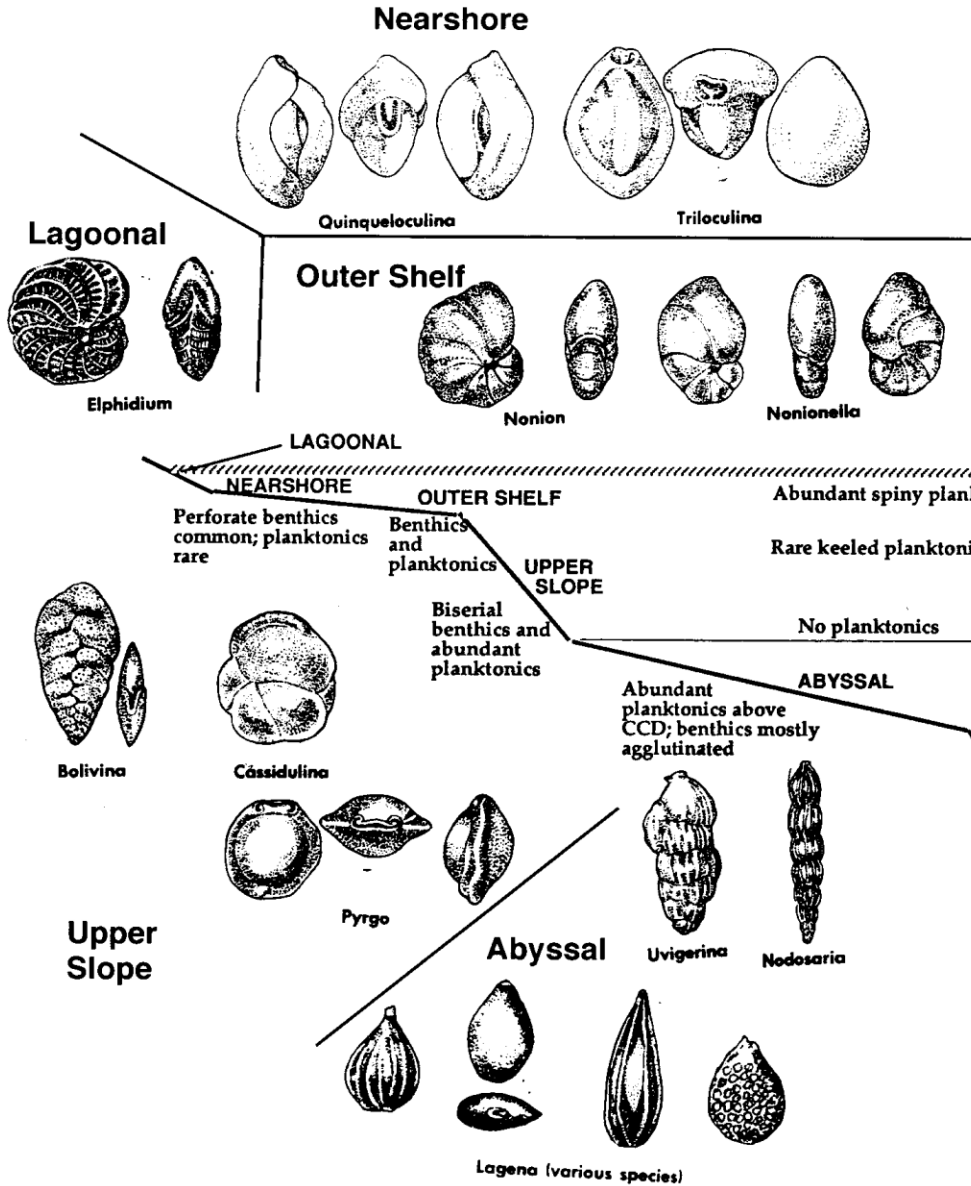
for paleoenvironment interpretation

- . diversity
- . dominant organism group (miliolid, rotaliid, agglutinated)
- . associated fauna
- . planktic/benthic ratio
- . dominant species
- . transportation, reworking effects

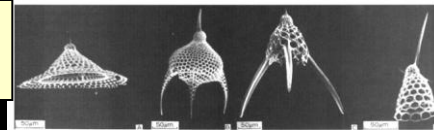
Age & Paleoenvironmental Interpretations

BENTHICS

PLANKTONICS



RECENT MARINE ENVIRONMENTS



Terrestrial

Back reef

Reef

Fore reef

Open sea

Ostr./Diatom

Ostrc.

