



## Arolla - Pra Gra - Lac Bleu - La Gouille

by **Pierre Kunz** (an excerpt from the booklet *Three Geologic Field Trips in the Commune of Evolène "Upper Val d'Hérens-Valais"* published by Evolèn'art. Adapted by Sébastien Ruttimann and translated by Charles Gutowski.

This field trip will introduce us to the different facets of the Val d Arolla: **glacial morphologies, periglacial and fluvial**, but also **outcroppings** of the typical rocks found in the local geology. **The path is difficult and even at times somewhat dizzying and breath-taking**, but with the reward at the end of the trail **of coming upon the Lac Bleu with its extraordinary blue color!**

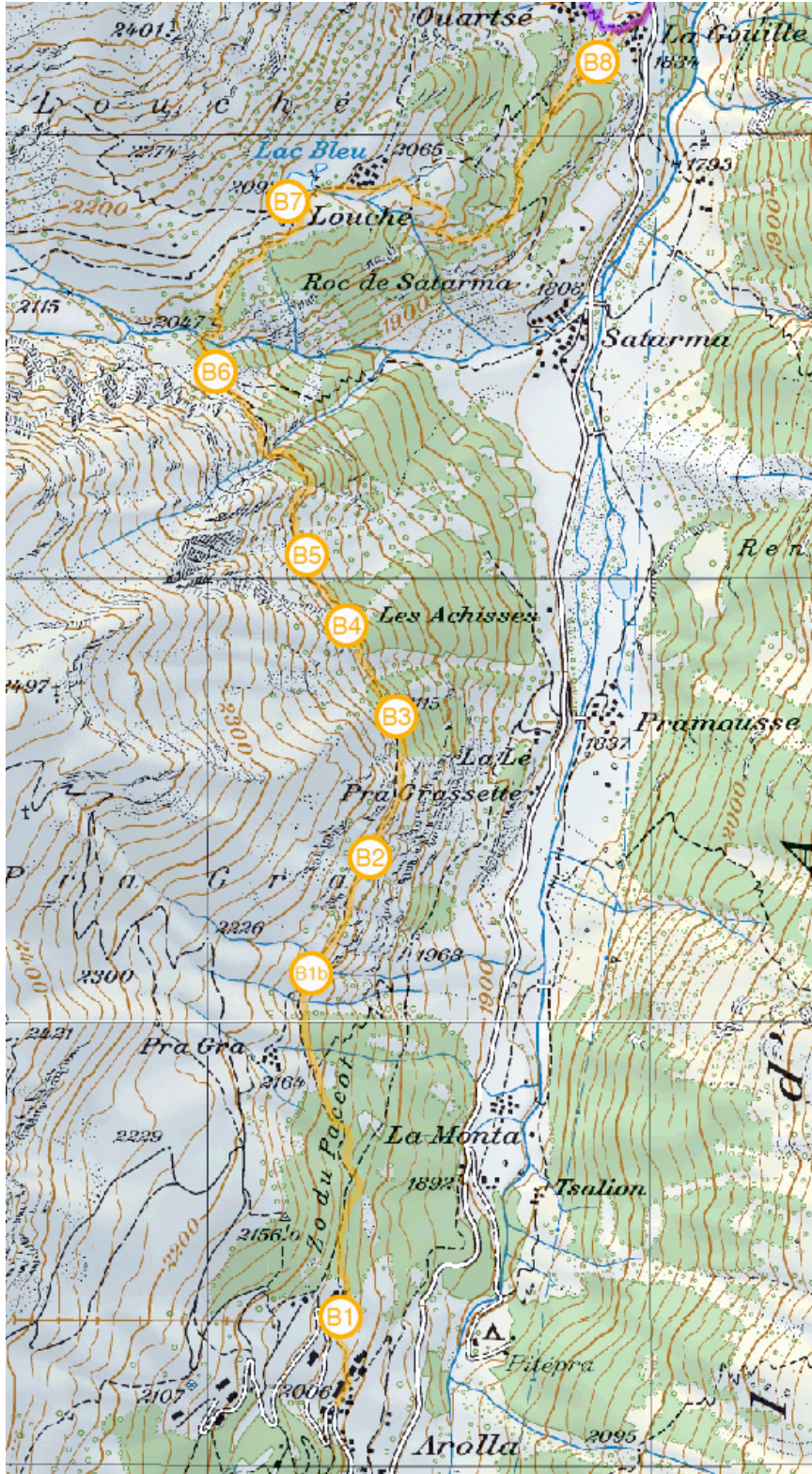
### Description

- Departure from Arolla, Place de la Poste (2000m).
- Take the paved road going up toward the chalets in the lotissement des Marmottes, pass by the first hairpin bend where a path leads to the Hotel Kurhaus, and follow the road for another 300 m. Before the second hairpin bend, take the road descending on the right to the Centre Alpin.

