
Welcome to
EOSC 330
Geomorphology

Instructors: Matthias Jakob (mjakob@bgcengineering.ca) and Wayne Savigny (wsavigny@bgcengineering.ca)

Teaching Assistants:

- Kathryn Grodzicki: kgrodzic@eos.ubc.ca
- Arthur Hazell: ajshazell@gmail.com
- Brandon Nguyen: quynguyen604@gmail.com
- Birgit Rogalla: birgit.rogalla@gmail.com

Lectures: Mondays 12:00-13:00, Wednesday 12:00-13:00, Fridays 12:00-13:00 (3 hours/week)
Room 2012, EOS Building

Labs: 2 hours/week
Room 101, EOS Main

- L1A Monday 14:00-16:00 Rm 105
- L1B Tuesday 11:00-13:00 Rm 101
- L1E Tuesday 15:00-17:00 Rm 101
- L1C Thursday 13:00-15:00 Rm 101

Laboratories will start during the week of Sept. 18. See course outline.

Prerequisites:
GEOB 103, EOSC 110 or EOSC 210, or instructor approval

Web site: www.eos.ubc.ca
follow link to courses, 300 level, EOSC330

To open folder with handouts - Username: eosc330, Password: given in class**: geomorph**

Course outline: download from web site (subject to intermittent updating)

Learning Goals (abbreviated)

Geomorphology is the art and science of studying landforms of the Earth surface and the processes that form them. We humans live on the surface of our planet, and so the surface landforms and the biological and hydrological forms associated with them constitute our living environment.

Our main resources – food, living space, building materials and energy -- largely originate at or near the ground surface. Most natural and environmental hazards that endanger our lives originate at the ground surface.

Geomorphological skills are useful to any earth scientist. Being adept at geomorphology is a bit like having X-ray vision; an experienced geomorphologist looking across a landscape can 'see' the soils and rocks underground.

The general purpose of this course is to provide you with a basic understanding of Earth surface processes and landforms, with an emphasis on recognition and observation.

The laboratory assignments in the course will be devoted to API (Airphoto Interpretation), one of the basic tools of a geomorphologist.

The course will aim for a global view of Geomorphology, looking at processes relevant to all climate zones.

Topics to be covered:

1. Introduction to geomorphology
2. Airphoto interpretation and other tools of geomorphology
3. Tectonic landforms
4. Isostacy
5. Magmatic landforms
6. Volcanic hazards
7. Chemical and physical weathering
8. Stream hydrology and sediment transport
9. Landslide classification
10. Introduction to basic slope stability concepts
11. Landslide hazards – recognition and assessment
12. Glaciers
13. Glacial landforms
14. Periglacial (permafrost) landforms
15. Snow avalanches
16. Coastal landforms
17. Aeolian (wind-blown) landforms
18. Introduction to the B.C. terrain classification system
19. Examples of applied geomorphology

Main objectives of the course

1.To introduce landform morphology and processes of landform development

2.To practice techniques for recognition and analysis of landforms and processes

3.To describe typical applications of geomorphology to geoscience, engineering and environmental protection

Fair warning:

Geomorphology a descriptive and quantitative science a bit of memorization is required (comparable to learning a new language)

Examinations:

There will be two mid-term quizzes and a final examination.

Course Evaluation:

Laboratories:	25% (5 x 5% each)
Project:	10%
Quizzes:	15% (2 x 7.5% each)
Final exam:	50%
Total:	100%

Textbook:

Trenhaille, A.S., 2013. Geomorphology, a Canadian Perspective. Either 4th 5th or 6th Edition is acceptable. Oxford, N.Y.

Laboratories:

There will be 5 lab exercises, each due to your TA one week after introduction of the assignment, unless indicated otherwise. There will also be an independent project.

Lab evaluation (grading):

- Laboratory assignments will be marked by the TAs
- Marking will focus on care and understanding, as evidenced by well-written, intelligent, brief but relevant comments in the report, clear map and legend and excellent presentation quality.
- Undesirable qualities of the labs include: poor or illegible report, incorrect or obtuse comments, poorly drawn map and poor presentation, especially evidence of a lack of interest.

EOSC 330
Laboratories

- We need to get ~20 students into each of the sections.
- If you do not have a place in a section, show up for the section you want and sign up with the TA. We may need to negotiate distribution of students within the sections, so we have ~20 in each.
- It is possible not everyone will get into their first choice section. Please help us make this work.

Lab sections

Section	Time	Location
L1A	Mon 14:00-16:00	EOS 105
L1B	Tue 11:00-13:00	EOS 101
L1E	Tue 15:00-17:00	EOS 101
L1C	Thu 13:00-15:00	EOS 101

Please come to your lab section to meet the TA and sign your name on the list. Labs will start the following week (week of Sept the 18th).

We need a few students to move from: L1C to L1A or L1B and one more student move from L1E to L1A or L1B. Volunteers, please come see us after the lecture.

A note about the use of slides and attendance in classes

All of my lectures will be delivered with the help of Powerpoint. All the presentations will be available on the course web site.

So, if all the material is on the web and in the book, why attend classes?

Caution:

The presentations contain only essential notes and illustrative material. They should enrich the narrative, but cannot really replace it. If you are not in class, you may miss explanations, descriptions, discussion and other stuff that is supposed to help you understand the material.

What should I do then?

1) **Attend classes 2) keep your own notes 3) ask questions, give comments, interact with classmates, participate**


EOSC 330
Geomorphology

Geomorphology:

Definitions:

- *"Study of surface processes and landforms"* (Easterbrook, 1993)
- *"Science which studies the nature and history of landforms and the processes of weathering, erosion and deposition which created them"* (Selby, 1985)

Most geological processes that influence us and our environment occur within a few tens of metres beneath the ground surface.

So Geomorphology is arguably the most practically important of all geosciences…

Development of earth surface:

