RECORD OF LIFE

by
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and
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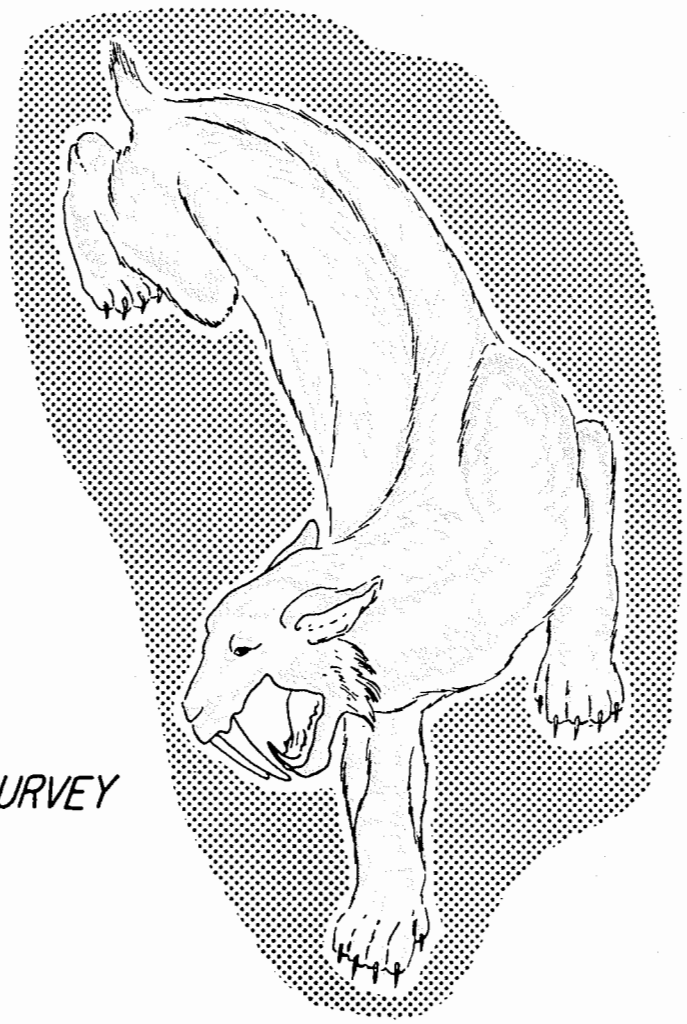


Illustrated by
Dennis Johnson

SOUTH DAKOTA GEOLOGICAL SURVEY
EDUCATIONAL SERIES 2

THE BEGINNING OF LIFE

How and when did life appear on earth? What was the nature of the earliest forms of life? These two questions are answered by two views that are in part opposed to one another. The first view states that life began by special creativity, that plants and animals on earth depend upon the creative art of a Divine Power. The second view holds that life began by certain physical and chemical conditions that are dependent upon the "Laws" of nature. These laws are an expression of inherited characteristics of the universe when it was created. Furthermore, nature's laws are the result of an initial Divine order of things in which there is a beginning and an end.

If the beginning of life results from special creation both biologic and geologic evidence supports the idea that the many kinds and varieties of life must result from gradual change into various forms. To this principle we apply the word, "evolution." It is then believed that special creation applies only to the beginning of life on earth and not to the making of each different kind of life.

If life began by some union of a physical and chemical condition, then in some way certain elements such as carbon, hydrogen, oxygen, nitrogen, sodium, calcium, iron, phospherous, etc. must be brought together to form a living substance. How this union takes place, no one knows. It is known, however, that living matter is composed of several elements and how these elements get together to form life is still a scientific mystery.

The rightness or wrongness of either view can be argued. The intent here, however, is merely to give background to our title, A Record of Life, for without life and rocks, no record of its past existence would be found.

EVOLUTION

When you were a tadpole and I was a fish
In the Paleozoic time,
And side by side, on the ebbing tide,
We sprawled through the ooze and slime;
Or skittered with many a caudal flip
Through the depths of the Cambrian fen,
My heart was rife with the joy of life,
For I loved you even then.

Mindless we lived and mindless we loved,
And mindless at last we died;
And deep in a rift of the Caradoc drift,
We slumbered side by side.
The world turned on in the lathe of Time,
The hot lands heaved amain,
Till we caught our breath from the womb of death,
And crept into light again.

We were Amphibians, scaled and tailed,
And drab as a dead man's hand.
We coiled at ease 'neath the dripping trees,
Or trailed through the mud and sand,
Croacking and blind, with our three-clawed feet,
Writing a language dumb,
With never a spark in the empty dark
To hint at a life to come.

Yet happy we lived and happy we loved,
And happy we died once more;
Our forms were rolled in the clinging mold
Of a Neocomian shore.
The aeons came and the aeons fled,
And the sleep that wrapped us fast
was driven away in a newer day,
And the night of death was past.

Then light and swift through the jungle trees
We swung in our airy flights;
Or breathed in the balms of the fronded palms,
In the hush of the moonless nights.
And oh, what beautiful years were these,
When our hearts clung each to each;
When life was filled, and our senses thrilled
In the first faint dawn of speech!

(continued)

Evolution--continued

Thus life by life, and love by love,
We passed through the cycles strange;
And breath by breath, and death by death,
We followed the chain of change;
Till there came a time in the law of life
When over the nursing sod
The shadows broke, and the soul awoke
In a strange, dim dream of God.

I was thewed like an Auroch bull,
And tusked like the great Cave Bear;
And you, my sweet, from head to feet,
Were gowned in your glorious hair.
Deep in the gloom of a fireless cave,
When the nights fell o'er the river bed,
We mumbled the bones of the slain.

I flaked a flint to a cutting edge,
And shaped it with brutish craft:
I broke a shank from the woodland dank,
And fitted it, head to haft.
Then I hid me close to the reedy tarn,
Where the Mammoth came to drink:
Through brawn and bone I drave the stone,
And slew him upon the brink.

Loud I howled through the moonless wastes,
Loud answered our kith and kin:
From west and east to the crimson feast
The clan came trooping in.
O'er joint and gristle and padded hoof,
We fought and clawed and tore,
And cheek by jowl, with many a growl,
We talked the marvel o'er.

I carved that fight on a reindeer bone,
With rude and hairy hand;
I pictured his fall on the cavern wall,
That men might understand.
For we lived by blood, and the right of might,
Ere human laws were drawn,
And the Age of Sin did not begin
Till our brutal tusks were gone.

Evolution--continued

And that was a million years ago,
In a time that no man knows;
Yet here tonight, in the mellow light,
We sit at Delmonico's
Your eyes are deep as the Devon springs,
Your hair as dark as jet:
Your years are few, your life is new,
Your soul untried, and yet--

Our trail is on the Kimmeridge clay,
And the scarp of the Purbeck flags:
We have left our bones in the Bagshot stones,
And deep in the Coralline crags.
Our love is old, our lives are old,
And death shall come amain:
Should it come today, what man may say
We shall not live again?

God wrought our souls from the Tremadoc beds,
And furnished them wings to fly:
He sowed our spawn in the world's dim dawn,
And I know that it shall not die;
Though cities have sprung above the graves
Where the crook-boned men made war,
And the ox-wain creeks o'er the buried caves,
Where the mummied Mammoths are.

For we know that the clod, by the grace of God,
Will quicken with voice and breath;
And we know that Love, with gentle hand,
Will beckon from death to death.
And so, as we linger at luncheon here,
Over many a dainty dish,
Let us drink anew to the time when you
Were a tadpole and I was a fish.

Langdon Smith

EACH IN HIS OWN TONGUE

A fire-mist and a planet-
  A crystal and a cell-
A jellyfish and a saurian,
  And caves where the cave-men dwell;
Then a sense of law and beauty,
  And a face turned from the clod;
Some call it Evolution,
  And others call it God.

A haze on the far horizon,
  The infinite, tender sky,
The ripe, rich tint of the cornfields,
  And the wild geese sailing high;
And all over upland and lowland
  The charm of the goldenrod:
Some of us call it Autumn
  And others call it God.

Like tides on a crescent sea-beach
  When the moon is new and thin,
Into our hearts high yearnings
  Come welling and surging in;
Come from the mystic ocean,
  Whose rim no foot has trod;
Some of us call it Longing,
  And others call it God.

A picket frozen on duty-
  A mother starved for her brood-
Socrates drinking the hemlock,
  And Jesus on the rood;
And millions who, humble and nameless
  The straight, hard pathway plod:
Some call it Consecration,
  And others call it God.

