

Geoscience education for the Google generation

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Google Earth: Visualizing the Possibilities for Geoscience Education and Research



<https://sites.google.com/site/gepenrose/>



Outline

- ▶ Students – how will their skills/needs change in 21st century?
- ▶ HE Landscape – how will this evolve in next 5-10 years?
- ▶ Educators – what do we teach in the future and how?
- ▶ Resources/tools – what is available to us – and how do we make use of them?



Students

- ▶ highly skilled in internet, gaming, smartphones and other emerging IT/media technologies
- ▶ Google, Facebook, YouTube, flickr,
- ▶ SMS, blogs, video messaging, Twitter
- ▶ Wii, PS3, Xbox, Second Life
- ▶ Life



Skills

- ▶ Increase in spatial cognitive skills - a result of TV from early age, computer games internet etc?
- ▶ but decrease in more abstract reasoning skills – perhaps attributed to decrease in reading books
- ▶ Against background of increasing IQ due to improved education and other environmental factors

Needs – (Employability)

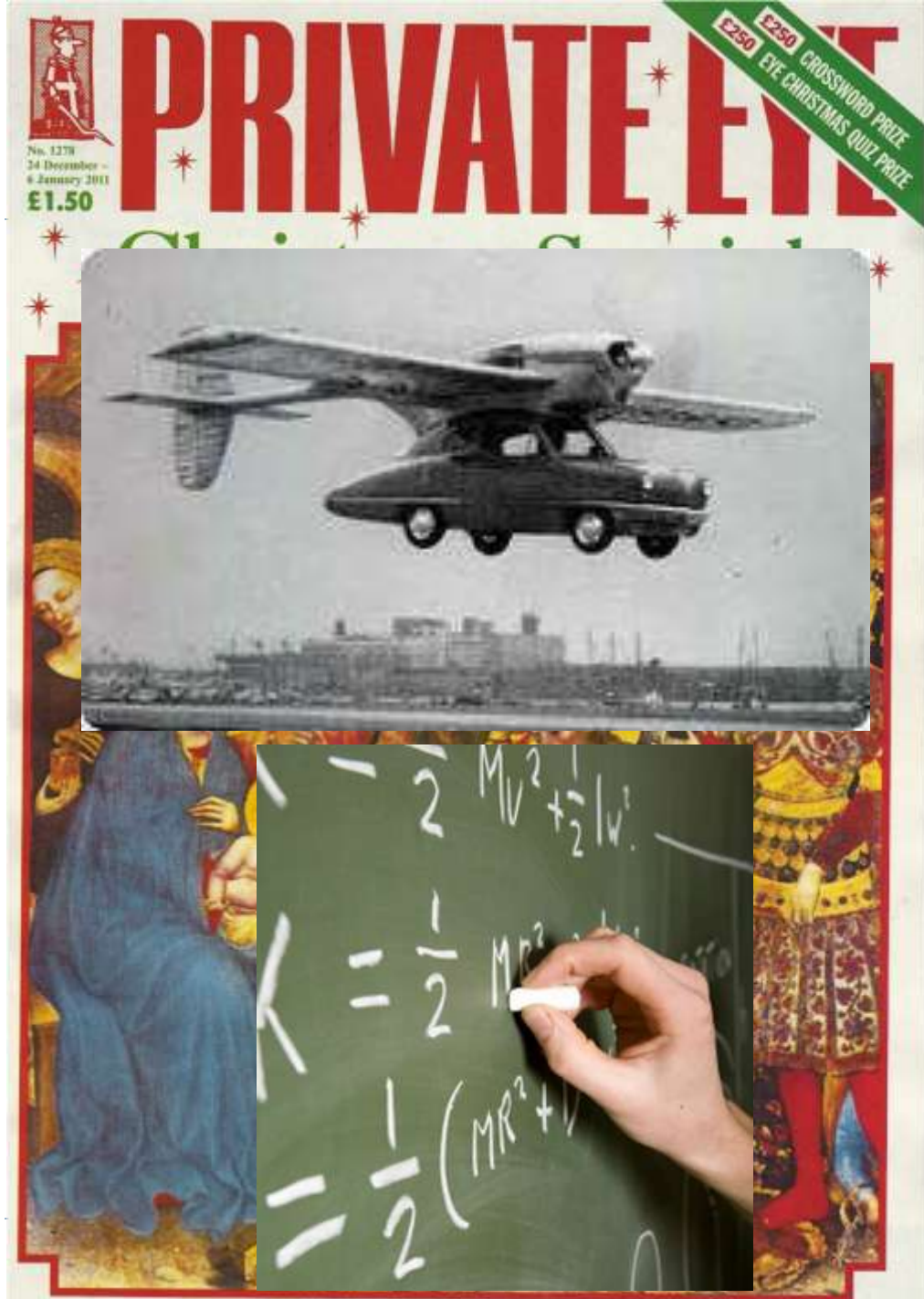
- ▶ What will work environment look like? How do we know?
- ▶ The Google model?
 - ▶ Flat organisation,
 - ▶ Organic structure around teams
 - ▶ Entrepreneurship key
- ▶ Remote working likely to be important but staying connected will be key - ‘the Cloud’!



