Permafrost Excursion to Hochebenkar Rock Glacier/Oetztal Alps

1. Basic information

The excursion goes to the inner Oetz Valley which is situated in the heart of the Oetztal Alps (Central Eastern Alps, Tyrol/Austria).

Starting point: Obergurgl (1910 m a.s.l.), easily accessible by car or bus via the Oetz Valley. Nearest railway station Oetztal – from there frequent bus connections to Obergurgl.

Duration: The excursion at least lasts a half day (Obergurgl – rock glacier Outer Hochebenkar), yet it is recommended to stay a whole day which allows to visit also the summit of Hohe Mut (2659 m a.s.l.) and Langtalereck refuge (2430 m a.s.l.) as described in the itinerary.

Requirements: High alpine hiking tour with demand of good alpine equipment (solid boots, warm and water-proof clothes, shelter against sunburn). Yet the tour entirely runs on marked mountain paths so that there are no specific dangers for visitors except of situations with snowcover or bad weather conditions.

Recommended time: End of June to end of September.

Maps: Oesterreichische Karte 1:50.000, sheet 2103 Vent and 2104 Sölden; Alpenvereinskarte 1:25.000, sheet 30/1 Ötztaler Alpen, Gurgl (the latter is the best available topographical map)

Further information: Besides the specific papers on the Hochebenkar rock glaciers there is a compact excursion description: Patzelt G., Stötter J., Nicolussi K., Wastl M. (2007): Indicators of Past and Present Climate Changes: Excursion from Obergurgl to Gurgler Ferner. In: Kellerer-Pirklbauer A., Keiler M., Embleton-Hamann C., Stötter J. (eds.), Geomorphology for the Future. Innsbruck University Press, Conference Series. Innsbruck, pp. 13-22.

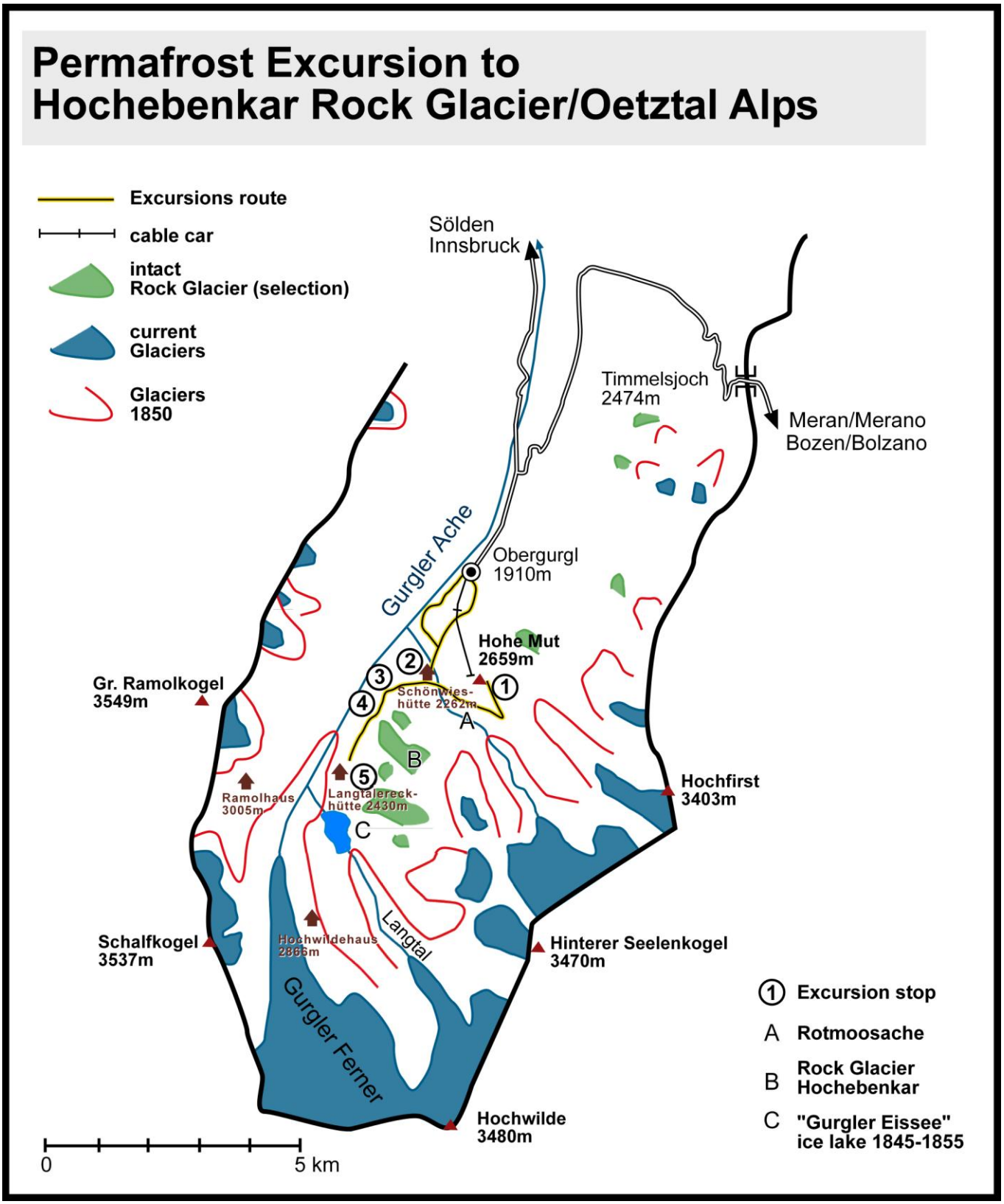
2. Permafrost and other high mountain features

