

How To Carve Stone

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Overview

What You're Reading

If you want to learn how to carve stone - as a sculptor, making art - this document is for you. It's an overview discussing tools and techniques that let an artist turn a block of stone into a sculpture. After this overview there is a short Quick Start Guide that encapsulates the three major lectures the instructors writing this give during a stone carving class. These lectures do not, of course, contain everything you need to learn. Instead they give you the basics to get going. After that come sections that describe - in depth - every aspect of stone carving and sculpture that we could think of. While there is some overlap between the quick start guide and the rest of the document, the later sections are deeper and cover more material.

NOTE: This is still a draft document, subject to major review and revision. In fact, at this writing, there are major sections still not yet written. Please check back from time to time to see how it grows and changes.

Introductions:

Several people contributed to this document in various ways, including:

Jeff Powell: a sculptor and instructor. <<insert bio here>>

Sue Toorans: a sculptor and instructor. <<insert bio here>>

Douglas Howatt: a sculptor who started out taking classes from Jeff and Sue. <<insert bio here>>

<<Insert others as needed>>

How This Document Came To Be:

How To Carve Stone is the result of over ten years of stone carving instruction in the real world. We have at least three goals:

- To give new students in Jeff and Sue's classes a reference they can read as needed, along with a guide to what is coming throughout a class
- To assist new carvers in other places - who can't take our classes - in finding information and assistance in their areas
- To help prospective carvers know more about what to expect, and go into it with reasonable expectations about what can be done, how to do it, and how long it takes

Only time will tell if we've achieved these objectives.

Feedback: We Need To Hear From You

We love and need feedback on this document. If you think we've missed something, got something wrong, appreciate our work, or anything else, please contact Jeff Powell ([email](#))

[link](#)) with your feedback. This is a living document and changes will be incorporated as time allows.

Quick Start Guide

The following outline has developed over the years we've been teaching. Essentially we have three major lectures. To this we've added a fourth in this written form, whose contents precede the others. It's there to help you plan for your stone carving before you start, and doesn't generally take time in our classroom environment. Of course these four lectures don't cover everything. Far from it, in fact. In class we cover additional topics as they come up. So, for example, the selection of a base and the mounting of a sculpture is discussed when someone needs to do it, not in a specific lecture. Many additional topics - and more details about the items covered in these introductory lectures - appear in the ***Digging Deeper*** portion of this document..

Lecture 0: What You Need To Know Before Starting

Stone Carving Is Slow - You Need Patience And Time

It may sound obvious, but stone carving takes time. Our class meets once a week for 2.5 hours and it is our experience that a new stone carver, working only in class, starting with a stone in the 15 - 25 pound range, and creating a relatively simple shape, can finish in twelve weeks if they are diligent. In such a case the time breaks down roughly as follows

- 1 introductory session, getting the sense of the tools
- 6 sessions shaping with hammer & chisel and/or files
- 4 sessions polishing
- 1 session signing and sealing

That's about 30 hours of work in total, and there's no allowance for changing plans, stopping and thinking, etc. We occasionally see students take 24 weeks or more to finish their first piece, though we do our best to help them avoid that fate. New carvers are encouraged to try something simple and abstract to get them through the entire process in as short a time as practical. That way they can evaluate the medium and see if it is right for them. Those who are willing and able are encouraged to purchase tools and work at home too.

Experienced carvers get work done more quickly, of course, but even with practice and power tools you should be prepared for extended time and effort to go into your art. By way of example, it is not unusual for a carver to spend 80 or more hours working on a relatively simple sculpture carved from a block of alabaster starting out at about 60 pounds, even using power tools.

Occasionally we're asked why we don't suggest power tools for beginners. There are two major reasons: cost and learning. Power tools for stone carving cost quite a bit of money, while hand tools are relatively inexpensive. If you discover stone work isn't for you it's best to have only bought some hand tools, rather than hundreds of dollars worth of power tools. More importantly, though, it's important to learn what stone can and cannot do. The best sense of that is developed in a tactile fashion - using your hands to make it happen and making a few mistakes along the way - so you learn the limitations of the medium. Power tools remove the sculptor from the stone in a certain sense, making it less likely that he will see problems and know what to do about them. They are, in fact, invaluable to experienced carvers but it is best not to use power tools until you have an intuitive sense of how stone actually works. You'll become a much more accomplished sculptor for doing so.

Carving Stone Takes Physical Effort

Another obvious statement, but just as true. You're going to be swinging a hammer for long period - potentially hours - at a time. You'll be using files that are sharp on both ends and require you to bear down to remove stone. Even polishing isn't easy on the body. Hours of sanding can cause sore muscles and joints. Add in the fact that you'll probably be standing while doing much of your work, and there is clearly a level of effort and discomfort that you may encounter. We don't want to dissuade anyone from carving, but we want to be honest about what you're getting into. You may hurt for a while when you take it up, and some - particularly those with existing shoulder, elbow, wrist, or hand problems - may not be able to sustain the effort needed.

If you discover that something hurts as a result of working stone, the first thing to do is take a break and give your body a chance to rest. Secondly, be sure you're using any required safety gear to avoid injury. Next, note the nature of the problem and see if there are changes you can make to avoid it. And finally, give yourself time to adapt to what you're doing. Any new task is harder on you while you're learning it. Once you've been carving stone regularly for even a few months you'll find you don't tire as easily and things that used to hurt don't anymore.

Carving Is A Subtractive Rather Than Additive Process

Stone carving is a subtractive process and few realize how much this changes the mindset needed to work in the medium. Clay, by comparison, is additive. If a clay sculpture is too small or formed incorrectly, it is possible to simply add more clay and try again. Since the removal of stone is pretty much a permanent thing, people sometimes become overly cautious in their work. If they haven't picked a form or don't have a design selected, they may be hesitant to remove stone at all.

The only remedy we know of for this is practice. Artists who've carved a few pieces develop a sense of when to go easy with the hammer and chisel to avoid removing stone they need, for example. Be prepared to make a few mistakes - particularly on your first piece or two - while you're developing a fluency with stone.

Three Dimensional Thinking Is Required

We see all kinds of students with all kinds of backgrounds. We haven't found that people who have art background are generally better sculptors than those who lack artistic training, but we have seen that people who have already worked in a three dimensional medium successfully - or who work in three dimensions in some other aspect of their life - are more likely to be successful at stone carving. It turns out that seeing and working easily in three dimensions isn't a universal skill, and learning that skill isn't as simple as we'd like.

At this point we're better at recognizing the symptoms of a problem than in knowing how to fix it. If, for example, a student concentrates only on surface features of their stone, they may not be able to visualize things *inside* that stone. If a phrase like "This part of your sculpture is going to be about an inch below the surface my finger is on" elicits questioning looks, it is possible that the student isn't yet seeing their sculpture inside the space defined by their stone.

Once again the only thing we've found that helps overcome these hurdles is practice.

Students need to carve - sometimes several pieces - before understanding dawns. Sadly we have seen some students get frustrated by the process before they come to understand the thinking required to work successfully in three dimensions.

If you can't see your carving within your stone, try changing your approach. Get some clay and make the shape you're envisioning with it. You don't have to make it the same size as your stone; smaller is fine. The point is to look at the relationship between the shape you want and the stone you have. Look at your form from various angles. Will it fit within your stone? If so, find the place or places where the form comes close to the edges of your stone and start carving there. Envisioning your work within the stone can be a challenge, but is a critical skill.

Stone Is Messy - You'll Need A Place To Work Where Dust & Slop Don't Matter

Another obvious point, but be prepared to get really filthy. Carving stone is messy work. A hammer and chisel throw rock chips into your hair and across the room. Filing to your final shape creates lots of fine dust that gets all over your clothing - and **everything** else. Sanding - which we recommend doing wet - is messy too, with water slopping everywhere and a muddy mess left behind.

Wear old clothes that you won't worry about, and dress in layers so you can keep cool or warm enough while you work. In addition, see the sections below about eye and lung protection in particular. If you have a place where you can carve and not worry about the mess, great. If you have to share your carving space with others or with other activities, be sure dust and rock chips won't cause a problem, and allow adequate time for cleanup.

Lecture 1: Shaping

This lecture is generally less than an hour long and intended to get new students moving quickly. The information here plus those things that come up in the class sessions that follow let students get a stone shaped using common hand tools.

Choose an abstract design

New students generally don't know what they are going to carve for their first piece when they arrive in our class. That's actually a good thing. In engineering there is a saying: "Build one to throw away." In stone carving we say your first piece won't be a masterwork. In fact, you have so much to learn about tools and materials, that it is best if your first carving is something simple. You need to learn how to handle various tools, carve both inside and outside curves, sharp and rounded corners, discover what kinds of things are easy and hard to do, and so on.

To make this easy, we suggest that your first carving be totally abstract. If you're trying to carve something representational, you may well get stuck on things like making it look "right", keeping it symmetric in the needed ways, etc. These issues, combined with learning new tools and the medium have been a source of frustration for some new students. So, keep it simple.

Once you have some familiarity with the tools and techniques and have actually convinced yourself that stone carving is something you want to do for a longer time, then you can

start to work in whatever style you prefer, and can carve anything you like. At that point your focus on the more artistic aspects of the work won't keep you from using the tools effectively.

How to pick a stone

Selecting a stone seems simple, but it is best done with care. Your initial concerns are what kind of stone to get and how big should it be. If you have something specific you want to carve, you'll also need to be sure that whatever stone you use is large enough and properly shaped to become your envisioned work. Finally you need to know if your stone is solid or not. We'll address each of these concerns separately.

What kind of stone?

There are many kinds of stone that can be carved, of course, but the best choices for a beginner are fairly limited. Avoid the very hard stones, as you'll need specialized tools to carve them. You could start with a softer marble, but even that will take extra time because of its hardness. Soapstone is certainly soft enough, and it comes in many colors, but some contains asbestos and much is so soft it can be scratched with a fingernail, which means your final piece will be easily damaged.

In our experience the ideal carving stone for new sculptors is alabaster. Generally a bit harder than soapstone, it still carves easily. It comes in a broad range of colors and is available from many suppliers. You might also start with a softer limestone, if alabaster isn't available. Limestone tends to carve easily and regularly, but lacks the color choices of alabaster, can be harder if you get the wrong piece, and doesn't polish nearly as well.

