CHAPTER II

ANIMALS OF THE ANCIENT SEA

Scientists are constantly pushing back the age of the earth. Each new discovery seems to indicate that our planet is far older than it was formerly thought to be, and that life has been upon it for a much greater period than was formerly supposed.

The table on two following pages estimates in very conservative figures the approximate length in years of the various geological eras with their subdivisions, as estimated by present day geologists.

Such an estimate would mean that our earth is over seven hundred million years old; that there has been life upon the earth for over two hundred million years; and that man himself has been on earth for over four hundred thousand years, since it is now definitely known that man dates back at least to Pleistocene times. In the Western United States in Oklahoma and New Mexico, his rude stone implements have been found associated with Pleistocene mammalian fossils.

Moreover, life developed on the earth very slowly and gradually. At first, during the Archeozoic Era, only the simplest marine protozoans were present; more than a hundred million years elapsed before we see signs of the simple sponges and coelenterates, and nearly another hundred million before we begin to find the fossils of trilobites, brachiopods, molluscs and crustaceans. Then slowly through the ages were evolved higher and higher forms—corals, jellyfish, insects, fishes, reptiles, birds and mammals, and at last primitive man—each in turn appeared upon the scene.

According to the geology of Kentucky, the most of this State was under water until a little before the Pennsylvanian Age, which is theoretically placed at approximately seventeen million years ago. Consequently any life on this part of the earth before that time must have been marine life, and just what that life was may be judged from the fossils in the rocks which were laid down in these ancient waters.

The surface rocks of Kentucky are almost entirely sedimentary in structure, that is, they were formed by the sediment

Era	Period		Theoretical Duration in Years	Designation
Psychozoic (Era of Man)	Present		Roman times to present	Age of steel
	Modern		50 B. C. to Roman times	Later iron age
	Recent (Prehistoric man)		1500—500 B. C.	Earlier iron age
			4000—1500 B. C.	Bronze age
			7000—4000 B. C.	Neolithic (New stone age)
			40,000—7000 B. C.	Paleolithic (Old stone age)
			100,000—40,000 B. C.	Eolithic
Cenozoic	Quaternary	Holocene	100,000 years	Era of Mammals
		Pleistocene	200,000 years	
	Tertiary	Pliocene	3 million years	
		Miocene		
		Oligocene		
		Eocene		
		Paleocene		
Mesozoic	Cretaceous		9 million years	Era of Reptiles
	Comanchian			
	Jurassic			
	Triassic			
Paleozoic	Carboniferous	Permian	18 million years	Age of Amphibians
		Pennsylvanian		
		Mississippian		Age of Fishes
	Devonian			
	Silurian			Age of Invertebrates
	Ordovician			
	Cambrian			
Proterozoic	Keweenawan		50 million years	Lower Invertebrates
	Animikean			
	Huronian			

Archaeozoic	Algoman Timiskamian Laurentian Logonian	150 million years	First Invertebrates
Azoic	Crust formation	200 million years	No life
Red star evolution		27 million years	
Yellow star evolution		125 million years	
White star evolution		135 million years	
Nebulae		?	

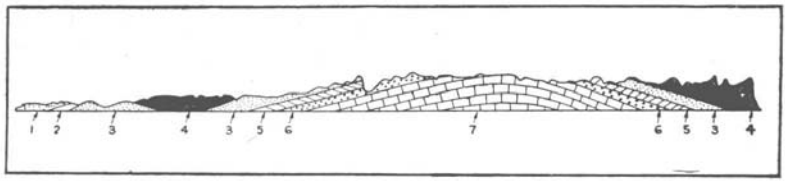
which settled to the bottom of the sea and later became hardened to form rock. Such sediment is always deposited in layers or strata and the resulting formations are therefore spoken of as stratified rock. These rocks are chiefly limestones, formed principally of carbonate of lime; sandstones, formed of sand grains cemented together; and shales and slates, formed chiefly from clay. Since we know that any part of the earth's surface showing stratified rock must have at one time been under water, and since a series of strata means that it must have been under water several times or under different conditions, it is obvious that Kentucky was not only the bed of an ocean or lagoon for long ages, but that it probably was subjected to many elevations and depressions, for the strata are numerous and varied.

When an aquatic animal dies, its body, or its bones, or its shell sinks to the bottom and becomes covered with the constantly accumulating sediment, thus leaving a record of its existence in the rock which is formed from this sediment. Any evidence of a living form of a previous geological age is called a fossil and there are three common types. Sometimes parts of the body itself, particularly the hard parts such as the bones, teeth or shell, remain intact, still composed of their original matter preserved without change. Sometimes the original organic matter is slowly replaced by mineral matter and we then speak of it as petrified; occasionally this replacement is so perfect that we can actually see the microscopical cell structure as in petrified wood. Sometimes the entire organism slowly decays leaving only its imprint in the rock which gives us a cast of the original form; these casts may also be very distinct, even of such delicate structures as the wing of an insect or the leaf of a plant.

Paleontologists recognize the fact that it is much more likely for an aquatic form to become a fossil than it is for a land form, for the bodies of land animals seldom find their way to the sedimentary bottom of a lake or ocean. It is not surprising, therefore, that our rocks should be so rich in marine life and so barren of evidence of land animals. In fact our principal mammalian fossils are of animals which have drowned in marshy bogs or whose bones have been trodden into the soft mire about salt licks.

When Kentucky was elevated from the shallow sea which had covered it for millions of years its first form was that of an island. This was due to the domal structure of what is now the Bluegrass region. Gradually the top of this dome was worn off, exposing the edges of the underlying strata as shown in the accompanying figure which represents a cross section of the State from east to west.

