

**UVM Cosmogenic Group  
Laboratory Safety Manual**

# **Delehanty Hall Room 108**

## **Rock and Sediment Preparation**

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**Individuals responsible for lab and lab safety**

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The rock preparation laboratory is where field samples are prepared to the specified grain size ready for processing in the mineral separation laboratory. Several different techniques are employed to begin the purification process including washing samples, drying samples, crushing and grinding rocks, sieving sediment and ground rock, and magnetic separation. In this space, we also inventory samples and prepare them for long-term storage in the Quonset hut.

The most important thing to remember when working in the rock preparation lab is to reduce sample cross talk and to clearly maintain sample identity. This is accomplished by working with only one sample at a time and by double checking bag and container labels.

In terms of health and safety, the most important concern in this laboratory is dust control. Dust control is accomplished best by controlling dust at its source and by thorough cleaning (vacuum and wipe down) after each time the lab is used. This is a shared lab. Please respect other users by cleaning up after yourself. **Always vacuum before using compressed air to minimize dust release.**

This manual contains the following chapters:

1. **Safety Considerations and Equipment** including: laboratory access, safety equipment in the lab, laboratory safety training protocol, personnel capability checklist for laboratory procedures
2. **Sample Processing Protocols including:** Sieving to size (wet or dry), washing with water to remove fines, drying sample, magnetic separation as well as special procedures for certain samples.
3. **Laboratory Maintenance and Sample Storage:** How to clean up after yourself and where to keep your samples during processing

## Chapter 1 - Safety Considerations and Equipment

### 1. Lab, supply, and sample access – Room 108

Access to the rock preparation laboratory is restricted to faculty, staff, students, and visiting scientists and students who have been trained specifically as outlined in the safety training protocol below. Keys will be issued on request (and with a deposit paid to the department) to those meeting the training criteria.

Note that the cosmogenic lab sample import permit requires that samples are stored in a locked room. Thus, when you are not working in the lab, it is imperative that the door be closed and locked.

Cosmogenic group supplies for grinding, sieving, and sample curation are located in the red drawers that are secured with cables and master locks (key 3383). When you are done working in the lab for the day, please lock up all equipment so it is not borrowed by others.

### 2. General Laboratory Practice

- a. Personal protective equipment must be worn, specifically a respirator (dust mask), eye protection and hearing protection.
- b. Suitable clothing should be worn, no loose materials that could get caught in machinery
- c. Samples must not be left on the counter except when work is active. Samples should be put away at the end of each work day.
- d. The lab should be cleaned at the end of each work day including vacuuming the crusher and plate grinder and sweeping off the counter as well as cleaning the floor.

### 3. Safety equipment in lab

**Personal Protective Equipment - Should be worn at all times when working with acids.**

**Goggles or safety glasses** – Stored in drawers below the workbench. Must be worn when crushing, grinding, or sieving rock.

**Hearing protection (ear muffs)**- Stored in drawers below the workbench. Must be worn when crushing, grinding, or sieving rock.

**Particle masks** – Stored in drawers below the workbench. Must be worn if crushing, grinding, or sieving rock.

**Lab Coats** – Stored on hooks on the wall next to the rock grinder and crusher.

**Fire Alarm** – Is located in the hall outside the lab near the stairs and should be used for major emergencies including any fire.

**Fire Extinguisher** – Two are located in the lab. Use these only if you are confident in how they work and you have an easy and safe escape path from the lab; otherwise, evacuate and pull the fire alarm immediately.

#### 4. **Safety training protocol**

As soon as is practical, all personnel must complete the following *in person* safety classes. These courses are offered at regular intervals and require pre-registration.

Emergency Response for Laboratory Workers (1.5 hours)

Van Safety Training (3 hours)

Respirator training and fitting

Before using any of the machines, new cosmogenic workers in the lab should review safety protocol including emergency shut down, with Paul. Other workers should review procedures with the departmental technician.

**5. Personnel capability checklist for laboratory procedures**

During training, each person who will be working in the lab needs to complete this list with initials as they master skills and gain knowledge. Only after this list is complete, can a new user work alone in the lab.

