Geology and Geophysics 303
Structural Geology
Course Notes
Fall 2011
MW (lecture) 10:30-11:20, W (lab) 1:30-4:20

Steve Martel
Department of Geology and Geophysics
University of Hawaii

POST 805
956-7797
smartel@hawaii.edu
http://www.soest.hawaii.edu/martel/Stevem.html

Fractures

http://volcanoes.usgs.gov/Imgs/Jpg/Photoglossary/fissure4_large.JPG

Dike: Fissure Eruption (1/13/11) Aerial View

http://hvo.wr.usgs.gov/kilauea/update/archive/2011/Jan/

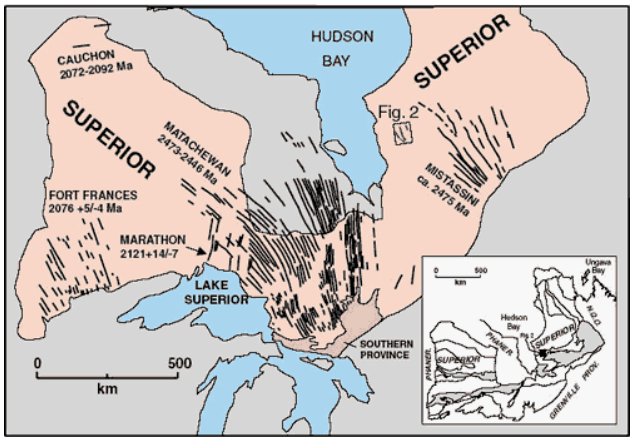
Dike: Fissure Eruption (1/13/11) View from the Ground

