

# GUIDE FOR BEGINNING FOSSIL HUNTERS

Charles Collinson

Cover: The Ordovician sea floor, more than 400 million years old.

First Edition 1956  
Revised Edition 1959  
Reprinted 1964, 1966, 1973, 1980, 1991, 1997, 2000  
Second Revised Edition 2002



*Calymene*, a Silurian trilobite



♻️ printed with soybean ink on recycled paper

The Geoscience Outreach Program of the Illinois State Geological Survey uses many channels to inform the public about the geology and mineral resources of the state and the results of the Survey's research projects. The Survey distributes nontechnical publications, offers sets of rock and mineral specimens to Illinois schools and educational groups, presents lectures and exhibits, responds to inquiries, conducts workshops for teachers, and leads field trips. The program's full-day field trips, each given in widely separated areas of the state, offer teachers, students, and the public the opportunity to learn about the geologic processes that shaped the land and formed the rocks and glacial deposits.


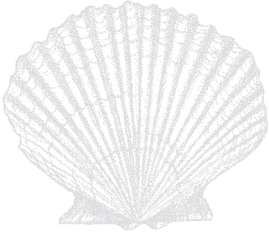

The outreach program is specifically designed to assist in the teaching of earth sciences and to help citizens understand how the research programs of the Illinois State Geological Survey protect the environment and strengthen the economy of Illinois.

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**Note:** Fossil drawings were prepared mainly during the 1960s. Consequently, the nomenclature reflects that period and, in some cases, may have changed. The names in this guide, however, are familiar to many users.

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Charles Collinson



Geoscience Education Series 15 2002  
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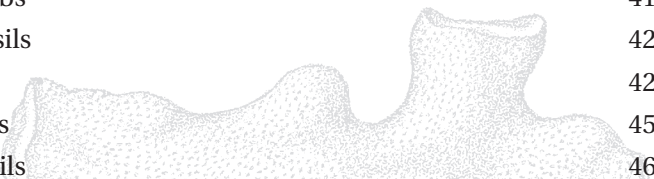
George H. Ryan, Governor  
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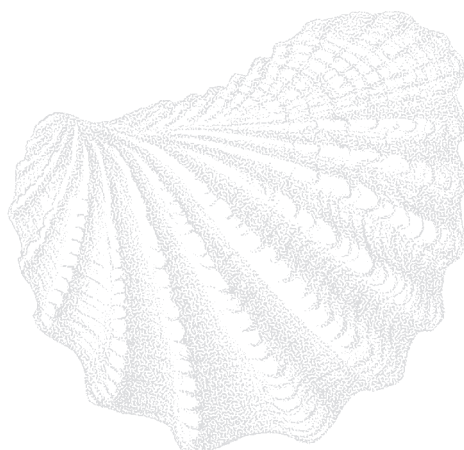
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# Guide for Beginning Fossil Hunters

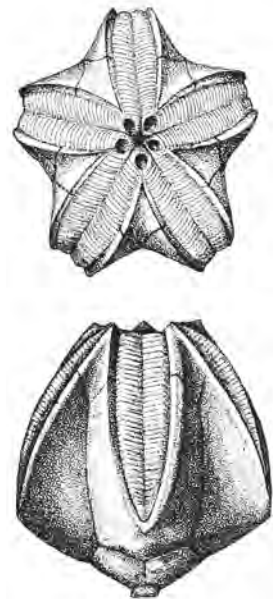
## Introduction

Long before the first humans appeared on Earth and such familiar features as our lakes and rivers were formed, the Earth was inhabited by plants and animals.

Even though humans are the only creatures able to record their history, we know that plants and animals lived an incredibly long time before human beings were here to see them. We have evidence that single-celled organisms swarmed in the seas half a billion years ago. We know that after this small beginning animals grew bigger, more complex, and more varied, and that after millions of years such monsters as dinosaurs evolved. We can also prove that they in turn gave way to the mammals that today dominate the Earth.

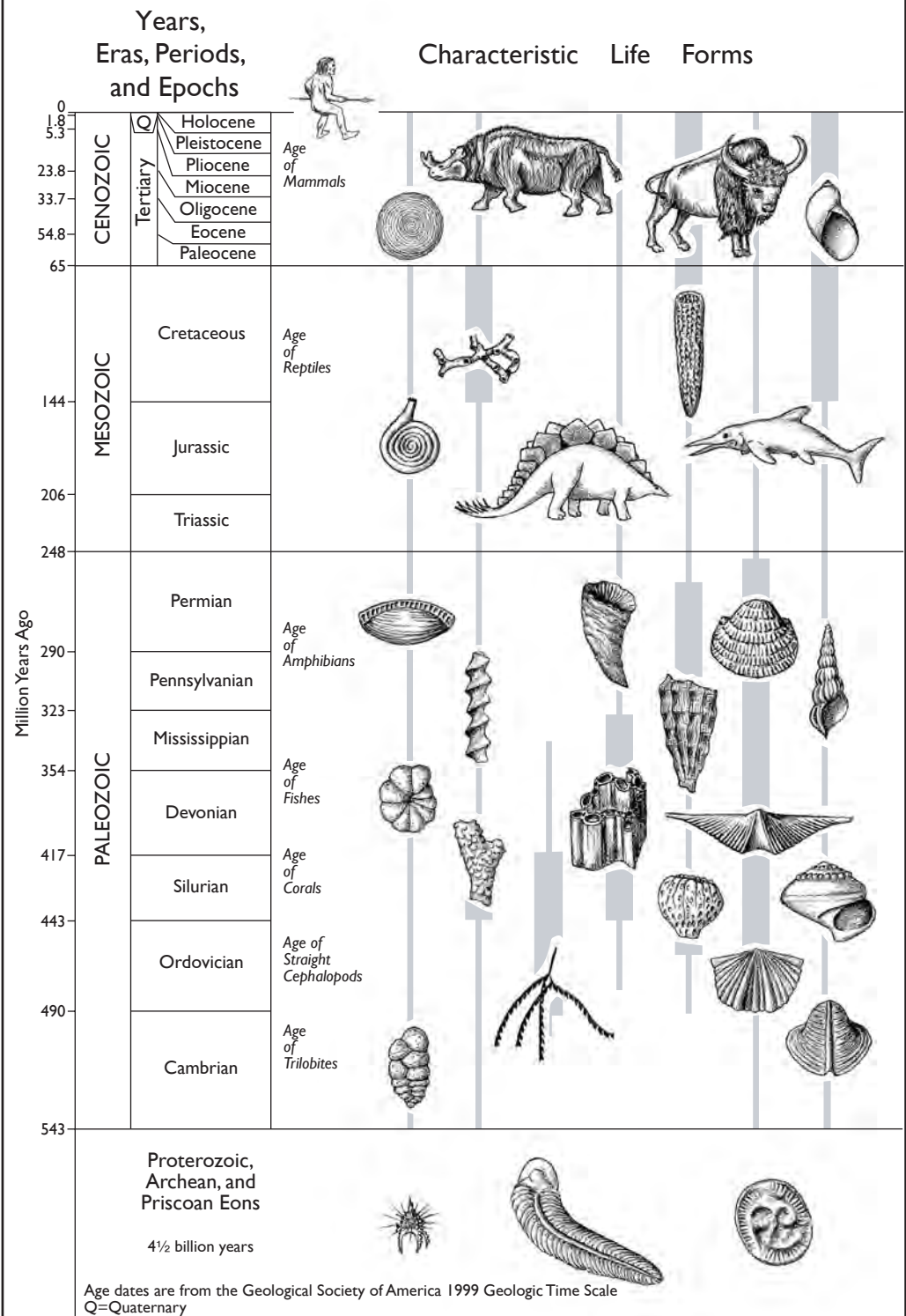
We know these things because the prehistoric creatures left behind the telltale marks that we call fossils. Some fossils are merely foot tracks or worm holes. Others are impressions of an entire animal or plant. Many are bones or shells—or even skin and hair.

The materials in which the fossils are encased were not always rocks. At one time they were mud or sand on the floor of a sea or sand dunes on an ancient land. As time went on, these sediments were buried under more



*Pentremites*,  
a blastoid

# Geologic Time Chart

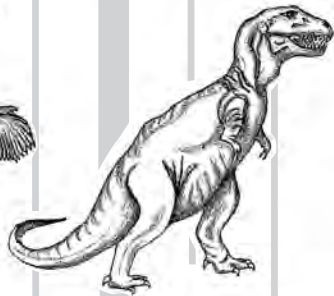
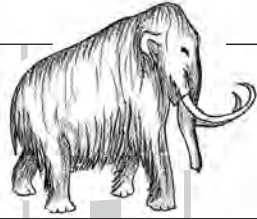


Age dates are from the Geological Society of America 1999 Geologic Time Scale  
 Q=Quaternary



# Geologic Time Chart

## Characteristic Life Forms



Key to Ranges

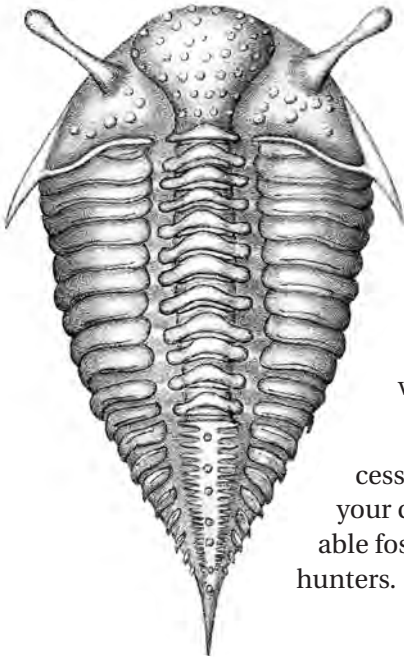
minor importance

major importance

sand and mud. Layer after layer piled up, and the sediments with their enclosed fossils were cemented into rock.

The great numbers of fossils in the rocks represent only a small part of all life that has existed on our planet. For every fossil we see, millions of animals have lived, died, and been destroyed without leaving a trace. Nevertheless, by carefully collecting the fossils and recording the layers of rocks they came from, we can reconstruct hundreds of generations that have lived on both land and sea at one time or another.

Paleontologists devote their lives to seeking and studying fossil remains in order to interpret Earth history, but the search for fossils can be an adventure for almost anyone. It can be an excursion to an ancient beach or a plunge to the bottom of a long-vanished sea.



A trip to a quarry may yield fossil clams and corals; a search through a strip mine may produce tropical ferns; mastodons or snails may be the subject of a hunt along the river bluffs. All such excursions provide good outdoor fun—whether for an afternoon, a weekend, or an entire vacation.

In addition to outdoor adventure, a successful hunt provides interesting trophies for your collections. Many of science's most valuable fossil finds have been brought in by amateur hunters.

*Encrinurus*,  
a Silurian trilobite

## What Are Fossils?

A fossil is some evidence of a prehistoric animal or plant, preserved in rock, that gives a clue to the characteristics of the organism. The remains of animals or plants that lived during historic time are not considered fossils.

The oldest fossils in Illinois are found in rocks such as sandstone, limestone, or shale. Some are only impressions of the outside of a shell; some are fillings of the inside. Parts of the original shell may be preserved, but in many fossils, the hard parts of the animal have been replaced by a material different from that of the original. Silica and calcium carbonate, which are readily preserved, commonly replace the original shell material.



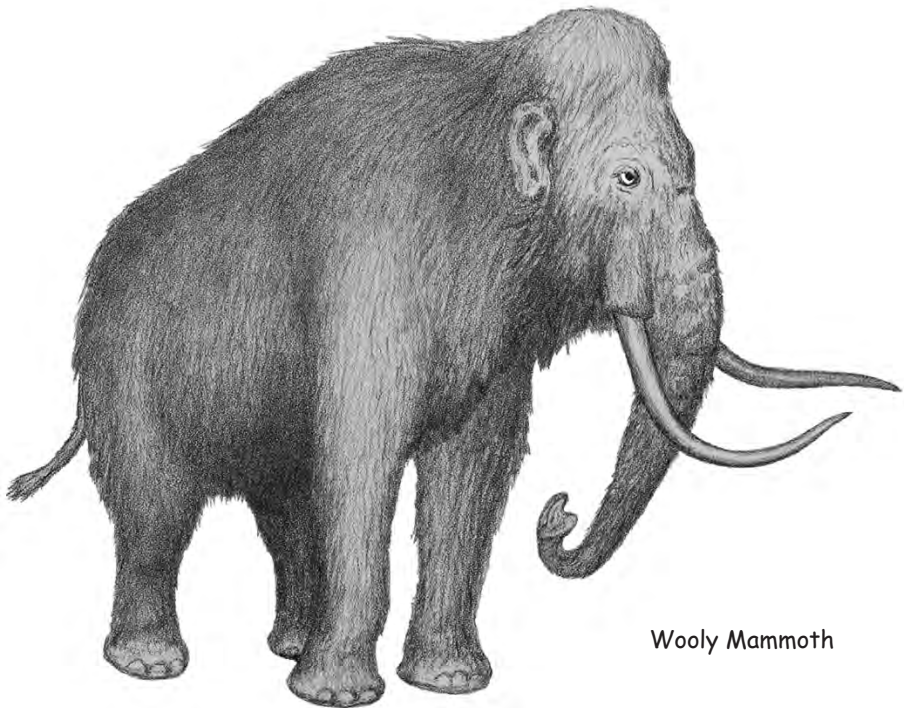
Dinosaur foot tracks

Some fossils were made by marine worms that burrowed in the sand or mud of the sea floor. The worms themselves are rarely found as fossils, but their trails and burrows are common. The tracks left by prehistoric animals are fossils just as much as the animals themselves would be if they had been preserved.

In many places in Illinois, shells of clams, snails, and brachiopods are preserved with little change and are much as they were the day they were buried on the floor of the prehistoric sea.

The plant fossil materials that make up the coal beds of Illinois are the remains of primitive trees and plants that lived in swamps during the “Coal Age,” or Pennsylvanian Period. When the plants died, they fell into the water and were preserved as peat, which later became coal. Many fine fossils found in the coal and overlying shales represent the roots, trunks, and leaves of the plants. A few of the insects that lived in the trees also are preserved.

