

HANDICRAFTS SERIES No. 8

# CUTTING AND POLISHING SMALL STONES

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ADULT EDUCATION SERVICE

HANDICRAFTS DIVISION  
MACDONALD COLLEGE, P.Q.

Macdonald College Handicraft Pamphlets

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## The Principal Product of a Handicrafts Program should be Better People

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*Better people* because of the greater knowledge of their own latent talents for creative work.

*Better families* because mother and daughter, father and son and whole families can plan and work together on individual or joint handicraft projects.

*Better homes* because homes can be tremendously enriched by the innumerable articles that can be designed, knitted, woven, carved, thonged, moulded by the members of that home.

*Better communities* because an active handicrafts program encourages a community handicrafts centre where people can work together, use equipment in common, exchange ideas, hold exhibitions and become better acquainted.

Ample opportunities are also afforded for supplementing incomes through the sale of high quality handicraft products.

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*"Every rise in the quality of the work that men do is followed swiftly and inevitably by a rise in the quality of the men who do it."*

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# CUTTING AND POLISHING SMALL STONES

by

DOUGLAS LEECHMAN

## *Introduction*

There are few of us who have not, at some time or other, picked up a handsomely coloured stone and wished that we could in some way enhance and perpetuate its beauty. We may have realized, rather vaguely perhaps, that stones can be cut and polished and that their hidden beauties may be revealed in this way, but we have not taken the next step, which is to find out how this may be done.

As a matter of fact, the craft of the amateur lapidary is a fascinating one, and it has many features to recommend it. The necessary equipment is simple and inexpensive; it is easily installed in the home workshop, and does not take up too much room. It is work which requires no great initial skill though practice in this, as in most other crafts, tends towards perfection. Furthermore, it is work which may be interrupted at any stage without injury to the job in hand, so the ringing of the telephone does not present an alternative between an unanswered summons and a ruined piece of work.

The raw materials for your cutting and polishing may be picked up on a country hike, on a planned collecting expedition, or bought from dealers. Many of the most attractive minerals, suitable for polishing, are quite inexpensive and, if you are interested in the possibility of financial rewards from your hobby, their value is often greatly increased by the work and skill expended upon them.

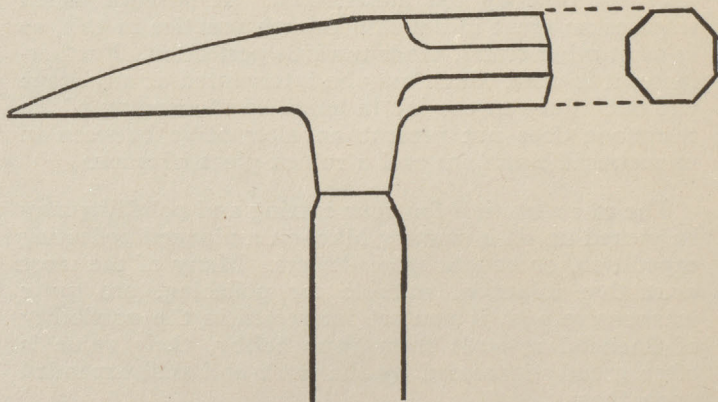
### *Paper Weights*

Let us start our discussion of methods of cutting and polishing with the simplest of all jobs undertaken by the amateur lapidary. We shall assume that you have a stone which, by reason of its colouring or markings, has aroused your admiration and you wish to polish one side of it. When finished it will be suitable for use as a paper weight or as an ornament for your desk.

The first step is to bring the surface which you wish to polish to an approximately even level. In some cases this has already been done, either by nature or artificially; if not, you can frequently manage it with a hammer. The best tool for this job is a geological hammer (Fig. 1), which has an octagonal face at one end and a short pick at the other. The point of the pick, or one of the corners of the octagonal face, is used, striking light slanting blows, away from the body; this method will strike off small chips of the stone without breaking it in half.

Some kinds of stone will not tolerate such treatment and are likely to split along natural lines of fracture. Often such specimens may be intentionally broken along these lines and the flat surface thus obtained may then be polished.

Polishing is done in three steps: rough grinding, polishing, and buffing or finishing.

