GEODE

Google Earth for Onsite and Distance Education

www.geode.net

Virtual Geological Mapping and Development of Geospatial Analysis Competencies Using Google Earth and Related Digital Technologies

Declan De Paor, ODU

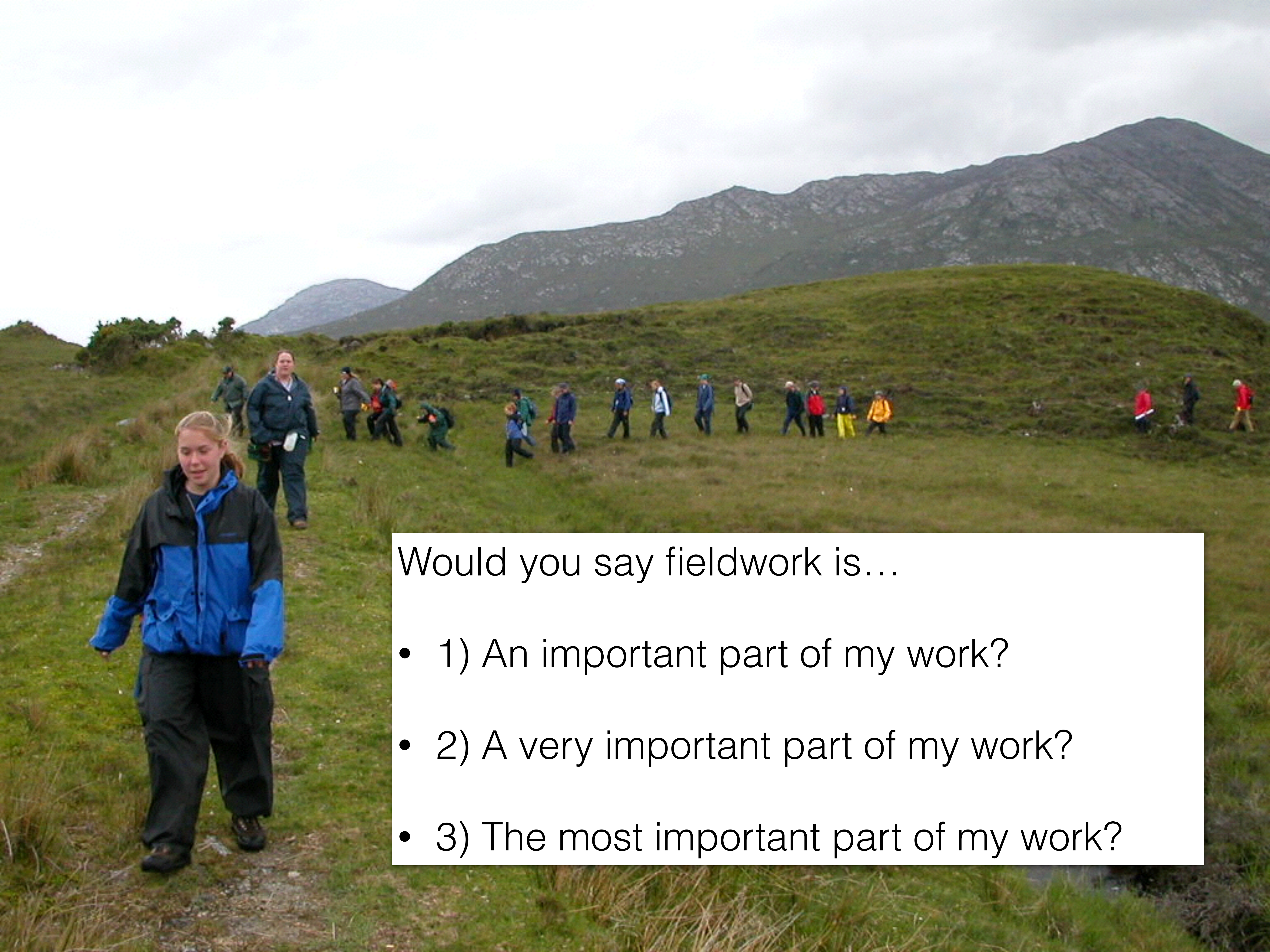
and the GEODE Team:

Heather Almquist, Callan Bentley, Stephen Burgin, Cinzia Cervato, Gene Cooper, Mladen Dordevic, Janice Gobert, Paul Karabinos, Terry Pavlis, Jen Piatek, Bill Richards, Jeff Ryan, Ron Schott, Kristen St John, Barb Tewksbury, Steve Whitmeyer

DUE 1323419 2013-2017

Google GEO Curriculum Awards 2014

ODU Teaching with Technology Award and Faculty Innovator Grant 2014



Would you say fieldwork is…

- 1) An important part of my work?
- 2) A very important part of my work?
- 3) The most important part of my work?

Would you describe yourself as:

- Hispanic / Latino?
- African American?
- Native American?
- Paraplegic?

MiKayla Briere, Whitman College

The Problem:

- Hispanic / Latino?
- African American?
- Native American?
- Paraplegic?

Carol Simpson & Steve Whitmeyer in Argentina

MiKayla Briere, Whitman College

Aspects of geoscience that attracted many of us—fieldwork, camping, hiking—are unavailable and / or unattractive to many (Maguire, 1998)

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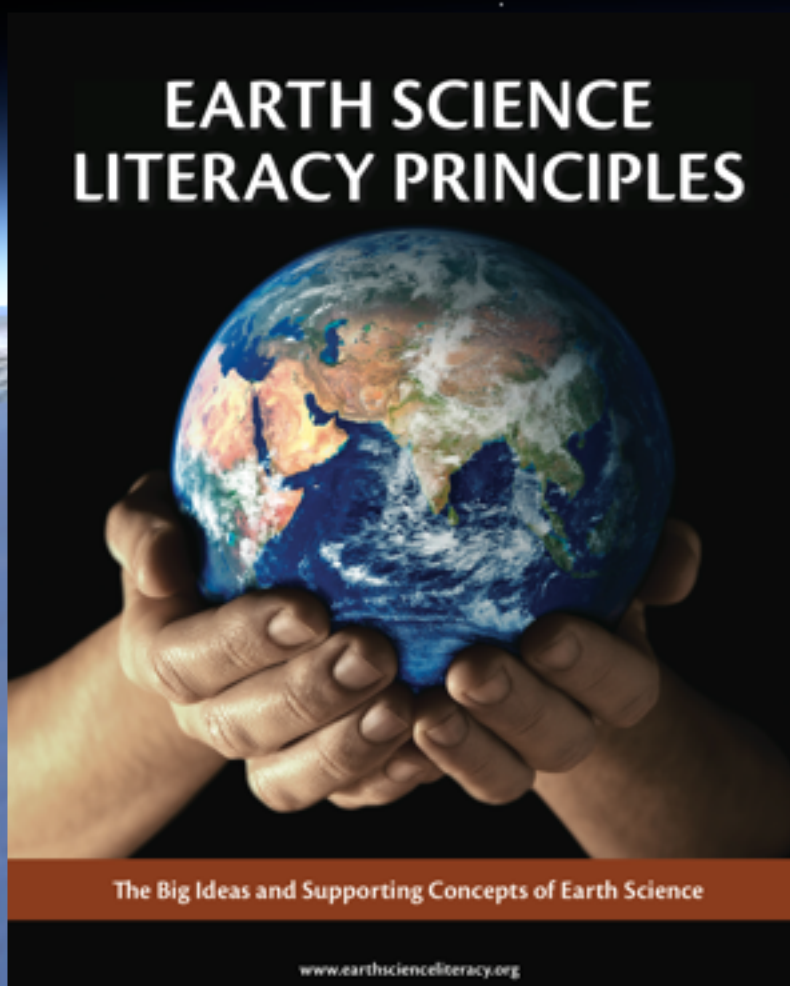
4) Build a gallery of innovative geological GigaPans

5) Deliver a sequence of faculty professional development workshops

The Grand Tour

Where on (Google) Earth should every geoscience student go?



