

# A Levantine Coastal Economy: New Evidence from the Dor Harbor for the Maritime Transport of Locally Quarried Stone

Ehud Arkin Shalev<sup>1</sup>, Anthony Tamberino<sup>2</sup>, Thomas E. Levy<sup>2</sup>, Assaf Yasur-Landau<sup>1</sup>

<sup>1</sup>Leon Recanati Institute for Maritime Studies, University of Haifa; <sup>2</sup>Department of Anthropology and Scripps Center for Marine Archaeology (SCMA), UC San Diego

## INTRODUCTION

The ability to procure, transport and utilize stone has been an intrinsic part of the development of both rural and urban society in the eastern Mediterranean (Fig. 1). In the southern Levant, easily accessible aeolianite sandstone ridges sometime run parallel to the coastline. These wide and rocky outcroppings, on which Dor and other sites have been built, have long provided a convenient source of stone to be quarried (Fig. 2A, 3). Widespread coastal evidence for the use of this sandstone, known locally as 'kurkar' rock, is demonstrated by its utilization for the building of homes and public structures dating back to the 7th millennium BCE<sup>1</sup>.

## SURVEY AND EXCAVATION RESULTS

Our joint underwater surveys and excavations have documented a 17 meters long by 7 meters wide concentration of newly hewn stones along with a one-hole stone anchor has been documented resting on the seafloor, inside the Dor harbor basin (Figs. 2B, 4). This deposit, originally alluded to by Wachsmann and Raveh<sup>2</sup> and Raban<sup>3</sup> likely originated from an overturned barge used to ferry the stones, and may pre-date the Late Antique 6th century CE coaster shipwreck of Dor 2001/1, a sailing vessel which sank laden with recently quarried building stones in the nearby Tantura lagoon<sup>4</sup>. In addition to this a possible mooring installation, which may have been used by such barges and other vessels, was also excavated within the Dor harbor (Figs. 2C, 5). The hewn stones of which it was built show grooves possibly intended as guidelines for permanently attached mooring ropes (Fig. 6).

## METHODOLOGY

After underwater excavations were completed, both features were documented by photogrammetry using a Sony a6000 digital camera equipped with a 19mm focal length Sigma f2.8 DN ART prime lens in an underwater housing. The f-stop was set to 4.5 with aperture priority. All images were shot in RAW format. Imagery over the site was collected in a double grid pattern in tracks, first in an East-West orientation and then a North-South orientation.

A total of 1796 images were collected. Due to the shallow depth of these sites (i.e. from 1-3 meters), photogrammetry data were georeferenced by ground control points taken with a shore based Total Station and Prism Pole. The Images were aligned in Agisoft Metashape on "high" settings and a colorized dense point cloud was created and georeferenced with the ground control points obtained with the total station. A DEM (Fig. 7) was generated and images were ortho-rectified over the DEM creating a photo mosaic with a 0.731mm GSD per pixel. The DEM and photo were then exported to ArcGIS Pro where the top plan was digitized in a vector shapefile, georeferenced in an ITM projected coordinate system.

## SUMMARY

These new data point to the extensive framework within which the complex enterprises of quarrying, transport, supply, use, and sometimes re-use of stone successfully operated along the Levantine coast. These activities reached their peak during the Roman and Byzantine periods, as attested by the use of this material in the construction of the breakwaters of Herodian harbor of Sebastos in nearby Caesarea. This grand imperial endeavor, known for its use of imported pozzolana on a hitherto unprecedented scale, nevertheless saw 80% of its raw construction materials, including sandstone and limestone, sourced locally<sup>5</sup>.

