THE SMITHSONIAN INSTITUTION FACT SHEET

The Smithsonian Institution is a museum, education and research complex of 17 museums and galleries, and the National Zoological Park. Fifteen museums and galleries are located in Washington, D.C., two are in New York City, and the National Zoo is in Washington. Ten of the museums and galleries are situated on the National Mall between the U.S. Capitol and Washington Monument.

One of the world's leading scientific research centers, the Institution has facilities in eight states and the Republic of Panama. Research projects in the arts, history, and science are carried out by the Smithsonian all over the world.

The new National Museum of the American Indian is scheduled to open on the National Mall in 2002. The centerpiece of the museum is the priceless collection of Native American artifacts transferred to the Smithsonian from the Museum of the American Indian, Heye Foundation (New York). The New York exhibition facility - the Heye Center of the National Museum of the American Indian opened October 30, 1994 in lower Manhattan.

Another new museum, the National Postal Museum, is located near Union Station on Capitol Hill. Devoted to the history of the U.S. mail service, the museum houses the world's largest and most comprehensive collection of its kind, with more than 16 million stamps, covers, and artifacts.

HISTORY

James Smithson (1765-1829), a British scientist, drew up his will in 1826 naming his nephew, Henry James Hungerford, as beneficiary. Smithson stipulated that should the nephew die without heirs (as he did in 1835), the estate would go to the United States to found "at Washington, under the name of the Smithsonian Institution, an establishment for the increase and diffusion of knowledge..."

On July 1, 1836, Congress accepted the legacy bequeathed to the nation by James Smithson, and pledged the faith of the United States to the charitable trust. In 1838, following approval of the bequest by the British courts, the United States received Smithson's estate - bags of gold sovereigns - then the equivalent of $515,169. Eight years later, on August 10, 1846, an Act of Congress signed by President James K. Polk, established the Smithsonian Institution in its present form and provided for the administration of the trust, independent of the government itself, by a Board of Regents and Secretary of the Smithsonian.

SMITHSONIAN MUSEUMS, GALLERIES AND ZOOS

Anacostia Museum
Arthur M. Sackler Gallery
Arts and Industries Building
Cooper-Hewitt, National Design Museum
Freer Gallery of Art
Hirshhorn Museum and Sculpture Garden
National Air and Space Museum
National Museum of African Art
National Museum of American History
National Museum of the American Indian
National Museum of Natural History
National Portrait Gallery
National Postal Museum
National Zoological Park
Renwick Gallery
S. Dillon Ripley Center
Smithsonian American Art Museum
Smithsonian Institution Building ("Castle")

SMITHSONIAN INSTITUTION ®

ATTENTION:
Made ONLY for Electrical Rating Listed Below.

UL LISTED

63B2 TOYS

ITEM #6354
ITEM #26354
AGES 10 & UP

SMITHSONIAN
ROCK TUMBLER™

DANGER: TO PREVENT ELECTRIC SHOCK DO NOT IMMERSE IN WATER - WIPE CLEAN WITH DAMP CLOTH.

CAUTION: ELECTRICALLY OPERATED TOY. NOT RECOMMENDED FOR CHILDREN UNDER 10 YEARS OF AGE. AS WITH ALL ELECTRICAL PRODUCTS, PRECAUTION SHOULD BE OBSERVED DURING HANDLING AND USE TO PREVENT ELECTRICAL SHOCK. ADULT SUPERVISION RECOMMENDED WITH ALL ELECTRICAL TOYS OPERATING AT 120 VOLTS. THE TOY SHOULD PERIODICALLY BE EXAMINED FOR POTENTIALLY UNSAFE CONDITIONS SUCH AS: DAMAGED CORD, PLUG, HOUSING OR PARTS. IN THE EVENT THAT SUCH DAMAGE IS FOUND, THE TOY SHOULD NOT BE USED UNTIL PROPERLY REPAIRED.

CAUTION: ABRASIVE GRITS AND POLISH AND ROCK DUST CAN CAUSE EYE IRRITATION.

PRECAUTION: AVOID CONTACT WITH EYES.

