

<i>meeting place, time:</i>	lecture: Piez Hall, rm. 228; Mon & Wed, 3:00 - 4:30 p.m. lab: Piez Hall, rm. 207; Thr, 9:35 a.m. - 12:30 p.m.
<i>instructor:</i>	Dr. Paul Tomascak
<i>office hours:</i>	open door policy or visit by arrangement
<i>phone and email:</i>	315.312.2786, <tomascak@oswego.edu>
<i>instructor web site:</i>	http://www.oswego.edu/geology/tomascak
<i>textbooks:</i>	<i>required: online textbook by W. White, Cornell Univ.</i> <i>http://www.geo.cornell.edu/geology/classes/geo455/Chapters.HTML</i> <i>useful for lab: <u>Modern Analytical Geochemistry</u> (1st ed.) Ed. by R. Gill</i>

course philosophy and goals: The chemical and isotopic compositions of materials Earth and solar system give us key information about their formation and history. This course is designed to give an overview of where the fields of pure chemistry and Earth science intersect (within principally inorganic processes) and is expected to give students an appreciation for how chemical processes in the solid Earth can be assessed quantitatively. The major topics include (1) the origin and differentiation of the solar system and Earth-Moon system; (2) uses of trace elements, radiogenic and stable isotopes in understanding high temperature geologic processes. The course includes a laboratory, in which students will be introduced to the fundamentals of geochemical analysis and the theory, practical application, and limitations of a range of modern geoanalytical techniques.

nature of the course: It is anticipated that approximately one half of lecture sessions will be devoted to discussions of assigned geochemical literature; although we will only follow a few chapters in White's book, you should expect to have supplementary reading each week. In some cases target questions will be given to steer discussions. In other cases, students will be tasked to summarize papers and lead parts of the discussion. Obviously class discussions are beneficial to a group only when all parties contribute. Please read the articles, take notes, and come armed to discuss.

grading format: The course grade is split 3/4 lecture, 1/4 laboratory.

lecture grade: weekly assignments +/- quizzes = 35%, comprehensive final exam = 25%, research paper = 25%, presentation = 15%

lab grade: assignments +/- quizzes = 100%

semester research papers and presentations: Each student will prepare a paper on one of a list of pertinent topics (below), or on an original topic in consultation with the instructor. The purpose of the paper is mainly to expand your geochemical horizons past what we cover in the main content of the course.

timetable: 9/7 - selection of topic due via email by 5:00 p.m.;

9/19 - preliminary list references due (at least 10) in class;

11/2 - first draft due in hard copy before 5:00 p.m.;

11/26 - final draft due in class.

paper format: The paper will be in the format of an article in the professional journal *Geochimica et Cosmochimica Acta*, 1.5 line spacing, using 11 point font, 1" margins all around. Drafts must include a title page, abstract, introduction, and remaining sections appropriate to the topic. Please number pages sequentially. Length of text should be of adequate length to cover the topic. Figures and/or tables should be used and annotated appropriately.

details on papers: I reserve the option to deduct points from the final grade owing to any part of the process coming in late or not following instructions. The initial list of references is designed to (a) get you started researching the topic, and (b) allow me to point you in productive directions you may have missed. It is intended to be a starting point; the final paper should have substantially more references cited. The first draft is **not** to be a rough draft -- at this point your research should be essentially complete, and your draft should have benefited from feedback from your fellow students. I will return satisfactory first drafts with a general review of the formatting, results of a spot check of mechanics, and a brief review of the primary strengths and weaknesses. I will return deficient first drafts and ask for

revised draft(s) until a satisfactory version is delivered. No credit will be lost during this process unless it becomes clear that the progress is not being adequately made. The grade for the final draft will take into consideration response to my comments on the first draft, technical correctness, effectiveness of the research, and the overall quality of the science relative to what has been discussed in class.

presentations: The presentation will comprise a 15 minute summary of the paper utilizing appropriate media, followed by questions from the audience. Presentations will be given on the last lab meeting in a random order. A successful presentation uses the time effectively to give a lucid overview of the major findings of the paper and avoids simply repeating word-for-word segments of the paper. The grade for the presentation will consider accurate communication of information as well as the ability to respond coherently to questions.

attendance and disability: Success in the course depends on students attending every class and every laboratory. I reserve the option to give unannounced quizzes, particularly if attendance becomes an issue. If you are absent for reasons of personal or family illness or SUNY-sanctioned events, you will need to provide adequate documentation in order to be given make-up assignments. If you will be absent for religious reasons, you will need to contact me at least one week in advance to arrange any make-up assignments. Students who miss class because of required field trips are expected to cover the reading independently. If you have a disabling condition, which may interfere with your ability to successfully complete this course, please contact the Office of Disability Services (226 Hewitt Union; 312.3358).

academic integrity: The University has clear policies concerning academic integrity which will be followed. For clarification of the policy on intellectual integrity (which includes intellectual dishonesty, cheating and plagiarism), see page 187-188 in the 2007-2008 Undergraduate Catalog, or http://www.oswego.edu/administration/registrar/policy_text.html

