Iron smelting a vanishing tradition: Ethnographic study of this craft in South-west Ethiopia

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Abstract

Smelting of iron is a craft which is still practised in south-west Ethiopia. This study was done in 2000 and 2003; the last fieldwork had as a main objective to film the whole process of smelting and we now have this documented on 20 hours of film. The focus in this article is on the technological aspects of the work. The iron smelting is based on a shaft furnace made of clay with a slag pit. Pot bellows and two types of tuyeres are used to attach the bellows to the furnace. However, the ideology related to procreation is strongly emphasised and this is manifest in the terms used for the tuyeres which are the same as the male sexual organs indicating that the smelting process is metaphorically linked to sexual intercourse, the furnace is impregnated and gives birth to the bloom. The metaphorical association between birth and making iron is also manifested in the idea that the woman giving birth is polluted and so is the smelter. When a woman is giving birth she is brought outside to a specially erected hut, just as the polluting smelting activities takes place outside the village boundaries.

Résumé

Keywords: Ethiopia, iron smelting, technology, symbolism.

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Background to the study

The fieldworks were conducted in a village called Oska Dencha in March 2000 (Haaland *et al.* 2000) and in October 2003. During the last fieldwork we video recorded the whole smelting process. The team consisted of a camera crew of three people plus two anthropologists (Data Dea and Gunnar Haaland), and myself as archaeologist. The main reason why people are still smelting iron in the area is its remoteness. The nearest road was 100 km away and the village can only be reached by following a footpath crossing several mountain ranges.

We expect that the smelt we observed will be one of the last since a road is being made to the village of Kocha which is only one and a half days walk away, and with that scrap iron will be more readily available. The smelting of iron is very labour intensive involving a range of activities such as making charcoal, breaking the ore, making the furnace and the smelting itself.

Although I focus on the technology of iron smelting, I shall briefly draw attention to ideological and ritual aspects of items and activities involved. Iron workers are in Oska Dencha called *mana*.

The study area

Oska Dencha (about 225 households) is located at an altitude of roughly 2000 metres on the escarpment on the western bend of the Omo river, overlooking the Omo valley to the south, and the smaller Dencha river to the west (***Fig. 1***). The difficulties of access has so far discouraged traders, and has served to restrict import of bulky or heavy goods like scrap-iron. However on the weekly market day the village was visited by itinerant petty traders, who carry most of the goods on their back. They sell elementary consumer goods like cloth, sugar, and salt; and purchase coffee beans, wild cardamom and honey.

Human settlement in the region has partly been shaped by varying opportunities for agricultural and pastoral production in different environmental zones, and partly by considerations of defence - particularly in periods of unrest. The villagers are farmers and keep some livestock, mostly cattle, sheep and goat. The village is frequently raided for livestock and women by pastoralists from the lowlands.

The crops cultivated are ensete, teff, various types of sorghum, corn, maize, banana and some coffee. Coffee is still growing wild in the area. The main agricultural tool is the iron tipped digging stick used in an agricultural system based on shifting cultivation. Ox drawn ploughs are sometimes used for cultivating teff. Houses and cultivated plots are quite dispersed, and it takes more than one hour to walk from one end of the village to another.

The population of the village consists mainly of Tsara (also called Cha´ra) speaking people and is divided into ranked endogamous social strata associated with specific occupations. Intermarriage and commensality between members of different strata or castes are prohibited and leads to pollution of higher-ranking castes. Such pollution requires purification in order to avoid the danger of supernatural as well as social sanctions. Their low and impure status is expressed in the location of their settlement, at the outskirt of the village. Otherwise their houses were similar to Tsara farmers. Previously they were not allowed to own land and livestock, but today they cultivate as well as rear animals. In the past it was claimed that they were dependant on the chief for their food and in return had to provide iron objects.

In Oska Dencha the iron smelters belong to a social category in Tsara language named *mana.* The iron-workers consisted of four households all closely related and they were the only craft specialists of this category in the village. In addition to smelting, men performed iron forging while women did pot making. The Tsara also call the smiths *dimemana,* since they had immigrated from the Dime (for iron work among the Dime see Todd 1976, 1978, 1985).

