



1-4. Hypothesize what type of climate change would have to occur for extensive alpine glaciers to form in the central Oregon Cascades. Let's say for example that what would it take for 500 feet of glacial ice to completely cover Santiam Pass and extend down the Santiam River valley half way to Salem. Discuss your answer in terms of average annual temperature, average annual precipitation, type of precipitation, and total incoming amount of solar radiation

A) Think about the type of vegetation that presently covers the western slopes of the Cascades. How would your hypothesized climate above impact the type and amount of vegetation? What effect would your climate change have on the ecosystem?

## Part 2 - Lab Manual Exercises.

The primary objective of this lab is to compare glacial features represented on topographic maps and air photo features to those represented on block diagrams and charts (Figures 13.1-13.7 in lab manual). Examine these figures and charts before answering the lab manual questions.

Complete the following lab manual exercises. Hints and tips are provided where necessary.

Question 1 p. 254 (hint: think about how liquid river water would move a cobble versus that of solid, flowing ice).

Additional questions: Visit station 8-3. The deposit in A was melted out of ice left in the freezer for a week. Describe the sorting and texture of this “melt-out” glacial deposit.

Visit station 8-3B (samples 8B1 and 8B2), examine the two cobbles on the table and compare to the diagram on Fig. 13.8 of your lab manual. Which cobble was likely transported by river water and which by ice. Describe your observations and reasons for your hypotheses.

### Questions 2-7 is on page 256

- 2- hint: these are alpine erosional features match them to diagram on fig 13.1, 13.2, and 13.3
- 3 - ditto hint as Q2
- 4- ditto, plus fig. 13.5
- 5- ditto as above
  
- 6 - NOTE: circle and label all the glacial features that you can identify on the Siffleur River map. Compare the map patterns to the block diagram on Fig. 13.2.
  
- 7 - Draw a map diagram to show how this type of moraine forms.

### Question 8-13 is on page 258

- 8 - Compare to fig. 13.1
  
- 9 – Think about glaciers converging down gradient and how ice shapes the land
  
- 10- compare to fig. 13.7 and fig 13.4
  
- 11- hint: these are streamline shaped hills; compare to fig. 13.7
- 12- look up drumlin in your text book and how it forms
- 13- hint: would subglacial sediment have a chance to become well sorted during transport? Compare to fig. 13.7 and fig 13.4. Think about subglacial rivers flowing through ice tunnels.

### Question 14-22 is on page 262

Look at airphotos (figure 13.13) on p. 258 before answering questions 14-19. Using your textbook and examine the map on p. 516 Figure 18.36. Look at the map showing the extent of Northern Hemisphere ice during the last glaciation 20,000 yrs ago. Was Wisconsin covered by ice 20,000 yrs ago? Use this information to formulate your answers to the next six questions.

Q. 14, NOTE: circle and label all the glacial features that you can identify on the map.

Q. 15, Use the stereoscopes and view the air photos on fig. 13.13

Q. 16 hint: look at the shape of drumlins north of the river / creek

Q. 17

Q. 18 hint: look up moraine types on fig 13.7

Q. 19

Q21 - Q22. inclusive. Draw profile on cross-section graphs provided.

Q23-26 p.265 inclusive

**Question 27-34 is on page 267**

Q 27 hint: examine the glacier area data on the bottom of the map

Q 28 Note: the rate of retreat would be the change in area divided by time of change

Q 29 Use the rate of Q 28 to determine how long it will take the rest of the ice to melt:  $\text{time} = \text{area} / \text{rate}$

Q. 30-34, Note: record all of your calculations and graphs on p. 269

**Part 3 - In- Lab Materials**

Examine the Three Sisters, OR topographic map in the lab and answer the following questions.

3-1. Do you see active glaciers on this quadrangle? If yes, where? (list locations by Township and Range).

3-2. List the elevation range of the following features:

Prouty Glacier \_\_\_\_\_

Carver Glacier \_\_\_\_\_

Lost Glacier \_\_\_\_\_

Diller Glacier \_\_\_\_\_

Collier Glacier \_\_\_\_\_

3-3. Is there a relationship between glacier occurrence and elevation? What is the minimum elevation that you observe active glaciers?

3-4. What is the meteorological explanation for your observations in 3-3 above? Why does that relationship exist?

3-5. Why are there no glaciers on Mt. Washington? Do you see evidence for past glaciation? If so list.

*Examine the two air photo stations in the lab, and answer the following questions.*

**Photo Station 8-1 (Crystal Set 1 Photos 6L/6R).**

- 3-6. If north is to the top of the photo, which direction is this glacier flowing?
- 3-7. What are the names of the linear cracks present near the snout of the glacier? Are the transverse or longitudinal with respect to glacial flow?
- 3-8. Note the small glacier in the lower left of the photo. What is the name of the bowl-shaped depression that it is occupying? How does it form?
- 3-9. Note the waterfall emanating from the small glacier (in 3-8 above). What is the name of this type of tributary glacial valley?
- 3-10. Does your observation in 3-9 suggest that the main valley ice was much thicker in the past? Cite your reasoning.
- 3-11. Note the fan-shaped deposit of sediment along the main glacier front. Where is this sediment coming from? What is this fan being deposited into? What is the name of this type of deposit (remember back to river systems)?

**Photo Station 8-2 (Crystal Set 1 Photos 8L/8R).**

This photo set is from northern New England. The area was extensively glaciated by the Laurentide Ice Sheet, ~20,000 years ago.

- 3-12. Note the "hummocky" topography in the norther 1/2 of the photo. Given the glacial history of the area, what are these deposits composed of? What is the name of this type of glacial deposit? Comment on the likely nature of sorting in these types of deposits.

3-13. Note the numerous lakes inset into the glacial deposits. What are the names of these types of glacial lakes? How do they form?

3-14. Does it look like this land is being used for agricultural crop production? Explain why you think this is so.

### **Glacial Model 1**

3-15. Using the block diagrams of glacial landforms in your lab manual, was this portion of upstate NY subject to valley glaciation, continental glaciation or NO glaciation?

3-16. Depending on your answer in 3-15, identify the landforms represented by the small hills in the vicinity of point D. How are these landforms created (hint: use your lab manual). Are they erosional or depositional landforms?

### **Glacial Model 2**

3-17. Using the block diagrams in your lab manual, identify the landform located at point A. How did it form? Is it erosional or depositional?

3-18. Using your lab manual, explain the nature of the drainage pattern located in the vicinity of point B. Why is this type of drainage indicative of glacial landscapes?

3-19. Identify the group of hilly landforms in the vicinity of point C. Are they erosional or depositional? How do they form? Based on their topographic configuration, determine the paleo-ice flow direction in this landscape (i.e. which direction was the continental glacier moving over the landscape).