

Phylum Echinodermata

Echinoderms (see Figs. 4.29 and 4.30) are marine animals with calcareous skeletons composed of plates. Most have fivefold (pentameral) symmetry. They possess a water vascular system for locomotion, food gathering, respiration, and sensory functions and have a poorly developed circulatory system. Some have light-sensitive cells that function as simple eyes.

Class Crinoidea (middle Cambrian to Recent) (Fig. 4.29)

Class Cystoidea (lower Ordovician to Devonian) [Fig. 4.30 (d), (e)]

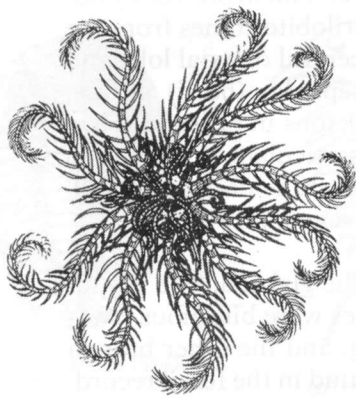
Class Blastoidea (middle Ordovician to Permian) [Fig. 4.30 (f), (g)]

Crinoids, cystoids, and blastoids were most common in the Paleozoic. Only one group, the crinoids (sea lilies), continues to recent times. The anatomy of these three classes of attached echinoderms is very similar. They have a root or anchor system attached to a stem or column of circular plates with a central hole through which run ligamentous fibers. Atop the column is a cup-shaped calyx that houses the internal organs. Arms covered with calcareous plates and pinnules trap food from the seawater and food grooves in the arms direct it to the mouth.

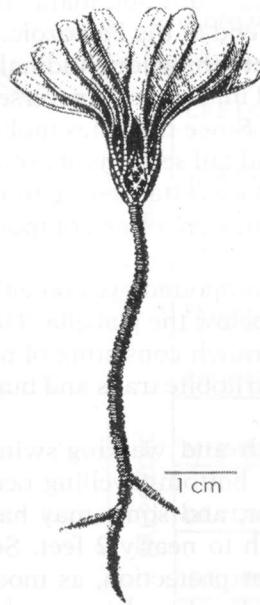
The major differences among the stalked echinoderms lie in the structure of the calyx. In crinoids, the calyx is composed of two or three groups of five plates each. Cystoids have irregular numbers of plates, and the body is not symmetrical. The plates are pierced with pores for respiration. Blastoids have three groups of five plates in the calyx, and ambulacral grooves make a five-rayed pattern.

Class Echinoidea

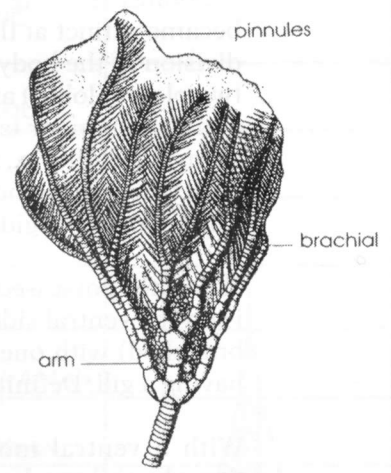
This class includes sea urchins and sand dollars and ranges from Ordovician to Recent [see Fig. 4.30 (a), (b), (c)]. Echinoids, which fall into two cate-



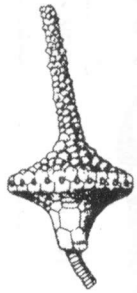
(a) a modern swimming crinoid



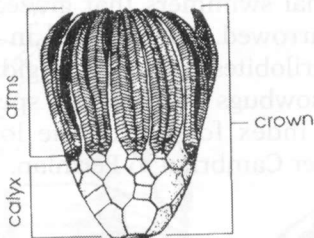
(g) Glyptocrinus (Ord-Sil)



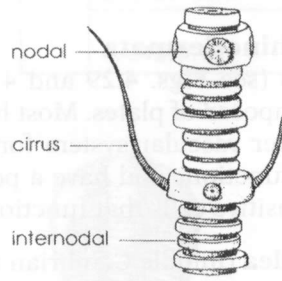
(h) Retencrinus, Ordovician



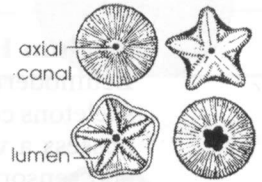
(b) Eutrochocrinus (Miss)



