

DREGS OF OUR FORGOTTEN ANCESTORS

Fermentative Microorganisms in the Prehistory of Europe, the Steppes, and Indo-Iranian Asia and Their Contemporary Use in Traditional and Probiotic Beverages

F. M. Dugan*

Abstract

Evidence for the deep antiquity of kvass, mead, wine, and koumiss, alcoholic beverages used by early Indo-European peoples, is encountered in comparative linguistics and in archaeology. Cognates and artifacts pertaining to these beverages illuminate possible patterns of dispersal of Indo-European languages and peoples. Drinking rituals, sanctioning of royal power by beverage consumption, and deities with the power of brewing and intoxication span an inter-continental range of ancient Indo-European language and myth. Traces of such cultural practices survive today. Kvass and koumiss, beverages unfamiliar to most western Europeans and Americans, continue to be produced and consumed in eastern Europe and central Asia. Modern, cataloged germplasm collections contain yeasts and lactobacilli isolated from kvass, mead, or koumiss, or used to produce these drinks. Contemporary enthusiasm for these beverages, and research into the microorganisms used to produce them, contribute to popular and scientific interest in probiotics.

Key words: ale, beer, *Debaryomyces*, *Hyphopichia*, Indo-European, Indo-Iranian, *Kluyveromyces*, koumiss, kvass, *Lachancea*, *Lactobacillus*, mead, Proto-Indo-European, *Saccharomyces*, *Wickerhamomyces*, wine, yeast, *Zygosaccharomyces*.

Introduction

The ancient Indo-Europeans have long been a preoccupation of the ideologically obsessed. To numerous persons in the 19th and 20th centuries, writing from the perspective of their supposed racial superiority, Indo-Europeans were heroic ancestors. Nearly simultaneously, other persons postulated a remotely ancient, matriarchal, and peaceful Europe brought to collapse by invading patriarchal, violent Indo-Europeans. The first (racist and heinous) notion is unfortunately not eradicated, and the second (less virulently racist, but scientifically naïve) currently flourishes (Anthony, 1995). Persistent is the tragicomic stereotype of the beer- or mead-swilling barbarian, usually a Celt or Teuton, a cliché with some historical basis (e.g., Tacitus on drinking bouts of the Germans; Mattingly, 1967). Numerous archaeologists or anthropologists, sometimes with a nationalist agenda but often ideologically neutral (and probably meeting each other over a beer or two), have passionately defended one hypothesis or another on Indo-

European prehistory. Replication of alcoholic beverages produced in ancient times has become a frequent preoccupation of the contemporary, adventurous brewer. Heather Ale, Tutankhamen Ale, Ninkasi Brew, and a Pompeii red (from putatively Druidic, Egyptian, Babylonian and Roman traditions, respectively) are but a few examples (Dugan, 2008). [Try combining “ancient beer” with “brewing” and “recipe” on Google – be prepared to expand both purchases of raw materials and the sensitivities of your palate if you aspire to brewmeister status.] Use of fermented beverages in putatively ancient Celtic or other Indo-European rituals now comprises part of Neopagan lore. [You can have fun with this on Google, too!]

It is the purpose of this review to i) examine fermented beverages in Indo-European prehistory, to place evidence and conclusions in the context of current debates on Indo-European studies, and to trace the profound impact of these beverages on Indo-European belief and custom; ii) to document how the beverages themselves, especially those unfamiliar to most readers, are still produced and are occupying a growing place in modern beverage technology; and iii) to impart some familiarity with the array of microorganisms knowingly or unknowingly used to produce these beverages, and to document contemporary sources and uses of the available microbial germplasm. For the first of these objectives, examination of the cognates (words of common origin) pertaining to these beverages is highly instructive. Accordingly, a brief digression into the topic of Indo-European (IE) and/or Proto-Indo-European (PIE) languages is essential, including referencing of alternative visions of Indo-European prehistory.

Debates over the original homelands of people speaking IE or PIE language are vigorous, as are debates regarding patterns of dispersal of such people or peoples (e.g., Anthony, 2007; Gimbutas, 1973; Mallory, 1989; Nichols, 1997; Renfrew, 1987, 2000). Further focal points for debate have been the degree to which agricultural crops and livestock spread by transfer of technologies versus by movement of peoples (e.g., Bellwood, 2005; Richards, 2003) and the degree by which PIE and/or IE spread by acquisition of language or by movement of peoples (e.g., Anthony, 2007; Renfrew, 2000, 2002). Attempts to resolve these questions have utilized archaeology (including archaeobotany), linguistics (including methods analogous to construction of phylogenetic trees in the biological sciences), and comparative studies based on human mitochondrial, nuclear and Y-chromosome DNA (e.g., Armelagos and Harper 2005a, 2005b; Balter, 2007; Gray and Atkinson, 2003).

* USDA-ARS Western Regional Plant Introduction Station, Pullman, WA 99164. The author can be contacted at fdugan@wsu.edu.

Arguments of two principle camps regarding an Indo-European homeland (Eurasian steppes versus Anatolia) have been concisely summarized (Atkinson and Gray, 2006; Diamond and Bellwood, 2003; Mallory, 1997). According to Anthony (2007), "the principle alternative to a homeland in the steppes dated 4000–3500 BCE is a homeland in Anatolia and the Aegean dated 7000–6500 BCE." The "steppes camp" relies especially on a combination of archaeological evidence for wheeled transport and analysis of relevant cognates in several languages. Representations (clay models, pictograms) of wheeled wagons, and archaeological evidence of wagons themselves, suggest that wheeled transport did not much pre-date 3500 BC. Accordingly, "we can say with great confidence that wheeled vehicles were not invented until after 4000 BCE," (Anthony, 2007). Anthony makes the further point that cognates for "Indo-European wheel-wagon vocabulary" are distributed throughout the range of Indo-European languages (western Europe to central Asia, including northern India). The inference is that migration from a hypothetical homeland was not prior to 4000 BC. The position of the "Anatolian camp" has been bolstered by deployment of quantitative phylogenetic methods for analysis of Indo-European cognates (e.g., Atkinson et al., 2005; Gray and Atkinson, 2003), with results indicating a split ca. 6000 BC between Indo-European languages in Anatolia and elsewhere. Also, there are widely distributed cognates ("wheat," "barley," "apple," "farmer," "plough," "pottery," etc.) which seem difficult to reconcile with the vocabulary of steppe peoples whose lives would be centered on nomadic, pastoral tending of livestock, even if "there is no question of [Proto-Indo-Europeans] adhering to some form of (largely mythical) pure pastoral economy" (Mallory and Adams, 2006). Cognates for fermented beverages are also widely distributed, but as discussed below, cognates for any given beverage are not always present throughout the range of IE, nor always unambiguously present in PIE.

A number of caveats apply to the above synopsis. Published hypotheses regarding putative homelands or migration routes for an Indo-European people or language are exceedingly diverse ("anywhere from the North to the South poles," as Mallory [1997] sardonically noted). One such, not mentioned above but deserving of consideration, has been promulgated by Robert Drews and others (summarized in Kristiansen, 2005), in which a "new package" (a warrior elite trained in the use of the light chariot, lances, etc.) rapidly proliferated amongst the Mitanni, Hurrians, Kassites, Hyksos and others in early to mid-second millennium BC. Highly mobile warrior elites, most often speaking IE languages, came to dominate local populations over wide geographic areas. This "new package" accentuated ritualized drinking of fermented beverages (Kristiansen, 2001). Current earliest evidence for true chariots (light, two-wheeled vehicles serving as a platform for combat) is from kurgan burials distributed in the steppes and slightly precedes appearance of chariots in the Near East (Kuznetsov, 2004).

Finally, it should be noted that some persons dispute the very idea of an Indo-European expansion into Europe, holding that IE languages and peoples are indigenous to western Europe from the Paleolithic, e.g., Mario Alinei and colleagues at www.continuitas.com. (So too for India, where demonstrating that region as the geographic origin of Indo-European has become "a cottage industry" [Witzel, 2001]). There are divergent perspectives on the proper use of phylogenetic methods as applied to linguistics (reviewed in Atkinson and Gray, 2006; Croft, 2008). Moreover, the concept of Proto-Indo-European language *per se* has been sometimes been decried as non-scientific; Anthony (2007) summarizes rationales which have "led many serious people to question the entire idea of proto-language" and cites examples of academically inclined skeptics. However, reconstructed IE languages have successfully predicted specific attributes of language prior to the discovery of texts confirming those attributes. For example, a predicted word for "guest" in Proto-Germanic, found inscribed on a gold horn excavated in Denmark; a specific labiovelar ($*k^w$, pronounced "kw-") in Greek, found after decipherment of Linear B (Anthony, 2007), and in "a stunning confirmation of the predictive power of comparative linguistics" a "lost consonant" (the laryngeal h_2 and two related ones) predicted by the linguist Ferdinand de Saussure later appeared when Hittite inscriptions were deciphered, and in just the positions predicted by Saussure (Anthony, 2007). Since much of what follows pertains to cognates (often reconstructed, as indicated by an asterisk preceding the word) denoting words for various fermented beverages, it is necessary to assure readers of the usefulness of such reconstructions, and also to document ranges of opinion on interpretation.

Most parties agree that Indo-Europeans or their immediate predecessors were among the early (not necessarily earliest) innovators in agriculture, and the expansion of IE languages was accompanied by use of livestock and agricultural plants (and their fermented products) as attested in reconstructed IE and PIE vocabularies (Anthony, 2007; Diebold, 1992). The plant remains, especially as revealed by the use of modern archaeobotanical techniques capable of recovery of significant numbers of charred seed, are of intense interest to persons studying the transfer of agricultural germplasm from one geographic locale to other locales during the expansion of the Neolithic from the Fertile Crescent toward other areas in Asia and to Europe (see Colledge et al., 2005). Evidence of potentially domesticated animals is of analogous interest (Anthony, 2007; Diebold, 1992; Harris, 1996). Sometimes agricultural products (milk fats, fermented beverages) can be inferred from their vestiges on ancient pottery, when residues are subjected to appropriate analytical methods (see Craig et al., 2005, and references therein, as well as McGovern, 2003). Understandably, the applicability of certain methods can be controversial, and critiques of methods have been published, e.g., Boulton and Heron (2000), Gausch-Jané et al. (2004) and Stern et al. (2008) on earlier methods favored by Patrick McGovern and colleagues.

Conspicuous among the vocabulary of IE and PIE cognates in mythology and customs, and tantalizingly glimpsed in ancient artifacts, are three fermentation products from early prehistory: kvass, mead, and koumiss. As discussed below, “kvass” and “mead” have cognates distributed throughout Indo-European languages, while “koumiss” is a word from the Turkish language family; this word eventually replaced the original Indo-European cognate for the beverage and is the word most widely used today. Many (not all!) linguists believe that “wine” came later, but a study of the cognates for “wine” is equally intriguing. Each of the beverages is also documented to some degree by archaeological artifacts.

Fermented beverages in Indo-European and Proto-Indo-European

Mallory and Adams (2006) give a short list of reconstructed Proto-Indo-European words for barley, cabbage, grain, millet, oats, rye, wheat, and other plants of relevance to crop agriculture, and for various domestic animals. Included in this list of cognates pertinent to agriculture are cognates for honey, mead, milk, beer, and “(fermented) juice.” Earlier, on the subject of agriculture of the Indo-Europeans, Diebold (1992) had written, “cereal beers and kumiss [koumiss] were the earliest Indo-European alcoholic beverages.” As documented below, some authorities argued that mead preceded cereal-based beverages, whereas others merely noted that archaeological evidence for mead dates “from the third millennium BC but it may be considerably older . . . [and] beer (**h₂elut-*) is earliest attested, about the mid fourth millennium BC . . . but it too may be older” (Mallory and Adams, 2006).

