EOSC 350 : Environmental, Geotechnical and Exploration Geophysics

Instructors and TAs

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Today's Lecture

- Course Composition
- Marking
- Resources
- Problems in Geoscience
- What is Geophysics
- Geophysics Examples

Course Composition

- Lectures
- In Class Quizzes
  - Multiple choice with bubble sheets
- Team-Based Learning (TBL)
  - Read an article
  - Multiple choice and short answer
- Labs
  - Short answer questions
- Exams
  - Midterm and a final
  - Multiple choice and long answer

Marking

- Quizzes (10%)
- Team-Based Learning (10%)
- Labs (20%)
- Exams (60%)
  - Midterm (20%)
  - Final (40%)

Marking

- TBL:
  - multiple choice and short answer questions
  - mark out of total possible marks

- Individual quiz:
  - multiple choice questions;
  - paper-based bubble sheet

- Labs: (short-answer questions; paper-based worksheet)
  - Word grade evaluation
  - No specific comments will be made on papers
  - Answers available after worksheets are evaluated.

Lab Marking: Word-grade evaluation

- Awesome: = 95% (you did the work very well and very clearly understand the material)
- Brilliant:= 80% (did the work and understand all of the concepts)
- Competent: = 65% (you did the work and understand most of the concepts)
- Decent: 50% (you did the work but don't quite understand all the concepts)
- Fall-Short = 0% (you didn't do the work, or only some of it)

Resources

- Course website
  - http://eosc350.geosci.xyz/en/latest/index.html

- “Textbook”
  - GPG: Geophysics for Practicing Geoscientists
  - http://gpg.geosci.xyz/

