PETROLOGY (GEOLOGY 308)
Course Syllabus Spring, 2006
TTh 12:40-1:50 Harrington 217 and Th 9:20-12:30 Harrington 216

Instructor: Dr. Jennifer Wenner, Harrington 107, wenner@uwosh.edu, 424-7003 (office) or 237-2098 (home – please do not call after 10PM)

Office Hours: T and Th 1:50-4 and *by appointment*.

Text: Winter, J. D., 2001, *An Introduction to Igneous and Metamorphic Petrology*, Prentice Hall, Upper Saddle River, NJ, 697 p.

Supplementary Reading:
Philpotts, A.R., 1990, *Principles of Igneous and Metamorphic Petrology*, Prentice Hall, Englewood Cliffs, NJ, 498 p.

Wilson, M., 1989, *Igneous Petrogenesis A Global Tectonic Approach*, Chapman and Hall, London, UK, 466 p.

Spear, F.S., 1995, *Metamorphic Phase Equilibria and Pressure-Temperature-Time Paths*, Mineralogical Society of America, Washington, DC, 799 p.

COURSE GOALS

This is an upper-level course in igneous and metamorphic petrology that is designed to teach you about the origin and modification of the Earth's crust. The scale of our investigation will range from microscopic (*e.g.*, Under what conditions in the Earth do sodic and potassic feldspar exsolve to form perthite?), to regional (*e.g.*, What is the origin of aluminous granites in the Himalayas?), to global (*e.g.*, Why is the Pacific ocean surrounded by a ring of active volcanoes?). This will not be an easy course, but it should be fun and exciting as you begin to understand how the Earth works. You will rely heavily on your geology, math, physics and chemistry backgrounds. Igneous and metamorphic petrology are huge subjects that we will only begin to cover in this course. I am principally interested in teaching you the fundamental concepts, the professional vocabulary and the applications of hard rock petrology to geological problems. When you leave this course, you should have most of the tools you need to address a plethora of common questions in petrology – granted, you won't necessarily HAVE the answers, but you WILL know a number of ways to address the questions!

Petrology and the Liberal Arts: A more general goal of this class is to contribute to your liberal arts education (the type of education that the College of Letters and Science strives to give you). A liberal arts education is unique because, rather than developing professional or vocational skills for a specific job, it prepares students for work in a variety of jobs. Students who receive a liberal arts education are prepared to enter the workforce because they have been taught to solve problems and to think critically; they have a broad base of knowledge grounded in a variety of disciplines. Petrology lets *you* utilize the broad backgrounds you already have by drawing tools from chemistry, mathematics, and physics. It should contribute to your base of knowledge through the use of tools and ideas for **addressing some of the most fundamental questions in geology**. The vast majority (>95%) of the Earth is composed of igneous and metamorphic rocks that form in places that we cannot visit. Because of this, the study of petrology can be used to address some of the most basic questions in geology – How did Earth form? – How does plate tectonics work? – Where does crust come from? - What is the source of magmas erupting at Mt. St. Helens? Hawaii? Mt. Kilimanjaro?

GRADING

[1]EXAM 1 .....15%	A 92-100%
[1]EXAM 2 .....15%	AB 87-92%
[2]LAB 30%	B 82-87%
[3]Homework.....10%	BC 77-82%
[4]Field trip 5%	C 72-77%
[5]Participation, quizzes..... 5%	CD 67-72%
[6]Final Project 20%	D.....60-67%
	F..... ..... <60%

[1]**Exams:** There will be **two** take-home exams (You will have 7-8 days to complete these (3/21-3/28 and 5/4-512). The exams will be open book, open notes (& open library, if you like). However, there will be a gag rule in effect -- no talking to your classmates (or anyone else) about the exam. It will be on your honor (which I take VERY seriously). Each exam is worth 15% of your grade.

[2]**LAB:** The lab component of this class is significant and therefore counts the most toward your grade. In most labs, there will be a number of thin sections and hand samples to describe. All observations made during lab (including any sketches) and the answers to lab questions should be recorded in a *non-spiral-bound lab notebook* (you may use your (optical) mineralogy notebook). Your lab notebook should be turned in before you leave the lab on the due date specified in the lab. You may pick up your notebook on the following day. Lab is worth 30% of your grade.

[3]**Homework:** Problem sets will be handed out from time to time. Each assignment will indicate the date it is due (usually within a week). All assignments are due at the beginning of class. Since I expect you to turn assignments in on time, I will do my best to have them back to you by the following class period. I anticipate several homework sets and together they will be worth 10 % of your total grade.

