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# Sedimentological and geochemical properties of a tsunami deposit in a lagoon north of Sea of Marmara, Turkey

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The coasts of the Sea of Marmara have been hit by numerous tsunami waves in the past, which might have surged up along its northern coastal strip and invaded inland more than 2 km. In order to understand and determine the tsunami potential and their possible effects along these coasts, detailed studies are needed on the past earthquake- and landslide-related tsunamis whose effects are presently unknown. These studies include gathering appropriate historical data, mapping out the underwater topography in detail, determining the active faults and underwater landslides and modeling. Marine geophysical works and numerical wave modeling applications show that three near surface faults out of six main structural elements outlined in the Sea of Marmara may trigger tsunami waves which may be effective along the northern coast. These are the west boundary fault of east Marmara ridge, the northern boundary fault of the middle Marmara ridge and the segment of Kumburgaz-Gaziköy. Ground motions on these fault segments may cause important wave runups along the coasts of Buyukcekmece and Kucukcekmece lagoons in the north with 2.5 to 4.5 m high waves depending on their source mechanism. Another indispensable study is to trace paleo-tsunami deposits in low-energy depositional environments such as coastal wetlands and places protected from the sea by sand barriers. The coasts of the Sea of Marmara, however, have been under rapid urbanization during last 50 years and only a very few areas preserve original coastal sediment successions. Meanwhile lagoons may also be important depositional areas for tsunami deposits and protect them from post-depositional erosion.

The Kucukcekmece lagoon, which is separated from the sea by a narrow strip of sandbar (300-350 m), was investigated in the present study. A piston core (TKÇ-5) was recovered in the southern part. It is 463 cm long and composed by fine sediments, from clay to silt, with some distinctive thin coarse grained layers. An enigmatic coarse sediment layer lies between 253 and 311 cm below the lagoon floor. It is bounded by gray to dark gray mollusk-bearing laminated mud with intercalations of organic-rich laminae. It is 58 cm-thick unit, and consists of three layers from bottom to top; muddy, a 6 cm-thick shelly gravel with well rounded pebbles of 1-1.5 cm diameter, a 16 cm-thick grey mud with broken and whole bivalve shells, and a 26 cm-thick dark gray normally graded, coarse shelly sand with plant remains. The overlying and underlying sediment units consist of gray to dark gray mollusk-bearing laminated mud with intercalations of organic-rich laminae and 2 cm-thick layers. The upper sandy part of the possible tsunami deposit is characterized by high density, magnetic susceptibility and resistivity, and low porosity. The basal part of this layer consists of sandy gravel which passes upward into gravelly, coarse to medium sand with shell fragments. The lower gravel layer is low in p-wave velocity, density and magnetic susceptibility. The core scanner analysis show that the upper sandy layer is enriched in Si, Ca, and Sr, indicating high concentrations of quartz and shell fragments. The basal gravel layer is high in Cl and P, possibly due to seawater intrusion and organic matter, respectively. Based on the AMS radiocarbon ages from a bivalve shell (305-306 cm) and sea grass (Zostera marina) (247 -248 cm) the sandy layer was deposited between 950-1000 AD. This work was partly supported by the project TRANSFER (Tsunami Risk ANd Strategies For the European Region) supported by the CEC, contract n. 037058, FP6-2005-Global-4.