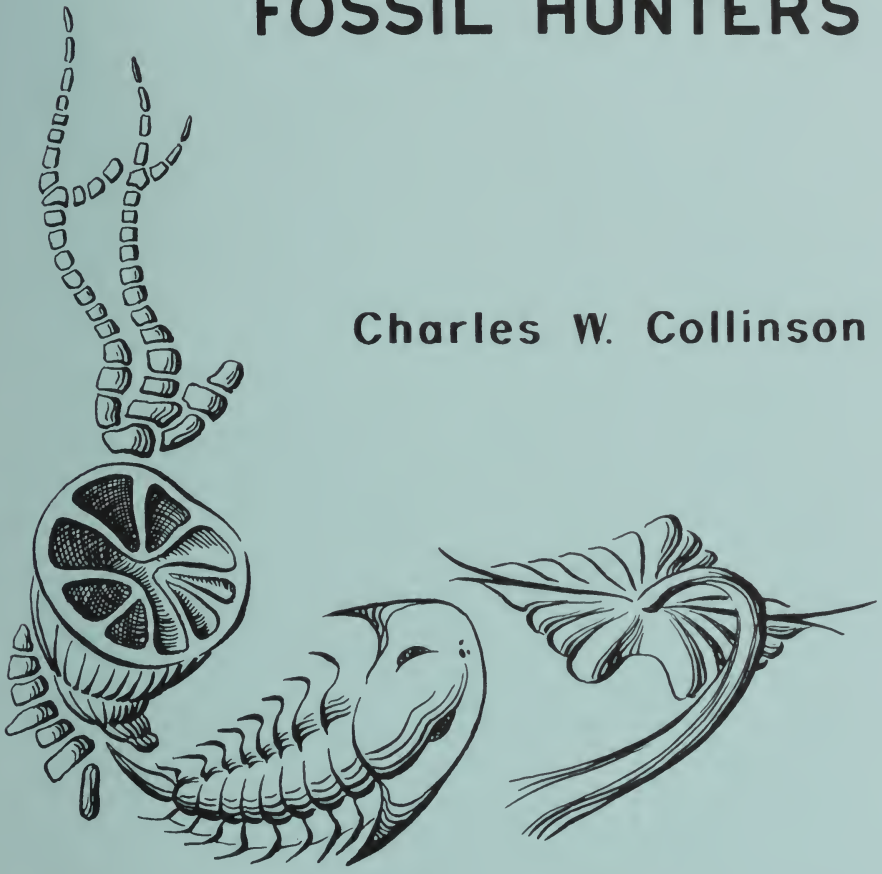
Educational Series 4

GUIDE FOR

BEGINNING FOSSIL HUNTERS



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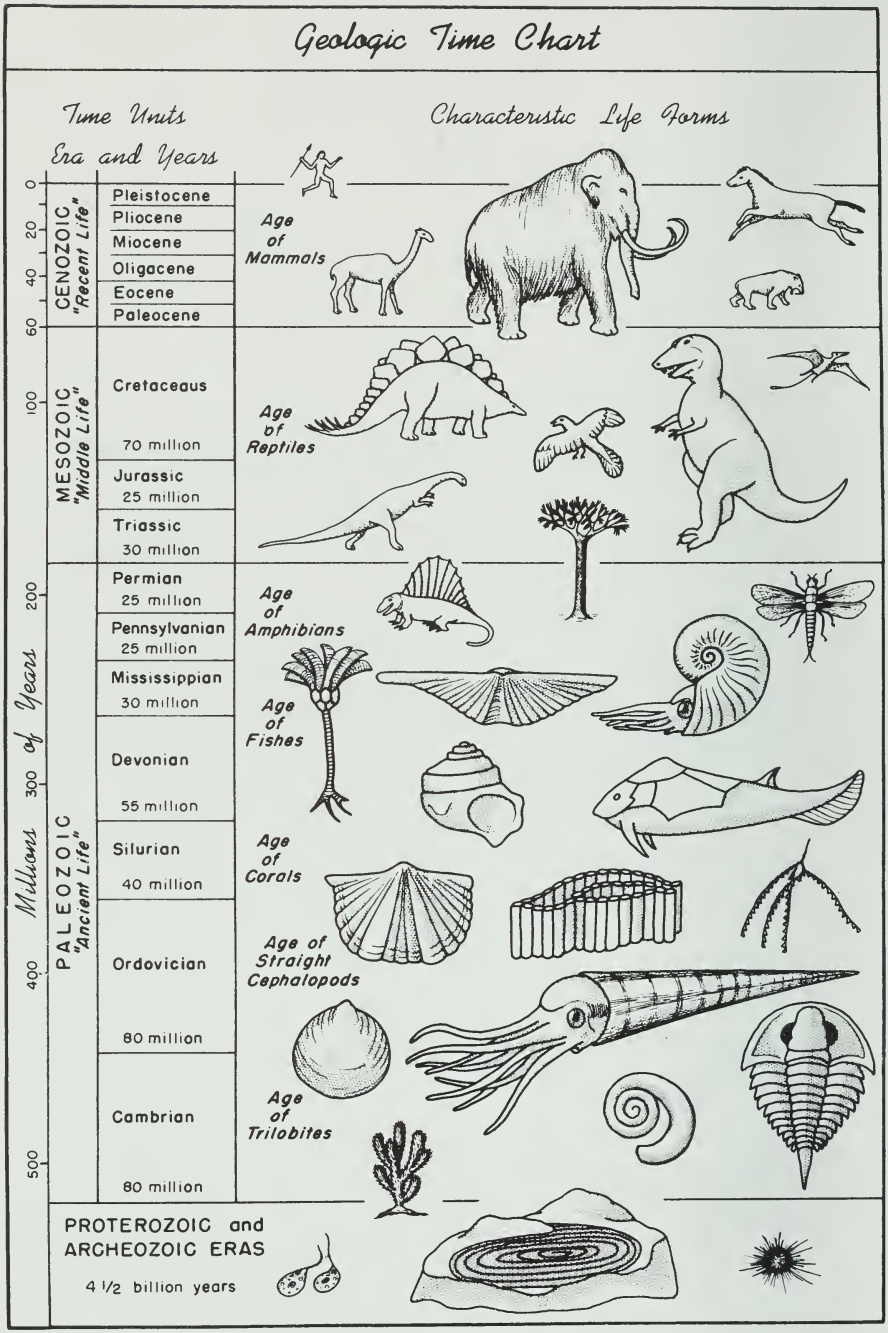
Illustrations by Marie E. Litterer

Geologic Time Chart

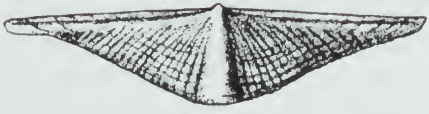


GUIDE FOR BEGINNING FOSSIL HUNTERS

Charles W. Collinson

LONG before the first man appeared on earth and such familiar features as our lakes and rivers were formed, the earth was inhabited by animals.

Even though man is the only creature able to record his history, we know that animals lived incredibly long before human beings were here to see them. We have evidence that single-celled animals 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 which 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 sand and mud. Layer after layer piled up and the sediments with their enclosed fossils were compressed and 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 and plants 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.

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.

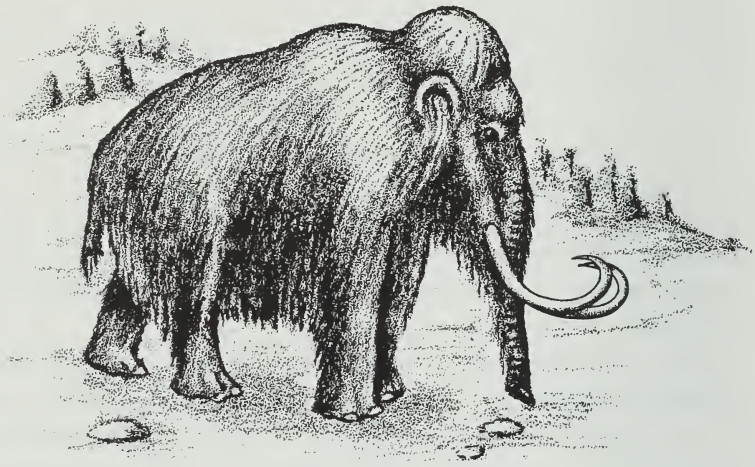
Some fossils were made by marine worms which burrowed in the sand or mud of the sea floor. The worms themselves are rarely found as fossils but their trails and holes are common. The burrows and holes are fossils just as much as the animals themselves would be if they had been preserved.

