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ABSTRACT

This booklet, one of a series developed by the Frederick County Board of Education, Frederick, Maryland, provides an instruction module for an individualized or flexible approach to 7th, 8th, and 9th grade science teaching. Subjects and activities in this series of booklets are designed to supplement a basic curriculum or to form a total curriculum, and relate to practical process oriented science instruction rather than theory or module building. Included in each booklet is a student section with an introduction, performance objectives, and science activities which can be performed individually or as a class, and a teacher section containing notes on the science activities, resource lists, and references. This booklet introduces the student to the methods of interpreting the distant past through the study of fossils. The estimated time for completing the activities in this module is two weeks. (SL)

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MINI-COURSE UNITS

BOARD OF EDUCATION OF FREDERICK COUNTY

1973

021 652

Frederick County Board of Education

Mini Courses for
Life, Earth, and Physical Sciences
Grades 7, 8, and 9

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1973

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FOREWORD

The cont[illegible] represented in these modules of instruction, called mini courses, is a [illegible]dication of our sincere desire to provide a more individualized and f[illegible]le approach to the teaching of science.

Data was accumulated during the school year relative to topics in life, earth, and physical science that were felt to be of greatest benefit to students. The final selection of topics for the development of these courses during the workshop was made from this information.

It is my hope that these short courses will be a vital aid in providing a more interesting and relevant science program for all middle and junior high school students.

Dr. Alfred Thackston, Jr.
Assistant Superintendent for Instruction

ACKNOWLEDGEMENTS

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INVERTEBRATE FOSSILS: CLUES TO THE DISTANT PAST

Prepared by

John E. Geist

CONTENTS

Estimated Teaching Time

2 weeks

INVERTEBRATE FOSSILS: CLUES TO THE DISTANT PAST

INTRODUCTION:

The word fossil means "something dug up". Fossils are actually known to be plant and animal remains, or some evidence of their remains, that have been preserved in the earth's crust. Fossils have one other basic characteristic and that is their age. All fossils are greater than 10,000 years old! Why? How old are the oldest fossils? Can you identify several fossils? What do fossils tell us about the past?

OBJECTIVES:

Students will be able to:

1. explain how fossils form.
2. describe the different types of fossils.
3. identify various fossils.
4. list and describe the major geologic time units.

ACTIVITIES:

1. Obtain the handout titled "Fossilization and Types of Preservation" from your teacher. Read this and complete Worksheet #1. Turn this in.
   a. Observe transparencies "Types of Preservation" in Milliken series "Life of the Past".
2. Obtain handout titled "Types of Fossils" from your teacher. Read this and write the words and definitions which you do not know. Show this to your teacher.
3. Complete the chart "Geologic Time Scale". Use any earth science text or any other source. Show this to your teacher.
4. Observe the station on the Geologic Periods.
   a. Write the name of each period and time span.
   b. Calculate the duration for each period and construct a time-line as shown.
   c. Identify 2-3 life forms which existed in each period.

   Show it to your teacher.

5. Identify the specimens in Fossil Kit #1. Write the fossils names on a sheet of paper and match this name with a fossil. Have your teacher check this.

6. Identify the specimens in Fossil Kit #2. Use same procedure as above.

7. Complete the chart on the page titled "Problems in Fossil Study". Use the transparencies and your previous information. Turn this in.

8. Complete the lab page titled "Fossil Assemblages". Turn this in.

9. Try the fossil puzzle. Show your results to your teacher.

10. Research: Choose a topic listed below and write several paragraphs on it. This will count extra credit.

    a. Explain how coal was formed.

    b. Describe fossil fuels.

    c. Explain how index fossils are used.

    d. Explain how fossils are classified.

    e. Explain how fossils are dated.

EVALUATION:

In addition to completing the above activities, this will consist of a short quiz.

