Desk Reference
For
Preparing Sand Thin Sections

A step by step guide

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Section I.
Preparation, it's all in the Resin

First things first. Gather the following materials; ice cube tray (plastic), resin, samples of sand and some type of disposable stirring stick. The resin will need to be accompanied by a hardener, both of which can be found at most plastic supply houses.

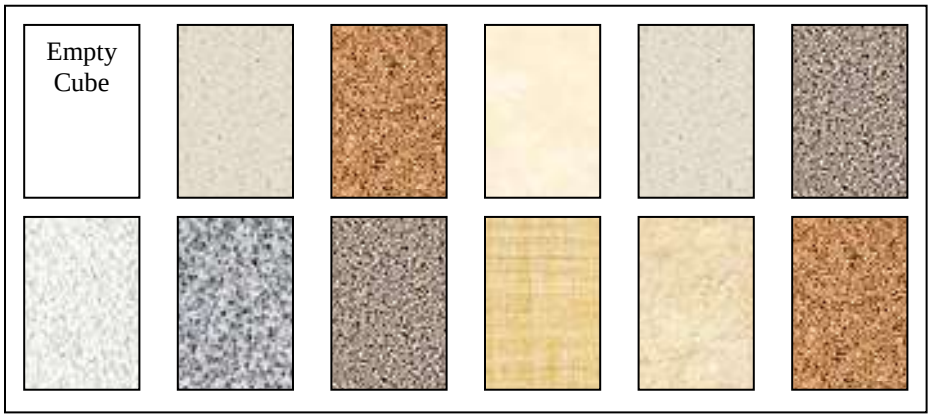
Samples of sand. Notice how each sample has been labeled with a small strip of paper on the inside of the container.

Section I.

Clean the ice cube tray free of dirt and dust. Fill each cube ½ full with resin. Add 8 to 10 drops of the hardener. The more hardener used, the quicker the cubes will set; however the less hardener used, the less brittle the cubes will be. 8 to 10 drops works pretty well.

Stir the resin and hardener together until well blended. There will be air bubbles, but do not be concerned, as they will settle out of the mixture before it is hardened.

When selecting the sand to sample, draw a diagram of the ice cube tray and label which type of sand is going into each cube. This is very important because when your samples harden, they often do not look like the sample put into the resin in beginning. Also, label which side will be facing "North" by leaving one cube empty as in the diagram:



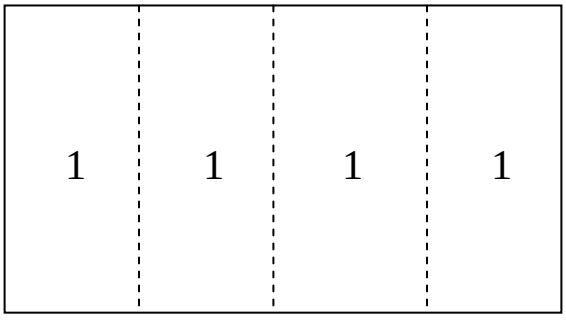
Label each cube on a sheet of paper, then number each type of sand. This will become useful later on.

On a sheet of paper, write the type of sand in each cube, then correspond that type with a number. Keep this reference in a safe place because further into the procedure there may be times when this will be the only way to determine the type of sand in the sample.

Add enough sand to displace ½ of the resin mixture, thus making the cubes ¾ full of sand/resin mixture. It will be apparent if more or less sand is needed to make a useful sample. If the sand has large granules, then probably less will be needed; however, if the grains are very small, more may be needed. A colorant may be used and added to the resin to help distinguish sand from air pockets in the finished product.

Mix well with a stirring stick. Set mixtures aside for 24 hours or until well set.

After the resin is set, gently remove each "sand cube" much in the same manner as removing an ice cube. As each cube is removed, use a permanent ink pen to label each cube, using the number from the reference sheet, four times as shown:



Top of cube, not the resin side

Section I.

You will be cutting on the dotted lines as in the diagram, so it is important that all four sections are labeled with a number.

This illustration shows the sand cubes out of the tray and labeled in preparation for the first cut. Once again, make sure that the numbers correspond to the type of sand used in each sample, for this will be the only way to identify each sample throughout the process.

Section II.
The First Cut

Before using the rock cutting saw, there are a few maintenance items that will need to be checked. First, make sure that the saw has enough water in it. To check, turn on the saw. There should be a steady mist spraying onto the saw blade and directly in front of it to wet the sample to be cut. If there is not enough water, using a funnel, pour water into the small fill holes located on the floor of the saw as shown in the illustration below:

Section II.