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. When the plants died they fell into the water and were preserved as peat that 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. Complete skeletons of the animals are rare, but teeth and tusks are on exhibit in many museums.



Woolly Mammoth
(After drawing by Charles R. Knight)

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 quarryman 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 in the cliffs and bluffs along our major rivers, the Mississippi, Illinois, Ohio, Wabash, and their tributaries. At these places whole fossils are often weathered out and may be picked up easily.

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. A map of the Braidwood area appears on page 36. Many strip mines yield fine brachiopods, snails, clams, and cephalopods.

Highway cuts through bedrock commonly expose beds containing fossils. 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.

Most of Illinois' major rivers have banks of windblown glacial dust, or loess. Shells of air-breathing snails that lived during the Ice Age are common in the loess.

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.

TOOLS FOR COLLECTING FOSSILS

1. Hammer - a bricklayer's hammer will work well.

2. One or two cold chisels, preferably one large and one small.

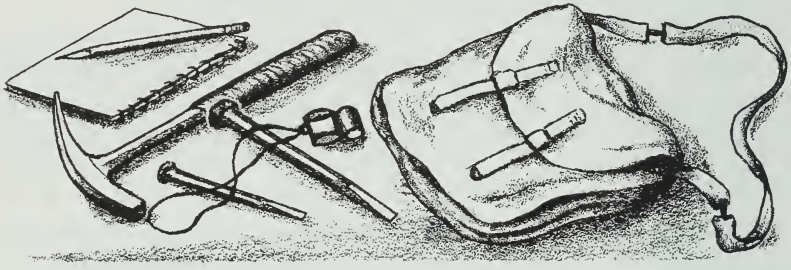
3. Knapsack or basket in which to carry your fossils.

4. Old newspapers or a roll of tissue paper for protecting fragile specimens.

5. Magnifying glass or hand lens, 3 to 10 power.

6. 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. It is important to keep records of your collecting.

7. 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.



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

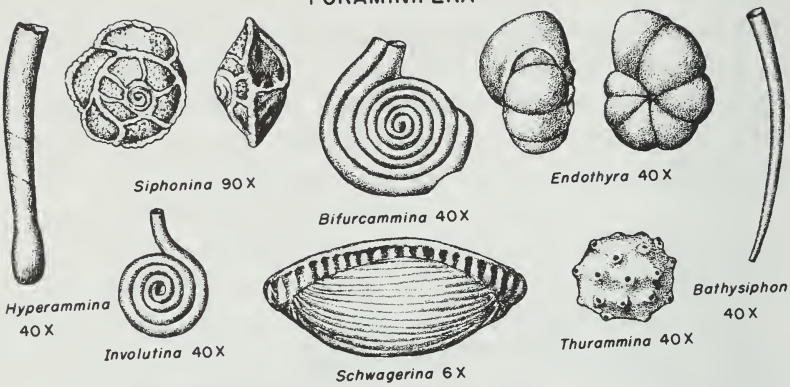
been found in places that other hunters have passed over many times.

If you find a good fossil embedded in rock and you are not certain that you can get it out 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.

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 worth while 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.

FORAMINIFERA



SPONGES

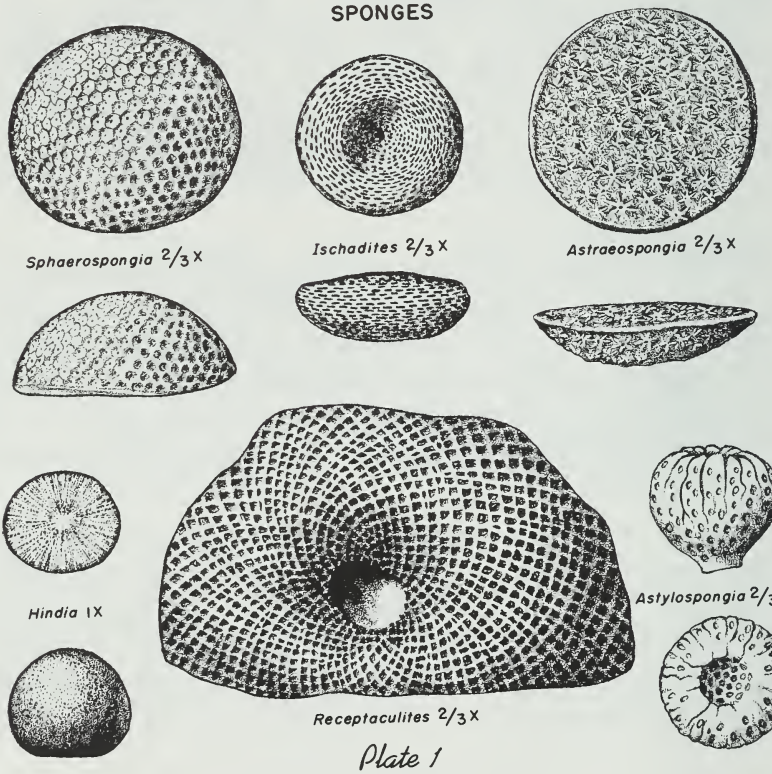


Plate 1

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

Fusulina, a foraminifer
Magnified 10 times (10X)

These very tiny fossils are beautifully shaped, but you will be able to 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 foraminifera make their shells of parts from the skeletons of other animals. Some of them are so particular about the kind of materials they use that they select only grains of a special size and color.

Foraminifera 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, page 2).

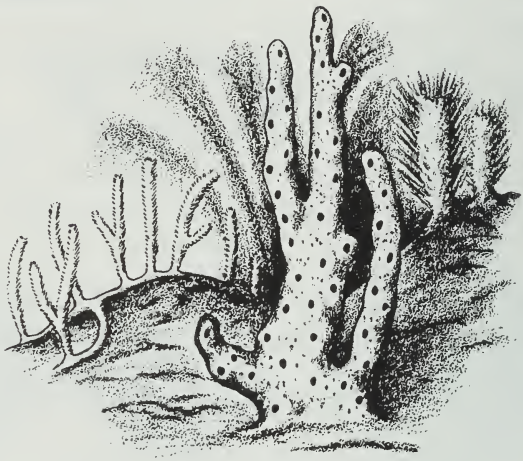
Calcareous foraminifera such as *Endothyra* (en-doh-thy′-rah, plate 1) are very abundant in Illinois in the Salem Limestone, which occurs in the bluffs of the Mississippi River along McAdams highway northwest of Alton and in the bluffs of Monroe and Randolph Counties. The Salem Limestone also crops out near Anna and Jonesboro in southern Illinois.

Another kind of calcareous foraminifer, *Fusulina* (few-su-lye′-nah), is very common in the rocks of Pennsylvanian age throughout Illinois. The fossils

look like grains of wheat and are so abundant in some limestones and shales that they can be collected by thousands.

For a list of localities where foraminifera are abundant, see pages 162-167 of Illinois Geological Survey Bulletin 67.

SPONGES (plate 1). Sponges 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.

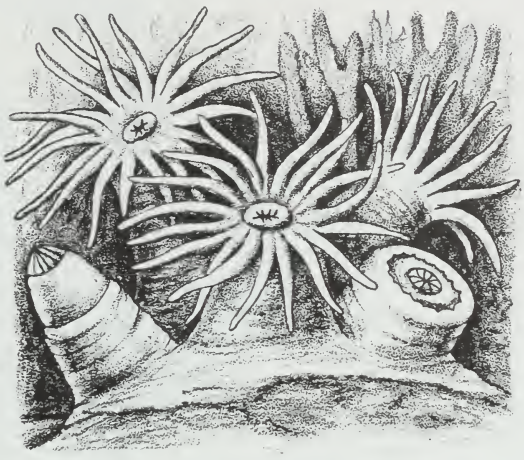


Modern Sponges

One fossil sponge, called the "sunflower coral," is common in the Ordovician rocks of north-central and northwestern Illinois.

