

## Section 4

### "Graptolithengraben (graptolite gorge) north of Upper Bischofalm (fig.10)

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The graptolitic facies of the Carnic Alps has its main distribution in the middle part of the range on both sides of the Austrian/Italian border. Typically, the individual outcrops are in tectonic contact with other rocks.

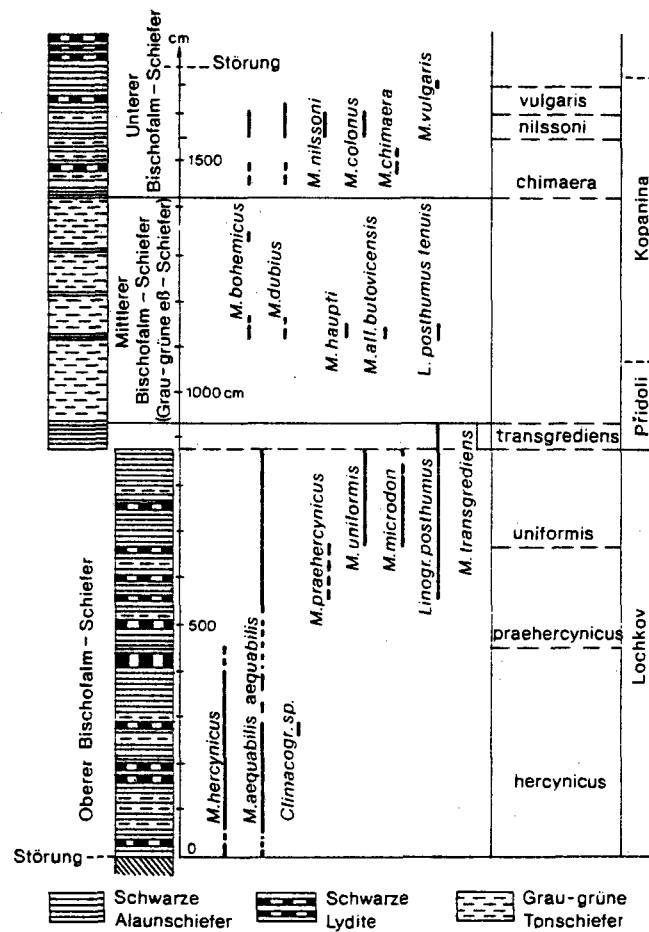


Fig. 10: Type section of the Silurian to Lower Devonian Bischofalm facies north of the upper Bischofalm ("Graptolithengraben"). After JAEGER in FLÜGEL et al. 1977, modified.

The black shale facies well known since the first finds of Silurian graptolites by Stache 1872 is supposed to range from the base of the Silurian through most of the Devonian though fossil evidence for the Lower Devonian and Middle Devonian are scarce. However, Upper Devonian and Lower Carboniferous cherts contain locally abundant conodonts.

Lithologically, the graptolitic rocks form a monotonous sequence of interbedded radiolarian cherts and alum shales. The chert beds dominate in the Llandovery and Wenlock part of the sequence, whereas higher up the alum shales prevail. The occurrence of grey-green shales that do not contain graptolites except in rare black bands results in a natural tripartite division of the whole graptolitic sequence as shown in fig. 10.

The composite thickness for all the graptolitic Silurian plus Lochkovian is certainly not less than 50 m and not more than 100 m. It is thus an extremely condensed sequence. The condensation is due to a very low but continuous rate of deposition, not to hiatuses. Such is indicated by the very complete graptolitic zonal succession. The environment was extremely euxinic except during deposition of the grey-green middle part of the Bischofalm Shales.

Graptolites (and rare conodonts) are the only fossils to be found. Planktic microfossils and nannofossils that are to be expected, have not been looked for yet. The graptolites are common in many layers both in the alum shales and the chert beds. But there are beds one metre thick or more that do not yield any graptolites. Due to the intense alpine type of tectonics also thicker portions of the sequence may locally not yield graptolites. For the same reason larger undisturbed sections are rare.

