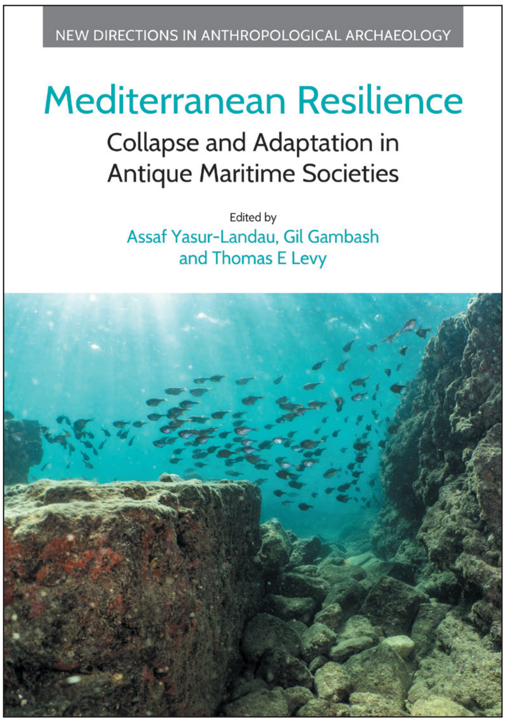
Mediterranean Resilience

Collapse and Adaptation in Antique Maritime Societies

Edited by Assaf Yasur-Landau, Gil Gambash and Thomas E. Levy

Mediterranean Resilience examines various forms of adaptation adopted by coastal societies in the ancient Mediterranean in response to external pressures. This investigation spans the *longue durée*, stretching from the epi-paleolithic to the Medieval period. Special attention is given to the impact of two groups of variables: climate and sea level changes on the one hand, and fluctuations in political circumstances connected with the domination of empires, on the other. For adaptation, the volume analyses modes of coastal residence, subsistence, and maritime connectivity, not as static features, constant throughout history, but as processes that require permanent adjustments due to changes in environmental, social and political conditions. Methodologically, various forms of case studies are employed, isolating thematic issues, geographic micro-regions, temporal boundaries, and disciplinary perspectives, ultimately seeking to embrace as wide an array of phenomena as possible in the human experience of collapse and adaptation.



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8 A 12th-Century BCE Shipwreck Assemblage Containing Copper Ingots, from Neve-Yam, Israel

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Abstract

A shipwreck assemblage from the Neve-Yam bay is described, reevaluated, and discussed in relation to the associated artifacts recovered at its site, including copper ingots, stone anchors, hematite weights, bronze artifacts, and pottery. Taking into consideration the site formation and postdepositional processes, and the possible dating of the various finds based on their typology, a radiocarbon date, and the suggested provenance of the copper ingots in the 'Araba Valley, the cargo is dated to the transition period between the Late Bronze Age and the Iron Age (12th century BCE), known as the 'crisis years'. The maritime activity and trading routes of metal in the eastern Mediterranean during these years are discussed, suggesting that the Neve-Yam shipwreck provides direct evidence for the inland and maritime transport of copper during this time, when evidence for international maritime activity along the Syro-Canaanite-Anatolian coast is scarce. A holistic view from the Middle Bronze Age till Iron Age II is provided, indicating the oscillations of Mediterranean maritime activities, based on the underwater and inland finds from the southern Levant.

Introduction

The 195 km long Israeli coast is generally straight, and it lacks natural havens that can provide sufficient shelter for ships during severe storms (Galili 1986). Small islets, partly submerged *kurkar* ridges, and small bays can provide temporary shelter during most of the year; however, none of them can provide sufficient haven during the prevailing winter storms in the region (Galili 2009; 2017b:324). Small estuaries, coastal marshes, and wetlands were available during the Middle and Late Bronze Ages (MB and LB respectively; Raban 1985; Morhange *et al.* 2016; Burke *et al.* 2017), but they were most probably silted by fluvial sediments and separated from the sea by swash bars and sandy berms, and thus unnavigable. So far, none of these inland features has revealed archaeological evidence supporting the presence of a harbor or anchorage (Galili 2009; 2017b:324; Yasur-Landau *et al.* 2018).[1] Thus, the basic unfavorable physical characteristics of the Israeli coast have not changed much since the Middle Bronze Age, when the sea level reached its present elevation. The stormy, and often unpredictable, eastern Mediterranean weather, and the lack of sufficient shelters, resulted in hundreds of wreckage events along the Israeli coast during the last 5000 years (Galili *et al.* 2018). Most occurred when watercraft drifted ashore during storms and were grounded and wrecked close to the coastline. South of Haifa, along the ca. 40 km long Carmel coastal strip, 2–3 m thick sandy deposits are common, often overlying hard bedrock. Heavy artifacts originating in shipwrecks were rapidly buried in the sand for millennia, preserved there, and were basically unsalvageable. However, in recent decades, following human intervention in the coastal environment, marine erosion has often removed the overlying sand, and ancient artifacts have been exposed on the sea bottom (Galili and Rosen 2008). Soon after exposure, the artifacts undergo severe erosion and are threatened by treasure hunting. Underwater rescue surveys carried out in the last 50 years have revealed hundreds of shipwrecks, marked by concentrations of artifacts scattered on the sea bottom at a water depth of 2–4 m, some 70–150 m offshore. Wooden hulls rarely survive the harsh conditions, but, nevertheless, some have been identified in partly protected areas at Caesarea, Dor, Ma'agan Michael, and 'Akko (Fitzgerald 1994; Galili *et al.* 2002; Linder 2003; Kahanov *et al.* 2004; Cohen and Cvikel 2019).

The bay of Neve-Yam is situated some 3 and 5.5 km southwest of the coastal Bronze Age sites of 'Atlit and Megadim, and 2 and 6.5 km north of Tel Nami and Tel Dor, respectively (Figs. 8.1, 8.2a). The bay is a J-shaped basin open to the south, west, and southwest. To the west, it is bordered by a submerged *kurkar* (aeolian calcareous sandstone) ridge, creating a small islet in its northern end (Tmanun Islet). The anchorage area is protected from the west and northwest winds by the submerged ridge and the islet, and from the north by the rocky 'Atlit protrusion. Under the sand that covers the bay floor (up to 2 m thick) lies a layer of hard, dark clay of terrestrial origin (paleosol). Remnants of shipwrecks (mainly anchors, metal artifacts, and heavy objects) of various periods have been exposed and identified on the sea bottom, after sea storms removed the overlying sand.

Underwater surveys in the Neve-Yam anchorage and bay have been carried out by the University of Haifa and the Israel Antiquities Authority intermittently since the early 1980s. Various shipwreck assemblages, comprising mainly anchors and metal, stone, and pottery artifacts dating from the Early Bronze Age onward, have been recovered (Galili 1985; Galili and Sharvit 1999b; Galili *et al.* 2011). A copper ingot assemblage was discovered in 1993, during an underwater survey conducted southwest of Kibbutz Neve-Yam (Fig. 8.2a; Galili *et al.* 2011:68–69). During the early 1980s, a few bronze artifacts and two hematite weights were found at the site (Fig. 8.2b:15–18); since the copper ingot assemblage was not yet known, these artifacts were associated, with some doubt, with the Middle Bronze Age Byblos-type anchor assemblage discovered some 150 m to the south (Fig. 8.2a:1; Galili 1985).

