The Beginnings of Winemaking and Viniculture in the Ancient Near East and Egypt

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The origins of winemaking and viniculture are shrouded in the mists of human prehistory. Scenarios of how wine might have been discovered, however, are easily conjured up. One can imagine a group of early humans foraging in a river valley, dense with vegetation. They are captivated by brightly colored berries hanging in large clusters from thickets of vines and are further enticed by the tart, sugary taste of the grapes. They gather up as many berries as possible, perhaps into an animal hide or even a crudely fashioned wooden container. Some grapes rupture and exude their juice under the accumulated weight of the fruit. As the grapes are gradually eaten over the next day or two, this juice will ferment, owing to the natural yeast "bloom" on the skins, and become a low-alcohol wine. Reaching the bottom of the "barrel," our imagined caveman or woman will sample the concoction and be pleasantly surprised by the aromatic and mildly intoxicating beverage. Additional intentional squeezings and tastings might well ensue.

Other circumstances could have spurred on the discovery. Under the right climatic conditions, grapes will literally "ferment on the vine." The berries are attacked by molds, which concentrate the sugar and yield a product of higher alcoholic content upon fermentation. Observant humans, such as our prehistoric ancestors must have been *per force*, will see various animals, especially birds, eagerly eating the grapes, followed by some uncoordinated muscular movements, and possibly will carry out experimentation of their own.

The greatest obstacle in the way of substantiating a "Palaeolithic hypothesis" is the improbability of finding a preserved container with intact organic material or microorganisms that can be identified as exclusively due to wine. For example, leather or wooden containers are yet to be recovered. It is possible that stone vessels or even a crevice in a rock might have been used. However, the stone vessels recovered from Palaeolithic sites are not closed containers of a type that can be readily stoppered. Consequently, any Palaeolithic wine made in a stone receptacle must have been produced only during the fall when the grapes matured, and must have been drunk quickly before it turned to vinegar.

NEOLITHIC WINEMAKING AND VINICULTURE

If winemaking is best understood as an intentional human activity rather than a seasonal happenstance, then the Neolithic period, from about 8500 to 4000 BC, is the first time in human prehistory when the necessary preconditions for this momentous innovation came together.

Most importantly, Neolithic communities of the ancient Near East and Egypt were permanent, year-round settlements that were made possible by domesticated plants and animals, such as cereals and ruminants. With a more secure, although more restricted, food supply than nomadic groups and with a more stable base of operations, a Neolithic "cuisine" emerged. Using a variety of food processing techniques—fermentation, soaking, heating, spicing—Neolithic peoples are credited with first producing bread, beer, and undoubtedly an array of meat and grain entrées that we continue to enjoy today.

Crafts important in food preparation, storage, and serving advanced in tandem with the new cuisine. Of special significance is the appearance of pottery vessels around 6000 BC. The plasticity of clay made it an ideal material for forming shapes such as narrow-mouthed vats and storage jars for producing and keep-

FIG. 1. One of six jars once filled with resinated wine from the "kitchen" of a Neolithic residence at Hajji Firuz Tepe (Iran), dating to 5400–5000 BC.

UPM no. 69-12-15. H. 23.5 cm. Photograph courtesy of Hasanlu Project, University of Pennsylvania Museum

ing wine. After firing the clay to high temperatures, the resultant pottery is essentially indestructible, and—a boon for archaeological chemists—its porous structure helps to absorb organics.

Horticulture of grapevines and other Near Eastern plants (such as the olive, fig, date, and pomegranate) has often been viewed as a relatively late prehistoric development, beginning toward the end of the 4th millennium BC and rapidly expanding during the 3rd millennium. Archaeobotanical remains (seeds, wood, skins, etc.) of horticultural products are more prevalent in archaeological contexts of this later period (see map, Fig. 15, at end of article). However, systematic collection of botanical materials has been carried out at ancient Near Eastern and Egyptian sites only over the past few decades, and the morphological features that have been used to distinguish wild from domesticated types are dubious at best (see box on The Grapevine).

A late prehistoric date for viniculture does not explain why cereals were domesticated some 3000 to 4000 years earlier than the grapevine, nor does it account for what is presumably viniculture at Chalcolithic (ca. 4000–3300 BC) and Early Bronze Age I (ca. 3300–3000 BC) sites in the Jordan Valley. Even though the grape pips from the latter sites are of the proposed wild type (short and broad), the *sylvestris* vine is unlikely to have grown in such an arid climate, and the pips must therefore derive from domesticated vines which had been transplanted to the Jordan Valley.

For the origins of viniculture, one must look farther north and at higher elevations where the wild subspecies thrives and where other conditions for the development of winemaking are met. Neolithic communities in upland regions of the northern Zagros Mountains, the Taurus Mountains of eastern Turkey, and the Caucasus Mountains were well established from an early

date, and are probably the best candidates for early winemaking and viniculture. Unfortunately, few sites in this ethnically diverse and politically divided region have been excavated, let alone published in a Western language. Tantalizingly, grape pips of the "domesticated" type are reported from Chokh in the Dagestan Mountains of the northeast Caucasus, dating to the beginning of the 6th millennium BC, and from Shomutepe and Shulaveri along the Kura River in Transcaucasia, dating to the 6th through early 4th millennium BC. Until these finds are assessed within a larger regional framework, their significance for the prehistory of winemaking will remain uncertain.

HAJJI FIRUZ TEPE, IRAN

A major step forward in our understanding of Neolithic winemaking came from the analysis of a yellowish residue inside a jar excavated in 1968 by Mary M. Voigt at the site of Hajji Firuz Tepe in the northern Zagros Mountains of Iran. The jar, with a volume of about 9 liters (2.5 gallons), was found together with five similar jars embedded in the earthen floor along one wall of a "kitchen" of a Neolithic mud-brick building, dated to ca. 5400–5000 BC. The structure, consisting of a large living room which may have doubled as a bedroom, the "kitchen," and two storage rooms, might have accommodated an extended family. That the room in which the jars were found functioned as a kitchen was supported by the finding of numerous pottery vessels, which were probably used to prepare and cook foods, together with a fireplace. A second jar from the kitchen (Fig. 1), with a reddish residue on its interior, was also subsequently analyzed.

the Hajji Firuz sample clearly was a mixture of a grape product and terebinth tree resin.

Chemical Analysis of Resinated Wine

The battery of infrared, liquid chromatographic, and wet chemical analyses that have been carried out clearly showed the presence of calcium tartrate in the two jars (Fig. 2). Tartaric acid occurs in large amounts in nature only in grapes, and its insoluble calcium salt formed in the calcareous environment of the site. Unaltered tartaric acid was also attested in one of the jars (Fig. 1, for which the spectrum is shown in Fig. 2). The jar originally contained a liquid, judging by its relatively long, narrow neck and the residue being confined to its bottom half. Under normal conditions and at room temperature, grape juice quickly ferments to wine. Because of slow pressing methods in antiquity and high temperatures in the Middle East, fermentation had probably begun before the liquid went into the jar. Clay stoppers of approximately the same diameter as that of the jar mouth were found nearby, so the expertise was available to seal the jar and prevent the wine from turning to vinegar.