The ethnography of the area

This is an ethnographically very complex region. The main languages belong to the sub-branch of Omotic languages. A major factor behind the cultural variation is the legacy of the several centralized kingdoms (e.g. Woleita, Gamu, Goffa, Dawro, Male, Konta, Kaffa) that emerged in the region from the 15th century. During the 19th century the area of Oska Dencha was part of the Konta kingdom, located at the south-western outskirt of this kingdom. The different kingdoms were partly in conflict and partly in alliance with each other. During the 18th and most of the 19th century southern and south-western Ethiopia was in a continu-

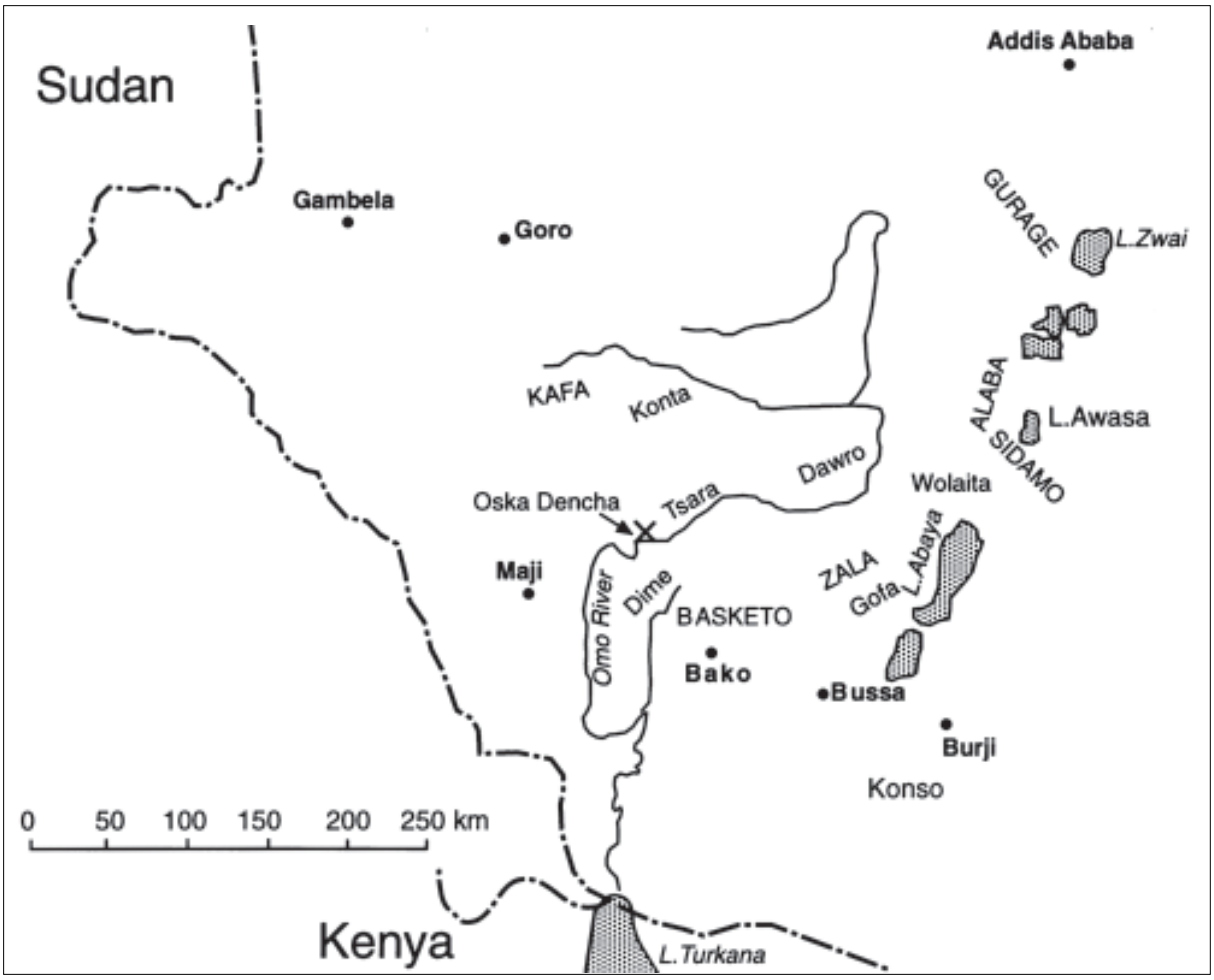

Fig. 1. Map of south-west Ethiopia showing location of Oska Dencha and some major groups.

ous state of war, and continued to be so, until Ethiopia was united by Menelik II during the last decades of the 19th century (Abir 1968: 73-74). Important networks of affinity and clan-ship criss-crossed the political boundaries between states. However, developments internal to different states served to create a certain variation in caste composition, as well as with regard to which occupations that were associated with specific castes. (Dea 1997).

