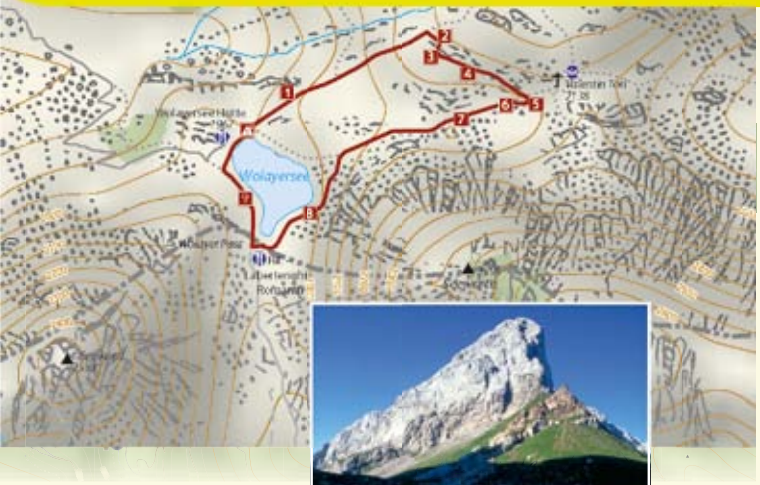
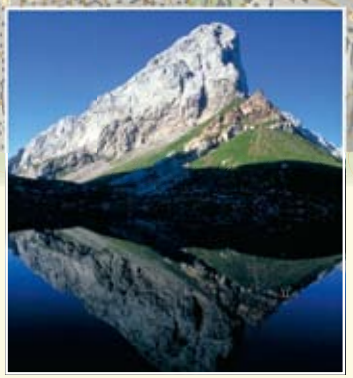
Geotrail Wolayersee

„Walking on the sea floor"





Lake Wolayersee with the Seekopf peak

The Geotrail at Lake Wolayersee takes you through a world of ancient seas which are long gone, but have left their traces in the form of fossils such as corals, sea lilies, snails and trilobites inside the rocks, some of which are highly colourful.

This sea embraced great parts of Europe including the Lake Wolayersee region some 460 million years ago, where it remained until 320 million years ago. It was followed by the turbulent Variscan mountain building event: some areas were lifted while others subsided. Rocks were folded, displaced and thrust upon each other. The sea disappeared, and with it its inhabitants. The entire Carnic and Gailtal Alps were affected by this mountain formation period. During the Upper Carboniferous the sea returned, but this time did not reach as far as Lake Wolayersee.

The Wolayersee Geotrail itself takes only 2.5 hours, but the long ascent of approx. three hours to the starting point at the Wolayersee Hütte lodge makes this geotrail a demanding day tour. It is recommended that you extend the hiking tour over two days and spend the night at the Wolayersee Hütte. For the most part, the geotrail itself follows the much-used hiking paths from the Wolayersee Hütte onto the Rauchkofel (path no. 438) as well as the Carnic High Trail (Karnischer Höhenweg, path no. 403); they require surefootedness but do not run across precipitous terrain. Only crossing the Rauchkofelweg path towards Karnischer Höhenweg, i.e. from geopoint 2 to geopoint 5, requires more caution.

Car	via the B111 Gailtal Bundesstrasse to Birnbaum, turn off towards Nostra and on to the Hubertuskapelle chapel or via the B110 Plöckenpass Bundesstrasse towards the Plöckenpass, turn off towards Untere Valentinalm
Parking	at the Hubertuskapelle chapel or Untere Valentinalm
Start of the Geotrail	Wolayersee Hütte lodge
Length	2,6 km
Difference in altitude	250 m
Duration	2 ½ h

View from the west over the Biegengebirge mountains to Lake Wolayersee

Note

Along the Geotrail at Lake Wolayersee, no information boards have been erected. So as to preserve the landscape. Instead, the individual stopping points are marked with a numbered post.

Red Findenig Limestone

1 The Findenig limestone – still a mystery

From the start point, the Geotrail is accompanied by a red rock. It extends from the green meadows below the Seekopf peak to the Valentin Törl and is known as Findenig Limestone named after the typical occurrence on the Findenig mountain further east in the Carnic Alps.

Dark and light-red layers alternate within the rock. The colour is derived from the finely distributed iron mineral, haematite, better known as blood stone. The dark red layers are rich in clay while limestone dominates the light red sections.

The Findenig Limestone developed from a clay-rich lime mud which was deposited at sea depths of 100 m and more during the Devonian Period, some 390 million years ago. The shells and skeletons of marine organisms began to accumulate in this mud, making a significant contribution to the development of the rock. These were primarily plankton groups and not larger inhabitants of the sea floor. As a result, there are virtually no fossils present in this Findenig Limestone which are visible to the naked eye. It still remains a mystery how this network-like structure was formed.