## Itinerary

See the [interactive map of the itinerary](#) available in the [GéoGuide Val d'Hérens](#) (« Map » tab)

<http://www.evolene-geologie.ch/geologie/geoguide-herens-285.html>



## Stop B-1 (603300/97333) (46° 1' 39.109" 7° 28' 52.576")



Panormama (Photo: S. Ruttimann)

Near the lower building of the Centre Alpin

The peaks adorning the top end of the Val d'Arolla follow each other in line from East to West:

- The Arête de Tsalion and the Aiguille de la Tsa on the opposite right bank.
- The Mont Collon at the end of the valley.
- The Pigne d'Arolla and the Vuibé.
- The Mont Dolin and La Roussette upright before us above Arolla.

Historically, Arolla **owes its name to the superb forests of Arolla pines which completely carpeted the end of the valley at the end of the 19th century.** Built at an altitude of 2000m on an old alpine pasture, Arolla is today inhabited year - round. A sports resort since 1968, **tourism has been a feature of Arolla since the middle of the 19th century,** and the first hotels in the valley were built here: **the Hotel du Mont-Collon in 1875 and the Hotel Kurhaus in 1897.**



1862

Arolla, 1862 (Unknown author)



Arolla et Zinareffien

CORBAZ & CIE., LAUSANNE

Hôtel Mont Collon and Tsijiore-Nouve glacier  
~1900 (Photo : Corbaz et Cie)

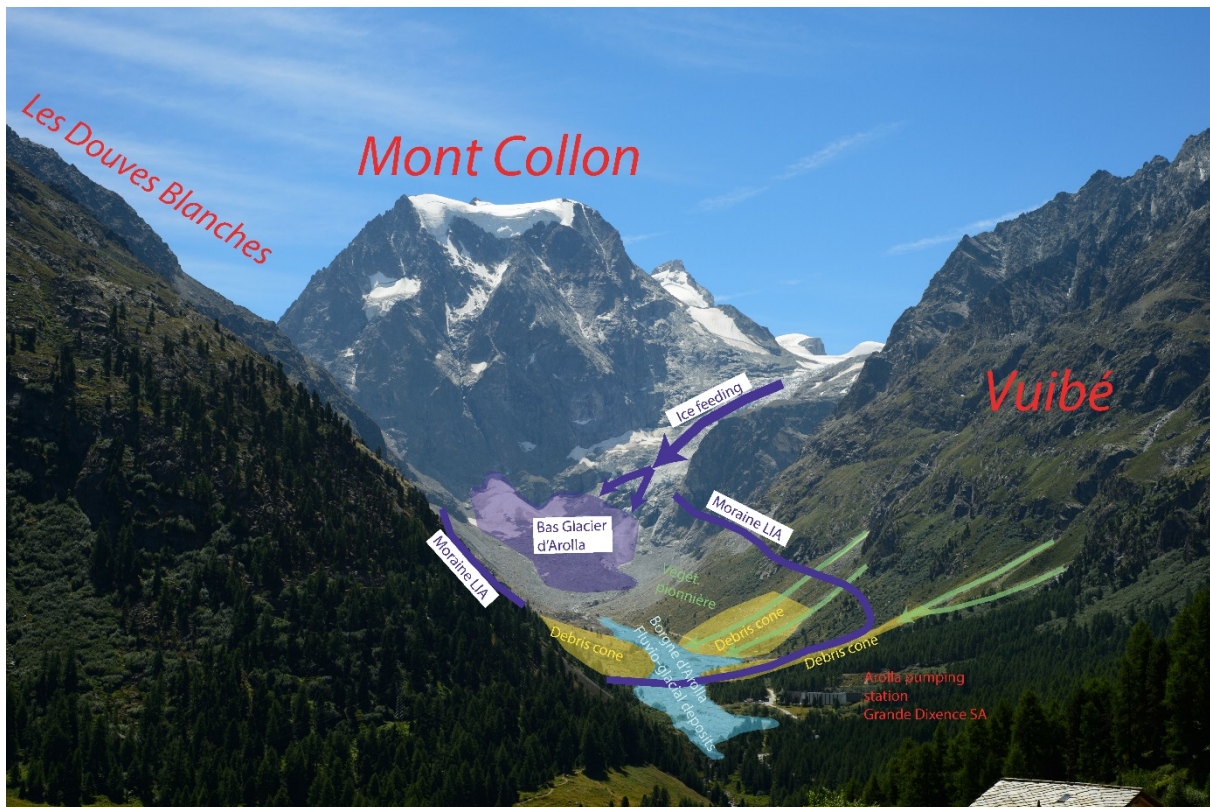
### Geology :

**All of the mountains visible from the site B-1 belong to the *Dent Blanche nappe* and its *sedimentary cover*.** This *nappe* is essentially made up of *gneiss* and *granites* (the *Arolla series*, examples : Pigne d'Arolla and Vuibé) as well as basic rocks which compose the Mont Collon Unit (*metagabbros*). The front of this *nappe*, toward the north in the direction of La Gouille, is markedly more schistose and flaked; it is sometimes difficult to differentiate from the *nappe du Tsaté* which lies underneath. Some large folded structures appear locally, for example beneath the Aiguille de la Tsa.

