TEACHER LED ACTIVITIES
FOSSIL DIG

TEACHER BACKGROUND:
Fossils are the remains or evidence of ancient plants or animals that have been preserved in the rocks of the earth's crust.

The majority of fossils are found in sedimentary rock. These are rocks that were formed when salt-water sediments, such a limy mud, sands or shell beds were compressed and cemented together to form rocks.

Almost all plants and animals possess some type of hard parts which are capable of becoming fossilized. Such hard parts may consist of the shell materials of clams, oysters, or snails, the teeth or bones of vertebrates, the exoskeletons of crabs or woody tissue of plants.

Some fossils are very fragile and some are impossible to remove from the rock, especially if the fossil is an imprint. Many paleontologists therefore, will make plaster casts of their fossil finds to strengthen them for transport or to make copies of the original fossil.

WHERE TO LOOK FOR FOSSILS:
- Most fossils are found in sedimentary rocks. Lime stones, limy shales, and certain types of sandstones are good sources.
- Quarries are good places to look but one should be sure to obtain permission before entering.
- All railroads and highway cuts are good places.
- Gullies, canyons, and stream beds are also good places to examine.
- The most common fossils in this area are found in chalky limestone which extends from Austin through Dallas, to the Red River and beyond.
- In this limestone sharks' teeth have been found and they are probably the most common vertebrate fossil to be found in Texas.

MATERIALS SUPPLIED:
- Fossils
- Trowels
- Laminated student keys
- Clay for molding
- Plaster of Paris
- Water to mix with plaster
- Stirring tools
- Cups for edges to contain plaster
- Fishing string to cut clay
- Tooth brushes to remove sand from fossils
- Markers

PROCEDURE:

1. Discuss background information and explain that the sands are rich in fossils. The first 15 minutes will be allotted for digging fossils while the remaining time will be used for identifying finds and making a plaster cast of one or two of the best fossils.

2. Alert students that no dirt/sand throwing or foolishness will be tolerated or they can sit out the activity. Safety is first priority.

3. Discuss the student activity sheet and help them answer the questions before looking for fossils. Use laminated fossil guide for answers.

4. Pass out trowels and let students began digging. Any fossils they find should be placed in a small pile on top of the railroad ties or on the benches.

5. After 15 minutes, have students pick a few of their fossils to clean. Fossils with unique shapes or line markings are best for plaster casting. Clean by removing sand and dirt with toothbrushes.

6. Students should then identify those fossils using laminated student keys and the fossil display cases. They should record the name of the fossil, describe its characteristics, and make drawings on their student answer sheet.

7. Cut flat pieces of clay (1/2 inch) with fishing string or flatten a piece of recycled clay into a pancake shape.

8. Place clay on work table for each student.

9. Press fossil into clay (being sure not to go all the way through the clay) and then remove fossil carefully on to damage print.

10. Make a rim around fossil impression with cups.

11. Students should write their name on the cup with a marker.

12. Mix plaster with water until a pancake batter consistency is formed. Do this only after most if not all students have made a print in the clay.

13. Pour plaster into cup around the fossil print. (about 1 to 2 inches deep)

14. When cast is almost dry place clay and cast into trays for each class. (Students can pick up casts of fossils at the end of the day) Best to wait until back at home school.

15. Bury all fossils back into sand so other school can enjoy the dig.

16. Return all tools to the box as well as the laminated fossil keys.

FOSSIL DIG
STUDENT ACTIVITY

Student Name: _____

Listen to the teacher's instruction on how to find fossils. Answer the questions below.

1. The majority of fossils are found in which type of rock? _____
2. Name three places where to look for fossils.
   - _____
   - _____
   - _____
3. What kind of habitat (environment) was in the Dallas area when the fossils were formed? _____
4. What is a fossil?

   _____

   _____
5. Wait patiently for equipment to be handed out.
6. Place fossils you find in an area where you can identify them using the fossil information guides and display cases.
7. Fill in the information of each fossil type you find.
8. Bury fossils back into fossil pit and return all equipment.

Identify and draw a picture of a fossil.

Name of Fossil	Description of Fossil	Drawing of Fossil

(TEACHER EXTENSION)
FOSSIL FACTS AND INFORMATION:
A fossil is the preserved remains or trace of a plant or animal from the past. That's the simple answer to "what is a fossil?"

Plants can be preserved with a carbon film on a piece of shale, an animal bone can be naturally replaced by minerals and preserved, or a footprint in the sand can harden into a fossil.

