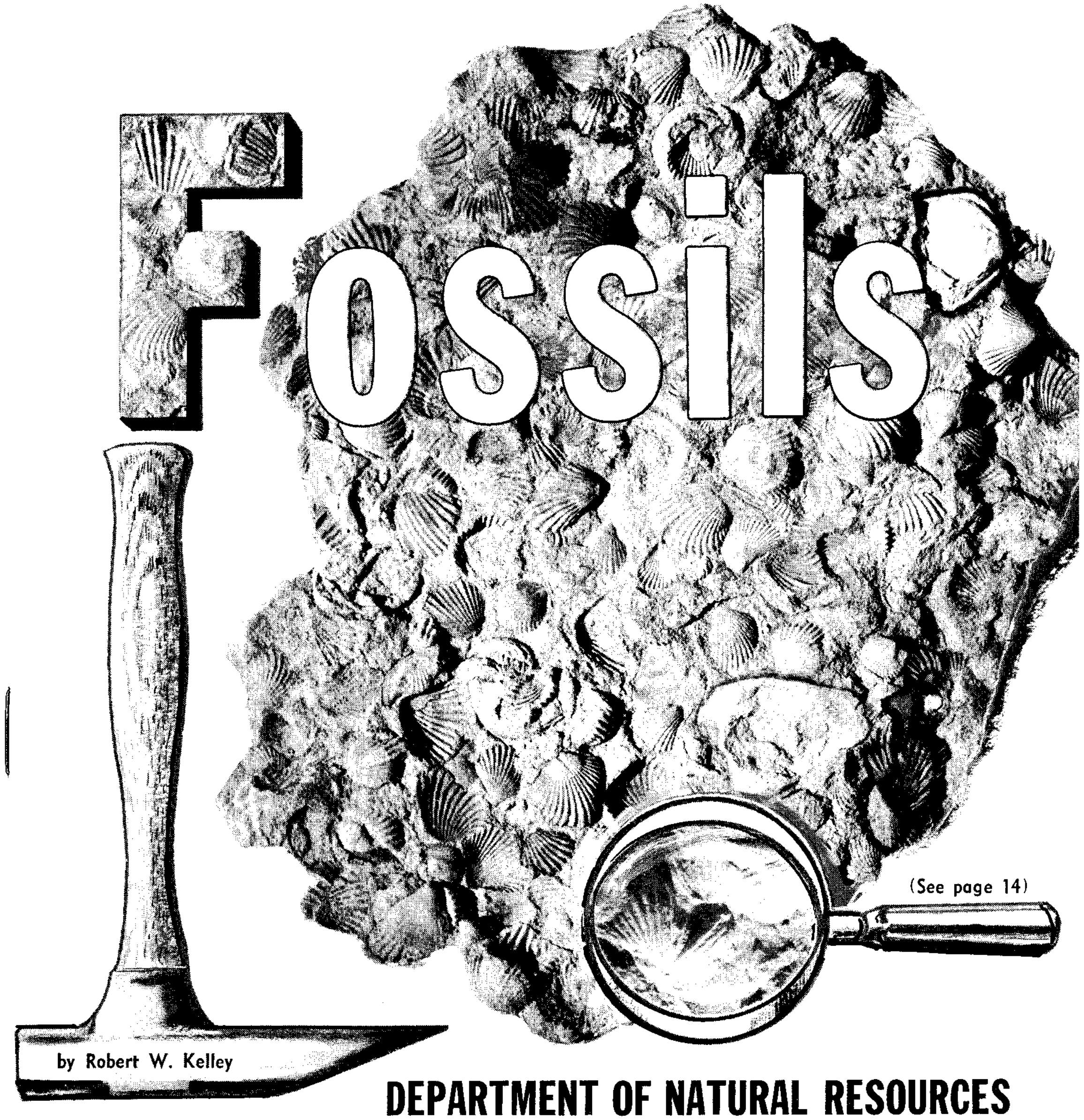
Geological Survey
Pamphlet 3
1962

Guide to MICHIGAN Fossils



(See page 14)

by Robert W. Kelley

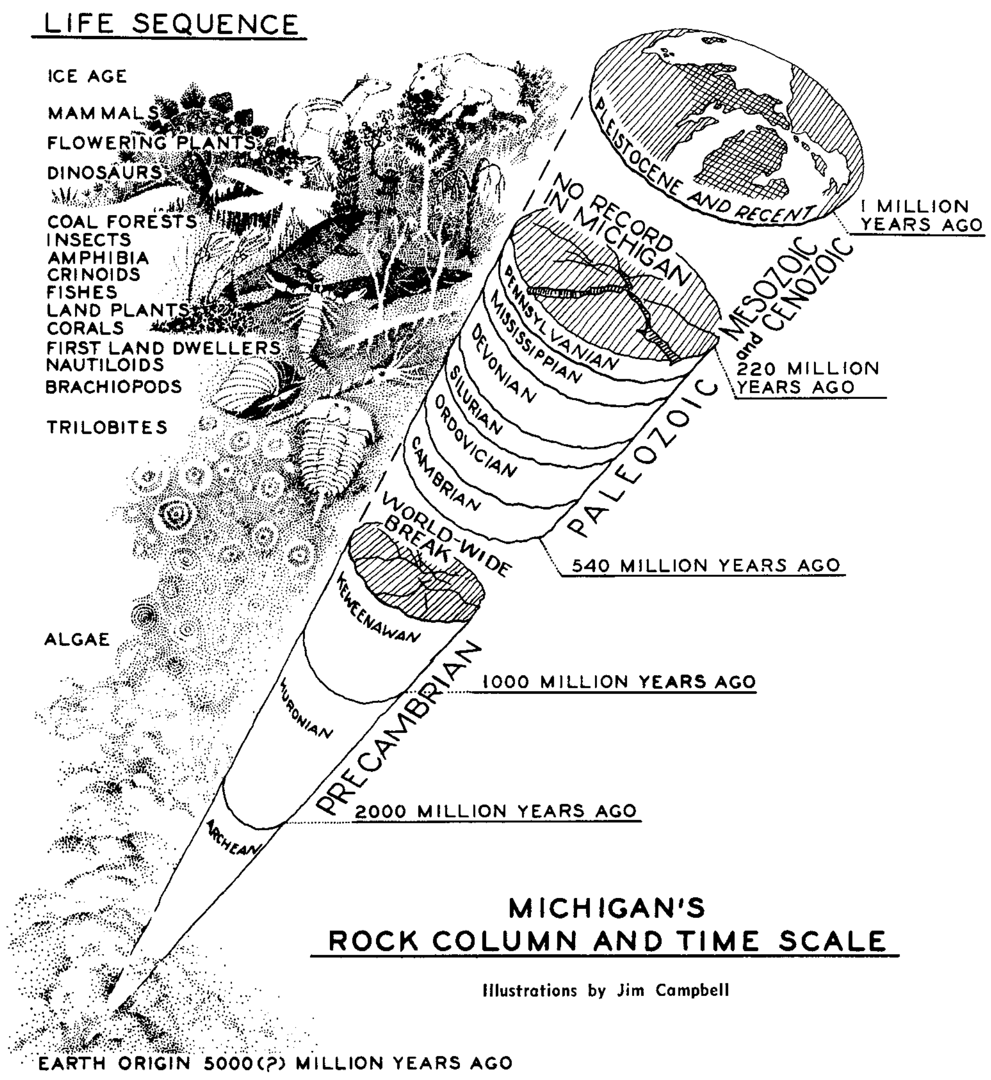
DEPARTMENT OF NATURAL RESOURCES

WHAT'S A FOSSIL? Are there any in Michigan? Where? How old? Are they real? How do you identify them? What's this one? Is it worth anything? Who's interested in them anyway? Why? Where can I find some information? These are typical questions which come to the Conservation Department.