- Interactive apps
  - GPG labs

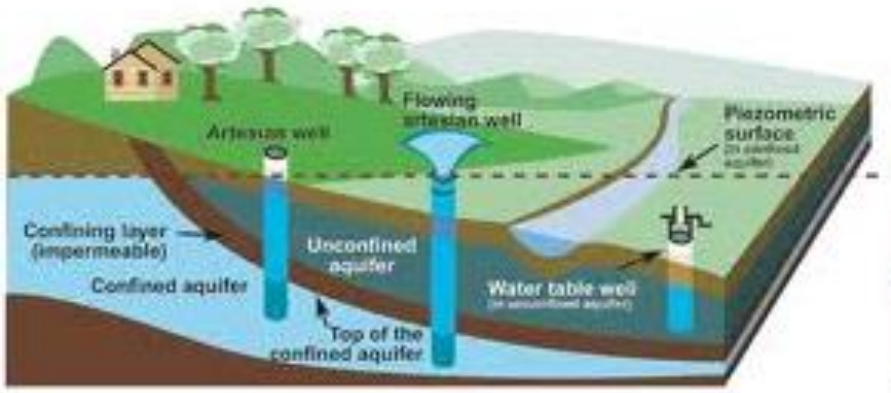
Problems in Geoscience

Finding Resources

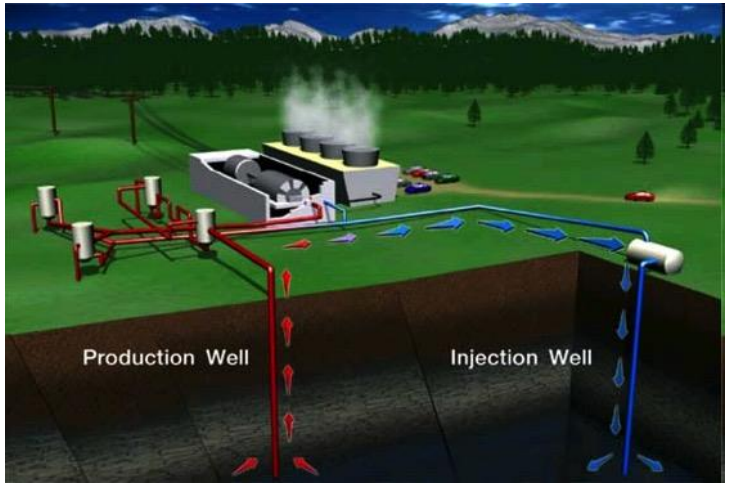
Minerals

Hydrocarbons

Ground Water



Geothermal Energy



Natural Hazards

Volcanoes

Tsunami

Earthquakes

Geotechnical engineering

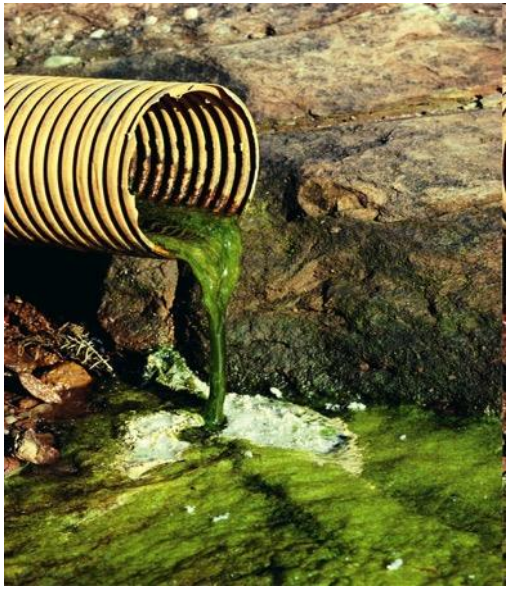
Tunnels

Slope stability

In-mine safety

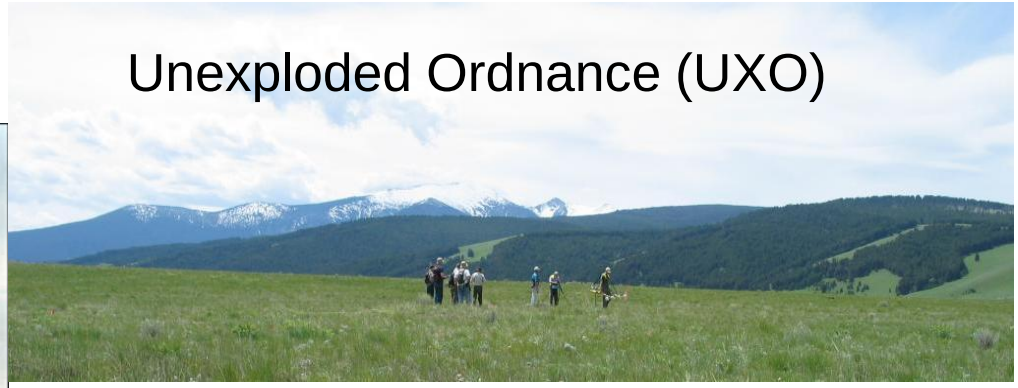
Environmental

Water contamination



Salt water intrusion

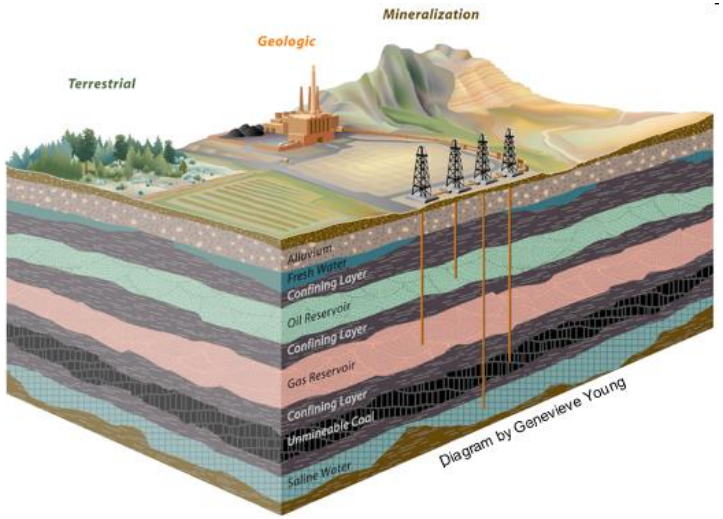
Unexploded Ordnance (UXO)