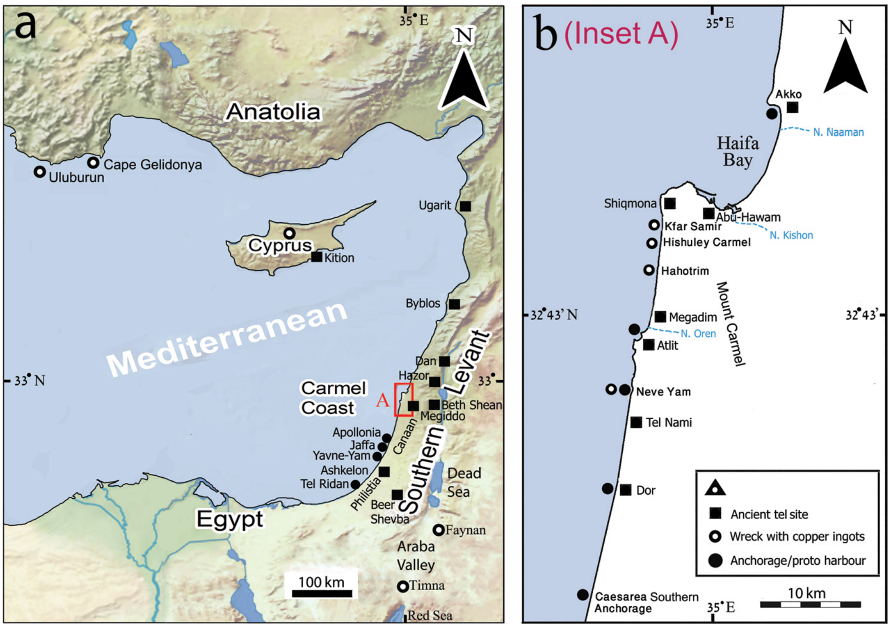


Figure 8.1: Location map: (a) the eastern Mediterranean and the Levant; (b) copper cargoes recovered off the Carmel Coast.

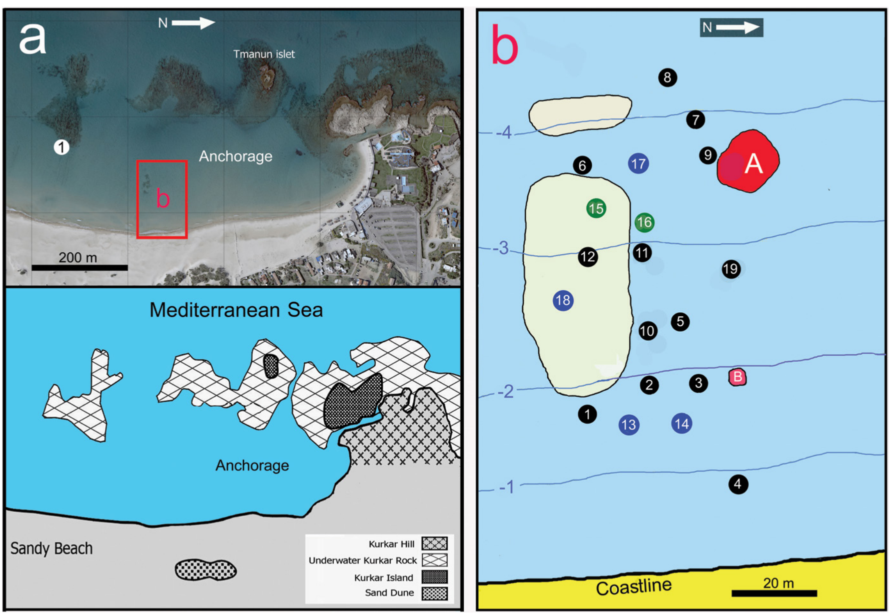


Figure 8.2: The Neve-Yam anchorage: (a) aerial photo with the location of the ingot-site assemblage (marked ‘b’) and of the Middle Bronze Age Byblos-type anchor assemblage (marked ‘1’); (b) site plan with the distribution of finds: anchors (1–12, 19), copper-ingot concentrations (A, B), bronze artifacts (13, 14, 17, 18), and hematite weights (15, 16); the cream color depicts submerged *kurkar*.

In this paper, we present the recent finds from the Neve-Yam bay in detail, and discuss them in light of inland finds and previous underwater finds recovered from nearshore Bronze Age shipwrecks, harbors, and anchorages on the Carmel Coast, as well as finds retrieved offshore by trawler fishing boats. The multilevel study of these underwater finds provides a sequence of maritime activity in the region during the Bronze and Iron Ages, and sheds new light on the activity during the Late Bronze–Iron Age transition – the so-called 'crisis years' (Ward and Joukowsky 1992; for a tentative chronology of the Neve-Yam finds and the crisis years, see Fig. 8.3).

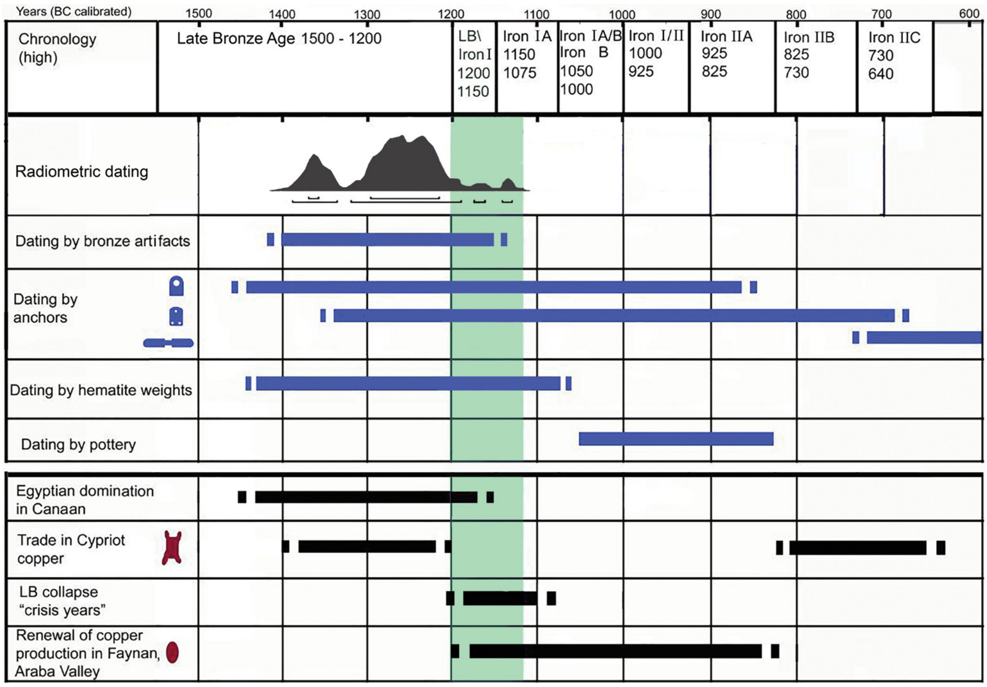


Figure 8.3: Chronology (Late Bronze to Iron Age) of the Neve-Yam assemblage, based on ^{14}C dates, bronze artifacts, anchors, hematite weights, and pottery (blue horizontal lines), and on relevant events in the region. The green color designates the probable date range of the wreckage.

