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Prehistoric (Chalcolithic) Eastern Mediterranean tsunami deposit identified offshore central Israel

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The shallow shelf area (∼15-30 m water depth) offshore Israel, bears great potential for paleo-tsunami studies. It was shown in the course of previous research that in these offshore marine deposits, tsunami generated sedimentary layers can be well preserved and readily identified; unlike in onshore sedimentary sequences, which experience continuous exogenous natural and anthropogenic influence. A sediment core, 219 cm long, was obtained from 15.3 m water depth, in about 4 km north of Caesarea. Grain size at 1 cm interval as well as XRD and XRF analyses at coarser resolution were performed. Previously carried out research allowed correlation of two anomalous layers in this core with well described sediment sequences offshore Caesarea. These two events correspond best with the proposed events of 749 AD and ∼1500 BC. Identified unusual layers in this core bear certain set of proxies that are characteristic for tsunami generated deposits and easily distinguished from the local normal marine setting. The latter is characterized by three dominating mineralogical components, such as carbonaceous sand derived either from biogenic material, namely shell fragments or from eroded limestones and dolomites that outcrop the mountains to the east; siliciclastic quartz for the sand fraction and mineral smectite for the clays. The supply of the two latter terrigenous sedimentary components comes from the Nile River, which has been a stable and predominant source of sediments for the past 8 ka. The aim of this study is to characterize the earliest unusual sedimentary layer found down core between 191 and 211 cm. This layer was attributed to a tsunami-generated sedimentary sequence in the studied core. Absolute age determination based on 14C gave the time frame from 5.6 to 6 ka BP, making this event the oldest identified in the Eastern Mediterranean to date. This tsunami corresponds to the Chalcolithic (‘Copper Age’) cultural period of the region. Prehistoric age of these sediments makes it impossible to correlate these identified tsunami generated sediments with any known tsunami or earthquake, since the event pre dates any written catalogues of the mentioned hazardous events. The results of this study allow to make following conclusions: (1) the unusual sedimentary layer carries indicators, characteristic for tsunami generated sediments in the studied core, such as distinct deviation of granulometric coefficients (mean, median, standard deviation, skewness, kurtosis) and presence of whole, imbricated bivalve mollusks shells; (2) the upper part of tsunami generated layer is characterized by increased content of illite, a characteristic clay mineral for terrestrial sediments; (3) increased content of heavy minerals and such elements as iron, titanium and zirconium at the top of the layer coincide with increased content of coarse sand fraction (541-1821 micron) suggesting deposition in high energy sedimentological setting and influence of a strong backwash wave, carrying terrestrial material to offshore marine environment.