The Buddhist monasteries of Dunhuang, beer and brewing ratios.

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Abstract:

The accounting records of Buddhist monasteries discovered in Dunhuang (China) reveal that beer was the main fermented beverage in this region in the 10th century. It was a daily drink, a drink used to barter work for payment in kind, a drink invested with cultural values and a drink offered at diplomatic receptions with dignitaries from neighbouring peoples.

The full accounts for the years 924 and 930 give details of the meticulous management of grain (millet, wheat, barley) and its transformation into beer in three different ways by the leaders of the Buddhist communities. They brew the beer they need, they barter grain for beer, or they buy beer from specialist lay brewers in the oasis-city of Dunhuang. Beer ferments are the technical key to brewing beer mainly with millet. This brewing method links Dunhuang and its region to the great brewing tradition of Asia, in this case that of China.

Detailed daily accounts reveal that each social category drinks a beer of varying density according to status, from political dignitaries at the top of the social scale, through workers and peasants, to servile people at the bottom. The overall picture that emerges is of a complex multicultural society in which Buddhist monastic institutions play a central economic role. As owners of vast agricultural estates, they redistribute grain, the country's main source of wealth, in the form of food and fermented beverages to their dependents.

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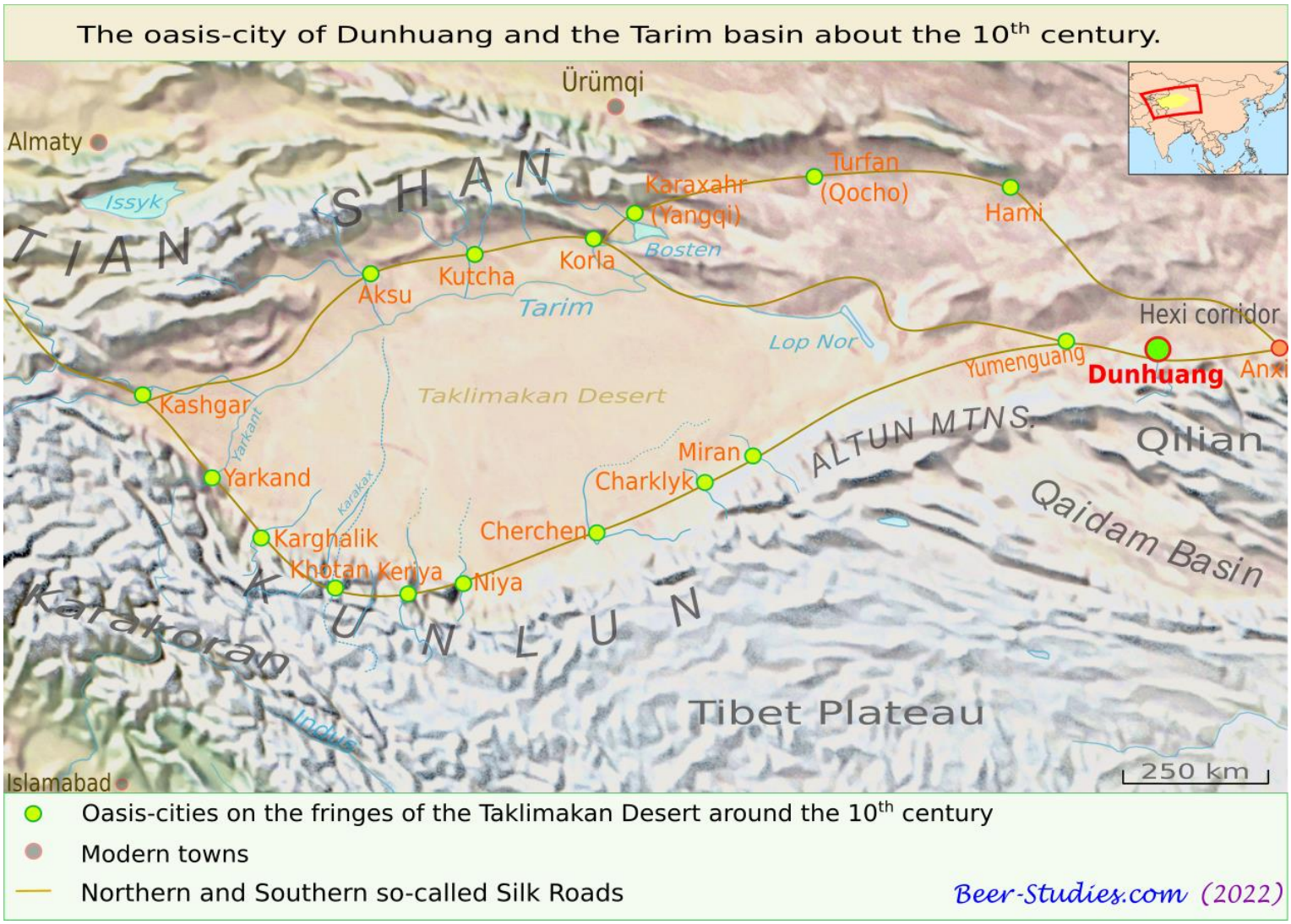

Map 1: the Tarim basin, the Takla-Makan desert and Dunhuang oasis-city location

In the 10th century, the Buddhist monks who ran their communities in Dunhuang, on the eastern edge of the Tarim basin, left us a legacy of voluminous archives hidden in one of the Mogdao caves. Some of these documents are annual or daily accounts recording the income or expenditure on grain, cloth or oil of the Buddhist monasteries in the region. Éric Trombert has studied them to build up a general picture of daily life in this 10th-century oasis town. His analysis highlights the central role played by beer in the lives of the monks, nuns and lay people who served the Buddhist communities. Dunhuang was part of a vast multicultural network of cities encircling the Takla-Makan desert, a buffer region between China to the east, the Tibetan world to the south, the Indian world to the west, and the Uyghur then Kyrgyz Khaganat to the north[1]. The Tarim basin is also a region where brewing traditions rub shoulders with the wine-making traditions of northern oasis cities such as Kutcha and Turfan (Map 1).

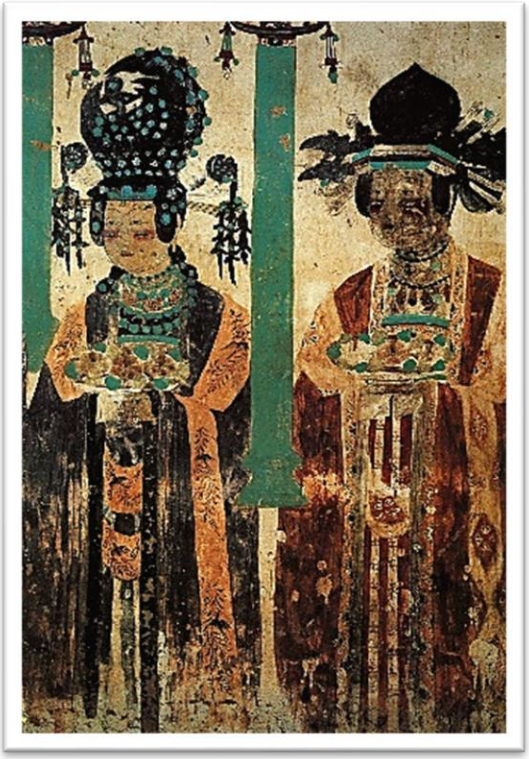

Figure 1: Khotanese female donors. Dunhuang, Mogdao cave 61, 10th century

Besides the great Buddhist celebrations that punctuate the year, during which beer flows freely, other less solemn occasions are accompanied by communal meals and distributions of beer drunk by monks, nuns, monastery dignitaries and their lay staff. Beer seems to be the only fermented beverage consumed in the Dunhuang region, as it is throughout China[2]. Incidentally, we learn that both men and women specialised in brewing and trading beer.

