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Chapter 7
Submerged Pottery Neolithic Settlements off the Coast of Israel: Subsistence, Material Culture and the Development of Separate Burial Grounds

Ehud Galili, Liora Kolska Horwitz, Vered Eshed, and Baruch Rosen

Abstract Eight inundated archaeological sites dating to the Pottery Neolithic period (Wadi Rabah culture), 8000–6500 cal. BP, have been exposed under water off the Carmel coast of Israel. The sites represent in situ settlements with architectural remains comprising domestic stone-built structures and water wells built of wood and stone. Rich assemblages of flint tools, ground stone artefacts and pottery were recovered in addition to organic remains (wooden bowls, baskets etc.). Faunal and botanical remains demonstrate that the subsistence economy consisted of animal husbandry, hunting and fishing complemented by cultivation of domestic crops and gathering of wild plants. Special features include the beginning of olive oil extraction, a major component of the Mediterranean subsistence economy, demonstrated at the site of Kfar Samir, while at the Neve-Yam site, the earliest separate burial ground in the region was found with a concentration of stone-built cist graves.

7.1 Introduction

The Mediterranean coast of Israel is about 200 km long. It is slightly curved with mostly sandy beaches in the south, eroding coastal cliffs in the centre and some rocky areas in the north along the Carmel and Galilee coasts (Fig. 7.1). Eight submerged Pottery Neolithic (PN) settlements inundated by Holocene sea-level rise have been discovered along a 15 km strip of the northern Carmel coast (Fig. 7.1b).

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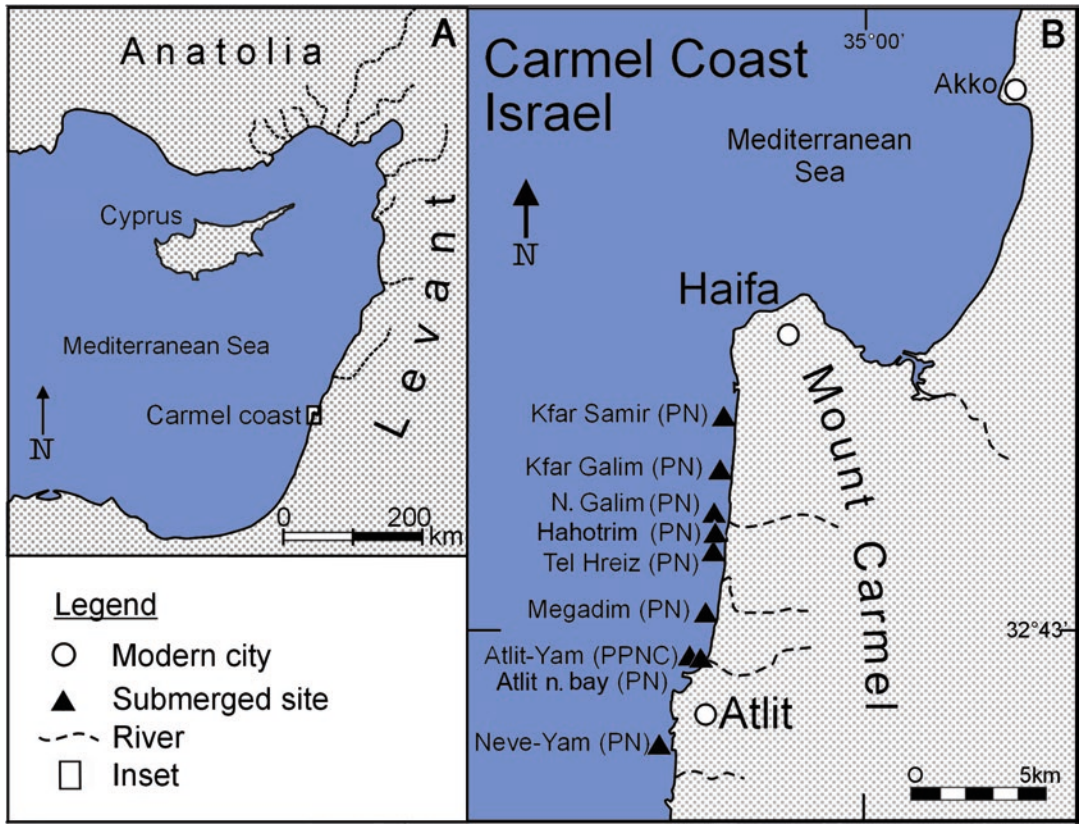

Fig. 7.1 Location map: **a** The Israeli coast; **b** Submerged settlements off the Carmel coast (E. Galili)

These settlements are embedded in the upper part of a hard clay palaeosol (Galili 2004). Due to continuous sea-level rise (Galili et al. 1988, 2005; Galili and Rosen 2011b), the duration of each site was relatively short and there were no earlier or later occupations. Thus, mixing of layers and post-depositional disturbances were minimal. Following inundation, the sites were covered by a protective layer of sand 1–2 m thick that prevented disturbance and intrusions. In recent years these submerged settlements have been exposed by human activities – mainly sand quarrying and construction of marine structures – together with seasonal sea storms that have removed the sand layer and exposed parts of the sites (Wreschner 1977a, b; Galili and Weinstein-Evron 1985; Galili and Inbar 1987; Galili et al. 1988).

Until recently, information on Levantine coastal Neolithic communities was relatively scarce and their role in the Neolithic revolution was barely understood. The unique physical conditions of the submerged sites and the circumstances of their preservation and exposure, together with intensive underwater rescue surveys and excavations over the past four decades, have yielded a mosaic of randomly uncovered portions of the sites. Collating the accumulated data has enabled us for the first time to draw a comprehensive picture of the material culture, economy, and socio-cultural practices of these coastal societies, and to reconstruct the palaeoenvironment of the Mediterreanean shore during two critical transitional periods: the Pre-Pottery Neolithic C (PPNC) c. 9250–8000 cal. BP (Hershkovitz and Galili 1990; Galili et al. 1993; Galili et al. Chap. 6) and the late Pottery Neolithic (PN), or Wadi Rabah Culture[1] c. 8000–6500 cal. BP (Fig. 7.2, Table 7.1). In this chapter we describe the sites of the

[1] The Wadi Rabah (WR) culture is attributed by some to the late Pottery Neolithic period (Gopher and Gophna 1993) and by others to the Early Chalcolithic period (Garfinkel and Dag 2008).

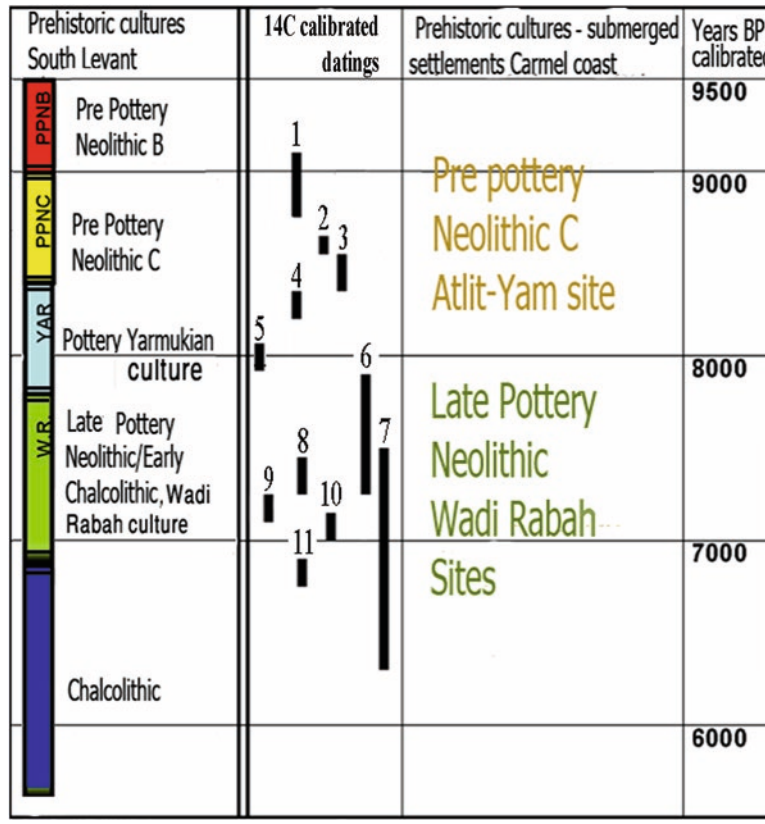

Fig. 7.2 Cultures of the 7th–10th millennia BP in the Levant (B. Galili) and radiocarbon dates obtained from the submerged sites: (1) Atlit-Yam, charcoal taken near structure 13; (2) Atlit-Yam, charcoal from the fill of well 66; (3) Atlit-Yam, charcoal taken near structure 10A; (4) Atlit-Yam, charcoal from the fill of well 11; (5) Kfar Samir, wooden bowl; (6) Kfar Samir, wood taken from the construction of the wells; (7) Kfar Samir, olive pits, woven mat and wooden branches; (8) Neve-Yam south, charcoal; (9) Megadim, jaw of a mammal; (10) Tel Hreiz, wooden poles; (11) Kfar Galim, wooden branches from a well

Pottery Neolithic Wadi Rabah phase and discuss the main changes in subsistence and material culture that occurred from the PPNC to the later Wadi Rabah PN.