WORKSHEET #1

Answer the questions below using the "Fossilization and Types of Preservation" handou

1. What is a fossil?

2. List and explain the most important conditions needed for the formation of a fossil.

3. List and describe several ways an organism could be preserved in tact.

4. Explain dessication and carbonation.

5. Explain petrification and the different types.

6. Identify:

   a. Gastroliths

   b. Coprolites

   c. Tracts, trails and borings

   d. Molds and casts

You will need class sets of the handouts titled "Fossilization and Types of Preservation" and "Types of Fossils". Try to have available on bulletin board or in showcase, examples or pictures of these terms.

Using the transparencies from the set titled "Life in the Past", set up a teaching station on a rather large bulletin board or chalk board. (See accompanying diagram for a possible arrangement titled "Geologic Periods Station".)

Fossil Kit #1 is the idealized plastic fossils in the ESCP kit. If this is not available, skip this activity and have students identify the actual specimens you have available. (This is Activity #6.) Suggested specimens are:

Brachiopods	Plecypods
Trilobites	Gastropods
Corals	Blastoids
Crinoids	

Suggested audio visuals are listed below. You should use when most appropriate.

Film:

F 566 . Fossil Clues to Prehistoric Time

Study Print Sets:

Prehistoric Animals and Plants - Ancient

Prehistoric Animals and Plants - Middle

Prehistoric Animals and Plants - New

Filmstrip:

The Story Fossils Tell

A suggested activity is to have the students complete the Reconstruction Stories which are available in the Milliken transparency book "Life of the Past".

Also clay and plaster of Paris models can be made and used with Activities 1 and 2.

Resource:

Milliken, Life of the Past (Transparency and Duplicating)

FOSSILIZATION AND TYPES OF PRESERVATION

The term fossil (from the Latin, foders, to dig; fossilis, dug out, dug up) may be defined as the remains of trace of an organism that can, if well enough preserved, be identified by its form and structure as a particular kind of animal or plant. It is generally agreed that in order for the remains of an organism to be regarded as a fossil, the organism must have lived prior to the beginning of recorded human history. Remains of life from Pleistocene (Ice Age) or older are certainly fossil.

In order that fossilization may take place, an organic body normally must have some kind of a preservable hard skeleton, and must be rapidly buried by sediments before it has a chance to decompose.

Fossils may be preserved by the following methods:

1. Essentially Unaltered or Actual Preservation. This type of preservation allows for very little chemical or physical change in the entire organisms or part of an organism. Included under this type of preservation are examples of fossils found as follows:

    a. Frozen intact (flesh and all) within ice such as the wooly mammoth and rhinoceros of the Pleistocene Ice Age.

    b. Trapped within conifer tree resin or gum such as insects, spiders, and other arthropods have been in the past.

    c. Entombed in ancient tar pools, such as the birds and mammals which are preserved within the tar pits at Rancho La Brea at Los Angeles, California.

    d. Unaltered, in which the original shells or tests are essentially unchanged such as in mollusks, echinoderms, foreminiferans, and distoms.

2. Dessicated. This type of preservation is not common and includes remains of animals which were dried up and thus preserved. An example of this type is the remains of an extinct fround sloth found in a crater in New Mexico. The skeleton of the sloth was found articulated by ligaments and contained pieces of skin which were still attached to the carcass.

3. Carbonized. As organic remains decompose under water, volatile constituents (oxygen, hydrogen, and nitrogen) are slowly lost which is a process known as distillation. When this occurs, carbon concentrations are sometimes left behind as thin films. These films may show in detail form organs of the original plant or animal. Plants, graptolites, crustaceans and fish have been preserved in great numbers in this way.

4. Petrifaction. Many fossils have been altered by mineralizing solutions, especially shells and internal skeletons of invertebrates. Trees have also been preserved in this manner. Types of petrifaction include:

    a. Replacement, where the original material of the skeleton has been replaced by another mineral -- that is by a molecular exchange of substances that were once part of the organism, with other substances carried in by percolating water solutions.

b. Permineralization, where additional minerals fill the pores of the skeleton -- may occur by gradual addition of a chemically precipitated substance into pore spaces.

c. Recrystallization, where original minerals have been reorganized into other crystalline forms.