The main topic of the excursion is the observation of the rock glacier in Outer Hochebenkar which ranks among the best known active rock glaciers of the entire Alps. There is a long tradition of research dating back already to the 1930ies when Pillewizer for the first time measured the surface velocity along two transversal profiles. Since then the surface velocity as well as the changes of surface velocity and volume have been monitored again and again thus enabling a very detailed knowledge of the behaviour of the permafrost system according to its response to climatic and topographic conditions. The latter ones have made the rock glacier quite famous in recent years because the snout advanced down over a steep slope approaching the road situated beneath it.

Picture 1: Overwiew of the Rock glacier Outer Hochebenkar seen from the opposite side of the Gurgl Valley in southeastern direction. To the right one can see the rock glaciers at the margin of Inner Hochebenkar (Photo: Krainer)

Furthermore the excursion offers a great opportunity to study a rock glacier system in the context of other elements of the high mountain environment. Among them are:

- Current glaciers and their retreat since the Little Ice Age advance
- Holocene glacial history documented within a peat bog
- Altitudinal limits of vegetation, especially the timberline ecotone
- Erosional and gravitational processes on steep slopes
- Traditional landuse systems which have partly been preserved
- Changes in the socio-economic system under the influence of mass tourism
- Impacts of technical measures on vulnerable environments
- Natural hazards and hazard protection



Picture 2: Overview map (with excursion route and stops)

3. Itinerary

The excursion starts in Obergurgl (1910 m a.s.l.) from where a cable car brings you in a few minutes to the summit of Hohe Mut (2659 m a.s.l., stop 1) which ranks among the most spectacular view points of the Oetztal Alps. From here you first take the marked path to Mutsattel (2556 m a.s.l.) and then the path which leads to the right descending across a steep slope in Western direction (special attention in wet conditions!) to valley bottom of Rotmoos. Here you pass an artificial pond – the water in it is stored to produce artificial snow in winter –, cross the Rotmoosache (Ache = local name for creek or river) via a bridge and reach Schoenwieshuette (2262 m a.s.l., stop 2). This refuge offers a restaurant thus representing a good resting point. Walking time 40-50 minutes.

Schoenwieshuette can also be reached without using the cable car. For the ascent there are two alternatives: (1) the direct route using a road closed for public traffic directly through a part of the Obergurgl skiing area (sign 922) with a walking time of 70-90 minutes. (2) the path through the famous "Gurgler Zirbenwald" (picturesque stands of Pinus cembra; nature trail with guide book about biological aspects available also in English) which avoids the skiing area and thus gives more natural impressions with a walking time of 90-100 minutes.