The boundary beds are exposed at a number of sites in a two kilometer long area between Zollner See and Bischofalm. By far the best exposed and least disturbed section is the "Hauptprofil" (main section) in the *Graptolithengraben* north of Obere Bischofalm (fig. 10).

It is located 8 km northeast of Plöcken-Paß and 5 km southeast of the village of Würmlach. The "Hauptprofil" is in about the middle of the *Graptolithengraben*. It is in a tectonic block not quite 20 m thick. The beds dip 45° degrees to the northeast. The section covers the stratigraphic interval from the *hercynicus* Zone to the *vulgaris* Zone. The rocks are overturned, with the *hercynicus* Zone below and the *vulgaris* Zone on top. At the base of the section the *hercynicus* Zone is in fault contact with dark shales of unknown age; these disappear under slope debris. The upper fault is half a metre above a 5 cm thick compact bed with *M. vulgaris*. On the other side of that fault are a few metres of disturbed and poorly exposed alum shales and cherts which are succeeded by shales with early Wenlock graptolites.

The "Hauptprofil" is virtually undisturbed except for a fault at the critical place between the *uniformis* Zone and the *transgrediens* Zone, i. e. at the Silurian-Devonian boundary. There the beds of the *uniformis* Zone are disturbed, and they disappear upwards under slope debris, whereas the section continues two metres to the left, beginning with the *transgrediens* Zone. The *transgrediens* Zone and the grey-green e-beta Shales form a cliff.

For visitors to the section it may be helpful to note that in about the middle of the Lochkovian part, at 400 - 436 cm, an unusually thick chert bed forms a distinctive marker in these extremely uniform rocks.

From comparison with other sections and general experience with this type of graptolitic rocks it is deduced that there is no substantial loss of strata at the fault between the *transgrediens* Zone and the *uniformis* Zone. It is estimated that not more than 1 m of strata be missing.

The following points of more than local interests may be made:

- (1) The Silurian-Devonian boundary is within a homogeneous black shale facies. There was no obvious physical event at the boundary. The choice of the base of the *uniformis* Zone as a system boundary is thus supported.
- (2) A distinct change in facies from grey-green shales to black shales preceded the faunal change at the boundary by one zone.
- (3) Also in the Carnic Alps is no evidence for possible overlapping ranges between *M. transgrediens* and *M. uniformis*.
- (4) The non-graptolitic e-beta Shales have exactly the same stratigraphic position as the non-graptolitic *Ockerkalk* in the graptolitic sequence of Thuringia some 400 km to the north and (less precisely dated) the *Ockerkalk* in the graptolitic black shale sequence of southeastern Sardinia 900 km to the south.

All the graptolite species collected in the section are listed in Fig. 10, and their ranges are shown. In addition, *Abiesgraptus* was found in the *praehercynicus* Zone in a section some 30 m to the left of the "Hauptprofil".

*Monograptus aequabilis aequabilis* that elsewhere has been found only in the *uniformis* Zone, ranges here through all three Lochkovian zones.

As a great surprise a sole rhabdosome of a *Climacograptus* of *scalaris* type (sketch in Jaeger 1973, Fig.1) was found in the *hercynicus* Zone. It occurs together with *hercynicus* specimens on the same slab and on the same bedding plane. Two possibilities that might be envisaged to account for this faunal anomaly appear unlikely.

- (1) There is no lithological or other faunal evidence for a presumed redeposition of Llandovery rocks in this extreme euxinic environment.
- (2) Being familiar with many graptolites etched out of the rock and having seen many growth aberrancies, one might think of interpreting this *Climacograptus* as a growth anomaly. However, there is no Lochkovian monograptid that through

aberrant biserial growth could develop to a *Climacograptus* of simple generalized morphology without undergoing improbably drastic transformations.

Consequently, this *Climacograptus* may be considered as an extremely rare relict of the Ordovician-Llandovery graptolite fauna, a truly living fossil in Lower Devonian times.