The high-performance liquid chromatographic results pointed to another component that made it virtually certain that the jar originally contained wine. The ultraviolet absorption spectrum of the unknown component closely matched that of terebinth tree resin. Neolithic peoples, such as those in the village of Hajji Firuz, probably already appreciated the preservative and medicinal properties of tree resins, which are most amply attested in Roman times (see box on Tree Resins). Their use, particularly in combination with wine, continued to expand in later periods throughout the ancient Near East and Egypt; the pharmacopeias of these regions during literate times are dominated by tree resins. In an upland region such as Hajji Firuz, the wild grapevine and the terebinth tree grew together and produced their fruit and resin about the same time of the year, so mixing these products together might have occurred accidentally or as a result of an innovative impulse. However it happened, the Hajji Firuz sample clearly was a mixture of a grape product and terebinth tree resin. And that grape product was most likely wine.

It is not known whether the Hajji Firuz wine was made from the domesticated or the wild grape. The site lies within the ancient and modern distributional zone of the wild grapevine, as established by pollen cores from nearby Lake Urmia. The quantity of wine in the "kitchen"—about 50 liters (14 gallons) if all six jars contained wine and were nearly full—does suggest fairly large-scale production and consumption for a household. If the same pattern of usage were established across the whole of the site's Neolithic stratum, only part of which was excavated, it might be concluded that the grapevine had already come into cultivation.

EGYPT

The wild grape never grew in ancient Egypt. Yet a thriving royal winemaking industry had been established in the Nile Delta by at least Dynasty 3 (ca. 2700 BC), the beginning of the Old Kingdom period. Winemaking scenes appear on tomb walls, and the

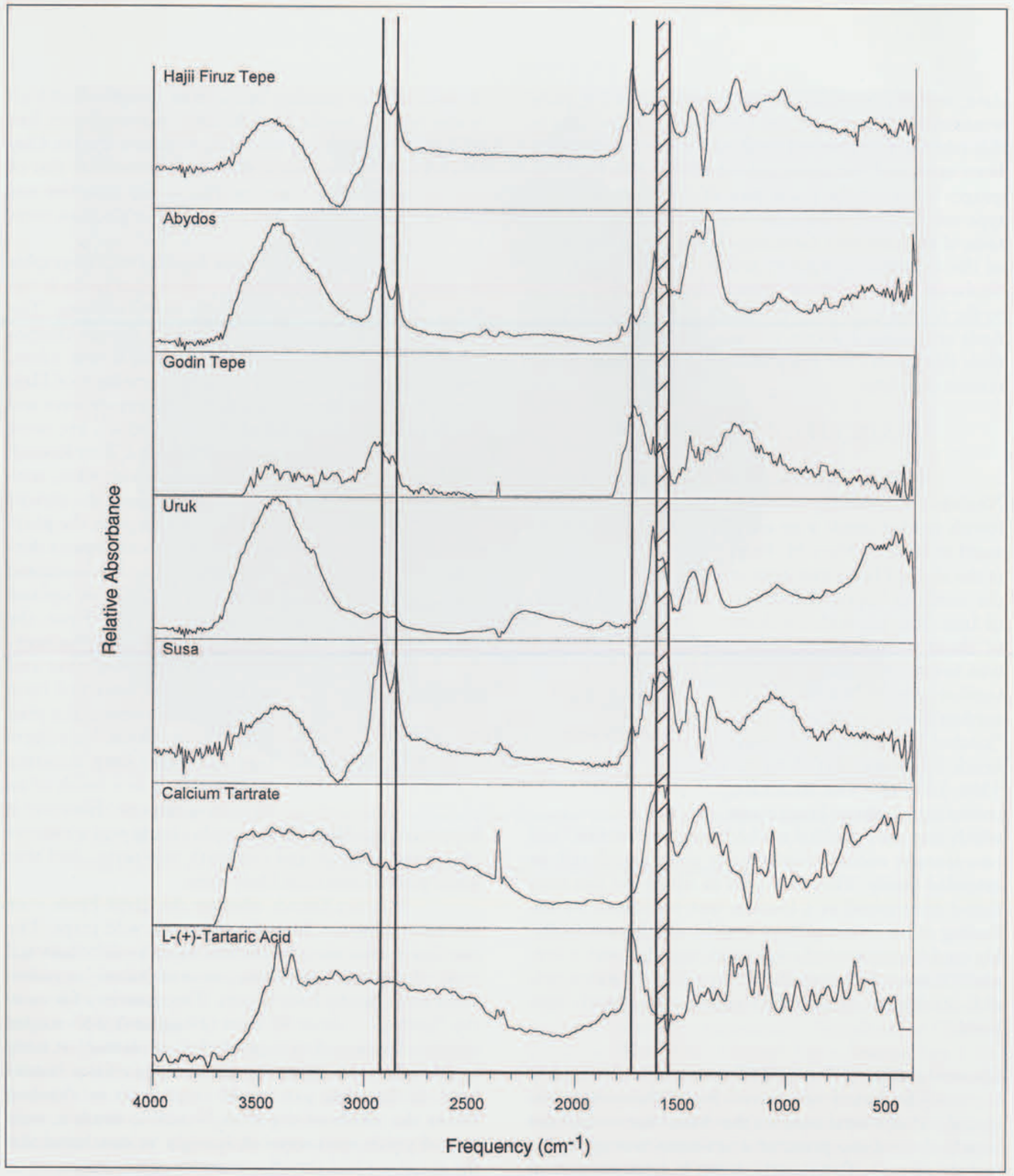

FIG. 2. The infrared spectrum of the organic contents of one of the Neolithic Hajji Firuz Tepe jars (Fig. 1) is dominated by the absorption peaks of both tartaric acid (at 1740–1720 cm^{-1}) and calcium tartrate (at 1613 and 1561 cm^{-1}). This salt of tartaric acid forms in calcareous geological environments. Tartaric acid occurs naturally in large amounts only in grapes. The jar contained a grape juice which quickly fermented to wine, and was preserved by stoppering and adding terebinth tree resin (as indicated by the absorption maxima at 2926 and 2858 cm^{-1}). Later wine jar samples from late 4th millennium BC Egypt (Abydos, tomb U-j, no. 10-115) and upland and lowland Mesopotamia—Godin Tepe (sherd Gd. 73-A01 44, Royal Ontario Museum), Uruk (Badler et al. 1996: fig. 1), and Susa (see Fig. 11)—sometimes contain relatively more tartaric acid than calcium tartrate (note the Godin Tepe sample).

