

TUMBLER STONE POLISHING

by Roy Hargreaves



Introduction to Stone Polishing

The art of stone polishing is one of the earliest crafts developed by ancient man. Even the oldest of civilizations show some evidence that efforts were made to polish and embellish tools and artifacts.

Before long, flint and obsidian were being chipped and shaped to make arrowheads, spear points, knives and axes. The skills learned from tool-making were refined and stones, horn, shell and bone were worked to become the central theme of personal adornment.

At this point mankind had discovered the first essential....

.....A SUITABLE MATERIAL.

Probably the more observant noticed that a lot of work could be saved by gathering stones from beaches or river gravel. Nature had done much of the wearing down of sharp corners by the action of sand and movement. This gave us the remaining two essentials that still apply....

.....ABRASIVE and MOVEMENT.

These are the only three fundamental requirements for stone polishing; everything else is only a refinement.

The road to stone polishing, however, does have divisions. There are three main groups into which polished stones can be divided.

A) TUMBLE-POLISHED STONES.

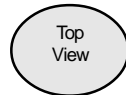
This is the simplest method and needs the least outlay, but giving the most basic results. Stones produced are 'baroque' - irregular shaped - but may be readily used in jewellery by the use of special fittings or 'findings'.

It is the method most people start with and it is recommended as a means of getting a good basic knowledge of gemstones and their characteristics.



B) CABOCHON CUT STONES.

In this method each stone is individually cut by hand using specially developed equipment. It is relatively expensive to set up, but produces stones of a controlled shape and size. It is usually reserved for better quality material, flat surfaces or when a stone is required to fit an existing setting.



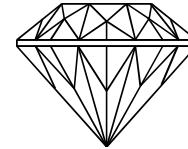
Shapes:

Most commonly OVAL or Round but can be any shape such as 'antique or 'cushion' (a rectangle with curved sides)

C) FACETED STONES.

Stones cut by this method are instantly recognisable by the flat faces on them; e.g. Diamond, Garnet, Ruby, Sapphire etc. It is a skilled technique reserved for valuable (and usually clear) material, but nevertheless still uses the three fundamentals of ...

.....SUITABLE MATERIAL,
ABRASIVE & MOVEMENT.

































































































































Enlarged view of a faceted stone, showing the degree of accuracy required

This leaflet is intended as an introduction to tumble-polishing, with descriptions of stones and their properties, abrasives and polishing powders, types of equipment and their usage, plus basic ideas on how to use polished stones to make up jewellery.

Several books are available detailing the more advanced stages of gem-cutting and these can be obtained from your local Lapidary/Craft shop. (Contact the British Lapidary and Mineral Dealers Association)

www.blmda.com

Gemstone Descriptions

Stone	Colour & Description	Clarity	Suitability
Blue Lace Agate	Pale, milky blue/white striped. Occurs in bands up to 5cms thick.	 - 	   
Green Moss Agate	Deep/mid green in clear matrix. Looks like moss trapped in glass.	 - 	   
Brazilian Agate	Mainly deep brown to red banded. Occurs in very large pieces.	 - 	    
Indian Agate	Most often grey/bluish with lighter banding.	 - 	    
Botswana Agate	Pink/grey banded. Pieces tend to be smaller ... up to about 120gms		   
Australian Agate	Fine material when available. Colours usually blue/red or pink/white.		    
Carnelian	An Agate, usually pale flesh to deep orange brown; some banded.		    
Chalcedony	Agate family: usually semi-clear to pale grey with vague banding.	 - 	    
<i>There are many different types of Agate - those above represent only a selection.</i>			
Quartz crystal	Colourless & Transparent. As single crystals or as large lumps.		   
Milky (Snow) Quartz	White. Usually in massive lumps or as banding in other rocks.		  
Amethyst Quartz	Shades of purple, often banded with white.	 - 	   
Citrine Quartz	Pale golden to deep rich honey colour.		   
Smokey Quartz	Mid brown to almost black; known also as 'Cairngorm' or 'Morion'.		   
Rose Quartz	Pale to mid pink. Rarely crystalline - usually massive lumps.	 - 	   
Aventurine Quartz	Pale to bright green. Mica content gives a spangled appearance.	 - 	    
Goldstone	Man-made aventurine glass; usually brown but also in blue.		  
Obsidian	Natural volcanic glass. Mahogany brown to black: some with 'snowflake' quartz inclusions.	 - 	  
Jasper	Usually brick red in large lumps, often patterns of contrast colour.		    
Flint & Chert	Similar to Jasper but in cream/brown/grey colours.		   
Sodalite	Deep blue with whitish areas. Can be confused with expensive Lapis.		  
Tiger Eye	Usually golden brown, red or blue. Bands of light 'float' in the stone.		   
Hematite	Bright silvery metallic black when polished. 'Dirty' to polish.		 
Petrified Wood	Reddish brown with some yellow. Original 'wood' pattern remains.		    

