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Water saturated sand and a shallow bay: Combining coastal geophysics and underwater archaeology in the south bay of Tel Dor

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ABSTRACT

The south bay of Tel Dor was examined during a detailed underwater archaeological expedition and through an onland, coastal Frequency Domain Electromagnetic (FDEM) geophysical survey. The aim was to find out if the bay situated adjacent to the southern edge of the tel, was used for maritime activity when the tel was inhabited. Results indicate that the FDEM method provides useful data in waterlogged coastal environments, where other more conventional methods are not satisfactory in terms of identifying archaeological remains. A number of linear features were detected on the FDEM maps, the most visible being a rectangular area facing the sea on the shoreline and an NW-SE trending near-linear feature. Distribution of underwater archaeological evidence for marine activity such as anchors and mooring stones also seems to be aligned in an NW-SE direction, parallel to the latter feature on shore. If indeed related to archaeology, the features detected by the FDEM method are probably located on the clay substrate, buried underneath thousands of years of sand accumulation. Given the sedimentary history of the bay, and the ages of the nearby coastal structures, it is possible that this is a maritime structure dating to the Bronze Age or even earlier.

1. Introduction

Tel Dor is an 8-hectare tel site located on the coastal plain between Mt. Carmel and the Mediterranean Sea (Fig. 1), approximately 30 km south of Haifa (Stern, 1993, pp. 357). Habitation at Tel Dor began in the Middle Bronze II period (ca. 1950–1550 BCE) and continued to grow and develop throughout the Roman period (third century AD). More meager Byzantine and Crusader remains also exist on and near the tel. Dor's unique coastline of naturally protective bays provided possible anchorages for seafarers in antiquity. Maritime activity in Dor is likely to have begun in the Bronze Age with the natural bays serving as proto-harbors. This is especially true for the south bay and the “Love bay” (Stern, 1993, pp. 19–22; Raban, 1995, pp. 286–289; Marriner et al., 2014: 5). The use of Dor's bays as unmodified anchorages in later periods is most conspicuous in the Tantura Lagoon where over 25 shipwrecks dating from the Roman to the Ottoman period were discovered (Kingsley and Raveh, 1996, pp. 314; Mor and Kahanov, 2006). One of the periods of greater prosperity for Dor was the Iron Age Ib and II (ca. 11th-7th centuries BC), for which significant archaeological remains were found, from monumental structures to fortifications, including ample evidence for international maritime trade (Gilboa and Sharon, 2008). Furthermore, the 11th century BC Tale of Wenamun and the early 7th century BC Treaty of Esarhaddon with Baal of Tyre portray Dor as a significant harbor town during the Iron Age, first under Sikil rule and then under Phoenician rule. The south bay of Dor also yielded possible maritime installations dating from the Iron Age. Excavations in the area (Raban, 1995, pp. 335–339) uncovered a series of massive ashlar walls on the southern edge of the tel by the sea, on the shoreline (Fig. 1c). These were identified by Raban as series of quays dating from the Late Bronze Age to the Iron Age II. If these are indeed quays, they are the earliest harbor installations to be found in the southern Levant. Further analysis of pottery found near these walls confirmed an 11th century BC date for their earliest stage (Artzy, 2006, pp. 75–77). A monumental Iron Age Ib structure that possibly served administrative functions was found on top of the tel above the quays, further supporting the

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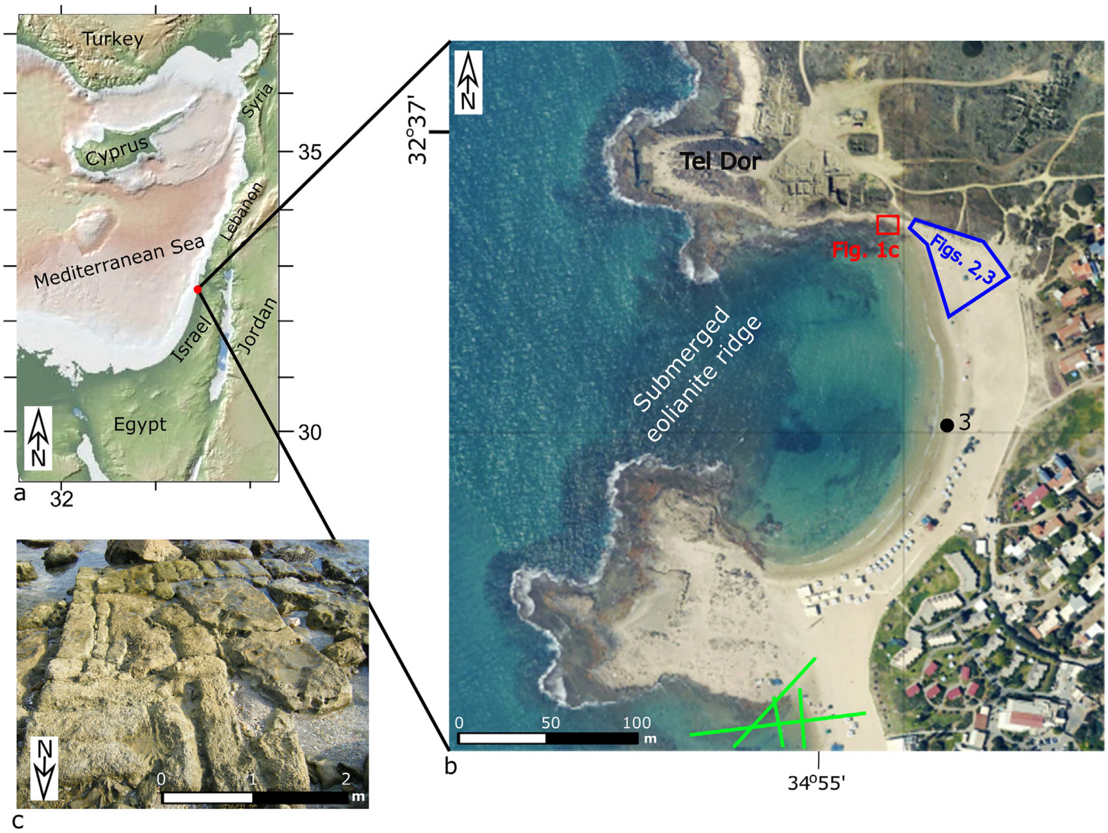

