Jewelry Making DAILY

# 5 Stone Cutting Techniques and Projects:

## Cabochon, Faceting, Inlay, Slabbing, Trim Saw Setup

*Plus Bonus Dopping Tips*

EVERY PIECE OF GEM ROUGH IS DIFFERENT, with many different potential gem cuts sitting inside it just waiting for you to bring it to the light of day. Whether you intend to set a stone in jewelry or display it proudly on a shelf, and whether the lapidary rough is transparent to opaque, all the same or elaborately patterned, in brilliant colors or the softest of earth tones, the first question to ask is: what's the best way to cut this stone?

In this exceptional lapidary eBook, you'll find five approaches to gem cutting that will help you learn how to best take advantage of all kinds of gemstones and put your cabochon units, faceting machines, lapidary saws, and more to good use. See how a piece of patterned stone containing ruby mixed with other materials progresses from gem rough to finished cabochon, with details of the wheels and polishing compounds used at each stage—plus great tips for dopping your stone. Find complete cutting sequences for an oval cut created to take advantage of an unusually long, thin piece of quartz faceting rough. In a fully illustrated, step-by-step project for making an inlaid silver cuff, take in the loads of ideas and techniques available for creating dramatic stone mosaics and how to custom fit them into a piece of jewelry. And discover valuable tips and techniques for slabbing chunks of rock into slices suitable for cabbing, and excellent information on how to set up your lapidary saw in the first place.

From rough gem to final polish, *5 Stone Cutting Techniques and Projects: Cabochon, Faceting, Inlay, Slabbing, Trim Saw Setup—Plus Bonus Dopping Tips* will tell you what lapidary tools and equipment you'll need and shows you how to get there. It's a fabulous sampling for any lapidary or any jewelry maker who wants to do their own rock cutting and create cabochons, faceted stones and more! !

Merle White

Merle White
Editor-in-Chief, *Lapidary Journal Jewelry Artist*

# Designer Ruby Cabochon with Dopping Tips

*Slab and cab a striking stone*

BY AHNA V. WHITE

**SKILLS**

- cabbing machine use

OPENING PHOTO: AHNA V. WHITE
PROJECT PHOTOS: AHNA V. WHITE

Ah, Ruby, the Queen of gemstones—it isn't just for faceted stones, anymore. Deeply colored but translucent to opaque material also occurs that can make great cabochons—sometimes with interesting patterns courtesy of other materials found with the ruby.

After examining the front and back of my slab, I decided to create a freeform design over the entire stone to make a designer cabochon. What is a designer cabochon, you ask? It means that you have used the best part of the stone in terms of the design in the rock to create an exceptional cab. A regular, plain oval cabochon usually comes from chopping the slab up to yield the most cabs with the least waste, so finding a stone with carefully positioned markings is rare.

I use a Diamond Pacific "Genie" with 6 wheels (3 grinders and 3 polishers, with polishing pad at the end). You may only have 4 wheels and that will work as well—but for this project I'll refer to wheel #1, #2, #3 and so on. Each wheel will make your cabochon smoother and smoother. It's hard to gauge how much time to spend on each wheel—the harder the material, the longer it will take. What's most important is that your movements are quick and smooth. This skill is something that will develop over time.

## FINER GRINDING

Grinding takes a little bit of practice to perfect. Some stones are harder than others and will take longer to shape—you need to decide which angle works best for you. Try holding the cabochon with the face to the wheel, or holding the cab so its side is at the wheel to see which way works best for you.

**MATERIALS**
Rough rock or slab
Acrylic caulking
2 x 4 or wood chunks

**TOOLS**
Trim saw, cabbing machine, X-acto knife, permanent ink pen or pencil, dopping wax, sticks, heat source, chromium oxide
**OPTIONAL:** Cabochon template

**SOURCES**
Most of the tools and materials for this project will be available from well stocked lapidary supply vendors.

## SAFETY FIRST!

Before working, be sure you've been trained and understand how to use a trim saw, you know to follow all safety guidelines—and wear your safety glasses!


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**PHOTO 1** Apply a good amount of caulk to top of 2 x 4 and set stone in place. Using fingers, fan out caulking over 2 x 4 and up the rock at least 1/4". Let dry for at least 48 hours.

**PHOTO 2** Make a first sawing pass on ruby to create flat surface wide enough and long enough to make desired cabochon shape. Make second pass, about 9mm wide, to create a small slab.

**PHOTO 3** Use a pencil or permanent ink pen and cabochon template to trace desired shape onto slab; if preferred, draw shape freehand. For darker stone such as ruby, I use a silver or gold permanent marker that can be bought at a local craft store.

- *Lay slab flat on trim saw deck and cut as closely to outlines as possible to remove excess stone. While dopping wax is melting, heat cabochon. Dip dop stick into melted wax and place on back of cabochon, then hold stick in place while wax hardens. Set cabochon aside to dry for about 15 minutes.*

**PHOTO 4** Start on wheel #1. Grind off any material you were unable to cut away with trim saw. Lay stone face-down and flat on table, and with pencil or permanent ink pen, run a line all the way around cabochon edge about 2mm from top. Return to wheel #1, tilt cabochon at an angle, and grind away until you reach line.

- *Move to wheel #2 to smooth out edge you created with edge of cabochon facing wheel.*
- *Use a rotating up and down motion all the way around; this is making the dome. Grind along flat surface of both sides and cab top.*
- *Continue process on all remaining wheels. Final step is a high gloss finish with chromium oxide. Remove dopping wax. If you're going to set the cabochon with a backplate, there really is no need to polish the back since it will not show.*

## SAWING SUCCESS

I recommend using a green or a black sintered blade to cut ruby. Examine the rock to determine how wide to make your first cutting pass. Never force the rock into the blade, use medium pressure, and take your time.

*If you're creating an open-back setting or will be wire wrapping the cabochon, I recommend polishing the back. To do so, repeat the entire process on your cabbing machine for the back.*

AHNA V. WHITE is the creative force behind www.ArtCreated.com, a wide-ranging jewelry and crafts site. She has studied photography at CCAC in Oakland, California, stained glass in Morgan Hill, California, and metalsmithing at Butte College, California.

# DOPPING TIPS

## CONVENTIONAL DOPPING

- Dopping the cabochon once it's trimmed allows greater control over the shaping and also keeps your fingers a safe distance from the spinning wheel on the cabbing machine. You'll need a heat source to melt the wax. You can buy a heat source from a lapidary outlet or you can use things found around the house. I rigged up a small 3" x 3", non-stick cake pan I had in the kitchen, and I have a fragrance oil burner that uses tea lights to create a wax melter. Use the melter on a fire-safe surface such as firebrick.
- Make sure not to get any wax onto the sides of the cabochon because wax can easily clog your grinding wheels. This is a little tricky—you don't want to burn yourself—but I very quickly pat the wax down, usually about 1 minute after I've put the wax in place to help make it more stable.
- There are several methods used to heat a cabochon—here are two. In a frying pan on low heat, set the cab in a cup of hot water. You can also use a hair dryer.
- For dopping sticks for very small cabochons, I've cut up some kabob skewers. For larger cabochons, I use 1/2" round wood dowels found at a local hardware store in the trim department. I cut them into 3-4" lengths.

## OFF THE DOP

Here's a great trick for removing wax once you've completed your stone: ice water! Fill a bowl with cold water and several ice cubes, and place your cabochon in the bowl for about 10 minutes. Hold both the cabochon and the stick and break off the wax—it usually takes the entire wax area off. If it doesn't, add more ice to your water or leave the cabochons for another 5 to 10 minutes. Any remaining wax can be removed with an X-acto knife—again, always cut away from yourself and your fingers!

