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Tracking the 1912 Tsunamigenic Earthquake: A Multi-Proxy Study of Rapid Coastal Evolution and Event Stratigraphy in Kumlubent Lagoon, NW Türkiye

Emin Berke Tülümen[1,2,3], Ufuk Tarı[1,3], Nazlı Olgun Kıyak[2], Ulaş Avşar[4], and Sevinç Kapan Ürün[5]

[1]Department of Geological Engineering, Faculty of Mines, Istanbul Technical University, 34469, Istanbul, Türkiye
[2]Climate and Marine Sciences Division, Eurasia Institute of Earth Sciences, Istanbul Technical University, 34469, Istanbul, Türkiye
[3]MATAM (ITU Türkiye İş Bankası Marmara Active Fault Hazard and Risk Application and Research Center), Istanbul Technical University, Istanbul, Türkiye
[4]Department of Geological Engineering, Middle East Technical University, 06800 Ankara, Türkiye
[5]Department of Geological Engineering, Faculty of Engineering, Canakkale Onsekiz Mart University, 17000, Canakkale, Türkiye

Coastal lagoons are dynamic, semi-enclosed sedimentary environments highly susceptible to high-energy disturbances, such as storms and tsunamis. Their sedimentary archives are critical for reconstructing paleoseismic activity. This study aims to identify the lithostratigraphic imprints of historical seismic events in the sedimentary record of Kumlubent Lagoon (Gallipoli Peninsula, adjacent to the Sea of Marmara, NW Türkiye) using two sediment cores (KLB-S1 and KLB-S2). However, the lagoon's high-energy hydrodynamic regime resulted in a discontinuous biogenic carbonate record, preventing a conventional radiocarbon-based age-depth model for the entire sequence. A chronology for recent sedimentation was instead established using ^{210}Pb radioisotopes on the upper 20 cm, indicating a background sedimentation rate of ~ 3.6 mm/year.

To characterize rapid lithological transitions, we integrated targeted radiocarbon dating with high-resolution ITRAX XRF core scanning. Remote sensing analysis also reveals a phase of rapid geomorphological evolution, with approximately half a meter of sediment accreted over five-years. This rapid infill is expressed as stratigraphic reversals and the presence of reworked, anomalously-aged allochthonous material in the upper core sections. In contrast, within the lower, lower-energy facies -particularly in core KLB-S1- distinct event horizons were identified. ITRAX geochemical analysis shows that the elemental profiles and scattering ratios of these horizons are consistent with a marine sediment provenance, suggesting a sudden marine incursion. Radiocarbon dating of these specific event layers yields calibrated ages clustering within the 1912–1919 AD. This temporal constraint correlates strongly with the 1912 Şarköy-Mürefte earthquake (M_w 7.4), a major seismic event in the Sea of Marmara known to have triggered submarine landslides and tsunamis. These findings suggest that the sedimentary succession of Kumlubent Lagoon preserves a distinct record of the 1912 tsunamigenic event, thereby validating the site's potential for archiving historical seismic activity in the Western Marmara region.