

## Geological itineraries

### **Gardena Pass - Crespeina plateau - Colfosco**

The itinerary, approximately 7 km long, is located in the south west sector of the Puez-Odle Natural Park and does not show any particular difficulty for hikers. Starting from the Gardena Pass (2,121 m) and taking footpath no. 2 (Upper Dolomite Trail), the route climbs along sharp rocky hairpin turns up to the Cir Pass (2,469 m), then it comes down a little along gravelly scree towards Val de Chedùl, and goes up again as far as Forcella di Crespeina (2,528 m). Following for the Crespeina Lake, you come across the Crespeina plateau and eventually the Forcella del Ciampei (2,366 m). From here, following footpath no. 4, you descend eventually as far as the village of Colfosco (1,700 m).

From a geological viewpoint, this itinerary goes across the Ladinian-Carnian terrigenous formations of La Valle and San Cassiano, which are mostly made up of sandstones, marls and clays, and the Carnian-Norian dolomite formations of Dolomia Cassiana and Dolomia Principale. The latter are bounded by thin layers of the Raibl Formation, which is made up of marly limestones and clays showing a typical reddish colour. From a geomorphological standpoint, typical landforms linked to both the LGM glacial modelling and the periglacial action of frost and snow, can be observed. The path winds along ancient moraines, cutting across glacial cirques, proglacial ramparts, rock falls and talus fans, flanking also several small lakes. Moreover, from some panoramic points, it is possible to admire the surrounding Dolomite peaks, in particular the Sella and Puez-Odle groups, with their typical and peculiar profiles resulting from the selective morphological action on various rock types.

### **Gardena Pass (2,121 m) - Hotel Cir - Malga Clark (2,222 m)**

The initial tract of the itinerary corresponds to an easy footpath which, immediately uphill of Gardena Pass (2,121 m), goes up to Hotel Cir and continues towards Malga Clark (2,222 m), ascending on the southern slope of the Puez-Gardenaccia Group.

In this part, the footpath runs along the accumulation material of a rock fall occurring from the sheer slope of the Gran Cier Dolomia Cassiana, probably during the deglaciation phases of 15,000 to 10,000 years ago. On this slope the detachment crown in correspondence with the Gran Cier (2,592 m) is still visible, whereas the landslide body is made up of a vast accumulation of dolomite blocks and boulders some metres wide, extending from the foot of the relief as far as state road no. 243. From this point, by looking towards the opposite slope, it is also possible to admire the typical profile of the Gardena Pass and appreciate the different landforms of the Sella Group's northern slope, which have been strongly conditioned by geological structures: steep subvertical rock faces made up of dolomite rocks with their typical light colour emerge from mild, grass-covered slopes constituted of soft terrigenous rocks of the San Cassiano Formation. Numerous, mainly plastic, more or less chronic or recurrent mass movements, as witnessed by irregular morphological features showing humps, furrows and depressions have affected these wide, low-angle slopes.

### **Malga Clark (2,222 m) - Forcella Cier (2,469 m)**

The itinerary from Malga Clark towards Forcella Cier is uphill; here the ascent is harder because you move from the San Cassiano Formation to the rocky slope of Dolomia Cassiana. The footpath climbs across a wide complex landslide body, which, apart from the dolomite rocks of the impressive cliffs of the Puez-Gardenaccia Group, has also involved the underlying Ladinian-Carnian soils belonging to the La Valle and San Cassiano Formations. The landslide body, which was detached from the southern Gardenaccia slope, between Passo Cir (2,538 m) and Col Toronn (2,655 m), at first slid as a single block, covering the underlying more ductile rocks, then was dismembered into several portions, thus inducing other slope movements in the underlying rock types. In its first part the footpath stretches across a moon-like landscape, among huge rock blocks and high, isolated dolomite pinnacles up to 150-200 m high, still showing their original structure, although they are often displaced and extremely jointed. The last stretch of the uphill route to Forcella Cier winds on the landslide crown area, where the outcropping rocks appear all shattered owing to mechanical stress.