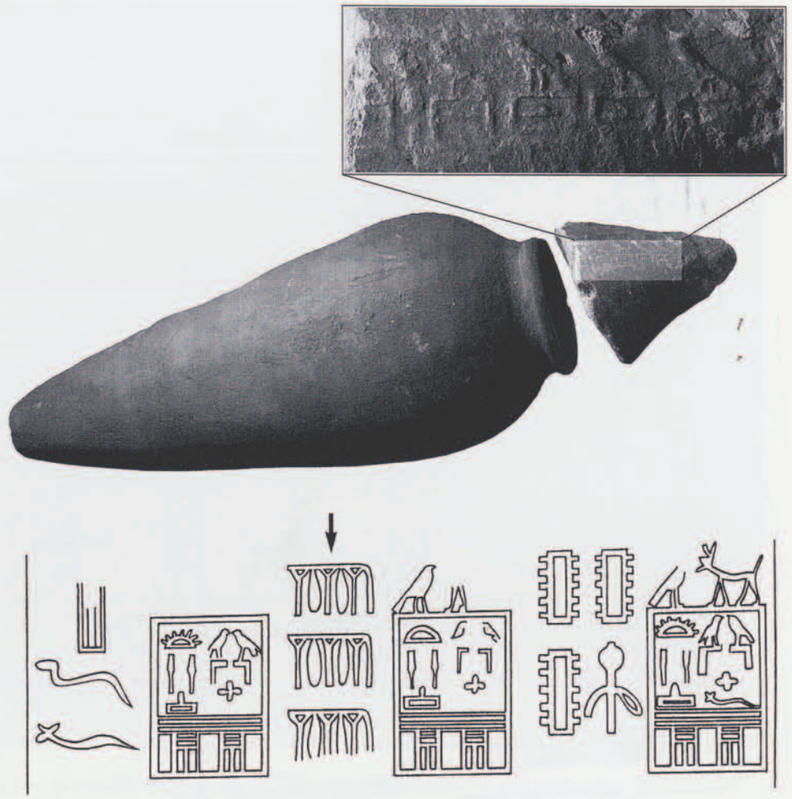

FIG. 3. (a) Early Dynastic "wine jar" from a royal tomb at Abydos, Egypt, with stopper showing the *serekh* (the early hieroglyphic form of the cartouche) of Den, a Dynasty 1 pharaoh (see inset). (b) The early hieroglyphic sign for "grapevine/vineyard" (arrowed) occurs on a more elaborate cylinder seal impression on a jar stopper with the *serekh* of Khasekhemwy, a Dynasty 2 pharoah.

(a) UPM no. E6943. H. 66.5 cm (Petrie 1901: I:29, pls. 40.26 and 52.743); unprovenanced stopper UPM no. 60-15-23. Photograph courtesy of the Egyptian Section, UPM, modified by P. Zimmerman, MASCA. (b) Drawing after Kaplony 1963–64: fig. 310

accompanying offering lists include wine that was definitely produced at vineyards in the Delta. By the end of the Old Kingdom, five wines—all probably made in the Delta—constitute a canonical set of provisions, or fixed "menu," for the afterlife.

The evidence for winemaking in the Delta during the preceding Early Dynastic Period (Dynasties 1 and 2) is more inferential. Rather than recording a large number of jars of wine or other goods in an offering list, actual jars in large quantities were buried in the tombs of the pharaohs at Abydos and those of their families at Saqqara, the main religious centers. The putative wine jars have standardized shapes and volumes (approximately 10, 20, or 30 liters), and are sometimes decorated with rope appliqués running around the neck, shoulder, and/or base. Most importantly, they are stoppered with a round pottery lid and a conical clay lump that was pressed over the lid and tightly around the rim. The clay stopper was generally impressed with multiple cylinder seal impressions giving the name of the pharaoh.

While chemical tests have yet to verify that the Dynasty 1 and 2 jars contained wine, less common seal impressions on the jar stoppers do include hieroglyphic signs for "grapevine/vineyard" and possible geographic locations (e.g., Buto/Tell el-Fara' in the north-central Delta, and Memphis, the northern capital, near Saqqara), in addition to the king's name (Fig. 3a). Such seals have been interpreted as a primitive kind of wine label, possibly giving the location of the winery and its owner. The impressions with only the king's name might then be an abbreviated form of registration for jars that generally contained wine. Viniculture in Egypt must have taken some time to develop, and the Early Dynastic "wine jars" may well represent the "first fruits" of the nascent industry.

Is it possible to know when the first grapevines were transplanted to the Nile Delta? The answer to this question is vital for understanding the prehistory of an industry that eventually spread over the entire Delta, to the large western oases, and even to towns on the upper Nile where the climate would seem to preclude viniculture. Moreover, it may have far-reaching implications for the consolidation of one of the earliest literate civilizations. The domesticated grapevine could only have come from some region of the Levant that was already exploiting it, and many specialists—farmers/horticultur-

