

## **The Rossberg landslide history reconstructed by Lake Lauerz sediments.**

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The Rossberg slide of 1806 A.D. (Goldauer Bergsturz), which involved approximately 36 million m<sup>3</sup> of rock (Thuro et al. 2006) caused next to the direct impact on the village of Goldau also a catastrophic impact wave of ~15 m height in perialpine Lake Lauerz (Central Switzerland) resulting in a disastrous flood that caused loss of lives and destroyed part of the infrastructure within the villages on the southern shores of the lake. Additionally, the lake's superficial area was reduced by at least 1/7 of its original size. Various studies have shown, that the 1806 A.D. slide was not the only mass wasting event emanating from the slopes of Rossberg but rather the preliminary terminus of an ongoing landslide succession (e.g. Kopp 1936, Thuro et al. 2006). However, the present knowledge about this succession is scarce since exact datings of the different mass wasting events are lacking. In this study, a new approach to reconstruct the Rossberg landslide history uses limnogeological techniques in order to detect lacustrine event layers in the subsurface of Lake Lauerz left by the enormous amount of mobilised sediment during such major mass wasting events.

Lake sediments provide some of the most precise natural archives that might record past environmental changes as well as past extreme and possibly hazardous events such as floods, earthquakes and subaqueous or subaerial mass movements. Such exceptional events often create characteristic sedimentological fingerprints within the lake deposits, which can be detected using standard limnogeological methods. Moreover, different dating techniques provide an excellent time control and allow a highly resolved reconstruction of these past events. A landslide generated impulse wave, as triggered by the 1806 A.D. rockslide and probably by preceding similar events, is likely to have left a characteristic sedimentologic fingerprint in the lacustrine succession of Lake Lauerz. The present study is based on a series of up to 10 m long piston cores from the sedimentary subsurface of Lake Lauerz and aims to reconstruct the Rossberg landslide succession by (1) recognition of the 1806 A.D. event layer for calibration purposes and (2) detection and dating of layers with petrophysical and petrochemical patterns that are similar to these recognized in the 1806 layer. Our approach is based on (a) visual core description, (b) petrophysical properties (density, magnetic susceptibility) of the sediment, (c) grain size analyses, (d) determination of inorganic and organic carbon content and (e) XRD analyses.

The proximal sedimentological signature of the 1806 A.D. event layer found at the bases of two cores that were retrieved in the northwestern part of the lake is characterised by a coarse, organic-rich lithology reflecting debris flow processes. These deposits likely originated from a mobilised swamp occurring between the lake and the source of the landslide indicating that the 1806 A.D. impact wave was not caused by the immediate

impact of the rockmass into the lake itself but rather by the mechanical failure and mobilisation of a large amount of the swamp deposits that delimited Lake Lauerz on its western shore. Such a swamp failure was probably the result of the additional load due to the accumulating sliding mass.

Generally, the basinal sediments can be subdivided into three different lithologies: (1) Moderate to dark yellowish brown background sediment, (2) cm-scale greyish graded layers, interpreted as flood layers and (3) few brownish layers of outstanding thickness (up to 32 cm) and colour. Preliminary results reveal at least two layers, which show sedimentary patterns that are highly similar to the patterns recognised for the 1806 A.D. event layer, in particular expressed in decreased bulk density and increased organic carbon content coinciding with lithology 3 (see above). We interpret these layers thus to be the product of depositional processes (i.e. mass movement) comparable to the 1806 A.D. rockslide. The uppermost of these pre-1806 A.D. event layers shows a unique accumulation of coarse organic debris (mainly plant macrofossils) and can be dated using the sedimentation rate (without flood layers) established for the post-1806 A.D. interval. This results in an approximate age of 1330 A.D. for this mass wasting event, which coincides nicely with the assumed age (1222 A.D. to 1354 A.D. depending on the reference cited; Zay 1807; Zehnder 1988) of the so-called historic Röthener Landslide. Planned <sup>14</sup>C datings will provide an accurate time control of this and the other events.

The results of this study point towards the great potential in reconstructing past landslide processes and frequencies for historic and prehistoric times through the studies of lake sediments, when a lake system is affected directly or indirectly by subaerial mass movements.

#### REFERENCES

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