

## **BREWING TECHNOLOGY IN EARLY EGYPT. INVENTION OF UPPER OR LOWER EGYPTIANS?**

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For centuries beer was for Egyptians the most common and basic of comestible. The oldest record where beer was mentioned is the list of the grave goods offered to Secherchabau in the stele from his tomb at Sakkara dated for the Third Dynasty (MURRAY 1905: 2-4, pl. 1). Since then beer has been constantly listed among grave offerings just next to bread. Together with bread it was a form of payment for public workers and soldiers. The oldest known brewery, till present, is located at Hierakonpolis HK24A and is linked to the Naqada culture (GELLER 1992: 23) but considering the Lower Egyptian culture, the only brewery from this period is up to now known from the Tell el-Farkha site (Fig. 1; CHŁODNICKI & CIAŁOWICZ 2005: 134).

The occupation of the Western Kom of Tell el-Farkha is surely confirmed from the Lower Egyptian culture (Naqada IIB) until the First Dynasty. The oldest stratum on the Western Kom shows traces of a simple habitation area which quickly transformed for industrial purposes. In this place a sequence of at least five breweries was detected (CHŁODNICKI & CIAŁOWICZ 2005: 132-134; 2007: 145-146; CIAŁOWICZ 2012a: 149). The first uncovered phase of the brewery was the very badly destroyed by the overlaying layers structure 201A. During its examination only approximately size (2 by 1.5m) and shape were recognized (CICHOWSKI 2008: 39). It seems to consist of 2 rows of joined vats. This phase was dated on Naqada IIB period and it's probably the early stage of the structure W200 (CIAŁOWICZ 2012a: 151). In the next layer the structure W201 appears. This phase was only in a slightly better condition and measured about 6 by 3.4m. It's oriented on the same north-west and south-east axis as previously described structure W201A. At this structure two examples of vats were found *in situ*. This allowed to recognize a method of circular seats construction. Each of them consists of at least two rows of diagonally arranged D-shaped bricks better known as fire-dogs (CICHOWSKI 2008: 38).