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

CORALS (plate 2). Corals 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 which divide the body into chambers. The animal itself is called a polyp, and the skeleton is called coral.



Modern Corals

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

The skeletons of solitary polyps may be cushion-, horn-, or tube-shaped, 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 forms 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 rock, but they also are found in shale and sandstone.

BRYOZOA

Thamniscus 12 X

Fistuliphragma 1 X

Archimedes 1 X

Stomatopora 18 X

Fenestrellina 8 X

Lioclema 6 X

CORALS

Aulopora 1 X

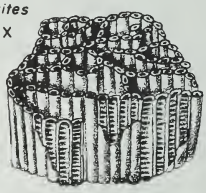
Plasmopora 1 X

Palaeacis 1 X

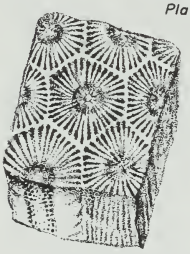
Favosites 2/3 X

Synaptophyllum 1 X

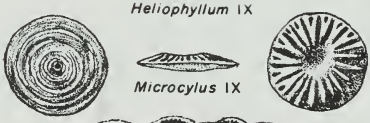
Heliophyllum 1 X



Halysites 2/3 X

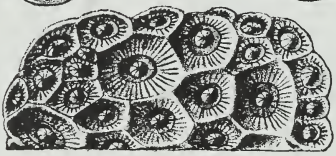


Hexagonaria 1 X



Microcylus 1 X

Streptelasma 2/3 X

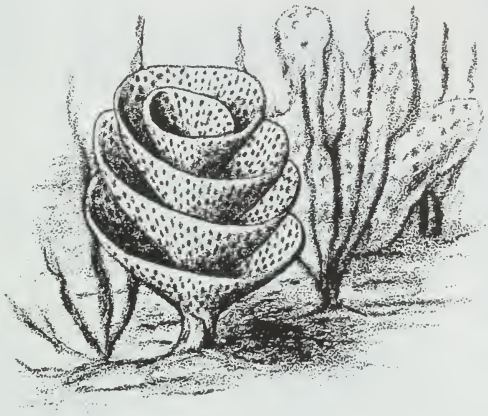


Lithostrotionella 1/2 X

Lophophyllum 1 X

Plate 2

BRYOZOA (bry′-oh-zoh′-ah, plate 2). The tiny colonial animals called bryozoa generally build stony skeletons of calcium carbonate.



Archimedes, a Mississippian bryozoan. The fronds are commonly called *Fenestella*.

They 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.

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

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.

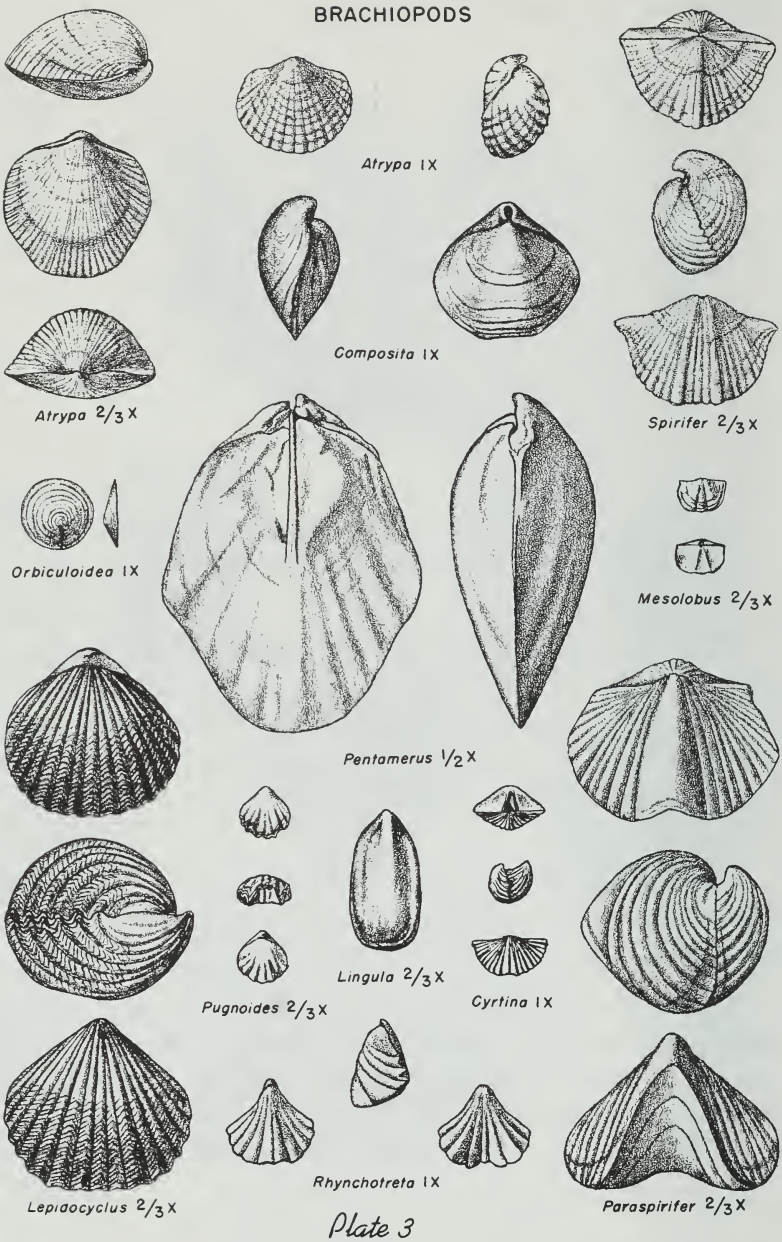
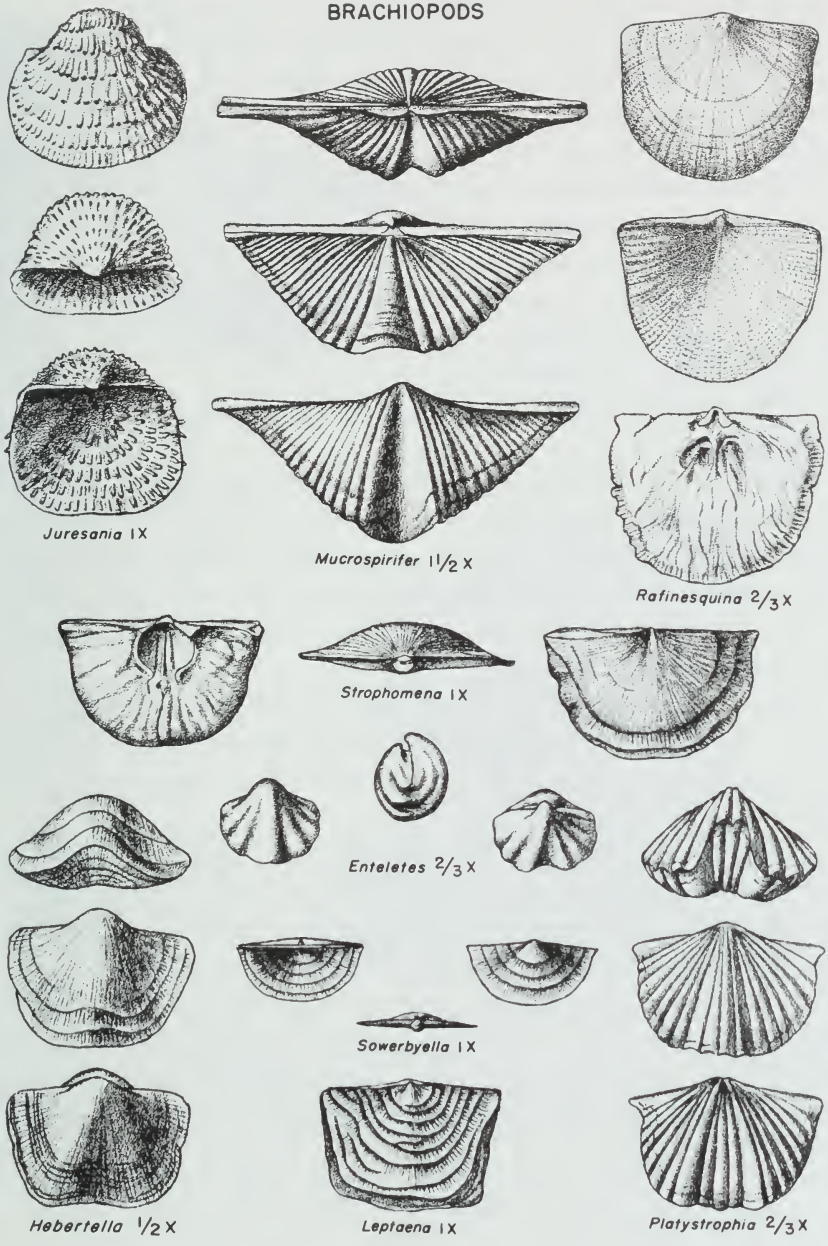

