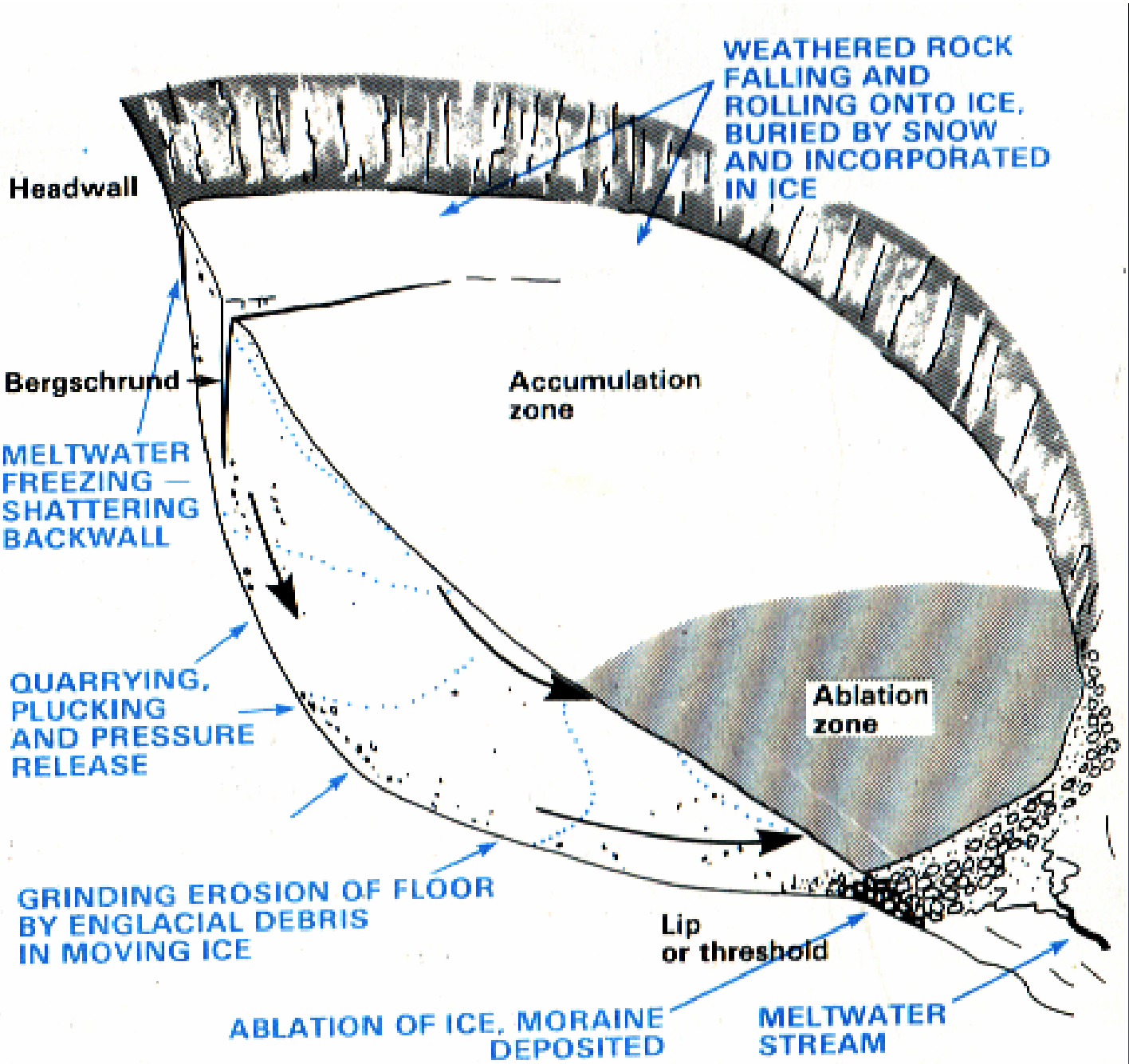
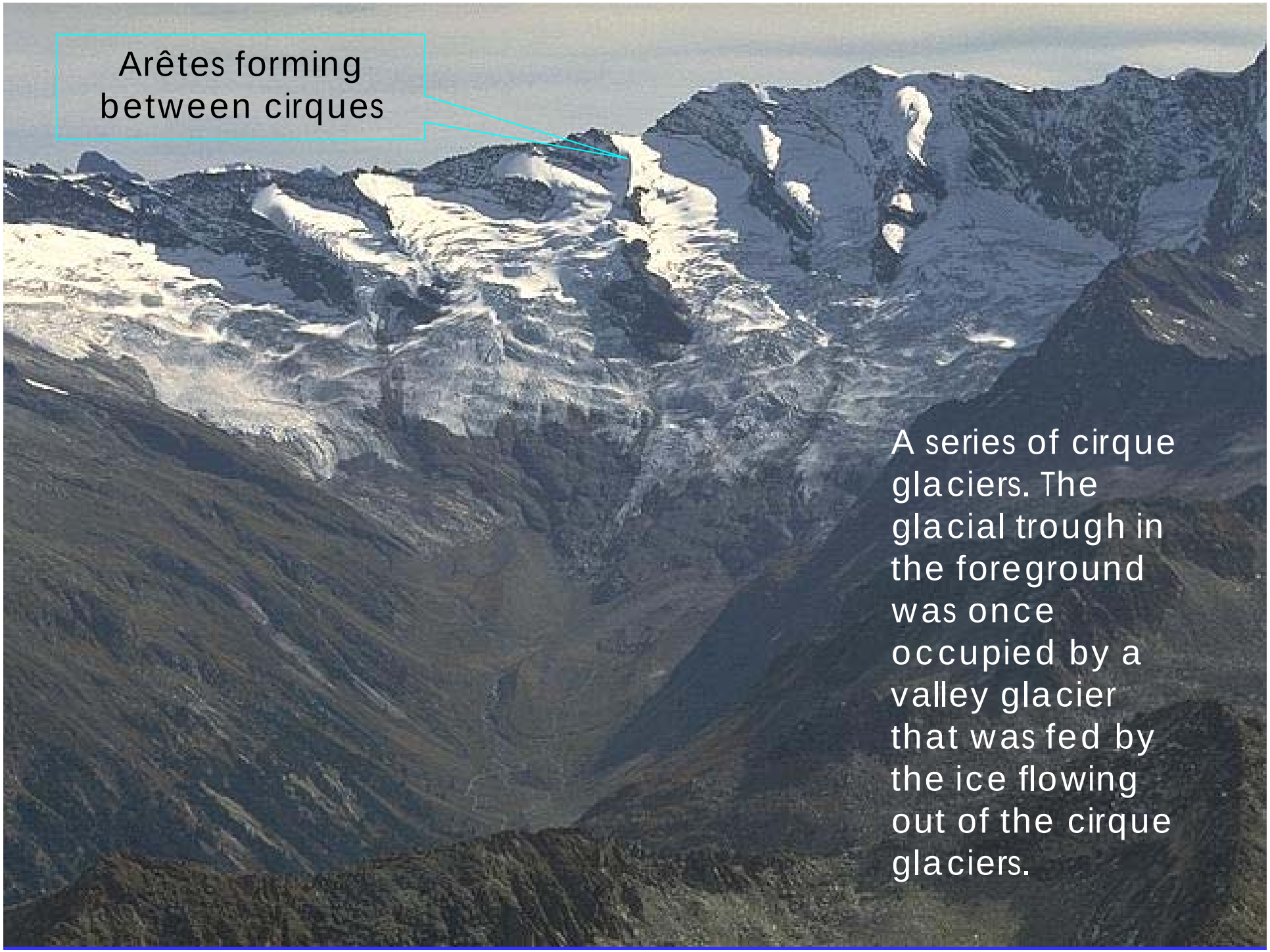
Erosional landforms