Tour Themes

Plates and Plumes

Geology Through Time

Rocks and Regions

Resources and Hazards

National Parks

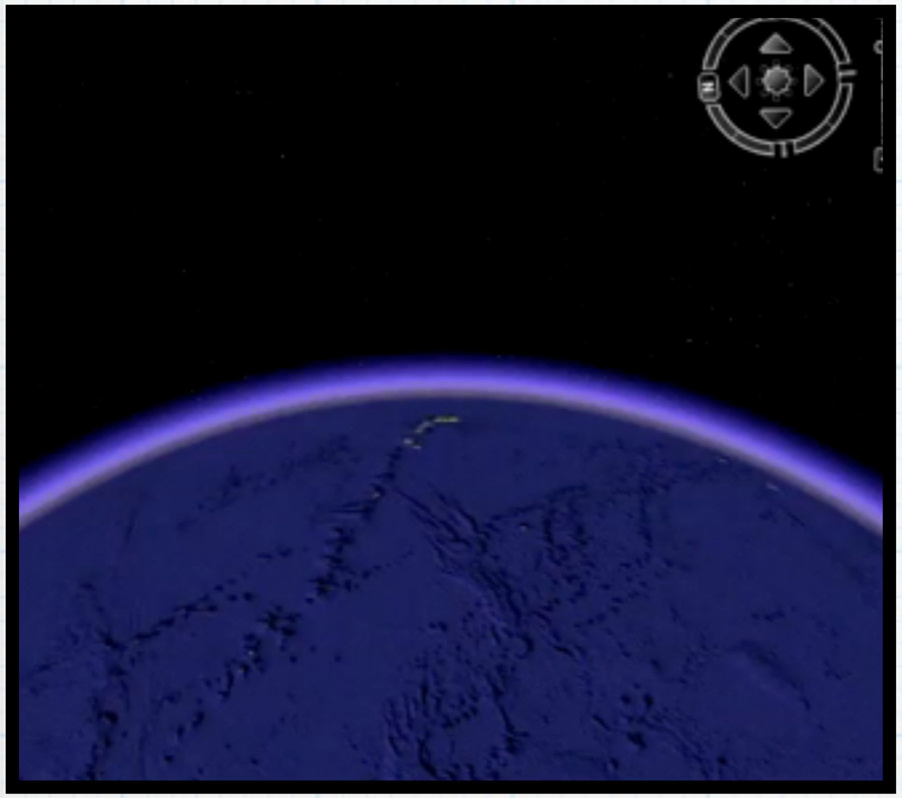
Magical Mystery Tour

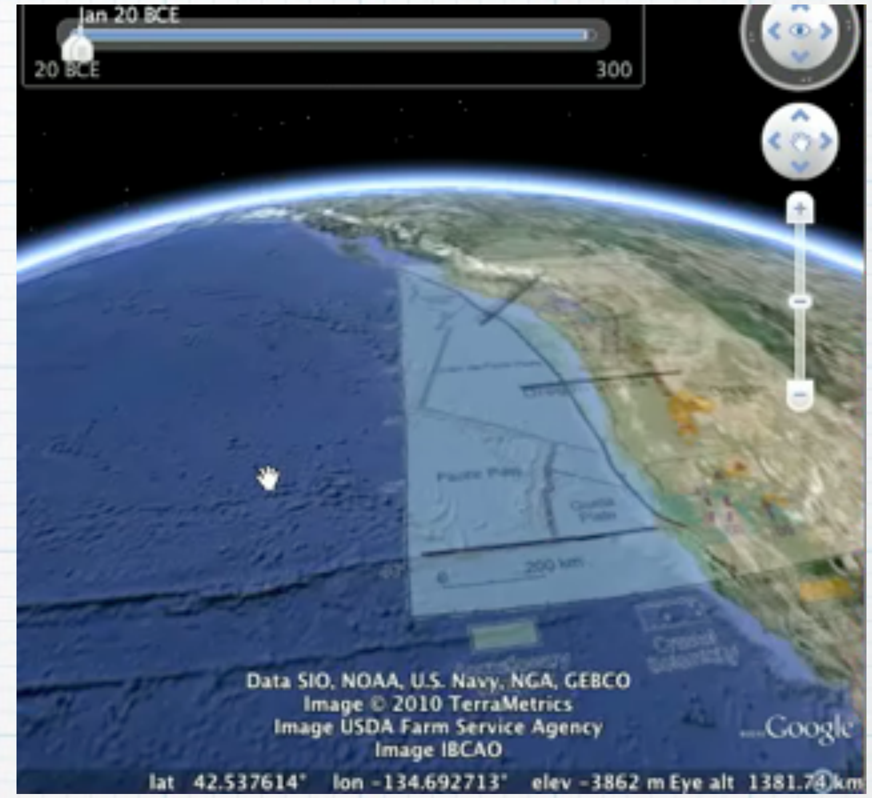
Mapping Exercises

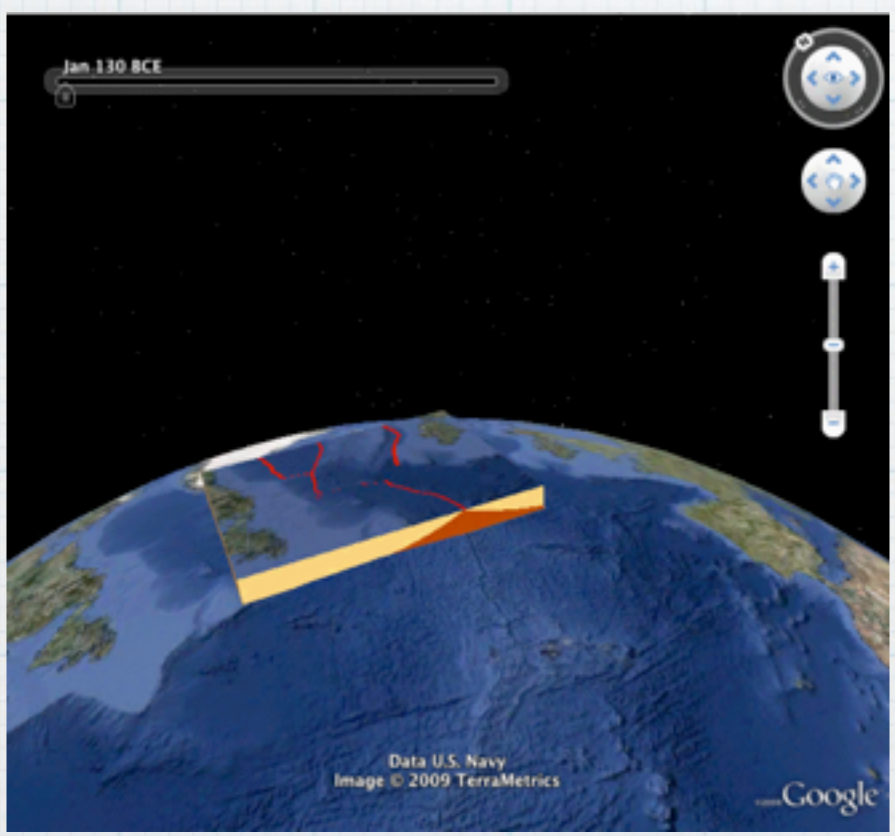
Layered Earth

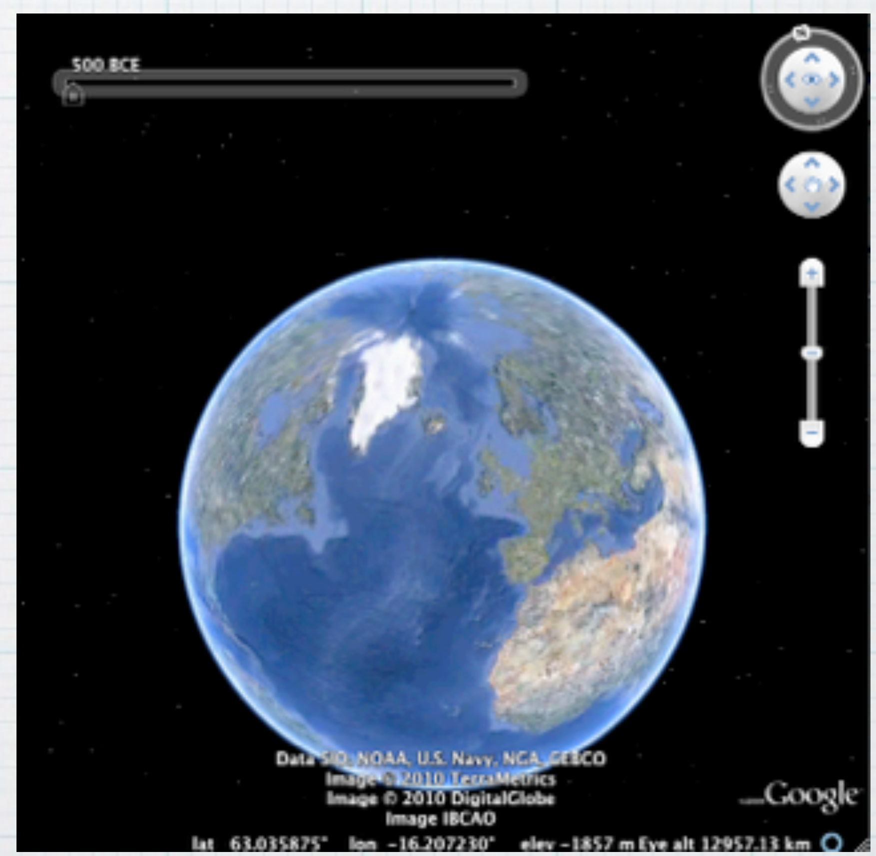
Planets and Moons

A Tour of Plates and Plumes



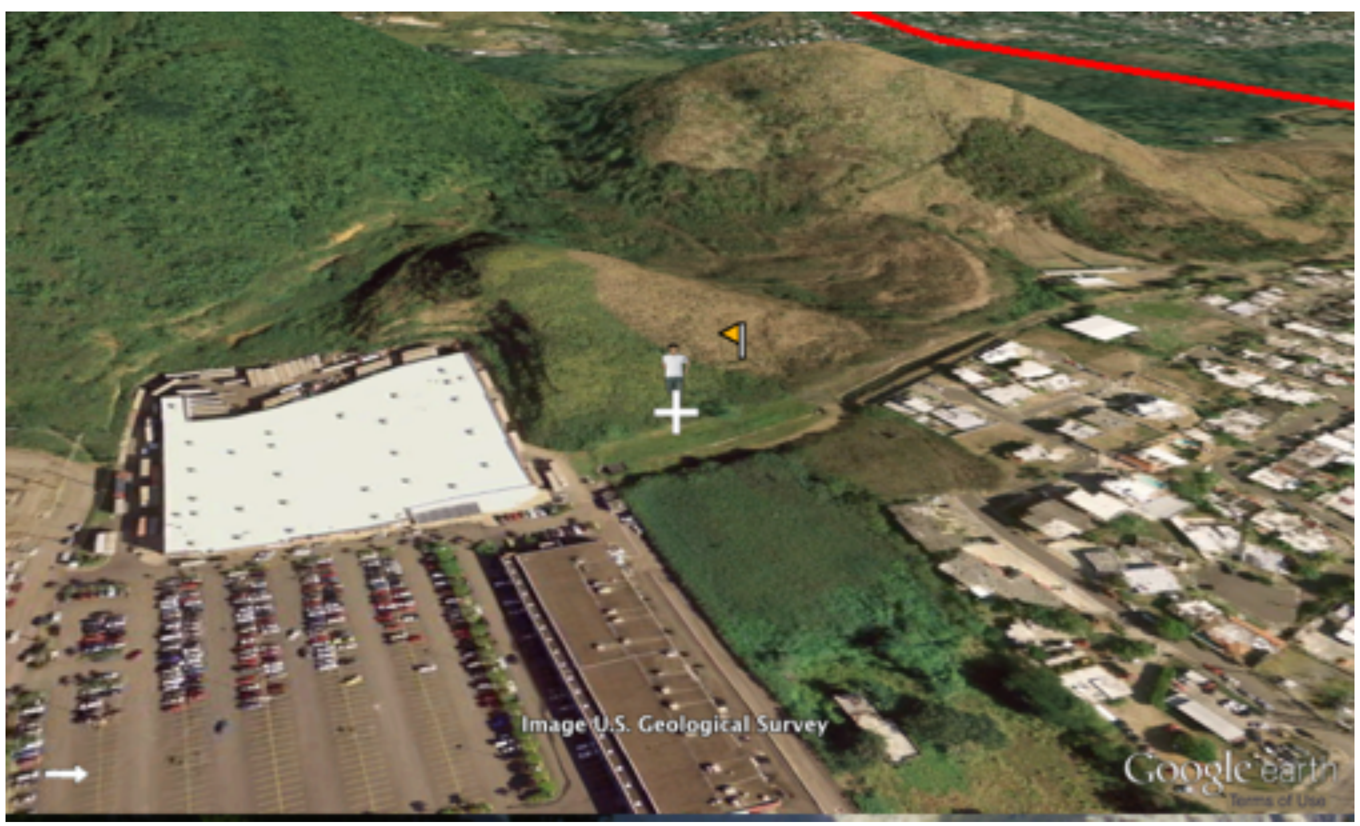




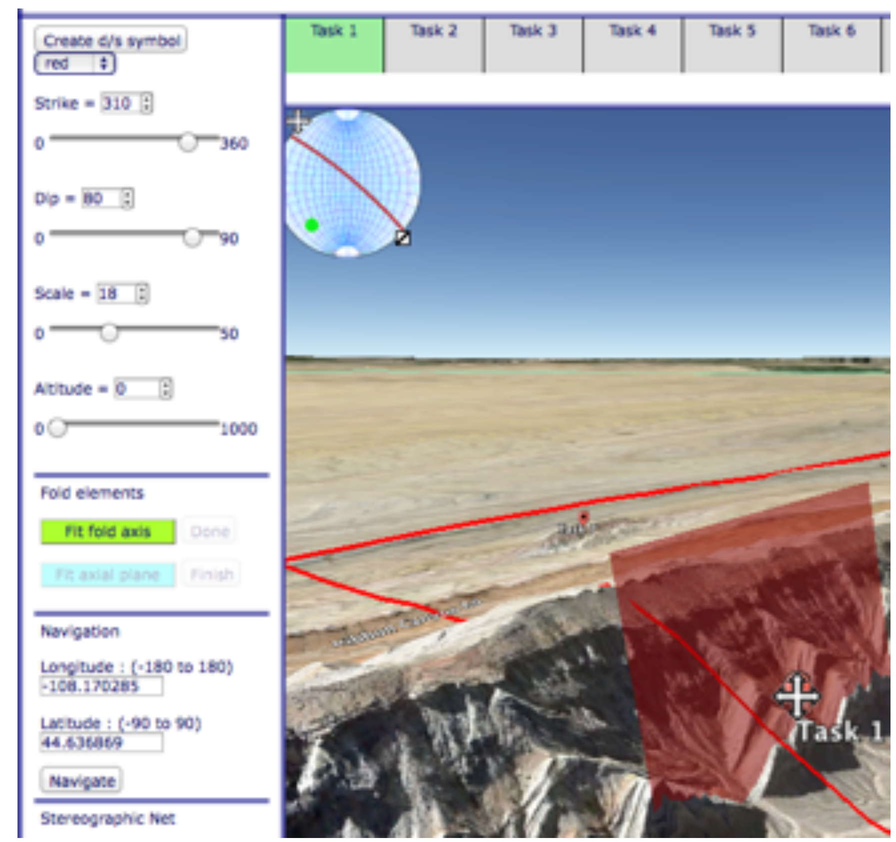


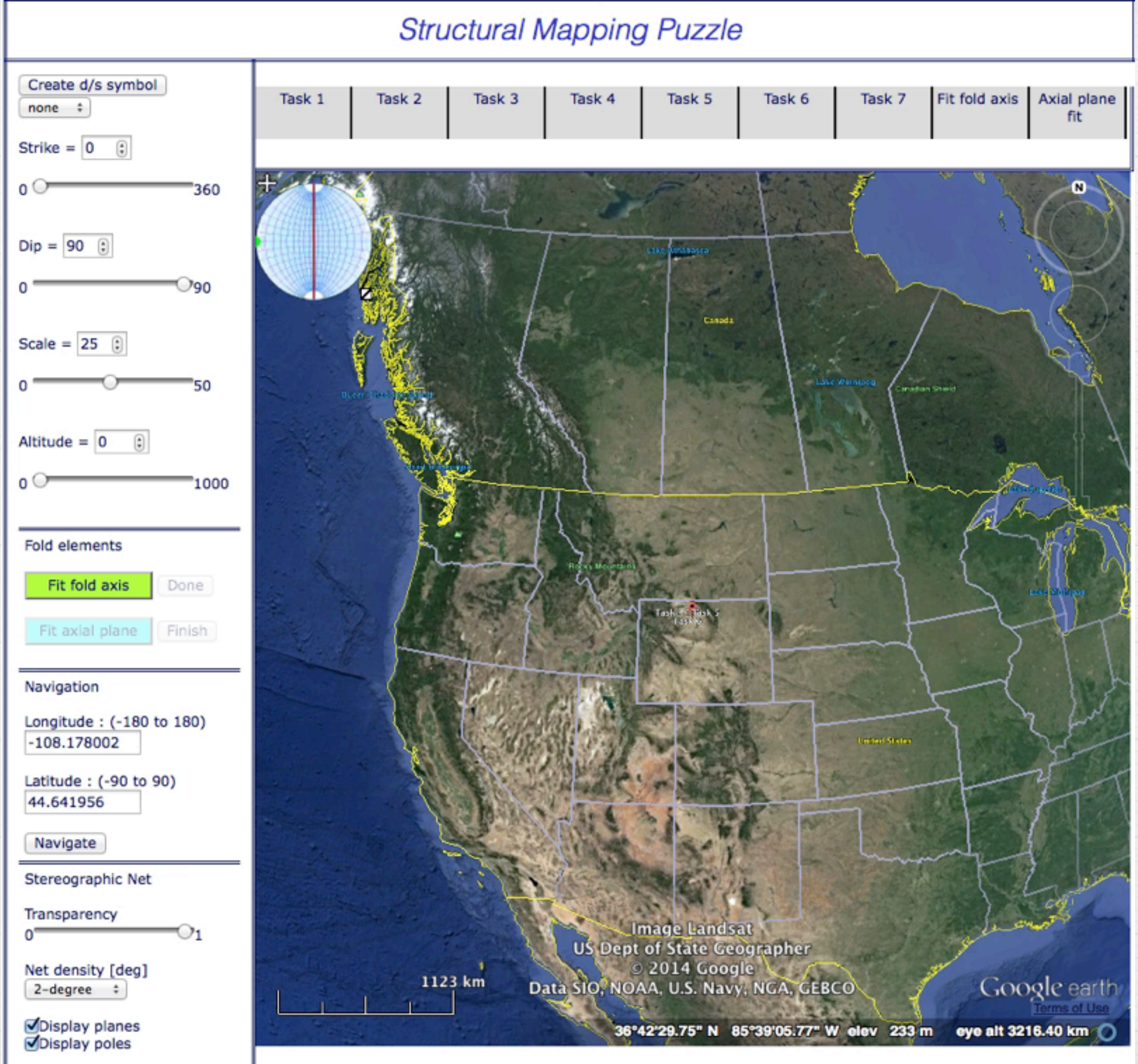
Mapping Games

- Puerto Rico



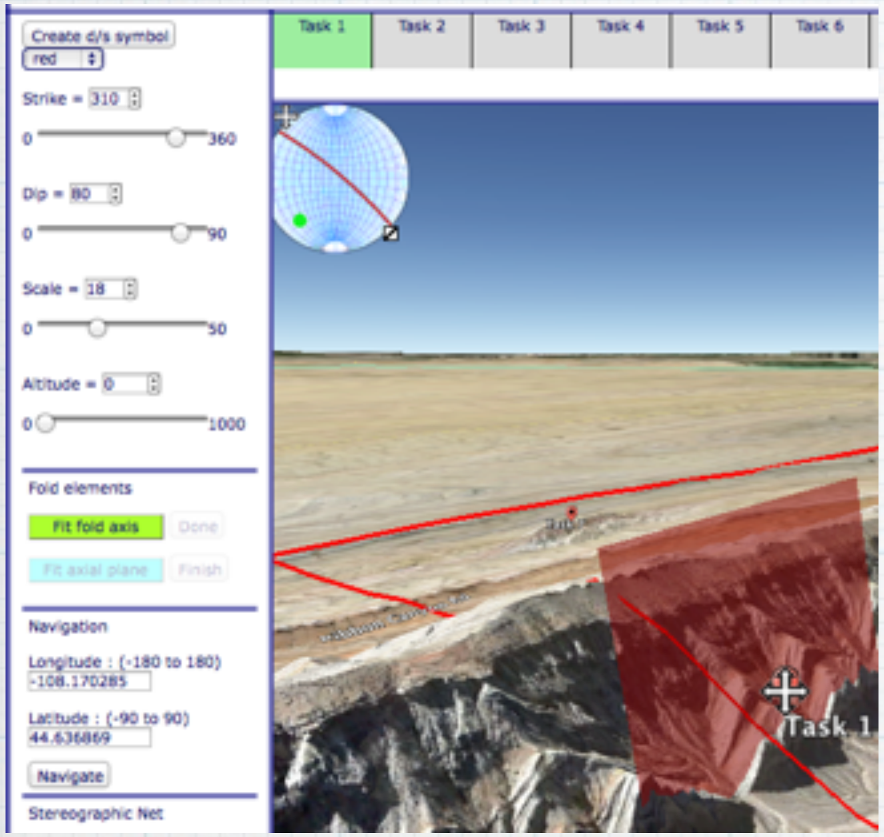
- Wyoming

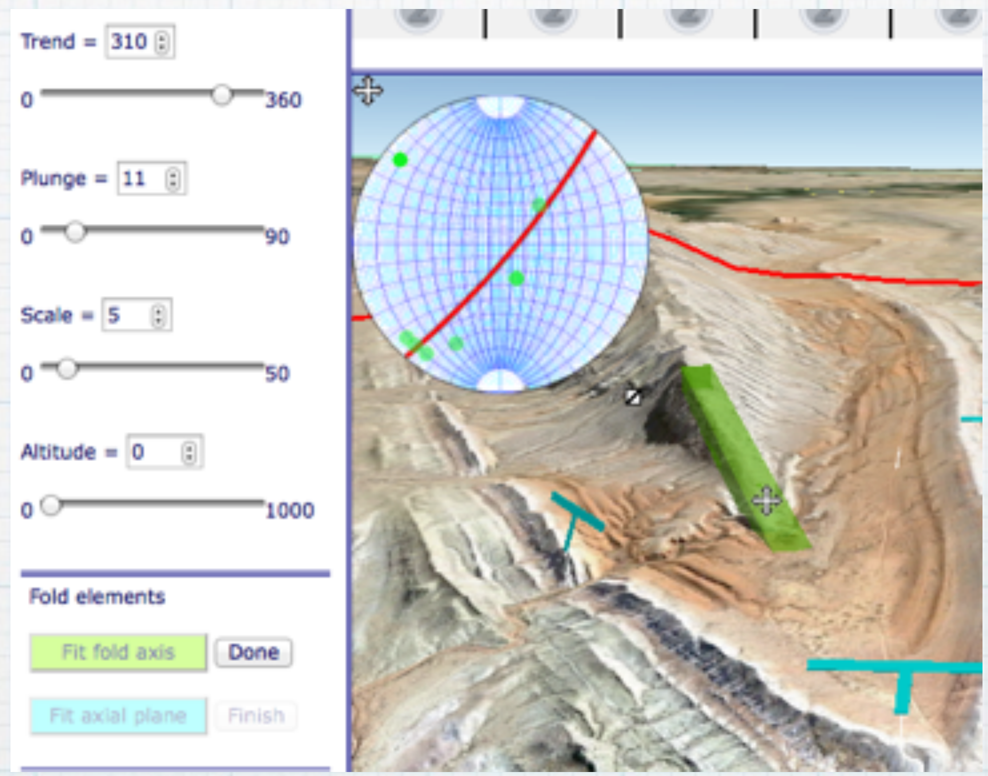


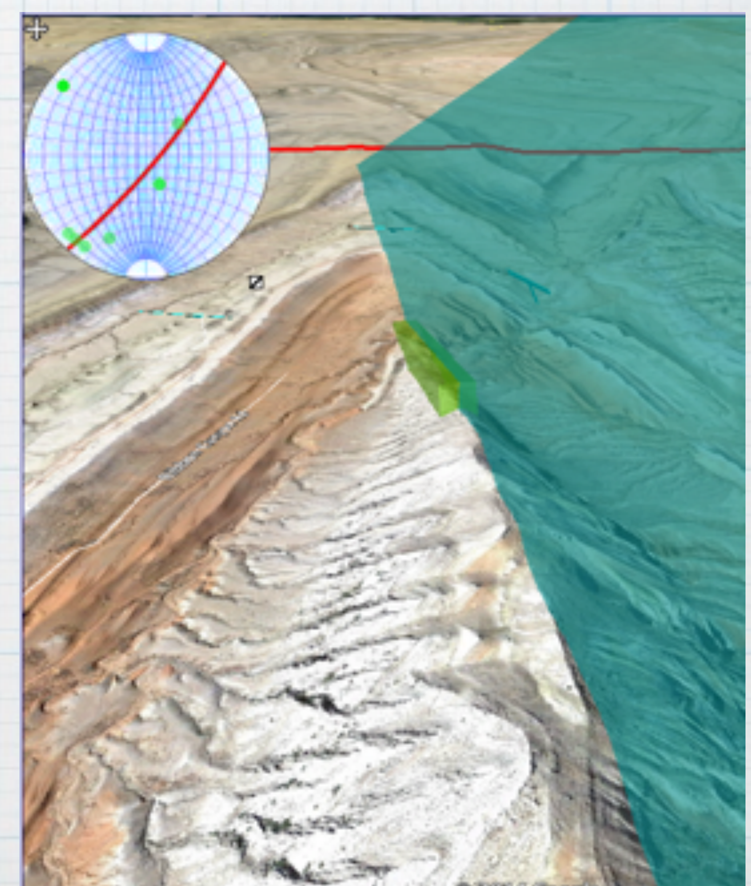


Structural Mapping Puzzle
Create d/s symbol
none
Strike = 0
0 360
Dip = 90
0 90
Scale = 25
0 50
Altitude = 0
