

Clay Fun(damentals) I

What is Clay? A Geology Lesson

Clay is simply granite rock that has been ground and weathered into very small particles. It is composed of *silica* and *alumina*, just like granite rocks, sand and even glass. What makes clay so different, and in fact, so unique, is that it has been worn into such tiny particles. Each particle is a tiny crystalline structure that has a characteristic plate-like shape.

The other ingredient of clay is water. We take water for granted; but it actually has unique characteristics that set it apart from other liquids. One of these is *polarity*; each water molecule is like a tiny magnet. Each molecule is attracted to the molecules around it and this attraction causes a thin “skin” to form on the surface of the water. This attraction is called *surface tension*.

Now let's put the clay and water together. Picture a stack of plate glass. Each piece of glass is smooth and flat and not unlike a giant clay crystal. Kept dry, it is easy enough to lift a piece of glass off the stack. However, picture those pieces of glass wet. The pieces stick together; they are difficult to lift from one another, but they will slide. The surface tension of the water is holding the plates together. Because of this, considerable water can be added to the clay without the clay particles separating from the water as they would if the water were added to sand. This large quantity of trapped water and the ability of the clay crystals to slide freely but resist removal give clay the unique characteristic of *plasticity*. Plasticity refers to the ability of a substance to be bent and modeled without collapsing or cracking apart.

A popular experiment with surface tension is to add a compound to water that will interfere with the attraction of the water molecules and surface tension. These compounds are called *surfactants*. Soap and detergent are popular surfactants. A surfactant added to clay will produce dramatic results; the clay will liquefy and become the consistency of heavy cream. Liquefied clay is called *slip*. The surfactant added is often sodium silicate. Clay that has been liquefied through the disruption of polarity is called *deflocculated* clay and is sometimes called casting slip. Casting slip has the same amount of water as plastic clay but can be poured into a mold. Vinegar also has a mild deflocculating action on clay, and is often used to join moist clay together.

When clay is dried, some of the water leaves the clay and it becomes harder. It is still chalky and easily broken. If it is placed in water, it will soften and return to its plastic state. Clay shrinks as it dries.

The dry clay must be *fired* in a *kiln* in order to become the finished clay piece we are so familiar with. When clay is fired, it is heated to a high temperature (about 1700 degrees F). All organic material is driven out at this temperature, along with a certain amount of chemically combined water. The clay molecules then realign themselves and form into a completely new crystalline structure. This process is called *inversion*. The clay now

finishes shrinking; total shrinkage is about 10 to 15%. The clay can never be returned to its plastic form after inversion takes place. Even if it is very finely ground, it will only become silt-like. It will not return to a plastic state. It will also become very durable. Fired clay objects have been found that date back to the earliest human civilizations.

Students often confuse clay with soil. Clay is indeed a vital ingredient of soil, but the clay we use in the studio is very different. It is mined from the ground, cleaned of organic material, and blended with other clays to have certain precise characteristics. Iron compounds occur naturally in clay and give it a red or brown color. Different clays are blended for different uses. Porcelain has very fine particles and is fired at a high temperature (about 2300 degrees F). Stoneware is fired to a medium temperature. Clays that are fired to the highest temperature possible without melting are referred to as *vitrified*. They are more glass-like and no longer porous.

Glaze is the glossy coating on the outside of the piece. It is similar in composition to clay or glass and is formulated to melt at a temperature between the two. There are many different types of glaze. Colors are obtained by adding different metal compounds to the glaze.

In order to assure that the clay reaches exactly the right temperature, ceramic artists use a specially formulated piece of clay called a *cone*. The cone is formulated to melt at a given temperature. It is placed in a mechanical device that will shut off the kiln when the cone starts to melt. A cone is actually more accurate than a *pyrometer* (a high temperature thermometer) as melting depends on time as well as temperature. Kiln temperature is often referred to by cone number.

