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

PALEONTOLOGY

Muhittin Görmüş

Department of Geology

Lecture 3

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

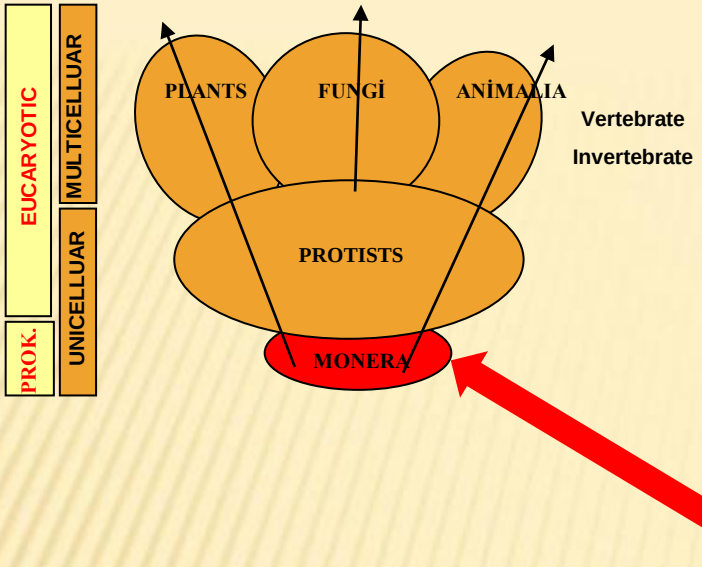
ANKARA UNIVERSITY

M. Görmüş,
Ankara University, 2017
Lecture 3

Topics

- Microfossil groups
  - Bacteria
- Organic walled microfossils (Architarch, Dinoflagellates, Chitinozoa, Scolecodonts, Spores & Pollens)
- Inorganic walled microfossils (Coccolithophores & discoasters & nannoconus, Foraminifera, Radiolaria, Diatoms, Slicoflagellates, Tintinnids & calpionellids, Ostracods, Conodonts)
- Foraminifera
  - General characteristics, view
  - Test shapes, aperture, auixiliary apertures, ornamen
  - Wall structure
- Textulariina
  - *Cuneolina* sp.
  - *Loftusia* sp.
  - *Orbitolina* sp.
  - Other selected textulariids

M. Görmüş,
Ankara University, 2017
Lecture 3

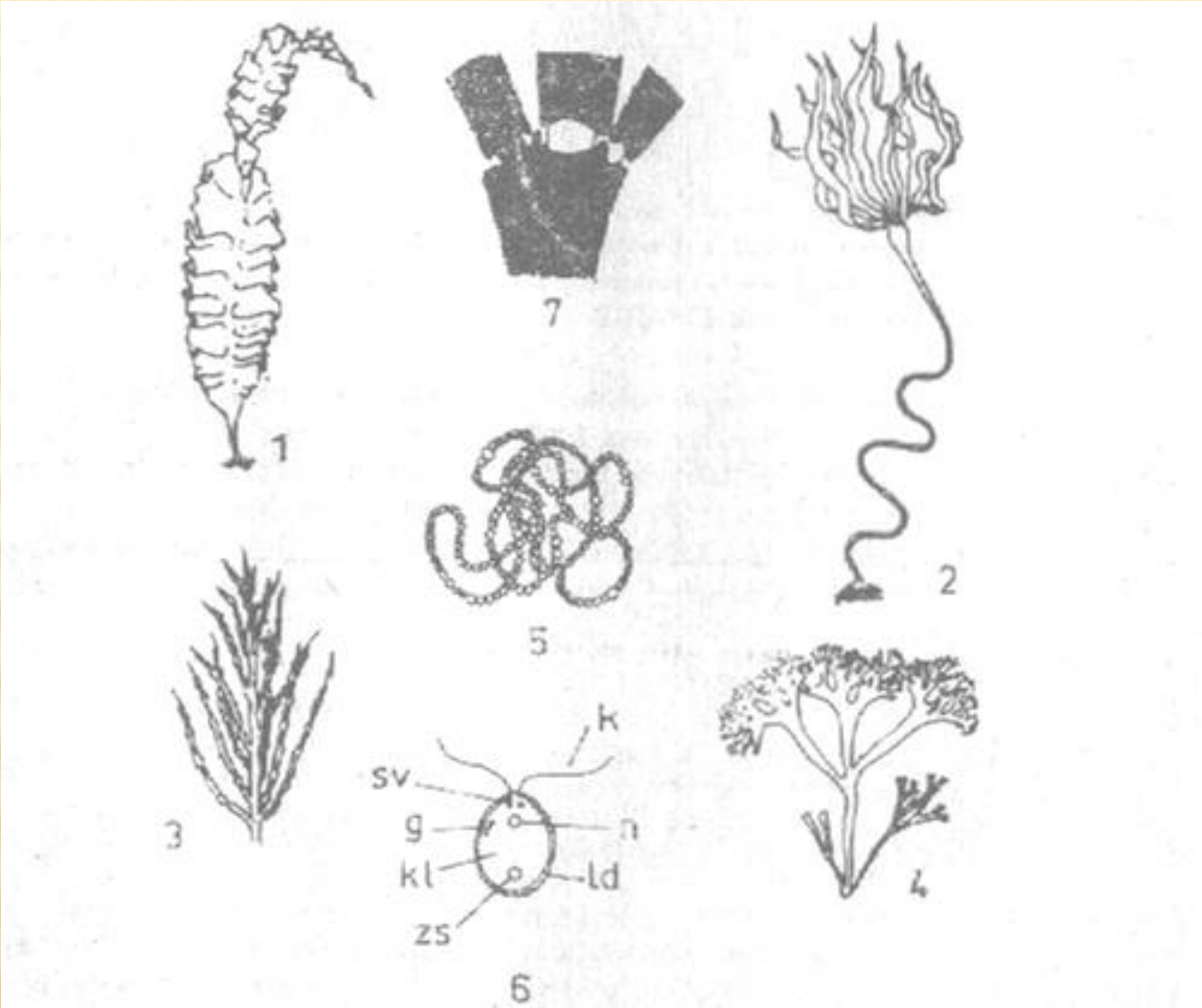


Prokaryote

Bacteria -Cyanobacteria

Eubacteria

Archaebacteria



Examples of microfossils

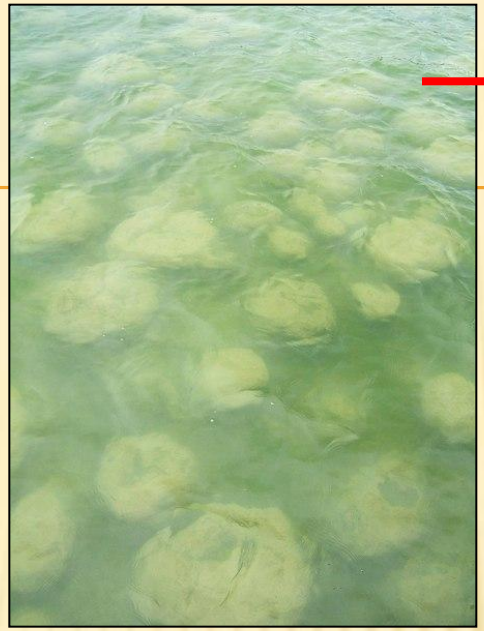
in MONERA kingdom

Meriç, 1980

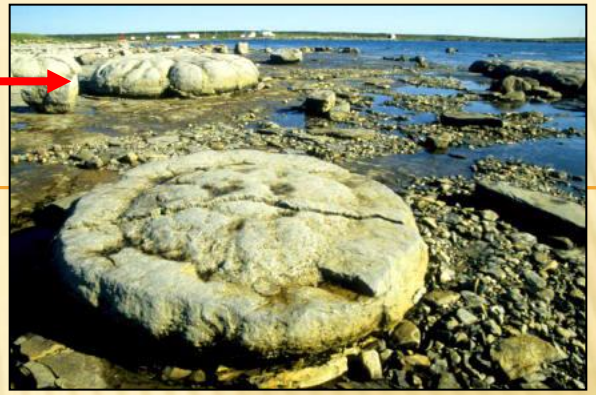
M. Görmüş,
Ankara University, 2017
Lecture 3

Cynabacteria are the producers of organic sedimenter structures as stromatolite & trombolite, and terrestrial carbonates such as travertene & tuffa. They mainly live in fresh waters, brackish waters & shallow marine environments.

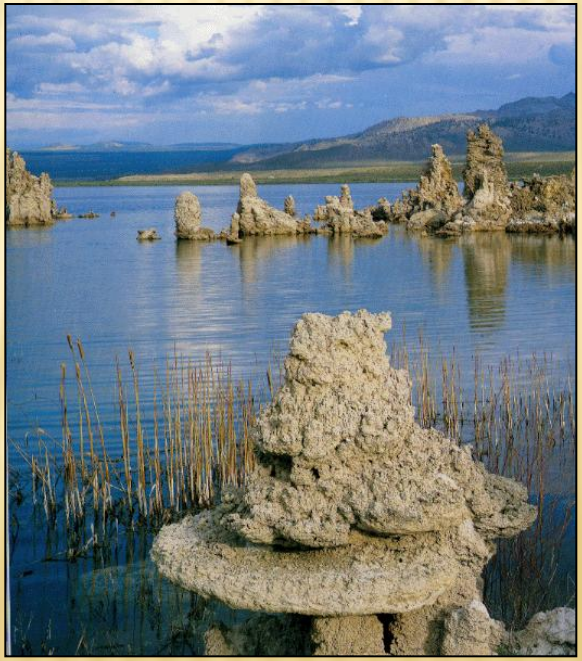
Pictures from Alkaya (Selçuk Univ.), lecture notes, by forgetten references



trombolite



stromatolite



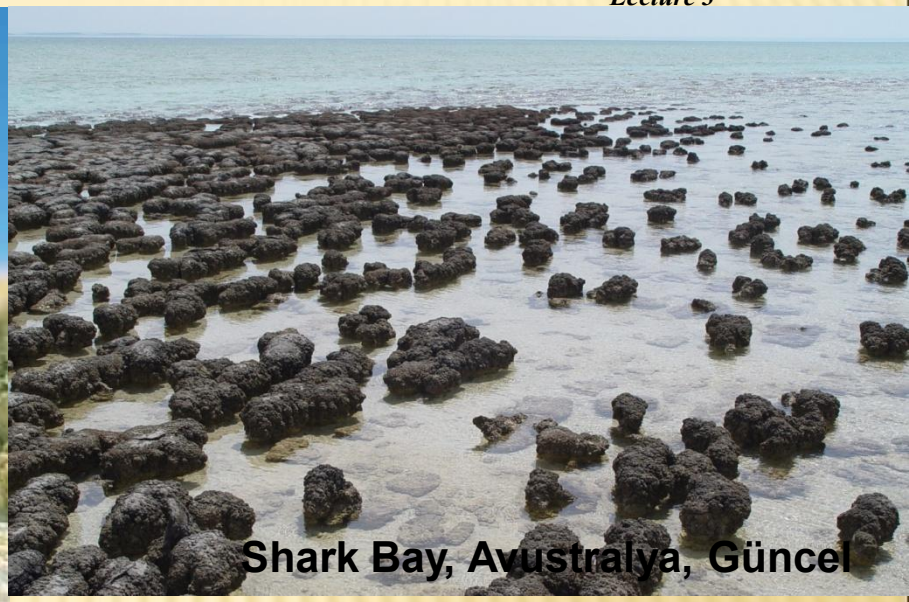
tufa

traverten

Stromatolites

M. Görmüş,
Ankara University, 2017
Lecture 3

Hamelin Pool, Shark Bay, Avustralya, Güncel



Shark Bay, Avustralya, Güncel

straight columnar lamina

branched columnar | wall

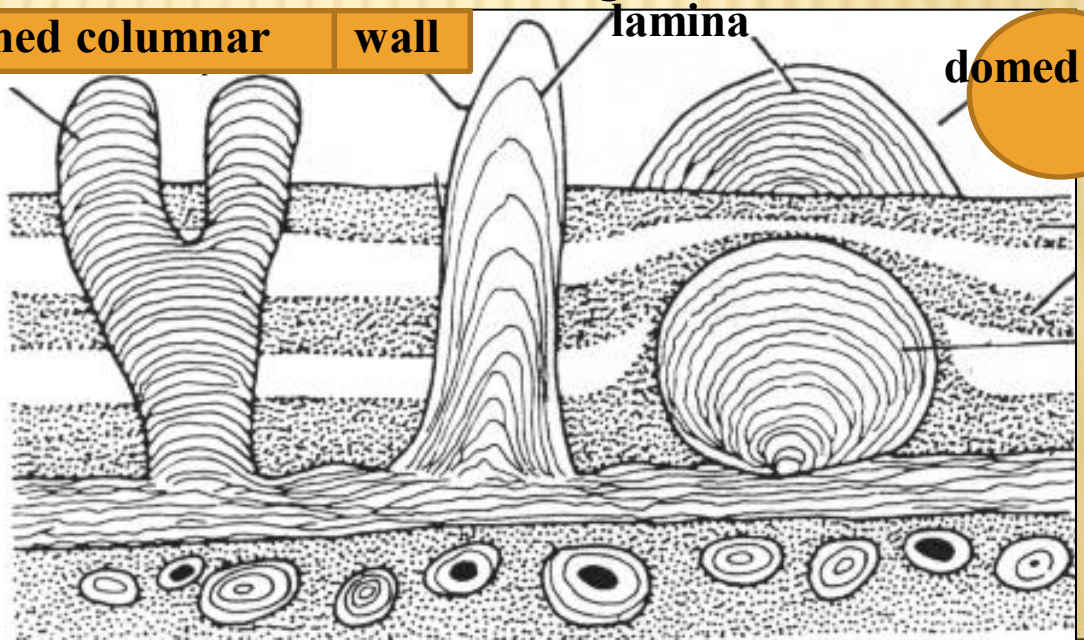
domed hemispherical

Sediment

domed subspherical

planar

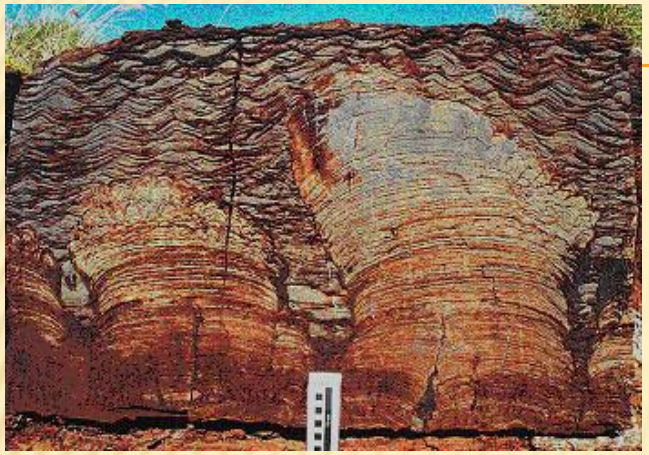
oncolitic



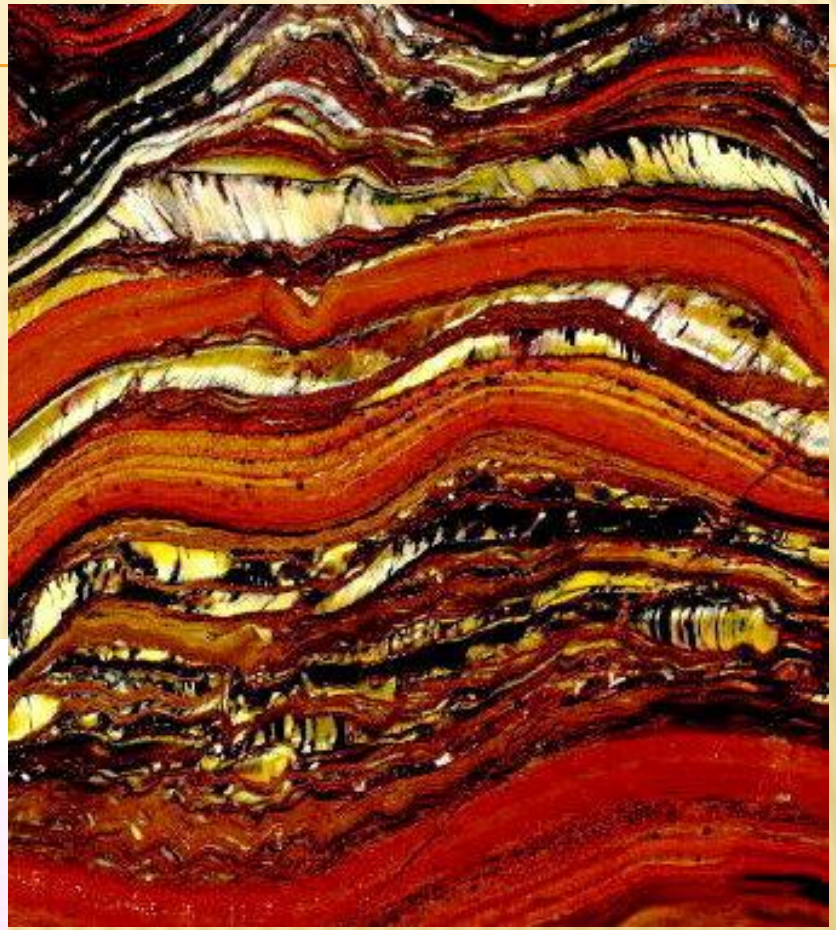
Pictures from Alkaya (Selçuk Univ.), lecture notes,

Pictures from Alkaya (Selçuk Univ.), lecture notes, by forgetten references

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

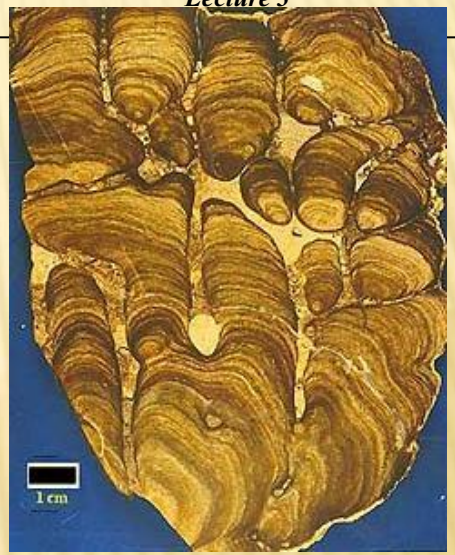


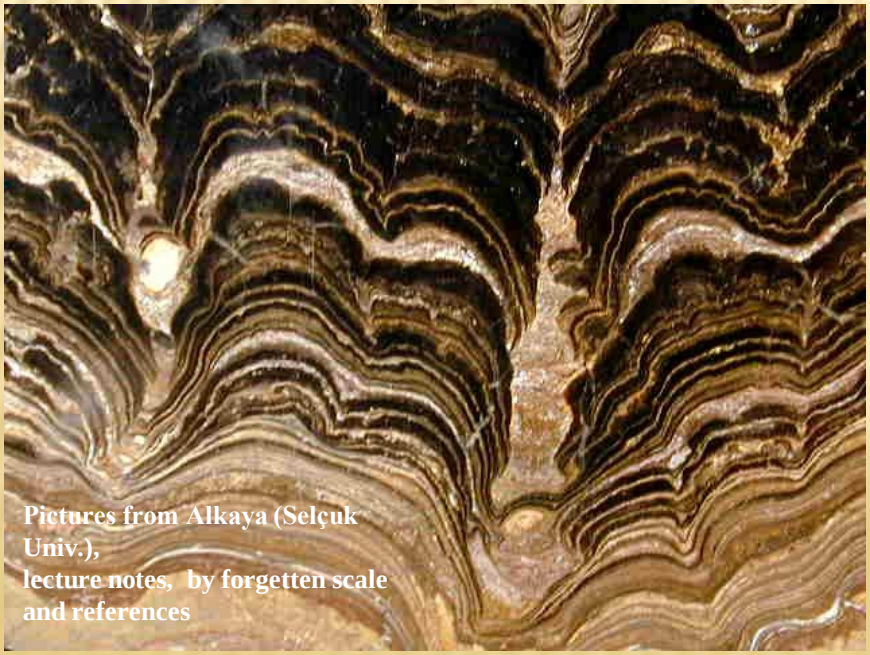
Stromatolites, Western Austuralia, Arkeen (~2,700-Ma)
(I. Williams, Geol. Surv. West. Aust.)



www.lakeneosho.org/More7.html

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





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

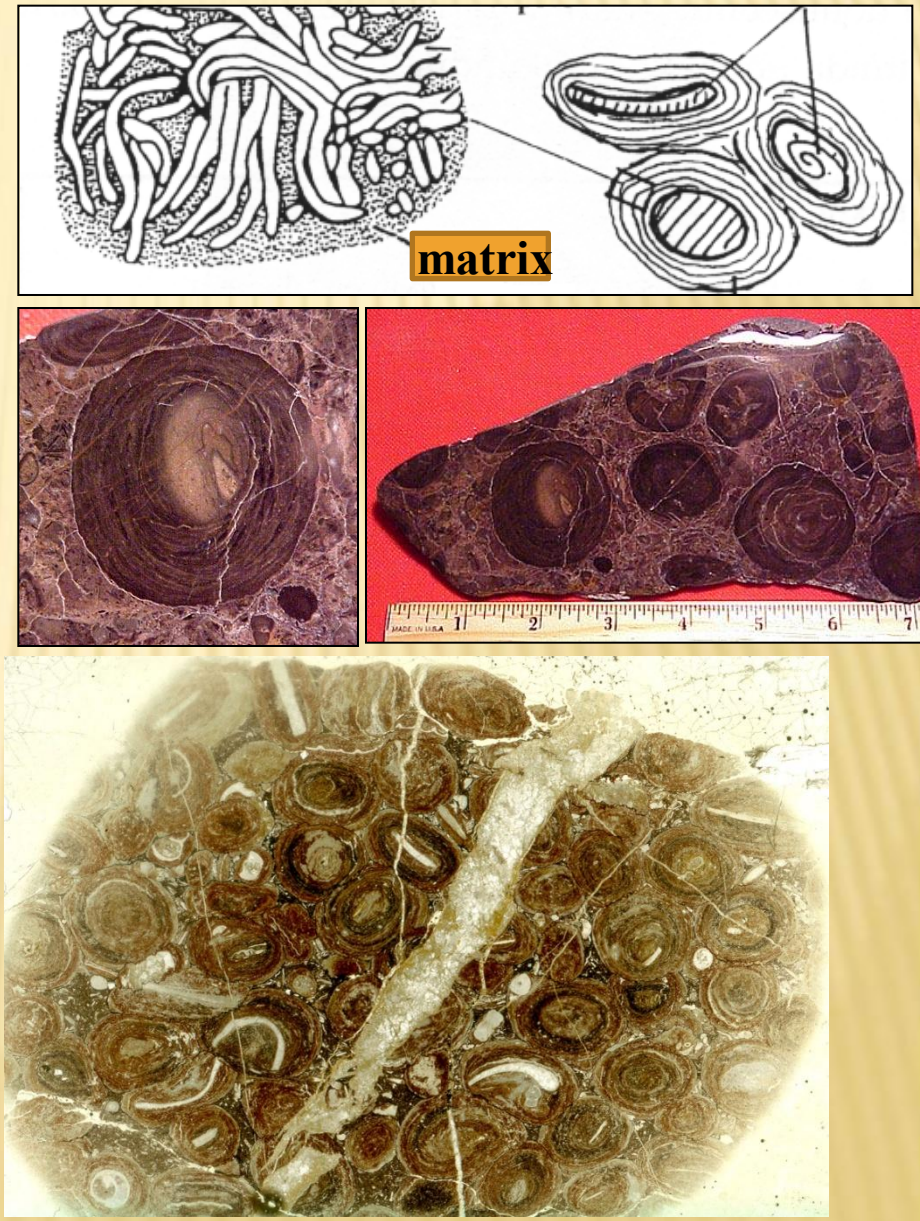

Photograph: Yaşar EREN, Konya

M. Görmüş,
Ankara University, 2017
Lecture 3

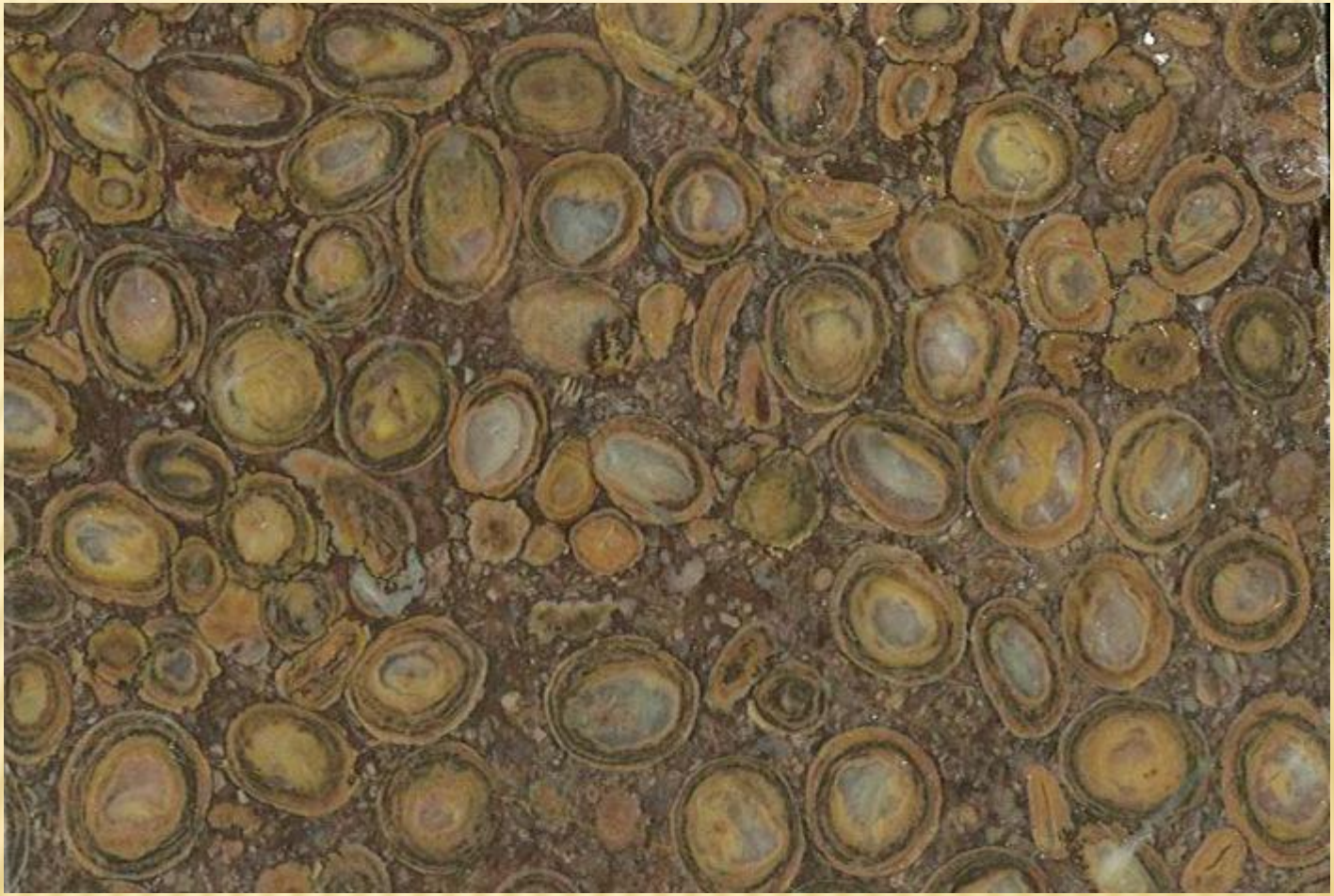
Oncoliths

***Girvanella* sp.**
(Cambrian to Recent)

It has tangled calcerous tubes



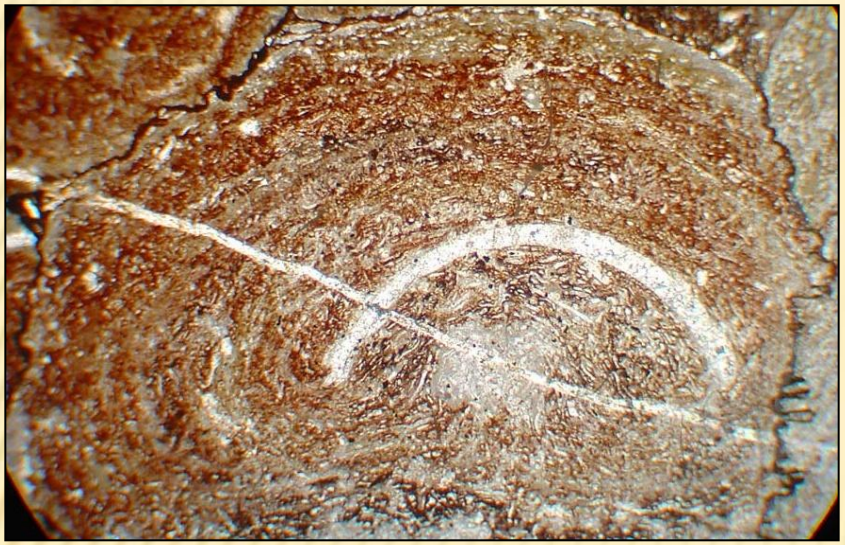
Pictures from Alkaya (Selçuk Univ.),
lecture notes,