These relatively recent opinions overlap (but seldom coincide, especially with regard to beer) with those held for decades: “Language indicates that the food did chiefly consist of *meat* and *milk*; and though a name for *flour* seems to be in existence there exists none for either *bread* or *porridge*. As for *butter*, it did certainly exist, but was scarcely much used for food; classical writers remarked that the barbarians used it as a cosmetic—especially perhaps in a state of rancidity—and this seems to have been its oldest use. There is no proof whatsoever of the existence of *cheese*. Nor does the language testify to the existence of either *ale* or *wine*; but *honey* was in extensive use, and it seems quite probable that the Indo-Europeans knew how to produce, by the fermentation of mare’s milk, an alcoholic beverage” (Charpentier, 1925). Of similar vintage is Harrison’s (1922) opinion: “The . . . primitive beers . . . have this in common, . . . that they are spiritous drinks made of fermented grain, they appear with the introduction of agriculture, they tend to supersede mead, and are in turn superseded by wine.” So, although no sources proclaim wine the very earliest fermented beverage, it seems that fermented honey, cereals, or even milk may exercise competing claims for first intentional alcohol production, and perhaps production of wine ensued not long after. Further opinions are cited below, dependent on context.

Wine later dominated alcohol production and con-

sumption by western Indo-European peoples of the Mediterranean, such as the Mycenaeans and, later, Greeks and Romans of the classical era. Wine is often considered a later development than mead or kvass (but see Mallory and Adams [2006] and McGovern [2003].) Although beer is mentioned, Palaima (2004) focuses on wine, and Wright (2004) exclusively so, in their respective reviews of feasting in Mycenaean society. It is certainly true that Greco-Roman societies highly regarded wine and usually relegated beer to those foods and beverages preferred by barbarians (Nelson, 2005).

For each of the respective beverages, there are below synopses of data from comparative linguistics (relatedness and geographic range of pertinent cognates) and fermentation biology (microorganisms responsible for beverage production). Also noted are instances of containers believed to be used for beverage consumption, some of which contained residues examined for traces of fermented honey, milk, grains or grapes. Subsequent sections present further evidence from archaeology, myth and other sources. Microorganisms are addressed in more detail in the context of contemporary, available germplasm, and current beverage manufacture.

Names of yeasts and bacteria encountered in literature may change with time because of advances in nomenclature and taxonomy. Modern synonyms of yeast names are given following Barnett et al. (2000) or Index Fungorum (CABI Bioscience, www.indexfungorum.org). Readers should be aware that names in which the varietal name repeated the species name are often now given omitting the varietal name, e.g., *Kluyveromyces marxianus* var. *marxianus* is given simply as *K. marxianus* (E. C. Hansen) Van der Walt. Readers also should be aware that modern brewers sometimes use scientific names that are technically just synonyms of the common brewer’s and baker’s yeast *Saccharomyces cerevisiae* Meyen ex E.C. Hansen (Fig. 1). Brewers still use these names because strains under that name tend to have special properties of interest to the brewer. Names of bacteria, including authors of names, follow Prokaryotic names with Standing in Nomenclature (www.bacterio.cict.fr). Authors of species names were not located for a small number of names for which authors are omitted. Abbreviations for names of IE languages can be located with Online Etymology Dictionary (www.etymonline.com). Cognates from PIE or other languages are rendered as transcribed by the works cited, and the reader may notice that *med^hu* is the equivalent of *medhu*, etc.

Kvass

Cognates for “beer,” often rendered as *kvas* or similar sounding words (*kvas*, *kwass*), are widely distributed in Indo-European languages, ancient and modern. However, *kvas* and etymologically related words are not the only words for beer, as some other widely distributed ones have roots similar to *ale*, and then of course, there is *beer* itself.

The OED (Oxford English Dictionary, second edition 1989, on-line) etymology for kvass goes no further than

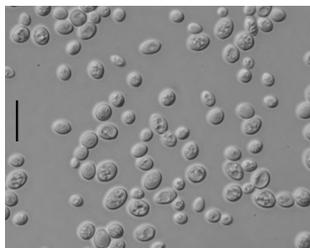


Figure 1. Cells (conidia) of *Saccharomyces cerevisiae* from Red Star Montrachet wine yeast. Differential interference contrast microscopy. Bar = 12 μ m.

the Russian. However, as seen below, the etymology is seen as ancient by several authorities. As for “ale” and its cognates [by the OED: “OE. *alu*, cogn. w. OS. *alo*, ON. *öl* (:–*alu*)”] the situation is slightly more expanded: “we can tentatively meet our criteria for positing a Proto-Indo-European ‘beer,’ **h₂elut-*, if we add to the North-Western forms (e.g., NE *ale*, OPrus *alu* ‘mead,’ Lith *alus* ‘beer’) an Iranian (Ossetic) cognate *ælūton* ‘beer’” (Mallory and Adams 2006). Mallory and Adams (1997) give additional cognates in Old Church Slavonic, Latvian, etc.

Bailey (1960), in discussing aspects of the Khotanese¹ word *kumjī* (“yeast”), notes a base, “either **kuma-* or **kuna-* of which the *ku-* can be found in other words connected with fermentation in solid and liquid form. From the Indo-European side occur Old Ind. *kvath-*, Old Slav. *kvasŭ*, Lit. *kūšlas*, Lat. *cāseus*, from *kuā-* or *kā-*.” Other examples of the base occur in Ossetic,² with an example translated as “the lees [dregs] of *kvass*” (Bailey, 1960). Bailey also discusses a cluster of words, (“traceable to Indo-European times”), putatively linking words for yeast with words for hops (but note that use of hops was generally considered a later development—see below). Mallory and Adams (2006) explore a similar line of reasoning by linking PIE **kwat-* “ferment” to Latin *cāseus* “cheese,” Gothic *hwaþjan* “foam up,” Old Church Slavonic *kvasŭ* “leaven, sour drink” and Sanskrit *kvāthati* “boil.”

Whittaker (2000) lists among words present in the hypothetical and putatively Indo-European language Euphratic, “*kaš* ‘barley beer’ : cf. IE **kuath₂-so-* ‘fermented substance’ (Russian *kvass*).” Whittaker quotes from a colleague: “Doubtless most Sumerologists have paused at such readings as /bi/ of the sign KAŠ... /bi/ should represent some object or actions related to the production of beer (Sumerian *kas/š*). The most plausible explanation would seem to be that such readings represent loan words from an unknown language,” (Whittaker, 2000). In other words, our earliest written evidence for beer (Sumerian) uses a word borrowed from a non-Sumerian language held, by Whittaker, to be in the Indo-European language family. Note that Bottéro (2004) also says that the Sume-

1. Khotanese is a Middle Iranian language spoken in Sinkiang, in northwestern China and preserved in Buddhist and secular documents that date from about the 7th through the 10th centuries AD.

2. Ossetic is an eastern Iranian language in the northern Caucasus. Both Khotanese and Ossetic are of the Indo-Iranian branch of the Indo-European language family (Encyclopedia Britannica On Line, Encyclopedia Britannica, Inc.).

rian brewing vocabulary was non-Sumerian in origin. The general subject of a pre-Sumerian linguistic substratum is reviewed, somewhat skeptically, by Rubio (1999), who covers the words KAŠ (“emmer beer”), and various cognates for “wine.”

Hornsey (2003) noted that the Sumerian sign (pictogram) for KAŠ was a beer jug. There were various permutations of the pictogram, denoting beer bread, etc. Further, “most Assyriologists had interpreted the major grain-based drink to be something akin to, what we now know as, *kvass*” (Hornsey, 2003). The use of KAŠ for “beer” in Hittite is treated in depth by several authors. Goetze (1971) gave numerous references for how KAŠ was used in descriptions of beer, libations and sacrifices, etc., often in combination with “wine” - (*wiyana-*, written as GEŠTIN, the Sumerogram for wine), which in other contexts could also denote cheap wine or vinegar (Hoffner, 1995). There are many other examples, e.g., combinations of KAŠ with terms for honey (for honeyed beer) (Hoffner, 1968), and a discussion of possible interpretations of Hittite writings, as to whether a certain symbol pertains to salt or a fermented item, “‘Beer,’ however, is already preempted by KAŠ and *siyessar*” (Sapir, 1938).

As for “beer” itself, the OED has this to say: “Common WGer.: OE. *béor* = OHG. *bior*, MHG. and mod.G. *bier*, MLG. *bêr*, MDu. and Du. *bier*, all neut.; cf. also ON. *bjor-r* masc. Etymology uncertain. The OTeut. form might be **beuro-(m)*, f. **beuwo-* barley (whence ON. *bygg...*); the Gothic form [has been suggested as] **biggwis* :– OTeut. **beuwiz-*; ... one of the other forms of the neuter suffix *-os, -es, -s*, viz. **beuwoz-*, or rather **beuwz-* would better account for the WGer. forms. [A possible connection with] *brew* (taking *beuro-* as for **breuro-*) [but] . . . an Aryan **bhur-* ‘to ferment’ seems unwarranted.” Thus there are a number of cognates for a fermented, cereal-based beverage in IE or PIE, with the most ancient probably related to the contemporary Russian *kvass* in both etymology and possibly production technique. Dugan (2008) summarized various opinions on the co-evolution of baking and brewing.

Hornsey (2003) calls *kvass* a “fossil beer” and notes it “has been produced and consumed in eastern Europe and Russia for centuries” and that it was familiar to the ancient Egyptians. It was made by mixing flour and water, heated for a day, then left to ferment for a day. The similar *braga* or *bosa*, made “over a huge area of Europe, stretching from Poland to the Balkans” was made by soaking millet in water, subjecting the “porridge” to heat, and then fermenting it for about 24 hours (Hornsey, 2003). Harrison (1922) thought that mead preceded fermented cereals (presumably including *kvass*). After discussing mead in myth and in a historical context, she commented, “Next in order came the drinks made of cereals fermented, the various forms of beer and crude malt spirit.” [Wine, in Harrison’s view, came later.]

Certain containers, together with archaeobotanical evidence, point to the adoption of grains (barley, wheat) for the purpose of fermentation, sometimes to the exclusion of other crops such as winter pulses (see Fuller,

2005, for examples from India). Archaeological evidence for prehistoric beer production in Europe is scarce, but large amounts of sprouted barley from an archaeological site near Stuttgart may indicate a site for deliberate malting, i.e., a possible Iron Age Celtic brewery (Stika, 1996). Although use of sprouted barley for beer production has a long history (sources in Dugan, 2008), hops (*Humulus lupulus* L.) were probably not consistently used in beer until much later. A tenth century AD boat excavated in Kent, England, contained a probable cargo of hops (Wilson, 1975). Hopped beers, as early as late medieval times, tended to displace kvass in eastern Europe, but less so in the countryside (Unger, 2007).

Fermentative microorganisms: From commercial kvass (Canada, Toronto), were isolated the yeast *Saccharomyces cerevisiae*, and the bacteria *Lactobacillus casei* (Orla-Jensen) Hansen & Lessel and *Leuconostoc mesenteroides* (Tsenkovskii) van Tieghem (Dlusskaya et al., 2008). Deak (2007) lists *S. cerevisiae* and “mixed wild yeast.” Hessiltine (1983) specifies only “mixed culture fermentations combining yeast and lactic acid bacteria” and Unger (2007) also specifies “airborne lactic-acid bacteria, which would cause the beverage to sour, and infection by yeast, which would cause the beverage to have alcohol.” Hessiltine (1965) provides a brief list of ingredients for modern kvass production, including peppermint for flavoring (detailed recipes, including the peppermint, are posted on www.bigoven.com, www.ruscuisine.com, www.recipes.eu.com and other Web sites), but specifies only “yeast.” Russian and German immigrants, farming in the central and western parts of Kansas, were recorded as producing home-made kvass during Prohibition times (Randolph, 1929). Commercial production of kvass is largely concentrated in eastern Europe, where research is actively pursued for yeasts and/or bacteria that will optimize production, e.g. Wzorek et al. (2003).

Note that the Czech Journal *Kvasný Průmysl* (“Ferment”) was established in 1873, and continues to the present (www.beerresearch.cz). Its original masthead, KVAS, in nineteenth century rendition, is elegant evidence for the persistence of an ancient IE cognate for fermented grain (Fig. 2).

Mead

Mead (fermented honey) may have preceded the Neolithic in Europe (Dietler, 2006; citing several sources). In some cases, words for mead later came to represent wine, as illustrated below.