### **Forcella Cier (2,469 m) - Forcella Crespeina (2,528 m)**

Turning to the north, from Forcella Cier the view stretches over the head of the Val de Chedul, which was deeply modelled by the action repeatedly exerted by the Quaternary glaciers. The path leading to Forcella Crespeina runs above the valley, or across it, among typical landforms of the glacial environment. The head of the valley is, in fact, modelled in the shape of a glacial cirque, that is a typical semicircular depression dug in-between steep subvertical dolomite faces, where once there was an ice tongue flowing down the valley until it joined the Vallunga glacier. The valley floor of Val de Chedul is covered by detrital material, in part ascribable to glacial and gravitational processes. Proceeding along the path that runs along the southern valley flank, before starting the short uphill stretch leading to Forcella Crespeina, you come across vast rock screes, with their typical cone-like shape, which are scattered all over the foot of the overlying vertical faces (fig.4). These deposits are originated by rock fragments due to frost shattering processes, which are particularly effective on jointed dolomite faces, and were subsequently deposited by gravity at the foot of the slopes. Other characteristic forms of these environments can be found here: protalus ramparts, elongated debris ridges running parallel to the slope which, as previously stated, are due to rock fragments sliding on snow-covered slopes.

The last stretch of the footpath, climbing to Forcella Crespeina, runs across the Raibl Formation, which is stratigraphically found between the Dolomia Cassiana (231-224 million years ago) and the Dolomia Principale (223-215 million years ago). The latter formation, which is made up of clays, marls and prevalently red sandstones with thin levels of dolomite and gypsum, is less resistant to the action of meteoric agents than the surrounding dolomite formations and has formed a saddle on the crest.

### **Forcella Crespeina (2,528 m)**

Once across the relief watershed, the view stretches over the Crespeina plateau, with a subhorizontal surface conditioned by the strata attitude of the Dolomia Principale, which makes up also the vast plateaux of Gardenaccia and Puez. From this panoramic point, the imposing peaks of the Puez-Odle Group are visible quite clearly. On the background of the Crespeina

plateau the majestic ridge of Col de la Soné rises, which can be admired along the entire itinerary on this plateau. This mountain, with its typical cone-shaped feature, is made up of isolated remnants of the Jurassic and Cretaceous late sedimentation processes, which took place in a deep-sea environment, between 1,000 and 2,000 m b.s.l. This mount is in fact made up mainly of the so-called Marne del Puez (marls), corresponding to thinly stratified, reddish or greenish soft materials which were deposited about 144 million years ago. Owing to their easy erodibility, the presence of these marls in the Dolomites is confined to small outcrops. Col de la Soné has been preserved to this day since tectonic displacements caused the overthrust of a Dolomia Principale plate on top of the Marne del Puez, forming in this way a sort of protective slab: the oldest rocks were pushed on top of the more erodible younger ones, thus allowing their conservation.

### **Crespeina Plateau**

The footpath, which remains at the same altitude as far as Forcella Cier, runs across the Crespeina plateau, which is made up of resistant, horizontally arranged, Dolomia Principale layers. This plateau is partially affected by depressions and furrows due to both tectonic fractures and karst weathering processes. On the plateau all these depressions are arranged according to the main fracture lines, following their preferential directions. By following footpath no. 2, which goes across the plateau, the Crespeina Lake is quickly reached. This small body of water was formed within a depression developed along a fracture, which stretches across the whole plateau. It is also partly bounded by a large landslide body, which dams this basin on the Vallunga side. This landslide body, made up of chaotically arranged boulders of Dolomia Principale, is in part cut through by the path descending from the Forcella Crespeina crest towards the plateau bearing the same name. By proceeding in the walk, a small spring is found not far from the lake. It gushes out of the dolomite blocks accumulated at the foot of the northwestern slope of Sas Ciampac.