The Shipwreck Site: The Archaeological Setting

The site (Fig. 8.2b) lies at a water depth of 1–4 m, approximately 30–150 m from the nearest beach, and the finds were scattered over an area of ca. 100 × 50 m, on a small *kurkar* outcrop and on a clay paleosol layer adjacent to it. The assemblage contains ten one-holed stone anchors (Fig. 8.2b:1–9), two three-holed stone anchors (Fig. 8.2b:10, 11), one stone anchor stock (Fig. 8.2b:12), and 86 plano-convex copper ingots. The copper ingots were concentrated in two piles, 40 m apart, delineating the assumed wreckage site (Fig. 8.2b: A, B). Additionally, a socketed adze, with the remains of a wooden haft, and a socketed spearhead lay some 20–25 m southeast of Pile B (Fig. 8.2b:13, 14, respectively). Several fragments of pottery vessels were recovered at the site and adjacent to it. As noted above, during the early 1980s, two hematite weights (Fig. 8.2b:15, 16), a socketed chisel, and a flat adze were recovered at the site (Fig. 8.2b:17, 18, respectively).

Site Formation and Postdepositional Processes

Based on the distribution of artifacts on the sea bottom, and on our studies of dozens of shipwrecks along the shallow Israeli coast (e.g., Galili *et al.* 2010), the site formation dynamics and the postdepositional processes of the wreck may be proposed. The assemblage most probably represents the remains of a ship driven to the coast by a storm and wrecked in the breaker zone, either while sailing or during an attempt to dock in the natural anchorage. During the wrecking event, the vessel drifted ashore, grounded at a depth that was then about 1–2 m, and broke up in the surf. The depth at the site is now ca. 2–4 m, because much of the sand has been eroded away in modern times (Galili *et al.* 2002). An analysis of the composition of scores of wreck sites along the Israeli coast has demonstrated that the products of a shipwreck in the surf zone were generally separated into three main classes by the forces of the sea: people and livestock drifted ashore; light cargoes, as well as wooden parts and objects firmly attached to them, also washed ashore; and heavy stone or metal objects underwent settling during the storm or soon thereafter, accumulating on the hard substratum (clay paleosol or rock) under the constantly shifting sand. Ceramic amphorae, either broken or whole, either drifted ashore or rolled on the shallow sea bottom and gradually drifted away from the site (Galili *et al.* 2010; 2012:16–17). Therefore, only heavy objects, such as metal artifacts, anchors, and other stone items, remained at the wreck site itself. We may postulate that, unlike the cargo of ships that sank rapidly into relatively deep water, which remained on site, much of the Neve-Yam ship's cargo may have been salvaged in antiquity. Additionally, postdepositional processes may have added intrusive artifacts to the site. These may have originated in fishing activity or later wreckage events that occurred in the anchorage. Underwater surveys in the region have yielded several shipwreck assemblages dating from the Middle Bronze Age to the Ottoman period (Galili and Sharvit 1999b).

The Finds

The Anchors

Ten one-holed stone anchors were documented at the site, of which two were retrieved (Figs. 8.2b:7, 9; 8.4:7, 9). They were located 1–10 m southwest of the main group of ingots. The largest of the two (80 × 60 × 16 cm; hole diameter 15 cm; weight 120 kg; Fig. 8.4:7) is made of *kurkar*, has a rounded top, and is similar to anchors recovered at coastal sites in Lebanon and Syria, which were classified by Honor Frost (1970; 1973) as belonging to the Syrian type. The second retrieved anchor is relatively small (50 × 30 × 12 cm; hole diameter 15 cm; weight 30 kg; Fig. 8.4:9) and made of limestone. Eight additional one-holed anchors were identified at the site during later surveys and were left in place (Figs. 8.5, 8.6). They were scattered south, west, and east of the two ingot piles (Figs. 8.2b:1–6, 8, 12; 8.4:1–6, 8, 12). Seven of these are robust and medium sized, weighing ca. 50–80 kg, with hole diameters of 15–17 cm; and two others (Figs. 8.2b:9, 12; 8.4:9, 12) are similar in shape. Most one-holed anchors have a biconical hole, while the hole of no. 7 is straight sided. Two stone anchors with three holes were found southwest and southeast of the ingot piles (Figs. 8.2b:10, 11; 8.4:10, 11). One of them (Fig. 8.4:11) bears unidentified markings on its front. Most of the anchors are made of limestone or chalk, while nos. 1, 7, 10, and 11 are made of *kurkar* or coarse sandstone. Based on their overall shape and relatively small size, the three-holed anchors (nos. 10, 11) are probably not associated with the Neve-Yam wreck. An anchor stock made of limestone (Figs. 8.2b:19; 8.4:19) was found halfway between the two ingot piles. It dates to the Archaic period, and its association with the discussed assemblage is questionable.

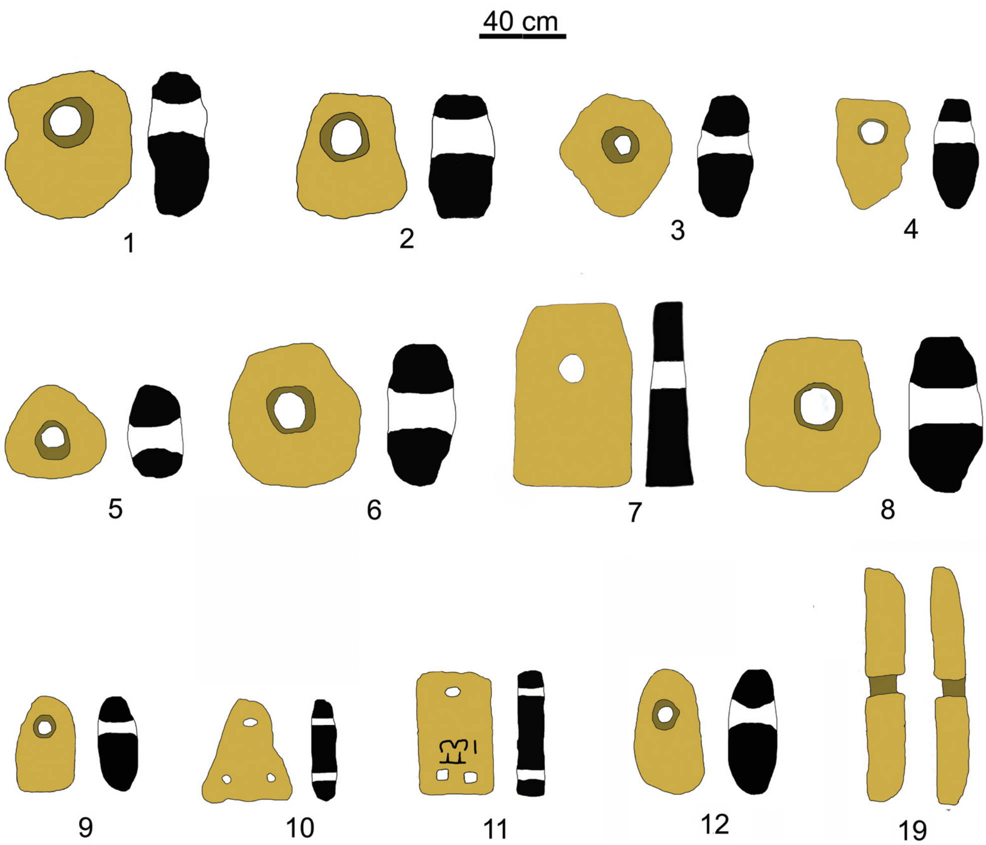


Figure 8.4: Drawing of the anchors (nos. 10, 11, and 19 are probably late intrusions).

