

At the Cellon section the Plöcken Fm. attains a thickness of 5.40 m. The lower 0.80 m thick portion is composed of arenaceous siltstones followed by impure limestones and calcareous sandstones with layers of bio- and lithoclasts. The fossil debris mainly represents disarticulated brachiopod shells but also bryozoans, trilobites, ostracods and conodonts are quite abundant. The whole package is strongly bioturbated, partly graded and convolute bedding and channeling occurs. This lithology suggests a storm-dominated shallow water environment which formed during the retreat of the ice in the *N. persculptus* Biozone.

Representatives of *N. persculptus* occur approx. 0.25 m above the base of the Plöcken Fm. Hence, this index graptolite testifies the upper Hirnantian Stage during which the transgression started on a global scale. Due to local tectonic uplifts, however, in the Carnic Alps a gap in sedimentation occurred at the base of the Silurian. Thus, at the Cellon section the equivalences of the lower and middle Llandovery are missing. Continued sedimentation across the passage from the Ordovician to the Silurian seems to have only occurred in the basinal black shale environment of the Bischofalm Facies.

Stop 2 – Devonian Succession at Mount Freikofel

Mt. Freikofel is located to the east of the Plöckenpass (Passo di Monte Croce Carnico) and can be reached by following Trail # 403 from the Plöcken Haus (1215 m) to the trail head of trail # 401 which climbs to the top of Mt. Freikofel (Cuelat, 1757 m). The trail on the Austrian side shows good exposures of the Frasnian/Famennian succession whereas the branch on the Italian side follows an old army track and shows best exposures of the Lochkovian to Middle Devonian succession.

Note: *The military track is not difficult to walk (it was made for mules) but it is not secured and drops off steeply to the sides. It is not recommended for those afraid of heights and great care must be taken not to dislodge stones. Good foot wear (boots) is essential.*

Mount Freikofel exhibits a spectacular section which spans almost the entire Devonian, it is easily accessible, well preserved and well exposed.

Based on lithological criteria the succession can be subdivided into five units (Fig. 23):

- Unit 1 Basal dark grey platy and lumpy limestones (~77 m thick).
- Unit 2 Yellow-grey lumpy to nodular bedded limestones with intercalated calcarenite beds (~74 m thick).
- Unit 3 Massive lithoclastic limestone with reefal debris and lithoclasts (~68 m thick).
- Unit 4 Bedded lithoclastic limestone with intercalated calcarenite units, increasing bed thickness up section (~56 m thick).
- Unit 5 Grey stylo-bedded fine-grained limestone and grey to pink burrow-mottled limestone with intercalated calcarenite and calcirudite beds (~36 m thick).

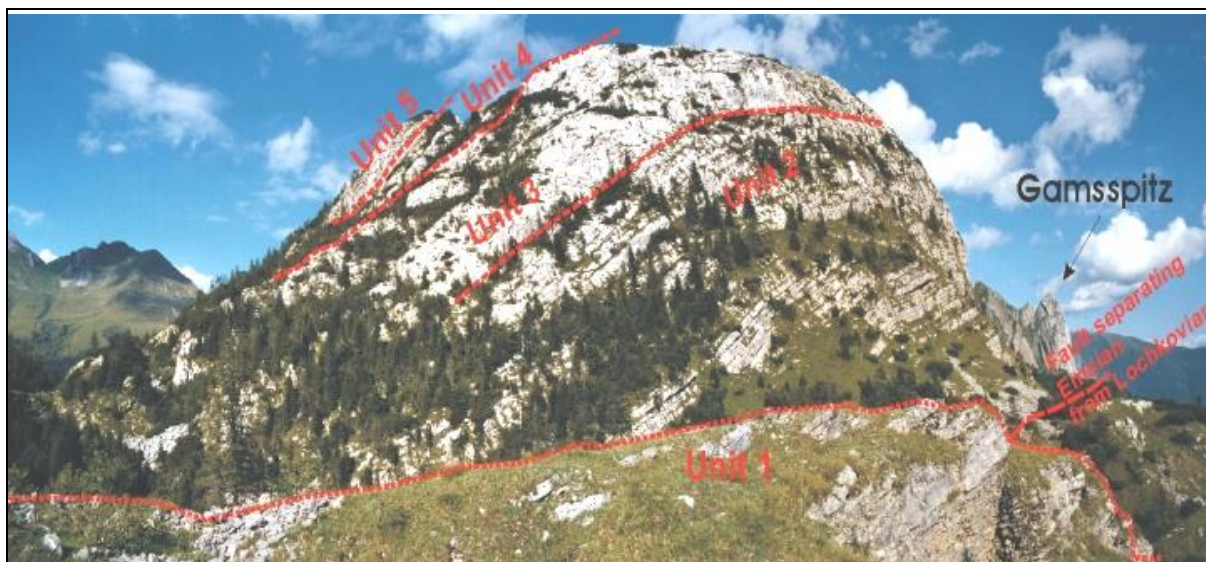


Fig. 23: The Devonian section at Mount Freikofel viewed from southwest.

