

# THE GORNER GLACIER THROUGH THE AGES

## Panel 1

### The Gorner Glacier through the ages

When Mark Twain visited the Gorner Glacier during a tour of Europe and pondered the speed of the glacier's progress, he was overtaken by a mood of reflection and a growing sense of man's insignificance in its shadow. And it is true that glaciers have a rhythm of their own and the lifespan of a human being is too short to experience a glacier both at its maximum and most impressive extent, as for example during the mid-19th century, and during its less spectacular phases – such as we see today. There is, however, a way to speed up the “characteristic snail's pace” of a glacier (as Twain described it), at least as far as the past is concerned, and see how it has changed in length over a period of thousands of years. Using a variety of methods, including analysing old pictures and texts, interpreting archaeological clues found in the glacier's wake and dating trees and soil samples passed over or buried by the glacier during its advances, we can recreate the history of our Alpine glaciers during the postglacial period (the Holocene epoch, covering the last 11,700 years). And as Alpine glaciers are also visible and sensitive climate indicators which, depending on their size, respond with varying periods of delay to changes in the climate, their history also indirectly reflects the natural variability of the climate during the Holocene period. The history of the Gorner Glacier can be reconstructed for a continuous period of 3300 years; with some gaps we can trace it all the way back over the past 10,000 years.

On your tour you will see the geographical boundaries within which the Gorner Glacier has moved back and forth during the Holocene period, and how it turned into a troublesome and destructive neighbour during its final advance in the first half of the 19th century. You will also find out how quickly the vegetation has established itself in the new, moraine-strewn terrain, the glacier forefield that has been created by the dramatic, steady retreat of the Gorner Glacier over the last 150 years or so, and discover that there have been several such phases of re-vegetation during the history of the Gorner Glacier. As a landscape designer, the Gorner Glacier has left some interesting features for you to look out for on your walk – moraine deposits, smoothly polished rock surfaces with striations, and roche moutonnées.

### Did you know...?

- The Gorner Glacier is composed of several subsidiary glaciers (see map).
- The Gorner Glacier is the second largest (41 km<sup>2</sup>) and third longest (12.5 km) glacier in the Alps.

- The Grenz Glacier transports “cold ice” at -2 to -5 degrees Celsius, which is formed from cold firn (approx. -10 to -14 degrees Celsius) in zones at altitudes above 4200 metres in the Colle Gnifetti area.

---

**HANSPETER HOLZHAUSER Author: Text and scientific support**

**KLAUS JULEN & OTHMAR PERREN Idea for the glacier discovery trail**

**METALOOP AG Design**

**ZERMATT BERGBAHNEN AG Realization**

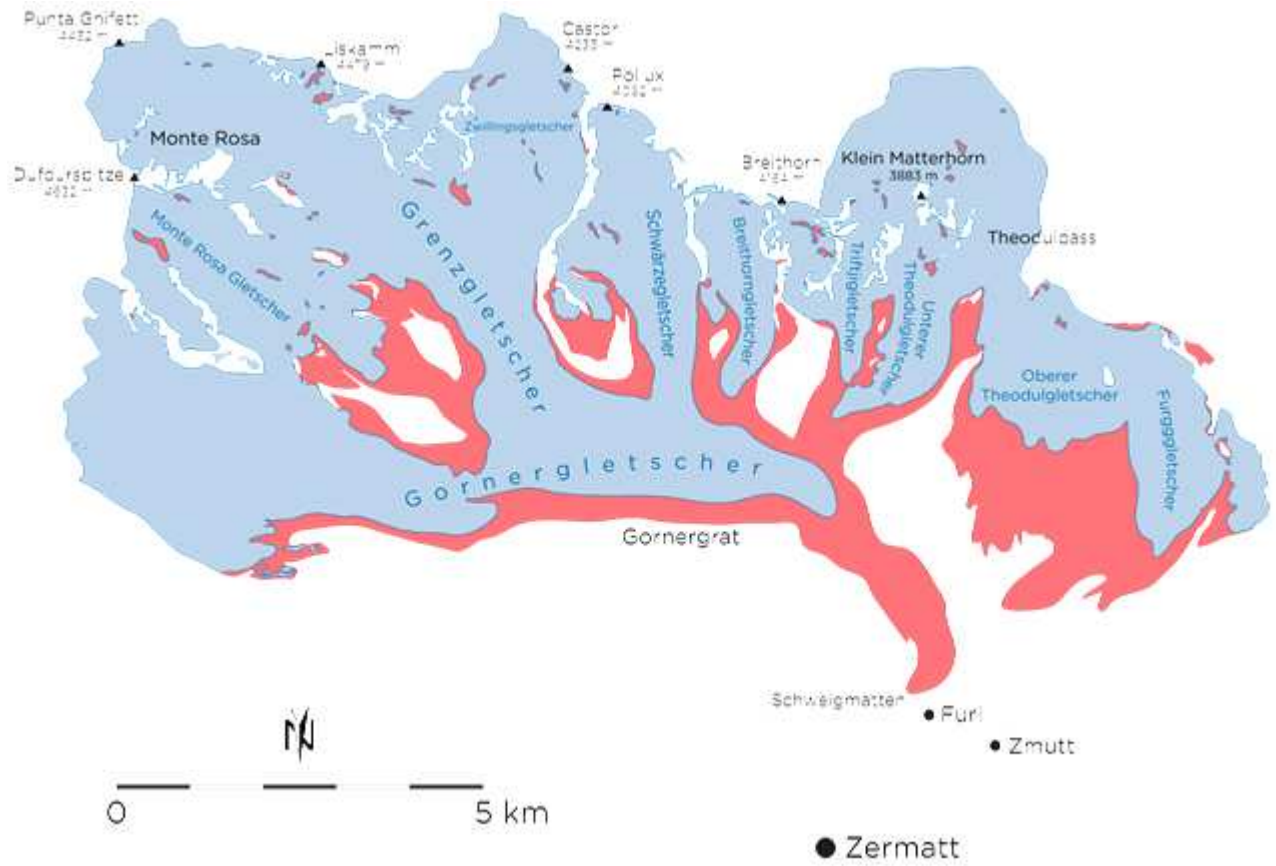
Further reading: Holzhauser, H. 2010: Zur Geschichte des Gornergletschers. Ein Puzzle aus historischen Dokumenten und fossilen Hölzern aus dem Gletschervorfeld. Geographica Bernensia G 84. 253 pages