## UNCONVENTIONAL DOPPING

- Normally, I begin by gluing my rough to something stable, a process known as dopping. Usually, it's a rough cut cabochon that gets dopped using wax and a wooden stick for easier manipulation on the cabbing machine, but when the rock is large, a stick would just fall off from the force of cutting. So I asked my husband to cut up a wooden 2 x 4 into 4" lengths. This gives me plenty of room to glue down the rock as well as a safe amount of wood to hold onto, as I'm cutting by hand. Of course, if you have an automated cutting saw, you may use that. I have 2 saws, a 6" trim saw, and a 14" slab saw. The 14" slab saw is much too aggressive for this small rock, so I prefer to use my trim saw.
- For the glue, I use acrylic latex caulking with silicone, available at any hardware store. This product is a bit rubbery and will allow me to remove the remainder of the rock once I'm done cutting, so nothing goes to waste.
- To release the remaining rock glued to the 2 x 4, I use a sharp X-acto knife to cut into the caulking. Always cut away from yourself. Most of the caulk can be removed from the stone just by pulling it off. It's important to remove as much as possible because you don't want to grind caulk on your cabbing machine, as it could clog your wheels.


OPENING PHOTO: JIM LAWSON
PROJECT PHOTOS: STEPHEN TANEY

# Trim Saw Setup

*Get off to a good start with your gem rough*

BY STEPHEN TANEY

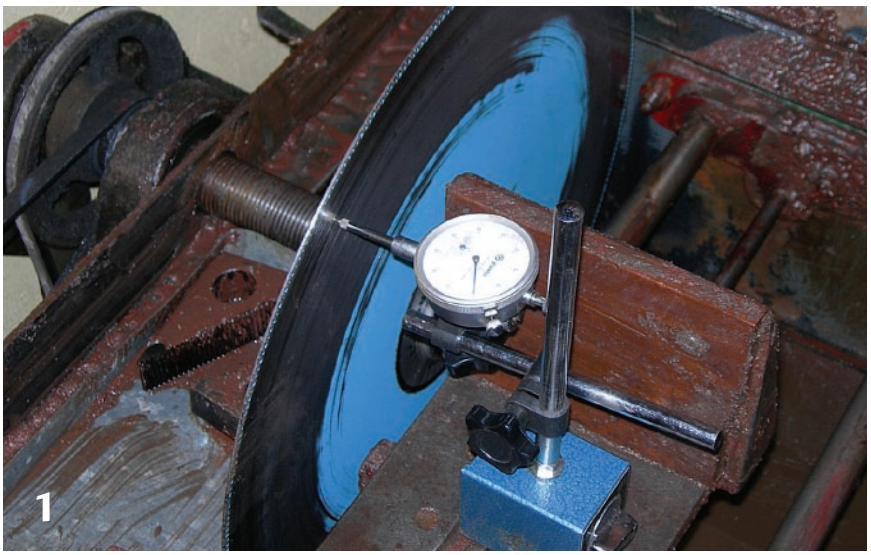
The lapidary slab or trim saw is a roughing tool. It is important to remember that getting the best surface finish on a slab in the beginning will help make subsequent grinding and polishing operations easier.

When you get a new blade or are switching a blade on your saw, you should begin by truing it to the arbor, or making the saw blade as perpendicular to the axis of the drive shaft as possible. A perpendicular setup will ensure that the blade won't wobble while rotating on the drive arbor, which will minimize vibration as well.

This procedure can be used on any size saw, but my methods may need to be modified to your particular saw. For this demo, I will be using a reconditioned 18" Highland Park saw.

Begin by breaking down saw. First, unplug it. This is the most important safety precaution. It's not necessary to drain lubricant out of saw, but it will keep mess down. Remove saw, blade, nut, and flanges. Inspect flanges for rust and pits. Sand them clean and shiny if they need it.

- *I place a sheet of silicon wet or dry sandpaper (200 to 400 grit) on a flat surface, either a plate of glass a piece of Formica countertop. I sand in a circular motion to remove any high spots on the metal and to make the surface flat. You want to create maximum contact with the flange to the blade, because the flanges add to the blade stiffness.*



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Inspect arbor where flanges are mounted. Use a Scotch-Brite pad to clean up any dirt or rust.

- *Don't use sandpaper here unless the shaft is really bad. Over time, sanding the shaft could change the fit of the blade to arbor tolerance, and then the shaft would need to be replaced.*

Replace saw blade and both flanges and hand tighten nut.

**PHOTO 1** To true blade, first set up dial indicator in saw vise as shown. Open vise to maximum and place magnetic base of indicator on floor of vise as shown. Engage half nut to drive shaft—as if you were going to saw a slab. This will prevent vise and indicator from moving too much while readings are made.

- *If you have the carriage on a weighted system, then you may have to devise a method so that the vise will not move. A C clamp and a couple of pieces of wood may work—and you won't need anything more than hand tightening for the clamp. If your saw has no vise, clamp a piece of steel to the tray with a C clamp for a magnetic base.*

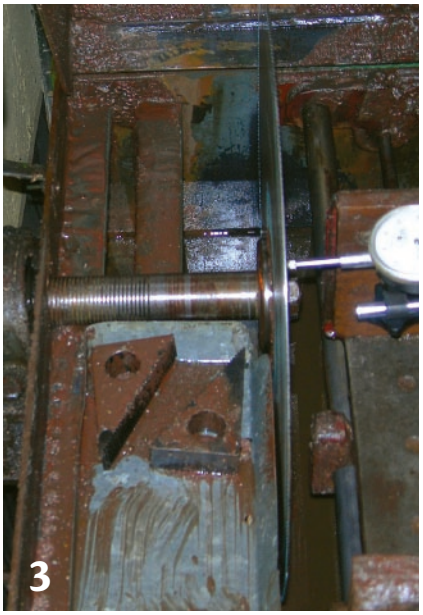
**PHOTO 2** Dial indicator should have at least .050" sweep on face, although a full .100" would be better.

- *These indicators come in many styles. Some are very expensive and precise but are not needed here. The tolerances here will be +/- .015" range under optimum conditions. The magnetic base dial indicators can be bought through machine tool suppliers for around $30 to $50.*

**PHOTO 3** Position dial indicator stem so it touches saw blade body but not at abrasive diamond tip. If you have one, use advancing handle of vise to fine tune adjustment. Once indicator is positioned and you're sure components won't shift, begin truing the blade.

Grasp pulley by hand and slowly rotate saw blade. Observe hand on dial indicator. Watch for point where saw blade is farthest left of indicator. You might need to repeat this step a few times to see this point. If there are multiple spots, choose the worst one. Once located, reset dial indicator to zero by rotating bezel. Make a legible arrow on blade with marker at chosen spot.

- *Clean the spot with acetone or alcohol first, so the marker makes a clear, easily seen mark. Prep some shim stock—it can be made from small pieces of cardboard from the backs of legal pads, credit cards cut into strips, or feeler gauges from the auto parts store—my personal favorites.*



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### MATERIALS
Scotch-Brite pad; sandpapers; clean rags
Black marker; acetone or alcohol; shim stock

### TOOLS
Trim saw and blade, dial indicator, trenches

### SOURCES
Most of the tools and materials for this project will be available from well stocked lapidary supply vendors.

