



MUSEUM & SCHOOLS PROGRAM

EDUCATOR GUIDE
Kindergarten-Grade 12

THE ART OF Terroir

April 28 – July 15, 2007



*George Rose, Windmill in the Vineyards of Camelot Highlands Estate,
Santa Maria Bench, Santa Barbara County, 2006*

Museums & Schools program sponsored in part by:

Clover-Stornetta, Kendall-Jackson Winery

and



**FOR MORE INFORMATION ABOUT THE EXHIBITION OR EDUCATION PROGRAMS
PLEASE CONTACT:**

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707-579-1500 x 8 or mcecil@sonomacountymuseum.org

Hours:
Open Wednesday through Sunday 11:00 a.m. to 5:00 p.m.

Admission:
\$5 General Admission
\$2 Students, Seniors, Disabled
Free for children 12 & under
Free for Museum members

The Museum offers free tours to school groups. Please call for more information.

SONOMA COUNTY MUSEUM
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INTRODUCTION – Teacher information

The concept of the French term *terroir* is that the soil, water, and climate of a particular area create distinct flavors and characteristics in wine, coffee and food. The French have long used this concept for wine and coffee production emphasizing the importance of a particular area or region for specific wines or coffees. The United States is now discovering the validity of this concept and using it in the production of wines on our soil. *Terroir* touches upon several important issues of the day – climate (how climate affects growing seasons and climate change), soil (how we use it to grow food, to build things, etc.), and water (water quality, limited resource) emphasizing the connections between the *terroir* and the food we eat and drink.

MAIN GALLERY

THE ART OF *Terroir*

Terroir {ter' • wâr}: French term meaning “sense of place,” or the geography of a local environment that contributes to making a food product.

April 28 to July 15, 2007



George Rose, *Alexander Valley, Sonoma County*

The Art of Terroir is a photographic collection of over sixty color images by Healdsburg photographer George Rose that highlight the “sense of place” of Sonoma County vineyards. Over the last four years, Rose has roamed Kendall-Jackson’s California coastal vineyard estates and captured the seasonal changes in some of the regions most elite, mountain and hillside estate vineyards. The estate vineyards, all owned by Jess Jackson, Sonoma County resident and founder of Kendall-Jackson and his family, provide the “place” that sheds light on what Jackson refers to as “a mystical combination of light, water, air and soil, an all-important ingredient in helping to create world-class wines,” or the French viticultural concept of “terroir.”

The Artist

George Rose, is Vice President of Public Relations at Kendall-Jackson Winery and a former Pulitzer-Prize nominated Los Angeles Times photographer who has captured a long list of public figures and celebrities during his prolific career. For seventeen years he also prowled the sidelines of the San Francisco 49ers and Oakland/Los Angeles Raiders games as a photographer for the National Football League. However, after living in Northern California for several years, nature’s bounty has lured Rose away from the Hollywood limelight.

The Book

This exhibition coincides with the publication of a 110-page book published by San Francisco-based *Chronicle Books* with feature essay by noted wine writer Rod Smith and designed by Jennifer Barry.

Light

The grapevine is an extraordinarily efficient processor of sunlight. Its leaves act as solar panels, and as sunlight falls on them it motivates complex processes throughout the plant. Even the roots, foraging for nutrients in the absolute darkness of earth, feel the sun's life-giving power.

In late spring, the sun's mighty arc takes it far north of the equator, and California days grow longer and longer. This is the time of bud break, of leafing, and of flowering of new fruit. Then the earth comes gradually closer to the sun, and the days get hotter. This is the time of ripening. In late fall, the vines are closest to the great furnace. This is the time of harvest.

Water

Like air, water is colorless and transparent. Yet it can be solid, liquid, or gas. It conforms to its container, be it an ocean or a creek bed. Most importantly, water is restless. It wants to be moving, and where it wants to go is down, making its way over and under the landscape to the lowest place, where it gathers mass and momentum to make its way toward the sea. Even where its progress is halted by a natural basin or man-made dam or one of the subterranean lakes called an aquifer it only swirls and eddies and seeps through fissures and waits patiently until it can rise enough to find a gap and flow toward the ocean.

In these images, we see water as clouds, fog, and snow, and occasionally as glimpses of a shining river. Some of the foods and beverages we consume come from some of that water—filtered through rock and siphoned into plants. This entire process is sublimated into a delicious expression of *terroir*.



George Rose, *Hawkeye Mountain Estate, Sonoma County*

Rock

Our planet is made of stone. Landscapes on the third rock from the sun may be dressed up by foliage and water, but their flesh and bones are rock. While air and water are the moving parts of a grand cyclical machine, their powers and effects renewed at regular intervals as the earth revolves around the sun, rock is imponderably oblivious to seasons. Yet it is alive, and its life is dynamic. Rock is eternally subject to change, broken down by weathering forces such as erosion, leeching, and microbial activity—billions and billions of microscopic organisms whose metabolisms and secretions help break down rock and transform it into soil.

In California's coastal ranges, the soil in the valleys may be deep and rich, a sublime mixture of sand, clay, and organic material that offers a happy home to almost any kind of plant. On the slopes and ridges, however, it's

often just a thin veneer of marine sediment or residual volcanic ash that's still relatively uncompromised, blended with just enough digested plant debris to qualify it as soil.

The camera gives a surprising amount of information about the soil in a given place, and tells us something about the qualities we might expect to find in wines from each specific site. Color is the immediate clue. Each soil type has its own physical properties, such as texture, water-holding capacity, acidity, and mineral balance, which affect the vines and the wines they yield.