 = Opaque,  = Translucent,  = Transparent.

 = Easy to polish,  = Difficult.

Stone Properties

The Stones

The first - and most obvious requirement - is that the material should be attractive; closely followed by the fact that it should be hard and wear well. These attributes can briefly be described as ...

... **BEAUTY** and **DURABILITY**.

BEAUTY

... is very much in the eye of the beholder, but there are certain basic characteristics which set some stones aside as old favourites, the first of which is **COLOUR**. We notice it more than almost all other properties and most people give colour first when describing something.

STRENGTH of colour is important in such precious stones as sapphire, ruby and emerald but for tumbling materials it is more often a case of colour variation or **PATTERN** as in agate, chert, obsidian etc.

Another type of colour variation is found in tiger eye and aventurine quartz (the green and yellow varieties which are natural, and the man made version - Goldstone). This is called **PLAY OF COLOUR** and is caused by reflected light, in tigereye this takes the form of a band of light moving across the surface of the stone, whilst in aventurine it shows as pinpoints of light reflected from within. The prime example of play of colour is precious opal. Lower grades of opal are sometimes tumble polished, but it more often receives the care and attention of cabochon cutting.

See the separate checklist for further details of gemstone colours.

DURABILITY

..... is actually a combination of two properties, **HARDNESS AND TOUGHNESS**, and when both are present they result in a stone which will take and retain a

high polish. Some stones lack one or other of the properties; for instance amber and jet are both very soft, whilst opal and obsidian chip easily because they lack toughness.

There is also a third characteristic which should be present and that is **DENSITY**. A stone which has holes and pits will not polish well and should be avoided as it will lead to contamination in subsequent processes.

The properties needed for stone to polish are perhaps best explained by comparing to the more familiar material of wood. You could work on a piece of cork or balsa forever, using all grades of sandpaper and every type of wax and polish, but you are unlikely to bring it to a polished finish. Apply the same technique to a piece of rosewood or walnut and you would soon achieve an end result !

HARDNESS

In general hardness needs to be about equal to that of quartz, the most common of the materials found in rocks and the main constituent of dust etc., hence if a stone is harder than quartz it will not be scratched by the majority of grits and dust.

Deciding whether a stone is hard enough for tumble polishing is not easy. It is necessary to suspend the normal understanding of hardness and think of glass as soft.

The degree of hardness in gemstones is anything from as hard as glass up to ten times as hard. Forget the old story that only a diamond will scratch glass because almost every stone mentioned in this booklet will score glass with ease.

The yardstick for hardness, as far as tumble polishing is concerned, is the hardness of quartz, or about twice as hard as window glass. Most of the gemstones used are of the quartz family e.g., agate, jasper, amethyst etc. so if you are going to search for your own materials it is useful to have some means of assessing hardness.

A piece of known quartz is a versatile tool. If it will scratch a specimen with ease then the hardness is well under that of quartz (7 on Moh's scale of hardness). If it scratches with difficulty - or not at all - then the material is probably suitable. Note: Be sure that it is actually a scratch and not just crushed stone.

