

SERÇE LIMANI

An Eleventh-Century Shipwreck

VOLUME I

The Ship and Its Anchorage, Crew, and Passengers

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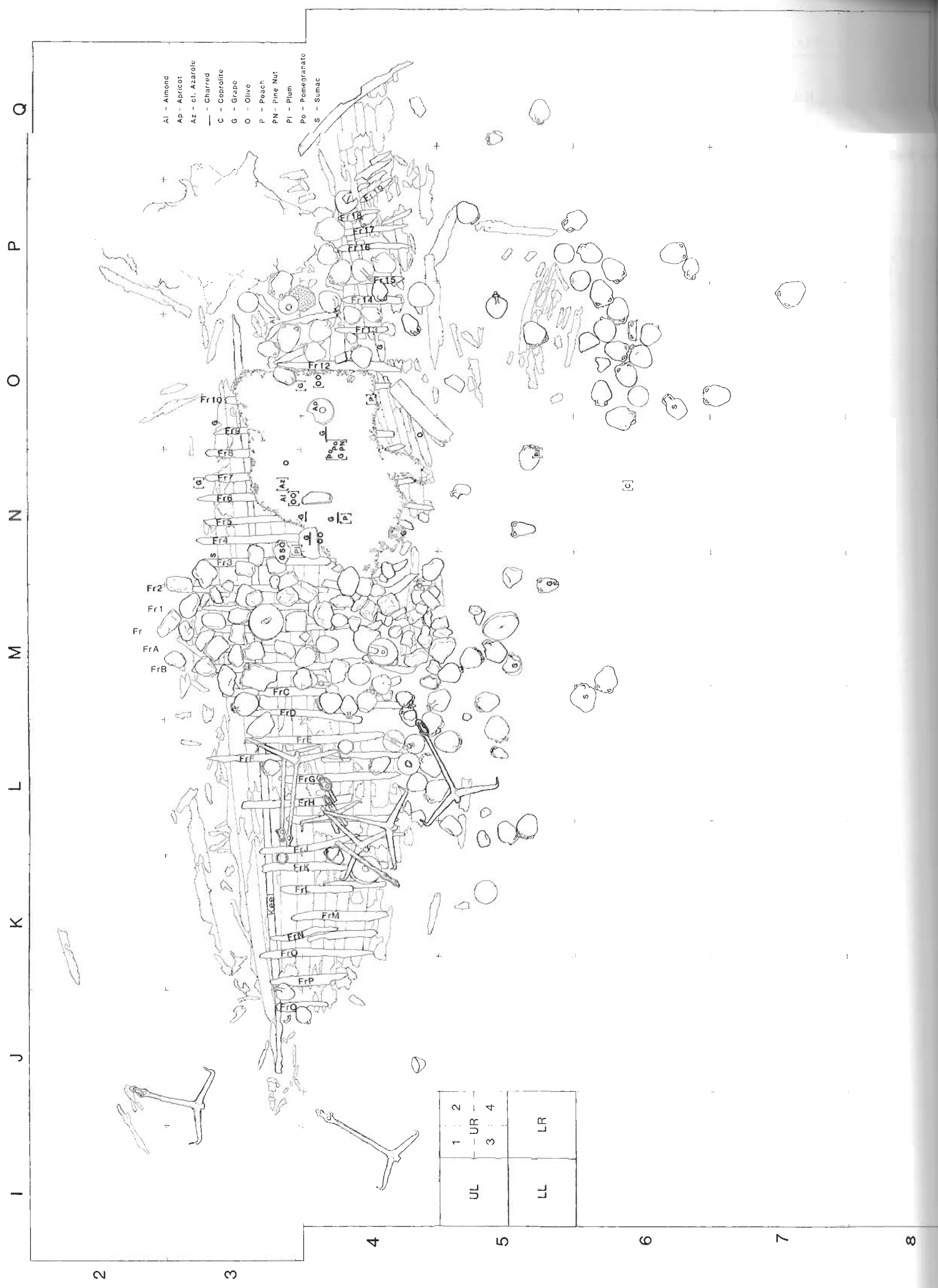
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- Al - Almond
- Ap - Apricot
- Az - ct. Azarole
- Charred
- C - Coprolite
- G - Grape
- O - Olive
- P - Peach
- PN - Pine Nut
- Pl - Plum
- Po - Pomegranate
- S - Sumac

1	2	UR	LR
JUL		3	4
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Fig. 26-1. Distribution of plant remains



CHAPTER 26

Plant Remains

Cheryl Ward

Illustrated by the Author

Among the materials recovered from the Serçe Limanı wreck were seeds, fruits, and nuts (Figs. 26-1 to 26-4). These plant remains might easily have been overlooked if the excavation had taken place a decade earlier, for although fruit stones and nuts had been found on Mediterranean shipwrecks since the 1950s, it was not until the 1970s that archaeologists attempted the systematic retrieval of plant remains other than parts of ship hulls. In this, they followed the lead of their land-based colleagues.

Arid tombs in Egypt and waterlogged Scandinavian lake villages had provided nineteenth-century archaeologists and botanists with exciting discoveries of well-preserved flowers, foliage, and fruits and seeds. H. Schliemann, at Troy, noted jars full of charred grains in burned habitation layers and briefly described their contents. During the 1960s, when archaeologists sought the origins of Near Eastern agriculture, archaeobotany played a central role in tracing the progress of people, crops, and agricultural techniques across the landscape.

The introduction of flotation processes in the 1960s to separate charred plant remains from the archaeological soil matrix revolutionized archaeobotany and allowed more thorough investigations into human activities centered on plants. Samples obtained by flotation were larger and more complete, and contained a greater variety of plant remains, than those spotted visually and collected, or collected after passing soil samples through mesh screens.

Archaeobotanists learned a great deal about the ecology and economy of seed crops, such as wheat, barley, lentils, beans, and linseed, from studying charred Near Eastern flotation samples. The arid nature of the Near East makes waterlogged materials scarce, so the application of archaeobotanical techniques to shipwreck excavations was seen as a way to recover waterlogged plant remains that would enhance our understanding of how a particular shipwreck may be viewed within the greater human, economic, and ecological systems of which it is a part.

From early in the course of the Serçe Limanı excavation, at the suggestion of Donald H. Keith, attempts to recover plant tissues became a standard procedure. Since then, we have learned that samples from shipping jars and other contexts on this and other shipwrecks can contain waterlogged and charred plant seeds and twigs, leaves, fruits, resin, wood, and other plant tissues, as well as artifacts, animal and fish bones, insects, dung, and hairs.¹

PRINCIPLES OF SAMPLING AND RECOVERY

Ship hulls and associated timbers are a major source of archaeobotanical remains on shipwrecks, but this discussion will focus instead on sources of plant tissues more likely to have changed with each voyage: cargo, ship's provisions, and

