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Paleontology

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Lecture 11

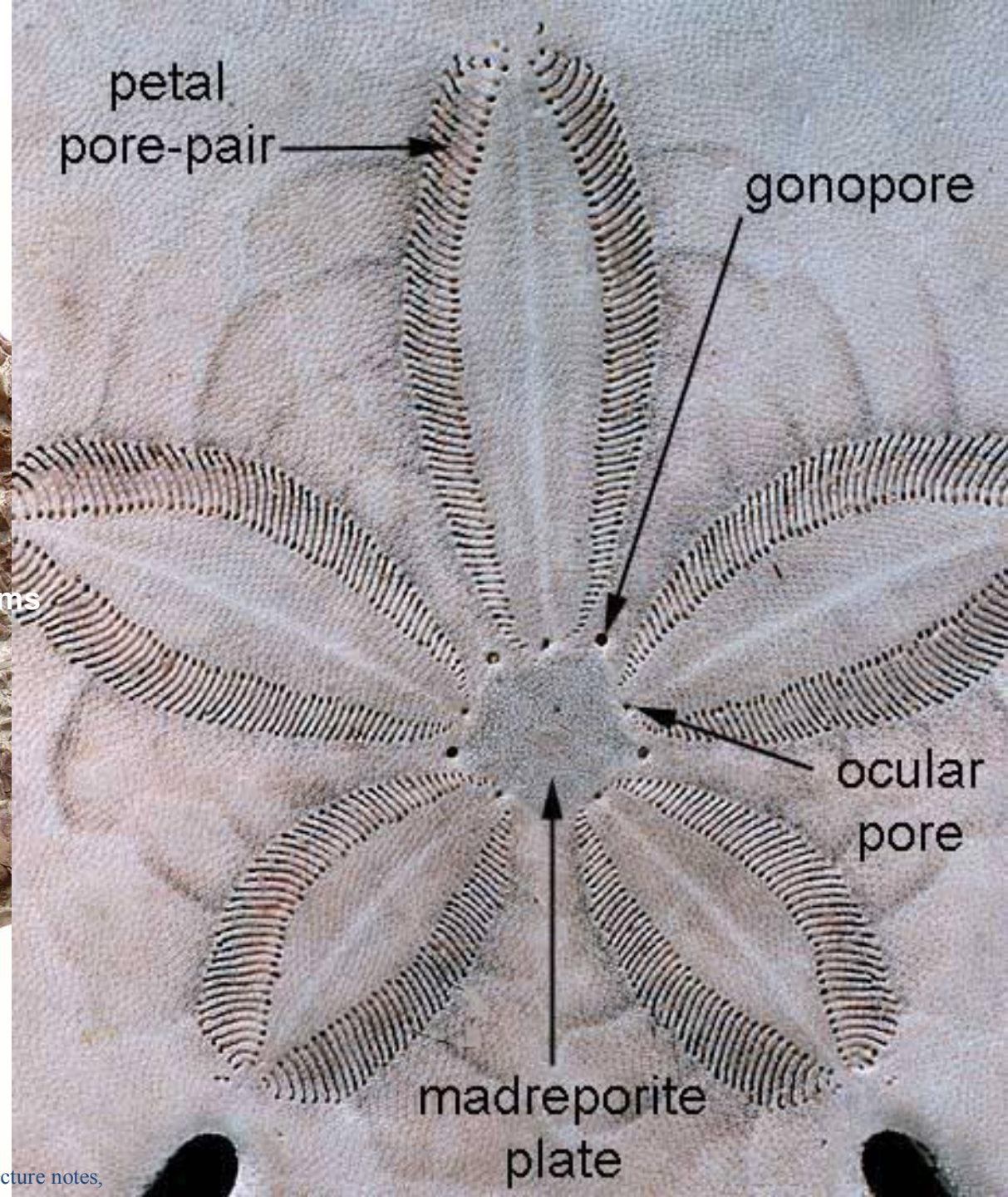


ANKARA UNIVERSITY



Topics

1. Echinodermata
 - General characteristics
 - Classification
 - 1.1 Echinoidea
 - General characteristics
 - Body organisations & related terms
 - Classification
 - Selected genera
 - 1.2 Crinoids
 - General characteristics
2. Arthropoda
 - 2.1 Trilobita
 - General characteristics
 - Classification
 - Selected genera



Echinodermata

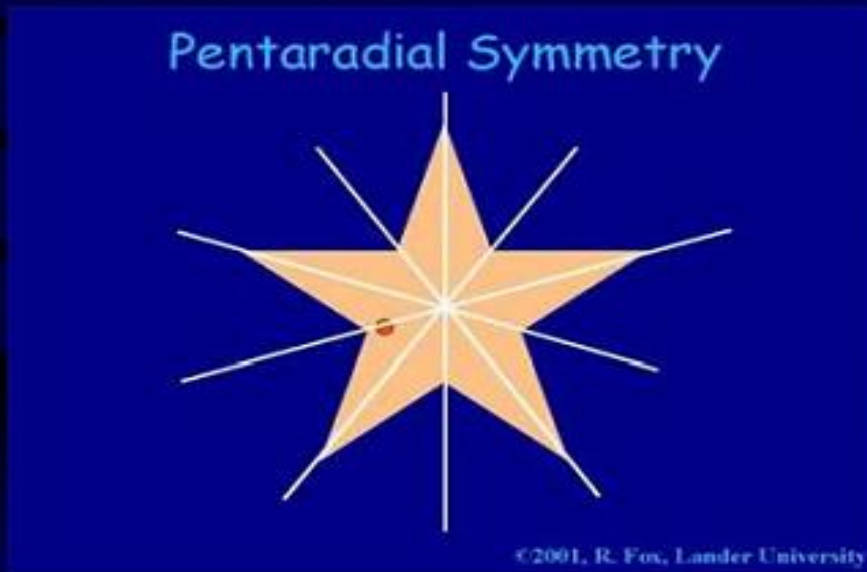




Phylum Echinodermata

General characteristics

- Adults exhibit **pentamerous** radial symmetry
- Radially symmetry is secondary; larvae are bilaterally symmetrical and undergo metamorphosis to become radially symmetrical adults.



Echinoderm larva

Phylum **Echinodermata** (Spiny skin organisms)

General characteristics

- * **Echinoderms** (Phylum **Echinodermata**) are a [phylum](#) of [marine animals](#).
- * The word "echinoderm" is made up from [Greek](#) *ἐχινόδερμα* (*echinóderma*), "[spiny](#) skin", cf. *ἐχῖνος* (*echínos*), "hedgehog; sea-urchin" and *δέρμα* (*dérma*), "skin", ***echinodérmata*** being the Greek plural form.
- * The adults are recognized easily by their (usually five-point) radial symmetry.
- * They include such well-known animals as [starfish](#), [sea urchins](#), [sand dollars](#), and [sea cucumbers](#).
- * Echinoderms are found at every ocean depth, from the [intertidal zone](#) to the [abyssal zone](#), benthics, epifaunal or infaunal.
- * The phylum contains about 7000 living [species](#),
- * Echinoderms are also the largest phylum that has no freshwater or terrestrial (land-based) representatives.
- * Geologically, the value of echinoderms is in their [ossified](#) skeletons, which are major contributors to many [limestone](#) formations,
- * They can provide valuable clues as to the geological environment.

Phylum Echinodermata

General characteristics

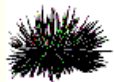
- Echinoderms sometimes pose a health threat to humans. The fine structure of the spines of certain species of sea urchins means that if the spine pierces the flesh, it may break off when an attempt is made to remove it. It may require patience — or the assistance of a physician — to fully remove the remaining piece of spine.
 - In 2010, 373,000 tonnes of echinoderms were harvested, mainly for consumption. These were mainly sea cucumbers (158,000 tonnes) and sea urchins (73,000 tonnes).
 - Sea cucumbers are considered a delicacy in some countries of south east Asia; particularly popular are the (Pineapple) roller *ananas* (*susuhan*) and the red *edulis*. They are well known as *bêche de mer* or *Trepang* in [China](#) and [Indonesia](#). The sea cucumbers are dried, and the potentially poisonous entrails removed.
 - The strong [poisons](#) of the sea cucumbers are often [psychoactive](#), but their effects are not well studied. It does appear that some sea cucumber toxins restrain the growth rate of [tumour](#) cells, which has sparked interest from [cancer](#) researchers.
 - The [gonads](#) of sea urchins are consumed particularly in [Japan](#), [Peru](#), [Spain](#) and [France](#). The taste is described as soft and melting, like a mix of seafood and fruit. The quality depends on the color, which can range from light yellow to bright orange.
 - The calcareous [tests](#) or shells of echinoderms are used as a source of lime by farmers in areas where limestone is unavailable; indeed, 4,000 tons of the animals are used annually for this purpose. This trade is often carried out in conjunction with [shellfish](#) farmers, for whom the starfish pose a major irritation by eating their stocks.
- Sea-urchin and sand dollar skeletons are popular collectibles, as are dried starfish.

Phylum Echinodermata

Classification

Classification

Phylum Echinodermata



Subphylum Blastozoa

-Class **Eocrinoidea** (Cambrian - Silurian, 30-32 genera)
-Class **Parablastoidea** (Ordovician, 3 genera)
-Class **Rhombifera** = Cystoidea in part (Ordovician - Devonian, 60 genera)
-Class **Diploporita** = Cystoidea in part (Ordovician - Devonian, 42 genera)
-Class **Blastoidea** (Silurian - Permian, 95 genera)

Subphylum Crinozoa

-Class **Crinoidea** - sea lilies (Cambrian? Early Ordovician - Recent, 1005 genera)
-Class **Paracrinoidea** (Ordovician - Silurian, 13-15 genera)

Subphylum Echinozoa

-Class **Echinoidea** (Sea Urchins) (Ordovician - Recent, 765 genera)
-Class **Holothuroidea** (Sea Cucumbers) (Ordovician - Recent, 200 genera)
-Class **Edrioasteroidea** (Early Cambrian - Carboniferous, 35 genera)
-Class **Edrioblastoidea** (Ordovician, 1 genus)
-Class **Helicoplacoidea** (Cambrian, 3 genera)
-Class **Cyclocystoidea** (Ordovician - Devonian, 8 genera)

Subphylum Asterozoa (= Stelleroidea)

-Class **Asteroidea** - starfish - (Early Ordovician - Recent, 430 genera)
-Class **Ophiuroidea** - Brittle Stars - (Ordovician - Recent, 325 genera)

Phylum Echinodermata

Classification



Starfish

Snake-like starfish

Sea-urchins or sea
dollars

Sea cucumbers

Sea lily

Phylum Echinodermata

Class Crinoidea



Class Holothuroidea



Class Ophiuroidea



Class Echinoidea



Class Asteroidea



Phylum Echinodermata

Classification

1. Classis (Sınıf):Asteroioidea (Deniz Yıldızları)



Acanthaster spp.



Linkia spp.



Solaster spp.

2. Classis (Sınıf):Ophiuroidea (Yılan Yıldızları)



Amphiura spp.



Ophiactis spp.

3. Classis (Sınıf):Echinoidea (Deniz Kestaneleri)



Echinus spp.



Salmacis spp.



Brissopsis spp.



Strongylocentrotus spp.



Arbacia spp.

Phylum Echinodermata

4. Classis (Sınıf): Holothuroidea (Deniz Hıyarları)



Holothuria spp.



Cucumaria spp.



Thyone spp.

5. Classis (Sınıf): Crinoidea (Deniz Laleleri)



Antedon spp.



Leptometra spp.



Cenocirunus spp.

KAYNAK :

*www.bilim ve teknik.com.tr

*EGE Üniversitesi. Fen Fak. Biyoloji Böl. Omurgasızlar Sist. Kitabı

*www.soc.soton.ac.uk/GDD/DEEPSEAS/deepcoral.html

*http://perso.wanadoo.fr/gonzales.manuel/textes/oursincr.html *http://privat.egersund.com/erling/Pigghuder/page12.htm

Echinozoidea (sea urchins, sand dollars)

Echinozoa is a subphylum of free-living [echinoderms](#) in which the body is essentially globoid with meridional symmetry.

They lack arms, brachioles, or other appendages, and do not at any time exhibit [pinnate](#) structure (en.wikipedia.org/wiki/Echinozoa)

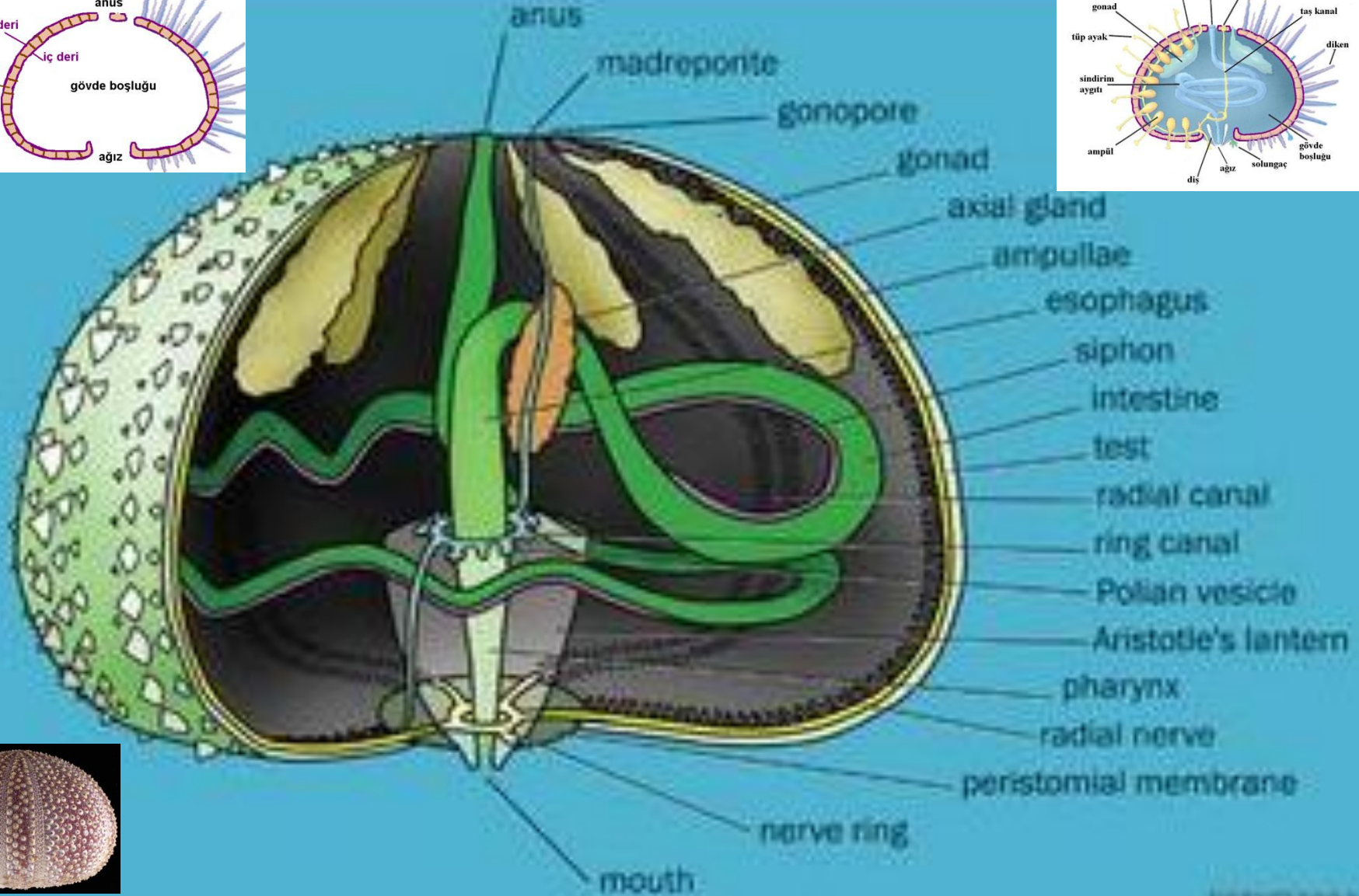
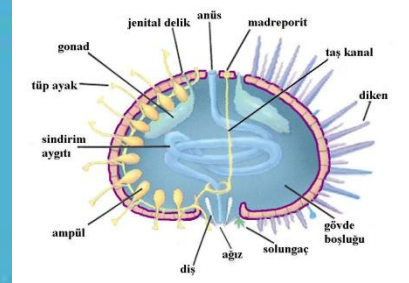
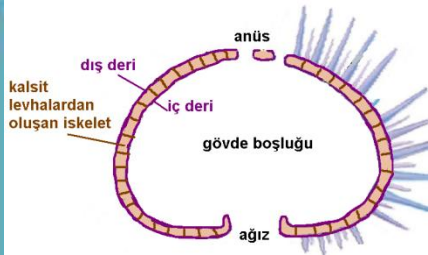
Class Echinoidea