Traces or direct evidence of animals may be found in the geologic record as:

1. Gastroliths or Stomach Stones. Many gastroliths have been described and associated with extinct reptiles. The stones are rounded and highly polished from grinding against one another. Experience is usually required to accurately identify gastroliths.

2. Coproliths. Coproliths are solid excretory wastes of animals. They are commonly preserved and may contain undigested materials which indicate the diet of the animal which deposited them. They can be helpful also in identifying the feeding habits of the animal in question.

3. Tracks, trails and borings. They supplement other fossil remains in interesting ways. The tracks of a land animal can be identified as bipedal or quadripedal, whether the animal moved by running, leaping or sprawling, and whether it was agile or ponderous. These so-called trace fossils can prove to be of great value in the interpretation of ancient environments. Sediments that have been reworked by the burrowing and plowing through of organisms might suggest marine conditions of deposition.

4. Molds and casts. Entire plant remains or animal bodies may be dissolved away following their burial so that only cavities in the sediments are left. The walls of these cavities are considered natural molds of the fossils. Later, sediment or minerals may fill the cavities and form natural casts of the original organisms. Molds may be termed external if the outline of the outer surface of a hard portion of the fossil is shown, or it may be internal if the impression of the inner surface is preserved. An internal mold is frequently referred to as a "steinkern".

TYPES OF FOSSILS

Definitions:

1. FOSSIL: The remains or traces of animals or plants which have been preserved by natural causes in the earth's crust, exclusive of organisms which have been buried since the beginning of historic time (roughly 5000 years ago).

2. UNALTERED SOFT PARTS: Preservation of soft tissues of organisms by freezing in permafrost, dessication in arid regions, or encasement in natural tar or amber.

3. UNALTERED HARD PARTS: Hard skeletal structures of organisms preserved by rapid burial in a protective medium. Such fossils are composed of biologically produced cellulose, chitin, calcite, aragonite, hydroxylapatite, opaline, silica, celestite, magnetite, or goethite.

4. CARBONIZATION: Transformation of the composition of the tissues of plants and animals to a thin film of carbon by solution and other chemical action under water.

5. PERMINERALIZATION: Deposition of mineral substances by ground water into porous shell, wood, or bone; commonly of calcite, silica, hematite, limonite, or glauconite.

6. RECRYSTALLIZATION: Solution and reprecipitation of minerals in skeletal structures, resulting in a reorientation of the crystals and general loss of original microstructures; most commonly from aragonite to calcite, or from opal to quartz.

7. REPLACEMENT: Solution of a hard structure coupled with simultaneous deposition of some other substance in the voids formed; commonly by pyrite, hematite, limonite, glauconite, calcite, dolomite, siderite, rhodochrosite, or silica.

8. EXTERNAL MOLD: An impression of skeletal hard parts in adjoining rock, showing the shape of the outer sides of the hard parts; formed by the close packing of sedimentary materials around the preserved hard parts of an organism.

9. INTERNAL MOLD: Impression of skeletal hard parts in adjoining rock revealing the form and markings of inner surfaces.

10. IMPRINT: A very thin mold lacking any evidence of original organic material.

11. CAST: Filling by mineral matter of a cavity formed by the solution and removal of skeletal hard parts by ground water.

12. BODY FOSSIL: Preservation of actual body or skeleton of an organism as an altered hard of soft parts, mineralization of skeletal structures, or as a cast, or mold.

13. LEBENSSPUREN: Imprints, tracks, trails, and burrows made by organisms moving over or through the sediment, or the habitation burrows, or tubes constructed in the sediment.

14. TRACK: Individual impression made in soft sediment by the foot or locomotory appendage of an organism; commonly produced only by vertebrates.

15. TRACKWAY: A series of successive tracks made by the movement of an individual organism.

16. TRAIL: Marks produced by organisms lacking feet moving through soft sediment; commonly produced only by invertebrates.

17. BURROW: Cavity produced in soft sediment by organic activity; most commonly for purposes of feeding or habitation.

18. BORING: Cavity produced in hard sediment or other material by organic activity; most commonly for purposes of habitation or for penetrating the hard shells of prey organisms.

