Instructor: Ray Coish, SC 220, ext 5423, coish@middlebury.edu
Class Time: MWF 9:05- 9:55 SC 405 **Lab Time:** M 1:30 - 4:15 SC 405
Web Site: http://cweb.middlebury.edu/s99/gl211a/

General:

Mineralogy deals with the identification and origin of mineral species. It is a foundation for all branches of petrology; a good understanding of mineralogy is essential for **all** geologists. Also, a knowledge of mineralogy is often useful in dealing with environmental and health issues.

In this course, we will look at both the theoretical and practical aspects of mineralogy. We will cover are: *crystallography* - a study of the external form and internal structure of crystalline solids by means of their shape, symmetry and x-ray signature; *mineral chemistry* - a study of crystal chemistry, theories of chemical bonding, and the chemical composition of mineral species by chemical analyses (SEM, microprobe); *optical mineralogy* - a study of minerals under the microscope; *systematic mineralogy* - a systematic study minerals in both hand sample and thin section.

Textbooks:

Perkins, Dexter, 1998, *Mineralogy*, Prentice-Hall (required)

Nesse, William D., 1991, *Introduction to Optical Mineralogy, 2nd edition.* Oxford University Press (not required but recommended)

Klein, C. and Hurlbut, C.S. *Manual of Mineralogy*. 21th Edition (after J.D. Dana). John Wiley & Sons (reference book in SC 405, several editions)

Lectures and Labs:

Lectures will give the theoretical basis for mineralogy - mineral chemistry, crystallography, optics, and systematic mineralogy. As much as possible, the lectures will be coordinated with topics covered in labs. Occasional homework exercises will be used to support the lectures.

However, the bulk of "hands-on" work will be related to the lab. The main purpose of the lab work is to teach you techniques of mineral identification - in hand sample and under the microscope. Secondarily, as a result of understanding and applying these techniques, you will, of course, learn to identify many minerals. During lab, most of the time will be spent learning and applying techniques. Hand sample identification of minerals will be done outside of lab, and you will be given quizzes periodically to help with identification. At the beginning of the semester, I will hand out a list of all minerals to be studied. At the end of the semester, you will be expected to quickly identify 30 or so minerals from that list.

Project:

Collect or find a rock sample, cut for thin section, analyze using petrographic microscope and SEM, and write short report on origin of the rock. You will work on this project throughout the semester; here are some deadlines to guide you through the project.

Feb 15 - collect rock (avoid monomineralic samples - check with me on suitability)
Feb 19 - have sample cut to be sent away for thin sectioning
Mar 19 - thin section ready
Apr 2 - have written description of petrographic analysis of rock
Apr 5 - 23 - analyze for mineral compositions using the SEM
May 3 - written report on origin of sample due

Fieldtrip:

I plan a field trip to see minerals in their natural setting - in rocks. We are restricted by the season but in early spring, a wonderful place to visit is the Adirondack mountains in New York. There are excellent mineral localities, as well as great igneous and metamorphic rock exposures. The tentative plan is for a trip on a Saturday in late April, probably the 25th.

Guidelines for grades:

• labs (20%) • mid-term (20%) •lab exam (20%); •final exam (25%);•project (10%); •quizzes (5%)

Monday	Wednesday	Friday
2/8 Introduction, Origin of Elements ***LAB*:** Intro to Minerals *(Text ch 3)*	2/10 Atoms and Elements *(Text ch 1)*	2/12 Bonding, Mineral formulae *(Text ch 1)*
2/15 Crystallization Features *(Text ch 2)* ***LAB*:** Intro to Microscope	2/17 Classification *(Text ch 2)* ***QUIZ:*** Native Elements/Sulfides	2/19 Optics, isotropic, anisotropic minerals *(Text ch 4; Nesse ch 2,4,5)*
2/22 Birefringence, Interference colors ***LAB***: Uniaxial Minerals	2/24 Uniaxial Minerals *(Nesse ch 6)* ***QUIZ***: Oxide/Hydroxide/Halide	2/26 Winter Carnival Recess
3/1 Biaxial Minerals *(Nesse ch 7)* ***LAB***: Biaxial Minerals	3/3 Biaxial Minerals	3/5 Review silicate structures ***QUIZ***: Carbonate/Sulfate/Phosphate
3/8 Igneous Processes *(Text ch 5)* ***LAB***: Tectosilicates	3/10 Phase Diagrams	3/12 Quartz/Feldspars in Igneous Rocks
3/15 Feldspars in Igneous Rocks ***LAB:*** Ino/Cyclo- Silicates	3/17 **MID-TERM EXAM**	3/19 Pyroxene in Igneous Rocks
3/22 Spring Recess	3/24	3/26
3/29 Amphibole in Igneous Rocks ***LAB:*** Ino/Cyclo- Silicates (cont'd)	3/31 Olivine/mica in Igneous Rocks	4/2 Mica/ classification of igneous rocks
4/5 Metamorphism *(Text ch 7)* ***LAB:*** Neso/Soro/Phyllo Silicates	4/7 Thermodynamics of reactions	4/9 Metamorphic minerals and rock ***QUIZ***: Tectosilicates
4/12 Sedimentary Minerals *(Text ch 6)* ***LAB:*** SEM work	4/14 Economic minerals, *Text ch 8*	4/16 Crystallography *(Text ch 9, 10)* ***QUIZ***: Ino/Cyclo silicates
4/19 Crystal Symmetry and Morphology ***LAB:*** Crystal systems, symmetry	4/21 Crystallography	4/23 Unit Cells *(Text ch 11)* ***QUIZ***: Neso/Soro/Phyllo Silicates
4/26 Principles x-ray diffraction *(Text ch 11)* ***LAB:*** Review	4/28 Atomic structure, coordination number *(Text ch 13)*	4/30 Crystal Chemistry
5/3 Structures of Silicates **LAB EXAM**	5/5 Review	5/7 Course Summary
5/10	5/12	5/13 **FINAL EXAM** **Thursday May 13, 9 - 12am**

Revised 4/8/99