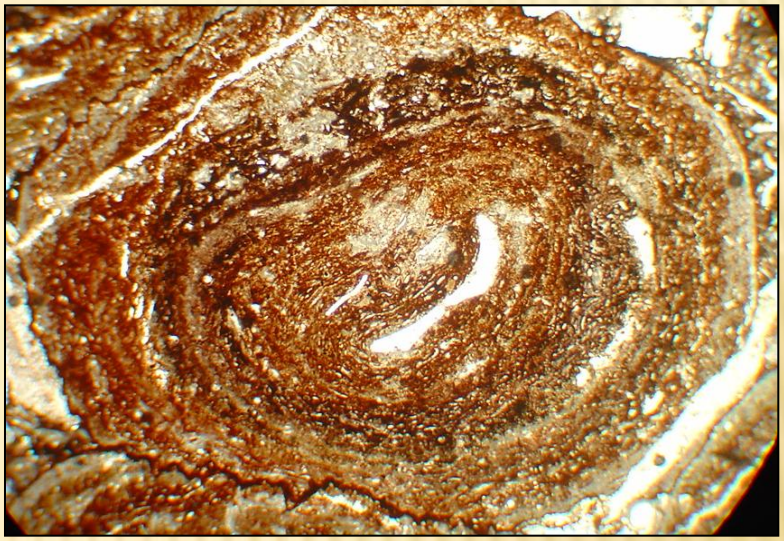


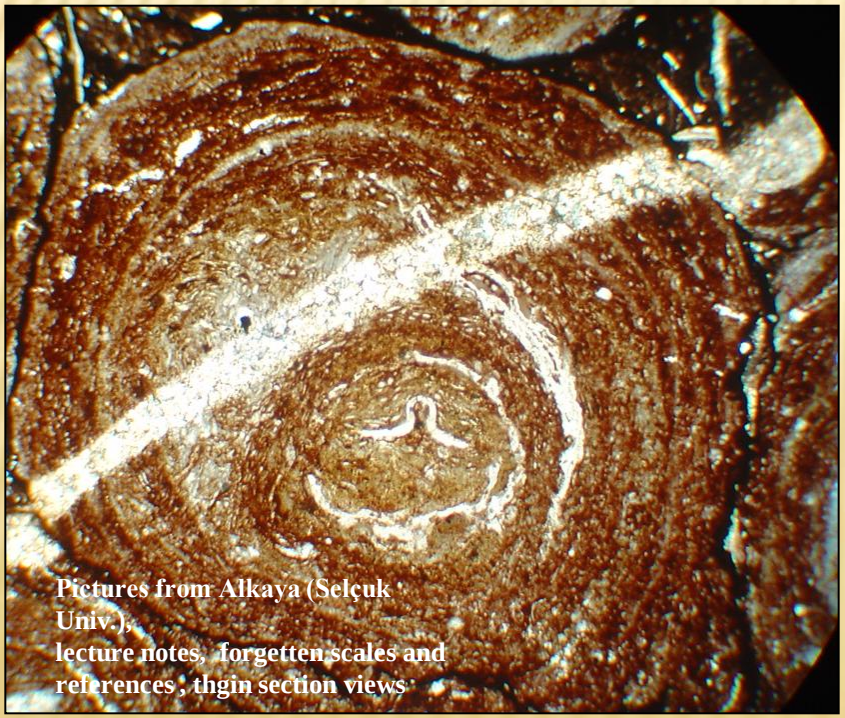
poolished surface

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

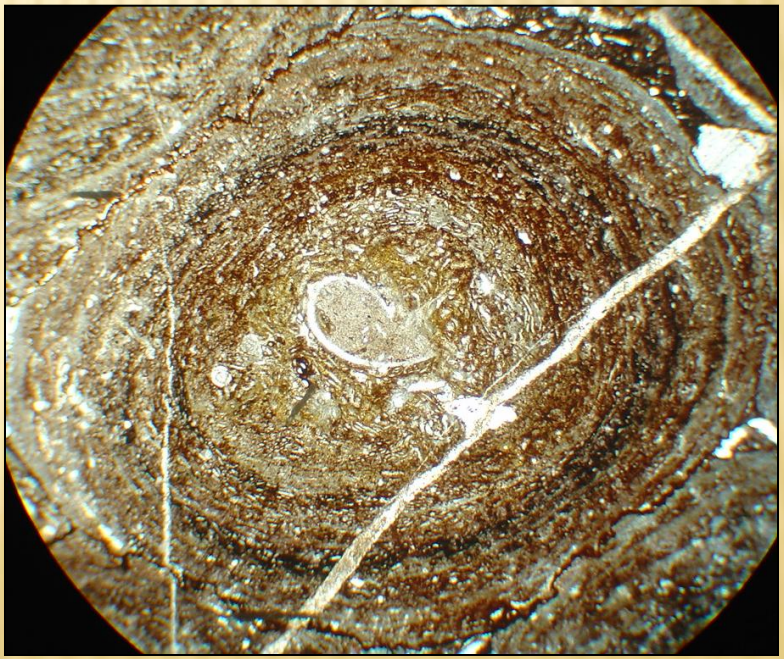
M. Görmüş,
Ankara University, 2017
Lecture 3



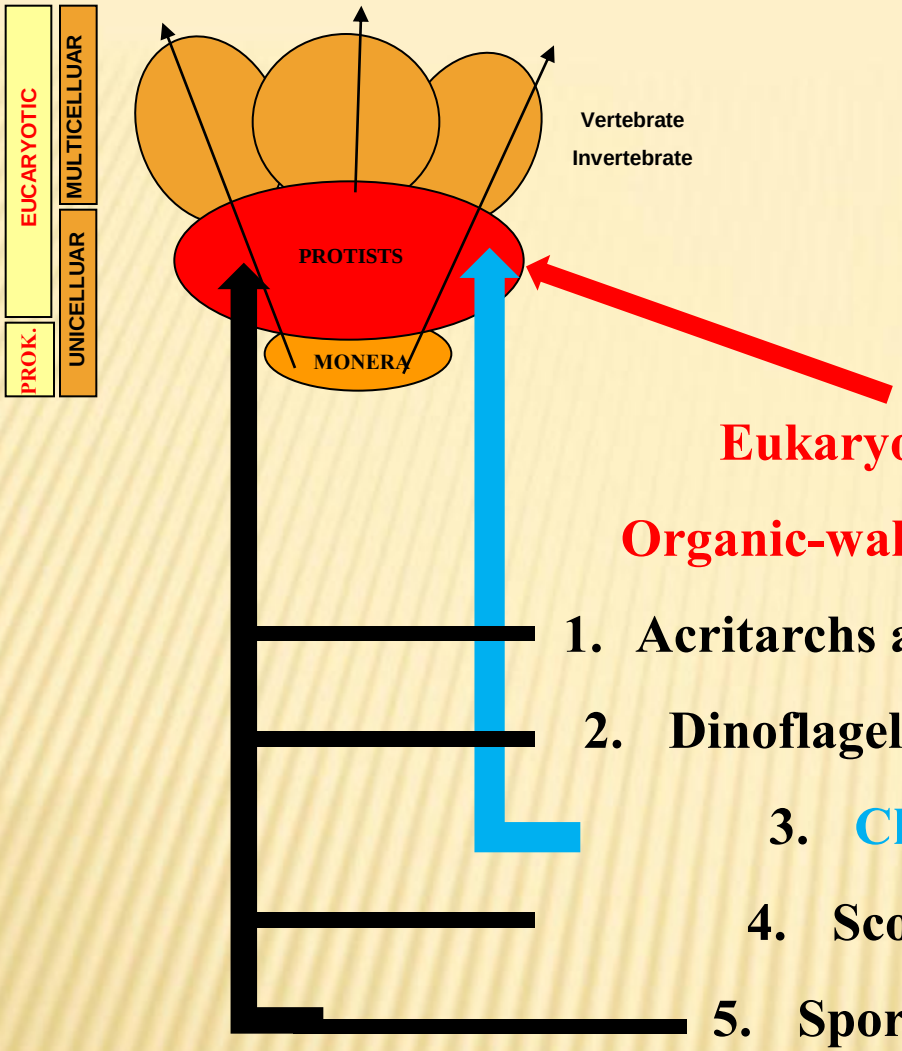




Pictures from Alkaya (Selçuk Univ.), lecture notes, forgetten scales and references, thgin section views



M. Görmüş,
Ankara University, 2017
Lecture 3

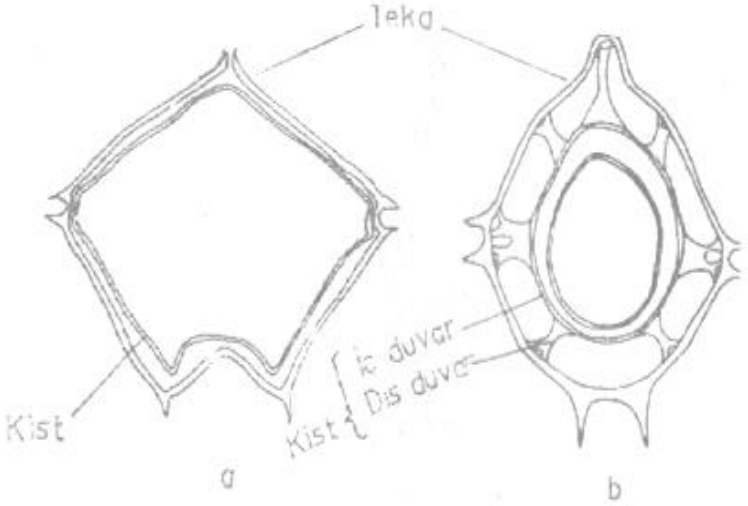


Eukaryota-Protists

Organic-walled microfossils

1. **Acritarchs and prasinophytes**
2. **Dinoflagellates & ebridians**
3. **Chitinozoa**
4. **Scolecodonts**
5. **Spores & pollen**

1. Acritarchs



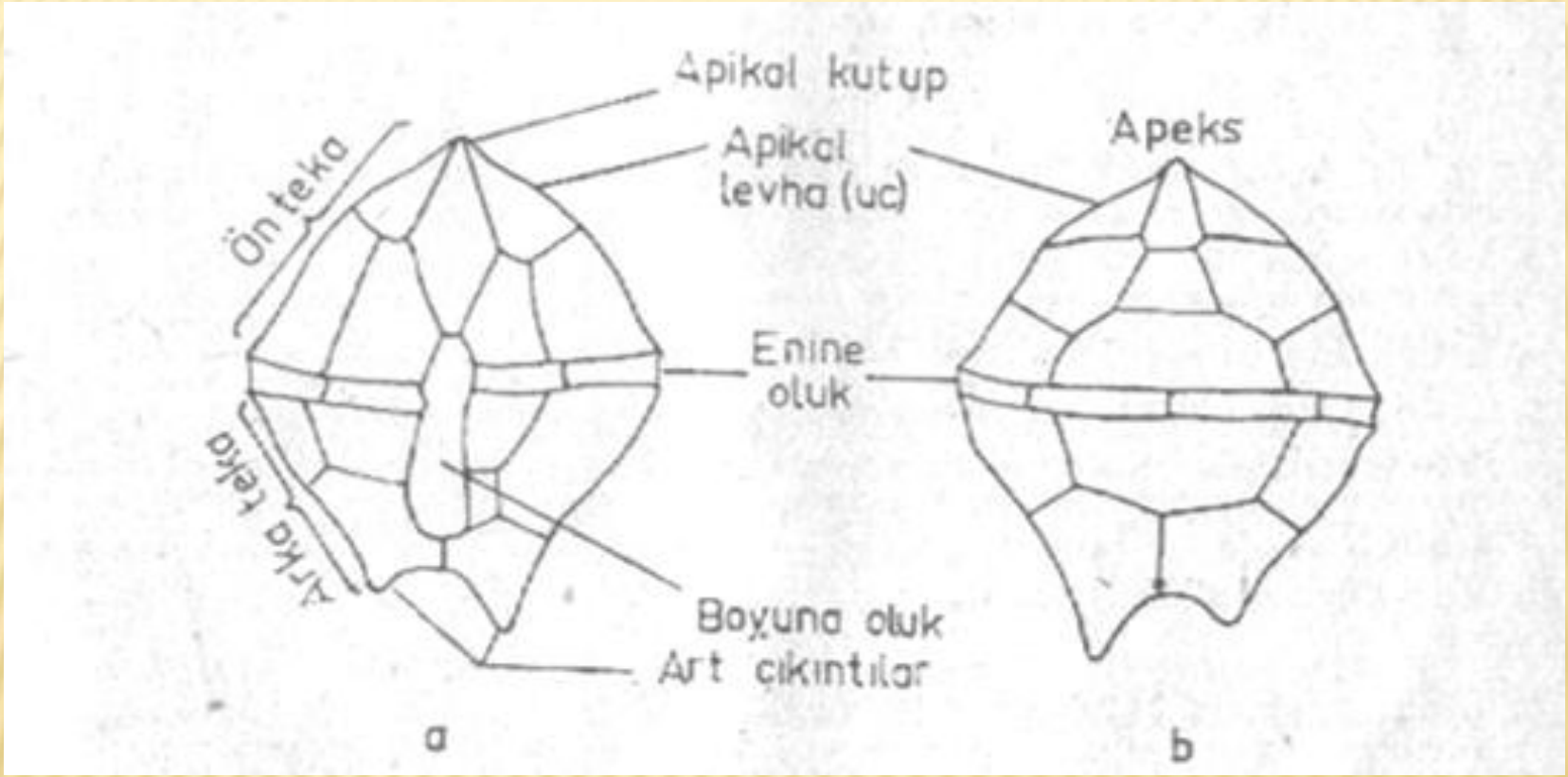
Şek. 9 — Teka içinde, kistin şematik şekli. a — Teka içinde bir düzgün kist, b — Teka içinde bir uzantılı kist (GİTMEZ, 1978).

Meriç, 1985

2. Dinoflagellates

Geologic range: Silurian to Recent
Composition: Organic material (sporopollenin)
Size: 5 µm - 2 mm
Significance: Cause red tides, secrete "paralytic shellfish poison", luminescence. An integral part of the food chain (phytoplankton). Useful in biostratigraphy and paleoenvironment interpretation.
Morphology: Covered with a series of tiny plates, indentation around their equator that held a coiled flagellum in life; shape variable, may resemble a top or a star; some are covered with spines.
Environment: Marine and freshwater; most planktonic. Others are symbionts or parasites (zooxanthellae in corals).

http://www.gpc.edu/~pgore/geology/historical_lab/microfossils.php


Apikal kutup
Apikal levha (uç)
Apeks
Ön teka
Enine oluk
Arka teka
Boyuna oluk
Art çıkıntılar
a
b

Gitmez, 1978

M. Görmüş,
Ankara University, 2017
Lecture 3

Dinoflagellates - Pyrrhophyta

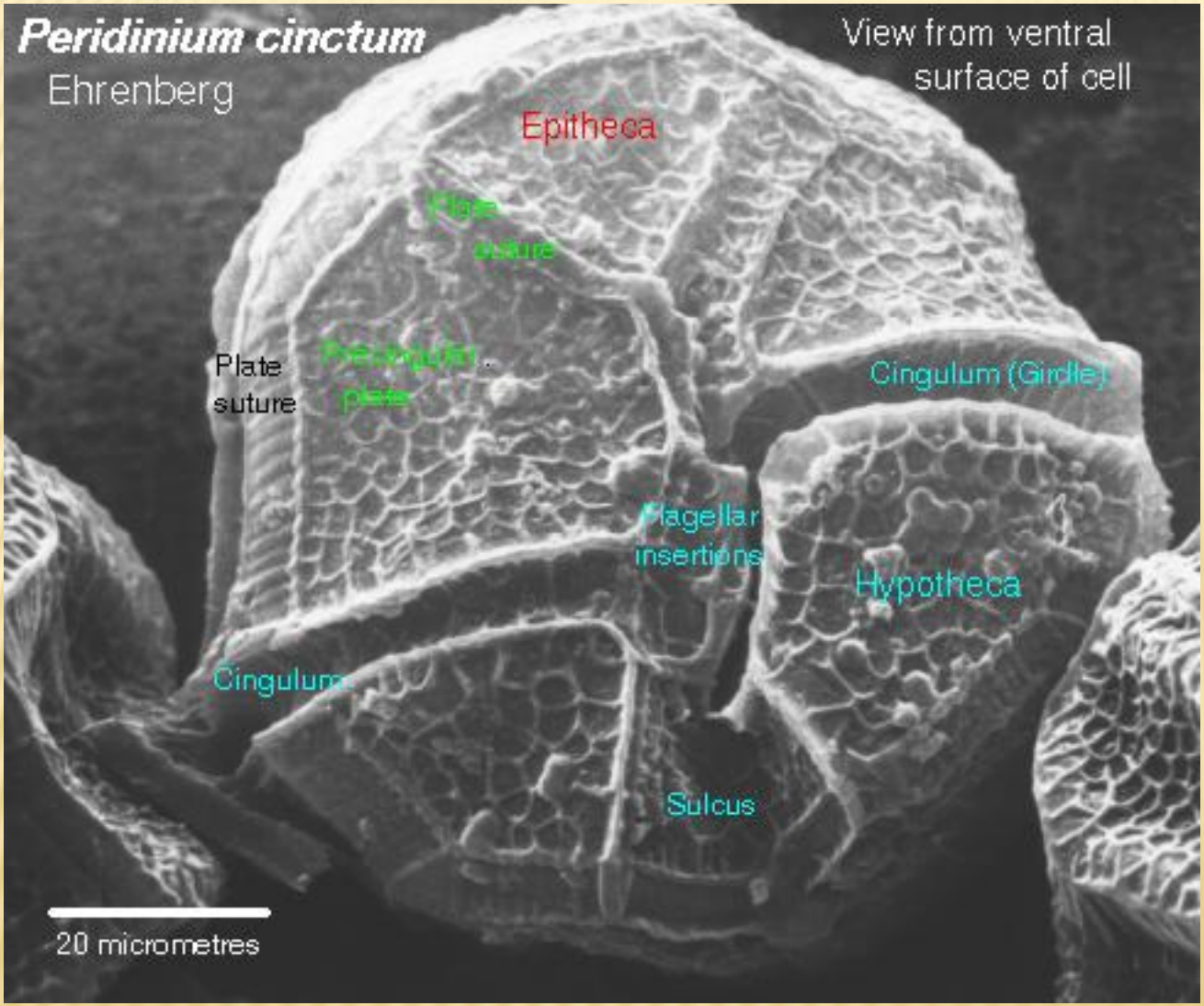
Sporopollenin

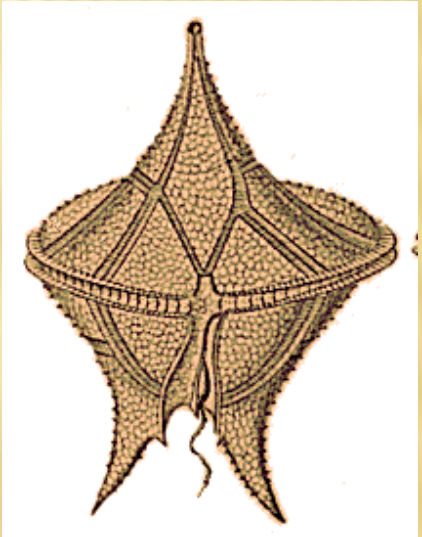
Algal Microfossils

living

fossil

http://people.hofstra.edu/faculty/J_B_Bennington/K_16/marine_microfossils.html

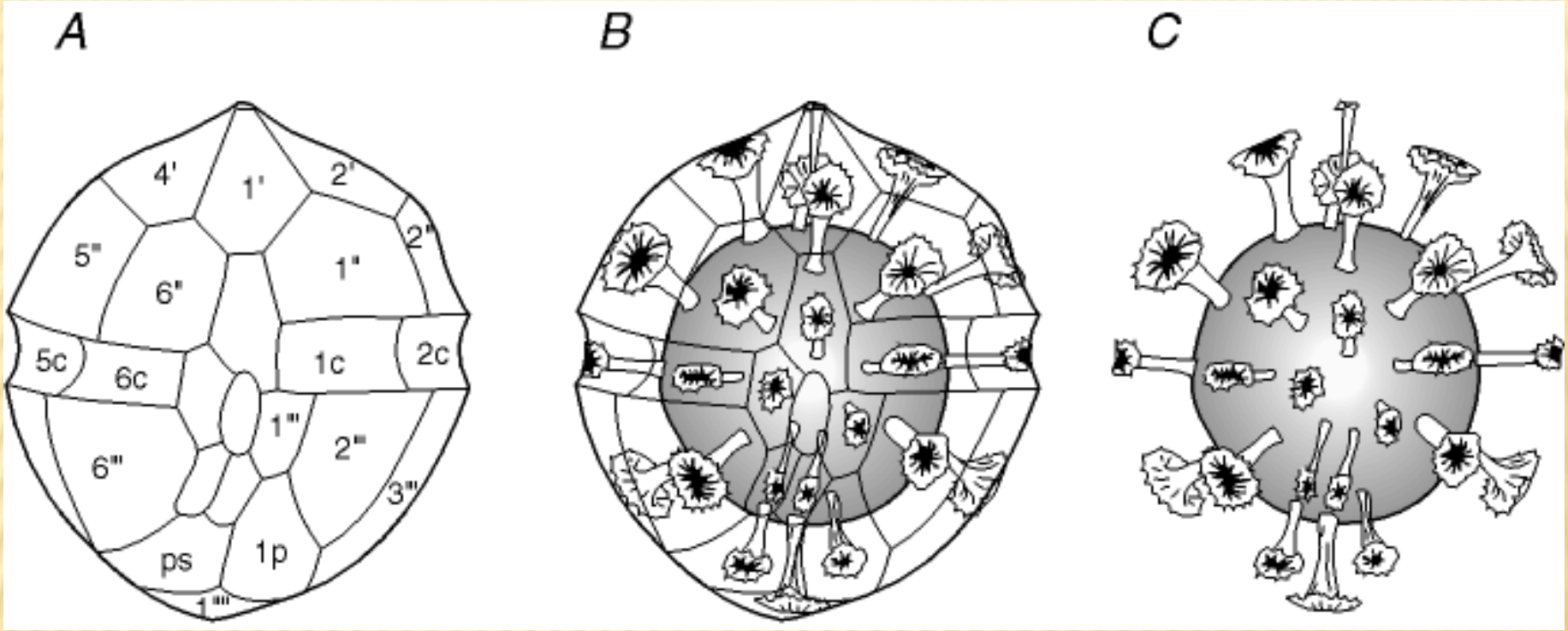


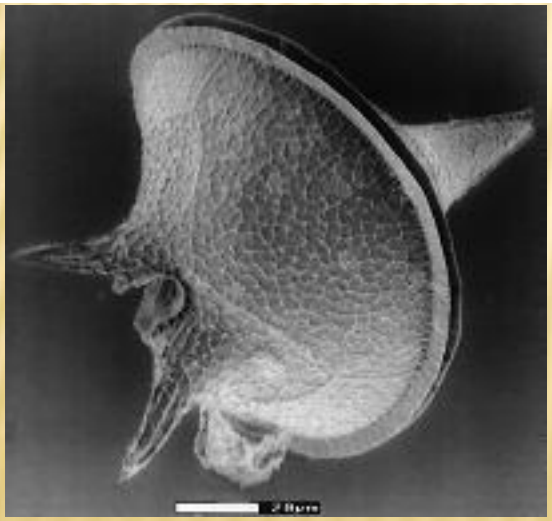


http://people.hofstra.edu/faculty/J_B_Bennington/K_16/marine_microfossils.html

Dinoflagellates - Pyrrhophyta

M. Görmüş,
Ankara University, 2017
Lecture 3

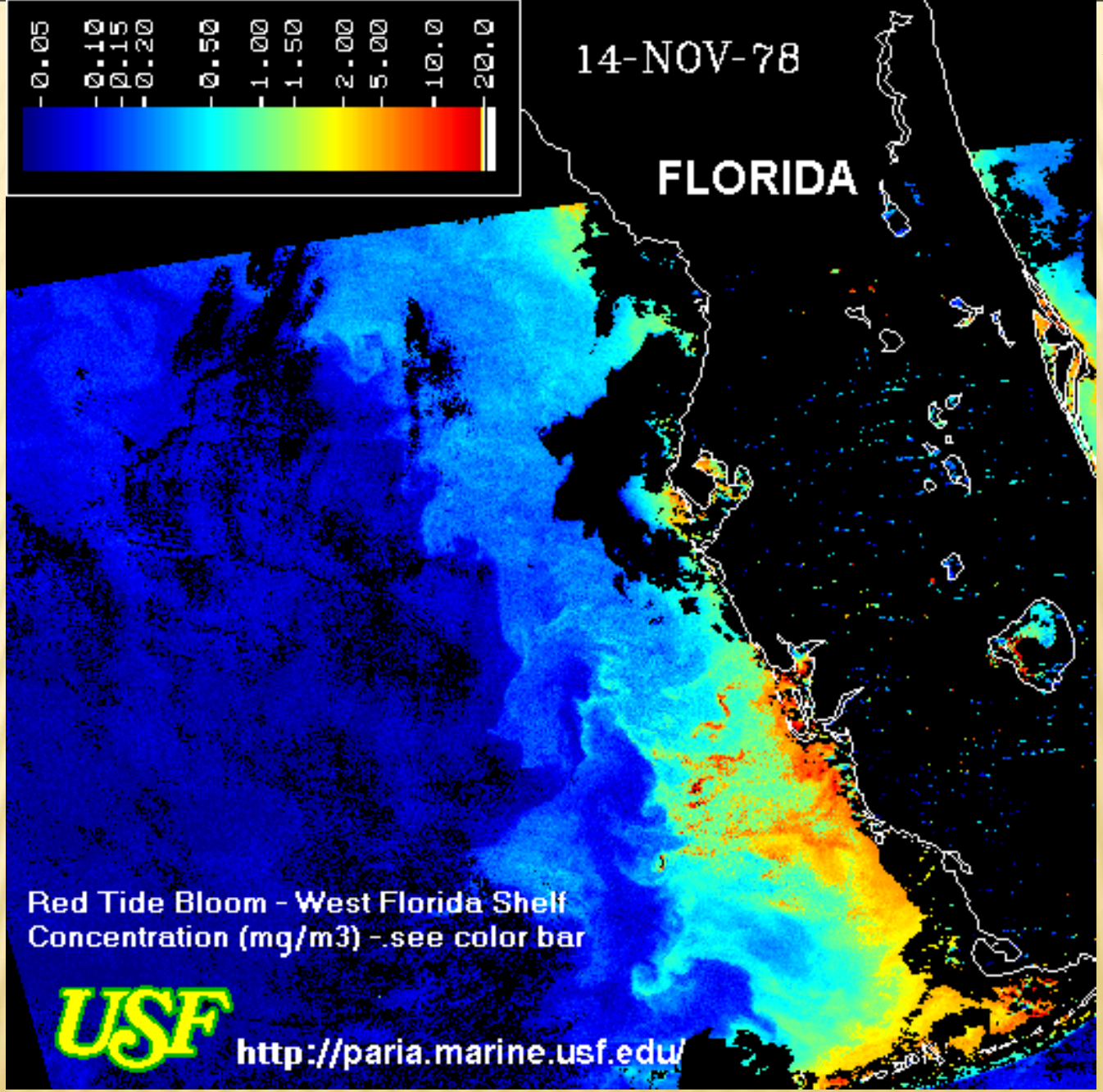




Cyst

Living cell

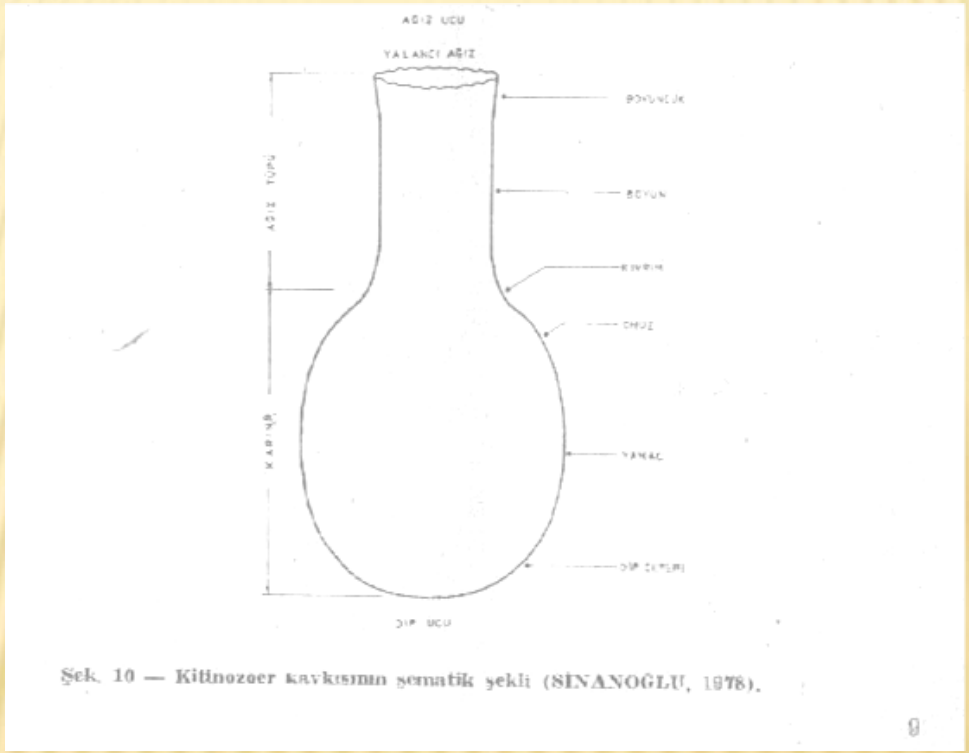
http://people.hofstra.edu/faculty/J_B_Bennington/K_16/marine_microfossils.html



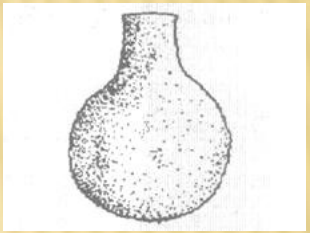
http://people.hofstra.edu/faculty/J_B_Bennington/K_16/marine_microfossils.html

http://people.hofstra.edu/faculty/J_B_Bennington/K_16/marine_microfossils.html

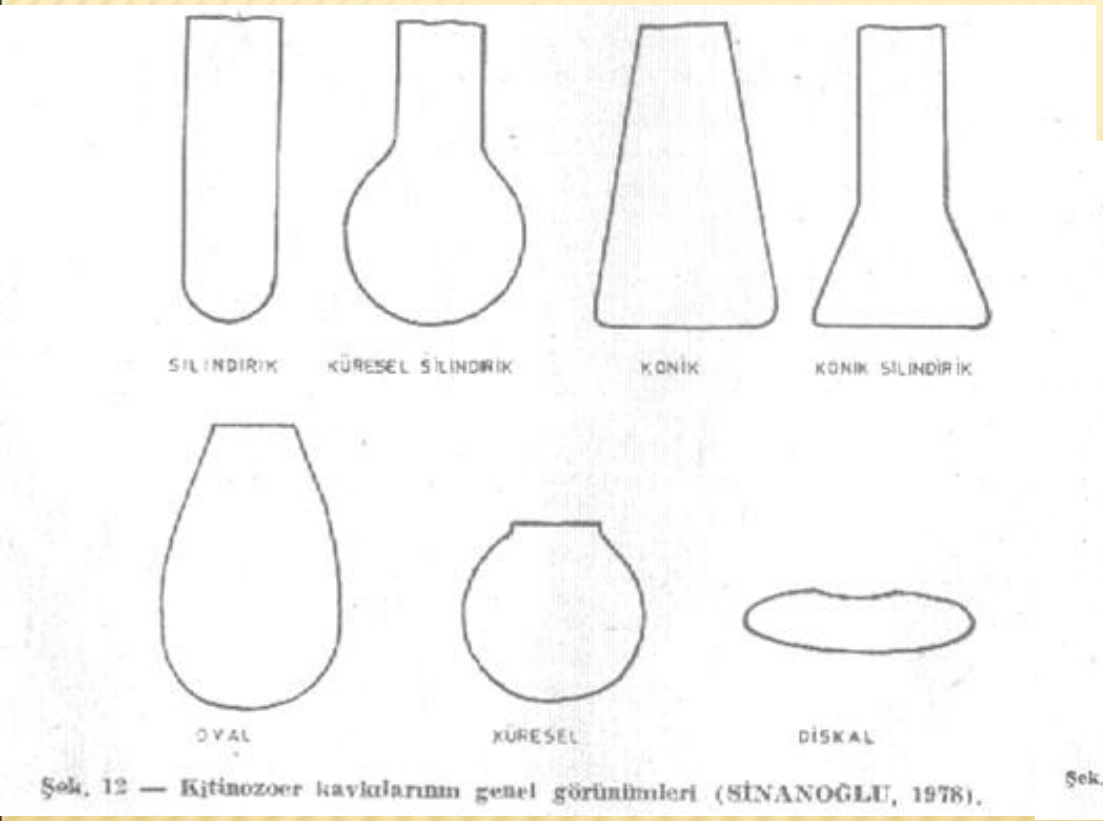
3. Chitinozoa



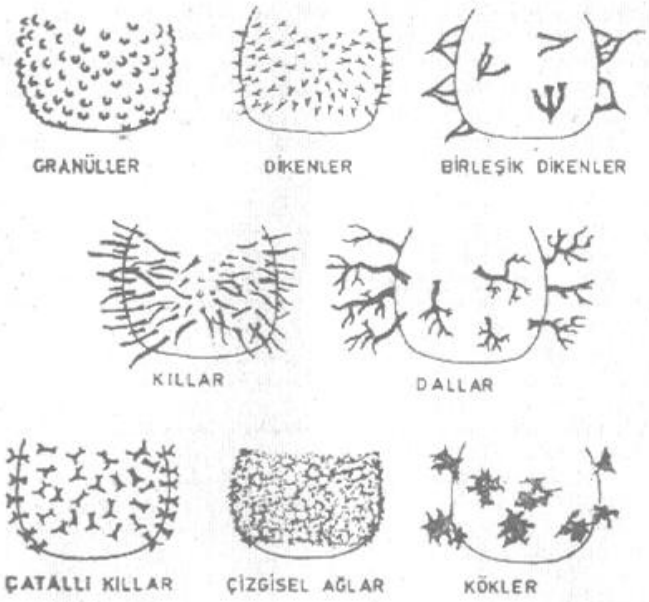
Şek. 10 — Kitinozoer kavkısının şematik şekli (SİNANOĞLU, 1978).



