

EPSC 240: GEOLOGY IN THE FIELD

# ORIENTATION AND SCALE



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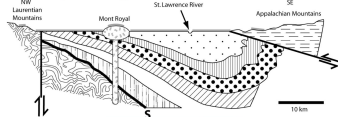
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McGill University  
Earth and Planetary Sciences/Earth System Sciences  
First year field trip

September 21, 2018 (Friday) All day (8:30 to 5:00)

See some of the local Geology. Get a free lunch  
Contact [william.minarik@mcgill.ca](mailto:william.minarik@mcgill.ca) if you're interested in going!

The remnants of Volcanoes, Glaciers,  
Ancient Life (fossil hunting) and Ocean-bottom slime.



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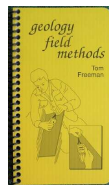
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## CLASS LOGISTICS

- TA office hours
- All-day trip dates
- Textbook (\$20)
- Introduce term project –  
Geology of Québec
- Field notebooks DUE  
(first outcrop description)



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## TA OFFICE HOURS

### FRIDAYS, 10-11 AM

- Fiona FDA 130A Sept 7-Sept 28
- Lauren FDA 131B Oct 5-Oct 12; Oct 26-Nov 2
- Shane FDA 130A Nov 2-Nov 23

ON THE COURSE WEBSITE: <http://eps.mcgill.ca/~courses/c240/>

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## ALL-DAY TRIPS

### WEEKS 7 & 8 OPTIONS

- All day Wednesday, Friday or Saturday
  - Anyone have classes Wed or Fri?
- Week 7: October 17, 19, 20
- Week 8: October 24, 26, 27

### VOTE

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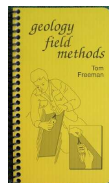
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## TEXTBOOK

- \$20 CAD / \$15 USD



WEEKLY READINGS ON THE COURSE WEBSITE

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# TERM PROJECT

## GEOLOGY OF QUEBEC

Presentation (5%)      Due Wed Nov 28, in lab; email file  
Report (15%)          Due Tue Dec 4; email file

- Individual projects
- Includes peer review (2%)
- French / English

ASSIGNMENT HANDOUTS ON THE COURSE WEBSITE

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# LIST OF TOPICS

1. Modern Saint Lawrence Estuary (present-day depositional environment)
2. Hudson Bay Lowlands (glacial-modern)
3. Glacial geology of Quebec, e.g., Champlain Sea (Neogene)
4. Monteregian Hills (Cretaceous)
5. Saint Lawrence lowlands (Paleozoic)
6. Appalachian foreland - Ophiolites (Paleozoic)
7. Appalachian foreland - Dunnage and Humber Zones (Paleozoic)
8. Grenville Orogen (Proterozoic)
9. Labrador Trough (Archean-Proterozoic)
10. Abitibi region gold (Archean)
11. Superior Province (Archean)

<https://mern.gouv.qc.ca/english/mines/geology/geology-overview.jsp>

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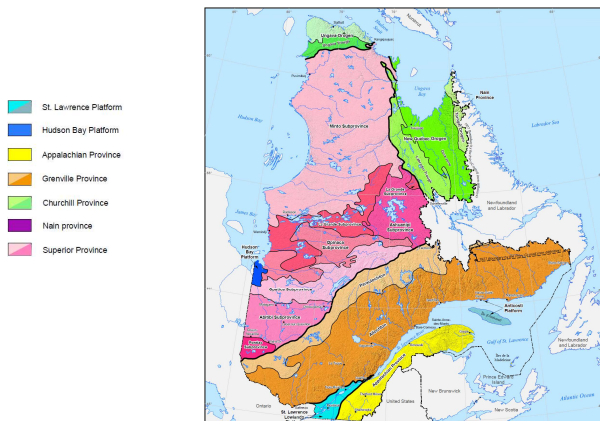
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# GEOLOGICAL DOMAINS, QC