DIAGRAMMATIC EAST-WEST CROSS-SECTION OF KENTUCKY



KEY

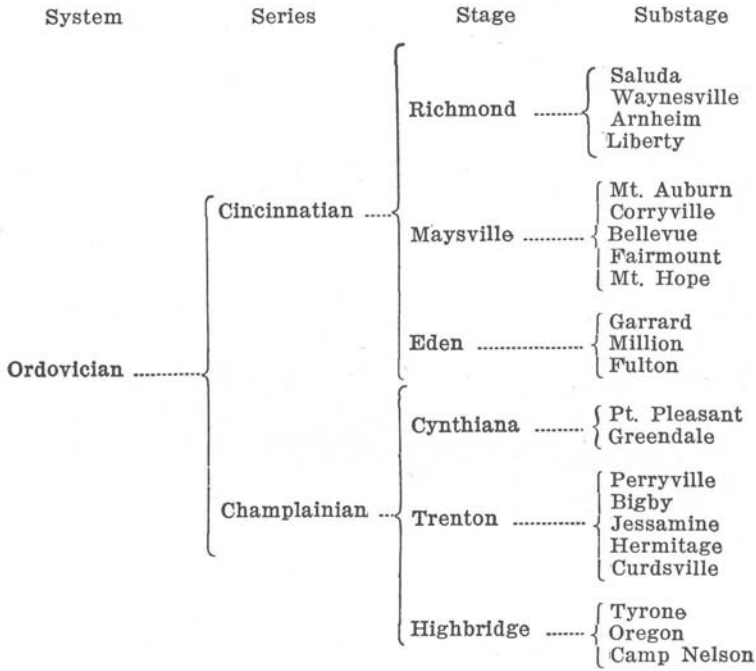
1. Tertiary
2. Cretaceous
3. Mississippian
4. Pennsylvanian
5. Devonian
6. Silurian
7. Ordovician

It will be seen upon following the rock formations as roughly indicated in this figure, that the oldest rock exposed in the State is the Ordovician limestone in the Blue Grass region. On both the east and the west sides of this formation we come successively to the Silurian, Devonian, Mississippian and Pennsylvanian. Each of these in order, except the Pennsylvanian, once extended over the top of the now broadly exposed Ordovician. The Coal Measures now represented by the eastern and the western fields at opposite sides of the State were probably connected across Pulaski, Casey, Taylor, Hart and adjacent counties of central southern Kentucky.

Therefore in various sections of Kentucky, various formations outcrop, so that it is possible to examine the fossils in each and determine the kinds of animals which inhabited the waters just before that type of rock was formed. In this way we secure an accurate knowledge of the ancient marine life.

Since the oldest fossil-bearing rock exposed in Kentucky is the Ordovician, it follows that our record of the ancient marine

life in this State must begin with the forms shown in this formation. The great Ordovician System, however, is extensive and covered a long period of time so that it is usually subdivided into series, stages and substages which are represented in Kentucky as follows:



Of course those layers of rock which are lowest in the series and ordinarily buried the deepest contain the oldest fossils, while the more recent layers show the remains of later forms of life.

The deepest natural cut in the Ordovician rocks in Kentucky, as the foregoing table would indicate, is that made by the Kentucky River near Camp Nelson. Here at low water may be seen the oldest exposed Ordovician strata in the State.

The Ordovician rocks as a whole are rich in fossils and each stage and substage has its characteristic forms by which that particular formation may be recognized. Such fossils are sometimes called "index fossils" since they serve to identify the rocks. The characteristic fossils of the Ordovician include

sponges, corals, crinoids, bryozoans, brachiopods, pelecypods, cephalopods, gastropods, and trilobites, and a brief description of each of these forms will give us an idea of the kind of animals which lived in the waters of this part of the earth twenty or thirty millions of years ago.

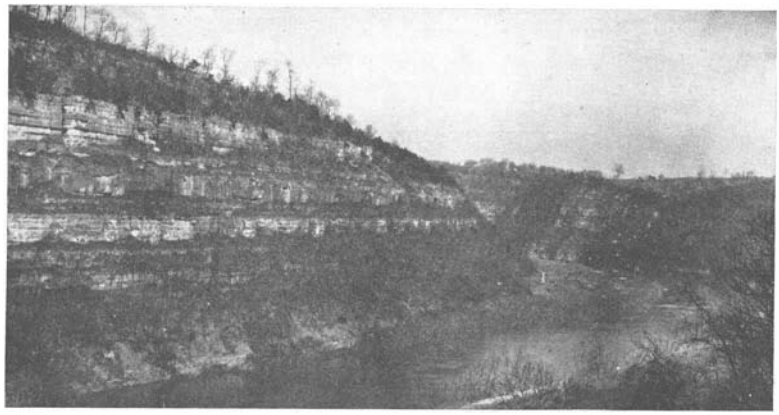


PHOTO BY W. R. JILLSON

FIG. 2. A NATURAL CUT.
Deep gorge in Kentucky River.

The *sponges* are the lowest of the metazoans, or animals which have more than one cell, and are very simple in structure. The body is hollow, with an opening at the top; the body wall

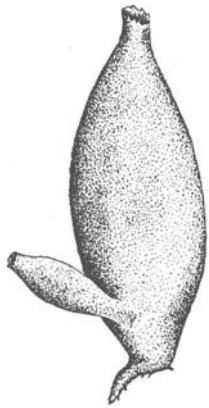


FIG. 3.
A SPONGE WITH A BUD.
A primitive marine animal.

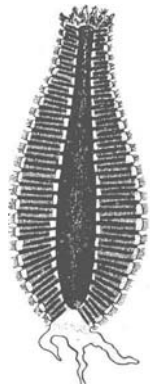


FIG. 4. LONGITUDINAL SEC-SECTION OF SPONGE.
Showing the hollow body and the canals.

contains numerous spicules of lime or of silicate and is permeated by many pores through which water enters the body cavity. Sponges reproduce chiefly by simple processes such as budding or fission and are very primitive. They are mostly marine and somewhat plantlike in appearance.

The ancient sponges were not unlike the modern forms in general appearance and since their spicules consisted of mineral matter the structures are often well preserved.

FIG. 5. SPONGE SPICULES.
Curious designs in skeletal fibers.