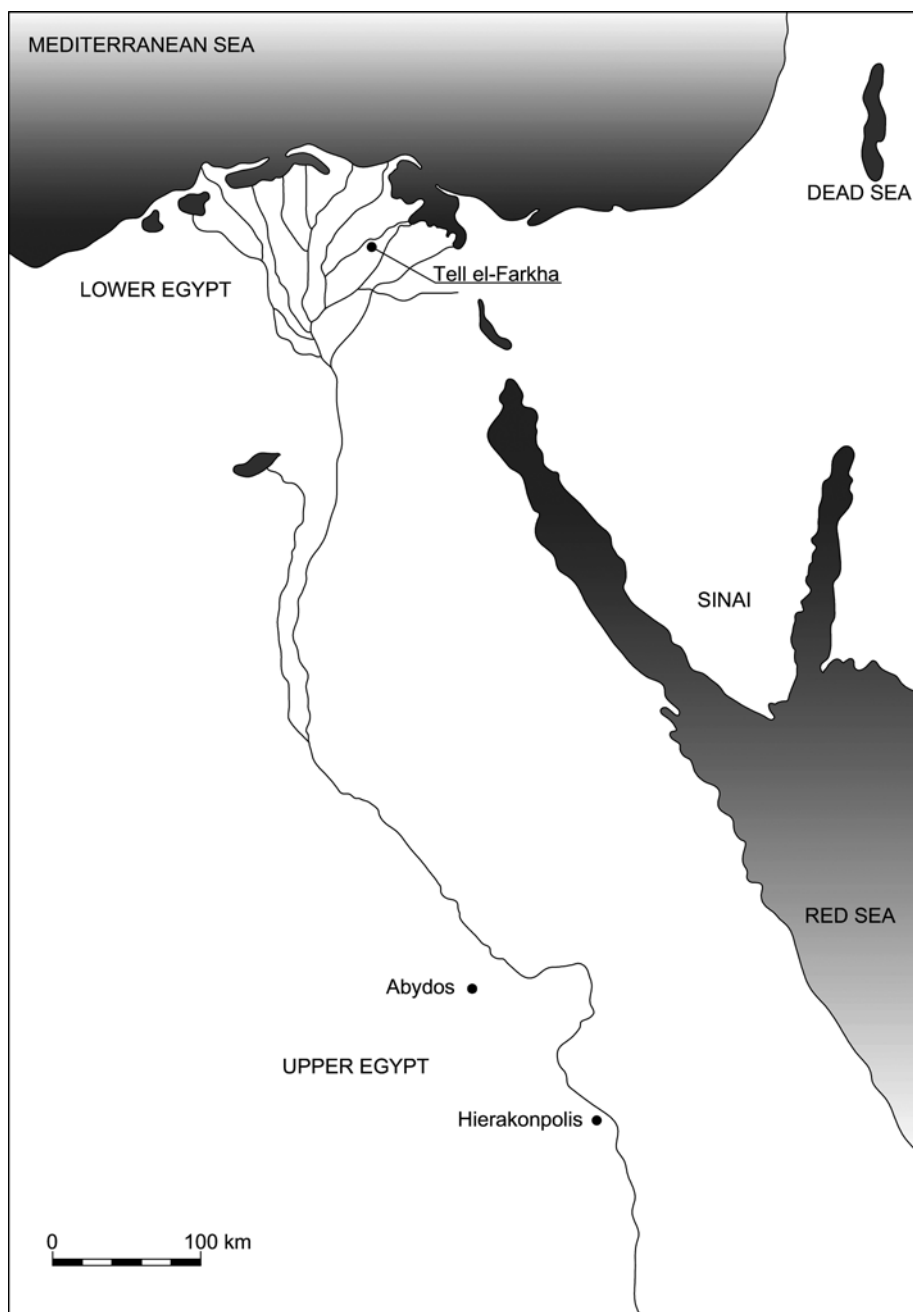


Figure 1. Localization of Lower and Upper Egyptian early breweries  
(drawing by K. ROŚIŃSKA-BALIŃ).

The next overlaying structure W200, located to the north from structure W201, is dated to the next Naqada IIC period (CICHOWSKI 2008: 37, 39). As it was mentioned before this was most probably the second stage of W201A and it is the best preserved example of brewery from Tell el-Farkha. Together with its first phase it constructs a L-shaped brewing device with total number of 13 vat seats arranged in two rows. The structure seems to be well planned and organized for the long time before its erection (CIAŁOWICZ 2012a: 151, 155-157). The structure W200 was arranged as a complex of vats with total measurements 9 by 3.4m. In this stage of beer industry complex uncovered examples of vats *in situ* confirmed size of this vats and construction of its seats (Fig. 2). In average this brewery could produce about 200 litres at once (CHŁODNICKI & CIAŁOWICZ 2007: 145-146; CICHOWSKI 2008: 37). This structure was fully covered with thick layer of mud what clearly pointed at occurrence of destructive Nile floods what was frequently recorded on the site (CHŁODNICKI & CIAŁOWICZ 2004: 102; 2007: 147; CIAŁOWICZ 2012a: 149-155, 157-160).

After this local disaster subsequent brewery was erected almost at the same spot. The structure W192 was the most complicated one. It measured 6 by 5.4m and consists of 11 circular seats for vats. At first only a few of them were build and during exploitation due to a high temperature it begun to be damaged so some new vat seats were added (Fig. 3; CHŁODNICKI & CIAŁOWICZ 2004: 102-103; 2005: 133; CICHOWSKI 2008: 37).



Figure 2. The vat seat *in situ*  
(photo by R. SŁABOŃSKI).

Up to date, the smallest discovered brewery from the Western Kom of Tell el-Farkha is the structure named W47 (CHŁODNICKI & CIAŁOWICZ 2001: 93). However, as we know from the last season of research it was not the youngest. The brewery W47 is dated from Naqada IID1 to the beginning of Naqada IID2. It consisted only on 3 places for vats and measured about 3.4 by 4m. Whole the three-leaf clover shaped structure was surrounded by at least 0,6m high brick wall from 10-30cm thick depending on brick arrangement. The vat seats were also separated from each other by much thinner inner walls. This example of the brewery device revealed some exceptional solution for vat seat construction. In order to stabilized the vat itself a kind of basis was implemented. Basis was additionally encircled with kind of clay band. This type of construction was probably to provide better heat distribution around the vessel (Figs. 4-5; CHŁODNICKI & CIAŁOWICZ 2001: 91- 93; 2002: 70; CICHOWSKI 2008: 34-39). During 2013 season our team discovered another 2 examples of brewery on the Western Kom: W272 and W273. The second one was in such bad condition that it was impossible to distinguish its exact number of vat seats. The brewery W272, however still under examination, revealed up to now 3 vats but



