

WINE revision: September 2018

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The wild eastern *vitis vinifera sylvestris* was domesticated and the first wine made c. 6000 BCE in Neolithic Transcaucasia and eastern Anatolia. Wine played important roles as a safe drink (normally mixed with water) as well as in religion, medicine, and trade. The Phoenicians introduced viticulture around the Mediterranean Basin and the Ancient Greeks made wine a drink accessible at all levels of society. The Romans perfected the technology for its mass production and expanded viticulture away from the Mediterranean coast.

Wine is defined here as the result of the intentional fermentation of *vitis vinifera* grapes. When the berries are crushed, yeast gains access to the sugars in the juice, breaking them into ethanol and carbon dioxide. ‘Intentional’ implies the existence of an appropriate container (e.g. a clay jar) in which the fermentation can occur. The word also suggests cultivation. Clay jars and cultivation appear in Neolithic times.

The wild eastern *v. v. sylvestris* is native to a region between the Black and Caspian seas that includes Azerbaijan, Armenia, Georgia, and Eastern Anatolia (Turkey). It is dioecious (separate male and female plants) and propagates by seed. The female produces small clusters with loose berries filled with short pips. Birds eat the berries and propagate the pips through their digestive system. But a few percent of the wild females become hermaphrodites, the result of a single genetic mutation. Their pips are more elongated. These hermaphrodites propagate vegetatively and are less successful in the wild as the offspring grows too close to the parent. But they produce more clusters with larger, sweeter, and more tightly bound berries. Neolithic farmers selected them for agriculture. Today’s 10,000 or so wine cultivars (almost all hermaphrodites) are their descendants.

The domestication of the eastern *v.v. sylvestris* occurred around 6000 BCE. The oldest domesticated *v. vinifera* pips were found at Shulaveris-Gora (southern Georgia), Shomu-Tepe (Azerbaijan), and Çayönü (Anatolia). The cultivated wild hermaphrodite evolved into the domesticated *v. vinifera vinifera*. When the eastern *v. v. vinifera* was exported to the western side of the Mediterranean, after 1000 BCE, it crossed with the wild western *v. v. sylvestris*. This gave rise to many European cultivars that are distinct from those found in Transcaucasia.

Today, Georgia has over 500 native *v. vinifera* cultivars, some of which have great antiquity (Rkatsiteli, Mtsvane...). Only a few of them are cultivated commercially but most are preserved (Fig. 1). Nearly 800 cultivars exist in Anatolia (some were imported), and about 250 in Azerbaijan. Such diversity of native grapes is further evidence that this region is where domestication occurred.

The word for “wine” changed very little over millennia. It was *woi-no* or *wei-no* (reconstructed) in Proto Indo-European, the language spoken in Transcaucasia c. 4500 BCE. Vavilov reported that many ancient civilizations use a word derived from it: Hittite *wijana* (or *wiyana*), Akkadian *īnu*, Proto-Semitic *wainu*, Ancient Greek *oinos* (οἶνος), Latin *vinum*, etc., all of which are close to today’s Georgian ‘hvino’ (ღვინო), French *vin*, German *wein*, or English *wine*.

The archeological and chemical evidence of wine comes from the chemical analysis of the residue in ancient jars. One looks for traces of wine-related chemicals such as tartaric acid (the principal acid of grapes) and its salt, calcium tartrate; syringic acid and its precursor malvidin (associated with red wine); succinic or pyruvic acids (markers of alcoholic fermentation); DNA of the yeast *saccharomyces cerevisiae*, etc.



Fig. 1: This blend involves 417 preserved Georgian native v. vinifera cultivars. Photo by the author.

The oldest proof of wine-making, dated c. 6000 BCE, comes from reddish residue in large Neolithic jars from the Shulaveris-Gora site (Georgia). The second-oldest proof (c. 5400-5000 BCE) comes from Hajji Firuz Tepe in the Zagros Mountains of North-Western Iran. The residue in the six jars (about 9 liters each) included tartaric acid and calcium tartrate. The inside of these jars was coated with resin from the terebinth tree (*pistacia terebinthus*). All the ancient wine jars until Roman times were fully or partially coated with this resin. Its antibacterial properties inhibit the growth of the vinegar bacteria and help preserve the wine (today's Greek *retsina* is unrelated: it involves pine-tree resin added for flavor).

