

Rum as a Medieval European Possibility

A discussion on the possibility and probability that a rum-like drink was available in Europe during the late medieval period

The Honorable Lord Madoc Arundel

Companion of the Order of the Silver Hammer
Companion of the Order of the Leather Mallet
Companion of the Order of the Sycamore

September 2014
Revised 2016

Christopher Miller
137 Shoshone Trail
Mercer, PA 16137
(724) 475-6111
meadbrewer@yahoo.com

Introduction

I have been an active brewer since 1995 in both the Society for Creative Anachronism, Inc. (SCA) and the American Homebrewers' Association. Beginning in 1997, I became loosely associated with the SCA's inter-kingdom brewers' guild, or IKBG. The IKBG email group has always been a hotbed of discussion on a variety of topics firmly and loosely related to brewing. In mid-2005, one of the list members posted a question. He stated that his SCA persona was that of a pirate, and he was curious as to what would be an appropriate beverage for him to drink. Several other list members replied with various suggestions before I glibly responded that any pirate should be able to drink rum. I was immediately challenged on that assertion by more than a dozen commenters who maintained that rum was not only post-period, but an American invention. While I successfully argued that the West Indies rum industry did in fact supply the European market, I could not persuade any of the detractors that the beverage itself was present during the SCA time period. The principle argument stemmed from the word "rum", and the assertion that the oldest rum distillery in the new world only dated its products to the early 1600s. My counter-argument was that sugar cane distillates would have existed earlier – well within the SCA time period – under a different name. At that point, one list member in particular challenged me to prove it. Since that time, I have read countless books, sought assistance from several translators of French, Spanish, Italian, Latin, and Arabic, corresponded with university professors in Italy, Belgium, Jordan, Israel, Malaysia, India, and Indonesia, and visited innumerable museums both in person and virtually. Although I was unable to find explicit evidence that a distilled beverage made from molasses was produced in Europe during the SCA time period, I was able to show that such a beverage would have been known to the people, and may in fact have been available to them through importation. Given the fact that sugar cane, sugar processing, and the science of distillation were all known in Europe in period, it is reasonable to extrapolate that a variation of rum may have even been produced from the molasses byproduct. Therefore, despite the lack of explicit evidence, I believe that I have in fact answered the challenge levied on me nearly a decade ago.

Rum as a Medieval European Possibility

THL Madoc Arundel, CSH, CLM

Modern rum production uses molasses – a byproduct of sugar cane processing – as the principle ingredient. Sugar plantations in the 16th century West Indies were attempting to keep up with the demand for refined sugar in Europe – particularly France and England. Refining removed the molasses byproduct which caused an unpleasant color and consistency, and did not allow for proper crystallization. Enterprising sugar producers in the West Indies found that the molasses could be fermented and distilled into a hard liquor and sold for additional profit. The term “rumbullion” as a name for this beverage appears in Richard Ligon's History of Barbados, written in 1651. Various etymologists attribute the common name “rum” to a shortening of the word “rumbullion.”

However, a rose by any other name... although modern rum only dates to 1636 (per the public relations information put out by the Foursquare distillery in Barbados, the oldest extant sugar plantation in the western hemisphere), distilled beverages using sugar as the principle ingredient date to within the SCA period and region. Discovering those beverages requires us to look beyond pure apothecary distillation, and to follow both the trade routes used in period between Europe/North Africa and the middle and far East and the migration of knowledge of technology and agriculture.

Sugar

Sugar cane has been known to mankind for thousands of years; but it would seem that practical harvesting of the sugar itself from the cane only dates to India sometime during the 500 years prior to the birth of Christ.¹ At the time of Gupta rule in India (roughly 4th century AD) cultivation of multiple species of sugar cane in the Ganges Valley was well established.²

Sugar became known to those in the middle east and the region around Greece via the avenues established for the spice trade between the Far East and the Roman Empire. Isidore of Charax describes various routes and way stations along the more commonly traveled routes, some of which passed through India and other areas where sugar cane was already being cultivated.³ Dioscorides, the Greek naturalist, writes in the 1st century AD about sugar as a medicinal plant substance:

There is a kind of coalesced honey called sugar found in reeds in India and Arabia. The honey, similar in consistency to salt and brittle [enough] to be broken between the teeth like salt. It is good dissolved in water for the intestines and stomach, and taken as a drink to help a painful bladder and kidneys. Rubbed on, it disperses things which darken the pupils.⁴

