

## **A catastrophic event from a non-catastrophic cause: The 1996 AD megaturbidite in Lake Brienz (Switzerland)**

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Sudden changes in sedimentation patterns are very often the consequence of catastrophic events. A detailed study of these sediments provide valuable information leading to disentangle the causes behind their formation. Modern lakes located in areas where instrumental and historical data are available provide ideal systems to constraint these causes. They further provide necessary geophysical and sedimentological criteria to apply to other records at various geographical and temporal scales. In spring 1996 AD, the occurrence of a large mass-transport in Lake Brienz (Switzerland) was associated with a chain of connected events: loss of a sediment trap mooring in the centre of the lake, turbidity increase and oxygen depletion in deep waters, release of an ancient corpse into surface waters and occurrence of a mini 'tsunami-like' wave. The sediment mass-transport generated a very thick turbidite deposit ('megaturbidite'). This deposit is studied by combining high-resolution reflection seismic data with detailed sediment core analysis. The megaturbidite deposit correlates to a prominent onlapping unit in the seismic record. Attaining a maximum of 90 cm in thickness, it is longitudinally graded and thins out towards the end of the lake basin. Thickness distribution maps show that the megaturbidite extends over  $\sim 8.5 \text{ km}^2$  and has a total volume of  $2.72 \times 10^6 \text{ m}^3$ , which amounts to  $\sim 8.7$  years of the lake's annual sediment input. It consists of normally graded sand to silt-sized sediment topped by a thin, white, clay-sized layer containing clasts of hemi-pelagic sediments (Fig. 1).

The source area, the exact dating and the possible trigger of this megaturbidite deposit, as well as its flow mechanism and ecological impact are discussed along with environmental data (river inflow, wind and lake-level measurements). The combined results indicate that no catastrophic cause (i.e., earthquake, explosion, flood, wind storm, lake-level change, seiche or sediment dredging) triggered the 1996 AD megaturbidite deposit. Instead, it was due to a non-catastrophic delta slope failure most likely caused by oversteepening by normal sediment accumulation. This example illustrates the use of modern lake sediments as archives of various sedimentological processes that can provide essential criteria to identify similar events in the marine and geological record.

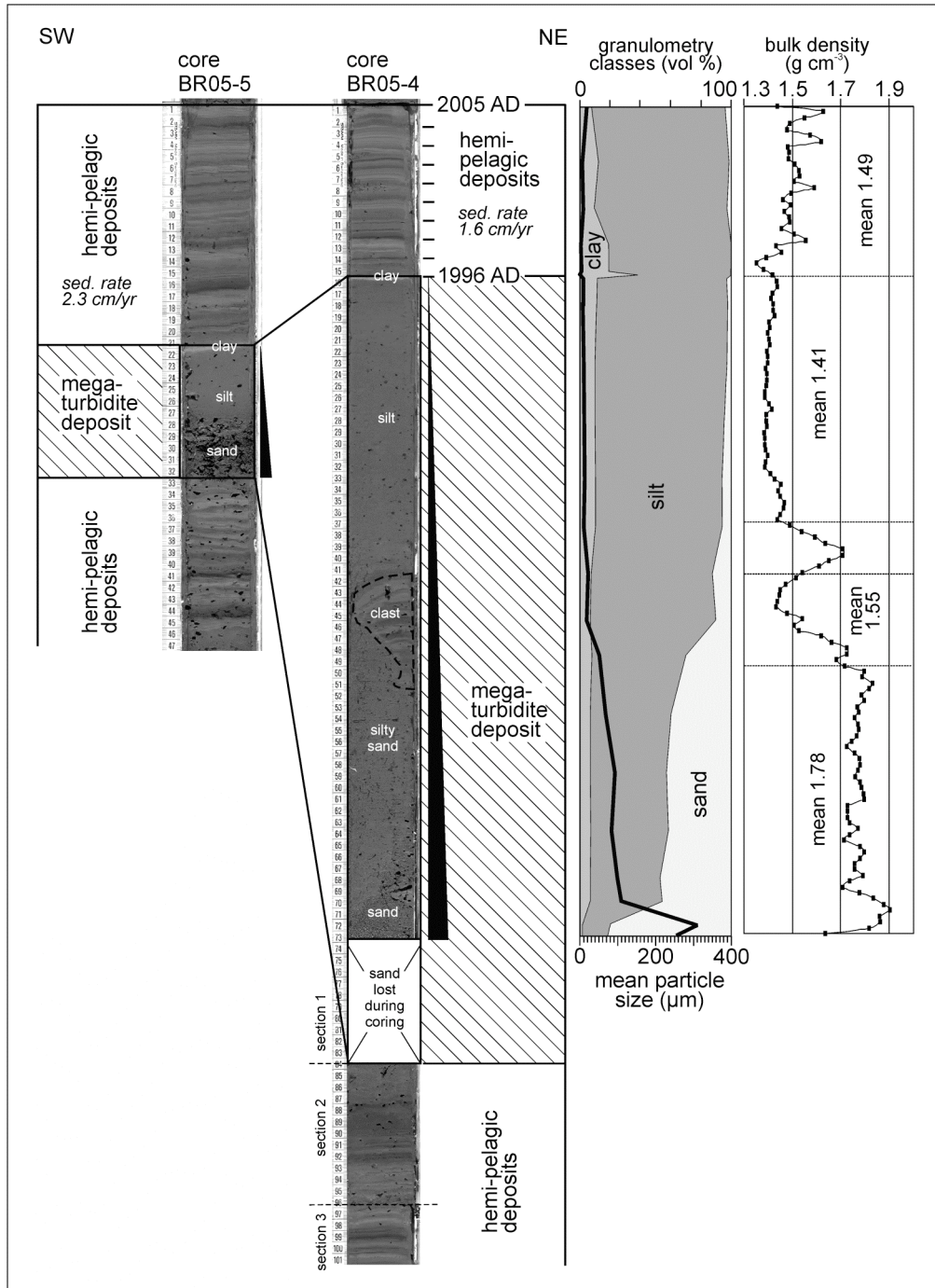


Figure 1. Hemi-pelagic sediment (silt/clay laminations) and 1996 AD megaturbidite deposit (grey homogenous graded bed) in sediment cores. The megaturbidite deposit is graded from sand to silt at its base, followed by a thick homogenous silty part, which is topped by a thin white clay layer. Clasts of hemi-pelagic sediment occur within the megaturbidite.