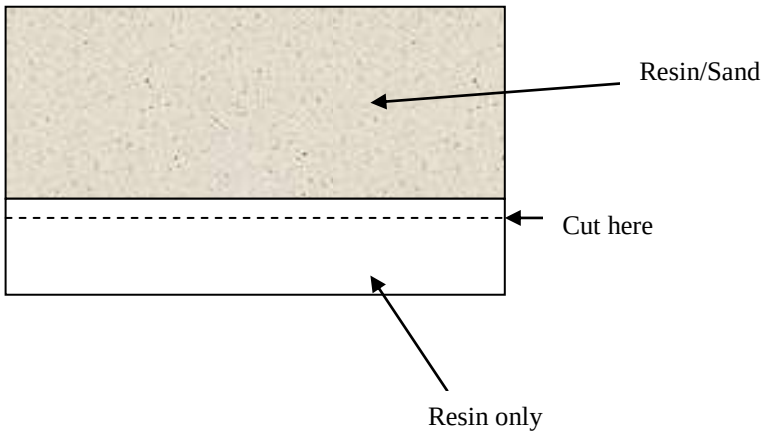
Turn the saw on, but do not turn on the “feed” switch, as you will be feeding the samples by hand.

Feed sample from here using a single point of pressure in order to protect the diamond blade saw from damage.

The active saw blade will not cut your skin, however avoid contact with the skin for more than just a second. Put on a plastic smock and begin cutting the samples into four sections. Each section will be labeled with a number.

Section II.

In order to make the samples easier to sand, cut the piece of resin off of the sample as shown in the diagram below:



When you are finished cutting all of the samples, wash them well. Also, make sure that all of the numbers are still legible on each of the sections. If not, go over them with a permanent marker so that the samples do not get mixed up.

This will be all the cutting that is necessary on this type of rock saw. The next cutting will be done on a thin sectioning saw. However, before making the thin sections, they will need to be glued to a piece of glass. In order for the sections to stick to the glass, they will need to be sanded smooth. This will be covered in the following section of this handbook

Section III.
Sanding, a delicate Operation

The materials you will need for this step are:

A piece of glass, large enough to sand the samples on (approximately 10”X20” will work)
600 grit silicon carbide powder and 400 grit silicon carbide powder
Water

On a piece of glass large enough to sand the samples on, about 10”X12” should suffice, pour a small amount of 400 grit silica sand. Add enough water to make the sand smooth enough to slide the samples across in

a figure-eight formation. The reason to sand in a figure eight is so that the pressure against the surface will remain constant and the sample will be sanded evenly. Continue sanding until the entire surface is smooth, with no saw marks remaining.

Experiment with the consistency. The water tends to dry out of the silicon carbide after a while, so add water as needed.

Sand all sides that were cut. The end pieces only need one side sanded, as this section will only produce one thin section. Sanding with the 400-grit silica sand will be the most time consuming. When the sections are smooth, dispose of the 400-grit silica sand and clean the glass. Using the same procedures, sand each piece with 600-grit silica sand to get an even smoother surface. The surface needs to be very smooth in order to adhere well to the glass slides.

On a side note; the silica sand can be saved by using a catch basin to catch the water used to wash each sample after sanding. Using a bottle of water, wash each piece after sanding. When all the sanding is completed, save the water and grit that washed into the basin. This water can be used the next time sanding needs to be done to wash the samples; also, this water can be evaporated away from the sand and the sand can be recovered. See your lab instructor for more details.

Sand in a "figure 8" formation.

After sanding samples adequately (there will be no saw marks in sections), wash thoroughly in order to remove any grit that may have gotten stuck in between the tiny grains of sand and resin. This can be detected by looking at the sample under a microscope.

Section IV.
The Joys of Epoxy

Gather the following materials for this phase:

- ✓ Epoxy, 90 second
- ✓ Glass specimen microscope slides
- ✓ Razor blade
- ✓ Etching tool

The epoxy used for this step of the procedure is the double barrel epoxy that does not mix until ready to adhere. There are several kinds, however the 90 second drying works adequately. In order to get an appropriate amount of epoxy on the glass slide, it is best to mix the epoxy on another surface, preferably glass, then move it to the slide once thoroughly mixed. This process needs to be done quickly because of the rapid drying of the epoxy, and it is best to mix only enough for a couple slides at a time.

Epoxy a glass slide to each side of the samples that has been sanded. So, for some samples, there will be a glass slide glued to both sides as shown in the following example:

Section IV.

After the samples are glued to the glass and they have had plenty of time to set, use a razor blade to shave all excess epoxy off the backside of the glass. Do not worry about the side where the sample is adhered to, there will be a better opportunity later to clean this side up.