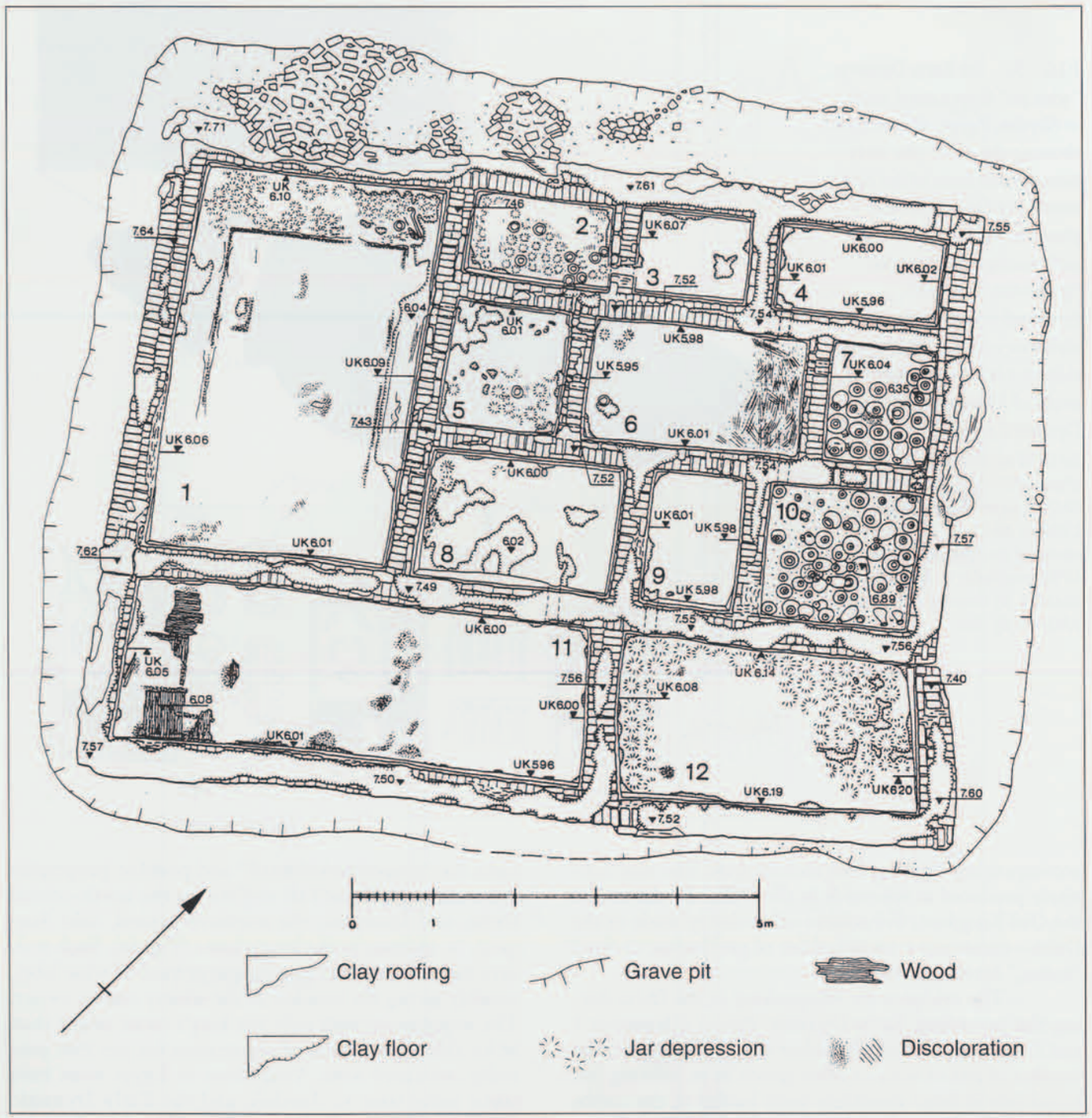

FIG. 4. Plan of tomb U-j in the predynastic royal cemetery of Abydos, Egypt, measuring about 10 by 8 m and dug about 2 m into the desert ground. The chambers represent a model funerary house. Traces of a shrine show that chamber 1 was the burial chamber; a scepter of ivory found in the northeastern corner of the chamber marks the owner and occupant of the tomb as one of the first kings of ancient Egypt.

Each of the other chambers was equipped with funerary offerings for the afterlife: chambers 1 and 2 with Egyptian wide-mouthed, cylindrical jars, possibly containing oil or fat; chambers 3 and 4 with locally manufactured Egyptian pottery, probably including beer jars, bread molds, and serving plates; chamber 11 with stone vessels, possibly clothing, and ivory and bone objects stored in cedar boxes; and chambers 7, 10 and 12 with as many as 700 imported wine jars from the southern hill country of Palestine, the Jordan Valley, and Transjordan.

After Dreyer 1993: fig. 4

FIG. 5. Tomb U-j, as seen from the northeast, with imported wine jars in situ in chamber 10.

Photograph courtesy of German Archaeological Institute in Cairo

FIG. 6. Clay sealing from tomb U-j, with a miniaturized and intricate cylinder seal impression showing animals and various enigmatic signs surrounded by a geometrical pattern. Numerous sealings of the same general type were evidently attached to strings that held covers made of an organic material in place over the mouths of the wine jars.

L. of impression 2.45 cm. Drawing courtesy of German Archaeological Institute in Cairo

alists, transporters/traders, pottery-makers, and, above all, vintners—would have been involved in and essential to the establishment and success of the developing industry. The grapevine hieroglyph itself (Fig. 3b), showing a grapevine trained to run along a trellis or arbor, indicates that the Early Dynastic viniculture was quite sophisticated.

Abydos Tomb U-j

Our understanding of the prehistoric background for the Delta industry leaped forward with the discovery of 360 jars buried in a tomb of one of Egypt's first kings at Abydos. The multi-chambered, mudbrick-lined tomb in the royal cemetery has been the focus of on-going excavations directed by Günter Dreyer of the German Institute of Archaeology in Cairo (Dreyer 1992 and 1993). Tomb U-j (Fig. 4) is dated to about 3150 BC (Naqada IIIa2 in Upper Egypt), according to radiocarbon determinations (Boehmer et al. 1993). This is 150 years earlier than the nearby tomb of King Aha of Dynasty 1, about 100 meters to the north, and somewhat later than the Late Uruk period of Mesopotamia (see below).

The tomb included a burial room (chamber 1) and 11 storage rooms for various items of funerary importance (Dreyer 1993 and n.d.). Chamber 10 and part of chamber 7 were almost intact, and 207 jars were found piled up in three or four layers (Fig. 5). De-

FIG. 7. The wine residue adhering to the inside of an imported wine jar from tomb U-j. Note, especially, the ring of material that accumulated at the surface of the liquid before it evaporated; it is slanted, because the jar was not upright.

No. 7-50. H. of sherd 33.5 cm. Photograph courtesy of German Archaeological Institute in Cairo

pressions in the floor of chamber 12, together with numerous jar sherds of the same types as those in chambers 7 and 10, show that another 150 vessels once covered the floor of this room. Assuming that more vessels were piled one on top of another, the three rooms can be estimated to have originally contained as many as 700 jars.

Many small clay sealings (Fig. 6) found associated with the vessels had jar rim and string impressions on their backs. They were probably once pressed onto covers made of an organic material, such as leather, that were tied over the jar mouths with string. On the sealings were hitherto unknown and extremely fine-cut cylinder seal impressions. Only three seal motifs of the same general type are attested for the numerous wine jars, possibly indicating a common registration procedure.

Other finds are also noteworthy: inked hieroglyphs on cylindrical jars and incised hieroglyphs on small perforated bone and ivory plaques, evidently labels that were attached by strings, represent the earliest written records from Egypt. None of the written signs on the tomb U-j sealings, jars, or labels can be related to winemaking or viniculture. However, once the sand filling had been removed from the jars, rings of a yellowish crusty residue, which were slanted off from the horizontal, were seen on the interiors (Fig. 7). They are best interpreted as the remains of a liquid that had gradually evaporated, with materials on the surface of the liquid agglomerating to form the rings.

Forty-seven jars contained grape pips, generally between 20 and 50 each, and several completely preserved grapes were also recovered. According to F. Feindt of the Botanical Institute of Hamburg University, the pips are morphologically most similar to the domesticated subspecies, but not far removed from the more rounded wild shape. Eleven vessels had remains of sliced figs (*Ficus carica* or *F. sycomorus* L.), which had been perforated, strung together, and probably suspended in the liquid.

tests . . . conclusively indicated the presence of both tartaric acid and its salt, calcium tartrate, in three Abydos jars from [tomb U-j]

The archaeobotanical remains of grapes and the likelihood that the jars had once contained a liquid and been sealed were presumptive evidence that the vessels were originally filled with wine. Although a fig additive is otherwise unattested in ancient Near Eastern and Egyptian wine, it might have served as a sweetening agent or for special flavoring.

