

## **Historical extreme wave and landslide deposits on the Shirasuka coastal lowlands, Shizuoka Prefecture, Japan**

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Future megathrust earthquakes and consequential tsunamis pose exceptional hazards to densely populated and highly industrialised coastlines facing the Nankai-Suruga Trough, south central Japan. Geological investigations of coastal sedimentary sequences play a key role in understanding megathrust behaviour and developing seismic and tsunami hazard assessments. In this study, we revisit a previously published palaeoseismic site at Shirasuka, located on the Enshu-nada coastline of Shizuoka Prefecture, seeking both to provide further information on past earthquakes and tsunamis and to explore the prospects and limitations of geological data with respect to assessing seismic and tsunami hazards.

At Shirasuka, six closely-spaced vibrocores reveal four sand layers interbedded with organic muds. Photographs, X-ray CT scans and grain size analysis reveal a variety of sedimentary structures within these layers, including abrupt contacts, massive sands, rip-up clasts, internal mud drapes and cross bedding. Microfossil assemblages (diatoms, pollen, non-pollen palynomorphs) and optically stimulated luminescence overdispersion values of single grain feldspars highlight varying sediment sources and transport mechanisms. We suggest that the uppermost sand layer records a landslide from the landward margin of the site, while the remaining three sand layers reflect at least four extreme wave events, some of which are overprinted. We refine the published chronology using AMS radiocarbon, radionuclide and infrared stimulated luminescence approaches. Our Bayesian age models suggest that the oldest two sand layers relate to historically documented tsunamis in AD 1361 and 1498. The second youngest sand layer provides ages consistent with tsunamis in AD 1605 and 1707 and potentially also storm surges in 1680 and/or 1699. The modelled age of the landslide sand layer is consistent with the AD 1944 earthquake. The presence of a fresh scarp in US military aerial photographs from 1947 and revegetation by 1959 is also consistent with possible coseismic triggering of this landslide.

Difficulties in correlating sand layers between cores, the identification of overprinting of evidence and the lack of prehistoric deposits exemplify ongoing issues in the search for palaeotsunami deposits along the Nankai-Suruga Trough. The identification of a subaerial mass movement deposit as possible evidence for coseismic shaking provides a potentially complementary palaeoseismic approach and an area for further investigation.