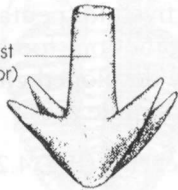
arms
crown
calyx



nodal
cirrus
internodal



(j) Crinoid columnals



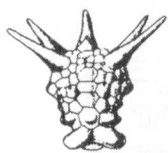
holdfast (anchor)



(c) Dizygocrinus (Miss)

(f) Ancyrocrinus, Devonian

(i) Crinoid column (enlarged)



(d) Dorycrinus (Miss)

column ("stem")

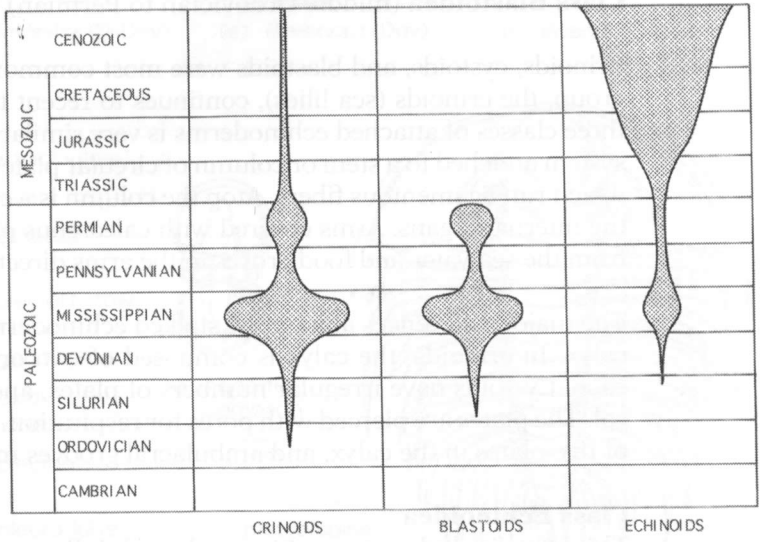
radix ("roots")

1 cm

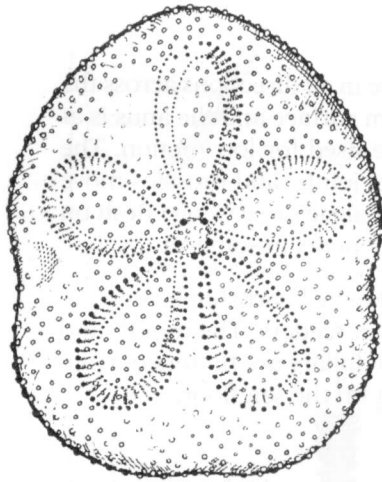


(e) Eucalyptocrinites, Silurian

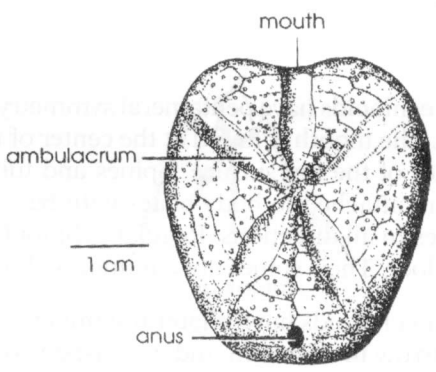
PHYLUM ECHINODERMATA



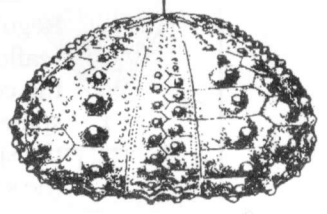
PHYLUM ECHINODERMATA



(a) Clypeaster (Eoc-Rec)
CLASS ECHINOIDEA



(b) Epiaster, Cretaceous



Goniopygus, Cretaceous



(d) Caryocrinites (Ord-Sil)



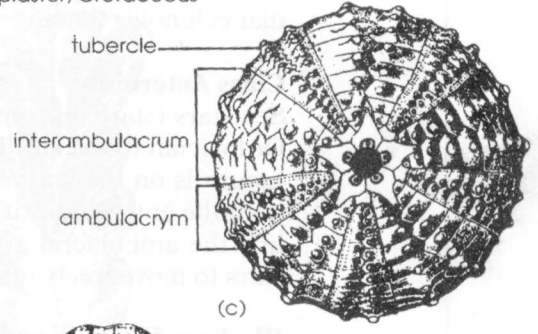
(e) Holycystites (Sil)