**The Arolla Mountain is dominated by La Roussette (*gneiss*) and the Mont Dolin (*triassic breccias and dolomitic limestones which are the sedimentary cover of the Dent Blanche nappe*)** . The topography is made up of soft reliefs, pasture land resting on thick morainic deposits. A number of blocks of rock have come down from the Dolin-Roussette crest across the Arolla forest.

### Glacial morphologies :

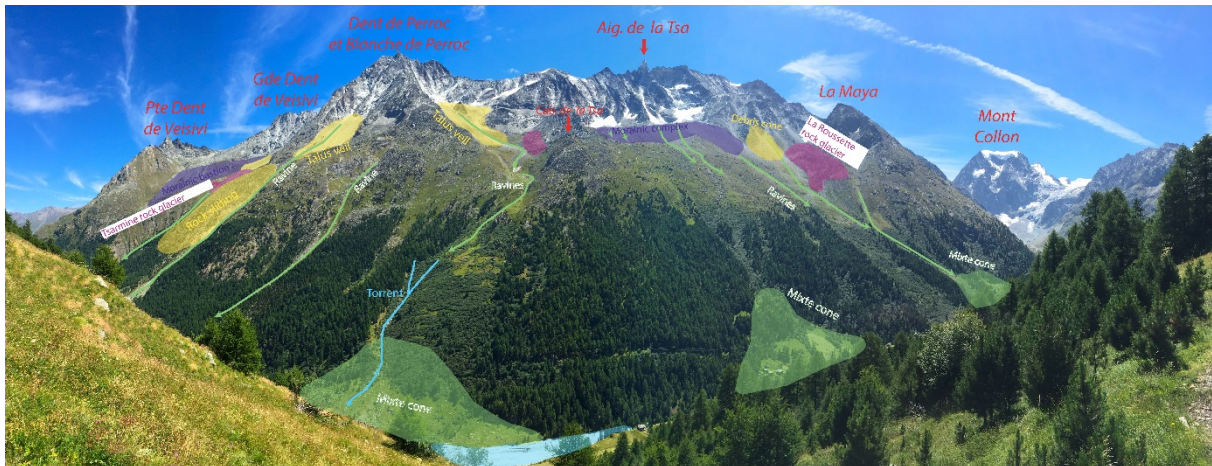
- The Lower Arolla Glacier, with **its two large lateral *moraines* dating from the *Little Ice Age (LIA)* was still growing during the 1970's**. Since then, the retreat has been very substantial; the Lower Arolla Glacier **is now almost totally unattached from its accumulation zone except for two bands of ice** on the wall to the right of Mont Collon (the accumulation zone - not visible from this point - is between the Petit Mont Collon and the Mont Collon). The Lower Arolla Glacier is at risk of soon becoming *dead ice*.
- The back of the valley exhibits **the profile of a typical glacial valley in the form of a U**. The steep sides are carpeted with lateral *moraines* and **numerous debris cones with the Borgne d'Arolla winding through them**. The valley floor is also covered over with morainic materials and fluvio-glacial deposits (*sandur*) ; some large rocks show through with marks of glacial polishing (on the *roches moutonnées*) . The vegetation there is of the pioneer type (**bushes, larch trees, alpine grasses,...**).
- To the right of the Pigne d'Arolla we can see the magnificent Tsijiore Nouve glacier whose terminal tongue descends quite far down to about 2300m, **enclosed by large lateral *moraines* of which the inner one dates from the *Little Ice Age (LIA)***. The last major advances of this glacier date from **1816 (historically, the maximum known extension), 1852 and 1882**, the date when the glacier stemmed its frontal *moraines*. By way of comparison, **8'000 years ago, it rejoined the Arolla glacier at the bottom of the valley!** The Tsijiore Nouve glacier is actually retreating now after having been stationary and even advancing slightly according to the last inventories (1980-1990).



Mont Collon et Bas Glacier d'Arolla (Photo : S. Ruttimann)

- We pass by the lower building of the Centre Alpin and follow a wide path for 100m. At the beginning of the forest we take the path climbing to Pra Gra - Lac Bleu.
- At 2050 m, we come upon another path above the Centre Alpin and go to the right. The trail continues horizontally through a handsome forest of *arolla pines* and *larch trees* strewn with fallen rocks.
- At 2040 m after about 200 m, we go to the left at another intersection in the direction of the Lac Bleu. The path climbs through the forest, **winding around some large isolated blocks, bearing witness to ancient rock falls.** The composition of these blocks is two-fold:
  - a large majority are *granites* and *gneiss* showing small *folds* (Arolla Series)
  - sedimentary *breccias*, calcareous and *dolomitic* (Mont Dolin)
- At 2110 m at the end of the forest, we cross a path which climbs toward Pramousse and another descending from the lower Pra Gra pasture. We continue straight on horizontally and cross the first torrent. The path continues climbing to 2130m.