Buddhist discipline requires monks and nuns to abstain from fermented beverages. The Dunhuang archives present a divergent, and at first sight disturbing picture. The Buddhist faith is unquestioned, as evidenced by the number of caves used for prayer and meditation, and their decoration financed by wealthy donors. The permeability between the religious and secular worlds – the collective consumption of beer is just one of many signs – is part of a very flexible and persevering Buddhist policy and doctrine. Moreover, the multicultural society of the Dunhuang region lives mainly from agriculture and sheep breeding. The prosperity of the monasteries depends on this agricultural

1. Buddhism, Manichaeism, Zoroastrianism (Mazdeism) and many other religious syncretisms coexist more or less peacefully.

2. Vines have been cultivated since the 5th century in the western margins of the Tarim Basin, in Turfan and Kutcha, two Tokharian kingdoms (Trombert 2001 and 2002). It seems to have been cultivated under the Tang in Shanxi before disappearing.

backbone. The almost total fusion between the Buddhist and secular worlds explains why the Buddhist clergy are so permissive when it comes to beer[3].

The Dunhuang accounting archives shed light on a little-known aspect of the economic organisation of Buddhist communities in the western reaches of China during the Tang (618-907) and Song (960-1279) dynasties. These communities were major economic players, fully integrated into the regional multicultural society crossed by the Silk Road. The main economic resource is cereal growing (millet, wheat, barley). Beer is one of its material embodiments. It is at once a daily drink, a drink for bartering work for payment in kind, a drink charged with cultural values (sowing or harvest festivals) and a drink offered at diplomatic receptions with dignitaries from neighbouring peoples (Uyghurs, Tibetans, Tokharians, etc.).

Figure 2: Uyghur dignitary from Turfan assisted by his servants, painted on cave 409 at Mogao (11th-13th century)

3. For Buddhism, there are several degrees of perfection depending on the people involved in one of their existences. There are also different ways of living with non-Buddhists. Violent conversions are not part of their arsenal. But the highly hierarchical social structures, including the slave trade, encouraged more or less forced economic dependence on the Buddhist clergy. The economic history of Buddhism in China has been studied by J. Gernet (1956).

Figure 4: a row of cave sanctuaries at Mogao by Aurel Stein in 1907 (Serindia 1921, vol. 2, fig. 199)

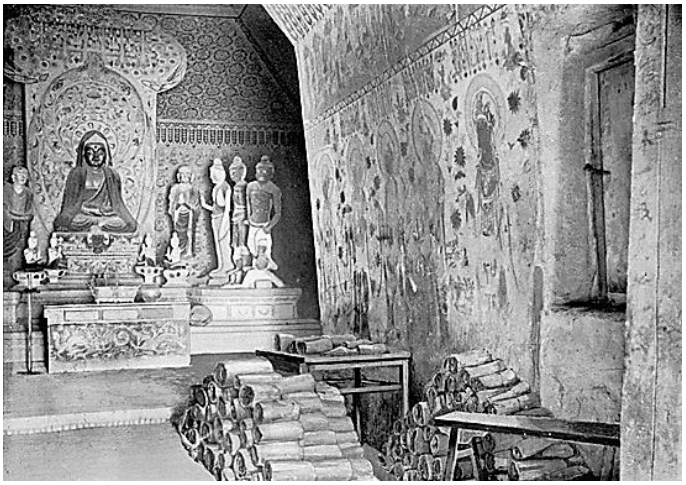

Figure 3: Aurel Stein and the walled-up chapel 16 with manuscripts stacked next to the entrance to grotto 17 at Mogao (Dunhuang) in 1907

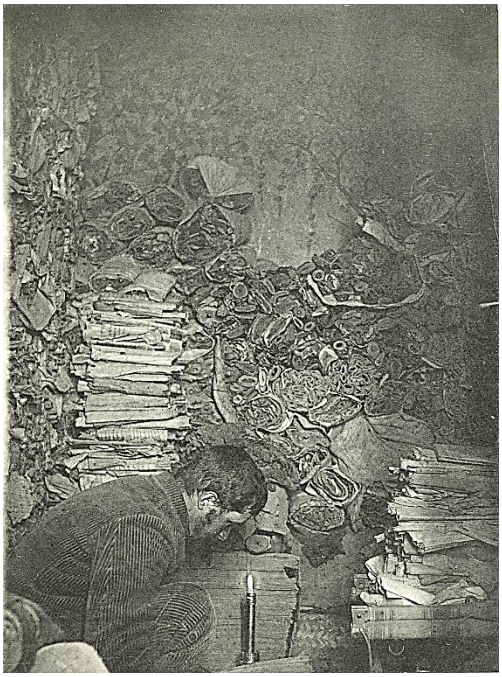

Figure 6: Paul Pelliot sorting manuscript scrolls inside the cave 17 in 1907 at Dunhuang

Figure 5: the Mogao caves at Dunhuang today

1. The annual accounts of Buddhist monasteries

The Dunhuang texts were discovered in cave 17 on the Mogdao site in 1900, by the Taoist monk Wang Yuanlu, who sold them in batches to Aurel Stein in 1907, Paul Pelliot in 1908, a Japanese expedition in 1911, a Russian expedition in 1914, and an American expedition in 1924. The economic documents, mainly monasteries' accounts, make up a tiny part of the Dunhuang treasure.

For the most part, these documents record the grain income and expenditure of around twenty Dunhuang monasteries. The documents preserved concern one of the main monasteries, the *Pure Land Monastery* (*Jingtu si*). The annual accounts, which are complete for the years 924 and 930, make it possible to assess both grain reserves and expenditure, and to ascertain the destination of this grain.

This dossier is astonishing for several reasons. It presents the annual accounts drawn up by long-established Buddhist communities in the Dunhuang oasis (Gansu province, north-west China). These accounts of grain, flour, oil, cloth and other products show that beer plays a central role in the management and daily life of these religious communities. The details of some of the accounts make it possible to calculate two brewing ratios (the volume of grain brewed per person). These ratios, which measure the density of the beer, vary according to people's social status.

These documents date from the 10th century, a troubled period between the Tang (618-917) and Song (960-1279) dynasties on China's western border. Dunhuang lies on the south-eastern edge of the great Tarim basin (Map 1). The region, which is crossed by the Silk Road, was the site of ongoing economic and cultural exchanges between sedentary Sinicized populations and nomadic or urbanized populations from Central Asia, Mongolia and the Tibetan plateau.

This dossier reveals other surprising facts. Buddhist texts, such as the *Vinaya Pitaka*, forbid fermented beverages for those who have found refuge in the Path of the Buddha. In the Buddhist communities of Dunhuang, where religious and lay people mingle, fermented beverages are widely consumed, including monks, nuns and senior religious leaders. They drink a beer (jiu) made mainly from millet, or barley and wheat, brewed using the Asian method of amylolytic ferments (*qu*).

There were plenty of opportunities to drink: collective work for the sanctuaries, religious and secular festivals, meetings of monks to close the monasteries' annual accounts, collective meals, payment in kind to those who worked for the nuns or monks, etc. The accounts hide nothing about the circumstances that justify the monasteries' expenditure on grain for brewing

beer or having beer brewed. We learn that brewers made a lucrative trade out of it. Local beer production is not confined to the Buddhist monasteries.

The original comments written by Buddhist accountants on the detailed or annual accounts give us an unprecedented insight into the daily life, social structures and customs of the communities of Dunhuang. These cereal farmers lived according to the rhythm of the agricultural seasons, drinking beer, their almost exclusive fermented beverage. The semi-nomadic pastoralists living in the surrounding regions - Uighurs, Mongols, Tibetans and Qarakhanides of Turkish origin - occasionally share the same pleasures with beer. This observation calls into question the boundary usually drawn between beer-drinking cereal farmers and fermented milk-drinking pastoralists in Central Asia. What applies to beer also applies to wine[4].

These data are of great significance for the history of beer, which often lacks concrete data. The Dunhuang accounts are full of practical information: brewing methods, treatment of beer ferments and spent grains, size of a beer jar, daily beer ration, social scale translated into volume of grain brewed per person, beer trade, relationship between beer and Buddhist festivals, etc.