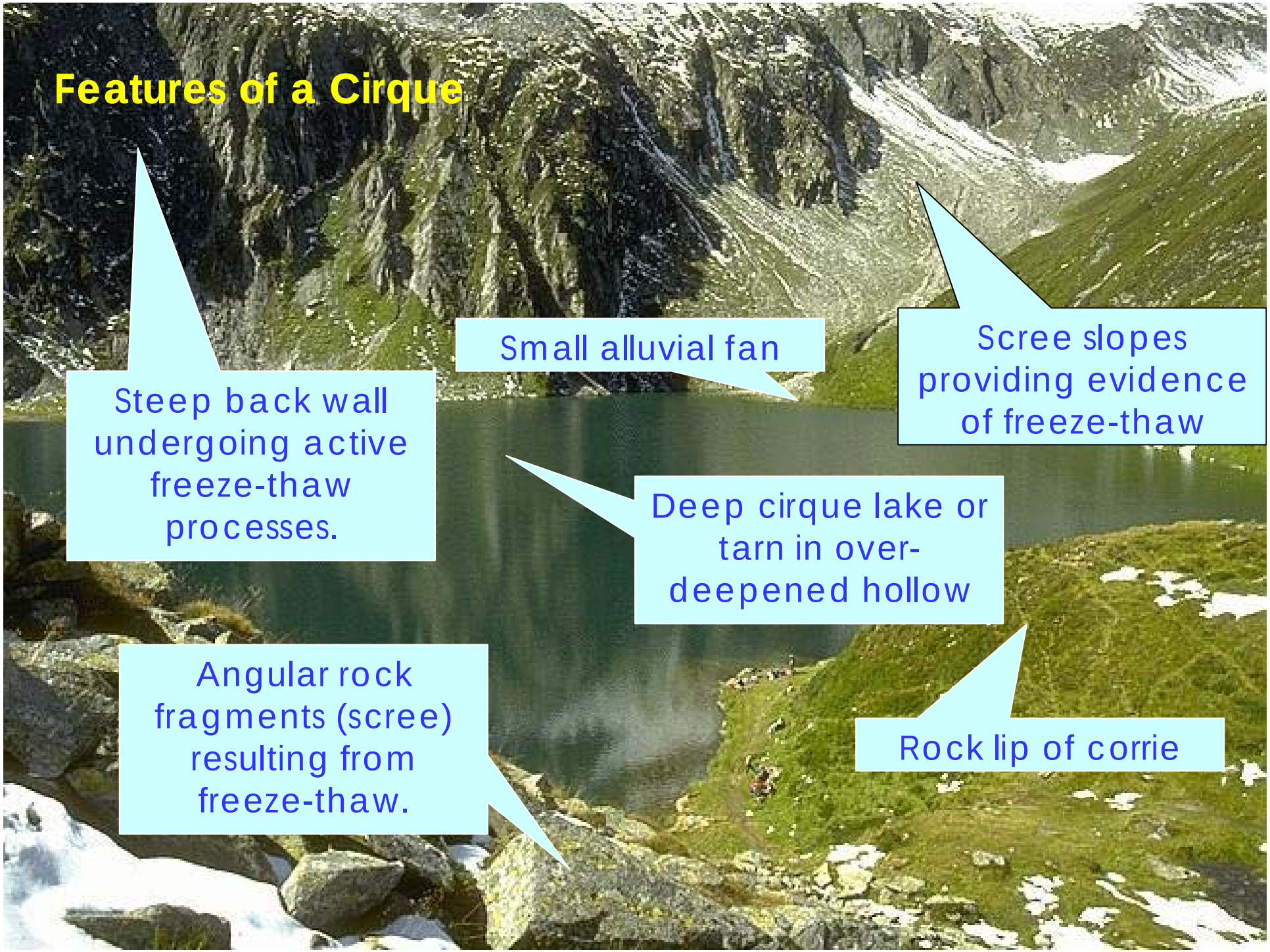
A cirque glacier

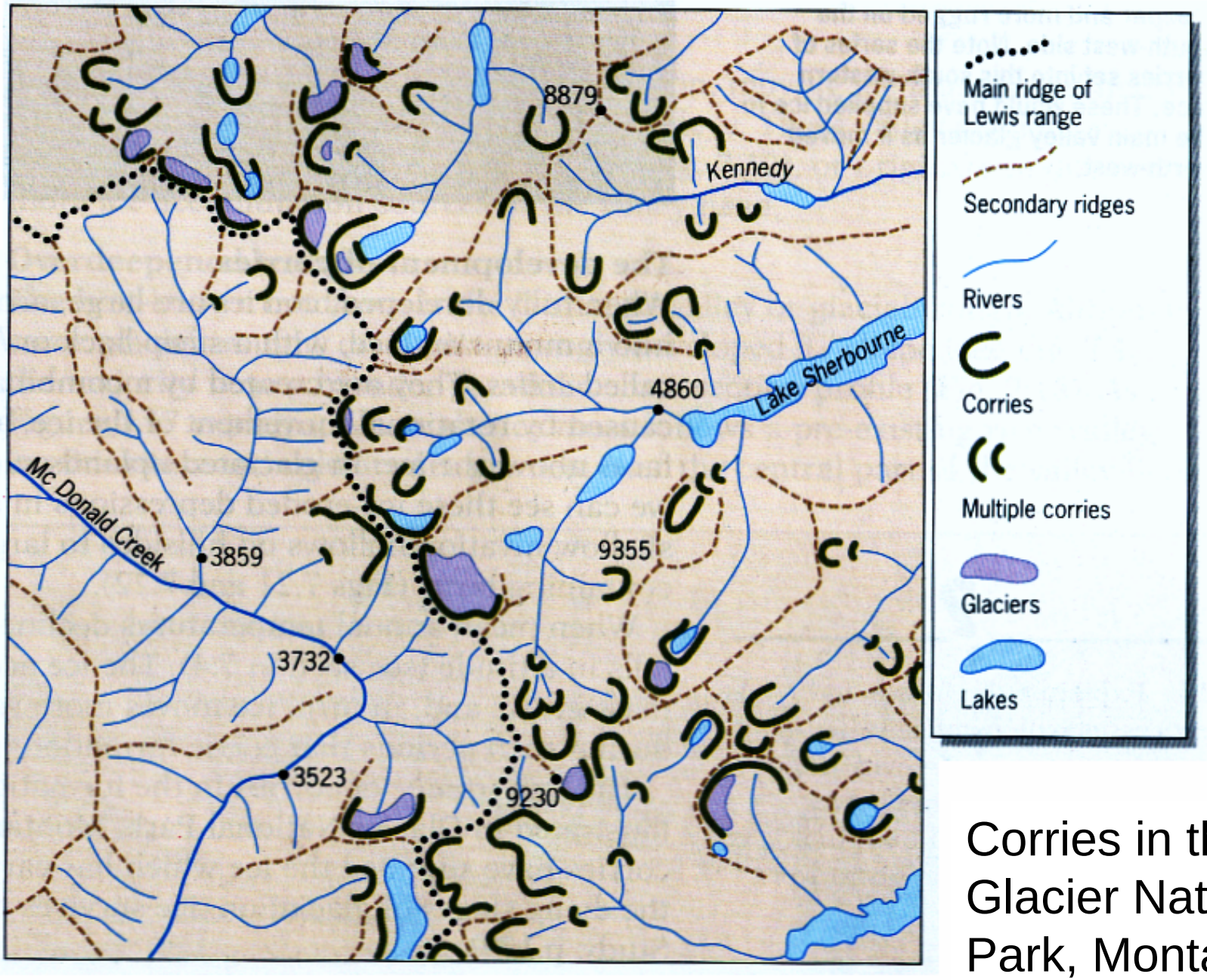

Cirque glaciers on the Grand Montet in the French Alps

A bergschrund at the head of a glacier on Mount Shasta, California.

