

### Elementary Scanning Electron Microscopy

Instructor: Ken Severin, kpseverin@alaska.edu

Office 324 Reichardt, X5821

SEM Lab: 162 Reichardt, X2706

Office hours by appointment. Please try email to set one up. I can often be found in the probe lab, 156 Reichardt, X5820

Phone: 907-978-6369, calls are OK between 9am and 11pm. Really.

Assistant: Dierdre LaBounty (djlabounty@alaska.edu)

Students completing this class will have become acquainted with the basic theory and operation of a scanning electron microscope and have a rudimentary understanding of sample preparation for scanning electron microscopy. Students will learn to operate the Advanced Instrumentation Laboratory's Quanta 200 environmental scanning electron microscope (ESEM), to obtain digital images with the Iridium Digital Imaging System, and to use the SEM's Energy Dispersive X-ray spectrometer for qualitative elemental analysis. My hope is that students will learn how scanning electron microscopy can (or can't!) be applied to their own interests. I do not intend for the course to be all-encompassing, It is up to you to get as much out of the class as you want.

The lecture portion class will consist of three two-hour lectures held during the first part of the semester. There will be three three-hour laboratory sessions, each session slightly after the lecture of the week. For the rest of the semester students are free to work on project(s) of their own choice. At the end of the semester each student will give a 10 minute presentation (and a poster for those in GEOS 628) to the class.

Lectures: Monday evenings, 233 Reichardt 6-8 PM.

LABS: Meet in Room 162 Reichardt and will be scheduled at the first lecture.

Reading material consists of articles gleaned from several sources; there are many "intro to SEM" texts, a few are mentioned in the handouts.

#### Grading is Pass/Fail Only. To pass you must:

- 1) Show evidence of passing the UAF Lab Safety Quiz (**or equivalent – just send me an email saying "I have completed XXX" - if something bad happens we can show that you have adequate awareness training**) <http://www.uaf.edu/safety/training/required-lab-worker-train/> - Look at the "UAF Laboratory Safety" powerpoint and take the associated Quiz.
- 2) Attend all three lectures and both final presentation sessions
- 3) Attend all three labs (not necessarily the one you signed up for)
- 4) Turn in all laboratory assignments **on time**.
- 5) Give your final talk (and poster for GEOS 628)

There will be no make-up lecture or laboratory sessions. Late assignments will not be accepted. Working together to obtain information is encouraged, but the work you turn in, and your project, must be your own. If you wish to collaborate on your final project it must be cleared with me in writing no later than March 13.

**Schedule:**

Lecture 1 (January 25) - Lab Scheduling, Lab Safety, and SEM Overview

Lecture 2 (February 1) - Selecting appropriate operating conditions, sample preparation, ESEM

Lecture 3 (February 8) - Qualitative elemental analysis, digital images and image processing

Lab 1 to be held before Lecture 2- Turning on the SEM, changing samples, getting an image  
**(Lab Assignment Due Feb. 8)**

Lab 2 to be held between Lectures 2 and 3 - Sample preparation, Critical Point Drying **(Lab Assignment Due Feb. 15)**

Lab 3 to be held after Lecture 3 - X-ray detection, optimizing operating conditions **(Lab Assignment Due Feb. 22)**

Talks will be 10 minutes **MAXIMUM** and will be critiqued by the other members of the class as well as interested outsiders. Posters (for GEOS 628) and the first set of talks will be presented **April 25**; the second set of talks will be **May 2**. Class members are expected to attend all talks.

It takes most folks about 10-20 hours on the SEM to become fairly competent, and some 100+ hours to become somewhat expert. Practice is the key. **You do not need to be an expert to successfully complete the class!** Successful completion of the course includes attending all lab sessions and completing the lab assignments, as well as presenting a short talk on data gathered in an independent project. Projects need not be complex or even scientific (using the SEM artistically is OK too), but must emphasize the use of the SEM. Students enrolled in GEOS 628 will also present a single panel (maximum 24" X 41" - the point here is two feet of whatever width paper the plotter has) poster. Poster printing information is available at <http://www.uaf.edu/geology/facilities/poster-printing/> - don't wait until the last minute or you will be paying big bucks at Dateline or Kinkos (but then you can make it as big as you want).

The emphasis of your project should be less on the "scientific meaning" of the project and more on "how scanning electron microscopy makes this project possible." An example might be "I looked at four pumice samples and was able to see that the vesicles were different sizes. This is how I had to prep the samples, operate the machine, and the SEM let me see things I couldn't otherwise see." The comments about what the vesicle size means in term of volcano evolution, while interesting, are not necessary for this class. Feel free to use the data gathered in this class for other **non-commercial** projects you may have. **If you have any thoughts about using the SEM commercially, contact me first so no one gets in trouble with the University.**

Students will conduct themselves in accordance with the "Student Code of Conduct" as put forward in the applicable University of Alaska Fairbanks Catalog.

**Disabilities Services:** The Office of Disability Services implements the Americans with Disabilities Act (ADA), and insures that UAF students have equal access to the campus and course materials. The assistants and I will work with the Office of Disabilities Services (203 WHIT, 474-7043) to provide reasonable accommodation to students with disabilities.

This syllabus is a contract between you as a student and me as the instructor and it cannot be changed after the first lecture. If you do not wish to be governed by it then do not take the class.