

**The Glarus thrust an erosional unconformity?  
An old idea of Otto Ampferer revisited.**

Bas den Brok, Oliver Jagoutz

Geologisches Institut ETH, Sonneggstrasse 5, 8092 Zürich.

The well-known Glarus thrust at the base of the Helvetic nappes in Eastern Switzerland is a very remarkable structure. The thrust is only 20 to 200 cm wide, yet cuts as a single plane (straight, smooth, extremely sharply cut) over an area of probably more than 40\_40 km through intensely folded and foliated Infrahelvetic rocks. It is difficult to imagine how this could have happened. How can such a single plane develop in mechanically very anisotropic rocks such as the Infrahelvetics must have been at the time that the thrust developed? One could imagine that the thrust developed by ductile shear localisation within a large-scale ductile shear zone, but the Infrahelvetic structures (the folds and foliation) do not show large-scale bending inwards towards parallelism with the thrust plane. Such a bend is only apparent locally within the upper meter of the Infrahelvetic rocks. At a larger scale, the Infrahelvetic foliation does not appear to be affected by the thrust. At some localities the foliation even bends into the wrong direction. How then could this spectacular thrust have developed?

According to Otto Ampferer (1934) the Glarus thrust originally was an erosional unconformity. According to him, the Infrahelvetic foot wall was already eroded before the Helvetic nappe complex was thrust onto it (“Reliefüberschiebung”). This idea was immediately rejected by Jakob Oberholzer and Albert Heim (1934) and has not received much attention anymore since then. However, at least at first sight, the idea of an erosional unconformity would provide a nice explanation for the sharply cut nature of the Glarus thrust. What if Otto Ampferer *was* right? Uplift and a major erosional event must have taken place *after* Calanda phase thrusting, folding and foliation development, and *before* the entire Helvetic Glarus nappe complex (including the already Calanda-phase folded and foliated Glarus s.s, Mürtchen, and Säntis nappes ...) was thrust over the Infrahelvetic basement. When could this have happened? Is there time for uplift, erosion and a second major thrusting phase?

The youngest sediments overthrust by the Glarus nappe complex are of Aquitanian age (~22-23 Ma, Lower Freshwater Molasse). Within the Molasse basin, major, basin-wide Burdigalian age erosional events are reported to have occurred around 20 and 18 Ma. Enhanced subsidence of the Molasse basin has taken place between 17 and 14 Ma indicative of renewed tectonic activity, immediately followed by the deposition of the massive conglomeratic deposits of the Upper Freshwater Molasse (~14-11 Ma). These events are consistent with an Upper Oligocene Calanda phase deformational event, an Early-Miocene erosional event, and a Middle Miocene (Helvetian) thrusting event during which the entire Glarus nappe complex could have thrust over an eroded Infrahelvetic basement.

It seems that a possible erosional origin of the Glarus thrust deserves further attention to see, for example, whether available radiometric age data and the different metamorphic events are in agreement with it, and to think of how we could prove whether or not Ampferer was right.

Ampferer, O. (1934) Über die Gleitformung der Glarneralpen, *Sitzungsberichte der Akademie der Wissenschaften in Wien, Mathem.-naturw. Klasse, Abteilung I, Band 143*, S. 109-121.

Oberholzer, J., Heim, Alb. (1934) Zu Otto Ampferers „Gleitformung der Glarneralpen“ und „Flimser Bergsturz“, *Eclogae. geol. Helv.* 27, 507-516.