As with virtually everything in this universe, fossils more or less conform to a pattern or design, or scheme of things. With even a little study, this becomes apparent. The main purpose at hand, however, is to help you identify some of the fossils you are most likely to pick up here in Michigan. Only a smattering of all the known types are illustrated, and for the most part, the selection is quite random. Nor have we attempted to narrow down the identification to the full scientific name — a task strictly for experts specializing in the field of paleontology, the science of fossils.

Fossils are designated by a double Latin name of which the first applies to the genus and the second to the species. Standard practice also requires that the surname of the discoverer be tacked on. In general, a species is an assemblage of individuals having one or more distinctive reproducible attributes. A genus is simply an assemblage of related species. For most purposes, generic names of fossils suffice. In this booklet, generic names appear in italic type. Incidentally, since the experts sometimes admit difficulties in deciding on species, don't be too concerned about deriving species names now—unless, of course, it really bothers you. Then, by all means, go to it, and do something about it!

Intensive scrutiny of the earth's crust in the last century has revealed a prolific fossil record. One of the more unusual discoveries of geologists is that fossils are almost entirely absent from the first nine-tenths of geologic time (see the simplified version of Michigan's rock column and time scale). In other words, most of the fossils found so far, have come from rock formations originating during the last one-tenth of the earth's known history — some time during the Paleozoic, Mesozoic, and Cenozoic eras. For the most part, the great Precambrian span is practically barren of identifiable fossils even though there are quite a few inconclusive indications of life. Probably the most puzzling feature is the sudden appearance in Cambrian times of an abundance and variety of rather complex animals without backbones. The sharp break between the very ancient Precambrian formations and those of the Paleozoic "ancient life", though readily distinguished over most of the earth, is not yet understood. Surely many of the Cambrian animals began to evolve earlier, but what happened during the transition is not apparent in the presently available record. This is one of the foremost unsolved earth history puzzles confronting geologists. A particularly vexing problem here in our own backyard is the total absence of any rocks representing the 200-plus million years of Mesozoic and Cenozoic time — a span which saw the rise and fall of the dinosaurs, the beginnings and development of flowering plants, and the rise of mammals. If the great reptiles did romp in the Great Lakes region, as they surely did in the west and elsewhere, we will probably never know, because any geologic record that may have been here is now gone.



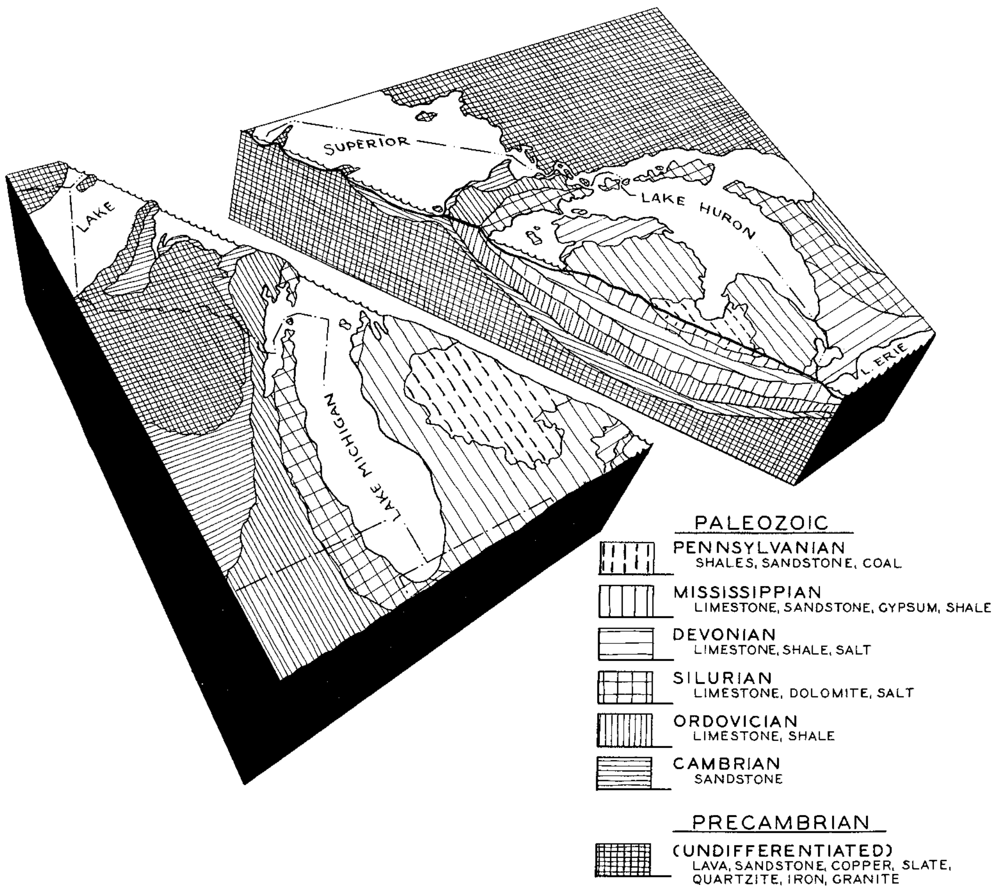
MICHIGAN'S
ROCK COLUMN AND TIME SCALE

Illustrations by Jim Campbell

During Paleozoic time, the Michigan region was periodically inundated by rather shallow salt water seas that spread over much of the interior of North America. Layer upon layer of limestone, shale, and sandstone accumulated and subsided, forming a great structural rock basin that now covers all of the Lower Peninsula and parts of adjoining states. This can be seen in the block diagram below.

The central part of this basin more or less coincides with the central area of the Lower Peninsula. Here the sedimentary rock layers attain their greatest thickness and are also warped downward to their greatest depths. In all directions away from the center of the basin, the strata gradually rise upward until eventually becoming exposed at the surface as irregular concentric bands. The oldest formations mark the distant outer fringes of the basin itself. Where these rocks outcrop, collectors have the opportunity of searching out the inevitable fossils. Long ago, it was learned that certain "bugs" are associated with certain layers of rock. This knowledge proves invaluable in tracing rock formations over wide areas, and in working out a logical sequence of rock and time units in the earth's history.

