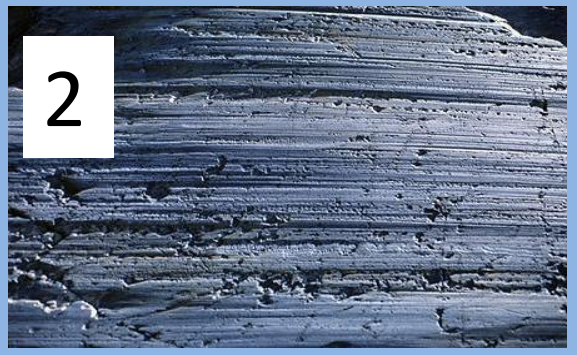
Match up the pictures and key terms

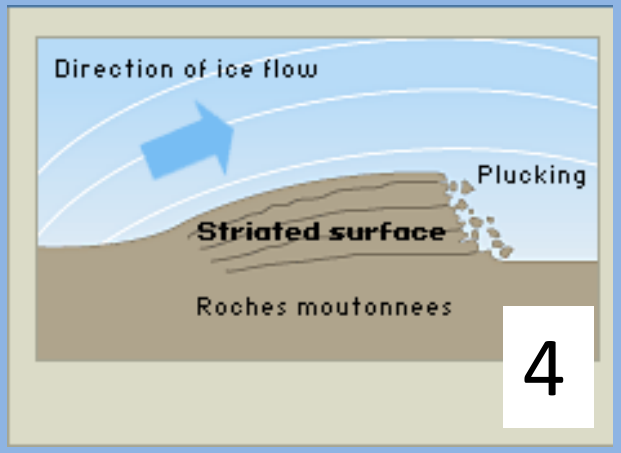
Plucking

Roche Mountonnees

Chatter Marks

Striations





What is the difference between plucking and abrasion?

Glacial Processes

Erosion, Weathering and Deposition

Today's Lesson

By the end of the lesson we will:

- Be able to differentiate and identify the main processes occurring in glacial and periglacial areas.
- Begin to identify features of cold environments.
- Skill – Creative thinking and team work.

Weathering in Cold Environments

Mechanical Weathering – when there is no change in state ; just disintegrates, usually as a result of sudden temperature change.

Freeze-Thaw Weathering

1. Fractures in the rock occur due to pressure release - deglaciation.
2. The removal of the glacier leads to a massive decrease in the weight/pressure pushing down on the underlying rock.
3. When the pressure is reduced the rock can expand forming cracks in lines of weakness in the upper parts of the rock.
4. Freeze-thaw will cause the expansion and contraction of joints – dilation – which leads to fracturing. Once moisture seems into the cracks and freezes, it expands 9%, therefore weakening the rock further.
5. These fractured rocks are then more likely to be attacked by the glacier in future glacial advance.

Freeze-thaw weathering

What factors might effect the rate of freeze-thaw weathering?

- Number of freeze-thaw cycles when temperatures fluctuate above or below freezing.
- The availability of moisture.
- The density of joining in rocks exposed to or near the surface.

In sub-arctic areas freeze-thaw weathering is less effective as temperatures remain below freezing for 6-7 months and precipitation is light.

Freeze-thaw is most effective in periglacial environments.

What is Congelifraction?

It refers to the splitting of rocks by freeze-thaw action.

When the rocks are fractured by the freezing and thawing of rocks through meltwater in glacial and periglacial environments.

Chemical Weathering – change in state just decomposes.

Chemical weathering below glaciers is important. Carbon Dioxide is more soluble at low temperatures= meltwater streams have the capacity to hold carbon dioxide.

This increases the acidity of the meltwater and increases the carbonation.

Carbonation= a form of weathering where calcium carbonate reacts with an acid water to form calcium bicarbonate which is soluble and removed in solution.

Hydrolysis is also important because of the large presence of organic acids in the marshy soils once the glacier has retreated.

Hydrolysis = Chemical weathering where water reacts with minerals to produce clay minerals.

Biological – weathering by plants and animals.

Cold environments can also be weathered through plants and animals when in search of food, water or shelter.

Complete the missing words to complete your notes on weathering in cold environments.

Definitions?

Ice-lensing

The growth of ice crystals in the soil.

