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SHELLS FROM SAREPTA (LEBANON) AND EAST MEDITERRANEAN PURPLE- DYE PRODUCTION

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ABSTRACT

This paper concerns the shells from the 1969-74 excavations at Sarepta (Lebanon) under the direction of the late J.B. Pritchard (University of Pennsylvania). Most of the 500 marine shells, ranging in date from the LB I to Roman/Byzantine, are typical Mediterranean forms. Of special interest are three large accumulations of crushed *Murex trunculus* of LB II, LB III to Iron I, and LB III or Iron I date. The Sarepta shell purple-dye evidence is described in detail and is compared with the other evidence from the Eastern Mediterranean.

KEYWORDS: *Murex*, Phoenicians, Royal purple, Tyrian purple

INTRODUCTION

Located in coastal Lebanon between Tyre and Sidon, Sarepta is the site of biblical Zarephath. The site was excavated from 1969 to 1974 under the direction of the late J.B. Pritchard. He entrusted the publication of the faunal remains to the author, and this is the first of several planned studies to be published. The material is stored in the Mediterranean Section, University of Pennsylvania Museum, Philadelphia.

Previous reports on the excavation include Pritchard 1971, 1975, 1978, 1988; Koehl 1985; Anderson 1988; and Khalifeh 1988.

The late W.P. Anderson very kindly provided all contexts and phasing. For specific details on Area X,K see Khalifeh (1988) and for Area Y see Anderson (1988).

THE SHELLS

The study is divided into two sections. The first is on the species found presented in order of quantity preserved. The second part deals with the Sarepta and East Mediterranean evidence for shell purple-dye production.

For the entire site there are a minimum number of 501 marine shells. There are 226 shells (45.1%; 41 deposits) from Area X including 158 (69.9%) from one crushed *M. trunculus* sample. There are 136 shells (30 deposits) from Area X,K with 39 (28.7%) from one crushed *M. trunculus* sample. Finally, there are 139 from Area Y (16 deposits) with 120 of these shells (86.3%) from one crushed *M. trunculus* sample.

The shells come from the following periods: six LB I (six deposits), two LB I-II (one deposit), 114 LB II (22.8%, 24 deposits; 49 *M. trunculus* with one crushed sample with 35 MNI), eight LB III (six deposits), 16 LB II/Iron I (five deposits, ten *M. trunculus*), 158 LB III or Iron I (31.5%, one deposit, a crushed *M. trunculus* sample

with 150 MNI), six transitional LB III/Iron I (two deposits), 119 LB III to Iron I (23.8%, one crushed *M. trunculus* deposit which also has very many small water-worn gastropods), 22 Iron I (six deposits), one Iron I-II, 26 Iron II (ten deposits; 13 *Arcularia* from one deposit), nine Iron II-Persian (four deposits), six Persian-Hellenistic (five deposits), seven Hellenistic (six deposits), four Hellenistic-Roman (two deposits), five Roman/Byzantine (three deposits), and nine Mixed to Modern (three deposits). So 133 (26.5%) are clearly LB while 57 (11.4%) are Iron II or later. Details are provided in the Catalogue, below.

Murex and Thais

There are 297 *Murex* (=Hexaplex, =Trunculariopsis, =Phyllonatus) *trunculus* (rock murex) individuals (59.3% of all shells present), mainly found in three large accumulations: 150 MNI (925 fragments, LB III or Iron I), 68 MNI (625 fragments, LB III to Iron I), 35 MNI (100 fragments, LB II). These three samples make up 85.2% of all *M. trunculus* found.

There are 28 *Thais* =Purpura, =Stramonita *haemastoma* rock shell or oyster drill, from 25 deposits. There are ten shells water-worn and another also collected dead. They are found in small numbers, including 18 from 15 LB II deposits. While this species could be used to produce shell purple-dye, there is no evidence that it was used for this purpose at Sarepta.

There is only one water-worn LB III or Iron I *Murex* (=Bolinus) *brandaris* (dye murex).

Tell Ta'annek in the northern West Bank (30 km from the Mediterranean) produced a small number of *Murex* and *Thais*: 13 LB I (of 218 marine shells), 10 LB II (of 48 shells), eight Iron I (of 56 shells), seven Iron II (of 120 shells), and one Persian (of eight shells). Twelve of the 38 LB and Iron Age (IA) shells are holed

(Ezzughayyar and Al-Zawahra 1996, 77, 79) and are probably ornaments.

Murex and *Thais* from other Near Eastern sites are noted elsewhere (Reese 1995, 266-67). The use of these shells in shell purple-dye is described later in this paper.

Charonia

There are 29 *Charonia sequenzae* (= *C. variegata*), trumpet or triton shells, with 22 from Area X. Six are water-worn. They are distributed as follows: five LB II (one water-worn, five deposits [with two samples from one Area Y deposit]), one LB II/Iron I, one Iron I (water-worn), one Iron I-II, four Iron II, two Iron II to Persian (one water-worn, two deposits), two Late Iron II to Hellenistic (one water-worn, two deposits), three Persian to Hellenistic (two deposits), four Hellenistic (one water-worn, three deposits), one Hellenistic to Roman (water-worn), one Hellenistic to Roman / Byzantine, one Roman/Byzantine, one Byzantine to Modern, and one Mixed.

There is no evidence that any of these were modified into shell trumpets or vessels, as known from elsewhere in the Mediterranean basin (Åström and Reese 1990, Reese 1985, 353-64).

Ta'anek yielded one LB II *C. sequenzae* (Ezzughayyar and Al-Zawahra 1996, 77). LB Tel Nami in Israel produced a *Charonia* (Bar-Yosef Mayer 2007, 278). IA Kadash Barnea produced four *Charonia* fragments (Bar-Yosef Mayer 2007, 276, fig. 18.11). A broken specimen was found in a probable Hellenistic context at Horvat 'Eleq (Bar-Yosef Mayer 2000b).

Tell Rifa'at, over 100 km from the Mediterranean coast in Syria, produced a large (L 255 mm) almost complete Hellenistic *C. variegata* from the 1960 excavation (Biggs 1967, 77, 1970, 425, pl. XVIIIc). The excavator says it was "cut for blowing" (Seton-Williams 1967, 71) but Biggs (1970)

notes that "it was not holed at the apex for blowing" and his photograph shows that it was not modified. Two fragments of a Hellenistic example are known from Jerusalem (Mienis 1992, 123). The Late Roman-Byzantine farmhouse at Horvat Raqit in northern Israel produced a *C. variegata* body fragment and a complete *Charonia* was found on the floor of a Byzantine house in Jerusalem (Mienis 2000). There is one unstratified broken *Charonia* from Busayra in Jordan (Reese *et al.* 2002, 462). Apamée in Syria produced a rather complete *Charonia* with an open apex and broken body (Gautier 1984, 312, pl. LXXI: 8).

Arcularia and Hinia

There are 28 *Arcularia* (= *Nassarius*, = *Nassa*) *gibbosulus*, nassa or basket shells, with one LB II, 13 Iron I (two deposits), 13 Iron II (one deposit), and one Iron II to Persian. None of these shells have been modified (one water-worn shell from the Area Y LB III to Iron I crushed *M. trunculus* sample is naturally holed near the apex) although these forms are a frequent bead at other Near Eastern sites (Reese 1991, 135, figs. 81-82, 1995, 267; Ezzughayyar and Al-Zawahra 1996, 79; Baruch *et al.* 2005, 142-43, fig. 8).

There are five *Hinia costulata*. Three were found in one Iron I deposit along with the nine *Arcularia*. The Area Y LB III to Iron I crushed *M. trunculus* sample also yielded one water-worn *Hinia*. One water-worn Hellenistic-Roman shell was found inside a *Charonia* shell.