Meriç, 1985



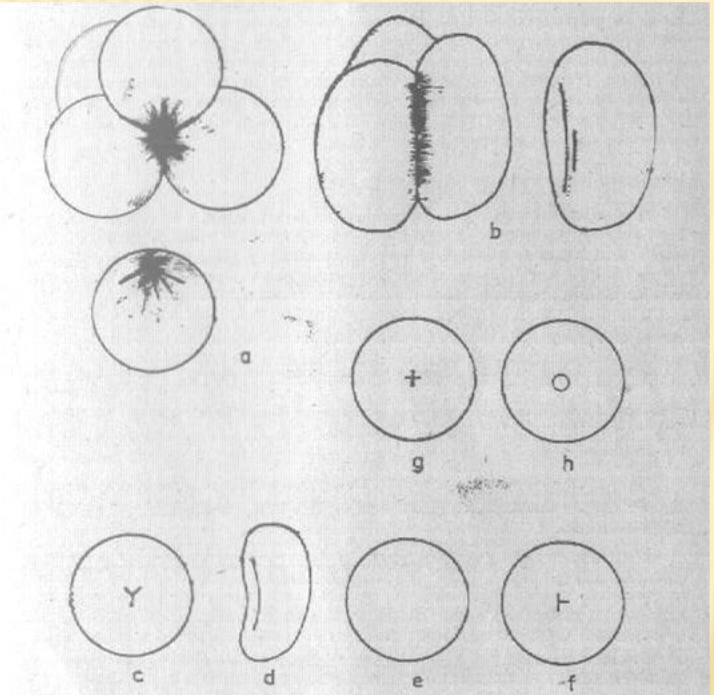
Şek. 12 — Kitinozoer kavkılarının genel görünümleri (SİNANOĞLU, 1978).



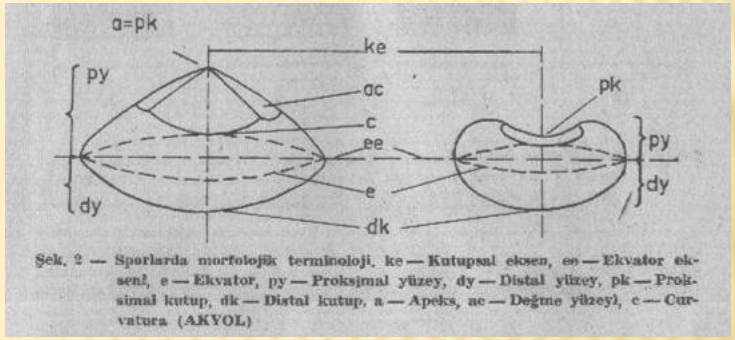
Şek. 13 — Kitinozoer'lerde yüzey süsleri (SİNANOĞLU, 1978).

5. Spores & pollens (unicellular reproductive structures of multicellular plants)

Geologic ranges: Spores (from algae, fungi, mosses and ferns): Silurian to Recent
Pollen from gymnosperms (conifers, ginkgoes): Pennsylvanian to Recent
Pollen from angiosperms (flowering plants): Cretaceous to Recent
Composition: Organic material (sporopollenin)
Size: 0.02 - 0.08 μm; some to 0.2 mm
Significance: Useful in biostratigraphy, and paleoenvironmental and paleoclimatic interpretations.
Morphology: Globular or spheroidal. Some pollen is shaped like "Mickey Mouse" ears.
Environment: Pollen and spores come from land plants. Fossils are found in continental and transitional environments.



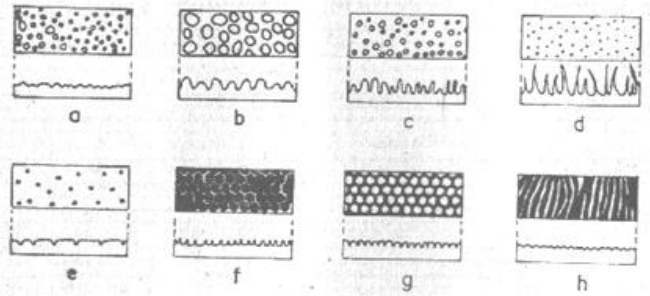
Şek. 1 — Tetrad şekilleri ve sporlardaki izler. a — Nokta etrafında yapışmış sporlardan oluşan tetrad, b — Çizgi boyunca yapışmış sporlardan oluşan tetrad, c — Trilet spor, d — Monolet spor, e — Alet spor, f — Dilet spor, g — Tetralet spor, h — Sirküleret spor (AKYOL).



Şek. 2 — Sporlarda morfolojik terminoloji. ke — Kutupsal eksen, ee — Ekvator eksen, e — Ekvator, py — Proksimal yüzey, dy — Distal yüzey, pk — Proksimal kutup, dk — Distal kutup, a — Apeks, ac — Değme yüzeyi, c — Curvatura (AKYOL)

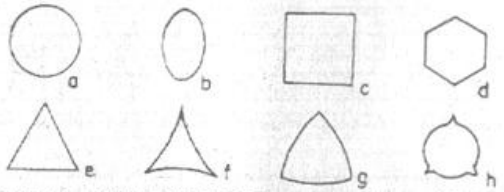
Meriç, 1985

Exinium üzerinde hiçbir süs görülmez ise düz anlamına gelen "laevigat" terimi kullanılır.



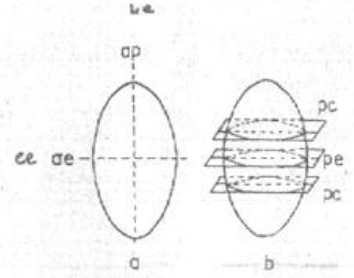
Şek. 3 — Spor süslerinden bazıları, a — Granum, b — Verrucа, c — Baculum, d — Spina, e — Fovea, f ve g — Reticulum, h — Cicatricula (NAKOMAN, 1971). Üst şekiller exinium'un üstten görünüşü, alt şekiller ise kesitidir.

Görünüşlerinin tamamen farklı olmasına rağmen spor ve pollenleri birbirinden ayırtlamakta bazen zorluk çekilir. Pollenler ekvatoral görünüşte yuvarlak, eliptik, dörtgen, altıgen, üçgen (düz, dışbükey ve içbükey kenarlı ile dikenli) şekiller verebilir (Şek. 4). Bir pollenin en uzun eksenine kutupsal eksen denir. Bu eksen aynı



Şek. 4 — Pollenlerin ekvatoral görünümleri, a — Dairesel, b — Eliptik, c — Kare, d — Altıgen, e, f, g ve h — çeşitli üçgenler (NAKOMAN, 1971).

zamanda bir simetri eksenidir. Kutupsal ekseno dik ve pollenin merkezinden geçen düzlem ekvator düzlemi olup, pollenin ekvatoral simetri düzlemi ile çakışır (Şek. 5). Pollenlerin bir kısmında "Porus" adı verilen yuvarlak delikler bulunur. Sayıları 1, 2, 3 veya daha fazla olabilir. Bunların konumu ve sayısı cins ve türlerin ayırtlanmasına yardım eder (Şek. 6). Yüzeyde, delik şeklindeki porusların dışında "Colpus" adı verilen, kutupsal eksene paralel olarak bulunan boyuna çizgiler vardır ve bunların sayıları değişken olabilir. En az rastlanan tipler 1-3 colpuslu olanlardır (Şek

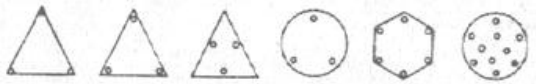


Şek. 5 — Pollenlerin simetri elemanları, ap — Kutupsal eksen, ae — Ekvatoral eksen, pe — Ekvatoral düzlem, pc — İkincil simetri düzlemleri (NAKOMAN, 1971).

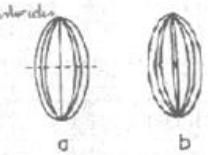
7 a). Colpus-Porus bağlantısında, porusar ekvatoral bir durumda colpuslar ile çakışırlar. Bu çakışma yerinde colpuslar "Caverna" adı verilen bir genişlik oluşturur-lar (Şek. 7 b).

Fosilleşen bir spor veya pollenin hangi bitki türüne ait olduğunu tespit etmek oldukça güçtür. Eski zamanlara gidildikçe bu iş dahada güçleşir ve bunun nedeni söyle özetlenebilir :

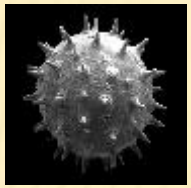
Farklı jeolojik zaman ve devirlerde yaşamış olan bir kısım bitkilerin nesilleri tükenmiştir. Ender olarak üzerinde spor kesesi bulunan bitki fosillerine rastlanılmaktadır. Bu şekilde bulunmuş bazı Paleozoyik yaşlı Eğrelti otu fosillerinin incelenmesinde'de, bir tür bitkinin birkaç spor cinsi ürettiği veya aynı cins sporun birkaç eğrelti türü tarafından oluşturulduğu anlaşılmıştır.



Şek. 6 — Pollenlerde deliklerin pozisyonu (NAKOMAN, 1971).

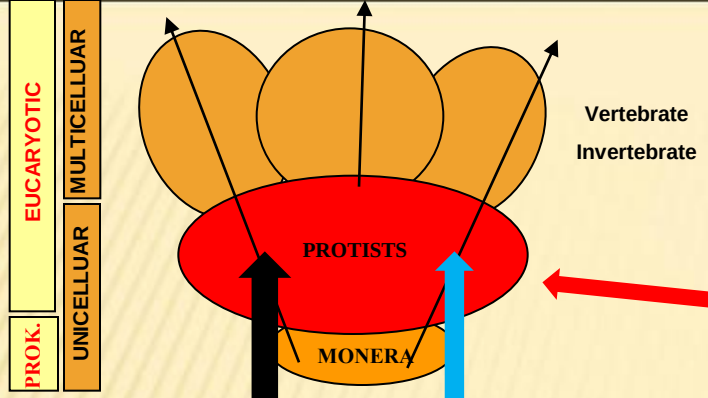


Şek. 7 — Colpus ve Colpus-Porus'lar, a — Colpuslar, b — Colpus-Porus'lar (NAKOMAN, 1971).



Meriç, 1985

M. Görmüş,
Ankara University, 2017
Lecture 3



Eukaryota

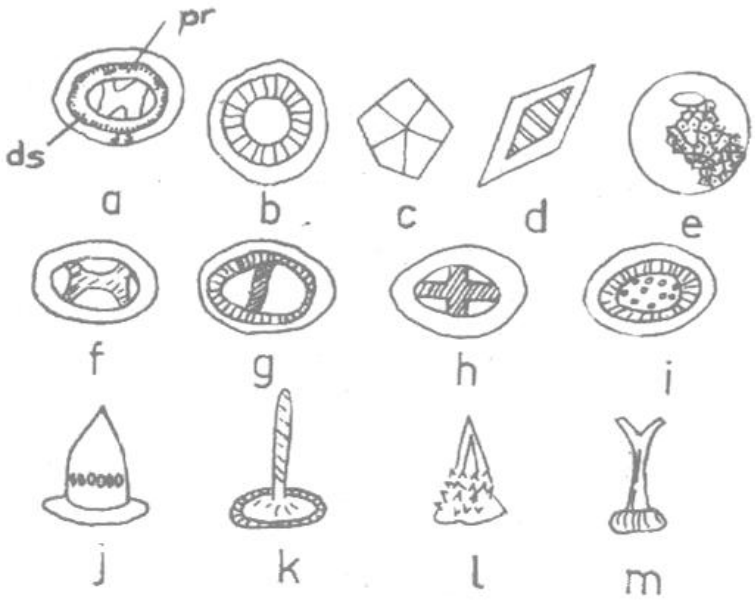
Inorganic-walled microfossils

1. Coccolithophores & discoasters & nannoconus
2. Foraminifera
3. Radiozoa (Acantharia, Phaeodaria & Radiolaria) & Heliozoa
4. Diatoms
5. Slicoflagellates & chrysophytes
6. Ciliophora: tintinnids & calpionellids
7. Ostracods
8. Conodonts

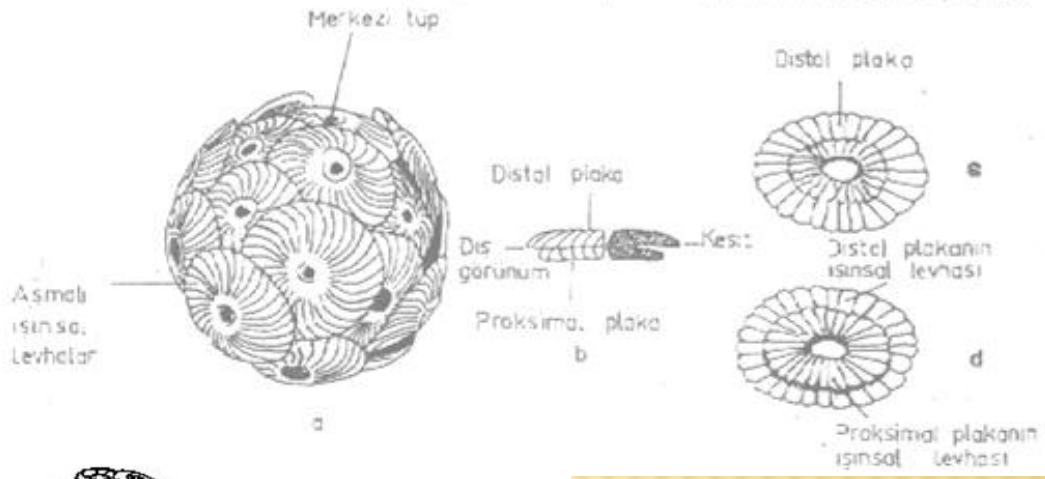
1. Coccolithophores & discoasters

Geologic range: Early Jurassic to Recent
Shell composition: Calcite
Size: 0.002 - 0.02 mm (2 - 20 µm). They are so small that they must be studied with an electron microscope. We will look at photos in lab.
Significance: The base of the marine food chain (phytoplankton); useful in biostratigraphy.
Morphology: Organism is spherical to sub- spherical and covered by circular plates called coccoliths. Coccoliths may resemble a button or a daisy with petal-like ornamentation around the edge.
Environment: Marine only; exclusively planktonic.

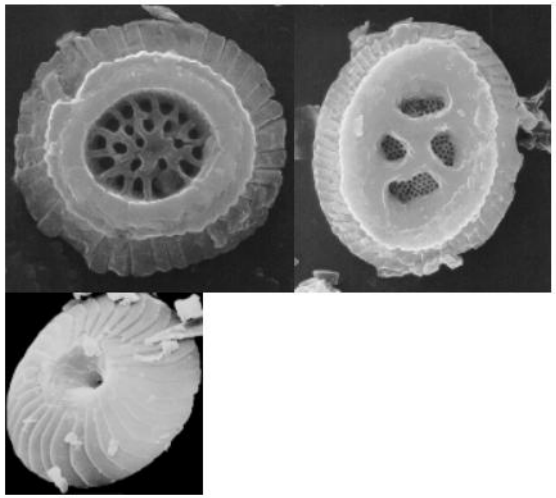
http://people.hofstra.edu/faculty/J_B_Bennington/K_16/marine_microfossils.html



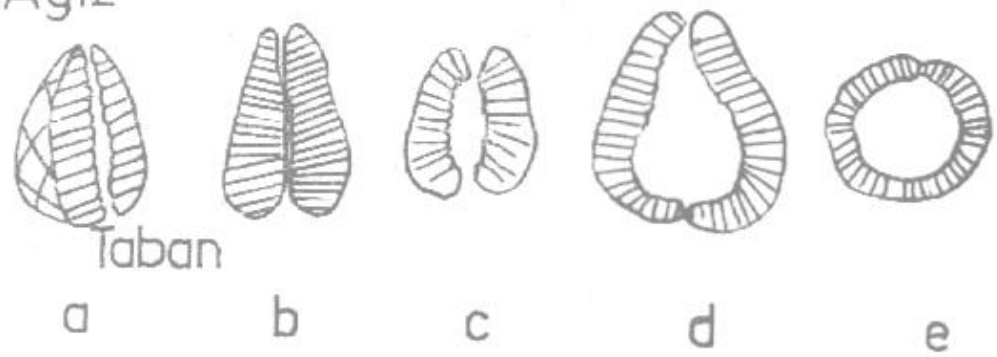
Meriç, 1985



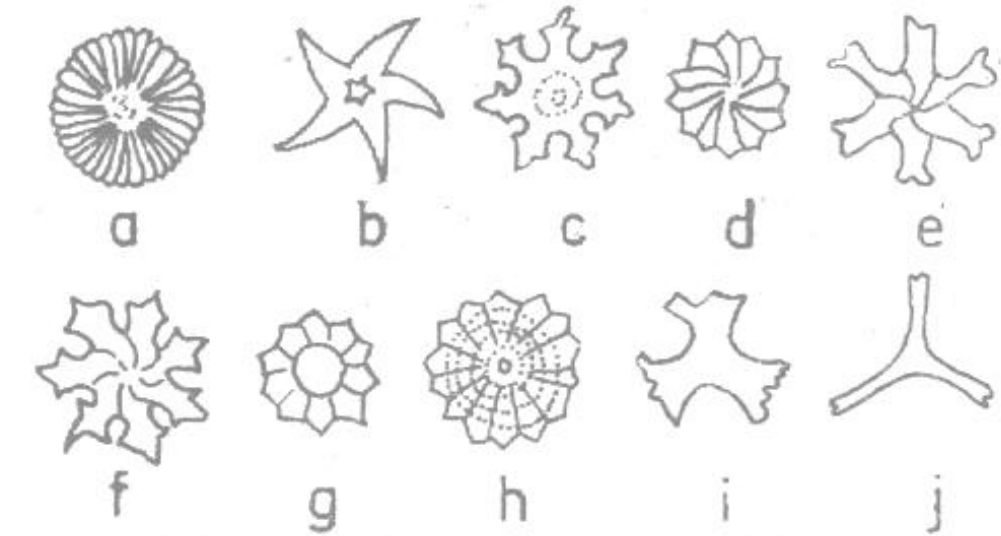
Coccolithophore (left) and coccolith (right)



Coccoliths (calcareous nannofossils). (Public domain images from the U.S. Geological Survey).



Şek. 19 — Nannakonus'ların genel şekilleri. a — Bir Nannokonusun genel görünümü, b, c, d, e — Farklı Nannokonus tipleri (TOKER, 1979).

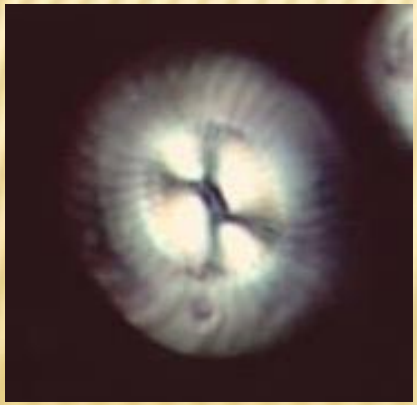


Şek. 20 — Diskoaster'lerin genel şekilleri. a — Kol sayısı fazla, b — Beş kollu, d — Üçgen biçimli kol uçlu, e — Ucu iki çatallı kollu, f — Üç çıkıntılı üçgen biçimli, g — Düğmesi iri, h — Düğmesi küçük, i — Üç kalın kollu, j — Üç ince kollu (TOKER, 1979).

Nannoconus

Discoasters

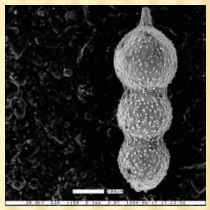
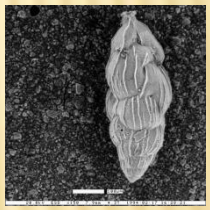
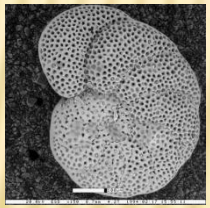
Coccolithophorids - Haptophyta calcite



http://people.hofstra.edu/faculty/J_B_Bennington/K_16/marine_microfossils.html

2. Foraminifera

Geologic range (benthonic foraminifera): Cambrian to Recent.
Geologic range (planktonic foraminifera): Jurassic-Recent.
Shell composition: Calcite or aragonite. Some have shells with cemented grains.
Size: 0.1 - 3.0 mm (some larger; up to 1 cm or more)
Significance: Source of carbonate sediment; useful in biostratigraphy and marine paleoenvironmental interpretation; paleotemperature determination from oxygen isotope ratios of their shells.
Morphology: Microscopic shell which may be coiled, straight, globular, etc. (Wide range of shapes.)
Environment: Marine; benthic and planktonic; large ones are benthic.


Foraminifera **(Public domain images from the U.S. Geological Survey)**

Foraminifera - sarcodina (amoeba)

Protistan Microfossils

http://people.hofstra.edu/faculty/J_B_Bennington/K_16/marine_microfossils.html

Foraminifera - sarcodina (amoeba)

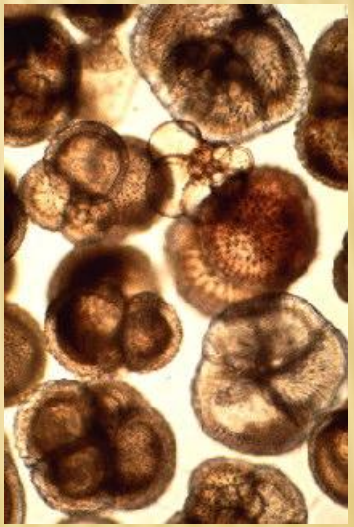
Benthic forams

Life mode: • live in sediments

Size: • relatively large, if they are larger than mm in size, they are called "larger foraminifera"

Shape: • different shapes, lenticular, elongated etc.

Environment: • mainly shallow marine



Planktic forams

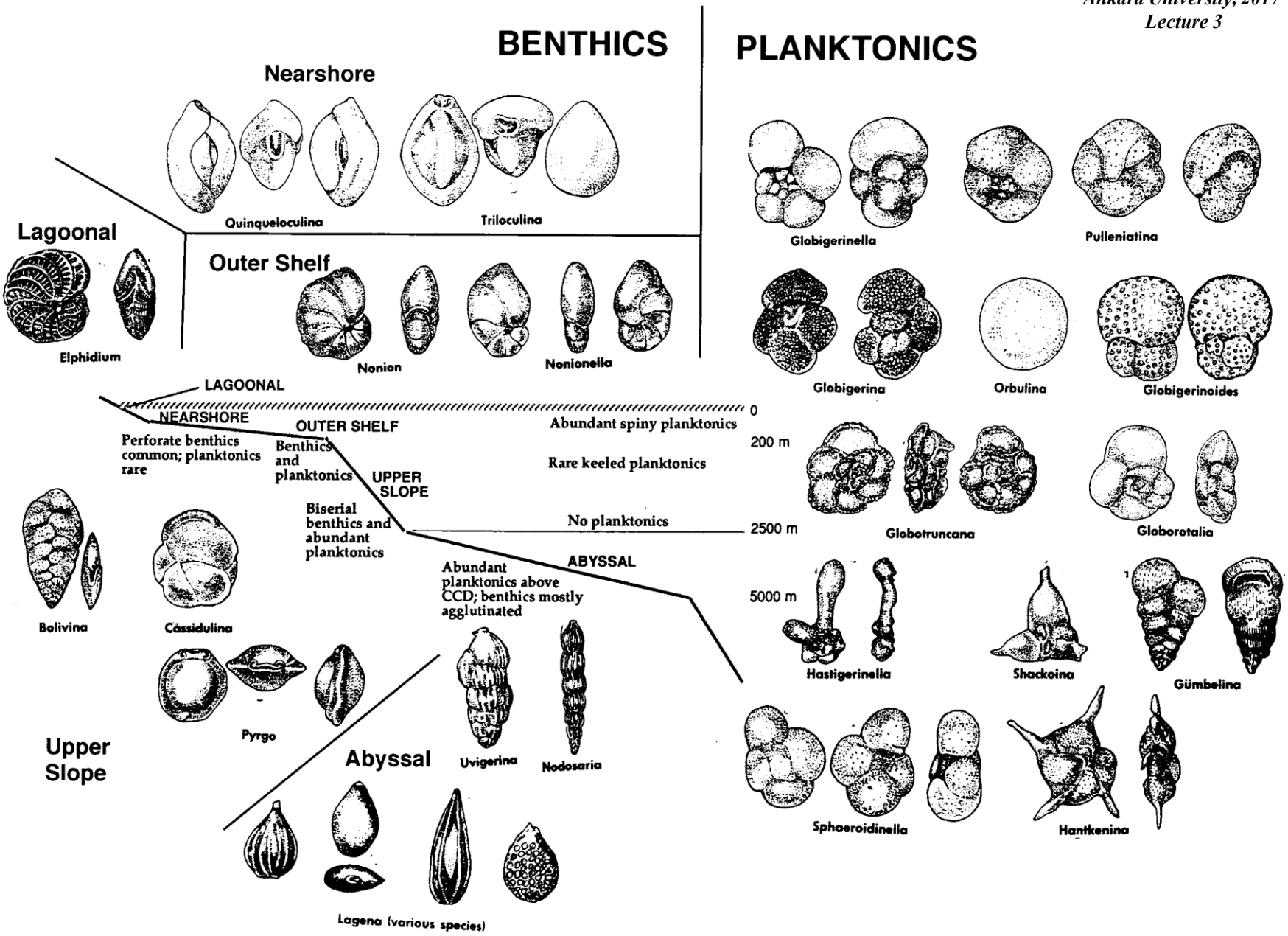
Life mode: • live floating in the water column

Size: • relatively small, usually micron in size

Shape: • mainly globular chambers

Environment: • mainly open sea

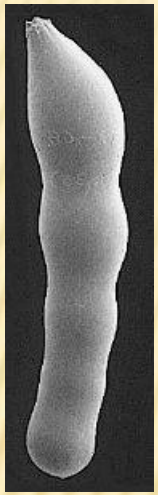
http://people.hofstra.edu/faculty/J_B_Bennington/K_16/marine_microfossils.html

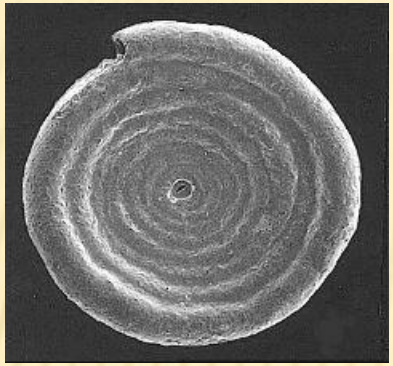


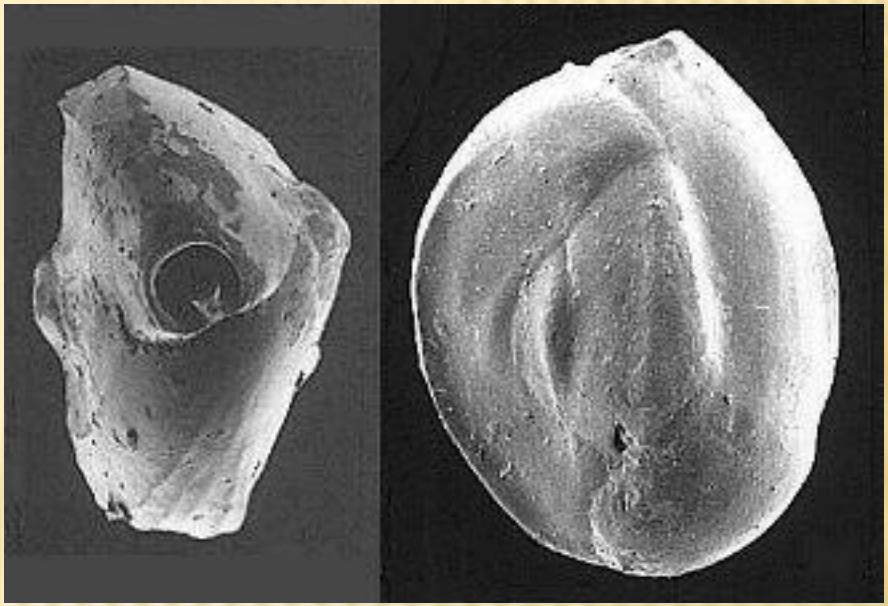
http://people.hofstra.edu/faculty/J_B_Bennington/K_16/marine_microfossils.html

M. Görmüş,
Ankara University, 2017
Lecture 3

Foraminifera - sarcodina (amoeba)