Once you've carved a stone or two and know you enjoy it, you can branch out, try different stones, purchasing any specialized tools needed to work them. For beginners, though, alabaster is probably the best choice, followed by a softer limestone or a reasonably hard soapstone.

How big?



If you're a new carver and don't know if you'll actually enjoy the process, it is best to limit the size of your stone to something you'll finish in a relatively short period of time. Starting with a 100 pound block can be a bit overwhelming. That said, if your stone is too small you won't be able to use hammer and chisel on it; it will break if you try. The happy medium

there for beginners appears to be somewhere in the 15 - 25 pound range in our experience. That's just barely large enough to let you use chisels, but small enough to let you complete a sculpture in a reasonable time.

If you have a particular idea in mind, remember to be sure that your stone is large enough and properly shaped to hold it.

Is it a good stone?

If you're in a stone yard looking at a possible stone, how do you know if it is any good? Will it break or will it stand up to hammer and chisel work?

The first answer is that there are never any sure things. You're working with natural materials, and they have flaws - cracks in particular - that can cause problems. That said, it is possible to reduce the likelihood that the stone you select will break.

Carefully examine the stone, looking for surface cracks and fissures. Sometimes it is easiest to see these if the stone is wet, so ask for a spray bottle to wet the stone. If you find any, try following them along the surface of the stone to get a sense of how far they go. If you can clearly follow a crack all the way around a stone, you're at more risk of breakage than if it disappears. This isn't a guarantee; some things that look like cracks are actually well bonded and harmless, while a crack that disappears might still be a serious problem. It's a start, though.

Next, tap all the surfaces of the stone with the back of a chisel (or a hammer, if the stone is large enough). Listen to the sound the stone gives off. If the stone rings, it means there is a higher chance the stone is solid in the area where you're hitting it. If the stone gives off a dead "thud" and no ring, it means there is a crack in there that is absorbing the energy of the tap. That indicates a higher chance of breakage. Once again, though, nothing here is a sure thing. The "thud" response to a tap may indicate surface mud on the stone for example, and even if the stone rings it is still possible cracks that are a problem. It is, however, less likely. As you gain experience your ability to pick solid stones will get better.

If possible, ask an experienced carver to help you with stone selection the first few times. Alternately, someone who works at the stone yard can help. Once you get the hang of this, though, it takes only a minute or two to evaluate a stone and make an educated guess at whether or not it is solid. A quick look, a few taps, and you'll have a pretty good idea.

Protection you need: glasses, gloves, dust mask

To carve stone safely you will need some basic safety equipment. The safety section below gives more details, so we suggest reading it.

At a minimum, some kind of eye protection is required. If already wear glasses and you're using just hand tools, they may be acceptable. However, stone is abrasive and you don't want to scratch your lenses when you clean your prescription glasses, so consider safety glasses as an alternative. If you don't need a prescription, there are many choices at any hardware store. Be wary of goggles, as they fog up quickly. You may need them to cover your prescription glasses, though.

You may want gloves as well. Once you've been carving a while you'll develop callouses and gloves will be less necessary, but until then, a lightweight set of gardening gloves may be a good idea. Again, your local hardware store will probably have what you need.

Finally, dust protection may be required. Everyone varies in how sensitive they are to dust, but no one needs to breathe it in general. If you're working outdoors in a well ventilated

space with a hammer and chisel, you might not want a mask. Working in an enclosed, small space and filing vigorously, though, is much more likely to require one. There are many choices, but the cheapest paper masks are rarely good enough. Consider an N95 or N100 rated mask at a minimum, and see the safety section for additional comments.

Basic tools to get: hammer, chisels, sandbags, files (aka rasps or rifflers), and maybe a saw

There are many different tools that can be used while carving stone. Beginners, however, don't need them all. Most shops catering to sculptors will sell beginner's kits consisting of a hammer, a few chisels, and a few files. These are generally great places to start, and they usually don't cost that much. You'll add to your tools over time, of course, and we discuss many of your choices in the ***Digging Deeper*** sections. Here, however, we touch on those needed just to get started, and assume you're carving our recommended beginner stone: 15-25 pounds of alabaster, limestone, or soapstone.

Sandbag(s)



You'll need at least one sandbag, possibly two or three. In our area these are easily made. Hardware stores often sell empty sand bags made of a woven plastic material for less than \$1 each. You can also make your own from scrap cloth; the legs of old jeans can be ideal. Whatever you use for the bag, do NOT fill it with sand. Sand is far too heavy and settles too well, making it hard to support your work. Instead fill your bags about half full of the cheapest cat litter you can buy; not the clumping, sand like litter, but the larger, inexpensive stuff. This is lighter weight and will let you support your stone in many positions. Tie your sandbags closed

with twine, being sure to leave plenty of empty space in the bag. You need that space to be let you shape the contents to fit your stone as you're working.

Hammer



For beginners, a 1.5 or 2 pound soft iron hammer is usually ideal. The exact weight is a matter of preference and your size. If you're short, the smaller weight is probably best, at least for starters. If you're tall, the difference won't be noticeable and the heavier weight let you carve a bit more quickly, as you can remove more stone with each blow. There are several hammer shapes and a number of other sizes / weights available, but beginners should keep this simple. A normal hammer with 2 flat faces is just fine. Beginner kits generally include the right sort of hammer.

Chisels



The most commonly used chisels on our recommended starter stones are toothed and flat chisels. See the larger discussion about chisel types below for more details, but if you get one or two toothed chisels and at least one flat chisel, you're probably fine. Beginner's kits usually include a point chisel as well, but on smaller, soft stones it isn't often needed. You'll use it later on larger and/or harder stones, though, so it isn't money wasted.

Files



Once you're done with the chisels, you'll achieve your final shape with files. Beginner's kits often include files, and if yours does you're probably fine. If not, you'll need a couple of different shapes to handle your first carving. An inexpensive option is the purchase of a set of Chinese made files. These usually come in three sizes (small, medium, large), with eight to twelve files per set, and each set costs roughly \$10. The medium size is usually fine for the beginner. Such files, however, are not well made, and won't last all that long. If you can spend a bit more consider buying 2 or 3 Italian stone files. You have a lot of choices here, but a single Italian file

will probably cost more than twice what an entire set of Chinese files costs. If carving is something you'll do for years, few investments are worth as much as Italian stone files. Again, see the more detailed selection below for additional information about your choices.

Saw(s)

Major material removal might also involve a saw. There aren't a lot of hand saws designed for stone, but they do exist, and some wood saws will cut soft stones. The use of a saw can save a lot of time in certain cases, and sometimes the pieces cut off can be saved for other work. As a beginner you probably won't buy or use a saw, but if your stone is larger than you want and you'd like to save some of it a saw might be useful. If this comes up, see the related Digging Deeper section below for more specifics. Also note that any hand saw you use on stone is ruined for wood, so don't just grab a wood saw, use it, and put it back thinking it's fine. It won't be.

Resources: Briefly, where to buy this stuff

In our classes, we provide new students with basic equipment, so they can determine if stone carving is something they're going to love doing without spending a lot of money to figure it out. Other places require students to get their own tools right from the beginning,

and if you're on your own, you won't have any choice. On the assumption you need to purchase tools and stone, you'll need suppliers.

Your hammer, chisels, and files will need to come from some place that specializes in selling to artists, and possibly just to stone carvers. There are major suppliers and stone yards in California, New York, and Florida, among others. If you're lucky enough to live near such a place, please visit it in person. These companies are almost always willing to give a beginner with advice and help. Over time the benefits of being able to pick out your stone and tools will become obvious. And while mail order certainly works - it may be your only choice - you should support your local vendors if you have them. We've included a list of suppliers later in this document. See that for possibilities.

Sandbags, saws, and some inexpensive files can come from almost any hardware store. Kitty litter for sandbags can come from just about any place, including a drug store.

How to use the hammer and chisels

If you are right handed you'll hold your hammer in your right hand and your chisel in the left. Lefties obviously do this the other way. Start by grasping the chisel at about the mid point as if it were a microphone you were going to hold while giving a talk. Then, to keep from hitting it, move your thumb to the other side of the chisel. This grip will feel a bit strange at first, but when you forget and hit your thumb with the hammer you will remember and appreciate it.

<<picture needed: holding the chisel>>

Point chisels can be held loosely, but toothed and flat chisels need to be held firmly. They should remain in constant contact with the stone; do not let them bounce or jiggle in your hands as you strike them. Toothed chisels, in particular must be used with all teeth on the stone. If you ever find yourself positioning a toothed chisel in a way in which one or more teeth are not on the stone, stop. The chances of breaking a tooth go way up when you do that, and a toothed chisel with missing teeth isn't all that useful. If you must work on an edge or corner where you cannot get all the teeth on the stone, switch to a flat chisel for that part of the work.

If your stone was perfectly flat, you would hold the chisel at approximately a 45 degree angle to the surface you are carving. That, however, is almost never the case. First, stone is generally rough and naturally shaped, or it's rough because you've already been carving in that area. Where possible, bring the chisel into a lower angle (45 degrees or less) to avoid stone bruises (discussed below).

<<picture needed: holding the chisel against a stone>>

Strike the end of chisel with the hammer. If your angle is right, chips of stone will come off. If your angle is too steep, all that will happen is your chisel will slowly embed itself into the stone, getting slightly deeper with each hammer strike. This is causing a stone bruise, and should be avoided. Change to a shallower angle, and consider looking for a different direction to carve from. If your angle is too shallow the chisel will skitter off the stone, removing nothing. This can also happen on a harder stone or a smooth surface. To avoid this, increase the angle on the chisel so the teeth bite.

Sometimes you really want to carve at a shallower angle - taking off thinner chips of stone - but the chisel won't bite. To make that happen start with the chisel at a steeper angle and

tap gently with the hammer, just until the chisel starts to bite into the stone, then you can gradually bring the angle back down, and hit harder.

Special considerations for hammer and chisel

What is a stone bruise?



A stone bruise is a white, discolored area of stone caused by a direct blow of some sort. The natural color of the stone is caused by the particular way it absorbs and reflects light. When a part of the stone is damaged by a hard blow, the crystal lattice that makes up the stone is deformed, and it changes its optical properties. Now it reflects more light - instead of absorbing some - and turns white.

The bruise pictured here is on a polished, black soapstone.

