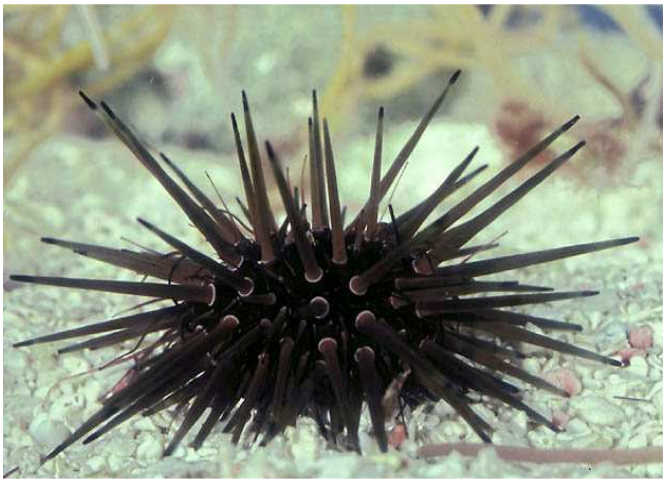
geographyjohn

GEOLOGY

CASE STUDY REVISION BOOKLET

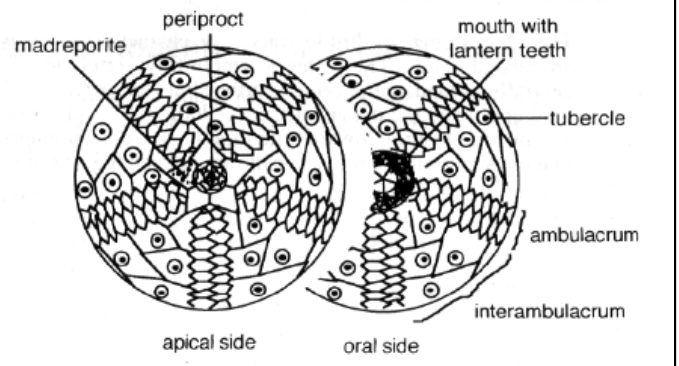
ECHINOIDS/CRINOIDS

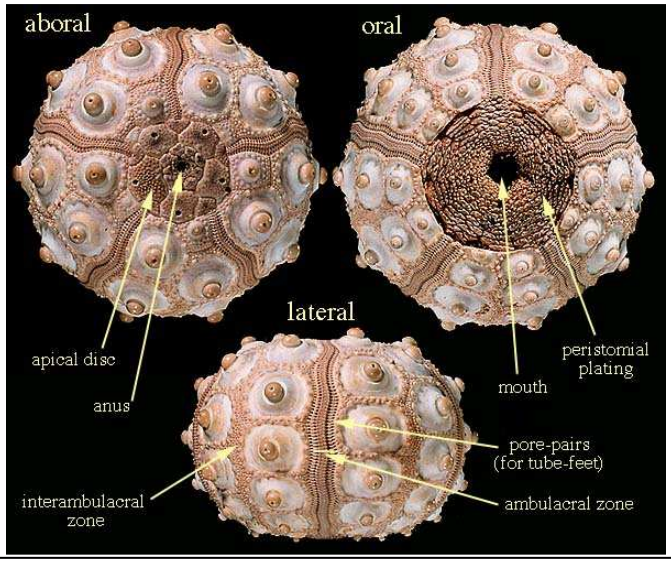
Echinoderms (Phylum **Echinodermata**) are perhaps the most unique group in the invertebrate world today. They are entirely marine *(with a few exceptions inhabiting estuaries)* and have a fossil record stretching back to the Cambrian.They build skeletons to varying degrees from calcite and this makes them amenable to fossilisation. Today echinoderms such as starfish and sea urchins are commonly found on beaches and in the shallow marine realm. In the past their relatives - the sea lilies - dominated the sea floor.



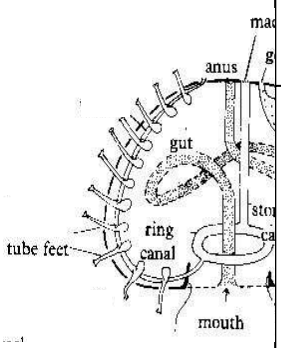
There are two types: Regular echinoids which have five fold radial symmetry and live on the sea bed, and irregular echinoids that show bilateral symmetry and live infaunally