George Rose, *Mount St. Helena, from Alexander Valley Vineyards, Sonoma County*

Air *Terroir* is often presented in terms of a watershed, a terrain defined by the outermost sources of water flowing to the same place. Yet air flows and currents also define viticultural areas. Like water, air is restless.

Air is ambient temperature, and ambient temperature regulates the ripening process to a great degree. Because there are no limits to how

hot or cold air can be, it can damage fruit and vine. Very hot air can cook the fruit and stress the vine; frost can literally nip an entire crop in the bud. That's why vineyards thrive only in temperate latitudes, or in cool places within warm zones and warm places within cool zones. Wind keeps fruit and foliage dry.

Fog is the ocean's ghost, a separate sea that rises from the water to migrate inland and haunt the former sea floor that's been uplifted to form the coastal mountains. An image of Knights Valley shows cold, wet air from the sea engulfing a forest of giant Douglas firs. Another shows ridgetop trees and vineyards standing like islands in a sea of fog.

One striking image captures the ominous arrival of a massive winter storm in the Russian River Valley, where the emerald vineyards and glistening river bask in the last sunshine before the wind and rain revitalize the terrain and replenish the groundwater in the interval between growing seasons. Though miles from the Pacific Ocean, its power impacts the coastal wine regions.

Cultivation

Terroir isn't *terroir* until it's actualized: The human influence starts with the decision to plant a vineyard, and continues through all the countless choices that influence how the vines grow and what kind of wines they produce. Astute viewers of these images will note details like row orientation, vine spacing, trellis configuration, pruning style, and many other aspects of cultivation.

The payoff of careful cultivation is uniformly dark-hued grapes, handpicked from compact, meticulously pruned vines. In this world of respect for the culture of wine, even the by-product of the harvest is treasured: A close-up of a double handful of grape compost, made from the pressed seeds and skins of vintages past, speaks volumes about the grower's philosophy. Planting a vineyard, nurturing the vines, picking the grapes at just the right time and turning them into wine that conveys a sense of place—this is the true art of *terroir*.

And there are images here of a cataclysmic event that shows another side of the nature of California wine country. It's debatable whether the smoke and falling ash from a vast brush and forest fire directly affect wine character, and yet the very fact that such fires are not uncommon here has everything to do with the nature of California wine country. Vines shrouded in smoke, with a dimmed sun glaring balefully through the haze, give a sense that this landscape, formed by earthquakes and volcanoes and floods in the distant past, still has a touch of the apocalypse in its nature.



George Rose, *Chuck Berry, Hollywood, 1980*, black & white photograph

George Rose

During a prolific 17-year career as a photojournalist in Los Angeles in the '70s and '80s, Rose developed a truly stunning body of photographic work focused on popular culture, including rock 'n' roll, entertainment and sports icons.

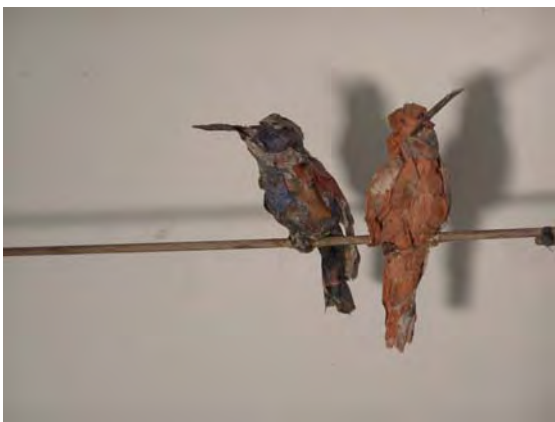
In the 1970s, Rose was staff photographer for six years at the Los Angeles Times. His independent assignments, focused primarily on the entertainment industry, have been published in *USA Today*, *Time*, *Newsweek* and *Rolling Stone*. From 1982 to 1996 he prowled the sidelines of the San Francisco 49ers and Oakland/Los Angeles Raiders games as a photographer for the National Football League.

Rose is a recipient of a 1987 World Press Photo Award for news, and was named California

"Newspaper Photographer of the Year" in 1976 by the University of Missouri, School of Journalism. He was twice nominated for a Pulitzer Prize by the Los Angeles Times.

All of his images can be found on the Getty Images website.

CONTEMPORARY PROJECT SPACE RENÉE CARRIERE: *Momentary Perch* April 28 to July 15



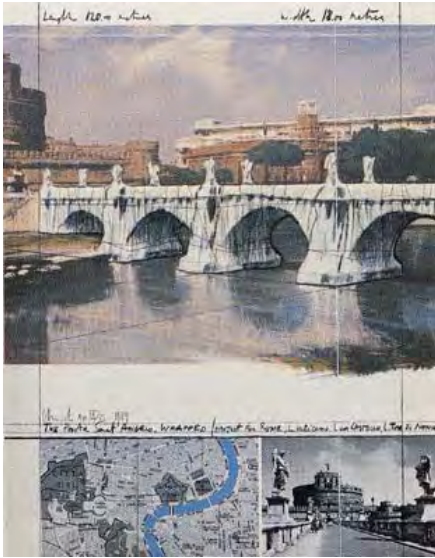
Sonoma County artist Renée Carriere presents an evocative installation of papier maché birds made from shreds of *The Press Democrat* (Santa Rosa, CA) newspaper. Carriere delicately sculpts layers of torn newspaper, using only a thin paste to shape vulnerable forms of fleeting nature. The colors in her work derive directly from the colored ads randomly present in newspaper print and appear like painted signature avian markings. It is not, however, the particular species of bird that is of much concern to Carriere. It is her ability to communicate aliveness through impermanent materiality that is her fascination and inspiration.