Because of the very great differences in hardness of stones it is necessary, when selecting tumbling material, to keep to stones of similar hardness, otherwise you may well find that softer material has literally disappeared before the grinding stage is complete. See separate listing for further guides to hardness.

Scale of Hardness

No.*	Material type
10	Diamond
9	Corundum (Ruby & Sapphire)
8.5	Chrysoberyl (Alexandrite)
8	Topaz & Spinel
7.5	Beryl (Emerald, Aqua.), Zircon.
7.25	Garnet, Tourmaline
7	Quartz (Amethyst, Citrine etc), Agate
6.5	Spodumene, Garnet (some), Jade
6	Opal, Moonstone, Sodalite, Hematite
5.5	Obsidian, Turquoise, Glass.

* The numbers in the left-hand column refer to the Moh's scale of hardness. A good knife blade, or file, will scratch up to about '6' but not harder.

STONE SIZES

For most smaller tumbler barrels (up to about 1400gms capacity) stones should not exceed approx. 3.5cms in any dimension and should include sizes right down to 1cms and less.



These smaller stones act as 'fillers' and ensure that the greatest area of stones are in contact during the grinding process. If breaking your own stones it is best to include all the small chippings.

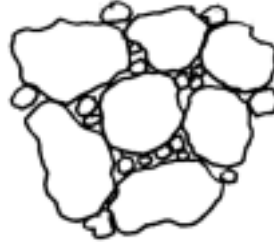
Always wear safety goggles when breaking stones and beware - the edges of freshly broken pieces can be sharp as a razor.

The use of an open ended ring, such as a cut-down bucket or an old plastic washbasin, will lessen the likelihood of injury from flying chips of stone. Another alternative is to wrap the stone in some old cloth or sacking and then smash it with a lump-hammer.

WARNING: Always wear protective goggles of some kind when breaking rock.



No small stones.
Very little contact on the grinding



Range of stone sizes
Good contact and fast grinding of all faces

BIRTHSTONE CHART

Month	Precious Stone	Colour	Semi - precious
Jan.	Garnet	Deep Red	Garnet
Feb.	Amethyst	Purple	Amethyst
Mar.	Aquamarine	Pale Blue	Blue Lace Agate
Apl.	Diamond	Colourless	Quartz Crystal
May	Emerald	Green	Aventurine or Peridot
June	Pearl	Cream	M.O.Pearl
July	Ruby	Red	Carnelian
Aug.	Peridot	Pale green	Aventurine
Sept.	Sapphire	Deep blue	Sodalite
Oct.	Opal	Variiegated	Jasper
Nov.	Topaz	Yellow	Citrine or Tigereye
Dec.	Turquoise	Sky blue	Howlite (dyed)

There are many 'Official' birthstone lists, especially when it comes to the ornamental semi-precious stones and many of them give two or three alternatives to the 'Precious stone'. This list is a guide only.

WHERE TO FIND STONES

One of the easiest places for the beginner to look for suitable material is on a shingle beach. Any stone which has survived as far as that is almost certainly hard enough to polish.

Other advantages are that it is possible to see pretty much what the finished stone will look like, and nature has done much of the 'donkey work'.

Other popular places are river beds and banks, beach cliffs, road and rail cuttings, quarries and mine dumps - but do remember safety first, especially near quarries or mines.

It is also possible to buy tumbling mixture from lapidary supply houses, and this is the best way, at least for the first couple of runs. With material that is known to accept a good polish any difficulty experienced can be attributed to the technique.

Handling proper tumbling material will soon give you a good idea of the look and feel of what is right for polishing and this will help when looking for your own stones at a later date. Commercial tumbling mixes are sorted for hardness - i.e. contents are of similar hardness.

