Introduction

Consider this *Pottery* merit badge pamphlet an introduction to pottery making, a potter's tool in its own right to help you understand the process and learn some of the language.

The resources listed in the back of this pamphlet are good materials to help you learn. The local library is a good place to look for information. Many libraries have magazines about pottery making and ceramics with illustrated articles about techniques and design, tips for professionals and beginners, and advertisements from manufacturers and dealers of clay and supplies.

All of this information will be useful to you, but the greater part of your new knowledge will come with experience—the skill and understanding you will gain from actually creating pottery. You will be involved in hands-on production of a work of art, from start to finish. Enter this adventure with a positive attitude, roll up your sleeves, grab a lump of clay, and get started!

Pottery has a language of its own. To know what a potter is talking about, you have to know the language. When you read a word in **boldface,** first try to figure out what it means by how it is used in the text. Then, you can look it up in the glossary.

What Is Pottery?

Pottery can be defined simply as any item that is formed from clay then hardened by heat, and a bit more specifically as the baked-clay wares of the entire ceramic industry.

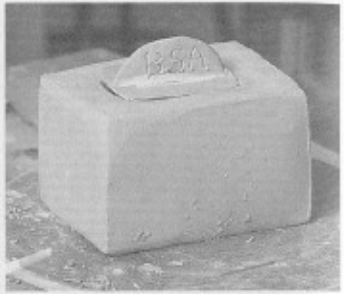
Archaeologists have uncovered pottery objects that have been on Earth almost as long as the human race, which places them among the oldest human-made artifacts ever found. As an art form, pottery is one of the oldest and most widespread in the world.

It's no wonder that pottery making has stood the test of time. Not only is the process fun and challenging, but the end product can be as useful as it is beautiful. As you work on the requirements for this merit badge, you will see that pottery making is as much science as it is art. You will gain greater self-confidence, an advanced set of skills, and a sense of accomplishment when you have produced your first pieces of pottery.

There are three broad categories of pottery: **earthenware, stoneware,** and **porcelain.** Within each category are many different styles of pottery, each of them unique according to the type of clay used, the kind of **glaze** or decoration applied, and the **kiln** temperature at which it is **fired.** There are so many different styles that they cannot all be covered in this pamphlet. However, some of the most famous and most popular ones will be discussed and the three main categories will be more fully defined.

The word *ceramic* has been traced back to an early Greek term, *keramos,* which means "pottery" or "potter's clay." *Keramos* is related to an ancient root word that means "to burn." The Greeks used the term to mean "burned stuff" or "burned earth" when referring to articles they produced through the action of fire upon materials they dug from the earth.

The Ceramic Industry



The term *ceramic* refers to any human-made solid produced from nonmetallic mineral substances—such as clay—by firing in a kiln. The ceramic industry provides much more than just dinnerware and decorative articles; it includes all manufacturers that use clay and that produce or use clay products. The products this industry produces include brick, sewer pipe, floor and wall tile, electrical porcelain, glass, abrasives, engine components, superconductors, rocket nose cones, and cements used in the construction of concrete roads, bridges, buildings, and dams.

Ceramics and Our Environment

Ceramics play an important role in our environment by helping to decrease pollution. The catalytic converters in cars and trucks, which are made of ceramics, help change harmful exhaust fumes into harmless carbon dioxide and water. Ceramic engine components are lightweight and heat- and wear-resistant, which results in significant fuel savings, more efficient combustion and, ultimately, cleaner air. Ceramics also are used in oil-spill cleanup equipment, which helps restore our environment after a man-made disaster.

Ceramics in Medicine

Ceramics are increasingly being used in medicine and dentistry. Special ceramic materials are being used for repairing and replacing human hips, knees, teeth, and even heart valves. Ceramic materials that are used in the human body, whether they are replacement parts or just coatings on metal replacements, can stimulate bone growth, promote tissue formation, and help protect the immune system. Modern ceramic materials are also used in ultrasound and X-ray computed tomography (CT) systems.

Ceramics play a significant role in NASA's space shuttle program. The shuttle has a protective shield made up of about 34,000 lightweight, reusable ceramic tiles that protect the astronauts and the shuttle's aluminum frame from the extreme temperatures generated as they pass through the Earth's atmosphere.

The History of Pottery

No one knows for sure *how* the process of making pottery was invented, but for many years archaeologists throughout the world have been uncovering pieces of pottery from as far back as prehistoric times. Since the clay base of pottery does not react to chemicals and does not corrode like metal, cloth, or wood, these artifacts often are preserved nearly unchanged, while other items of the same age are at least partially destroyed. For this reason, pottery is used extensively by archaeologists to determine how ancient peoples lived their daily lives.

The First Ceramics

It is believed that the earliest uses of clay were not for functional purposes. Archaeologists in Czechoslovakia have uncovered human-made ceramics that date to at least 24,000 B.C. These artifacts are in the form of slabs, balls, and animal- and human-shaped figures, and are made of animal fat, bone, bone ash, and a claylike material. It is not clear what these articles were used for, but they might have been used for ritualistic or religious purposes.

The earliest clay vessels were sun-dried, not fired. They probably were used to store only grain and other dry foods, because filling them with water would have caused the clay to absorb the liquid and soften. Not long after these first crude clay vessels were made, people learned how to use fire to make them stronger, harder, and more watertight.

Many scientists believe the discovery that fire could change clay into a useful and beautiful vessel occurred independently among different cultures throughout the

prehistoric world and led to the development of structural clay products, including brick and tile.

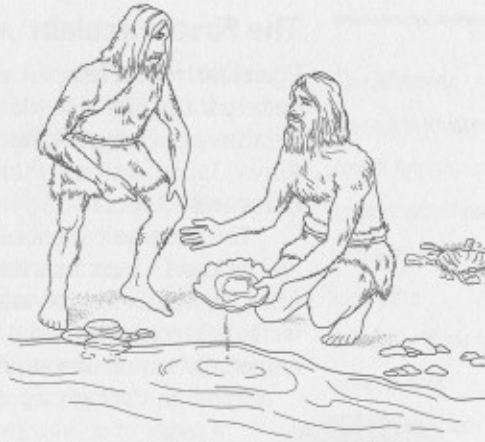
The oldest known functional pottery came from Neolithic cultures in Japan and Turkey. Dirt-brown pot fragments, or shards, unearthed from a cave in Kyushu, Japan, date to around 10,500 B.C. and were made by a fishing, hunting, and shellfish-gathering culture. This Japanese pottery is called Jomon, which means "cord markings," because much of it was decorated with cord patterns. Also, pot shards found in other Japanese sites are believed to be even older—by about 500 years. Pieces of crude, soft earthenware excavated from a Neolithic settlement on the Anatolian Plateau of Turkey are thought to be 9,000 years old.

How Was Pottery Discovered?

There are several theories about the long-ago discovery that fire could change clay into a material that would not dissolve in water. At least two of them involve the hunter-gatherers who lived at the beginning of the Neolithic stage of cultural evolution. During this time, cultures around the world gradually were changing from a nomadic lifestyle to a more settled one. The people were learning to raise crops and keep livestock. This new lifestyle not only created a necessity for food storage, but it also gave the people more time to pursue handicrafts such as weaving and pottery.

You might wonder how these people came up with the idea of making pottery. One theory holds that these Neolithic families would often camp alongside rivers and build their fires in pits that they had dug into the clay banks. When the fires burned down, the people noticed that their pits had turned into hard, sunken "bowls" that could hold water.

Another theory involves Jomon pottery. To begin with, it is thought that Neolithic people had learned from their Paleolithic ancestors to line their baskets with clay and then leave them to dry in the sun so that they would hold water—at least until the clay dissolved. Because some of the Jomon pottery has a basketlike texture, some scholars believe that it might have originated when baskets lined with clay either fell into a fire or were intentionally used for cooking. The natural fibers of the basket would have burned away, leaving behind a crude and more watertight pot.



People in ancient times discovered that the intense heat from their fire pits caused the clay in the ground to harden.

The Development of Glaze

The earliest pots were decorated with liquid clay **slip,** a mixture of clay and water that had a practical use of holding pieces of pots together. Another form of pottery decorating, **glaze,** was discovered around 2700 B.C. in Egypt, when Egyptians at the time found that the sand they used in making their pottery created a colored glaze when overheated in a kiln. By 1500 B.C., potters learned that by sprinkling their pots with powdered lead, they could produce a glaze that covered the piece. Lead glaze is still the most widely used glaze today.

Around A.D. 1500, German potters found that salt made an effective glaze. This was a major contribution to the evolution of pottery and would later play an important role in English and American ceramic industries.

The First Porcelain

Porcelain was developed and first produced in China between A.D. 618 and 906 to withstand the extreme temperatures of Chinese kilns. The ware was exported to Korea, Japan, and the Middle East, where it became immensely popular.

The Chinese potters continued to refine their ware and by the 13th century had learned how to use cobalt from the Middle East to make beautiful blue-and-white ware. When supplies from Persia were cut off by the emperor's ban on overseas travel, the potters began using copper in their glazes and enamels, which gave them a range of shades from blue to green. Eventually the Chinese potters added other colors such as red, yellow, turquoise, deep violet, and purple to their pottery.

Ming porcelain

The highly prized Chinese porcelain had influenced Middle Eastern potters, and their product in turn greatly influenced European potters. Middle Eastern and European potters tried to imitate the blue-and-white porcelain, which had been widely imported into Europe, and developed a tin-based glaze that was bright white on buff or red **clay bodies**.

Japanese potters succeeded in producing true porcelain in the 16th century, having been influenced by Chinese as well as Korean ware. However, it was not until the 18th century that true porcelain was produced in Europe—first in Germany, then in England.

Hard-paste, or true, porcelain was developed in China and gradually was exported to many parts of the world. Made primarily of petuntse (china stone) and **kaolin** (white china clay), the semitranslucent ware fired bright white and quickly became the envy of the Western world.

During the sixteenth century, Italian potters tried to imitate the semitranslucent Chinese porcelain and eventually developed soft-paste, or artificial, porcelain from a mixture of white clay and **frit**. This ware required a lower, or "softer," firing than that required for hard-paste porcelain, which resulted in a softer, warmer body.

Pottery in North America

The first potters in North America were Pueblo Indians, who made plain, undecorated pots. It is thought that the earliest pots were baskets that had been smeared with clay and then dried in the sun.

By about A.D. 1000, Mimbres potters used **slips** to decorate their pottery with black-on-white designs of insects, animals, birds, or geometric shapes. Over the next few hundred years, they introduced black decorations on a red slip. After the 12th century, they started replacing these older styles with polychrome ware decorated with stylized birds, feathers, animals, and human figures amid the geometric patterns.

When European settlers first came to North America, they brought only woodenware and some pewter mugs and utensils. They didn't have china as we know it today. Although there were potters in the colonies, they were so busy making bricks and tiles to meet the urgent need for building materials, they didn't have time to make pottery.

Household pottery was not in common use among the colonists until the late 17th century when a reddish slip-decorated earthenware was imported from England.

As English, Dutch, and German immigrants came to the New World, they brought their rich heritage of pottery making with them. Soon the colonists were buying earthenwares from local farmers who also worked as part-time potters.

A sophisticated pottery industry did not emerge in colonial America until the middle of the 19th century, partly because of the British government's restriction on all colonial industries. Only the well-off had luxurious, decorative ceramics imported from England, Germany, and China.

The first American potteries were established in Virginia, Pennsylvania, and New York. The first whiteware was produced in 1684. A stoneware factory opened in New York in 1730, and in North Carolina, Jugtown pottery was first produced around 1750. Soon after, **terra-cotta**

The Mimbres were a prehistoric North American people who lived in the mountains along the Mimbres River in what is now known as southwestern New Mexico. They are famous for their beautiful black-on-white pottery.

works began operating in Massachusetts and Pennsylvania. The first porcelain was produced in Philadelphia in 1769. The first of several famous potteries in Bennington, Vermont, opened in 1793. A pottery center in East Liverpool, Ohio, became established as one of the foremost in the industry by 1839, producing the first American Rockingham ware, famous for its manganese-brown glazes.

Modern Pottery

In the 1900s, art pottery became very popular, and the influence of Oriental and European potters revitalized the studio pottery life beginning in about 1950. The 20th-century development of mass-production techniques and the use of synthetic materials did not diminish the demand for fine, handcrafted pottery. Major artists of the century, including Pablo Picasso and Henri-Émile-Benoît Matisse, produced exquisite ceramic works.

Historical Pottery Styles

Throughout the history of pottery, different cultures have developed individual styles, and from those styles, others have evolved. The following is a brief introduction to some of the most famous and most popular styles.

Chinese

The Chinese were the world leaders in the production of beautifully glazed and decorated porcelain and stoneware.

