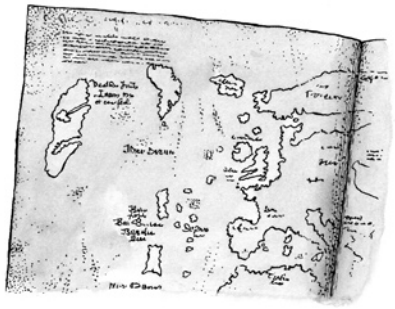
NOVA

Original broadcast: February 8, 2005 PBS

The Viking Deception

PROGRAM OVERVIEW



NOVA investigates the history and authenticity of the Vinland Map, a document believed by some to be the first to depict America, and to date to 1440, half a century before Columbus' famous voyage.

The program:

- recounts the Vinland Sagas, 13th-century chronicles that relate Leif Erikson's discovery of Vinland, an island named after the vines found growing there.
- reports how the Vinland Map first came to light in 1957 when an Italian book dealer tried unsuccessfully to authenticate a world map bound in a 15th-century manuscript titled the Tartar Relation.
- notes that the map indicates an island labeled Vinland located at approximately where North America would be and includes a short description that details the island's discovery by the Vikings.
- details how the manuscript was sold to an American dealer who used watermarks and worm holes to try to date the Tartar Relation and the map.
- describes how the discovery of a manuscript titled the Speculum Historiale led to the belief—confirmed by the location of worm holes—that the Speculum, the Vinland Map, and the Tartar Relation had once all been part of the same medieval volume.
- relates Yale University's subsequent purchase and unveiling of the map.
- reports on archeological finds from a fishing village in Newfoundland that provided evidence that the Vikings had reached North American shores prior to Christopher Columbus.
- notes that when scholars questioned the map's genuineness, Yale officials agreed to scientific tests to verify the map's authenticity.
- reviews the testing of the map's ink, including analyzing the ink under different lights and microscopes, comparing it to medieval inks, testing it at the atomic level, and subjecting it to microprobe spectroscopy.
- notes that evidence indicated that the map was a forgery.
- concludes with a proposed suspect who might have created the map—an Austrian Jesuit priest and map authority who may have made the map as a private exercise, thinking that it should exist but never believing it would be seen by others.

BEFORE WATCHING

1 Ask students what they know about the Vikings and their colonization of other areas? (The Vikings were a people from Scandinavia who were farmers, traders, shipbuilders, and colonizers; they began colonizing in the second half of the eighth century when they raided England.) How far west did they colonize? (There is archeological evidence of a Viking settlement on Newfoundland.)

2 What do students think of when they hear the word forgery? Define forgery for students (The act of falsely making, altering, or imitating something with the purpose to defraud.) What kinds of items are forged? (Some examples include money, art, historical artifacts, and check signatures.)

3 Divide the class into three teams and have them take notes on one of the following topics: evidence that the Vinland Map was forged, evidence that the map is authentic, and why the Vinland Map is important.

AFTER WATCHING

1 Hold a discussion about the topics students took notes on while watching. Discuss the evidence supporting and disproving the forgery. How does it compare? Poll students to find out whether they believe the map is authentic. If students have differing opinions, ask them to explain the reasoning behind their views. Conclude by discussing what it means if the map is or is not authentic.

2 Scientists used a number of different technologies to examine the map's parchment and ink. Have students choose and research one of the technologies featured in the program. Ask students to write a one-page paper on how the technology works and what it is used for.

CLASSROOM ACTIVITY

Objective

To learn about the chemical pigments of some plant-based dyes.

