

## Making Paint from Minerals

Paint is a mixture of microscopic grains of pigment that are suspended in a liquid vehicle. A *pigment* is an insoluble colorant, in contrast to a dye in which the colorant is dissolved. The *vehicle* in which the pigment is dispersed for watercolors is a mixture of three materials with specific purposes: 1) *Binder* adheres the pigment to the page. (Gum arabic is a commonly used watercolor binder. It is a natural, water-soluble gum that is produced by acacia trees of the Middle East and northern Africa to seal wounds in the bark. Starches and animal glues also are used); 2) *Plasticizer*, such as glycerin, helps to soften the binder and help it to redissolve; and 3) *Humectant*, such as honey or corn syrup, helps the paint retain moisture.

In this laboratory session you will investigate the properties that determine whether or not a mineral is well suited for use as a pigment in a primitive water-based paint, and then make a palette of paints using minerals as pigments and organic, non-toxic materials as a plasticizer and humectant.

### Mineral Properties and Pigments

Examine the five mineral samples provided (albite, kaolinite, white calcite, orange calcite, and hematite), and document their properties in the table below.

	<b>Albite</b>	<b>Kaolinite</b>	<b>White Calcite</b>	<b>Orange Calcite</b>	<b>Hematite</b>
Color					
Streak					
Luster					
Cleavage					
Hardness					
Solubility					

One mineral at a time, take a few fragments of each mineral and crush them to powder with a mortar and pestle. After crushing each mineral, document how difficult it was to crush (difficult, moderate, easy), and the color of the powder. Discard the crushed mineral.

	<b>Albite</b>	<b>Kaolinite</b>	<b>White Calcite</b>	<b>Orange Calcite</b>	<b>Hematite</b>
Difficulty to Crush					
Color of Powder					

Which mineral property best correlates with the difficulty to crush the mineral?

\_\_\_\_\_

Which mineral property best correlates with color of the mineral powder?

\_\_\_\_\_

What are the three ideal properties for a pigment for a water-based paint?

\_\_\_\_\_

Which of the five minerals would make the best white pigment? Explain.

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Examine the hand-samples of minerals that were used historically for paint pigments. Document their properties for inclusion in your mineral guidebook.

Mineral	<b>Azurite</b>	<b>Cinnabar</b>	<b>Lazurite</b>	<b>Malachite</b>	<b>Orpiment</b>
Formula	$\text{Cu}_3(\text{CO}_3)_2(\text{OH})_2$	HgS	$\text{Na}_3\text{Ca}(\text{Al}_3\text{Si}_3\text{O}_{12})\text{S}$	$\text{Cu}_2(\text{CO}_3)(\text{OH})_2$	$\text{As}_2\text{S}_3$
Pigment Name	<i>Blue Verditer</i>	<i>Vermillion</i>	<i>Ultramarine</i>	<i>Green Verditer</i>	<i>King's Yellow</i>
Color					
Streak					
Luster					
Hardness					
Toxic?					

Follow the instructions provided by your instructor to make a palette of mineral-based gouache paints. Take home samples of your paints.

Before next class, research a culture that uses/used a limited color palette such as the one that you created from common minerals (red, black, yellow, green, and white) (e.g., cave paintings, Australian aborigines, native Americans, African tribes). Create a painting in the style of your selected culture on an appropriate piece of earth material (stone, wood, tile, etc).

Write a one-page accompanying description of the artifact that you created. This “curation record” (see attached blank form) will be posted beside your artifact in a gallery-like showing during the next class. This write-up should serve to educate viewers regarding the artwork that you created, just as plaques in authentic museums. (See example plaque of a pair of gold earflares from Peru that are displayed at the Metropolitan Museum of Art.) Your write-up must include the following: Where are the people/culture that you studied located? At approximately what date did they create similar artwork? What is the climate of the region? What is the general physiography (mountainous, volcanic, plains, etc) of the region? What minerals are used for pigments? Where do the people obtain these pigments? Do the colors/paints have symbolic/spiritual meaning? What use/meaning would your homemade artifact have in this culture? Mark the location of the people/culture that you studied on the blank world map that is attached.

