



# Fossils

the age of man

the ice age

QUATERNARY

TERTIARY

the age of mammals

65,000,000  
years

CRETACEOUS

the age of dinosaurs

JURASSIC

the age of reptiles

TRIASSIC

the age of ammonites

225,000,000  
years

PERMIAN

the age of plants

CARBONIFEROUS

the coal age

DEVONIAN

the age of brachiopods

SILURIAN

the age of eurypterids

ORDOVICIAN

the age of graptolites

CAMBRIAN

the age of trilobites

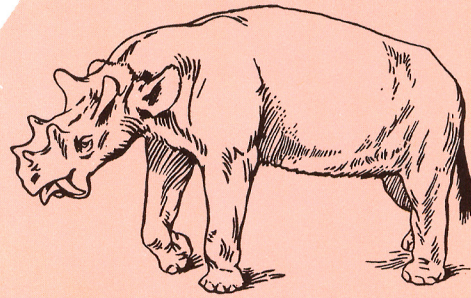
600,000,000  
years

PROTEROZOIC

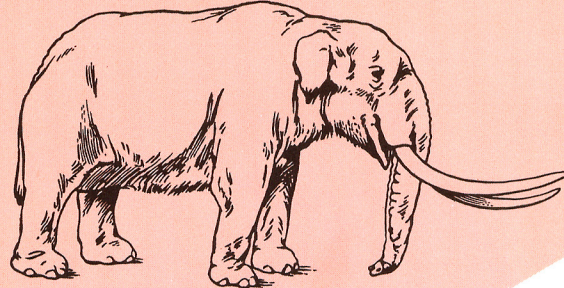
the first fossils

2,500,000,000  
years

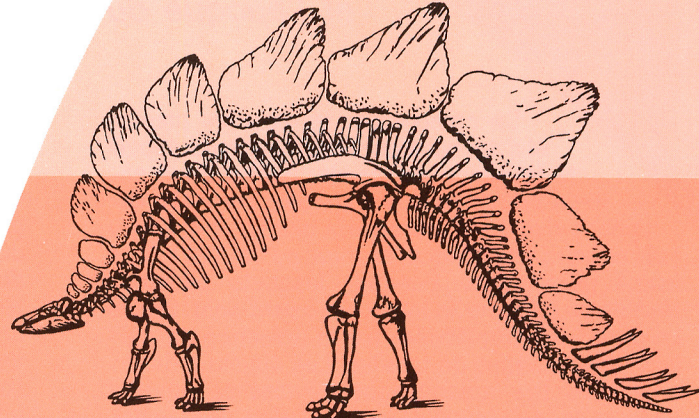
ARCHEAN



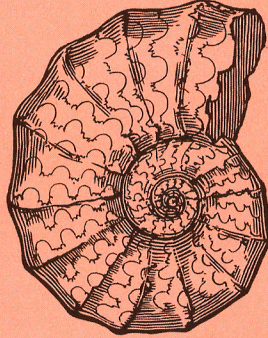
UINTATHERIUM



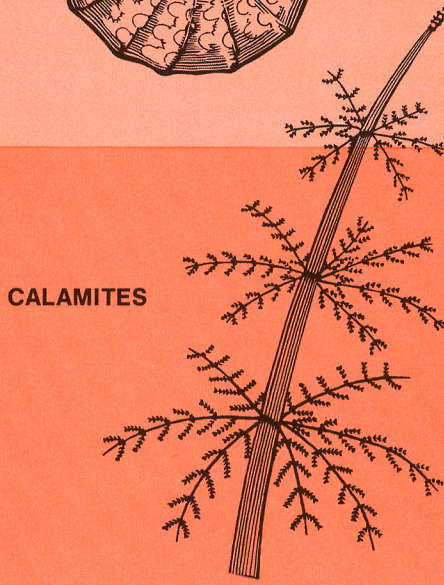
MAMMUT



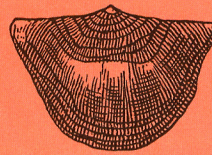
STEGOSAURUS



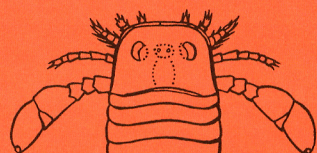
CERATITES



CALAMITES



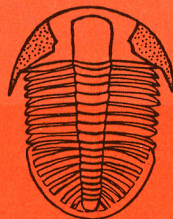
LEPTAENA



EURYPTERUS



TETRAGRAPTUS



OGYGOPSIS

**FOSSILS ARE** the remains or traces of animals and plants preserved in rock. Paleontology, the study of fossils, seeks to determine the biology of these long dead organisms and the original environment and time of deposition of the rocks in which they occur.

Many diverse types of animals and plants have inhabited the Earth since the preservation of the first fossil some two billion years ago; some types still exist but most have become extinct during the long history of the Earth. The part of geological time in which animals and plants have existed can be divided into periods that are characterized by the presence of different assemblages of fossils. Paleontological study of fossil assemblages makes possible the dating and correlation of fossiliferous rocks throughout the world.