Carriere is represented by Triangle Gallery in San Francisco
www.triangle-sf.com

WEST GALLERY

Christo and Jeanne-Claude

The Sonoma County Museum is home to one of the largest collections in the nation of works by environmental artists Christo and Jeanne-Claude. The collection was donated to the Museum in 2001 by local art collector Tom Golden who spent several years working closely with the artists' to help realize many of the their epic projects. Rotations from the Tom Golden Collection will be displayed on an ongoing basis. Themes of the land, wrapped architecture, objects wrapped and unwrapped, and the artists' process will be assembled concurrently. Acquiring the Tom Golden Collection has been one of the primary inspirations for the Museum's programmatic focus of Where Land Meets Art.



Christo and Jeanne-Claude,
Wrapped Ponte S. Angelo, Rome

architectural

Christo and Jeanne-Claude have wrapped buildings and bridges and have surrounded islands with fabric, as well as created other, more traditional sculptures. This suite of selected works from the Tom Golden Collection, entitled *Architectural*, features the wrapped buildings, bridges, and monuments, most of which were conceived of over forty years ago and realized in the last twenty-five years.

These environmental artworks are the product of years of inspiration and planning, and of working with public officials, landowners, and engineers; preparing environmental impact reports; attending community meetings; and obtaining special permits. The artworks, or the “hardware,” are temporary. The preparatory works, or “software,” and the photo documentation are what remain after the art installation is removed. Included in *Architectural* are drawings, collages, prints, and photographs.

MEZZANINE GALLERY

Sonoma County and a community of Artists: Selections from the Permanent Collection

Sonoma County has long served as a refuge for artists, visionaries and utopian dreamers. When considering the artists of the Bohemian Club and their Russian River encampment established in the 1880s, or this area's “back-to-the-land” communities of the 1960s, it is clear that Sonoma County holds a certain, undeniable attraction. Among other things, the appeal of this place is connected to the region's natural beauty and diversity, as well as its geographic location—close to San Francisco, but far enough away to be outside the direct influence of the city.

In the mid-twentieth century, Sonoma County attracted a small but superlative community of artists and craftsmen. While each of them moved here for different reasons--some fairly mundane-- the influence of the sweeping changes of the 1930s, '40s and '50s can still be seen in many of their stories. Thus from the tumult of the mid-twentieth century, including economic depression, world war, and the McCarthy era, Sonoma County

reaped a distinct community of artists who left an important legacy, connecting Sonoma County to a wider world of art.



Carroll Barnes (at left)

Sculptor Carroll Barnes attended the renowned art school, Cranbrook Academy, in Michigan beginning in 1940. He was influenced by the faculty which included Walter Gropius, the founder of the Bauhaus, and Charles Eames. Though he did not move to Sonoma County until 1970, he was an important, mid-twentieth century artist.

Harry Dixon

Harry Dixon, a renowned metal worker from San Francisco, came to Sonoma County in 1953 and taught classes at Pond Farm with Marguerite Wildenhain. He took up permanent residence in Santa Rosa.

Dixon was the brother of famous western painter Maynard Dixon, who was married to photographer Dorothea Lange. Dixon's presence linked Sonoma County to the heart of the arts and crafts movement and to his well-known relatives. Dixon's wife Florence became an accomplished artist as well.

Hansel Mieth and Otto Hagel

Photographers Hansel Mieth and Otto Hagel arrived in Sonoma County in 1941 after years of chronicling the struggles of the Depression and organized labor. After living in New York and working for Life Magazine during the Depression and war years, Sonoma County offered a new life for the couple. They bought a ranch near Mark West Springs.

Hassel Smith (at right)

Painter Hassel Smith, one of the well-known abstract expressionist painters from San Francisco, came to Sonoma County after turmoil at the California School of Fine Arts where he taught inspired him to move from the city. Some of the upheaval among the arts community in San Francisco evolved out of the McCarthy era and the fear of Communism. Many artists left the city during this period. In 1951 Smith moved to Sebastopol, where he spent some of the most important years of his career.



Marguerite Wildenhain (at left)

The rise of Nazism created a diaspora of European artists, particularly those of Jewish ancestry. Hundreds of artists made their way to the United States in the wake of Nazi aggression, including Marguerite Wildenhain. Many European artists came to the United States and gravitated to places of artistic learning—including Pond Farm near Guerneville. The original corps of artists and teachers at Pond Farm included Gordon Herr, Victor Ries, Trude Guermonprez, and Frans and Marguerite Wildenhain. With the exception of Herr, all of them had been displaced by the rise of Nazism in Europe.

IN GALLERY QUESTIONS

Terroir: (ter'whor) French term meaning "sense of place," or the geography of a local environment that contributes to making a food product.

The Art of Terroir (Main Gallery)

George Rose

1. These photographs chronicle Sonoma County's wine grape region through the seasons. In these photographs identify the following seasons: Winter, Spring, Summer, and Fall.
2. What types of geography are seen in these photographs? Can you name at least three?
3. How many forms of water can you see? Can you name or describe the three states of water?
4. Photography is fairly young in the art world having been invented in the 1830's, while painting and sculpture have been around for thousands of years. This type of art is called landscape photography. Hundreds of years ago landscape paintings were very popular. Today landscape photographs are more common. Have a discussion about different forms of art and the ways that technology has changed existed art or formed new types of art.