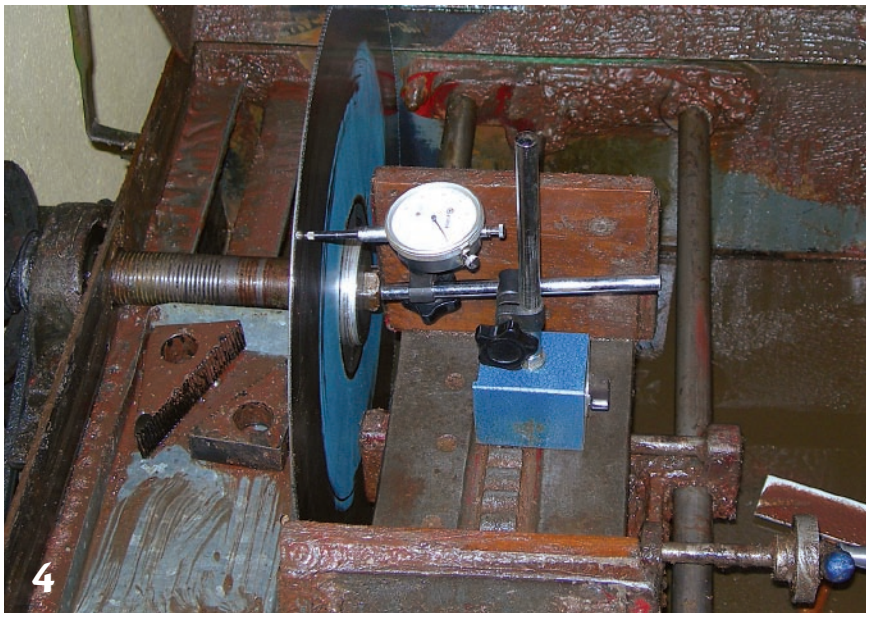


**PHOTO 4** Without moving saw blade, loosen nut (hence only hand tightening). Reach to opposite side of saw blade where flange and blade meet, and place first shim. Hand tighten.

- *Notice I didn't say what size shim to use? This will depend on the distance the blade needs to move, and what size blade is in the saw.*

*Reset zero on indicator. Rotate blade at least 1 rotation by hand again without moving vise and dial setup. Go back to first mark and see what dial reads. Is it more or less? If it's more, add a larger shim or add more shims to it. If it goes past zero on dial, shim is too large, so replace with thinner one.*

- *This procedure gets easier once you've done it a few times. Remember earlier I mentioned that there can be several "high" spots on the blade? These will sometimes correct as each one is addressed.*

Rotate blade by hand and watch indicator to get smallest deviation possible. We are looking for something around +/- .016" for a reasonable tolerance—try for better if possible. If your blade is new, this should be easy. If a new blade is badly warped, you should return it for a replacement.

Tighten saw blade when you are satisfied. Go only about 1/4 of a turn past hand tightening.

- *Overtightening your blade will cause it to distort and nullify all your careful work. Tighten only enough to prevent the blade from slipping and so the flanges do not warp the blade.*

Check deviation once more before plugging in saw.

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STEPHEN TANEY has been stonecutting for more than 15 years. Bringing out the natural beauty of a stone is one of the things he loves most about his work. He holds a B.F.A. in sculpture from the University of Massachusetts, Amherst.

# Golden Oval

*Make use of those long skinny stones*

BY JIM PERKINS

**SKILLS**

- understanding of basic faceting techniques

This design was inspired by a piece of Oro Verde citrine rough given to me by a friend who wasn't sure what to do with it. The stone had a very odd shape and was very thin. Frankly, I wasn't sure what to do with it myself at the time, but then the idea of cutting this stone popped into my head and I sat down and created the design.

It is a reasonably easy and enjoyable design to cut because it is a little different than typical ovals. Although the design was intended for quartz, it could be used to cut material with a higher refractive index without any adjustments to the angles, and of course material with higher R.I. would perform better. The most important thing is to cut it from material with 50% saturation or less in order to achieve good performance.

JIM PERKINS began to cut stones at age 12 in his father's rock shop. He studied art and design at Cuyahoga Valley Art Center and at the University of Akron, and faceting at William Holland School of Lapidary Arts. He has published several books, including Learning to Facet in the 21st Century using the Fac-ette and Learning to Facet in the 21st Century using the Facetron.

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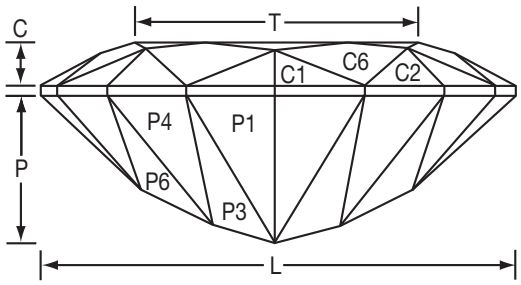
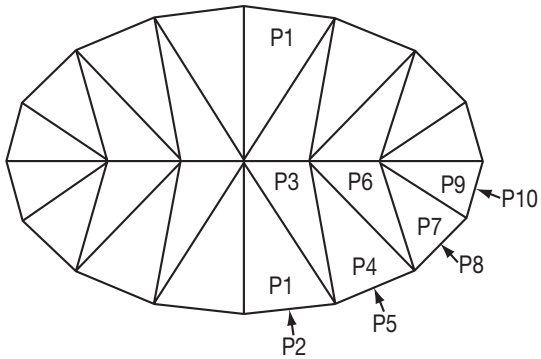
## PAVILION

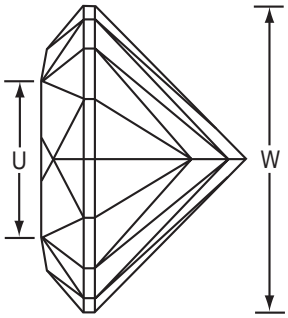
| Facet | Angle | Index | Comments |
|---|---|---|---|
| P1 | 43.70° | 02-46-50-94 | Create a center point |
| P2 | 90.00° | 02-46-50-94 | Set size; level girdle |
| P3 | 42.30° | 04-44-52-92 | Meet points (MP) at center point |
| P4 | 42.80° | 06-42-54-90 | MP at p2-p3 |
| P5 | 90.00° | 06-42-54-90 | MP at p2-p3 |
| P6 | 41.00° | 10-38-58-86 | MP at p3-p4 |
| P7 | 42.60° | 12-36-60-84 | MP at p4-p5 |
| P8 | 90.00° | 12-36-60-84 | MP at p5-p6 |
| P9 | 43.80° | 20-28-68-76 | MP at p6-p7 |
| P10 | 90.00° | 20-28-68-76 | MP at p8-p9 |

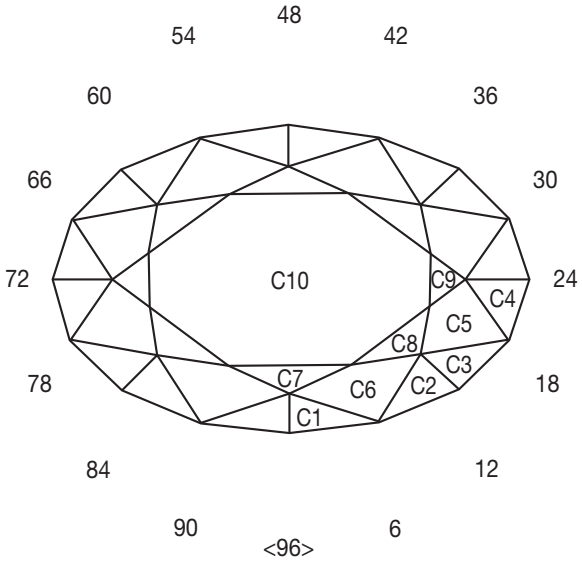



## CROWN

| Facet | Angle | Index | Comments |
|---|---|---|---|
| C1 | 40.40° | 02-46-50-94 | Set girdle height |
| C2 | 38.20° | 06-42-54-90 | Set girdle height |
| C3 | 35.80° | 12-36-60-84 | Set girdle height |
| C4 | 28.20° | 20-28-68-76 | Set girdle height |
| C5 | 26.10° | 18-30-66-78 | Girdle meet point |
| C6 | 34.00° | 04-44-52-92 | Girdle meet point |
| C7 | 15.20° | 96-48 | MP at c1-c1 |
| C8 | 9.00° | 10-38-58-86 | MP at c2-c3 |
| C9 | 17.20° | 24-72 | MP at c4-c4 |
| C10 | 0.00° | Table | MP at c5-c6 |



# Inlaid Cuff

*Expand your repertoire with a classic technique*

BY JEFF FULKERSON

OPENING PHOTOS: JIM LAWSON
PROJECT PHOTOS: SPENCER BRAUN

**SKILLS**

- soldering
- fabrication
- basic lapidary
- stone polishing

**TIME IT TOOK**

This bracelet took me about 20 hours to complete, between the metal and the stone work. You'll need patience to get good results inlaying the stones, so go slow, and don't get discouraged if you cut a stone too small. Just get another piece and try it again.