1) **Construction (building up) - endogenic**

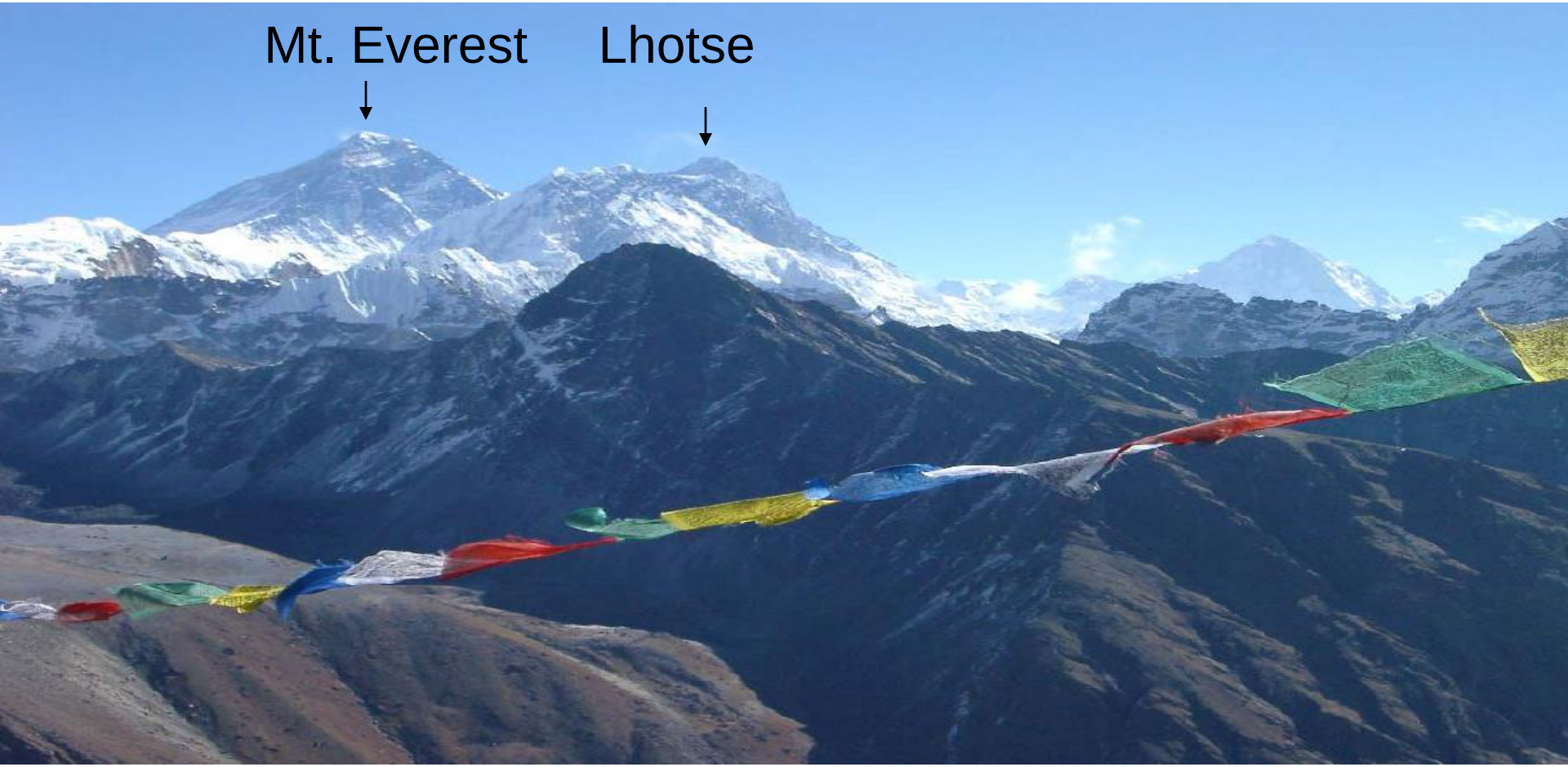
Orogeny (folding, faulting)
Epeirogeny (uplift, subsidence)
Magmatism (intrusion, extrusion)

2) **Erosion (breaking down) - exogenic**

Weathering (to weaken and disaggregate)
Erosion and mass wasting (to move)
Transport and deposition

“What goes up, must come down”

Orogeny



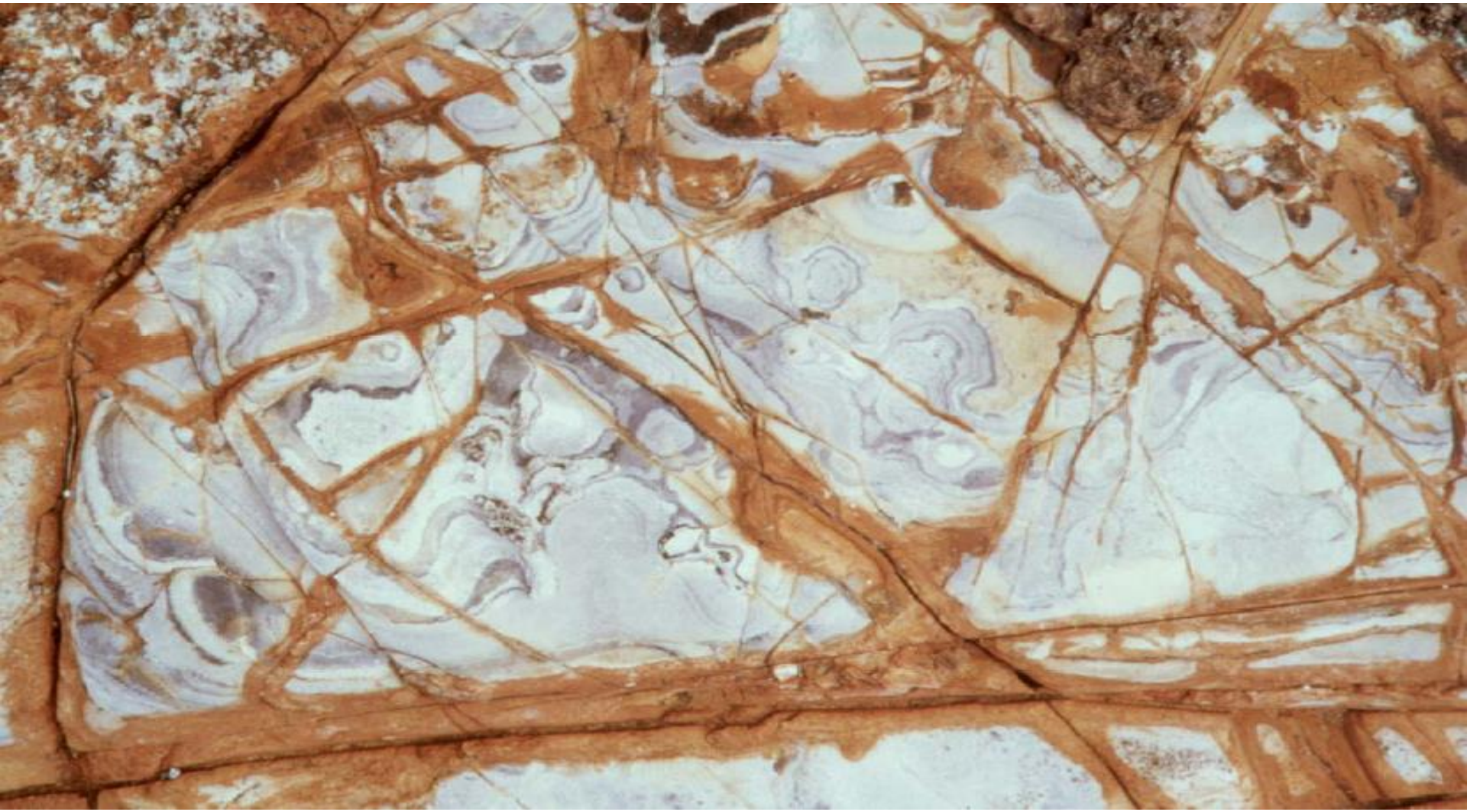
Epeirogeny (uplift) and Erosion

Bryce Canyon National Park, Utah

Magmatism

Dawson Club trip to Hawaii – do not attempt!

