

Welcome to...

ESS103A Igneous Petrology



Please pick up handouts

Plan for today:

- Who are we?
- What is this class about?
- What is the structure of this course?

- How does the scientific method work?



Who are we?

Professor: Liz Johnson

Born: North Little Rock, AR

Undergrad: Rice University, Houston, TX

Grad: Caltech, Pasadena, CA

Postdoc: Smithsonian Institution

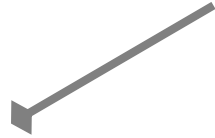
At UCLA for one year

My first paying job was....

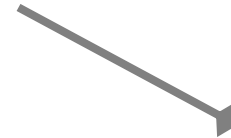
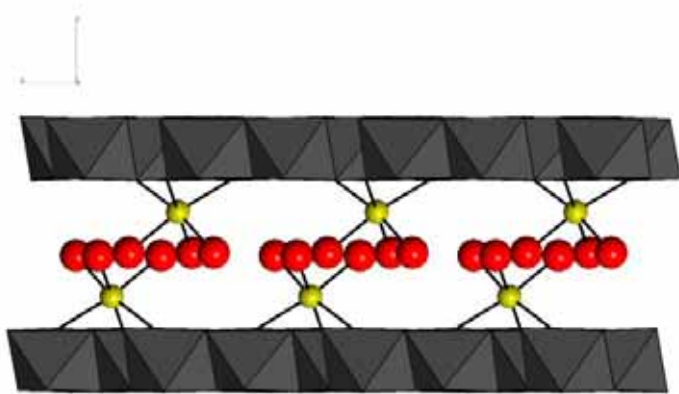


What are my research interests?

Interaction of water with earth materials



How do soil minerals take up and release nutrients and toxins?



Volatile history of explosive volcanoes
and fluids in subduction zones



Where can you find me?

