

# Pigments Historically Sourced From Gem Materials

By Britni LeCroy



<b>Hematite</b> $Fe_2O_3$	<b>Azurite</b> $Cu_3(CO_3)_2(OH)_2$	<b>Malachite</b> $Cu_2CO_3(OH)_2$
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## Hematite

One of the earliest gemstones known to have been used as pigment is hematite. The dark, metallic color associated with gem-quality hematite is a result of densely stacked deep red microscopic crystals that ultimately absorb most visible-color wavelengths. Hematite's red color can be seen when the mineral exists as either pulverized powder or thin crystals that allow light to pass through. Within the realm of art, the powdered pigment form is referred to as red ochre and has been used from the dawn of artistic expression. The use of red ochre as a pigment has been recorded in works of art from all periods and traditions around the world, from the Pleistocene to the present day. The earliest cave paintings from every habitable continent on Earth, revealing humans at their most primitive artistic abilities, feature red ochre. It has become widely accepted by scholars that the adoption of red ochre is synonymous with the beginnings of art and therefore human intellectual evolution. Its importance to modern artworks is incalculable. Twentieth-century masters such as Pablo Picasso, Mark Rothko, and Andy Warhol created works featuring the color, bringing it full circle. Modern red ochre paints continue to be predominantly made with natural hematite.



The Cueva de las Manos in Argentina shows hand silhouettes created from red ochre (hematite) 13,000 to 9,500 years ago. Photo by Pablo A. Gimenez/CCBY SA 2.0

## Azurite and Malachite

Possibly the earliest application of azurite and malachite came in the form of cosmetics. Malachite pigment can be traced to ancient Egypt, where it was used as an eye paint during the predynastic period, spanning from 6000 BCE to 3100 BCE. Although azurite is far less abundant than malachite, azurite pigment has been utilized more widely. It was the most important and heavily used blue pigment in Europe throughout the medieval period since it was far more affordable than ultramarine (sourced from lapis lazuli) and enjoyed peak use during the Renaissance. In European easel painting, malachite was vitally important from the fourteenth to seventeenth centuries. Both colors were replaced by synthetics by the nineteenth century.



Irises at Yatsuhashi (Eight Bridges) by Ogata Korin, from the early eighteenth century. These screens feature a flat malachite green and deep azurite blue on gold foiled paper. Photo Courtesy of the Metropolitan Museum of Art.



## Lapis Lazuli

Of all the natural pigments created throughout history, ultramarine, a blue derived from lapis lazuli, reigned supreme. Ultramarine was said to be as expensive as an equal weight of gold. Its high cost was due to the inconvenience of only one source location, the Sar-e-Sang mines in Afghanistan, supported by the arduous procedure required to process the rock into pure pigment. During its prime, the blue was deemed so sacred that it was reserved for the most important works and only the holiest of religious figures. Its high cost inspired a contest for synthesizing artificial ultramarine and in 1828 a French winner was awarded. This synthetic known as "French ultramarine" has been a pigment staple since the mid-nineteenth century.

Girl with a Pearl Earring (1665, oil on canvas), Johannes Vermeer's most celebrated painting, depicts a girl wearing an ultramarine (lapis) turban and an exceptionally large pearl earring. Pearl was the most valuable gem at the time. Other pigments include cinnabar (lips) and bone black (background and turban shadows). Photo courtesy of Mauritshuis, The Hague.



A meeting of Greek mythological figures is imagined in Titian's Bacchus and Ariadne (1523, oil on canvas). Ariadne (far left) wears a robe in ultramarine and a red vermilion sash. Ultramarine is also featured in the sky and distant landscape. Malachite is used in the green foliage to the right of Bacchus. The sea and greener areas of the distant landscape are composed of azurite. Photo courtesy of the National Gallery, London.



<b>Lapis Lazuli</b> Blue colored by member(s) of the sodalite group	<b>Bone and Ivory</b> Carbon After Charring	<b>Cinnabar</b> HgS
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## Bone and Ivory

For centuries, bone and ivory have been used to create black pigments. When they are heated in the absence of oxygen via a closed crucible, black pigment is produced. The carbon source is primarily protein collagen that is incorporated in the matrix of the material. A variety of animal bones have been used as pigment source material throughout history, including cattle and lamb and possibly even human remains in earlier centuries. Bone black has been found in prehistoric, Egyptian, Greek, Roman, medieval, and Renaissance art. Ivory black pigment was manufactured until the end of World War II. Due to species protection measures, all ivory black sold on the market today must be sourced solely from old stock or be composed of high-grade bone black. Charcoaled bovine bones are still commonly used to create bone black pigment and the color is still easily found at art stores today.



Kazimir Malevich's Painterly Realism of a Football Player-Color Masses in the 4th Dimension (1915, oil on canvas) features ivory black, artificial ultramarine blue, and vermilion red. The work is painted in the Suprematist style, a movement focused on geometric shapes and a limited range of colors. Photo courtesy of the Art Institute of Chicago.

## Cinnabar

Cinnabar's color is derived from simply crushing and grinding the mineral in a stone mortar. A synthetic form, commonly referred to as vermilion, has existed for several centuries and is obtained from synthesizing mercury and sulfur. After ultramarine, cinnabar was historically the most valuable and prestigious pigment in the trade with Spanish and Chinese sources being the most significant. Of the more than 800 Dead Sea Scrolls discovered in Israel and considered the world's earliest copies of biblical books, four fragments have been shown to contain red ink composed of cinnabar. Ancient Romans indulged in the use of the pigment in wall paintings assigning it great importance and sacred associations and the ancient Chinese used it considerably in lacquerware. Production of vermilion has largely replaced cinnabar since the fourteenth century.



Combing of the Hair (La Coiffure) by Edgar Degas (1896, oil on canvas) is a near monochromatic celebration of red showcasing vermilion, red ochre, and red lead pigments. Photo courtesy of the National Gallery of Art, London.