Fig. 1. a. Location of Tel Dor along the Israeli coast, b. Airphoto from 2013 showing location of Ashalr building stones (red rectangle); blue polygon: extent of FDEM geophysical survey; black dot: core 3 of Sivan et al. (2004); green lines: ERT survey of Swarzenski et al. (2006) and c. photograph looking south showing archaeological remains. See text for details. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

importance of the south bay during the early Iron Age period (Gilboa and Sharon, 2008). The use of ashlar masonry for maritime and coastal construction in the Iron Age, a method attributed to the Phoenicians, is by no means limited to Dor. Excavations at the harbor of Atlit, only 7 km north of Dor, yielded Ashlar moles and quays dated to the 9th century BC. Another example of Iron Age Phoenician-style maritime construction was found at Tabbat-al-Hammam in Syria (Haggi and Artzy, 2007; Morhange et al., 2016, pp. 87–88). For two decades however, Raban's pioneering work on the quays (Raban, 1995) and a survey by Kingsley and Raveh (1996) remained the only field studies dealing with a possible anchorage, or harbor, in the south bay of Dor.

1.1. The environment of the south bay of Dor

Although not conducted for archaeological purposes, one previous geophysical survey in the area supplied important information on its geomorphology, especially on sand cover. Sivan et al. (2004) used shallow seismic reflection profiles (up to 30 m penetration) complimented by a series of cores analyzed for sedimentary properties to deduce sand, clay and bedrock cover (Fig. 1b). Only one borehole, core #3, is relevant for the current study. None of the seismic lines were collected near enough to the site to be considered here. Core #3 was drilled in the middle of the southern bay some 150 m south of the study area and close to the present-day shoreline. It was composed of 5 m of sand above an additional 5 m of clay overlying the eolianite bedrock (Sivan et al., 2004, pp. 1042). Top clay was deposited in a wetland/coastal marsh environment and was dated to 9520 ± 130 BP or 8940–8430 BCE (calibrated ^{14}C). This was revised in the current study to 8938–8166 BCE using OxCal v4.2.4 with a reservoir age of 364 ± 54 (Boaretto et al., 2010, pp. 967). According to Sivan et al. (2004) and Cohen-Seffer et al. (2005), sand started to accumulate in the area around 5000–4000 years ago, when sea levels along the Mediterranean coast rose to 1–2 m below their present level, allowing sand to reach the coast. Kadosh et al. (2004, pp. 146) dated the onset of sand accumulation in the Dor area (to the south of the area examined by Sivan et al., 2004) by infrared stimulated luminescence to 5100 ± 500 years. However, this age was corrected in the present study for anomalous fading to 6200 ± 700 years using a fading value of 2.3 ± 0.5% per decade measured for samples nearby (Naomi Porat, pers. comm). These results have some implications for archaeology, since they indicate that the bay extended further to the west before the rise in sea level and the subsequent cover of sand. Since the marsh deposits were exposed for 3600 years before the onset of sand accumulation (Cohen-Seffer et al., 2005), this raises the possibility that Bronze Age or older structures could have been built on, or dug into, the clay and subsequently buried during the preceding thousands of years of sand accumulation.

