

## Spring 2018 Geoscience 777: SEM-Electron Microprobe Analysis

The purpose of this course is to provide the theoretical background to permit the intelligent use of the scanning electron microscope (SEM) and the electron probe microanalyzer (EPMA) (also called electron microprobe) for scientific research. To the extent feasible, students will get hands-on experience with the Hitachi S3400 SEM and the CAMECA electron probes in the course of lab exercises. Full training for independent use of these instruments in an individual's research is arranged at the time when her/his samples are ready and he/she is ready to begin a regular schedule of instrument use. ("If you don't use it, you lose it" is very true for instrument instruction—particularly for the electron probe.)

I teach this class differently today compared to how I did it 22 years ago. I want you to study the lecture notes BEFORE you come to class. All class lecture notes are available in advance as a series of PowerPoint slides on the website <[www.geology.wisc.edu/~johnf/g777](http://www.geology.wisc.edu/~johnf/g777)> Each student is responsible for carefully reading this material prior to the class, and bringing questions (e.g. difficulties in understanding it, and/or implications/applications of it) to class. It has been shown that you learn more that way. Ask questions!

On occasion, a paper or series of short articles may be assigned to all students as part of the required material (such as the ones on the DTSA software during weeks 5-7).

There will be quizzes each week on the assigned materials: 1-2 questions from the assigned powerpoint/s for the week, and 3-4 questions from previous material. This helps both you (you stay up-to-date) and me (I quickly see if there are difficulties with particular topics.) There will be two lab practical exams (on SEM and then on EPMA) instead of midterm and final exams.

Research paper: each student is responsible for a short research paper ( $\geq 3$  pages), on a mutually agreeable topic, that focuses upon using the SEM/EDS/EPMA for your own research, that covers procedures used, sources of problems/errors, why or why not other techniques are used, and how results are evaluated.

Research paper topic must be turned in by March 6<sup>th</sup>. First draft due April 3<sup>rd</sup> (after Spring Break). Last draft due April 24<sup>th</sup>. There should be references cited, in a standard format (pick your favorite journal's format).

Textbook: There is none required. Several standard references are listed at the end and are on reserve in the geology library.

Class meetings will be ~100 minutes per week (with a 10 minute break), with a weekly problem set assigned to accompany major topics, and 2 hour lab sessions with SEM/electron probe to demonstrate key parts of the theory and application of SEM and EPMA.

Grading: The final grade will be based upon  
(1) weekly problem sets and lab exercises (40%)  
(2) weekly quizzes (25%)

(3) lab practical exams (25%)

(4) Assigned research paper (10%)

Assignment of grades will follow the general 90-100%=A, 80-90%=B, with the 'border regions' being AB, etc.

Instructor: John Fournelle, either A262 or 306 or 306A or 312, Cell 438-7480 (8AM-9PM).  
Formal "office hours" 11AM-noon, Monday. I am around a lot and additional times can be arranged. If you cannot find me, I may be elsewhere in Weeks Hall and available by calling my cell phone. Don't be shy in calling me!

Email: johnf@geology.wisc.edu

Class listserv: please use this to communicate questions you have! There is no such thing as a dumb question! Something you have some confusion about may well be stumping others to, so we all can learn. The address to send questions (and comments etc to the whole class) to is <geosci777-1-s18@lists.wisc.edu>

Reference books: (on reserve in the Geology Library)

*Scanning Electron Microscopy and X-Ray Microanalysis (Third Edition)* 2003, by Joseph Goldstein, Dale E. Newbury, David C. Joy, Charles E. Lyman, Patrick Echlin, Eric Lifshin, Linda Sawyer and Joseph Michael. Plenum Press, 689 pp + CD. Hardback.

\*\*2<sup>nd</sup> Edition is available on Amazon for under \$15. A bargain if you move fast! Better than the 3<sup>rd</sup> edition in some ways.

*Electron Microprobe Analysis and Scanning Electron Microscopy in Geology*, 1996, by S.J.B. Reed. Cambridge University Press. 201 pp.

*Electron Microprobe Analysis. Second Edition.* 1993, by S.J.B. Reed. Cambridge University Press. 326 pp.

*Cathodoluminescence of Geological Materials.* 1998, by D.J. Marshall. Allen & Unwin, 146 pp.

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