Red Findenig Limestone in the alpine pasture area, grey limestone in the Biegengebirge mountains

2 Fragmentary history of the Earth

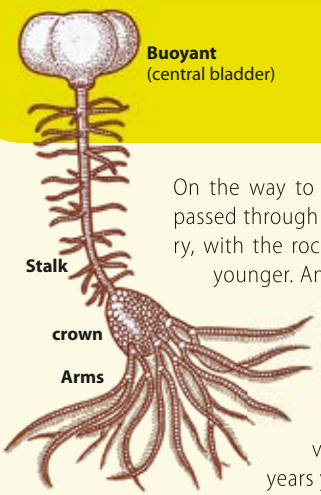
Striking rock boundary

While you have conquered a degree of height difference here, in terms of the Earth's history, you have gone back millions of years. The site is a communication trench from the First World War and consists of the second oldest rock in the GeoPark: the 450 million year old light-grey Wolayer Limestone. This borders the younger brownish Kok Limestone. These date from the Silurian Period and are around 430 million years old.

The Kok Limestone contains the chambered tubes of Orthoceras ('straight horn') which are a decimetre in size. They are now extinct but once populated the open sea along with snails, trilobites and shells. The Wolayer Limestone contains the fossilised remains of extinct creatures known as cystoids. They lived in relatively flat water with significant movement.

There is a gap of approx. 20 million years between these two rocks. No sediment is preserved from this interval of time. Geologists explain this by the rising of the sea floor or retreating of the sea, meaning that no limestone could be deposited.

Longitudinal section of Orthoceras



Complete free-floating sea lily

3

Formed in the sea – shaped by the rain

On the way to this stop, you have once again passed through 40 million years of Earth's history, with the rock layers becoming younger and younger. Another change in the rock type is evident at the site itself. The approx. 420 million year old dark grey Silurian limestone on the slope is replaced by lighter limestone from the Devonian which is some five million years younger.

The dark-grey limestone on the slope contains Orthoceras as well as some circles with a diameter of up to 20 centimetres. These are the remains of free-floating sea lilies which once lived in the flat sea here. They indicate the fall in sea level towards the end of the Silurian. After this time, the sea became deeper again for a short period and hostile conditions set in. Conditions then improved quickly and the light limestone present at this site was deposited. Groove-shaped channel erosion can be seen in this limestone, which is typical of this rock type. This is the result of rainwater running off which acts as acid due to the carbon dioxide it absorbs from the air.

Fossilised remains of a free-floating sea lily

Channel erosion

4

At the mass grave of primeval octopus

Life in the primordial sea

The 420 million year old limestone block at this stop, which has fallen from the Rauchkofel, contains more Orthoceras than any other rock along the Geotrail. Thanks to the dark rock and fossils filled with white calcite, the delicate structures of these extinct creatures are clearly visible. These Orthoceras of up to 9 m in length evolved into loosely twisted forms and then the famous ammonites. The latter died out 65 million years ago. Orthoceras lived on only in the form of the chambered Nautilus. The creatures had a shell divided into chambers and the animal lived in the largest chamber. The chambers were filled with nitrogen and the animal regulated the exchange of gas between the chambers via a kind of tube, the sipho. Based on the reaction principle, the creature was therefore able to swim, sink, rise and float. It is assumed from the current living environment of the chambered Nautilus that Orthoceras lived in warm seas with depths of up to 600 m.

The 420 million year old limestone block

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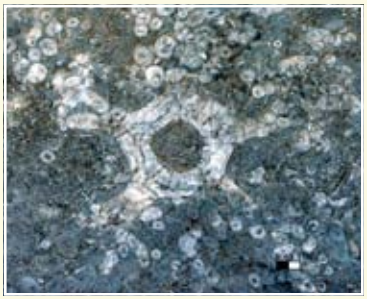
'Animal' flowers and other mysterious creatures

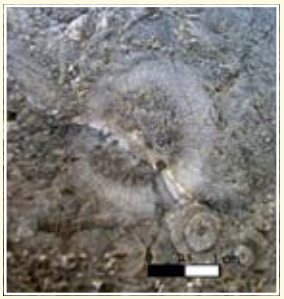


Sea lilies

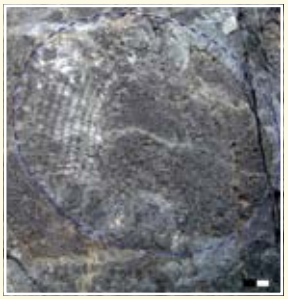
The striking Kellerwand cliff towers up to the south of this stop and consists entirely of marine deposits from the base to the peak. These were deposited over a period of 100 million years, starting some 460 million years ago.

The fossil-rich limestone block is derived from this cliff, as does virtually all of the debris in the Wolayertal valley. The rock is dominated by sea lilies (crinoids) which derive their name from their flower-like appearance. However, they are actually animal organisms and still populate the seas today. A stem with roots anchors them securely to the sea bottom. The top end of the stem contains a kind of flower, the so-called crown, from which the tentacles of the animal extend. The lime-based individual segments of the animal's hard components lost their cohesion after the death of the animals. As a result, it is rare to find fully preserved sea lilies. Usually only part-fossils are found: the crown or stem segments.