Some very early styles of imperial ware (porcelain made for and sponsored by the emperor's court) included a buff stoneware covered with a dense greenish-blue glaze, a stoneware washed with brown slip and glazed in colors that varied from pale green to lavender blue, and a dark stoneware with a grayish-white glaze. Most of these styles also had a well-marked **crackle** as a design element. A style of imperial ware made during the Ming dynasty was the fine white porcelain painted in blue underglaze that made "china" a household word.

Another very famous and prized Chinese pottery is celadon ware, which has a gray or grayish-white body with a transparent sea-green glaze and usually a well-marked crackle.

Chinese export porcelain includes most of the porcelain shipped from China from the 17th through the 19th centuries. It was specifically designed to appeal to the Western world; most of the styles were based on European pottery or metalwork designs or on a combination of Western and Oriental motifs. Blue-and-white decoration was the most common, but Chinese potters also were influenced by the Japanese Imari ware, imitating their blue, red, and gold patterns, among others.

Chinese export blue-and-white porcelain

One famous type of Chinese export porcelain is called Canton ware, which was made in one area of China then sent to the port of Canton for the final decorating process. This blue-and-white patterned ware with blue-lattice borders was favored by George Washington and became highly collectible.

Celadon ware was very important in China's trade with the Middle East because of the superstition that a celadon dish would crack, break, or change color if a poisoned food were served on it.

Greek

The pottery of early Greece was notable for its graceful use of human and animal figures. Commonly, the design was painted in shiny black pigment on the reddish clay body, or the design was left unpainted on the red body and the black pigment was applied to the surface outside the design.

In 1592, during the Japanese invasion into Korea, many Korean potters were taken back to Japan, where they were put to work making porcelain for the traditional tea ceremony. These Korean potters later helped to establish the Japanese porcelain industry.

Japanese

Japanese pottery was influenced by Chinese and Korean pottery. One style that became popular in the West is called Imari, a generic term for Japanese porcelain made in the Arita kilns on the island of Kyushu and shipped from the port of Imari. Imari ware is believed to date from 1616, when porcelain clays were discovered in Arita by Korean craftsmen. It is still made today.

Most early Imari work was blue-and-white only, but with the gaining popularity of Chinese porcelain, the Japanese potters began to add gold and color enamels to porcelain decorated in underglaze blue. One common style was produced in red with touches of gold in imitation of some Chinese Ming porcelain. By the mid-17th century, native Japanese designs were introduced, and during that century Imari ware became so popular in Europe that even the Chinese, the English, and the Dutch imitated it.

Imari ware

Raku is a traditional Japanese pottery that was developed in the 16th century to replace the Chinese bowls that were being used in the tea ceremony. Traditional raku is still made today by the 14th-generation ancestors of the man who originated the technique.

Raku ware is molded entirely by hand, which makes each piece a unique creation. The shape of traditional raku tea bowls was very simple: a wide, straight-sided yet irregular form set on a narrow base. Raku glaze colors included dark brown, light orange-red, straw, green, and cream. The special firing technique used for raku ware produces unique characteristics throughout the glaze, and sometimes in the pottery itself, that set it apart from any other type of pottery. Potters throughout the world admire this interesting ware for its rugged shapes and soft lead glazes.

Majolica

Majolica pottery is **bisque-fired** earthenware that is coated with an opaque white tin-based glaze then decorated with colorfully painted designs on the white surface before firing.

Majolica was first made in the Middle East to emulate Chinese porcelain. Later, the technique spread to Spain (where it later came to be known as Talavera ware), then to Italy from the island of Majorca, Spain, where it got its name. From there, the tin-glazing technique spread to France, where it was called faience, and to the Netherlands where it was called delft.

Delft

The potters of Delft, Holland, decorated their pottery in imitation of Chinese porcelain and some Imari ware, usually in blue and white. They used the majolica technique of applying a white opaque tin-based glaze to earthenware, then painting and firing the piece. But there was a difference between the two in that cobalt was used as the main colorant in delftware.

From Holland, the art of tin-glazing earthenware was introduced to England. Generally, the Dutch and the English potters copied the Chinese motifs, but occasionally the Dutch delftware was decorated with landscape and seascape scenes of windmills, dikes, and ships.

Della Robbia Ware

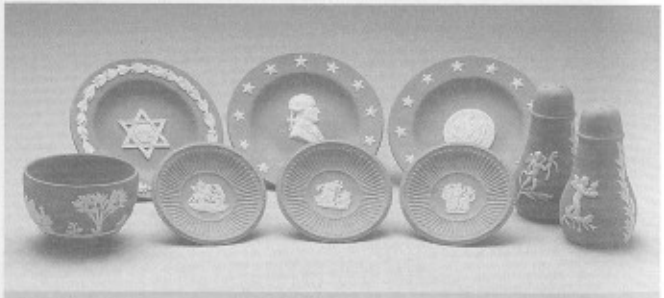
Luca della Robbia was a great Florentine sculptor in the 1400s. His beautiful glazed terra-cotta sculptures are most famous for the interesting effects he achieved from layering glazes.

John Astbury was a pioneer of English pottery technology and was one of the earliest great Staffordshire potters. It is said that he pretended to be an idiot so that he could learn the secrets of the craft from potters who had emigrated from Holland in 1688.

English

Staffordshire ware is a famous English stoneware that began production in the late 17th century in and around Staffordshire, England. The local abundance of coal and clay gradually turned a small community of farmer-potters into a substantial industry by 1740, and the area later became the center of England's pottery industry. The first products were lead-glazed earthenware and unglazed or **salt-glazed** stoneware. Porcelain was first made in Staffordshire around 1750.

English potter Josiah Wedgwood started his famous manufactory in Staffordshire in the mid-18th century. By 1765, he was well-known for his version of creamware, a lead-glazed earthenware that soon replaced tin-glazed ware in popularity. In 1775, he introduced jasperware, a fine-grained, unglazed stoneware decorated with white figures or Greek classical scenes in relief on soft or dark blue, sage green, lilac, black, or yellow backgrounds.



Jasperware

Jasperware was so named because it resembled the natural stone jasper in its hardness. Jasperware was the result of a long series of experiments in trying to discover the techniques of producing porcelain.

Before 1800, Josiah Spode II, also of Staffordshire, introduced bone china after successfully adding bone ash (ground bone) to porcelain clay, which strengthened the porcelain and gave it an ivory white look. To this day, bone china is one of the more popular types of porcelain, and some say it is the most successful English porcelain ever made.

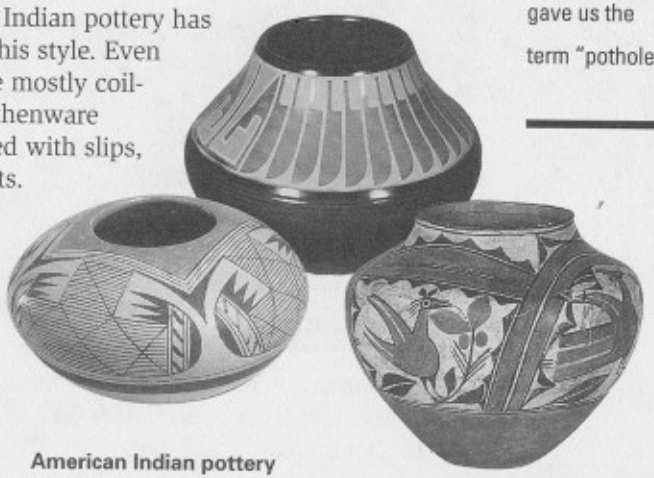
Sèvres

In the mid 1700s, a famous pottery in Sèvres, France, was sponsored by King Louis XV to produce extravagant dinner services, urns, centerpieces, and serving ware. Sèvres ware, which was made of the highest quality soft-paste porcelain, prospered and became widely known for its superb glazes and richly colored backgrounds in royal blue, turquoise, yellow, green, and rose. It was decorated with floral patterns and birds, often in white panels outlined in gold, and was lavishly trimmed in gold on the edges, handles, and bases.

American Indian

This pottery often was **coil-built** and smooth, decorated with colored slips, and **burnished** before being pit fired. Common designs were geometric forms or shapes inspired by animals.

American Indian pottery has continued in this style. Even today, pots are mostly coil-built from earthenware clays, decorated with slips, and fired in pits.



American Indian pottery

English potters in the 17th century dug their clay from the roads so they could conserve land for cultivation. Eventually the roads became so dangerous that a law was passed to forbid the potters from continuing the practice. Many believe it was the potters' unpopular practice that gave us the term "pothole."

All About Clay

Clay is found almost everywhere, maybe even in your own backyard. It can be white, beige, buff, gray, green, red, brown, or, in rare cases, black. When moist, it is soft and malleable, which means it is capable of being molded or modeled. Some potters get clay by digging it out of the ground, or they buy it from brickyards, potteries, ceramic factories, trade and crafts schools, hobby shops, or from other retailers of clay and ceramic supplies. Many suppliers advertise in pottery-related magazines; their ads explain how to contact them for a catalog.

Clay also can be created from inexpensive dry clay powder. Prices for dry clay powder can range from a few cents for a pound of common clay to around a dollar a pound for imported English porcelain.

Properties of Clay

Clay powder is packaged in bags like this.

Pure clay is made of chemically combined silica, alumina, and water. Clay in its natural state is rarely pure. Natural clay usually contains impurities such as sand, limestone, pebbles, iron oxide, and traces of other elements that it has accumulated over the very long time it has taken to become clay. These impurities—in any combination—provide each type of clay with a unique set of properties. Pure clay, with little or no impurities, does not have all of the properties that a potter needs.

The fired piece at *left* shows the effects of shrinkage when compared with an identical piece, *right*, that has not yet been fired.

One of these properties is plasticity, which refers to how well the clay holds a shape when bent or molded. Clay that cracks when bent around an object is called nonplastic or short.

Shrinkage is another property of clay. The process begins naturally as water evaporates from air-drying clay. During firing, further shrinkage occurs when the clay particles undergo chemical changes that cause them to fuse into a solid material.

The hardness, or strength, of a particular clay is another important property. It refers to how well the clay stays together when it is **leather hard, bone dry,** and in the fired state.

Color and texture are two more properties of clay. When planning pottery projects, you will want to know what color a particular type of clay will be when fired and whether it is coarse and rough or fine-grained and smooth.

These properties make different types of clay useful for different purposes.

One of the world's few natural sources of pure clay is in Cornwall, England, where there are vast deposits of kaolin, or china clay. The mining industry in that area creates huge heaps of mined clay that cause the local streams to run milky white in rainy weather.

Kinds of Clay

Choosing the type of clay for each project is the first step in pottery. There are several types from which to choose:

- Kaolin
- Ball clay
- Stoneware clay
- Fireclay
- Earthenware clay

Kaolin

Kaolin, or china clay, is a very pure form of clay, weathered from granite rock by water, dissolved carbon dioxide, and organic acids. It fires white in color and **vitrifies,** or becomes glasslike, at very high temperatures. Kaolin is an essential ingredient in high-fire whiteware and porcelain clay bodies.

Ball Clay

Ball clay, also weathered from granite rock, is a plastic, fine-grained cream- or white-firing clay. It is deposited by wind or water erosion in swampy areas where the organic acids and gases have broken it down into fine particles. Ball clay provides plasticity and dry strength in clay bodies. It generally can be fired to high temperatures, but it is rather sticky and shrinks more than other kinds of clay. Ball clay is not useful alone and is only used in combination with other clays.

Stoneware Clay

Stoneware clay is usable right from the ground as a clay body, although other clays and chemicals often are added to introduce various properties such as color and texture and to affect **maturation** temperature. Stoneware clay will vitrify when fired at middle- to high-range temperatures. Some stoneware clays are smooth like ball clays, and some are coarse like fireclay. Iron and other impurities color stoneware clay, which can be white, beige, buff, red, brown, gray, or, in rare cases, black. It usually has an attractive fired color.

Fireclay

Fireclay has a coarse texture, but some fireclays are smoother than others. Fireclay can withstand high firing temperatures without disintegrating or deforming, and it is widely used in making brick. Fireclay also is used in clay bodies to lend strength and decrease shrinkage. Coarse fireclays often are used for the gritty texture they add to clay bodies.

The term "ball clay" has been traced to historic mining methods in England, in which the clay was scooped and rolled into balls, each weighing 30 to 50 pounds and measuring about 10 inches in diameter, then wrapped in burlap for shipping.

If you desire whiteness in your finished piece, use kaolin clay; for plasticity, add ball clay; for dry strength, fireclay; for red color, earthenware clay—although chemicals can be added to a clay body to make just about any color you want.

Earthenware Clay

Earthenware clay is found in every part of the United States and is often used in its natural form. Earthenware clays are usually full of iron impurities, which give it color but also cause it to melt at a low temperature. If left unglazed, earthenware is **porous** after firing and is useful for making flowerpots, tile, and brick.