Weathering



Chemical weathering of joints in rock

Erosion, mass wasting

Transport, deposition

Florence, Oregon

Basic concepts:

Uniformitarianism

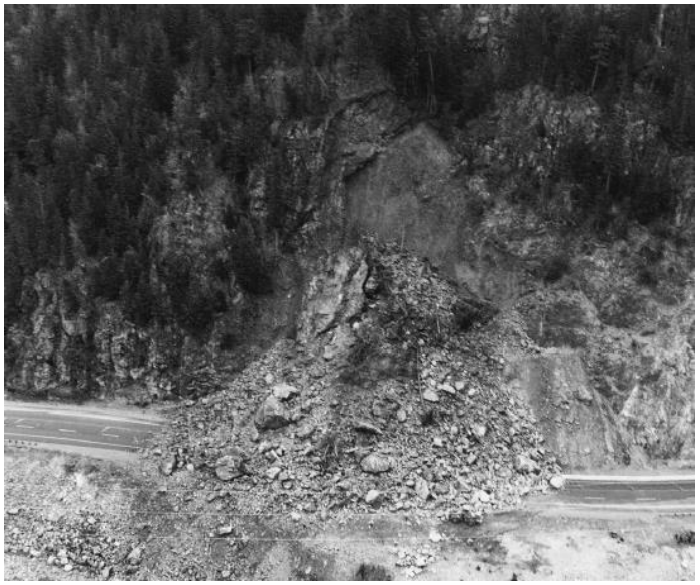
- (Hutton, Lyell, late 18'th century)
- ***"No vestige of a beginning, no prospect of an end"***
- ***"The present is a key to the past"***
- **(also, the past is a key to the future**!) or is it?

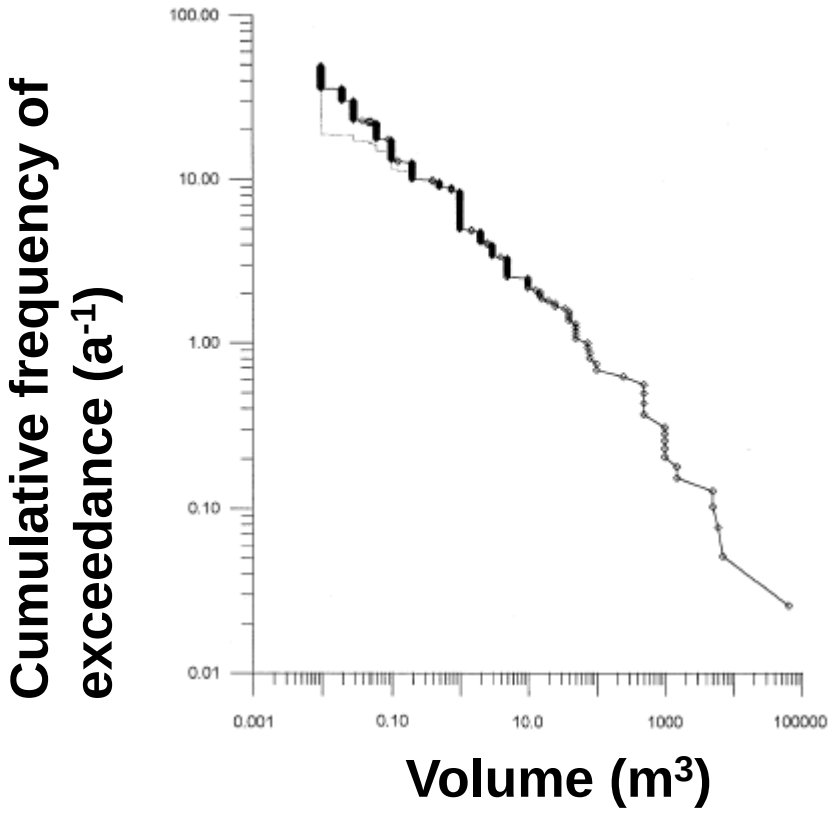
Equilibrium in Geomorphology

- Steady state (static): Nothing changes
- Dynamic equilibrium: Changes occur, but are soon compensated back to a quasi-stable state
- Metastable: Susceptible to a sudden change (notion of geomorphic thresholds!)
- Also: Positive feedback (more brings more)

Fractal Distribution

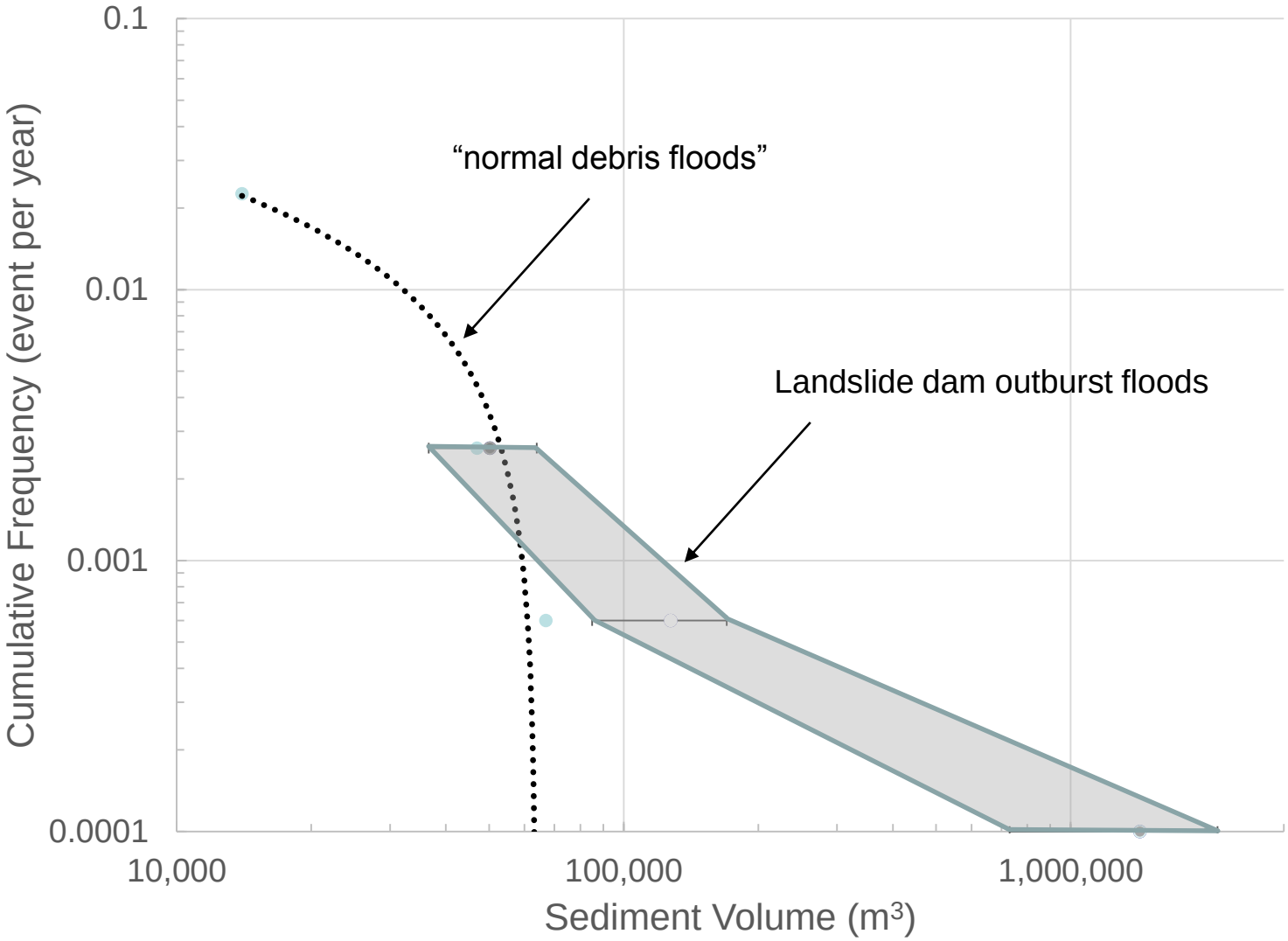
e.g. rock falls on Squamish Highway





"many small, fewer large"