### **Forcella Ciampei (2,366 m)**

The itinerary continues with mild ups and downs along the western margin of the Gardenaccia Group, as far as Forcella Ciampei (2,366 m), where footpath no. 4 from Colfosco and the footpath from the Gardenaccia Pass merge. From here the view stretches to the east as far the Ciampei (Campaccio) great glacial cirque, which is characterised by vertical dolomite cliffs remodelled by slope processes subsequent to the glacier's withdrawal. At the edge of the cirque, evident moraine ridges left by the glacial tongues flowing downstream are visible, whereas the flat area at the bottom of the cirque is occupied by a wetland fed by snowmelt. The ephemeral lake, present only during the snowmelt season, has collected very fine sediments carried by rillwash waters which have covered the lake's bottom, thus burying every trace of older glacial deposits.

Before continuing the excursion, it is opportune to take a little diversion towards Puez Refuge, some metres from the fork, where it is possible to observe in detail the traces and inner casts of Megalodon fossils and lamellibranch molluscs which are typical of the Dolomia Principale, and which, when examined in section, appear shaped as small hearts or as prints of cow's hooves. The landscape in which these rocks were formed can be compared to the present sea plains found in some of the Bahama Islands or in coastal areas of the Persian Gulf. In the vast marine basin of the Upper Triassic, typical mollusc species, greatly varying in size up to 0.5 m, used to live

partially buried in the mud; they were often associated with other faunas living on the sea floor, such as, for example, the *Worthenia* gastropod.

### **Forcella Ciampei (2,366 m) - Colfosco (1,700 m)**

The route now turns towards its end with the descent from Lago Ciampei to the Edelweiss Refuge and, eventually, the village of Colfosco. Along the footpath large accumulation areas arranged at the foot of the dolomite cliffs, forming talus fans, can be observed. In some places, these accumulation areas are fed by actual debris flows, occurring mostly during the summer in concomitance with heavy rainstorms. The most recent ones correspond to tongues of whitish material inside the shrub belt where the Swiss mountain pines thrive. Descending along the ski piste, from the Edelweiss Refuge towards the first houses of Colfosco, a ridge of dolomite boulders, a few metres high, can be observed. It is the product of a vast rock fall occurring some 5,000 years ago on the Sas Ciampac dolomite faces overhanging the Forcelles ridge, which discharged its material as far as the village of Colfosco and beyond. The landslide age is known with fair precision since it was detected by means of radiometric methods (C14).

### **Corvara - Vallon - Corvara**

The itinerary, approximately 4 km long and has a difference in altitude of about 350 metres. It is not particularly difficult for trekking, but a good level of fitness is required.

The itinerary starts from Corvara and goes up by the Boè cableway to Lake Boè Refuge at an altitude of 2198 m a.s.l. From here, it proceeds along the eastern slope of the Sella Group following a ski piste and footpath no. 638 as far as F. Kostner al Vallon Refuge (2550 m). From this refuge the route goes down along footpath no. 637 towards Campolongo Pass then there is a turning just uphill of Bech de Rocas and the path goes back to the cableway station terminal. From a geological viewpoint, this itinerary goes mainly through the terrigenous Ladinian-Carnian La Valle and S. Cassiano formations, which are mainly made up of sandstones, marls and clays, and the Carnian and Norian (Dolomia Cassiana and Dolomia Principale) dolomite formations. The latter are in turn separated by the thin Raibl Formation, made up of marly limestones and clays, which is a typical reddish colour, in some places verging on green. From a geomorphological standpoint, this footpath winds across the eastern sector of the Sella Group, whose geomorphological features are strictly linked to the geological characteristics of the area, which is affected by various tectonic displacements. In addition, the area has been affected with time by the modelling actions of glaciers, atmospheric agents and gravity. Among the most frequent elements of this landscape there are talus cones and talus fans generated by intense frost shattering on the steep dolomite faces. Other characterising landforms of this itinerary are given by traces of erosion and moraine accumulation deposits left by glaciers during the Last Glacial Maximum and a series of more or less evident surface karst forms. Furthermore, from some panoramic points it will be possible to observe the spectacular morphological features of other Dolomite groups.