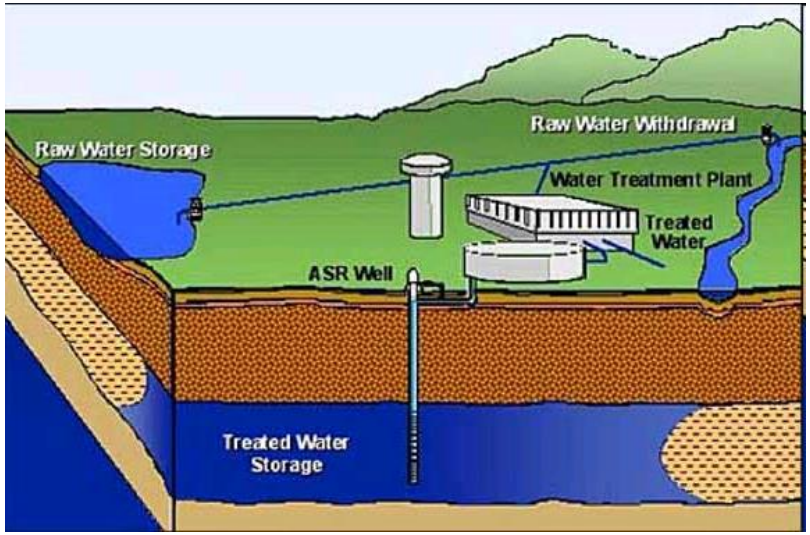
http://www.centennialofflight.gov

Surface or Underground Storage

CO2 sequestration



Aquifer Storage and Recover



Industrial Waste Disposal

What do problems have in common?

What do problems have in common?

Want to learn about what is underground without directly sampling (digging, borehole)

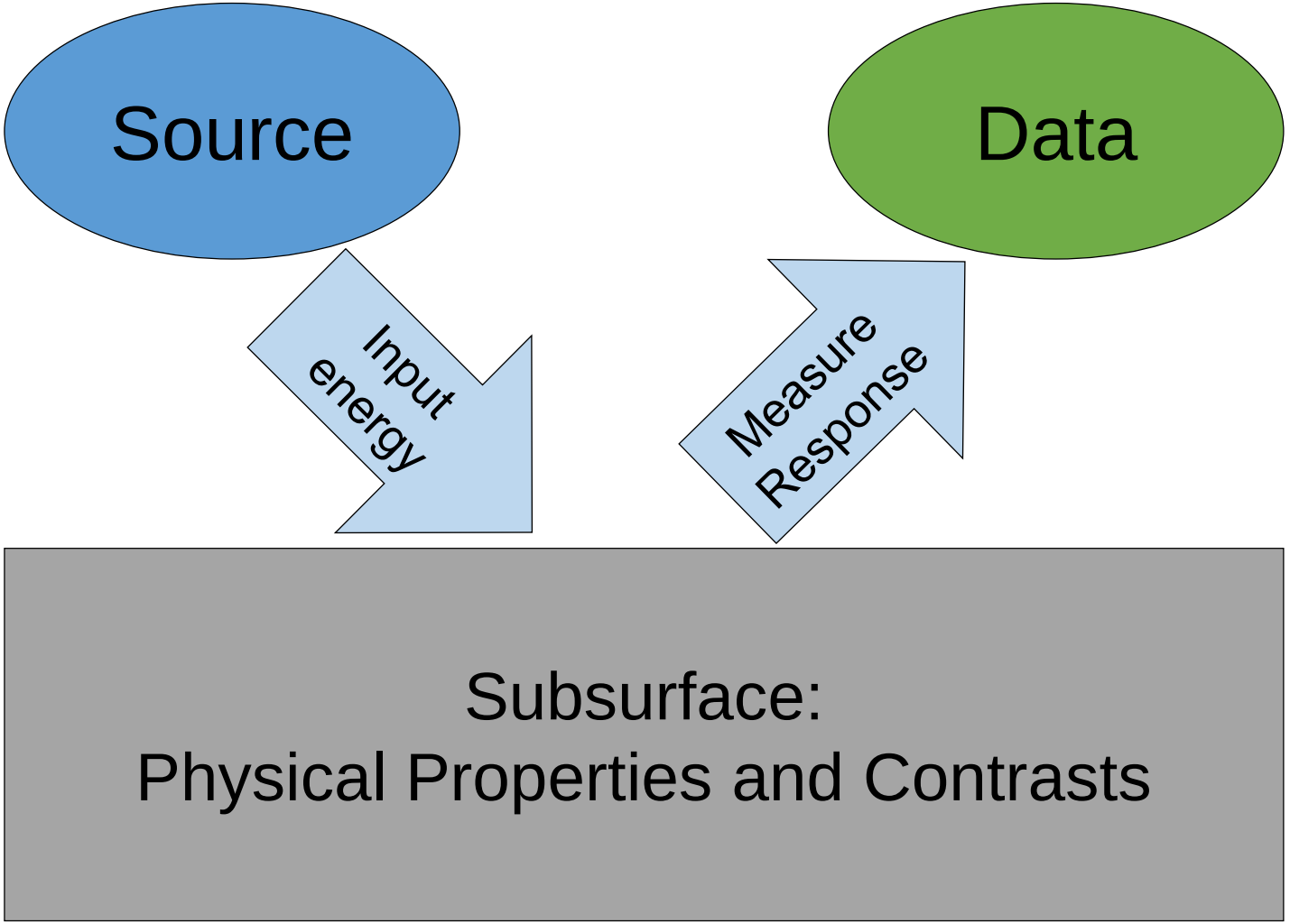
What is geophysics?