Momentary Perch (Contemporary Project Space)

Renee Carriere

1. When you enter the room ask students "What do you see?"
2. Without looking at the wall labels what material do you think these works are made of?

Architectural (West Gallery, upstairs)

Christo & Jeanne-Claude

1. These artworks are very large pieces that are temporary, that is they can take many years to create but are only on display for as little as a few weeks then the whole is taken down again and only photographs and sketches remain. If you could make an artwork like these what would it be?

History Gallery (East Gallery, upstairs)

1. An artifact is an object that tells a story about the past and helps us understand how people lived. Find an artifact and write down what you think it was used for. Later you can research the object and find out its official use(s).
2. Choose an artist who came to Sonoma County and think of the major national or world events that were happening at the time. Why do you think people chose to come here?

SAMPLE ACTIVITIES

Grade 2 (these lessons can be adjusted to be appropriate for all age levels)

The attached lesson plans are from *A Child's Place in the Environment* Series courtesy of Olga Clymire. The entire series and individual units are available for purchase, see below for more information.

UNIT 2, LESSON 3

What Is Soil?

In this lesson students identify the components of soil. Students will also understand that soil is made up of living and non-living things.

Content Standards Grade 2

Science

3c – understand soil's composition.

4c – Compare, sort objects physically.

4d – Describe steps, sequence of events, observations.

English – Language Arts

Reading

1.2 – Apply knowledge of syllabication when reading.

1.6 – Read aloud fluently, accurately.

2.7 – Interpret diagrams, charts, graphs.

3.4 – identify rhythm, rhyme, alliteration in poetry

Writing

1.4 – Revise to improve text.

2.1 – Write narratives based on experiences.

Listening and Speaking

1.4 Give, follow three-and four-step oral directions.

1.6 Speak clearly at right pace.

UNIT 2, LESSON 8

How Do Plants Depend on Soil?

In this lesson students will examine some of the ways plants depend on soil. Students will also understand that soil supports life, and life enriches soil.

Content Standards Grade 2

Science

2e – External factors affect plant germination, growth.

3c – Understand soil's composition.

4a – Make predictions based on observations.

4b – Measure and express findings in standard, metric systems.

4d – Describe steps, sequence of events, observations.

4e – Construct bar graphs to record data.

4g – Follow verbal instructions for scientific investigation.

English – Language Arts

Reading

2.7 – Interpret diagrams, charts, graphs.

Writing

1.4 – Revise to improve text.

2.1 – Write narratives based on experiences

Listening and Speaking

1.4 – Give, follow three-and four-step oral directions.

1.6 – Speak clearly at right pace.

1.9 – Report with supportive facts, details.

UNIT 2, LESSON 12

In What Ways Do People Depend on Soil?

In this lesson students examine other ways that people depend on soil.

Content Standards Grade 2

Science

Know that people use resources from soil.

English – Language Arts

Writing

1.1 – Group ideas; maintain focus.

1.4 – Revise to improve text.

Listening and Speaking

1.9 – Report with supportive facts, details.

A Child's Place in the Environment curriculum

California Department of Education

TO PURCHASE:

A Child's Place in the Environment Series

All 6 units for \$120 (normally \$320) including tax & shipping through June 30, 2007

Or 1 unit for \$25 including tax & shipping

Student pages in Spanish are available; each teacher may receive up to 10 copies for free (\$2.00 each after that).

Send a check or PO payable to:

Olga Clymire

Lake County Office of Education (LCOE)

1152 South Main St.

Lakeport, CA 95453

VISUAL ARTS

2.0 Creative Expression

Creating Performing, and Participating in the Visual Arts

Students apply artistic processes and skills, using a variety of media to communicate meaning and intent in original works of art.

Skills, Processes, Materials, and Tools

Grade One

2.3 Demonstrate beginning skill in the manipulation and use of sculptural materials (clay, paper, and papier mâché) to create form and texture in works of art.

Grade Three

2.2 Mix and apply tempera paints to create tints, shades, and neutral colors.

Grade Seven

2.3 Develop skills in using mixed media while guided by a selected principle of design.

Grade Eight

2.2 Design and create maquettes for three-dimensional sculptures.

Grades Nine

Through Twelve – Advanced

2.1 Create original works of art of increasing complexity and skill in a variety of media that reflect their feelings and points of view.

SAMPLE ACTIVITY

Getting started with Papier Mâché

By Jackie hall (adapted from The Papier Mâché Resource, <http://www.papiermache.co.uk>)

Materials

- Paper (newsprint is ideal – torn into 4” wide strips, torn with the grain)
- Adhesive (make in advance, recipes included)
- Paintbrush
- Plastic table covering
- Paints (water based acrylic are great)
- Balloons (one for each student)

Papier mâché recipes for adhesive

Flour and water glue:

1. Boil 5 cups of water in a saucepan.
2. In a bowl, mix 1/4 cup of sieved flour with a cup of cold water. Mix to a smooth consistency (a bit like making custard). When completely free of lumps, add the mixture to the water in the saucepan. Gently boil, stirring constantly for two or three minutes until the mixture thickens.
3. Allow to cool before using.
4. This will make a runny glue. If you prefer a very thick glue (or if you are in a hurry for it to dry) use this recipe instead:

Thick flour and water glue:

Use 1 whole cup of flour to three cups of water. Make using the same method as above.

White glue

Slightly water down the glue in a bowl and use straight away.