The OED has this: “Cognate with Old Frisian *mede*, Middle Dutch *mede*, *meed*, *meede*, *meedt* (Dutch *mede*, *mee*), Middle Low German *medde*, *mēde*, *meit*, *meth*, Old High German *medo*, *met*, *meto*, *metu*, *mito* (Middle High German *met*, *mete*, German *Met*), Old Icelandic *mjǫr* (Icelandic *mjöd*, *mjödur*), Old Swedish *miödher*, *miöper* (Swedish *mjöd*), Danish *mjød*, Gothic **midus* (only attested in Greek transcription as *μέδος*, given by Priscus as the name of a drink used in place of wine at the Hunnish court AD 448)



Figure 2. The original nineteenth century masthead for the journal *Kvasný Průmysl* (“Ferment”), named with an ancient Indo-European cognate for fermented grain, “kvas.” By permission of *Kvasný Průmysl* (www.beerresearch.cz).

< the Indo-European base of Sanskrit *madhu* (neuter) honey, sweet drink, ancient Greek *μέθυ* wine, Old Irish *mid* mead (Old Welsh *med*, Welsh *medd*), Old Church Slavonic *medŭ* honey, mead, Lithuanian *midus* mead, *medus* honey. The word may have been orig. a use as noun of an adjective meaning “sweet”; compare Sanskrit *madhu* (adjective). The Germanic word >post-classical Latin *medus* (6th cent.; from 11th cent. in British sources).” Further etymological parallels given by Mallory and Adams (2006) include root words implying “honey” or its products, fermented and otherwise, in Greek, Armenian, Hittite, New English, Latvian, Old Church Slavonic, Albanian, Sanskrit, and Tocharian B. Anthony (2007) made the pertinent comment that “reconstructed Proto-Indo-European vocabulary tells us that honey and honey-based mead . . . were consumed, probably on special occasions.” It is interesting that the Chinese word for honey is “the one and only guaranteed loanword from Proto-Tocharian into Chinese” (D. Adams, personal communication).

Moreover, “for the Proto-Indo-Europeans . . . honey (**medhu*) was important as the source of mead, which was also called **medhu*: this original meaning is preserved in the Celtic, Germanic, and Baltic cognates, while the Greek cognate *méthhu* has come to denote . . . wine, and Sanskrit *mádhu* in Vedic texts usually denotes the honey-sweetened variety of the sacred Soma drink, and in later Indian texts often wine” (Bryant and Patton, 2005). So, words which originally denoted mead or honey, could later denote wine. Moreover, the “wine” word seems to have been imported into several languages, e.g., with regard to Etruscan: “It may be a heavily ‘Anatolianized’ non-Indo-European Asiatic language, i.e., with areally diffused features. Note the Etruscan word for ‘wine,’ *matu-*, from a Luvian-like language: Cuneiform Luvian *maddu-*, Hieroglyphic Luvian *ma-tu-*, with a specifically Luvian sound change from Indo-European **médhu-*, Greek *méthhu* ‘wine.’” The semantics is a shared feature of Greek and Western Anatolian; elsewhere the word means “sweet; honey; mead,” the English cognate” (Watkins, 2001). “One can detect a tendency for ‘mead’ to widen and come to mean ‘alcoholic drink [in general]’ and then possibly to narrow to ‘wine’” (D. Adams, personal communication).

The Scythians may have been mead drinkers as well as koumiss drinkers (see below for the latter): “the Greek lexicographer Hesychios mentions *melítion* (from Greek *melí* gen. *melítos* ‘honey’) as a Scythian drink. The Ossetes of the Caucasus, descended from the Scythians, are said to have worshipped a bee goddess . . . ; Ossetic *mid/mud* has preserved the meaning ‘honey,’ while the Avestan *maōw* and Modern Persian *mai* mean ‘wine’” (Bryant and Patton, 2005).

Scheinberg (1979) summarizes opinion on the use of mead in Greece, “known to primitive Greek society . . . although not directly attested in the *Iliad* and *Odyssey*.” We know “from a Linear B tablet” that honey was mixed with wine in Mycenaean times and such a mixture was added to Nestor’s cup in the *Iliad*. Scheinberg interprets this and other evidence—including root words for “honey” common to IE and Greek and sometimes used in Greek “as related words for drunkenness”—as reminiscent “of a time when the chief intoxicant was not honeyed wine, but mead.” Harrison (1922) discusses mead, and notes, “When Zeus would intoxicate Kronos he gave him not wine . . . for wine was not, but a honey-drink to darken his senses.” She then cited Plutarch’s commentary that mead was used as a libation before the appearance of wine.³

Mallory and Adams (2006), as previously noted, accepted archaeological evidence for early production of mead. In addition, Rösch (2005) presented an instance from Bavaria (late Hallstatt/early La Tène period, Iron Age), and reviewed several others, mostly of the same period but also some Bronze Age and medieval examples.

3. Libations with fermented beverages were a widespread form of worship in antiquity (Dugan, 2008), and “the [PIE] verb **spend-* means ‘pour a libation’ in both Greek and Hittite (Grk *spéndō*, Hit *sippand-* ~ *ispant-*),” (Mallory and Adams, 2006).

Residues from ancient containers were characterized by quantity and species of pollen, etc., and inferences are drawn as to the method and timing of collection of honey. Some of these specific instances, plus additional evidence, were accepted by Guerra-Doce (2006) as documenting mead in Bell Beaker pottery. Hornsey (2003), however, urged some caution when interpreting archaeological evidence of beeswax or pollen since their presence might merely indicate sweetening by honey of another beverage.

Fermentative microorganisms: As one might expect, there is a literature devoted to discovery of yeast strains that optimize production of mead under conditions of modern, commercial manufacture (see below). And there are ethnographic studies of mead or “honey wine.” However, little literature is devoted to microbiological studies of mead produced specifically by Europeans in a traditional manner. Atacodor-Ramos et al. (1995) noted that in Krakow, Poland, “the honey cooperative . . . still makes mead, mainly from dark honeys by traditional processes [and] fermented with osmophilic yeast.” Presumably the yeast is *S. cerevisiae*. Ng (2004), citing authorities publishing from India, notes that *S. cerevisiae* is used for alcoholic fermentation in mead. On the basis of ethnographic studies from Africa (see below), it is likely that *S. cerevisiae* plus a variety of wild yeasts are responsible for fermentation. Brewing of mead is currently addressed in brewing and food science literature, e.g., Sroka and Tuszynski (2007) using *S. cerevisiae* or its synonym, *S. oviformis* Osterw. (Houille, 1979). Some persons studying ancient alcoholic beverages also believe that *S. cerevisiae* was the fermenting yeast for ancient mead. As attested in a seventh century AD document from China, the Chinese of that time knew that honey contained its own fermenting agent, which became active with the dilution of the material with water and produced mead. As McGovern et al. (2005) explained, “Because the principal yeast species, *Saccharomyces cerevisiae*, is not airborne, the success of the fermentation was assured by using honey as an ingredient or additive.”

Some studies of African folk production of honey wine have a microbiological component: From Ethiopian “honey wine” (ogol, a form of mead), were isolated a yeast “considered to closely resemble *Saccharomyces cerevisiae*” (Teramoto et al., 2005, who state that “scientific studies of honey wine are very rare” although ethnological reports are numerous). Bahiru et al. (2006) studied the yeast and lactic acid flora of *tej*, an indigenous Ethiopian honey wine. The yeast isolates were most often *Saccharomyces cerevisiae*, followed by *Kluyveromyces bulgaricus* (Santa María) Van der Walt [= *K. marxianus* var. *bulgaricus* (Santa María) Johannsen & Van der Walt], *Debaryomyces phaffii* Capr., and *K. veronae* (Lodder & Kreger-van Rij) Van der Walt [= *Lachancea thermotolerans* (Filippov) Kurtzman]. Others included *Zygosaccharomyces rouxii* (Boutroux) Yarrow, *Hansenula subpelliculosa* [= *Wickerhamomyces subpelliculosa* (Kurtzman) Kurtzman, Robnett & Basehoar-Powers], *Saccharomyces norbensis* Santa Maria, *K. vanudenii* (Van der Walt & E.E. Nel) Van der Walt and *Endomycopsis*

burtonii (Boidin, Pignal, Lehodey, Vey & Abadie) Kreger-van Rij [= *Hyphopichia burtonii* (Boidin et al.) von Arx & Van der Walt]. Bacteria were not identified to species, but included *Lactobacillus* and some others. Bahiru et al. (2006) cite literature indicating that yeasts in *Saccharomyces* are the organisms responsible for fermentation in *tej*, but detailed studies had not been performed. Contemporary *tej* (e.g. Camas Prairie Winery, Moscow, Idaho) is flavored with hops or with other hops-like agents.

Some yeasts are naturally occurring in honey: From the Belgian Coordinated Collections of Microorganisms, MUCL 20471, *Pichia membranifaciens* (E.C. Hansen) E.C. Hansen var. *membranifaciens*, was isolated from honey, as was MUCL 27722, *Pichia canadensis* (Wickerham) Kurtzman. Note that a strain of *P. membranifaciens* var. *membranifaciens* from CBS (see below) was isolated from koumiss, although in Teramoto et al. (2005) the strain isolated by them did not show fermentation ability. Generally *Pichia* spp. are regarded as undesirable (spoilage) yeasts in beverage production (e.g., Sponholz, 1993). However, CBS has *Saccharomyces cerevisiae* isolated from honey (= CBS 426) and the Phaff Yeast Culture Collection (www.phaffcollection.org) has several other yeasts from honey (but not necessarily fermentative). The All Russian Collection of Microorganisms (VKM) has numerous strains from honey, including a fermentative strain Y-890 (= CBS 737) *Zygosaccharomyces rouxii* (deposited as *Z. ravennatis* Sacchetti). Yeast taxa presently assigned to *Zygosaccharomyces* are often isolated from honey and are commonly regarded as spoilage yeasts (Mrak and Phaff, 1948; Munitis et al., 1976). See “Domestication of microbial fermentative agents, and isolates in modern culture collections” below.

Fermented Mare’s Milk

The term most commonly employed today, *koumiss* (*koumiss*, *kumiss*, *kuymiss*), is from the Turkic language family and has largely displaced the word *hurā*. Although the root for koumiss has been taken into several Indo-European languages, the more original word (*hurā* in Iranian, *surā* in Indo-Aryan) persisted in the Indian and Iranian branches of Indo-European. The OED renders the following for koumiss: “= F. *koumiss*, G. *kumiss*, Pol. *komis*, *kumys*, Russ. *kumys*, a. Tartar *kumiz*.” But, our prime concern will be with the cognates related to *hurā*.

Evidence for koumiss in ancient times is archaeological as well as linguistic. Of the Timber-Grave culture [southern Russia, Indo-Iranian (Encyclopedia Britannica Online)]: “Discoveries of bone devices, possibly designed for milking mares, and beaker-form vessels, suggest the possibility of the invention of *kumiss*” (Kuzmina and Mair, 2007). Regarding the burial remains of a fifth century BC female in the Altai Mountains (Pazyryk Culture, a kurgan culture of the Ukok Plateau): “A bowl with a handle in the form of two Tien Shan snow leopards had contained koumiss, [for] nourishment [on the] journey to the Otherworld” (Davis-Kimball, 2003). Detection of horse adipose lipids on ancient shards is becoming sufficiently refined so that lipids from milk can be distinguished from those

originating in flesh. Finds of such lipids from milk can be interpreted as evidence of horse domestication (Olsen, 2006). In some instances, prehistoric ceramics of great antiquity have been interpreted as having a possible function for curdling of milk, e.g., Fuller (2005, who speculated that such containers from prehistoric India (the Deccan—3rd to 2nd millennium BC) were curd strainers.

According to Nelson (2005), “Our first reference to peoples who live north of the Black Sea (later to be identified as Scythians) is in Homer, who speaks of the Mare-milk-drinkers who drink mare’s milk. In our first reference to Scythians, they are called milk-drinkers, and many later authors also give them this epithet. Herodotus also says that the Scythians are milk-drinkers and seems to speak of them making fermented milk by having blind slaves agitating mare’s milk and curdling it. One Hippocratic work also discusses the Scythian practice of agitating mare’s milk to make cheese, butter, and presumably also a fermented product.” Of the Scythians and Sarmatians (the latter also nomadic horse riders of the Black Sea area, and known to the ancient Greeks): “In place of wine they were served kumiss (a drink made of fermented mare’s milk)” (Rostovtzeff, 1960).

