DMAE Earth Science Name:

FOSSILS AND EARTH'S HISTORY

Introduction

The only evidence we have of what Life was like in the Past comes from the very incomplete and scattered collection called the "fossil record." **Fossils** are remains of organisms that lived long ago, well before recorded history. The study of fossils is called **paleontology.**

In this investigation, you will use resources to learn how organisms can become preserved as fossils, and why most are not persevered. You will learn how to recognize some major types of fossils, some from groups no longer common or completely extinct. Finally, you will understand better how the "fossil record"—as incomplete as it is—helps us recreate the story of why our planet is now the diverse ecosphere that it is.

Types of Fossilization

Most living organisms consist of soft and hard parts. Soft parts make up the important metabolic components, such cells. Hard parts, such as shells or bones, play protective or supportive functions for the soft parts.

1. On rare occasion, actual soft and hard parts are preserved as fossils. Give some examples of ways in which these parts can be preserved after death.

Three examples of how these parts can be preserved are in molds and casts, through distillation, and Petrification. Distillation occurs by the volatile elements of the fossil leaving a little film of carbon preserving it, and petrification is when the rest of the animal is converted into mineral matter.

2. Mostly, the original hard and soft parts decompose, disappearing forever. Sometimes, though, they are preserved through chemical alteration—the shape is preserved, although none of the original material remains. Three important types of alteration are listed below—explain what each means. Also, example samples from the available kits.

Carbonization: Carbonization is a process which substances of a plant or animal decay leaving behind the carbon. Animals and plants that were carbonized have a dark and flattened appearance.

Permineralization ('petrifying'): Permineralization is the most common and it is when the pores of a plant or bone are filled with minerals that come from the ground .This found mostly by the tissues of a bone or wood.

Molds and casts: Molds and cast occur when a the shape or figure of a organism is molded through the process of being filled with a precipitating mineral but this does not contain the actual remains of the organism. THis occurs on mud or clay that later turn into stone.

Why are molds and casts the most commonly found types of fossils?

- Molds and casts are the most common type of fossils because many of the organisms were had shells and the mud or clay they lived in took the figure of the shell and hardened becoming a mold or a cast.

3. Indirect evidence of ancient organisms tells us something about their behavior, although none of the organism has been preserved. Explain what we can learn from each of these:

Tracks and trails: What we can learn from tracks and trails was the types of dinosaurs roamed the area and this can tell us how large the creature can be. Knowing the trails, it can lead to other fossils and we can also know what type of environment was back then .

Burrow holes: Burrow holes tell us that worm type insects roamed the land and also tells what type of species of worms were there.

Gastroliths: Gastroliths are found in the gastrointestinal tract and this can be used to see what the species eat. This can help us on figuring out the food chain of millions of years ago and also we can discover smaller species that can be small as ants.

Coprolites: Coprolites tell us on the basic level the former presence of organisms in the area where they are found. Even though they mostly can not tell us which organisms were present there are exceptions such as sharks because since they have distinct spiral valves in their intestines, the coprolites show grooves made by them. Coprolites can even indicate the diet of the of the organism or even the ecosystem.

4. What are the two conditions most likely to lead to fossilization? In what environments are they most often found?

The two conditions that most likely lead to fossilization is pressure and heat. The environments that they are most found in are in sediments deposited on river flood plains.

Recognizing Major Fossil Phyla and Classes

You know that all organisms have been classified according to **taxonomy**. The basic levels are:

Kingdom
Phylum
Class
Order
Family
Genus
Species

In beginning paleontology studies, we often focus at the level of Phylum, and sometimes Class. During the activities that follow, you should be prepared to identify specimens at these levels. Some phyla that are important in paleontology will be new to you because the organisms were major parts of ancient **ecosystems**, but today are either rare or **extinct**. For example, brachiopods and bryozoans are common fossils, but are hard to find now; trilobites and ammonites were important millions of years ago, but died out completely.

Remember, only an organism's **structure** can be preserved, not the way it functioned (was used) or behavior. Even so, we have learned a lot about Life in the Past, and learn more each year.

Activities

Use the specimens and print and online resources to learn about each of the follow groups of fossil and living organisms. When asked for, make simple drawings of the organisms.

A. MICROFOSSILS

These organisms are so tiny that they can only be examined under microscopes. See online image, drawings, or actual specimens, and then describe important characteristics of each type.

DIATOMS- They are one-celled plants such as Siliceous shells Phytoplankton.