Figure 3. Overlapping breweries W192, W200 and W201 (photo by R. ŚLABOŃSKI).

during next year research this number could increase. Two of three discovered vat seats had fragments of vats standing in it. This two brewery devices are the youngest examples et Tell el-Farkha site and are dated on Naqada IIIA period (Fig. 6; CIAŁOWICZ *pers. comm.*) The sequence of brewing devices from the Western Kom: W201, W200 and W192 was most probably connected to the Lower Egyptian residence located on the Central Kom. They were used as a mass production industry not only for the local needs but there is also an assumption of exporting it in exchange for a trade goods. The W47 brewery due to its rather small size and neighbourhood of large sized edifice – newly erected Naqadan residence – is considered to being used only for purposes of its inhabitants (CIAŁOWICZ 2012a: 161-162). The breweries W272 and W273 are chronologically younger than this residence and were erected after its existence. As it was established during previously examined area on Western Kom next to this the administrative and cultic centre had been uncovered and this two installations most probably were used as a source of provision for workers employed to build it (Tab.1; CIAŁOWICZ *pers. comm.*).

All of described devices were located relatively close to habitation area however they were always separated from it with some kind of fencing. At first this border was created by simple fence built with organic material but shortly after it was followed by rather solid mudbrick wall (CIAŁOWICZ 2012a: 157-160).

### BEER BREWING TECHNOLOGY AND THE BEER RECIPE

The most important data for Predynastic beer recipe come from Tell el-Farkha, and were obtained after the botanical analysis of beer remains. Thanks to L. KUBIAK-MARTENS and J. LANGER'S (2008: 429-431) studies we know that beer from Tell el-Farkha was mostly made of emmer wheat and that it used to be brew in two-part process.

First the whole cereal was divided into two portions, each of them was treated differently. One part of grain was converted into a malt (by sprouting and drying) and then was coarsely ground. Then cold water could have been added. This portion wasn't cooked at all. The other batch (which also could have been sprouted but it wasn't necessary) was at first pounded or ground very well and then well-cooked in certain amount of water. The result of these different treatments of the grain batches, were two different semi-products: uncooked malt on the one hand, and the porridge or gruel-like mass of well cooked grain on the other (SAMUEL 2000: 553-555; KUBIAK-MARTENS & LANGER 2008: 431-435).



Figure 4. The smallest brewery from Tell el-Farkha – W47 (photo by R. SŁABOŃSKI).

Table 1. Chronology of the Tell el-Farkha breweries.

STRUCTURE	PERIOD
TF W 201 A	Naqada IIB
TF W 201, TF W 200, TF W 192	Naqada IIC
TF W 47	Naqada IID1/D2
TF W 272, TF W 273	Naqada IIIA

Next, these two portions were mixed together. At that step the starch granules of wheat porridge were easily attacked by the active enzymes (amylase), highly concentrated in the malt. These enzymes were necessary to break down the starch cells into sugars, obtaining of which was essential for the rest of the brewing. Once the two batches blended, sort of filtration was required in order to rid the starch-protein mixture of cereal husks. To obtain a clean liquid, the mixture must have been drawn out of the vat and rinsed with water through a sieve. It is worth to mention that the act of sieving was very often depicted on the walls of the noble's tombs. The result was the sweet and presumably quite cloudy