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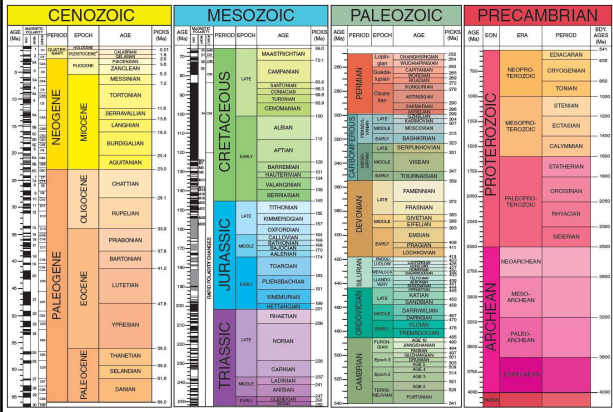
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# GEOLOGIC TIMESCALE



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## OUTCROP DESCRIPTIONS ON MOUNT ROYAL

1. Overview/location/context
2. Sketch including locations, relative position/size of different rock types. Description of contacts between rock types. Colour! Can help your sketch a lot if you are struggling.
3. Detailed notes on each rock type (colour, grain size/shape, weathered color, appearance of surface, lustre, roughness, description of layering/bedding including scale, variability of rock)
4. Additional details as you found them

**HAND IN AT END OF CLASS TODAY**

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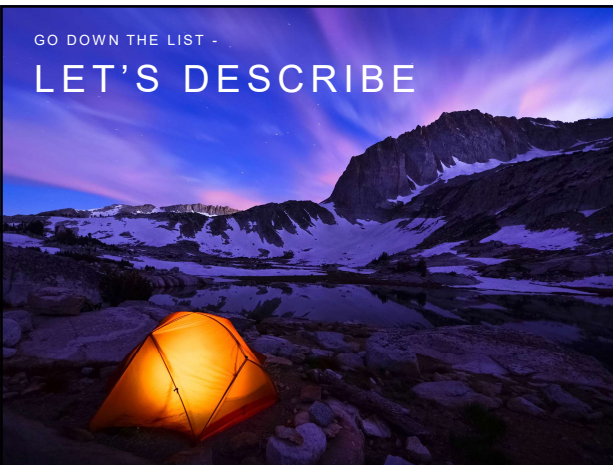
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GO DOWN THE LIST -  
**LET'S DESCRIBE**



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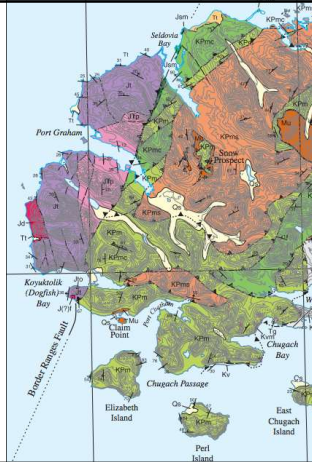
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## GEOLOGIC MAPS

- Display geologic information in a reference frame
- Incorporate 3D information: 2D in "map view" by x-y position on page, and the 3rd dimension (vertical) using symbols
- To compare data from different areas, we need global reference frame



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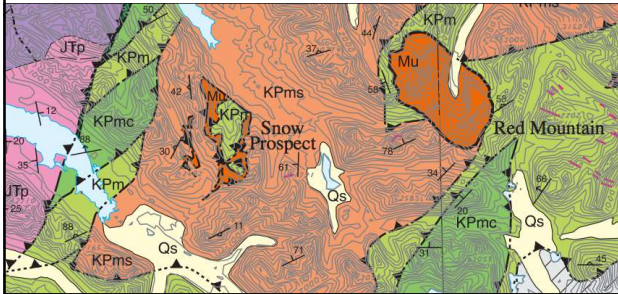
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"A map does not just chart, it unlocks and formulates meaning; it forms bridges between here and there, between disparate ideas that we did not know were previously connected"

-REIF LARSEN



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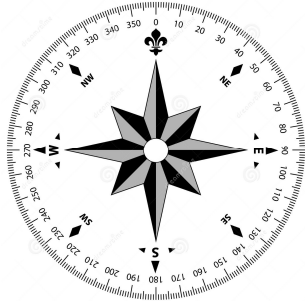
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## AZIMUTH