The basal **unit 1** is exposed at the southern branch of Trail # 401 towards Rossboden Törl (Passo Cavallo).

The succession begins with dark grey fine grained wackestones and mudstones with chert nodules which are probably Lochkovian in age (Unit 1). Up section hackly weathering calcisiltites appear, intercalated with interbedded lumpy and nodular limestones. About 65 m up section the nodular limestones disappear and calcisiltites and thinly bedded wackestones and mudstones dominate the top part of the section up to 77 m. A Conodont sample from the top indicates upper Lochkovian age with *Oz. stygia*. The fauna is similar to that found at Rauchkofelboden (Bodenkalk) and section Oberbuchach (at the transition between black Rauchkofel Limestones to red Findenig Limestone).

About 50 m to the east and separated by a fault (Fig. 23) follows the base of the Mt. Freikofel section with unit 2.

Unit 2 begins at the lowest accessible limestones below the military track to the top of Mount Freikofel with yellow-grey lumpy limestones intercalated with stylo-bedded and nodular limestones. The yellow stain comes from high dolomite content and associated iron. About 21 m up section the first substantial lithoclastic limestone bed occurs (1.9 m thick) with up to 8 cm long lithoclasts, some *Heliotithes* and rugose corals. These lithoclastic beds are spaced in 1-10 m intervals with decreasing distance and increasing thickness up section. The intercalated fine grained limestone beds become more calcareous and massive up section. Unit 2 ends at 74 m.

Three Conodont samples taken from the base of the Freikofel succession indicate *P. dehiscens* Zone, Ems. Obviously the Pragjan limestone (Vinz Limestone) is cut out at the fault between lower and upper sections (Fig. 23).

Unit 3 begins with 7 to 12 m thick massive lithoclastic limestone beds with a few calcarenite units separating them. The conglomeratic units are dominated by large rafts and flat pebbles of fine-grained limestone lithoclasts with subordinate numbers of bioclastic debris, namely crinoids, rugose and tabulate corals, stromatoporoids, and locally abundant *Stachyodes*. The

amount of these reefal bioclasts increases up section, whereas crinoids are abundant throughout. Frequently the coarse lithoclastic units are capped with graded calcarenites suggesting deposition from waning flows. At 112 m large stromatoporoid fragments occur (up to 50 cm diameter) and very fossiliferous limestone clasts can be found in the adjacent loose debris. At 128 m there is a horizon with dark-stained (phosphoritic?) lithoclasts which could indicate the late Eifelian age (Kacak event) or the Eifelian/Givetian boundary (cf. BANDEL, 1972). At 137.8 m Unit 3 ends.

Unit 4 begins with bedded lithoclastic limestones with bed thicknesses ranging from 1 to 2 m. Flat pebble lithoclasts and reefal bioclasts are still common here but smaller in size. Conodont samples from this interval indicate basal Frasnian age with *Ancyrognathus triangularis*.

The dominantly clastic sedimentation ends at 166.9 m with finer-grained bedded calcarenites, calcisiltites, mudstones and wackestones which are, however, still intercalated with calcirudites. Unit 4 ends abruptly with a facies change to fine-grained stylo-bedded limestone at 193.6 m.

Unit 5 is characterized by 0.5-1.0 m thick beds of lithoclastic calcirudite with conspicuous absence of reefal debris. A conodont sample taken from the base of this interval indicates basal Famenne. The thickness of the calcirudite beds decreases up section and stylo-bedded mudstones and bioturbated grey and pink mottled wackestones become dominant. However, at 210.2 m coarser (up to 1.2 m thick) lithoclastic beds reappear. The succession ends with a 1.0 m thick lithoclastic limestone unit.

Summary

The section at Mount Freikofel is clearly dominated by gravity flow deposits. Their coarseness and abundance indicates proximity to the source. The varying clast sizes and massiveness of the lithoclastic beds reflects changes in the marginal slope or ramp region. Finer-grained units presumably are more distal and indicate back-stepping of the marginal source region and/or lack of transport and/or lack of marginal buildups. The composition of the clasts with reefal debris and rafts of fine-grained limestone lithoclasts reflects a source area with reef growth and (presumably) a fore slope region with fine-grained, early lithified lime mud. The largest clast sizes of reefal and lithoclastic debris are found in the most massive beds and are Middle Devonian in age. This time interval also yields the highest amounts of reefal debris whereas the Famennian interval (predictably) yields hardly any.

The slope succession as a whole reflects the buildup of a massive carbonate platform which reached its acme in the Middle Devonian and began to regress in the Frasnian to finally collapse in the late Devonian and early Carboniferous with onset of the Variscan orogeny.

Compared to the much thicker section at Mt. Cellon the Freikofel was probably located further away from the shelf platform and represents a more distal nappe in a series of imbricated thrust slices of slope sediments.