## IMAGES

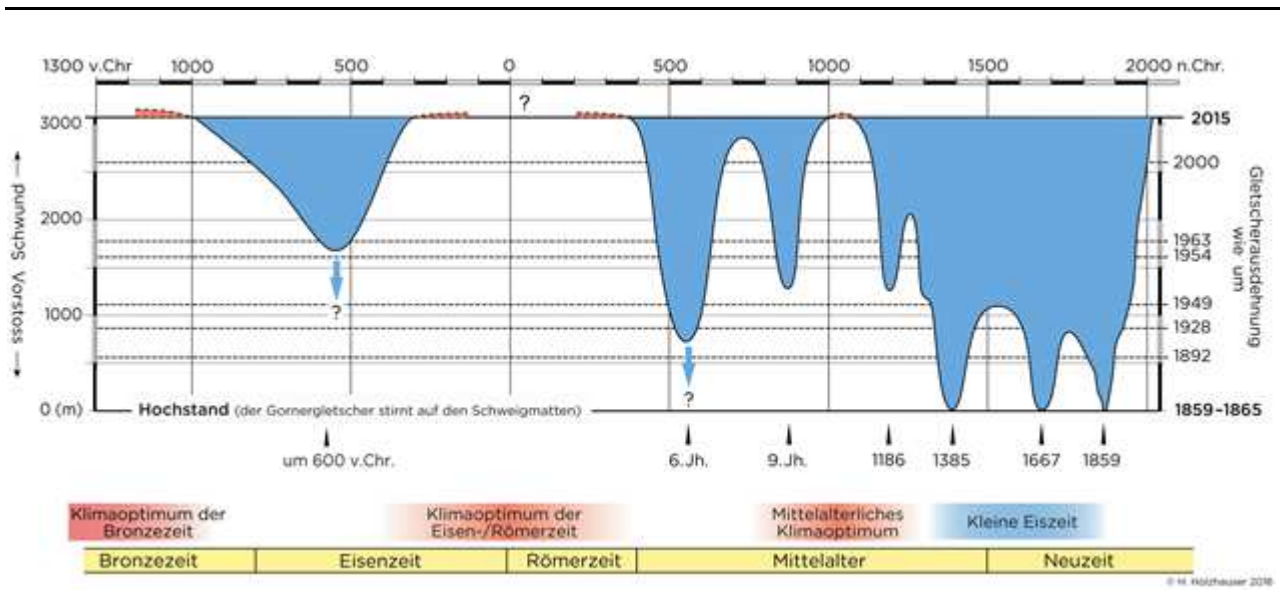


You will see a map like this on every panel during your walk (the route is marked as a dotted red line). It will show your current location (in dark red) as well as the sites of the other panels (light red). The map also shows the extent of the glacier in the 19th and 20th centuries.

---



The Gorner Glacier and its tributaries in 1859 (red) and 2015 (blue). (Map: A. Wipf, updated)



Changes in the Gorner Glacier's tongue length in the last 3300 years.



View of the snout of the Gorner Glacier in October 2015. Since it reached its maximum extent in 1859–1865 (dashed line) the glacier has become 3120 m shorter.



The Gorner Glacier in 1858, shortly before reaching the maximum extent of its advance. The glacier extended into the Schweigmatten from 1859 to 1865. In the foreground, buildings can be seen on the Furi. (Lithograph: Gabriel Loppé, Photo: J.-M. Biner).



The melting snout of the Gorner Glacier in 1876 photographed from the Furi (Ze Chännle). (Photo: A. Jullien, ETH-Bibliothek Zurich, Image Archive)

---

## Panel 2

### Maximum extent circa 1859

If you had stood on this spot in the middle of the 19th century you would have been buffeted by a biting wind – you would have been right up at the edge of the ice. Around 1859, towards the end of the Little Ice Age, the Gorner Glacier advanced to its final maximum extent, depositing this huge ridge of terminal moraine. This moraine also contains remnants from previous advances during the Holocene period such as those of 1385 and 1667. The ridge marks the outer perimeter of what is known as the glacier forefield, and also delineates the boundary beyond which the Gorner Glacier has never extended since the end of the last Ice Age 11,700 years ago.

The Gorner Glacier's advance phase, which reached its maximum extent in around 1859, is thought to have begun shortly after 1800. At that time the snout (terminus) of the glacier reached as far as the Furggbach river. In the next 60 years or so it pushed relentlessly onwards, burying fertile land and destroying large numbers of houses, barns and stable buildings. This maximum extent of the Gorner Glacier in around 1859 was followed by a period of retreat starting in about 1865. Since that time, the glacier has become 3120 metres shorter. As it receded it left behind a wasteland of moraine, which has gradually been reoccupied by vegetation. In the most forward area of the glacier forefield, a light larch forest has grown up. We know that a similar situation prevailed during the Neolithic period, when the Gorner Glacier also extended its reach slightly. Within the

glacier forefield, around 250 metres from this spot, an ancient layer of soil was discovered under the moraine. It contained a large number of pieces of charcoal which date back 7000 years and, combined with the red tinge of the soil, testify to the fact that this land was cleared by fire. Further evidence of human habitation at that time was also uncovered in an archaeological dig beneath a rock shelter near the Schwarzsee lake at about 2600 metres above sea level.

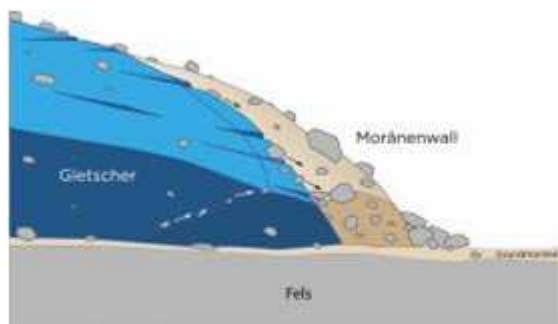
### How is a moraine ridge created?

The action of the weather and avalanches cause boulders of varying sizes to break off the rock walls around the glacier's accumulation zone and penetrate the firn and, ultimately, the ice. The glacier acts like a conveyor belt to transport these boulders down the valley, where they are eventually deposited when the ice of the glacier's snout melts. Some rocks remain on the surface of the glacier and form glacial moraine, while others fall to the sides of the glacier. If the snout of the glacier remains in roughly the same place for a long time, lateral moraine collects at the sides of the glacier and terminal moraine forms at its snout. A moraine ridge contains a multitude of large and small rocks, mostly angular in shape or angular with the sharp edges rounded off, together with a mix of gravel, sand and silt known as rock flour. This distinguishes glacial deposits from fluvial deposits, where the stones are rounded smooth (river cobbles) and where a natural sorting process takes place according to the power of the river (from gravel in the Alpine regions to fine, sandy material far down on the Swiss Plain).

### Did you know...?

- The Gorner Glacier used to be called the “grand glacier de Zermatt” or “glacier de Zermatt”, “Zermattgletscher” “Zermatt Glacier”), “Rosagletscher” (“Rosa Glacier”) or “Grosser Gletscher vom Monte Rosa” (“Great Monte Rosa Glacier”).
- The Little Ice Age lasted from around 1300 to 1850/60 and produced glacial advances which peaked in the 14th, 17th and 18th centuries.

### IMAGES



A moraine ridge is created.

Illustration: Hanspeter Holzhauser

---



The lowest section of the Gorner Glacier, the Boden Glacier, on the original ordnance map from the year 1859 (Map: A. M.-F Bétemps, Detail, ©swisstopo, 2010)



The snout of the Gorner Glacier (the Boden Glacier) in 1853, photographed from the site of the Hübélwäng above Zermatt (Photo: F. Martens, Alpine Club London, taken by H. J. Zumbühl).