I love to make inlaid jewelry. You can create and design well enough with just metal, and if you add a cabochon or faceted stone, you expand your creativity around their shapes. When you cut and inlay your own stones, though, you not only make the metal conform to your will but also the stones. Your piece can be anything you can imagine!

When buying your silver for this project, make sure you get the triangle wire as specified because it is different from other triangle wire in that it has sharp angles. When laid on its side, the wire I use gives you a reverse slope so that your channel gets wider as you go into it, allowing you to get a good, tight fit when setting your stones.

Don't be afraid to use this project only as a guide to get you started with inlay. You don't have to do all of the techniques like putting in dots or checkerboards on your first try, and you certainly don't have to do it exactly like mine. Be creative. Mix and

match. With inlay, there are endless possibilities of shape, contour, contrast, height, depth and color. For this demo, I'll give you the basics for an inlaid bracelet, but with these techniques you can inlay stone into any channel you have—a belt buckle, pendant, ring, or whatever.

I like using both a flat lap and a lapidary arbor. You can get a perfectly flat cut on the flat lap, which is great for gluing up stones. However, many people get along just fine with only an arbor—you don't have to run out and buy a flat lap. We will not be using the typical lapidary technique of dopping our stones before shaping and polishing them. Instead, we'll use our fingers to hold the stones as we polish, so be very careful, especially on the flat lap as you're grinding your pieces. You can rub your fingers up against the wet wheels, and it won't hurt, nothing happens—at first. However, you are still sanding away your skin, and all of a sudden you will notice blood on your piece and it will be yours! Don't ask me how I know this, but it hurts and takes a long time to heal. . . . Oh, and kiss your forefinger and thumb nails good-bye. I'll assume you know how to polish stones already, so I won't dwell on getting a nice polish, but Contributing Editors Tom & Kay Benham have provided some tips (see the box "How to Polish Stone with Confidence").

I call this bracelet Carthiamou ("My Heart" in Greek) for my wife, Roxanne, who is my inspiration. I hope it will inspire you to stretch yourself and expand your skills.

## MATERIALS

18-gauge sterling sheet: 2" x 6"
.215" x .097" triangle wire: 16" length
Medium silver wire solder
Ivoryite rough
Black nephrite jade rough
1" & 1½" wide masking tape
5-minute epoxy
Pipe cleaners
Acetone
Super glue
Toothpicks
Q-Tips™

## TOOLS

**LAPIDARY TOOLS:** Lapidary arbor: 220, 400, 600, 1200 belts or wheels, trim saw, cut-off saw (optional), cerium oxide belt or wheel, flat lap, diamond drills in assorted sizes.

**HAND TOOLS:** jeweler's saw and blades, files, leather mallet, steel block, bracelet mandrel, small square, dividers, #31 & #48 drill bits, Dremel or rotary tool, medium & fine silicone wheels

**SOLDERING TOOLS:** torch, Solderite™ pad, pickle pot, flux

**OTHER TOOLS:** polishing station.

## SOURCES

Most of the tools and materials for this project will be available from well stocked jewelry or lapidary supply vendors.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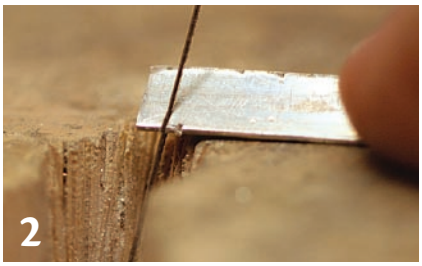
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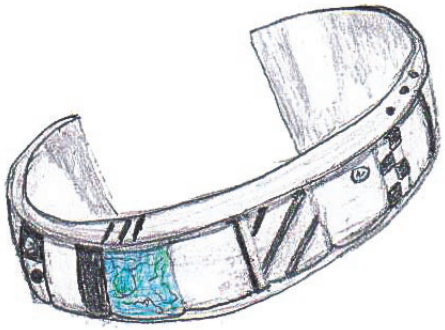

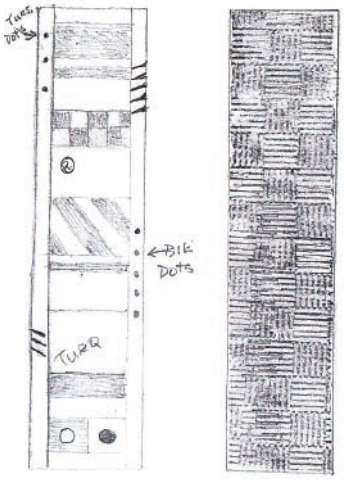


## THE METAL FORM

**PHOTO 1** Temporarily straighten triangle wire.

**PHOTO 2** Cut 2 side lengths at 6¼" (for a 6" bracelet) and 2 end pieces that are 1" wide at the top with a bevel that fits the inside of the sides exactly. The bottom will be slightly longer due to the taper of the triangle wire. You can make your bracelet as wide or narrow as you like. Just make sure both end pieces are the same length. The fit here is the most difficult part of the metalwork, and extra time spent getting it right will make your piece easy to solder and look good. Straighten and flatten the sides with a mallet on a steel block. If the sides are not straight, they will not be parallel, making your channel much harder to inlay, and the result won't look as nice.

**PHOTO 3** Cut a piece of 18ga sheet at 2" x 6". I like to roll-print a design on the inside of the bracelet using patterned brass. Anneal and flatten. If you want your signature or hallmark stamp on the bracelet, now is the time to stamp it.

**PHOTO 4** Flux all pieces and lay out flat on a Solderite™ pad. Make sure ends are square.

**PHOTO 5** Use medium wire solder to stick-solder the triangle wire to the sheet. Always point the flame away from yourself. Feed the solder into the flame from the inside of the piece, and draw the solder along first on one side of the bracelet and then the other. Ensure the ends get soldered both to the sheet and to the side wires. Try not to get solder on the outside of the triangle wire. Allow to cool before pickling.

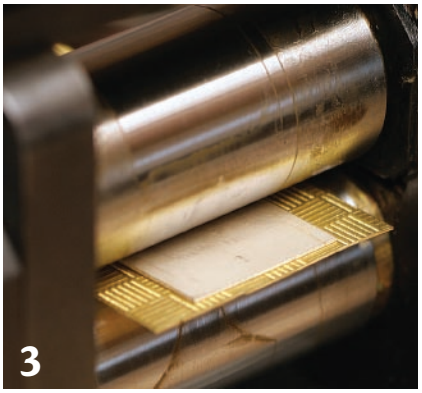
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**PHOTO 6** Trim the excess sheet and wire from the bracelet with a jeweler's saw.