19. COPROLITE: Undigestible residue that has passed through the digestive system of some organism and preserved in lithified sediment.

20. ARTIFACT: Inorganic material acted upon, formed or affected by organic activity; examples are prehistoric human tools, ant hills, and wasp's nests.

21. BIOTIC ACCUMULATION: Accumulations of organic matter such as peat, coal, petroleum, or other biologically produced materials are regarded as evidence of past organic activity.

Name _____ Date _____

GEOLOGIC TIME SCALE

ERA	PERIOD	EPOCH	
			
			
			
			
			
			
			
			
			
			
			
			
			
			
			

1B

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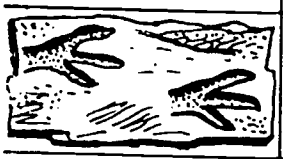
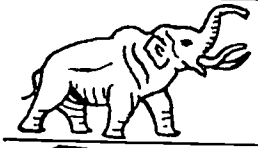
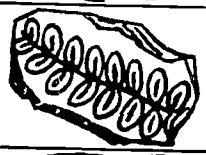
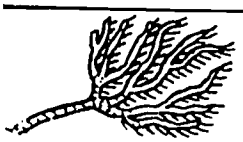
Name _____ Date _____

PROBLEMS IN FOSSIL STUDY

Suppose you find a fossil. Before positive identification is possible by use of keys, laboratory results, etc., you will make a tentative identification in the field.

Identify each fossil in the left column (by common name). Supply proper information in other columns. Number 1 is completed as an example:

FOSSIL	Possible Form of Preservation	Era When Dominant	Probable Period or epoch	Environment (land, fresh water, marine)
	cast and / or mold	Mesozoic	Jurassic to Cretaceous	land
				
				
				
				
				
				
				
				
				

1A

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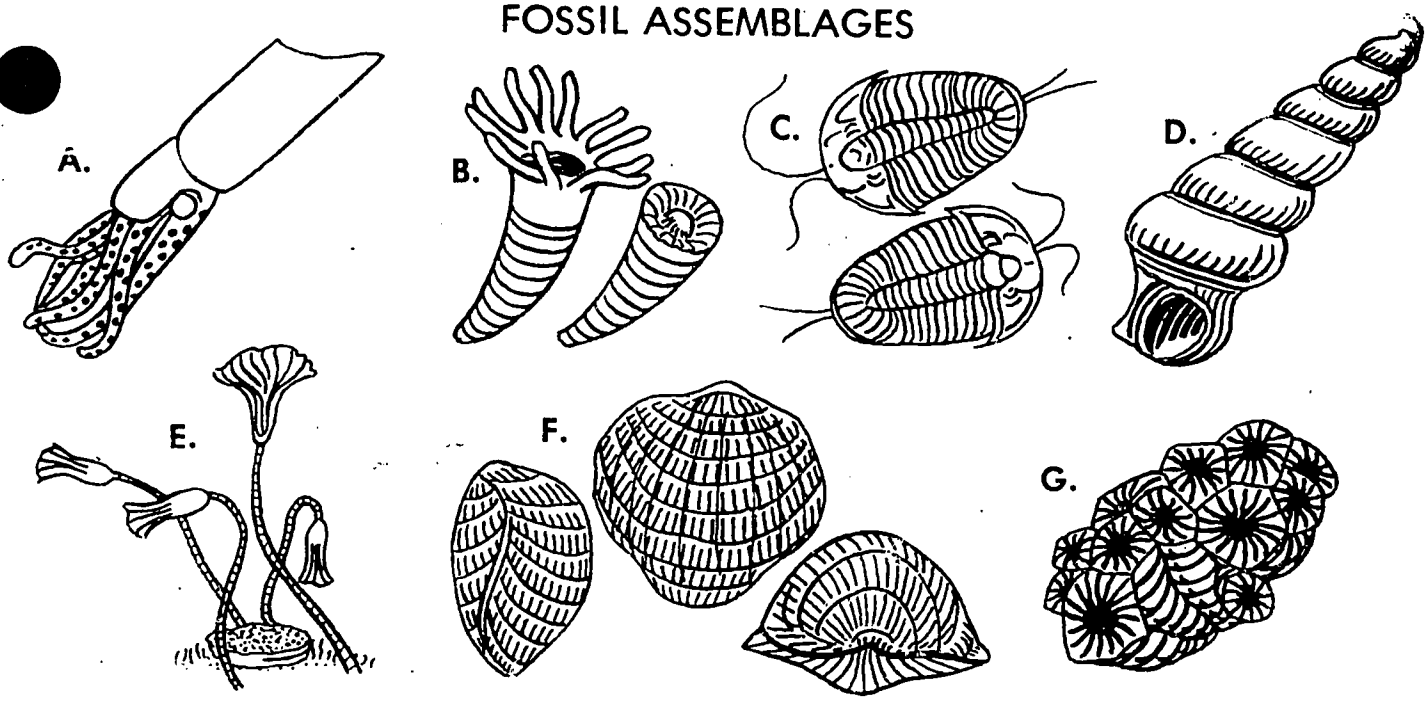
Name _____ Date _____