Among the youngest fossils found in Illinois are the teeth and bones of bison, giant beaver, deer, and elephant-like animals called mammoths and mastodons, all of which lived during the “Ice Age,” that is, the Pleistocene Epoch when glaciers moved in and out of Illinois. Complete skeletons of the animals are rare, but teeth and tusks are found in near-surface excavations.



Woolly Mammoth

## Where to Look for Fossils

Quarries are excellent places to find fossils because so much rock is exposed. Old abandoned quarries are best because the rocks have been weathered and the fossils are easier to see and collect.

If you plan to collect in a quarry or any other private property, be sure to get permission to enter it. In that way, someone will know where you are in case of accident. In active quarries, there is danger from falling rock during blasting. If the operator of the quarry doesn't know you are there, he cannot warn you when he is going to set off a blast.

Some of the best collecting sites in Illinois are the cliffs and bluffs along our major rivers, the Mississippi, Illinois, Ohio, and Wabash Rivers and their tributaries. At these places, whole fossils are often weathered out and may be picked up easily. Most of Illinois' major rivers have banks of windblown glacial dust, or loess (pronounced "luss"). Shells of air-breathing snails that lived during the Ice Age are common in the loess.

Well-known collecting sites for plant fossils are coal strip mines of Illinois. Perhaps the most famous is the Mazon Creek area near Braidwood in northeastern Illinois, which has supplied beautifully preserved impressions of ferns, tree leaves, and a few insects to museums throughout the world.



ISGS field trip participants scouting for fossils at a quarry near Savannah.

A map of the Mazon Creek area appears on page 44. Many strip mines yield fine brachiopods, snails, clams, and cephalopods.

Highway cuts through bedrock commonly expose beds containing fossils, but be careful along road cuts, especially if there is heavy traffic.

Ice Age fossils, such as mammoth and mastodon teeth and tusks, have been found mostly in gravel pits but also in foundation excavations and ditches in all parts of the state.

Actually, you can find fossils almost anywhere, in the gravel or crushed stone of your driveway or in stone walls and foundations. You may see fossils in many places where you cannot collect them, such as counter tops in restaurants, utility marble in public buildings, in stone sidewalks in several of our older cities, or in riprap along the shores of Lake Michigan and our major rivers.

## Tips on Collecting Fossils

When you look for specimens in a quarry or on a shale slope, sit down or get on your hands and knees and look carefully. Spend some time in one spot before you move on to another. Excellent fossils have been found in places other hunters have passed over many times.

If you find a well-preserved fossil embedded in rock and you are not certain that you can get it without breaking or destroying it, don't spoil the fossil. If you leave it, the wind and weather may help loosen the fossil from the rock, and you can collect it on your next visit.



A young fossil hunter works patiently to remove his find from its surroundings.

If you do decide to chisel a fossil from the rock, be patient and take your time. If possible, chisel a narrow trough around the fossil, taking care always to point the chisel away from the specimen. When the trough is as deep as the fossil, or deeper, strike the base of the pillar you have made and the fossil should pop out.

Where the rock is very fossiliferous, it may be worthwhile to take small blocks of rock and break them into pieces with your hammer. In the process, the rock tends to break around the fossils. If there are enough fossils in the rock, you will get some unbroken specimens.

## Tools for Collecting Fossils



1. Hard hat. Important in the field where rock strata occur overhead.
2. Safety glasses. Your eyes must be protected from rock chips when using a hammer or chisel.
3. Gloves to protect your hands.
4. Hammer. A bricklayer's hammer will work well.
5. One or two cold chisels, preferably one large and one small.
6. Backpack or cloth bag in which to carry the fossils.
7. Old newspapers or a roll of tissue paper for protecting fragile specimens.
8. Magnifying glass or hand lens, 3× to 10× power.
9. Pencils and paper for labeling the specimens. Much of the value of a particular fossil lies in knowing where it was found and the bed it came from. Keep records of your collecting.
10. A good map is very helpful as a record of the location of your fossil-collecting sites. Maps that show the shape of the landscape, as well as roads, houses, and rivers, are called topographic maps. They can be purchased for a moderate price at your state or federal geological survey offices.

# FORAMINIFERA

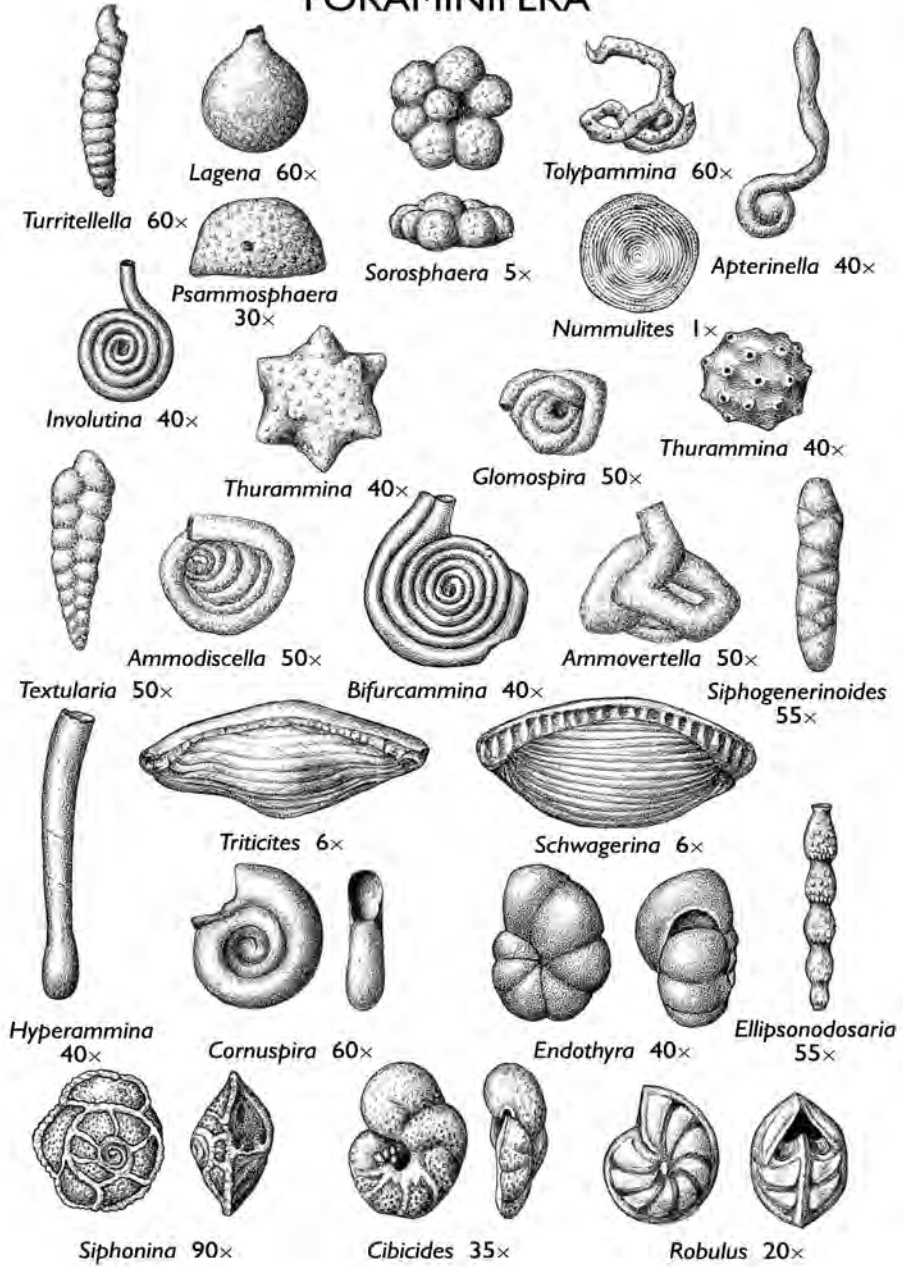


Plate 1



## Common Types of Illinois Fossils

**Foraminifera** Foraminifera (for-am'-in-if'-er-ah; plate 1) are very small one-celled animals, commonly called "forams." They are important to geologists, who use them to identify oil-bearing rocks.

These tiny fossils are beautiful, but you will see them clearly only with the aid of a magnifying glass or hand lens. Some are calcium carbonate; others are made of tiny sand grains cemented together with silica.

Some forams make their shells from parts of the skeletons of other animals. Some are so particular about the kind of materials they use that they select only grains of a special size and color.

Forams live in tremendous numbers in the seas today. They lived as far back as the Ordovician Period, more than 400 million years ago (see the Geologic Time Chart on pages 2 and 3).

Calcareous forams such as *Endothyra* (en-doh-thy'-ra; plate 1) are abundant in Illinois in the Salem Limestone, which occurs in the Mississippi River bluffs along the Mc Adams Highway northwest of



*Fusulina*, a foraminifer

Alton and in the bluffs of Monroe and Randolph Counties. The Salem Limestone also crops out near Anna and Jonesboro in southern Illinois.

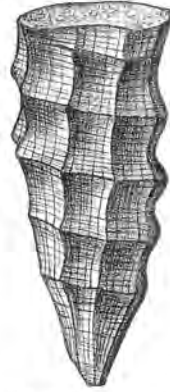
Another kind of calcareous foram, *Fusulina* (few-su-lye'-nah), is common in rocks of Pennsylvanian age throughout Illinois. The fossils look like grains of wheat and are so numerous in some limestones and shales that they can be collected by the thousands.

For a list of localities where forams are abundant, see pages 162–167 of Illinois State Geological Survey Bulletin 67.

# SPONGES



*Astraeospongia* 2/3x



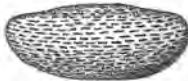
*Asteractinella* 1/2x



*Sphaerospongia* 2/3x



*Astylospongia* 2/3x



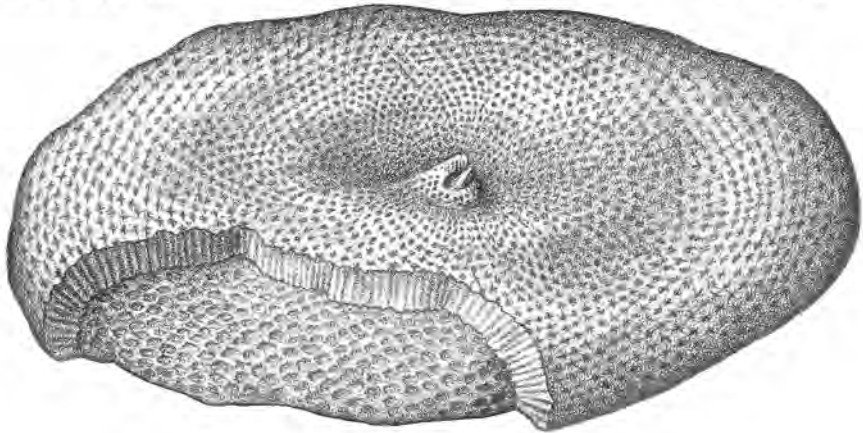
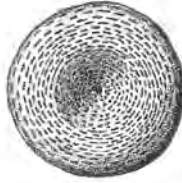
*Ischadites* 2/3x



*Zittellella* 1/2x

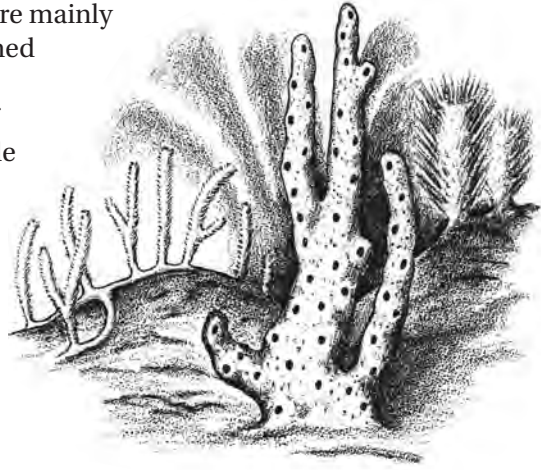


*Hindia* 1x



*Receptaculites* 1x

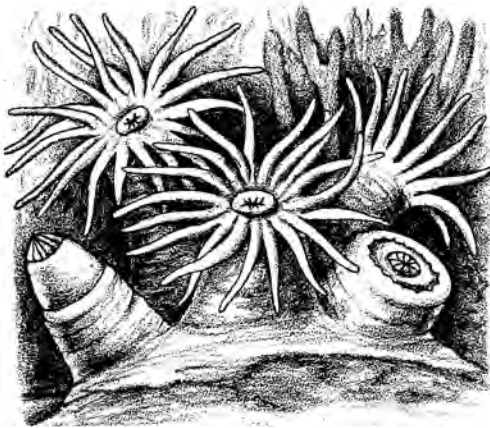
**Sponges** Sponges (plate 2) are mainly marine animals that live attached to the sea floor. Fossil sponges are numerous in some parts of Illinois. They are not the flexible sponges you and I know, but instead have a hard skeleton of calcium carbonate or silica. The oldest ones are known from Cambrian rocks and are about 500 million years old.



Modern sponges

*Receptaculites*, called the “sunflower coral,” is common in Ordovician rocks of north-central and northwestern Illinois. Although here placed with the sponges, paleontologists are increasingly convinced that *Receptaculites* belongs with the algae.

Another, called *Hindia*, is found in Silurian rocks exposed in quarries in the Chicago region. *Hindia* looks like a small round ball, but, when broken, is seen to be made of thousands of radiating rods of calcium carbonate.



Modern corals

**Corals** Corals (plate 3) are small, brightly colored marine animals that look much like flowers. The animal grows an external stony skeleton, connected on the inside with radial partitions that divide the body into chambers. The animal itself is called a polyp, and the skeleton is called coral.

Some corals live together in colonies made up of hundreds of individuals attached to one another by their outer skeletal walls. At some places, they form coral reefs hundreds of miles long.