0 1000
Fold elements
Fit fold axis
Done
Fit axial plane
Finish
Navigation
Longitude : (-180 to 180)
-108.178002
Latitude : (-90 to 90)
44.641956
Navigate
Stereographic Net
Transparency
0 1
Net density [deg]
2-degree
Display planes
Display poles
Task 1
Task 2
Task 3
Task 4
Task 5
Task 6
Task 7
Fit fold axis
Axial plane fit
Canada
United States
Image Landsat
US Dept of State Geographer
© 2014 Google
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
1123 km
Google earth
Terms of Use
36°42'29.75" N 85°39'05.77" W elev 233 m eye alt 3216.40 km

New Structural Mapping Game



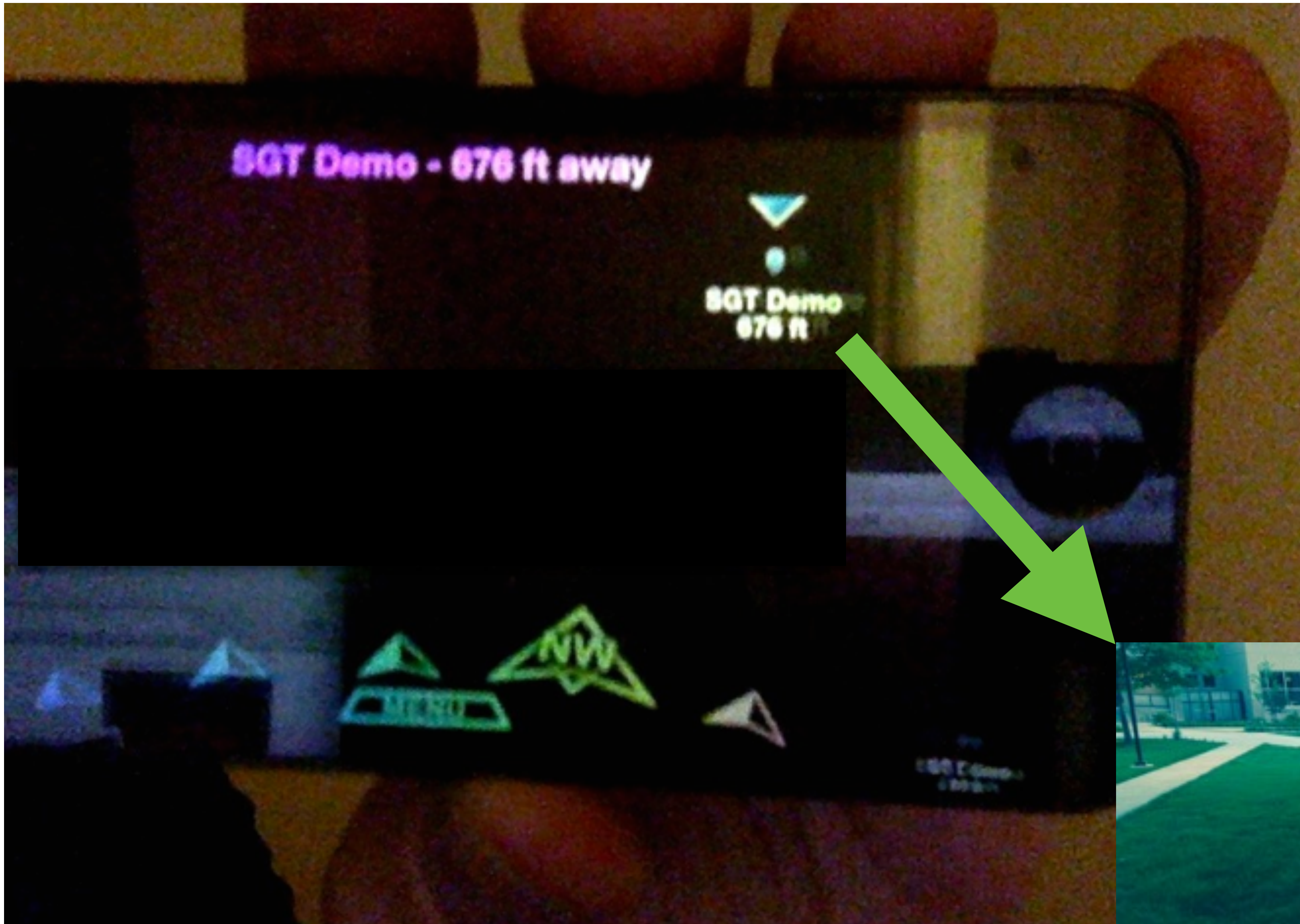




Next version will allow instructors to create their own game anywhere on Earth

Asynchronous field coursework

Fresh Air App Reality: “School of Mines”