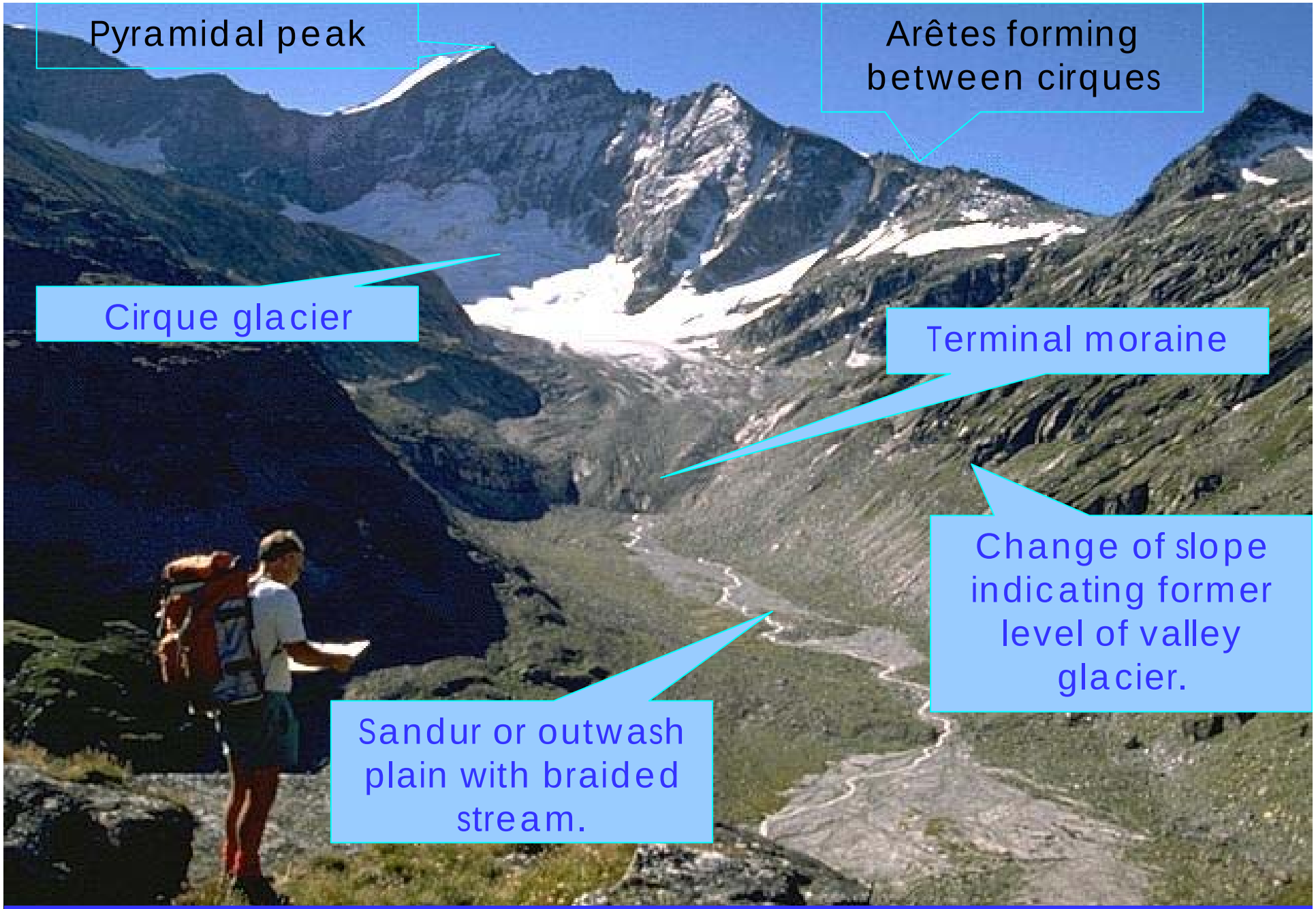


A series of cirque glaciers. The glacial trough in the foreground was once occupied by a valley glacier that was fed by the ice flowing out of the cirque glaciers.

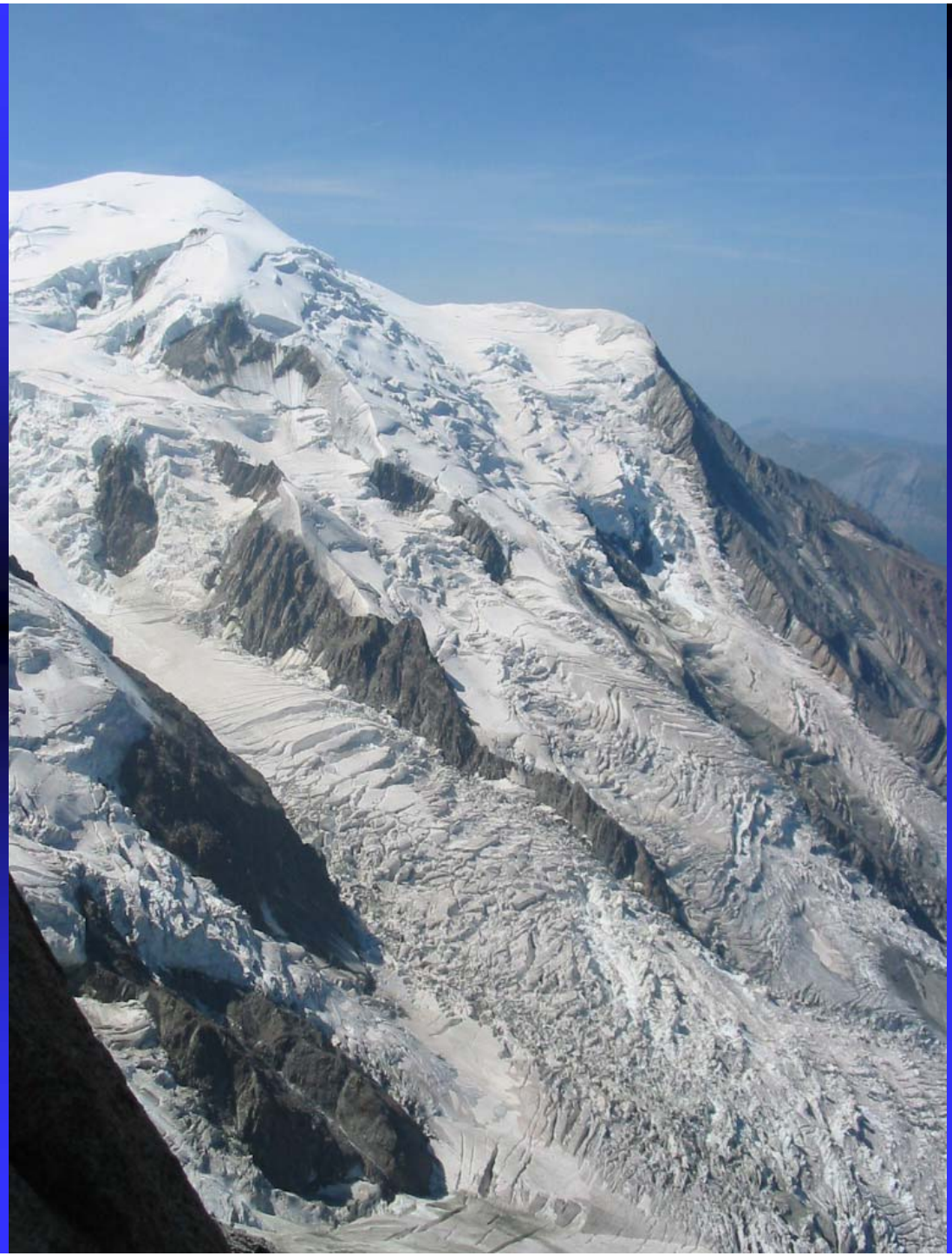

Features of a Cirque
Steep back wall undergoing active freeze-thaw processes.
Small alluvial fan
Scree slopes providing evidence of freeze-thaw
Deep cirque lake or tarn in over-deepened hollow
Angular rock fragments (scree) resulting from freeze-thaw.
Rock lip of corrie