FIRST AID: IN CASE OF EYE CONTACT, IMMEDIATELY FLUSH EYES WITH PLENTY OF WATER FOR AT LEAST 15 MINUTES. GET MEDICAL ATTENTION IMMEDIATELY IF IRRITATION OR BLURRED VISION OCCURS.

RATINGS: 110-120V AC ONLY 0.15 AMPS 10 WATTS 60HZ

ATTENTION: Your product is equipped with a polarized alternating current line plug (a plug having one blade wider than the other). This plug will fit into the power outlet only one way. This is a safety feature. If you are unable to insert the plug fully into the outlet, try reversing the plug. If the plug should still fail to fit, contact your electrician to replace your obsolete outlet. Do not defeat the safety purpose of the polarized plug.

DEAR PARENT - While every precaution has been taken in the manufacturing of this product, we recommend that the product be periodically examined for potential hazards, and that any potentially hazardous parts be repaired or replaced.

DEAR CUSTOMER,
NSI is the manufacturer of this kit. If we made an error and left something out of this set, or if something is damaged, we are sorry and wish to correct our error. Please do not return the set to the store where you purchased it, or to the Smithsonian, as they do not have replacement parts. Instead, write us a letter giving us:

1. Date of Purchase
2. Where Purchased
3. Model Number
4. Name of Set
5. Brief Description of Problem
6. Sales Slip

We will do our best to satisfy you.

Quality Control Department, NSI International, Inc.
105 Price Parkway, Farmingdale, NY 11735-1318
(888) 425-9113

PRINTED IN CHINA

ITEM #6354
ITEM #26354

You are now the owner of the new Rock Tumbler™. This machine has been engineered and developed by one of America's foremost industrial designers. It has many original and unique features which will make it easy and fun for you to start on the fascinating hobby of rock rumbling and jewelry making.

WHAT IS TUMBLING? Tumbling is the process by which rough rocks, turning around in a rotating barrel with water and abrasives, change into polished stones suitable for display or jewelry making. The process is similar to what occurs in nature. You will be able to do more in a few weeks than nature does in a few thousand years. You have seen smooth pebbles and rocks on the beach and river banks. A long time ago these were rough rocks, and over a long period of time the action of the water and sand pushing the rocks around gradually smoothed them down so that they eventually became extremely smooth. This is the same basic principle used in tumbling. With the Rock Tumbler™, using a rough grit on the first cycle, then progressively finer grit, the end result will be beautiful stones you will be proud to own.

THIS TUMBLER HAS BEEN TESTED AND INSPECTED AT THE FACTORY. IF THERE IS ANY PROBLEM, CONTACT THE FACTORY FOR NECESSARY ADJUSTMENTS. DO NOT RETURN TO YOUR PLACE OF PURCHASE. READ ALL INSTRUCTIONS BEFORE STARTING AND FOLLOW INSTRUCTIONS CAREFULLY.

ROCKS: DIFFERENT TYPES AND HOW THEY FORM

Since our planet's birth 4.6 billion years ago, rocks have been continually forming and changing from one kind to another. The record of Earth's long history is preserved in rocks, and geologists who study them work like detectives to search for clues to their origin. One of the first steps in this process is to identify the broad class to which a rock belongs. Geologists recognize three main types of rock: igneous, metamorphic, and sedimentary.

I) IGNEOUS ROCKS

Rocks that solidified from a molten state are called igneous, from the Latin word meaning *fiery.* Geologists use the word magma to describe that original molten state. Magma is made up of a liquid portion, crystals of various minerals, and gas bubbles. Depending upon where magma cools and solidifies, two types of igneous rocks form: volcanic and plutonic. Igneous rocks are included in this set.

a) Volcanic Rocks

Magmas that erupt at Earth's surface cool rapidly in contact with air or water to form volcanic rocks. The liquid portion of the magma commonly cools so rapidly that instead of forming crystals, it freezes to natural glass. Obsidian and pumice are both examples of natural volcanic glass.