### **Arrive cableway Boè (2198 m)**

From the top of the cable way there is a wide panoramic view of the main Dolomite peaks. Looking to the east, from left to right, the following are recognisable: Cime di Fanes, the Lagazuoi dolomite massif, the Valparola Pass, the Settsass dolomite ridge, Nuvolau, the Col di Lana volcanic peaks, Mt. Pelmo, Mt. Civetta, La Schiara, the Marmolada glacier, which is the last remnant of the vast ice sheet that used to cover all the Dolomite valleys and the Gran Vernel up to a considerable height.

Moreover, from this point it is also possible to observe the opposite side of the Corvara in Badia valley, which has mainly been shaped out of the weak and easily erodible rock types of the La Valle and San Cassiano formations, which are in sharp contrast with the prevalently competent rock types cropping out on the surrounding sheer Dolomite faces. Besides numerous surface slope movements affecting these formations - emphasized by the irregular slope morphology showing humps and depressions - from this position it is possible to analyse the great Corvara landslide in all its complexity. This is a slow slope movement that descends from the crest of Pralongià, between Punta Trieste and Bioch, towards Capanna Nera, further decreasing its velocity from the golf course to the hairpin turns of Campolongo, and eventually coming to a stop in proximity of the village of Corvara. This landslide started its movement some 10,000 years ago, as shown by means of 14C dating carried out on fragments of tree trunks involved in the movement.

#### **Arrive cable way Boè (2198 m) - Lech de Boà (2252 m)**

The first stretch of the itinerary follows footpath no. 638, which runs parallel to the ski piste, along the outcrops of stratified dolostone which dip downstream approximately with the same inclination as the slope. From the geomorphological viewpoint, these kinds of slopes, coinciding with stratum surfaces, are named structural slopes. After a few minute walk, Lech de Boà is reached. This site is contained within a very characteristic depression that has been shaped by several modelling agents. This depression originally developed along a tectonic displacement line: its north-east face is made up of a massive fault scarp, that is a surface corresponding to a fracture along which the relative movement of the rock blocks took place. The movement of the blocks along the fault plane is recognisable owing to both the grooves left on the surface and the different geometrical positions in which the same rocks are found on both sides of the fault. Subsequently, this depression has also undergone important modelling processes by karst activity: indeed, carbonate and, to some extent, also dolomite rocks are subject to these phenomena whereby rock minerals are dissolved by meteoric water, giving rise to the formation of typical concave forms. When carbonate rocks are penetrated by waters carrying even small amounts of carbon dioxide, they react with it and are very slowly transformed into bicarbonates, which are soluble and removable by surface water. Finally, also the action of an ancient glacier contributed to the modelling of this characteristic trough as is witnessed by the smooth rock faces and rounded shapes found all over the area.

#### **Lech de Boà (2252 m) - in the vicinity of F. Kostner al Vallon Refuge (2500 m)**

The ascent continues up the Gruppo Sella eastern slope and if a short detour to the right is taken from footpath no. 638, another depression is found whose origin is ascribable partly to structural processes and partly to glacial processes: the Vallon pond. During the summer this concavity is practically dry since the source of its water is mainly the springtime snowmelt. The bottom of

this small body of water is covered by thin lacustrine deposits, whereas its shores are covered by considerable talus fans and talus cones in the form of light-coloured accumulation materials that surround the foot of the steep overhanging dolomite slopes. Their origin is linked to the abundant production of material that is detached from the overhanging vertical faces and accumulated at their foot following intense frost and thaw processes affecting the intensely jointed dolomite rocks. Proceeding along the path ascending to the Kostner al Vallon Refuge, it is possible to observe evident traces of the modelling action carried out by glaciers during the last glaciation: glacial cirques (typical semicircular depressions that used to host ancient glaciers), moraine deposits (detrital deposits transported and emplaced by glaciers), overdeepened hollows and rock faces made smooth by glacial activities. In particular, as one enters the Vallon, dolomite faces made smooth by the passage of the large ice tongue descending in a north-east direction from the overhanging Lech Dlacé, are easily recognised. In correspondence with the terminal station of the Vallon chairlift, looking towards Piz Boé to the south-west, it is possible to observe a main glacial cirque and two smaller ones arranged in a step-like pattern on top of the main one. Another well preserved cirque is located on the Piz del Vallon eastern flank, some hundreds of metres away from Kostner al Vallon Refuge (2500 m). A bit further to the north, uphill of the chairlift, in proximity of Piz da Lech, there is another very narrow cirque below which small moraine arcs - probably linked to various periods of withdrawal of the ice tongue descending towards lake Boè - are recognisable. The ice tongues that used to flow inside these typical depressions, similar to an armchair, descended in a north-east direction along the Vallon, carrying with them and accumulating debris materials at their front, thus giving origin to moraine ridges.

