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Limits in detecting tsunamites in the stratigraphic record – an example from the Early Miocene

HARZHAUSER, Mathias[1], DJURICIC, Ana[1, 2], MANDIC, Oleg[1], ZUSCHIN, Martin[3], DORNINGER, Peter[1, 4], NOTHEGGER, Clemens[1, 4], SZÉKELY, Balázs[2, 5], MOLNÁR, Gábor[2, 6], PFEIFER, Norbert[2]

[1] Natural History Museum Vienna, Geological-Paleontological Department, Austria
[2] Department of Geodesy and Geoinformation, Research Group for Photogrammetry, Vienna University of Technology, Austria
[3] Department of Palaeontology, University of Vienna, Austria
[4] 4D–IT GmbH, Austria
[5] Department of Geophysics and Space Science, Eötvös University, Budapest, Hungary
[6] Geological, Geophysical and Space Science Research Group of the Hungarian Academy of Sciences, Eötvös University, Budapest, Hungary

Shell beds are frequently discussed as indicators for tsunamites. Studies on coastal tsunami versus storm deposits suggest that wedge-like bed-load dominated deposits are more typical for storms, whereas sheet-like, suspended-load dominated deposits with mudclasts point to tsunamis. Co-occurrence of shells from spatially distinctly separate environments is a further characteristic of some tsunamites. A potential tsunamite candidate from the Early Miocene of the Paratethys Sea is represented by an enormous accumulation of huge oyster shells in a thin layer in the Korneuburg Basin (Austria). To evaluate this shell bed, more than 10.300 shells were manually outlined and the data were stored in an ArcGIS-based database. The data are derived from a digital surface model based on high resolution Terrestrial Laser Scanning (TLS) and orthophotos obtained by photogrammetric survey, with a resolution of 1 mm and 0.5 mm, respectively.
Earthquakes as trigger of a high-energy hydrodynamic event are very likely to have occurred frequently during the late Early Miocene Styrian phase in the seismically active area at the junction between Alps and Carpathians. Tsunami deposits form as product of tsunami run-up or backwash, and may be deposited onshore or offshore. This process has a strong directional force and the elongate and large oyster shells are expected to be excellent indicators f currents. Our analyses, however, revealed complex and partly even contradicting local patterns suggesting considerable distortion of a potential original pattern. We document unorthodox mechanisms explaining high ratios of convex-up shell positions and local alignment of shells in “pseudo-directions”. Finally, we document the difficulties in detecting potential tsunami signatures even in exceptionally preserved shell beds due to taphonomic bias by post-event processes in shallow marine settings.

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