Major earthquake at the Pleistocene-Holocene transition in Lake Vättern, southern Sweden

Martin Jakobsson1, Svante Björck2, Matt O’Regan1, Tom Flodén1, Sarah L. Greenwood1, Henrik Swärd1, Arne Lif1, Linda Ampel1, Hemin Koyi3 and Alasdair Skelton1

Abstract

Lake Vättern, Sweden, is within a graben that formed through rifting along the boundary between two Precambrian terrains. Geophysical mapping and geological coring show that substantial tectonic movements along the Lake Vättern graben occurred at the very onset of the Holocene. This is evident from deformation structures in the soft sediment accumulated on the lake floor. Our interpretation of these structures suggests as much as 13 m of vertical tectonic displacements along sections of a >80-km-long fault system. If these large displacements are from one tectonic event, Lake Vättern must have had an earthquake with seismic moment magnitudes to 7.5. In addition, our geophysical mapping shows large landslides along sections of the steep lake shores. Pollen analysis of sediment infillings of some of the most prominent sediment deformation structures places this major seismic event at the Younger Dryas–Preboreal transition, ca. 11.5 ka. We suggest that this event is mainly related to the rapid release of ice-sheet load following the deglaciation. This paleoseismic event in Lake Vättern ranks among the larger known intraplate tectonic events in Scandinavia and attests to the significance of glacio-isostatic unloading.

- Received 20 October 2013.
- Revision received 23 January 2014.
- Accepted 4 February 2014.