7.2 Submerged Pottery Neolithic Sites

Eight submerged PN settlements were discovered between Haifa and Atlit on the Northern Carmel coast: Kfar Samir (north, centre and south), Kfar Galim North, Kfar Galim South, Nahal Galim, Hahotrim, Tel Hreiz, Megadim, Atlit northern bay and Neve-Yam (north and south) (Fig. 7.1b). Recently another PN site was located off Habonim, ca. 2.4 km south of Neve-Yam are located close to the present coastline at depths of 0–5 m below sea level (Ronen and Olami 1978; Olami 1984; Galili and Weinstein-Evron 1985; Galili and Inbar 1987; Galili et al. 1988, 1989, 1997, 1998, 2002; Galili and Schick 1990; Galili 2004). Most of the archaeological material was collected in the course of underwater surveys and sometimes on the coastline after storms, while in a few instances limited excavations were carried out. Radiocarbon dates, and ceramic and lithic typologies, place the sites in the late Pottery Neolithic period i.e., the Wadi Rabah culture (Table 7.1).

Table 7.1 List of radiocarbon dates from sites mentioned in the text

Site and lab no	C14 age – uncalibrated BP	C14 age – calibrated BP	Sample material and feature	Location at site
Kfar Samir				
BETA −82851	5860± 140	7005–6385	Wood from well 113	Centre
RT–282B	6470 ± 130	7453–7257	Wood from well 5	Centre
RT–682A	6670 ± 160	7666–7625	Wood from well 3	Centre
PTA–3820	6830 ± 80	7698–7582	Wood from well 5	Centre
PTA–3821	6830 ± 160	7730–7530	Wood from well 3	Centre
BETA–82850	6940 ± 60	7890–7615	Wood from pit 10	Centre
BETA–82845	6080 ± 70	7165–6765	Olive from pit 6	Centre
BETA–82846	6210 ± 150	7385–6740	Olive from pit 6	Centre
BETA–82847	6210 ± 80	7240–6885	Olive from pit 6	Centre
BETA–82848	6230 ± 80	7255–6900	Olive from pit 6	Centre
BETA–82715	6500 ± 70	7480–7230	Olive from pit 6	Centre
RT–1898	5790 ± 55	6669–6519	Olive from pit 6	Centre
RT–1930	5870 ± 70	6785–6575	Olive from pit 6	Centre
BETA–82843	6100 ± 60	7165–6805	Olive from pit 7	Centre
BETA–82844	6290 ± 60	7270–7020	Olive from pit 7	Centre
RT–1929A	5630 ± 55	6669–6519	Olive from pit 7	Centre
RT–1929	5870 ± 70	6466–6317	Olive from pit 7	Centre
BETA–82849	6350 ± 90	7390–7020	Branch from it 9	Centre
RT–855	6420 ± 120	7517–7038	Mat from pit 8	Centre
RT–1360	7230 ± 80	8115–7949	Wooden Bowl	South
Kfar Galim				
RT–1748	5985 ± 70	6910–6670	Wooden structure	South
RT–1749	5985 ± 55	6890–6740	Wooden structure	South
RT–1750	6890 ± 50	7790–7670	Wooden branch	South
Tel Hreiz				
RT–779A	7330 ± 120	8330–7970	Wooden pole	North
PTA–3460	6310 ± 70	7210–6980	Wooden branch	North
RT–779B	6269 ± 150	7160–7000	Wooden pole	North
Megadim				
PTA–3652	7960 ± 70	8990–8650	Clay outside pit	South
PTA–3648A	6310 ± 70	7310–7020	Canine bone (jaw)	South
PTA–4339A	6270 ± 50	7270–7100	Canine bone (jaw)	South
Neve-Yam				
HV–4256	6510 ±395	7600–6750	Charcoal	Centre
RT–1723	6390± 70	7480–7270	Charcoal	South
RT–1724	6565 ± 70	7580–7320	Charcoal	South

7.2.1 Kfar Samir

Kfar Samir lies at a depth of 0.3−5 m, some 10–200 m offshore (Fig. 7.1b). The prehistoric remains are scattered along a 1200 m strip on the sea bottom, parallel to the coastline. The site may be divided into northern, central and southern sectors.

7.2.1.1 Northern Sector

This part of the site is located at 34° 57′ 20″ E, 32° 47′ 58.5″ N Fig. 7.1b). In the north sector of the site, four vertical stone slabs (1.3 × 0.9 × 0.5 m) and some similar sized tilted slabs (angled at ~45° angle) were recovered at a water depth of 1.5–2.5 m, some 30–60 m offshore. One end of the slabs was partly inserted in the clayey bottom and they may represent symbolic or ritual features, burial markers or other locations of importance.

7.2.1.2 Central Sector

This part of the site is located at 34° 57′ 8.65″ E, 32° 47′ 6.72″ N (Fig. 7.1b), 1–200 m from the water line, at a depth of 0–5.5 m.

Architectural Remains In the central sector, floors made of unworked local stones (8–10 cm in diameter) were found partially embedded in the clay palaeosol, as well as floors constructed of flat stone slabs. A few hearths (c. 0.5 m in diameter) were located. In one, the bottom of the hearth was lined with stones and contained fragments of burnt bones and charcoal. Several dozen metres to the south of this hearth, a pit contained crushed olive pits and pulp, evidently waste from olive oil extraction (Galili and Sharvit 1994–1995; Galili et al. 1997, 1989; Galili and Rosen 2007). The radiocarbon dates of the olive pits range from 7480–7230 to 6669–6519 cal. BP (Table 7.1).

Water Wells Three water wells were identified on the north-west edge of the central sector submerged at a depth of 5 m, some 200 m offshore. They were constructed of alternating courses of wooden branches and undressed kurkar and limestone pebbles (Fig. 7.3). The southern well (No. 3) had a rectangular opening 1 × 0.8 m. It was excavated to a depth of 2 m, but the bottom was not reached. With increasing depth it widens and becomes more circular in plan. In its lower part, two courses of stones were laid between the wooden beams. The well's fill consisted of soft clay, small pieces of stone as well as several bird bones, olive pits, some pot sherds (one with an incised design), flint flakes and waterlogged plant remains such as tree branches and straw. Wood samples from the well construction were radiocarbon-dated with ages ranging between 7890–7615 and 7005–6385 cal BP.

Olive Oil Extraction A feature associated with producing olive oil was recovered at a water depth of 1 m. It comprised a pit dug in the clay (Fig. 7.4a). Its base was paved with stones and it contained thousands of crushed and whole stones and traces of pulp, evidently olive oil extraction waste (Fig. 7.4b, Galili et al. 1997, 1989; Galili and Rosen 2007). Several stone basins recovered from the site (e.g., Fig. 7.5a) could have been used for crushing the olives. These finds suggest that about 8000 years ago the Neolithic inhabitants of the Carmel coast started to produce olive oil and they represent the earliest known evidence for its production.

Flint Implements Two groups of flint tools can be identified; those which represent the period of site occupation (flint axe, burin) and a few Middle Palaeolithic implements that had been found by the Neolithic inhabitants and apparently reused.

Special Finds At a depth of 0.5 m and 15 m from the shoreline, on a section of stone paving, a fragment of a pot-shaped wooden bowl was found. The fragment included a part of the flat base, a straight wall that is slightly inverted and a section of the rim. An elongated knob handle on the upper part of the wall is perpendicular to the rim and has a narrow lateral perforation.

At a depth of 2.3 m, a pit 0.9 m in diameter and 0.55 m deep had been dug into the clay palaeosol. It contained water-logged pieces of a braided basket (Fig. 7.5a), tree branches and dozens of olive pits. The basket was made of braided pieces 3–5 mm in diameter. One of the braided pieces was round and

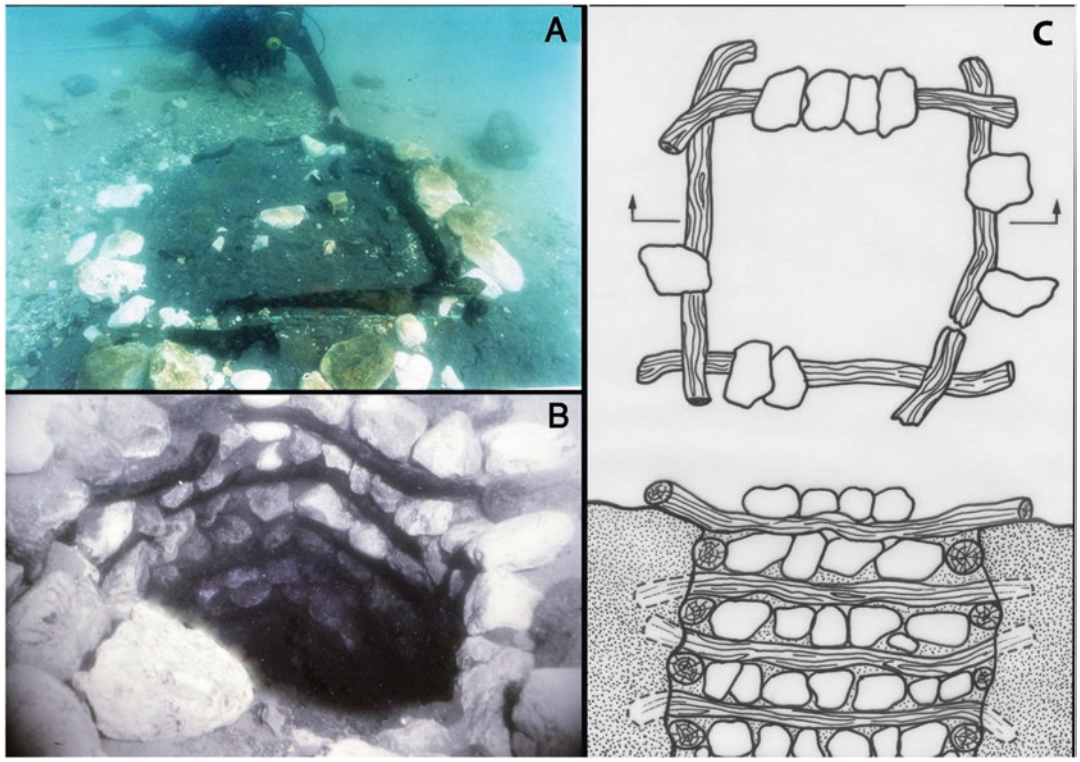

Fig. 7.3 Kfar Samir Central Sector: water-well 3 constructed of alternating courses of wooden branches and stones: **A** before excavation; **B**, **C** after excavation (E. Galili)