HOW DO FOSSILS FORM?
Fossils usually only form in sedimentary rock. Sediments have to accumulate over the organism in order to preserve it. This could be a rapid burial, such as a volcanic eruption or mudslide; it could be sap from a tree oozing over an insect, or simply a slow sediment accumulation on the bottom of a lake.

Most fossils are marine in origin, or are land animals that fell into a water environment. This is because sediments easily accumulate in water environments (lakes, streams, oceans). Land environments are usually the sites for erosion, not sediment deposition.
Let's answer the question "what is a fossil" in a little more detail by going into a specific example about fossils

Think about someone finding a Native American arrowhead in a recently ploughed farm field. That plough disturbed and dug up a few inches of soil. The arrowhead, which was previously buried in the soil popped to the surface. How did that arrowhead end up underground in the first place? A Native American left it on the surface hundreds of years ago. Over time, vegetation grew and died, creating soil. The soil slowly accumulated and buried the arrowhead.

This is similar to how a fossil forms. Let's take that lost arrowhead above and replace it by a leaf. Let’s say the leaf falls into a lake with a low oxygen content, so it does not rot away. Now, let it sit there for a year. It will be covered by a small amount of sediment. Another year goes by and more sediment covers it. Now, multiply the time frame by an unimaginable number of years, millions of years. Instead of the leaf being buried by a few inches of sediment, it is buried by miles and miles of sediment! Something now begins to happen to that sediment. Under miles and miles of pressure it heats up, the leaf literally cooks. Only the carbon ash remains. Chemical processes start to occur under the tremendous pressure, and the sediments compact into a type of rock... sedimentary rock.

Now, add millions of more years, and change the geologic context. Geologic forces thrust that sedimentary rock onto the surface. Wind and weather take its toll. The sedimentary rock outcropping begins to erode away. In one of the pieces of the eroded rock outcropping falls a fossil leaf impression, a preserved carbon footprint of that leaf that fell in the lake millions upon millions of years ago. This is how fossils form.

Preservation methods for fossils vary. Plants are fragile and often cook so that the carbon only remains. Animal bones and hard shelled animals are harder, and often have minerals leaching into them replacing the original bone. Sometimes volcanic ash layers cover the plants or animals and preserve them.

TYPES OF FOSSILS AND MODES OF FOSSIL PRESERVATION:

There are many ways an organism can become preserved as a fossil. Some of the ways include Casts and Molds, Per mineralization, Replacement, and Carbonization. Sometimes the fossil is unaltered, meaning it is the actual organism.

FOSSIL CASTS AND MOLDS:

A cast and mold is created when an organism is buried and rots away. The empty hole where the organism was is filled in with sediments or minerals, that become a cast. The mold is the impression in the rock it left. This is like pouring chocolate into a mold. When the chocolate hardens, it pops out as a chocolate cast, ready to eat.

EXAMPLES:

Fossil shells are often casts, and shell impressions on rock are often molds.
A fossilized footprint is a mold.
Plant fossils and trilobites are often found as casts and molds.

PER MINERALIZATION AND REPLACEMENT:

Per mineralization is when the organism is buried in the ground, minerals from ground water seep into the organism and slowly fill in the pores in the animal, adding rock forming minerals to the hard parts of the animal.

Replacement is similar, in that minerals seep into the organism. However, the minerals replace the original organic material, as the organic material rots away. In the end, the organism is replaced by minerals.

Many fossils are preserved these ways, from Fossil Sharks Teeth, to Trilobites, to Bone.

CARBONIZATION:

Carbonization is the process where only the residual carbon of the organism remains. In nature this usually happens over time when the organism is subject to heat and pressure.
A very common example of carbonization are fossil plants, where only a thin carbon layer is left on a piece of shale. In the Carboniferous time period, fast fern forests created miles of carbon, which we mine today as coal.

Another, more recent example is the fossilized feathers found on dinosaurs in China. These are left as carbon imprints in the shale around the mineralized dinosaur bones.
It's important to note that most fossils are preserved by more than one mode. For example, the fossil leaves are carbonized, but also leave a cast and mold. Fossil ammonites are casts; however, they also are mineralized. Fossil trilobites are often found as casts and molds, but their exoskeletons are mineralized (usually replaced by calcite).

UNALTERED REMAINS:
An organism is considered unaltered if there is no change in the original composition of the organism. A famous example of this is found at the La Brae Tar Pits in Los Angeles. Here, Ice Age animals became trapped and sunk into the tar pits. The soft tissues rotted away, but the original bones still remain. Original bones from Saber Toothed Cats, Giant Ground Sloths, Short Faced Cave Bears, Dire Wolves, and many more strange creatures are all unaltered.