Sugar cane migrated from India to the near East first in the form of a refined product, and later in the form of actual cultivation of the cane plant itself. There is evidence that sugar cane was cultivated on the island of Cyprus as early as the 10th century.⁵ Arab merchants and travelers are also likely responsible for cultivation spreading across eastern Africa.⁶ Guillaume de Tyr gives evidence of sugar trade between the Holy Land and southern Europe following the First Crusade in his historical documentation of life in Jerusalem, stating that access to sugar is essential for the life and health of mankind.⁷

Ponting talks about the advent of the early European sugar industry during the 12th and 13th centuries: “The industry only began on a major scale after the loss of the Levant to a resurgent Islam and the shift of production to Cyprus under a mixture of Crusader aristocrats and Venetian merchants.”⁸

In North Africa, the first reference to production comes from Morocco and occurs in the work of Abu Hanifa, an author who died in 895. Reports by Ibn Hawqal, a tenth-century writer, confirm the presence of an industry in North Africa. By the eleventh century, sugar

cane production existed around Gabes and Djalula in Tunisia and around Ceuta in Morocco; the most significant area of production was in southern Morocco in the Sous and neighboring valleys on the flanks of the High Atlas. Spain's first account of a sugar industry is in the so-called Calendar of Cordoba, which listed the major activities of the agricultural year and dates from 961, two and a half centuries after the Arabs crossed to Spain. ...There is a record of the export of sugar from Sicily about 900, and Ibn Hawqal described the industry as flourishing half a century later.⁹

Jagory, also known as gur, is a particular variety of sugar produced primarily in India and some parts of the East Indies. Jagory differs from conventional sugar in that it is completely unrefined and may contain impurities from the cane itself or from other plant juices added to the cane juice before processing. While modern jagory (usually spelled jaggery) is generally made with juice from the *Borassus flabelliformis* or palmyra plant¹⁰, historically it was produced from sugar cane, and in old Hindi is synonymous with raw sugar. The key point in the definition of jagory for our purposes is that the final sugar product is *non-centrifugal*, meaning it does not have the molasses separated out during processing.¹¹

Jaggery or *gur* is a specific type of sugar popular in India. It is normally manufactured from either sugar cane or date palms, but recent trends in its manufacture have resulted in jaggery made from the sap of coconut and sago palms. While jaggery is useful in cooking, it is also an ancient part of Ayurvedic medicine and has spiritual significance in India too. This type of sugar is considered unrefined and is produced by boiling raw sugar cane or palm juice in iron pans. It is then formed into blocks. Because it does not go through additional processing, it does retain some of the natural vitamins and minerals of the ingredients used, though boiling the juice does deplete some of these. Many people do consider jaggery healthier than more refined sugar since it is less stripped of natural nutrients. In traditional Indian medicine, called Ayurveda, this sugar has several purposes. It may be prescribed for use for people with sore throats. It has some use in the treatment of bronchial or lung infections...¹²

The first stage of the manufacturing of jaggery and sugar is the same. This first step is the boiling of sugar cane juice. It changes from that point however, as explained below.

- Sugar: After the initial boiling, in the case of sugar, this syrup is treated with charcoal (preferably bone charcoal) to absorb unwanted particles and to give a clear, transparent solution. This solution, once it condenses and crystallizes, results in the commonly known form of sugar.
- Jaggery: In the case of jaggery, there is no treatment with any kind of charcoal, nor is there any kind of crystallization... For jaggery, the mother syrup is boiled and boiled continuously until it is formed into a thick paste, which is then poured into molds to make blocks of jaggery of the desired quantity.¹³

I simply need to reiterate here that the key point for our purposes is: jagory – the traditional sugar form in and around the Indian subcontinent for hundreds of years – retains the molasses byproduct as part of its processed form.

Distillation Equipment and Process

The practice of distillation in medieval Europe appears to have derived from various processes of alchemy in the Islamic world. These processes in turn derived from practices handed down from the time of Alexander the Great and his conquest of south-eastern Europe, the middle east, and the Indian

subcontinent. Water distillation can be dated to 2nd century Alexandria, described by Alexander of Aphrodisias who wrote a treatise that included an article on the desalination of sea water for drinking.¹⁴

Distillation was one of the most important processes in Islamic chemical technology and was employed for both medicinal preparations and a variety of other technological and industrial uses, including the preparation of acids and the distillation of perfumes, rose-water and essential oils. As the equipment and processes of alchemy developed – with its methods of evaporation, filtration, sublimation, crystallization, and distillation – they came to influence pharmacy and medical chemistry. A medical treatise entitled *The Foundations of the True Properties of Remedies*, written in the 10th century by Al-Muwaffaq, also included instructions for distilling fresh water from sea water.¹⁵

