



Natural Red Earth

[Pigments and Binders]



Pigment Labsetup

Names/synonyms: Natural Red Earth

"iron oxide pigment"

"earth colors"

Source of Pigment:

Earth pigments are inorganic and derived from mineral sources, river beds, and volcanic areas. ⁸ (Thomas, 8) They are mined specifically in France, Cyprus, Italy, the Persian Gulf, Andalusia, the Province of Jaen, and mainly in Spain (not necessarily on the plain). Earth Pigments are also found in the US in New York State. Once the pigment is mined in Andalusia and Province of Jaen, it is shipped to Málaga for grinding. ¹³⁻¹⁴ (Thomas, 13-14)

Earth pigments can also be manufactured synthetically, and often are due to the high cost of transportation. The red hue is reproduced by using a dry process called thermal decomposition. In this process, ferrous sulfate is put into a two-step calcination process. The final product is calcium sulfate and iron oxide (Fe_2O_3) ¹⁷ (Thomas, 17)

History of Use:

The principle earth colors have been used since the dawn of man. In the Paleolithic and Primitive Cultures, natural red earths were used in cave paintings and for ritualistic purposes; specifically death ceremonies, because the red color can easily symbolize blood. They are also used because of their permanence. Some paintings with red earth hues in the Italian city of Pompeii have withstood wind and rain for over a millennium. In fact, this pigment was so important that the people took risks in locating the it.

In Ancient times, Red Earth was used inside the Egyptian pyramids and temples. It was also utilized in India with vegetable or animal glues as binders, as well as China. ²⁰⁻²² (Thomas, 20-22) They were usually prepared by grinding the earth on a rock and using binders to make the paint. ¹⁹⁻²⁰ (Thomas, 19-20) Interestingly enough when

samples were prepared in the pigment lab the same technique, save grinding, was used.

Red Earth was put to use in the Classical period because it was perfect for fresco painting. In particular, the Minoans, Etruscans, and Greeks used this technique. The pigment was mixed with water and applied to a wall surface covered with wet lime plaster. As the plaster dried, the pigments bonded to it and became part of the wall's surface. Only pigments that are compatible with lime could be used in this way, and earth pigments are not affected by alkalies, so they make a good pair. ■ (Thomas, 22)

Medieval and Renaissance painters used Red Earth pigments for fresco, tempera, and oil painting. Using the pigment in the form of chalks was a new technique that came out of the Renaissance. Chalks are made by cutting sticks directly from the deposits of colored earth. Conté pencils are a modern commercial equivalent to the chalk used during the Renaissance. ■ (Thomas, 23-24)

In the modern world, Red Earth pigments are used in paints and stains. They are also used in the manufacture of rubber, plastics, concrete products, paper, magnetic inks, and fertilizers. Because of their non-toxic nature, they are legal to use in drugs, foods, and cosmetics. ■ (Thomas, 24-25)

Chemistry:

In any earth pigment, there are three components that are necessary. The first is a principle color producing agent, which is iron oxide. The second component is a secondary color producing agent, which can be either calcium, manganese, carbon, or an organic material such as silica or limestone. The third component is a base filler, diluent, or carrier of color, which is usually clay. Natural Red Earth is possibly a product of low humidity and high temperature. ■ (Thomas, 8-9) Red Earth is also a hematite, which is anhydrous ferric oxide. ■ (Thomas, 10) On a side, they are resistant to acids and bases, this attributes to their permanence.

Characteristics with Binders:

Before a pigment can be added to a particular binder, the pigment must first be prepared. Once it is mined, the pigment must be dried and sifted. Then, it is washed by a process of levigation which is the separation of fine and coarse materials into a suspension. Then the pigment is ground up. ■ (Thomas, 28-30)

Pigments can be mixed with many different binders. One in particular is oil. Vegetable oils are best for binders because they dry by oxidation, not by evaporation which makes tough adhesive films. The best to use is linseed oil, but some other good oils to use are poppy, walnut, soybean, and tung. Linseed oil was the binder used in the pigment lab. Different oils also yield different levels of permanence. Different pigments have varying rates of oil absorption, so it is important to consider the specifics of the pigment when preparing the paint. Natural earths are thirsty for oil. Furthermore, the pigment needs at least forty percent oil in order to become a useful paint. This is congruent with the lab observations made, for the oil paint created required more than the initial amount of Linseed oil to be added so that the paper could be painted. A good test for proper oil amount is to spread the paint on a glass. If the paint cracks or rolls, then there is not enough oil present to bond with the pigment.

Another type of binder used is an emulsion, which is any mixture of oil and water, such as egg. These paints tend to dry very quickly. This mixture of pigment is most commonly made when the egg yolk is separated from the white. The yolk skin was then poked with a needle and the excess yellow solution was added to the pigment to make a tempera paint. It is important that the pigment be ground as fine as possible. If the pigment is ground with water, it can be stored indefinitely. A preservative can be added to the emulsion and pigment. An example of such a preservative is vinegar, but a better one to use is oil of clove. To test the ratio of binder to pigment one would paint on a piece of glass and let dry overnight. The next day, if the paint comes up together, the ratio was good. If the paint crumbles and powders, then the ratio was bad. ■ (Thomas, 53-56)