Rocks that are dropped on each other in the stone yard will have large bruises, and you'll see some related to the equipment used to remove stone from the ground or split it. The biggest problem, however, is creating them with your chisels by using too steep an angle; hitting the chisel too directly into the stone. When you polish your stone you will see white marks. No matter how much we tell you about these - and show you pictures - the only thing that stops people from creating them is practice and realizing what it is that causes them. You can know intellectually what to do, but until you've created a few stone bruises - and tried to get rid of them - you're unlikely to be able to avoid them.

Once a stone bruise is created your only choices are to remove it - with more chiseling or file work - or ignore it, leaving a white area on your finished sculpture.

Keeping your stone steady

New carvers often find that they have trouble keeping their stone in one place while they work on it. If your stone is large enough this isn't a problem. Pound on a 3000 pound stone all you want with a hammer and chisel, it's not going to move. But most of us find that our smaller works do move. If the stone is moving - even if it is just rocking a bit - you're losing energy (in movement) that could be removing stone. To avoid this, reposition the stone to avoid the problem.

Use your sandbags to hold the stone in a comfortable working position. If possible, work so your chisel is pointing down, towards the floor. This will give you the maximum effect from each hammer blow, and reduces stone movement. When working this way it may be necessary to stop every few minutes and reorient the stone on your sandbags. Often it is best to carve standing up, rather than seated, as this helps keep you working in a downward direction. Larger stones, of course, can be worked on in any orientation that is comfortable, as they won't move.

If you're carving on a folding table - a reality for many of us - work directly over the legs at one end. The table is strongest there, and more of your energy will go into removing stone instead of making the table flex.

At times you won't find a way to carve with the chisel pointed down. At other times you'll be tired or forget. In any case, one day you're going to find yourself chasing your stone

across the table. Every hammer blow will push the entire stone away from you instead of taking off chips. This is frustrating, to say the least. The fix, often, is to stand against the table with the part of the stone you need to carve away from you, lean over, push the stone into your body, and carve it there. This will keep it from moving.

<<picture; carving against the body>>

Another common problem is that despite your best efforts the stone still rocks when you're using hammer and chisel. Maybe the shape is just exactly wrong and you can't quite get it to hold still. A possible fix is to slide your grip down the chisel, towards the tip, then rest your palm on the stone, holding it steady at the same time as it holds the chisel in place. This can feel awkward, and it isn't how you'll do a lot of carving, but it can reduce stone movement in certain situations.

<<picture: holding palm and chisel against stone>>

Carve towards the center and not towards edges

Without thought and planning you will regularly wind up carving towards an edge or corner of your stone. There is risk, however, as you get closer to any edge. Since the stone becomes less thick and less supported it can break in uncontrolled ways near the edge. Such a break can remove stone you want to keep. To avoid this, carve from an outer edge towards the center of your piece. Alternatively, work along a corner or edge, rather than across it.

<<picture (or graphic): carving directions>>

If there is simply no way to avoid carving over or across an edge, slow down, use gentle hammer blows, and consider making a stop cut (described in the details section below). Remember that once a stone breaks, it's gone. Yes, technically you can glue things back together, but you'll always see the glue lines, and you may be missing small chips. Be cautious.

Creating holes in stone

Eventually every sculptor wants to punch a hole through their stone. It's only natural. Note, however, that the simple act of making any hole greatly reduces the strength of the stone in the area around it. If you then continue with the hammer and chisel on other parts of the sculpture the chances of breakage in the area of the hole go up dramatically. To help avoid that, it is best not to create the full hole right away. You can start it - from both sides of the stone - and carve enough out so you clearly know where it is and see what it will look like, but stop before going all the way through. The strength difference between a hole and a depression with half an inch of stone remaining to be removed is quite large, and your carving will be much less likely to break while you work on it if you remove that last bit of stone - called a bridge - at the very end. Once it's gone you should only use files; no more hammer and chisel work.

Actually creating a hole with chisels is a matter of working with the narrowest toothed or flat chisels you have and working from the center of the hole out. Work all around the outer edge in a circular pattern, going deeper as you can. Eventually you'll be unable to remove any more stone from the bottom of the hole because the sides get in the way of the chisels. At that point you have to widen the hole more before you can go deeper.

Power tools, of course, change the entire process, but (as stated above) we don't recommend using power tools early on. See the power tools section later, though, if you feel you're ready to use them.

Carve along cracks, not across them

Every natural stone has flaws, and some of those flaws manifest as cracks or fissures. When carving, it is best - particularly when near your final surface - to use chisels along the direction of the crack if possible, instead of at right angles to them. Any crack - even if it doesn't significantly weaken the stone - is a place where the stone on one side of the crack is not well bonded to the stone on the other side. Your carving will tend to chip off tiny flakes on either side of the crack, making it more difficult to polish smooth. This problem is more significant in softer stones.

To avoid it as best you can, the first thing to do is avoid using chisels at right angles to the crack when close to your final form. Chisel use puts more stress on the stone than files or sanding, and is therefore more likely to keep the crack visible. If you can use files - also along the direction of the crack if possible - you'll reduce the problem.

What to do if your stone breaks

Stop! Immediately. You may be able to glue it back together with an epoxy (see the detailed section below) but it will be less obvious if you carefully gather any little chips and make sure they are glued back in during the process. This isn't something you're going to undertake for a small error, but if your entire stone breaks you have little choice but to glue it back together or completely rethink your sculpture. Also, take note of the actions you were making when it broke. Were you hitting harder than normal? Were you working on or near a crack? Was the stone very thin in the area of the break? Had you created a hole in the piece, weakening it? Note these things so you can avoid causing similar problems later.

It is also important to know this happens to every sculptor. Even experienced carvers find stones with hidden flaws that cause things to break. This can be minimized with experience and care in your tool use, but sometimes it simply cannot be avoided. Stone is a natural material and contains natural flaws. Be prepared to redesign your sculpture in the event of a break. Or abandon it altogether and start something else.

Saws



In soft stones you'll find that a number of saws you can purchase in a hardware store will work. We've had good luck, though, with pruning saws, coping saws (for small work) and drywall saws. Use them as you would in wood, but note that by doing so your are effectively deciding not to use those blades again on wood. Stone is hard on saw blades, and you'll never get a good cut in wood with a saw after you've used it on stone.



A more durable saw - that will cut even harder stones with patience - is made for cutting tile. The tile cutting blade we have is made of an abrasive grit adhered to a steel wire. It fits into a standard hacksaw and will cut just about any stone we want. Because of the design of the blade it cuts on both the push and the pull, but the teeth are very small, so cutting isn't particularly quick.

Files



Files (also called rasps and rifflers) are used to remove small amounts of stone. They can remove marks left by chisels, and can bring a sculpture to its final shape before polishing. Usually made of steel, there are many, many shapes and sizes available. Most files sold in common hardware stores are intended for use on wood. These will generally work on soft stones, but will not work well on anything reasonably hard, like marble.

File that work well on hard stone include those specifically intended for stone carving (generally made in Italy) and those with structured carbide or diamond coatings, rather than steel teeth.

Despite the vast number of choices, files come in only two primary kinds: those with teeth that cut in one direction only, and those which cut in any direction. Most files and rasps are of the former variety, and nearly everyone knows how to use them in the simplest sense: grasp the file by the handle and rub it back and forth on the thing to be filed. That works, but isn't quite right when working on stone.

On any file with directional teeth, the backstroke - pulling the file back towards your body - isn't removing stone, but it is doing something worse: it's dulling the file. To avoid this, pick up the file after each forward stroke (push), return it to the beginning position without touching the stone, push forward to remove material, and repeat. The simple back and forth movement we all use by default works, of course, but your files will last longer if you avoid that backstroke with the file in contact with the stone. And since some files are expensive, it makes sense to take care of them and help them last as long as possible. (On wood - a much softer material - the backstroke matters less.)

Another benefit of this filing method is that it gets the file out of your line of sight on every stroke, letting you see the surface more as you work. You're much less likely to remove too much - or leave an unexpected depression in your surface - if you're seeing it clearly during the process.

<<picture series: filing with lifted backstroke>>

On occasion you will find that bio-mechanics simply require that you cannot lift the file for each stroke. That's fine, but it should be rare. The vast majority of filing can be done without the backstroke being in contact with the stone.

As mentioned above, there are quite a few kinds of files available. All those shapes are there for a reason: you may need a particular shape to work in a particular part of your sculpture. In time, as a result, you're going to wind up owning quite a few files of various sizes and shapes, to let you work on just about anything.

Since files are mostly made of steel, they can rust, which destroys them. They must be kept dry and out of damp environments. You'll probably wind up with a tool box or bag that contains most of your stone carving tools.

Do not, however, just throw your files into a tool box and let them rattle around. That will dull them too, and reduce their life. Keep them safe by wrapping them in a tool roll of some sort. If you cannot find such a thing at one of your suppliers roll them in a towel, well spaced so they don't hit each other. Fold the ends over, roll it up, and tie it closed with a bit of string. Good files can last for years despite hard use, but only if you take care of them.



These are common files that might be purchased at a hardware store. Neither is particularly expensive, and all will work on soft stone. The one on the left is a Sureform 21-295 file made by Stanley, with a curved file blade replacing the usual flat blade. (We've generally found more use for the curved blade in this file.) The one on the right is a common four-in-hand.



These are Italian stone carving files. They have very evenly spaced teeth and are properly hardened to work well on stone, even on most marbles. They are generally only available from a stone carving tool supplier.

Nothing approaches these files for quality and durability. You will wind up owning a selection of these if you carve for any length of time.



These files are inexpensive, Chinese versions of the Italian files shown above. They generally come in sets of eight to twelve and an entire set costs much less than a single Italian file. You get what you pay for, though. The teeth aren't as even and the steel isn't nearly as durable. Still, they are a fine investment for your first couple of sculptures, particularly while you're figuring out whether stone carving is something you want to do in the long term.



Structured carbide files are very durable and cut stone in any direction. (That is, they remove stone on both the push and the pull. They can even be used with a sideways motion.) They also work on very hard stones. Highly recommended, and even more durable than Italian stone files, but not available in as many shapes and sizes.



Diamond files come in various shapes and sizes. Like structured carbide they cut in any direction. Since diamond is so expensive you won't find big, course files made with it. As a result you'll generally use diamond files in limited situations - to do finer shaping - generally on hard stones.



Sometimes - depending on the nature of the stone and the shape of the teeth of the file you're using, the file will "load" with dust, as shown here in a structured carbide file in the image on the left.