But beware of multi-hazards



Solutions to problems in Geomorphology:

Rational approach *(theory)*

Empirical approach *(past is a key to the future)*

Tools:

- **Multiple hypotheses (not just the one you like)**
- **Analytical and empirical tests**
- **Occam's Razor ("keep it simple") - parsimony**
- **Always ask yourself important questions**

Example: building foundations

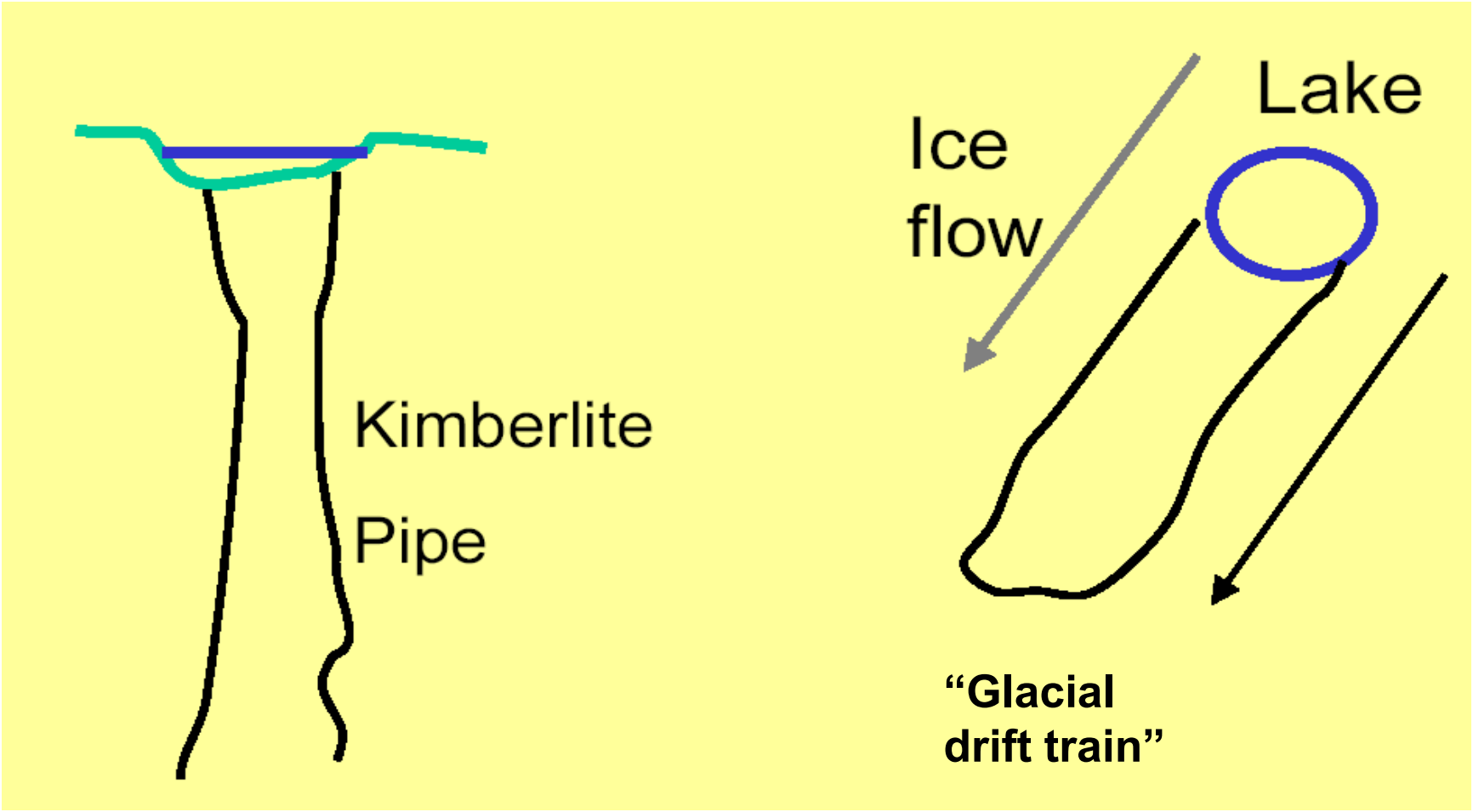
- Soil bearing capacity
- Earthquake susceptibility

Colour	Material	Bearing Capacity (kPa)	Earthquake Liquefaction susceptibility
	Intrusive bedrock	50 000	Low
	Sed. bedrock (sedimentary basin)	10 000	Low
	Dense Glacio-fluvial sand (terrace)	8 000	Medium
	Loose Alluvial sand (floodplain)	2 000	High
	Glacio-Marine clay	1 000	High