Develop close links with employers - Employer forums, advisory panels – placements, secondments – CeREES model

HE Landscape

- ▶ Uncertainty post-Browne
 - ▶ High tuition fees
- ▶ Students' school experience
- ▶ Increasing complex technology-rich society
 - ▶ Wide array of tools at our disposal –
 - ▶ What to use/when to use?
 - ▶ How can we be sure of effectiveness?



What do we teach students?

- ▶ how to address real-world problems;
- ▶ to critically evaluate the validity of data
- ▶ methods, and scientific concepts
- ▶ build scientific, technical, quantitative, and communication skills.



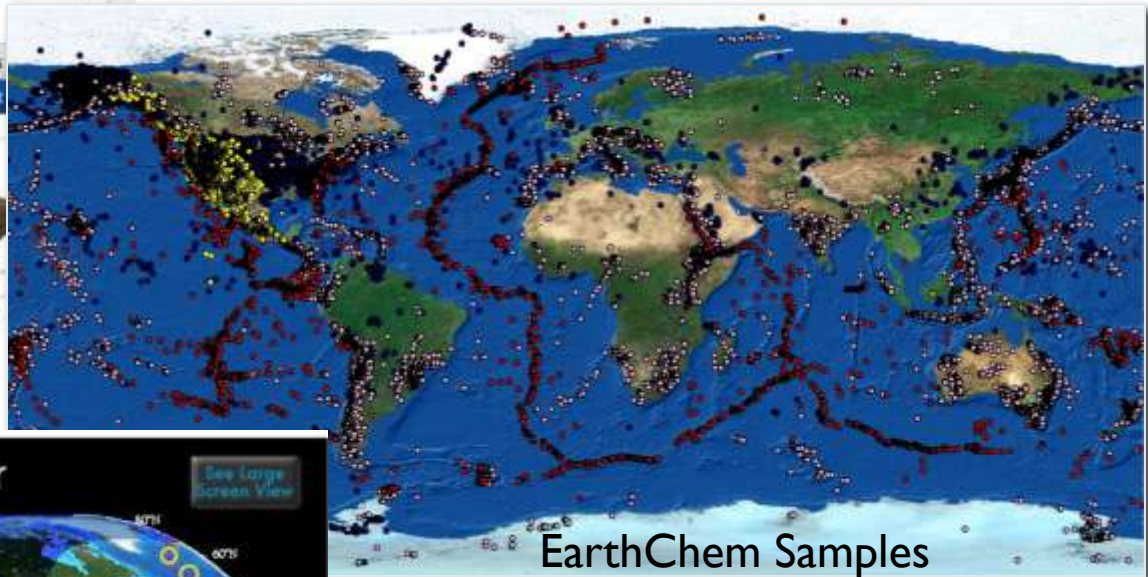
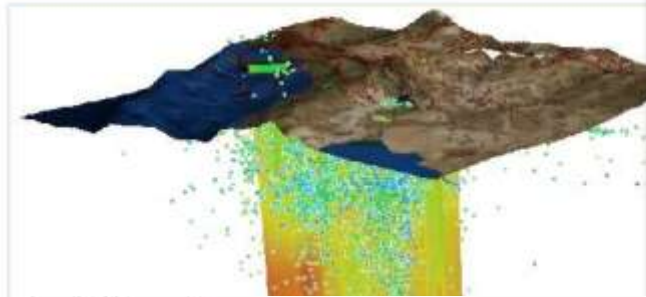
But now also data mining – global datasets, Multi-attribute geospatial visualisation, and scale issues
How best to teach the ‘soft’ skills alongside the ‘hard’ science? What else?

Data Resources for Geoscience Research

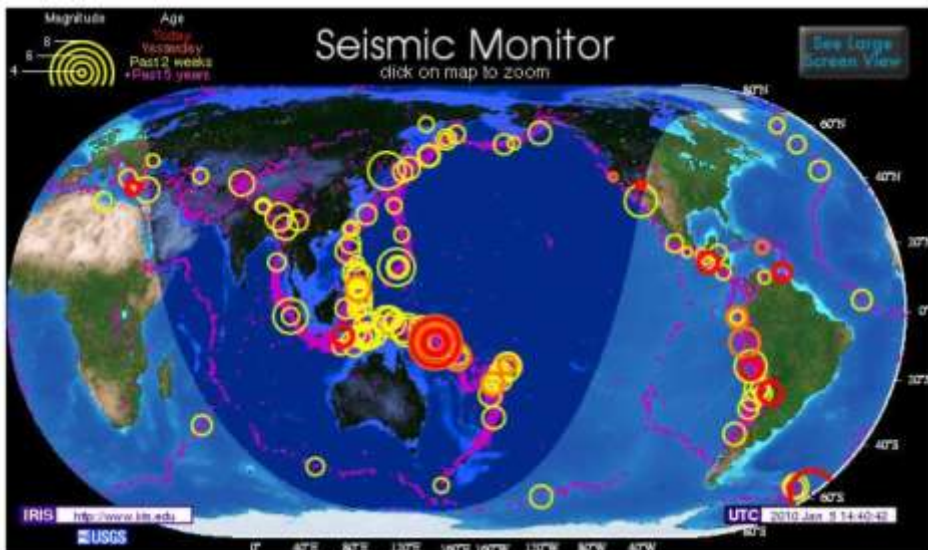
GEON

GEON is an open collaborative project that is developing cyberinfrastructure for integration of 3 and 4 dimensional earth science data

