

## CLASS 1: ROCK CYCLE

### WHAT IS THE ROCK CYCLE?

The rock cycle is a conceptual framework that describes relationships between genetic classes of rocks.

Perhaps the most obvious starting place to study the cycle is eruption of magma (molten rock material) from a volcano. The lava (erupted magma) cools to form volcanic rock, a kind of igneous rock. As time goes on the volcanic rock weathers (breaks down) into dissolved chemicals and mineral grains (sediment). These materials may be carried away by streams, glaciers, etc. and deposited to form sedimentary strata.

As sediments are buried they become compacted and cemented by chemicals in the ground water. They become sedimentary rocks. Sedimentary rocks may be uplifted, weathered and recycled to form new sedimentary rocks.

Alternatively the sedimentary rocks may be carried deeper into the earth, heated up and reconstituted to form metamorphic rock. Metamorphic rocks can be uplifted, weathered and recycled as sedimentary rock or even new metamorphic rocks.

Some metamorphic rocks can be heated to such an extent that they begin to melt thus producing new magma. This magma may ascend to the surface and erupt forming new volcanic rock. Some magma, however, may freeze underground to produce plutonic igneous rock. Eventually this may be exposed by uplift and erosion and converted to sediment and chemicals in solution. So here we are back at the start of the cycle.

### BASIS FOR THE ROCK CYCLE

The rock cycle became generally accepted about two centuries ago although many unknowns and controversies persist even today. Three main lines of evidence support the rock cycle.

“Actualism” is one strong support for the rock cycle. By this word we mean that the past can be largely explained in terms of observable processes and causes. For example we can go to Hawaii to see how basalt lava is erupted and cooled to form volcanic rock. We can observe how sediment layers are deposited in a new reservoir and witness many other parts of the cycle with our own eyes.

A second kind of support is provided by laboratory and field experiments. We can produce artificial rocks and minerals in the laboratory and thus discover the conditions (temperature, pressure, etc.) needed to form them.

The well-tested laws of physics and chemistry form a third line of evidence for the rock cycle. There is no reason to suppose that rivers used to run uphill, that high temperature didn't melt rock or that radioactive decay didn't occur.

Thus the rock cycle in particular, geology in general and science overall depend on rationalism; that is logical thought applied to understand observations and measurements. The program of science doesn't necessarily deny supernatural events and causes but simply excludes them as outside the realm of science.

#### WHAT THE CYCLE DOESN'T TELL US

Except for "above ground" and "underground" the rock cycle says nothing specific about where these processes take place and where the various classes of rock are found. The rock cycle says nothing about how fast changes occur and how long the various products last. Finally the rock cycle is not predictive. It doesn't require periodic or regular repetition.

Much of this course is about examining the materials and processes in the rock cycle and locating them in space and time. The rock cycle is a useful abstraction or framework that we'll use to organize study of our planet.

#### GEOLOGY AND THE GREAT FLOOD

As time passed by, people gradually lost their original innocence and started to behave badly. From a golden age society drifted into an iron age of violence, cruelty and sin. The gods decided to punish mankind by a huge flood. Everyone drowned except for a virtuous man, Deucalion, and his wife, Pyrrha.

They went to Oracle at Delphi to find out what they should do. The Oracle told Deucalion to scatter the bones of his mother over the earth. Needless to say Deucalion, a very pious man, was appalled at this advice. Pyrrha, however, had a less literal mind and explained that the instructions referred to their mother earth, not to his biological mother. So Deucalion filled a basket with stones and scattered them in a field. From the stones new people sprang up and the world was repopulated. Although this tale, like many others, is not supported by actualism, lab experiments or our current understanding of chemistry and physics it has obvious moral and spiritual power and meaning.