[4]**Field trip:** Since the study of igneous and metamorphic petrology hinges on observation and collection in the field, it only makes sense to have a field trip in this course. We need to discuss the logistics of time and place together. This trip is mandatory. There is a fantastic trip in Missouri (the St. Francois Mountains – cool A-type granites!). However, this is far away (about 10 hours) and will require 4 days (Thurs-Sun or Fri- Mon). So, let's talk about whether you can miss Friday or Monday classes…and what our other options are. The field trip will be worth 5 % of your total grade.

[5]**Participation and quizzes:** Your grade for participation is based on your willingness to engage in class. This does not necessarily mean that you HAVE to speak up in class. It *does* mean that you should be engaged in class (i.e., not dozing in the back or skipping class regularly). From time to time, we will have in-class exercises; these will be collected and count toward participation. This class is small enough to allow me to get to know all of you quite well and I will be aware of your attitude in class. Once per week, there will be a quiz posted on D2L – these are open book, open notes, ask your classmates kind of quizzes on the reading. Participation and quizzes are worth 5% of your grade.

[6]**Final Project:** Since one goal of this class is to teach you about the tools of igneous and metamorphic petrology, your final project will be a double-spaced, 12-point font, 15 page research proposal. You should *propose* to do some *innovative* research in igneous or metamorphic petrology. I *highly* encourage you to pursue a proposal that interests you and that you could actually complete. Students might find a project and samples in the Oshkosh area, or something they might work on at field camp this summer, or some project sponsored by someone on the faculty. This could be an excellent opportunity to start on a senior thesis project (a rewarding exercise that will prepare you for graduate school or an industry research career). Page 4 of this syllabus indicates deadlines and guidelines for this project. The project is worth 20% of your total grade.

SOME THINGS YOU NEED TO KNOW:

- I do NOT accept late assignments (except in extreme extenuating circumstances and then only with prior notification – it never hurts to ask beforehand). There are several reasons for this: One, you need to keep up with the work because subjects build on one another; so keeping up with the work is essential. Second, I try to correct assignments as soon as I get them so that I can hand them back and you can learn from them. If you turn an assignment in late, I cannot return your classmates' assignments to them in a timely manner. Third, late assignments make more work for me and that means I have less time to help you.
- If you want "credit" for assignments or class periods that you have missed, you must have an excused absence. According to the Student Handbook, an excused absence is one of the following:
  - "There are certain activities, beyond the classroom, that can be considered as field trips, which are all-university in nature, e.g. athletics, debate trips, and certain music trips. The instructor or academic staff member originating the trip must verify the trip and provide a list of participating students. Students are excused from class for all-university type events and circumstances beyond the student's control such as extended illness, medical emergency, and family emergency. Students may not be penalized for these excused absences as long as *appropriate documentation* is provided to the instructor in a timely manner. In all cases of absence, excused or otherwise, the student is responsible for completing missed work. The instructor is not required to do extra teaching." Appropriate documentation for illness is a note from a doctor, hospital or health services upon return from your illness. Appropriate documentation for family or medical emergency includes documentation from hospital or funeral home (this may be in the form of a phone number, funeral announcement, hospital admittance form, etc.).
  - Also from the student handbook: "If a student will be absent from class for emergencies, medical reasons or exceptional personal reasons, the student is responsible, if capable of doing so, for contacting instructors individually or through their departments. If the student, family member, or friend are not able to contact instructor or the student will be absent more than three (3) class days, the Dean of Students office may be asked to send notification of the absence as reported to staff."
- There is a lot of opportunity to collaborate in this class (as in geology in general). Because there is often a fine line between collaboration and plagiarism, I must include a statement about plagiarism and academic honesty: The Wisconsin Administrative Code states: "Students are responsible for the honest completion and representation of their work, for the appropriate citation of sources, and for respect of others academic endeavors." (§ UWS 14.01) Plagiarism and other forms of academic misconduct are serious offenses with severe penalties. "Academic misconduct is an act in which a student: (a) *Seeks to claim credit for the work or efforts of another* without authorization or citation; (b) Uses unauthorized materials or *fabricated data* in any academic exercise; (c) *Forges or falsifies academic documents or records;* (d) Intentionally impedes or damages the academic work of others; (e) *Engages in conduct aimed at making false representation of a student's academic performance*; or (f) Assists others in any of these acts." (§ UWS 14.03). See the University of Wisconsin Oshkosh Student Discipline Code 2002-2003 for details about procedures, sanctions, and other relevant information. Specific questions about the provisions in the Student Discipline Code should be directed to the Dean of Students Office. I take this *VERY* seriously and if you do not understand any part of this, PLEASE see me as soon as possible.