**Pair of Earflares**

Peru; Moche

3rd–7th century

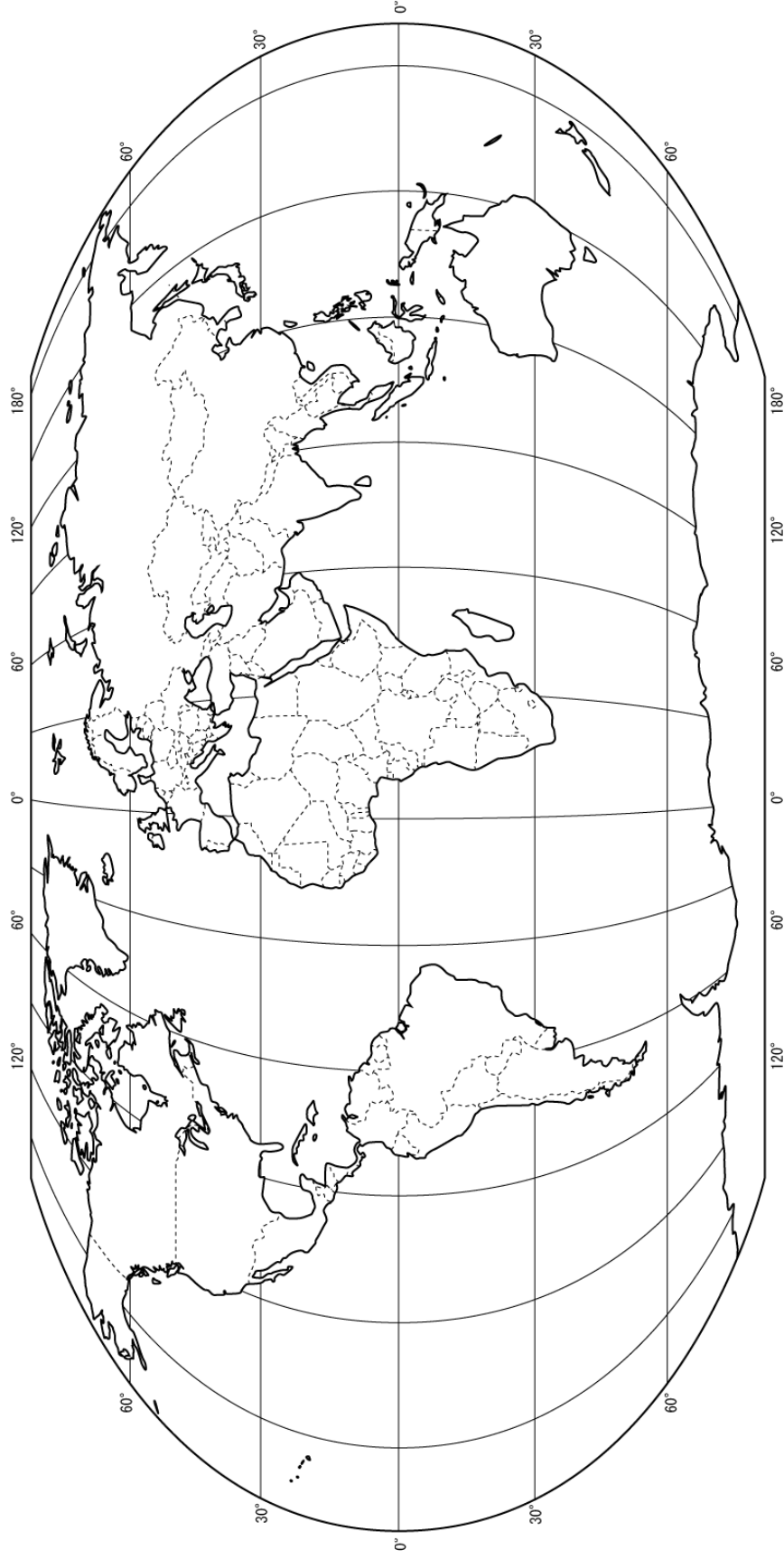
Hammered gold, turquoise, sodalite, and shell inlay

