Geology for Rock Art Recording

Why is geology important for rock art recording?

An understanding of basic geology is valuable for recording rock art. Appreciation of natural geological features and forms helps us to:

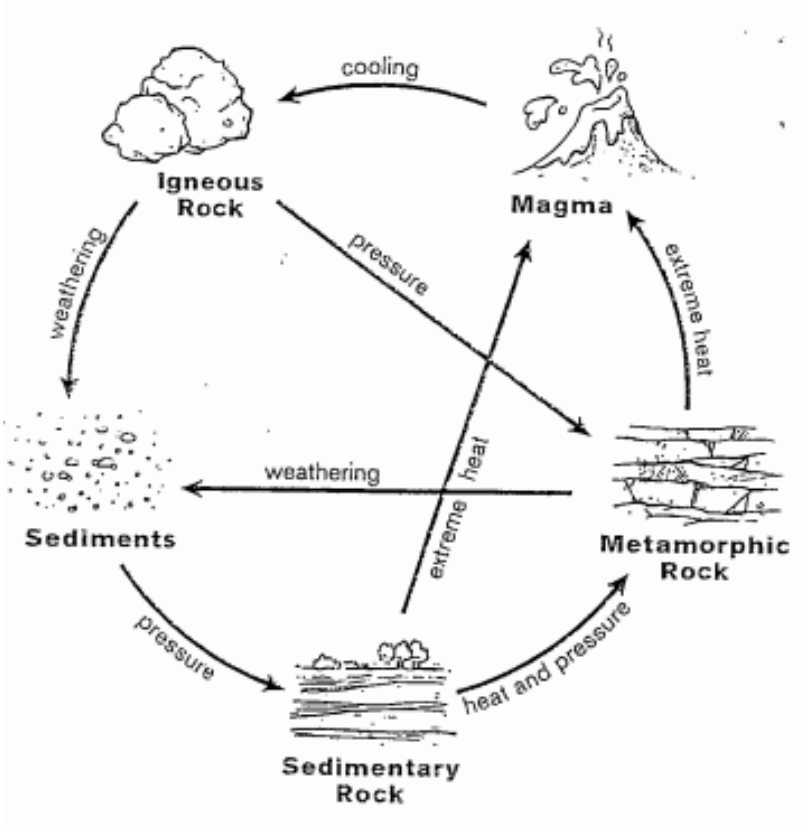
a. Recognise different rock types
b. Distinguish carved motifs from natural features
c. Assess the current condition of the rock surface and identify potential threats to its future preservation.

These guidance notes describe how different rock types are formed, and how to identify them.

Geology in a nutshell

Scientists classify rocks into three main groups, according to how they were formed. The first rocks to form were **igneous** rocks. These crystallised from molten magma (underground) or lava (on the surface). Igneous rocks were then weathered and eroded over many years. They broke down into tiny particles, becoming sands or muds which were eventually laid down in layers to form **sedimentary** rocks. In some cases, these were then transformed into **metamorphic** rocks by extreme heat from magma or lava, or by pressure and heat deep underground.