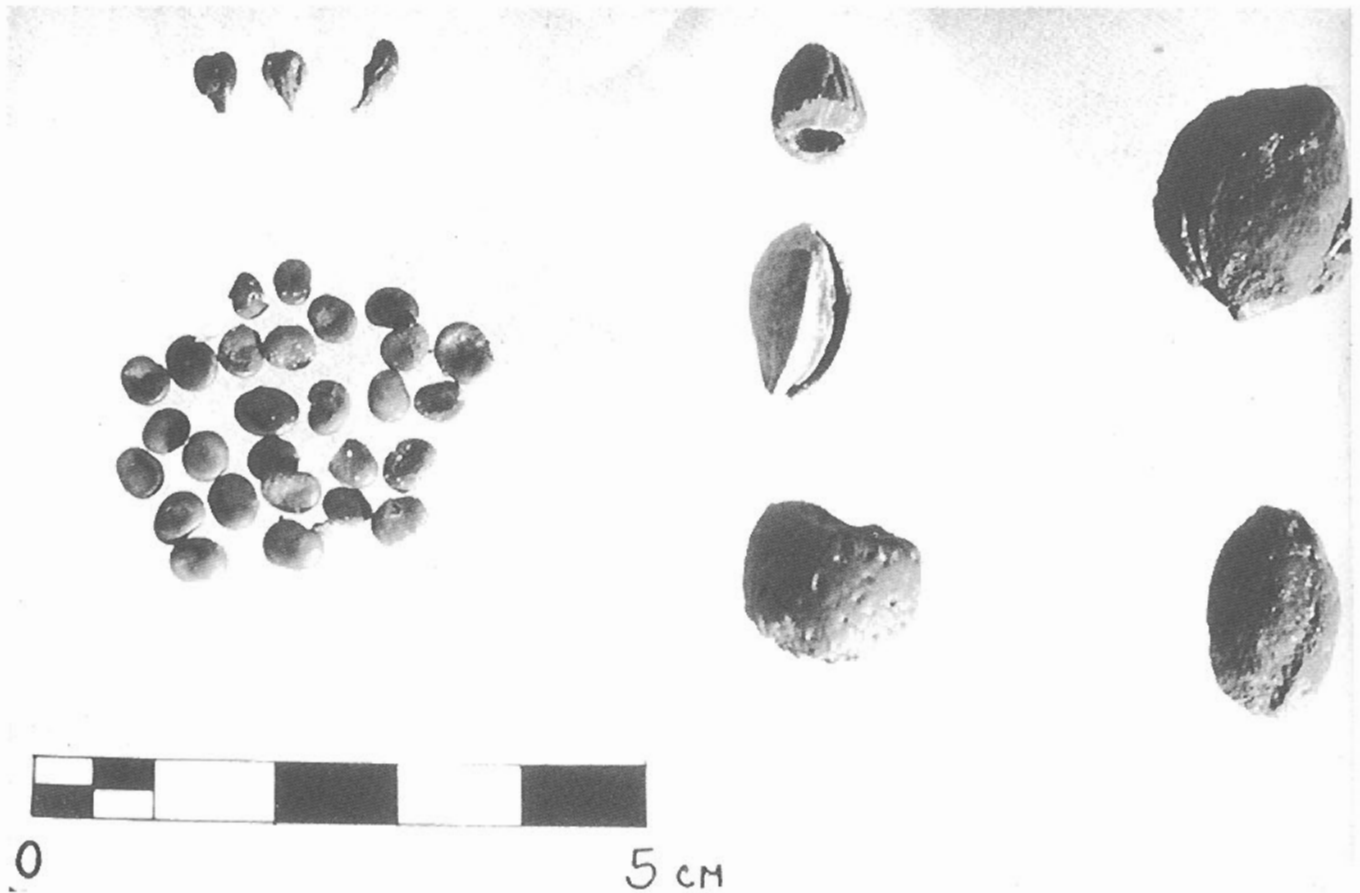


Fig. 26-2. Clockwise from upper left: grape (*Vitis vinifera* L.), cf. azarole (*Crataegus azarolus*), apricot (*Armeniaca vulgaris*), plum (*Prunus domestica*; also center), almond (*Amygdalus communis*), and sumac (*Rhus coriaria*)

dunnage. Organic cargoes, such as grain, wine, olives, textiles, and other plant products, constituted a major portion of ancient and medieval overseas trade. Archaeologists can expect to find these and other remains of plants aboard shipwrecked vessels, but the older the shipwreck or the more exposed it is, the greater the probability that shipped goods will no longer be found in their original containers. As bags, boxes, bales, and baskets disappear, their contents spread across the shipwreck, leading to some serious concerns about sample integrity, yet increasing the likelihood that individual taxa will be represented in botanical samples.

As the Serçe Limanı wreck disintegrated, residues of spilled cargoes, both organic and inorganic, drifted into its shipping jars, which were filled with a matrix of sand and shells when found. Although the mouths of such jars must have been sealed when full, few stoppers remained, suggesting that original jar contents were exposed to the sea and accompanying sources of contamination at some point during wreck formation. On this and other wrecks excavated by the Institute of Nautical Archaeology, excavators and archaeobotanical workers have discovered fragments of glass, pottery, metal, and wood in jars thought to carry wine and resin; fishing weights, beads, and even complete pottery vessels also have been found as discrete products trans-

ported in shipping jars. At least one octopus lived in one of the Serçe Limanı shipping jars. These creatures carry bits of shipwreck debris with them, further mixing samples.

Archaeological finds of jars stopped with wads of vegetation² or dried figs³ point to another potential source of sample mixing. While temporarily protecting jar contents, such stoppers could easily contribute to plant remains found both within jars and elsewhere on the ship. It is likely that the Serçe Limanı amphoras were stopped in many, if not all, cases with pine bark disks shaped to fit their mouths and sealed with pine resin. At least eight bark stoppers, lying loose, were found widely scattered over the wreck, and one remained seated in the mouth of amphora *Am 71*.

Defining the nature and quantity of cargo carried aboard a sunken ship can add substantial data to archaeological interpretation. Cargo composition affects the interpretation of a shipwreck site in several ways. Ship reconstructors make estimates of a ship's carrying capacity (tonnage) based on cargo density, and total cargo weight also affects the sailing ability of a ship. Direct evidence of cargoes helps define the distribution of individual products aboard the ship, their value, origin, and archaeological significance, and may even point to the ship's season of sailing.

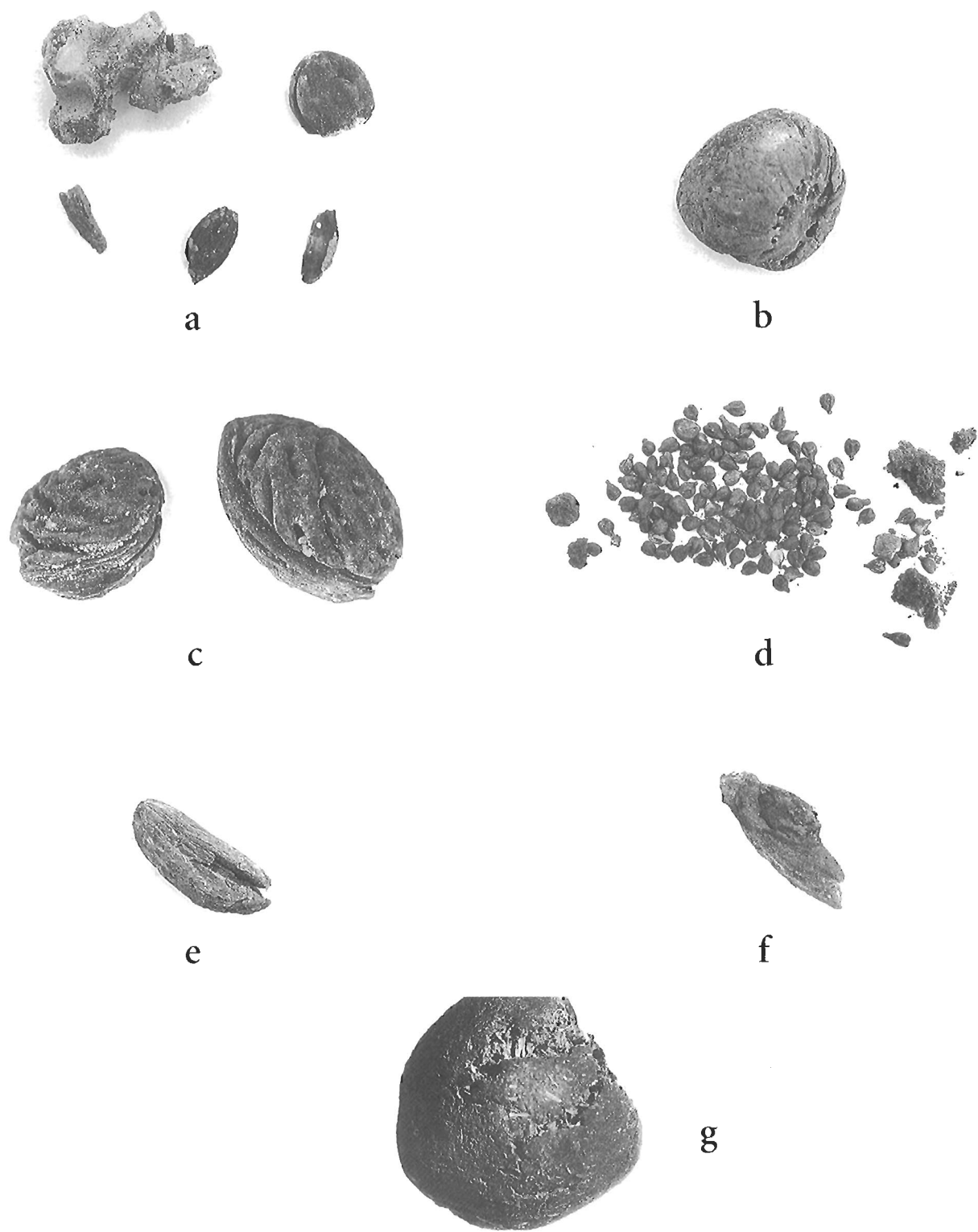


Fig. 26-3. (a) Top row: fragment of a concretion lump showing olive stone impressions, cf. azarole; bottom row: three olive stone fragments; (b) almond GW 1053; (c) peach; (d) grape seeds from storage jar BN; (e) olive stone; (f) watermelon seed; (g) coprolite, probably sheep or goat in origin. (Objects at various reduction scales; see text for dimensions.)