Layered papier mâché activity

1. Paste the strips of paper both sides with a paintbrush.
2. Place your strips one at a time over the inflated balloon and smooth down to remove air bubbles.
3. Cover with two to three layers at a time. Don't put too many on at once or it will take too long to dry. More advanced students can create an armature of paper, cardboard, etc. to create more varied forms.
4. When it is completely dry, you can gradually build up as many layers as you require until you have the required thickness.
5. To add features such as rims, handles or decoration, stick pieces of cardboard onto the model with masking tape. Cover the whole object in more papier mâché.
6. When completely dry, paint with two coats of emulsion paint to seal it and kill the newsprint. You could also use gesso for a slightly tougher base.
7. Paint your papier mâché artwork.

VOCABULARY

Armature – in sculpture this is a framework around which the sculpture is built. This framework provides structure and stability, especially when a plastic material such as wax or clay is being used as the medium. When sculpting the human figure, the armature is analogous to the major skeleton and has essentially the same purpose: to hold the body erect.

Climate – the average course or condition of the weather at a place usually over a period of years as exhibited by temperature, wind velocity, and precipitation.

Cultivate – to prepare or prepare and use for the raising of crops; *also* : to loosen or break up the soil about (growing plants).

Elements of art – Sensory components used to create works of art: line, color, shape/form, texture, value, space.

Erode – to wear away by the action of water, wind, or glacial ice; erosion

Leech – to drain the substance of: exhaust.

Maquette – a small preliminary model (as of a sculpture or a building).

Media – plural of *medium*, referring to materials used to make art; categories of art (e.g., painting, sculpture, film).

Mixed media – A work of art for which more than one type of art material is used to create the finished piece.

Papier Mâché – a light strong molding material of wastepaper pulped with glue and other additives.

Plant – **a** : a young tree, vine, shrub, or herb planted or suitable for planting **b** : any of a kingdom (Plantae) of multicellular eukaryotic mostly photosynthetic organisms typically lacking locomotive movement or obvious nervous or sensory organs and possessing cellulose cell walls.

Season – a period of the year characterized by or associated with a particular activity or phenomenon as a period associated with some phase or activity of agriculture (as growth or harvesting).

Soil – the upper layer of earth that may be dug or plowed and in which plants grow.

Terroir – a French term meaning “sense of place,” or the geography of a local environment that contributes to making a food product.

Water – the liquid that descends from the clouds as rain, forms streams, lakes, and seas, and is a major constituent of all living matter and that when pure is an odorless, tasteless, very slightly compressible liquid oxide of hydrogen H₂O which appears bluish in thick layers, freezes at 0° C and boils at 100° C, has a maximum density at 4° C and a high specific heat, is feebly ionized to hydrogen and hydroxyl ions, and is a poor conductor of electricity and a good solvent.

Weather – to expose to the open air: subject to the action of the elements.

RESOURCES

Written

Alt, David and Donald W. Hyndman. Roadside Geology of Northern and Central California. Missoula, MT: Mountain Press Publishing Co., 2000.

Fellman, Jerome; Arthur Getis and Judith Getis. Human Geography: Landscapes and Human Activities. McGraw-Hill, 2005.

Knowlton, Jack and Harriett Barton. Geography from A to Z. Harper Trophy, 1997.

Parsons, Jayne. Geography of the World. DK Childrens, 2006.

Pitman, Ruth. Roadside History of California. Missoula, MT: Mountain Press Publishing Co., 1995.

Sawyer, John. Northwest California: A Natural History. Berkeley, CA: University of California Press, 2006.

Smith, Rod; Jess Jackson and George Rose. The Art of Terroir: A Portrait of California Vineyards. San Francisco: Chronicle Books LLC, 2007.

Web

<http://www.papiermache.co.uk/> Papier Mache, with information and activities.

<http://www.terrywrightgeology.com/terroirs.html> Information on *terroirs* in general and Sonoma County in particular.

http://en.wikipedia.org/wiki/Sonoma_County,_California Wikipedia online encyclopedia – link to Sonoma County section, includes geography of the county with images & maps.

<http://www.kj.com> Kendall-Jackson's official website, under *Learn* find information on terminology, history, varietals, vineyards and more.

<http://www.yea-art.com/> YEA! Young Exhibiting Artists! A Sonoma County arts program created by artist Lisa Fredenthal-Lee to assist students in creating and exhibiting art.

<http://www.dontthrowthataway.com> Don't Throw That Away, a television show on using recycled objects to create art with students; some segments focus on papier mâché; produced by Lisa Fredenthal-Lee.

<http://www.georgerose.com> George Rose's official website, view some of his celebrity photographs

<http://www.gettyimages.com>

INTRODUCTION TO GEOLOGY FOR ORDINARY FOLKS

The study of rocks, earthquakes, volcanoes and mountains goes back to the Egyptians and Greeks. Pliny the elder, a Roman naturalist, succumbed in 79AD during an explosion of Vesuvius because he was a curious student of volcanoes. The first geologists thought that volcanoes erupted from "subterranean fires" from within the earth. They observed coal beds which burned underground as evidence. It was not until the late 18th century that James Hutton, a geologist from Edinburgh, saw veins of granite baking and cutting across layers of sedimentary rock. He convinced the world that melting could occur deep in the earth and melted rock would later cool to form crystalline rock. During the same period, Etienne Guettard and Nicolas Desmarest described volcanoes in Auvergne in France and proved the connection between the crystalline rock we call igneous ("fire-born") and volcanoes. James Hutton also set the main ground rules for modern geology. In 1783 he stated the principle of Uniformitarianism: "the present is the key to the past". This meant that we could study present geologic processes and assume that they were active in the past, millions of years ago. We can look at the explosion of Mount Saint Helens and see a duplicate of the process that formed the Petrified Forest of Sonoma County long ago. The trees felled by the blast from Mount Saint Helens were also blown over in the direction of flow and peppered with high-silica ash. We see the same relationship today at the Petrified Forest. Geology sets the stage for understanding what formed the rocks and landscape of Sonoma County so let's take a minute to understand the language of geology. Bear in mind that for most of you, this will be like learning a new language, culture and way of thinking. The knowledge will help you understand rocks around you and introduce you to some of the most fascinating new ideas in science today.