If a magma is poor in gas, it will probably erupt to form lava that will flow downhill away from the eruption site. Depending upon its chemical composition, particularly the abundance of silica (SiO_2), lava can be extremely fluid and fast moving (low silica), or a viscous pile of solidified blocks that moves sluggishly (high silica). Basalt is the name for Earth's most common volcanic rock. Typically black to gray in color, this silica-poor rock floors the ocean basins that cover 71% of Earth's surface. Basalt is also the main eruptive product of volcanoes on oceanic islands like Hawaii and Iceland, but it erupts from many continental volcanoes as well. At the opposite end of the compositional spectrum of lavas is obsidian. This silica-rich lava is so viscous that atoms are unable to move through the liquid to feed growing crystals. As a result, many obsidians are essentially crystal-free and consist of pure glass. Because glass, like quartz, fractures in a conchoidal manner, humans could fashion obsidian into extremely sharp blades, cutting tools, and arrowheads that are of great archeological significance.

If a magma is rich in gas, it will probably erupt explosively, blowing itself apart into innumerable glassy and bubble-rich particles called pyroclasts (Greek for fire-broken). Volcanologists (scientists who study volcanoes and volcanic rocks) use a variety of terms for pyroclasts (ash, lapilli, pumice, scoria, bombs, and blocks) depending upon their size and shape. The way pyroclasts erupt leads to the two main types of pyroclastic rocks. Pyroclasts can be blasted into the atmosphere and then fall back to the surface in a pyroclastic fall. While they travel through the air, the wind plays an important role in sorting the pyroclasts by size. Smaller and less dense particles are carried farther by the wind, whereas larger and more dense particles fall closer to the eruption site. This is why pyroclastic-fall deposits have a restricted range of particle sizes.

Alternatively, an eruption cloud of pyroclasts and gas can collapse under its own weight and race down the flanks of a volcano in a turbulent density current called a pyroclastic flow. Pyroclastic flows are fast-moving and extremely hazardous phenomena. When the flow comes to rest, it forms a pyroclastic-flow deposit. Because little sorting by wind takes place, pyroclastic-flow deposits contain a wide range of particle sizes, from tiny ash fragments to large blocks. Volcanologists can tell these two types of pyroclastic deposits apart by observing them in the field, and by measuring the abundances of different particle sizes using a stack of sieves with increasingly smaller openings.

b) Plutonic Rocks

Some magmas fail to reach the surface and instead solidify in contact with relatively warm rocks within Earth's crust or mantle. As a result, they cool slowly to form plutonic rocks, named for Pluto, the Greek god of the underworld. Plutonic

TABLE 1: Classification of pyroclasts in explosive volcanic deposits.

Pyroclast	Grain Size	Comment
ash	less than 2 mm	
lapilli	2mm to 64mm	called pumice if light-colored and possible to break by hand; called scoria (or cinder) if dark-colored and not possible to break by hand
bombs	greater than 64mm	smooth surface
blocks	greater than 64mm	angular surface

rocks never contain glass. Instead, the liquid portion of the magma completely crystallizes, and the crystals are able to grow to relatively large sizes. Grain size is one of the best ways to distinguish volcanic (fine) and plutonic (coarse) igneous rocks. The best known plutonic rock is granite. It is rich in silica, equivalent in chemical composition to obsidian, and one of the dominant rocks of the continents. The ocean basins also contain plutonic rocks. Gabbro is the name of a silica-poor plutonic rock, equivalent in chemical composition to basalt. It forms a layer of the oceanic crust that lies beneath the volcanic basalts of the sea floor. Some gabbros show prominent color banding formed by abrupt changes in the proportions of light-colored minerals (plagioclase feldspar) and dark-colored minerals (pyroxenes and olivine). These are called layered gabbros.

II) Metamorphic Rocks

Inside their cocoons, caterpillars change into butterflies. This is called metamorphosis, from a Greek word meaning "to transform". Inside the Earth, heat and pressure can change a rock's minerals from one set to another. This is called metamorphism. In each case, the basic ingredients stay the same. They're just reassembled into new forms. Metamorphic rocks differ from igneous rocks in that these transformations occur in the absence of melting.

In trying to classify a metamorphic rock, a geologist needs to ask two questions: (1) What was the original rock? (2) What minerals now make up the rock? Prior to metamorphism, the original rock may have been of any kind: igneous, sedimentary, or even a different metamorphic rock. Below we trace the process of metamorphism for a sedimentary rock: shale.

