GG 305 - Geological Field Methods (3 credits, Writing-Intensive)
HERITAGE

1970s: Gordon Macdonald?

late-1970s(?) to early 1980s: Kost Pankiwsky

mid- to late-1980s: Mike Garcia

~1990 - 1998: Steve Self
WHY DO WE HAVE THIS CLASS?

...no field camp
TANGIBLE GOALS

1. Learn how to orient yourself with respect to topography and topographic maps
   - with Brunton compass
   - with hand-held GPS
   - by relating topography to topographic contour forms

2. Learn how to measure strikes & dips with a Brunton

3. Learn how to follow contacts in the field

4. Learn how to produce cross-sections from field and map data

5. Learn how to use stereo air-photos

6. Learn to identify real-life rocks, minerals, and structures

7. Learn how to present field data in graphical and written forms

8. Learn to be self-sufficient in the field
INTANGIBLE GOALS

1. Synthesize knowledge from other G&G courses

2. Gain self-confidence in the field (learn to survive frustration on the first day in a new area, deal with wind, rain, cold, and >100º heat, obscured contacts, etc.)

3. Learn to think in 3-d

4. Understand how reality differs from textbook and laboratory examples

5. Learn a bit of Hawaiian geology
The class meets for 1 hour on Fridays (in POST) and 8 hours on Saturdays (in the field).

There are two big, multi-week field projects (mapping at Hanauma Bay and the California field trip), plus 6 one-day field projects.

There are also a few assignments from the Friday lectures.

The class is Writing-Intensive so both of the big projects require rough drafts, revisions, and final reports.
- Intro., purpose, equipment, goals
- Strikes, dips, faults in maps and the field
- Topographic maps, geologic maps I, cross-sections
- Using a handheld GPS
- Air photo interpretation
- GPS software
- Geologic maps II
- Graphics techniques (by SOEST pubs.)
- Intro. to Hawaiian calderas
- Intro. to pyroclastic mapping techniques
- Computer graphics packages
ONE-DAY FIELD PROJECTS

- Azimuths with a Brunton, pacing distances, geologic sketches (Dole)
- Strikes & Dips (U.H. Mall)
- Orientation in the field with Brunton, hand leveling (Makapuʻu)
- Measured stratigraphic section (Makapuʻu)
- Rock ID practice (prior to California trip)
- Caldera mapping (Waiʻanae)
- Isopleth mapping (Tantalus)
HANAUMA BAY MAPPING

- rock ID
- stratigraphic correlation
- structural analyses
- interpolation of contacts and structures where not exposed
- measuring strikes & dips
- determining locations in the field
- producing a written report
-Devised by Steve Self
-Originally funded by the Hawai‘i Space Grant Consortium (NASA)
-Excuse was a remote-sensing exercise in Death Valley
-HSGC discontinued funding in 1999
-The trip is hard work but fun and students look forward to it
-G&G Dept. has therefore inherited having to pay for it (~7K)
-Funding this year is OK, but in the future???
TYPICAL SCHEDULE

Night 0: fly to Las Vegas

Day 1: drive to Barstow, start Rainbow Basin mapping

Days 2-3: Continue Rainbow Basin, drive to Baker

Days 4-6: Cowhole Mtns. mapping

Days 7-8: Cronese Hills mapping

Days 9, 10: Death Valley, drive back to Las Vegas

Day 11: fly home
RAINBOW BASIN

- Mapping the Skyline Tuff (in the Mud Hills (mid-Miocene volcanics and volcaniclastics)

- Brunton, topo. map, air photos

- Dealing with folds, thrusts, strike-slip and vertical faults

- Dealing with steep, rough terrain, cold wind, snakes, and tortoises
Map of Skyline Tuff, Rainbow Basin, CA
COWHOLE MOUNTAINS

- Mapping a variety of rock types and ages (Permian metavolcanics, Pennsylvanian limestones, Jurassic sandstones, intrusions, alluvium)

- Faults and unconformities

- Map, Brunton, GPS, hand lens, hammer

- Learning to recognize weathering patterns, topo. expression of contacts, faults, intrusions

- Difficult working environment (heat, long walk from car)
Cowhole Mtn. geologic map
(one version, by S. Self, R. Torres, and T. Hulsebosh)
CRONESE HILLS