- Lack arms
- Body is enclosed in a shell or **test**
- Body surface is usually covered with moveable spines

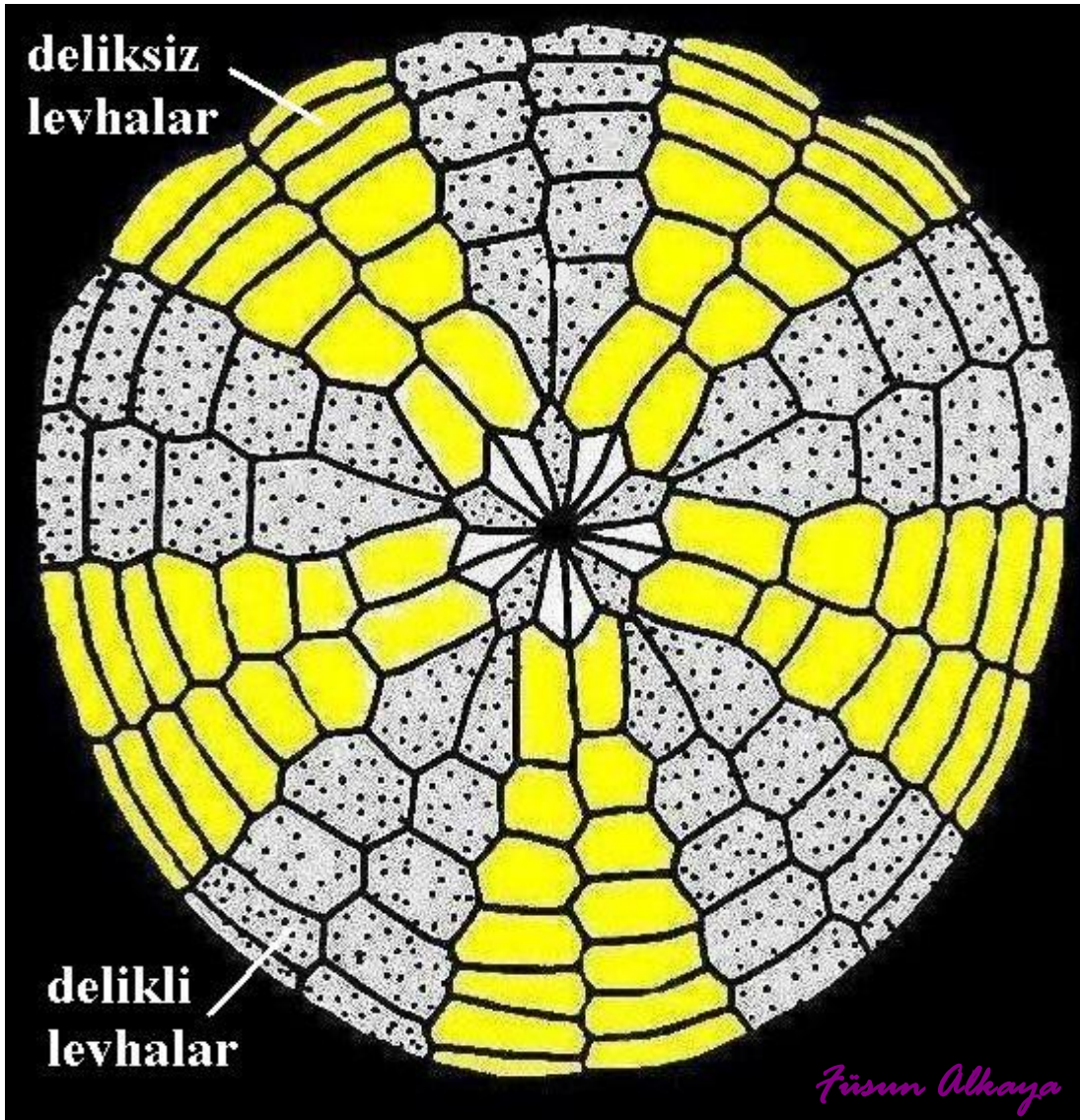




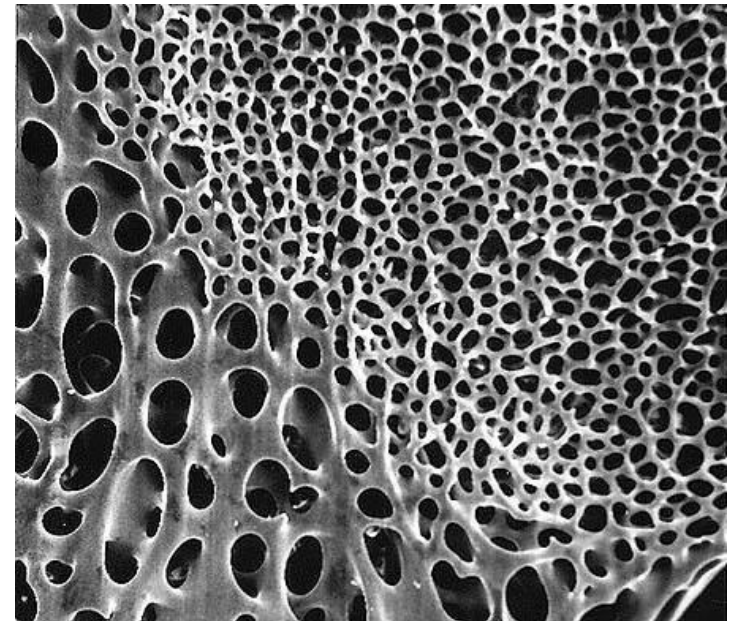
Class Echinoidea



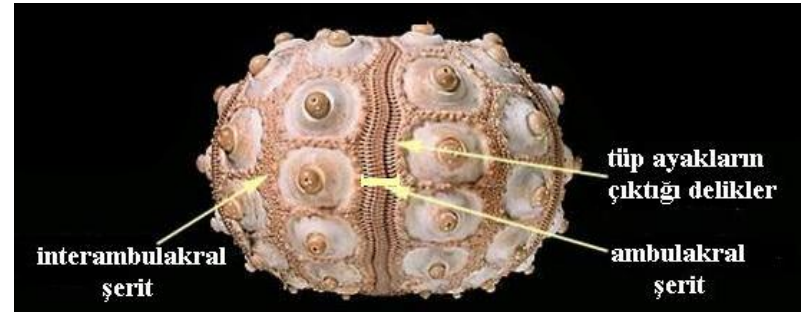
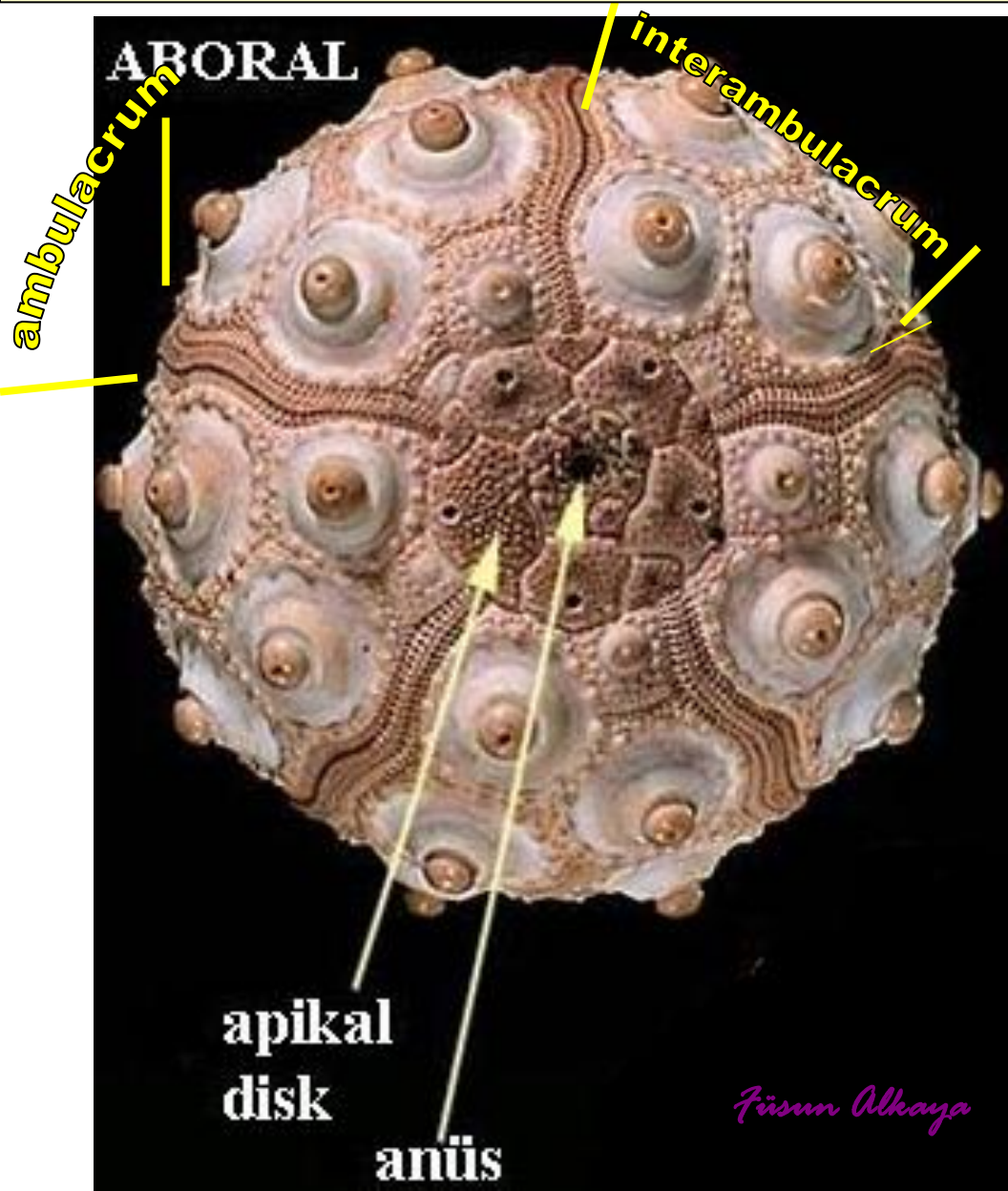
Class Echinoidea



- ❖ Echinoid skeleton includes numerous calcitic plates that have many pores.
- ❖ Plates make 10 bands on the test as seen in the figure. Among these, five of them **AMBULACRUM**, other five of them **INTERAMBULACRUM** bands.



Class Echinoidea



**ambulacral band
(ambulacrum- singular)
(ambulacra – plural)**

Class Echinoidea



ambulacral band

Class Echinoidea



Living echinoid
Notify skin & spines



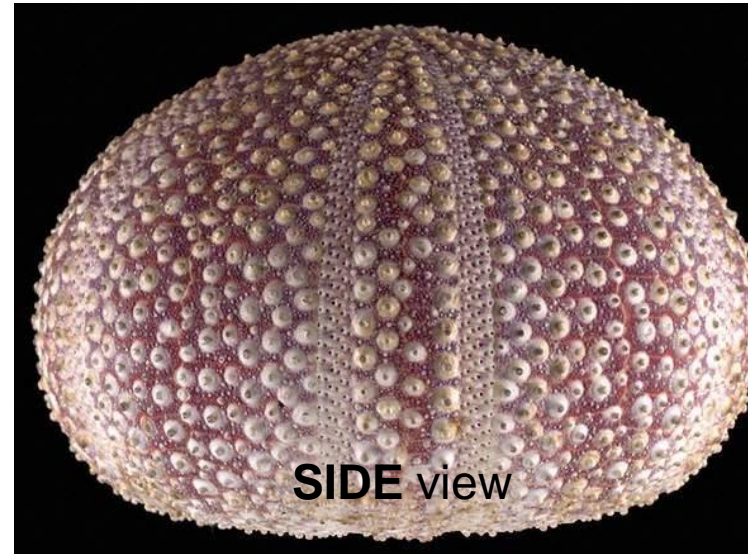
Calcitic test surface (removed skin)



