

Geoscience Lesson #4: Geophysics

Topic: Geophysics

Total Time: 50 minutes

Location: Old drill hole/245 Wallace

Required materials:

- Water depth sensor (from 316 Wallace)
- 9 volt battery (for water depth sensor)
- Flat head screwdriver (to install battery)
- Drill bits
- a dozen pieces of core - more is better
- An earthquake trace - boxing day tsunami trace is on wall in 315 Wallace
- Several handsamples of distinct colour (I use the rocks from my desk)
 - Make sure that at least a few of these sample contain magnetite
 - grab the uranium ore sample (dk brown) from 316 Wallace
- As many Pencil magnet(s) and fridge magnet(s) as you can find
- Scintillometer from 316, with batteries and calibration puck

Class Setup:

- Move projectors out of the way
- Lay out random pieces of core on front two tables
- Put hand samples on lower of two lecture tables
- Hide scintillometer and calibration puck under desk or kids will want to play with it
- Put remaining items (especially drill bits) on front desk
- On the board:
 - 5 rules
 - Education requirements:
 - High School Graduation
 - Take Math, Physics, Chemistry
 - Go to University: U of Manitoba has a geophysics programs
 - Job name: Geophysicist
 - Draw a picture of a drill rig on the board which will be referred to when talking about drilling
- Make sure that the old drill hole behind Fitzgerald is accessible, and not blocked or frozen
 - This drill hole is in an old cage behind Fitzgerald that looks like a rabbit cage
 - The lid for this hole is rusted off, and can be lifted off of the whole
- Make sure that the 9V battery is installed in the water depth sensor, and test it by lowering it into any water (toilet works)

Outdoor portion of class (10-15 minutes):

- With the water depth sensor in hand, meet your first class outside or at U Centre
- Instead of heading towards Wallace, go to the old drill hole
- Open the cage and remove the lid
- Let the students look into the hole to see if they can see the surface of the water
- Take out the water depth sensor and turn it on
- Allow students to dip sensor into the hole to find out how deep the water table is
- When complete, get one student to take the end of the coil and walk until it's totally unwound
 - explain to class that this is 100 feet and that the hole is over 2000 feet deep
 - tell them it would take 20 of these coils to reach the bottom - they are always

- impressed
- note that this is the deepest hole in all of Winnipeg, and they dug it in the 60's to see what rocks were underneath the city
- Lastly, get the kids to guess how much that hole would cost to drill - by today's standards, it would be around 2 million
- Allow the students to drop the plumb down the hole as far as it goes (you will run out of tape)
- When you pull it back up, they will note that the water stinks - explain how the water is stale and full of rusty pipe
- When done packing up, return to Wallace

Before entering class (2 minutes):

- Quick lesson summary before class begins
- Let them into the lab, instructing them to sit in the front two rows

Lecture section (10 minutes):

- Review rules - emphasize that rolling the core around on the tables is distracting to you and the other students in the "respect others" section
- Review education requirements
 - Need math to be able to survive geophysics - if the students hate math, discourage them from taking geophysics but that they should rather take geology
 - Need physics to understand things like gravity, electricity, magnetism and radiation
 - Need chem to understand why some minerals have certain properties
- What is Geophysics:
 - Geophysics is the study of the Earth indirectly using physics
- What do Geophysicists do?
 - Study earthquakes (pass out seismic trace)
 - Look for new mines -- Thomson was discovered by geophysics
 - Travel a lot, as most jobs are contract jobs
- What is the connection to drilling?
 - When we were outside and looking at the drill hole, it should have been mentioned how expensive it was to drill
 - Explain that drilling is the most expensive way to collect information
 - Show the drill bits, and explain how core the core in front of the students is collected (use apple core analogy, it seems to work) -- pass small drill bits around
 - Explain that the drill bits are coated in industrial diamonds just like the saw used in lesson #3
 - Explain that we use geophysics to help us decide where to drill -- if you tell the drillers to drill for oil and it comes up dry, it's very bad for the company
 - Because of this extra responsibility, geophysicists make a lot of money

Activity #1: Magnetism (10 minutes):

- Have the students try to find samples that are magnetic or have magnetic grains
- Having more samples and magnets makes this more fun for the students, however obtaining 15 pencil magnets is almost impossible
- Explain that this is how Thomson was discovered, only using a larger magnet in an airplane

Activity #2: Radiometrics (15 minutes):

- Currently this is done with a single scintillometer by having the students test the hand samples at the front of the room, one sample at a time
 - The machine has an On-Off switch which is useful to turn on so that they don't have to squeeze the trigger
- You can demonstrate the expected response by using the calibration puck, so they know what to expect
- Make sure that the Uranium sample isn't in the first few samples, in order to build suspense (the kids are usually very focused during this exercise)
- If there are more kids than samples, have the kids try to find the radioactive samples throughout the room
 - There are two samples containing UO_2 in the cabinets
 - There is one sample that registers decently which is located on the top row on the shelf, towards the centre
 - There is Uraninite in Case #8 in the hallway

Teardown after class (3 minutes):

- Have students redistribute the core for the next class
- Make sure that all hand samples are accounted for
- Hide Scintillometer again
- Once they are out of the room, ask if any of them remember one of the high school subject they needed

Teardown (end of day):

- Remove battery from water depth sensor
- Remove batteries from scintillometer, and return to case (with puck)
- Return all items to cart/rooms of origin