- Apply physical principles to solve problems in Earth sciences
- Measure physical signal/response from the Earth

  → Process and interpret data

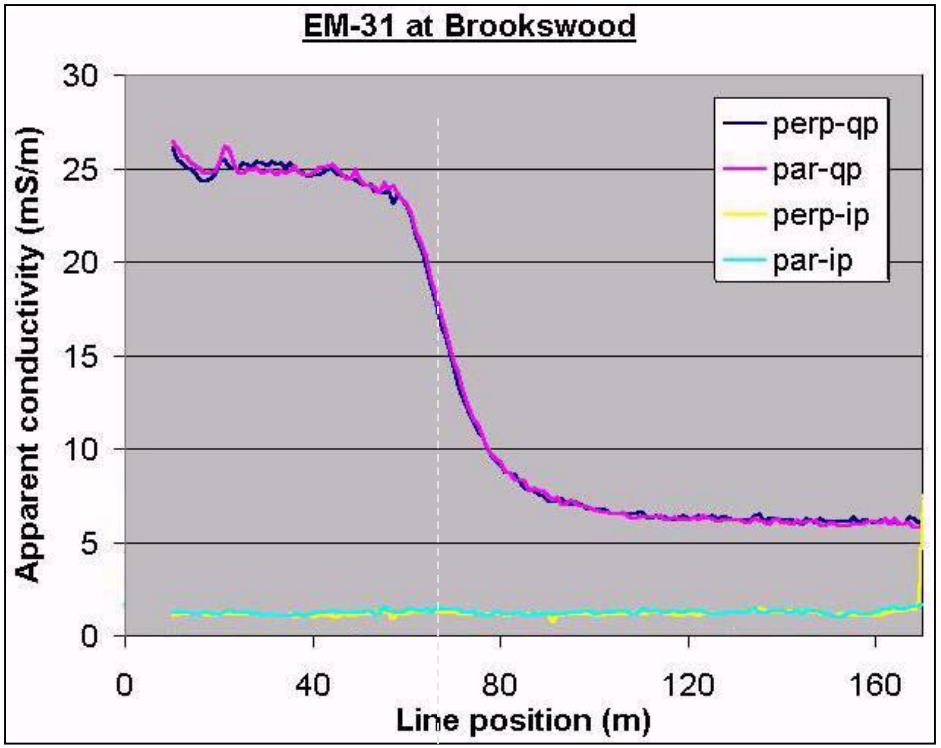
  → Infer something about subsurface
- Successful if there is a physical property contrast between the target and background

