Identification of Tsunami deposits and their impact on coastal zones: a study case of the Boca do Rio estuary (Algarve, Portugal)

Eric Font[a], Cristina Veiga-Pires[b*], Manuel Pozo[d], Silvia Nave[e], Susana Costa[e], Francisco Ruiz Muñoz[c], Abad Manuel[c], Nuno Simões[b], Silvia Duarte[a],

[a] *IDL-UL, Universidade de Lisboa, Ed. C3.3.22, Campo Grande, 1749-016, Portugal*
[b] *CIMA-FCT, Universidade do Algarve, Campus de Gambelas, 8005-139 Faro, Portugal.*
[c] *Departamento de Geodinámica y Paleontología, Facultad de Ciencias Experimentales, Campus de El Carmen, Avda. Tres de Marzo,21071-Huelva, Spain*
[d] *Departamento de Geología y Geoquímica, Universidad Autónoma de Madrid, 28049-Madrid, Spain*
[e] *Laboratório Nacional de Energia e Geologia (LNEG), Apartado 7586, 2721-866 Alfragide, Portugal*

***Corresponding author:** Cristina Veiga Pires, *CIMA-FCMA, Universidade do Algarve, Campus de Gambelas, 8005-139 Faro, Portugal* Phone: +351 217500811; e-mail: cvpires@ualg.pt

Abstract

Tsunamis are unforeseeable phenomena and therefore one of the most devastating natural disasters in terms of human and economic losses. Their impact on coastal and nearshore zones is substantial and need to be accurately evaluated to improve their prevention and management. In the last decades, numerous investigations focused on the identification of paleotsunamis in order to evaluate their frequency in the geological record. However, because storm- and tsunami-deposits are generated by similar depositional mechanisms, their discrimination using classic sedimentological methods is an elusive prospect. A promising approach is to couple classic geological criteria with geophysical and geochemical proxies to search for new benchmarks of tsunami deposits and to integrate them into a multi-disciplinary study. To test our method, we investigate the 1755 Lisbon tsunami deposit from the Boca do Rio estuary and other Tsunami-induced deposits from Algarve (Portugal). First results show that, Sr and Ca are enriched in the tsunami layer probably linked to the presence of shelled organism. Contrarily, others marine seawater indicators, such as Ba and Br, which are usually more concentrated in brackish than in fresh water, and heavy minerals, which are generally used as high energy event indicators, are depleted in the Tsunami deposit. Very low magnetic susceptibility values for the Tsunami deposit also indicate a dilution of iron oxides, reworked from the estuarine clays, within the huge volumes of quartz and carbonate (i.e. diamagnetic), issued from the abrasion of the littoral sandy dune and the surrounding carbonated cliffs. Diffusive Reflective Spectrophotometry analyses show changes in the siliclastic fraction on the sediments from above and below the tsunami layer. These apparent colour variations seem linked to the deposition of finer siliclastic particles after the tsunami, rather than to mineralogical composition. These data suggest that the high energy event affected the geomorphology of the estuary in such a way that it could induce a mis-interpretation of the geological record regarding local sea level changes and coastal evolution history.

Keywords: rock magnetism, tsunami deposit, estuary, natural hazards.

Unit C:

Ammonia beccarii, Quinqueloculina seminulum, Elphidium

Loxoconcha rhomboidea

Unit A:

ostracod: Cyprideis torosa

Herpetocypris reptans, Cyprinotus salinus, Cyclocypris laevis, Ilyocypris lacustris

characeas:Chara hispida, Chara vulgaris