Another example includes insects and small animals trapped in Amber. The sap from a once living tree entombed the animals. This sap eventually hardened, and the original animals are preserved inside the amber.

TRACE FOSSILS:
A trace fossil is a fossil not of an organism, but instead a fossil of an organisms activity. For example, a trace fossil can be a mold or cast of a footprint, or a cast of a fossil burrow. Animal borrows that have been filled in by sediment are very common in many sedimentary rock outcroppings.

FOSSIL GALLERY:

Image of a few Ammonite Fossils. These are the mineralized shells of marine animals, similar to todays Nautiloids.

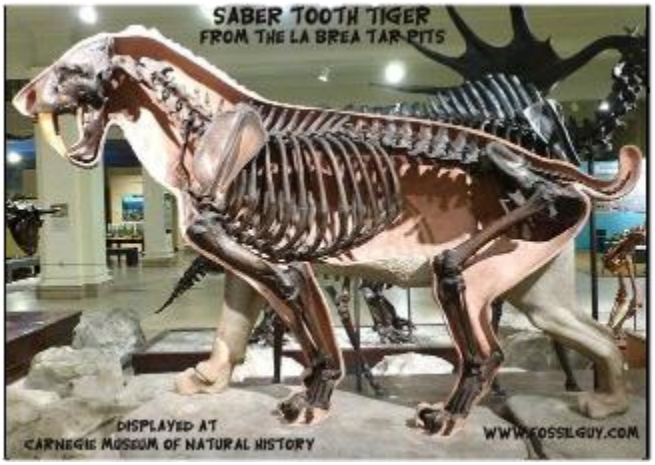
A fossil fern preserved as a carbon film

FOSSIL GALLERY:

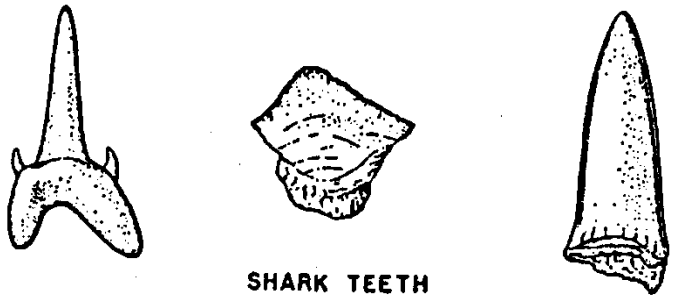
*This fossil dolphin vertebra from the **Calvert Cliffs** of MD has been preserved through per mineralization. The minerals that replaced it gives it a beautiful rusty-brown color.*

This is a fossil Huntonia Trilobite. The exoskeleton has been replaced by calcite (per mineralization); it was also filled in with sediment (cast).

FOSSIL GALLERY:



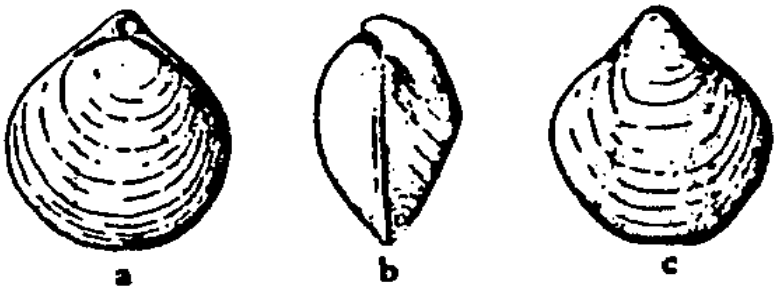
This is a fossil Saber Toothed Cat from the La Brea Tar Pits in Los Angeles. The skeleton is the original Unaltered Remains. The animal fell in the tar, and the bones are original, just stained a brown color from the tar.