Nivation

Freeze-thaw weathering under a snow bank – the broken and weathered rocks are removed in the spring and summer by melted snow.

Mass Movement in Cold Environments

Frost Heave

Water freezes in the soil and pushes the surface upwards and churns it.

Solifluction

Flowing soil, an accelerated form of soil creep. In winter the water freezes in the soil, expands and separates individual soil particles. In spring the ice melts and water flows downhill. It cannot infiltrate through because the ground in frozen (permafrost). The separated soil particles are carried and deposited downslope.

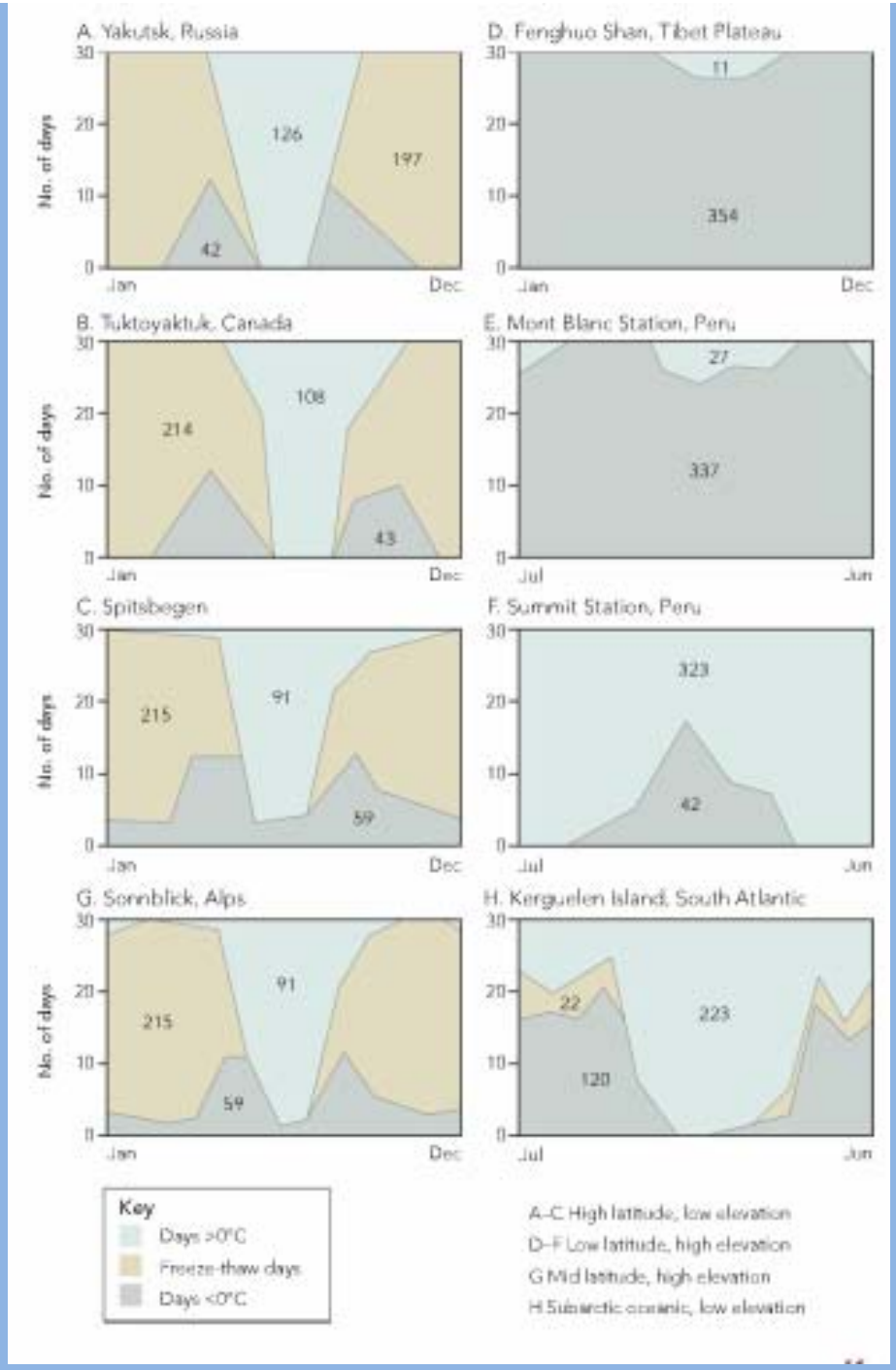
Avalanche

Mass movement of snow and ice form on slopes greater than 22 degrees. Occur more on north and east facing slopes where the snow is unstable.