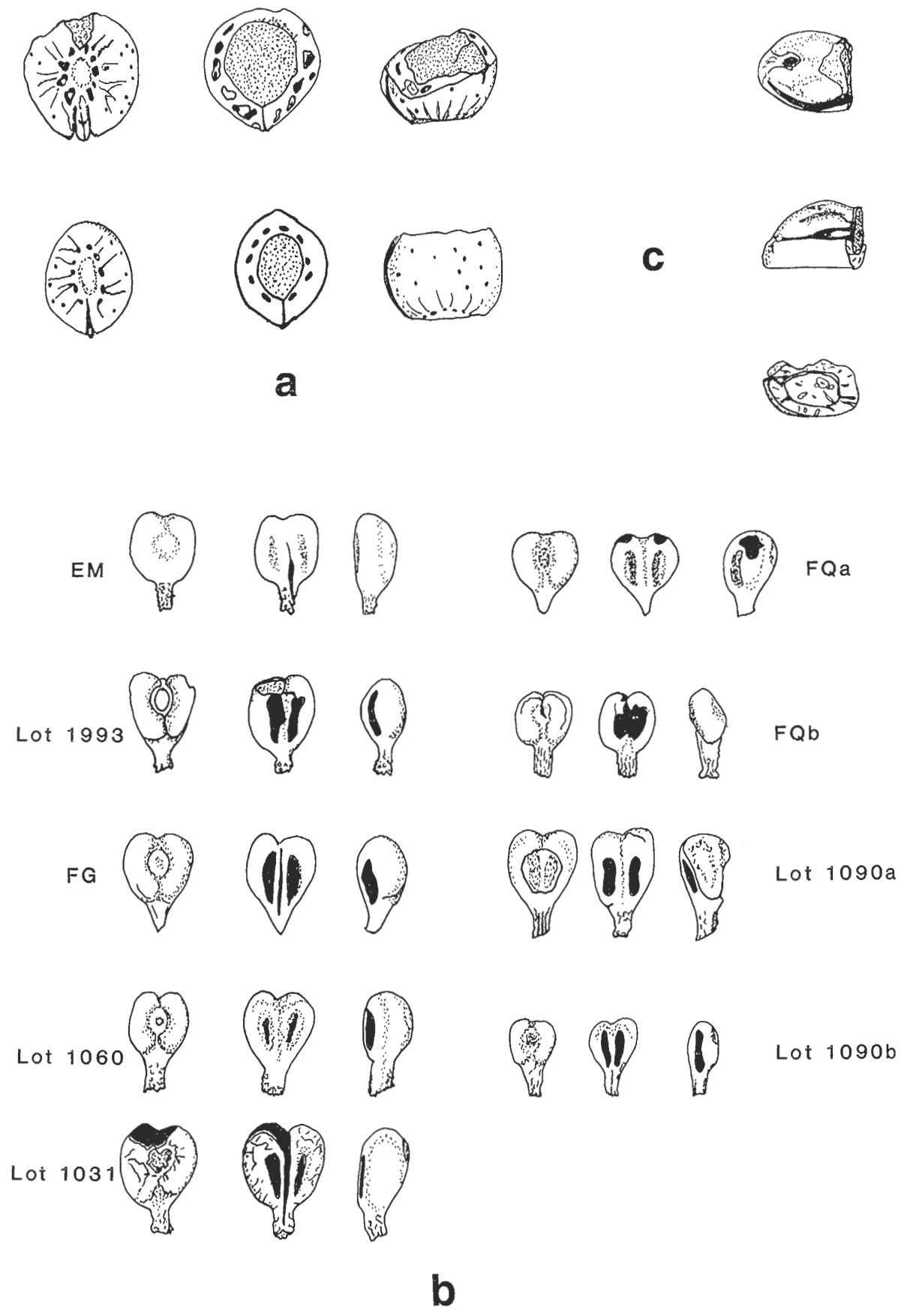


Fig. 26-4. (a) Almond shell fragments (GW 1053 and GW 1949); (b) grape seeds (note variation in beak morphology and body shape); (c) *cf. azarole* from O₃ LL_{3/4}; see text for dimensions

Ancient wreck sites may also provide us with information on cooking and provisioning. Historical texts, archaeological evidence, and, in some cases, residues of ship's stores or charred food can contribute to our knowledge of plant use aboard ancient ships. The galley of the seventh-century Byzantine merchantman at Yassiada was reconstructed, even to details of hearth and roof construction and location of storage shelves.⁴ Recovering the charred remains of plants from a shipboard hearth would contribute to our knowledge of what people ate while at sea. The Dramont A shipwreck site included burned pine branches, charcoal, and fire-blackened cooking pots,⁵ and the Dramont D wreck contained finely ground wheat in a pot.⁶ D. Cerda Juan describes olive oil and charred food residues clinging to the inner walls of kitchen urns and cooking pots on the Colonia de Sant Jordi A wreck,⁷ suggesting the potential for acquiring direct knowledge of shipboard diet from submerged artifacts.

Waterlogged plant remains from shipwreck sites also include dunnage, a springy layer of twigs and brush used to cushion the hull against the weight of its cargo. The Marsala Punic shipwreck illustrates the diversity and abundance of this type of sample: samples from the bilge area contained at least ten taxa.⁸ Lavender or thyme shrubs cushioned shipping jars on the Binisafuller wreck, an indication of the multiple uses different plants had in the ancient world.⁹ Excavators of the Late Bronze Age shipwreck at Uluburun, Turkey, have also found shrubs used as dunnage: entire thorny burnet (*Sarcopoterium spinosum*) plants, from branches to roots, still fulfill their function after more than three millennia beneath the sea.¹⁰

Ancient shipwrecks with excellent preservation of organic remains—usually the case when the remains are covered with fine, silty mud, as in the case of the *Amsterdam*¹¹—allow straightforward sampling for plant remains. In many cases, wooden, fabric, and ceramic or glass artifacts retain their original contents and can simply be placed in modern storage boxes underwater, lifted, and stored wet. Techniques to concentrate plant remains are required for dispersed deposits, such as those contained in shipping jars on Mediterranean wrecks.

Flotation of large amounts of sand or sediment is one way that botanical remains can be concentrated. Flotation works by disaggregating sediment and encouraging objects less dense than water to float. On many land sites, plant tissues are charred and float easily. On an underwater site, both charred and uncharred remains are waterlogged and therefore do not readily float. Most INA excavations now routinely employ effective flotation techniques to recover organic remains from ceramic containers and other deposits.

Efforts to recover organic remains from ceramic containers and other deposits from the eleventh-century Serçe Limanı wreck were not begun until the second excavation campaign in 1978.¹² Regrettably, a majority of the ceramic containers on the wreck already had been raised and cleaned out during the

first campaign. The contents of only eighteen amphoras (*Am* 9, 11, 23, 31, 32, 44, 49, 57, 63, 67, 73, 79, 80, 81, 88, 90, 100, and 103) could be included in the recovery efforts of 1978; organic remains thought to be of archaeological significance were collected from nine of them (*Am* 44, 67, 73, 80, 81, 88, 90, 100, and 103).

After amphoras were raised, their contents were emptied into large buckets. Manageable amounts of material were transferred to empty buckets, which were then filled with water. The water and contents were stirred vigorously with a stick, whereupon the water and whatever low-density material, including organic remains, it contained were poured as quickly as possible through a sieve with mesh openings that measured about 0.0013 x 0.0013. The process was repeated until low-density material no longer appeared in the sieve. A bucket's contents were then sieved, and all the material that could not pass through the sieve openings was spread out in trays, sorted through, and examined with the naked eye in an attempt to find additional organic material. The collected organic remains were stored in water.

In the years following the excavation, as conservation workers gradually accomplished the long and difficult task of removing glass cullet from lumps of cementlike concretion that had formed around them, they encountered small quantities of additional large seeds and nuts. Also retrieved from the wreck site was a single coprolite, probably from a sheep or goat, with macerated bits of grasses embedded in its surface.

This early attempt to retrieve organic remains of archaeological significance from a shipwreck site would probably have been more successful if the excavation staff members involved had been better informed about both archaeobotanical recovery processes and the actual appearance of these organic remains. Furthermore, it is difficult to separate dark seeds and shreds of plant materials from bits of sand, broken shell, and metal corrosion products that wash into amphoras once they have lost their stoppers. Such work is more productively done with the aid of a microscope.