**PHOTO 7** On a bracelet mandrel, pound the blank into shape. Make sure it is symmetrical.

**PHOTO 8** Go to your lapidary arbor, put a 220-grit belt on, turn on the water, and sand down the excess metal. (You could file the metal by hand, but this is so much easier!)

After sanding the edges, switch to a 400-grit belt and go over both the edges and the face of the triangle wire to remove excess solder from the exposed surface. Check the inside of the channel and file away any solder on the top inside edge to ensure the channel will be straight and clean.

**PHOTO 9** Use a large triangle file to add decorative notches along the edge of the bracelet.

**PHOTO 10** Patinate the inside of the bracelet and brush it with a brass brush. Polish the bracelet.


## HOW TO POLISH STONE WITH CONFIDENCE: 8 TIPS

- **GRIND WET.** Always grind wet to protect your lungs from breathing in the dust. The dust from some stones, such as malachite, is quite toxic. In addition, wet grinding eliminates damage to expensive diamond wheels.
- **JUDGE DRY.** Although we always grind wet, we recommend that you always dry the stone completely before judging its surface. Water on the stone surface will only hide scratches and give a false reading.
- **USE THE WHOLE WHEEL.** Use the entire width of the grinding wheel, not just the center. This will ensure a longer life and better performance.
- **SKIP NO GRIT.** Work sequentially from the coarsest to the finest grit. Don't be tempted to take a short cut by skipping a grit. The progression through finer and finer grits is necessary to remove the scratches left by the previous grit. The goal is to have the scratches become finer with each grit size until they can no longer be seen. Our experience has been that if you skip a grit, the final polish will show big scratches. You will wonder where those scratches just came from! The truth is that they were there all the time, but you just didn't sand them out when you were supposed to. If you skip a grit and find deep scratches, you'll have to go back three or four grits to remove them. It's always faster to do it right the first time.
- **POLISH SLOW.** Polishing is the final step. There are a myriad of polish and polishing pad combinations; our preference is charging a soft leather pad with a thin paste of Holy Cow polishing compound and water. The actual polishing occurs as the pad starts to dry and the stone starts to pull against the surface. We keep the speed of the pad low to eliminate any heat buildup.
- **KEEP IT CLEAN.** Remember, "cleanliness is next to godliness" when it comes to lapidary work. To prevent cross-contamination from coarse grits, we are careful to rinse the stone and our hands at every grit change—and we thoroughly clean our machines after each grinding session. Polishing compounds and wheels should be kept in sealed plastic containers when not in use.
- **BELIEVE WHAT YOU SEE.** Your eyes are your most important tools when it comes to polishing your stone. They are your feedback loop. If your eyes tell you that something is not quite right about the surface, believe them. Stop! Figure out what the problem is before continuing.
- **GRIND A LITTLE AND LOOK A LOT.** This is the mantra of the successful lapidary.

— Tom and Kay Benham, Contributing Editors

## DOTS ON THE SIDE

**PHOTO 11** Lay out the dots with dividers and make indents to guide the drill bit. With a #48 bit, drill holes approximately 3/32" deep. I drilled the middle hole a little larger, with a #31 just to add a little spice. Do not drill all the way through the metal!

**PHOTO 12** Cut at least twelve 1/8" x 1/8" pieces of black jade at the trim saw. We'll only use 8—but you'll be glad you have extras. Cut off the pointy ends from 12 round toothpicks and insert into Styrofoam. Mix a small amount of 5-minute epoxy. With tweezers, dip the jade pieces into epoxy and carefully place on the upright end of a toothpick. Repeat for all 12 pieces. Allow at least 30 minutes to cure.

**PHOTO 13** After the epoxy has hardened, use the lapidary arbor with a 220-grit belt to grind corners off the jade. After grinding the rough shape, chuck the toothpick into a handheld rotary tool.

**PHOTO 14** With the rotary tool at a medium to slow speed, run on a wet 220-grit belt to form a slight cone shape from jade. Go slow, and try the cone in the holes until it fits. Take the toothpick out of the rotary tool, dry the jade and hole very well, put a drop of super glue in the hole, and press the jade into the hole. Wipe away excess glue with a paper towel. After a moment, you should be able to push down on the toothpick and gently twist it off, leaving your dot glued into the bracelet. Repeat process for remaining 7 dots.

**PHOTO 15** After all the dots are glued in place, sand on a 400 grit belt at the arbor until they are flush with the metal. Move to a 600- grit belt and gently go over the areas, then move to a 1200-grit belt and repeat. Dry the bracelet and polish with bobbing compound and then rouge or Zam. Go slowly and don't allow the metal to get too hot.


11


12


13

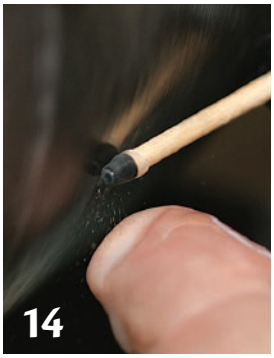
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**PHOTO 16** After you've polished the bracelet, use masking tape to protect the back and sides so you don't get epoxy on them when you start gluing in stones.

## STONE ON TOP

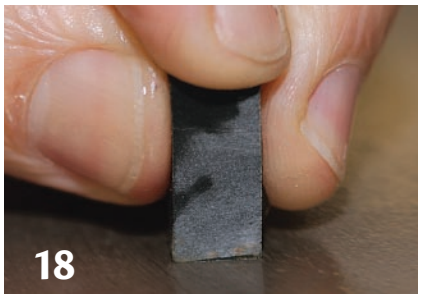
Choose which end of the bracelet you'll start with and mark the inside with a felt pen so you won't forget where you are working. I also like to mark the underside of each stone, so I know which side goes where. The first stone will be half black jade and half white ivoryite.

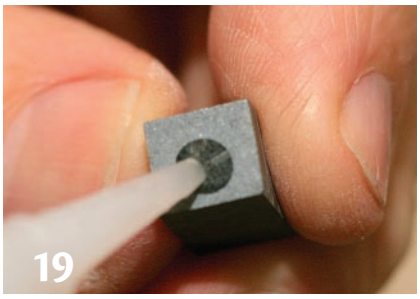

16

For clarity, we will call the sides of the stone that touch the metal the "ends" and the sides that are perpendicular to the metal we will call the "sides."

**PHOTO 17** Measure and cut a piece of each stone on the trim saw at a little over 1/2" wide and to the same thickness. I try to use slabs that are about 1/4" thick so all of my stones start out about the same.


17



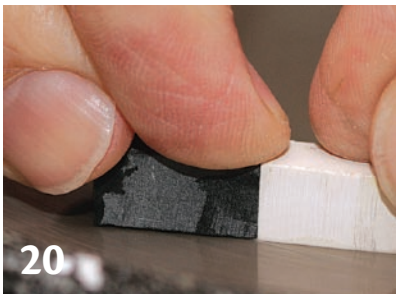




**PHOTO 18** Square one end of each stone flat on the flat lap.

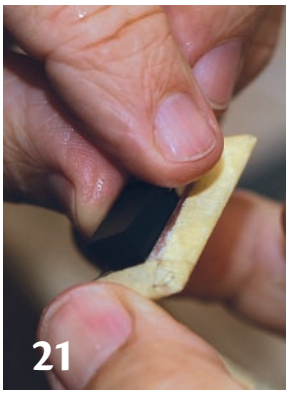
**PHOTO 19** Put a drop of super glue on one end and glue the stones together. If any excess glue runs out of the joint, wipe it off with a paper towel.