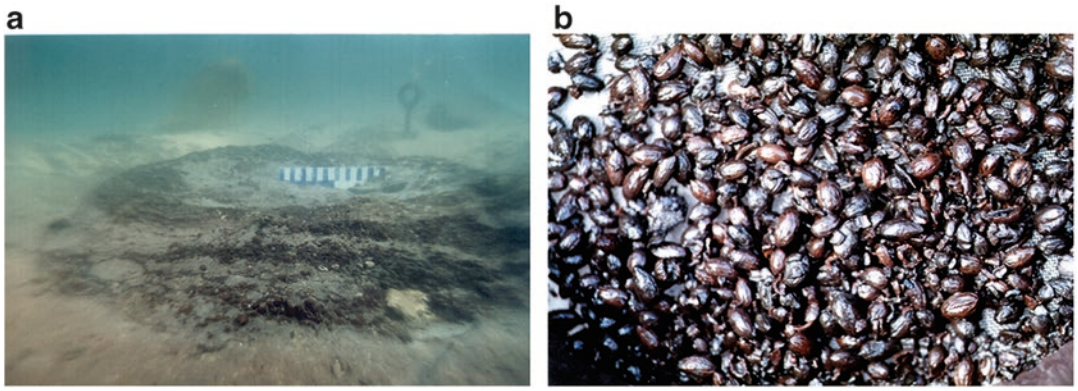

Fig. 7.4 (**a**) Kfar Samir Central Sector: Pit filled with olive oil extraction waste of crushed olive pits and pulp (scale = 20 cm), (**b**) Crushed olive pits from the pit (J. Galili)

may have formed the base. The braiding method used was alternate pair twining: the warps emerge from the centre of the base, perpendicular to its rim and parallel to each other while the wefts are alternately twined around two warps and cross over after each pass. In several places the wefts were twined around three warps or only around a single warp. Usually the warps are made of one branch, but in a few places they consisted of a pair of thin branches (Galili et al. 2007). We interpret this artifact as a strainer, similar to modern ones known as *aqal* (Fig. 7.5b), which are used to squeeze the oil from the olive pulp after the olives have been crushed. Several stone basins recovered nearby could

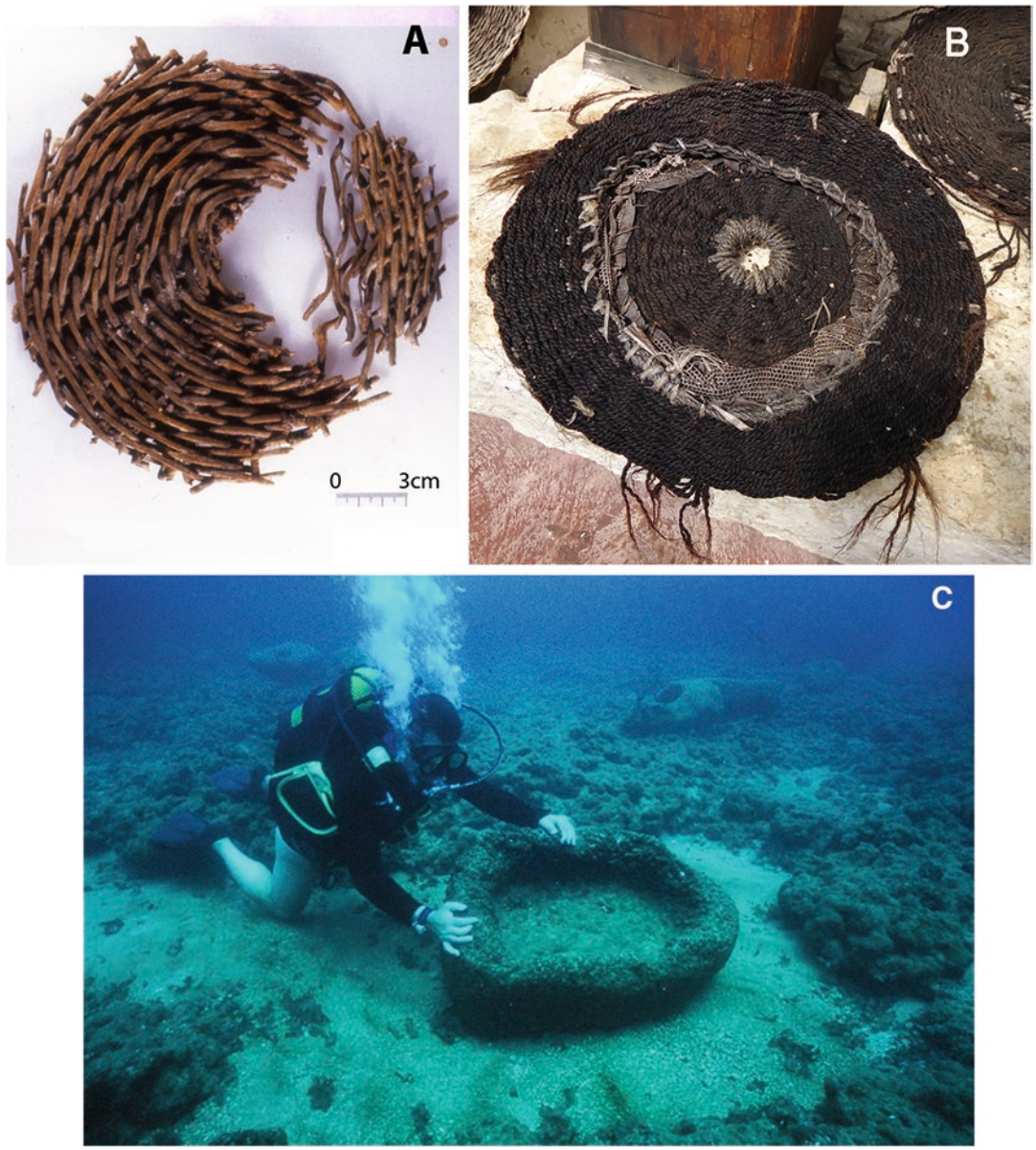

Fig. 7.5 Kfar Samir Central Sector: finds associated with olive oil extraction: **a** Basketry item made of woven twigs, interpreted as a strainer for olive oil extraction (Israel Antiquities Authority); **b** Example of modern strainer for olive oil extraction still in use today; **c** Stone basin from the Kfar Samir site, possibly used for crushing olives (E. Galili)

have been used for crushing the olives (Fig. 7.5c). Another mat fragment 70 × 160 mm was found at a depth of 1.5 m in an unlined pit no. 8 dug in the upper clay level. It is made of bundles of unidentified material, perhaps rushes or straw. Technologically, it belongs to a type known as 'coiled basketry with intricate stitch'. The mat fragment was dated by radiocarbon to 7517–7038 cal BP (Table 7.1) (Galili and Schick 1990).

Faunal Remains In the central sector of Kfar Samir, faunal remains were scarce. A few bird bones were recovered from well No. 3 and included seven bones of mallard duck (*Anas platyrynchos*) and one unidentified mammalian bone fragment (Galili and Weinstein-Evron 1985, p. 40, Horwitz et al. 2002).

Fig. 7.6 Kfar Samir Southern Sector: elliptical building constructed of upright stone slabs (E. Galili)

7.2.1.3 Southern Sector

This part of the site is located at 34° 57′ 8.6″ E, 32° 47′ 6.72″ N (Fig. 7.1b).

Architecture An elliptical structure of upright stone slabs was exposed near the shore in the southern part of the sector (Fig. 7.6). Hundreds of olive pits were discovered in the vicinity of this structure (Galili and Rosen 2013).

Special Finds A complete wooden bowl (Fig. 7.7) was found in a pit in the clay c. 300 m south of the Kfar Samir central sector (Galili and Schick 1990). It was made of *Ceratonia siliqua*, the carob tree or St John's bread. Pieces of waterlogged tree branches and straw, perhaps remains of a mat or a basket, were found next to it. Tool marks of an adze or a chisel were visible on the outer face, as well as traces of an imperfection left by a fracture in the flint tool used to form the bowl. The inner surface of the bowl was made using a different tool and it is rougher compared to the outer surface – perhaps because of difficulties in forming such a surface using an adze or a chisel-like tool. The base and the rim of the bowl are very smooth, either polished intentionally or abraded by lengthy use. The bowl was radiocarbon-dated to 8115–7949 cal. BP (Table 7.1).