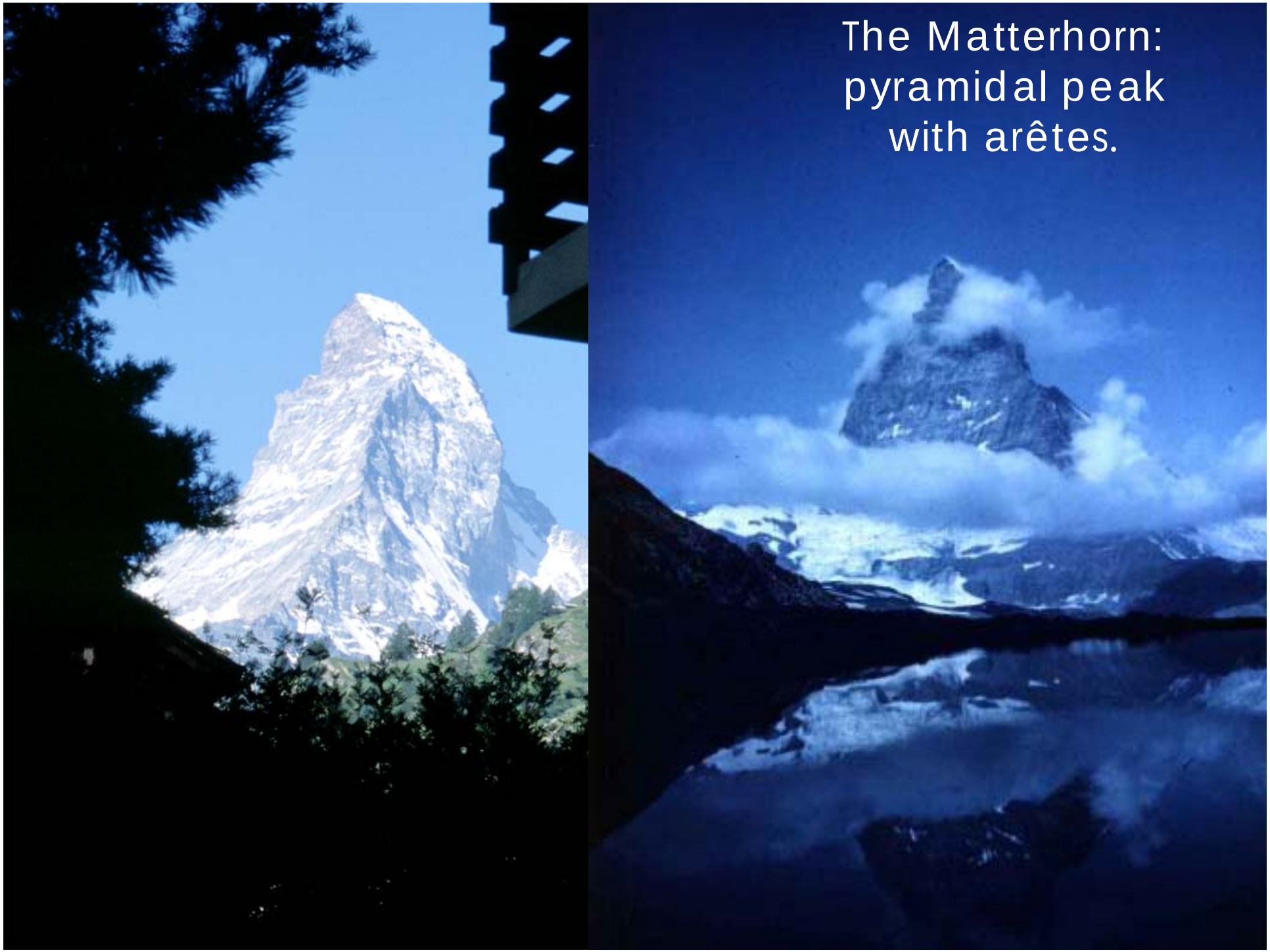
Corries in the Glacier National Park, Montana



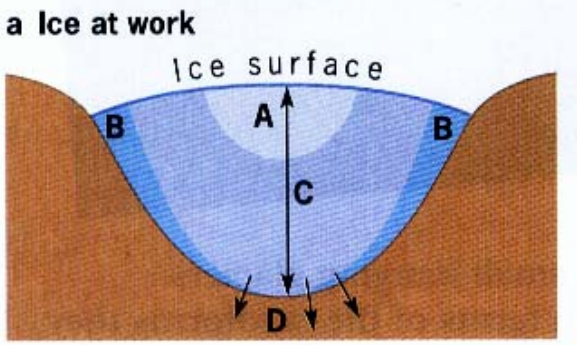
Evidence of direct glacial erosion and deposition in the Rockies



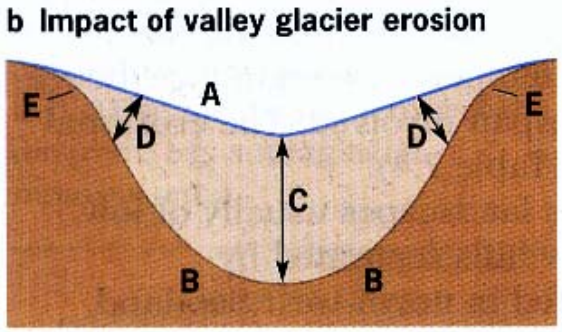
Arêtes appearing between a series of glaciers on the slopes of Mont Blanc.


The Matterhorn:
pyramidal peak
with arêtes.

The Formation of a Glacial Valley



A Zone of maximum ice velocity
B Zone of minimum velocity and maximum drag
C Maximum ice thickness
D Maximum forces applied



A Pre-glacial fluvial valley cross-section profile
B Post-glacial valley cross-section profile
C Greatest overdeepening
D Minimal deepening and slope retreat
E Shoulder of overdeepening (break of slope)

A glacial valley in Scotland.

Glacial Valleys

In cross-section, glacial valleys tend to have a parabolic shape that is efficient for the evacuation of varying volumes of ice (Sugden and John, 1976). At the close of phases of glaciation, the basic shape is modified by glacial and glacifluvial deposition to give a flat or terraced floor.

Linton (1963) introduced a useful classification scheme for glacial valleys:

Alpine valleys were cut by valley glaciers that were overlooked by high ground

Icelandic valleys form beneath ice sheets from existing valleys. The preglacial valley is deepened and straightened, often to leave a well-developed *trough head* at the point of accelerating erosion.

