

Ankara University  
Faculty of Languages and History-Geography  
Department of Geography

# Glacial Geomorphology

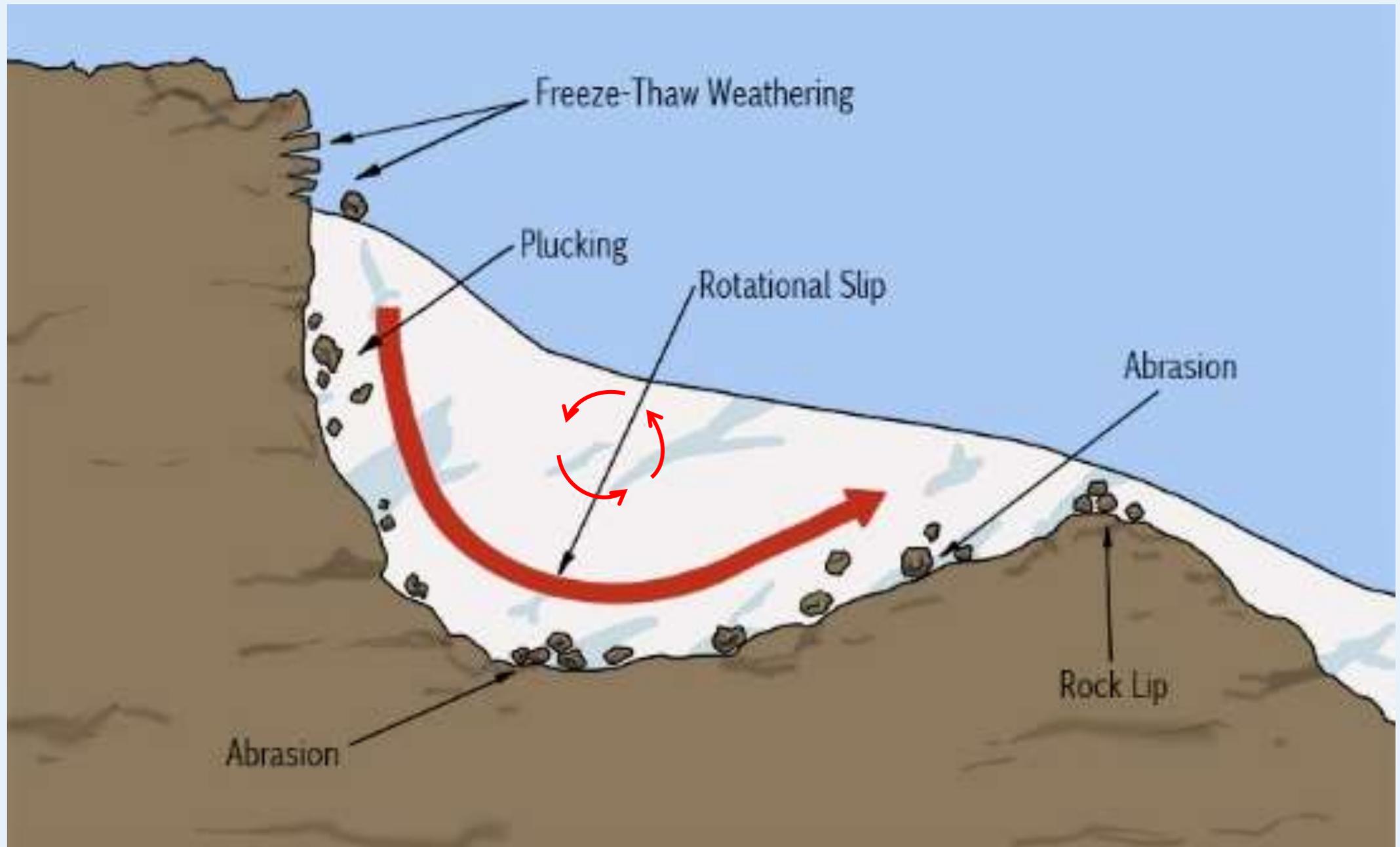
*Dr. Serdar Yeşilyurt*

## Cirques

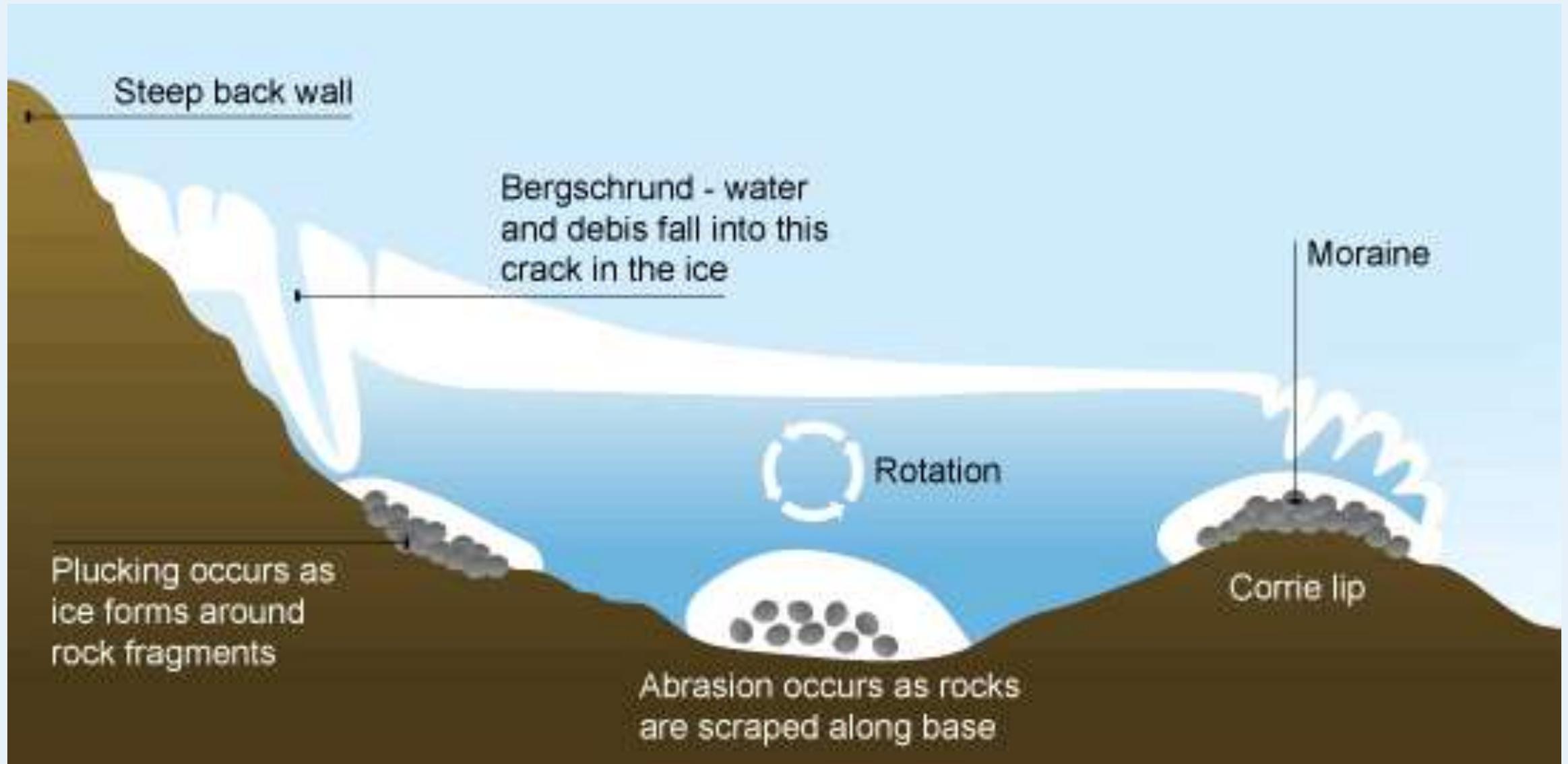
- The term "cirque" comes from French and is derived from the Latin word *circus*, meaning "circle.«
- These formations, found at the source areas of mountain glaciers, are shaped by glacial erosion.
- Cirques are semi-circular hollows on mountain slopes with one side open, facing downhill, and a gently sloping floor. The hollow is surrounded by steep rock walls that can be several hundred meters high.
- Active cirque glaciers have demonstrated that overdeepening is intensified by a rotational ice flow pattern, combined with an influx of abrasive tools in the form of rock debris. This debris falls into the **randkluft** (a gap between the glacier ice and the bedrock of the cirque's back wall) or the **bergschrund / rimaye** (a crevasse where the moving ice of the cirque glacier separates from the stationary ice / firn).
- The diameters of cirques range from 200 meters to 4 kilometers.
- **Corrie, cwm**