SIMPLIFIED BLOCK DIAGRAM
OF THE
MICHIGAN BASIN



In case you may still be wondering what fossils are, they can be *any* evidence of former life — even a worm burrow. Fossils appear to be so common that we might assume that many of the answers to past life have been worked out. But reflect on this problem a moment: How many places can you cite today where organic remains are accumulating naturally, and have a reasonable chance of being preserved for the ages? Of course, hard parts like teeth, bones and shell resist decay the longest, but even they disappear if the many optimum conditions for fossilization are not satisfied. It would appear, therefore, that those fossils that have been preserved are doubtless a very minor percentage of the total number of the earth's inhabitants at a given time. Fossils, therefore, are the exception — not the rule — even though some formations are so jammed with their remains we call them "fossil cemeteries" *(see cover illustration).*

Most fossils found in Michigan date back several hundred million years when the warm, clear, salt-water Paleozoic seas were entering the Michigan basin. Most of the creatures preserved from those ancient seas are the many various types of lime-secreting shellfish and corals whose remains, incidentally, make up a very large part of present limestone beds. Occasionally, parts of primitive fish are found. Also,

A PRE-CAMBRIAN PLANT — The only Michigan Precambrian fossil which can be positively identified— calcareous algae (Collenia undosa) *occurring in a conglomerate formation of Middle Keweenawan age along the Lake Superior shore between Copper Harbor and Eagle Harbor.*

in the coal measures, carbonized impressions of ancient plant parts are not uncommon. Quite apart from the foregoing Paleozoic forms, however, are the not-so-ancient fossils found occasionally in the unconsolidated glacial deposits, only a few thousand years old. Many skeletons of the extinct mastodon and woolly mammoth — ancestors of the modern elephant — have been unearthed in these surface deposits. Bones and teeth are seen in various stages of preservation, some closely resembling the original material. More commonly found is a variety of snails and clams, not readily differentiated from those living today.

The most common type of fossilization involves a chemical process where the original organic material is entirely replaced by calcite or silica or some other mineral — a petrifaction — often resulting in the preservation of infinite detail. There are many other kinds of fossilization, but replacement mineralization gives the paleontologist the opportunity of finding out a great deal about faunas in stone.

As you may have guessed, the paleontologist has much in common with the biologist. He takes the longer view of things. Sometimes, too, he may have to search a little harder for his specimens, but there's one consolation, his material doesn't need to be pickled!

There is a fascination in working with life images of such fantastic age. Each specimen tells us a little of its own and the earth's history. This story is beautifully and accurately displayed in museums at the University of Michigan, the Cranbrook Institute of Science, and at Michigan State University. A visit to any one of these museums is both interesting and enjoyable.

Enthusiasts who collect fossils should know that whatever is removed from a collecting site will never be replaced. Eons of time were required to create these phenomena, so every effort should be made to insure their being put to good use. To prevent bruising specimens in transport, wrap them in old newspaper. Also, if a fossil is to be useful to the scientist, it is essential that he know exactly where you found it.

In general, the best places to look for fossils are in those areas where Paleozoic bedrock is at or near the surface and has been exposed to weathering processes for a long, long time. In most instances the fossils are somewhat more resistant to decay than the rock matrix in which they are imprisoned. Look for shore line exposures, road cuts, and old abandoned quarries. The following counties afford particularly good collecting: Monroe, Alpena, Presque Isle, Charlevoix, Chippewa, Schoolcraft, and Delta. But don't be surprised to find fossils most anywhere in Michigan's glacial drift hodgepodge, especially in gravels containing limestone pebbles. Remember, those Pleistocene glaciers scattered all types of rock materials over the entire region. Few good fossils come from active quarrying operations, because freshly broken rock is not generally productive of specimens. Furthermore, most quarries are busy and oftentimes hazardous places that are necessarily barred to visitors.

In viewing the illustrations, keep in mind that all specimens have been reduced to one-half their natural size.

Robert W. Kelley is research geologist and head of the general geology section of the Department's Geological Survey Division. He joined the Department in 1955. All photos in this booklet were taken by Mr. Kelley and by John Byerlay, hydro-geologist, also of the Geological Survey Division.

FOSSIL PLANTS—(examples at right)—Without plants, there would be no animals.

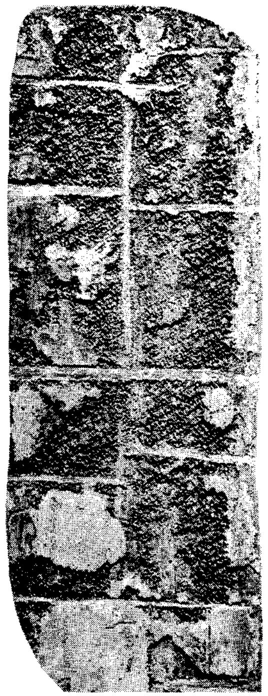
Trace the food chain of any animal back only a step or two, and see how dependent everything is upon the life-sustaining process of photosynthesis—the production of basic sugars in plants in the presence of the amazing green matter—chlorophyll—and sunlight.

Prior to middle Paleozoic time, all life had always been in the marine seas—both plant and animal. Though there's no direct evidence to prove it, perhaps some time during the Silurian period, plant life migrated to the land along continental margins. Thus the stage was set for animal life to leave the sea, because Devonian rocks are replete with a record of both land plants and animals. By late Paleozoic time, vegetation in brackish continental swamps was so profuse and rank, much of it that was buried under sediments became the vast coal measures upon which we are now dependent for sources of energy and chemicals.

Unfortunately, fossil plants have not been studied as intensively as the invertebrates, otherwise they might be more useful indexes to working out the past.

FOSSIL PLANTS

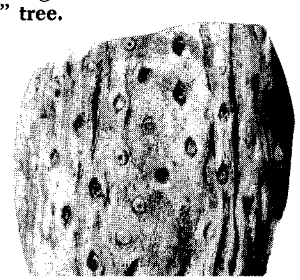
See FOSSIL PLANT text, bottom of page 6.



Callixylon (DEV.?) A thin carbonization and shale impression of the trunk of an extinct type of tree belonging to the Cordaites.

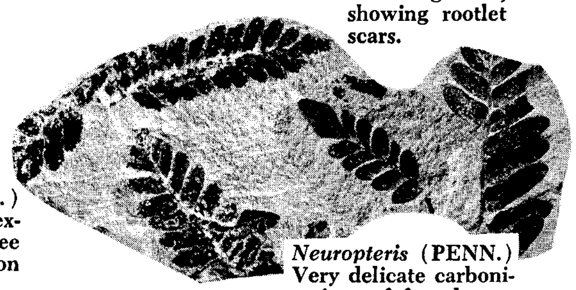
Calamites (PENN.) Sandstone casts of pith cavity of a "jointed stem," or "horsetail" plant.