# CORALS

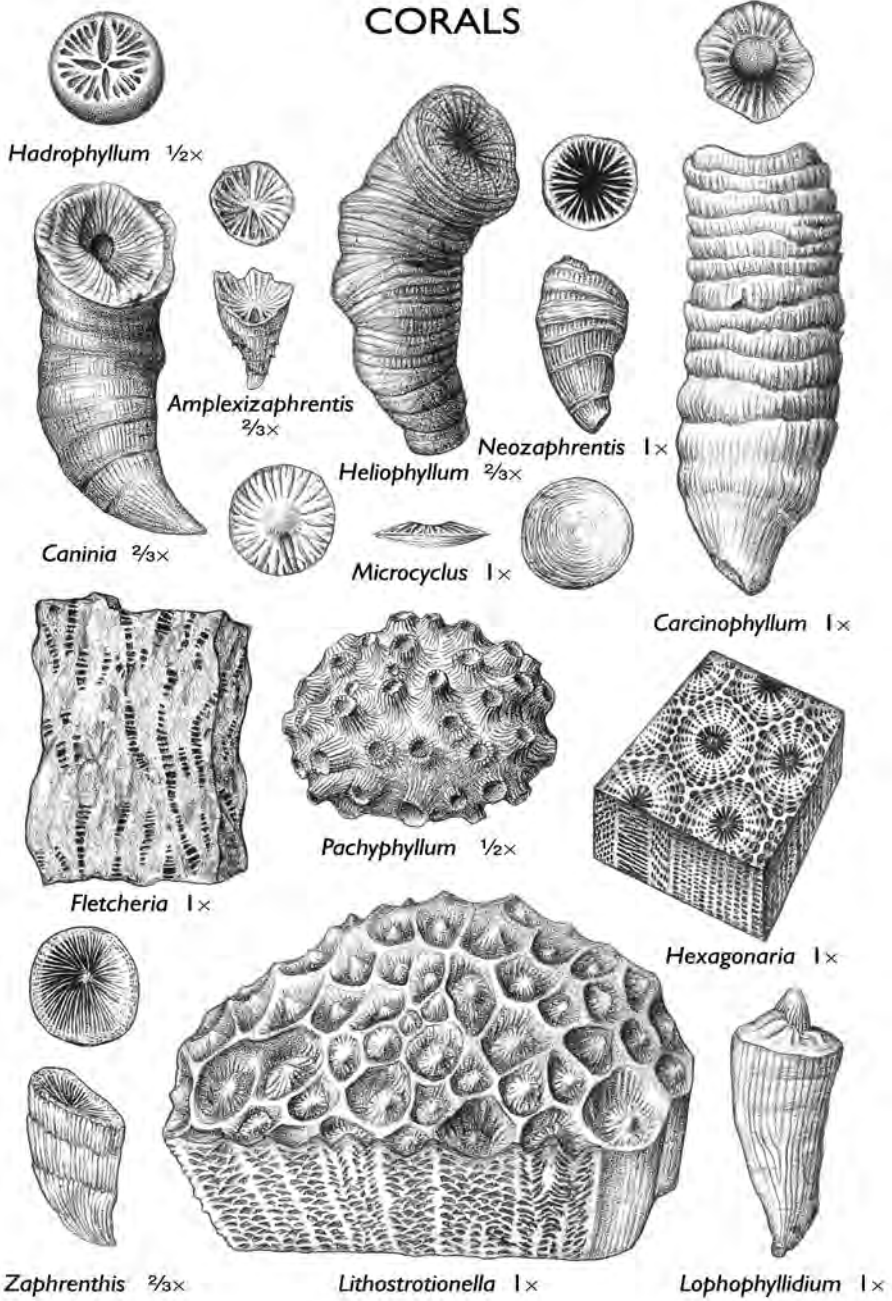


Plate 3

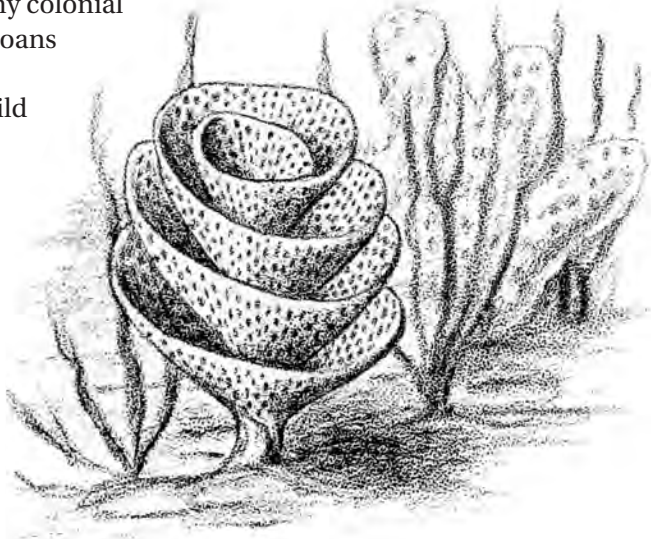
The skeletons of solitary polyps may be shaped like cushions, horns, or tubes, each with a depression in the top in which the animal lived. The solitary corals are referred to as horn or cup corals.

In colonial polyps, the skeletons may be either branching or closely packed and massive. Corals live mainly where the seas are warm and shallow. They are numerous in today's tropical seas. The animals have been common throughout geologic time, so it is easy to collect fine specimens in almost any part of Illinois.

Fossil corals are most common in limestone, where they sometimes make up a large part of the rocks, but they are also found in shale and sandstone.

**Bryozoans** The tiny colonial animals called bryozoans (bry'-oh-zoh'-ahns; plate 4) generally build stony skeletons of calcium carbonate.

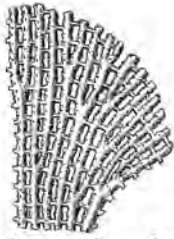
Bryozoans grow in a variety of shapes and patterns, mound-shaped, lacy, tree-shaped, or even screw-shaped. The skeleton has numerous tiny holes, each of which is the home of a minute animal. They spend their lives attached to the sea floor, to stones, or to other animals.



*Archimedes*, a Mississippian bryozoan colony

Bryozoans are among the common fossils. The oldest ones come from Cambrian rocks over 500 million years old, and their descendants live today.

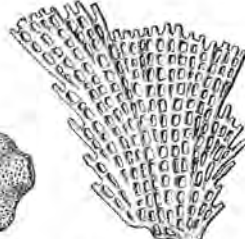
# BRYOZOANS



*Fenestrellina* 8×



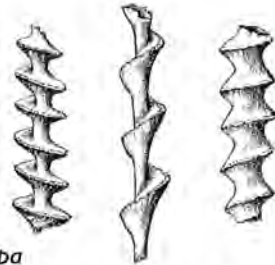
*Fistulipora* 1×



*Fenestella* 1×



*Streblotrypa*  
14×



*Archimedes* sp. 1×



*Prismopora*  
1×



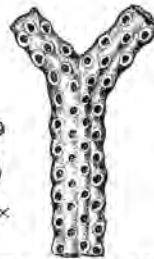
*Diploporaria* 12×



*Rhombopora* 4×



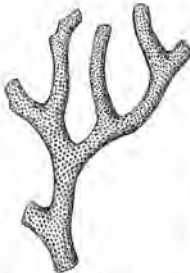
*Stomatopora* 18×



*Thamniscus* 12×



*Penniretepora*  
4×



*Rhombopora* 1×



*Stenopora* 1×



*Constellaria* 1×



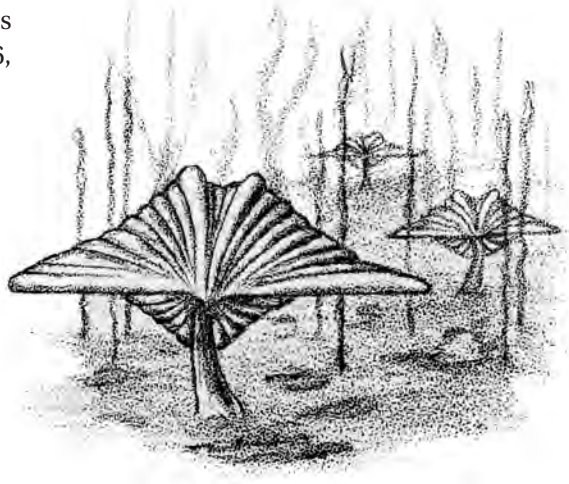
*Leioclema* 6×

Plate 4

During the Mississippian Period bryozoa were so common that their broken skeletons formed entire limestone beds.

Fossil bryozoa may be found either in shales or limestones, and they occur throughout Illinois.

**Brachiopods** Brachiopods (brack'-i-oh-pods; plates 5, 6, and 7) are marine animals with two shells, an upper one and a lower one. The right and left halves of each shell are mirror images, but the two shells are not exactly alike. The shells may be of lime, phosphate, or a horny substance, and the shells range in size from less than a fourth of an inch to several inches.



Mississippian brachiopods

Most brachiopods live attached to the sea floor by a fleshy stalk that is an extension of the soft body. Some forms lose the stalk when they become adults and either attach themselves directly to the sea floor or lie loose in the mud or sand. Some have spines that serve as anchors.

Brachiopods are not common in most oceans today, but at times in the past they were the most abundant shellfish and sometimes formed large shell banks, much as oysters do today.

The oldest fossil brachiopods are found in Cambrian rocks, which are over 500 million years old. The animals first became abundant in Ordovician time and remained so throughout the Paleozoic Era.

In Illinois, the fossils are especially common and well preserved in the limestones and shales of Mississippian age in the Ohio and Mississippi River bluffs, but you can find them easily in almost any part of the state.