From Mud to Migmatite

The most common sediment on Earth is clay. Clay forms from the chemical weathering and erosion of rocks on the continents. Clay particles are small and readily moved by flowing water, but they eventually settle to the bottoms of lakes and oceans, where thick sequences of mud accumulate. The mud later turns into a rock called shale. Collisions between continents and other plate-tectonic processes can cause shales to be compressed and heated in the roots of a growing mountain range. As a shale is progressively heated and compressed it begins to metamorphose. Four different things can happen to the rock as temperature and pressure increase:

(1) New minerals form at specific temperatures and pressures. If temperature and pressure continue to increase, the clay minerals of the shale will convert first to the mineral chlorite and then to the mica minerals biotite and muscovite. At still higher temperatures and pressures, the minerals garnet, staurolite, kyanite, andalusite, or sillimanite appear. Geologists have used pressurized furnaces in the laboratory to "cook" shales and calibrate the temperature and pressure conditions necessary for growth of these various minerals. These experiments allow geologists to estimate how deep a rock was in the Earth and how hot it was, based on the minerals it contains.
(2) The sizes of crystals increase and different minerals segregate from one another. As metamorphism progresses, the sedimentary rock, shale, transforms into a series of different metamorphic rocks with increasing grain size: slate, phyllite (pronounced fillite), schist (shist), and gneiss (nice). Light-colored minerals like quartz and feldspar, and dark-colored minerals like chlorite and biotite become concentrated in roughly alternating layers. In schists, these layers are typically about a millimeter thick. In gneisses, the layers may be a centimeter or more thick.
(3) The rock develops a foliation, which is a roughly planar arrangement of biotite, chlorite, muscovite, and other platey minerals in the rock. These aligned minerals cause the rock to easily split along foliation planes, either naturally or if struck with a hammer.
(4) Metamorphic rocks can become strongly deformed. In some cases, they are folded into simple geometric patterns. In other cases, the light-colored and dark-colored layers can become swirled and contorted until they look like a marble cake. This is typical of the highly metamorphosed rock called migmatite, which represents the last step of metamorphism, just as melting begins.

III) Sedimentary Rocks

Unlike igneous and metamorphic rocks, sedimentary rocks form at the low temperatures and pressures near Earth's surface. Geologists recognize three different classes of sedimentary rocks: clastic, biogenic, and chemical. Formation of every sedimentary rock is a three-step process:

(1) First an older rock is broken down and its components are transported by water, wind, or ice to a new site, perhaps many hundreds of kilometers away. The components can be transported in water either as solid particles, like sand grains, or dissolved, like the salts in seawater.
(2) Next, these components accumulate. In the case of solid particles like sand, the grains stop moving and pile up to form a deposit of sand. In the case of dissolved components like salt, crystals grow from the solution and fall to the floor of the lake or ocean to form a deposit.

TABLE 2: Classification of clastic sedimentary rocks

Rock Name	Grain Size	Comment
shale	less than 0.004mm	mostly quartz and clay minerals
siltstone	0.004mm to 0.06mm	rich in quartz
sandstone	0.06mm to 2mm	rich in quartz
conglomerate	greater than 2mm	rounded particles
breccia	greater than 2mm	angular particles

(3) Finally, those loose particles or crystals must be hardened into rock. Geologists call this process lithification, from the Greek word *lithos*, which means "rock". Lithification usually involves compacting the fragments and cementing them together with a natural mineral cement like calcite ($CaCO_3$) or a form of silica (SiO_2).

