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

Paleontology

Muhittin Görmüş

Department of Geology

Lecture 4

ANKARA UNIVERSITY

http://members.cox.net/jdmount/paleont.html

Topics

- Fusulinina
  - *Fusulina* sp., *Fusulinella* sp.
  - *Schwagerina* sp. *Polydiexodina* sp.
  - *Neoschwagerina* sp. *Verbeekina* sp.
- Miliolina
  - *Peneroplis* sp, *Spirolina* sp.
  - *Quinqueloculina* sp., *Triloculina* sp., *Biloculina* sp.,
  - *Orbitolites* sp., *Opertorbitolites* sp.,
  - *Lacazina* sp., *Somalina* sp.,
  - *Alveolina* sp., *Borelis* sp. and etc.
- Globigerinina (Planktik Foraminifera)
  - Cretaceous planktics (*Globotruncana* sp., *Heterohelix* sp. etc.)
  - Paleogene to Recent planktics (*Globigerina* sp.)
  - Neogene to Recenet planktics (*Orbulina* sp.)

Suborder Fusulinina

Fusulinina showing various axial and equatorial sections on the rock's surface

Picture from internet

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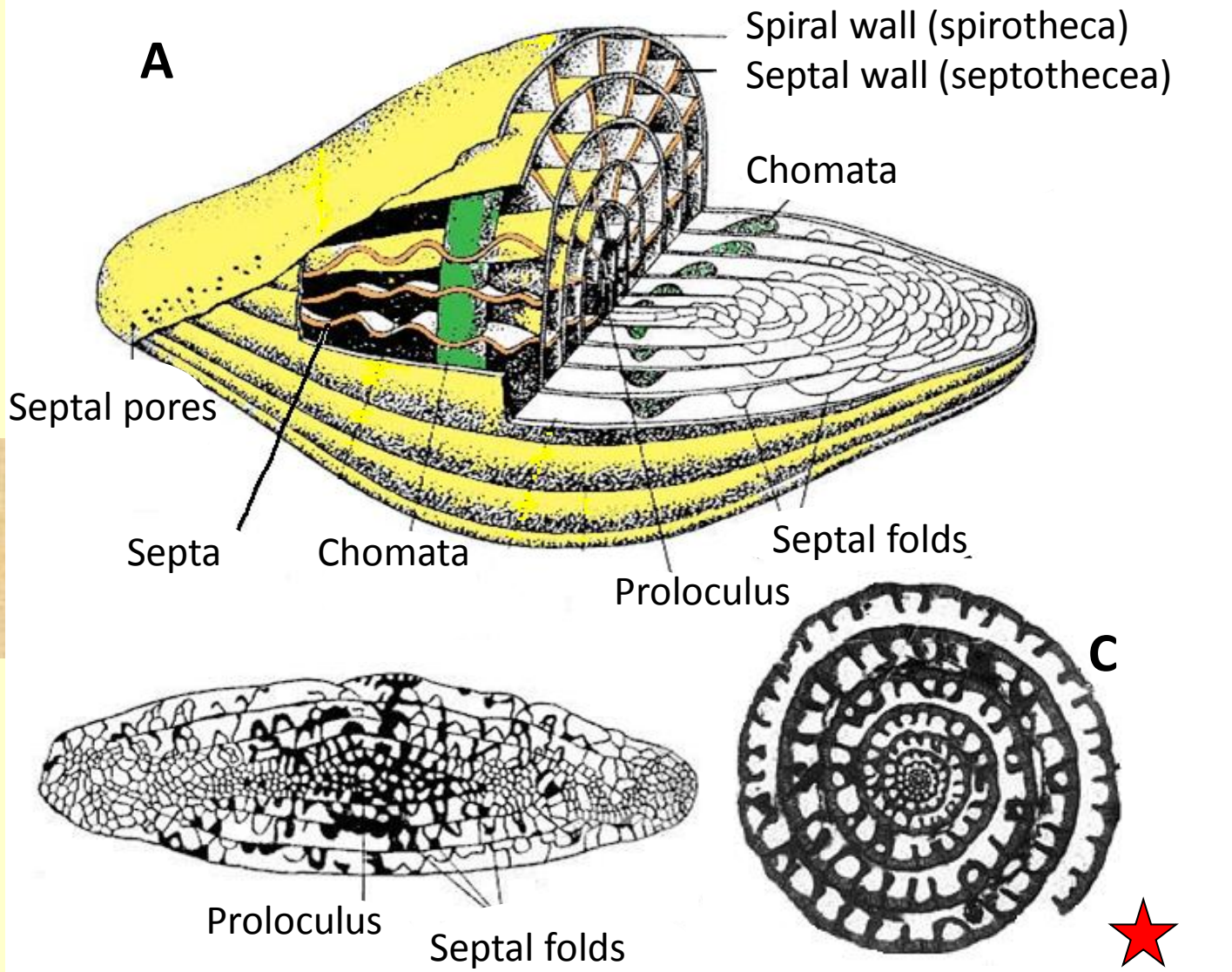
Suborder Fusulinina



Schematic block diagram (A), axial section view (B) and equatorial section view (B)

Drawings from Alkaya (Selçuk Univ.), lecture notes, by forgetten scale and reference http://www.fusunalkaya.net/micropalaeontology/micropalaeontology.html

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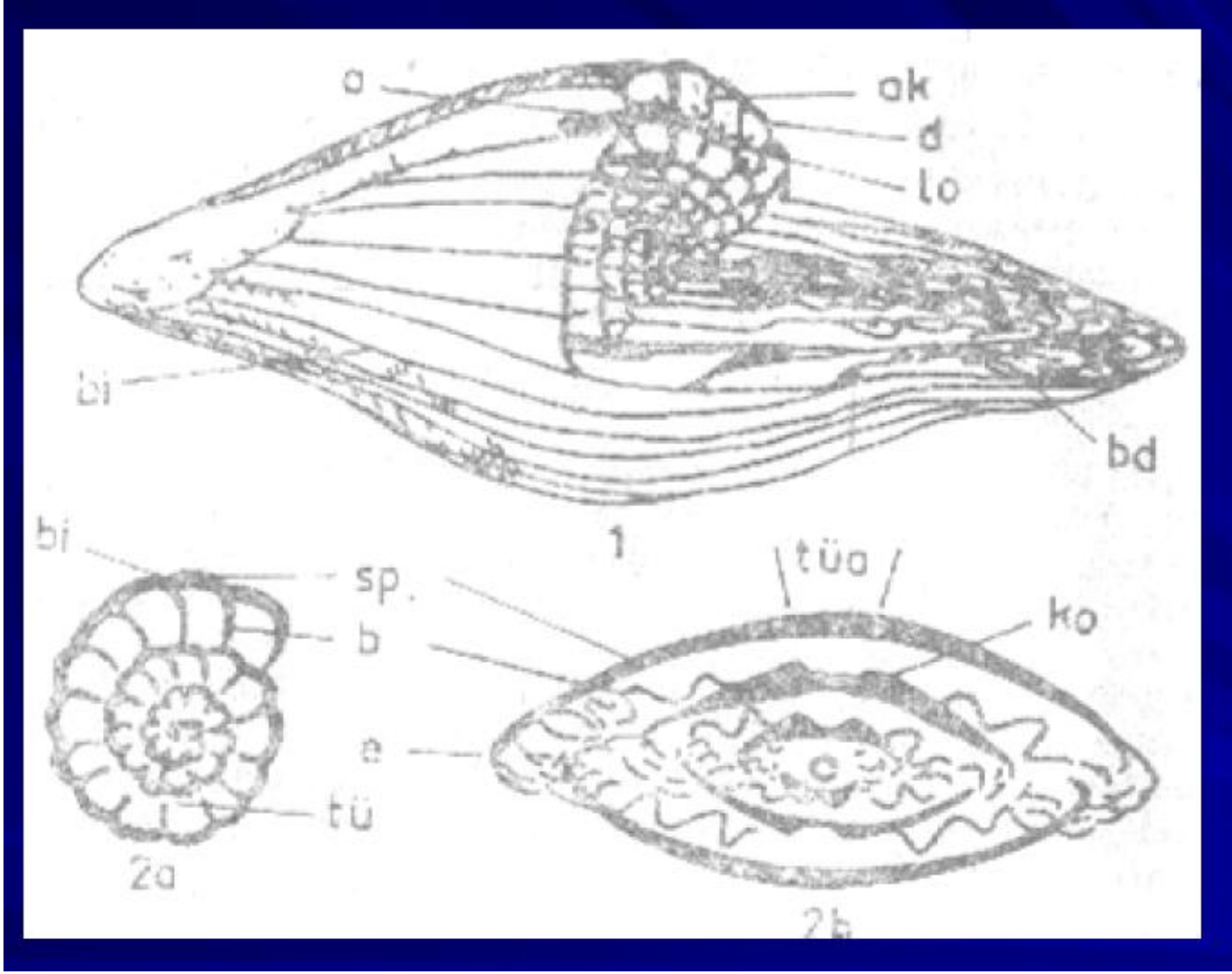
Suborder Fusulinina

Terminology of a fusulinid foraminifera



a. aperture, ak. axial septa, d. wall, lo. chamberlet, bd. septa undulations, bi. septa trace, tua. tunnel angle, ko, comata (carbonate filling), b. septa, tü. tunnel

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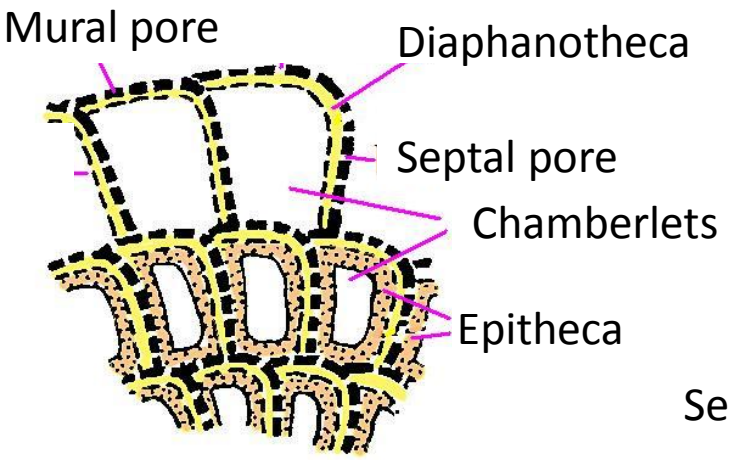
Suborder Fusulinina

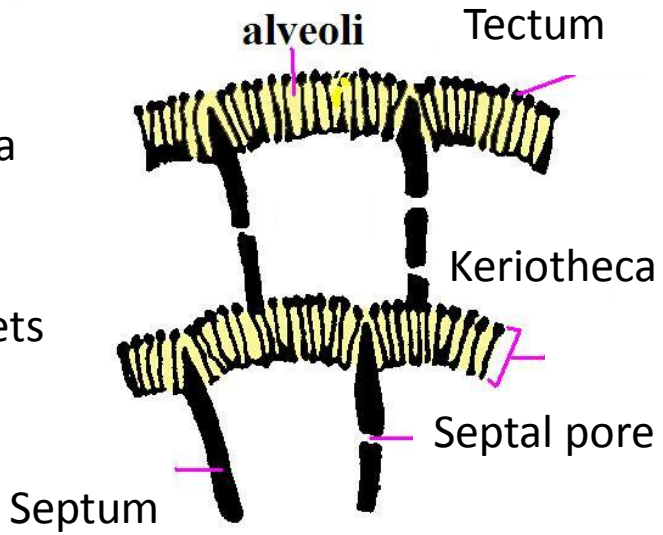
Fusulinid wall structure (A), schwagerinid wall structure (B)

A



Fusulina
Fusulinella

B



Schwagerina
Polydiexodina
Triticites
Verbeekina
Neoschwagerina

From Armstrong & Brasier (2006) and Alkaya (Selçuk Univ.), lecture notes

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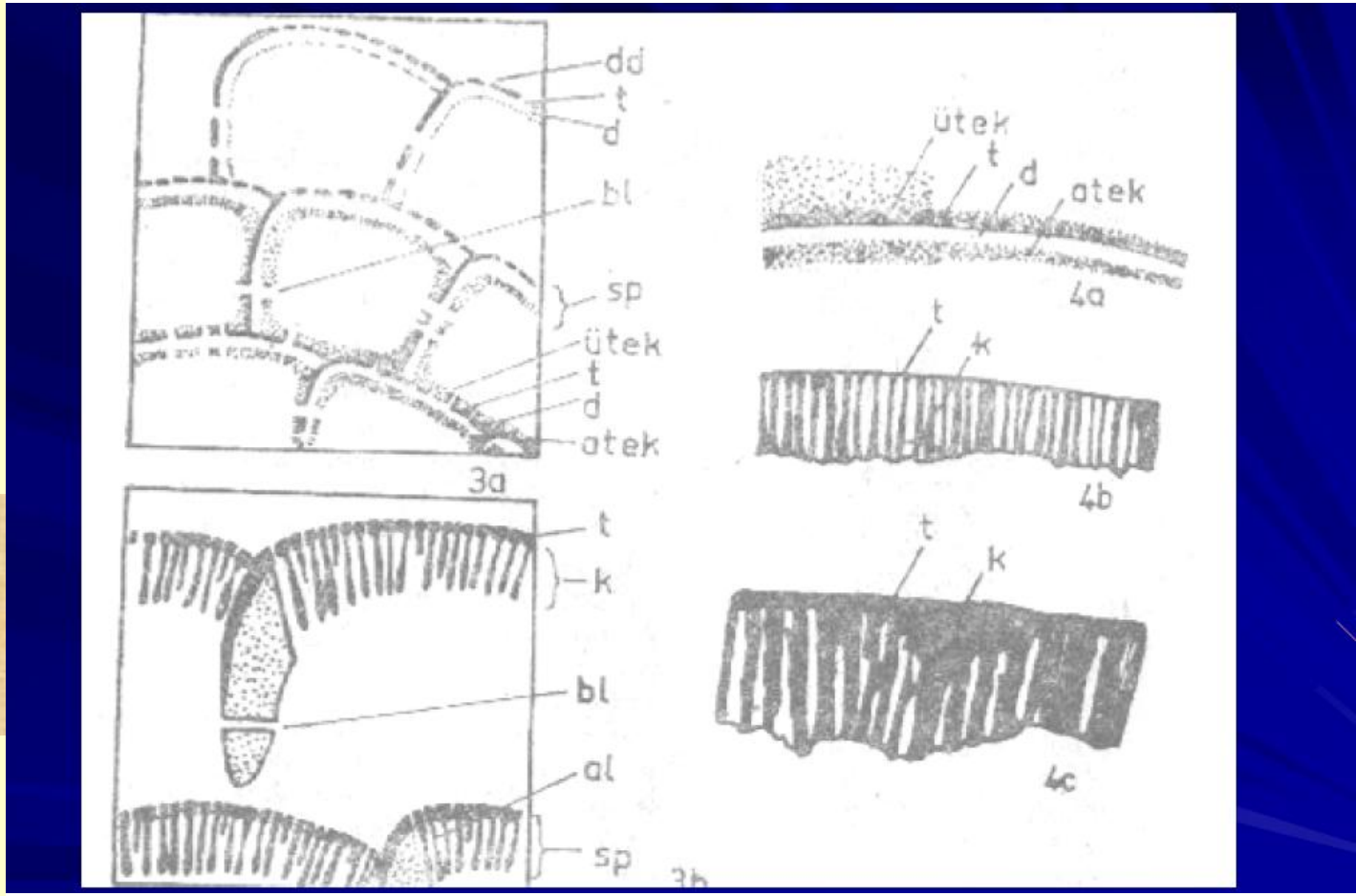
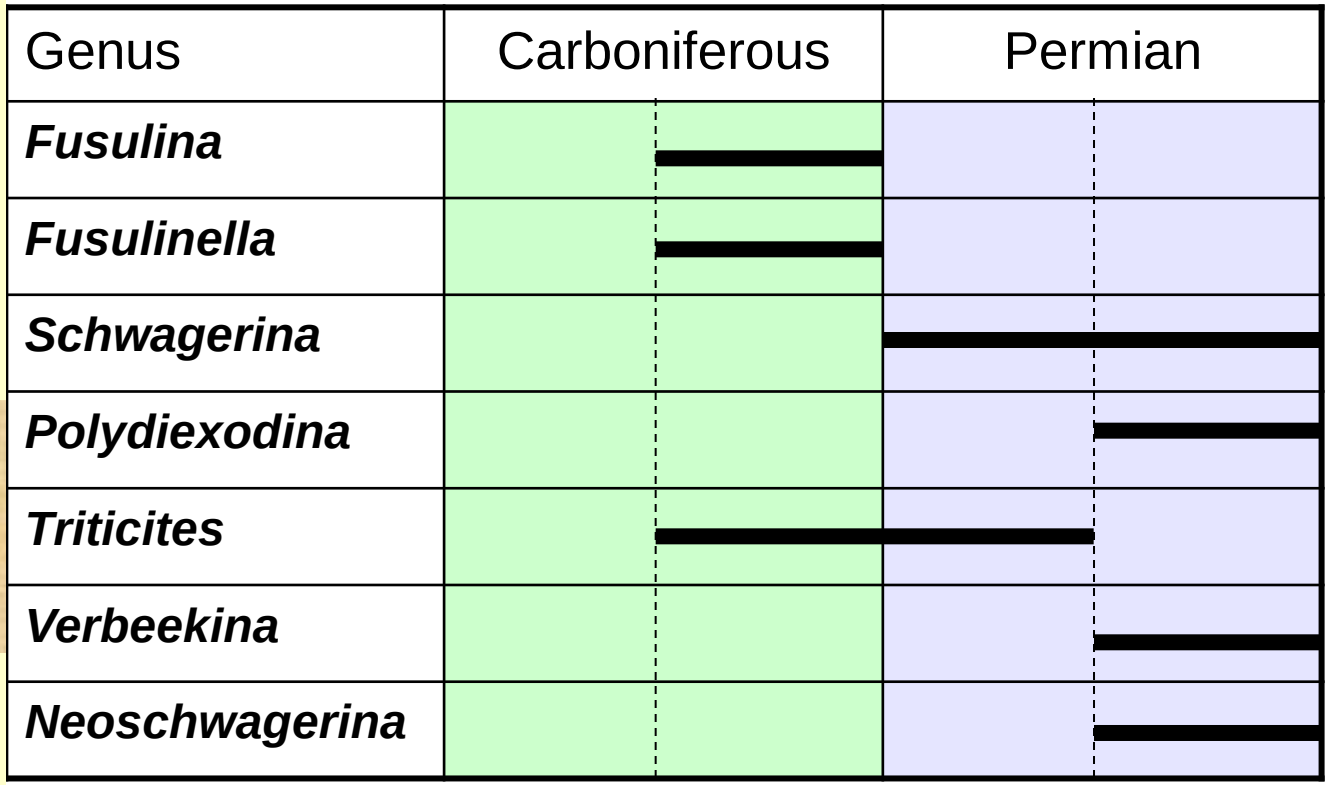
Suborder Fusulinina



Different views of wall structure, dd. Pore, t. Tectum, d. Diaphonotheca, bl. Septa, sp. Spirotheca, utek. Upper tectirium, atek. Lower tectirium, al. Alveolus

Suborder Fusulinina

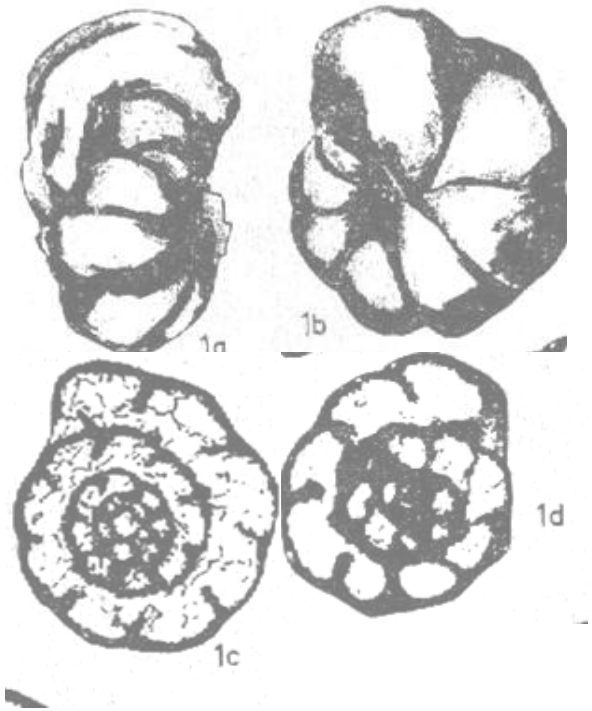


Modified from Alkaya (Selçuk Univ.),
lecture notes,

Endothyra sp. (Carboniferous-Permian)

Suborder Fusulinina

Selected genera



Meriç (1985)

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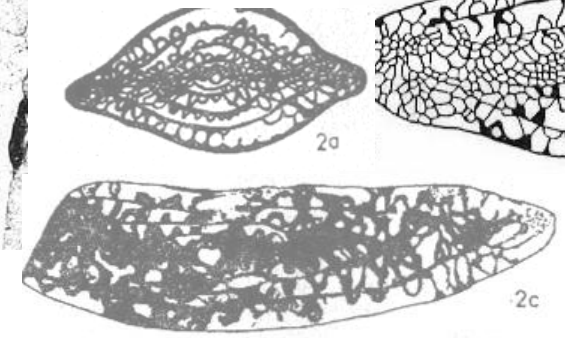
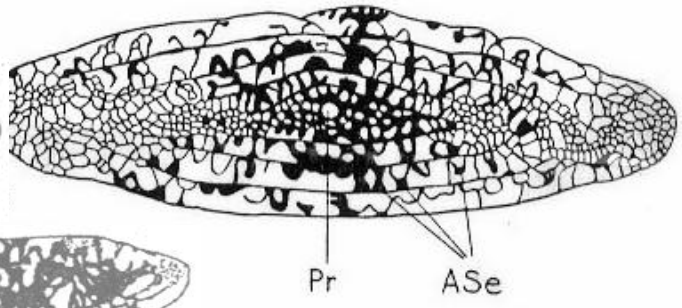
Fusulina sp. (Carboniferous)

Equatorial sections



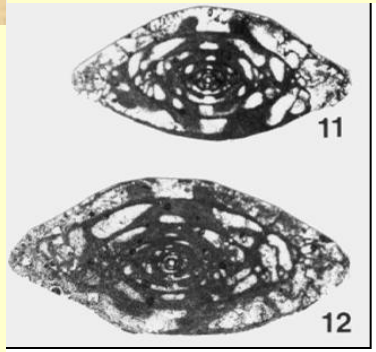


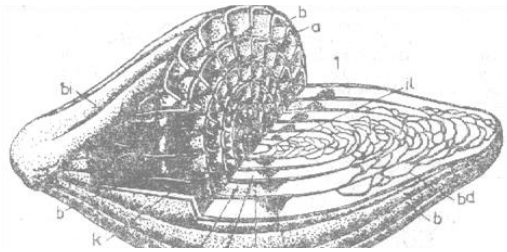
Axial sections

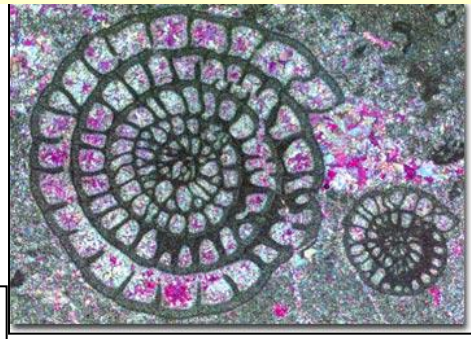
Suborder Fusulinina

Fusulinella sp. (Carboniferous)

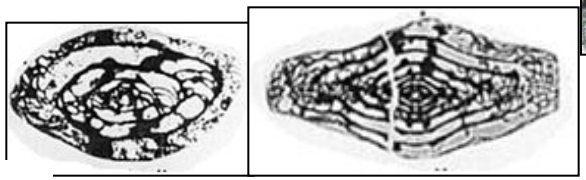
Selected genera







Equatorial sections



Axial sections

Modified from Alkaya (Selçuk Univ.), lecture notes,

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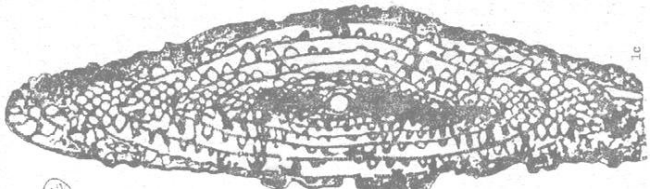
***Schwagerina* sp.** (Permian)

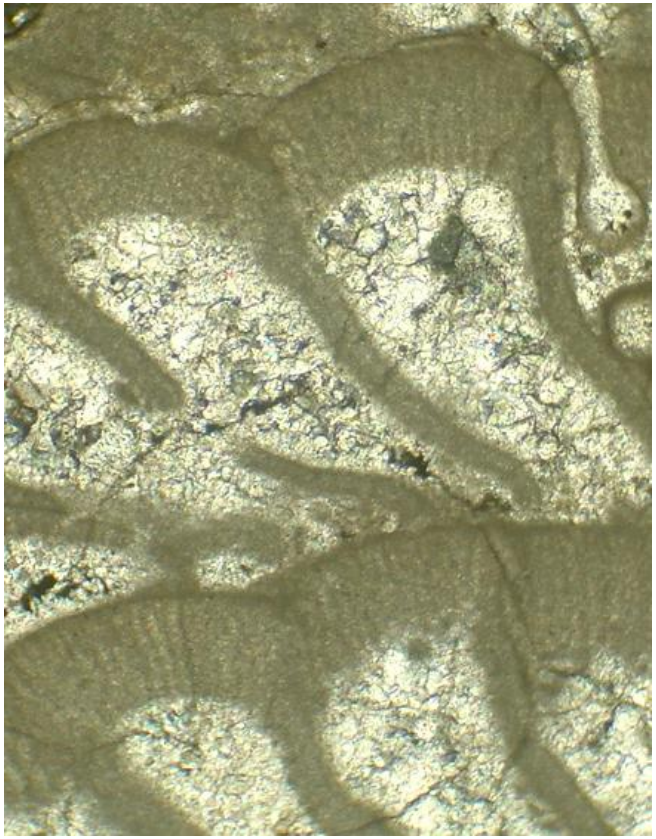
Suborder Fusulinina

External view

Equatorial section



Axial section



Wall details

Oblique section, nearly equatorial

Characteristic features: test wall (tektum, tectirium), fusiform shape

larger foram, dimorfic

Some pictures from Alkaya (Selçuk Univ.), lecture notes, by forgetten scale and reference, others Meriç, 1985

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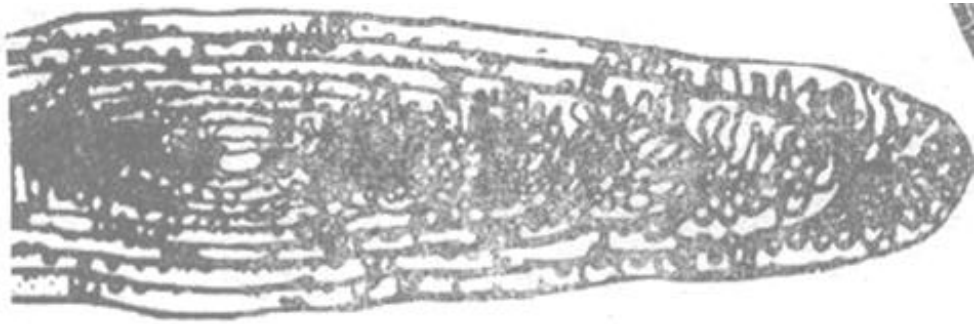
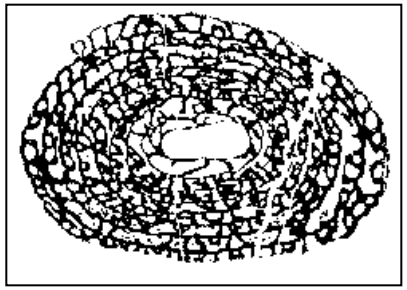
***Polydiexodina* sp.** (Permian)

Suborder Fusulinina

Equatorial section (a) and transversal section (b)



Axial section



Equatorial section

Some pictures from Alkaya (Selçuk Univ.), lecture notes, by forgetten scale and reference, others Meriç, 1985

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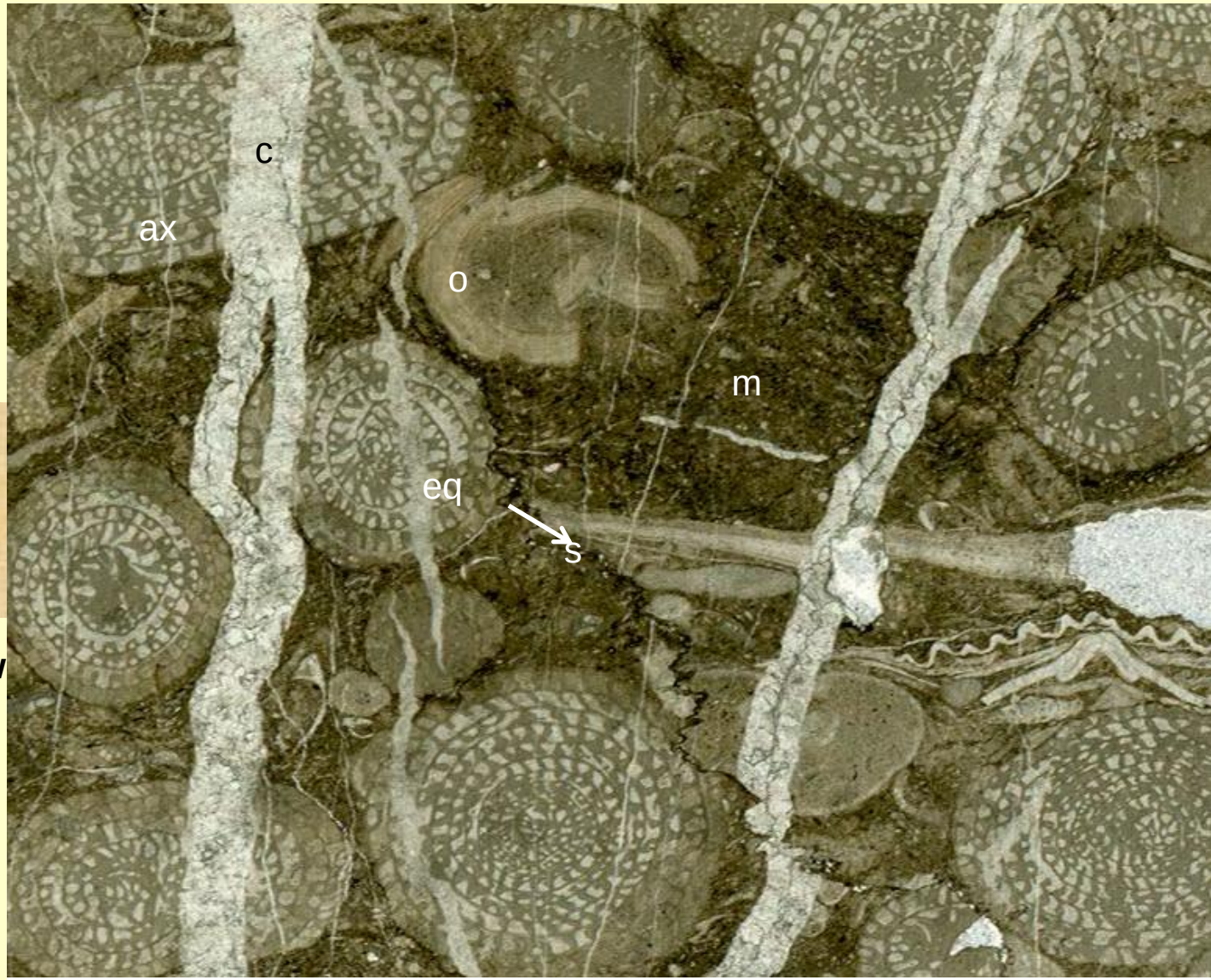
***Polydiexodina* sp.** (Permian)



Suborder Fusulinina

A rock thin section view including mainly *Polydiexodina* sp.
Equatorial sections (eq),
Nearly axial sectin (ax),
Micrite matrix (m),
Stilolite (s)
Calcite filling (c) within a fracture,
Ooid ? (o)

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

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***Polydiexodina* sp.** (Permian)

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

Suborder Fusulinina

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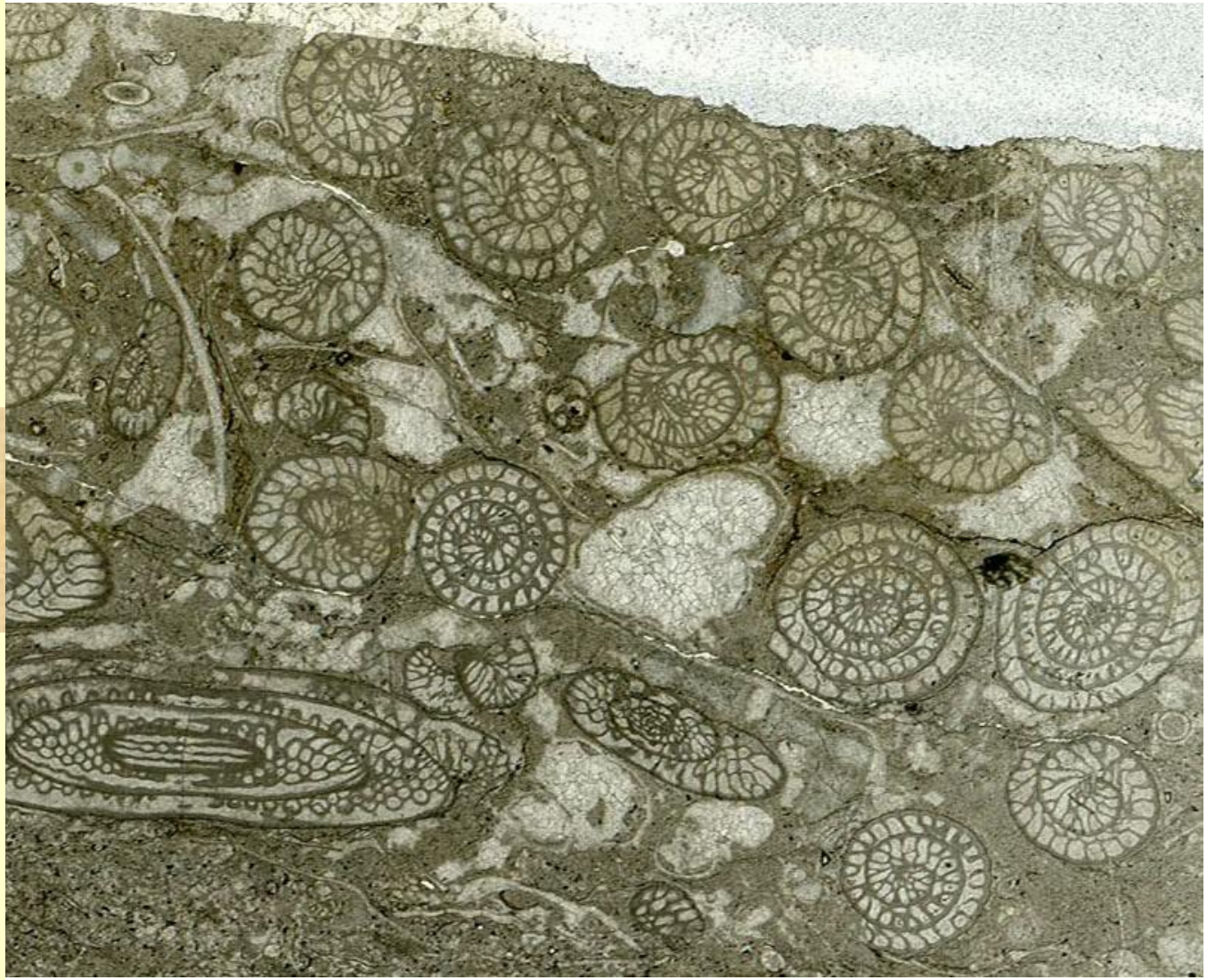
***Triticites* sp.** (Late Carb.-Permian)

Suborder Fusulinina

External views

Picture from internet

***Triticites* sp.** (Upper Carb.-Permian)



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

Suborder Fusulinina

Thin section including *Triticites* sp.