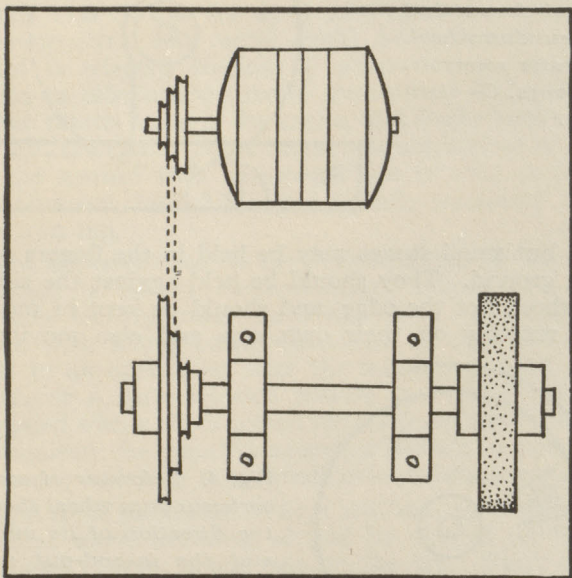


*Fig. 1. Geological hammer, best for rough shaping of minerals.*

### *Rough Grinding*

This is usually done on a carborundum wheel, turned either by hand or by an electric motor. Carborundum is a trade name for silicon carbide, an artificial product of great hardness made by combining coke and sand in an electric furnace. Carborundum wheels are made in a variety of degrees of hardness and coarseness ('grits'). For rough grinding, wheels of 150 or 180 grit are usually suitable.

A carborundum turned by hand is slow but has the advantage of giving very good control; much more rapid progress will be made if the wheel is driven by an electric motor. One of  $\frac{1}{4}$  horse-power will do for everything on

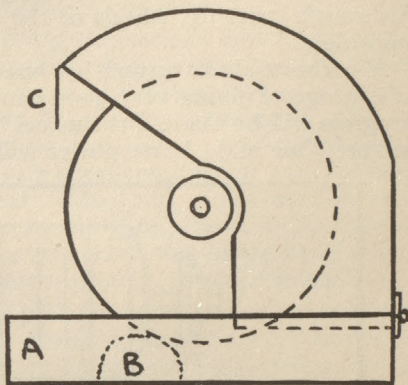


*Fig. 2. Plan of vertical carborundum wheel, on spindle, driven by electric motor. Three speeds are provided for. The position of the motor on the bed should be adjustable.*

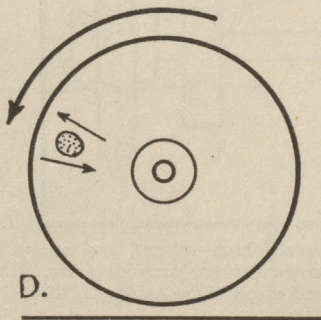
an amateur scale in lapidary work. The speed of the wheel should be about 800 revolutions per minute, and the top of the wheel should turn towards the operator. (Fig. 2).

The wheel should be protected by a guard which will act also as a splash arrester, and the lower part of which is a water reservoir. Fill the reservoir with water to a depth just below the wheel, and wire a sponge into position so that it will rub against both sides of the wheel, and can thus keep the wheel continuously wet but not dripping. (Fig. 3).

*Fig. 3. Guard, splash arrester, and water reservoir for vertical carborundum wheel. A—water reservoir. B—sponge. C—cloth apron.*



All but small stones may be held in the fingers while being ground. They should be held against the side of the wheel, not the edge, and should be kept in motion, both rotating on their own axis and also moving in



*Fig. 4. Side view of vertical carborundum wheel showing the direction of its motion, and the in-and-out movement of the stone being ground.*

towards the spindle and out again. (Fig. 4.) These two movements will produce a figure-eight motion, pre-

venting uneven grinding of the stone and grooving of the carborundum wheel from excessive use of one part of it. Continue the process till all irregularities have gone and a flat, evenly frosted surface is secured.