Chemical analyses of jar contents, resin linings, and jar walls might have added further information about former contents. Phytoliths (characteristic silica bodies formed in fleshy tissues of plants) might also have been used to suggest now vanished cargoes. Pollen analysis is likely to be helpful only when wrecks are buried in mud. Because only identified plant remains were saved, none of these options is available for the Serçe Limanı wreck. INA excavations now include standard collection of sediment samples for microscopic evaluation through these varied techniques.

IDENTIFICATION

Identified plant remains include *Amygdalus communis* (almond), *Armeniaca vulgaris* (apricot), *Persica vulgaris* Miller

(peach), *Prunus domestica* ssp. *insititia* (plum), *Vitis vinifera* (grape), *Olea europaea* (olive), *Punica granatum* (pomegranate), *Citrullus lanatus* (watermelon), and *Rhus coriaria* (sumac) (Table 26-1; Figs. 26-2 to 26-4). Two other specimens are probably a pine nut (*Pinus* sp.) and the stone of the azarole (*Crataegus azarolus*). Identifications were made with the assistance of the reference works *Flora of Cyprus* and *Flora of Turkey*, and the modern seed collections at the Institute of Archaeology (London) and the British Institute of Archaeology at Ankara, Turkey.¹³

Plant remains at Serçe Limanı were preserved by waterlogging. Most of the finds were woody fruit stones or nuts; sumac is the exception, but its fruit pericarp is very tough. Few of the sumac fruits were complete, but some retained both the outer, leathery pericarp with hair bases as well as the softer drupe. During the millennium of immersion, water dissolved and replaced much of the cellulose in the woody pits, as it does in waterlogged wood. Recovered, waterlogged plant remains were stored in a solution of water and alcohol for seven years. After an initial examination, conservators recommended a series of dehydration baths in acetone and impregnation by an acrylic compound in order to dry the material.

The results were unsatisfactory; some identifying features were obscured, and the woody pits shrank an average of 10% in length. Sumac fruits shriveled and became extremely friable, prompting an immediate rehydration sequence to reverse conservation measures. Today, the sumac fruits remain in a water-alcohol solution, while the other material is stored dry. Polyethylene glycol impregnation, in conjunction with freeze-drying or simple wet storage of plant remains, offers more acceptable treatment options than those used on this material.

Plant remains found by conservation workers as they chiseled apart large lumps of glass cullet concretions were placed in glass bottles for storage. Most of these examples exhibit extreme desiccation in both width and length when it is possible to compare the present appearance of the object with the

natural mold that formed around it while it was still waterlogged. The extreme reaction of these remains is probably due to the extended drying sequence they underwent as part of the concretion surrounding masses of broken glass. The most extreme example is afforded by the 0.013 x 0.006 mold of an olive pit whose present length is 0.0101 x 0.004, a difference of 15% in length and 33% in width.

CATALOG OF PLANT REMAINS

Amygdalus communis L. (Almond)

Two fragments of almond shells, pitted and moderately keeled (Figs. 26-2 and 26-3b). The interior of each fragment is smooth; the exterior is worn. Walls are of two layers, and channels run inside the walls from the exterior of the base toward the now missing apex. These fragments have ten channels each. Breadth was measured across the shell at the keel.

Lot No. & Location	Description of Sample	L	B	Th.	Th. of Wall
[1949] O3 LR2/4	basal half	11	14	11	3
[1058] N3 LR3	basal third	14	15	11	3

Note: measurements in millimeters.

Almonds are one of the most commonly recognized plant remains from ancient shipwrecks. Excavators of the fourth-century B.C. Kyrenia shipwreck recovered more than 10,000 almonds;¹⁴ the Uluburun shipwreck gives evidence that almonds were also transported in the Mediterranean as long ago as the fourteenth century B.C. They date back to Neolithic times on land sites and are a popular food item in the area today.

Two main types of almonds exist: sweet almonds are eaten, and bitter almonds are pressed for their oil. The twelfth-

TABLE 26-1. TAXA FROM THE WRECK

Taxa	Samples	Individuals
<i>Rhus coriaria</i>	4	78
<i>Amygdalus communis</i>	2	2
<i>Prunus domestica</i> ssp. <i>insititia</i>	2	2
<i>P. dom. insititia</i> or <i>cerasifera</i>	1	1
<i>Persica vulgaris</i> Miller	2	2
<i>Armeniaca vulgaris</i>	1	1
<i>Vitis vinifera</i>	25	243
<i>Olea europaea</i>	7	9
<i>Punica granatum</i>	2	2
<i>Pinus</i> sp.?	1	1
<i>Crataegus azarolus</i> ?	1	1

century Andalusian author ibn al-ʿAwwām described almonds with large fruits and those with sweet and small fruits, the size of a pistachio, both of which require the same tending.¹⁵ Many different kinds of almond trees are present around Mediterranean shores, partly because each cultivar must be fertilized by the pollen of another cultivar in order to set fruit. Since the almond can be one of the earliest blooming fruit trees, it is also the most subject to damage by frost. Some of the different varieties may offer slightly later blooming and harvest times. Trees that begin to bloom in March begin harvest in late August; later blooming varieties are harvested from late September to the end of October.¹⁶

The almond fruit is a green and downy drupe resembling a small, oval peach. Inside the drupe, a shell encloses a single kernel high in protein and fat.¹⁷ Shells vary in hardness, but most of the “paper shell” varieties, such as those sold in modern grocery stores, are recent additions to the almond cultivars. The thick walls of the Serçe Limanı almonds suggest that they were fairly resistant to cracking.

Since almonds aboard the Serçe Limanı ship were transported in the shell, we can assume that they were intended for consumption. They are small according to modern standards in use in Spain.¹⁸ The fourteenth-century catalog of products sold in major marketplaces includes three kinds of almonds: shelled, crushed, and those remaining in the shell.¹⁹ Medieval people ate roasted almonds, but one of the most common uses for the rich and mild-tasting nut was as a finely ground powder used as a thickening agent in sauces.²⁰ Levantine cuisine routinely used almonds in sauces and sweets, and also in more exotic recipes, such as one in which a meat dish of kabobs wrapped around a peeled sweet almond was garnished with dates whose stones had been replaced by peeled sweet almonds.²¹ S. D. Goitein’s research in the Cairo Geniza documents of the tenth and eleventh centuries records the *lawwazin*, processors of almonds, who had their own lane in the bazaar and their own toll house. Almonds and raisins are praised as the ideal food by Maimonides and in Jewish folklore.²²

Although the Serçe Limanı wreck was not extensively searched for plant remains, the large size of almonds makes them readily apparent to excavators, suggesting that the few recovered were not from a cargo on the ship but were intended for a meal or snack on board. The shells were found about 2 m apart aft of midships in grid squares O3 LR2/4 and N3 LR3. While they add to the complement of plant remains from this general area, they contribute little to a spatial analysis of these remains (Fig. 26-1).

Armeniaca vulgaris Lam. (Apricot)

One stone, dark brown, with a prominent keel surrounded by ridges; surfaces compressed and smooth; l. 0.017; B 0.014; th. 0.008 (Fig. 26-2). Apricot stones are usually ovate or elliptic, about 0.015–0.020 long and 0.010–0.015 wide; smooth, with a

furrowed margin.²³ Native to China and Western Asia, the apricot was probably introduced into the Near East from Iran or Armenia about the first century B.C.²⁴ It spread quickly from there and was widespread throughout the area by the time the ship sank at Serçe Limanı.

Apricots grow best in dry and mild climates but are not as drought-tolerant as almonds. They bloom early in spring and are harvested from mid-July to mid-August. The golden fruits are smaller and more delicate than those of the peach and have a smoother skin. Ibn al-ʿAwwām described two kinds of apricot, one with small and one with large fruits.²⁵ Apricots are eaten fresh, cooked, or pitted and dried.

Because dried fruits are usually pitted, the single apricot kernel found on the wreck probably came from a fresh fruit. Since dried fruits are hand-processed, however, some pits may remain with the fruits. Although Arab recipes called for apricots cooked with meat, spices, and ground almonds, they usually meant rehydrated dried fruits.²⁶ Goitein states that there was a special street in Cairo for “sellers of dried fruit” (*naqliyyin*) where dried or half-dried apricots, peaches, and plums imported from the eastern Mediterranean were sold to be made into preserves or sweets.²⁷

Syria was a primary source for apricots during medieval times. The geographer Yāqūt records their production in the mountain district of Western Aleppo on Jabal as-Summāk.²⁸ Apricots were also grown in the Hebron valley.²⁹

Persica vulgaris Miller (Peach)

Two peach stones from the wreck display the typical ovate shape with deeply rugose surfaces (Fig. 26-3c).