When this happens the file becomes less effective and must be cleaned. That dust is removed with a file brush, a wire brush specifically designed to clean files, shown in the image on the right.

Run the brush across the file, 90 degrees from the teeth (or in all directions for structured carbide). It will remove the dust from the file and let you work effectively again, at least until the file loads up once more.

Drawing and Writing on Stone

You may not believe this, but using the right thing to draw on a stone - while you're planning your composition, or to mark areas that need some kind of work - isn't as simple as it sounds. Pencil lines vanish in dust almost instantly. Ink sinks into stone and stains it, possibly permanently. The best tool we've found for this is crayon, so get yourself a box of crayons and keep them handy. You'll probably want several colors, too, so you can explore different alternatives as you draw on the stone and keep track of which is which. In the end, just remember which color has the design you selected, or use a file or sandpaper to remove the other marks.

Special Considerations While Shaping

Inclusions

While you're carving you may encounter hard spots in your stone. Generally these are places where the chemicals that make up the stone change, resulting in a different kind of stone in the midst of your work. Usually you won't notice these while using hammer & chisel, unless they are very large. Instead they usually show up while filing and polishing. The sound a file makes on the stone will often change when you encounter an inclusion, and it won't file nearly as easily as the rest of the stone.

You have three choices for how to handle an inclusion:

1. **Ignore it.** If the inclusion is small or near your final surface you can often just ignore it. After all, you're working with a natural material, and it isn't perfect in any case. See the section on polishing for information about that step if you chose to leave an inclusion behind.
2. **Attempt to file it down.** This can be difficult. If the inclusion is well exposed and easy to get at, a file may reduce it, particularly a diamond or structured carbide file. However, just as often an inclusion is in some fold of your sculpture, difficult to reach in general and hard to file, even if it is obvious to the eye. These situations, unfortunately, suggest leaving the inclusion behind rather than filing it down.
3. **Attempt to remove it.** This last choice is the riskiest of all. The problem is that you don't know how big the inclusion is. Often they are small - substantially less than 1/4" - but sometimes what you don't see is larger than anticipated, like an iceberg.

In those cases removing it could mean radically changing your sculpture when you discover what is going on. Be prepared, if you attempt to remove an inclusion, for the worst. What will you do if it turns out to be an inch deep when it's finally gone?

Which you chose will be based on your preferences and how it will affect your composition. Good quality carving stone has fewer inclusions, and harder stones have fewer than softer stones, but surprises can come up anywhere.

How to Strengthen a Crack In a Stone

If you have a stone that might be weak in some location - because there are cracks in it - you can make it stronger by dripping some clear cyanoacrylate adhesive (super glue) into the cracks. Get standard super glue (not the thick (or gel) variety) and keep feeding it into the crack until no more will go in. Let it dry for several hours at a minimum before carving again. Check the instructions for the curing time on the glue you're using. The glue will help hold things together and you can carve and polish it as if it was stone.

Voids & Pits

Some stones contain holes & pits of various sizes, and some of those may contain mud and grit that isn't solidified into stone. Where possible, you can try to remove these entirely, though as with inclusions you usually cannot determine the full size ahead of time. Occasionally a translucent stone will let you see the pit, though, and a decision can be made based on that information.

If you cannot remove the void or pit, carve as if it wasn't there and file to your final shape. Then review the related instructions in the polishing section, since there are issues with polishing where grit might come loose.

Mud

Some stones have a muddy layer, usually on one or more external surfaces. These mark boundaries present as the stone was forming. The transition from stone to mud can be somewhat gradual, sometimes getting up to half an inch thick or so. What you do about this varies with the circumstances. If you want - and have enough stone available - you can simply carve off all the mud. Note that determining exactly how deep it goes in any particular place isn't possible until you get through it, but this approach will leave you with solid stone.

Another option is to remove the obvious loose mud - perhaps with a chisel held in your hand, not using a hammer. What remains, though it will be partly mud, may still be solid enough to carve and polish. If in doubt, get it wet - really wet, soak it down - and see if it rubs off or rinses away before committing to a carving plan. If the mud is solid enough to stick around despite a lot of water and abrasion, then you can leave it around if you need it. It's not ideal, but (since this is the quick start guide) we're not talking about carving a masterpiece here. When you're doing more significant work you'll want to remove muddy layers from your stones.

Bruises & Color Changes

Stone bruises, as mentioned above, can only be ignored or removed. Stones can contain other, natural, color changes as well, of course, and you might find them distracting in certain circumstances. In other cases they can be an unexpected delight. Get your stone wet to see a closer approximation of the actual color when it is polished. If you find unexpected color changes you may decide to change your carving to get rid of - or feature - them.

Lecture 2: Polishing

Overview

There are several polishing techniques available to stone sculptors. In this section we discuss only the most basic, but the one that has worked best for us on a variety of stones and in any number of situations. It is simple, uses no chemicals, and doesn't require power tools. This makes it simple, flexible and powerful. Additional polishing methods - and variations on this one - are discussed in the ***Digging Deeper*** sections below.

We assume your goal is to achieve a glossy surface on your final piece, free of scratches and marks, showing off the natural figuring and color of the stone. We are somewhat fanatical about a good finish. We have seen professionally made sculptures for sale in galleries - sometimes with prices well above \$10,000 - which had poor finishes. File and chisel marks on a finished sculpture indicate the sculptor didn't care about his product. It is nearly always possible to get rid of them all, leaving behind a beautiful surface that stands up to any examination. That's what we want, and this process will help you create it.

Put simply, you're going to sand the stone smooth, using various grits of sandpaper until the process is done. That's it. You'll sand your stone wet - to reduce the dust. Other sculptors only sand dry, so they can see scratches more quickly. If you want to work that way you'll need to wear a respirator to protect your lungs. We prefer to sand wet and let the stone dry between passes to see problems.

Only use wet/dry sandpaper for this process, which is usually black or gray in color. Standard sandpaper will fall apart when it gets wet. There are various brands of wet/dry sandpaper available. We've had the best luck with Mirka, but it may not be readily available in your area. Eventually you will probably develop a preference for one particular kind of sandpaper or another, and will find a supplier.

Sandpaper is rated in several different ways. The most common appears to be the number of grits per linear inch of paper, so 100 grit sandpaper has about 100 grains of grit per linear inch, or 10,000 per square inch.

We suggest sanding up to at least 2000 grit. You're going to find that anything above 600 grit or so is hard to find in standard hardware stores. Auto body supply shops may have additional grits available. Lapidary supply shops and metal working supply houses may also have what you need. Your local hardware or tool store might also be able to order additional grits for you. Sadly, such purchases generally require buying whole boxes of paper, rather than individual sheets, and a box of 2000 grit will last a long time. Purchasing sandpaper over the Internet turns out to be relatively simple, however, and while you'll still probably buy boxes and pay for shipping, you'll be able to get exactly what you want.

The full range of grits we're concerned with is:

80, 100, 120, 180, 220, 320, 400, 500, 600, 800, 1000, 1200, 1500, 2000, 2500, 3000

Each manufacturer makes a specific set of grits, though, and since things vary between manufacturers it is best to use just one brand of sandpaper if possible. Mirka, for example, doesn't make 80 or 800, and we haven't seen anything over 2000 made by them either. Whatever manufacturer you select may have a slightly different range. As a rule, use the grits they provide.

To keep things wet and dust free while you're working you'll need a tub or pan of water. It is often easiest to use a low pan padded with a towel to protect your stone from getting scratched on the tub as you turn it. Fill the pan with a couple inches of lukewarm water (no sense in freezing your hands) and put your piece in the pan. Get the entire piece wet along with your paper. Every few strokes dip the paper into the water to clean it off. Also, rinse your piece with water from the pan regularly too, so you can see what you're doing.

If you don't have a suitable tub, you can work on a towel and use a margarine tub to keep water handy. Be sure your table (or other surface) isn't going to be damaged by the water, though. This is a messy process.

We generally use sandpaper in pieces about three inches on a side. If you use a larger piece you often wind up folding it, and that's bad because the grit flakes off on the creased edges, leaving sharp spots on the paper that will scratch your stone. Also, a larger piece often just gets in the way, making it harder to see what you're working on.

As you sand the paper degrades. At the very minimum it gets dull. You can feel this: take a new piece of sandpaper and run your finger across the grit. Now run your finger over a used piece of the same sandpaper. You'll feel a substantial difference if the sandpaper is used enough; used sandpaper isn't effective. You need to change sandpaper as you wear it out, but of course try to use all areas of your piece before you throw it away, since anything else is wasteful.

Often we encounter students using sandpaper well past the reasonable point, however. If the grit is falling off and there are creases in the paper, you're at risk of scratching your stone with those edges. Avoid that. Keep an eye on your paper and discard it when it gets dull and before it starts losing grit. Experience will help you recognize these conditions.

When you change to a new grit also change all water, rinse out the tub completely, thoroughly rinse out the towel, and rinse off your piece. That's because the old grit and mud from your stone (and anything shed from the sandpaper you were using) will be larger than your new grit. If it gets in between your paper and the stone it can scratch it, leaving marks you'll have to go back down a grit to remove. To avoid that simply keep everything clean and rinse everything off between grits.

In general you'll start sanding with 100 or 180 grit, but 80 and 220 are also possible, depending on your stone and the file or chisel marks you've left behind. If you've filed things very smooth, you can start at 180 or 220. On the other hand, if there are large marks to remove you'll need to start with 80 or 100 grit. (If you're working on a harder stone you'll need to remove large marks with files before you start sanding.)

Whatever grit you start with, be prepared to use it for much longer than you expect. That first grit - and the finish you achieve with it - determines how good your final polish is. If you leave file marks behind they won't come out later with any other grit. And, to make

matters worse, as soon as the stone is wet all kinds of marks and flaws become invisible, or nearly so. To get around this work in a regular manner: sand the entire piece in a pattern, so you know you've done it all, completely and thoroughly. When you think you're done, rinse the stone with fresh water and dry it with a clean towel or paper towels. Let it sit for a few minutes until it is truly dry, then examine it closely. If you wear reading glasses, put them on. You're going to need them.

After your first pass with your first grit you are going to be disappointed. You'll be certain you sanded it all, diligently. How can so many scratches still be present? You'll need to sand it all over again with the same grit. So do that. Get fresh water, more sandpaper, and redo the entire thing. Then rinse and dry as before and look again. Once again you're going to be disappointed. It will be better, but there will still be lots of scratches.