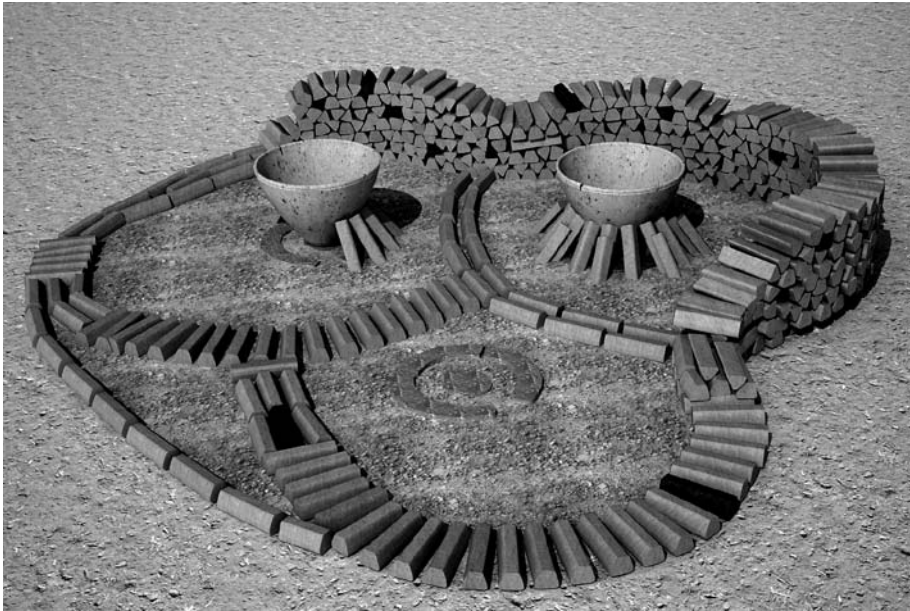


Figure 5. 3D reconstruction of W47 (by K. ROSIŃSKA-BALIK).

liquid, which could be called the wort in modern brewer's nomenclature. This wort was rich in simple sugars (maltose and glucose) which made it available for further fermentation (SAMUEL 2000: 553-555; KUBIAK-MARTENS & LANGER 2008: 435).

Fermentation posed the final step of the whole brewing process. We don't have any data to prove that Egyptians in the Predynastic times knew how to collect yeast. Furthermore, we don't know if they were even aware of its existence and importance for beer production. For sure, yeast could not have come from the skins of fruits because none remains of them have ever been observed in beer residues (KUBIAK-MARTENS & LANGER 2008: 427). The only alternative left was so called spontaneous fermentation, in which the yeast cultures get into the wort from the air. In such a way the first fermentation must have been carried out. For the next times, some amount of previously brewed beer could have been used as a fermentation starter (SAMUEL 2000: 556; KUBIAK-MARTENS & LANGER 2008: 435).

In the term of fermentation, we have to consider the possible location where the process could went on. In one hand fermentation could have been going on inside the brewery kiln itself. In this case the sieving must have been undertaken after the fermentation process. In the other hand the wort could have been transferred into other vessels after the sieving but before the fermentation. And for that we have some indications at Tell el-Farkha site. A few storage pits were found in close proximity to the brewery W192.



Figure 6. The youngest breweries from Tell el-Farkha – W272 and W273 (photo by M. CZARNOWICZ).

The organic material collected from the pottery sherds, connected to these objects, proved to have been beer remains. Moreover, these remains and only these remains contained the 100% sure traces of fermentation process – so called fermentation bubbles. After the fermentation, the final product – the beer was poured into the beer jars and then could have been stored, transported and distributed (CHŁODNICKI & CIAŁOWICZ 2005: 133; CICHOWSKI 2008: 37; KUBIAK-MARTENS & LANGER 2008: 437).

This recipe for Egyptian beer survived at least till the end of the New Kingdom period. We know that because of D. SAMUEL's analysis of *i.e.* Amarna's beer remains (SAMUEL 2000) which proved that the same beer brewing technology as in Tell el-Farkha was still in use after almost 2000 years.

#### COMPARISON BETWEEN THE BREWING INSTALLATIONS USED IN TELL EL-FARKHA WITH THOSE FROM HIERAKONPOLIS AND ABYDOS

Coming to the most important question posed in this paper, we have to compare the breweries from Tell el-Farkha site with the installations known from Upper Egypt.