Like the apricot, the peach probably was domesticated in China and Western Asia. Several varieties are grown in the region today, and it is a popular fruit. In addition to its role as a food, the peach provides a kernel that can be pressed for a high-quality oil. Other parts of the plant are used medicinally.³⁰

The peach grows well in Syria and in the Mediterranean zones of Anatolia; the earliest reported find in the region dates to seventh-century B.C. Samos, although peaches did not become common until the Roman period.³¹ Medieval texts describe a trade in dried fruit, but the Serçe Limanı stones probably came from fresh fruit, for the same reasons as described above for apricots.

Prunus domestica ssp. *insititia* (Bullace)

Four examples of plum stones were found on the wreck, but only three have been examined by me (Fig. 26-2). Two of these fall into the subspecies *insititia*, formerly called the wild plum, but now known to be a hybrid native to Asia Minor.

The sample from Lot 1272 (Fig. 26-1: N3 + N4, between Frs 3 and 4, downslope of keel) is ovate and flattened in ventral view without prominent ridges or furrows. Its slightly rough surface is very worn. The apex is rounded, but the base is

tipped. The sample from Lot 1956, of uncertain provenance, shares the surface texture, ovate shape, and flattened ventral view of that from Lot 1272, but its base is slightly indented and it has a small, though distinct, ridge.

The main differences between the damson (ssp. *domestica*) and the bullace are seen in the relief on the surface and the ventral view. Damson stones are heavily sculptured and asymmetrical with jagged bases. The furrows and blades are usually distinct and heavy, with blades sometimes protruding, unlike stones from Lot 1956 (uncertain provenance) and Lot 1272.

Table 26-2 records the dimensions and some diagnostic indices. These dimensions and indices can be reliably used to separate the fruit stones of different varieties, as K. Roder³² demonstrated in his study of the stones of modern cultivated plums (ssp. *insititia*), damsons (ssp. *domestica*), and greengages (*Prunus spinosa*, which has a small, round, highly textured stone). K.-E. Behre applied Roder's techniques to hundreds of *Prunus* stones from the ninth- to tenth-century Viking town of Haithabu and the twelfth- to sixteenth/seventeenth-century town of Alt Schleswig, and demonstrated that for samples with many constituents, different stone forms (*Formenkreise*) corresponding to varieties could be determined.³³ Another study of fruit stones repeats Behre's statement that the degree of variation within a particular variety prevents this type of determination for samples with limited numbers, such as ours.³⁴ Nevertheless, the Serçe Limanı stones are so similar that it is possible to say they are of the same variety, closest to Type C of Behre's categories.³⁵

Behre designates this type as var. *pomariorum* Bout., which is also pictured by U. Körber-Grohne.³⁶ The flattened and compressed form of the stones from Lots 1272 and 1956 agrees with both the appearance and dimensions given by these authors.

The third stone has been more problematic to identify. The sample from Lot 1685 (Fig. 26-1; N5 LR) is a smooth, ovate,

thick-walled stone with two prominent furrows, each 0.002 wide, on the ventral side. It has split between the furrows, so its already plump shape is slightly exaggerated. The base is flat and slightly concave.

Although the stone resembles some modern plum stones with its prominent furrows, most plum stones are neither as plump nor as smooth as the stone from Lot 1685. Dimensions and ratios of the stone fall within the range of *P. domestica* ssp. *insititia*, but it most closely resembles a cherry stone, *Prunus avium*. Its length precludes this possibility,³⁷ but a tempting identification is that of *Prunus cerasifera*, the cherry plum or myrobalan.

P. cerasifera stones are ovoid and plump, with marked but shallow furrows and a smooth surface. According to R. D. Meikle, they range from 0.012 to 0.015 long and from 0.010 to 0.012 wide.³⁸ No comparative material is available to me at this writing, so I cannot exclude this possibility, despite the difference in furrow characteristics shown by Körber-Grohne's photographs of *P. cerasifera* and a modern specimen of bullace.³⁹

Plums aboard the shipwreck could have been fresh or dried; both could have retained their stones. If the stone from Lot 1685 can be identified as cherry plum, it probably came from a fresh fruit, for the cherry plum tends to have more local use than broad trade.⁴⁰

Plums were a popular fruit, and several named varieties were known during the medieval period. Ibn al-'Awwām described large and small black plums, as well as green, white, yellow, and red varieties, and the geographer al-Muqaddasi recorded the Kafuri plum as being unique to the province of Palestine.⁴¹ Cairo Geniza documents include plums, usually in connection with other dried fruits, sold as sweets or as ingredients in preserves, upon their import from the eastern Mediterranean.⁴² Prunes and walnuts were shipped from Suwaydiyya, the port of Antioch, to Egypt in the tenth and eleventh centuries.⁴³

TABLE 26-2. DIMENSIONS OF PLUM STONES IN MM

Sample	L	B	Th	Th:L	B:L	Th:B	Description
[Lot 1272] N3+N4, between Frs 3&4 downslope of keel	16	6	11	69	37.5	1.83	Flattened, ovate, low relief
[Lot 1956] uncertain prov.	16	6	11	69	37.5	1.83	Ovate, distinct keel, low relief
[Lot 1685] N5 LR	14	6	10	71	43	1.67	Smooth rounded, prominent furrows

Vitis vinifera L.; *Vitis sylvestris* L.
(Cultivated and Wild Grape)

Grape seeds are the most frequent species encountered, primarily because a single sample from resin-filled storage jar BN (O4 LL2/4-UR1/3) held more than 200 of them. The shape of the individual seeds varies from plump, heart-shaped seeds with long, delicate beaks to thick-beaked, oblong examples (Fig. 26-4). Peduncles also were preserved. Seeds recovered from amphora samples were light to medium brown; some of those from lumps of concreted glass shards were charred. Table 26-3 provides measurements, ratios, and sample locations for this class of material.

The sweet and juicy fruits of the grape vine, both fresh and dried, have been exploited by humans at least since Neolithic times, with evidence for cultivation of the vine at the end of the Early Bronze Age at Lerna,⁴⁴ and definite winepress installations dating to the latter part of the Middle Bronze Age on Crete. The vine is a woody climber whose fruit is a fleshy berry that contains from one to four pyriform seeds.⁴⁵ Grape vines along the southern and western coasts of Turkey begin to ripen in late August, but the principal harvest season is mid-September to early October. Kislev provides a thorough discussion of the biological characteristics of the vine and its seeds.⁴⁶

Several authors discuss criteria used to separate wild (*Vitis sylvestris*) from domesticated (*Vitis vinifera*) grape seeds based on physical characteristics of the seed.⁴⁷ Most agree that seeds of cultivated grapes are oblong or egg-shaped and are larger, with a longer beak, than those of wild grapes, which tend to have a heart-shaped or spherical body with a very short beak. Almost all separations have been based on A. Stummer's analysis of a wild grape population from Austria based on breadth to length (B:L) ratios (generating a B:L ratio for wild seeds of 54–83 and 44–75 for domestic) and on E. Schiemann's measurements of wild grapes in the Rhone Valley (domestic B:L 54–70, and 64–83 for wild seeds).⁴⁸ Interestingly, almost all the archaeological applications of the criteria to separate cultivated from wild varieties on the basis of B:L ratio yield ambiguous results, with most specimens falling in the range of overlap.

Another problem with using measurements of dried grape seeds to rank charred grape seeds was brought forward by M. Hopf, who measured grape seeds before and after charring. She found that charring causes seeds to swell, creating a shorter length and increased breadth, thus artificially increasing the B:L index.⁴⁹ This is particularly relevant to analysis of the Serçe Limanı seeds, since five seeds are charred, and the others have been waterlogged and dried, most in uncontrolled conditions. Comparing these specimens to each other, much less to other populations, thus calls for great care, but measurements are presented here to add to the corpus for medieval grape seeds.