The *corals* belong to the phylum of animals, most of which are marine, which includes also our modern jellyfishes, hydroids, polyps, sea-anemones and hydras, but the corals are characterized by the fact that they secrete in their body walls a large amount of lime so that after the death of the individual the skeleton persists as a stony mass. New generations grow upon the remains of the old and as a result great islands, reefs, atolls and barriers are often built up by the continued deposits. Sometimes the mineral matter is brilliantly colored as in the case of our precious corals, and often the growth takes remarkable and fantastic forms, producing the interesting tree-corals, fan-corals, head-corals, rose-corals, cup-corals, and brain-corals.

Since the body wall of this animal contains so much mineral matter, there is little to decay and the form is easily preserved. As a result, corals lend themselves well to fossilization. Moreover, since corals are so abundant and grow in so many types of habitats, from the surface of the water to five hundred fathoms below the surface, fossils of this class of animals are extremely common and may be found, not only in the Ordovician, but in practically all of our Kentucky rocks. Apparently the ancient

corals were very similar to those of today for in many cases the fossils are almost identical with certain modern forms.

FIG. 6. A PIECE OF CORAL.
Showing tree-like habit of growth.

The *crinoids* or "sea-lilies" are marine animals which are very plant-like in appearance, usually consisting of a long slender stalk at the top of which is the body or "calyx" from which radiate a whorl of branched, feathery tentacles or "arms." The entire animal is thus extremely flower-like. There are only about five or six hundred species of this class of ani-

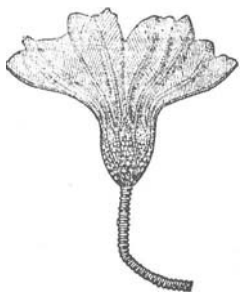


FIG. 7. A FOSSIL CRINOID.
Popularly known as the "sea-lilly."

mals now on earth but they were apparently very abundant in ancient times for their fossil remains are common in most limestone formations. They belong to the same great group of ani-

mals as the star-fish, brittle-star, sea-urchin, sand-dollar and sea-cucumber, and closely resemble the other members of the group in their physiology and life history. They live in both deep and shallow water and the body is firm enough to leave excellent impressions in the rock. Very beautiful and perfect specimens of crinoids may be found in the Ordovician limestones of Kentucky.

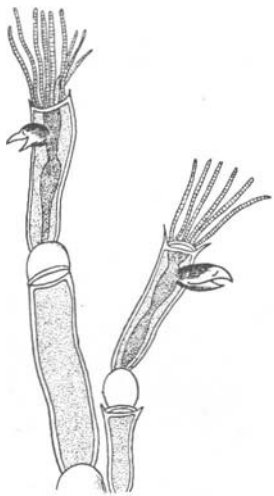


FIG. 8. BUGULA AVICULARIA.
A modern bryozoan.

The *bryozoans* or "moss-animals" also suggest plant structures in their appearance. They are colonial aquatic animals usually found growing in tufts an inch or two in height on rocks or drift-wood along the ocean shores. They are very abundant in almost all parts of the world but are seldom noticed because of their modest appearance or, if noticed, are supposed by most persons to be plants. Most of them are marine, ranging in habitat from tide-level to a depth of over fifteen thousand feet, but a few inhabit fresh water. The colony is made up of a bunch of tiny stems, each stem bearing a series of little heads or cups suggesting the blossom of a flower. In the center of the cup is the mouth, which is surrounded by a crown of ciliated tentacles. The animals are attached to the rocks or drift by means of root-like fibers. On the cups are peculiar appendages, the avicularіae,

which resemble the head of a bird with little beaks which are always in motion and probably protect the animal from attacks of small organisms which might settle upon it. Bryozoans are very simple animals. The digestive system is primitive, there are no blood-vessels nor excretory organs, breathing is accomplished through the tentacles, and no nervous system has been found.

Like the crinoids, the bryozoans must have been very numerous in the former geologic ages for we find their fossils from the lower Ordovician to the present. The fossil figured is a specimen from the Cynthiana formation in Kentucky.

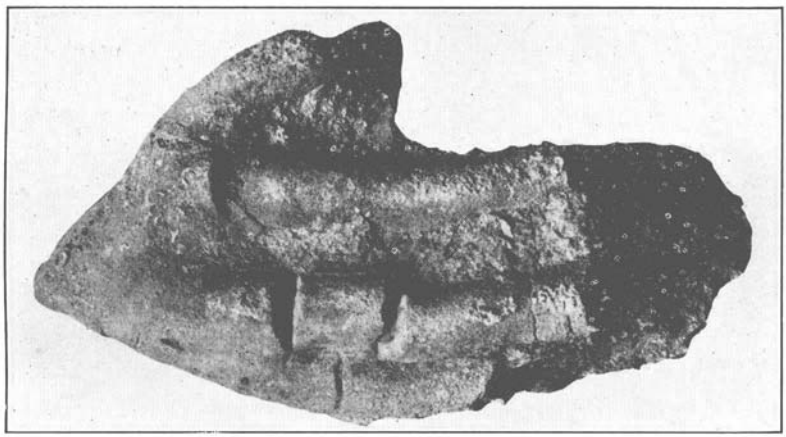


FIG. 9. ERIDOTRYPA BRIAREUS.
A fossil bryozoan from Kentucky.

The *brachiopods* belong to the same phylum of animals as the bryozoans but in appearance they more nearly resemble certain of the bivalve molluscs since they have a pair of hard calcareous shells. In fact, for a long time zoologists regarded them as molluscs because of this resemblance. In the brachiopods, however, the shells are dorsa-ventral instead of lateral as in the molluscs and they are not symmetrical. One valve is larger and shows a beak while the other is smaller and usually does not agree with its mate in convexity. The large beaked valve is called the pedicle valve and the other the brachial valve. It is this peculiar appearance of the valves which gives the very characteristic imprint or cast in many of our fossils.