a) Clastic Sedimentary Rocks

These rocks are made of particles, or clasts, of older rocks or minerals. Geologists name clastic rocks based upon the sizes and shapes of their particles. With increasing clast sizes, the common rock names are <u>shale, siltstone, sandstone, conglomerate</u>, and <u>breccia</u> (Table 2). Mountains are the source of clastic sediments. Fast-moving mountain streams commonly contain large angular to rounded boulders. These coarse sediments can later lithify to form conglomerates and breccias. As water carries particles farther downstream, away from the source area, the particles become rounded and smaller. This results from two processes: (1) countless collisions with other grains and the rocks in the stream bed cause the particles to abrade, rounding them and reducing their size; (2) as the stream becomes more sluggish away from mountain slopes, it can no longer transport large particles, so these are left behind. With increasing distance from the source rocks in the mountains, sand give way to silt and finally clay. These sediments can later lithify to form sandstones, siltstones and shales. Large volumes of sandstone and siltstone are found on the sea floor along the margins of continents. Shales are an important rock of the oceanic crust. They form by lithification of the muds that blanket much of the ocean floor.

b) Biogenic Sedimentary Rocks

These rocks are made of material from once-living organisms. <u>Limestone, chert,</u> and <u>coal</u> are common examples. Many marine organisms extract calcium carbonate ($CaCo_3$) from seawater and build themselves shells of the minerals <u>calcite</u> or <u>aragonite</u>. Clams and oysters are familiar examples of large marine organisms that live on the shallow ocean floor. When they die, their shell fragments can accumulate and later lithify into biogenic limestones. Other tiny organisms with calcium carbonate shells float in the sea. When they die, their shells fall to the sea floor where they, too, accumulate to become biogenic limestones. Still other marine organisms extract silica from seawater to build their shells. These shells also fall to the sea floor when the organisms die, and accumulate and lithify into chert. Coal is a rock-like substance that forms from dead plant material accumulating in a swampy environment. The swamp waters prevent the carbon in the rotting plants from reacting with oxygen and being released to the air as carbon dioxide. With progressive burial and heating, the plant remains change to <u>peat,</u> soft brown <u>lignite</u>, coal, <u>bituminous</u> coal, and finally jet-black <u>anthracite</u> coal. Anthracite, the highest quality coal, is the richest in carbon, the poorest in oxygen, burns at the highest temperature, and gives off the least smoke.

c) Chemical Sedimentary Rocks

Every liter of seawater (about 1,000 grams) contains 35 grams of dissolved minerals. About 27 of those grams represent the mineral <u>halite</u> (NaCl), also known as table salt. Dissolved halite makes seawater taste salty. If you completely evaporate a liter of seawater, 27 grams of halite and 8 grams of other minerals will be left behind. Large-scale natural versions

of this experiment have occurred numerous times throughout geologic history. It can happen when faulting associated with plate-tectonic activity causes an arm of the sea to be cut off from the rest of the ocean. Once isolated, the sea begins to evaporate. Halite and other minerals precipitate and settle to the bottom of the drying sea bed. When the water is finally gone, a layer of these evaporite minerals is left behind. Evaporite deposits provide important raw materials for society. The evaporite mineral <u>sylvite</u> (KCl) is an important source of potassium for fertilizers, and the mineral <u>gypsum</u> ($CaSO_4$-$2H_2O$) is mined to produce plaster, used in medical casts and in the wallboard of most homes and offices.

EARTH RECYCLES ITS ROCKS

Rocks on Earth are continually changing from one form to another. This natural recycling process is extremely slow by human standards, but over the long spans of geological time, it is very efficient. Two different sources of energy power Earth's recycling centers: solar energy and internal heat and pressure. The processes that convert igneous, metamorphic, and sedimentary rocks from one type to another are represented graphically in the endless rock cycle.