Clay Bodies

Nature is not always kind enough to combine the right kinds of clay in just the right proportions for a specific ceramic purpose. An experienced potter mixes several different kinds of clay and other substances in specific proportions according to a formula, or recipe, to get a certain result. This mixture is called a **clay body.**

The terms "clay" and "clay body" do not have the same meaning. Clay is a naturally occurring material, but a clay body has been mixed from several clays and other ingredients. The difference is similar to the difference between flour and a cake mix. For your project, you can use a premixed clay body or mix your own to suit your needs, with guidance from your merit badge counselor or an experienced potter.

The Qualities of a Clay Body

Several things should be considered when mixing a clay body. First, you need the right clay for the job. To do this, you must know which qualities the clay body must have for a particular project.

For instance, any clay body must be plastic—it must hold together and bend and mold easily. In a clay body, the clay provides the plasticity. Also, the clay must be appropriate for the kiln. Some kilns will not produce the high temperatures required for some clays to mature. It also is wise to choose a clay that is easily available.

Next, a material must be added to help the clay melt into a solid material when fired. This is the **flux.** Flux is like the glue that holds the clay particles together when fired.

The final kind of material in any clay body is the **filler.** Fillers lend fired strength, determine **porosity,** and affect shrinkage. Very porous clay bodies usually contain sand or **grog,** which creates more space between their clay particles than between those of dense clay bodies that have no sand or grog. Porous clay bodies can be used to make bigger, thicker pots that will not crack, warp, or burst when dry or fired.

Kinds of Clay Pottery and Their Clay Bodies

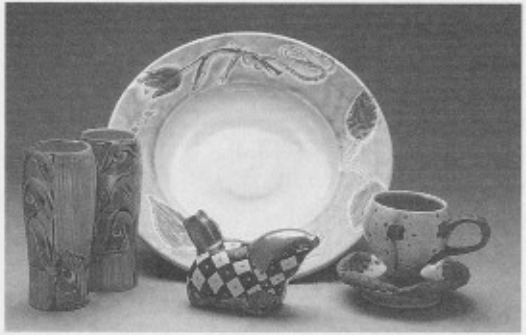
Each of the three major types of clay pottery—earthenware, stoneware, and porcelain—are made by creating a unique mix—or recipe—for their clay bodies. The ingredients in the recipes are what give each type of pottery its distinguishing qualities.

Earthenware

Earthenware is the oldest and simplest form of pottery. The clay is usually full of impurities that, aside from giving it color in ranges of buff to red and gray to black, cause it to mature at low temperatures. The result is that the clay does not completely solidify into a watertight state. For this reason, depending on the intended use, glaze can be applied inside and out.

Terra-cotta is a type of earthenware pottery. Common orange clay flowerpots are made from terra-cotta clay. Because of its attractive color, terra-cotta is often left unglazed, but throughout history, beautiful glazed and heavily decorated pots also have been made from terra-cotta.

Terra-cotta



Majolica

One example would be majolica, which is first bisque fired, then covered with an opaque white tin glaze that is allowed to dry, and then overpainted with colored **oxides** before being fired a second time.

Here is one recipe for a white-colored earthenware clay body:

30 percent plastic kaolin + 30 percent ball clay (the clays) + 40 percent talc (the flux)

And here is a terra-cotta earthenware recipe:

15 percent ball clay + 15 percent stoneware clay + 40 percent earthenware clay (the clays)

+ 10 percent nepheline syenite + 10 percent talc + 10 percent borax frit (the fluxes)

Stoneware

Stoneware fires to higher temperatures, which leaves the surface very hard and **nonporous.** It is usually opaque, but when thinly potted can be somewhat translucent. Stoneware is more plastic than porcelain, which makes it much easier to use in **throwing** on the wheel or in **hand-building**.

Some natural clays are stoneware, but often several clays are combined to make a stoneware clay body. Grog or sand can be added for wet strength.

Here is a good recipe for stoneware:

18 percent ball clay + 55 percent stoneware clay + 12 percent fireclay (the clays)

+ 10 percent potassium **feldspar** (the flux)

+ 5 percent silica (the filler)

Porcelain

Porcelain is known for its beautiful smooth white surface when fired. Some kinds of porcelain objects are known as whiteware. This would include some restaurant and hotel china, fine china, and plumbing fixtures such as toilets and sinks. China is a kind of porcelain that has special properties. It is usually fired to a high maturing temperature before being glazed at a lower temperature. The name "china" was coined by the British, who tried to imitate the porcelain made by Chinese potters.

A good mix for whiteware follows:

55 percent plastic kaolin (the clay)

+ 25 percent potassium feldspar (the flux)

+ 20 percent silica (the filler)

Equipment and Tools

While your hands and fingers can be used to make almost any kind of pottery, most potters also employ basic tools to create their works.

The Potter's Wheel

It isn't known exactly when the potter's wheel was invented, but the earliest evidence of the device is shown in ancient Egyptian paintings. It *is* known that the potter's wheel was widely used in Egypt and Mesopotamia before 3000 B.C.

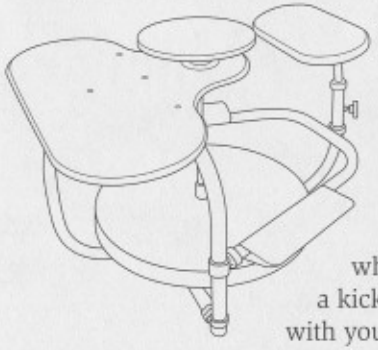
The wheel remained unknown in North America until the arrival of Europeans, although it is thought that the native peoples of this country might have used a turntable occasionally.

Early potter's wheels were just circular slabs of stone or wood that pivoted on a wooden axle so that the wheel head revolved freely in a horizontal plane. The wheel was hand-turned either by an assistant or by the potter moving a stick that fit into a notch on the wheel's surface. These wheels rotated very slowly and even wobbled a bit.

In contrast, modern potter's wheels are precise machines that turn quickly and smoothly. Although there are many variations of each kind of wheel, three types are now most common:

- The kickwheel
- The treadle wheel
- The electric wheel

The first potter's wheel was turned by hand, which made for slow, difficult work. Next came the kickwheel, which was turned by foot. By the 18th century, the wheel was no longer powered by the potter's foot but by small boys who worked as apprentices to learn the pottery-making trade.

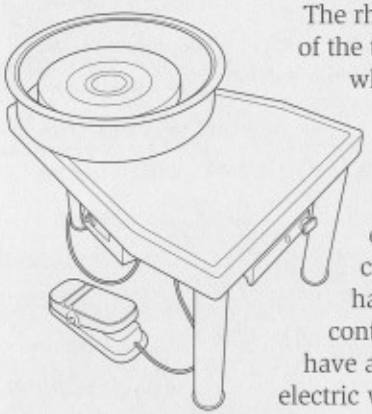


Kickwheel

The modern kickwheel usually has a heavy, round flywheel near the ground, with a shaft that connects it to the wheel head. The wheel head and shaft are usually made of metal, and the flywheel, either concrete or metal. Ball-bearing attachments fasten the shaft to a frame, which in most cases includes a seat. To use a kickwheel, sit in the seat and turn the flywheel with your right foot, which turns the wheel in a counterclockwise direction. The faster the flywheel is turned, the faster the wheel head turns. This fast foot motion is the "kicking."

Treadle Wheel

A treadle wheel is similar to a kickwheel. It also has a flywheel, a shaft, and a wheel head, but usually the flywheel is not as heavy and, instead of "kicking" the flywheel, a treadle bar is pushed with the foot. The treadle bar is a straight bar attached to a central point on the frame and to a cog on the flywheel. It must be pedaled constantly, usually with the left foot, to keep the wheel rotating. The rhythm of the pedaling controls the rhythm of the throwing. Some treadle wheels have seats, while others are used while standing.



Electric Wheel

The electric wheel is popular with potters and is the type most commonly used at colleges and crafts schools. Electric wheels can be small and portable, and they usually have a foot pedal that allows the potter to control the speed. Most electric wheels do not have an attached seat. The power provided by electric wheels is helpful when making objects that require more than 15 pounds of clay.

Tools

Potters use a variety of tools in their work. Perfectly wonderful pots can be made using only the most important tools—hands and fingers—but potters also enjoy using tools for various jobs. Pottery tools can be sophisticated or simple. For example, to **score** a clay surface, a serrated rib, a needle tool, a wire brush, a cork with sewing needles sticking out of it, or a kitchen fork could be used.

Ribs are tools used for shaping or for adding surface texture to clay articles. They can be made of wood, flexible steel, rubber, or plastic. Some creative potters cut ribs out of expired credit cards or from the sides of empty plastic detergent bottles.

Carving and modeling tools come in an amazing array of shapes, and most are made of wood, metal, or plastic. Discarded (and sterilized) steel dental tools are excellent for detailing, as are wood-carving tools. Restaurant suppliers and hardware and kitchenware stores are great sources for tools that can be used in pottery making. These tools include rolling pins, cookie cutters, shortbread or butter molds, paddles, cheese

Commercial tools

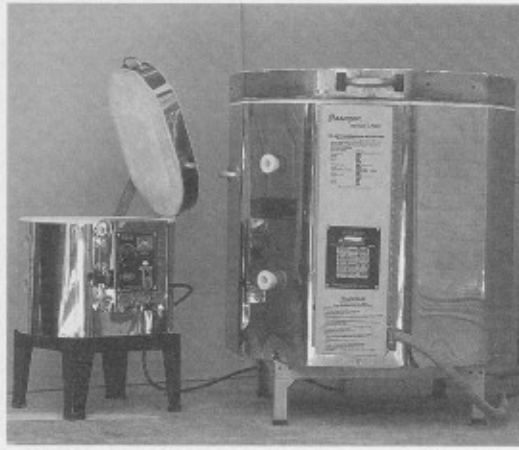
Handmade and improvised tools

slicers, sandpaper, utility knives, rasps, chamois cloth, wallpaper rollers, drill bits, soft paintbrushes, and sponges. Small, very smooth river stones are useful for **burnishing** and **compressing** clay surfaces, as are spoons. Even seashells or pinecones could be used to make interesting textures on pottery.

An experienced potter probably has collected a variety of tools, but beginners will do well with a basic tool set from a clay supplier. These sets commonly contain a sponge, a metal rib, a rubber rib, a metal loop tool, a wooden stick, a metal needle tool, a **fettling** knife, and a **cutoff wire.** Pottery tools should be kept handy and safe in a sturdy container.

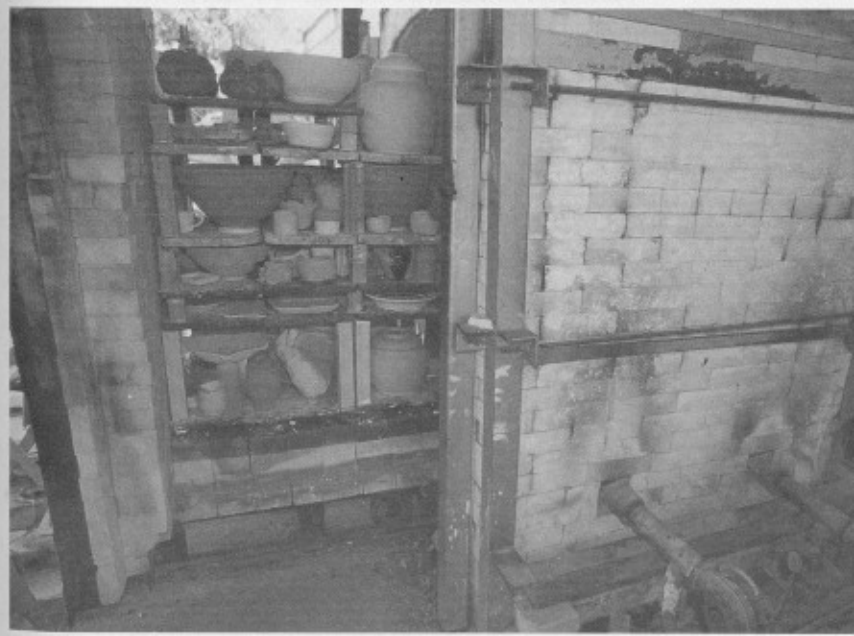
Kilns

A **kiln** is a structure that generates and holds heat. The first kilns were just open trenches covered with firewood and a dome of broken pots to hold in the heat. Although today's kilns are more sophisticated, the principle is the same. Heat is introduced into the space where the clay articles have been placed. The temperature is raised and the amount of oxygen around the ware is controlled according to the needs of the clay and the glaze.



Electric Kiln

Electric kilns are popular and easy to use. Electricity generates heat from wire elements attached to the brick walls of the kiln. Because electricity generates the heat, the oxygen level in the kiln remains the same as in the atmosphere outside the kiln. This kind of atmosphere is referred to as neutral.