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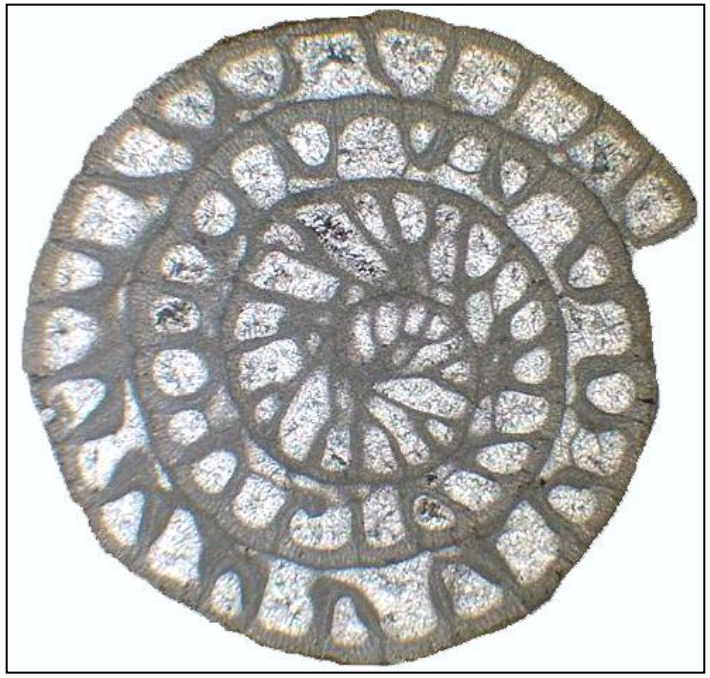
***Triticites* sp.** (Upper Carb.-Permian)

Suborder Fusulinina



Transverse section

Wall structure

Tangential section

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

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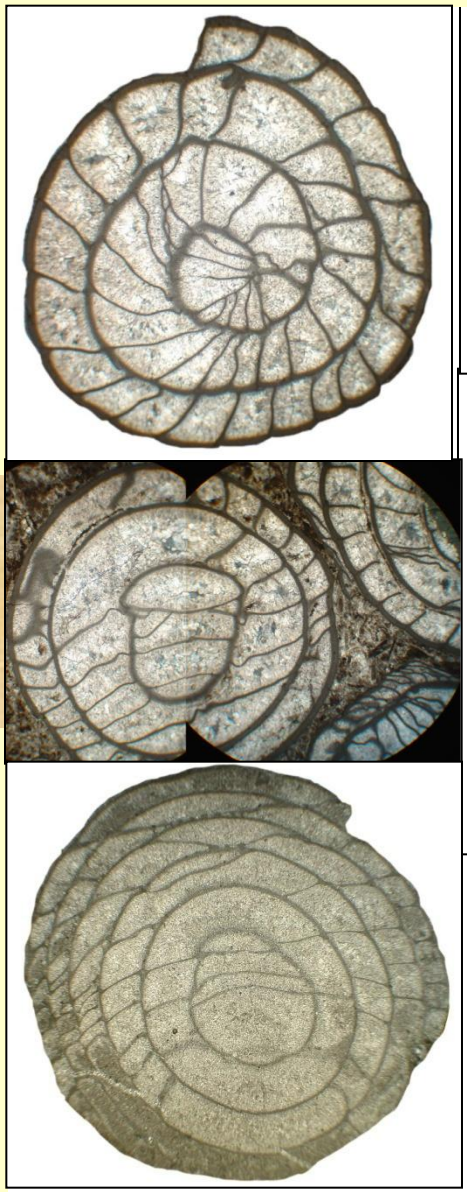
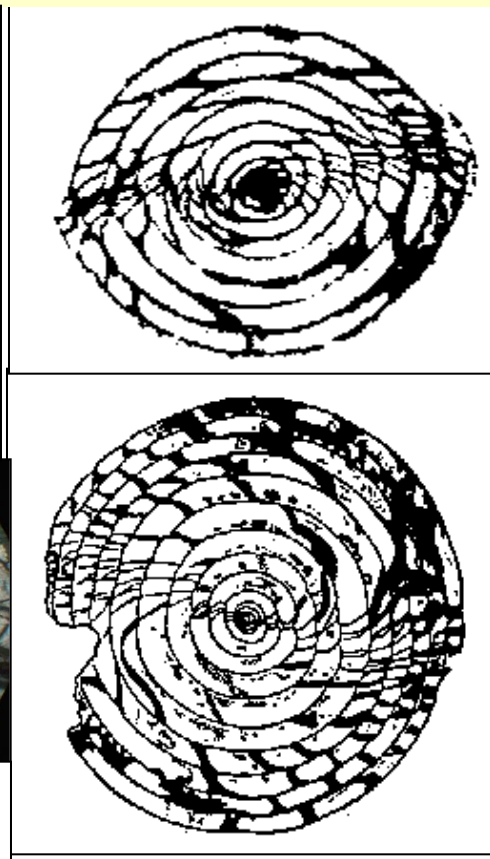
***Verbeekina* sp.** (Upper Permian)

Suborder Fusulinina

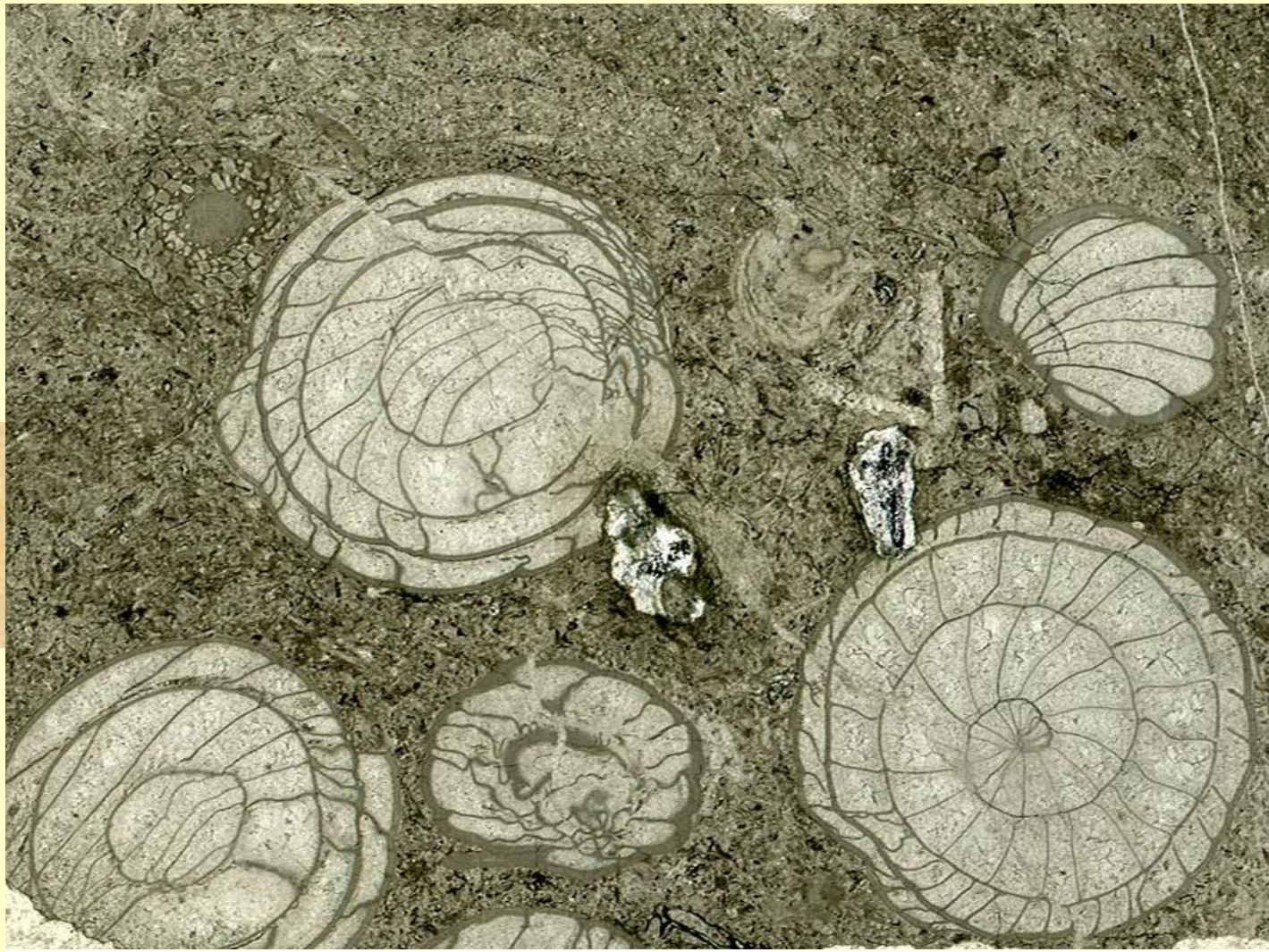




Pictures from Alkaya (Selçuk Univ.), lecture notes, by forgetten scale and reference

***Verbeekina* sp.** (Upper Permian)

Suborder Fusulinina



Verbeekina sp. in thin section

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

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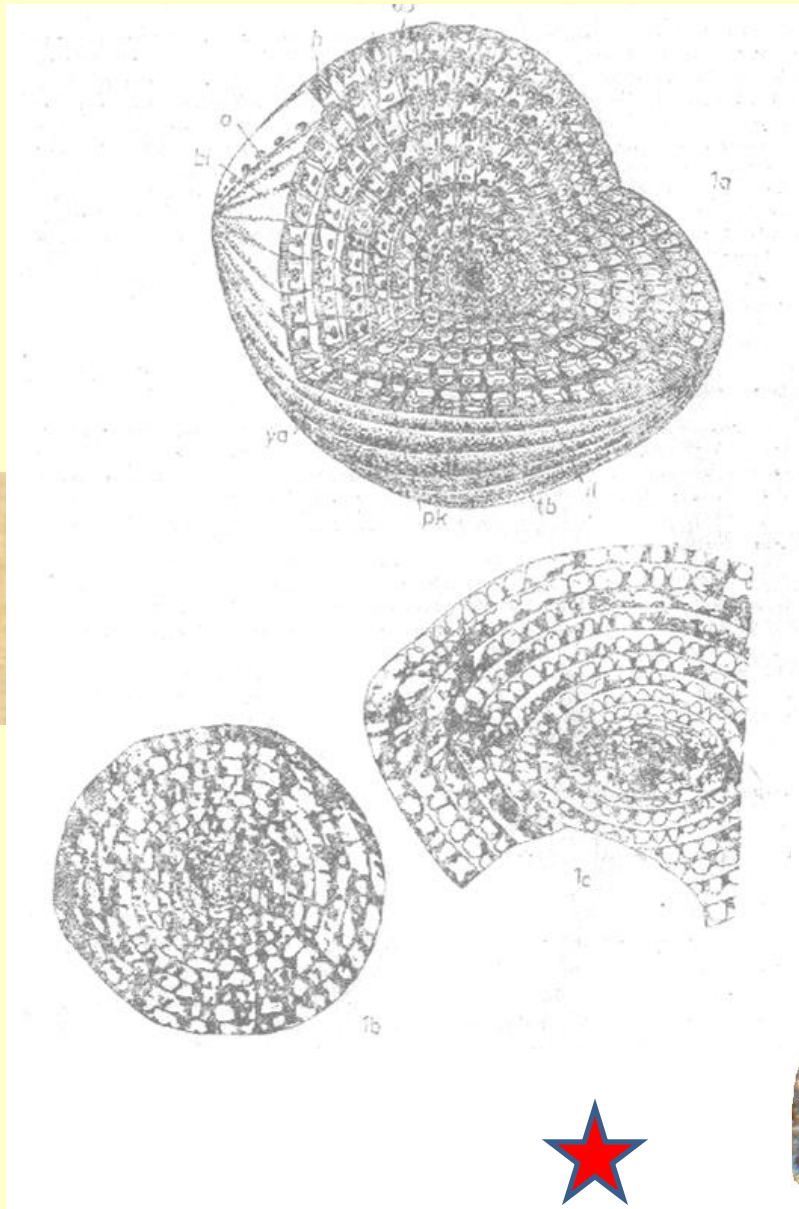
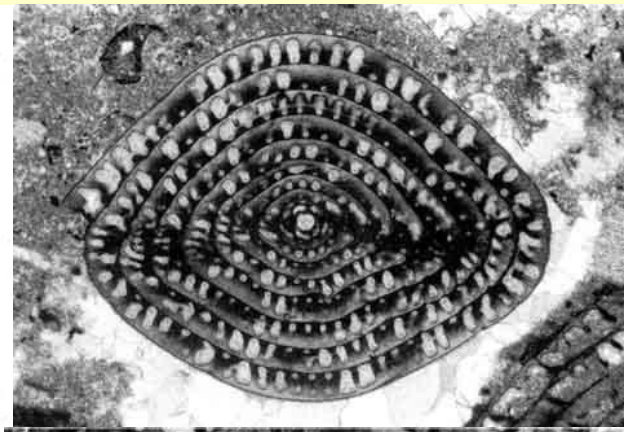
***Neoschwagerina* sp.** (Permian)





Suborder Fusulinina

Characteristic features: test wall (septum and septulas), globular fusiform shape

larger foram, dimorfic

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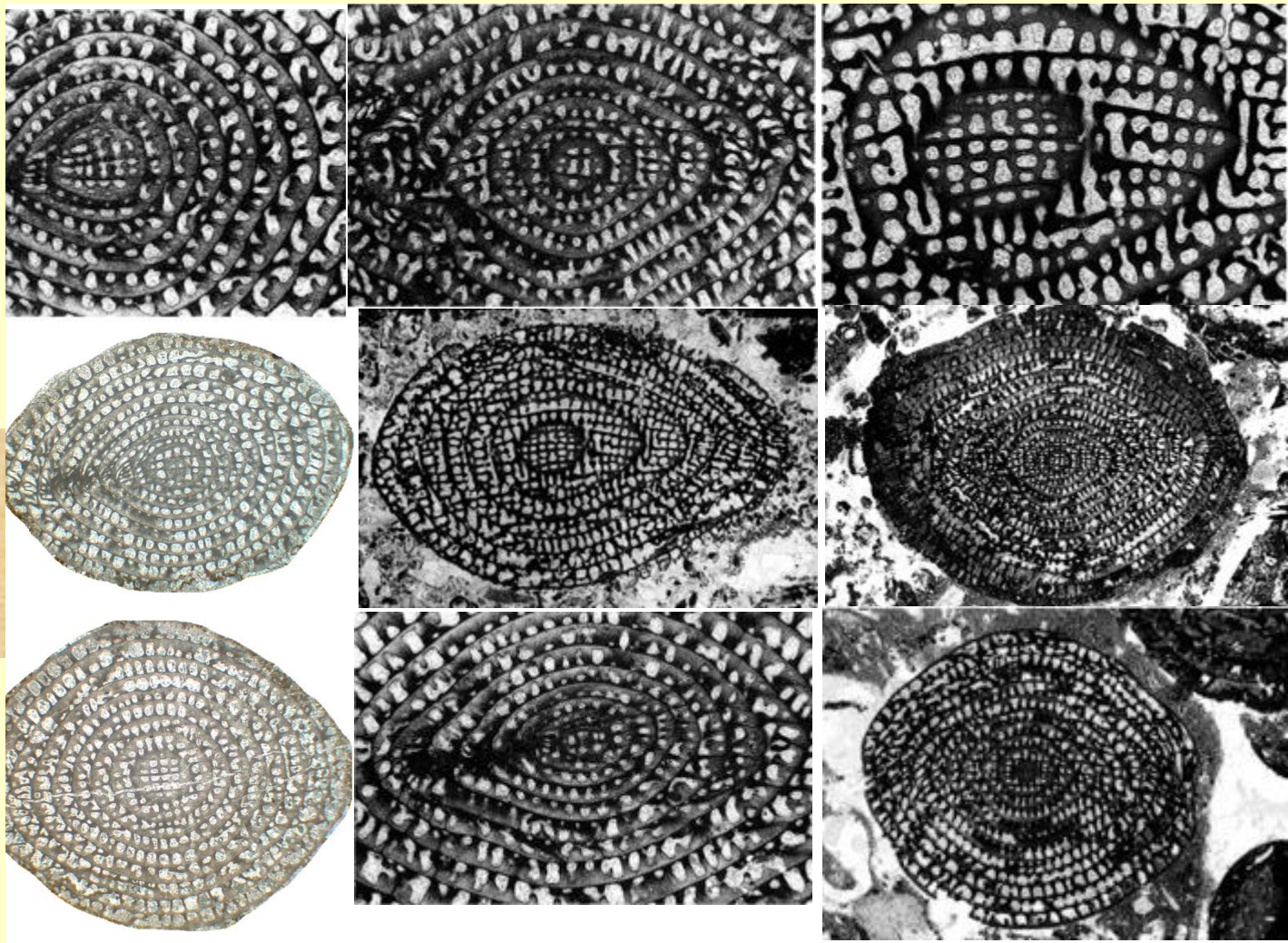
***Neoschwagerina* sp.** (Permian)

Suborder Fusulinina



Neoschwagerina sp. sections

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

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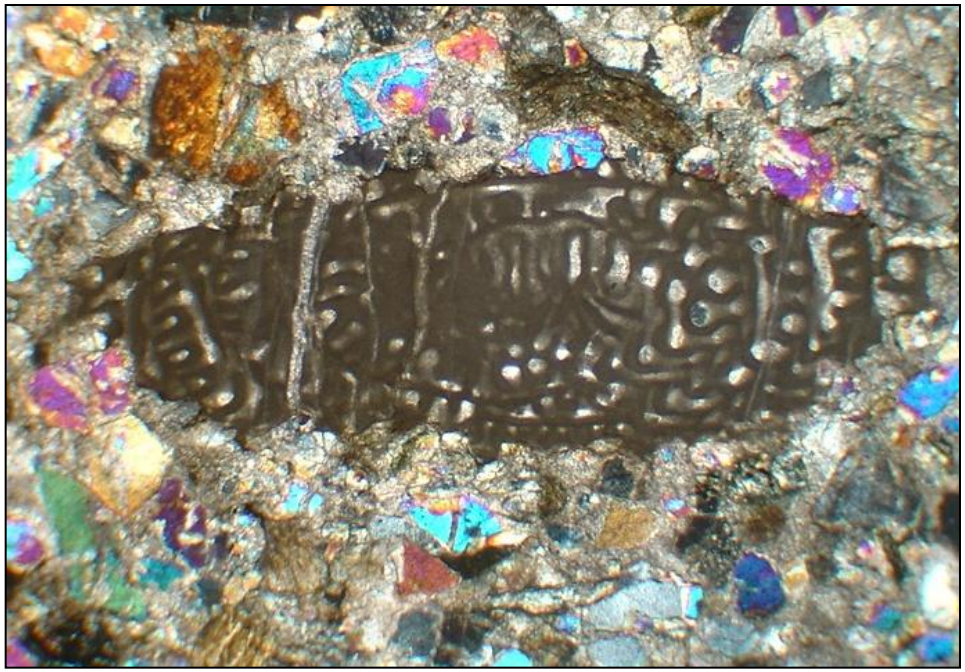
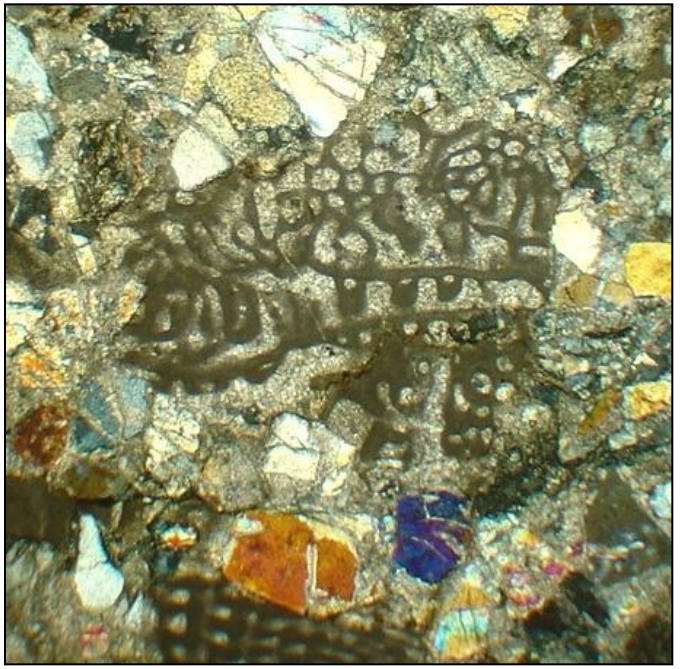
Suborder Fusulinina





Fusulinina in sandstone thin sections

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

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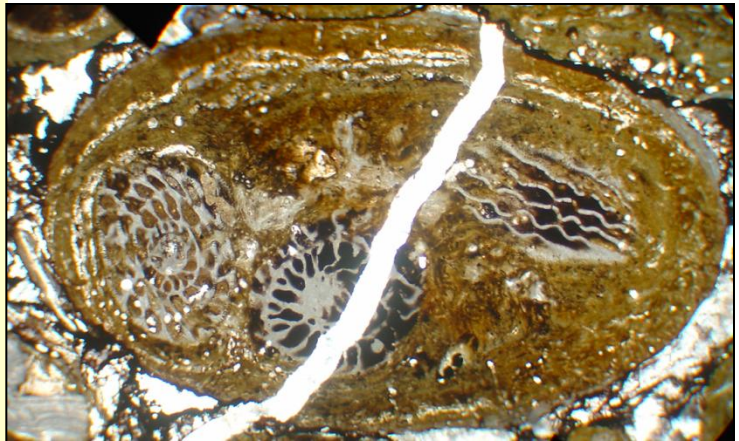
Suborder Fusulinina



Onkoliths with fusulinids within its nucleus

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

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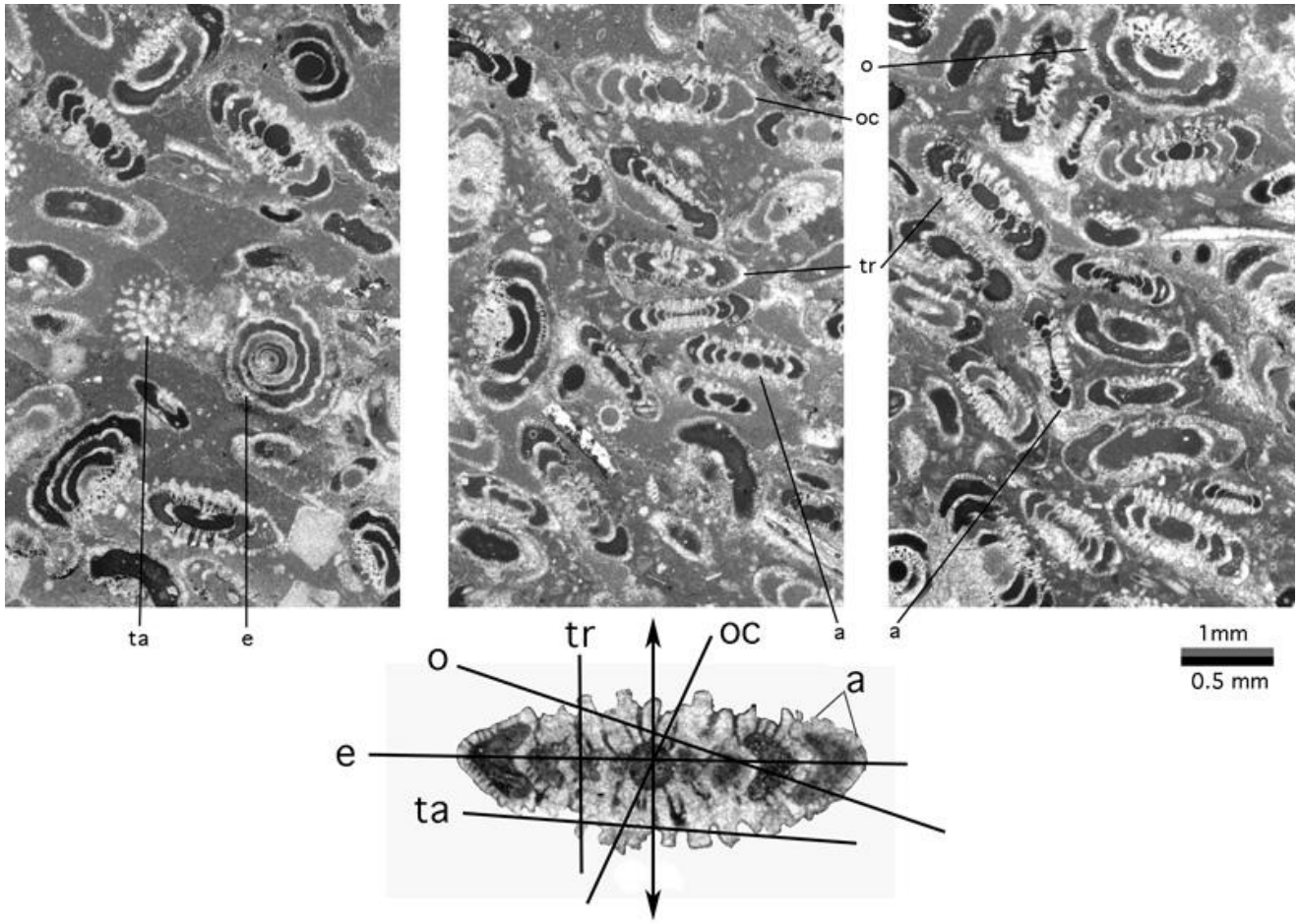
***Involutina* sp.** (Triassic to Jurassic)

Suborder Involutina

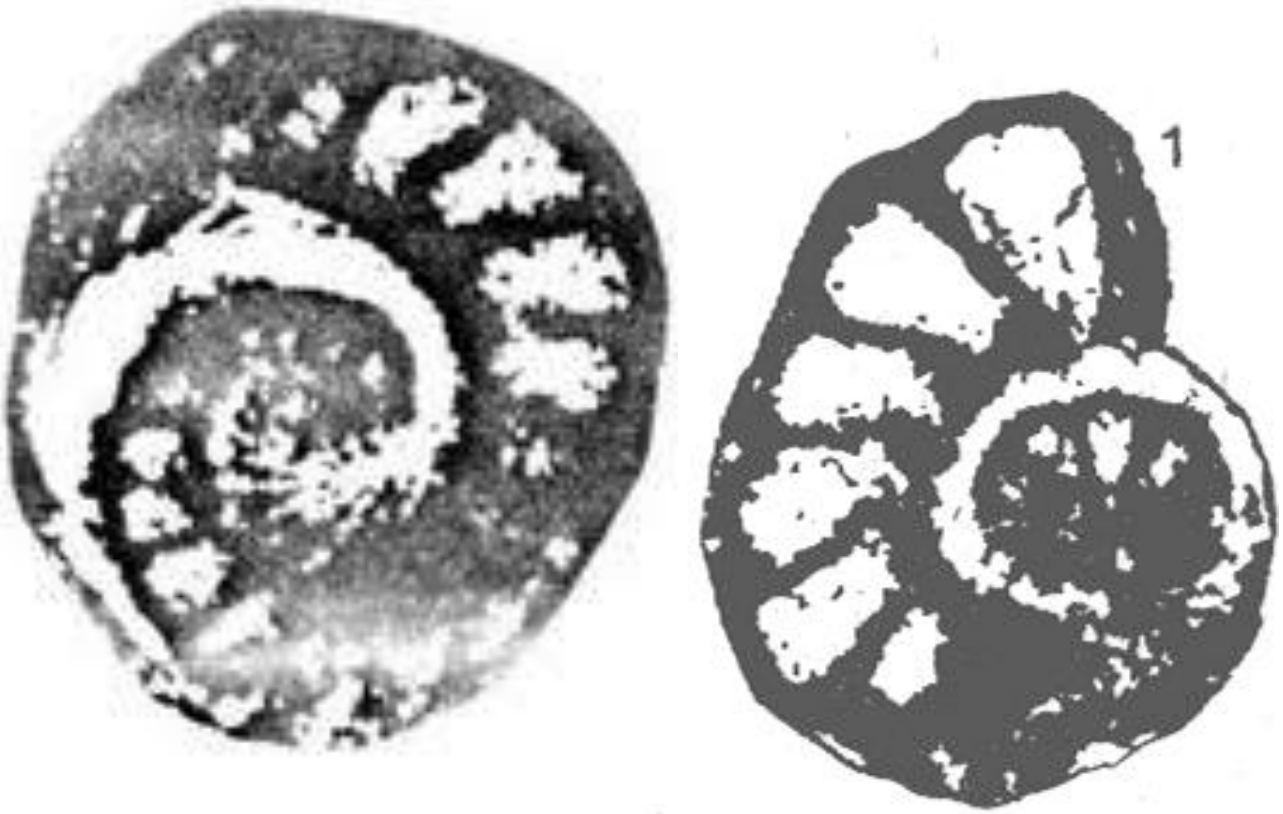


Involutina sp. thin section views

http://paleopolis.rediris.es/cg/CG2006_M02/images/Fig_15.htm

Protopeneroplis sp.
(Triassic to Early Cretaceous)

Suborder Involutina



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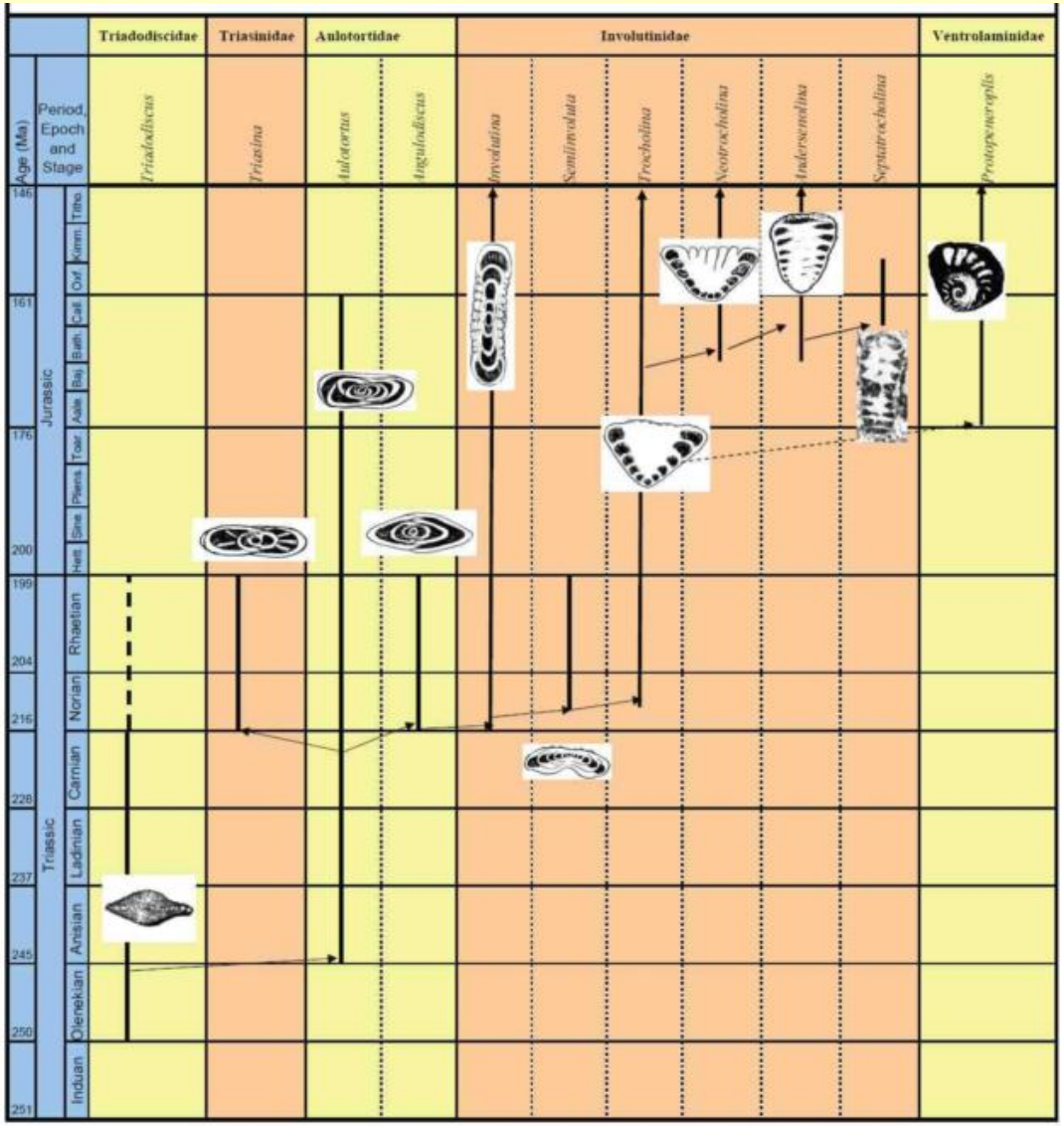
Involutidler (Triassic to Juras.)

