Name: _____ Laboratory Section: _____

Date: _____ Score/Grade: _____

Video
Exercise 25
Pre-Lab Video
http://goo.gl/46Pujm
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LAB EXERCISE

25 Topographic Analysis: Glacial Geomorphology

Lab Exercise and Activities

SECTION 1

Glaciated Landscapes

Analyze Figure 25.3. The NAIP photos were taken in 2014.

Virtual Tour
Mt. Darwin
https://goo.gl/nvFWWd

1. A cirque basin may serve as an accumulation zone for alpine glaciers. Using contour lines on the mountains and on the glaciers, how many ice-filled cirques (scooped out amphitheater-like basins) do you identify on the map? ***15*** What is the elevation of the highest glacial ice surface on the map?

   13,000′

2. What type of glacial feature is the unnamed peak, with an elevation of 13,253 ft, north of Mount Darwin?

   Horn

3. What is the relief (elevation difference) in feet between Mount Goethe and Goethe Lake?

   1733′

4. **a)** What is the linear distance in feet between Mount Goethe and the south shoreline of Goethe Lake?

   6178′

   b) Take the relief in feet that you determined in Question 3 and divide it by the distance between the two locations in miles (divide the distance you found in 4 a) by 5280 to find the distance in miles). In terms of slope, state this distance in feet per mile: (Show your work.)

   1481′ per mile

   c) Take the relief in feet that you determined in Question 3 and divide it by the distance between the two locations in feet from 4 a) to determine the percent grade (relief divided by distance). What percent grade did you determine? (Show your work.)

   28%

5. Locate Sky High Lake in Section 34 on the topo map. What type of feature is Sky High Lake? Use a blue pencil or pen to circle two similar features on Figure 25.3.

Sky High Lake is a tarn, which is a lake in a glacial cirque.

6. What is the term for the string of lakes in Darwin Canyon?

Paternoster lakes

7. South of Goethe Lake find Mount Goethe on Figure 25.3 (topographic map) and **Figure 25.4** (NAIP photo).

a) How many glaciers and moraine fields are there north of the red line that indicates the Wilderness Boundary that runs from the west edge of the map to Mt. Goethe and Muriel Peak? Count features along the length of the boundary across the bottom of Sections 31 (not labeled), 32, and 33. How many are there to the immediate south of that same Wilderness Boundary line?

4, 0

b) Compare and contrast the number of glaciers and moraine fields that lie on either side of the National Forest and Wilderness Boundary (also labeled National Park Boundary) that runs roughly north and south from Mt. Darwin to the top of the map. East-facing slopes receive sunlight in the morning when the air is cooler, and west-facing slopes receive sunlight in the afternoon when the air is warmer. Would you expect to find more on the west-facing or east-facing slopes? How many did you find on each side?

The cooler eastern-facing slopes should have more glaciers and moraine fields. There are more on the east.

c) Describe the orientation of the slopes with snow on them on the topographic map and the NAIP photo. Is there more snow on north- facing slopes or on south-facing slopes? Which slope receives more direct sunlight? How would this affect the amount of glaciation that would occur on each slope? On which slope would you expect to find more glaciers in the Southern Hemisphere, north-facing or south-facing slopes? Briefly describe the relationship between slope orientation, snow accumulation, glacier formation, and glacial abrasion.

The north-facing slopes have more glaciers and moraine fields. North facing slopes would be more shaded, leading to deeper snowpack, larger glaciers, and more rapid glacial erosion.

8. a) What term would you use to describe the ridge west of Mount Goethe?

The ridge is an arete.

b) What is the term for the feature found on the ridge between Mount Goethe and Muriel Peak?

The pass on the ridge is a col.

9. Optional Google Earth™ activity, Mount Darwin, California. For the KMZ file and questions go to mygeoscienceplace.com. Then click on the cover of *Applied Physical Geography: Geosystems in the Laboratory*. Or visit the Mastering Geography Study Area.

SECTION 2

Alpine Glacier and Mount Rainier Quadrangle

Activities and completion items related to alpine glacier geomorphology:

Virtual Tour
Mt. Rainier
https://goo.gl/6ezfCQ

1. Figure 25.4 shows a contour map of a hypothetical landscape that has been shaped by alpine glaciation. As glaciers carved their way down preexisting V-shaped stream valleys, they widened the valleys into U-shaped valleys separated by sharp ridges. Hanging valleys/troughs left stranded above the main valley floor will be occupied by streams that form picturesque waterfalls as they plunge over the steep edge.

Glaciers may scour out the bedrock of the valley floor, leaving depressions that, as the glacier retreats and a stream reoccupies the valley, subsequently fill with water, forming glacial lakes called tarns. Steep-walled cirques mark the origin of the glaciers high on the mountain slope. Keep this contours map, along with the Mount Darwin topo map and aerial imagery, in mind when analyzing the topographic map of Mount Rainier.

After reviewing Figures 25.1 and 25.2, answer the following questions about Figure 25.5:

If you wanted to go swimming in a tarn, which letters would you look for?