Vocabulary

Polarity	Slip	Cone
Surface tension	Deflocculate	Cone number
Plasticity	Inversion	Pyrometer
Fire	Vitrify	
Kiln	Glaze	

Glaze Colorants

Iron	Black, brown, red-brown
Copper	Green, red
Cobalt	Blue, Pink, Purple
Manganese	Brown, Purple
Chrome	Green

Cone Temperature (in degrees F)

Cone 022	1000	Enamels and metal lusters
Cone 08	1700	Inversion completed
Cone 06	1850	Low fire glazes mature
Cone 5	2200	Stoneware vitrifies
Cone 10	2300	Porcelain vitrifies

Clay Fun(damentals) II

What You *Really* Need to Know

Wet clay can be formed by pinching, rolling and coiling. Tell your students not to let their clay get any thicker than an adult's thumb, or any thinner than a pencil. Thick clay will take too long to dry and will trap water; it can break or even explode in the kiln. Thin clay is fragile and likely to break in handling.

Two pieces of clay can be joined together if the pieces are roughened and moistened with water or vinegar. This is called *slipping and scoring*. Vinegar or "magic water" (sodium silicate) is sometimes used in place of water to reduce shrinkage in the joint. It also helps to completely smooth the join between the two pieces.

Rolling clay with a rolling pin is best done on a folded newspaper so that it does not stick to the table. Students can then cut the clay into pieces and assemble the pieces, being careful to slip and score.

Clay can be rolled into long "snakes" and then coiled to make a pot or other large shape.

Animal bodies and egg shapes are made by joining two "pinch-pot" shapes together. Make sure that students cut an air hole in their piece. Trapped air can cause the clay to break as it shrinks, or worse, the heated air can expand rapidly in the kiln and the piece will explode.

After clay has dried for about a day, it becomes "leather hard". It can no longer be bent or joined at this stage, but it can still be carved. When clay dries it shrinks – sometimes as much as 10%. If it cannot shrink freely, it will crack. Dry clay is called greenware. It is very fragile, and if broken can present a dust hazard. I do not recommend that children handle greenware. Discard broken greenware; reusing it is certainly possible, but rarely worth the effort. It is very difficult, if not impossible, to mend.

Have children clean up promptly. Cleanup should be "wet". Use wet sponges, damp rags and wet mops. Avoid sweeping or other cleanup that will create dust. If your sink is not equipped with a trap for clay or paint, have students wash in a bucket. Pour the water off after a day or two, and discard the sludge in the garbage.

When clay pieces have dried completely they will no longer be cool to the touch. They can now be fired in the kiln.

Moist clay can be recycled by placing it in a plastic bag. Add a little water to the bag. Let it sit overnight to soak up the water. Empty the clay from the bag and drop it a few times until it forms a solid brick. Cut slices from the brick and slap them together. Drop the resulting stack until the brick is reformed. Repeat several times. Now the clay can be reused.

Clay Fun(damentals) III

Firing Your Kiln

Modern kilns are safe, easy to use and produce consistent results.

Clay is often fired two or three times. The first firing is called the *bisque* firing. For this firing, use Cones 08, 06 or 04. Bisqued clay is quite sturdy and will not dissolve in water. It is not dusty if broken or pulverized and can even be sanded. It will be strong enough to be handled for glazing.

After glazing, the ware is fired again. This firing is often to a higher temperature. Note the recommended cone for the glaze and fire to this temperature. Make sure that the clay can also be fired at this temperature.

Kiln Lid

THE LID MUST BE SECURELY PROPPED UP BEFORE YOU LOAD OR UNLOAD THE KILN. This is vitally important if you have a large kiln or children can approach the kiln.

On-Off Switches

Turn all the switches to OFF before you load the kiln.

Kiln-Sitter©

Some kilns shut off automatically with a Kiln-Sitter and use a small carefully formulated bar or tapered cone of clay. This will melt and deform when the kiln reaches the right temperature. The number of the cone is stamped on the box and on the cone; be sure to check the cone itself. The cone is placed horizontally on the top of the supports. The round sensing rod rests on top of the cone. Simultaneously raise the hinged weight that hangs outside of the kiln and position it behind the release claw. When the kiln reaches temperature the cone will melt, the sensing rod will drop and the claw will release the hinged weight. This will cause the plunger to pop out and the kiln will shut off. The timer will stop, recording the time that the kiln took to reach temperature. **MAKE SURE NOTHING INSIDE THE KILN CAN INTERFERE WITH THE CONE AND THE SENSING ROD. MAKE SURE NOTHING OUTSIDE THE KILN CAN INTERFERE WITH THE HINGED WEIGHT WHEN IT FALLS.**

Loading the Kiln

The unglazed pottery can be placed in the kiln touching, or even stacked for the bisque firing. Make sure that each piece can shrink freely and that steam cannot be trapped.