Early Islamic chemists such as Jabir ibn Hayyan [al-Tusi], Al-Kindi and [Muhammad ibn Zakariya] Al-Razi made important chemical breakthroughs such as perfumery; distillation apparatus; muriatic, nitric, acetic and sulfuric acids; purified distilled alcohol, soda and potash; and filtration.¹⁶

Equipment that we often associate with modern distilling appears to have originated in the heart of Persia. Alembic is a multi-use term sometimes used to refer to a single piece of a still (the still cap or still head being the top of the distilling apparatus with a tube attached) while at other times used to refer to the entire distilling apparatus.¹⁷ Alembics are found in the works of ancient Persian alchemists, such as Jabir al-Tusi (commonly referenced in later works under the name Geber)¹⁸, who is credited in some sources with creating the alembic in the design used for more than a thousand years.¹⁹ Muhammad ibn Zakariya al-Razi also is known to have used alembics while conducting the first documented scientific studies on distillation, dating to the 9th century.²⁰

The alembic or still seems to have been the earliest specifically chemical instrument, the first piece of equipment which the chemist did not borrow ready-made from the kitchen or workshop. Its design remained substantially unchanged throughout the whole of the Christian era. The complete apparatus...was referred to as a still, alembic, or limbeck. The vessel...in which was placed the matter to be distilled, was termed the body, matrass, or cucurbite. The condensing apparatus...was termed the still-head, head, helm, or alembic. The vessel into which the condensed liquid flowed was known as the receiver.²¹

One additional piece of distilling equipment that is essential to efficient distillation is the refrigerated coil. This is a chilled coil within which the steamed distillate is condensed back into liquid without having to wait for the natural cooling process to take place. The first refrigerated coil was invented around the turn of the 11th century by a Persian physician and scientist named Abu Ali Husain ibn Abdallah Ebn-e Sina or as he was more commonly known, Avicenna.²²

The following diagram shows a variety of still-heads in use in the 16th and early 17th centuries. The diagram is taken from *Alchymea* by Andreas Libau, written in 1597 and published in 1606. Libau was a German chemist, physician, and alchemist, and professor of history and poetry at the University of Jena. He made important chemical discoveries but is most noted as the author of the first modern chemistry textbook.²³

The second diagram shows a complete alembic still with the heat source, body, head, and receiver, and is taken from Taylor's *The Evolution of the Still*.²⁴

The photo shows an example of distilling equipment from the Arabian Peninsula, circa 1500. The photo is reprinted here courtesy of the Museum of Islamic Civilization, Sharjah, United Arab Emirates.

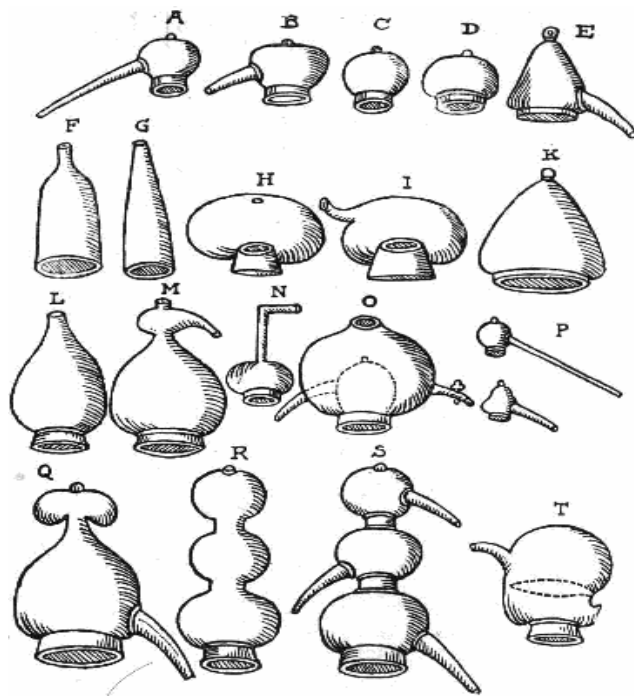


Plate I. Alembicis

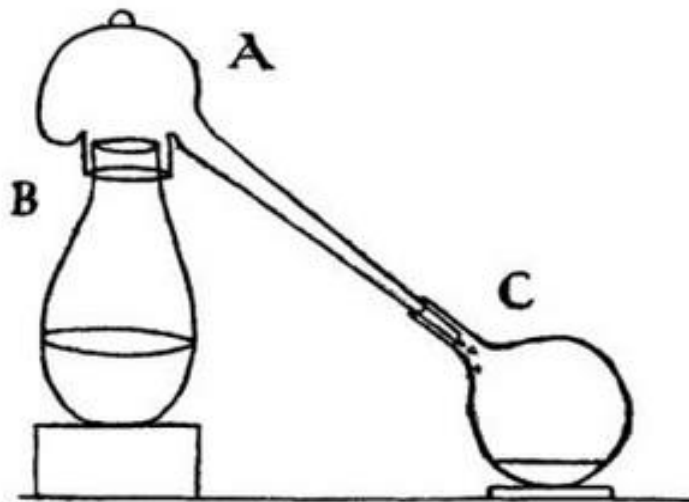


FIG. 1.—Traditional form of still.