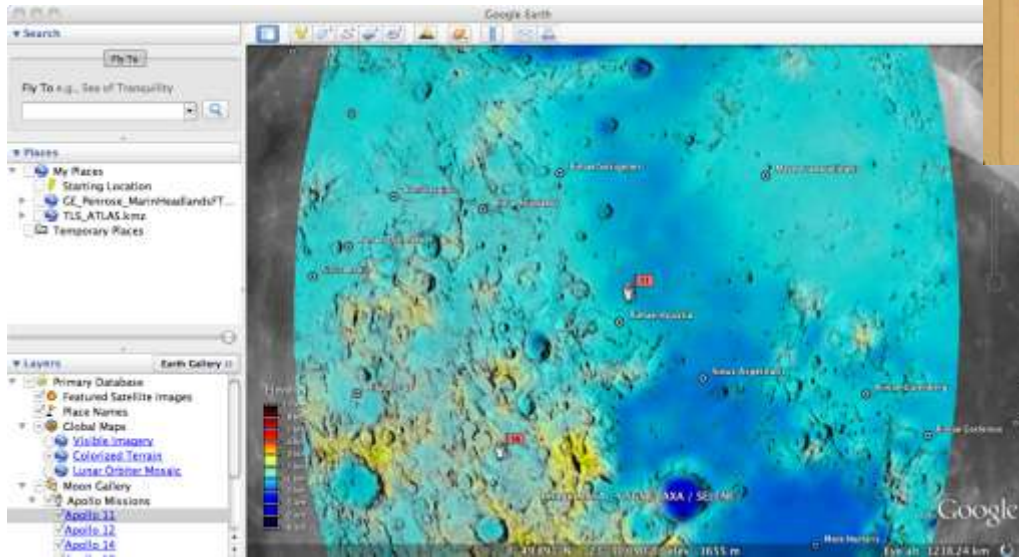
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EarthChem Samples



‘Virtual’ environments



High resolution imagery



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my daughter smiled at this one when we found it



▶ <http://www.gigapan.org/gigapans/2575/>

Virtual Outcrops

HOME OUTCROPEDIA ABOUT US FREQUENT QUESTIONS CONTACT US



"A Public database of all important and beautiful outcrops in the World."

Welcome to Outcropedia!


Outcropedia is an online public database initiated by a group of structural geologists dedicated to fieldwork. Outcropedia is sponsored by Tectask, which is the Commission on Tectonics and Structural Geology of the International Union of Geological Sciences (IUGS).

The aim of Outcropedia is to make a central, online public database of the most important and magnificent geological outcrops in the World.

Outcropedia serves two main purposes:

1. to make outcrops in unfamiliar places known and accessible to other geoscientists who would like to organise field trips, study particular structures at excellent exposure or set up new cooperative research projects.
2. to increase protection of our geological heritage. Many beautiful outcrops are threatened by building activity or otherwise permanently damaged because the geological importance of the site is simply unknown outside the Earth Science community. The documentation of interesting outcrops in a central database will increase public awareness and the chances of getting early warning when certain sites are endangered.

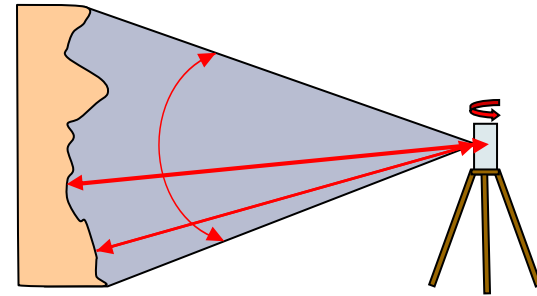
Outcropedia depends on the submission of data by its users. Please add your favorite, most beautiful outcrops to the collection!



Virtual Outcrop Geology

<http://org.uib.no/cipr/Project/VOG/>

Example Virtual Outcrop – Kepier Quarry, Durham, UK

A screenshot of the Google Earth interface. The main window displays a 3D view of a quarry face. A pop-up window titled "Virtual Outcrop Atlas" is overlaid on the map. The pop-up contains project details and a thumbnail image of the quarry face.

Virtual Outcrop Atlas

Project Details

- Scanned by: Alan McCallery
- Collaboration with: Gareth Bergh, (Thomas) Woody Wood (DP)
- Feature/purpose: Sweeping survey on 19 structures
- Date of Acquisition: August 2017
- Scanner: Riegl LMS-4200
- No. of scans/pulses: 2
- Number of points: 6,400
- Angular resolution: 0.5°
- Deck volume: 1.53 Mb
- Colour photos: Yes

Data
Models

Henningsvaer

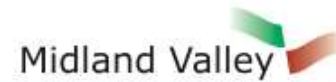
Scan of hillside exposing two sets (NW-SE and ENE-WNW) of features, as associated with Mesozoic normal faulting located in Palaeoproterozoic granites (orthogneiss) intrusions.

