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Large mass movements, probably earthquake triggered, in Lake Geneva off the city of Lausanne revealed by seismic and sediment coring data

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Recent seismic studies in the central part of Lake Geneva have revealed the presence a series of Holocene sedimentary layers with either well-organized reflections or with chaotic or transparent seismic character. While the former correspond to lacustrine sediments deposited as hemipelagic or turbidite layers, the latter are interpreted to be related to mass movements. One of these events has recently been identified in the lake off the city of Lausanne. The total volume of the mass flow deposits, the surface of the associated turbidite and the length of its failure scar show that it was a major slide event.

To study this lacustrine slide, two types of seismic data were acquired. The first one was a multichannel system with a 15 inch3 water gun with a central frequency of 800 Hz and the second one was a 3.5 kHz single channel pinger. The data sets provide complementary data, because of their differing vertical resolution, respectively 0.5 m and 0.15 m. Some data were acquired with both systems along the same profiles for direct comparison.

A depth-age relationship derived from a sediment core located above the main mass deposit yields an age for the mass movement deposit between 3488 and 3820 cal BP (2 sigma uncertainty). The failure scar that lies close to the lake north shore appears to be continuous over a distance of more than 7 km. However, the presence of two separated mass flow deposits associated with this scar suggests that there were in fact two simultaneous slides and not only one. This, together with the observation of another simultaneous mass movement on the lake south shore of the lake, suggests that the mass movements were triggered by an earthquake. The mass movements off the city of Lausanne are located over a major fault zone affecting the Mesozoic substratum under the Quaternary sediments. The fault zone which is related to the formation of the Alps is not known to be seismically active at present. However, conspicuous features within the Holocene sediments such as apparent vertical offsets above the fault zone are observed in both the water-gun and pinger seismic data. While several clues support the hypothesis that the mass movements were triggered by an earthquake, the question whether or not its epicenter was located on the underlying fault zone remains open.