Glycymeris

There are 15 *Glycymeris* (= *Petunculus*) *insubrica* (= *G. violascens*), dog-cockles or bittersweet clams, including 13 water-worn and eight holed at the umbo (bivalve "beak"). They are distributed as follows: one LB I (water-worn and holed

umbo), five LB II (three water-worn, one holed umbo, one with umbo a bit ground-down but unholed), two LB III (two water-worn, one holed umbo), one LB III/Iron I (water-worn), four Iron I (four water-worn, four holed umbo), and two Iron II (two water-worn, one holed umbo).

There is also a water-worn Hellenistic to Roman / Byzantine *Glycymeris pilosa* which may have been used as a small container or dish.

Glycymeris, often holed at the umbo, are known from numerous other Near Eastern sites (Mienis 1992, 125-26; Reese 1995, 265-66, 2002a, 277-78). A few recently published examples are noted here.

Ta'annek produced mainly *Glycymeris*, usually holed at the umbo: 140 LB I (of 218 marine shells, 64.2%), 33 LB II (of 48 shells, 68.8%), 40 Iron I (of 56 shells, 71.4%), 90 Iron II (of 120 shells, 75%), seven Persian (of eight shells), and one Hellenistic (of two shells) (Ezzughayyar and Al-Zawahra 1996, 77).

From the 1992-96 excavations at Megiddo the LB II Level F-9 produced 219 marine shells with 98.2% *Glycymeris*, the LB II Level 4 had 24 shells with 14 *Glycymeris*, the Iron I-II Level F-5 62 shells with 96.8% *Glycymeris*, the Iron I-II Level K-4 27 shells with 20 *Glycymeris*, and the Iron II Level H-3 64 shells with 82.8% *Glycymeris* (Bar-Yosef Mayer 2000c, 479, figs. 16.2:5, 16.3: 18-20).

They are the most common shell at LB-IA Tell Abu Hawam in northern Israel, with 1930 valves (1580 MNI) with 92 holed (68 naturally, two gastropod-bored, 22 holed by man) (Baruch *et al.* 2005, 136, fig. 3.1:9).

Kadesh Barnea produced numerous *Glycymeris*: Iron IIA: 13 (nine holed umbo); Iron IIB: 11 (five holed umbo); Iron IIC: 14 (9 holed umbo), and Mixed: 13 (five holed) (Bar-Yosef Mayer 2007, 273-76, figs. 18.2,7).

Conus

There are ten *Conus mediterraneus* spanning all periods, including two Iron I and two Hellenistic. Three cone shells were collected dead. One worn Iron II to Persian shell has an open apex and a ground-down distal end and was probably a pendant. A Byzantine to Modern shell has an open apex and a hole on the side near the apex and was also probably a pendant.

Ta'annek produced ten *Conus*, including eight holed at the apex and one holed on the body whorl. Five are dated EB III, two LB I and three Iron II (Ezzughayyar and Al-Zawahra 1996, 74, 77, 79). At Megiddo there are two water-worn and apically holed *Conus*, one of Iron I-II date and the other from a mixed context (Bar-Yosef Mayer 2000c, 481, 482, figs. 16.2:4, 16.3:12).

At LB-IA Abu Hawam there are 69 (60 MNI) with 20 holed (14 naturally, one gastropod-bored, five holed by man) (Baruch *et al.* 2005, 136).

Phalium

There are three *Phalium* (=Semicassis, =Cassis, =Tylocassis) *saburon*, a helmet shell: two LB II, one Roman to Byzantine. One LB specimen is a lip carefully cut from the body (Reese 1989, 36, fig. 9). I have elsewhere dealt with these cassid lips (Reese 1989), including the LB examples from Megiddo (old excavations), Ta'annek, and Beth Shan. The Late LB IIB Beth Shan example, with a hole at one end, has been illustrated (James and McGovern 1993, 201, fig. 58:22).

Ta'annek produced 25 *Phalium*, including 13 water-worn lips. The phase distribution of the lips is unclear, but the distribution of all *Phalium* remains is: one EB II-II, one MB I, 17 LB I, and five Iron II (Ezzughayyar and Al-Zawahra 1996, 77, 80).

The 1992-96 excavations at Megiddo have also produced helmet shells and lips, with lips of Iron I-II, Iron II (burnt), mixed date, and one of unknown date (Bar-Yosef Mayer 2000c, 482, 483, fig. 16.3:15).

Iron IIA Kadesh Barnea produced a polished cassid lip and from the Iron IIB a naturally polished cassid lip (Bar-Yosef Mayer 2007, 272, 274).

Tel Migne/Ekron in southern Israel produced seven *Phalium* lips, with two Early Iron I, three Iron I, one Late Iron I and one undated.

Other shells

There are 14 *Euthria cornea*, a whelk, spanning the LB II to Iron II. The LB II crushed *M. trunculus* sample produced one shell, seven came from the LB III or Iron I crushed *M. trunculus* sample and two water-worn apex fragments from the Iron I crushed *M. trunculus* sample.

There are six fresh *Tonna* (=Dolium) *galea* (tun shell, dolium shell, cask shell). Four separate LB II deposits in Area X,K produced remains. Two deposits in II-A-8, level 9 produced fragments which might come from the same individual. There are also fragments from the LB III and Hellenistic to Roman/Byzantine periods. Megiddo produced a Roman and an undated example (Bar-Yosef Mayer 2000c, 482, 483, fig. 16.3:3).

There are five *Luria* (=Cypraea, =Talparia) *lurida* with three LB II (two from one deposit), one Iron II, and one Iron II-Persian. There is also one LB II *Erosaria* (=Cypraea, =Zonaria) *spurca*. None of these cowries have been modified.

There are four fresh *Patella caerulea* from: LB I, LB I-II, LB III/Iron I, Roman to Byzantine. These are likely to be food debris.

There are three vermetids (worm tubes): one LB I (burnt black), one LB II, and one LB III (could be strung).

There are two *Gibbula varia*, topshells, from one LB II deposit. These, like the four *Patella*, could be food remains.

There is one LB I *Acanthocardia* (=Rudicardium) *tuberculata* (red-nosed or knotted cockle) valve which is water-worn and probably has a hole at the umbo. Umbonally holed cockles are known from other Near Eastern sites (Reese 1991, 134, 1995, 267; Ezzughayyar and Al-Zawahra 1996, 75, 77, 78).

There is one fresh LB II *Macra corallina* (trough shell) valve. LB II Ta'annek also produced one holed shell (Ezzughayyar and Al-Zawahra 1996, 76, 77).

There is one fresh LB II *Spondylus gaederopus* (spiny or thorny oyster) valve.

There is one water-worn Hellenistic to Roman *Columbella rustica* (dove shell) found inside a *Charonia* shell.

There is one Late Hellenistic *Fasciolaria lignaria* (tulip, band, or spindle shell) with an irregular hole on the body and an open apex and was probably a pendant. Roman Jerusalem also produced an example with an open body (Reese 1995, 267).

The Area Y LB III to Iron I crushed *M. trunculus* sample is composed of mainly water-worn fragments. In addition to the 625 *M. trunculus* fragments (12 burnt) there are: four *Arcularia*, two *Euthria*, one *Hinia*, and 41 other shells of four small gastropod species not previously found at Sarepta: *Alvania montagui*, *Cantharus d'orbigny*, *Mitra* sp. and *Rissoa* sp. These are considered chance specimens which came to the site when the *Murex* sample was picked up on the coast and brought to the site, probably to be used as fill.

Fresh-water Shells

Area X produced a large fresh-water bivalve hinge fragment from Phases III-IV (LB II-III), II-A-2, Locus 6-8 (L-923-16).

Unstratified in Area X,K are a *Unio* (right valve, broken, H 33.5) and a large fresh-water bivalve hinge fragment (II-B-9; L-923-258c).

Land Snails

The LB I in Area Y yielded a large *Helix* (no color) (II-K-20, Locus 31-3, Stratum K1; L-923-249c). The LB III or Iron I in Area X also produced a large *Helix* (trace of color, large, L 40) (II-C-9, Level 6; L-923-251). These are edible forms, but could also be intrusions into the ancient deposits.