Application of B:L criteria to seeds from the wreck shows

that the B:L indices fall within a range of 60–83, with an average of 65, in both Stummer's and Schiemann's zone of overlap between domestic and wild seed forms. Thus the seeds in this sample add their testimony to a growing body of evidence suggesting that such ratios are inappropriately applied to archaeological material.⁵⁰ Other researchers have suggested using different seed features for their diagnostic value.⁵¹

The work of M. E. Kislev, R. M. N. Nesbitt, and D. Samuel is based on that of botanists who studied wild and domestic populations and concluded that the beak lengthens proportionately faster than the corpus length under cultivation and selection.⁵² They suggest that beak length expressed as a percentage of seed length may be a better criterion for separation. A. Terpo regards the comparison of beak length (BL) to corpus length (CL) as the most crucial consideration in separating seed types. His work also suggests that a length:breadth analysis offers less of an overlap between wild and cultivated varieties than the length:breadth data commonly used.⁵³

Basic measurements of the Serçe Limanı grape seeds in Table 26-3 also include five ratios used by botanists and archaeobotanists to analyze grape seeds. The small sample size prevents definitive statistical analyses, especially since one source dominates the sample and the remainder is divided into charred and uncharred specimens, some of which are broken or immature. Nonetheless, several suggestions can be offered.⁵⁴

Results of the L:B analysis for this set of material do not coincide with Terpo's analyses and are not particularly useful for distinguishing seed groups. Like the B:L index, however, L:B calculations for charred seeds differ significantly from those of uncharred. Charred seed ratios are 10% larger. As Nesbitt points out, comparing the indices of seeds from different periods of the same excavation or from other ancient sites is likely to be useful.⁵⁵ It is clear, however, that one encounters serious problems in applying data collected on fresh or dried seeds to charred archaeological specimens.

Comparative archaeobotanical material for Islamic sites is extremely rare. D. Samuel's study of plant remains from the site of Qaryat Medad on the Middle Euphrates of Syria includes detailed analyses of grape seeds from two twelfth- to thirteenth-century hearths, which contained more than 2,000 grape seeds each.⁵⁶ Her measurements of 100 seeds from each sample provide the only contemporary comparative material for the Serçe Limanı seeds. The most striking difference between the Serçe Limanı and Qaryat Medad seeds is the average length of the beak. Charred seeds on the wreck had an average beak length of 0.0022; averages for both samples at Qaryat Medad are 0.0012 and 0.00128. Uncharred examples from Serçe Limanı have an average beak length of 0.00159. Serçe Limanı seeds are also longer and broader, but Qaryat Medad seeds are slightly thicker (0.00296 as compared to 0.00275 for uncharred and 0.0029 for charred Serçe Limanı seeds).

TABLE 26-3. MEASUREMENTS AND SAMPLE DATA FOR SEEDS OF VITIS SP.

<i>Sample Location</i>	<i>L</i>	<i>B</i>	<i>Th</i>	<i>BL</i>	<i>CL</i>	<i>BL:CL</i>	<i>BL:L</i>	<i>B:L</i>	<i>Th:B</i>	<i>L:B</i>
[Lot 1965] N ₃ UR	6.0	5.0	3.0	[2.2]	3.8	58	37	83	60	120
[Lot 1956] (?)	5.3	3.6	2.5	1.6	3.7	43	30	68	69	147
[Lot 1985] ^a N ₄ LL _{1/2}	4.4	3.3	1.8	0.5	3.9	13	11	75	55	133
[Lot 1993] O ₃ LL _{2/4} + O ₄ UL _{1/3} , between Frs 10&12	6.1	4.0	3.0	1.8	4.3	42	30	66	75	153
GW BN O ₄ UL _{3/4} -UR _{1/3} (100 seeds, average measurements)	6.1	4.0	2.7	1.5	4.6	33	25	65	6	153
Am 103 M ₅ LL ₁	6.0	4.0	2.5	2.0	4.0	50	33	67	63	150
Am 88(b) N ₃ LL ₃	5.1	3.6	2.1	1.8	3.3	55	35	71	58	142
Lump CL N ₄ UR	7.1	5.0	3.0	2.0	5.1	39	28	70	60	142
Am 88(a) N ₃ LL ₃	5.2	4.0	2.9	1.5	3.7	41	29	77	73	130
Am 81 M ₅ LR _{3/4}	5.5	4.0	3.0	2.1	3.4	62	39	73	75	138
[Lot 1999] N ₄ LL _{1/2}	6.0	4.3	2.8	2.0	4.0	50	33	72	65	140
Unlabeled finds from glass lumps										
	5.9	4.2	3.1	1.4	4.5	31	24	71	53	140
	6.4	4.1	2.8	1.6	4.8	33	25	64	68	156
	6.3	3.8	3.1	1.6	4.7	34	25	60	82	166
	5.2 ^a	5.2	2.8	—	—	NA	NA	NA	54	NA
	6.1	4.1	3.0	1.7	4.4	39	28	67	73	149
	6.1	3.6	2.8	1.7	4.4	39	28	49	78	169
	6.9	3.8	2.8	1.7	5.1	33	25	56	74	182
	5.2 ^a	4.2	3.1	—	—	NA	NA	NA	74	NA
	4.7	2.7	1.4	1.4	3.3	42	30	57	52	174
Average	6.1	4.0	2.75	1.59	4.51	35	26	65	68	152

TABLE 26-3. MEASUREMENTS AND SAMPLE DATA FOR SEEDS OF *VITIS* SP. (cont.)

Sample Location	L	B	Th	BL	CL	BL:CL	BL:L	B:L	Th:B	L:B
Charred seeds										
Untagged lump	7.0	4.5	[2.8]	2.2	4.8	46	31	64	62	155
Lump X2 N4 UR2/4	6.2	3.8	3.0	2.5	3.7	68	40	61	79	163
Lump C N3 LL4-LR3 + N4 UL2	6.6	4.8	2.8	2.0	4.6	43	30	73	58	138
Lump Y4a x1 N4 UL2	6.3	4.1	3.0	2.1	4.2	50	33	65	73	154
Lump Y4b N4 UL1 ^b	4.7	2.8	1.8	2.1	2.6	80	45	60	64	169
Average	6.5	4.3	2.9	2.2	4.3	52	33.5	65.75	67.2	152.5

Note: Measurements in millimeters. L = overall length; B = breadth; Th = thickness; BL = beak length; CL = body length without beak.

^a Dimensions partially reconstructed. Excluded from averages.

^b Immature specimen. Excluded from averages.

Medieval trade in the grape centered on raisins, which retained their seeds, and wine, which could include seeds in the lees at the bottom of amphoras. *Dibs*, like the classical *defrutum*, was a more local product made by boiling equal amounts of raisins and water until a thick, sweet paste resulted. Ibn al-'Awwām provides instructions both for making raisins and for preserving fresh grapes for a year.⁵⁷ Raisins occur frequently in recipes from the Abbasid cookbook already mentioned,⁵⁸ and the annual dispensation of foodstuffs by Fatimid Caliph al-'Azīz (A.D. 976–996) included 600 *ardab* (about 23 tons) of raisins.⁵⁹ Cairo Geniza records frequently mention raisins. They are included in a cargo that arrived in Alexandria from Suwaydiyya, the port of Antioch; many letters refer to importing raisins for eating and making beverages; and two kinds of raisins are included in the inventory of a store that stocked candymaking supplies.⁶⁰ During the medieval period, vineyards were so prolific in Syria that some authors considered the grape to represent that country, much as the date was representative of Iraq. Farmers paid their taxes in raisins and olive oil.⁶¹ Three varieties of Syrian raisins (the 'Ainuni, the Duri, and the 'Asimi) are mentioned by the tenth-century geographer al-Muqaddasī.⁶²

With the exception of the single grape seed in amphora Am 103 in grid square M5 LL1, the seeds are concentrated in the general area of grid squares N3, N4, and O3 (Fig. 26-1). Amphora Am 88 in grid square N3 LL3 included two fragmentary

seeds, which were not available to me for examination, bringing the total number in that amphora to four. The charred seeds whose locations are known are from lumps of concreted glass broken from the large concretion in the N4 UL-UR area. A pair of seeds from the N4 LL area and three other isolated examples in the N3 UR and O3 UL-LL areas do not create a specific distribution pattern.

Olea europaea L. (Olive)

Olives in the Serçe Limanı samples were identified by gross morphological features, including the reticulate pattern of veining on the exterior seed surface and a long, fairly large, thick-walled seed coat (Fig. 26-3e). The olive is one of the most common features of the eastern Mediterranean coastal areas, and its growth habits are well known. Olive harvest along the southern Turkish shores usually begins in late October or November; the olives are usually preserved in a briny solution or pressed for their highly prized oil.

Most of the Serçe Limanı specimens came from lumps of concretion and seem to be mineralized or impregnated by iron. Although the stones are black, and seem to have the characteristic appearance of charred seeds, they retain dark brown material in the veining on their exterior surfaces and in some delicate embryo structures. An iron sulfide solution like that which caused the ship hull to become dark black could easily be responsible for their present appearance. Table 26-4 presents

measurements of the olive stones and of a natural mold formed in a concretion.

The olive remains have clearly shrunk a great deal, and I do not believe they should be subjected to statistical analysis or used for comparison with other material. Their value stems from their presence on the shipwreck. An amphora located in area L6 LL4 that does not belong to the wreck contained a single stone that may or may not be intrusive to the site. The other olive remains were concentrated in several areas, shown in Figure 26-1.