Figure 7: ruins of a granary in the fortress of Hecang near the Yumen pass, 75km north-east of Dunhuang (Western Han, rebuilt during the Western Jin period around AD 280-316). Evident strategic role of grain

[4] Around 1000km west of Dunhuang, the vineyards and wines of Kutcha were renowned at that time. Kutcha is one of the oasis towns on the northern edge of the Tarim basin, capital of the Tokharian kingdom of Kutch. The Chinese monk Xuanzang, who left for India in summer 629 to study Buddhism, described it as follows: "The soil is good for red millet and wheat. It also produces gengtao rice, grapes, pomegranates and large quantities of pears, plums, peaches and almonds" (Stanislas 1857, p. 3).

2. The volume of grain converted into beer

In Dunhuang, most beer (酒, *jiu*)[5] is brewed from hulled millet (*mi*) from the two unhulled species (*men* and *su*)[6], followed by wheat and barley in the same category (*mai* = wheat/barley), wheat alone (*xiaomai*), barley alone (*qingmai* = naked barley, *damai* = unhusked barley), or a mixture of these three cereals (Trombert 1999, 178-179).

Two complete annual accounts are available for the years 924 and 930. Expenditure on grain used to brew beer represented 27.5% and 22.4% respectively of the total grain used for food purposes in these two years.

In 924, the monastery spent 122 piculs (73.2hl) of grain of various kinds (wheat, barley, millet, soya, hemp seed) and in various forms (whole grain, flour, bran, lumps). 27.1 piculs (16.5hl) are used to brew beer, i.e. 23% of the total. However, some of the 112 piculs were used to pay for services or to barter products for the monastery. In relation to the volume of grain used for purely food purposes, the proportion used for beer = 27.5%.

1 picul (*shi*)=10 *dou* (bushels) ≈ 60 litres
1 *dou* (bushel) = 10 *sheng* ≈ 6 litres
1 *sheng* ≈ 0.6 litre

Table 1: volume decimal units used for cereals, beer and liquids used in Dunhuang during the 10th century (Trombert 1996 n. 5)

Annual grain account of the Jingtu monastery for the year 924 (Trombert 1999, 133-135)		
Total expenditure:	73.2hl (122 piculs)	100%
For food	42.4hl (70.6 p.)	58%
For the beer	16.3hl (27.1 p.)	23% *
To barter fabrics	4.7hl (7.8 p.)	6%
Bran for vinegar and feeding animals	1.8hl (3 p.)	2%
Grain bartered for products or services	8.1hl (13.5 p.)	11% **
* or 27.5% of the « grain used for food » (27.1 + 70.6 = 97.7). ** some of these grains are used to buy beer (cf. **3**)		

Table 2: distribution of grain from the Jingtu monastery for the year 924 (p. for piculs)

5. *Jiu* beer is brewed in a semi-solid medium. The ratio between the volume of fermented grains and the beer obtained after dilution(s) of this fermented mass is highly flexible. In fact, it depends on how the beer is drunk. The guests gathered around the jar of beer decide on the level of dilution as they drink.

6. At that time, the volume ratio imposed by the authorities between raw and hulled millet was 1 for ≈0.6-0.7.

In 930, the same monastery spent 271 piculs (162.6hl) on grain, of which 28.9 piculs (17.5hl) was used to brew beer, i.e. 11% of the total, but 22.4% of the monastery's "food" grain.

Annual grain account of the Jingtu monastery for the year 930 (Trombert 1999, 135)		
Total expenditure :	162.6hl (271 piculs)	100%
For food	60hl (100.1 p.)	37%
For the beer	17.4hl (28.9 p.)	11% *
Other (vinegar, animal feed, lumps)	37.8hl (63 p.)	23%
Grain bartered for products or services	47.4hl (79 p.)	29% **
*or 22.4% of the « grain for food » (28.9 + 100.1 = 129) **idem year 924		

Table 3: distribution of grain from the Jingtu monastery for the year 930 (p. for piculs)

In 939, the monastery of Jingtu consumed 33.6hl of grain for beer during a year of major works, which resulted in higher beer consumption. However, in relation to the total volume of grain used for food, it remained within the same range.

The partial accounts of other monasteries give comparable figures (Trombert 1999, 136).

The proportion of grain used to brew beer is high and relatively constant over the years. On the other hand, beer volumes are low in absolute terms. Each monastery hosts around ten monks or nuns. The teams working for them or preparing the major annual Buddhist ceremonies average between 5 and 20 people. Certain events, such as banquets, the closing of annual accounts and receptions for dignitaries, result in higher beer consumption.

The amounts of grain spent on brewing are small in absolute terms. If we estimate that one litre of grain produces around 3 litres of beer using the brewing method described below (How is beer brewed in Dunhuang?), an average expenditure of 20hl of grain equates to 6,000 litres of beer per year, or 16 litres per day. A tiny volume compared to modern consumption, but proportionate to the staff of a large monastery such as Jingtu, from which the annual accounts for 924 and 930 were drawn.

The number of monks and nuns in the monasteries was modest: 10 to 20 per religious establishment. In 932, a large meeting to close the annual accounts was attended by only 18 signatories in Jingtu. The majority of beer drinkers were lay people working for the monks in teams of 5 to 10. Major Buddhist celebrations required the work of craftsmen to repair statues and procession

carts, and to repair or create ceremonial embroidered banners (Trombert 1996; Wang-Toutain 1996). The monasteries therefore devoted more grain to beer for the preparation and performance of these ceremonies.

We can conclude therefore that beer is shared between the monks and their servants, and that the former drink moderately or not at all outside the community's banquets and Buddhist festivities.

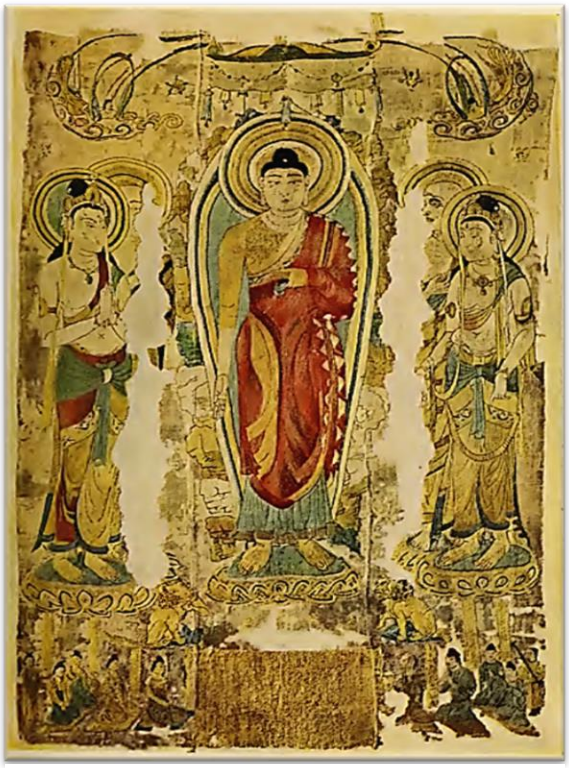

Figure 8: a ceremonial embroidered silk banner (Aurel Stein 1912, Ruins of Desert Cathay Vol. 2, plate IX, p. 206)

3. Who brews the beer in Dunhuang?

There are three ways of obtaining beer for a monastery: brewing beer on one's own (臥酒, *wo jiu*), buying beer from 'professional' brewers (沽酒, *gu jiu*), and bartering grain for finished beer (苻本臥酒, *fu ben wo jiu*, delivering/providing [the] base/raw material [to] make the beer). Éric Trombert illustrates these three possibilities (Trombert 1999, 137-138):

The monastery brews its own beer: "[Spent] 12 litres of millet in honour of the Grand Master on his return day to buy beer."

The monastery buys beer: "[Spent] 42 litres of millet to make beer for the monk community to prepare the spring banquet."

