Spring 2012 Geoscience 777: Electron Microprobe Analysis

The purpose of this course is to provide the theoretical background to permit the intelligent use of the electron probe (EP), also known as microprobe (EMP) and scanning electron microscope (SEM) for scientific research. To the extent feasible, students will get hands-on experience with the Hitachi S3400 SEM and the Cameca SX51 electron probe 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 true for electron probe.

I teach this class differently. I require 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.geoscience.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 THIS WAY.

Weekly class sessions will focus the material in the slides, together with discussions of relevant papers. Each student will be responsible for leading at least one discussion of a substantial paper relevant to the material.

There will be quizzes each week on the assigned materials: 1-2 questions from the assigned paper, 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.

Textbook: optional. If you desire and can afford it, the revised 3rd edition of Goldstein et al's ***Scanning Electron Microscopy and X-ray Microanalysis*** is a useful reference book to supplement the lecture notes (it is cheapest from Amazon). It and other books are on reserve in the Geology Library.

Class meetings will be ~100 minutes per week (9-10:50 AM with a 10 minute break), with a weekly problem set assigned to accompany major topics, and 2 hour lab sessions with the SX51 and S3400 to demonstrate key parts of the theory of electron probe microanalysis (EPMA) and SEM. The lab sessions will be in Room 306 or 308.

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) presentation of assigned 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, Room 306A, phone office 262-7964. Cell 438-7480 (8AM-9PM). Office hours 11AM-noon, Monday. I am around a lot and additional times can be arranged. Email: johnf@geology.wisc.edu

Class listserve: 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 stuff to is geosci777-1-s12@lists.wisc.edu

Reference books:

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. (new on Amazon for $63, vs list $85)

This (above) and others (below) are on reserve in the Geology Library:

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.

Principles and Practice of Variable Pressure/Environmental SEM, 2009, by Debbie Stokes, Royal Microscopy Society (Wiley), 234 pp.

Electron Backscatter Diffraction in Materials Science. 2000. Edited by Adam J. Schwartz, Mukul Kumar and Brent L. Adams. Kluwer Academic. 339 pp.

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

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