Figure 8.5: Diver sampling anchor no. 6, in situ.

Figure 8.6: Anchor no. 2, in situ.

In her pioneering studies of anchors, Frost (1970; 1973) established a basic typology based on anchors recovered from datable contexts on land. At the coastal sites of Ugarit and Kition she identified one-holed stone slabs with round or trapezoid tops as Syrian weight anchors (Frost 1970: figs. 5a, c, d; 6; 7a; 1973), and suggested that they were in use from the 18^{th} to 13^{th} centuries BCE. Galili *et al.* (2011) related similar anchors from datable shipwreck assemblages off the Carmel Coast to the Late Bronze Age. From the Middle Bronze Age onward, stone anchors with more than one perforation were used contemporarily with the one-holed weight anchors. They were defined by Frost as composite anchors, having wooden arms to improve anchor hold at the sea bottom. Such anchors were identified in shrines at Ugarit, Hala Sultan Tekke, and Kition (Frost 1970: figs. 5a, b; 7b; 8a–e). However, with the exception of the Byblos-type one-holed weight anchor (Galili *et al.* 1994), which is a clear marker of the Middle Bronze Age, the various one-holed weight anchors and composite anchors remained almost unchanged during the Bronze and Iron Ages. They continued to be in use until the late Iron Age, when they were replaced by two-armed wooden anchors with stone stocks (Kingsley and Raveh 1996:78).[2] These anchors have a shank with one or two arms at its bottom, and a stone stock at the top. Thus, it is impossible to distinguish between Late Bronze Age stone anchors and Iron Age ones (Raveh and Kingsley 1993:371). The two composite anchors recovered from Neve-Yam (Fig. 8.2:10, 11) cannot provide a reliable cultural or chronological framework, as such anchors were in use for long periods (Fig. 8.3). The association of these two composite anchors and the stone stock with the assemblage of the copper ingots will be further discussed. Given the limitation of using the stone anchors for dating, the identification and dating of the Neve-Yam shipwreck will be made by other means (see below).

The Copper Ingots

The assemblage contains 86 plano-convex copper ingots (Figs. 8.7–8.9), their lengths ranging from 17.5 to 24.4 cm; their width from 9.5 to 17 cm; their thickness from 3.5 to 6.5 cm; and their weight from 1.35 to 4.35 kg, averaging 3.1 kg. The total weight of the recovered ingot assemblage is 266 kg. They differ in shape and size, suggesting that they were cast in cavities dug ad hoc in the ground. Six similar oval-shaped copper ingots that were cast in molds were recovered from the late-14^{th}-century BCE Late Bronze Age shipwreck at Uluburun (Pulak 2000b:144, fig. 10). Additional similar ingots have been recovered from land sites in Sardinia (Atzeni *et al.* 1981: figs. 282, 284 297, 298). A single oval plano-convex copper ingot (reconstructed dimensions: 19.0 × 14.5 cm, 5 cm thick), cut in half, was found near ‘Ain Yahav and is similar in shape and size to the Neve-Yam ingots. Based on composition analysis, it is associated with the Wadi Faynan copper industry (Rothenberg 1990:65, 66, figs. 100, 101).

Figure 8.7: The copper ingots and anchor no. 9, in situ.

Figure 8.8: Anchor no. 7 and copper ingots, retrieved.

Figure 8.9: A group photo of the ingots and anchor no. 7, on land.

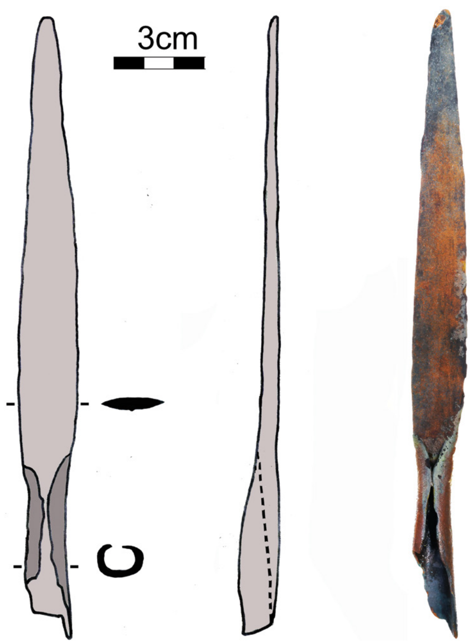
Microstructure and Chemical Composition of the Copper Ingots

Nine oval-shaped ingots from Neve-Yam were sampled by drilling, and analyzed using inductively coupled plasma-atomic emission spectrometers (ICP-AES; Yahalom-Mack *et al.* 2014). One of the nine was also examined using optical and electron microscopy (Yahalom-Mack *et al.* 2014: no. 14). Copper grains were identified throughout the matrix, with cuprite observed in the grain boundaries. A thin greenish crust of cuprite, ca. 100 microns thick, also covers each ingot, and is underlined, in spots, by a heavy layer of lead carbonate, possibly cerussite ($PbCO_3$). Quartz crystals regularly embedded in the crust surface of the ingots were previously understood as resulting from sand casting (Yahalom-Mack *et al.* 2014:164); however, they may have adhered to the ingots' surface while they lay in the sand following the wreckage event. Globules of lead copper oxide associated with arsenic are distributed in the copper matrix, while sulfur inclusions are absent. The latter indicates that oxidic rather than sulfidic ore was used. The relatively pure copper grains indicate that the ingots were not the product of primary smelting but rather of refining and casting. A comparison of the bulk compositions of the ingots from Neve-Yam with three fragments of oxhide ingots from the Late Bronze Age Kfar Samir North shipwreck, and two whole oxhide ingots from the Ḥishuley Carmel shipwreck, showed that the Neve-Yam ingots are relatively rich in lead and poor in arsenic, clearly discerning them from the oxhide ingots from these two sites. The lead isotope ratios of the Neve-Yam ingots are similar to those of ores from the ʻAraba copper mines. The high lead content points to Wadi Faynan as the more probable ore source (Yahalom-Mack *et al.* 2014). An examination of thin sections of the ʻAin Yahav ingot (see above) indicated that it contains inclusions of slag and concentrations of lead, suggesting that, unlike the Neve-Yam ingots, this was a primary product collected at the bottom of a smelting installation (McLeod 1962:71).