SHELL PURPLE-DYE PRODUCTION AT SAREPTA AND ELSEWHERE IN THE EAST MEDITERRANEAN

Twenty three years ago I surveyed the evidence for Bronze Age shell purple-dye production in the Mediterranean (1987, 203-06). This study is now out of date. More recently I have surveyed the Italian evidence (Reese 2005). This is not the place to discuss the details of this industry, which I and other researchers have presented elsewhere (Reese 1980, 1987; Jackson 1916; Thompson 1947, 209-18; Forbes 1956, 112-41; Jensen 1963, Jensen and Jensen 1965; Bruin 1970; McGovern and Michel 1984, 1985, 1990, Michel and McGovern 1987; Reinhold 1970; Spanier *et al.* 1982; Spanier 1987; Ziderman 1987, 1990; Cooksey 1994, 2001; Edens 1999; Cardon 2003, 421-67). Suffice it to say that enormous numbers of *M. trunculus*, *M. brandaris*, or *Thais* are required to produce the dye.

Here I discuss the Sarepta shell remains and their contexts and present the available shell evidence from elsewhere in Lebanon, Syria, Israel, Egypt, Turkey and Cyprus.

The Sarepta Evidence

A LB II (Period III, ca. 1350-1300 B.C.) sample from a working area in Area X,K

excavated on June 21, 1972 produced 100 crushed *M. trunculus* fragments from at least 35 individuals (II-B-8, level 8).

The main deposit of crushed *M. trunculus* was found on June 8, 1972 in a pit measuring 1 x ½ m cut to a depth of 20 cm into the floor of the room from which Kiln G was fired (Area X, II-C-9, Level 6). It dates to LB III or Iron I (ca. 1350-1200 B.C.). The quantity collected from the pit and the surface of the floor filled ten of the standard rubber buckets used in the excavation (Pritchard 1978, 126-27, figs. 121-122). The sample saved includes 925 fragments and 31 complete shells (mainly small individuals) from at least 150 individuals.

A LB III to Iron I sample in Area Y (II-K-20, Level 26, Strata E-G1; ca. 1300-1025 B.C.) produced 625 crushed *M. trunculus* fragments from at least 68 individuals, with many fragments water-worn and about 35 water-worn pottery sherds. Also present in this shell sample are four *Arcularia*, two *Euthria*, one *Hinia*, and 41 other small gastropods (*Alvania*, *Cantharus*, *Mitra*, *Rissoa*). I assume that the water-worn sherds and these water-worn shells came to the site when this largely *Murex* sample was collected from a shell purple-dye production dump on the coast and brought to Area Y, probably to be used as fill.

There is also a large murex pile in the embankment along the shore of the excavated site which appears to be Hellenistic or Roman in date, but was not excavated (personal communication from Anderson, 28 September 1996).

Three 14th/13th c. Canaanite transport / storage jar or vat / basin sherds had a purple deposit on their interiors from X,K II-A-8 (Periods III-IV, LB II; ca. 1350-1275 B.C.) and three more from X,K II-B-9 (Period V, LB II/Iron I; ca. 1275-1150 B.C.)

(McGovern and Michel 1984, 67-68, pl. 2, 1985, fig. 2, 1990, 71-72, fig. 3, color pl. F [same as 1985 published sherd]; McGovern 1990, 33; Lambert 1997, 87, fig. 4.8; Cardon 2003, 430, 431, fig. 13; pers. comm. from Anderson, 11 January 1998). Analysis showed that these were indeed from shell purple-dye.

Finally, there is a *M. trunculus* fragment with purple color on the interior from X,K II-A-8 (Period V, LB II/Iron I; ca. 1275-1150 B.C.).

Note that several authors (McGovern and Michel 1984, 67, 1985, 1990, 69, 71; Michel and McGovern 1987, 141; McGovern 1990, 33; Stieglitz 1994, 48; Lambert 1997, 87; Burke 1999, 80) are incorrect in dating the Sarepta industry to only the 13th century, while MacAdam (1990, 68) dates it to the 15th-14th century B.C.

LEBANON

Beirut

Jensen (1963, 105, 111, Jensen and Jensen 1965, 5, 22) suggested that a shell purple-dye industry near Beirut used *Janthina* spp. (called here *Helix ianthina*). However, I know of no archaeological evidence for *Janthina* from any Mediterranean site. On *Janthina* see Mienis and Spanier 1987.

Beirut (Berytus) produced a Greek inscription of the 5th-6th c. A.D. which honors a dyer of purple which had a golden cast (pers. comm. from L.J. Hall, 28 April 1995). If this refers to shell purple-dye it suggests production here as late as the 5th/6th c. A.D.

Sidon

Thompson (1947, 209) noted that the shell heaps of Sidon and Tyre were first seen by M. Ulysse de Sales in 1793. In early 1863 de Saulcy found a colossal mass of broken *M. trunculus* (de Saulcy 1864,

216-18, 1865, 283-85 fig.), with some holed shells. Nearby, in 1864 the French physician Gaillardot (1865, 1873, 750-59) discovered remains of broken *M. trunculus* as well as unbroken *M. brandaris* and *Thais*.

An 1874 article (Anonymous 1874), apparently based on the de Saulcy and Gaillardot publications, incorrectly referred to separate middens of *M. brandaris* and *Thais*, thereby misleading subsequent writers such as Born (1937, 111) and Ziderman (1987, 27, 1990, 99). Lortet (1883, 102) recorded that in the area of Sidon great banks of broken *M. trunculus* a hundred yards long and several yards thick were found. One bank of only broken *M. trunculus* was recorded as 120 m long and 7-8 m high (Forbes 1956, 118).

Cooke (1909) also visited these shell mounds. Vast numbers of *M. trunculus* were also seen during the 1914-20 excavations of G. Contenau (Cardon 2003, 430, 449, figs. 11, 31). The Jensens suggested that the Sidon industry used mainly *M. trunculus* and noted large shell mounds by the old walls of the site, by the south gate, as well as south of the site (Jensen 1963, 105, 111, Jensen and Jensen 1965, 5, 9, 22). Dunand's 1964-65 work here also noted enormous numbers of shells (1967). Dalley (1991, 124, misreading Ziderman 1987), recorded that Sidon produced heaps of "*Purpura trunculus*". It is quite clear that *M. trunculus* was used here in the shell purple-dye industry, but that *M. brandaris* and *Thais*, and probably numerous other marine shell forms, were also found along the coast.

Tyre

Murex shells were found here in 1793 (noted above) and in 1811 *M. trunculus* were found by Lord Valentin. Along the coast, the Irishman Dr. Wilde in 1839-40 (1839, 1844, 148-51, 378-80, 468-88) found

round pits cut into the sandstone which contained broken *M. trunculus* in breccia as well as heaps of murex-shell breccia. Girardin (1877) was also an early writer on the purple-dye of Tyre. Lenormant (1881, 107) noted both *M. trunculus* and *M. brandaris* from here. Tristram (1865, 48) noted large quantities of crushed and broken *M. brandaris* here. Broken *M. trunculus* were noted by Born (1937, 112 fig.). The Jensens suggested (Jensen 1963, 105, 111, Jensen and Jensen 1965, 5, 22) that the Tyre industry mainly used *M. brandaris*, and that middens around Tyre used *Janthina* (called here *Helix ianthina*).

Botsford and Robinson (1956, 401-02) noted Hellenistic production here. Chehab (1965, 114) noted a Roman deposit of crushed murex from within the industrial quarter of the city and with a Byzantine dye shop above. Jidejian (1969, 142-59, pls. 136-44) mentioned the Tyre shell evidence, noting that some of the evidence dates to the 1st c. A.D.

It is therefore worth noting the *M. brandaris* on the coins of Tyre from 112 A.D. and later (Jackson 1916, 5-6). There is textual evidence for the imperial manufacture of purple here during the reign of Diocletian (before 300 A.D.) (Eusebius, *Hist Eccles.* vii, 32) and in 383 A.D. the production became a state monopoly (*Codex Justinianus* iv. 40.1).