The emergence of castes seems to be intimately connected to division of labour anchored in the centralized kingdoms' redistributive economic systems (see Haaland *et al.* 2004).

Iron working

In the following I describe different activities taking place in connection with iron smelting. The description is mainly based on our fieldwork in March 2000.

Preparation of ore

Iron ore is found along the hills at a one-hour walking distance from the furnace place. The ore is extracted from small pits with digging sticks. Nine men from the village and the master-smith, Chilacho, with two relatives and six people from the farmer caste worked together to dig out the iron ore. The smith insisted that he was the only person who knew where the iron ore could be found. He searched around to find the place were he knew good ore to be found. However, in the end it was one of the men from the village who spotted the place. Before extracting the ore the smith sat down to drink local liquor, but first he poured part of it on the ground outside the pit as a sacrifice to the god of his ancestors. They had to dig about three meters deep to find the good pieces of ore that occurs in bands along the hillside. The digging was heavy work and the men were frequently relieved to rest (every half an hour). Only three men could work together inside the pit. It took

Fig. 2. The uncle of Chilacho is crushing the iron ore.

around 5 hours to extract 73 kg of iron ore. Chilacho participated in digging but was also examining the ore very carefully and weighing it in his hands to pick out the good pieces to be used in the smelting. The smith later estimated that they did not extract enough ore and 34 kg was mined from the same place three days later. The total amount of ore was thus 107 kg. The ore was packed in bundles of grass and carried on the head back to the furnace place, where it was crushed (***Fig. 2***).

Preparation of charcoal

The same group of men who extracted the ore also prepared the charcoal. They picked out three very big dried and partly charred hard-wood trees that had previously been partly cut in connection shifting cultivation. This was considered sufficient for one smelt. The making of the charcoal took place a few hundred meters from the furnace to which it was brought in eight large grass bundles.

Making of tuyeres

The master smith and his wife made the tuyeres. They made 15 small ones (*zeida*) and 15 of the larger flared type (*tsole*). *Tsole* when translated means penis and *Zeida* means the foreskin of the penis (both names are in the Tsara language). The clay used was the same type of clay used for making pots. The tuyeres were sun-dried or put close to the fire for drying, a process that took about 24 hours. The tuyeres were made in the blacksmith's homestead, just outside the hut (***Fig. 3***).

Making of the Furnace

The furnace was erected outside the homestead in bush land in an area located below the village. This was said to prevent people who were unclean (mainly menstruating women) to harm the smelting operation. The smith re-used a furnace from earlier smelts (***Fig. 4***). This was possible since the furnace was not destroyed after each smelt as the bloom was removed through the top. This is different from other areas in Africa were the furnace is knocked down to take out the bloom, and a new furnace has to be made each time they are smelting (Haaland 1985). According to the smith the furnace can be re-used several times if it is not too damaged. The furnace had some cracks that were repaired by a mixture of clay and water.

Fig. 3. Drying of tuyeres (photo Randi Haaland).

