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Two Firing Structures from Ancient Sudan: An Archaeological Note

Sébastien Maillot*

The Kushite temples of Amun at Dukki Gel¹ and Dangeil² (*fig. 1*) feature in their precincts large heaps of ash mixed with ceramic conical moulds (or “bread moulds”), which are dumps associated with the production of food offerings for the cult. Excavation of the areas dedicated to these activities resumed in 2013 at both sites, uncovering numerous firing and storage features. This paper will focus on two atypical firing structures discovered last season.

The Firing Structures

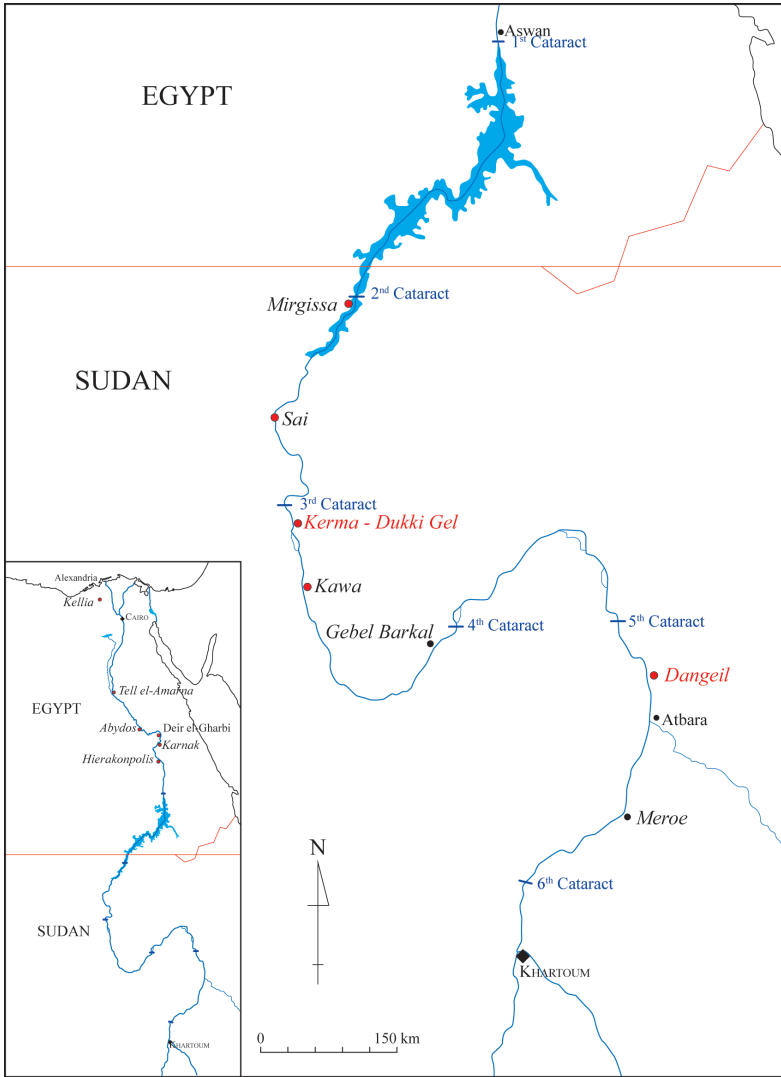
Dukki Gel

The annexes situated west of the Napatan–Meroitic temples were uncovered in 2003–2006, but are the object of new excavations in order to get an accurate idea of their chronology and their use. They are organized in several units structured around a long court, with two openings leading to the sacred wells and the temples to the east. Research has focused on the northern units, which comprises five spaces including an entrance hall, two rooms devoted to storage and one to butchery, and a small courtyard to the west. Reasonably good

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- 1 Joint Swiss-French-Sudanese mission of Kerma-Dukki Gel, directed by C. Bonnet (Institut de France), D. Valbelle (University of Paris-Sorbonne/Paris IV), Abdelrahman Ali Mohamed Ali (NCAM), and S. Marchi (CNRS/UMR 8167), sponsored by the French Ministry of Foreign Affairs, the University of Paris-Sorbonne/Paris IV, the CNRS (UMR 8167), the Foundation Kerma, and the National Corporation of Antiquities and Museums, Sudan (NCAM).
- 2 Berber-Abidiya Archaeological Project (BAAP), mission of the National Corporation for Antiquities and Museums of Sudan (NCAM) in collaboration with the British Museum, directed by J.R. Anderson (British Museum), Mahmoud Suliman Bashir (NCAM), and Rihab Khider el-Rasheed (NCAM).