http://hvo.wr.usgs.gov/kilauea/update/archive/2011/Jan/

Dike: Ship Rock

http://www.rci.rutgers.edu/~schlisch/structureslides/shiprock_LJM.jpg

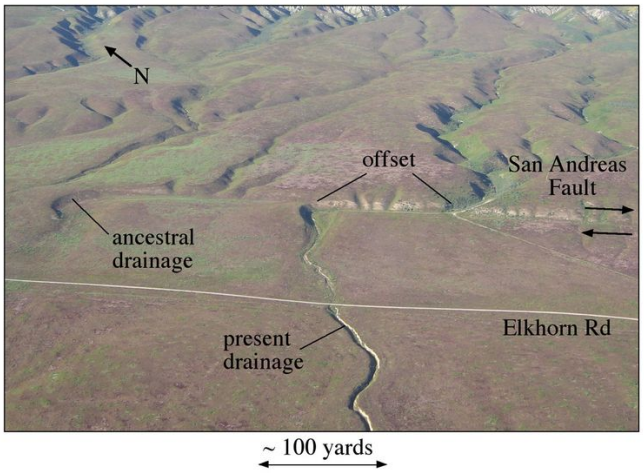
Giant Dike Swarm, Canada



http://www.mantleplumes.org/images/GiantPatternsFig3_500.gif

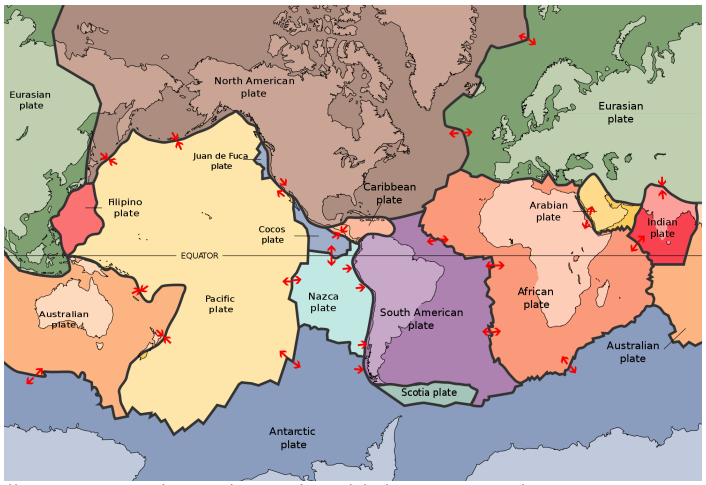
Fault, Sierra Nevada, CA

San Andreas Fault
Wallace Creek, California



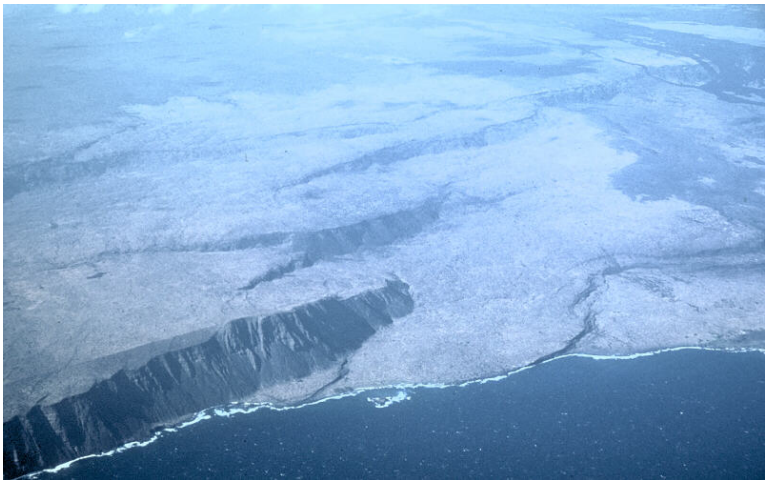
http://www.tf.uni-kiel.de/matwis/amat/def_en/kap_5/illustr/dislocation_3dim.jpg

Plate Boundaries



http://upload.wikimedia.org/wikipedia/commons/thumb/8/8a/Plates_tect2_en.svg/2000px-Plates_tect2_en.svg.png

Faults in Hawaii
Hilina Pali



volcanoes.usgs.gov/ images/pglossary/fault.php

Small Fold
Rainbow Basin, California

http://en.wikipedia.org/wiki/File:Rainbow_Basin.JPG

Large Fold
King Oscar Fjord, East Greenland

http://en.wikipedia.org/wiki/King_Oscar_Fjord

1. INTRODUCTION AND COURSE PHILOSOPHY

I Main Topics

A What is science?

B Course philosophy

1. INTRODUCTION AND COURSE PHILOSOPHY

II What is science?

A Possession of knowledge as distinguished from ignorance or misunderstanding;

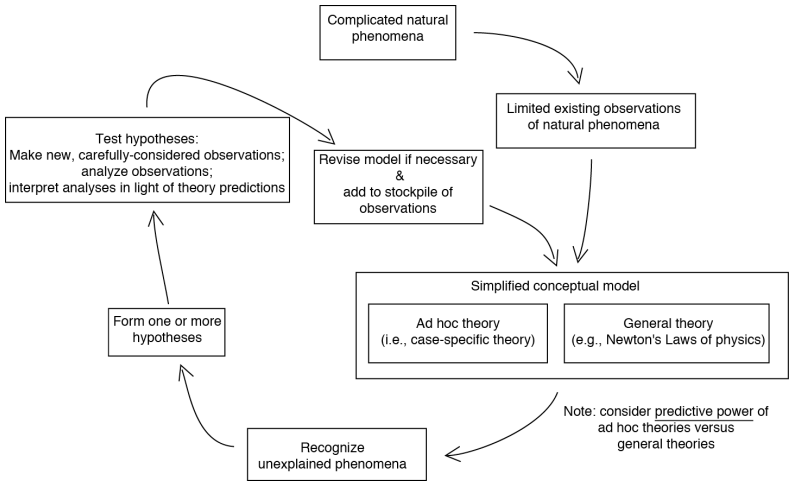
B Knowledge attained through study and practice

C Knowledge covering general truths or the operation of general laws especially as obtained and tested through the scientific method

D Scientific Method

Principles and procedures for the *systematic* pursuit of knowledge involving the *recognition and formulation of a problem, the collection of data through observation and experiment, and the formulation and testing of hypotheses.*

Scientific Method



1. INTRODUCTION AND COURSE PHILOSOPHY

III Course philosophy

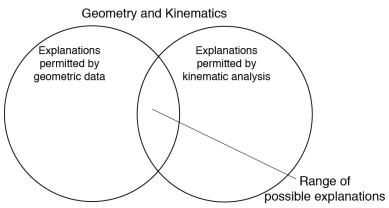
- A Geology can be treated as a scientific discipline
- B Course is intended to challenge students
- C Course emphases
  1. Concepts (not vocabulary)
  2. Critical thinking (not “cookbooks”)
  3. Fundamentals (not fashion)
  4. Quantitative predictions (Where? When? How big?)

