Instructor: Dr. Sean Regan, HUD 127, sean.regan@plattsburgh.edu
Class Time: TTh 11:00 – 12:15 HUDSON 0130 **Lab Time:** W 1:00 – 3:50 HUDSON 0130
Office Hours: Wednesdays from 9 AM – 11 AM; Thursdays from 1:00 PM – 3:50 PM; open door policy

Textbooks:

- Winter, J.D., 2010**, Principles of Igneous and Metamorphic Petrology – 2nd edition**: Pearson Publishing

General:

Earth is composed of rocks, and therefore the study of rocks is the best way to understand the processes operating on the planet today and in the past. Petrology is the study of rocks and builds upon mineralogy with strong connections to structural geology and tectonics. In this class we will explore Igneous and Metamorphic petrology within the context of plate tectonic theory, and hopefully provide a robust introduction to the vast array of problems and processes that govern Earth's evolution.

In this course, we will look at both the theoretical and practical aspects of petrology. Unlike most traditional petrology courses that are divided into igneous and metamorphic components, we will discuss them simultaneously as you can not make an igneous rocks without metamorphosing another. Using plate tectonic theory as our vehicle, we will start with simple petrologic systems, like mid-ocean ridges, to explore the basic tenants of thermodynamics, and move through more complex tectonic settings, which are progressively more complicated with respect to petrology. Hopefully, this will provide a dynamic view of petrology, and give insight into not only how rocks form and evolve, but how petrologic processes govern the composition, strength, density, and other aspects of planet Earth.

Lectures and Labs:

This course deals with the origin and evolution of igneous and metamorphic rocks. Attention is focused upon the chemical aspects of rock systems, e.g. equilibria between minerals and melts. The nature and plate tectonics of melting of the mantle and crust are examined, as well as the processes involved in magmatic differentiation. Metamorphic histories of continental and oceanic rocks are studied. These topics are unified by the plate tectonic settings of igneous and metamorphic activity. Laboratories involve the study of rock suites from classic areas around the world and a field trip to southern New York.

Three meetings a week will involve lecture material and in-class exercises. Regular attendance in class is required; it is the only way to do well on the exams and is part of the Participation component of the grade. As much as possible, I want create a learning environment that will work for all my students. If you have particular learning needs or requests, please let me know so we can discuss how to make this class a success for you. If you are a student who happens to experience a disability and needs accommodations, please contact Laura Cronk, Educational Specialist/Coordinator of Extended Time Testing - Special Programs, and then talk with me about the accommodations determined by that office.

Project 1: Report on an isotope system of petrographic utility. This will be on the exam, so all students are expected to produce a thorough presentation. Topics include: Oxygen isotopes; Re-Os; Pb/Pb; Hf in zircon; Li isotopes; Fe isotopes; He isotopes, etc.

Project 2: You will be expected to have a look at the petrographic and geochemical attributes of a suite of rocks in the Proterozoic to Archean history of Earth, and give a powerpoint presentation on applying modern plate tectonic principles to interpret them. You will need your geochem machine.

Fieldtrip:

A mandatory field trip will be held on 05/05/2018. We will explore rocks of the Adirondack Mountains, which have been a proving ground for new petrologic methods and analytical procedures. Needless to say, the region is a premier place to study petrology!

Grades: •labs (25%) •Quizzes (25%) •non-cumulative tests (25%) •final exam (25%) •projects (25%)

*You will notice that this adds up to over 100 points (125). As the semester progresses you can choose to keep two of the three: 1) quizzes, 2) non-cumulative tests, and 3) the final exam.

Percentage	***Grade***	***Percentage***	***Grade***	***Percentage***	***Grade***
>90.0	4.0				
87.5	3.75	77.5	2.75	67.5	1.75
85.0	3.5	75.0	2.5	65.0	1.5
82.5	3.25	72.5	2.25	62.5	1.25
80.0	3.0	70.0	2.0	60.0	1.0
				<60.0	0.0

Academic Dishonesty/Accommodations Policy

- Please review the University's academic dishonesty policy. Cheating, fraud, and plagiarism are not allowed and will result in academic censure through appropriate University procedures.
- I will do anything within my power, that is legal, to help you succeed and thrive. If you have any type of learning disadvantage, consider meeting with Student Support Services staff to figure out the best actions to take.