Outcrop description/image/ audio triggered by proximity

Instructor can select content:

Text | Image | Text + Image | Video | Multiple Choice | Fill in the Blank | Numeric Question

* Google Glass for Accessibility (EAGER)

- Steve Whitmeyer

- Declan De Paor

- Chris Atchison

- Jen Piatek

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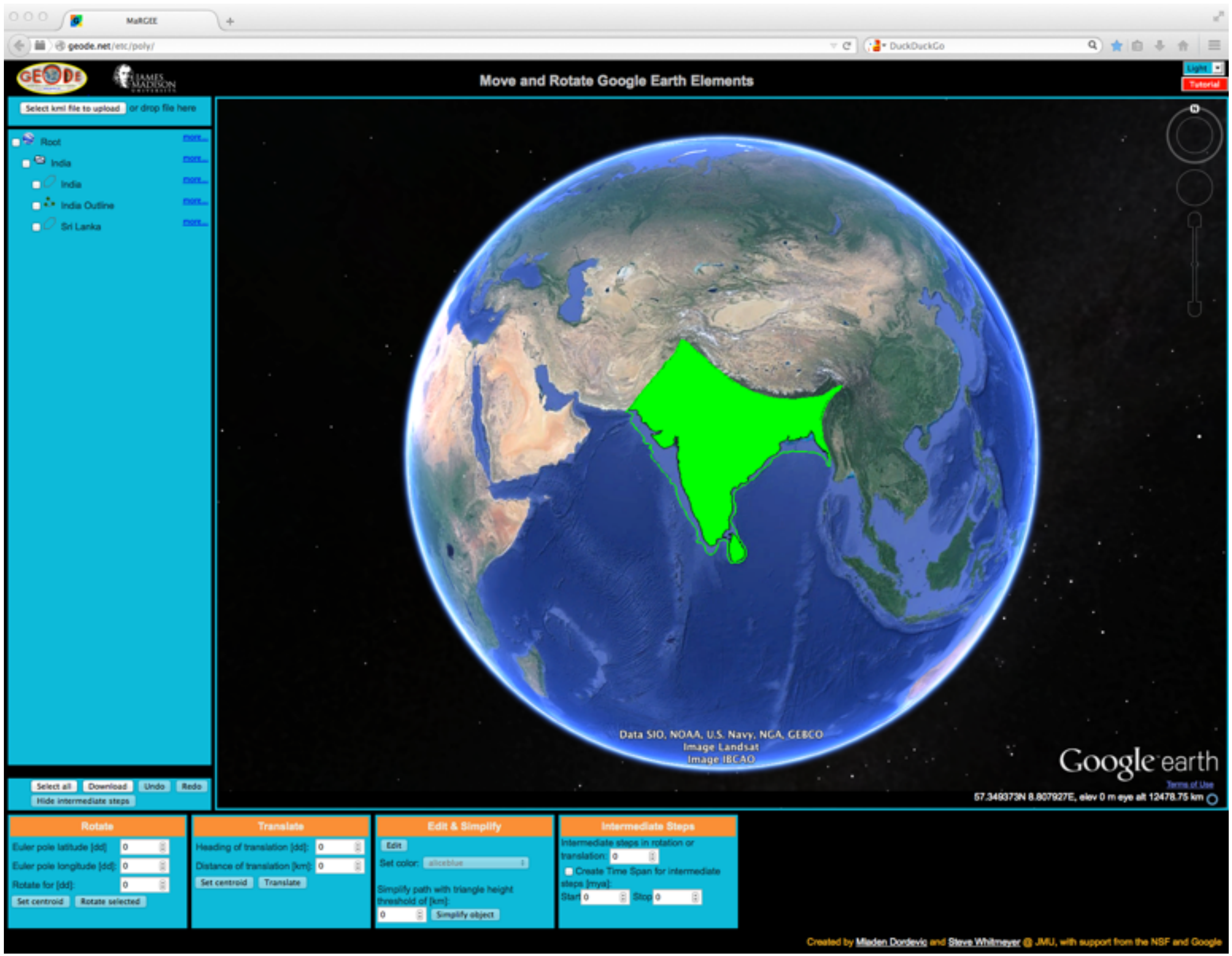
4D Tectonic Reconstructions in Google Earth

Move and/or rotate polygons and other KML elements

1. Load KML elements
2. Enter euler pole location and degrees of rotation

or

3. Enter heading and distance for translation
4. Intermediate steps with or without a timespan can be created
5. Download resulting KML file



4D Tectonic Reconstructions in Google Earth

Directed inquiry for students:

Compare the Copley et al. (2010) and the Torsvik et al. (2010) models for the movement of India during the past 80 million years

1. At what times are there noticeable changes in the rate of movement of India?

2. How do the models for the movement of India differ?

3. How might the inherent parameters for each of the models influence the differences you noted?

Comparative movements of Greater India over the past 80 million years
Copley et al.,2010 (light green)
Torsvik et al.,2010 (dark green)

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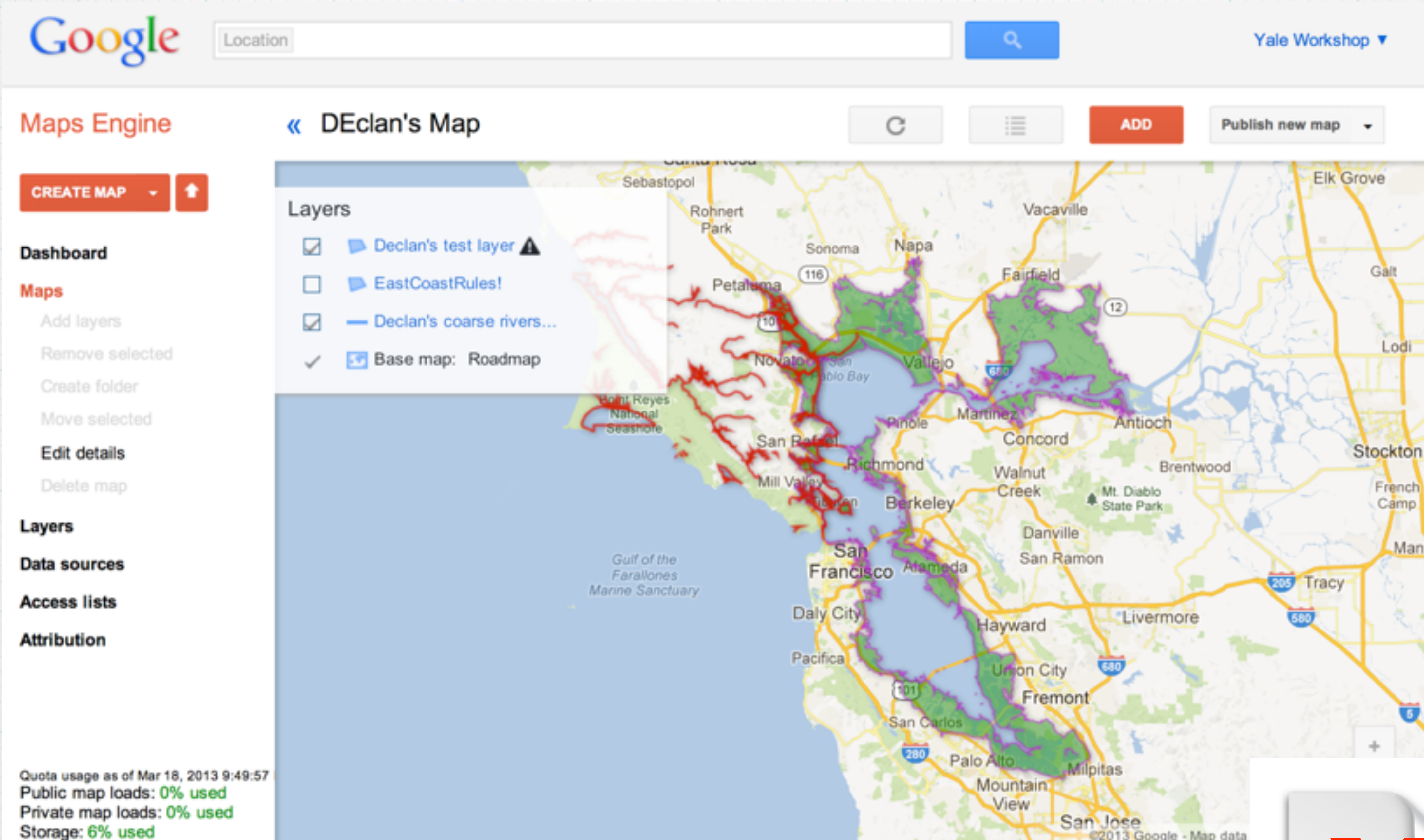
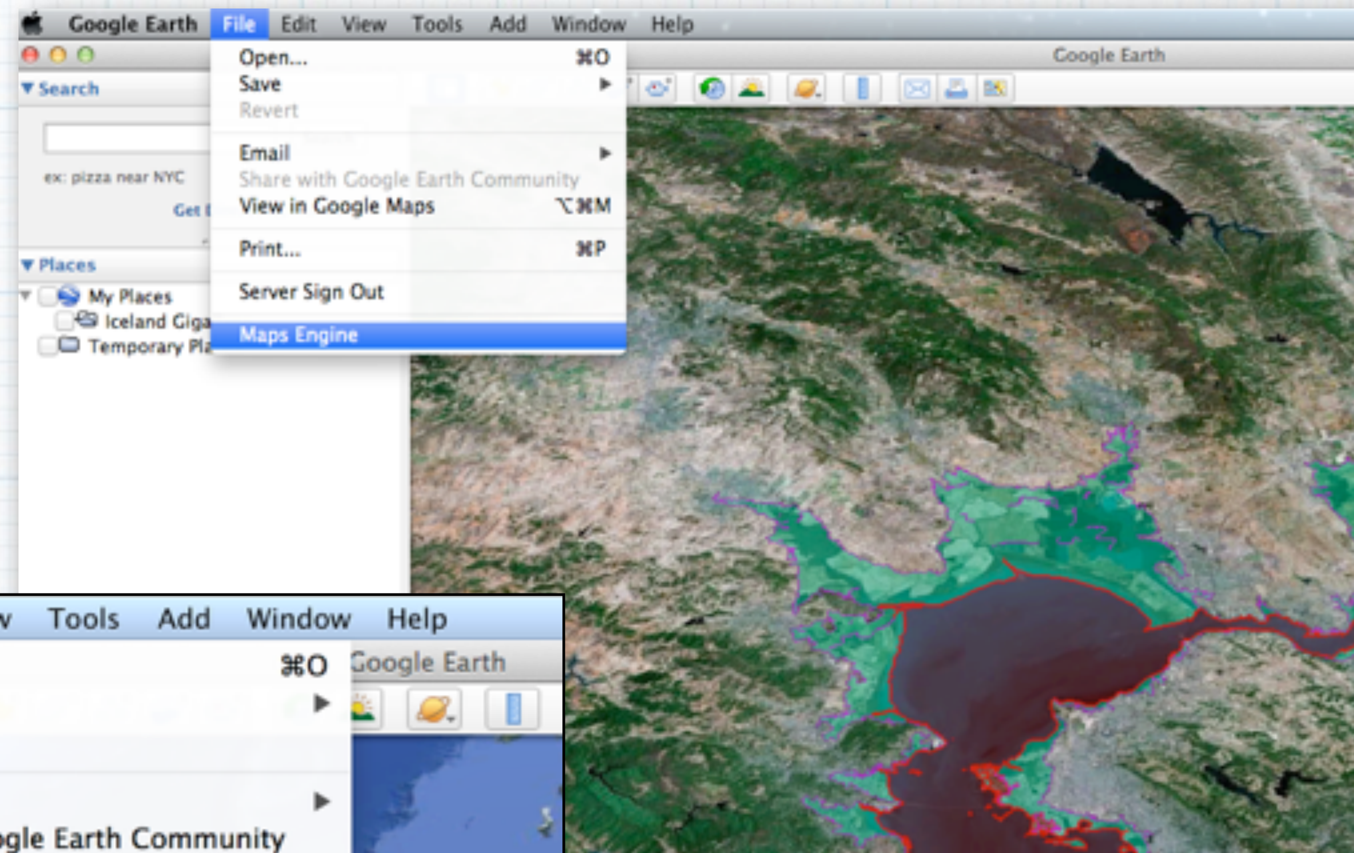
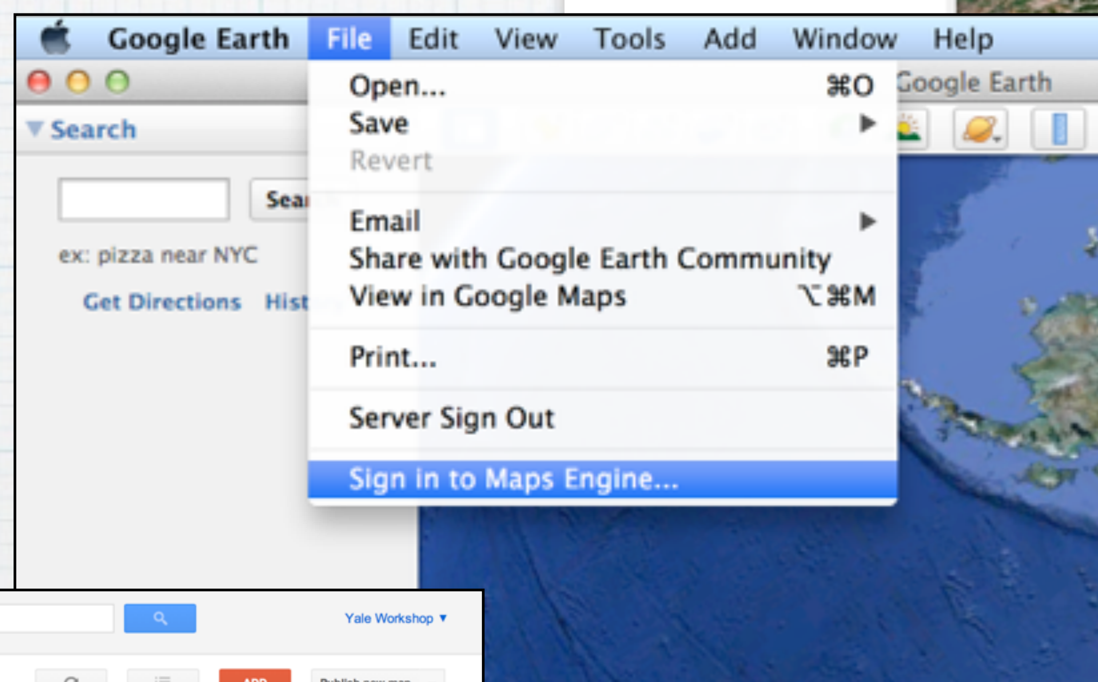
Google Maps Engine, Google Earth Engine

