Luminescence characteristics and IRSL-chronology of extreme-wave event deposits recorded at the Shirasuka lowlands, Japan

*Svenja Riedesel[1], Dominik Brill[1], Geoff A.T. Duller[2], Osamu Fujiwara[3], Ed Garrett[4,5], Georgina King[6], Helen Roberts[2], Toru Tamura[3], Anja Zander[1], Helmut Brückner[1]

1. Institute of Geography, University of Cologne, Germany, 2. Department of Geography and Earth Sciences, Aberystwyth University, United Kingdom, 3. National Institute of Advanced Industrial Science and Technology, Japan, 4. Department of Geography, Durham University, United Kingdom, 5. Geological Survey of Belgium, Royal Belgian Institute of Natural Sciences, Belgium, 6. Institute for Geology, University of Bern, Switzland

The location of Japan at the Pacific-Philippine-Eurasian subduction zones makes it vulnerable to earthquakes and subsequent tsunamis. Furthermore tropical cyclones cause destructive storm surges. Both natural hazards may generate extreme-wave events, which are a major threat for coastal communities.
The Shirasuka lowlands, sandwiched between a Mid-Pleistocene terrace and a coastal dune, record evidence for numerous extreme-wave events. Located along an important historical trade route, their impact history is well documented in written sources and a radiocarbon chronology has been developed for seven extreme-wave event deposits previously identified in this area (Fujiwara et al., 2006; Komatsubara et al., 2008). Therefore, this study area provides an excellent opportunity for testing the applicability of OSL dating to young (< 800 years) coastal, potentially incompletely bleached extreme-wave event deposits.
Quartz is preferred for dating such sediments, due to its faster rate of signal resetting. However, OSL measurements failed due to low signal intensities, absence of a fast component, and sensitivity to IR stimulation. Consequently, feldspar was used instead. The $IRSL_{50}$ signal has high signal intensities and resets quickly. However, thermal transfer affects these young feldspars. To minimise this effect and thus reduce recuperation, a second optical stimulation at 130 ˚C was included in Lx and Tx cycles of the $IRSL_{50}$ protocol.
Final dating was performed on single-grains of feldspars to (i) lower residuals, and (ii) account for potentially incomplete bleaching.
The resulting ages cover the known historical record of the extreme-wave events of the last 800 years at Shirasuka. Sand sheets can be correlated with tsunamis in AD 1361, 1498, 1605 and 1707. A poorly bleached equivalent dose distribution of the uppermost sand sheet hints at a different transport mechanism. The IRSL age range suggests a correlation with the Tonankai earthquake in AD 1944. Since the subsequent tsunami did not inundate the study area, a terrace slope failure due to intense shaking, is suggested for this sand sheet.

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Keywords: feldspar, single grain, tsunami deposits, storm surge deposits