Present-day brachiopods, which are very abundant, are all marine and are found in almost all parts of the world. Most species live in shallow water but some are found at very great depths. It is noticeable that the shallow-water forms are more numerous and have much thicker shells than the deep-sea varieties and this fact gives us a clew as to the depths of different parts of the seas in ancient times, since we may judge the type of habitat by the abundance of the fossils and the thickness of their valves. Brachiopods are usually attached to some object by a stalk or peduncle and inside the shell is a curious organ, the lophophore, which bears two arms, each arm provided with tentacles for securing food. Although primitive and simple animals they have well developed digestive, circulatory and nervous systems.

The brachiopods are an extremely old race and seem to have changed but little through the ages. In fact, one form, *Lingula*, which is on earth now, is apparently the same as it was in the Silurian some twenty-five million years ago. Fossil brachiopods are abundant in Kentucky and a number of species are represented. The specimen figured is from the Arnheim beds of the Ordovician .

FIG. 10. A PLATYSTROPHIA.
One of the common fossil brachiopods of Kentucky.

The *pelecypods* are mulluscs which are distinguished by having a thin hatchet-shaped foot and usually possessing a pair of symmetrical lateral shells. Our present-day clams, mussels, oysters and scallops belong to this class. The inside of each shell shows the scars of the powerful muscles which hold the valves together, the teeth which interlock when the valves are closed to prevent opening by twisting, and often a deposit of beautiful iridescent nacre or "mother-of-pearl," which in many of the

marine forms is extremely attractive. The body of a pelecypod is soft and ends in the muscular foot which is used in locomotion. On each side of the body is a pair of gills by means of which the animal breathes, and between the gills and the valves, a thin mantle which secretes the lime of which the shell is composed.

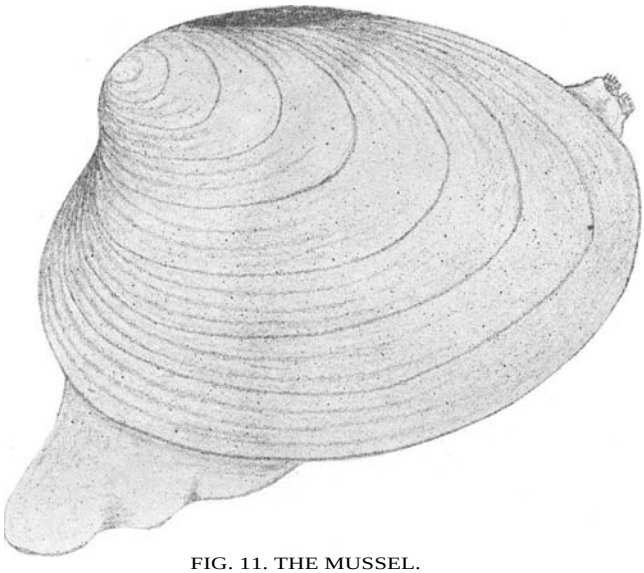


FIG. 11. THE MUSSEL.
A modern pelecypod.

At the posterior end of the body the mantles form two siphons, the inhalent siphon through which the water is brought in, and the exhalent, through which it is discharged. The pelecypods have complete and rather elaborate digestive, circulatory, respiratory and reproductive systems.

Most pelecypods burrow in the mud or sand and are found in comparatively shallow water. Some species are parasitic in their larval stages, living in the bodies of fish or other aquatic animals. Many species secrete pearls and are much in demand for this reason.

Because of their characteristic shape and the equal, symmetrical, compressed, "mirror-image" valves, pelecypods are usually easily recognized, whether modern or ancient. Moreover, since the shells are composed entirely of mineral matter,

they lend themselves well to fossilization and therefore their shells, casts and imprints are common as fossils. Many of the Ordovician pelecypod fossils are very well preserved and very suggestive of modern forms.

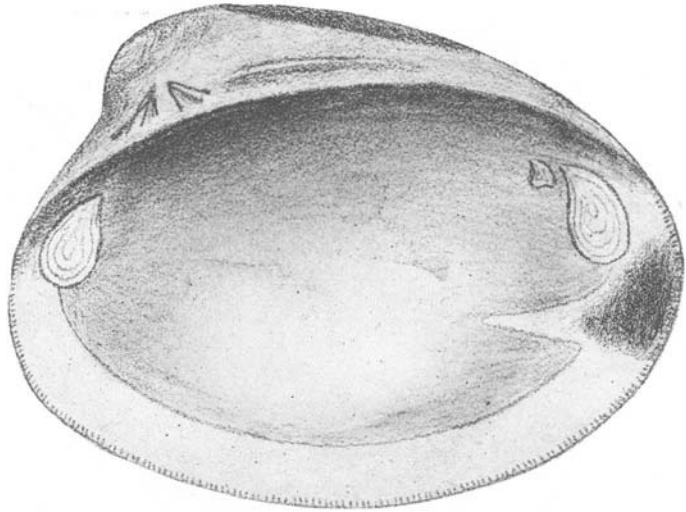


FIG. 12. INSIDE OF MUSSELL SHELL.
Showing teeth and muscle-scars.

The *gastropods* are those molluscs which are not symmetrical, have a distinct head, have the foot on the abdominal part of the body and usually have a univalvular spiral shell. Belonging to this class of animals are our modern snails, which have the typical spiral shell and the slug, in which the shell is vestigial. Gastropods are very abundant at the present time and are

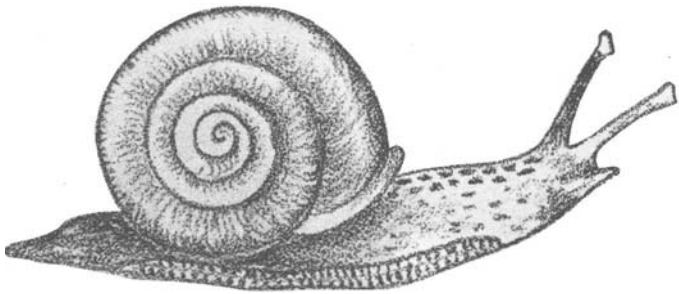


FIG. 13. THE SNAIL.
A modern land gastropod.

found in almost all parts of the world and in a great variety of habitats. Some are marine, some live in fresh water, and some are terrestrial. Some are found beneath the surface of the earth and some in the tops of trees. Some live in marshes; others in the desert. Along the sea-shore and around ponds and

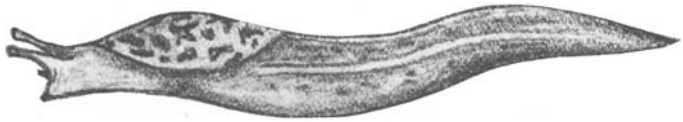


FIG. 14. THE SLUG.
A modern gastropod without a well developed shell.

streams their shells may be found in vast numbers and may usually be recognized by the typical spiral shape although some are saucer-shaped or almost flat. Sometimes these shells coil toward the right (dextral) and sometimes toward the left (sinistral).