SHARK TEETH

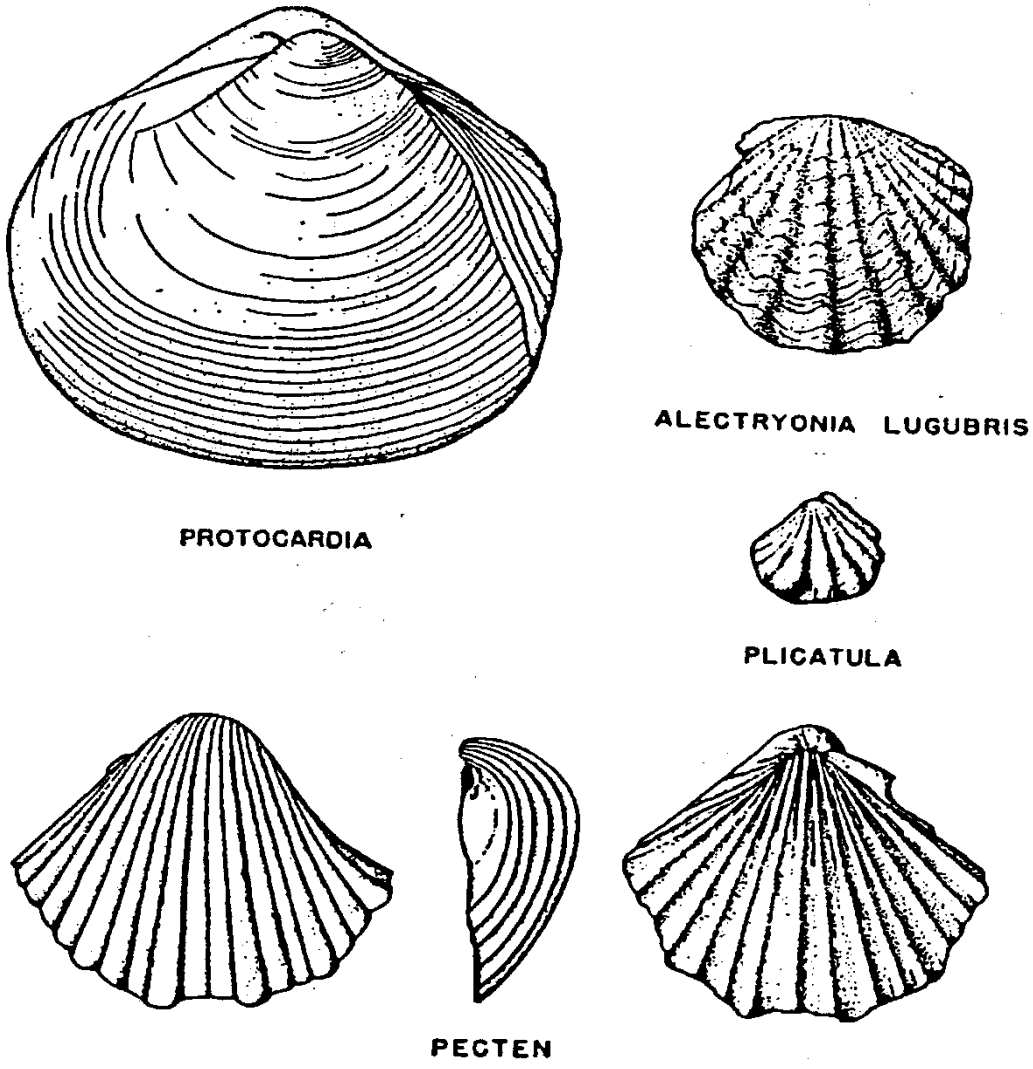
Some of the common invertebrate fossils found in shale and chalky lime stones in this area are listed below.

The brachiopods are a large group of marine organisms with shells composed of two pieces called valves.



Kingena wacoensis, a common Cretaceous brachiopod. (a) Dorsal view. (b) Lateral view. (c) Ventral view.

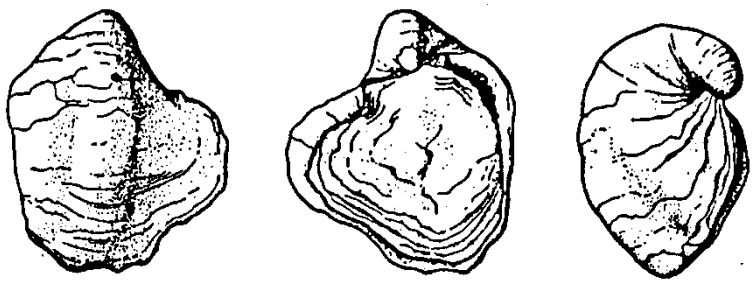
The mollusks group includes a large number of aquatic and terrestrial invertebrates which include such familiar forms as snails, clams, oysters, squids, and octopuses, most mollusks possess a calcareous shell that serves for preservation as fossils.