REGULAR ECHINOID MORPHOLOGY

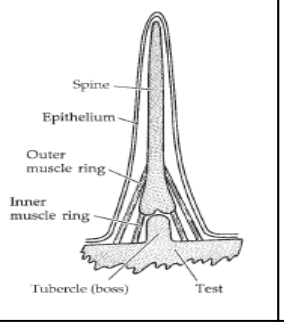




Tube feet. Echinoids have an **internal water vascular system**. This utilises fluid filled **tube feet** which protrude through tiny pores in the ambulacrum skeletal plates. Tube feet are used for:
*__Locomotion__ and attaching to rocks with sucker action
*__Feeding__, moving food to the jaws
*__Respiration__, excange of oxygen and carbon dioxide



Spines. (made of calcium carbonate) are attached to tubercles on the interambulacra, and muscles allow them to be used for movement and defence. The spines become disarticulated from the tubercle at death as the soft tissue decays. The size of the tubercles indicates the size of the spines. The spines may be found separately.

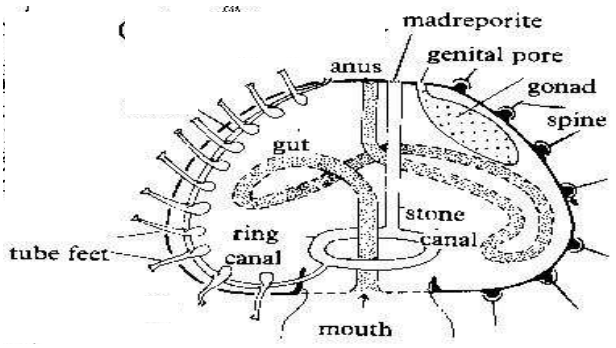


Mode of life

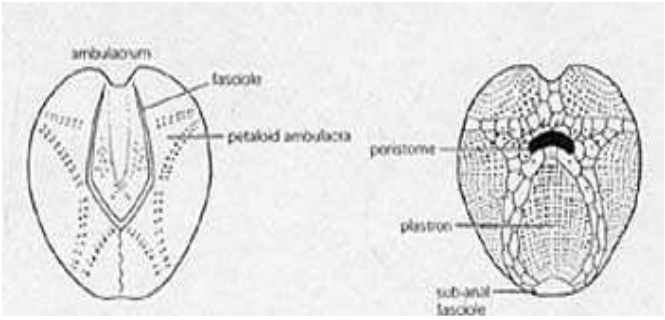
- They are usually mobile, moving about looking for food and protection. **Benthonic, epifaunal, vagrant**.
- Many are capable of living on hard rocks: anchoring themselves to the rocks via tube feet even in relatively shallow water.
- Common between the sub littoral (tidal) zone down to 100 m.
- Can also use the tube feet to climb steep rock surfaces.
- On sand they use their spines to support them and move themselves using the spines on the oral surface and low down on the aboral.
- They eat sea weed/algae but are also partly carnivorous: sponges in particular.
- Have strong jaws e.g. *Echinus* lives on rocks.

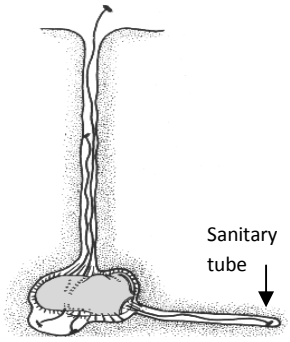
Apical system. Found on the top or arboral surface. Here on the genital plates is the **madreporite** through which water enters the water vascular syetem that powers the tube feet. The anus is also found here allowing waste to be taken away by currents.

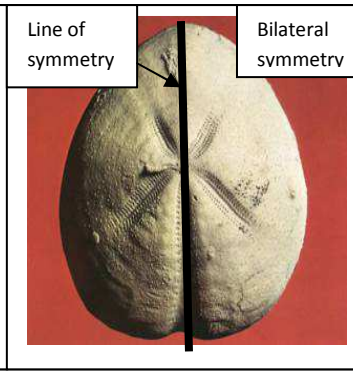
Mouth. Found on the lower oral surface. The 5 jaws are called Aristotle's lantern and are used to scrape algae and other food from the sea bed.



IRREGULAR ECHINOID MORPHOLOGY







Irregular Echinoid – mode of lfe

- *Micraster* and *Echinocardium* which could be completely buried.
- Common down to 50 m but can survive down to 200 m below sea level.
- Lived in burrows of soft sediment (*Micraster* in fine lime mud).
- Burrows forwards using spines and tube feet (Mucus can be secreted to help stabilise the sediment to stop collapsing.
- Streamlined shape and few spines aid burrowing.
- Sand etc. is pushed aside and backwards..
- Organic matter is extracted from the sediment and the waste disposed behind.
- Some food is also obtained from the sea water via a **FUNNEL** which extends from the burrow.
- The tube feet in the upper areas extend out of the burrow.
- Water is drawn into the animal and **CILIA** help waft it into the tube feet respiratory system.