Suborder Involutina



Involutidlerin stratigraphical ranges

nttp://www.ucı.ac.uĸ/EarthSci/people/d-price/WebImagesPages/INVOLUTINOIDEA.htm

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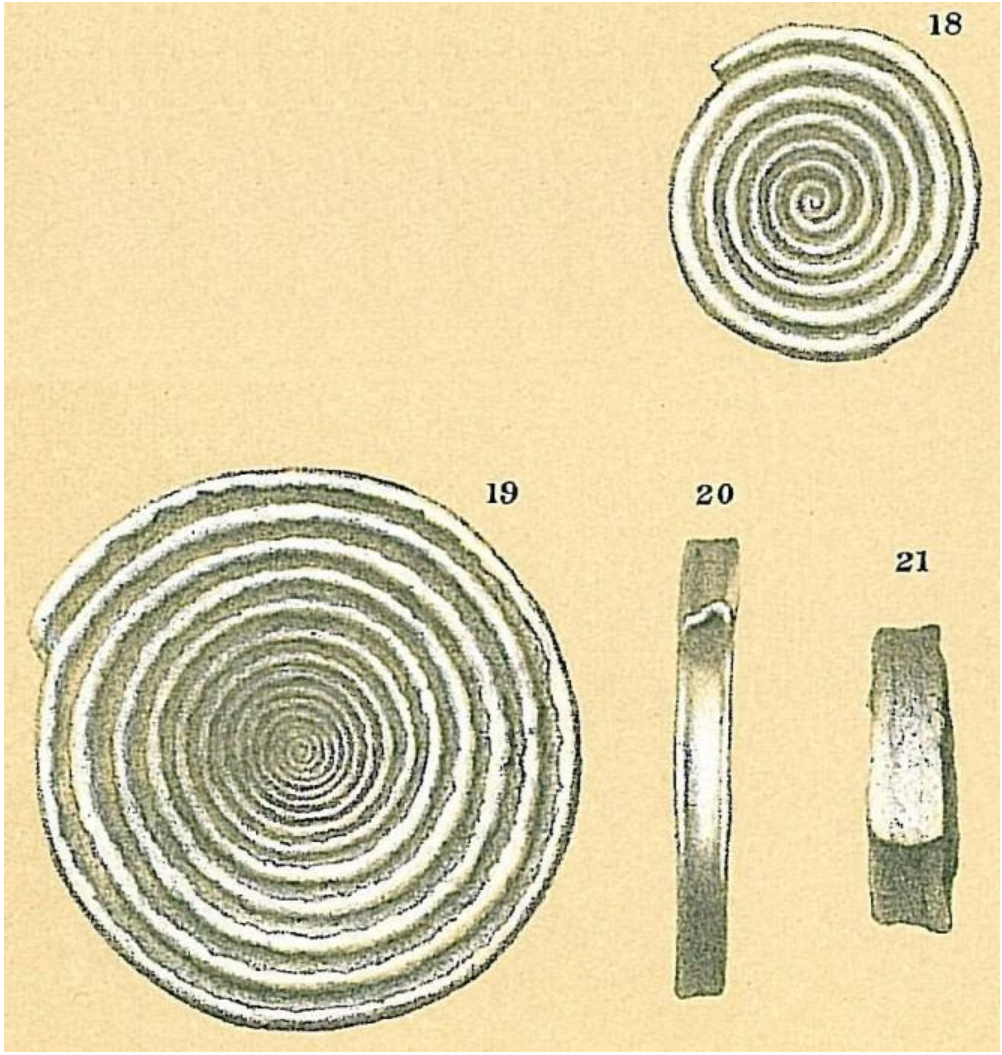
***Spirillina* sp.** (Late Triassic to Recent)

Suborder Spirillinina



External views

http://www.marinespecies.org/foraminifera/aphia.php?p=image&pic=35848

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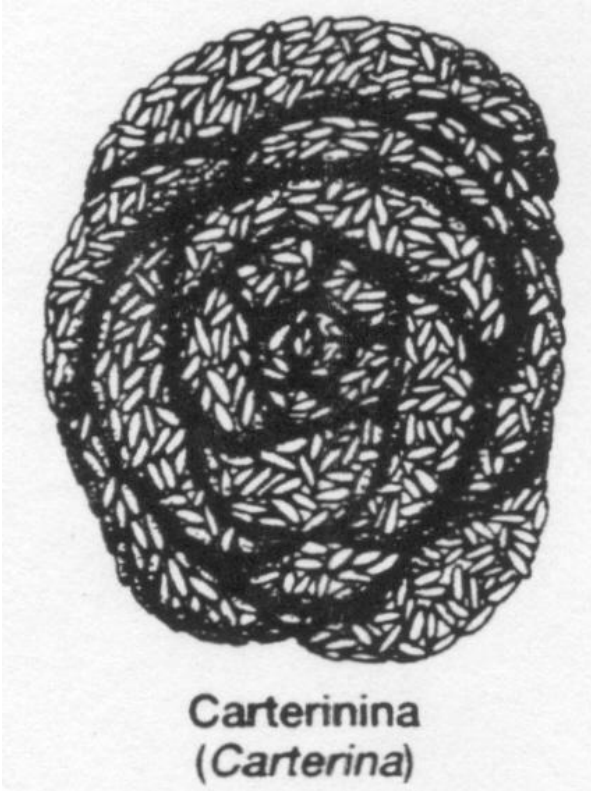
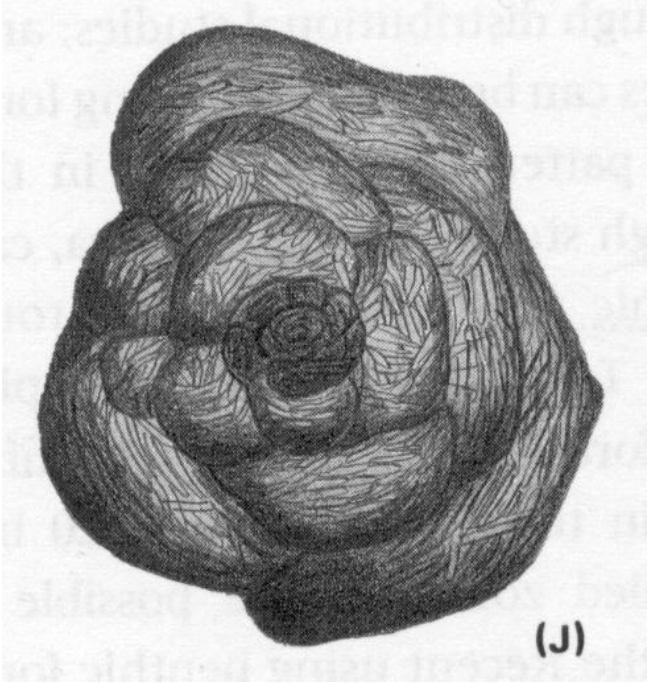
***Carterinina* sp.** (Eocene to Recent)

Suborder Carterinina





External views

http://plato.acadiau.ca/courses/geol/cameron/geol3213-micropaleontology/Pictures/Foraminifera/Carterinina/Carterina.jpg

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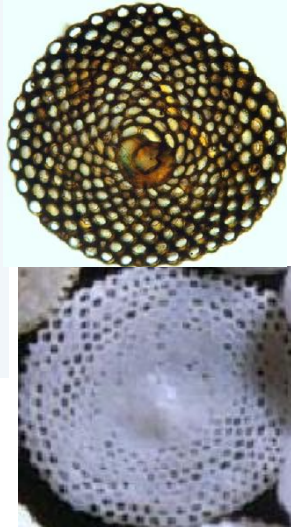
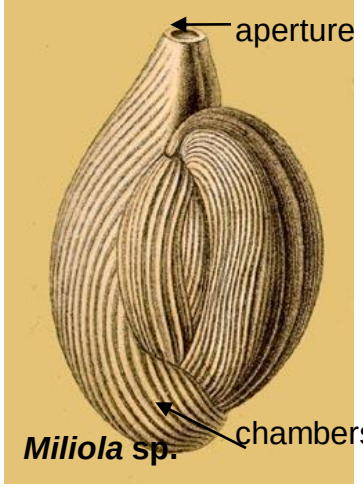
Suborder Miliolina

Main test structures of miliolids with selected genera



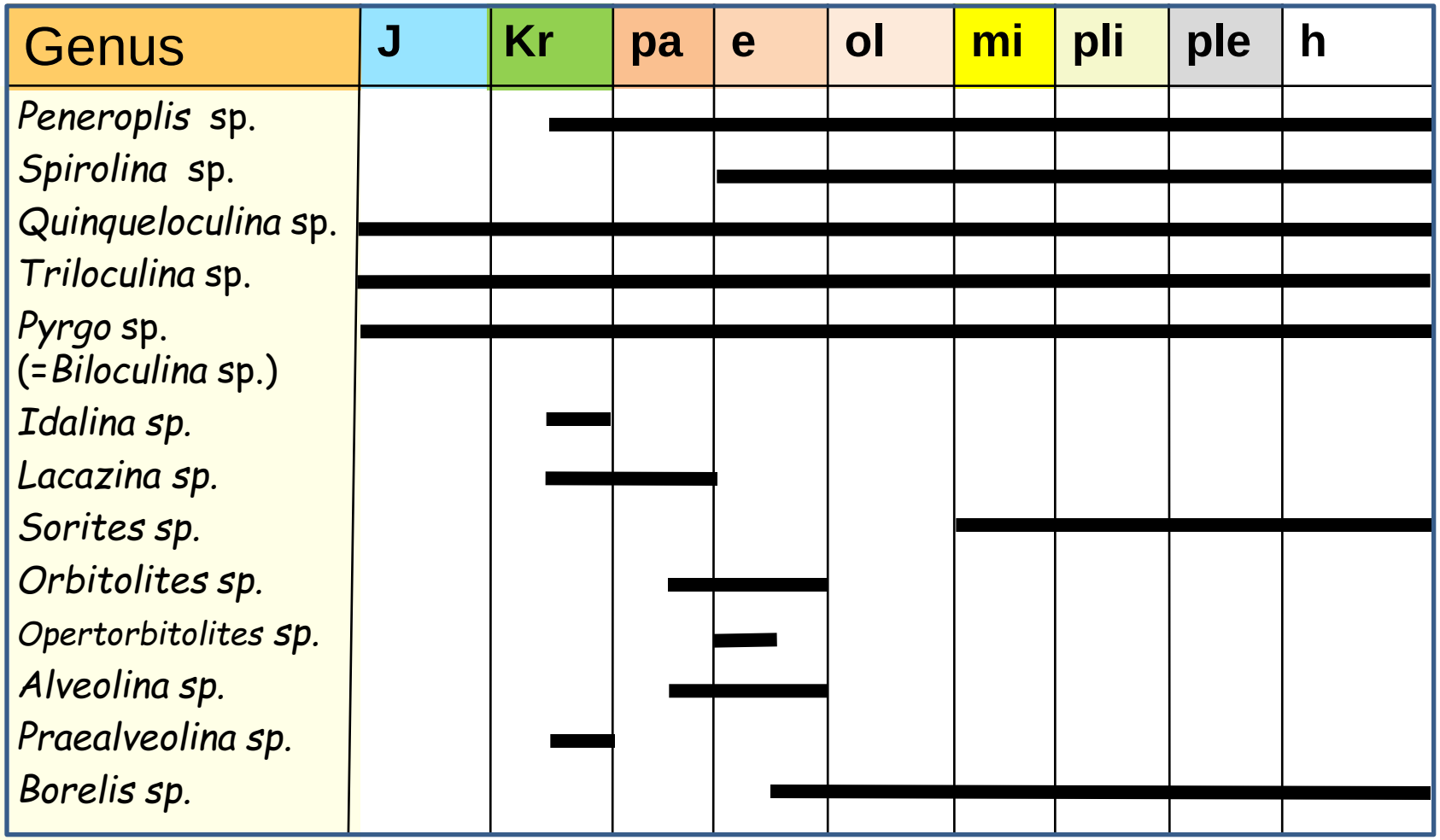


***Miliola* sp.**

planspiral Coil	discoidal or lenticular	elongated chambers	fusiform
Examples *Peneroplis* sp. *Spirolina* sp.	***Examples*** *Sorites* sp. *Lacazina* sp. *Orbitolites* sp. *Opertorbitolites* sp.	***Examples*** *Quinqueloculina* sp. *Triloculina* sp. *Biloculina* sp. (*Pyrgo* sp.) *Spiriloculina* sp. *Miliola* sp. *Idalina* sp.	***Examples*** *Alveolina* sp. *Praealveolina* sp. *Borelis* sp.

Some pictures from Alkaya (Selçuk Univ.), lecture notes, by forgetten scale and reference others indicated in the next slides

Main miliolid selected genera with their stratigraphical ranges



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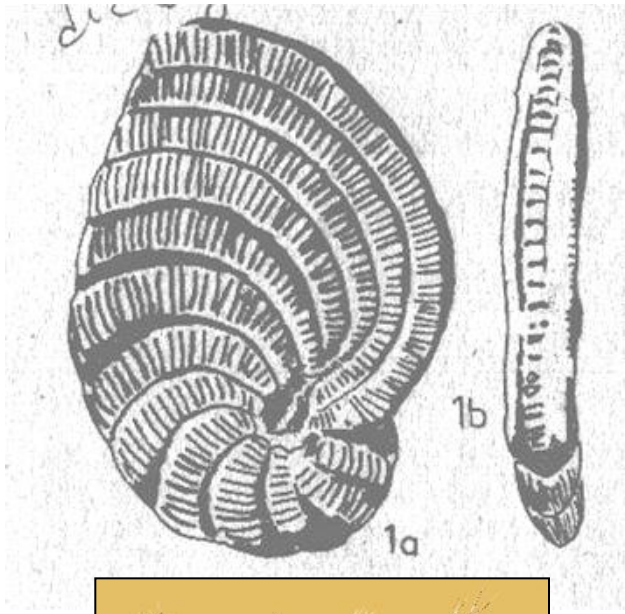
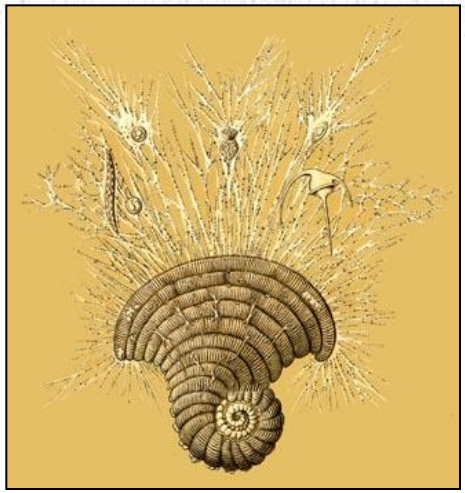
Suborder Miliolina

Peneroplis sp. Late Cret.? to Rec.





External view

Peneroplis planatus

http://www.microscopy-uk.org.uk/mag/indexmag.html?http://www.microscopy-uk.org.uk/mag/artmar00/forwim.html

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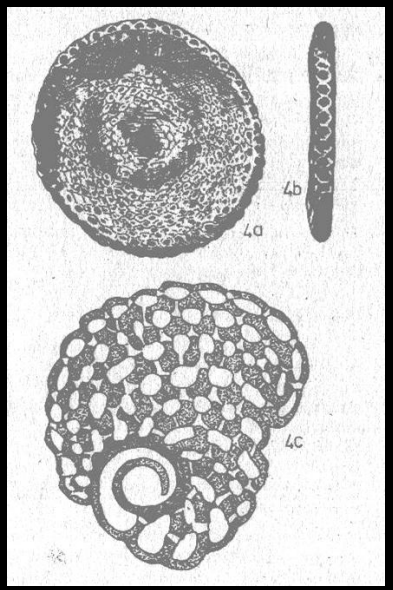
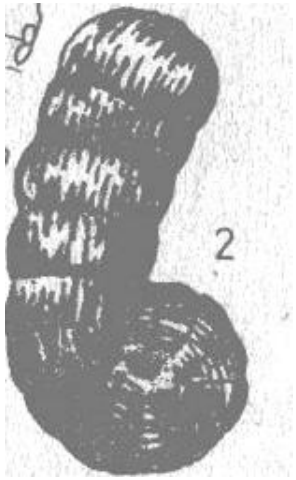
Suborder Miliolina



Spirolina sp. Eocene to Rec.



External views

Sorites sp. Miocene to Rec.

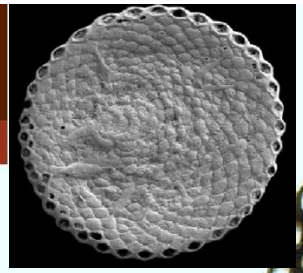
Foram Gallery

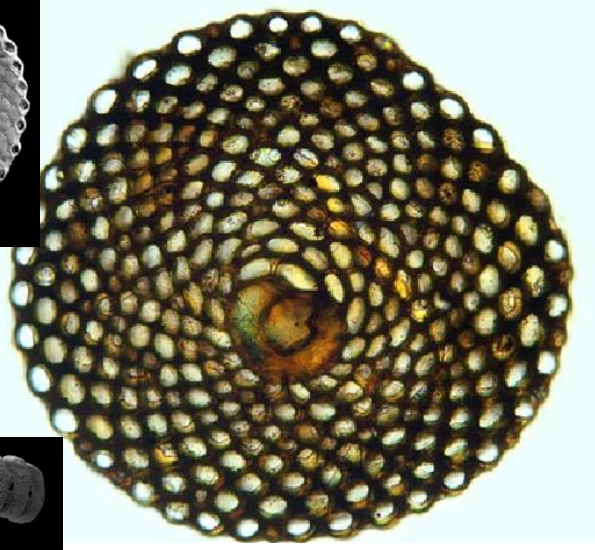
Parasorites marginalis

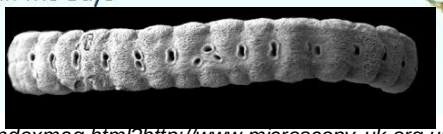
(recent example)

Collecting Foraminifera can be very rewarding. Because of their size and structure they will be 'precollected' for you by the wind.

Parasorites is a large flat ornate foram with many chambers. It is very numerous and can often be found in heaps deposited to the leeward side of low headlands within the bays of the mediterranean.







http://www.microscopy-uk.org.uk/mag/indexmag.html?http://www.microscopy-uk.org.uk/mag/artmar00/forwim.html

miliolid

?*Sorites* sp.

Peneroplis sp.

http://www.microscopy-uk.org.uk/mag/indexmag.html

?http://www.microscopy-uk.org.uk/mag/artmar00/forwim.html

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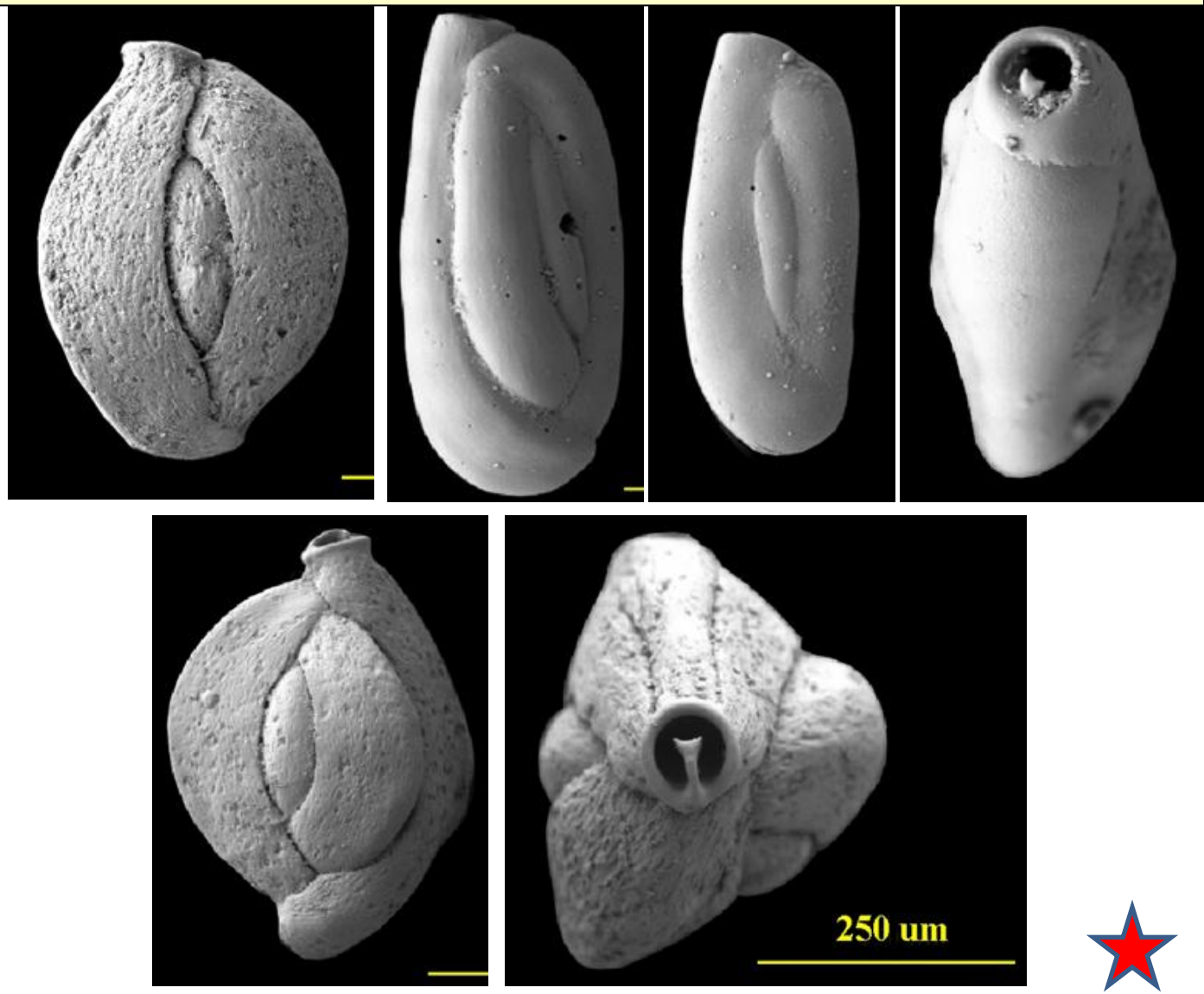
Quinqueloculina sp. Jurassic to Rec.



Suborder Miliolina

Characteristic feature: test wall (porcelaneous), Longitidunal chambers, terminal aperturte with bifid tooth

External views

http://www.marine.usf.edu/reefslab/foramcd/html_files/sm.htm

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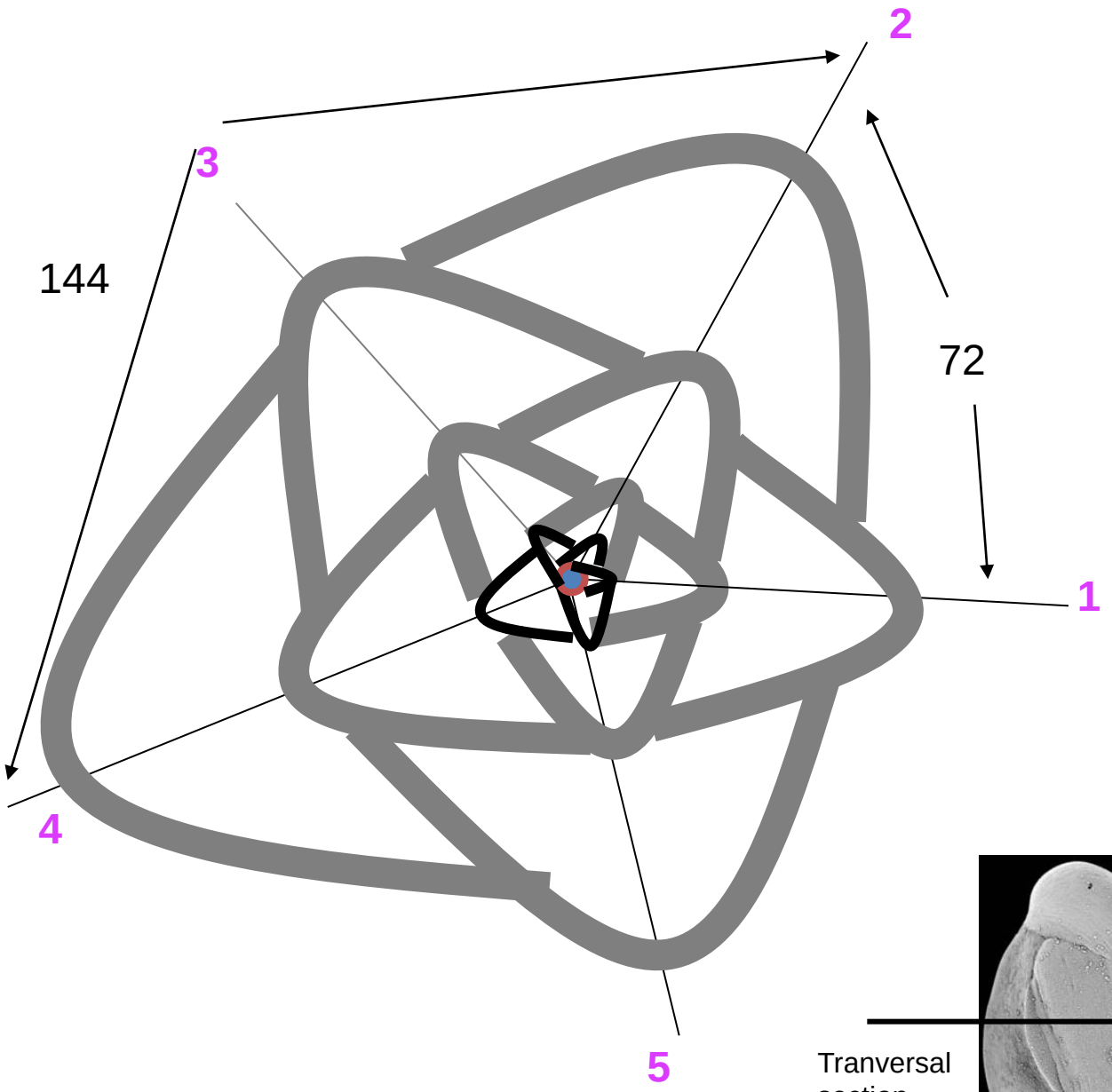
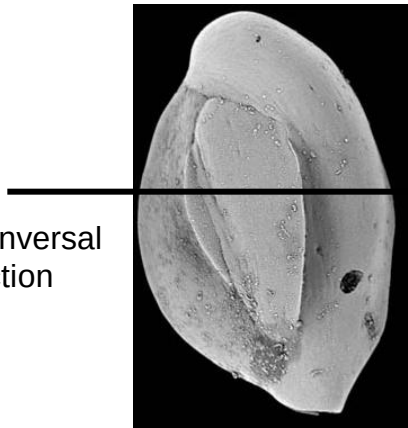
Suborder Miliolina

Quinqueloculina coiling



Drawing modified from Alkaya (Selçuk Univ.), lecture notes



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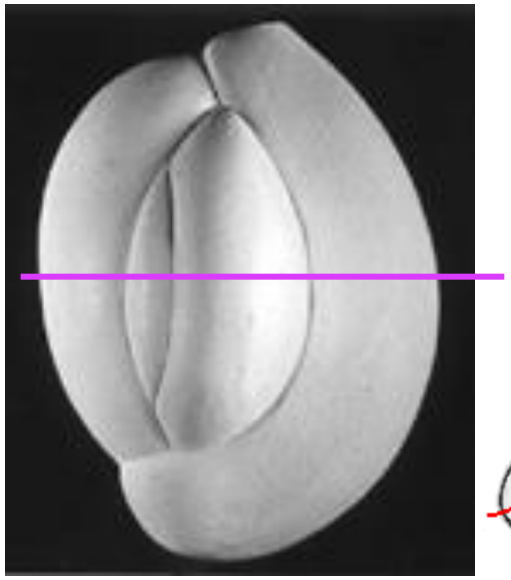
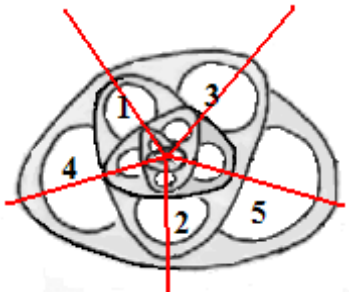
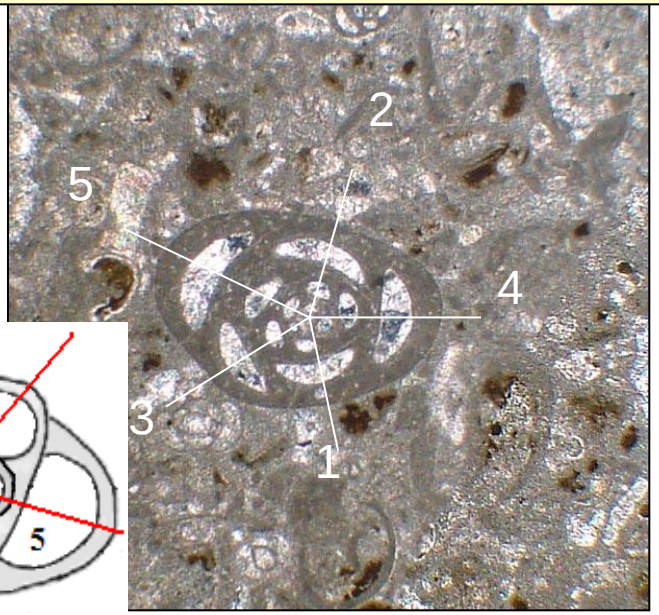
Quinqueloculina sp. Jurassic to Rec.