A second geophysical survey was conducted by Swarzenski et al. (2006) on, and adjacent to, a tombolo that acts as the southern border of the south bay. The authors collected resistivity measurements (Time Series Resistivity using a 56 electrode cable with 2 m spacing) along a number of transects along and across the tombolo (Fig. 1b). The aim of their study was to assess groundwater discharge. The authors calculated the mean value of formation resistivity (R_f) and found that for saturated sand it was 1.85 ± 0.23 Ω-m and for eolianite sandstone it was 3.57 ± 2.17 Ω-m (eolianite is less porous thus more resistive and less conductive than saturated sand). Their survey focused on the deeper subsurface structure of

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the area thus it is difficult to discern changes in the top few meters, which is relevant to the current study. However, from their interpretation it seems that there could be a layer of saturated sand (as opposed to eolianite) from the surface down to a depth of ~3.5 m across the tombolo (Fig. 4 of their paper). Together with the results of a shallow coring campaign carried out as part of a study complimentary to the current one, it is clear that beneath the large volume of sand, there are intermediate layers across the bay, which are saturated with seawater.

Since the pioneering studies of Raban (1995) and Kingsley and Raveh (1996), the development of underwater survey methodology and technology (mainly the introduction of GPS location) and advances in geophysical tools that can aid in archaeology have enabled a new approach to the study of underwater and coastal Dor. The aim of the present study was to further understand the nature of maritime activity within the south bay. Additional maritime installations or evidence for maritime activity such as anchors was sought, as well as their spatial relation to the quays. This was then combined with a coastal geophysical survey to relate the findings to possible onland structures. Since there are no indications that the geophysical method applied here has been used in the past in coastal areas and in saturated sandy environments, there was first the need to show its potential.

2. Methods

Two different environments were examined in this study. The first was the bay itself, with a water depth reaching 6 m in its deepest part. Currently water level is less than 1 m close to the quays. A thorough, GPS aided, physical underwater survey of the entire bay was conducted during three separate campaigns (see section 2.1). Due to the active morphodynamics along the Israeli coast, the cover sand overlaying the clay was continuously shifting throughout the surveys. The second environment, the coastal part of the bay closest to the quays, was sandy and saturated with water in the area close to the shoreline. A geophysical survey utilizing the Frequency Domain ElectroMagnetic (FDEM) method (section 2.2) was chosen to image the subsurface of the waterlogged coastal area. Both the archaeological and the geophysical methods are relatively low cost, thus applicable for many similar environments.

2.1. Archaeological survey

The choice of a diving survey in the southern bay of Dor, rather than a preliminary geophysical survey (e.g. Dao, 2011) was dictated by the specific conditions in the area. The very shallow water as well as some beachrock reefs close to the tel, made the use of towed remote-sensing instruments, such as a magnetometer, sub-bottom profiler or sidescan sonar, impossible (e.g. Bowens, 2009, pp. 103–113; Gerhart, 2011; Quinn, 2011). Shifting sand enabled surveying the entire bottom of the bay over several seasons without the need to excavate.

The underwater survey covered the entire area of the south bay, approximately 30,000 m^2, from Tel Dor on the north to the tombolo on the south (Fig. 1). The western extent of the survey was limited to a submerged eolianite ridge (Fig. 1b). A total of 132 dives were carried out.

Artifacts discovered during the survey (anchors, pottery, building stones) were given a basket number and the GPS point (WGS, 1984 grid) at location was noted. All anchors and major concentrations of building stones were photographed in situ. In addition, artifacts removed from the sea were photographed, measured, catalogued and transported to the University of Haifa for conservation and storage. Objects that were left in situ were too heavy to be removed. Those that were imbedded deep in the sand could be classified, but not all aspects could be measured.

2.2. Geophysical survey

A 3000 m^2 FDEM survey was carried out in the northern corner of the south bay of Dor (Fig. 1) using a Geophex GEM-2 sensor with a scanning depth down to 10 m and the ability to record 10 frequencies between 30 Hz and 93 kHz (e.g. Won et al., 1996; Huang and Won, 2003). The aim was to uncover the continuation of archaeological features interpreted by Raban (1995) as marine structures and to locate additional buried targets. Most established high-resolution shallow geophysical methods are limited in their ability to work near the shoreline. Ground penetrating radar (GPR), for example, is greatly affected by moisture and salinity (Bristow and Jol, 2003; Conyers, 2004; Rogers et al., 2012). More conventional methods, such as seismic reflection, suffer from poor vertical and spatial resolution, while magnetics would provide poor results for sand covered sandstone. Other techniques, such as electrical resistivity tomography (ERT) have been shown to work in coastal areas and in shallow water (e.g. Passaro, 2010; Apostolopoulos, 2012). However, this method is time consuming as it involves setting up complex arrays for each cross section measured.

The Frequency Domain Electromagnetic (FDEM) method has the potential to overcome problems of conventional geophysical methods in coastal areas. The technique involves generating an alternating magnetic field, which induces an electrical eddy current in the earth. This in turn causes a secondary magnetic field in the subsurface that is proportional to the conductivity of the target. By measuring relations between the primary and the secondary magnetic fields, subsurface properties and features can be deduced from the apparent magnetic susceptibility and electrical conductivity (EC_a) (Huang and Won, 2003; Huang, 2005). EC_a is a measurement that is sensor-specific and dependent on the coil spacing within the instrument itself. EC_a provides information on salinity, clay content, minerology, moisture etc (Sudduth et al., 2005 and references therein). and is used to illuminate contrasts in electrical conductivity in the subsurface. In general, as salinity increases, conductivity increases and resistivity deceases.

