The Rock Cycle

Prepared by the Michigan Department of Environmental Quality
Office of Geological Survey
What is the **Rock Cycle?**
The **Rock Cycle** explains how **Rocks** and **Natural Processes** are related.

- **Sedimentary**
- **Metamorphic**
- **Igneous**

The cycle includes processes such as weathering, melting, and pressure, heat.
A more traditional definition is:

**Rock Cycle**

A sequence of events involving the formation, alteration, destruction, and reformation of rocks as a result of natural processes ...

_Glossary of Geology, Bates & Jackson, AGI_
We will use the graphic seen in the background to help represent the **Rock Cycle**.

There are many ways to show the various relationships between the rocks and the related natural processes.
Before we look at the **Rock Cycle** in detail,

let's look at some basic information ...
The **Rock Cycle** involves the recognition of three main classes of rocks.

The three rock types are ...
Sedimentary Rocks

Metamorphic Rocks

Igneous Rocks
The 18th century lawyer, doctor, gentleman farmer and founder of modern geoscience, **James Hutton**, developed the concept of the **Rock Cycle** to show how rocks and natural, physical processes are interrelated.
The understanding of the world in the 18th century was different from today ...
Hutton knew about solar energy and gravity at the surface. He did not know about radioactive heating from inside the earth.

Solar energy, gravity and radioactive heating are the major forces driving the Rock Cycle.

As a result, the Rock Cycle will be self-sustaining for thousands of millions of years.
How does a concept like the **Rock Cycle** hold up in light of data and scientific thinking?
Plate Tectonics.
The mantle, crust and surface of the earth can be thought of as a giant recycling machine; rocks are neither created nor destroyed, but redistributed and transformed from one rock type to another.
If you were to ask a geologist what the earth is ... What do you think the response would be?
Diagram of the Interior of the Earth

- Crust
- Upper Mantle
- Lower Mantle
- Outer Core
- Inner Core
Some **Rocks** are made up of just one mineral - like the sedimentary **rock salt** (made up of the mineral halite) that is mined near **Detroit**.

Others **Rocks** are made up of many minerals - like the igneous rock **granite** and the metamorphic rock **gneiss**, found near **Marquette**.
Now that some of the basics have been covered, let's consider some of the details about the **Rock Cycle**.
The **Rock Cycle**

Rocks are weathered, eroded, transported, deposited, and lithified to form sedimentary rocks.
The igneous rock granite can be physically weathered to produce clay and sand.

These sediments can be transported deposited and lithified to form sedimentary rocks.

Clay can become shale

Sand can become sandstone.
Becoming a SEDIMENTARY ROCK ...

The metamorphic rock gneiss can be physically weathered to produce clay and sand.

These sediments can be transported deposited and lithified to form sedimentary rocks.

Clay can become shale
Sand can become sandstone.
Sedimentary rocks can be physically weathered to produce sediments that can become other sedimentary rocks.
Chemical weathering dissolves the minerals in rocks. The resulting dissolved compounds could form evaporites like rock salt or rock gypsum or chemical precipitates like some kinds of limestones. What forms depends upon composition and depositional environment factors.
The Rock Cycle

**Igneous Rocks** form from molten rock or magma in the subsurface or from lava extruded at the surface.
Becoming an **IGNEOUS ROCK** ...

Any existing rock - **igneous**, **metamorphic** or **sedimentary** - can be subjected to enough heat and or pressure causing it to melt.

Molten rock is called magma.

When magma cools to a solid it becomes an igneous rock.

The kind of **igneous rock** formed depends on what was melted and how it cooled.

**Igneous rocks** are classified based on their mineral composition and texture.
Igneous rocks include:

- granite
- basalt
- rhyolite
- granodiorite
- pegmatite
Pressure, heat and fluids cause preexisting rocks or sediments to become metamorphic rocks.
Becoming a **METAMORPHIC ROCK** ...

If the igneous rock **basalt** is exposed to sufficient heat and or pressure it can be transformed into the metamorphic rock call **metabasalt**

When the prefix **meta** is applied to a rock name that means that the original rock has been metamorphosed.
The Rock Cycle

Sedimentary  

weathering  

Metamorphic  

pressure, heat  

Igneous

The Rock Cycle does not go in just one direction. Any given rock can go through any part of the cycle any number of times.