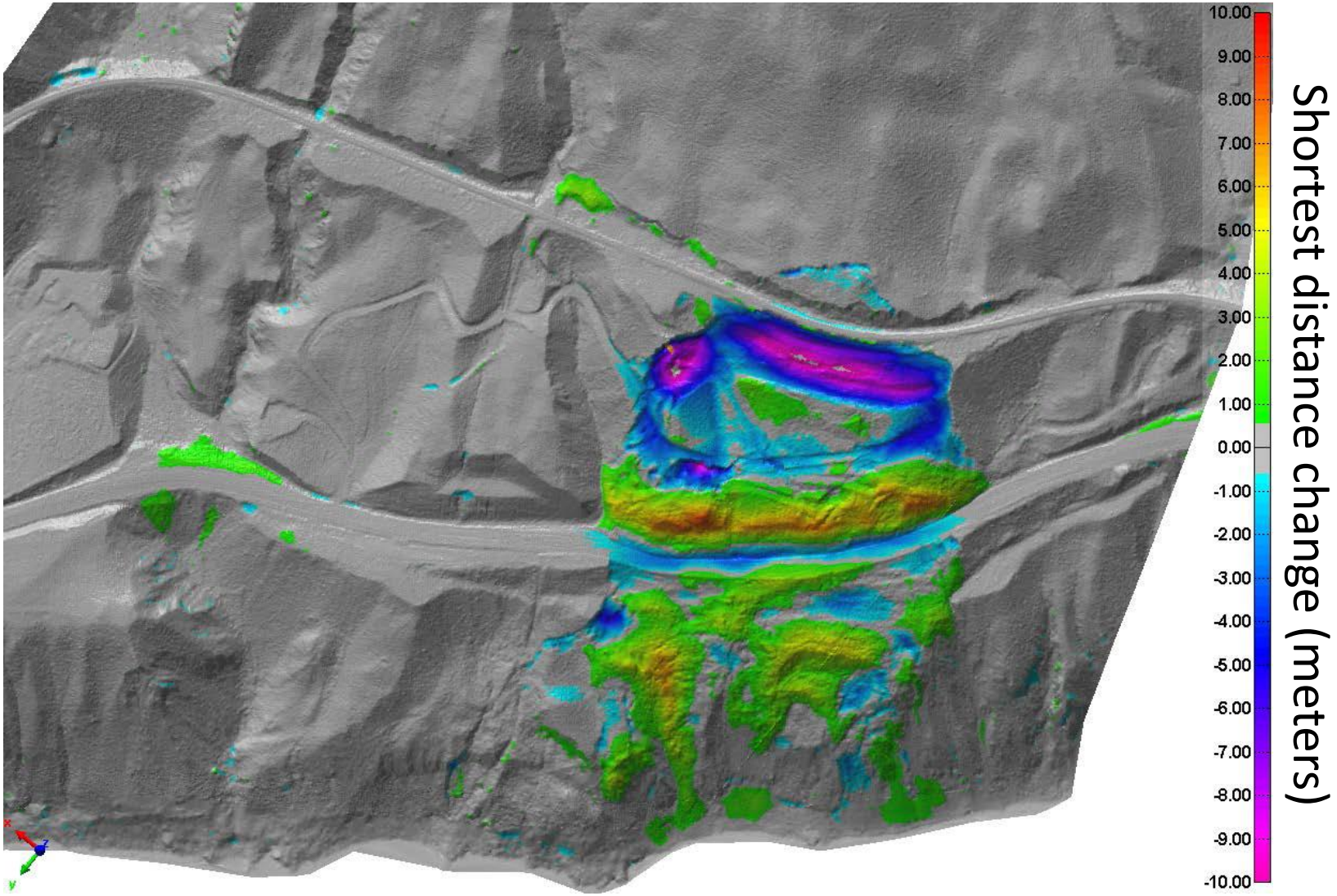
GeoMap Vancouver

Geol. Survey of Canada Open File 3511, 1998

Example: looking for diamonds

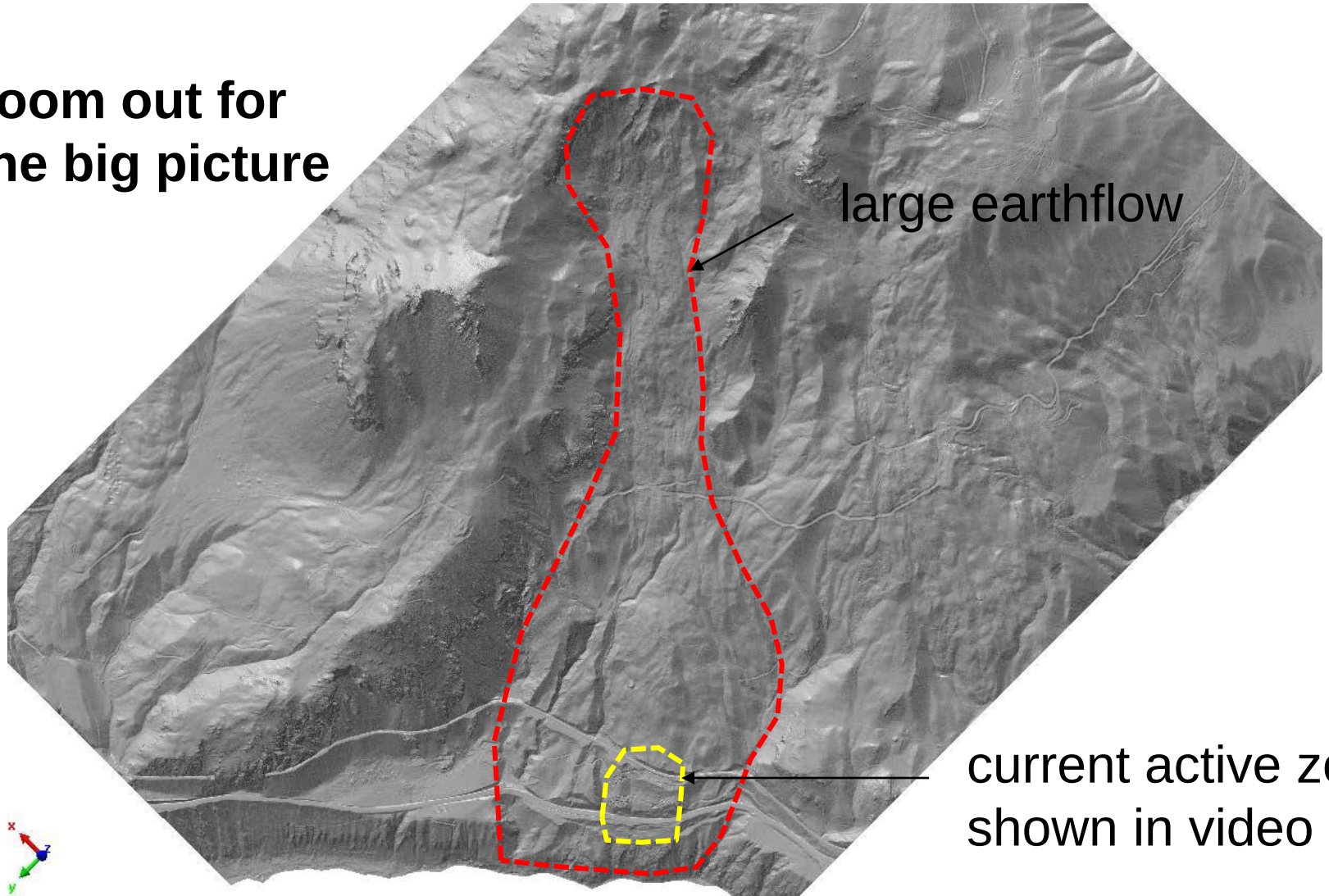


Example: landslide affecting a railway and highway

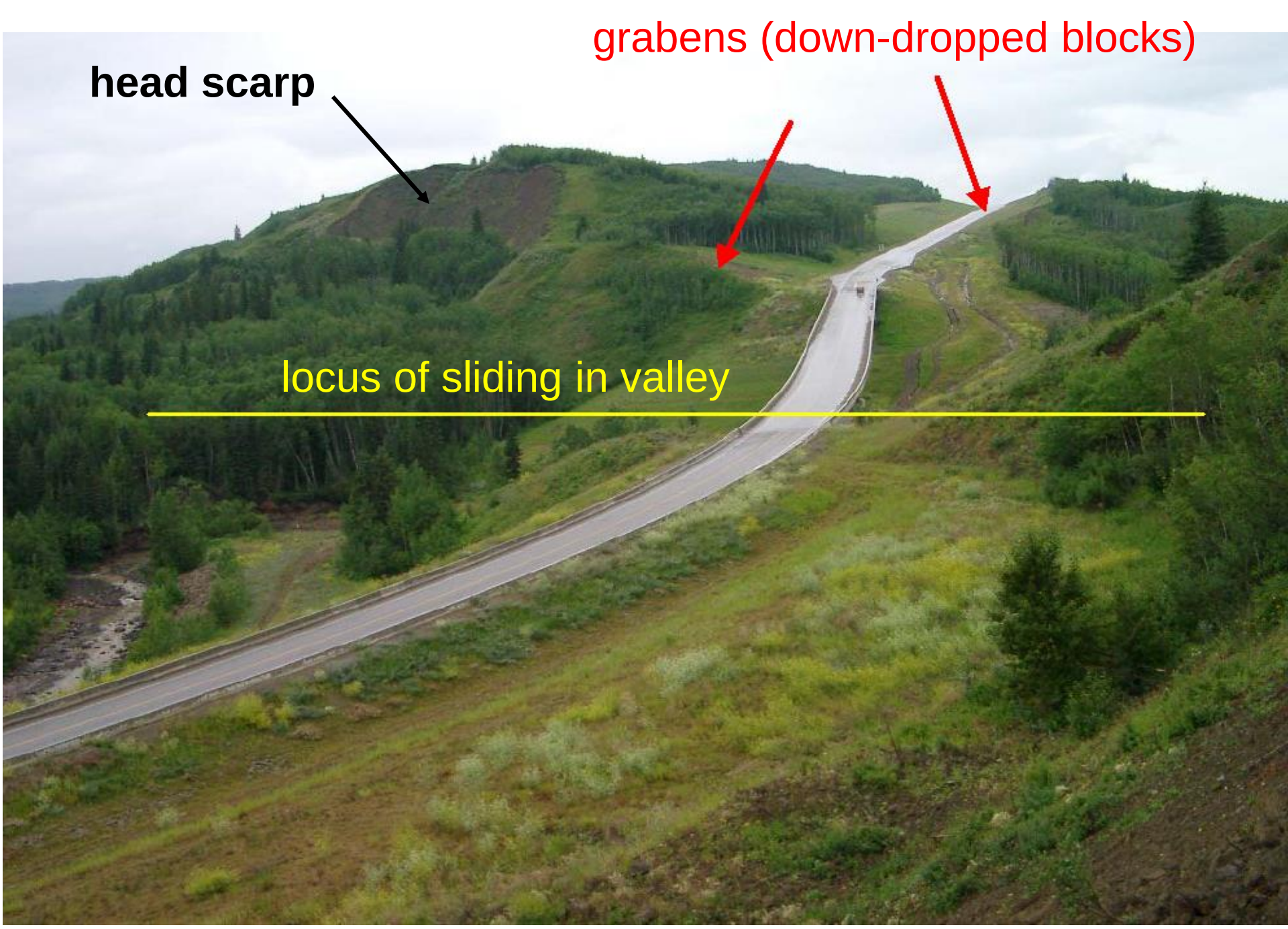