ABORAL view

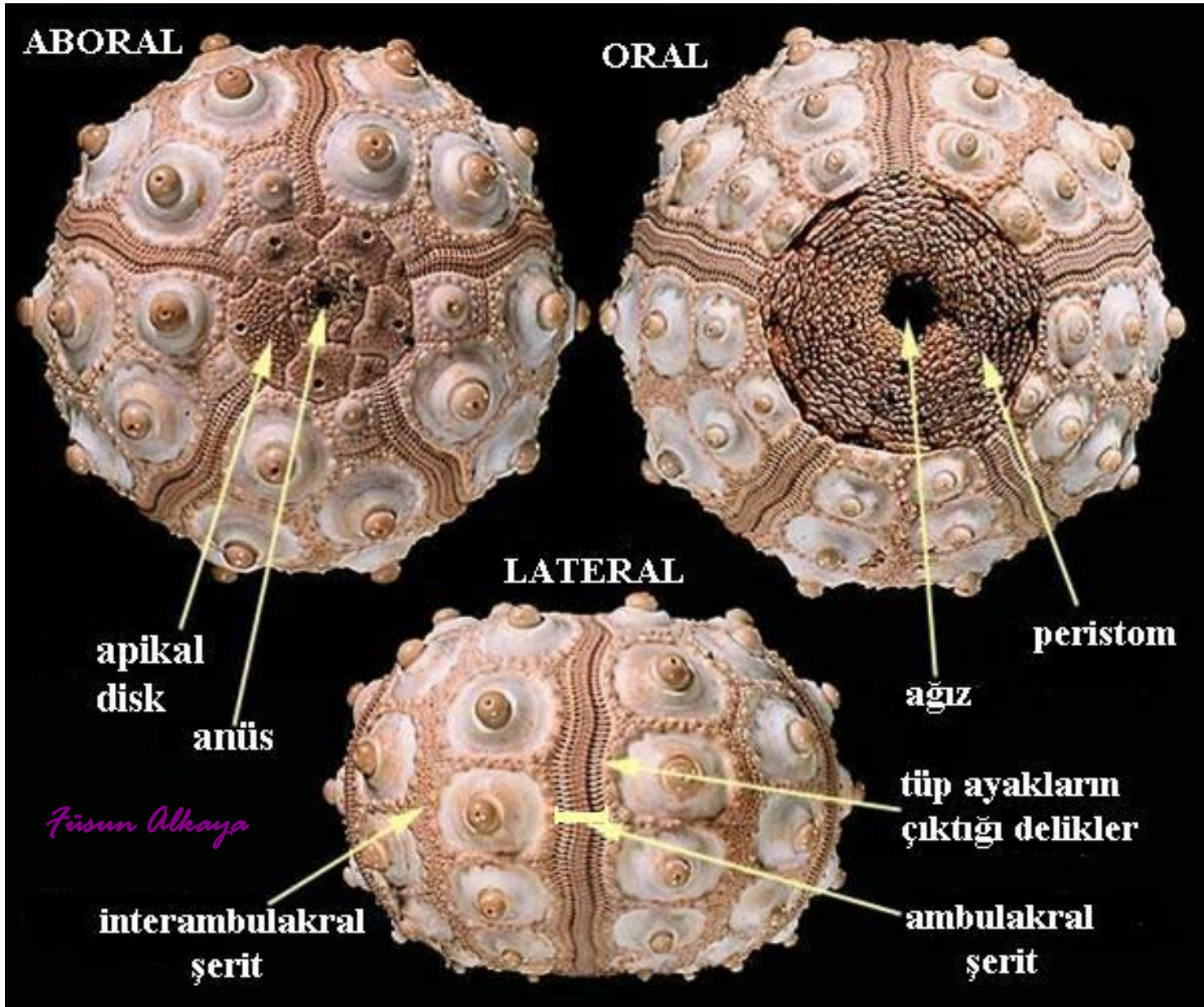


ORAL view



SIDE view

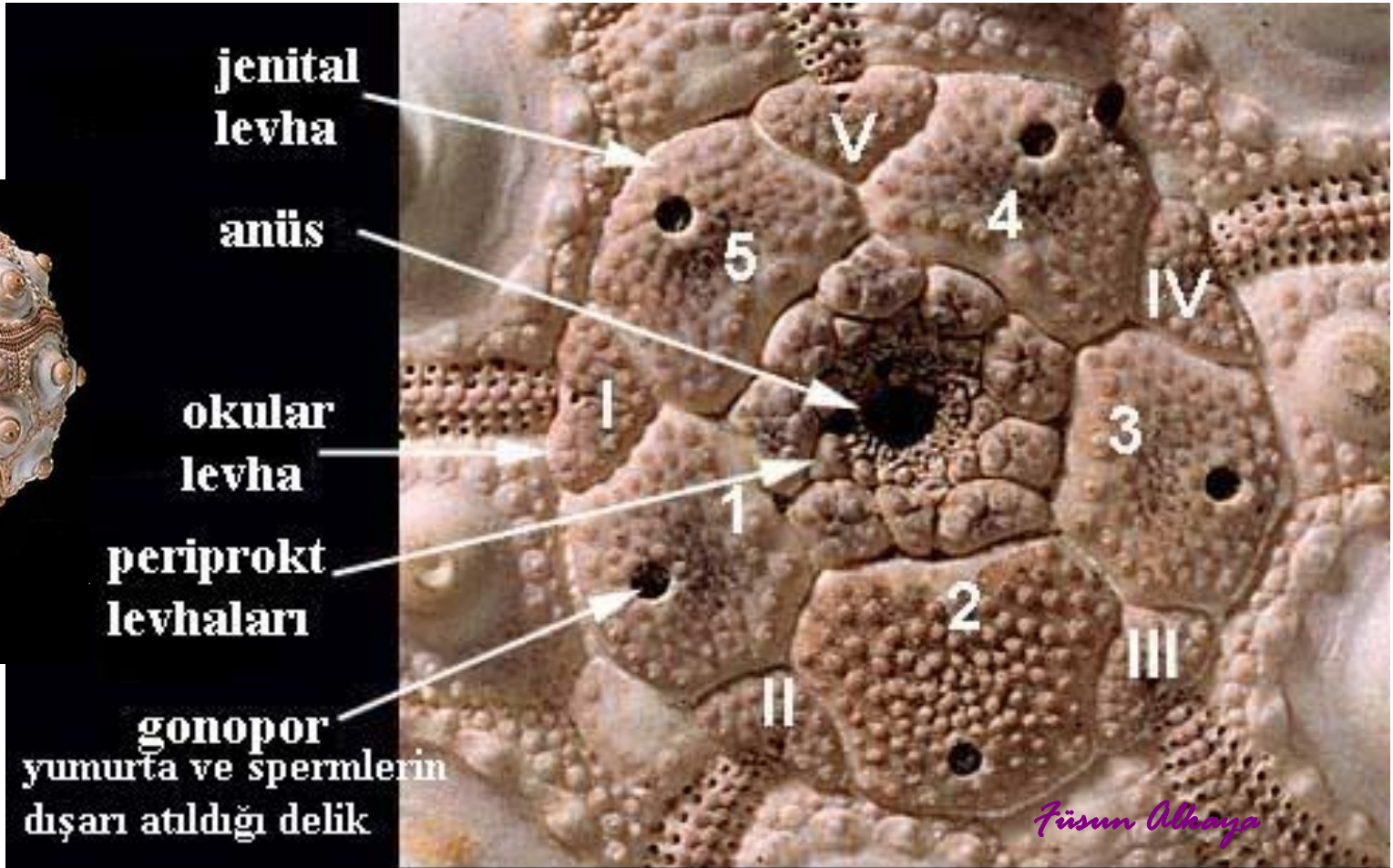
Class Echinoidea



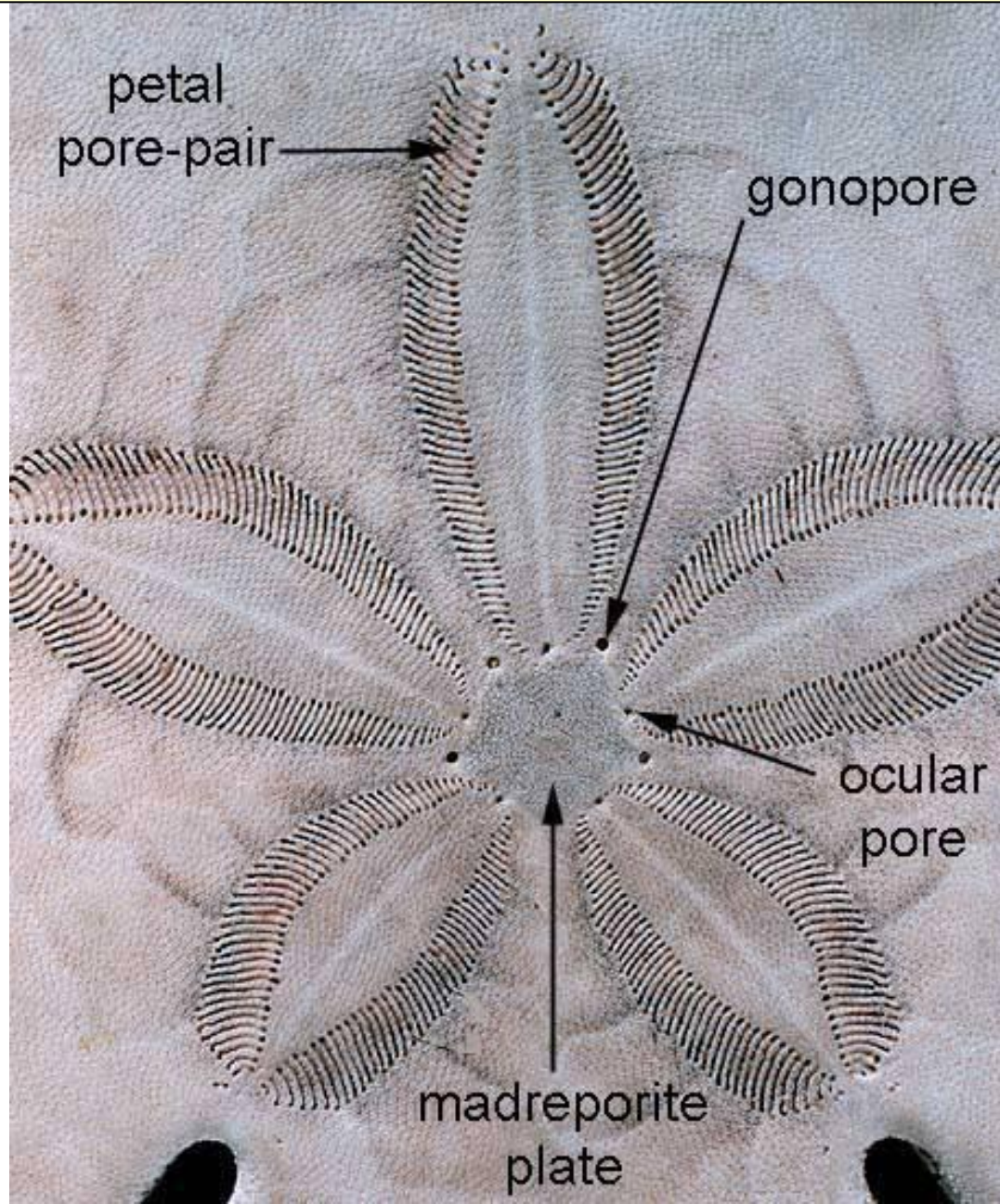
Class Echinoidea



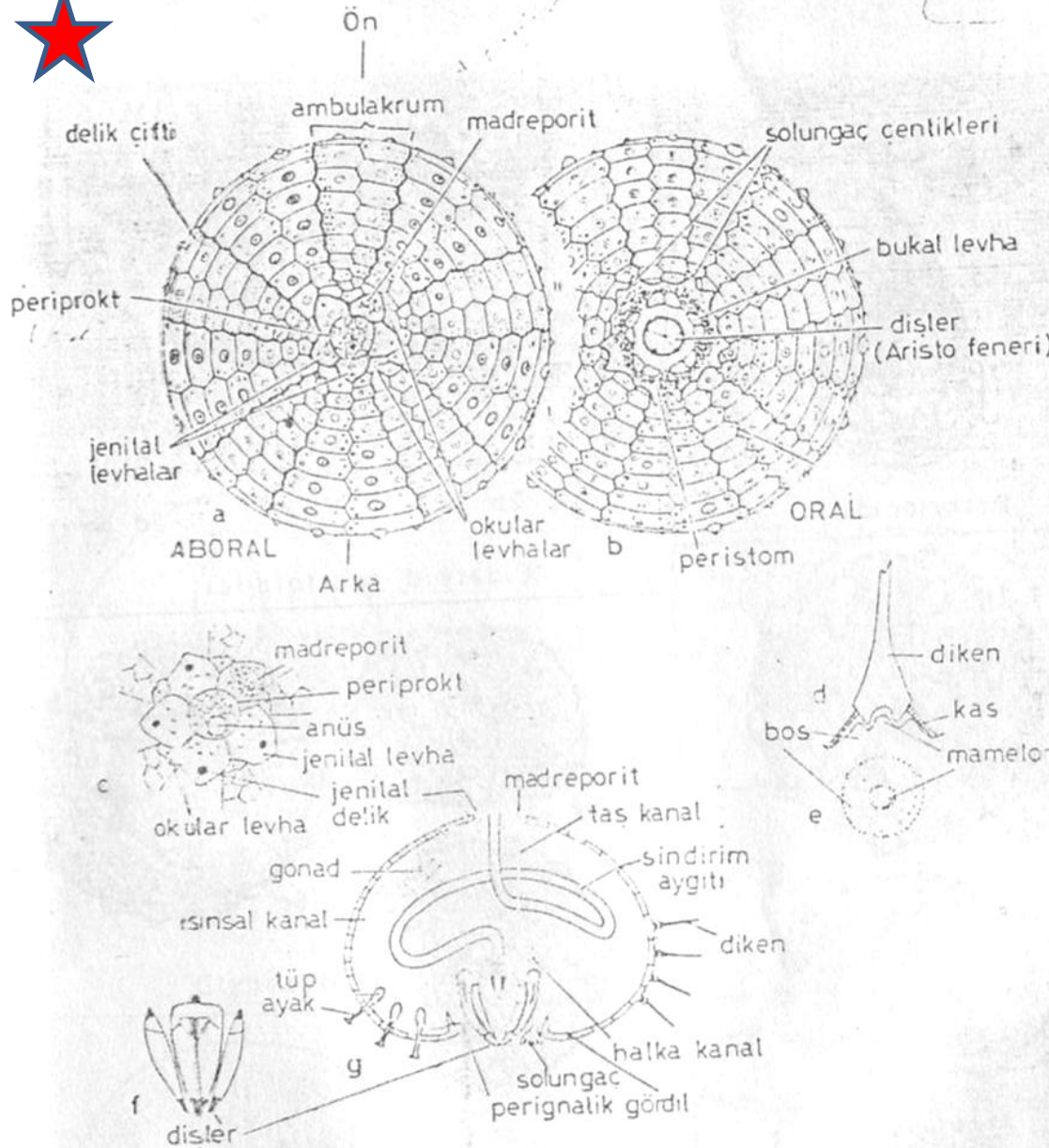
ABORAL



Class Echinoidea

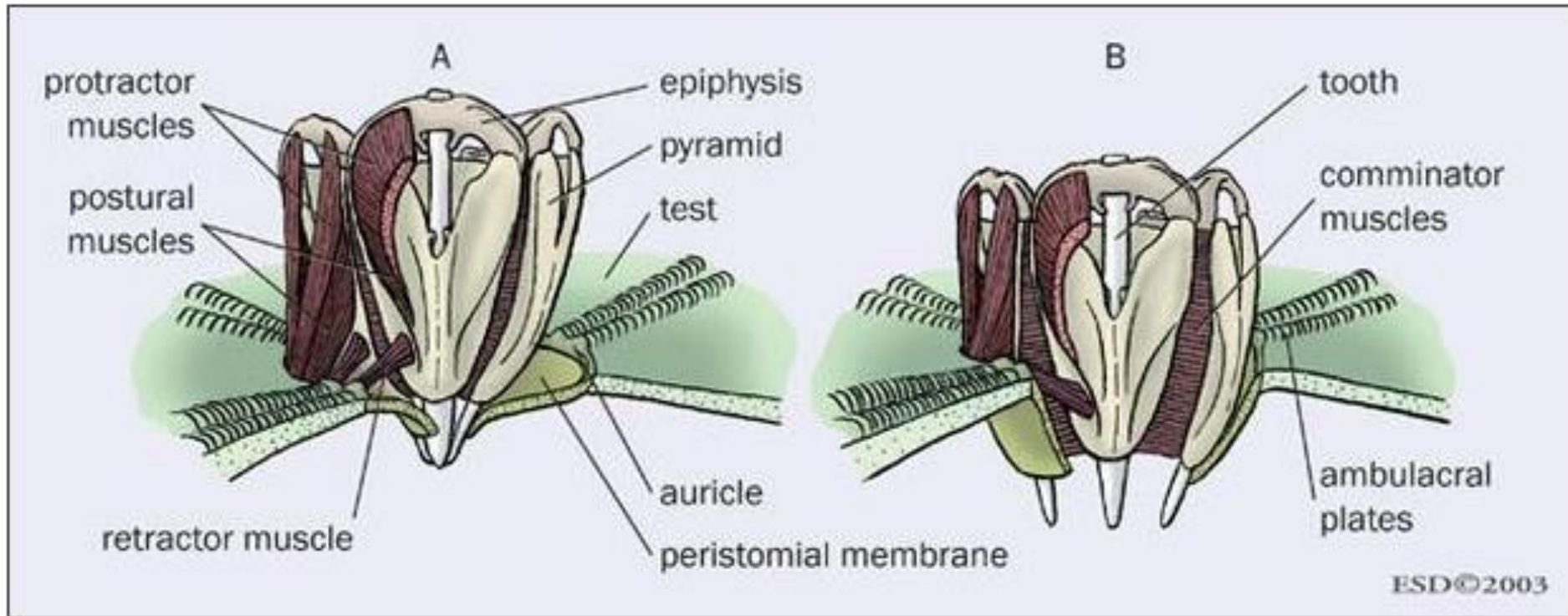


Class Echinoidea



- Oral:** anterior side
- Aboral :** posterior side
- Ambulacrum:** includes pinnates
- İnterambulacrum:** includes spines
- Periprokt:** membrane around anus
- Jenilal plate:** larger first plates opening towards interambulacrum sides
- Jenilal opening:** openings in Jenilal plates
- Ocular plate:** first plates opening towards ambulacrum side
- Madreporit:** a jenilal plate including numerous small openings
- Aristotlet's lantern:** includes tooth
- Bukal plate:** first plates around tooth
- Peristome:** membrane around tooth

Class Echinoidea



http://animaldiversity.ummz.umich.edu/site/resources/Grzimek_inverts/Echinoidea/v01_id146_con_echanat.jpg/view.html



Class Echinoidea

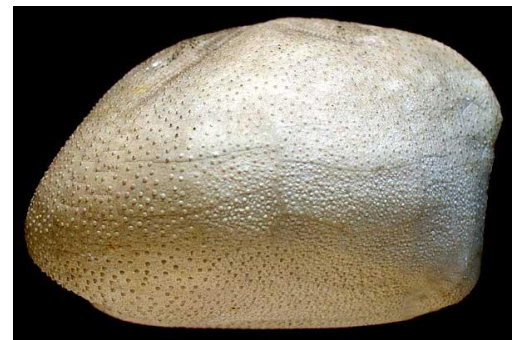
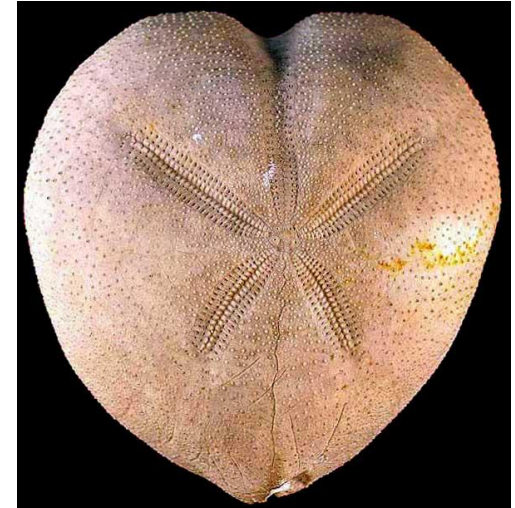
Shapes