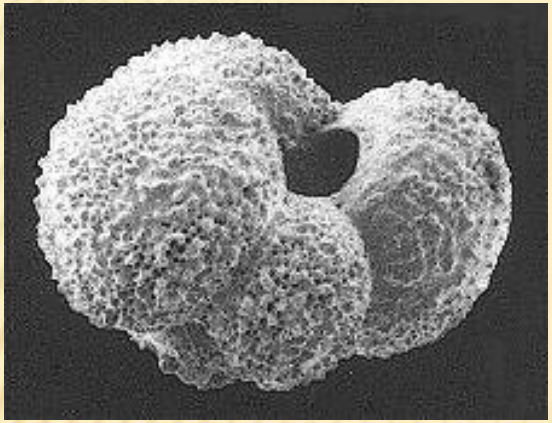


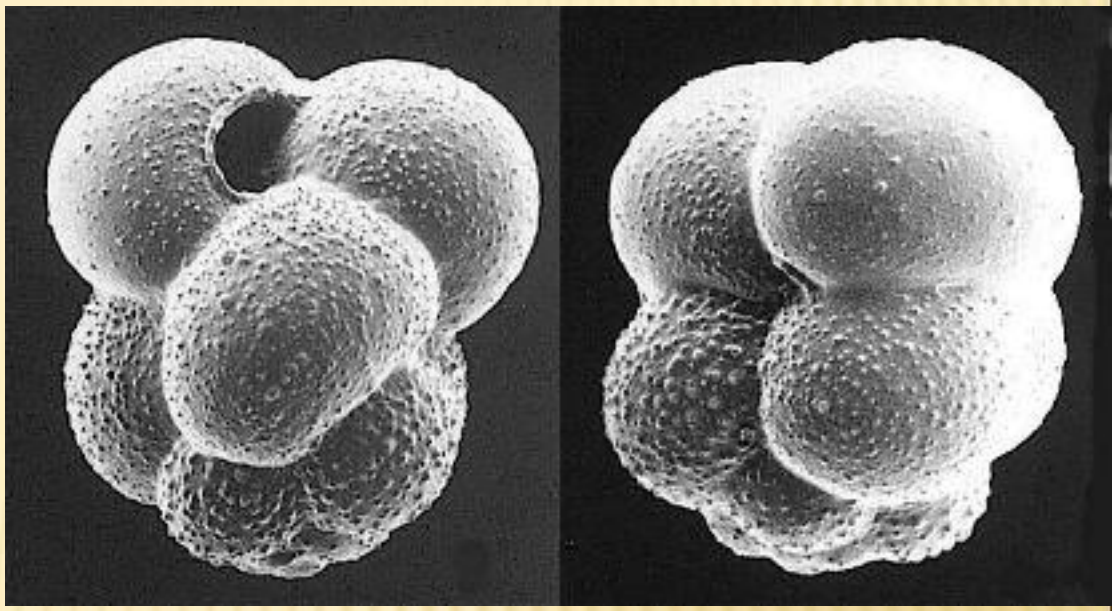
Benthic forams

http://people.hofstra.edu/faculty/J_B_Bennington/K_16/marine_microfossils.html

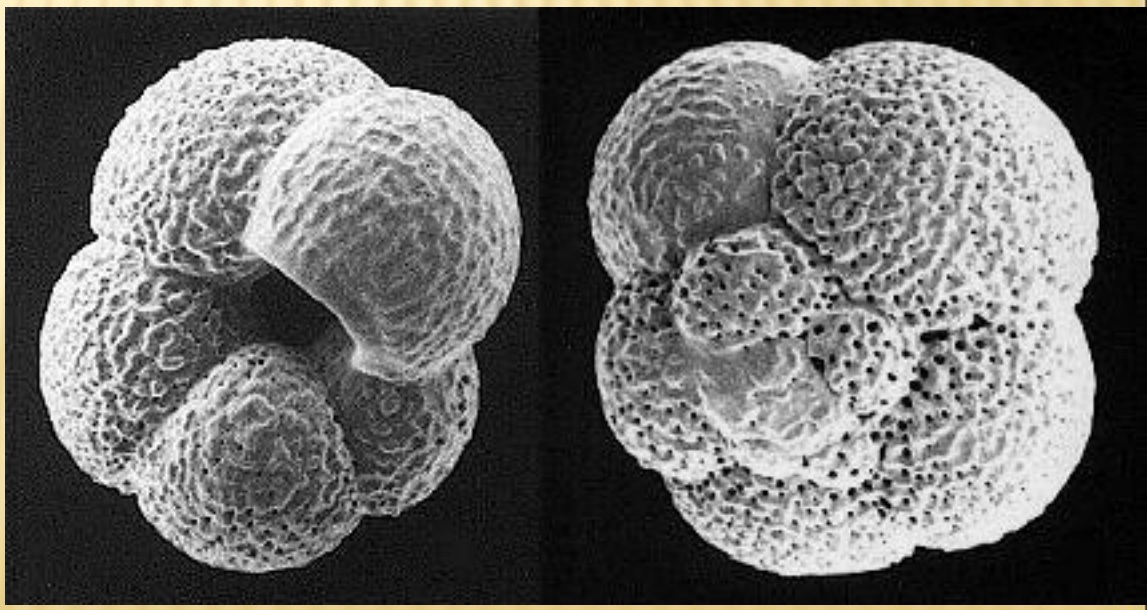
M. Görmüş,
Ankara University, 2017
Lecture 3

Foraminifera





Planktic forams

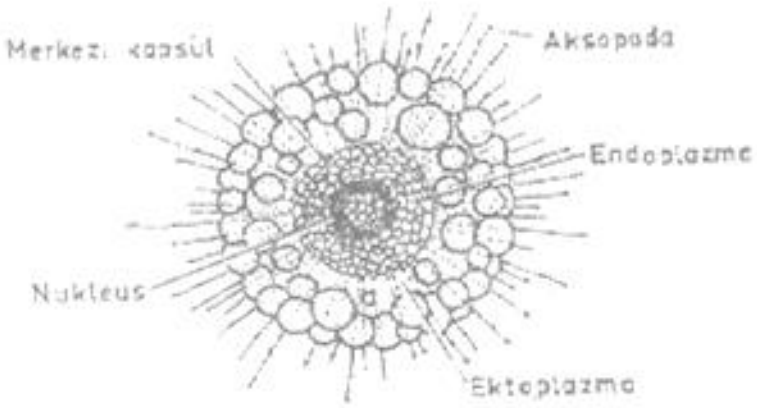


http://people.hofstra.edu/faculty/J_B_Bennington/K_16/marine_microfossils.html

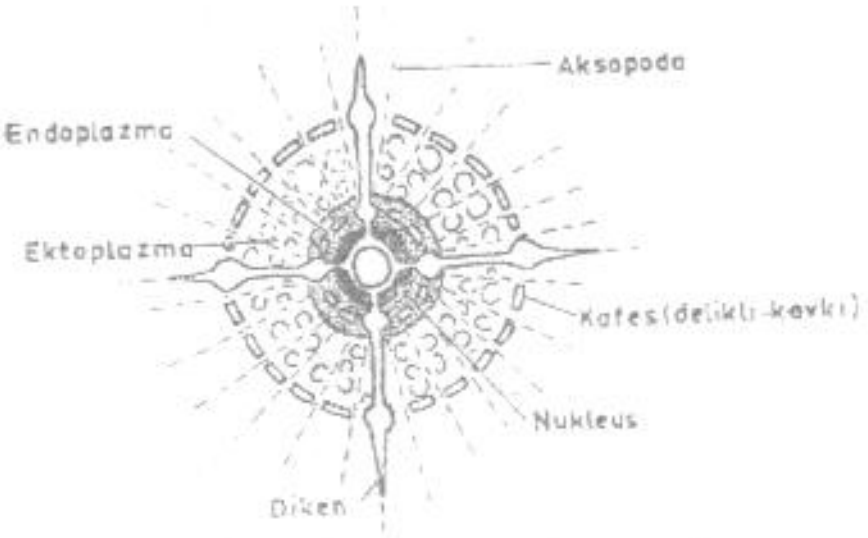
3. Radiolaria

Geologic range: Cambrian to Recent
Shell composition: Silica (amorphous, opaline silica)
Size: 0.1 - 2.0 mm
Significance: Useful in biostratigraphy; they accumulate to form radiolarian ooze on the abyssal plain.
Morphology: Microscopic spiny globes with large, lace-like pores, or helmet-shaped (or space-ship shaped) with large, lace-like pores. Very transparent and glassy.
Environment: Marine only; planktonic.

http://people.hofstra.edu/faculty/J_B_Bennington/K_16/marine_microfossils.html


Merkezi kapsül
Aksopoda
Endoplazma
Nukleus
Ektoplazma

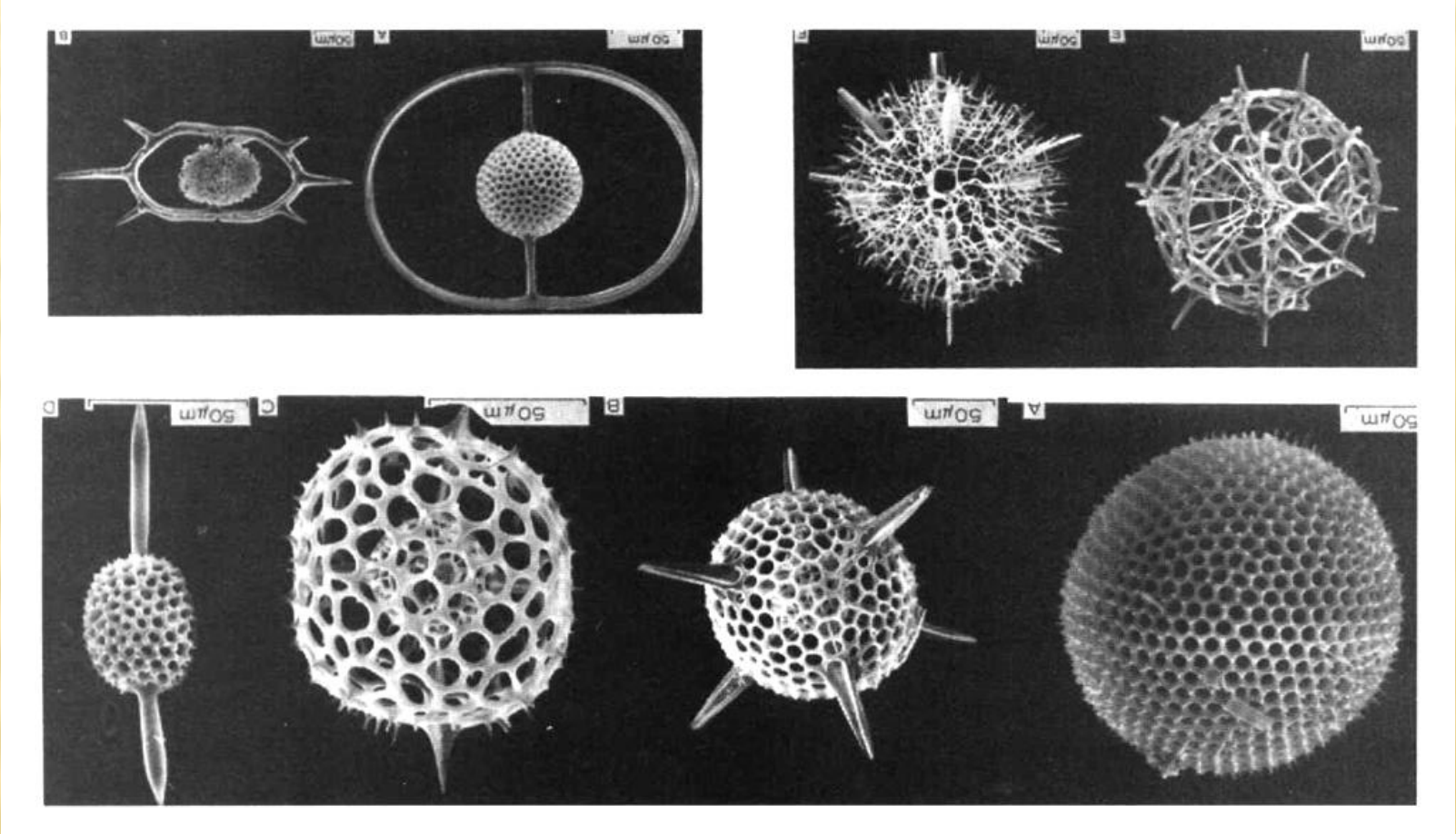
a


Aksopoda
Endoplazma
Ektoplazma
Kafes(delikli kavkı)
Nukleus
Diken

Meriç, 1985

M. Görmüş,
Ankara University, 2017
Lecture 3

Radiolarians - Spumellarians

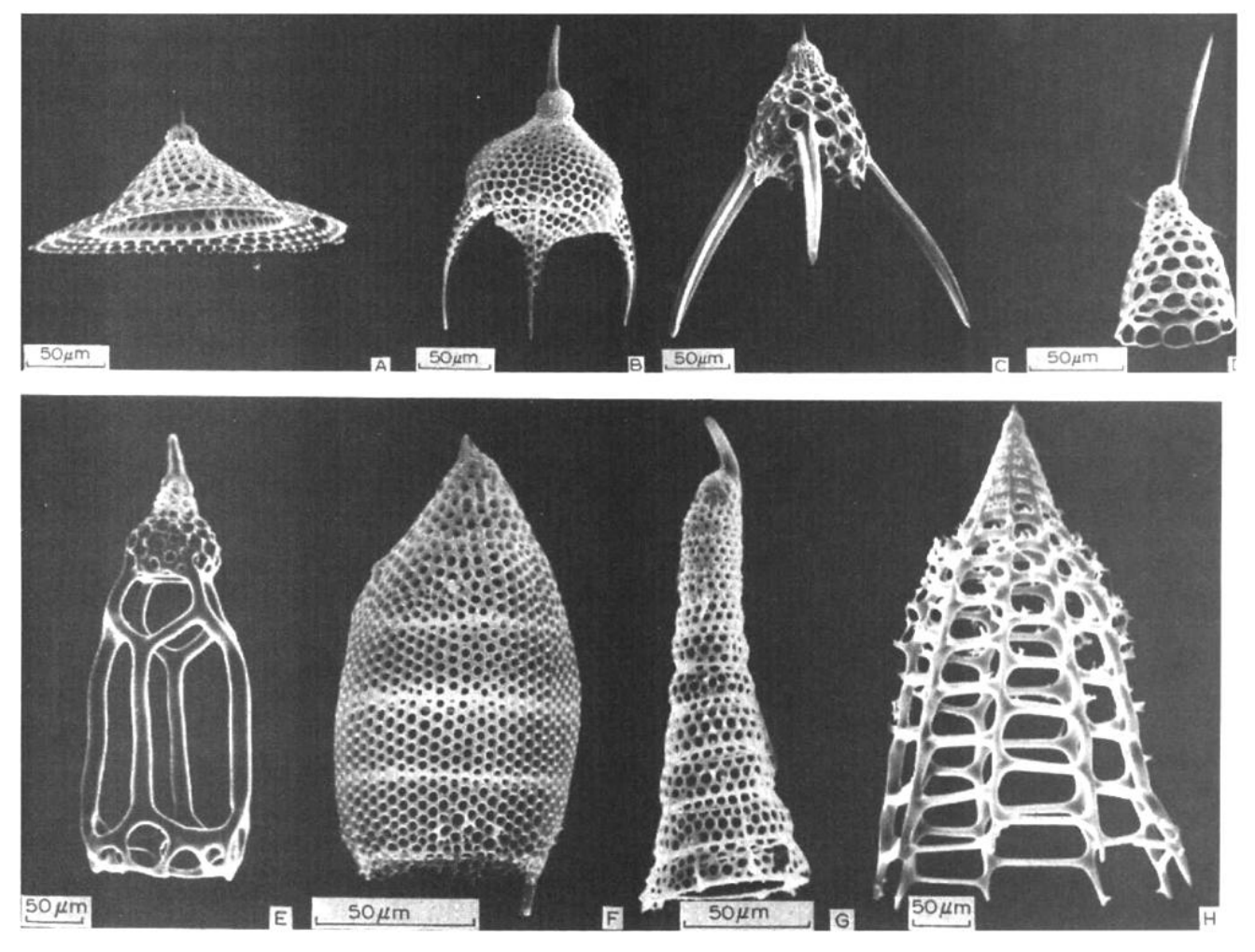


Silica

http://people.hofstra.edu/faculty/J_B_Bennington/K_16/marine_microfossils.html

M. Görmüş,
Ankara University, 2017
Lecture 3

Radiolarians - Nacellarians



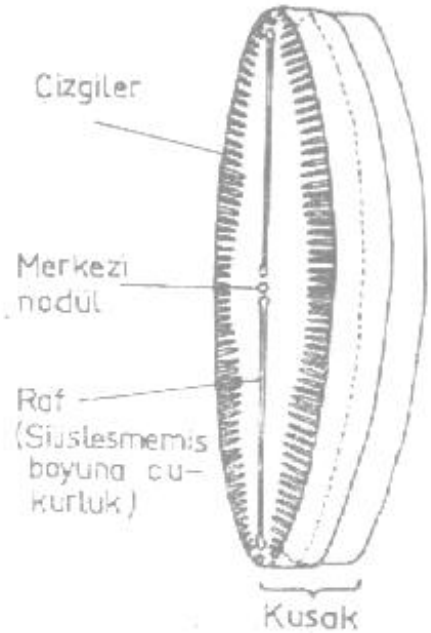
Silica

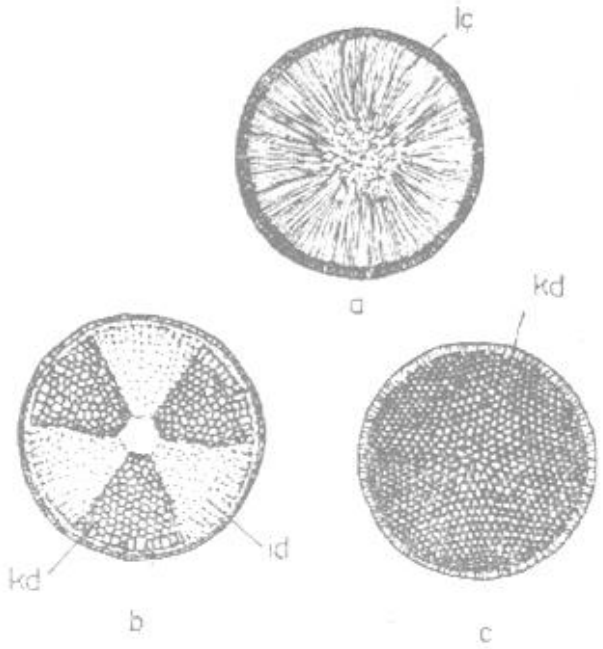
http://people.hofstra.edu/faculty/J_B_Bennington/K_16/marine_microfossils.html

4. Diatoms

Geologic range: Cretaceous to Recent
Shell composition: Silica
Size: Most are 0.05 - 0.02 mm (some up to 1 mm)
Significance: Useful in biostratigraphy and paleoenvironmental interpretation; major constituent of diatomite or diatomaceous earth; an integral part of the food chain (phytoplankton). Most abundant phytoplankton in the modern ocean.
Morphology: "Pillbox" shape, consisting of two valves (shells) which may be circular, triangular, or elongate. Circular forms have radial ornamentation. Elongate forms have transverse markings. They are covered with pores.
Environment: Both marine and non-marine. Planktonic or attached.

http://people.hofstra.edu/faculty/J_B_Bennington/K_16/marine_microfossils.html

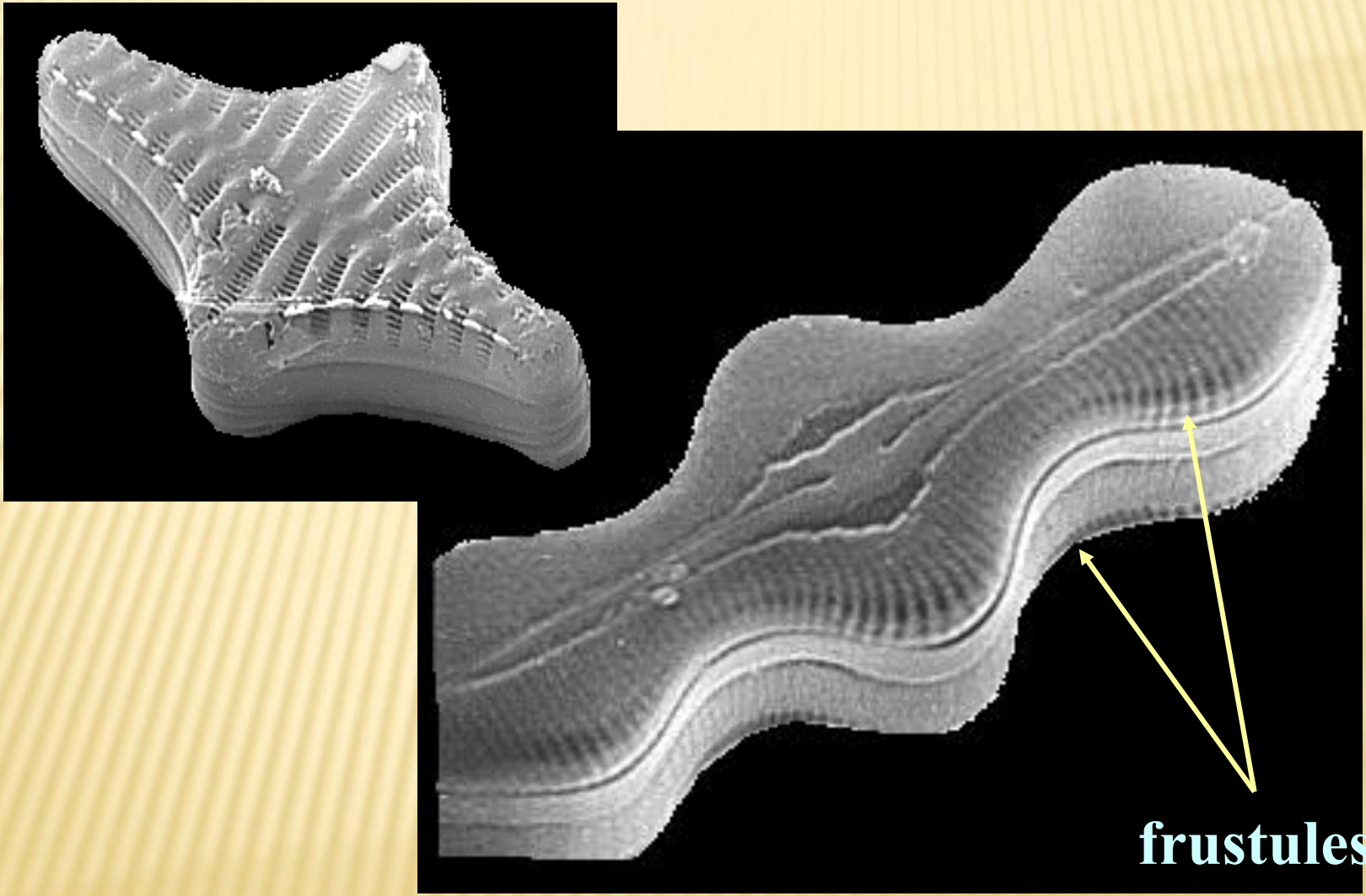

Cizgiler
Merkezi nodül
Raf
(Silislesmemis boyuna cukurluk)
Kusak


Ic
a
kd
kd
id
b
c

Meriç, 1985

M. Görmüş,
Ankara University, 2017
Lecture 3

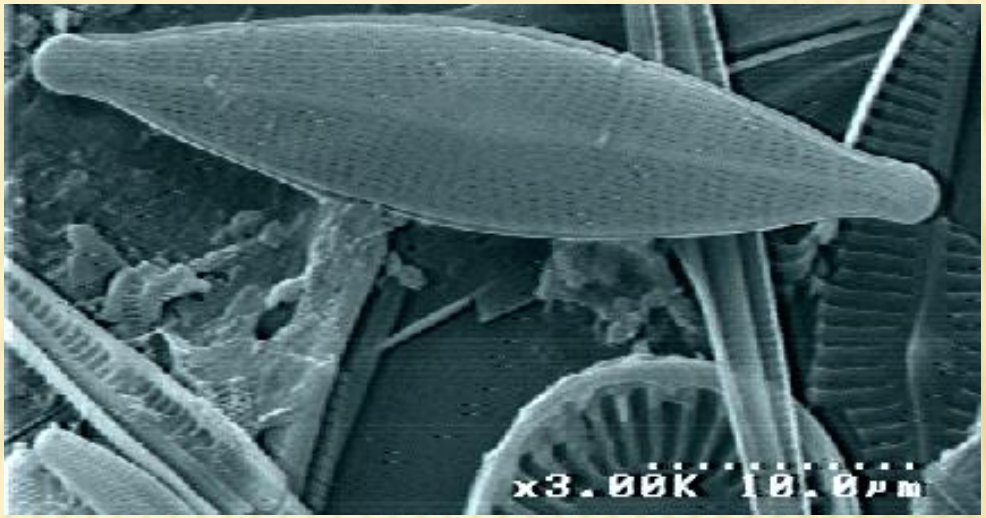
Diatoms - Chrysophyta silica

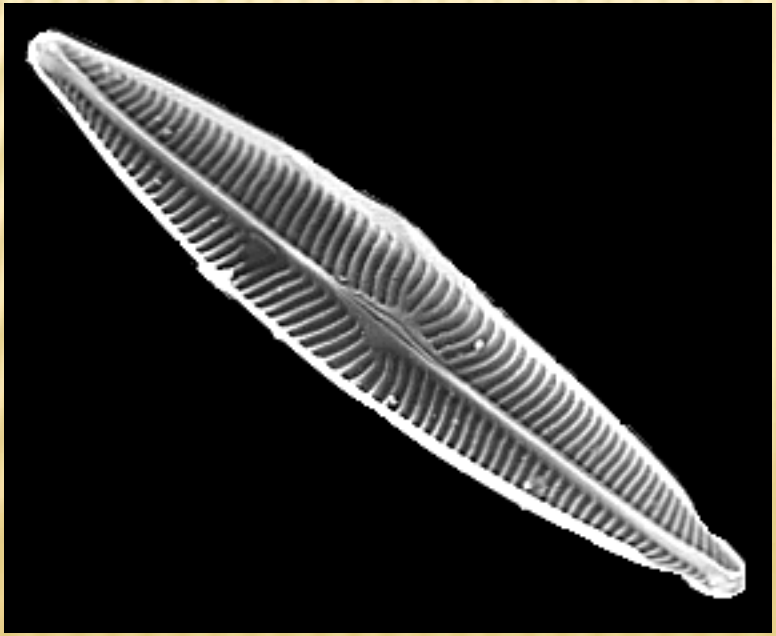


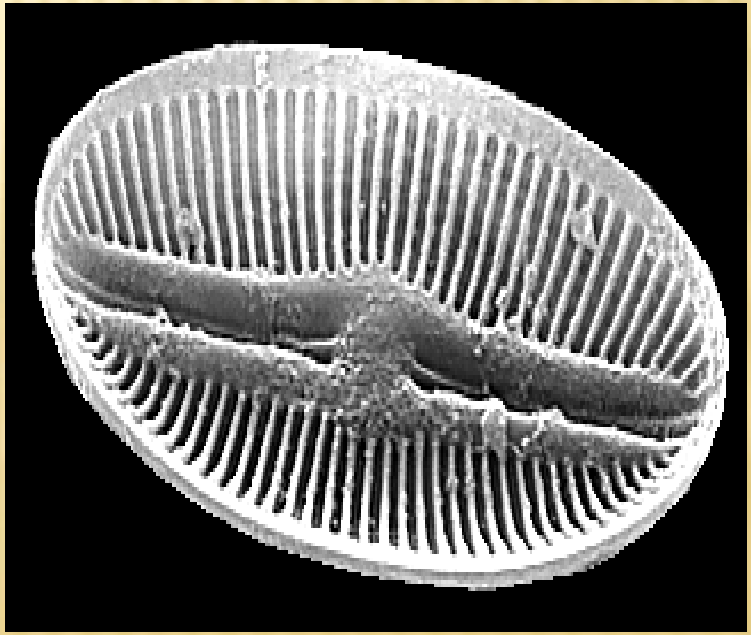
http://people.hofstra.edu/faculty/J_B_Bennington/K_16/marine_microfossils.html

M. Görmüş,
Ankara University, 2017
Lecture 3

Diatoms - Chrysophyta silica

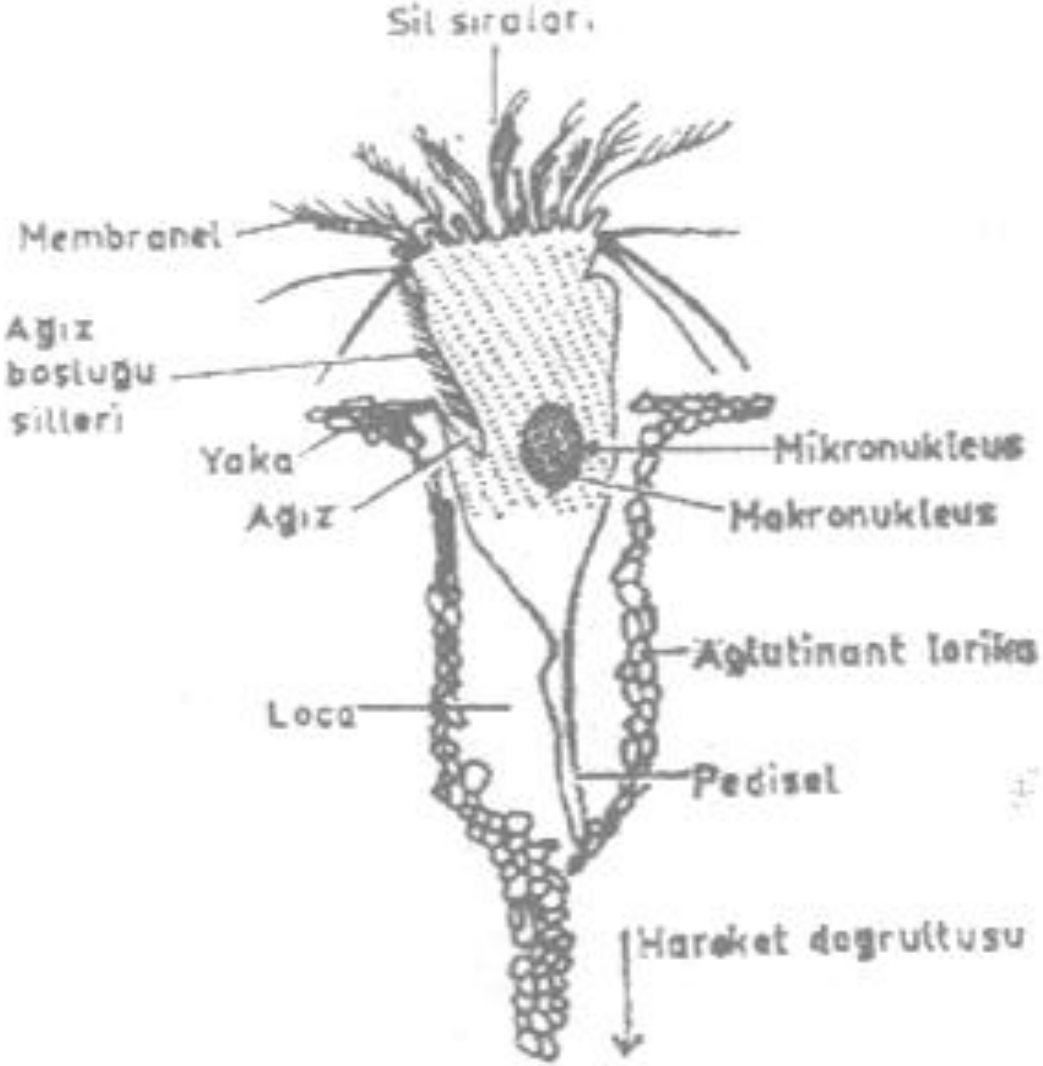




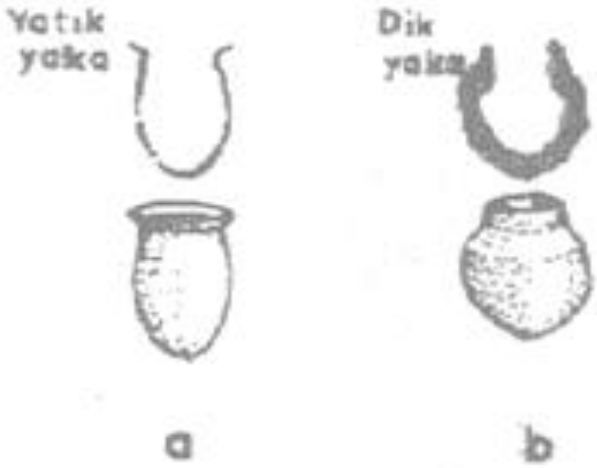


http://people.hofstra.edu/faculty/J_B_Bennington/K_16/marine_microfossils.html

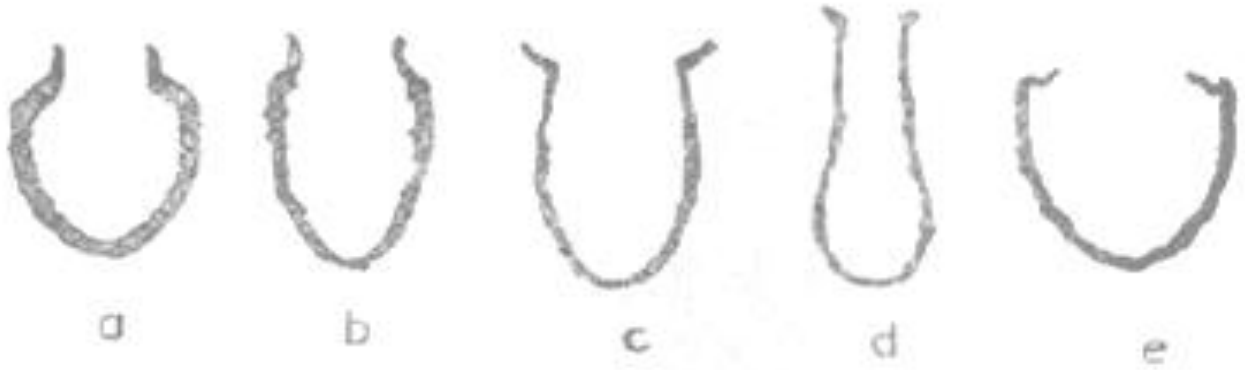
6. Tintinnid & calpionellids



Şek. 26 — Güncel Tintinnid'lerden Tintinnopsis'in şematik şekli, x 400 (BRASIER 1980).