### **In the vicinity of Franz Kostner al Vallon Refuge (2500 m)**

On arriving at Kostner al Vallon Refuge, it will be possible to observe numerous typical landforms that characterise considerably the landscape: a long series of talus fans, talus cones and protalus ramparts are spread all about at the foot of the sheer dolomite Vallon faces. This debris was deposited thanks to the combined action of gravity and current water transport and deposition, and is made up of rocky fragments generated by mechanical rock degradation that takes place mainly because of the frost-thaw process. This process is caused by the pressure exerted by water on the rock slopes - that here are particularly jointed - when it turns into ice thus increasing in volume. After the end of the Würm glaciation, some 10,000 years ago, the most elevated areas, no longer covered by ice sheets, were modelled mainly by intense processes of this kind. In Vallon at least three cones can be easily recognised at the foot of narrow defiles leading to hanging glacial cirques: one is found west of the Kostner al Vallon Refuge whereas the other two are located at the foot of the defile leading to Piz da Lech. Other debris material detached from the dolomite cliffs slides on the snow and accumulates at the foot of the slope giving origin to protalus ramparts. These are arcuate or festoon-shaped ridges of debris arranged parallel to the slope. Forms of this type are observable west of the Kostner al Vallon Refuge. From this point it is also possible to observe vertical dolomite faces characterised by deep vertical moderately open joints along which numerous and spectacular "vie ferrate" of the Sella Group have been traced.

### **Vallon (2500 m) - Bech de Roces - Lake Boè Refuge**

From the refuge the itinerary continues for a short while at the same altitude along footpath no. 638, then it takes footpath no. 637, which descends towards the Campolongo Pass. At first this route is very steep since it goes across competent dolostones and winds between sheer dip-downstream rock walls. In some points, in correspondence with particularly jointed layers, there are small water springs. The path continues to descend more gently as far as the crossroads with the mountain tracks coming from Arabba (no. 637), Campolongo Pass (no. 636) and Lake Boè Refuge. From this point, the vast Bech de Roces landslide body can be observed. The hikers will be able to observe these typical morphological features during the descent as far as the cableway and the end of the track. This large landslide is characterised by a set of rock blocks, high pinnacles and isolated peaks of Dolomia Cassiana that, after being detached from the Col de Stagn (2517 m) overhanging cliffs, slid downstream west of Campolongo Pass. Although their present arrangement shows a good degree of displacement, they have partly preserved the original rock structures. Like other gravitational movements occurring in the Dolomite region, this landslide is very old and can be traced back to the early stages of the glaciers' withdrawal from these valleys.

The descent towards the cableway continues between ups and downs across a landscape characterised by milder and smoother slopes corresponding to the ductile S. Cassiano Formation. On arriving at Lake Boè Refuge, before descending to Corvara by means of the cableway, there is a view of the underlying ski pistes stretching over the characteristic Crep de Munt relief, which is a landform resulting from the local geological structure: in fact, near the piste the Dolomia del Dürrenstein layers have a nearly vertical attitude.