CLASS CYSTOIDEA



(f) Pentremites (Miss-Penn)

CLASS BLASTOIDEA

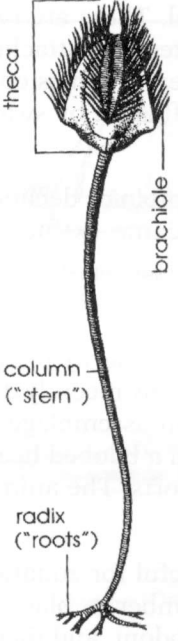


(c)

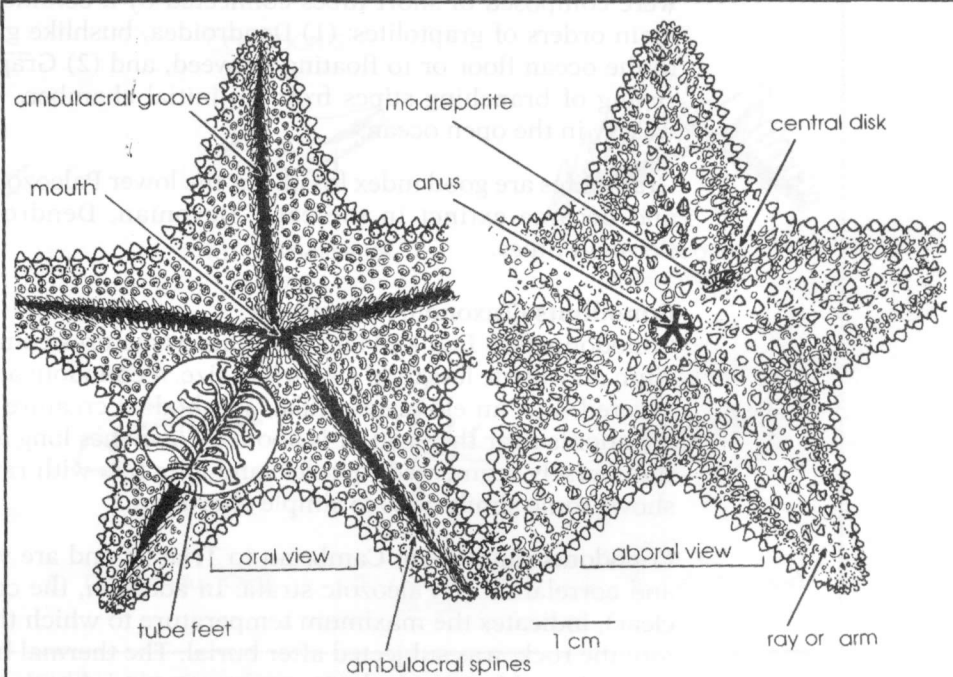


(i) Enallaster (Cret)

CLASS ECHINOIDEA



(g) Pentremites, Mississippian (restored)
CLASS BLASTOIDEA



(h) CLASS ASTEROIDEA

PHYLUM ECHINODERMATA

Figure 4.30 Phylum Echinodermata

gories, irregular and regular, are most common in the Mesozoic and Cenozoic.

Regular echinoids have pentameral symmetry and move in all directions across the seafloor. The mouth is found at the center of the bottom surface and the anus is at the center of the top surface. Spines and tube feet are used for locomotion. The spines are attached to body plates with ball-and-socket joints, and muscles move the spines in all directions. Regular echinoids graze on algae or scavenge flesh on the sea floor. Their spines are common sediment components in some strata.

Irregular echinoids have bilateral symmetry, and tend to be heart shaped or oval. They burrow in sediment and are suspension or deposit feeders. The mouth and anus are at opposite ends of the bottom surface. Sand dollars are flattened irregular echinoids that live under a thin layer of sediment on the sea floor.

Class Asteroidea

Sea stars (starfish) [see Fig. 4.30 (h)] fall within this class, which ranges from Ordovician to Recent. They possess fivefold symmetry and extended arms. The mouth is on the bottom of the body and the anus on top. The madreporite is both the entry and exit point for water to the water vascular system. Tube feet line the ambulacral grooves on the underside of the body and allow the sea stars to move freely over the seafloor.