- Direction from north as measured in degrees (0-359°) counted in the clockwise (easterly) direction
- "Bearing" also used, technically bearing could be measured from any direction, e.g., bearing of "20° west of south" = azimuth of 200°



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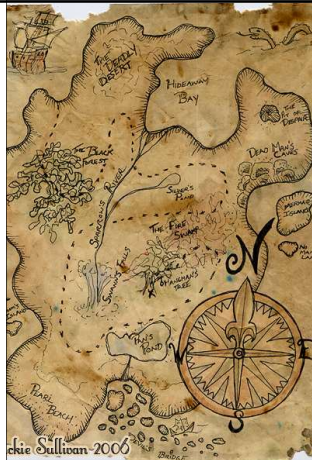
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## USES OF AZIMUTH AND BEARING

- Identifying the direction between two locations
- Describing the orientation of geological features where you measure them
- Finding pirate treasure



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## ORIENTATION AND SCALE



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GEOLOGICAL COMPASS

# BRUNTON

MAGNETIC NEEDLE

LIFT PIN

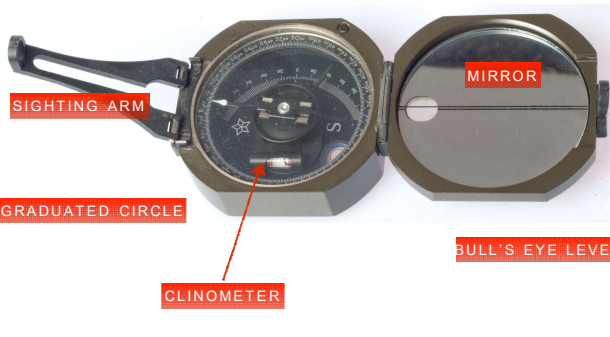
MIRROR

SIGHTING ARM

GRADUATED CIRCLE

CLINOMETER

BULL'S EYE LEVEL



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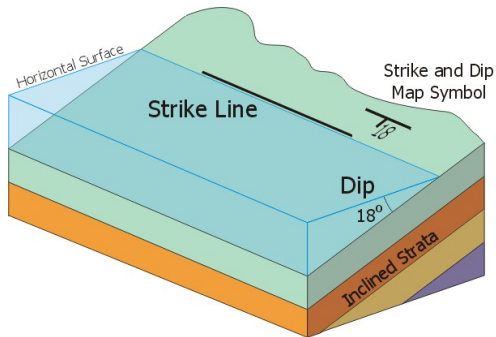
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ORIENTATION OF PLANES

# STRIKE AND DIP



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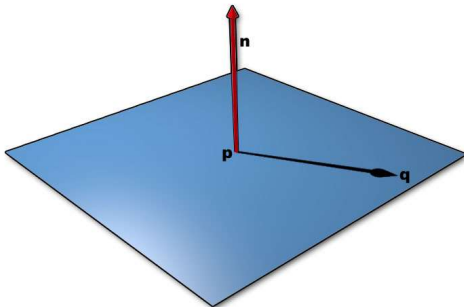
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ORIENTATION OF A PLANE

# DEFINED BY LINES IN PLANE AND LINES PERPENDICULAR TO PLANE



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# STRIKE OF A PLANE

- Strike line: Horizontal line within a plane of interest
- Strike is reported in AZIMUTH or BEARING - we will use AZIMUTH (0-359°).
- Strike line has 2 ends - can report either azimuth (e.g. 090° is the same line as 270°)
- Use 3 digits to report strike (e.g. 005° or 120° or 020°)

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## DIP OF A PLANE

- Dip vector: perpendicular to strike line, lies in same plane
- The dip vector is the steepest line in the plane (greatest angle from horizontal).
- Dip is measured in vertical plane which is perpendicular to strike line and to the plane being measured.
- Dip is reported as degrees from horizontal ( $00^\circ - 90^\circ$ ) with 2 digits
- Must always report direction of dip (e.g., N, SE, etc)

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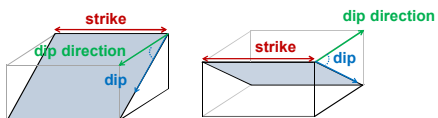
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## DIP DIRECTION