The Bronze Artifacts

Socketed Spearhead

The spearhead (Fig. 8.10) has a long split tubular socket and an elongated blade. The length of the artifact is 213 mm, the maximum width of the blade is 21 mm, the maximum external diameter of the socket is 18 mm, and its inner diameter is 10 mm. Spears with split tubular sockets were common in Canaan during the Middle Bronze Age (e.g., Garfinkel and Cohen 2007:105–106; Gernez 2007:125–127) and, to a lesser extent, during the Late Bronze Age. One example, with a leaf-shaped blade, was found in the Late Bronze II 'Mycenaean' tomb at Dan (Ben-Dov 2002: fig. 2.90:120), and another, from Megiddo, likely belongs to LB II Strata VIII–VIIA (Loud 1948: pl. 173:10). Of the 22 spearheads found in the Uluburun shipwreck, 12 display characteristics of non-Mycenaean/Aegean spearheads, having split sockets and long and slender blades (Pulak 2008:374–375), similar to the Neve-Yam spear. Another spear similar to the Neve-Yam example was found in the 'house of the high priest' at Ugarit, dated to the (late?) 13th century BCE (Schaeffer 1929: figs. 224:16; 226, spear on the right). Spearheads with long sockets appeared in Canaan during the Iron Age IB, but are considered foreign to the local Canaanite tradition, possibly arriving through a Late Cypriot (LC) IIIA connection with the island (Yahalom-Mack 2009:156, 271). Examples of socketed spearheads have been found in an Iron Age IB context in Megiddo Stratum VI (Loud 1948: pl. 173:11–13); Iron IIA contexts in Tomb 1029 at the Tel Akhziv cemetery (Edrey *et al.* 2018: fig. 9:1); Tomb ZR XXXVI at the southern Akhziv cemetery (Dayagi-Mendels 2002:89–90, fig. 4.27.130); the Iron Age IB–IIB tombs of Tel Zeror (Ohata 1970: pl. 63:6–7); and an Iron IB–IIA tomb at Tell Jatt (Artzy 2006:37, fig. 2.6). It has been suggested that after Iron Age IIA, these were replaced by iron spearheads (Artzy 2006:60).



24 **Figure 8.10:** Socketed bronze spearhead.

Socketed Hoe

The hoe (Fig. 8.11) has a split tubular socket and a narrow blade widening from the socket to the rounded cutting edge of the blade. Two parallel grooves, about 1 cm apart, extend along both sides of the blade. Part of the wooden haft was still preserved in the socket. The hoe weighs 250 g, its length is 135 mm, the width of the blade is 29 mm, the external diameter of the socket is 33 mm, and its inner diameter is 28 mm. Similar hoes were recovered from the Uluburun shipwreck (Bass *et al.* 1989: fig. 8), and from the Cape Gelidonya shipwreck, dated to ca. 1200 BCE (Bass *et al.* 1967: figs. 102:54, 103:66). A similar artifact was found in the Late Bronze Age shipwreck at Ḥishuley Carmel, containing tin and copper ingots, located 11.5 km north of the Neve-Yam site (Galili *et al.* 2012:10). Another similar hoe was found in the 'house of the high priest' at Ugarit (Schaeffer 1929: figs. 227, second and third from the right; 232:1, 3). It is possible that such tools had a longer history in the southern Levant. A close parallel is an object from the inland site of Ḥazor, found in Stratum 2 of Area F, which is dated to LB I. It is described as a spear butt (Yadin *et al.* 1961: pl. CCXLII:9), probably because a spearhead with a tang came from the same context (L. 8164). Like the Neve-Yam object, the one from Ḥazor has a rounded cutting edge. Hoes, albeit with wider blades, are also found in early Iron Age inland sites (Yahalom-Mack 2009:125–126), such as in 12th-century Beth Shemesh Level 7 (Ashkenazi *et al.* 2016: fig. 2), Beth Shean Stratum VI (James 1966: fig. 103:3), and Megiddo Stratum VIIA (Loud 1948: pl. 185:2).

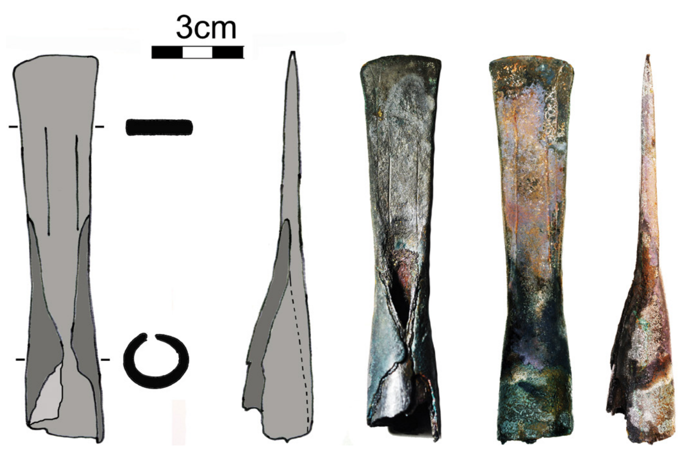


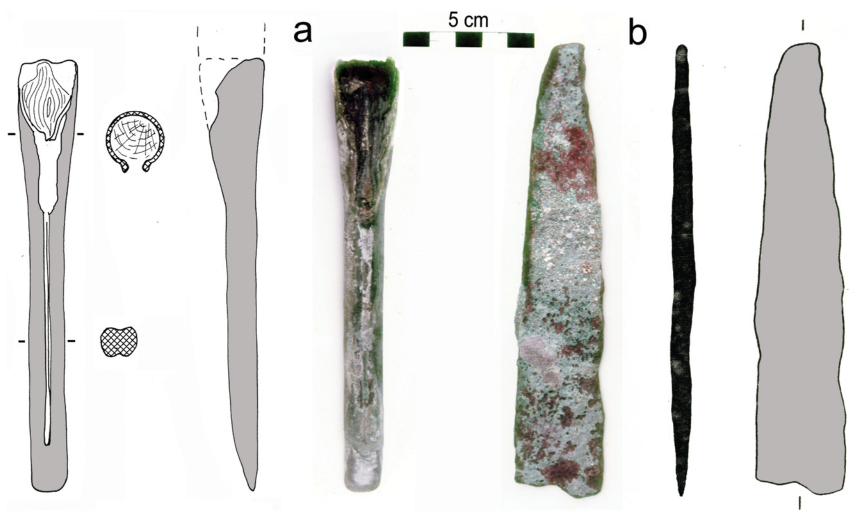
Figure 8.11: Socketed bronze hoe.

The wooden remains in the socket were analyzed at the Laboratory of Archaeobotany and Ancient Environments at Tel Aviv University. The waterlogged wood had suffered deterioration, and its anatomical structures were poorly preserved. The sample was identified by D. Langgut as *Tamarix* sp. (tamarisk). It is a large genus of trees and shrubs naturally distributed throughout western Europe, the Mediterranean, India, and northern China. Tamarisk is common in desert environments and can also thrive in or near salt marshes, brackish water, or springs (Gale and Cutler 2000:251). On the Israeli coastal plain, *Tamarix tetragyna* is a major component of the plant community of the salt marsh vegetation (Zohary 1982:52–53). *Tamarix* sp. was commonly used as raw material in the region for the preparation of wooden artifacts (Gale and Cutler 2000:251; Langgut *et al.* 2016; Sitry and Langgut 2019), and has been found in small numbers at archaeological sites in the Mediterranean zone. In the Carmel region, it has been identified in the Natufian el-Wad Cave (Lev-Yadun and Weinstein-Evron 1994) and at the Pre-Pottery Neolithic C site of ʻAtlit-Yam (Liphschitz 1986).