### **La Villa - altipiano del Gardenaccia - Val de Juel - La Villa**

Geological itinerary no. 3 is some 8 km long with a difference of altitude of about 900 m. It is located in the eastern sector of the Puez-Odle Natural Park and does not present any particular difficulty for hikers although a good level of fitness is preferable. The starting point for this excursion is the village of La Villa, where one can take a chairlift up to an altitude of 1700 m, near Sponata refuge. From here, hikers can proceed along the south-eastern portion of the Gardenaccia massif by taking footpath no. 5. This is a mountain track winding upstream through thick forests located at the foot of the Gardenaccia ridge. Once at Gardenaccia refuge (2050 m), the upstream itinerary continues first along footpath no. 11 and then footpath no. 15 towards Forcella de Gardenaccia.

From here, the last uphill stretch of the route follows footpath no. 5, coming from the Puez Group, and eventually goes down along the flank of the Para Dai Gai ridge. On the right-hand side, hikers can admire the quietness of Val de Juel, as far as Gardenaccia refuge and, from here, still along footpath no. 5, they can reach Sponata refuge once more. The descent to the village of La Villa can be made by chairlift.

From a geological viewpoint, the itinerary mainly runs across the Carnian and Norian Dolomite formations (Dolomia Cassiana and Dolomia Principale), which are separated by the thin Raibl Formation, made up of typically reddish marly limestones and clays. In addition, along the itinerary the youngest rocks of the Dolomite region can be admired. These are the famous "Rosso Ammonitico", which is very common in the districts of Verona and Vicenza but very rare in this area, and the "Marne del Puez", that are soft, weathered, grey-greenish Cretaceous rocks deposited 120-130 million years ago in a deep-sea environment. From a geomorphological standpoint, the itinerary goes across the eastern sector of the Gardenaccia Group, whose configuration is strictly linked to the geological and structural features of the area, characterised by several tectonic discontinuities. Through time, these have been alternately subjected to the modelling actions of glaciers, weathering and gravity. Among the most frequent elements of this alpine landscape there are talus fans and debris cones, which are the result of intense frost shattering processes on the steep dolomite cliffs. Other landforms characterising this itinerary are the traces of moraine erosion and accumulation left by glaciers during the Last Glacial Maximum and a series of more or less evident epigeal karst forms. Furthermore, the spectacular morphological features of other Dolomite groups can be admired from some panoramic points.

**A - Arrival station of the Sponata chairlift (1703 m) - Gardenaccia Plateau (near the refuge bearing the same name)**

Taking the chairlift from the village of La Villa, one arrives at an altitude of 1750 m, near Sponata refuge. From here, hikers can follow footpath no. 5, up towards the Gardenaccia plateau through thick larch woods situated at the foot of the ridge. The final stretch of the ascent winds along the steep dolomite slope, ending at the summit of the Gardenaccia fossil reef, near the refuge bearing the same name, at an altitude of 2050 m. If one takes some time to look around during the ascent, a panoramic view of Valparola and its main centre, San Cassiano, can be admired to the south-east. The arrangement of the Valparola is a clue to the typical morphology of these valleys, with the vertical dolomite cliffs of the Cunturines Group dominating the less steep underlying slopes which were shaped in the Ladinian-Carnian La Valle and S. Cassiano terrigenous formations and are mostly made up of sandstones, marls and clays. In the background the Valparola Pass can be seen; this was modelled during the Last Glacial Maximum by the pressure of an ice tongue flowing towards the Falzarego Pass. Traces of the glaciers' passage and modelling are to be found also in a series of irregular ridges stretching across the valley floor: these are the remains of moraine bars and can be observed in correspondence with the village of Armentarola.

Once arrived at the top, near Gardenaccia refuge (2050 m), hikers should take a short break so as to appreciate the panorama offered by the Cunturines and Settsass groups, with the adjacent Pralongià plateau.

**B - Gardenaccia Plateau (near the refuge bearing the same name) - Forcella Gardenaccia (2548 m)**

From the Gardenaccia refuge the route continues along footpaths no. 5 and, afterwards, no. 11. Eventually, there is a fork where footpath no. 15 should be taken as far as Forcella Gardenaccia,

which is the highest point of this itinerary at 2548 m a.s.l.