Put simply, it isn't uncommon for experienced sculptors to repeat the first grit three, four, or even five times. Really. Five long sanding sessions with just the very first grit. Towards the end you may not have to sand the entire piece, but instead focus only on specific problem areas. To help you know where the scratches are mark them with a crayon before you get the stone wet again. The crayon will sand right off and you'll know you've hit all your scratches if you've removed all the crayon.

Remember: the finish you establish with the first grit is critical. If you don't get all the file and chisel marks out with your first grit they're still going to be there when you're done. This simply cannot be overstated. You need to get into every nook and cranny with that sandpaper and remove every file mark, every indentation, every scratch, all of it. Only when you have done that are you ready to move on to whatever grit comes next.

Once your first grit is finally done - you see no scratches of any kind remaining other than those left behind by your sandpaper - it is time to go to the next grit. At this point things become simpler and faster.

Change out the water, rinse the sculpture and towel, all as discussed above. Then sand your entire piece - being sure to get it all - with the new grit. When you're done rinse it off, dry it, examine it for any obvious scratches or issues. Assuming you find none, you're done with that grit. At this point all you need is one thorough pass with each grit, since all each pass does is remove the scratches left behind by the previous grit. That isn't too hard, actually, and generally one pass with each grit is all that is required.

Continue following that pattern: change water, rinse & clean stone, towel, etc., get new paper of next grit, do one thorough sanding pass, rinse, dry, check for problems. Repeat until you reach at least 2000 grit.

You'll probably find you cannot accomplish all the sanding in a single session. Indeed, given the number of passes needed with the first grit and the effort required to get that right, you'll almost certainly be spending multiple sessions on that same grit. A trick to remembering where you were is to get your next piece of sandpaper ready and leave it with your sculpture. If you cannot read the grit on the back of the paper write it there so you'll know what you're working on next. Also, try to stop only when an entire sanding pass is done, so you don't have to remember which part of a piece has been sanded already with that grit, or waste effort sanding an area twice.

When you've sanded all the way through your last grit and you're done, clean everything up, rinse your sculpture off and let it stand at least 24 hours to dry.

Special Considerations While Sanding

A Big Scratch Appeared Out Of Nowhere!

Sadly, this does happen from time to time. There are several explanations. Scratches can come from grit that flakes off sandpaper, edges on folded sandpaper, bits of mud and grit that come out of pockets in the stone, random stuff that falls into your sanding water, and small inclusions that come loose. Any of these can get caught between the sandpaper and the stone, leaving potentially large scratches behind. Sometimes - if you're not rinsing and looking regularly, or if the scratches stay hidden because things are wet - you may not figure this out until you think you're done with a grit and dry the stone.

The good news is that these scratches are generally repairable with additional sanding. The bad news is that you'll have to back up to a lower grit to get rid of them. How far back to go is difficult to say without seeing the exact situation. If the scratches are large and deep you may have to back up two, three, or more grits to get rid of them. Once you do that, you'll have to work your way back through all the intervening grits again to get back to where you were.

If the scratches are in a limited area it isn't necessary to sand the entire piece again. Sand the area with whatever grit is needed to remove the scratches. When you change to the next grit (changing water, rinsing, etc. as usual) sand the same area but expand it just slightly, to be sure that you get it all. With each additional grit expand again, until you get back to where you were. At that point you can go back to sanding the entire stone with each grit as usual.

Pits & Cracks & Mud

As mentioned in the shaping section, some stones have naturally occurring pits or pockets in them, and sometimes those pits contain mud or other loose material. This isn't an issue while carving or filing, but while sanding it can be a problem if something comes out and causes scratches. It is sometimes necessary to avoid these issues.

In addition, some cracks can throw flakes along the edges while they are being sanded, and while that can also lead to scratches, it can also make the crack more visible, effectively a defect in the polished surface.

Your choices here amount to avoiding the problem in one of two ways.

The best solution is to completely remove any mud in the pits or cracks. A toothbrush and some warm water will often remove mud from pits and thus get rid of any chance of things causing scratches during sanding. If the pit is too deep for a tooth brush, you can try a dental pick or other probe, but be careful to avoid scratching the stone inside the pit.

If you cannot get all of the mud out, your next best bet is to bind it into place. Let the stone dry completely and then drip standard super glue into the pit or crack to bind it up. You don't have to fill the pit, just bind all the potentially loose material together so it can't come out. The glue soaks in, dries clear, and will generally be invisible. As mentioned above, it will also bind cracks together as well, helping to reduce flaking and make your stone stronger. Let the glue dry completely before doing additional polishing.

Inclusions

Inclusions - those previously mentioned hard spots in an otherwise (relatively) consistent stone - can cause problems while polishing. Often as you sand they will become more - not less - pronounced. That's because while you're sanding the inclusion you're also sanding the softer stone around it, and naturally more of that softer stone comes off than comes off the inclusion itself, effectively making the inclusion more visible.

Try not to get caught in that trap. Sand the area as if the inclusion isn't there and move on, leaving the inclusion alone. If you're really desperate to get rid of an inclusion and it is on an obvious and accessible surface you might be able to file it (and only it) with a diamond file of the right shape. Doing so, however, requires that you do not touch the rest of the stone with the file. After all, your goal is to reduce the inclusion, not the stone around it. This is tricky and takes a lot of practice - as well as the right file. Generally it's best to ignore inclusions entirely while polishing. If you do wind up filing one down after you've started sanding, then take great care to sand it again through all the grits to get back to the same grit you were working on in the rest of the piece.

Sanding complex surfaces

Where possible we prefer that you sand a surface with just the paper and your hands. Your sense of touch will help you know how much progress you're making, and you will discover irregularities and rough spots that need cleanup in the process. In short, the more connected you are to the stone and the process the better.

But there are places and shapes that human fingers simply cannot sand well. Perhaps they are too small or too deep to get your fingers into, or you're trying to keep sharp edges and corners on your stone and you find that your hands tend to round them off. In these cases you should resort to sanding aids of one sort or another.

One of the best we've found is a set of rubber shapes called "Tadpoles" and sold by Klingspore. These objects are designed to let you wrap pieces of sandpaper around them and then work the sandpaper into small curves and corners. Using them you can polish many surfaces that would otherwise be impossible by hand.

If you don't have tadpoles, you can use just about anything else that will let you shape your sandpaper effectively. We've wrapped it around bits of found wood, plastic, and even broken CDs to get something that will work well.

Another technique is to roll your sandpaper very, very tightly. A two inch square of 400 grit sandpaper can become a tube about 1/4" in diameter. The end of such a tube can get into all kinds of places with limited access, and as it abrades new sandpaper is exposed, so it can be quite effective.

A note of caution about all of these techniques: they usually result in the sandpaper wearing faster than usual - sometimes as a result of bends or folds - and that means you get the sharp edges and lose grit problem previously mentioned. Watch carefully, check for scratches regularly, and change your paper often to reduce the chances of needing to re-sand your stone.

Finally, you may find that large and/or flat surfaces are sanded more effectively if you use a sanding pad of some sort. Your fingers alone may exaggerate any deviations and/or round

any sharp corners. A simple sanding pad will even out the pressure you apply and help avoid these issues.

Dry Skin

All this wet sanding will dry your hands out. If you want, wear rubber exam gloves of some kind. (The best are currently made of nitrile. Avoid latex as it is possible to develop a latex allergy over time.) These will help a bit with the drying issues, but nothing works completely. Use plenty of skin lotion of some kind to avoid perpetually chapped fingers.

What If I Don't Want A Polished Surface

In the ***Digging Deeper*** sections below we will discuss different finishing choices. There are several options: frosting tools leave a stippled, white surface; files can leave fine lines; toothed chisels can leave a regular pattern behind, and you can always leave raw stone surfaces on your work. In addition, these techniques can be combined in various ways, for example: polishing a surface and then using files to put lines on it; polishing a rough, chiseled surface but starting with (say) 400 grit sandpaper leaving polished highlights over rougher stone, and many other combinations well beyond what we can present in an introductory discussion.

Note, however, that a good, polished surface is something most sculptors will want on many, if not all, of the sculptures they create. Learn that technique and you'll have the basis from which to branch out and create any surface your work requires.

Lecture 3: Signing & Sealing

Signing

We recommend signing your work, just as a painter signs his. With any sculpture you have to find the right place to sign. In some cases it is possible to sign on the bottom. This works if the work isn't affixed to a base so it can be picked up and viewed. If, however, the work is attached to a base or is heavy enough that examination isn't simple, you'll want to sign it on a visible part of the piece itself. As a rule you'll look for an unobtrusive spot near the bottom, and you'll probably want to keep the signature itself relatively small. You don't want to make it intrusive, just mark it as your work.

What to sign is always a question, and the answer varies with the artist. Some use just initials while others use part or all of their name. A date (at least the year) is generally a good idea, but not required. Some include a piece number, and some include a copyright mark. Finally, others use a unique mark that isn't actually a name or initials, but something unique to them. You'll have to determine what you want to include, then practice laying it out with pencil on paper so you know what you'll actually put on the stone.

The actual signing process can be done in a few ways. First, though, draw the signature on your selected spot in pencil. Exactly how big to make it depends on the space available and the way you're going to engrave it into the stone. You can use a dental pick or similar tool to scratch it into a soft stone. Scratch deeply enough that it will be legible once waxed or sealed. For harder stones we find the best tool for this is a Dremel tool with a fine, thin diamond grinding bit. It is also possible to use an engraving tool. Regardless of your selected method, you may want to practice on a scrap of the same stone to figure out your

best technique and how to make it legible.

When you're done, if any pencil marks remain, simply sand quickly over the signature with the finest grit of sandpaper you used on that part of your sculpture. Just a dry pass or two will remove any stray pencil lines.

After you've done this a few times you may not need to draw it out with pencil first, of course.

Note that your signature will probably appear as whitish lines on your final work. That's normal. Your sealer will make it a bit less obvious, but it won't vanish entirely.

Sealing

As with polishing, there are several options for sealing your completed sculpture, and here we discuss only the one we use most often. Alternatives are discussed later.