The battery of chemical tests that the MASCA laboratory has developed for identifying organic compounds specific to wine conclusively indicated the presence of both tartaric acid and its salt, calcium tartrate, in three Abydos jars from chambers 7 and 10, only one of which contained grape pips. In addition, a tree resin additive is evidenced by the strong absorptions in the 2900 cm^{-1} region shown in Figure 2; its ultraviolet absorption spectrum is most similar to the terebinth tree

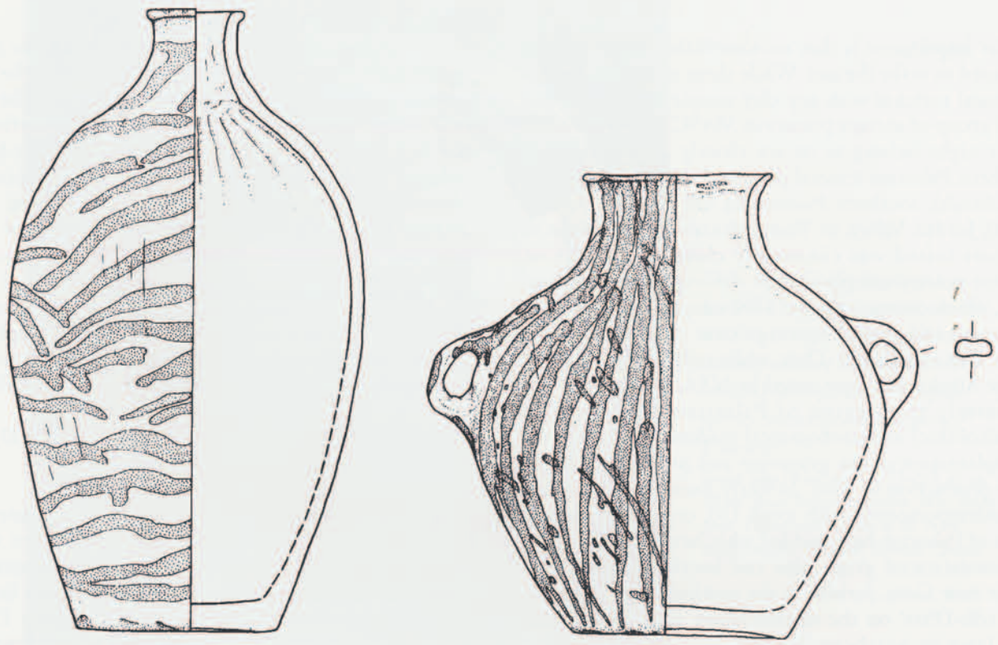

FIG. 8. The most typical shapes of the imported wine vessels in the tomb U-j assemblage are bottle-shaped jars with generally narrow mouths (a). Jars with loop or ledge handles (b) are less common.

(a) No. 10-33. H. 40.8 cm. (b) No. 7-35. H. 30.2 cm. Drawings courtesy of German Archaeological Institute in Cairo

resin found in the Neolithic wine from Hajji Firuz Tepe.

Imported Palestinian Wine at Abydos

With an average volume of 6 to 7 liters for each of the projected 700 wine jars in tomb U-j, the king could have drawn upon some 4500 liters in his afterlife. Where had such a large quantity of wine been produced? Abydos, located almost 400 miles up the Nile in an extremely dry terrain, did not support vineyards during this period. In the Nile Delta, grape remains of predynastic and Early Dynastic date are thus far very sparse, having been confirmed only for Buto and Tell Ibrahim Awad in the east. The stoppered and sealed wine jars found in Early Dynastic cemeteries, which are of Egyptian type and made of Nile alluvial clay, remain the best evidence for the earliest Egyptian viniculture, but the Abydos jars predate this period.

The Abydos wine jar corpus is dominated by bottle-shaped jars with narrow mouths, which would have been easy to stopper and suited to long-distance trade (Fig. 8). Differences in fabric, shape, decoration, and other features suggest that they originated from more than one place. The best typological parallels, especially for the handled jars, are examples from greater Palestine: Tel 'Erani in the southern coastal plain, Lachish in the nearby lowlands, Megiddo in Jezreel Valley, Jericho in the Jordan Valley, Bab edh-Dhra' on the eastern shore of the Dead Sea, and Lehun on the southern Transjordanian plateau. However, exact parallels for the bottle-shaped jars that lack handles do not occur in Early Bronze Age I Palestinian assemblages. Possibly, this absence is due to the relatively small number of sites that have been excavated in the southern hill country of Palestine and in Transjordan. One might also propose that a specialized trade in wine would demand a special container that would therefore be found at relatively few sites. Neutron Activation Analysis (NAA), which is an important complement to the MASCA laboratory's organic residue analysis program, was carried out to determine the clay source(s) of the jars, on the assumption that the jars were probably manufactured in the vicinity of where the wine was produced.

Eleven wine jars from tomb U-j, representing all the major fabrics in the corpus, were tested. Of par-

ticular importance is that no identifiable Egyptian clay was used to make the jars. While three of the jars had no chemical matches with any clay sample or well-defined local group of ancient pottery in MASCA's databank, the other eight belong to or are closely associated with southern Palestine (coastal plain and the lowlands of the Shephelah), southern Palestinian hill country (Judean Hills), Jordan Valley, or Tranjordanian groups. None of the jars tested was chemically close to any clay or ancient pottery sample outside this region in our database, which constitutes over 5700 samples with excellent temporal and spatial coverage over the whole of the Near East and Egypt. Thus, while only a small number of the Abydos jars were tested by NAA, the results point uniformly to a region of Palestine where earlier (Chalcolithic) archaeobotanical evidence exists for the transplantation of the grapevine and presumably larger scale production of wine. In Early Bronze Age I, which is contemporaneous with tomb U-j, only these specific areas of Palestine have yielded what have been classified as domesticated grape pips and berries, namely, 'En Besor near Gaza, Jericho in the southern Jordan Valley, Bab edh-Dhra' on the eastern shore of the Dead Sea, and Jawa in northern Transjordan.

One of the clay sealings associated with the Abydos jars was also analyzed by NAA. It was composed of Nile alluvial clay. Because of the latter's chemical heterogeneity, a precise geographic origin along the Nile cannot be determined. The finding does indicate that before the jars were deposited in tomb U-j a final stoppering and sealing process took place in Egypt, perhaps at Abydos or, alternatively, at a site in the Delta where the wine entered Egypt before being transported to the south.

Archaeological investigation has established that the use of the overland trade route—"the Ways of Horus"—between southern Palestine and the eastern Nile Delta intensified during Early Bronze Age I. An exchange of goods or even technologies (pottery-making and metallurgy)—facilitated by Palestinian merchants—can be documented going in both directions during Naqada IIIa2 times, at least for sites along the most easterly branch of the Nile (e.g., Minshat Abu Omar). Shortly thereafter and until the beginning of Dynasty 1, the Egyptians themselves became more involved and founded trade stations in southern Palestine, most notably at 'En Besor (Hartung 1994 and n.d.).

A two-stage process in the Early Bronze Age I interactions between Egypt and Palestine may be proposed to account for the Abydos wine jars and the start of a native winemaking industry shortly thereafter. In the first phase, increasing Egyptian demand for horticultural products, especially grapes/wine and perhaps olive oil, spurred trade in these goods (Hartung 1994 and n.d.). Fig, one of the additives in the Abydos wine jars, had probably also been taken into cultivation in Palestine by this time (Zohary and Spiegel-Roy 1975). Once a market for wine had developed in Egypt, a second stage of interaction was possible: the transplantation of grapevines to the Delta and the production of wine, probably under the tutelage of foreign specialists.