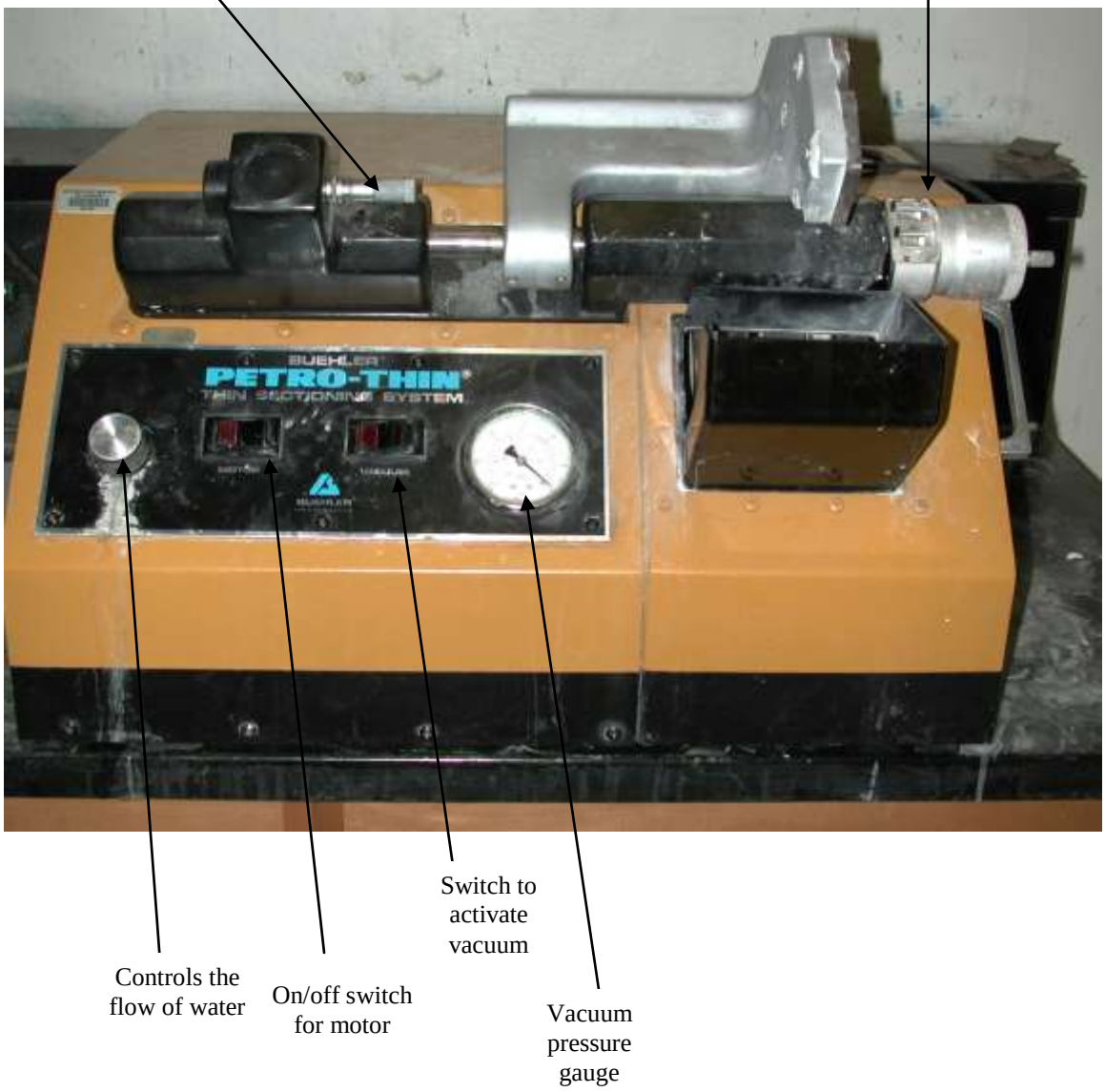
Since the next step is to cut off the excess sample into a thin sample, it will be necessary to transfer the sample number from the sample to the glass slide. This can be done using an etching tool. Simply etch the number of the sample onto one corner of the slide. Be sure to etch both pieces of glass on the samples that two slides are glued to. See the sample below:

The number "4" is etched into the glass slide.

When all samples are marked with a number and the excess epoxy has been removed from the backs of the slides, then the samples are ready to be thin sliced.

Section V.
The Final Cut

The following picture is an example of the type of saw that is used to cut thin sections:



Section V.