The monastery barters millet for beer: "Also given to the Ma family 42 litres of millet, supply of material to make beer (*fu ben wo jiu*) for the people who helped build the bell tower of Bao'en Monastery."

These three means are broken down as follows in the full accounts for the years 924 and 930:

Allocation of grain (litres) between brewing, buying and bartering beer						
	Grains	Brewing	Buying beer		Total	%
Year 924	Millet	732	534		1266	73%
	Wheat/barley	258	0		258	15%
	Ground wheat/barley	210	0		210	12%
	Total	1200	534		1734	100%
	%	69%	31%		100%	
	Grains	Brewing	Buying beer	Barter for beer	Total	%
Year 930	Millet	624	216	378	1218	75%
	Wheat/barley	405	0	0	405	25%
	Total	1029	216	378	1623	100%
	%	64%	13%	23%	100%	

Table 4: quota of grains according to the three ways used by the Buddhist monasteries to obtain beer (Trombert 1999, 138)

Table 4 shows that millet is the grain of choice when a monastery wants to buy beer, or to barter grain for its beer equivalent. In both cases, the beer is brewed by specialists or traders. They prefer to use millet to brew the beer they supply to monasteries or sell to their customers in taverns or shops.

For the monasteries, brewing by their own means remains the main way of obtaining beer (64% to 69% of the annual volume of grain). It is brewed with millet or wheat/barley from their granaries. These two types of beer correspond to different qualities, wheat/barley beer being considered superior. Some brews mix millet and wheat/barley, while others use only barley or wheat. The latter categories of beer are the most highly regarded, judging by the social standing of the recipients.

Buddhist monks brewed beer. The four examples given by E. Trombert (1999, 146) for the year 924 show that beer was brewed on site by monks assisted by women servant-cooks:

"27 litres of wheat/barley to make beer (*wo jiu*) for the monks to prepare the banquet for the dignitaries".

"228 litres of wheat/barley from the Western granary reserves provided as *jiu ben* for the monks to prepare the winter banquet for the dignitaries at the winter solstice, and for [various works] in the Western caves, Western granary, etc." (grain output from the Western granary).

"150 litres of wheat/barley for making beer (*wo jiu*) so that at the winter solstice the monks can prepare the winter banquet for the dignitaries, and for [various works] in the western caves, in the western granary, etc." (output of grain from the Eastern granary).

"72 litres of millet for making beer (wo jiu) for the monks to prepare the banquet for the dignitaries. 252 litres of millet provided to all the monks and maids to make beer (*wo jiu*) at the winter solstice during the collection of manure at the Western caves, for the reporting of the Western granary accounts, etc.".

Do the monks brew themselves? Do they supervise the operations carried out by the cooks or other categories of servants?

In some cases, "those who make the beer", *jiu ren* (*chang-pa* in Tibetan, *chang*=barley beer) belong to the *ren* social category, the domestic servants (Trombert 1999, 155). Brewing regular beer is not considered a valued technical activity. High quality beers, made from crushed and sieved wheat/barley, have to be brewed with special care because they are intended for dignitaries and the political elite.

Who are the people who brew the beer that is bought or bartered for millet by Buddhist monasteries?

On the 14th day of the 7th month of the year 924, at least 70 monks go up to the caves, those of Mogao and the surrounding sites. The next day, a banquet is held (*the Buddha's dish*). The brewer Hanku receives 42 litres of millet to brew beer. On the 17th day, the "*breaking of dishes*" ceremony takes place. Hanku and Ma, another family of brewers, receive 96 litres of millet to brew beer (Trombert 1999, 160).

In 935, the Jingtu Monastery delivers wheat/barley and millet in equal quantities to Guo Qingjin's shop (*dian*) "for him to make beer" (Trombert 1999, 150). The brewers have their own premises (*dian*) to brew, sell or serve their beers on the spot to the craftsmen employed by the monastery. Some minute accounting records from 982 state that musicians, monks and monastic rectors went to drink beer in a shop (Trombert 1999, 139). There are several of these taverns or beer shops at the same period:

"36 litres of wheat/barley to go to Chongzi's shop to buy beer" and "30 litres of millet to buy beer at Zhao's shop" (Trombert 1999, 139).

These beer shops are called *jiusi* (酒司), "beer-office" which can be translated as "brewery" since they brew and sell beer exclusively. Those in charge of it are called *jiuhu* (酒戶), lit. "beer-family". It is likely that families inherit this assignment (and privilege) over the generations, and are responsible for the proper functioning of the brewery and the quality of the beers brewed and bartered for grain according to a rate prescribed by the authorities. In the 8th-9th centuries, *jiuhu* designated families who were responsible for beer duties in the monasteries. In the 10th century, these *jiuhu* were also peasants, small civil servants (*yaya*), modest masters of *vinaya*, i.e. specialists of Buddhist discipline.

These *jiuhu*, suppliers of beer, are economically and socially dependent on the monasteries and political authorities who buy beer, but they can also provide the material (grain, jars, fuel, ferments) and the premises (*dian*) for brewing.

There were also millers (*weihu*) and oil pressers (*lianghu*) attached to the service of these same monasteries (Trombert 1999, 141). An account of 982 lists some thirty loans of millet and wheat/barley granted to nine different people to brew beer. These beer suppliers also include three *falü*, petty ecclesiastical dignitaries of the Jingtu monastery:

Loan of grain by the Jingtu monastery for brewing beer, year 982		
Clients/Borrowers	Number of loans	Total grain lent (litres)
Falü Fan's shop	1	210
Yan Zimo's shop	8	2478
Liu Wanding	4	378
[Zhang] Fuchang	6	384
yaya Fan's shop	3	378
Xingzi	3	252
Xintong's shop	1	42
yaya Dingyuan's shop	1	210
falü Guo	2	144
Total	29	4476

Table 5: grain loans for brewing beer (Trombert 1994, 328)

Éric Trombert noted that the majority of loans (24 out of 29) are granted during the 5 winter months, between November and April (from the 10th to the 3rd month in the Chinese calendar). The two loans granted in summer (5th and 7th months) were for just 168 litres of grain out of an annual total of 4,476 litres. Beer brewing based on grain loans is mostly carried out in winter. The reasons are both technical (winter is the best time to maintain a constant brewing temperature) and economic (use of grain from old harvests, labour available for domestic work). This winter peak in beer brewing means that the beer has to be stored in jars for a certain length of time, which in turn affects the shelf life of certain types of beer. This observation refutes the usual clichés about the ephemeral storage of beer in ancient times, in Asia and elsewhere.

The recycling of brewers' spent grain for animal feed may also be controlled by the monasteries. The Tarim basin and the Takla-Makan desert are not suitable for livestock. Pastures and pastoralists cover the foothills of the mountain ranges surrounding the basin. The inhabitants of Dunhuang must therefore rely on brewer's grains to supplement the food of their animals, mainly sheep and poultry.

The female brewers *Yang the Seventh* and *Ma the Third* are named in some accounts as being responsible for the grain supplied by the monastery to obtain beer in return (fu ben wo jiu, see §3). They manage their families and oversee the brewing:

Yang the Seventh: "On the 11th of the 9th month of the year gengyin (990), we went to the Beifu estate; we supplied 1260 litres of millet as jiuben to Yang the Seventh, and 1260 litres of millet as jiuben to Cao Fuyuan, and 300 litres of hemp seed for autumn milling" (Trombert 1999, 139 and 174).

Ma the Third is an official supplier (*guan jiuhu*) of the Dunhuang government (Trombert 1999, 174), associated with *Long Heap-of-powder*. In the spring of 887, they delivered 77 jars of beer (3000 litres ie. ≈ 40 l/jar) in one month to the stewardship of the Dunhuang government for various ceremonies and for the reception of delegations from neighbouring oasis towns, including the powerful Uighurs of Ganzhou (now Zhangye, in the Gansu corridor).