Project supported by Shell

Image © 2010 TerraMetrics
© 2010 Europa Technologies
© 2010 Google

Industry/Academic partnerships

Academic Software Initiative

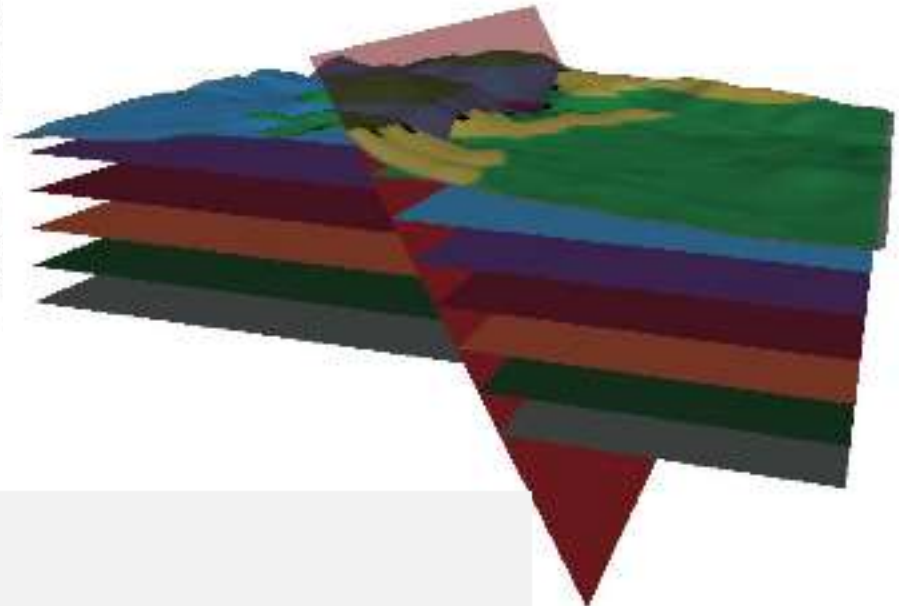


Get your hands on the most complete structural modelling and analysis toolkit for your teaching and research.

A deal for universities providing free access to move

To celebrate our 25th anniversary in 2008 Midland Valley launched its Academic Software Initiative (ASI), opening up access to Move, our structural modelling and analysis software, by providing licences free of charge to universities and other academic institutes.

The initiative significantly increases the investment Midland Valley makes in training the next generation of geologists and builds on our Field Mapping Initiative launched in 2007. Within the ASI academic institutes will be supplied (on an annual basis) with as many licences of Move as they require, free of charge.



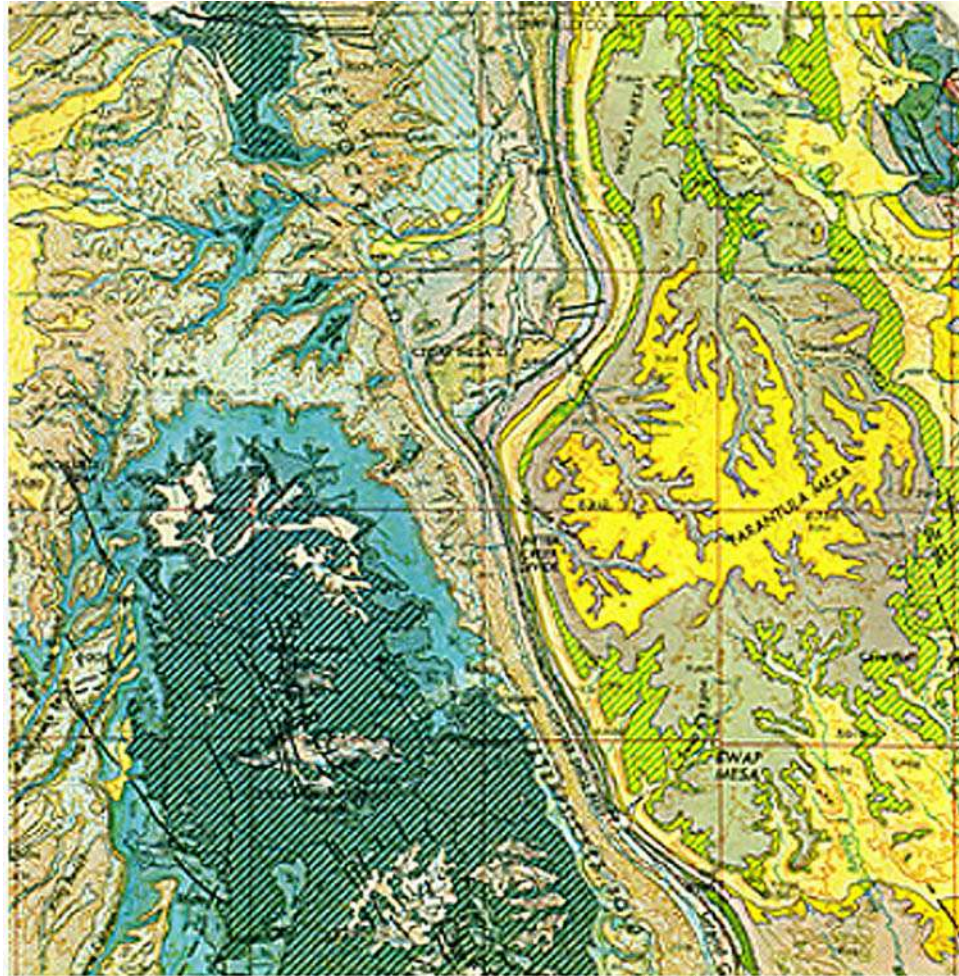
Teaching Map Interpretation and Cross Section Construction Using Google Earth