7.2.2 Kfar Galim North

This sector of the site is located at 34° 57′ 64″ E, 32° 46′ 14″ N (Fig. 7.1b) some 50–120 m off the coast at a depth of 1.5–4 m. Surveys revealed several round structures 1–1.5 m in diameter made of undressed stones, representing either refuse pits or water wells. Several rows of undressed stones, some forming right angles, imply the existence of rectangular structures, possibly dwellings. Other structures investigated were pits, probably water wells, walled with water-logged tree branches and stone pebbles. A test excavation carried out in one of these round structures yielded a few potsherds

Fig. 7.7 Kfar Samir Southern Sector: complete wooden bowl made from a carob tree (J. Galili)

and flint flakes and fragments of plant material in the fill. A cylindrical 'tower' 1.2 m high consisting of six courses of undressed stones was found above one of these round stone structures. Its function is unknown, but it may have served as a superstructure over a well.

Finds of material culture from the site include an abundance of ground-stone artefacts made of limestone, sandstone and basalt, including mortars, grinding stones, basalt goblets on high cylindrical bases ('chalices'), rectangular troughs or mangers, and a few potsherds. Flint artefacts include several flake tools and four bifacials (adzes and an axe). The fauna comprise two remains, a horncore of an adult male mountain gazelle (*Gazella gazella*) and a mandible of Palestine molerat (*Spalax ehrenbergi*) (Horwitz et al. 2002). A single radiocarbon date of 7790–7670 cal BP taken from a wooden branch places this site well within the range of the Wadi Rabah phase (Table 7.1).

7.2.3 Kfar Galim South

This sector of the site is located at 34° 57′ 8″ E, 32° 46′ 5″ N (Fig. 7.1b), some 30–100 m off shore, at a depth of c. 2–4 m.

Architecture Architectural remains consist of ten round stone-built pits including water wells lined with stones and tree branches, some branches up to 0.2 m thick (Fig. 7.8). Four water wells c. 1 m in diameter were at a depth of 1.5–3.0 m below sea level. In one of these, there were three pieces of waterlogged wood about 25 cm long and 15 cm in diameter that had been worked at both ends (Fig. 7.9). Their dimensions and shape suggest that they were pre-forms intended for the production of wooden bowls as found at Kfar Samir. Test excavations, in two of the round structures revealed fills of sherds, flint artefacts, water-logged plant remains, animal bones, and wooden branches radiocarbon-dated to the PN at 6910–6670, 6890–6740 cal BP.

Fig. 7.8 Kfar Galim South: water-well built of tree branches and stones (I. Greenberg)

Artefacts Pottery finds include 15 fragments of bases and handles, all typical of the Wadi Rabah culture, as well as a few non-diagnostic body sherds. Flint implements include several undiagnostic flakes.

Faunal Remains Seven animal species were identified (NISP = 31 bones). Remains of domestic pig (*Sus scrofa*) dominated at 55% and these were mainly immature animals, while domestic cattle (*Bos taurus*) at 22% were the next most common taxon, all adults. Present in far lower frequencies were remains of domestic sheep/goat (*Ovis aries/Capra hircus*) at 3.5%, dog (*Canis familiaris*) at 3.5%, grey heron (*Ardea cinerea*) at 3.5%, and vertebrae of an unidentified species of snake (Ophidia) at 6%. Two fish bones belonging to the family Sparidae (sea bream) were also identified (Horwitz et al. 2002).

7.2.4 Nahal Galim

The site is located at 34° 56′ 55″ E, 32° 45′ 23″ N, opposite the outlet of the river Nahal Galim (Fig. 7.1b). At a depth of 3–5 m, there were two round structures constructed of undressed stones 1–1.5 m in diameter, probably water wells. One of these structures, located some 150 m offshore at 4 m depth (Fig. 7.10), was marked by three courses of stones projecting above the sea bottom, apparently a superstructure forming the well mouth (Galili and Rosen 2013).

7.2.5 Hahoterim

The site is located at 34° 56′ 59″ E, 32° 44′ 59″ N (Fig. 7.1b). Several round structures constructed of undressed stones c. 1 m in diameter, probably water wells or storage pits, were identified at a water depth of 2–5 m. Hundreds of waterlogged olive pits and wooden branches were embedded in the clay palaeosol, indicating olive exploitation, probably for oil.

Fig. 7.9 Kfar Galim South: waterlogged piece of wood cut at both ends, perhaps intended for the production of wooden bowls (E. Galili)

Fig. 7.10 Nahal Galim: water-well constructed of undressed stones (I. Greenberg)

7.2.6 Tel Hreiz

This site is located at 34° 56′ 55″ E, 32° 44′ 45″ N, at a depth of 0–5 m adjacent to the terrestrial Tell of the same name (Fig. 7.1b). The submerged site was first identified in the 1960s and initially identified as Chalcolithic or Early Bronze Age. Further surveys since 1984, as well as radiocarbon dates of 8330–7970, 7210–6980 and 7160–7000 cal BP, indicate that it represents a late PN Wadi Rabah settlement.

Architecture The 1965 survey revealed stone paving, hearths containing charred remains of wood, animal bones including a jaw of Persian fallow deer (*Dama mesopotamica*), flint artefacts, potsherds and a basalt mortar. Likewise the 1984–1985 and 1993 surveys noted the presence of stone structures and a row of upright wooden poles. During surveys in 2012, a large section of the southern part of the site was exposed from the coastline to a depth of 4.5 m (Galili and Rosen 2013). A megalithic structure c. 60 m long and 1 m high built of boulders up to 1 m in length was discovered at a water depth of 3–4 m. The structure comprises an elongated concentration of boulders broadly parallel to the coastline at some 80–100 m offshore and 2.5–3.5 m depth. A tail-like row of boulders protrudes from the southern end of the concentration and two additional rows, parallel to each other, protrude from its northern end. This structure could have been a coastal defence representing an effort to minimize damage from the rising sea. Also recorded at the site were several upright wooden poles (12–17 cm in diameter) located some 15 m seward from the row of boulders. These may have been the foundations of a hut. Other architectural finds include the remains of a square building 3 × 4 m constructed of undressed fieldstones, a hearth with charcoal and two round structures built of undressed stones.

Artefacts Flint artefacts include bifacial axes and adzes, sickle blades and other blade tools, but no arrowheads. The pottery comprised numerous fragments of bowls and scores of handles typical of the Wadi Rabah culture, and a few handles of ceramic churns. Ground stone remains included bowls and grinding stones made of sandstone or limestone, and mortars and chalices made of basalt.

Botanical Remains These included hundreds of waterlogged olive pits, numerous tree branches and a circular ring woven from twigs. The olive remains suggest that oil extraction took place on-site.

Faunal Remains Eight animal species were identified (NISP = 106 bones), the majority representing domestic animals. Remains of cattle (*Bos taurus*) were the most common (53%), while sheep/goat (*Ovis aries/Capra hircus*) amounted to 16% and pigs (*Sus scrofa*) to 14%. Based on size, cattle were identified as domestic animals. The majority of pig bones came from immature individuals but included domestic pigs as well as wild boar. Dogs (*C. familiaris*) comprised a significant proportion of the remains at 14%. The several canine skulls belong to adult domestic dogs, resembling those at Kfar Galim. Game species were limited in number and comprise Persian fallow deer (*Dama mesopotamica*), mountain gazelle (*Gazella gazella*) as well as two fish Families (Serranidae and Tilapia sp.), sea water and freshwater taxa respectively (Horwitz et al. 2002).

Human Remains During 2015 a winter storm exposed two stone-built cist graves, two disturbed skeletons buried in the clay with no grave structure, comprising a lower jaw and a few fragmentary ribs and calvaria.

7.2.7 Megadim

Megadim site is located north of Atlit (Fig 7.1B) at 34° 56′ 40″ E, 32° 43′ 39 N″, some 80–120 m off shore, at a depth of 2.5–3.5 m (Galili and Weinstein-Evron 1985). Finds included three round pits lined with undressed stones, possibly water wells, found some 50 m apart. The southern pit was partly excavated to a depth of 0.4 m. Finds included a few flint flakes, ground tools including three basalt chalices and two limestone bowls, some waterlogged botanical remains of small tree branches and straw and a canid mandible, probably a dog, radiocarbon dated to 7310–7020 cal BP.