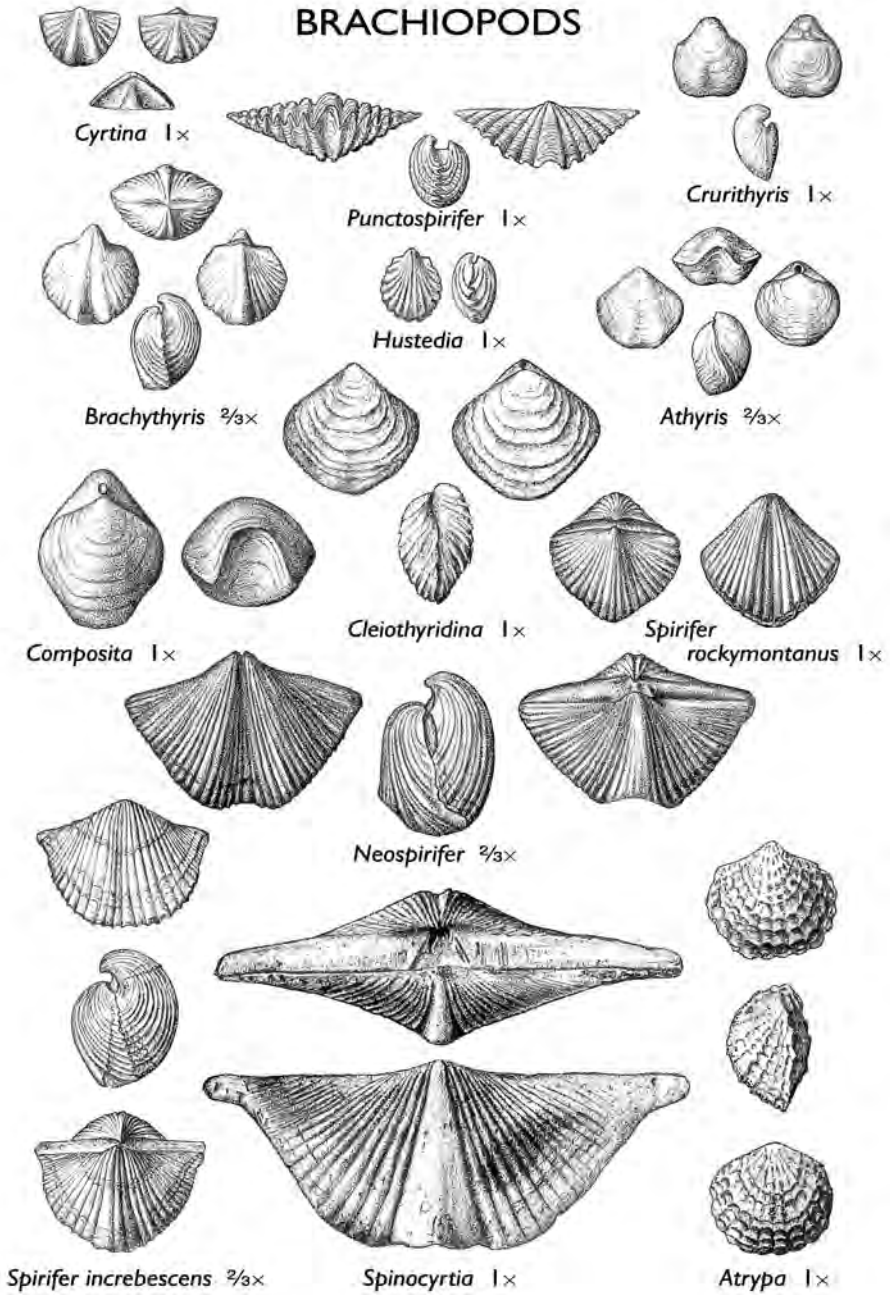


Plate 5



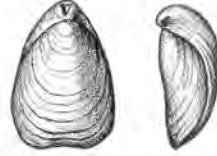
# BRACHIOPODS



*Centronella* 1x



*Lingula* 1x



*Beecheria* 1x



*Dinobolus* 1x



*Orbiculoidea* 2x



*Trimerella* 1x



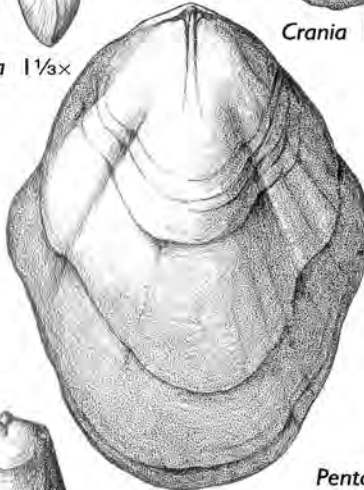
*Girtyella* 1 1/3x



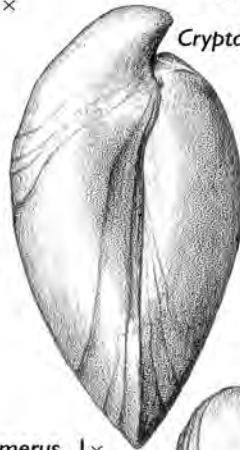
*Crania* 1x



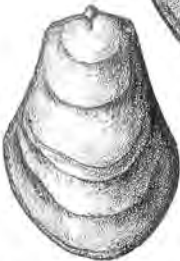
*Cryptacanthia* 1x



*Pentamerus* 1x



*Pentameroides* 1x



*Microcardinalia* 1x



*Kozlowskia* 1x

# BRACHIOPODS

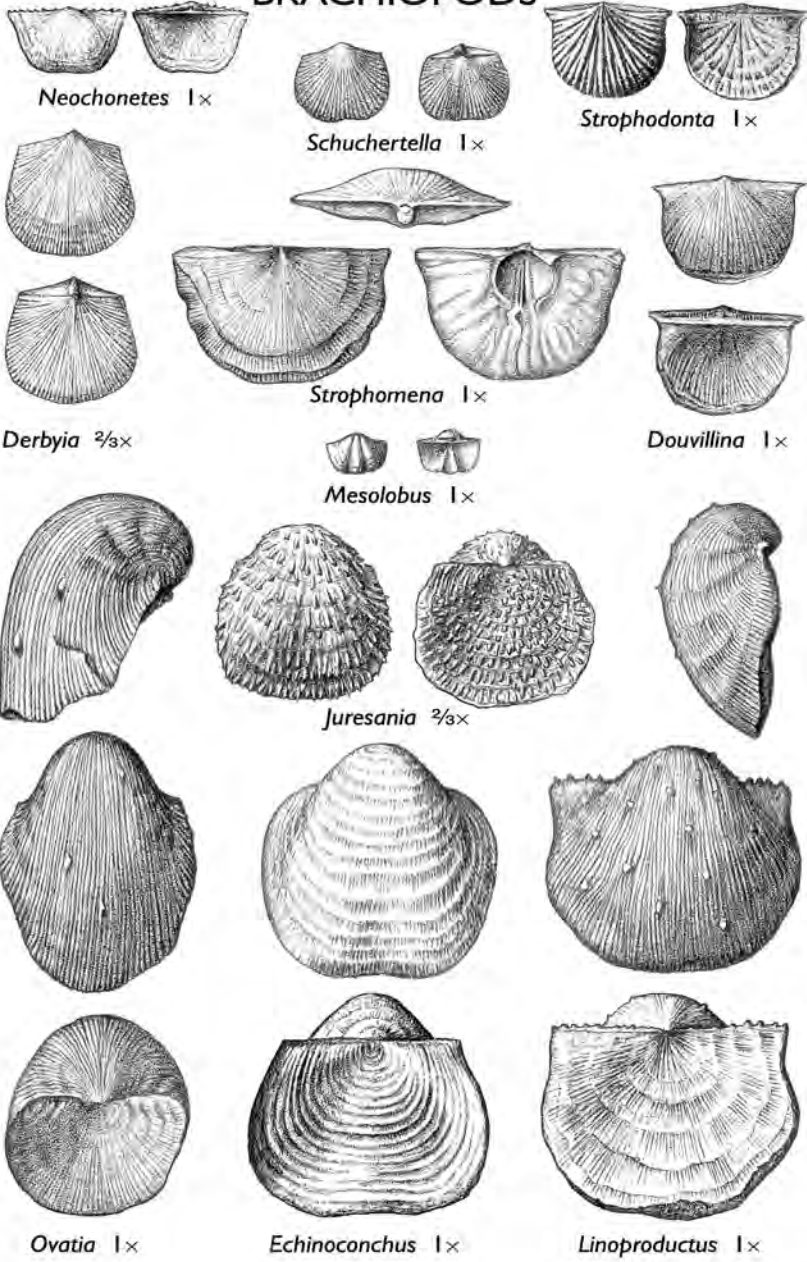


Plate 7

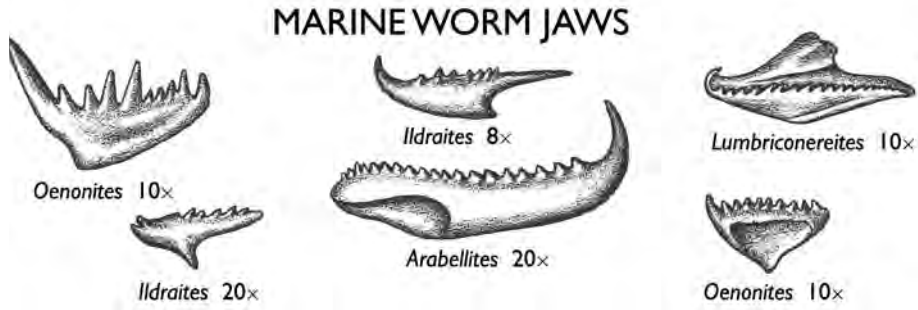
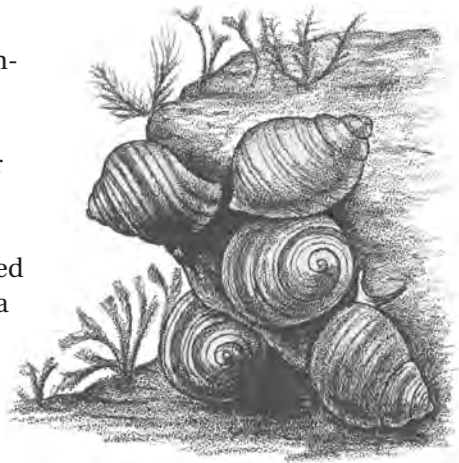


Plate 8

**Marine Worm Jaws** Marine worm jaws (plate 8) are easily preserved and are known in nearly every system. Most are composed of chitin (finger-nail material). They are black and shiny, and have many teeth. Sea worms live today, and the fossil record of worm trails goes back to Precambrian time. The oldest worm jaws are found in Ordovician rocks, but they are most common in the Silurian rocks of northeastern Illinois. Most are so small that they can only be identified with a magnifying glass.

**Gastropods** Gastropods (gas'-troh-pods; plate 9) commonly are called snails. The snail carries its shell on its back and retreats into it whenever danger threatens. As a snail grows larger, the shell expands and lengthens. Most commonly the shell is coiled in a spiral, but some are shaped like a Chinese coolie hat.



Modern marine gastropods

There are many kinds of gastropods. Some live in the sea, some live in rivers, and still others live on land. The ones that live in water have gills like fish, but those that breathe air have simple lungs. Gastropods have a distinct head, feelers, eyes, and a mouth. Some of the snails have a rasp-like tongue and may use it for boring into other shellfish, which they eat.

# GASTROPODS

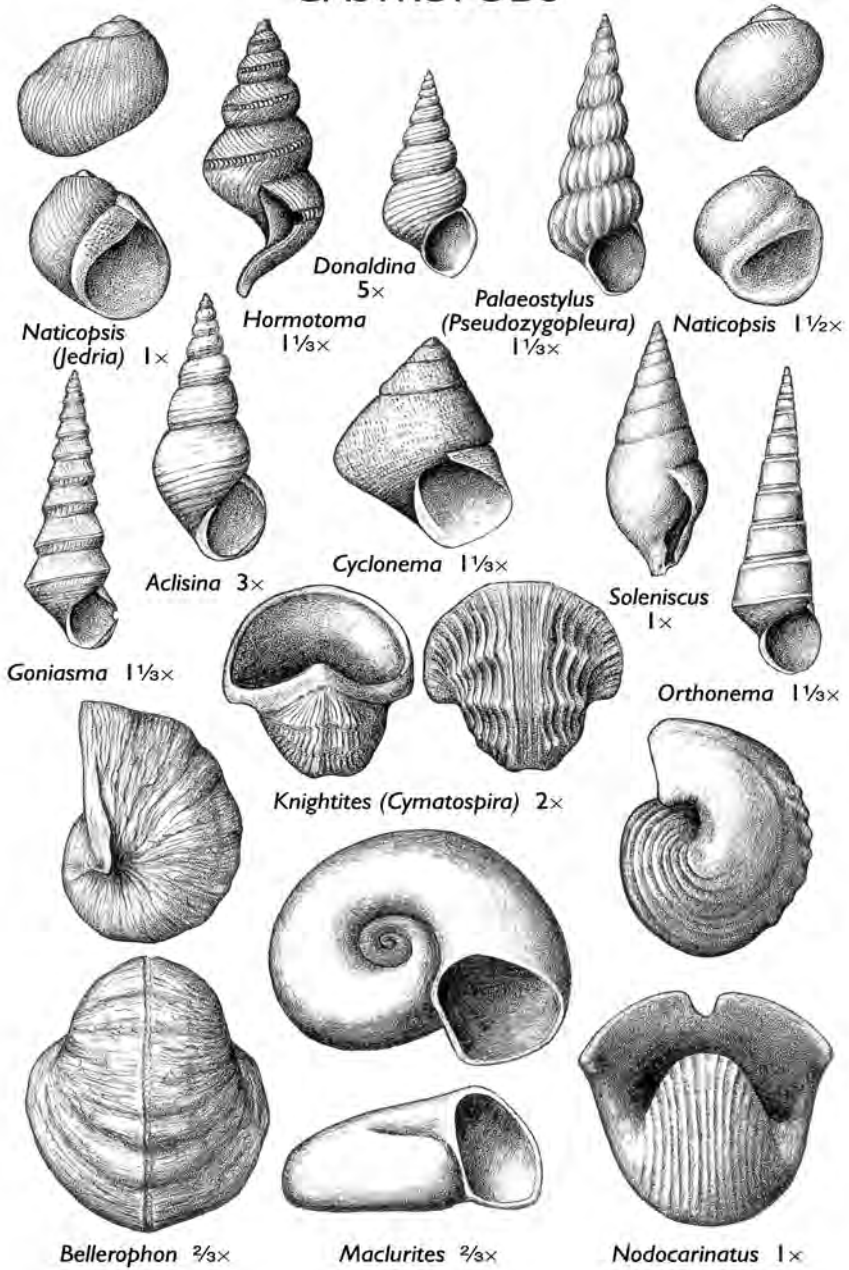


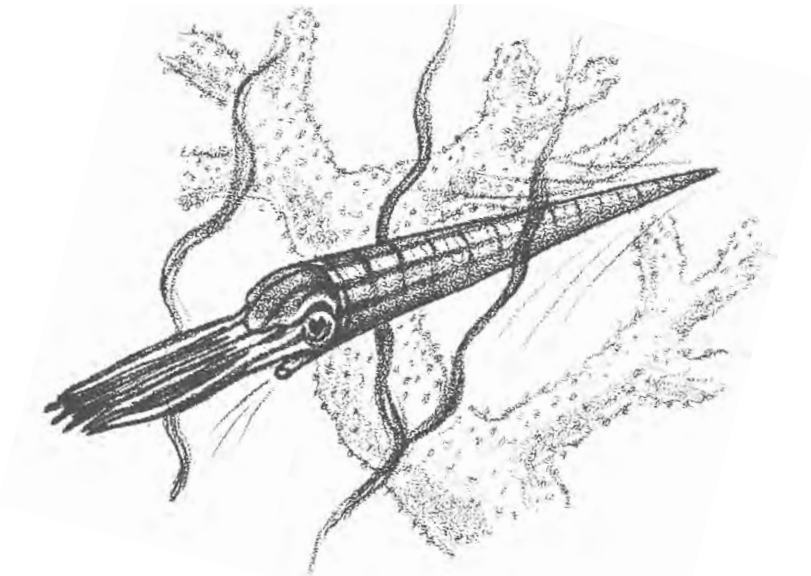
Plate 9

Snails are common as fossils in the rocks of Ordovician and Pennsylvanian ages in Illinois. Those that lived during the Ice Age are abundant in the loess along the bluffs of the major rivers, and their shells may be recovered by washing the loess through a coarse screen. The oldest snails lived during the Cambrian Period, more than 490 million years ago.

**Cephalopods** Fossils of cephalopods (sef'-al-oh-pods; plates 10 and 11) have been found in rocks of many ages, and numerous representatives are alive today. Squids, octopuses, cuttlefish, and the chambered nautilus are among the cephalopods living in modern seas.

Cephalopods are the most advanced of all animals without backbones. They have a highly developed nervous system and have eyes much like those of humans.

The cephalopod's mouth is surrounded by long tentacles commonly armed with suckers. Beneath the tentacles is a tube through which the animal can force a jet of water and thus move about by jet propulsion.