D

If you were a rock climber and wanted to scale the steep sides of the valley, which letters would you look for?

B

Which letters indicate the location of a pass on the ridge between two valleys?

F

If you wanted to climb the horn created by three glaciers, which letter would you look for?

E

What is the elevation of the peak?

10,400′

Find and label the following features on Figure 25.5: a hanging valley; the U-shaped valley formed by the main glacier; a cirque; a horn; an arête (the narrow ridge that separates two valleys); a col (a pass on an arête); and a chain of paternoster lakes (if they were filled with water).

2. Refer to the Figure 25.6 Mount Rainier topographic quadrangle. What is the scale of this map as a representative fraction (1:???)? as a written scale (one inch equals ??? miles)?

1:60,000 ***one inch equals 0.94 miles***

What is the contour interval of the topo map?

80′

3. Name several glaciers on which you identify medial and lateral moraines. Use a brown colored pencil or dark pen and color down the middles of at least three medial moraines.

Nisqually Glacier, Cowlitz Glacier, Ingraham Glacier, among others.

4. What type of feature is Sunset Amphitheater?

   It is a cirque.

5. What type of feature is labeled Nisqually Cleaver? List several other features that are the same type, including at least two that are not named Cleaver.

   It is an arete.

6. The summit of Mount Rainier is at 14,410 ft (4392 m). What is the lowest elevation shown on this map?

   2951′

   Where is this location? Give its name.

   Benchmark southwest of Cougar Rock

   Therefore, the relief on this map segment is

   11,459′

   What is the linear distance between these high and low points?

   7.06 miles

   In terms of slope, state this distance and relief in *feet per mile*:

   1623′/mile

   State this in terms of *percent grade* along an ideal slope between these two points (relief in feet ÷ distance in feet): %.

   30.7%

   Show your work:

SECTION 3

Continental Glaciation and the Jackson, Michigan, Topographic Quadrangle

Activities and completion items related to continental glaciation:

1. Figure 25.8 is a hypothetical landscape that has been shaped by continental glaciers. Note the unsorted and unstratified deposits of gravel, sand, and clay that form moraines, including terminal moraines (A) and interlobate moraines (B).

Virtual Tour
Jackson, MI
https://goo.gl/mdpYSQ

   After reviewing Figures 25.7 and 25.8, answer the following questions about Figure 25.8:

   If you were looking for drumlins, which letters would you look for?

   D

   Which letter shows kames?

   G

If you wanted to walk along the crest of an esker, which letter would you look for?

E

If you were looking for kettles, which letters would you look for?

I, hatchure marks indicating a depression

Which letter is located on the ground moraine?

C

Which letter is located on the outwash plain?

H

2. Refer to Figure 25.9, the Jackson, Michigan, topographic quadrangle. What is the scale of this map?

1:28,000

Convert this to a verbal scale. Show your work.

One inch equals 0.4 miles

What is the contour interval?

10′

3. A sinuously curving, narrow ridge of coarse sand and gravel is called an esker. Eskers form along the channel of a meltwater stream that flows beneath a glacier, in an ice tunnel, or between ice walls beneath the glacier. As a glacier retreats, the steep-sided esker is left behind in a pattern roughly parallel to the path of the glacier.

Locate and identify by name a prominent esker on the map:

Blue Ridge

What is the average elevation of this esker?

Over 1000′

How long is this esker, in miles? (Use a string placed along the esker, then pull it straight and compare it to the scale.)

5.5 miles

4. Identify the drainage pattern for the portion of the topo map that is generally covered by the Kalamazoo moraine (southwest part of map). Explain what evidence you used to determine this.

Deranged! There isn't an overall pattern of high ground to low ground.

5. Use a dark blue colored pencil or pen to trace the drainage of the Grand River. Add arrows to indicate the direction it is flowing.

Student activity

6. Is this area well drained or poorly drained and swampy? Explain your answer.

Poorly drained, as shown by the many swamps.

7. Sometimes an isolated block of ice, perhaps more than a kilometer across, persists in a *ground moraine*, an outwash plain, or valley floor after a glacier retreats. Perhaps 20 to 30 years are required for it to melt. In the interim, material continues to accumulate around the melting ice block. When the block finally melts, it leaves behind a steep-sided hole. Such a feature then frequently fills with water. This is

called a kettle. Locate several named kettles that are ponds or lakes on this map and identify their general location:

Peter White Lake, Green Lake, Hammer Lake in the NW section.

8. What type of feature is Hatt Hill? Briefly describe how it was formed. Use a red colored pencil or pen and circle several other of these features on the map.

It is a kame, a pile of glacial debris that accumulated in a depression on top of the glacier that was deposited as the glacier melted.

9. If you were walking from Hammer Lake to Blue Ridge, would you be walking over a till plain or an outwash plain? Explain.

Till plain, as shown by the presence of the esker. Eskers are formed beneath a glacier.

10. What is the highest elevation on the map segment? Location and name:

1150′ Hatt Hill

What is the lowest elevation on the map segment? Location and name:

950′ along the Grand River in the NE corner.