These two surfaces have identical strike azimuths and dip values, but **dip in different directions**



Important to **define dip direction** when describing the orientation of planar structures

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To practice, visit Visible Geology

[app.visiblegeology.com](http://app.visiblegeology.com)

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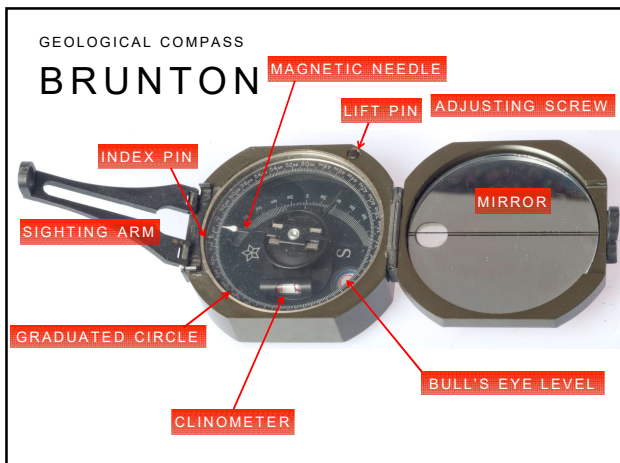
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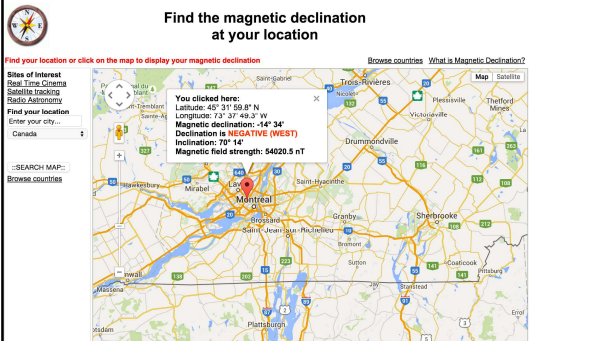
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Or, use the map interface

<http://www.magnetic-declination.com/>



Find your location or click on the map to display your magnetic declination

Find your location  
Enter your city...  
Canada

SEARCH MAP:  
Browse countries

Find your location or click on the map to display your magnetic declination

Latitude: 45° 31' 59.8" N  
Longitude: 73° 37' 48.3" W  
Magnetic declination: -14° 34'  
Declination is NEGATIVE (WEST)  
Inclination: 70° 14'  
Magnetic field strength: 54028.5 nT

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## METALS AND ELECTRONICS CAN INTERFERE

- Always keep compass away from strong magnets (e.g. camelback magnets)
- Don't use near iron
  - rebar, pipes in ground
  - engine blocks, buildings
  - small but close: belt buckles, knife in pocket
- Beware of strong electrical fields



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## ARTIFICIAL OUTCROPS

- Advantage: Planar surface to learn to measure
- Advantage: Obvious what to measure
- Advantage: Wide range of orientations to practice
- Disadvantage: Not a rock. Real practice will come later once you master the compass technique.



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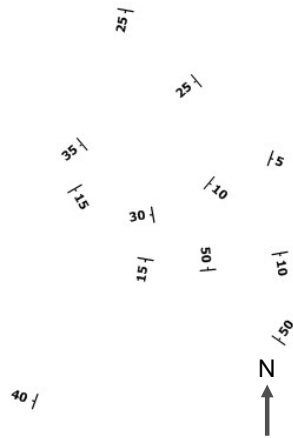
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## STRIKE AND DIP ON A MAP

- Long line in the direction of strike (relative to true north as shown by north arrow on map)
- Short perpendicular line on the side of strike line, indicating the direction of dip
- Small numbers next to dip line indicate dip angle




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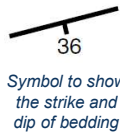
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## STRIKE AND DIP ON A MAP

- Different map symbols for vertical or horizontal planes



### Examples

Written: 042 / 32° SE    081 / 90 (vertical)    horizontal

Symbol:      

(no dip number needed!)

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