

WAS THE 1531 LISBON TSUNAMI GENERATED BY A LANDSLIDE ALONG THE CASCAIS CANYON? PRELIMINARY RESULTS

Claudio Lo Iacono^{1*}, D G Masson¹, V A I Huvenne¹, R B Wynn¹, S G Moreton², C Harbitz³, S Glimsdal³

¹ *Marine Geoscience, National Oceanography Centre, Southampton, United Kingdom*

² *NERC Radiocarbon Facility, East Kilbride, Scotland*

³ *NGI, Norwegian Geotechnical Institute, Oslo, Norway*

**clo@noc.ac.uk*

In 1531, a 6.5 magnitude earthquake, with an epicentre inland of Lisbon, caused severe damage to the city, rendering a third of its buildings uninhabitable. This earthquake was followed by a destructive tsunami of slightly smaller size than the 1755, although in contrast to the latter it was only observed locally along the entire Tagus estuary and in coastal belt surroundings the mouth of the Tagus River. For the 1531 tsunami, a satisfactory mechanism for its generation has yet to be found, but the inland earthquake epicentre and the absence of large submarine scarps rule out fault-related seabed displacement. An alternative possibility is that the 1531 tsunami was caused by a submarine landslide triggered by the earthquake, producing near-field high amplitude waves close to the source and decaying rapidly with distance. Here we describe a submarine landslide along the Cascais Canyon, whose head faces the Tagus estuary, which may have caused the 1531. At a depth of around 2000 m, up to 150 m across and 45 m high blocks have been imaged over an area of at least 15 km² using 30 kHz deep-towed sidescan sonar. Furthermore, erosional furrows and possible gravel waves extending 10 km west of the main block field are seen in sidescan sonar imagery, and seafloor scours extend for ~40 km, suggesting a geologically recent large-scale flow event, which probably involved both a landslide and a turbidity current. High-resolution bathymetry and seafloor photographs acquired at around 4000 m using a remotely operated vehicle (ROV) in the blocky landslide area show boulders at the seafloor, mantled with a thin sediment cover, again suggestive of a recent landslide. Radiocarbon dates from collected cores show that this landslide is likely to have been generated during the 16th century, suggesting a cause-effect relationship with the 1531 earthquake. Preliminary tsunami models suggest that a landslide potentially fitting the characteristics of the Cascais landslide is able to generate a near-field tsunami wave reaching the Lisbon coast but not crossing the whole Tagus estuary, as described in historical documents. Recognising that the 1531 Lisbon tsunami may have been generated by a submarine landslide along a canyon has important implications for understanding geohazards in SW Europe. Our study suggests that small earthquakes with short recurrence periods can generate tsunamigenic submarine landslides, reinforcing the message that hazard analysis must take this threat into account.