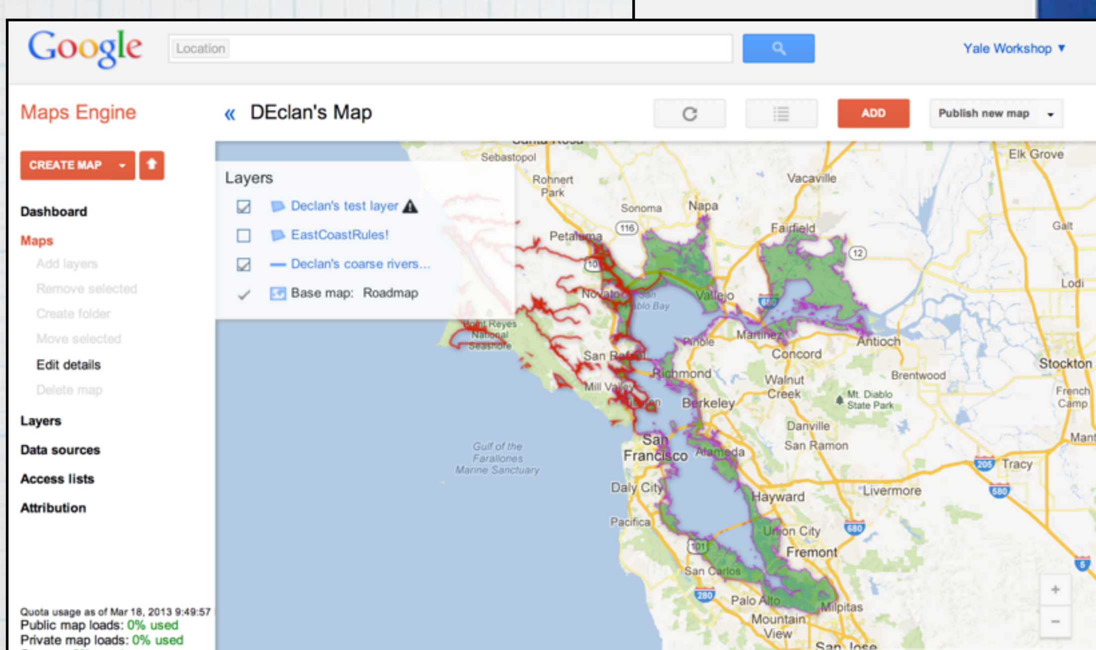


Google wants our map data in the cloud, not on hard drives

Content created in Maps Engine







Viewed on Google Earth

Philosophy of graduate program

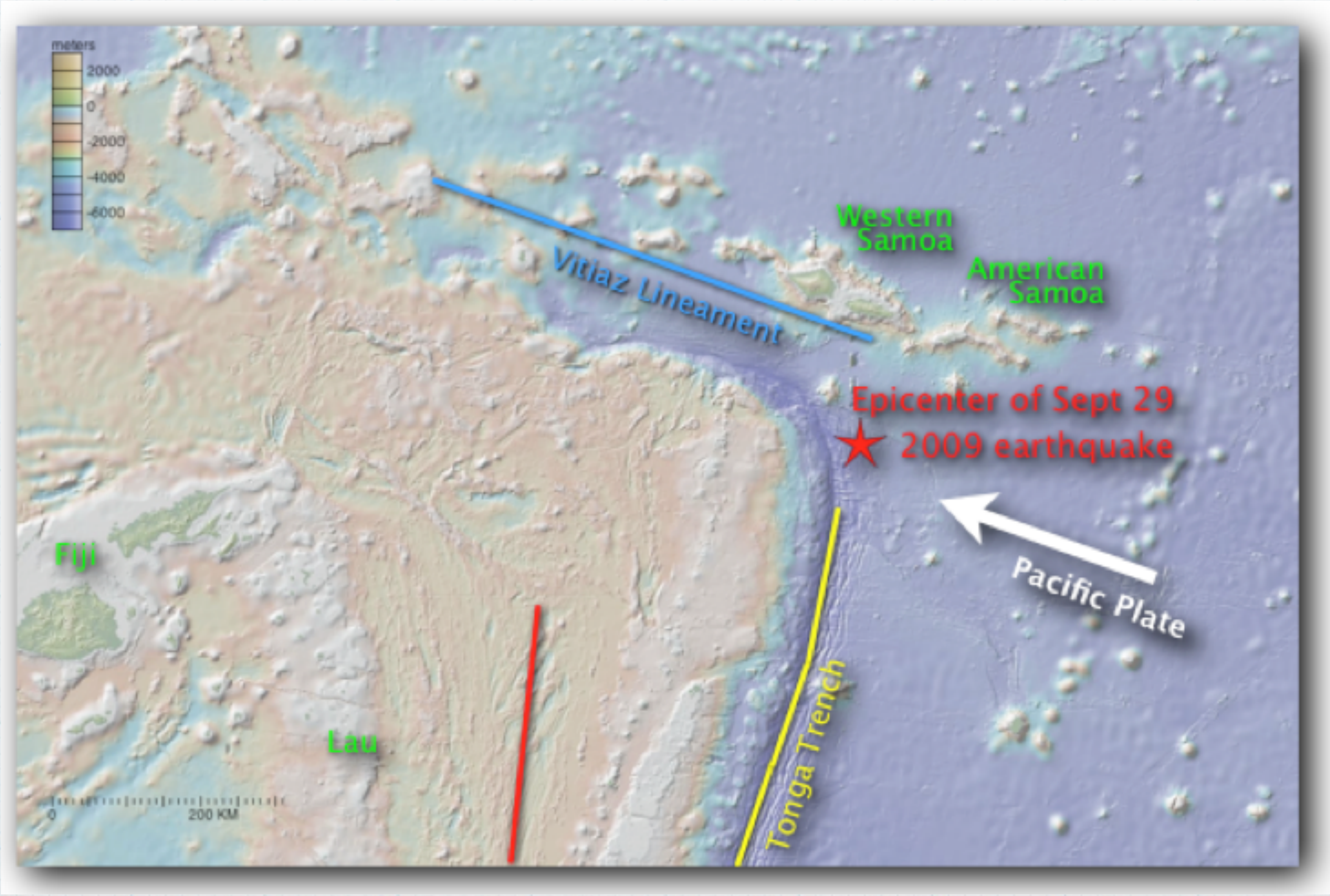
Graduate students acting as teaching assistants develop and test teaching resources