### *Horizontal Laps*

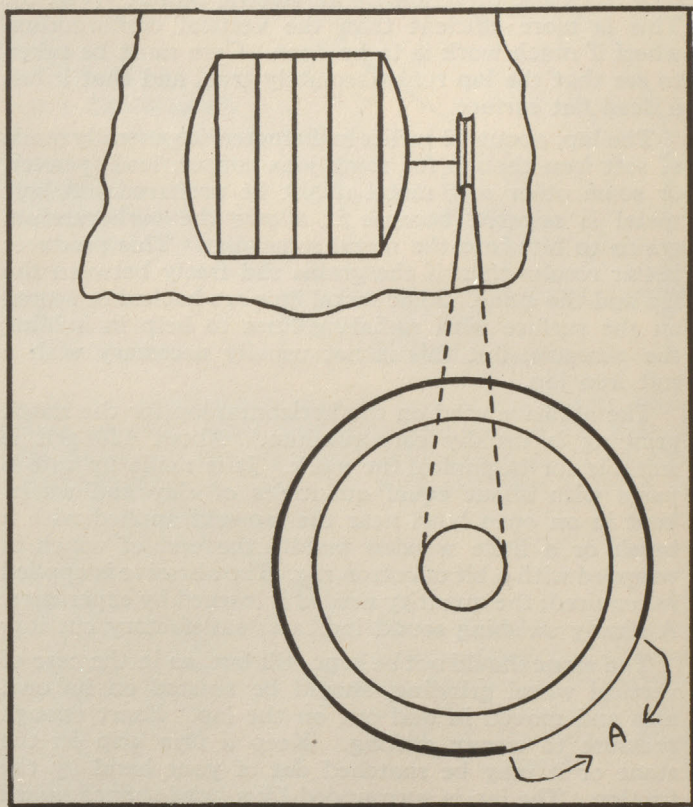
Another means, usually employed by professional lapidaries only, is to use a horizontal lap which is driven in a clockwise direction by an electric motor. (Fig. 5). This is more efficient than the vertical carborundum wheel if much work is to be done. Care must be taken to see that the lap runs absolutely true, and that it has a dead flat surface.

The lap, about 12 inches in diameter, is generally made of soft iron though for some jobs copper, lead, pewter, or some other soft metal might be preferred. A soft metal is selected because it allows the carborundum grains to bite into the metal somewhat. This produces better results than if the grains slid freely between the lap and the stone. Some metal laps are hacked or scored on the surface with radiating lines to help in holding the abrasive, but this is not usually necessary with a soft iron lap.

The abrasive used on the horizontal lap for the rough grinding is usually carborundum. About 120 grit is suitable for beginning the work. It is made up into a paste with about equal quantities of clay and water, kept in an open bowl near the lap and applied with a brush or a little wooden paddle the end of which is wrapped with a bit of cotton rag. The abrasive is applied as required; the quantity needed is learned by experience. A steady swishing sound indicates satisfactory cutting.

The stone should not be kept still but, as in the case of vertical wheel grinding, should be twisted on its own axis and moved in and out on the lap. Exert enough pressure to ensure cutting. Keep a firm grip on the stone or it may be snatched out of your hand by the friction. The lap is surrounded by a bowl-shaped guard to protect the worker and to prevent splashing. One part of the side of the guard is cut down to allow the hand to reach the surface of the lap.

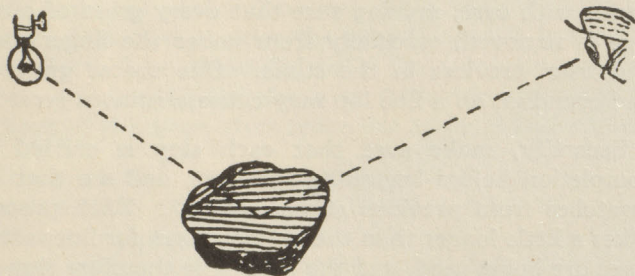
As soon as the work has made some progress, wash it off under running water and inspect it. While the stone is still wet, hold it about level and turn it in your hands till the light from an electric bulb or from the window is reflected from its surface to your eye. (Fig. 6.) If the work is flat, as it should be, the reflection will be seen to come from a single surface; if not, more than one surface, and uneven reflection of the light, will be seen.



*Fig. 5. Plan of a horizontal lap driven by an electric motor mounted under the table top (shown cut away). Note cut in outer guard, at A, to admit the operator's hand.*



Rough grinding is finished as soon as the stone shows an even, frosted surface, free from scratches and quite flat.



