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Sea-Level Reconstructions and Archaeological Indicators: A Case Study from the Submerged Hellenistic Harbor at Akko, Israel

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With the impending threat of continued sea-level rise and coastal inundation, it is important to understand the short- and long-term factors affecting sea-level in a particular region. Such a feat can be accomplished by turning to indicators of past sea-levels. This study aims to highlight the utility of archaeological indicators in sea-level reconstructions, using Akko on Israel's northern Mediterranean micro-tidal coast as a case study. Here, installations belonging to the maritime metropolis' Hellenistic Period (3rd to 1st centuries BCE) harbor, which have well-constrained chronological and elevational limitations, were identified at depths averaging 1.1 to 1.2 meters below present sea-level (mbpsl). These features would have been located sub-aerially during the time of their construction and use, indicating a change in relative sea-level in the area since this time. Utilizing a multiple proxy approach incorporating marine sedimentological and geoarchaeological methodologies with previously recorded regional data, three possible explanations for this apparent sea-level change were assessed: structural deterioration, sea-level rise, and vertical tectonic movements. This study revealed that, although signs of structural deterioration are apparent in some parts of the quay, this particular harbor installation is well-established as in situ as it has a continuous upper surface and its southern edge is built directly on the underlying bedrock. Consequently, the harbor's current submarine position can instead be attributed to sea-level change and/or vertical tectonic displacements. While this amount of sea-level rise (over 1 m) is in agreement with glacio-hydro-eustatic values suggested for other areas of the Mediterranean, it falls below those previously reported locally. In addition, most studies suggest that the tectonic movement along this stretch of coastline is negligible. These new data provide a reliable relative sea-level marker with very little error with regard to maximum sea-level, thereby renewing the overall consideration of the tectonic and sea-level processes that have been active along this stretch of coastline during the last 2,500 years.