NEW MEXICO MUSEUM OF NATURAL HISTORY & SCIENCE

BRIEF GUIDE TO ROCKS

Sandia Granite

What is a rock?

- A mixture of minerals.
- A naturally occurring solid.
- A "time machine" with a story to tell. All rocks tell a story; a rock represents a period of time (during which it was formed), an environment (in which it was formed) and a geologic process (how it was formed). By "reading the record of a rock" you can understand its history.

How are rocks classified?

• **Igneous**: solidified from magma (molten, or liquid, rock within the Earth)

Note: Igneous rocks are further divided into Plutonic (the magma solidified beneath Earth's surface) and Volcanic (the magma erupted onto Earth's surface to become lava and the lava solidified at the surface).

Examples: Plutonic = granite, gabbro, granodiorite, monzonite
Volcanic = basalt, rhyolite, pumice, obsidian

• **Sedimentary:** rocks produced by the movement and deposition of eroded minerals, sand, silt, pebbles, or cobbles or by the deposition of precipitates.

Note: Sedimentary rocks are divided into Clastic (a rock with layers of sediment of various grain sizes) or Chemical (a rock formed by precipitation of chemicals layer by layer out of water).

Examples: Clastic = sandstone, shale
Chemical = limestone, travertine

• **Metamorphic:** a pre-existing rock (igneous or sedimentary or even metamorphic) that has been altered by changes in temperature, pressure, or stress into a different type of rock by mineralogical, chemical, and/or structural changes, while in the solid state.

Note: Metamorphic rocks are sometimes classified by geologists into levels of metamorphism (how much it has changed) from low to high intensity. Metamorphic rocks that have been under pressure show an alignment of minerals that is called **foliation**. If the rock has been under both high pressure and high temperature, new minerals can sometimes **crystallize**.

Examples (listed from low temperature to high temperature):
Slate = metamorphosed shale
Greenstone = metamorphosed basalt
Marble = metamorphosed limestone
Quartzite = metamorphosed sandstone
Schist = metamorphosed sedimentary rock
Gneiss = metamorphosed granite

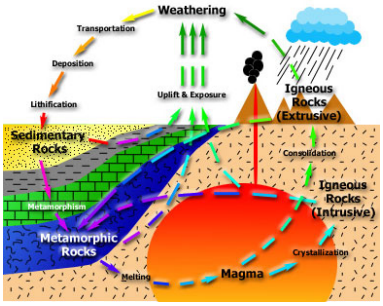
How are different rocks named?

Sandstone (Capital Reef National Park)

- Igneous rocks are described and named by the type and amount of minerals within them
- Clastic sedimentary rocks are described and named by the grain size of the material that makes them (sand, silt, clay, pebbles)
- Chemical sedimentary rocks are described and named by their chemical composition and how they are formed.
- Metamorphic rocks are described and named by their minerals and by the rock's texture.

What is the rock cycle?

• A sequence of events involving the formation, alteration, destruction, and reformation of rocks as a result of the following: (1) crystallization from a magma; (2) erosion; (3) transportation; (4) deposition; (5) lithification (cemented and hardened into rock); (6) metamorphism; (7) and on and on in a continuing cycle. The sequence can change and does not always happen in a circle.



Graphic:Mineralogical Society of America

Are rocks used as economic resources?

• Many rocks are excavated in quarries, and cut and polished for use in building construction or decorative architectural purposes. Examples of rocks that are quarried include limestone (used to make cement)'s, travertine, granite, and marble.

• Sand and gravel, crushed stone, and volcanic cinder, perlite, and pumice are all economically quarried (in New Mexico and elsewhere) for industrial purposes such as road building, cleaning compounds, kitty litter, insulation, or decorative rock.

Does New Mexico have a state rock?

• No. New Mexico has a state gem mineral but does not have a state rock. Utah's state rock is coal. Colorado has a type of marble. Texas has petrified palm wood – really a fossil, not a rock. Arizona does not have a state rock. What rock do you think should be New Mexico's state rock?

What rock is the most common on Earth? On our nearest neighbor planets in the solar system?

Basalt (Petroglyph National Monument)

•On the surface of Earth, the most common rock is basalt. It forms the ocean basins and oceans cover 70% of the surface.