Geophysical Surveys



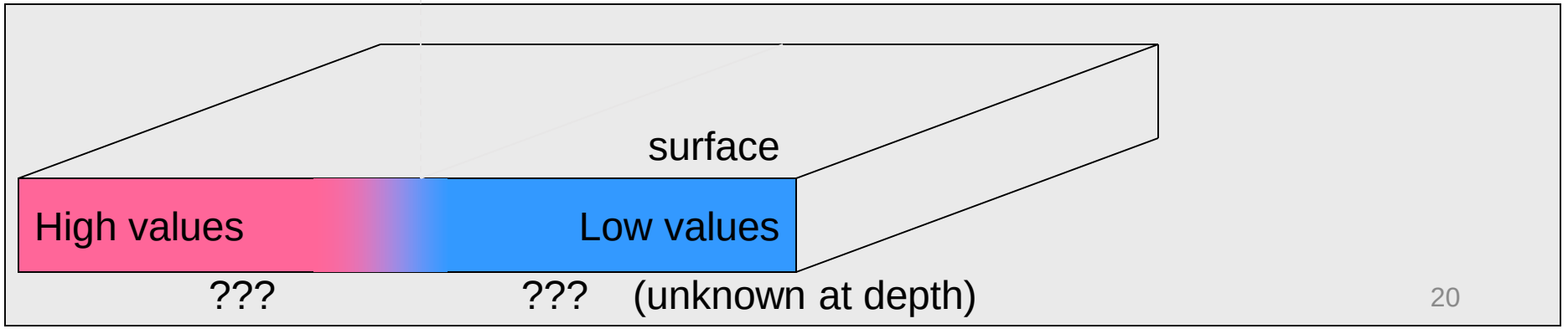
Geophysics Examples

Electromagnetics

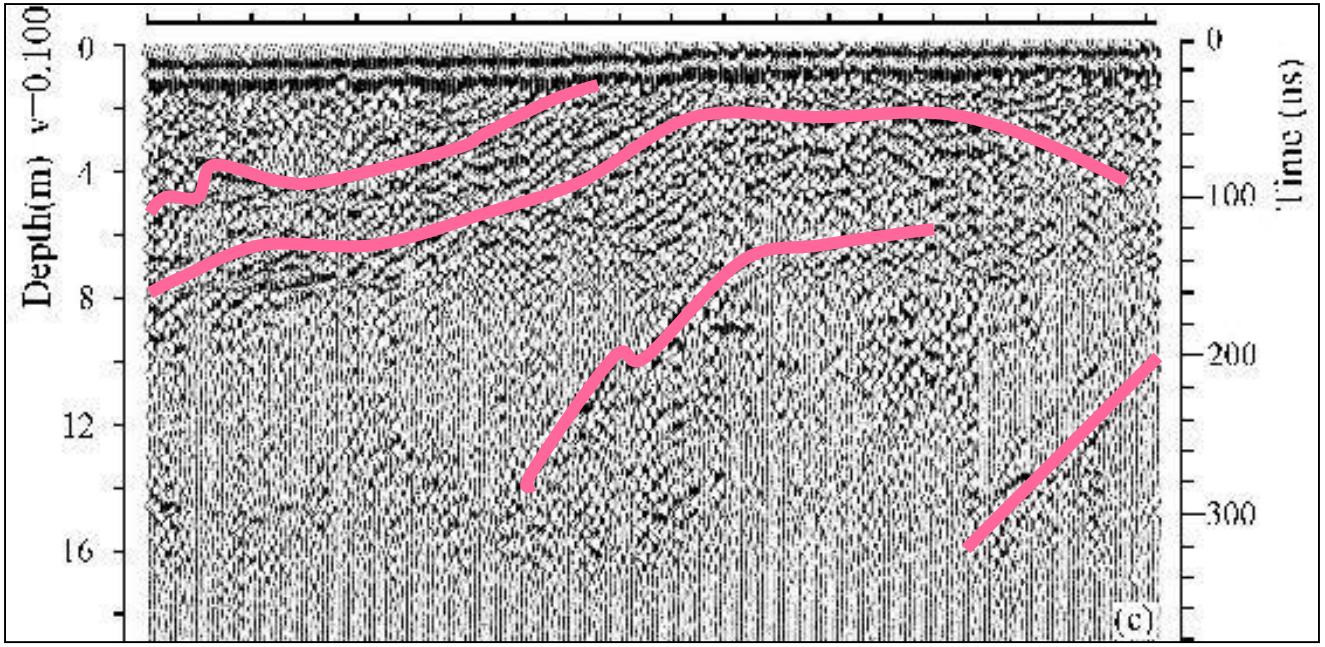


Profile of measured electrical conductivity over an aquifer

Outcome:
physical property values.



