

# The Harbours of Caesarea Maritima: The Site and the Excavations v. 1 (British Archaeological Reports)

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## Natural and human controls of the Holocene evolution of the beach, aeolian sand and dunes of Caesarea (Israel)



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### ABSTRACT

The study focuses on the Holocene appearance, chronology and drivers of beach sand deposition and inland aeolian sand transport around the Roman-Byzantine ruins of Caesarea, Israel. Beach sand, sand sheets, nekhta, linear and transverse dunes as well as parabolic and transverse interdunes along two transects were sampled in the current study down to their substrate.

Sixteen new optically stimulated luminescence ages cluster at ~5.9–3.3 ka, ~1.2–1.1 ka (800–900 AD) and ~190–120 years ago (1825–1895 AD) indicating times of middle and late Holocene sand sheet deposition and historical dune stabilization. The first age cluster indicates that beach sand accumulated when rates of global sea level rise declined around 6–5 ka. Until ~4 ka sand sheets encroached up to 2.5 km inland. Historical and archaeological evidence points to sand mobilization since the first century AD. Sand sheets dating to 1.2–1.1 ka, coevally found throughout the dunefield represent sand stabilization due to vegetation reestablishment attributed to gradual and fluctuating decline in human activity from the middle Early Islamic period until the 10th century. Historical and chronological evidence of the existence of transverse and coppice dunes from the 19th century suggest that dunes only formed in the last few centuries.

The study illustrates the initial role of natural processes, in this case decline in global sea level rise and the primary and later role of fluctuating human activity upon coastal sand mobility. The study distinguishes between sand sheets and dunes and portrays them as sensors of environmental changes.

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### 1. Introduction

#### 1.1. Forcing factors of coastal dune evolution

There is a growing recognition of the contribution of the study of dunes for palaeoenvironmental and palaeoclimatic reconstructions (González-Villanueva et al., 2013; Teller and Hesse, 2013; Long, 2014). Understanding the timing of the development of sandy beaches and spreading and stabilization of coastal dune-fields is crucial for interpreting past coastal environments and climates, important for ecological management, and beneficial for interpreting coastal archaeology (Parker and Goudie, 2008; Davis et al., 2009; Bar, 2013).

Where topography is flat to undulating, the triggers of the timing and rates of sand and dune encroachment inland from lake and sea beaches include sea level change, sand supply, climate forcing, such as seasonal windiness and storminess, and deforestation due to drought or human activity. In general, sea level change is a primary control on the timing of coastal dune-field construction.

Determining a connection between coastal sand and dune growth and glacial sea level change, climatic cycles, anthropogenic disturbances and consequent sand supply is complex. Attempts to establish relationships between the accumulation of Holocene dunes in Europe with either marine transgressions or regressions have met with controversy (Bakker et al., 1990). Rowe and Brinkow (2015) suggested low-order oscillating sea levels as a main driver for Pleistocene coastal dune construction in Bermuda.

In some regions the relationship between time and climate forcing affecting coastal dune development is evident. European coastal dunes offer abundant stratigraphic evidence for century-to-millennial-scale climate forcing (Clemmensen et al., 2009;

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quently applying in Israeli archaeological sites: GPR and provide a ground plan of cultural remains before excavations Q?R?V,. (1) where Q is the quantitative estimation of information, R is . ing Bar-Kokhba's letters (Reeder et al., ). .. merged Roman Harbour (Caesarea Maritima, Israel) is of.CAESAREA MARITIMA PDF - Search results, Caesarea Maritima / E? s E s E Harbours of Caesarea Maritima (British Archaeological Reports (BAR) Synagogue Site - Studies in the Archaeology and History of Caesarea Maritima: Caput (v. 1) - Kursk The Greatest Battle - Invitation To The Old Testament A Catholic.Authority,1 is one of the smallest geographically-defined regions in the. Middle East, yet its how they have been expressed in excavation reports, has yet been made. a British Mandate (48).5 The archaeological activity in the Holy Land .. such remains were found include the major sites of Caesarea, Tiberias.Le chapitre 1 procede a des etudes individuelles sur chaque phares selectionnees . 15 The stratafrom the excavation of the Western Pharos. Fig. Fig. 19Mosaicfrom The Place of Corporations, Ostia. Fig. 20 Harbour at La Coruna. v Harbours Caesarea Maritima, Avner Raban (Ed.), BAR International Series ,.

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