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SERC - Cutting Edge

http://serc.carleton.edu/sp/library/google_earth/index.html

Geologic map interpretation



http://www.fas.org/irp/imint/docs/rst/Sect2/Sect2_3.html

- ▶ Really hard for students

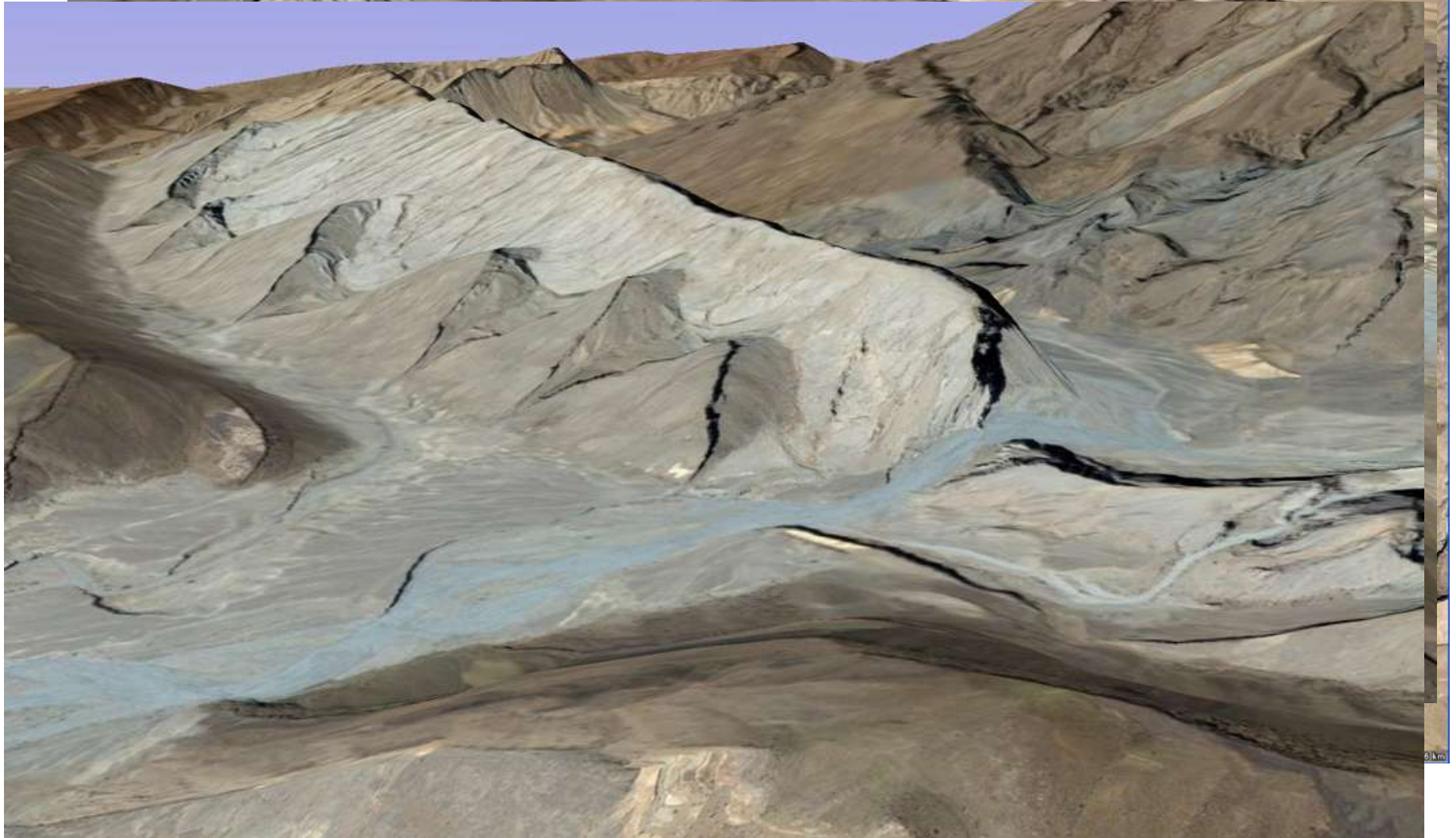
My old approach to teaching map interpretation

- ▶ Define symbols
- ▶ Define units
- ▶ Teach on vertical cross-sections
- ▶ Teach on rule of V
- ▶ Lots of PlayDoh[®]
- ▶ Have students practice interpreting geologic maps and drawing X-sections