In PIE, we have: “Some form of intoxicating drink is suggested by **súleh_a*- with meanings ranging from ‘curdled milk’ (OPrus *sulo*) and ‘kumiss’ (AV *hurā*) to ‘(birch) sap’ (Latv *sula*) and an unspecified ‘intoxicating drink’ (Skt *surā*)” (Mallory and Adams, 2006). “Iranian evidence suggests that, in Proto-Aryan times, *surā* was (mare’s or any other) milk fermented with honey, in other words, kumiss. This is also suggested by the facts that the Aśvins (Vedic deities) were offered a drink of hot milk mixed with honey . . . and that the Soma drink, when offered to the Aśvins and to Mitra and Varuna, had to be mixed with milk and honey. . . . In Vedic times, *surā* was beer made of germinated rice and barley” (Parpola, 2004–2005). “In Khotanese Saka, *hurā* means ‘fermented mare’s milk,’ and the Avestan text Nirangistān expressly states that *hurā* is made of mare’s milk,” (Parpola, 2004–2005). This modern perspective is essentially unchanged from that of Charpentier (1925): “The liquor denoted in Sanskrit by *surā*, in the Avesta by *hurā*, possibly originally meant a beverage prepared from mare’s milk. Later on *surā* certainly means ‘rice-wine’ or ‘rice-brandy.’”

“The ritual use [of the Soma plant] is at least of Proto-Indo-Iranian origin, as revealed by the equivalent use in Iranian rites of *Hoama*, cognate in name to Sanskrit *Soma*” (Woodard, 2006). “It has long been suggested that the Indo-Iranian ritual use of the intoxicating **sauma* continues a Proto-Indo-European use of **med^hu-* ‘mead’ . . . There is, however, another intoxicating substance which receives ritual use in Vedic India—the fermented beverage called *surā* . . . Its sacred use is restricted to . . . primitive [Vedic] rituals—undoubtedly a testimony to the great antiquity of their heritage” (Woodard, 2006). Woodard interprets *surā* as spiced rice wine. Woodard, in a footnote, acknowledges without further elaboration Gordon Wasson’s attempts to identify soma, but he doesn’t specify Wasson’s candidate,

the mushroom *Amanita muscaria* (L.) Lam.

Koumiss remains a beverage favored by horse-riding nomads, and is associated in the modern world not just with horse-riding, but with horse meat in the diet “in the belt from the Ukraine to Mongolia” (Simoons, 1978). Kazakhstan is currently the nation with the most koumiss production (Olsen, 2006).

Fermentative microorganisms: There has been considerable variability in the microorganisms isolated from koumiss by various investigators, although lactobacilli and fermenting yeasts are consistently held responsible for the product. Demain et al. (1998), note that “Milk has been made into . . . Koumiss using *Kluyveromyces* species in Asia for many centuries.” From “Mongolian artisan koumiss” were isolated *Lactobacillus salivarius* Rogosa et al., *L. buchneri* (Henneberg) Bergey et al., and *L. plantarum* (Orla-Jensen) Bergey et al. (Danova et al., 2005). Citing Montanari et al. (1996), Danova et al. wrote that the most common *Lactobacillus* spp. in koumiss are *Lactobacillus delbrueckii* (Leichmann) Beijerinck, *L. acidophilus* (Moro) Hansen and Mocquot, *L. casei* (Orla-Jensen) Hansen and Lessel, *L. rhamnosus* (Hansen) Collins et al., *L. paracasei* Collins et al., and *L. kefir* (sic) (presumably = *L. kefir* corrig. Kandler and Kunath), but note that the title of Montanari et al. is “*Saccharomyces unisporus* [A. Jörg.] [= *Kazachstania unispora* (Jörg.) Kurtzman] as the principal alcoholic fermentation microorganism of traditional koumiss.” Sun et al. (2006) isolated from Mongolian home-made koumiss *L. helveticus* (Orla-Jensen) Bergey et al. and *L. casei*, and (“classified temporarily”) *L. ferintoshensis* Simpson et al. Chen et al. (2007) isolated and characterized *L. acidophilus* from koumiss. From Xinjiang (China), Ni et al. (2007) isolated *Saccharomyces unisporus* (48.3% of the yeast isolates), *Kluyveromyces marxianus* (E.C. Hansen) Van der Walt (27.6%), *Pichia membranifaciens* (15.0%), *Saccharomyces cerevisiae* (9.2%).

Wszolek et al. (2006), citing various authors, state, “The microflora of koumiss is not well defined, but it consists mainly of Lactobacilli (*Lb. delbrueckii* subsp. *bulgaricus* [(Orla-Jensen) Weiss et al.] and *Lb. acidophilus*), lactose fermenting yeasts (*Saccharomyces* spp., *K. marxianus* var. *marxianus* [Fig. 3] and *Candida koumiss*); Non-lactose-fermenting yeast *Saccharomyces cartilaginosus* [Lindner] [= *S. cerevisiae*]; Non-carbohydrate-fermenting yeasts (*Mycoderma* spp.) [*Candida* spp.]” They cite other authors to add *Saccharomyces unisporus* and they mention the lactobacilli *L. rhamnosus*, *L. paracasei* subsp. *paracasei*, *L. paracasei* subsp. *tolerans* (Abo-Elnaga & Kandler) Collins et al., and *L. curvatus* (Troili-Petersson) Abo-Elnaga & Kandler, plus the yeasts *K. marxianus* subsp. *lactis* (Dombr.) Johannsen & Van der Walt and *Candida kefir* (sic) (presumably = *Candida kefir* (Beij.) Uden & H. R. Buckley = anamorph of *Kluyveromyces marxianus*).⁴ [Varieties or subspecies *lactis*

4. Taxonomy of the genus *Kluyveromyces* is summarily reviewed by Fonseca et al. 2008. *Kluyveromyces lactis* and *Kluyveromyces marxianus* in particular have been considered as conspecific

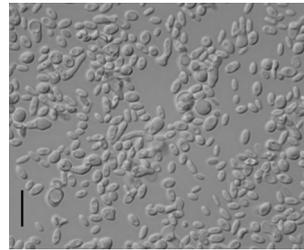


Figure 3. Cells (conidia) of *Kluyveromyces marxianus* var. *marxianus*. Differential interference contrast microscopy. Bar = 12 μ m. This strain (03-1) can induce a soft rot in onions! Courtesy of B.K. Schroeder.

of *K. marxianus* are now typically considered *K. lactis* (Dombrowski) Van der Walt.]

Other reports have microorganisms isolated from koumiss as *Kluyveromyces marxianus* var. *lactis* (Ishii et al., 1999), *Candida kefir* and *L. curvatus* (Ishii et al., 1997), *L. bulgaricus* (Orla-Jensen) Rogosa and Hansen (= *L. delbrueckii* subsp. *bulgaricus*) (Grudzinskaya, 1968; Makhanta, 1961), yeasts in *Pichia* and *Rhodotorula* (Grudzinskaya, 1968), and *Streptomyces lactis* and *S. thermophilus* (Gilbert) Waksman and Henrici (Makhanta, 1961). Seiler (2003) found the dominant yeasts in koumiss to be *K. marxianus* and *K. lactis*. Ng (2004), citing an older source, reported the yeasts as *Torula kumiss* Bachinskaya-Raichenko (a name not in known synonymy with any modern name, see Barnett et al., 2000) and *Saccharomyces lactis* [*Saccharomyces lactis* Dombrowski is a homotypic synonym of *Kluyveromyces marxianus* var. *lactis* (Dombr.) Johannsen & Van der Walt]. Mistry (2006) tabulated the microflora of koumiss as *Candida kefir* (sic), *Candida buensis*, *Kluyveromyces marxianus* subsp. *lactis*, *Saccharomyces unisporus*, *S. cartilaginosus*, “other yeasts,” *Lactobacillus caucasicum*, *L. curvata*, *L. delbrueckii* subsp. *bulgaricus*, *L. paracasei* subsp. *paracasei*, *L. paracasei* subsp. *tolerans*, and *L. rhamnosus*, but not all the yeasts fermented lactose. Isolation and characterization of *Lactobacillus* spp. are addressed in numerous publications from East Asia, sometimes with an emphasis on probiotic aspects. In experimental koumiss manufacture, Kucukcetin et al. (2003) used *Kluyveromyces lactis* (= *Kluyveromyces marxianus* subsp. *lactis*), and the bacteria *Lactobacillus delbrueckii* subsp. *bulgaricus*, and *L. acidophilus* (each specified by strain number and culture collection).

Wine

As briefly noted above, opinions vary regarding the antiquity of wine versus that of fermented grains or fermented milk. For etymology, the OED says: “OE. *wīn* = OFris., OS., MLG., MDu. *wīn* (Du. *wijn*), OHG., MHG. *wīn* (G. *wein*), ON. *vín* (Sw., Da. *vin*), Goth. *wein*: — OTeut. **wīnom*, a. L. *vīnum*, the source also of the Balto-Slavic (OSl. *vino*, Lith. *vīnas*) and Celtic words (Ir. *fīn*, W. *gwīn*). L. *vīnum* is primitively related to Gr. *Foίvoς*, *oίvoς* wine, *oίνη* vine, wine, Alb. *vēne*, Arm. *gini*, which according to some scholars are all derived from a common Mediterranean source, while according to others prim. Arm. **woiniyo* (Arm. *gini*)

or distinct, and have been recovered from a very wide spectrum of environments. The strain in Fig. 3, for example, can induce soft rot in onions!

is the immediate origin of the Gr., Lat., and Alb. words; the nature of the connection of the Indo-Eur. words with the Semitic (Arab., Ethiopic *wain*, Hebrew *yayin*, Assyrian *înu*) is disputed."

Chronologies for the earliest wine production

In spite of some controversies regarding methodologies for detecting wine residues (see references in Introduction), it appears that many authorities are convinced that wine was produced quite early, although earliest producers were not necessarily Indo-European speakers. For example, "Archaeological research has traced the earliest evidence for large-scale winemaking, presumably exploiting a domesticated plant, to the Neolithic period in the northern mountainous regions of the Near East, encompassing the northern Zagros, eastern Taurus and Caucasus Mountains. . . . From there, wine and grape cultivars were transplanted to the Jordan Valley (c. 4000 BC) and Egypt (c. 3000 BC) on the western side of the Fertile Crescent, and to the central and southern Zagros Mountains, bordering Mesopotamia on the east, by 3000 BC" (Arroyo-García et al., 2006). McGovern (2003) expressed similar views: "The grape pips from the earliest levels of Shulaveris-Gora ["one of the earliest known permanent settlements in Transcaucasia"] had been radiocarbon dated to about 6000 BC . . . very likely the earliest domesticated grape seeds of *Vitis vinifera vinifera* ever found." Other collections from the same general geographic vicinity are much later but still quite ancient, e.g. 3500 BC (McGovern, 2003). Charred grape pips with skins ("clear evidence for the extraction of juice") and dating towards the end of the fifth millennium BC were recovered in excavations at Neolithic Dikili Tash (northern Greece); two-handled cups and jars were also found, similar to cups excavated at other locations in northern Greece, of similar date, and "deposited during or after large scale feasting" (Valamoti et al., 2007).

