

# THE PALEO GEOGRAPHIC ENIGMA OF A SHIPWRECK FOUND OFF MA'AGAN MICHAEL, CENTRAL ISRAEL

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## Abstract

A 2,400 years old shipwreck, discovered in the shallow continental shelf off central Israel, shed light on the recent paleogeography of that region. Analyses of the sand near the wreck-site suggest stable sealevel and wave climate since that time.

*Key-words* : ocean history, sediment transport, eastern Mediterranean

A 2,400 years old shipwreck was discovered buried in the sand in the shallow sea off Ma'agan Michael in central Israel (Figure 1). The pine and oak built vessel was 13 m long, 4 m wide, and it was remarkably well preserved. The ship was discovered at water depth of 1.5 m, with its bow facing southeastwards, toward the beach (1). This archaeological discovery instigated a multidisciplinary research, the sedimentological part of it used the wreck as a temporal bench-mark in the reconstruction of the coastal paleogeography. The Ma'agan Michael coast is sandy, and is protected from the erosional effect of the winter storms by a ridge of late Pleistocene calcareous sandstone. Most of the ridge is submerged, but for several small islands which protrude above sealevel, the largest being HaYonim Island. The water depth between the sandstone ridge and the coast is less than 2 m in most places. It was of paleogeographic and archaeological interest to reconstruct the sailing conditions of the ship during its wreckage. Ma'agan Michael is located 2 km north of the present mouth of Crocodile River. Aerial photographs show that the river mouth shifted nearly 1 km southwards due to sediment transport along the coast (see also 2). We presume that the river mouth was located close to the wreck-site some 2,400 years ago. Rivers were known to be preferred site for harbors in antiquity, because they were better protected from the wrath of nature and ferocity of man (3). It is presumed that the ship beached while trying to enter the river mouth to find safe haven.

The coastal sand in the proximity of the wreck was sampled in 12 shore-normal profiles and analyzed for its size and mineralogy. Two 5 m deep boreholes were drilled on the coast, 220 m apart, in the lee of HaYonim Island, and a series of probes was carried along the coast and in the shallow offshore zone. Qualitatively, the sand at Ma'agan Michael comprises mainly quartz grains of Nilotic origin, which is the major constituent of all the size fractions. Minor components, which were found in all the fractions as well, are opaque mineral grains, shell fragments, and microfauna such as foraminifers and ostracods. The sampling of the coastal sand in Ma'agan Michael shows that the principal fraction of the sand is fine grained (0.25-0.125 mm), and the second most abundant fraction is medium grained (0.5-0.25 mm). While most fractions were found to be nearly uniform in all the profiles, the spatial analyses of the medium-grained fraction presented some geographically meaningful variations. The quantity of medium-grained sand increases towards the breaker zone and in the segment of the beach, which is not protected by the submerged ridge (4). It seems that the increased amount of coarser sand reflects higher level of wave energy along the coast. A detrital fraction of a different provenance is a very coarse sand and grit, comprising mainly shells and shell fragments of *Glycymeris* sp. Considerable increase in this fraction was encountered in the boreholes at depth of approximately 2 m, where a 0.5 m layer was encountered. The jet probes of the coastal and offshore sand also encountered that layer, and observations during the excavation of the wreck indicated that the hull was embedded in that anomalous layer, enriched with large shells of *Glycymeris* sp. as well. These coarse fragments suggest either a depositional environment of higher hydraulic energy than the present one, or anthropogenic interference.

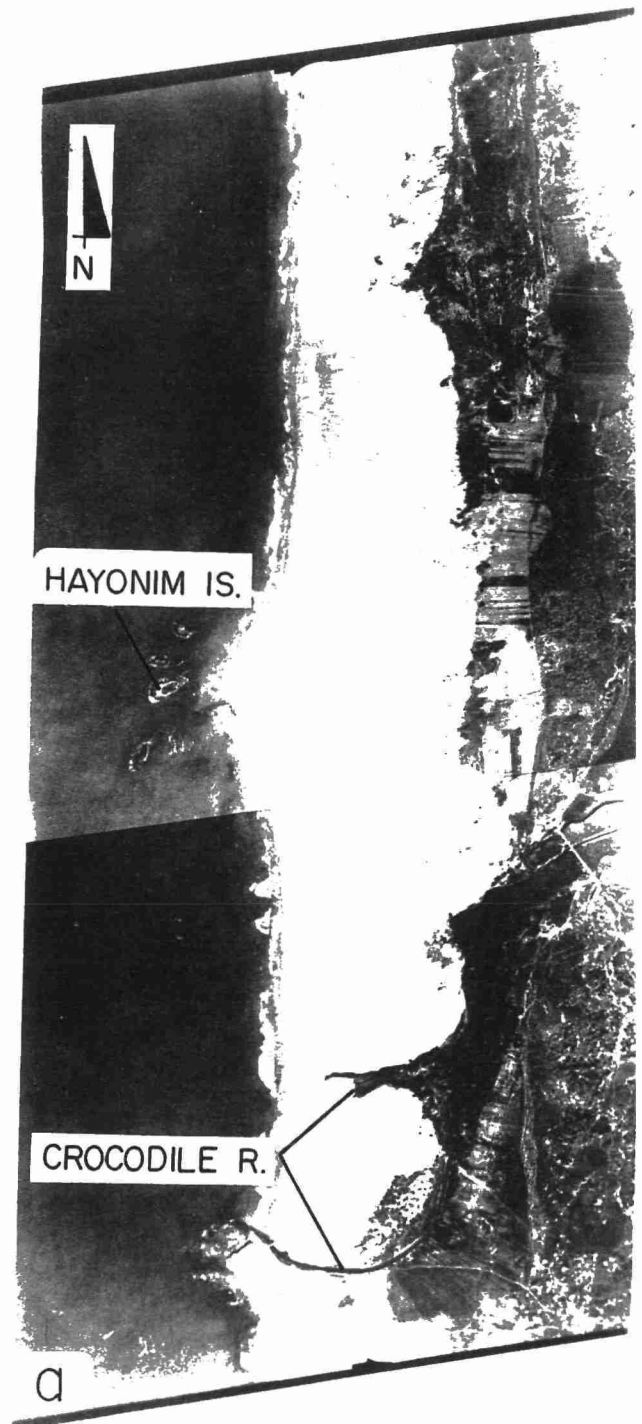


Figure 1. a. The coast of Ma'agan Michael, and the site of the shipwreck.