Electric kilns are commercially built of a soft brick that enables them to heat up and cool down quicker than fuel-burning kilns. It generally takes 10 to 20 hours for an electric kiln to reach low-fire temperatures and another 12 to 15 hours to cool.

Fuel-Burning Kiln

Kilns also can be heated by burning oil, wood, natural gas, propane, or coal as fuel. Natural gas and propane are the most common fuels for these types of kilns. Fuel-burning kilns have in common several construction features:

- Entry ports for the fuel
- Controlled air intakes
- Interior baffles to deflect and spread the flame from its source
- Exit flues
- Dampers to control air flow
- Chimneys to draw air through the kiln

A typical fuel-burning kiln will take 12 to 24 hours to reach high-fire temperatures and another 24 hours to cool.

Wood is sometimes used as the primary fuel in a kiln. Wood gives a particular quality to pottery. As the wood burns, it creates ash that is so light it flows through the kiln and lands on the pottery, creating a special glaze. Also, the variable flame produced by the burning wood creates **flashing marks** on the pottery.

Wood-burning kilns need more open space around them than other fuel-burning kilns because the fire must be stoked regularly. Wood-burning kilns also need larger fireboxes and chimneys, and they give off more smoke and fumes than other kilns. Wood-burning kilns can be fired continuously for days.

Kiln Furniture

Kiln furniture is the shelves, posts, or bricks used to support clayware in the kiln. The items are made of ceramic **refractory** materials, which means that they are heat-resistant and will not melt. Kiln furniture is available in many shapes and sizes.

Kiln shelves can be expensive, so it is wise to take care of them properly. Before use, make sure the shelves are dry and there are no cracks. Also, kiln wash must be applied to shelves to protect them against glaze drips. Kiln wash is a thick solution of two parts kaolin and one part silica or alumina mixed in a bucket of water. Apply kiln wash with a brush or roller, to the tops of the shelves only, and allow it to dry completely before using the shelves in the kiln. Once the kiln shelves are protected, any glaze drips can be scraped away easily.

Pottery Projects

As with any project, you should know the general safety rules and the basics of the craft before you begin.

Handling Clay Safely

Clay dust can be a serious health hazard. A deadly lung disease called silicosis can be contracted from breathing in fine clay particles. It is very important to protect yourself whenever you are working with clay. Follow these guidelines at all times:

1. When using dry, bagged clay, wear a protective mask.
2. Do not sweep a dusty studio. Always wet-mop to prevent clay dust from flying into the air.
3. Do not use sandpaper or other abrasive materials to refine a pot unless you are wearing a protective mask.
4. Work outside when possible.
5. Do not eat or drink in an area where clay dust might be in the air or might be contaminated with chemicals.

In rare cases, a skin rash called dermatitis can develop on the hands and arms from handling wet clay. This form of dermatitis is an allergic reaction to the clay. If you notice any redness, itching, tenderness, rash, swelling, or even a feeling of warmth in the exposed

area, wash the affected skin thoroughly with lots of water, and avoid any further contact with the suspected irritant until you have seen a health-care provider. Do not try to treat the condition yourself; some remedies can actually make the condition worse, especially if overused. It is wisest to let a medical professional treat you.

You should learn and follow all pottery safety guidelines. People of all ages all around the world have found that working with clay is fun and rewarding—be sure to keep *your* pottery-making experience a safe one!

Getting Started

Before starting each project, think about the desired look and size of the finished piece. Sketch the design in actual size, and remember to allow for shrinkage. Be sure to design the piece so your fingers can reach inside.

Some potters like to use **templates** to help check their work as they build. Templates are easy to make. When you are satisfied with the shape and size of the piece, make a final drawing of it on cardboard, then cut the template from it. Templates can be especially useful for geometric forms that fit together at precise angles, such as squares or parallelograms. If you decide to use templates, don't be afraid to change the design during the building process. In other words, don't limit your creativity just because you've made a sketch or a template of your design!

Another step to be done before you begin the project is to prepare the clay by thoroughly **wedging** and **kneading** it so that the moisture is evenly distributed and there are no air bubbles, lumps, or hard spots. The clay must have a consistent texture for it to be suitable for working.

WEDGING CLAY

Wedging is the first phase in preparing clay for pottery making.

Step 1. Use the cutoff wire to slice the block of clay into several uniform slices.

Step 2. Lay the slices down, turning every other slice sideways. Then, pick up the first slice and slam it down on top of the slice next to it. Slam the next slice on top of those two and continue until all of the slices have been slammed onto the stack.

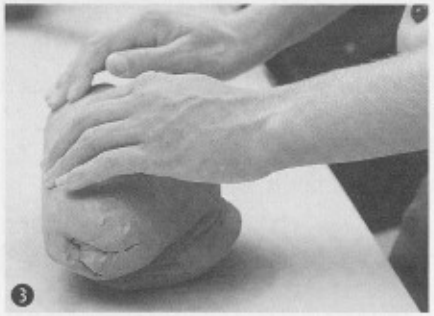
Step 3. Re-form the clay into a block (with the slices still alternately vertical and horizontal). Turn the block on its side so that the slices are perpendicular to the work surface, then repeat the slicing, turning, and slamming together until the clay is well-mixed.

KNEADING CLAY

One kind of kneading, known as "ox's head," "ram's head," or "dog's head" kneading, is accomplished this way:

Step 1. Take a lump of clay the size of a grapefruit from its container and form it into an oval ball.

Step 2. Grasp the oval ball with both hands, one on each end. Press the heels of your hands downward and toward each other at the same time, pushing the clay into itself.



Step 3. Rotate the top edges of the clay forward with your fingertips and again press the heels of your hands and downward and toward each other, pushing the clay into itself.

To get the proper consistency, you should repeat steps 2 and 3 about 40 times.

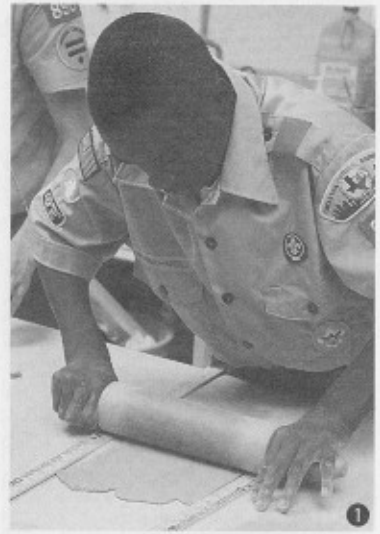
Slab Pottery

Clay slabs are simply sheets of clay; they can be of any size or thickness. The slabs are pieced together to make forms.

When working with slabs, pay attention to the amount of moisture in the clay. Low-moisture, stiff slabs will be difficult to curve without breaking, but they are good to use for making box-shaped forms. High-moisture, soft slabs will curve easily but might not stand up without complete support. Generally, the slabs must be made while the clay is soft and then allowed to dry out a little before use.

Forming a Clay Slab

There are three basic ways to form a slab:



1. **Rolling by hand.** Begin by preparing the working surface. Spread out a piece of heavy fabric, such as canvas, to prevent the slab from sticking and to make it easier to move the slab to another working space. Flatten a ball of clay in the center of the fabric. Using a rolling pin or other long wooden cylinder, roll along the surface of the ball to further flatten and smooth it into a slab. Some potters place guides at the sides of the slab to support the rolling pin and force the clay into a uniform thickness. These guides are made from wooden or metal strips that are at least ¼ inch thick. Roll the slab on one side, then cover it with another piece of heavy fabric, flip it over, and roll it again. This action compresses both sides of the slab and makes it strong.

2. **Throwing.** This is just what it sounds like. Start by forming the lump of clay into a fat, bunlike shape. Grasp the clay in both hands, extend your arms out in front of you, then quickly throw the clay down on the table at an angle toward your body. This will cause the clay to spread in one direction and thin into a slab. Rotate the clay 180 degrees and repeat the process to prevent the clay from becoming too thin in one direction. Repeat the turning and slamming until the slab reaches the desired thickness, commonly about ¼ inch.

3

3. Using a mechanical slab roller. These rolling machines have a series of gears or cables and rollers that squeeze the clay into a uniform slab. They are expensive and difficult to repair, but they make uniform slabs quickly and easily. To use a mechanical slab roller, prepare the clay by wedging it and flattening it into a thick pancake. Spread a piece of heavy fabric on the bed of the slab roller and place the clay pancake on top. Place a similar piece of fabric on top of the pancake, making sure that the fabric does not overlap the slab roller bed. The fabric will keep the clay from sticking to the bed or the roller. Turn the handle of the slab roller to finish rolling the slab.

Building With Slabs

Slabs should be shaped when they are fairly soft. Building with them should be done when the slabs have had time to set and are fairly firm.

BUILDING A CYLINDRICAL POT

Slabs can be used to make a cylindrical pot.

1 2 3

Step 1. Think about the shape and size you want your pot to be. Draw a picture of your idea, but don't let that limit your creativity.

Step 2. Use a cylindrical form like a coffee can, soft drink can, or cardboard tube as a support for the pot. Measure the circumference with a tape measure or piece of string.

Step 3. Make a slab several inches longer than the circumference of the form. The width of the slab will be approximately the height of your finished pot. Trim rough edges off all four sides of the slab and reserve this excess for the bottom of the pot. Make sure the edge that will be at the bottom of your pot is trimmed straight with a ruler.

Step 4. While the slab is resting and firming up a little, cover the support form with newspaper, neatly folded and taped with masking tape. The tape should be applied to the newspaper only, not to the support form itself. This newspaper layer will keep the clay from sticking to the form.

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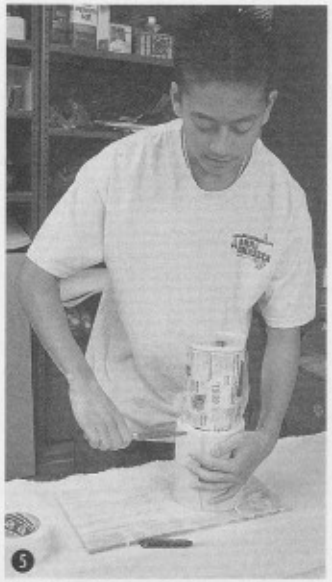
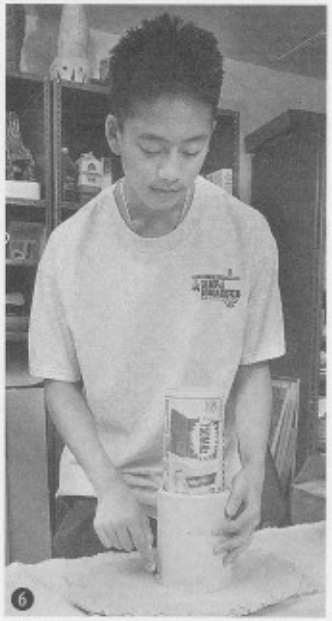


Step 5. Wrap the slab around the form. At the overlap, cut through both layers of clay at a 45-degree angle so that you have two mitered edges that will fit perfectly together. Reserve the excess length of clay for the bottom. Slip and score the mitered edges, and press them together to form a smooth seam. Tap the form on the table to make sure the slab is resting at the bottom of the form. The pot can rest like this for a few minutes.



Step 6. If none of the reserved pieces is large enough to use for the bottom, knead them together and roll out a new slab. Set the cylindrical form on the bottom slab and gently trace the outline of the bottom with a needle tool. Remove the cylindrical form; trim the excess clay from the traced outline of the bottom piece. Slip and score the bottom piece and the bottom edge of the pot. Attach the cylinder to the bottom and *carefully* remove the form, leaving just the newspaper layer for support. At this point, the newspaper will be sticking to the clay and the form should pull out easily.

Step 7. Remove the newspaper when the pot is leather hard. Refine the pot if necessary, and carve, **stamp,** or decorate if desired.

BUILDING A FOUR-WALLED SLAB POT

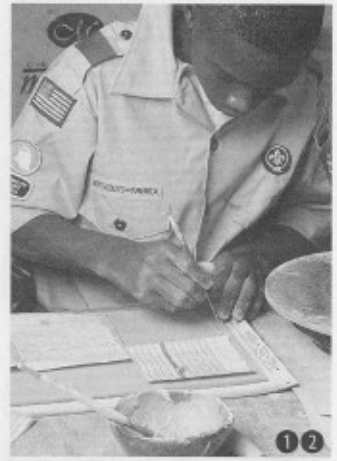
Step 1. Draw a template for each wall and for the bottom of the pot. For a square pot, the walls and bottom will be the same size. For a rectangular pot, two opposite walls will be the same size, and the other two walls will be another size. The bottom can be any size. Cut out the templates.

Step 2. Form five slabs, cutting one for each template. Let the slabs rest until they are firm enough that they do not bend when picked up.