At first the track goes across a flat area near the refuge, curving around a sort of a small, steep, narrow valley of structural origin. In fact, this valley developed along an important regional fault which has undergone displacements also in recent times. Geomorphological evidence of this tectonic alignment is given by a reverse slope east of the refuge and the deep rock defile stretching from the refuge to the south-east, towards Varda.

Subsequently, the track winds along a surface composed of dolostone layers composed of large blocks along this stretch of the path, but after the fork with footpath no.15, they appear to be stratified.

The dip-upstream attitude of the strata, that is inclined in a opposite direction to the slope, confers a peculiar aspect to the slope, as if it were arranged in gigantic steps. Along the route there are several depressions created by the attitude of the dolostone strata and in some places also by faults and joints which affect the whole surface of the Gardenaccia fossil reef. With the passing of time these depression have also undergone complex modelling due to the combined action of several agents: karst processes and glacial activity during the Last Glacial Maximum often contributed to shaping the concave landforms typical of this area. Carbonate rocks, and partially also dolostones, are subject to well-known karst processes which cause the chemical solution of minerals by meteoric water rich in carbon dioxide, thus leading to the formation of typical concave landforms. In fact, the presence of carbon dioxide transforms carbonates into soluble bicarbonates, which are subsequently removed by running waters. The modelling action of Quaternary glaciers is particularly evident along footpath no. 15 which ascends towards Forcella Gardenaccia, following a wide, round-shaped valley where glacial ridges and cirques arranged like steps are quite evident.

### **Forcella Gardenaccia (2548 m)**

Once at Forcella Gardenaccia, the highest point of the whole itinerary, the view stretches over the great Puez-Gardenaccia Group plateau and the entire Dolomite landscape. From here, the result of selective erosion on different rock types can be seen in detail. This particular geological situation is well- represented at Col de la Soné, a typical cone-shaped hill formed by the isolated remains of the last Jurassic and Cretaceous sedimentation processes taking place in a deep-sea environment, 1,000 to 2,000 m b.s.l. This hill is mainly made up of the so-called Marne del Puez, which are thinly stratified, reddish or greenish soft marls, deposited in a deep sea some 144 million years ago. Owing to their high erodibility, only small outcrops of these marls are preserved in the Dolomite region, surrounded by intensely weathered, debris-covered slopes. Col de la Soné happened to be preserved because tectonic displacements caused the overthrusting of a Dolomia Principale slab on top of the Marne del Puez, thus forming a sort of protective plate. The oldest rocks were pushed over the younger rocks - which were also the most erodible - thus allowing their conservation.

If a short diversion is taken from the path towards Col de la Soné, typical Megalodon fossils can be observed, which appear in section in the shape of small hearts or cow footprints. Dolomia Principale was formed in a vast, shallow marine environment which was slowly subsiding, thus permitting the progressive deposition of considerable thicknesses of sediments. The landscape where these rocks were formed can be compared to the tidal sea-floor environment found today

in some of the Bahama islands or in coastal areas of the Persian Gulf. In this vast Triassic marine basin typical molluscs used to live half-buried in the mud. Their dimensions were rather varied, attaining a length of up to 50 cm. They were often associated with other species living on the sea floor, such as the Worthenia gastropod.