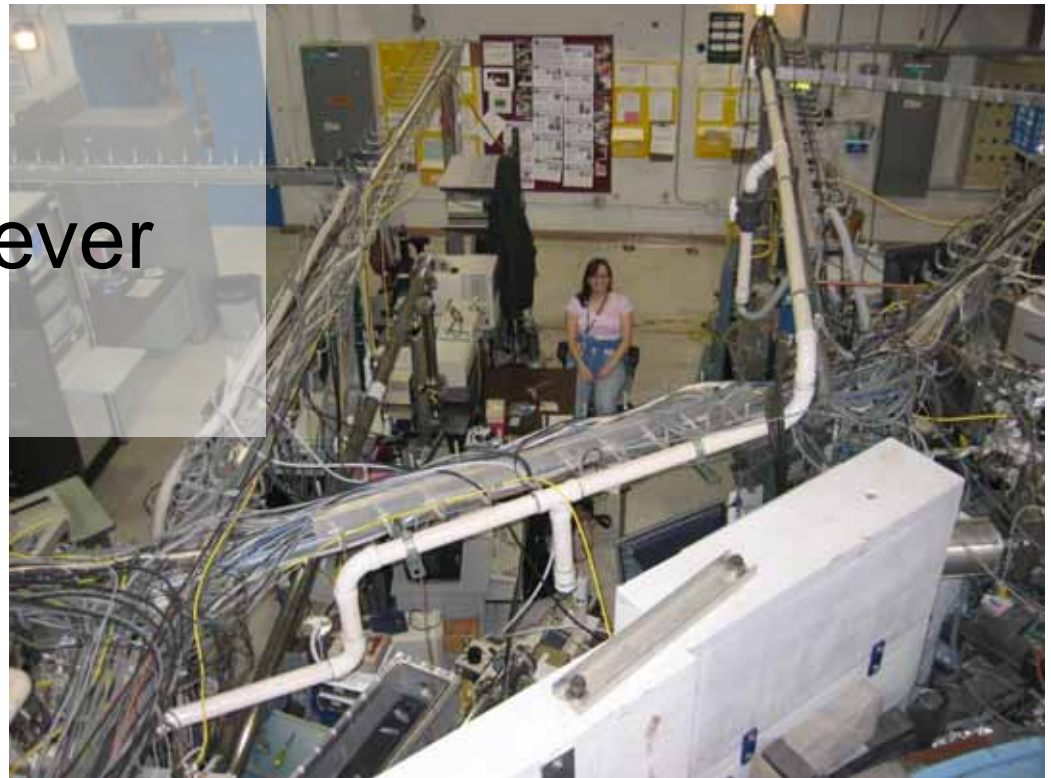
Instructor: Liz Johnson

3687b Geology

johnsoel@ucla.edu

825-9084

Office Hours: Whenever
the door is open



Who are we?

TA: Codi Lazar

Graduate Student, UCLA

Research Interests:

Astrobiology,
experimental petrology



Where can you find the TA?

What is this class about?

Igneous Petrology

Lecture, two to three hours; laboratory, six hours; field trips. Requisites: courses 51A, 51B, Chemistry 14B and 14BL, or 20B and 20L, Mathematics 3B or 31B.

Mineralogy, chemical composition, and field occurrence of igneous rocks with reference to their origin by melting in earth. Introduction to thermodynamics as applied to petrology. Formation of magma, its movement, eruption, crystallization, and chemical evolution. Petrologic structure of crust and mantle and its relation to seismology.

Overview of petrological and chemical evolution of Earth, moon, and other planets from their origin to the present.

Course objectives

1. Evaluate the origin of an igneous rock based on petrologic, thermodynamic, and geochemical evidence
2. Identify and classify igneous rocks



Secondary Goal

Critically assess information using the principles of the scientific method.



Things we'll cover

What is “igneous petrology?”

Introduction to Ig Pet:

Structure of the Earth

Heat generation and the geotherm

Melt production, structure and rheology



Topics we will cover

Petrologic tools:

Mass balance

Chemical composition

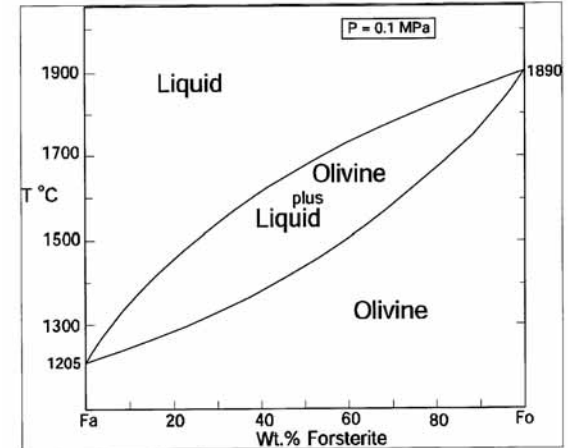
Thermodynamics

phase diagrams

Geochemistry

element partitioning

isotopic systems



Topics we will cover

Igneous provenances:

Continental subduction zones

Layered mafic intrusions

Mid-ocean ridges

Ocean islands

Flood basalts

Alkaline volcanoes in
continental rift zones

Field trips

Two mandatory field trips (**Why?**) :

- 1. April 22-23**, Peninsular Ranges Batholith, San Diego County
- 2. May 19-21**, Volcanic structures, Long Valley and Owens Valley, Eastern CA

We will be camping on both trips

I will provide you with a list of things to bring



Class Structure

Schedule:

Classes: MWF, 1:00 PM – 1:50PM,
Geology 4641

Labs: WF, 2-4:50, Geology 4641

Textbooks:



Winter, An Introduction to Igneous and
Metamorphic Petrology



Mackenzie, A Color Atlas of Rocks and
Minerals in Thin Section



Mackenzie, Atlas of Igneous Rocks and their
Textures

Class Structure

You will need...

