# Geologic Time Perspective in Biological Studies

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**A contributor to these pages, the author describes some of the fossil remains which the biology student may find and which will effectively link his understanding of present-day forms to the past. The author is a professional paleontologist. Fossil sketches were made by John R. Beeder.**

## Introduction

The perspective of time may be effectively introduced in biological studies with the aid of a few rock specimens. A fascinating adventure in earth and biological sciences is enjoyed by students with the small expenditure of time needed to obtain a hand specimen of limestone. Teachers in most areas of the United States have access to limestone in nearby outcrops; however, trades or purchase may also supply the basic source material. Addition of individual fossil specimens through similar efforts introduces students to a new world of scientific investigation.

This activity places ocean bottom investigation within reach of any inland classroom with the added benefit of the dimension of time. The following suggested approach may be simplified, or the content increased for application at various levels of instruction. Fossil studies provide a foundation for subsequent examination of recent marine animal populations and distribution.

## Classroom Presentation

Ask a builder what is in a piece of limestone, and as he visualizes a cold steel framework becoming clothed in blocks of natural building stone, his reply is "strength and beauty." Ask a mineralogist the same question, and he will say that a limestone is chemically composed of calcium carbonate ($CaCO_3$) with minor amounts of impurities. When the magnesium content becomes high and is united with the calcium and carbonate, the rock is called dolomite ($CaMg(CO_3)_2$). To the geographer, compositional effects on physiography and economic products such as building stone or chemicals are most important. The ecologist is concerned with the effects upon soil, vegetation, and fauna.

We are interested in another aspect of the composition of a limestone—the record of past animal life. The Beil Limestone of eastern Kansas illustrates this fascinating facet of natural history. This limestone was deposited approximately 300 million years ago in the seas of the Pennsylvanian Period. At that time waters washed back and forth on a broad submerged platform covering much of the United States.

Animal life on the submarine platform was abundant, and those organisms having hard parts, or shells, left their remains as evidence of activity in the ocean. The story is told in a collection of these shells from a weathered outcrop of the Beil Limestone along the Kansas River near Lecompton, Kansas (Figs. 1 and 2). Representatives of these same general groups of invertebrate animals may be found in most limestones of similar age. Limestone of older and younger ages will also yield interesting assemblages of fossils. Illustrated here are only a few of the more common

Fig. 1. The Beil Limestone member of the Lecompton Formation is shown exposed along the south bluff of the Kansas River valley west of Lecompton, Kansas. The illustrated fossils were collected from the weathered surface of the Beil Limestone in the foreground. Another limestone, seen in the background, is called the Avoca Limestone and also contains many fossils in the upper part. The King Hill Shale lies between the two limestones.

Fig. 2. The Beil Limestone is located near the top of the slope on the south bluff of the Kansas River valley west of Lecompton, Kansas. The limestone in the foreground is called the Big Springs Limestone and also has many fossils. Exposures of this type may be seen frequently in travels across the country.

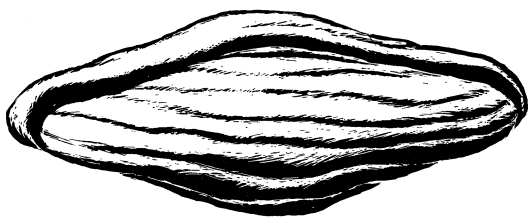
forms of marine animal life found in the Beil Limestone. Many other shelled invertebrates inhabited this ancient ocean floor. Forms without hard parts left very little indication of their former presence. There are many satisfying rewards for students who pause long enough to look closely at a limestone and view its record of ancient animal activity.

### Fusulinids

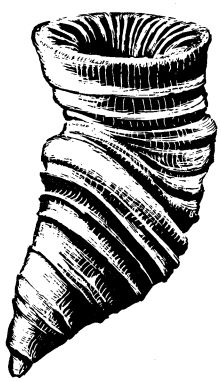
Fusulinids are an extinct family of ameba-like protozoans. The Beil Limestone representatives of the Protozoa secreted a calcareous shell. These animals secreted larger chambers as they grew. The arrangement is studied and classified by the micropaleontologist. We believe the protoplasm flowed in and out of small pores on the front of the last-formed chamber. Most fusulinids look similar on the outside, but a section through the first chamber, or proloculus, reveals the history of the individual and permits close identification.