The earliest-known 'winery' is Areni-1 in Southern Armenia (c. 4100 BCE). Shallow clay basins with elevated ridges were positioned such that the juice from crushed grapes (probably by foot) would flow into buried clay jars for fermentation. The remains of three adolescent girls have also been found there, buried in funerary jars with clusters of grapes. They died of an identical blow to the head, and could have been ritually sacrificed to some wine deity.

The oldest evidence of wine storage and trade, c. 3500 BCE, comes from the Sumerian site Godin Tepe. Archeologists found numerous large jars (capacity ~30 l) laid on their side, some of which had contained beer and others wine. Some wine jars had a small decanting hole drilled near the bottom, just above the lees.

The oldest proof of wine-making in Europe, dated c. 4100 BCE, comes from Dikili Tash in Macedonia (Northern Greece). Many chemical markers associated with wine were present in clay jars. The grape pips found nearby resemble those of the wild *v.v. sylvestris*. But there are variations among sub-species, and the charring that occurred early at this site could have affected the shape of the pips. It is not clear if wine making was imported there (e.g. from Anatolia) or re-invented locally.

Evidence for the spread of wine and viticulture throughout the Near East comes from resinated wine jars showing traces of tartaric acid and other wine residue. Additives would sweeten the wine and/or mask some odd flavor. 360 wine jars were found in the tomb of Scorpion I in Abydos (3150 BCE). Some of them contained pips, resin, stems, figs, dates, and biological traces of *s. cerevisiae*. The clay stoppers were made from a different clay than the jars themselves, which came from Southern Palestine or the Jordan Valley. Wine could have been imported, tasted, and then the amphorae stoppered with local clay. But empty amphorae could also have been filled with local wine, although the oldest-known evidence of winemaking in Egypt dates to c. 2800 BCE.

In Ancient Egypt, wine was a luxury and most Egyptians drank beer. Numerous amphorae, with clay stoppers marked with the quality and origin of the wine, have been found in pharaonic tombs. For example, thousands of wine amphorae were buried with Amenhotep III (c. 1350 BCE) with markings such as ‘genuine’, ‘good’, ‘very good’, or ‘very very good’. Some wines were labeled *Northern*, others came from *Abesh*, *Sunu*, *Hamm*, and *Imet* (locations unknown).

The earliest civilization in Greece is Minoan (c. 3600-1350 BCE). It flourished in the Cycladic Islands and Crete (Knossos). The important center on Thera (today Santorini) was destroyed by a huge volcanic eruption c. 1600 BCE. The earliest Minoan wine jars (from the palace at Myrtos Fournou Korifi) are dated c. 2200 BCE. The Minoans produced a wine strengthened during fermentation with barley (for starch), honey (for sweetness), and flavoring elements such as saffron. Residue of the same type of wine was found in king Midas’ tomb (c. 700 BCE) in Anatolia.

The Mycenaeans (c. 1600-1100 BCE) became the dominant power around 1350 BCE. In the *Iliad*, Homer reports that they always drank wine mixed with water and never drank water unless it was mixed with wine. The exception was water from the Nile which had the reputation of being very clean (it is no longer the case).

In Classical Greece (5th – 4th centuries BCE), viticulture was widespread and wine was consumed at all levels of society. Ancient Greece, more than any other civilization, made wine a democratic drink. Many sweet and flavored wines were produced, sometimes even mixed with sea water. The reputation of the wines from Samos, Lesbos, Chios, Santorini, and other regions survives to this day.

Ancient wine was transported primarily in amphorae, at least until the Romans introduced much larger containers (*dolia*). *Amphora* derives from the Greek *amphoreus* – earlier *amphiphoreus* (ἀμφιφορεύς): *amphi* (both sides) and *phoreus* (carry), referring to the two handles. The basic design is Canaanite (15th century BCE). Ancient amphorae came in many shapes and sizes but had common features: a pointed tip allowing them to be partially buried in sand, a narrow mouth, and the characteristic two handles. As amphorae became mass produced with capacities of about 10, 20, or 30 liters, it became common for markings to be imprinted in the clay before firing, to identify the content, origin, and/or merchant (Fig. 2).



Fig. 2: Greek amphora handles, c. 300 BCE. Top: cluster of grapes and “Themisonium” (a Phrygian city). Bottom: stamp of the Rhodian manufacturer Agortanax. Photo by the author.

The dissemination of wine and viticulture around the Mediterranean basin started with Phoenician traders from city-states such as Tyre on the coast of Lebanon. They established trading centers and settlements on islands, the coast of North Africa, and Southern Spain. The Tyrian settlement that would become Carthage was established around 800 BCE. At about the same time,

the Phoenicians established Gadir (Cádiz) in South-Western Spain. It is not known if the inhabitants of Southern Spain cultivated *v. vinifera* prior to the arrival of the Phoenicians, but there is no doubt that the newcomers brought vines and viticulture with them. The oldest wine press in the region is at *Castillo de Doña Blanca*, half-way between Cádiz and Jerez (Fig.3).