Lepidodendron (PENN.?) Sandstone cast found in glacial drift. Shows leaf scars characteristic of the trunk of a big extinct "club-moss" tree.

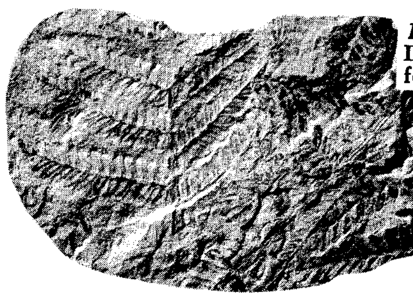


Stigmaria (PENN.) Probably the root-like part of *Lepidodendron* and *Sigillaria*, showing rootlet scars.

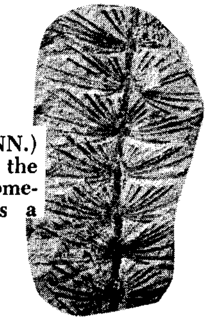
Sigillaria (PENN.) Another type of extinct "club-moss" tree showing leaf scars on trunk.



Neuropteris (PENN.) Very delicate carbonizations of fern leaves in shale.



Pecopteris? (PENN.) Delicate impressions of fern fronds in shale.

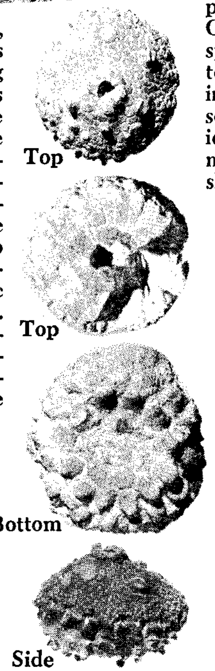


Asterophyllites (PENN.) A close relative to the modern horsetail—sometimes referred to as a living fossil.

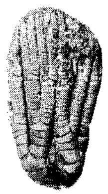
CRINOIDS

A slab of Devonian bedrock, above, from Alpena County. Some crinoids had lateral appendages, resembling arms, attached to their stems, as shown in three places on the above specimen. The surface of the above rock is covered with lace-like fossils of Bryozoa (pronounced bri-o-zoh'-ah) which means "moss-animal." Once believed to resemble plants, they comprise a big group of complex and predominantly marine animals that span geologic time from Cambrian to the present. Being colonial, bryozoans build various encrustations resembling netted fabrics, bushes and leaves. Generally, microscopic studies are required to classify them.

CRINOIDS—Crinoids (pronounced cry'-noids)—sea "lillies"—belong to a very large group of spiny-skinned marine invertebrates that include such familiar forms as the starfishes, sea urchins, and sand dollar—scavengers of the sea bottom. Crinoids first appeared in the Ordovician and are widely distributed in present seas. Fossil evidence indicates they attained their greatest development in favorable environments in shallow Mississippian seas. Rooted to the bottom by a stem, sometimes 70 feet long in extinct forms, and having ornate food-gathering fronds (called arms and pinnules) arrayed on their calyx, these delicate creatures look like plants—especially as they sway to and fro with the currents. Since the crinoids, and all their relatives, are composed of fragile limey plates, rarely are whole specimens preserved intact. Judging from the many limestone strata that are literally packed with crinoid "buttons" (stem columnals), they must have lived in great numbers, especially in the vicinity of coral reefs. Occasionally, in Michigan rocks we find specimens of the crinoids' cousins, blastoids (sea "buds"). They lived only during the Paleozoic, resemble crinoids somewhat but are without arms, and ideally exhibit the fivefold radial symmetry characteristic of many "spiny-skinned" animals (or Echinoderms).

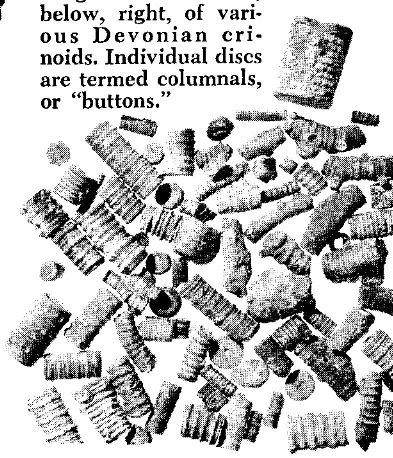


Megistocrinus (DEV.) Above, views of four calices (bodies) of several species. Note the geometric arrangement of small plates.



Taxocrinus? (DEV.? MISS.?) Right, an unusually well-preserved specimen found in the glacial drift. Shows how the arms branch. Calyx is concealed at the bottom.

Looking down inside the basal part of a crinoid calyx (body). Note where the stem was attached in the central area.



Fragments of stems, below, right, of various Devonian crinoids. Individual discs are termed columnals, or "buttons."

CORALS

CORALS—The corals (examples are shown on this page and also on pages 10 and 11) belong to a very large group of invertebrates called the Coelenterates (pronounced se'-len'-ter-ates) which means "hollow-intestine", referring to their hollow body cavity. Common examples are: The jellyfish, Portuguese man-of-war, sea anemone (a-nem'-o-nee), fresh water *Hydra*, sea fans (e.g., *Gorgonia*), and, of course, the stony corals that build such extensive barrier reefs in today's oceans. Coelenterates have left a comprehensive record from Cambrian time to the present. Perhaps the most important subdivision of the "hollow-intestine" animals are the corals, or Anthozoans—which means "flower-animal", referring to the colorful soft body polyp crowned with a circle of numerous stinging tentacles. During Silurian time, they showed such an extraordinary expansion of types that it is sometimes called "the age of corals".

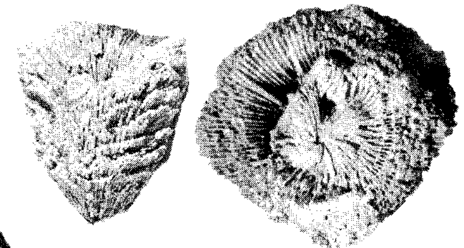
Corals always live in marine seas and most of them secrete a limey external skeleton roughly resembling a tube or cone. Some are solitary individuals, many are colonial or gregarious (like apartment dwellers). The single cup secreted by one polyp is called a corallite. Two or more corallites combine to form a corallum. The principal features in identification of corals are: The arrangement of the vertical partitions (septa) radiating from the central axis, the succession of horizontal supporting structures which the growing polyp built underneath itself as it continued to grow, and the size, shape, and relation of the corallites.

Of the four main types of corals, only two are living today, and neither of these has close Paleozoic relatives. The fossil corals in Michigan, therefore, all belong to extinct types—the Tetracorals (Paleozoic) and the Tabulate corals (Paleozoic through Mesozoic).