Şek 27 — Tintinnid ve Kalpionellid lorikaları, a — Tintinnopsella, boyuna kesit ve temsili dış görüntüm, x 133, b — Calpionella, boyuna kesit ve temsili dış görüntüm, x 333 (BRASIER, 1980).



Şek. 28 — Çeşitli Tintinnid ve Kalpionellidlerin boyuna kesitleri. a — Calpionella alpina, b — C. elliptica, c — Tintinnopsella carpathica, d — T. oblonga, e — Calpionellites darderi (PIVETEAU, 1952).

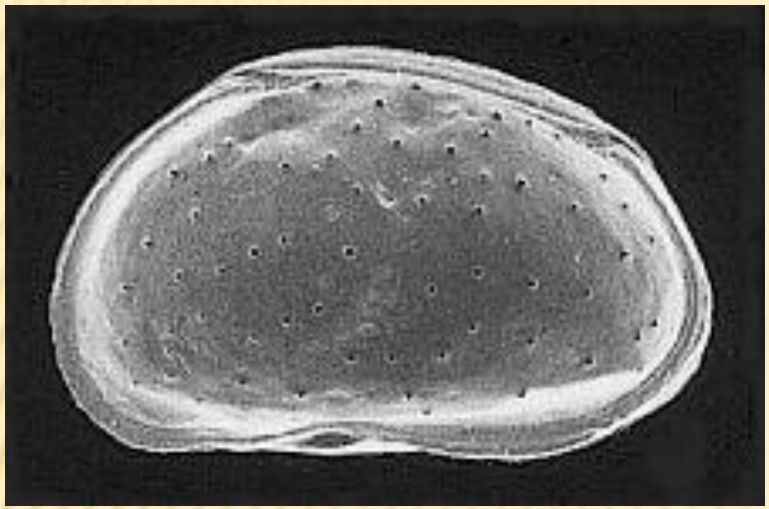
7. Ostracods (*Phylum Arthropoda*)

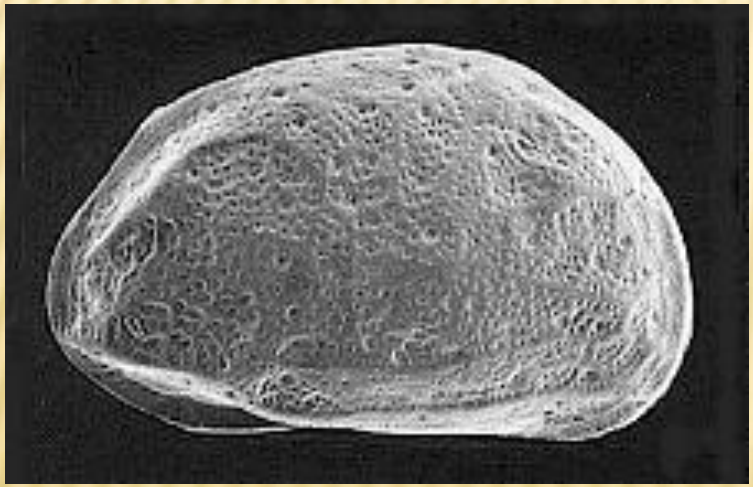
Geologic range: Cambrian to Recent.
Shell composition: Calcareous (some organic)
Size: 0.5 - 3.0 mm (some larger)
Significance: Useful in biostratigraphy and paleoenvironmental interpretation.
Morphology: Microscopic shrimp-like animal inside a clam-like shell consisting of two valves (shell halves), with a dorsal hinge.
Environment: Marine and non-marine (fresh, brackish and hypersaline); most benthic.

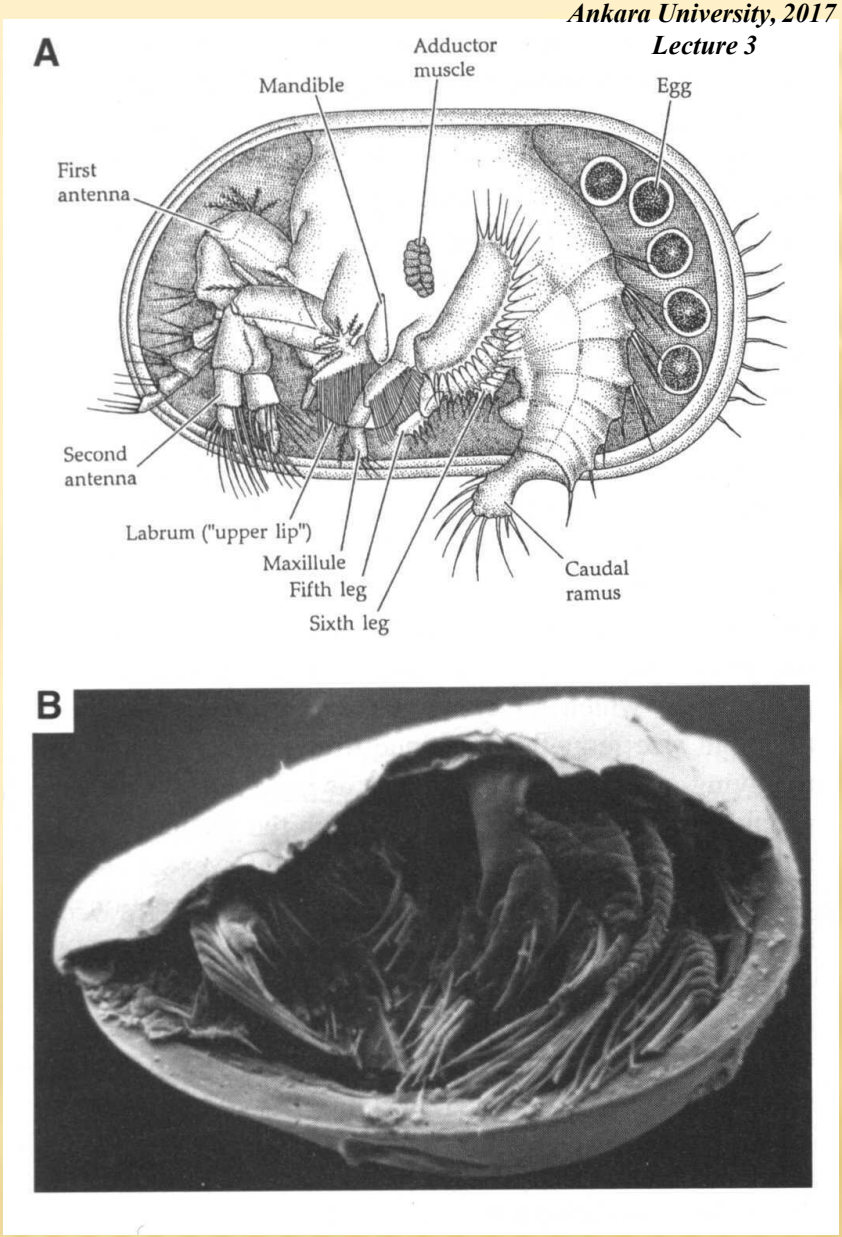
http://people.hofstra.edu/faculty/J_B_Bennington/K_16/marine_microfossils.html

M. Görmüş,
Ankara University, 2017
Lecture 3

Ostracods - Arthropoda



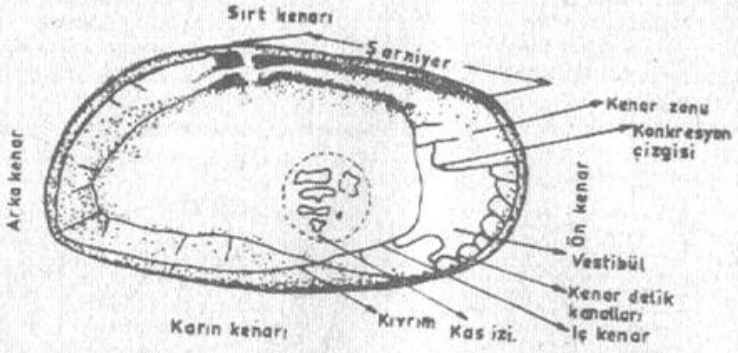




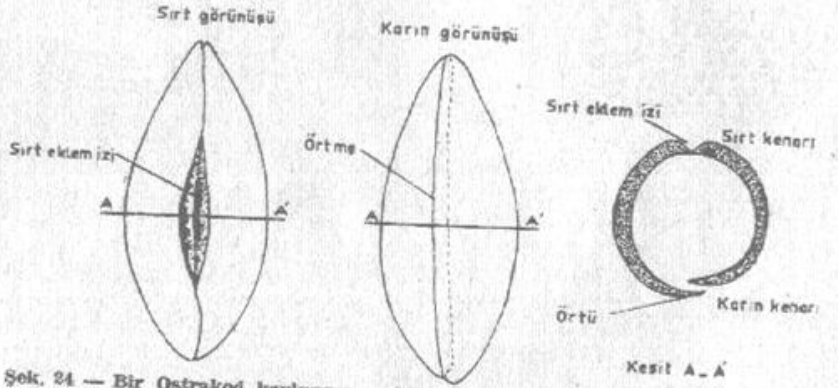
Animal Microfossils

http://people.hofstra.edu/faculty/J_B_Bennington/K_16/marine_microfossils.html

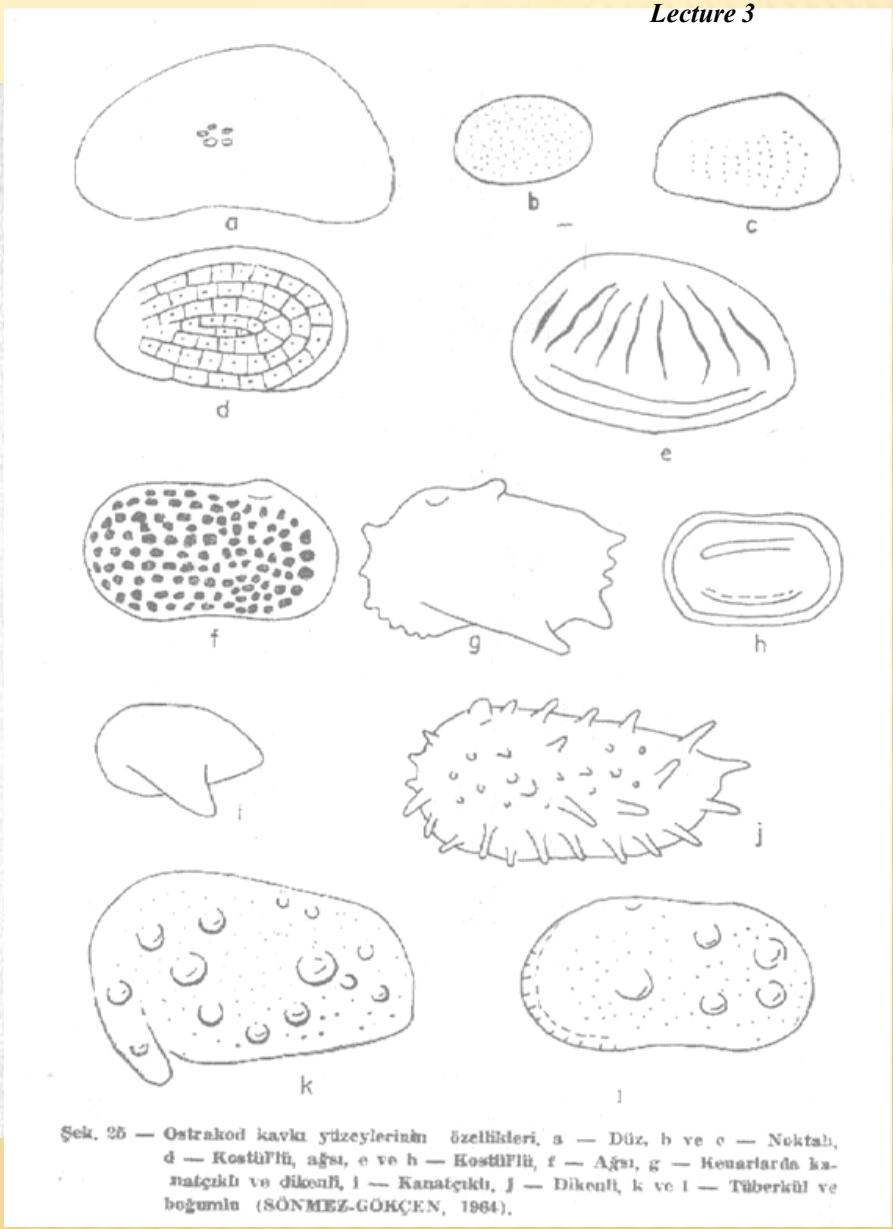
calcite



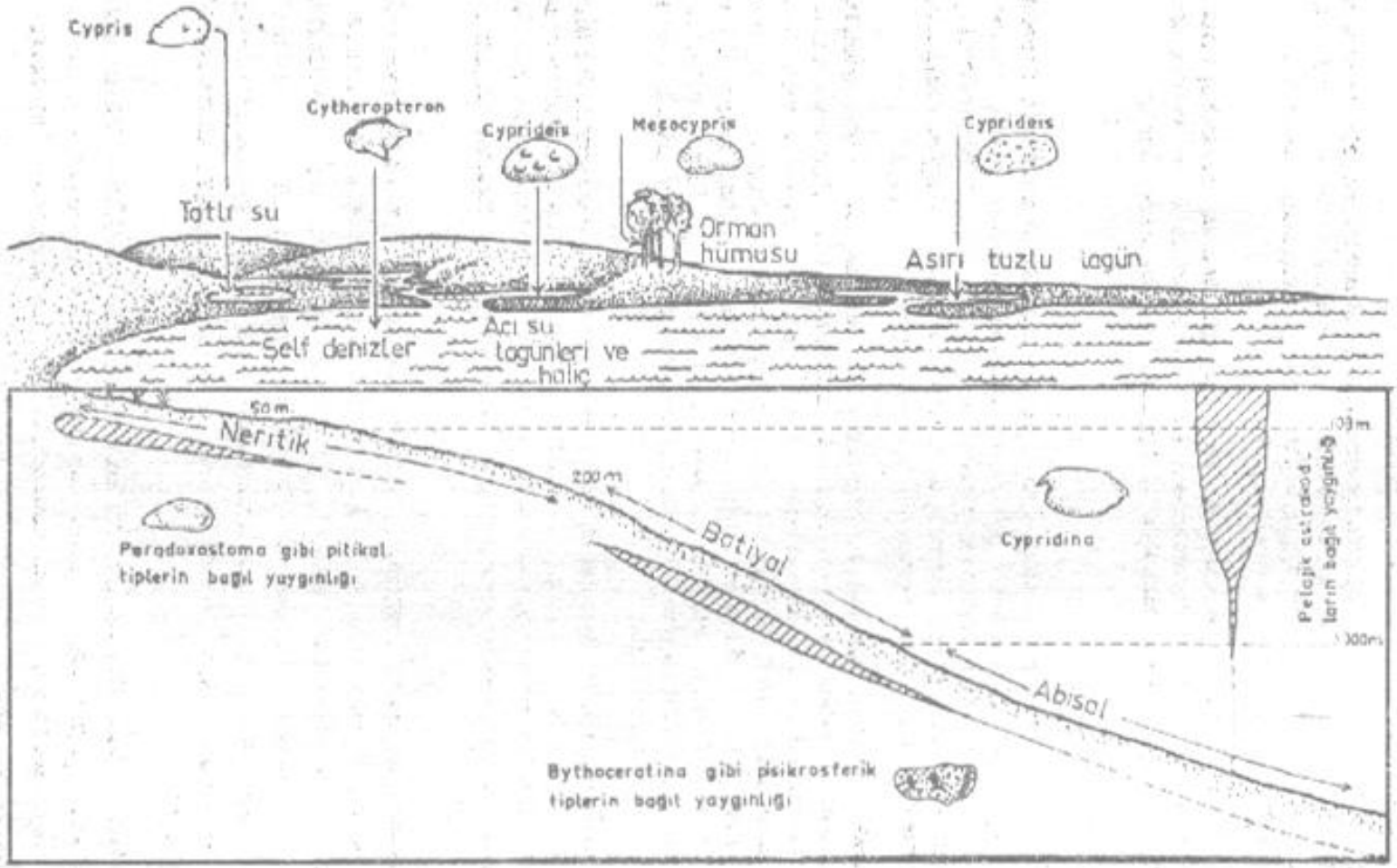
Şek. 23 — Bir Ostrakod kavkısının iç görünümü (SÖNMEZ-GÖKÇEN, 1964).



Şek. 24 — Bir Ostrakod kavkısının sırt ve karın görünümü ile uzun eksene dik (enine) kesiti (SÖNMEZ-GÖKÇEN, 1964).



Şek. 25 — Ostrakod kavkı yüzeylerinin özellikleri. a — Düz, b ve c — Noktalı, d — Kostülü, ağsı, e ve h — Kostülü, f — Ağsı, g — Kenarlarda kanatçıklı ve dikenli, i — Kanatçıklı, j — Dikenli, k ve l — Tüberkül ve boğumlu (SÖNMEZ-GÖKÇEN, 1964).



Şek. 22 — Bazı tipik formlarla temsil edilen güncel Ostrakod'ların ekolojik dağılımları (BRASIER, 1980).

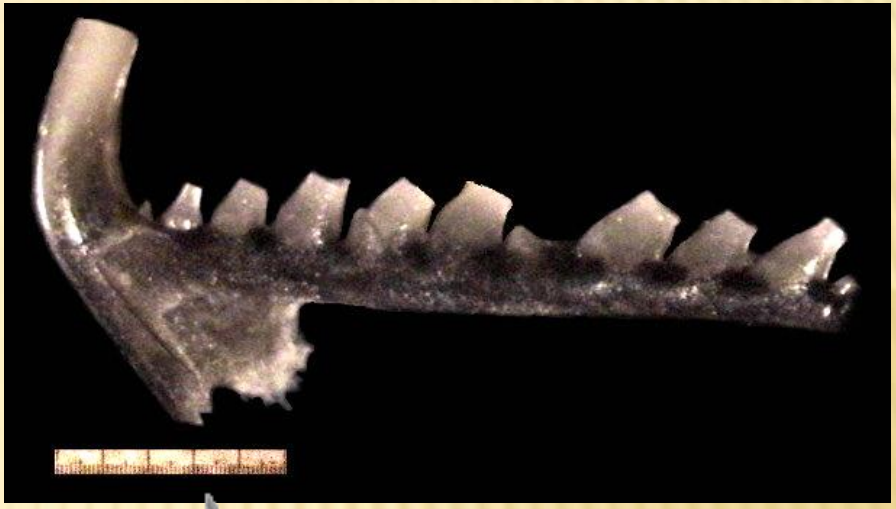
8. Conodonts (*Phylum Chordata*)

Geologic range: Cambrian to Late Triassic. Conodonts are extinct.
Composition: Phosphate (calcium fluorapatite)
Size: Most are 0.5 - 1.5 mm (some up to 10 mm, and some as small as 0.1 mm)
Significance: Useful in biostratigraphy and marine paleoenvironmental interpretation; their color is a good indicator of the temperature to which the enclosing rock has been subjected (this is important in determining whether oil or gas may be present in the rock).
Morphology: Parts of a larger organism which resemble cone-shaped teeth, or consisting of bars with rows of tooth-like denticles, or irregular knobby plates called *platforms*.
Environment: Marine, free-swimming.

http://people.hofstra.edu/faculty/J_B_Bennington/K_16/marine_microfossils.html

M. Görmüş,
Ankara University, 2017
Lecture 3

Conodonts. Images courtesy of Anita Harris, U. S. Geological Survey.

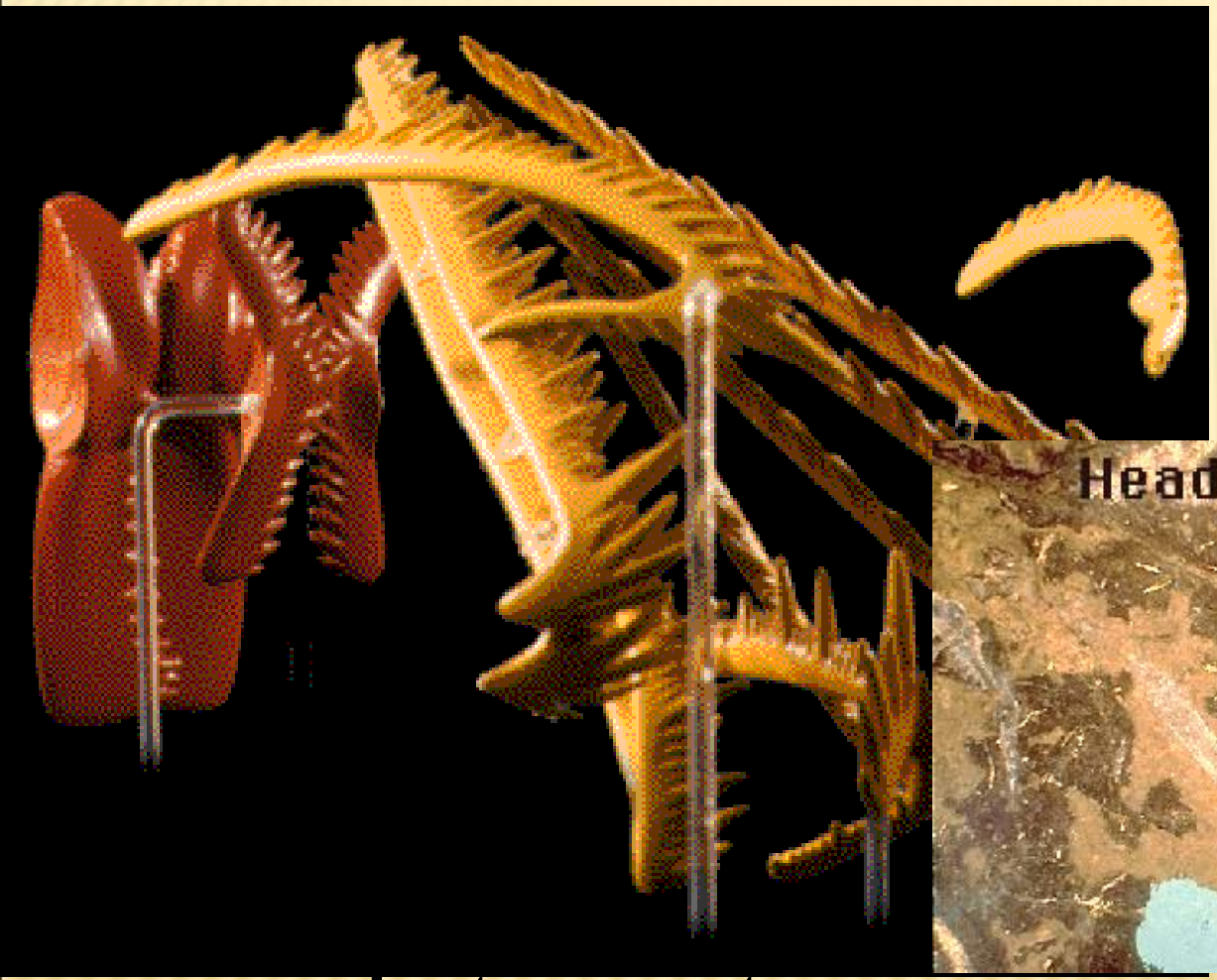


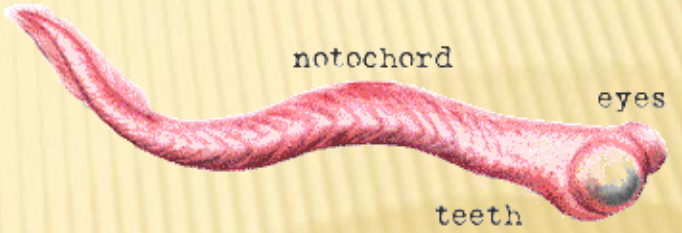
http://www.gpc.edu/~pgore/geology/historical_lab/microfossils.php

http://people.hofstra.edu/faculty/J_B_Bennington/K_16/marine_microfossils.html

Conodonts - Vertebrata

M. Görmüş,
Ankara University, 2017
Lecture 3





conodont apparatus

http://people.hofstra.edu/faculty/J_B_Bennington/K_16/marine_microfossils.html

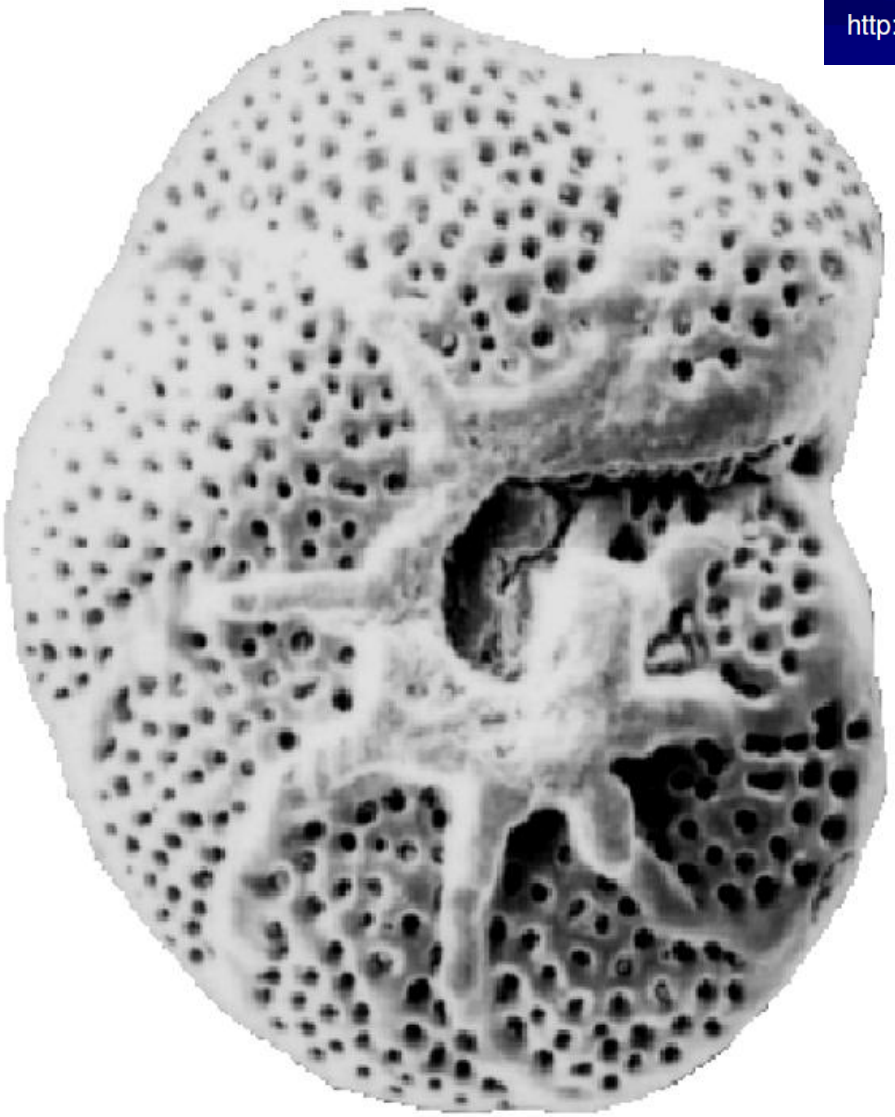
microwear facets

calcium phosphate

http://people.hofstra.edu/faculty/J_B_Bennington/K_16/marine_microfossils.html

M. Görmüş,
Ankara University, 2017
Lecture 3

FORAMİNİFERA

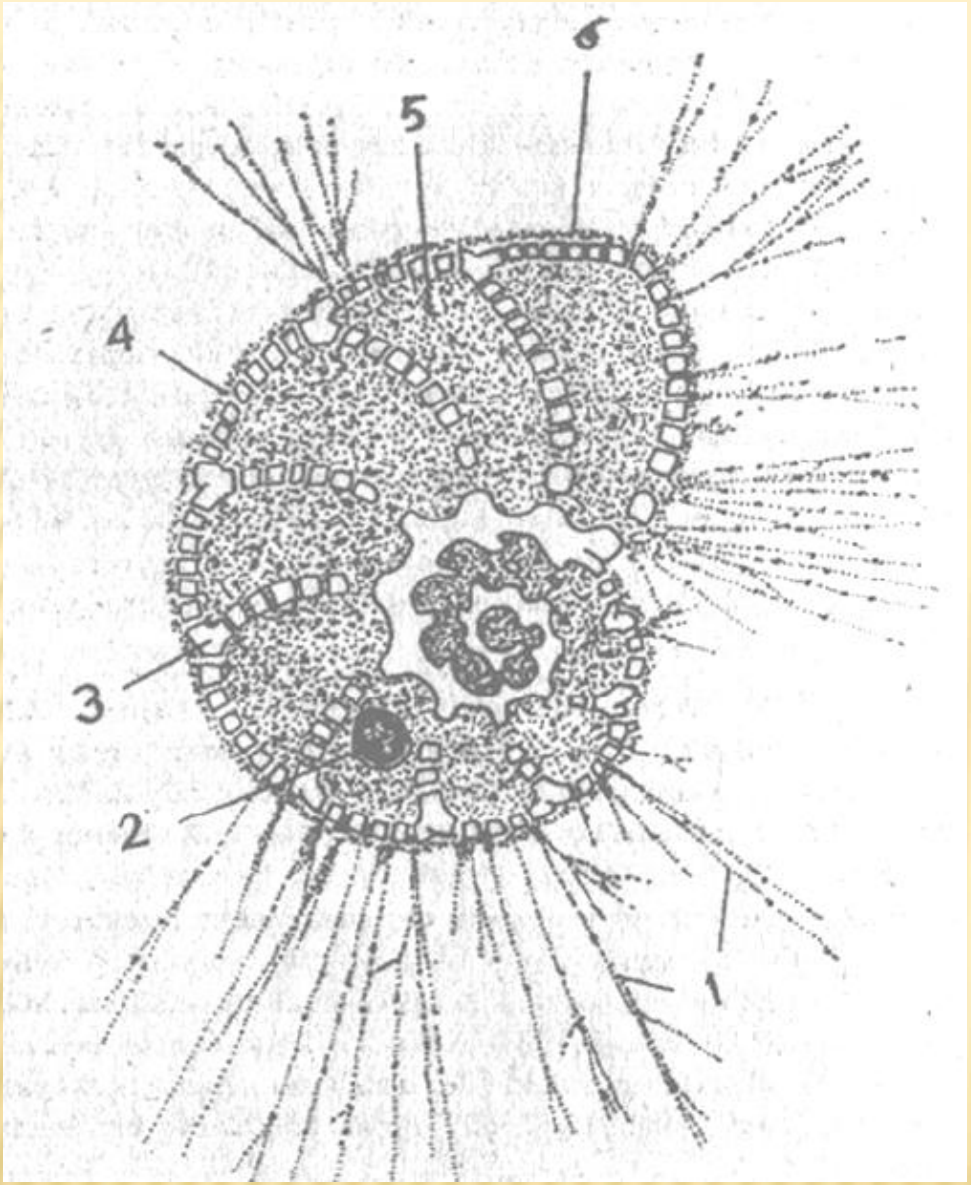


http://hoopermuseum.earthsci.carleton.ca/2001_benthicforams_jk/cont.html

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

M. Görmüş,
Ankara University, 2017
Lecture 3

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



1. pseudopodia, 2. nucleus, 3. test, 4. foramen, 5. endoplasm, 6. Ectoplasm

Foraminifera

. single-celled

. micron, mm, and cm in size

. live either on the sea or amongst the marine plankton

. from Cambrian to Recent

. mainly marine, just a few brackish

. short-lived period life (from two-three months to a few years)