Fig. 1. Map of Sudan and Egypt with the archaeological sites mentioned in the text.



preservation of the archaeological remains in this sector allows us to define three major phases related to the successive reconstructions of the western wall of the annexes. The court contains many bread ovens as well as ceramic granaries, and is characterized by the accumulation of layers due to a continuous activity. This phenomenon led to the abandonment of the first western wall, and soon thereafter a group of circular bread ovens was set directly in its brickwork (fig. 2).

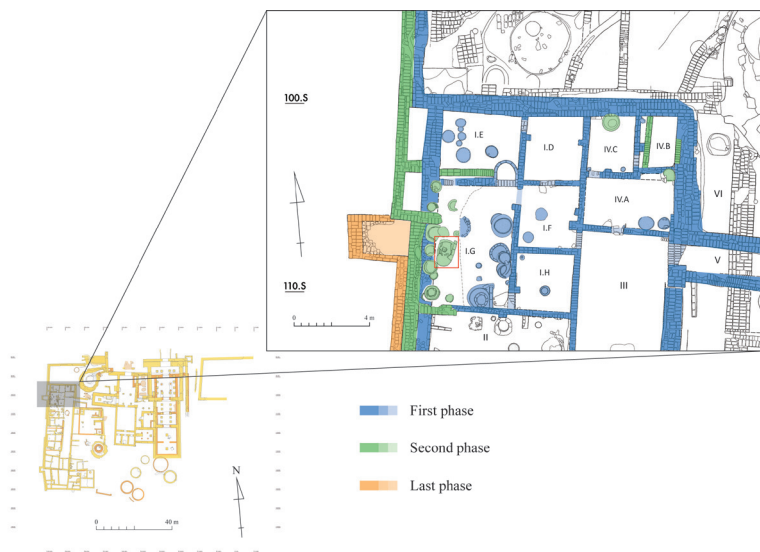


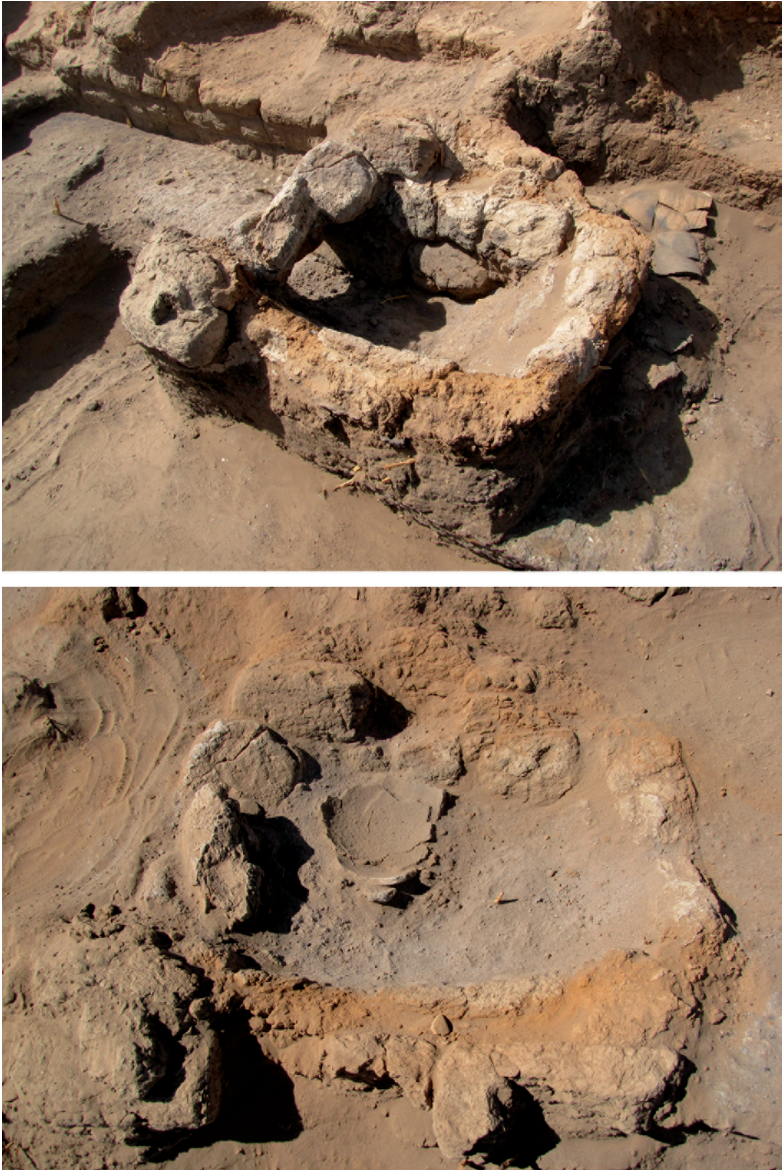
Fig. 2. Plan of the northern units of the annexes of the annexes (Dukki Gel) (© Joint Swiss-French-Sudanese Mission of Kerma - Dukki Gel).