Step 3. Attach the walls to each other using one of the following methods:

- Slip and score the edges of two walls, then press them onto a third wall that also has been slipped and scored. The two outside walls are perpendicular to the third wall between them, which is lying flat. Add the fourth wall to the top, then stand the structure and add the bottom.
- Cut the edges of the slabs at 45-degree angles and make mitered corners. Slip and score the edges, then press them firmly together. The structure should be able to stand unsupported.

Step 4. Roll a thin coil of soft clay and press it with your fingers into the joint where two walls come together inside the pot. Repeat for the remaining inside joints.



Step 5. Refine the joints, carve or **clean** the rim, and trim the base to be flush with the outside walls, if desired. Decorate the piece when it is leather hard.

Pinch Pottery

Pinch building was probably the first method used to make a pot from clay. It is almost instinctive when holding a ball of soft clay in your hands to push your thumb into it and then turn it around while pinching the sides, making a hollowed-out shape. Although the method is simple, the result does not have to look primitive or rough.

To begin pinch-building, thoroughly wedge and knead the clay. Then make a test pinch. Your finger and thumb should have no clay sticking to them. If any clay sticks, continue the wedging and kneading process.

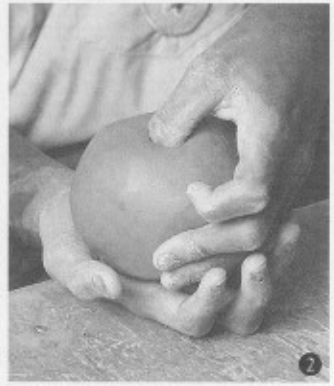
Continue pinching the clay, turning the clay in one hand and pinching with the other. The warmth of your hands will dry out the pot. This natural drying of the clay as it is worked can help the walls hold their shape as the pot becomes larger, but it also can cause the rim to become crumbly. It is best not to add water to the walls while they are being pinched out; they can become slimy and tear easily if they get too wet.

Making a Pinch Pot

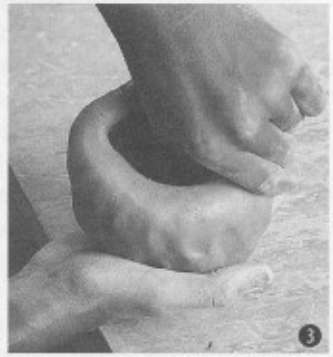
Use the pinch-building technique to create a ceramic pot.

Step 1. Draw a picture of how you want the pot to look and what size you would like to make it. If you have more design ideas during the building process, don't let the picture stop you from using them.

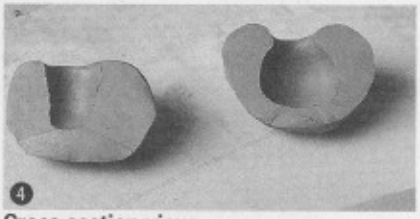
Step 2. Hold a ball of prepared clay in one hand. Using the entire pad of your thumb, gently push the thumb of the other hand into the center of the ball. Slowly rotate the clay and continue pushing the pad of your thumb into the center while rounding out the base of your pot. Work slowly and patiently, using small body movements.



Step 3. With the base established, use a circling series of pinches to raise the walls. Gently pinch the clay between your finger and thumb while turning the pot, making a ring of depressions, each slightly overlapping the ring before. It is important to keep the pressure between your finger and thumb even, and the distance between each squeeze equal.



Step 4. If the pot is to curve inward, gently ease the top inward between each row of pinching. Also, more pressure can be applied from the outside while pinching. If an outward curve is the goal, pinching with more pressure on the inside will cause the pot to expand outward.



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Cross-section view

Step 5. Variations in the rim—such as bending, curling, or splitting—are part of the pinching process. Sometimes this effect can emphasize the look of the pot, and sometimes a more refined rim is preferred. To refine the rim, cut off the ragged edges with a sharp knife, a needle, or sharp scissors. Then, using a tiny bit of water on your fingers, smooth out the newly cut edge.

Coil Pottery

Coil building is an ancient method of forming pottery. It is still the preferred method for many American Indian potters. Modern potters use this method because coiling allows greater freedom in constructing very large forms and forms that have unusual profiles.

To form coils, first place a small lump of thoroughly wedged and kneaded clay on the table. Place your hands next to each other, with your palms facing down, gently touching the lump of clay. Roll the lump forward and backward in a smooth, even motion.

Rolling coils is not as easy as you might think. If the clay is not soft or bendable, the resulting coil might have a rough, cracked surface and will not be suitable for construction. The coils must be round; making short, choppy movements with your hands will result in a coil that has flat sides. The coils must be of an even thickness; coils that are irregular tend to break easily.

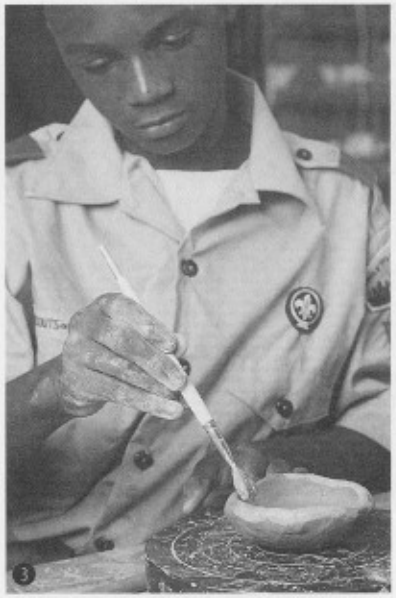
Try to relax your hand muscles, and roll the clay at least 10 to 12 inches forward and backward. Some

potters roll coils vertically between their palms instead of on a table.

Building With Coils

Coil-built pieces are always built on a slab- or pinch-formed base, which serves as a strong foundation. If the base of a pot were made only of coils, it would very likely crack open and not be structurally sound. When the base is firm, but not leather hard, you can begin adding coils, working in a spiral. Each coil layer must be firmly attached to the layer below it by slipping and scoring. As you work, the bottom layers will start to firm while the top layers are still soft.

Wet coils that are under the pressure of additional layers sometimes sag and fall or collapse, so you might need to pause after adding several layers to allow the wall to become firmer. As you build, weld the coil layers together with your fingers or a tool. This will help prevent cracks from developing in the walls of your pot during firing.



COIL-BUILDING A CYLINDRICAL POT

Practice the coil-building technique by creating a pot.

Step 1. It is always helpful to design a pot before you begin building it. Draw a picture to help you plan the height and width. Cut a template of the profile if you wish, and use it to check your progress as you work.

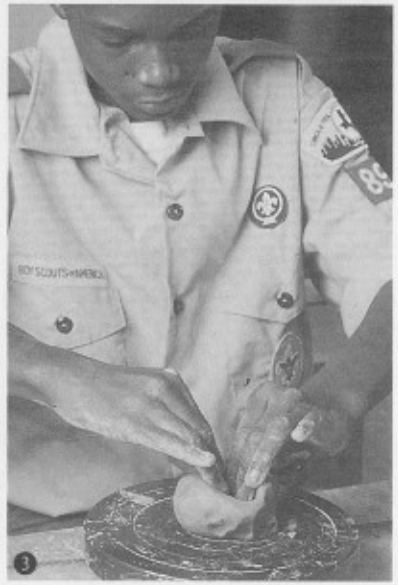
Step 2. Ensure that the clay is properly prepared.

Step 3. Form a flat base in the shape of your cylinder. Allow this base to become firm.

Step 4. Slip and score the top edge of the base. Place a coil on this edge, working in a spiral and applying slip to the top edge of each layer.

Step 5. After adding several coils, weld the walls together inside and out, and allow the pot to become firm and strong. This could take several hours, so you will need to cover the top edge with plastic. The top layer must stay soft so that you can add another coil later.

Step 6. When the pot has reached the desired height, smooth the surface if desired. Add a final thick coil to the rim for strength.



COIL-BUILDING A SPHERICAL POT

The same basic technique can be applied to coil-building a spherical pot.

Step 1. Design your pot. Draw a picture to help you visualize the curve. Cut a template of the profile to help check your progress.

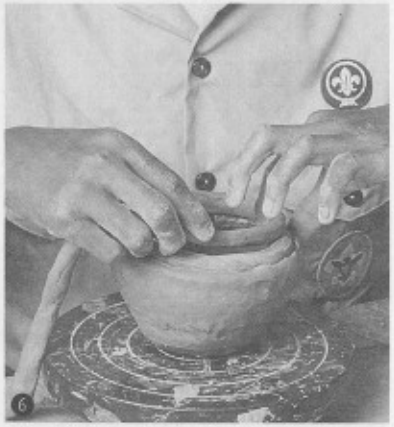
Step 2. Ensure that the clay is properly prepared.

Step 3. Form a rounded base by pinching a shallow bowl with the bottom and sides of uniform thickness. For example, the very bottom of your base might be ½ inch thick and the side would be ½ inch thick and slightly taller than the

bottom piece. Some potters put this pinch-bowl base into a wooden or bisque-fired clay dish for support, but the walls of the pinched base must be a little higher than the support dish so that a coil can be added when the base becomes firm.

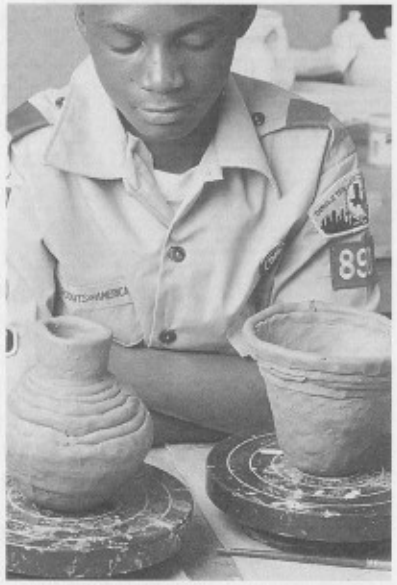
Step 4. Slip and score the rim of the pinched base and apply a coil to the top outer edge. Continue to apply slip to the rim of the exposed coil, but apply the coil to the top outside edge of it. This will make your pot expand outward in a ball shape.

Step 5. Pause periodically to weld the coils together, inside and out, and then let the walls become firm, leaving the very top edge covered with plastic.

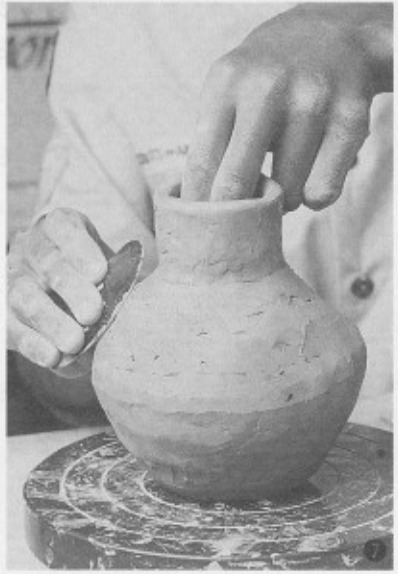


Step 6. Halfway through building, begin to curve inward rather than outward. Now apply each coil to the *inside* edge of the top coil instead of the outside edge.

Continue to build the walls, welding and allowing them to firm, until the pot is complete.



Step 7. Smooth the surface with a rib if necessary.



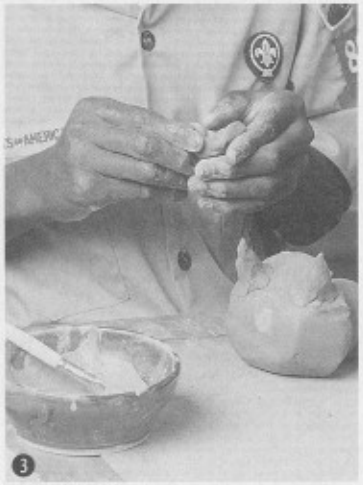
Ceramic Sculpture

Most ceramic sculptors use common methods for forming sculptures, but the best clay for sculpting might be different from that used for other clay articles. Grog added to a clay body makes the clay more porous and easier to form into irregular shapes.

While you are preparing the clay, think about what kind of sculpture you want to make. Size is one consideration: A small-scale sculpture is generally one that will fit on a table; anything bigger than that is considered large-scale and will require very special treatment to survive the creating, drying, and firing processes.

Making an Animal Sculpture

Follow these instructions to create a ceramic animal sculpture.



Step 1. Draw a rough picture of the animal to help you plan the body parts.