Example: landslide affecting a railway and highway

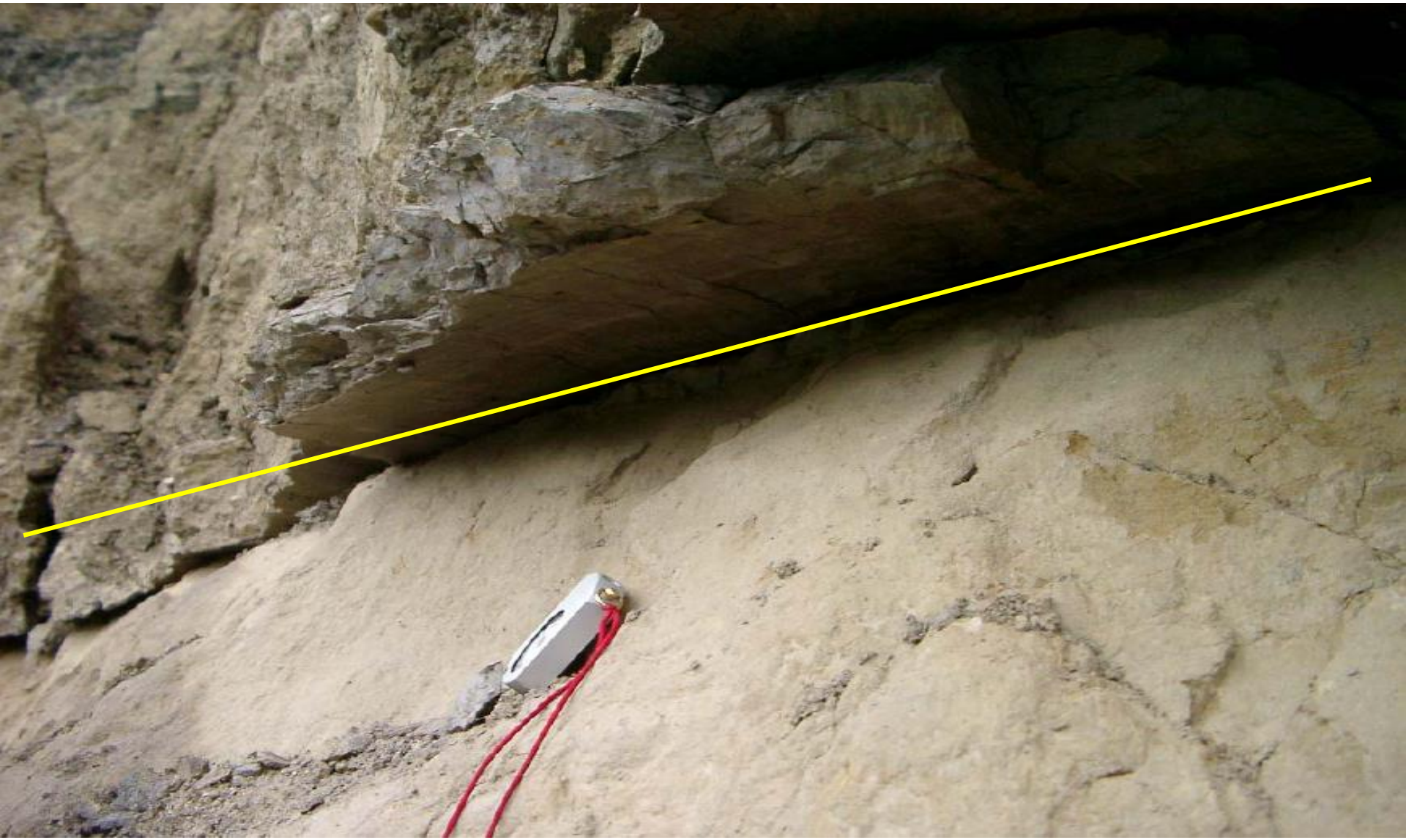
zoom out for the big picture

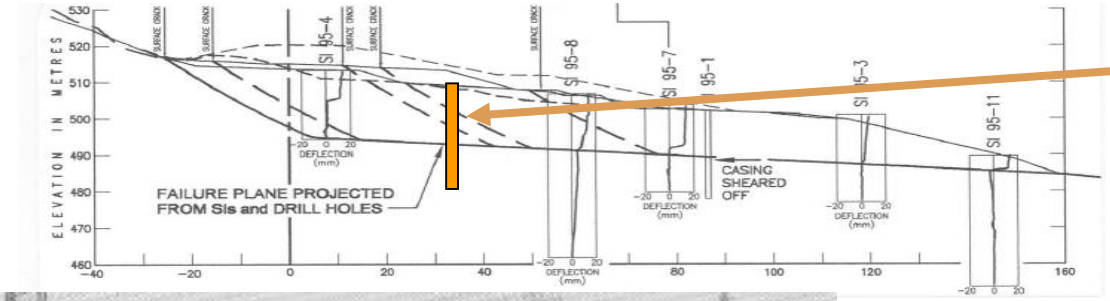


Example: Road through difficult terrain


grabens (down-dropped blocks)