The Gorner Glacier as seen from Zermatt in 1865. The picture also shows the old church and the village centre (Photo: A. Gabler).

### Panel 3

#### The Im Boden alp

In 1927, Stanislaus Kronig, then mayor of Zermatt, noted in his “Family Statistics of the Municipality of Zermatt” that in the late 18th century there had been two rows of stables to the south of the Waldbachla beck, which were completely buried under the advancing ice mass in the 19th century. And historical documents show that there were indeed over a dozen stable buildings and mountain huts here on the Im Boden alp right up to the early 1840s.

In August 1825, Samuel Birman, an amateur painter from Basel, drew these Alpine huts alongside the Gorner Glacier, which can be seen as a solidified billow of ice on a more or less even terrain, pushing a mighty ridge of moraine ahead of it and terminating ominously close to the huts. On the serpentinite outcrops called the Blatteten (but marked on the 1:25,000 map as Plattelen) a stream emerges from the glacier and flows down steep rocky steps to the snout.

The icy behemoth continued its advance in the following years. The historian Christian Moritz Engelhardt observed the inexorable progress of the Gorner Glacier between 1836 and 1839, and wrote: “Where one of the glacier’s paw-like extremities presses up to a meadow known as Im



Boden a few minutes above Forren [today's Furi - ed.] you come close up to the glacier. [...] The glacier has evidently moved forwards very recently, for along the length of its foremost terrible wall of ice the ground upon which it rests is churned up, or rather forced upwards, as when the firm mud of a street is pressed up high alongside the tracks carved by heavy carriage wheels. Just as the street mud is separated into several layers, the clay ground here has been forced up in several parallel furrows, each 7-8 feet [approx. 2-2.5 m - ed.] deep, between which were raised layers of soil approximately a foot wide, on the upper surfaces of which it was possible to walk, although they were soft underfoot and threatened to subside. [...] It is this very meadow from which the glacier's advance has already taken away a number of cattle sheds and which continues to be threatened by it."

Only a couple of years later, in 1842, the whole Im Boden alp disappeared under the glacier. We presume that most of the buildings had been taken down beforehand so that the wood could be used elsewhere.

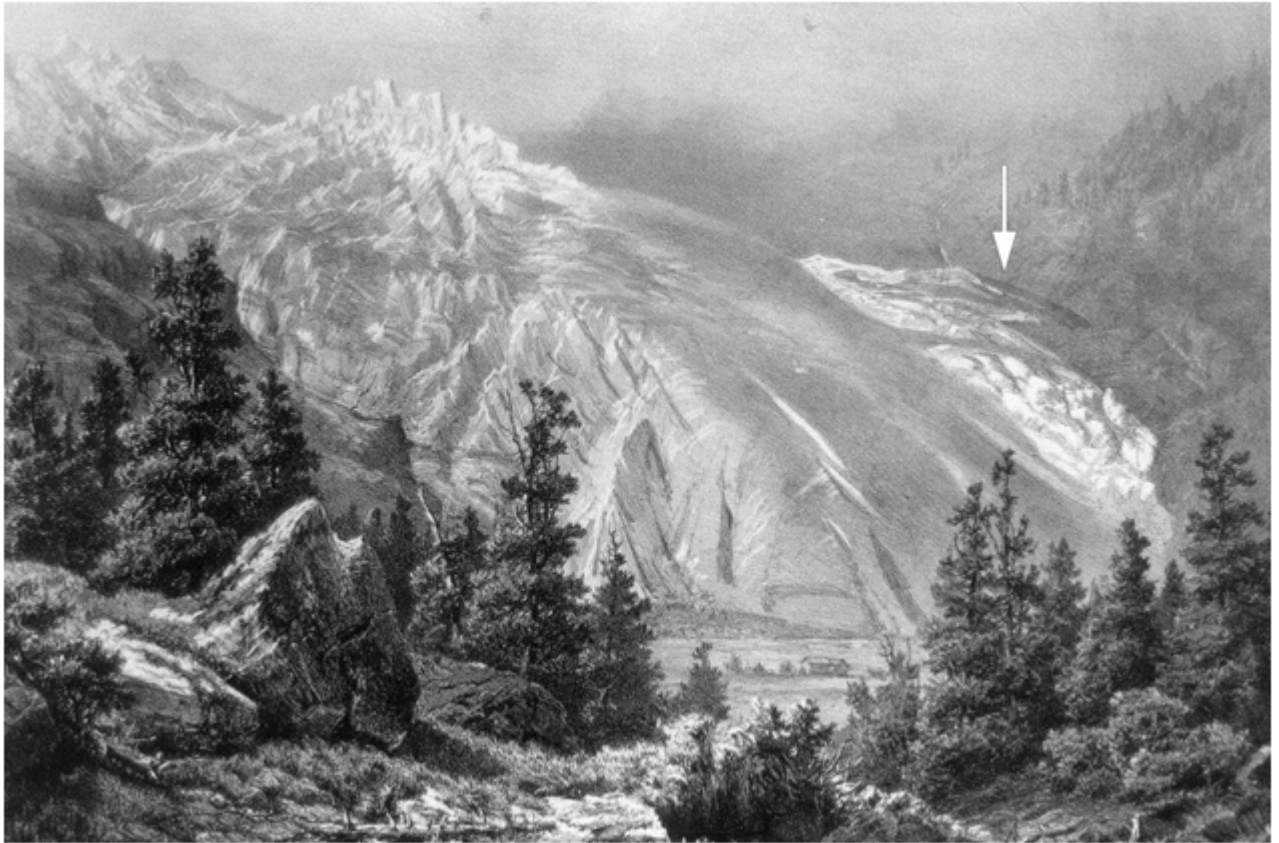
#### Did you know...?

- The lowest, tail-shaped section of the Gorner Glacier, which has now melted, was called the "Boden Glacier".
- The local name for this flat area is "dr Bode", which recalls the former Im Boden alp. This most likely gave rise to the name of the most advanced section of the Gorner Glacier at the time: "the Boden Glacier".

#### IMAGES



The Im Boden alp and the advancing Gorner Glacier in 1825. A dozen Alpine buildings can be seen in the bottom left of the picture. A torrential stream emerges from the glacier onto the Blatteten (Water colour by S. Birrmann, Kunstmuseum Basel, Martin P. Müller).



View from the Bächen to the north-west of the Schweigmatten over the snout of the vividly portrayed advancing Gorner Glacier in 1848 or 1849. Buildings in the Schweigmatten can be seen through the trees. Arrow: The Im Boden alp has disappeared under the ice. (Lithograph: C. M. Engelhardt photo: B. Perren-Barberini)



Drawing of the snout of the Gorner Glacier as seen from the lower level of the Augstchummenalp on 23 July 1835. Circled: the hamlet of Zer Briggu, which was to succumb to the glacier a few

years later. Arrow: the location of the Im Boden alp (Water colour: J. R. Bühlmann, Collection of Prints and Drawings, ETH Zurich).