When is freeze-thaw weathering most effective?

- Look at figure 3.7.
- Under which conditions is it most effective?
- Under which conditions is it least effective?
- Why?

- Write a short paragraph to answer these questions
- –use figures, months and place names in your answer.

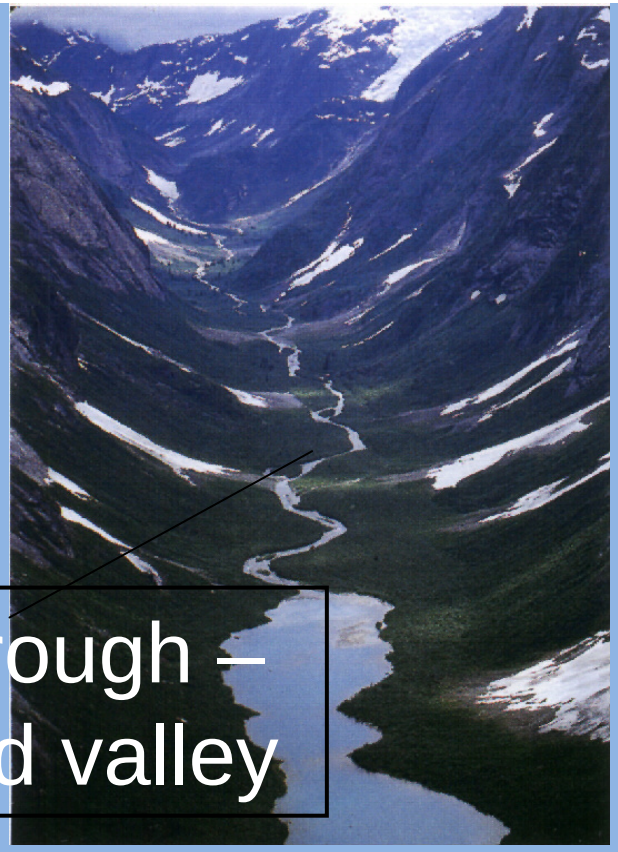

A. Yakutsk, Russia
No. of days
30
20
10
0
126
197
42
Jan
Dec
D. Fenghuo Shan, Tibet Plateau
11
354
Jan
Dec
B. Tuktoyaktuk, Canada
214
108
43
Jan
Dec
E. Mont Blanc Station, Peru
27
337
Jul
Jun
C. Spitsbegen
215
91
59
Jan
Dec
F. Summit Station, Peru
323
42
Jul
Jun
G. Sonnblick, Alps
215
91
59
Jan
Dec
H. Kerguelen Island, South Atlantic
22
223
120
Jul
Jun
Key
Days >0°C
Freeze-thaw days
Days <0°C
A–C High latitude, low elevation
D–F Low latitude, high elevation
G Mid latitude, high elevation
H Subarctic oceanic, low elevation

Features of Cold Environments.

Many erosional features – especially those in lowland areas – have been protected and hidden by deposits of till.

Till – sediment deposited by a glacier – unsorted, angular and variable in size. Sometimes called moraine or boulder clay.

Cirque



Roche Moutonee

Glacial trough – U-shaped valley

Erratic

Cirque Formation

A cirque is an armchair shaped hollow surrounded by knife-edged ridges called arêtes.

It starts with a shallow, pre-glacial hollow is the original site of snow accumulation.

The hollow is enlarged by freeze-thaw weathering – as this continues the hollow enlarges so neve proper can form, as the basin further develops ice can accumulate.