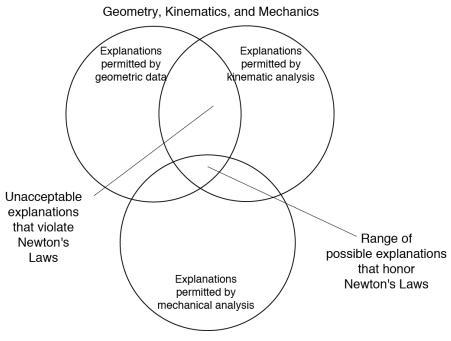
1. INTRODUCTION AND COURSE PHILOSOPHY

D Topics of Course

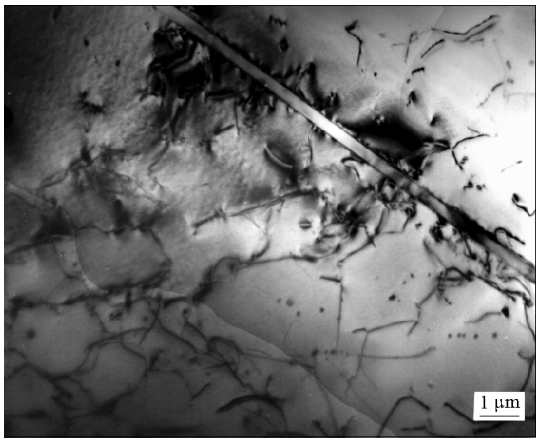
Topic	Definition	Application to structural geology
Descriptive Geometry	Representation of the spatial relationships of points, lines, and planes by means of projections	Used to describe the geometry of deformed or undeformed bodies ~40% of class
Kinematics	Study of the position of bodies through time without regard to the causative forces	Describes how a body changes shape and/or position through time ~20% of class
Mechanics	Study of forces and their effects (e.g., how bodies deform in response to forces)	Used to understand and predict how bodies deform ~20% of class
Geologic Structures	Deformational features in the crust Systematic, organized features	Fractures (including faults) Folds ~20% of class

Why Use Geometry, Kinematics, & Mechanics?



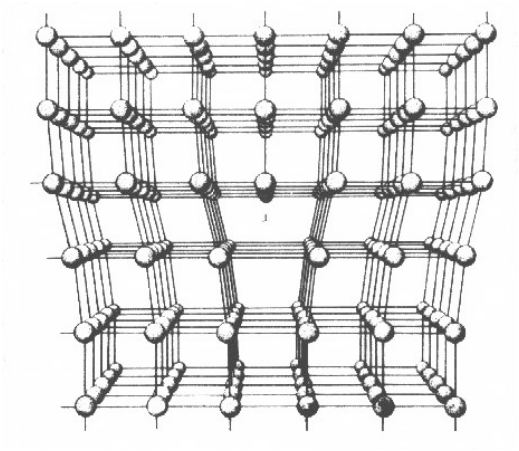


Dislocation in a Crystal



http://www.geol.ucsb.edu/faculty/hacker/geo102C/lectures/dislocation2.jpg

Dislocation in a Lattice



http://www.tf.uni-kiel.de/matwis/amat/def_en/kap_5/illustr/dislocation_3dim.jpg

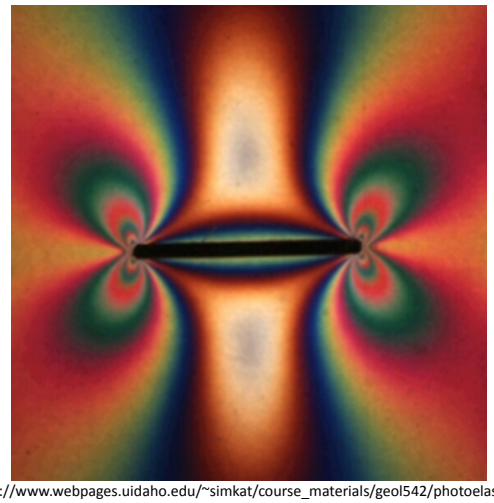
San Andreas Fault Offset in an Orchard

http://tommcmahon.typepad.com/photos/uncategorized/2008/10/20/sanandreas2.jpg

Photoelastic Image
Stresses around a Hole

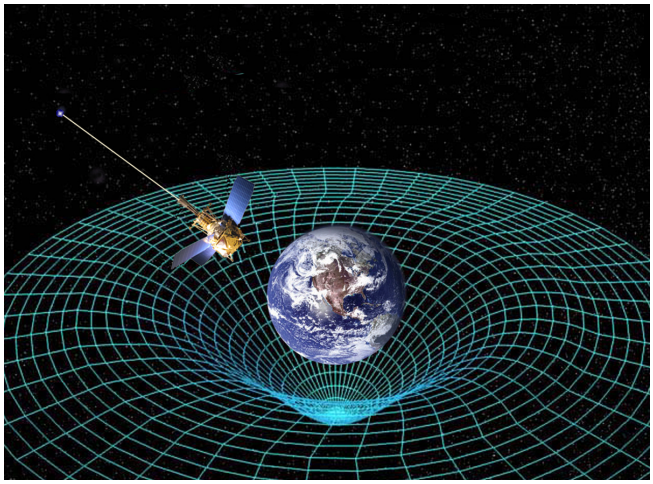
http://medesign.seas.upenn.edu/index.php/Main/HomeHistory

Photoelastic Image
Stresses around a Crack



http://www.webpages.uidaho.edu/~simkat/course_materials/geol542/photoelast.jpg

Differential Geometry:
Mathematics of Relativity Theory & Folding



http://www.kipnews.org/wp-content/uploads/2011/05/Gravity-Probe-B-01.jpg