# Cirques



## Cirques



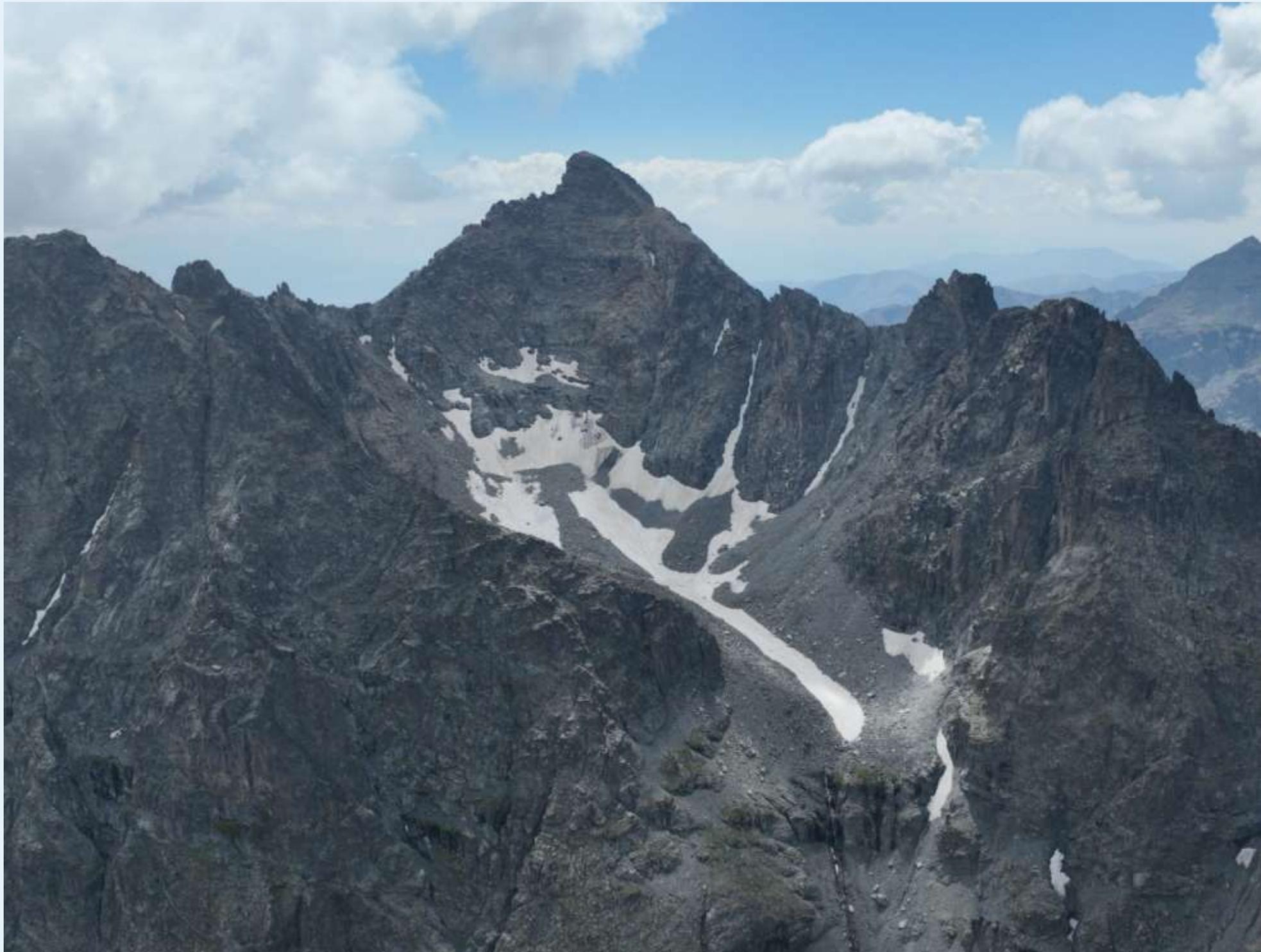
Cirques



Cirques



Cirques



Cirques



# Cirques



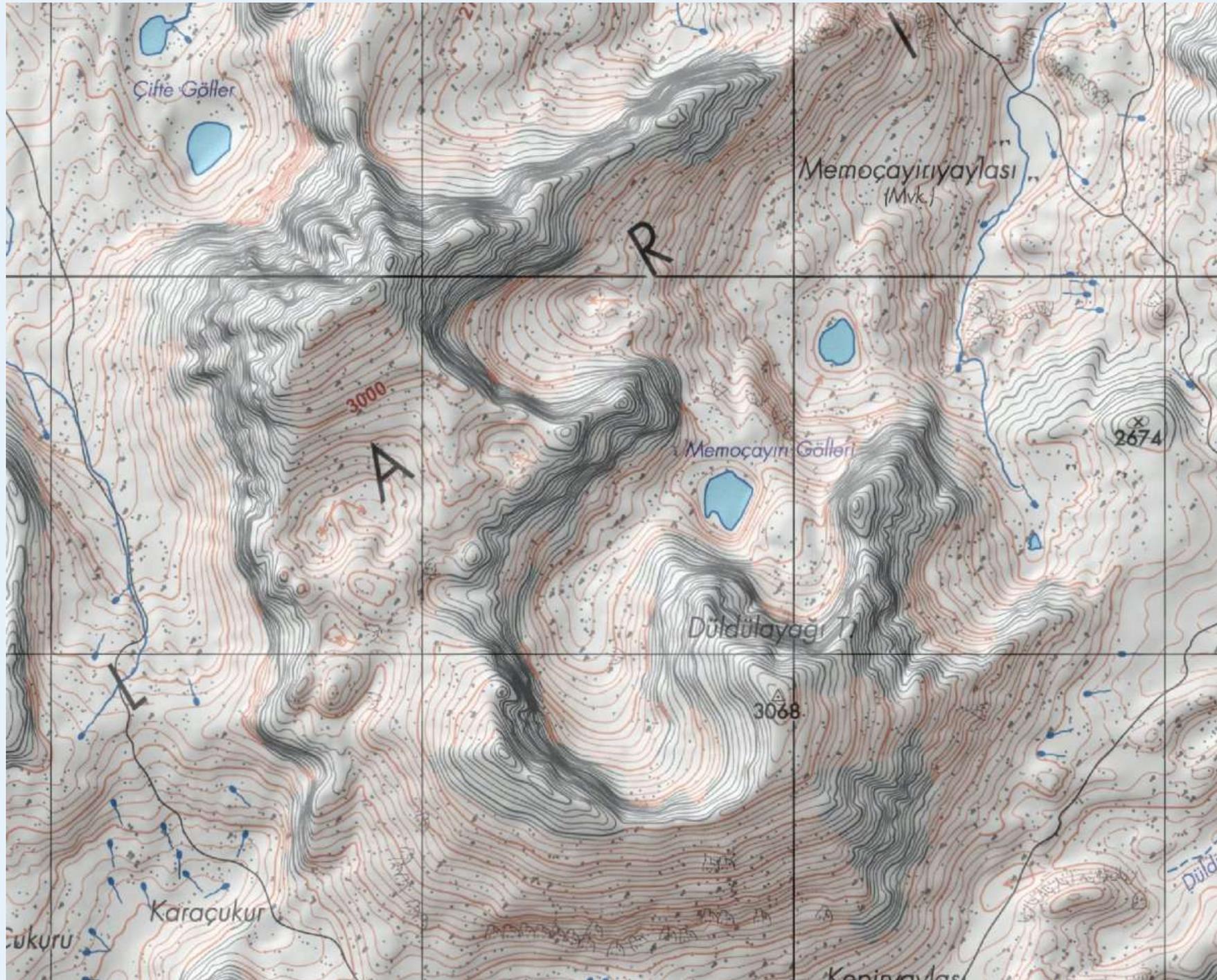
Cirques



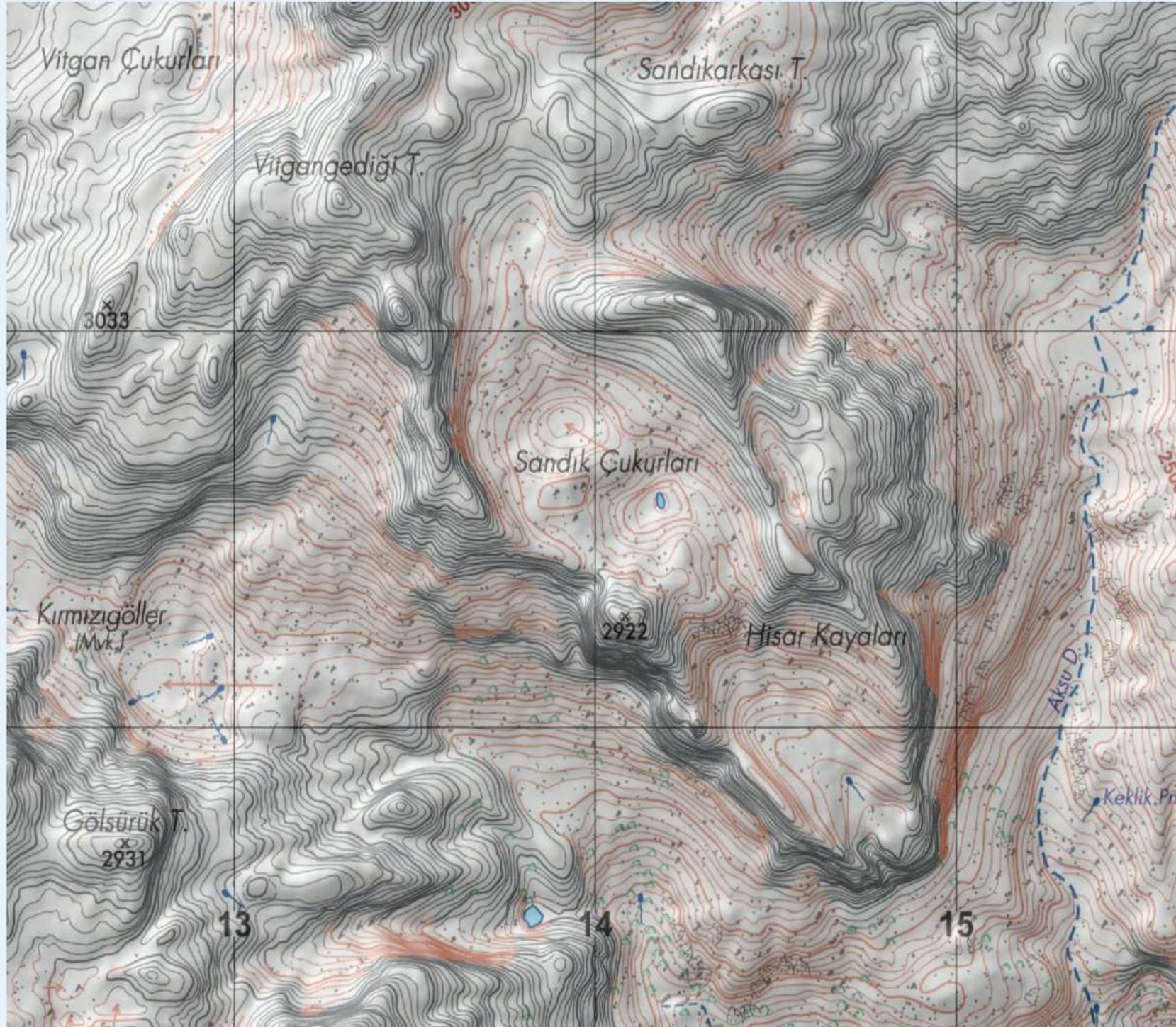
Cirques



## Cirques



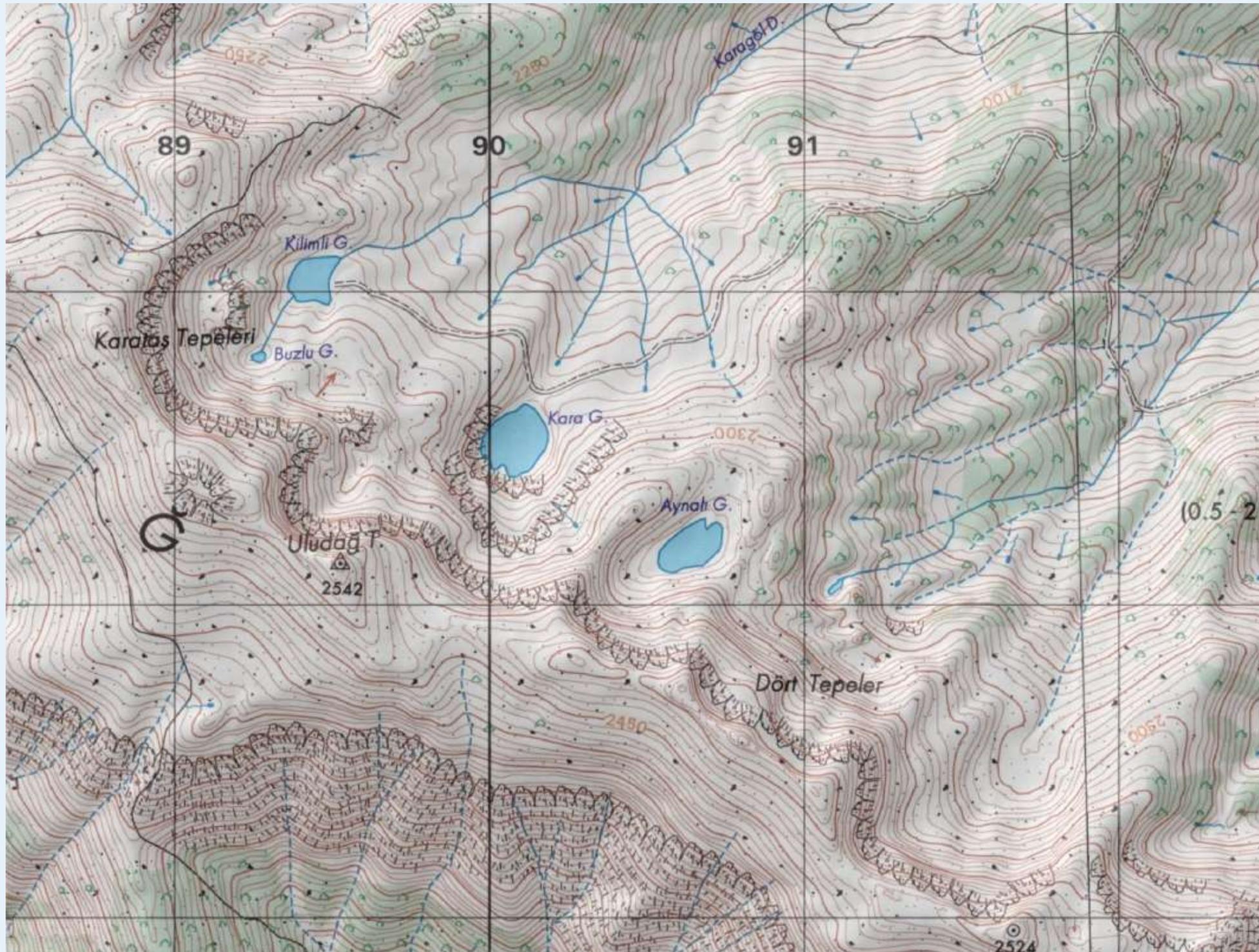
## Cirques



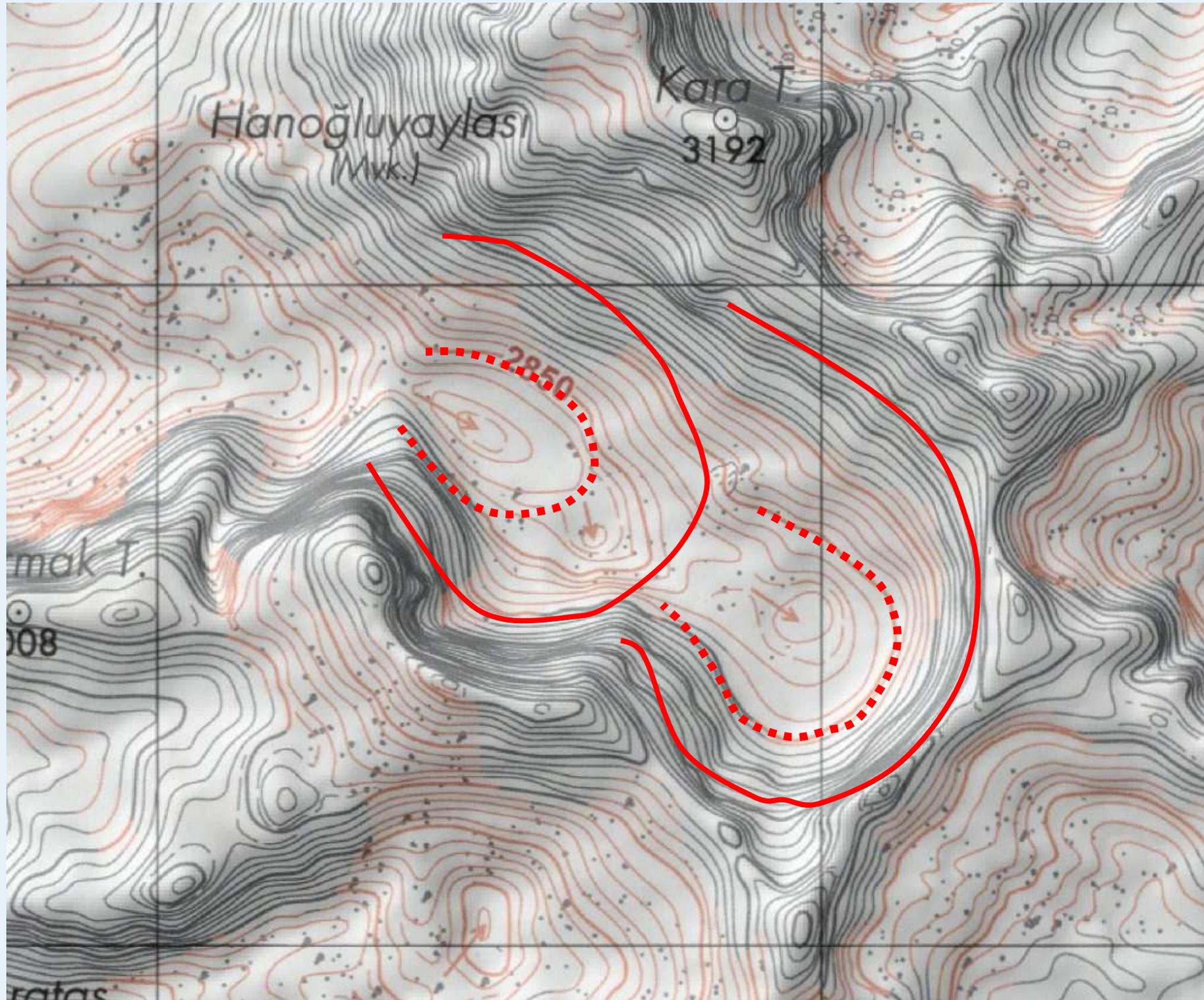
## Cirques



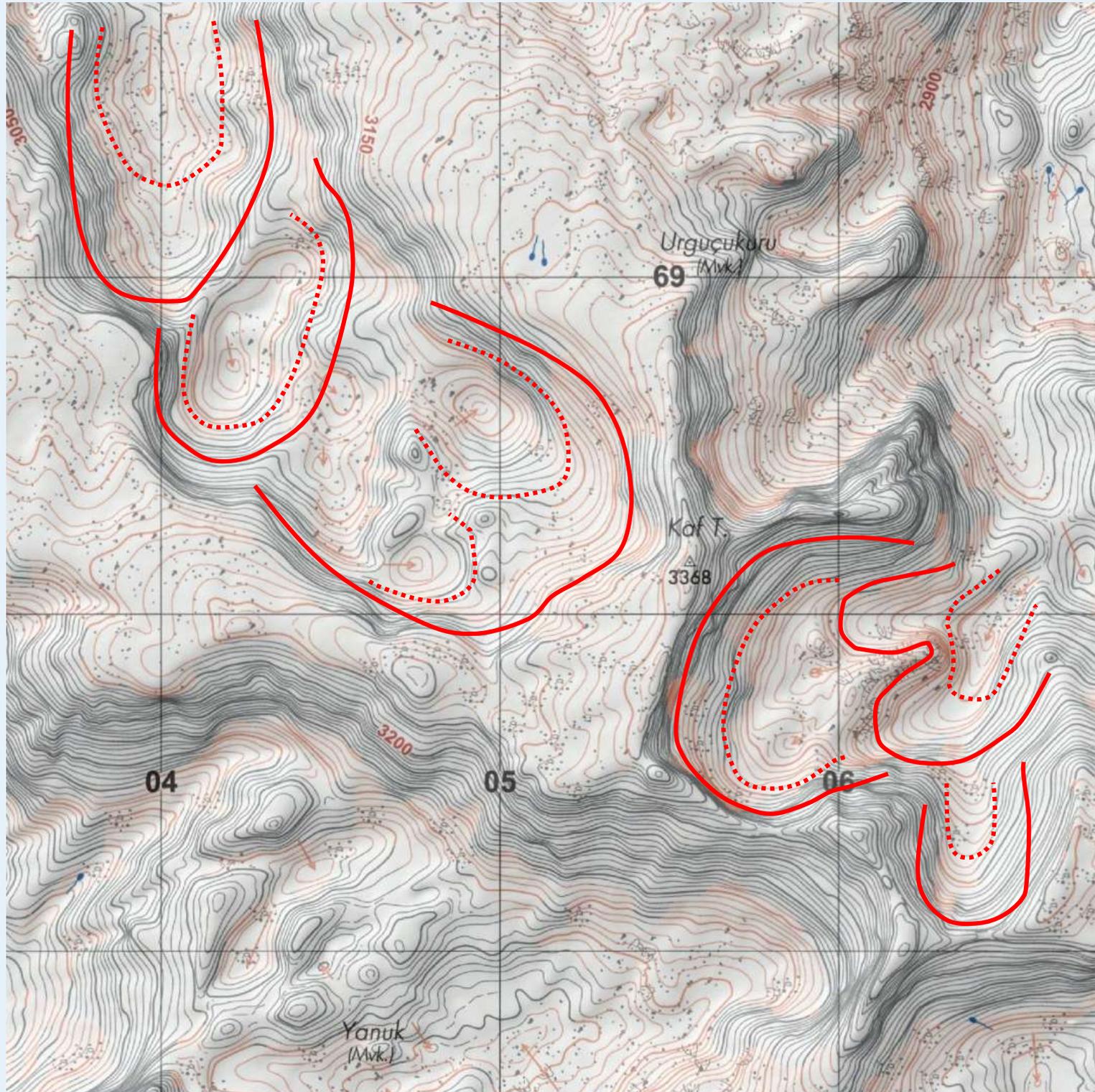