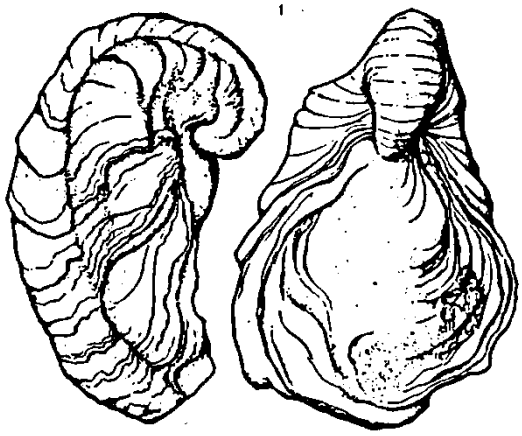
CRETACEOUS PELECYPODS

The group of clams, mussels, oysters, scallops (pelecypoods) have shells composed of two valves, usually, but not always of equal size.

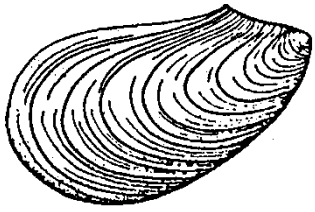
Examples: Pecten, and Gryphocea, Graysonana (oyster).



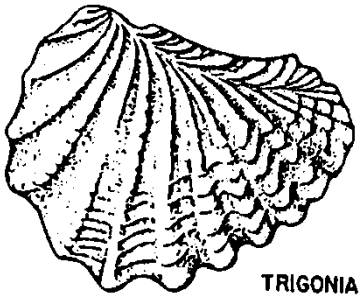
GRYPHAEA WASHITAENSIS



GRYPHAEA GRAYSONANA