4. How is beer brewed in Dunhuang?

The brewing method used the amylolytic ferments (*qu*). These are made by mixing a paste of cooked grains with the roots or stems of plants harbouring microscopic fungi rich in amylases. Once the mycelium of these fungi has covered the grain pellets or cakes, they are dried. When it's time to brew, these amylolytic ferments are mixed with the mass of cooked millet or wheat/barley. They simultaneously liquefy this mass (saccharification of the starch) and trigger alcoholic fermentation of the sugars released (cf. Beer-Studies: cultivation of amylolytic fungi).

Brewing beer in monasteries implies that the monks or lay staff attached to the monasteries know how to brew. The secret of the method using amylolytic fungi lies in the very making of these beer ferments. You need to know the right plants, how to pick them at the right time, how to dry them, how to preserve them and, above all, how to grow the mycelium on a substrate of cooked grains, before drying these patties over a fire or under the sun.

These dry ferments can be kept for several years[7]. They were traded actively and profitably in the form of whole or powdered cakes. The Tang dynasty strictly regulated this trade, which was a source of profit for the imperial state. At the beginning of the 9th century (the time of the 1st Tibetan domination between 787 and 848), an account mentions loaves (*bing*, 饼) of beer ferments. "[Expenditure] 6 litres of wheat/barley, 6 litres of millet, 2 cakes of ferment (qu liang bing, 麴两饼)". The destination is illegible (Trombert 1999, 155-157). There are two possible explanations for its use: 1) these ferments are used to brew beer using the usual brewing method; 2) these ferments and the 12 litres of grain are used to make new beer ferments, which is the most likely hypothesis.

7. The translation *qu* = yeast (or leaven) is unfortunate. Beer ferments are first and foremost a means of saccharifying starch thanks to the mycelia that produce amylases. These same mycelia can also trigger an alcoholic fermentation, or the yeast symbionts associated with them. Brewing diagram pathway no 3.

In fact, it is common practice to crumble ferment patties to make new ones. This is a convenient way of inoculating 12 litres of cooked grains to replenish a stock of beer ferments.

In the first hypothesis, we have an approximate proportion of ferments to cooked grains for one brew. For 12 litres of grains, 2 fermenting cakes is the equivalent of a ladleful of ferments reduced to powder. A current beer ferment = Ø 5 to 10cm[8]. But the accounts of the brews for the Shazhou banquets give a proportion of beer ferments between 9% and 12% of all the grains brewed (Table 6 below). In our case, the volume of beer ferments (*qu*) would be between 1 and 1.5 litres, and each of the two loaves between 0.5 and 0.75 litres. In other words, the beer ferment cakes (*qu*) would be as large as traditional Chinese beer ferments, which around 1945 weighed around 1kg, or ≈ 1.5 litres (Chia Ssu-hsieh 1945, note 8). In the 6th century, Jia Sixie gives for a standard *qu* cake: Ø=6.5cm, thickness=2.2cm, that is 70 cm^3, barely 0.073 litre! (Chia Ssu-hsieh 1945, 31).

Who prepared these beer ferments? This essential question remains unanswered for lack of explicit mention in monastery accounts. One of the accounts of the Shazhou county granary (Trombert 1999, 178, P. 2763 R° 3) mentions beer ferments (*qu*) supplied with grain for brewing beer. However, these same ferments are not included in the expenses. We can deduce that they were made on site and not bought from beer-ferment sellers. Is this the general rule for Dunhuang monasteries?

The account provided by the Shazhou granary is exceptional: "Supply of foodstuffs made before the 12th month of the year chen (788) to the kitchens in charge of banquets to make beer: 32 piculs 2 bushels 4 sheng [= 1,934.4 litres]" (Trombert 1999, 178). The details of this account mention two deliveries of beer ferments (*qu*).

Deliveries of grain and beer ferments (litres) from the Shazhou granary to banqueting kitchens, year 788. * and ** are the original annotations in the document (Trombert 1996, 178)

Delivery dates	Hulled millet	Barley	Flour	Bran	Beer ferments (*qu*)	Unhulled millet	Total excluding beer ferments
9th month 8th day	60	60	18	24	66		228
10th month 2nd day	120	120	36	48		*214.2**	324
10th month 5th day		300	45	60	114		405
10th month 8th day		300	45	60			405
12th month 10th day		300	64.2**				405
Total	60	1080	208.2	192	180	214.2*	1767
* "214.2 litres of unhulled millet for the value of 120 litres of hulled millet"							
** "Of which 45 litres to be used as such and 19.2 litres for the value of 60 litres of bran"							

Table 6: proportions of grains and beer ferments (*qu*), piculs converted into litres

8. These beer-ferment cakes also exist in the form of cakes, pellets or tablets in China, Tibet, northern India and south-east Asia.

We can calculate the proportion of beer ferments/total volume of raw material (grain + flour + bran) after distribution between the 5 brews: no.1 = 28 litres, no.2 = 38 litres (66 litres proportionally divided between 42% and 58% of raw material), nos.3 to 5 = 38 litres each (same volume of raw material). For the first 2 brews, ≈12% ferment is used, for the last 3 brews 9.6%[9]. This is a high proportion compared with current and similar methods of brewing traditional beers in China, Northern India or Nepal, for example. But we know nothing about their composition in the 9th century, unless we refer to the section devoted to brewing in the *Qí mín yào shù* written in 533-544 (Chia Ssu-hsieh 1945, 25-29; Huang 2000, 161). These recipes for making beer ferments (*qu*) may not have been applied in the Tarim basin, as they are closely dependent on local plant resources that contain more or less potent amylolytic fungi.

Table 7 reveals another piece of information: the proportion of different grains used to brew beer is perfectly regular. The Dunhuang brewers had their recipes under control.

Regular proportions of grains for brewing beer, excluding beer ferments				
	Hulled millet	Barley	Flour	Bran
1st and 2nd brews	37%	37%	11%	15%
3rd, 4st and 5st brews		74%	11%	15%

Table 7: proportions of different types of grain for brewing beer

The high proportion of bran in these brews is noteworthy. The husks of millet or barley grains carry wild yeasts. Bran also avoids compacting the fermented mass, which would be unfilterable through the cotton, wool or silk fabrics used at the time. Cereal bran, mixed with ground grains, is also used to make vinegar (cu 醋) in Dunhuang: 180 litres used in the annual count of 924 (Trombert 1999, 134). Cereal husks also harbour acetic and lactic bacteria.

5. When and why do people drink beer in Dunhuang?

The main ceremonies in the Buddhist calendar play an important part in the expenditure of grain for brewing beer. Two of these are well documented in the full annual accounts for the years 924 and 930: the festival of the 8th day of the 2nd month and the celebration of the Avalambana[10].

9. The volume of grain-based ferments must be taken into account, as well as the notes from the accountant.

10. In China, the Avalambana is a ritual performed to save from torment the deceased relatives who have fallen into hell as a result of their evil deeds. It takes place on the 15th day of the 7th month to help hungry ghosts (skr. *preta*) by offering them food, drink and riches (often in the form of paper or representations), with the aim of helping them through prayers and devotional ceremonies (Przyluski 1932).

These Buddhist monasteries are major economic institutions in the region. They interact with the lay population (servants, slaves, craftsmen, Sogdian merchants, political leaders, donors, administrative authorities), offering banquets and taking part in secular festivities. All these activities provide indirect information about the role of beer in the civil society of Dunhuang.

Furthermore, the daily life of the Buddhist clergy was compatible with the beer jars in the Tarim basin at that time. Buddhist directives and discipline were applied with moderation in a multicultural environment that favoured a certain degree of religious syncretism. Buddhist dignitaries had to come to terms with the habits and customs of the people who ensured their economic prosperity.

It appears that the monks and the lay people who served them drank beer all year round, even during the critical lean periods between harvests of millet, wheat and barley. The vast granaries of the monasteries acted as a buffer but also as a treasure trove of grain. The monasteries were willing to lend seeds for new harvests. Loans of grain or fabrics (wool, hemp, silk, cotton), free of charge or at interest, on trust or on mortgage, were one of the main sources of income for monasteries (Trombert 1994, 299). The granaries of monasteries replaced the public granaries (*cang*, 仓) managed by an institution (*gongxie*) when the imperial power of the Tang withdrew from the region.

