New Course Proposals to DEES

Please Submit to the Curriculum Committee:

1. **One Page Rationale** – please include the following (see example):
   Rationale for the new course – what instructional need is being filled? Instructional goals/philosophy – what will students gain from this course? Expected enrollments/audience – who will take this course?
   Non-majors? Majors? DEES Grads? Other Depts/Schools/Colleges?
   Justify level – undergrad (1000-3000), grad (≥ 6000), both (≥ 4000)? Pre-requisites – what is the ideal preparation for the student?
   Where does this fit within the UG/Grad curric? Requirements? Depth/Breadth?
   How does this relate to other courses within the Discipline (grad) or Track (UG)? Please provide a list of related courses, and how these courses relates
   How does this course differ in content and goal from other related courses? Course funneling – what courses are feeders, and what courses could follow on?
   Instructor commitments - are there resources? What are existing teaching commitments?
   Scheduling – what other courses should be sequenced/alternated/avoided in overlap?

2. **Proposed Course Syllabus** – It should include (see example):
   Title, Proposed EESC number, number of credits, Instructor information Course Description – for catalog. May also include goals, overview
   Pre-requisites – please include these as guidance for students; they are not restrictive
   Required Readings, Expectations/Assignments/Basis for Evaluation
   Provisional list of topics/weekly schedule

3. **Course Description for the Bulletin**: (see examples):
   Title, Proposed EESC number, number of credits
   Prerequisites:
   Pithy Description

**Deadlines for submission** to DEES Curriculum Committee

- **Fall courses**: DEES Curriculum Committee mid-Feb (COI mid-March)
- **Spring courses**: DEES Curriculum Committee mid-Sept (COI mid-October)
- **Summer courses**: DEES Curriculum Committee mid-Oct (COI mid-November)

**Procedure**: After submission to Curriculum Committee, proposals receive feedback, and if recommended, are forwarded to the DEES Faculty for vote. Successful proposals are then submitted to College Committee on Instruction. Courses # 4000 and below go to Columbia College. Courses #4000 and above go to GSAS.

4. **After Approval by DEES Faculty, Please Reach out to Carol Mountain to help Complete Forms needed for submittal to Committees on Instruction**
Rationale for a New Course:

**What instructional need is being filled?**
A graduate level course on the role of magmas and volcanoes in earth processes.

**What will students gain from this course?**
This course explores the origin of magmas and their subsequent movements; their ascent, stalling and eruption; their transport of heat and mass through the earth; their formation of crust and creation of volcanoes. The course will explore magmatism itself - its chemical and physical underpinnings – and also develop magmatic tools used to understand other earth processes. Topics will be focused around Grand Questions. Example questions include: What do magmas tell us about the thermal structure of the earth? Why do magmas store and stall where they do? What drives the largest eruptions on Earth? Does continental extension drive melting or melting drive extension?

**Expected enrollments/audience – who will take this course?**
The course is designed to serve as an accessible breadth course for Earth Science graduate students in any discipline. The course will also serve as a depth course for the Geochemistry Discipline. The expected enrollment is 5-15 students, drawn primarily from Geology, Geophysics, Geochemistry Disciplines.

**Justify level –graduate (≥ 6000)**
This is intended as a graduate course, to strengthen offerings in several Disciplines. The topics and discussion require a depth of understanding of physics, chemistry and plate tectonics. Pre-requisites are such that they require graduate preparation and status. Undergraduates with appropriate background may take the course with permission.

**Related Courses**
No existing courses cover this span of topics, from magma generation, movement and eruption as expressed in the recent literature with focus on Grand Questions.

EESC 4009 – Chemical Geology
This course is a development of thermodynamics, focused on high pressure and temperature equilibria. It does not focus on magmatic problems that bear on tectonic processes.

EESC 4701 – Igneous Petrology
This course is a development of phase equilibrium as applied to the microscopic study of igneous rocks. It does not focus on topical questions from the recent literature.

Seminar Courses do not provide the fundamental background, nor hands-on problem solving, provided in this course. Such background in necessary to enable in-depth understanding and
discussion from graduate students with a wide range of interests and preparation, including geologists, geophysicists, geodynamicists and geochemists.

**Course Funneling** – this is a stand-alone course in the graduate curriculum.

**Instructor commitments** - Plank has yet to teach at the graduate level, except seminars. And yet, when she has offered topical seminars, like “Volcano Petrology” (2008), “Volcanic Eruptions” (2010), “Volcanism Associated with Continental Extension” (2011) there has been good attendance (5-15) and interest across divisions. By broadening the scope of topics, providing structured background, and offering alternate years, Plank hopes to strengthen the topical approach to provide graduate students background in magmatism and volcanism.