Glazed ware cannot touch or it will become fused together. **MAKE SURE NO GLAZE IS ON THE BOTTOM OF THE CLAY PIECES OR IT WILL FUSE TO THE SHELF.**

MAKE SURE NOTHING CAN FALL OR BLOW AGAINST THE KILN. Kilns do not get very hot on the outside, so a fire is very unlikely.

Ventilation

Your kiln will be outside or equipped with a ventilation fan. Some fans have a hood over the kiln, others are vented into the bottom of the kiln. Sometimes the fan will come on automatically, sometimes you will have to turn it on. **DO NOT FIRE YOUR KILN WITHOUT ADEQUATE VENTILATION.** If your kiln has a built-in fan, plug all the peepholes. If your fan is overhead, or your kiln is outside and has no fan, it is customary to leave the top peephole open for ventilation. (Sometimes older kilns will not come up to temperature with a peephole open. If you are told that your kiln will not work without all the holes plugged, put the top plug in after the kiln starts to glow red inside; all the water and smoke will have burned off by then).

Back Up Timer

Some kilns have a back up timer that will shut the kiln off after a certain time. Turn the timer to ½ hour beyond the estimated shut-off time. It is helpful to keep a log of the time of firing. After each firing, note the time from the backup timer and record this in the log. You will then know how long to set the timer for in the future, and you will be able to quickly identify any problems with the kiln.

On Button

The hinged weight has a hole in the middle with a round button. Push the button in.

Kilnwatch© (FireRight), or Digital Kiln Turn Up Controller

If your kiln will turn up automatically, consult the manual for operation of the turn up devise. Many lucky schools have a Kilnwatch controller. (*Directions attached*). If you are *really* lucky, you might have a digital controller. Read your manual or call the supplier. Digitally controlled kilns make use of a pyrometer and are quite different from above.

If you have a Kilnwatch, I still recommend letting your kiln sit on LOW overnight (you will need to set the Kilnwatch). Then in the morning turn all the switches to HIGH and reset the Kilnwatch.

Manual Turn Up

You will need to turn up the kiln using the Off-Low-Medium-High switches. I recommend that you let the kiln sit at the lowest temperature overnight and then start turning up the switches in the morning. As kilns go up at different rates, consult teachers who are familiar with the kiln for a turn up schedule for the next day. In the absence of good advice, turn the kiln up every hour. Waiting longer between turn ups is OK

Sample Firing

After school:	Engage Kiln-Sitter with the correct cone
	Load the kiln
	Lower the lid

Turn on fan
Leave peephole open (if fan is not vented to bottom of kiln)
Set timer
Turn bottom switch only to LOW
Push in button in middle of hinged weight

Next morning Turn all switches to LOW
Check around kiln for hazards or obstructions

After one hour Turn all switches to MEDIUM
(or morning recess)

After two hours Turn all switches to HIGH
(or at lunch)

IF YOUR KILN HAS NOT SHUT OFF BY THE TIME YOU LEAVE FOR THE DAY,
MAKE SURE SOMEONE ELSE WILL CHECK THE KILN HAS SHUT OFF AT THE
EXPECTED TIME.

Unloading Your Kiln

PROP THE LID UP SECURELY. Sometimes molten glaze will touch another piece or the shelf and as the clay shrinks, be drawn into a needle sharp stalagmites. WEAR GLOVES WHEN UNLOADING FINISHED GLAZEWARE. If you find any sharp parts grind them off with a grinding stone or the concrete floor.

Questions?

Call Seattle Pottery Supply @ (206) 587-0570, or visit them at 35 S. Hanford, Seattle
They are very helpful.

Clay Giraffe Lesson Plan

Lesson 1 – Preparation

Discussion of the nature of art: “There are no mistakes in art”. “Art comes from the heart and is always personal and unique”. “Even if another’s art is not something you would ever make, you can always find words both kind and true to refer to it”, “Be absolutely sure that someone else wants your help before you touch their artwork”.