Thompson (1947, 209, 217) was incorrect in stating that the Tyre shell heaps consisted of only *M. trunculus* and Ziderman (1987, 28, 1990, 99) was incorrect in stating that only *M. brandaris* was used at Tyre. Kirk-Othmer (1963, 627) noted that Tyre was producing shell purple-dye as early as 3000-2000 B.C. and Aubet (1987, 290) stated that Tyre produced purple-dye between 1650 and 1050 B.C. However, I know of no reason to suggest a 17th century or earlier date.

SYRIA

Minet el-Beidha and Ras Shamra

Heaps of murex were found at Minet el-Beidha, the harbor of Ras Shamra, dated to the 15th-13th c. B.C., as well as a vessel stained with purple, and workshops for dyers (Schaeffer 1929, 290, 1931, 2, 1939, 38, 1951, 188-89, fig. 1, 1957, xxvi). Jensen and Jensen (1965, 6) published that the mounds of crushed shells dated to before the 16th c. B.C.

The local production of purple-dyed cloth are also referred to in Ugaritic texts of the first half of the 14th c. from Ras Shamra found in 1933 and 1937 (Thureau-Dangin 1934; Schaeffer 1951; Reinhold 1970, 10-11).

Tell Rifa'at

This site on the Orontes River in inland Syria, over 100 km from the Mediterranean coast, produced a large bank of crushed *M. trunculus* over 2.5 m thick outside a Hellenistic house apparently used by weavers and dyers (Seton-Williams 1967, 71; Biggs 1967, 77, 1970, 424). Biggs studied only a very small shell sample, about 20 individuals.

Palymra textiles

Textiles dyed with shell purple-dye are known from several graves of the 3rd c. A.D. (Pfister 1934, nos. T.1, T.4, T.18, T.21 and T.23, 1935, 44; Born 1937, 115 fig., 117; Vogler 2000, pl. 2).

Jensen and Jensen (1965, 5) noted that *Purpura lapillus* was used along the coast from Ugarit south to Mt. Carmel in Israel. However, this is not a Mediterranean species, but one restricted to the Atlantic Ocean.

ISRAEL

Tell Akko

In northern Israel the LB IIB (13th to early 12th c. B.C.) in Area A/B, excavated in 1980, produced large numbers of the three usable species in excavation layers, a special thick-walled vessel containing *murax* shells, and kilns. All this suggests the production of purple-dye (Dothan 1981, 111; Raban 1983, 61; Karmon and Spanier 1987, 151, fig. 6).

Area F (the Sea Gate) also produced thick layers of crushed shells dated from the 13th through the 12th c. B.C. (Karmon and Spanier 1987, 153).

In Area H, between Areas A/B and F, a fairly large number of crushed, broken, and intact shells (including the three usable species) were found dating to the Persian-Hellenistic periods (Karmon and Spanier 1987, 153, 1988, pl. 27C).

Tell Abu Hawam

This site north of Mount Carmel is today 1.5 km from the sea. The 2001 excavation in Square 5a produced a LB II-III deposit of crushed *M. trunculus*. A 0.5 liter sample produced a MNI of 155 individuals. An estimate of the minimum volume of c. 40,005 yields an estimated MNI for the deposit of 12,400 shells (Baruch *et al.* 2005, 140-41, fig. 6).

Tell Keisan

This site is today about seven km from the coast. A purple-colored large circular stripe was found on the interior of a large vessel of the Iron I period (11th c. B.C.). It was tested and shown to be shell purple-dye. In the same context were found small quantities of *M. trunculus* and *M. brandaris*, with the large shells broken and the small ones crushed. The eastern area of the tell also produced storage jars, juglets

(some containing color), and fragments of stone basins (Puech 1980, 226-27, 233 [#108-113], pls. 69, 132; Karmon and Spanier 1987, 151, fig. 2).

Capernaum

This site is about 40 km from the Mediterranean coast on the northwestern shore of the Sea of Galilee. In 1987 a cache of over 65 complete *M. trunculus* (mainly) and *M. brandaris* were found on the floor of a Byzantine house (pers. comms. from J. Russell, 17 November 1987 and V. Tzafiris, 29 February 1988).

Tel Shiqmona

Numerous *M. trunculus* and *M. brandaris* were found on the tell, but not in any concentration or related to any kind of installation (Karmon and Spanier 1987, 153, figs. 7-8, 1988, 185).

Complete and broken shells of all three species were found in undatable contexts about half a km south of the tell and may be evidence of a dye industry (Karmon and Spanier 1987, 154, 1988, 185, pl. 27D).

A number of Iron II (9th-8th c.) sherds contained purple staining which was tested and shown to be shell purple (Karmon and Spanier 1987, 154-55, fig. 9, pl. A, 1988, 185, fig. 1; Cardon 2003, 431, fig. 14).

Tel Megadim

The 1967-69 excavations directed by M. Broshi on the coast produced numerous *M. brandaris* and *M. trunculus* from Persian (5th c. B.C.) levels (personal analysis, and pers. comm. from S. Wolff, 5 March 2002).

The 1968 excavation in Locus 58, 301/4, Box 91, produced: 56 fresh *M. brandaris* (most large and five burnt gray) as well as two *M. trunculus* (one fresh, columella / part body, very large; one water-worn, open apex and body, medium/large).

Box 89 produced 54 fresh *M. brandaris* (most large and one fragment burnt gray), one water-worn *M. brandaris* (small / medium) and one fresh *M. trunculus* (distal / lip fragment, medium).

Box 90 produced 22 fresh *M. brandaris* (most large, two burnt gray) and one fresh *M. trunculus* (broken body, medium).

Tel Dor

In the Area C workshop area a thick fill layer of thousands of crushed similarly-sized *M. trunculus* were found between two Hellenistic (Stratum IV) floors. Some whole shells were also found (Karmon and Spanier 1987, 155, fig. 11; Lanigan 1989; Stern 1994, 198).

In 1986 a Persian (mid 5th c. B.C.) dump of murex, huge clay jars, and lime was found next to clay-coated basins in Area G, the center of the town, thought to be debris from the purple-dye industry (Stern and Sharon 1987, 208, pl. 27c; Stern 1994, 198-99, fig. 132).

In 1986 a purple-dye manufacturing installation of the Persian/Hellenistic period was found in Area D1, at the extreme southwestern edge of the mound. It consisted of a deep pit filled to the top with crushed *M. trunculus* and which was lined with stones at the upper edge of the pit. A small channel or canal 2 m long lead off from the pit to another pit. Near the second pit was found a small nearly square stone-lined and plastered basin next to a third pit. Along the channel, inside the basin, and in the second pit were found remains of a purple material and the soil inside the pit was impregnated with it (Stern and Sharon 1987, 208, pl. 26a; Stern 1994, 199, figs. 133-34). Other IA vessels from the site were also found to contain traces of purple coloration at the bottom (Stern 1994, 200).

Rock-cut installations along the coast here may have been used for raising murex or a dyeing installation (Raban 1981, 21; Stern 1994, 198).

Yavneh Yam

This coastal site produced many uncrushed *M. trunculus*, *M. brandaris* and *Thais* of Persian, Hellenistic, and Roman date (personal analysis). It is unclear if this is to be considered purple-dye production evidence as other shell forms are found with these three species.

Tel Mikhmoret

From the excavations of 1982-84, R.R. Stieglitz wrote (pers. comm., 20 December 1989)

"We found numerous *murex* and *purpura* shells. In two large piscinae, cut into the western edge of the tel, we also found living *murex brandaris*. I believe the piscinae are from the Byzantine era. The shells are from mixed fill, Persian-Hellenistic, Byzantine".

These shells and the rock-cut coastal features have only been referred to in passing (Porath *et al.* 1993; Stieglitz, pers. comm., 1 April 2003).

Tel Mevorakh

This site produced numerous IA shells, including *M. trunculus* and *Thais* (Stern 1978, 25, 95, pl. 45:2, 4) as well as a 4th/3rd c. B.C. dye vat (Stern 1978, 24, pl. 44:4). It may have produced shell purple-dye.