BRACHIOPODS
Atrypa 1X
Composita 1X
Atrypa 2/3X
Spirifer 2/3X
Orbiculoidea 1X
Mesolobus 2/3X
Pentamerus 1/2X
Pugnoides 2/3X
Lingula 2/3X
Cyrtina 1X
Lepidocyclus 2/3X
Rhynchotreta 1X
Paraspirifer 2/3X

Plate 3

BRACHIOPODS



Juresania 1X

Mucrospirifer 1 1/2 X

Rafinesquina 2/3 X

Strophomena 1X

Enteletes 2/3 X

Sowerbyella 1X

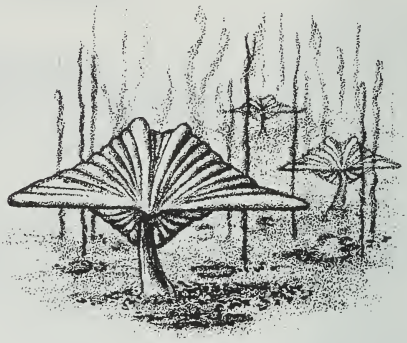
Hebertella 1/2 X

Leptaena 1X

Platystrophia 2/3 X

Plate 4

BRACHIOPODS (brack'-i-oh-pods, plates 3 and 4). Brachiopods 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 they 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 about 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.

MARINE WORM JAWS (plate 5). Marine worm jaws are easily preserved and are known in nearly every geologic system. Most of them are composed of chitin (fingernail material). They are black, 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.

Marine Worm Jaw
(Greatly magnified)

GASTROPODS (gas'-troh-pods, plate 5). Gastropods commonly are called snails. The snail carries its shell on its back and retreats into it whenever danger threatens. As a snail grows larger it expands and lengthens the shell. Most commonly the shell is coiled in a spiral, but some are shaped like a Chinese coolie hat.

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.

Modern Marine Gastropods

WORM JAWS

Oenonites 10X

Ildraites 20X

Ildraites 8X

Arabellites 20X

Lumbriconereites 10X

Oenonites 10X

GASTROPODS

Polygyra 1X

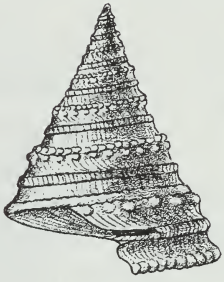
Succinea 1X

Platyceras 1X

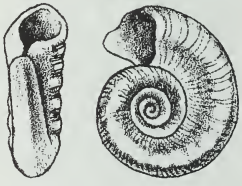
Cyclonema 1X

Busycon 1/3X

Loxonema 1X



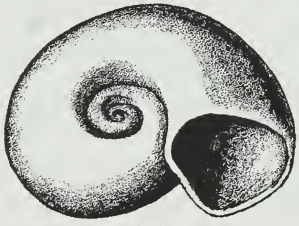
Pleurotomaria 1X



Euomphalus 2/3X

Hormotoma 1X

Trochonema 1X



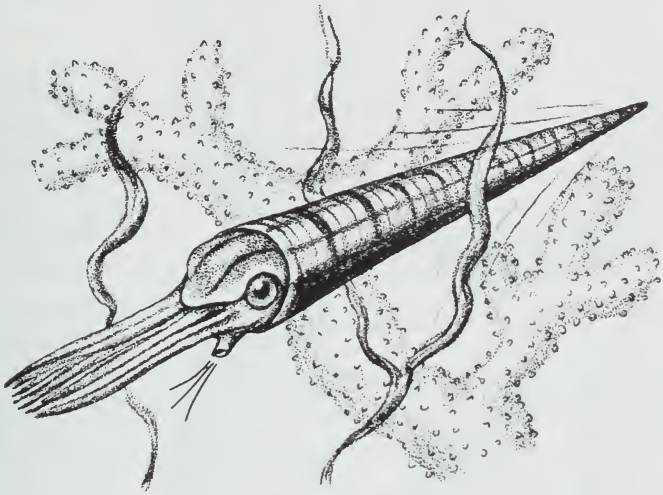
Maclurites 1X

Bellerophon 1X

Plate 5

Snails are common as fossils in the rocks of Ordovician and Pennsylvanian age 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 500 million years ago.



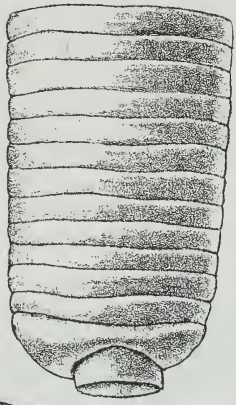
Straight Ordovician Cephalopod

CEPHALOPODS (sef´-al-oh-pods, plate 6). Cephalopod fossils have been found in rocks of many ages, and numerous representatives are alive today. Squids, octopuses, cuttlefish, and the pearly 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 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.

CEPHALOPODS



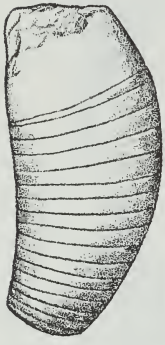
Schistoceras 1X

Eoasianites 2/3X

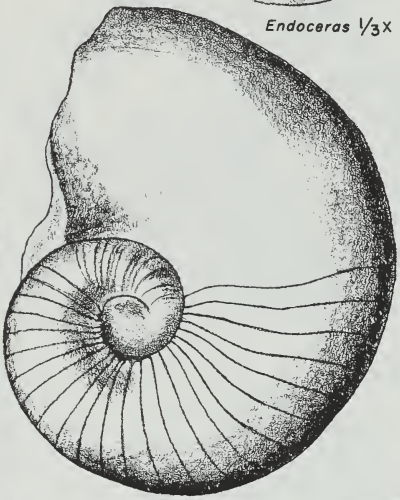
Mooreoceras 2X

Endoceras 1/3X

Protocanites 1X

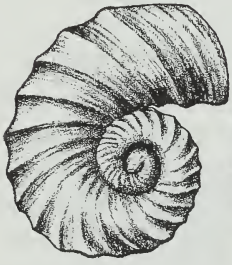


Westonoceras 1X

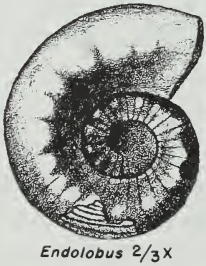


Charactoceras 2/3X

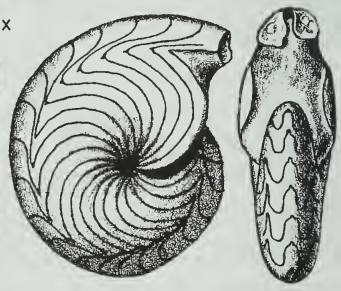
Cyclendoceras 1/3X



Lechritrochoceras 2/3X



Endolobus 2/3X

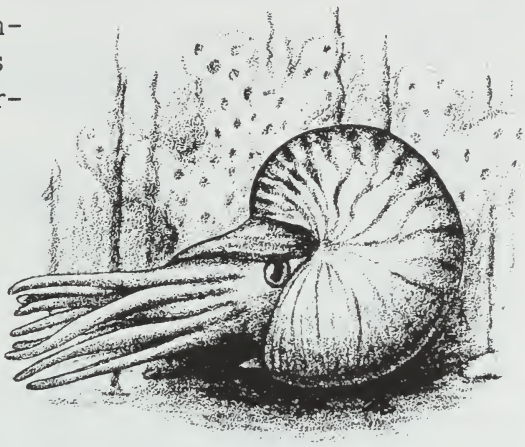


Imitoceras 2/3X

Plate 6

Coiled cephalopods live today only in the South Pacific, but in the geologic past they were 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 tightly coiled, and others were shaped like a tapered tube.