---

#### Panel 4

##### **Glacial polish on hard serpentinite**

The environment shaped by the glacier is impressive indeed. The Gorner Glacier created this typical glacial landscape both by abrasion and depositing, leaving rocks which have been worn to a round, smoothly polished finish, isolated boulders, and between them a covering layer of moraine. Looking into the Gorner Gorge, we can see hollows both large and small, created by the force of the waters of the Gornera river, the run-off from the Gorner Glacier.

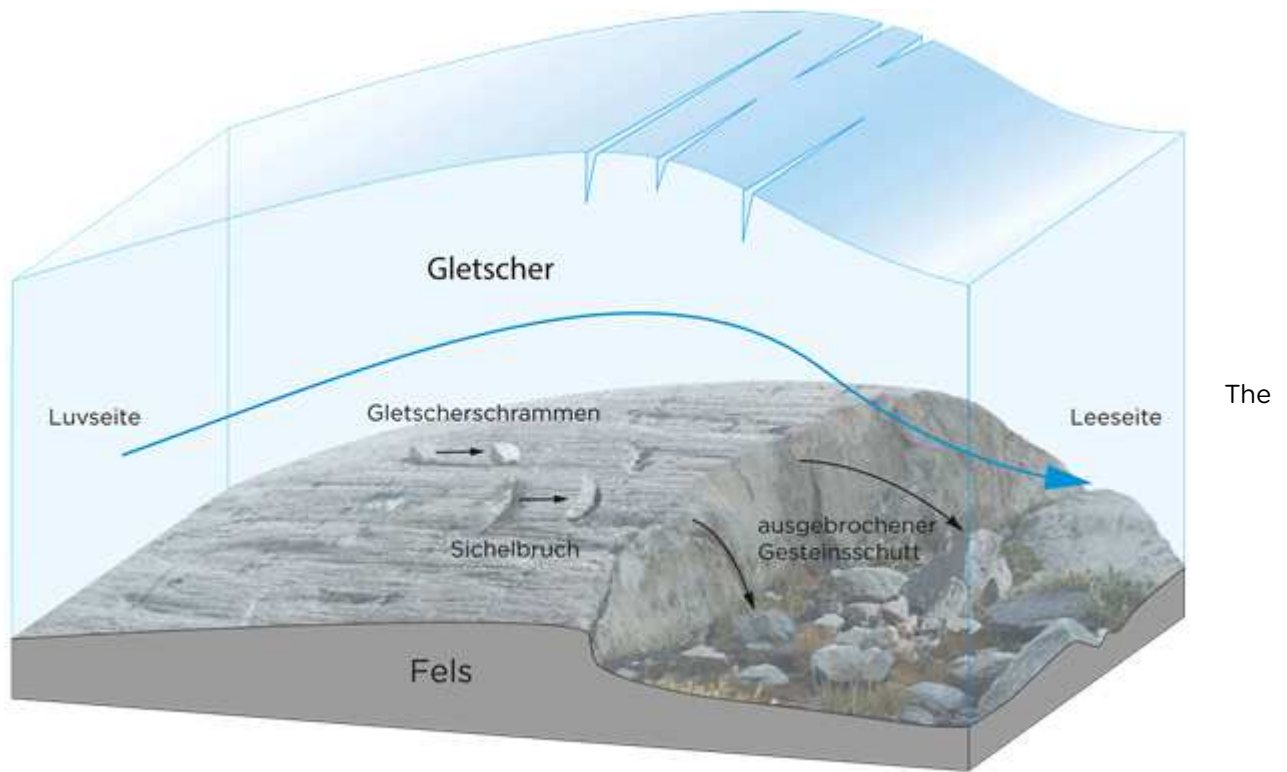
The abrasive effect of the glacier can be compared with sandpaper rubbing on a piece of wood. Grains of sand and rock flour carried in the ice and melt-water have eroded the rocks in their path. Sharp stones frozen within the ice and carried in the underside of the glacier have been scraped across rock surfaces by the movement of the glacier, leaving scratches and deep furrows, or glacial striations. These reveal the direction of the ice flow. Striations are a clear indication of glaciation and played a major role in the acceptance of ice age theory in the mid-19th century. Up to this point, it was believed that powerful bodies of water had been responsible for depositing the large boulders of non-local stone, known as erratics, found in the Swiss Plain (flood theory).

In places we can see whale-shaped outcrops of rock known as roches moutonnées. The side facing the glacier (the stoss side) slopes up gently and is polished smooth. The side of the roche moutonnée facing away from the glacier (the lee side) drops steeply. As a result of differences in pressure the rock was frozen to the ice here, with pieces being split off due to the movement of the ice. This also created smaller chip marks on the basal rock surface, which we call chatter marks.

##### **Did you know...?**

- The erosive effect of glaciers was underestimated for a long time. Even in the early 20th century, it was still thought that U-shaped valleys like the Lauterbrunnental were primarily the result of water erosion, which was then just exaggerated by the action of the glacier.
- Twenty-four labourers were killed during the construction of the Lötschberg Tunnel on 24 July 1908 when loose rock collapsed into the tunnel gallery. The geologists believed that the Gasterntal valley had not been carved out as deeply by the glacier during the Ice Age as it really had, and therefore thought the tunnel was intended to be driven through solid rock.

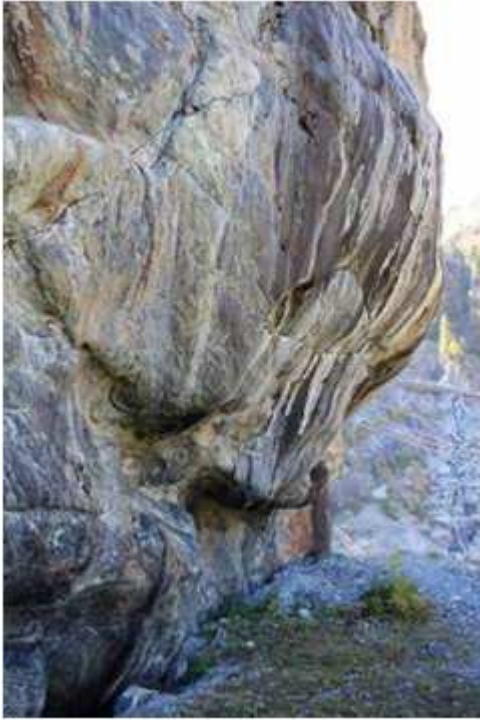
## IMAGES



The creation of a roche moutonnée.  
Illustration. Hanspeter Holzhauser



Glacial striations on the raised, highly polished serpentine.



Boulders polished and hollowed out by the glacier, to the south-west of the glacier garden.

---



Eroded boulders in the forefield of the Gorner Glacier. The direction of the ice flow is easy to identify from the long, deep grooves (striations).

---



Roche moutonnée with a gentle slope on the up-glacier (luff) side and a steep face on the down-glacier (lee) side, showing its eroded surface and striations.