A quadrangular mud brick structure (L. 1.05 × W. 0.85 × H. 0.46 m; internal dimensions L. 0.55 × D. 0.45 m) filled with ash is also contemporaneous with this intermediate phase (fig. 3); it is situated along the abandoned wall, and cuts the surrounding layers. The installation is built with recovered materials (complete or fragmented bricks) probably coming in part from the wall. The brickwork is flared and roughly arranged, the courses overlapping each other; the bricks do not stand by themselves but rest actually on the walls of the hole dug to set the structure. The mud bricks are heavily reddened by heat, especially in the lower courses, and the internal faces of the lowest bricks are strongly hardened by encrusted ash. There is a rounded opening (around 15 cm high, 14 cm wide) on the southern side, quite irregular, preceded by a pit (fig. 4).

Examination of the southern profile of the structure revealed an earlier underlying structure, probably of similar use, with a 20 cm gap towards west. The visible remains of this earlier structure consist of a fill of ash between two bricks, partly cut by the later pit and the construction of the subsequent installation (fig. 4).

The later structure contained few bread mould fragments, some pieces of dried and burnt mud, and a certain number of Napatan jar sherds, some of them covered by soot. We should also note that part of a layer with large jar sherds covered by soot was discovered to the north of this structure. The material coming from the associated pit is composed mainly of bread mould sherds (over 350 fragments), some of them charred or reddened (wasters). A dokka fragment and some possible cooking pot sherds were also present in this pit; fur-

Fig. 3. Original (top) and last phase (bottom) of use of the Dukki Gel firing structure (© Joint Swiss-French-Sudanese Mission of Kerma - Dukki Gel).



thermore, the opening of the structure may have been blocked at some point by lid fragments (a handle has been recovered in front of this opening). Ash accumulated inside as well as in front of the firing structure, covering completely the opening on the south; nevertheless it was probably still in use when the opening was blocked, as

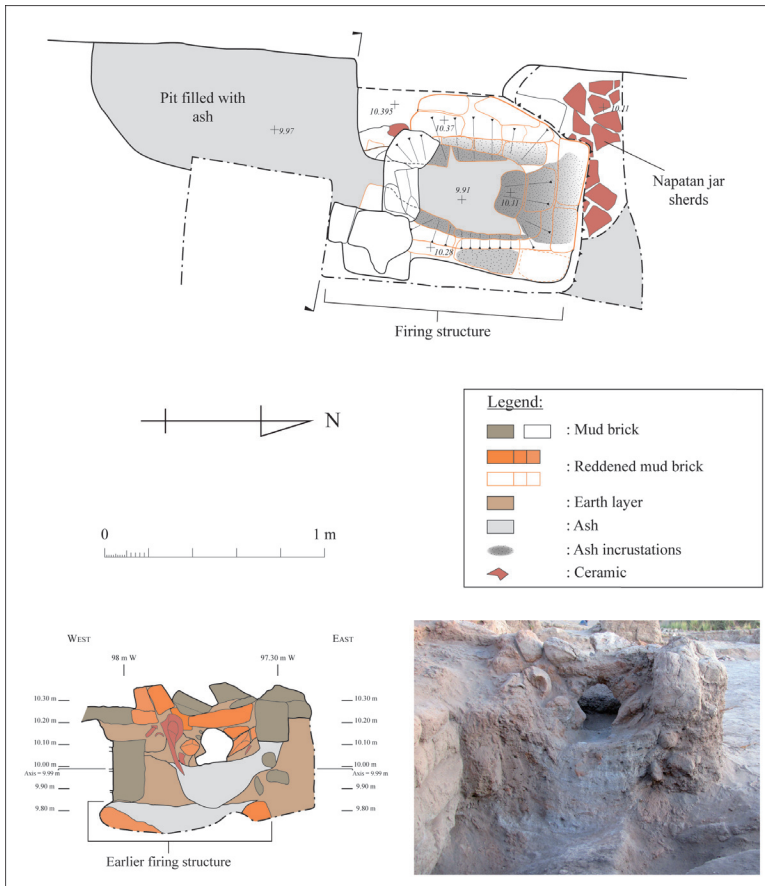


Fig. 4. Plan and southern profile of the Dukki Gel firing structure, including a section through the pit filled with ash in front of the installation and an earlier underlying firing structure (© Joint Swiss-French-Sudanese Mission of Kerma - Dukki Gel).