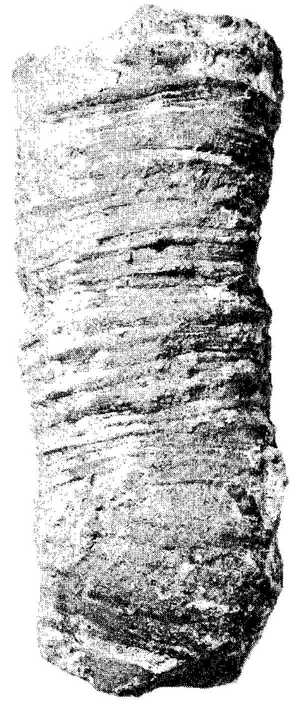
SOLITARY CORALS

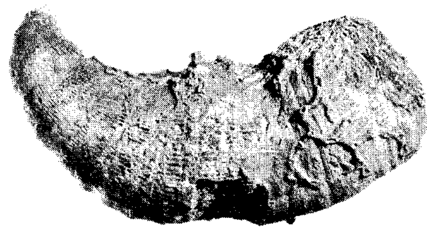
Belonging to Tetracoral type.

Cystiphyllum (SIL.) Above. Note blister-like development in the top, instead of the usual radiating septa; also regeneration by budding.

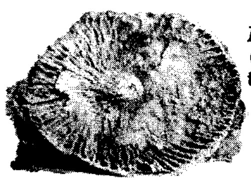


Ptychophyllum (SIL.) Above, left, side view. Outer wall completely gone. Right, top view.





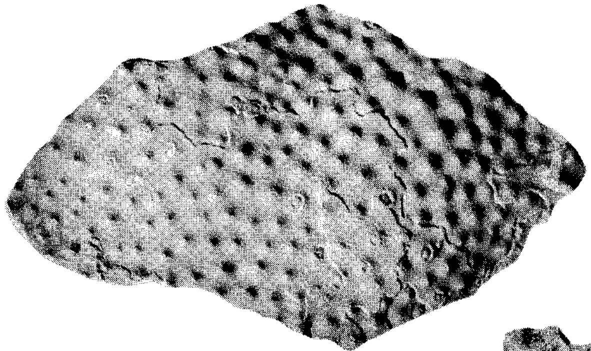
Siphonophrentis (DEV.) Above and left. Base is missing on the large specimen. Note the chain of minute connected tubes on the upper wall of the small specimen. These, too, are called *Aulopora* and belong to the Tabulate type.



Dinophyllum? (SIL.) Left, top view.

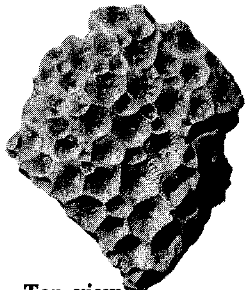
Typical Devonian "cup corals" or "horn corals," right. Mostly the genera *Heterophrentis* and *Zaphrentis*. The apex formed the attachment to the bottom. The polyp occupied the concave depression at the top of the cup.

COLONY CORALS

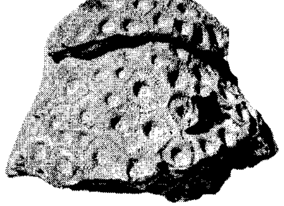


Parallelopora (DEV.)— Left, belongs to the Stromatoporoids, an uncertain group of extinct coral-like marine organisms which built laminated irregular limey masses on coral reefs.

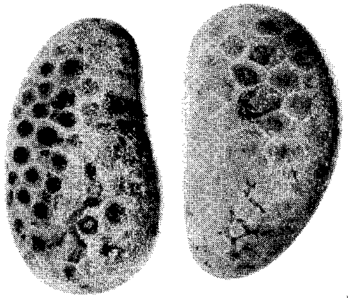
Hexagonaria (DEV.) Right and below, are six "Petoskey stones" (type of Tetracoral).



Top view

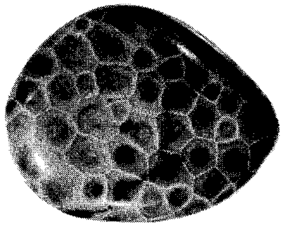


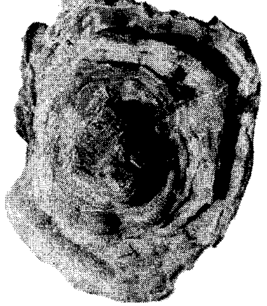
Side view. Above, note younger colony developed on top.



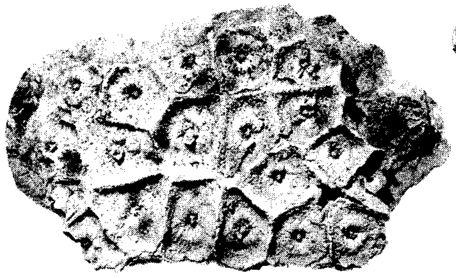
Beach pebbles, above.

Polished specimen, below. The reason for "hex" in the generic name is apparent.



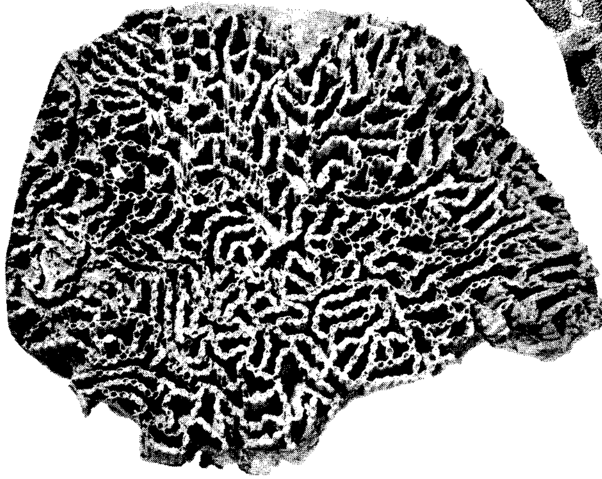


Bottom view

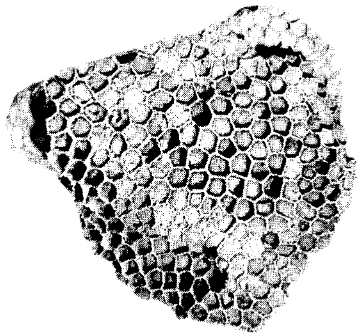


Arachnophyllum (SIL.) Above, belongs to the Tetracorals. (Note: All others on this page belong to the Tabulate type of colony corals.)

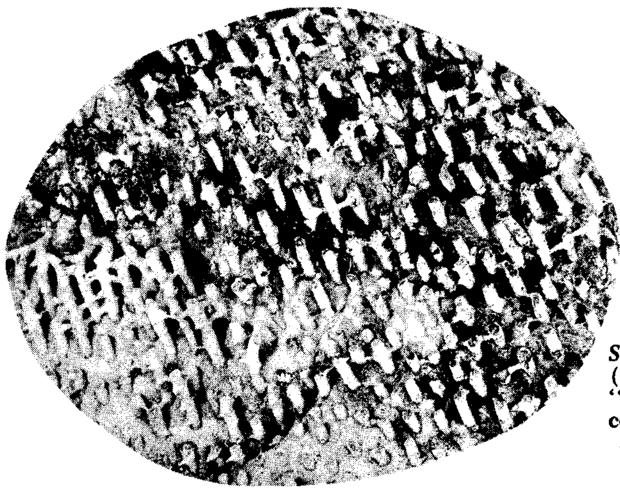
Coenites (DEV.) Above, a branching type coral.



