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Sedimentary imprints of tsunami and storm deposits on the Shizuoka coastline, south central Japan

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Differentiating between the deposits left by extreme wave events – including tsunamis and storms – presents a major challenge for the palaeotsunami and palaeotempestology communities. The coast of Shizuoka Prefecture, south central Japan, is impacted by typhoons and by tsunamis triggered by great subduction zone earthquakes along the adjacent Nankai Trough. A low-lying organic swale close to the town of Shirasuka is well-placed to preserve sedimentary layers left by both event types. The swale lies between a 5 to 10 metre high beach ridge and a 60 to 80 m high riser of the mid-Pleistocene Tenpakubara marine terrace. Investigating the stratigraphy and sedimentology of the site, Komatsubara et al. (2008) identified seven sand layers and attributed these to four tsunamis and one storm, with two sand layers identified as of terrestrial origin. Revisiting the site, we adopted a multi-proxy approach to further analyse the characteristics of selected deposits.

We visualise the stratigraphy of retrieved vibrocores in 2D with linescan photography and in 3D with X-ray computed tomography. While problems remain in attempting to fully correlate all sedimentary layers with the published stratigraphy, we suggest that this reflects the difficulties of using a vibrocoring system in an environment characterised by alternating units of unconsolidated sand and compressible humic mud. Nevertheless, by focussing on sand units that are entirely contained within single core sections and by applying Bayesian age models based on new radiocarbon dates, we are able to identify and correlate selected sand layers. Radiocarbon ages, derived from terrestrial plant macrofossils and the acid-insoluble organic fraction of bulk samples sieved to <180 μm, constrain the timing of sand sheet emplacement, facilitating correlation with the historical record. We combine X-ray diffraction, geophysical characterisation and particle size analysis to provide a comprehensive assessment of the variations within and between deposits. While foraminifera are absent throughout the sampled sections, quantification of diatom assemblages provides further information about sediment sources and post-depositional change. We discuss our findings with reference to published literature that has sought to differentiate between palaeostorm and palaeotsunami deposits and highlight findings that are of relevance to the development of new palaeoseismic records for the Nankai Trough.