Nonetheless, the idea that the "wine" word was a latecomer to IE has been held for decades; "they certainly made an intoxicating drink out of honey, i.e., 'mead.' Words for wine, however, seem confined to European languages and Armenian. Whether they made beer is likewise doubtful" (McFayden, 1946). Fortson (2004) noted, "Most researchers believe rather that it [word for wine] diffused into the IE languages at a post-PIE date." But Mallory and Adams (2006) addressing possible loan words into PIE from Semitic, write: "Proto-Indo-European **wóinom* 'wine': Proto-Semitic **wayn* 'wine' (although this last word could also claim to have a decent IE pedigree)." Later, they write "The word for 'wine,' **wóinom*, is found in Lat *vīnum*, Alb *verë*, Grk *oīnos*, Arm *gini*, and Anatolian (e.g. Hit *wiyana-*) and would appear to be old in Indo-European; it may derive from the verbal root **wei(h_x)-* 'twist,' hence originally 'that of the vine' . . ." In a similar vein, we find, "the Greek, Latin, Armenian, and Hittite roots for "wine" are cognates, and some linguists feel that the root was of Semitic or Afro-Asiatic origin" (Anthony, 2007). "Thus PIE **woino-*, Kartvelian [a south Caucasian

language, unrelated to Indo-European or Semitic] **γwino-*, and Semitic **wajn*, all 'wine,' count as comparanda, since they have three segments **w*, **i* or **j*, and **n* in common as well as their meaning. (Dolgopolsky (1987: 20) regards the Kartvelian form as a borrowing specifically from pre-Armenian)" (Nichols, 1997).

Of certain words in Greek, we have, "They are without Indo-European (or non-Indo-European) etymology, and—like *oīnos* 'wine' . . .—at the present state of our knowledge they must so remain" (Francis, 1992). Note that the Hittites made use of the Sumerogram (written by specialists in cuneiform as GĒŠTIN) for wine (e.g., Hoffner, 1968), but that the Hittite word for "wine" is transcribed as *wiyana-* (e.g., Watkins, 2001). "Both Greek and Common Anatolian also attest the widely diffused 'Mediterranean' wine word: Italic *uīnom*, Greek (*w*)*oīnos*, Hittite and Luvian *wiyana-*" (Watkins, 2001). Rubio (1999) lists several cognates for "wine" (Semitic **wayn-*) in Arabic, Hebrew, and "perhaps Akkadian" which might be related to Egyptian, and mentions the Indo-European cognates from Greek, Latin, Hittite, Gothic and "even Kartvelian" and Old Georgian. At any rate, it appears that related cognates for "wine" are distributed throughout west Asia, the Aegean, and the Caucasus, but are not readily demonstrated farther to the east.

McGovern (2003), in reviewing evidence for very early wine production in Transcaucasia (roughly, modern Georgia), sided with Gamkrelidze and Ivanov (1990), who advocated a center of origin for wine production in the Caucasus. McGovern states, "The word for wine (PIE **woi-no* or **wei-no*, the asterisk indicating a reconstructed form) is shared by a host of languages, Indo-European and non-Indo-European . . . When the dead languages of the ancient Near East are examined, one finds [the cognate for wine] in the primary languages of Anatolia (Hittic *windu* and Hittite **wajnu*, and Early Hebrew *yayin*), Greece (Linear B *wo-no* and Homeric Greek *oivos*), and Egypt (Old Kingdom **wnš*). The equivalent in Kartvelian is **γwino*, which is still the spoken word for *wine* in Georgia today." Gamkrelidze and Ivanov (1990) postulated (in the words of McGovern's synopsis) "agricultural groups leaving Transcaucasia and eastern Turkey about 5000 BC, heading eastward toward Iran, southward to Egypt, and westward to the Balkans. These migrants already tended the grapevine and enjoyed its principal product, wine."

However ancient was the appearance of wine and "wine," both the beverage and the cognates pertaining to it appear much earlier in west Asia than in central Asia. Only with expansion of Greco-Roman civilization did wine make a definite appearance in some central Asian locales. In the region of modern Ferghana (central Asia) was the ancient state of Dawan. This state "was famous for its grape wine [which] might be one of the legacies of Hellenistic influence" (Liu, 2001). The inhabitants of Dawan apparently spoke an Indo-European language, Tuharan, which may be the same as or related to Tocharian (Liu, 2001; Thornton and Schurr, 2004). There is little evidence that the inhabitants of the region were familiar with wine

prior to Hellenistic times, but this is not unequivocal. Tocharian itself may possess a PIE-related cognate for “wine”: “It is possible to see in mot [an equivalent] of mit ‘honey,’ q.v., that is, in Indo-European terms *mCēdʰu- [*mēdhu] ‘that made from honey, mead’ and *me’dʰu- [*médhu] ‘honey,’” (Adams, 1999, citing other sources.) It seems that people speaking Tuharan (a people often called the Yuezhi, and arguably ethnically distinct from the original Tocharian-speakers of the Bronze Age) gained supremacy of the region after the Greeks, whose name for the region was Bactria. The region was located on the silk route between China and the West, so knowledge of wine spread eastwards. In spite of Muslim and Buddhist strictures against alcohol consumption, some contemporary peoples of east central Asia, e.g., the Uyghurs, enjoy wine (Liu, 2005).

From Gandhara, a Hellenistic kingdom established in the time of Alexander in what is now northern Pakistan and eastern Afghanistan, we have carvings of grape-gatherers, Dionysius amongst the vines, representations of a wine press and other representations of wine or vine (Banerjee, 1920). There are controversial claims that certain tribes of this region, pagan until the 1970s when converted to Islam, were descendants from this Hellenistic kingdom. What is more certain is that they made and drank wine (Klimburg, 1999). “Whether there was a wine-drinking culture in [ancient] India is another matter, and texts can be found in support of both sides of the argument,” (Tomber, 2007). The Greek geographer Strabo “quotes Aristobolus as stating that wine was produced in India . . . but he also notes that other writers said that India produced no wine,” (Unwin, 1991). Late Roman, and of similar dates Mesopotamian, imports of wine into India are analyzed by Tomber (2007).

Fermentative microorganisms: Unlike the mixed flora responsible for production of kvass, koumiss, or even (in some cases) mead, there is little doubt that *Saccharomyces cerevisiae* is the only fermentative microorganism of primary importance for wine. However, there is considerable literature devoted to debates over the origin of domesticated strains. See “Domestication of microbial fermentative agents” below.

Fermented Beverages in Worship, Ritual Drinking, and Bestowal of Kingship or Immortality

Dumézil and the tripartite division of Indo-European societies

Georges Dumézil (1898–1986) frequently discerned Indo-European motifs in myth, legend and culture as being of tripartite composition. Most notable is the division of Indo-European society into producers (essentially, farmers or herders), a warrior class, and a priestly or ruling class. The latter were intimately linked to ritual use of alcohol, especially alcoholic beverages in rituals bestowing royal power (Dumézil, 1973a). Woodard (2002) describes “a feature binding together Irish Sovereignty and

Indo-Ayran Śri-Lakṣmi (the prosperity of the kingdom) that is of a quite specific, idiosyncratic nature, and so a valuable diagnostic in identifying their ultimate common Indo-European origin. Sovereignty . . . is linked with a fermented, intoxicating substance.” Woodard specifies an Irish goddess, Flaith, and two mythical personages, “the two Melbs.” Woodard continues, “The very name of Melb . . . belongs to that cognate set that includes Old Irish *mid*, Welsh *medd*, Sanskrit *māhdu*, Old English *meodo*, all meaning ‘mead’ or some alcoholic beverage made with honey.” Further, “A man could not be king over Ireland, unless the ale of Cuala should come to him” (Woodard, 2002, quoting Dumézil). Documentation for extensive alcohol use in Celtic society, and further references for use of alcohol in legitimization of power, are extensively provided by Arnold (1999) and summarized in FitzPatrick (2004) and Sopena (2005).

Likewise, immortality was bestowed on the gods by certain alcoholic beverages. De Angulo (1926) in review of Dumézil’s early writings, summarizes: “Immortality is acquired by partaking of the ambrosia, the nectar, the amṛta, the beer, that drink whatever its name from the Indus to the North Sea, which is the appanage of the Gods. The Gods are the Immortals. The others that do not drink it, are the mortals. That theme . . . can be traced all over the Indo-European world.” This motif, the “ambrosia cycle,” encompasses not only the bestowal of immortality on the gods, but also various failed attempts by mortals to attain immortality by stealing the ambrosia (Littleton, 1982). Although Dumézil’s opinions eventually evolved away from his original stance on the ambrosia cycle, he authored several works on the subject (Littleton, 1982). Littleton noted in summary: “The idea of a deified drink and the ritual of its consumption are thus seen as uniquely I-E [Indo-European], having no parallels either in contemporary primitive religions or in those of the ancient non-I-E civilizations,” [although Littleton devoted a footnote to pulque (Aztec religion), chibcha beer (Inca religion) and ritual use of peyote in North American Indians].

Mead or other alcoholic beverages may also have played a role in the widely debated “horse sacrifice” purportedly characteristic of Proto-Indo-European societies. Mallory and Adams (1997) discuss lexical support (words combining “mead” with “horse” from Gaul and ancient India), variants on the ritual (including mock couplings between human participants and equines) and significance (the mare as “the goddess who [imparts] to her chosen mate the blessings of the three ‘functions’ [religion/law, war, fertility] of IE society”). Symbolic mating in a context with drinking or drinking equipment is a theme in Irish, Etruscan and Hallstatt tales or artifacts (Arnold, 1999).

Strutynski (1984) comments at length on a myth in Herodotus (4:5–8) for the origin of the Scyths, incorporating perspectives of other authors, including Dumézil. Three sets of gold objects fall from the sky (a plow and yoke, an axe, and a cup—symbolizing the peasantry, the warriors, and the priests and sovereigns respectively) and

are taken up by one Kolaxais, who represents the power of the priests. Analogous objects are encountered in Roman lore, in the legend of Quintus Curtius: a plow and yoke (“whereby the fruits of the earth are made available to our friends”), a spear and arrow (“for our enemies”), and a cup (“to hold the wine we offer the gods”). Strutynski describes similar motifs involving three objects or three sets of objects, sometimes including cups or goblets, in Germanic lore. Littleton (1982) noted that “the cup . . . associated as it is with the preparation and consumption by priests of sacred beverages—an I-E pattern that has long been recognized [Dumézil is cited]—of which mead, *madhu*, *soma*, and *haoma* are examples, serves as a symbolic expression of the first function [power of rulers and priests] in a number of ancient I-E traditions, as well as in modern European folklore.” Drinking horns (see below) were also “symbols of sovereignty” and are sometimes described in the context of multiples of three (Arnold, 1999).

Also “tripartite” was the Indo-European motif of death by drowning in vat of beer or mead (Lacy, 1980). Following the lead of Dumézil, some of his followers have described a number of tri-partite motifs in Indo-European myths and legends. One such is the threefold death pattern, in which three deaths occur, each by a different means, or in which a single death occurs by three means simultaneously. In either of these instances, one such type of death is drowning in a large container of alcoholic beverage. Various versions include the death of Swedish kings, Hundingus (falling into ale), and Fjölnir (perishing in a vat of mead), Odin’s son Veraldur (death by “brewing vat” in a Faroese ballad), Irish King Diarmaid (drowning in a beer vat), and others (Evans, 1979). Tradition also has it that the Duke of Clarence, after being “attainted in Parliament of high treason” in 1478, was executed by being “drowned in a butt of malmsey wine—at the Tower of London” (Encyclopedia Britannica Online). Drowning in vat of beer is classified by folklorists under Thompson’s tale type 943A (Evans, 1979). “Drowning in beer” is common expression in modern English (ca. 2,500 hits in Google), including a generous portion of macabre jokes.⁵

Indo-European deities and mythical figures connected to drinking and fermentation

There are several deities from cultures with IE languages and who are intimately connected with production or consumption of alcoholic beverages and/or ritual drinking. The most famous is certainly the Greek god Dionysius, who was virtually synonymous with wine, but who may have evolved from a beer deity (Graves, 1960, concurring with Harrison, 1922). Scandinavian minor deities were Byggvir, identified with barley, and Beyla,

linked with the bee. These gods were representative of beer and mead, respectively (Dumézil, 1973b; Evans, 1976). Dumézil (1973b) provided an extended analysis of how Byggvir (representative of barley as it is transformed into beer) and Beyla (identified with the bee as the precursor to honey and mead) are amongst the gods, major and minor, targeted by Loki’s malicious sense of humor. Loki’s mocking them for the troubles caused by intoxication with beer and mead provides clues for their identity, but Dumézil noted alternative opinions from other authors.

