

## Syllabus for Petrology

Course: Petrology, GEO-320, Tu-Th 9:00-10:45, lab Th 1:55-4:40

Professor: Kurt Hollocher

Petrology web site: [http://minerva.union.edu/hollochk/c\\_petrology/index.html](http://minerva.union.edu/hollochk/c_petrology/index.html)

Office hours: Tuesday afternoon, 12-4.

Textbooks: Petrology, by Blatt, Tracy, Owens, 3<sup>rd</sup> ed., and your mineralogy book

### Course Outline

Section	Month	Date	Subject	
Igneous rocks	March	31	Igneous rocks: identification and classification, optical review	
		April	2	Igneous rocks: tectonic settings, field relations, processes <i>Lab: Igneous minerals in thin section</i>
	7		Binary liquidus systems	
	9	Ternary liquidus systems <i>Lab: Igneous rock textures and sample descriptions</i>		
	14	More ternary liquidus systems, magmatic geochemistry		
	16	More magmatic geochemistry <i>Lab: Comparing felsic plutonic series</i>		
	21	Magmatic geochemistry: trace element models		
	23	Magmatic geochemistry: the lanthanides, ocean ridges <i>Lab: Comparing mafic cumulates</i>		
	28	Arc volcanism		
	30	Arc and hot spot volcanism <i>Lab: Iceland volcanics</i>		
	Metamorphic rocks	May	5	Igneous rock exam
			7	Metamorphic rocks: tectonic settings, field relations <i>Lab: Metamorphic minerals in thin section</i>
		12	Metamorphic rocks: classification, facies, isograds, fabrics	
		14	The phase rule and reactions in P-T space <i>Lab: Western New England mafic volcanics</i>	
19		Petrogenetic grids, binary systems, petrographic textures		
21		Petrographic textures and interpretation <i>Lab: Western New England pelites</i>		
26		Reactions in P-T space: ternary systems, projection		
28		Reactions in P-T space: quaternary systems, projection <i>Lab: Western Norway high pressure rocks</i>		
June		2	Metamorphic assemblages in P-T space, mafic and pelitic rocks	
		4	Geothermometry and geobarometry <i>Lab: Fault rocks</i>	
	??	Metamorphic rock exam		

### Introduction

Rocks can tell stories about their geologic history. The stories are written in a language of rock chemistry, mineralogy, mineral textures, and mineral chemistry. In this course we will study this language and read some of the stories contained in igneous and metamorphic rocks. To do so, we will use several theoretical and mechanical devices, including the most basic and powerful of all petrographic tools: the polarized light microscope. Rocks are divided into three categories based on the principal geologic processes that form them:

- Melting within the earth, movement of the liquids, and their crystallization below and on the surface: these processes form igneous rocks.

- Change of rocks under the influence of heat, pressure, chemical flux, and differential stress: these processes form metamorphic rocks.
- Weathering, transport, and deposition of materials at or near the earth's surface: these processes form sedimentary rocks.

On our dynamic planet there is constant cycling between these three broad categories of rocks. This course involves the petrology of igneous and metamorphic rocks. Because rocks are aggregates of minerals, this course is a natural continuation of Mineralogy. You will learn to recognize, describe, and classify many rocks in both hand sample and thin section. With practice, your skills at hand specimen identification and optical mineralogy will improve dramatically. In addition you will learn about many aspects of mineral textures, process, occurrences, and principles that will allow you to interpret parts of the geologic record held in igneous and metamorphic rocks. Lab work, principally the study of rock hand samples and thin sections, is a major focus of the course that will require individual work outside of lab time.

Petrology can be tough stuff, but it is a powerful and rewarding tool. Petrologic concepts are valuable not only in geology, but have direct applications in ceramics, metallurgy, and other aspects of materials science. Petrologic concepts may initially be difficult to grasp if you are first exposed to them in class. Please be prepared by reading the text and doing any requested introductory work. Warning: getting behind in Petrology can be detrimental to your physical and mental well-being.