*Fig. 6. The light reflected from the surface shows that one corner "runs off." Continue polishing till only one completely flat surface is seen.*

### *Polishing*

The next step is to polish this flat, but still dull, surface by means of a series of abrasive powders of ever increasing fineness. The actual abrasives used vary with different kinds of stone. A good series for general purposes is: coarse carborundum (220), fine carborundum (400), tin oxide, tripoli powder, and rouge. Others which are often used are pumice stone, rotten stone, whiting, and precipitated chalk. The carborundums are usually used with metal laps; the others may be used with cloth, felt, leather, or wooden laps. Either vertical wheels or horizontal laps may be used, the former being generally preferred for the softer laps and finer powders. Such a wheel should turn towards the operator at about 800 revolutions per minute. The soft materials are usually kept wet while working, water being applied with a brush as needed, with the abrasive mixed in, forming a thin paste or cream. Experiment will soon show which is the best series of abrasives for each kind of stone.

There are two points which deserve special attention. The first is to make sure that abrasives of different

grades never get mixed. Before transferring a stone from one process to the next, wash both it and your hands with care, making sure that every grain of abrasive is removed, especially from under the finger nails and from crevices in the stone. One coarse grain of carborundum on a fine lap may cause a ruinous scratch.

Secondly, make sure that each step is carried to completion before beginning the next, and see that no scratches from previous stages are left. Each process takes a little longer than the previous one, for finer abrasives are being used, and the cutting is therefore slower.

### *Finishing*

The final polish, obtained by buffing on a dry flannel wheel using rouge and very light pressure, should give you a flat, highly polished surface on one side of your original specimen, its colour brightened and its beauty increased. It is now ready for use as a paper weight or a desk ornament. However, you may find it desirable to rough grind another face parallel with the polished one and to cement a piece of green baize or felt to it so that your highly polished surface may be seen when the weight is in use. A celluloid cement gives good results. Apply the cement to the rough ground surface in a thin coat, right up to the edges, wait a moment or two for it to get tacky, then lay the stone down on the cloth with only its own weight to hold it. When dry, trim the baize to shape. Don't be in too much of a hurry, but give the cement several hours to dry if you can.

### *Cabochon Cutting*

After you have gained some knowledge and control of your equipment and materials, you will probably want to go on to more elaborate cutting and polishing enterprises. Many stones, especially transparent and semi-

precious varieties, are frequently cut *en cabochon*. Literally, this means cabbage-shaped; in fact, the two words cabbage and *cabochon* come from the same source. In actual practice the term is applied to stones which have been "rounded off," like a cabbage-head, either in some regular shape or following the original outlines of the stone after removing minor irregularities.

Stones treated in this way may be set in rings or brooches; they may be used as insets in art metal work, or in any of many other ways. The use to which they are put will, to a large extent, determine their final shape, and whether the base is to be flat or rounded, polished or rough ground. If the stone is to be cemented into place as an inset, a rough ground base will give better results; for pendants, on the other hand, the stone is usually polished all over.

### *Lap Stick*

Reasonably large stones may be held in the hand while working, but the method of mounting stones in a cement on the end of a lap-stick gives much better control, allows greater pressure to be exerted, and is in all ways preferable. There are a number of suitable cements available, among them chaser's cement, seal-engraver's cement, dental wax, sealing wax, and Canada balsam. Special prepared cements can also be bought from dealers.

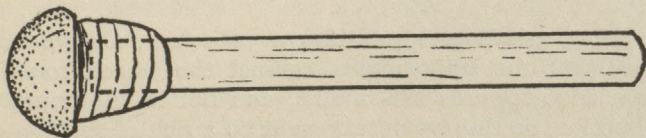


Fig. 7. Method of mounting stone on lap-stick with a blob of cement.

The lap stick should be of convenient length, about six inches, and of a diameter less than that of the stone to be polished, but large enough to fit the hand comfortably. Most people use a round stick, but some prefer a square one saying that it is easier to remember which parts of the stone have been worked on when using a square-handled lap-stick.

The cement should be warmed in a double-boiler until it is soft enough to form a thread or "hair" when it is touched with a lap-stick which is then pulled away from it. To cement the stone into position, first heat both it and the lap-stick; dip the end of the lap-stick in the hot cement, and smear some of it across the base of the stone, using tongs if the stone is too hot to handle. Then dip the end of the lap-stick in the cement again and press the stone into place. Mold cement round the base of the stone and the end of the lap-stick with wet fingers, working it as hot as possible, but not hot enough to risk splitting the stone. (Fig. 7). There should be a lump of cement connecting the stone and the stick, but it must not extend beyond the basal edge of the stone. Once you have armed a lap-stick with cement it is not necessary to add more each time a stone is cemented into place; heating the cement is all that is needed.