## Panel 5

### Like a white goat

Local tradition has it that in the final years of the 18th century the Gorner Glacier seemed to peer out from behind the Riffelhorn like a white goat. According to contemporary commentators, however, the Gorner Glacier had by then advanced as far as the Furggbach river. So which version is true? Fortunately, we have picture sources emanating from the time in question which can help us answer this question. A sketch map from around 1791 by the Engelberg engineer Joachim Eugen Müller, and another from 1806 by Hans Conrad von der Linth, both show the Gorner Glacier terminating at the Furggbach river. In fact, on Müller's map it has actually passed it. The "white goat" is therefore known to have drunk from the waters of the Furggbach river much further down the valley in the late 18th century. Shortly after 1800 the Gorner Glacier began to advance, reaching its furthest extent in around 1859. The advance covered a total of 600 metres, at a rate of 10 metres per year.

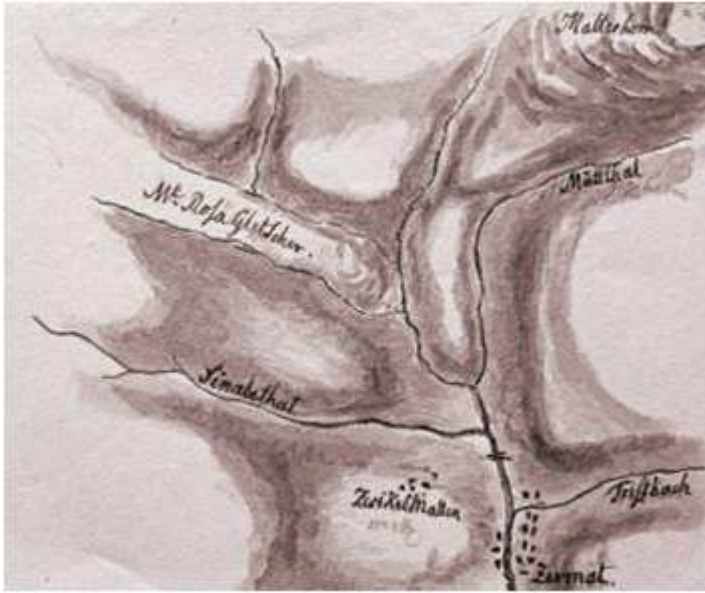
### Did you know...?

- From 1882, changes in the tongue length of the Gorner Glacier were recorded at intervals, and then measured annually from 1892, with a few gaps.

(Source: <http://glaciology.ethz.ch/messnetz/glacierlist.html>)

- Between 2007 and 2008 the glacier retreated by 290 metres, the highest figure ever recorded for this glacier.

## IMAGES



Sketch map showing the Gorner Glacier ("Mt. Rosa Glacier"), (Drawing: H. C. Escher von der Linth in 1806, Zentralbibliothek Zurich, Map Department)



View of the snout of the Gorner Glacier and the Liskamm, Castor and Pollux, the Breithorn, the Klein Matterhorn and the Upper Theodul Glacier in about 1900 (seen from left to right). The Schweigmatten can be seen in the bottom left-hand corner of the picture. (Photo: Gebrüder Wehrli, Kilchberg)



View of the Zermatt valley head («Matt», bottom right) with the Gorner Glacier («K») in the middle of the picture, the Breithorn on the left («Der Rosa») and the Matterhorn on the right. (Drawing: J. E. Müller, ETH-Bibliothek Zurich, University Archives)



On 10 July 1928, the pawshaped snout of the Gorner Glacier was just behind the confluence of the Furggbach river with the Gornera river. (Photo: A. Renaud, ETH-Bibliothek Zurich, Image Archive)



## Panel 6

### **A tree makes history**

You are standing on the moraine ridge in the glacier garden. The ridge was both reached and added to by the Gorner Glacier at the furthest extent of its advance. The edge of the ice last lay here between 1859 and 1865. The Gorner Glacier also reached this extent in around 1385 and around 1667.

Beneath the large boulder in front of you, which is supported by this terminal ridge, you can see the stump of a larch tree. This tree was not in fact toppled by the glacier, but by human hand: axe marks can be seen on the stump. The tree lived from 1453 to 1623 – it grew on this very bank. It is more than likely that the Gorner Glacier was just starting to advance in 1623. Trees would be felled in order to save the wood before they were swallowed up by the glacier, and so it was with this larch.

The Gorner Glacier finally reached the peak of its advance in about 1667, depositing this boulder on the stump of the tree. The glacier also pushed over larch trees in this period, the trunks of which have been recovered from the Blatteten rocks and slightly below the glacier garden and dated.

The method used to date trees such as these is usually radiocarbon dating (also called carbon-14 dating). The outermost tree-rings from the sample are normally dated to determine when the tree died and therefore the time of the glacier's advance. If the wood is well preserved and there are enough rings, it is possible to use dendrochronology (the dating and analysis of tree-rings) to specify the age of the tree when it died down to the exact year. This degree of accuracy cannot be achieved with radiocarbon dating.