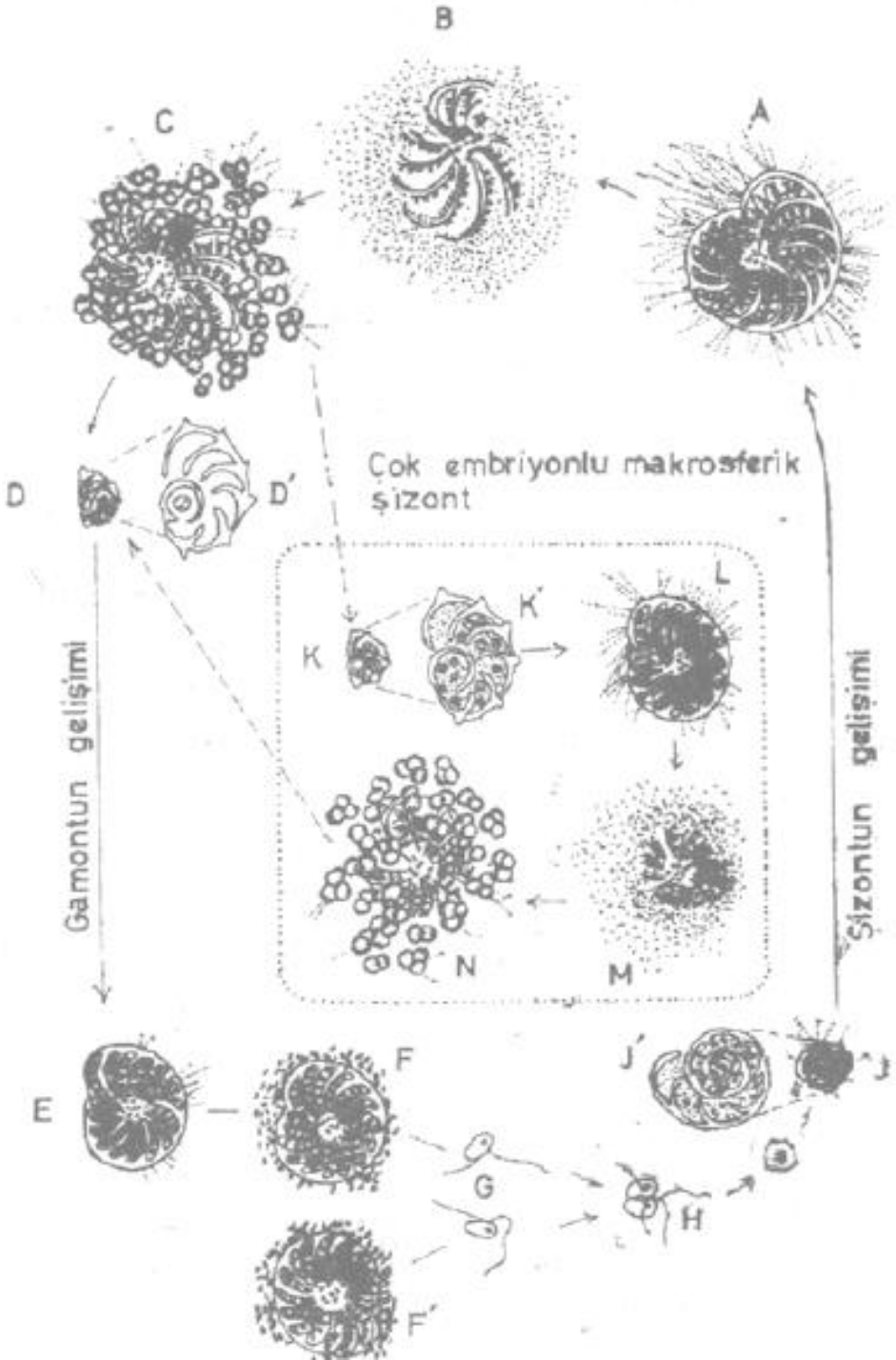
. feed with other algal planktons

. benthic or planktics

animal like organisms (Prototists)

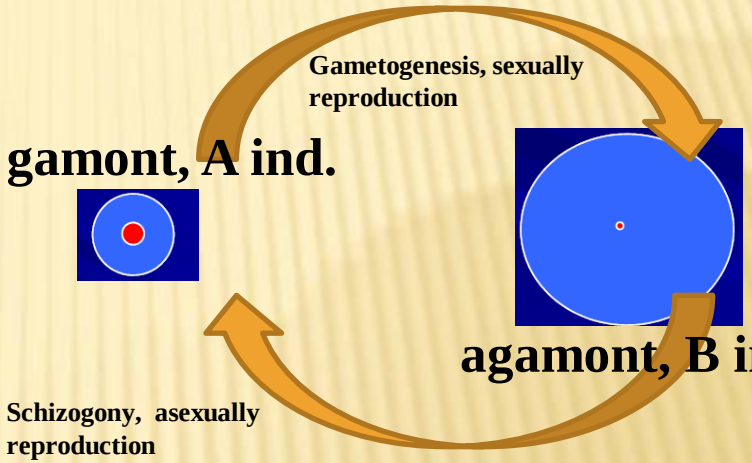
***Orbulina universa, a* sand-sized single chambered test surrounded by delicate spines.**
(Photo courtesy Dr. Howard Spero, University of California, Davis)

http://oceanworld.tamu.edu/students/forams/forams_what_is.htm



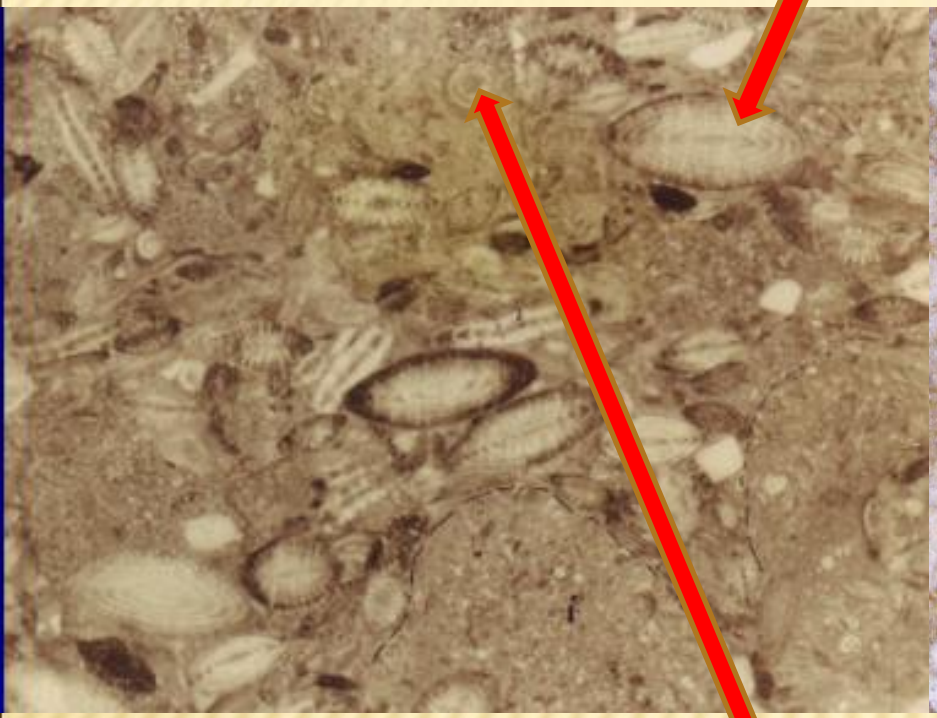
M. Görmüş,
Ankara University, 2017
Lecture 3

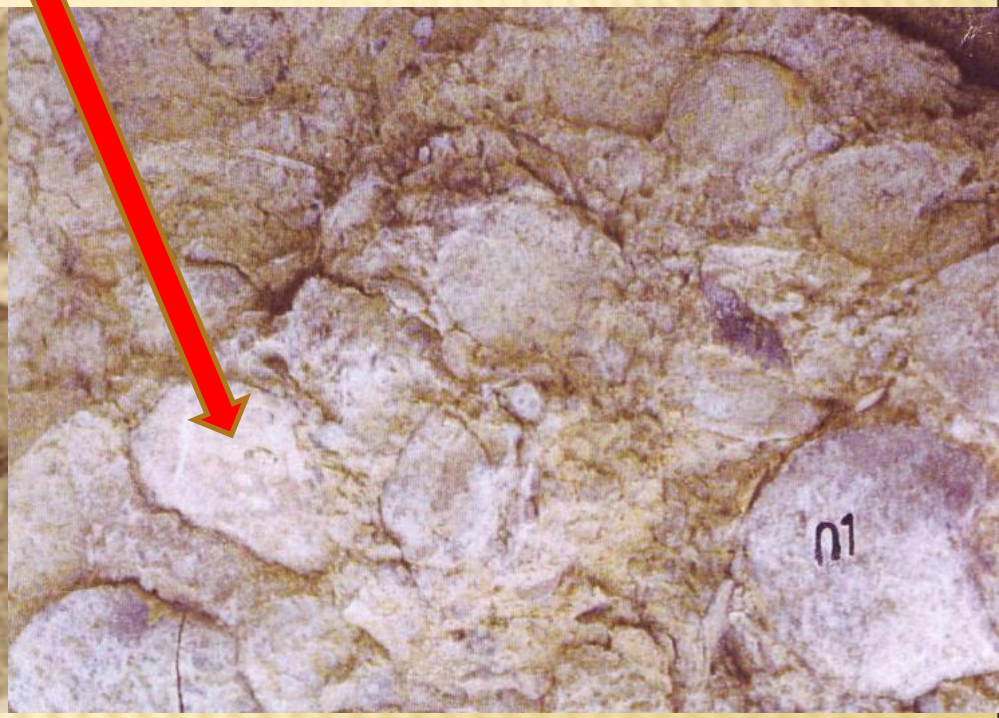
Dimorphism



Dimorphism: If a genus or species of foraminifera has two different individuals (A and B individuals) related to its reproduction, it has a dimorphism character.
A individual: megalospheric individual, by large proloculus, but smaller test
B individual: microspheric individual, by tiny proloculus, but larger test

B individuals, microspheric





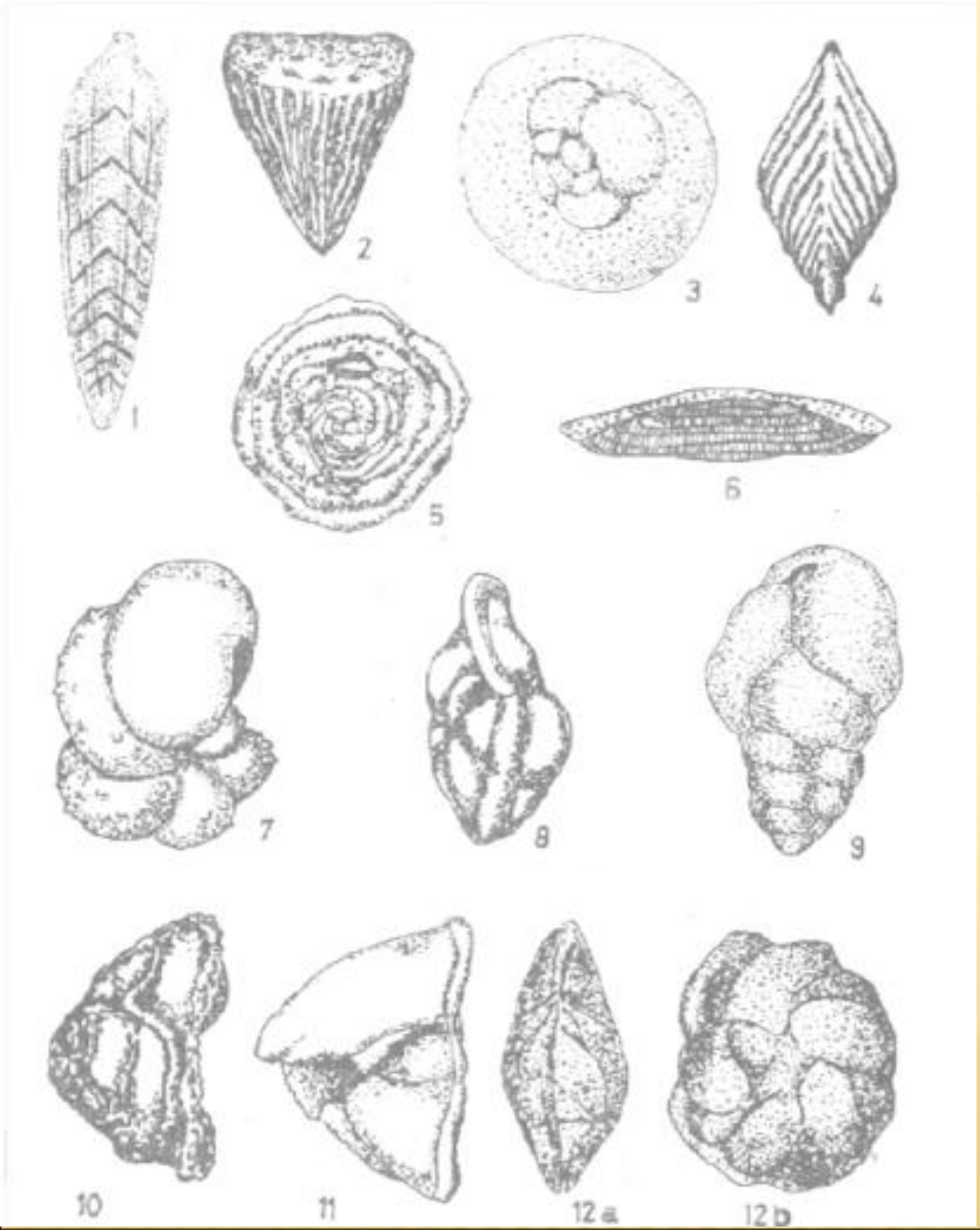
A individuals, microspheric

When we examine a foraminifera, we have to get the following observations:

External characters
- **Test shape**
- **Test size**
- **Test surface architecture**
- **Main apertures**
- **Auixiliary apertures**

Internal characters
- **Wall composition**
- **First embryo features**
- **Whorling**
- **Septa shape etc.**

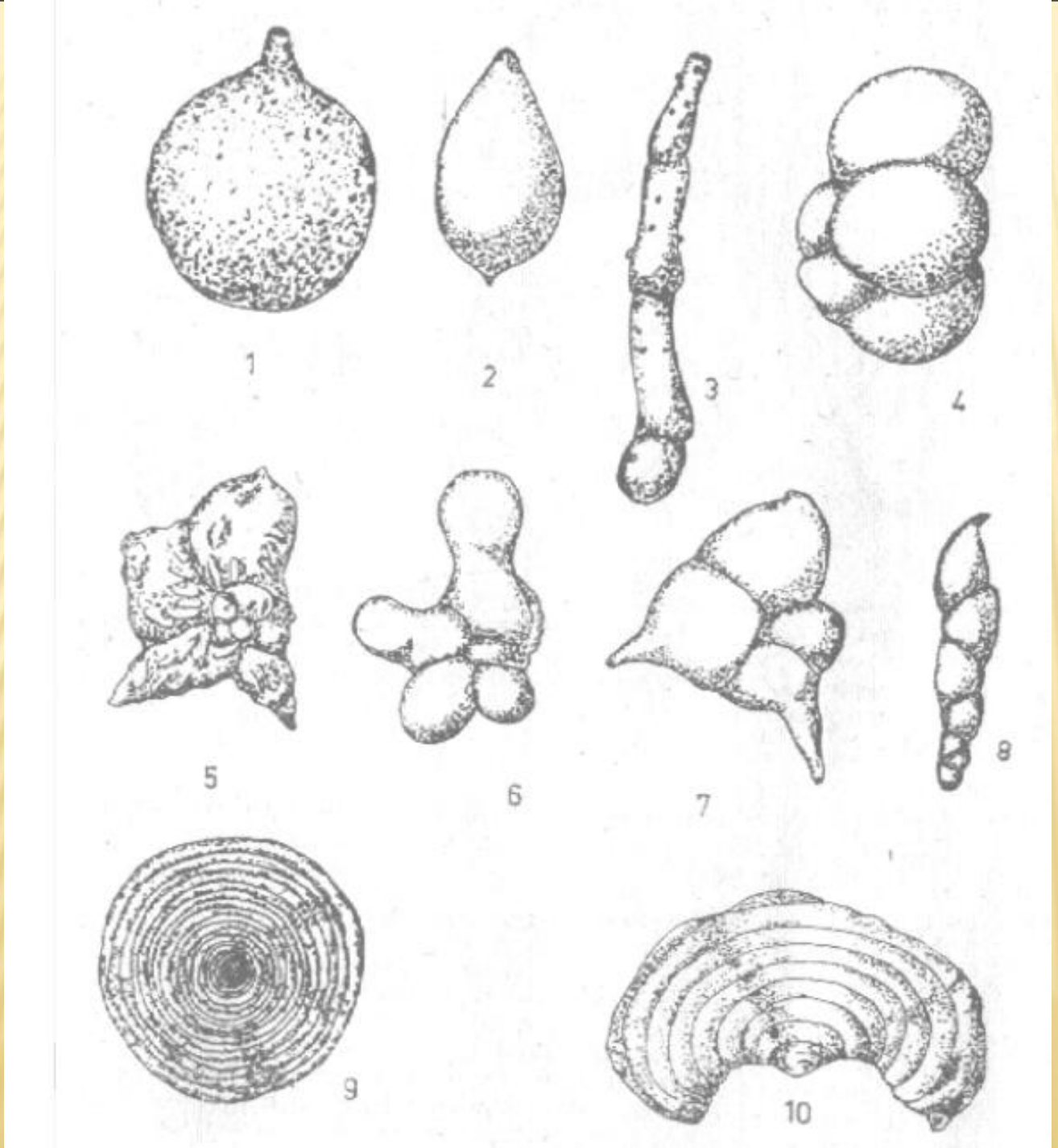
In this lesson, the following pictures are from Meriç (1985)



Test shapes:

spearhead shaped (1), conical (2), globular (3), palmet, leaf shaped (4), discoidal (5), fusiform (6), with two ombilical (7), biconvex (8), with many chambers, trochospiral (10-11), lenticular (12)

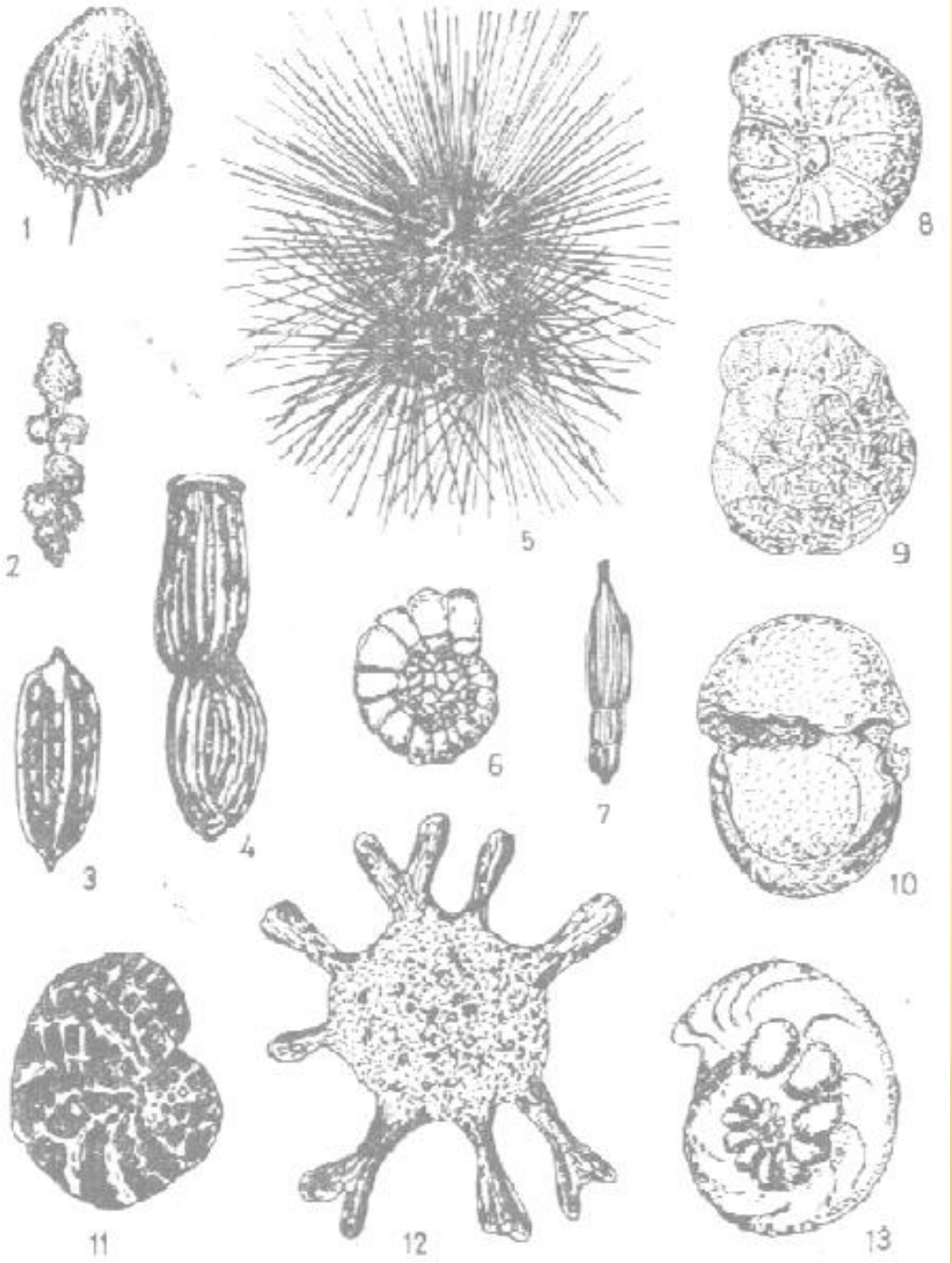
M. Görmüş,
Ankara University, 2017
Lecture 3



Other test and chamber views

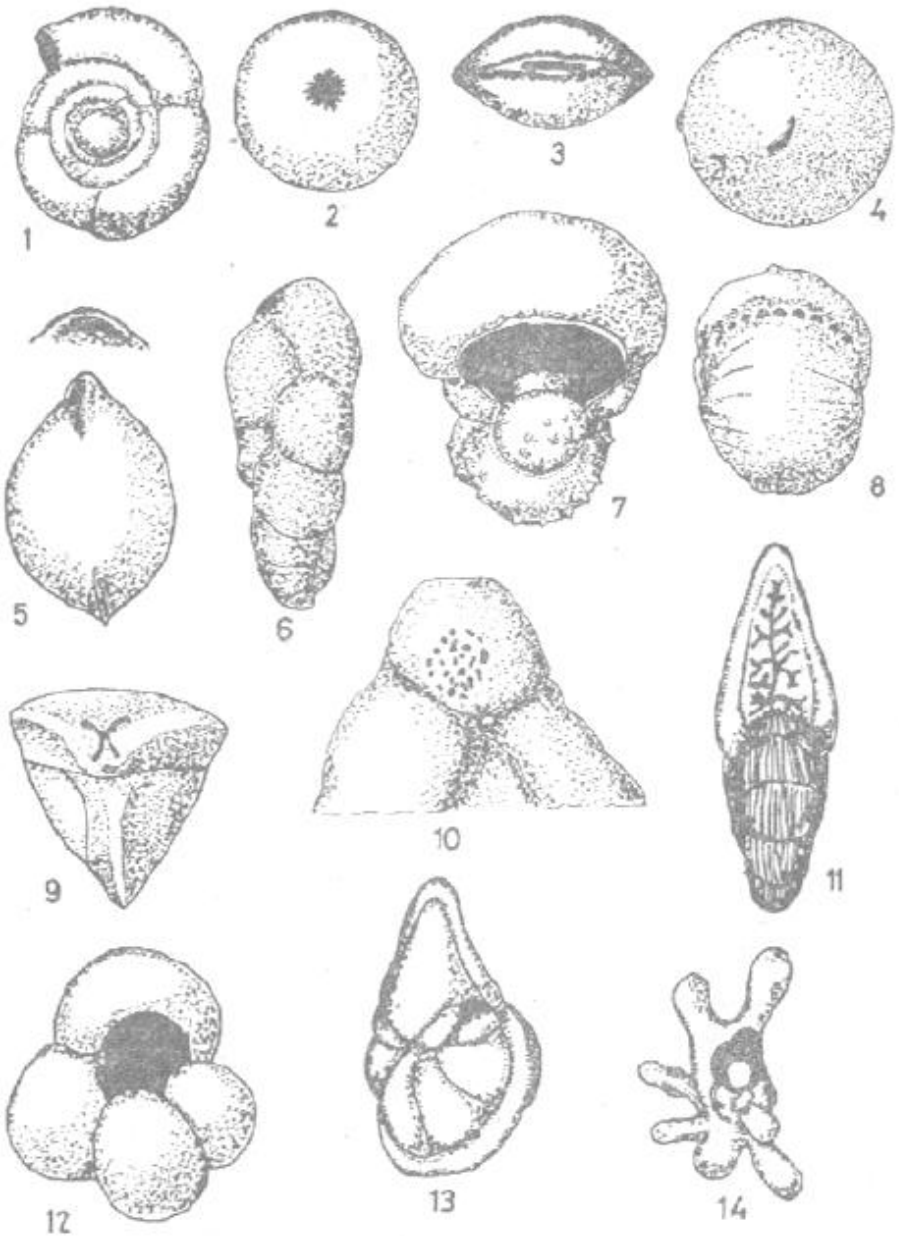
Other test and chamber views

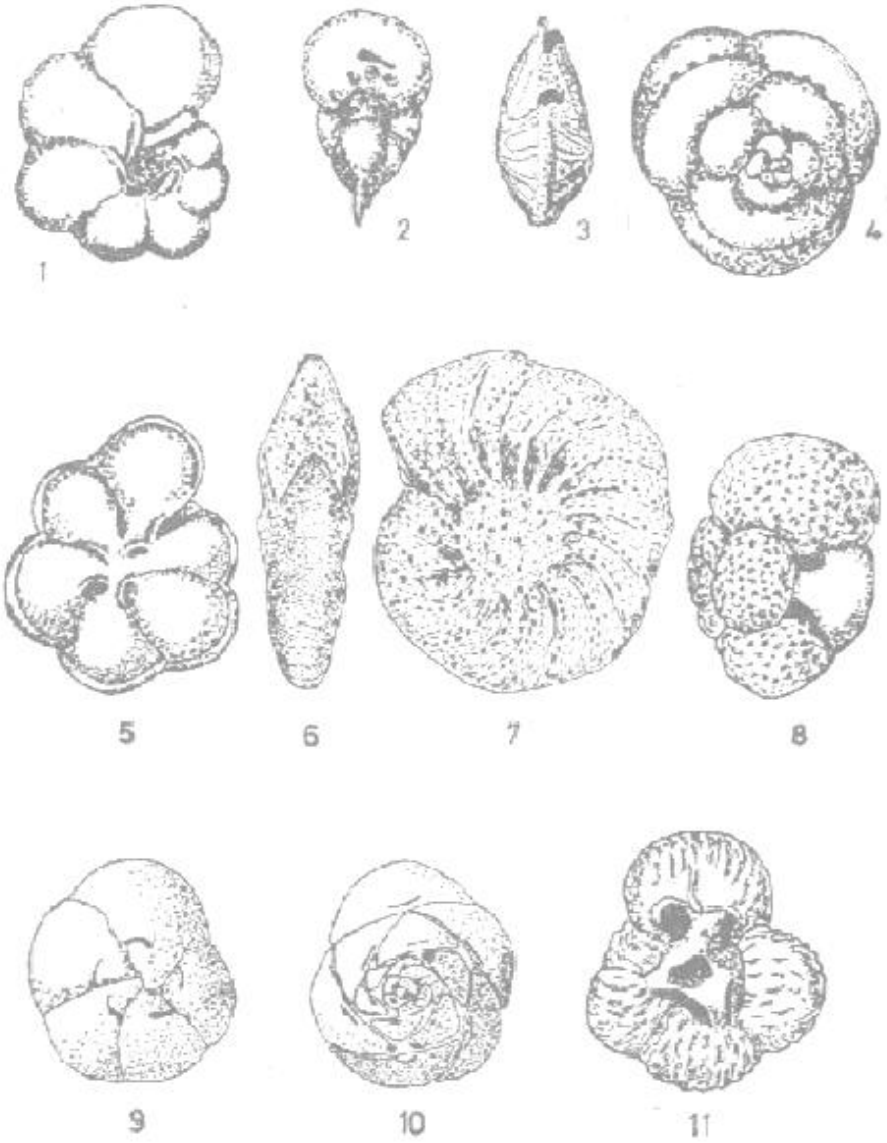
M. Görmüş,
Ankara University, 2017
Lecture 3