Semi-globular



discoidal



heart-like

Class Echinoidea

pentameral symmetry

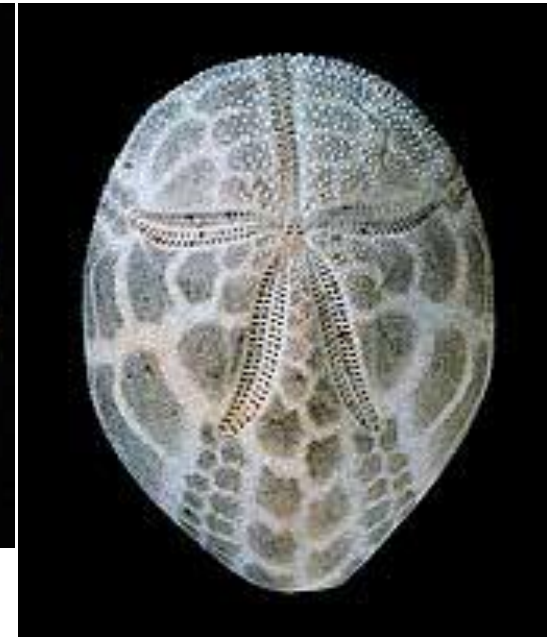


regular echinoids

bilateral symmetry



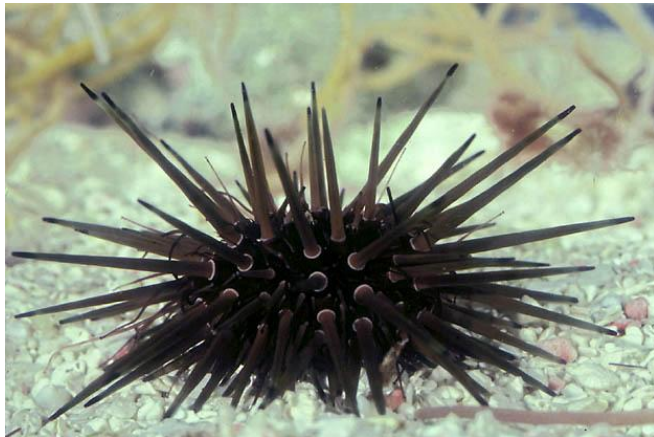
irregular echinoids
sand dollars



heart urchins

Symetry

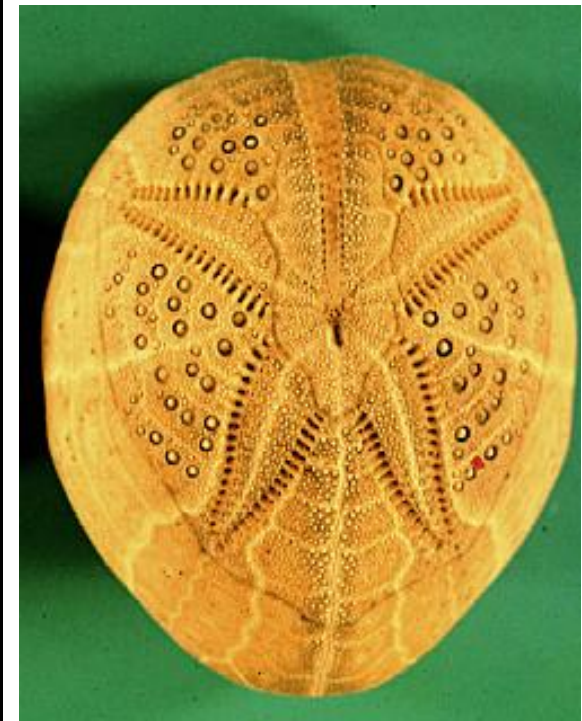
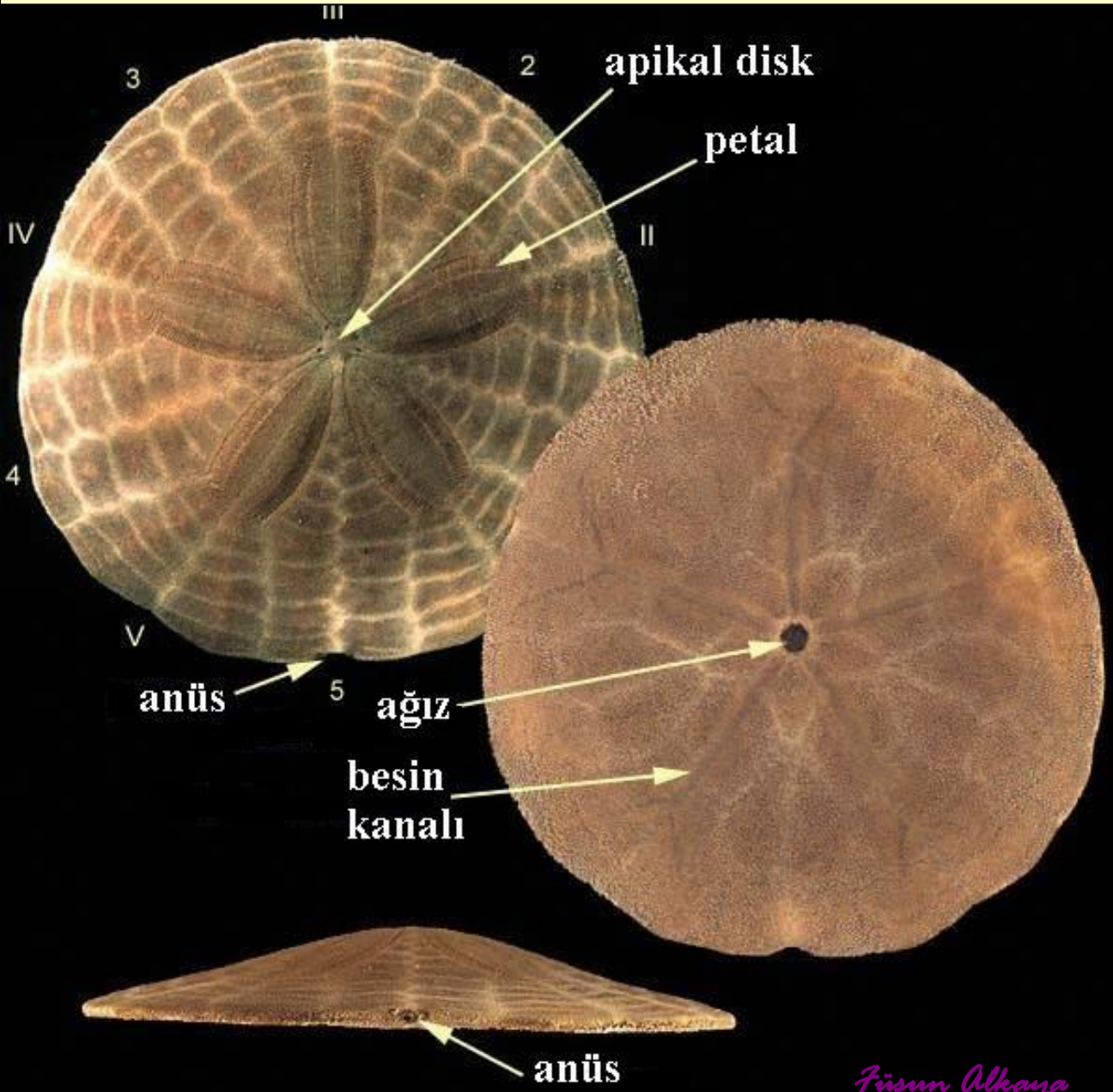
Class Echinoidea



Regular echinoids

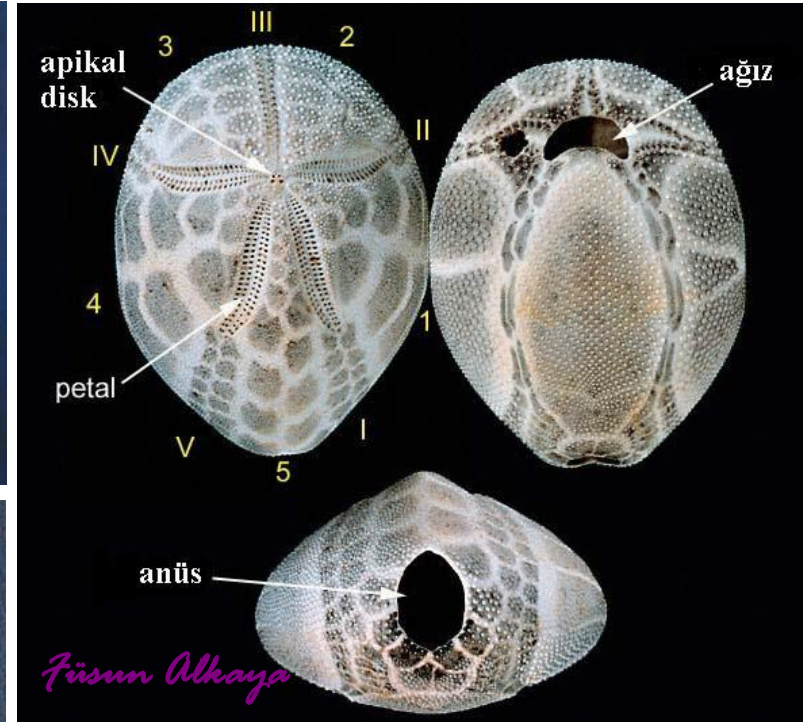
Fisun Alkaya

Class Echinoidea



irregular echinoids

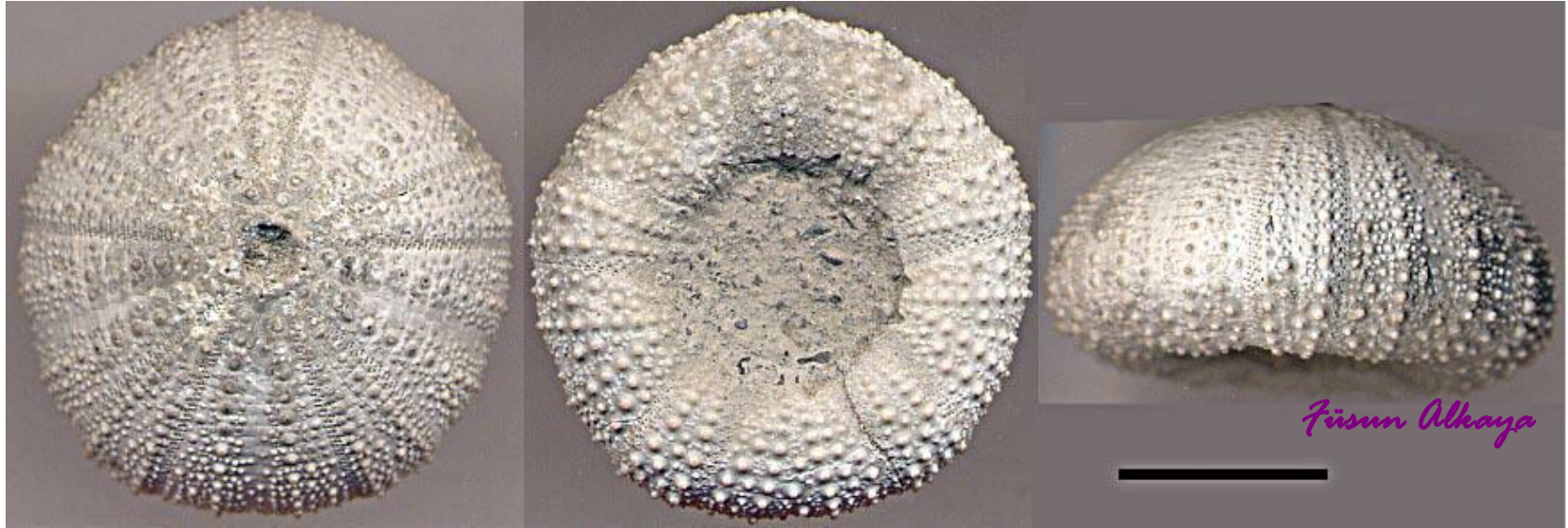
Class Echinoidea



Füsün Alkaya

irregular echinoids

Stomechinus sp. Jurassic-Early Cretaceous



Holectypus sp. Middle Jurassic-Early Cretaceous



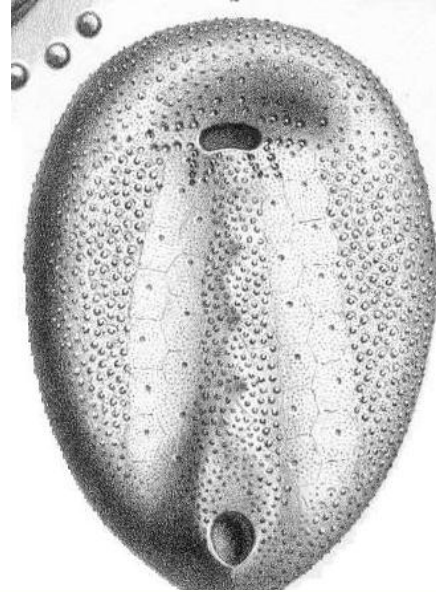
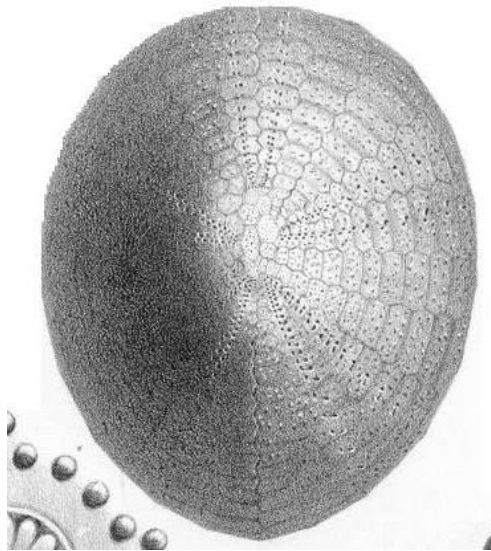
Conulus sp. Late Cretaceous



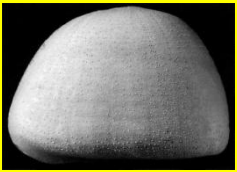
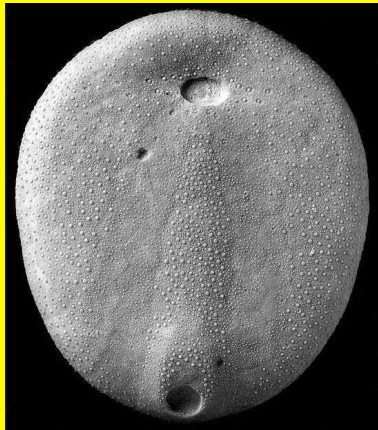
Class
Echinoidea