A. The economic activities of lay people with the monasteries

Figure 9: ploughing (south wall of cave 85 at Mogao)

Figure 10: butcher and sheep (Mogao cave 85, Lankavatara Sutra on the east wall of the main chamber ceiling)

Figure 11: potter turning a pot on a wheel (Mogao cave 85, Lankavatara Sutra on the east wall of the main chamber ceiling)

Many craftsmen and peasants worked for the monasteries. They received compensation in kind: grain, beer, cloth, oil, etc. No metal money circulated in the Tarim basin under the Tang and Song. The economy was based on barter, including city-to-city trade along the Silk Roads. Social structures were essentially based on bonds of personal dependence and servitude within families, clans and tribes.

Here are a few cases that are also good examples of beer brewed with blends of barley/wheat + millet:

In 939 for lumberjacks:

"When felling timber at Jiang Suohu estate, 3 litres of wheat/barley and as much millet to make beer" (Trombert 1999, 149).

"For the food of the monks when felling wood to make beams at the Wu Xiangzi estate, 3 litres of flour, 6 of coarse flour, 4.5 litres of wheat/barley and 4.8 of millet to make beer. For the woodcutters at the Luo dutou estate, 3 litres of wheat/barley and 3.6 litres of millet to make beer" (Trombert 1999, 149-150).

For the shepherds:

"For the shepherds, 45 litres of millet and 9 litres of wheat/barley to make and buy beer three times" (Trombert 1999, 150).

For harvesters, monks or laymen:

In 970: '36 litres [of grain] purchase of a jar of beer to quench the monks who harvested the wheat/barley fields of the Canal estate' (Trombert 1999, 167).

Servants and craftsmen working in the orbit of the monasteries, but also monks and dignitaries, receive regular allocations (*jieliao*) of grain, beer and oil. They are granted for example at the winter solstice or at the lunar new year (Trombert 1999, 162).

Food is almost always served with beer. The normal ratio between food and fermented beverage is 3:1 calculated in volume of grain (Trombert 1999, 170).

The *saishen* ceremonies are performed on the borderline between the economic activities sponsored by the monasteries and their religious function. The construction or repair of a mill, a craftsman's workshop, sowing, harvesting, sheep-shearing and various agricultural works all call upon the monks to bless the beginning or completion of these tasks (Trombert 1999, 165). These *saishen* do not take place without brewing beer for the attendees. It is possible that some of this beer was used for sacrificial libations (see below).

B. The religious activities in monasteries

Figure 13: offerings to Buddhist deities (Mogao cave 85)

Figure 12: dancing figure during a festival (south wall cave 85, Mogao)

The beer is specially brewed and drunk collectively during festivals and ceremonies that are strictly religious and Buddhist, such as the festival on the 8th day of the 2nd month in honour of Buddha (in the middle of winter) and the Avalambana in honour of departed souls (from the 14th to the 17th day of the 7th month, in the middle of summer).

Other celebrations are of a secular nature, such as the Lunar New Year, the Lantern Festival, the Cold Eating festival, the Winter Solstice, and provide an opportunity to drink beer, as shown in the tables below.

Éric Trombert has been able to isolate expenditure linked to the annual ceremonies of the Buddhist calendar for the years 924 and 930. Expenditure on grain for brewing beer was substantial compared to expenditure on grain or oil consumed for purely dietary purposes.

Expenditure of grain (litres) for the festivals organised by the Jingtu monastery, year 924								
Festivals	Grain for beer	Wheat	Millet	Flour	Oil	Soja	Coarse flour	Soja oilcakes
8th day of the 2nd month (≈20th March)	84		78	75	2.7			
Cold eating (5th April)	84			42	1.2			
Buddha's food (spring)				189	2.4			
The Spring Banquet	42			7,5	1.8			
Avalambana (mid-August)	126			234	16.2	6	6	5 cakes
Buddha's food (autumn)				204	3.6			
Winter Solstice (20th December)	402	234		12	0.3			
12th month ceremonies				54				
New Year 925 (18th February)				66	0.3			
Lanterns Festival					30			

Table 8: spending on grain for Buddhist festivals in 924 (Trombert 1996, 31)

Expenditure of grain (litres) for the festivals organised by the Jingtu monastery, year 930							
Festivals	Grain for beer	Millet	Flour	Oil	Soja	Coarse flour	Soja oilcakes
Banquet to drive out the grasshoppers	84		84	3			
8th day of the 2nd month (≈20th March)	162	228	246	6.48			
Cold eating (3rd-5th April)	84		64.8	1.83			
Buddha's food (spring)			210	3.6		12	
Avalambana (mid-August)	24	126	273	17.4	12		5 cakes
The Fall Banquet	42		78	2.4			
Buddha's food (autumn)			210	3.6		12	
Winter Solstice (20th December)	108		15				
12th month ceremonies			54	2.4			
New Year 931 (18th February)	108		12	0.3			
Lanterns Festival	18	30	15	0.06			

Table 9: spending on grain for Buddhist festivals in 930 (Trombert 1996, 35)

The festival of the 8th day of the 2nd month takes place between the 27th of February and the 29th of March depending on the year of the Chinese lunar calendar. This festival marks the resumption of agricultural activities, particularly sowing. The Buddhist calendar and the agrarian cycle are intertwined. It is one of the most important annual celebrations along with the Avalambana, which takes place in summer.

The expenditure of grain for brewing beer rewards and feeds the laymen, monks and nuns who ensure the preparations, repair the statues of the Buddhas, the canopies, the banners, the procession carts, etc. that will be shown and paraded during the ceremonies. It is clear from the day-to-day details of these accounts that the monasteries are bustling with life. Each monastery has only ten or so monks or nuns, but the laity double or triple these

numbers during the year and especially during these festivities (Trombert 1996).

Spending of grain (litres) for the feast of 8th day of 2nd month (≈ 20th of March) year 924			
Main events of that festival	Millet to brew beer	Flour	Oil
*Zhai** offered to the guardians of the Buddhas and the monks on the 8th of the 2nd month	84	39	1.5
Preparation of noodles in soup for the *zhai* of the 8th day		18	0.6
Refreshment at the North Gate of the city for the statue bearers		18	0.6
Refreshment for the guardians of the Buddhas	36		
Millet to the Buddha keepers to go to Hanku [beer shop] to drink beer and celebrate the end of their task (9th day)	18		
Millet to the statue procession association to buy beer	24		
* Collective meal theoretically lean but well supplied with beer			

Table 10: spending on grain for the feast of the 8th day 2nd month of 924 (Trombert 1996, 29)

Spending of grain (litres) for the feast of 8th day of 2nd month (≈ 20th of March) year 930			
Main events of that festival	Millet to brew beer	Flour	Oil
Making of boddhisattva crowns by goldsmiths, *ācārya**, tinsmiths for their 3 daily meals (20th to 29th in the 1st month)	24	108	2.4
3 daily meals for the nuns who sew the canopies (2 to 6 of the 2nd month)	42	90	2.52
Zhai of monks for the recultivation of the gardens, banquet on the 8th of the 2nd month		12	0.61
Banquet of the association of procession of statues to make beer and cook *baotou*, *hubing* and *xibing***	126	72	2.46
Refreshment for the statue bearers at the North Gate	36	24	0.6
To the Buddha bearers and their helpers (7th of the 2nd month)	72		
Lighting of the lanterns (7th of the 2nd month)			0.6
Lean banquet of the monks (9th of the 2nd month)		12	0.3
3 meals a day for 2 more days for the sewing of the canopies by the nuns and monks	30	36	1.2
To celebrate the *sengsheng* (9th of the 2nd month)	72	12	0.3
Canopies removal feast for all the craftsmen and monks of our monastery (Jingtu) (9th of the 2nd month)	84	138	3.12
* *ācārya* are spiritual Buddhist teachers or preceptors ** cakes, patties, fried or steamed ravioli (Wang-Toutain 1996)			

Table 11: spending on grain for the feast of the 8th day 2nd month of 930 (Trombert 1996, 33)

The Avalambana in honour of the departed souls is coupled with an evening of preaching. The monastery brews beer on the 15th of the 7th month for the Buddhist dignitaries and lay people in attendance (Trombert 1999, 165). The

lean banquets (*zhai*) of the monks are also watered with beer (Trombert 1999, 161).