The advantage of using the GEM-2 FDEM system lies in its ability to collect continuous swath data and not single, 2D transects. In this way, results are obtained in map-view with little interpolation (if at all). Since different frequencies penetrate to different depths (with lower frequencies corresponding to deeper penetration), the result is a series of frequency maps corresponding to the integration of all subsurface data in a specific sampled volume (i.e. down to the frequency-related depths). Thus, the values obtained are for apparent electrical conductivity (EC_a) and not true electrical conductivity. Simple inversion can then provide the information needed for a particular depth interval.

Five frequencies were selected for this study, corresponding to the effective penetration depths listed in Table 1. These were chosen partially based on lithology described by Sivan et al. (2004, pp. 1042) to include the subsurface section comprised of 5000–6000 years of sand accumulation (~5.5 m in the northern bay) above a

Table 1
Transmission frequency and effective penetration depth of the northern survey.

Frequency (Hz)	Effective penetration (m)
2025	0–5.9
4725	0–4.9
11,025	0–4.0
25,725	0–3.2
60,025	0–2.7

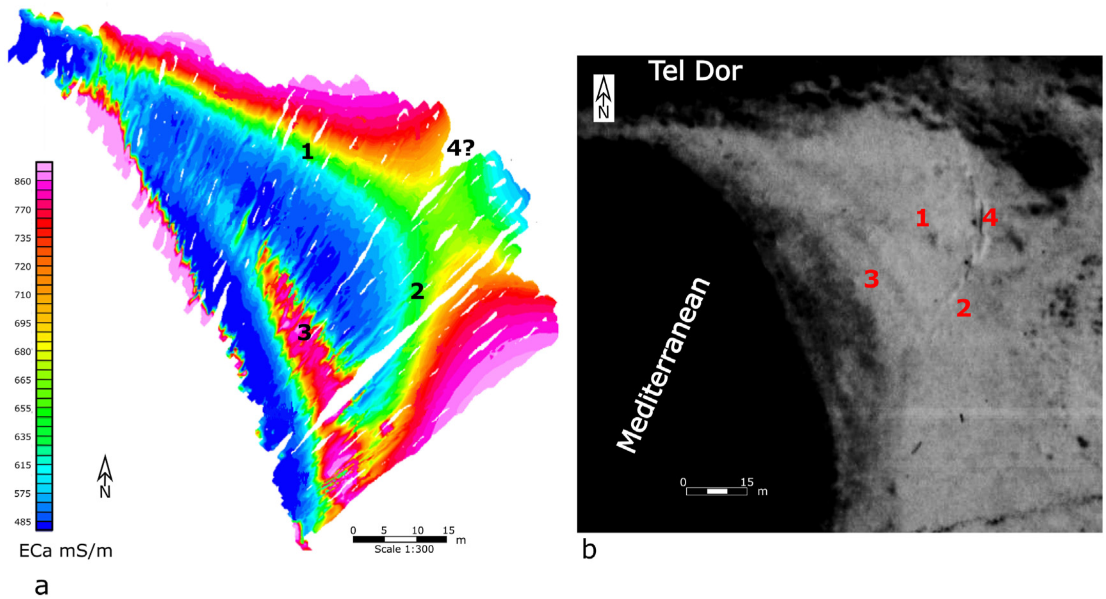

Fig. 2. a: FDEM trend map for frequency 60,025 kHz representing the integration of all apparent electrical conductivities from the surface down to 2.7 m, after the removal of the effect of seawater on the subsurface. See text for more explanation. Color scale is EC_a in mS/m. Anomalies numbered 1 to 4 correspond to numbers 1–4 visible on b: Enlargement of the geophysical survey area (see Fig. 1 for location) on a 1944 RAF airphoto. Note the different scale. The continuation of element number 2, which corresponds to part of the green anomaly in Fig. 2a, was marked as 4 and is suspected to lie just outside the area surveyed in this study. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

clay layer indicative of marshy conditions.

The effect of seawater on the total apparent electrical conductivity of the subsurface was computed and modeled, using a method developed in house for commercial applications. The basic assumption was that the EC_a of seawater decreases with distance from the shoreline landwards. This was then subtracted from the measured total EC_a maps to produce residual (or trend) maps, which should represent the regional signal with anomalies related solely to changes in soil-bedrock-archaeology (Fig. 2a). In addition, inversion maps were created between two frequencies in order to obtain information on electrical conductivity between two depths (and not from the surface down to that depth).