Medieval distillation equipment (HafeezAHS, Apr 2014) ²⁵

المشقة المشركه: زوبرا كرهه كرس في مشقة بار

المتعلق فلا بد وان يكون واسع الا يمزج حتى لا يتجه في الدوائر العنيفة
 ولا ينكسر الا تارة وكذا كان الا ينق وسعا وطولها الا ينزبه واسمها كان احسن
 واسمها وتكنى القالب كبرية واما الا ينق الا في المعدن والخرق من رفيع
 القبة المزروطة وفي اعلاه خشق تدويرا من فلان الاورة الكبيرة لاخذ الرطبة
 وليكن الدوائر التي تلت القبة وتوضع على كاون ناغ نفسه وهذا
 الا في نال ك القبة ودانها بخلاف ابيق التقطير واما الكلبة وهي
 الفطاة مثل القبة من زجاج او حضا وتطلى على محيط الترس من
 داخل افرز الترس وترفعه القبة المزروطة وفي اعلاه خشق ايضا واما
 الا تال في قبة من خزف من حجة مشبعة بالطلاء والخل وعا رصقا
 وطولها وسعها وجميع واصفها مثل القبة بعينها وهذا مسجبه
 قوه تدويرا في اناك واحد والا تال ترس في رفق فوه مسجبه
 تدويرا اصابع وفي محيط الترس افرز كاشفة البارزة من جوانبه
 لتدخل الكلبة في جوف الا فرز والمكبته محيطه بالترس من جميع جهات
 والا فرز محيطه بالمكبته اطرافها البسعد المعادل القبة ثم يحد
 ويستقر على الترس والا تال افرز كاشفة الترس وبارا من جانب
 الا تال فوق ثلثها المستغلبين حتى يدخل الثلثان في الكانون
 فيبقى الثلث الاعلى خارجا من الكانون ليسر صعود الدوائر الى الموضع



وهذا المشقة
 المشقة المشركه
 المشقة المشركه



البيد

Ink drawings of a triple alembic, with 3 distilling heads, only the top one having a delivery tube. The lower drawing shows a cold still or "Moor's head still" in which the distillate when it rises is cooled by water placed in a trough at the top of the alembic.

Photo from an alchemical commentary on a poem composed in Spain by Ibn Arfa' Ra's (died 1197). Copy produced in 1712

- - National Library of Medicine magazine, A65, folio 81b

Rum-like Distillates

“Rum, in some crude form, appears to have been developed either in ancient India or China; its precise origins are uncertain. What is known is that Persians of the Middle Ages distilled sugarcane juice into alcohol.”²⁷

Marco Polo (1254-1324) is noted for his travels to and from the Mongolian empire during the reign of Kublai Khan.²⁸ His travels took him through Persia, across India, into China, and to many of the islands in the East Indies. *Livre des merveilles du monde* is a sort of diary dictated by Marco Polo himself to Rusticella di Pisa when they were both imprisoned in Genoa together.²⁹ Fortunately for our purposes, the level of detail in his narratives included some of the food and drink he was served in several of the regions he visited.

There are numerous translations of Polo's diaries, many of which include commentary that assists us with understanding the cultural nuances and context of his writings. I note the commentary from Ernest Rhys in 1908: “What our author terms wine in this place is properly an ardent spirit, distilled from the coarse, imperfectly granulated sugar, called jaggri or jagory.”³⁰ As discussed at the beginning of the article, jagory is an unrefined sugar that still contains the molasses byproduct. Polo dictates:

When you quit Maabarand go 500 miles towards the south-west you come to the kingdom of Coilum [ed. note – modernly, Coilum is located on the west coast of India in the very southern part of the country]... Corn they have none but rice. So also their wine they make from sugar; capital drink it is, and very speedily it makes a man drunk.³¹

At Kermán [ed. note – modernly, Kermán is located just southeast of the center of Iran, about 300 miles north of Hormuz] a sort of wine or arrack is made with spices and alcohol distilled from sugar; it is called Má-ul Háyat (water of life), and is recommended as an aphrodisiac.³²

It is reasonable to conclude that the 'wine' Polo speaks of is a distilled liquor, and that it derives its consistency, flavor, and alcohol content from the fact that it comes from jagory – a sugar product with a high concentration of molasses byproduct.