## Cirques



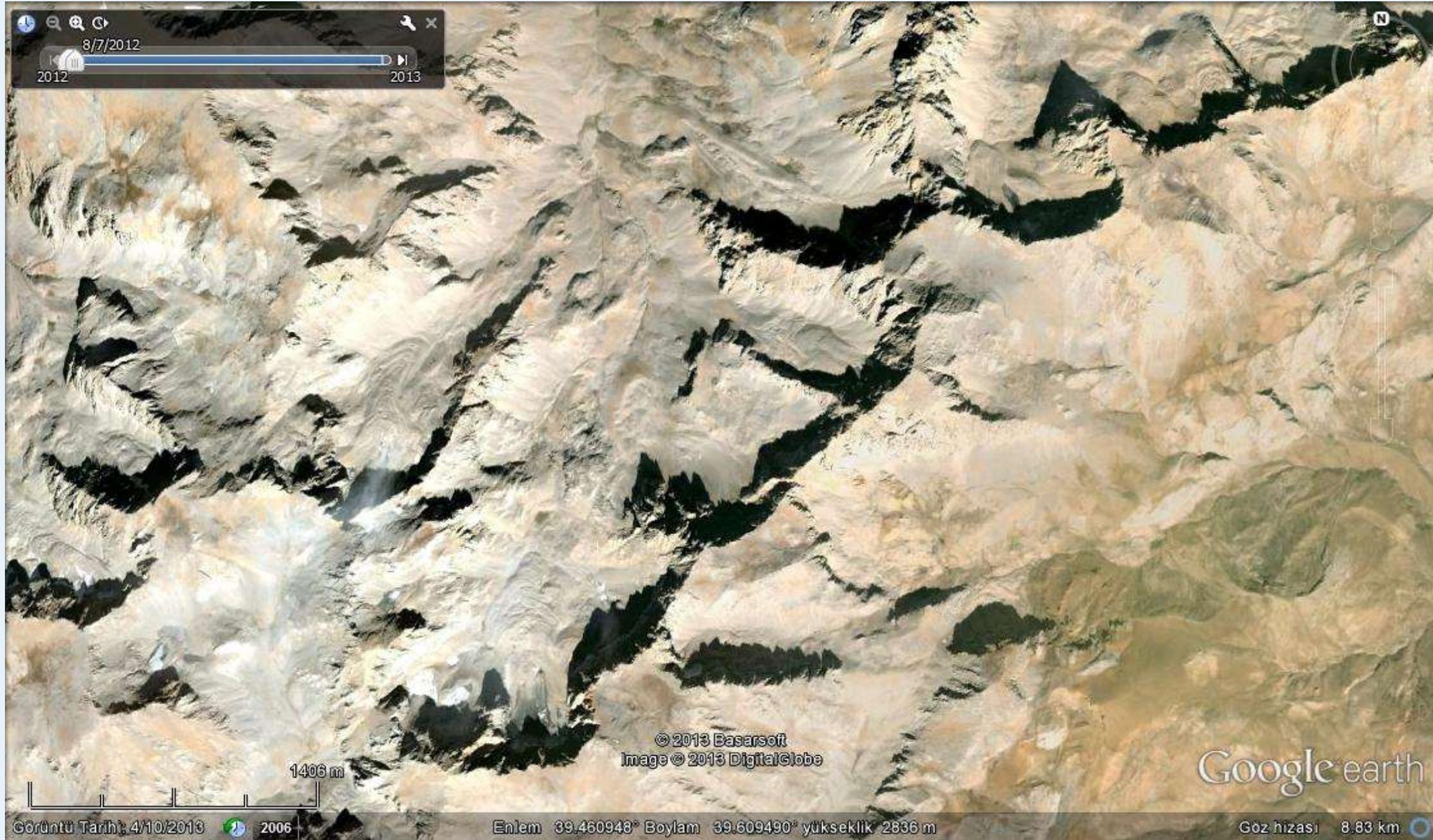
## Cirques



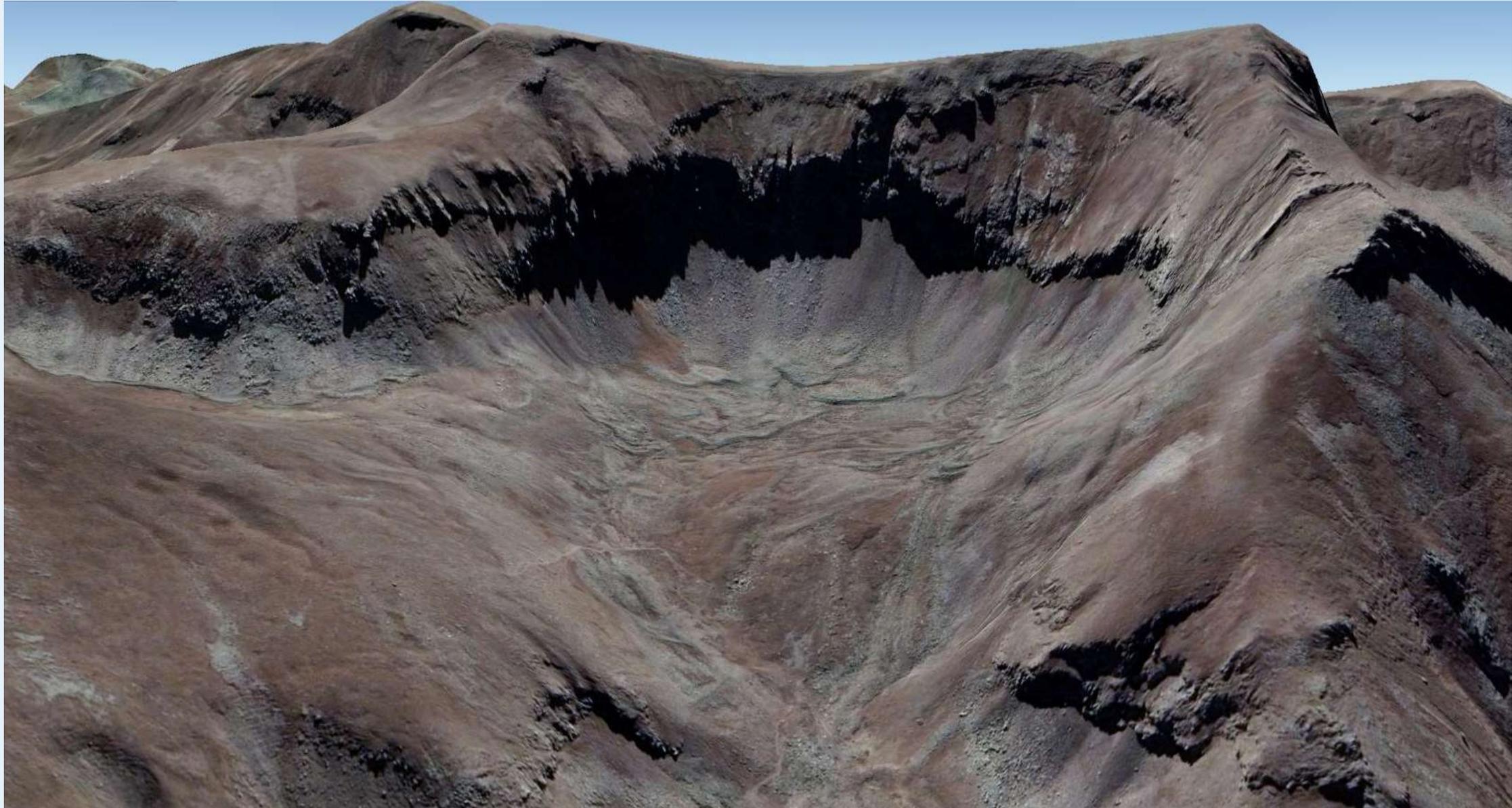
## Cirques



## Cirques



# Cirques



Cirque lakes (Tarn)



Cirque lakes (Tarn)



Cirque lakes (Tarn)



Cirque lakes (Tarn)



Cirque lakes (Tarn)



Cirque lakes (Tarn)



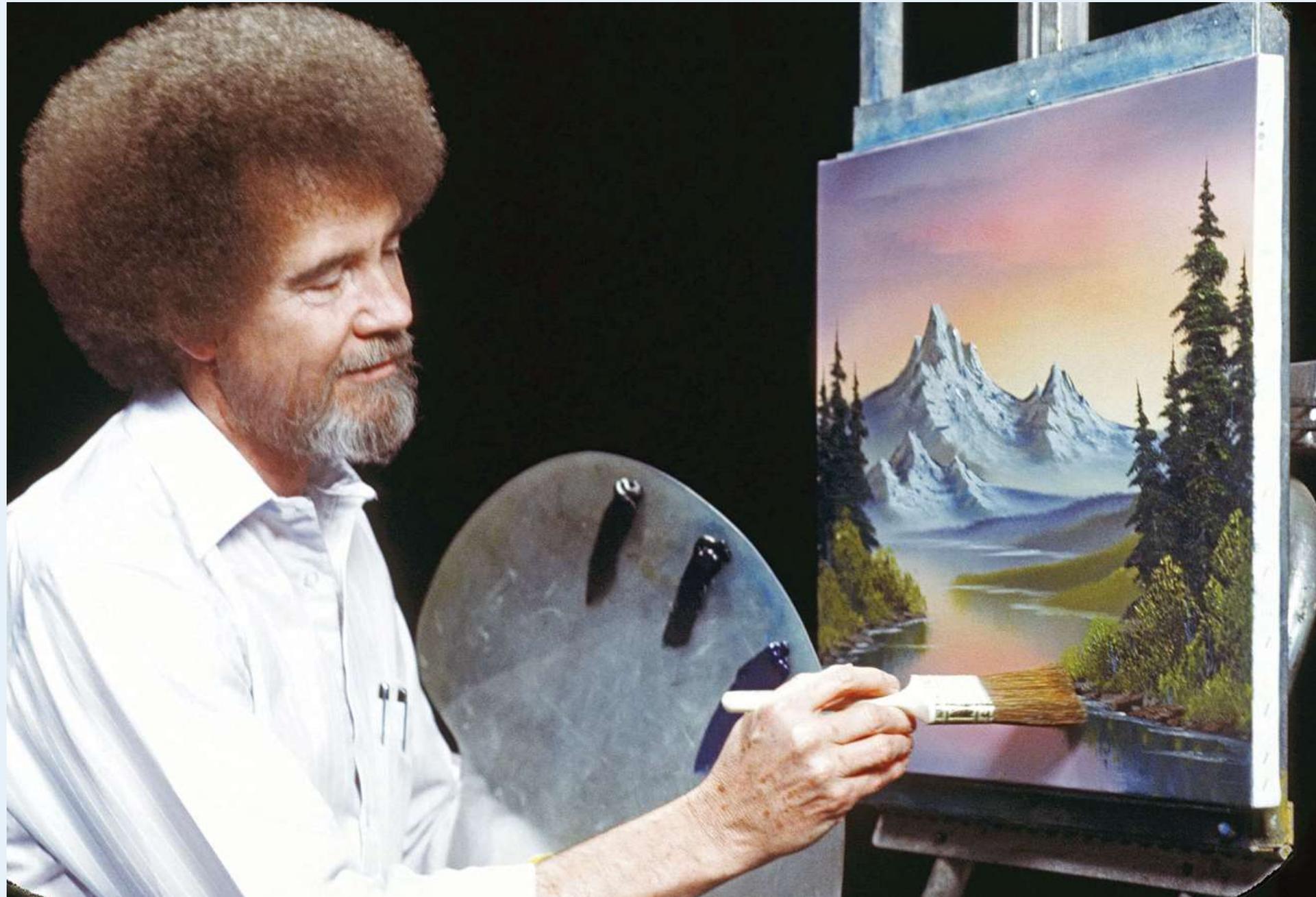
Cirque lakes (Tarn)



## Cirque lakes (Tarn)



Horn and Arête



# Erosional Processes and Landforms

# Large-scale Landforms

## Horn and Arête

When mountain peaks are eroded by glaciers from multiple sides, they form pyramidal peaks or horns. These horns characterize the landscape of glaciated mountains. The sharp summits, known as glacial horns, are shaped by the erosion of cirque glaciers coming from different directions, usually resulting in three or more cirques surrounding each horn. Horns typically feature steep slopes and sharp, jagged ridges that extend to the summit.



## Horn and Arête

Aretes are sharp ridgelines with steep slopes formed between pyramidal peaks due to glacial erosion from both sides. They may sometimes consist of small, tooth-like towers, resulting from the backward erosion of glaciers that separate two neighboring cirque or valley glaciers.