3. Results

3.1. Archaeological finds

Distribution maps of artifacts from the underwater survey indicate three different spatial patterns according to the type of finds: ashlar building stones, ceramic finds and stone anchors and mooring stones. Approximately 50 ashlar building stones were discovered. Piles of four or more hewn stones were more abundant in the southern area of the bay, close to the quarry on the tombolo. These are likely to reflect stones that fell from stone-laden barges heading for the tel. The ceramic finds totaled 298 pieces from various periods, dating from the Middle and Late Bronze Age to the Late Roman period. These seem to be evenly distributed across the entire bay. This pattern is very likely caused by the fact that these were transported and then deposited (perhaps more than once) by wave activity. Sherds that are less worn, and therefore more typologically indicative were found in proximity to the shore, perhaps indicating that some of them were carried by high energy waves from the tel and deposited in the bay nearby without going through lengthy processes of deposition and redisposition endured by other ceramic finds.

Twenty perforated stone artifacts were uncovered in the south bay of Dor (Table 2). 10 objects were removed for classification at the Laboratory for Coastal Archaeology, University of Haifa (e.g. Fig. 3). The remaining items were left in situ and measured underwater and included one which was broken and deemed not indicative (and therefore not listed in Table 2). Based on attributes of weight, size, shape and proportion they were categorized as either stone anchors or mooring stones. Both categories are connected to maritime activity, but while an anchor is carried by a boat, mooring stones are fixed features, resting on the bottom of the

Table 2
Size and weight of anchors and mooring stones found in the southern bay of Dor. Objects left in situ could not be weighed, while those embedded deep in the sand could not be fully determined.

No	Anchors	Weight (kg)	Max. length (cm)	Max. width (cm)	Max. thickness (cm)
1	DS8	73	70	46	13
2	DSR16	100	65	53	22
3	DS34	49	57	47	13
4	DS34/1	44.5	45	55	14
5	DS37/17	>120	72	57	22
6	DS37/18	77	71	46	16
7	DS55	75	65	43	17
8	DS69	80	77	47	15
9	DS76/1	–	66	46	13
10	DS76/2	–	60	28	10
Mooring stones					
11	DS35	>120	70	49	41
12	DSBA	–	80	30	28
13	DS31	–	60	30	–
14	DS37/19	–	80	30	–
15	DS47	–	–	–	–
16	DS63	–	50	30	–
17	DS65	–	50	40	–
18	DSB/1	–	40	40	–
19	DS2HS	–	30	35	–

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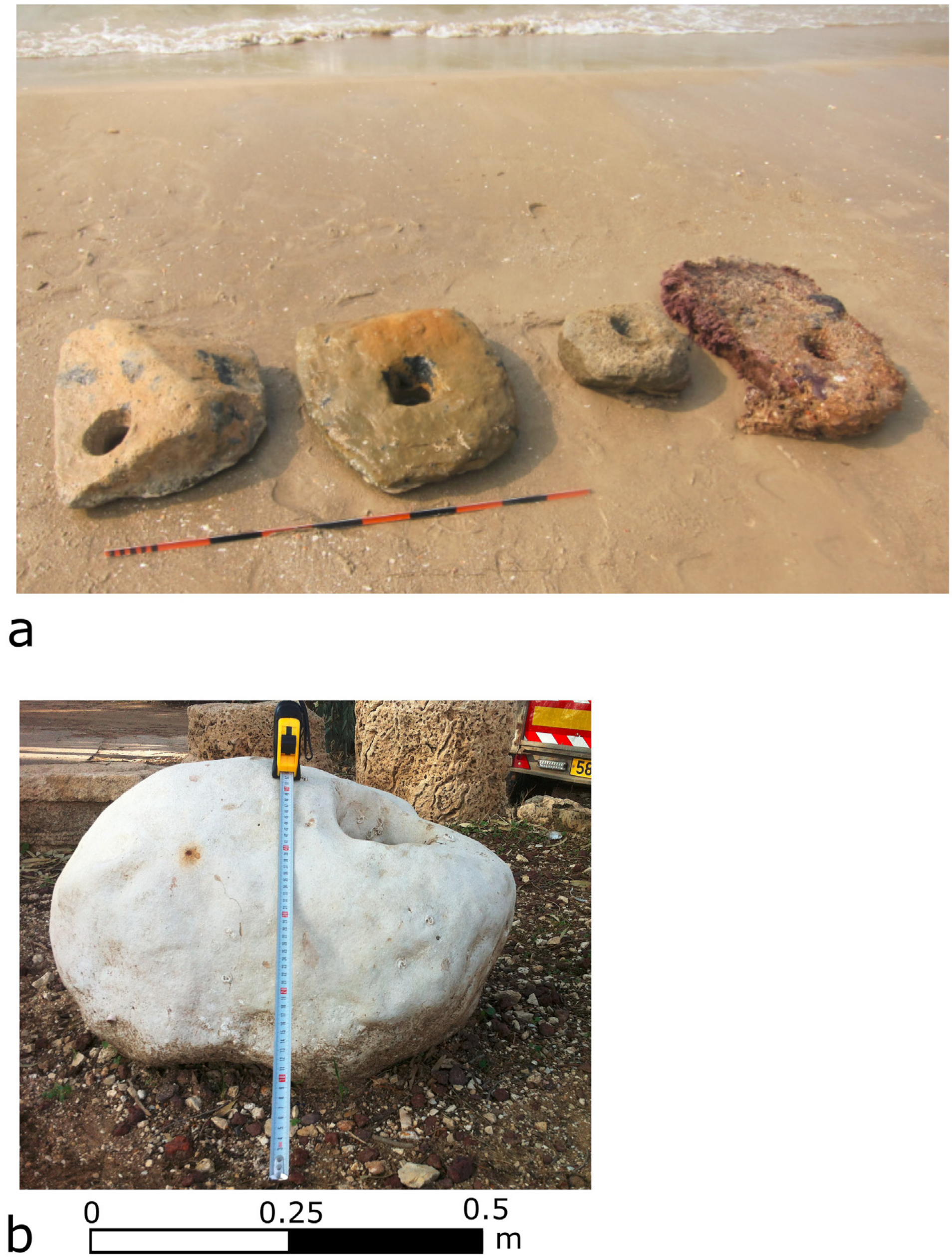