Suborder Miliolina

External view & transversal sections







Pictures from Alkaya (Selçuk Univ lecture notes, by forgetten scale an reference

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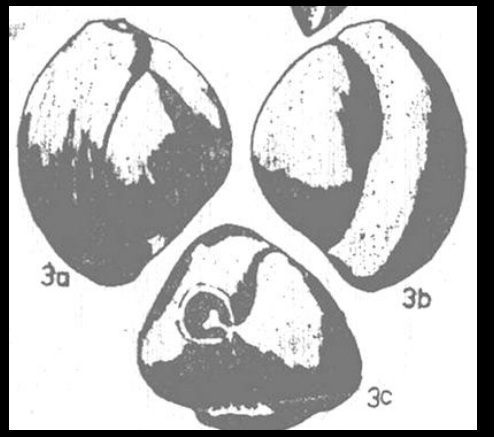
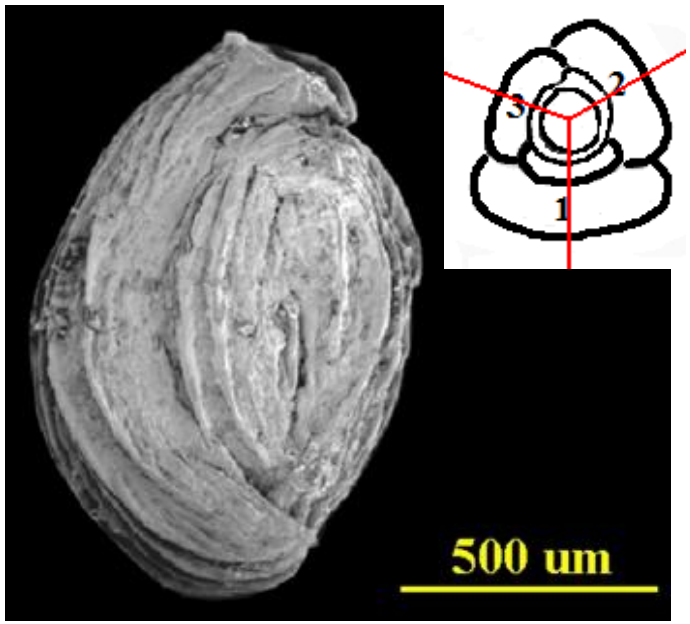
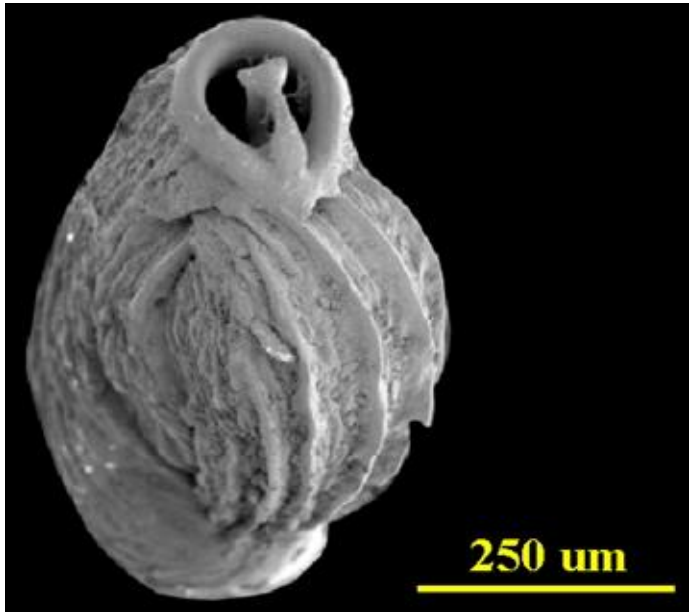
Triloculina sp. Jurassic to Recent







Suborder Miliolina

External views & transversal sections

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

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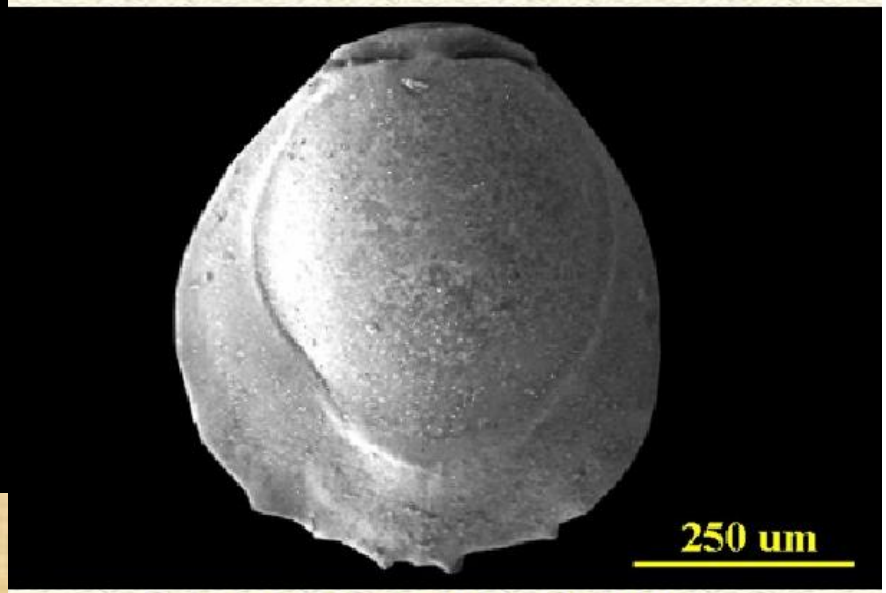
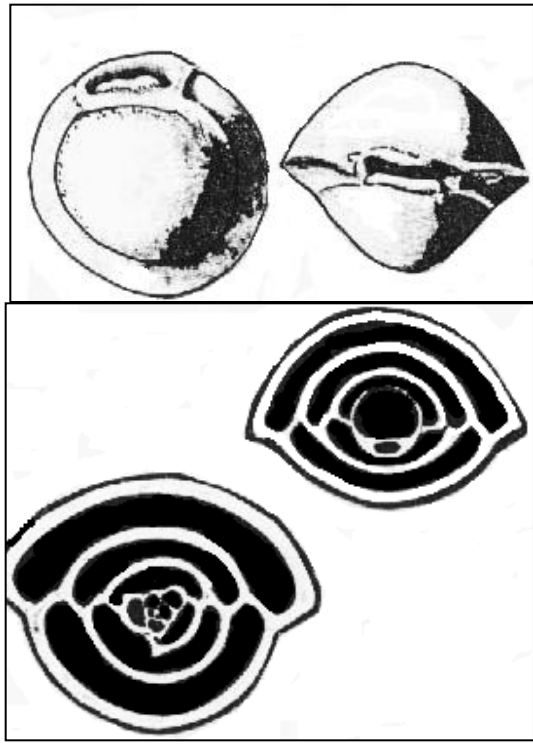
Pyrgo sp. (=Biloculina sp.) Jurassic to Rec.

Suborder Miliolina



from the Florida Keys, side view, SEM, X120



External view & transversal sections

http://www.marine.usf.edu/reefslab/foramcd/html_files/sm.htm

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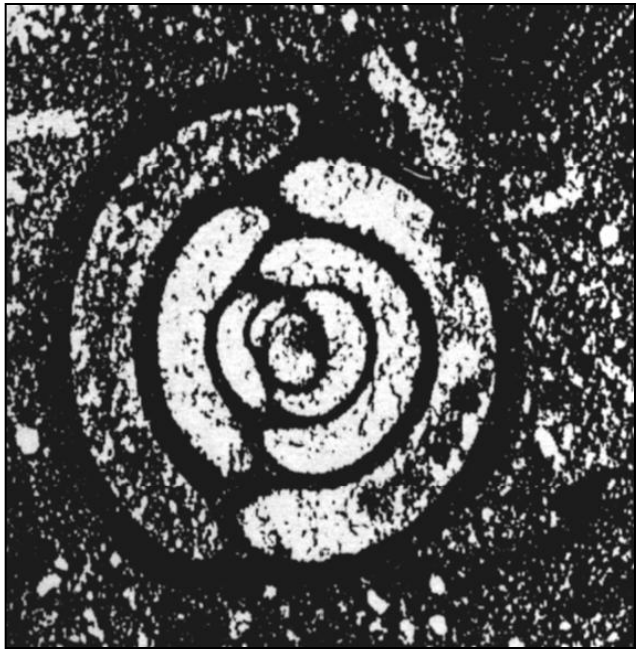
Pyrgo sp. (=Biloculina sp.) Jurassic to Rec.

Suborder Miliolina

Transversal sections

2009-13

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



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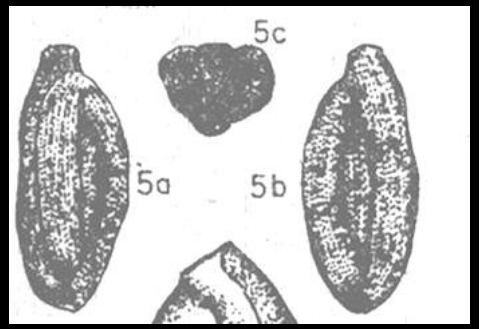
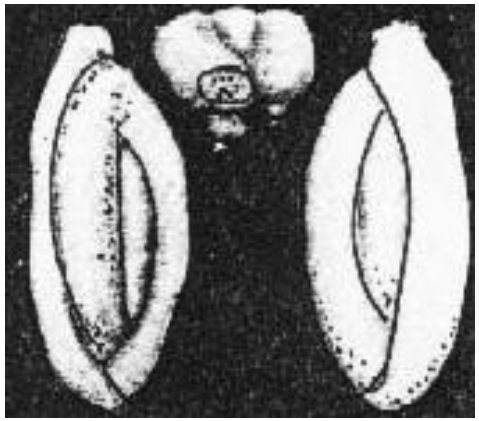
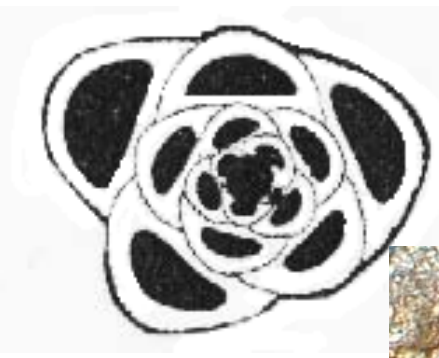
Miliola sp. Eocene







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Suborder Miliolina

External view
& transversal
Sections,
Aperture: pores

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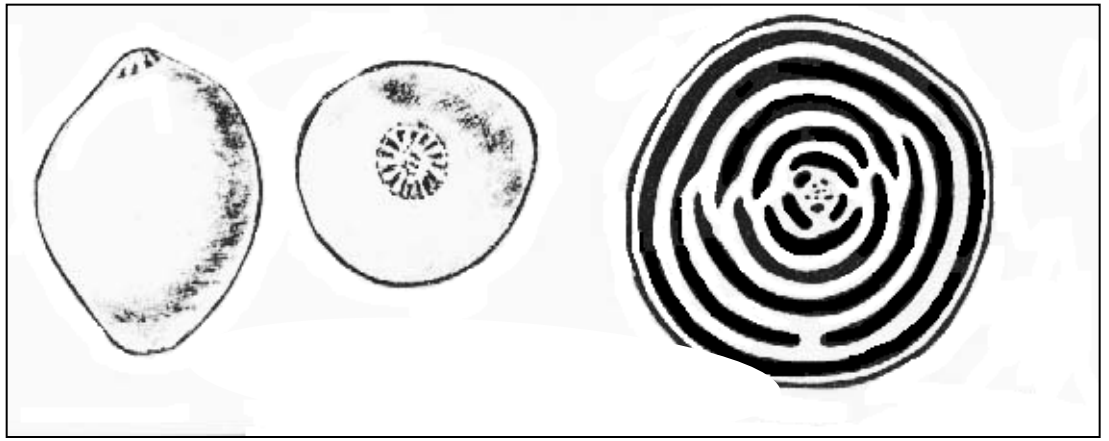
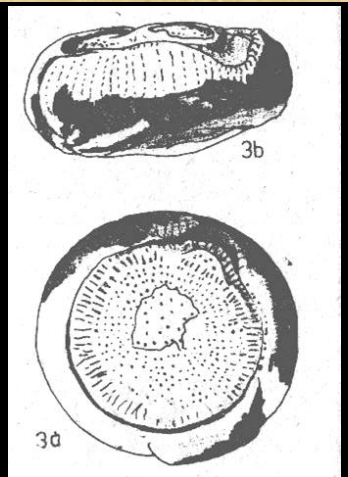
Idalina sp. Late Cretaceous

external views
& transversal
section

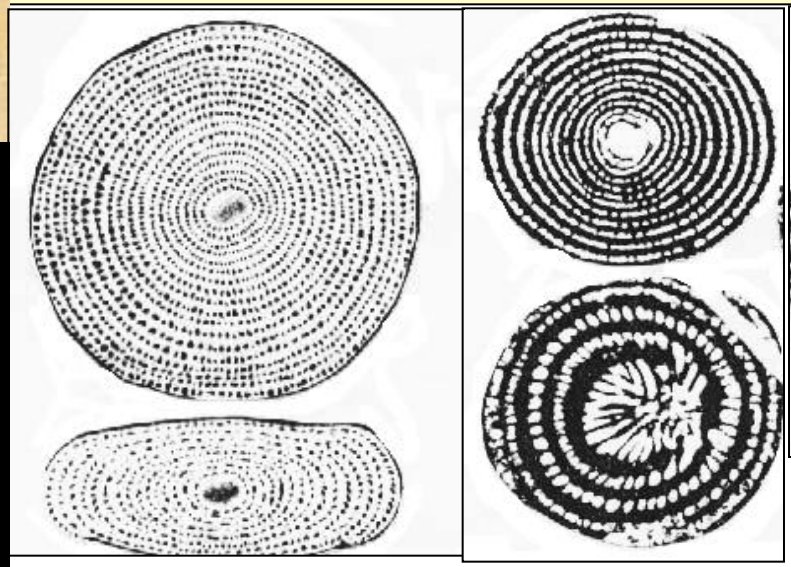


Suborder Miliolina

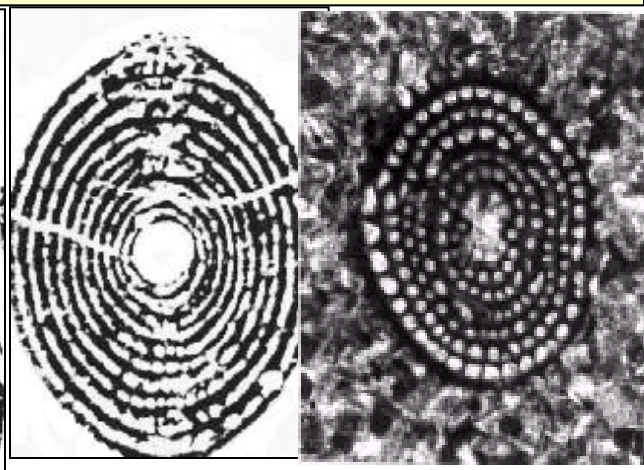
Lacazina sp. Late Cretaceous to Paleocene



external views

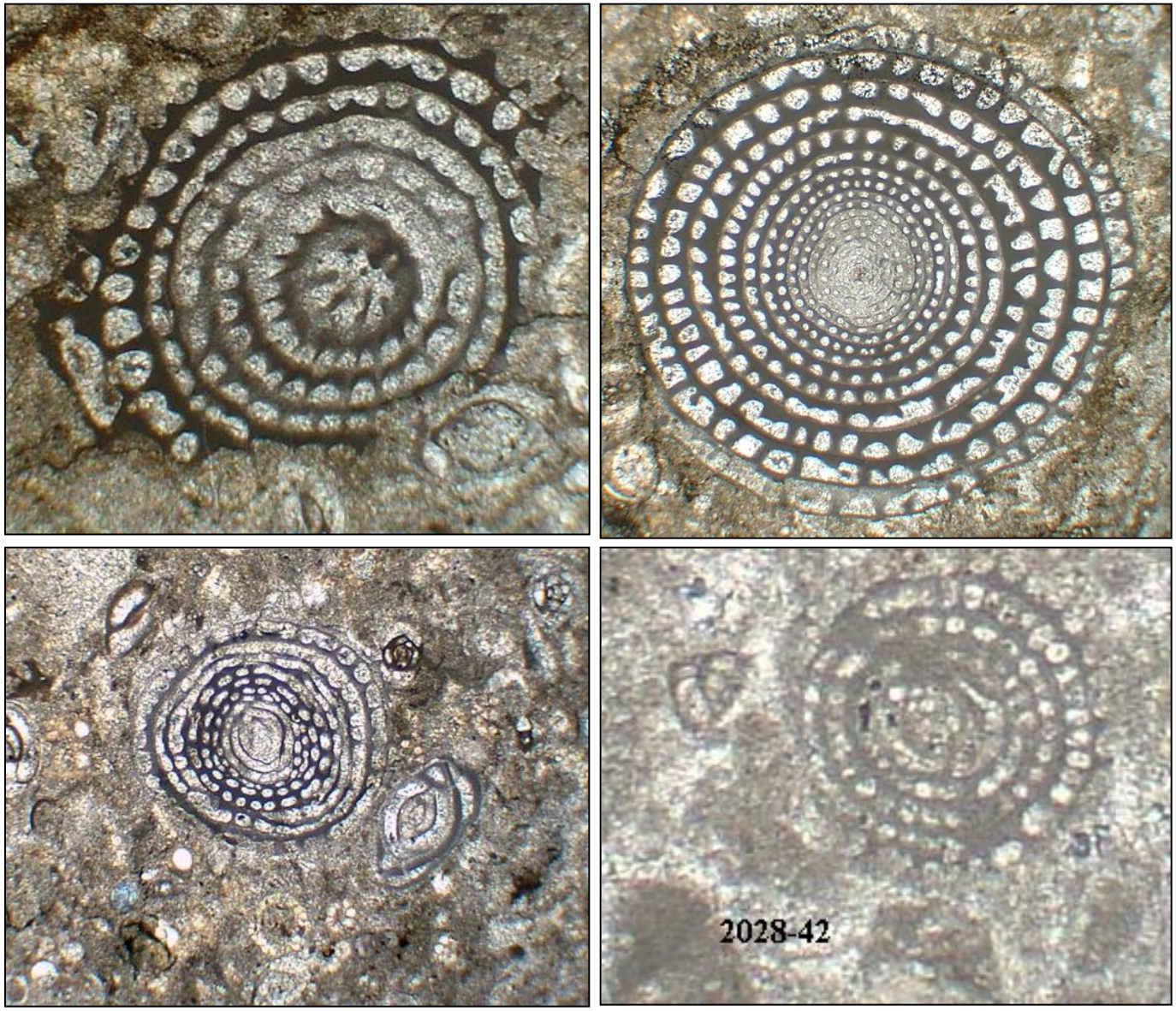


thin section views



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

Lacazina sp. Late Cretaceous to Paleocene



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

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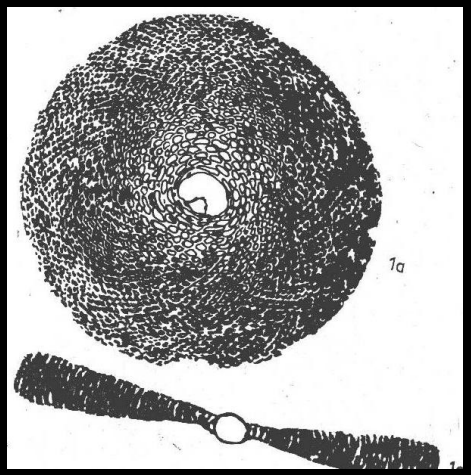
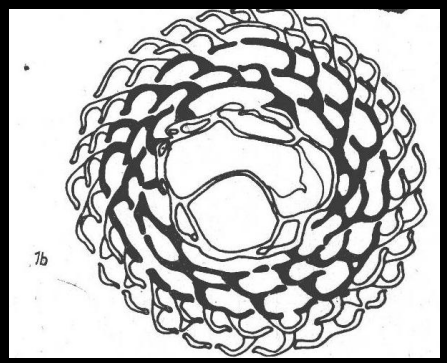
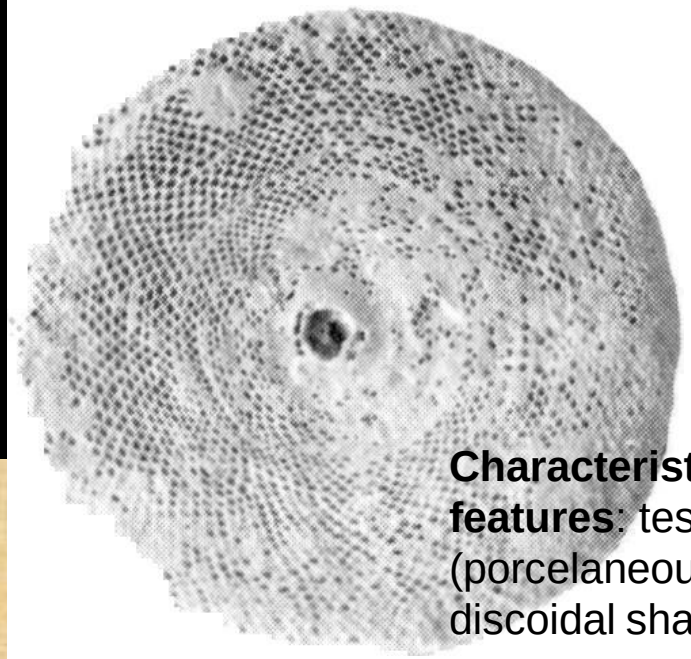


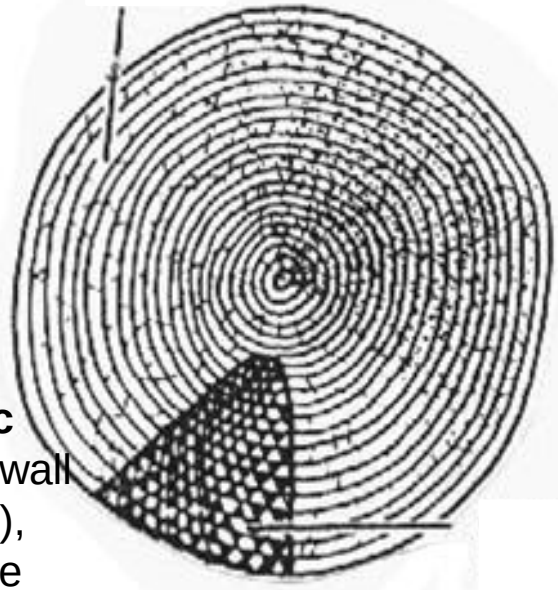
Suborder Miliolina



Pictures from Alkaya (Selçuk Univ.), lecture notes, by forgetten scale and reference, others Meriç (1985)

Orbitolites sp. Late Paleocene to Eocene



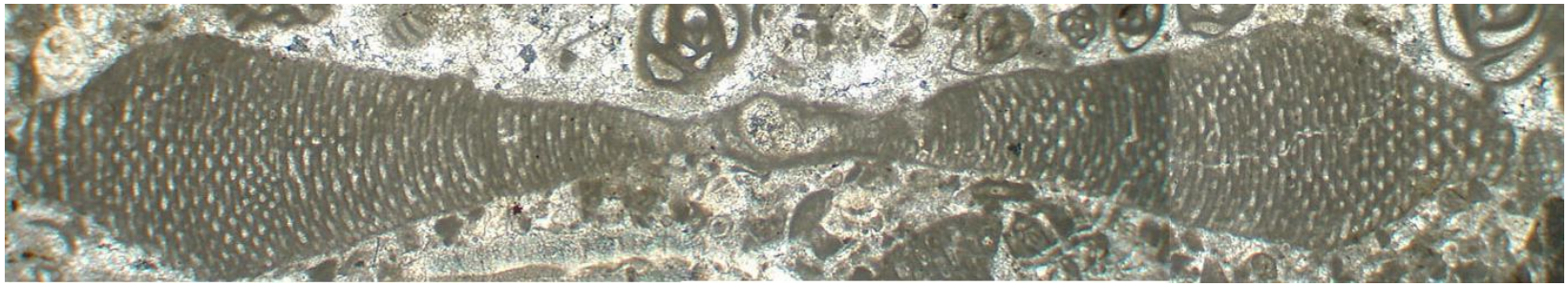


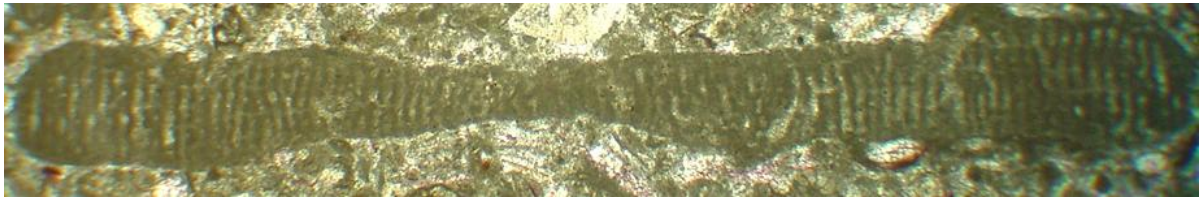
Characteristic features: test wall (porcelaneous), discoidal shape

larger foram, dimorfic

external view (a), schematic diagram showing equatorial chambers (b) and axial section (c), showing. *bow-tie shape* in axial sections

Orbitolites sp. Late Paleocene to Eocene





Axial sections

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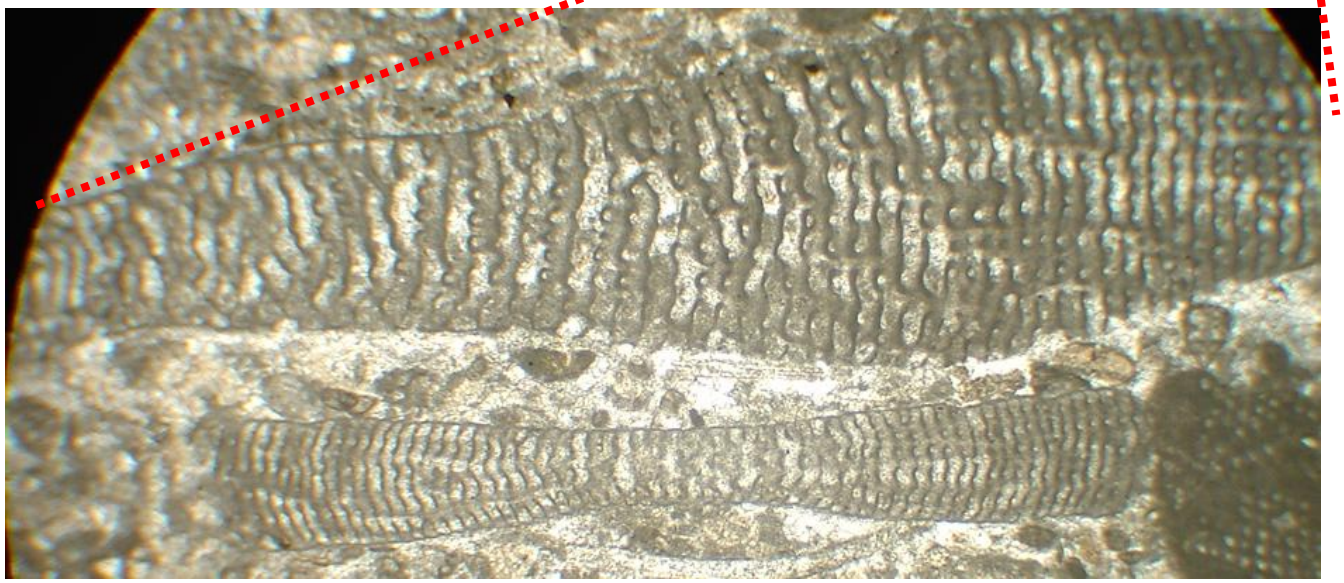
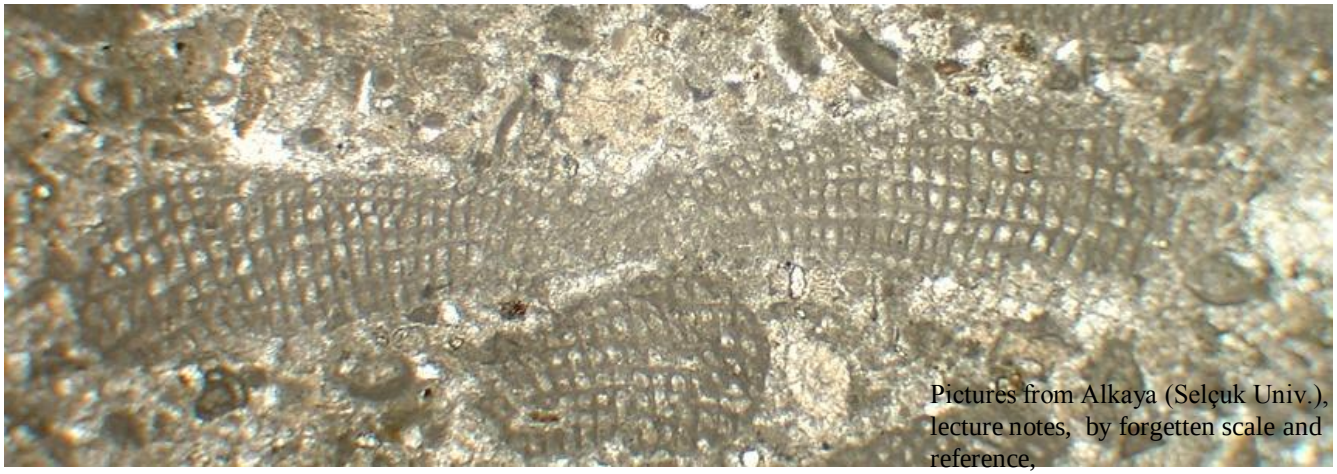
Orbitolites sp. Late Paleocene to Eocene

Suborder Miliolina





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

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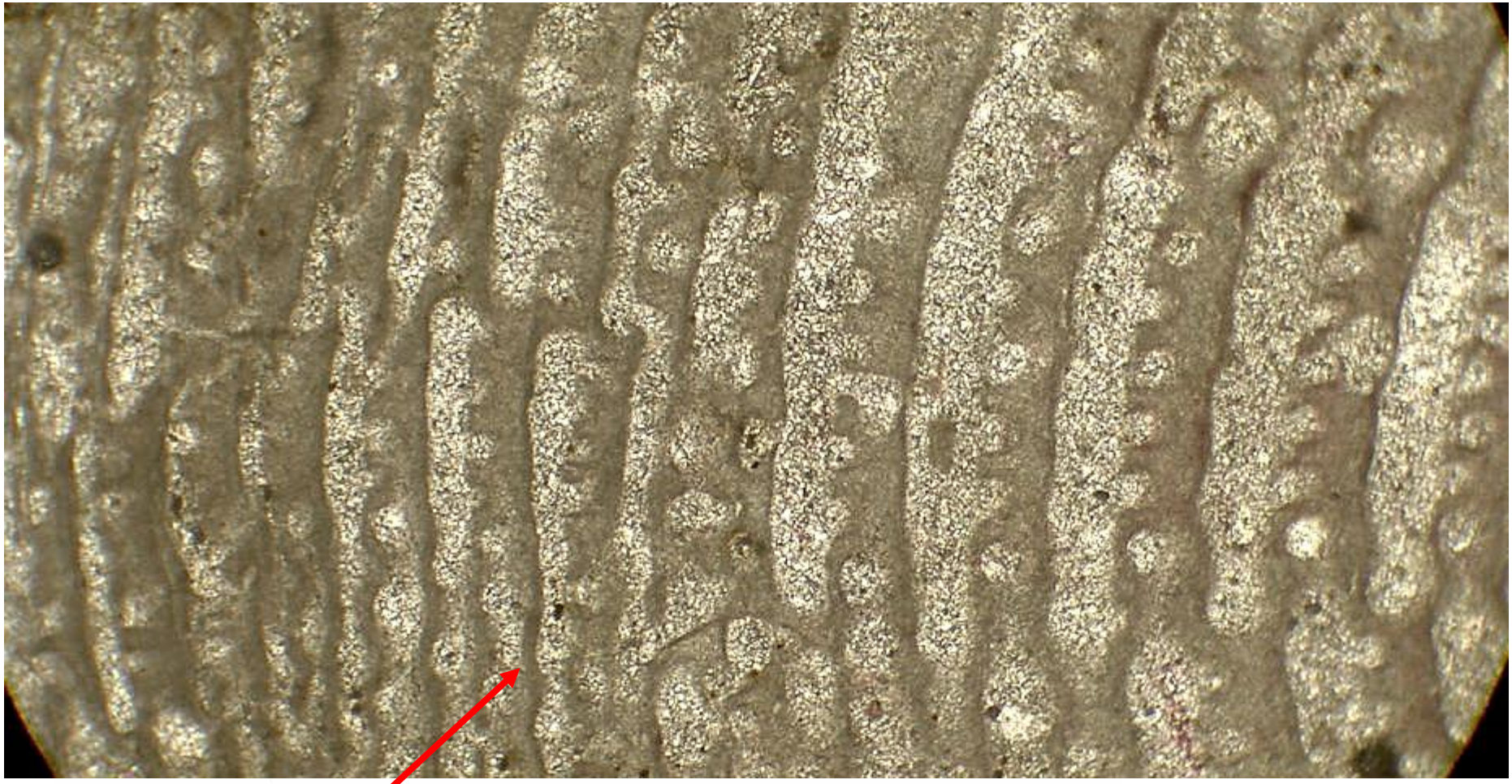
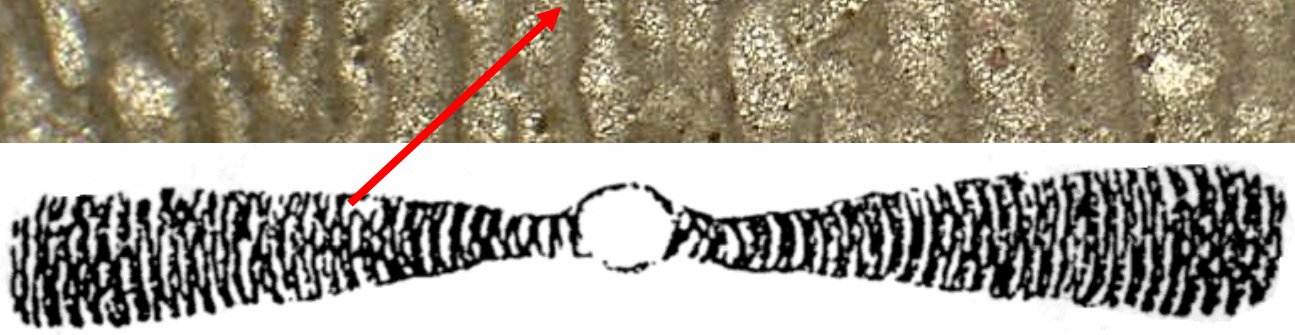
Orbitolites sp. Late Paleocene to Eocene