When polishing is finished, the stone may be removed from the cement by pressure sideways, or by warming the cement and prying the stone off carefully with a knife.

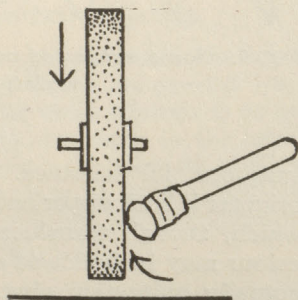
When grinding or polishing a cabochon, always take care that the stone moves against the wheel from its own edge towards the middle, and not in the opposite direction, as this would expose it to a risk of spalling or flaking off. (Fig. 8.) Whenever a sharp edge forms between two surfaces, grind it off as a bevel.

Over-heating from friction is another cause of flaking and spalling and may easily occur if you exert too much pressure on a high-speed wheel. Test the stone for heat occasionally with your finger tips if you think there is any danger of this, and keep the work wet.

As before, each step in the process must be brought to completion, and the stone must be washed free of every grain of abrasive, before the next step is begun. The stages are precisely the same as in the making of a paper-weight: rough grinding, polishing, and buffing.

Vertical laps are generally used for polishing; metal ones for the rough work; felt, cloth and leather for the finer grades of abrasives. The felt laps are specially cut from sheets of heavy felt an inch or more thick and very dense, and the edge should be used rather than the side.

Get your stone ground to the proper shape as soon as you can, thus avoiding much tedious grinding in the later stages.



*Fig. 8. When cutting a cabochon, the motion of the stone against the wheel must be in a direction away from the edge of the stone.*

### *Cabochon Shapes*

The number of possible cabochon shapes is very great. While regular forms, such as ovals and half-rounds, are popular and familiar, there is no need to restrict oneself to them, for irregular shapes, especially if they bring out some point of beauty about the stone, are often to be preferred. The more regular the shape geometrically, the more difficult it is to attain perfection of form. (Fig.9.)

Opaque stones often look best when cut with a flat base and a flat top, unless they are light in colour as is

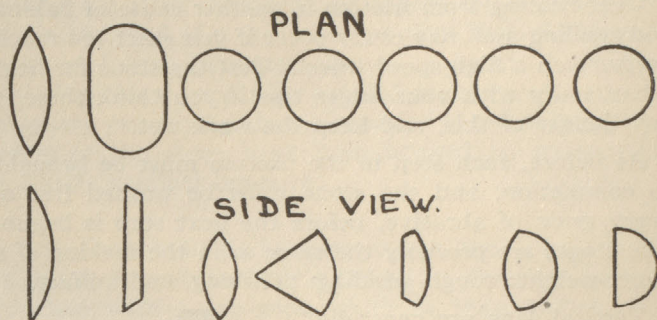


Fig. 9. Some suggested cabochon shapes. Any imaginable variation is possible.

turquoise for instance. Very translucent stones are brighter if both upper and lower faces are curved. Stones which, though translucent are very dense or dark in colour may be hollowed out in the base so that they are actually quite thin, but give an appearance of size and solidity, thus allowing a good deal of light to pass through them. Fairly deep hollows may be ground by means of hardwood sticks with rounded ends fastened in the chuck of a drill, using carborundum powder and water as an abrasive. (Fig. 10.) Do not use too much pressure, and do not let the stone become too hot from the friction. Let the abrasive do the cutting, without forcing.

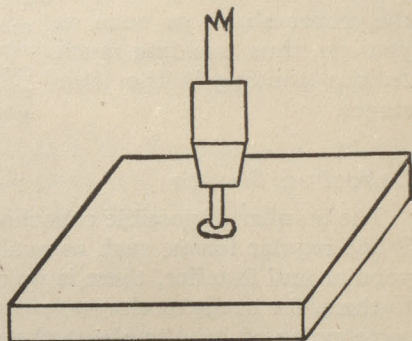


Fig. 10. Drilling a hollow in the base of a stone by means of a rounded hardwood stick in a drill chuck. The stone is cemented to a wooden base to hold it securely.

