

Title: Identification of tsunami-induced deposits using numerical modeling and rock magnetism techniques: A study case of the 1755 Lisbon tsunami in Algarve, Portugal (vol 182, pg 187, 2010)

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Abstract: Storm- and tsunami-deposits are generated by similar depositional mechanisms making their discrimination hard to establish using classic sedimentologic methods. Here we propose an original approach to identify tsunami-induced deposits by combining numerical simulation and rock magnetism. To test our method, we investigate the tsunami deposit of the Boca do Rio estuary generated by the 1755 earthquake in Lisbon which is well described in the literature. We first test the 1755 tsunami scenario using a numerical inundation model to provide physical parameters for the tsunami wave. Then we use concentration (MS, SIRM) and grain size (chi(ARM), ARM, B1/2, ARM/SIRM) sensitive magnetic proxies coupled with SEM microscopy to unravel the magnetic mineralogy of the tsunami-induced deposit and its associated depositional mechanisms. In order to study the connection between the tsunami deposit and the different sedimentologic units present in the estuary, magnetic data were processed by multivariate statistical analyses. Our numerical simulation show a large inundation of the estuary with flow depths varying from 0.5 to 6 m and run up of similar to 7 m. Magnetic data show a dominance of paramagnetic minerals (quartz) mixed with lesser amount of ferromagnetic minerals, namely titanomagnetite and titanohematite both of a detrital origin and reworked from the underlying units. Multivariate statistical analyses indicate a better connection between the tsunami-induced deposit and a mixture of Units C and D. All these results point to a scenario where the energy released by the tsunami wave was strong enough to overtop and erode important amount of sand from the littoral dune and mixed it with reworked materials from underlying layers at least 1 m in depth. The method tested here represents an original and promising tool to identify tsunami-induced deposits in similar embayed beach environments.

Author Keywords: Tsunami Deposit; Beach Embayment; Rock Magnetism; Numerical Modelling

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