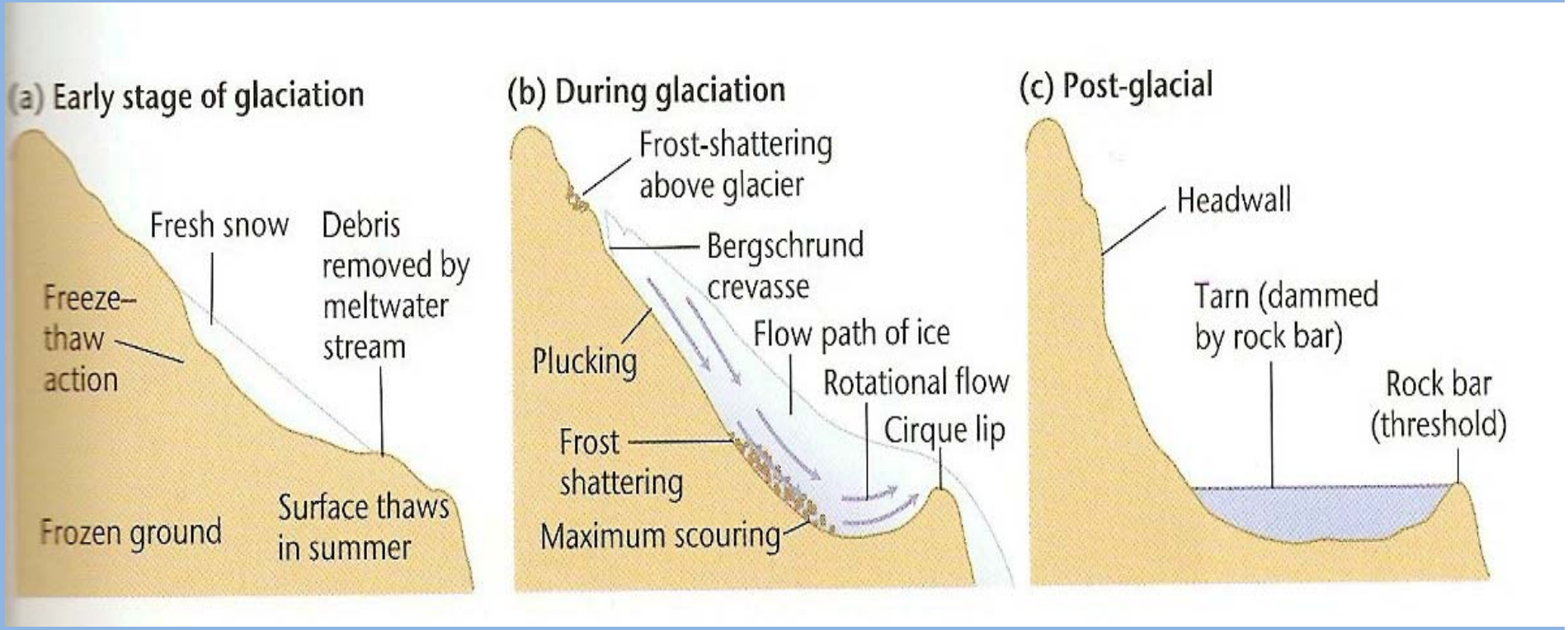
At a critical depth and weight of ice, the ice begins to move out of the hollow by extrusion flow in a rotational manner.

Rotation is the main form of erosion - helps to erode further through plucking and abrasion.

Meanwhile, meltwater which makes its way down the bergschrund and randkluft helps contained cirque growth – freeze-thaw.

When the ice disappears the armchair shaped hollow remains, often containing a small lake – tarn – dammed back by the cirque lip as a result of rotational movement of the ice.