## *Book Ends*

The method of making a pair of book ends is similar in all respects to the processes already described, except that two identical shapes are needed, preferably cut from the same block of stone and with similar bands or other markings showing in each piece.

A suitable block of stone might measure about four by five by eight inches and weigh perhaps fifteen pounds. These measurements will be less when the book ends are finished, but there should still be enough weight in them to hold books securely without slipping.

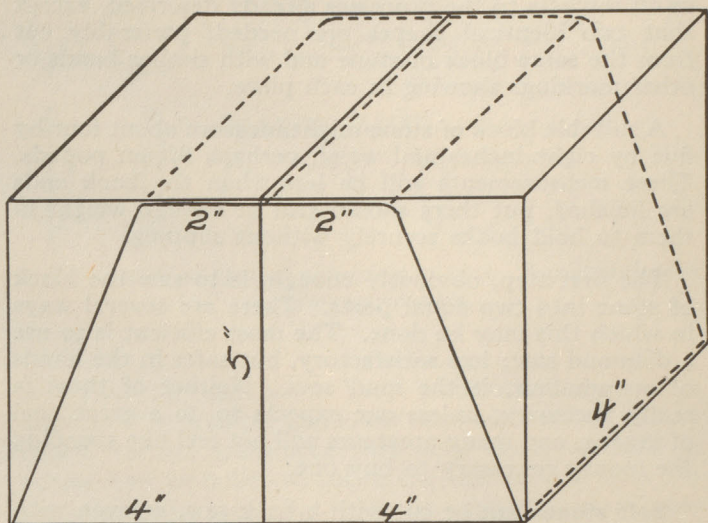
The first step, obviously enough, is to saw the block of stone into two equal parts. There are several ways in which this may be done. The most efficient is to use a diamond saw; less satisfactory, but safer in the hands of an amateur, is the mud saw. Neither of these is really necessary, unless one expects to do a great deal of sawing, and many amateurs will not feel like spending the money necessary to buy one.

Soft stones can be cut with a hack saw, or even with an ordinary wood saw. A thin strip of steel can be used as a toothless hack saw blade and will cut if used with carborundum and water mixed with clay. There are also carborundum wheels, made specially thin, to be used for slicing. For an occasional cut, it may pay you best to take the block of stone to a local stone mason or monument maker.

Having cut the stone, you proceed to shape each half. The design to which the block is to be reduced is drawn upon it in ink or pencil on all sides which will show it. (Fig. 11.) The base of the completed article should be flat and larger in diameter than the upper part, while the side that faces the books should also be flat and at right angles to the base.

In some designs, two different kinds of stone are used in each book end, the base being perhaps of granite with a vertical piece of marble rising from it. When designing your book ends remember that they should be

easy to handle and not of such a shape that they slip out of the fingers when picked up.



*Fig. 11. Block of stone marked for cutting and shaping to make a pair of book ends.*

Sharp edges are to be avoided; where they might occur the work should be beveled or rounded off smoothly. The base should be covered with felt or baize and, if so desired, the face next to the books may be treated in the same way, or finished with a thin piece of ornamental wood.

The work will go better if the two pieces keep step through the various processes, for then there is less trouble in changing from one grade of abrasive to the next and so on. There is also less risk of introducing an unintentional difference in the appearance of the two pieces.

#### *Soft and Hard Stones*

Stones vary greatly in hardness. Mineralogists use Moh's scale, which is divided into ten degrees; each of



these degrees is represented by a typical mineral of that hardness, as follows:

- |             |             |
|-------------|-------------|
| 1. Talc     | 6. Feldspar |
| 2. Gypsum   | 7. Quartz   |
| 3. Calcite  | 8. Topaz    |
| 4. Fluorite | 9. Corundum |
| 5. Apatite  | 10. Diamond |

Most minerals are of a hardness which lies between some two of these degrees, and may also vary in hardness through one or more degrees. Nephrite, for instance, will vary from 6 to  $6\frac{1}{2}$ . All the degrees of hardness in the scale are not equidistant; diamond, with a hardness of 10 on the scale is actually about a thousand times as hard as quartz, which is 7, but talc (1) is only a little softer than is gypsum (2). Even the diamonds themselves vary considerably in hardness.