Product and Technology Migration

Obviously, Marco Polo brought any collected knowledge with him on his return to Genoa. Therefore, knowledge of an ardent spirit made from fermenting and distilling the juice of sugar would have been known in Europe in the 14th century. However, this by itself does not show us the possibilities that such a beverage would have been reproduced. To extrapolate this possibility, we must look at the migration of both the technology for distilling and the processing of sugar.

To start, I am going to latch on to the phrase Polo used to describe the spiced distillate he experienced in Kermán in Persia - Má-ul Háyat (water of life.) 'Water of life' is a term we see used in more than one language to describe distilled spirits.

In Latin, the term *aqua vitae* translates to 'water of life.' We find references in several sources as far north as the British Isles of *aqua vitae*. Irish abbeys were reportedly distilling *uisce beatha* (life water) in 1170 when Henry II invaded. Irish alembics were documented as being taxed by the English as early as 1276.³³ An early record of whiskey posted in 1405 states that the death of an Irish chieftain was due to "taking a surfeit of aqua vitae" at Christmas.³⁴ This may or may not be the first recorded death by alcohol poisoning. In the *Exchequer Rolls* of Scotland for 1494, there is a reference to malt sent "to Friar

John Cor, by order of the king, to make *aquavitae*".³⁵ Arnau de Vilanova, a Catalan physician in the late 13th/early 14th centuries and personal physician to the King of Aragon, described in *Tractatum de vinis* how to produce *aqua vitae*. He is credited with being the first European to fortify wine by adding distilled alcohol.³⁶

Two men were named as authors of one or the other of the earliest aqua vitae treatises: Taddeo Alderotti (1223-1303), called by his Latin name, Thaddeus Florentinus, in the texts; and his contemporary Teoderico Borgognoni (1205-1298), called simply Theodericus in the surviving copies. Both men practised medicine at Bologna during the later thirteenth century. Soon afterwards a third name began to appear on copies of the aqua vitae treatises, that of Mondinus, who was Mondino de' Luzzi (c. 1275-1326). He was an apothecary who studied under Taddeo Alderotti, and went on to become a physician himself at Bologna. Later still, the discovery of aqua vitae was attributed to Raymond Lull or Arnald of Villanove, both scholarly celebrities of their time, and the links between these early treatises and the Latin names Thaddeus, Theodericus and Mondinus were forgotten.³⁷

Obviously, the practice of distillation was well known throughout medieval Europe, albeit more for medicinal purposes than recreational. What of the processing of sugar cane?

By 900, the cane was being grown in Arab Sicily, one of the few European regions where this tropical plant has ever been grown... Sicilian sugar cane cultivation gradually declined beginning in the 1400s, probably as a result of the climate becoming somewhat dry compared to its medieval condition, and also the abandonment of the Arabs' effective irrigation systems... The Venice refinery was famous; the hard "confetti" candy produced in the Veneto region was made from sugar produced there.³⁸

"Most sugar was imported from Asia, hence the great cost, but there were experiments by the Spanish and Portuguese to grow it in Madiera, the Canary Islands and other sub-tropical locations in the Old World."³⁹

"By the late 1200s, traders from Venice...began to control the sugar trade. Spanish and Portuguese explorers used islands off the coast of Africa, such as Madiera, the Canary Islands, and São Tomé to grow sugar cane...By the 1470s, sugar refineries were built in the European cities of Venice, Bologna, and Antwerp to process sugar."⁴⁰ Hugo Fridaevallis from Antwerp wrote in the late 16th century, "No type of food becomes more insipid with the addition of sugar. No magnificent feast, nor everyday food will please without sugar."⁴¹ Speaking of the refining process used in Venice and Bologna, Eagen writes:

To make sugar from cane, the sugar cane was crushed in a mill. Early mills were powered by humans or animals. Around 700 A.D., mills began to be powered by water wheels. After the mill, the crushed sugar cane was put into a press, which squeezed out more sugar juice. The juice was collected in buckets, and then boiled in copper pots. Boiling removed most of the water from the cane sap, but it was still full of impurities, such as dirt. Ashes were added to the boiled cane syrup, which caused most of the impurities to float to the surface as a layer of scum. The scum was scraped off the top of the mixture, and the sap was boiled again. The process was repeated until the cane syrup was clear. The sugar syrup was left to cool and then poured into clay pots and placed in a hot room. Within six days, the syrup in the pots turned into loaves of dry sugar, with a puddle of thick molasses at the bottom.⁴²