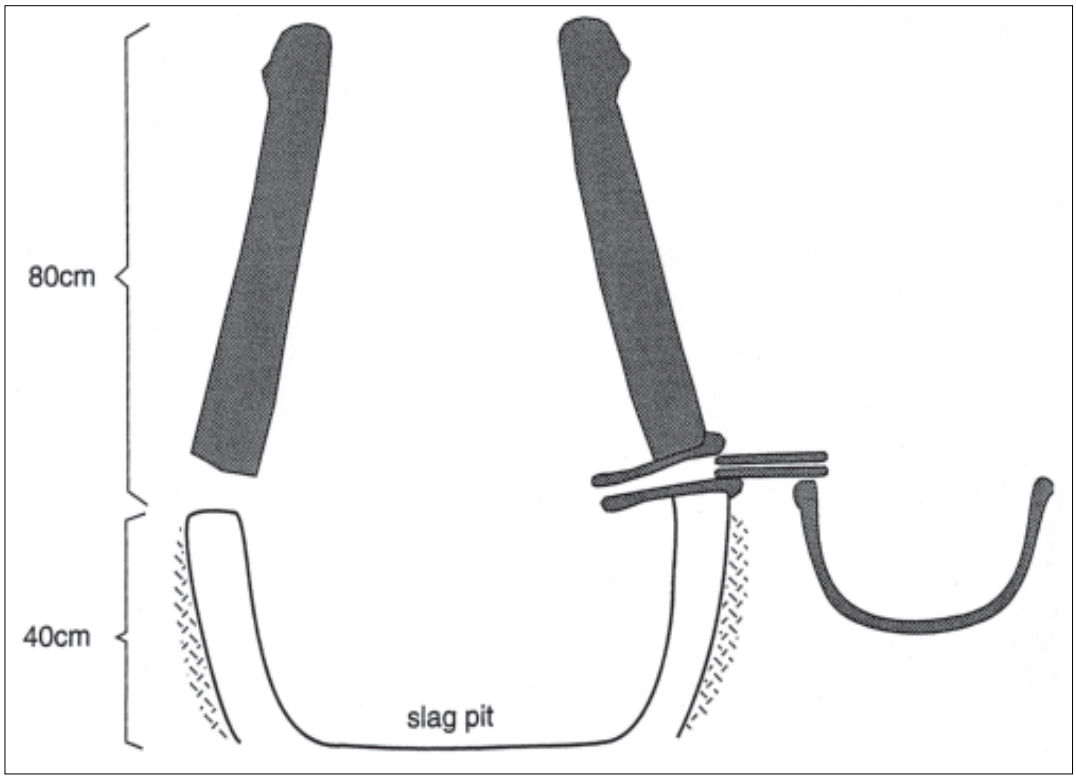

Fig. 4. Cross-section of the furnace with pot-bellows and tuyeres put in place.

Fig. 5. Chilacho has stepped into the furnace pit naked, and is lining the slag pit with clay blocks (photo Gunnar Haaland).

In the fieldwork we did in 2000 we did not observe the construction of a new furnace. However, during our new visit in October 2003 Chilacho organised the activities needed to make a new furnace. The same group of men who were involved in charcoal making and digging of ore mixed clay and water with straw from teff to make the new furnace. Before the work started Chilacho poured some local beer on the ground around the heap of ore as well as on the old furnace. Three or four men were kneading the clay with their feet. This is heavy work and the group of men involved were relieved at regular intervals. When the clay was considered properly mixed, it was left until the next day, and covered with banana leaves to keep it moist. The same group of men shaped the clay into clay blocks (about 30 cm long and 12-13 cm wide and high) that were to be used for the furnace wall. Before constructing the wall Chilacho dug a pit (the slag pit) about 40 cm deep and 50 cm in diameter. When the pit was completed Chilacho tied a creeper branch around his waist above his pants. Then suddenly he took off his pants and went into the pit naked only slightly covered with the leaves of the creeper (***Fig. 5***). While he was sitting in the pit clay blocks were handed to him and he started constructing the furnace wall from the bottom of the pit, gradually building it upwards and above the soil surface. The wall construction below soil surface thus looks like lining, while the part above surface is what looks as the wall proper. The people involved in making the furnace were restricted to Chilacho and his closest family. The group of people from the village that helped in digging for ore, making charcoal, mixing clay for the furnace were not involved in the activities directly connected with smelting activities.

Chilacho did not manage to complete the construction of the furnace. The walls collapsed when it was half finished. The reason for this he said was that he had been in a hurry and had not allowed the walls to dry (by sun and by firing) the required 9-10 days. Chilacho told us that when the construction of a new furnace was completed he used to sacrifice a goat and sprinkle its blood on the furnace walls.

Making pot bellows

Both during the observations in 2000 and 2003 Chilacho had to make three new clay pot-bellows and repair two broken ones. The pot-bellows had to be made four to five days before the smelt since they needed this long time to dry (***Fig. 6***).

The five pot-bellows had a diameter of 40 cm across the opening, and the same type of clay soil was used to make the bellows as to repair and make the furnace. The clay was kneaded with the feet at the furnace place. Villagers did the mixing of clay and water, while Chilacho and his family made the pot-bellows.

Fig. 6. Preparing the old furnace and the pot bellows for the smelting, note the two types of tuyeres in the foreground (photo Randi Haaland).

Smelting Iron

The following timetable of smelting activities is based on our observations in 2000. The raw material used consisted of 107 kg of ore, and 120 kg of charcoal.