Echinocorys sp. Late Cretaceous-Paleogene



Class
Echinoidea



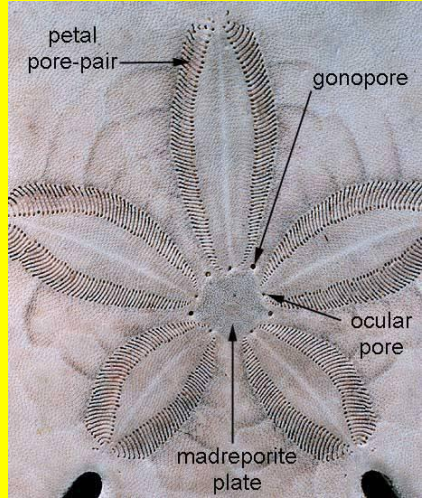
Conulus



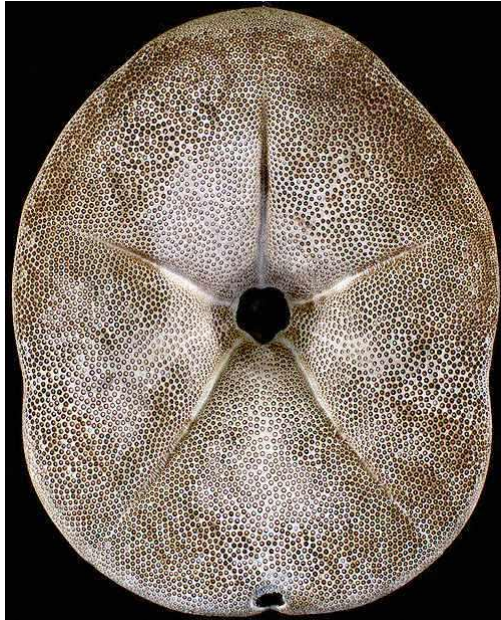
Echinocorys



Clypeaster sp. Late Eocene to Recent



Class
Echinoidea



Clypeaster sp. Late Eocene to Recent

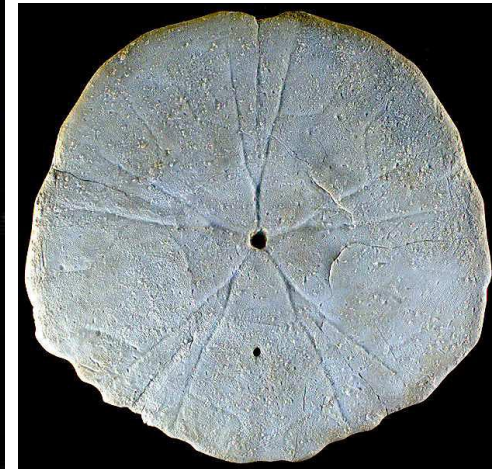


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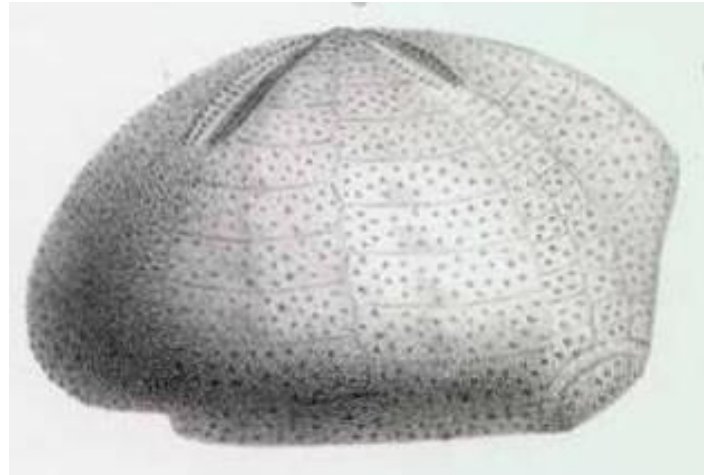
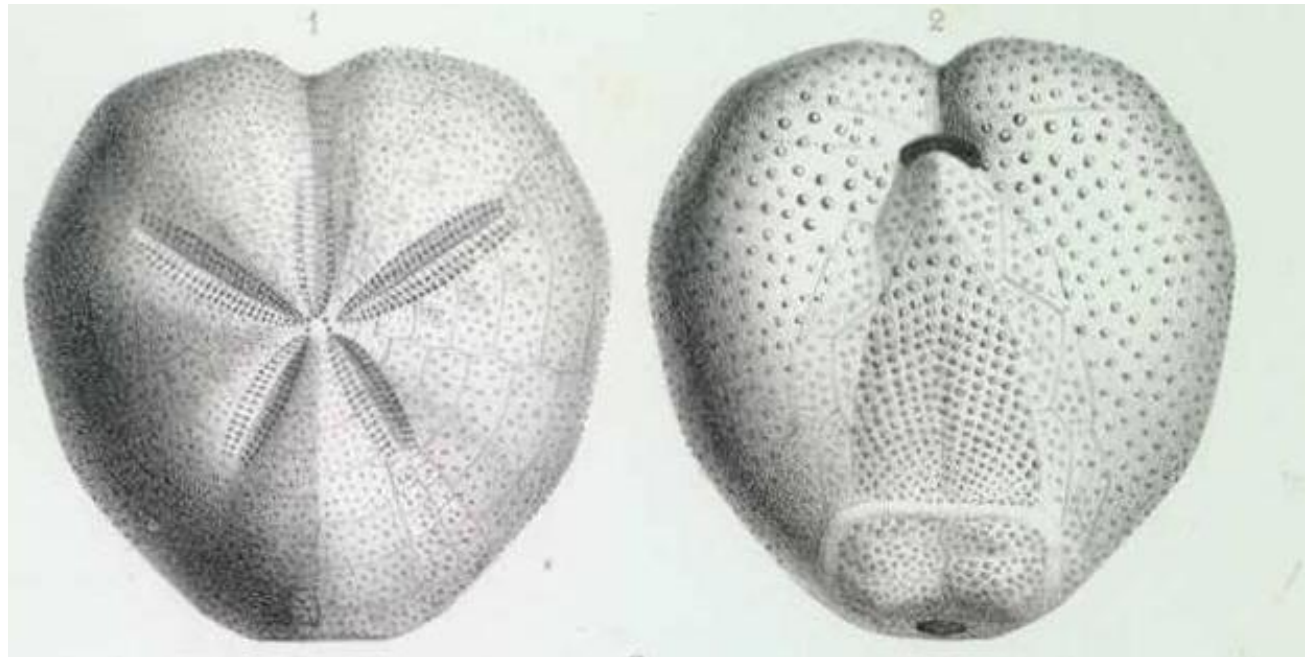
Scutella sp. Eocene to Miocene

Class
Echinoidea



Micraster sp. Late Cretaceous

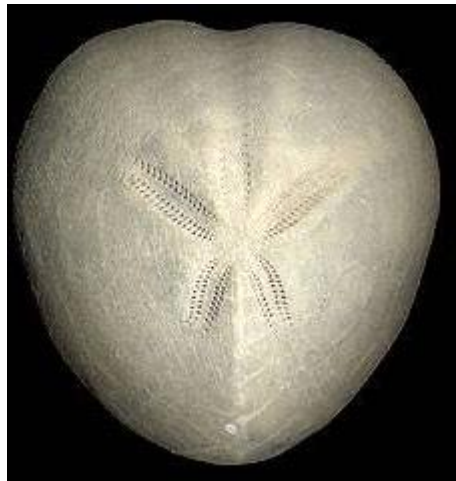
Class
Echinoidea

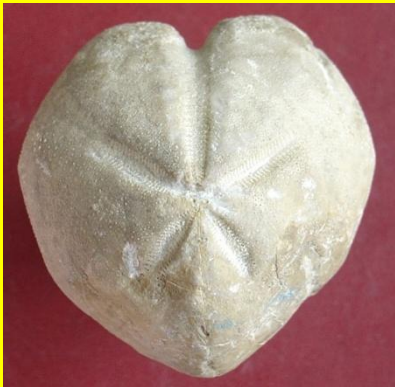


Micraster sp. Late Cretaceous

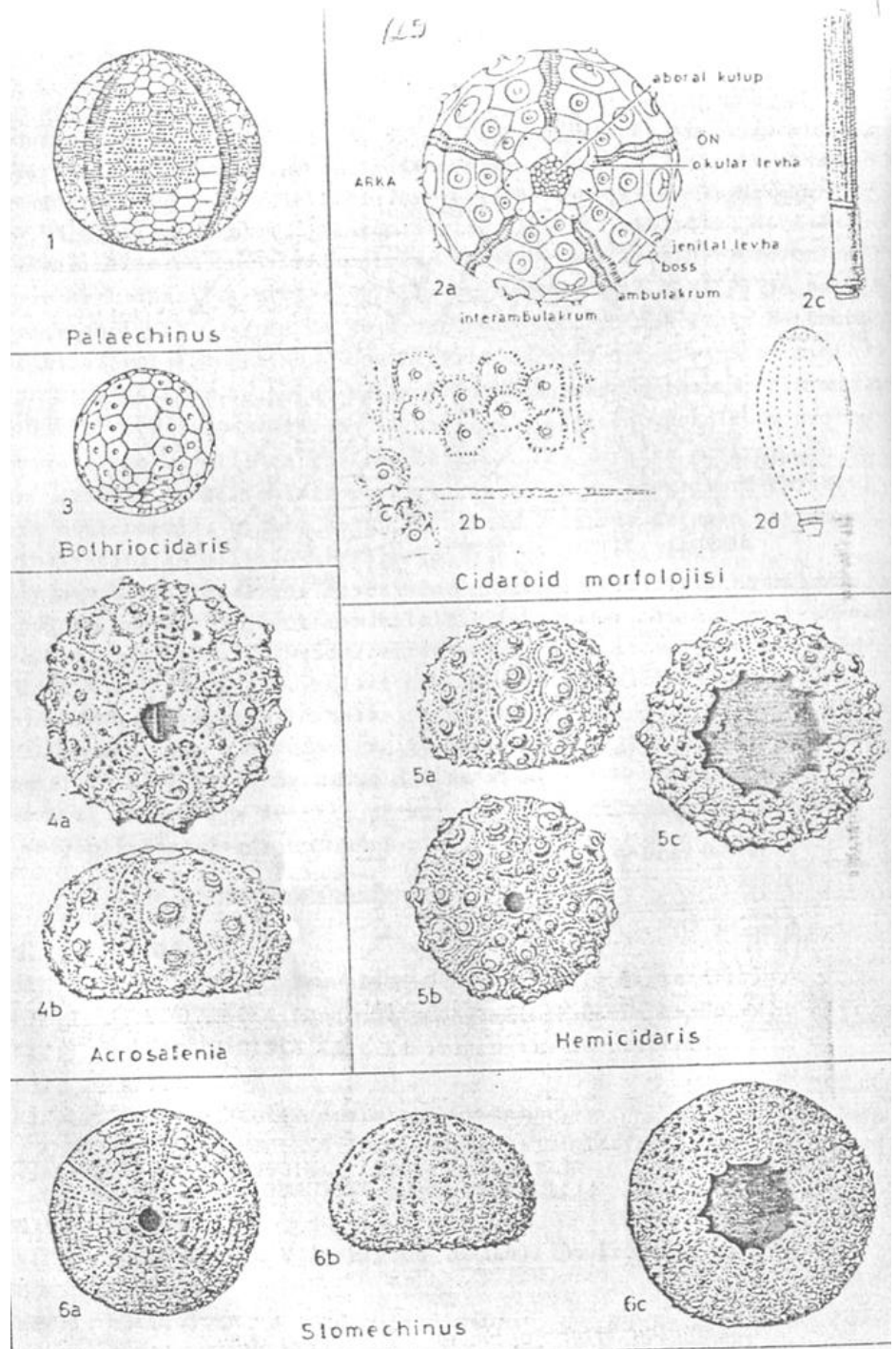
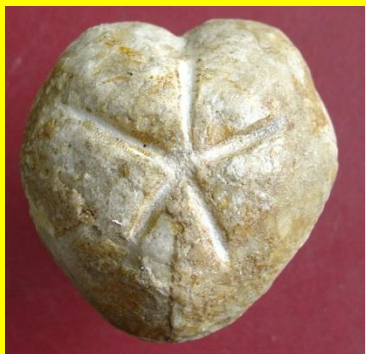


Class
Echinoidea



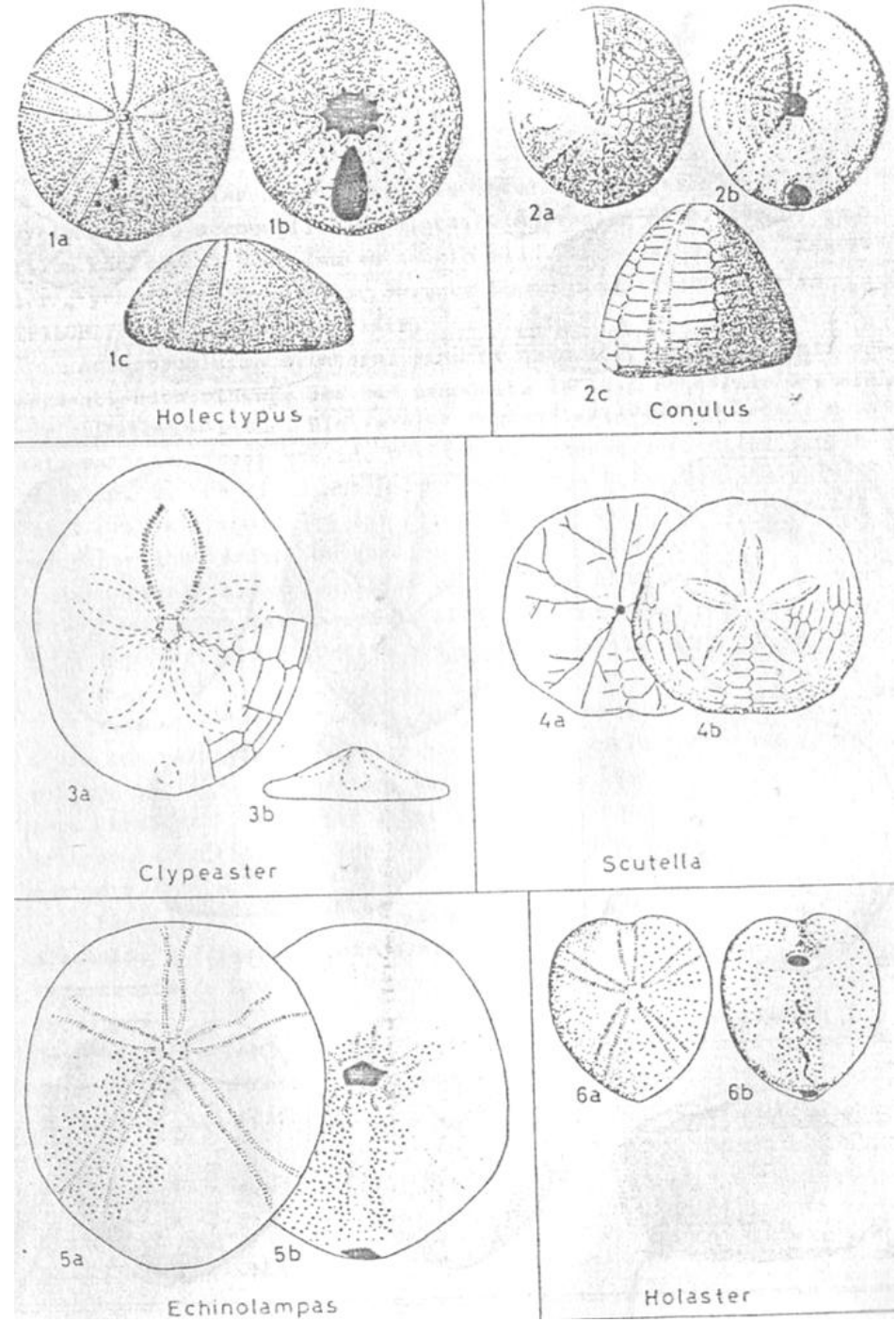


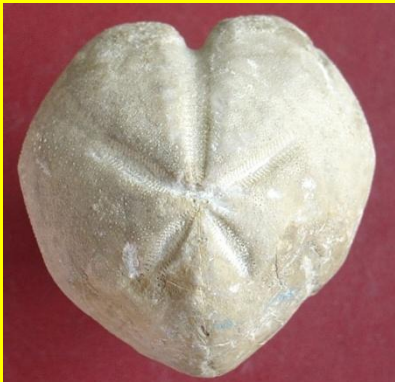
Class Echinoidea



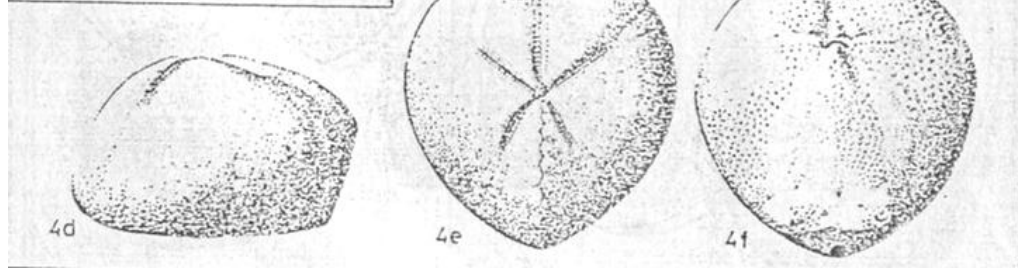
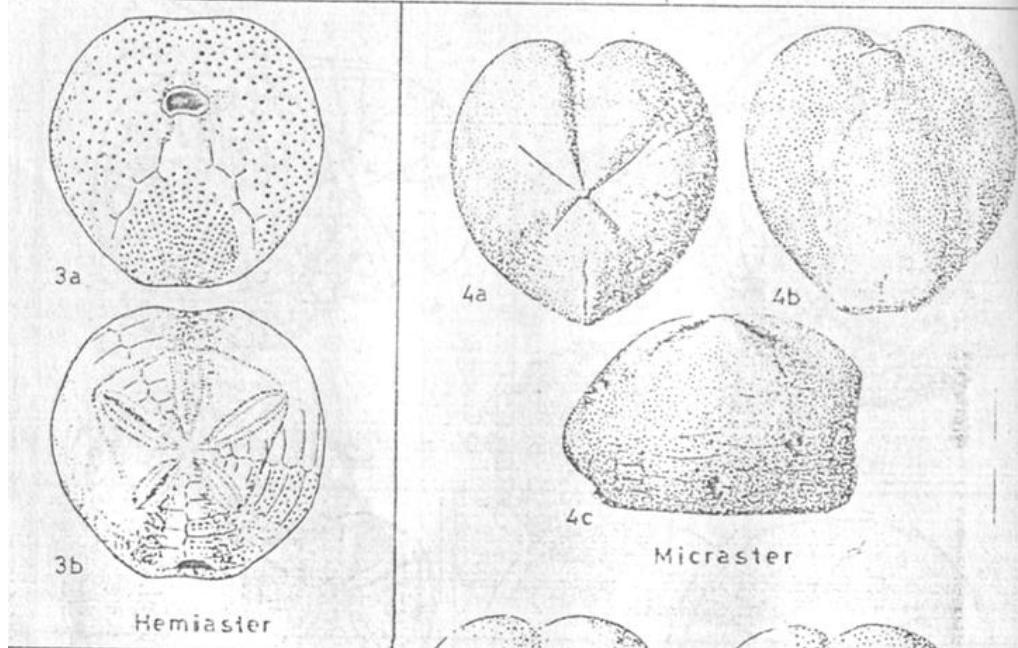
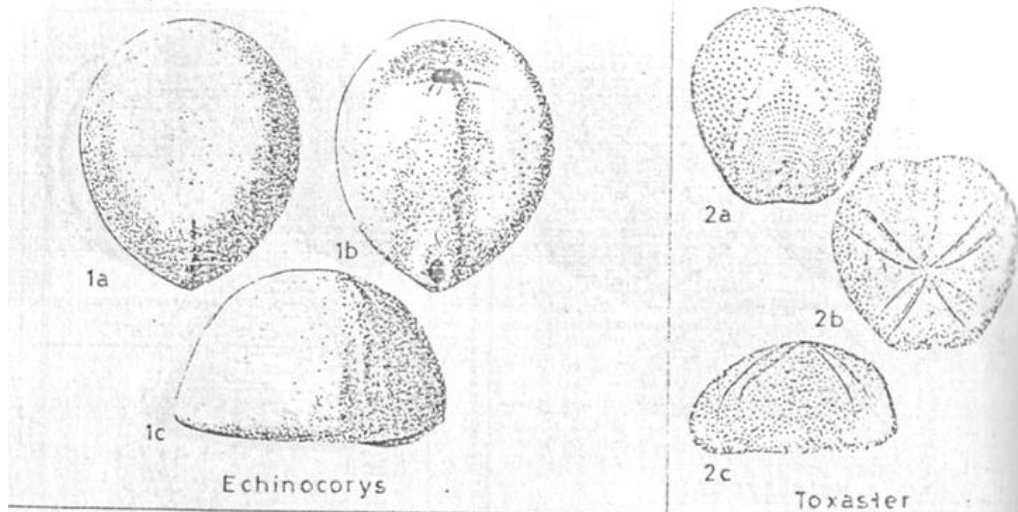
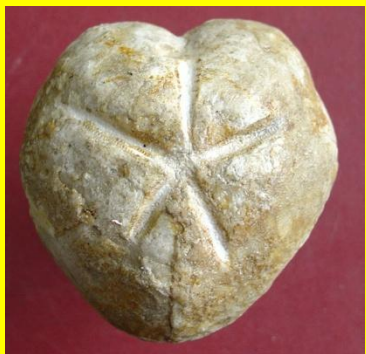