Halysites (SIL.) Above, "Chain coral." Over 400 million years ago, each tiny round opening (a corallite) in this corallum was occupied by an individual living polyp.



Favosites (SIL.) Above, "Honeycomb coral." Size and geometry of the individual corallites varies greatly with the species.



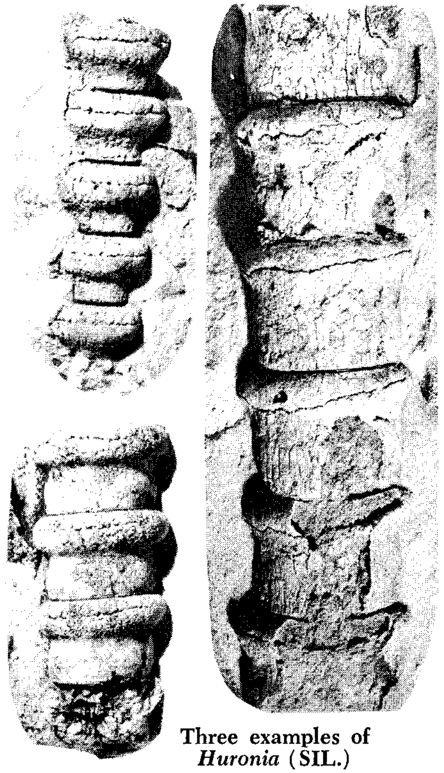
Syringopora (SIL.) Left, "Organ pipe coral."

CEPHALOPODS

CEPHALOPODS—(pronounced sef'-a-lo-pods) means "head-foot", referring to the tentacles arranged about the head of these creatures. Relatively few species live today but several thousand have been described for Paleozoic and Mesozoic time. The earliest rocks containing their remains are Cambrian, but during Ordovician time, cephalopods underwent great development. As a matter of fact, one straight-shelled cephalopod attained a length of more than 15 feet — both the largest creature in the early Paleozoic, and the greatest *shellfish* of all time.

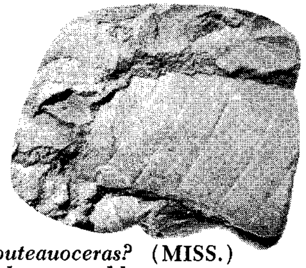
The squid, cuttle fish, octopus, and chambered nautilus are modern forms of cephalopods. Perhaps you imagined that jet propulsion is a Twentieth Century innovation. Well it isn't, for these creatures have always used water-expelling tubes in swimming. Another rather unusual attribute is their set of highly developed eyes — closely resembling those of the vertebrates.

Incidentally, the largest invertebrate of all times is living in our oceans right now — the giant squid which attains lengths exceeding 50 feet!

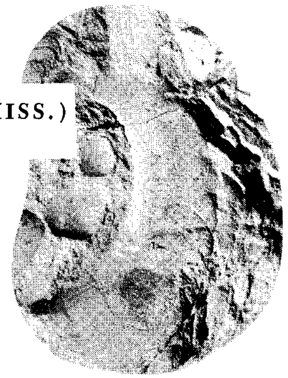


Three examples of *Huronia* (SIL.)

The discoverers of these fossils, believing them backbones, named one species *vertebralis.* Paleontologists ascertained the true identity as inner buoyancy-controlling tubes in cephalopods. Little is known about their outer shells, but, in general, they were probably about twice the diameter of these tubes. Some specimens have been reported about 5 or 6 feet long.

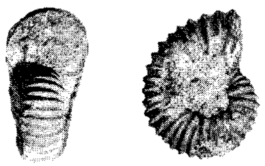


Chouteauoceras? (MISS.) Sandstone mold



Maccoyoceras? (MISS.) Sandstone mold

Pseudorthoceras (PENN.) An orthocone, or straight, type of cephalopod shell.



Front view — Side view

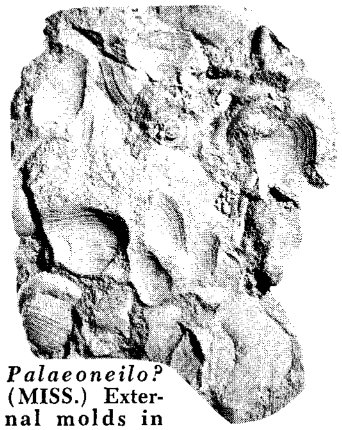
A nautiloid, or coiled type of cephalopod shell.

CLAMS

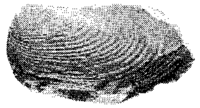
CLAMS—Clams belong to a class of shellfish called pelecypods (pronounced pe-les'-i-pods) which is literally interpreted as "hatchet-foot" because of a hatchet-shaped muscle used for pulling itself about. They are considered more highly organized creatures than the brachiopods. Most forms are free-moving. Clams are more numerous now than at any time in the past, there being several thousand genera today. Oysters are common marine pelecypods. Many species of clams have adapted themselves to fresh-water habitats. Besides being an important source of food, pelecypods provide us with precious pearl and mother-of-pearl.

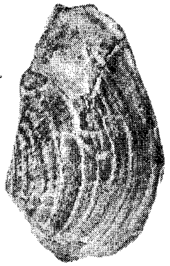
SNAILS—Snails belong to the gastropods (pronounced gas'-troh-pods) or "stomach-foot" creatures owing to the fact that they appear to tread on their stomachs. Next time you see one crawling along the window of an aquarium, perhaps you can determine how they accomplish this feat. They abound today, some even having invaded land habitats. Snails usually secrete whorled shells without chambers in a distinct spiral. In some snails however the whorling is so flattened that they can be mistaken for their relatives, the coiled cephalopods, in which the whorls occur in a plane— not a spiral. Cephalopods, which are always chambered, exhibit bilateral symmetry, snails do not. Some snails have no shell at all, so there is no way of knowing when they first appeared on the scene, though it is not unlikely that some got their start in Precambrian times.

Did you know snails have teeth? Some forms have literally thousands of microscopic teeth that are effective rasps or files. A small, neat conical hole in a clam valve, whether fossil or modern, could mark the spot where one of the "boring" variety of snails had a clam chowder meal—the demise of the clam. Is this not a "natural death"?



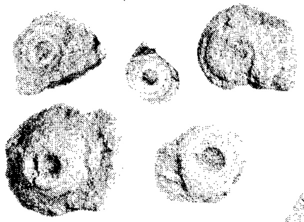
Palaeoneilo? (MISS.) External molds in sandstone.