Among the softer stones in which the amateur lapidary is likely to be interested are: Alabaster, Gypsum, Malachite, Opal, Satinstone, Talc, and Turquoise besides many others. These all work very easily and quickly and many beautiful varieties of them may be obtained. While not many of them are apt to be found by the amateur collector, they are not expensive and may readily be obtained from dealers.

The harder varieties of stone are more numerous, and include such kinds as: Agate, Amethyst, Aquamarine, Beryl, Bloodstone, Carbuncle, Cat's-Eye, Chalcedony, Emerald, Feldspar, Fluorite, Garnet, Granite, Heliotrope, Jade, Jasper, Lapis-lazuli, Marble, Onyx, Peridot, Petrified Wood, Porphyry, Quartz, Sardonyx, Serpentine, and Topaz. There are, as you realize, hundreds of others.

Some of these may well occur in your own neighbourhood. For others you may have to arrange special collecting expeditions. Still rarer and choicer examples have to be obtained through dealers.

Very hard stones, such as topaz, are difficult for the beginner to handle, and diamonds are generally far beyond his skill.

### *A Permanent Collection*

Many lapidaries, instead of making useful or ornamental articles, prefer to collect beautiful examples of minerals, cut and polished so as to show them to the best advantage. It is a rich field and a hobby which is certain to offer worth-while rewards to one who is interested in minerals from the scientific standpoint. Some collectors specialize in certain groups, such as fossil wood, agates, or some other material which may be specially abundant in their particular district. In forming such a collection careful records should be kept of the name of the mineral and the source from which it was collected, as well as any other data which may be relevant. A collection without such information is worth much less than one which has the essential facts carefully recorded.

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### *PAMPHLETS SOON TO BE PUBLISHED*

*An Introduction to Pottery—(Equipment, Coil Method and Throwing.)—by Members of the Canadian Guild of Potters.*

*Clay Modelling—by Mrs. Dora Wechsler.*

*Finger Weaving— I — (A technique which requires no equipment whatever for making purses, shopping bags, tea cosies, hobo-bags, belts, etc. No seams are made in weaving.)—by Ivan H. Crowell.*

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## PRICE LIST

(Prices are subject to revision)

Grinding wheel—Carborundum—	
6" diameter x 1" wide x $\frac{1}{2}$ " hole—120 grit...	\$3.00
6" diameter x 1" wide x $\frac{1}{2}$ " hole—180 grit...	3.00
Carborundum powders— 80 grit—2 oz. packages	
220 grit—2 oz. packages	.20
400 grit—2 oz. packages	.25
Rouge—polishing—per $\frac{1}{4}$ -pound block	
1-pound block	1.00
Tripoli powder, block form, per $\frac{1}{4}$ -pound block	.15
Aluminum oxide—2 ounce package	.25
Cotton buffing wheels 6" diameter x $\frac{1}{2}$ " hole x $\frac{1}{4}$ " thick—each	
Felt lap wheel 8" diameter x 1" thick	7.00
Wooden lap, birch— 8" diameter	
10" diameter	1.00
Sealing wax—small stick	
large stick	.60
Canada balsam—1 ounce bottle	.60
Diamond Saw 8" diameter x $\frac{5}{8}$ " arbor (on special order only)	7.50

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## THE PURPOSE OF THIS SERIES OF PAMPHLETS

About 90% of our boys and girls will earn their livelihood, after they leave school, by the skilful use of their hands. Because they have had little experience with which to guide them in selecting work suitable to their talents, many of them take the first job that they can get. Under such conditions this job is usually a short one. By a trial and error method, often covering a period of years, they find positions which they hold for life. In many cases the work is not really suited to their natural abilities.

Handicrafts offers one means of meeting this great problem. The opportunity to learn a range of crafts provides a means of discovering natural talent. This talent may be in woodwork, metalwork, leatherwork, weaving, pottery, or in design. A person who has talent in a certain craft or phase of a craft will find greatest pleasure and productiveness in a position where that talent can be used to advantage. The nation needs all the natural talents available for its Industries, Arts and Sciences. Hence all will profit when talent finds its useful outlet. Handicrafts in the schools, churches, homes, scout rooms, etc., will give to young people an opportunity to find the sort of work in which they will produce best and be happiest. This pamphlet is one of the arrows pointing the way.

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