### **C - Forcella Gardenaccia - Val de Juel - arrival station of the Sponata chairlift**

After a stop at Forcella Gardenaccia the route goes down towards Sassongher, along footpath no. 5, which runs along the left of the sheer slopes of Para da Gai as far as the head of Val de Juel. From here the landscape drastically changes and from this position there is an excellent view of the effects of Alpine glaciation which are particularly evident just in the underlying Val de Juel. The head of this valley - a typical semicircular depression created between subvertical dolomite faces - is in fact modelled in the shape of a glacial cirque, where there was once an ice tongue descending along the valley. The valley was arranged in a southwest-northeast direction and merged with the upper Badia Valley. The floor of the Val de Juel is covered with debris materials which are partially derived from glacial processes - especially in the innermost part of the valley floor - and partially to gravitational processes, mainly found along the flanks. The glacial deposits on the valley floor are easily recognised since they are arranged in the shape of transversal ridges which were formed during stationary stages of the ice tongue. The present morphological features, though, are no longer modelled by glacial processes: after the end of the Würm glaciation (about 10,000 years ago), periglacial conditions substituted proper glacial conditions. Although still rigid, the climate no longer allows the presence of ice all the year round, and the landscape has since been modelled mainly by intense frost/thaw alternances. These processes produce large amounts of debris which is detached from the dolomite faces. The intensity of the phenomenon is considerably increased by the dense joints found in the dolostone rocks of this area. The two flanks of the valley are in fact characterised by the evident presence of faults and fractures which have weakened these rocks to the point of making them particularly erodible. The Sassongher northern slope shows a typical serrate outline, with deep cuts and steep rock towers which form thick talus fans and debris cones accumulated by gravity and snow at the foot of the rock cliffs. The track runs across the entire Val de Juel, remaining at the same altitude at the foot of the dolomite face, crossing over the apexes of the Para dai Gai debris cones and using a narrow ledge cut into the Raibl Formation, which is stratigraphically placed between the Dolomia Cassiana (231-224 million years ago) and the Dolomia Principale (223-215 million years ago). The Raibl Formation, made up of clays, marls and generally reddish sandstones, with occasional thin layers of dolostone and whitish gypsum, is less resistant to the action of exogenetic agents than the surrounding Dolomite formations. The saddle-like shape of the crest is therefore explained by the presence of these reddish, less resistant rocks. Before leaving Val de Juel, the path becomes more exposed during the short passage across the crest, although it is still easy to walk. From here, once again crossing the Dolomia Principale, footpath no. 5 leads the hikers back to the Gardenaccia refuge and to the descent towards the La Villa skilifts and chairlifts.

## **The larch wood excursion Dolomites**

The naturalistic and educational trail with start from the localities of Glira or Armentarola goes through the farmsteads of Rü and Larscei and leads to the Rudiferia farmstead where you can admire a characteristic water mill that was recently restored and that is perfectly functional. The trail, which was set up thanks to the work of the natural parks office of the Province of Bolzano, unwinds through larch forests and alpine meadows at the foot of the Fanes - Senes - Braies natural park.

Apart from offering suggestive views of the countryside, the route also gives excursionists the possibility of admiring some interesting man-made creations that are in perfect harmony with the surrounding nature, such as the characteristic fences of the alpine region, the dry walls and the aforementioned water mill. Along the trail a series of data plates give most important information regarding certain types of plants and shrubs and there are also some tables with information on the flora, fauna and geology of the area.

During the summer season, guided excursions along the trail and visits to the mill will be organised.

## **The Summer Sellaronda**

How about trying the SELLA RONDA in the summer?

The route around the Sella massif, the heart of the Dolomites, that in the winter is the dream of every skier is in summer a great challenge for every mountaineer.

In winter the SELLA RONDA tour is made by means of ski lifts and the unique ski-carousel, in summer these are replaced by a combined offer of lifts, public buses and hiking paths. The frequency of buses, in both directions, and the lifts available make it possible to organise the round on an individual basis.

Approximately 5 to 8 hours are necessary to make the entire round, using the available lifts and covering the remaining route by bus or/and on foot, according to one's personal taste.

From July to the first week in September the tourist board Alta Badia organizes weekly (every Tuesday) a guided Sella Ronda excursion.

## **"Klaus and Dorothea von der Flühe" Meditation Route**

The meditation route that goes from the locality of Sarè to the "Sass Dlacia" chapel was set up during the summer of 2003. Along this easy route measuring approximately 1km you will find a series of symbolic statues and tables with aphorisms, quotations and prayers.

We hope that this route, which is rendered even more fascinating by the splendid dolomitic scenery surrounding it, will prove to be a source of peace and serenity for those who walk along it.