Gift and Bequest of Alice K. Bache, 1966, 1977  
66.196.40, .41

Large circular ear ornaments were popular personal adornments of prominent ancient Peruvian lords and a symbol of their status and wealth. The weight of the frontal was counterbalanced by a long tubular shaft worn in the distended hole in the earlobe. Particularly impressive are those earflares with colorful mosaics. On this pair, bird-headed (or masked) winged runners, worked in turquoise, sodalite, and spondylus shell, hold bags in their outstretched hands. Their eyes and beaks are sheathed in gold. They may be depictions of mythological messengers.

Be prepared to answer questions regarding your artwork, and its origin during a discussion in class.

# Location of Artifact



CURATION RECORD

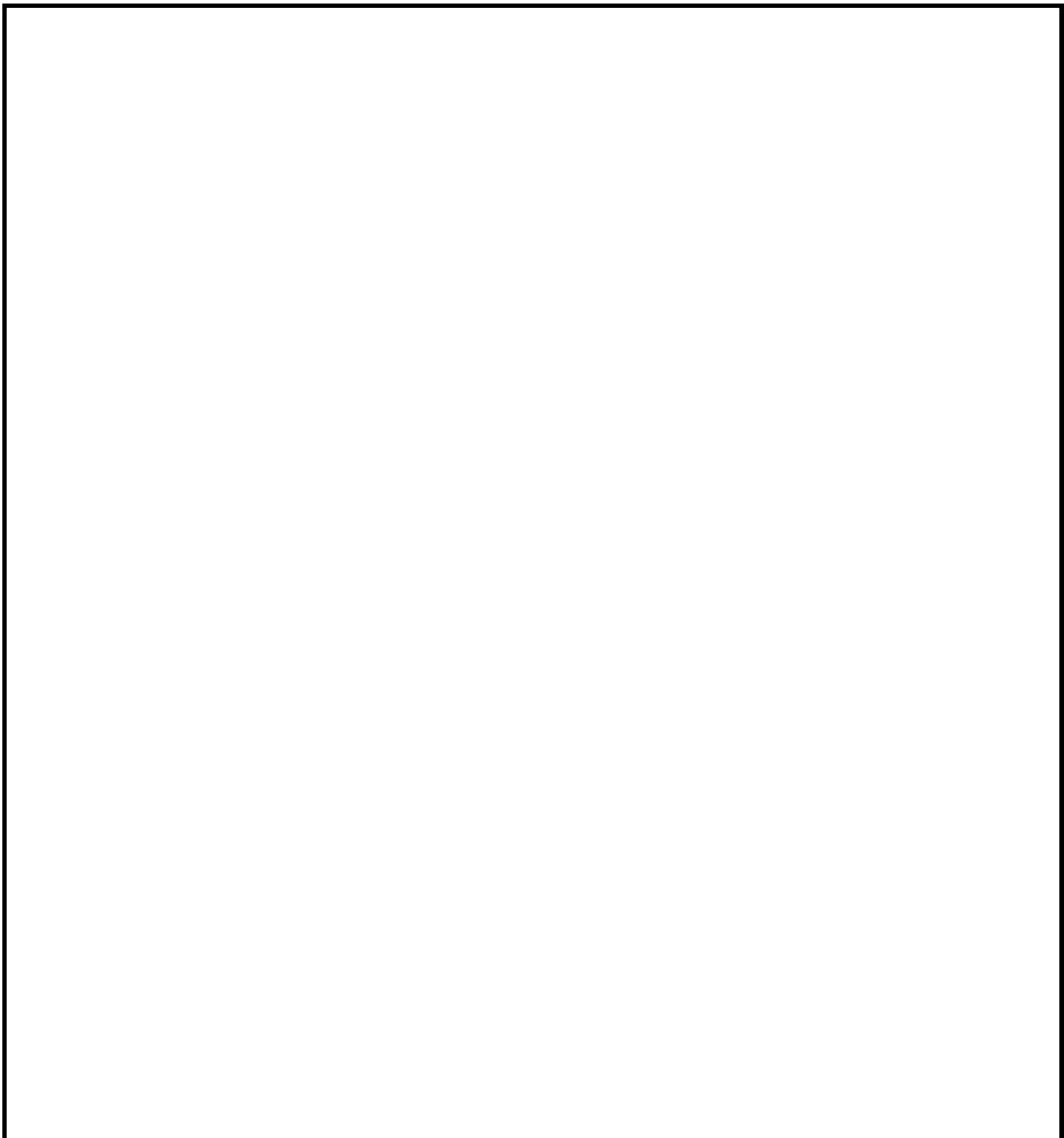
Curated By: \_\_\_\_\_

Object Name: \_\_\_\_\_

Region of Origin: \_\_\_\_\_

Age of Artifact: \_\_\_\_\_

Pigments Used: \_\_\_\_\_



# Instructions for Making Paints from Minerals

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## **Pigment Powder**

Grinding minerals is a time consuming process. However, the grinding process demonstrates the importance of hardness and streak versus color in choosing pigments for paint; some in-class mineral grinding is necessary to achieve the learning objectives. Mineral powders can be purchased from pottery supply stores (glaze ingredients) or from specialty retailers ([www.earthpigments.com](http://www.earthpigments.com) or [www.naturalpigments.com](http://www.naturalpigments.com)). If you choose to grind the samples rather than purchase powders, the procedure is as follows:

- Grind the sample of the mineral pigment (e.g., hematite) using a mortar and pestle.
- Pour the powder into a beaker of water and mix well
- Wait 1 minute for the coarse grains to settle, then pour off the water and suspended pigment into another container