### **All day field trips**

There will be two all-day weekend field trips: one across the Taconian orogen in New York and northern Massachusetts, and one to the eastern Adirondacks and high peaks region. You will have to attend one of the trips, for which there will be a signup sheet. Both trips will leave Union College at 6:00 AM sharp at the Olin Building traffic circle, and return at ~8:00 PM. We will be out in the open for extended periods and your comfort and safety require shoes and clothing appropriate for the conditions. All field trips will travel to moderately high elevations, so cold weather, wind, and rain should be expected.

If you miss a trip you will have to write a paper instead. I assume that field trip participants get the full benefit from the trip (must actually participate, not sleep all day in the van). Papers, on the other hand, will be graded for scientific content and writing quality. You should let me know at least the Thursday before a field trip if you plan to miss it. There may be others who wish to go.

### **Basis for the course grade**

If you have to miss a class or lab for some valid (e.g., medical) reason, let me and the Dean of Students office know beforehand to make alternative arrangements, *as per Union College policy*. All late work without an excuse via the Dean of Students Office will lose 10% credit per day late.

<b>Work type</b>	<b>Proportion of grade</b>
Homework, readings	21 %
Labs	34 %
Field trip/paper	3 %
Igneous rock exam	20 %
Metamorphic rock exam	22 %
Total	100 %

### **Readings**

You don't need to read the chapters on sedimentary rocks, but they may be valuable in your professional future and could be useful as a reference during the metamorphic rock section. In addition to the text, there are copies of various petrology, mineralogy, and optical mineralogy books, thin section atlases, and lab manuals available in 306. Please use these as reference books as needed. It is very important that you complete the readings (and other assignments) on time.

### **Week Read chapters in BTO**

1	1, 2, 3, Appendix 1
2	4, 5
3	6, 7
4	8, 9, Appendix 4
5	10
6	17, 18
7	19, 20, Appendix 2
8	21, 22
9	23, Appendix 3
10	-

### **Extra help**

For extra help there is always me, of course. I am generally available and I can always make appointments. I can even schedule weekly or more frequent regular appointments to give extra help to individuals or small groups. In addition, please feel free to stop by Olin 306, 322, 332 (if no classes). Geology majors hanging out in those rooms are mostly harmless and can be quite helpful.

### **Learning or other disabilities**

From the Union College Student Handbook: "*Students seeking reasonable accommodations should be aware that it is their responsibility to...request accommodations from the Director [of Student Support Services] in person with at least two (2) weeks' notice of the accommodation needed.*" Contact them directly: [Accommodative Services Office](#), 388-8785, <mailto:shinebas@union.edu>. No accommodations can be provided without a letter or card from the [Accommodative Services Office](#). You talk the them, they will notify me. You should also talk to me, too, to make sure I am aware of (or remember) the issue so we can arrange things appropriately.

### **Academic misconduct**

You will sometimes work in small groups, but *all work that you hand in must be your own!* No copying or otherwise duplicating lab reports or computer-generated figures. No giving or accepting access to old course materials. This and all other forms of plagiarism, cheating, destruction of resource materials, and other forms of academic dishonesty will be referred immediately to the [Dean of Studies](#), as per *Union College policy*. We have an [Honor Code](#) at Union College. Here is the "[model statement](#)" that I have been asked to place right here in this very spot:

*"Union College recognizes the need to create an environment of mutual trust as part of its educational mission. Responsible participation in an academic community requires respect for and acknowledgement of the thoughts and work of others, whether expressed in the present or in some distant time and place. Matriculation at the College is taken to signify implicit agreement with the Academic Honor Code, available at [honorcode.union.edu](http://honorcode.union.edu). It is each student's responsibility to ensure that submitted work is his or her own and does not involve any form of academic misconduct. Students are expected to ask their course instructors for clarification regarding, but not limited to, collaboration, citations, and plagiarism. Ignorance is not an excuse for breaching academic integrity. Students are also required to affix the full Honor Code Affirmation, or the following shortened version, on each item of coursework submitted for grading: "I affirm that I have carried out my academic endeavors with full academic honesty."*

*Signed  
Whoever you are*

Note that, if you forget to "...affix the full Honor Code Affirmation, or the following shortened version, on each item of coursework submitted for grading: I affirm that I have carried out my academic endeavors with full academic honesty.", I will assume that you meant to.