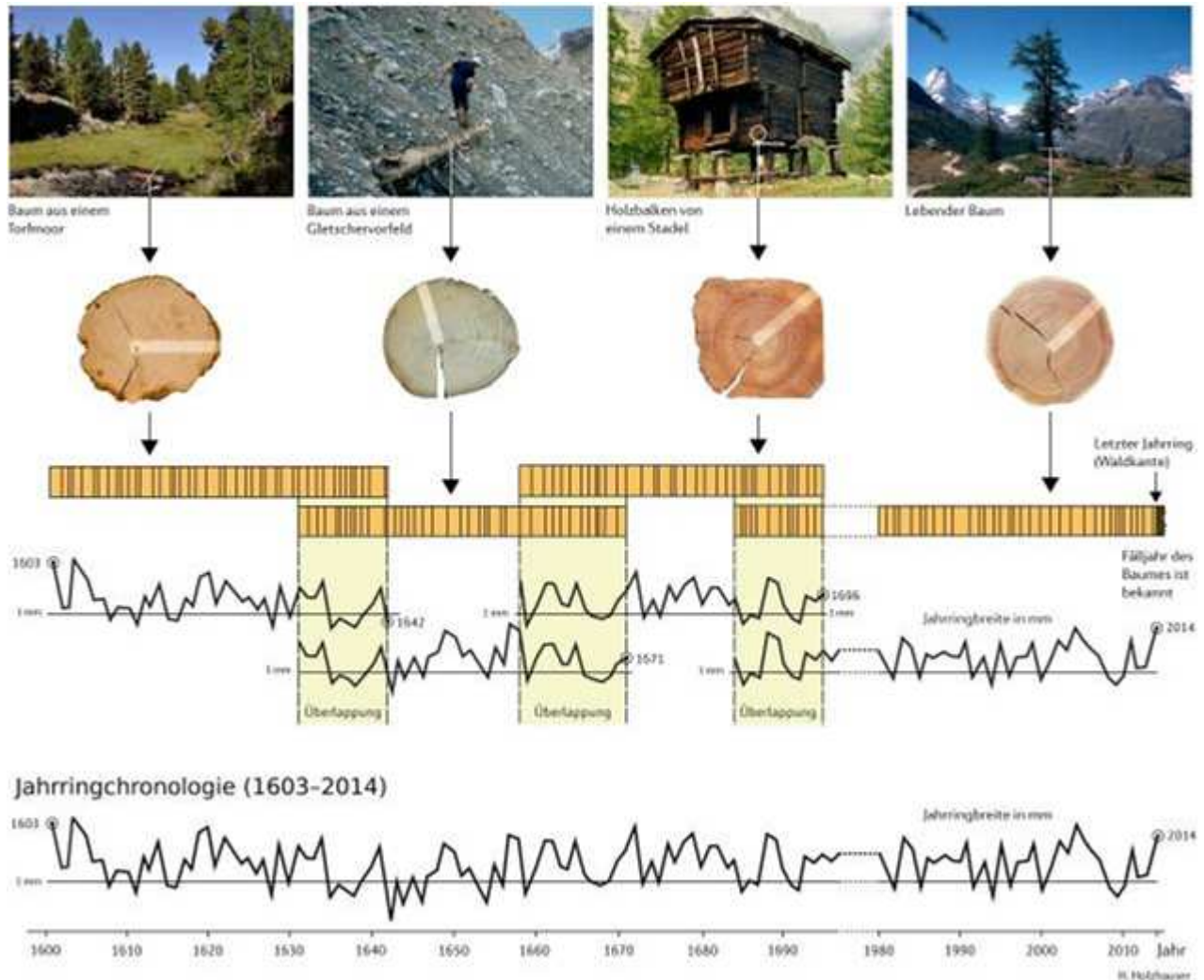
### **Did you know...?**

- Trees were also systematically felled on the Great Aletsch Glacier during its powerful advance in the 1850s.
- The oldest larch trees in the most advanced section of the glacier forefield are between 135 and 145 years old.

IMAGES



The neighbouring Zmutt Glacier on 22 August 1849. The advancing ice mass is pushing over the tall forest trees. (Detail from a Lavis Aquarelle Lithographique: H. Hogard)



Measurements of the width of tree-rings in trees growing today, timbers from old buildings, and wood retrieved from glacial and peat bogs, are used to generate curves which can be combined to produce a tree-ring chronology extending far into the past. This makes it possible

to compare and accurately date the patterns of tree rings from trees of the same species if they match the chronology.

---



The Gorner Glacier in 1863, photographed from above the huts at Hermetje. The arrow indicates the site of today's glacier garden. (Photo: A. Braun)

---



The snout of the Gorner Glacier, photographed from Furi in 1876. Arrow: moraine ridge at the glacier garden. (Photo: A. Garcin, ETH Bibliothek Zurich, Image Archive)



Part of a larch tree felled in 1623 protrudes from under this boulder which was deposited by the Gorner Glacier during its maximum advance in 1667.

---



Larch trunk on the Blatteten, it was pushed over by the glacier's maximum advance in 1667.

---

## Panel 7

### The hamlet of Zer Briggu

In 1839 the snout of the Gorner Glacier reached the exit of the gorge-like depression which can be seen to the south of this panel. At the time, a man named Louis Agassiz was residing in Zermatt. He was a professor of zoology and palaeontology who also spent time conducting glacier research, and he was a passionate champion of ice age theory. With his companions C. Vogt, G. Studer, E. Desor, the illustrator J. Bettanier and the botanist C. N. Nicolet, he carried out a number of glaciological tests. On 15 August, they inspected the smoothly polished boulders over which the ice of the Gorner Glacier was creeping forward. It was here that Agassiz was able to convince the Bernese geologist G. Studer that glaciers were responsible for the erosion of rock surfaces – an important argument in the fiercely debated ice age theory at the time.

In the years that followed, the glacier continued its advance unabated, threatening the hamlet of Zer Briggu, which stood on this flat area of land. The hamlet, which according to the “Family Statistics” recorded by Stanislaus Kronig, was home to one Johann Jakob Lauber and his family, consisted of a domestic dwelling, a stable-barn and three other farm buildings. The banks of the Gornera river were spanned here by a small wooden bridge. This was also the site of a field owned by Aloys Julen (1823–1907) in around 1850; it was bordered by the glacier to the south and the Gornera to the east.

In the 1840s, the ice mass was said to have advanced at a rate of up to about two metres a fortnight, especially in the spring time, so it is not difficult to imagine the concern the valley-dwellers must have felt at the glacier’s inexorable progress. In an attempt to ward off the continuing destruction of farmland, the local priest, Father Johann Peter Schulzki, conducted a ceremonial banishment of the glacier. To counter the impending danger posed by the glacier, Schulzki is said to have hammered a cross into the rock at the foot of the Dossen. The glacier banishment met with no success, however, as the Gorner Glacier continued to advance in the following years as never before. Shortly after 1851, the same fate befell the Zer Briggu settlement as that suffered by the Im Boden alp: it was swallowed up by the icy mass of the advancing glacier, little wooden bridge and all.

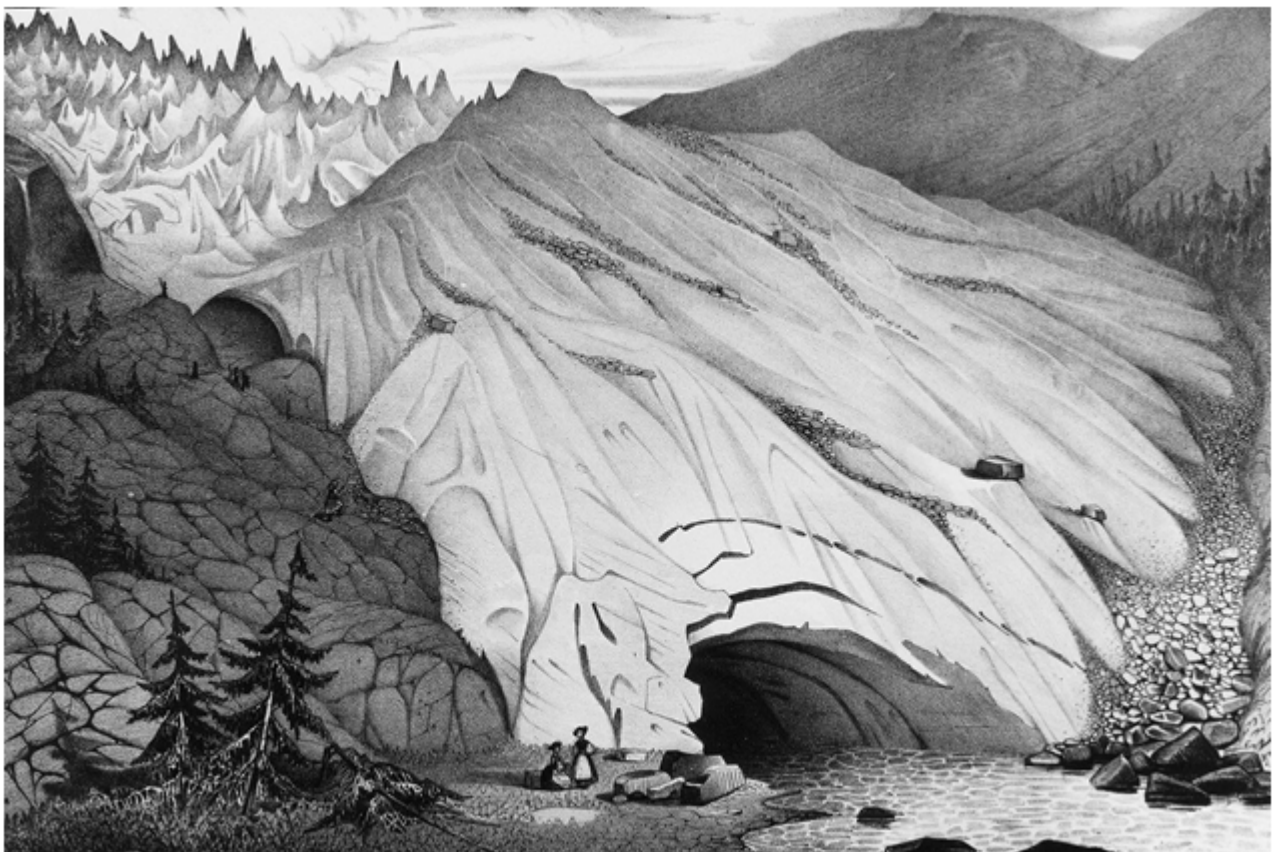
### Did you know...?