William Herbert Carruth

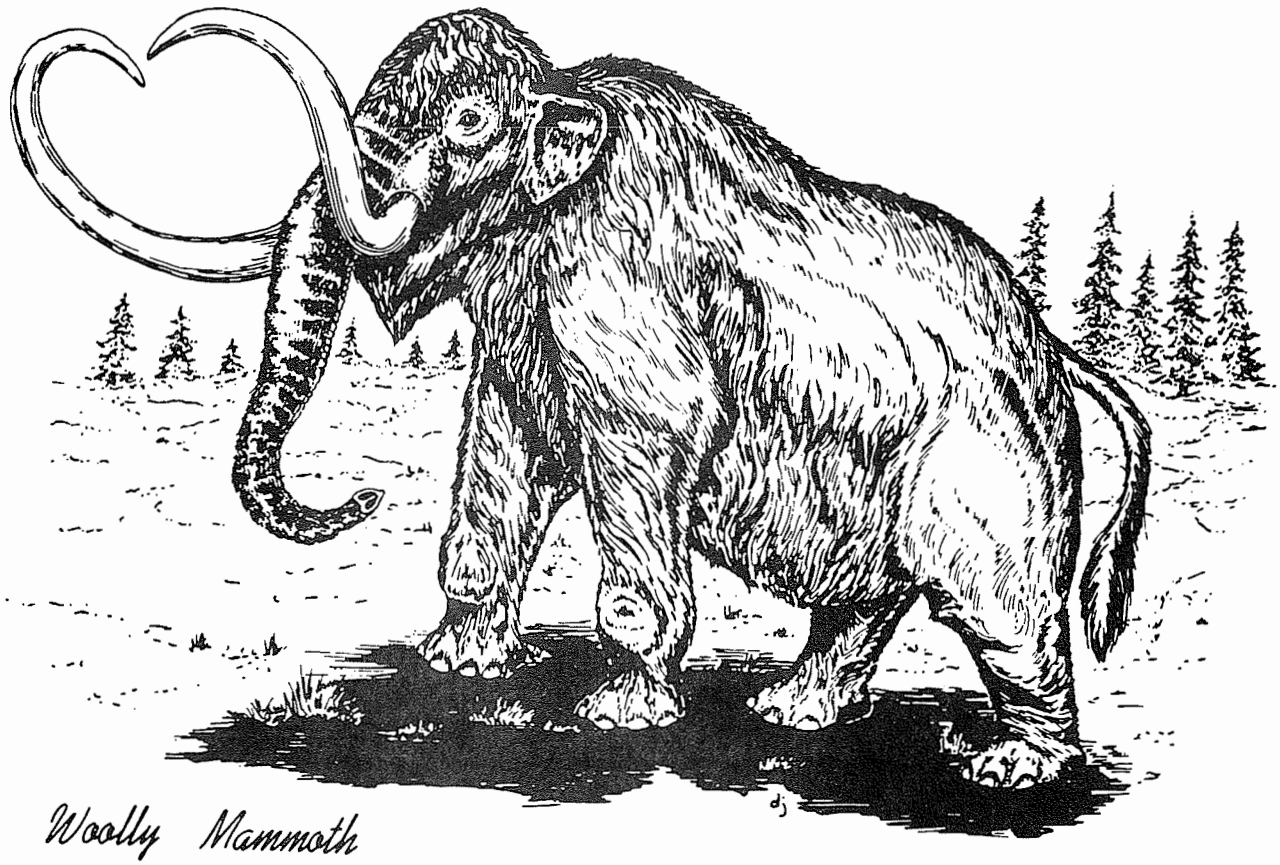
OUR RECORD BEGINS

Woolly Mammoth

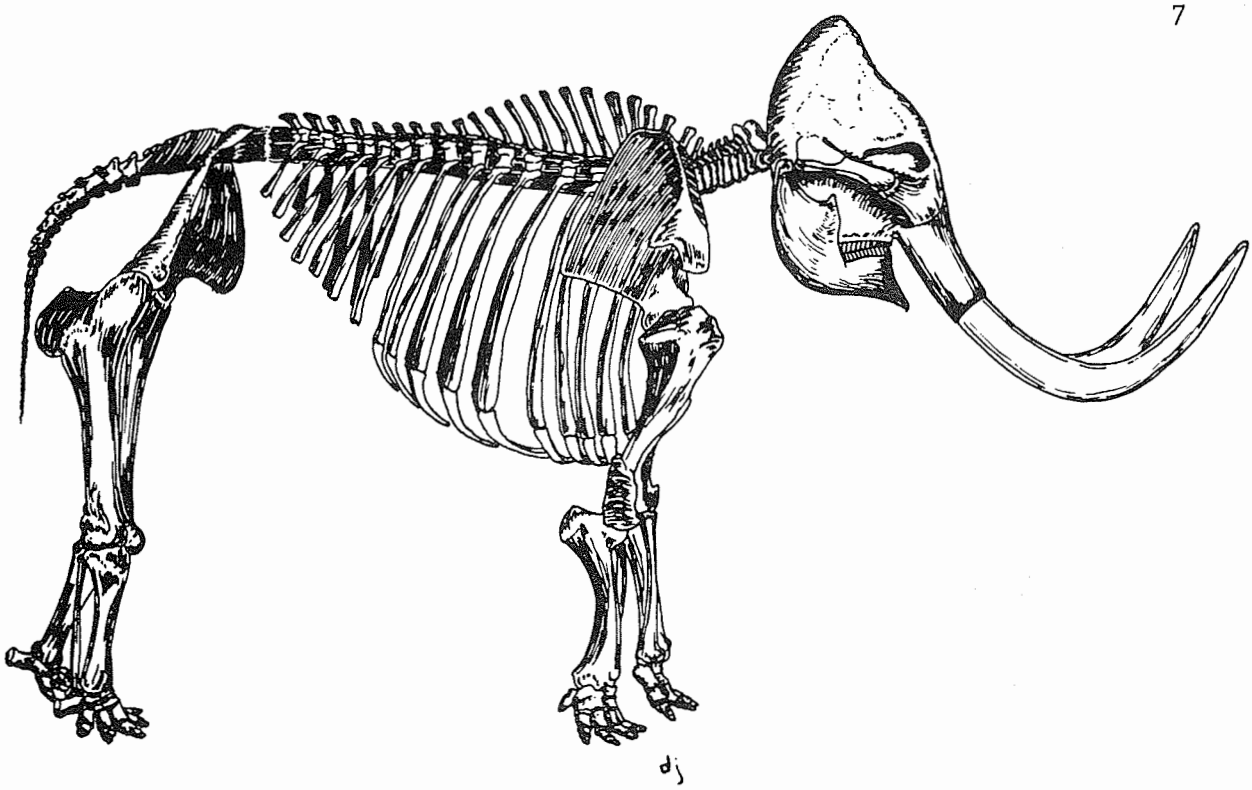
What do you think of a piece of meat stored in a refrigerator for 30,000 years would look like? Way up north where it is very cold some hunters found the head of an elephant sticking out of the frozen ground. Some men dug the animal out of the ground and found flesh clinging to the bones. The flesh was dark red in color and looked like an ordinary piece of meat. Although the men did not eat the meat, their dogs had a hearty meal.

This elephant died a long time ago. His skeleton was examined and several bones were broken. Even some undigested food was found in his stomach. The animal must have met a sudden and violent death.

No living form of this elephant is alive today. This animal had thick, long reddish-brown hair mixed with black hair. It was an animal that lived when part of the country was covered by ice. The elephant needed this coat of hair to keep warm. Reindeer in the cold north country today have a thick coat of hair. The elephant has been called the woolly mammoth.



Woolly Mammoth



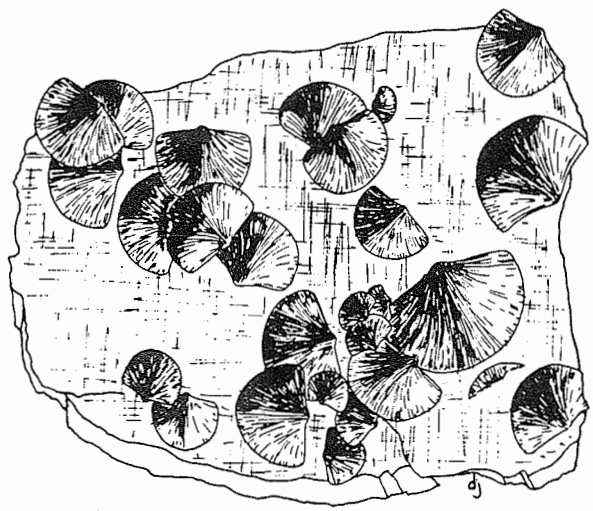
Woolly Mammoth

Several of these mammoths have been found. You can see them if you have the chance to visit a big museum of natural history.

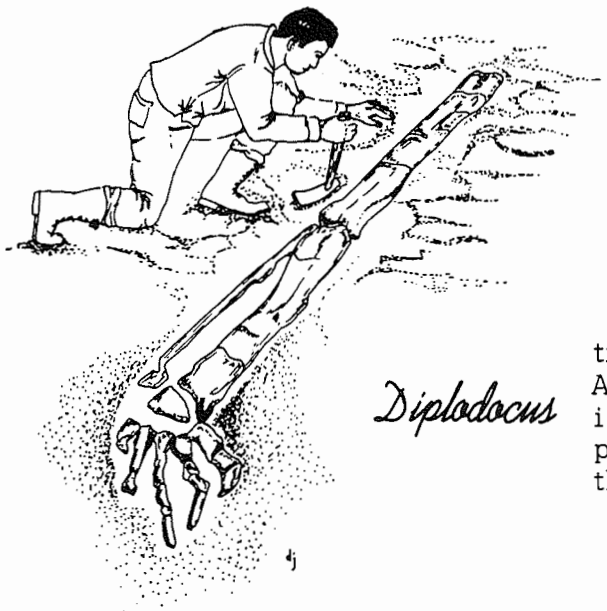
The finding of the remains of the woolly mammoth is interesting. It is interesting because the animal does not live today. It is interesting because it tells us about life that existed 30,000 years ago.

But just as interesting as the remains of the woolly mammoth are the bones and shells of animals and the remains of plants found in rocks. They are the remains of life that lived when the rock was made. Rock before it became hard was the graveyard for animals and plants.

Before we had the science of geology people thought remains of animals and plants found in rocks were freaks of nature. Some thought that rocks that contained shells had special curing power. The Roman people called the remains of bones, shells, and plants found in rocks by the word fossil.



Brachiopods



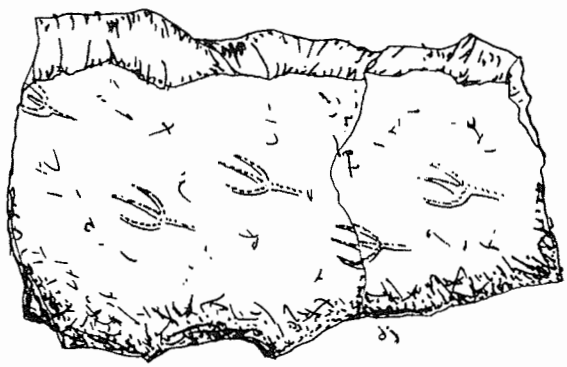
Diplodocus

Fossil is the word still used by scientists who study the remains of past life. A scientist who hunts and studies fossils is called a paleontologist. The study of past life as revealed in rocks is a part of the science of geology.

The Nature of Fossils

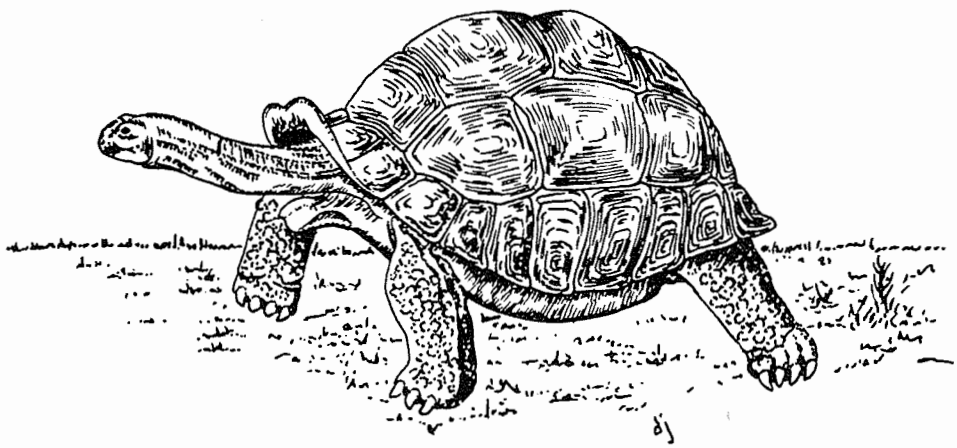
A fossil is defined as the remains of once living things that have been preserved from the past. Coal and petroleum are made from past life. Coal and petroleum are not fossils because there are no bones, shells, or plants to study. Coal may contain plants and shells which are fossils.

Fossil as a word sometimes is used for other things preserved in rocks. You may hear or read of fossil rain prints, fossil mudcracks, fossil soil, fossil dunes, fossil fuels, ripple marks, or fossil animal tracks.



Thecodont tracks

Sometimes people talk about "living fossils." They mean that some living plant or animal should have died a long time ago. Somehow it still lives. The land tortoise and the ginko tree are commonly called "living fossils."



Land Tortoise

THE FOSSILS

At midnight in the museum hall
The fossils gathered for a ball.
There were no drums or saxophones
But just the clatter of their bones,
A rolling, rattling, carefree circus
Of mammoth polkas and mazurkas.
Pterodactyls and brontosauruses
Sang ghostly prehistoric choruses.
Amid the mastodonic wassail
I caught the eye of one small fossil.
Cheerup, sad world, he said, and winked--
It's kind of fun to be extinct.

Our use of the word fossil will be the study of the remains of past life as found in the rocks.