Stone Polishing Equipment

THE ABRASIVES

THE GRITS

The most common form of abrasive for use in tumblers is Silicon Carbide, a man made version of the mineral corundum (an impure form of sapphire and ruby). This is a relatively inexpensive grit which comes in a lot of different forms. For our purposes the loose powder version is ideal.

For most types of stones three grades of abrasive are use - 80 grit for the coarse first grind stage; 220 grit as a middle grind stage; and 400 grit for a final grinding stage. For some troublesome stones a further stage using 600 grit or sometimes pumice powder may be useful to get a quicker or higher polish.

These grades of abrasive are chosen carefully. Each one is capable of removing the scratches left by the previous coarser grit - but don't expect them to do much more than that ! As a general rule marks that are still visible when leaving the 80 grit stage will still be visible in the finished gemstone.

THE POLISH

For almost all stones cerium oxide will give a high finish at a reasonable cost. Tin oxide is also used but it is expensive. The polish powder can be used over and over again (provided it doesn't get contaminated), so use the best you can afford.

THE EQUIPMENT

The equipment needed for tumble polishing is fairly basic, and once the initial cost is met the running costs are minimal.

The heart of the system is the ...

DRIVE UNIT.

In its most common form this consists of a drive motor, geared down to drive one of a pair of parallel shafts.

The drum (or drums) filled with stones are placed on these shafts and driven by friction. Electric current consumption is minimal (about 50 watt - similar to a low powered light bulb) and a professionally produced unit should run quietly and efficiently for many years.

The biggest enemy of a tumbler has to be leakage from the barrel of the highly abrasive contents. When putting a fresh barrel onto the machine it is well worth spending a few minutes checking for leaks.

Many of the drive units on the market are designed to accept multiple barrels. When making a purchase be sure to bear this in mind because there are many advantages to being able to run more than one barrel at a time; not least that of a saving in time.

The other part of a tumbler is the ...

BARREL.

Usually made from a heavy plastic pipe about 5" in diameter and with a push-on lid for each end. If the barrels are purchased as part of the drive unit they will need to be of the correct diameter to run at the right speed.

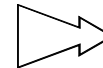
Another important property of the barrel is that it should be watertight to prevent leakage and also resistant to abrasion.

When buying barrels you will need at least two: one for abrasive stages and one for polishing. It is preferable to have a barrel for each stage to prevent contamination by coarser stages.



Tumbler Barrel Rotation Speeds

5" barrel	40rpm
6" barrel	35rpm
7" barrel	30rpm



Stone Polishing Instructions

The Method

STAGE ONE.

Select enough material of suitable size and hardness to fill a barrel 2/3 to 3/4 full. Add enough water to cover the stones by 1cm and 1 heaped tablespoon of 80 grit abrasive for each 700gms of stone. Fit the barrel lid and expel as much air from the barrel as possible by pressing the lid in the centre. This achieves a better seal, and allows room for the build up of carbide gas from the action of the abrasive.

Wipe the outside of the barrel clean and dry and put it into the rollers of the motor unit. Run for 7-10 days continuously. Do not stop the tumbler as the slurry inside the barrel sets, and it takes up to 4 hours running for the stones to settle down to the correct action again.

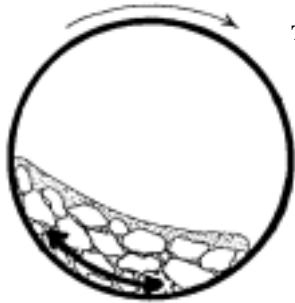
For beach pebbles this initial run of 7-10 days may be long enough, but for freshly broken hard material this stage may need to be repeated 2 or even 3 times. Either way it is now time to make the first inspection. Remove the top of the barrel and use an old spoon to remove a few of the stones. Wash them and inspect. They should appear smooth, with all corners rounded, no flats and no pits.

Remember that the subsequent grinding stages will do no more than to remove the surface scratches from the previous grit. If the stones obviously aren't ready then return them to the barrel, add 1 more tablespoon of grit and run again for 7 days.