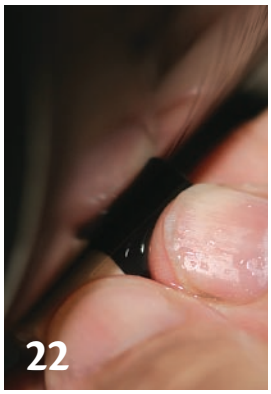
**PHOTO 20** Flatten the side that will go against the end of the metal. Since the bracelet is curved, you must also put a bevel on the sides so each stone will fit snug against the adjacent stone.

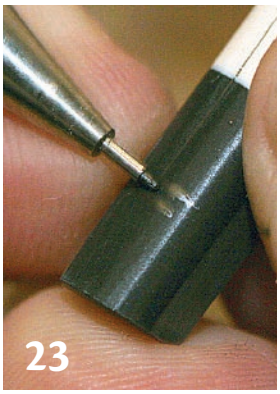
**PHOTO 21** Put a straight cut on one end, and check the fit to see if the side and the end meet the metal with no gaps.

**PHOTO 22** Make a slight bevel on the ends, so when both ends are fitted, there will be a slight wedge to insert into the metal channel. Once you have a good fit on the first side and end, cut the other end down until it fits in the channel with no gaps showing.

Go slow. It's much easier to take off a tiny bit 10 times than to cut the stone too small and have to start over with a new piece. Since this section is half jade and half ivoryite, carefully grind each side down evenly. Once you have the two ends and one side fitted, cut the remaining side so that parallel. When you have your shape the way you want it, put a bevel on that side also—so the next stone will snug against it with no gaps.




## Choosing Stones for Inlay

When you inlay stones, it's best to choose stones that are similar in hardness. If you put a soft opal next to a hard agate, when you grind them down, the opal will disappear and you will lose your effect. Nevertheless, you can still use stones of different hardnesses, but you'll have to be very careful when cutting or grinding them together.

For this project, I choose a black and white color scheme of black nephrite jade, which takes a great polish, and white ivoryite, which is softer, but still takes a good polish. Be careful not to overgrind the ivoryite, as it will cut faster than the jade.

Both stones show a little pattern, so the finished product doesn't look like plastic. You may want to use inexpensive stones for your first attempt. There are many beautiful jaspers that are inexpensive, come in a variety of colors, take a great polish, and are easy to work with.

Since we are making each stone stand alone, polish each piece before installing into the bracelet. Shape the stone with a 400-grit belt on the lapidary arbor, smooth with a 600-grit belt, then move on to 1200.

**PHOTO 23** To put dots on this piece, lay out, measure, and drill two 2mm holes using a diamond drill with water. Create a starter hole with the side of a small (.75mm) diamond drill without water so it just scratches the smooth surface enough that the 2mm drill will not move when you drill the hole for the dot.

**PHOTO 24** Put the stone in a shallow metal dish with a little water, and keep the hole and the drill wet at all times so you don't overheat the stone and crack it. Keep the drill upright for a straight, round hole. Cut the dots as you did for the dots on the sides of the bracelet, remembering to dry everything thoroughly before gluing.

# MORE INLAY PATTERNS


## CHECKERBOARD

Cut 4 strips of jade and ivoryite, being extremely careful to make them each exactly ¼" wide. Glue them together, alternating colors. Square off one end, mark a cutting line at ¼", then cut it a little wide of the line at the trim saw. Square the cut side so the piece is a perfect rectangle. I made mine a little deeper than the ¼" width. Repeat for the remaining piece, flipping one cut piece over to alternate the colors. Superglue strips together for a checkerboard pattern. When dry, fit into the bracelet like all of the other stones.

## METAL SPACERS

I like to put pieces of 18ga metal between the stones to break up the look. Cut a scrap of 18ga into a slight wedge shape and put it against the stone. Scribe the top contour of the stone onto the silver, then cut it out and file it smooth. Hold the silver tightly in parallel jaw pliers and polish the edges. You won't see anything but the edges, so you don't have to worry about polishing the entire piece. Place the metal spacers wherever you like.

When you glue in the next stone, put a little glue on the silver, install it, then glue the next stone to butt against the silver instead of the last stone. You can also put silver against the side of a stone if you like. Once again, use your imagination.

## DIAGONAL STRIPES

Cut out 4 strips each of jade and ivoryite, each l ¼" wide. Flatten both sides of each strip on the flat lap. Dry and superglue the strips together, making sure the tops are all flush. Next, cut a diagonal line across the stripes for the first side, and use a square to get a perpendicular edge to the first side. Continue fitting from this point like all of the rest of your stones.

## RACING STRIPES

Cut off about ⅓ of the stone piece and square up the end. Cut a thin strip of ivoryite, flatten one side, and superglue it to the piece. Grind the ivoryite down to a thin line on the end of the jade. Repeat with a thin strip of jade and then another strip of ivoryite. True up the end and glue the rest of your piece of jade onto your "stripes." Fit and polish as usual.

## INLAID WIRE

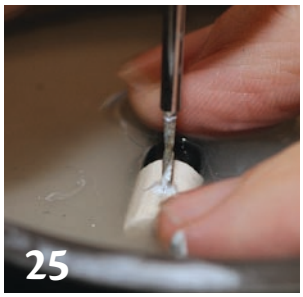
If you want to inlay silver wire into your stone, drill the appropriate size hole, superglue the wire onto the hole, snip it off, and grind it down on the 400 grit wheel, then polish.

## DOTS

Dots of various sizes can be used throughout the piece as you see fit. I wanted a turquoise dot on the opposite side of the bracelet, so I used a 5mm core drill to create the hole. For a good, clean hole with a core drill, use a scrap stone (I used a piece of old treated turquoise) and drill a hole in it with your core drill to create a drill guide. Then, use double-sided carpet tape to adhere the drill guide to your chosen stone. Put the stone in your water pan, insert the wet core drill, and drill a nice straight hole.I drill all the way through so I won't damage the side of the stone trying to get the core out. Once you've glued the turquoise dot, shape and finish as before.

## DOTS WITH SILVER OUTLINES

Dots can also be created with silver tubing and then filled with another color stone, much like the dots on the metalwork. To glue in silver tubing, drill a hole the size of your tubing, cut off a very short piece of tubing and superglue it into the stone. Grind down the tubing flush with the stone on the 400 grit wheel. Cut a dot to fit inside the tubing and glue it in position. Finish dot as for the others.









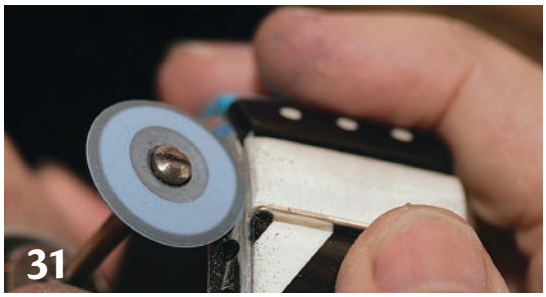



**PHOTO 25** Repeat for second dot. Grind dots down on a 600-grit belt. When both dots are smooth, move to the 1200-wheel and polish with the cerium oxide wheel. Epoxy the first stone and position in the bracelet.

**PHOTO 26** Put a generous amount of epoxy in the bottom of the channel and a small amount on the sides of the metal.

**PHOTO 27** Install the stone, making sure it is positioned correctly and not flipped end to end—remember your mark on the bottom?

Gently push the stone into the channel, and use the toothpick to remove excess glue. Make sure the small gap between the metal and the bottom of the stone is filled with glue, so the finished piece will be supported. Set aside at an angle so that the glue will stay where you want it. Allow the glue to set about 5 minutes.