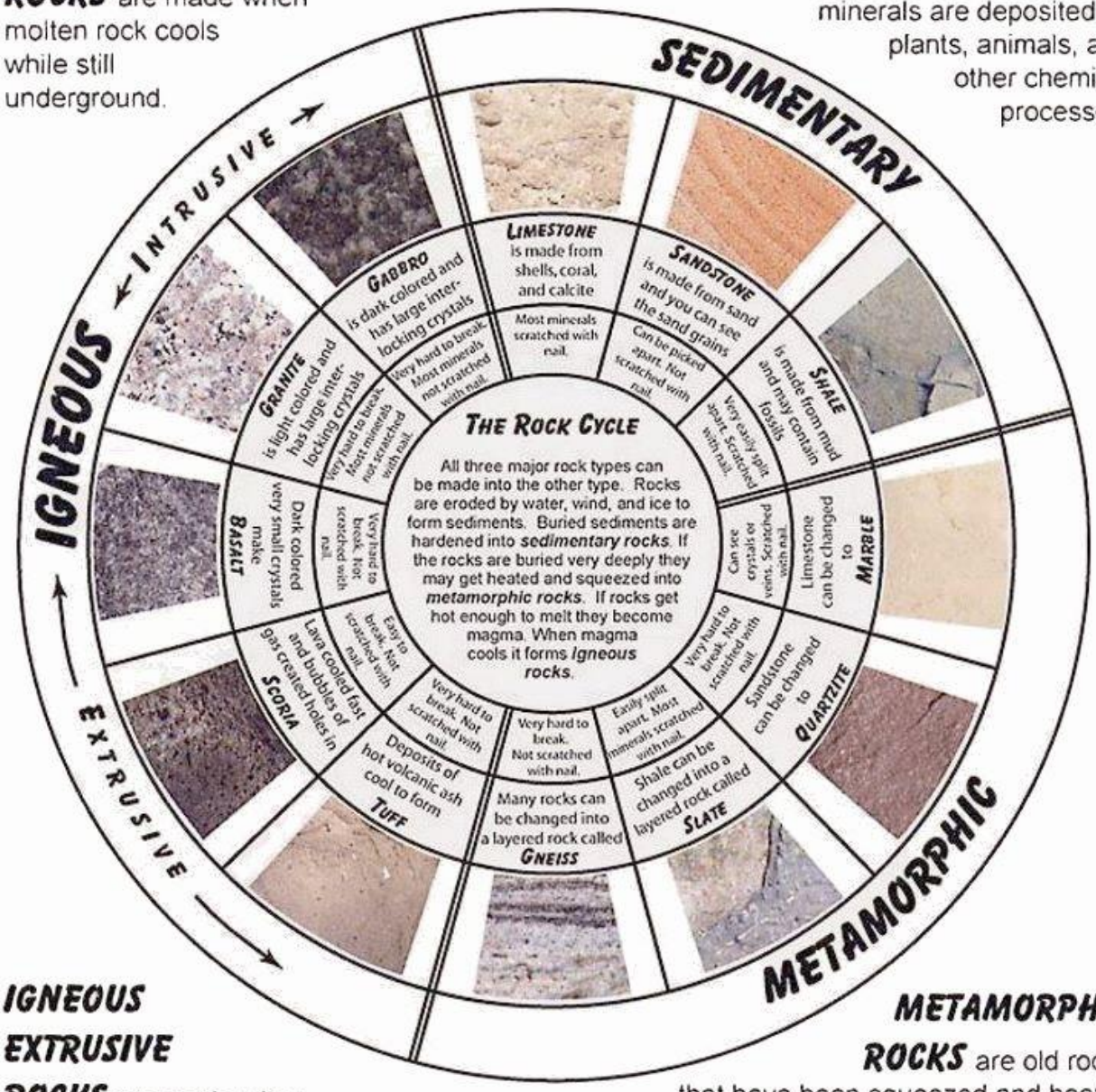
The diagram below explains how rocks are formed, and transformed over time. The diagram on the next page illustrates the main rock types and their formation processes.



HOW TO IDENTIFY ROCKS

IGNEOUS INTRUSIVE ROCKS are made when molten rock cools while still underground.

SEDIMENTARY ROCKS are made when pieces of rocks settle from the water or when minerals are deposited by plants, animals, and other chemical processes.



IGNEOUS EXTRUSIVE ROCKS are made when molten rock flows on the land surface or is thrown into the air and then is cooled into rock.

METAMORPHIC ROCKS are old rocks that have been squeezed and heated but not melted. What new rock is made depends on what the original rock was and on the amount of heat and pressure.

Source: Bill Langer, U.S. Geological Survey.

Tips for identifying rock types

1. **First of all, try to find out whether our rock is igneous, sedimentary or metamorphic. You can do this by assessing the following:**

- **Igneous rocks** are **tough**, frozen melts with **little texture or layering**; mostly **black**, **white** and/or **grey minerals**. They often look like granite.
- **Sedimentary rocks** are **hardened** sediments with **sandy** or **clay-like layers**; mostly **brown** to **grey in colour**. They often have visible **bedding planes** formed by different layers of sediment. They may contain **fossils** and **water or wind marks**.
- **Metamorphic rocks** are **tough**, with **visible straight or curved bands, formed by layers** (foliation) of **light and dark minerals.** They come in **various colours**, and are often **glittery due to their high mica content**.

2. **Next, check your rock's grain size and hardness:**

- **Grain size**: 'Coarse' grains are visible to the naked eye, and the minerals can usually be identified using a magnifier. 'Fine' grains are smaller and usually cannot be identified with a magnifier.
- **Hardness:** Hardness[1] actually refers to minerals rather than rocks, so a rock may be crumbly and appear soft, yet consist of hard minerals. In simple terms, a 'hard' rock scratches glass and steel (e.g. a steel knife), which usually signifies that it contains the minerals quartz or feldspar. A 'soft' rock does not scratch steel, but scratches fingernails. A very 'soft' rock does not scratch fingernails. Igneous rocks are always hard. Metamorphic rocks are generally hard. Sedimentary rocks are often soft.