Materials for each team

- copy of "Extracting Colors" student handout
- one of the following: 1 cup blueberries, 1 cup blackberries, large handful red onion skins, or large handful yellow onion skins
- goggles
- hot plate or stove
- enamel or stainless steel pan (1 liter)
- large wooden or plastic spoon
- sieve
- 1 knee-high nylon stocking (for groups using onion skins)
- large spouted heat-resistant measuring cup with ml markings
- cheese cloth for groups using berries (twice the size of jar mouth)
- 2 pot holders or oven mitts
- 1 clean, empty jar with lid
- thin paint brushes, or four 2.5-cm sponge squares
- white construction paper

Procedure

1. Ask students to name some different plants or plant parts they think could be used to make dye. Discuss dyes and how inks can be made from natural dyes (see Activity Answer on page 4 for more information).
2. In the Middle Ages, scribes often used iron gall ink, a dye-based ink made from galls of oak trees. Many inks are dye-based. In this activity, students will use natural ingredients to make four different dyes (each team makes one dye) and will investigate the pigments responsible for creating the colors in those dyes.
3. Organize students into teams. Distribute the materials and a copy of the handout to each team. Each team will work together to make a dye from one of the following plant parts: red onion skins, yellow onion skins, blueberries, or blackberries. (If you have the materials available, you may want to have more than one team make the same dye. If multiple teams will be making dye, you might want to have half the class make its dye while the other half does research, and then switch the roles.) Students will predict the color of the dye, learn about the pigment responsible for each color, and investigate the pigment's uses and benefits for humans.

STANDARDS CONNECTION

The "Extracting Colors" activity aligns with the following National Science Education Standards.

GRADES 5–8
Science Standard B:
Physical Science
Properties and changes of properties in matter

- Chemical elements do not break down during normal laboratory reactions involving such treatments as heating, exposure to electric current, or reaction with acids. There are more than 100 known elements that combine in a multitude of ways to produce compounds, which account for the living and nonliving substances that we encounter.

Video is not required for this activity.

Classroom Activity Author
Developed by WGBH Educational Outreach staff.

CLASSROOM ACTIVITY (CONT.)

4 Review the instructions on the handout with students. Have students first predict the color of their dye. Teams will also record the color extracted and the color the dye imparts on paper. Have them research and record the pigment responsible for the color, the pigment's function for the plant, and any uses and benefits the pigment may have for humans. Ask students to save their jar of dye and share it during the class discussion.

5 To conclude, make a chart on the board that includes: the type of berry or the kind of onion skin used, the dye's color, the color imparted on paper, the pigment's function for the plant, and the potential benefits for people. Compare dye results from the different teams. Which dye had the richest color? What might be some of the reasons for this? Which dyes show up well on paper? What, if any, findings surprised students?

6 As an extension, have students explore the history of ink and how the process of making ink has changed over time.

SAFETY NOTE

Review the proper use of a hot plate with students prior to beginning the activity. Remind students to wear goggles, use potholders when moving hot pans or materials, and work carefully when using the hot plates. Supervise students as they use their hot plates to make their dyes.

Major funding for NOVA is provided by the Park Foundation, Sprint, and Microsoft. Additional funding is provided by the Corporation for Public Broadcasting and public television viewers.

ACTIVITY ANSWER

Dyes are soluble matter that impart color. Inks can be made from natural dyes that come from metals or the outer covering of nuts or seeds. Many plant pigments can be extracted and used as dyes, and with additives, made into inks.

The process of ink-making has changed over time. Iron gall inks were used during the 1400s and were made from a mixture of tannic acid and iron salt (often ferrous sulfate). The pigment in iron gall ink does not completely form until it is exposed to air, and the ink is transparent until it is put on parchment or paper. It then darkens and becomes permanent. Gum Arabic, a thickener, increases the flow of the ink and helps it stay on the writing surface. If too acidic, these inks damage paper or parchment.

During the mid-1800s, people started using ammonia-based aniline dyes to make ink. Precursors of today's inks, they were less damaging to parchment and paper. However, these inks tend to fade. Fountain pen inks are often made of aniline dyes plus chemical additives that help increase the flow of ink (ethylene glycol) and prevent bacterial growth (phenols). Other additives make the ink more stable and prevent dyes from solidifying in the pen.