- ...access to a computer (word processing and spreadsheet programs; internet)
- ...a hand lens and magnet
- ...a dedicated lab notebook (3-ring binder)

Course web page:

[http://www2.ess.ucla.edu/~ejohnson/
ess103a/ess103a_2006.htm](http://www2.ess.ucla.edu/~ejohnson/ess103a/ess103a_2006.htm)

Class Structure

Grading:

Labs (45%)

Homework (15%)

Field trips and projects (15%)

Midterm (10%)

Final exams (lab and class) (15%)

Key to doing well: show up and participate!

Grading Policies

1. Collaboration on labs, HW, and class activities *is strongly encouraged*, **but** write all assignments in your own words.
2. All assignments must be turned in on time to receive full credit. Extensions will be considered on a case-by-case basis
3. Don't cheat. (copying from previous years' assignments or fellow students, sharing answers during exams, etc.)

What is science?

Science is knowledge or a system of knowledge covering general truths or the operation of general laws especially as obtained and tested through the **scientific method. Scientific knowledge relies heavily upon forms of logic.**

-Wikipedia

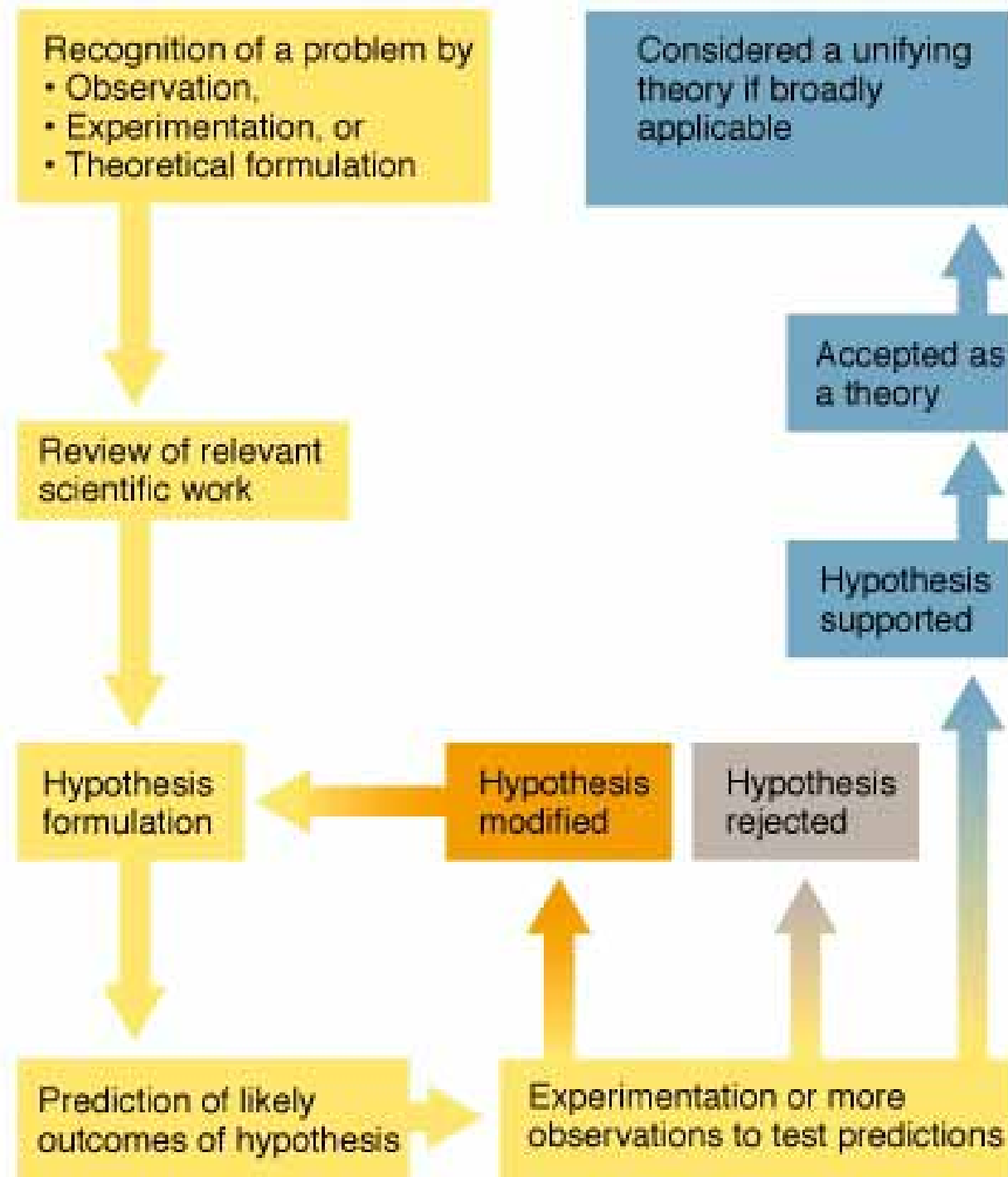
The scientific method

Driven by **LOGIC**

Continually **QUESTION** each step

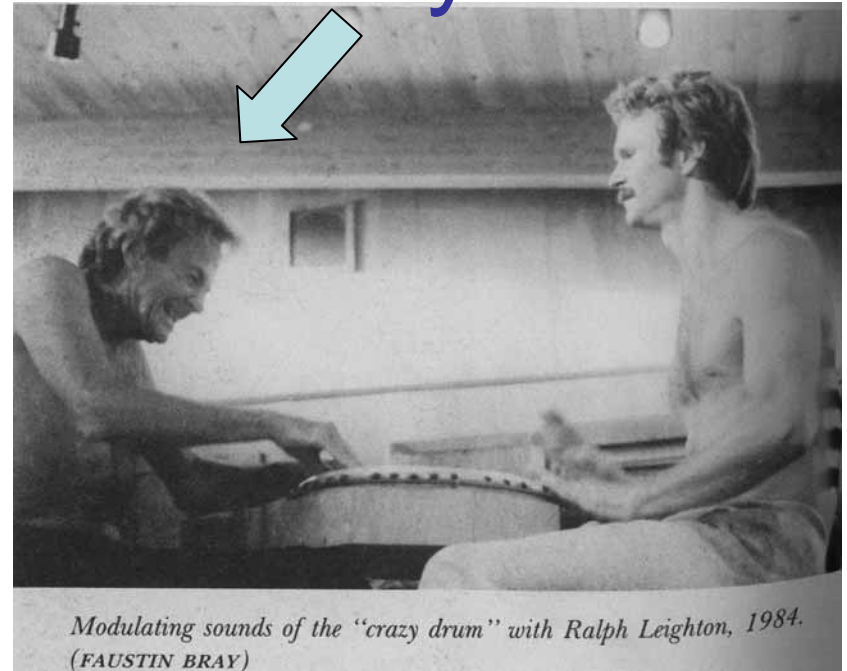
Do we follow box diagrams in real life?

How does this work for igneous petrology?



Thoughts from Richard Feynman

“The scientist has a lot of experience with ignorance and doubt and uncertainty, and this experience is of very great importance, I think.



When a scientist doesn't know the answer to a problem, he is ignorant. When he has a hunch as to what the result is, he is uncertain. And when he is pretty darn sure of what the result is going to be, he is still in some doubt..."

Thoughts from Richard Feynman

“We have found it of paramount importance that in order to progress we must recognize our ignorance and leave room for doubt.

Scientific knowledge is a body of statements of varying degrees of certainty- some most unsure, some nearly sure, but none *absolutely* certain.

Now, we scientists are used to this, and we take it for granted that it is perfectly consistent to be unsure, that it is possible to live and *not* know. But I don't know whether everyone realizes this is true.”

Science is a human endeavor

Other human activities include:

Philosophy

Politics

Law

Arts

Technology

These may interact with scientific reasoning, producing mixed results!



Reading assignment

p.2-11; review igneous mineral formulas, structures, and optical/hand sample properties in your mineralogy book

- Olivine
- Pyroxenes
- Feldspars
- Quartz
- Garnet
- Amphiboles
- Micas
- Magnetite
- Ilmenite
- Spinel
- Zircon
- Nepheline