I) Energy from the Sun

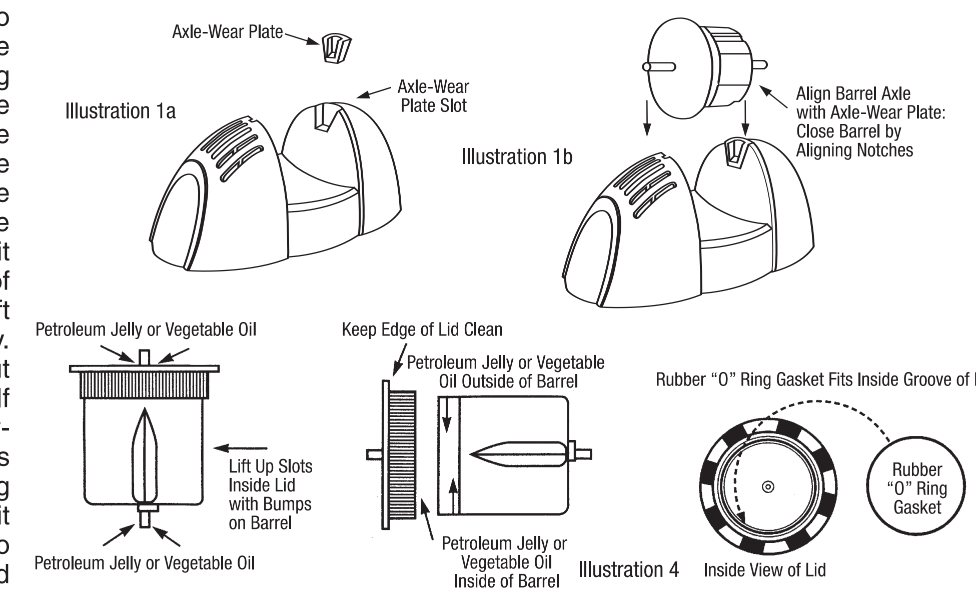
At Earth's surface, the sun works to recycle rocks, whether they are igneous, metamorphic, or sedimentary. In vegetated areas, the sun feeds plants and microorganisms that slowly work to eat away at the underlying solid rocks, converting them to soil. Rocks exposed at Earth's surface are destroyed by solar-powered changes in air temperature and moving water, ice, and wind. These work together to dissolve or break up exposed rocks, converting them into dissolved components or particles that can be carried away to form new sedimentary rocks.

II) Energy from the Inner Earth

The other major source of energy for rock recycling is the heat and pressure within the Earth. The deeper a rock is within the Earth, the hotter and denser it must be. Both temperature and pressure increase steadily with depth below Earth's surface. With every kilometer in depth, temperature increases by about 25°C and pressure increases by about 250 <u>atmospheres</u> (an atmosphere is the air pressure at Earth's surface). Most of Earth's inner heat is generated by the decay of radioactive elements within minerals, which sends subatomic particles speeding through the surrounding mineral structures. When the subatomic particles collide with atoms in the crystal structures, the collisions produce heat. The increased pressure within the Earth is simply caused by the weight of the overlying rocks. High temperatures and pressures can transform pre-existing rocks of any type (igneous, metamorphic, or sedimentary) into new metamorphic rocks. If temperature rises higher still, rocks can begin to melt, a process that ultimately forms a new igneous rock.

SETTING UP YOUR TUMBLER

Locate an area in your home near a properly wired 110-120v 60HZ outlet where the constant sound from the tumbling action will not be disturbing. The machine draws about the same power as a small light bulb. Level the machine on a flat corrugated board or similar material. Because of vibrations, the machine may have a tendency to "walk". You can place a small weight next to it to prevent this. Test to see that the motor is working properly by plugging in the line cord without placing the barrel on the machine. The machine should start right up and you will see the shaft rotating. You can then place an empty barrel on the machine which will give you an idea of how it operates. Sometimes, because of shifting in shipment, the drive shaft may stick and not start immediately. You will hear a humming sound but the drive shaft will not be moving. If this happens, spin the drive shaft several times with your hand and this should start the machine operating properly. See Rock Tumbler™ unit for drive shaft label. If it still fails to start, check the section called "Helpful Hints".



The Rock Tumbler™ unit is easy to assemble. Your unit is provided with two axle wear plates. Position one axle wear plate as shown in illustration 1a and 1b. Remember to keep the other as an extra replacement. Refer to illustration 2 and 3 for areas that must be lubricated with basic petroleum jelly before actually using your Rock Tumbler™. Illustration 4 represents the positioning of the "O" ring sealer in the groove inside the lid. The "O" ring should fit snugly into the groove. If necessary, push it in with a pencil point.