- Allow 2 days for the pigment to settle, then pour off the water
- Allow the sediment to dry, then powder it with mortar and pestle and store the pigment powder.

## **Gum Arabic Solution (Vehicle)**

The vehicle must be made at least one day in advance to provide sufficient time for the gum to dissolve. Gum Arabic is a natural, water-soluble gum that is produced by acacia trees of the Middle East and northern Africa, and is available from art supply stores. Oil of clove can be purchased at a pharmacy.

- Place 1 part gum arabic powder or crystals in a saucepan.
- Heat 2 parts distilled water to a boil, remove from heat, and slowly pour over gum arabic, stirring to mix.
- Add one part glycerin per 5 parts gum Arabic solution.
- Add one part honey per 10 parts gum Arabic solution.
- If you intend to keep the paint for a while, you can add a few drops of oil of clove as a preservative
- Cover with cheesecloth and let stand for one day, stirring occasionally. (Some gum crystals may need longer to dissolve.)
- Strain the solution through several layers of cheesecloth to remove impurities and sediment.

## **Mixing Paint**

- On the glass sheet, make a pile of about 1-1/2 tablespoons of pigment powder. For gouache (an opaque watercolor paint which would be better for painting on objects like stone or wood) add 1/4 tablespoon of calcite powder (whiting).
- Use the back of the measuring spoon to make a hollow in the center of the pile.
- Pour 1 teaspoon of gum Arabic solution into the hollow, and knead very slowly with the putty knife. As needed, add more gum arabic solution or distilled water until pigment forms a creamy paste.
- Use a muller/pestle to break apart and grind the pigment aggregates. You cannot overwork the paint. Add more vehicle or water as needed to counteract evaporation.
- Transfer paint mixture into containers. (Seven-day pill boxes from a drugstore serve as convenient and inexpensive paint boxes.)