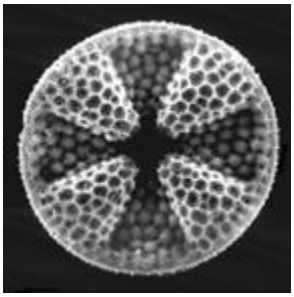
FORAMINIFERANS-They are one-celled animals such as Foraminifera which look chalky.

RADIOLARIANS-Another one-celled animal such as Radiolaria which are nicknamed "glassy."

PTEROPODS-They are microscopic snails.

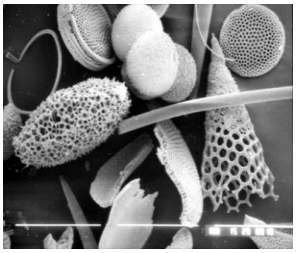
COCCOLITHOPHORIDAE-Looks like a round sphere with intricate designs.

Labeled sketches of microfossils:



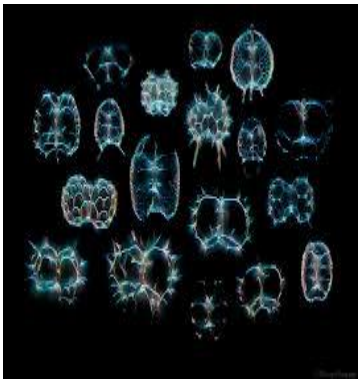
(Diatom Fossil)

(http://www.utexas.edu/tmm/npl/images/microfossils/Diatom1.jpg)



(miscellaneous microfossils)

(http://earthsci.org/fossils/microfossils/wel002.gif)



(Radiolarians)

(http://soundnautic.com/wp-content/uploads/2012/12/radiolarians.jpg)

B. COELENTERATES (CNIDARIA)

This phylum includes such diverse life forms as jellyfish and corals. Corals are among the most important 'structure-builders' on our planet—their reefs provide homes to many marine organisms. Fossil corals provide evidence of ancient reefs.

Labeled sketches of some fossil corals:

(Cnidaria)

(http://members.wolfram.com/jeffb/Fossils/grewingkia2.jpg)

(Cnidaria)
(http://members.wolfram.com/jeffb/Fossils/grewingkia5.jpg)

Jellyfish have only soft parts, so in what ways are they preserved in fossils?

Under extreme conditions Jellyfish have the potential to fossilize as long as they are buried in less than a day. An example would be a flood washing the sandstone over the jellyfish which would preserve it instantly.

C. Bryozoans ("Moss Animals")

This is one of the groups that is more important in the fossil record than as parts of living ecosystem, although in some places living bryozoans are part of local ecologies. What are some of the features seen in bryozoan fossils?

Some of the features that are seen in this fossil are that they are bilaterally symmetrical, the body has more than two layers, and it has no circulatory system.

Labeled sketches of some bryozoans fossils:

(Bryozoan fossil)
(http://www.kgs.ku.edu/Extension/fossils/jpegs/Septopora.jpg)

(Bryozoan fossil)
(http://www.ohiohistorycentral.org/images/f/f3/Bryozoan_fossils.jpg)

D. ANNELIDS (SEGMENTED WORMS)

Worms, such as earthworms, are one of the groups that is more important to biologists than to paleontologists. The obvious reason is that worms are only soft part and are difficult to fossilize. But their behavior can be interpreted from what they leave behind as 'trace fossils.' What type of fossilization can preserve a record of annelid behavior? What do these look like?

The type of fossilization that can preserve a record of annelid behavior is carbonization. These annelids look like worms, and they can be preserved in shales.

E. MOLLUSCS

Molluscs (or mollusks) are among the most important groups of animals, living or fossilized. One reason is that most have hard shells, which gave them protection against many predators. Because of their great diversity, it is necessary to study mollusks at the Class level. What are the main characteristics of these classes?

GASTROPODS: The main characteristics the class is a spiral form shell that is made from a horn like material which is called the univalve. They have a soft body underneath the shell and has its anus near the head.

PELECYPODS (BIVALVES) : The main characteristics of this class is that they have no head and eat by filtering. The body is flat covered by doubled shells and live mostly in burrowes.

CEPHALOPODS: The main characteristic of this class i s that it has tentacles and mollusks with a radula**.** This class is extremely similar to today's squids.

Labeled sketches of some fossil molluscs—include at one from each Class.

www.ekspresiruang.com 

cephalopods

F. BRACHIOPODS

"Brachs," like bryozoans, are more important in the fossil record than as living organisms. Some are called "lampshells" because their look like oil lamps used in olden days.