There is a painting dating from about 1580 by Hans van der Straat, of a sugar factory near Palermo. A contemporary description says that going into the place was like entering the Forge of Vulcan: 'the men who worked there being blackened by the smoke from the fires,

dirty, sweaty, and scorched, more like demons than men.' It goes on to describe all of the various jobs: cutting cane, crushing, boiling the juice, even planting cane tops in manure as seed for the following year.⁴³

Moreover, the lower costs translated by 1490 into prices reduced to one-third of their former level, bringing sugar within the reach of the larger market of the less affluent. In 1500, Madeira alone was producing in the neighborhood of 1,000 tons per year. At the same time, Antwerp's role as the principal refining center of northern Europe helped that city to attain its later prominence.⁴⁴

So, by the late 15th and early 16th century, sugar processing was in full bloom in Antwerp in the north and various locations throughout Italy in the south. We also see that molasses is a known byproduct, being collected at the bottom of the clay pots used to form the sugar loaves.

England had its own sugar refineries by 1540. The first use of the word 'molasses' appears in English in 1582⁴⁵, although all of its pre-1600 references refer to it existing in other countries. It first appears as a sweetener in English food in Hugh Platt's 1609 work, *Delights for Ladies*.⁴⁶ "When the production of molasses in Britain's refineries outstripped the needs of both apothecaries and distillers, it was sold off in its natural, unmedicated state as a cheap sweetener."⁴⁷ This reference implies that molasses was in fact distilled in England during the late 16th century in addition to being a principle ingredient in the medicinal *treacle*.

Conclusion

We have explored a brief history of the cultivation of sugar cane and its processing into a crystallized form. We have discovered the early days of the distilling process, and tied the juice of sugar cane to that process through the early practice of medicine in the Greek, Persian, and Islamic empires. We have seen the introduction and/or migration of sugar, the technology to process it, and the process of distilling into medieval Europe. We know that Marco Polo enjoyed a distilled beverage made from fermented sugar, and that he brought those details at least as far as Genoa, Italy. We know that the molasses used in contemporary alcohol production was a known and recognized byproduct of sugar processing in medieval Europe. Sugar itself remained a very expensive commodity when the bulk of it was imported from Arabic lands, and those price levels contributed to the genesis of processing plants on the European continent. We also know that the advent of processing centers in Belgium and Italy helped bring the price down to a level the business class could afford. Given these facts, it is logical to conclude that some form of fermented and distilled spirit originating from molasses or from raw sugar juice itself was available to Europeans in the middle ages, despite the lack of specific primary documentation.

Footnotes

1. Galloway, pg. 21
2. Maity, pg. 109
3. Department of Ancient Near Eastern Art
4. Dioscorides, Book Two. Numerous herbals throughout the medieval period indicate De Materia Medica was widely read and reproduced during the Middle Ages in Latin, Arabic and Greek. For fifteen hundred years it was the standard authority in botany and materia medica. The finest surviving comprehensive manuscript copy, magnificently illustrated, was made in the sixth century in Constantinople (circa 512AD) and is known as Codex Vindobonensis. The citizens of Honoratae, a suburb of Byzantium in Turkey, presented it to their Christian patroness Patricia Juliana Anicia, daughter of Flavius Anicius Olybrius (Emperor of the West) in 472AD. The manuscript is on vellum, written in Greek uncials in the tradition of early sixth-century calligraphy.
5. Ponting, pg. 353
6. Ibid
7. Caxton
8. Ponting, pg. 481
9. Galloway, pg. 33-34. Galloway cites three other works to document his date references: Berthier 1966, Vanacker 1973, and Deerr 1949-50.
10. <http://www.lexic.us/definition-of/jaggery>
11. Russell, pg. 2
12. Ellis-Christensen
13. "Jaggery and Sugar"
14. Taylor, pg. 186
15. Levey, pg. 173
16. Sorensen
17. Britannica Online Encyclopedia
18. UNESCO, pg. 228
19. Sorensen
20. Forbes, pg. 20-23
21. Taylor, pg. 185
22. Sligocki
23. Libavii, Plate I
24. Taylor, Fig. 1
25. Museum of Islamic Civilization, Sharjah, United Arab Emirates
26. Schullian and Sommer
27. Pacult
28. Bergreen, pg. 339-340
29. Jackson, pg. 83
30. Rhys, pg. 316
31. Yule, volume II, pg. 376
32. Yule, volume I, pg. 115
33. Toussaint-Samat, pg 243-244