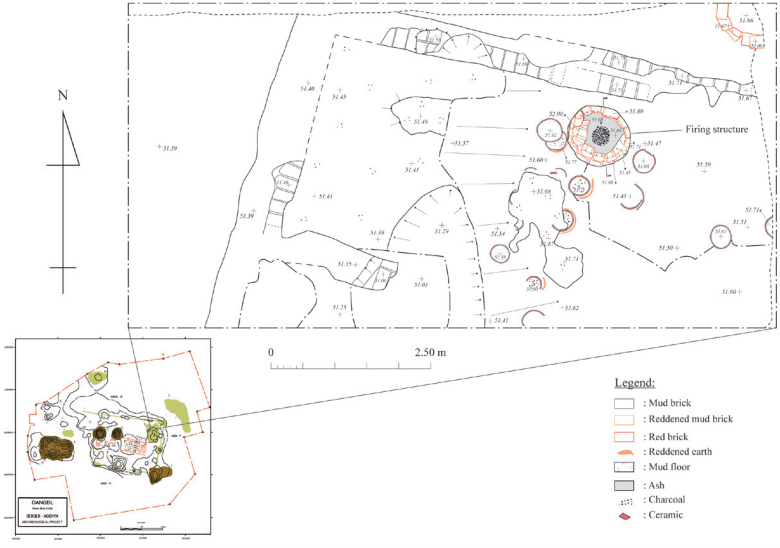
we found an almost complete cooking pot (charred on the exterior) in the upper fill of the installation (fig. 3 bottom).

Dangeil

The sounding in the large rubbish heap situated behind the Amun temple (to the east) was dug along its northwestern edge. So far, we are able to identify two phases of use before the abandonment of this sector: the earlier phase was partially uncovered, and can be characterized by leveled mud brick walls associated with an irregular mud floor. The second phase is not associated with any architectural remains, but contains more than 15 ceramic vessels set into the ground, with their upper part removed, probably reused as cooking fireplaces and storage features (fig. 5).

This later phase, dated by the ceramic material to the Meroitic period, also features a circular structure (diameter ca. 0.95-1 m, in-

Fig. 5. Plan of the sounding dug in the rubbish heap to the east of the Amun temple (Dangeil) (© Berber-Abidiya Archaeological Project).



ternal diameter about 0.60 m, with a maximum height of about 0.40 m) built mainly in red bricks with a fill of ash and charcoal (figs. 5 & 6). Its setting cuts surrounding layers, especially the northern wall of the earlier phase. It is also composed of a few damaged, crumbly mud bricks, reddened by fire. There are two rows of sailors (bricks put on their end) on the southern half, and one row on the northern half, forming flaring walls; there is no evidence of a second course. Bricks are bound by mud mortar, and the joints are also blocked by brick fragments. Their internal facing is covered by a very thin layer of white and grey incrustated ash, under which the brick is more or less charred. The structure’s walls are founded on a leveling layer of crumbly earth. Examination of the fill in section shows at least three stages of use that alternates layers of white ash and charcoal pieces with earth layers, probably corresponding to episodes of cleaning in the structure (fig. 7). However, the last stage was not cleaned, and we are thus able to see the outcome of the feature’s use, consisting of a thick layer of white ash (ca. 9 cm) topped by a dense concentration of charcoal pieces. The structure was then filled in the upper part by strata of ash mixed with loose earth and conical mould fragments, which are actually quite similar to the dump deposits covering the sector after its abandonment.

Although the feature walls are bonded, the excavation has shown that the brickwork was too much fragile to stand on its own without falling apart, which is due to its flared shape, and possibly rested on the filling of the hole dug in the surrounding layers. The installation does not look to have been built initially with two rows of bricks: the



