FIELD METHODS IN VOLCANIC TERRAINS *(4803/8803 JD)*

Instructor: Joe Dufek
Office ES&T 2248
Phone: 404-894-9472
Email: dufek@gatech.edu

Overview

The class will provide field experience and will enable students to make the link between process-based models and field observations related to volcanic eruptions, subsurface magma interaction, and crustal heat flow and tectonics.

Description

Igneous rocks comprise the bulk of our crust on Earth and the other terrestrial planets, and volcanic eruptive processes shape the surface morphology and provide a link between solid earth and atmospheric processes. Our understanding of these processes has been transformed by the careful study of classic field localities. This course will give students the hands on experience of interpreting past environments using the natural laboratory - going out into the field. We will particularly emphasize the types of knowledge that can be garnered from different scale observations in the field, and will use several features that can be observed remotely and on the ground to serve as analogues for the interpretation of processes on other planets. This course will be particularly useful for those interested in the structure of the crust, reconstructing past environments from field studies, planetary studies, and volcanology.

Goal

This class will provide students with foundational experience in field observations and in designing hypothesis driven investigations. Students will also discuss the proposal process relevant to funding agencies, and will gain experience constructing and reviewing proposals, and then in following through on the research they propose.

Learning Outcomes:

Upon completion of this class students will be able to:

1. Be able to describe the igneous and tectonic history of the region of the field trip, and more broadly describe how these forces shape the landscape.
2. Understand the proposal writing process be able to critique scientific proposals.
3. Plan a set of field measurements that tests a process-based hypothesis, and perform analysis.
4. Identify major rock units in the area of the field trip, and describe the environment in which they are produced.
5. Be able to map major geologic units in the field and perform a field stratigraphic section.
6. Relate field scale measurements with remote observations.

7. Apply mathematical models (sediment transport, heat transfer, or fluid dynamics) to natural processes which have field constraints.
8. Describe eruptive styles and the physics that govern these eruptions, especially expressed by deposits at the field site.

Academic Integrity:
Academic dishonesty will not be tolerated. This includes cheating, lying about course matters, plagiarism, or helping others commit a violation of the Honor Code. Some exams (when specifically announced in class) allow the use of self-prepared supporting information (one sheet of paper, either typed or handwritten, could be double-sided); no other support materials are allowed at tests. Plagiarism includes reproducing the words of others without both the use of quotation marks and citation. Students are reminded of the obligations and expectations associated with the Georgia Tech Academic Honor Code and Student Code of Conduct, available online at www.honor.gatech.edu.

Absences:
See the Institute Absence policy is available at: www.catalog.gatech.edu/rules/4/

Learning Accommodations:
If needed, we will make classroom accommodations for students with documented disabilities. These accommodations must be arranged in advance and in accordance with the Office of Disability Services (http://disabilityservices.gatech.edu).

Grading:
This course is centered around a field excursion. Groups of students will prepare a competitive proposal of research conducted in the field, prepare a introduction to their field site before the trip, and present a report and presentation of their final findings. Each person will also lead a discussion of a paper in the class.

20% Field activities, group interaction, contribution
20% Introduction Presentation of Field Site and Paper Presentation
30% Proposal of Research (10 pages)
This includes:

A. Initial 1 paragraph description of the project (5%)
B. Outline (5%)
C. Progress Report (10 %)
D. Proposal (60 %)
E. Peer Review (20%)

30% Final Report and Presentation

Undergraduate vs. Graduate Expectations: Undergraduate and Graduate students often have different research experience, and grading in this course reflects these different experiences. The group proposal, report, and presentation is designed such that undergraduate and graduate students work in mixed groups. In each of these activities the students list their individual contributions and undergraduates are expected to help make measurements in the field and help prepare introductory material, but their sections in the proposal and report are graded relative to other undergraduates and not graduate students.

Research Proposal
Student groups will prepare a 10 page proposal (not including references) based on a NSF style proposal (focusing on the intellectual merit aspects of the proposal rather than broader impacts criteria). Normal NSF proposals are 15 pages long, and the shortened version you will prepare will neglect aspects of a normal proposal such as outreach, etc. Use the criteria and examples we discussed to help guide your proposal structure.

Proposal preparation should follow the guidelines suggested in the 2013 NSF proposal guide (http://www.nsf.gov/publications/pub_summ.jsp?ods_key=gpg).

Here are the relevant timelines for the proposed work:

1. **Proposal due date: *Feb. 19***
   Each group will submit a proposal electronically (by email) to dufek@gatech.edu by midnight on the 19th. These proposals will be distributed for peer review.
2. ***Presentation on Feb. 20*** groups will prepare a 15 minute presentation briefing the larger group on the scientific question and methods that will be used to answer these questions. (Basically reviewing key aspects of the proposal with discussion from the larger group).
3. **Peer reviews due: *Feb. 24*** Peer and instructor reviews will be turned back to the groups on Feb. 25. That class and the following class will be used to address any comments and make final preparation for fieldwork.

Notes for peer review
Each of you will be providing a review of a proposal, based on its intellectual merit, as well as commenting on the strengths and weaknesses of the proposal. Please construct your review in the following format (this shares some similarity with the NSF review process).

1. Summary of proposed work.
2. Intellectual Merit
   A. Strengths
   B. Weaknesses
3. Comments on improving the field methodology.
4. Strengths, weaknesses, and suggestions for improving the presentation of the proposal.

Topics
1. Volcanic Terrains Overview
2. Eruption Dynamics and Landforms
3. Volcanism: A Planetary Perspective
4. Tectonics of field site
5. Insight into Crustal and Mantle structure of field site
6. Igneous rocks and identification

7. Remote Detection of Rocks
8. Remote Geomorphology: Accessing Process from a Distance
9. Constructing Scientific Proposals
10. Magma Chambers
11. Eruption dynamics and field relations
12. Phreatomagmatism: Steam Driven Eruptions on Earth and Mars
13. Evolution of the volcanic conduit and ash dispersal