34. O'Donovan, pg. 785
35. Ross, pg. 158
36. Taurellus
37. Wilson, pg. 116-117
38. Gangi
39. Albala, 2003, pg. 59
40. Eagen, pg. 11
41. Albala, 2003, pg. 59
42. Eagen, pg. 11
43. Tomer
44. Hunt and Murray, pg. 187
45. Duxbury. Duxbury appears to be quoting from another document, as the text is encased in quotation marks, but does not provide her reference. The direct statement is "...The word is from the Portuguese 'melaco', derived from the Latin 'mel' for honey. The first use of the word was in Nicholas Lichefield's 1582 translation of Lopez de Castanheda's *First Booke of the Histoire of the Discoverie and Conquest of the East Indias*, which described 'Melasus' as a 'certine kind of Sugar made of Palmes of Date trees'."
46. Friedman & Cook, pg. 140
47. Wilson, 1974, pg.

Bibliography

- Adas, Michael (ed.), *Agricultural and Pastoral Societies in Ancient and Classical History*, Temple University Press, Philadelphia, 2001.
- Ajram, K., *Miracle of Islamic Science*, Knowledge House Publishers, Illinois, 1992.
- Albala, K., *Food in Early modern Europe*, Greenwood Press, Connecticut, 2003.
- Albala, K., *The Place of Spain in European Nutritional Theory of the 16th Century*, University of Pacific, California, 1999.
- Arberry, A., *The Spiritual Physick of Razas*, translated from the Arabic, Johnn Murray, London, 1950.
- Barber, M., *The Two Cities: Medieval Europe, 1050-1320, 2nd Ed.*, Routledge, Taylor, and Francis, Oxford, 2004.
- Benbow, P.K., "Theory and Action in the Works of Andreas Libavius and Other Alchemists", *Annals of Science* 66, no. 1: 135-139, 2009.
- Bergreen, L., *Marco Polo: From Venice to Xanadu*, Quercus, London, 2007.
- Britannica Online Encyclopedia: distilled spirit/distilled liquor, <http://www.britannica.com/EBchecked/topic/166115/distilled-spirit>, accessed September 2014.
- Brunschwig, H., *Liber de arte Distillandi de Compositis*, Straßburg, 1532.
- Burke, K., *A Note on Archaeological Evidence for Sugar Production in the Middle Islamic Periods in Bilād al-Shām*, University of Chicago, Illinois, 2004.
- Department of Ancient Near Eastern Art, "Trade between the Romans and the Empires of Asia", *Heilbrunn Timeline of Art History*, The Metropolitan Museum of Art, New York, 2000.
- Dioscorides, *de Materia Medica*, 1st century, translation and editorial by T.A. Osbaldeston and R.P.A. Wood, IBDIS Press, Johannesburg, 2000.
- Duxbury, Natalie, "Sugary Ideals For Christmas And Special Occasions: The Facts Of Candy & Sugar – The History", *Foodilicious*, December 2014, retrieved 25 June 2016, from <http://foodilicious.thebuzz.co.za/?p=6076>.
- Eagen, R., *The Biography of Sugar*, Crabtree Publishing, New York, 2005.
- Ellis-Christensen, T., *What is Jaggery?*, edited by O. Wallace, <http://www.wisegeek.com/what-is-jaggery.htm>, 2003, accessed August 2009.
- Forbes, R.J., *A Short History of the Art of Distillation: from the beginnings up to the death of Cellier Blumenthal*. E.J. Brill, 1970.
- Friedman, David and Elizabeth Cook, *How to Milk an Almond, Stuff an Egg, and Armor a Turnip: A Thousand Years of Recipes*, Self-Published, 2011.
- Galloway, J.H., *The Sugar Cane Industry: An Historical Geography from Its Origins to 1914*, Cambridge University Press, Cambridge, 2005.
- Gangi, Roberta, "Sugar Can in Sicily", *Best of Sicily Magazine*, November 2004.
- Ghosh, A., *In an Antique Land: History in the Guise of a Traveler's Tale*, Vintage Books, New York, 1992.
- Goodman, L., "Al-Razi, Abu Bakr Muhammad bin Zakariya", *Encyclopaedia of Islam*, new ed. Vol. VIII: 474-77, 1994.
- Guillame de Tyr, *Historia rerum in partibus transmarinis gestarum*, translated from the French by William

Caxton, and printed by him in 1481 (edited for the Early English Text Society by K. Paul, Trench, Trubner & Co., London, 1893.)

Haw, S.G., *Marco Polo's China: A Venetian in the Realm of Kubilai Khan*, Routledge, New York, 2006.

<http://www.lexic.us/definition-of/jaggery>, accessed January 2013.