•Beneath the surface, the most abundant rock making up Earth's mid- to lower-crust is probably gabbro (a dark igneous plutonic rock). Granite and other related granitic and metamorphic rocks in the lower crust of the continents are a distant third. Sedimentary rocks, sandstone, shale and limestone, appear to be common at surface, but they form a very thin skin at the surface and therefore do not make up a large volume of total rock.

• Basalt appears to be the most common rock on the other inner rocky (solid surface) planets of he Solar System (Mars, Venus, Mercury, and our Moon). The Moon rock and the Mars meteorite on display in the Museum's Space Science wing are both basalt.

What rock is found on Earth but may not be on other planets?

• Quartzite (metamorphosed sandstone) is a relatively common rock on Earth, but it has not been identified on other planets in our Solar System, and may or may not occur elsewhere.

• Why? Quartzite results from Earth's geological processes: (1) uplift of a mountain bringing an igneous rock to the surface; (2) erosion of the rock by surface water; (3) collecting the quartz minerals to form sand; (4) that becomes sandstone, and (5) metamorphism of the sandstone.

On the first Monday of each month, when the museum is open, you can bring a rock for identification.
Or…Go to http://www.nmnaturalhistory.org/exhibits/youth-and-family-programs/mineral-monday-online-edition for information about sending a photo/description of a rock to be identified.

For questions about this Brief Guide, contact: *Jayne Aubele, Geologist and Educator, New Mexico Museum of Natural History and Science, email: jayne.aubele@state.nm.us*

NEW MEXICO MUSEUM OF NATURAL HISTORY & SCIENCE

ROCKS IN THE MUSEUM

Where can you find rocks on exhibit in the Museum?

• Orbicular granite (from the Sandia Mountains) and Lapis Lazuli are both rocks. They are displayed in small cases in the *Atrium Mineral Gallery.*
• Rocks that demonstrate environmental change in the *Degrees of Change* exhibit.
• Some of the oldest rocks found on Earth are metamorphic rocks displayed in the *Origins Hall*
• Sandstone, claystone, and limestone in the *Age of Supergiants* Hall.
• Shale with plant fossils, sandstone and shale from the San Juan Basin, and impact breccia from the Chixculub Crater (extinction exhibit) are all in *New Mexico's Seacoast* Hall.
• The "volcano-on-its-side exhibit in the *Land of Volcanoes* Exhibit and New Mexico volcanic rocks near the entry to the volcano.
• The Moon rock and the Mars meteorite (both are basalt) in the *Space Science* wing.
• Meteorites in the *Meteorites and Meteorwrongs* exhibit at the entry to the *Space Science* wing. and inside and just outside the *Origins* Hall.
• Rock counters in the Café and NatureWorks, Museum entry floor, and the Atrium floor!

What is the story told by the faux rockwall in the Atrium?

• The rock wall is similar to the rock layers in a canyon or highway roadcut; and it represents the significant rock units in central and northern New Mexico.
• Each rock layer represents a time period and an environment of formation (ocean, river, desert, volcanic eruption). The oldest rock on the bottom represents the Sandia Granite dated at 1.4 billion years old, the youngest on the top of the stairs represents the Albuquerque Volcanoes' lava flows that erupted about 200,000 years ago.
• Each rock layer in the wall also relates to a hall or exhibit in our Museum "Walk through Time" sequence of halls.

How are rocks displayed in the Volcano exhibit?

• Inside the Museum's walk-through Volcano, you will find a display showing a volcano turned on its side, with Earth's mantle on the left and Earth's surface on the right.
• The display shows various minerals and rocks at the depth and temperature at which they form within the Earth.
• Granite, for example, is formed at a mid-crustal level where minerals such as quartz, feldspar, and mica crystallize.
• It is an amazing exhibit – no other museum has anything like it – don't miss it!

What about the Moon Rock?

• Yes. It <u>is</u> real and it <u>was</u> collected on the Moon by New Mexican astronaut/geologist Dr. Harrison H. Schmitt during Apollo 17.
• It is the largest lunar sample on display anywhere in a public facility – a truly one-of-a-kind exhibit!
• Dr. Schmitt was born and grew up in Santa Rita, New Mexico. He is one of only 6 scientists chosen for Apollo and the only one to fly on a mission. So far, he is the only geologist to explore another world.
• It is basalt and very similar in many ways to the Albuquerque Volcanoes basalt, but it is old (about 3 billion years old) and the visible crystals are the mineral ilmenite, a titanium mineral that has been found to be abundant in lunar basalts.