



Geological Work of Glaciers

(Part-3)

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Geological Actions of Glaciers- The glacial performs three types of geological actions as it moves downhill under the action of gravity. They are-

1. Erosion
2. Transportation
3. Deposition

These actions together constitutes the process of glaciation.

1. Erosional Actions of Glacier: Glaciers performs three erosional activities as it moves down along the glacial valley under the action of gravity, mainly eroding the bedrock surface and also the constituents they carry along with them. The three erosional actions of glaciers are as follows-

- a) **Plucking-** It is also known as frost wedging or quarrying. During the summer, the surface parts of a glacier may partially melt. This melted water or rainwater steps down along the sides of the ice mass finding its way into the cracks and fractures in the rocks along with the edges and at the head of the glacier. Whenever temperature freezes this water, it breaks up the rock by frost action and with the movement of the glacier they are frozen in suspension in the ice.
- b) **Rasping-** This term is used to describe the scraping the glacial action. The front edge of the glacier functions as bulldozer pushing and scraping the ground in front of the ice.
- c) **Avalanching-** It is a process of mass wasting. Along the margin of the valley glacier, the valley sides are scraped and blocks are broken off which become frozen into the ice and are carried away. This leads to under cutting of the sides of the valley make ground for sliding and debris avalanching. This brings great quantity of rock waste. But avalanching is absent in case of continental glacier.

Erosional Features Produced by Valley Glaciers

- **Cirque- Cirque** (French: “circle”) are amphitheatre shaped basin with precipitous walls, at the head of a glacial valley. It generally results from erosion beneath the bergschrund of a glacier. A bergschrund is a large crevasse that lies a short distance from the exposed rock walls and separates the stationary part of wall from the moving ice. In early summer it opens and exposes the rock at its base to diurnal changes of temperature. Frost action then causes rapid disintegration of lower rock, which causes the upper rock to avalanche and thus produces an almost vertical head wall. Resulting rock material is embedded in the glacier and scours a concave floor. This overall feature is caused due to erosional action by glacier and is called as cirque. In other words, a cirque is formed by ice and indicates the head of a glacier. They are also known as “**Corrie**” or “**Kar**”
- **Tarns / Cirque Lakes-** Tarn is a small mountain lake which is set in a glaciated steep-walled amphitheatre known as a cirque. There are some features of the tarn, they are-
 - Tarn is lakes that are formed in glacially carved cirques.
 - They are obstructed by moraines below a tarn.
 - Tarns are often full of tiny, glacially-ground sediment that pass the light and make the watercolour.
 - They are found in mountainous areas.
 - The highest tarns of the world are found in Snowdonia, Lake District and Scotland.
- **Aretes- Arete** (French: “ridge”) are sharp-crested serrate ridge separating the heads of opposing valleys comprising of cirques that are a type of Valley or Alpine glaciers. It has steep sides formed by the collapse of unsupported rock, undercut by continual freezing and thawing action.
- **Col-** When two opposing valley glaciers meet at an arete they carve a low, smooth gap, or depression called as col.
- **Horn-** When the aretes of three or more cirques enlarge by headward erosion, they may culminate at a point to form a high, sharp, pyramidal or triangular peak called as horn.
- **Glacial Troughs-** Also known as glacial valley are the stream valley that has been glaciated, usually to a typical catenary or U-shaped cross section. U-shaped valleys occur in many parts of the world and are characteristic features of mountain glaciation. These glacial troughs may be several thousand feet deep and tens of miles long. When allowed to spread out, a glacier erodes the landscape uniformly, but when confined within valley walls it tends to deepen and widen the valley floor. The commonly

V-shaped stream valley is converted to a U-shaped valley because the U-shape provides the least frictional resistance to the moving glacier. Because a glacier has a much greater viscosity and cross section than a river, its course has fewer and broader bends, and thus, the valley becomes straighter and smoother. The valley walls may be almost vertical and may be striated by boulders dragged by the glacier, and the valley floor may be covered with till or moraines.

- **Hanging Valleys-** As thickness of the ice in glaciers is the dominant factor in the deepening process of glacial valleys, smaller tributary glaciers having less thickness of ice can erode their troughs (glacial valley) less rapidly than the main glacier. Thus the glacial valley of main glaciers are deeper than that of tributary glaciers. When the glaciers melt, the tributary troughs are left as hanging valleys high on the walls of the main glacial valley. Postglacial streams may form waterfalls from the mouths of these hanging valleys over the main glacier valley.
- **Truncated spurs-** A truncated spur is a spur, which is a ridge that descends towards a valley floor from at a higher elevation, that ends in an inverted-V face and are produced by the erosional truncation of the spur by the action of glaciers.
- **Glacial boulders-** The larger sized clasts that are carried en-mass by a glacier downhill. They are deposited at some downhill regions where the carrying power of the glacier decreased by virtue of decrease in gradient of the valley.
- **Glacial scars-** Glacial scars (or striations or striae) are scratches or gouges cut into bedrock by glacial abrasion. They indicate the flow direction of the glacier.
- **Roches Moutonnees-** *Roche moutonnée* are sheep-back rock formed due to glacial abrasion. The glaciated bedrock surface occurs usually in the form of rounded knobs that look like sheep lying down or resemble the curls on a layer's wig. The upstream side of a *roche moutonnée* is subjected to glacial scouring that produces a gentle, polished, and striated slope whereas, the downstream side is subjected to glacial plucking that results in a steep, irregular, faulted, jointed and jagged slope. The ridges dividing the upstream and downstream slopes are therefore perpendicular to the general flow direction of the former ice mass.



- **Fjords**- Also called as fjord are long narrow arm of the sea, commonly extending far inland, that results from marine inundation of a glaciated valley. These are deep glacial troughs which have been eroded below mean sea-level. Glacial erosion produces U-shaped valleys, and fjords are characteristically so shaped. Within fjords, the glacier comes in contact with the sea-water, due to which the ice sheet gets partially melted and crevasses develops within the sheets. As a result when the cracks deepens and grows bigger, huge slabs of ice gets detached and dislodged from the main glacier off-shore and floats on the water surface as icebergs. This process of wastage of ice is called as calving.

Retreat mechanism of a fjord-type glacier at glacial front- As the process of calving continues during inter-glacial periods (when temperatures are high), the glacier retreats back more and more upland. Thus it results in larger portions of the valley to be occupied with sea water and some parts of glaciers being present at the mountains in snow-field regions.