Modern Coiled Cephalopod

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 400 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 time; coiled ones became fairly common only by later Paleozoic times. We find both kinds in Pennsylvanian rocks in Illinois.

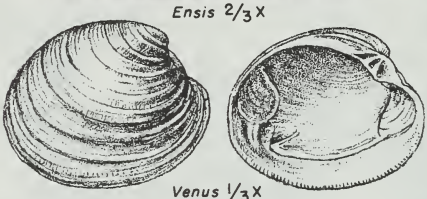
PELECYPODS (peh-les'-i-pods, plate 7). Pelecypods include oysters, clams, mussels, and cockles. They have been found in some of the oldest marine rocks known and still are very numerous in the seas and rivers today. Many of our pearl buttons are made from Mississippi River clam shells.

PELECYPODS

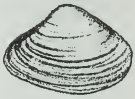
Ensis 2/3X

Exogyra 2/3X

Vanuxemia 2/3X



Venus 1/3X



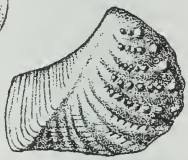
Ctenodonta 2/3X

Cardiopsis 2/3X

Paleoneilo 1X

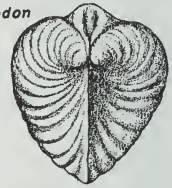
Pterinea 2/3X

Parallelodon 2/3X



Trigonia 2/3X

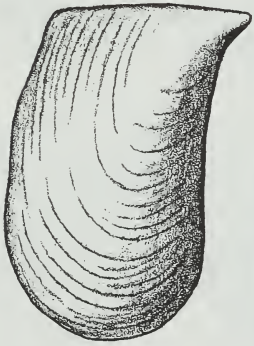
Allorisma 1X



Modiolopsis 1X

Ostrea 2/3X

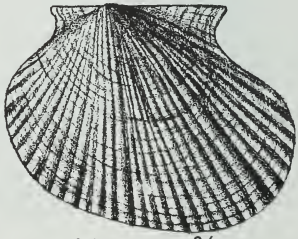
Grammysia 2/3X



Myalina 2/3X

Honeoyea 3X

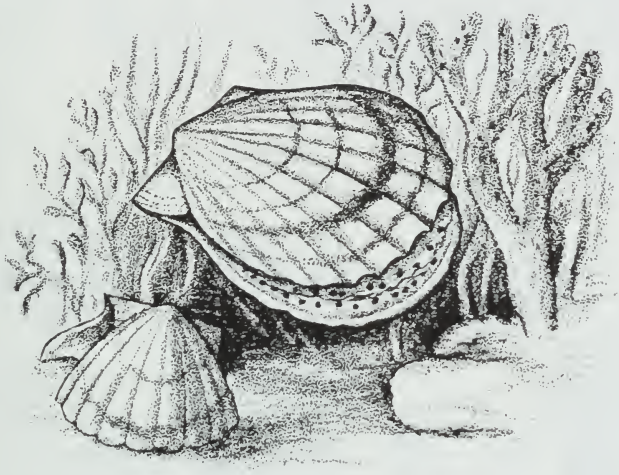
Clionychia 2/3X



Aviculopecten 2/3X

Plate 7

Most pelecypods have two shells which 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.



Pecten
A Modern Pelecypod

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, opening the two valves slowly and snapping them shut to force the water out in a jet stream.

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

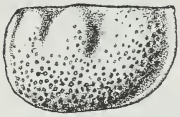
OSTRACODES

Paraechmina 30X

Monoceratina 40X

Zygobolba 10X

Hollinella 26X



Zygobeyrichia 9X

Leperditia 3X

Bollia 18X

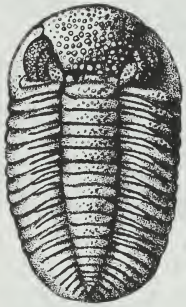
Beyrichia 16X

Primitia 12X

Tetradella 20X

TRILOBITES

Flexicalymene 1X

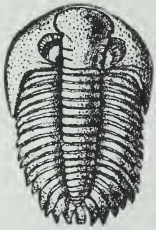


Calymene 1/2X

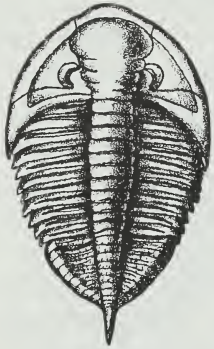
Illaenus 1X

Phacops 2/3X

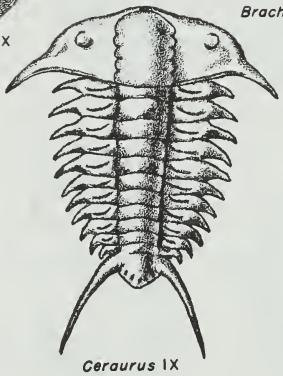
Brachymetopus 2X



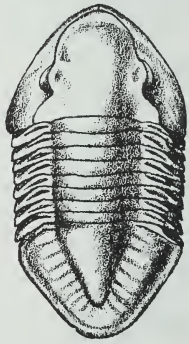
Greenops 1X



Dalmanites 1/2X



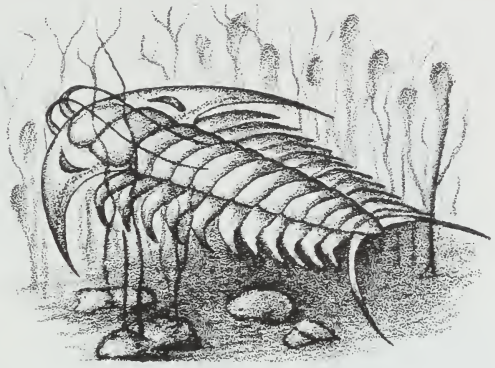
Ceraurus 1X



Isotelus 1/3X

Plate 8

TRILOBITES (try'-low-bites, plate 8). Trilobites have been extinct for more than 200 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."



Ordovician Trilobite

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

They were covered with a horny armor, jointed so 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. There are several well known collecting localities in northeastern Illinois and one in the central western part of the state.

OSTRACODES (aws'-trah-cods, plate 8). Ostracodes are very small animals which are common as fossils but are rarely large enough to be seen by the naked eye.

They 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.