7.2.8 Neve-Yam

The Neve-Yam site actually comprises two separate areas (Figs 7.11a,b and Fig. 7.11c). The north area (C) has very few remains, including a round stone structure 1 m in diameter, probably a well, and

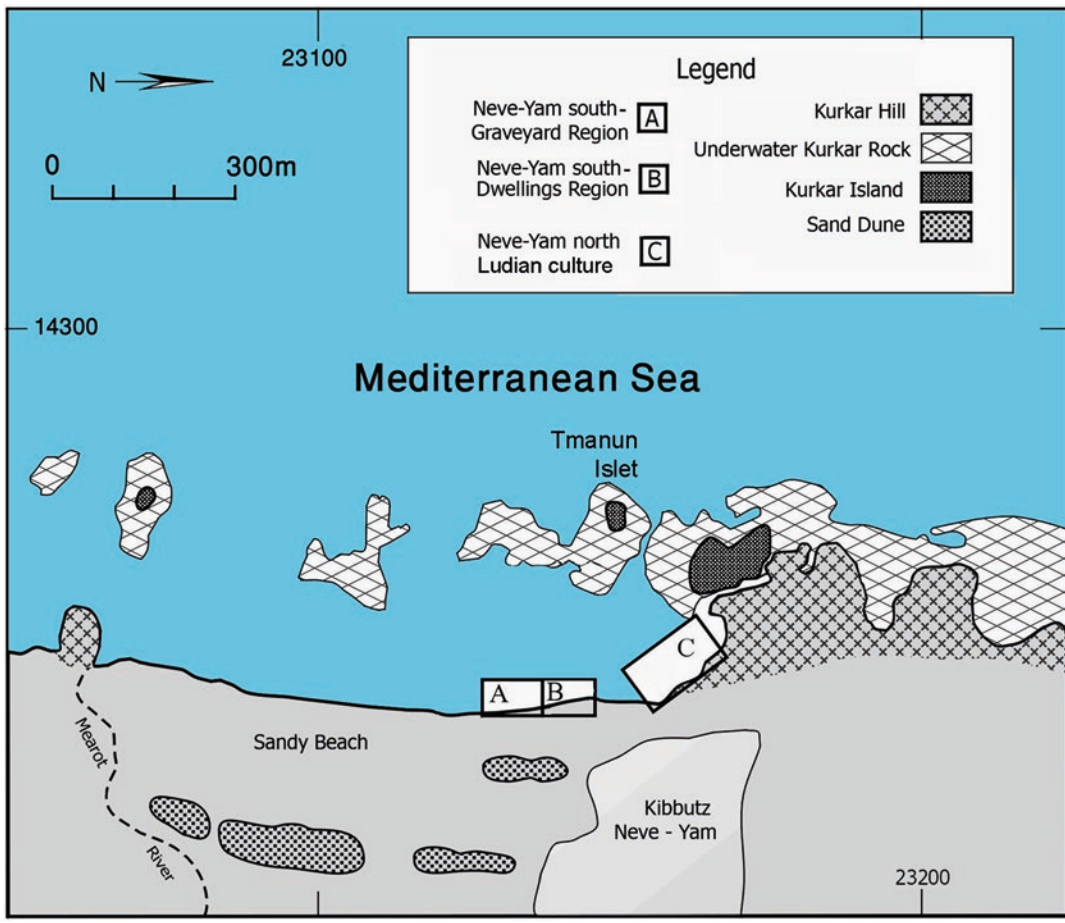

Fig. 7.11 Location map of Neve-Yam sites: (A) Neve-Yam south, Wadi Rabah site, the graveyard area, (B) the dwelling area, (C) Neve-Yam north, site of the Lodian culture (For details see inset in Fig. 7.12) (E. Galili)

pottery fragments—rims, handles and bases of bowls and containers—attributed to the Lodian culture as defined by Gopher and Gophna (1993), which predates the Wadi Rabah culture.

A rather important area is Neve-Yam south (Fig. 7.11a,b) which is located at 34° 55′ 40″ E, 32° 40′ 30″ N. It is one of the southern submerged Neolithic sites on the Carmel coast and is located between the coast line and a submerged ridge of Kurkar (aeolian sandstone) at a water depth of 1–5 m. Some 5000 m^2 have been investigated to date. The site can be divided into northern and southern sectors (Figs. 7.11A, B and 7.12). A portion of the coastal section of Neve-Yam was first exposed during the late 1960s following a sea storm (Wreschner 1977a). During 1968, a small rescue excavation was carried out on the shore in the northern sector of the site (B). Over the period 1983–1995, parts of the southern sector were exposed and underwater rescue surveys carried out (Galili et al. 1998, 2009; Galili and Rosen 2011b). The southern sector mainly comprises stone-built cist graves (Fig. 7.12a), the northern sector mostly rectangular dwellings (Fig. 7.12b). Three radiocarbon dates ranging from 7580 to 7270 cal BP place both sectors in the Wadi Rabah culture.

Architectural Finds In the north sector (Fig. 7.12b), there were foundations of rectangular structures, probably dwellings, and straight sections of walls c. 0.5 m wide built of two rows of undressed pieces of sandstone (Fig. 7.13). Also found were unpaved pits, paved surfaces made of small undressed stones, stone slabs, or postholes, probably of huts.

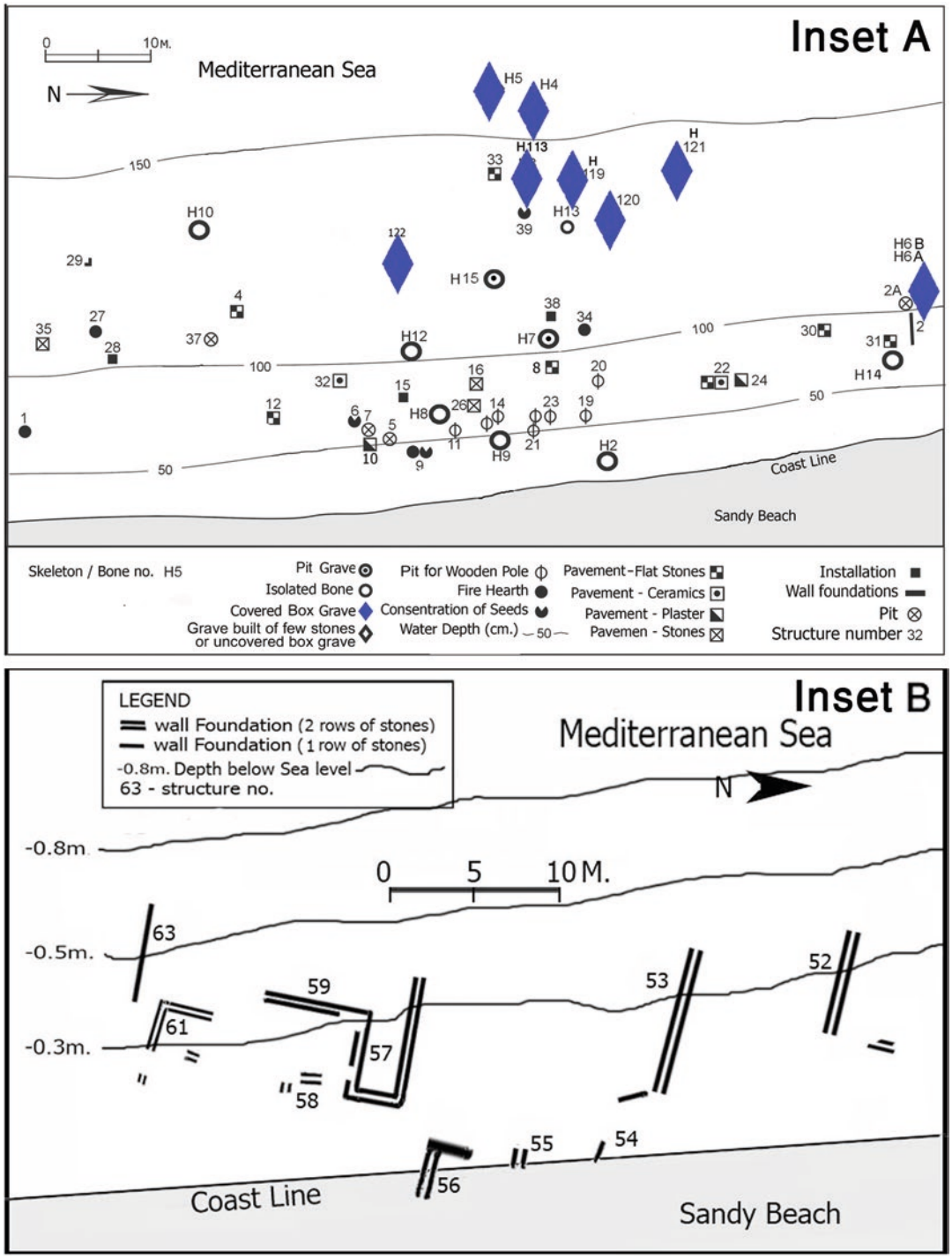

Fig. 7.12 Plan of the Neve-Yam south site: (A) Graveyard area, (B) Dwelling area (E. Galili)

Fig. 7.13 Rectangular dwellings at Neve-Yam (J. Galili)

The southern sector contained graves, hearths, paved surfaces and remains of small structures, pottery vessels (Fig. 7.14), flint and ground stone artefacts and plant remains. Of particular interest is the fact that this south sector was used primarily for burial in stone-built cist graves arranged in an organized pattern (Figs. 7.12.A, 7.15a, b). Thus, a clear division is discernible between the northern sector of the site, used as a residential area for the living, and the southern 'suburb of the dead', containing the graves.

Flint Tools The flint assemblage includes a high percentage of narrow chisels of plano-convex section, adzes, wide but short rectangular sickle blades which are backed and truncated, polished bifacial tools with polished working edges, including adzes, chisels and a low percentage of axes. Noteworthy is the absence of arrowheads.

Ground Stone Assemblage This includes basalt chalices, basalt and limestone grinding tools, limestone bowls and large basins made of Kurkar. About 6% of the ground stones in the site and also in the earlier Atlit-Yam site are perforated stone weights. These could have been used for fishing nets (Galili et al. 2002, 2004).