Research question emerge from this process

Graduate students acting as research assistants tackle the research questions

Data Mining GeoMapApp Example 1: Tonga Project

Grad students Steve Wild and Mladen Dordevic



Hypocenter data from Syracuse and Abers

Converted depth to KML altitude

19	ID	Mw	location	date		lat		<latitude>	lon	</latitude>	<altitude>	depth (km)	</altitude>	Link
20	C201305112046A	6.4	TONGA ISLANDS	May 11 201	<longitude>	-17.89	</longitude>	<latitude>	-174.72	</latitude>	<altitude>	–242.1	</altitude>	http://global.shakemovie.princeton.edu/event.jsp?evid=C201305112046A
21	C201302250259A	5.5	TONGA ISLANDS	Feb 25 201	<longitude>	-15.24	</longitude>	<latitude>	-175.97	</latitude>	<altitude>	–12	</altitude>	http://global.shakemovie.princeton.edu/event.jsp?evid=C201302250259A
22	C201302192229A	5.7	TONGA ISLANDS	Feb 19 201	<longitude>	-17.46	</longitude>	<latitude>	-173.01	</latitude>	<altitude>	–47.4	</altitude>	http://global.shakemovie.princeton.edu/event.jsp?evid=C201302192229A
23	C201302150302A	5.7	TONGA ISLANDS	Feb 15 201	<longitude>	-19.85	</l							?evid=C201302150302A
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26	C201211301120A	5.7	TONGA ISLANDS	Nov 30 201	<longitude>	-18.86	</l							?evid=C201211301120A
27	C201210171723A	5.4	TONGA ISLANDS	Oct 17 201	<longitude>	-19.03	</l							?evid=C201210171723A
28	C201204281008A	6.7	TONGA ISLANDS	Apr 28 201	<longitude>	-18.76	</l							?evid=C201204281008A
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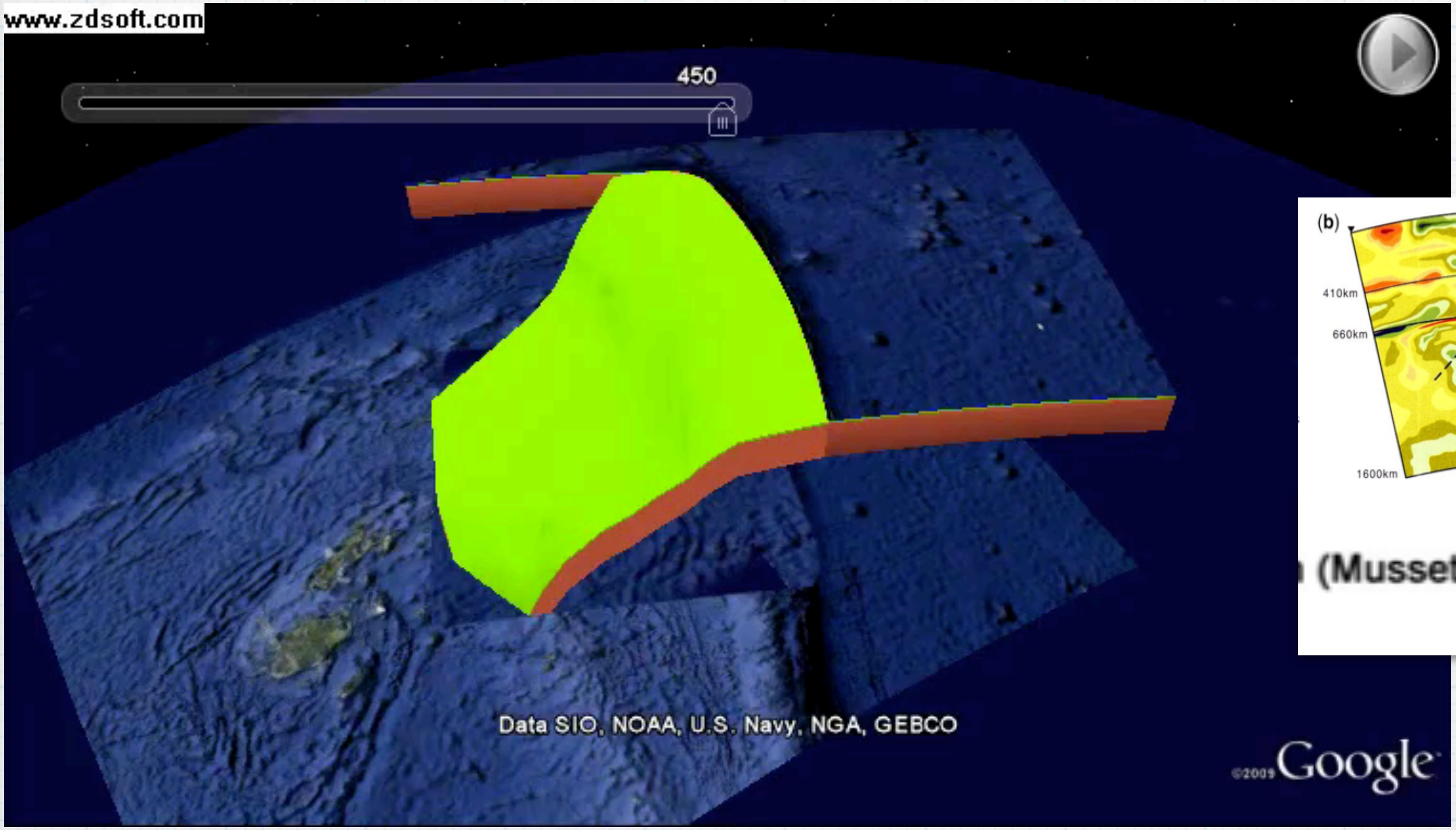
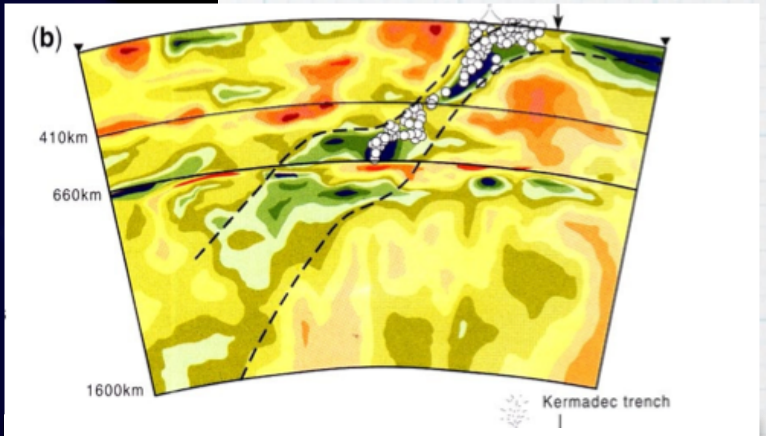
e>	<altitude>	depth (km)	</altitude>	Link
e>	<altitude>	–242.1	</altitude>	http:
e>	<altitude>	–12	</altitude>	http:
e>	<altitude>	–47.4	</altitude>	http:

Animated altitude using KML TimeSpan

Created COLLADA model of Slab in SketchUp

Research Question: Explain Shape of Slab





(Mussett and Khan 2000)

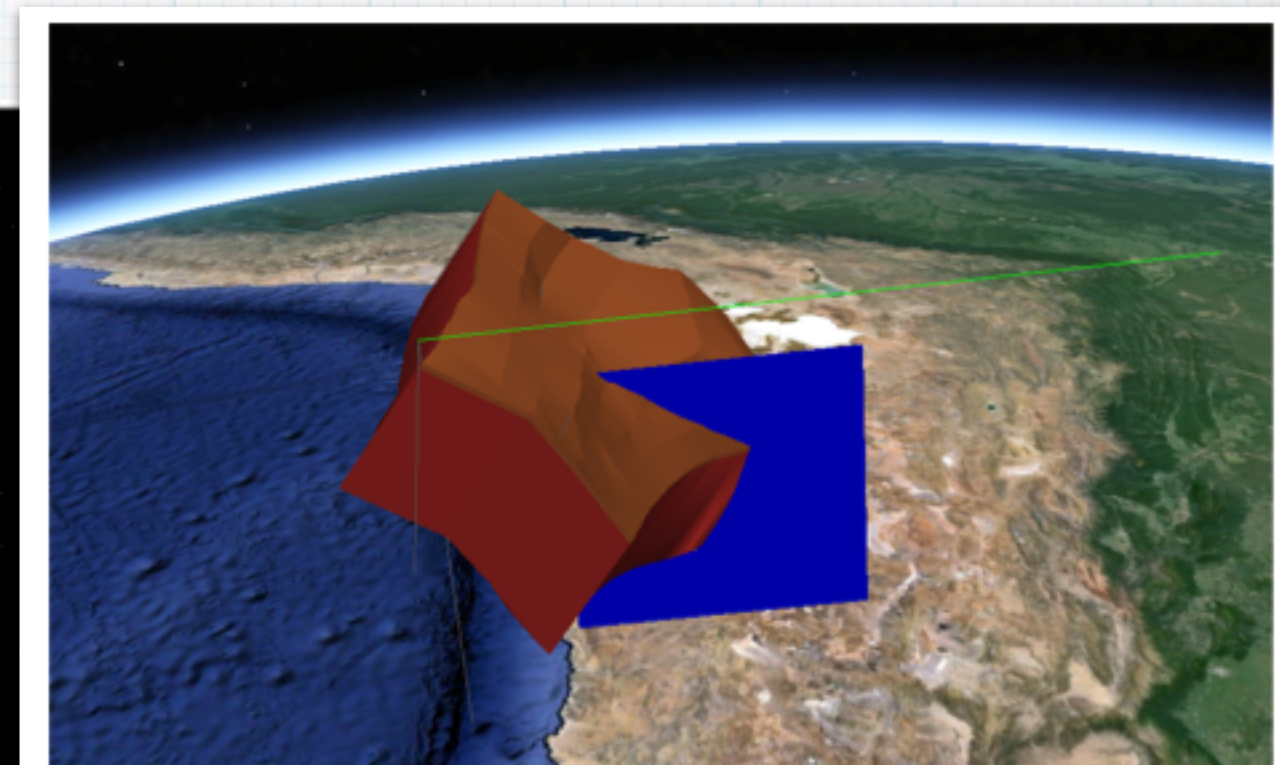
Declan De Paor, Steve Wild, and Mladen Dordevic Geosphere 2012

Teaching tool

COLLADA models Steep & Flat Slabs in Andes

Research Question

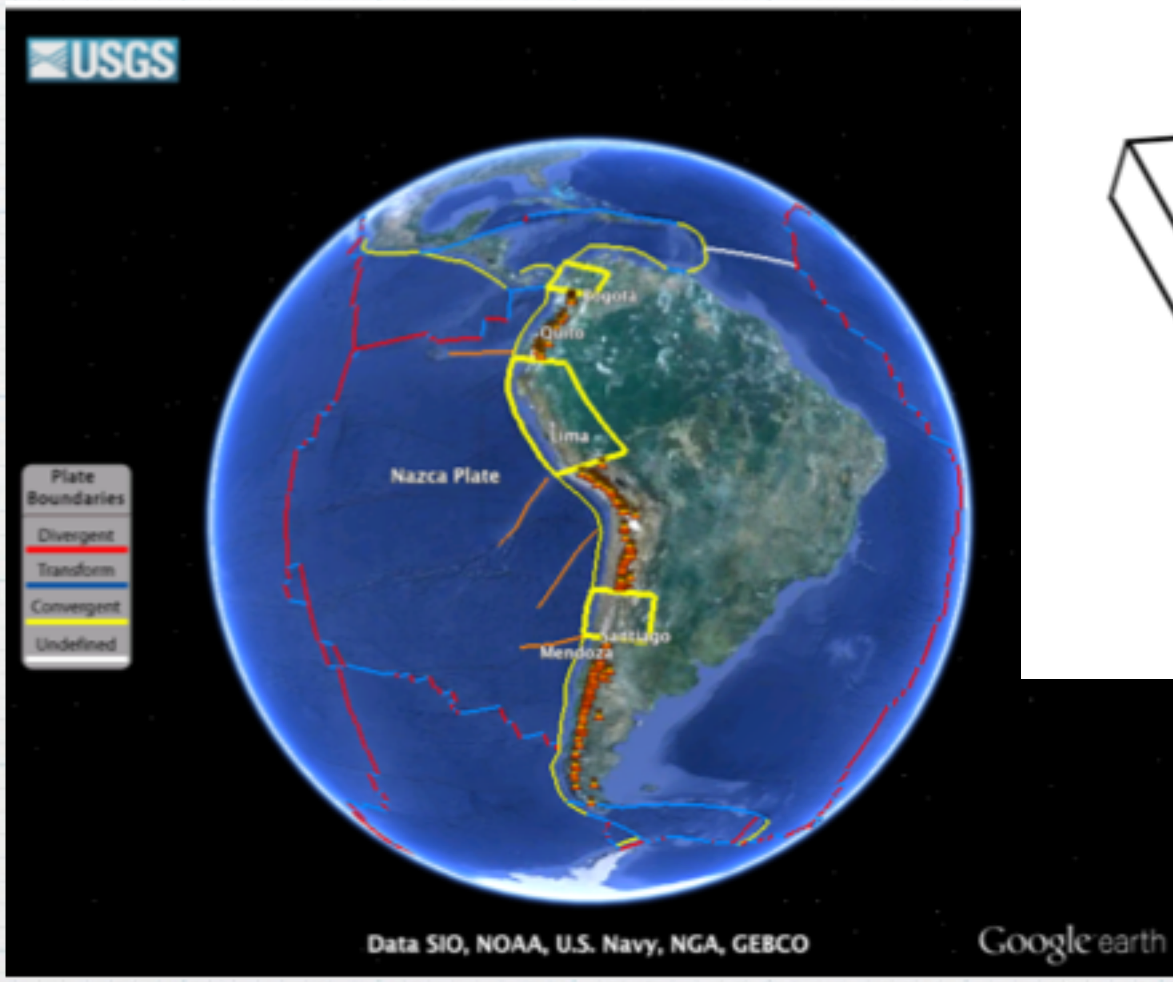
Tearing or shearing between steep and flat slabs?