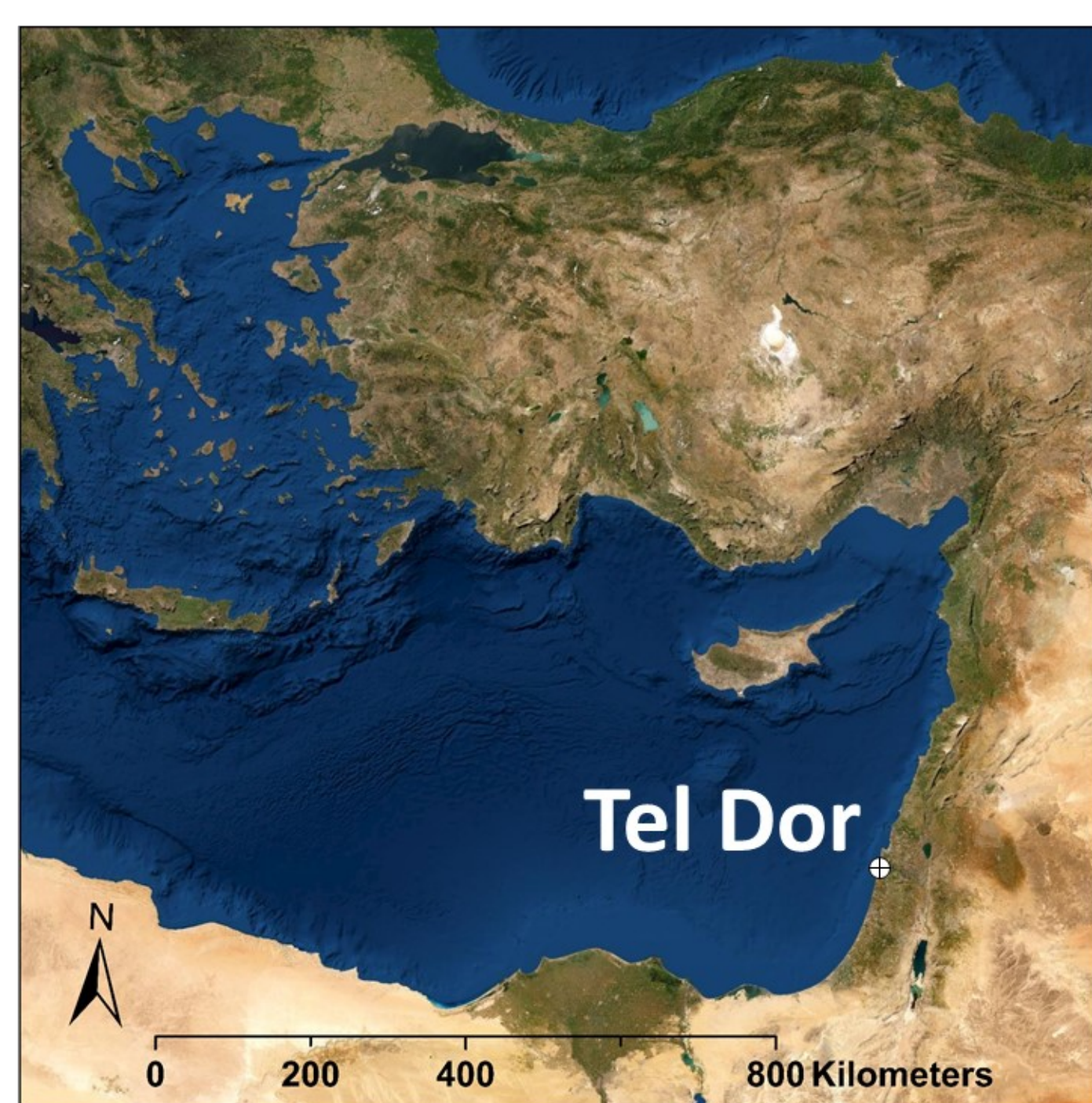


Fig. 1 Dor in the eastern Mediterranean