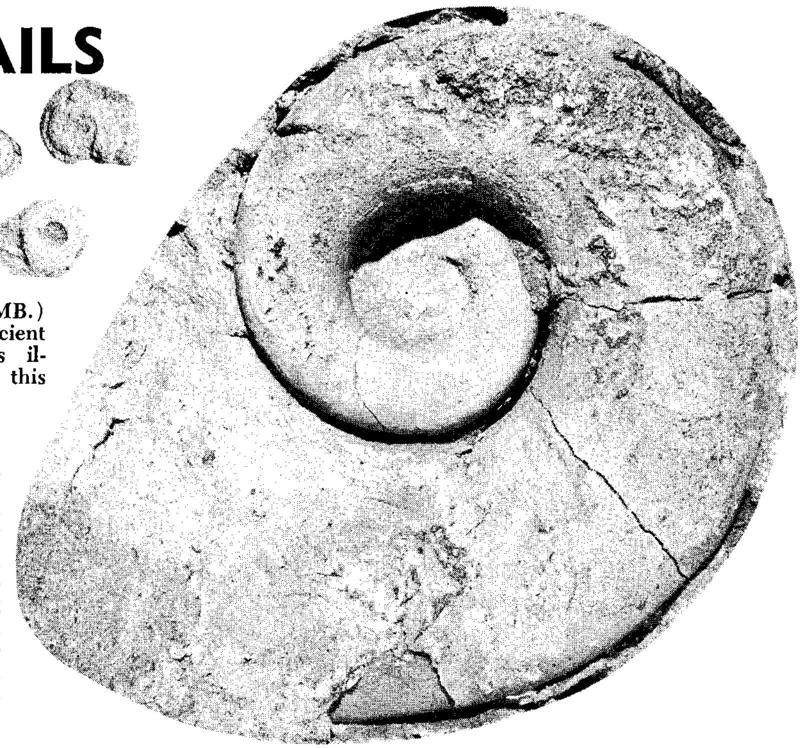


Allorisma (MISS.) View of left valve, above. Specimen is a limestone cast. Right, unidentified specimen from glacial drift.

SNAILS



Ophileta (CAMB.) The most ancient animal fossils illustrated in this booklet.

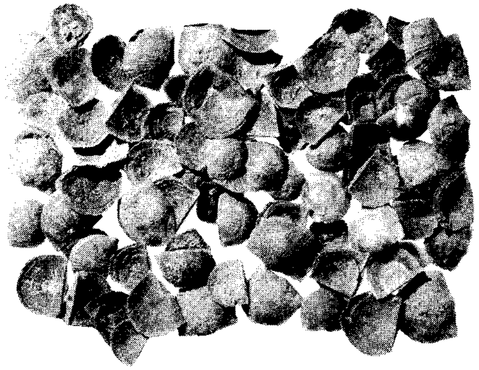


Omphalocirrus? (DEV.) Bottom view (base of spire). A smooth interior filling around which the ornamented shell has not been preserved.

Platystrophia (ORD.) Front view, left. The attaching stem protruded through a small opening in the horizontal hinge line area of the lower valve. Rear view, right.

BRACHIOPODS — The literal interpretation of brachiopod (pronounced brack'-e-o-pod) is "arm-foot", referring to an interior food gathering and respiratory appendage once incorrectly thought to be comparable to the muscle most clams use for locomotion. Sometimes brachiopods are called lamp shells because a side-view of many resembles "Aladdin's lamp."

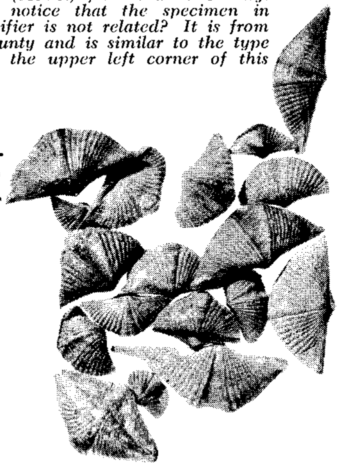
Brachiopods superficially resemble the pelecypods, or clams, because both are bivalved shell creatures. Both likewise have a long geologic history persisting from Cambrian time to the present. But the similarity ends there. Brachiopods were very numerous in Ordovician seas but began to decline thereafter, until now, only a few species remain. Most forms attached themselves to other objects on the sea bottom by means of a fleshy stalk protruding between the valves at the hinge line. The valves are unlike, one being upper, the other lower. In the case of most clams, however, one valve is left, the other right — one being the mirror image of the other.



Stropheodonta (DEV.) — Each specimen consists of two valves of which the upper is concave, the lower convex, leaving between them a very limited space for the living tissues. The average mature individual is usually larger than these.

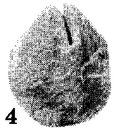
BRACHIOPODS

COVER ILLUSTRATION: Actual size casts and molds of Camarotoechia in sandstone (MISS.) from Huron County. Did you notice that the specimen in the magnifier is not related? It is from Delta County and is similar to the type shown in the upper left corner of this page.



Mucrospirifer (DEV.) The well-known "butterfly valves."

1 2 3



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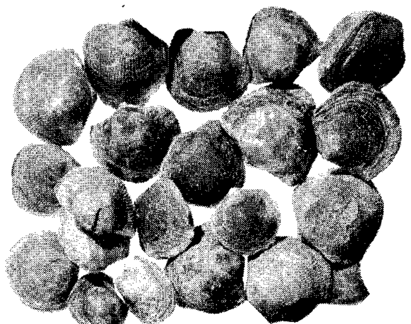
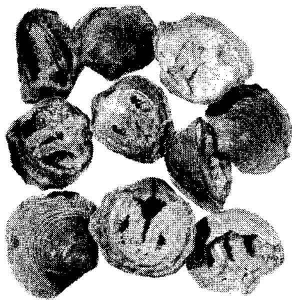
Pentamerus (SIL.) Internal casts. 1, upper valve; 2, oblique view of bottom valve; 3, left side view, and a good example of why branchiopods are sometimes called "lamp shells;" 4, lower valve, also called "deerfoot" shell.

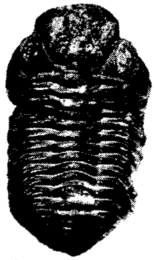
Atrypa (DEV.) Shapes somewhat resemble "tortoise shell," below. The upper valve is well-rounded. Note stem opening in "beak" of lower valve.





Atrypa (DEV.) A look inside, left, sometimes reveals a fossil geode in which calcite crystals have replaced former respiratory and food gathering organs, giving the appearance of "petrified walnuts."

TRILOBITES



Phacops (DEV.) Below, oblique side view. The mouth was on the underside, behind the tip of the head, and cannot be seen in these photos. A top view is at right.