Then intent of sealing your stone is to protect it from dust, spills, and skin oils. Remember: people are going to touch your sculpture - that's half the fun - and they won't all have clean, dry hands. You need something on the surface to protect it. Our usual recommendation is a simple floor wax. We prefer commonly available waxes that contain a lot of Carnauba. These will have a slight yellow cast to them in the tin, but are nearly invisible on a finished stone. The brand we typically purchase locally is Trewax hardening floor wax, but just about any good floor wax with Carnauba should be fine.

The wax is applied in several coats - we suggest five - and it is buffed to a shine between each pass. Use some kind of counter to remember how many coats you've applied. Experience tells us that for some reason no one is capable of counting to five while doing this. Honestly.

Using a soft, lint free cloth or a good quality paper towel apply wax to a part of your sculpture. How much depends on how big it is and how workable the wax is. You'll develop a sense of this with practice. Then, using another cloth or towel, buff the waxed area to a shine, then repeat the process in other areas until the entire piece is waxed. Once you've waxed the entire piece once, start over and repeat the entire process again until you've applied five coats.

The intent of buffing is to generate heat and essentially melt the wax into the small fissures in the surface. That's helps give it the shine. As a result of the need to build up the heat you'll find that buffing is easier in warmer weather than in the middle of Winter. Do not be tempted to heat your stone in an oven to speed the process. Too much heat will discolor some stones - particularly alabaster - turning them white. If you're waxing during cold weather it's fine to use a room heater to heat the room to a normal temperature of course, and you'll have an easier time buffing in that warmer room. It's also best in colder temperatures to work smaller areas and buff vigorously to generate the needed heat.

If you're using paper towels to apply the wax and buff, change them regularly. If they start to shed any paper lint it will be caught in the wax and you'll have a tough time getting it out.

Finally, keep the lid on your wax tin when you're not actually extracting wax to apply. Wax contains some volatile chemicals that you don't want to evaporate out before you actually

apply it.

Digging Deeper

These sections provide additional details on all the aspects of stone carving that we can cram into them. Some material from the introductory lectures is not presented here, though, so read those through before looking for specifics here.

General Comments

Just about everything in this document needs to be taken with a pinch of salt. We provide the best advice we can throughout, but if there is one thing that years of teaching has revealed it is that students differ. Bio-mechanics vary from person to person in ways that simply cannot be predicted. Two people of the same height and build may find that radically different tools or carving methodologies work for them. Beyond that, though, we find that people's intents and desires vary so much that general rules often don't apply. For example, a professional sculptor might want to get to a selected shape as rapidly as possible, and so use hammer and chisel to get very close to the final form. Others, however, might find that process frustrating or irritating in any number of ways, and switch to files much earlier. It may take them longer to get done, but if they enjoy the process, that's fine.

What this means is that there is no way to specify "this is the right way to do X", no matter what "X" may be, at least within the realm of stone carving. Even with the best intentions and all the information we can convey, you may find that something different from what we present here works better for you. Additionally, we do not claim to know everything about stone carving, so the more information sources you make use of the better.

Additionally, nothing here is complete. There are always things the authors don't know or haven't remembered to document. If you find something we don't mention - or that you do differently - please share it with us. We're happy to add just about any practical suggestion to this document so that others may benefit, and we certainly won't be offended.

Safety

This section is not intended to scare anyone, but carving stone - like many other activities - has both risks and rewards. This chapter deals with the risks and doing your best to mitigate them. Consider these sections to be guidelines - the authors are artists, not safety specialists - and the advice given here is general in nature. Seek the advice of a safety or medical professional as appropriate if you have questions.

Eye Protection

Several things involved in stone carving can damage your eyes. Rock chips are the obvious problem, but hand tools can break and power tools only make the risks bigger. To reduce these issues eye protection is required. Safety glasses are a requirement while carving, and goggles may be a better choice in some circumstances, though they do fog up. Goggles, however, can be worn over prescription glasses, so they may be a good choice to protect both your eyes and your lenses. Over time safety glasses get scratched up and obscure vision. Be prepared to replace them on occasion. You can buy safety glasses at just about

any hardware store.

<<Pictures needed: safety glasses, goggles>>

You might also consider a face shield. These look like something a welder might wear, cover the full face, and are worn over prescription or safety glasses. It can take some time getting used to a shield, and they can fog up, but they definitely offer more protection, and can be quite comfortable. Be sure any face shield you buy is easily adjustable to the size of your head and comes with a clear shield.

Another choice is a PAPR (see lung protection below) with an included face shield. These protect both your eyes and lungs, don't fog up, but are expensive.

Regardless of your choice, don't ever make the mistake of doing "just a little work" without wearing eye protection.

Lung Protection

Stone dust is a hazard. If you are working outdoors or with adequate ventilation, you might be fine, but it's best to err on the side of caution. Many stones contain silica, which can lead to silicosis. Others may contain asbestos, and still others may actually be toxic. But even if you're sure the stone you're working on is free of those hazards, no one needs to breath that much dust.

Protection from dust comes in two forms: avoidance and filtration. Avoidance is simple: find ways to avoid generating dust while working, or to avoid breathing the dust you create. The simplest of these is to sand your stone wet, which avoids dust issues entirely. (See the section on sanding for advice on how to make this work.) However, even carving with chisels will create some dust, files still more, and unless specially designed, power tools cannot be used with water, so dust is a real problem.

Another way to avoid dust inhalation is to change the environment. Working outdoors is always helpful, but - particularly with power tools - sometimes not good enough. You might setup a fan to blow clean air through the area you're working in and thus continuously remove the dust before you breath it. If you're working indoors you might use a dust collection system something like wood shops setup, though that will probably be less effective since carvers tend to move around a lot and the dust collection inlet needs to be close to the work.

In general you'll need some sort of filter or respirator to avoid the issue if you're creating any significant quantity of dust.



The cheapest paper masks bought at a hardware store aren't usually enough. You need at least two elastic straps per mask and a metal band over the nose to assure a good, snug fit, as shown here. To avoid fogging up your safety glasses you'll want to either adjust the mask to be a little tighter on the top than on the bottom so that you "exhaust" downward under your chin. If that doesn't work with your anatomy, you might want to look for masks with an actual downward pointing exhalation valve. A minimum recommended rating for these masks is N95, but N100 is a better choice if you're carving a stone that might contain asbestos. Men, if you have a beard you'll find paper filters are iffy at best. They may help, but the seal will never be great. Consider your alternatives carefully.

For hours of continuous work, or if you're going to be using power tools and/or working in a very dusty environment, you'll need something better than any paper mask. One choice is a respirator. There are many models and choices, with filter cartridges available for many environments. Respirators come in different shapes, too, and so don't fit all faces equally well. Thus, you want to try one on and assure a snug fit with a good seal against your skin. Your local hardware store will have a few choices. If you have access to a specialty safety supply store you can find dozens of models from various manufacturers. Finally, though you cannot try them on, there are many suppliers of this equipment on the Internet.

For cartridges, you need a basic model designed to filter dust. Read labels carefully and ask for assistance if you're not certain of the best choice.

<<picture needed: bug nose respirator>>

Even better than a simple respirator is a Powered Air Purifying Respirator (PAPR). These are expensive, but they provide a constant supply of clean air. Many come with full face shields, allowing them to replace your safety glasses as well, and because they continuously supply fresh air into the face piece they do not fog up. Choices include belt, face-piece, and helmet mounted fans and filters. Batteries are almost always on a belt.

Another kind of PAPR makes use of a separate, plug in filtration unit and a hose that supplies air to the user. The filtration unit gets put somewhere outside the dusty work area and 40 or 80 feet of hose connects the user to the unit, and lets him get into the area where the work is being done. As with battery operated PAPR units these can be had with full face shields if desired.

PAPR units cost several hundred dollars, but are definitely worth the money if you are carving seriously, particularly with power tools.

<<picture needed: PAPR>>

Hearing Protection

If you're only carving with hand tools - even hammer and chisel - hearing protection may not be needed, but then again it might. An acoustically live room and a hammer can make a poor combination, so use caution and protect your hearing if needed. Power tools make hearing protection a must.

The primary choice in hearing protection is between "in the ear" and "over the ear" styles. In the ear styles include foam and flexible plastic ear plugs that insert into the ear canal. Over the ear styles are basically ear muffs like those worn on shooting ranges. The two can even be combined if noise is a particular problem, though that should rarely be needed.

Comfort is your guide. If you cannot wear ear muffs but foam earplugs are comfortable, your choice is simple. But read packages carefully as different products provide different levels of noise reduction, and obviously the less noise the better. Often it is foam ear plugs that - if properly worn - provide the best noise reduction available.

<<picture needed: ear plugs & ear muffs>>

Tool Safety

Throughout this document the use of tools will be discussed, and we do our best to call out safety issues with each tool when it is introduced. It is always assumed, though, that you will use your tools safely, and that you will maintain them to minimize risks. Remember that any tool can cause injury if used improperly, and that you should always use all of the safety equipment that comes with your tools as specified by the manufacturer. This is particularly true of power tools, where misuse can lead to very serious injury or worse.

If your tools come with a manual or user's guide be sure to read it before you use the tool. Safety is your responsibility, and while we will call it out in this document, it is up to you to do things correctly. If you have any questions seek the advice of the manufacturer or someone knowledgeable in the field rather than risk injury.

Repetitive Stress Injuries

Repetitive stress injuries (RSIs) are a special class of injuries that can occur while stone carving. Usually caused by power tools, they include nerve and other damage from regular use of vibrating tools like angle grinders or air chisels. That said, some people get RSIs in wrists or elbows from the use of a hammer and chisel, so caution is the best policy. Avoiding RSIs is a matter of avoiding prolonged tool use and using the right safety gear.

The first step in avoiding RSIs is to take regular breaks from any repetitive or vibrating tool use. New carvers often report pain in their hands or arms as they use muscles and joints in ways they aren't used to. Those pains generally aren't RSIs, which take time to develop, but avoiding and reducing any pain will also help avoid RSIs over time. If you stop regularly and give your body a rest, you'll be healthier and less likely to suffer pain. Eventually your body will adapt to the conditions and you'll be able to carve for longer periods over time.

Alas that won't prevent you from getting an RSI from a power tool. The vibration of many such tools can cause damage over time. At least some of that can be avoided through the wearing of anti-vibration gloves. These special gloves contain a closed cell foam in the palm that reduces the vibration from the tool that gets to your body. Both fingerless and full fingered anti-vibration gloves are available, depending on your preferences.