They have two shells, one on each side of the body, so that some ostracodes look much like small

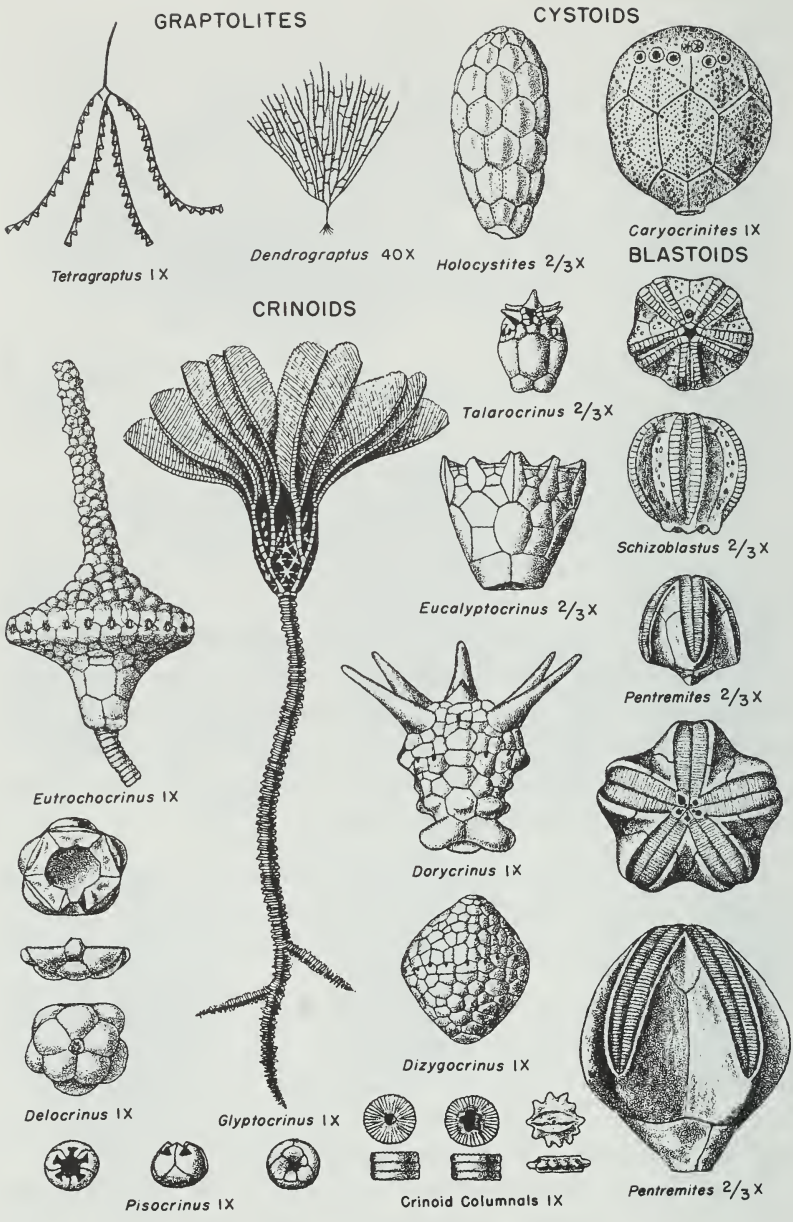
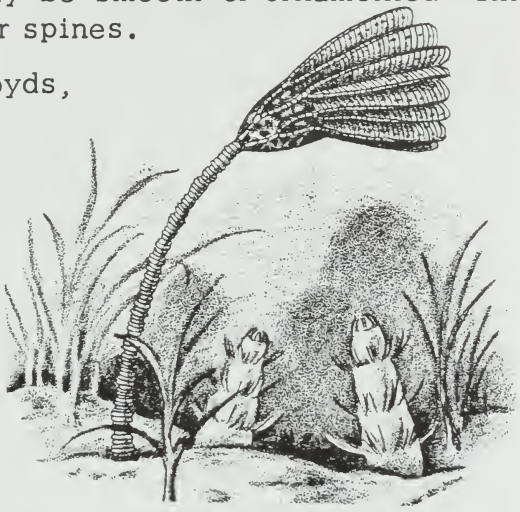

GRAPTOLITES
Tetragraptus 1X
Dendrograptus 40X
CYSTOIDS
Holocystites 2/3X
Caryocrinites 1X
BLASTOIDS
CRINOIDS
Talarocrinus 2/3X
Schizoblastus 2/3X
Eucalyptocrinus 2/3X
Pentremites 2/3X
Eutrochocrinus 1X
Dorycrinus 1X
Dizygocrinus 1X
Delocrinus 1X
Glyptocrinus 1X
Pisocrinus 1X
Crinoid Columnals 1X
Pentremites 2/3X

Plate 9

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.

CRINOIDS (cry'-noyds, plate 9). Crinoids 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 which sweep food into the mouth. The body is made of calcareous plates which fit together like irregular bricks.



Ordovician Crinoid

When the animal dies, the plates and discs tend to fall apart and sink to the sea floor. Many of the limestone beds in Illinois are composed mostly of crinoid plates and discs.

The complete calyx is a highly prized fossil. Good ones are found in the limestone cliffs along the Mississippi River between Burlington and Alton.

Stems or stem discs are common throughout most of Illinois and popularly are called "Indian beads" or "fish bones." The oldest crinoids come from Ordovician rocks. Some crinoids live today, mainly in deep parts of the ocean, but they are not nearly so common as in the past.

BLASTOIDS (blas′-toyds, plate 9). Blastoid fossils commonly are called "sea buds." They are closely related to crinoids but differ from crinoids in that, instead of arms, they had small hair-like pinnules which swept food into the mouth. The soft pinnules rarely were preserved.

Some blastoids had stems, but others did not and were attached directly to the sea floor. Like crinoids, they had a mouth at the top of the body (calyx) surrounded by small round holes that conducted water into the body.

The oldest blastoids, found in Ordovician rocks, lived about 400 million years ago. The animals survived until the Permian Period, about 200 million years ago, when they became extinct. Blastoids are beautiful fossils that look much like small hickory nuts.

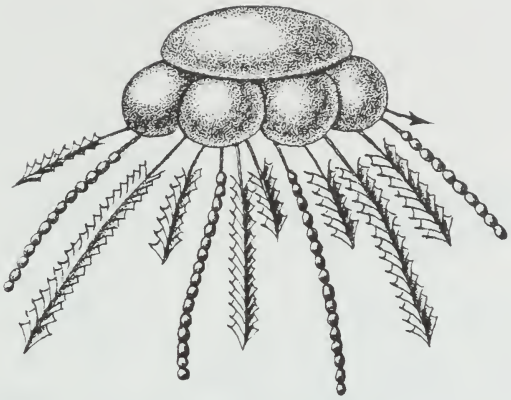
They most commonly are found in the river cliffs and stream banks of western and southwestern Illinois, especially in Randolph County, and in southern Illinois near the Ohio River.

CYSTOIDS (sis′-toyds, plate 9). Cystoids 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. Nearly all cystoids are stemless, and the body plates are quite irregular in arrangement.

The cystoids lived from the Ordovician Period, 400 million years ago, until the Mississippian Period, 250 million years ago.

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

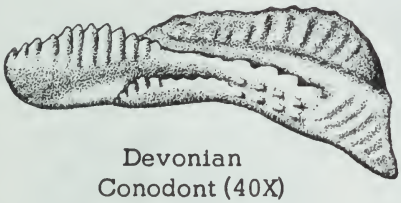
GRAPTOLITES (grap′-toe-lites, plate 9). The graptolites were a very simple kind of marine animal that appeared in the Cambrian Period. They became abundant in Ordovician and Silurian times but gradually died out. The last ones lived during the Mississippian Period.



Ordovician Graptolite

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 might be attached together. Most graptolites floated free in the oceans and were scattered throughout the world.

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

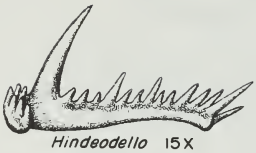


Devonian Conodont (40X)

CONODONTS (ko′-no-dahnts, plate 10). Conodonts are small fossils which barely can be seen by the naked eye. Almost nothing is known about the animal from which these beautiful amber-colored, tooth-like little fossils came.

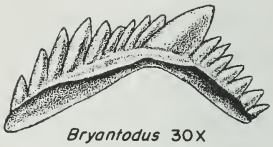
Even though we don't know much about them, conodonts are of value because they help geologists determine the age of the rocks in which they are found.