FINAL PAPER DEADLINES AND GUIDELINES

The following deadlines are **ABSOLUTE** and guidelines are modeled after the guidelines for proposals to the National Science Foundation. Treat this as though you are a professional. In academics and industry, proposal writing will occupy a significant amount of your time.

FINAL PAPER DEADLINES

February 2 - February 10: arrange 15-30 minute meeting with me to discuss your research topic. Come in with ideas – think about rocks that you've been curious about, or larger questions in geology that you might want to answer. *(5% of final paper grade)*

February 14: Preliminary research proposal summary due at the beginning of lecture. This is ***limited to*** a one-page double-spaced summary of what you will propose and why it is important. It should be concise and clear, *kind of like an abstract*. It may change during the course of your research but I want to see that you are progressing. You are a salesperson...sell your idea. *(10% of final paper grade)*

March 9: Detailed proposal outline (or rough draft) due at the beginning of lecture. The better and more detailed your outline; the more I will be able to help. This should include *most of the references* you plan to use as well as a *realistic budget proposal*. I will be grading on organization, clarity and use of references. *(10% of final paper grade)*

April 4: Proposal draft (relatively complete) due at the beginning of lecture. As with NSF, this proposal draft will be reviewed by your peers (other members of the course) as well as corrected by me. You will be given a "score sheet" for evaluating the proposal that you have been asked to review. "Peer reviews" will be due in one week (April 11). *(25% of final paper grade – peer review 10%, draft 15%)*

May 4, 1:50 PM: Proposal due at the beginning of lecture. This is an **ABSOLUTE** deadline. *(50% of final paper grade)*

FINAL PAPER GUIDELINES (*more information to be added later****)***

Your proposal **MUST** be *double-spaced*, 12-point type, and **MUST** have the following components in this order:

1. Title page
2. Project Summary: **MAXIMUM** 1 page, *double-spaced*, 12-point type. The Project Summary should summarize what it is you propose to do and why it is important. ***There must be a clearly stated hypothesis that you will test.***
3. Table of Contents
4. Body of Proposal: **MAXIMUM** 15 pages, *double-spaced*, 12-point type (including all figures and tables). I suggest that your proposal body include 1) an INTRODUCTION summarizing your hypothesis, what you want to do and why it is *important*, 2) a GEOLOGIC BACKGROUND summarizing the *pertinent* work (that you will build on) that has already been done in this area of research, 3) PROPOSED RESEARCH detailing what *important* new work you will do (if you have samples or started any research, this is a great place to summarize what ground-breaking results you are already obtaining), 4) METHODS detailing how you will complete the work and why it is *important* to use these methods, 5) RESEARCH SCHEDULE detailing the timeframe for completion of your work. 6) IMPLICATIONS OF THIS WORK reminding us of how *important* this new work is.
5. References Cited: No page limit, **single**-spaced, 12-point type, listing all references cited in your proposal. (I will provide a handout in reference to citations later in the course.)
6. Budget: Detail how much it will cost to complete this research. Money is no object!

TENTATIVE SCHEDULE AND READINGS

Because igneous and metamorphic petrology are such enormous topics, no single book does them justice. We will be using a text by Dr. John Winter because it is fairly comprehensive and covers topics in a logical order, but it fails to cover some subjects in significant detail. Therefore, in addition to reading from your general text, I suggest additional readings from three other excellent books by Drs Philpotts, Wilson and Spear. Copies of these texts are available in the cabinets in lab (H 216). This reading is supplemental; it is not required, but encouraged. Below is a *tentative* schedule of lectures and labs. Again, this is a huge subject we are tackling. We will take things as they go this semester. If a topic comes up during the semester that you want covered in greater detail, see me. I will do what I can.

