

## **An angular unconformity below the Wildflysch nappe in the Glarus Alps - Observations from the area around the Landesplattenberg in Engi.**

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Den Brok & Jagoutz (2000) proposed that the Glarus Thrust would possibly have followed a pre-existing Miocene age erosional angular unconformity (Fig. 1; German: "Reliefüberschiebung"). Field work carried out in 2005 and 2006 in the area around the Landesplattenberg in Engi (Kanton Glarus) reveals that this angular unconformity may be found at the base of the Glarus Wildflysch nappe\*\*\*, which lies as a roughly 5 to 100 m thick, more or less continuous sheet below the Glarus Thrust.

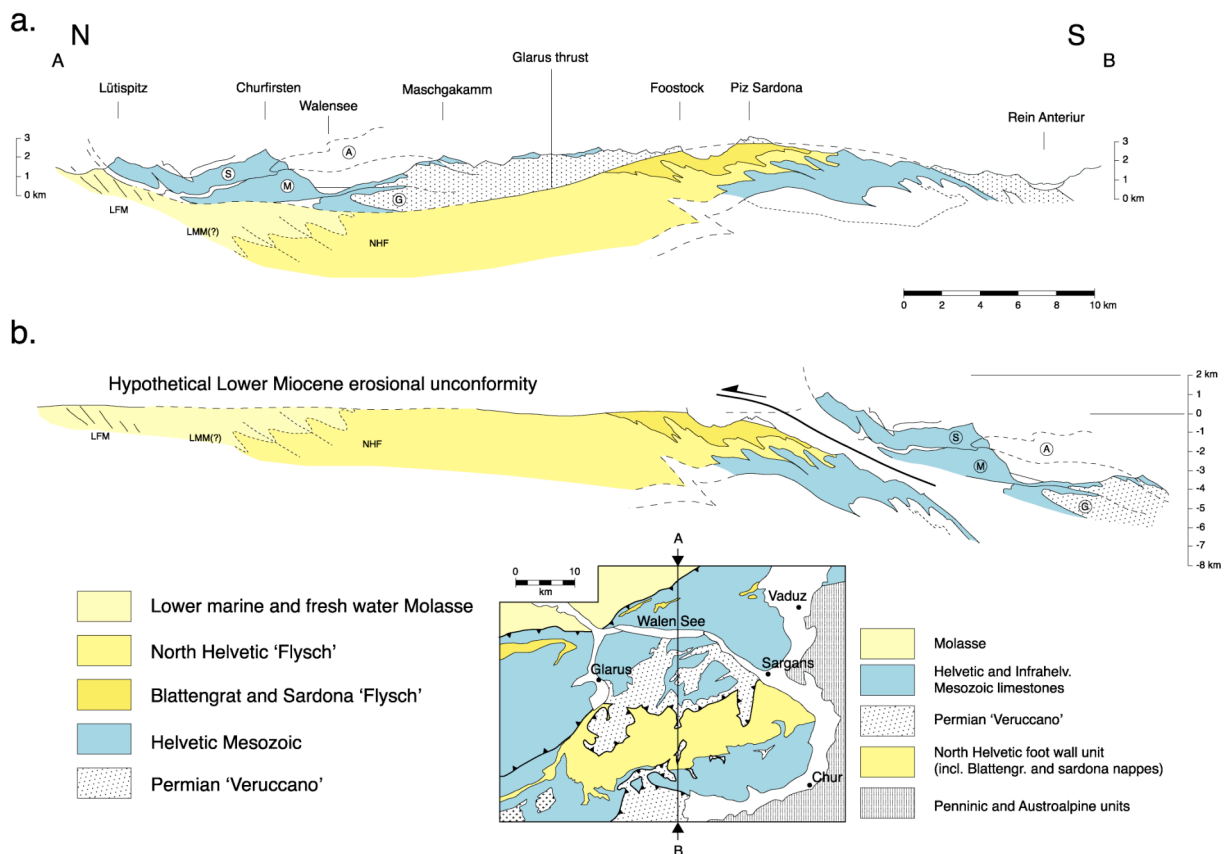
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The Landesplattenberg in Engi is an abandoned mine from which slates were extracted, mainly for roofing. There is a small museum and there are guided tours through the mine shafts. The mine is dug in the Lower Oligocene Engi Slates (Engi Dachschiefer), the youngest member of the Matt Formation, North Helvetic Flysch.

A geological map and tectonic profiles 1:5'000 of the area around the Landesplattenberg were made in the framework of a diploma thesis (Gasser 2006). A detailed structural analysis was carried out, thin sections were made and studied. Even though the Engi Slates are lithologically monotonous, structural profiles could be constructed with relative ease due to the presence of a 5 to 10 m thick turbiditic sandstone member. The turbiditic sandstones also provided unequivocal top-bottom criteria in most cases. The Engi Slates appear to be tightly folded at deca- to hectometer scale into folds with straight limbs and sharp hinges. Fold axes plunge 10 to 30° to the East and North-East; fold axial planes dip 20 to 30° to the South-East. They are Calanda phase folds in the terminology of Milnes & Pfiffner (1977).

Two foliations were recognised: (i) a bedding-parallel slaty cleavage, probably developed during sedimentation and compaction, and (ii) a tectonic, disjunctive, pressure solution cleavage ("fracture cleavage"), further referred to as Plattenberg cleavage. The Plattenberg cleavage is oriented sub-parallel to the overturned limbs of the Calanda phase folds in most cases. It is the dominant tectonic cleavage, but it is *not* the axial plane cleavage to the Calanda phase folds. It is *not* parallel to the fold axial plane and in some localities, cuts through both limbs of the folds. The Plattenberg cleavage is younger than the Calanda folds. Meter- to decameter-scale open folds locally *do* have the Plattenberg cleavage as axial plane cleavage, but these folds are of only minor importance.

The Calanda phase folds are cut-off unconformably by the lower, tectonic boundary of the Upper Eocene to Lower Oligocene (?) Flecken marls from the Glarus Wildflysch nappe, which overlies the Engi Slates. The Plattenberg cleavage cuts *through* the contact. A study of this contact at various other localities in the Glarus Alps corroborates our observation, that the Wildflysch nappe overlies an angular unconformity.



**Figure 1.** (a) Simplified geological cross section through the Glarus Alps modified from Trümpy (1991, fig. 18.2). (b) Same cross section illustrating hypothetical situation at the onset of out-of-sequence thrusting of Helvetic nappes over Glarus thrust along pre-existing Lower Miocene erosional unconformity.

\*\*\* The Glarus Wildflysch nappe mainly consists of a tectonic (?) mélange of Upper Cretaceous to Lower Oligocene rocks from the Sardona and Blattengrat Units: various, mostly dark coloured marls and slates, boudins of nummulitic limestone, sardona quartzite, amongst others. Hectometer-scale slices of dominantly Mesozoic Helvetic limestones float in (or on) this mélange, commonly referred to as Subhelvetic slices (e.g. at Tschingelhörner and at Foostock).

## REFERENCES

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