### Corals

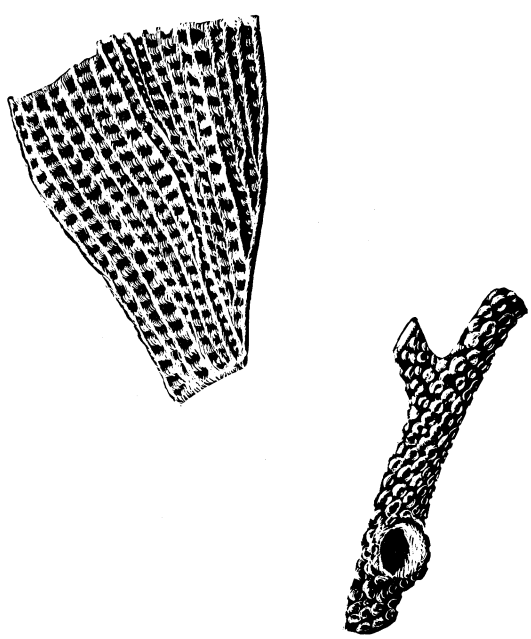
Many fossil corals are distantly related to those which make up the coral reefs of today. They are radially symmetrical with vertical plates dividing the circular shell into numerous parts. Flat or curved platforms were deposited below the animal. The polyp lifted itself up into a larger space as it grew and secreted another platform beneath. Thus, as growth progressed, the shell expanded to look like an ice-cream cone.



Fusulinid



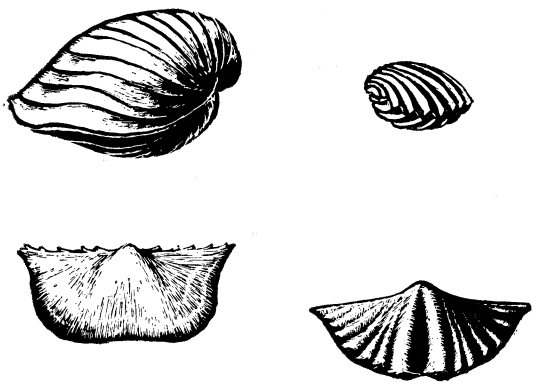
Coral



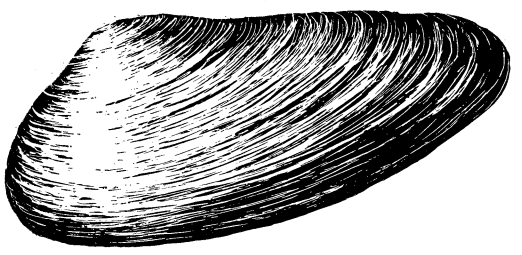
Bryozoans

### Bryozoans

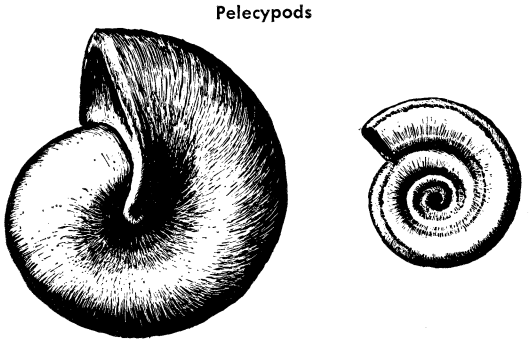
Colonies of delicate and minute animals called Bryozoa make up another element of this interesting fauna. They are also found in the oceans today. The lace-like forms are called fenestrate Bryozoa and each animal played its part in the construction of the frond. The twig-like Bryozoa are made up of



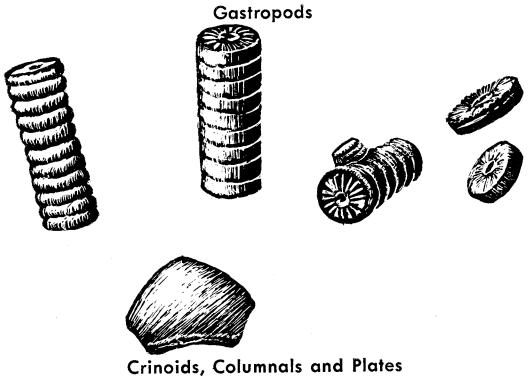
Brachiopods



Pelecypods



Gastropods



Crinoids, Columnals and Plates

individuals which radiate from a common central column and grow outward to enlarge the colony.