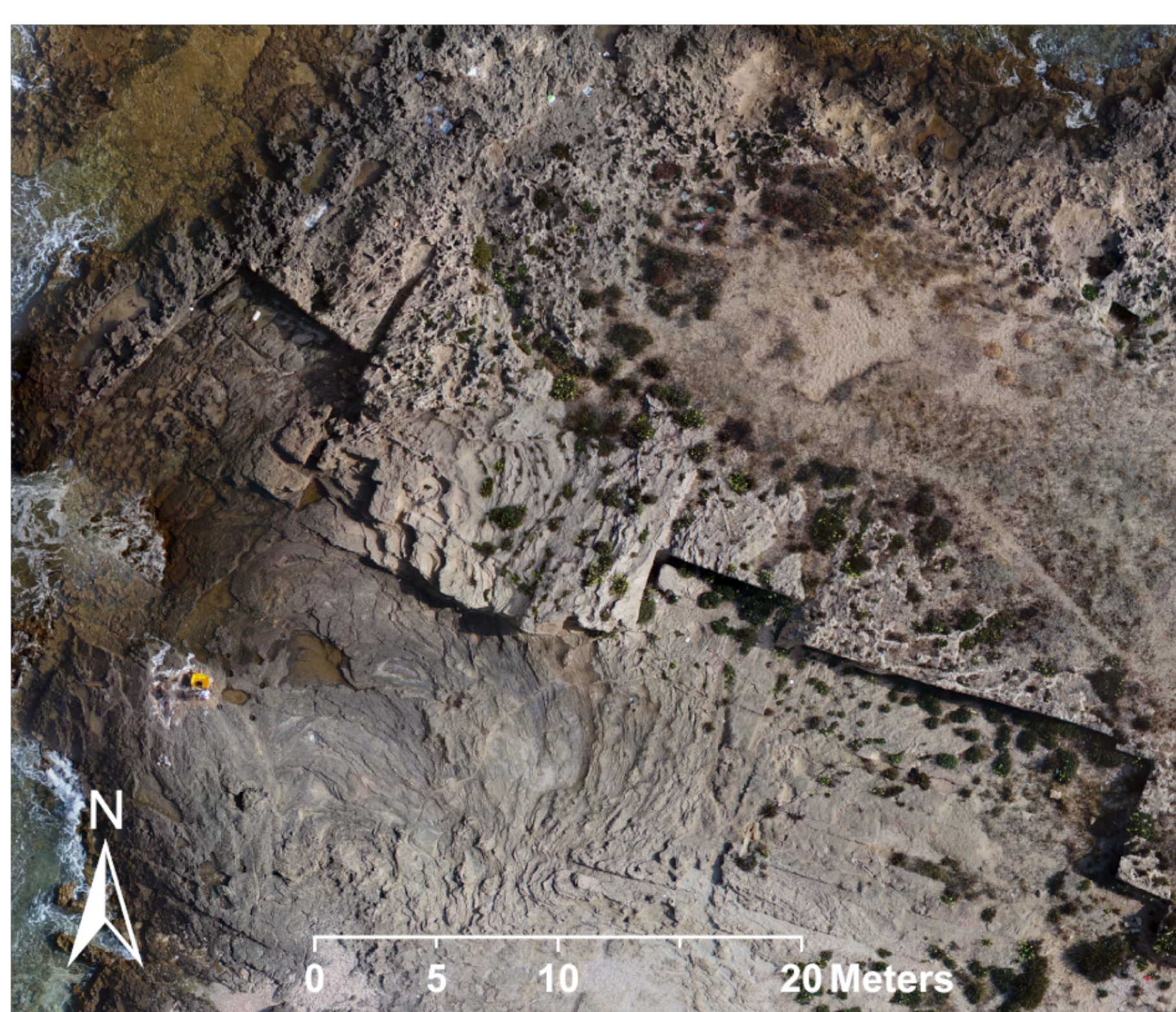


Fig. 3 Point "A" Sandstone quarry at Dor