NAME: \_\_\_\_\_

<b>Item</b>	<b>Date</b>	<b>Personnel initial</b>	<b>Trainer initial</b>
Understand lab access limitations			
Complete in person lab and van safety courses			
Understand need to keep lab locked and supplies locked in drawers			
Understand the location and use of all personal protective equipment – safety glasses, respirator, hearing protection.			
Understand how to minimize dust release into the lab			
Understand the policy of cleaning up the lab and putting away sample after each day's use			
Understand the importance of wearing proper clothing			
Understand how to operate and clean the jaw crusher including how to disconnect the power			
Understand how to operate and clean the plate grinder including how to disconnect the power			
Understand how to adjust the plate grinder to maximize the grain size you need.			
Understand how to identify when the rock grinder plates are worn and know how to replace them			
Understand how to use the small crusher and grinder for tiny samples.			
Understand how to operate the Ro-Tap, which sieves to use, and how to stack them.			
Understand how to clean sieves			
Understand how to turn on magnetic separator			
Understand what each control on magnetic separator does			
Understand nominal settings for magnetic separator and how to change them to optimize yield			
Understand how to check samples for magnetite			
Understand how to bag, label and store samples			
Understand how to enter sample inventory data into the sample information database			

**6. Monthly self inspection**

UVM mandates that we conduct a monthly self inspection of all laboratories to identify and remediate hazards before they cause accidents and injuries.

On or about the first of each month, **XXXXXXXXXX** will inspect the laboratory and note on the self inspection cards any outstanding issues. She will email her findings to all students, faculty and staff using the rock preparation facility as well as lab supervisor Bierman. We expect that any deficiencies noted by Larsen will be addressed as quickly as is possible.

During the monthly self-inspection, the BICO Badger jaw crusher and the Plate grinder will be lubricated and the vacuum inspected.

Please familiarize your self with the self-inspection sheets. They are hanging by the door of the lab.

## Chapter 2 - Sample processing protocols

The following are sample processing protocols have been designed to yield sample of the correct grain-size for processing in the mineral separation laboratory.

### Overview of Rock Lab Processes

1. Enter samples into the database.
2. Dry samples in the oven if necessary (usually only for sediments)
3. For bedrock samples, break rock into small pieces and then crush and grind rock to the appropriate grain-size.
4. Sieve samples to the appropriate grain-size.
5. Use the magnetic separator to remove the magnetic fraction from sieved sample.

Manuals for the equipment in the lab are placed in plastic folders next to each piece of equipment and are appended to this manual. Please read the manual for each machine before you use that machine.

### Materials and equipment

- Manual crusher for breaking up rock
- Rock or sledge hammer
- Plastic sample bags and markers
- BICO jaw crusher
- BICO pulverizer (plate grinder)
- Sieves
- Ro-Tap
- Magnetic Separator

### Safety

- Eye protection
- Hearing protection
- Particulate mask (respirator)
- Lab coat or tyvek coat

#### 1. Entering samples in the database

Each sample needs to be entered in the on-line cosmolab database before it is processed. Data entry is usually done by the person who collected the sample and includes: sample ID, sample site photographs, sample information including rock type, collector, and GPS location. Scanned field notes and sample sheets also need to be uploaded. This should be done through the cosmolab web site: [uvm.edu/cosmolab](http://uvm.edu/cosmolab).

2. **Initial sample preparation** – To maintain sample integrity and avoid confusion between samples, it is imperative that you work with only one sample at a time.

NOTE: Whenever you are working with the mortar, the jaw crusher, and the plate grinder, safety glasses or goggles, as well as hearing and respiratory protection are mandatory.

### a. Rock and clast samples

#### For Bedrock Samples –

- Wire brush sample to remove lichen and adhered material.
- To avoid contaminating samples with foreign rocks or pieces of rock from other samples, make sure to clean the manual crusher with a vacuum before adding samples. Work in an area free of other rock material. Sweep and vacuum between samples.
- Place rock samples into the manual crusher (steel mortar and pestle) and break the sample into approximately 1 x 3 inch fragments.
- Place rock fragments into a plastic sample bag and **label the bag with the sample name.**