Class
Echinoidea



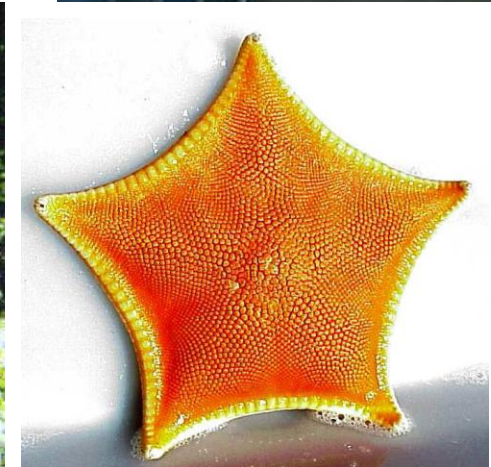
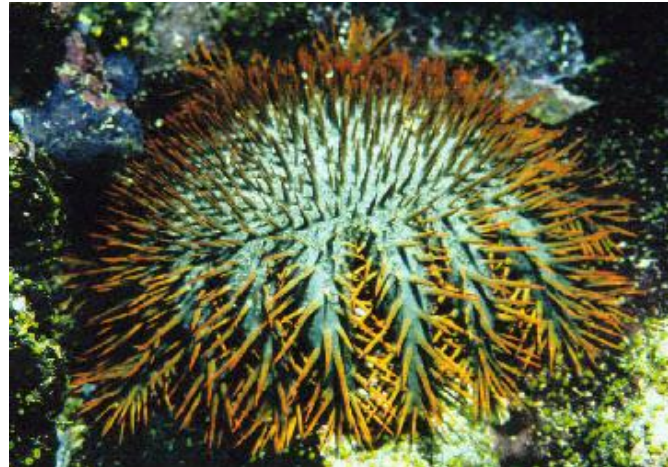
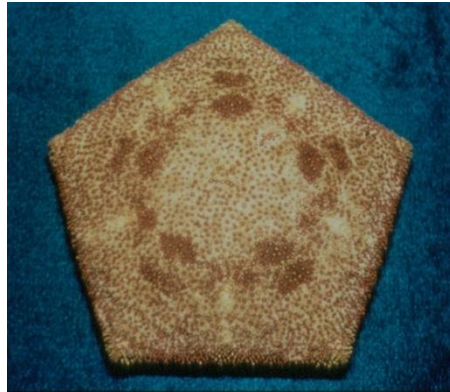
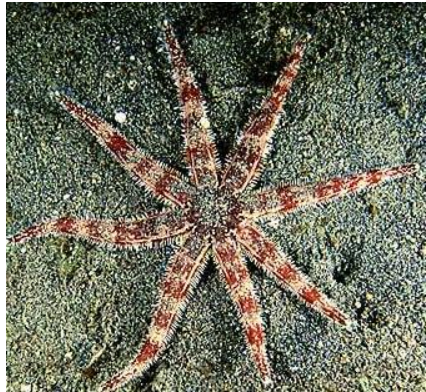


Class
Echinoidea

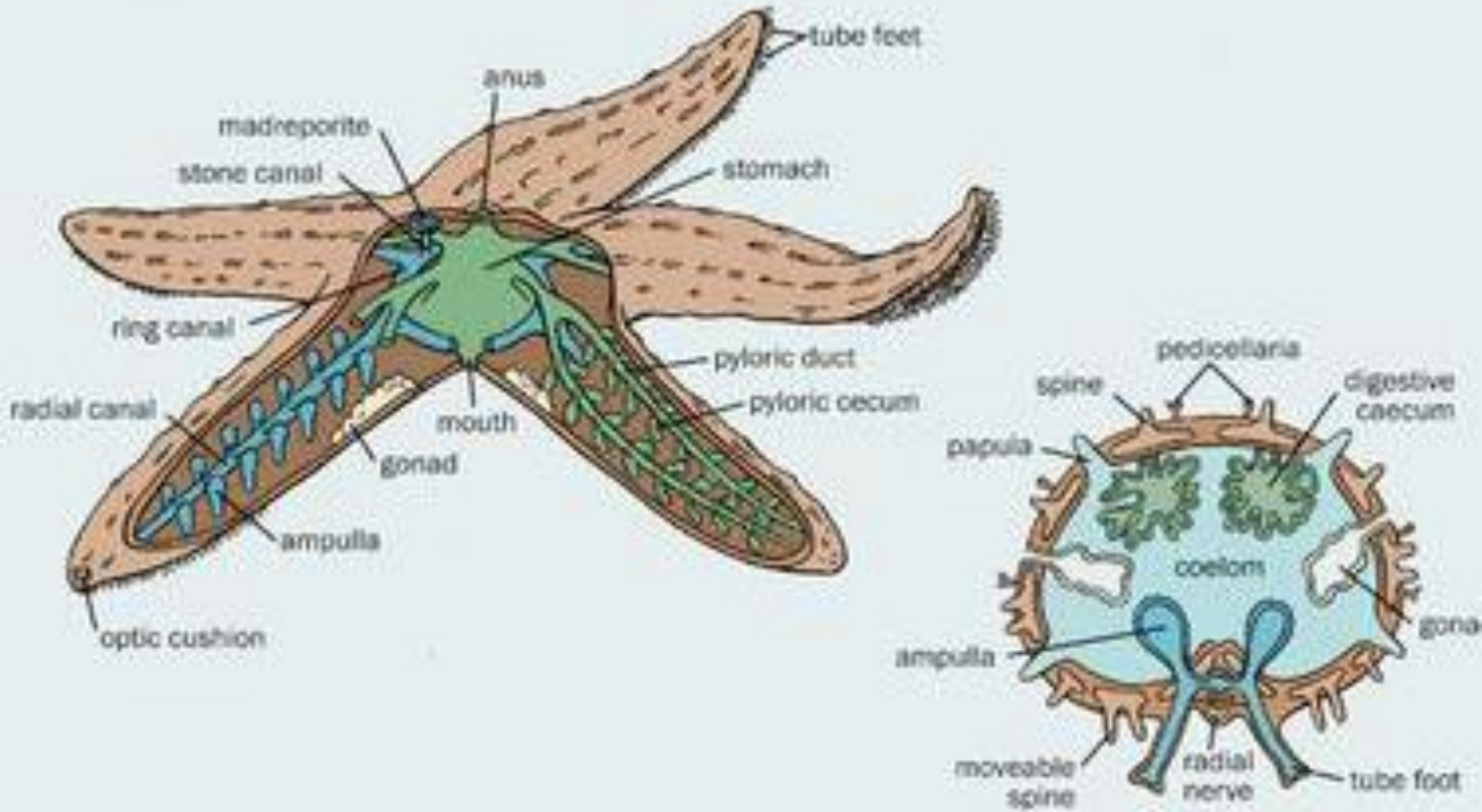


Class Asterozoidea

“starfish”



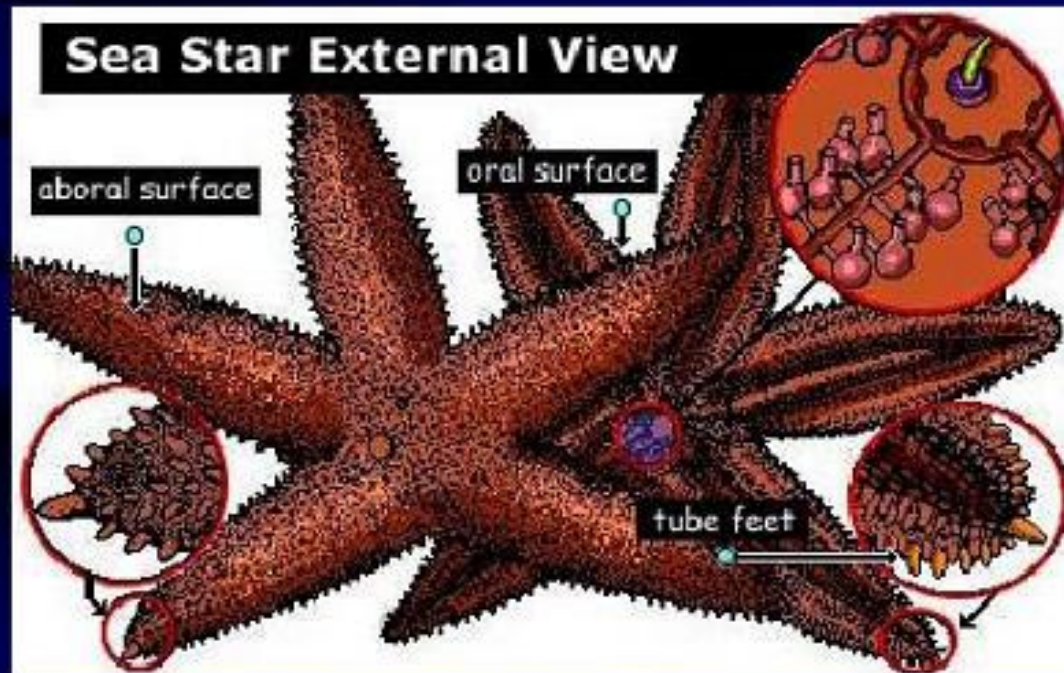
Class Asterozoidea



Class Asterozoa

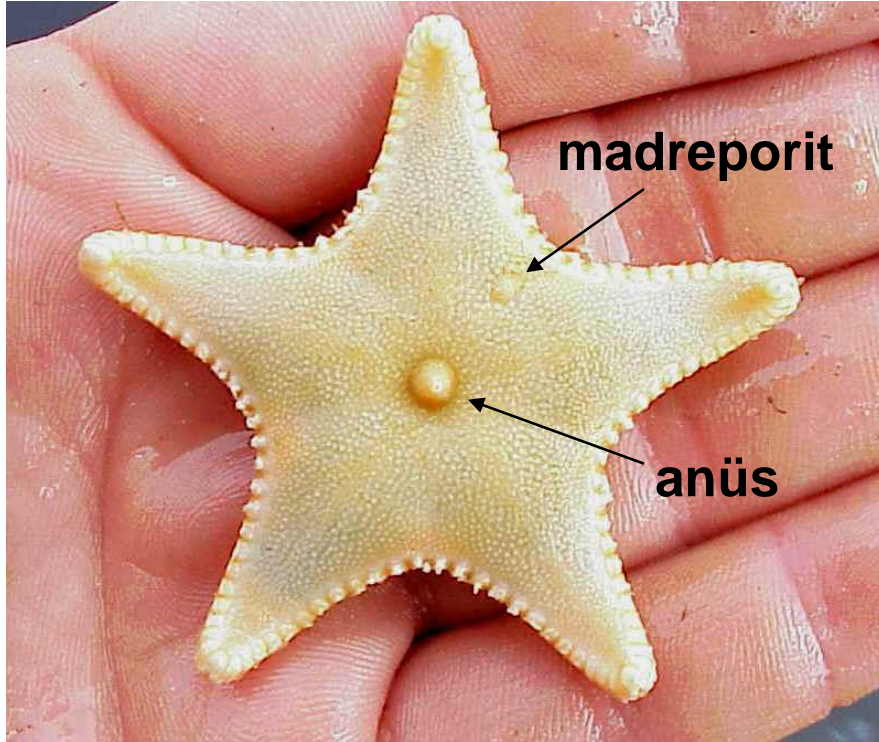
General Characteristics cont.

- Possess a network of canals throughout the body **-water vascular system**.
- The canals are connected to extensions called **tube feet (=podia)**, located on the oral surface
- The water vascular system is important for locomotion, feeding, and gas exchange.



- Sexes are separate; gametes shed into the water; fertilization is external

Class Asteroidea



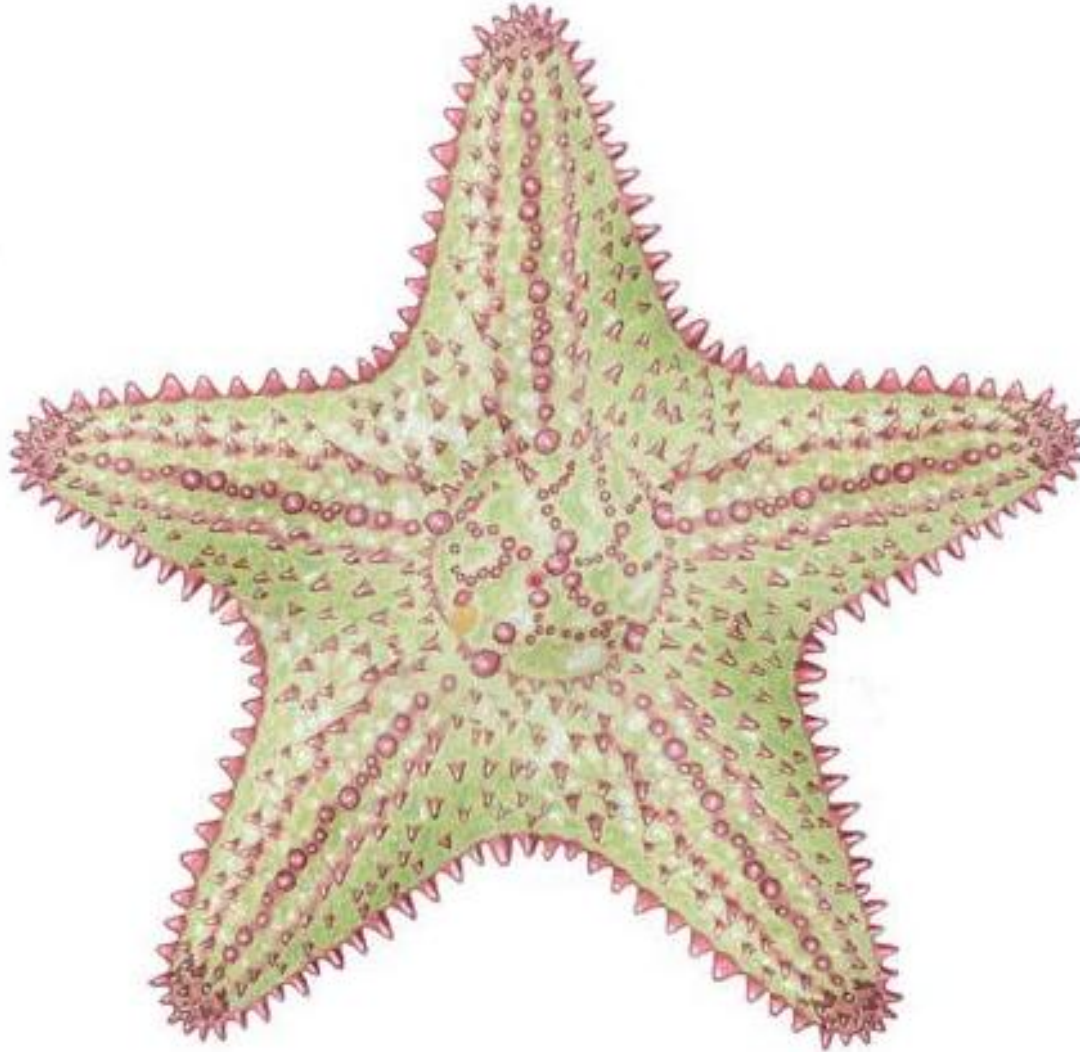
aboral



oral

Fisun Alkaya

Class Asteroidea



Class Asteroidea

Identification

Oreaster reticulatus (cushion sea star)