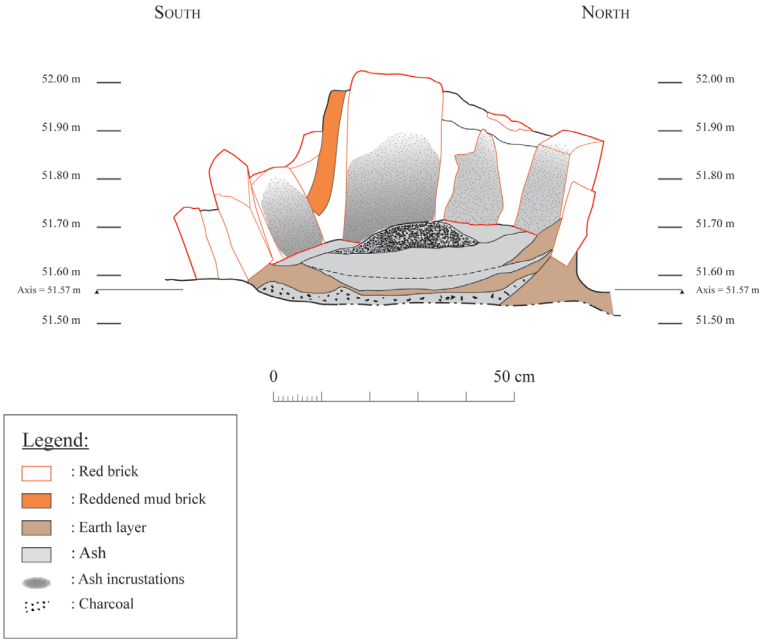
Fig. 6. Dangeil circular firing structure (© Berber-Abidiya Archaeological Project).

inner row on the southern half could actually be a reconstruction. Indeed, it was observed in the section that the earlier fills, corresponding to the first stages of functioning, pass under the first row of bricks to the south whereas, above, the last layers rest against the inner facing of this row of bricks (*fig. 7*). Therefore, it reveals that the original structure was built with only one row of bricks (external row), and that the inner row was added later on. Furthermore, it is also clearly visible that the fills were cleaned from the top as we observe the successive layers being more and more basin-shaped (*fig. 7*). Incrustations on the inner faces of the bricks, generally concentrated on the lower two-thirds, suggest that the structure was usually filled with hot ash up to this point. The fills contemporaneous with use do not contain any archaeological material, but some charred textile or rope fragments were found at the interface between those fills and the upper layers, which were presumably deposited after the structure fell out of use. Therefore, we cannot conclude that they are connected to the functioning of the structure.

Discussion

The structures from Dukki Gel and Dangeil share some characteristics: they are both enclosed brick installations, with flared walls, set into a hole, not covered on the top; they are filled with ash and display traces of fire or high temperatures (charring, reddening, ash incrustations, etc.). However, the Dukki Gel firing installation has

Fig. 7. Section of the Dangeil firing installation (© Berber-Abidiya Archaeological Project).



an opening and is associated with a pit on one of its sides, unlike the feature from Dangeil.

Baking Installations?

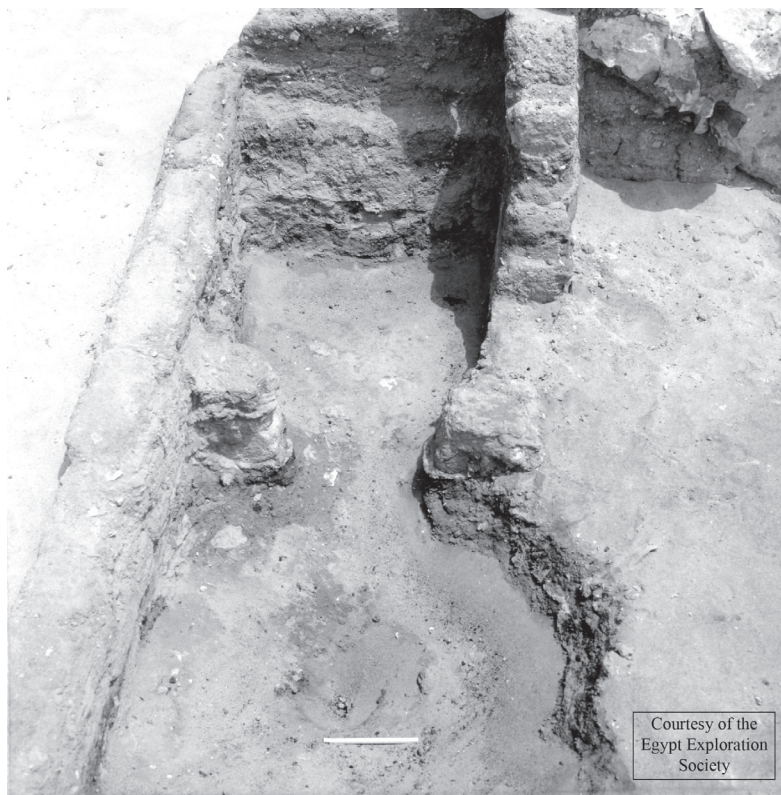
Several installations similar to the Dukki Gel feature are known in Sudan and in Egypt as well, associated with baking activities according to the excavators. In Sudan, we can find our first parallel at the Middle Kingdom site of Mirgissa, in the “ville ouverte” to the

