PALEONTOLOGY

Finding Life's First Beginnings

"Animals" two billion years old, four times older than any found before, have been discovered as new evidence of early life on earth, Tove Neville reports.

➤ THE SEARCH for the beginning of life on earth is a triple adventure:

1. Scientists probe for the earliest plants and animals.
2. Chemists investigate organic materials, such as graphite, in very old rocks to see if they came from living matter.
3. Biochemists try to create life in test tubes from chemicals.

Not only has plant evidence almost three billion years old been discovered, now "animals" two billion years old, or four times older than any found before on earth, have been discovered in rocks from the shore of Lake Superior.

Until now, fossilized animals have been known only from the Cambrian geological age that began 550,000,000 years ago. Evidence of very early life is generally seen only as imprints of plants and animals or as organic material left by them in rocks.

Of great significance to the new discovery is that the two-billion-year-old organisms had three-dimensional forms—they were not merely imprints in rocks. This is most unusual for animals originally soft and jelly-like without skeletal parts. Fossilized algae, primitive plants related to seaweed, were also found.

The ancient organisms, believed to be animals, are microscopic and were magnified 2,300 times to obtain photographs of an image one inch long. The tiny fossils look like little sacs with a mantle, or lobe, at one end.

The mantle, sometimes star-shaped, worked like a parachute in reverse and was used by the organism to propel it up and down in the water where it lived. This is assuming the mantle worked as this type mechanism does in today's living forms. The "animal" would pump this mantle in and out to achieve up and down movement.

All the creatures studied do not look exactly alike, possibly because they represent different stages of the same organism, their discoverer, Dr. Elso S. Barghoorn, professor of biology at Harvard University, told SCIENCE SERVICE.

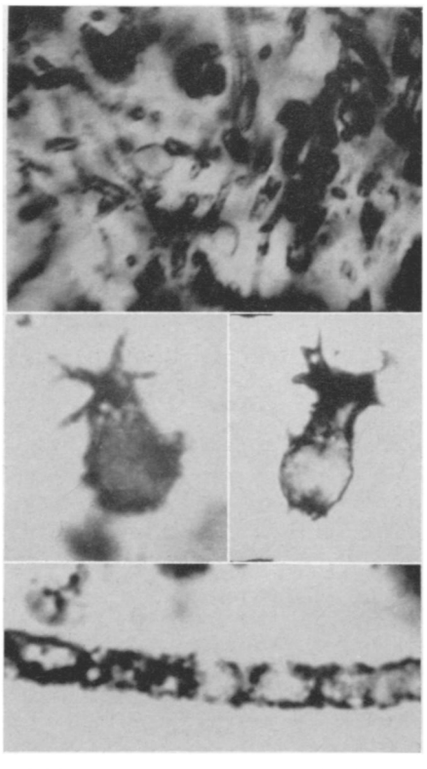
The tiny creatures appear similar in form and organization to jelly fish and hydra. However, they cannot be included in the zoological division to which these and also corals and sea anemones belong (coelenterates). They must be considered as a non-assignable group, Dr. Barghoorn said, because they were probably experiments in evolution that died out.

The two-billion-year-old Ontario gunflint chert, in which the organisms were found, is sedimentary rock. The rock, named for Gunflint Lake, is related to quartz, which includes precious stones such as jasper and agate. The rock was part of the Canadian shield rock formation covering central Canada, parts of Wisconsin, Minnesota and Michigan. Dr. Barghoorn and Dr. Stanley A. Tyler of the University of Wisconsin studied under a microscope thin sections cut from the rock.

The plant fossils are of primitive blue-green algae and filamentous algae which are now brownish as are also the animal structures. Algae are believed to be some of the earliest living things on earth. The blue-green algae produced their food by photosynthesis as plants do today.

Some of the fossilized blue-green algae are one-celled and have the appearance of flagellates (having whip-like arms); others are multicellular blue-green algae consisting of simple filaments. Certain of the filamentous structures look like iron bacteria which live in iron-rich water.

Hydrocarbons, chemical compounds found only in living things, were also in the rock, which was dated at two billion years by Dr. Patrick Hurley of the Massachusetts Institute of Technology. Dr. Hurley used the potassium-argon method by which the radioactive decay products in the material give its age.



FOSSIL "LIFE"—Top, algal filaments matted together. Center, two of the unknown organisms believed to be animals two billion years old. Bottom, algal filament. All are microscopic and here are seen highly enlarged.

To bridge the gap between detailed fossil record and the origin of life on earth, other scientists are picking up where fossil studies stop.

Drs. Philip Abelson and Thomas Hoering of the Carnegie Institution of Washington's Geophysical Laboratory, are proving chemically that the material found in a South African sedimentary rock, the Transvaal dolomite, is evidence of plant life between two and three million years old.

Dr. Hoering said that chemical experiments have been made with graphite fractions from large semicircular formations of the dolomite believed to have been colonies of algae. The graphite fractions are black limestone containing graphite, much like the very high grade hard coal called anthracite. The graphite is believed to have been formed from living things.

In one experiment, the graphite was heated in a vacuum to a temperature of more than 1,200 degrees Fahrenheit. Hydrogen gas and hydrocarbons resulted. When the graphite was treated with other chemicals, hydrocarbons and organic acids similar to those derived from coal were obtained.

The scientists concluded from these experiments that the graphite is of biological origin and comes from some form of life. Infrared studies show the material is also like that of organic compounds making up plants and animals.