Tools and materials needed; paper and pencils for sketching, board for teacher demonstration, giraffe images.

Observation of giraffe pictures and discussion of details of giraffes.

Basic skill: observation of actual object for a realistic depiction.

Assessment: student attempts drawn or sculpted image true to observation rather than symbolic or “cartoon” depiction.

Step by step giraffe drawing; demonstrated and copied by students.

Basic skill: Complex shape is broken down into a set of simple shapes and reproduced in a set sequential order.

Assessment: Students execute the steps to draw and sculpt their own project.

Step 1: Giraffe’s round body as a circle or oval

Step 2: Long neck as two parallel lines

Step 3: Oval head

Step 4: Details of head: ears, horns, eyes, nostrils, tongues and also tails, manes and split hooves. Depth of detail is very dependent on age; kindergarteners should be able to recall, sculpt or draw eyes, ears, horns and tails. Second graders will add manes and sometimes split hooves as well as realistic leg joints and body shape.

Step 5: Legs: all 4 legs depicted.

Step 6: Color: yellow or tan body, brown spots, dark brown or black eyes.

Lesson 2 – Clay

Tools and materials needed; clay – SPS Vashon White or equivalent (1 box/classroom), small containers, plastic forks, inexpensive paintbrushes, newspaper, paper clip with one end bent straight (may need to be controlled by adult for younger students)

Basic skills: pinch pots, coils or “snakes” of rolled clay, attaching clay by slip and score method, Sculpting by additive method, impressing a mark in clay.

Assessment: Students sculpt a giraffe that has all body parts attempted in sequence. Clay object is executed with correct techniques to withstand firing.

Step 1: Pinch pot. Students will need a folded newspaper work surface. Give students a ball of clay as big as their closed fist. If clay is too thick it will not dry, so a round ball of clay is pinched with thumbs and fingers into a pinch pot with walls as thick as a finger. After students complete a pinch pot, give them another ball of clay and repeat for two pinch pots of about the same size.

Step 2: Slipping and scoring. Give students a small container of water and a plastic fork. Students must make both joining surface slippery with water and roughened with the fork. Attach both halves of the sphere and gently rub the joint smooth. (If students collapse their sphere an adult helper can reform it into an inverted pinch pot).

Step 3: Rolling a coil; Give students a “granola bar” shaped piece of clay and have students roll the clay with both hands. Students should start with their hands flat in the middle of the coil and move them towards the ends. Coil should make at least one revolution to remain round. (Students may need to stand and may need to roll on actual table surface.) Have students make the snake as thick as an adult finger.

Step 3: Have children cut a section of clay the length of the child’s finger with the paper clip. (Adult can hand child paper clip for cutting and then remove). Attach neck to sphere, using slip and score method. (If neck is floppy, adult can add a “collar” at base of neck, be sure to slip and score).

Step 4: Give students a piece of clay about as big as a grape for the head, or have them cut a small section from remainder of coil. Have students roll this into an egg shape and slip and score to top of neck.

Step 5: Add detail to head and add a tail – be sure to have students slip and score even the smallest pieces they add. End of paintbrush can be used to impress some details.

Step 6: Instruct students to lay the giraffe on the table. A “pillow” of clay or paper will help preserve ears if necessary. Students will need more “granola bars” of clay to roll coils similar to the one for the neck. Cut four equal lengths of clay as long as a finger. Check that legs are equal, then slip and score to bottom of body.

Step 6: Adult helper holds giraffe upright and adjusts leg length; the giraffe will not be able to stand unassisted until it has dried for several hours. Make a small hole on the underside of body so air can escape during firing. Add child’s name and room number to project using paperclip.

When giraffes are dry, fire on their sides. If you need to fire them upright, sprinkle refractory sand on the shelf so that legs will not crack as they shrink and drag during firing. Bisque to Cone 06 or 04 or as directed on clay box.

Lesson 3 - Glazing

Materials and tools: Amaco Deep Yellow, Red Brown, and Chocolate Brown or equivalent colors, Over-glaze, good quality paintbrushes; large, small and fine detail.

