THE SCIENCE OF ANCIENT ART

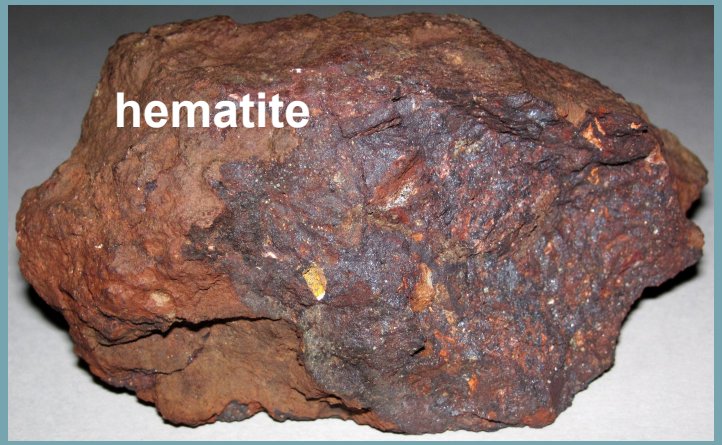
Have you ever wondered how people could make paints and pigments that last for hundreds, even thousands of years?

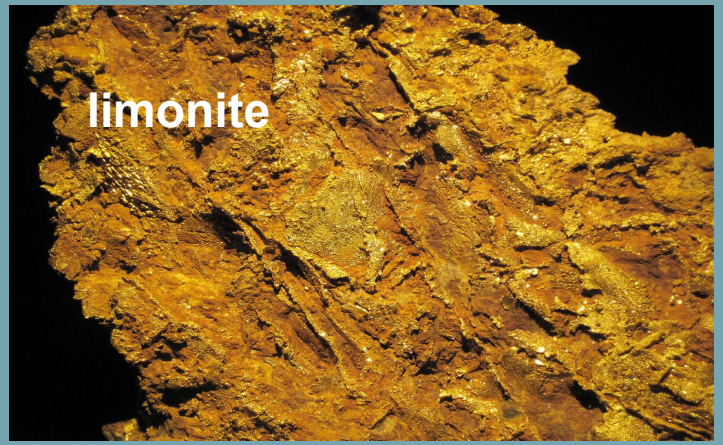
All around the world and throughout time, people created rock art and rock writing to communicate with one another and connect to their spirituality. Today, travelers most often come across *pictographs,* painted images, in protected caves and rock shelters. These pictographs use a variety of colors, but some of the most common colors we see are reds, yellows, and browns.

These colors come from *ochre*, a mineral that people use to create natural paints. Ochre is found around the world and has been adapted by people for a variety of uses to make their lives more colorful.

What is Ochre?

Ochre occurs naturally in rocks around the world. Some *sedimentary rocks* contain minerals that have *iron* incorporated into their *crystalline structure*, such as hematite (Fe_2O_3), and limonite ($2Fe_2O_3 \cdot 3H_2O$). Chemical weathering breaks down these minerals, releasing their iron into the surrounding sedimentary rock.





What is Ochre?

Ochre is formed when iron encounters clay particles, binds to them, and *oxidizes*. As iron becomes exposed to oxygen in the air or in water, it oxidizes, or rusts. This rust color becomes incorporated into the clays of the sedimentary rock, transforming into bright reds, yellows, browns, or even purples. Have you ever seen sedimentary rocks or soils with these colors? Where did you see them?

What is Ochre?

Coalville yellow ochre deposit.

Ochre is sometimes found in secondary deposits, like this example from Coalville, Utah. Iron-oxide has stained clays, silts, and sands from a sandstone formation, and these materials have been carried down the face of a cliff by running water from rain and snow storms. The yellow oxidized material has become trapped in cracks and *fissures* in the rock, creating this natural deposit of yellow ochre.

How Do People Use Ochre?

Because ochre occurs all over the world and all through time, as soon as behaviorally-modern humans discovered it, they started using it. The following examples give a sense of the range of ways people have used ochre, and the depth of time associated with ochres use.

Ochre provides a beautiful range of vibrant colors, so people around the world have used ochre to create paints. These paints were used to create rock art, communicate important events, decorate homes, bury the dead, and even adorn bodies and hair.

Hands at the Cuevas de las Manos upon Río Pinturas, near the town of Perito Moreno in Santa Cruz Province, Argentina. The art in the cave dates between 13,000–9,000 BP.