In 930: "2100 litres of wheat/barley ground into flour to make beer (weimian wojiu) for the lean banquet of the monks of the accounting meeting on the 2nd year [changxing era]" (Trombert 1999, 154).

Similarly, the reading of Sūtra given in different parts of the city on the 12th month (Trombert 1999, 160).

Beer is not only the beverage of collective meals. It serves as a sacrificial offering, integrated into the rites that are closely related to the agrarian cycle. Beer offerings are made during the Cold Eating and the Winter Solstice, two celebrations inherited from the Chinese religious background and integrated into the Dunhuang calendar. Beer symbolises the abundance of grain, the hope of the coming harvest and the rebirth of nature at the winter solstice under the benevolence of the agrarian fertility deities. Beer is brewed for sacrificial offerings and prayers (*jibai jiu*)" (Trombert 1999, 164).

The Alang (prince-governor of the Dunhuang district) buys beer for the trays of offerings to the deities of the Chinese pantheon and the great figures of Sinicised Buddhism.

Funeral rituals include beer as an offering beverage, whether the deceased is secular or religious, a jar of beer in one case or the equivalent of 18 litres of grain in another (Trombert 1999, 166).

C. The diplomatic activities of Buddhist monasteries

Figure 15: foreign dignitaries (Mogao, cave 85, Tang dynasty 618-907)

Figure 14: Sogdian orchestra with pipa player. Middle Tang period, 762-827 (Mogao, cave 46 or 112).

Beer jars or horns are offered to Buddhist or lay dignitaries in special codified circumstances.

When a master of Buddhist discipline and a master craftsman left for the West around the end of the summer of 924, the monastery offered beer without food. People rejoiced by drinking without eating. In 930, a reception was held in honour of the linggong (head of the secretariat) who had returned from a trip to the East. Large quantities of beer were brewed to welcome emissaries from the oasis cities of Turfan or Khotan (Map 1), or to celebrate the departure of a Buddhist master to the West (Trombert 1999, 163).

A beer horn welcomes a *senglu* (middle-ranking cleric) from nearby Shouchang. The beer horns seem to have meant "welcome" and "brotherhood". They are also distributed among teams of workers or as a beer ration to nun-cooks and men who have sewn skins.

Beer jars are given as ceremonial gifts. "On the 6th of the 11th month of the 4th qingtai year (December 937), Longbian general administrator of the dusengtong (*saṃgha*) of the Shazhou region and his two acolytes Huiyun and Shaozong thank the *sikong* [prince-governor of the Dunhuang region] for sending them seasonings and two jars of wheat/barley beer" (Trombert 1999, 152).

In 982, the Jingtu monastery bought beer "to be served to the prefect's wife or daughter" (Trombert 1999, 173 n. 70).

6. How is beer drunk in Dunhuang ?

The accounting records of Dunhuang tell us about the drinking manners of its inhabitants. The main brewing method used implies that the beer could be drunk already filtered, or sucked through a straw when the more or less liquefied fermented batch has just been diluted.

Beer is brewed, sold and probably consumed in jars whose capacity can be estimated. When beer is brewed by monasteries, the average volume of grain is usually a multiple of 42 litres (Trombert 1999,143). After hulling (millet), crushing, boiling the grain and adding the beer ferment to them, the final volume of the fermented batch is between 50 and 60 litres. This is probably the volume of a large beer jar or 2 small ones containing 25-30 litres.

Figure 16: a merchant from the Tarim basin with a goose-shaped pouch of beer or wineskin, Tang dynasty 7th-8th (The Metropolitan Museum of Art Bulletin No. 2, 1973/1974, fig. 72)

Finally, an account of the general administration of the *saṃgha*[11] dated in the middle of the 10th century provides an equivalence between grains and beer jars: "2100 litres of wheat/barley crushed into flour (*wei baimian*), and 1008 into sifted flour (*wei luomian*) to make 30 beer jars" (Trombert 1999, 154). It must be assumed that only the sifted flour was used for brewing: 1008 litres/30 = 33.6 litres of flour/beer jar. Again, the estimated capacity of a beer jar ≈ 40-50 litres after brewing the flour.

The accounts of two brewers working for the Dunhuang government in 887 indicate that a *weng* jar of beer was exchanged for 36 litres of grain (Trombert 1999, 151, n. 27). In 970, the accounts of a monastery indicate "36 litres [of grain] for the purchase of a jar of beer" (Trombert 1999, 167). In both cases, we are dealing with a smaller jar.

Regardless of the capacity of the beer jars, drinking collectively from them involves the use of a straw or beer-pipe to suck out the liquid portion.

In contrast, drinking individually from cups or bowls requires dilution and filtration of the fermented and clarified mixture.

The Dunhuang documents say nothing about customs that would go beyond the accounting of material goods. These two ways of drinking beer, collective vs. individual, must have followed a social division: collective drinking for the vast majority, individual drinking for the economic, political or religious elites.

There is a third way of drinking beer: the beer horn. This clearly reflects the importance of pastoral activities in the regional economy of Dunhuang and the Tarim basin. Drinking horns were part of domestic crockery, but they were also used for ceremonial purposes. Nothing is known about their origin (goat, cattle, antelope?). Antelope horns were part of ceremonial gifts, along with perfumes, aromatics and jade (Trombert 1999, 152-152). Perhaps decorated or engraved, they contained only a few litres of beer.

The Dunhuang lay administration "spent a horn of beer for the people who sewed the skins" (Trombert 1999, 152-153).

On the 27th of the 11th month of 930, a horn of beer was served to welcome the *senglu* from Shouchang (Trombert 1999,163-164).

In the 2nd month of 982, the rector Li of a monastery was given a horn of beer to oversee the sowing of wheat/barley (Trombert 1999,167, n. 58).

Some *ācārya* nuns worked for two days to prepare a feast and each received a horn of beer (Trombert 1999, 173).

11. Sanskrit term for the entire community that has vowed to follow the Buddha's Path.

7. Brewing ratios and daily accounts

The day-to-day accounts indicate brewing ratios (Trombert 1999, 169). The original volumes expressed in piculs or sheng are converted here into litres (see Table 1).

For the closing of the accounts of the year 930 at Jingtu Monastery, "90 litres of millet to buy beer day after day for the assembly of accounts [presented by] Yuanda" (Trombert 1999, 169, P. 2049 col. 259)[12]. The expenditure of 90 litres of grain ground into flour for the same meeting states that it lasted five days. The signatories are 18: Yuanda, 15 bursar monks and two high officials of the local clergy.

The wheat/barley flour "ration": 90 litres / (5 days x 18 monks) = 1 litre / day / monk. The "quota" of millet for beer is the same: 90 / (5 x 18) = 1 litre / day / monk.

For the next day's banquet following this closing of accounts "210 litres of wheat/barley were crushed to make beer for the monks' banquet held for the 2nd year's accounts assembly [*changxing*]" (Trombert 1999, 169, P. 2049 col. 194). It can be inferred that this banquet was attended by approximately 210 Buddhist monks and dignitaries, each granted 1 litre of wheat/barley for that day.

The accounts provide the brewing ratios for the stonecutters (Trombert 1999, 170). One craftsman employs 5 stonecutters for 10 days on behalf of the monastery. Thye spend 18 litres of flour/day, one sheep for the 10 days and 6 litres of grain (millet?) for beer/day.

The flour ration = 6 litres / 5 = 1.2 litres / day / stonecutter.

The grain "quota" for beer = 6 litres / 5 = 1.2 litres / day / stonecutter.