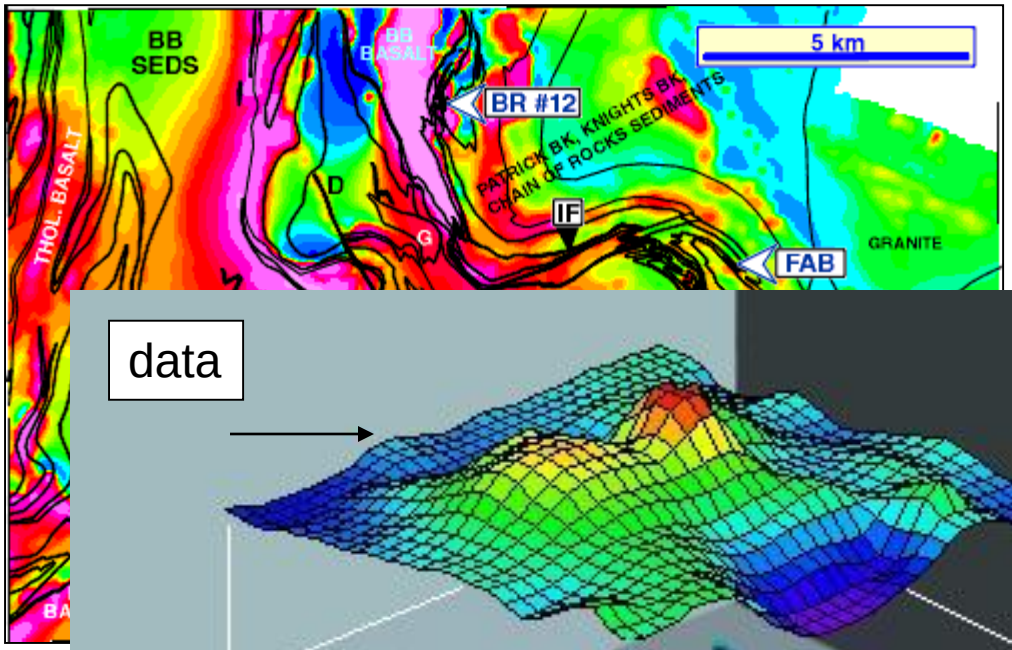
Geo-penetrating Radar (GPR)



Seismic data: Echoes of sound energy

Model: locations of interfaces.

Magnetics



Map: magnetic response, NB

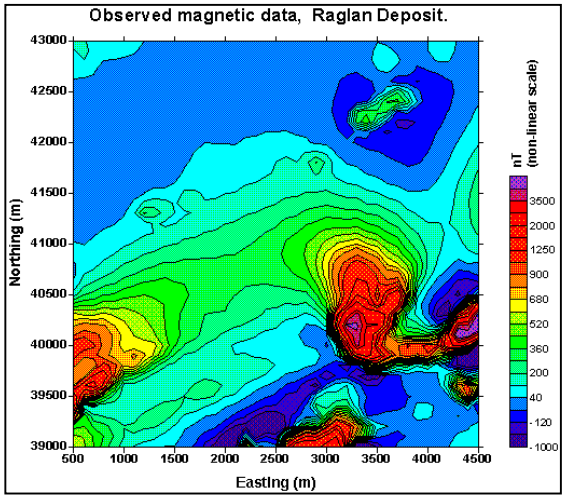
Possible outcomes:

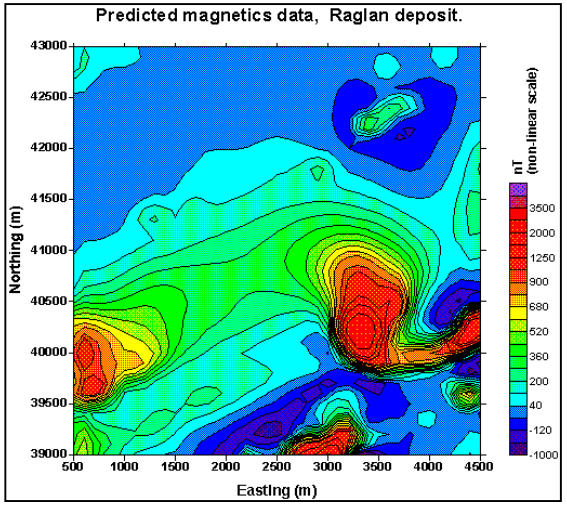
1) Structures on surface map.
2) Structures under surface.
3) Physical property distribution