How Do People Use Ochre?

Photo courtesy of Yves Picq 2007.

People today still use red ochre. This Himba woman from northern Namibia is cosmetically adorned with red ochre mixed with oils and aromatic resins; she has rubbed red ochre onto her skin and coated her hair with it. In some cultures, red is a spiritually powerful color, and this practice also may provide sun protection.

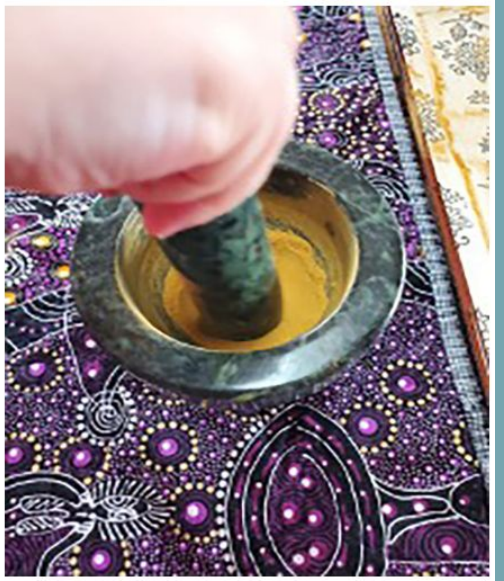
How Do People Use Ochre?

Shell of the Giant Clam (Tridacna gigas) from the Red Sea reused as a container for red paint made from ochre (iron oxide), plant oil and plant gum, a similar recipe to that used in a tomb in the Valley of the Kings, Thebes. Egyptians often used natural objects to store paint and cosmetics, such as this shell. The paint found in this shell could have been used by *artisans* to sketch out guidelines of carvings for *stonemasons* as well as to detail rough outlines of figures on tomb walls. This dates to the Predynastic Period, about 3600-3150 BC.

How Do You Get Ochre Ready to Use?

There are few places in the world where red ochre can be mined directly from its source and used immediately. More often, the ochre must be processed to become suitable for painting.

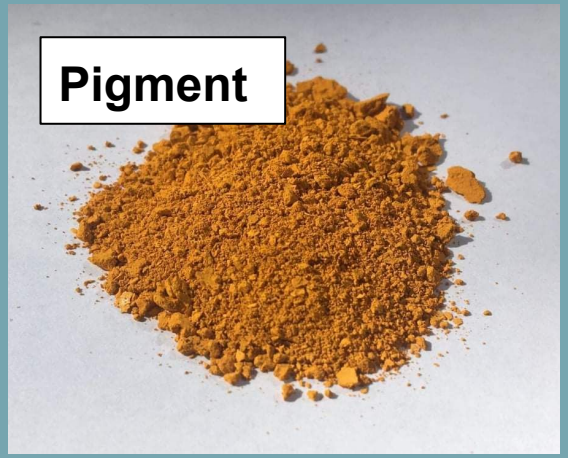
An easy, two-step process transforms the raw, mined ochre and refines it into a powdery *pigment* that can be mixed into a paint.



The first step is milling the mineral. Milling is the act of grinding the material into a smaller size, and in this case, it releases the clays from the parent material. *Levigation* is the process of grinding the insoluble mineral into a fine powder, while wet.

Left: *raw ochre from Coalville is poured into a mortar and pestle.*
Right: *the ochre was crushed and ground to separate it from other sedimentary rock. Look how bright it is!*

The powdered ochre is just the pigment; it is not a finished paint yet. In order to make a paint that will adhere to other surfaces—whether upon skin or cave walls—artists need to mix other ingredients into the ochre. The next step for creating paint involves mixing essential components, like ingredients in a recipe.



Paint is composed of:

- ***Pigment***
- A ***carrier*** (often water)
- A ***binding agent*** (This helps it stick to the material it's painted on.)
- An ***emulsifier*** (If the binding agent and the carrier do not mix together, an emulsifier is added.)

People around the world experimented to find the best mixtures of these components. They also experimented to find out what were the best substances to use as binding agents to stick to different surfaces like rock and skin…

Above: Kohl pot and stick from ancient Egypt; brown ochre was used in making their eyeliner mixture.

Left: Face painting, Elderly Woman in São Jorge,Brasil
Above: Canyonlands, pictographs in Utah.