Igneous rock classification and partial melting in one lecture

1. Preclass learning journal assignment (one per day, 20% final grade)
2. Learning objectives
3. Preclass concept checkpoint (multiple concept tests etc.)
4. Lecture part 1
5. Two concept tests
6. Lecture part 2
7. Two short answer interpretation questions
8. Repeat learning objectives

*Concept tests worth ~7% of class grade

Flipped Introductory Class

• Flipped Class Model: Some physical geology instruction presented online before class
  • Students watch a video and complete low stakes online quiz
  • Frees ~15 minutes of class for more challenging concepts

Lesson timeline and content before/after introduction of videos

<table>
<thead>
<tr>
<th>Year</th>
<th>LO</th>
<th>Igneous rock classification</th>
<th>Partial melting processes</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2015</td>
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Pre Class Assignment

Students view brief videos as preclass assignments then . . . complete an online quiz

Videos begin with learning objectives, often contain formative assessments, and end with a reflection activity

Average completion time ~30 minutes

Present learning objectives for today’s lesson

MEA 101: Module 3: Learning Journal 2 Learning Objectives

• I can explain how the texture and composition of volcanic and plutonic igneous rocks vary
• I can give examples of volcanic and plutonic rocks that formed from felsic, mafic and intermediate magmas.

MEA 101: Module 3, Part 2 Class Learning Objectives

• I can describe how mafic magma differs from felsic magma.
• I can explain the three principal mechanisms for melting rocks.
• I can define the term, partial melting.
• I can explain how different types of magma form in association with the following plate settings:
  • oceanic ridge, subduction zone, hot spot, rift valley.

What is the most likely cooling rate and composition of a small grained, light-colored igneous rock?

- A. Cooled rapidly, low silica
- B. Cooled rapidly, high silica
- C. Cooled slowly, low silica
- D. Cooled slowly, high silica
Which table best illustrates the classification scheme for igneous rocks?

A. A  
B. B  
C. C  
D. D

I can classify common igneous rocks on the basis of their texture and composition.

- Gabbro  
- Basalt  
- Rhyolite  
- Diorite

Name (classify) these igneous rocks on the basis of their texture and composition.

- Granite  
- Basalt  
- Gabbro  
- Andesite

Magma at X forms as a result of which process?

Lecture sequence
1. Present slides to define partial melting, discuss three partial melting processes.
2. Ask two conceptests that ask students to predict melting process at various plate boundaries (exploration).

LO: I can explain how magmas and igneous rocks form in association with plate settings.

3 types of plate boundaries

- Convergent
  - Ocean
  - Ocean
  - Partial melting of ultramafic rocks
  -生成Mafic magma that heats continental crust
  -生成Andesite

- Divergent
  - Ocean
  - Ocean
  - Partial melting of oceanic crust
  -生成Mafic magma that forms below the ocean floor

- Continental
  - Continental
  - Partial melting of continental crust
  -生成Felsic magma that produces Andesite and Rhyolite

Use the cross-section below to identify the causes of partial melting at each location (1-5) and label where the igneous rocks listed below could be found.

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MEASURING TEACHING PRACTICE

Reformed Teaching Observation Protocol

• Maximum score = 100
• Reformed classrooms featuring more active learning practices have higher RTOP scores

Classroom Observation Project
205 instructors/classes
Average RTOP score = 39.7

Reformed classrooms
featuring more active
learning practices have
higher RTOP scores

Active Learning Options – Degree of Difficulty

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<th>Multiple, short duration activities per lesson</th>
<th>Few, longer duration activities per lesson</th>
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<tr>
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<td>No/low questions from students</td>
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<tr>
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<tr>
<td>Lesson adjustments based on student work or prior knowledge</td>
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OBSERVED TEACHING PRACTICES

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<th>Most Traditional Lecture n=10</th>
<th>Mean Traditional Lecture n=10</th>
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