northeast of the fortress, published as MKC2 by Rotislav Holthoer.³ Sets of rectangular fireplaces, delimited by mud brick walls, were discovered in the antique town of Kerma, notably in the vicinity of the eastern fortifications of the Kerma Classique town,⁴ as well as in the annexes (E XVII and E XX) of the chapels in the secondary settlement (Kerma Moyen and Kerma Classique) to the southwest.⁵ Rectangular mud brick features were also uncovered in the sector to the south of the Treasury of Thutmose I (New Kingdom) at Karnak North.⁶ However, the most relevant structure may be the “box oven” discovered in the annex of Chapel 556 near to the Workmen’s Village at Tell el-Amarna.⁷ Indeed, this oven, situated in a corner, is made of mud brick walls (reddened by heat to a depth of 2 cm⁸), measuring 0.75 × 0.64–0.66 m, with an opening at the base on one side and a pit filled with ash in front of it (fig. 8).⁹ The structure MKC2 (L. 0.90 × W. 0.70 m, with a height of 0.50 m) has the same characteristics, except for the pit which is lined with mud. The rectangular firing features discovered at Karnak North also have an opening at the base and a pit full of ash in front of it,¹⁰ and moreover, some of them are dug in the surrounding ground.¹¹ The fireplaces of Kerma are generally arranged in alignments of 4 to more than 10 features opened on one side – measuring each ca. 1–1.20 × 0.50 m¹² – which are rebuilt several times. Besides a range of equivalent dimensions, one of the most recurrent characteristics is the opening at the base on one side of the installation, associated with a pit full of ash: more than a stoke-hole used for draft to activate the fire, the opening was probably also used to load the fuel and to clean regularly the ash accumulated inside the structure.

The archaeological material associated with these installations consists mainly of conical and cylindrical bread moulds; some were even found stuck in the ash within the installations.¹³ Egypt-

- 3 HOLTHOER, *New Kingdom Pharaonic Sites*, p. 16, pl. 72.2; the feature is actually located in the “Northern town” in this publication, but it is most likely situated in the “ville ouverte,” see VERCOUTTER, *Mirgissa I*, p. 11, fig. 4.
- 4 BONNET, “Fouilles archéologiques de Kerma (1986–1987 et 1987–1988),” p. 10, fig. 6; BONNET, *La Ville de Kerma*, pp. 85–86, fig. 51–52.
- 5 BONNET, “Fouilles archéologiques de Kerma (1993–1994 et 1994–1995),” p. 38; BONNET, “Fouilles archéologiques de Kerma (1995–1996 et 1996–1997),” p. 106, fig. 5.III–IV; BONNET, *La Ville de Kerma*, pp. 192, 194–96, fig. 117–119.
- 6 JACQUET, “Fouilles de Karnak-Nord. Quatrième Campagne, 1971,” pp. 154–55, pl. 1; JACQUET, *Karnak-Nord V*, vol. 1, pp. 82–84; JACQUET, *Karnak-Nord VII*, vol. 1, pp. 88–102.
- 7 KEMP, “Report on the 1986 Excavations: Chapel 556,” pp. 73–76.
- 8 *Ibid.*, p. 76.
- 9 *Ibid.*, fig. 6.4.
- 10 JACQUET, “Fouilles de Karnak-Nord. Quatrième Campagne, 1971,” p. 154, pl. 1; JACQUET, *Karnak-Nord V*, vol. 1, pp. 82, 84, vol. 2, pl. LVI c; JACQUET, *Karnak-Nord VII*, vol. 1, pp. 88–100, 143, vol. 2, pl. xxxiv, xxxvi–xxxix, XLIV–XLV.
- 11 JACQUET, *Karnak-Nord VII*, vol. 1, pp. 88–92, 97, vol. 2, pl. xxxiv, xxxvi–xxxviii; see also oven 404: *ibid.*, vol. 1, p. 99, vol. 2, pl. xxxix A, XLIV B.
- 12 BONNET, *La Ville de Kerma*, p. 86.
- 13 Kerma: *ibid.*; Amarna: KEMP, “Report on the 1986 Excavations: Chapel 556,” fig. 6.5–6.6.