GEO/CHE 475 -- Solid Earth Geochemistry -- Lecture Schedule, Fall 2007

This is a tentative schedule with some of the major questions we will use to frame discussions. Please refer to the course web site regularly for updates and modifications.

date	topic	text ch.
Thr 8/30 lab	course introduction, overview and expectations	1
Mon, 9/3 Wed, 9/5 Thr 9/6 lab	No Meeting - Labor Day Let's review elemental behavior and how the periodic table is set up.	1
Mon, 9/10 Wed, 9/12 Thr 9/13 lab	Why does the solar system have its particular composition? How do we know?	handouts
Mon, 9/17 Wed, 9/19 Thr 9/20 lab	What is the composition of the Earth relative to the Moon? How do we know? What about the composition of the Earth's core?	handouts
Mon, 9/24 Wed, 9/26 Thr 9/27 lab	Before we get ahead of ourselves, let's review what the mantle and crust are made of, shall we?	1
Tue, 10/1 Wed, 10/3 Thr 10/4 lab	How can the distribution of trace elements tell us anything about where magmas come from?	7
Mon, 10/8	How many different things can trace elements in lavas tell us about	7

Wed, 10/10 Th 10/11 lab	the composition of their sources or about magmatic processes?	
Mon, 10/15 Wed, 10/17 Th 10/18 lab	How do we know the age of the Earth? How “absolute” are the ages we determine by these techniques?	8
Mon, 10/22 Wed, 10/24 Th 10/25 lab	What other ways can we use to determine the ages of geological materials?	8
Mon, 10/29 Wed, 10/31 Th 11/1 lab	Beyond geochronology, how can we use radiogenic isotopes to tell us how the Earth has changed over time?	8
Mon, 11/5 Wed, 11/7 Th 11/8 lab	Beyond geochronology, how can we use radiogenic isotopes to tell us how the Earth has changed over time?	8
Mon, 11/12 Wed, 11/14 Th 11/15 lab	Trace elements and isotopes are great by themselves, but could they be even better at solving geological problems if we combine them?	7, 8
Mon, 11/19 Wed, 11/21 Th 11/22	What about stable isotopes? Thanksgiving Recess - No Meeting Thanksgiving Recess - No Meeting	9
Mon, 11/26 Wed, 11/28 Th 11/29 lab	Surely stable isotopes can help answer these kinds of questions?	9
Mon, 12/3 Wed, 12/5 Th 12/6 lab	What chemical and isotopic methods can be used to assess temperatures (and pressures) rocks have experienced?	4, 5, 9
Final Exam: Wed, 12/12, 2:00 - 4:00 p.m., Piez 228		

GEO 475L/CHE 475L -- Solid Earth Geochemistry Laboratory, Fall, 2007

The eleven laboratory periods available to us in GEO/CHE 475 will emphasize the development of quantitative skills and hands-on work with analytical methods. In the lab we will see a combination of chemical hazards and we will at times be guests in the facilities of other scientists. Any student seen to deviate from the strict set of guidelines concerning safety and laboratory behavior will be removed from the laboratory and will not be invited back. As such, the laboratory component of the course grade will automatically revert to zero.

format of evaluation: For many of the lab meetings we will split time between an introductory lecture, an activity, and a discussion of results. Each lab meeting will have an associated assignment to be turned in during the week that follows, emphasizing quantitative and interpretive aspects of the exercise. These will count equally, and the average of the total will constitute 1/4 of the course grade. Note that some assignments will entail a number of equivalently “correct” results. The purpose of the lab is to learn how techniques work and to understand what the crucial considerations are to a geoanalyst, not to memorize what elements can or can’t be measured by one or another technique.

required equipment: Students in GEO/CHE 475L are expected to have the following at every meeting: **safety glasses, lab notebook** (dedicated to GEO/CHE 475L--not a shared notebook with another course), **calculator**. Students who fail to have these items in possession may be asked to leave the laboratory for that meeting, and will receive no credit for the assignment.

GEO/CHE 475L: Solid Earth Geochemistry anticipated lab schedule for Fall 2007:

Thurs, 8/30	introduction -- qualitative vs. quantitative
Thurs, 9/6	calculation, statistics, precision, error propagation, regression
Thurs, 9/13	no meeting - Rosh Hashana
Thurs, 9/20	geological sample prep I: sampling considerations and rock processing
Thurs, 9/27	geological sample prep II: acid digestion (and lab protocols & safety)
Thurs, 10/4	geological sample prep III: flux fusion digestion
Thurs, 10/11	ion exchange chromatography
Thurs, 10/18	atomic absorption I: analytical method, calibration, and practical considerations
Thurs, 10/25	atomic absorption II: measurement
Thurs, 11/1	isotope ratio mass spectrometry I: isotope dilution
Thurs, 11/8	isotope ratio mass spectrometry II: geochronology
Thurs, 11/15	Syracuse U lab tour

Thurs, 11/22	no meeting - Thanksgiving Break
Thurs, 11/29	applications of X-rays in geoanalysis (w/ Dr. Raymond, Dept. of Chemistry)
Thurs, 12/6	student presentations of research papers