Fossils exhibit a biological sequence of increasing complexity through time, and the appearance and disappearance of certain fossils tells a story of changing geological conditions. Great upheavals or orogenies of the Earth's crust are recorded by the fossil record. The late Precambrian Grenvillian Orogeny that produced the Laurentian Highlands of southern Ontario and Quebec some one billion years ago, marked the opening phase of paleontological time as most people know it. Before that time, only one-celled organisms and masses of plant-like algae are known; after that time the equatorial oceans that covered most of Canada contained increasingly complex creatures such as jelly fish, trilobites, graptolites, eurypterids, brachiopods and corals. The Acadian Orogeny near the end of the Devonian Period, some 350 million years ago, caused most of the present Atlantic Provinces of Canada to rise above the ocean and marked the beginning of land plants. The great Carboniferous coal basins record the luxuriant growth of plants that thrived in Nova Scotia and New Brunswick. The Appalachian Orogeny, some 225 million years ago, caused all of eastern Canada to rise above the sea and most of that area has remained as land ever since. Western and Arctic Canada was covered by vast seas in which ammonites swarmed. Great dinosaurs and other reptiles roamed the low-lying lands adjacent to the seas. These great inland seas retreated during the Laramide Orogeny some 65 million years ago, with the formation of the Rocky Mountains and western plains. Various groups of mammals evolved on these plains, including ancestors of the horse. The beginning of the ice age brought cold conditions some 2 million years ago; many groups of mammals became extinct and others evolved to fill new ecological niches. Long-haired mammoths, ancestors of the elephant, roamed much of the Northern Hemisphere and were hunted by primitive man. Today, paleontologists study these various types of fossil remains, from one-celled organisms to primitive man, in order to interpret the story of the past.

## WHERE DO FOSSILS OCCUR?

Fossils are most abundant in sedimentary rocks such as shale, sandstone and limestone; they are very rare and difficult to recognize in metamorphic or volcanic rocks, and are absent in igneous rocks. Fossils are widespread in Canada except for parts of the Precambrian Canadian Shield and some small areas of the Atlantic Provinces and British Columbia. Almost anyone who can find beds of unaltered sedimentary rock has the opportunity of discovering fossils lying where those animals and plants lived and died millions of years ago. Many

organic remains were deposited in the sediments of vast marine embayments that advanced and retreated across what is now Canada. Other fossilized remains are found where prehistoric freshwater lakes and swamps once existed, and still others occur in glacial deposits that cover vast parts of the continent. To be preserved, organic remains had to be quickly buried within and beneath layers of sediment, so that their skeletons would lie, undisturbed, through the ages, until uncovered by man or by Nature's slow processes of erosion.

Fossils may be preserved in several ways. Some are relatively unaltered, such as mammoths frozen in Siberian ice and insects preserved in Baltic amber; some are merely faint impressions left after the skeleton had disappeared; others are recorded only as carbon films, such as most plants. The remains of many organisms, however, were changed by mineral-bearing solutions; calcite replaced many sea-shells, silica invaded fallen trees of the petrified forest of Arizona, and iron-rich solutions altered Mesozoic ammonites into fossils of golden beauty. Each type of preservation has its own story to tell of the chemical and physical processes that have been active over millions of years.

## HOW DO WE IDENTIFY FOSSILS?

Most fossils have the general shape of modern animals and plants. A fossil snail (gastropod) looks like a modern snail shell, with one important difference, the fossil lacks the soft-bodied animal inside. A fossil fish may be preserved as a skeleton, and a fossil tree may resemble a stem or twig to which leaves are attached. There are also suggestive shapes, called pseudofossils, that may be confused with true fossils, but these are caused by inorganic physical or chemical processes.

Like modern animals and plants, true fossils are divided into zoological and botanical groups. Paleontological studies are based mainly on the hard parts or skeletons of organisms because delicate tissues are seldom preserved. Many groups of organisms are extinct and are known only as fossils, such as trilobites and dinosaurs. Biological terms and names are used to classify these dead organisms; for example, a Tertiary clam (pelecypod) bears the name *Ostrea percrassa* in order to differentiate it from the very similar but slightly different present day oyster *Ostrea edulis*.

## WHY ARE FOSSILS IMPORTANT?

Paleontology, by investigating the past, helps to explain the present organic world. Apart from their importance to biological science, fossils are of great geological significance. Because the sequence of fossil assemblages is constant around the world, paleontologists are able to establish a biostratigraphic (life-rock) succession from rock of different ages. Using such detailed knowledge we can determine the geology and configuration of fossiliferous rocks that have undergone little or great upheaval. This is particularly valuable in our search for fossil fuels that are derived from once living animals and plants. From rock samples obtained during drilling, paleontologists can identify fossil remains and date the layers of rock that yielded the fossils. Paleontologists can combine knowledge of past organisms with the life habits of modern organisms and determine the environment of deposition of fossiliferous sedimentary rocks. Using this and other information, geologists can determine the ecology that existed when these sediments were deposited and whether they might contain exploitable reserves of oil and gas.