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Late-Pleistocene evolution of the East Mediterranean shallow continental shelf of north-central Israel

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Sea-level fluctuations are a dominant and dynamic mechanism that control coastal environmental through time. This is especially the case for the successive regressions and transgressions over the last interglacial cycle, which have shaped the deposition, preservation and erosion patterns of unconsolidated sediments currently submerged on continental shelves. The current study focuses on an integrated high-resolution marine and terrestrial litho-stratigraphic and geophysical framework of the north-central Mediterranean coastal zone of Israel. The interpretation enabled the reconstruction of the coastal evolution over the last ∼130 ka.

A multi-disciplinary approach was applied by compiling existing elevation raster grids, bathymetric charts, detailed lithological borehole data-sets, a dense 110 km long sub-bottom geophysical survey and seven continuous boreholes sediment records. Based on seismic stratigraphic analysis, observed geometries, and reflective appearances, six bounding surfaces and seven seismic units were identified and characterized. Meanwhile, the chronostratigraphy of the terrestrial side was constructed through integration of magnetic susceptibility, sedimentological and geochemical analysis with 17 new OSL ages. The seismic units were correlated with the available terrestrial borehole data and then associated to the retrieved terrestrial chronostratigraphy to produce a 4D reconstruction model of the paleo-landscape.

The entire unconsolidated sequence overlies a calcareous aeolianite (locally named Kurkar unit) dated from ∼131 - ∼104 ka, which represents the top of the last interglacial cycle dune sediments. The lower unconsolidated unit consists of a red silty loam dated to ∼71 ka. This Red-Paleosol unit is overlaid by a dark brown clayey silty loam This Brown-Paleosol unit dates to ∼58 - ∼36 ka and is overlaid by a dark silty clay wetland deposit dated to ∼21 - ∼10 ka. The wetland unit is topped by a quartz sand dated to ∼6.6 - 0.1 ka.

This approach allowed us to investigate the relationship between the lithological units and sea-level change and thus enable the reconstruction of the coastal evolution over the last ∼130 ka. This reconstruction suggests that the stratigraphy is dominated by a sea level lowstand during which aeolian, fluvial and paleosol sediments were deposited in a terrestrial environment. The coastal-terrestrial landscape was flooded by the early to middle Holocene transgression. The results of this study provide a valuable framework for future national strategic shallow-water infrastructure construction and also for the possible locations of past human settlements in relation to coastal evolution through time.