If you want to study fossils you must know something about living plants and animals. From the knowledge of living things you can get ideas about life as it existed a long time ago. The present is a key to the past is a phrase often used by geologists.

A paleontologist must have a good background in the sciences of botany and zoology. Botany is the study of plants. Zoology is the study of animals.

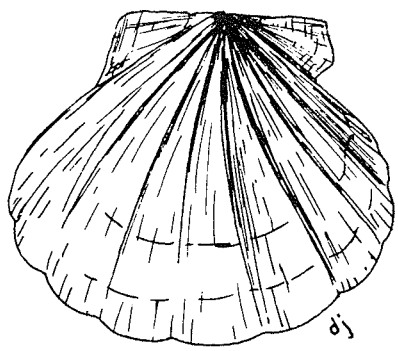
Does every living thing end up as a fossil? The simple animals that look like clear jelly seldom become fossils. These simple animals have no head, legs, eyes, or mouth. They do not have a body. One such creature is called an amoeba.

Such an animal may have an advantage. If it wants to live in water and has nowhere to go, it probably is content being a jelly-like substance.

Amoeba

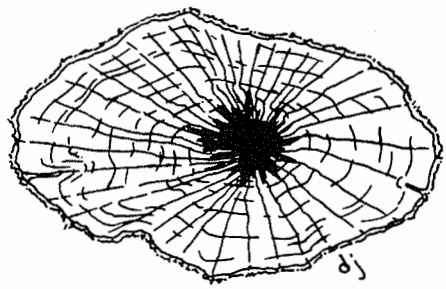
Most animals like to roam around. To do this they must have some kind of stiffening in their body. This stiffening is called a skeleton. A skeleton may be on the outside or inside of an animal.

A clam has an outside skeleton we call a shell. The shell is composed of the minerals calcite, dolomite, or aragonite.



Clam (Pelecypod)

A dog has an inside skeleton made up of bones. Bones are composed of the elements calcium and phosphorous.



Wood section

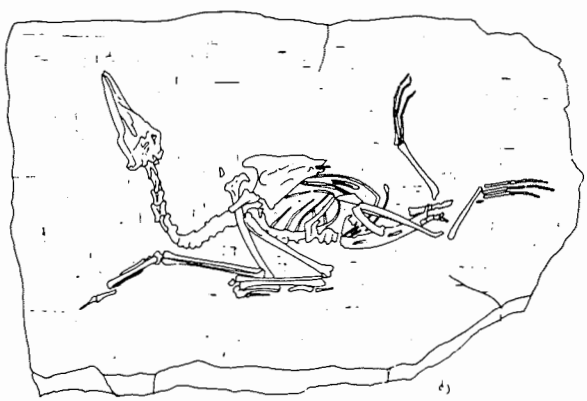
Plants also have a stiffening material. This is the woody tissue. The inside of a tree is made up of woody tissue.

Most plants and animals have hard parts. Bones, teeth, shells, and woody tissue are hard parts. This is important. Without hard parts you would have no record of past life.

Soft parts of plants and animals decay very quickly. Hard parts decay slowly. Hard parts have a good chance to become fossils, but soft parts do not.

Preservation of Fossils

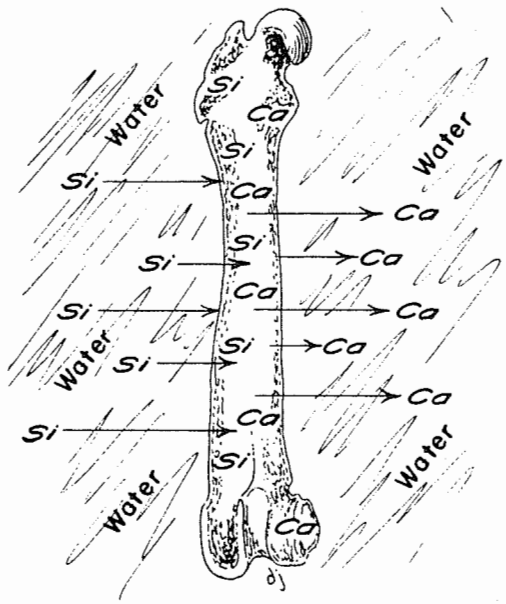
How do hard parts become fossils? The hard parts must be preserved. Let us discuss this further.



Lompoc Shearwater

If you have a rock that contains a fossil, the fossil looks as though it too were stone. You may say it has become petrified. Right you are--the fossil has become stone.

Bones and shells are porous. Water slowly runs through them. Some of the mineral matter in the water may be left in the pore spaces. This makes the object heavier and stone like. The shape of the object is not changed. The mineral matter left in the bone protects it from air or solution that would cause it to decay. Petrified bones are formed this way.



Petrification

The original substance that makes up shells and bones may be dissolved. In its place other mineral matter is left. Wood is often preserved in this way.

Woody tissue is replaced quite often with the mineral quartz. The replacement is very slow. Even the tiny cells of the wood are preserved, and you can even see the growth rings.

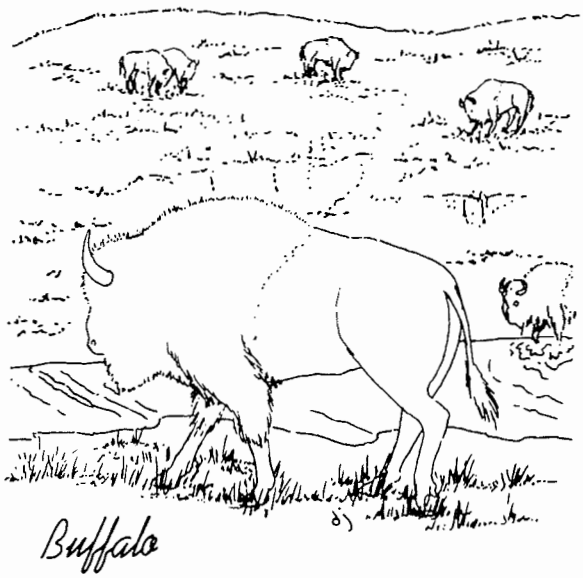
Petrified wood

Sometimes you find a shell made of quartz. The original mineral calcite has been replaced by quartz. The outside looks as if the shell was not changed.

When plants and animals decay they give off a gas. Over a period of time all the gas goes away. Left behind is a black substance that looks like carbon. That is just what the material is, the element carbon.

Leaves and stems of plants, and fish scales are preserved in this way. You actually get carbon copies of the original.

Shells and bones in rocks may not be replaced by quartz. They may be completely dissolved. The open space left is the actual mold. It is like placing your hand in fresh concrete. When the concrete hardens you have a mold of your hand. The hole left in the rock may be filled in later on. Then you get a cast. Molds and casts of thin objects sometimes are called imprints. Animals and plants that lived a long time ago left footprints, trails, and imprints that are preserved in the rocks.

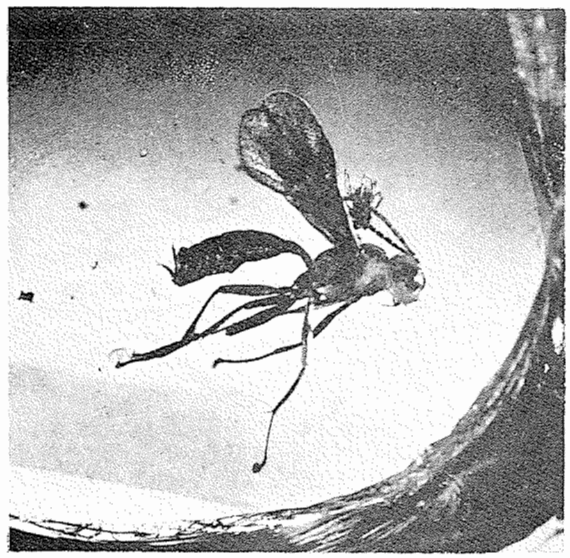


We have used this word preserved. What does it really mean? Is everything preserved? The answer is no. You have read stories about how the Indians hunted buffalo. Lots of buffalo were killed, but very few bones of the buffalo were preserved as fossils. The meat was eaten by wolves and vultures. The bones dissolved and washed away. No part of the animal was left to become a fossil. You may wonder what must happen in order to preserve a plant or animal.

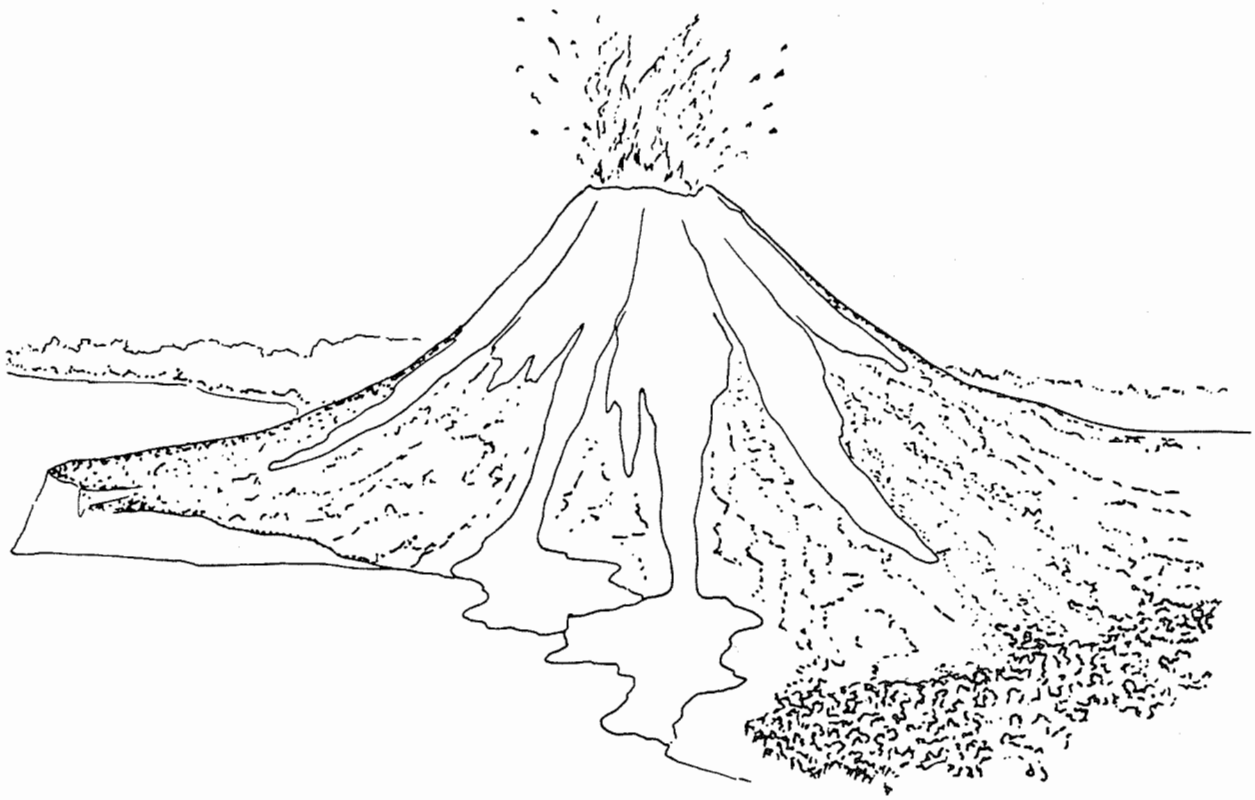
Two things must happen. The plant or animal must have hard parts. These hard parts must be buried quickly. Worms, jellyfish, and meat of animals seldom make fossils. Bones and shells make good fossils. Hard parts of animals and plants that die and are quickly buried have a good chance to become fossils. If hard parts are not buried quickly they dissolve and wash away.

