Geophysical Research Abstracts
Vol. 20, EGU2018-5960, 2018
EGU General Assembly 2018


# The subaquatic landslide cycle in South-Central Chilean lakes: The role of tephra layers, slope gradient and seismicity.

Jasper Moernaut (1), Maarten Van Daele (2), Gauvain Wiemer (3), Ariana Molenaar (1), De Batist Marc (2), and Strasser Michael (1)

(1) University of Innsbruck, Institute of Geology, Austria (jasper.moernaut@uibk.ac.at), (2) Ghent University, Renard Centre of Marine Geology, Belgium, (3) MARUM - Center for Marine Environmental Sciences, Germany

Subaquatic landslide deposits are ubiquitous components in the sedimentary infill of large and deep lakes. In settings of low to moderate seismicity, sublacustrine landslide records have been used for reconstructing the timing, magnitude and location of strong paleoseismic events. In high seismicity areas, it is often found that not all strong earthquakes succeed in triggering landslides on the investigated slope segments, because short recurrence intervals may impede the accumulation of potentially unstable slope sequences between earthquakes. In such settings, sequences of subaquatic landslide deposits may form an underrepresentation of strong earthquake recurrence and are thus of limited use for paleoseismology.

Here, we present the detailed spatio-temporal distribution of landslides in two large Chilean lakes over the last 5000 years. We find a strong influence of slope gradient on the occurrence and volume of landslide events; i.e. most (small) landslides take place on slopes of 5-15°, whereas the few large (tsunamigenic) landslides exclusively occur on slopes of <5°. For the largest landslides, a sandy tephra layer of a few cm thick just underlies the sliding surface. Core correlation shows that this tephra layer did not got involved in the sliding mass, which means that earthquake-induced flow liquefaction of the tephra is very unlikely to have caused the sliding. This can be explained by its burial depth (6-7m) and associated confining stresses, and possibly by repeated seismic strengthening of the tephra. On the opposite, tephra layers in some other lacustrine sites in Chile show strong evidence of liquefaction when they were buried less than ∼0.5m. We further discuss this contrasting role of sandy tephra for subaquatic slope failure using geotechnical experiments with a dynamic triaxial testing device on the different lithologies encountered in the slope sequences.

The AD1960 Mw9.5 earthquake triggered several small landslides in the two lakes. However, some strong regional paleoseismic events failed to produce mappable landslide deposits. This suggests that overall slope stability may have changed over time, and that slope sequences need sufficient recharging (i.e. a function of recurrence time and sedimentation rate) in order to produce a consistent paleoseismic record. However, the most voluminous event in both lakes seem to have occurred at the same time, which is difficult to explain by slope preconditioning processes alone, and may thus point towards an exceptionally strong shaking event in the study area. Moreover, seismic profiles show traces of the development of an incipient large-scale slide with the same sliding surface of the previous large event. This suggests that this particular slope segment reached a potentially critical thickness and may fail during future strong shaking.