Smear Slides

A smear slide is a thin layer of unconsolidated sediment embedded on a glass slide for petrographic microscopic examination. Smear slides are a powerful method for rapidly evaluating tiny quantities of sediment (mineralogy, provenance, form, size) as the basis for sediment classification, and for ascertaining the presence of microfossils. With experience, smear slides provide surprisingly accurate percentage data useful for recognizing trends in cored sequences. Tephras and ash falls are easily identified.

Samples for smear slides should be taken at regular intervals (e.g. 10-50 cm) as part of the routine examination and description of cores, and from any anomalous layers. Smear slides can also be used to examine treated sediment to determine the efficacy of the procedures being used. Treatments may also be used to isolate particular sediment fractions (e.g. sieving for fine fractions) for examination in smear slides.

For information on the identification of smear slide components, see the Smear Slide Manual (http://lrc.geo.umn.edu/smears/smear.html); for a quick-start guide to basic smear slide description, see smear slide basics (http://lrc.geo.umn.edu/smear_slide_basics.pdf).

Procedure:

1. Label a standard (1"x3") glass slide with information about the sediment sample. This should include the core code (e.g. "GNP-JOS05-1A-3B-1" for the third Bolivia drive collected from the first core at site A in Josephine Lake in 2005), sample depth in cm from the top of the core, reason for slide (coarse layer, tephra?, indurated nodule, routine), color (white lamination, black fragments), and any special treatment (e.g. "HCl" if pre-treated with acid to remove carbonate, “CF” for coarse fraction). Bear in mind when choosing label materials that adhesive properties may be lost over time. Standard marking pens (e.g. Sharpie) may also rub off easily. The most permanent label is made using a diamond tipped pencil to scratch the label on the end of the slide.

2. Turn on the hot plate to the lowest setting, or slide warmer to medium heat. Place a bottle of Norland optical cement (the mounting medium) upside-down in a 100-mL beaker on the hot plate. This sends the bubbles to the bottom of the bottle (away from the spout) and makes the cement less viscous.

3. Clean the slide by wiping with water or alcohol on a lint-free tissue (e.g. Kim-Wipe). It is particularly important to remove any glass shards as these may be mistaken for volcanic ash when viewed under the microscope.

4. Place a very small amount of sediment (e.g. toothpick tip) on the slide. Although it is tempting to use a larger amount of sediment, individual components will be indistinguishable under the microscope if the sample is too crowded.

5. Add a drop or two of deionized water or alcohol to the slide. (You may find it easier to add the liquid *before* the sediment.) Choose water if the sediment is high in organics (alcohol will dehydrate organic matter) and alcohol if the sediment contains evaporites or other highly soluble minerals. Using a toothpick, tiny spatula, or glass rod, disperse and spread sediment on the slide. Fresh, wet sediment works best. Dry sediment may need to be moistened and soften before it can be smeared, and it may also be necessary to break up lumps with the danger of damaging any microfossils. Try to make a uniform, thin coating approximately the same size as the cover slip. If this is your first time, make a few slides and then inspect them so that you can adjust the amount of sediment you're using and the thickness of the mount. Ideally grains will be more or less in a single layer and close together. Clumpy organics will make a more sparse slide than fine clays and silts, given the same volume of material.

6. Place the slide on the slide warmer or hot-plate and allow it to dry (2-5 minutes). The slide must be completely dry before adding the optical cement. The cement is not miscible with water and if the sediment is still wet, the cement will form blobs and crazed patterns instead of a uniform, isotropic sheet.

7. Drip 2-3 drops of mounting medium onto the slide (or on the cover glass). Do not touch the dropper to the slide, to avoid contaminating the mounting medium. Bubbles are almost unavoidable in the first slide made after removing the cap from the bottle, but should be minimal thereafter. For this reason it's best to wait until you have several slides ready for medium and mounting them all in sequence before recapping the bottle. Because sand-sized grains create more void space between the slide and the cover slip than organics and silt/clay-sized grains, use more drops of Norland (4-5 or more drops).

8. Carefully place the cover slip on the slide. If you have coarse-grained sediment you may need to use more mounting medium to fill the space between the slide and cover-slip. You should try to anticipate this in step 7 above, but it is possible to introduce additional mounting medium at this stage if necessary. This can be done by carefully dropping medium at the edge of the cover slip where capillary action will draw the medium under the cover slip.

9. Place the slide under ultraviolet light to cure (1-2 minutes).

UV light sources: LacCore uses cheap hardware-store "black light" bulbs in fluorescent desk lamp fixtures. These bulbs emit the right wavelengths to cure the Norland optical cement (see below), and are an order of magnitude cheaper than scientific UV light fixtures. In the most low-tech situation, smear slides mounted with Norland may also be cured on a windowsill or other location with strong sunlight.

Mounting media: a variety of types are available depending upon the refraction index needed. Water or glycerin may suffice for microfossil checks. Petrography requires a medium with RI = 1.55-1.56 (splitting quartz and feldspars). The most common are Canada Balsam and synthetic

Canada Balsam available from large scientific suppliers. They require long curing times (several days in drying oven at 50º+ C).

LRC/LacCore uses Norland Optical Cement 61, a clear epoxy which cures without heat, within a few minutes under ultraviolet light. This material is available in a number of configurations from www.norlandprod.com, or by the 1 oz. bottle from the LRC Core Lab.

As with glass slide shards, tiny fragments of toothpick, clothing threads, and other exotics may get into the mount. Toothpick is the most puzzling: fibers appear as bright, elongate, multi-colored strands that can be mistaken for odd-shaped micas or other igneous/metamorphic minerals. Either learn to recognize and discount these, or use metal tools (pins, spatulas) instead of toothpicks. Some toothpicks shed more than others, so changing brands may help.

Materials:
spatula
Norland cement
Wash/dropper bottles containing alcohol, acetone, or water
glass slides (standard 1"x3")
Kim-Wipes
cover slips
toothpicks
labels

Equipment:
petrographic microscope
binocular microscope
hot-plate/slide warmer
diamond tipped pen for engraving
ultraviolet light
small sieve for coarse fraction (CF)

Safety:
As inocuous as smear slide preparation may seem, there are still opportunities to hurt yourself – in this case, with broken glass. Microscope slides and cover slips often come stuck together, and if they break while you're trying to pry them apart, your fingers can get badly cut. Don't force them; try gently tapping the slides' edges on a countertop, or using a tool or workgloves to pull gently on an overhanging edge of one of the two slides. A slide dispenser can help separate slides, but it too can choke trying to overcome the attractive forces between two very flat pieces of glass. If slides are really stuck together, discard them.

Norland Optical Cement may be irritating to the skin. If you are sensitive, wear lab gloves or finger cots while making smear slides. Wash your hands frequently, and especially before eating or drinking.