Ceramics The ceramic assemblage of Neve-Yam South is very similar to that initially collected by Wreschner in the 1960s, and to other Wadi Rabah sites in the Southern Levant. It consists mainly of bowls, spouted vessels, hole-mouth jars, bow-rim jars and pithoi, all decorated by painted, incised and applied elements. Of special interest is a sherd fragment with an incised decoration of fishes and a herringbone design (Fig. 7.14a).

Figurines A schematic, anthropomorphic stele made of Kurkar was recovered near the burial area. Also recovered from the burial area was an anthropomorphic figurine engraved on bone (Fig. 7.16). A third anthropomorphic figurine made of greenstone was found on the shore (Fig. 7.17) (Galili et al. 2016).

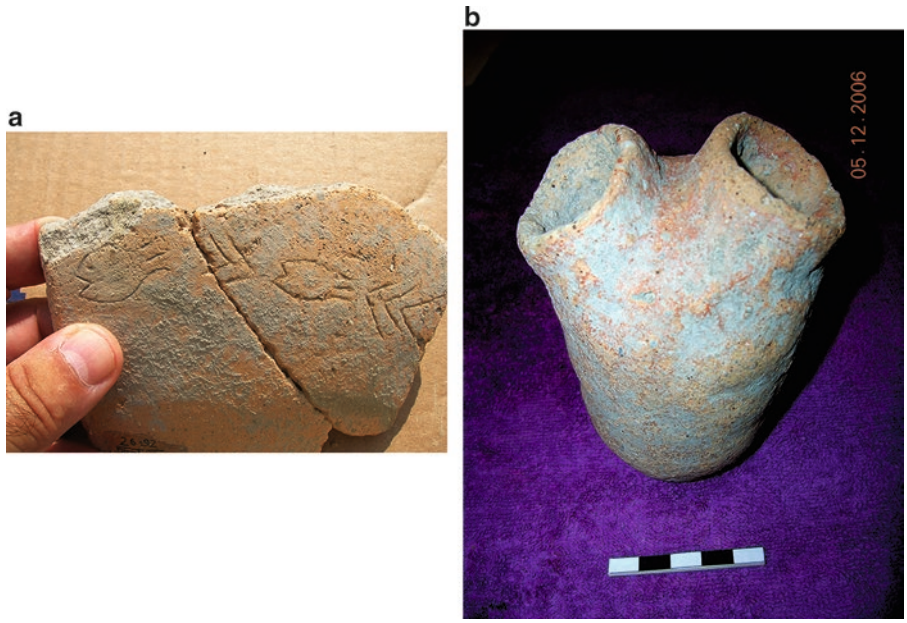

Fig. 7.14 Neve-Yam: **a** Fragment of a pottery vessel with incised fishes and herringbone design, **b** Pottery vessel with two openings (E. Galili)

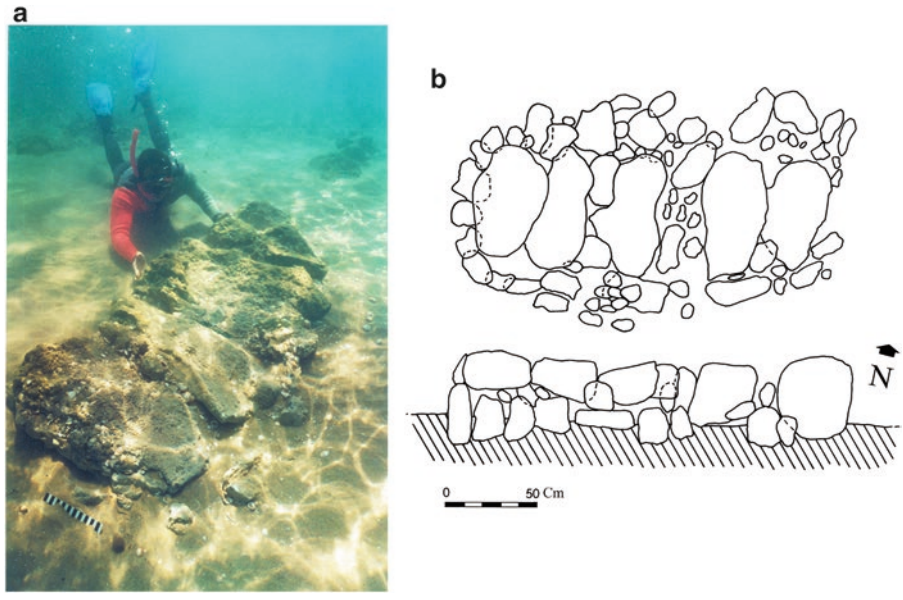

Fig. 7.15 Neve-Yam: **a** Stone-built cist grave, **b** drawing and section of the cist grave (E. Galili)

Botanical Remains Three large concentrations of charred seeds, possibly associated with the burials, were recovered in the southern part of the site. Concentration #1 (Fig. 7.12a, no. 6) comprised about 300 cc of seeds mixed with clay, all identified as domesticated lentils (*Lens culinaris* var. *microsperma*) (Galili et al. 2009). The seeds varied in size and some were infested by pests, probably a

Fig. 7.16 Neve-Yam: anthropomorphic bone Figurine (E. Galili and L. Zeiger)

Fig. 7.17 Neve-Yam: anthropomorphic Figurine made of greenstone, 5.7 cm high (Israel Museum)

Fig. 7.18 Neve-Yam: a concentration of charred legumes found near burial H3 (Concentration #3). (J. Galili)

beetle of the genus *Bruchus*. Concentration #2 (Fig. 7.12a, no. 9) comprised about 100 cc of grains mixed with clay, including seeds of various shapes and sizes that were concentrated in a hearth built of burnt mud bricks. About 90% of the grains were of domesticated barley (*Hordeum sativum* = *H. vulgare* L.). In addition, several seeds of edible plants and wild plants were recovered: domesticated emmer (*Triticum dicoccum*), one seed of *Vicia* sp., a few seeds of the Liliaceae family and several unidentified seeds. Concentration #3 comprised about 300 cc of seeds free of clay (Fig. 7.12a, no. 39, Fig. 7.18), and was found c. 1.5 m east of burial H3. This sample consisted of several species of pulses apparently domesticated, including (by frequency): pea (cf. *Pisum Vicia narbonensis*), vetch (*Lathyrus cercula*), horse bean (*Vicia faba* var. *minor*), lentil (*Lens culinaris* var. *microsperma*), domesticated flax (*Linum usitatissimum*), and remains of a few wild plants or weeds of Galium, of the genera Lolium and Liliaceae. The presence of field weeds and wild plants in the seed assemblages seems to indicate harvesting in cultivated fields. Barley and the pulses are harvested in the spring, while wheat is usually harvested in early summer. The under-representation of barley may be of significance, hinting at a spring event.

Faunal Remains A small faunal assemblage (NISP = 91 identified bones) was recovered during the 1960s salvage excavation and from collections along the sea-shore by Wreschner, and was described by Horwitz (1988). The subsequent 1989–1885 surveys yielded a more substantial faunal collection (NISP = 380 identified bones) but the remains were hand-collected during dives and so primarily consisted of large, relatively complete elements (Horwitz and Ducos 2005; Horwitz et al. 2006). Both collections indicate an animal economy based on four domestic herd animals: sheep (*Ovis aries*), goat (*Capra hircus*), cattle (*Bos taurus*) and pigs (*Sus scrofa*). The few remains of wild species that were recovered are mountain gazelle (*Gazella gazella*), badger (*Meles meles*) and perhaps wild boar (*Sus scrofa ferus*), attesting to the continuation of hunting, but also to its relative unimportance as a subsistence activity. Two-thirds of the ungulates were immature, a kill-off pattern indicative of herd management aimed at meat procurement. Analysis of cut marks indicates that animals were butchered and consumed on-site using a variety of stone tools (Greenfield et al. 2006). The scanty fish remains may indicate that the role of fishing was limited, or it may result from the fact that smaller-sized bones, such as fish bones, were missed because of recovery by hand-collection during dives.

7.2.8.1 The Neve-Yam Burial Ground

The burials were concentrated in a relatively small area, 40 × 70 m. The cist graves (Figs. 7.11A, 7.12A, 7.15a, b, and 7.19) were oriented in an east–west direction and consisted of an oval burial chamber lined with undressed stones covered by large stone slabs. Altogether, 11 graves were located, of which