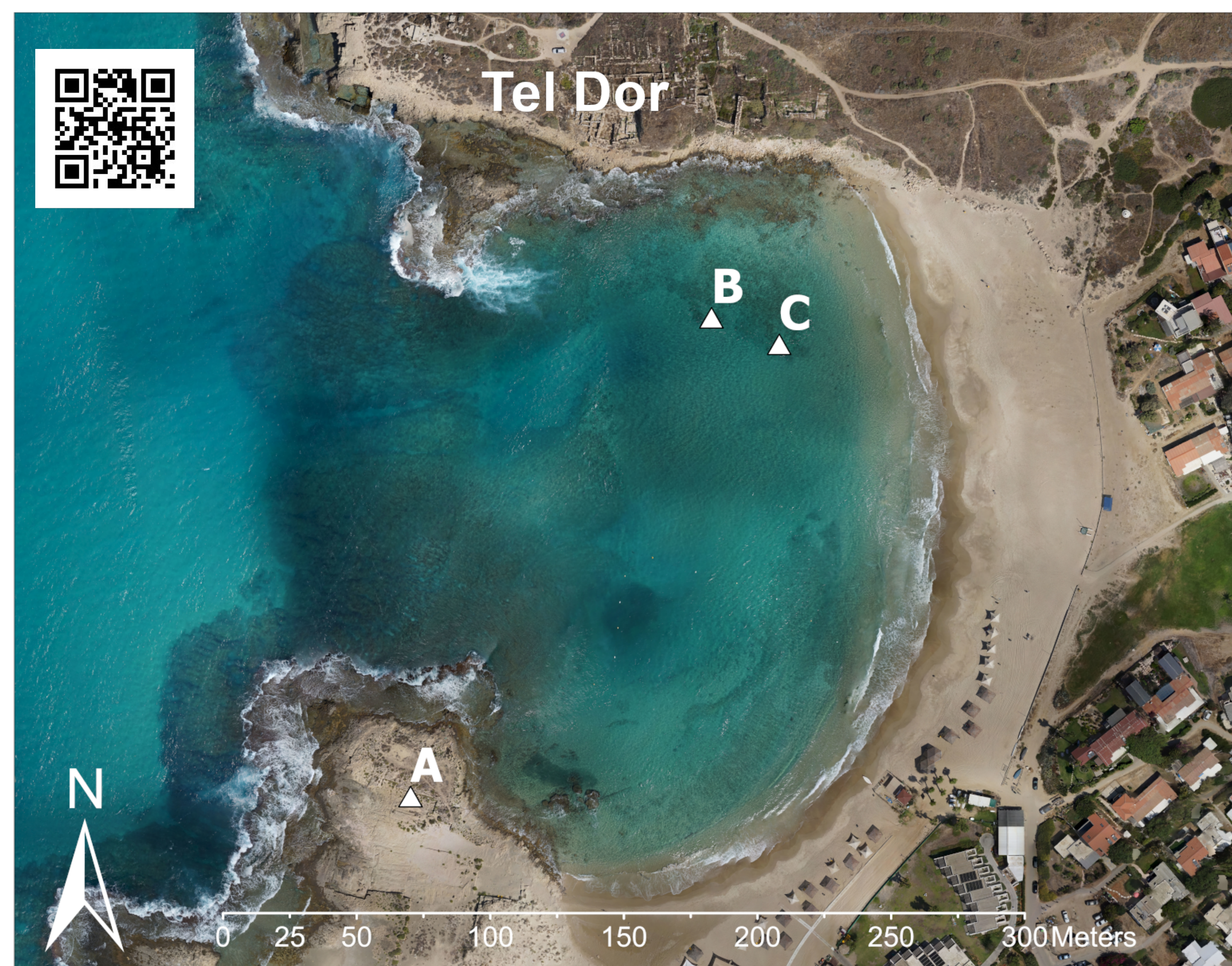


Fig. 2 The South Bay of Dor.

