Aims of the course

• Revisit and synthesize knowledge from previous classes
• Learn how to read and write a scientific paper
• Write a 6000 word review on a selected topic within Planetary Volcanism
• Give an oral presentation on same topic
Logistics

• Tu/Th 1:30-3:05 in E&MS D258
• Homeworks due on Tuesday (in class)
• Office hours immediately after class (or by appointment; fnimmo@es.ucsc.edu)
• Class website
  – http://eps.ucsc.edu/~fnimmo/eart191b/
Why volcanism?

- It cuts across disciplines – surfaces, interiors, atmospheres
- It is present almost everywhere in the solar system
## Outline

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<td>Introduction &amp; topics</td>
<td>Reading a paper</td>
<td>Write an abstract; pick topics</td>
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<td>Writing a paper</td>
<td>Summarize topic paper +5 key references</td>
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Report

- 6000 words
- At least one figure
- At least 20 references

- We’ll practice writing e.g. outline, introduction
- You’ll be doing a lot of reading
- Don’t plagiarize! (“Any duplication of more than 50% of a sentence appearing in a published abstract or paper should be identified via quote marks and appropriately referenced.”)
- Don’t cite Wikipedia, cite the original reference
10 topics

• Or you can suggest your own
• Email choices to me by end of this week
Are there currently active volcanoes on Venus?


• Infra-red observations can look for recent and/or active lava flows

• SO$_2$ variability in atmosphere might be due to volcanic eruptions

• Change detection using images taken at different times
How important is volcanism for heat transfer on planetary bodies?

- Dominant on Io
- Potentially important for Earth, Venus, Mars, especially early in their history
- What is the evidence?
Does Io really have a magma ocean?

- Induction technique can probe magma ocean
- Distribution of volcanoes can tell us about internal structure
- So can distribution of heat
- What about tidal response?
How different is volcanism on Venus to volcanism on Earth?

- Compositional differences?
- Effect of plate tectonics?
- Rates and amounts of volcanism?
- Resurfacing: tectonic vs. volcanic
- Effect of atmosphere and surface temperature on volcanic style?
- How much outgassing? ($^{40}$Ar)
Are there “supervolcanoes” on Mars?

- Define “supervolcano”
- Why are Martian volcanoes larger than terrestrial ones?
- Are there deposits from supervolcanoes?
- Is the Medusae Fossae Formation volcanic in origin?
- How can we tell pyroclastic flows from impact deposits?
What is the history of volcanism on Mercury?

- What lava compositions?
- When and how much was erupted?
- Intrusive activity? (magnetic anomalies)
- Were volatiles erupted?
- What does this tell us about Mercury’s thermal evolution?
What is the evidence for cryovolcanism on Titan?

- How is cryovolcanism defined?
- What is the evidence – imaging, topography, spectroscopy?
- CH$_4$ and $^{40}$Ar resupply?
What is the evidence for cryovolcanism in the outer solar system?

- Define cryovolcanism
- Active cryovolcanism (Enceladus, Triton?, Europa?, Titan??)
- Ancient cryovolcanism (Ganymede?, Ariel?, Pluto/Charon?, etc.)
Was the climate of Mars influenced by volcanic activity?

- How much material did volcanism supply?
- What mechanisms affect the climate?
- What is the evidence for these effects?
Was the climate of Earth influenced by volcanic activity?

• How much material did volcanism supply?
• What mechanisms affect the climate?
• What is the evidence for these effects?
• Mass extinctions?
EART 1931B Topics and starting references

Wilson, *Nature Geosci.* 2, 389-397, 2009 is a good general review

Are there currently active volcanoes on Venus?

How important is volcanism for heat transfer on planetary bodies?

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How different is volcanism on Venus to volcanism on Earth?

Are there “supervolcanoes” on Mars?

What is the history of volcanism on Mercury?

What is the evidence for cryovolcanism on Titan?

What is the evidence for cryovolcanism in the outer solar system?
Chapter 9 of Lopes and Gregg (though this was written before Enceladus!)

Was the climate of Mars influenced by volcanic activity?

Was the climate of Earth influenced by volcanic activity?
Sources of Information: Books

• University of Arizona Press series
• Cambridge Planetary Science series

On reserve in library
Online Resources

• Wikipedia (very useful, but don’t cite it!)
• Hawaii Planetary Research Discoveries
  http://www.psrd.hawaii.edu/Archive/Contents.html

• Article Databases:
  – Google Scholar
  – Lunar & Planetary Institute abstract database
  – NASA Astrophysical Data System (ADS)
  – Web of Science
Web of Science

• Get to it via http://library.ucsc.edu