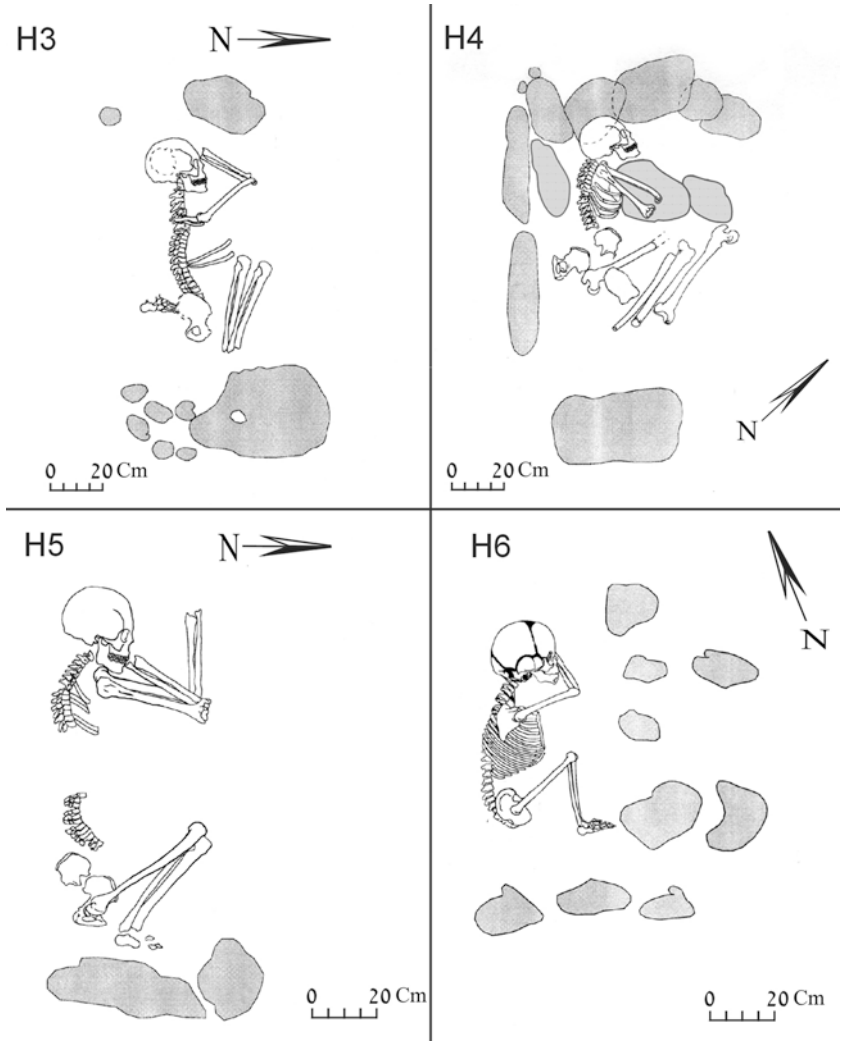

Fig. 7.19 Burial positions of skeletons from Neve-Yam south site (After Galili et al. 2009)

two were covered cists, four were uncovered cists, two consisted of a few undressed stones in the clay, and three were pits dug into the clay. Some cist graves were eroded by sea action with only the skeletons and a few stones remaining. Four such eroded graves were excavated. No grave offerings were recovered within the excavated graves. However, the three charred seed assemblages found in the vicinity of the graves and the nearby hearths and paved surfaces, may be related to the burials and/or ritual activities, e.g., ceremonial meals that took place near the graves.

Human Skeletal Remains The sample consists of an estimated 15 individuals (Galili et al. 2009). Six skeletons, either primary or disturbed burials, were recovered from the graves. Nine additional individuals were represented by scattered bones. Four skeletons were buried in a fully flexed position, and four were partly flexed (Fig. 7.19). Eight children aged up to 10 years, one adolescent (10–18 years) and six adults were identified. Among the adults were three females, one male and two individuals of unknown gender. No charred bones or group burials were found. An unusual pattern of tooth attrition (oblique wear) was noted in one of the adult individuals suggesting use of the teeth as a working tool (Galili et al. 2009).

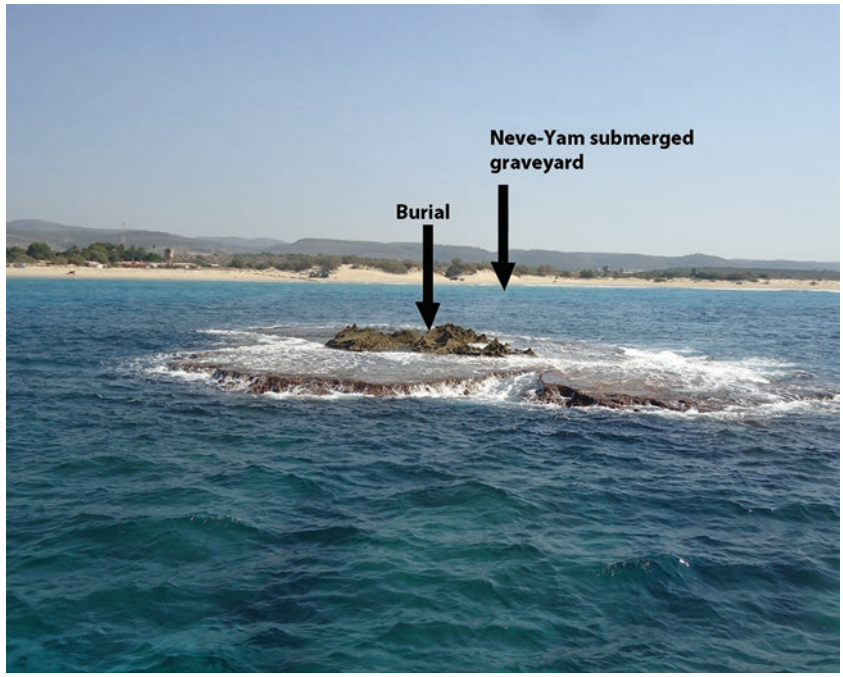

Fig. 7.20 The Tmanun islet looking east and the location of the infant burial

7.2.8.2 The Neve-Yam Baby Burial on the Tmanun Islet

During October 2014, burial remains were identified on the rocky Tmanun islet located opposite the site of Neve-Yam, presently c. 140 m off shore (located at 34° 55′ 32.7″ E, 32° 40′ 39.2″ N) (Figs. 7.11 and 7.20). The remains were embedded in a mass of conglomerate (60 × 40 × 30 cm) adhering to the Kurkar bedrock, some 60–100 cm above the present sea level. The human remains included a skull cap (calvarium), parts of a jaw with three teeth, long bones and fragments of ribs of a 1–2 year-old infant (Fig. 7.21). They were associated with a broken fragment of a bowl with an elongated nozzle. It is proposed that the burial took place in the PN period, when the sea level was lower by c. 7–8 m and the Tmanun islet was a prominent sandstone hill on the coast, partly covered by sand and facing the open sea.

7.3 Discussion

The Development of the Traditional Mediterranean Subsistence Economy At the end of the tenth millennium BP, a mixed mode of subsistence that included farming, animal husbandry, hunting and fishing evolved among the indigenous coastal inhabitants on the Levantine coast. This is shown by the archaeological remains recovered from the submerged PPNC site of Atlit-Yam (Galili et al. 2002, 2004), and possibly also from the terrestrial coastal sites of Ras Shamra in Syria and Ashqelon in Israel (Van Zeist and Bakker-Heeres 1984; Helmer 1989; Perrot and Gopher 1996; Garfinkel and Dag 2008). Galili et al. (2004) have noted that this represents the earliest appearance of the Mediterranean-Levantine fishing village. It is suggested that, subsequently, this coastal-adapted subsistence system continued to evolve locally in the PN, and also spread westward throughout the Mediterranean basin via sites on the Anatolian coast, e.g., Mersin-Yumuktepe on the Cilician coast, Coşkuntepe in western

Fig. 7.21 Skull calvarium of a 1–2 year-old infant from Tmanun Islet near Neve-Yam

Anatolia and Karağaçtepe on the Gallipoli Peninsula (Lichter 2005; Takaoğlu 2005) and on to countries and areas located further to the west (Galili et al. 2002, 2004).

Overall, the subsistence mode of the submerged PN settlements on the palaeo-coast resembles that of their terrestrial counterparts (e.g., Gopher and Gophna 1993; Horwitz et al. 2002; Horwitz 2012) but with the addition of marine resource exploitation, primarily of fish.

Exceptional finds in the submerged Wadi Rabah sites are the installations and artefacts associated with olive oil extraction. In contrast to the botanical assemblage from PPNC Atlit-Yam, in most PN sites thousands of olive stones were recovered. This change may be seen as the beginning of intensive exploitation of olives for human consumption. Olive oil extraction, probably from wild olives, seems to be a PN innovation, first attested to in these submerged Wadi Rabah sites (Galili et al. 1997). Later still, during the fourth millennium cal BC, more plants were introduced into the subsistence economy such as the domesticated grape vine, which enabled the production of wine in the Levant (Zohary and Hopf 2000). By 3000 cal BC, the commonly termed 'traditional Mediterranean diet' had evolved (Galili et al. 2002, 2005), a complex defined by Butzer (1996) as based on cereal agriculture (primarily of wheat and barley), cultivation of fruit trees (olives, grapes, almonds and figs), vegetable gardening and husbandry of domestic caprines (sheep and goat) for meat as well as secondary products (milk and wool), while cattle were exploited as beasts of burden and for traction, as well as for other purposes.

Material Culture in the Submerged Sites In terms of material culture—lithic tools and technology, ground-stone artefacts and ceramics—there are no marked differences between the submerged Wadi Rabah sites and their terrestrial counterparts in the southern Levant (e.g., Gopher and Gophna 1993). However, one of the notable innovations on the coast is the construction of water wells built of wooden branches and stones. These are considered some of the earliest known wooden constructions. In contrast, the wells at the submerged PPNC site of Atlit-Yam, which pre-date the PN wells by ~1000 years, were lined only with undressed stones (Galili and Nir 1993; Galili and Rosen 2011a, Galili et al. Chap. 6).