FIG. 15. MODERN GASTROPOD SHELLS.
Showing dextral and sinestral types.

The body of a gastropod is soft and is asymmetrical, due to the torsion in growth. In the more typical modern forms, such as the snail, the animal has a distinct head on which is a pair of tentacles and a pair of eyes on stalks which can be raised or lowered. Like other molluscs, the snail has a mantle which secretes the shell. The digestive system is well developed and consists of a mouth, oesophagus, salivary glands, stomach, intestine and anus. The food is usually vegetable matter which is scraped up with a peculiar rasp-like tongue. The snail has a

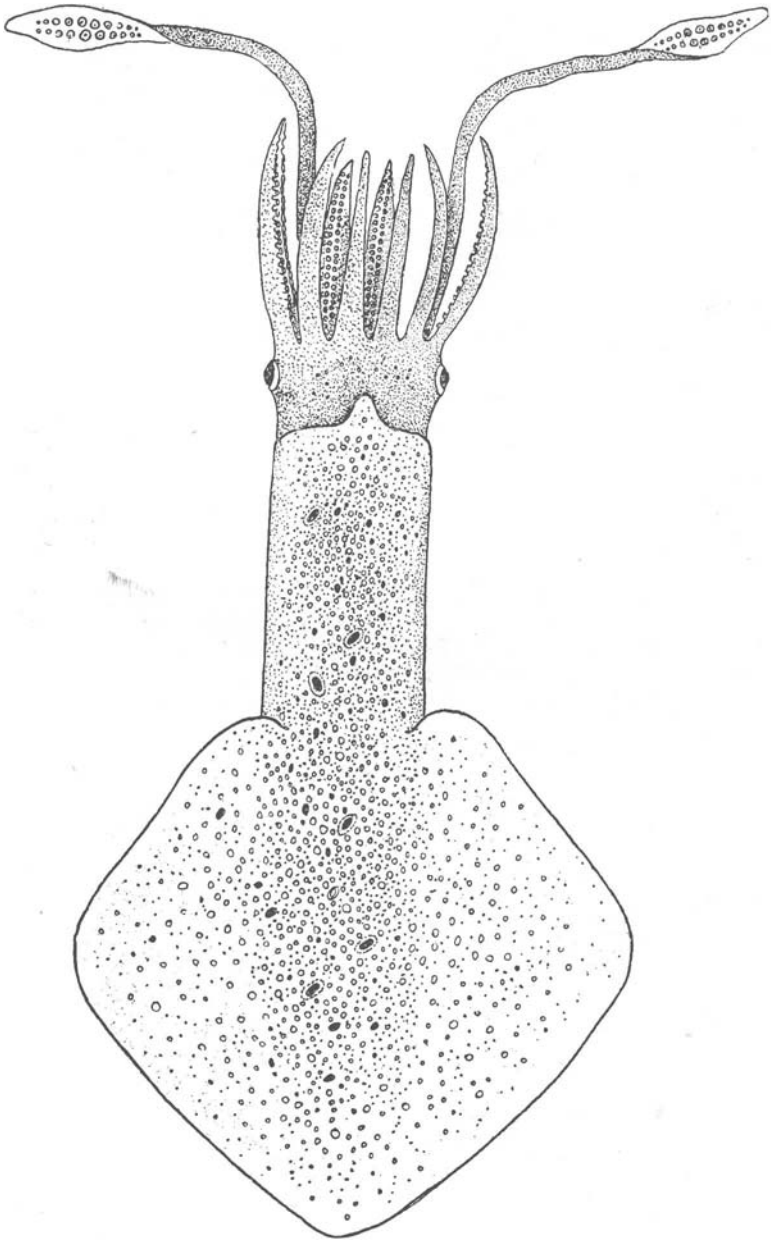


FIG. 16. THE SQUID.
A modern cephalopod.

heart with one auricle and one ventricle and colorless blood with a definite circulation. It breathes through a single gill. The nervous system consists of a series of well developed ganglia and same of the special senses seem distinct. Sometimes the sexes are separate and sometimes the animals are hermaphroditic. Of course these soft body parts are not often preserved as fossils and usually only the shells or their casts are represented in the fossil forms.

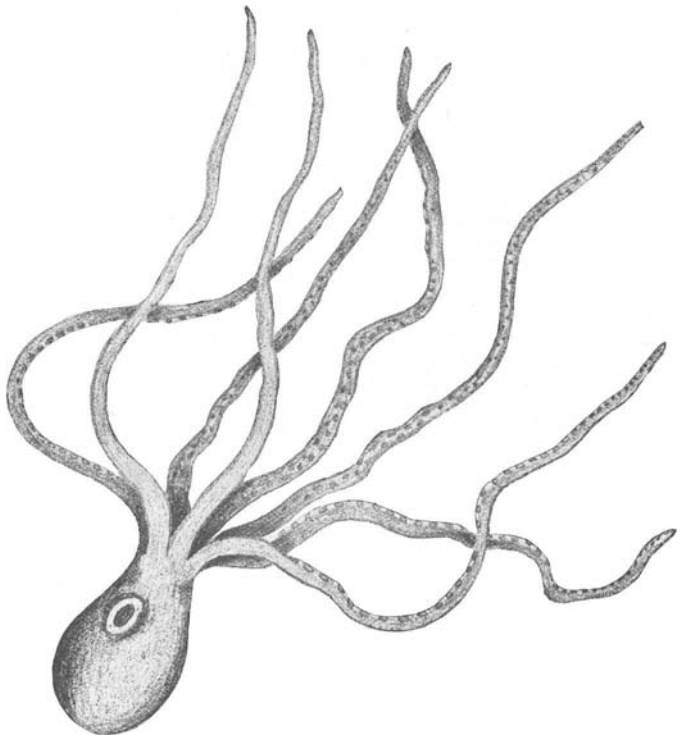


FIG. 17. THE OCTOPUS.
The largest living cephalopod.