GEOLOGY-THE STUDY OF OUR DYNAMIC EARTH

The Rock Cycle

Geology consists of crystals, rocks, structures and processes. The relationship among all of these aspects of geology is demonstrated simply by the rock cycle. The earth is a dynamic, ever-moving being, with something happening all the time. The cycle can start anywhere, but for our purpose let us start with magma, molten rock formed deep in the earth by heat from decay of radioactive elements. Molten rock is less dense and more mobile than its surroundings, so it pushes upward towards the earth's surface. When magma reaches the more shallow and cool depths 5-10 miles (8-12 km) atoms are attracted to each other and build 3-dimensional snugly fitting structures that become crystals or minerals. When magma forms minerals, it becomes igneous rock which forms under the surface as plutonic rock or on the surface as volcanic rock. Magma on the surface cools quickly, so the crystals are tiny or even glass as in obsidian. Plate I has pictures of typical rocks from Sonoma County. Magma may flow across the surface as lava, commonly trapping gas seen as round holes in dark rocks of the Sonoma Mountains. Magma may also explode from a volcano forming rocks made of fragments: ash or tuff is made of tiny fragments. The fine-grained white rocks around the Petrified Forest trees are ash or tuff that fell from the air after a nearby volcanic explosion. Welded tuff is a hard rock formed by ash clouds which sweep down the sides of volcanoes and are welded by hot glass. This resistant rock forms the heights of Mount Saint Helena, exploded from a volcano 2 million years ago. Plutonic rock cools slowly deep within the earth so the crystals are larger. Salt and pepper textured granite and diorite are typical rock types on Bodega Head, west of the San Andreas Fault. Rock at the surface is exposed to the weather, and can break down into solid fragments or be dissolved or changed by weak acid in water. Light colored sand on the beach at Bodega Head comes from the minerals in the granite bedrock loosened by the weather and blasted by storm waves. Rain, running water, wind, glaciers and landslides can move solid and dissolved pieces of rock down slope to be deposited in the ocean, in lakes or rivers and in sand dunes. These surface processes commonly form layers of loose sediment which become solid sedimentary rock. Quartz-rich, light colored sandstone forms on beaches and shallow seas. Dark Graywacke sandstone forms in the deep ocean from rapid erosion and dense "turbidity currents" that flow down the continental slope at freeway speeds. Limestone forms in shallow warm oceans near the equator. Chert forms in the deep ocean by "blooms" of microscopic silica-bodied animals. Shale forms from mud deposited far offshore. Rock may get buried under other layers of rock and forced deeper into the earth with increasing temperature and pressure.

This makes rock weak. If a vice-like directed pressure is applied to layers, they can bend in folds or break along fault surfaces. These are called geologic structures, the underlying form of mountain ranges, built by the process of orogeny. Sudden movements along faults cause earthquakes like the one that devastated San Francisco and Santa Rosa in 1906. As rock becomes buried deeper in the earth, crystals adjust to high heat and pressure and change into different forms. The changed rock from this process is called metamorphic rock. Directed pressures will cause flat, platy mica minerals to become parallel. This forms a flat plane of splitting in the rock called foliation. Blueschist has this rock structure formed by high pressure, but relatively low temperature. Iron-rich rock from deep in the earth can be changed by addition of hot fluids to form slick, green serpentine, the California State Rock. Deeper burial and higher temperatures will eventually melt rock. The cycle returns to magma. Rocks can take short-cuts in the cycle also. Igneous rock can become changed directly by directed pressure and burial to become metamorphic rock. Uplift of the land and erosion of deeply buried rocks can cause metamorphic rocks to directly change into sedimentary rocks. This same uplift can cause sedimentary rocks to become recycled. During the process of uplift and erosion, mountains can be built as we can see in the Coast Ranges today. If younger rocks are laid down over older eroded rocks, a discordant surface forms in between called an unconformity. This is a gap in the geologic record. This feature was interpreted by James Hutton as proof that the earth is a dynamic being, actively being uplifted and eroded and changed by the rock cycle.

Geologic Time

The geologic clock ticks slowly; we talk about geologic events in terms of millions of years. We tell geologic time by studying the slow natural radioactive breakdown of elements such as uranium in rocks. We know the rate of decay from uranium to lead, so when we can determine relative amounts of these elements in a rock, we are able to determine its absolute age. When we consider the increasing pace of everyday life, with computers and instruments doing thousands of tasks in milliseconds, a million years is a strange concept. We can compare geologic time to our lifetime. If we live to the ripe old age of 100 years, we can compare our life's clock to the clock of the earth which has now been ticking for about 4.6 billion years. The result of this calculation is that one million years of the earth's life is equal to about one week of our life if we set these clocks equal. In an average week, not much happens, and so with the earth; a million years is an average week in the history of the earth. Ten weeks, or ten million years, is time enough for major events to happen in your life, and for the earth that is enough time to go through the rock cycle, or to build a mountain range. The oldest rocks on earth are 4,000 million years old and the first complex forms of life were preserved 570 million years ago. The modern Sierra Nevada uplifted during the last 9 million years, and the volcanoes that formed the Petrified Forest and Mount Saint Helena had violent explosions of ash which leveled a forest about 3.4 million years ago, or just a few weeks ago in the age of the earth on our time scale.