Dugan (2008) summarized aspects of some other legendary figures from Indo-European cultures, personages who were strongly tied to fermented beverages. These include the Celtic Braciaca and Goibniu, the Flemish Gambricus, and the Norse Odin and Aegir. Gambricus was said to have invented hopped beer, and Goibniu hosted an underworld feast in which his beer bestowed immortality. Odin, of course, had his beer hall in Valhalla. The legendary Sigurd in the Volsung sagas was given drugged mead to induce forgetfulness, as Telemachus was given drugged wine by Helen to induce the same. One Kvasir (of the same root as *kvas*) was a legendary personage of enormous wisdom, created by the gods and murdered by dwarfs, who converted him into one of the ingredients of the primordial mead. Dumézil (1973b) compares the Nordic myth of Kvasir, and his demise, to that of the created monster Mada (“Drunkenness”), who is cut into portions, all of which intoxicate in different ways: drink, women, gambling, and hunting. Another clue linking western European and central Asian myths as possessing a common IE heritage is revealed in “the possible Celtic-Indic cognate **medhwih_a-*, ‘intoxicator’ (OIr Medb, the queen of Connacht, Skt Mādhavi, a daughter of Yayāti), which is employed as the name of a deity,” (Mallory and Adams, 2006). Rosen (1987) in reference to his own observations and those of others, noted “striking formulaic and thematic correspondences” between “Homeric passages and references in the *Rig-Veda* to the ritual drinking of Soma.”

The Greeks were acquainted with the beer gods Bromios, Sabazios and Braitēs (Harrison, 1922). It was fermented cereals that “gave to the Thracian Dionysos his names Bromios, Braitēs, Sabazios, but they never seem to have found a real home in Greece . . . they are always named as barbarian curiosities.” “To the [Greek] wine-drinker, the beer-drinker seemed a low fellow. . . . Sabazios, god of the cheap cereal drink, brings sleep rather than inspiration.” The fermented cereals were “never like mead even in primitive times the national drink of Hellas,” (Harrison, 1922). But Bromios had other attributes. He was born at Thebes as “the thunder child Bromios;” Dionysius was also associated with thunder and lightning and the deities appear interchangeable in the *Bacchae* (Harrison, 1927).

The Greeks also knew the Thriae, prophetesses who fed on honey and performed soothsaying whilst intoxicated (according to Harrison (1922), who termed them “honey-priestesses”). There were several Bee-goddesses and Bee-priestesses whose exact relation to each other and

5. The tripartite motif may be persistent even here: Pat came to tell Mrs. O’Flaherty about her husband’s untimely drowning in a vat of beer at the brewery. “Oh the poor man” she sobbed, “Please tell me, did he suffer much?” “I don’t think so madam; he climbed out three times to piss” (from Google, 6 Oct 2008, www.lawrence.com).

to mead is a matter of some controversy (Harrison, 1922; Scheinberg, 1979). Ott (1998) documented varied instances in which “toxic” honey, produced from psychoactive plants, is plausibly linked to “bee-oracles,” shamanistic rites, etc., and stated that “Pliny noted *meli mānomenon* [‘mad honey’] was made into mead.” Other intoxicating drinks were deployed in prophetic ritual, e.g., in the parallels between the use of soma in Vedic lore, mead in Norse lore (“a prophetess’ source of inspiration”), intoxicating beverages as used by Greek soothsayers, and the Welsh goddess Gorgyrwen or Ceridwen, whose cauldron generates “drops of inspiration” that bestow knowledge on persons tasting them (Scheinberg, 1979).

The myth involving Kvasir, above, is a portion of a larger Norse story about wisdom, poetry and mead. This mead, capable of rendering whoever drinks it a scholar or a poet, is hidden by giants, but stolen by Odin in the form of an eagle. Mitchell (2001) recapitulates the myth, reproduces the figure of the Odin-eagle from the Gotlandic Lārbo stone [try “eagle Odin mead” on Google Images, and cf. Figs. 11 and 12]. He places the myth in the context of additional Indo-European and other mythologies, including other instances from Norse legends in which mead confers poetic ability or wisdom. The myth of “the eagle’s theft of Soma in Rgveda 1,93,6 . . . has a close parallel in the Greek myth of the nectar-bringing eagle of Zeus and in the Nordic myth of Odin, who in the shape of an eagle carried off the mead – which corresponds with the honey-beer originally connected with the Aśvin cult rather than with Indra’s drink Soma,” (Parpola, 2004–2005).

Although Dionysius was associated with wine and drinking in Greek custom, it has been stated that the Greeks themselves were relatively restrained in the degree to which they imbibed. “The Greeks were not as a nation drunkards” (Harrison, 1922). The restraint of Greeks is contrasted with the lack thereof by Thracians, Celts, Persians and others. However, Harrison points to myths in which Dionysius himself becomes drunk, “a brutal though still splendid savage.” The satyrs, centaurs and Maenads can behave similarly. Nonetheless, the proper use of wine in classical Greek culture is held as inspirational and sacramental.

Ritual drinking

Ritual drinking was not just a component of Indo-European society. It was widespread throughout ancient societies, but recognizable by special forms in Indo-European cultures. Various investigators have shown interest in tracing the origins and evolution of drinking paraphernalia and customs.

Drinking cups of various sorts are often documented in an archaeological context, for example the “loop-handled drinking cups and tankards called ‘Scheibenhenkel,’ a new style of containers and servers [in the Danube valley] . . . interpreted . . . as the first clear indication of a new custom of drinking alcoholic beverages,” (Anthony, 2007, citing sources). The two-handled tankards illustrated in Anthony’s figure 11.12 are from ca. 3900–3600 BC. A few

hundred years later, the Corded Ware horizon (“northern Europe, from Ukraine to Belgium, after 3000 BCE”) and Trichterbecker (TRB, Poland, ca. 3500–3350 BCE) pottery styles, were interpreted as associated with “the spread of a drinking culture” (Anthony, 2007). Mallory and Adams (2006) noted, “If Corded Ware societies . . . evolved from local, late TRB origins, as many believe, they might have already spoken an Indo-European language. The proliferation of drinking cups . . . seen in central and eastern Europe about 3500 BC has been associated with the spread of alcoholic beverages and, possibly, special drinking cults.” Anthony (2007) adds, somewhat colorfully but citing sources, “Between 2700 and 2600 BCE Corded Ware and late Yamnaya [early nomadic, steppe culture, putatively Indo-European] herders met each other on the upper Dniester over cups of mead and beer.” The allied and widely distributed Bell Beaker horizon, approximately sequential to Corded Ware, also provides evidence of the drinking culture: “the inevitable drinking-cup [that] symbolizes beer as one source of . . . influence, as vodka flask or a gin bottle would disclose an instrument of European domination in Siberia and Africa respectively,” (Childe, 1957, on the Bell Beaker cups). Drinking cups of the Bell Beaker type have been intensively studied and cataloged for decades (Fig. 4). “The Beaker ‘culture’ has often been associated with the Indo-Europeans since there are good reasons to derive it from the area of the earlier Corded Ware culture . . . which is frequently regarded as early Indo-European For those who argue for movement of people, the Beaker culture represents the earliest evidence for Indo-Europeans (or more specifically Celts) in the British Isles” (Mallory and Adams, 1997). Analysis of some Beaker cups strongly suggests that they were used to consume mead (Mallory and Adams, 1997, 2006).

Even within the camp that regards Beaker culture as Indo-European, alternative perspectives derive Beakers from either western Europe (e.g., Netherlands/Rhineland) or eastern/central European interactions with steppe peoples (Mallory and Adams, 1997). Note that Herm (1976) regards Beaker peoples in France as “obviously able to repel” invading Indo-Europeans originating from the steppes. A recent review of Bell Beakers by Linden (2006) gave great credence to the idea that elements of the Bell Beaker culture were highly mobile, but avoided reference to invading Indo-Europeans or Celts. The idea that Bell Beaker drinking cups always imply alcohol and a male-dominated elite, invading or otherwise, has not always been accepted, at least not without modification (e.g., Brodie, 1997). Other “cultures” have been associated with drinking rituals and Indo-Europeans, e.g., the Baden culture (3600–2800 BC) of central Europe; drinking paraphernalia include drinking cups shaped like miniature wheeled carts (Mallory and Adams, 1997). See also Sherratt (2002) for “drinking and driving” (“wagon shaped cups”) as a metaphor for elite elements (wheeled transport, access to alcohol) in the Baden culture.

In a later epoch (early second millennium Europe), drinking persisted as an important cultural trait, espe-



Figure 4. Bell Beaker drinking cups, UK. From Abercromby (1904).

cially when combined with new military technology: "The appearance of warrior aristocracies represent . . . a new chiefly elite culture . . . centered around values and rituals of heroic warfare, power, and honor and . . . a set of new ceremonies and practices [which] included ritualized drinking," (Kristiansen, 2001). Kristiansen goes on to mention cups "with relics of mead" in burials from Scandinavia, men seated on stools and drinking mead, drinking sets in bronze and gold, etc. At roughly the same time, this phenomenon appears to have been present in IE speaking peoples of Anatolia and possibly the Levant: "Second millennium assemblages such as Old Imperial Hittite have a wide variety of elaborate jars, jugs, chalices, and cups . . . The early Iron Age Philistine assemblage is made up almost exclusively of vessels related to drinking" (Joffe, 1998). Woudhuizen (2006) claimed to have located examples of Indo-European (pre-Greek) in the language of the Philistines, largely in the context of his identification of the Philistines with the Pelasgians.



Figure 5. The Vaphio Cups, of gold, from a grave in Laconia, Greece. Found in a Mycenaean grave, but probably of Minoan origin. From Richter (1917).

Many examples of drinking ware exist from the Aegean, west or central Asia or Europe, especially from the late Bronze Age into classical antiquity. Mycenaean drinking ware was influenced by styles from Minoan Crete (Fig. 5). Styles produced in Mycenae itself in turn influenced styles for drinking ware in Europe, e.g., the Rillaton Cup (Fig. 6). The rhyton, exemplified by an elegant Achaemenid rhyton, was another popular form (Fig. 7). Flagons (Fig. 8) became popular with Celtic elites. Some drinking paraphernalia were very elaborate as discussed below.

Ritual drinking ware, although possessing roots in relatively primitive ceramics or other wares, attained the



Figure 6. The Rillaton Gold Cup, from a barrow in Cornwall. From Evans (1881).

status of fine art even in antiquity: A "well-known piece of Scythian art, the gilded silver amphora from the kurgan of Chertomlyk on the Dniپر River in southern Russia" was held by Soviet scholars to display iconography that "quite literally illustrates Indo-Iranian myths, epics, rituals and religious beliefs described in Herodotus, in the Rig-Veda, and other such sources" (Farkas, 1977). Farkas finds it difficult to either prove or disprove this perspective, but notes "scholars have suggested that the vessel was intended for a drink with a scum or dregs, like *kumys* (or *koumiss*), the Scythian beverage of fermented mare's milk. In view of the decoration of the central spout—the head of a winged horse—this explanation is very fitting" (Farkas, 1977).

Products based on animal or even human body parts were also used to make drinking paraphernalia: Of drinking ware of the northern barbarians at the time of the classical Greeks, Harrison (1922) wrote, "Large drinking cups were a northern barbarian characteristic; they were made originally of the huge horns of . . . cattle . . . , set in silver and gold, and later sometimes actually made of precious metals and called *rhyta*." Both the Celts and the Scythians



Figure 7. An Achaemenid rhyton with the head and forelimbs of an ibex. Rhytons were often made in the shapes of heads of lions, bulls, goats, horses, etc. Musée du Louvre. Photograph by Jastrow, Wikipedia Commons.

of this time occasionally drank beverages from cups made from the skulls of their enemies; sometimes these macabre souvenirs were ornamented with gold (Freeman, 2002). Human skulls may have been too macabre (or perhaps just too expensive) for routine use, but drinking horns enjoyed long popularity (Figs. 9, 10). "It seems that to be offered alcohol in a horn was a mark of special status," (Hagen, 2006, with regard to English and Welsh ceremonies). Drinking horns also endured in myth and folklore, e.g., the Valkyries filled drinking horns for gods and warriors in Odin's hall (Figs. 11, 12), or in the experiences of mortals with drinking horns (or goblets) of elves and fairies in Celtic lore (Kelly, 1969, reprint of 1863). Life imitated myth, as when mortal (but high status) women cupbearers offered goblets, cups or horns of drink to guests at medieval banquets, e.g. in *Beowulf* and other sources (Hagen, 2006). One Irish tale has St. Patrick himself inquiring of the ancient Fenians, "Were there drinking horns, or goblets of crystal and gold?" The answer, of course, is affirmative, with the great Finn possessing 300 gold horns (Arnold, 1999). Replicas of ancient drinking horns, in a wide diversity of Teutonic or Celtic styles, are readily available today [try "drinking horn" on Google Shopping].

