OSL Sampling Sheet

The Optically stimulated luminescence (OSL) technique dates the last time sediments were exposed to sunlight, which zeros the luminescent signal. The luminescence signal grows with time due to exposure to radioactive isotopes within the sediment and incoming cosmic rays. The age is calculated by dividing the dose the sample received by the dose rate of its depositional environments

Needed Equipment

1. Opaque metal tubes with a styrofoam plug in the sharpened end
2. Hammer to pound tube into outcrop (2 lb sledge works best), hand trowel to excavate a sample for dose-rate
3. Ziplock bags to collect dose-rate samples (quart-sized good for DR sample, gallon good for packing the tube and DR samples together)
4. film container to collect water content (or other airtight container)
5. tape measure, eye height or good eye to get depth below landform surface

OSL sampling guidelines:

1. Samples must be collected in a light-proof container. I usually use a metal pipe that is pounded into the outcrop. I use 1.5" (3.8 cm) stainless steel electrical conduit cut to 8" (20 cm) pieces. Do not use PVC, it is too thick and shakes too much during pounding which will shake and mix the exposed sediment into the target sediment. Additionally, the use of a styrofoam plug in the end pounded into the sediment will keep the sediment packed during pounding and will further prevent mixing of the sediment from the surface of the exposure (near-zero age) with the target sand at depth.

2. Use a 1.5-3 inch (3-8 cm) diameter tube, so we will have enough sediment to work with in the lab. Good length is ~ 8 inches (20-25 cm).

3. We can date very fine sand (quartz) (90-150 μm typically, 63-250 maximum range) -- deposits that look silty usually have enough of the grain-size needed to date. The deposit or sand lens should be mostly the correct grain size. Very coarse sand may not have enough fine sand to date. If uncertain, bring sieve into field to check.

4. OSL works best for sediments that are >100's yrs old, sediments <100 yrs old commonly do not have enough signal to date and can be dominated by residual signals from partial bleaching (non-complete zeroing of the luminescence signal).

5. Use geologic/sedimentologic knowledge of the deposit to sample well bleached sediments (exposed to sunlight before deposition). For example, well sorted rippled

sands are good, avoid debris flow deposits. Eolian works best, but fluvial, lacustrine and hillslope deposits may also work. It is best to see primary sedimentary structures.

6. It is best to sample from thick deposits/lenses (at least 30 cm thick). Dose rate will vary with heterogeneity of deposit. **Avoid sampling** near widely different grain-size variations (i.e. clay layer in sand lens)

7. **Avoid sampling** <1m below the land surface – due to difficulties in determining cosmic dose rate (and also for reasons below).

8. **Avoid bioturbated sediments, soils (modern and paleosols), cracks in the sediment and samples immediately above an unconformity**. It's best to only sample sediments where you can see primary sedimentary structures. Bioturbation will cause a mixed signal and will make it much harder to get a real age from the sediments. Soils have similar problems with mixing and bioturbation and changes in dose rate due to additions or losses of minerals. Sediments immediately above an unconformity may contain material eroded from the underlying deposit that was deposited without exposure to sunlight.

9. Make sure the tube is packed tight -- any shaking of the sediments in the tube will cause the outer sediments, exposed to light during sampling, to be mixed with the non-exposed sediments. If there is extra space at the end of the tube, pack with something to make sure the sediments don't move and mix. Don't pack empty ends with sand! as we won't know that this was added to the tube and was not part of the sample.

10. Give samples good individual labels. We get too many labeled OSL 1, OSL 2 --- these can get confused in the lab.

When in the field, you will need to collect from each sample location:

1. Tube filled with sediment, ends capped or taped shut.

2. A sample for the dose-rate of the deposit from a 30-cm region surrounding the sample tube (put in a plastic bag). It is most easily collected by digging out the sample tube. It is best to sample from homogenous sediments (i.e. thick sand layers). Remember that the environment affecting the dose rate constitutes a 3D sphere surrounding your sample tube similar in dimensions to a beach ball - so sample accordingly. This means including a representative sampling of the sediment surrounding and behind the sample tube. In most cases half of the sphere is missing because samples are collected from an outcrop.

3. A sample for water content -- this needs to be in an air-tight container, like a film canister. Note on the sample submittal sheet if the moisture sample you collected is representative of the burial history of the sample (ie, has the outcrop surface been exposed to drying and therefore the long-term moisture content was higher?). Collect moisture content from the same grain-size as the sample and from a deep into the outcrop surface as possible to avoid surface drying effects.

4. Depth of burial for the cosmic contribution (if there is recent erosion or excavation estimate the pre-erosion burial depth). If the sample was collected from an accumulating landsurface and there are stable land-surface horizons in the stratigraphy (soils), note these also and the burial depth below those past land surfaces -- especially if they we long-lived.

5. The lattitude, longitude and elevation of the sample (for cosmic contribution).

6. A USU Sample Submittal sheet with the required information filled out -- fill this out in the field. (see webpage for sheet http://www.usu.edu/geo/luminlab/)

Good luck!

Tammy Rittenour
Utah State University
USU Luminescence Lab
http://www.usu.edu/geo/luminlab/

Mail sample to: (using ground transport if possible to avoid airport scanning)

USU Luminescence Lab
1770 North Research Parkway, Suite 123
North Logan, UT 84341