Basic skills: Using ceramic glazes correctly (two to three coats of the same color and the bottom unglazed) and following step-by-step sequence.

Assessment: Students attempt a glazed figurine using sequential steps.

Step 1: Give students large brush and Deep Yellow glaze. Instruct students not to glaze the soles of the giraffe's feet and have the students point out this body part. Assure students that if glaze gets on soles by accident it can be wiped off. Have students apply two or three coats of the same color. Portions of the giraffes can be left the natural off-white of the clay.

Step 2: When yellow glaze is dry, give students the medium brush and the red brown glaze. Have the students paint the spots.

Step 3: Using the detail brush and the chocolate brown or black glaze have the students add the eyes, mouth and other painted detail. (Adults may need to load the brush and hand it to the child)

Step 4: Adults assure the student's name is still clearly visible. Repaint with detail brush if necessary. When colored glaze is dry, apply over-glaze. Wipe the bottoms of the feet.

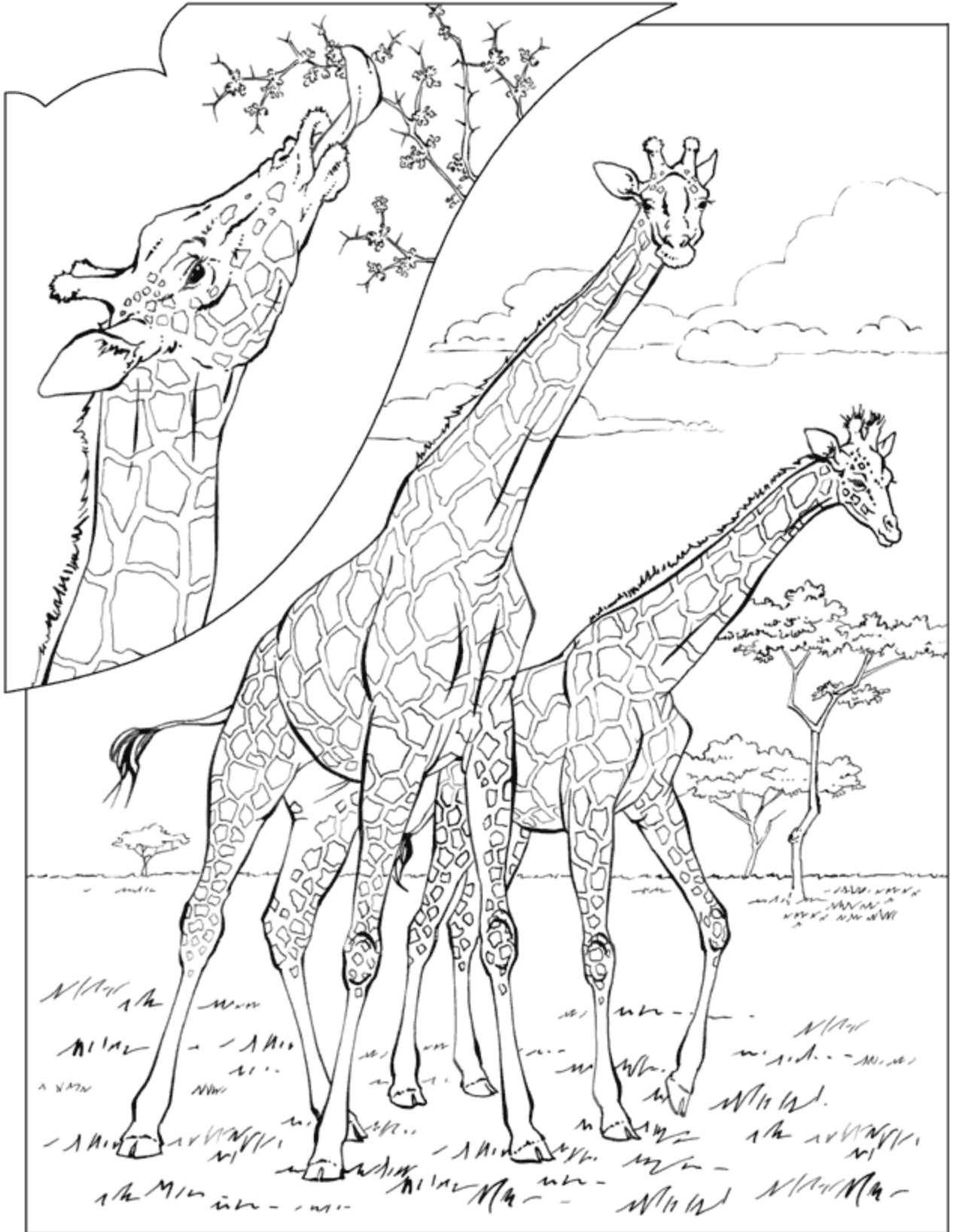
Fire to Cone 04 or as directed on bottles of glaze. If any giraffes break, they can be glued after firing with epoxy or superglue. Wrap well with several sheets of crumpled paper, smooth paper and tape. Instruct students to get adult help when they unwrap them.