Straight Ordovician cephalopod

## CEPHALOPODS



*Protoceras* 1x



*Temnocheilus* 1/3x



*Lytoceras* 1/3x



*Gastrioceras* 1x



*Eoasianites* 1x



*Jolietoceras* 1/3x



*Characteroceras* 1/4x



*Lechritrochoceras* 2/3x



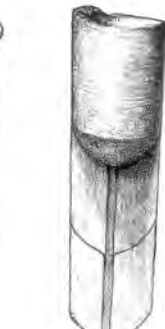
*Ascoceras* 2x



*Dawsonoceras* 1/3x



*Metacoceras* 1/3x



*Michelinoceras* 1/3x

# CEPHALOPODS



*Schistoceras* 1x



*Muensteroceras* 1x



*Imitoceras* 1x



*Endolobus*  $\frac{2}{3}x$



*Tetrameroceras*  $\frac{1}{2}x$



*Brachycycloceras* 1x



*Austinoceras*  
 $\frac{1}{3}x$



*Pseudorthoceras*  
1x



*Mooreoceras* 2x



*Westonoceras*  
 $\frac{1}{3}x$

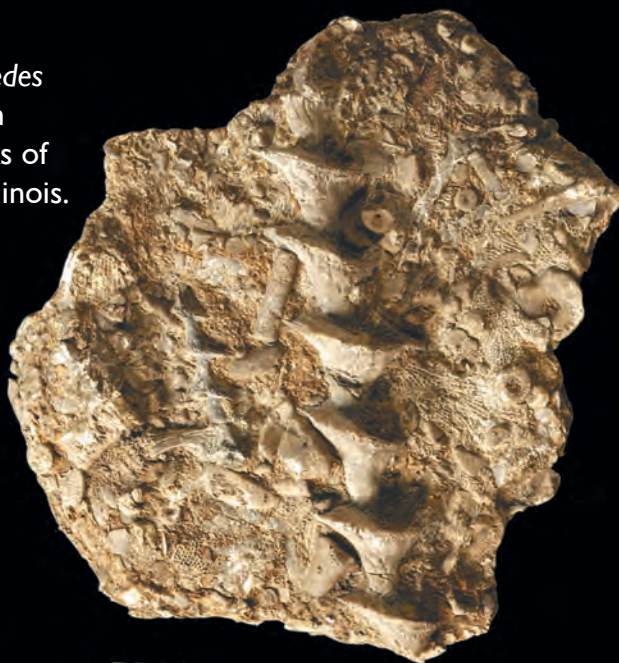


*Actinoceras*  
 $\frac{1}{2}x$



*Endoceras*  $\frac{1}{3}x$

Byozoan *Archimedes*  
columella from  
Mississippian rocks of  
Hancock County, Illinois.



Mississippian bryozoan fronds from Monroe County, Illinois.

Plate A





*Platystrophia*, an Ordovician brachiopod from Will County, Illinois.



*Neospirifer*, a Pennsylvanian brachiopod from Peoria County, Illinois.



Pennsylvanian brachiopods and bryozoa from Will County, Illinois.



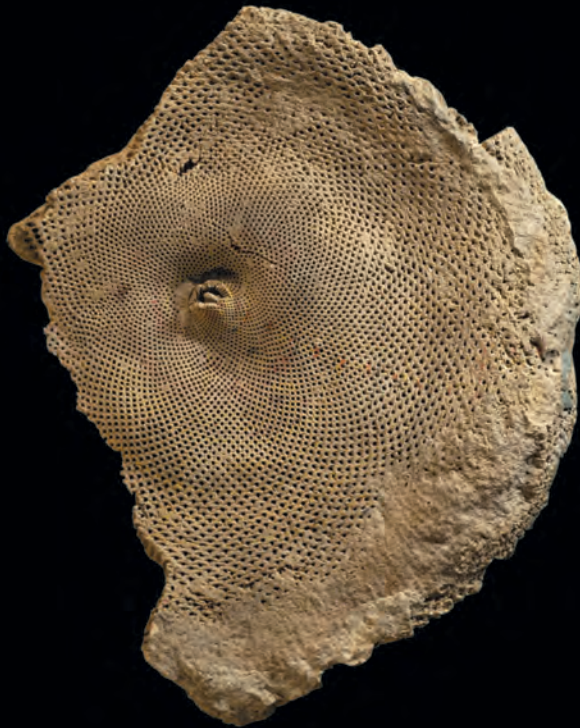
*Composita*, a Pennsylvanian brachiopod from Edgar County, Illinois.



*Stellarocrinus*, (top) and  
*Brabeocrinus* (bottom),  
Pennsylvanian crinoids  
showing stems and  
calyxes, from  
Livingston County,  
Illinois.



*Ischadites*, a sponge-like animal from the Ordovician rocks of northern Illinois.



*Receptaculites*, common in Ordovician rocks of northwestern Illinois; possibly an algal colony.



*Hexagonaria*, a colonial coral  
from Devonian rocks of western Illinois.



*Halysites*, the Silurian chain coral, from northwestern Kentucky.



Foliage from a seed fern that grew in a coal swamp,  
from Johnson County, Illinois.



*Knightoceras*, a coiled cephalopod from  
the Mississippian rocks of Scott County, Illinois.



*Trepospira*,  
a marine gastropod  
from the Pennsylvanian  
from Sangamon County,  
Illinois.



*Euomphalus*, marine gastropods from Mississippian rocks  
of Randolph County, Illinois.



Top and side views of *Pentremites* from the Mississippian rocks of Randolph County, Illinois.

Plate H



Modern coiled cephalopod

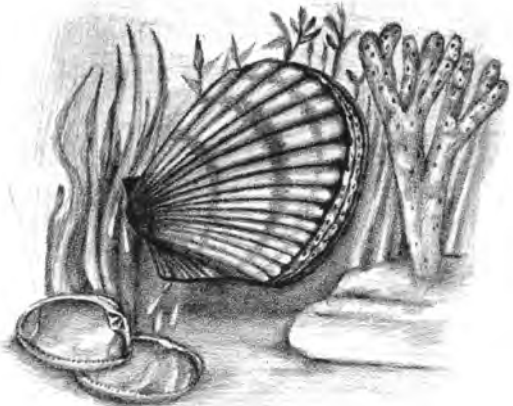
Coiled cephalopods live today only in the South Pacific, but in the geologic past they were found scattered throughout the world. Modern squids live in shallow coastal waters over much of the globe.

Most of the cephalopods we find as fossils had a calcareous outer shell. Some were loosely coiled, some

were tightly coiled, and others were shaped like a tapered tube. As the shelled forms grew, they periodically made new and larger shell chambers to fit their bodies and sealed off the old part of their shells with a wall of pearly calcareous material—hence, the name “chambered nautilus.”

During the Ordovician Period, about 460 million years ago, some straight cephalopods grew to be as long as 19 feet, although most were much shorter. Straight cephalopods were common in Ordovician and Silurian times; coiled ones became fairly common only by later Paleozoic times. We find both kinds in Pennsylvanian rocks in Illinois.

**Pelecypods** Pelecypods (peh-les'-i-pods; plates 12 and 13) include oysters, clams, mussels, and cockles. They have been found in some of the oldest marine rocks known and still are very numerous in the seas and rivers today. In the past, some pearl buttons were made from clam shells from the Illinois and Mississippi Rivers. This major industry caused near extinction of some species.



A modern pelecypod



# PELECYPODS

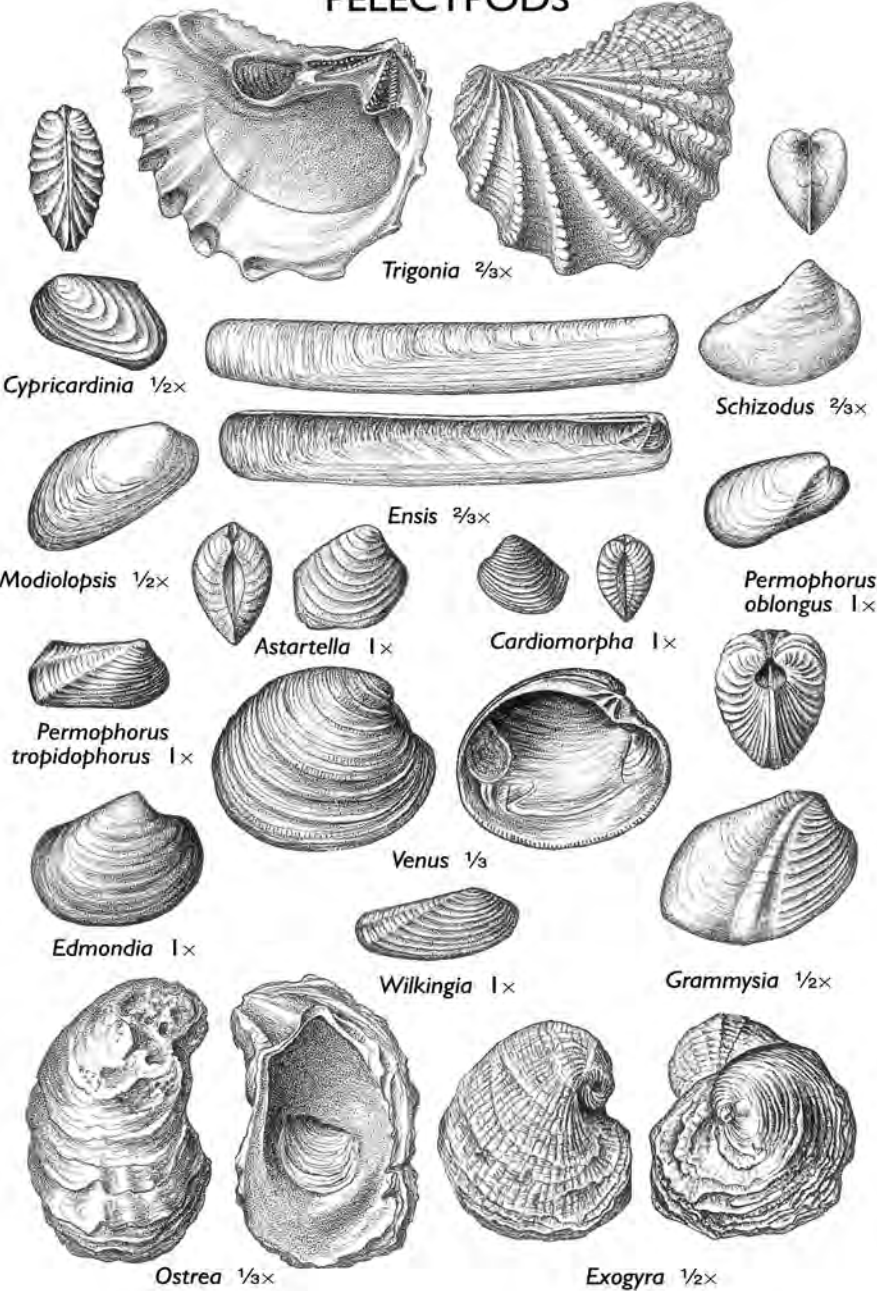


Plate 12

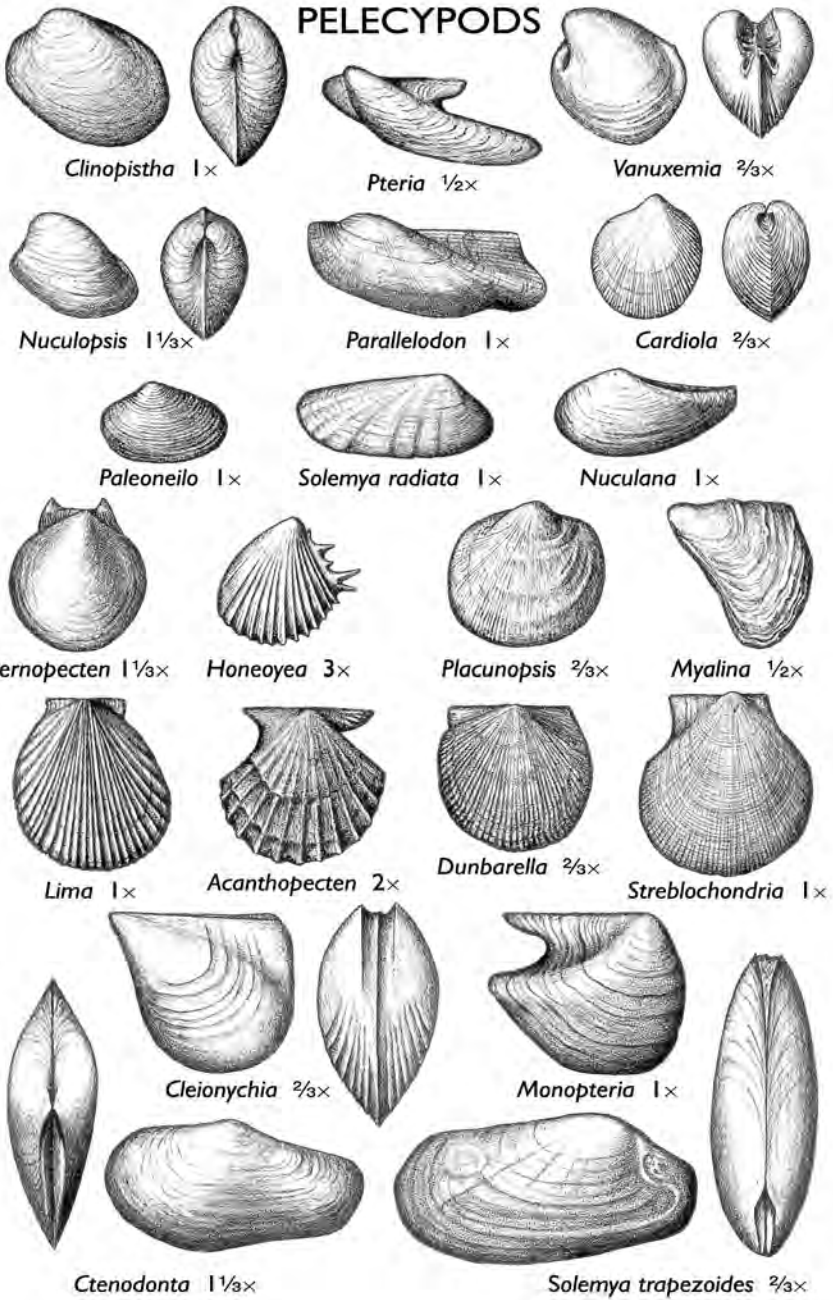


Plate 13

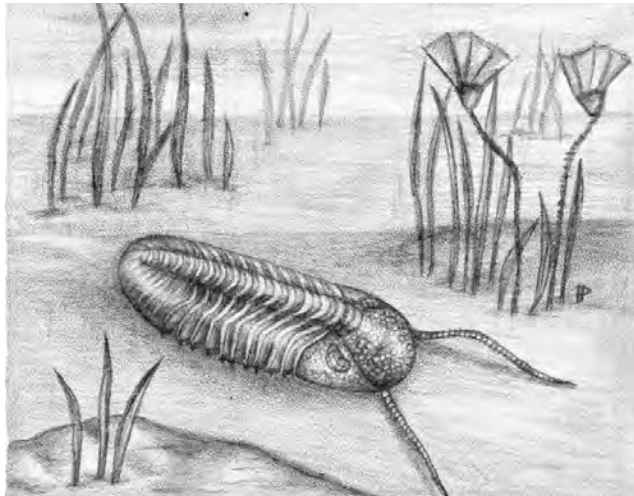
Most pelecypods, also known as bivalves, have two shells that are mirror images of each other, one on the right and one on the left. Each shell has a beak that points forward and represents the spot where the shell began to grow. The top edge of each shell commonly has several teeth and sockets that fit into those of the opposite shell to make a hinge. The outside of the shell generally is ornamented by ribs, spines, and growth lines.