MESOPOTAMIAN UPLANDS AND LOWLANDS

At approximately the same time—or somewhat earlier—that the wine trade and viniculture were expanding in Palestine and Egypt, similar developments were occurring in the other main region where a literate civilization was forming: the alluvial plains of the Tigris, Euphrates, and Karun Rivers in lowland Greater Mesopotamia. Archaeological evidence suggests that southern Mesopotamian cultural influence extended over a large geographic area during the Late Uruk Period (ca. 3500–3100 BC), extending east into the Zagros Mountains of Iran, north to Syria, Turkey, and the Caucasus, and even, in a much more limited way, to the Nile Delta.

any transplantation of the domesticated grapevine probably was preceded by trade that would have created a market for the commodity.

Late 4th millennium BC Godin Tepe, a site in the central Zagros Mountains of Iran that was excavated by T. Cuyler Young of the Royal Ontario Museum between 1965 and 1973, typifies the political and economic changes of the period, especially as they impacted upon viniculture and winemaking. At this site, proto-Sumerians and/or proto-Elamites established a trading post/administrative center cum military base, along what later became the Silk Road.

In the citadel complex, which had been specially constructed and reflects Mesopotamian architectural style, several jars of two "standard volumes" (30 and 60 liters) were found (Fig. 9). Like the Hajji Firuz and Abydos vessels, these jars had relatively narrow mouths, high necks, and interior residues that indicated they had once been filled with a liquid (Badler 1995). Chemical

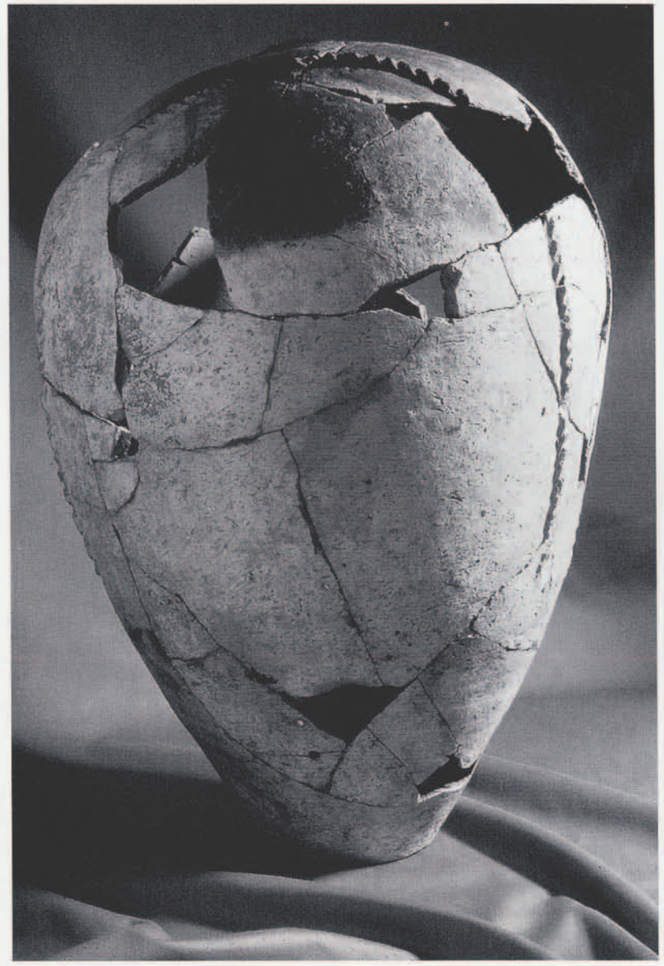

FIG. 9. Godin Tepe wine jar from the Late Uruk period citadel, which was a specially constructed trading-military base inhabited by lowland Mesopotamian peoples (proto-Sumerians and/or proto-Elamites).

Godin Tepe Project no. Gd. 73-113. H. ca. 55 cm. Royal Ontario Museum, West Asian Dept. Photograph courtesy of W. Pratt, Royal Ontario Museum, Toronto, Canada

tests demonstrated that this liquid was a resinated wine, although the chromatographic results were inconclusive in identifying the tree species of the resin. The jars had evidently been stoppered and stored on their sides. The pottery fabric and the unusual inverted-U rope appliqués on the vessels' exteriors suggested that the jars were of local manufacture, and probable evidence of local winemaking—a large rectangular basin which could have been used for treading grapes, and a large funnel and "lid" for pressing grapes piled into the funnel—was recovered from one of the rooms of the citadel.

Before accepting a local winemaking hypothesis at Godin Tepe, two counter-arguments need to be addressed. First, no grape remains were identified in the Late Uruk level of the site. Since grape pips belonging to the 1st millennium BC were recovered, however, and since the excavations were carried out at a time when systematic archaeobotanical collecting was not done, this negative evidence is not compelling. Second, the wild grape does not grow in the central Zagros today. To have had local winemaking, either the wild grape's geographic range extended farther south in the Zagros under moister, milder conditions prevailing in antiquity, or the domesticated grapevine had already been transplanted there from farther north. Since the area is extensively planted with the domesticated subspecies today, the latter possibility is the more likely.

Wine Jar Types

As has been seen for Egypt, any transplantation of the domesticated grapevine probably was preceded by

FIG. 10. Piriform wine jar from Susa, a proto-Elamite center in lowland southwestern Iran.

Louvre Museum no. Sb18693. H. 13 cm. Photograph courtesy of the Louvre Museum, Paris

trade that would have created a market for the commodity. In lowland Greater Mesopotamia of the period, several pottery jar types (that have not yet been tested by NAA) have been proposed as likely candidates for transporting wine, made in the hill country, to the major urban centers.

Piriform jars, of a type characterized by a narrow everted neck and variable capacity of 0.5–20 liters, are attested at Uruk, Nippur, and Tello in southern Mesopotamia,and at Susa in southwestern Iran (Khuzistan) during the Late Uruk period (Fig. 10). The type also occurs at Tepe Sialk in north-central Iran, at Habuba Kabira along the Euphrates in northern Syria, and elsewhere. The Godin Tepe wine jars have a similar shape, but are decorated. The organic residue analysis of one example of this jar type from Susa showed that it had originally contained wine, with an unidentified tree resin additive. A larger size jar of this type would have been ideal for transporting wine.

Another Late Uruk jar type, which is most common at Susa (compare LeBrun 1971: fig. 54:2), is rectangular in cross-section, with a flat base. It is made of stone, and has a rope pattern running vertically along each edge. An example of this type in the Louvre Museum (Fig. 11), with a volume of only ca. 50 milliliters, also tested positive for wine and an unidentified tree resin additive (see Fig. 2).

The ovoid or elongated droop-spouted jar (Fig. 12) has been proposed as the jar type most likely to have been used to transport wine during the Late Uruk period. Yet it has a relatively small volume, and both the mouth and spout of the jar would need to be stoppered.