FOSSIL ASSEMBLAGES



Time divisions include groups of plants and animals that are characteristic of that specific time. These groups are called assemblages

1. Give the common name of the fossils pictured above.

A. _____ E. _____

B. _____ F. _____

C. _____ G. _____

D. _____

2. This fossil assemblage is typical of which geologic period? Justify your decision.

_____

3. Name some modern invertebrates to which these fossils are distantly related:

A. Fossil C _____

B. Fossil A _____

C. Fossil D _____

D. Fossil E _____

Choose any geologic period and draw a group of plants and animals that you think would form a fossil assemblage typical of that period. Be prepared to justify the inclusion of each organism.

4A

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GEOLOGIC PERIOD STATION

TIME LINE

RECENT	PLEISTOCENE	PLIOCENE	MIOCENE	OLIGOCENE	EOCENE	PALEOCENE	CRETACEOUS	JURASSIC	TRIASSIC	PERMIAN	PENNSYLVANIAN	MISSISSIPPIAN	DEVONIAN	SILURIAN	ORDOVICIAN	CAMBRIAN	PRECAMBRIAN

500 mill. 600 mill. 4.5 bill. In the Beginning

PERIODS AND KINDS OF LIFE

Transparencies from Milliken series "Life of the Past"

Upper Cenozic	Lower Cenozic	Cret.	Triassic & Jurassic	Pennsyl. & Permian	Miss.	Dev.	Sil.	Ordov.	Cambrian 500 mill. 600 mill.	Precambrian 600 million 4.5 billion

Evaluation Form for Teachers

1. Name of the mini course _____

2. Was this unit appropriate to the level of your students?

3. Explain how this mini course was used with your students. (Individual, small group, or total class)

4. Identify the plus factors for this course.

5. List the changes that you would recommend for improvement.

7. Did you use any other valuable resources in teaching this unit? If so, please list.

PLEASE RETURN TO SCIENCE SUPERVISOR'S OFFICE AS SOON AS YOU COMPLETE THE COURSE.

ADDITIONAL SCIENCE MINI-COURSES

	Prepared by
LIFE SCIENCE	
A Study for the Birds	Terrence Best
Creepy Critters (Snakes)	Terrence Best
How's Your Plumbing?	Paul Cook
Guess Who's Been Here for Dinner	Paul Cook
Plants - The "Other" Living Things	Sharon Sheffield
Let's Look at You - The Human Organism	Sharon Sheffield
Classification: Why is There a Need?	Melvin Whitfield
Protist: The "Unseen" Kingdom	Melvin Whitfield
EARTH SCIENCE	
Coastline Development	Nelson Ford
Ocean Currents	John Fradiska
Features of the Ocean Floor (Ocean Floor Topography)	John Fradiska
Space and Its Problems	John Geist
Invertebrate Fossils: Clues to the Distant Past	John Geist
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Notions on Motions	Kenneth Howard
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