From Schoenwieshuette you continue the tour along a narrow jeep track (marked route with sign 922) to Gurgler Alm (2255 m a.s.l., a small hut which serves as a shelter for the shepherds, stop 3) where you see the snout of the rock glacier Outer Hochebenkar for the first time. The track approaches the rock glacier (stop 4) and then leads further to the Southwest – in between crossing the deposits of a Holocene landslide – to Langtalereckhuette (2430 m a.s.l., stop 5). This refuge is run by the German Alpine Association and offers a restaurant, too. It is a great viewpoint especially for observing glaciers and glacial history. Walking time from Schoenwieshuette 60-70 minutes.

The way back to Schoenwieshuette is the same (40-50 minutes). From there you can choose one of the alternatives described above in the opposite direction (1: another 40-50 minutes, 2: 50-60 minutes).

An alternative offering a better overview of the entire Hochebenkar rock glacier system is the mountain path 902 which leads across the slopes on the opposite side of the Obergurgl valley to Ramolhaus (3006 m a.s.l.). After a walking time of some 90-120 minutes there is a splendid view to Hochebenkar though with the disadvantage of the remarkable distance of more than 2 km of the rock glacier.

4. Suggested excursion stops

Stop 1: *Hohe Mut (2659 m a.s.l.)*

The summit of Hohe Mut has been accessible by a chair lift since the 1950ies. The infrastructure of that time was replaced by a modern cable car, a panorama restaurant and a broad ski track in 2007. The smoothed shape of the summit and the adjacent ridge to the Southeast was formed during the Pleistocene glaciations maxima when these topographic features were covered by ice masses whose surface can be assumed in some 2800 m a.s.l. – the rough morphology of the higher crests and mountain tops is due to the fact that they towered above the ice masses and thus were sharpened by glacial erosion. The panorama shows most of the inner Oetz Valley with nearly all elements of a high alpine landscape. Furthermore there is a nice view to the village of Obergurgl whose development from a small rural settlement with only four farmsteads to a major tourist resort offering some 4000 guest beds within only a half century can be observed well from here. Due to the inner alpine climate conditions grassland farming and perennial settlement has been possible here up to almost 2000 m a.s.l. ranking among the most elevated settlements of the entire Alps. Also other altitudinal limits are to be found at high elevations, e.g. the current timberline up to 2200 m a.s.l. and the equilibrium line of glaciers depending on exposure at 2900-3200 m a.s.l.
The Oetztal and the Stubai Alps (which you see in the North) are built of crystalline rocks such as gneisses and micaschists. The view to the Southeast is of specific scenic quality showing two valley glaciers, Gaisbergferner (left, Ferner = local name for glacier) and Rotmossferner (right). The latter has covered an area of 4.6 km^2 during the LIA maximum (around 1855) from which 38 % have disappeared until 1998. In the mid 19th century 25.5 % of the entire Oetztal catchment area (210 km^2) were glaciated, in 1998 the respective area was 115 km^2.

Stop 2: *Schoenwieshuette (2262 m a.s.l.)*

Schoenwieshutte is located above the uppermost part of the gorge of Rotmoosache which developed due to the larger amount of erosion in the main valley thus forming a typical hanging valley. There is a fine view towards the innermost part of Rotmoos Valley with the LIA moraine of Rotmoosferner – the current glacier has yet retreated to such an extent that it is no longer visible from here. Rotmoos is a peat bog which is partly exposed by lateral erosion of the Rotmoosache. It is the type locality of the so called “Rotmoos Variation” in mid Holocene times. Within the pollen profile which has been investigated at least twice the accumulation of glaciofluvial sediments indicates a cool and humid period between 4000 and 3000 BC corresponding well with findings from other sites in the Alps – at that time Rotmoosferner was approximately as large as in the mid 19th century.
The surroundings of the refuge are currently above the timberline. There is evidence from a pollen profile that this was not the case during long periods of the Holocene for which the timberline can be reconstructed at 2300-2400 m. The depression of the timberline is primarily caused by human impacts which started as early as 6000 years ago with pasture activities.

Picture 3: Schoenwieshuette offers an impressive high mountain scenery when looking to the Southeast. In the centre you see the peat bog Rotmoos and the LIA moraines of Rotmoosferner, in the background left the smooth ridge of Hohe Mut and the peaks on the central crest of the Oetztal mountains.