Model of susceptibility:

Red=high values

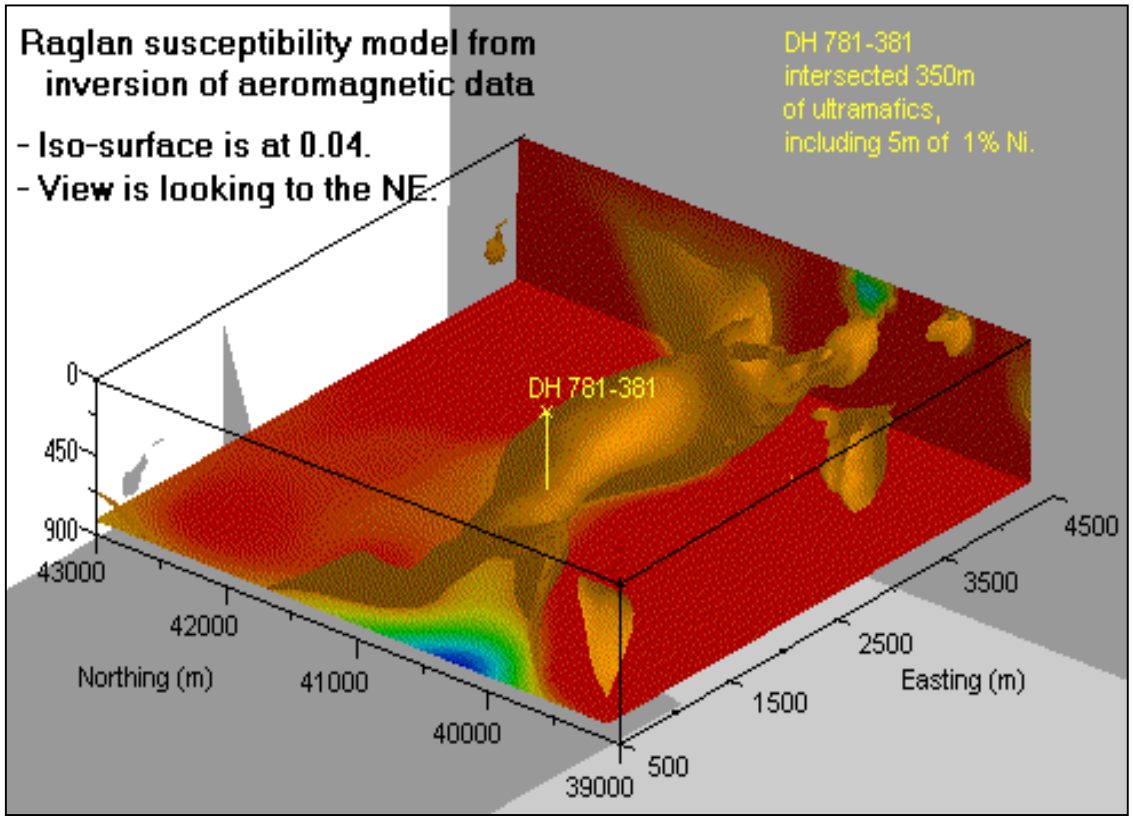
Exploration : Magnetics - Raglan deposit





Geological question:

"Are outcrops connected at depth?"



Course Topics

- Foundations:
  - Physical properties
  - A 7-step framework for applying geophysics
- Geophysical surveys (modules):
  - Magnetic (magnetic susceptibility)
  - Seismic (density, elastic parameters)
  - Ground penetrating radar (electrical permittivity)
  - DC resistivity (electrical conductivity/resistivity)
  - Electromagnetic (electrical conductivity/resistivity)
- Emphasis throughout:
  - Understand the basics of the surveys.
  - Have reasonable expectations for when and a survey should be used and information provided.

Your expectations for this course?

- New knowledge?
  - “Geophysics 101”
  - Some physics, a little math
  - Application-oriented
- New skills?
  - Using geophysical information to make decisions
- Attitudes?
  - Geophysics is not intellectually scary
  - It is fun!

Unit Activities

- **Labs: (Physical Properties)**
  - Monday, September 9th
  - Tuesday, September 10th
- **TBL:**
  - Wednesday, September 11th
- **Quiz:**
  - Wednesday, September 11th