## Stop B-1b (603234/98110) (46° 2' 4.275" 7° 28' 49.486")



Panorama of the opposite slope (Photo: S. Ruttimann)

The path now crosses a wet zone **where we can see a landslide scar which affects the entire slope** down to the Route d'Arolla. It is now covered over by green alder bushes. From this site there is a nice panorama of the right bank, that is to say the Arête de Tsalion (the Veisivi Massif - Dent de Perroc - Aiguille de la Tsa - Doves Blanches). This opposite side of the valley is carpeted with fragments of rock falls along with enormous blocks of *gneiss* punctuating the trail to the cabane de la Tsa.

**Numerous landforms of geomorphology are visible on this side of the valley** (from left to right): an imposing **morainic bastion** below the Dents de Veisivi (the Tsarmine glacier). To the right, slightly masked by the relief, is a **veiled talus** terminating in a **rock glacier** (the Tsarmine *rock glacier*). More to the right we see the veiled talus beneath the Dent de Perroc. A torrent appears at the foot of this *talus veil* and has created a **mixed dejection cone** at the level of the Borgne d'Arolla. A rock compaction is visible at the left of the torrent.

Looking more to the right, we can see the refuge, the Cabane de la Tsa, on a promontory and then a **morainic complex** visible beneath the Aiguille de la Tsa. The glaciers have most likely disappeared or may be hidden under a protective morainic cover. Lastly, a large **rock glacier is visible beneath La Maya** (La Roussette *rock glacier*).

Near a torrent *ravine*, we continue along horizontally beside a rock face in the direction of the Lac Bleu. Here the path becomes quite steep and vertiginous, **so exercise caution!**

## Stop B-2 (603366/98372) (46° 2' 12.761" 7° 28' 55.627")

Chemin Pra Gra - Lac Bleu, small climbing steps. Place name: *Les Leigères*.

Roughly 500 m after the torrent we come to the B-2 site where the vertiginous path makes a hairpin turn in the rock face (with a chain serving as a hand guide). Here we pass across a large rock face, which begins at Pra Gra and descends all the way to the Route d'Arolla.

This outcrop **is made up of granitic gneisses**, the same mineralogic type as the blocks scattered in the forest above Arolla. These are the **typical gneisses of the Arolla Series** (Aiguille de la Tsa, Pigne d'Arolla, etc.). They are very closely folded and flaked, and the small folds are accentuated by beds of white *mica* and green *chlorite*.

From here **we have a very good view of the debris cone of the torrent descending from the Dent de Perroc which has altered the course of the Borgne between Pramousse and Satarma**. This cone has been built up not only by the action of the torrent, but rather by a variety of factors such as *rockfalls* from the Tardiglacière period to the *Little Ice Age* (LIA), material from avalanches as well as mudflows. Today the fallen blocks no longer descend as far as the Borgne but generally remain in the *talus veil* below the Dent de Perroc.

We continue on the path going along the wall; at times the vegetation broadens out and the path zigzags among *green alders* indicating a humid zones and here in particular instability.



Mixed cone resulting from the torrent action, rock falls and avalanches (Photo: S. Ruttimann)

## Stop B-3 (603426/98690) (46° 2' 23.071" 7° 28' 58.427")

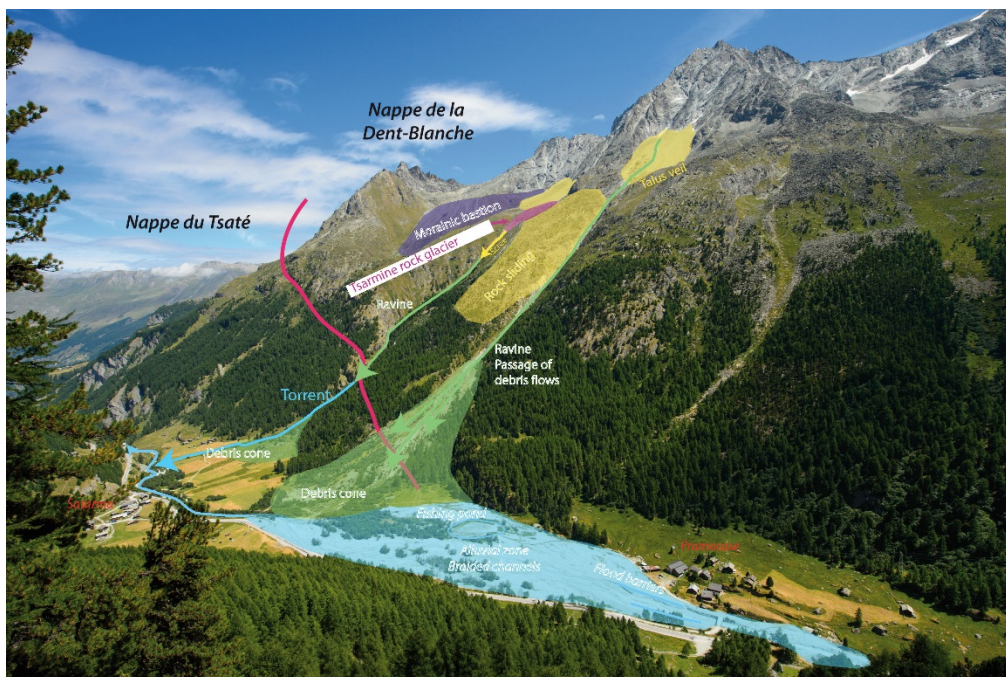
Place name: *Rouùna blântsa*.