Tell Mor

There are murex of the Canaanite period here according to Raban (1981, 21 n. 16). He cited an old report of Dothan (1960, 125) for his date of this material, but it is more likely that the shell purple-dye evidence here should be dated to the Hellenistic period.

A probable dyeing workshop was found in 1959. It consisted of a deep well (locus 153) full of thousands of *M. brandaris* and next to it a large rectangular plastered basin (locus 150) and a small semi-circular plastered basin (locus 151). The area was full of Hellenistic pottery (Stratum I, largely 2nd c. B.C.) (Dothan 1959, 272, 1960, 125; Milgrom 1983, 64 fig. [photo by Reese]; Stern 1994, 195-98 [as found in late 1960s]). Horn (1968, 21, fig. 14) dated it to 4th-2nd c. B.C. Crushed shells were also found. One sample of 547 complete and fresh *M. brandaris* from the well were retained and studied (Reese 2007, fig. 12.1).

Tel Kabri

This site produced two 7th c. B.C. potsherds with a purple pigment on the interior which analysis showed was from *M. trunculus* (Koren 1994, 1995, 2003).

However, the shells from the 1986-93 excavations indicate that the dye was not produced here. The dye-producing shells found include 12 *M. trunculus* with one Late Neolithic, two Early Bronze II, eight Middle Bronze II (seven deposits) and one undated; four *Thais* with one EB IA, one EB II, and two MB II (two deposits); and one MB II *M. brandaris*, all old shells collected dead on the beach (Mienis 2003a, 28, 30, 36, 2003b, 402).

Apollonia-Arsuf

This site produced murex shells in the Persian and Hellenistic periods (Karmon 1999).

'Ein Boqeq textile

This 7th c. B.C. site on the Dead Sea produced a woolen textile which was published as dyed with shell purple (Sheffer 1987). However, Z.C. Koren (pers. comm., 18 August 2009) found that the pigment is indigo from the plant woad.

Darius I stone jar

A pear-shaped marble jar with four inscriptions praising the Persian King Darius I (Darius the Great; inscriptions in Egyptian hieroglyphs and cuneiform scripts in Old Persian, Elamite, and Akkadian) dates to 486/485 B.C. Its provenance is unknown and it is now in the Bible Lands Museum, Jerusalem.

It had its entire exterior covered with white kaolinite plaster and then painted with shell purple (probably *M. trunculus*), based on high-performance liquid chromatography and coupled photodiode array detection analyses (Koren 2008).

EGYPT

Bates' Island (Marsa Matruh)

This coastal LB to Islamic site near the Libyan border produced 2,352 shells with 311 *M. trunculus* and 45 *M. brandaris*. One fill deposit (E4-II/E west balk, 2.1) produced 19 complete shells and 640 fragments of *M. trunculus* from at least 98 individuals. While this fill deposit dates to the Roman period, all the pottery is LB and so suggests ca. 1370 B.C. purple-dye production at the site (Reese 2002b, 95, 101).

Coptic textiles

In the past two *Murex*-dyed Coptic textiles were identified (Pfister 1951, 54 [3rd c. A.D.]; Walton 1985 [5th c. A.D.]).

A purple-dyed woolen ornament on an undyed woolen background of an Egyptian mantle of the 3rd c. A.D. is apparently made from a mixture of *M. trunculus* and *M. brandaris* dye (Wouters 1992, 20).

A 3rd/4th c. A.D. tunic fabric in Philadelphia has been shown to include *M. trunculus* dye (Michel *et al.* 1992b, 78, 72).

Two Coptic textiles now in Flemish collections have been analyzed: Textile 139, an atypical textile probably imported from Per-

sia or Mesopotamia of the 8th-9th c. A.D. (Wouters 1993, 61, 63, 1995, 41, 42-43 [using *M. brandaris* or *Thais*] and Textile 10, probably of Egyptian manufacture and of the 5th or 6th c. A.D. (Wouters 1993, 61, 63, 1995, 41, 43 [probably using *M. trunculus*]).

More recent analysis of textiles from Maximianon/al-Zerqa (two) and Krokodilô excavated in the Eastern Desert in the 1990s show that they were dyed with shell purple-dye (Cardon 2003, 440, fig. 20, Cardon *et al.* 2004, 151, 152).

TURKEY

Troy

The original excavations by Schliemann in the 1880s and all later excavations at Troy have produced evidence of crushed *M. trunculus* used for purple-dye production. This evidence has recently been collected by Cakırlar and Becks (2009) and need not be repeated here. The crushed murex evidence from Blegen's 1930s excavations all seem to date to late Phase VI, ca. 1425-1300 B.C. (LB).

Murex from the more recent excavations is found in significant numbers in early Phase VI, is even more common in late Phase VI, and is the most frequent shell in Phase Vila. The Phase Via crushed *M. trunculus* from Squares KL16/17 (but found with other shell species and bones) suggest that shell purple-dye production may possibly have begun here as early as the late Middle Bronze Age (=Middle Hellenic III, ca. 1750 B.C.) and continued as late as Phase Vila (late LB). Sometimes the crushed *M. trunculus* were also used as a construction material (Cakırlar and Becks 2009, 94-97).

Uluburun (Kaş) shipwreck

This late 14th/early 13th c. B.C. shipwreck produced thousands of *Murex* oper-

cula, some still piled in stacks, which seem to be an ingredient of incense (Bass 1987, 729, 1997, 163; Pulak 1988, 5, 1994, 12, 13, 1997, 242, 1998, 204; Zideman 1992, 412). Holy Incense in the Old Testament, *onycha*, is recorded as being made from such snail opercula (*Exodus* 30.34, *Ecclesiasticus* 24.15).

It has never been found in the Levant, but some commentators (Wood 1869) think it may have been made from the powdered operculum of a Red Sea stromb shell (*Strombus*). Other ingredients may have been added, and when burned produced a fragrant odor.

The Uluburun operculae are probably a by-product of a shell purple-dye industry.

Kinet Höyük

This Mediterranean harbor town in eastern Cilicia north of Iskenderum (identified by many as Issos), today ½ km from the sea, produced large quantities of *M. brandaris* (mainly) and *M. trunculus* from the latest LB into the Late IA (6th c. B.C.).

The peak of *Murex* occurrence is in the 7th to mid 6th centuries (Periods 7 and 6). In Period 7 the house/courtyard floors are paved with thick layers of crushed *Murex*. In Period 6 *Murex* deposits have been found primarily on the east (inland) side of the mound, in an industrial area with pits, bins, and a hearth-like structure provisionally called a potter's kiln. Beside it, and near a second poorly preserved kiln on the mound edge, were two shallow subrectangular depressions which contained, together, about 200 kg of crushed *Murex*. Beside the kiln were two pisé bins filled with burnt shells, in one case already converted into lime. Some of the pottery does have a lime temper.

In 1992 a basket-handled amphora of about 600 B.C., from one of the pits near the kiln, was found containing a purple

residue (pers. comm. from M.-H. Gates, 5 February 1998).

Aperlae

Beginning in 1996, large quantities of broken and rather complete *M. trunculus* were found at this Early Roman-Byzantine site on the Lycian coast (Hohlfelder and Vann 1998, 29-31; Reese 2000, 645).

Andriake

Surface survey of this Hellenistic to Byzantine port city in southwest Turkey in 2003-2004 found concentrations of thousands of heavily crushed young *M. trunculus*. The pottery from the surface suggests that dye production took place in the Late Roman period, post 6th c. A.D. in date (Forstenpointner *et al.* 2001, 2008, 253-56).