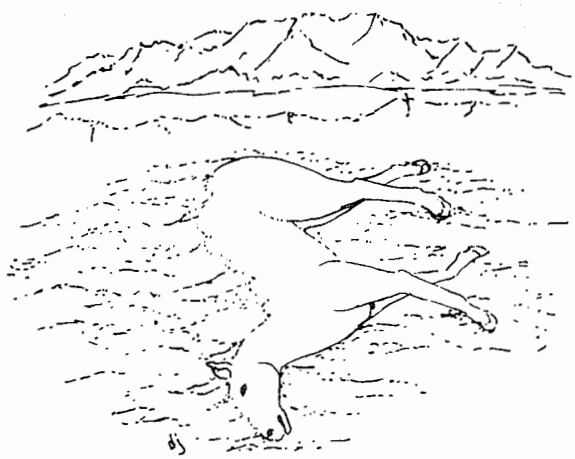
Animals may drown during a flood and become buried. Plants also may be quickly buried by mud in a stream. Animals may walk or fall into a bog, quicksand, or a natural tar pit and become buried. Caves are used by animals as dens. These animals killed their food and dragged them to their dens to eat. The bones were left. These bones were protected from the weather and some became fossils.

Insects have been caught in the sap of trees. When the sap becomes hard, it is called amber. The insect was preserved in the amber.



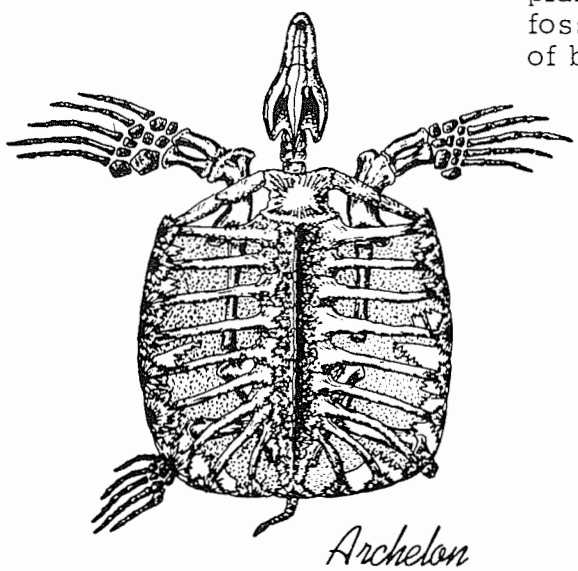
When volcanoes exploded, the ash that fell covered up animals and plants that later became fossils.





Sand in the desert may quickly bury animals and plants.

Animals and plants that live in the sea have a good chance to become fossils. The sea bottom is an excellent place to preserve fossils. Animals and plants that live on land seldom become fossils. They do not have a good chance of being preserved.



Are fossils found in all kinds of rocks? The answer is maybe. Fossils are seldom found in igneous rocks. The ash fall or nearly cooled lava may contain a fossil. You have to look and look, and if you are lucky, you may find one.

All kinds of sedimentary rocks contain fossils. Sedimentary rocks formed in water often contain many fossils. Limestone and shale are rocks that contain many fossils. When a limestone that contains fossils is changed to a marble the fossils may be destroyed or damaged so you cannot identify them.

Some metamorphic rocks contain fossils. If the heat and pressure that formed the metamorphic rock is great, the fossils will be destroyed.

How long does it take a dead animal or plant to become a fossil? The answer is many thousands of years. We should make one thing clear. Animals and plants are organisms.

Their remains are organic material. Our definition states that fossils are the remains of organisms or indications of organic remains preserved in rocks. Many paleontologists do not include as fossils all organic remains that have died since the coming of man on earth.

This avoids doing the same work as the archaeologist, botanist, and zoologist. These scientists study organisms that exist on earth since the coming of man.

Do not confuse the word fossil with petrified. To petrify is to turn to stone. Not all fossils are petrified. Everything that is petrified is not a fossil. Remember, to be a fossil it must be remains of a once living organism.

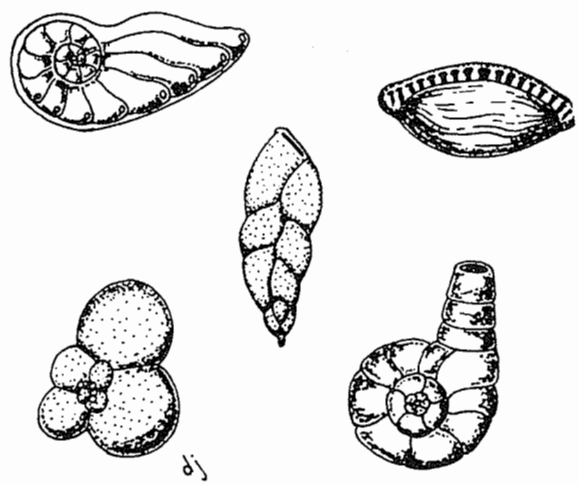
Kinds of Fossils

How do you study fossils? To begin we must learn a little more about them. Remember back on page 11 we said that stiffening could be outside or inside. This is important. We can begin our study here. Animals that have an outside skeleton are called invertebrates. These animals have no backbone. Animals with inside skeletons are called vertebrates. They have a backbone. A clam or a sea shell is an invertebrate animal. Dogs, cows, horses, even humans are vertebrate animals.

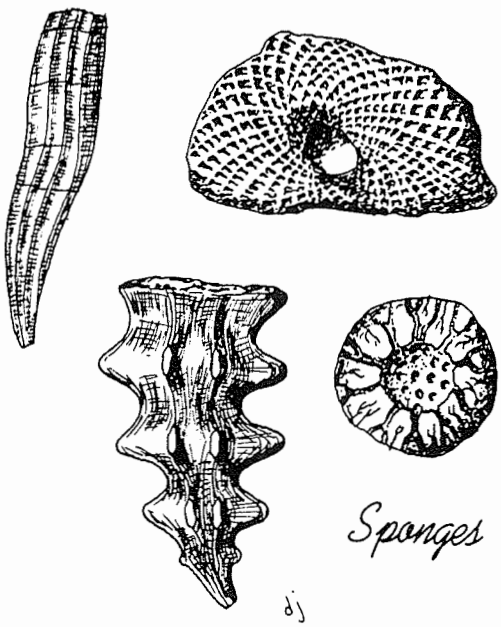
Invertebrates

There are a great many fossil invertebrates. Let us talk about some common types. Some fossil invertebrates are small. So small that you cannot see them well without the use of a magnifying glass. These fossils are called foraminifera or just forams.

One type looks like a grain of wheat. Many millions of them lived in the seas. In some rocks you can collect them by the bushel baskets full.



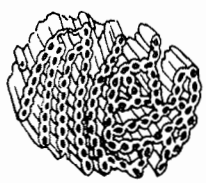
Foraminifera



Sponges

Sponges are invertebrates that live attached to the sea floor. The sponge was once soft and flexible. Fossil sponges are hard. The mineral calcite has preserved the original sponge. Sponges live today in the oceans. Probably you have helped your father wash your car with one.

Corals are invertebrates that look like a flowering plant. Corals as you see them are not just one animal. What you see are many, many little animals. Each little hole in the stalk of a coral is the home of an animal. Many stalks of corals form a colony. Coral colonies grow to be very large. They make coral reefs. Corals develop many kinds of shapes and patterns.



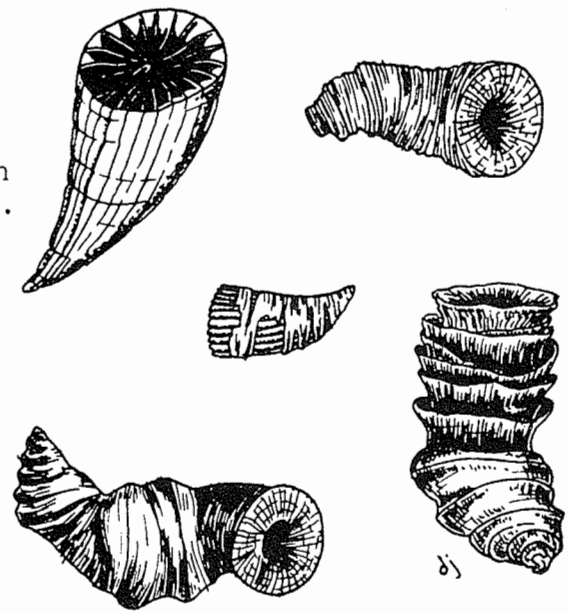
Chain coral

One coral develops a pattern that looks like links in a chain. Some people call it chain coral.

Prism coral

Another coral grows to form a five-sided pattern. This coral is called prism coral.

Still another coral looks like a horn on a cow. We call it the horn coral. Corals live in the oceans today.



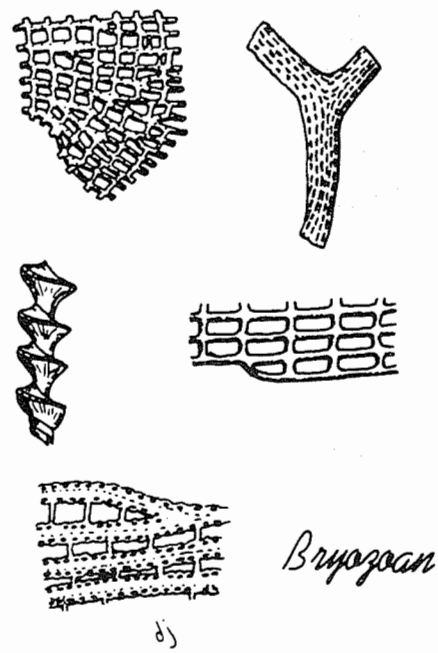
Rugose or "horn coral"

Bryozoans are invertebrates that also look like plants. The stalk of a bryozoan also contains holes. Each hole is the home of an individual animal. Bryozoans do not look like corals. They do not form reefs.

One type looks like the threads of a screw. People sometimes call this fossil Archimedes screw.

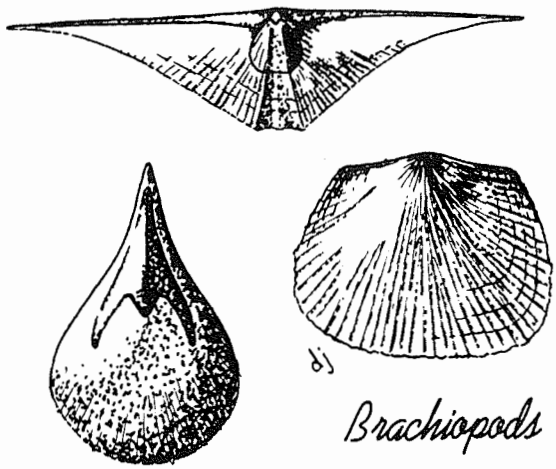
Another looks like a delicate piece of lace.