A wood sample from the hoe socket was radiocarbon dated by accelerator mass spectrometry (AMS) at the Beta Analytical Laboratory in California (no. Beta-529356). The sample yielded a date within LB II/III–early Iron Age I: 1390–1130 cal BCE (2σ; Bronk Ramsey 2009; Reimer *et al.* 2013), similar to the dating range of adzes recovered from both the Uluburun and Cape Gelidonya wrecks (see above). It should be noted that, while preparing the sample for dating, the laboratory informed the authors about the presence of a black/gray material throughout the sample that could not be removed. It is not clear whether this material was part of the wood or an intrusive contamination (Carlos Barroso, pers. comm.).[3] Considering the lack of alternative organic material for ^{14}C dating, we decided to proceed, while being aware of possible deviations in the results. Thus, the time span of the date is relatively wide (260 years). Possible recycling of the tamarisk wood, and the age of the tree when it was cut, must also be taken into consideration. It is known from regional studies that tamarisk trees can live for more than 200 years (e.g., Frumkin 2009); however, it is reasonable to assume that, for tool hafting, the thin, young, malleable branches would have been favored, rather than thick, old trunks.

Socketed Chisel

The artifact (170 mm long) has a narrow, rounded cutting edge (9 mm wide). The socket's outer diameter is 22 mm, its inner diameter is 19 mm, and it contained waterlogged wooden traces (Fig. 8.12a; Raban 1983: unpublished diving report D 112, 11.11.1983, underwater survey of the University of Haifa; Galili 1985:152, fig. 8). Such narrow chisels could have served for cutting narrow grooves for joints, as well as in mortise and tenon works on the hull of a ship. The Neve-Yam chisel finds very close parallels in a chisel from nearby Tel Nami, dated to LB IIB (Artzy 2000: table 1:6), and in another chisel from Ashkelon Grid 83, Phase 17, dated to late Iron Age I (Aja 2020:481, no. 32).



29 **Figure 8.12:** Narrow socketed bronze chisel (a) and flat bronze adze (b).

Flat Adze

The artifact is 180 mm long and 6 mm thick, and its cutting edge (30 mm wide) is eroded (Fig. 8.12b). Its body is trapezoid and tapering, having a wide cutting edge and a narrow upper end (Galili 1983: unpublished diving report D 109, 15.11.1983, underwater survey of the University of Haifa; 1985:152, fig. 9).

We suggest that the bronze artifacts recovered were part of a ship's carpentry tool kit. Wooden watercraft were easily damaged but could also be easily repaired, and, until recently, traditional wooden sailing ships carried a carpenter as a crew member. Among the tools and equipment recovered from shipwrecks off the Israeli coast, the remnants of such carpentry tool kits containing woodworking tools are clearly distinguishable (Udell 2003; Galili and Rosen 2008; Galili *et al.* 2010; 2014; Golani and Galili 2015). Based on the parallels described above, the Neve-Yam kit is reminiscent of similar kits from the Uluburun and Cape Gelidonya shipwrecks (Bass *et al.* 1967; 1989; Pulak 2008).

Hematite Stone Weights

Two hematite weights weighing 275 and 47 g were recovered from the wreck site (Fig. 8.13; Galili 1983: unpublished diving report:134, 17.11.1983, underwater survey of the University of Haifa; 1985:151, fig. 7). The heavier one (67 × 35 × 19 mm) is of the type described as 'sphendonoid' – shaped like an elongated wheat grain with truncated tips – its circular cross section is only nearly circular, due to its flattened side; the other (23 × 27 × 19 mm) has the shape of a sphere truncated on opposite sides. Such weights are known from the Levant, and are usually associated with Mesopotamian-Syrian origins. Though often found in Late Bronze Age strata (e.g., Megiddo Strata XIII–VII; Loud 1948: pl. 168:1–7, 9, 10, 20), weights of similar types were in use during most of the Bronze Age (Eran 1994:151–157; Kletter 1997:110–111). The small, 47 g weight measures 5 Ugaritic Shekels (1 Ugaritic Shekel = 9.4 g), and the larger one, weighing 279.5 g, measures 29.7 Ugarit Shekels.

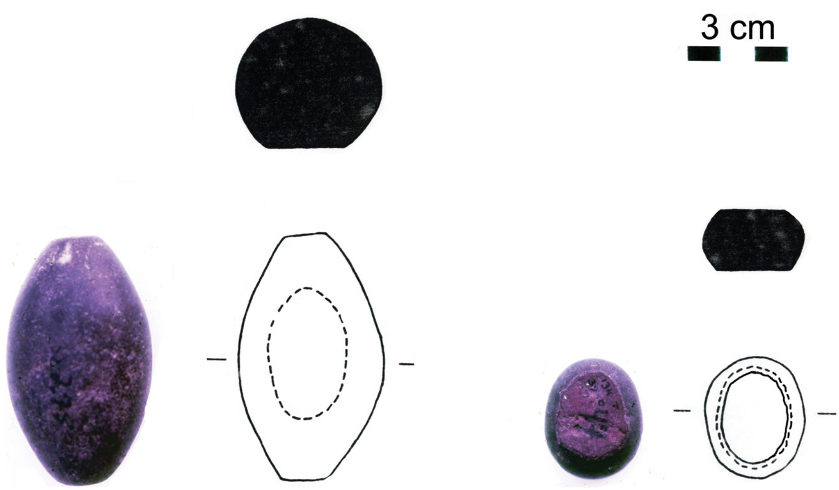


Figure 8.13: Hematite weights.

A set of sphendonoid weights conforming to a similar standard of 9.3–9.4 g Shekel units was found in the Uluburun shipwreck (Pulak 2000a; 2008:300). Hematite weights of a type identical to those recovered at Neve-Yam were discovered among shipwreck assemblages from the Yavne-Yam anchorage (Golani and Galili 2015: table 1) and Cape Gelidonya shipwreck (Bass *et al.* 1967:135–138). A comparison of the weights indicates an equivalency between the grain-shaped weight from Neve-Yam, weighing 276 g, and weight W.55 from Cape Gelidonya, weighing 279.5 g. The small 47 g weight from Neve-Yam is similar to no. 23 from Cape Gelidonya (weighing 47.7 g). Thus, the weights from Neve-Yam and those from Cape Gelidonya seem to belong to the same metric system. Sphendonoid hematite weights were used into Iron Age I, as seen in examples from Ashkelon (Master 2020a) and Megiddo Strata VIIA and V (Loud 1948: pl. 168:14, 16, 20), yet they do not necessarily conform to the 9.3–9.4 g standard.

Pottery Recovered from the Site and Its Surroundings

Iron Age IIA pottery was found at the site, along with abundant pottery sherds from various later periods. The Iron Age IIA pottery, including five jar rims, four shoulder fragments, and a few undiagnostic sherds, was published separately (Arkin Shalev *et al.* 2021: table 2, fig. 7). The pottery dispersal partly overlapped the distribution of the copper ingots, stone anchors, and bronze artifacts, which were scattered over a relatively small area (ca. 100 × 50 m, see above). However, while the distribution of the metal and stone objects marks their primary deposition, the distribution of the Iron Age IIA and later pottery certainly does not. Pottery finds from several periods were strewn across the anchorage in an apparently random pattern (see also Galili *et al.* 2012:16–17, endnote ii). The association of the Iron Age IIA pottery with the metal and stone finds is thus highly questionable.

Discussion

The Dating of the Ship

Based on the finds described above, we suggest that the ingots, bronze artifacts, and hematite weights, along with most of the stone anchors (with the exception of nos. 10, 11, and 19), belong to a single wreck (the ingots wreck), while the pottery is most probably intrusive. Based on the associated finds, the dating of the Neve-Yam shipwreck to the Late Bronze/early Iron Age transition is reinforced (Galili *et al.* 2011; Yahalom-Mack *et al.* 2014). While the typology of the stone anchors provides a wide chronological framework, the typology of other finds from the assemblage may provide a more precise date.