**PHOTO 28** Before the glue completely hardens, use a craft knife to clean up the side of the stone and the metal channel to prepare for the next stone. You can now start forming your next stone (see More Inlay Patterns sidebar). As you work on stone 2, the epoxy will completely harden, and you can proceed along the entire bracelet following the process of creating a stone to inlay, gluing it into position, and allowing the glue to dry as you create the next stone. Follow the design suggestions that follow to create your own stone order and unique cuff.

When inlaying a wider stone, curve the top to conform to the curve of the bracelet. For fancy stones, the basics are still the same, just make sure you give all of your stones a little curve on the top, or it will be difficult to get a good polish on them.

**PHOTO 29** Remove dried glue from the stones and bracelet with a cotton swab dipped in acetone.

**PHOTO 30** Once you have cut, polished, and inserted all of your stones, the last stone must fit on all 4 sides. Go slowly. This is the hardest stone to inlay, because it must fit perfectly. Start on one side, then do both ends. The final side must fit nicely into the slot. Epoxy as before, being sure to let any excess epoxy ooze out as you install the stone. Clean up excess glue and let it set for at least half an hour. Remove protective masking tape.

**PHOTO 31** Use a silicone wheel to clean up bracelet, being careful not to hit any of the ivoryite—it is very soft and you don't want to ruin all of your hard work. It won't matter if you hit the jade.

Final polish the metal. I tape off the stones, because the ivoryite will pick up the polish compound and turn dark.

## 2 SECRETS TO GOOD GLUING

**1. EQUAL PARTS GLUE AND HARDENER.** Use the exact same amount for both the glue and the hardener. If anything, use a tiny bit more hardener.

**2. MIX WELL.** Once you think you have mixed well, mix it a little more. I cut off the pointed end of a toothpick and use it as both a stir stick and an applicator. I put a piece of wide masking tape on my bench and mix the epoxy on that. You can check the curing of the epoxy by touching the toothpick to the leftover puddle of glue on the tape. When the masking tape becomes covered with dried epoxy, I pull if off my bench and and put a new piece down.

JEFF FULKERSON started making jewelry at age 16. His teachers include Michael Cheatham, Richard Tsosie, and Jesse Monongya. He has won numerous awards and has taught silversmithing classes over the years, including summer classes at the San Diego Museum of Man. Jeff lives in San Diego's East County with his wife and has 3 sons.

# Successful Slabbing

*The key is clamping the stone securely*

BY STEPHEN TANEY

I love to saw stone. Every cut reveals a section that no one has ever seen. But getting to that point has some challenges.

Have you purchased a diamond saw and noticed there are no directions on how to use it? I searched my lapidary books and some websites and found there wasn't much information on clamping stones in the saw for slabbing. Speed of the blade in RPM, feed rate of material into the spinning blade, coolants, yes—but not much on holding the rough, and holding the work is a critical part of any task, as I learned in machine shop schooling. So I've decided to pass along some techniques I've adapted from machining for slabbing stone with a diamond saw.

## BLADES

The saw blade is a disc of metal with diamond grit bonded to the outside edge. The method of attachment and amount of grit varies by manufacturer. The size of the blade is given in diameter, the blade thickness (in thousandths of inches), and the arbor size. For example, 18" x .064" x ¾" means the blade is 18" in diameter, has a kerf of .064" (approximately 1/16"), and fits on a ¾" shaft.

Technically, diamond blades aren't really saw blades—they're thin grinding wheels. In conventional sawing, blades remove a "chip" of material, as in a woodworking saw. Some of the heat generated by this action is carried away from the blade through the chip, which is why a coolant is so important.

Under normal conditions, diamond fractures in a predictable pattern as the cutting surface wears. The crystal breaks away and reveals a new cutting edge or crystal to resume abrading a surface. Thermal shock is the biggest reason for premature diamond blade failure. Thermal shock occurs when there are sudden or dramatic changes in temperature, which cause the diamonds to shatter. On a microscopic level, there is enough heat (over 400 degrees in some cases) and pressure at the interface to boil off water-based coolants. Boiling water creates steam and pressure that will force the liquid out, which is then replaced suddenly with room temperature liquid that will then fracture the diamond crystal.

**KERF** is the width of a slit made by a cutting tool. For stone, it is the amount of material being removed when grinding through the rough material. The term is also used for sawing metal, wood, paper, plastic, or any other material.

Oil based coolants are designed to wet the interface even under these harsh conditions. For saws 10" and above, oil based coolant is recommended. The coolant depth should cover about ½" of the lower saw blade edge in the coolant reservoir. The blade will then drag this liquid up, over, and into the kerf, cooling the cut and flushing out the stone dust.

## VISE

A vise is made up of a few elements that work together to hold a stone securely while it's being fed into the rotating saw blade. The vise is made up of two clamping surfaces, a bearing surface that the vise moves on, and the feed mechanism. The clamping surfaces should be covered with plywood ½" to ¾" thick to help in gripping the rough stone. These wooden pieces will need periodic replacement.

If there are no wooden pieces on the vise, a shifting stone could fracture, and a small section could break free of the clamping vise. This is usually disastrous for a saw blade, because shards can become trapped against the blade, or jammed, and it may bend, break, or freeze

the motor. The added wood faces will provide a soft but resilient surface to continue gripping the rock even in the case of a fracture.

Take some measurements of your vise; these will tell you the maximum size of material that will fit in your particular saw. Line up the vise with the middle of the saw blade. Measure from the base of the vise to the top of the saw blade: this is the maximum height of rough that can safely be cut in the saw. Next, slide open the movable jaw vise to the maximum opening and engage the ratchet or feed nut and verify that the cover can close: this is the maximum length of the rough you can saw. Write these numbers down for future reference, and take them with you when looking for rough.

The movable jaw of the vise allows for rapid movement by means of a disconnecting nut, or a ratchet and a finer adjustment by means of a hand screw. Maximum clamping force is attained when the jaws are working parallel to each other. This is not an issue if the length of stone being cut is large enough to go beyond the center pivot point of the vise jaw, but many times this is not the case. The movable jaw can pivot right and left to allow for holding irregular surfaces. A small amount of tilt to the jaws is acceptable, but try and keep them as close to parallel as possible.

## MAKING THE CUT

Pull the carriage toward the front of the saw and free of the blade, ready to feed into but not touching the blade. Place the stone in the vise with the largest and flattest face toward the solid part of the vise and overhang the rock to cut. Advance the movable jaw to just touch the work. Engage the ratchet and gently tighten with the hand screw. The point where the stone touches the jaws first must stay within the clamping surface. Adjust the stone as necessary.

You'll want to clamp the largest diameter of the stone first, supplementing with additional clamping area to overcome the forces of the saw. Look for any spaces where you can add smaller blocks of wood to support the work **(FIGURE 1).**

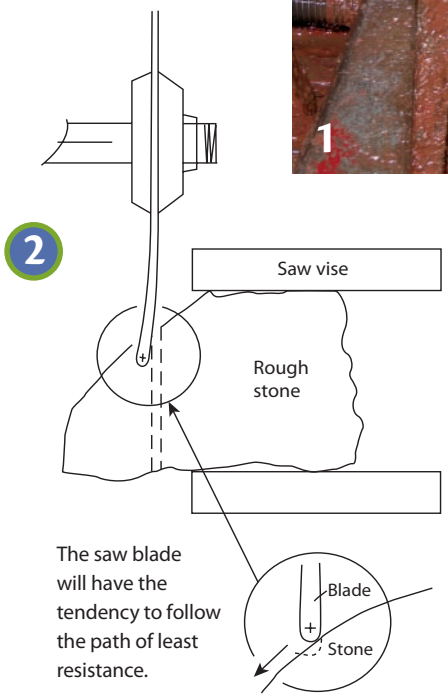
Loosen and retighten the vise, and give the piece a firm pull to see if there is any movement of the stone. If it shifts, loosen the vise and add more wood shims where you saw movement. This can take some time but is worth the effort to prevent damage to the saw blade. When you no longer detect any movement, you're ready to cut.