Most pelecypods form shell banks in the seas or rivers on sand and mud flats. Many burrow into the mud or sand and even into wood or rock. Some oysters attach themselves to rocks, and others creep about the sea floor by means of a hatchet-shaped foot thrust between the open valves. A few (scallops) move by jet propulsion, forcing water in a jet stream from openings at the beak end.

Fossil clams are common in some Pennsylvanian rock formations in central Illinois and in some Ordovician limestones in northern and western Illinois.

**Trilobites** Trilobites (try'-low-bites; plates 14 and 15) have been extinct for about 250 million years. They commonly are preserved in great detail and are prized as fossils. Two grooves extending down the back of the animal divide it into three lobes; hence, the name "trilobite."

Trilobites had a head with eyes and a mouth, a jointed body, and a tail. The animals were cousins of crabs and lobsters and lived in the sea.



A Devonian trilobite

# TRILOBITES



*Encrinurus* 1 1/3x



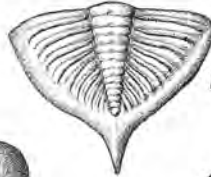
*Sphaerexochus* 1x



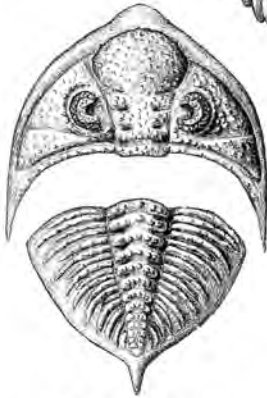
*Bumastus* 2/3x



*Fragiscutum* 1 1/3x



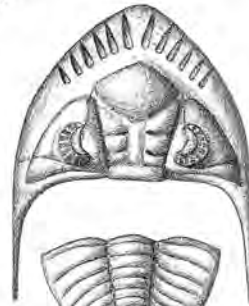
*Dalmanites* 1x



*Dalmanites* 2/3x



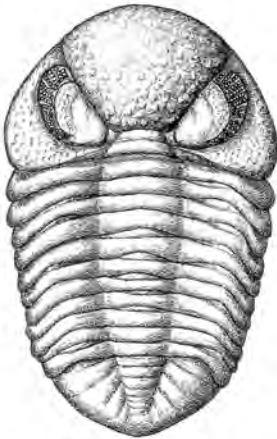
*Sphaerocoryphe* 3x



*Odontocephalus* 1x



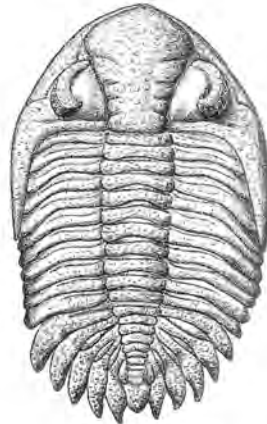
*Arctinurus* 2/3x



*Phacops* 1 1/3x



*Calymene* 1 1/3x

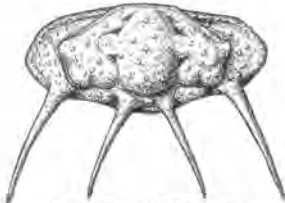


*Greenops* 2x

# TRILOBITES



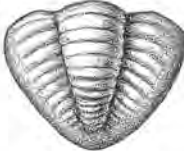
*Isotelus* 1/3x



*Ceratocephala* 2/3x



*Sevilla* 1 1/2x



*Flexicalymene* 1x



*Ditomopyge* 1 1/3x



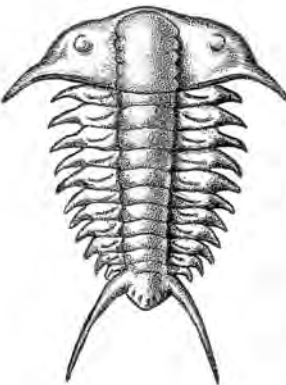
*Illaenus* 1x



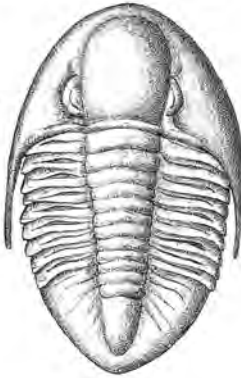
*Phillipsia* 1 1/3x



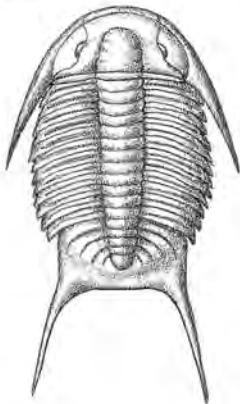
*Ameura* 1 1/3x



*Ceraurus* 1x



*Bathyrurus* 1 1/3x



*Crepicephalus* 1x

They were covered with a horny armor, jointed so that the animal could move. Trilobites shed their armor much as snakes shed their skins, so each animal could have provided several fossils.

Trilobites were abundant in Cambrian, Ordovician, and Silurian times and were among the most important animals then on Earth. They became extinct during Permian time.

Trilobites can be found in northeastern Illinois as well as the western part of the state.

**Ostracodes** Ostracodes (aws'-trah-cods; plate 16) are very small animals that are common as fossils but are rarely large enough to be seen by the naked eye.

Ostracodes have been present on Earth since the early part of the Ordovician Period and occur today in great numbers in lakes, rivers, and seas. Ostracodes prefer shallow water and live in vast hordes, crawling over the bottom or swimming near the surface.

Ostracodes have two shells, one on each side of the body, so that some look much like small clams. But the animal inside looks much like a shrimp or an insect with jointed legs and feelers. As the animal grows, it sheds its shells and forms a new pair. The shells may be smooth or ornamented with pits, bumps, ribs, or spines.



Plate 16

**Echinoderms** Echinoderms (e-ky'-no-derms; plate 17) are sea bottom animals that have external calcite skeletons. Echinoderms have a fivefold symmetry and an internal fluid-filled system that supports respiration, movement, and feeding. A special characteristic of some is their use of tube feet. The best known echinoderm fossils are the cystoids, blastoids, and crinoids, which are favorites among collectors.

Well known, but not common in the central United States, are starfish (asteroids) and sea urchins (echinoids). These animals arose during Ordovician time, about 490 million years ago, and continue to the present. Common in southern states, their fossils are found in many collections.

Brittle stars (ophiuroids), paracrinoids, and edrioasteroids are not common. Brittle stars appeared during the Ordovician and continued into the Mississippian. Paracrinoids are confined to Middle Ordovician rocks. Edrioasteroids appeared in the Cambrian and continued into the Mississippian.

**Cystoids** Cystoids (sis'-toids; plate 17) are related to the crinoids and blastoids but are more primitive than either. The body, or calyx, is not nearly so well developed, and the arms are irregular and rarely preserved. The body plates are quite irregular in arrangement.

The cystoids lived from the Ordovician Period, 490 million years ago, until the latter part of the Devonian Period, about 370 million years ago.

Many cystoids found in Illinois come from quarries in Silurian rocks of the Chicago region and in the Mississippi River bluffs of northwestern Illinois.

**Blastoids** Blastoid (blas'-toyd; plate 18) fossils commonly are called "sea buds." They are closely related to crinoids but differed in that, instead of arms, blastoids had long hair-like brachioles that swept food into the mouth. The delicate brachioles rarely were preserved.

Like crinoids, blastoids had a mouth at the top of the body (calyx) surrounded by small round holes that conducted food particles into and wastes out of the body.

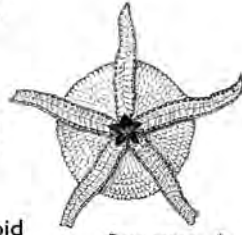
### ECHINODERMS



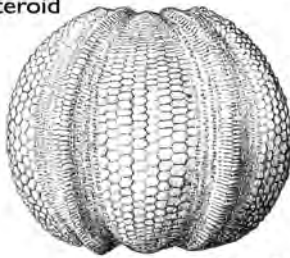
*Agelacrinites* 7x  
- edrioasteroid



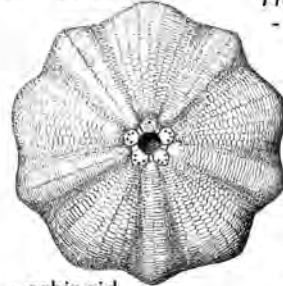
*Comarocystites* 2/3x - paracrinoïd



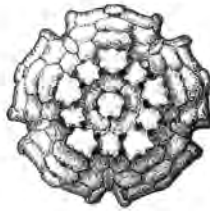
*Protaster* 4x  
- ophiuroïd



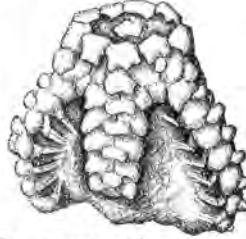
*Melonechinus* 2/3x - echinoïd



*Lepadocystis* 1 1/3x



*Calliasterella* 2x - asteroid



*Holocystites* 2/3x

### CYSTOIDS



*Echinosphaerites* 2/3x



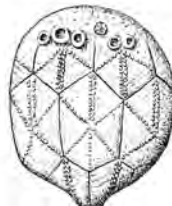
*Coelocystis* 2/3x



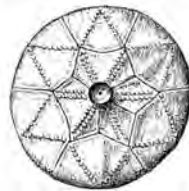
*Gomphocystites* 2/3x



*Sphaerocystites* 1 1/3x



*Caryocrinites* 2/3x

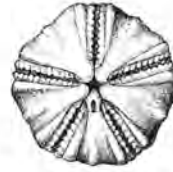




# BLASTOIDS



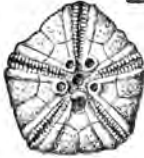
*Orophocrinus* 2x



*Schizoblastus* 1x

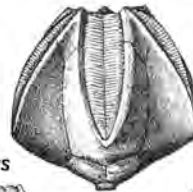
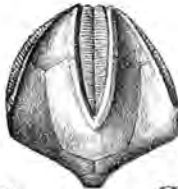


*Pyramiblastus* 2x

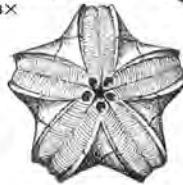


*Globoblastus* 2x

*Phaenoschisma* 4x

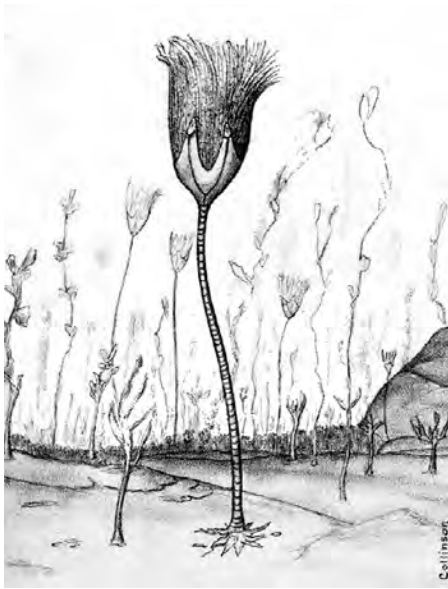


*Pentremites elongatus*  
1 1/3x



*Pentremites godoni* 1 1/2x

*Pentremites sulcatus* 2/3x

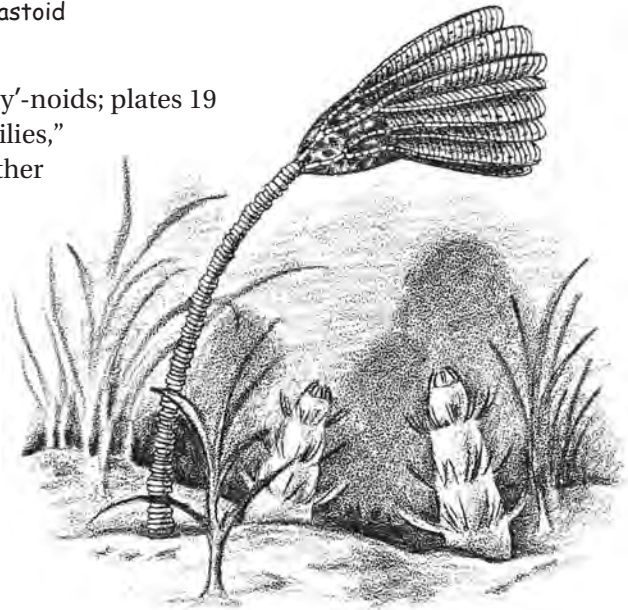


Mississippian blastoid

The oldest blastoids, found in Silurian rocks, lived about 425 million years ago. The animals survived until the Permian Period, about 260 million years ago, when they became extinct.

Blastoids are beautiful fossils that look much like small hickory nuts. They most commonly are found in the river cliffs and stream banks of western and southwestern Illinois, especially in Randolph County, and in southern Illinois near the Ohio River.

**Crinoids** Crinoids (cry'-noids; plates 19 and 20) are called “sea lilies,” but they are animals rather than plants. They look like plants, however, because the body skeleton or calyx generally is on the end of a stem made of button-like discs and held on the sea floor by either a stony anchor or root-like arms. The mouth, on top of the body, is surrounded by arms that sweep food into it. The body is made of calcareous plates that fit together like irregular bricks.