Open QR code for 3D virtual tour, or: <https://skfb.ly/6WnxP>

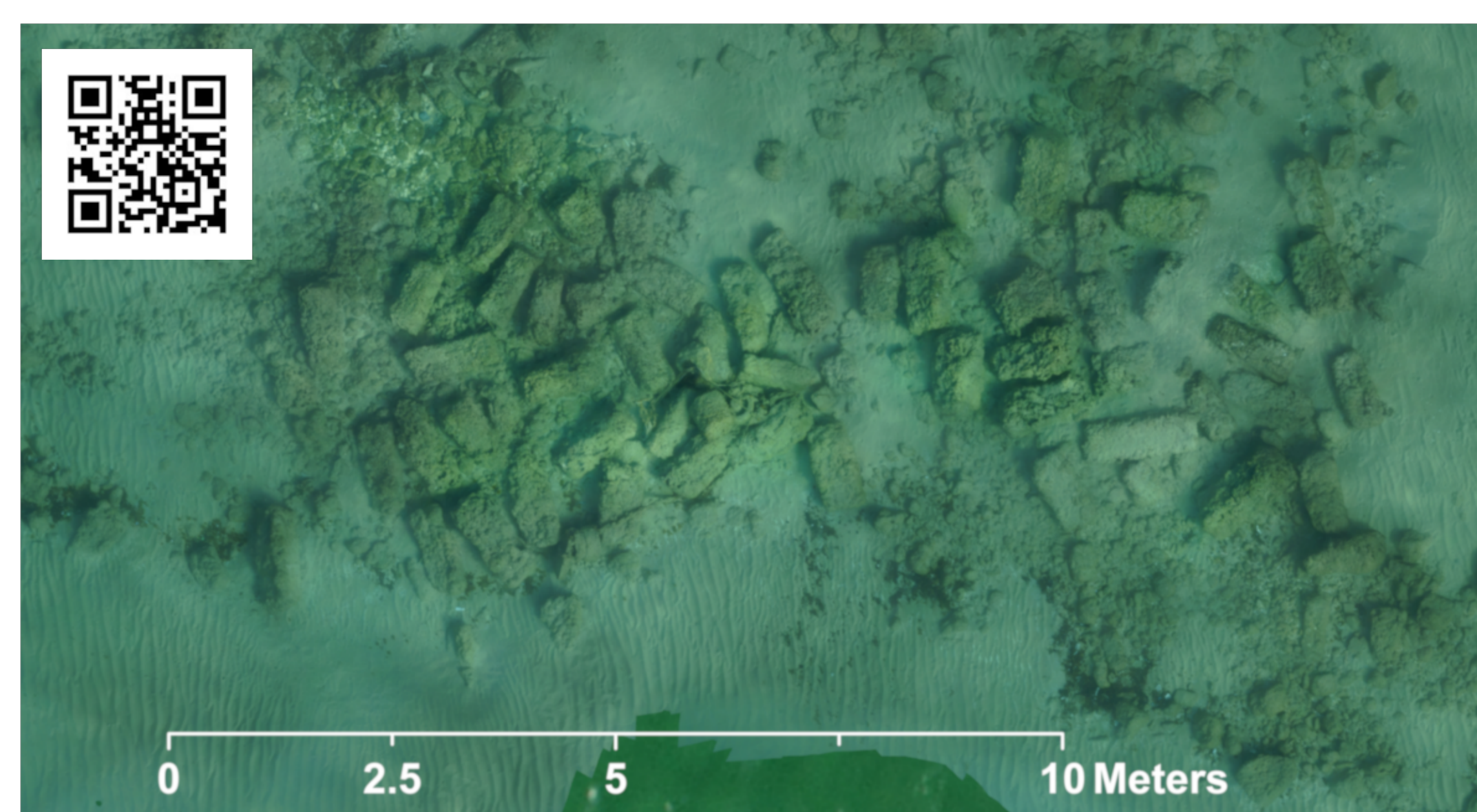


Fig. 4 Point "B" Wrecked hewn stone cargo.