Éric Trombert (1999, 170) mentions the expenditure on beer offered to the Uighur emissaries received in Dunhuang during a month in the spring of 887. Each received the equivalent of 1.5 litres of grain per day in the form of beer and up to 3 litres per day on reception days.

Eric Trombert (1996, 64) has also listed the grain rations for beer and flour distributed to the bearers of the Buddha statues during the Dunhuang processions. Based on a daily flour ration of 1 sheng (0.6 litre), the number of bearers is calculated and then related to the millet rations for beer. The quota of grain for beer for the porters is between 1.2 and 0.9 litres depending on the year (Table 12 below).

12. The total expenditure could be 90*5 days=450 litres if "day after day" meant spending 90 litres of millet every day to buy beer.

Refreshments and meals given to the statue bearers. Litres of grain (and oil)					
	Beer		Flour given for meal		Oil
	Millet for beer	Ration (litres/day)	Flour (litres/day)	Bearers staff (daily 0.6 litre)	
At the North Gate					
year 924	36	36/30 bearers =1.2	18	18/0.6 = 30	0.6
925	?	?	18	18/0.6 = 30	?
930	36	36/40 = 0.9	24	24/0.6 = 40	0.6
939	36	36/30 = 1.2	18	18/0.6 = 30	0.6
943	?	?	18	18/0.6 = 30	0.6
Unspecified location					
945	36	36/30 = 1.2	?	?	0.6
?	36	36/30 = 1.2	?	?	?

Table 12: refreshments given to statue bearers. Litres of grain and oil. Éric Trombert (1996, 64)

The data analysed by E. Trombert make it possible to calculate the share of grain given to nuns for their beer in the course of collective meals. In year 930, between the 2nd and 6th day of the 2nd month, nuns have to repair the ceremonial banners for the Buddhist festival of the 8th day (Trombert 1999, 167). During these 5 days, they receive 90 litres of flour supplied by the monastery for their 3 daily meals, that is 18 litres/day. Estimated number of nuns: 18 litres/0.6 (a nun's meal ration = one sheng)/3 meals = 10 nuns. And 42 litres of millet are supplied for their beer, that is 8.4 litres/day and 8.4/10 nuns = 0.8 litres per nun for her daily beer (Table 13).

Summary of ratios (litres of grain) for beer, in descending order	
Uyghur envoys	1.5 à 3 (during feasts)
Stone carvers	1.2
Statue bearers	1.2 to 0.9 depending on years
Buddhist monks	1
Buddhist dignitaries	1
Buddhist nuns	0.8
Serfs, servants, gardeners, ...	? (Table 14 below)

Table 13: summary of beer ratios for dignitaries and craftsmen, in descending order

The daily flour rations for peasants and male or female serfs employed as servants of monks or nuns are listed below. They relate to their three meals. We have no correlation with the grain used to brew their beer, if such rations ever existed. These lowest social categories probably had to divert grain from their food rations to brew their own beer. The servile women (*si'er nüren*) receive a coarse flour (*cumian*) of *mai* (wheat/barley) or mixed with bran (*lianfu mian*) (Table 14).

Flour rations for peasants and serfs	
Free peasant (*baixing*)	1.8 litre of flour (3 *sheng*)
Male serf (*si'er*)	1.2 litre of flour (2 *sheng*)
Monastery gardener	0.9 litre of flour (1.5 *sheng*)
Female cook or serf (*nüren*)	1.5 litre of coarse flour (2.5 *sheng*)

Table 14: flour rations for peasants and serfs

The grain quotas for beer do not seem to vary much between social categories, apart from political emissaries and serfs, these being at opposite ends of the social hierarchy.

However, these figures should be handled with caution. Data from domestic and commercial brewing (taverns and public sales of beer) are not included in the accounts of Buddhist monasteries. The servants, gardeners and peasants serving them may brew for themselves or barter beer for grain with professional brewers. The monasteries themselves call on the latter when they need to procure larger volumes of beer for certain religious festivities (Trombert 1999, 137-141).

The quality of the beer also varies. The 'standard' beer is based on millet. An apparently superior quality beer is brewed with a mixture of barley and wheat, or wheat only (Trombert 1999, 151 and 177-180). The use of more or less hulled grain, especially millet, affects the calculation of ratios depending on whether the volume of grain is that of raw grain or of groats from grain that has already been hulled. The documents do not provide these details. By uniformly applying a ratio of 1 sheng (0.6 litre) per meal, whatever the social category, we have erased the problems of the quality of grain used for meals or for brewing beer.

Lastly, the amylolytic fermenting technique (qu) used in Dunhuang does not change the way were are able to estimate the quantity of grain (hulled or not) allocated to each person for the beer they will drink. However, this brewing method means that the volume and density of the beer depend on the actual dilution of the mass of fermented and filtered grains at the time of drinking (note 5).

This question becomes critical when the texts refer to the delivery of beer jars. Their capacity can be estimated: 40 to 60 litres depending on the case. But what did they contain? A more or less liquefied mass of fermented grains, or beer that has already been filtered? The specific management of spent grain, the solid residue left by the brewing process, suggests that these jars are filled with filtered beer, the alcoholic liquid obtained after dilution/filtration of the mass of fermented grains.

Does a scale of the ratio of grain volume to beer according to social category apply in Dunhuang? This can be seen if we compare the volume of grain brewed for Uyghur emissaries and that given to craftsmen or porters. It does not have the amplitude seen in Mesopotamia or Egypt in the 2nd millennium BC, where ratios ranged by a factor of 1 to 3 from the lowest to the highest in the social hierarchy[13]. However, a social scale embodied by beer did exist in Dunhuang. If we assign a social value to the grain volume/person ratio grid, we can see that Dunhuang society shows a more "egalitarian" face than

13. In other words, 1 to 3 times, sometimes 4 times, more grains to brew the same volume of beer. See beer-studies.com/en/Advanced-studies/Brewing-ratios/Mesopotamian-brewing-ratios for Mesopotamia and beer-studies.com/en/Advanced-studies/Brewing-ratios/Egyptian-brewing-ratios for Egypt.

the society of ancient Mesopotamia or Egypt, provided that our text samples are representative of a society that extends beyond the Buddhist community of Dunhuang.

8. Conclusions

Buddhist monks were not allowed to accumulate material wealth or own anything other than their clothing and alms bowls. Conversely, the inalienable and permanent property of the community, the *saṃgha*, was the source of its prosperity, its relative economic autonomy from the secular authorities, and its longevity through political tumult.

Is it really surprising that grain, the main material treasure of the monasteries, and its conversion into beer, should play such an important role in the daily life of the Buddhist clergy?

Did they live as beer-thirsty people? No more so, it seems, than the rest of the population. In China, regular consumption of beer was the privilege of the richest or most powerful families. The volumes of beer recorded in the annual accounts for the years 924 and 930 are impressive. At an average consumption of 16 litres a day, they seem infinitesimal in relation to the number of people living in the Jingtu monastery and the staff around it.

Beer is mainly drunk during ceremonies and their preparatory stages, at banquets, collective labour and formal receptions. In other words, beer in Buddhist monasteries is a beverage of conviviality, a social lubricant, a customary fermented beverage.

However, drinking beer does not erase social stratifications. They are apparent and reaffirmed in the grain/volume ratios of beer, which reflect the quantity of grain allocated to each social category according to its status. The higher the ratio, the greater the density of the beer, i.e. the greater the quantity of grain brewed for the same volume of beer.

The quest for intoxication through beer can be traced back to the secular families of brewers and their beer shops. Peasants, shepherds, craftsmen, merchants, and sometimes monks, came to trade a little millet, barley or wheat for a jar or a horn of beer.

This bartering of grain for beer is a constant feature of ancient agricultural societies, whether it takes place in a village or a town. These micro-transactions almost always pass under the radar of the world's economic archives: they leave no written record and concern poor and precarious social categories. One of the merits of Éric Trombert's studies is that he has brought them to light in the 10th century oasis-city of Dunhuang.

9. Bibliography

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