Still another looks like a series of many tiny holes in a piece of pipe.



Bryozoan

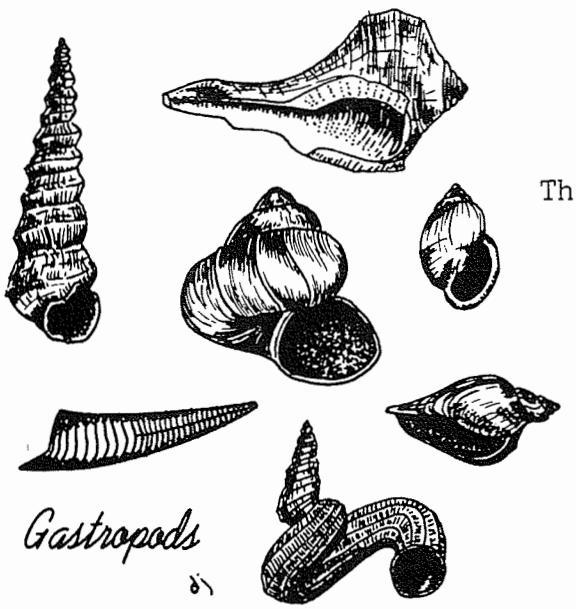
Brachiopods are invertebrates whose shell can be split into two halves. If you look at the two shells you will see they are not alike. Brachiopods were numerous in the ancient oceans. They are not common in the oceans today.



There are many shapes and sizes of brachiopods.

You know Gastropods as snails. Gastropod shells are coiled and make a spire. They look like the hats worn by the people in China.

Some lived on land. Some lived in the oceans. Snails are common as fossils in some rocks.



There are many kinds of gastropods.

Cephalopods are invertebrates that have many different shapes and sizes of shells.

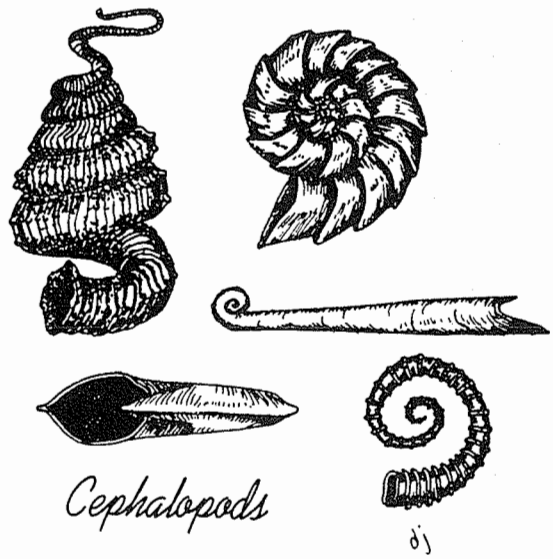
The squids, octopuses, cuttlefish and pearly nautilus are cephalopods that live in our present-day oceans.

Fossil cephalopods were abundant in the ancient seas.

Some are coiled like a rope.

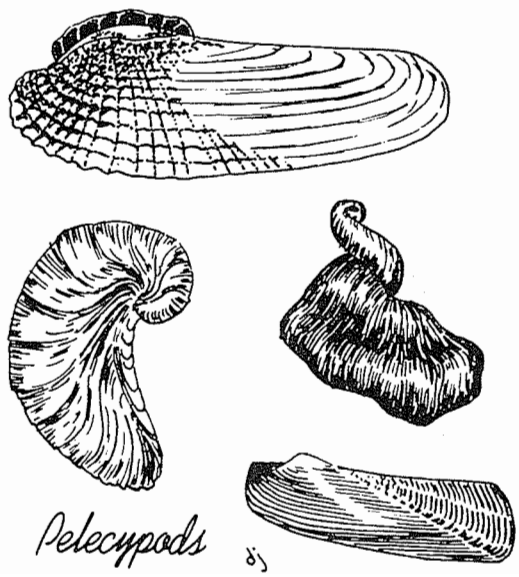
Some forms have very colorful patterns.

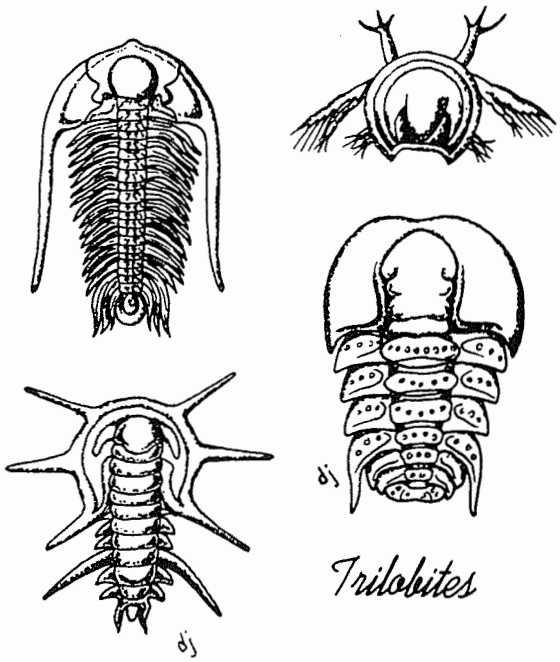
Other cephalopods are shaped like a cigar.



Pelecypods are commonly called clams. They have two shells, one the mirror image of the other. In this way they are different from shells of the brachiopods. Oysters, clams, mussels, and cockles are pelecypods. The sign you see at Shell gasoline stations is in the shape of a pelecypod. This pelecypod is called a pectin shell.

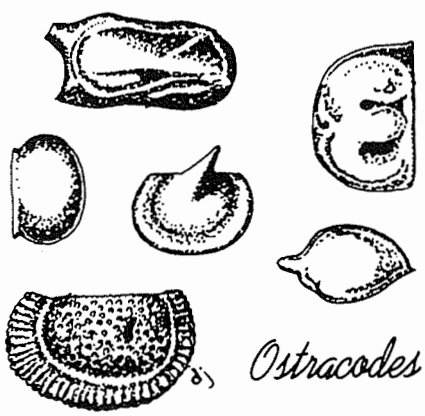
The shells of pelecypods have different shapes. Some are oval, others are oblong, and some are almost round. The outside of a pelecypod shell may be ribbed and show various patterns.





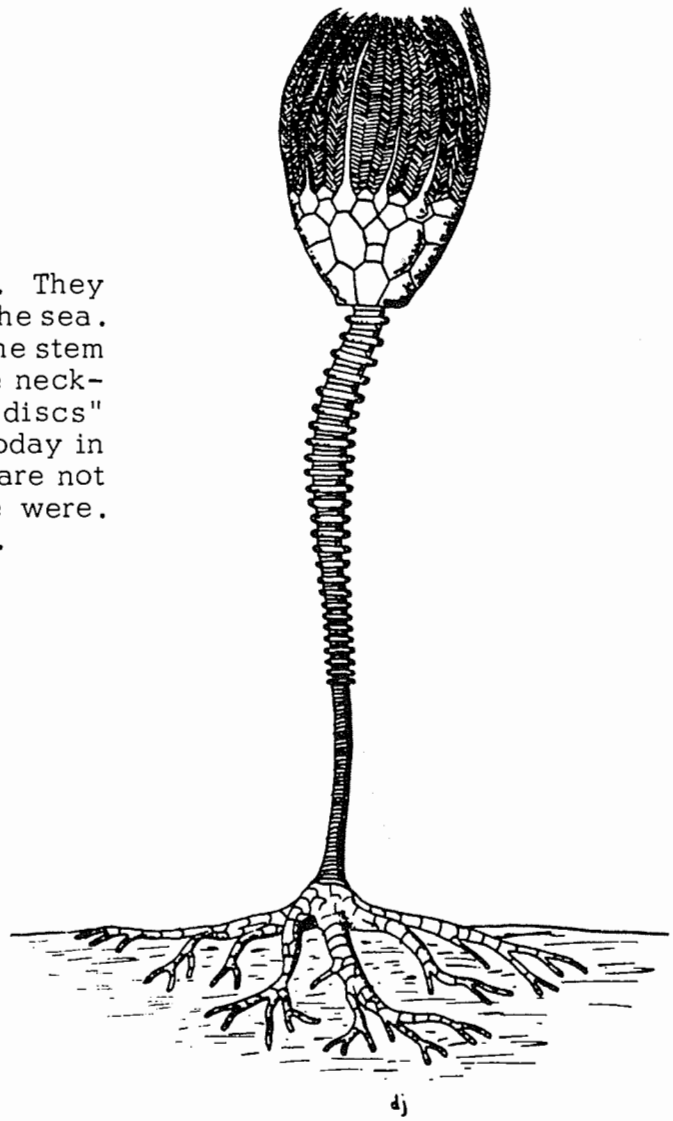
Trilobites are known only as fossils. They do not live in the ocean today. Trilobites have three lobes. The lobes are divided by a line that runs from the head to the tail.

Ostracodes are very small invertebrates. They live in present-day oceans, lakes, and ponds.

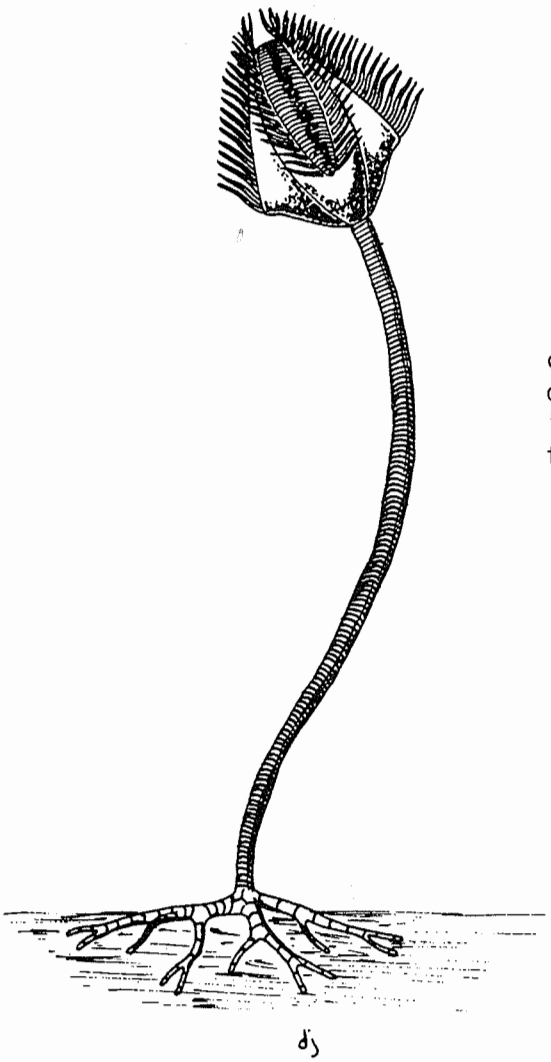


These animals are so small that you need a magnifying glass to see them. Ostracodes have two shells and may look like baby clams. Fossil ostracodes are many.

Crinoids are called sea lilies. They are animals though that lived in the sea. The fossil button-like discs from the stem were used by the Indians to make necklaces. A popular name for the "discs" is Indian beads. Crinoids live today in the deeper part of the oceans, but are not nearly as numerous as they once were. They look very much like a plant.