**After breaking up bedrock samples or when reducing the size of sediment samples.**

#### Jaw Crusher

- The crusher is turned on by first making sure the power switch is on and then pulling out the red kill button.
- First, check that the crusher has been cleaned. If not, clean by vacuuming. If this is your first rock to crush, blow out the crusher with compressed air. Run it for 10 seconds and blow it out again. Vacuum up any stray bits of rock.
- Rock and clast samples must first be crushed using the steel mortar and pestle so that fragments are small enough to fit in the jaw crusher.
- Pieces are then jaw crushed.
- Make sure there is a pan under the jaw crusher to catch falling pieces of rock.
- Only after the jaw crusher is running, should material be fed into the feed chute. If the machine jams, immediately hit the red kill button and pull the power lever to the off position BEFORE clearing the jam by removing the safety shield.
- **IMPORTANT:** never operate the crusher without the safety shield in place and never place a rock in the crusher when it is not running. These actions can be dangerous as rocks could be ejected suddenly and the machine can be broken if rocks are placed between the jaws without the machine running. ALWAYS push in the kill button and pull the power lever to off before cleaning or servicing the machine.



- After each use, remove the safety shield, vacuum all parts of the crusher paying special attention to the area below and behind, and only then blow out the crusher with compressed air, followed by vacuuming up any rock fragments.

### **Pulverizer (Plate grinder)**

After jaw crushing, the now smaller fragments are fed into the plate grinder.

- Before grinding any samples, clean the plate grinder. Do this by throwing the power lever to off then by opening the plate compartment, separating the plates, vacuuming all areas, and only then blowing out the machine thoroughly with compressed air. Make sure to clean completely the compartment where the sample tray resides. Use the vacuum to remove all loose rock and dust liberated by the compressed air.. Close and secure the plate compartment. Only then, flip the power lever to on.
- Turn the plate grinder on by pulling out the red knob.
- Make sure the sample tray is inserted.
- Make sure the large wooden doors are closed to contain as much dust as possible. Run the plate grinder with the doors closed.
- **You should grind and sieve a small amount of sample through and discard it to clean and pre-contaminate the plate grinder and to check that the bulk of the sample is in the 250 to 800 micron size fraction.**
- Plate spacing should be adjusted so that the most of the sample is ground to the 250-850 micron grain size. When in doubt, adjust the plates to favor the larger rather than smaller fraction. The larger fraction can always be reground.
- To avoid injury, keep your hands and fingers away from all moving parts
- Feed sample material slowly by hand into the plate grinder. If the grinder is laboring, slow down the feed rate. If the grinder stalls, hit the red kill button immediately, throw the power switch to off, open the grinder, and clear the jam.
- When you are finished grinding a sample, push the kill button in, throw the power supply lever to off, and clean the grinder completely between every sample and at the end of the day. Vacuum first and then use compressed air followed by a second vacuuming. Leave the grinder clean. Check the plates for deep pitting and excessive wear. Report worn plates to Paul. Worn plates will result in the coarse and fine fraction exceeding the medium sand fraction and will cause excessive jamming and sparking. Rates of plate wear vary greatly with sample type and size. It may take only several dozen unweathered quartz-rich rocks of kg size to wear out a set of plates.

### **b. Sieving**

- Sieves, bottom pan and lid are stored in the locked drawers; filler sieves are on the shelves above the Ro-Tap.
- Use the soft, small wire brushes to gently clean the sieves brushing both sides to loosen as many embedded grains as possible.

- Use the stainless 250 and 850 micron sieves and always clean them again before use. Place a pan at the bottom of the stack, then the 250 micron sieve, then the 850 micron sieve, then the filler stack.
- Fill the 850 sieve about 2/3 full. Place the filler sieves on top and then a lid on top of the stack.
- Place the stack on the shaker and run for one minute. Remove the filler sieves and separate the 850 and 250 micron sieves carefully to avoid spilling.
- Place the sample in three labeled bags (<250 micron, 250-850 micron, and > 850 micron). Place these bags in a larger bag labeled with the sample name.
- The bags should have sample name and grain size written with a sharpie on the outside.
- Clean sieves between each sample using the small wire brushes stored in our locked drawers. Don't worry that a few grains are left jammed in the sieves. They won't come out.
- When you have completed sieving, vacuum the closet in which the sieve shaker resides and place the cosmolab sieves back in the locked drawers.

### c. Magnetic Separation

The goal here is get the cleanest quartz separate possible without losing large amounts of quartz. There are several settings that can be changed to optimize your split. These settings will vary from sample to sample. Experiment with the settings by using the small amount of sample used to decontaminate the machine.

**Magnet control** (up and down arrows) - The green is the set point; the red is where the magnet is running. Note that over time the magnet may sag and the deflector may need to be adjusted.