Fig. 3: Phoenician wine press (600-500 BCE) at Castillo de Doña Blanca. The juice from crushed grapes would flow through the hole (far end) into an amphora for fermentation. Photo by the author.

Around 800 BCE, the Phoenicians also brought wine and viticulture to Southern Italy, Sicily, Sardinia, as well as regions controlled by the Etruscans (Tuscany, Latium, Umbria). The design of the Etruscan amphora was inspired by the Phoenician one. The Etruscans brought wine to Southern Gaul. The earliest ‘French’ wine press (425-400 BCE) was found in Lattara (Lattes) together with Massaliote amphorae, some of which were stoppered with corks. The earliest use of cork stoppers comes from an Etruscan shipwreck (515-475 BCE) off the coast of Southern Gaul.

Since its earliest days, wine was important for religious, sanitary, medical, and commercial reasons. It is likely that mature (sugar-rich) grapes were harvested and that the ancients did not know how to stop an ongoing fermentation: it would stop when no more sugar was available or when the alcohol level became high enough to kill the yeast. This depends on the strain of yeast, but a plausible figure is in the range 14-15% alcohol per volume. This is at least three times as much as in beer: wine was the most powerful alcoholic beverage until the distillation of wine produced nearly-pure alcohol (late 9th - early 10th century CE in Persia).

Ancient civilizations have associated many gods with wine, grapes, vineyards, wine making, wine presses, and even drunkenness. The best-known one is Dionysus (Greece) or Bacchus (Rome). The cult of Bacchus played important roles in many regions well into Roman times.

Water is easily contaminated. But wine contains sufficiently-high concentrations of alcohol to kill many harmful bacteria. Mixing wine with water makes water much safer to drink. Until the first century CE, wine was always drunk mixed with water (exception: Jerusalem and Judah: Isaiah 1:22, *your silver has become impure; your wine is diluted with water*). In the oldest codification of ancient Greek law (Zaleukos of Lokroi, c. 650 BCE), the punishment for drinking *unmixed wine without a physician’s prescription* was death. The Greeks and Romans mixed water and wine in kraters before drinking. The krater was a large vase into which water was poured and then wine added. Everybody dipped their cup into the common mixture. The water-to-wine ratios (4:1 to 2:3) varied with the type of wine and the wealth of the host. The Greek historian Diodorus Siculus (c.90–c.20 BCE) scorned the Celts for trading slaves for wine, and then drinking it unmixed. Today,

Catholic priests still mix wine with water during mass, a symbolic gesture that could be as ancient as viticulture itself.

Wine was commonly used in medicine. The writings attributed to Hippocrates of Kos (c. 460-370 BCE) contain many wine-based prescriptions, even for infants. But it was known long before his times that wine should be used to clean wounds.

Wine was also important for trade. Wine, wine jars, vine cuttings, and resin from the terebinth-tree were traded throughout the Near East. Amphorae filled with nodules of this resin have been found in ancient shipwrecks. Three of the 282 articles of Hammurabi's Code (c. 1750 BCE) regulated wine shops (or taverns) or the wine trade.

The ancient Greeks traded wines and established settlements in Southern Italy, Sicily, and Southern Gaul. The city of Massalia (Marseille) was founded by the Greeks from Phocaea in 600 BCE. They first imported wine from the Etruscans.

A huge Spartan bronze krater (the 'krater of Vix') was unearthed in a Celtic tomb dated c. 490 BCE. It is the largest krater ever found. It was probably manufactured in Taranto (a Spartan colony in Southern Italy), cut, transported to Gaul, and then re-assembled. Vix (Châtillon-sur-Seine) was a major trading center, including tin imported from Cornwall. The oldest evidence of viticulture in northern Gaul is a 1st century CE Roman vineyard near Gevrey-Chambertin.

Herodotus (c. 484-425 BCE) documents wine being shipped down the Tigris and Euphrates rivers. The containers for these shipments, *bikos phoinikeios*, are often mistranslated as "barrels of date-palm wood" instead of "Phoenician amphorae". Wooden barrels were first made by the Celts. The widespread use of barrels for the transport of wine dates to the first century BCE, as wine imported in amphorae was decanted into barrels in Toulouse and Châlon-sur-Saône for transport into Celtic Gaul. After Caesar's conquest of Gaul, the demand for wine increased because of the needs of the army.