Through valleys are open at both ends. Usually this means that glaciers have *breached* the preglacial watershed.

Glacial Alpine Valley – the Arve Valley in the French Alps near Chamonix

Glacial U shape valley of the River Rhone with steep sides, flat floor, and truncated spurs (middle left). Note the intensive land use on the flat valley floor

Glacial trough

A valley shaped by valley glaciers and ice streams within ice sheets that has a distinct trough form. The trough head is enclosed by glacial cliffs and may be overlooked by a extensive snow-gathering areas.

These pictures are of Glen Avon in the Cairngorms

Glacial trough formed by the Argentiere Glacier in the French Alps

Alps or valley benches

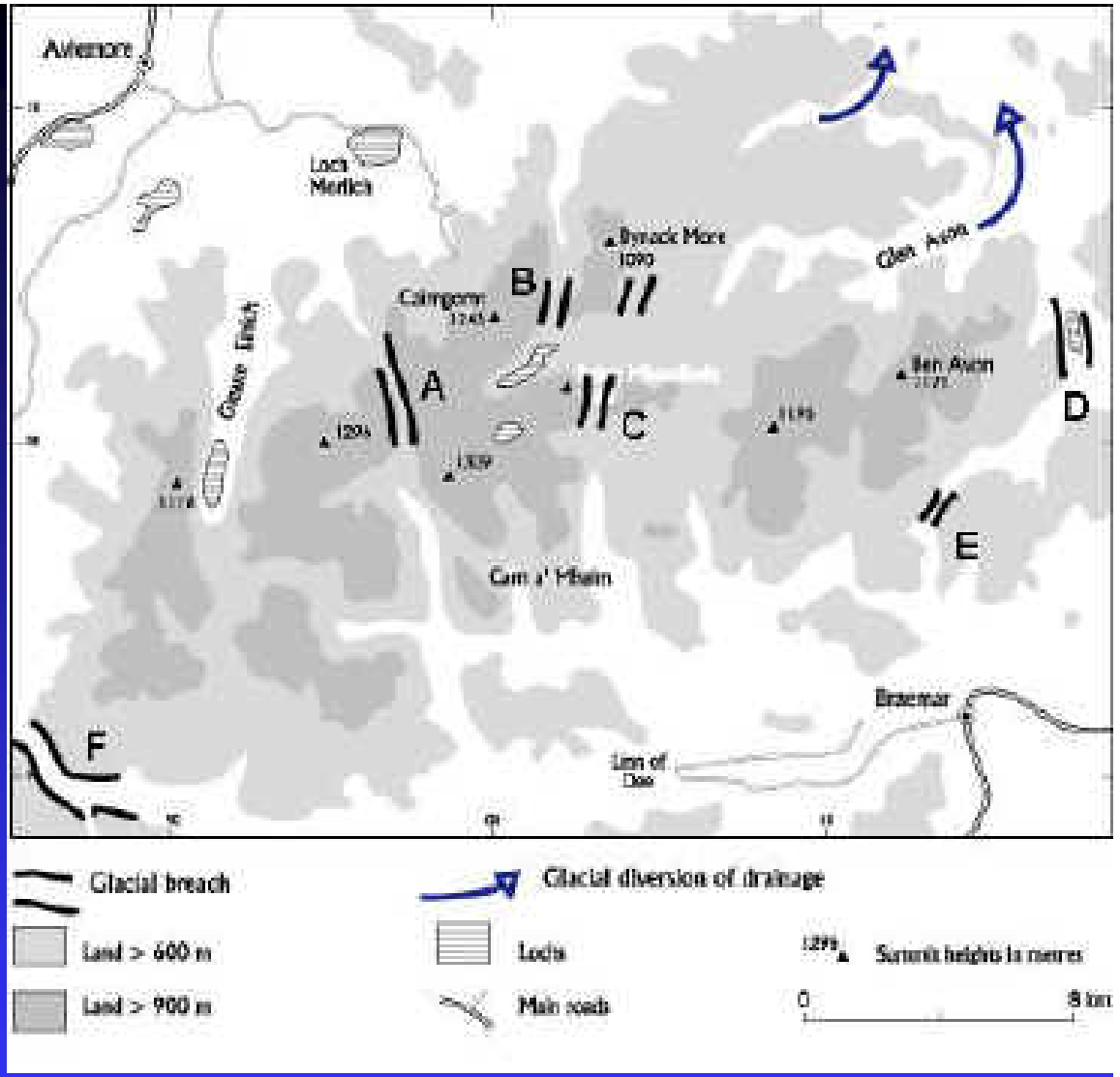
The upper limit of a glacier's erosion on a valley side is usually marked by a break of slope, above which is a more gentle sloped alp or bench. This may represent the former floor of the preglacial valley.

Where glacier ice has occupied a broad preglacial valley, glacial erosion often has been concentrated along the valley axis. This leaves a deep glacial trench or trough, but elements of the original valley floor may survive as flat-topped ridges along the valley margins.


“Alps” or valley Benches above
the Argentiere Glacier

Glacial breaches

A set of major glacial valleys have been cut though preglacial watersheds in the Cairngorms. The set includes the Lairig Ghru (A), the Saddle at the head of Strath Nethy (B), the Lairg an Loaigh (C) and its continuation to the N, Loch Builg (D), the head of the Gairn (E) and upper Glen Feshie (F).