In the late Naqada I/early Naqada II the process of so called *First Industrialization* can be observed (WENGROW 2006: 92-98). Many heating installations from this period were found in Hierakonpolis (GELLER 1989: 43; FRIEDMAN & GELLER 2007). Kilns from HK24A, HK24B and HK11C:OpB are believed to be the remains of the breweries

but they could have been also used for production of the other cereal food (SHIRAI & TAKAMIYA 2010: 22). Mentioned ovens differ in size, external shape and the detailed arrangement of the vats seats but the general idea of composing the vats in two-parallel-rows seems to be indicated.

One of these early structures, so called Operation B, is particularly interesting. In the first phase of exploitation this structure was a multifunctional kiln used in the pot and food (in particular beer) production processes (BABA 2008: 18-19). In this food production part, we can see six vats, organized into two parallel rows but with a big gap between them. The structure has got thick external walls with well-visible stoke-holes. The organic material extracted from the vats proved that beer was one of the product of this installation. The radiocarbon date for Operation B is 3762-3537 cal BC, which allows one to correlate it to Naqada IC-IIB period (BABA 2007: 27; 2009: 24).

The specially constructed vat seats are one of the characteristics of these early breweries but their construction was completely different than that known from Tell el-Farkha. In Operation B the vat supports are made of big and small pot sherds mixed with mud, sometimes even rocks were in use (BABA 2007: 27; 2008: 18-19; 2009: 24).

The early stage of brewing installations' development represented by kilns: Brewery HK24A, heating installation HK24B and by Operation B has little to do with Tell el-Farkha breweries. The only structural similarities are: the presence of big vats, the presence of specially prepared vat seats and general idea of layout of the kiln. For brewing technology, the late Naqada I/early Naqada II seems to have been the formative period, full of experiments and different solutions. It is worth to mention that such period is lacking in Tell el-Farkha, where breweries seem to be at the fully developed stage since the very beginning of their existence at the site (CIAŁOWICZ 2008: 200-209).

There is one brewery from Hierakonpolis 11C coming from Naqada IIB-C. It's called Operation A. Looking at its plan we can see some important changes or improvements in relation to the earlier brewing installations. First of all we have here very clear composition of two parallel rows of vats. Although one of shorter sides of the structure is missing, it is quite easy to observe that the original general shape of the kiln used to pose an elongated rectangle. Vats are located closer to the external walls, in which many stoke-holes and one probably ventilation-hole are present. The biggest change occurred in the construction of the vat seats. Specially formed mudbrick fire-dogs (mostly D-shaped in cross section) are the supports now, instead of sherd-mud mixture known for example from Operation B. An extraordinary shape of some of these fire-dogs, have no analogy elsewhere (AOKI & TAKAMIYA 2005: 18; TAKAMIYA 2009). The elongated general shape and clear two-parallel-rows-of-vats arrangement are also typical for the earliest breweries from Tell el-Farkha, these dated to the I phase of site's occupation. Unlike to Operation A, Tell el-Farkha breweries have a general shape much more associated to the circular shapes of vats set in their seats (CICHOWSKI 2008: 37-40). This association is visible very well in the younger breweries from Tell el-Farkha site. Last but not least difference which has to be emphasize is the composition of rows of vats.



In Operation A, as in the previously described earlier breweries from Hierakonpolis, the vats are arranged in simple parallel way. On the contrast, in Tell el-Farkha we deal too with two parallel but also overlapping rows. The vats from one row are filling the gaps between the vessels of the other row (CICHOWSKI 2008: 40).

In developed stage the new idea of constructing the vat seats were introduced. This innovation together with well established two vat rows idea seems to be the most important for the further development of breweries. According to that what we know from earlier stage, the Upper Egyptian genesis of this two rows arrangement of the vats seems to be so probable that almost obvious. Case of fire-dogs is not so easy though. The same type of bricks was detected in Upper and in Lower Egypt. Operation A is dated to the same period as the earliest Tell el-Farkha breweries: W201A (joint with the 1 phase of W200), W201, W200 and W192 (AOKI & TAKAMIYA 2005: 18; CICHOWSKI 2008: 40 TAKAMIYA 2009). Is it a simple coincident that so important innovation appears probably at that same time in Upper and Lower Egypt alike?