The olive was used by eastern Mediterranean peoples from Neolithic times on, and was cultivated and traded extensively from the Late Bronze Age, although its exact time of domestication is debated.⁶³ Palestinian Syria produced huge amounts of olives, olive oil, and soap, which were the most important of its agricultural exports during the tenth and eleventh centuries.⁶⁴ Al-Muqaddasi includes the olive in a list of Syrian exports.⁶⁵ Goitein's data from the Cairo Geniza refer mostly to olive oil rather than olives.⁶⁶

Punica granatum L. (Pomegranate)

Two desiccated pomegranate seed fragments—recovered in 1996 from lumps of broken glass from the mass of cullet that occupied the after third of the ship's hold—provide the sole evidence for the presence of this species on board. Gross morphological features, including a low ridge, overall seed shape, and seed color, were used to identify the seeds, which today are only 0.004–0.006 in length.

Pomegranate fruits are prized in the Mediterranean today both for their juice and for the translucent, brilliant pink or red flesh that surrounds the many seeds. The leathery rind itself is red, and the fruit measures between 0.06 and 0.15 in diameter. Pomegranates have long been a symbol of fertility, and breaking open a ripe fruit provides a vivid illustration of why that is so.

Both modern and medieval Islamic cuisine uses the seeds and juices of the pomegranate, often in conjunction with sumac, to add pungency and tartness to both meat and sweet dishes. Wine and fruit-syrup drinks also can be made from pomegranate juice.

Citrullus lanatus L. (Watermelon)

A single, broken seed (Fig. 26-3f) represents a popular and important fruit in the Mediterranean world. Watermelon, grown since at least the second millennium B.C. in the Nile Valley, seldom is visible in archaeological sites outside Egypt because both seeds and fruit are fairly soft.⁶⁷

Rhus coriaria L. (Sumac)

To my knowledge, the Serçe Limanı finds are the first archaeological finds of sumac (Fig. 26-2). Identification of these seeds and fruits was based on the characteristic shape of the seed and the red hairs that cover the drupe.⁶⁸ Comparison with

modern specimens from both wild trees and spice stalls of markets in Turkey bears out the identification, although the modern examples are slightly larger (0.0035–0.005 x 0.004–0.006, as compared to ancient drupe dimensions of 0.003–0.004 x 0.002–0.0035).

Sumac had many uses in the ancient world, particularly as a yellow dye, a tanning agent, and a spice. C. Joret noted the use of sumac fruits for tanning in the Middle East.⁶⁹ In addition to dried fruits and other commodities, Nahray b. Nissim, whose commercial activities lasted for fifty years (1045–1096), imported sumac and other dyeing materials from Syria to Egypt.⁷⁰ Sumac was also included in a medieval Islamic cargo of northern products that included walnuts, gallnuts, jujube, raisins, and tragacanth gum, and which arrived in Alexandria directly from Suwaydiyya, the port of Antioch in ancient Syria.⁷¹

Sumac was an important ingredient in medicinal treatments in the eleventh century. The medical writer ibn Jazlah classified two kinds of sumac, Khurasian and Syrian; the latter was red, smaller, and considered to be of higher quality. Ibn Jazlah cites Dioscorides, al-Kindī, and al-Samarqandī, who used sumac to treat menstrual disorders and other diseases of the womb, to strengthen the stomach, to quench thirst, to ease digestion, and to treat gum and mouth disorders. A solution of sumac was also used as an astringent and antihemorrhagic, and ibn Jazlah wrote that only Syria grew it.⁷²

The use of sumac as a spice also should be noted. Sumac fruits are very acidic and astringent, and were used to prepare a sumac juice added to meat dishes that contrasted sweet and sour flavors. A recipe for sumac juice appears in a chapter of the *Kitāb al-Wuṣṣā ila al-Habīb*, an Ayyubid cookbook that probably dates to the tenth century.⁷³ Sumac also appeared in minced meat dishes spiced with ginger, cinnamon, pepper, cumin, coriander, and mastic, or as a coloring agent in a popular mixture of dry spices eaten plain or on bread dipped into it.⁷⁴ A similar mix, often with the separate spices laid in colorful patterns, can be seen in the spice bazaar of the Aleppo market today, and the bright purple ground fruits are sprinkled on top of meat dishes throughout Turkey and the Near East.

The Arabic dish *sumaqiya* was popular throughout the Arab-speaking world and is even included in a fourteenth-century Italian cookbook.⁷⁵ Curiously, sumac is recorded as occurring three times more often in the Italian cookbook than in a thirteenth-century Baghdad cookbook:⁷⁶

SUMAQIYA. Cut fat meat into middling pieces and leave in the saucepan, adding a little scented salt. Boil until almost cooked, and remove the scum well. Throw in beets cut the size of a finger, and carrots. Take onions and Nabatean leeks, peel, wash in salt and water, and put in on top. If eggplant is in season, add this too, peeling off the black skin and boiling in a

TABLE 26-4. DIMENSIONS OF OLIVE PITS IN MM

Sample	Location	Length	Breadth	Comments
[Lot 1146]	N4 LR4	(9.0)	7.0	1/3 missing
Lump Y4a	N4 UL1	9.5	4.8	1/2 missing
Lump Y4b	N4 UL1	9.5	5.2	broken
Lump 714a	O4 UL1/3	12.2	4.5	charred
Lump 714b	O4 UL1/3	9.0	4.5	charred
[Lot 1973]	M4 LR3/4	12.0	6.0	broken
Lump a	N3 LR4	10.0	5.0	charred
Lump b	N3 LR3	10.1	4.0	impregnated
Lump c	N3 LR3	13.0	6.0	concretion mold

separate pot. Take sumach, place in another saucepan with a little salt and the pith of a loaf, boil well, and strain. If desired, pluck and wash a chicken, cut it into quarters, and throw it into the saucepan. Mince red meat fine with seasonings and make into cabobs of middling size, then add these to the saucepan, together with seasonings of dry coriander, cummin, pepper, ginger, cinnamon and mastic ground fine, and a few sprigs of fresh mint. Now take the sumach and put it into the saucepan. Grind walnuts, soak in water, and add: rub over the pot dry mint, and throw in a few pieces of walnut whole. Grind a little garlic, moisten with a trifle of the broth, and pour in. Some garnish with poached eggs. Leave over a slow fire to settle, then remove.⁷⁷

Both Pliny⁷⁸ and Yāqūt, an early thirteenth-century Islamic geographer, described Syria as the source of traded sumac. Yāqūt described Jabal as Summāk: "It gets its name from the word sumac which one uses for cooking. This is a great mountain region in the district of Western Aleppo. Jabal as Summak is called this for the Summak [sumac] tree, which abounds here. Sesame, cotton, and apricots are grown here."⁷⁹ Sumac is included in al-Muqaddasi's catalogue of Syrian products,⁸⁰ and Yusuf's survey of tenth- and eleventh-century Syria notes that sumac was grown in northeast Syria at the end of the eleventh century and also in the Hebron valley.⁸¹

Ibn al-'Awwām, writing in the twelfth century, and using an early tenth-century agricultural handbook as a reference, described the culture of sumac and the preparation of a bread from its fruits to be used in times of scarcity:

One uses the fruit, bark and leaf, when it is red; one takes them all and soaks them in water for two days; boil for a long time in sweet water with salt, adding fresh water as the old evaporates, that is to say, keeping the water level constant. The new water is lost by the effect of boiling; therefore at no point leave the

pot on the fire without adding water. On the contrary, keep the pot and its contents in a moist condition more or less in proportion to the quantity of volume. Whenever you boil sumac, one does it this way, that is to say removing it from the fire before it has been desiccated and when it has not been soaked with water, not dry, but plumped up. When one processes sumac this way, one dries it; when it is well dried out, one can pass it through a grindstone; if you knead it with hot water, you can get a kind of flour, after adding a certain quantity of flour from wheat or bread. One can cook the dough on the flat pans or in the oven, but the bread obtained is eaten with olive oil, jams, fats of meat or of butter, or other similar substances.⁸²

Unidentified Specimens

Two specimens remain unidentified at this writing. From a lump of concretion in grid square N3 LR3/4, a nut 0.011 long x 0.008 thick x 0.010 broad was recovered (Figs. 26-2 and 26-4c). The nut is flat on one face; two bulges on the other side may appear more prominent now than when the nut was fresh, due to the collapse of the single embryo. Cracks along the side of the nutshell are not symmetrical and do not mark a natural fission line. The wide end of the nut is slightly eroded and does not appear to have been broken off, but its original shape is not preserved. Wall thickness ranges from 0.0021 at the top to 0.007–0.010 along the lower walls.