Figure 8.3 shows the rough date ranges of the finds, as discussed above, including the radiocarbon range obtained from the wooden haft; however, the ^{14}C dates range widely from LB II to early Iron Age I (1390–1130 cal BCE), and the dating of the wooden haft is therefore uncertain (see above), as is the date of the other artifacts, given their wide possible range of dating. In order to determine whether the wreckage event may be dated to the earlier part of the ^{14}C range (14th–13th centuries BCE), or to its later part (12th century BCE), we must consider another aspect of the ingot assemblage, which comprises the main surviving part of the cargo. Oxhide ingots from Cyprus have been recovered in several Late Bronze Age shipwreck assemblages from the eastern Mediterranean (Ḥishuley Carmel, Kfar Samir North, and Ha-Ḥotrim on the Carmel Coast, and Uluburun and Cape Gelydonya in southern Turkey; Bass 1967; 1989; Pulak 2008; Galili *et al.* 2011). The Neve-Yam assemblage yielded no oxhide ingots, and lead isotope analysis negated Cyprus as a possible origin of the oval-shaped ingots. Instead, it showed that these were consistent with the ʿAraba copper ores, particularly from Wadi Faynan (Yahalom-Mack *et al.* 2014).

The earliest levels at Khirbat en-Naḥas and Khirbat al-Jariya indicate that the production of copper in the ʿAraba Valley, headed by Faynan, started as early as the final Late Bronze Age (12th century BCE), and that intensive copper smelting took place there during the Iron Age (Ben-Yosef *et al.* 2010; 2019; Levy *et al.* 2012; 2014:150–151).[4] Some have suggested that the catalyst for this production may have been the disruption, or even cessation, of maritime trade with Cyprus, and the breakdown of trading networks in the 12th century BCE (Knauf 1991:185; Fantalkin and Finkelstein 2006:25; Ben-Yosef and Sergi 2018:461).

As the Wadi Faynan mines were not exploited before the 12th century, the Neve-Yam shipwreck may be dated approximately to this time. According to other finds presented in this study, the ingots would indeed have been produced, during the 12th century, before the production reached its zenith in the 10th–9th centuries BCE (Fig. 8.3). This dating is earlier than in our previous conclusions, which suggested the ingots were produced during the peak of production at Wadi Faynan (Yahalom-Mack *et al.* 2014).

Given the location of the shipwreck, it is assumed that the ingots were transported from the ʿAraba Valley to the southern Mediterranean coast, where they were loaded onto a ship, which sailed northward and was wrecked just off the Carmel Coast. They may have been transported via the Beersheba Valley to the Mediterranean coast (Finkelstein 1995:103–126; Yahalom-Mack 2017:454–456; Ben-Yosef and Sergi 2018: fig. 6), possibly indicating the role of Philistia in the ʿAraba copper trade, which culminated during Iron Age II (Fantalkin and Finkelstein 2006; Gadot 2006; Ben-Yosef and Sergi 2018).

Late Bronze Age Collapse Reflected along the Coast

The 'crisis years' in the eastern Mediterranean have been widely described, discussed, and debated (e.g., Ward and Joukowsky 1992; Cline 2014; Knapp and Manning 2016). They have been associated with more than 100 years of dry climate, cold winters, and severe droughts, resulting in the shrinking of the Mediterranean forest, as evidenced by regional pollen studies (Kaniewski *et al.* 2013; 2015 Langgut *et al.* 2013; 2015). However, it is not clear if the climate was the only reason for the collapse, or one of a number of triggers (for details, see discussion in Knapp and Manning 2016:137–138 and references therein). The collapse, which was noted in the entire eastern Mediterranean basin, including Egypt, Canaan, southern Turkey, and Greece, encompassed the fall of the palatial system in the Aegean; the Hittite Empire in Anatolia; the maritime copper powerhouse of Alashiya (Cyprus); and prospering trade centers, such as Ugarit, on the coast of Syria, and those of Egypt, who finally withdrew from its province in Canaan (e.g., Mazar 1992; Drews 1993; Langgut *et al.* 2013 and references therein). Some cities, such as Ḥazor in the north and Lachish in the south, were totally ravaged and did not recover for a long period of time, while other places, such as Megiddo, were partially destroyed and recovered relatively quickly (Finkelstein 2003). According to some studies, the international economic network in the eastern Mediterranean was brought to an abrupt demise (e.g., Drews 1993). Others suggest that the collapse was not total and that the transition from the Late Bronze to the early Iron Age was more gradual and peaceful than previously proposed (Yasur-Landau 2010:220–227; Sharon and Gilboa 2013; Knapp and Manning. 2016:132). Seven decades of underwater archaeological research have yielded numerous finds providing another important dimension to the study of the Late Bronze–Iron Age transition in the southern Levant. These finds may enable one to evaluate whether the 'crisis years' are also observable in the underwater archaeological record.

Offshore Finds Retrieved by Fishing Trawlers

In 1961, on the verge of underwater archaeological research in Israel, Dan Barag (1961) studied ceramic jars salvaged by trawler fishermen along the Israeli coast. He identified and counted the jars, and produced an inventory spanning the Early Bronze Age to the Early Islamic period. Barag concluded that prior to the Middle Bronze Age, maritime activity along the Israeli coast was minimal. Evidence of ongoing maritime activity began at this time, and continued with an unexplained hiatus between the 12th and 8th centuries BCE. He suggested that this gap was associated with the cessation of Egyptian domination in the region.

Anchorages

Investigations in the natural anchorages and proto-harbors of Tel Ridan and Yavne-Yam (Raban and Galili 1985; Galili and Sharvit 1991; Galili *et al.* 1993; Golani and Galili 2015); the southern and northern anchorages of Caesarea (Galili *et al.* 1993; Galili 2017a; Arkin Shalev *et al.* 2021); the lagoon and the southern and northern bays of Dor (Raveh and Kingsley 1993; Kingsley and Raveh 1996:78; Lazar *et al.* 2017); Neve-Yam (Galili and Sharvit 1999b; Galili *et al.* 2011; Yahalom-Mack *et al.* 2014); and the southern and northern bays of 'Atlit (Galili and Sharvit 1999a; 1999b:97–101) have revealed numerous Late Bronze Age assemblages that are associated with the 14th–early-13th-century flourishing of eastern Mediterranean trade.

Open Coasts

Numerous Late Bronze Age shipwrecks and cargoes, including metal cargoes and concentrations of one-holed stone anchors, have been recovered from open, unprotected coasts, including five that yielded metal ingots (e.g., Ḥishuley Carmel, Kfar Samir North and South, Ha-Ḥotrim; Raban and Galili 1985:326–329; Galili *et al.* 2011; 2012).

The heavy maritime traffic along the Israeli coast during the 14th–13th centuries BCE is thus manifested in pottery retrieved offshore by fishermen, as well as in numerous shipwreck assemblages recovered from natural anchorages and open, unprotected coasts. In striking contrast to the underwater archaeological finds associated with the flourishing maritime activity of the 14th–13th centuries, until recently, no final Late Bronze/early Iron Age (12th century) shipwreck assemblages were reported from either anchorages or open coasts in Israel. Thus, similar to the archaeological evidence from inland tell sites (see above) and along the Carmel Coast (see below), the underwater archaeological finds along the Israeli coast indicate that maritime trade was considerably reduced during these years, as reflected in the scarcity of finds.