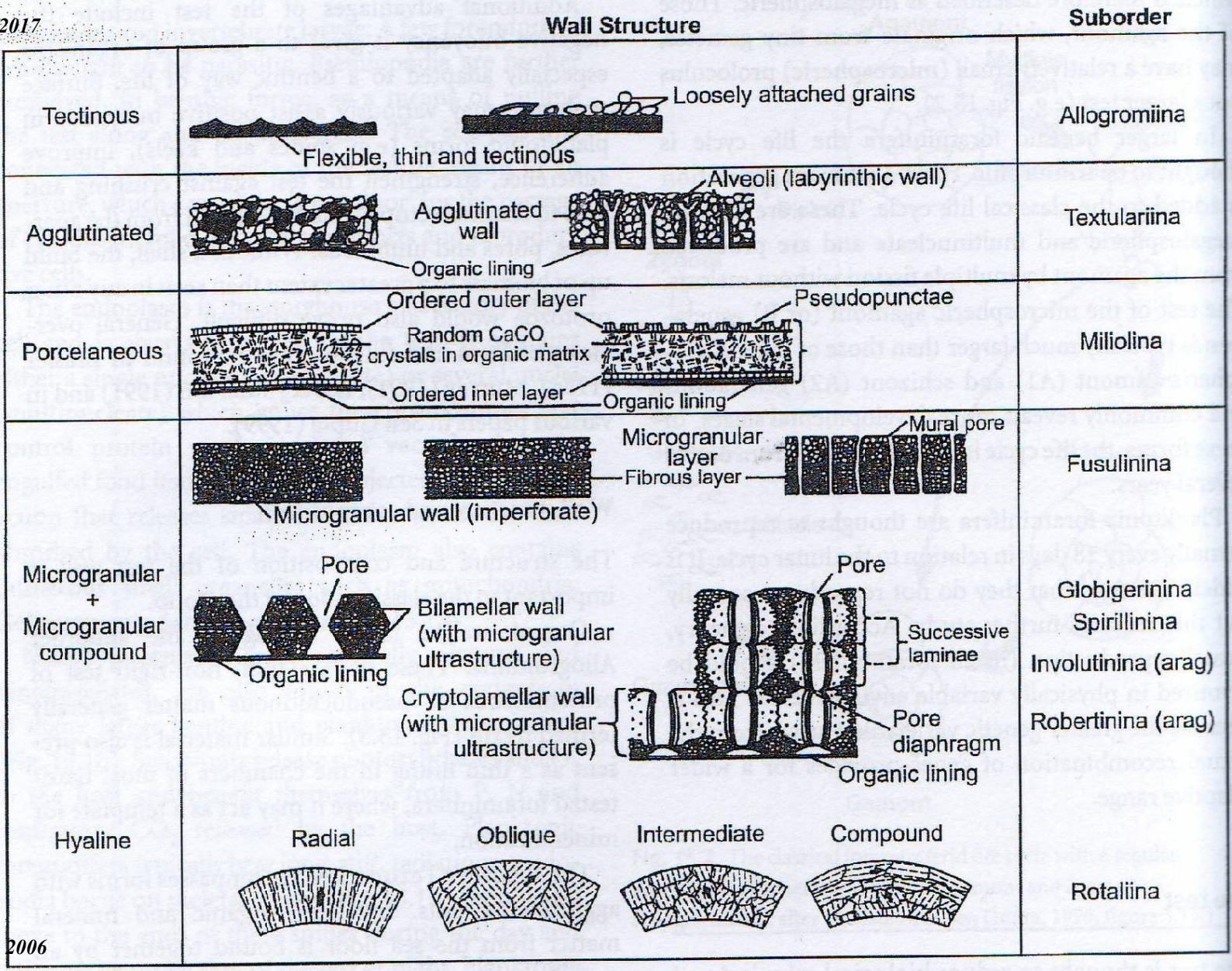
Test surface architecture, see Meriç for details

M. Görmüş,
Ankara University, 2017
Lecture 3





Aperture and auxiliary apertures, see Meriç for details

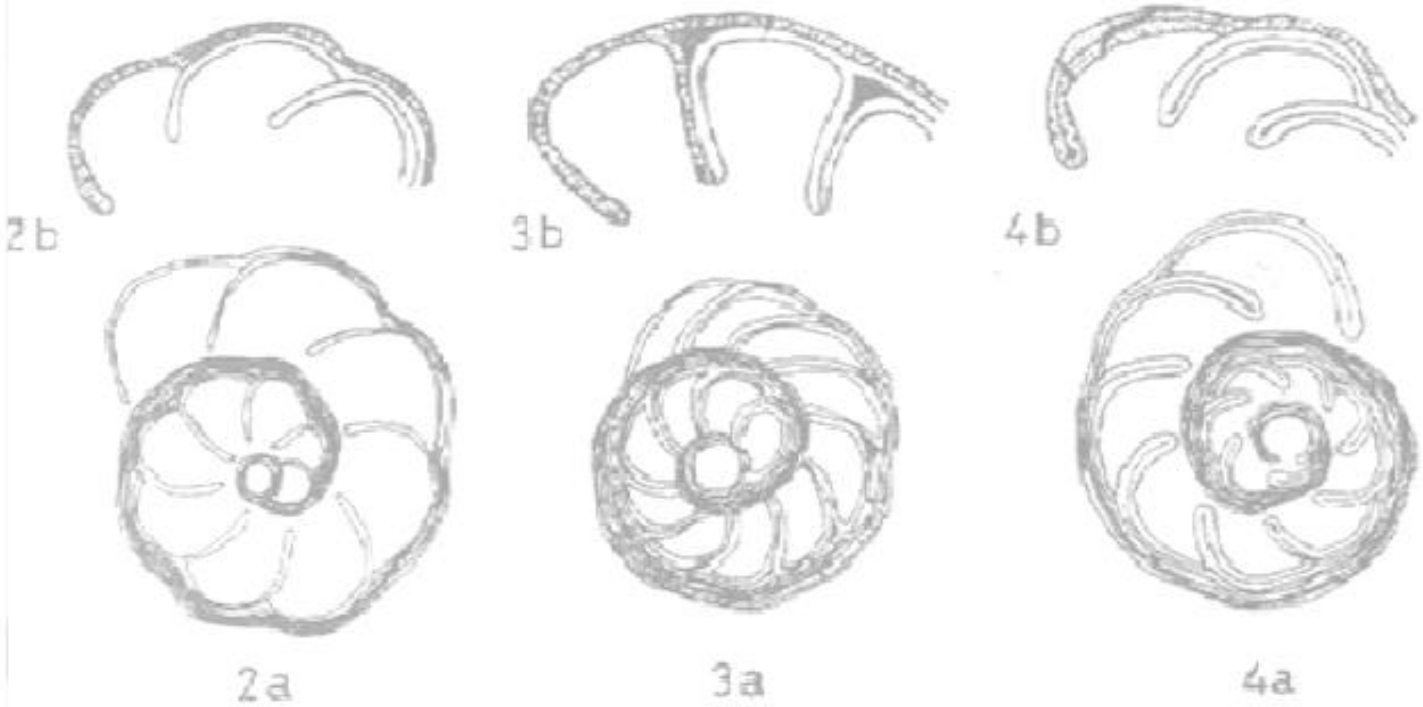


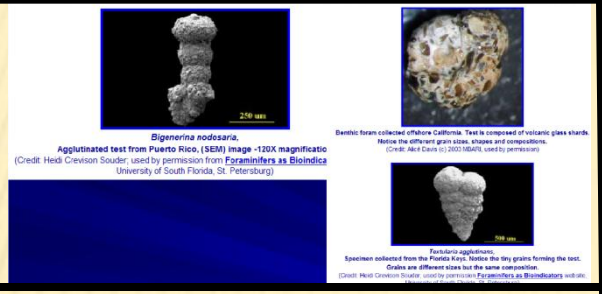
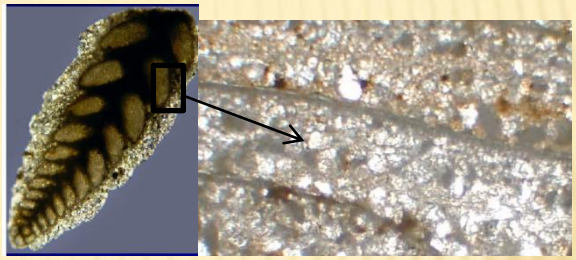
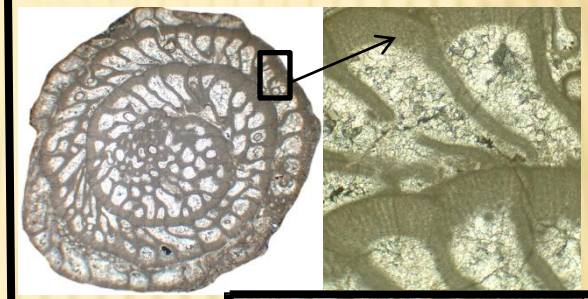
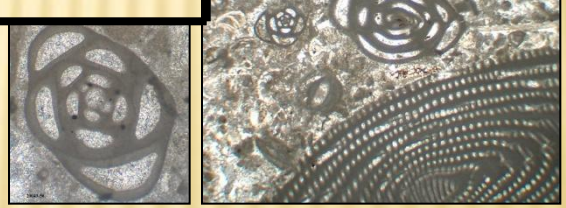
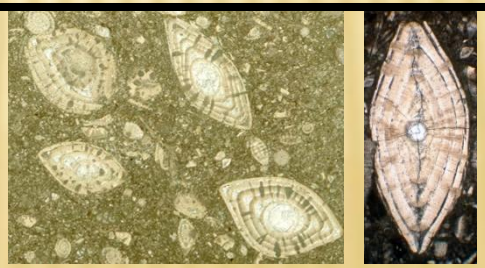
After Armstrong & Brasier, 2006

Fig. 15.3 Examples of wall structures in the foraminifera (diagrammatic, mainly based on studies using scanning electron microscopy).

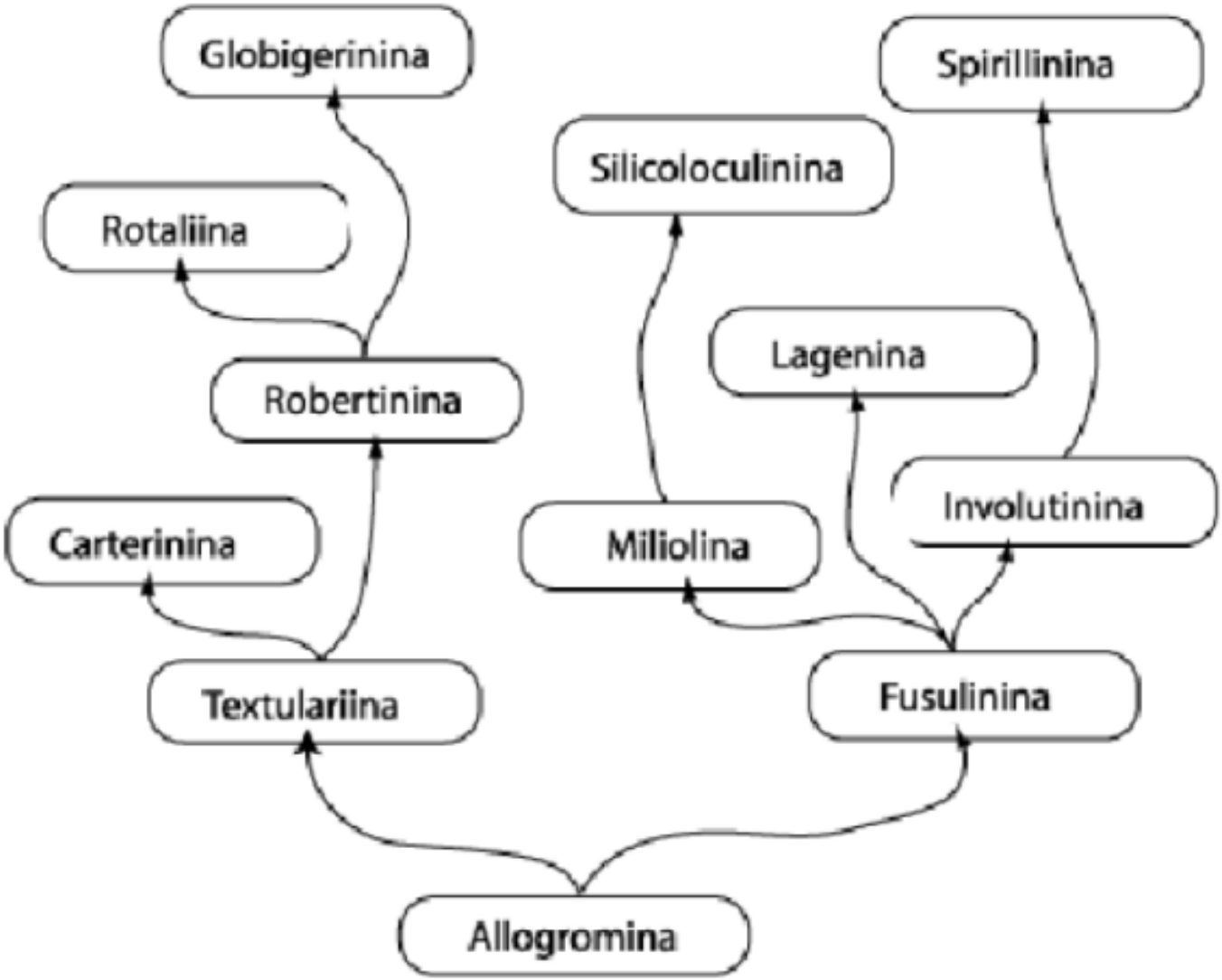
1

Rotaliid wall structure



	External views	Internal views
Textulariina		
Fusulinina		
Miliolina (white ones)		
Rotaliina (brilliant ones)		

M. Görmüş,
Ankara University, 2017
Lecture 3



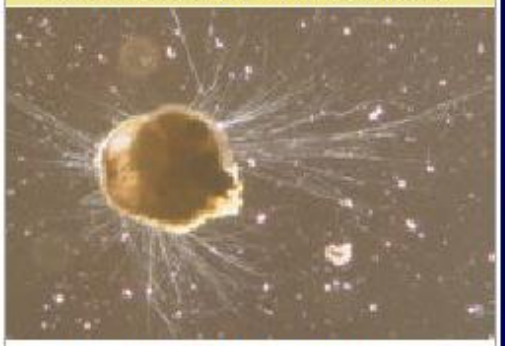
Foraminiferal suborders and their envisaged phylogeny. Redrawn from Tappan and Loeblich (1988). Among the suborders shown only the Fusulinina are extinct.

http://www.ucl.ac.uk/GeolSci/micropal/foram.html

M. Görmüş,
Ankara University, 2017
Lecture 3

Foraminifera

Fossil range: Cambrian - Recent



Live *Ammonia tepida* (Rotaliida)

Scientific classification

Kingdom: Protista

Phylum: **Foraminifera**

Orders

Allogromiida
Carterinida
Fusulinida- *extinct*
Globigerinida
Involutinida- *extinct*
Lagenida
Miliolida
Robertinida
Rotaliida
Silicoloculinida
Spirillinida
Textulariida
incertae sedis
Xenophyophorea
Reticulomyxa

http://en.wikipedia.org/wiki/Globigerinida

Globigerinida

Fossil range: Jurassic - Recent

Scientific classification

Kingdom: Protista

Phylum: Foraminifera

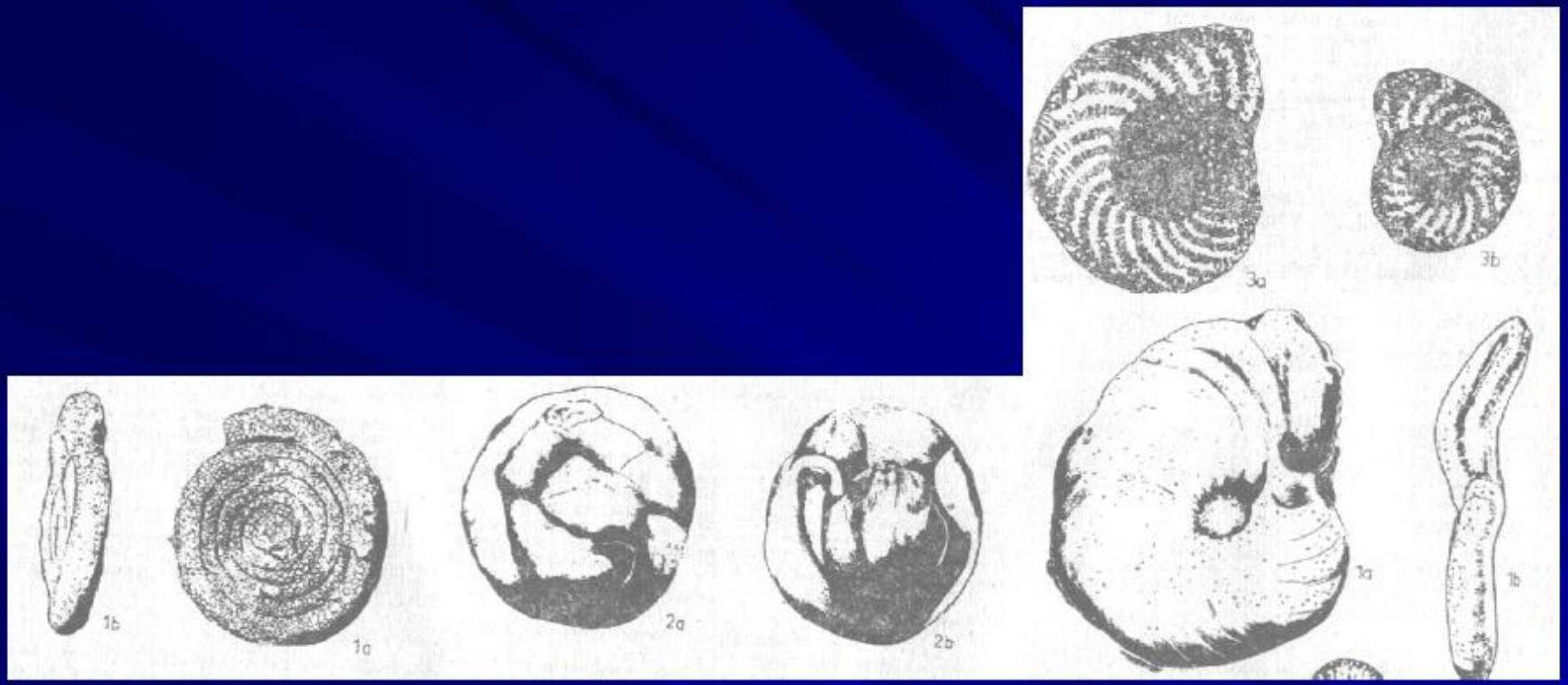
Order: **Globigerinida**

Superfamilies

Globigerinacea
Globorotaliacea
Globotruncanacea
Hantkeninacea
Heterohelicacea
Planomalinacea
Rotaliporacea

M. Görmüş,
Ankara University, 2017
Lecture 3

Suborder Textulariina



Ammodiscus sp.

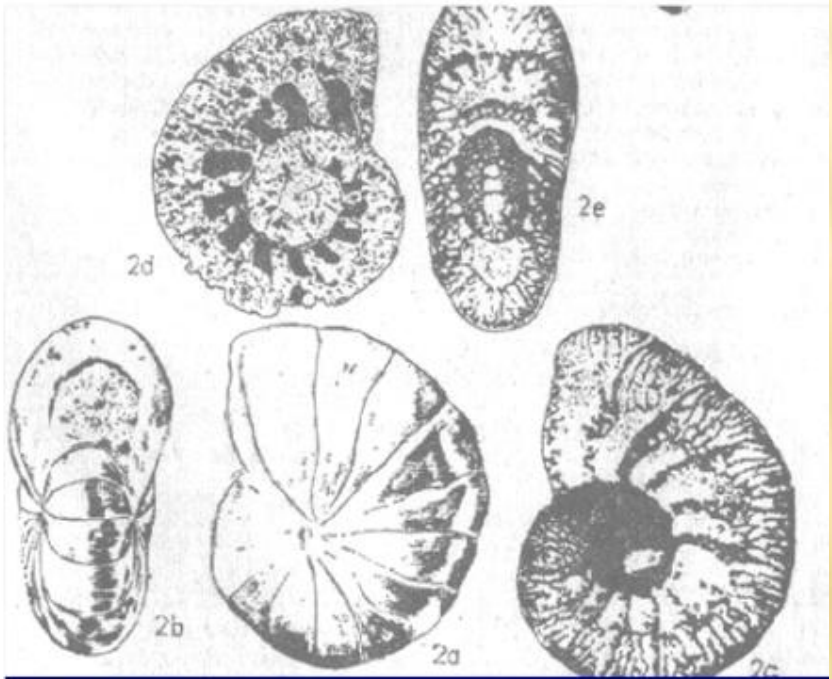
Silurian to Recent
Planspiral in sahape

Glomospira sp.

Silurian to Recent
spool, globular in sahape

Choffetella sp.

Lower Cretaceous
Involute whorling



Cyclammina sp.

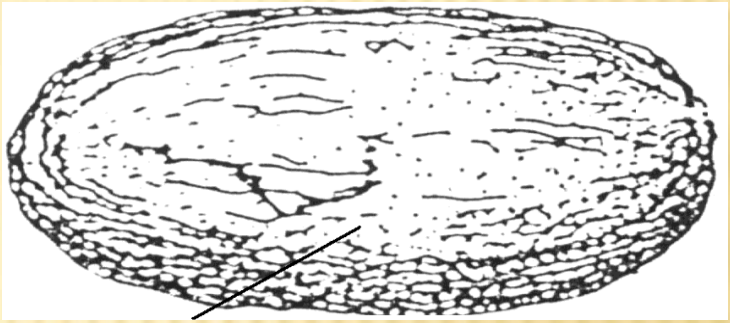
Cretaceous to Recent

Loftusia sp.

M. Görmüş,
Ankara University, 2017
Lecture 3

individuals

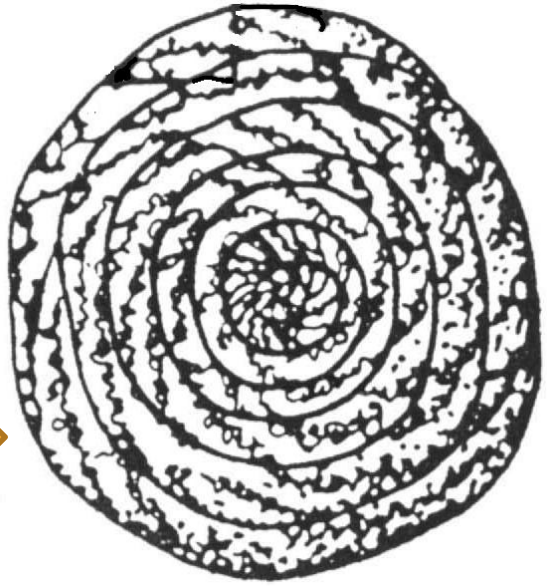
External views



- Planspiral, fusiform in shape
- Size changes between 2mm-120mm
- Shallow water paleoenvironment, benthic
- It has dimorphism
- Upper Cretaceous in age

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

Internal views



Equatorial sections

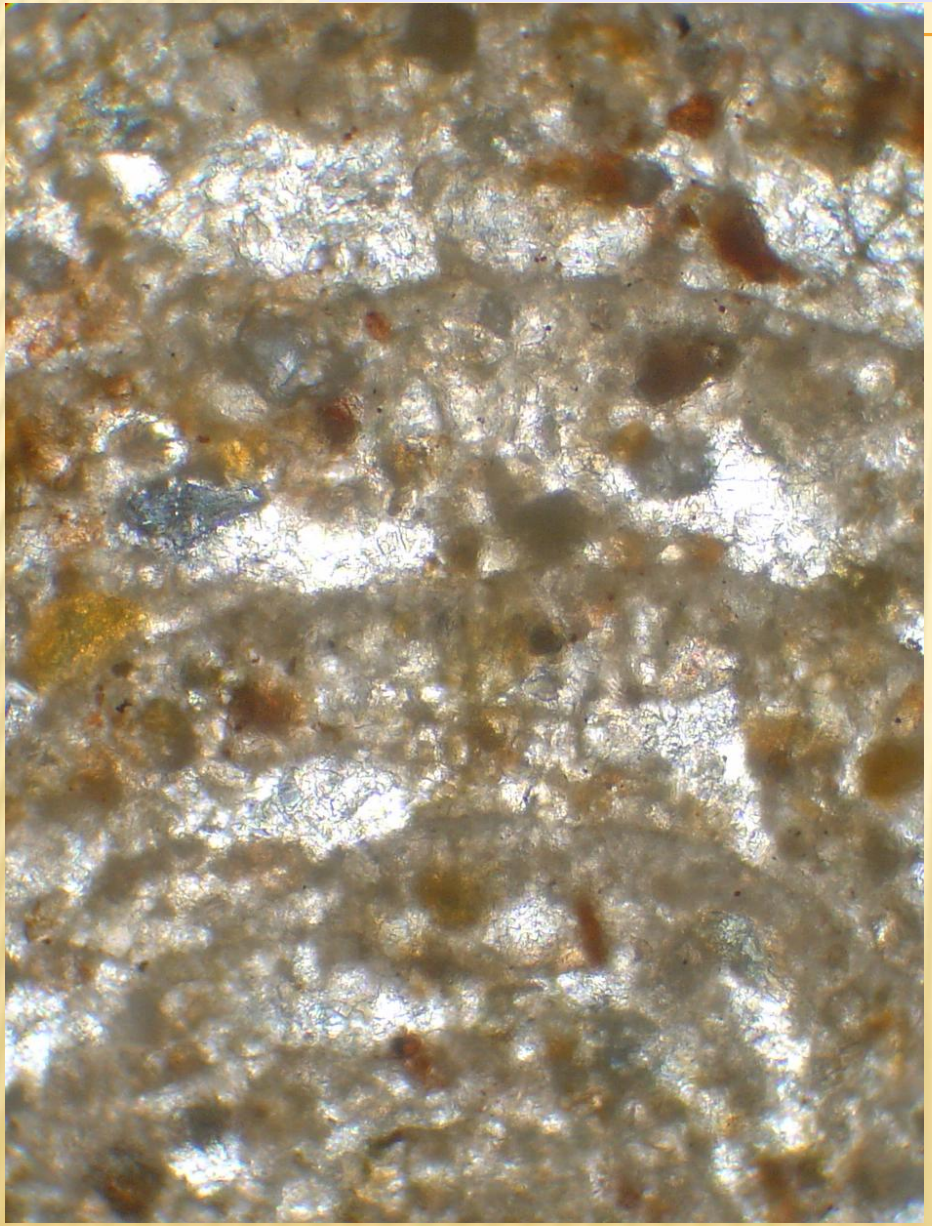
Axial section

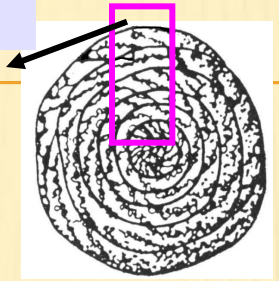
M. Görmüş,
Ankara University, 2017
Lecture 3

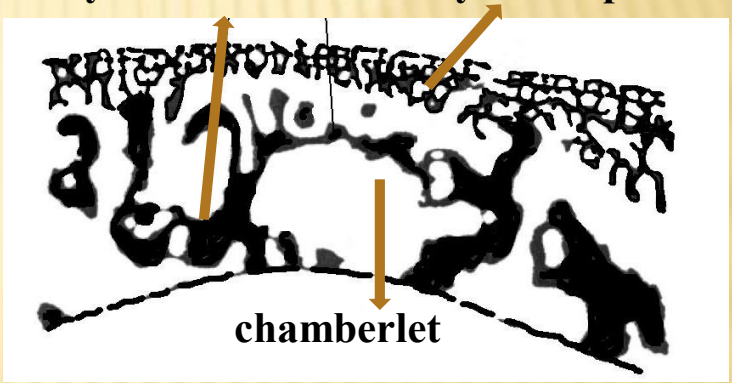
Pictures from Alkaya (Selçuk Univ.),
lecture notes, by forgetten scale and reference