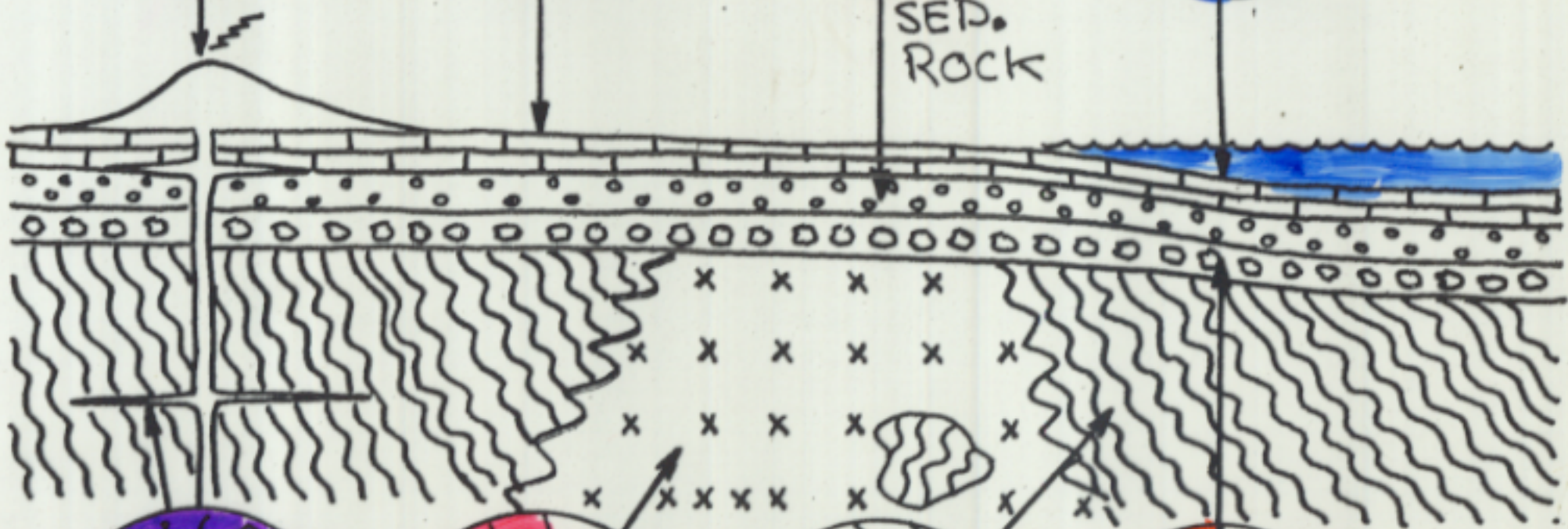
VOLCANIC

SEDIMENT

SEDIMENT



SED. ROCK



SED. ROCK

[IGNEOUS]

PLUTONIC

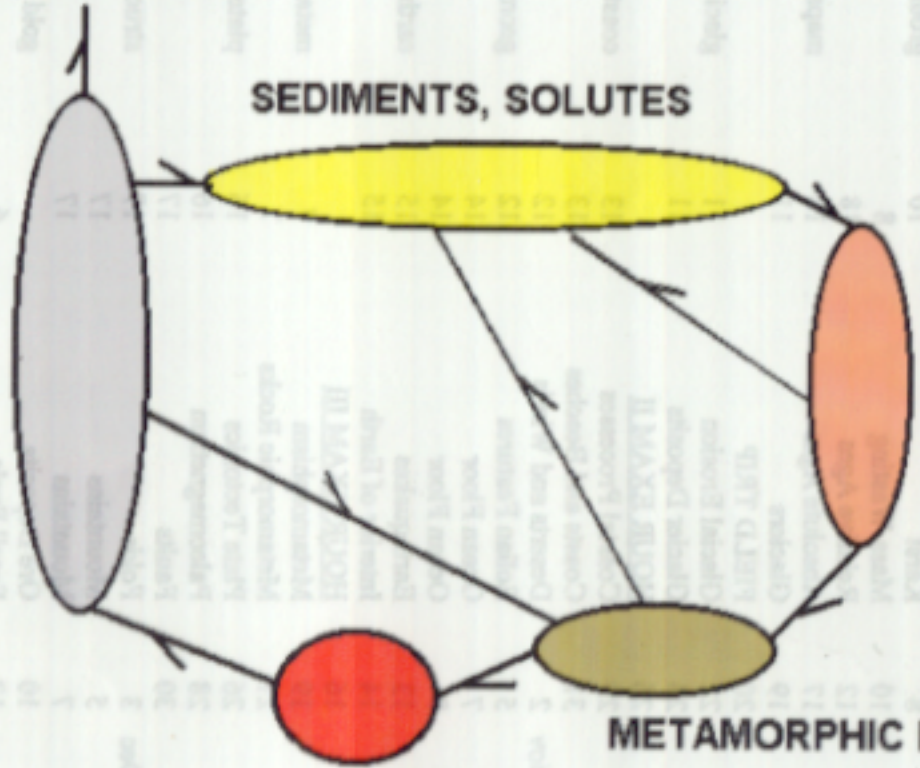
METAMORPHIC

**VOLATILE GASES**

**SEDIMENTS, SOLUTES**

**IGNEOUS  
ROCK**

**SEDIMENTARY ROCK**



**METAMORPHIC ROCK**

**MAGMA**

**THE ROCK CYCLE**