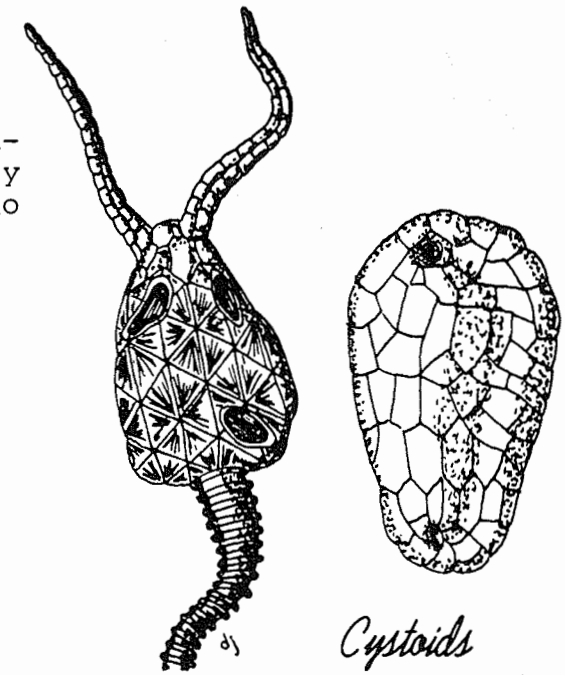
Crinoid



Blastoid

Blastoids are closely related to the crinoids. Some had stems while others did not. Blastoids commonly are called "sea buds." They do not live in the seas today.

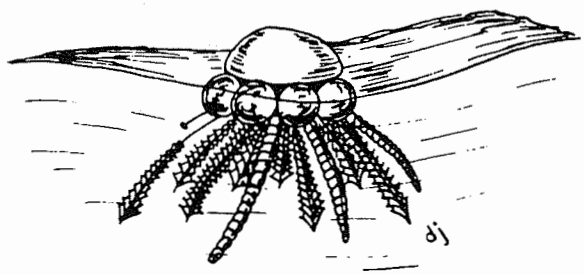
Cystoids are related to both the crinoids and blastoids. They are mostly stemless. Like the blastoids, they do not exist today in the seas.



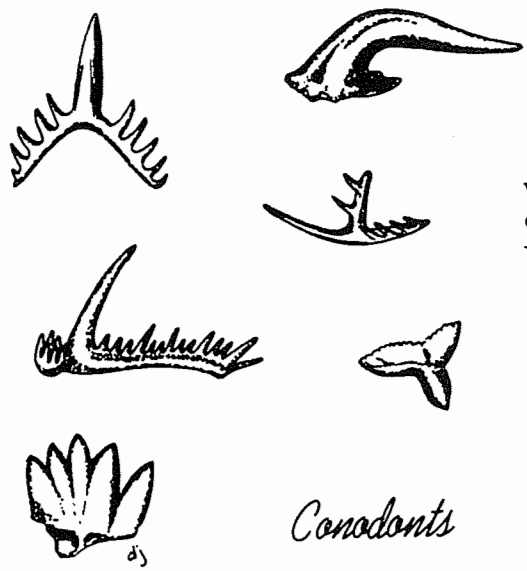
Cystoids

Graptolites were floating animals. Their bodies were made of a chitinous substance. When you find a graptolite, it will look like several black lines with saw-tooth edges.

Graptolites became extinct many millions of years ago.



Graptolite

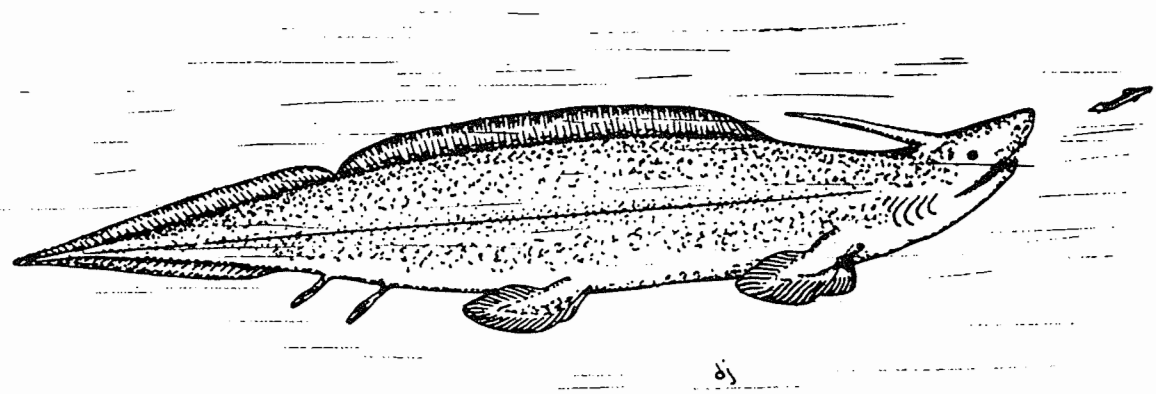


Conodonts

Conodonts are very small fossils which we know very little about. Most conodonts look like a small jaw with tooth-like projects

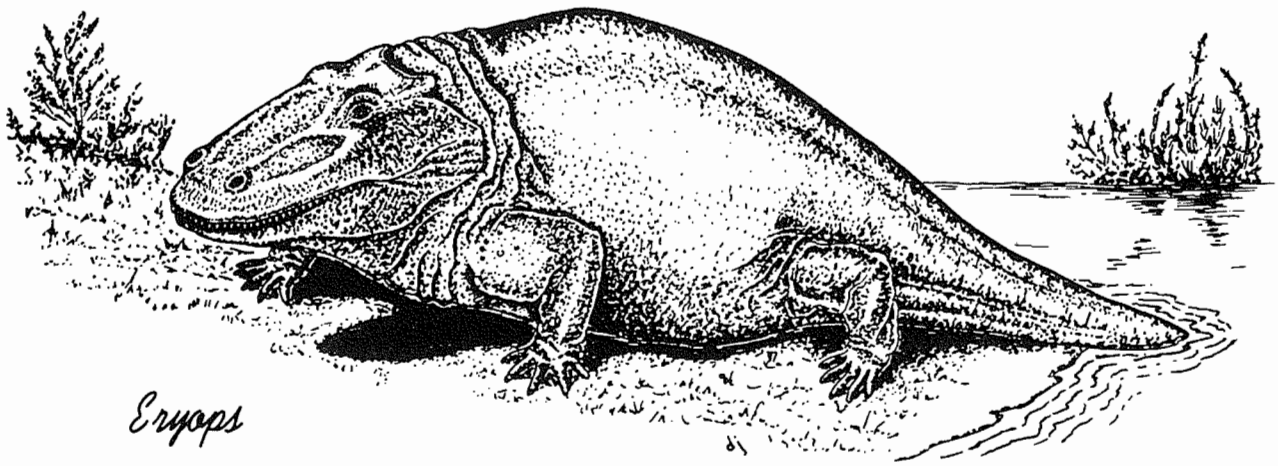
Vertebrates

Fish were the first vertebrates. They lived in the seas. They had scales or bony plates on the outside. The stiffening of the first fish was of cartilage. Cartilage is not preserved as fossils. We do find scales and bony plates of fish as fossils.



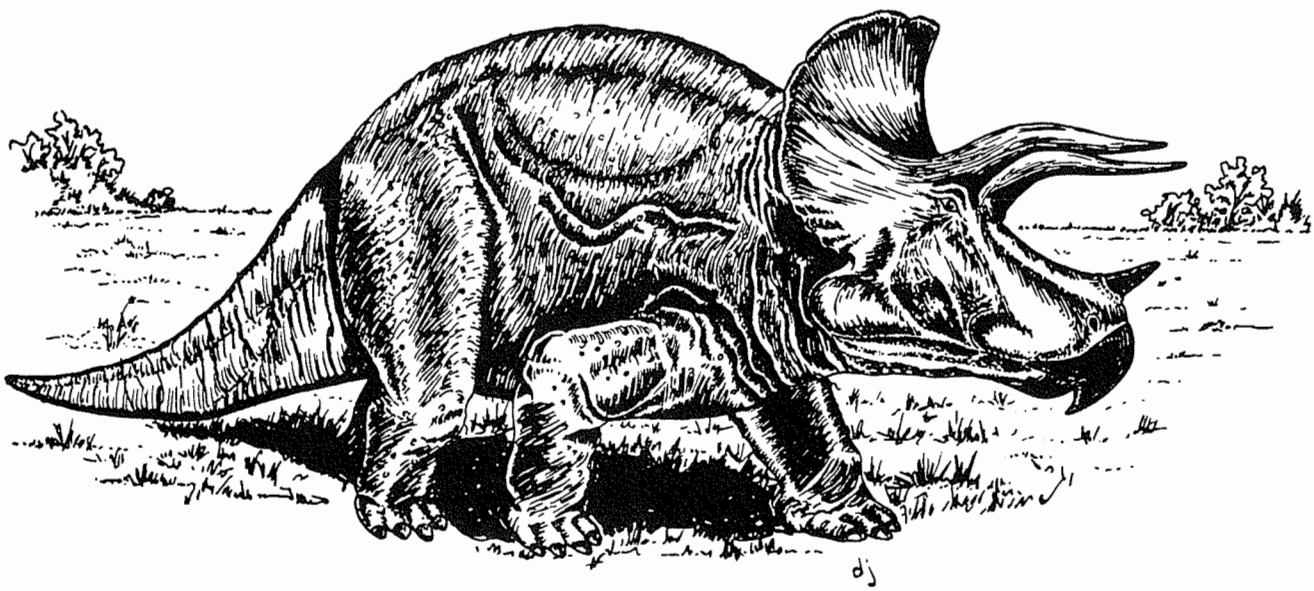
Pleuracanth

After the fish came the amphibians. These vertebrates lived both in the water and on land. Amphibians have a slimy skin or bony plates. Their stiffening was cartilage or bone. The bony plates and bone stiffening are preserved as fossils. They are rare. Frogs are amphibians. They have a bone stiffening.



Eryops

Next came the reptiles. Some of them had scales or bony plates. They had teeth. Their stiffening was made of bone. These hard parts are preserved as fossils. They are rare. You probably have seen pictures of dinosaurs. These were known as terrible lizards. They were both little and big. Some dinosaurs were small--about the size of a chicken. Others were very large. They weighed more than 40 tons.