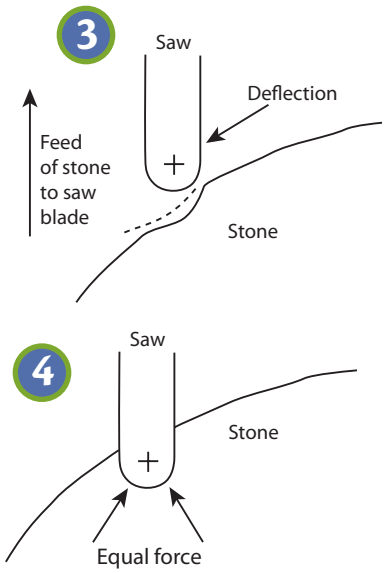
If the rough has a sloped surface, the edge of the saw may deflect. Continuing to cut when this happens will damage the saw blade **(FIGURE 2).** To detect and prevent this, start the saw and listen for the blade to begin cutting. Time the cut for about 30 seconds. Stop the saw, disengage the carriage, pull the assembly away, and then start to cut again. This time, wait a little longer. Stop and repeat.

This approach works because the edge of the saw blade is rounded and is cutting a rounded surface. At some point, the saw is cutting only on one half of the edge of the blade—forcing it to one side. Not until the blade edge has penetrated the stone enough to a depth where the blade is cutting on its full surface will the deflection stop **(FIGURES 3 & 4).**

## REPOSITIONING ROUGH

Often, you'll need to reposition the rough at some time. Trying to align and reclamp a stone so the next slab is parallel to a previous cut is always a challenge and will come with experience. Short pieces of 2x4 lumber are invaluable to have in the lapidary shop to help with this problem. I keep them around to glue to my end cuts.

This method works if the remaining piece is small enough. The flat surface area of the last slab becomes the reference point for the next step. Originally, I had used epoxy for the strength of the adhesive, but then I couldn't remove that last slab without damaging it. So instead, I use tan, water soluble wood glue for an adhesive. This type of glue is not affected by the oil-based coolant, and when I'm done the block can be soaked in a bucket of water to remove the last section of stone.

Before gluing, clean the stone surface with acetone and a fresh paper towel to remove all the cutting oil. Then, add a generous amount of glue to the clean surface. Set the pieces on a level surface; otherwise, the stone will slip out of place. No clamping is needed because the weight of the stone is enough to hold it in position. Allow at least 24 hours for the glue to set. If the 4" side of the 2x4 is clamped in the vise, an additional 2x4 will act as a counter-piece to keep the jaws parallel **(FIGURE 5).** Once you get the hang of it, both sides of a 2x4 can act as a gluing surface **(FIGURE 6).**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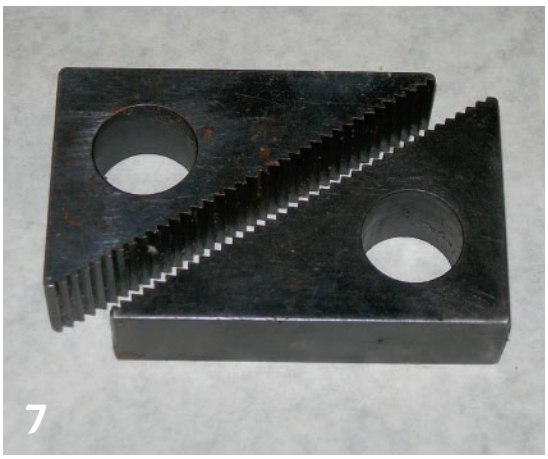
## CLAMPING WITH STEP BLOCKS

Sometimes a more flexible clamping method for odd sized pieces is needed. This is where step blocks are used, which machinists use when the table vise is not practical. Step blocks are a pair of steel blocks that have matching steps cut in them for creating small changes in height **(FIGURES 7 & 8)**. Step blocks can be used in varying orientations and come in many sizes, making them a very versatile tool.

They can be purchased as sets where machine shop supplies are sold (which also makes them expensive), but if you are lucky, you can trade some of your lapidary projects for them at a small machine shop. As a former machinist, I know these blocks are always hanging around. I have even traded some cut geodes in return for machining a shaft for my saw. Most machinists are quite approachable and knowledgeable about repairing or adapting machinery, so check around. Sometimes I do see these blocks on auction sites, but not very often.

## CREATING CUSTOM FORMS

Occasionally, I might want to cut rough at an extreme angle or get a specific pattern out of it. Once, I wanted to cut a limb section of petrified wood into matching pieces. I needed an angle cut at about 60 degrees from the center axis to show off the growth rings, which made using the vise impractical. To make cuts such as these, I often cast pieces in plaster of Paris, using a recycled box as a form. Then I can position the rough in many different orientations.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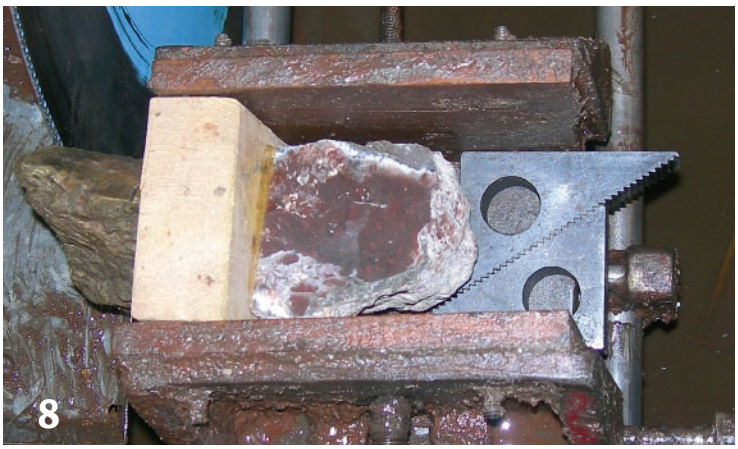
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First, make sure the box can fit into the vise with the cover closed. Next, tape the outside seams of the box to keep the plaster from oozing out. Tape the closing flaps down and out of the way. Place the stone inside in the same orientation in which it will be cut **(FIGURE 9)**, and shim it with small pieces of scrap stone as needed to hold it in position and keep it from shifting while the plaster is setting up. Ensure there is ¾" to 1" all around the stone for adequate support during sawing. Mark the inside of the box with a marker to show the direction of the saw cut—it's easy to forget while the plaster cures.

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Estimate the amount of plaster and mix it according to the manufacturer's directions. The plaster mix is heavy, so pour it along one edge of the box to avoid hitting the stone and disturbing the position. Don't be alarmed if you didn't mix enough plaster—another batch can be poured right on top of a previous mix without any separation of layers. Cover the rough to about ¾ of its height; covering the stone completely is not necessary Tap the outside of the box lightly to help dislodge any trapped air bubbles.

10

Let the casting cure overnight, and transfer the orientation markings from the box to the top of the casting. Cut—don't tear—the box free from the casting, because the plaster is not completely cured yet. Set the casting on a concrete floor (such as a basement) if you have one to help draw out the excess water. After a few days (the exact number will depend on the humidity), the plaster will cure and dry out completely. Then it's ready to be cut **(FIGURE 10)**. The plaster surrounding the rough will either fall away or be crumbled off as you slab.

STEPHEN TANEY has been stonecutting for more than 15 years. Bringing out the natural beauty of a stone is one of the things he loves most about his work. He holds a BFA in sculpture from the University of Massachusetts, Amhers.