Regardless of how drinking paraphernalia were manufactured, their use with copious amounts of alcohol was



Figure 8. The Waldelgesheim Flagon, Germany, La Tène culture, ca. 380 BC. From Read (1905).

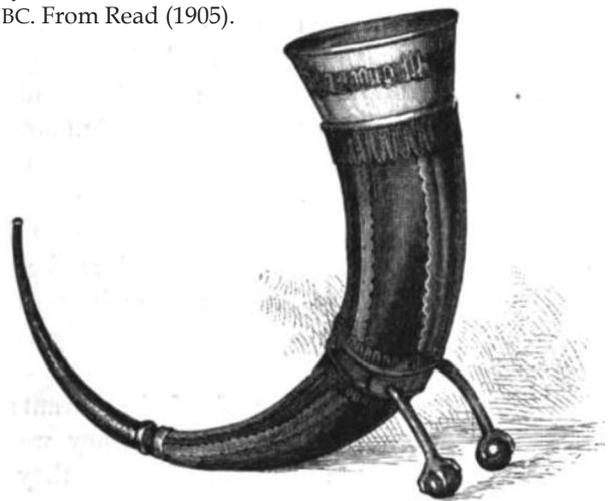


Figure 9. A Scandinavian drinking horn, "from the heathen times" (Du Chaillu, 1881).



Figure 10. Drinking scene from the Bayeux Tapestry (Norman), showing the use of drinking horns. From Du Chaillu (1890).

essential for maintaining political and social allegiances. "Attraction and reward of armed followers through warrior feasting became central features of 'this fundamentally new social fabric,'" (Joffe, 1998, citing Sherratt who terms alcohol a "social lubricant"). "Before the spread of hybrid grapes with high sugar content, the beverage of choice in Europe was mead (beer being a later development)" (Joffe, 1998). Analogous processes probably operated in Indo-Iranian societies with the use of soma. "Of all the [Vedic] gods, the Aśvins are most closely connected with honey (madhu), with which they are mentioned in many passages. . . . They are said to be . . . drinkers of it (madhupā). . . . All vājapeya charioteers [participants in chariot races in the Vedas] receive an abundance of alcoholic *surā*, a drink also associated with the Aśvins," (Parpola, 2004–2005).

Runes may provide some evidence for early ritual drinking in Scandinavia, especially the controversial *alu* texts. "The literal meaning of the word *alu* is ale, but its meaning or function in runic texts . . . is enigmatic. The interpretations run from 'magic' via 'ecstasy' to 'intoxicating drink,'" (Looijenga, 2003). Also suggested has been a meaning linked with "affected by sorcery" (Looijenga, 2003, citing Polomé, 1996). Other possible referents for runic "*alu*" include drinking vessels such as placed in graves ("grave-beer"). "On the whole, [runic] *alu* may be taken as a word indicating a connection with some type of cult or ritual, in which the use of ale may have played a central role," (Looijenga, 2003).

Hagen (2006) and Pollington (2003) extensively reviewed drinking in the "mead-hall" culture of Anglo-Saxon England. For broader perspective, Dugan (2008) gave concise summaries of literature regarding ritual drinking vessels (Mesopotamian, Phrygian, Mycenaean, Scythian, Anglo-Saxon and Celtic) and the use of intoxicating beverages to reinforce relationships of sharing and power in the Mediterranean, western Asia and Europe. Dietler (2006) provided additional sources on use of fermented beverages by PIE- or IE-speaking peoples in a broad review of anthropological and archaeological literature on alcohol.

Some vestiges of Indo-European (more specifically, Teutonic) rituals are plausibly present in modern holidays. Drinking of seasonal ales in contemporary Christmas festivities is historically linked to pagan Viking ritual drinking and other putatively pagan Teutonic rites, such as burning of the Yule log (Burne and Jackson, 1886; Forbes, 2007; Hardwick, 1872; Hutton, 2001).⁶ With less plausible authenticity, mead and other fermented beverages are imaginatively used by Wiccan or other contemporary Neopagan groups in putatively ancient, Indo-Eu-

6. Specially brewed beer can also be associated with seasonal occasions in other traditions. In Russia, "on St. Nikoli Zimmij's Day (St. Nikolas' Day) it was habitual to prepare a feast with beer, specially made for that day" (Golema, 2007). St. Nikolas's Day is December 19 in the Julian calendar, and of course St. Nikolas has become associated with Santa Claus and Christmas, but Golema's focus is on connections with pre-Christian Slavic cults and lore.

ropean rituals, as any quick Google search will attest. In fairness, some Neopagans admit that these rituals have been invented or re-invented, e.g.: "Is there any evidence that any ancient peoples did the same rituals . . . ? . . . the answer would have to be no" (www.adf.org/rituals).

Domestication of Microbial Fermentative Agents, and Isolates in Modern Culture Collections

We have little direct evidence about the fermentative microorganisms deployed in ancient technologies. Cavalieri et al. (2003) obtained sequences of ribosomal DNA indicative of *S. cerevisiae* from Egyptian wine jars of ca. 3150 BC, and earlier Kislev (1982) cited reports of yeast cells in remnants of Egyptian beer and wine. Debates regarding domestication of *S. cerevisiae* are summarized in Fay and Benavides (2005), who concluded that domestic strains are less diverse than, and derived from, wild strains. Mortimer (2000) discussed models of evolution in domesticated *S. cerevisiae* (selection, hybridization, genome renewal). Woolfit and Wolfe (2005) stressed the importance of a specific gene duplication for conferring ethanol tolerance,



Figure 11. A silver figurine of a Valkyrie holding a drinking horn, from Hildebrand (1903). The figurine is presently in the Swedish Museum of National Antiquities, Stockholm.



Figure 12. The Tjängvide stone, from Hildebrand (1903). A Valkyrie with two drinking horns greets a mounted Odin (or, perhaps a warrior) on the upper portion of the stone, presently in the Swedish Museum of National Antiquities. Note that Odin holds a cup, perhaps of mead.

which apparently evolved long ago with the appearance of fleshy fruits in the Cretaceous.

We presently have little way of knowing, other than intelligent guesses, whether or not the microorganisms used for contemporary production or isolated from contemporary beverages are the same as those in the beverages of our distant ancestors. However, living isolates exist as stored germplasm in a number of contemporary catalogued culture collections. Some examples are presented in Table 1. Moreover, there are many websites that promote or discuss the virtues or detractions of a given yeast for production of mead (e.g., avoid baker's yeast,

use a beer or wine yeast such as Lalvin EC-1118, Lalvin D-47, Red Star Cotes de Blanc, Red Star Montrachet, or Viekra Mead Yeast, etc.), and kvass (either baker's yeast or brewing yeast is acceptable). Corresponding on-line recommendations for yeast for koumiss are noticeably scarcer.

It is obvious that wine and beer production constitute active commercial activities, and to a lesser extent the same can also be said for production of kvass, mead, and koumiss. These latter beverages and the organisms responsible for their fermentation are not just historical, but part of a living heritage. Kvass, mead, and koumiss

Table 1. Examples of yeast and bacteria available in culture collections and originating from kvass, mead, or koumiss, or used in production of those beverages.

Yeast isolated from kvass:

ATCC 11428	<i>Saccharomyces</i> sp. ("kvass yeast")
CBS 797	<i>Lachancea fermentati</i> (H. Naganishi) Kurtzman (type of <i>Debaryomyces mandshuricus</i> H. Naganishi) (kvass, Manchurian rye beer)
IFO 0021	<i>Zygosaccharomyces fermentati</i> Naganishi (syns., <i>Lachancea fermentati</i> (Naganishi) Kurtzman, <i>Debaryomyces mandshuricus</i> , <i>Saccharomyces amurcae</i> Van der Walt, <i>S. montanus</i> Phaff, M.W. Mill. & Shifrine) from Manchurian kvass. IFO strains are now available from NITE Biological Resource Center.

Yeast isolates recommended for mead production:

ATCC 200168	<i>Saccharomyces cerevisiae</i> (for dry mead)
ATCC 200169	<i>Saccharomyces cerevisiae</i> (for sweet mead)
ATCC 58744	<i>Saccharomyces cerevisiae</i> (ferments mead, catalog provides literature)
ATCC 60348	<i>Zygosaccharomyces bisporus</i> Naganishi, teleomorph deposited as <i>Saccharomyces bisporus</i> (Naganishi) Lodder et Kreger-van Rij (ferments mead, catalog provides literature)
NCYC 356, 357, 358	<i>Saccharomyces cerevisiae</i> (357 & 358 originally isolated from mead and plum mead, respectively)

Yeast isolated from koumiss:

CBS 1518	<i>Kluyveromyces marxianus</i> (E.C. Hansen) Van der Walt var. <i>marxianus</i> (from Estonia)
CBS 1328	<i>Pichia membranifaciens</i> (E.C. Hansen) E.C. Hansen var. <i>membranifaciens</i> (from Russia) (probably a spoilage yeast, see Sponholz, 1993)
BIM Y-189	<i>Kluyveromyces lactis</i> (Dombrowski) van der Walt var. <i>lactis</i> (from Armenia) (syn. <i>Kluyveromyces marxianus</i> var. <i>lactis</i>)

Bacteria isolated from koumiss:

CCM 7061, 7062, 7064, 7066, 7067, 7070, 7071	<i>Lactobacillus helveticus</i> (Orla-Jensen) Bergey et al. (from Mongolia)
CCM 7063	<i>Lactobacillus paracasei</i> subsp. <i>paracasei</i> Collins et al. (from Mongolia)
CCM 7065	<i>Lactobacillus paracasei</i> subsp. <i>paracasei</i> (from Mongolia)
CNRZ 414	<i>Lactobacillus helveticus</i> (milk cow koumiss, from Russia)

Yeast used for experimental beverage production:

ATCC 56498	<i>Kluyveromyces lactis</i> for starter culture for koumiss (Kücükçetin et al., 2003).
ATCC 74012	<i>Saccharomyces boulardii</i> Seguela, Bastide & Massot for growth and survival in ultra high temperature treated milk (Lourens-Hattingh and Viljoen, 2001)

ATCC = American Type Culture Collection (USA)

BIM = Institute of Microbiology of National Academy of Sciences of Belarus

CBS = Centraalbureau voor Schimmelcultures (Netherlands)

CCM = Czech Collection of Microorganisms

CNRZ = Centre Nationale de Recherche Zootechnique (France)

IFO = Institute for Fermentation (Japan); NCYC = National Collection of Yeast Cultures (UK)



Figure 13. An example of contemporary, commercial kvass. Photo by Wesha, Wikipedia Commons. Figure 14. An example of contemporary, commercial mead. Anon. photographer, Wikipedia Commons. Figure 15. An example of contemporary, commercial koumiss. Photo by E. Schluessel, Wikipedia Commons.

are produced today (Figs. 13, 14, 15), and some examples have already been cited above under the respective sections for those beverages. Kvass and koumiss are seldom produced for western European or American markets, but are often encountered in both traditional and larger-scale, commercial production in eastern Europe and central Asia (Bennett and Feibelman, 2001; Kurmann et al., 1992; Mack and Surina, 2005; Mistry, 2006). Recent trends in commercially fermented milks, including koumiss, and the role of probiotic microorganisms have been reviewed (Khurana and Kanawjia, 2007).