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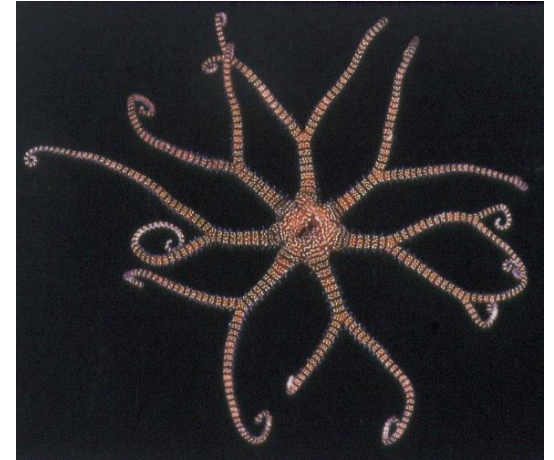
[More information](#)



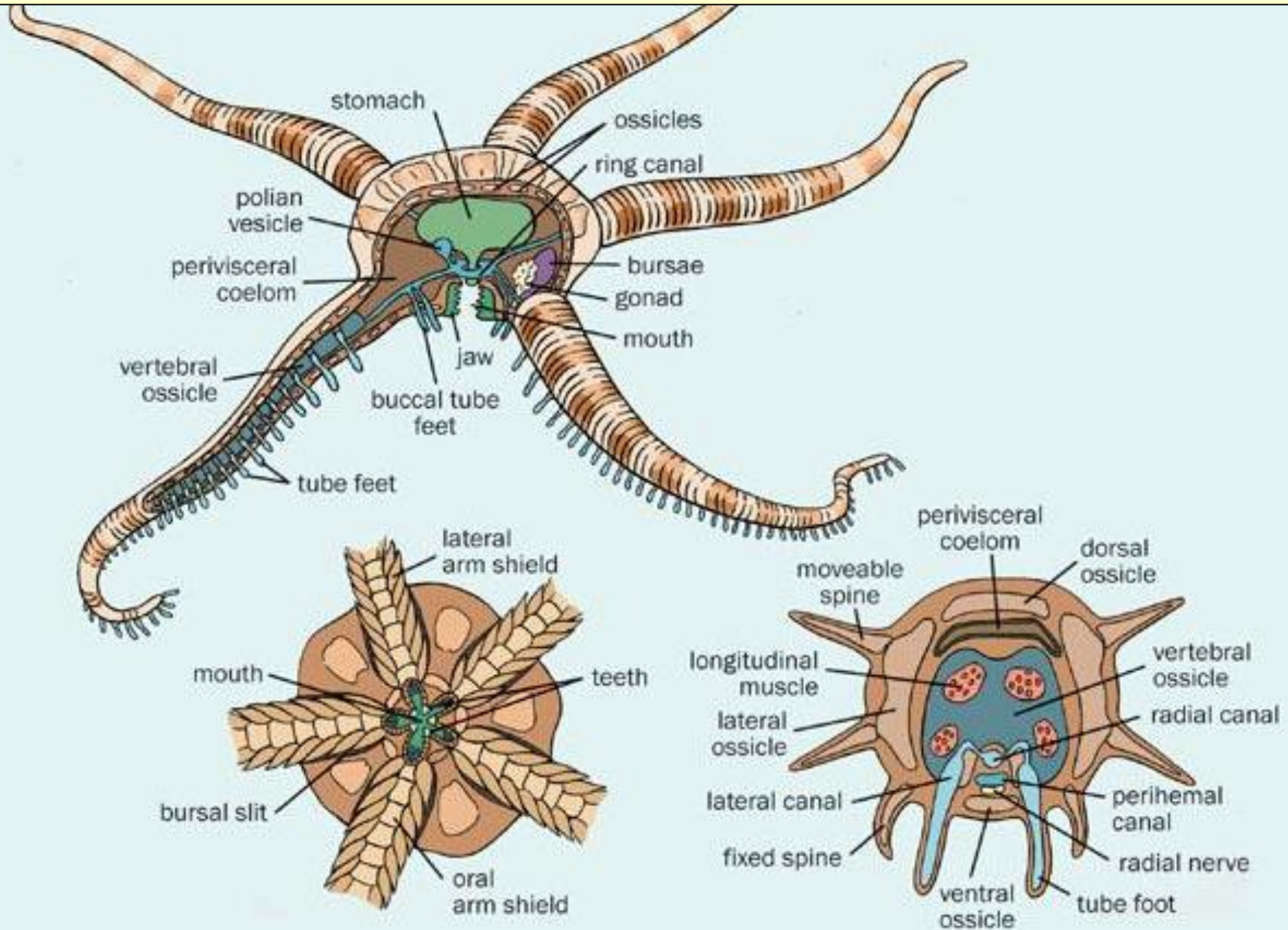
Class Asteroidea



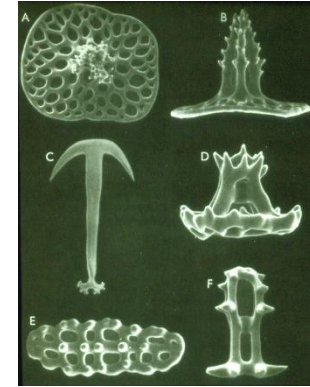
Class Ophiuroidea



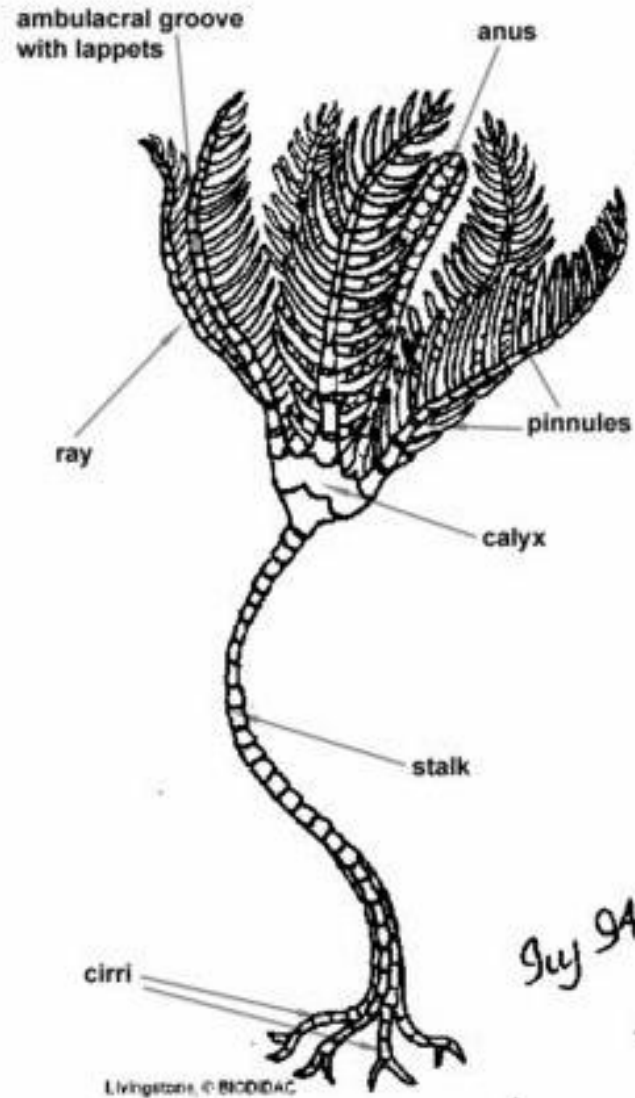
Class Ophiuroidea



Class Holothuroidea



Class Crinoidea

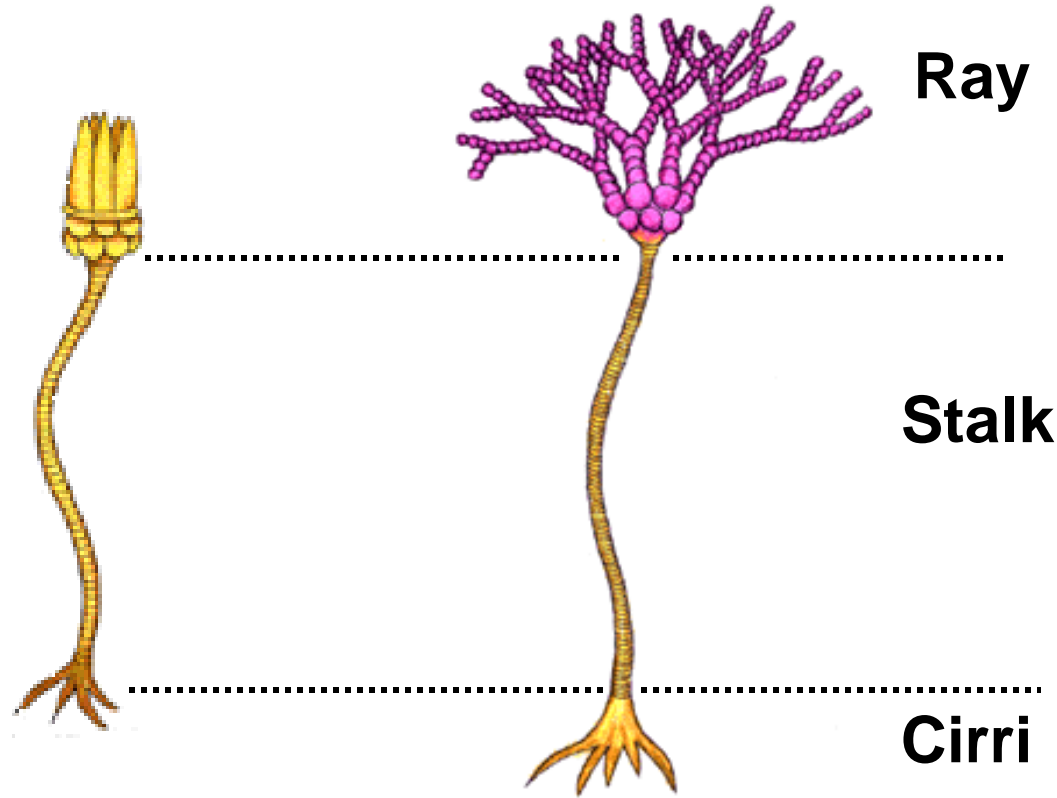
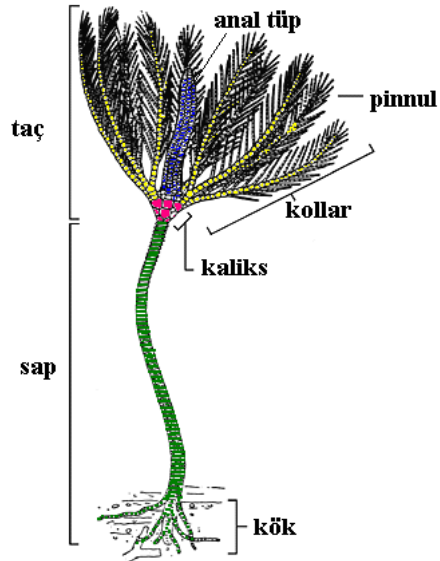


Class Crinoidea

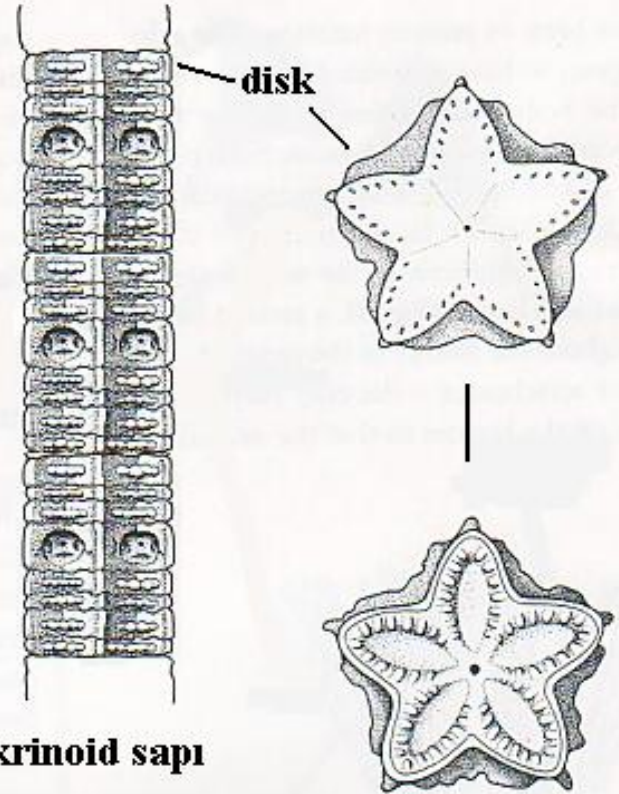
Stalky crinoids

In general, deep-sea epifaunal benthic organisms. Their body includes three parts:

Ray
Stalk
Cirri



Class Crinoidea

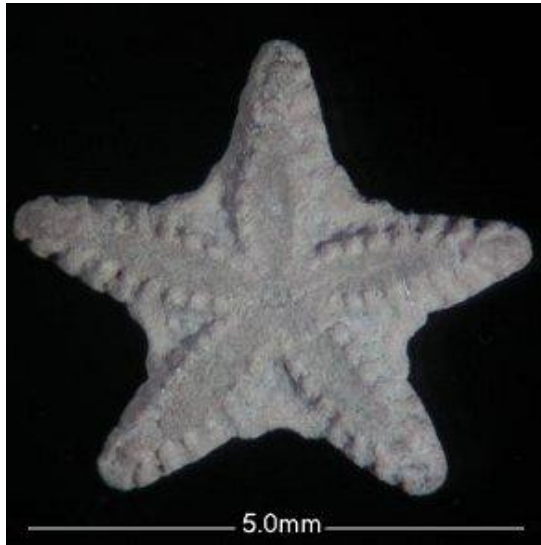


krinoid sapı

stalk

Class Crinoidea

discs of stalk

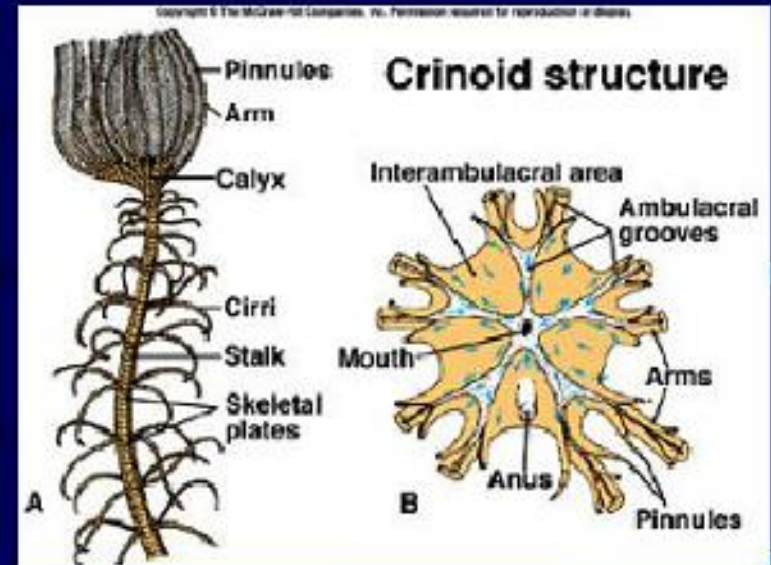


Füsun Alkaya

Class Crinoidea

Class Crinoidea

- Most primitive of the echinoderms
- Unusual in that the oral surface is directed upward
- Aboral surface is attached to the substrate by means of a bendable **stalk**
- The portion of the crinoid body attached to the stalk is called the **crown**; bears a number of arms
- Along the length of the arms are branches called **pinnules**
- The arms and the pinnules have ambulacral grooves with suckerless podia (secrete mucus)
- The ambulacral grooves are heavily ciliated and the cilia is used to direct food to the mouth (=filter feeding)



Class Crinoidea

- * **Crinoids** are marine animals
- * Crinoidea comes from the Greek word *krinon*, "a lily", and *eidos*, "form".
- * They live both in shallow water and in depths as great as 6,000 meters.
- * **Sea lilies** refer to the crinoids which, in their adult form, are attached to the sea bottom by a stalk.
- * **Feather stars** or **comatulids** refer to the unstalked forms.
- * Crinoids are characterized by a mouth on the top surface that is surrounded by feeding arms.
- * They have a U-shaped gut, and their anus is located next to the mouth.
- * Although the basic echinoderm pattern of fivefold symmetry can be recognized, most crinoids have many more than five arms. Crinoids usually have a stem used to attach themselves to a [substrate](#), but many live attached only as juveniles and become free-swimming as adults.
- * There are only about 600 extant crinoid species,
- * but they were much more abundant and diverse in the past.
- * Some thick [limestone](#) beds dating to the mid- to late-[Paleozoic](#) are almost entirely made up of disarticulated crinoid fragments