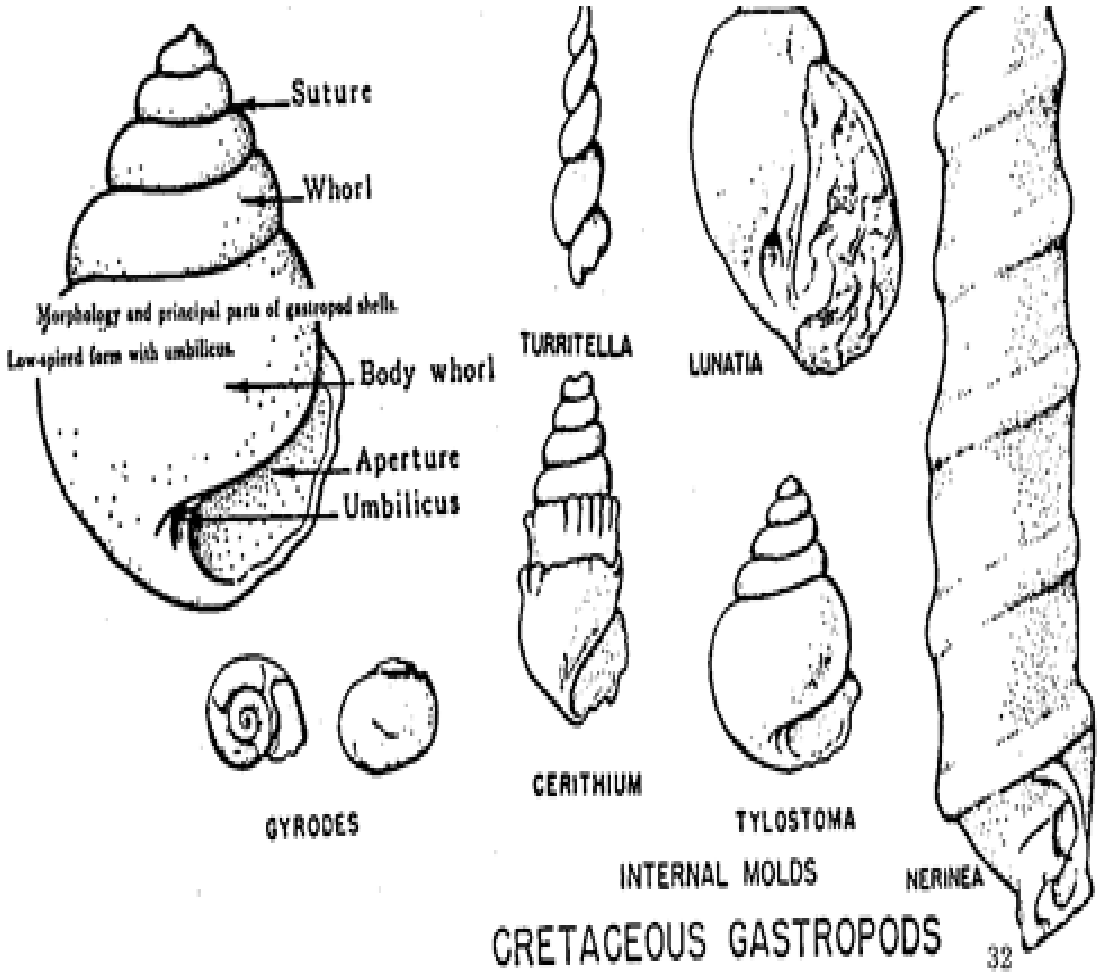


INOCERAMUS



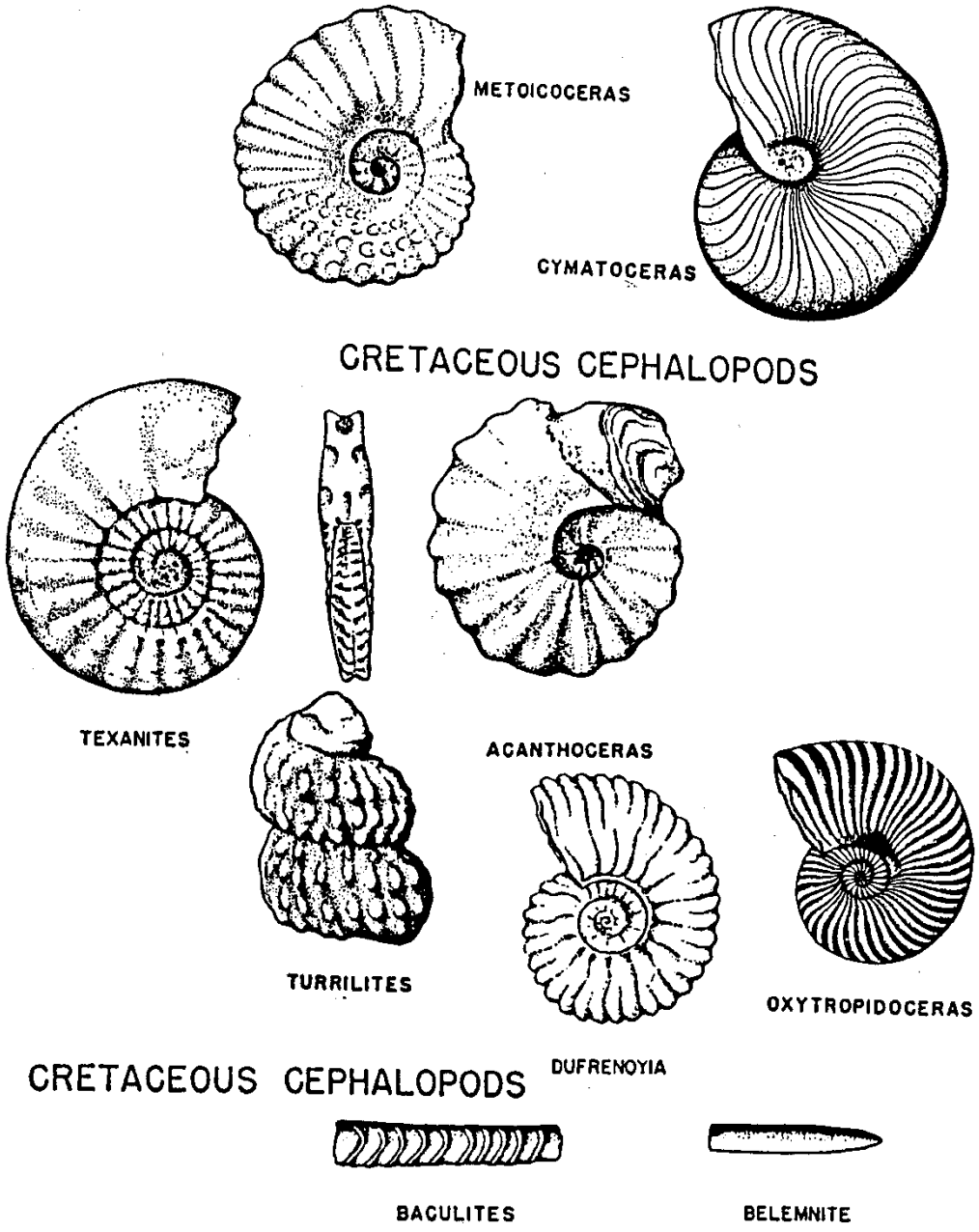
TRIGONIA

CRETACEOUS PELECYPODS



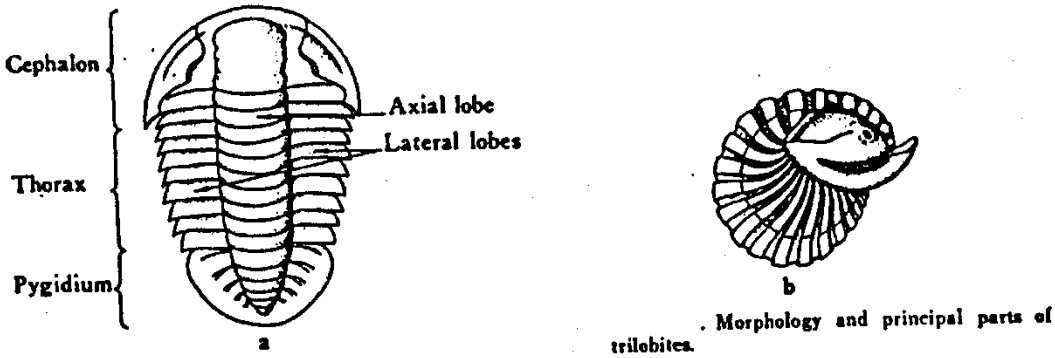
The group of snails, slugs (gastropods) has a spirally coiled single valved, unchambered shell. Some of the ones found around here are Lunatia, Turritella, and Tylostoma.