Ostrc.

Ostr.

Dinofl/Arch/Diatom/
Nannofls/Tintinnid/
Kitinozoer

Radiolarler
Globigerina
Orbulina

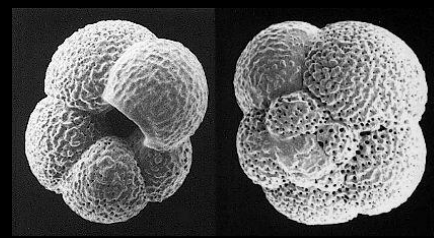
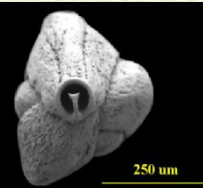


Spores &
Pollens
Vertebrate

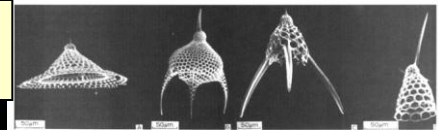
Miliolidae
Borelis

Alg
Mercan

Rotalidler



MIOCENE MARINE PALEOENVIRONMENTS



Terrestrial

Back reef

Reef

Fore reef

Open sea

Ostr./Diatom

Ostrc.

Ostrc.

Ostr.

Spores &
Pollens
Vertebrate

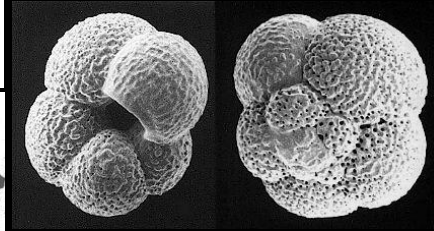
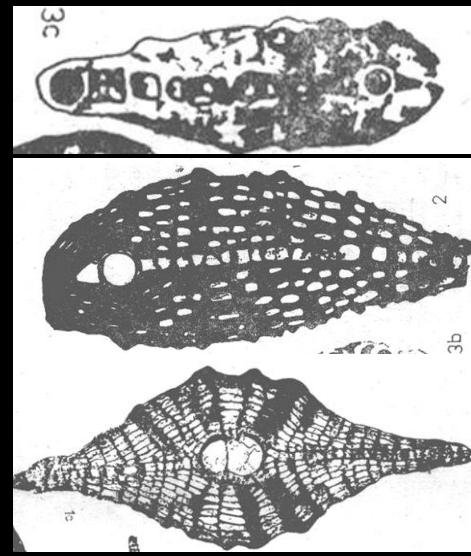
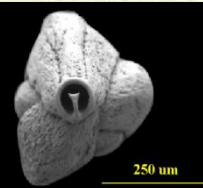
Miliolidae
Borelis

Alg
Mercan

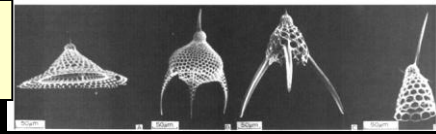
Rotaliidler

Dinofl/Arch/Diatom/
Nannofls/Tintinnid/
Kitinozoer
Radiolerler
Globigerina
Orbulina

Lepidocyclins
Miogypsinids
Operculins



PALEOGENE MARINE PALEOENVIRONMENTS



Terrestrial

Back reef

Reef

Fore reef

Open sea

Ostr./Diatom

Ostrc.

Ostrc.

Ostr.