The *cephalopods* are also molluscs in which the foot is developed from the head and is divided into tentacles with suckers. The shell is often poorly developed and sometimes entirely absent. The cephalopods are bilaterally symmetrical and the head is distinct. They are all marine. The general anatomy and physiology is homologous with that of the other molluscs

but the shape of the body and the habits of the animals are quite different.

Modern cephalopods are best known from our common squid, which is found in most of the oceans of the world and which is represented by the species *Loligo pealii* along the

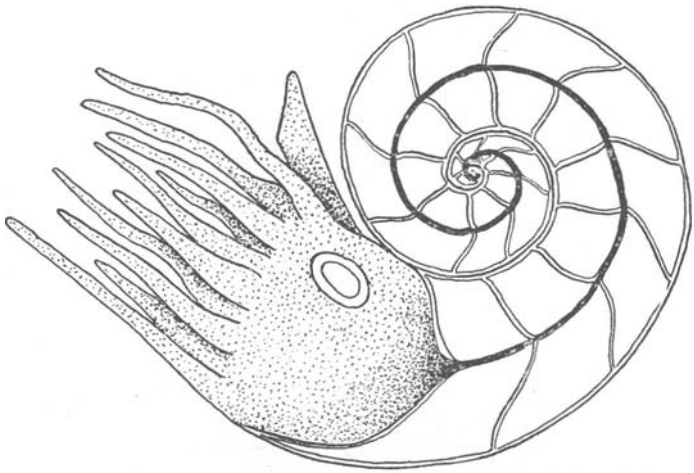


FIG. 18. THE PEARLY NAUTILUS.
One-half of the shell removed to show the chambers.

eastern coast of North America. The body of the squid is spindle-shaped and from the head projects the divided foot in the form of ten tentacles or "arms," two of which are much longer than the others. These arms are used for securing food and for steering the animal when it swims, for the squid usually swims backward. The head bears two large eyes and the mouth. On the sides of the body near the posterior end, the mantle projects in triangular flaps called "fins" which are used in locomotion. The skin is leathery and has the power of changing color. In the dorsal part of the body just beneath the skin is the remains of the shell which is known as the "pen." The body contains an "ink-bag" in which is secreted a black fluid which the animal discharges when disturbed.

The largest of modern cephalopods, and in fact the largest living invertebrates, are the octopods which are really dangerous and powerful animals. The octopus or "devil-fish" of the

tropical seas reaches a length of ten or twelve feet and a weight of nearly one hundred pounds. These giants among the molluscs have been known to destroy the unlucky bather who comes within their reach and the strength of their writhing arms with their powerful suckers has been made the theme of many an exciting tale of the sea.

Belonging to this same class is the famous pearly nautilus or "chambered nautilus" of the tropical waters, made classical by Oliver Wendell Holmes' poem. This animal builds a shell which consists of a series of chambers separated from each other by partition walls or "septa." The nautilus lives in the outer chamber but maintains connection with the old chambers by means of an extension of the body called the "siphon," the function of which is not entirely understood. As the animal increases in size it builds new chambers, continuing the curvature and structure of the shell. This habit has given the poet the theme:

"Build thee more stately mansions, O my soul,"

which is familiar to every school boy and girl.

Most of the fossil cephalopods are of the squid or nautilus type. They are very abundant and range through a long geologic series.

The *trilobites* are closely related to the crustaceans and in fact are included by most zoologists in that class of animals. Our modern crustaceans include such forms as the crayfish, lobster, crabs, barnacles and shrimps. Trilobites are entirely extinct and we know them only from fossils. These fossils, however, are so abundant and in many cases so perfect, that we know well what the animal was like.

The exoskeleton of the body consisted of a heavy dorsal shield which is the part best preserved in the fossils; a thin ventral membrane which is only occasionally evidenced; and the coverings of the appendages. The dorsal shield shows a head with a central disc called the glabella, two cheek or eye lobes, and a pair of antennae; a thorax consisting of many segments; and a single caudal plate, the pygidium. On the under side of the body were legs and on the under side of the head a series of mouth parts.