What are some ways in which brachiopod fossils can be distinguished from bivalve fossils?

Labeled sketches of brachiopod fossils:

http://www.sciencebuzz.org/sites/default/files/images/fossil_brachiopods.jpg

G. Echinoderms

The echinoderms are the “spiny-skinny” animals, which is very obvious in sea urchins. It is less obvious in their relatives, starfish and sand dollars. Common echinoderm fossils also include crinoids and blastoids.

What are some characteristics used to identify echinoderm fossils?

Some characteristics used to identify echinoderm fossils are that it has a mesodermal skeleton and the skeleton is covered by a thick skin. The skeletons are porous calcite plates and has a spongy structure known as stereom.

Labeled sketches of echinoderm fossils:

http://www.discoveringfossils.co.uk/echinoids.htm

H. ARTHROPODS

One of the significant events in the history of Life was the first appearance of arthropods, with their hard shells about 540 million years ago (mya). After more than 3 billion years of life forms that were microscopic or soft-bodied, suddenly the fossil record becomes more complete and detailed with the appearance of trilobites, eurypterids, and other early members of this phylum.

What are the main characteristics of trilobite fossils?

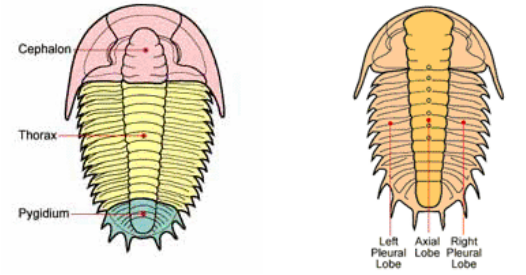
The main characteristics of a trilobite fossils is that it has a hard exoskeleton that have segments.

Trilobites rapidly diversified, and so became among the oldest **index fossils**. What does this term mean? Explain how these are used by paleontologists.

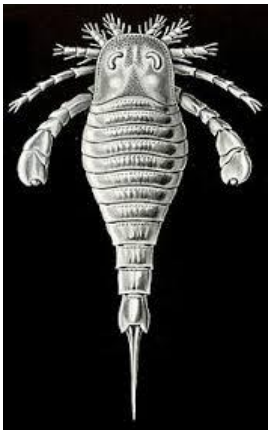
Index fossil is a fossil that is used for dating

Eurypterids were among the most important organisms in ancient oceans. What are some of their characteristics? How large could they grow?

Labeled sketches of trilobites and eurypterids:



http://www.fossils-facts-and-finds.com/trilobites.html



http://upload.wikimedia.org/wikipedia/commons/thumb/6/6a/Haeckel_Eurypterus_tetragonophthalmus.jpg/220px-Haeckel_Eurypterus_tetragonophthalmus.jpg

Arthropods, cont'd.

Later in the Paleozoic Era, arthropods became the first **terrestrial** organisms. Even today, their descendants—especially **insects**—are among the most ubiquitous life forms (found everywhere.) There are probably more species of insects than any other group of animals. They may also be the most numerous.

What are key characteristics of insects? What caused them sometimes to be preserved in amber? How large did some fossil insects grow?

Some of the major characteristic of insects is that they have three body parts namely the head, thorax and the abdomen. Insects are also characterised by one pair of antennae, compound eyes, mandibles, exoskeleton and an open circulatory system. What caused them to preserved in amber

Spiders are also Arthropods. Contrast spiders and insects.

Despite the visual similarities between the two both are actually members of distinct families. Spiders have 8 legs while insects have only 6. insects have 3 body parts distinct body parts, a head, a thorax and abdomen while spiders have only 2, a combined head the thorax known as the cephalothorax and an abdomen.

Another important class of Arthropods includes lobsters, crabs, and, surprisingly, barnacles. What are some of their characteristics? Explain why it is likely that they may be among the fossils from our time that will exist millions of years from now.

The mean characteristics of a lobster is that it has bilateral symmetry. It has two claws which are used for collecting and eating prey. It has walking legs for walking on the seafloor and at the end of them there are swimming appendages so they can swim. The characteristics of Crabs are that they don't move very fast. All crabs have eight walking legs and two claws. Finally, barnacles are exclusively marine and are quite unlike any other crustacean because of the permanently attached.

Enrichment:

What are some other Animal Phyla that can be studied by paleontologists? What parts of them are preserved??