

2023: EARTH 300 Physical Volcanology

Processes and impacts of erupting volcanoes



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Syllabus/Course Contents

Fall 2023

Bruce Houghton: phone (808)220-9273

Times: T,R, 10:30-11:45 pm

bhought@soest.hawaii.edu

Place: POST-703

3 credits

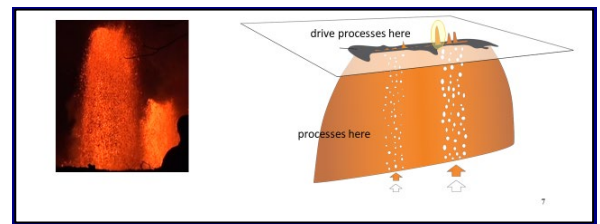
Office Hours: Tuesday 9:00 –10:00 am

Key topics covered in EARTH300

1. fluids and rheology
2. behaviour of complex multi-phase fluids
3. subsurface storage and transport of magma
4. links between surface and shallow subsurface processes
5. anatomy of volcanoes
6. how heat loss and environmental conditions drive behaviour of lava
7. the physics of explosions
8. vesiculation and the properties of bubbles and foams
9. fragmentation processes
10. tephra in the air and on the ground
11. anatomy of a long, complex eruption
12. physical and social impact of hazard events
13. techniques and limitations of monitoring volcanoes
14. relationships between hazards, impacts and risk
15. management and mitigation of natural hazards
16. institutions in crises
17. people during crises: behaviour in low frequency, high consequence events

Learning Objectives:

- Introduce the physical processes & concepts of volcanology
- Illustrate the impacts of volcanoes on communities
- Develop skills in scientific research, problem-solving, and critical thinking



Building blocks

ERTH300 is built around a framework of physical and social science.

It spans the range of physical approaches to eruption processes and the sociology of volcanic crises. It has a strong emphasis on characterizing eruption products on a range of time and length scales. In particular, we will chart the 2018 and earlier eruptions of Kilauea on a two-day excursion to the volcano.

Building blocks

- **PHYSICAL MEASUREMENTS:** introduction to process
- **PROPERTIES OF MULTIPHASE FLUIDS:** underlying causes
- **BEHAVIOR OF PEOPLE:** effects & role of society

Course design and content:

The course will involve lectures, including analog laboratory demonstrations, and student participation (giving presentations). Modules are: the rheology and transport of magma; models for intensity and style of explosive eruptions; transport and emplacement of lava flows; origins and characteristics of pyroclasts and pyroclastic deposits; integrated monitoring of active volcanoes, evaluation and impacts of volcanic hazards and volcanic crises.

COURSE DESIGN

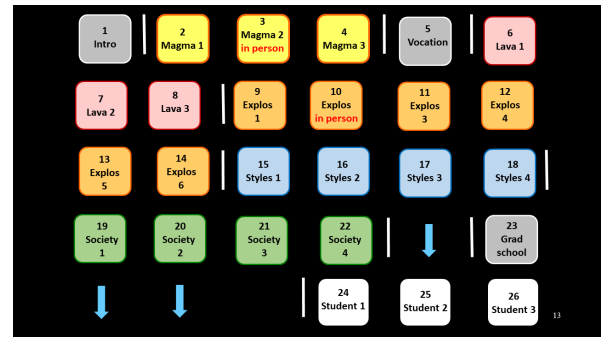
MODULES	FORMAT
1. fluid dynamics: magma	26 classes
2. lava effusion	2 or 3 labs
3. explosive eruptions	3 field trips
4. eruption styles	1 project
5. volcanoes + society	2 adopted eruptions

office hours: 9-10 am
Tuesdays (on Zoom)

Course characteristics

One research project linked to volcanic crisis management and eruption response.
Four homework assignments, and numerous on-line quizzes.

The figure shows the division of the classes into 11 modules of uneven length.