Triceratops

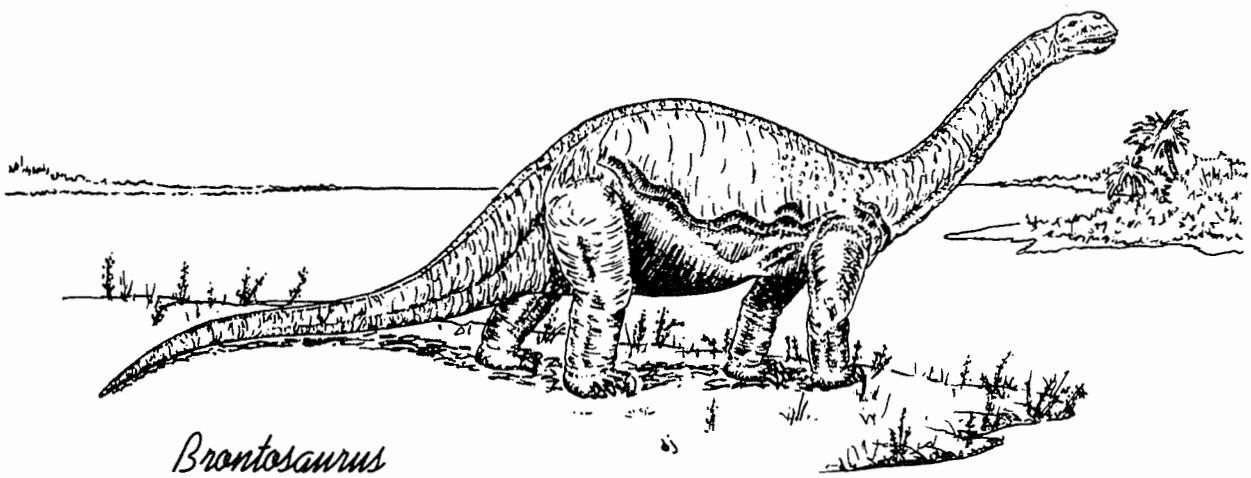
THE DINOSAUR

Behold the mighty dinosaur,
  Famous in prehistoric lore,
Not only for his power and strength
  But for his intellectual length.
You will observe by these remains
  The creature had two sets of brains--
One in his head (the usual place)
  The other at his spinal base.
Thus he could reason "A priori"
  As well as "A posteriori."
No problem bothered him a bit
  He made both head and tail of it.

So wise was he, so wise and solemn,
  Each thought filled just a spinal column.
If one brain found the pressure strong
  It passed a few ideas along.
If something slipped his forward mind
  'Twas rescued by the one behind.
And if in error he was caught
  He had a saving afterthought.
As he thought twice before he spoke
  He had no judgment to revoke.
Thus he could think without congestion
  Upon both sides of every question.
Oh, gaze upon this model beast,
  Defunct ten million years at least.

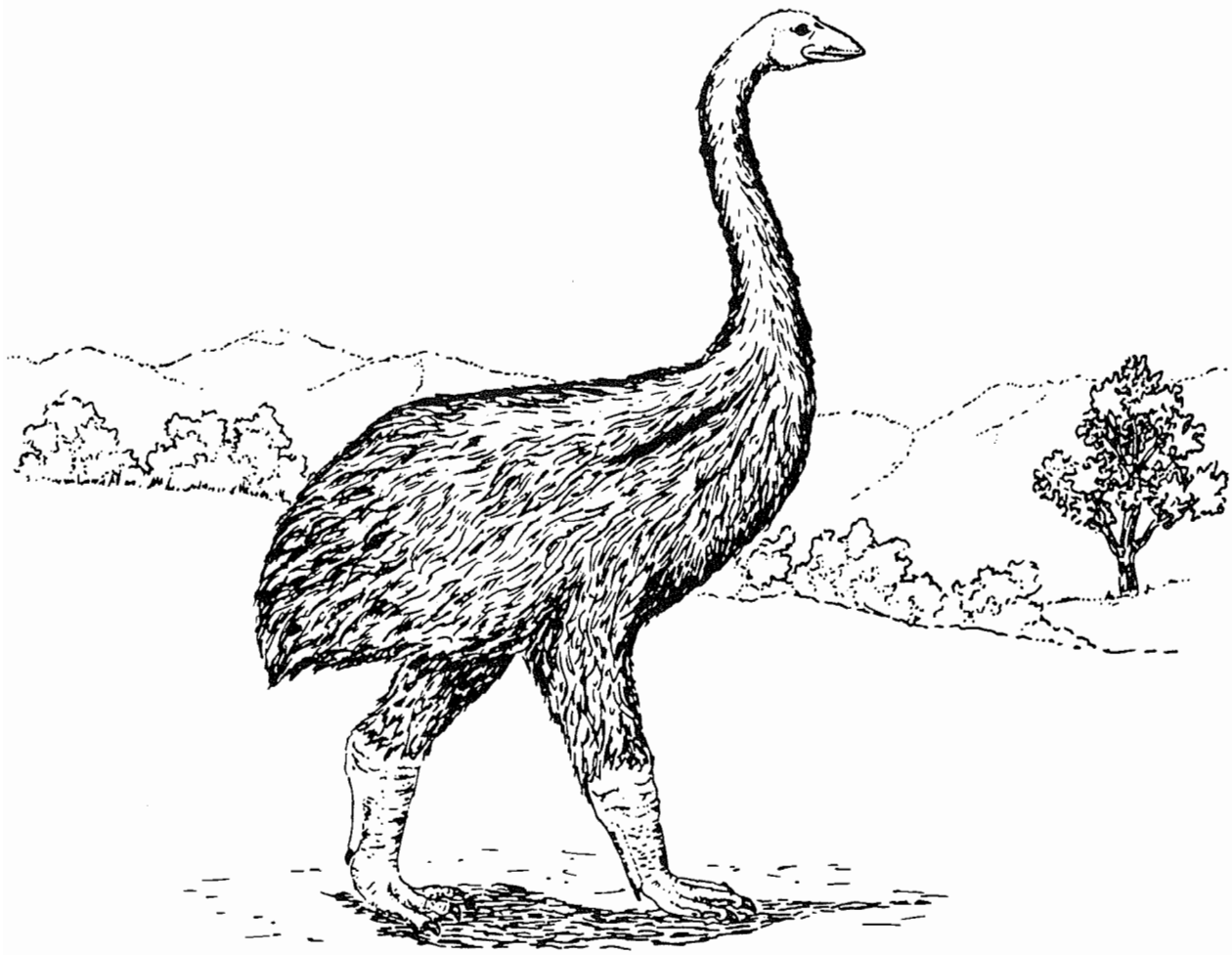
Bert Leston Taylor
Chicago Tribune

Some were as big as a Greyhound bus. Some were over 80 feet long. Dinosaurs are reptiles. We are lucky they do not live today. We do have snails , lizards, turtles, alligators, and crocodiles. These are reptiles that live today.



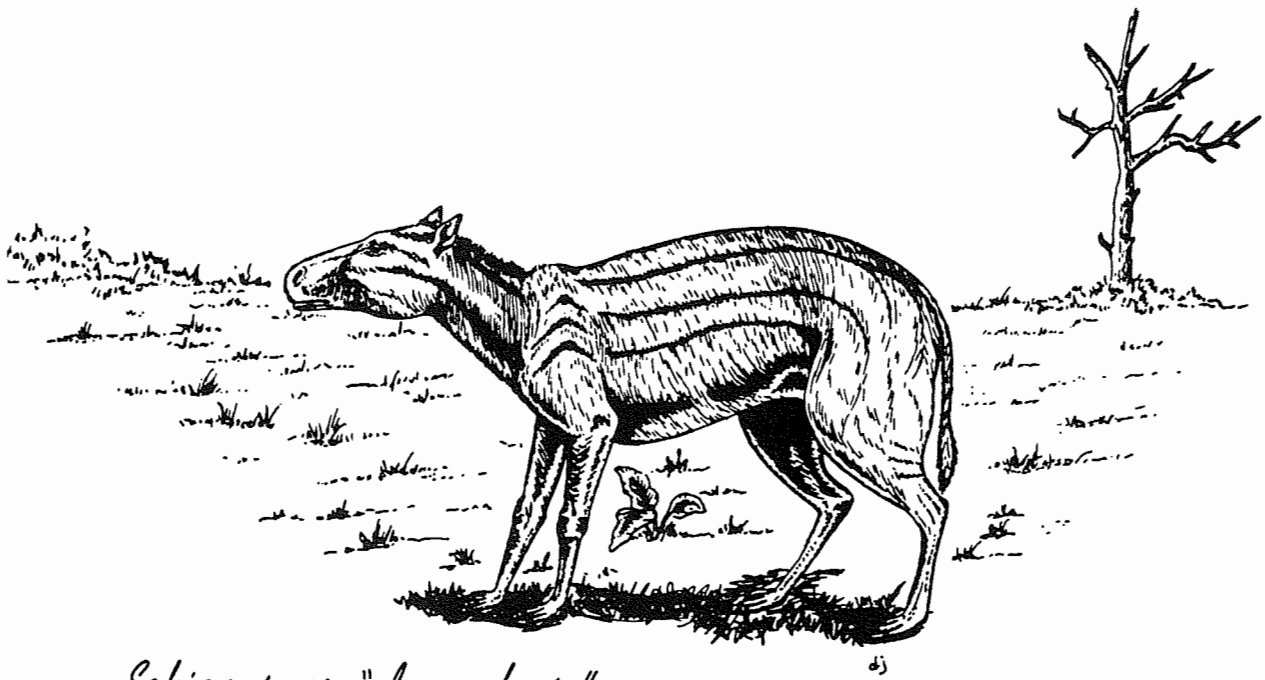
Brontosaurus

Birds came after the reptiles. They had feathers and a bone stiffening. Fossil birds have been found, but they are rare.



Moa

The last type of vertebrate is the mammals. Mammals have a bone stiffening. They have hair and teeth. There are many mammals. The horse is a mammal. Did you know the first horse was no larger than a small dog? The elephant you read about on the first page was a mammal. Bats, rats, dogs, cats, and cows are mammals.



Eohippus or "dawn horse"

A whale is a mammal. So are kangaroos, monkeys, and apes. Even you are a mammal. Fossil mammals are not found in great numbers. Do you know why? If you do not, go back and reread the part about preservation of buffalo on page 14.

SIMILAR CASES

There was once a little animal,
  No bigger than a fox,
And on five toes he scampered
  Over Tertiary rocks.
They called him Eohippus,
  And they called him very small,
And they thought him of no value--
  When they thought of him at all;
For the lumpish old Dinoceras
  And Coryphodon so slow
Were the heavy aristocracy
  In days of long ago.

Said the little Eohippus,
  "I am going to be a horse!
And on my middle finger-nails
  To run my earthly course!
I'm going to have a flowing tail!
  I'm going to have a mane!
I'm going to stand fourteen hands high
  On the psycozoic plain!"

The Coryphodon was horrified,
  The Dinoceras was shocked;
And they chased young Eohippus,
  But he skipped away and mocked.
Then they laughed enormous laughter,
  And they groaned enormous groans,
And they bade young Eohippus
  Go view his father's bones.
Said they, "You always were as small
  And mean, as now we see,
And that's conclusive evidence
  That your're always going to be.
What! Be a great, tall, handsome beast,
With hoofs to gallop on?
Why! You'd have to change your nature!"
  Said the Loxolophodon.
They considered him disposed of,
  And retired with gait serene;
That was the way they argued
  In "the early Eocene."

(continued)

Similar Cases--continued

There was once an Anthropoidal Ape,
  Far smarter than the rest,
And everything that they could do
  He always did the best;
So they naturally disliked him,
  And they gave him shoulders cool,
And when they had to mention him
  They said he was a fool.

Cried this pretentious Ape one day,
  "I'm going to be a Man!
And stand upright, and hunt, and fight,
  And conquer all I can!
I'm going to cut down forest trees,
  To make my houses higher!
I'm going to kill the Mastodon!
  I'm going to make a fire!"