Ordovician crinoid

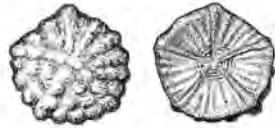
# CRINOIDS



*Talarocrinus* 1x



*Pisocrinus* 1x



*Ethelocrinus* 2/3x



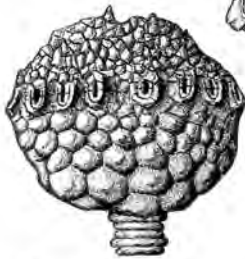
*Clathrocrinus* 1 1/2x



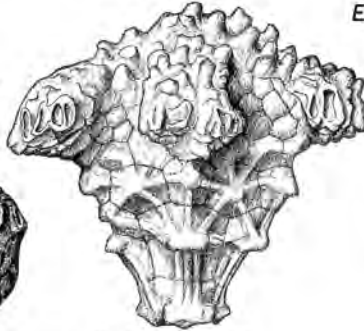
crinoid columnals



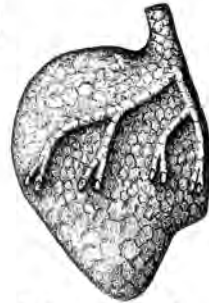
*Eucalyptocrinites* 2/3x



*Megistocrinus* 1x



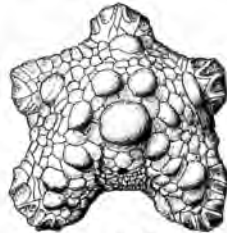
*Actinocrinus* 2/3x



*Siphonocrinus* 1x



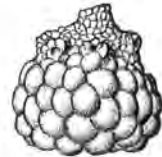
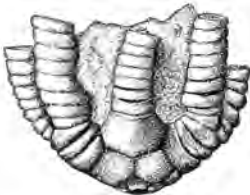
*Barycrinus* 2/3x



*Agaricocrinus* 2/3x



*Rhodocrinites* 2/3x



# CRINOIDS

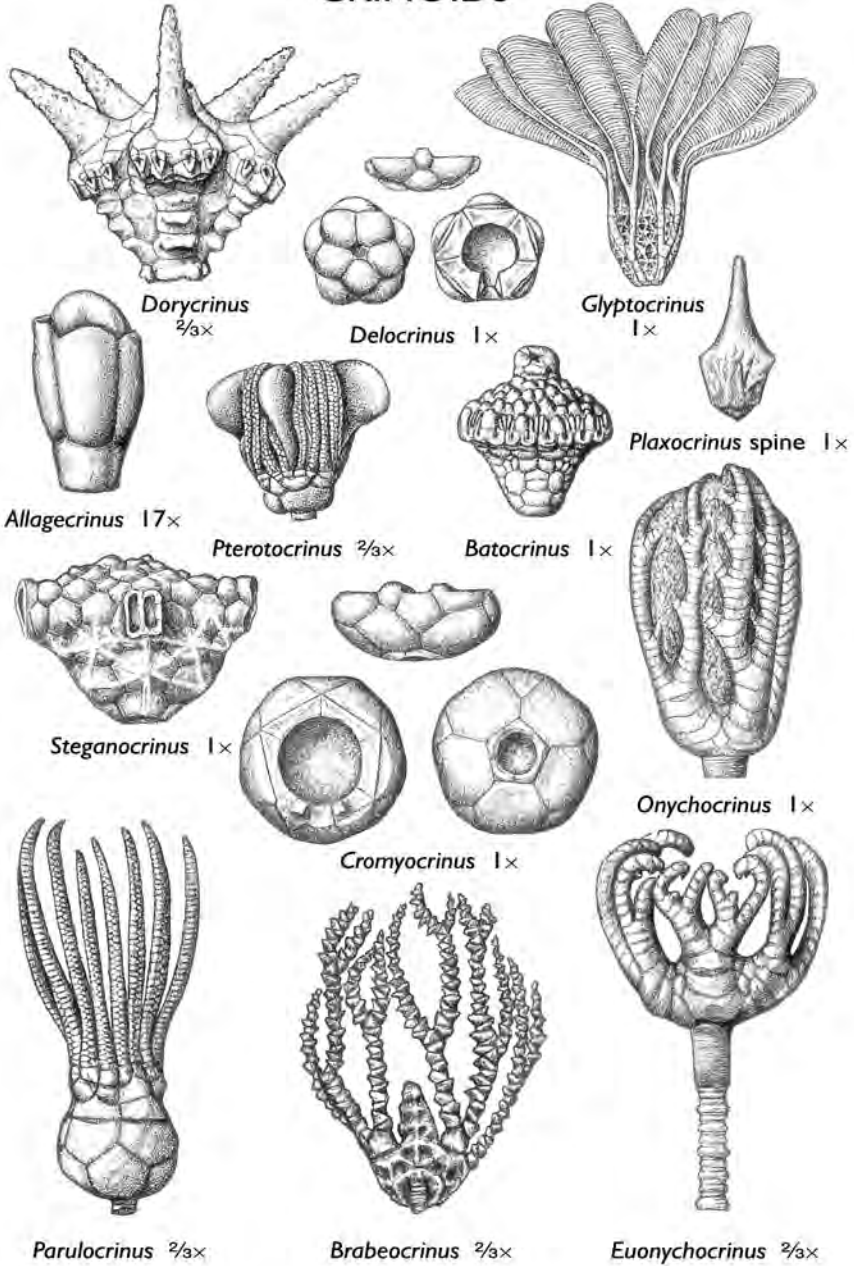


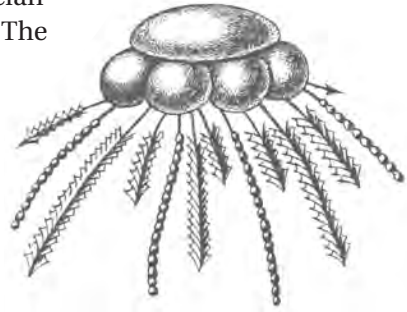
Plate 20

When the animal dies, the plates and discs tend to fall apart and sink to the sea floor. Crinoid stems or stem discs are common throughout most of Illinois, and their popular names include “Indian beads” or “fish bones.” Many of the limestone beds in Illinois are composed mostly of crinoid plates and discs. The complete calyx is a highly prized fossil. Well-preserved specimens are found in the limestone cliffs along the Mississippi River between Burlington and Alton.

The oldest crinoids come from Ordovician rocks. Some crinoids live today, mainly in deep parts of the ocean, but they are not nearly as common as in the past.

**Graptolites** Graptolites (grap'-toe-lites) were a very simple kind of marine animal that appeared in the Cambrian Period. They became abundant in Ordovician and Silurian times but gradually died out. The last ones lived during the Mississippian Period.

The animals lived in tiny chitinous cups arranged along slender stems. In some forms, the stem was attached to a round float, and, in others, two, three, or four stems were attached together. Most graptolites floated free in the oceans.

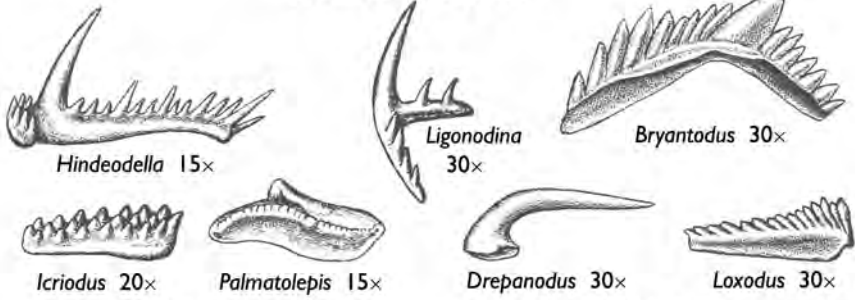


Ordovician graptolite colony

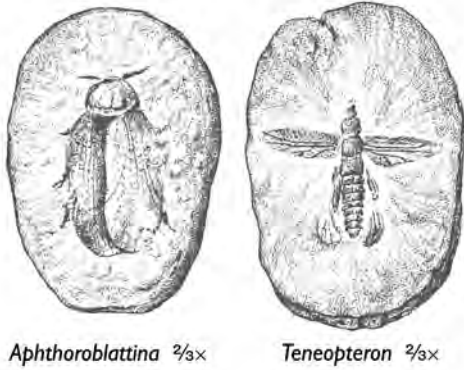
As fossils, they look like little black lines with sawtooth edges. They are found mainly in shales but also occur in limestones. In Illinois, they are most common in the Ordovician rocks of the northern part of the state.

**Conodonts** Conodonts (ko'-no-dahnts; plate 21) are small calcium phosphate fossils that are barely visible to the naked eye. They occur throughout Illinois, ranging from Cambrian through Pennsylvanian rocks. In other areas they continue through the Triassic. Reworked by erosion and by continental glaciers, they also are found in Ice Age sediments.

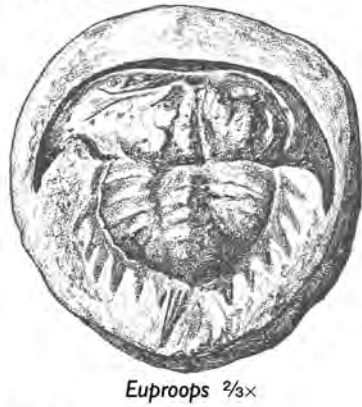
### CONODONTS



### INSECTS



### HORSESHOE CRAB



### VERTEBRATE FOSSILS

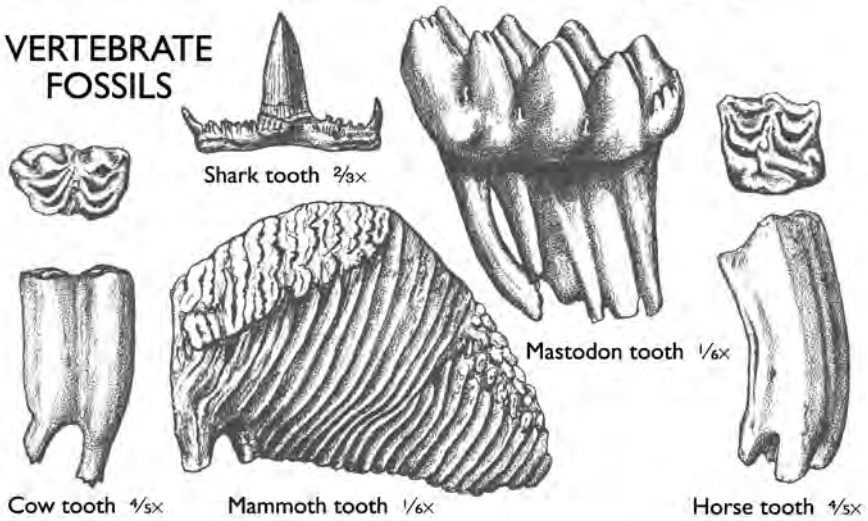
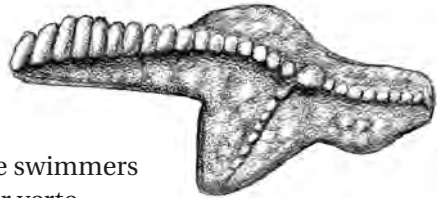


Plate 21

Abundantly distributed worldwide in marine sediments, conodonts are valuable because they help geologists correlate the age of rock formations from region to region and continent to continent.

The conodont-bearing animal, about which little is known, commonly contained multiple conodont elements, providing a number of fossils per individual.

Evidence indicates that conodonts were swimmers and may have been precursors of higher vertebrate life.



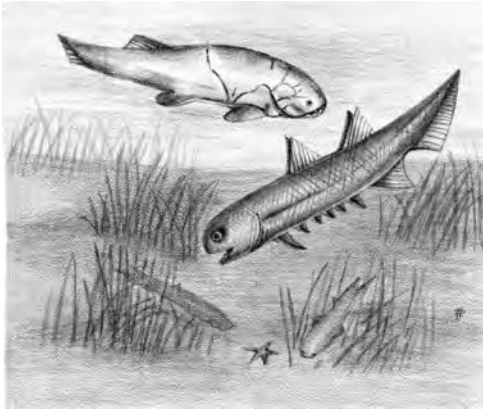
Devonian conodont

**Insects** Insects (plate 21) are among the rarest of fossils, yet more than 130 different kinds have been described from Coal Age rocks of Illinois. Nearly all came from the Mazon Creek–Braidwood area in Will and Grundy Counties where they are found preserved in ironstone nodules along with well-known plant fossils. Even through a fairly large number of fossil insects have been collected, it is necessary to examine thousands of concretions in order to have a chance of finding a single specimen.

Most of the fossils have no modern counterparts, but such familiar things as dragonflies, damselflies, and cockroaches are found. Many were giants of their race. The insects were of the kind that would be expected in a swamp growing near a low-lying seashore, and they probably lived among the plants that furnished woody material for the coal beds that were formerly mined.

**Horseshoe Crabs** Many kinds of fossils other than plants and insects are found in the Mazon Creek–Braidwood area of Illinois, and among them are the horseshoe crabs (plate 21). These marine animals were much like their present-day relatives and must have lived in shallow seas just offshore from Coal Age forests. A relatively few specimens have been found in Illinois. All are of Pennsylvanian age and came from the Mazon Creek area.

**Vertebrate Fossils** Animals with backbones are called vertebrates (plate 21). They include reptiles, amphibians, fish, birds, and mammals.



Devonian fish

The Paleozoic vertebrate fossils are fish teeth, scales, and bony plates, a few lizards, and amphibians. The Quaternary vertebrates included many formerly common but now extinct animals, such as mammoths and mastodons. Many forms still live in this region, such as horses, cattle, deer, and humans.

**Plant Fossils** Of all the fossils that have been found in Illinois, perhaps none are more famous than the fossil leaves and other plant remains from the world-renowned Mazon Creek–Braidwood area in northeastern Illinois (plate 22; see map on page 44). Fossil hunting is restricted, but permits can

In many western states, vertebrate fossils, such as skeletons of dinosaurs, camels, and saber-toothed tigers, are common in Mesozoic and Cenozoic rocks (see the Geologic Time Chart, pages 2 and 3).