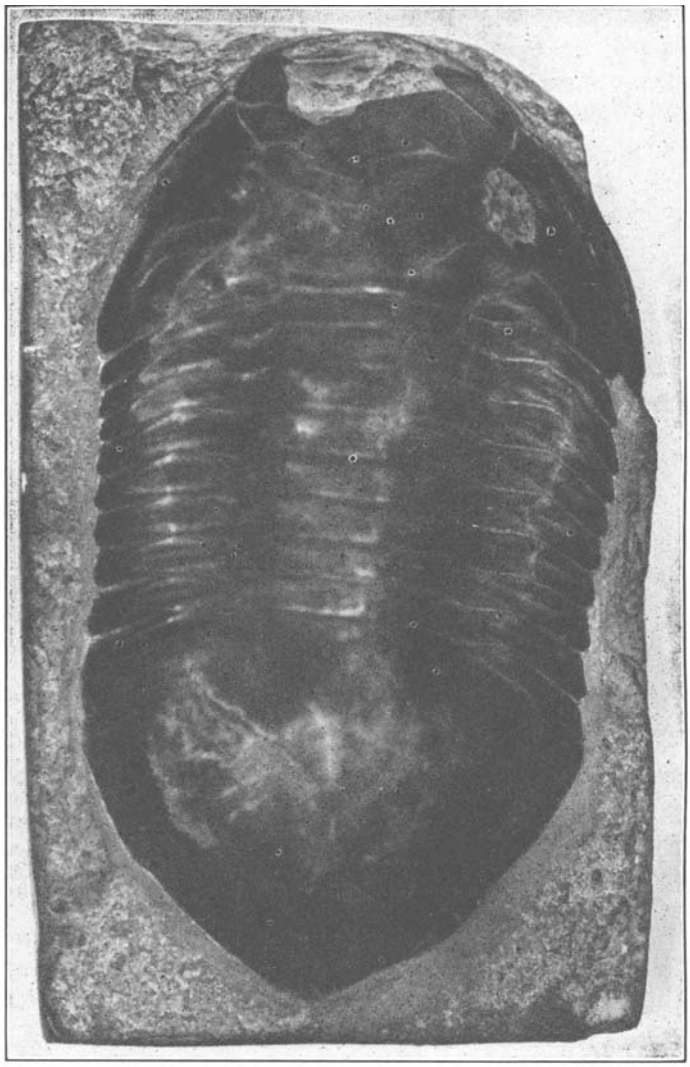


FIG. 19. A TRILOBITE FROM KENTUCKY.
An unusually fine specimen collected by W. J. Curtis on his farm in Robertson County.

The name "trilobite" refers to the fact that the dorsal shield is divided into three rather distinct lobes, a central or “axial” lobe, with a lobe on each side, the “pleural” lobes. The entire shield was segmented and the segments of the pleural lobes bore projections called the pleural spines.

In general physiology and habits trilobites were probably much like certain of our modern crustaceans. They were undoubtedly marine since they are always found associated with such other forms as corals, crinoids and brachiopods which are typically salt water animals. The food, as judged from the mouth-parts and intestine, was apparently animal matter, both living and dead, which was seized by the appendages, carried to the mouth and macerated by mandibles. Sense organs are represented by the eyes and the antennae. Breathing was accomplished through hair-like structures on the appendages and ventral membrane. It is possible to distinguish parts of nervous, circulatory and muscular systems. Judging from the muscles, as indicated by muscle scars and attachments, many trilobites had the power to curl themselves into a ball in the fashion of their modern relatives, the pill-bugs or sowbugs.

Trilobites are extremely abundant in our Ordovician rocks and certain species are used for the index fossil for some of the Eden formations. Typical forms are among the easiest of all fossils to recognize because of the characteristic three-lobed appearance.

The Silurian Age is represented by only a comparatively thin layer of rocks in Kentucky. These formations are classified as follows:

System	Series	Stage	Substage
Silurian	Niagaran	East of Arch	Louisville
			Waldron
		Alger (East)	Laurel
			Estill
		Osgood (West)	Waco
			Lulbegrud
	Oswegan	Indian Fields	Oldham
			Plum Creek
		Medina	Brassfield

It was during this age that the great "Cincinnati Arch" was lifted out of the sea, and between this time and the next

submergence (in the Devonian Age) much of this rock was eroded away so that it now measures only about 350 feet in thickness at its maximum. The fossils of the Silurian formation are largely those of corals, crinoids and brachiopods, very similar to those found in the Ordovician.

PHOTO BY W. R. JILLSON

FIG. 20. AN ANCIENT CORAL REEF.
Fossil coral exposed in Ohio River.

During the first part of the Devonian Age, Kentucky was apparently out of water and great erosion was taking place for in this State the rocks of the Mid-Silurian Age are immediately overlaid by the formations of the Mid-Devonian. This interval, during which no rock was deposited, must have been a very long one, for in Pennsylvania we find strata two thousand feet thick which were formed during this time. About the middle of the Devonian Age a submergence took place and the middle and upper Devonian formations are represented by a lower limestone series and an upper shale series as follows:

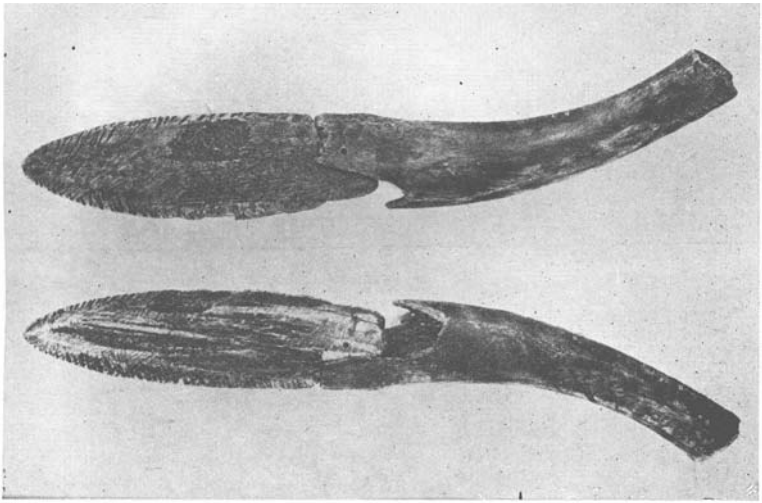
System	Series	Stage	Substage
Devonian	Upper Devonian	Genesee	Ohio
	Middle Devonian	Hamilton	Delaware
		Onondaga	Columbus

The Columbus limestone is characterized by the number and perfection of its corals, which are so abundant that it is evident that in some localities, such as the Falls of the Ohio at Louisville, there must have been in ancient days a great coral island or reef.

In this limestone are also found fine fossils of brachiopods and gastropods.

The Upper Devonian formation is almost entirely black shale which contains few fossils. In this shale, however, have been found the remains of both land and water plants, brachiopods and fish.