FIG. 11. Stone wine jar, rectangular in cross-section, with a flat base and rope designs along the vertical edges; from Susa.

Louvre Museum no. Sb2928. H. 15.5 cm. Photograph courtesy of the Louvre Museum, Paris

FIG. 12. Droop-spouted wine jar from Susa. Care would be required to prevent the spout from breaking off during transport, but once delivered, the jar could have doubled as a serving vessel.

Louvre Museum no. Sb18869. H. 18 cm. Photograph courtesy of the Louvre Museum, Paris

Stoppers for the sharply everted mouths are archaeologically attested, but thus far none have been reported for the spouts. Well-preserved jars have been recovered at Susa, Uruk, Nippur, and Tello in lowland Greater Mesopotamia, as well as at other sites to the northeast in Iran (e.g., Farukhabad, Godin Tepe, and Tepe Sialk) and to the northwest in Syria (Habuba Kabira) and Anatolia (Arslan Tepe).

The residues on the interiors of the droop-spouted jars were confined to the lower half or third of the vessels, where materials and precipitates settle out from liquids. One example each from Susa (Fig. 12), Uruk (Badler et al. 1996: fig. 1), and Tello (A01, 14344/TG5486, Louvre Museum) have been chemically confirmed as containers for a resinated wine. The three jars have the same volume: 1.3 liters.

Two other jar types have also been confirmed as containers of resinated wine. A miniature short-spouted jar of Late Uruk type, with a round base and a volume of about 0.15 liter, comes from Tello (A01, 5238/T.321, Louvre Museum). A miniature jar (W19496l, University of Heidelberg) of a unique type was found together with numerous other examples at Uruk (Lenzen 1961: pl. 16e-g), in a sherd layer under an oven in the Eanna temple complex (square Md XVI 4). These jars, which date to the subsequent late Jemdet Nasr/early Early Dynastic period, have narrow mouths and pointed bases and range in volume from 10 to 30 milliliters (Fig. 13).

Wine Drinking, Trade, and Production

It has usually been argued that barley beer was the alcoholic beverage of choice in ancient Sumer, since

FIG. 13. A hand-held miniature jar from Uruk of the late Jemdet Nasr/early Early Dynastic period.

University of Heidelberg W19496e. H. 14 cm. Photograph courtesy of V.R. Badler

grapevines are grown with difficulty in the hot, dry climate of southern Iraq and the textual evidence for viniculture and wine-drinking in Mesopotamia is minimal before the 2nd millennium BC. Based on the new chemical evidence for wine inside jars that could have been used to transport and serve the beverage, wine was probably already being enjoyed by at least the upper classes in Late Uruk times. Early Dynastic cylinder seals depict the royalty and their entourages drinking beer with tubes/straws from large jars and a second beverage—presumably wine—from hand-held cups (Fig. 14).

The wine imported into lowland Greater Mesopotamia could have been brought from the northern Zagros or other parts of the Near East, at least 600 kilometers away. The 5th century BC Greek historian Herodotus (1.193–94) describes shipping wine down the Euphrates or Tigris from Armenia at a much later period: round skin boats were loaded with date-palm casks of wine and delivered to Babylon. River transport was also an option in the Late Uruk Period; it might have been coordinated by an entrepôt specially established for the purpose in Upper Mesopotamia, where grapes, usually identified as of the wild subspecies, have been recovered from several late 4th millennium BC sites (e.g., Hama in Syria, and Hassek Höyük, Kurban Höyük, and Korucutepe in southeastern Turkey). But if demand for the beverage were great enough, transplantation of grapevines to closer locales in the central Zagros and possibly as far south as Susa would be anticipated. When the Late Uruk trade routes were suddenly cut off at the end of the period, the pressure to establish productive vineyards closer to the major urban centers would have intensified.

The pay-off for Neolithic humans who drank such resinated wine would have been better nourished societies, which . . . would have had a selective advantage in human biological and cultural development.

Susa has thus far yielded only a single grape pip (unpublished, identified by Naomi F. Miller) from a Late Uruk context, and none are reported from southern Mesopotamia. Even if more grape remains were identified or found at the lowland sites, however, excavation of contemporaneous hill country sites in Upper and Lower Mesopotamia will be decisive in tracing the prehistory of viniculture and winemaking in this region of the ancient Near East. Tepe Malyan in the Shiraz region of the southern Zagros mountains, which is identified as a capital city (Anshan) of ancient Elam, is a good case in point. Excavations of the protohistoric site by the University of Pennsylvania Museum, under the direction of William M. Sumner, yielded numerous grape pips and even grapevine wood (Zettler and Miller 1995), a strong indication that the domesticated plant had already been transplanted there as early as the mid-3rd millennium BC. Elamite cylinder seals, foreshadowing similar scenes on Assyrian reliefs some two millennia later, depict males and females seated under grape arbors, drinking what is most likely wine from cups (Amiet 1986: fig. 113:5).

FIG. 14. A Mesopotamian "banquet," the forerunner of the ancient Greek *symposion*, as depicted on an impression of a lapis lazuli cylinder seal from Queen Pu-abi's tomb in the Royal Cemetery at Ur, dating to ca. 2600–2500 BC. A male and female on either side of a wide-mouthed jar are shown imbibing barley beer through drinking tubes, while others below raise high their cups, probably containing wine, which is served from a spouted jar.

British Museum no. 121545. L. 4.4 cm. Joint Expedition of the British Museum and the University of Pennsylvania Museum to Babylonia. Photograph courtesy of the British Museum

DISCUSSION

The cuisine of the Neolithic period included relatively large-scale production of wine, a processed and fermented beverage made from grape juice, as attested by the chemical confirmation of its presence in jars of a Neolithic residence at Hajji Firuz in the northern Zagros Mountains of Iran.

Fermentation generally enhances the nutritional content and preservation of foods, and wine is no exception. Besides being an unusually complex mixture of organic compounds, wine has well-known antimicrobial and anti-oxidant properties principally due to the alcohol and polyhydroxy aromatic compounds. The latter are chemically related to and much more powerful than phenol, or carbolic acid, the antiseptic of the 19th and early 20th century pioneered by English surgeon Joseph Lister. The addition to the Neolithic wine of terebinth tree resin, which was a popular medicinal agent in later antiquity, increased the beneficial properties of the beverage. The pay-off for Neolithic humans who drank such resinated wine would have been better nourished societies, which were less prone to sickness and would have had a selective advantage in human biological and cultural development.

Fermented beverages such as wine also have profound mind-altering effects on humans that led to their incorporation into social and religious rites and customs of peoples around the world from antiquity up to the present. While wine's psychotropic effects partly explain its popularity, the process of fermentation itself, in which one material is converted into another, with the near-frenzied evolution of gases, would also invite speculations about something out of the ordinary. Once humans were settled into permanent villages in the Neolithic period, the conditions were ripe not only for experiencing and elaborating upon wine's special effects, but also for developing more predictable means of assuring a more productive grapevine and a better-quality product. The first steps in the domestication of the hermaphroditic plant very likely occurred in the Neolithic period somewhere in the general region of the northern Zagros, Caucasus, and eastern Taurus Mountains. Other Neolithic inventions, including pottery making and stoppering, assured that the wine could be stored for extended periods.