Note that even with anti-vibration gloves RSIs are still possible. If you feel pain or a tingling sensation in your hands while using a tool, stop and assess it carefully. At least take a break and note how long it takes to go away. Seek medical advice if at all unsure about the nature of the problem.

<<picture: anti-vibration gloves>>

Tools: Use and Care

This section discusses the basic tools of the trade in some depth. As mentioned above, your experience may vary from ours, so always be on the lookout for things that work better for you, as well as different ways to use the usual tools that help you work more effectively.

Hammers

A hammer is a hammer is a hammer, right? Not if you're carving stone. There are several different kinds of hammers available for use in different circumstances and/or by different people:

- Classic mason's hammers. Soft iron with a square striking face. Weight varies from 1 pound or less (sometimes called a "finishing hammer") to 1.5, 2, or more pounds.
- Round iron hammers (also called "mason's dummy hammers" for some reason). These were actually the most common stone carving hammer used long ago.
- Mason's Mallets. Round, with heads of wood on nylon. These are used with chisels with a mallet head and aren't particularly common in the US.

Your choice of hammer (or hammers) will depend on many personal factors. Setting aside the mallets - which most carving supply shops in the US don't even carry - your first choice is round or square faced. In our experience, this is entirely a personal decision. Some carvers love the round hammers and find that using them makes the carving process simpler. Others find that the round surface makes striking the chisels effectively more difficult. You'll have to experiment and determine what works best for you. You may also find you use different hammers for detailed shaping than for major stone removal.

Mason's mallets are designed to work with chisels that have a "mallet head". You may find them for sale in Europe and at a few US distributors, but they aren't common here.

There are a few other oddities in the stone carving hammer world. Bushing hammers have a grid of hardened points on the face and are meant to be used directly on the stone. Each hit abrades the stone. At their largest these are made like sledge hammers with long handles for aggressively carving large, hard stones. Their use isn't common in our experience, but you will hear about them from time to time.

Another rarely seen hammer in the US takes scutch combs in its ends. (Scutch combs are toothed or flat bits of metal that usually fit into a chisel like holder and act like toothed or flat chisels with replaceable ends in such a case.) When a toothed scutch comb is inserted into a hammer the tool that results can chip away stone with each blow. It will be less precise than a chisel, but can allow the removal of more stone when precision isn't required. See the chisel section below for more information on scutch combs and holders. It isn't likely you'll use one of these in the US, but if you're being trained in other parts of the world you might find it more common.

Care of your hammers is relatively simple. First, regularly examine the handles to be sure they are no breaks or cracks. Also check for splinters and sand them smooth if any are found. (If your hammers have fiberglass or other materials in the handle, contact the manufacturer and ask for advice if you see breaks, cracks, or splinters. Usually, though, such damage means it's time to get a new hammer.)

Over time soft iron hammers can mushroom out, creating sharp edges around the striking faces. For safety those should be filed off or ground down on a bench grinder. If left alone you will eventually cut yourself on them and they can chip off unexpectedly.

Any hammer might also develop cracks or damage to the striking material that can result in chips coming off. Look your hammers over and replace anything that looks like it could break or from which pieces might come off. Always wear safety glasses or goggles while using any hammer for any purpose. Your eyes are too valuable to lose to something that breaks when struck with a hammer, and it does happen from time to time.

<<pictures: hammers of various types>>

Chisels

General Comments

The chisel is perhaps the most versatile hand tool you'll use. It remains largely the same as the masters used in the Renaissance but with 500 years of advancements in metallurgy. Still, the chisel in its various forms can be used for everything from rough shaping of your stone to fairly delicate details. This is made possible by your technique and your hand eye coordination. Let's talk about technique. Fundamentally it comes down to how you hold the chisel, how you aim it at the stone, and where you aim it at the stone. Let's look at each of these.

Gripping the chisel needs to optimize your control of the chisel and minimize the possibility of hitting your hand with the hammer. Fortunately this is done quite easily. There are many variations but only two basic grips. One grip is perhaps the most natural. Just lay the chisel across your palm. For a right handed person this will often be the palm of the left hand. Put the pointed end out beyond the heel of your hand and the flat end just beyond and on top of your thumb. Then close your fingers around the body of the chisel. Make sure you keep your thumb on the same side of the chisel as the rest of your fingers and not "around" the chisel. This will reduce your chances of hitting your thumb. It will also keep you from making a "death grip" which would increase your fatigue and reduce your control.

The other grip is quite common and was actually used in medieval times. Hold the chisel as you did in the first example, but move your little finger to the other side of the chisel. This will have the chisel body go between your little finger and your ring finger. This grip is said to increase control though to be honest none of the authors of this carving guide finds the grip comfortable. But you should try it and see if it suits you. If it does, you will have centuries of tradition behind you. There is at least one other classical grip (pictured below), but its use isn't common now and it requires extensive strength and callouses.

<<pictures: normal grip, doug's classic grip, jeff's classic grip>>

As stated above, avoid gripping your chisels too firmly. In general it's tiring and usually isn't required. The point chisel - described in more detail below - in particular should be held loosely, as it can rotate without any harm at all. The other chisels should be held just firmly enough to maintain contact with the stone before and after the hammer blow. Practice will help you adjust this. In particular note if your chisel arm is getting tired or cramping up. If so, you're probably gripping the chisel too tightly.

It may seem obvious, but what a chisel does is transmit the energy from the swinging

hammer into the stone in a limited area. Each kind of chisel has specific ways in which it transmits that energy to the stone, and thus specific tasks it's better adapted for. The various chisels are discussed in the sections below, but there are some generalities about all chisels that you'll want to consider.

When the energy from the hammer enters the stone through the chisel, it causes chips to come off. In effect, it's breaking the stone in a (hopefully) controlled way. The harder you swing the hammer the more energy is available, and the more stone that may be removed with a given blow. Learning to control the amount of swing (energy) is critical to reducing stone bruises and producing your carvings with reasonable effort. There are also techniques in chisel use that will help reduce unexpected stone breaks, discussed in the rough shaping section below.

For the chisel to work - to remove stone - it must bite into the stone. A chisel held at too shallow an angle slides off the stone without removing any material. On the other hand, a chisel held at too steep an angle digs in - causing stone bruises, discussed later - not removing any material. In the extreme, a chisel used at too steep an angle can fracture a stone severely, something usually not desired.

As a rule, 45 degrees is about right, but the actual angle required in any specific case can vary. Hard stones usually require a steeper angle than soft stones, and sharp chisels require a shallower angle than dull ones. Other factors may influence things as well. For example, if you want to remove a thin piece of stone you'd want a shallower angle, but the chisel may not bite into the stone as a result. A way around this is to start with a steeper angle and tap gently with the hammer, just until the chisel starts to bite into the stone. Then, gradually increase the force of the hammer blows as you decrease the angle on the chisel. This technique can both reduce stone bruising and allow the effective removal of thin pieces of stone.

Another thing that may seem obvious: for the chisel to work the stone you want to remove must have some place to go. Imagine you take a chisel and hold it perpendicular to a flat piece of stone and hit it with a hammer. Clearly this action will not remove any stone. Instead it will bruise the stone, and it may even break the stone into two or more large pieces if you hit hard enough, but no chips will come off. There are times in carving when you may find yourself doing this kind of thing, generally when trying to create a hole or deep depression. It is ineffective at best and may be destructive to your stone or your chisels. Should you encounter this sort of situation stop and rethink your actions. If you can make the hole or depression wider you can probably find places to put the chisel that will remove stone, and the end result will be to let you get deeper into - or through - your stone. If wider isn't an option, it may be time to consider changing tools, specifically to a power drill with a masonry drill bit of some sort.

As mentioned above, chisels have specific uses. There are three classic chisels that everyone should be familiar with, and for which there is a general order of use. Other chisels are generally for special cases. (Note: sculptors differ in their approach to chisel use. We have encountered sculptors that use exclusively rondels, for example. What we describe here is the approach we were taught and which our research leads us to believe is relatively common. If you work in a different manner, or were taught something different, rest assured we don't think it's "wrong" in any way. We just teaching what we know.)

The most common chisels - used by most carvers in most cases - are the **point**, **toothed**, and **flat** chisels. On a suitably hard stone - like marble - they are used in that order: the point for removing large amounts of stone while you're relatively far from your final shape, the toothed chisel to refine the shape left by the point and get closer still to your final form,

and the flat chisel to remove the lines left behind by the toothed chisel, getting a surface ready for fling and/or polishing.

With softer stones - alabaster, soapstone, and the like (see the section on stone types below for more information) - and smaller stones, we find that the point doesn't get much use. Because it doesn't control the way the stone breaks it's more risky to use on a small stone, and toothed chisels can remove quite a lot of soft stone with reasonable effort. In fact, in these cases the choice of a flat or toothed chisel is more a matter of personal preference than necessity, though the toothed chisel will remove more material than the flat chisel, and that may guide your selection.

Before discussing each chisel type individually, here are some comments about safety and care:

Chisels are made of steel and thus rust. Keep them dry at all times. Store them in a cloth tool roll which helps avoid rust.

Chisel makers use different steel stock to make their tools. Some use thick, heavy steel, while others use thinner steel. In most cases your choice is matter of preference, rather than capability.

You will also see carbide tipped chisels. These have a piece of hardened carbide steel inserted in the tip. It can be used to carve harder stones, but carbide steel is more brittle than normal tool steel, and thus more likely to chip or break during use. For most carvers working on anything up through normal marble, standard tool steel chisels are fine. Save the purchase of carbide steel chisels for later, when you've had some practice and experience.

Most chisels are of similar length - approximately eight inches long, give or take. You will occasionally see longer versions of normal chisels for sale. These are called ***cathedral chisels***, and are useful for situations where you simply cannot reach something with a shorter chisel. As with carbide chisels, wait to purchase a cathedral chisel until you actually need it.

As they are used, all hand chisels can mushroom out on the top, creating sharp edges that can cut you when you grasp the tool. In addition, those edges can break off at any point and hit an eye. from time to time you need to file those edges off to avoid these problems. A bench grinder can speed the process if used carefully.