Class Crinoidea



Class Crinoidea

Sea lily
stalky crinoids



Feather stars
unstalky crinoids



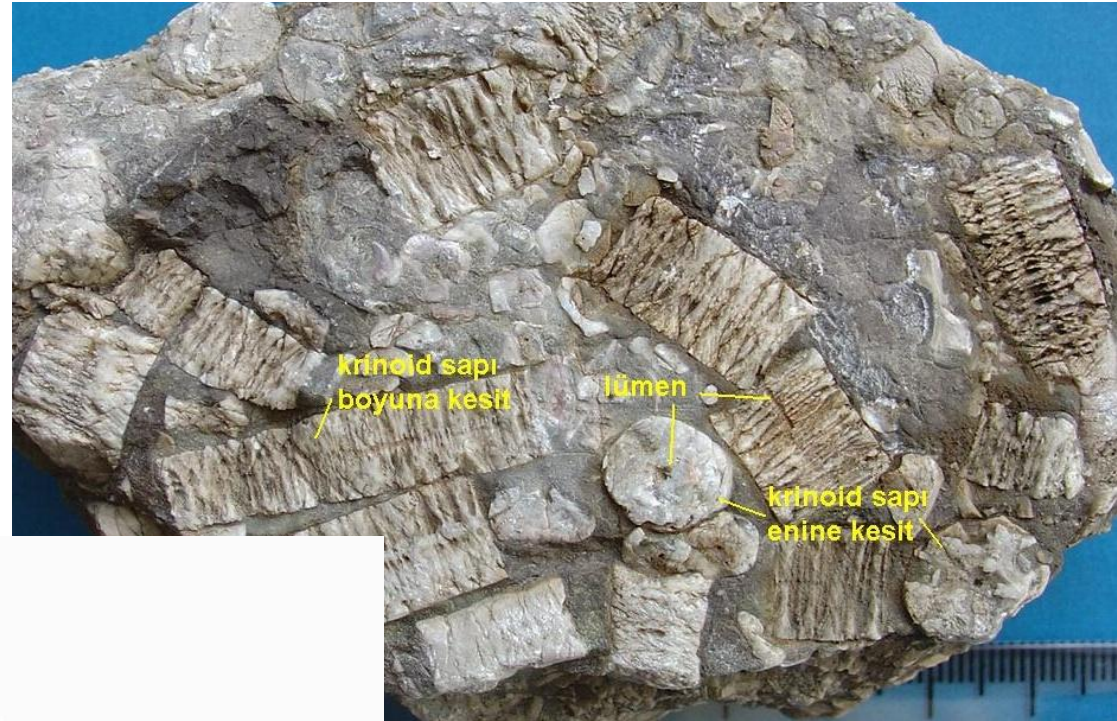
Class Crinoidea



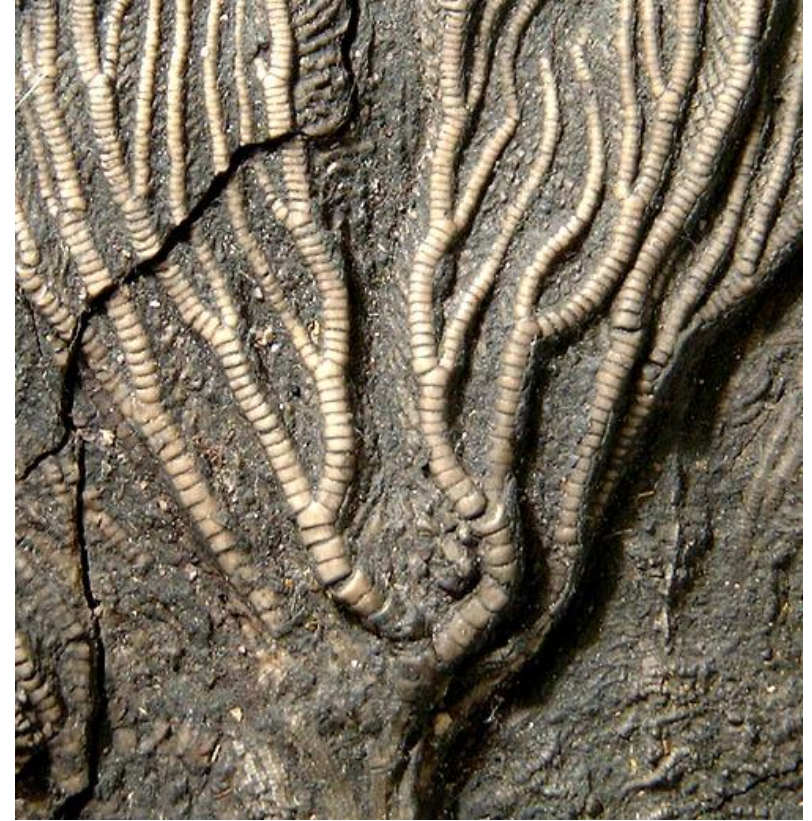
stalk



Class Crinoidea

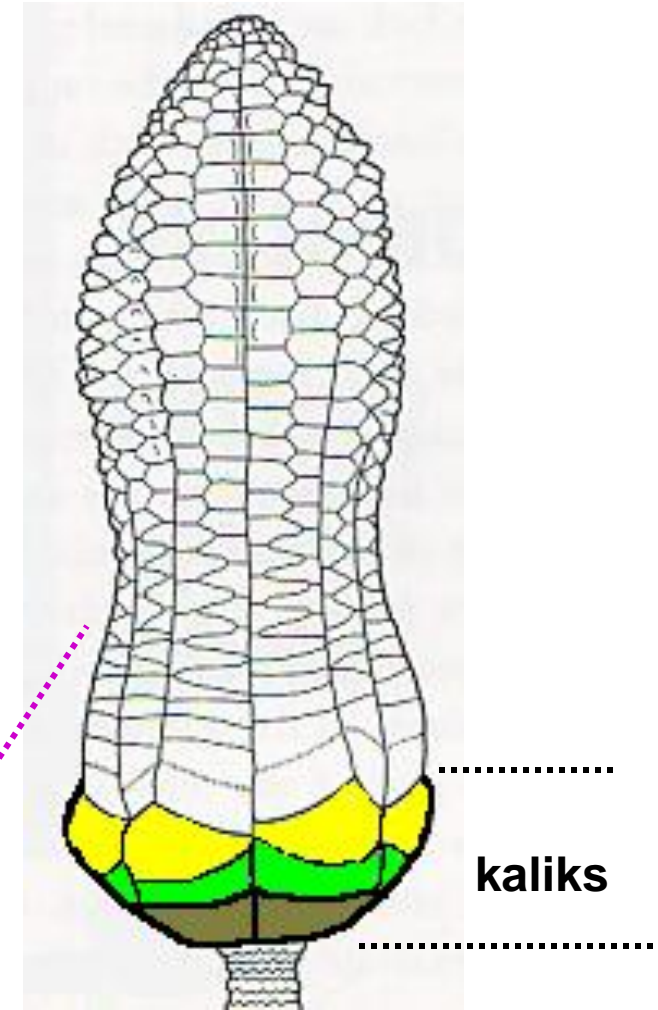
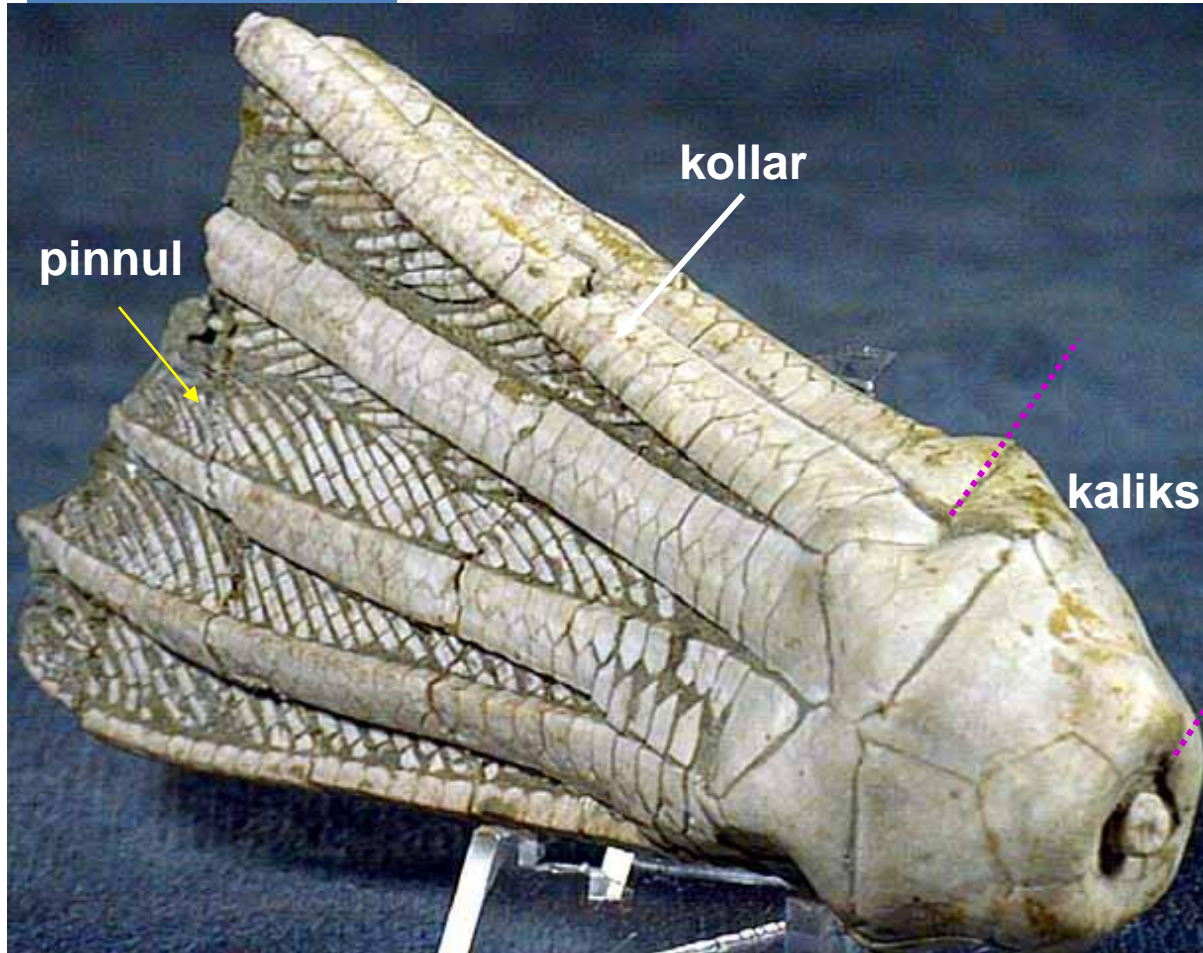


Class Crinoidea



Class Crinoidea

kaliks



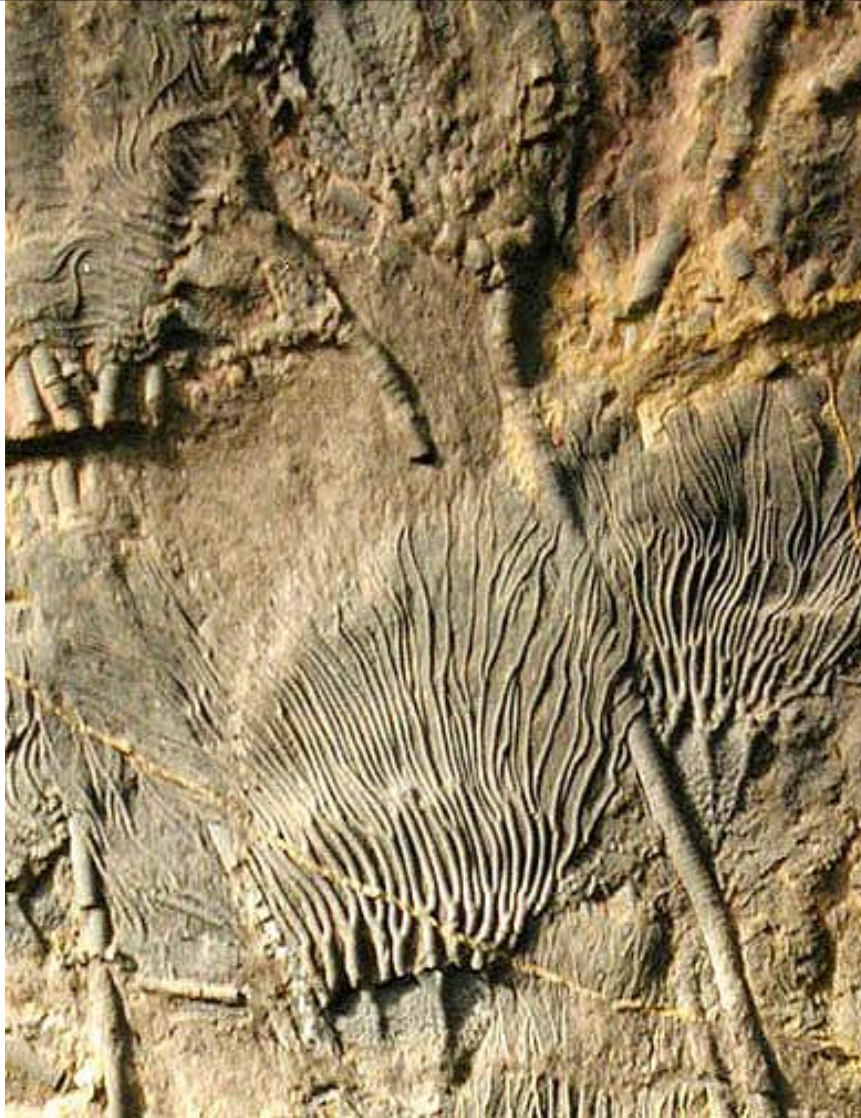




Class Crinoidea

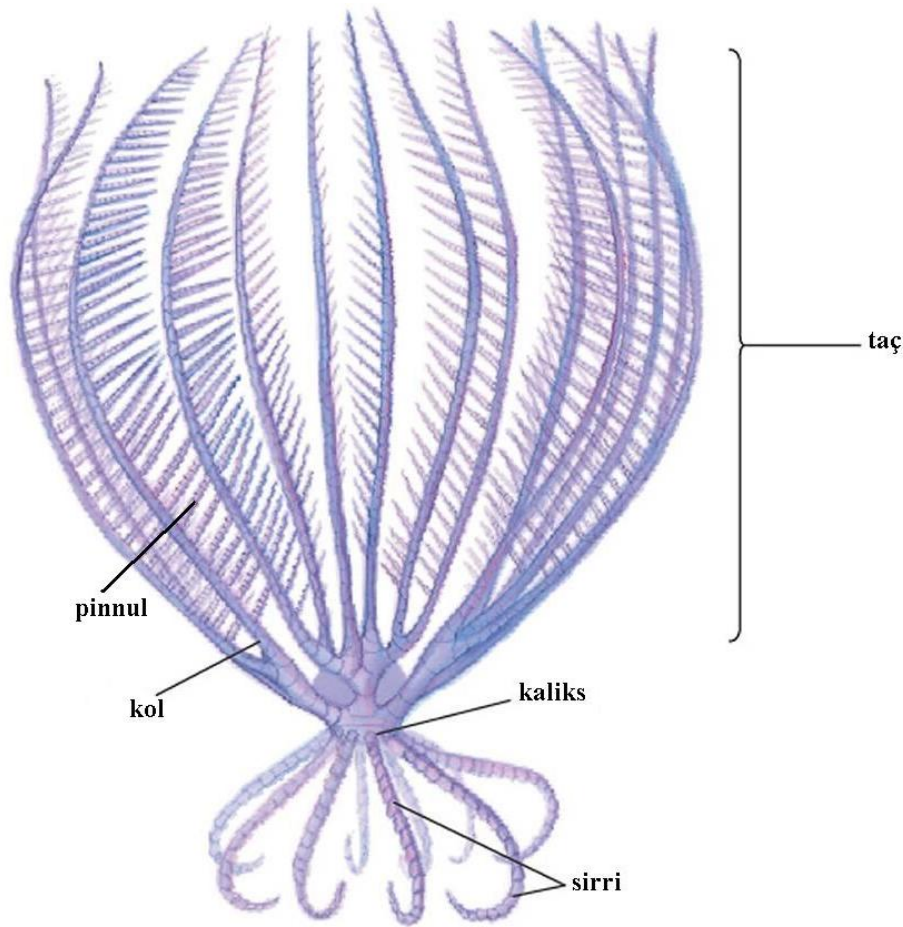


Class Crinoidea



Füsun Akhaya

Class Crinoidea



unstalky crinoids

Fisun Alkaya



Cupulocrinus sp. Ordovician

Class
Crinoidea



Encrinus sp. Triassic

Class
Crinoidea



Pentacrinites sp. Triassic to Recent

Class
Crinoidea



Fusun Alkaya

Pentacrinites sp. Triassic to Recent



Class
Crinoidea



Saccocoma sp. Jurassic

Class
Crinoidea



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