**Scheduling** – There are currently very few Geochemistry Graduate-Level Courses in odd-year Falls. See attached plan. So the plan would be to offer this course regularly in Fall 2017, 2019, etc. Nonetheless, there is a standing cohort of more senior students who are primed for taking this course in Fall 2016, and so the goal would be to offer it in Fall 2016 and thereafter odd-year Falls: 2017 and 2019, etc. Plank already teaches an undergraduate majors course regularly each Fall, EESC 3101 Geochemistry for a Habitable Planet, and plans to develop a new Introductory course to alternate even-year Springs, starting in 2018.

**Special Items** – please consult CIM Guide e.g., other kinds of Class Meetings, Fees, Multiple Sections, etc http://www.college.columbia.edu/coi-procedures
Course Syllabus:

EESC 6700 – Magmatism and Volcanism, 3 credits
Fall 2016

Professor: Terry Plank
Department of Earth and Environmental Sciences
Office: Comer 411, LDEO
Phone: 845-365-8410
Email: tplank@ldeo.columbia.edu
Office Hours: Lamont, by appointment
Class Meeting Time: Lamont, Monday and Wednesday mornings

Overview: This course explores the origin of magmas and their subsequent movements; their ascent, stalling and eruption; their transport of heat and mass through the earth; their formation of crust and creation of volcanoes. The course will explore magmatism itself - its chemical and physical underpinnings – and also develop magmatic tools used to understand other earth processes. Topics will be focused around Grand Questions. Example questions include: What do magmas tell us about the thermal structure of the earth? Why do magmas store and stall where they do? What drives the largest eruptions on Earth? Does continental extension drive melting or melting drive extension? Questions will evolve to reflect the state of the field and student interest. The course is designed to serve as an accessible breadth course for Earth Science graduate students in any discipline.

Course Structure: Each week will be devoted to a Grand Question, with a structured lecture providing fundamental background, and discussion of a key paper that articulates the question. Students will also research current papers on topic, and provide short pop-up talks on these. Problem sets will provide hands-on worked examples of magma principles and modeling tools for estimating pressure, temperature and other parameters of interest. The final research paper (≤ 10 pp of text) will be due at the end of the semester, on a topic of choice to the student.

Pre-requisites: graduate student status and coursework equivalent to admissions requirements to the Earth and Environmental Science Ph.D. program (one year each chemistry, calculus, physics) and at least two courses in geology/geophysics/geochemistry disciplines; or permission of instructor.

Required Textbook: There is no required textbook. Readings will be freely available from online resources.

Class Schedule and Other Events: Attached is a preliminary class schedule.

Late Work: Problem sets must be handed in on the date assigned in class. Ten points will be deducted (out of 100 total points) for each day late.

Grading Criteria:
Problem Sets (3): 30%
Final Paper: 30%
Class Participation: 40%
Total 100%

Academic Integrity: Students are expected to do their own work on all tests and assignments for this class and act in accordance with the Faculty Statement on Academic Integrity and Honor Code established by the students of Columbia College and the School of General Studies. Because any academic integrity violation undermines our intellectual community, students found to have cheated, plagiarized, or committed any other act of academic dishonesty can expect to [specify academic sanction: fail the class/receive a zero for the work in question] and may be referred to the Dean’s Discipline process.
### Magmatism and Volcanism

**EESC 6XXX Schedule, MW 11-12:15 pm, Fall 2016**

<table>
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<tr>
<th>Week of</th>
<th>Topic</th>
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<tr>
<td><strong>5-Sep</strong></td>
<td>(Labor Day Sept 5) Introduction</td>
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| **12-Sep** | How do H2O and CO2 drive melting?  
| **19-Sep** | What is the role of heterogeneities in driving and focusing melting?  
| **26-Sep** | Do subducting slabs melt?  
| **3-Oct** | Does continental extension drive melting or melting drive extension?  
| **10-Oct** | What do magmas tell us about the thermal structure of the earth?  
| **17-Oct** | How hot are plumes?  
| **24-Oct** | Why do magmas stall and store where they do?  
| **31-Oct** | How do magmas form the oceanic crust?  
| **7-Nov** | (Academic Holiday)  
What drives the largest eruptions on Earth? |
| **14-Nov** | How do magmas form the continental crust?  
| **21-Nov** | What drives the most explosive volcanic eruptions?  
| **28-Nov** | (Thanksgiving, Nov 24)  
What controls the run-up to an eruption? |
| **5-Dec** | What volatiles do volcanoes convey to the atmosphere?  
| **12-Dec** | (Last day of classes)  
How have magmas driven differentiation of the earth? |

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