<picture: mushroomed chisel>

Chisels also need to be sharpened. You can use a diamond sharpener, wet stone, dry stone, or water cooled electric polishing wheel to accomplish this. Carefully follow the instructions that come with your particular sharpening tool. Sharpening toothed chisels may require the use of an abrasive disk in a Dremel tool to reach between the teeth, though in practice we seldom do this. Don't let your chisels heat too much while you're sharpening them. Doing so can remove the temper in the steel, making them quicker to dull during use. If you're carving a hard stone you may need to sharpen multiple times per carving session, while you might sharpen very irregularly if you're carving soft stones.

Run your finger crosswise over the edge of a new, sharp chisel and compare it with an older chisel to help develop a feel for when sharpening is needed. You probably already do the same thing with your kitchen knives from time to time to see if it is dull. This is the same procedure, but we haven't found that the exacting kind of sharpening done for knives and

wood chisels is needed for stone chisels. If you put a beautiful, amazingly sharp knife edge on a chisel the first time you use it it will immediately dull back down to something "normal" for this kind of work. We recommend keeping your chisels reasonably sharp, but not spending the huge amounts of time at it.

Try to keep the same angle on your chisels that they had when you purchased them. Experienced carvers sometimes change those angles for particular stones, but even after 10 years we haven't found anything consistent on what makes one angle better or worse than another for a given stone. In most cases we find that sharpness matters more than angle, and after that it's technique.

Every Day Use

These are the chisels we use all the time.

Point Chisel

<picture: point chisel selection>

The point chisel is used for large scale material removal. Thinking in physics terms, all the energy from the hammer blow is transmitted to one point on the stone where it is absorbed. That means the energy is focused on breaking the stone in one spot, but there is no directional control of the resulting break. Thus the shape of the stone chip that comes off isn't as predictable as it is with a flat or toothed chisel. In soft stones you can easily remove pieces two inches in size or larger if you hit hard enough, so be sure you're far from your final surface when using a point.

The point really shows its value when working harder stones like marble. In that case the energy needed to remove even a small piece of stone is much greater than in a soft stone, so in most cases you'll find the point doesn't remove large pieces of stone.

A common use of the point - particularly in harder stones - is to carve cross hatched lines over any surface where stone needs to be removed. When that is done the marks left behind are convenient places to place a toothed chisel, which quickly removes the stone left behind by the point. Usually such a cross hatch pattern is one half to two inches on a side, depending on your chisel sizes and the hardness of the stone.

<picture: cross hatch pattern>

Toothed Chisel

<picture: toothed chisel selection>

The toothed chisel is - at least for soft stones - the workhorse for many sculptors. It comes in a variety of forms, varying in the number and size of the teeth.

Analyzing the tool in physics terms once again, the energy from the hammer blow is now distributed over a number of points in a line. As a result, the teeth have an easier time biting into the stone than a flat chisel, but the energy is distributed along a line, unlike the point. That line gives the sculptor much more control over what stone is removed.

In soft stone the toothed chisel can be used for most anything, from major removal to

reasonably delicate work on details. Note, however, that it leaves lines behind that need to be removed (unless you're going to incorporate them into your finish), so it isn't usually the final tool used on a sculpture. In hard stone the toothed chisel is often used in combination with the point as described above. It can also be used to carve without the point, of course, but if the stone is hard enough you may have trouble getting the teeth to bite.

As a rule, finer (narrower) teeth are less aggressive. That is, they remove less stone with a given hammer blow. The same is true for more vs. less teeth. More teeth distribute the energy over a wider area, making it hard to bite into the stone overall, so a 4 tooth chisel will remove more stone than a 5 tooth. What more teeth gives the sculptor is more control over a wider space; you'll have to hit harder or more to remove the same amount of stone, but chances are good it will be the stone you want in that wider area. In practice, though, these distinctions are not obvious to new carvers, and generally matter more on harder stones. You'll determine what kinds of toothed chisels you prefer with experience, and you'll almost certainly wind up owning several after you've carved a few different kinds of stone.

As a practical matter, toothed chisels are also the weakest in your toolkit. The teeth can break, and they do so in two ways that we know of so far:

- If you use the chisel without holding it flat and keeping all the teeth against the stone, you add strain to the teeth that are on the stone, and they may break as a result. This is particularly easy to do when working along corners or edges and hanging teeth off into space. If you find yourself doing that look for an alternative. Work in a different direction or change to a flat chisel to avoid breaking your toothed chisels in these conditions.
- Aggressively pounding the teeth into the stone, usually at too steep an angle so there isn't anywhere for stone to go, can break teeth too. In this case the strain generally builds on one side or the other and an outer tooth breaks. Always work at a reasonable angle with your chisels and make sure whatever you're doing leaves a place for chips to come out. If you follow those rules you won't break chisel teeth this way.

The lines left behind by toothed chisels can be removed with a flat chisel in most cases, or with a file in many stones, even marble. As hinted at above, though, if you carve carefully, keeping your lines controlled, you might use them in your finish. They can indicate movement (as in water and waves), hair, and any number of other things.

Though less common, it is possible to purchase carbide tipped toothed chisels.

Flat Chisel

<picture: flat chisel selection>

The flat chisel leaves behind a relatively smooth finish, making it simpler to file and polish your stone in the areas where it has been used. Flat chisels, particularly very narrow ones, are also useful when carving certain kinds of details. Some sculptors like flat chisels for general use in softer stones, while others skip them entirely. Your own usage is a personal choice, but in harder stones flat chisels are less effective and are usually used to remove the lines left behind by toothed chisels, and to remove features or obstructions that are raised from the desired surface and so give the chisel something to dig into easily.

As with points, you can find carbide tipped flat chisels for use on harder stone.

Special Case Use

Pitching Tool

Rondel

Gauge

Saws

Sandbags

Files (Rifflers)

Crayons

Misc

Choosing A Stone

Stone Types

Hardness

Special Concerns (toxicity and related issues)

Rough Shaping

if the stone is moving - lost energy
work towards the center of the stone when possible
stop cuts

Final Shaping

Polishing

Sanding

Types, grades, and sources of sandpaper and polishes.

need to discuss buffing wheel here, along with chemical polishing of marble

Alternative Finishing Choices

Natural Surface

Other Sanding Techniques

Textured Surface (Frosting Tool, etc)

Signing Your Stone

Sealing

Wax

Alternative Sealers

Bases and Mounting

Felting

Base Shape, Size, and Material

Drilling

Pinning

[needs additional steps on selecting rod size, length. Perhaps this is done in the Drilling section?]

Assuming you already have the holes drilled in the base and in your sculpture, here's how to pin them together:

1. Brush and blow the dust out of the holes (safety glasses are a good idea here).
2. Tape wax paper over the base and poke holes through the paper where the base's holes are. These are holes for the rods to go through.
 - Alternatively you can use electrical tape around the holes on the base and on the sculpture.
3. Place the base and the sculpture on a sturdy surface such that they can stay there without shifting for about 24 hours. This will probably require pads and supports. Use sandbags, rolled up towels; whatever seems sturdy and won't slip.
4. Mix up the epoxy, put some in one of the holes in the sculpture and slather some on the end of one of the rods.
5. Insert the epoxy end of the rod into the epoxy filled hole until it bottoms out.
6. Wipe off the excess epoxy with a disposable rag. Be sure that there is not so much excess epoxy that it will ooze further than you plan and glue the pieces together too soon or dry in visible places on the base or sculpture.
7. Repeat the epoxy steps for each hole and pin you've planned for your sculpture.
8. Slide the base (with the wax paper or electrical tape you taped to it) onto the rods.
9. Shift the rods as much as possible to align them with each other and make them vertical to the base. This will allow them to slide easily during future assembly and disassembly.
10. Double check alignment and that the base and sculpture are firmly supported.
11. Leave it all alone for 24 hours. Wait 24 hours even if the epoxy packaging says it will be ready in less time.
12. Remove the base from the sculpture.
13. Remove the wax paper from the base.
14. Remove any extra epoxy residue from the base and from the sculpture.
15. Wax and shine the sculpture to its finished polish.
16. Choose a felt with a color that will not stand out next to the base and sculpture. Black is often a good color because it disappears in the shadows of the seam between the base and the sculpture.
17. Cut the felt to be in the shape of the sculpture's bottom, but about a quarter of an inch in from the edge of the bottom. The felt will tend to spread with weight and time and this will keep it from sticking out and becoming visible.
18. Cut holes in the felt to correspond with the pin(s) that are now glued into your sculpture.
19. Place the felt over the rods, against the bottom of the blade. Follow directions in the Felting section for tips on gluing techniques. Once the felting is complete, move to the next step.
20. Slide the rods in the sculpture through the holes in the base. Depending on your base and your sculpture, it may be easier to slide the base onto the sculpture, or vice versa.
21. Put washers then nuts onto the rods protruding through the base.
22. Tighten the nuts a little more than hand tight.
23. Stand up the assembled sculpture and base. Check to see that it is stable on a flat surface and does not require extra support or ballast.
24. If it seems to stand well, re-tighten the nuts to be sure they haven 't loosened.
25. Stand the sculpture back up and admire your creation.

Special Considerations

Your First Piece: Consider An Abstract

Planning Your Stone: Drawings and Maquettes

Stone Bruises

Inclusions

Cracks

glues and gluing

Color and Consistency Changes

Mud & Holes In Your Stone

What To Do If Your Stone Breaks

Exhibiting your work

art shows

galleries

exhibit lighting

a list of local sculpture friendly places to exhibit

how to transport your sculpture safely

Selling Your Work

Pricing

Power Tools

Aesthetics -- How Do I Decide What To Carve?

Big vs. Small

Abstract vs. Representational

Where to find inspiration

Living with the raw rock

Google images

Sculpture sites

Static Composition vs. Movement

Resources -- Where can I get what I need?

Note that sometimes you'll have local suppliers but it won't be obvious. If you are unaware of any local stone carving suppliers and have a college of any sort nearby with an art program, see if they teach stone carving. If they do they may know of places in the area that can help. Local art supply stores may also know of such things, even if they don't carry the supplies themselves. So ask around. You might find a local gem.

Stone

Tools

For the moment, this information can be found here:

<http://www.bangtherockstogether.com/faq/suppliers.html>

<http://gibsonstools.com/> - a supplier of English stone carving tools, including some things that aren't common here in the US, such as scutch combs and holders, mason's mallets, and mallet head chisels.

klingspore for tadpoles

Safety Equipment

Education

Classes

Books

Websites

Advice

Art shows

Inspiration

Books

Movies