Horn and Arête



# Erosional Processes and Landforms

## Horn and Arête

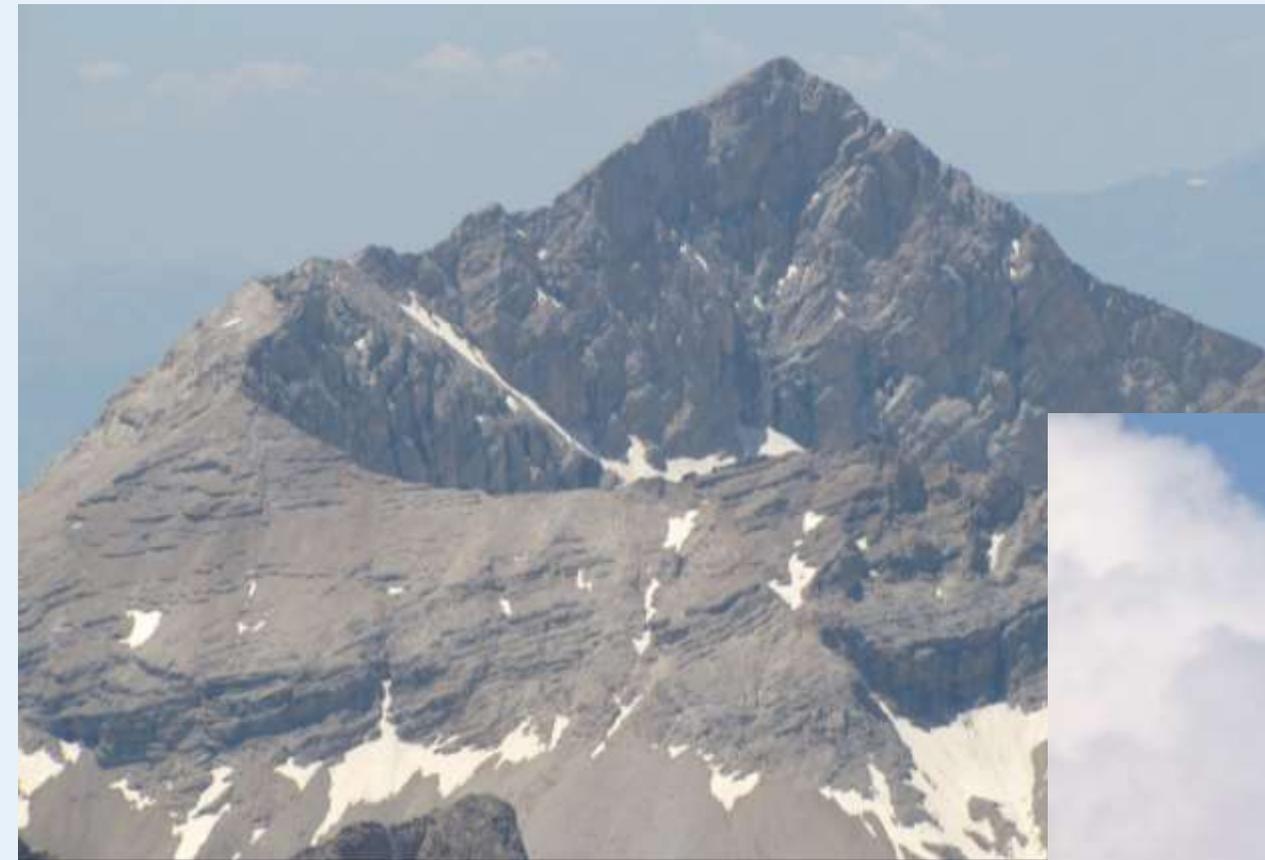
Alpine landscape

## Large-scale Landforms



# Erosional Processes and Landforms

## Horn and Arête



# Large-scale Landforms



## Horn and Arête



Horn and Arête



## Horn and Arête



Horn and Arête



## Horn and Arête

Aiguille du Dru  
Les Drus



Horn and Arête



Horn and Arête



Horn and Arête



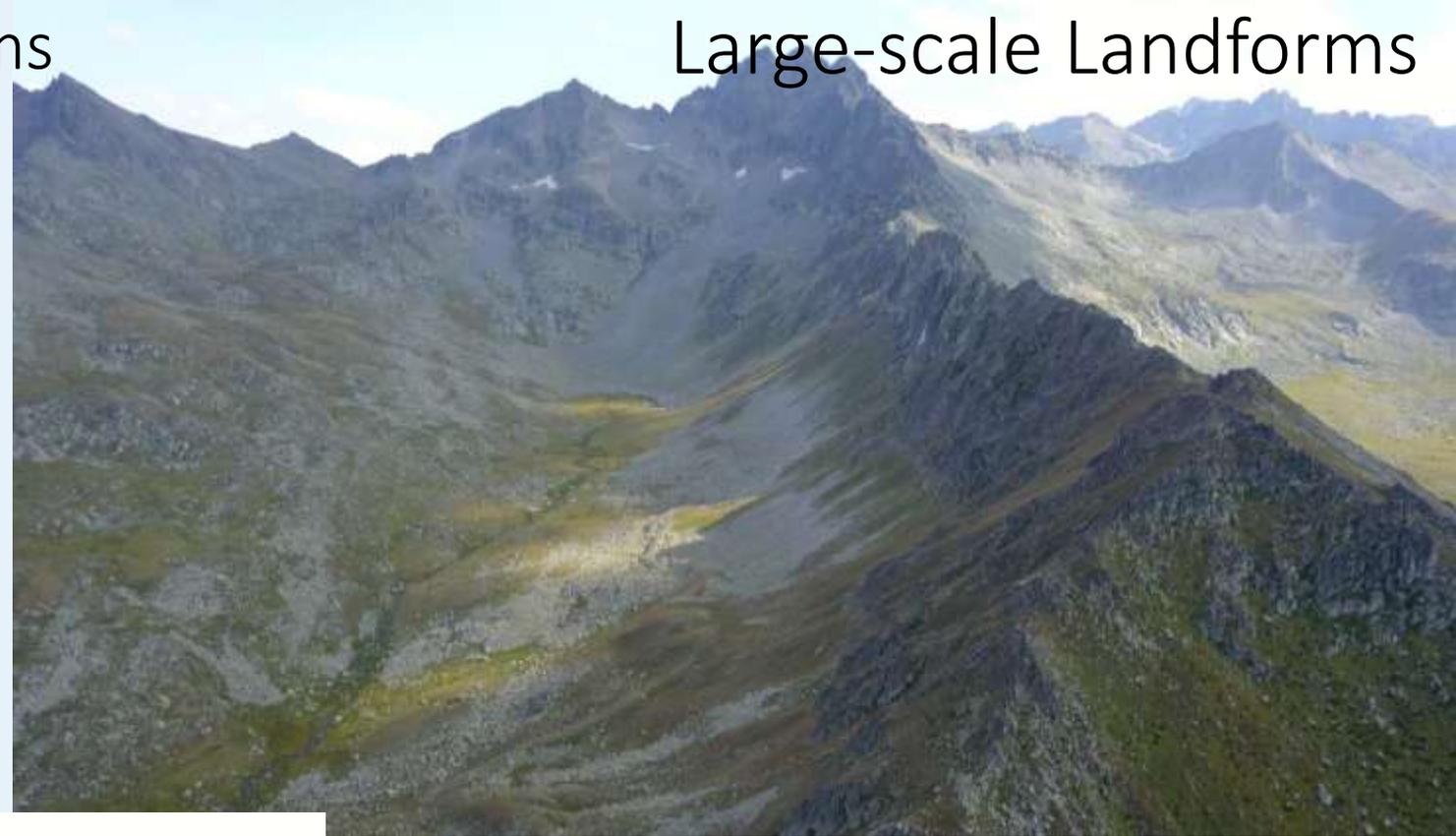
**Horn and Arête**



# Erosional Processes and Landforms

## Horn and Arête

# Large-scale Landforms



**Horn and Arête**



Horn and Arête



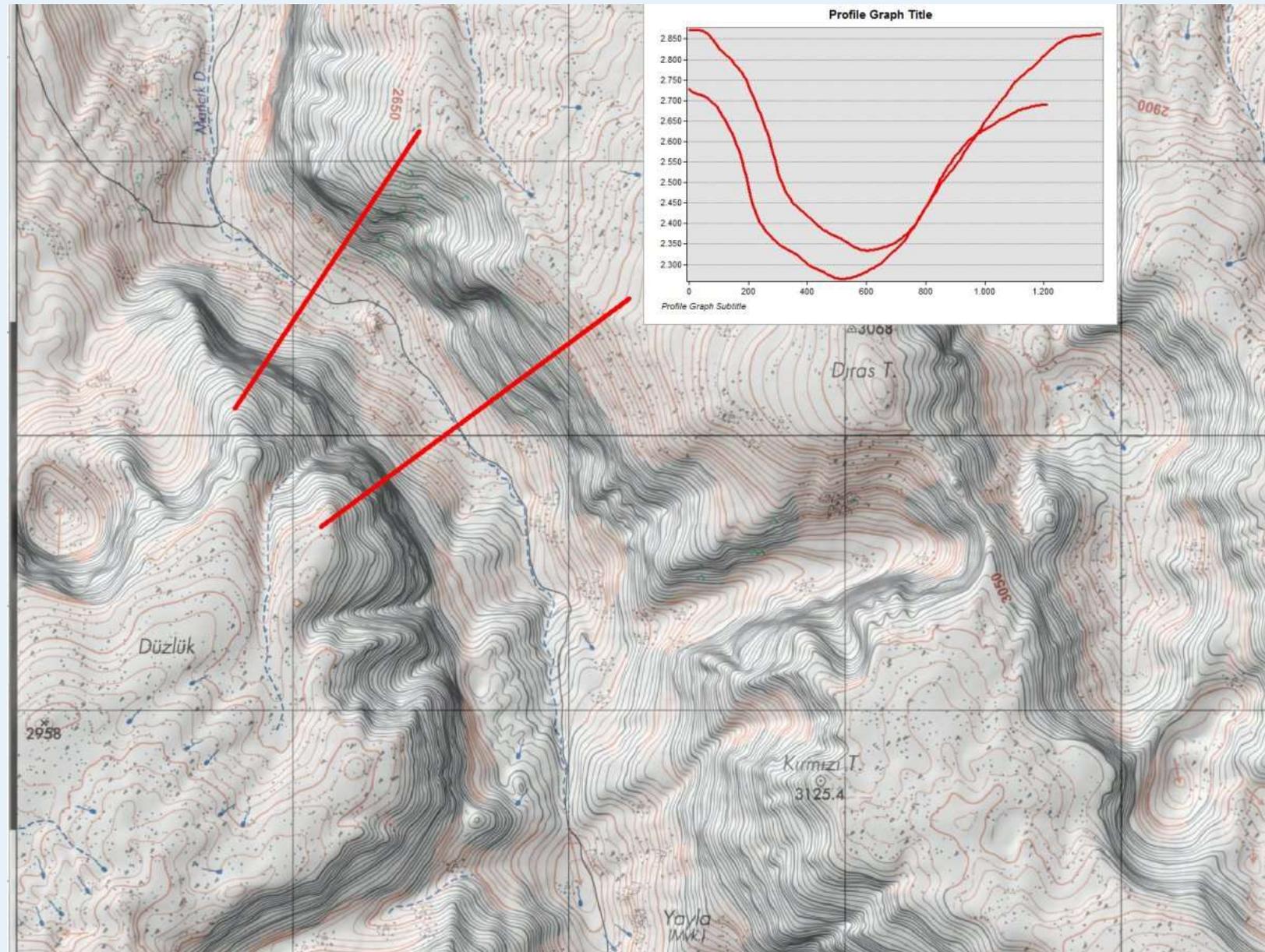
## Glacial Troughs (U-shaped) and Fjords

Glacial troughs are valleys eroded by glaciers, characterized by steep, smooth valley sides without spurs and a rounded 'U-shaped' cross-section.

Fjords are a type of glacial trough that extends into the ocean, usually being the largest examples of glacial troughs.

They vary in size, from troughs in mountain areas that are hundreds of meters wide to fjords that can stretch several hundred kilometers in length and reach depths of thousands of meters.