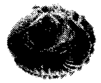
TRILOBITES—As their name implies, trilobites (pronounced try'-lo-bites) are three-lobed in a lengthwise direction. The last straggling survivors died out toward the end of the Paleozoic, so there are no living descendants. Present marine creatures remotely related to trilobites are the lobsters and crabs, particularly the horseshoe crab (*Limulus*). These invertebrates, along with such other familiar types as the shrimp, crabs, crayfish, insects, spiders, scorpions, and millipedes belong to a very large group called arthropods (pronounced ar'-thro-pods) which literally means "joint-foot" referring to their segmented appendages. In Cambrian rocks, trilobites outnumber all other creatures. Since it appears likely that they dominated that former sea, the Cambrian Period is called the "age of trilobites". Most species were about 2 to 3 inches long, but in middle Paleozoic time one fellow grew to 27 inches. Oddly enough, only a few specimens have been recovered from Cambrian formations in Michigan. They are found, however, in our other Paleozoic rocks. Incidentally, other extinct Paleozoic creatures closely related to the trilobites are the eurypterids, or sea scorpions. In general appearance, they resemble the present small land scorpions except the fossils are much larger—in fact, some specimens 9 feet long have been recovered from Silurian rocks in New York State. But the largest arthropod of all time, the giant Japanese spider crab (*Macrochira*) is living in the ocean today. The span of its appendages exceeds 11 feet!

Dipleura (DEV.) At left, top view, head missing. The lobes are barely detectable in this type.

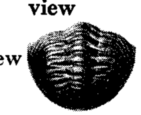
Phacops (DEV.) Four views, below. Most of the complete specimens found have the body tightly curled—the tip of the tail meeting the tip of the head—probably the only way of protecting its soft parts exposed on the under side.

Front view, above, the literal translation of this species' name *(rana)* means frog—the resemblance applying only to the protruding eyes!

Top view of head



Left side view



Top view of tail

Phacops (DEV.) Above, specimens usually look like this, because, like most arthropods, trilobites had three body segments that were easily separated—head, thorax, and tail. Furthermore, their "shell" consisted of a substance called chitin, similar to your fingernail, and this covering was molted, or shed, many times during the course of their lives.

IDEAS FOR FURTHER READING

BOOKLETS ON FOSSILS

Adventures with Fossils, by Robert Shaver. 49 pages (1959). Indiana Geological Survey, Bloomington, Indiana. Explains the various kinds of invertebrates and where to look for them. Especially good for young readers. Includes good book list. $.35

Fossil Plants of Indiana, by James Canright. 56 pages (1959). Indiana Geological Survey, Bloomington, Indiana. The classification and identification of fossils in Indiana. Much of the contents is applicable to Michigan. $.75

"Fossils Lift the Veil of Time", by Harry Ladd and Roland Brown. An article appearing on pages 363-386 in the March, 1956 issue of *National Geographic Magazine.* Tells what fossils are and their significance.

Fossils: Prehistoric Animals in Hoosier Rocks, by T. G. Perry. 83 pages (1959). Indiana Geological Survey, Bloomington, Indiana. An excellent summary of invertebrate classification. Includes glossary of paleontological terms. $.40

Guide for Beginning Fossil Hunters, by Charles Collinson. 36 pages (1956). Illinois Geological Survey, Urbana, Illinois. Popularly presented summary of main invertebrates. Especially appropriate for young readers. $.25

Ohio Fossils, by Aurèle La Rocque and Mildred Marple. 152 pages (1955). Ohio Geological Survey, Columbus, Ohio. An excellent guide for the layman on how to collect, prepare, and classify fossils. Many of the same types occur in Michigan. $1.00

INTERMEDIATE BOOKS ON FOSSILS

Handbook of Paleontology for Beginners and Amateurs, Part I. The Fossils, by Winifred Goldring, 392 pages (1960). New York State Museum, Handbook No. 9. Probably one of the best summaries of the science of invertebrate paleontology. Address Paleontological Research Institute, 109 Dearborn Place, Ithaca, N.Y. $3.00

The Fossil Book—a record of prehistoric life, by Carol and Mildred Fenton. 482 pages (1958). Doubleday & Co., Inc. An excellent encyclopedia of ancient life. Written in popular style and profusely illustrated. $12.50

BOOKS FOR ADVANCED COLLECTORS

Principles of Invertebrate Paleontology, by Robert Shrock. 816 pages (1953). A revised and enlarged edition. McGraw-Hill Book Co., Inc. $13.50

Index Fossils of North America, by Hervey Shimer and Robert Shrock. Published by Wiley and Sons, 837 pages and 303 plates (1948). The indispensable reference volume of professionals. $22.00

Treatise on Invertebrate Paleontology. The Geological Society of America, 419 West 117th St., New York 27, N. Y. A series of volumes in progress by various specialists. A price list of completed numbers is available from The Society.

Contributions from the Museum of Paleontology. The University of Michigan, Ann Arbor, Michigan. A continuing series of scientific papers, (dating from 1924) many of which treat Michigan fossil invertebrates.

RECENT PUBLICATIONS ON LIVING INVERTEBRATES

Living Invertebrates of the World, by R. Buchsbaum and L. J. Milne. (1960). Doubleday & Co., Inc. An extraordinarily beautiful presentation. $12.50

Life in Bays, by William Amos. 64 page booklet (1960). Nelson Doubleday, Inc. Prepared in cooperation with the National Audubon Society. Popular-style information on common marine invertebrates. Beautiful color illustrations come on separate sheets and are pasted in by purchaser.

Life on a Coral Reef, by Russ Kinne. 64 page booklet (1961). Nelson Doubleday, Inc. Prepared in cooperation with the National Audubon Society. Supplements above booklet.

MICHIGAN GEOLOGICAL SURVEY PUBLICATIONS

SURVEY PUBLICATIONS CONTAINING FOSSIL ILLUSTRATIONS

*Volume III (1876). Part II *Paleontology—Corals,* 55 plates.

Volume VII (1900). Part I, *Monroe County,* 1 plate; Part II, *Huron County,* 1 plate.

Publication 2 (1910). *The Monroe Formation of Southern Michigan and Adjoining Regions,* 29 plates.

*Publication 42 (1952). *Rocks and Minerals of Michigan,* 8 plates.

*Publication 44 (1945). *Geology of the Mackinac Straits,* 8 plates.

Publication 46 (1952). *The Middle and Upper Ordovician Rocks of Michigan,* 10 plates.

Publication 51 (1958). *The Cambrian Sandstones of Northern Michigan,* 1 plate.

*Out-of-print.

GENERAL REFERENCE VOLUME:

An Index of the Geology of Michigan, 1823-1955. Publication 50. Geological Survey Division. Available for $2.00 from the Publications Room, Michigan Department of Conservation, Lansing 26, Michigan. The following sections are of particular interest to fossil collectors:

"Reported Exposures of Paleozoic Rocks in Michigan", pages 199-243.

General index to Michigan paleontology, pages 426-430.

Index to fossil data in Survey publications, pages 43-45.