CYPRUS

Hala Sultan Tekke

At this south coast site, Area 8 produced large quantities of crushed *M. trunculus* shells in lime floors in 1972: *c.* 475 fragments (F 1048, Late Cypriote IIIA2, ca. 1200-1190 B.C.); *c.* 140 (F 1028, LC IIIA), 38 (F 1051, LC IIIA2) (Demetropoulos 1979, 137-38; Olofsson 1977, 63, 65; Hult 1978, 4-5, fig. 19). While the F 1051 sample removed for study was only 38 fragments, it was noted (Olofsson 1977, 63) that "Northwest of Wall F 1023, in F 1051, Layer 4 practically consists of purple shells (murex)".

In 1977 more of this layer of crushed *M. trunculus* was found (Åström 1981, IV; Hult 1981, 3, 5, 8-10, fig. 43 [F 1175]). In 1980 the floor packing in Area 8, Room 13, produced *c.* 60 *M. trunculus* fragments (Reese 1988, 59, fig. 30b). In 1981 the Area 8 Room 34 South, East, layer 5 (LC IIIA2),

produced 1154 *M. trunculus* fragments (208 MNI).

In Area 8 the courtyard of Building A yielded two heaps of crushed murex (Åström 1986, 11). Two other rooms also produced crushed murex above the floors (Åström 1986, 12).

The 1990 excavations at 6-7 m depth in the LC IIIA1-2 well F 1750 produced over 200 *M. trunculus* fragments (38 MNI) (Reese 1998, 137).

A number of 1995 samples produced *M. trunculus* fragments: the Area 8 Room 86E, Layers 2-3 with 169 fragments (30 MNI); Room 86E, Layer 3 around a "post-hole", 40 fragments (nine MNI); Room 86E, Layer 3b floor, 20 fragments (two MNI); the Area 8 South, cleaning of a wall in the street in the southwest, 38 fragments (four MNI); and the Room 33 cleaning of mud pisé from the northwest wall, one complete and 73 fragments (17 MNI).

All this is probably debris from a purple-dye industry ca. 1150-1110 B.C.

Polis (Marion)

The largely 7th c. B.C. Peristeries sanctuary at Polis in northwestern Cyprus produced an enormous quantity of crushed *M. trunculus* from the 1990s excavation inside a large *bothros* (Smith 1997, 90-91; Reese 2000, 645). This is evidence for purple-dye production in association with a sanctuary, as at 7th c. B.C. Kommos in southern Crete (Reese 2000).

Kourion (Amathus Gate cemetery)

The 1997-98 excavations here preserved over 70 complete *M. brandaris*, with the largest samples of 15 and 12 shells. There is also one sample excavated in 1998 (Trench B.XIX, 0.0, #1586) which produced seven complete and 223 fragments of *M. trunculus* from at least 69 individuals. This is probably debris some earlier shell-

purple-dye production reused as a source of lime in the Roman or Medieval period.

Enkomi textiles

Two late 1st c. B.C./1st c. A.D. textiles (Textile 1 [OxA 544, C14 date of 2025 ± 120 bp, c. 75 bc]; Textile 2 [OxA 545, C14 date of 1980 ± 100 bp, c. 30 bc]) produced evidence of being dyed with shell purple (Daniels 1985, 1987, 1989; Granger-Taylor *et al.* 1989).

CONCLUSIONS

This survey of the shell evidence from the East Mediterranean indicates that the earliest shell purple-dye evidence in this

area comes from the Late Bronze II-III at Sarepta, Minet el-Beidha, Akko, Abu Hawam, Bates' Island, Troy (with possible earlier production) and Hala Sultan Tekke. This can be dated no earlier than the c. 1350 B.C. The evidence available today, therefore, suggests that shell purple-dye was produced first in the Aegean (Reese 1987) and Italy (Reese 2005) before being introduced into the Near East. Additionally, while the dye has traditionally been associated with the Levantine Phoenicians of the Iron Age (i.e., Tyrian purple) it is clear that it was already produced in this already in the Late Bronze Age.

CATALOGUE OF SAREPTA MARINE SHELLS

Area X

LB I-II (Phase I, ca. 1550-1350 B.C.)

II-C-4, Locus 13-4 (L-923-155)

M. trunculus - water-worn, H 52, W 41.

Patella - L 39.25, W c30 (broken).

LB II (ca. 1450-1350 B.C.)

II-A-3, Locus 11-3; virgin soil (L-923-38) (Phases I-III)

Thais - water-worn, vermetids inside, open apex, L 57.75, W 39.

II-C-9, Level 8 (L-923-128)

Charonia - water-worn, lip fragment, pitted exterior, glossy interior, large.

LB III (ca. 1350-1275 B.C.)

II-A-2, Locus 4-8 (L-923-11) (Phase IV)

Glycymeris - water-worn, hole at umbo (6.75 × 4 mm), H 35, W 39.

vermetid - large, almost straight, has smaller vermetids growing in it, could be strung, internal D 8, 9; external D 11, 13.

II-A-7, "Floor D"; terrace wall (L-923-42)

Glycymeris - water-worn, H 29, W 30.25.

II-B-4, Level 11; cooking area (L-923-105) (Phase IV)

Tonna - upper body fragment, large.

LB III or Iron I (ca. 1350-1200 B.C.)

II-C-9, Level 6 (L-923-251)

Crushed *M. trunculus*: 925 fragments with 51 apices, 46 distal ends, 118 columella fragments, 5 worn (3 body/columella, 1 body, 1 apex), some have evidence for cutting/butchery, 3 burnt ([1 complete holed opposite mouth, L 26], 1 apex, 1 body); 1 complete (L 55, W 48+, fresh), 30 small complete examples: (36, 26 and burnt specimen also holed opposite mouth): 36, 35 (2),

30, 29 (2), 28, 27 (3), 26 (2), 25 (2), 24 (4), 23 (3), 22 (3), 21 (2), 20 (2), 18, 16; 150+ MNI (Pritchard 1978:126-27, figs. 121-22).

7 *Euthria* - 4 complete (L29, 26, 24, 19), 3 broken.

M. brandaris - water-worn, part of mouth broken, large, L 49.

Transitional LB III/Iron I (Phase V, ca. 1275-1200 B.C.)

II-A-2, Locus 7-5 (L-923-18)

Glycymeris - water-worn, H 34, W 33.75.

Patella - L 31, W 27.25.

II-B-4, Level 10; cooking area (L-923-104)

2 *M. trunculus* - water-worn, holed on lower whorl and near apex (probably natural), L 62.25, W 39.75; L-924-250; distal/ siphonal notch, large.

Thais - distal end and columella, large.

Euthria - L 36.

Iron I (Phases V-VI, ca. 1275-1025 B.C.)

II-D-2, Level 8 (L-923-165)

M. trunculus - water-worn, columella, L 23.

Charonia - water-worn, body fragment, some gloss inside.

Glycymeris - water-worn, hole at umbo (6 x 3 mm), H 36.25, W 34.5+.

II-D-2, Locus 8-1 (L-923-166)

Glycymeris - water-worn, small hole at umbo (0.5), H 28+ bit, W 29.5.

Iron I-II (Phases VI-VIII, ca. 1275-1025 B.C.)

II-B-2/3, Level 4 (L-923-82)

Charonia - upper body fragment.

Early Iron II (Phase VII, ca. 1025-800 B.C.)

II-A-3, Locus 8-3; cooking area (oven) (L-923-35)

Conus - vermetids inside, bit worn, broken lip, large, L 58, W 32.75.

II-B-3, Locus 7-1; cooking area (oven) (L-923-93)

2 *Glycymeris* - 2 water-worn and holed at umbo: H 37, W 35, umbo hole 3 x 2; W 33+ (broken), umbo hole 4.75 x 2.5.

Early to Mid Iron II (ca. 1025-800 B.C.)

II-D-3, Level 7 (L-923-184) (Phases VII-VIII)

Charonia - columella/siphonal notch fragment, large.

Glycymeris - water-worn, small hole at umbo (1.75 x 1), H 31, W 31.25.

II-A-2, Locus 5-4; storeroom (Phase VIII)

2 *Charonia* - 2 body fragments, 1 a bit worn, 1 MNI (L-923-12); columella / siphonal notch fragment, has gloss, medium/large (L-923-31).