Prestige exchange of wine and wine-drinking ceremonies among elite individuals have been invoked to explain the role of wine in increasingly more complex social and political contexts. This hypothesis has been

The Grapevine

Winemaking is very much constrained by the grapevine itself, even given the necessary containers and the means to preserve the product. The wild vine (*Vitis vinifera* L. subsp. *sylvestris*) is dioecious, that is, it has unisexual flowers on separate plants which must be cross-pollinated by insects. Only the female plant produces fruit, which is highly variable in its palatability. In general, the modern wild grape type produces a small, rather astringent fruit with many seeds.

The wild grapevine grows today throughout the temperate Mediterranean basin, as well as in parts of western and central Asia (Fig. 15). During the Neolithic, when wetter conditions prevailed, it appears to have grown farther south in the Zagros Mountains of Iran and in the hill country of Palestine (see Kislev et al. 1992). Somewhere in this vast region, the wild Eurasian grapevine was taken into cultivation and eventually developed as our domesticated type (*Vitis vinifera* L. subsp. *vinifera*). The domesticated vine's advantages over the wild type can be traced to its hermaphrodism: bisexual flowers occur together in the same plant, enabling self-pollination by the wind and fruit production by every flower. People selected hermaphroditic plants that yielded larger, juicier, and tastier fruit with fewer seeds, and then propagated this cultivar by rooting branches or grafting one vine onto another. In this way, the same genetic clones with desirable characteristics can be regenerated for thousands of years.

Carbonized pips (seeds) constitute the bulk of the archaeobotanical evidence for grapes. The pip of the supposed domesticated grape has been argued to be more elongated than its wild counterpart. However, experimental charring of modern pips has shown that a narrow pip's shape can be expanded and rounded, effectively blurring any valid distinction between the two subspecies.

The genetic "history" encoded in the genomic and mitochondrial DNA of modern wild and domesticated grapes, together with that of any available ancient samples, suggests an alternative means to track the development of viniculture in the Old World. Using recombinant DNA techniques, it might be possible to delimit a specific region of the world and the approximate time period when the wild grape was domesticated. Like the Eve hypothesis, which claims to trace all of humanity to an original mother in East Africa on the basis of mitochrondrial DNA lineage trees, a Noah hypothesis would seek the progenitor(s) of modern domesticated grape varieties and their sequence of development and transplantation. (Noah, the biblical patriarch and "first vintner," is said to have planted a vineyard on Mount Ararat after the flood, with dire consequences when he drank the fermented beverage [Genesis 9].)

◀FIG. 15. Map of the ancient Near East and Egypt, showing the distribution of the modern wild grapevine in purple shading and the principal sites mentioned in the text. Isolated occurrences of the wild grape also occur to the east, off the map, in Turkmenistan and Tajikistan. Grape remains (primarily pips but also occasionally grape skins and grapevine wood) that have been recovered from Neolithic through Early Bronze I/Late Uruk sites are indicated by the grape cluster symbol. The occurrence of wine jar types, which have been chemically identified as such, are indicated by the jar symbol.

Map prepared by P. Zimmerman, MASCA, after Zohary 1995: Map 2.1

The grapevine, *Vitis vinifera vinifera*, showing three varieties of the domesticated grape: blue, white, and red.

Colored engraving from Joseph Jacob Plenck, Icones Plantarum Medicinalium *(1784)*

Tree Resins

The terebinth tree (*Pistacia atlantica* Desf.) has been and is widespread and abundant in the Middle East, occurring even in desert areas. A single tree, which can grow to as much as 12 meters in height and 2 meters in diameter, can yield up to 2 kilograms of the resin in late summer or fall.

Pliny the Elder, the famous 1st century AD Roman encyclopedist, devoted a good part of book 14 of his *Historia naturalis* to the problem of preventing wine turning to vinegar. Tree resins—pine, cedar, frankincense, myrrh, and, very often, terebinth, which Pliny described as the "best and most elegant" resin—were added to Roman wines for just this purpose. Another 1st century AD writer, Columella, speaks of a *medicamentum* ("medicine") for preserving wine made of myrrh, terebinth resin, pitch, and various other spices (*De re rustica*, 12.18ff.), which was also a standard treatment or medication for a human wound. The pragmatic observations and practices of the ancients have been confirmed by modern chemical investigation; these resins do kill *Acetobacter* and other bacteria, thereby protecting organic compounds and structures from degradation. Myrrh, the famed Arabian incense and premier Roman wine additive, is also an analgesic. If the desired goal of preventing the wine from becoming vinegar failed, at least one's senses were numbed. The aromatics also cover up any offensive taste or smell.

In recent times, terebinth tree resin has been used to make chewing gum in Greece and to prepare perfume in the eastern desert of Egypt. Its "turpentine" odor and taste, which were not as concentrated in the resin as in the distillate commonly known by this name today, were evidently not considered to be offensive. The only modern carry-over of the ancient tradition of resinated wine is Greek *retsina*. Although terebinth tree resin is no longer used, village winemakers still claim special preservative properties for the added native pine and North African sandarac tree resins.

articulated for the Mycenaean and Classical Greek, Etruscan, and Celtic worlds. Likewise, in the ancient Near East and Egypt, the apparently more democratic world of prehistoric wine-drinking soon gave way to more limited, prestige usage, especially in regions where grapes were not grown. Also contributing to wine's value wherever and whenever it has been drunk are limited production, and a range and subtlety of tastes and bouquets which usually improve with age.

On either end of the "Fertile Crescent" where the earliest literate, urban civilizations developed—in Egypt and in Mesopotamia—viniculture and winemaking took a similar course from their prehistoric roots into the fuller light of history. The upper classes and royalty first built up a demand for the unique beverage in the late 4th millennium BC, and it was traded overland and probably by sea and along waterways in pottery jars. Then the domesticated grapevine was transplanted, which made local winemaking possible. The interactions between southern Palestine and the Nile Delta, which account for the prehistoric trade in wine and early historic Egyptian viniculture, are now well documented archaeologically, archaeobotanically, and chemically. More excavation and analysis, including NAA and petrographic provenancing of wine jars, is needed to firm up the picture for Mesopotamia.

From its beginnings in the ancient Near East, grapevine cultivar(s) derived from the Eurasian wild subspecies have been cloned throughout the world and account for almost all the wine that is produced today. Much of southern Europe, for instance, is planted with the vine, which has been selected to give an almost infinite range of tastes and bouquets, whether chardonnay or cabernet sauvignon.

Wine eventually passed back from the realm of the rich to the general populace by way of cultic rites, ceremony, celebration, and simple social gatherings. In modern Western culture, wine is still viewed as a high-end status symbol, yet enters into our daily life, whether at a wine-and-cheese party or in the mystery of the Eucharist or during Passover. The story of wine and the vine is a remarkable one, which has intertwined itself with human cultures throughout the world.

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