Here the path again becomes quite vertiginous and climbs a small rock face (a chain again serves as a hand-hold). We have an **unobstructed view of the lower Arolla valley, in particular the alluvial plain of Satarma-Pramousse**. At the center of this flood plain is the Borgne d'Arolla rambling through its *alluvium* (sands, pebbles and blocks). We can also see **the fishing basin which was gutted by the flood of September 1994**. The bed of the Borgne has been **pushed toward the west by the powerful and very active debris cones of Perroc and the Leviau** descending from the Dent de Perroc and which serve as trajectories for *rockfalls* and for avalanches (for example: March 1996).

Geologically speaking, we now find ourselves at **the end of the gneiss outcrops of the Dent Blanche Nappe: this is the border of the africain continent !** From this point on **the path continues in the Nappe du Tsaté** with its cortege of green rocks (*serpentinites, metagabbros, metabasalts*) and *oceanic sediments*.

On the right bank of the valley, we can follow relatively easily the *tectonic contact* line between these two nappes: the *gneiss* massifs lie directly on top of the *gray sediments* and the green rocks of the *Tsaté*. **All the reliefs and the summits dominating Pramousse (at the electric pylon) up to the crest of the Roc Vieux - Petite Dent de Veisivi belong to the Nappe de la Dent Blanche, while the Nappe du Tsaté makes up the underlying morphologies such as the Alpage de Veisivi**. This *tectonic contact* crosses the valley on the bias from Pra Gra at an angle of about 30° with the principal axis of the *valley line* or *thalweg* (direction North, 40° East).

We follow the path now through a short valley or coomb without any rocks and a gentle topography indicating the presence of the first *oceanic sediments*. The vegetation here is relatively abundant (high grasses, bushes, *green alders*, hazel trees, small larches and arollas).



The Tsarminic side and the Borgne d'Arolla (Photo. S. Ruttimann)



## Stop B-4 (603314/98894) (46° 2' 29.679" 7° 28' 53.232")

Lè Chéss (rocks) dè la Krochalûna along the edge of the Zau (forest) des Achisses.



Pillow lavas (Photo: G. Stampfli)

After a short descent of about 30m, the path continues along the base of a rock face. With its darkish green patine, this wall is covered over with gray and yellow lichens. **This outcrop is composed of metabasalt massifs, examples of ancient volcanic lava flows poured out in an under-sea environment.** We find *bedding* here tens of centimetres thick with relatively rounded forms, each one corresponding to a *lava tongue* (these are *globular lava flows extruded under-sea and called pillow lavas*). In some places this *bedding* disappears and the rock becomes very massive (large lava flows) or the *bedding* is replaced by *banding* made up of yellow and pistachio green lines. This latter type of rock constitutes the *banded prasinites*. They are very fine deposits punctuated by ashes and *lapillis*, **bearing witness to explosive underwater eruptions, as well as reshuffle by oceanic currents** (volcano-sedimentary deposits). **These rocks make up the rocky bar descending from the Tête du Tronc which we are now skirting around.**

We continue our path passing over a promontory consisting of groups of very fractured black *serpentinites*, pierres ollaires, and dark, highly schistose *sediments* (caution! Wet unstable terrain, hold on to the guidelines). Notice also the large meter sized *fold* in the *serpentinites*.

## Stop B-5 (603222/99053) (46° 2' 34.787" 7° 28' 48.945")

Former *Satarma mine*, 20 metres above the path. Place name : *La Zau des Achisses*.

This zone, with its absence of trees is actually a former dumping area for mine tailings which are now dissimulated under a cover of grass. **We now find ourselves at the *Pertù de la Méinna*, which is the entry of an exploration gallery of a copper mine** which was active up until the beginning of the 1900's. Cutting first through calcschists, then in *metabasalts* and *metagabbros*, the tunnel is part **of a network of working galleries dug into the large rocky barrier dominating above us**. Three other entryways, now partially collapsed, are still visible at the foot of this rock face at 2140m. As is also the case with first gallery mentioned above, it is strongly recommended **not to venture into any of these galleries**; the access is very hazardous, the ceilings provide no guarantee of security and water seepage is very important.

### Mineralisation:

Copper (chalcopyrite, bornite, pyrite, malachite, azurite, chrysocolla), mineralised traces are still visible above the upper galleries. The exploration gallery, about 100 m long, terminates with two corridors in the form of a Y.

### Host or country rocks:

crushed *metagabbros* pinched between *Metabasalts* (rocky bar of the site [B-4](#)) and *lustrous schists*.

The mass is tightly folded, going parallel along the wall of *metabasalts* in an east-west direction. Other ore masses of about a metre thick have been discovered under the rock bar by geophysical prospection in the 1980's.