- Variety of metamorphic rocks (schist, meta-conglomerate, gneiss, phyllite, quartzite dikes)

- Gradual and abrupt changes in metamorphic grade

- Mapping foliations, contacts, unconformities, faults

- Map, Brunton, GPS, hand lens, hammer
One version (of many) of the Cronese Hills geologic road map.
DEATH VALLEY
~geo-tourism
INTEGRATION OF TECHNOLOGY

1. Hand-held GPS and freeware GPS software to plot points and tracks on digital maps and/or images

2. Use of spreadsheet software to compile and graph field data (flow thicknesses, strikes & dips, etc.)

3. Use of computer graphics packages to produce maps and diagrams for reports and manuscripts
RELATIONSHIP TO OTHER G&G CORE COURSES

GG 200 (Geological Inquiry)

1. The students appreciate the age of the Earth better by being exposed to old rocks.

2. They are forced to actually use *Pennsylvanian, Jurassic, Quaternary*, etc.

3. They appreciate tectonics’ ability to juxtapose different rock types and ages.
RELATIONSHIP TO OTHER G&G CORE COURSES

GG 301 (Mineralogy)

1. The students have to identify rocks and minerals in hand sample *in the field*, without wasting time looking in mineralogy books.

2. They also use thin sections for parts of the California project.
1. The students have to identify rocks and minerals in hand sample in the field, without wasting time looking in mineralogy books.

2. They also use thin sections for parts of the California project.

3. They are required to make sense of the rock associations they find in the map areas (Hanauma Bay lithics and California mapping areas).
RELATIONSHIP TO OTHER G&G CORE COURSES

GG 303 (Structural Geology)

1. The students see actual structural features and relationships in the field and in real-life conditions.

2. They relate structural measurements (strikes, dips, cross-cutting relationships) to reality.

3. They have to remember how to use a stereonet.

4. They have to consider systematic structural patterns with respect to tectonic stresses.
RELATIONSHIP TO OTHER G&G CORE COURSES

GG 304 (Physics of the Earth and Planets)

1. This is a tough one and a place where the relationship is weak.

2. I have considered adding flux-gate measurements to the Makemehame measured-section exercise or active seismics to the Hanauma Bay exercise but I don’t know where I can find time to fit them in.
GG 308 (Earth History)

1. The students appreciate the age of the Earth better by being exposed to old rocks.

2. They are forced to actually use *Triassic*, *Permian*, *Holocene*, etc.

3. They use stratigraphic correlation in their mapping projects.

4. They also make paleo-environmental interpretations of some of their mapping areas.

5. Now and then we find a fossil.
RELATIONSHIP TO OTHER G&G CORE COURSES

GG 309 (Sedimentology & Stratigraphy)

1. The students are exposed to a wide variety of sedimentary rocks.

2. They are forced to use principles of superposition and cutting when making geological interpretations.

3. They use stratigraphic correlation in their mapping projects.

4. They become familiar with the weathering characteristics of different rock types and how these can be useful when mapping.
RELATIONSHIP TO OTHER G&G CORE COURSES

GG 313 (Geological Data Analysis I)

1. The students use graphs of varying types to analyze and present field data.

2. They use spreadsheets and simple statistical methods (i.e. averages) to analyze field data.

3. They learn the old-fashioned method of contouring spatial data (isopleths of the Tantalus pyroclastic deposit).
RELATIONSHIP TO OTHER G&G CORE COURSES

GG 325 (Fundamentals of Geochemistry)

1. This is another place where the relationship is weak.

2. I have not come up with any good ideas on how to work Geochemistry into GG 305.
1. Critical Thinking
   - interpretations of field outcrops must make geological & physical sense (use of provisional cross-sections and sketches)
   - rock associations should make sense with respect to geological sense (not as absolute, but something to think about)

2. The Scientific Method
   - avoiding hypothesis myopia
   - but at the same time being able to develop working hypotheses

3. Communication Skills
   - producing legible maps, graphs, and diagrams
   - producing consistent descriptions of rock units
   - tying observations and interpretations together in good written form
CAPSTONE COURSE ???

THE STUDENTS SEE THAT ALL THE STUFF THEY’VE BEEN LEARNING IS FOR REAL, BUT BEST OF ALL...

...THEY GET ENTHUSIASTIC ABOUT GEOLOGY!