The interior of the nut is now filled by a whitish concretion containing seashells and urchin spines, tiny fragments of wood or rope, and other seaborne debris. Parts of this oval concretion have a dark brown layer adhering to the outer edge. This may be what remains of the outer coat of the embryo.

The best possibility for the identification of this nut is *Crataegus azarolus* (azarole), but a lack of comparative material prevents positive identification. The azarole is preferred for this identification because its fruits are 0.015–0.018 in diameter, as opposed to the fruits of *C. monogyna*, whose

fruits are only 0.005–0.007 in diameter and whose stones measure about 0.006 long x 0.004 broad. The stone is furrowed on its dorsal surface and keeled or flat on its ventral surface like the Serçe Limanı nut, but the pyrene, or stone, is said to be only about 0.008 long x 0.005–0.007 broad.⁸³ The azarole is apple-flavored and is sold in markets of the eastern Mediterranean.

The other sample came from lump CL, mostly in N4 UR. This fragment of a woody nut or seed coat is golden brown with a lighter yellow wall interior. It tapers from a narrow apex to a bulging, broad base. It is broken, and about one longitudinal half remains, permitting embryo size to be reconstructed as (0.0085) long x 0.0065 broad at base x 0.004 thick. The fragment bears a general resemblance to the seed coat of *Pinus* sp., either *picea* or *strobilis*, a valued foodstuff in the eastern Mediterranean for thousands of years.

Coprolite

A single, black coprolite flecked with bits of macerated grasses was recovered from the wreck site (sample from Lot 2006; airlift spoil in N6). Its size and shape suggests that it is a sheep or goat dropping (Fig. 26-3g). If this dropping did originate on the ship and is not a later contamination, its presence in the collection of organic remains from the wreck lends some support to Philip Armitage's suggestion in chapter 25 that the ship may have carried live goats for shipboard consumption.

DISCUSSION

One of the principal questions facing archaeologists working underwater or on land deals with the context of material. In the case of plant remains from the Serçe Limanı wreck, it is safe to say that most of the finds were not discovered in their original context. By far the most samples were discovered in the lower edges of grid squares N3 and O3 and the upper part of grid square N4, the area of the large glass concretion (Fig. 26-1). Although it is tempting to identify this area as a food storage area, the finds are too dispersed and probably were subject to a skewed recovery. Since the glass concretion was broken into lumps that were subsequently chiseled apart by hand on land, conditions for recovery were far more favorable than under the limited recovery system in use for other contexts.

Because amphoras containing sumac are spread across the wreck site (grid squares O6, L6, M5, and N3), it is possible that each carried sumac, but amphora Am 88 in grid square N3 LL3 seems the strongest candidate. In the area beneath this upturned amphora, found with its mouth facing the seabed, were found several loose sumac fruits, and it provided the greatest number of fruits (more than sixty). Am 88 also contained two grape seeds and an olive stone, so the record is not clear.

We do not know how plant remains disperse on shipwrecks, but the evaluation of contents of lentoid flasks from a Late Bronze Age shipwreck suggests that there may be a soft layer of organic material that washes back and forth into containers. These lentoid flasks have very small openings—as small as 0.01—yet one example contained more than 250 fig seeds, 1 grape seed, 6 pomegranate seeds, 1 sumac fruit, and 1 weed seed.⁸⁴ Dispersal of organic remains on a shipwreck is a topic of continuing study and research.

The fruit stones on the shipwreck strongly suggest that the fruits were fresh when the ship sank. The fresh fruit may have been a delicacy, for the diet of the rich and poor differed greatly in the medieval period.⁸⁵ The poor ate primarily bread and fish or poor mutton, cheese, dates, and figs, while the rich of the Abbasid empire are described in the ninth century as eaters of fattened chicken, fresh fruits imported from the mountains of Upper Iraq, and dried fruits.⁸⁶ A parable of the period also ranked fruits with the food of the rich.⁸⁷ Circumstantial evidence for shipboard diet is provided by some regulations of slightly later date but probably based on earlier practice. The Barcelona ordinance of 1258 required ship owners to keep a fifteen-day supply of food on hand that had to include bread, wine, salt meat, and vegetables. Cheese, onions, garlic, oil, water, and vinegar are also mentioned as food for the crew.⁸⁸ The *Consulate of the Sea* required vessels with a deck to provide the crew with meat three times a week and with soup of mixed vegetables, meat, and flour, accompanied by bread, on the other days. Morning meals consisted of bread with cheese or onions or fish; wine rations and raisins or figs were also required if the goods were available.⁸⁹

The rather simple diet of crew members does not seem to have included fruits, so it is likely that fresh fruits were a delicacy reserved for well-to-do passengers or the captain. These fresh fruits may also have included grapes, since the distribution of seeds is unrelated to amphora contents. Grape seeds from the Serçe Limanı wreck could have come from raisins, in which case they may have been both cargo and to some extent a part of the provisions for either class. Olives can likewise be regarded as provisions for either passengers or crew.

In a list of much prized commodities offered for sale to travelers whose provisions were running low, the twelfth-century pilgrim ibn Jubayr describes the arrival of a laden ship during a journey from Acre to Crete in November: "but by the charity of God in this ship they were as if in a city filled with all commodities. All they might wish to buy could be found here: bread, water, and all kinds of fruit and victuals, such as pomegranate, quince, watermelon, pear, chestnut, walnut, chick pea, broad bean raw and cooked, onion, garlic, fig, cheese, fish, and many other things it would take too long to describe."⁹⁰

No dried fruits, except the abundant fig, are included, nor are almonds. Their lack may reflect the season or, more likely, the class of people being catered to.

Limited records for the Fatimid period prevent consideration of the value of goods. Prices for goods such as wheat, wine, and lentils are available in translated documents, but other commodities appear rarely. Our only indications of their former value comes in the reports of diets of the poor and in the knowledge that the cookbooks cited here were designed for use by the wealthier segment of society. The scarcity of archaeobotanical analyses from Islamic archaeological sites also prevents broader comparisons.

What can the plant remains tell us about the season of the ship's sailing? All of the plants could have been stored for quite some time, even if the fruits were fresh. Looking at the group as a whole, I tend to favor a later date for sailing, perhaps in early September or later, on the basis of the nuts, pomegranates, and grapes. Ibn Jubayr remarks that the autumn voyages set sail from the northern Syrian coast in the last two weeks of October upon the return of favorable, and fleeting, east winds. He himself was traveling from Acre to Crete and beyond on November 7, 1184.⁹¹

All the species represented on the shipwreck could have come from medieval Syria, which covered a larger area than the modern nation and was known for its production of fruits and olives. Arab geographers of the tenth and eleventh centuries described medieval Syria as a virtual orchard, producing almonds, apricots, grapes, olive, sumac, plums, black plums, peaches, and cherries.⁹²

Only sumac provides us with a definite area of limited production that stretched from the southeastern coastal area of modern Turkey, to the region near Aleppo, to the Hebron valley in Palestine. Because of a lack of small seeds and weed species on the wreck, it is not possible to suggest a less broad area as a source for the Serçe Limanı plant remains.

CONCLUSIONS

Archaeobotanical analysis of shipwreck sites can provide a different point of view than that presented by isolated studies of cargo components, such as glass or pottery. Although recovery of plant remains from the Serçe Limanı wreck was not as sophisticated as procedures used today, the broken fragments have their own story to tell. This study makes the assumption that all the plant remains were associated with the ship's final voyage, and the distribution of remains in amphoras and the glass concretion reinforces this.

The few examples of stone fruits, pomegranate seeds, and nuts suggest that these foods were present in limited quantities aboard the ship, probably as provisions for wealthier passengers or ship's officers. Olives and grapes or raisins may have supplemented their diets or made up a major portion of the crew's diet. Sumac fruits could have been either cargo or condiments. I suspect that they were cargo since they were not ground.

Historical evidence points to the medieval Syrian coast as the source of the Serçe Limanı plant remains. Botanical evidence offers contradictory evidence regarding the season of sailing but favors a date in the early fall, although each of the products aboard the vessel could have been dried and stored for as long as a year before use or transport.

Individual studies of each species represented on the wreck have contributed to the currently meager record of Islamic horticulture and to some questions concerning how archaeobotanists interpret metric data from plant remains. The careful recording of context for the seed samples by the excavation crew and the integration of historical evidence with the archaeological and archaeobotanical analyses make the interpretation of the small collection of plant remains from the wreck both possible and significant.

NOTES

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