Mouth – this is still underneath but is nearer the front. It has no jaws, but filters particles from the water.
Labrum – a lip under the mouth to direct currents into the mouth but keep out sediment.
Plastron – an area of tubercles for spine attachment to allow the echinoid to dig a burrow.
Petaloid Ambulacrum – with pore pairs for tube feet. The anterior ambulacrum has a groove with cilia called a fasciole to move food to the mouth.
Sub-anal fasciole – an area near the anus, which is at the back not on the top, with cilia to take waste away into the sinitary tube

Comparing regular and irregular echinoids

Regular	Irregular
Benthonic, epifaunal, vagrant	Benthonic, infaunal in burrows
5 fold radial symmetry	Bilateral symmetry
Uses jaws to graze	Filter feeds particles
Spines for defence and movement	Spines on Plastron for digging
Ambulacra all the way round	Petaloid ambulacra
Tube feet for movement, respiration and attaching	Tube feet for respiration, digging burrow and anal tube

CRINOIDS

Crinoids belong to the Phylum Echinodermata. This is due to the fact that they are made of calcareous plates and have the same 5 fold symmetry as echinoids.

They have and have had a very different mode of life however. Most attached themselves to the sea bed, catching and filtering food from sea currents with arms called Barchials and Pinnules which used tube feet cilia to move food down to the mouth.

Crinoids, *or sea lilies,* resemble plants, however they are very definitely **animals**. They are not particularly abundant today and are generally found in deeper water *(100m+).* During the **Palaeozoic** they **dominated the shallow marine** environment of the worlds seas *(particularly during the Carboniferous)* and bioclastic limestones formed almost entirely from their skeletal remains are commonly found.

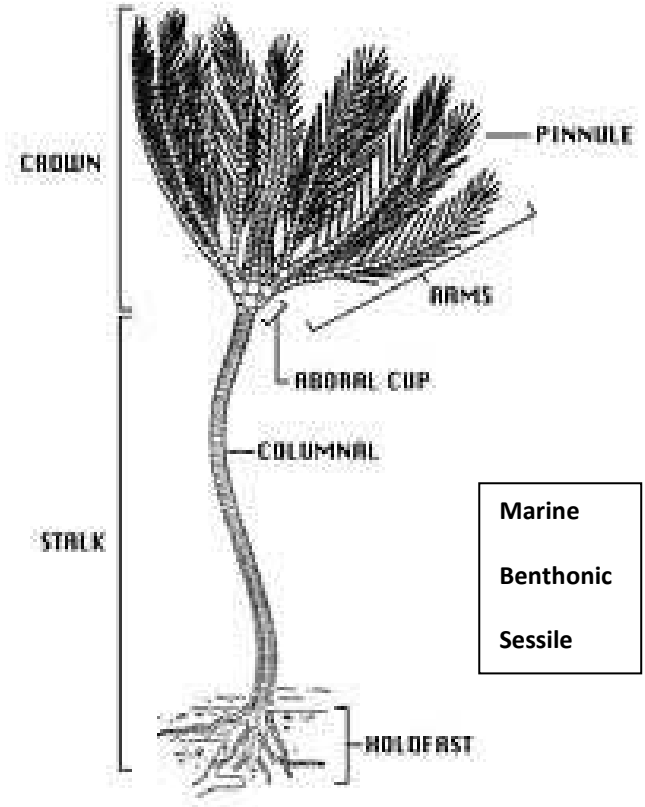
MORPHOLOGY

ARMS (BRACHIALS) AND PINNULES - Brachials open out like an **umbrella** to **filter feed**. The **pinnules** spread out also to increase the surface area for food capture. Both are lined with **tube feet** which grab the food particles and cilia to pass it down to Arboral Cup (CALYX) where the crinoids mouth is located.

CALYX – Has the soft tissue, the mouth and the anal tube. It consists of 3 layers of 5 plates.

STEM/STALK – Made of a flexible column of calcareous plates. A central hole in the discs of the stem (ossicles or columnals) carries a string of living material.

HOLDFAST – The root system that holds the creature to the sea bed and allows the stem and arms to flex and move in the currents



Crinoidal limsetones

The skeleton falls apart on death and in high energy environments may be completely disarticulated and broken before being deposited to form a bioclastic limestone.

In lower energy environments ‘strings’ of ossicles can be preserved, but the brachials are very easily broken.