

## FOSCAGNO ROCK GLACIER

Not far from Foscagno Pass you can observe a typical form of high-altitude landscapes of great interest: a rock glacier! The term glacier must not mislead us, we are outside the glacier system and instead we are visiting the periglacial system, the realm of "permafrost", of which the rock glaciers are the most evident expressions!

The term permafrost refers rock or soil that has been frozen for at least 2 consecutive years. In general, permafrost is characterized by a superficial layer, which melts in summer, and by a deep layer that is permanently frozen. The ice core hidden by rock, debris or soil can be massive or interstitial and the layer affected by the permafrost can vary from a few tens of meters to over 200 meters thick!

The European record for permafrost thickness was reached not far from Passo del Foscagno, at Passo dello Stelvio, where at over 3000 m of altitude the researchers of the SHARE STELVIO project found permafrost up to over 200 m of depth. The drilling that enabled this discovery was instrumented from top to bottom with thermometers that detected subzero temperatures for two consecutive years at the base of the hole, over 200 m deep! It is therefore not surprising that rock glaciers are so widespread in this area of the Alps!

The national rock glacier inventory reports over 1200 of them in the Italian Alps! About a third of the total is located in Lombardy and Valtellina has many medium and large ones!

The movement of rock glaciers is much slower than that of real glaciers! While a glacier moves several tens of meters per year, a rock glacier is characterized by a movement of a few centimeters or decimeters per year, difficult to detect without high-precision instruments! The wrinkles and lobes that characterize a rock glacier are the direct consequence of this very slow and continuous movement.

It is difficult to recognize the presence of a rock glacier! Often these fascinating bodies are mistaken for stony grounds or rock accumulations, but instead hide a heart of ice under a debris cover.

To understand what we are talking about we take a look at Foscagno rock glacier, located in the glacier modelled valley called Forcellina cirque, which opens SW of the Foscagno Pass. Foscagno rock glacier has a complex structure; it is in fact formed by several partially overlapping lobes that distinguish the various inactive portions (which do not move and are vegetated, testifying to the ceased dynamic) from those still active (with movement, not vegetated and probably with ice still present inside). For example, the lower portion, which reaches 2390 m, is covered with grass and is undoubtedly inactive.

It should be emphasized that in Forcellina cirque there was a small white glacier, i.e. not covered by debris, until the early 1930s. This suggests that the current rock glacier of Foscagno, like many others in the Alps, may derive from the transformation of a real glacier which over a period of even thousands of years was buried by collapses and landslides and progressively buried until it became a rock glacier.

In many other cases the ice present inside the rock glaciers is different in crystalline structure from glacier ice, it does not derive from the accumulation and transformation of snow and results from complex melting and freezing processes which then lead to the formation of permafrost which cement the boulders.

After having met and observed the rock glacier of Foscagno we will look at the accumulations of rocks in the high mountains with different eyes, asking ourselves if we are in front of a permafrost event!