Open QR code for 3D model, or: <https://skfb.ly/6WnzK>

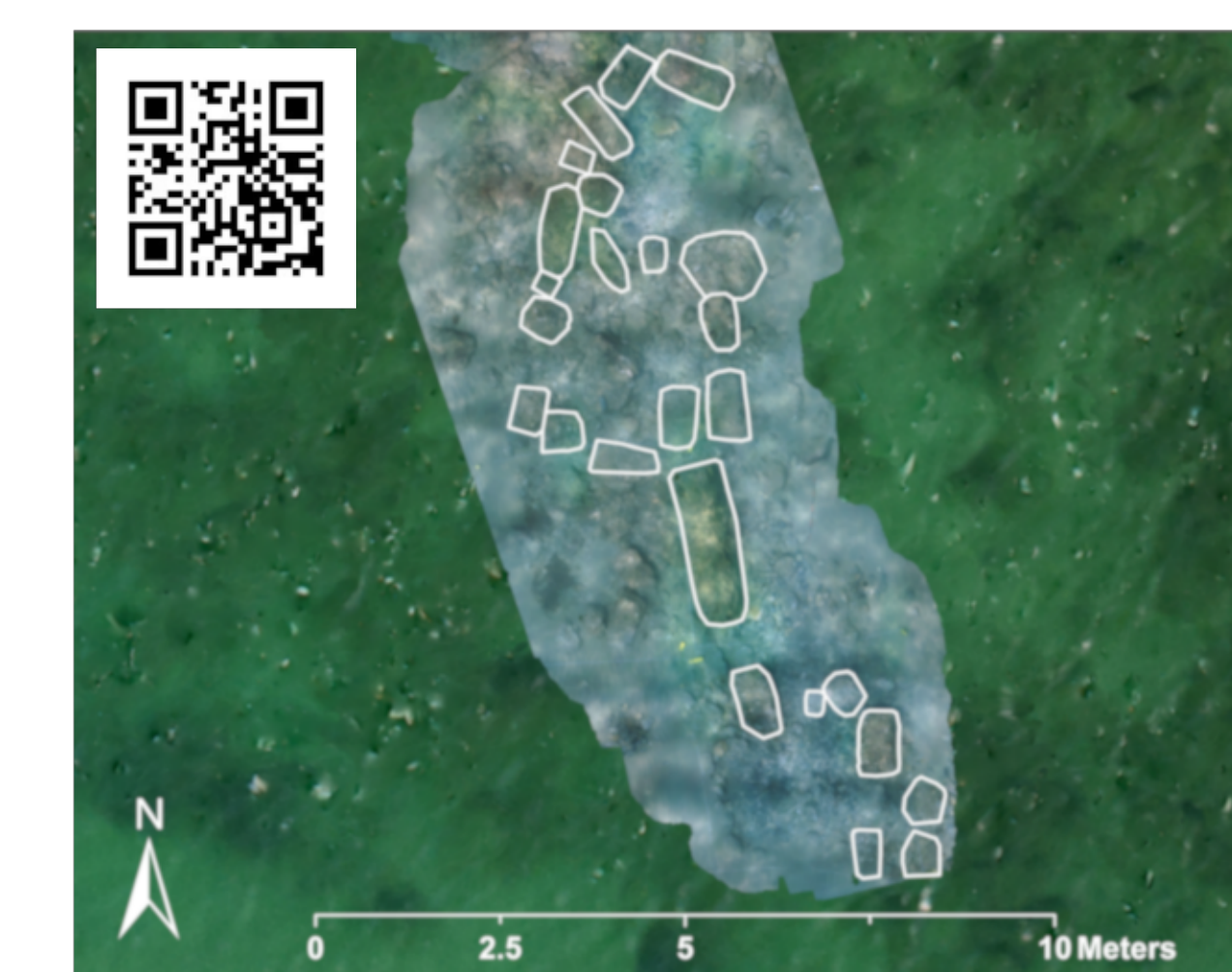


Fig. 5 Point "C" Possible mooring installation.