HELPFUL HINTS

- For good tumbling, do not mix different types of material together. For example, agates and amethysts when tumbled and polished together will not give the best results because the agates will chip the amethysts and neither will take a good polish. The bag of stones provided are selected so that each individual bag can be tumbled and polished in one batch.
- When tumbling small precious and semi-precious stones, make sure there is approximately 1/2 lb. of tumbling stones in the barrel as overloading or underloading does not give best results.
- There is a rubber drive shaft sleeve that turns the barrel. If it slips off or needs replacement, glue it back on. Be sure to replace the drive shaft sleeve before it is totally worn down.
- If the drive shaft does not turn when tumbler is plugged in, start it turning with your finger.
- Keep drive shaft and all parts that come in contact with the shaft clean of grit, sludge and dirt. If any loose particles of grit get into the area behind the drive shaft, it will damage your machine.
- Once you start tumbling continue until the cycle is finished. If contents of barrel is left standing for an extended period of time, the mixture will harden and become one solid cement like cake.
- If the stones do not take a polish, it usually means that they're not ground enough. To correct, you will have to go back to fine grind for 3 to 5 more days.
- A leaking barrel can be caused by improper cleaning between cycles or failure to lock in lid carefully. Be sure "O" ring sealer is properly secured. Slight leakage is common and will not affect results. As a matter of fact, the slight leakage will stop as the grit and water form a bond. If barrel leaks slightly, place newspaper under machine to catch water. The barrel will seal itself in about 30 minutes to 2 hours. Don't worry about water that spills unless barrel empties.
- Barrel Slippage: There are different reasons why a barrel may slip. We are listing some solutions to correct this. Each day, wipe off the accumulated powder from the outside of the barrel rim. If any oil, water, grease, or slippery substance gets onto the edge of the barrel that comes in contact with the drive shaft, be sure to thoroughly clean it off. Make sure the barrel is sitting on the motor base properly. A small part of the barrel lid should just barely be touching the whitish-gray drive shaft sleeve.
- Barrel Overloading: Never fill the barrel more than 3/4 full, including all ingredients.
- Removing Barrel Lid: Before putting lid on barrel, it is a good idea to take any type of lubricant and lightly coat the inside rim of the lid. This will help tremendously when removing the lid between operations. Holding the rim under hot water for several minutes also will aid in removal of the lid.

HOW TO TUMBLE

Step 1: Start with one 1/2 lb. bag of stones. Rinse stones to wash away dust and powder. Place the stones in the barrel. Empty bag of coarse grit (marked Step 1) into the barrel. Add water to just cover the top of the stones. Be careful not to let any grit get in the rim of the barrel. Place a small drop of vegetable oil on finger and wipe the outside rim of barrel and inside rim of lid. Do not get any oil on outside of barrel, drive shaft or edge of housing as barrel will slip. Wipe clean and dry. Replace barrel cover. ("O" ring sealer should be firmly secured in the groove inside the lid.) Be sure lid is locked into place by listening for a click. Start machine and put barrel onto base. The barrel will turn from 50 to 80 revolutions per minute, but slightly faster or slower is also acceptable. Check your barrel after 48 hours. See that the water color is gray and sludgy and that the water is above the stones. If there is not enough water add the right amount until it just covers the stones. The stones should be starting to wear down. Replace cover as described above. Let barrel continue tumbling. When stones lose their sharp points, rough edges, pit holes and deep gashes it is ready for the next cycle. Coarse grit cycle takes from 2 to 4 days depending on the type of stones and the amount of rough spots. It is always better to let grind longer if in doubt. It will not harm the stones. It will in fact give you a better finish.

Remember, you are grinding in days what it takes nature thousands of years to do in a stream, river or ocean. Note that in every batch of stones you will have some that are very rough and will be much slower in grinding than the average. It is almost impossible to grind every stone perfectly. The stones when finished with the first grit should be smooth. Remember the first grind is the most important. Make sure all tiny pit marks are out and stones are smooth.

If it takes a little longer, the result will be worth the wait. When the first cycle of coarse grinding is finished, open the barrel and empty into a pail of water. Separate the stones that are still rough from the smoothed stones. It's always better to let grind a few extra days. The next time you start a new batch, regrind these rough stones for a second time.