M. Görmüş,
Ankara University, 2017
Lecture 3

Equatorial section and wall

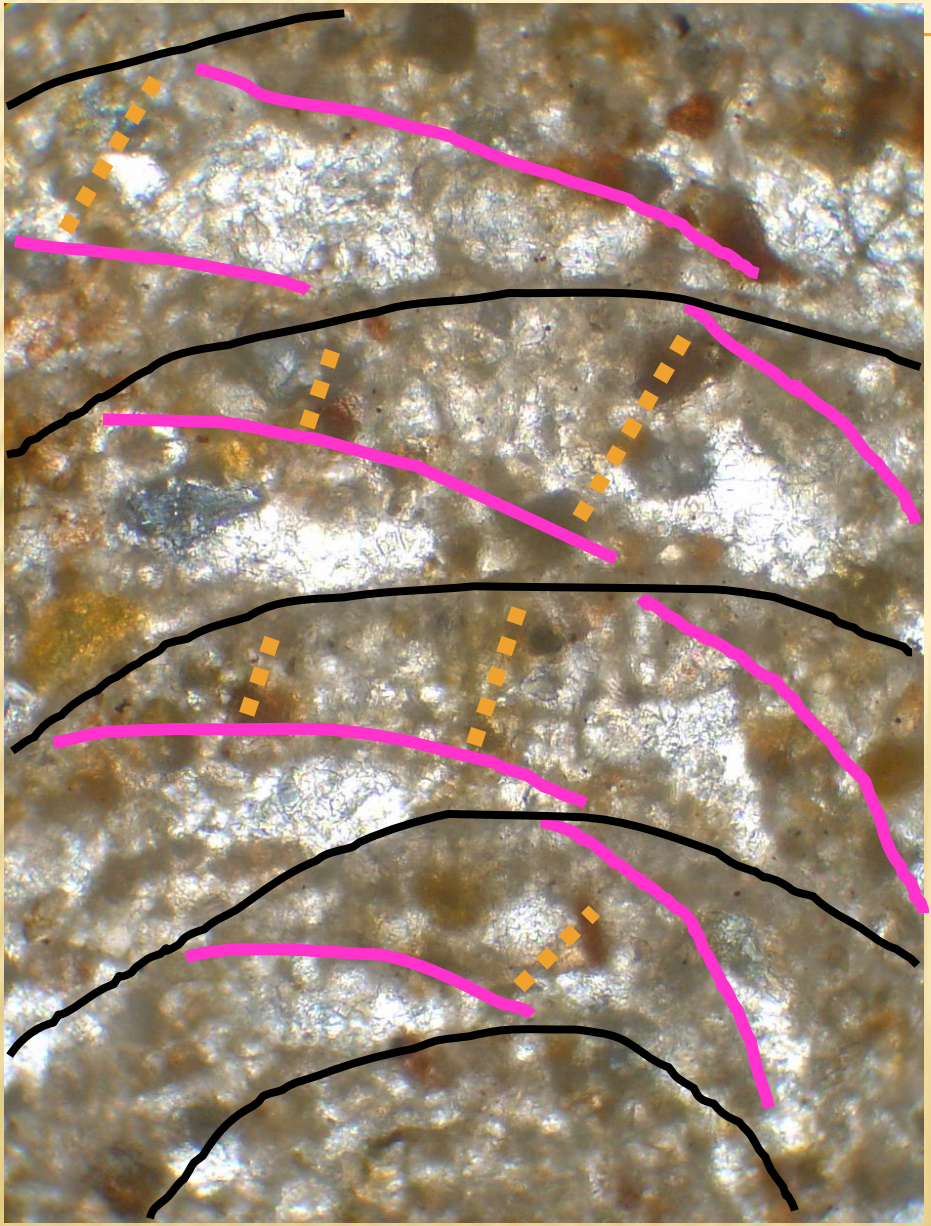


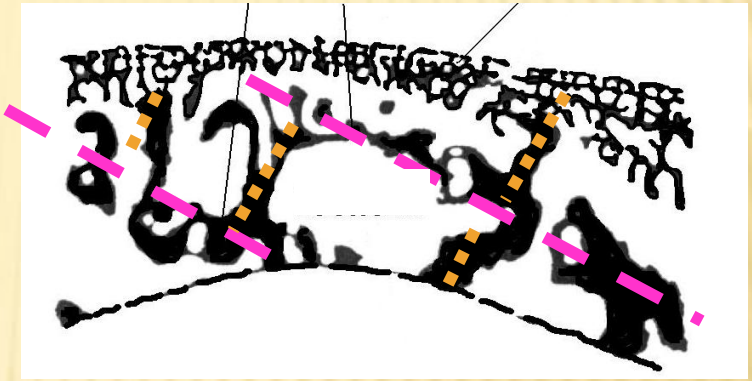




- Wall: alveolar and labryntic
- added tiny clasts make the wall agglutinant

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



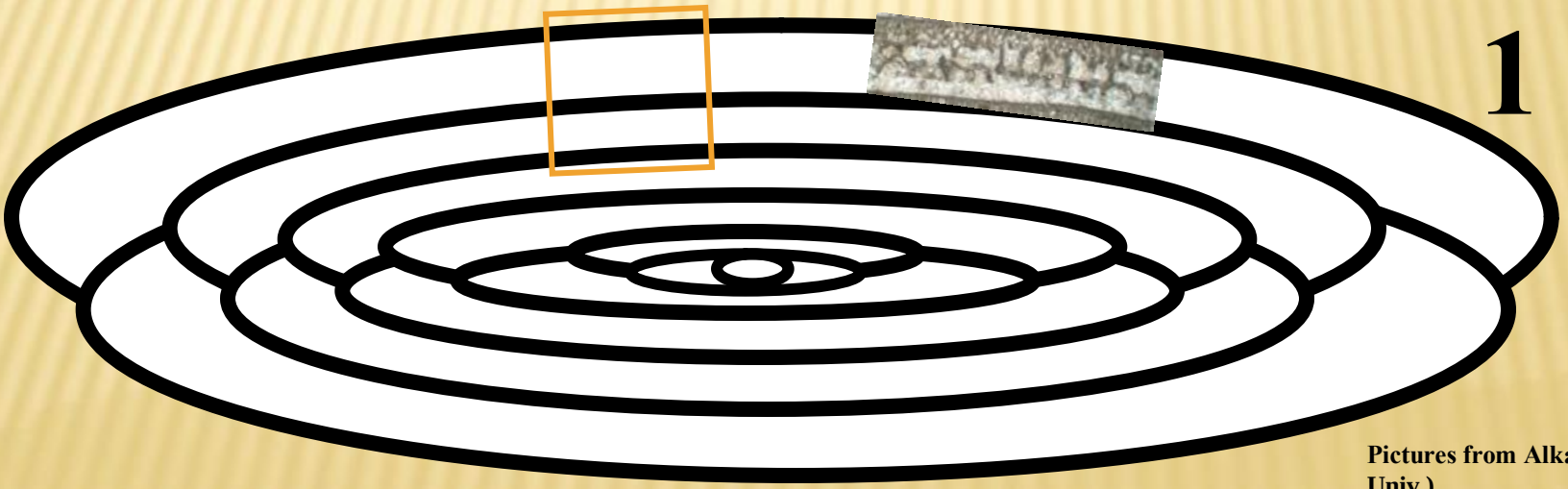


- Primary septa curved to wall,
- Secondary septa perpendecular to primary septa

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

Axial section

Labirentik duvar yapısı



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

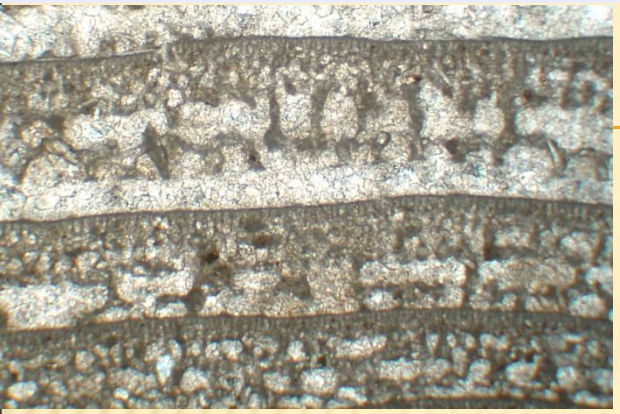
half test view

Axial section

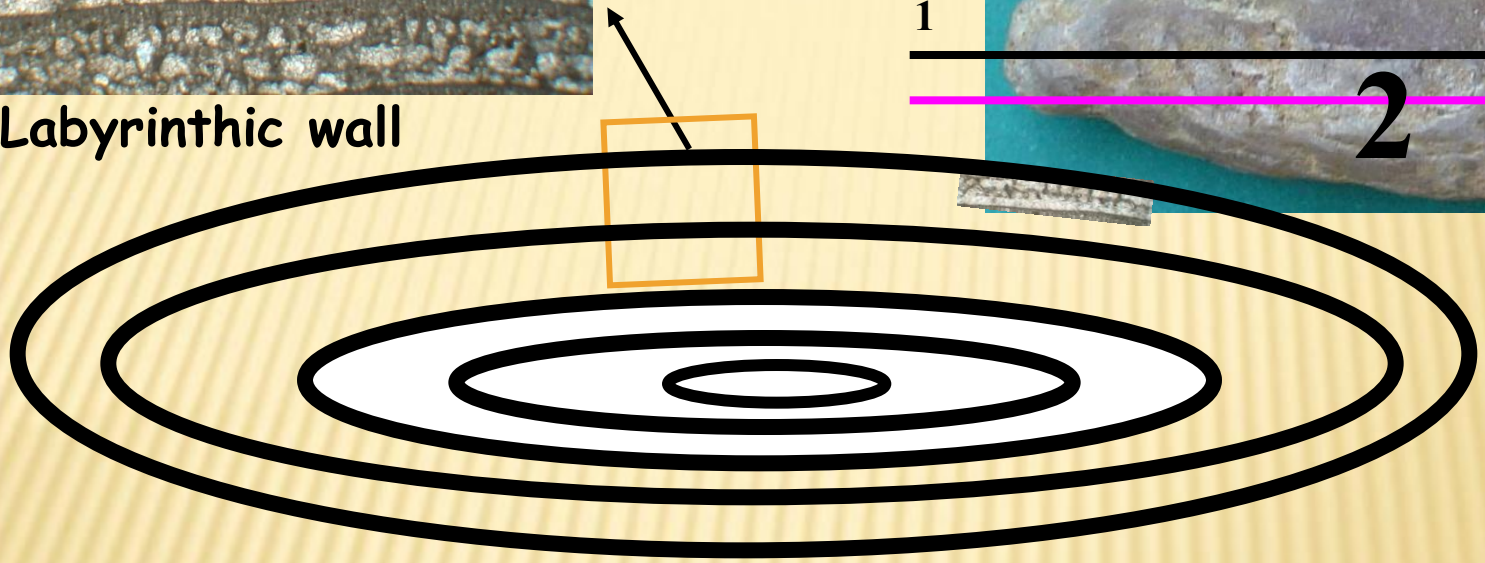
Picture from Alkaya (Selçuk Univ.),
lecture notes, by forgetten scale and reference

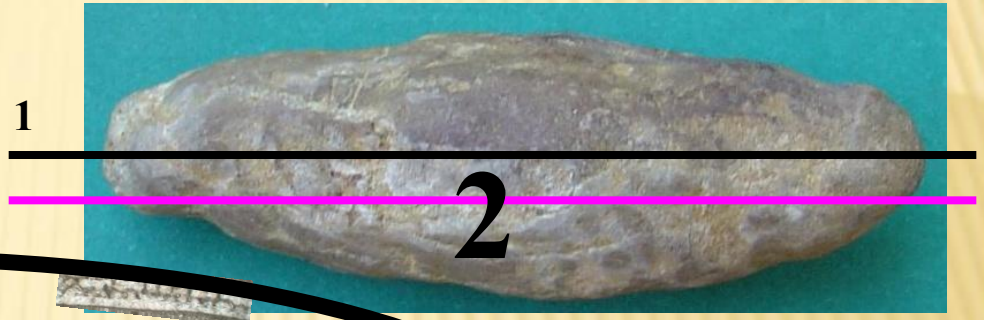
tangential section

M. Görmüş,
Ankara University, 2017
Lecture 3

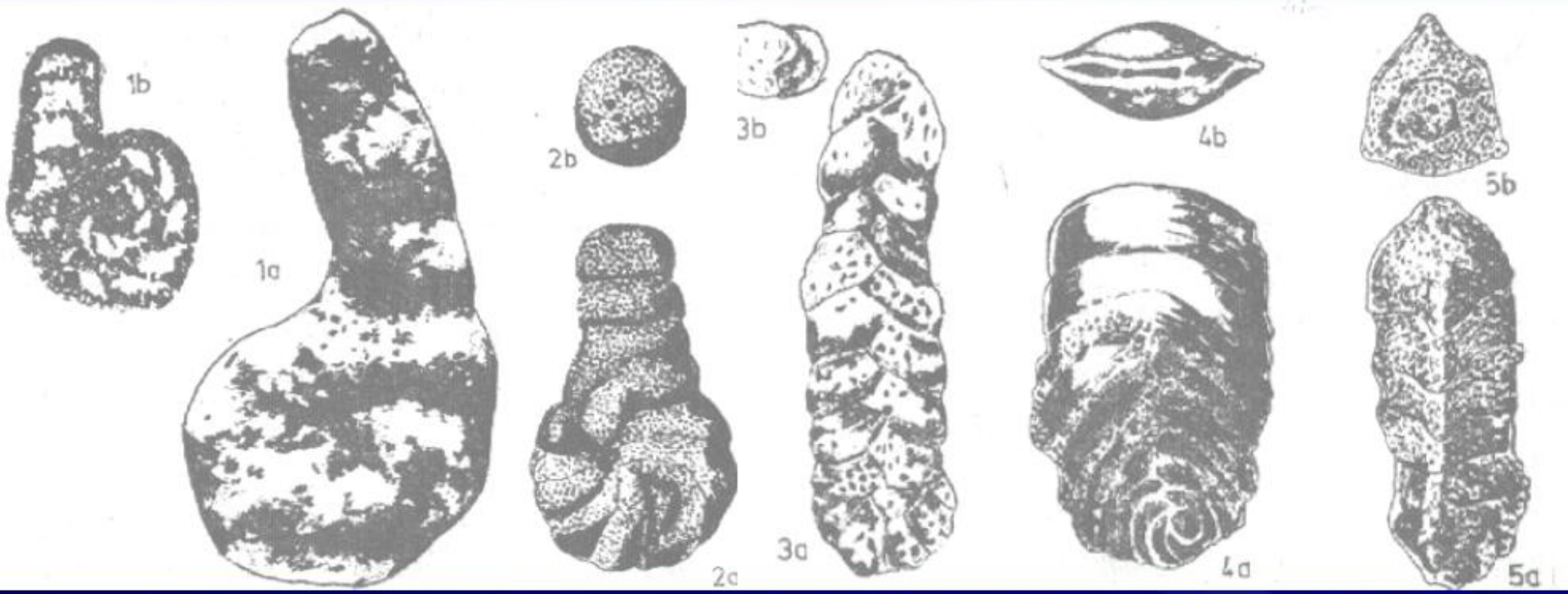


Labyrinthic wall





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



Pseudocyclammina sp. *Lituola* sp. *Spiroplectammina* sp. *Valvulina* sp. *Tritaxia* sp.

Jurassic-Cretaceous **Upper Triassic to Recent** **Carboniferous to Recent** **Cretaceous to Recent**

Homework 3

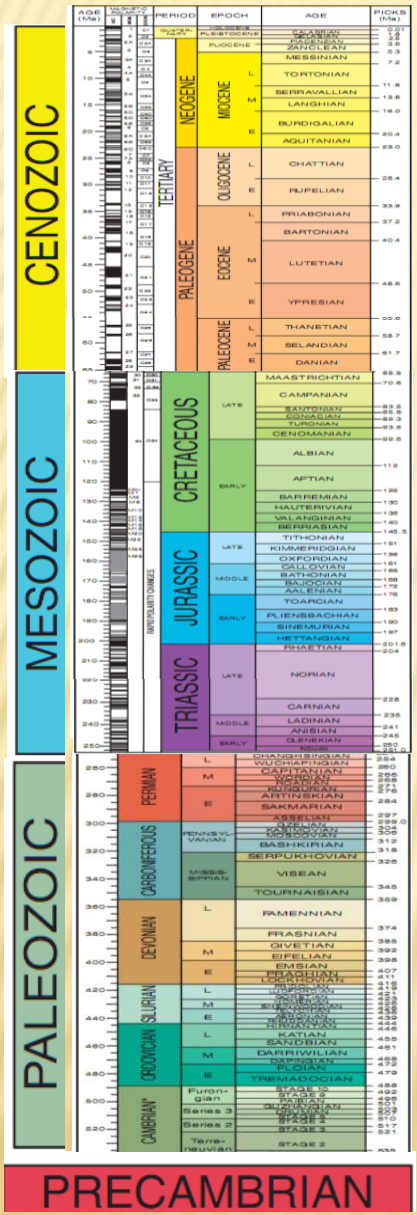
A rock includes the following fossils:

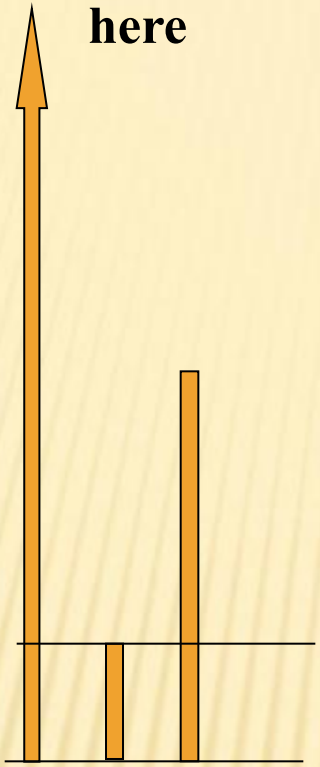
***Pseudocyclammina* sp. (Jurassic to Cretaceous), *Lituola* sp. (Upper Triassic to Recent), *Spiroplectammina* sp. (Carboniferous to Recent), *Valvulina* sp. (Cretaceous to Recent) and *Tritaxia* sp. (Cretaceous to Recent)**

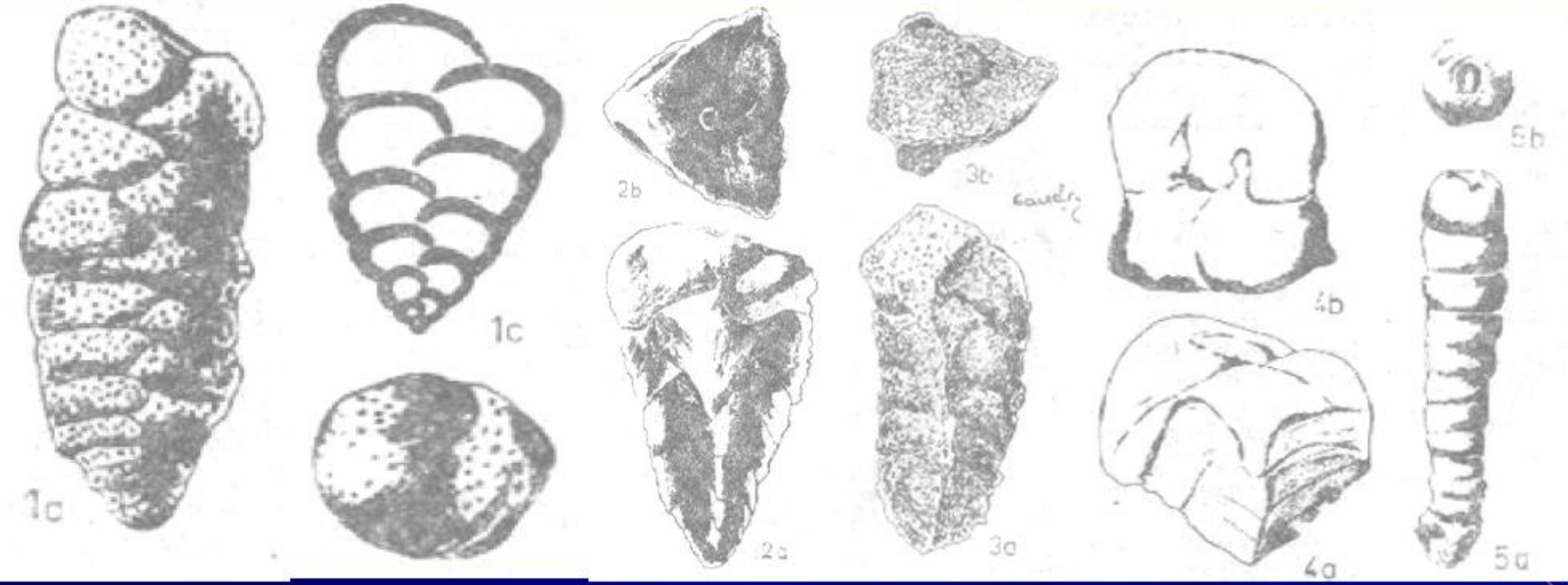
Draw simply the geological times and indicate the age of the rock. I have given the geological time table in the next slide, please use this table

M. Görmüş,
Ankara University, 2017
Lecture 2

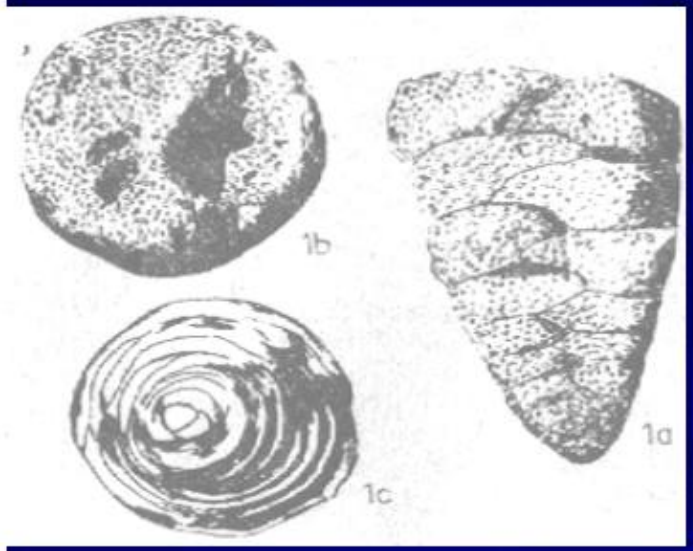
Write the genera here





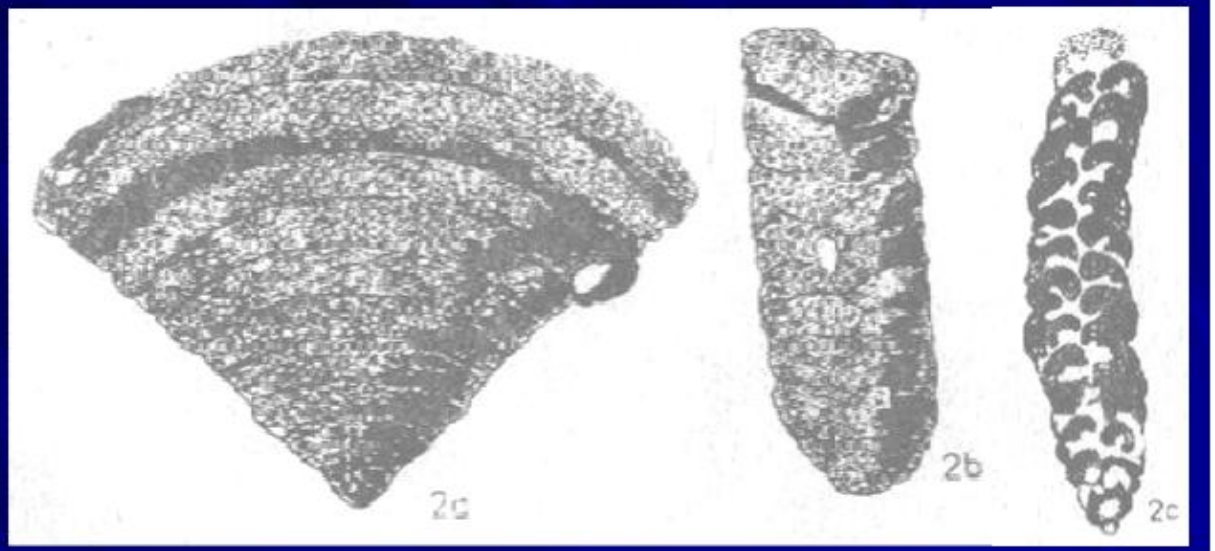


Textularia sp.	*Verneuilina* sp.	*Gaudryna* sp.	*Valvulina* sp.	*Clavulina* sp.
Carboniferous to Recent	**Jurassic to R.**	**Triassic to Recent**	**Triassic to R.**	**Paleogene to R.**



Dorothia sp.

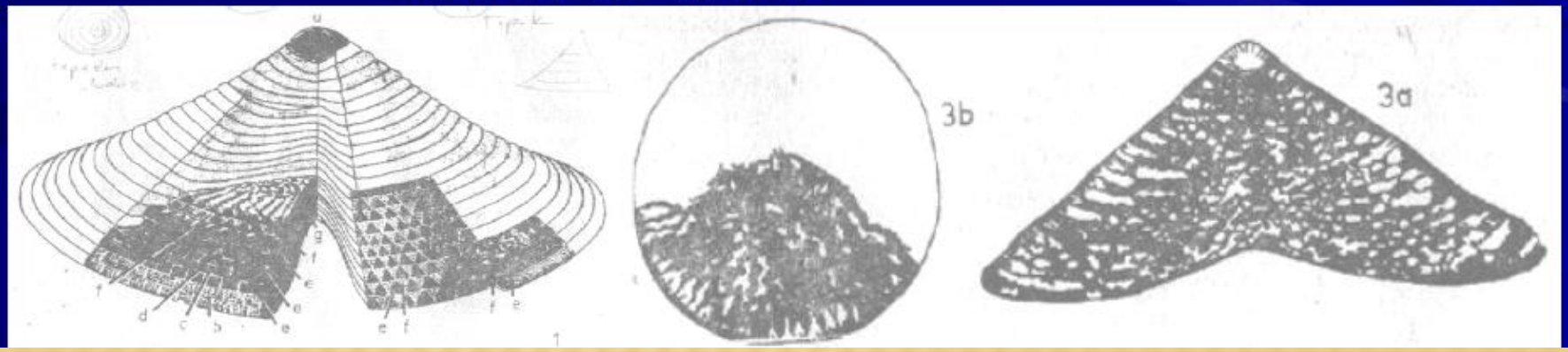
(Cretaceous to Recent)



Cuneolina sp.

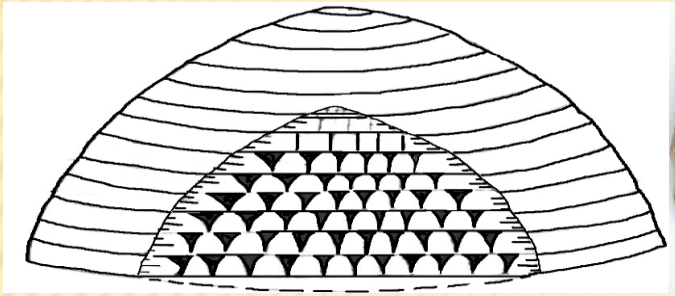
(Cretaceous to Miocene)

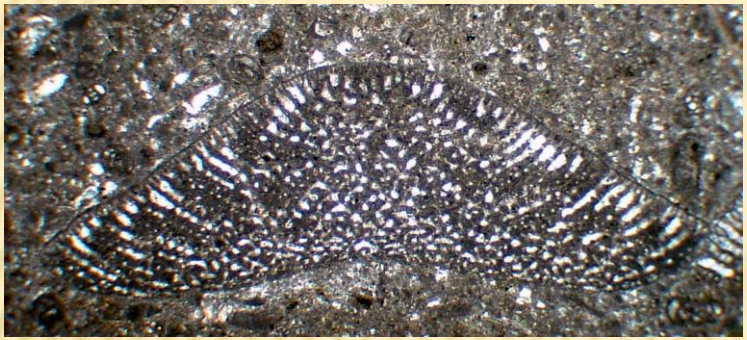
Orbitolina sp. **(Cretaceous)**

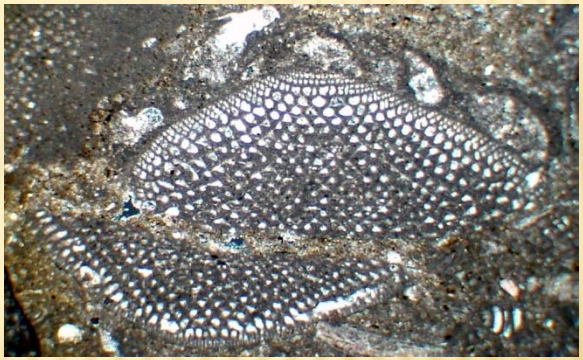


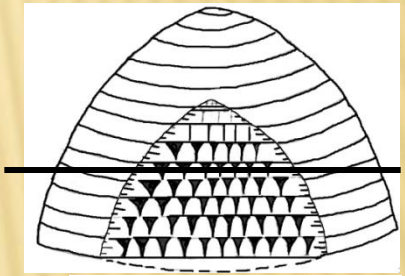
Orbitolina sp. Cretaceous

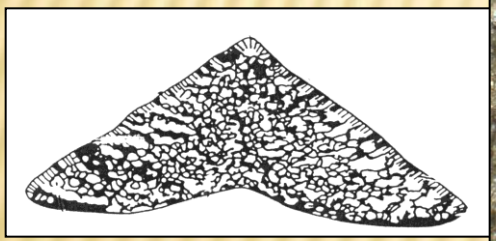
M. Görmüş,
Ankara University, 2017
Lecture 3

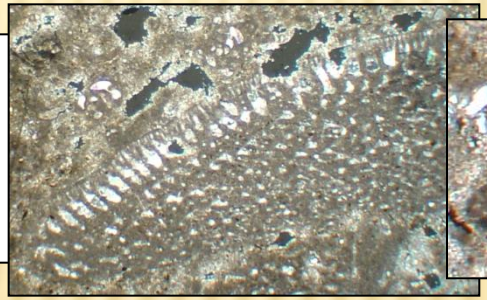


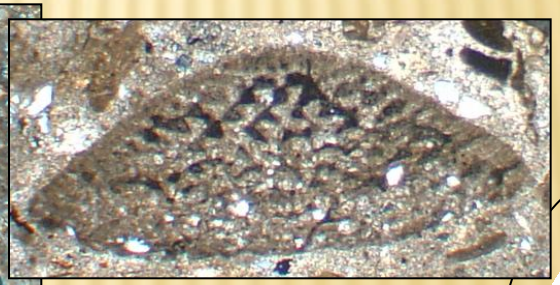


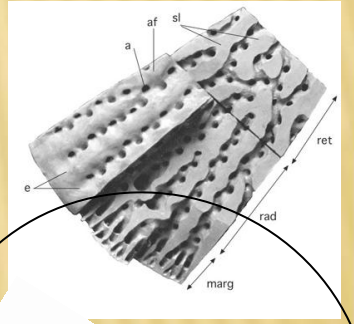


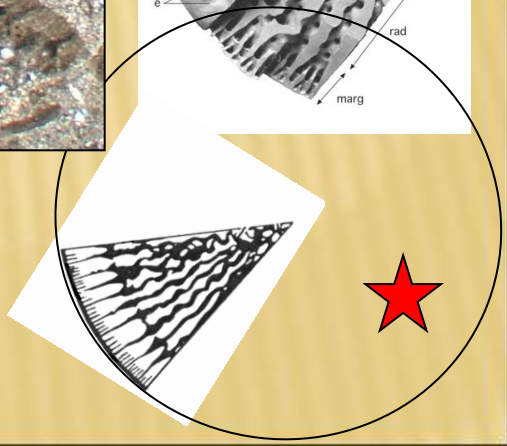






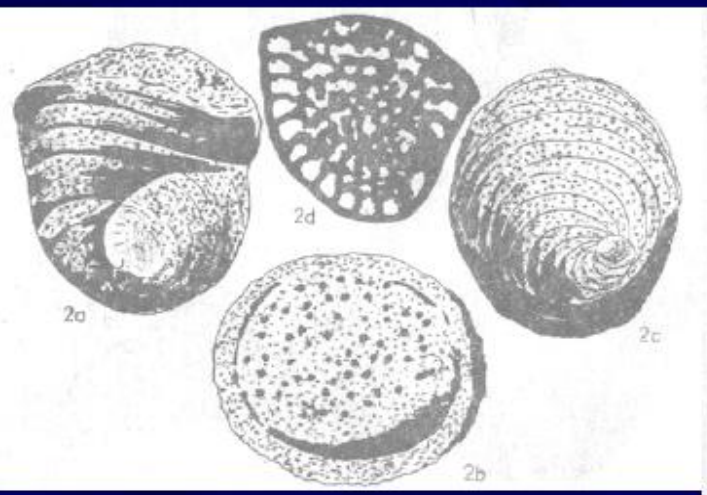




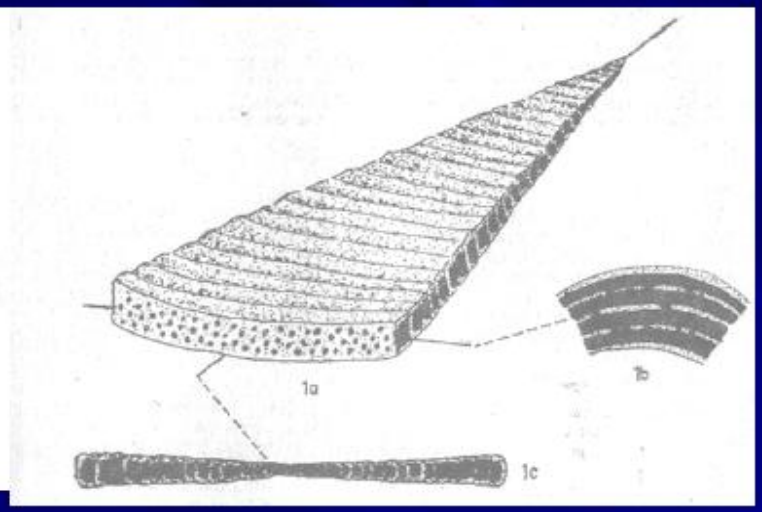


- Test conical, diameter reaches up to 30 mm
- Many chambers, chamberlets, septa and septula have been seen

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



Lituonella sp. **(Eocene)**



Cyclolina sp. **(Upper Cretaceous)**

Cyclopsinella sp.

(Upper Cretaceous)