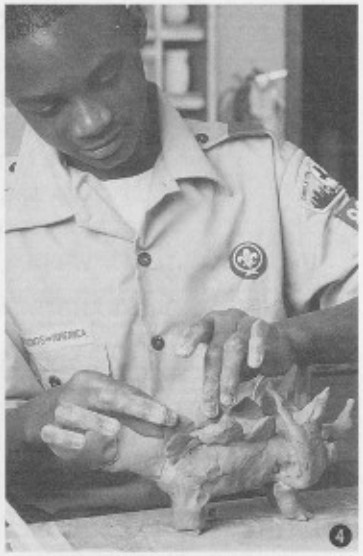
Step 2. Roll out a ball of clay for the body and a smaller one for the head. Score and slip both surfaces to weld the head to the body. Use your fingers to give the body and head their proper shapes.

Step 3. Roll out coils or cut slab pieces for legs, ears, paws, etc. Attach these to the body—largest parts first, smaller parts last—scoring and slipping the surfaces that will touch and welding them together.

Step 4. Add details, such as eyes, hair, fur, whiskers, etc., using a toothpick, needle tool, paper clip, or other sharp tool.

Step 5. When the piece is complete in the rough, you can smooth it, then add details and decoration. Do not worry about tool marks and fingernail marks that show at this point.

Step 6. Any piece more than ½ inch thick must be hollow so that it will not explode when heated in the kiln. To hollow out a completed sculpture, first wait until the clay is firm enough to stand without support. Carefully cut the sculpture in half. Use a loop tool to hollow out the walls to less than ½ inch thick. Score and slip the walls, and weld the sculpture back together. Use soft clay to repair any seam that shows. Carefully wrap the sculpture in a plastic bag and let it rest for 24 hours, then dry completely and fire.



Thrown Pottery

Making pots on a potter's wheel is known as **throwing.** Throwing pottery on the wheel takes a lot of practice. A skilled potter working at the wheel makes the process look easy, but first-timers nearly always are surprised at how awkward and difficult it can be. Most beginners do not produce an acceptable pot the first few tries. Don't get discouraged; with persistence, you will develop the skill.

The process of throwing a pot can be divided into six steps:

1. Prepare the clay.
2. **Center** the clay into a cylindrical shape.
3. Open the clay.
4. Pull up the walls into a hollow cylinder.
5. Shape the form.
6. Finish the form.

To accomplish these steps, you will need the following:

- An area for wedging and kneading the clay
- A bowl of water near the wheel to keep your hands and the clay wet while throwing
- Tools—sponge, needle tool, wooden knife, cutoff wire, and shaping rib made of wood, metal, plastic, or rubber

Centering the Clay

Because the wheel travels in a circle, pushing the clay into **center** is simply a mechanical process. For a beginner, soft clay is much easier to center than stiff clay. Save stiff clay for slab projects.

Step 1. Place a prepared ball of clay as close to the center of the wheel head as possible. Give it a little slap to push it down solidly onto the wheel. Dip your hands in the water bowl and turn the wheel to a high speed.

Step 2. Gradually press your hands onto the clay parallel with the wheel head. Then, using your whole body, brace your arms firmly against your hips or legs and stiffen your hands and fingers. Surround the clay on the top and sides with your hands and press toward the center of the wheel with your body weight leaning into it. If your body is braced and stiff, the clay has nowhere to go but into center. Usually, your left hand controls the side of the clay and your right hand controls the top. Rewet your hands often to keep the clay gliding easily.

Step 3. When the clay feels centered, gradually lighten your pressure on the clay and gently, slowly remove your hands. Any quick moves—either putting your hands onto the clay or taking them off suddenly—will move the clay off center.

Opening the Clay

There are many ways to open a hole in the center of a clay ball. The following is one effective way:

Step 1. With the wheel still spinning at a high speed, wet your left hand and brace the clay around the side. Then place the thumb of your right hand onto your left hand for further bracing.

Step 2. Using a strong finger from your right hand, slowly push that finger into the middle of the clay ball.

Step 3. When your finger gets near the bottom of the clay ball, stiffen your finger and slowly pull your right arm back toward your body. This should open up a hole in the clay.

Step 4. When the hole is large enough, slow down the wheel and, using the pad rather than the tip of your finger, compress the bottom you have just made.

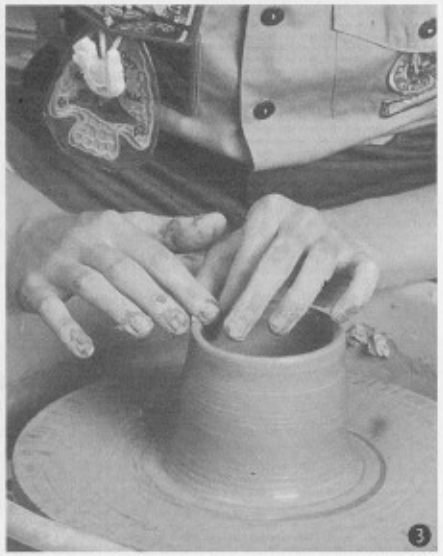
Pulling Up the Walls

Pulling up the walls of a pot is somewhat similar to pinching a wall. The difference is that one hand works on the inside of the pot and the other hand works on the outside, rather than just one hand pinching with the thumb and fingers.

Step 1. Thoroughly wet your hands. Place your fingers at the bottom of the pot, one hand inside and one outside. Your hands will be right next to each other with the wall in between, and your fingertips will do the work. Keep your elbows braced against your hips, your arms stiff, and your hands well lubricated with water. Press or pinch your hands slightly together, and very slowly, keeping that pinched distance the same, raise your arms to bring your fingers up the wall of the pot.

Step 2. The wall will rise as your fingers distribute the clay upward. As you get to the top, gently release the pressure so that the walls will stay a uniform thickness.

Step 3. As the wheel is going around, support the wall with the thumb and fingers of your outside hand and press down gently on the top rim with the index finger of your other hand. This is called "setting the rim."



Step 4. Repeat this procedure three or four times, or until the pot reaches the desired height and the walls are of the desired thickness.

Shaping the Form

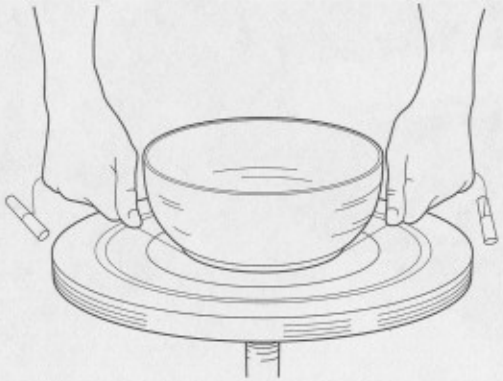
You will probably notice that pressure from your fingers makes the clay move. If your hands are lined up together, but you press harder with your inside finger than with your outside finger, the wall of the pot will swell outward. Similarly, if you press harder with your outside finger than with your inside finger, the pot will curve inward.

Once the wall of the pot has been moved outward, it is difficult to get it to go back in. However, a narrow pot can easily be made more spherical. Practice using your inside and outside fingers to make gradually curving walls.

Use a sponge to drip water on the walls of the pot to keep them slippery. But be careful; too much water can cause the walls of the pot to collapse. Use just enough to keep the walls well lubricated.

You also can use a rib to shape the walls. Hold the edge of the rib against a uniformly wet wall. As the wheel goes around, support the wall with one hand and press the rib to move the wall in or out.

Finishing the Form



Use a wooden knife to trim extra clay off the outside bottom of the pot. Then use the cutoff wire to free the pot from the wheel head.

Step 1. Holding the wire at both ends, place it firmly down on the edge of the wheel head that is farthest away from your body.

Step 2. Firmly hold the wire down with your fingers and slowly rotate the wheel, pulling the wire toward your body.

Step 3. When the wire has passed completely under the bottom of the pot, wipe your hands dry. As gently as possible, pick up the pot with both hands and place it on a board to dry.

Decorating and Glazing

There are many techniques that can be used to turn a simple piece of pottery into a uniquely decorated work of art. Experiment with each one to discover how the techniques affect the pottery.

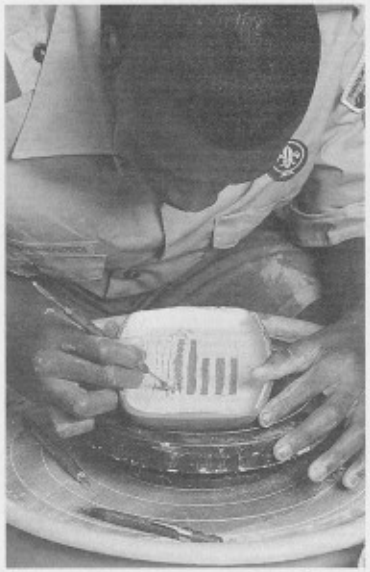
Textured Decoration

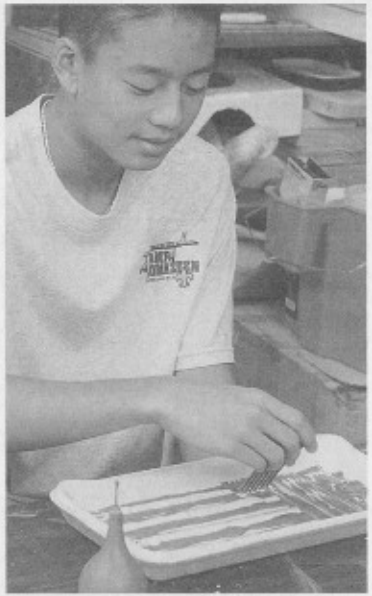
Pottery can be decorated in many ways. Some decorating techniques originally had practical purposes. When primitive potters formed wet pots, their fingers left indentations in the sides. The potters noticed after firing that these dents made the pots easier to handle. Some potters pressed rope into the sides of pots they were forming, and this made the pots not as slippery when wet. As the potters experimented with other objects and tools in their clay work, they noticed that adding these practical features made the pots more interesting to look at, too.

Use your imagination to design pottery projects that will make distinctive textured or indented decorations on the surface.

Decorating With Slip

Another ancient technique that you might consider is slip painting, which simply is painting colored **slip** onto the surface of an unfired pot. Using several fairly thin coats, you can cover the entire pot, or paint a specific design onto it, or you can paint a base coat and then paint a design of a different color on top of that.





Once the pot is painted with slip, use a sharp tool to scratch or carve a design through the slip, down to the surface of the clay. This technique is called **sgraffito.**

Slip also can be trailed onto the clay surface of the pot or onto a slip-painted surface for a raised effect. Put some thick slip into an applicator bottle (basically a rubber bulb with a removable nozzle, available from clay suppliers) or any clean squeeze bottle with a narrow, tapered tip (such as a mustard squeeze bottle). While applying constant pressure and working at a constant speed, squeeze out a line of slip in a unique pattern or design.

If several colors of slip trails are placed close together on a pot, the lines can be combed with a feather or a comb from which several teeth have been removed. A marbled effect can be created on the inside of the piece by pouring several colors of slip into a pot and swirling them around slightly. Keep in mind that pots with very thick layers of slip must dry very slowly to prevent cracks.

Most of the time, slips are used on clay that is still wet, and glaze is used on clay that has been bisque fired. There are exceptions: Some potters glaze their **greenware** and fire it only once, but they must use specially formulated glazes. Some potters apply slip to their **bisque ware,** but again, this slip must be specially formulated.

Applied Decoration

Another attractive way to decorate a clay article is to attach damp pieces of clay in various shapes. This is called sprigging. Sprigs are made by pressing soft clay into a small, decorative plaster mold. The clay hardens quickly and is easily removed with a needle. Paint the edges with a little water, then press the sprig onto the pot.

Decorating With Glaze

Glaze is a combination of several substances: alumina, which keeps the glaze from running too much; a flux, which helps the glaze melt into a glass at a safe temperature for the clay; silica to give it shine; and, often, chemicals to add color.

A Caution About Lead

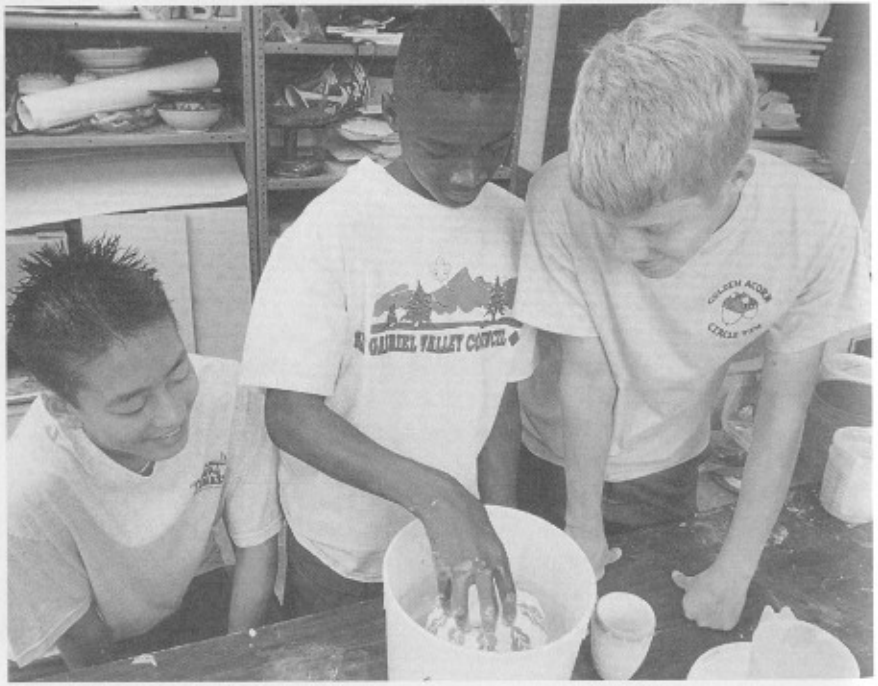
Lead is a toxic material. If handled improperly in glazes applied to ceramic ware made for drinking or eating, small amounts can leach into a person's system and over time will accumulate to a dangerous level.