In ancient times, the preferred wines were sweet and strong (high alcohol content), a combination that allows them to age for years. To concentrate the juice, the Greeks twisted the stems on the vine to cut the flow of sap, left the harvested grapes in the sun, or boiled wine or must to generate a sweet syrup that was used to strengthen other wines. The Romans followed similar recipes, and sometimes smoked the wine to give it the color (heat increased the oxidation rate) and feel of an aged wine.

During the Kingdom and the early Republic, much of the wine in Rome was Etruscan or Greek. Following the third Punic war and the destruction of Carthage, the Romans salvaged the 26 volumes of the Carthaginian Mago's treatise on agriculture. It contained details on viticulture and wine-making. This is when Rome began large-scale wine production. The great 121BCE 'Opimian' vintage established the reputation of many Roman vineyards. Wines from Setinum, Caecubum, Surrentium, Falernum (just to name a few) were famous, expensive, and sometimes aged for decades. The reputation of the Falernum was so great that, long after the fall of Rome, Gregory of Tours writes in his *History of the Franks* (591) that the wines produced on the hills near Dijon 'yield so noble a Falernum-type wine [...]'.
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Early in the 1st century CE, Rome reached its peak population (about 1 million). Its annual wine consumption exceeded 85M liters. The needs of the Roman army in the provinces have been estimated at about 2M liters a year. In addition to Roman production, wine imports came from Southern Gaul, Spain, and North Africa. The Romans vastly improved the wine-press technology and invented lever- and screw-presses. They used large dolia, (Fig. 4) for fermentation, storage, and transport (these were gradually replaced by wooden barrels by the 4th century CE).



Fig. 4: Left: *Dolium* from a shipwreck. Right: buried *dolia* (*Ostia Antica*). Photo by the author.

The best Roman wines were made from the first-run juice of un-pressed grapes. This production was very small. Other expensive wine-making techniques involved soaking almost dry raisins in wine to add sugar and induce a second fermentation (*passum*). The Romans also commonly added resin from exotic trees to wine, such as myrrh and frankincense.

Second-rate wines came from grapes treading by foot. Lower qualities involved a mechanical press. Some of these wines were manipulated to mimic the color or flavor of aged wines. The Romans fumigated amphorae with rosemary or sweet bay. Many additives were used. Grape juice was sometimes boiled in lead pots to concentrate the sugars, and the concentrate was then used to sweeten and strengthen other wines. Drinking such wines on a regular basis caused lead poisoning.

Cheap wines from a second pressing of the grapes were for common people and soldiers. These wines had a much lower alcohol content and rapidly turned to vinegar. The wines for slaves were obtained by adding water to whatever solid material was left in the wine press. The mixture was left to ferment as much as it could, and the result was pressed one last time.

The veterans of Caesar's invasion of Gaul received land and were allowed by the Senate to plant vineyards along the banks of the Rhône and Rhine rivers. Many wine regions of France (and Western Germany, England) originated in Roman times. Starting in the mid-1st century CE, the Romans established large-scale viticulture in Bordeaux, from where wine was shipped to their troops and settlements in Northern Gaul and the British Isles.

The Vesuvius eruption in 79 CE destroyed Pompeii, Herculaneum, substantial wine stocks, and many vineyards, leading to shortages. New vineyards were planted, often at the expense of food crops, and Rome began to import large volumes of wines from its northern provinces. This in turn led to wine surpluses and food shortages. Domitian (r. 81-96) ordered that no new vineyard be planted and that half the existing vineyards to be uprooted in all the provinces. Uprooting was only occasionally enforced (and then, for lesser-quality vineyards) and exceptions were granted for new vineyards in Bordeaux and along the South-North corridor up to Trèves. Domitian's edict remained on the books until rescinded by Probus (r. 276-282). Viticulture then expanded throughout Gaul.

When the Western Roman Empire collapsed (mid-5th century), the climate was colder, the population had dropped, few large cities remained, and long-distance trade had all but disappeared. The technology associated with the mass-production of wine was no longer needed and promptly forgotten. Monastic orders pursued viticulture and wine making. The large-scale production of quality wines in most of Western Europe resumed in the 11th century.

SEE ALSO: Abydos, Agriculture, Anthesteria, Bacchanal(ia), Dionysia, Dionysos, Dolium, Hippocrates of Kos, Symposium, Zaleukos of Lokroi

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