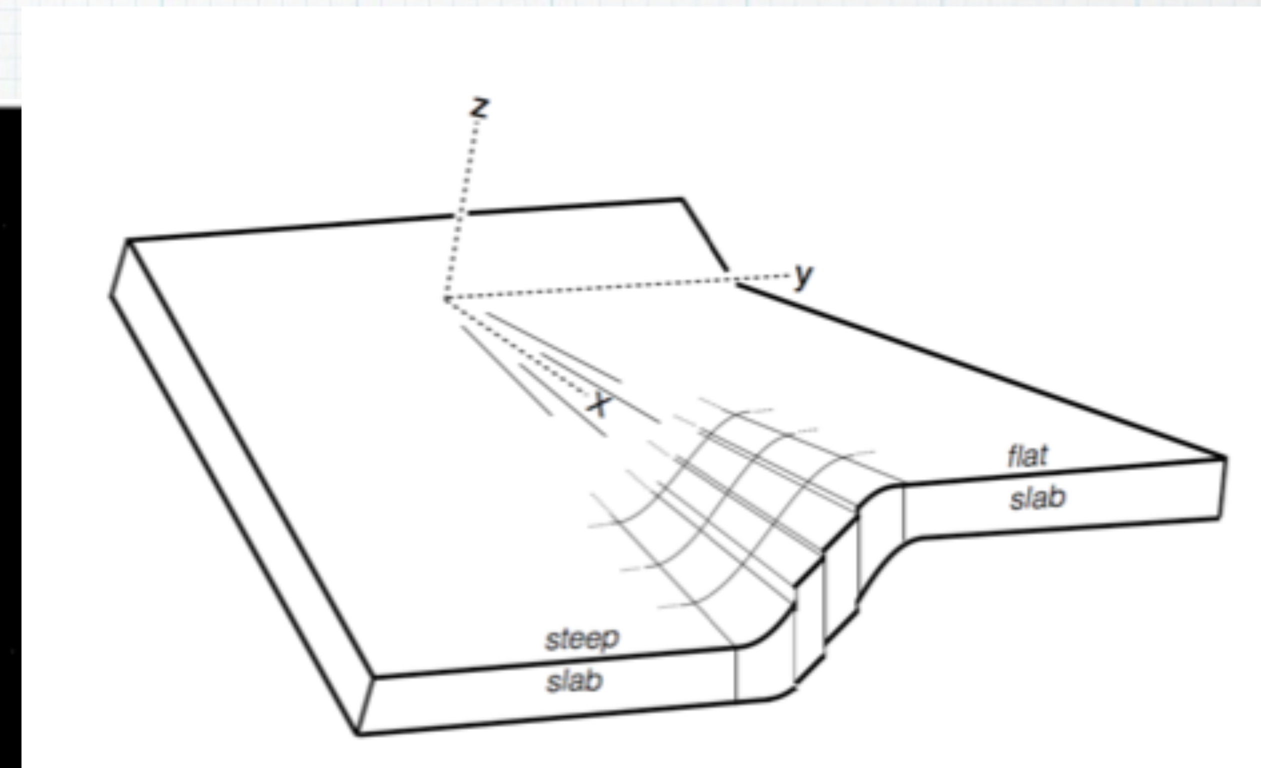


Syracuse & Abers 2006, Cahill and Isacks (1992), Anderson et al. (2007)

Research Question

Tearing or shearing between steep and flat slabs?





De Paor & Wild, Journal of the Virtual Explorer, in dynamic review.

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Bill Richards, North Idaho College

Microsoft Silverlight

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North Idaho College

GIGAmacro™
Exploring Small Things in a Big Way™

Virtual Specimens

* Salt Lake Crater, HI

* Acasta Gneiss

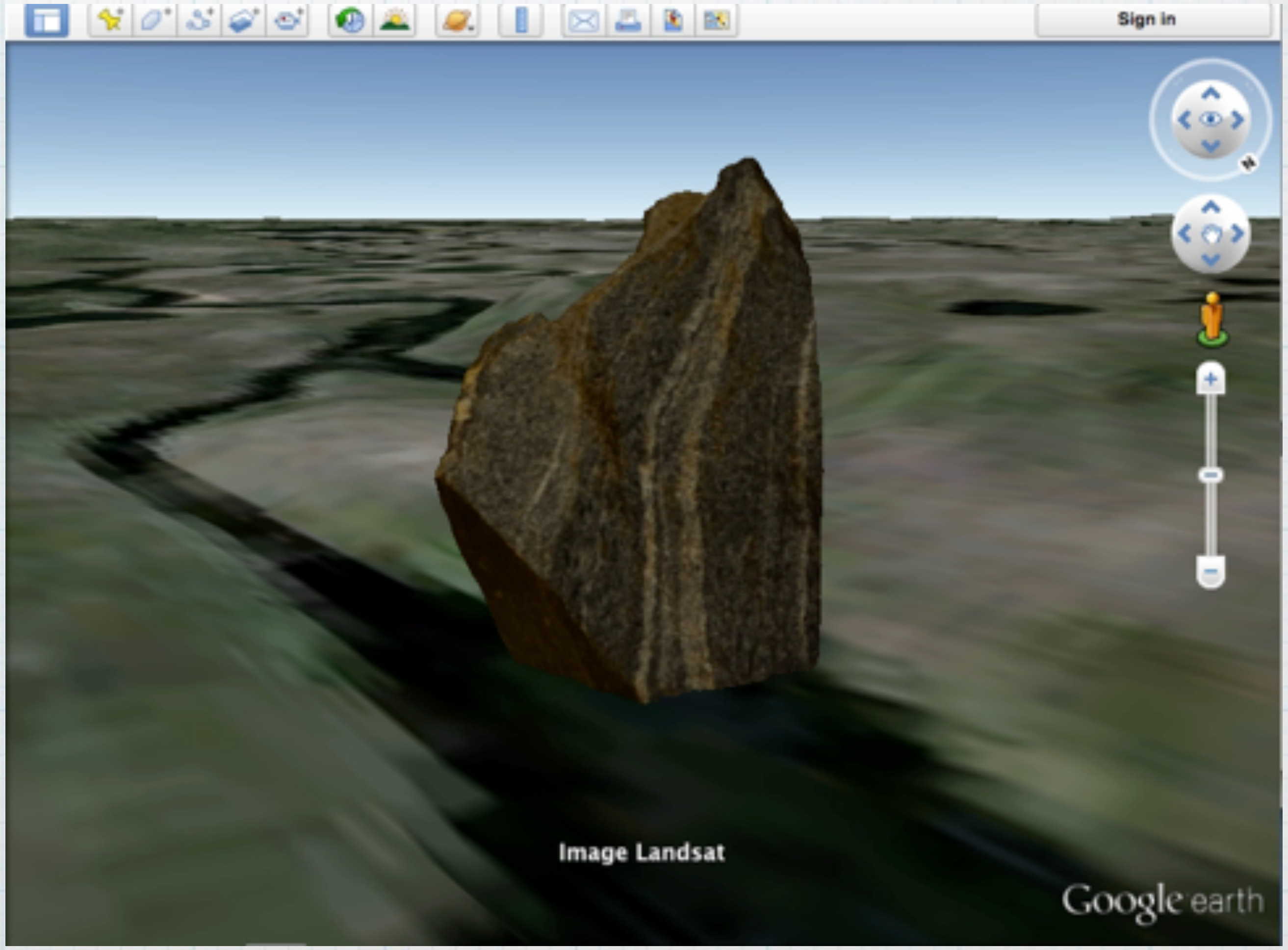
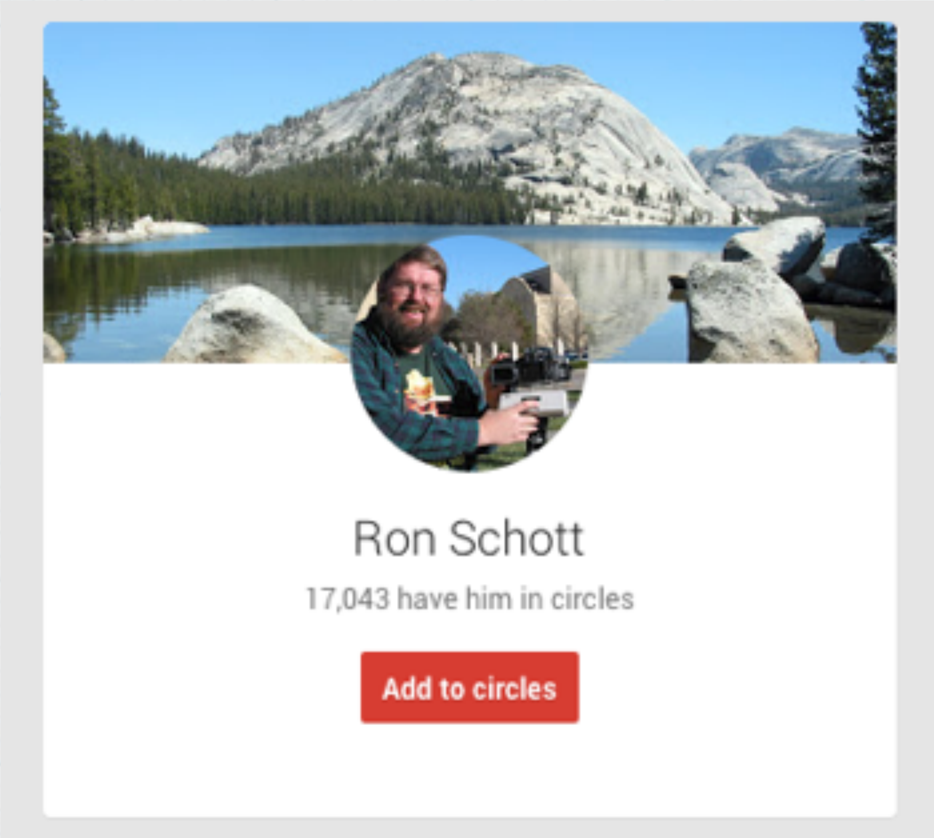
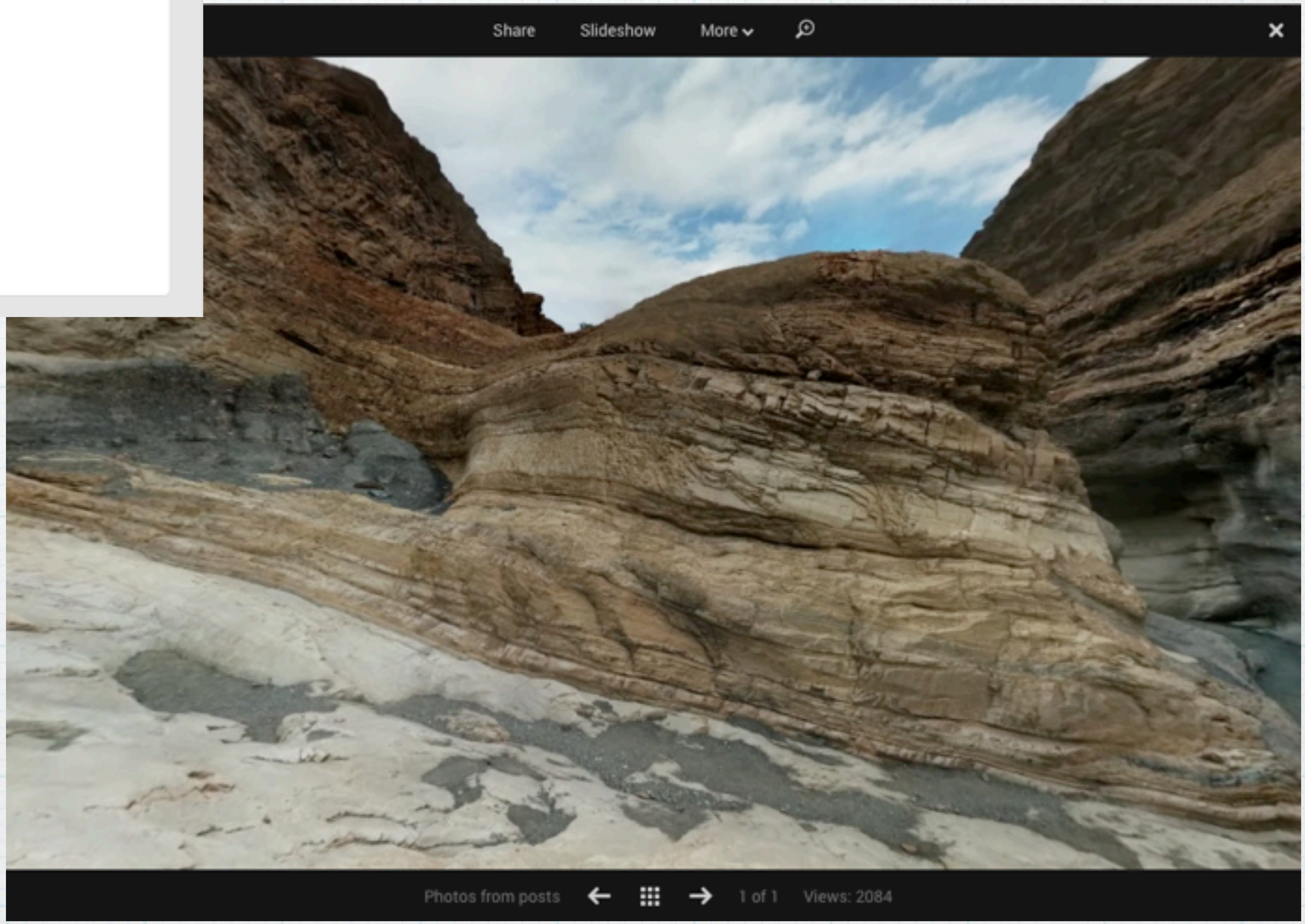