head scarp
locus of sliding in valley

Weak sliding surface in clay

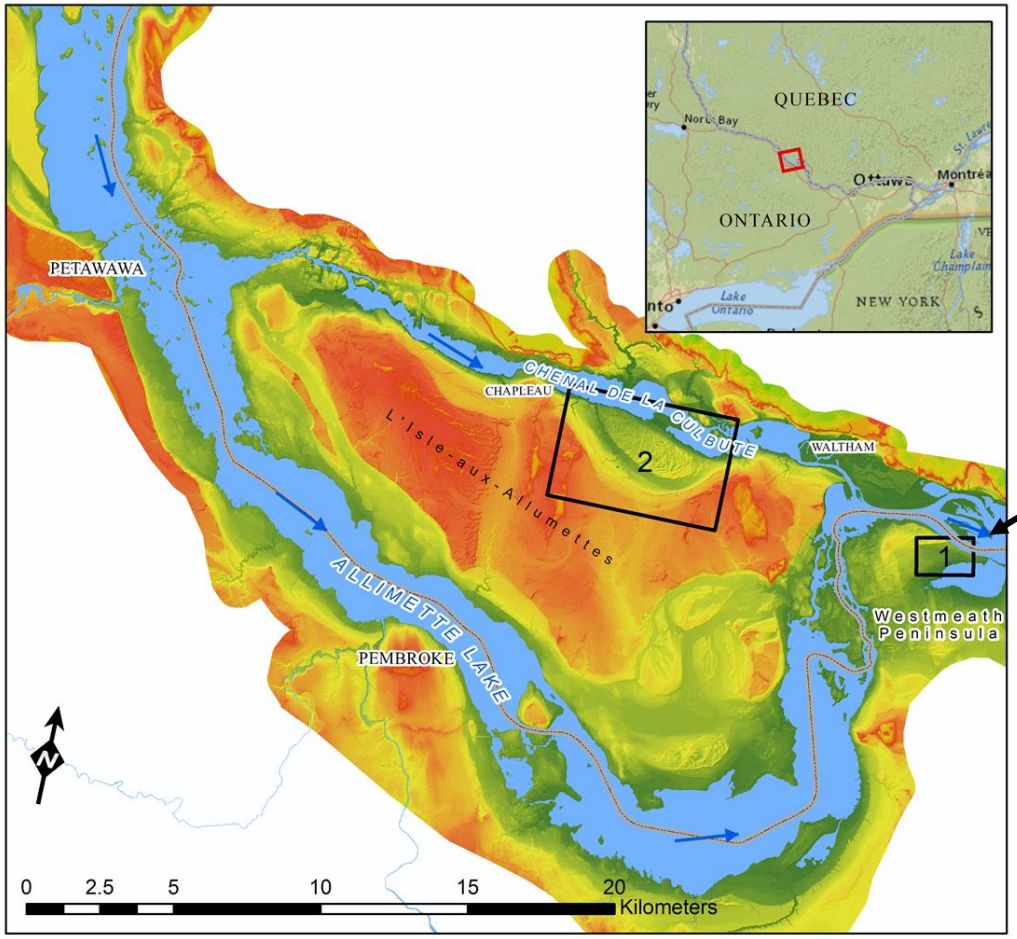


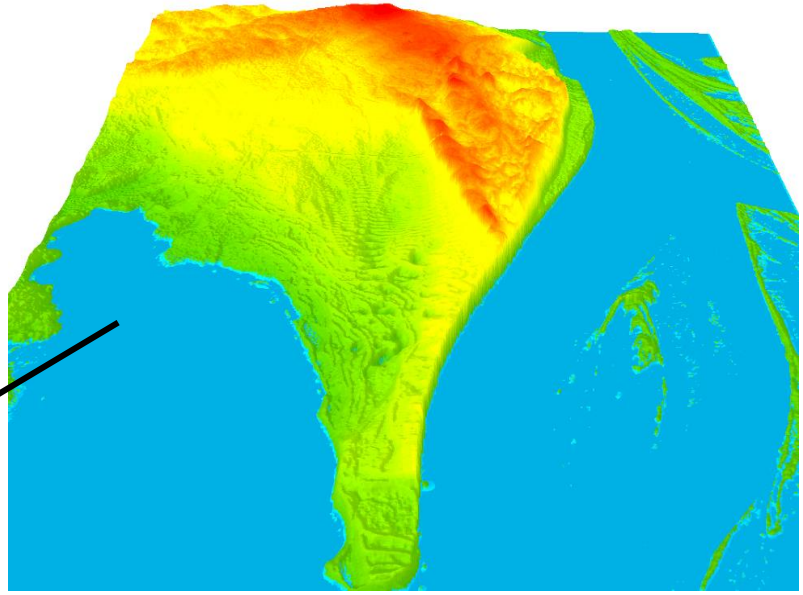


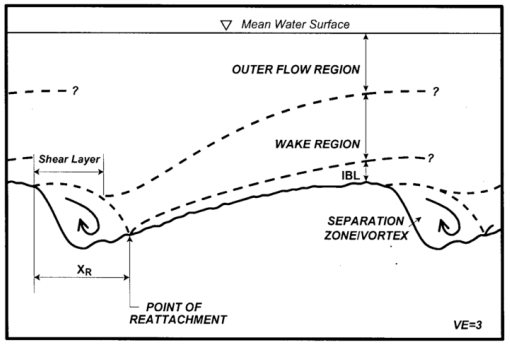
Two rows 150 cm diameter steel pipe piles, filled with concrete