II-B-3, Level 6; ash dump (L-923-91) (Phases VII-IX)

M. trunculus - 3 burnt fragments (lip, 2 body).

II-C-2, Level 4-1 (L-923-136) (Phases VII-IX)

Glycymeris - water-worn, broken distal and sides.

II-C-3, Level 6; dump (L-923-150) (Phases VII-IX)

Luria - recently broken dorsum, small, L 26, W 15.5, H 12.75.

Late Iron II (Phase IX, ca. 900-539 B.C.)

II-C-3, Locus 4-2; North-South street (L-923-146)

Charonia - body fragment and columella with part of distal end, body fragment has pitted exterior, large individual, 1 MNI.

Mid Iron II to Persian (Phases VIII-X, ca. 900-332 B.C.)

II-A-3, Locus 5-3; fill (L-923-30)

Charonia - lip fragment, bored on exterior.

Arcularia - unholed, L 17.

Conus - large, worn, open apex, hole 8 x 4.5, ground-down distal end, L 41.75, W 25.5.

Luria - L 40, W 24, H 19.75.

Late Iron II to Hellenistic (Phases IX-XI, ca. 700-63 B.C.)

II-B-1, Room 72, Level 4; pottery dump (L-923-257)

M. trunculus - inner body fragment.

2 *Charonia* - water-worn, siphonal notch; 4 upper body fragments (2 MNI).

II-D-3, Level 6 (L-923-179)

Thais - water-worn, body fragment with part of lip, medium.

Persian to Hellenistic (ca. 539-63 B.C.)

II-A-4, Level 3 (L-923-102) (Phases X-XI)

M. trunculus - water-worn, columella/distal, medium.

II-B-3, Locus 4-1 (Phases X-XI)

2 *Charonia* - 2 columellas (2 MNI).

II-B-3, Level 5; ?cooking area (L-923-90) (Phases X-XI)

M. trunculus - worn, apex fragment, burnt.

II-D-3, Locus 5-3 (L-923-178) (Phases X-XI)

M. trunculus - water-worn, columella/distal.

II-D-2, Level 4; cooking area (L-923-159) (Phase XI)

Charonia - upper body fragment, encrusted and slightly pitted exterior.

Hellenistic (Phases XI-XII, ca. 332-63 B.C.)

II-A-3, Level 2**; Shrine 2 (L-923-24)

Conus - water-worn, broken distal and lip, L 23.75, W 14.

II-C-2, Level 3 (L-923-133)

Charonia - body fragment and apex fragment missing tip (L 106+), both badly sponged-bored on exterior, 1 MNI (large).

II-D-3, Locus 4-1 (L-923-173)

2 *Charonia* - 2 distal columella fragments (small, medium/ large) (2 MNI).

II-Z-3, Level 3 (L-923-195)

Charonia - water-worn/smoothed, upper body fragment, roughly rectangular, L 45.25, W 21.25.

II-Z-4, Level 3 (L-923-201)

Conus - L 35, W 19.

Late Hellenistic (Phase XII, ca. 332-63 B.C.)

II-A-3, Level 2 (L-923-22)

Fasciolaria - irregular hole on body, open apex.

Hellenistic to Roman (Phases X-XIII, ca. 332 B.C. to 324 A.D.)

II-A-2, Locus 4-4; rubble fill (L-923-9)

M. trunculus - lip fragment, medium.

Hellenistic to Roman/Byzantine (Phases XII-XIII, ca. 332 B.C. to 400 A.D.)

II-B-2, Level 2 (L-923-69)

Tonna - upper body fragment, large.

II-Z-2, Level 1* (L-923-188)

Charonia - columella fragment.

Glycymeris pilosa - water-worn, smooth distal end, large, H 57.25, W 51.25.

II-Z-4, Locus 2-2 (L-923-199)

Thais - body fragment, large.

Roman to Byzantine (Phase XIII, ca. 332 B.C. to 400 A.D.)

II-A-2, Level 2 (L-923-7)

Patella - partly broken, W 28.

II-B-3, Level 2 (L-923-83)

Charonia - lip fragment and body fragment, large.

Conus - worn, body fragment.

Phalium - broken lip and body, L 56.

II-Z-2, Level 2 (L-923-189)

Charonia - body fragment, large.

Byzantine to Modern (Phase XIV)

II-C-2, Level 1 (L-923-131)

Charonia - almost complete, broken apex, incomplete distal, bit eroded, has some color, L 151.

Conus - water-worn, open apex (10 x 9), holed on side near apex (3.75 x 3.25), slightly broken lip, L 44.

Mixed

II-B-7/8; baulk removal (L-923-258a)

4 *Murex* - 4 fragments: 3 columellas, 1 distal (4 MNI).

Charonia - siphonal notch fragment, medium.

Area X,K

LB I (Period I, ca. 1550-1450 B.C.)

II-A-8, level 11 (L-923-54)

Patella - L 32.5, W 18.25.

II-A-9, level 10-2 (L-923-66)

M. trunculus - worn, eroded and bored, broken distal, H 42, W 31.

II-A-9, level 11 (L-923-64)

Acanthocardia - water-worn, 2 pieces, probably has a hole at the umbo, pres. H 38.

LB II (Period II, ca. 1450-1350 B.C.)

II-A-9, level 10 (L-923-253a)

Phalium - complete, fresh but water-worn stones on body, L 57, W 46.

II-B-8, level 9 (L-923-253b)

M. trunculus - open body, L 56.5.

2 *Luria* - no color or gloss, L 37, W 21.5, H 17.25; color and gloss, L 29.25, W 17.75, H 13.75.

Tonna - distal end, very large.

II-B-8, level 9 (L-923-119)

M. trunculus - apex fragment, L 46.75, W 38.

Conus - worn, upper body fragment, L 31.25, W 22.5.

II-A-8, level 8 (L-923-254a)

3 *M. trunculus* - L 63.25, W 51; L 59, W 48.25; water-worn, L 40, W 32.

Thais - water-worn, vermetids inside, sponge-bored exterior, open apex, L 68.5, W 61.25.

Charonia - 2 pieces, body with open apex, heavily sponge-bored exterior; inner columella fragment (1 MNI).

Tonna - 3 pieces, medium/large (1 MNI).

Glycymeris - right valve, H 37.25, W 38.

LB II (Period III, ca. 1350-1300 B.C.)

II-A-8, level 7 (L-923-51)

M. trunculus - medium.

Thais - small.

II-A-8, level 8

M. trunculus - L 47, W 37.

II-A-8, level 9 (L-923-53)

2 *Thais* - large, beach specimen/vermetids inside, broken distal end, H 89, W 73; large, open body, water-worn, H 79, W 50.

Tonna - large distal end fragment with part of columella.

Luria - water-worn stone in mouth, small, L 23, W 14, H 11.75.

II-A-8, level 9 (L-923-254b)

2 *M. trunculus* - broken lip, L 58, W 39; slightly broken distal, L 49.5, W 41.

2 *Thais* - worn, broken lip, vermetids inside, L 72.5, W 49; worn, broken lip, recent hole on body, L 70, W 47.

Tonna - fragment, medium/large.

Erosaria - L 24, W 16.25, H 13.

Mactra - broken, right valve.

II-A-9, level 9 (L-923-254c)

Thais - open apex, broken lip, two holes on body, L 51.5.

Charonia - internal columella fragment.

II-A-9, level 11-1 (L-923-67)

Glycymeris - umbo a bit ground-down but unholed, H 43.75, W 41, distal slightly broken.

II-A-9, level 12-1 (L-923-254d)

2 *M. trunculus* - complete, broken lip, L 54.25, W 45.5; water-worn body fragment.

Spondylus - upper valve, L 60.75, W 54.75.

II-B-8, level 8, a working area (Khalifeh 1988, 19)

Crushed *M. trunculus*: 100 fragments: 35 columellas, 11 apices, 12 distal ends (35 MNI).