Open QR code for 3D model, or: <https://skfb.ly/6WnDw>

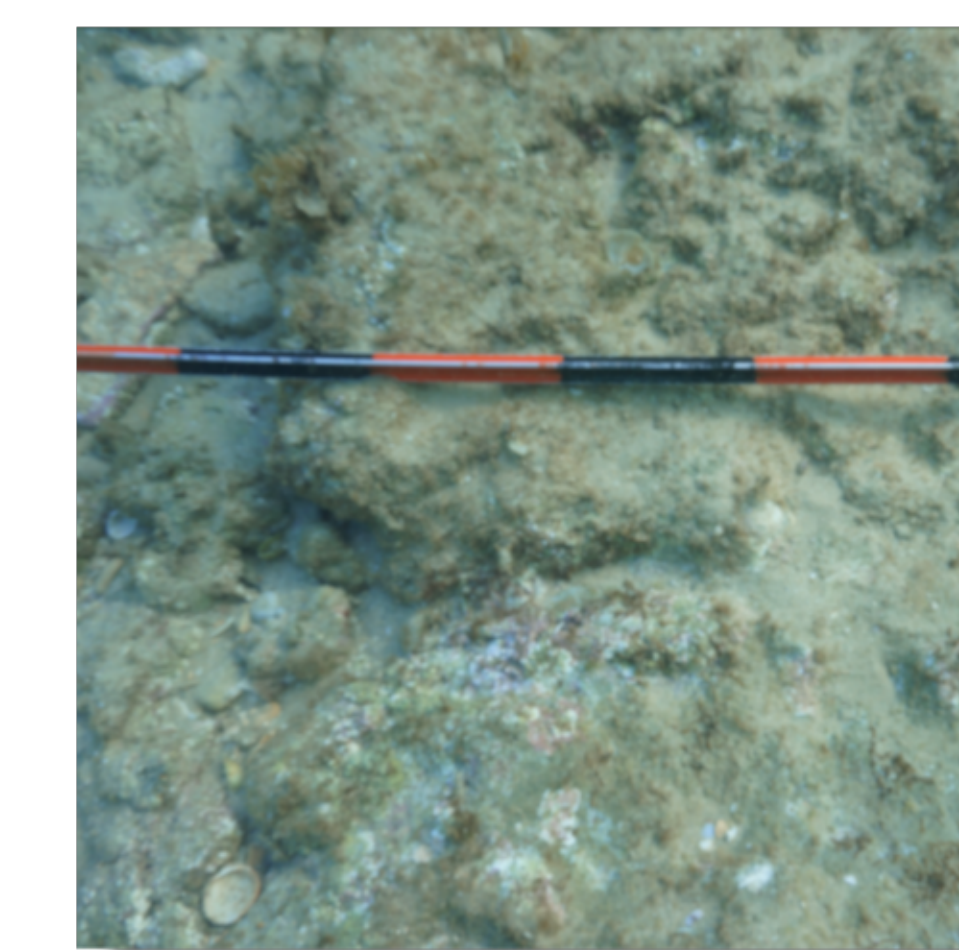


Fig. 6 Grooved stone block

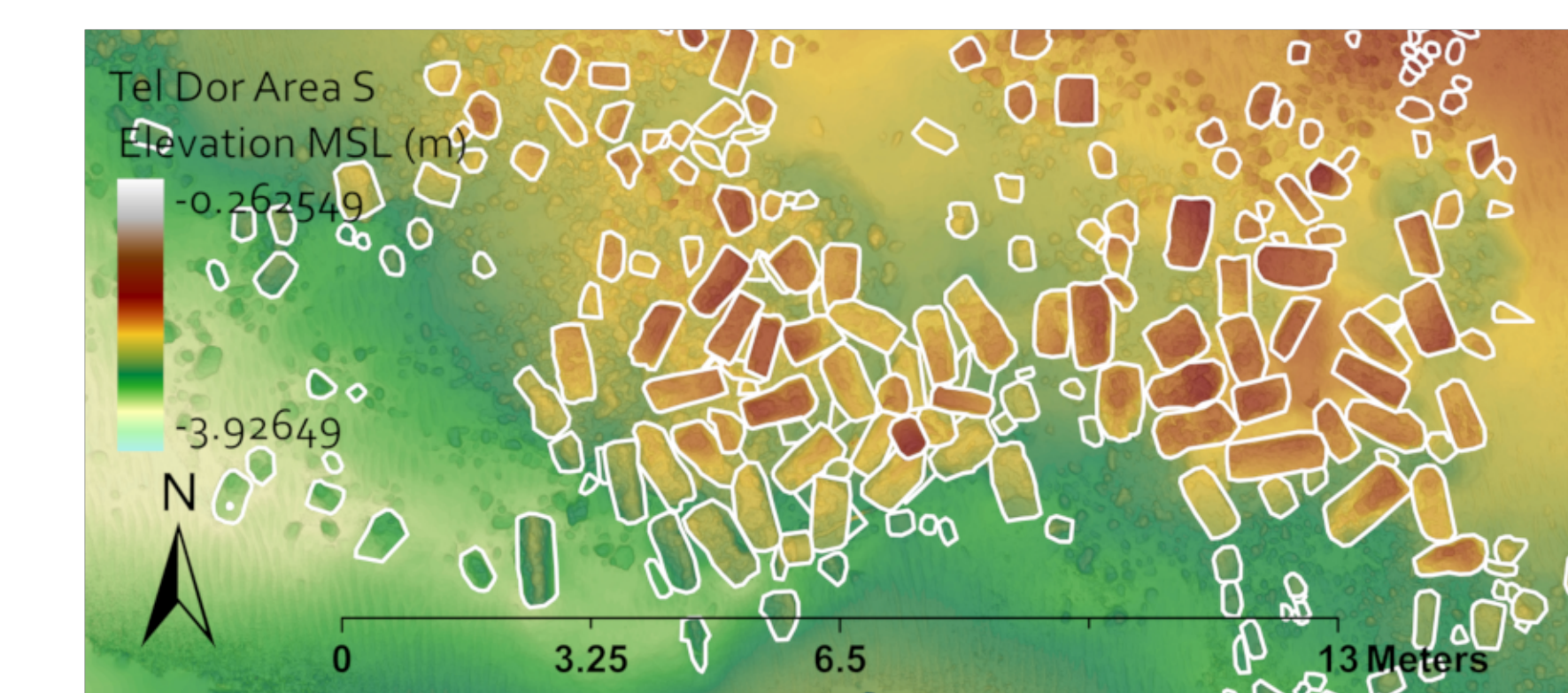


Fig. 7 DEM of wrecked hewn stone cargo

## REFERENCES

- (1) Gallili, E., et al. (2017). Submerged Pottery Neolithic settlements off the coast of Israel. pp. 105-130. Springer, Cham.
- (2) Wachsmann, S. and Raveh, K. (1980). Underwater Work Carried out by the Israel Department of Antiquities. *International Journal of Nautical Archaeology*, 9(3), pp. 256-264.
- (3) Raban, A. (1995). Dor-Yam: Maritime and Coastal Installations at Dor in Their Geomorphological and Stratigraphic Context. p. 349.
- (4) Kahanov, Y. and Mor, H. (2014). The Dor or 2001/1 Byzantine Shipwreck, Israel. *International Journal of Nautical Archaeology* 43. 1. pp. 41-65.
- (5) Votruba, G. F. (2007). Imported building materials of Sebastos Harbour, Israel. *International Journal of Nautical Archaeology*, 36(2), pp. 325-327