Fig. 8. “Box oven” discovered in Chapel 556 at Tell el-Amarna, preceded by an ash pit (after Kemp, “Report on the 1986 Excavations: Chapel 556,” fig. 6.4; courtesy of the Egypt Exploration Society/B. Kemp).



tian iconographical sources, such as the bakery and brewery model from the tomb of Meketre (Twelfth Dynasty)¹⁴ or a scene from the tomb of Antefoker (Twelfth Dynasty),¹⁵ tend to confirm that baking of conical loaves was made in rectangular ovens with an opening at the base, and not covered on the top. These parallels, along with the high quantity of bread mould sherds in the pit of the Dukki Gel firing structure, would then indicate the structure described above is an oven dedicated to the baking of conical bread loaves. The most recently published research on conical bread moulds of the New Kingdom has shown it was likely the dough was placed into the moulds before being heated and baked in ovens.¹⁶

However, careful examination of the context of discovery of the “box oven” in Chapel 556 (Tell el-Amarna) and its filling of complete ceramic moulds¹⁷ led some to consider the “box oven” as a ceramic

14 WINLOCK, *Models of Daily Life*, fig. 22-23, 64.

15 DAVIES, *The Tomb of Antefoker*, pl. XI-XII; KEMP, *Ancient Egypt*, fig. 43.

16 SAMUEL, “Staff of Life,” pp. 270-77; KEMP, SAMUEL & LUFFE, “Food for an Egyptian City,” p. 148; see also the discussion in BONNET, *La Ville de Kerma*, pp. 14, 86.

17 KEMP, “Report on the 1986 Excavations: Chapel 556,” fig. 6.5-6.6.

firing installation, and experimentation was undertaken in order to validate this hypothesis.¹⁸ Based on the model from Chapel 556, a new structure was reconstructed in mud brick,¹⁹ the fuel (palm fronds and dung) was inserted from the pit through the opening at the base, and the ceramic moulds loaded from the top. It was then covered by large pottery sherds, as observed in modern pottery workshops of Deir el-Gharbi in Upper Egypt.²⁰ Two firings were carried out with batches of replicated moulds, reaching respectively temperatures of 470°C²¹ and 560°C,²² whereas analyses of the ancient bread moulds revealed they had been fired between 450°C and 600°C.²³ Structure MKC2 is also thought by Paul Nicholson to have served for firing bread moulds.²⁴ This interpretation could also be applied to the rectangular installation of Dukki Gel, as we have found in its fill and nearby many large jar sherds covered by soot, which may have been used to cover the structure during the process of firing;²⁵ the function of such a cover was most likely to minimize heat loss, and maintain a certain atmosphere for the firing process.

Cooking or Brewing Installations?

Unlike the case of Dukki Gel firing structure, there are few parallels to the Dangeil circular installation. However the rare examples known on Sai Island and in Kerma may lead us to interpret this as a cooking feature. In the Egyptian fortified town of Sai, dwelling H5 (SAF, probably mid-Eighteenth Dynasty),²⁶ to the south of Temple A, contains several fireplaces dug into the ground and lined with bricks positioned on their edge.²⁷ A somewhat similar feature was discovered in the cooking area of the Napatan house associated to the pottery workshop excavated in Kerma: oven F3 (0.60 m of diameter and 0.66 m of depth) is a circular pit with flared and fired walls, which are not lined by bricks;²⁸ this installation was thought by Salah Mohamed Ahmed to be “probably dedicated in the different houses to specific cooking functions.”²⁹ Looking at the Dangeil structure, the presence of many charcoal pieces and of ash incrusta-

18 NICHOLSON, “Purpose of a ‘Box Oven.’”

19 *Ibid.*, p. 242.

20 NICHOLSON & PATTERSON, “Pottery Making in Upper Egypt,” pp. 230–31.

21 NICHOLSON, “Purpose of a ‘Box Oven,’” p. 249, table 11.1.

22 *Ibid.*, p. 251, table 11.2.

23 *Ibid.*, p. 242.

24 NICHOLSON, “Firing of Pottery,” p. 108; indeed, the recovered moulds are complete or almost complete.

25 WELSBY, “Excavations at Kawa, 2007–8,” p. 35, pl. 2: in the room III of the domestic building A2 at Kawa, similar large pot sherds lying on the ground were interpreted as a floor for an hearth, but it seems less convincing in our case at Dukki Gel.

26 AZIM, “Quatre campagnes de fouilles sur la forteresse de Saï,” pl. IV.

27 *Ibid.*, p. 118.