The Food and Drug Administration allows the use of lead glazes because of their durability but closely regulates their use with strict controls and guidelines to ensure consumer safety.

For the individual potter, the use of lead in glazes, particularly low-fired glazes such as for raku pottery, can be dangerous to the potter as well as the user of the pottery. Extreme caution is advised when using lead. Check with your merit badge counselor or an experienced potter for guidance on how to *safely* use lead in glazes.

Although much useful and attractive pottery is made without glaze, potters also like to use glaze because it gives functional ware a sanitary, nonporous surface and serves as decoration. To begin experimenting with this type of decoration, first get advice from your merit badge counselor or an experienced potter. Decorating with glaze is a fairly complicated technique, but the sense of accomplishment after a successful glaze firing can be well worth the effort.

Glaze is nearly always applied to bisque-fired ware. You can use a paintbrush, but it is more effective to dip the pot into the glaze or pour the glaze onto the pot. The inside is glazed first. Pour the glaze into the pot, roll it around to cover the entire inside, and carefully pour it out. After the inside has dried (in usually less than a minute), you can glaze the outside.



Dipping is the most effective way to glaze clayware.

Either dip the piece into the glaze, or hold the pot over the glaze bucket while pouring glaze over the outside. Be sure to wipe the glaze from the foot of the piece to keep it from sticking to the kiln shelf when the glaze melts during firing.

Many potters use tongs or gloves when applying glaze to prevent it from getting on their skin. Some chemicals in the glaze can irritate or be absorbed by the skin. If you do get any glaze on you, rinse off immediately with plenty of water.

Commercially prepared glazes, especially those manufactured for low-fire clays, are easily applied with a paintbrush. Follow the instructions on the label.

Wash your hands immediately and thoroughly after handling glazes.

Firing

Firing the kiln is undoubtedly one of the most exciting and challenging steps in pottery making. The process can be quite technical. There are several things you will need to know before you begin.

General Rules for Firing

The following safety rules must be followed when firing pottery:

- Wear full, sturdy shoes that won't easily melt or catch fire. Open footwear, such as sandals, is inadequate protection for your feet.
- All work must be bone dry before bisque firing to prevent cracking and possibly exploding. Hold the bottom of the clay article against your cheek. If it feels cold, there is still moisture in it and it is not safe to bisque fire.
- Before loading the kiln, vacuum it out completely to prevent bits of kiln dust or brick from landing on your work during firing and spoiling it.
- Never brush a kiln shelf with your bare hand. Jagged, razor-sharp pieces of glaze can be stuck to the shelf.
- Clayware must be stacked in the kiln skillfully. All pieces should stand level. Unglazed ware can be stacked or packed closely, but glazed ware must stand alone so that melted glaze will not stick or drip onto another piece.

- Make sure the undersides of the pieces are not glazed, or at least are unglazed where they touch the shelf, to prevent sticking to kiln shelves when the glaze melts.
- Always keep the room in which you are firing well ventilated; clay and glazes give off vapors that can be poisonous. Do not stay in the room with a kiln that is firing, even if the room is well-ventilated.
- Fire the kiln slowly. An average bisque firing should take no less than eight hours.
- Once the kiln has risen to 200 degrees, do not open the kiln door. This would be a safety risk for you as well as the pieces. Do not touch the sides of the kiln or the door handle.
- Wear protective insulating gloves and safety glasses or welding goggles when checking the cones through the peephole.
- Do not try to open the kiln or remove pieces from it until everything has cooled enough to handle with bare hands.

Assessing the Heatwork

Before you begin firing, you must know the proper firing temperature for clay (and glaze if you're using it). If you don't fire high enough to mature the clay, the surface will be soft and porous; if you fire too high, the piece will melt out of shape. You also will need to know how to measure the temperature in the kiln to determine whether the proper **heatwork** has been reached.

Before the development of modern aids to measure and control kiln temperatures, potters had to read the heat in a kiln by the color of the flame and the opaqueness of the kiln atmosphere. Today there are various instruments and tools to help potters track the progress inside the kiln.

Pyrometer

There is a special process for measuring kiln temperature that does not involve just an ordinary thermometer. No regular thermometer could withstand the extreme heat in a kiln, but many types of firing require the potter to know the actual temperature in the kiln. A pyrometer, a high-temperature thermometer, is used for this. But the pyrometer alone is not always sufficient for indicating shutoff time. It reads the actual temperature but does not indicate the amount of work done by the heat.

Temperature is not the potter's sole concern. He or she needs to know how much *work* has been accomplished by the heat in combination with how much time has elapsed. This is known as the heatwork.

Pyrometric Cones

Pyrometric cones are little pyramids made of clay and glaze that melt and bend, each at its own specific temperature, to signal the end of a firing or, in some electric kilns, to trigger a kiln shutoff. Since cones respond to time and heat, they are more reliable for assessing heatwork. For this reason, it is common practice to use cones in addition to the pyrometer.

Cones are available in a wide range of temperatures. Once you know the temperature at which the clay you are using matures, you would use the cone that corresponds to that temperature, as well as the next lowest and the next highest cones.

Pyrometric cones are numbered in a peculiar way. The lowest temperatures start with a zero; for example, cone 018 corresponds to a common temperature for certain low-fire glazes called **lusters.** Also, the cones are numbered in reverse order, with 018 representing a lower temperature than 015, which represents a lower temperature than 012, and so forth through 01. Then the numbering picks up at 1, and continues in regular numerical order, from the coolest to the hottest temperatures.

For instance, if a potter should say, "This clay matures at cone 06," this means that the firing will be finished and

the clay will have become dense and reached its optimum strength when an 06 cone melts in the kiln.

Potters typically do not use cones higher than 15. Earthenware and terra-cotta usually fire to maturity at cone 04. A common high-fire porcelain and stoneware temperature is cone 10. Raku is usually low-fire—cone 06—and salt or soda can create a glaze from cone 7 and up. Wood-burning kilns usually reach very hot temperatures, above cone 10.

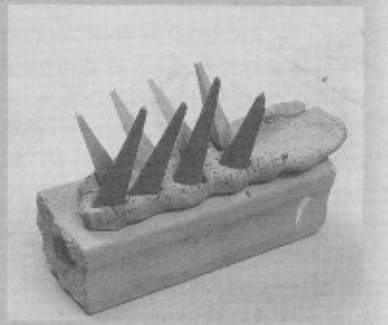
Cone Pack

To make a cone pack, you will need the cone that corresponds to the maturing temperature of the clay, as well as the next highest and the next lowest cones. For instance, if you will be firing to cone 4, you would use cones 3, 4, and 5.

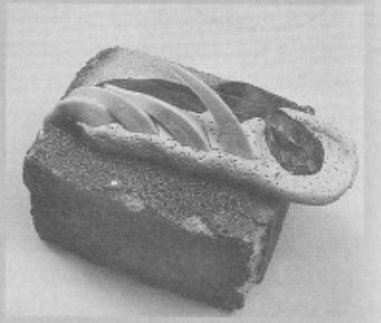
Line up the cones in a pad of clay and slant them slightly so that when they melt they will bend over in a direction that will allow you to see them. It works well to slant the lowest cone (the one that will melt first) away from the other two, then slant those two toward the first one.

When the cone closest to the bottom melts, this is a warning signal. When the middle cone melts—the one that corresponds to the maturing temperature of your clay—it is time to shut off the kiln. This must be done quickly before the third cone begins to melt.

For some larger kilns, it is common practice to make several cone packs, which are placed in different areas throughout the kiln.



Cones are lined up in the cone pack, all slightly slanting in the same direction.



A cone pack looks like this after it has been used in firing.

Packing the Kiln

When you consider the time and fuel spent in a single firing, you will understand why it is important to pack the kiln efficiently. Not only is it more economic, but it also ensures a more even firing and a good atmosphere in the chamber.

Make full use of the kiln's capacity by grouping similar sizes of ware together. Begin with short or flat pieces on the bottom; save the taller pots for the higher levels. Keep in mind that unglazed ware can be packed so that pieces touch each other; glazed pieces must not touch. Leave ample room for air to circulate around their bases. Keep ware at least 1 inch away from the kiln walls.

Support each shelf with three posts. Some electric kiln shelves require four posts, but an arrangement of three posts usually provides the most stable support, depending on the shape of the shelves. Posts should be at least 1 inch taller than the pots.

Before putting any clayware on the first shelf, place the posts that will support the shelf above. Then, when the first shelf is packed, lower the next shelf carefully into the kiln without touching the side walls or jarring the kiln. Carefully position the shelf and lower it onto the posts. It should be stable enough that it doesn't move when lightly touched.

Position the next set of posts directly over the base posts. It is important for the posts to be stacked directly in line with each other vertically. If posts are stacked vertically offset from each other, the shelves will not be as stable.

Clay articles should be fired in the position in which they will be used when finished. For example, a box, jar, or teapot should be fired with its lid in place. However, clock faces should be fired lying flat to prevent warping.

Make sure cone packs are clearly visible through the **peepholes** in the door or sides of the kiln. Don't place them too close to the peephole or it might be hard to tell which cone is which. If placed too far away among other vague outlines, it might be difficult to tell what is a cone and what is not. Cones are most easily seen against a plain, solid background, whether in front of a large pot or with nothing just behind them.

Average Bisque-Firing Schedule (Cone 06)

Once the work is properly loaded and you have ensured that the cones are easily visible through the peepholes, turn the bottom control on the lowest setting and prop the lid or door slightly open with a soft brick or post; this will allow steam to escape. It is extremely important to ensure that no one—a small child or a pet, for instance—will interfere with the kiln in any way during this preheating phase of the firing.

The kiln can stay in this position for two hours or even overnight, if necessary, depending on the thickness of the pots. From this point on, turn up the kiln once every hour as follows:

- Hour 1—bottom control on low
- Hour 2—middle control on low
- Hour 3—top control on low (Close the door or lid before turning the top control on low.)
- Hour 4—bottom control on medium
- Hour 5—middle control on medium (At this point, if color is visible through the peepholes you can also turn the top control on medium. If the kiln is still dark, wait until hour 6 to turn up the top control.)
- Hour 6—top control on medium, or bottom control on high
- Hour 7—bottom control on high, or middle and top controls on high
- Hour 8—middle and top controls on high if needed

Watch the cones carefully, checking every 30 minutes, until the appropriate cone has melted. Turn off the kiln and let it cool completely.

Firing Schedule for Low-Fire Glaze (Cone 04)

The following is a commonly used schedule for firing low-fire glaze in an electric kiln.

First, preheat by turning the bottom control on low for one hour with the lid or door propped open; this will allow any remaining moisture to escape as steam. Then, turn up the kiln as follows:

- Hours 1 and 2—all controls on low
- Hours 3 and 4—all controls on medium
- Hour 5—all controls on high

The kiln will be ready to shut off within three to five hours after the last controls are turned up. Watch the cones carefully after about two hours.

High-Fire Schedule

Because many high-fire kilns are built by individuals, each kiln follows a unique schedule. Do not attempt to fire any fuel-burning kiln without close supervision from the owner.

Most firings are documented by keeping logbooks. It is possible to follow another potter's log, but commonly the notes about temperature and atmosphere are subjective, and a beginner should never attempt this type of firing unsupervised.

Reduction and Oxidation Firings

Fuel must have a sufficient amount of oxygen to burn. The dampers in fuel-burning kilns enable the potter to adjust the amount of oxygen inside the kiln. When the kiln contains more than enough oxygen needed to completely burn the amount of fuel being used, the atmosphere inside the kiln is oxidized. However, if the dampers are adjusted so that not enough oxygen is available inside the kiln to burn the fuel, then the air inside the kiln looks smoky and hazy and the atmosphere is reduced.