Hunt, E.S. and James Murray, *A History of Business in Medieval Europe, 1200-1550*, Cambridge University Press, Cambridge, 1999.

Isidore of Charax, *Parthian Stations*, Greek text with a translation and commentary by Wilfred H. Schoff, transcribed from the original London edition, 1914.

Jackson, P., "Marco Polo and his Travels", *Bulletin of the School of Oriental and African Studies*, 61(1): 82–101, 1998.

"Jaggery and Sugar", *Organic Facts*, <https://www.organicfacts.net/health-benefits/other/jaggery-and-sugar.html>, 2014, accessed August 2014.

Levey, M., *Early Arabic Pharmacology: An Introduction Based on Ancient and Medieval Sources*, E. J. Brill; Leiden, 1973.

Levtzion, N., *Corpus of Early Arabic Sources for West African History*, Markus Wiener, New Jersey, 2000.

Libavii, Andreae, *Alchymea*, Petrus Kopff, Frankfurt, 1606.

Maity, S.K., *Cultural Heritage of Ancient India*, Humanities Press, Minnesota, 1983.

Moran, B.T., *Distilling Knowledge: Alchemy, Chemistry, and the Scientific Revolution*, Harvard University Press, Massachusetts, 2005.

Multhauf, R.P., *The Origins of Chemistry*, Oldbourne, London, 1966.

O'Donovan, J. (trans. and ed.), *Annals of the Kingdom of Ireland by the Four Masters: from the earliest period to the year 1616*, 2nd edition, volume IV, Hodges, Smith & Co., Dublin, 1856.

Pacult, F.P., "Proof Positive: Do rums reflect their places of origin?", *Wine Enthusiast*, July 2002, retrieved from <http://www.winemag.com/July-2002>.

Polo, Marco, *The Travels*, translated by Ronald Latham, Penguin Classics, London, 1958.

Ponting, C., *World History: A New Perspective*, Pimlico, London, 2001.

Powelson, J.P., *Centuries of Economic Endeavor: Parallel paths in Japan and Europe and their contrast with the Third World*, University of Michigan Press, Michigan, 1994.

Rhys, E. (ed.), *The travels of Marco Polo the Venetian*, E.P. Dutton & Co., New York, 1908.

Ross, James, *Whisky*, 1st edition, Routledge & Kegan Paul, London, 1970.

Russell, A., *Brown Sugar*, Practical Action, Rugby, 2003.

Schoff, W.H., *The Periplus of the Erythraean Sea: Travel and Trade in the Indian Ocean by a Merchant of the First Century*, Longmans, Green, and Co., New York, 1912.

Schullian, D.M. and F.E. Sommer, "A catalogue of incunabula and manuscripts in the Army Medical Library", *National Library of Medicine Magazine*, A65, Schuman, New York, 1950.

Sharpe, P., *Sugar Cane: Past and Present*, Southern Illinois University, Illinois, 1998.

Sligocki, *Avicenna: History of Medicine*, retrieved from Infosources.org/what_is/Avicenna.html, 2009.

Sorensen, T., "Arabic Medieval Alchemy", The Elements Unearthed: Our Discovery and Usage of the Chemical Elements, edited by David Black, retrieved from elementsunearthed.com, Weekly Post, Nov 7, 2012.

Stevenson, G.C., *Genetics and Breeding of Sugar Cane*, Longmans, London, 1965.

Taurellus, *Arnaldus*, Basel, 1585.

Taylor, F.S., "The Evolution of the Still", Annals of Science 5:3, 1945.

Tomer, B., *What is sugarcane? History of Sugar Cane*, at ChewingCane.com accessed September 2014.

Toussaint-Samat, T., *Histoire naturelle & morale de la nourriture*, Bordas, 1987

UNESCO, *History of Civilizations of Central Asia*, Motilal Banarsidass, India, 2002.

Whitfield, Susan, and Ursula Sims-Williams, *The Silk Route: Trade, Travel, War and Faith*, British Library, London, 2004.

Wilson, C.A., *Food and Drink in Britain: From the Stone Age to recent times*, Harper & Row, New York, 1974.

Wilson, C.A., *Water of Life: A History of Wine-distilling and Spirits from 500 BC to AD 2000*, Prospect Books, Blackawton, 2006.

Yule, Colonel Sir Henry (trans. and ed.), *The book of Ser Marco Polo the Venetian concerning kingdoms and marvels of the East*, vol I, 3rd edition, John Murray, London, 1903.

Yule, Colonel Sir Henry (trans. and ed.), *The book of Ser Marco Polo the Venetian concerning kingdoms and marvels of the East*, vol II, 3rd edition, John Murray, London, 1903.