The youngest breweries coming from Upper Egypt are kiln structures found a hundred years ago in Abydos (PEET & LOAT 1913: 1-7; PEET 1914: 7-10). On the plan of so called Brewery from Abydos the influences of both sides – Upper and Lower Egyptian – are easily recognizable: we deal here with the structure of elongated rectangular shape on the one hand and the vats arranged into two parallel but overlapping rows in the other hand (PEET & LOAT 1913: 4; PEET 1914: 7).

The way of constructing the vat seats themselves is practically the same like in all Tell el-Farkha breweries and in Operation A from HK11C. It has to be emphasized that vat seats with mudbrick fire-dogs must have very well served its purpose, since they actually didn't change since the Naqada IIB.

In the late stage we can observe mixing of the two, Upper and Lower Egyptian, brewing technology tradition. The date (which is quite late) itself is not the reason or not the only reason of that both sides influences. We cannot avoid the geography, according to which, Abydos lies to the north of Nekhen, so it was always closer to Delta. We cannot forget also about the great importance and political power of the rulers of Abydos in the late Predynastic or Protodynastic times. It's a fact that constructors of brewery and so called D-group kilns (which most probably also were breweries) knew the both traditions mentioned/or rather their local tradition was formed by the mixing ideas from north and south.

#### **SCHEMATIC CHRONOLOGICAL VIEW OF BREWING DEVICES' DEVELOPMENT**

The large-scale-production (by which we mean the production of goods, which were used not only as a source of supplying the local inhabitants but also could have been served for other purposes) in Egypt started in the transitional late Naqada I/early Naqada II period and it was related to the so called *First Industrialization* which occurred at this time and which proves that big socio-economic changes were going on then (WENGROW 2006: 92-98).

So far the formative stage of breweries development is proved only for Upper Egypt – it has been observed at the site of Hierakonpolis. This stage is still lacking in Delta region. Nothing like that has ever been found at Tell el-Farkha, where breweries seem to have appeared as the fully developed devices from the very beginning (CIAŁOWICZ 2012a: 151-160, 162; CICHOWSKI 2008: 37-40). That is why the leading hypothesis is that the beer making idea and the special constructional solutions were brought to Tell el-Farkha



Figure 7. The so called “Olympic Rings” on structure W200 (photo by R. ŚLABOŃSKI).

from somewhere outside. The dating of the brewing installations themselves is telling us something about the time when it must have happened – in Naqada IIB. In that period a crucial improvement in constructing the brewing devices is observed in the south as in the north of Egypt. Operation A from Hierakonpolis detects a very significant similarity to Tell el-Farkha breweries – the introduction of mudbrick fire-dogs (these D-shaped in section) as the vat supports. This innovation was used in all younger breweries. For that reason from that time we are talking about developed stage.

The roots of innovation mentioned above are still unidentified, because, according to the dating, it appeared in Hierakonpolis and Tell el-Farkha in the same time (AOKI & TAKAMIYA 2005: 18; CIAŁOWICZ 2012a: 151-160, 162; CICHOWSKI 2008: 37-40; TAKAMIYA 2009). This solution could have been invented in the previous periods in some other place, from where it could have been brought to both mentioned sites in Naqada IIB. There is also a possibility that it was Hierakonpolis where the innovation was introduced but in that case it must have spread northward very fast.

In the next periods, Naqada IID and Naqada IIIA, the only brewing installations we have are the younger breweries from Tell el-Farkha. Their general layout proves some evolution. The shape of the kilns evolved from elongated to much compact forms of so called three-leaf-clover shape (CHŁODNICKI & CIAŁOWICZ 2001: 93; 2002: 70; 2009: 170-171). The shortening tendency of younger Tell el-Farkha breweries might have been caused by different reasons and for different purposes. Maybe the smaller-sized breweries were more practical to build and maintain. The needs of site’s society could have changed. It is a possibility that small breweries were used to producing beer only for some particular small groups of inhabitants like specialized workers or elite from the residency (CIAŁOWICZ 2012b: 163).

Two other important features were observed first or only in Lower Egypt: the two overlapping rows of vats and the general shape of kiln closely associated to the circular

shape of vats, so called “Olympic Ring” Pattern (Fig. 7; CICHOWSKI 2008: 37-40). These last solution remained unknown in the south, where the oblong rectangular shape of kilns was dominant.

