Relative Dating with Fossils

-Fossils are used to determine the age of rocks by the **Principle of** Faunal Succession:
Life forms change through time so ... "Rocks are the same age if they contain exactly the same type of fossil organism"

-This allowed geologists to relate rock bodies, or a stratum / layer of rock, located in different areas of the world—called "Correlation"

-In identifying the habitat and lifestyles of extinct organisms, we assume that the same natural and physical laws have always operated (maybe at different rates.)

-By observing present processes, we can understand the past history and development of the earth and its inhabitants.

-This theory is called Uniformitarianism

-"The present is the key to the past"

Definition of Fossil:

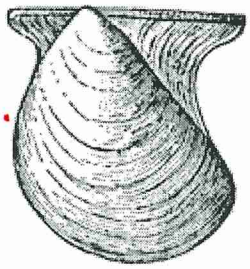
Fossils are only found in sedimentary rock. Why?

Process of original preservation:

-most fossils are only partial remains of plants or animals, generally the hard parts of the organism that was buried quickly and preserved from decay. Hard parts like shells, skeletons and teeth may be preserved.

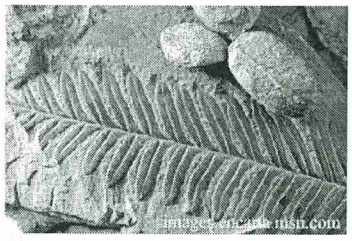
Fossilization Processes:

1. Molds



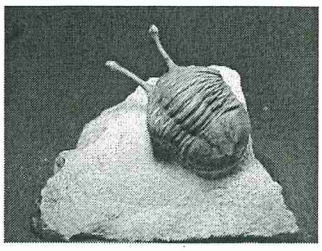
-Given enough time, even the hard parts of fossil may dissolve leaving a cavity in the hard surrounding sediment. This fossil cavity/space is called a mold. The mold of the interior of a shell formed when a shell fills with mud, hardens, and then becomes free of the surrounding shell.
-Trapped insects leave molds in amber (hardened pine tree sap.)

2. Casts

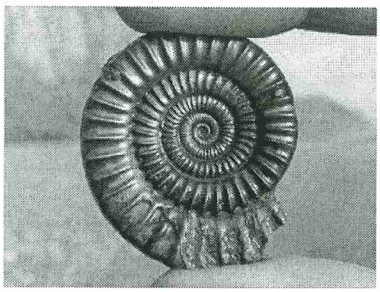


-If other sediment later fills the mold and lithifies, a matching cast is formed.
-No internal structure can be seen with this type of fossilization
-This is the most common mode of preservation of many trace fossils
e.g. animal tracks, worm burrows

3. Carbonization
–The removal of other elements leaving the carbon behind (like peat formation)
e.g. plants usually fossilized this way



4. Permineralization
-The original hard parts have **additional** mineral materials deposited in pore spaces.



5. Replacement
-Minerals in solution in pore waters replace original materials as it dissolves or decays
-With this type of fossilization, you can see the internal structure
e.g. Petrified wood is silica (quartz) replacement.

Conditions necessary for the preservation of Soft parts

-Soft tissues are destroyed due to decay before lithification or destruction during diagenosis. Usually they are best preserved as carbon films (carbonization) on a rock surface

-However under unusual conditions, soft part rock replicas may be preserved relatively intact.

-Ex. The world famous Burgess Shale Fossil Deposit near Field, B.C. found by Charles Walcott in 1909.

-This is what happened approximately 530 million years ago. There was no life on land and most life was small and lived along sea bottoms. A mudslide from a soft bank buried the living organisms in silt. The water was deep and low in O_2. The silt flattened, hardened (lithification) and became the sedimentary rock shale. Fossil replicas of the organisms were formed. Hundreds of millions of years later, colliding plates caused the shale to be thrown up as part of an 8,000 foot mountain. It is this unusual, detailed snapshot of life as it was 530 million years ago, replicas of soft parts and all, that makes the Burgess Shale deposit so valuable. (Note: not the actual flesh, but a fossil preserved (rock replica) version/shape of it.)

Therefore, the required conditions necessary for the preservation of soft tissue are:

1. rapid burial of
2. live organism in
3. deep, low oxygen water followed by
4. rapid lithification of sediment.

Another unusual event: Mammoth found in ice with flesh still intact. This is original preservation.

Index Fossils and the Necessary Characteristics

A fossil that is widespread geographically but restricted in time is useful in correlating rocks of the same age in different areas and is referred to as "index" (or guide) fossil. The required characteristics of index fossils are:

1. They must be easy to identify from other similar fossils. They must be unique in some way
2. They must be found over a wide geographic area.
3. They must have a short time range so that they occur in only a few rock layers.
4. They must be abundant and easy to fossilize