The group of invertebrates which include the squid, octopus, pearly nautilus, and the extinct ammonoids are the most advanced of all mollusks members (cephalopods). They have the shells of on valve, usually coiled, and partitioned by septa.



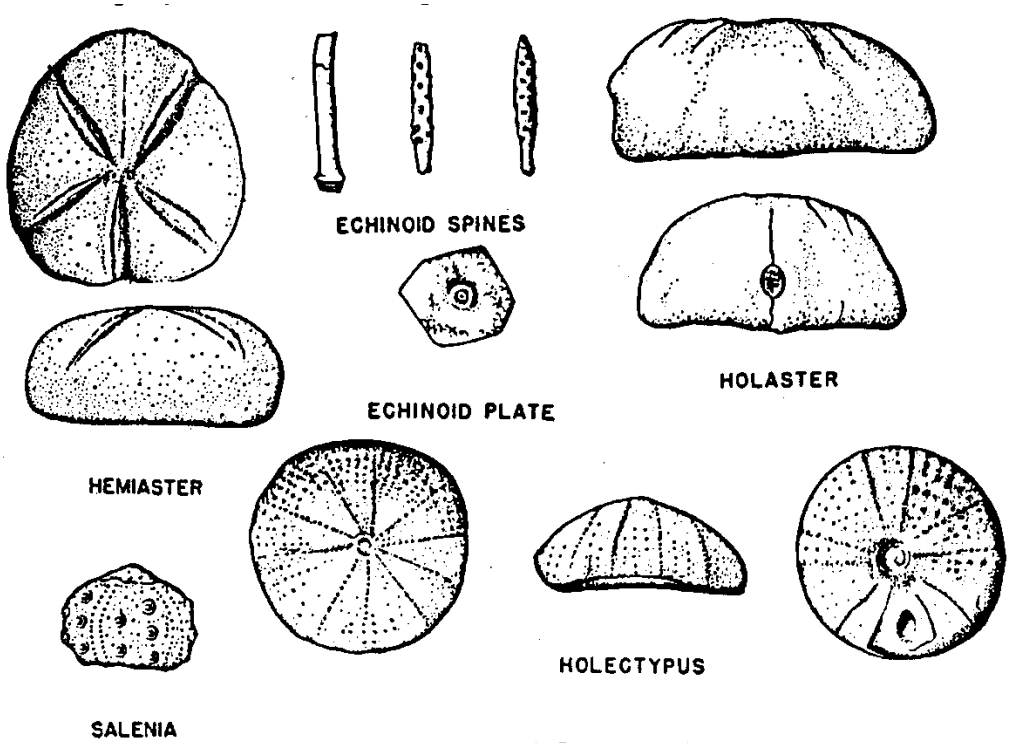
EXTINCT ARTHROPODS

The trilobites are a group of exclusively marine arthropods which derived their name from the typical three-lobed appearance of their bodies.