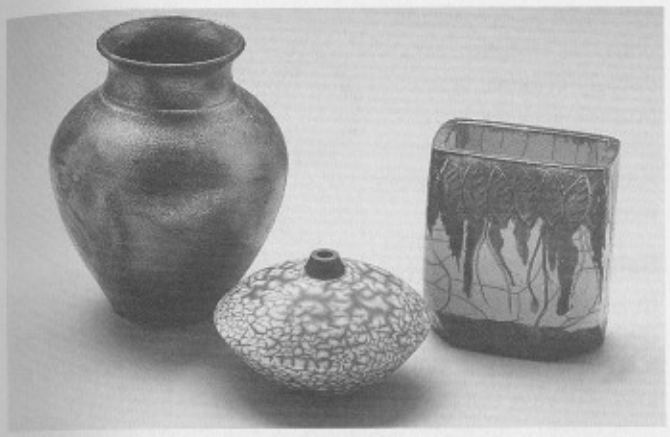
In a reduction firing, the flame is seeking oxygen inside the kiln, and since there isn't enough, it "steals" oxygen from the clay and glazes. This chemical reaction turns the clay a darker color and changes the look and texture of some glazes. For example, a celadon glaze works only in a reduction firing; it would turn yellowish if fired in an oxidizing atmosphere. Copper oxide can produce a brilliant red in a reduction firing, but it would produce greens in an oxidation firing.

Special Firings

Raku firing and salt or soda firing can be done in any of the fuel-burning kilns, although salt or soda firing should be done in a dedicated kiln because, over time, a thick layer of **salt glaze** will form on the kiln's inner surface. Electric kilns are not very suitable for salt, soda, or raku, because the heating elements in electric kilns are easily damaged when exposed to high levels of sodium or extreme temperature changes.

Raku Firing

Raku firing is a special process invented hundreds of years ago for the traditional Japanese tea ceremony. Raku tea bowls were actually made and used during the tea ceremony. Today, the raku technique is popular with many potters because it enables them to produce unique pottery in a relatively short period of time.



An American version of the raku technique involves first firing glazed pottery at a low temperature in a fuel-burning kiln until the glaze melts, often for only a few hours. Then, when the glaze is molten, the pieces are removed from the kiln with long metal tongs and placed into a fireproof container with sawdust, newspaper, banana peels, or other combustibles, and covered. The combustible materials catch on fire, but the fire is immediately smothered and the smoke penetrates the surface of the pots. This action creates black areas where there is no glaze (such as on pieces that are partially glazed as a design element), or a smoky crackle induced by the thermal shock, or other unique effects in the glaze.

Also, since the fire is trying to burn, it needs oxygen and takes it from the molten glaze. This reducing activity gives some raku glazes flashes of metallic gold, copper, blue, or green.

Removing pots from the kiln is a hazardous process that requires the potter to wear a special fire suit, protective face shield, and insulating gloves.

If you decide to try the raku technique, you *must* have the supervision of a knowledgeable adult, you *must* wear the protective clothing, and you *must* wear shoes that will not easily melt or catch fire if a pot were to accidentally fall on your foot while being removed from the kiln.

Raku pottery made with this technique is usually **crazed,** very porous, and not very strong, which makes it suitable only as decorative ware.

Salt or Soda Firing

In salt firing, the firing proceeds as usual until near the end of the firing, just before the peak temperature has been reached, when sodium is introduced into the kiln. Because the kiln is so hot, the salt immediately volatilizes—the sodium chloride splits into sodium and chlorine gas. The chlorine combines with moisture and forms hydrochloric acid, which eventually escapes from the kiln through the flue; the sodium chemically reacts with the surface of the clay to form a glaze that often has an "orange peel" texture.

Sodium can be put into the kiln in many ways. You can use regular salt, rock salt, baking soda, washing soda, or any combination of these. Just roll it up in sheets of newspaper and throw them in, or blow the powder into the kiln with a compressor, or you can dissolve the sodium in hot water and spray it into the kiln with a garden-type pump sprayer with a metal nozzle.

Baking soda (sodium bicarbonate) and washing soda (soda ash or sodium carbonate) do not change from powder to gas as readily as salt does, so these substances should be put into the kiln in a dissolved form or mixed with a good quantity of salt.

The fumes produced by salt firing are toxic, and safety procedures must be followed during the firing. Follow the instructions from your merit badge counselor or an experienced potter whenever you are participating in a salt firing.

Generally you can tell if the kiln is still hot by touching the outside or by opening the peephole. If heat comes out of the peephole, it's probably still too hot to open the kiln. If it feels warm, but you aren't sure if it's really *hot,* try this test: Stick some paper into the peephole for about 30 seconds. If it comes back charred or has actually caught on fire, then you know the kiln chamber is still at least 451 degrees, the combustion point of paper, and is much too hot to open.

Opportunities in Ceramics

The ceramic industry is one of the largest industries in the United States. Ceramics are useful because of their chemical, electrical, mechanical, thermal, magnetic, and structural properties. This makes the ceramic industry vital to the successful operation of other industries.

For example, kiln furniture and firebrick refractories are a basic component of the steel industry, which uses huge furnaces to make and recycle metal. Abrasive materials made from silica are essential to the machine-tool and automotive industry. Glass products are essential to the automobile industry and to architectural, electronic, medical, and agricultural industries. Uranium oxide fuels are packaged in ceramic rods for use by nuclear power plants. The chips in every computer are ceramic, as are the tiles that cover the NASA space shuttles. Even the coating on paper used for magazines and books is ceramic.

The field of ceramics is extremely diverse, offering many possibilities for employment. You might have an interest in the technical fields—chemical, mechanical, or ceramic engineering. Or maybe you prefer the executive side, such as managing ceramic manufacturing operations. You might be more interested in selling and distributing ceramic products, or you might want to specialize in ceramic art.

Be Prepared

A college education is very helpful to gain a thorough understanding of the technical aspects of this industry. Success is ensured to a capable worker who receives training for a place in this rapidly expanding field. Many colleges and universities offer courses in ceramics, the graduates of which are qualified to work as ceramists or ceramic engineers.

If you are interested in exploring the wide variety of courses leading to degrees in the ceramic industry, consult your school guidance counselor. High school courses that will help you gain knowledge important in the ceramic industry include chemistry, physics, math, and shopwork. Give special attention to art because it is closely allied with ceramic design and decoration. Also, a knowledge of machinery and drafting would be of great help.

If you are studying ceramics in school, some practical experience under actual working conditions would be of value. Try to locate a pottery studio in your community, then apply for part-time or summer work there. No matter what job you are assigned to do, you will learn something just from working in the environment and absorbing information.

Professional pottery artisans also are often good resources and may be willing to share their expertise.

After Graduation

Ceramists and ceramic engineers are concerned with the mining and processing of clay and other nonmetallic minerals and all the products manufactured from these raw materials. Many of them work in research, design, manufacturing, or sales. Some might specialize in such materials as brick, tile, pottery, glass, sanitary ware, enameled metals, abrasives, jet motors, refractories, cements, electronics, and more.

A large percentage of graduates of ceramic coursework are employed in the stone, clay, and glass industries. Other opportunities are in steel, electrical machinery, aircraft, or chemical industries, as well as in education.

And let's not forget the individual potter. Some potters have become well known for their masterful works of art. Some of the finest examples of pottery are now displayed in world-famous museums; others are commanding high prices at exclusive antiques and art auctions. The most popular designs and styles created by these potters are being reproduced by the world's most-respected makers of fine porcelain and stoneware.

Not everyone can create a masterpiece, but that doesn't mean they don't enjoy working with clay and making useful, attractive objects. It never hurts to try, and trying can be a reward in itself. You just might find that you have the creativity and natural ability to become a successful studio or artist potter.

Glossary

Pottery has a language of its own. To know what a potter is talking about, you will need to know the language. Here is a short glossary of some important terms:

bat. A disk or slab of wood, plaster, hardboard, or plastic on which clayware is produced or allowed to dry out. Slightly porous materials make the best bats for pots because they allow the bottoms of the pots to dry. Bats are used on the potter's wheel for large pots that cannot be easily removed after throwing.

bisque or biscuit ware. Unglazed clayware that has been fired once to a low temperature and is still porous.

bisque firing. The first firing, without glaze, to drive off the water chemically combined in the clay, thus making a clay article easier to handle for further work, such as decorating and glazing. (Slips can be used in a bisque firing.)

bone dry. Completely air-dried and not yet fired in a kiln.

burnishing. A finishing technique in which the surface of a clay article is smoothed and polished by rubbing it with a hard object, such as a stone or the back of a spoon.

centering. The process of moving the clay into a symmetrical, spinning axis in the middle of a wheel head so it can be thrown.

clay body. A combination of different types of clay and other substances, mixed according to a formula for a specific ceramic purpose.

clean. To scrape clay with a rib or wipe it with a sponge.

coil-build. To use pieces of clay rolled like rope in making pottery.

compressing. The process of pushing the clay down, forcing the clay particles closer together.

crackle. Cracks in a glazed surface, intentionally induced as a decorative element.

crazing. A fine network of hairline cracks in the glaze usually caused by uneven contraction and expansion of the clay article during changes in kiln temperature or during cooling; sometimes intentionally induced as a decorative element.

cutoff wire. A length of wire, usually with a handle at each end, used for cutting clay when wedging or to release the bottom of a clay article from the wheel head.

earthenware. Opaque, porous pottery made from a clay that matures at a low firing temperature; coarser in texture than porcelain.

feldspar. A crystalline mineral used as a fluxing agent in clay bodies and some glaze recipes.

fettling. The removal or correction of blemishes, seams, or other imperfections before bisque firing.

filler. A material added to a clay body to lend strength, determine porosity, and affect shrinkage.

firing. The process of heating clay articles, usually in a kiln, to a specific temperature for a specific time until mature.

flashing mark. An effect on glazed pottery caused by uneven heat during firing.

flux. A melting agent added to a clay body to help the clay particles melt together, or fuse, into a solid material when fired.

foot. The base of a ceramic form.

frit. Ground glass used to make lead salts nontoxic to the skin or certain fluxes insoluble.

glaze. A coating of a glasslike substance that is fired onto a clay surface for decorative purposes or to seal a porous pottery body.

greenware. Formed pottery articles that are not yet bisque fired.

grog. Unglazed, fired clay that has been ground up and added to a clay body to provide texture, increase porosity, lend strength and stability, or reduce shrinkage.

hand-build. To construct a piece of pottery from parts that might be pinched, coiled, slabbed, press-molded, extruded, or fashioned by hand.

heatwork. The combined measure of time and temperature.

kaolin. China clay.

kiln. A special oven used for firing clay.

kneading. The process of working and pressing plastic clay with the hands to help eliminate air bubbles, hard spots, and lumps, to distribute the moisture evenly, and to give the clay a consistent texture.

leather hard. A stage that clayware reaches during drying, when it is stiff enough to be picked up without distortion, yet soft enough to respond to pressure.

luster. A thin film of a metallic oxide applied to a fired, glazed surface, then fired at a low temperature to produce an iridescent effect.

mature. When ware and glazes have reached their proper heatwork—ware has reached its optimum strength and glaze has fully fused.

nonporous. Having no pores or openings to allow liquid to seep through; watertight.

oxide. One of various metal compounds used as colorants in glazes and clay bodies.

peephole. An opening in the side of a kiln for monitoring the pyrometric cones and the chamber during firing.

pinch-build. To manipulate clay by pushing the thumb into it and pressing with the fingers on the outside while turning the clay, creating a hollowed-out form.

porcelain. A high-fired, vitrified pottery with a white, fine-grained body that is usually translucent.

porosity. The degree to which fired clay can absorb water; also, the degree to which liquid can seep through fired or unfired clay.

porous. Having pores or tiny openings that allow liquid to seep through.

pyrometric cones. Little pyramids made of clay and glaze that are formulated to melt and bend as indicators of the temperature reached in the kiln.

refractory. Capable of being fired at high temperatures without deforming; a heat-resisting ceramic material.

salt glaze. A thin glaze produced by throwing salt into the kiln just before it has reached peak temperature.

score. To scrape a series of crisscross lines—using a needle tool, serrated rib, needle, paper clip, or other tool—onto a clay surface that has been brushed with slip. Two clay surfaces that have been slipped and scored can then be welded together.

slip. A creamy mixture of water and clay that is used to weld pieces of clay together or as a decorative element.

stamping. A decorating technique employing a recessed or raised design pressed into the clay.

stoneware. A strong and usually opaque ceramic ware that is well vitrified and nonporous when fired to a high temperature.

template. A pattern for shaping the profile of a piece.

terra-cotta. A low-fired earthenware that fires to an orange, red, or brown color.

throwing. The process of shaping clay on the potter's wheel.

vitrify. To become glasslike and nonporous.

wedging. The process of mixing plastic clay by cutting it in half and slamming the halves back together to eliminate air bubbles, hard spots, and lumps, to distribute the moisture evenly, and to give the clay a consistent texture.