3. **Now use the tables provided in the next pages, where the most common rocks in your area are described, to confirm your finds.**

[1] Hardness is measured scientifically with the Mohs scale. Hard rocks measure 6-7 or greater on the Mohs scale, whereas soft rocks measure Mohs 3-5.5 and very soft rocks measure Mohs 1-2

Guide to identifying rock types

Igneous Rocks

Rock Type	Picture	Grain Size	Hardness	Usual Colour	Composition	Other
Basalt		Fine or mixed	Medium	Black, brown, grey	Low-silica lava	No quartz; opaque rock
Granite		Coarse	Hard	Black, grey, orange, pink, white	Feldspar and quartz with minor mica, amphibole or pyroxene	It has a veined or pebbled appearance; granular texture
Diorite		Coarse	Hard	Black, brown, grey, white	Low-calcium plagioclase and dark minerals	Little or no quartz; shinny appearance
Gabbro		Coarse	Hard	Dark grey to black	High-calcium plagioclase and dark minerals	No quartz; may have olivine; opaque rock

Sedimentary Rocks

ROCK TYPE	PICTURE	GRAIN SIZE	HARDNESS	USUAL COLOUR	COMPOSITION	OTHER
Sandstone		Coarse (sand sized; visible to the naked eye)	Soft to hard (variable)	Grey, yellow, red to white	Quartz	Gritty to touch
Wacke/ Graywacke		Mixed (visible to the naked eye)	Soft to hard (variable)	Grey to black	Mixed sediment with rock grains and clay	Often with quartz veins
Conglomerate		Mixed (easily visible to the naked eye)	Soft to hard (variable)	Variable (dependent on the clast and matrix composition)	Mixed rocks and sediment	Round rocks in finer sediment matrix, may appear shiny
Limestone		Fine	Medium	Variable (beige, black, blue, brown, cream, green, grey, red, pink, white, yellow)	Calcite	Fizzes with acid; opaque; rough appearance

Metamorphic Rocks

Rock Type	Picture	Foliation	Grain Size	Hardness	Usual Colour	Other
Slate		Foliated	Fine	Medium	Black, brown, buff, green, purple, red, shades of blue	Strong cleavage; opaque rock; dull appearance
Schist		Foliated	Coarse, but also fine to medium grains	Medium	Black, blue, brown, green, grey, silver	Wrinkled foliation; often has large crystals
Gneiss		Foliated	Coarse, but also medium grains	Hard	Black, brown, pink, red, white	Banded
Marble		Non-foliated	Medium grained rock	Medium	Black, blue, brown, grey, pink, white	Opaque rock; granular texture
Quartzite		Non-foliated	Medium grained rock	Hard	Black, blue, brown, green, grey, purple, white, yellow	Quartz (but no fizzing with acid); granular texture

Tips for identifying Minerals

Minerals are a class of chemical compounds. They are composed by several types of bonds between atoms, the building blocks for the world around us. For the purpose of rock study, we are mostly interested in Silicate Minerals, the most important mineral class as they are by far the most abundant rock-forming minerals. The main rock-forming minerals are quartz, feldspars, micas, amphiboles, pyroxenes and olivine.

To identify a mineral:

1. Determine the luster (metallic or non-metallic) of your mineral
2. Determine the hardness of your mineral
3. Determine whether the mineral is light coloured or dark coloured (for non-metallic minerals only), and what colours it has
4. Determine whether your sample has a cleavage
5. Check the guide below to identify what type of mineral you have.

Guide to identifying mineral types

Biotite Mica

LUSTER	HARDNESS	COLOUR	CLEAVAGE	TRANSPARENCY
Pearly, vitreous	2.5 - 3	Black, dark brown, dark green	Basal	Translucent to opaque

Calcite

LUSTER	HARDNESS	COLOUR	CLEAVAGE	TRANSPARENCY
Vitreous, resinous, waxy, pearly	3	Colourless, white, yellow, brown, orange, pink, red, blue, purple, gray, black	Perfect; Rhombohedral; three directions	Transparent, translucent

Feldspar

LUSTER	HARDNESS	COLOUR	CLEAVAGE	TRANSPARENCY
Vitreous to pearly	6	White, yellow, pink, orange, light blue, light green, brown, grey	Basal, Prismatic, Pinacoidal. Cleavage is about 90 degrees	Transparent or opaque

Muscovite Mica

LUSTER	HARDNESS	COLOUR	CLEAVAGE	TRANSPARENCY
Pearly	2.7-3	Colourless, white, beige, yellow, brown, grey, pink, purple, red, black	Perfect	Transparent to translucent

Quartz

LUSTER	HARDNESS	COLOUR	CLEAVAGE	TRANSPARENCY
Vitreous	7	Colourless, white, purple, pink, brown, black. Grey, green, orange, yellow, blue, red	None	Transparent to opaque