Field photograph from the Athabasca granulite terrane, one of Earth's largest contiguous exposures of lower continental crust. Dark areas are dismembered and partially melted dikes that intruded ca. 3.4 Ga tonalitic gneisses. Melting and strain occurred at 1.9 Ga, and as dikes partially melted, they were weakened and strained, which facilitated the mobilization of melt to higher structural levels. This mix between igneous and metamorphic processes is common, and will help us understand the differentiation of continental crust.

Monday	Wednesday (Lab)	Thursday
01/30 **Earth** *(P.1, Ch. 1: p. 2-22)*	01/31 **Phase diagrams; feldspar**	02/01 **Gibbs Free Energy** *(P. 1, Ch 5, 6: p. 83-112)*
02/06 **Partial Melting** *(P. 1 Ch. 7; p. 113-134)*	02/07 **Chemistry of Mid Ocean Ridges – compatibility*** *(P. 1, Ch. 8, p. 135-137)*	02/08 **Q.1 Magma Transport and Emplacement** *(P.1, Ch 4: p. 54-82)*
02/13 **Fractional Crystallization** (P. 1, Ch. 11; p. 202-242)	02/14 **Fractional Crystallization**	02/15 **No Class – Texas Tech Lecture**
02/20 **Mid Ocean Ridges** *(P. 1, Ch. 13: p. 244 – 269)*	02/21 **Depleted Mantle Lab*** *(P. 1, Ch.9: p. 158-182)*	02/22 **Ophiolites** *(P. 1, Ch. 10: p. 183-201)*
02/27 **Petrographic textures** *(P. 1, Ch. 3: p. 34-53)*	02/28 **Petrography of Mid Ocean Ridges**	03/01 **TEST 1** *(Instructor at UMaine)*
03/06 **Ocean Island Basalts: plateaus and hot spots** *(P.1, Ch. 14: p. 270-291)*	03/07 **Comparing OIBs and MORBs***	03/08 **Tracking the source with phase equilibria** *(P.1, Ch. 15: p. 301-323)*
Spring Break – Take it easy		
03/20 **Onset of Subduction** *(P.1, Ch. 16: p. 323-351)*	03/21 **Bonin Arc chemistry – compare***	03/22 **Mantle Wedge Processes** *(P. II, Ch. 25: p. 537-578)*
03/27 **Continental Crust (Felsic)**	03/28 **Sm-Nd calculator***	03/29 **The Andean Arc**
04/03 **Metamorphic textures and equilibria** *(P. II, Ch. 27: p. 579-606)*	04/04 **Andean Arc chemistry – compare***	04/05 **Arcs: A spectrum of compositions** *(P. I, Ch. 17: p. 352-276)*
04/10 **Test 2**	04/11 **Theriak-Domino***	04/12 **Barrovian vs Buchan – isograds, P-T paths** *(P. II, Ch. 28; p. 607-634)*
04/17 **Crustal Melting** *(P. I, Ch. 18: p. 377-382)*	04/18 **Metamorphic petrography**	04/19 **Ore processes – a petrologic perspective**
04/24 **Continental Rifts** *(P. I. Ch. 19: p. 397 – 431)*	04/25 **Rift chemistry and isotopes***	04/26 **Low – T metamorphsim/ metasomatism** *(P. II, Ch. 30, p. 654-682)*

Monday	Wednesday (Lab)	Thursday
05/01 **Differentiating granitoids** *(P. I, Ch. 18: p. 383-396)*	05/02 **Granite comparison and petrography***	05/03 **Minerals in metamorphic rocks** *(P. II, Ch. 23: p. 477-517)*
05/08 **TEST 3**	05/09 **Project 2 presentations**	05/10 **Understanding Plate tectonic processes through Petrology**