Glacial troughs can be found in mountain regions worldwide, where glacier erosion has significantly shaped the landscape.

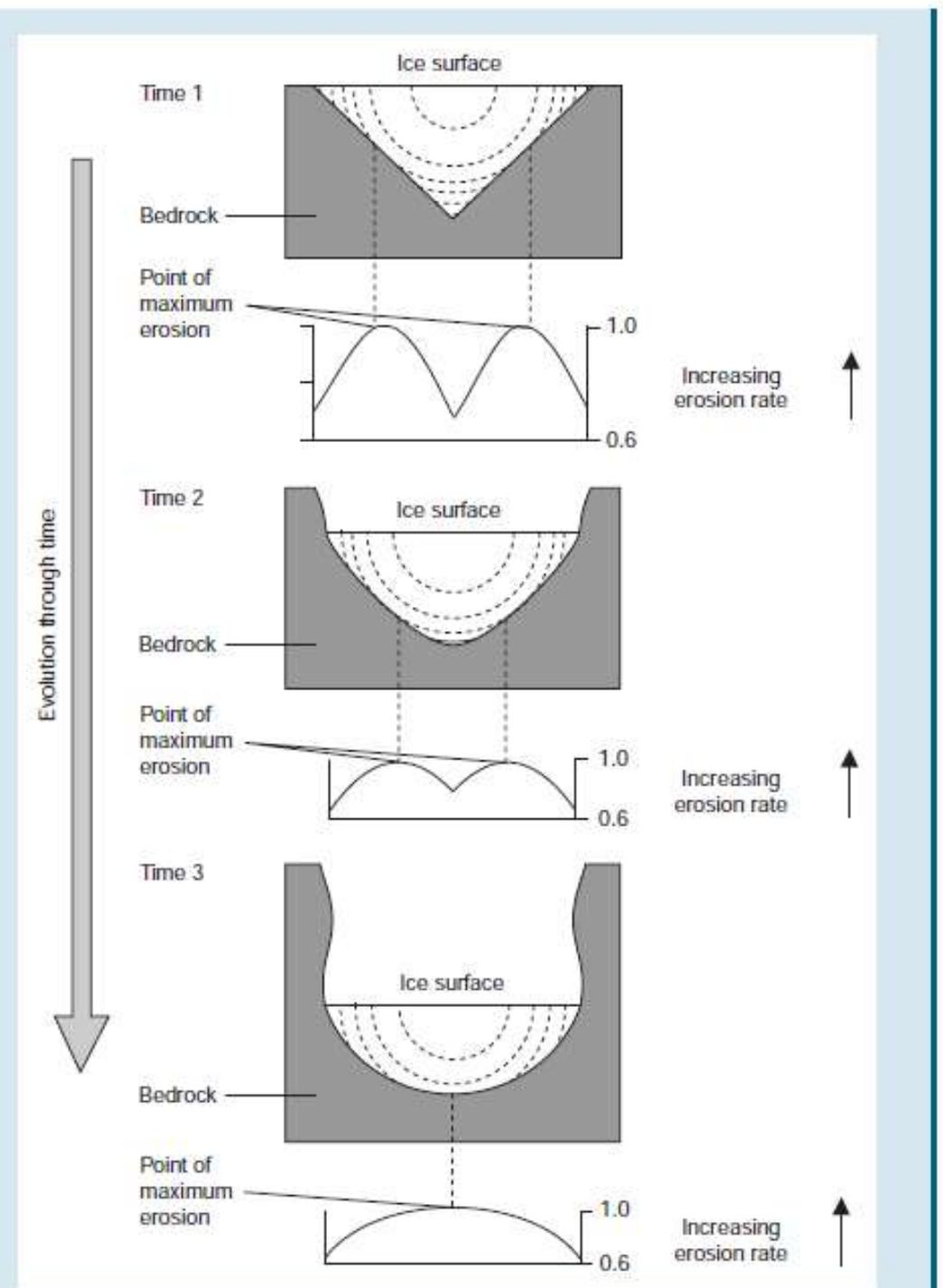


# Erosional Processes and Landforms

## Glacial Troughs (U-shaped) and Fjords

The U-shaped cross-section is a result of glaciers eroding to reduce friction at their base; Alpine glaciers tend to deepen these troughs, while ice sheets tend to widen them.

In an ideal V-shaped valley, the highest basal velocity and erosion rate occur at a certain height along the valley sides, which helps explain the transition to a U-shaped form. Once the valley becomes U-shaped, the basal velocity peaks at the mid-valley floor, and ongoing glacial erosion continues to deepen the valley.



Source: Harbor, J.M., Hallet, B. and Raymond, C.F. (1988) A numerical model of landform development by glacial erosion. *Nature*, 333, 347-9. [Diagram modified from: Harbor *et al.* (1988) *Nature*, 333, figure 1, p. 348]