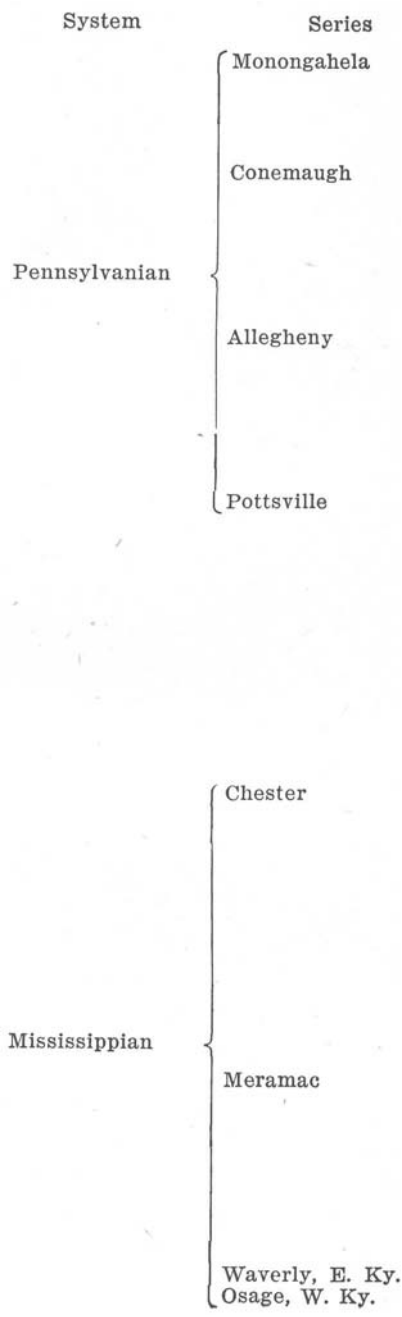
The great Carboniferous Age, during which the immense coal deposits were formed, is represented in this state by two great systems of rocks, the Mississippian and the Pennsylvanian. Both of these systems show numerous formations in Kentucky which are classified by geologists as follows:



ONE-THIRD NATURAL SIZE

A FINE INDIAN KNIFE

This splendid weapon was found by Charles B. Hodges in a rock house on the waters of Cub Run Creek, Western Hart County, Ky. Collected by Dr. W. R. Jillson, Feb. 5, 1928. The blade is part of an elk's antler, while the handle is fashioned from the rib of a deer. Gut and deer throngs were possibly used to hold them together. Numerous beads and trinkets were found in the same locality.


System
Series
Monongahela
Conemaugh
Pennsylvanian
Allegheny
Pottsville
Chester
Mississippian
Meramac
Waverly, E. Ky.
Osage, W. Ky.

Stage		Sub-stage
Henshaw	W. Ky.	
Dixon	W. Ky.	
Lisman	W. Ky.	
Morgantown sandstone	N. E. Ky.	
Ames limestone	N. E. Ky.	
Buffalo sandstone	N. E. Ky.	
Lower Cambridge limestone	N. E. Ky.	
Mahoning sandstone	N. E. Ky.	
Freeport form.	N. E. Ky.	
Kittaning form.	N. E. Ky.	
Vanport limestone	N. E. Ky.	
Brookville coal	N. E. Ky.	
Carbondale	W. Ky.	
Tradewater (upper part)	W. Ky.	
Breathitt	E. Ky.	
Lee	E. Ky.	Corbin, Rockcastle, Beattyville
Tradewater	W. Ky.	
Caseyville	W. Ky.	
Mauch Chunk	E. Ky.	Pennington, Glen Dean, Gasper
Kinkaid	W. Ky.	
Degonia	W. Ky.	
Clore	W. Ky.	
Palestine	W. Ky.	
Menard	W. Ky.	
Waltersburg	W. Ky.	
Vienna	W. Ky.	
Tar Springs	W. Ky.	
Glen Dean	W. Ky.	
Hardinsburg	W. Ky.	
Golconda	W. Ky.	
Cypress	W. Ky.	
Gasper (Paint Creek)	W. Ky.	
Bethel	W. Ky.	
Renault	W. Ky.	
St. Genevieve		Ohara, Rosiclare, Fredonia
St. Louis		St. Louis
Warsaw		Spergen, Harrodsburg
Logan		Vinton, Allensville, Byer
Cuyahoga		Berne, Blackhand, New Providence
Kinderhook		Sunbury, Berea, Bedford

The Mississippian includes the Waverly sandstones which are exposed to form the "Knobs" and the famous "Muldraugh's Hill"; the Mammoth Cave limestones which are noted for their immense caverns; and the Chester series of sandstones, shales and limestones which surrounds the western coal-fields in a belt from five to ten miles wide and is characterized by the strip of poor agricultural land which it marks. The Mississippian is rich in fossils, including bryozoans, pelecypods, blastoids, crinoids, corals, brachiopods and fish so that we know that life during this period was abundant. Some of these fossils are extremely interesting, particularly the crinoid, *Platycrinus sculptus*, the jointed, hollow stems of which are popularly known as "Indian beads" in the localities where they are found.

The Pennsylvanian is the great "coal-measure" formation in which the seams of coal are found between deposits of sandstones, shales or impure limestones. Geologists are not agreed as to whether the great masses of plants which were fossilized to form coal grew in vast marine swamps at the spot where the coal is now found or whether it was fresh-water vegetation floated there by the action of the streams. Whichever explanation is correct, the Pennsylvanian Age represents a time when the land plants and animals were beginning to appear, for the formations show evidences in the forms of tracks and fossilized skeletons of amphibious animals which were becoming independent of an aquatic life and fossils of plants which are distinctly land forms.

Thus the end of the Pennsylvanian ushered in the closing period of the reign of the marine forms in that part of the globe which is now Kentucky. New and higher forms were destined to take their places as the dominant animals of the earth. The land masses were increasing in size and the seas becoming smaller. Slowly the northern waters were pushed back by the rising continent, still more slowly the southern seas became shallower. Finally, sometime during the late Tertiary period, the waters receded for the last time and entirely from the "Purchase" region of Western Kentucky and this State was no longer the home of the Animals of the Ancient Sea.