Spores &
Pollens
Vertebrate

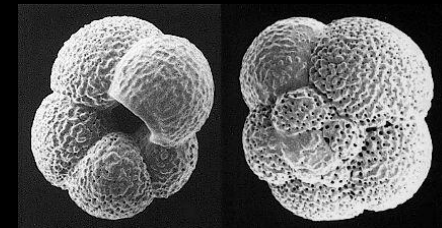
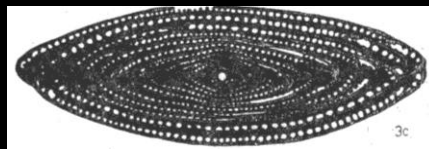
Miliolidae
Alveolina
Orbitolites

Alg
Mercan

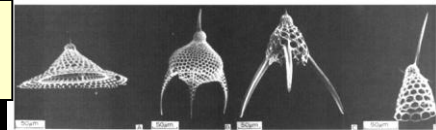
Rotalitidler

Nummulites
Assilina
Discocyclus

Dinofl/Arch/Diatom/
Nannofls/Tintinnid/
Kitinozoer
Radiolarler
Globigerina
Morozovella



CRETACEOUS MARINE PALEOENVIRONMENTS



Terrestrial

Back reef

Reef

Fore reef

Open sea

Ostr./Diatom

Ostrc.

Ostrc.

Ostr.

Dinofl/Arch/Diatom/
Nannofls/Tintinnid/
Kitinozoer

Radiolarler

Spores &
Pollens
Vertebrate

Miliolidae
Praealveolina

Rudist
Alg

Mercan

Rotalitdler

Globotruncana

Heterohelix/

Abathomphalus

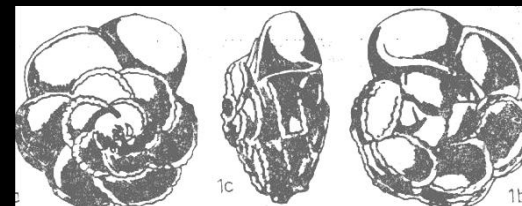
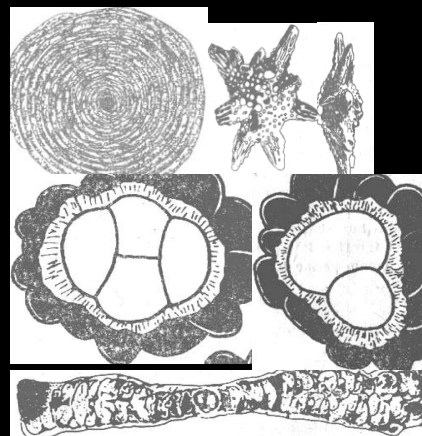
Loftusia/Orbitoides

Orbitolina/Omphalocylus

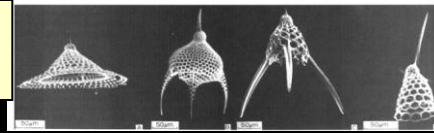
Siderolites

Hellenocyclina

Lepidorbitoides



Pm, Tr, J MARINE PALEOENVIRONMENTS



Terrestrial

Back reef

Reef

Fore reef

Open sea

Ostr./Diatom

Ostrc.

Ostrc.

Ostr.

Dinofl./Arch/Diatom/
Nannof./Tintinnid/CONOD.

Kitinozoer

Radiolerler

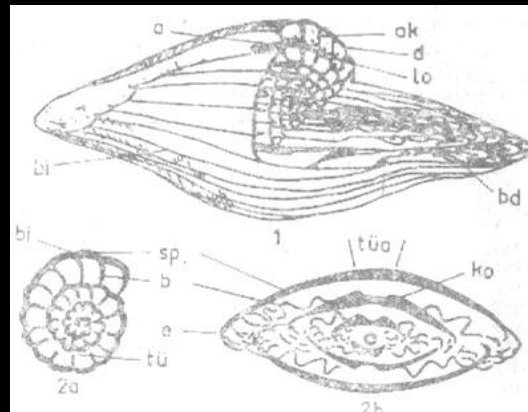
Spores &
Pollens
Vertebrate

Miliolidae
Protopenneroplis Mercan
(Jura-Kr.)

Alg

Rotalitidler

Fusulins (Krb.-
Permiyen)
Involutids (Tr-Jura)
Epistomina (Jura)



Homework 5

Where do we find Nummulitid fauna in Turkey? Search and write a few of the web sites that you have been visited, and also write references of the five articles in full.