Finally in the last stage of brewing devices’ development the mixing of both Upper and Lower Egyptian traditions can be observed (Tab. 2).

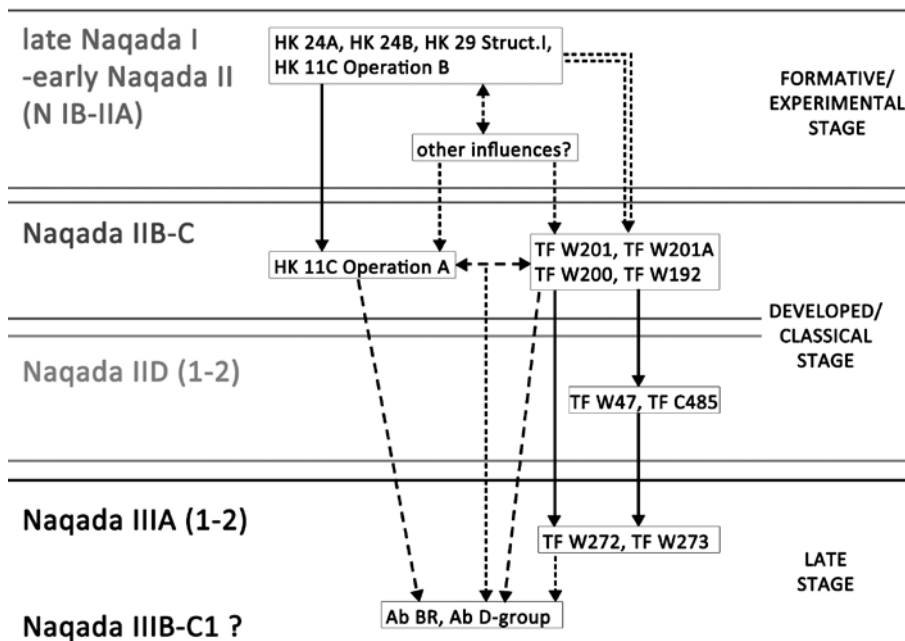
## CONCLUSIONS

After the Upper/Lower Egyptian breweries’ comparison, we are able to draw some characteristics of both brewing installations’ constructing traditions:

1. Upper Egyptian traditions:
  - elongated rectangular shape;
  - two parallel rows of vats;
  - stoke holes.
2. Lower Egyptian traditions:
  - shape strongly related to the circles of the vat seats;
  - overlapping parallel rows of vats.

Using the D-shaped, in cross section, mudbricks as vat supporting fire-dogs were observed in both areas and the roots of this innovation remained unidentified.

Table 2. Chronological development of brewing devices.



The size of earliest breweries proves that beer production in large scale was carried on. Although the oldest devices, dated to Naqada IB, come from Upper Egypt (Hierakonpolis), it doesn't mean that the recipe was invented in that time and place. Since it was relatively easy to brew the beer, we can suspect that the first ideas of beer-making can be older than above mentioned period. The beer recipe could have Naqadan roots but it's also possible that it was invented elsewhere, outside the Upper Egypt. The most important is that the recipe was first used for the large-scale-production in Hierakonpolis and that in Naqada IIB it become common probably in the whole Egypt.

Thanks to breweries-case studies, we can try to tell something more about nature of interactions between Upper and Lower Egyptians in Naqada II period. The simple Naqadans Ride North Model doesn't fit the actual situation, because very intensive contacts between both discussed regions can be observed long before Naqada IID period, which is believed to be the time of Naqadan "expansion". Early date for Tell el-Farkha breweries W201A and W200 – Naqada IIB (CIAŁOWICZ 2012a: 151-160, 162; CICHOWSKI 2008: 37-40) proves that, if beer-making was really a Naqadan concept, it must have spread to Delta rather throughout migration of ideas than the migration of Naqadans themselves. The strong not-Upper Egyptian tradition, which is clearly visible in brewing devices' constructing method in Tell el-Farkha suggests that maybe there was not something like Naqadanization of Lower Egyptian culture or that the acculturation was not as strong as it was previously thought. It must be emphasized that the Upper and Lower Egyptians contacts in Naqada II period were very intensive and that not only Naqadans influenced the north but they were also strongly influenced by the inhabitant of Delta.

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