This picture shows the saw from inside where the entire cutting process takes place:

Diamond imbedded grinding wheel

Rock cutting diamond blade

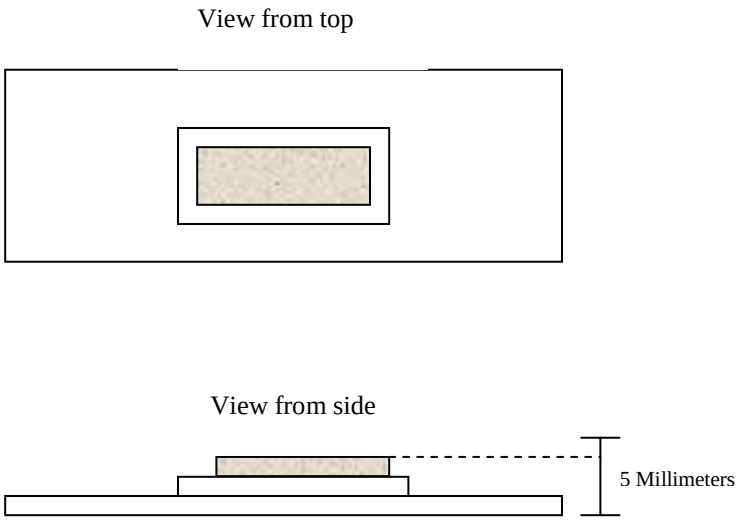
Arm to which the slide will be attached

Section V.

There are several things to point out before using the thin section saw. First, the maintenance items. Check to see that the saw is connected to a source of water. Turn the saw on and set the water dial to spray a healthy amount of water onto the blade, similar to that of the cutting saw used in the very beginning. Next, turn on the vacuum. This is what is going to hold the sample while it is being cut. Set the slide into the swing arm of the saw, as shown:

The vacuum gauge should read –15 to –20 inches of Mercury (Hg). If not, then the suction on the swing arm is not good and should be corrected before going any further. To get better suction, make sure slide is smooth on the side that is to be on the arm. Also, make sure the surface where the slide sets is clean. It will help if the slide has a thin layer of water on it as well.

Second, since the glue can measure several millimeters it will be necessary to set the cutting micrometer to a measurement that will allow for the glue and sample. To do this it is best to set the measurement to at least 5 millimeters, then test on one of the samples. If the section looks too thick, (it should be very thin, showing no depth at all) then perhaps set the micrometer to 4.5 millimeters and so on, until getting the thickness desired.



Finally, it will be necessary to set the micrometer for the grinding wheel. Most of the samples should be about the same thickness, so once the micrometers are set, they should not have to be set again. Set the micrometer on the grinding wheel (the red numbers) to the thickness of the sample desired. This will be between 1.20 and 0.75 millimeters. Set the black numbers to zero by pushing the small black button on the micrometer. Then, move the red numbers to zero. As the black numbers move up, the red numbers move down. Start with a high number on the black scale and move lower as needed. This will be explained later.

Begin by putting the sample on the suction area of the swing arm. Without bringing the arm down, push the arm firmly to the left. Once the arm is to it's furthest left, bring the arm downward toward the saw. This will bring the arm to the correct position to make the cut. This cutting is similar to the cutting done on the first rock saw; gently but firmly, lower the arm down to the saw. When the piece is cut, bring the arm back up. The arm will then spring back over to the right into the correct position for the grinding wheel. Make sure not to let the arm "snap" back.

Begin grinding the sample by bringing the arm down. If the sample doesn't hit the grinding wheel, move the dial of the micrometer so that the

black numbers decrease, thus decreasing the amount of space between the sample and the grinding wheel. Move the dial only 0.02 millimeters at a time, test to see if the sample is hitting the grinding wheel, then repeat if necessary. Once the sample begins to touch the grinding wheel, continue to move the micrometer only 0.02 millimeters until the black number reaches zero. This will be the thickness set at the beginning. Check the sample to see if more grinding is needed. The first sample will be the sample to set the thin sectioning saw, after it is set, not much adjusting will be needed. Try to get the sample thin enough without grinding it completely off. A suggestion would be to use a sample to see just how far the sample can be ground before it is ground off. This will be useful information.

This is what a freshly cut and ground thin section will look like. The smoother and slower the sample is ground, the fewer saw/grinder marks there will be, however, there will always be some that will need to be sanded.

Section V.

Since the thin section left from the saw is very thin, but perhaps not as thin as is useful, 1000 grit silicone carbide powder will be used to sand them to perfection. Using the techniques learned earlier in this process, sand the thin sections very carefully until the sand is transparent under the microscope. It is best to perform this step near a microscope so each sample can be checked frequently.

Good Luck!