1

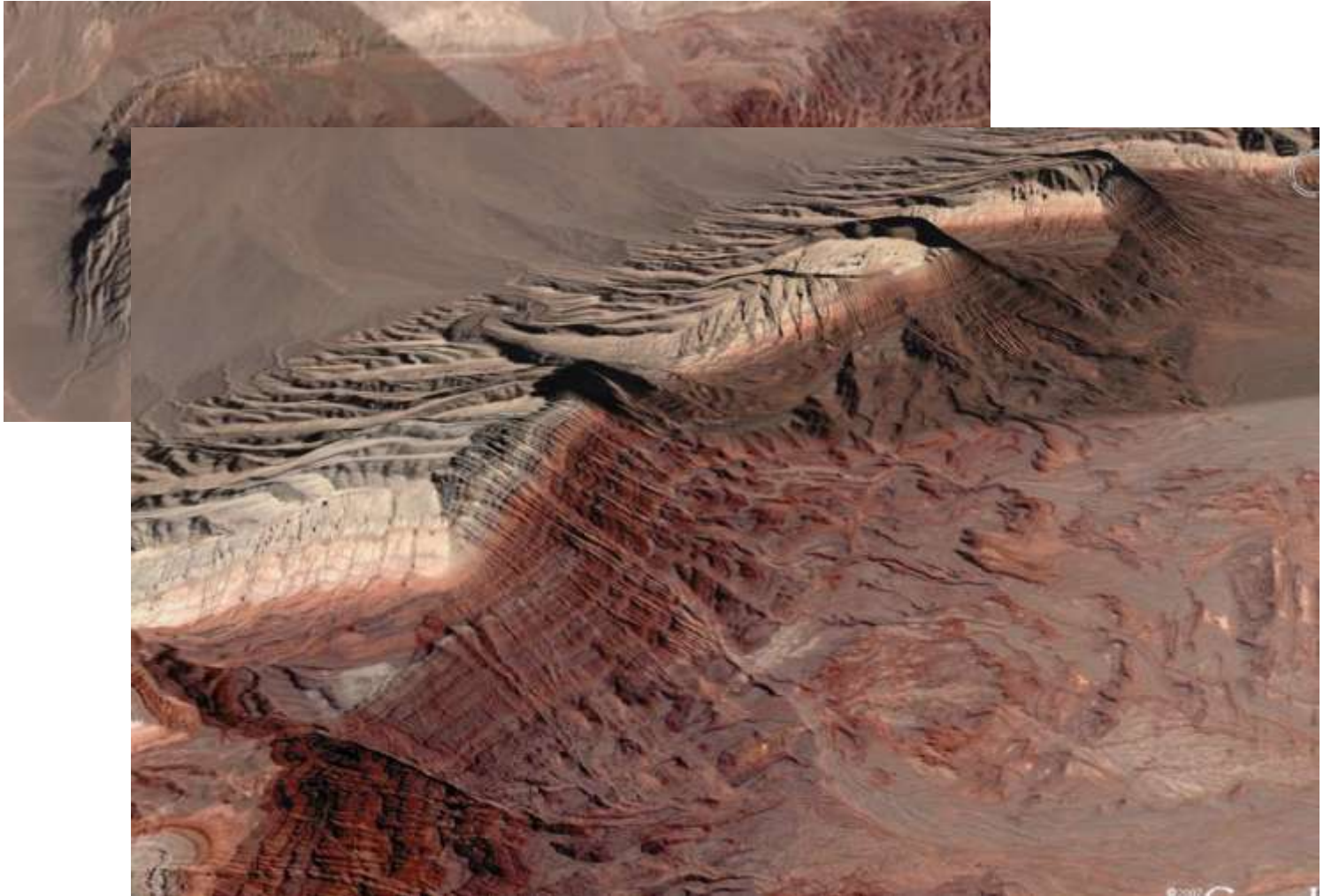
And then I discovered digital PlayDoh®



▶ <http://serc.carleton.edu/NAGTWorkshops/structure/approach.html>

2a

Value of Google Earth



▶ East of Yazd,

2b

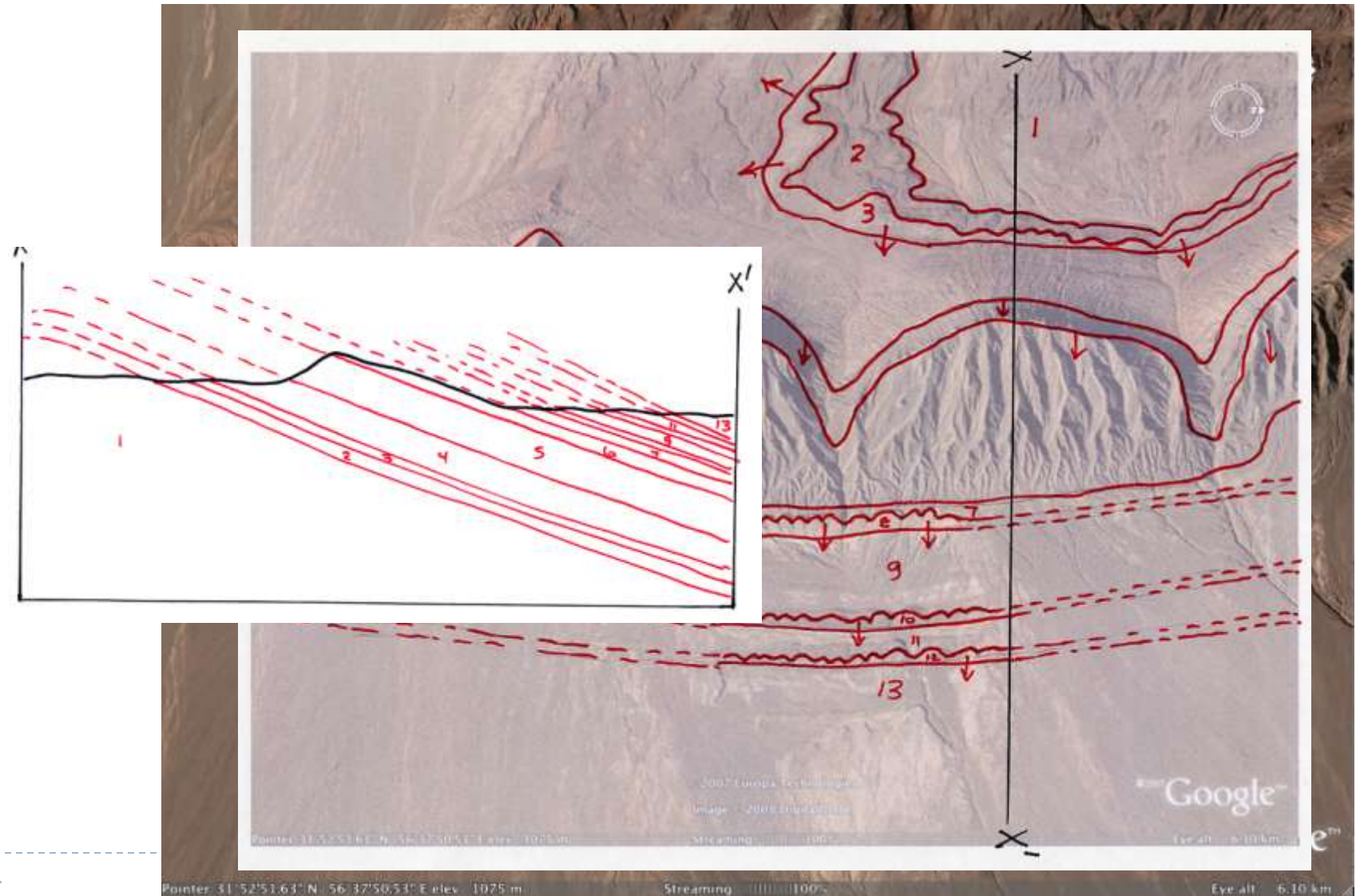
Visualizing units and contacts



East of Yazd, Iran

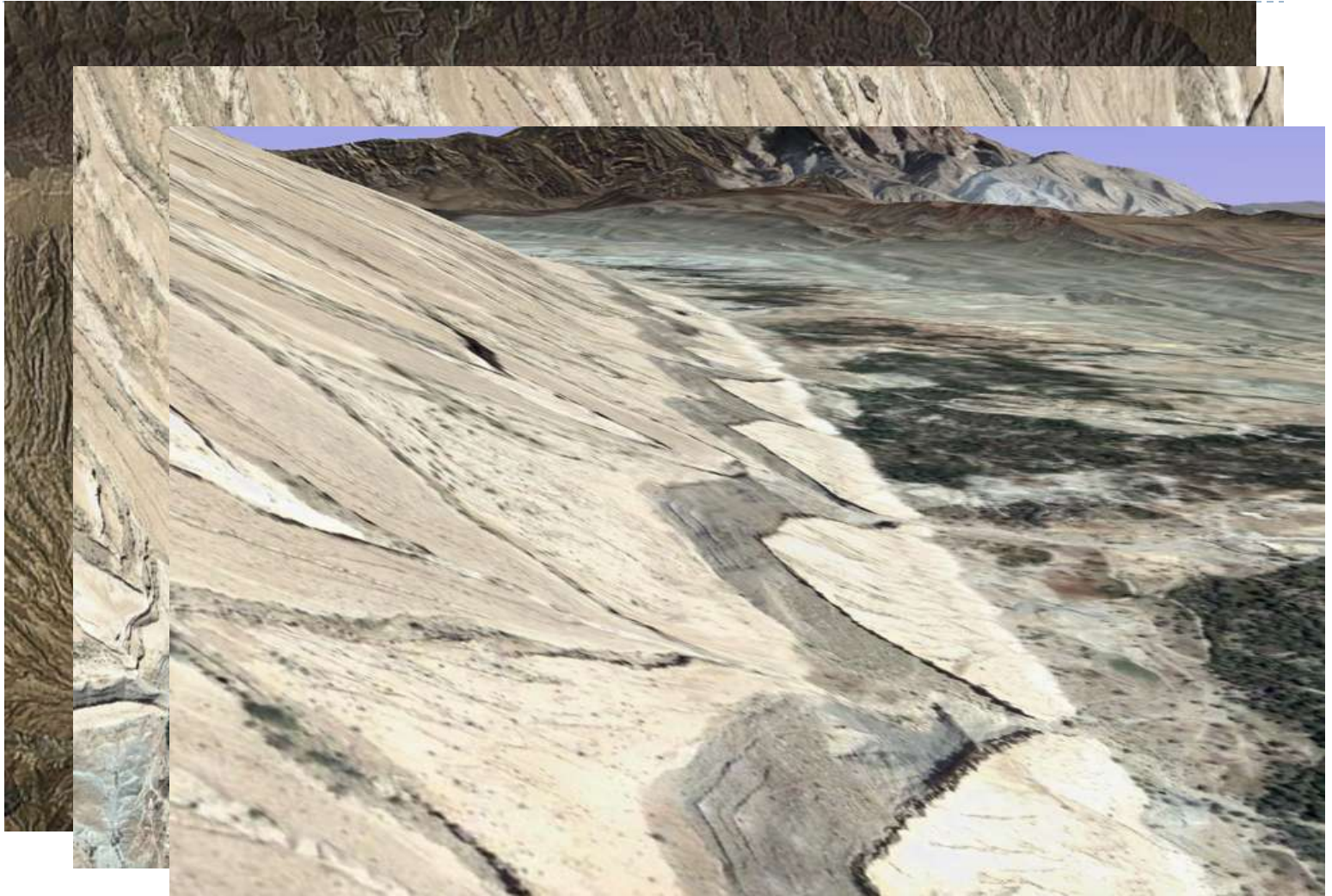
2b

Visualizing units and contacts



3

Visualizing dip