**Roll Speed control** (up and down arrows) – Start at 21 and bring up or down for cleanest split.

**Vibrator control** – off when sample loading, on when running sample; turn up to get reasonable flow.

**Gate control** – open sufficiently to allow sample to pass.

**Deflector** – adjust to get the split you need. This is the most critical adjustment and must be changed as other settings are changed.

Use the small ceramic magnet to determine if there is any magnetite in the sample. If there is significant magnetite in the sample, use a low magnet control setting at first (1.0). This setting will allow you to strip magnetite so it does not plug the machine.

\*\*\*\*Blow out the unit with compressed air to clean. **PAY SPECIAL ATTENTION** to the black brush it will clog with sediment and if it is not cleaned between **EVERY** sample will result in sample cross talk.\*\*\*\*\*

**You should run a small amount of sample through and DISCARD it to clean and pre-contaminate the machine. This pre-sample can be used to optimize machine settings.**

Place the non-magnetic and magnetic fractions into separate, labeled sample bags. Save and file away the magnetic fraction with the other sample remainders.

At the end of the day, please vacuum the floor in front of the magnetic separator. It usually accumulates a large number of sample grains.

Samples are now ready for processing in the mineral separation laboratory. The non magnetic, 250-850 fraction should be carried up to the mineral separation lab. The remaining sample should be stored in buckets or coolers until ready to be archived in the Quonset Hut.

### **3. Special Procedures**

Some samples require different handling than most. Below are some additional steps that might be required of your sample depending on what type of sample it is.

Meteorite split – All sediment samples for cosmogenic analysis should have a small aliquot (~50 grams) removed and reserved for meteoric  $^{10}\text{Be}$  analysis before any additional work is done to the sample. This aliquot should be stored DRY in a 3 by 4 inch bag labeled with the sample identification as well as the words “meteorite split”.

SPEX powdering – hope LUKE can write this? Samples intended for either whole rock chemical analysis or meteoric  $^{10}\text{Be}$  analysis need to be powdered using the spex mill.

Wet sieving – hope MATT will write Extracting quartz from soil profile samples is best done with wet sieving in the rock room sink.

Small samples – There are miniature versions of both the jaw crusher and plate grinder for use with very small samples. There are stored in the grey cabinet under the window and used on the grey rolling plastic cart. These units should be used in front of their larger cousins with a door open to maximize draw out of the room and minimize dust accumulation. For safety sake, these units should not be used sitting on the floor.

## **Chapter 3 - Laboratory Maintenance and Sample Storage:**

This is a shared lab that has the potential to generate large amounts of dust so cleanliness and attention to protocol is important both as a courtesy as well as to prevent cross contamination of samples.

### **a. Maintenance**

1. Vacuum cleaner – Before using the lab, open the center closet and check that the vacuum cleaner is hooked up to the copper piping and that the all valves with open ends are shut. If the valves are not shut, dust will be diverted into the room and vacuum efficiency will be reduced. Open the vacuum and check that it is not full and that the filter has not been

damaged. There should not be any significant amount of dust leaving the vacuum or in the closet in which the vacuum is stored (the shatter box, because the grinding containers are sealed with gaskets, generates almost no dust). If you see dust in the vacuum closet, do not work; rather, find either Paul or Gaby and have the problem addressed before using any dust generating equipment. If the vacuum is full or there is any filter damage, contact XX or YY immediately (656-xxxx) and do not use any dust generating equipment in the rock room until the problem has been resolved.

2. Trap cleaning -- hope GABY will write? The sink in the rock room has been equipped with a sediment trap to prevent the clogging of pipes. However, the trap must be maintained by cleaning. The trap may need to be cleaned daily if large samples are washed or a large number of smaller samples are washed.

3. Grinder and Jaw crusher – Both the grinder and jaw crusher have lubrication points. During the monthly self-inspection, both of these machines will be lubricated using a grease gun.

b. Sample storage – Samples need to be stored in a way that does not impact other users of the lab. Samples should not be stored on the counter or on the floor. There are a series of drawers under the counter that can be used to store samples and should be labeled with the user's name. There are shelves in the adjacent hallway that can also be used to store samples. After sample processing is complete, cosmolab-associated samples should be removed from the rock room, fully inventoried, and taken to the Quonset hut for long-term storage.