The Iron Age II ceramic finds in the southern anchorage of Caesarea and in the Neve-Yam anchorage (Arkin Shalev *et al.* 2021); the new finds from the bay of Dor (Arkin Shalev *et al.* 2019); and the Iron Age II finds from 'Atlit may thus represent a period of recovery after the collapse of the elaborate Late Bronze Age trade system.

The Neve-Yam Shipwreck and the 12th-Century Resilience of Maritime Trade

The dating of the Neve-Yam shipwreck to the 12th century BCE suggested here raises the question of the resilience of maritime trade during the turmoil years of the late 13th and early 12th centuries. Other shipwrecks dated to around 1200 BCE indicate a continuity of connection between the Aegean, Cyprus, and the Levant. The Cape Gelidonya shipwreck, with its cargo of Cypriot copper and Mycenaean and Levantine pottery, is one example of such maritime activity during this time. The humbler ceramic finds from the Point Iria wreck indicate the continuity of trade between mainland Greece, Crete, and Cyprus, during the Late Helladic (LH) IIIB2 period (Bachhuber 2020). Finally, the LH IIIB–C wreck off Modi Islet (Poros) is another example of such continuity and maritime trade during this time (Agouridis 2011; Agouridis and Michalis 2021).

In the southern Levant, Canaanite cities and sites connected to the Egyptian administration continued well into the 12th century. This is the case for Canaanite Megiddo and the Egyptian garrison at Beth Shean (Yasur-Landau 2010:322–323; Mazar 2011; Toffolo *et al.* 2014). These sites attracted small-scale imports of Cypriot-made LH IIIC-style pottery, found at Beth Shean, Tel Reḥov, and Tell Keisan, and imitated at Megiddo (Yasur-Landau 2010:200–204; Mazar 2020). Sherds of Cypriot basins found in the 12th-century levels of Ashkelon, as well as Cypro-Minoan signs on handles (if not residual from earlier Late Bronze Age levels), indicate similar low-intensity maritime trade (Master 2020b; 2020c). Petrographic analyses of jars found in 12th-century LC IIIA horizons on Cyprus, at Maa-Palaeokastro and Hala Sultan Tekke, suggest that at least some of them were produced outside Cyprus, and may thus indicate the flip side of the same maritime trade (Knapp and Demesticha 2017:57, 67).

The Carmel Coast was occupied during the Middle and Late Bronze Ages, as well as in the Iron Age. Finds indicate that if a hiatus in settlement occurred in the 12th century, it was a very short one, indicating the overall resilience of the coastal settlement system. During the late LB II, coastal settlements existed at Dor (Raban and Galili 1985:326–329; Raban 1993:368–371; 1995; Stern 1993:357–368; Gilboa *et al.* 2015; 2018: table 2.1; Arkin Shalev *et al.* 2021) and at Tel Nami (Artzy 1995; 2000; 2006:51–52). LH IIIB/C pottery (Cypriot made?), found mainly at Tel Nami, but also at Dor (Stockhammer 2020:292), suggests that the occupation continued until the very end of the 13th century, or even the early 12th century. Other Late Bronze Age sites existed at ʻAtlit (Johns 1933; 1947:10–11; Raban 1996), Megadim (Broshi 1993; Wolff and Bergoffen 2012), and Shiqmona (Elgavish 1993:1373–374; 1994:34; Zemer 2008:17–28). The exact chronology of these sites depends on further excavation and study; however, the general picture illustrated by the available archaeological data shows that the maritime and occupational activity of all these settlements was considerably reduced during the 12th century.

After the Late Bronze Age collapse, the earliest signs of recovery of the Carmel Coast settlements may have been seen during the late 12th century BCE. The bastion fortification at Dor was built during Iron Age IA, and trade relations with Egypt and Cyprus were restored. These relations initiated the considerable prosperity of Dor in Iron Age IB, and, according to the investigations, enabled the construction of harbor facilities (Gilboa *et al.* 2008; Sharon and Gilboa 2013; Waiman-Barak *et al.* 2014; Arkin Shalev *et al.* 2019; 2021).

Conclusions

Intensive underwater and coastal archaeological research has taken place in Israel in the last 60 years. The numerous finds recovered from underwater sites, including dozens of shipwrecks, most probably provide a reliable pattern of the ancient maritime activity in the region. In this regard, the absence of underwater finds related to the so-called crisis years, from anchorages, shipwrecks, and offshore finds by fishing trawlers, coupled with a similar absence in the main coastal sites in the region, must be indicative and not merely a relic of biased research. The decrease in maritime activity during this period, as indicated by underwater and coastal archaeological finds, may thus be considered part of the general post-Late Bronze Age crisis in the eastern Mediterranean.

Based on the data presented above, the Neve-Yam cargo, containing mainly copper ingots, is dated with high probability to the 12th century BCE. This dating positions it as evidence of maritime activity that followed the collapse of the Mediterranean trade at the end of the Late Bronze Age. The shipwreck may be related to the earliest stages of the renewal of the coastal settlement system and maritime activity during Iron Age IA. This activity included trade in ʻAraba copper during the 12th century BCE, which was a reaction to the collapse of the Late Bronze Age trade in Cypriot copper.

The finds from Neve-Yam suggest that along the Carmel Coast, and possibly beyond it, maritime activity continued to some extent during the so-called crisis years, suggesting that, in maritime terms, the collapse was not so dramatic. The new finds may also be designated as the first signs of recovery that followed the Late Bronze Age collapse, providing an indication of resilience of the eastern Mediterranean populations and their capacity to overcome crises. The people involved in this maritime venture could have been entities occupying the Syrio-Phoenician coast, Philistines, or other marine-oriented opportunistic agents in the region.

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Notes

1 Despite intensive underwater and coastal archaeological research over the last 60 years (at ʻAkko, Akhziv, Tell Abu Hawam, Tel Nami, Dor, Caesarea, Jaffa, Ashdod-Yam, and Ashkelon), no archaeological evidence of inland harbors or anchorages has ever been found in Israel. It seems that coastal marshes, wetlands, river courses, embayments, and estuaries, had they existed, were separated from the sea by swash bars

and coastal sand berms, and silted by sediments, and thus unnavigable for seagoing ships. On the other hand, there are various indications of Bronze Age natural anchorages in the lee side of partly submerged kurkar ridges, small islets, and small bays (e.g., Tel Ridan, Yavne-Yam, Jaffa, Apollonia, Caesarea, Dor, Neve-Yam, and 'Atlit); however, none of these could have provided shelter during winter storms. Thus, the statement that there were no natural features along the Israeli coast that could have provided safe haven for seagoing ships during winter storms is still valid.

2 Small weights and composite stone anchors continued to be used by small boats until relatively recently (Frost 1973:405).

3 Carlos Barroso, Beta Analytic Inc., personal correspondence with D. Langgut from July 10, 2019, concerning pretreatment of the wood sample: 'This sample was pretreated with acid/alkali/acid for the removal of carbonate and soluble humic acids. You will notice in the picture provided that there is a black/gray material throughout the sample. We do not know if this is part of the wood or if it [is an] intrusive contamination. [...] This material cannot be removed. We ask that you examine the picture and base your decision to proceed or not proceed'.

4 It should be noted that copper was also produced in this region during the Early Bronze Age.

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