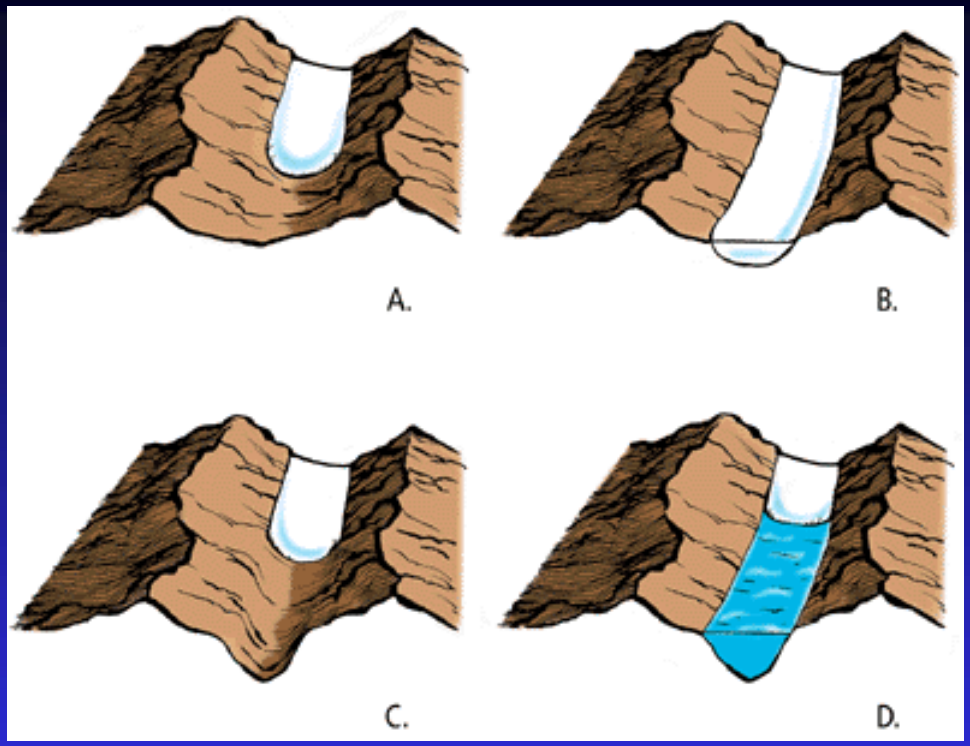
In each case, the breaching has been caused by ice over-riding a preglacial col

The Devil's Point in upper Glen Dee is perhaps the finest example of a truncated spur in the Cairngorms

Truncated Spurs

A blunt-ended, sloping ridge which descends the flank of a valley. Its abrupt termination is normally due to erosion by a glacier which tends to follow a straighter course than the former river

The formation of Fjords



A. Snow accumulates and the glacier expands down the shallow valley.

B. Size and weight of the glacier increases, carving out the valley.

C. As the climate warms, the glacier retreats, leaving a deeper valley.

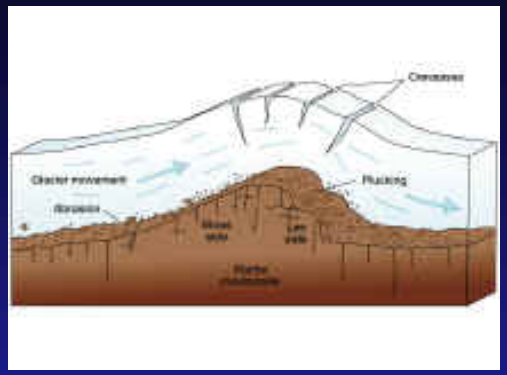
D. As sea level rises, water floods the valley, stopping at the terminus of the glacier