Extracting Colors Pigment Chart

	Dye Color in Jar	Color Imparted on Paper	Pigment Name	Function in Plant	Benefit for People
Red Onion	cranberry red	little to none	the flavonoid, anthocyanin	provides color to flower and fruit; color attracts animals for pollination	may act as antioxidant; may also help protect eyes from degenerative diseases
Yellow Onion	golden	little to none	the flavonoid, quercitin	provides color to plant; gives visual cues to pollinators	may act as antioxidant; may also protect against heart disease
Blueberry	deep red	purple	the flavonoid, anthocyanin	gives blueberries their color and provides color to flower and fruit; color attracts animals for pollination	may act as antioxidant; may also help prevent memory loss and disease
Blackberry	deep red	magenta	the flavonoid, anthocyanin	gives blackberries their color and provides color to flower and fruit; color attracts animals for pollination	may act as antioxidant; may also play a role in preventing disease

LINKS AND BOOKS

Links

NOVA Web Site—The Viking Deception
www.pbs.org/nova/vinland/
Find articles, interviews, interactive activities, and resources in this companion Web site to the program.

A Palette for the Palate
http://www.sciencenews.org/articles/20050108/bob9.asp
Details the health benefits that pigments in fruits, vegetables, and salad greens may provide.

Plant Pigments for Color and Nutrition
www.hort.wisc.edu/usdavcru/simon/publications/97hort0012.html
Describes the function of anthocyanin and quercitin for the plant.

Vikings: The North Atlantic Saga
www.mnh.si.edu/vikings/start.html
Describes the history of the Vikings and sheds light on their culture.

The Vinland Map: Some "Finer Points" of the Debate
www.econ.ohio-state.edu/jhm/arch/vinland/vinland.htm
Examines the scientific evidence regarding the Vinland Map.

Books

Fitzhugh, William W., ed.
Vikings: The North Atlantic Saga.
Washington DC: National Museum of Natural History, 2000.
Examines the evidence of the Vikings presence in the New World.

Editors of Time-Life Books.
What Life Was Like When Longships Sailed: Vikings AD 800 – 1100
Arlington, VA: Time-Life Books, 1998.
Describes the times and conditions under which the Vikings lived.

McIntosh, Jane.
The Practical Archaeologist: How We Know What We Know About the Past.
New York: Facts on File, 1999.
Provides an understanding of archeology and the work of archeologists.

Extracting Colors

Dyes are often organic colorants that are soluble in water. Inks can be made from natural dyes that come from metals or the outer covering of nuts or seeds. In this activity, you will predict the color of a dye made from plant-based material, extract the color, and research the pigment responsible for the color.

Procedure

1. Your team will work together and use one of the following ingredients—red onion skins, yellow onion skins, blueberries, or blackberries—to make dye. Before beginning, predict the dye's color and record your prediction in the chart.
2. Follow the recipe below for your berry or onion skin type to make your dye. Take the following precautions: Wear goggles. Use potholders or mitts when touching hot pots. Be careful not to spill dyes on your skin or clothing because they stain.
3. Make a chart like the one below on a separate sheet of paper, with areas large enough to record your results. After you have made the dye, record its color and intensity (i.e., blue, very light) in your chart.
4. Use a thin paint brush or sponge piece to test the color of your dye on white construction paper. Record the color results in your chart.
5. Next, research the name of the pigment that is responsible for the color of your dye. Also research the pigment's function for the plant, and the pigment's uses and/or potential benefits for humans. Record this information in your chart.

Extracting Colors Pigment Chart

	Dye Color Prediction	Dye Color in Jar	Color Imparted on Paper	Pigment Name	Function in Plant	Benefit for People
Red Onion						
Yellow Onion						
Blueberry						
Blackberry						

DYE RECIPE

- Boil about 500 ml of water.
- For onions: Add red or yellow onion skin preparations. (For each type of onion skin, place a large handful of onion skins in knee-high nylon stocking. Make a knot in the stocking at top.)
- For berries: Add 1 cup blueberries or blackberries.
- Simmer for 30 minutes.
- Cool, then carefully pour dye through sieve into the spouted measuring cup.
- For onions: Discard nylon sacks and pour dye into jar. Seal jar.
- For berries: One student should hold the cheese cloth over the jar so that the cheese cloth dips inside while another student slowly pours the dye into the jar. The cheese cloth will catch berry particles. Discard berries. Seal jar.