Modern beverage production technology for kvass or koumiss incorporates yeasts with probiotic lactobacilli (Danova et al., 2005; Dlusskaya et al., 2008; Shortt, 1999). Species of yeast found in these beverages are targeted for investigation of probiotic applications, e.g., Kumura et al. (2004) on various species, including *Kluyveromyces*. The species of *Lactobacillus* most noteworthy have been mentioned above in the section on koumiss. Mistry (2006) notes that "manufacture of koumiss requires controlled lactic acid using *Lactobacillus delbrueckii* subsp. *bulgaricus* and alcohol fermentation using yeasts." Further, "heavy draft horse breeds are used for koumiss production in Russia and they yield 10 to 20 liters of milk per day" and there are "concerted efforts" to increase production via "horse breeding and management techniques" (Mistry, 2006). Although there are efforts to increase production of mare's milk, there are also procedures to develop koumiss from cow's milk (Mistry, 2006). Wszolek et al. (2006) give

short synopses of traditional and industrialized production methods for koumiss, and note that koumiss-like fermented milks are commercially produced in Japan (Calpis™), Korea (kefir/koumiss "hybrids"), Iceland (*skyr*), and some others. Although interest in kvass and koumiss is limited in the United States, search of the United States Patent Office website (www.uspto.gov) with "kvass," "koumiss," or "kumiss" recovered over a dozen patents, ranging from 1909 to 2008. It should be noted in passing that koumiss is often discussed in association with the allied product kefir, a kind of fermented yoghurt (e.g., Wszolek et al., 2006).

Mead is still produced throughout Europe, North America, and elsewhere. Production processes have been documented in detail (see Caillas, 1972; Lear, 1997; and Løstang, 1997). There are various recipes for mead on the Internet, with some quite specific about the strains of *Saccharomyces* to be employed. A search with Google Products quickly recovers Lurgashall English Mead (Lurgashall Winery, West Sussex, England), Bunratty Mead (Bunratty Winery, County Clare, Ireland), Rabbit's Foot Dry Mead (Rabbit's Foot Meadery, Sunnyvale, California), Trapper Creek Mead (Trapper Creek Winery, Hamilton Montana), and several more, featuring traditional, spiced, or fruit meads. Within 15 minutes' drive of my office, Honey Mead is produced (Camas Prairie Winery, Moscow, Idaho). A search of titles and abstracts with "mead" at the U.S. Patent Office website above recovered U.S. Patent #3,598,706 ("Method of making wine from honey") from 1971. The yeast used was specified only as "yeast strain 618 (Professor Rahn collection)," but that strain is denoted as *S. cerevisiae* in Acree et al. (1972).

Interest in probiotic microorganisms often focuses on those species associated with the beverages of interest here. Phenotypic and molecular variation has been docu-

mented for isolates of *L. helveticus* from koumiss (Sedláček et al., 2005). Fonseca et al. (2008) comprehensively review the biotechnological potential of *Kluyveromyces marxianus*, and specify dozens of strains from ATCC, CBS, NCYC, NRRL (Northern Regional Research Laboratory, now National Center for Agricultural Utilization Research), and other collections (see Table 1 for abbreviations and host countries of culture collections). In the United States, ATCC and NRRL have collections of yeast encompassing tens of thousands of strains, and outside North America BCCM (Belgian Coordinated Collection of Microorganisms), CBS, IFO, NCYC, and several others have similarly large holdings. Although lacking an on-line catalog, the Key Laboratory of Dairy Biotechnology and Engineering at Inner Mongolia Agricultural University maintains a collection of yeasts from fermented milk products; representative strains from koumiss are well-characterized by physiology, morphology and 16S rRNA sequences (Wang et al., 2008).

Discussion

Fermented beverages have had conspicuous and often enduring impacts on the cultures of Europe, the steppes and Indo-Iranian Asia. Cognates for fermented beverages are conspicuously present in IE and PIE, but cognates denoting certain beverages are distributed asymmetrically throughout the range of IE languages. Consensus is sometimes lacking regarding specific cognates, most especially those for “wine” in PIE, but the more recent opinions indicate considerable antiquity for both the cognates of “wine” and wine production. Linguistic and archaeological evidence for beverages is significant of itself, as are the roles of these beverages in myth and legend. But can anything of further significance be deduced from the combined evidence?

Regarding the time depth for PIE, i.e. the dates when it was actually spoken, Mallory and Adams (2006) assess several methodologies, including determination of which roots, plural forms, etc., may have preceded others; shifts in meaning for a given word or root; geographic distribution of certain words; external borrowing of words from other languages; and glottochronology, i.e., estimating time depth from rates of change. They also assess informed estimation (intuitively informed estimates from experts) and methods involving reference to archaeological artifacts. None of the methods, at least in isolation, is regarded as satisfactory. They very cautiously exhibit a more favorable opinion of “lexico-cultural dating” – attempts to tie archaeological evidence, e.g., for first wheeled transport, to cognates obviously pertaining to that evidence, e.g., cognates for wagon yoke or wagon wheel, etc. Caution is similarly essential when drawing inferences about the location of a PIE homeland. Various theories, based on river names, distribution of putative cognates for trees (especially “beech”), fish (especially “salmon”), etc., have come and gone (Mallory and Adams, 2006) and we should extend this caution to any inferences based on our knowledge of beverages.

Linguistic and archaeological evidence for fermented

beverages are sufficiently abundant to be informational in the context of lexico-cultural dating. However, the resolution of that information is insufficient for rendering conclusive decisions regarding either time depth for PIE or the geographic location of a putative Indo-European homeland. The earliest beverages may have been kvass- or mead-like. “Kvass”-like and “medhu”-like cognates are present in PIE, and distributed throughout the entire range of IE languages. Cognates for “kvas,” “beer,” and “mead” long endured in European IE, and archaeological data (several types of ceramic drinking ware, e.g., Bell Beaker artifacts, etc.) are well documented throughout Europe and the Near East. Koumiss is represented by “sura”- or “hura”-like cognates in PIE and Indo-Iranian, and archaeological evidence (drinking ware) is present from the eastern range of IE. More speculatively, we have seen that some authorities link *kvass* with Sumerian KAŠ and posit an IE Euphratic language, making contributions to Sumerian (Whittaker, 2000). Although the subject of Euphratic has roused the skepticism of some (perhaps most) linguists, such a language in Mesopotamia prior to the Sumerians would give weight to any hypotheses positing a very early PIE presence in Anatolia or the Caucasus. At any rate, the production of fermented beverages from cereals may antedate the Sumerians, since they appear to have borrowed their vocabulary for brewing. For wine, “woino”-like cognates and early archaeological evidence are present over the western portion of the IE range. An origin in the Caucasus for the earliest wine production has archaeological support, although acceptance of the evidence is not universal. Some linguists derive a PIE pedigree for “wine”: **wóinom* (Mallory and Adams, 2006), although general use of cognates for “wine” and the spread of wine as a trade commodity throughout west Asia and the Aegean came later, and spread to central Asia much later.

If the Anatolian camp (positing a dispersal of PIE-speaking peoples at ca. 6000 BC) is correct, the absence of “wine” and archaeological evidence for grape wine from eastern IE languages could logically follow. Alternatively, if dispersal of PIE-speaking peoples occurred via the steppes about 3500 BC, lack of relevant cognates and archaeological evidence might only imply the relative absence of suitable conditions or lifestyles (pastoral vs. agricultural) for grape cultivation in most of the steppes. The absence of koumiss (both the cognate, either Turkish or IE, and archaeological evidence) from the western, non-steppe range of IE would simply reflect the absence of large horse herds, the prevalence of cow or goat dairy products in non-steppe Europe, and the comparative ease of obtaining ethanol from fermented plant products or honey.

Gray and Atkinson (2003) applied quantitative phylogenetic methods to a dataset of mostly modern Indo-European languages, and Atkinson et al. (2005), using an alternative dataset of ancient Indo-European languages, came to analogous conclusions: that deepest divergence between Anatolian languages (e.g., Luvian, Hittite) and

the remainder of Indo-European languages took place ca. 6000 BC, but that a secondary period of rapid divergence occurred between 4000–3000 BC. The first time frame supports the hypotheses of Renfrew (the Anatolian homeland), and the second supports hypotheses of Anthony, Mallory, Gimbutas etc. (a steppe homeland). Moreover, as Atkinson and colleagues have on several occasions noted, “the two theories of Indo-European origin [Anatolian vs. steppes] may not, in fact, be mutually exclusive” (Atkinson et al., 2005), a conclusion shared by others (Piazza and Cavalli-Sforza, 2006).

To persons not specializing in IE and PIE linguistics, it indeed sometimes seems as if the debates over a PIE homeland resemble the old fable about the blind men and the elephant—each person argues vigorously that the fundamental nature of the beast consists precisely of only that portion which the person has directly touched, since none of the persons sees an entire animal. The reconciliation of opposing theories suggested by Atkinson and colleagues is therefore refreshing, and implies recognition of multiple waves of expansion of persons speaking PIE or IE. There is evidence of such expansions from regions of Anatolia in the Neolithic; from various regions of the steppes in the Bronze Age; and in the late Bronze Age across portions of Asia and Europe from rapid conquests of chariot-equipped warrior elites. The spread of wine throughout west Asia and Mediterranean Europe may reflect early PIE expansions, but is absent from later expansions across the steppes of Eurasia. The views of Mallory and Adams (2006) on cognates for “wine,” combined with evidence for diffusion of wine technology from the Caucasus (McGovern, 2003) can be construed as support for Gamkrelidze and Ivanov (1990), that the Caucasus was a center of diffusion of PIE culture and language. It is interesting that the latter authors present a figure illustrating hypothetical migrations into southeastern Europe from both Anatolia and (more circuitously) the steppes.

Persons espousing an Anatolian origin, as well as those advocating a steppes origin for PIE, have recognized the “elite dominance” model, wherein the language and customs of the elite displaced to varying degrees the languages and customs of subject peoples, thereby contributing to the spread of IE language and custom (Anthony, 2007; Renfrew, 2000). As customs and language of the elites were assimilated, persons genotypically representative of the original PIE speakers probably comprised ever smaller components of populations in areas of IE language expansion. Such processes may eventually lead to instances in which genotype and language are demonstrably decoupled (e.g., Nasidze and Stoneking, 2001). But throughout these changes, beverage use (beer, mead, wine) remained a critical component of the Indo-European cultural package. Regardless of exact chronologies and diffusion pathways, fermented beverages were critical for ritualized drinking, a primary component of the “new package” characterizing the dominance of warrior elites in the late Bronze Age. Fermented milk, especially sweetened with honey, may have been analogously employed

in Indo-Iranian rituals. And drinking customs were probably a strong part of IE or PIE culture, even prior to the emergence of the “new package” of chariot-equipped warrior elites.

In the instance of fermented mare’s milk, the principle of elite dominance ultimately operated against the use of IE words for fermented mare’s milk. The original IE word (probably something related to PIE **súleh₂*- or AV *hurā*) was replaced by “koumiss,” a word from the Turkish language family and now used throughout the steppes (where the Turkish and Mongolian languages long eclipsed IE) and even in Eastern Europe. But IE-derived “soma” [OED: Skr. *sōma*, = Zend *haōma*, Pers. *hōm*; Indo-Iranian **sauma* (Woodard 2006)] also pertains to a milky, intoxicating beverage, probably with some connection to fermented mare’s milk.

It is quite impressive (either very sobering or pleasantly intoxicating, depending on state of mind and frame of reference) to contemplate how these alcoholic beverages, and the microbes responsible for their production, have altered ancient cultures, persisted through millennia of prehistory and history, and are still embedded in tradition and commercial exchange. More recently, they are the focus of concerted scientific explorations. Although no one is surprised at the commercial durability of beers and wines, many persons in western Europe and North America may soon be more aware of fermented milks (and their probiotic microbial agents). Even kvass seems headed for a renaissance, at least in eastern Europe and amongst ethnic communities in North America. And if you are unable to locate koumiss at your local food mart, you can still relax with a glass of mead while you contemplate buying the mare.

[The author thanks Douglas Adams, Michael Gregg, Justin Jennings, Cletus Kurtzman, and one anonymous reviewer for helpful commentary on the manuscript.]

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