Stop 3: *Gurgler Alm (2255 m a.s.l.)*

The predecessors of this shepherd shelter probably date back to prehistoric times (as mentioned above alpine pasturing has been proved already since the Neolithic period), the current building is still used for its original purpose. From here there is the best view of rock glacier Outer Hochebenkar which creeps down from the cirque between Hangerer (3021 m a.s.l.) and Hochebenkamm (3149 m a.s.l.). While the cirque itself is not visible the tongue of the rock glacier attracts attention because its bouldery surface contrasts to the surrounding areas which are widely covered with alpine meadows. This observation illustrates the fact that the rock glacier itself actively pushes the permafrost down to elevation where permafrost usually is absent. The lower limit of the rock glacier currently is situated at some 2370 m a.s.l. The entire rock glacier covers an area of 0.42 km^2 and with a total length of 1000 m represents one of the largest active rock glaciers of the Austrian Alps. Measurements of surface movement had first been carried out by Pillewizer in 1938 and since then several times using different methods altogether creating one of the longest continuous records of a rock glacier's surface velocity in the Alps. Furthermore numerous methods of alpine permafrost research were tested, applied and developed just here resulting in the fact that this rock glacier – together with the one in the neighbouring Inner Hochebenkar – belongs to the best known ones. The advance of the snout since the 1980ies with velocities up to 4 m/a is due to topography – the steep slope across which the advance took place is well visible from here.

Some 300 m Southwest of Gurgler Alm you see a shallow depression named Distelwies. In the centre of the depression there is a station which since 2008 measures the runoff of the creek coming down from the rock glacier snout. Discharge normally amounts to 100-300 l/sec during summer with a pronounced diurnal cycle similar to that of glacial meltwater streams.

Picture 4: Station of runoff measurement at Distelwies near Gurgler Alm. The glaciated peak in the background is Schalfkogel which ranks among the highest summits in the inner Oetz Valley.

Stop 4: *Beneath the rock glacier terminus (approx. 2300 m a.s.l.)*

The road crosses the meltwater stream coming down from the rock glacier snout in some 2300 m (small bridge). The steep viewing angle does not offer an instructive view of the rock glacier itself but the advance of the snout towards the road which is frequently used by tourists and serves as a basis for running three alpine refuges (Langtalereckhuette, Hochwildehaus, Ramolhaus) can be experienced best from here. The question arises if the advance of the snout which altogether amounted to some 200 m since the beginning of the measurements in 1938 endangers the persons using the road. So far no accident occurred but some big boulders already have approached to a critical distance. In recent times the dynamics of the advance has retarded so that currently there is no direct hazard – yet the behaviour of the rock glacier is observed with great attention.

With an experienced group it is possible to climb the pathless steep slope covered with an alpine meadow to the rock glacier snout. At the foot of the frontal slope there are some springs where temperature measurements can be carried out. These springs are only active in summer and then have a constant temperature between 0 and 1°C which is considered to be a good proof of the existence of permafrost. If you want to climb further up in order to have a closer look to the rock glacier margin and the character of the surface you can do so better on the western than on the eastern side of the rock glacier tongue.

Picture 5: View from an altitude of some 2600 m in eastern direction to the active rock glacier Outer Hochebenkar with Hangerer (left) and Hochebenkamm (right) in the background. The bouldery surface of the rock glacier and its marginal slope can well be seen.

Stop 5: *Langtalereckhuette (2430 m a.s.l.)*

The surroundings of this mountain hut are dominated by the remnants of former glaciations, e.g. whale back shaped rocks indicating glacial erosion. Of special interest is the development of Gurgler Ferner, the second largest glacier of the Oetztal Alps. His area was 16.6 km^2 in the mid 19th century and 9.6 km^2 in 1998 representing an areal loss of -42.3 % which is close to the respective value of glacier retreat in the entire Oetztal catchment area. During its maximum extents in the Holocene the glacier tongue blocked Langtal. In this tributary valley the ice-dam brought a temporary lake into existence which e.g. existed from 1845 and 1855 offering a spectacular scenery for early tourists. This is why the extent of this "Gurgler Eissee" (i.e. ice lake) is well documented by photographs, paintings and maps. Nowadays the only remnants of it are lake terraces which you can see when walking towards Hochwildehaus for some minutes. The former extent of Gurgler Ferner can easily be reconstructed by observing lateral moraines or vegetation limits.