28 SALAH EL-DIN MOHAMED AHMED, *Agglomération napatéenne de Kerma*, p. 78, fig. 6.

29 *Ibid.*, p. 98.

tions on the bricks suggests the use of embers and hot ash, in which a large cooking pot could have been buried, for instance to make a stiff sorghum porridge comparable to modern *aceda*.³⁰

Alternatively, the use of this firing installation within brewing processes may be considered.³¹ Indeed, modern malting in Western brewing processes includes a stage of heating germinated grains in water (60–65°C);³² furthermore, modern research has shown that Egyptian New Kingdom beer was probably made from two batches of heated and unheated malted grain.³³ During the Predynastic period, large ceramic vats supported by large bricks may have been used for this heating process, for example in Hierakonpolis and Abydos.³⁴ Nonetheless, the cereals associated with these contexts are wheat and barley, whereas in Dangeil, only sorghum was found. Until recently, two main malted sorghum-based beers were prepared in Sudan, the opaque *merissa* and the clear *assaliya*. After pointing out that modern sorghum malt preparation does not include any heating process,³⁵ we must recognize that our Dangeil firing structure might have been suitable for some other stages described in the preparation procedures of *merissa* and *assaliya*. For instance, opaque beer process includes the making of well-cooked and half-cooked porridges,³⁶ which could have been done in a cooking pot (see *supra*). *Assaliya* also involves porridge preparation, as well as the boiling of the preparation at different stages;³⁷ and it should be noted that beer preparations from other regions in Africa also often include heating.³⁸ All these heating procedures could have been done in the firing structure of Dangeil by embedding a large cooking pot or a beer jar in the embers and hot ash. Only a few cooking pot sherds have been recovered from the surrounding layers, but we have found on the other hand an important quantity of jar sherds.

We cannot exclude the possibility that the Dukki Gel firing installation could also be suitable for brewing beer, but no sign other than its flaring walls supports this hypothesis. However, it is clear the structure was used, in its latest phase, as a cooking fireplace; furthermore, its original shape bears some similarities with cook-

30 Analyses of botanical samples from the rubbish heap in Dangeil have revealed the use of *Sorghum bicolor* along with the ceramic conical moulds, and it has been proposed a kind of porridge was made, instead of bread: ANDERSON & AHMED, "Bread Moulds from the Amun Temple;" see also DIRAR, *Indigenous Fermented Foods*, pp. 114–16.

31 For the importance of beer and alcoholic drinks through the history of Sudan, see: *ibid.*; EDWARDS, "Beer and Kushite Society."

32 SAMUEL, "Baking and Brewing," p. 550.

33 *Ibid.*, pp. 553–54, fig. 22.2; SAMUEL, "Archaeology of Ancient Egyptian Beer," p. 9.

34 GELLER, "Recent Excavations at Hierakonpolis;" GELLER, "Beer in Egypt"; SAMUEL, "Baking and Brewing," pp. 540–41.

35 DIRAR, *Indigenous Fermented Foods*, pp. 85–88.

36 *Ibid.*, pp. 225–29, fig. 5.1.

37 *Ibid.*, pp. 272–75, fig. 5.5.

38 *Ibid.*, pp. 258–60.

ing stoves that were discovered in the Coptic hermitage at Kellia on the margins of the Western Delta. These are built of mud with a hole above the fireplace (internal diameter of 15–25 cm, height of 20–25 cm) to welcome the cooking pot, an opening at the base and sometimes a circular hole in front of it to clean out ashes.³⁹ However, the differences in the dimensions as well as the chronological and geographical distance do not make this comparison particularly relevant.

Conclusion

While there are some similarities between the Dukki Gel and Dangeil installations, it appears they have different functions: the firing structure of Dukki Gel possibly served first as a simple kiln for firing bread moulds, as well as an oven for baking conical loaves; whereas the circular feature of Dangeil might have been used for cooking sorghum-based meals or for brewery.

Lastly, we must draw attention on the paucity of parallels in the region, which currently prevents us from demonstrating our hypotheses, but, at the same time, should stimulate the growth of studies on ancient techniques in Sudan. The case of Dangeil is a good example, as the firing structure uncovered on this site may be seen as a purely Kushite installation, probably unparalleled anywhere.

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39 HENEIN & WUTTMANN, *Kellia II*, pp. 211–13, fig. 233.

chaeology, UK; National Corporation for Antiquities and Museums, Sudan; Nubian Archaeological Development Organization (Qatar-Sudan); University of Southampton, UK; Dr D. Bird, UK; University of Paris–Sorbonne, France; and Dangeil village, Sudan.

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