Wall structure details

thin section, polarized view





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

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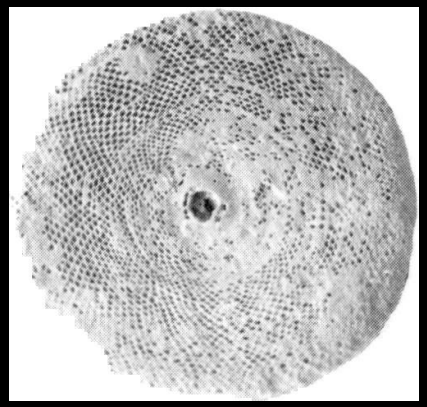
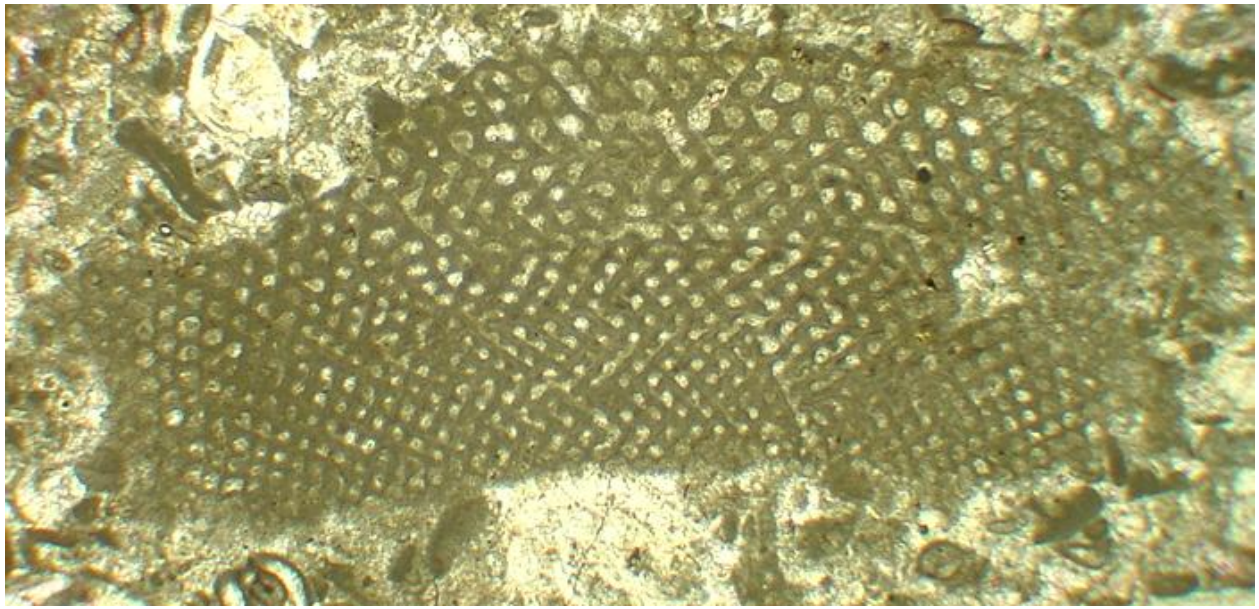
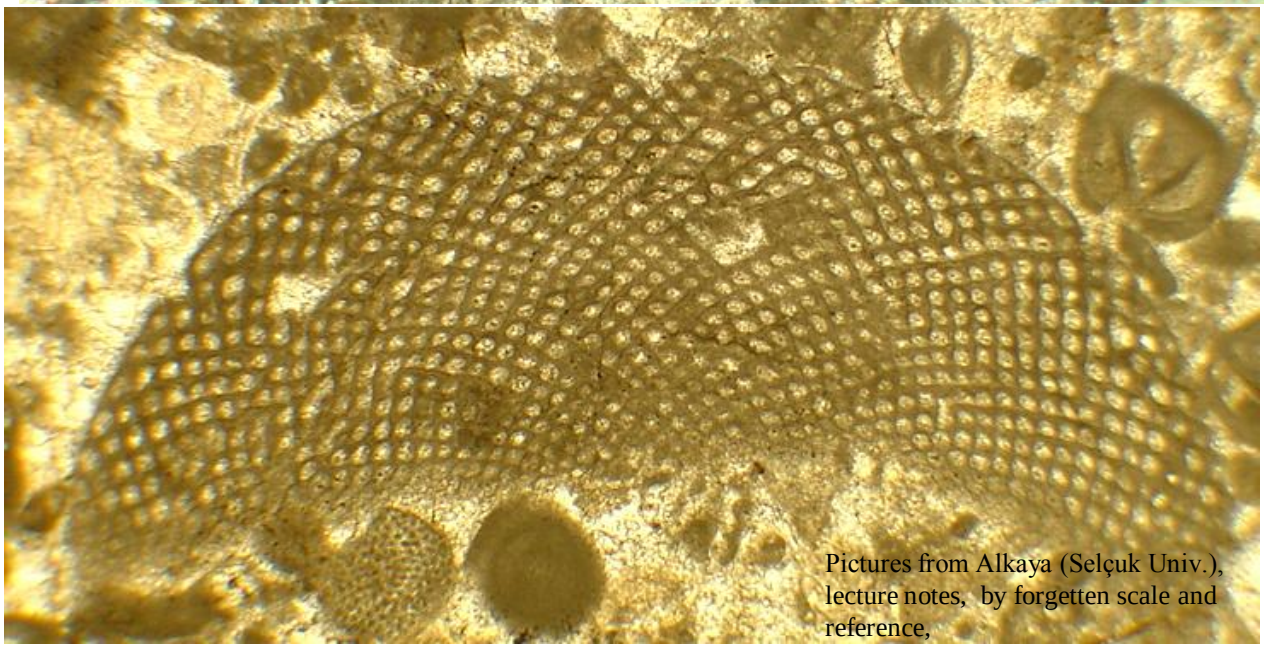
Orbitolites sp. Late Paleocene to Eocene



Suborder Miliolina

Equatorial sections showing a part of equatorial chamberlets





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

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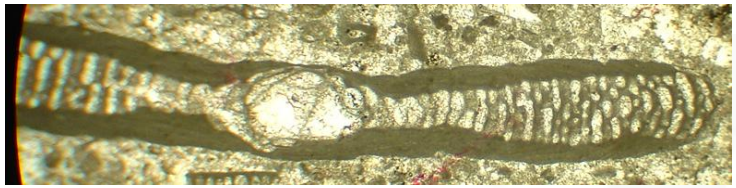
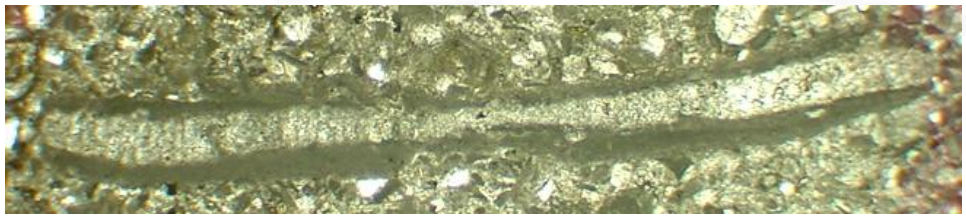
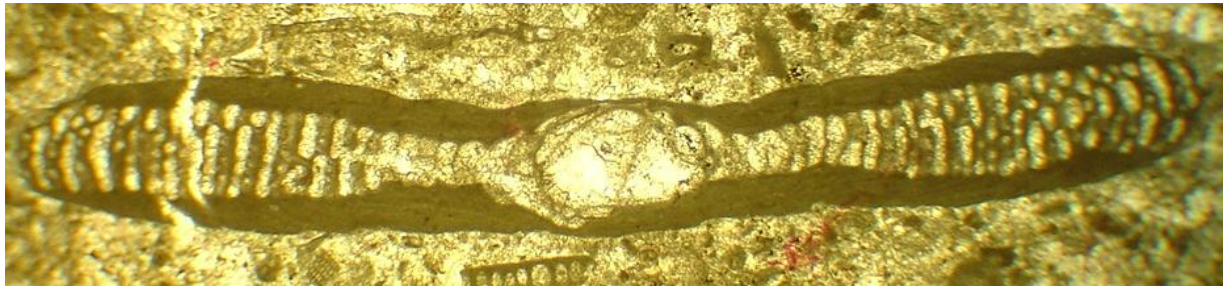
Opertorbitolites sp. Early Eocene







Suborder Miliolina

Characteristic features: test wall (porcelaneous), discoidal shape
Both sides of equatorial chamberlets include calcite accumulation

larger foram, dimorfic

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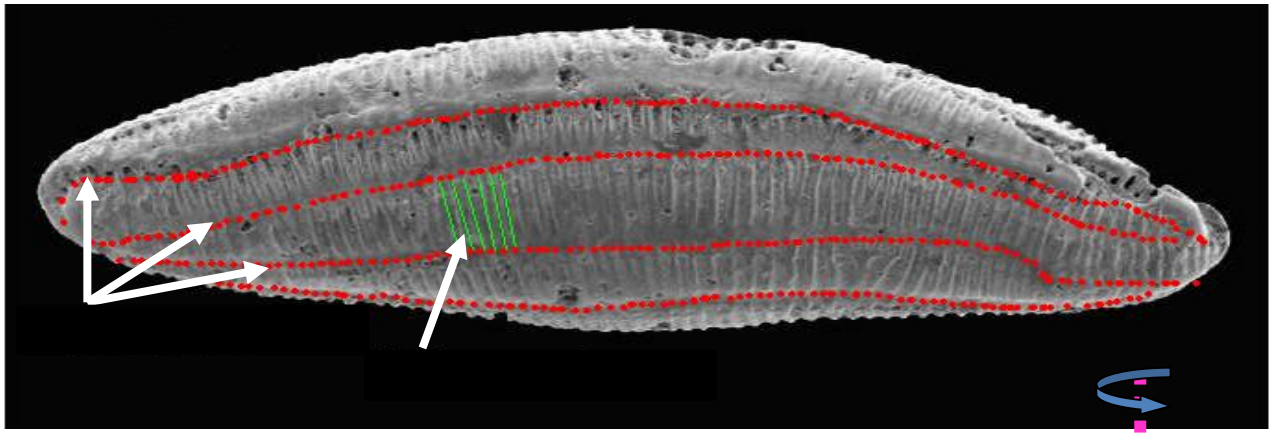
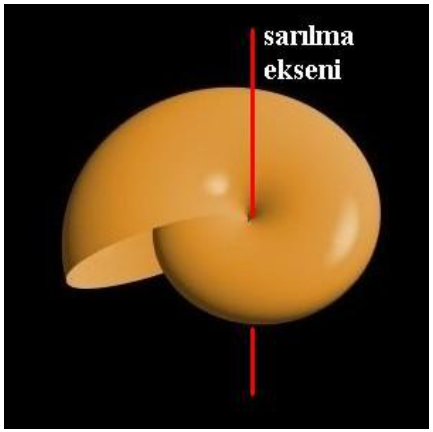
Alveolina sp. Late Paleocene to Eocene

External view
Red ones show septa
Green ones show septula

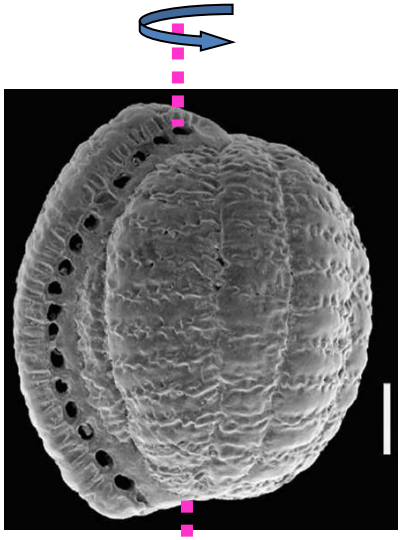


Suborder Miliolina

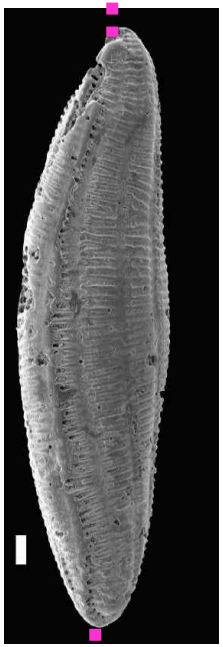
Various coilings views showing coil axis



Planspiral, involute



planspiral, involute
globular



planspiral, involute
fusiform

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

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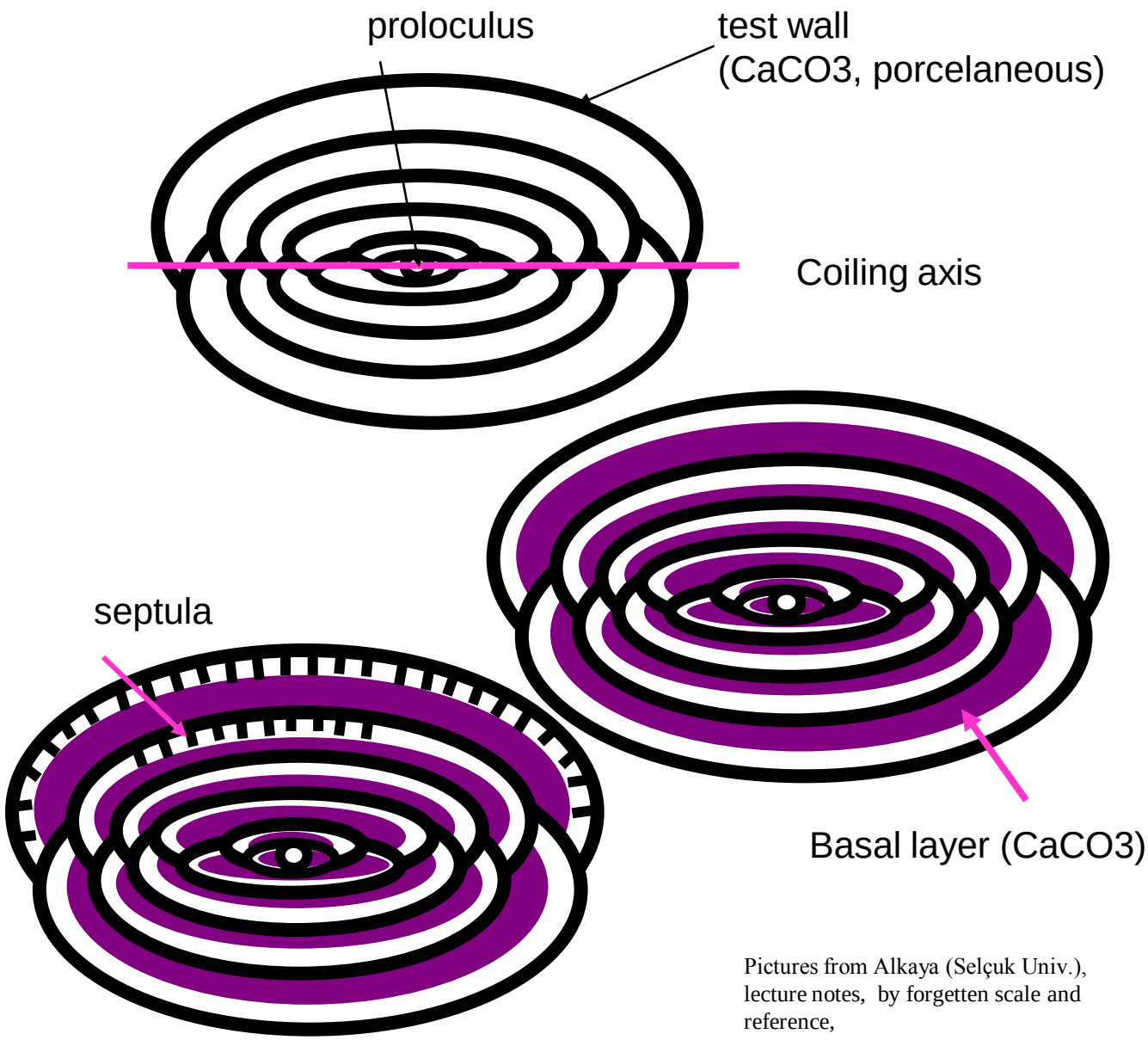
Alveolina sp. Late Paleocene to Eocene

Suborder Miliolina

Various coilings views showing coil axis



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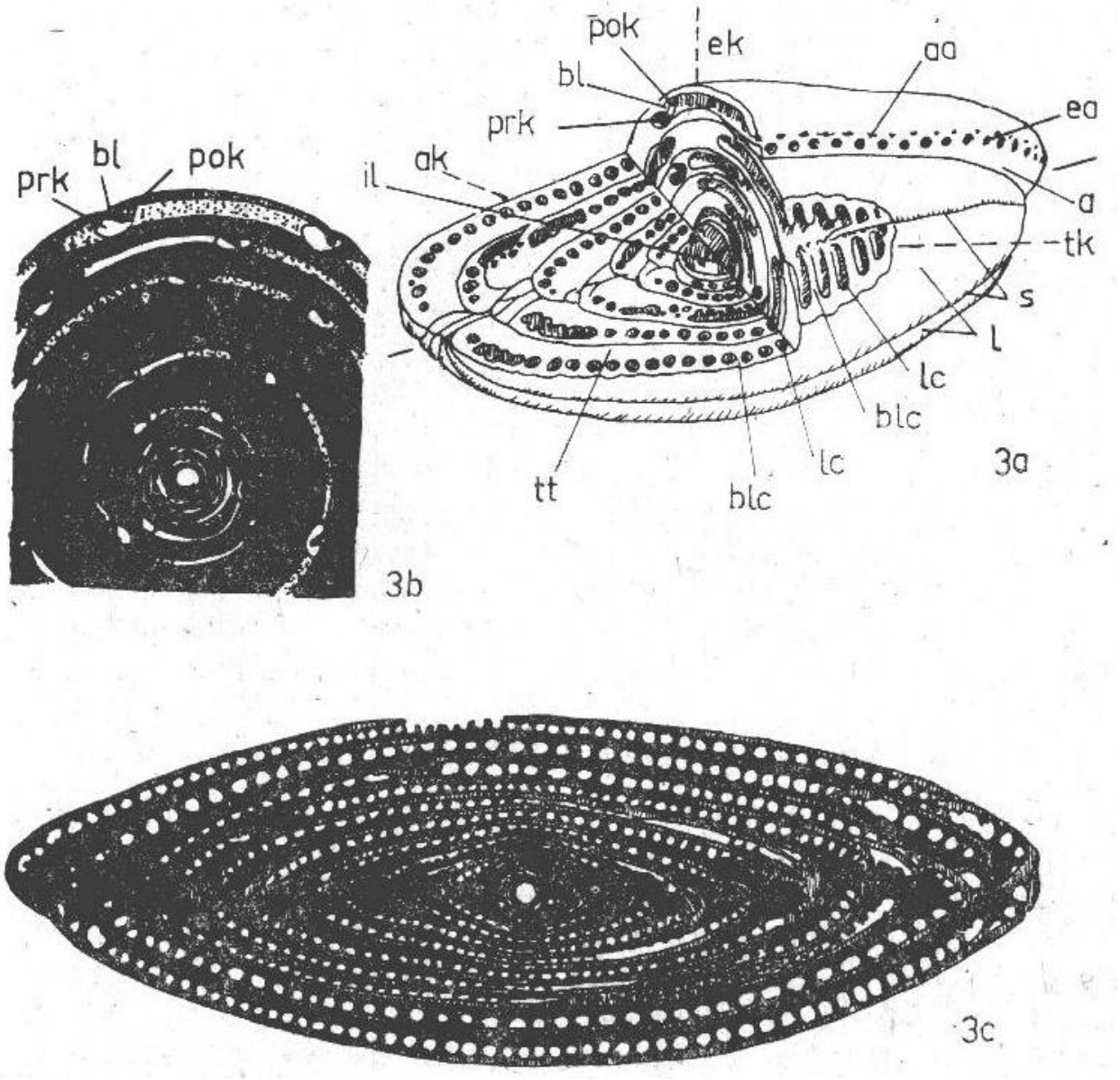
Alveolina sp. Late Paleocene to Eocene



İl: proloculus, ek: equatorial section, ak: axial section, tk: tangential section, sa: coiling axis, aa: auxiliary openings, ea: main apertures, ay: opening surface, s: septal lines, l: chambers, lc: chamberlets, bl: septa, blc: septula, tt: basal layer, prk: preseptal opening, pok: postseptal opening

Meriç (1985)

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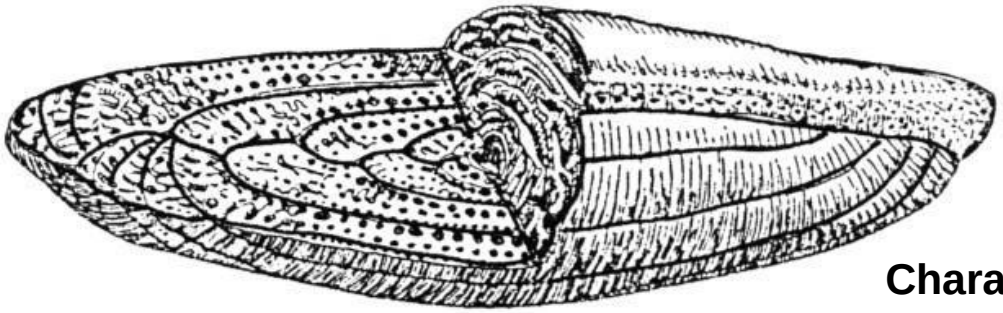
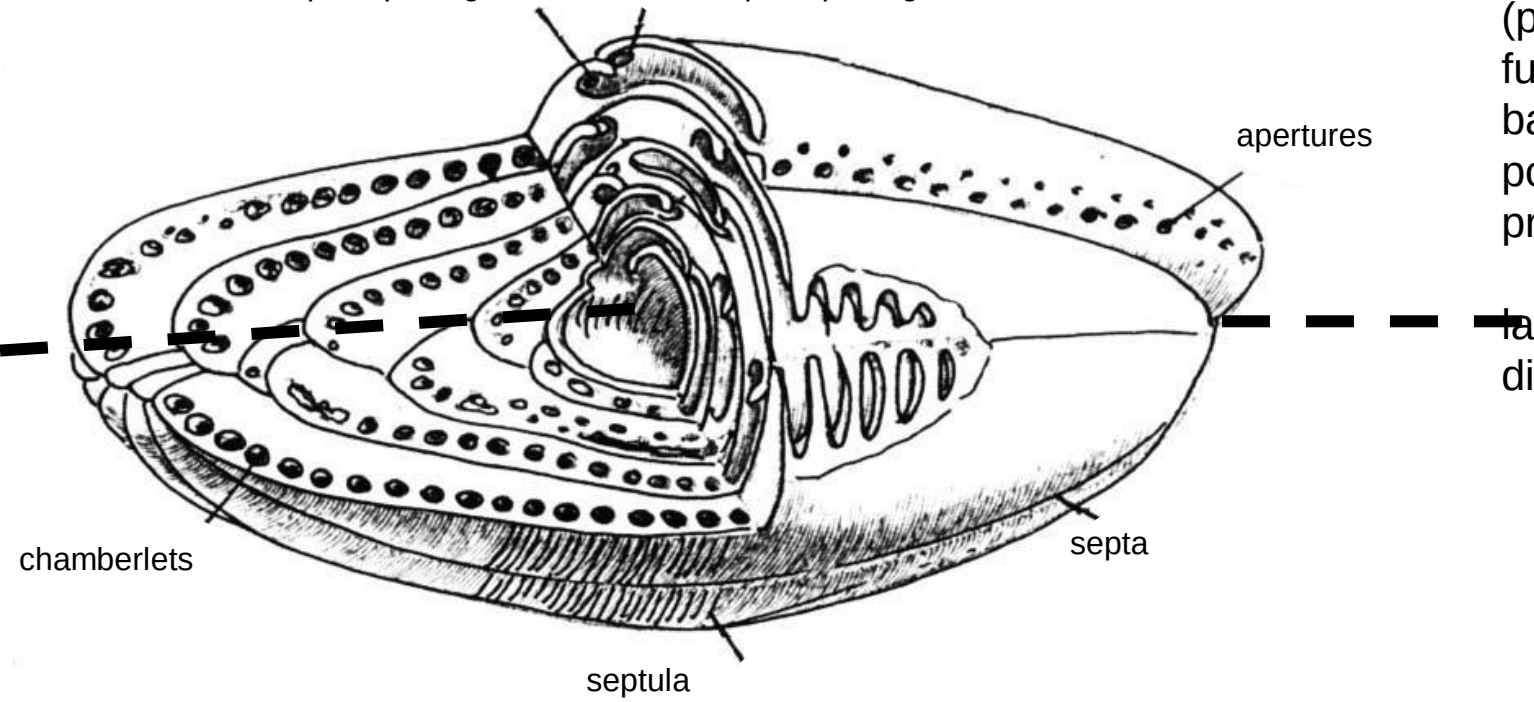
Lecture 4

Alveolina sp. Late Paleocene to Eocene

External features:
- Test shape
- Ornement
- Apertures

Internal features
- Whorling
- Septa/Septula
- Wall
- etc.





Characteristic features: test wall (porcelaneous), fusiform shape basal layer, postseptal opening preseptal opening

larger foram, dimorfic,

Drawings from Alkaya (Selçuk Univ.), lecture notes,

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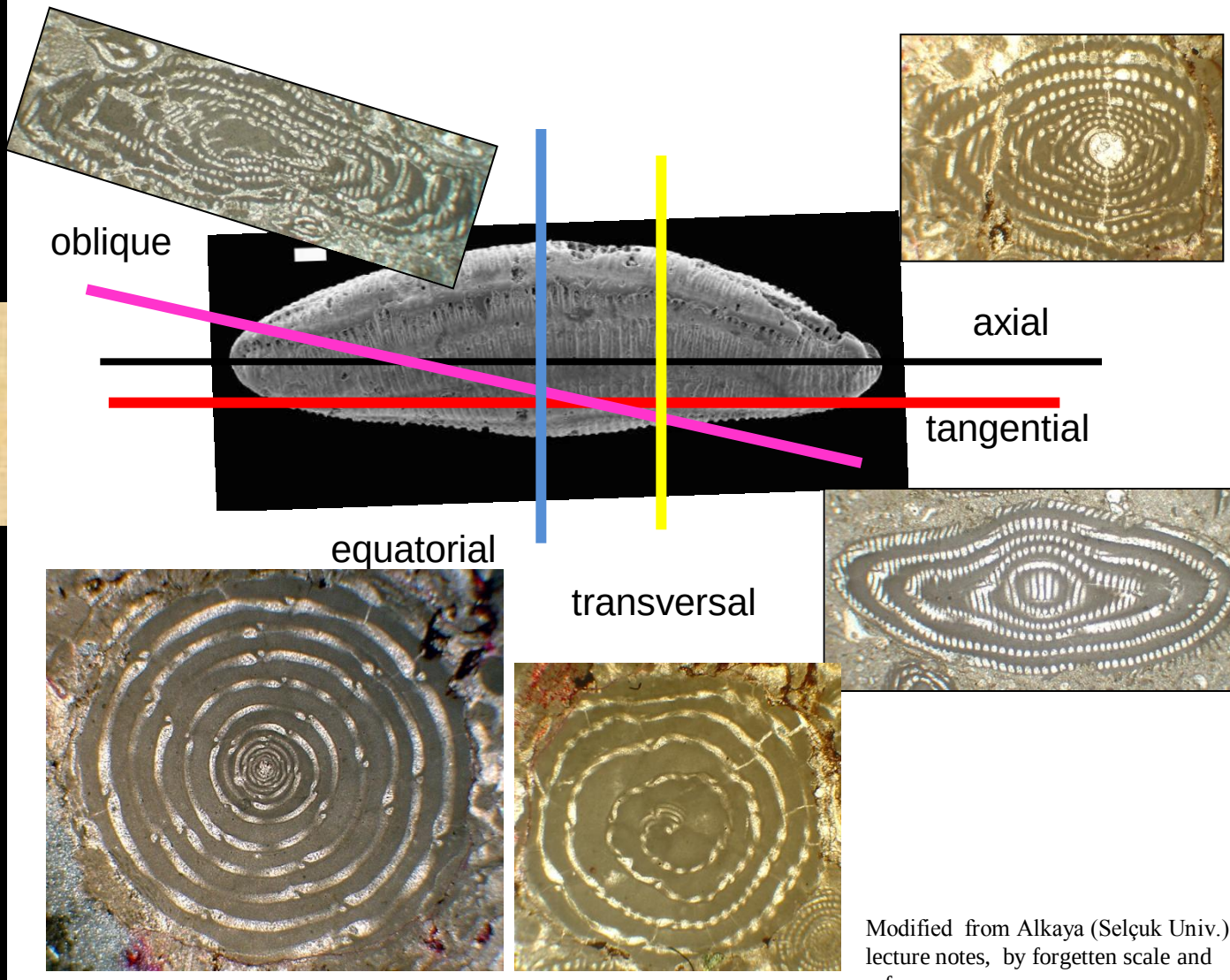
Alveolina sp. Late Paleocene to Eocene

Suborder Miliolina

Section types



Modified from Alkaya (Selçuk Univ.), lecture notes, by forgetten scale and reference,

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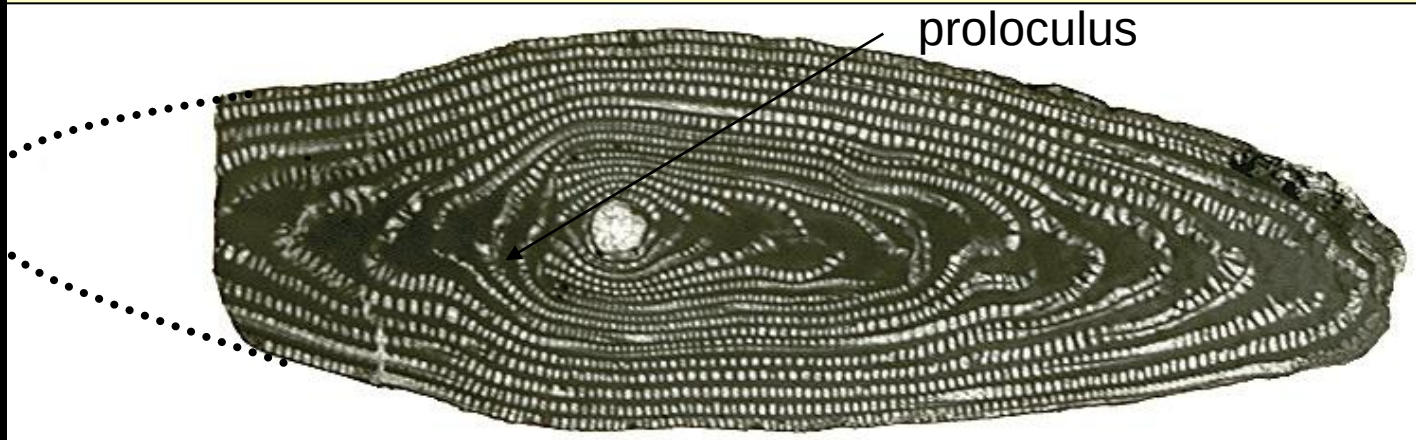
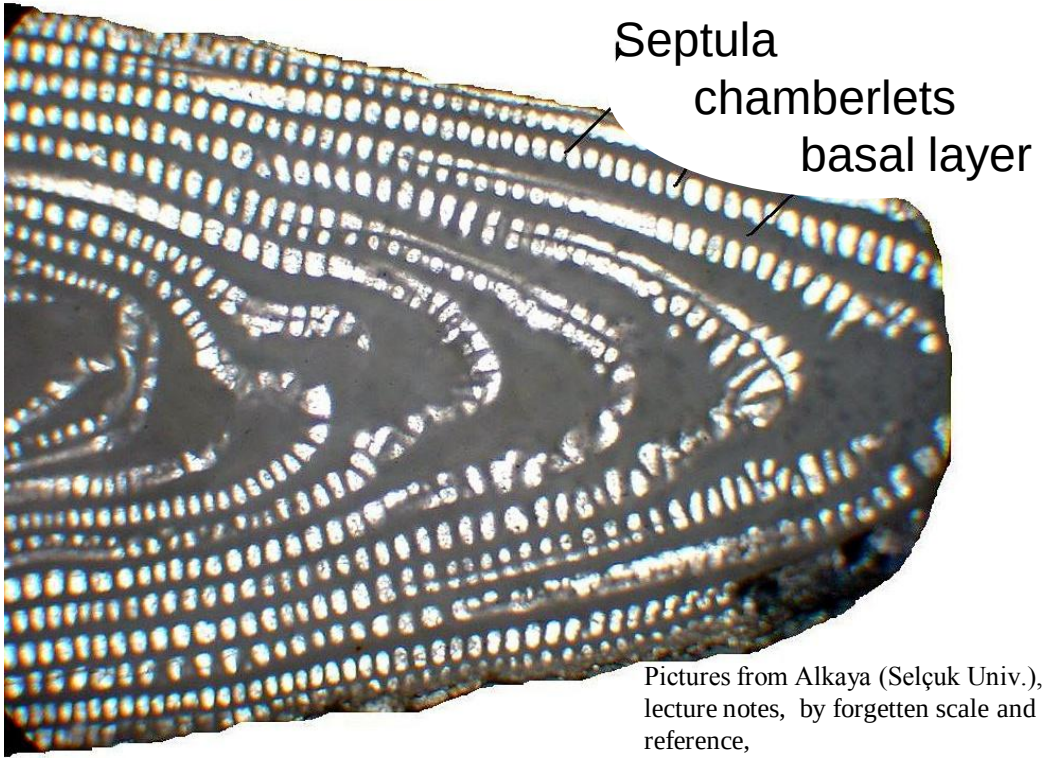
Alveolina sp. Late Paleocene to Eocene