### Brachiopods

The highly fossiliferous Beil Limestone contains a large variety of brachiopods, bivalved animals rarely found today in the oceans. A brachiopod may be confused with the familiar pelecypod, or clam shell collected on the present-day sea shore. They differ in symmetry; in pelecypods the two valves are identical; whereas in brachiopods the two valves are different, but opposite halves of the same valves are similar.

### Pelecypods and Gastropods

Mollusca is represented by gastropods (snails) and pelecypods (clams). Many of the Beil Limestone gastropods are coiled in one plane. These marine animals had a large muscular foot upon which they moved. Pelecypods are not as abundant in the Beil Limestone as brachiopods. Fossil clams are similar in appearance to those we find living today.

### Crinoid Columnals and Plates

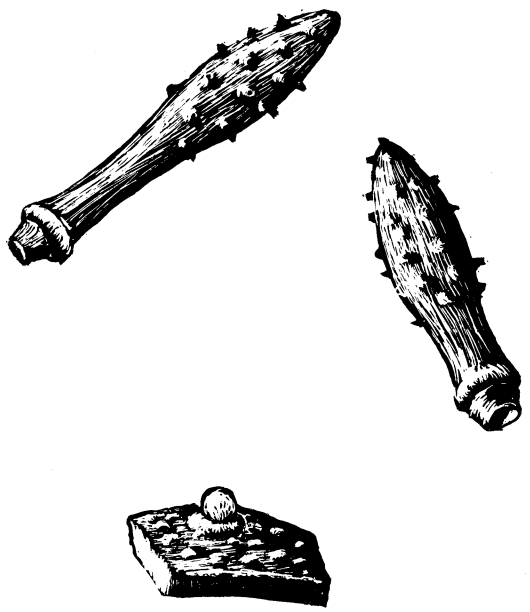
Fossil crinoids, a type of echinoderm, can be identified by stem and plate parts. Occasionally all of these plates may be found together as they were when the animal was living on the sea floor. These "sea lilies" are similar to those found today in very deep waters in some parts of the oceans.

### Echinoid Spines and Plates

Echinoids, or sea urchins, also lived on the Pennsylvanian sea floor. We have evidence of their presence in the form of plates and spines which were scattered as the tissues holding them together disintegrated. The spines show a tubercle or place for muscle attachment at their base.

### Concluding Statement

The brief comments for each of the fossil representatives contributing to the Beil Limestone serve only to introduce the subject. Teachers may encourage student reports from accessible literature sources for expansion upon the classroom presentation. Valuable fossil information is available in several of the more widely distributed books (Fenton and Fenton, 1958; Heller, ed., 1962; Matthews, 1962, Rhodes, *et al*; 1962). Additional



Echinoid Spines and Plates

information may be found in historical geology texts (Moore, 1958; Dunbar, 1958), and paleontology textbooks (Moore, Lalicker, and Fischer, 1952; Shrock and Twenhofel, 1953; Beerbower, 1960; Shimer and Shrock, 1944; Easton, 1960; and Jones, 1956). Occasionally a few students will be interested in the more comprehensive coverage found in exhaustive treatise form (Moore, ed., 1953-1963; Ladd, 1957). Many states distribute publications calling attention to local faunas. Texas (Matthews, 1960), Indiana (Shaver, 1959; Perry, 1959), and Illinois (Collinson, 1956) serve as examples. The American Geological Institute supplies information on the address and availability of material for all state geological surveys (American Geological Institute, 1961).

Early contact with fossil faunas introduces a time perspective of value in all subsequent biological investigations. A broader understanding of the field of biology is accomplished through examination of a fossiliferous limestone. More extensive studies of these ancient oceanic animals encourages students in the upper grades to conduct literature searches and attempt original research. Consideration of faunal assemblages of many millions of years ago teaches the concepts of time needed for a greater appreciation of present-day faunal distributions.

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