Cirque Formation…



Pyramidal Peaks

Arêtes

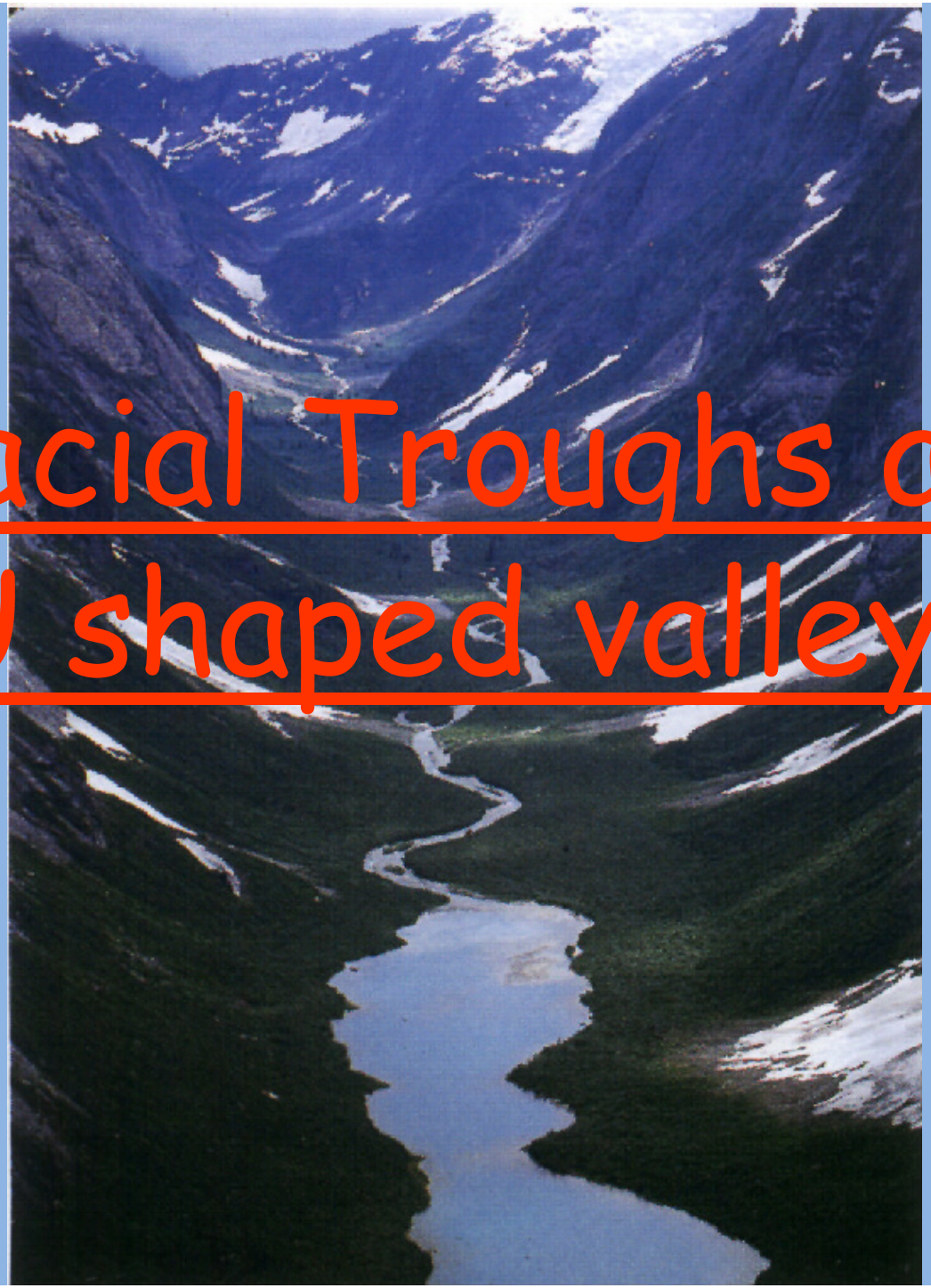
Group Work

Card sort…

Using the information on the sheet and your memory complete the card sort for the formation of Cirques.

You must also include 3 or more diagrams to accompany the statements.

Glacial Troughs and U shaped valleys



Shape of glacial troughs…

- Glacial troughs have steep sides and a relatively flat bottom.
- Although they are referred to as U-shaped, few are actually U-shaped because of the