When the stones are ready they must be scrupulously cleaned, and here a warning is needed.

DO NOT ALLOW THE SLURRY TO GET INTO THE WASTE PIPES OF YOUR HOUSE.

...It sets like concrete, even underwater. Do your washing up in a bucket and dispose of the slurry on the garden (it's quite harmless), or allow the water to settle and siphon off the clear water. Let the remaining sludge dry out and throw it in the bin.



TOO SLOW
No tumbling action
Flats will form

CORRECT SPEED

Good tumbling action
All surfaces worked



TOO FAST
Stones fall and will chip or bruise.

When the stones and barrel are quite clean put them back into the barrel with clean water (no grit) and a squirt of detergent. Run for about 4 hours. You'll be amazed how much grit is still there ! If necessary repeat until there is no sign of grit. Sort the stones and remove any cracked, damaged or pitted ones. These can go back to the start or be rejected altogether.

STAGE TWO.

Change to a new barrel if you have one - although this is not essential - as it cuts down the risk of contamination (and if your machine takes two barrels you can start 'Stage One' again with a new lot of material). Put your worked stones into the barrel with one heaped tablespoon of 220 grit per 700gms. of stones. Run for 5-6 days. Inspect and either re-run or wash up: - yes, thoroughly !! - Sort and reject.

STAGE THREE.

Once again use a fresh barrel if available and put in stones and one heaped tablespoon of 400 grit per 700gms stone. Seven days running should be enough this time to give a satin smooth finish. Inspect and reject any sub-standard or pitted stones. Wash up again. Remember any grit carried forward this time will contaminate the polish.

STAGE FOUR.

This time a fresh barrel is preferred. Put a similar amount of water in as for grind stages, plus a level tablespoon full of polish powder per 700gms stone to give a thin creamy consistency. Run for 7 days, open up and Hey Presto! You should have gleaming polished gemstones.

If the stones are producing a harsh and banging sound it sometimes helps to add a very small amount of 'Polycell' (or similar) wallpaper paste as a thickener to enhance the creamy consistency and reduce the likelihood of bruising on the stones.

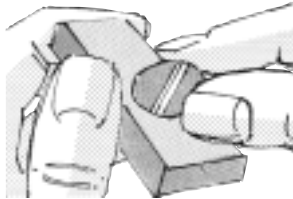
Jewellery

Tumble polished stones may be used in a great number of ways, but nearly all of them require the stone to be attached with glue (because they are too hard to drill). A large range of findings is available for jewellery making, and the use of an epoxy type glue is recommended.

The use of Jump Rings & Bell Caps

To attach tumble polished stones to such findings as keychains, curb bracelets or neckchains, a 'jump ring' and a 'bell cap' are used.

1) Decide which way the stone is to hang and then use an abrasive stick (or paper) to roughen the part which will go into the bell cap.



2) Press the bell cap over the roughened part of the stone and mould it to the shape of the stone.



3) Mix the adhesive, following the instructions carefully, then use a matchstick to apply a little glue, sparingly, to the inside of the cap; hold the ring on the top of the cap with pliers or fine tweezers.



4) After placing the stone in 'Blutac' with the 'rough' part upwards, gently place the bell cap onto the stone - try not to push or squeeze the cap with your fingers at this stage or the glue will go where you don't want it !

5) When the glue is dry (after about 15 minutes with fast-setting epoxy) link the bell cap to the jump ring. Do not pull the ring apart but TWIST it so that it will twist shut properly when the chain and cap have both been fitted.



6) Jump rings may be placed through the link as in the case of a bracelet or sliding for a necklace.



'BUG' Eyes!

To make 'bugs' or 'tumblies', glue small plastic eyes on to a tumbled stone, then use a Bell-Cap to create feet.



'Gem Trees'

Other popular uses for polished stones are for floral decorations, fish tanks and 'Gem-trees'.

Gem-trees, like the one on the cover of this booklet, can be made using small tumble-polished gemstones and coloured craft wire.

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