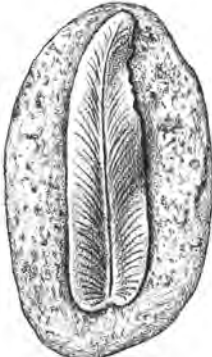
Most of the Mesozoic and Cenozoic rocks (except Quaternary) in Illinois have been removed by erosion. As a result, the vertebrate fossils found in our state are restricted mainly to Paleozoic and Quaternary rocks.



*Medullosa*, a Pennsylvanian seed fern



PLANTS



*Neuropteris* 2/5x



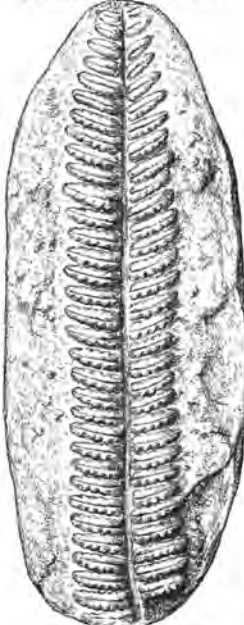
*Noëopteris stem* 2/3x



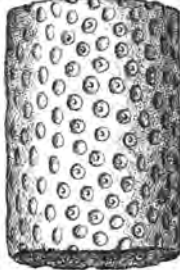
*Neuropteris* 1/2x



*Lepidodendron* 2/5x



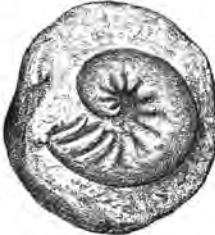
*Pecopteris* 2/3x



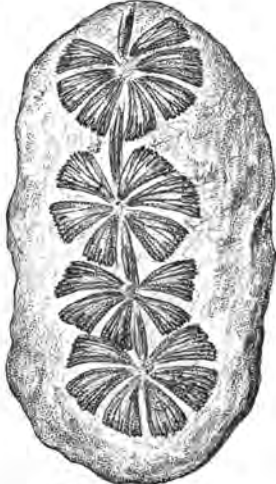
*Stigmaria* 2/5x



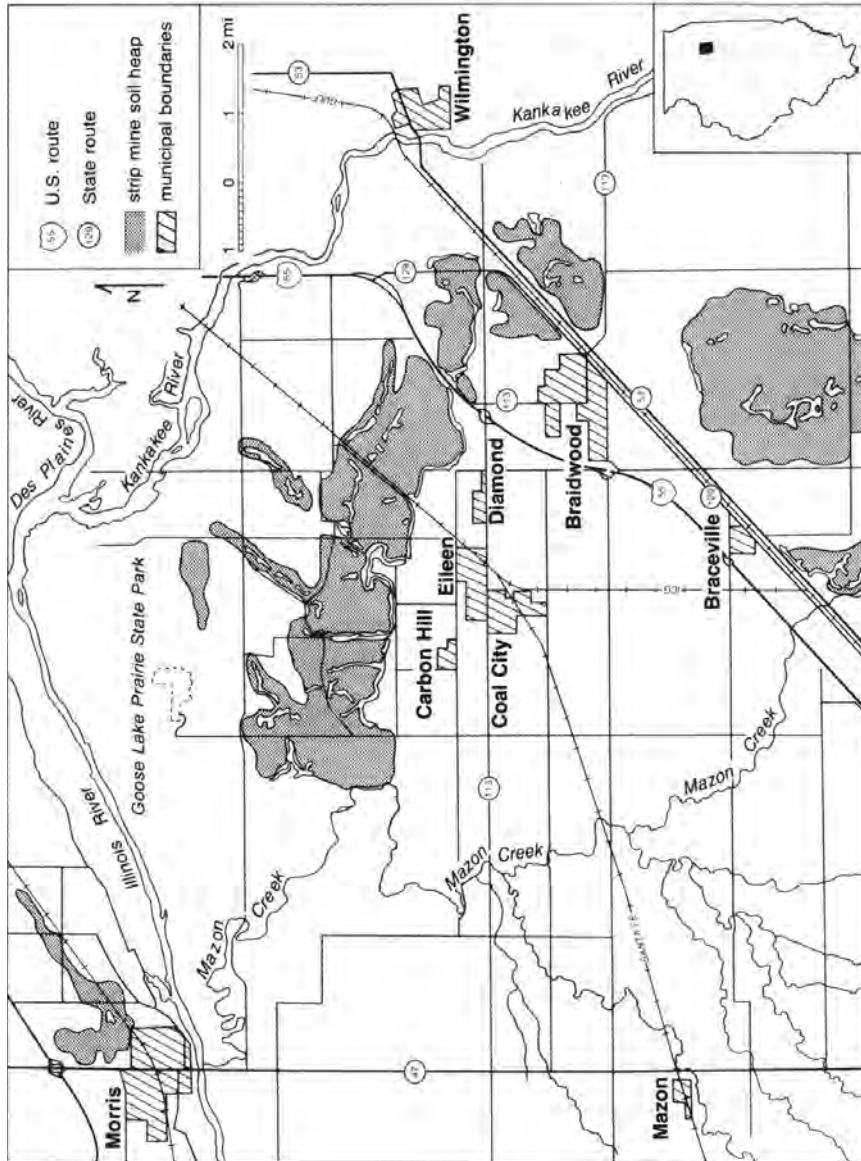
*Annularia* 2/3x



*Spiropteris* 2/3x



*Sphenophyllum* 1x



Map of the Mazon Creek Area

be requested from Mazonia Fossil Permit Office, P.O. Box 126, Braceville, IL 60407 or by calling the office at the Mazonia-Braidwood State Fish and Wildlife Area (815) 237-0063. In this area, which lies in Grundy and Will Counties, ironstone nodules containing plant remains are found in waste piles of strip and underground mines and at places along Mazon Creek.

The plant fossils are remains of fast-growing ferns and trees. In the jungle-like growth, the most common plants were huge ferns that had fronds 5 or 6 feet long and grew to a height of more than 50 feet. Along with them were seed ferns, now extinct, and giant scouring rushes, descendants of which are the small horsetail rushes that live today along our wooded streams. Scouring rushes can be recognized by their jointed trunks and the leaf whorls, common in the Mazon Creek nodules. *Neuropteris* and *Pecopteris* are from the seed ferns; *Annularia* is from the rushes. Herbs such as *Sphenophyllum* formed much of the undergrowth.

The most imposing plants of the Coal Age forests were the scale trees, which grew to heights of 100 feet or more. Close-set leaves grew on their trunks and limbs, and when the leaves fell off, they left rows of scars that are the identifying marks for the trees. Diagonal rows of scars identify *Lepidodendron*, and vertical rows identify *Sigillaria* (not shown).

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## Books About Fossils

- Arduini, P., and G. Teruzzi, 1986, Fossils: New York, Simon and Schuster, 321 p.**  
This comprehensive guide to fossils contains 260 color plates and fossil descriptions.
- Armstrong, C., and P. Armstrong, 1962, Trilobites of the Chicago Region: Naperville, Illinois, private publication, 59 p.**  
Illustrated guide identifies Chicago-area trilobites and the quarries where they are found.
- Baker, F.C., 1934, Fieldbook of Illinois Land Snails: Champaign, Illinois, Illinois Natural History Survey, Manual 2, 166 p.**  
This well-illustrated book identifies modern and Ice Age snails.
- Carpenter, F.M., A. Petrunkevitch, and E.N. Kjellesvig-Waering, 1979, Coal Age Fossils from Mazon Creek: Springfield, Illinois, Illinois State Museum, 48 p., 8 pls.**  
Fossil insects, spiders, horseshoe crabs, and eurypterids from northern Illinois are described.
- Case, G.R., 1982, A Pictorial Guide to Fossils: New York, Van Nostrand Reinhold Company, 514 p.**  
More than 1,300 photos and drawings illustrate this relatively advanced survey of the fossil world. Major emphasis is on animals with backbones.
- Daeschler, T., 1988, Fossils—Fossil Collecting Explained: Philadelphia, Running Press, 95 p.**  
This introduction for beginners explains evolution and the fossil record, how fossils are formed, what information is yielded by fossils, and how to collect fossils. A plastic viewing box on the cover contains several fossil fragments.
- Feldman, R.M. (ed.), 1996, Fossils of Ohio: Columbus, Ohio, Ohio Division of Geological Survey, Bulletin 70, 577 p.**  
A profusely illustrated series of chapters, written by twenty-three paleontological experts, covers in detail most fossil groups.
- Fortey, R., 2000, Trilobite! Eye Witness to Evolution: New York, Alfred A. Knopf, 284 p.**  
This book presents a popular history of trilobites from the Cambrian to the Permian time.
- Greb, S.F., 1988, Progression of Life: Lexington, Kentucky, Kentucky Geological Survey, poster.**  
A colorful poster featuring 150 animals and plants from the Earth's past.
- Greb, S.F., 1989, Guide to "Progression of Life," with Notes on the History of Life in Kentucky: Lexington, Kentucky, Kentucky Geological Survey, Special Publication 13 (Series XI), 44 p.**  
This booklet, written as a companion to the poster, contains photographs of common fossils in Kentucky and illustrations of the animals from which the fossils came. The booklet also contains illustrations that recreate what Kentucky looked like at various times in the past.

**Janssen, R.E., 1979, Leaves and Stems of Fossil Plants from Fossil Forests: Springfield, Illinois, Illinois State Museum, 140 p.**

Fossil plants from the Mazon Creek area of northern Illinois are described and illustrated in this publication.

**Jennings, J.R., 1990, Guide to Pennsylvanian Fossil Plants of Illinois: Illinois State Geological Survey, Educational Series 13, 75 p.**

This handsomely illustrated guide to Coal Age plant fossils found the world over provides current information on classification, identification, relationships of whole plants to parts of plants, distributions of plants through time, and tips on where and how to collect these fossils. This book will be a basic reference for anyone interested in fossil plants. The venation diagrams are excellent.

**Langford, G., 1958, The Wilmington Coal Flora from a Pennsylvanian Deposit in Will County, Illinois: Downers Grove, Illinois, Esconi Associates, 360 p.**

Illustrated guide identifies Coal Age fossils from the Wilmington area in Will County, the source of the famous Mazon Creek plant nodules.

**Levi-Setti, R., 1993, Trilobites, Second Edition: Chicago, The University of Chicago Press, 342 p.**

This volume has superlative illustrations and detailed descriptions of the class Trilobita. The book is an authoritative, exquisite work that is useful at all levels of expertise.

**Matthews, W.H., III, 1970, Fossils: An Introduction to Prehistoric Life: New York, Barnes and Noble, 337 p.**

The origin, collection, and identification of fossils as well as the evolution of life and the concept of geologic time are topics of discussion in this volume. Appendixes include a glossary and lists of dealers, museums, and geological surveys.

**Murray, J.W. (ed.), 1985, Atlas of Invertebrate Fossils: New York, John Wiley and Sons, 241 p.**

Authoritative, advanced articles covering the major invertebrate fossil groups appear in this well-illustrated collection. Each article represents a detailed classification and morphology for a fossil group.

**Nitecki, M.H. (ed.), 1979, Mazon Creek Fossils: New York, Academic Press, 581 p.**

This major collection of articles covers everything you wanted to know about the Mazon Creek fossils.

**Ostrom, M.E., 1962, Fossil Collecting in Wisconsin: Madison, Wisconsin, Wisconsin Geological and Natural History Survey, Educational Series 3, 10 p.**

This guide to Wisconsin fossils is nontechnical and suitable for collectors of all ages.

**Perry, T.G., 1954, Fossils: Prehistoric Animals in Hoosier Rocks: Bloomington, Indiana, Indiana Geological Survey, Circular 7, 83 p.**

Beautifully illustrated survey of Indiana fossils includes a list of twenty collecting localities. The booklet is aimed at high school students and adults.

**Pine, R.M., 1976, Guide to Collecting Illinois Fossils, Volume 1, Northern Counties: location unknown, Educational Visuals (single-sided machine copies), 31 p.**

This detailed map guide identifies twenty-eight collecting localities in the northern-most twenty-four counties of Illinois.

**Rhodes, F.H.T., H.S. Zim, and P.R. Shafer, 1962, Fossils: A Guide to Prehistoric Life, Golden Nature Guide: New York, Golden Press, 160 p.**

Colorful, well-illustrated book introduces the topic to beginners and amateurs.

**Rich, P.V., T.H. Rich, M.A. Fenton, and C.L. Fenton, 1996, The Fossil Book: New York, Doubleday, 740 p.**

Superbly illustrated comprehensive guide covers the entire field of paleontology and paleobotany. The 1,500 drawings and photos, along with its expansive text, are international in scope. They come with identification keys, a glossary, listings of collections, and thirteen pages of references.

**Rose, J.N., 1967, Fossils and Rocks of Eastern Iowa: Iowa City, Iowa, Iowa State Geological Survey, Educational Series 1, 147 p.**

Collectors' field guide includes detailed descriptions of collecting sites and their rock sections. Eighteen plates of drawings are provided for identifications. A geologic map of Iowa is included in a pocket.

**Shabica, C.W., and A.A. Hay, 1997, Richardson's Guide to the Fossil Fauna of Mazon Creek: Chicago, Illinois, Northeastern Illinois University, 303 p.**

An excellent guide covering the wide spectrum of fossil animals found in the Mazon Creek area, including chapters on the geologic and paleoenvironmental setting. Although aimed at the professional, it provides the detailed information relished by many amateurs.

**Shaver, R.H., 1959, Adventures with Fossils: Bloomington, Indiana, Indiana Geological Survey, Circular 6, 52 p.**

In this attractive introduction to fossils and collecting, thirty-four collecting areas in Indiana and adjacent states are described in some detail.

**Thompson, I., T.P. Dickinson, and C. Nehring, 1982, The Audubon Society Field Guide to North American Fossils: New York, Alfred A. Knopf, 846 p.**

Photographic field guide contains 474 color identification photos, an identification guide, detailed descriptions of fossils, and maps to collecting localities.

**Unklesbay, A.G., 1955, Common Fossils of Missouri: Columbia, University of Missouri, Bulletin Handbook 4, 98 p.**

General survey introduces fossils and fossil collecting in Missouri.