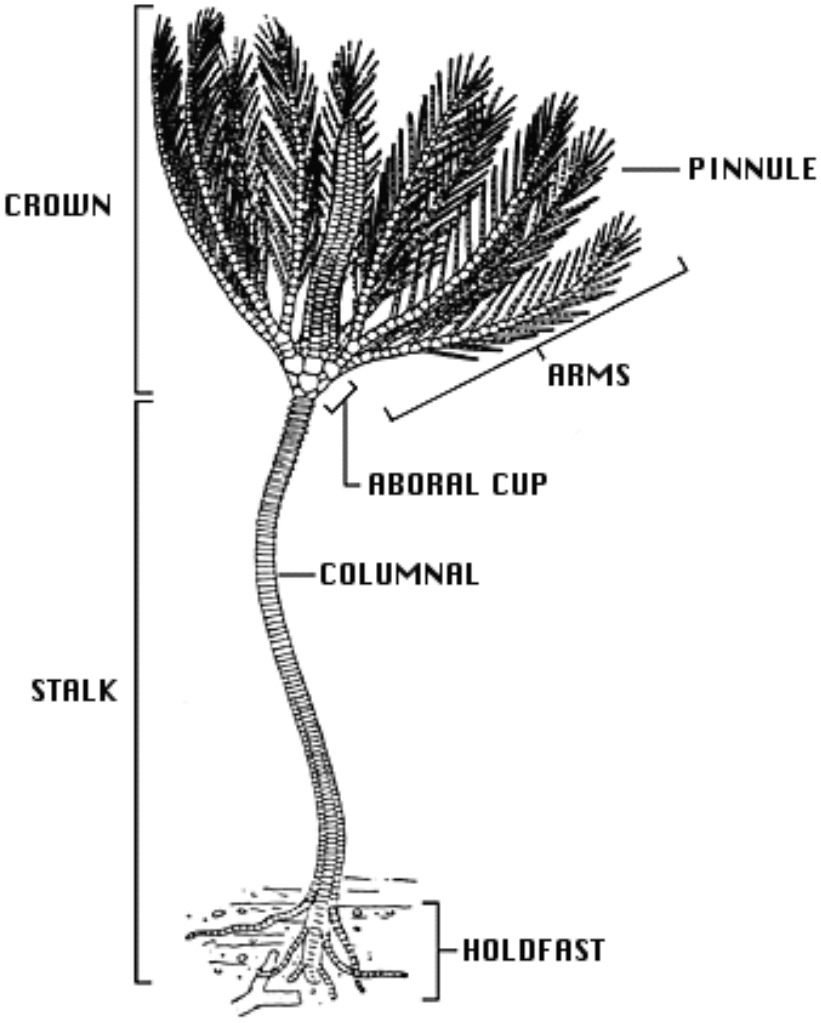
. Morphology and principal parts of trilobites.

The echinoderms are a large group of exclusively marine animals. The typical echinoderm has a skeleton composed of numerous calcareous plates which are intricately fitted together and covered by a leathery outer skin. The echinoderm body often exhibits a typical star-shaped form, but some types may be heart shaped, biscuit shaped, or cucumber shaped.



CRETACEOUS ECHINOIDS 36

The crinoids are commonly called sea lilies because of their flower like appearance.



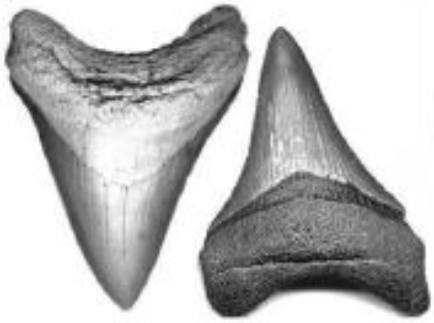
FOSSILS FOUND IN TEXAS:

*100-million year old pieces of tiny fossil skull found in Fort Worth, Texas, have been identified as a new species of **coelacanth** fish, according to paleontologist John F. Graf of **Southern Methodist University** (SMU) in Dallas.*

Eryops Amphibian Fossil
This fossil of an adult Eryops displayed at the Smithsonian Museum of Natural History (August 2010). The creature is an ancient amphibian that existed in the Early Permian Period (270 million years ago). Fossil was found in Texas.

Glen Evans (left) who managed much of the WPA effort to collect Texas fossils.

COMMON VERTEBRATE FOSSILS FROM THE MIOCENE OF MARYLAND AND VIRGINIA



Carcharodon megalodon
Extinct Megatooth Shark

Shark Vertebra

Carcharodon subauriculatus
Extinct Megatooth Shark

Isurus sp.
Mako Shark

Galeocerdo aduncus
Extinct Tiger Shark

Hemipristis serra
Snaggletooth Shark

Galeocerdo contortus
Extinct Tiger Shark

Squatina subserrata
Angel Shark

Alopias latidens
Thresher Shark

Notorhynchus cepedianus
Cow Shark

Carcharias sp.
Sand Tiger Shark

Carcharhinus sp.
Requiem Shark

Sphyrna sp.
Hammerhead Shark

Negaprion sp.
Lemon Shark

Porpoise teeth

Ray teeth/pavements

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