Week		Date	Topic	Reading †
1	T	31-Jan-06	Introduction – fundamental concepts of petrology	1JW
			SCHEDULE PROJECT MEETING WITH JEN	
	Th	2-Feb-06	Thermodynamics	*5JW,* 7P
	Th	**2-Feb-06**	**Lab 1 – Mafic Minerals, plagioclase and Petrographic descriptions**	***2-3JW***
2	T	7-Feb-06	Equilibrium, the phase rule and two component phase diagrams	*6.1-6.5.1JW,* 10P
	Th	9-Feb-06	Two-component phase diagrams	*6.5.2-6.5.3JW,* 10P
	Th	**9-Feb-06**	**Lab 2 – Felsic Minerals and petrographic descriptions**	
3	T	14-Feb-06	More two component systems -- ***PRELIMINARY RESEARCH SUMMARY FOR PROJECT DUE***	*6.5.4-7.1.1JW,* 10P
	Th	16-Feb-06	Three component systems	*7.1.2-7.1.4JW,* 10P
	Th	**16-Feb-06**	**Lab 3 – Basalts and Gabbros**	
4	T	21-Feb-06	Multi-component systems and pressure/fluid effects on melting	*7.2-7.5JW,* 10P
	Th	23-Feb-06	Chemical Petrology: Major and Minor Elements	*8JW,* 6P, 2MW
	Th	**23-Feb-06**	**Lab 4 – Rhyolites and Granites**	
5	T	28-Feb-06	Chemical Petrology: Trace elements	*9.1-9.6JW,* 6P, 2MW
	Th	2-Mar-06	Chemical Petrology: Isotopes	*9.7JW,* 6P, 2MW
	Th	**2-Mar-06**	**Lab 5 – Basalt-Andesite-Dacite-Rhyolite I**	
6	T	7-Mar-06	Generation of magmas -- ***DETAILED OUTLINE DUE***	*10JW,* 22P, 3MW
	Th	9-Mar-06	Modification of magmas –melting and fractionation	*11.1-11.2JW, 12.3JW,* 13P
	Th	**9-Mar-06**	**Lab 6 – Basalt-Andesite-Dacite-Rhyolite II**	
7	T	14-Mar-06	*SPRING BREAK!!*	
	Th	16-Mar-06	*SPRING BREAK!!*	
	Th	***16-Mar-06***	***SPRING BREAK!!***	

†JW = Winter (includes chapter and section or entire chapter if section omitted); P = Philpotts; MW = Wilson; S = Spear. *Reading from Winter is required.* Other texts are supplementary and *highly* recommended.

Week		Date	Topic	Reading †
8	T	21-Mar-06	Modification of magmas: mixing and assimilation EXAM 1 HANDED OUT	*11.3-11.7JW*, 13P
	Th	23-Mar-06	Plume-related magmatism: OIB's and CFB's	*14,15JW*, 9-10 MW
	Th	**23-Mar-06**	**Lab 7 – Gabbro-Tonalite-Monzonite-Granite I**	
9	T	28-Mar-06	Subduction related igneous activity – EXAM 1 DUE	*16JW*, 6MW
	Th	30-Mar-06	Subduction related igneous activity	*17JW*, 7MW
	Th	**30-Mar-06**	**Lab 8 – Gabbro-Tonalite-Monzonite-Granite II**	
10	T	4-Apr-06	Continental extension	*19JW*, 11MW
	Th	6-Apr-06	The origin of granites and continental crust	*18JW*
	Th	**6-Apr-06**	**Lab 9 -- Ultramafic and Alkalic Rocks**	
11	T	11-Apr-06	Introduction to Metamorphism -- ***FIRST DRAFT DUE***	*21JW*, 1-2S
	Th	13-Apr-06	Chemographic diagrams and petrogenetic grids	*24, 26JW*
	Th	**13-Apr-06**	**Lab 10 – Metamorphic minerals – textures and names**	***22, 23 JW***
12	T	18-Apr-06	Geothermobarometry– ***Peer reviews DUE***	*27JW*, 15S
	Th	20-Apr-06	Metamorphism of pelites –	*28JW*, 10S
	Th	**20-Apr-06**	**Lab 11 – Pelites I**	
13	T	25-Apr-06	Metamorphism of pelites	*28JW*, 10S
	Th	27-Apr-06	Metamorphic facies	*25JW*, 2S
	Th	**27-Apr-06**	**Lab 12 – Pelites II**	***26JW***
14	T	2-May-06	Metamorphism of calcareous and ultramafic rocks	*29JW*, 12S
	Th	4-May-06	Metamorphism of calcareous and ultramafic rocks ***FINAL PROJECT DUE–*** EXAM 2 HANDED OUT	*29JW*, 13S
	Th	**4-May-06**	**Lab 13 – Calc-silicates I**	
15	T	9-May-06	Metamorphic fluids –	*30JW*, 18-19S
	Th	11-May-06	TBA	
	Th	**11-May-06**	**Lab 14 – Calc-silicates II -** EXAM 2 DUE at the beginning of lab	

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