CONODONTS



Hindeodella 15X

Palmotolepis 15X



Bryantodus 30X

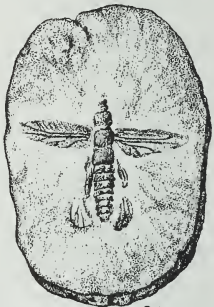
Aphthoroblattina 2/3X

Ligonodina 30X

Dreponodus 30X

Icriodus 20X

Loxodus 30X

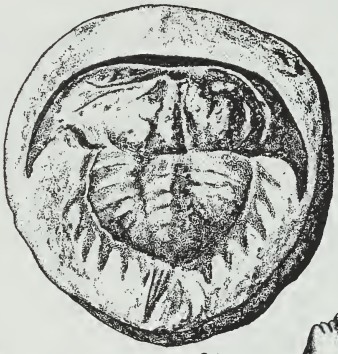


Teneopteron 2/3X

INSECTS

HORSESHOE CRAB

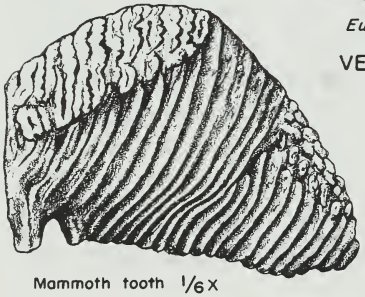
Horse tooth 4/5 X



Euproöps 2/3X

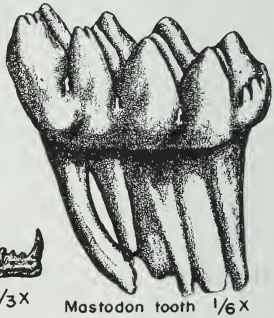
Cow tooth 4/5 X

VERTEBRATE FOSSILS



Mammoth tooth 1/6 X

Shark tooth 2/3 X



Mastodon tooth 1/6 X

Plate 10

Conodonts of the same type are found over much of the world in rocks of the same age, leading us to believe that the animal was a swimmer and could cover great distances. Because of this, we think these fossils may be remains of an extinct fish.

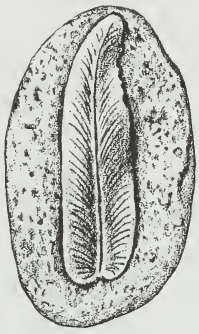
Conodonts have been found in rocks ranging from the Cambrian age to the Cretaceous. They are found in bedrock formations throughout Illinois.

INSECTS (plate 10). Insects 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 the well known plant fossils. Even though a fairly large number of fossil insects have been collected, it is necessary to examine thousands of concretions in order to have a good chance of finding a single specimen.

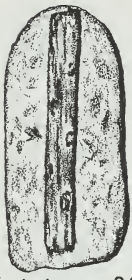
Most of the fossils have no modern counterparts, but such familiar things as dragonflies, damselflies, and cockroaches are found. Many are giants of their race. The insects are of the kind that would be expected in a woodland growing near a low-lying seashore, and they probably lived among the trees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

HORSESHOE CRABS (plate 10). 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. These marine animals were much like their present day relatives and must have lived in shallow seas just offshore from the Coal Age forests. A relatively few specimens have been found in Illinois. All are of Pennsylvanian age and came from the Mazon Creek area.

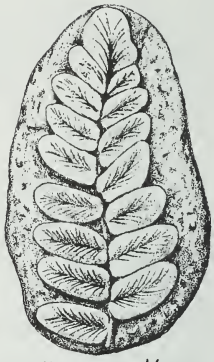
PLANTS



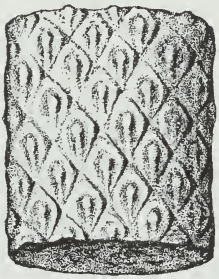
Neuropteris 2/5X



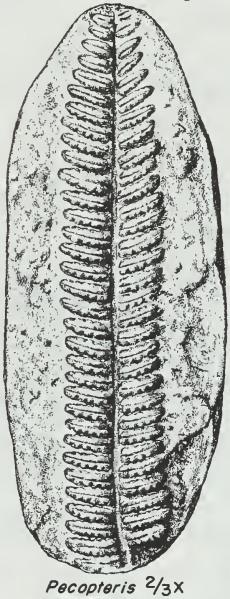
Noëopteris stem 2/3X



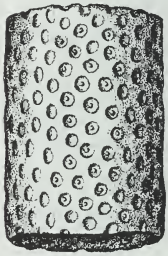
Neuropteris 1/2X



Lepidodendron 2/5X



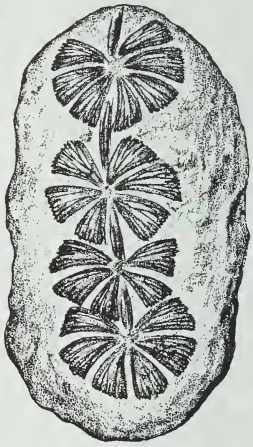
Pecopteris 2/3X



Stigmaria 2/5X

Annularia 2/3X

Spiropteris 2/3X

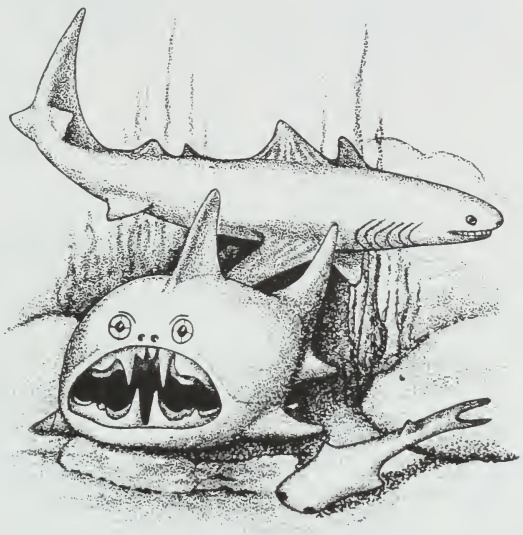


Sphenophyllum 1X

Plate 11

VERTEBRATE FOSSILS (plate 10). Animals with backbones are called vertebrates. They include reptiles, amphibians, fish, birds, and mammals.