Example: Paleodunes

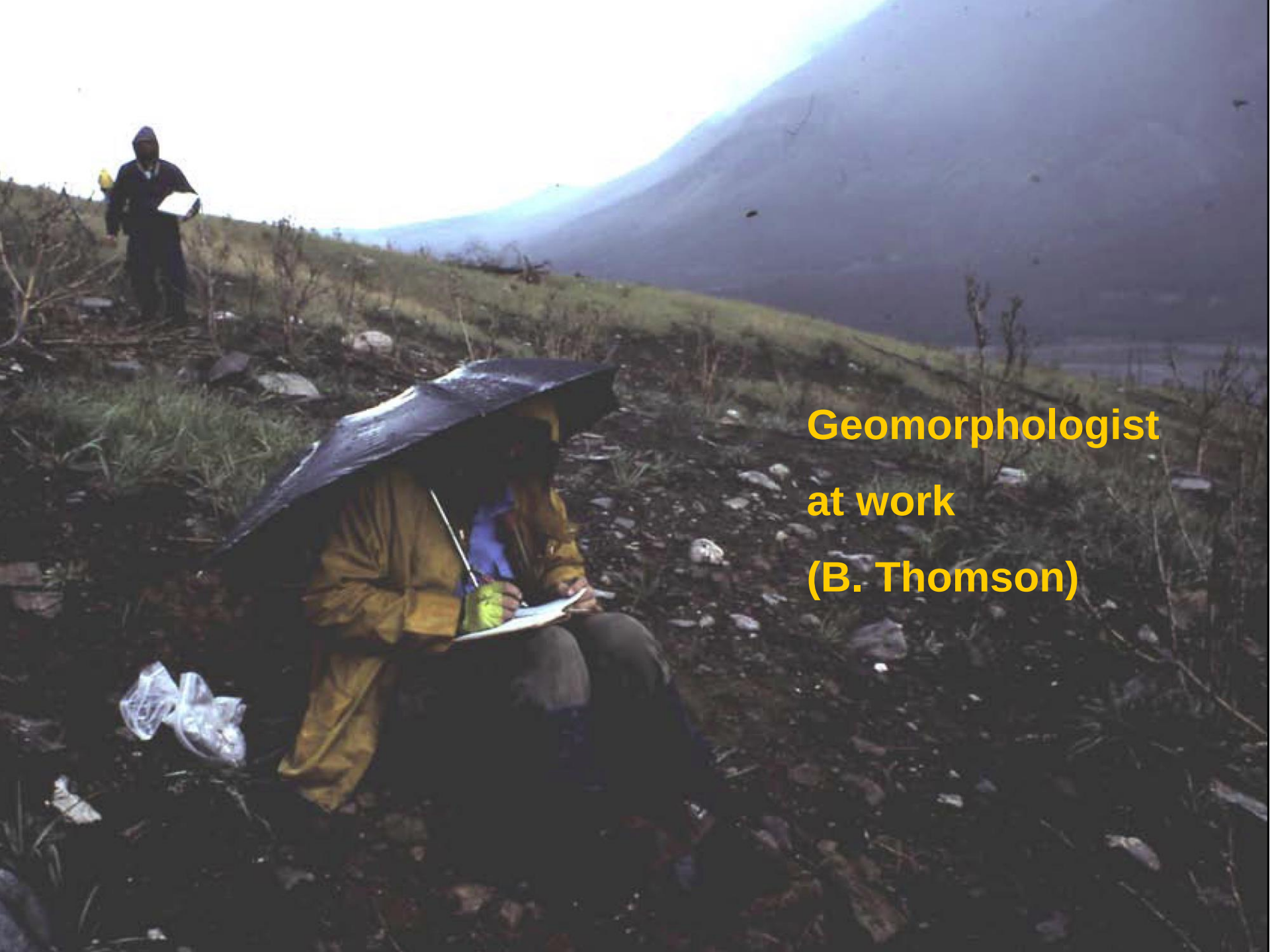
Reconstruction of paleofloods from fluvial dune morphology

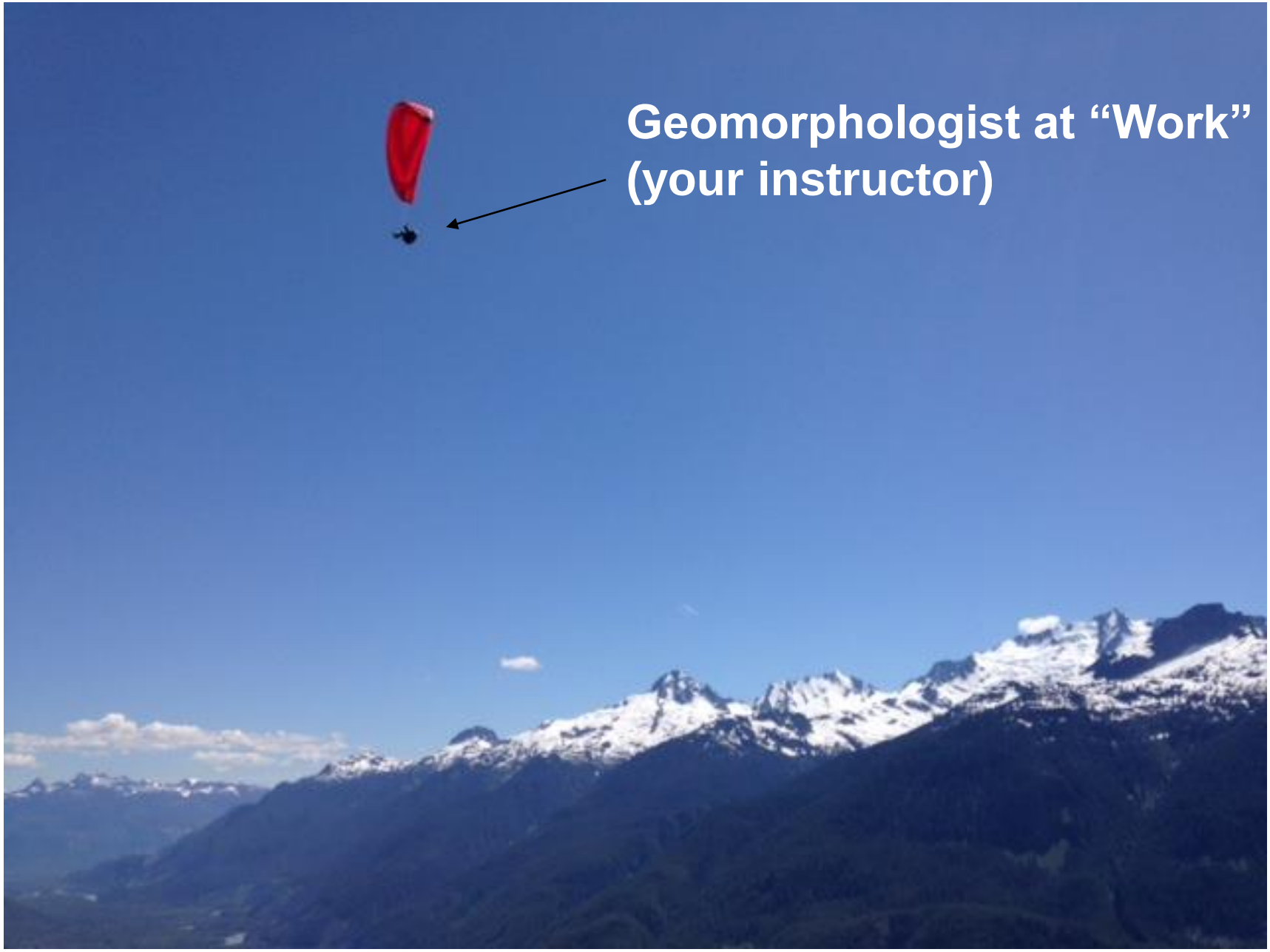






Example: Geohazards


Geomorphologist
at work
(B. Thomson)


Geomorphologist at “Work”
(your instructor)

This weekend…

What natural hazards, other than atmospheric or cosmic events, threaten the UBC campus? (Do a quick internet/literature search)