Plate Tectonics and Mountain Building

What drives all of the processes of the rock cycle? A revolutionary new theory called "plate tectonics" is the current explanation. This idea has its roots in the old concept of continental drift, which used the jigsaw fit of South America and Africa, as well as similarities in rocks and fossils on either side of the Atlantic Ocean as evidence that the continents had once been together and have since drifted apart. Plate Tectonic theory treats the surface of the earth as a series of gigantic slabs, or "plates" about 60 miles (100km) thick, that include ocean basins and continents. In California we are on the western edge of the North American plate, which stretches across the continent to the middle of the Atlantic Ocean. To the west, the Pacific Ocean plate stretches to Japan. The San Andreas Fault runs along our coastline and separates these two plates. The 1906 earthquake and continuing earthquakes are evidence of horizontal movement between plates. This is one kind of plate boundary which we call a transform fault. Plates are created by active formation of igneous rock at mid-ocean ridges in a process called sea-floor spreading. The volcanoes of Iceland sit on top of a continuous chain of mountains called the Mid-Atlantic ridge. The ridge is the seam that split the ancient continents to form the Atlantic Ocean 180 million years ago. Ocean rock forms by cooling magma and moves symmetrically away from the ridge. The oldest ocean rocks are closest to the continents and the youngest are at the ridge. The African and South American continents ride like rafts on the spreading ocean floor and are still moving

apart at about 1.2 inches per year (3 cm per year). Hawaiian volcanoes form as the Pacific plate moves over a stationary "hot spot" deep in the earth. All oceanic volcanoes have relatively quiet eruptions because the magma is low in silica and therefore is fluid. Where plates meet and move toward each other, something has to give, so one plate usually slides under the other in a process called subduction. Ocean floor is dense so it slides under the edge of an adjacent continent. This process is called subduction. Subduction forms a broad fault zone with many sheared fragments of ocean floor rock forming a mixture we call *mélange*. The faults are like a Cuisinart, cutting up and mixing different vegetables. Cool, descending crust acts like a heat sink, so conditions of high pressure but fairly low temperature prevail, forming odd metamorphic minerals. Subduction pushes rock deeply into the hot regions of the earth which melts to form magma. This results in an arc-like chain of volcanoes on the surface. This magma is rich in silica and forms sticky magma with explosive volcanoes such as Mount Saint Helens and the ancient volcanoes that exploded to form the Petrified Forest. Many older parts of the California Coast Ranges are *mélange*, and include large areas of unusual rocks that may have traveled long distances on the ocean floor. The ancient magnetism of a limestone in Laytonville tells us that it formed at 17 degrees south of the equator and traveled north on the moving ocean floor to the coast of California. We call these strange rocks "terranes"; some of which are exotic and came from far to the south and west. We think that these are orphan fragments of foreign continents, ocean floor, volcanic arcs and other rocks which travel on the ocean floor and eventually become accreted or stuck in the subduction zone. Mountain-building (Orogeny) and continents are built by the process of collision by accretion, or adding on of terranes swept into subduction zones by the ocean floor.

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OVERVIEW OF SONOMA COUNTY GEOLOGY

Geologically, Sonoma County is bisected by the San Andreas Fault. To the west on the tip of Bodega Head are ancient continental rocks formed far to the south and moved north at least 335 miles by the fault. To the east of the fault lies the Franciscan Complex; oceanic rocks mixed by faulting as ocean floor slid east under the edge of the continent. Both areas are covered by a thin mantle of more recent rocks formed in shallow seas, beaches, volcanoes and rivers. Recent sharp uplift and ongoing river erosion has sculptured the scenery.

We can see a side view of these rocks in the figure above. Different symbols and patterns show the relationships among rock units and faults. This diagram is reference point for virtual field trips accessed by links below. These pages are a distillation of information from my various [classes and field trips](#) on Sonoma County Geology.

West of the San Andreas Fault. Bedrock west of the fault is beautifully exposed on the ocean side of [Bodega Head](#) at Windmill Beach. The salt and pepper texture Bodega Head Diorite (100 million years) intruded as molten rock. It contains dark patches which are the remains of ancient layered rocks ripped off by the diorite as it pushed its way toward the surface, called the Sur Series. These rocks are laced by pink stripes of coarse grained granite pegmatite and aplite dikes. Faults offset the stripes, relatives of the San Andreas Fault. Orange layered sands overlie the diorite, and modern quartz-rich sand eroded from the granite forms the beach. We call this sequence "Salinia" because similar rocks form the Santa Cruz and northern Big Sur mountains near Salinas.

East of the San Andreas Fault. Bedrock east of the San Andreas Fault is mixed up bunch of rocks called the Franciscan Complex (140-42 million years). Its parts formed on the ocean floor far from here and accumulated in an oceanic trench. These rocks then mixed together by faults as the ocean floor slid under the continent. Some rocks were faulted deep into the earth where they were effected by high pressure, but fairly low temperatures, giving rise to blueschist. The California state rock, serpentine is also typical. Magnificent examples of these rocks are exposed at [Shell Beach](#) on the Sonoma County coast south of Jenner.

Geologic History **with ages in million years (my)**

Our landscape is created by opposing forces: constant uplift from pressure caused by the grinding of tectonic plates along the San Andreas fault: and continuous erosion by rivers, landslides and humans.