Fig. 3. a: Perforated objects classified as anchors retrieved from the south bay. From left to right: DS34/1, DS34, DSA, DS8. DSA is broken and hence, not listed in Table 2. Scale: 1 m. b: side view of mooring stone DS35. See Table 2 for more information.

anchorage or incorporated into a harbor installation and used for connecting mooring lines. In all, ten of these artifacts could be classified as anchors, while ten appeared to be mooring stones. The remaining broken artifact could not be grouped. All were found in situ. None of the mooring stones seemed to be embedded in any built installation.

Eight of the perforated objects classified as anchors appear to be weight anchors due to their dimensions and considerable mass (#1,2,5–10 in Table 2). The remaining two (#3 and 4, Table 2) were classified as sand anchors due to their relatively light weight and their shape. All anchors are single-holed without rope grooves or L-shaped perforations. Nine have circular holes with a diameter of 10 cm characteristic of rope tying. Anchor #3 has a square-cut hole that is more indicative of a post. All are irregular in shape except for #1, which is distinctly symmetrical and triangular. Five of the mooring stones contain circular holes (#11–13, 18, 19, Table 2), three square-shaped holes (#14, 16, 17, Table 2) and one (#15, Table 2) was not recorded. Both anchors and mooring stones were found along a NW-SE trending lineament located in shallow water facing the in the northeastern part of the bay, rather than facing the tel. Due to their size and weight, it can be assumed that they have not been effected by potential high energy events, such as those mentioned by Goodman-Tchernov et al. (2009).

3.2. Geophysical survey

Results of the geophysical survey are presented for two frequency ranges. The first is a trend map (seawater influence removed) of 60,025 kHz (Fig. 2a). This corresponds to the integration of all apparent electrical conductivities down to 2.7 m

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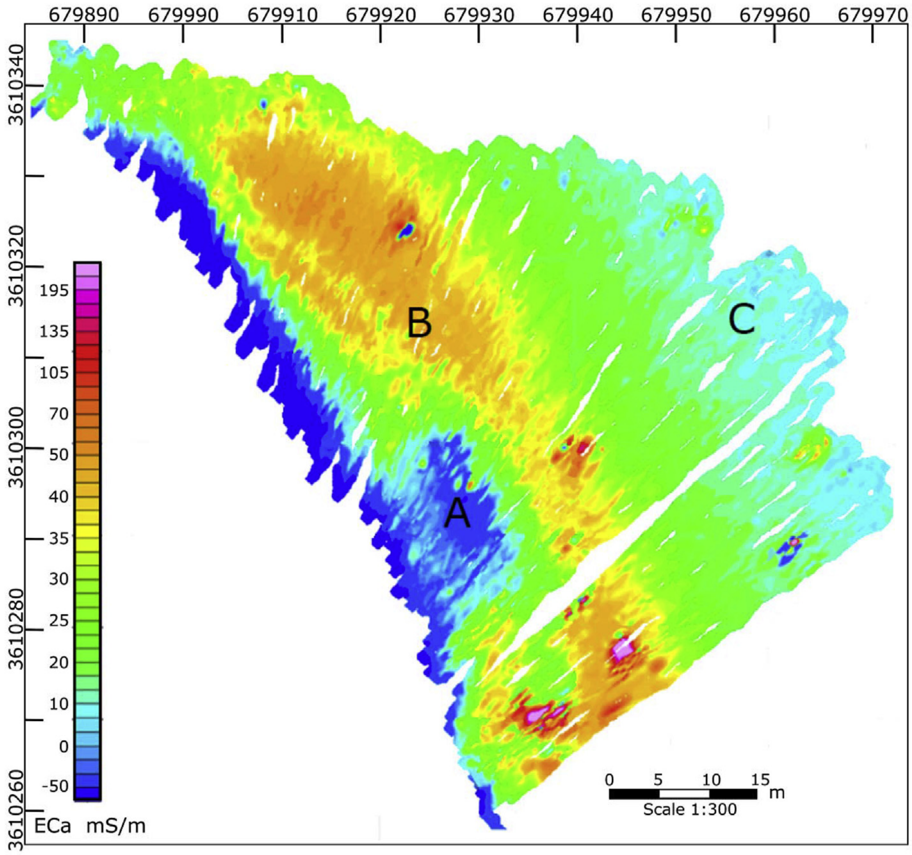