Fossilised corals and extinct stromatoporoids are also frequently occurring in this block. The latter are thought to have been a type of sponge and were important in forming reefs – although this is still the subject of debate.



Solitary coral in centre and sea lily stem segments



Stromatoporoids

6

Lifeless rocks – hostile times

Sedimentary rock in the Hochwipfel Formation

This site is the home of the youngest rocks along the Geotrail, although they are still 330 million years old, dating from the Carboniferous Period. They are grouped together under the term Hochwipfel Formation and have a completely different history of development compared with the limestone we have seen so far, as no living creatures have been involved in their creation.

During the late Devonian approx. 360 million years ago, the Carnic Alps were hit by stormy times. The first mountain development period in the Alps, the Variscan Orogeny, affected the whole of Europe and Asia. Mountains were lifted up and sea basins subsided. Huge quantities of rubble, sand and fine material in the form of sediment flows were carried from the continent to the sea and deposited into deep ocean troughs forming the Hochwipfel Formation (clay shale, sandstone, siltstone and breccias). Living creatures avoided such environments which is why there are few fossils in these rocks. The Hochwipfel Formation represents the dominating rock type in the Carnic Alps to the east of the Plöckenpass.

Goniatite

7 Appreciating the little things!

At this stop, you can see spiral-like fossils within the limestone. These are goniatites, the extinct predecessors of ammonites from the Devonian (approx. 370 million years ago). However, information about the events which took place at Lake Wolayersee is mainly provided by the dental remains of conodonts found in the cliff, although these are not visible to the naked eye. These were discovered in the 19th century, although the appearance of the animals remained a mystery for over 100 years. It was not until 1983 that the first complete fossil was found. This revealed that conodonts were approx. 4 cm long and eel-like in appearance.

Thanks to their fast-changing form, conodonts are ideal for determining the age of stones. The numbers in the cliff indicate the points where conodont samples have been taken. These investigations brought some interesting results, for example, the fact that at this stop 6.5 m of limestone have been deposited during 12 million years. On the Kellerwand cliff, at the other side of the valley, several hundred metres of limestone formed over the same period.

(Photo: H. Priewalder, GBA Vienna)

8 A tropical sea at 2,000 m above sea level

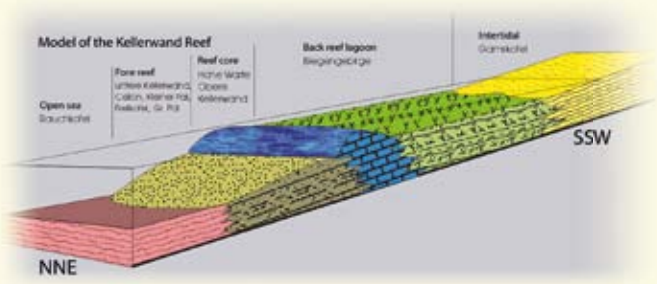
Fossilised snail

During the Devonian Period (420-360 million years ago), a shallow warm ocean extended across the Carnic Alps region. This offered optimal conditions for the growth of reefs. Reefs consist of a steep slope facing the sea (fore-reef), a reef core and a lagoon extending to the continent.

The centre of the reef in the Carnic Alps was located in the region of Lake Wolayersee. The Hohe Warte and Seewarte to the south represented a reef core of which only a maximum of 10% of the original core has been preserved. The deposits formed in the lagoon have formed the Biegengebirge mountains we see today.

The sea basin must have subsided in order to provide the space for the several hundred metres thick reef deposits. Only then could the environmental conditions needed to create a reef be maintained and these powerful rock sections be formed.

Corals, stromatoporoids, sponges, sea lilies, calcareous algae, snails and shells were all involved in the formation of the reefs. They can all be discovered in the debris from mountain Seewarte. The cliff block at the stop shows a beautiful fossilised snail.



Lake Wolayersee – in the centre of marine deposits

Lake Wolayersee is located at 1,960 m above sea level and its panoramic views are sure to impress any visitor. The Seewarte towers up to the southeast of the lake and the Seekopf to the southwest – separated by the deeply incised Wolayer Pass.

The lake is surrounded by rocks dating back 460 million years. However, in itself it is a very recent creation, developing during and after the last Ice Age, the Würm glacial period, which peaked at around 20,000 years ago. The glacier in the area at the time carved out a trough, flowed over the Wolayer Pass and ground out its rock bar. Once the ice had retreated, the trough filled with water and formed a lake. Analyses of pollen found at the bottom of the 14 m deep lake revealed an age of around 10,000 years. This means that the ice from the last inland glacier had melted at around this time and that the lake is at least this old.
The lake is fed by underground influxes of water from the surrounding talus material with the inflows and outflows maintaining a rough balance. The water temperature of this approx. 4 ha lake never exceeds 14°C.