Suborder Miliolina



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

Axial sections

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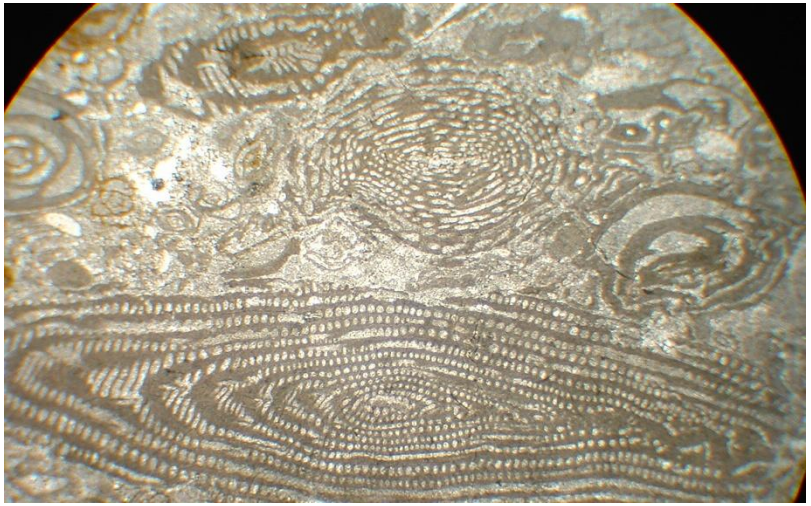
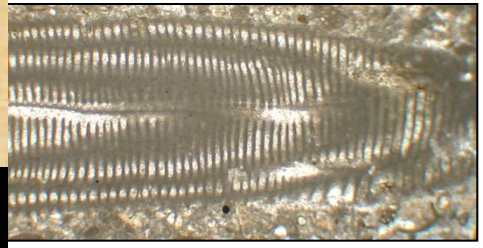
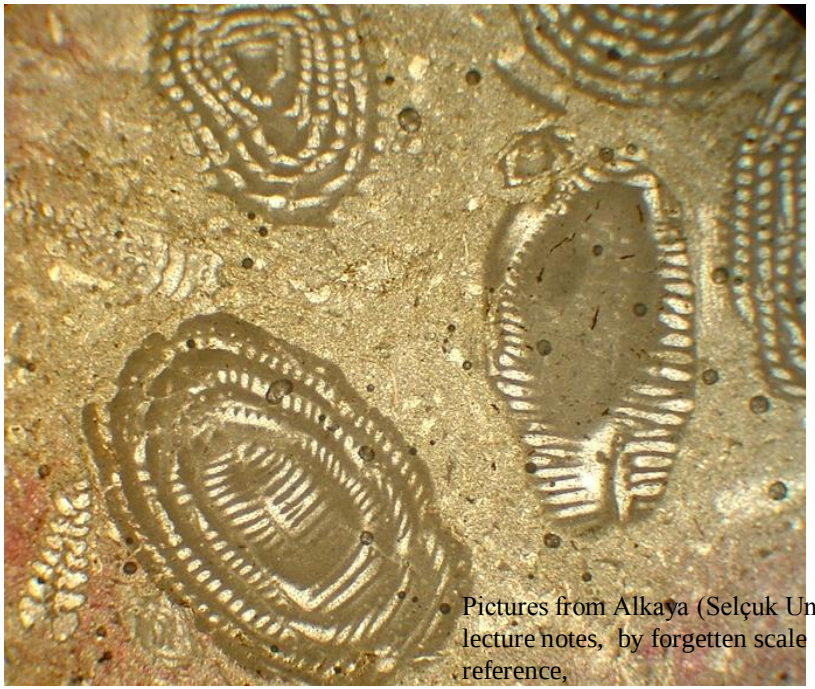
Alveolina sp. Late Paleocene to Eocene







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

Suborder Miliolina

Various sections

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Alveolina sp. Late Paleocene to Eocene

Suborder Miliolina

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

Equatorial section

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Alveolina sp. Late Paleocene to Eocene

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Suborder Miliolina

preseptal opening (channel) means that it was formed before septa, post later

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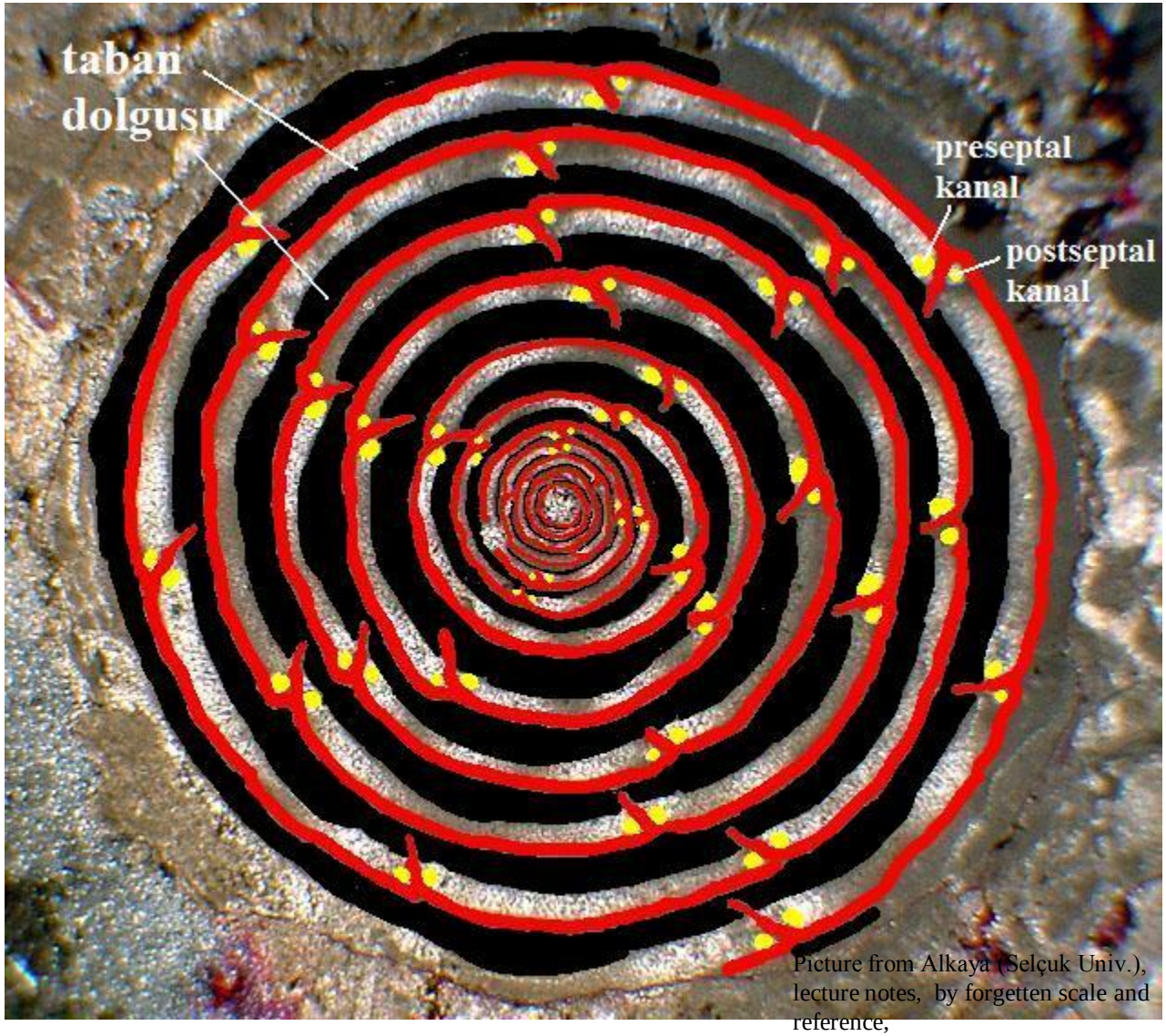
Alveolina sp. Late Paleocene to Eocene

Suborder Miliolina

Equatorial section
İncluding
based layer
(dark coloured)



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

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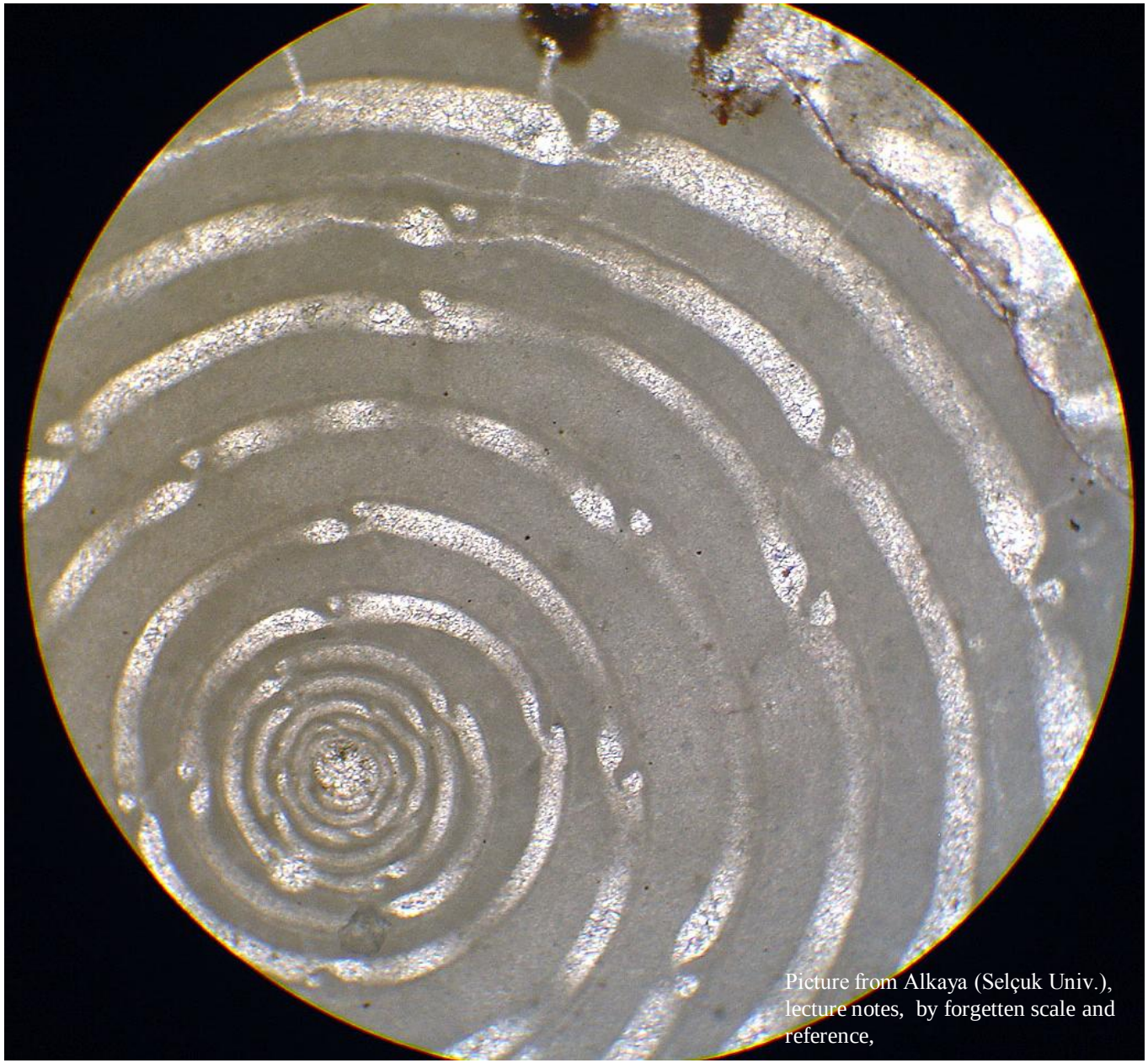
Alveolina sp. Late Paleocene to Eocene

Suborder Miliolina

Please note
pre and post septal
openings



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

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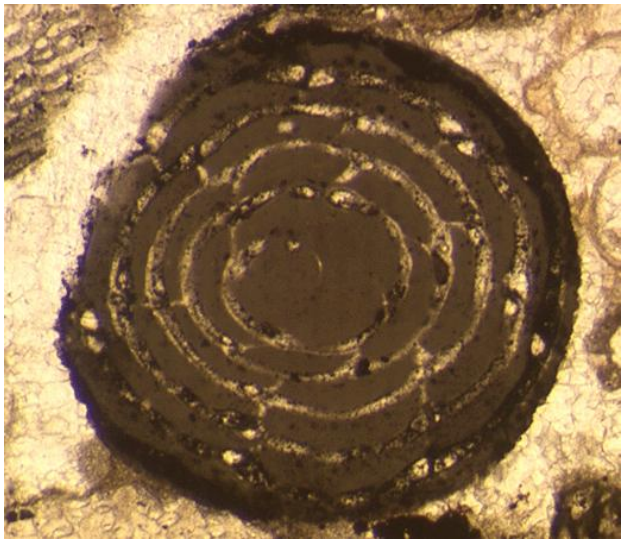
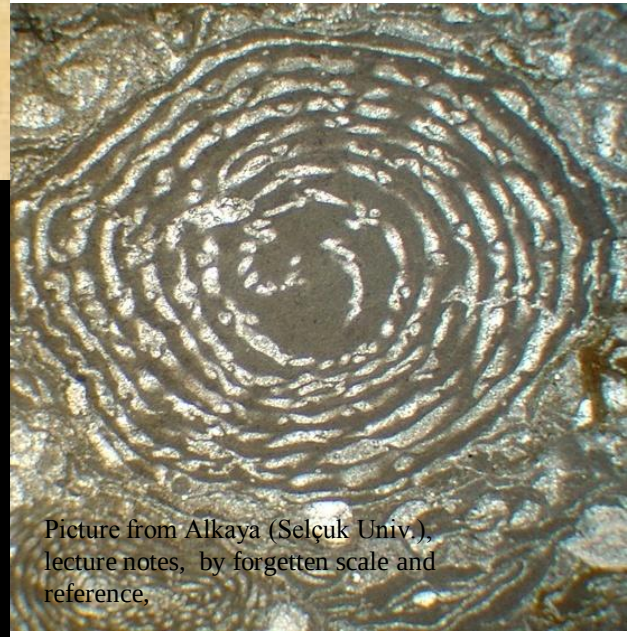
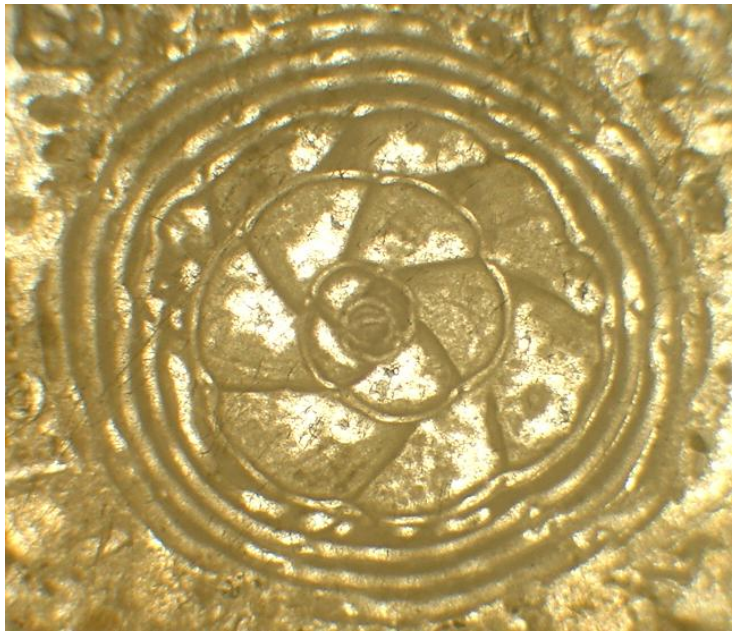
Alveolina sp. Late Paleocene to Eocene

Suborder Miliolina





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



Different thin section views

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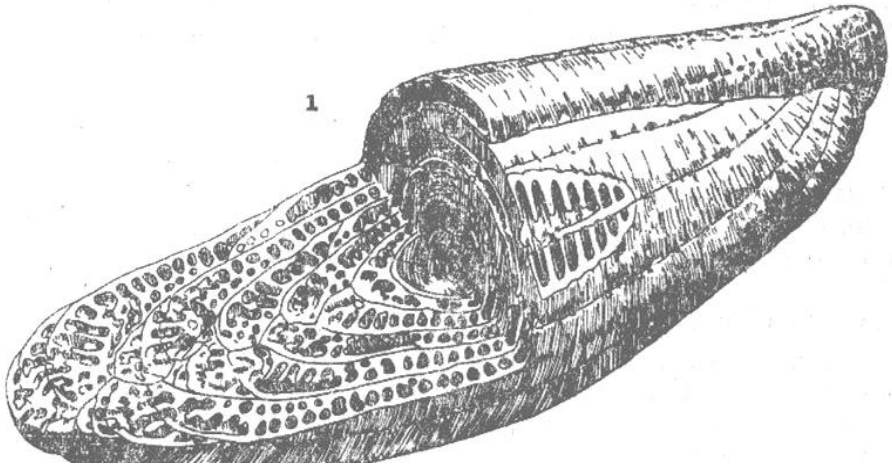
Praealveolina sp. Cretaceous(Alb.-Cen.)

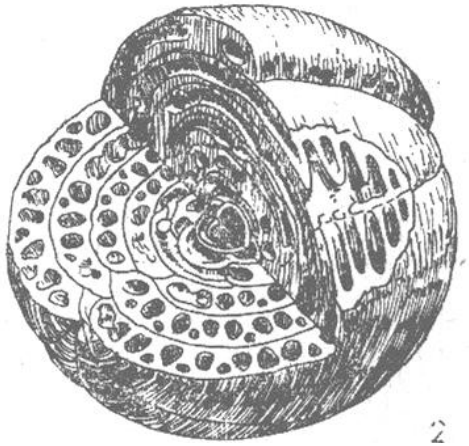


External features:
- Test shape
- Ornement
- Apertures

Internal features
- Whorling
- Septa/Septula
- Wall
- etc.

Suborder Miliolina

Borelis (=Neoalveolina) sp.
Late Eocene to Recent



Meriç (1985)

Please note
pre and post septal
openings

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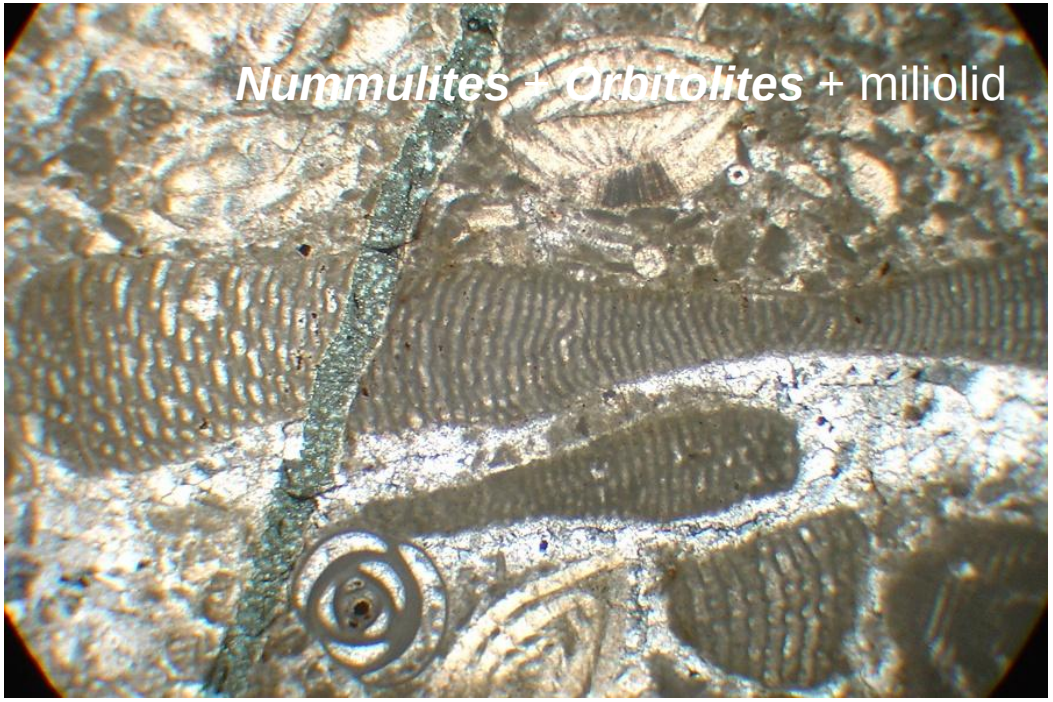
Suborder Miliolina



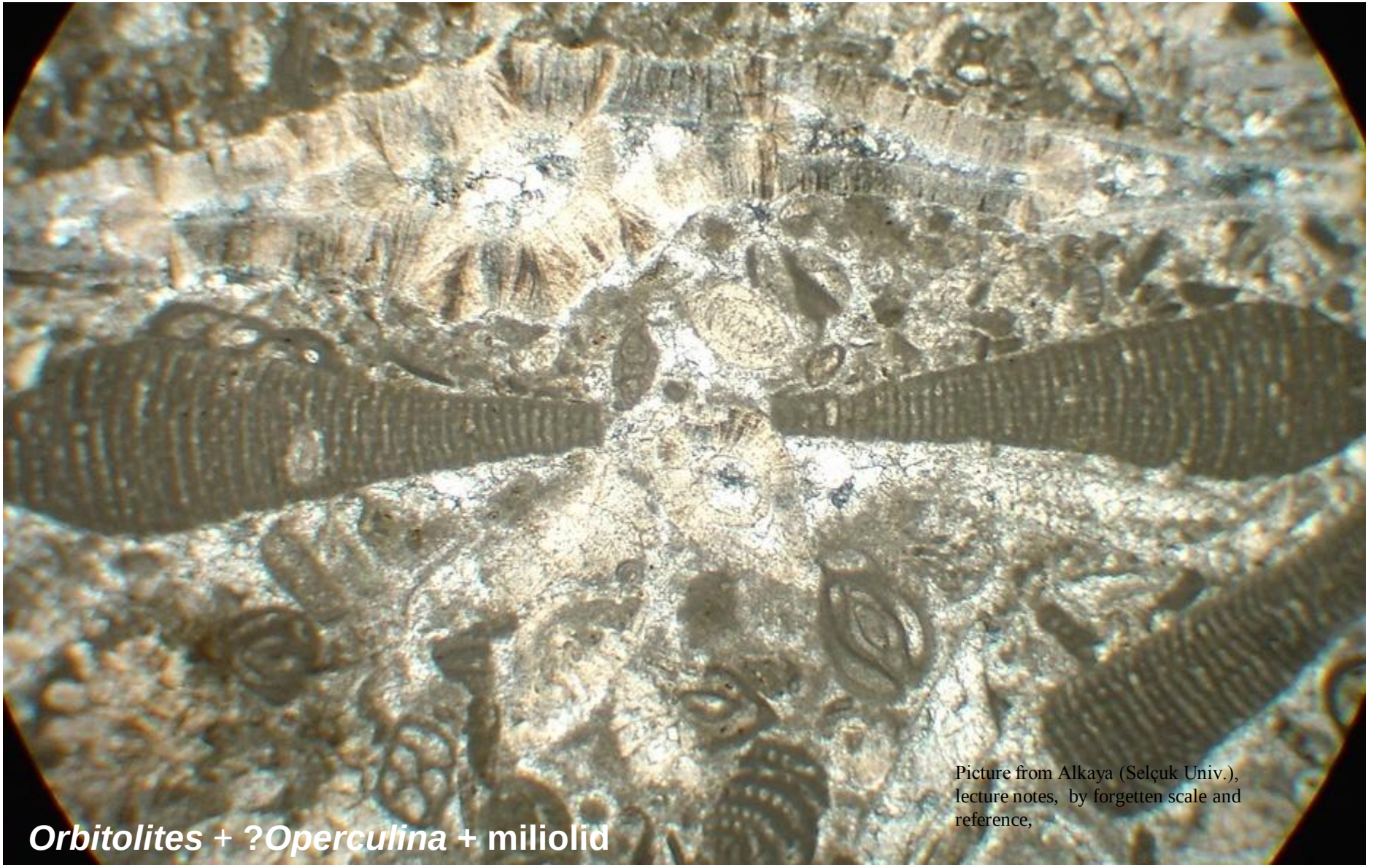
Picture from Alkaya (Selçuk Univ.), lecture notes, by forgetten scale and reference,

Thin section views

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

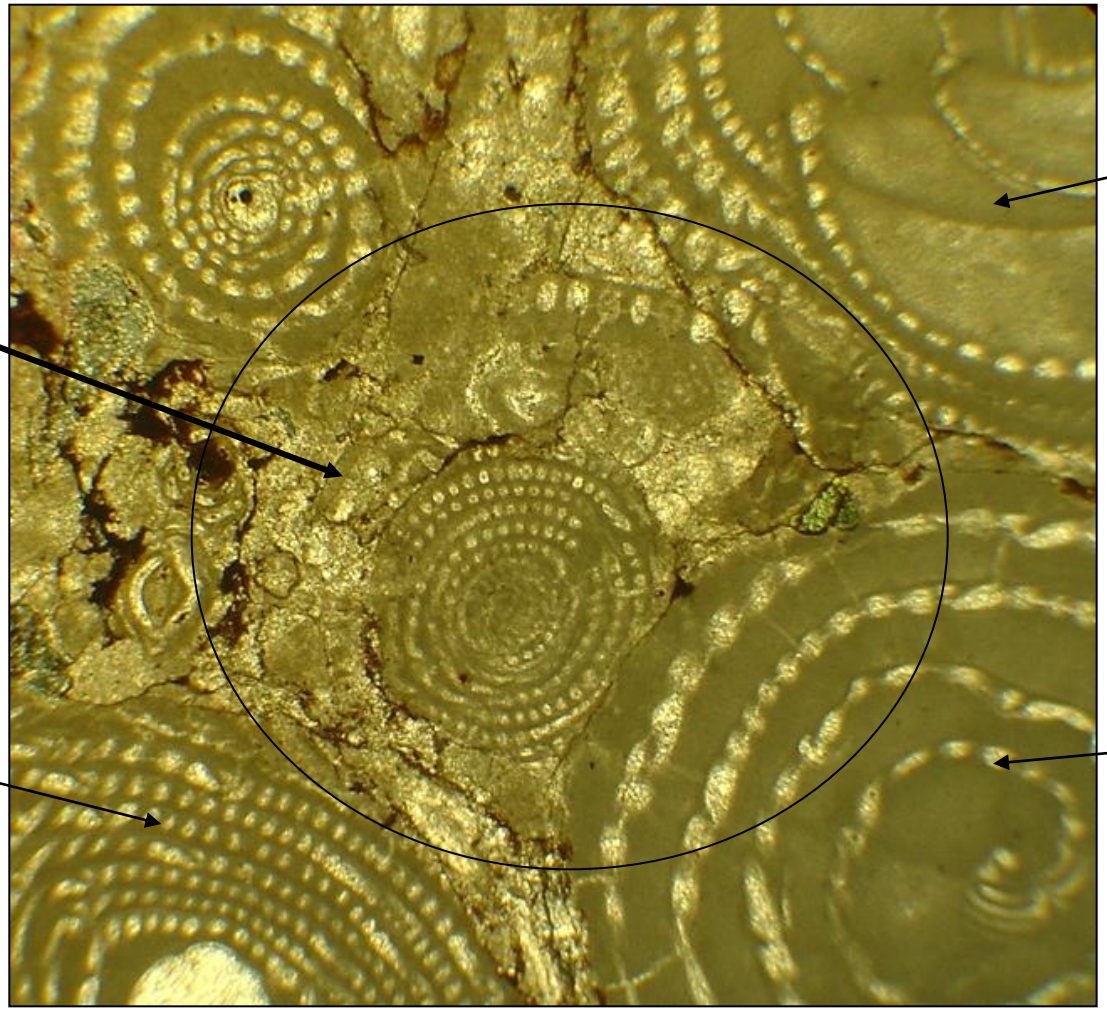
***Alveolina* + *Orbitolites* + *Nummulites* + miliolid**

Thin section views



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

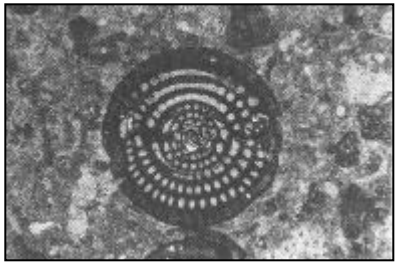
Thin section views



?Lacazina
?Alveolina

Alveolina

Alveolina



Alveolina (Gl.) primaeva

Alveolina

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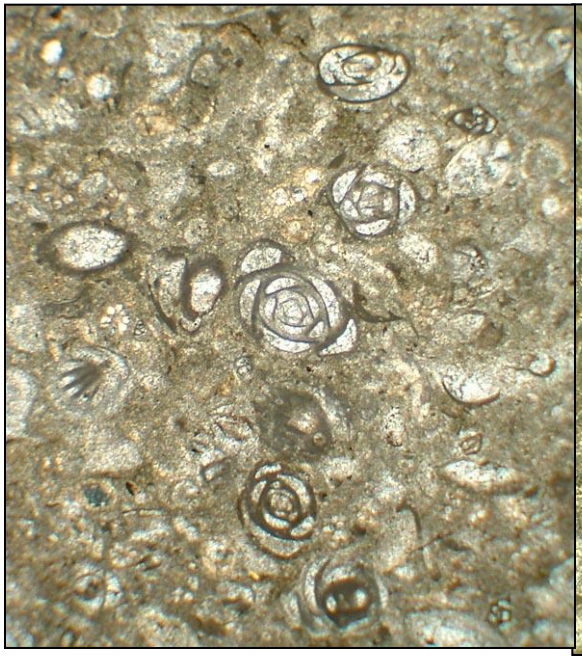
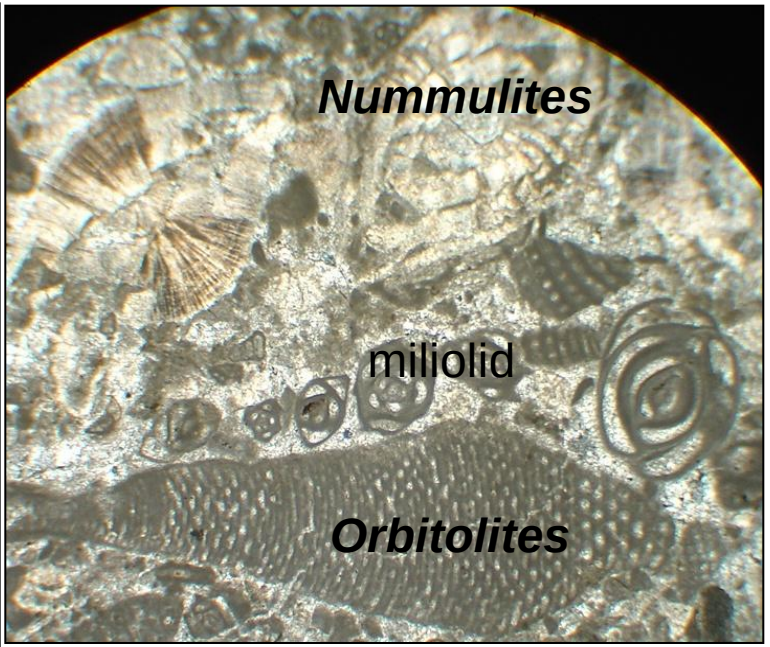
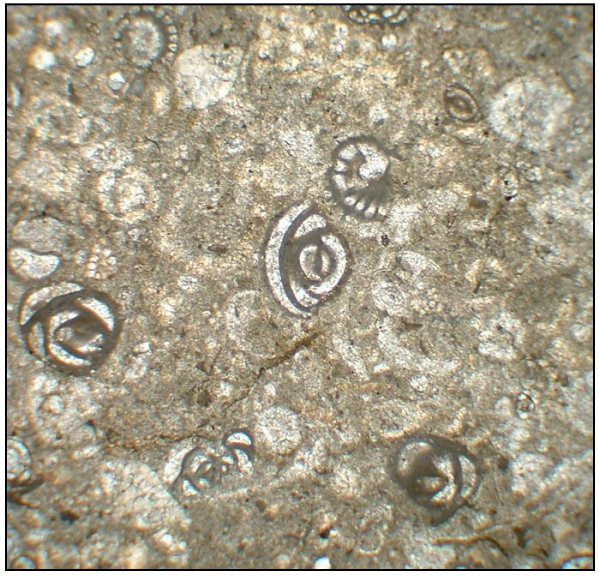
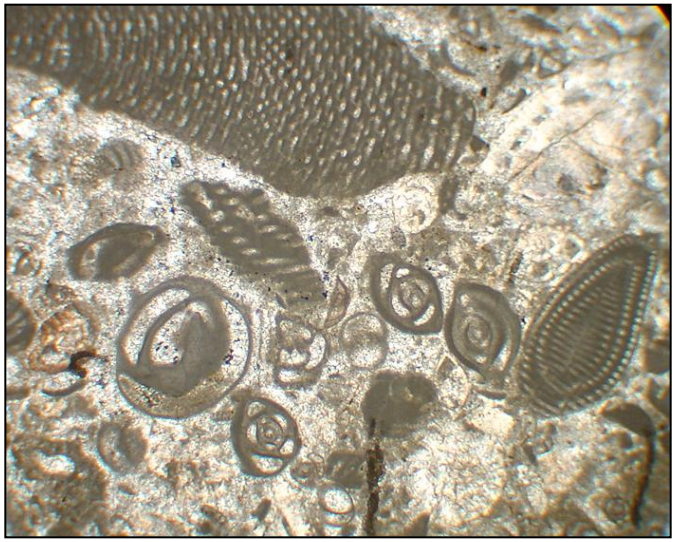
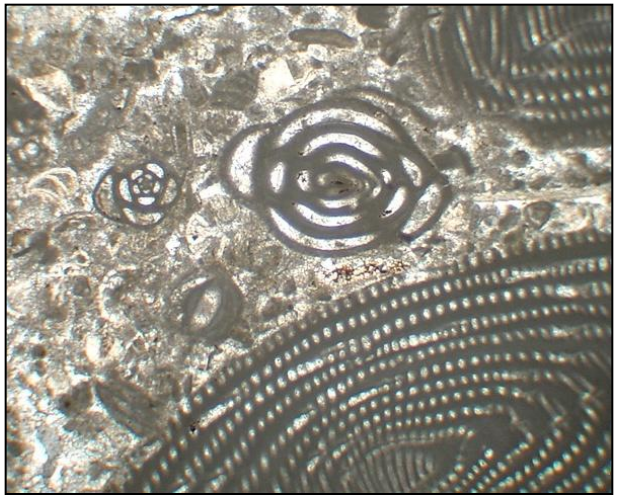
Thin section views