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<http://www.nationalgeographic.com/coloringbook/images/sketches/giraffe.gif>

The Art of Falling Leaves

Lesson Plan

Essential Question

How can an artist create a clay impression of a leaf and then use it to create an individual artwork? Can a design taken from nature be successfully used for creative expression?

Grade Levels

Kindergarten through adult, special populations.

Target Learning and Assessment Criteria

Science Target: Student learns the names and importance of native deciduous trees and shrubs. The student learns about the watershed.

Assessment: Student collects fallen leaves and identifies the species and its role in the watershed.

Writing Target: Student generates and refines a list of emotive and descriptive words relating to the watershed in autumn. The student uses these words to write a short poem or haiku.

Assessment: Student incorporates chosen words or poems into art.

Art Target: Student transfers image and texture of leaf into clay.

Assessment: Student uses clay replica and poetry to create a work of individual expression.

Arts Essential Learnings:

1.1.1 Elements: Texture. Shape

1.1.2 Organization: Repetition

1.2 Skills and techniques: Ceramics; rolling, cutting, impressions, glazing

2.1 Applies a creative process

4.1 Connections among arts disciplines

4.2 Connections between arts and other content areas

Writing Essential Learning

2.3 Write in a variety of forms: poems

Recommended Materials and Equipment

Clay: "Vashon" Red, Brown, and Orange.

Clay tools: Rolling pins, cutting wire, needle tool (or paperclip). Advanced students will need scoring tools and slip (vinegar or "magic water").

Alphabet noodles or alphabet stamps

Newspaper

Kiln, Cones 06 and 2 or 5

Black glaze; Cone 06 underglaze or cone 2 - 6 glossy black

Learning Expansions

Fossils, geology

Horticulture, gardens

Instructional Sequence and Strategies:

- Introduce the concept of the watershed and its importance. Teach the names and

- the roles of native riparian trees and shrubs.
- Have students collect leaves of native deciduous plants from the ground individually or as part of a field trip.
 - Have students name the species of their collected leaves
 - Brainstorm scientific, descriptive or emotive words. Organize and refine words into brief and concise poetry.
 - The teacher or another adult uses the cutting wire to cut lengthwise slabs of clay about 3/4 to 1 inch thick from the block of clay.
 - The student rolls the clay on a piece of newspaper to about 1/2 inches thick.
 - The student presses a leaf with the veined underside down into the clay and then rolls over it with the rolling pin.
 - The student cuts around the leaf with a wire tool. Leave a little blank clay area for the poem or word.
 - The student selects alphabet letters and presses them into the clay forming the words or poem. The letters are placed as they would normally appear.
 - Clay scraps can be gathered together, moistened, and pressed into a block shape. Cutting the block into slices results in “marble” clay that can be reused for this project.
 - Form the leaf into the bowl or rounded shape as desired. Remember that clay shrinks about 10% as it dries - make sure it can shrink freely.
 - DO NOT LET STUDENTS REMOVE THE LEAF.
 - Let the clay dry with the leaf still on.
 - Bisque fire the clay pieces. Leaves will burn harmlessly away.
 - Students paint on the dilute black glaze and then wash it mostly away. The glaze should only remain in the veins.
 - Fire the piece to Cone 2 or Cone 5