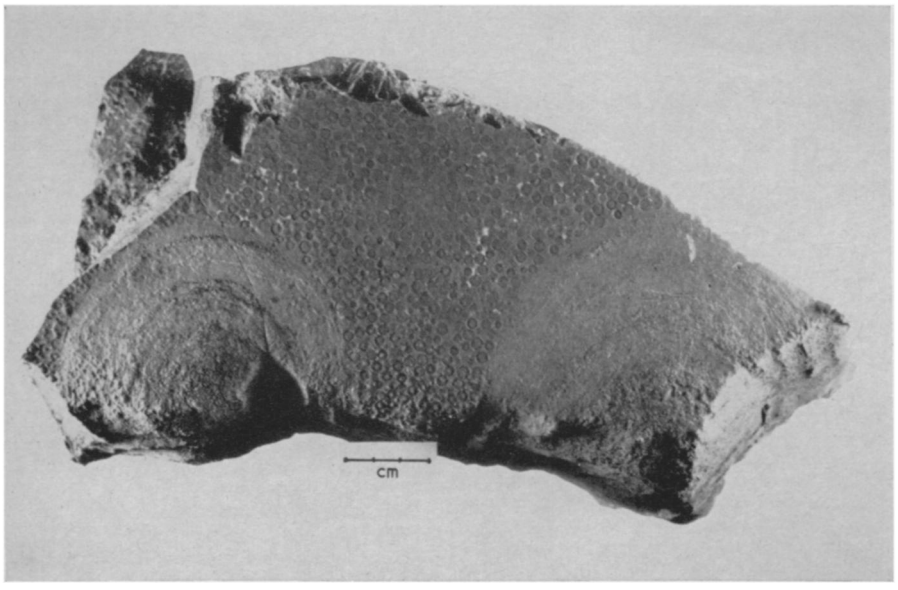
Drs. Abelson and Hoering also studied the Ontario gunflint chert and found it had the same chemical composition as the Transvaal dolomite. They also verified Dr. Barghoorn's observation that the chert contained fossil bacteria.

Living forms are believed to have developed on earth through a process of chemical evolution. Atoms such as carbon and hydrogen could have been influenced by the energy of cosmic rays, ultraviolet light and electrical storms to join together and form complex molecules.

The structure of living organisms is based on three kinds of long complex molecules, called macromolecules—protein, nucleic acid and carbohydrate. Most geneticists believe that nucleic acids developed before protein. However, some scientists have claimed that protein molecules came first.

Recent work by biochemists has indicated that life could have started from both existing side by side. One of the goals of today's "new biology" is to attempt to produce some form of living, reproducing "organism" from the raw chemicals and conditions similar to those believed present on earth when life was first formed.

Dr. Harold C. Urey of the University of California, La Jolla, has suggested that the



"LIFE" IN A ROCK—The half-circles left and right on a rock, dated at 2.6 billion years, are believed to have been colonies of primitive plants. The pock-like marks are oolites, structures of unknown origin.

earth originally had an atmosphere mainly of methane and ammonia, similar to that of the planets Saturn and Jupiter today. The earth's atmosphere gradually changed into the one now known, composed mainly of nitrogen and oxygen.

Although the early atmosphere could not have supported life, it may have contained the stuff of life. To prove that lightning flashing through this early atmosphere helped make the first organic compounds, Dr. Stanley L. Miller, now at Columbia University and a former student of Dr. Urey, created in a laboratory flask an atmosphere of methane and ammonia plus hydrogen and water. Electric sparks were passed through the flask producing a mixture of organic compounds, among them amino acids, the chief building blocks of proteins essential to living cells.

A biochemist, Dr. Sidney W. Fox of Florida State University, went a step further when he heated amino acids and obtained "proteinoids" that behave like natural proteins.

Further evolution in the life-creating process, according to one theory, would be the grouping of protein molecules into cells that grow by absorbing smaller molecules and multiply by dividing.

Dr. Fox produced cells by dissolving some proteinoids in hot water. When the solution cooled, microorganisms looking like bacteria were found. A similar process could have taken place in the early development of earth, with the eventual result that one of the cells contained the spark of life that started the evolution ending with man.

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MEDICINE

"Innocent" Medicines

➤ THE "SOOTHING SYRUP" that grandma used may have contained enough opiates to produce habituation if not addiction.

Before the Harrison Act of 1914 many patent medicines were heavily opiated, Dr. Walter C. Bailey, lecturer in social welfare at University of California, Los Angeles, said. Dr. Bailey noted that drug stores customarily carried such "comforting" cures as McMunn's Elixir of Opium, Godfrey's Cordial, Mother Bailey's Quieting Syrup, Winslow's Soothing Syrup, Black Drop, Laudanum, and others.

Users of these medicines were usually middle-aged or elderly women, highly respectable and middle-class.

Their opium careers probably began with an innocent request to their druggist for "something good" for rheumatism or perhaps a cold, Dr. Bailey explains.

"As tolerance set in, grandma began taking just a little bit more each day to recapture the feeling of relief from her pain.

"Then one Sunday or holiday she got caught with her medicine bottle empty and the drug store closed. She undoubtedly complained of feeling more than a trifle under the weather—for grandmother was suffering from withdrawal pains."

Although grandma was probably not actually addicted, she was more likely "physically habituated."

One characteristic of an addict is a compulsive use of an opiate to avoid withdrawal distress. Though he may temporarily stop using the drug, he may become addicted again when confronted by any crisis, no matter how slight.

But not so with grandma, Dr. Bailey says. By not making a conscious connection between her feelings of relief and the taking of an opiate as such (the "medicine" got the credit), or between her suffering and the withholding of the opiate (described as the "crucial drug experience"), she was not likely to relapse once withdrawal was effected.

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