We continue on the path which remains horizontal at an altitude of 2100m and pass through a large mass of combe rocks consisting of gray calcschists (rock falls).

At the extremity of this combe, the path climbs back up on a massif of *metabasalts*. Then it skirts a wall of the same type of rock by with a descent followed by a sharp climb through a wood with a scattering of *larch trees*. Here we are looking down on the village of Satarma.

**Through some openings in the vegetation, we have a view of the Roc de Satarma** (or rather the finger of Satarma), which rises above the village. It is a peak or aiguille **consisting of light green metabasalt**. A favourite place for rock climbers.



Roc or Finder of Satarma

Next, the path crosses a torrent coming from the Tête du Tronc (2549 m). In the torrent bed are *outcrops* of green rocks (*serpentinites*) and *sediments* while the two sides of this *gorge* are made up of *Metabasalts*. **This observation confirms the very complex structure of this zone with the various lithologies succeeding each other almost vertically.**

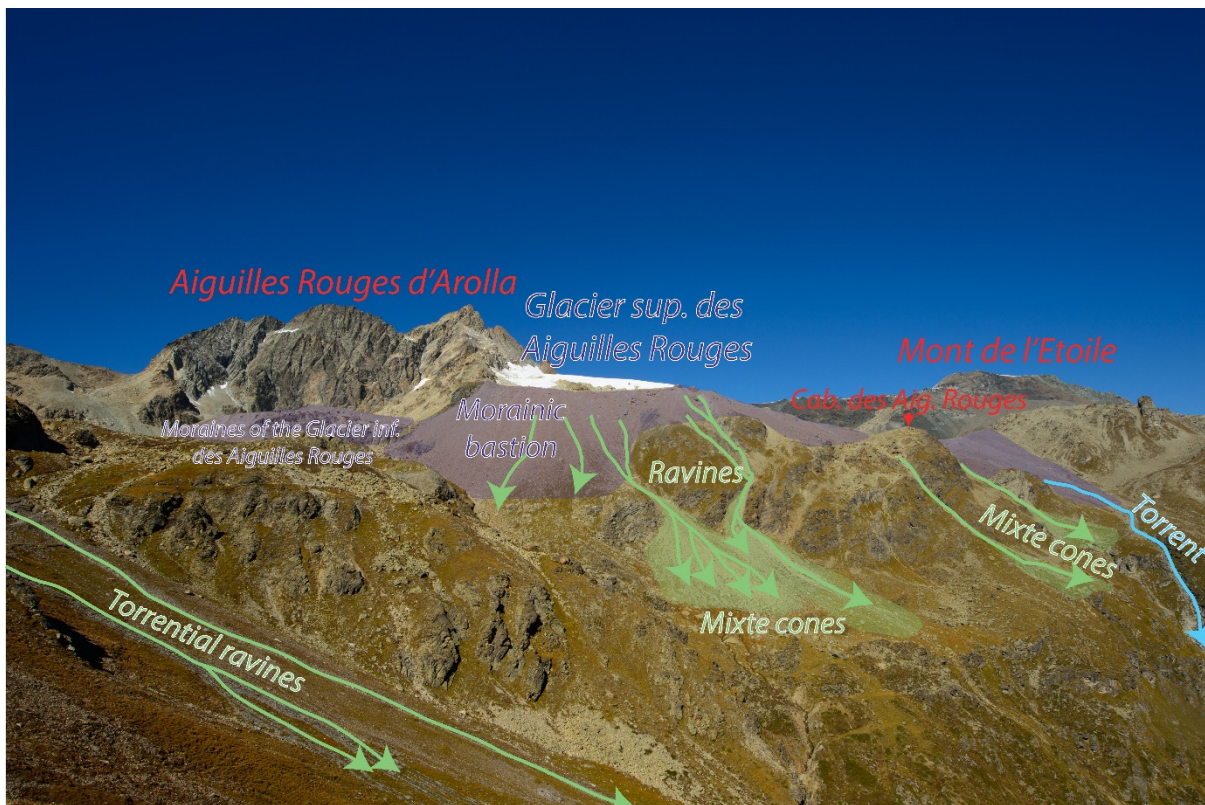
After passing the torrent, the path presents a rather tricky passage necessitating a short jump, which is facilitated by a ladder. The path then re-descends sharply to skirt the base of the cliff which makes up the principal part of the Tête du Tronc. The rocks here are the same type as in Site [B-4](#) (*Metabasalts*), and the vegetation consists of alders and larches. Caution! The path here is steep, wet and very slippery!

## Stop B-6 (603015/99466) (46° 2' 48.191" 7° 28' 39.347")

Beneath the Tête du Tronc. Place name : *Les Douves*.