- Banishment ceremonies with processions were also conducted on other advancing glaciers in the Alps. These include the Fiescher and the Great Aletsch glaciers, in 1652 and 1653 respectively.
- “Glacier crosses” would be erected during the banishment ceremony to halt the expansion of the glacier. Vows were often taken as part of the banishment rituals, which in the case of the Fiescher Glacier also featured a procession and special mass every year.

## IMAGES



The snout of the Gorner Glacier on 23 July 1835. In the foreground is the hamlet of Zer Briggu with a house, a stable-barn and other farm buildings. (Water colour: J. R. Bühlmann, Collection of Prints and Drawings ETH Zurich)



Snout of the Gorner Glacier in 1839 with moraine ridge (right) and boulders polished by the glacier (right) on which Louis Agassiz and his companions are conducting research. (Lithograph: J. Bettannier, 1841)



The Gorner Glacier reached right up to the buildings in the hamlet of Zer Briggu in 1842. (Pen and ink drawing: R. Weinmann, Museum zu Allerheiligen Schaffhausen)

---



Ice cave in the glacier snout on 23 July 1835 at the gorge exit. (Water colour: J. R. Bühlmann, Collection of Prints and Drawings ETH Zurich)

---

## Panel 8

### **The Schweigmatten meadows – the impact of the glacial advance**

Here at the end of your walk, you are once again standing by a ridge of moraine deposited here in the Schweigmatten meadows by the Gorner Glacier between 1859 and 1865. This moraine probably also contains remnants from previous advances during the Holocene period, such as those of 1385 and 1667. According to witnesses at the time, the ice flow destroyed all the worldly belongings of many of the residents of Zermatt. From the writings of the castellan Stephan Biner on 26 September 1859, published in 1870 by Father Moritz Tscheinen, we know that the Gorner Glacier headed towards Zermatt for a substantial period of time. During this lengthy advance there were some years when the Gorner Glacier encroached by a distance of 15 to 26 paces (11.25 to 12 metres), but others when it only advanced by 5 or 6 paces (3.75 to 4.5 metres). In the years prior to this, the glacier buried an average of 2000 to 3000 “klafters” of meadowland (or 0.72 to 1.08 hectares) each year.

Biner’s record goes on: “It caused havoc for half a century; it destroyed everything in its path, overrunning a beautiful alp (known as the Boden) as well as cornfields and pretty meadows, insatiably swallowing up all the fertile soil down to the bare rock below and rolling monstrous boulders, scree and moraine before it. This agent of devastation, a quarter-hour across, inflicted great damage upon many a Zermatt resident, especially in the meadowlands. Not only a large number of barns and stables had to yield to it, some houses were also destroyed. [...] [...] In an attempt to make judgement of the damage caused, one may in all truth remark that one single family suffered the loss of 9 to 10 “klafters” of hay , 8 barns and stable buildings, 5 “fischels” of arable land and one house.”

The residents often barely had time to rescue the contents of their homes; in a few rare cases they were able to retrieve the wood itself. There were some stables here which were to be used for overwintering cattle, but the buildings had to be cleared out even before the hay was cut as the ice mass had already reached them. At that time, State Councillor Johann Anton Clemenz purchased a house which threatened to disappear under the glacier. In order to be able to re-use at least the timber from the building, he made plans shortly thereafter to remove the roof, but too late: the house had already been pushed over into the lateral moraine. There is a story that a farmer of the time sold his stables in the Schweig meadows for a “fünflieber” (a five-franc coin) because he had spent the entire summer chipping away ice that he feared was going to push the building aside, and he had no wish to repeat the process the following year. In the area known as “Zwischen den Blatten” in the Aroleit district, the family of Johann Joseph Julen owned a property close to the Gorner Glacier. In 1855 he reportedly told his family: “This year we will mow the meadow, but next year it will be under the glacier.” This was not the case, however, and the buildings here close to the moraine ridge were also spared.



**Did you know...?**

- According to local tradition, over fifty houses, barns and stable buildings gave way to the glacier during its advance in the first half of the 19th century.
- Contemporary witnesses reported that in May 1839 potatoes were planted in a field which in August was already being compressed like a telescope by the Gorner Glacier.

**IMAGES**

The Gorner Glacier advanced onto farmland in 1849 and threatened buildings in the hamlet of Zer Briggu (bottom left). (Lavis-Aquarelle Lithographique: H. Hogard)



View over the Furi and the Schweigmatten. The Breithorn rises up in the background on the right-hand side.



Snout of the Gorner Glacier in around 1870. The ice portal is visible in the bottom right of the picture. Circled: huts in the Schweigmatten near the terminal moraine of 1859. (Photo: F. Charnaux)

---



View from the Augstschumme of the snout of the Gorner Glacier and the Schweigmatten in around 1885. Circled: huts in the Schweigmatten near the terminal moraine of 1859. Arrow: Site of the former Im Boden alp. (Photo: A. Jullien )

---

## Panel 9

### Tales told by ancient trees

It is said that the Gorner Glacier once retreated quite extensively and was much smaller than it is today. During that magical time the ice-free terrain became heavily overgrown with scrub and a forest rose up. The area around the Monte Rosa was also said to be heavily wooded, with large herds of chamois and ibex present. In those days there was frequent trade with the Aosta Valley, and a mule trail ran from Bine in Findelen, where a wine tavern reportedly stood, to the foot of the Riffelhorn, where the Gorner Glacier now lies. From there the path led up over the Wängje rock barrier on the western border of the Lower Theodul Glacier and finally into the Aosta Valley via the Theodul Pass. Wine, rice and maize were imported and cattle exported. The mule drivers who crossed the Theodul Pass from the Aosta Valley often lost their beasts of burden in the bottom of the Riffelhorn valley and had to search for them for hours, so dense was the scrub and the forest.