Arcularia - unholed, unworn, slight gloss, L 14.

Euthria - 2 pieces (apex, distal), 1 MNI.

2 *Gibbula* - 1 small, 1 medium.

II-B-8, level 8, a working area (L-923-118) (Khalifeh 1988, 19)

vermetid - large, was attached to bivalve, max. D 12.

II-B-8, level 8-1 (L-923-254e)

M. trunculus - water-worn, distal/columella/lip.

Thais - broken lip, large, L 82, W 59.5.

2 *Glycymeris* - 2 water-worn: one 30.5 x 30.5, hole at umbo 2.5 x 1.75.

LB II (Period IV, ca. 1300-1275 B.C.)

II-A-8, Wall 508 (L-923-46) (Khalifeh 1988, 20, pl. 6)

Phalium - lip carefully cut from body, thick, L 53.75, max. W 14, max. T 7.5 (Reese 1989, 36, fig. 9).

II-B-8, level 7 (L-923-255)

M. trunculus - no apex, open upper body, medium.

Thais - broken lip, large, L 72, W 56.75.

LB II/Iron I (Period V, ca. 1275-1150 B.C.)

II-A-8, level 5-1; Room 74 floor (L-923-48) (Khalifeh 1988, pl. 7)

M. trunculus - body fragment, encrusted exterior, purple color in interior.

II-A-8, level 5-1; Room 74 floor (L-923-252a) (Khalifeh 1988, pl. 7)

M. trunculus - 2 pieces (columella, lip), medium (1 MNI).

Conus - broken lip, L 34.5, W 27.

II-A-8, level 5; Room 74 (L-923-252b) (Khalifeh 1988, pl. 7)

5 *M. trunculus* - open body, water-worn, vermetids inside; 2 fresh: distal / columella, large and distal / columella, medium, broken lip, no apex; 2 water-worn: distal / columella with side, body fragment.

Thais - 2 pieces: distal/columella, lip, medium (1 MNI).

II-B-8, level 6; Room 74 (L-923-252c) (Khalifeh 1988, pl. 7)

3 *M. trunculus* - columella/distal/lip; distal/columella, large; water-worn, columella/distal/lip.

Thais - water-worn, broken lip, L 51.

Charonia - lip fragment, sponge-bored exterior; 2 body fragments, both sponge-bored exterior (1 MNI).

Euthria - complete, L 33.

II-B-8, level 6; Room 74 (L-923-461) (Khalifeh 1988, pl. 7)

Thais - distal fragment, large.

Iron I (Period ?VI, ca. 1150-1025 B.C.)

II-B-8, level 4-1; below Room 65 (L-923-241) (Khalifeh 1988, pl. 9)

M. trunculus - water-worn, lip fragment, burnt.

9 *Arcularia* - 8 with gloss, 4 worn.

3 *Hinia* - 3 with gloss, 2 small, 1 broken lip.

Conus - slight color, small, L 15.25.

Euthria - slight gloss, broken lip.

Iron II (Period VII, ca. 1025-800 B.C.)

II-A-9, level 4-1; Room 57 (L-923-256a) (Khalifeh 1988, 41, pl. 9)

13 *Arcularia* - 13 unmodified and with gloss.

Thais - water-worn, burnt black, large.

II-B-8, level 4; Room 61 floor and material above it (L-923-240) (Khalifeh 1988, 39, pl. 9)

Euthria - open body (recent), L 30, W 15.75.

Iron II to Persian (Period VIII, ca. 800-332 B.C.)

II-A/B-9, level 3; Baulk cleaning (L-923-256b)

Charonia - 2 water-worn pieces: columella, water-worn stones inside, large; apex.

Hellenistic to Roman (Period IX, ca. 332 B.C. to 324 A.D.)

II-B-9, level 2 (L-923-258b)

Charonia - water-worn, columella/siphonal notch fragment.

Columbella - water-worn (inside *Charonia*).

Hinia (inside *Charonia*).

Mixed

II-B-9 (L-923-258c)

2 *M. trunculus* - L 33, W 21.25; water-worn, L 51.5, W 44 (2 MNI).

Area Y

LB I (ca. 1550-1450 B.C.)

II-K-20, Locus 30-1, Room 39, Stratum K1 (L-923-249a) (Anderson 1988, 65, pl. 3A)
vermetid - broken, burnt black, small.

II-K-20, Locus 31-2, Stratum K2 (L-923-249b) (Anderson 1988, 64)

Thais - water-worn, very large, L 91, W 68.

II-K-20, Locus 31-3, Stratum K1 (L-923-249c)

Glycymeris - water-worn, small natural hole at umbo (1 x 0.5), H 33.25, W 34.25.

Early LB II (ca. 1450-1400 B.C.)

II-K-20, Level 29-4, Stratum J (Anderson 1988, 67-68)

Thais - large, L 65, W 45.

Glycymeris - water-worn, H 29.5, W 34 (L-923-229).

II-K-20, Level 29-4, Stratum J (L-923-248a) (Anderson 1988, 67-68)

2 *Thais* - water-worn, open apex, L 73, W 54; worn, broken lip, L 64.75, W 45.25.

LB II (ca. 1450-1350 B.C.)

II-K-21, Level 31, "J-H Deposit"; mostly fill (L-923-248b) (Anderson 1988, 69)

Thais - very water-worn, open apex and body, medium.

Charonia - 2 body fragments, pitted exterior but fresh (1 MNI).

II-K-21, Level 31, "J-H Deposit"; mostly fill (Anderson 1988, 69)

M. trunculus - very water-worn, L 44.

Charonia - 2 body fragments, 1 columella fragment, 2 pieces worn and pitted on exterior (1 MNI).

Late LB II (ca. 1400-1350 B.C.)

II-K-20, Locus 29-2, Strata G2-H; heavy fill (L-923-248c) (Anderson 1988, 71)

Thais - bit worn, broken lip, very large, L 95.25, W 76.

II-K-20, Locus 29-3, Stratum H; heavy fill (L-923-248d) (Anderson 1988, 71)

Thais - gastropod-bored on upper mid body, broken lip, collected dead, large, L 63, W 47.5.

Late LB III (ca. 1300-1275 B.C.)

II-K-10, Locus 29-1, Stratum H; heavy fill (L-923-225)

Thais - columella fragment, large.

II-L-20, Locus 27-1, Stratum G1; hard floor and fill (L-923-218)

2 *M. trunculus* - 3 pieces (columella/distal, distal, body) (2 small MNI).

II-L-21, Level 28, Stratum G1; floor and fill (L-923-221)

Thais - 2 pieces (columella/distal, distal), large.

LB III to Iron I (ca. 1300-1075 B.C.)

II-K-20, Level 26, Strata E-G1 (L-923-246)

Crushed *M. trunculus* - 625 fragments with 41 apices (2 burnt), 68 distal / columellas (8 burnt), 3 rather complete (L 11.75, 18.0, 20.75), 52 burnt (2 apices, 8 distal / columellas, 1 columella), most water-worn, 68+ MNI. About 35 water-worn pottery sherds present in sample.

4 *Arcularia* - 4 water-worn, 1 holed near apex.

2 *Euthria* - 2 water-worn apex fragments.

Hinia - water-worn.

44 *Alvania*, *Cantharus*, *Mitra*, *Rissoa* (small gastropods) - largely water-worn, 4 burnt.

II-K-20, Level 26, Strata E-G

Conus - open apex, L 49, hole 9 x 7.

Early Iron I (ca. 1275-1150 B.C.)

II-L-20, Level 27*, Stratum F (L-923-247a) (Anderson 1988, 85)

Thais - broken lip, L 57.75, W 39.5.

II-L-20, Level 27, Stratum F; ash pit (L-923-247b) (Anderson 1988, 87)

Thais - columella and distal, very large.

Abbreviations:

| | |
|------|-------------------------------|
| D | diameter |
| H | height |
| L | length |
| max. | maximum |
| min. | minimum |
| MNI | Minimum Number of Individuals |
| W | width |

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