**We do not stop at the marker B-6, but continue in the direction of the Lac Bleu until the middle of the combe.**

A small window opens onto **the massif of the Aiguilles Rouges d'Arolla**. This massif is composed of *metabasalts* and *metagabbros* **rich in iron, whose oxidation is responsible for the characteristic red color of this mountain**. Above the site B-6 is the mouth of the small suspended valley of Les Ignes, now no longer possessing a glacier. Effectively, **both the upper and lower Aiguilles Rouges glaciers terminate today at about 2900m in a vast frontal moraine or bastion just above the path of the Aiguilles Rouges refuge**. This small glacial valley is carpeted by morainic deposits, and numerous mixed cones cover its flanks. The valley slopes are composed of only **massive rocks**: *metabasalts* and *metagabbros* which are responsible for the bold topography of this region. This lateral *hanging valley*, perpendicular to the Val d'Arolla dominates the *alluvial plain* of Satarma, facing the great debris cones of Perroc and Le Leviau descending from the Dent de Perroc.



Les Aiguilles Rouges d'Arolla as seen from along the path of the Aiguilles Rouges refuge (Photo: S. Ruttimann)



The Tsarmines slope above Satarma

Notice the very wise choice of the site of the village of Satarma; protected from **both rock slides and floods**. It should be mentioned that in 1950, the Satarma plain was researched for the eventual construction of a hydroelectric project.

We cross the torrent *Déchèna* at the point of 2047m on a small bridge just newly rebuilt. We then take the short climb toward Le Lac Bleu through a forest of larches and a few *arolla pines* with scattered blocks of *Metabasalts*.

**Stop B-7 (603177/99850) (46° 3' 0.629" 7° 28' 46.917")**



Le Lac Bleu (Photo : S. Ruttimann)

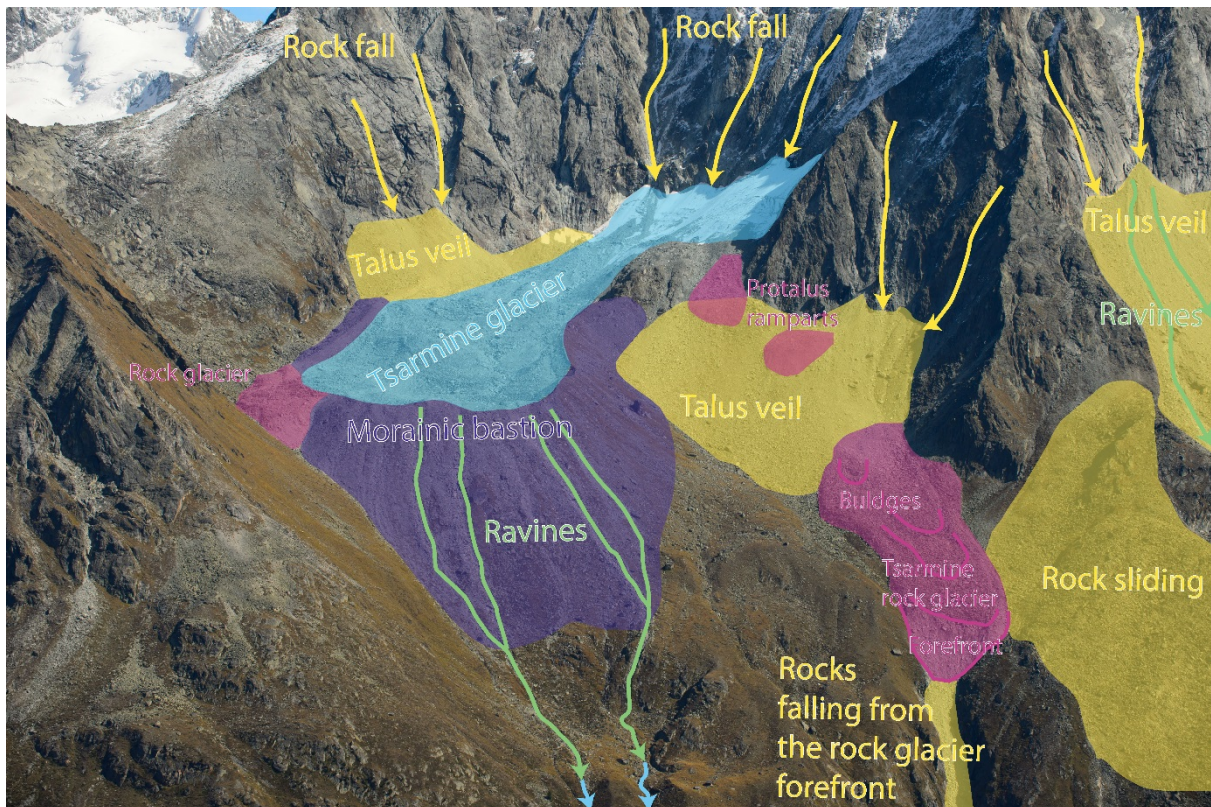
**The Lac Bleu was created by a hollowing glacial action and is dammed downhill or aval by a cordon of *moraines*. It is fed by only a single rock spring, sourced from subterranean water flows from the slope of the Mont des Ritses. These flows originate from melt water and torrents infiltrated in the *soil*. The lake maintains its bold blue color year round (the combined action of algae and glacial clays).**

Caution! The water is very cold for bathing!