# Erosional Processes and Landforms

## Glacial Troughs (U-shaped) and Fjords

# Large-scale Landforms



# Erosional Processes and Landforms

## Glacial Troughs (U-shaped) and Fjords

# Large-scale Landforms



# Erosional Processes and Landforms

## Glacial Troughs (U-shaped) and Fjords



# Erosional Processes and Landforms

## Glacial Troughs (U-shaped) and Fjords

# Large-scale Landforms



# Erosional Processes and Landforms

## Glacial Troughs (U-shaped) and Fjords

# Large-scale Landforms



# Erosional Processes and Landforms

## Glacial Troughs (U-shaped) and Fjords

# Large-scale Landforms



# Erosional Processes and Landforms

## Glacial Troughs (U-shaped) and Fjords

# Large-scale Landforms



# Erosional Processes and Landforms

## Glacial Troughs (U-shaped) and Fjords

# Large-scale Landforms



# Erosional Processes and Landforms

## Glacial Troughs (U-shaped) and Fjords

# Large-scale Landforms



# Erosional Processes and Landforms

## Glacial Troughs (U-shaped) and Fjords

# Large-scale Landforms



# Erosional Processes and Landforms

## Glacial Troughs (U-shaped) and Fjords

# Large-scale Landforms



# Erosional Processes and Landforms

## Glacial Troughs (U-shaped) and Fjords

# Large-scale Landforms



# Erosional Processes and Landforms

## Glacial Troughs (U-shaped) and Fjords

# Large-scale Landforms



# Erosional Processes and Landforms

## Glacial Troughs (U-shaped) and Fjords

# Large-scale Landforms



# Erosional Processes and Landforms

## Glacial Troughs (U-shaped) and Fjords

# Large-scale Landforms



# Erosional Processes and Landforms

## Glacial Troughs (U-shaped) and Fjords

# Large-scale Landforms





# Erosional Processes and Landforms

## Glacial Troughs (U-shaped) and Fjords

## Large-scale Landforms

### Hanging valleys

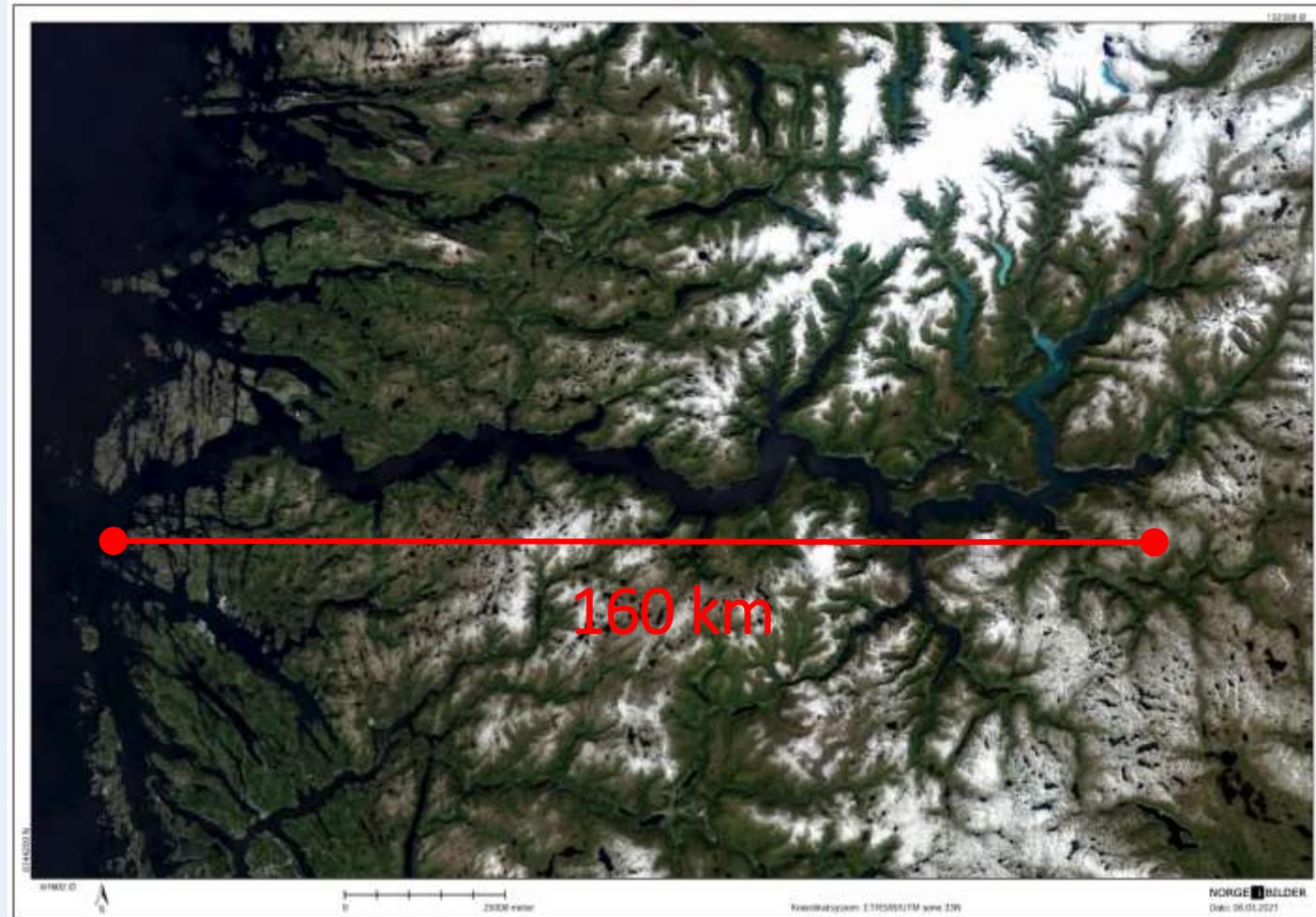
Main glacial valleys are connected to tributary valleys in a hanging manner because the larger main glacier carves a wider valley cross-section and cuts deeper than the thinner glaciers in the tributary valleys. As a result, the floors of the tributary valleys are elevated compared to the main valley floor, causing them to hang. These hanging valleys sometimes have streams flowing from their floors, creating waterfalls on the slopes of the main valley.



# Erosional Processes and Landforms

## Glacial Troughs (U-shaped) and Fjords

# Large-scale Landforms



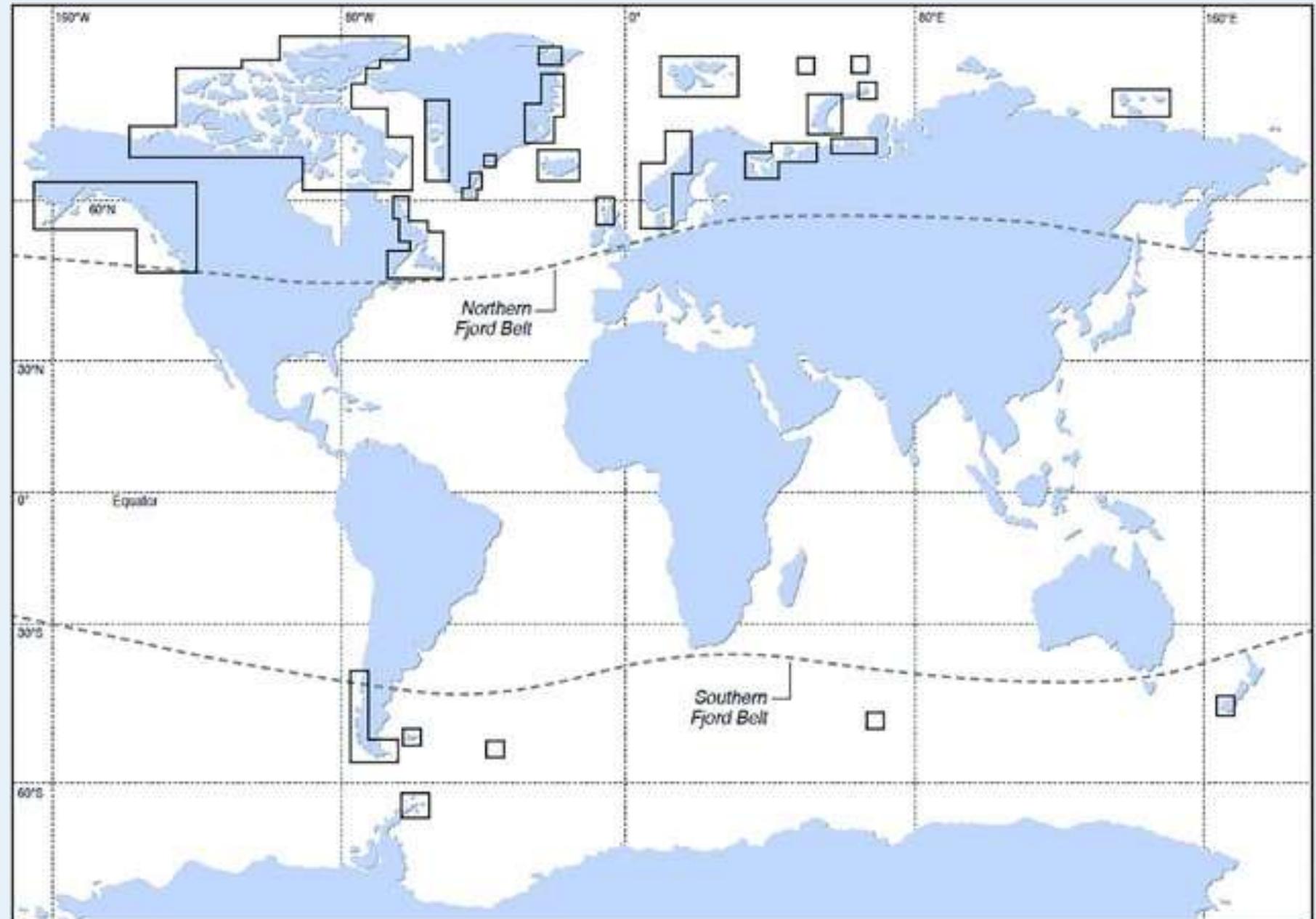
# Erosional Processes and Landforms

## Glacial Troughs (U-shaped) and Fjords

# Large-scale Landforms

## Distribution of Fjords

- Norway
- Iceland
- Spitsbergen (Svalbard)
- Greenland
- Canada
- Alaska
- Patagonia
- Antarctica
- New Zealand



[https://www.researchgate.net/publication/339626378 Fjords as Aquatic Critical Zones ACZs/figures?lo=1](https://www.researchgate.net/publication/339626378_Fjords_as_Aquatic_Critical_Zones_ACZs/figures?lo=1)

# Erosional Processes and Landforms

## Glacial Troughs (U-shaped) and Fjords

# Large-scale Landforms



# Large-scale Landforms



# Erosional Processes and Landforms

## Glacial Troughs (U-shaped) and Fjords

# Large-scale Landforms