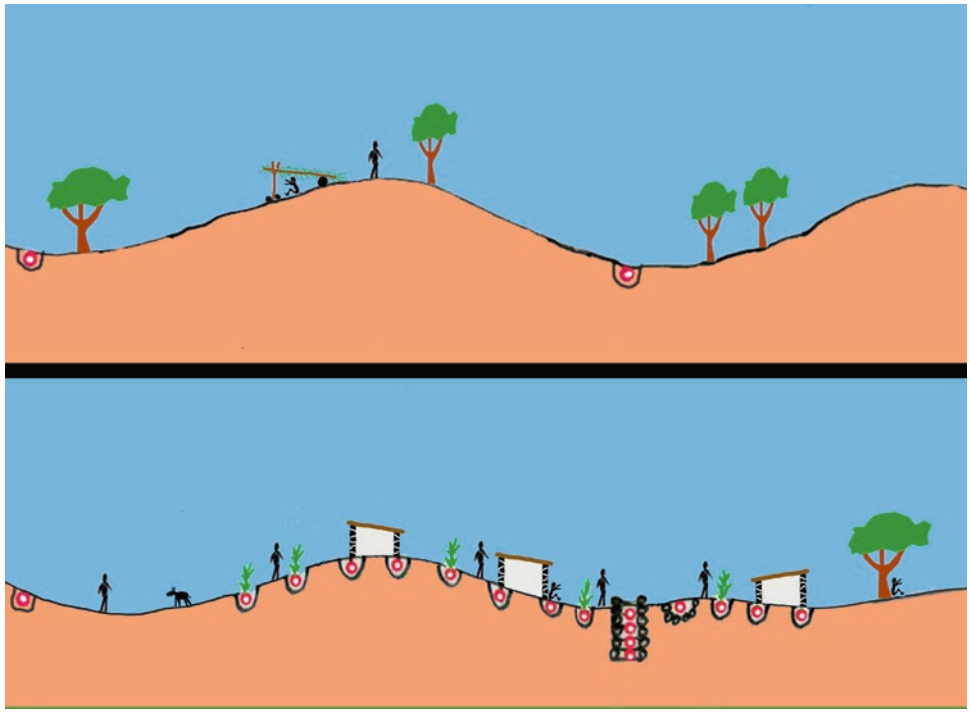

Fig. 7.22 Drawing illustrating the difference in the intensity of sub-soil excavations for pits, refuse, burials, wells etc. in a permanently occupied settlement (*lower*) and a temporary camp site (*upper*)

Mortuary Practices and the Emergence of Separate Graveyards Gopher and Eshed (2012) suggested that the burials found outside dwellings in many of the PN sites in the southern Levant were a product of socioeconomic and cultural changes. They referred to the two-dimensional distribution. The vertical dimension however, is associated with intensive excavation beneath the soil surface to create burial pits, which played a major role in settled Neolithic farming communities. Even during the Pre-Pottery Neolithic, sedentary agriculturists dug into the sub-surface intensively and systematically (Bar-Yosef 2001; Bar-Yosef and Belfer-Cohen 1991). The excavation work required would have resulted in considerable soil disturbance often within settlements or adjacent to them. Aside from the cultivation of fields, the appearance of extensive food storage facilities such as silos and pits after 9500 BP (Kuijt 2000) would also have disturbed the local sub-soil. In the PN, the digging of water wells, house foundations, and refuse and storage pits is included in this 'invasion' of the sub-surface. These combined factors must have greatly increased the number of intentional penetrations of the sub-surface in and immediately around settlements, resulting in the exposure and disturbance of older burials within sites settled for generations, centuries or even millennia (Fig. 7.22). This may have provoked frequent but unintended conflict between the use of ground for burials and their use by the living for cultivation, building, storage, refuse disposal and so on. Several forces may thus have influenced the separation of burial areas from residential ones as evident in Neve-Yam:

(a) Practical: hygienic and aesthetical considerations of smell, diseases etc.

(b) Lack of space: competing needs, especially the need to keep burials free from disturbance by other activities

(c) Social: at home the deceased ancestors and graves would have been the responsibility of the family, while in a common graveyard they are also a communal responsibility

(d) Ideological/symbolic: taboos and issues of purity versus impurity—the dead may not be pure and are thus not suitable to reside with the living but belong to the next world and should be kept apart from residential areas (Bartel 1982; Fahlander and Oestigaard 2008; Kuijt 2008).

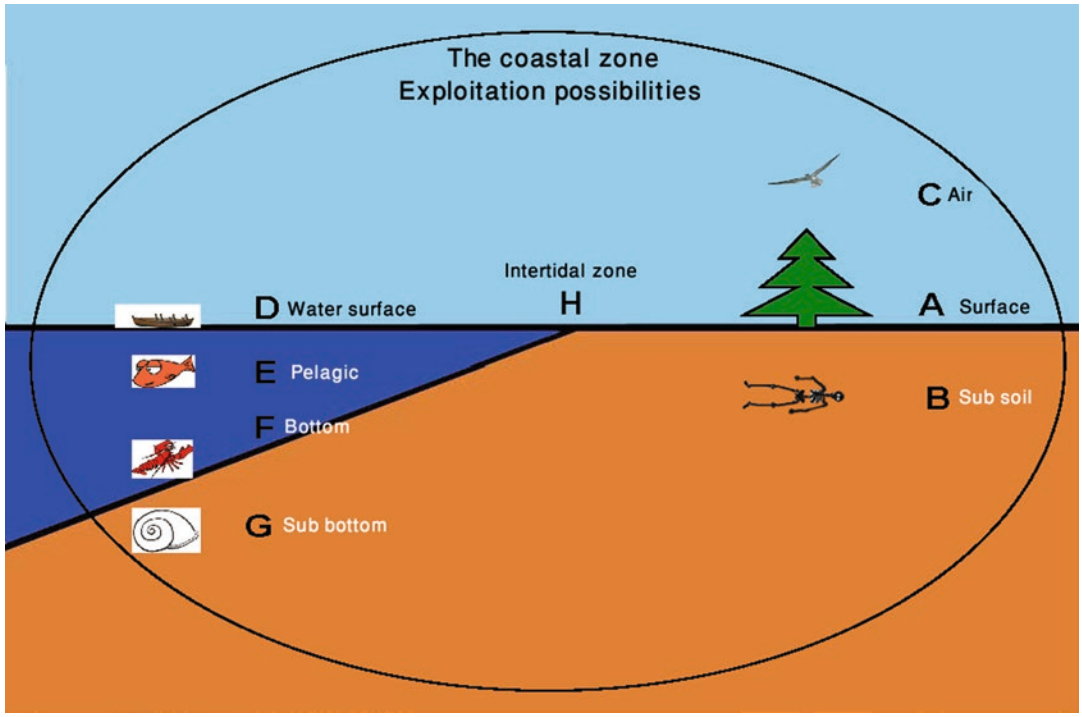

Fig. 7.23 Schematic diagram showing the diversity of economic resources available in the coastal zone

Thus, the well-preserved submerged settlements discovered off the Carmel coast enable us to trace the significant changes that took place in burial practices from the late PPN to the late PN periods. A unique feature of these submerged PN fishing villages is the evidence for a separate burial ground. In the earlier PPNC site of Atlit-Yam, burials lack grave structures, and are scattered all over the site (Galili et al. 2005; Eshed and Galili 2011). In PN Neve-Yam, the graves are stone-built cists, a form known from the very beginning of the PN in terrestrial sites such as Byblos (Dunand 1973), Sha'ar Hagolan in Israel (Stekelis 1972) and Tabaqat Al-Buma in Jordan (Banning 1995; Banning et al. 1996,). The significance of the Neve-Yam burials is their organized pattern and concentration in a separate area of the site, set apart from the residential area. The presence of an organized burial area with standardized grave types outside the dwelling zone, accompanied by ritual and symbolic activities, should be considered as a burial ground or cemetery (Galili et al. 2009). The presence of agricultural products, perhaps representing offerings or leftovers of ritual or ceremonial feasts close to the graves, may reflect the later well-known practice of offering part of the harvest to the ancestors and gods as reflected in local archaeology, regional myths and biblical sources. Separate burial grounds with all these features are unknown in other PN sites in the region. The motivation to develop separate burial grounds may have been associated with the necessity to resolve 'territorial friction' between the living and the dead over the use of sub-surface space. During the late Chalcolithic period this mode of burial became the most common burial practice, and it is common in many human societies up to the present-day.

The Abandonment of Sites The earlier PPNC site of Atlit-Yam had been abandoned due to a global rise in Holocene sea-level from −16 to −8 m below sea level (See Galili et al. Chap. 6, Fig. 6.6). This sea-level rise resulted in salinization of PPNC water wells, and flooding of fields and homes. Relative to the PN sites, Atlit-Yam lies in deeper water off the Carmel coast, implying that post-PPNC settlements shifted inland and were established on the new coastline further to the east. However, the cur-

rently submerged PN settlements were also gradually abandoned following additional sea-level rise, from −8 m to the present level (Galili et al. 2008, Galili et al. Chap. 6, Fig. 6.7). Post-PN occupation of this region on the new coastline was less intensive, perhaps because the Carmel coast became quite narrow and marshy as the sea level rose.

The ever-changing coastal environment required ongoing adaptation, with changes of settlement location and subsistence strategies. Artificially raising the fresh water level of Atlit-Yam wells by adding a layer of stones is an example of such an adaptation (Galili and Rosen 2011a). However, the coastal dwellers were compensated for these difficulties by the diverse possibilities offered by the coastal zone for the exploitation of terrestrial and marine environments and resources (Fig 7.23).

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