Here we are at the upper limit of the forest (larches and *arolla pines*).

Above the Lac Bleu towards the south-west, the horizon is obstructed by the Tête du Tronc (2549m) and its massif of *metabasalts*. The very imposing rocky cirque of Les Iignes is the site of some picturesque waterfalls.

To the south and to the east, **a clearing looking toward the Mont Collon et the Arête de Tsalion gives us a magnificent view of the *Dent Blanche Nappe***. Facing us on the opposite side of the valley is the large indentation made by the Col de Tsarmine which separates the Petite from the Grande Dent de Veisivi.



Zoom on the Tsarmine glacier, the morainic bastion and the Tsarmine rock glacier (taken from the Aiguilles Rouges refuge, Photo: S. Ruttimann)

We now have in front of us a somewhat different view of the various forms of geomorphology on the Tsarmine slope, in particular on the Tsarmine *rock glacier* and the Tsarmine glacier's *morainic bastion*.

**This *morainic bastion* was formed by eroded materials, transported, deposited and piled up by the glacier.** The frontal position of the glacier has **varied very little since the end of the *Little Ice Age (LIA)*** most notably due to the thick cover of debris from the walls of the Grand Dent de Veisivi and the Blanche de Perroc.

We can also glimpse **a small part of the front of the *rock glacier* on the left of the bastion, which has formed from the *moraines* of the glacier as well as the fallen blocks from the Petite Dent de Veisivi.**

On the right of the bastion, the materials which have come down off the flanks of the Blanche de Perroc have formed a *talus veil*.

**Due to the presence of *permafrost (pergelation)* certain supersaturated ice zones have begun to slide or creep** thus forming some pre-talus ramparts (embryos of *rock glaciers*) as well as the *rock glacier* of Tsarmine, quite visible with its **front extending far into the torrent below.**



Example of an active rock glacier, Muottas Muragl (Grisons, Photo. S. Ruttimann)

### **What in fact is a rock glacier?**

It is one of the most visible forms of *permafrost* in the alpine environment. A **rock glacier** is a mass of rocky debris of various sizes with the empty spaces (pores or interstices) saturated with ice. This phenomenon (called *fluage*) permits a **rock glacier** to move down a slope in the same fashion as an ice glacier. The speed at which a **rock glacier** travels is a function of ice saturation in the pores. The movement itself depends on the *reptation* or creeping of the ice often concentrated in the interior shear zones of the rock glacier **and which causes a surface formation of rolls, mounds and furrows, arranged in convex arcs going uphill**. With the *fluage* being more rapid on the surface than in the interior, the edges and the fronts of active **rock glaciers** are stiff and straight showing no rock fragments or boulders which have all dropped to the foot of the glacier. **The front's degree of slope is generally a good indicator of the activity of a rock glacier**: a steep slope is the sign of an active **rock glacier**, a gentle slope, with **rounded edges** and a **debut of vegetalisation** will often be the sign of an inactive **rock glacier**, but one still containing a certain amount of ice. This is called a fossil **rock glacier**. (Reynard et Regolini, 2008)

Concerning fauna, this slope is a region known for its numerous ibexes or wild alpine goats (Chamois).

We now take the path, which begins at the principal outlet of the Lac Bleu, passing by a group of chalets in the pasture (*tsaleù*) of Louché (a refreshment stand in the summer) and continue our descent toward La Gouille.



### Stop B-8 (603878/100167) (46° 3' 10.869" 7° 29' 19.496")

Above the hamlet of La Gouille: a panorama of La Gouille (the hamlet and the lake) and the Dents de Veisivi. Place name: *Tsaleù de la Goélye*.

From this point, we have a good View of the Veisivi massif (*Dent Blanche gneiss*) and the Roc Vieux (2213 m, *Tsaté metabasalts*) . The relatively massive wall, about 200m high facing La Gouille and dominating La Borgne, is **made up of a large thickness of very monotonous gray calschists** shot through with *veins* of quartz and calcite.

**The site of La Gouille-Ouartsé is a large morainic terrace** slightly inclined and covered with pastures. Uphill, the grand slopes descending from the Mont des Ritses are scattered with rock fragments and boulders relatively stabilized by vegetation while the corridors are the scenes of avalanches in the winter (the Cherné avalanche killed two people at Christmas 1935). **The hamlet of Ouartsé (1891m), just above La Gouille groups together the oldest habitations, perched up high.** It was only later that the hameau developed on the site of La Gouille **in a zone protected from avalanches.**

The lake of La Gouille is fed by small torrents winding through the fields. **In the summer tourist season, trout are stocked in the lake** (daily fishing permits available).

We arrive in La Gouille (1834m) just above the Pension du Lac Bleu, on the old Les Haudères-Arolla road.

The return to Arolla can be made via postal bus or by foot following La Borgne to La Monta and then up to Arolla.



The hamlet of La Gouille and Veisivi Massif (Photo: S. Ruttimann)