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

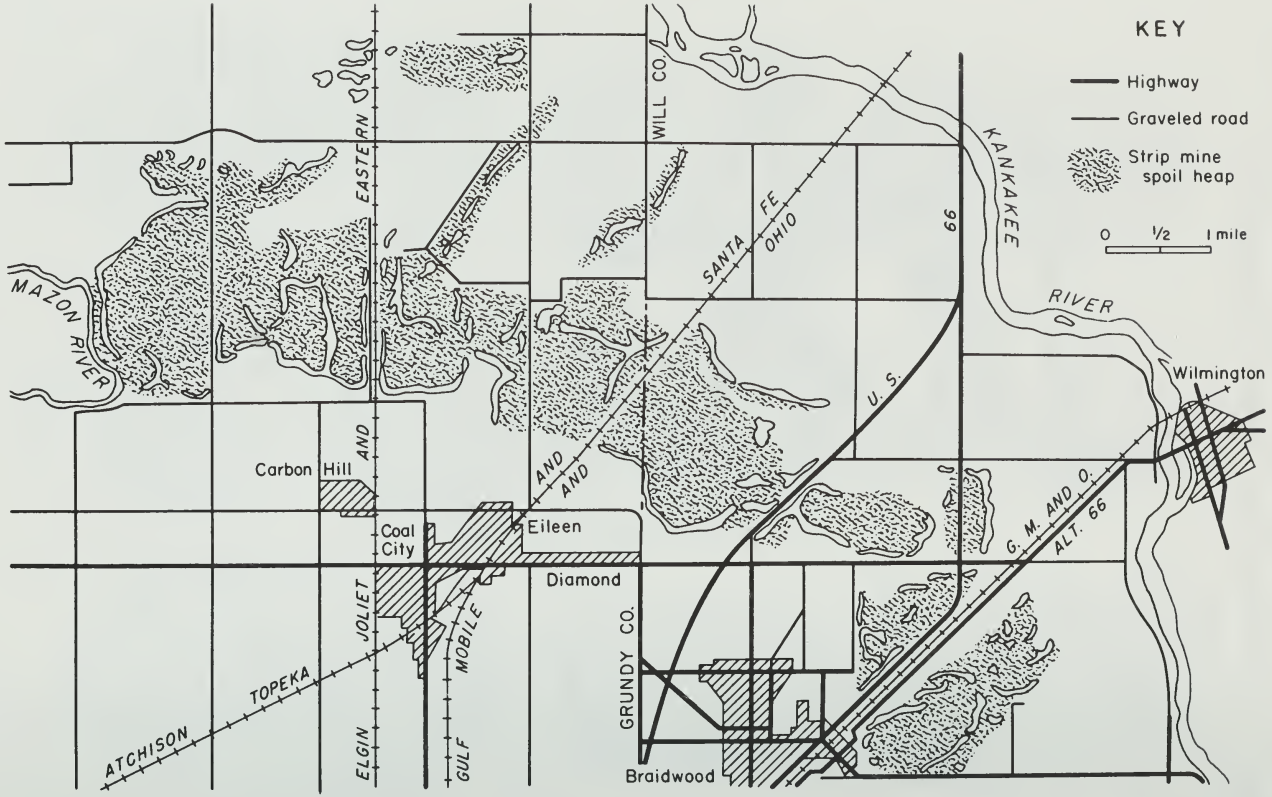


Devonian Fish

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

The Paleozoic vertebrate fossils are fish teeth, scales, and bony plates, a few lizards, and amphibians. The Pleistocene vertebrates included many forms now extinct, such as mammoth and mastodons, and many forms still living in this region, such as horses, cattle, deer, and man.

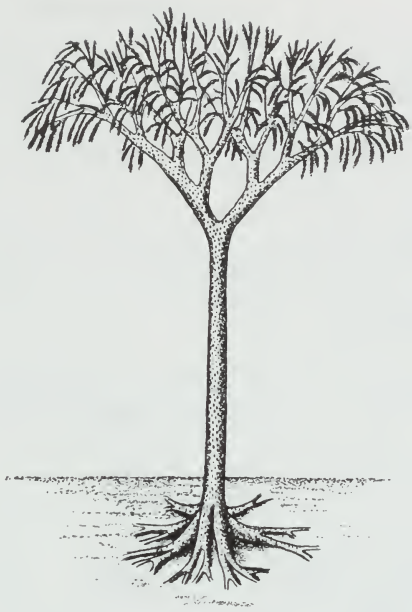
PLANT FOSSILS (plate 10). Of all the fossils that have been found in Illinois, perhaps none are more famous than the fossil leaves and other plant remains from the world-renowned Mazon Creek - Braidwood area in northeastern Illinois.



MAZON CREEK STRIP MINING AREA SHOWING DISTRIBUTION OF SPOIL HEAPS

In this area, which lies in Grundy and Will Counties, ironstone nodules containing plant remains are found in the 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 damp lowlands and swamps that covered Illinois during the Coal Age, they formed a dense growth and were preserved in our coal beds.



Lepidodendron, a Pennsylvanian scale tree

In the jungle-like growth the most common plants were huge ferns that had fronds five or six 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. You can recognize scouring rushes by their jointed trunks and the leaf whorls, common in the Mazon Creek nodules. *Neuropteris* and *Pecopteris* are from the seed ferns, *Annularia* from the rushes. Herbs like *Spenophyllum* 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 the *Lepidodendron* and vertical rows identify the *Sigillaria*.

BOOKS ABOUT FOSSILS

Armstrong, Charles, and Patricia Armstrong, 1962, *Trilobites of the Chicago Region*: private publication, Naperville, IL, 59 p.

Illustrated guide identifies Chicago-area trilobites and the quarries where they are found.

Baker, F. C., 1934, *Fieldbook of Illinois Land Snails*: Illinois Natural History Survey Manual 2, 166 p.

Well-illustrated book identifies modern and ice-age snails.

Case, G. R., 1982, *A Pictorial Guide to Fossils*: Van Nostrand Reinhold Company, New York, 514 p.

More than 1300 photos and drawings illustrate this relatively advanced survey of the fossil world. Major emphasis is on animals with backbones.

Daeschler, Ted, 1988, *Fossils-Fossil Collecting Explained*: Running Press, Philadelphia, 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.

Fenton, C. L., and M. A. Fenton, with P. V. Rich and T. H. Rich, 1989, *The Fossil Book*: Doubleday, New York, 740 p.

Superbly illustrated comprehensive guide covers the entire field of paleontology/paleobotany. The 1500 drawings and photos, along with its 740-page text, are international in scope. They come with identification keys, a glossary, listings of collections, and 13 pages of references.

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, distribution of plants through time, and tips on where and how to collect these fossils. This will be a basic reference for anyone interested in fossil plants. The venation diagrams are superb.

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

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

Matthews, W. H., III, 1970, *Fossils: An Introduction to Prehistoric Life*: Barnes and Noble, New York, 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. (editor), 1985, *Atlas of Invertebrate Fossils*: John Wiley and Sons, New York, 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.

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

Beautifully illustrated survey of Indiana fossils includes a list of 20 collecting localities. The booklet is aimed at high school students and adults.

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

Detailed map guide identifies 28 collecting localities in the northernmost 24 counties of Illinois.

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

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

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

Iowa City, 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.

Shaver, R. H., 1959, *Adventures with Fossils*: Indiana Geological Survey Circular 6, Bloomington, 52 p.
In this attractive introduction to fossils and collecting, 34 collecting areas in Indiana and adjacent states are described in some detail.

Thompson, Ida, T. P. Dickinson, and Carol Nehring, 1982, *The Audubon Society Field Guide to North American Fossils*: Alfred A. Knopf, New York, 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*: University of Missouri Bulletin Handbook 4, Columbia, 98 p.
General survey introduces fossils and fossil collecting in Missouri.

GEOSCIENCE EDUCATION AND OUTREACH

The Geoscience Education and Outreach Unit 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 Geological Survey's research projects. The unit distributes non-technical 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 unit's four full-day field trips, each given in widely separated areas of the state, offer teachers, students, and laymen the opportunity to learn about the geologic processes that shaped the land and formed the rocks.

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

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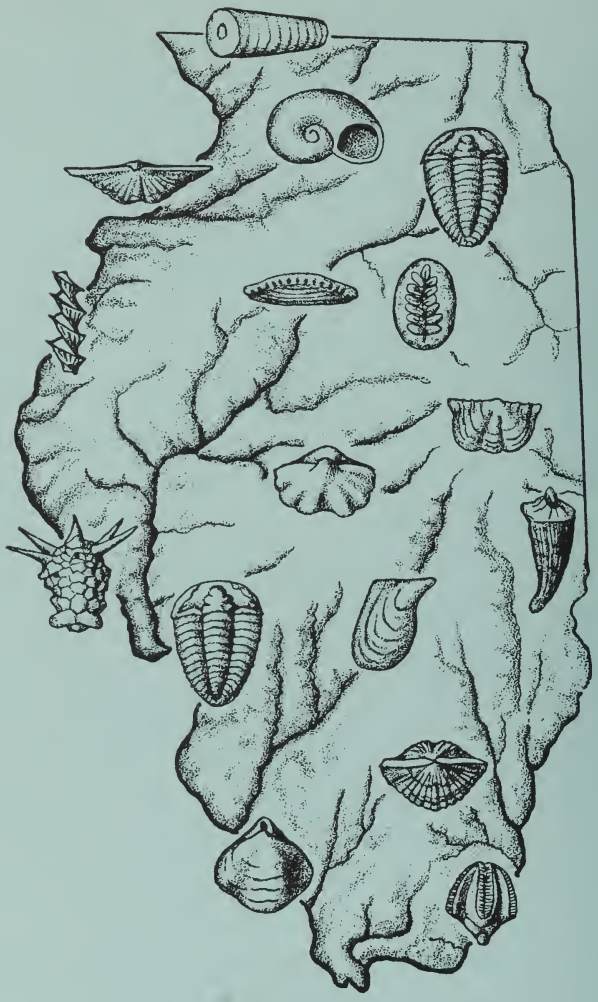

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