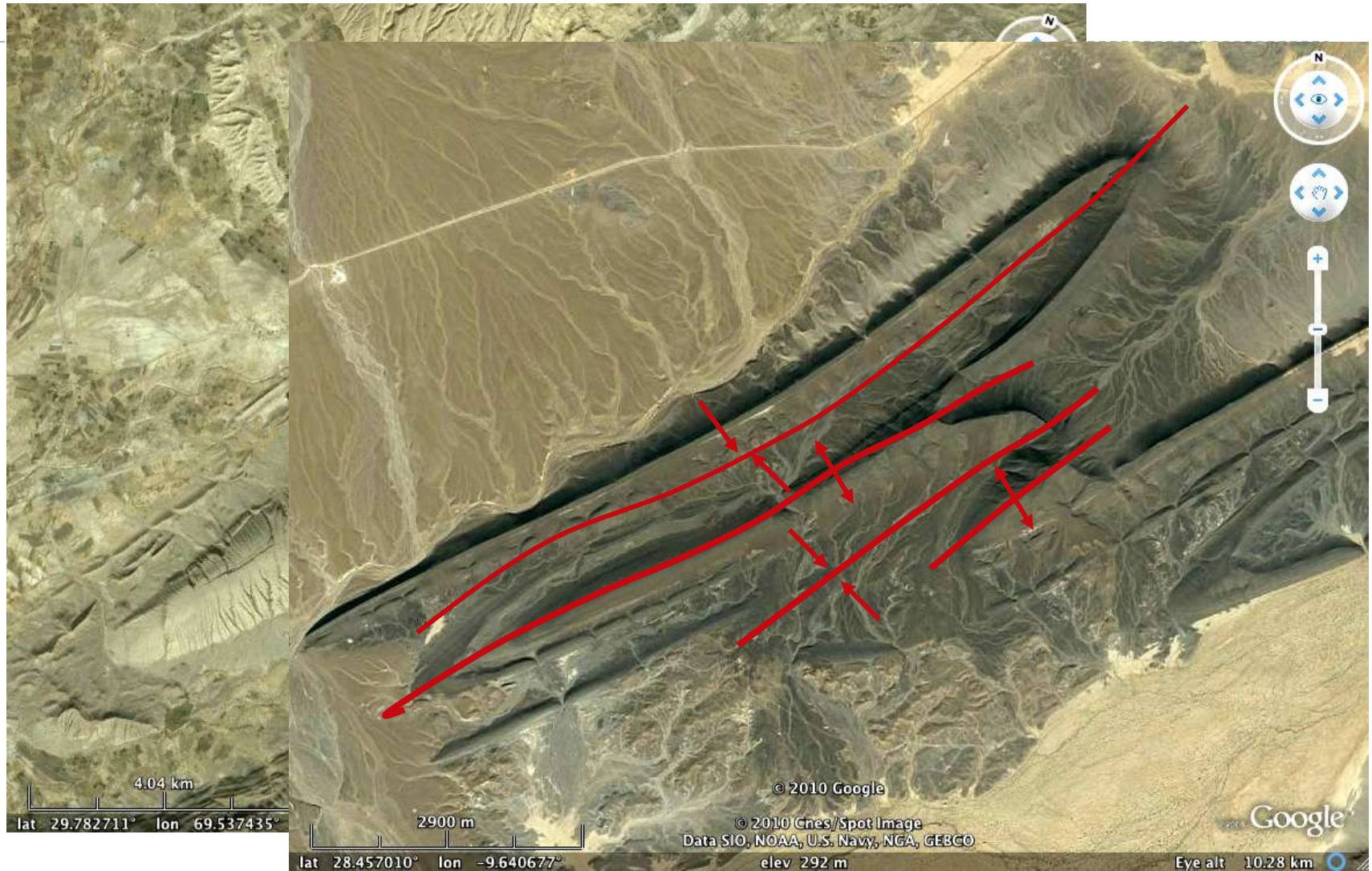


► Khvorgu, Iran

3 Backing into strike



4,5 Visualizing folds



▶ Partially breached - shows limbs, hinge, plunge

Final thoughts

- ▶ Despite very high level IT skills, students are likely to need even more support on entry to University
- ▶ Do students really learn with technology and informatics tools and resources? We need evaluation and recommendations for best practice
- ▶ Simple user-needs first approach most effective?



Final thoughts

- ▶ Should we rely on the 'open-access' private sector tools and data systems. They are becoming the "standards" for geo-information access
- ▶ Virtual Outcrops can provide a fantastic resource for teaching and public outreach & archive purposes, but...we almost certainly will have to defend real fieldwork more vigorously than ever