West of the San Andreas fault, the Sur series formed as ancient sedimentary layers which were changed by heat and pressure (250 my). Molten rock then cooled deep below to form speckled Diorite and white bands of coarse granite seen at Bodega Head

(100 my) . The San Andreas Fault moved the Sur series and underlying Diorite at least 320 miles north relative to the mainland during the last 29 million years.

After uplift and erosion of 5 miles of overlying rocks, sand and gravel accumulated on a beach and became Marine Terrace deposits (40,000 years). These ancient beaches are being uplifted and eroded today along the coast. Look for Native American white shell middens in dark organic soil above the sands at Bodega Head. Alluvium is sand and gravel forming today in river valleys and on beaches.

East of the San Andreas Fault, the Franciscan Complex is a faulted mixture of ocean crust rocks (140-42 my). Its contents formed on the ocean floor, some many thousands of miles southwest from here. They mixed along faults and stuck to the continental edge as the ocean floor slid down under western North America, visible at Shell Beach on the coast. After 30 my of uplift and erosion, the Petaluma Formation formed from sedimentation in a shallow sea (10my). After more uplift, tilting and erosion, the Sonoma Volcanics resulted from erupting lava and ash (3-8 my). The Wilson Grove Formation of sands and fossil shells formed in a shallow sea to the west of the volcanoes (3-5 my). With yet more uplift and erosion, the Russian River cut its path across rising mountains to the sea. Glen Ellen gravel, sand and clay formed in local valleys (1my). Alluvium is the eroded sand and gravel that washes into the river valleys and up onto the beaches of Sonoma County , part of the ongoing dynamics of geologic change.

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WINEMAKING TIMELINE

~ 1800's ~

1812 -- Russian Colonists planted grapes at Fort Ross (Sonoma Coast.)

1823 -- Spanish Franciscan Father Jose Altamira (Sonoma Mission) planted several thousand vines.

1845 -- Bear Flag Revolt in Sonoma, California becomes independent.

1855 -- The Hungarian Count Agoston Haraszthy "The father of California Wine Industry" founded Buena Vista winery in Sonoma Valley.

1856 -- Cyrus Alexander plants grapes in northern Sonoma County.

1873 -- Worldwide outbreak of phylloxera.

~ 1920-30's ~

1920 -- There were 256 wineries. With more than 22,000 acres (8,900 ha) in production, Sonoma County had surpassed Los Angeles.

1920-33 -- 18th Amendment launches Prohibition. Home winemaking booms. 200 gallons (757 liters) per household are allowed. California produces 150 million gallons (567 million liters) of home wine. Acreage grows to over 30,000 acres (12,000 ha) in grape production.

1933 -- Repeal of Prohibition. Only 160 of California's 700 wineries remained. Under 50 wineries in Sonoma County survive.

~ Recent Years ~

1960's -- Acreage down to 12,000 acres (4,900 ha). Bulk wines are produced from Central Valley grapes. A second generation of wineries begin following a nationwide wine boom. Consumption grows at a 40% rate.

1975 -- Wine labels are regulated and appellations begin to be important in marketing Sonoma County's wines. Planted acreage grows back to 24,000 acres (9,700 ha.)

1999 -- Over 49,000 acres (19,800 ha) of vineyards owned by more than 750 growers and 180 bonded wineries.

HISTORY OVERVIEW

Few districts have more of the character of old California than Sonoma County, and grapes and wine have been integral to its history. As early as 1812, Russian colonists planted and cultivated grapes at Ft. Ross on the Coast. But it was the Spanish Franciscan Fathers who laid the foundation for our wine industry in 1823 when Padre Jose Altamera planted several thousand grape vines at their northernmost mission, San Francisco Solano in Sonoma.

In 1834, political upheaval brought an appropriation of all missions by the Mexican government. During this period of disarray, cuttings from the Sonoma Mission vineyards were carried throughout the northern California area to start new vineyards.

By the time of the "Bear Flag Revolt" and the subsequent annexation of California by the United States in 1854, the vineyards of General Mariano Vallejo, the military Governor of Mexican California, were producing an annual income of \$20,000. Other areas in the county were developing at this time: Rocky Mountain trapper Cyrus

Alexander in northern Sonoma first planted grapes in what would become Alexander Valley; the county's first "feminine vineyardist", Senora Maria de Carrillo, had 2,000 vines in what would be Santa Rosa; Captain Nicholas Carrigan, probably the first American settler, had vineyards in the Valley of the Moon, and later in 1852, his neighbor William Hill, planted the first non-mission grapes in the county.

All of this viticulture activity took place prior to the arrival in 1855 of the man considered "The Father of California Wine Industry", Count Agoston Haraszthy. The Hungarian Count purchased the Salvador Vallejo vineyard in Sonoma Valley, renamed it Buena Vista, and soon was producing fine wines from the vineyard. In 1861 he was commissioned, but never paid, by the California legislature to study viticulture in Europe. He returned to Sonoma County the following year with over 100,000 cuttings of prized grape varieties from France, Italy and Spain. Haraszthy is credited with first promoting the concept that fine table wines could be produced in Sonoma County as well as Europe.

Today, in Sonoma County approximately 190,000 tons of grapes are produced on nearly 65,000 acres of vineyards. There are over 250 wineries, over half less than 20 years old. And, as it was over 150 years ago, small, family-owned wineries continue to exist comfortably alongside larger entities, each producing premium wine in its own unique style.

From Sonoma County Vintners website

http://www.sonomawine.com/index.php?option=com_content&task=view&id=50