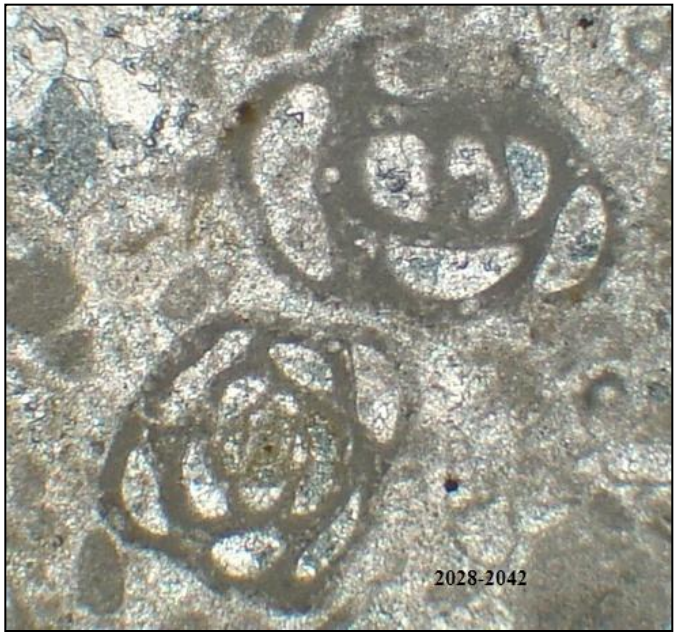


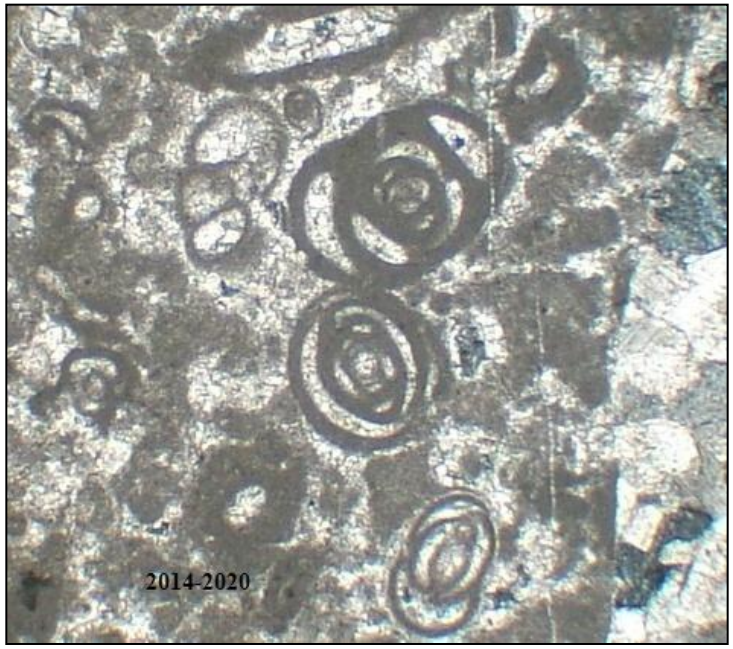


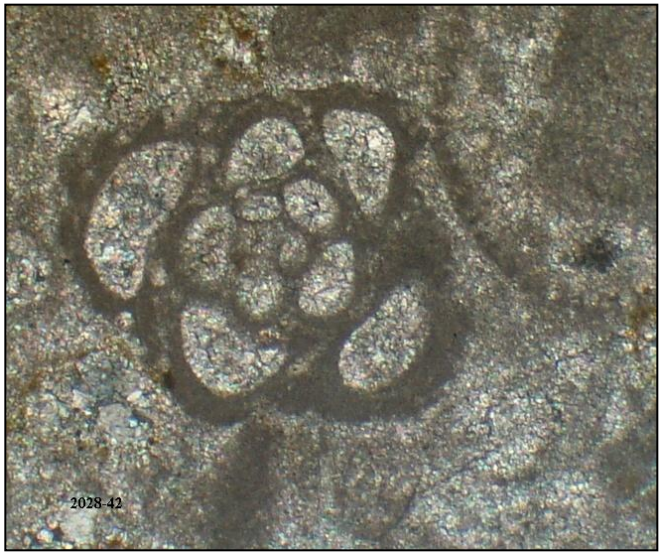


Pictures from Alkaya (Selçuk Univ.), lecture notes, by forgetten scale and reference,

Thin section views







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

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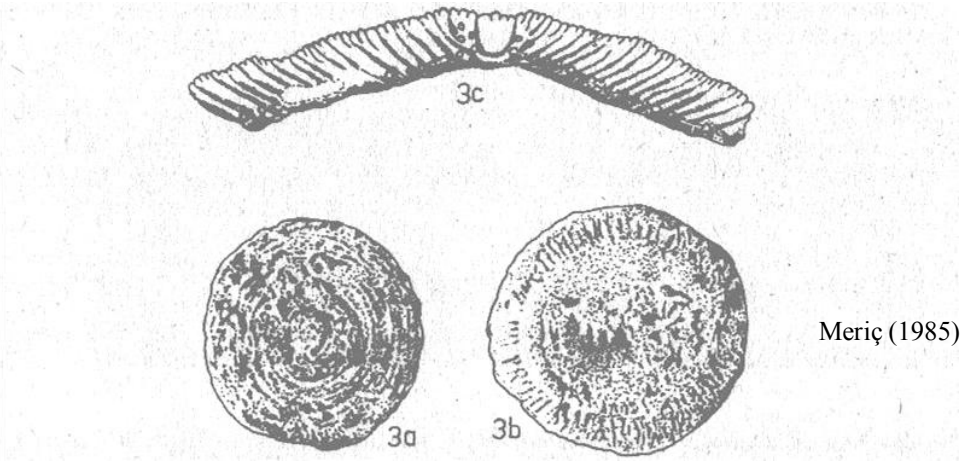
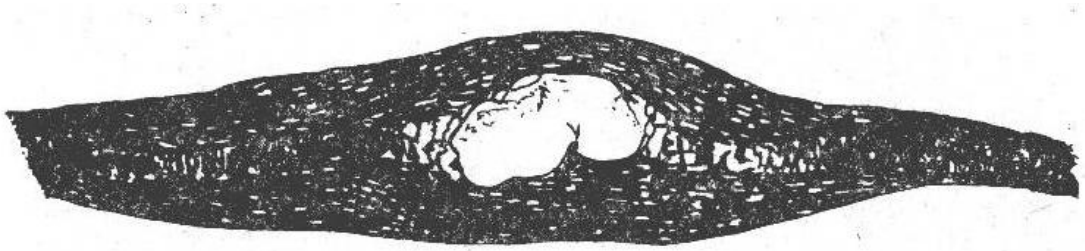
Suborder Miliolina

Pseudorbitolina sp. Late Cretaceous



Meriç (1985)

Somalina sp. Eocene



Meriç (1985)

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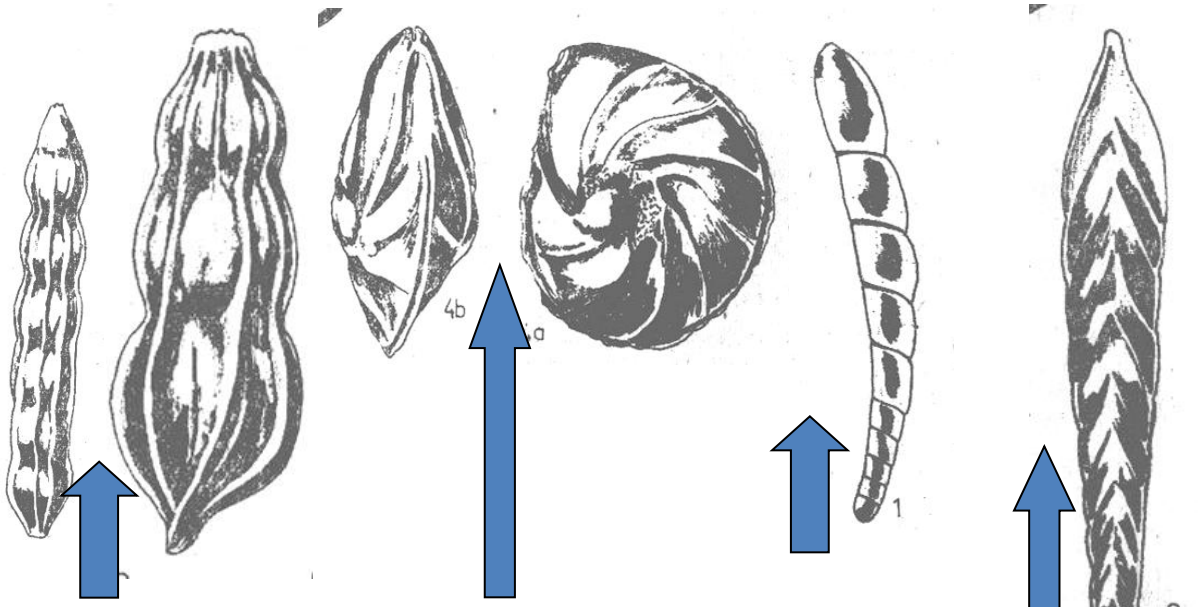
Suborder Lagenina



Nodosaria sp.
Perm-R.

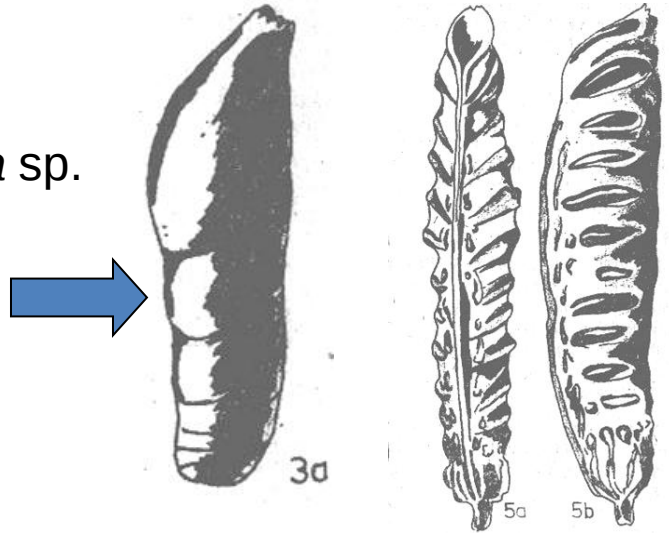
Lenticulina sp.
Trias.-R.

Dentalina sp.
Perm.-R.

Frondicularia sp.
Permian-R.

Marginulina sp.
Trias.-R.

Vaginulina sp.
Trias.-R.



Meriç (1985)

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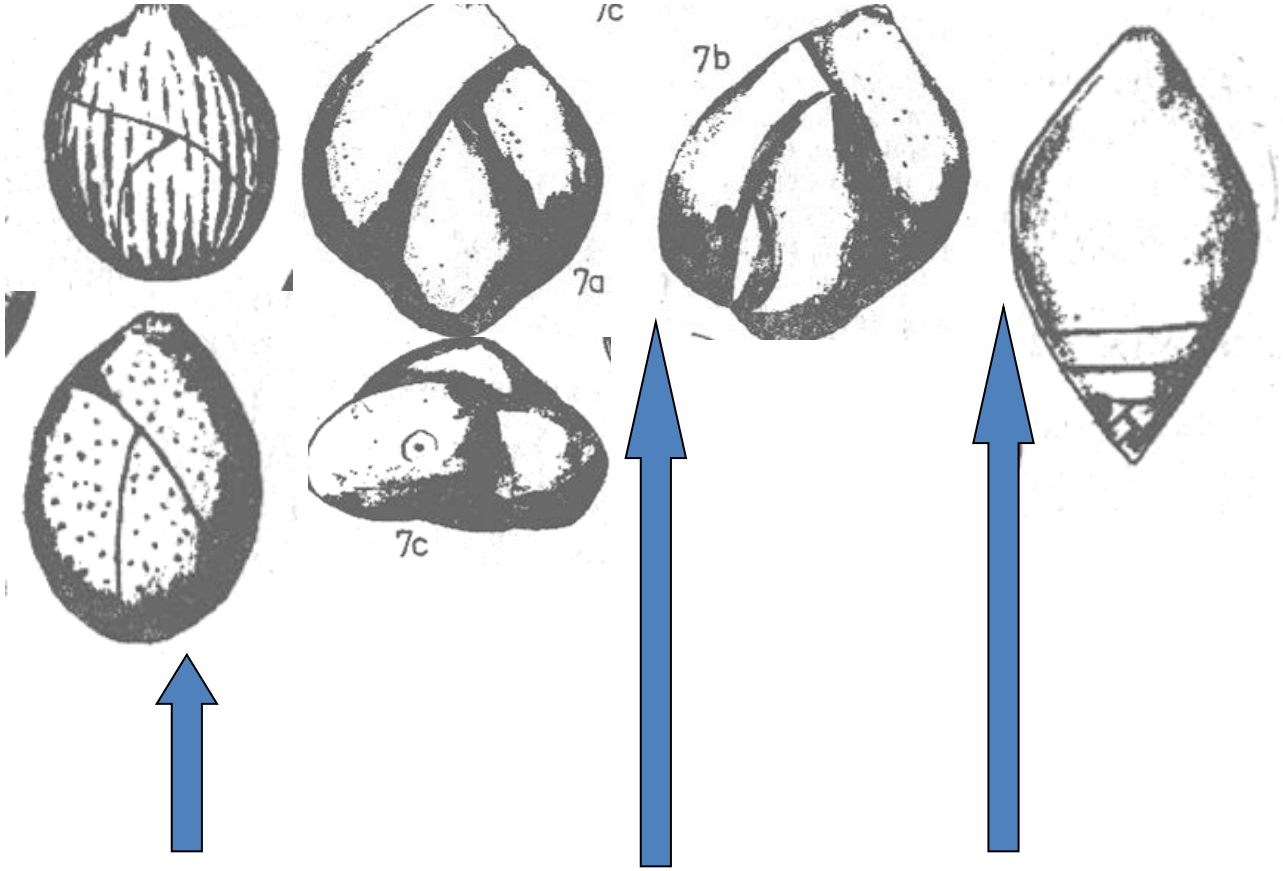
Suborder Lagenina



Globulina sp.
Late Jura-R.

Guttulina sp.
Jura-R.

Glandulina sp.
Paleocene-R.

Meriç (1985)

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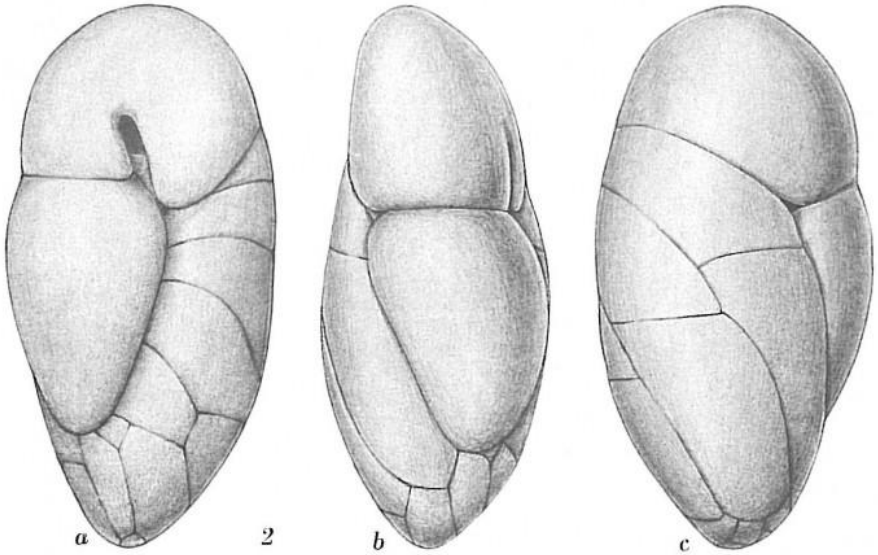
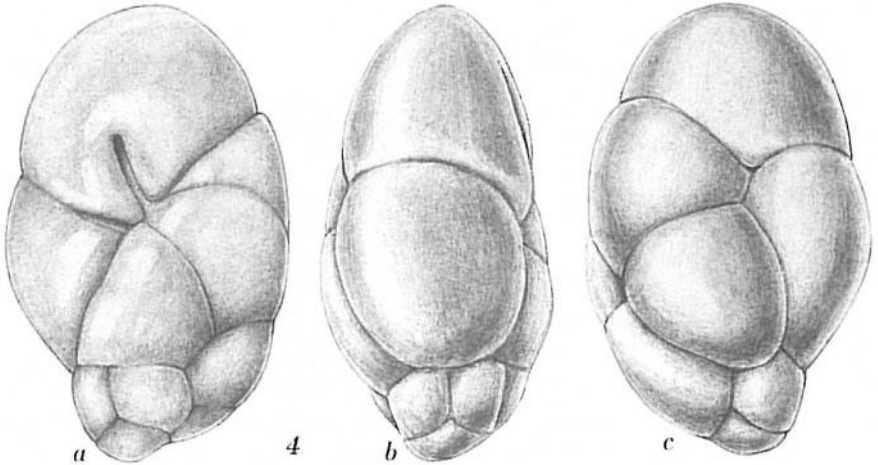
Robertina sp. /*Robertinoides* sp.

Suborder Robertinina



http://www.marinespecies.org/foraminifera/aphia.php?p=image&pic=43917



http://www.marinespecies.org/photogallery.php?album=772&pic=43925

http://www.marinespecies.org/foraminifera/aphia.php?p=image&id=9550

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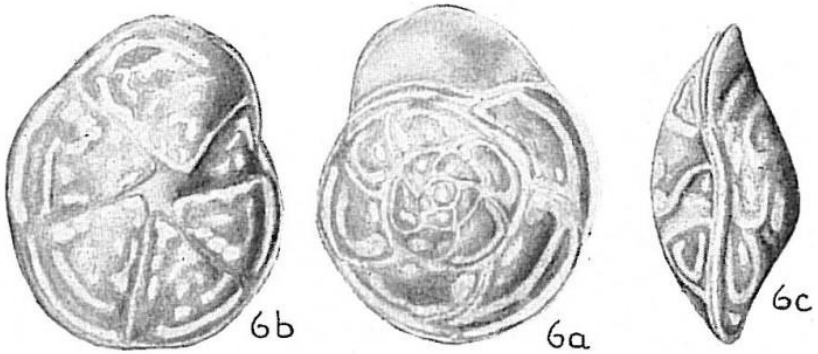
Eponides sp. Jura-Cretaceous

http://www.foraminifera.eu/epistomina-sp2-kleby.html

Suborder Robertinina



http://www.bgs.ac.uk/discoveringGeology/time/Fossilfocus/foraminiferaEvolution.html

http://www.marinespecies.org/photogallery.php?album=772&pic=36803

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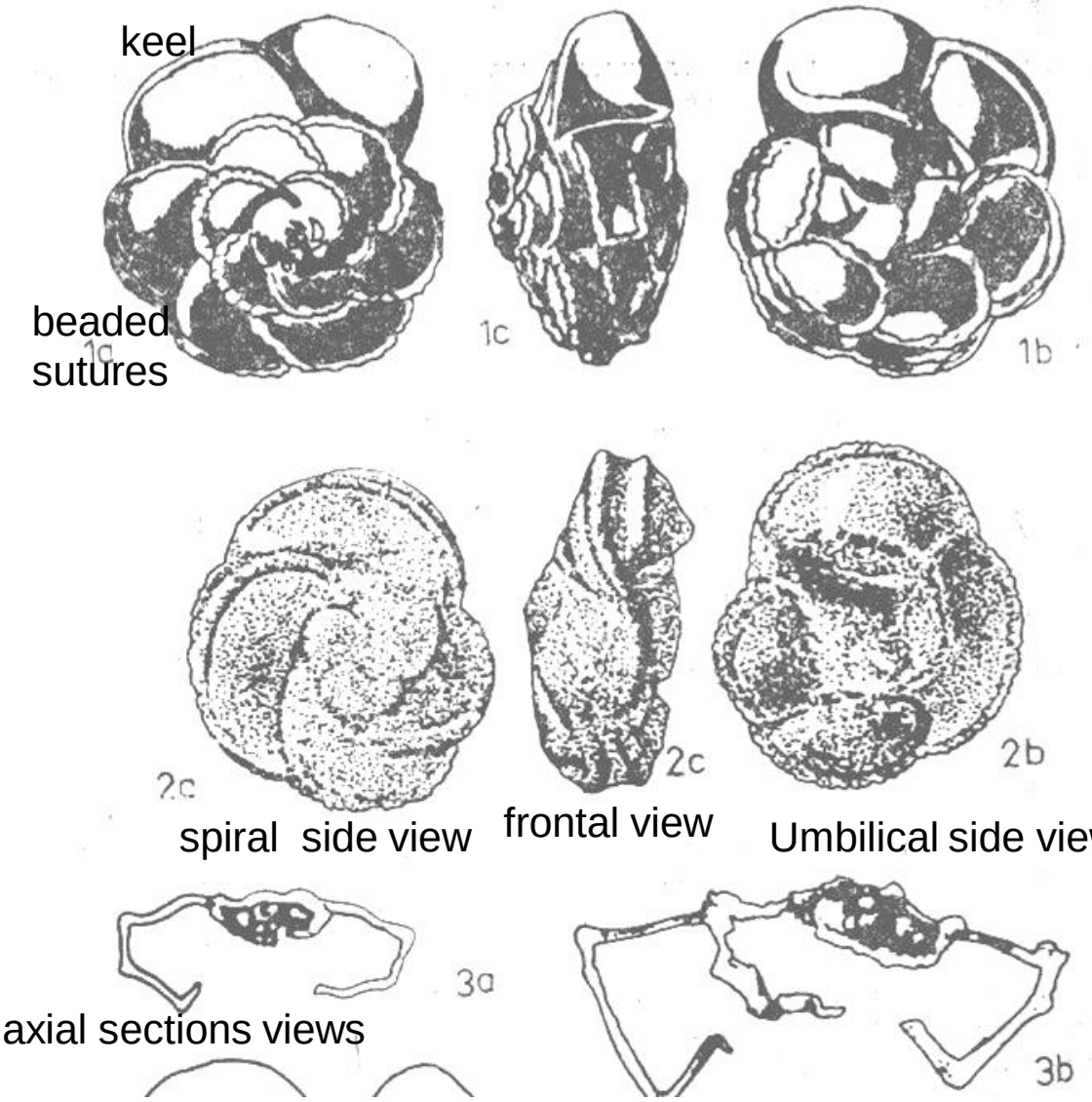
Globotruncana sp. Late Cretaceous



Meriç (1985)

Suborder Globigerinina

Characteristic features: test wall (microgranular compound), trochospiral shape planktic foram, keel, beaded sutures aperture basal umbilical

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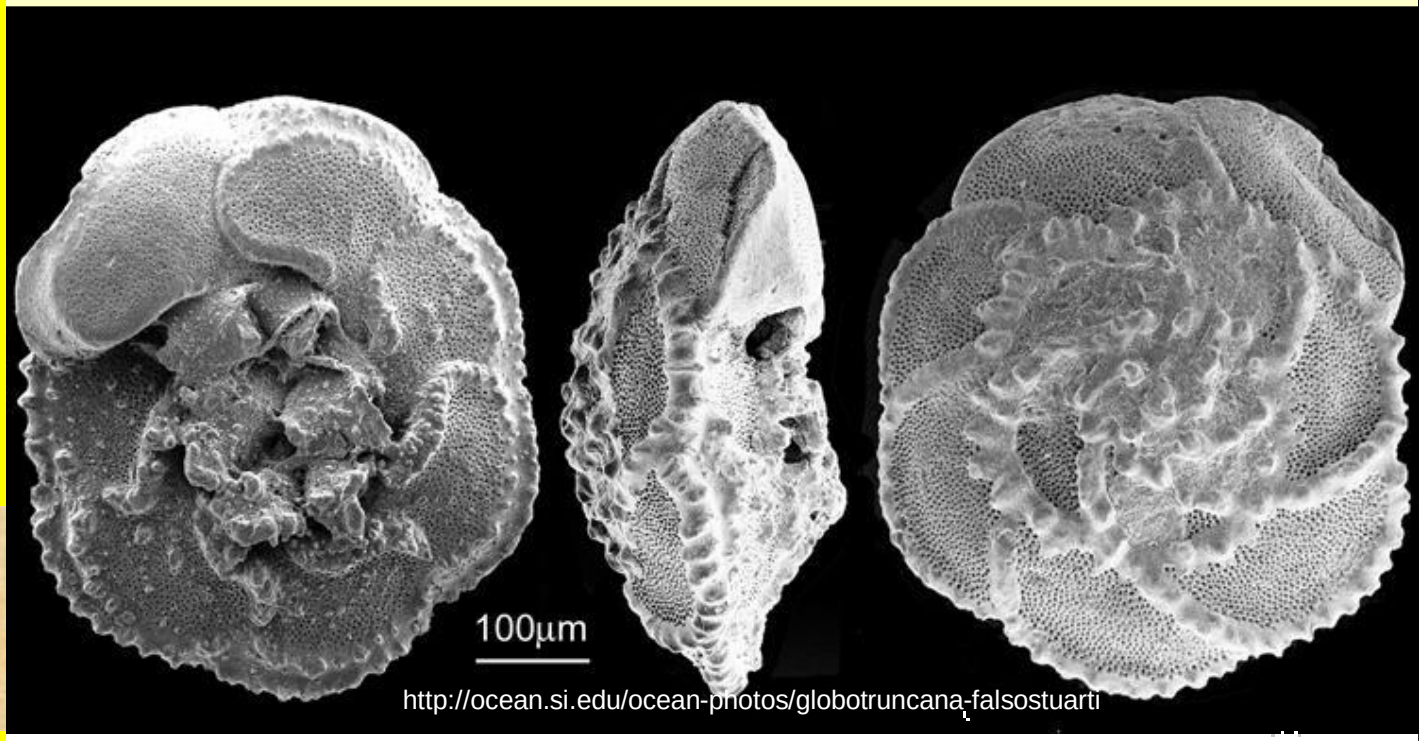
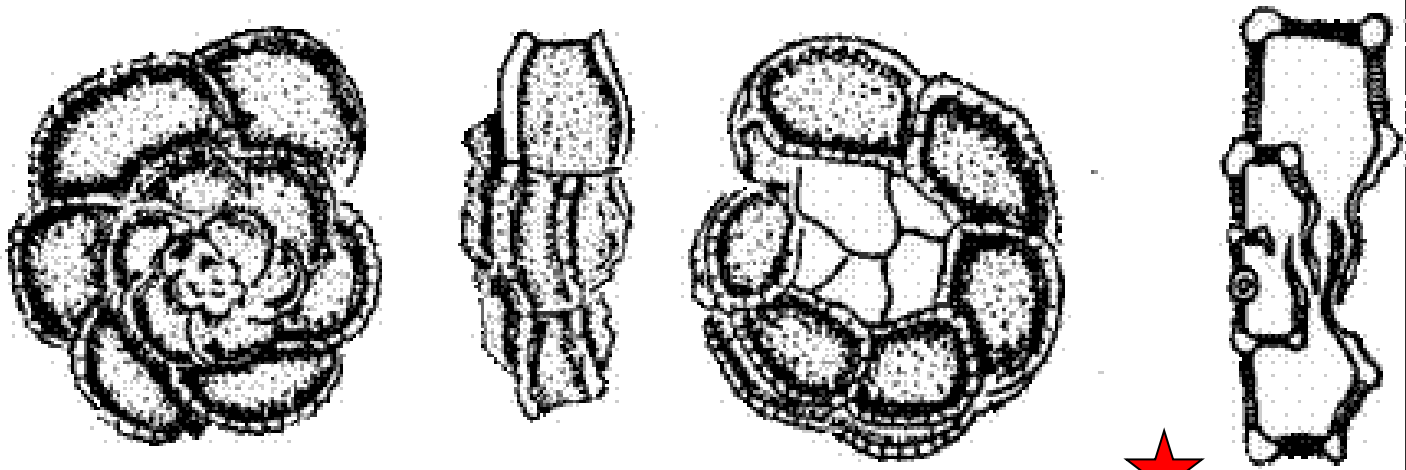
Globotruncana sp. Late Cretaceous