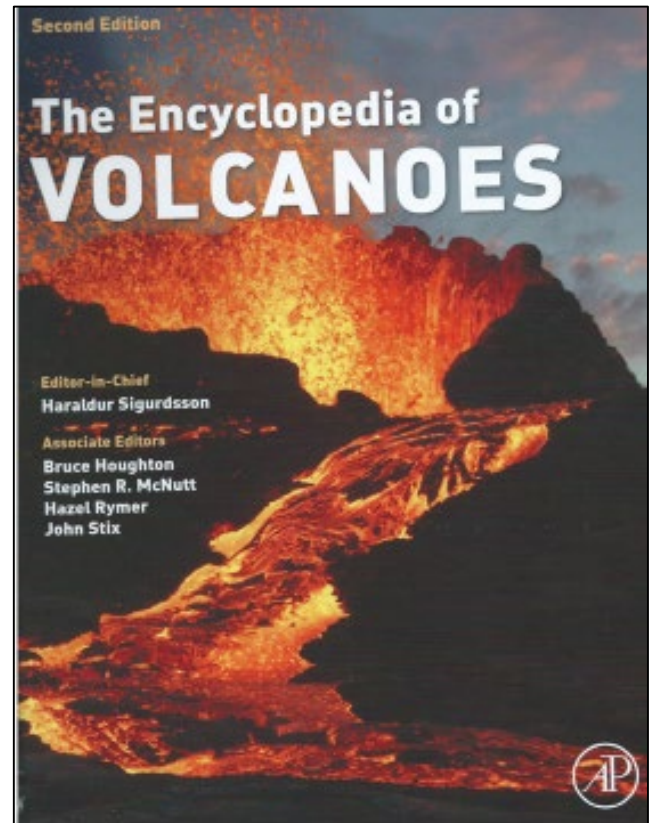
'Recommended' Reading:

Encyclopaedia of Volcanoes. Sigurdsson, H.; Houghton, B.F.; McNutt, S.; Rhymer, H.; Stix, J. (eds). (2015) Academic Press, San Diego.

We will use the text more as a **supplementary reference** than as a guide for the course; we will not spend much class time regurgitating the information in the text; specific chapters or part-chapters will be assigned, not necessarily in the order in the book. I will make chapters available to you as a pdf.

Prerequisites:

100 level geology and basic sciences (math or phys or chem), 200/300 level mineralogy/petrology/earth materials, *or* permission of instructor.



Evaluation:

- No extra credit
- No curving grades
- 90%, B > 80%, C > 70%

• project	30
• final exam	10
• tests and quizzes	30
• homework	30
• attendance	10
• TOTAL	100

Other class requirements

- Use of e-mail and the world-wide-web: As a student at UH, you are entitled to an e-mail account. We will use e-mail and Laulima as means of communicating with each other outside class time. We will also be using WWW resources for our projects and homework.
- Assignments turned in on time: Assignments must be turned in at the beginning of class on the designated day. **Unjustified late assignments will receive one grade-step lower.** The only exceptions will be pre-arranged absences or verified illness.
- Attendance: Because we will be doing tests in every class, attendance is crucial in this class. If you know you will miss a class, because of scheduled travel or another reason, **please let me know in advance.** There will be no make-up tests except by prior arrangements with me, under exceptional circumstances.

The University of Hawai'i is committed to providing a learning, working and living environment that promotes personal integrity, civility, and mutual respect and is free of all forms of sex discrimination and gender-based violence, including sexual assault, sexual harassment, gender-based harassment, domestic violence, dating violence, and stalking. If you or someone you know is experiencing any of these, the University has staff and resources on your campus to support and assist you. Staff can also direct you to resources that are in the community. Here are some of your options:

As members of the University faculty, your instructors are required to immediately report any incident of potential sex discrimination or gender-based violence to the campus Title IX Coordinator. Although the Title IX Coordinator and your instructors cannot guarantee confidentiality, you will still have options about how your case will be handled. Our goal is to make sure you are aware of the range of options available to you and have access to the resources and support you need.

If you wish to remain ANONYMOUS, speak with someone CONFIDENTIALLY, or would like to receive information and support in a CONFIDENTIAL setting, use the **confidential resources available here:** <http://www.manoa.hawaii.edu/titleix/resources.html#confidential>

If you wish to directly REPORT an incident of sex discrimination or gender-based violence including sexual assault, sexual harassment, gender-based harassment, domestic violence, dating violence or stalking as well as receive information and support, contact: Dee Uwono, Title IX Coordinator (808) 956-2299 t9uhm@hawaii.edu.

Disability Access: If you have a disability and related access needs the Department will make every effort to assist and support you. For confidential services students are encouraged to contact the Office for Students with Disabilities (known as "Kokua") located on the ground floor (Room 013) of the Queen Lili'uokalani Center for Student Services: KOKUA Program; 2600 Campus Road; Honolulu, Hawaii 96822 Voice: 956-7511; Email: kokua@hawaii.edu; URL: <http://www.hawaii.edu/kokua>