Loud screamed the Anthropoidal Apes
  With laughter wild and gay;
They tried to catch that boastful one,
  But he always got away.
So they yelled at him in chorus,
  Which he minded not a whit;
And they pelted him with cocoanuts,
  Which didn't seem to hit.
And then they gave him reasons
  Which they thought of much avail,
To prove how his preposterous
  Attempt was sure to fail.
Said the sages, "In the first place,
  The thing cannot be done!
And, second, if it could be,
  It would not be any fun!
And, third, and most conclusive,
  And admitting no reply,
You would have to change your nature!
  We should like to see you try!"
They chuckled then triumphantly,
  These lean and hairy shapes,
For these things passed as arguments
  With the Anthropoidal Apes.

There was once a Neolithic Man,
  An enterprising wight,
Who made his chopping implements
  Unusually bright.
(continued)

Similar Cases--Continued

Unusually clever he,
  Unusually brave
And he drew delightful Mammoths
  On the borders of his cave.
To his Neolithic neighbors
  Who were startled and surprised
Said he, "My friends, in course of time,
  We shall be civilized!
We are going to live in cities!
  We are going to fight in wars!
We are going to eat three times a day
  Without the natural cause!
We are going to turn life upside down
  About a thing called gold!
We are going to want the earth, and take
  As much as we can hold!
We are going to wear great piles of stuff
  Outside our proper skins!
We are going to have Diseases!
  And accomplishments!! And Sins!!

Then they all rose up in a fury
  Against their boastful friend,
For prehistoric patience
  Cometh quickly to an end.
Said one, "This is chimerical!
  Utopian! Absurd!"
Said another, "What a stupid life!
  Too dull, upon my word!"
Cried all, "Before such things can come,
  You idiotic child,
You must alter Human Nature!"
  And they all sat back and smiled.
Thought they, "An answer to that last
  It will be hard to find!"
It was a clinching argument
  To the Neolithic Mind!

Charlotte Perkins Gilman

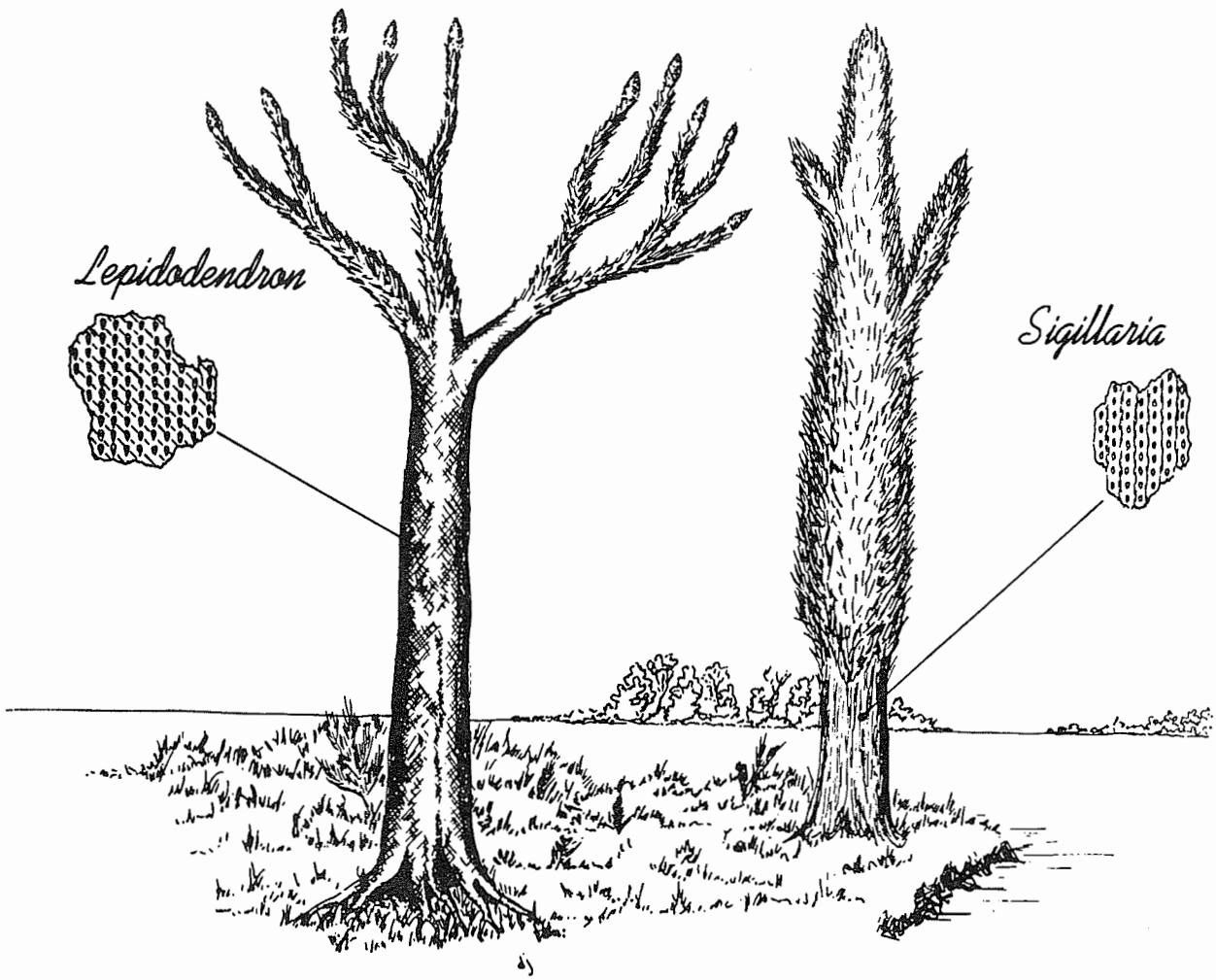
Insects

There are few fossil insects. Insects do not have hard parts. Some insects may become trapped in the sap of a tree. (See page 15.) Amber is sap from a tree. Insects sometimes are seen in amber. Insects have been found with fossil plants. You find them in concretions. Concretions are round or oblong. They are made by the building up of layers around a leaf or insect. The insects look like the present-day dragonflies. You will be lucky if you ever find a fossil insect.

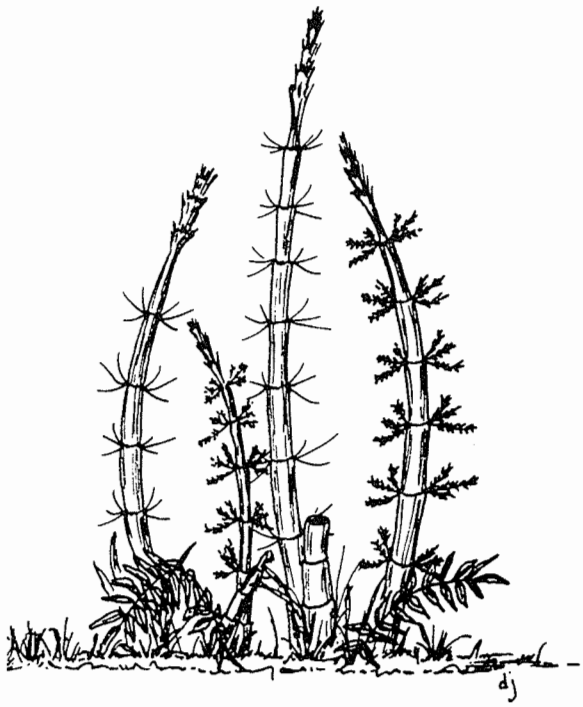
Plants

Many fossil plants have been found. Plant fossils are found in coal beds. They look like stems and leaves of ferns and trees.

Some fossil plants have interesting designs called scars. Scars that line up on slanting rows are named lepidodendron. Scars that line up one over the other are named sigillaria.



Remember the phrase "living fossils"? The horsetail rush or joint grass, the ginko tree, the cycads or palm trees, are living fossils. They do not differ very much from fossils of these plants.



Horsetail rush

How Fossils Are Named

We have talked about fossil invertebrates, vertebrates, insects and plants. There are millions upon millions of them. You may wonder how the geologists or paleontologists study them without getting all mixed up. Does he give them names? The answer is yes, he does.

All fossils can be placed in groups. Fossils that are alike are put in one group. Those not alike are put into other groups. The scientist calls this a classification.

Wouldn't you say that a cat at first glance looks more like a lion than a cow? That a cow is more like a cat than a fish? When a name is given, the name itself suggests a kind of likeness. A man named Linnaeus was first to use names. Two words are used. The first word is called a generic name. It suggests a kind of likeness. The second word is called a specific name. It suggests some outstanding thing about the plant or animal. Felis is the generic name for cats. Felis leo is a lion. Felis tiger is the tiger. Felis catus is the house cat. The lion, the tiger, and the house cat have a kind of likeness. I am sure you have seen a lion and said, "That looks like a big cat." You also saw its size, its thick mane, its tail, and you knew it was not a cat. Felis is the word that tells us of this likeness. It says that these animals all look like cats. The other words say that each animal is a little bit different in the way it looks.

In time you undoubtedly will collect many different kinds of fossils. No doubt you will notice that some of your fossils look like living animals and plants. There is much variation in the life that lives today and this is also true with fossils. Therefore, the paleontologists must use some means of arranging their knowledge of fossils in an orderly way. We arrange books on a shelf so we can find them easily. The paleontologist arranges his fossils to help him talk about them and study them.

Paleontologists and zoologists have devised various compartments in which fossils can be placed. These compartments are called phylum, class, order, family, genus, and species. Each phylum is divided into smaller compartments called classes, and classes are further divided into orders and so on.

All animals that fall in a phylum are in some way related. We can say the same thing about the smaller compartments of order, class, family, genus and species.

To illustrate what we are saying, let us show the classification of the modern lion, tiger, and common house cat.

Kingdom	Animalia	Animalia	Animalia
Phylum	Chordata	Chordata	Chordata
Class	Mammalia	Mammalia	Mammalia
Order	Carnivora	Carnivora	Carnivora
Family	Felidae	Felidae	Felidae
Genus	Felis	Felis	Felis
Species	leo	tigres	catus
Common name	lion	tiger	cat

Each of the three animals is closely related and this kinship is shown in their classification. Each animal shares the same compartment down to species. Maybe this further illustration will help you.

Like modern life, fossils also can be placed in various compartments. Those that are closely related are placed in the same compartments and those that are different are placed in other compartments.

To illustrate, all one-celled animals are placed in the phylum protozoa. The one-celled animal, mentioned earlier, that commonly is called a foram and looks like a grain of wheat, is placed in these compartments.

Phylum	Protozoa
Class	Sarcondina
Order	Foraminifera
Family	Fusulinidae
Genus	Fusulina
Species	cylindrica

In our discussion about fossils you have learned that fossils are the remains or traces of plants and animals that have been preserved in the rocks. You have learned that preservation is dependent upon quick burial of a plant or animal in a protective substance and that the possession of hard parts generally is necessary. Hard parts may be preserved with little change in the original look. Replacement of original substances by calcium carbonate, silica, etc., is common. Carbon copies of original substances are not uncommon. You have learned also that fossils can be placed in their proper compartments and that each is generally referred to by a generic and specific name.

THE RECORD CONTINUES

As noted, life has a beginning and an end. When life dies, the remains generally are buried. If conditions are right when life of today dies, it may be preserved for future generations to dig up, study and classify as fossils.