However, no actual proof has emerged yet that the Gorner Glacier really was so reduced in size, although there were periods when the extent of the Gorner Glacier was about the same as it is today. At times it was indeed somewhat smaller than at present – during the Bronze Age, for example. During these periods of favourable climate, the vegetation extended into the glacier forefield. The first larches and Swiss pines established themselves, some of which grew to be over 400 years old.

When the Gorner Glacier advanced again it pushed the trees over and buried them. Remains from these larches and pines – trunks, roots and branches – have been revealed frequently since the glacier began its retreat in 1865. These samples of wood have been analysed using radiocarbon (carbon-14) dating and dendrochronology (tree-ring analysis; see panel at the glacier garden), which show that they died between about 200 and 9500 years ago. This not only confirms that the legend of trees growing on the glacier forefield in earlier times has some truth in it but also that the Gorner Glacier has made numerous advances during the Holocene period.

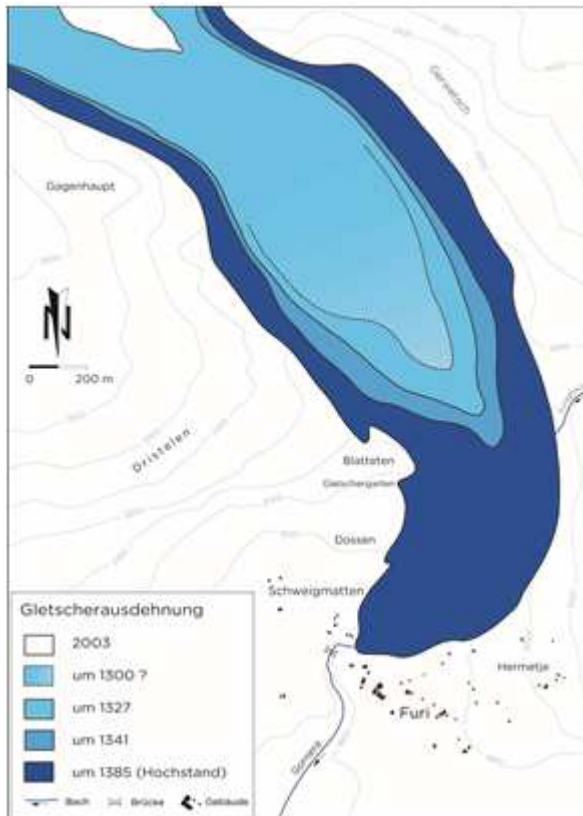
Dating this glacial wood has enabled us to accurately reconstruct the powerful advance of the Gorner Glacier which began at the start of the Little Ice Age, in around 1300, and reached its maximum extent by about 1385. There were then at least 100 metres of ice above this panel, and the Gorner Glacier reached all the way down to the Schweigmatten meadows, just as it did in 1859.

### Did you know...?

- When the Gorner Glacier retreats it only takes five to ten years for the larch trees to re-establish themselves in the forefield.

- The Swiss pine generally takes far longer to reappear in the forefield. It's a more demanding tree than the larch, and it also relies on spotted nutcrackers to distribute its nuts. The seeds of the larch, on the other hand, are dispersed by the wind. Over time, however, the larch is suppressed by the Swiss pine, as it needs plenty of light and does not thrive in the shade of the taller pine.

## IMAGES



Advance of the Gorner Glacier at the beginning of the Little Ice Age in the 14th century, reconstructed with the aid of larch trees accurately dated to a specific year by dendrochronology.

---



The larch re-established itself quickly after the ice in the forefield of the Gorner Glacier melted. The white dashed line shows the extent of the ice in 1859. Arrow: location of the panel

---



Cross-section of a larch trunk from the forfield of the Gorner Glacier. This larch died during an advance by the Gorner Glacier 9500 years ago. The tree rings have been greatly compacted by the weight of the ice. (Scale: 1 graduation mark = 1 mm)

---



Stump of a larch tree which germinated in the year 950 and was pushed aside by the advancing Gorner Glacier in 1186. The Gorner Glacier reached the same extent then as it did in 1950.

---



Larch trunk with rootstock. This larch was over 336 years old when it died in 1322 as the Gorner Glacier advanced at the start of the Little Ice Age.

---

## Panel 10

### **The old stable on the Blatteten**

Where there is cultivated land near a glacier it is often possible to make connections between traces of human activity found there and the history of the glacier, for example through the foundations and timbers of Alpine buildings. Although local tradition has it that over fifty houses, barns and stable buildings gave way to the glacier during its advance in the first half of the 19th century, hardly any evidence of these buildings has ever been found. The wood was apparently brought to a safe place before the Gorner Glacier reached the huts and the foundations would have disappeared under the moraine.

Written accounts and a few picture sources show that most of these Alpine buildings and houses stood on the left-hand side of the valley at the Im Boden alp and on the flat valley floor near the Schweig meadows. The steep, rocky right-hand valley slope with the Dossen and the Blatteten was much less suitable for buildings. Nevertheless, it was precisely here that the only datable remains of one of these buildings were found. They were five remaining timber beams from a stable building that was pushed aside and destroyed by the Gorner Glacier shortly before it reached its maximum extent in 1859. The timbers lay on the periphery of the glacier forefield and were partially covered by the ridge of terminal moraine. With the aid of dendrochronology (tree-ring analysis) the beams were dated and the stable was shown to have been built between 1696 and 1697. The Gorner Glacier obviously did not present any immediate danger at that time, otherwise the stable would not have been built. The ice mass did not begin its mighty advance until about a hundred years later, at the beginning of the 19th century.

Here on the Blatteten rocks, the trunks of two larch trees were found, pushed over by the Gorner Glacier in 1385 and 1667 respectively as it reached the maximum extent of its advances in those years.

### **Did you know...?**

- At the foot of the Monte Rosa massif, between the Gorner and Grenz glaciers, lies Lake Gorner. Every year it bursts its banks and in the past, when it was much bigger, the floods would cause great damage in Zermatt.
- When the edge of the Gorner Glacier lay on the Blatteten a torrential stream emerged from it. It probably only flowed when Lake Gorner was in flood.

## IMAGES



Arrow: Site where the timbers were found on the Blattere.



The Gorner Glacier at its maximum extent in 1863. Arrow: Site where the timbers were found.  
(Photo: A. Braun, ETH-Bibliothek Zurich, Image Archive)





Probably part of a door post.



Recovering the roof timbers in 1990. Part of this beam is on display in the Matterhorn Museum.

*All texts, graphics and pictures are protected by copyright and may only be used with the permission of the copyright holder.*