A Norwegian Fjord

Hanging valleys on the flanks of a Fjord

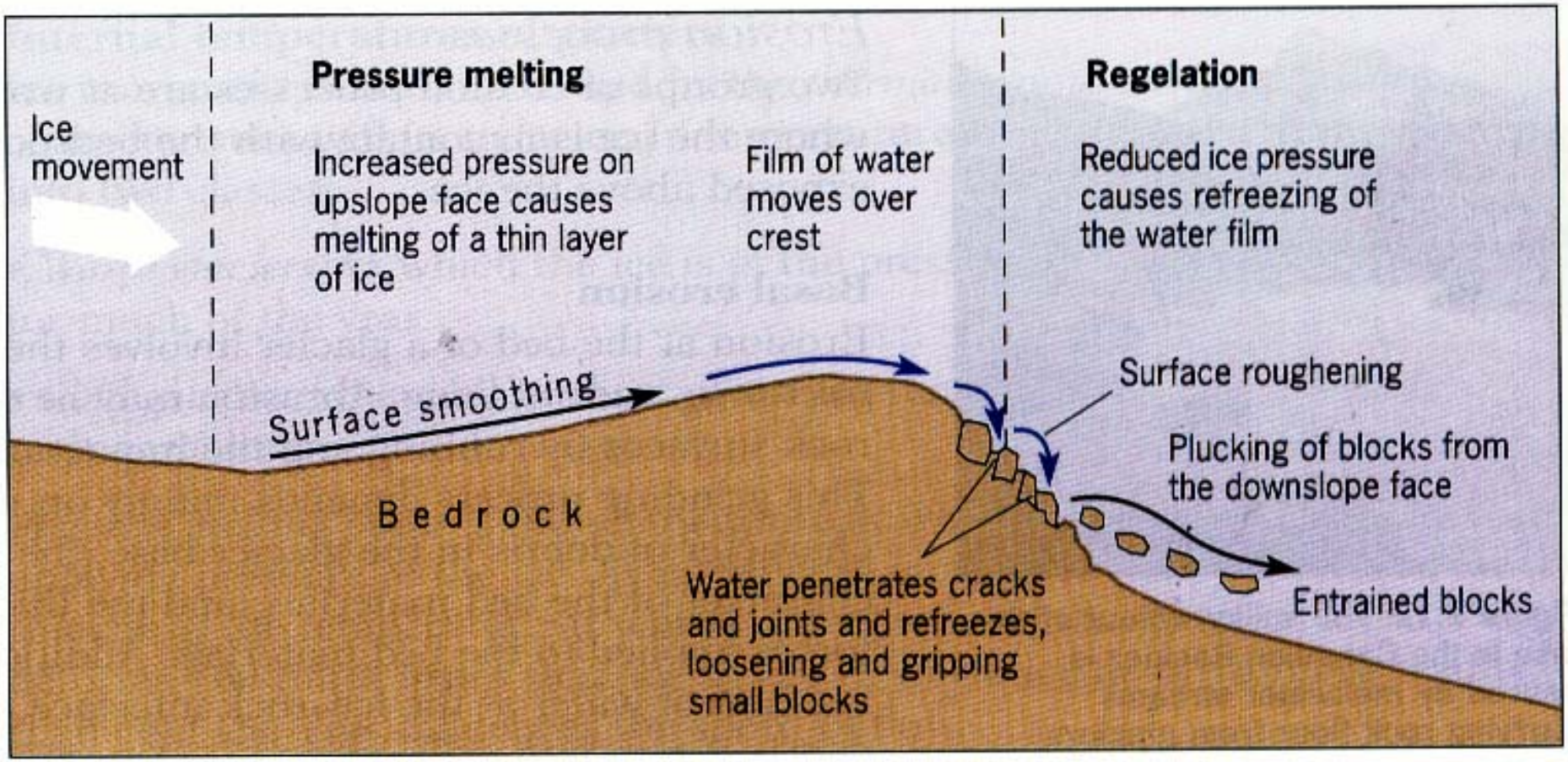
Roches moutonnées

Definition: rock hills shaped by the passage of ice to give a smooth up-ice side and a rough, plucked and cliffed surface on the down-ice side. The upstream surface is often marked with striations.



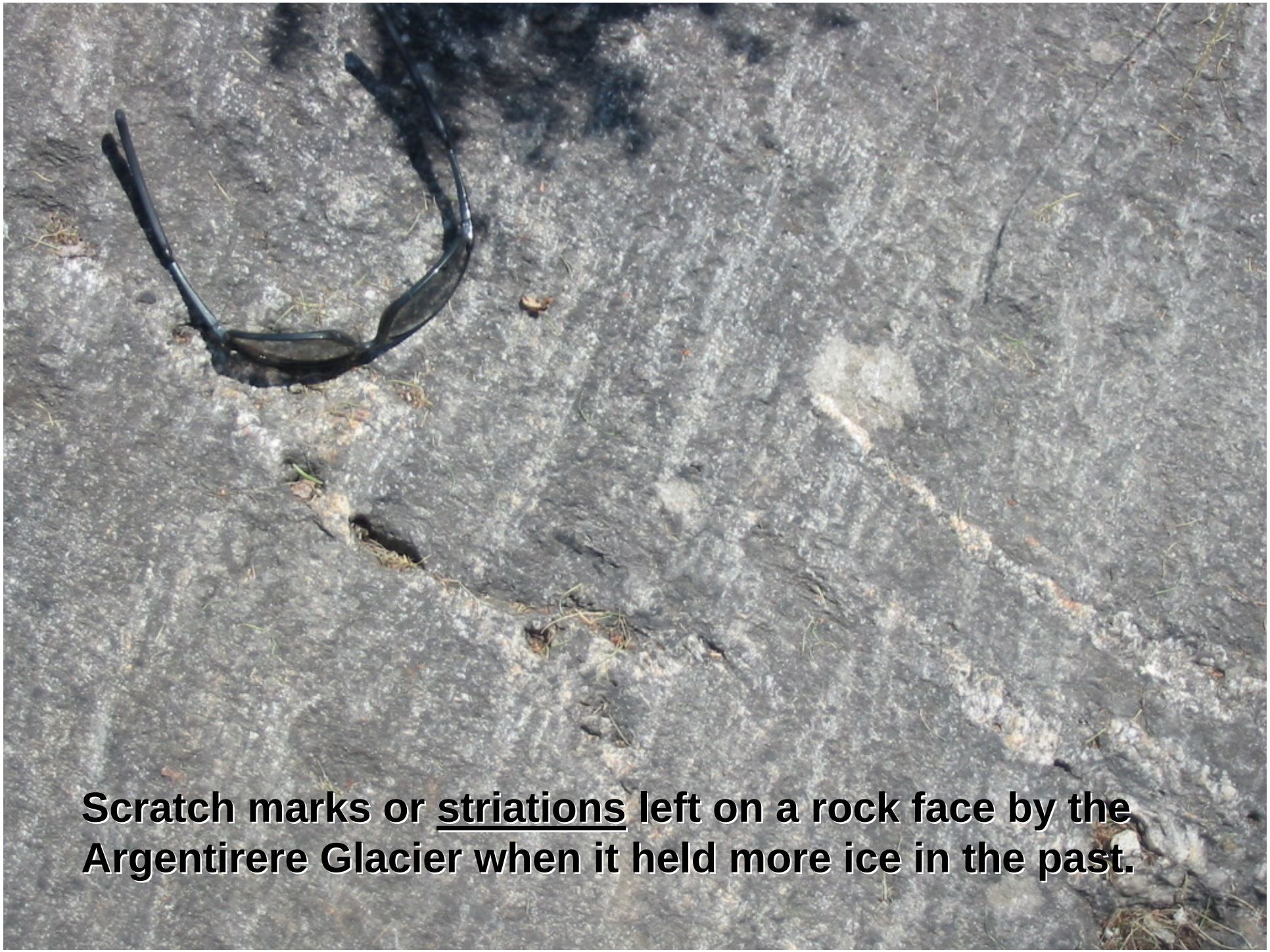
Patterns of ice flow: roche moutonnées are aligned roughly parallel to ice flow.

Processes of pressure melting and regelation at the ice-rock interface leading to the formation of a roche mountonnee.



A *roche moutonnee.* Ice rides over the upstream side and smoothes off the outcrop, but pulls blocks away from the downstream side, creating a blocky, steep front. Thus the ice flow here was from right to left.

Roche mountonnees



Scratch marks or striations left on a rock face by the Argentirere Glacier when it held more ice in the past.

Striations

The gouges in the otherwise glacially polished surface are called ***crescentic gouges***. They appear to form when large rocks are pushed down with great force into the underlying surface, creating a conical fracture. Melt water gets under the lip of the fracture, freezes and expands, and part of the fracture is exposed.
The bow of the crescent points in the direction of ice movement (here, right to left).

These rows of small crescent-shaped cracks are often called ***chatter marks***. In contrast to crescentic gouges, the *horns* of the crescents point in the direction of ice movement (here, bottom to top). Note the striations as well.