Fig. 4. FDEM inversion map between frequencies 4725 kHz–11,025 kHz corresponding to the 0.9 m thick interval between depths of 4.9 m and 4.0 m. A – low value (−45–7 mS/m) square anomaly with straight edges protruding from the present-day shoreline. B – a NW-SE trending linear anomaly (36–72 mS/m) running near-parallel to the present day shoreline. C – an area representing the return to low EC_a values (1–9 mS/m). Coordinates are in UTM to allow for more precise location of anomalies.

(Table 1). A number of clear linear anomalies are present. The most prominent features in the map are the high change in gradient (740–920 mS/m, red-pink values) within a triangular area of lower changes (~480 mS/m, blue values). An additional linear anomaly that delineates the area of low change can clearly be seen (centered around 650 mS/m, green values).

Fig. 4 shows the inversion map for frequencies 4726 kHz–11,025 kHz corresponding to the 0.9 m thick interval between depths of 4.9 m and 4.0 m (Table 1). This was chosen to represent the interval above top clay in accordance with the findings of Sivan et al. (2004). The idea was to illuminate possible archaeological structures built on top of the clay unit. Three prominent anomalous areas are clearly evident. The progression from −51 mS/m (dark blue) at the shoreline to higher values inland is interrupted by a rectangular protrusion in the lower part of Fig. 4 (marked A). The second area is the 36 mS/m – 72 mS/m anomaly (yellow-orange, marked B on Fig. 4). A number of sharp singular anomalies appear in this area but are related to features on the beach such as a metal barrel and a signpost. The third area is the return to low values of 1–8 mS/m and appears as light blue (marked by C on Fig. 4).

4. Discussion

4.1. Feasibility of using FDEM in a waterlogged coastal environment

Since no reference to the use of FDEM in coastal archaeology could be found, it was first necessary to validate the results and show that the method can be applied successfully in such a setting. A large-scale archaeological excavation in the south bay of Dor could not be carried out at the time. Therefore, the earliest historic airphoto found from the area (a Royal Air Force photo from December 16th, 1944) was examined for the presence of features on the beach, which are now no longer visible (Fig. 2b). The image was rectified, scaled and loaded to a Google Earth database created for the project. This was to insure that the results of the geophysical survey could correctly be located on the 1944 airphoto for accurate comparison.

Initial observations of the 1944 RAF airphoto clearly show curved and linear features exposed on the surface (Fig. 2b). Today, there is no sign of them in the field. Whether archaeological or modern-day (pre-1944) structures, it can be assumed that if they have not been removed, then given the morphodynamics of the Israeli coastal areas, it is likely that they are buried in the shallow subsurface, i.e. below no more than 1–2 m of sand. For this reason, the shallowest electrical conductivity "trend" map (i.e. with the effect of seawater removed) was examined in detail (section 3.2).

There is a clear correlation between the EC trend map and features observed on the beach in the 1944 airphoto (marked 1–3 on Fig. 2a and b). A good example of this is the linear feature centered around 650 mS/m ("green" anomaly), which corresponds exactly to a curved, somewhat triangular feature seen in the airphoto. This provides strong support for the success of using this geophysical method in the coastal environment of Tel Dor as well as confidence in the interpretation of the results despite the lack of confirmation by excavation. Thus archaeological evidence will be discussed in synergy with the findings from the geophysical survey.