http://ocean.si.edu/ocean-photos/globotruncana-falsostuarti

Suborder
Globigerinina



http://www.normalesup.org/~clanglois/Fossiles-epoques/Cretace.html

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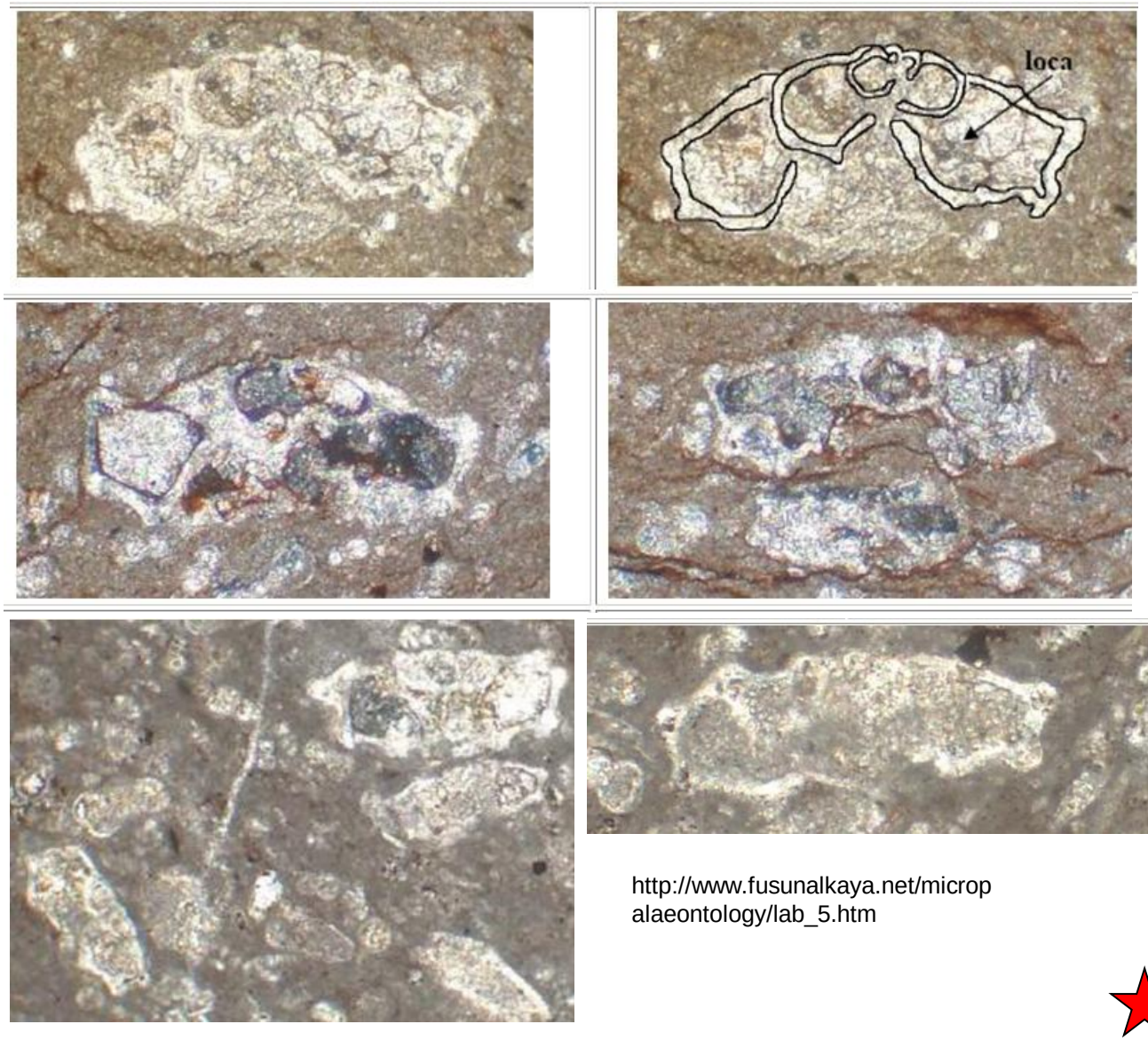
Globotruncana sp. Late Cretaceous



http://www.fusunalkaya.net/microp
alaeontology/lab_5.htm

axial sections views

Suborder
Globigerinina

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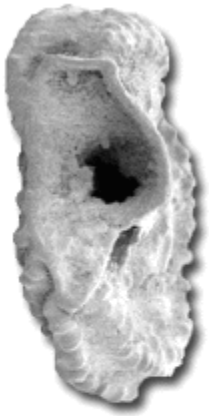
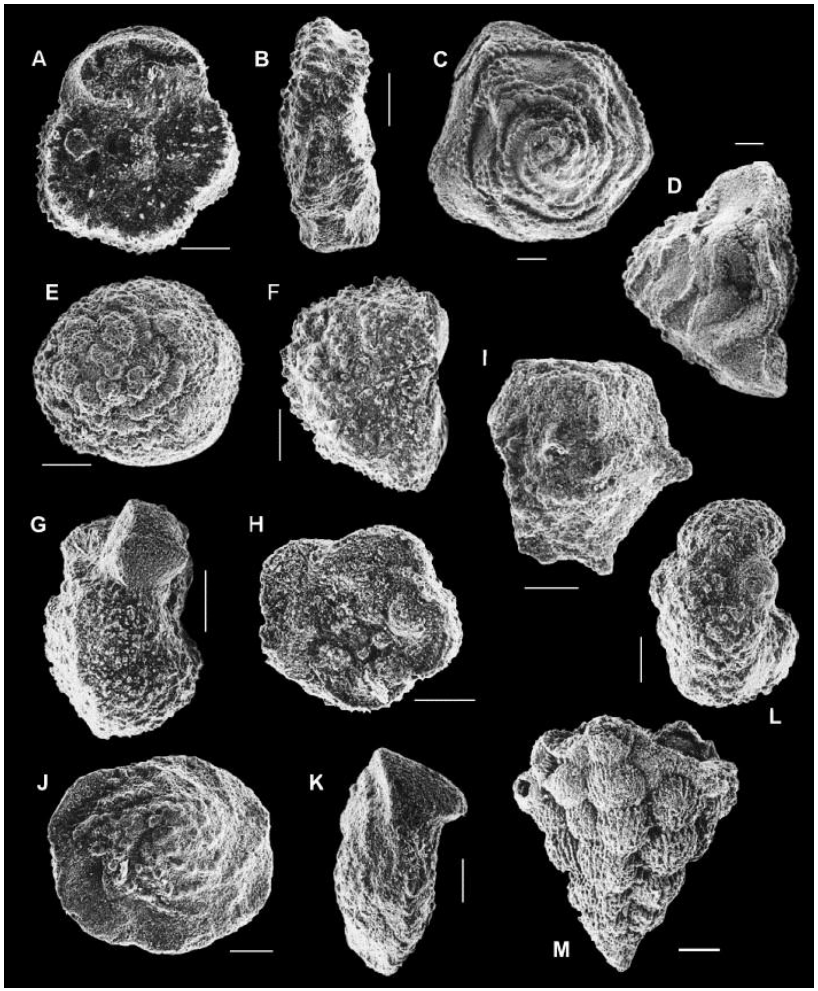
Abathomphalus sp. & other globotruncaniids

Suborder Globigerinina

http://www.ucl.ac.uk/GeolSci/micropal/foram.html
***Abathomphalus mayaroensis* (Bolli)**
Maastrichtiense Superior
(Cretácico Superior)
Vista umbilical
Imagen de barrido electrónico



http://www.ucl.ac.uk/GeolSci/micropal/foram.html
***Abathomphalus mayaroensis* (Bolli)**
Maastrichtiense Superior
(Cretácico Superior)
Vista lateral
Imagen de barrido electrónico



http://www.sciencedirect.com/science/article/pii/S0195667104000552

Abathomphalus, Gansserina, Rosita, Globotruncanita are also important genera for late Cretaceous

http://www.pdv.com/lexico//centro/catalogo/afp-abathomphalus_mayaroensis.htm

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Suborder Globigerinina

Heterohelix sp.

Planoglobulina sp.

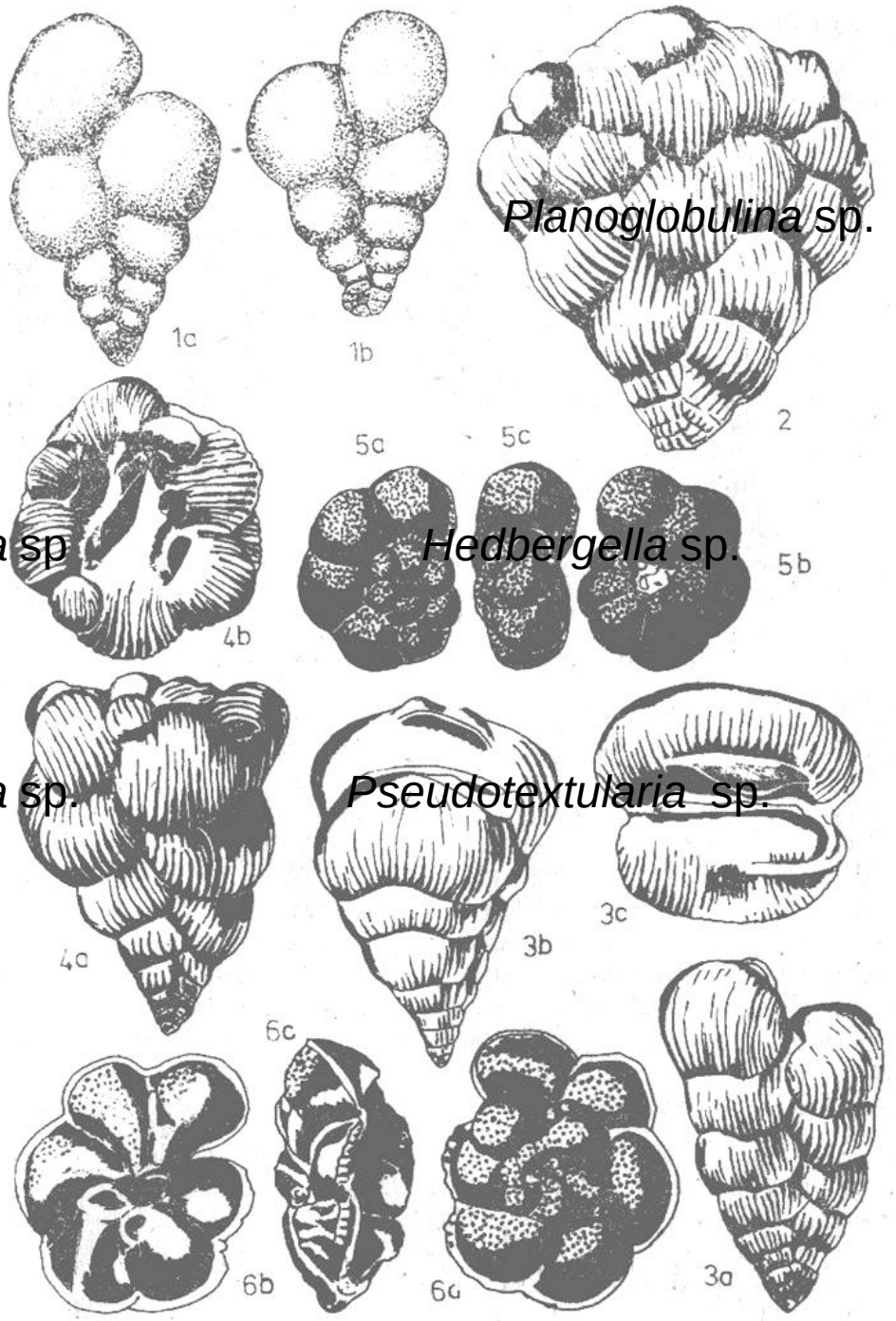
Racemiguembelina sp.

Hedbergella sp.

Racemiguembelina sp.

Pseudotextularia sp.

Rotalipora sp.



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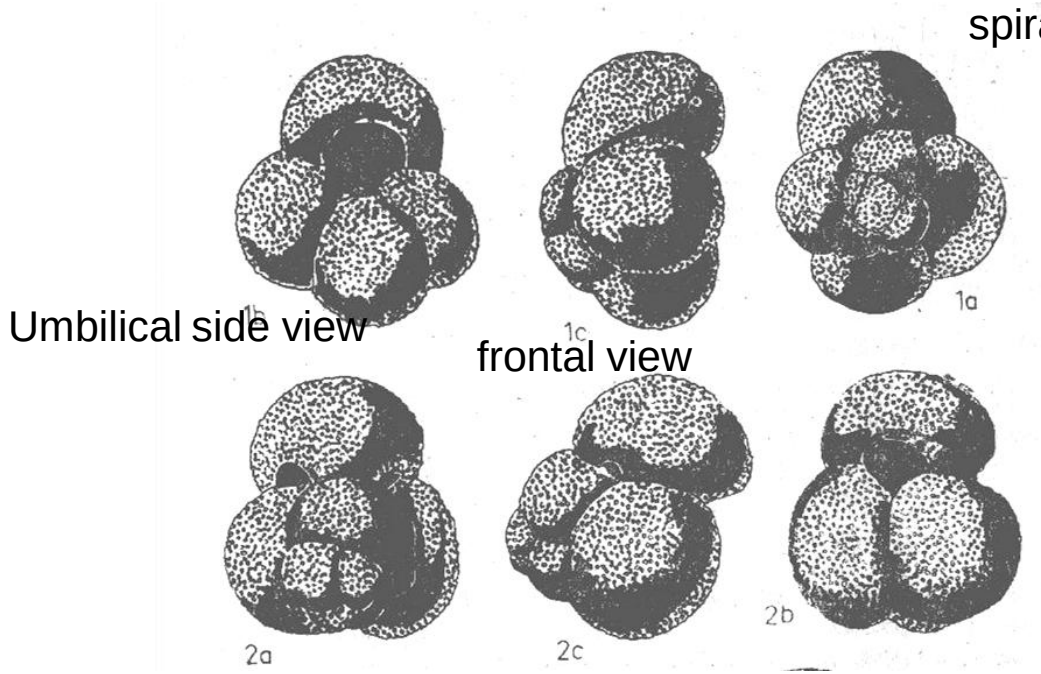
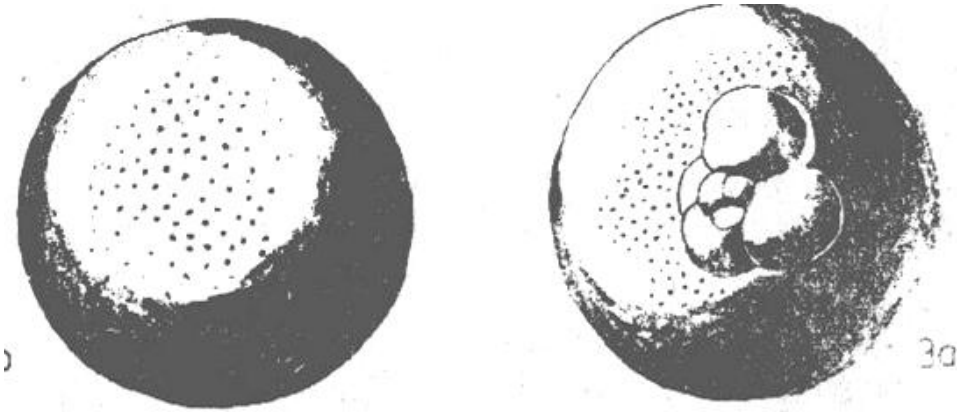
Suborder Globigerinina

Characteristic features: test wall (microgranular compound), trochospiral shape planktic foram, globular chambers aperture basal umbilical

Globigerina sp. Paleocene to Recent



Globigerina sp. Miocene to Recent



Meriç (1985)

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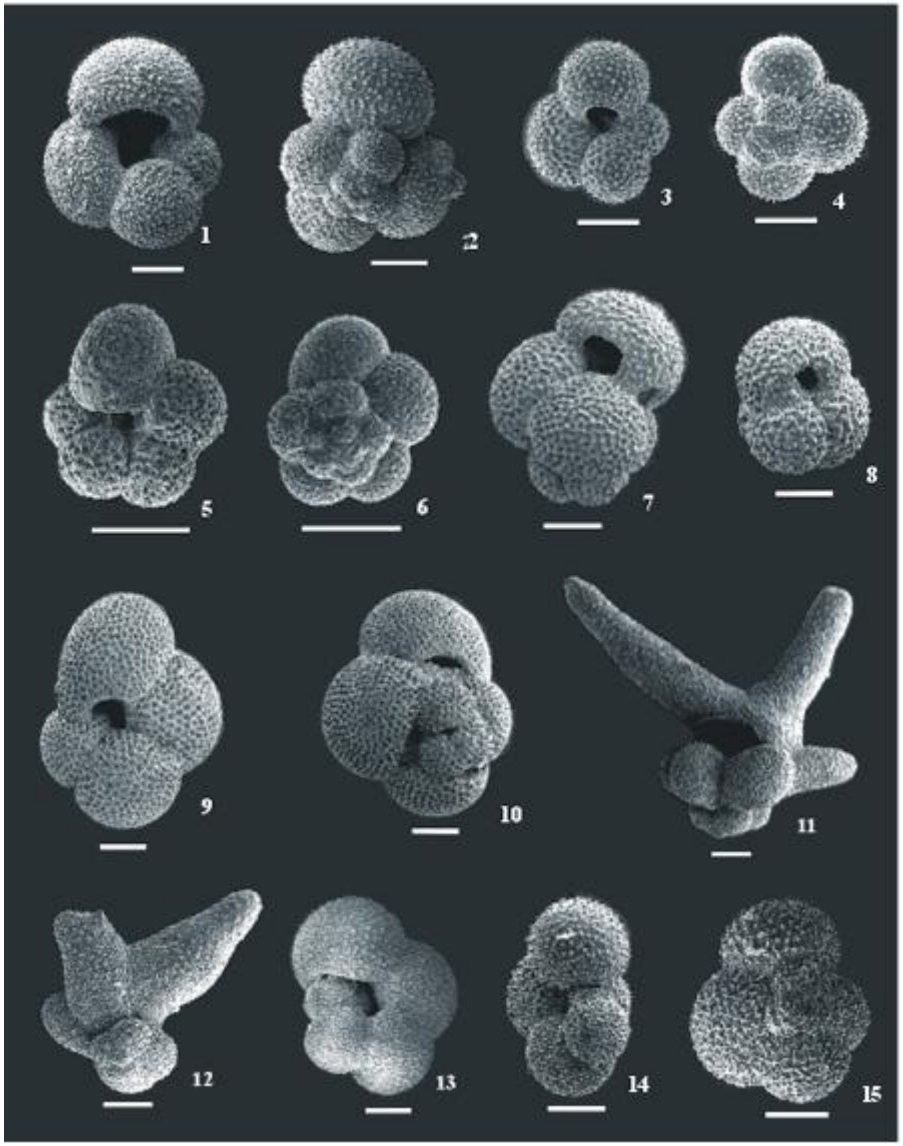
Globigerina sp. Paleocene to Recent



http://www.soes.soton.ac.uk/resources/collection/fossils/Forams/Eelco/med-agean2/pages/pl-12.htm

Suborder
Globigerinina

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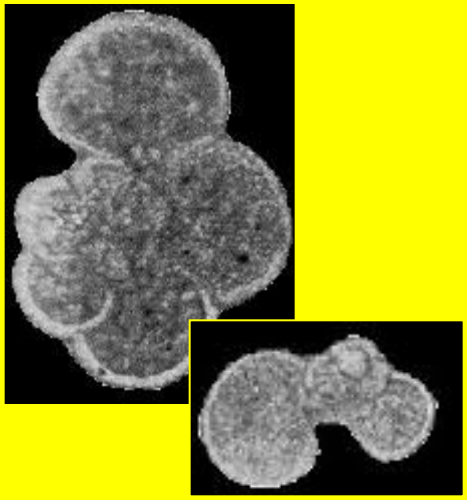
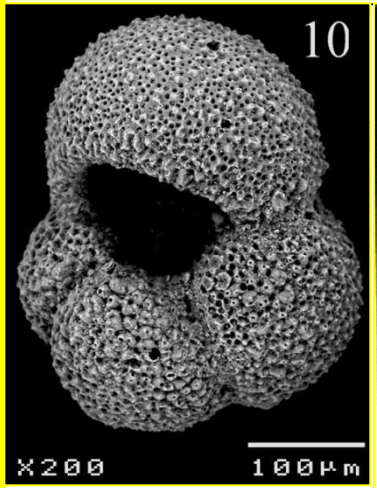
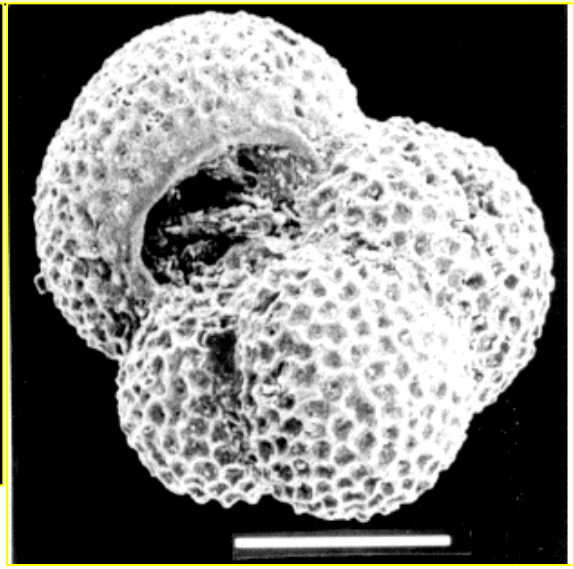
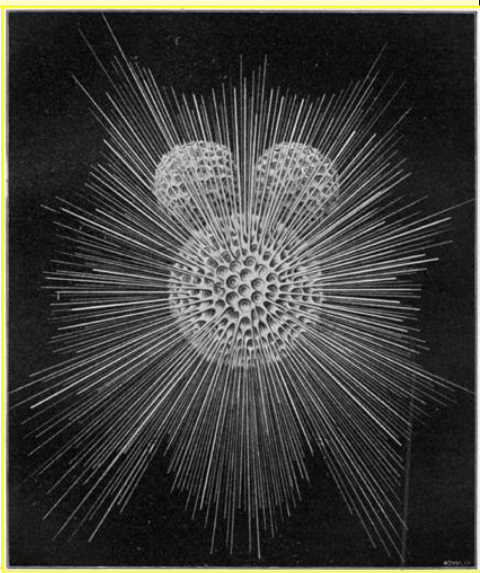
Globigerina sp. Paleocene to Recent

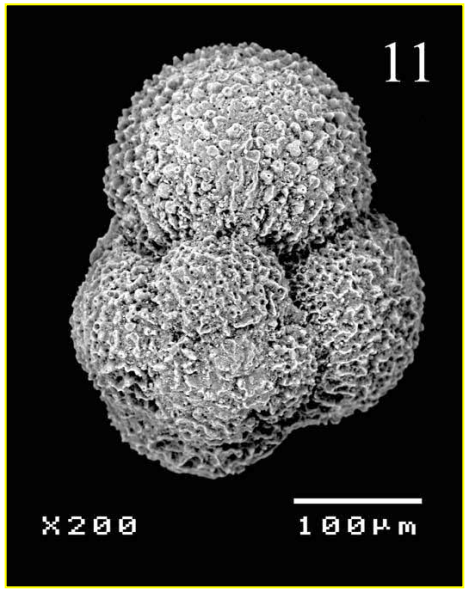


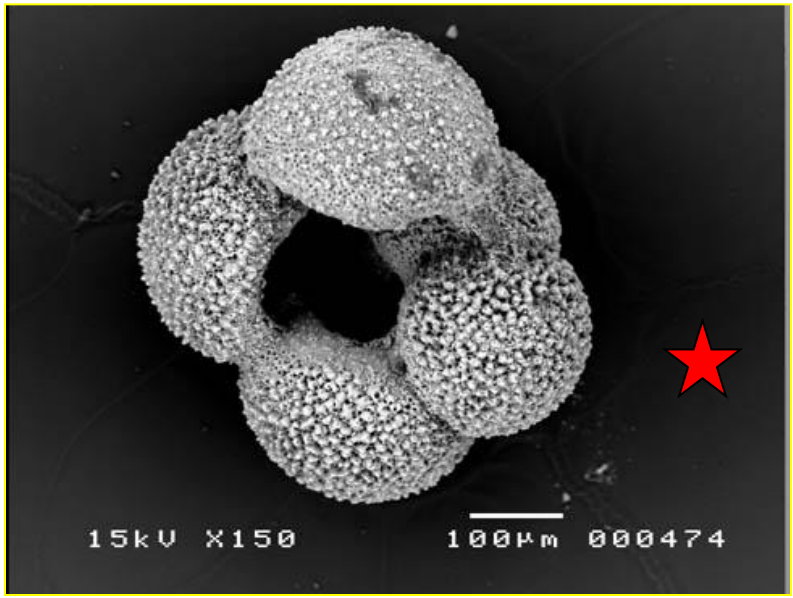






Suborder Globigerinina





Resimler internetten

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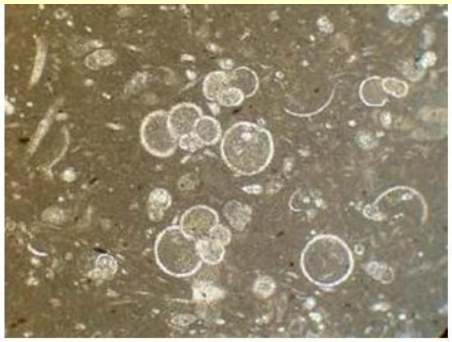
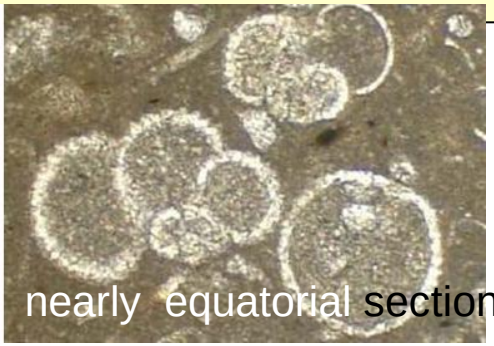
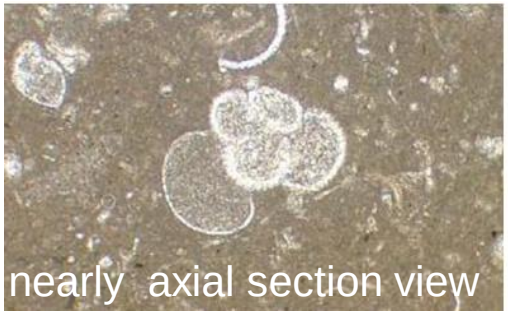
Globigerina sp. Paleocene to Recent

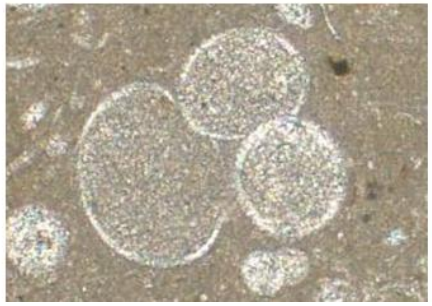


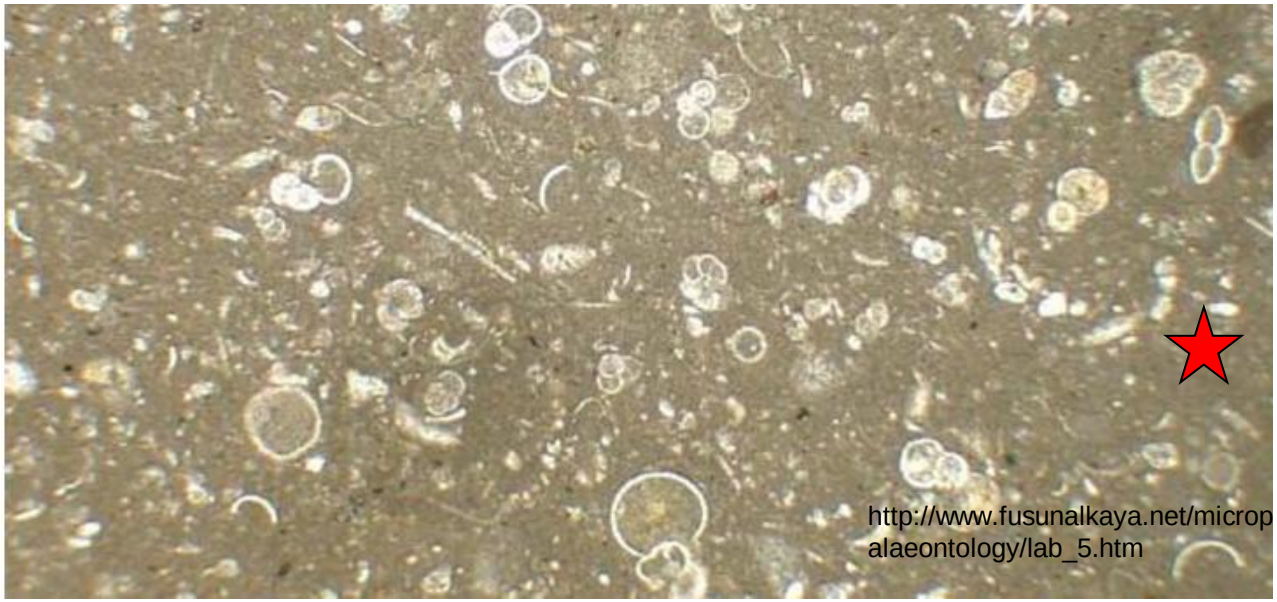


nearly equatorial section view



nearly axial section view





http://www.fusunalkaya.net/micropalaeontology/lab_5.htm

Suborder
Globigerinina

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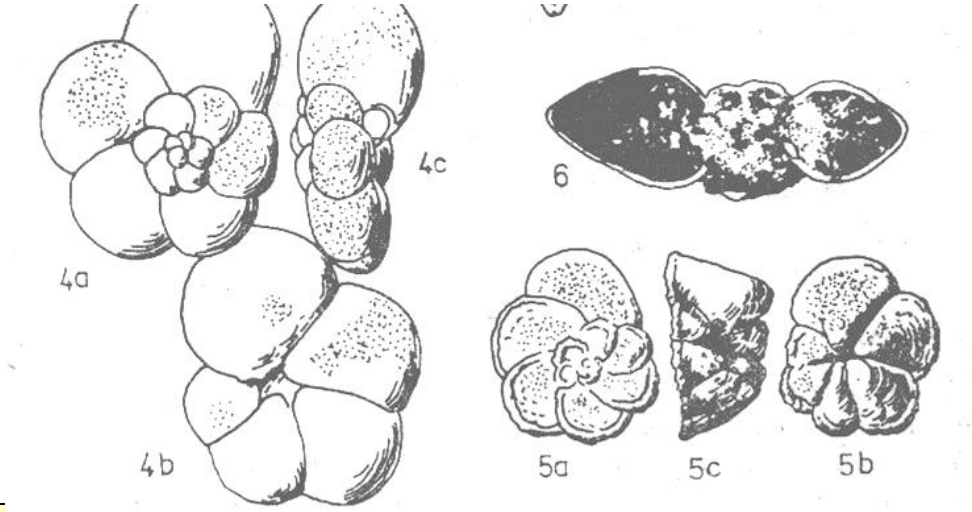
Suborder Globigerinina

Globorotalia sp. Paleocene to Recent



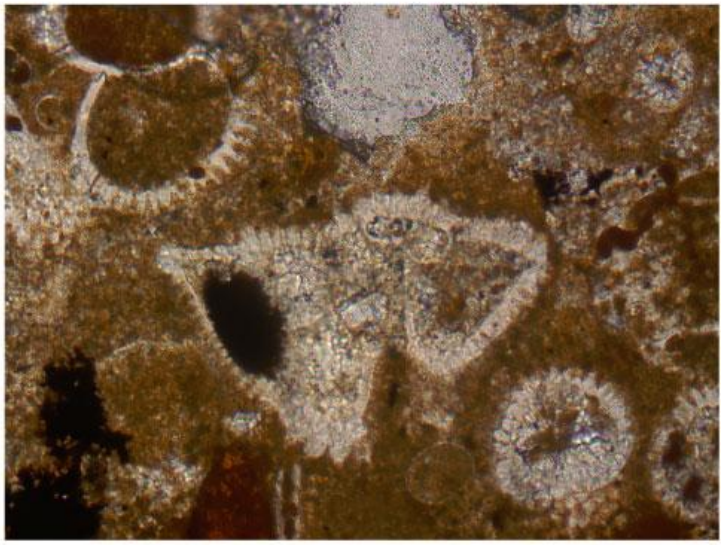
Meriç (1985)

Orbulina sp. Miocene to Recent

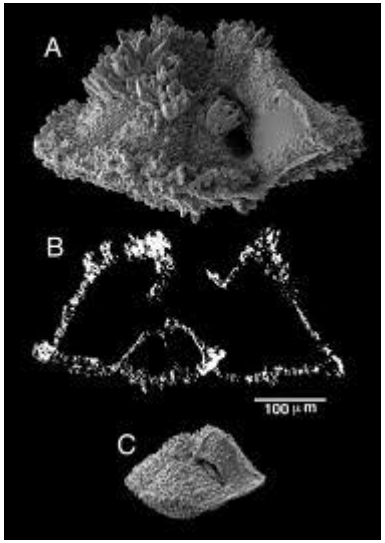
Morozovella sp. /*Acarinina* sp.

Suborder Globigerinina

A



axial section



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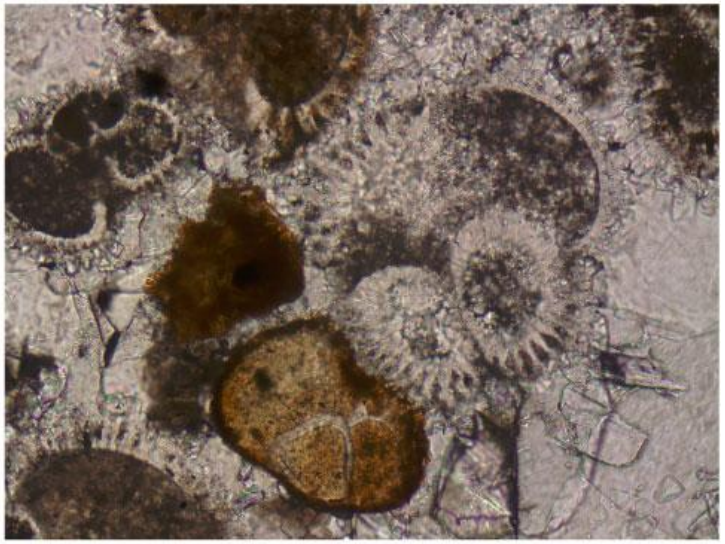

http://publications.iodp.org/proceedings/330/108/108_f7.htm

Homework 4

Find a species description of fusulinina or miliolina or globigerinina (it is up to you) including *its taxonomic hierarchy, description, remarks and occurrences* from a web site on internet or somewhere (book, thesis, article, etc.).