

EarthScope Student Geochronology Research and Training Program Laboratory Overview
Utah State University Luminescence Geochronology Lab

Tammy Rittenour, Lab Director

Lab Description

The USU Luminescence Lab is equipped with two automated TL/OSL dating systems (Model Risø TL/OSL-DA-20A/B), the latest generation luminescence reader, with a laser-driven single-grain attachment that allows for the dating of individual sand grains. The lab has all the facilities needed for optically stimulated luminescence (OSL) analysis including a dedicated sample preparation lab under constant amber safe-light conditions, which includes a HF-certified fume hood, centrifuge, drying oven, de-ionized water system, full set of sieves, and the required acids and heavy liquids for sample processing. The outer lab (in the light) houses a new PC workstation with the OSL analysis software provided by Risø National Labs and improved/updated data analysis software created as macros within excel files. Dose rate analyses are routinely conducted through external ICP-MS analysis.

The lab has the capability to analyze quartz and feldspar sand using common analysis procedures such as the single-aliquot regenerative-dose (SAR) protocol on both quartz (blue-light stimulated OSL) and feldspar (infrared stimulated luminescence, IRSL) and more specialized techniques such as the post-IR-IRSL, tt-OSL, isothermal-TL (thermoluminescence) and traditional TL dating and variations thereof.

Expected Time Frame

Students are recommended to visit the USU Luminescence Lab during the annual two-week OSL Short Course, offered in early June each year. The USU OSL dating short course provides students a solid background on luminescence dating techniques, applications, laboratory processing, field sampling methods, final data analysis, and age and error calculation. The course focuses on the latest optically stimulated luminescence (OSL) dating techniques and the single-aliquot regenerative-dose (SAR) procedure. During the two-week short course students will fully process up to 10 of their own samples and bring two of these samples to the point of initial data collection and preliminary age determination.

Students unable to attend the OSL Short Course will need to arrange a separate time to visit the lab. Students should plan on spending a minimum of 5 business days at the lab to process their samples, longer if more than 10 samples are processed. Students will be expected to conduct the physical processing of their samples (sieving, splitting, weighing), dissolution in weak acids (10% HCl, bleach, dispersant) and heavy liquid separation (non-toxic sodium polytungstate). Lab staff will treat samples with concentrated HF acid, conduct routine loading of samples after the student leaves, analyze all results and produce final age reports.

The basic steps students will learn and perform at the USU Luminescence Lab include:

- Sampling strategies and methods, if attend the OSL Short Course - otherwise students will be instructed on proper sample-collection prior to arrival
- Proper lab protocols for cleanliness, chemical handling and general procedures in the dark lab
- Collection and measurement of water content
- Preparation of samples for dose-rate analysis
- Physical processing of samples via wet sieving
- Removal of organics, clays and carbonates
- Heavy mineral separation
- In the OSL Short Course students will learn:
 - the theory and physics behind luminescence dating methods
 - production of equivalent doses and ages using the SAR protocol and calculation of sample dose rate
 - the features of and operation of the Risø luminescence reader and software
 - potential sources of error and problems in OSL dating
 - Importantly students will have the benefit of first hand production of their ages and will learn a valuable skill set of lab and data analysis procedures

Costs for OSL Analysis and OSL Short Course

Students should budget \$1000 for the two-week OSL Short Course (includes on-campus apartment housing) for training in laboratory procedures and theory and principles behind luminescence dating during the lecture portion of the course. Costs for sample analysis are \$400/sample for small aliquot OSL/IRSL analysis of quartz and feldspar sand and \$900/single-grain analysis of quartz sand. These prices are reduced from the standard collaborative rates of \$700 and \$1500. Students should contact the lab first prior to sample collection to ensure collect sample collection procedures and for advise on the most suitable samples for analysis.

Preparation for Visit

Students should have collected their OSL sample tubes, samples for dose-rate and water content and filled out the sample submittal sheets (see <http://www.usu.edu/geo/luminlab/>) prior to arriving at the lab. Prior to sample collection, students should have discussed the most suitable target sediments in their field area for sampling and have received instruction on sample collection. Appointments for visiting the lab should be made at least one month in advance. It is highly recommended that students attend the USU OSL Short Course in early June and should contact the lab regarding interest in this short course 4-6 months in advance, as space fills up fast. Note that OSL analysis is quite time intensive and final results typically are available 9-12 months after samples are brought into the lab.

Relevant Laboratory Staff

The USU Luminescence Lab is directed by Dr. Tammy Rittenour (tammy.rittenour@usu.edu) and managed by Michelle Summa-Nelson (michelle.summa@usu.edu). Laboratory technicians will assist visiting students with sample processing and Dr. Rittenour or other Lab staff will perform the HF-dissolution steps.

Data Processing and Interpretation

Visiting students will primarily be in charge of the processing of their samples and purification down to quartz and/or k-spar separates. While students will learn steps involved in data analysis and age calculation during the OSL Short Course, the lab manager and director will conduct all data analysis and age calculations and produce final reports for the students. Preliminary reports and updates on the preliminary age results will be supplied to the student upon request.

Expected Lab Availability

Students are highly recommended to attend the two-week USU OSL Short Course in early June and should contact the lab regarding interest in this short course 4-6 months in advance, as space fills up fast. Students with EarthScope awards will be given priority in the registration for the short course. Following attendance of the short course students are welcome to return to the lab to process additional samples. Students should contact the lab at least one month in advance prior to visiting the lab in order to schedule a time when lab staff will be available to help with sampling processing.