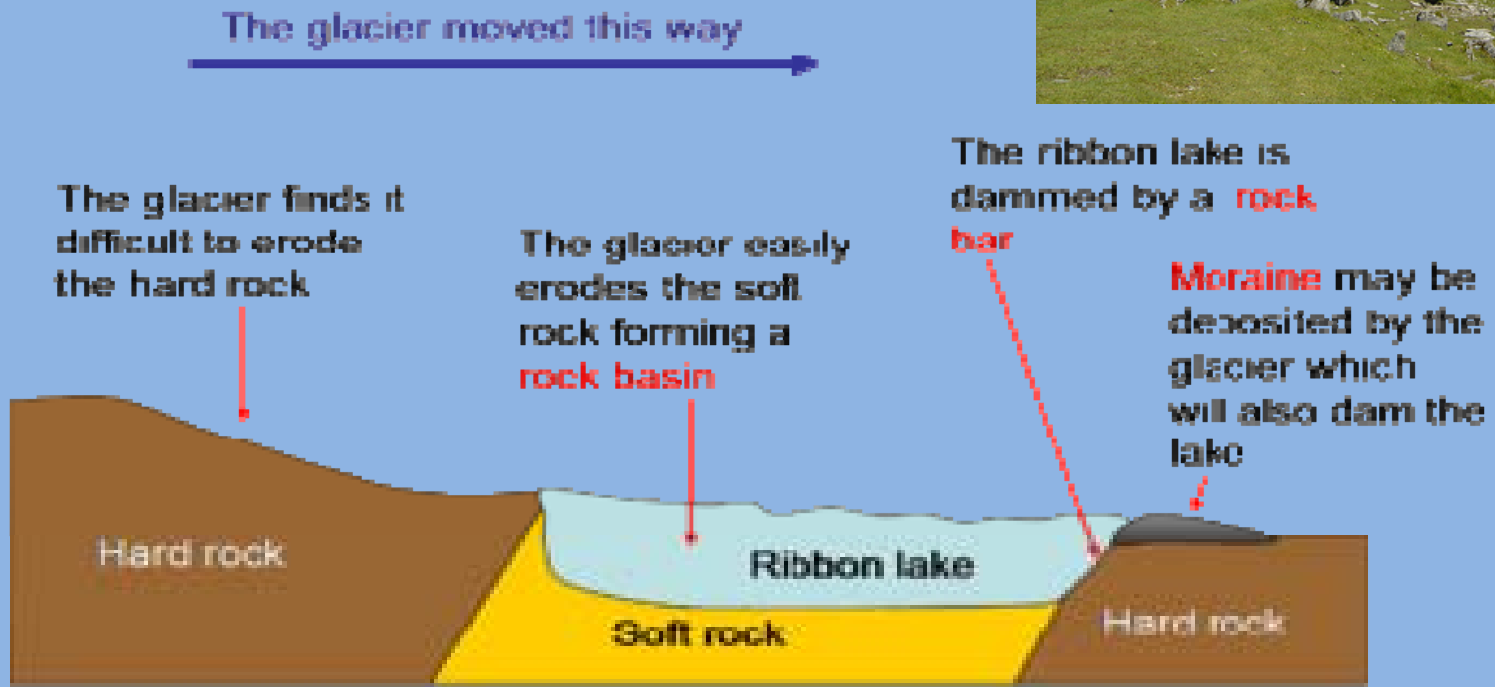
activity such as mass movement, deposition and erosion by rivers, since the last glaciation.

Formation of Glacial troughs/ U-shaped valleys…

- Before the onset of glaciation, freeze-thaw weathering under periglacial processes weaken the floor and sides – preparing it for erosion.

- At the end of a glacial period there will be pressure release as the weight of the ice is reduced (Pressure release – sigh of release- type of weathering in which the rock is able to expand and therefore cracks appear.
- During glaciation the eroding power of ice will cause valley to become U-shaped.

- The valley will become straight (was winding) as the interlocking spurs are bulldozed out to leave truncated spurs.
- Extrusion in the ice can cause the ice to erode deep rock basins in the valley floor – later occupied by ribbon lakes.



- As the ice moves it may also erode steps by the scouring out of lines of weaker rock, by opening up joints or by experiencing periods of intense and potent extrusion flow.

- The addition of a tributary glacier can also develop rock steps due to the increased erosion associated with thicker mass of ice.

- A further feature of U-Shaped valleys is a Hanging Valley. This is a small u-shaped valley formed by a small glacier that joins and hangs above a large u-shape valley formed by a large glacier.

- The small tributary glacier does not have the weight or power to cut down to the depths of the main trough, therefore the hanging valley is formed.

Key Word Bingo!

Insolation Striations Carbonation

Roche Mountonee

Chatter Marks Katabatic Winds

Glacial climate Chatter marks

Divergent Flow Hydrolysis Insolation

Periglacial climate

Orographic Rainfall Mountainous climate