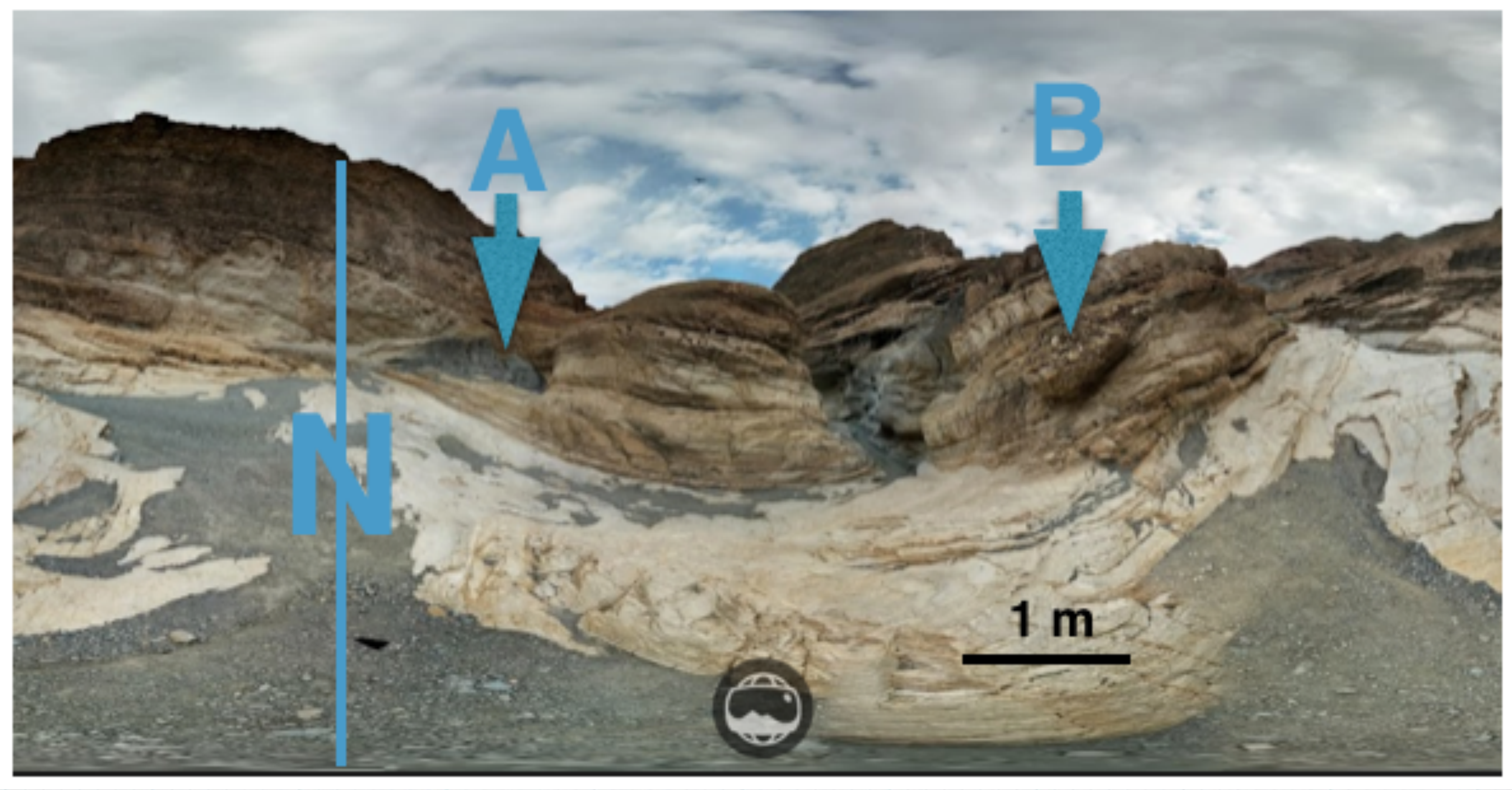
Photo Sphere





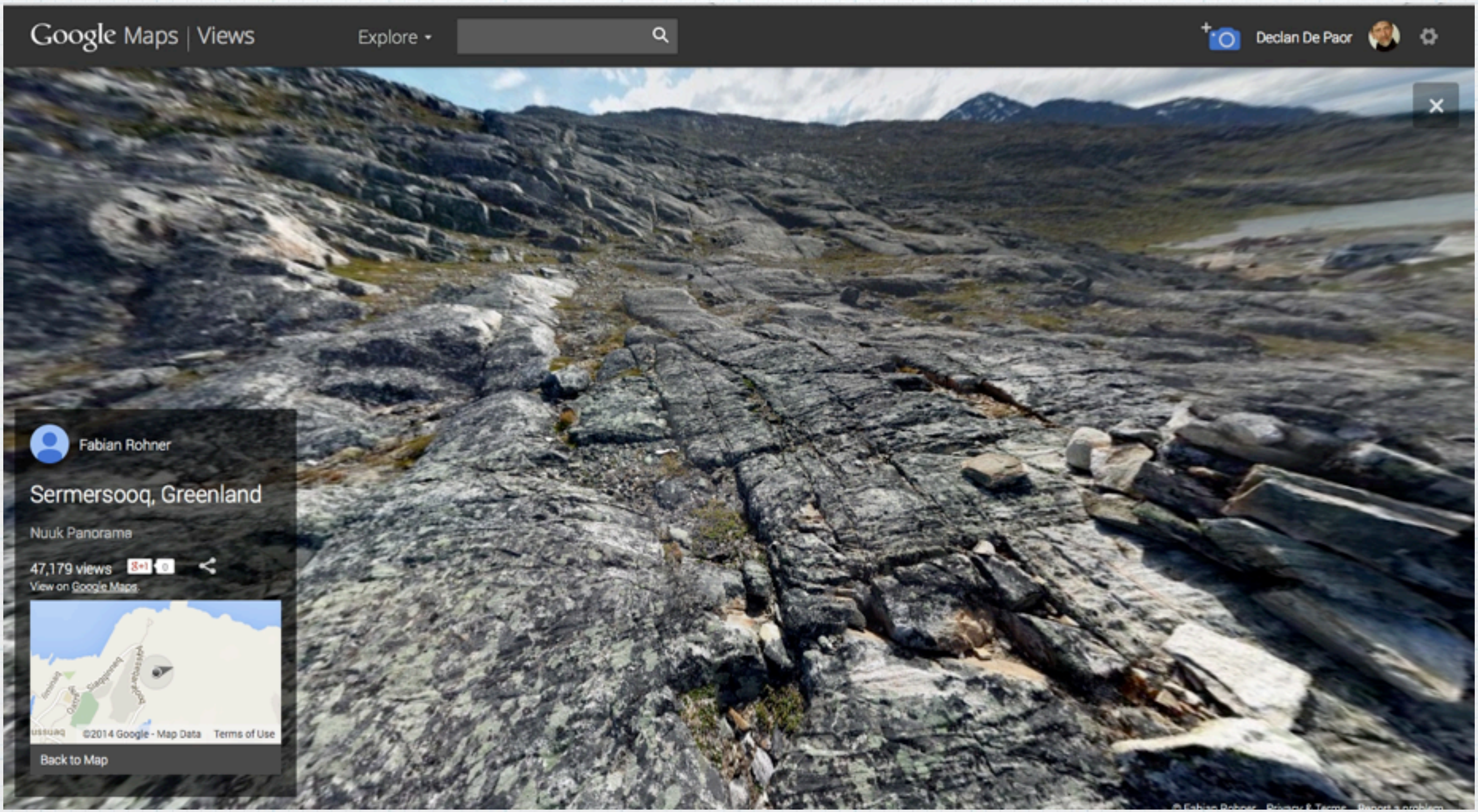
https://plus.google.com/+RonSchott/posts/AJFDurQzMBC

Photo Sphere for Field Education



What type of rocks are these? What's the average bed thickness? What's the dip and strike? Discuss two working hypotheses for the rock labeled A: (i) it's an dark igneous intrusion, probably basalt; (ii) it's unconformable sediments. What' the average grain size of the rocks labeled B and what is this stuff doing there? What's the prominent direction of jointing? Is the longest joint just a joint or a fault? Etc.

There's a wealth of imagery awaiting to be geo-annotated!



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GSA Vancouver: Four short courses & sessions

519A. Digital Mapping and Data Collection for Field Environments +
When: Sat., 18 Oct., 8 a.m.–noon
Where: Centre for Dialogue, Strategy Room 320
Cost: US$50 for one course — or get two-for-one! — pay the same amount when combined with an afternoon course (add 519C or 519D)
Instructors: Steven Whitmeyer, James Madison Univ.; Terry Pavlis, Univ. of Texas–El Paso; Lawrence Malinconico, Lafayette College; Richard Langford, Univ. of Texas–El Paso
Cosponsors: GSA Environmental and Engineering Geology Division; GSA Geobiology & Geomicrobiology Division; GSA Geoscience Education Division, GSA Hydrogeology Division; GSA Mineralogy, Geochemistry, Petrology, and Volcanology Division; GSA Sedimentary Geology Division; GSA Structural Geology and Tectonics Division; and the National Association of Geoscience Teachers Geo2YC Division

519B. GigaPan and GigaMacro for the Geosciences +
When: Sat., 18 Oct., 8 a.m.–noon
Where: Centre for Dialogue, Executive Room 370
Cost: US$50 for one course — or get two-for-one! — pay the same amount when combined with an afternoon course (add 519C or 519D)
Instructors: Jennifer Piatek, Central Connecticut State Univ.; Bill Richards, North Idaho College; Ron Schott, Bakersfield College
Cosponsors: GSA Environmental and Engineering Geology Division; GSA Geobiology & Geomicrobiology Division; GSA Geoscience Education Division, GSA Hydrogeology Division; GSA Mineralogy, Geochemistry, Petrology, and Volcanology Division; GSA Sedimentary Geology Division; GSA Structural Geology and Tectonics Division; and the National Association of Geoscience Teachers Geo2YC Division

519C. Google Maps Engine, Earth Engine, and Big GeoData +
When: Sat., 18 Oct., 1–5 p.m.
Where: Centre for Dialogue, Strategy Room 320
Cost: US$50 for one course — or get two-for-one! — pay the same amount when combined with a morning course (add 519A or 519B)
Instructors: Jeffrey Ryan, Univ. of South Florida; Kristen St. John, James Madison Univ.
Cosponsors: GSA Environmental and Engineering Geology Division; GSA Geobiology & Geomicrobiology Division; GSA Geoscience Education Division, GSA Hydrogeology Division; GSA Mineralogy, Geochemistry, Petrology, and Volcanology Division; GSA Sedimentary Geology Division; GSA Structural Geology and Tectonics Division; and the National Association of Geoscience Teachers Geo2YC Division

519D. Using Google Earth to Teach Interpretation of Geologic Processes, Bedrock Structures, and Geologic History +
When: Sat., 18 Oct., 1–5 p.m.
Where: Centre for Dialogue, Executive Room 370
Cost: US$50 for one course — or get two-for-one! — pay the same amount when combined with a morning course (add 519A or 519B)
Instructors: Barbara Tewksbury, Hamilton College; Heather Almquist, Univ. of Montana
Cosponsors: GSA Environmental and Engineering Geology Division; GSA Geobiology & Geomicrobiology Division; GSA Geoscience Education Division, GSA Hydrogeology Division; GSA Mineralogy, Geochemistry, Petrology, and Volcanology Division; GSA Sedimentary Geology Division; GSA Structural Geology and Tectonics Division; and the National Association of Geoscience Teachers Geo2YC Division

Short course 519 A,B,C,D

T57. Digital Geology Sandpit (Digital Posters)

T59. A Grand Tour of the World's Most Important Geological Sites on Google Earth

NE GSA Bretton Woods: Workshop & Session

The Challenges:

- To teach geospatial visualization to a diverse population of agile and sessile students

Future of field geology:

- Must scale massively to meet national workforce needs
- Must involve both onsite and online geoscience courses
- May include synchronous and asynchronous delivery
- Must teach geospatial skills ± field presence
- Must offer authentic research experiences