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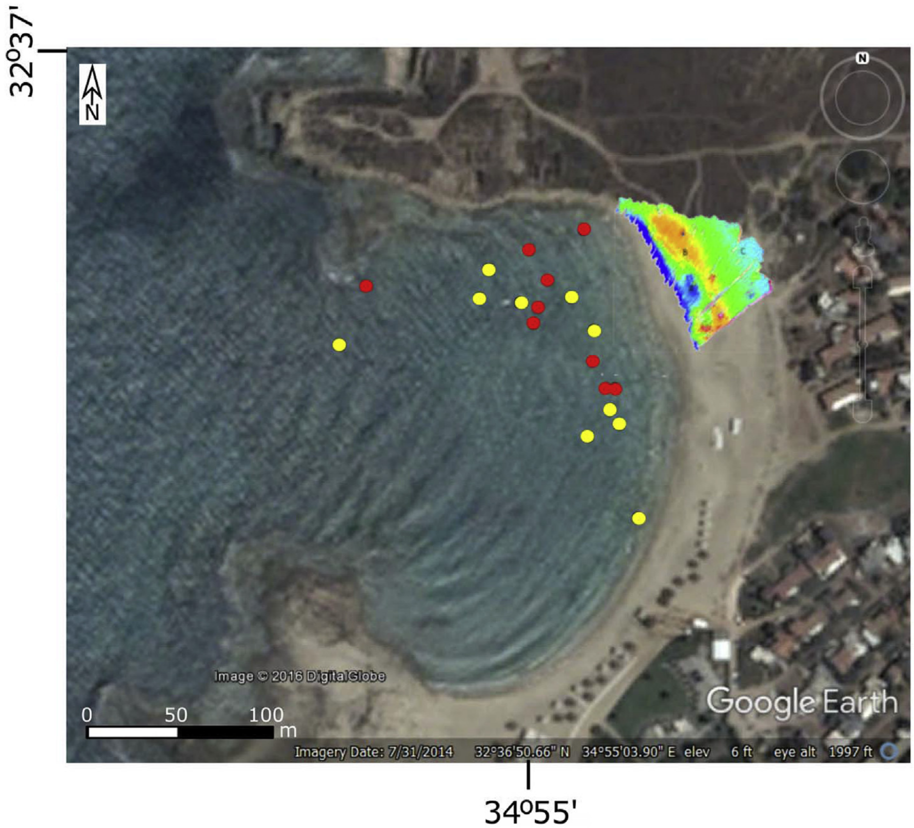

Fig. 5. Distribution of underwater archaeological findings and FDEM inversion map (Fig. 4) superimposed on a *Google Earth* image from July 31st, 2014 (accessed October 10th, 2016). Yellow dots: anchors; red dots: mooring stones. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

4.2. Inversion map

Since anomaly A on the inversion map (Fig. 4) has similar values as the area close to the shoreline, it can be assumed it is saturated with seawater at these depths (the interval between 4.9 and 4 m). As this represents the top of the clay unit and given the rectangular nature of this area, which is clearly isolated from its surroundings, it is not unlikely that this represents something that was dug into the clay and subsequently covered by sand. The fact that the direction of the anomaly (SE-NW) does not correspond to the direction of data collect (E-W) lends support to the interpretation that this is not an artifact of data collection or processing. According to Sivan et al. (2004, pp. 1046) and Kadosh et al. (2004) sand began to accumulate only during the Bronze Age, when sea levels rose. This pushed the coastline further inland, closer to its present-day location and allowed for sand to accumulate in the bay (Sivan et al., 2004, pp. 1046). Thus, the FDEM anomaly could possibly indicate a structure from that period, an older feature (possibly Neolithic) or shallow bedrock. In any case, its straight edges strengthen the assumption that this is a manmade feature.

Archaeological evidence places the spatial distribution pattern of stone anchors and mooring stones, the most indicative objects related to maritime activity, in a clear linear trend located in shallow water facing the northeastern coast of the bay. This pattern does not conform to the use of Late Bronze(?) and Iron Age quays in the southern edge of the tel for mooring, which should have created a distribution pattern of an arc facing the northern part of the bay, hugging the southern edge of the tel. The distribution pattern becomes clearer when placed on the same map as the results of the FDEM inversion map (Fig. 5). They seem to face not the tel, but rather the buried rectangular anomaly in the sandy, southwestern edge of the bay, near the shoreline and are parallel to the linear "orange" anomaly (marked B in Figs. 4 and 5). This provides additional support to the interpretation that these could be structures related to maritime activities, which were unknown before. They were covered with sand during the rise of the sea levels after the Iron Age and perhaps consequent processes of sedimentation in later periods. Still, The directionality of anchors and mooring stones and their relation to the possible buried structures does not negate the identification of the large walls along the south edge of Tel Dor as quays of the early(?) Iron Age. They may have been used to directly moor boats, without the use of anchors.

5. Conclusions

The study presented here shows that the FDEM method has the potential to detect buried structures in coastal areas that are also waterlogged and where other geophysical methods fail or are cumbersome. The combined archaeological and geophysical surveys produced results, which can explain the spatial distribution of marine-related artifacts in the southern bay of Tel Dor. The most prominent anomaly in the geophysical survey could possibly represent a quay that was in use in Brone-Age Dor. However, this would need to be verified in a targeted archaeological excavation. The combined surveys have additional synergic value by being methods, which are of minimal impact on the environment and on cultural heritage assets, in contrast to excavations. The area immediately south of Tel Dor was recently declared a nature reserve and is part of the Tel Dor National Park. New guidelines issued by the Israel Academy of Sciences and Humanities (Tsafrir and Shai, 2015, pp. 46) for best professional practice in archaeology now recommend the use of geophysical prospection prior to

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any terrestrial archaeological excavation. We expect that the results of this study in Dor will have a bearing on the policy of cultural heritage protection in coastal areas in Israel, which will have to take into account the existence of structures buried under the coastal sand. We expect that next step in the exploration of the buried and waterlogged coastal features at Tel Dor will include additional geophysical surveys, before any further excavations that would require extraordinary permits are carried out.

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