WATCH OUT! Do not pour any grit into sink as it can clog your drain. Rinse stones carefully and completely. You must be careful to remove all the coarse grit from the barrel, cover and stones before placing the medium grit into the barrel.

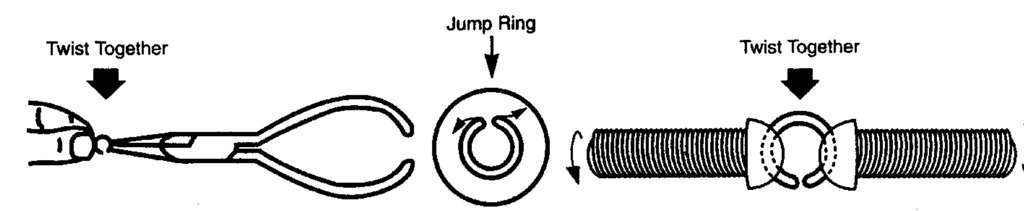
Step 2: Be sure barrel is thoroughly cleaned before loading with new grit. Open the bag (marked Step 2) and repeat loading process with water as before. Let grind 12 to 14 days. The amount of smoothing of the stones from now on will be small. What you're doing is grinding down the invisible grooves and nicks made by the coarse grit. When the medium grind cycle is finished, open the barrel and empty into a pail of water. Again, rinse stones carefully and completely. You must be careful to remove all the medium grit from the barrel, cover and stones before placing the polish into the barrel.

FINAL POLISH (Step 3): Before putting polish into barrel, scrub the inside of barrel and lid with soap and brush. Remove as much of the gray color as possible. To do a really good cleaning job, add some non-sudsing scouring powder like Ajax® to the stones. Add water to level of stones and let tumble for about 2 hours. This will clean the inside of the barrel.

Cleaning is very important at this stage. All stones and the inside of the barrel must be perfectly clean of tiny black grit. Then empty the bag of polish (marked Step 3) and add water to level just under the stones. Let stones tumble in polish for 7 days or longer. Remove stones, wash and let dry. You should now have your first batch of polished gemstones. Remember, tumbling is not an exact science. After you use the machine for a while, you will constantly improve your technique. Each batch of stones is different from the ones before. Some are larger or smaller. Some types are softer or harder. All this affects the tumbling, so do not be afraid to experiment with tumbling time.

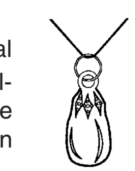
JEWELRY MAKING

The aim of rock tumbling and polishing is to produce gemstones ground and polished to their natural beauty. There are many projects you can do with the polished stones. You may decide to mount them in a display case. You can decorate boxes, use them in arts and crafts projects and of course, make jewelry. This kit contains an assortment of jewelry settings and findings. Pick out the stones and settings you wish to use. Apply a small amount of glue to the stone and setting, and glue together. You can use tape to hold the pieces in position while the glue is drying. Allow to dry overnight.



How to attach jump rings: Professional jewelry workers use thin, long nosed pliers. If you have such a tool available, all you do is hold the jump ring in one hand, between thumb and forefinger and grasp the other part of the jump ring with the pliers. A simple twist of the pliers will open the jump ring. Loop it through the jewelry piece, chain, etc. and then close up. If you don't have a pair of pliers, two screws with slotted heads will do the trick quite nicely. See the illustration on using common screws to work with jump rings.

How to attach bell caps: The bellcap is a small metal piece with a ring on one end and prongs on the other. The metal is soft and you can easily push it apart with a toothpick or your fingertips. Just add a drop of glue to the inside of the bellcap. Then, firmly press the cap on to the small end of the stone. Press the prongs down so you have a snug fit. A little glue will always leak out. Wipe away the excess, but don't be concerned if a little glue remains. It will be colorless when dry.



BELOW IS A SAMPLE OF A TIME CHART TO KEEP TRACK OF THE CYCLES:

EXAMPLE OF TIME CHART

DATE	GRIT CYCLE	# OF DAYS
	STEP 1	2-4
	STEP 2	12-14
	STEP 3	7-8

YOUR TIME CHART

DATE	GRIT CYCLE	# OF DAYS
	STEP 1	
	STEP 2	
	STEP 3	