Timetable
Tuesday

noon. The master smith and his family gathered around noon to prepare the smelt. Chilacho started by smearing cow dung mixed with water around the rim and on inside of the pot bellows. According to the Chilacho this should be dung from a heifer, to ensure a successful smelt. The smith picked the cow dung on the way to the smelting site. He took the dung and examined it closely to see if it was from a heifer, and that, he said, he could see from the structure of the dung. The five pot-bellows were placed in small depressions that had been dug close to the furnace.

They then started to prepare the tuyeres to be fitted to the furnace. The larger tuyeres (*tsole*) were fitted into holes at the base of the furnace and sealed with wet clay soil. The small tuyeres (*zeida*) were sealed with clay to the openings (three) of each pot bellow and fitted to bridge the gap to opening of the large tuyeres inserted into holes in the furnace (***Fig. 7***). The top opening of the pot bellows were covered with goat hide (The hairy side of the hide down) and tied around the rim of the bellows with a rope made of plant fibre. The fitting of the clay tuyeres was the responsibility of master smith and his family.

Before the bellows were closed, a mixture of cow dung and water was poured into the pot bellows, to insure that the inside of the bellows would be humid and thereby prevent the hide from cracking because of the heat that was produced during bellow blowing. In the middle of the hide a hole had been made to serve as a valve – the blowers closing the hole with their hands as they pressed the hide down to blow air from the bellows to the furnace, and open-

Fig. 7. Chilacho is attaching the tuyeres to the furnace and pot bellows with wet clay (photo Randi Haaland).

Fig. 8. The furnace lit and ready for smelting (photo Gunnar Haaland).

ing the hole when they lifted the skin to allow air into the bellows. When the preparation of the tuyeres and pot bellows were completed the smith put branches of trees around the furnace to give shade for the workers when they were blowing the bellows. The ore was now crushed further into smaller pieces, the size of walnuts.

1 pm. They now started to fill the furnace, first four bundles of long dry grass were put through the top of the furnace. One of Chilacho relatives went inside the furnace to pack the grass more solid. The furnace was then lit though the openings at the base and charcoal was filled in at the top.

2.30 pm. When the charcoal was red hot Chilacho put the first tray of iron ore into the furnace. Filling of charcoal and ore was done with a long wooden tray. Charcoal and ore were filled continuously with the ratio of 3 trays of charcoal to one tray of ore. Chilacho did the filling of the furnace with charcoal and ore (***Fig. 8***).

4 pm. Six people started to blow the bellows. The people who started to operate the bellows were three men and three women, all from Chilachos closest family. Since only five people were needed to operate the bellows the sixth person was ready to release those who were tired, and wanted to rest, drink, or eat. Chilacho would occasionally participate in operating the bellows, although he did this to a lesser degree than the other family members, since he took great care in overlooking the furnace. The women seemed to work equally hard as the men. Flames were occasionally seen bursting out through the tuyere openings (***Fig. 9***). The tuyeres were, several times, during the smelt cleared of slag with small tree branches.

10 pm. The smelting was completed. Chilacho said he could tell from the colour of the flame, the noise made from the slag, and the content of the furnace that the smelting was completed. The furnace was left until the next morning.

The smelting which we observed in October 2003 took place in a previously constructed furnace, and the observations we made confirmed those we had made in 2000.

Removing the iron bloom

The next day at 11 am water was poured into the furnace to quench the bloom. An iron stick was used to break up the bloom and slag (***Fig. 10***). Chilacho's son climbed inside the furnace through the top to take out the bloom, which consisted of iron, slag and charcoal. He handed this to Chilacho who examined it. He carefully picked out pieces, which he put aside as either good iron or what he called un-cooked iron (***Fig. 11***). The un-cooked iron consisted of iron ore where the slag had not been successfully removed. He judged this to be due to the fact that it had rained during the night before the smelt. This had prevented the ore to be sufficiently dry he explained. During our observations in 2003 Chilacho seemed satisfied with the iron bloom produced. He estimated the yield of the iron to be enough to make two irons picks. By taking the bloom and the slag from the top they do not have to break down the furnace after each smelt. It can be worked continuously over extended periods. This is contrary to what has been hypothesised before. Rostoker & Bronson (1990) estimate that the shaft furnace with a slag pit is less economical since they would have to break down the furnace to get out the product.

During the smelt the smith sacrificed a goat (***Fig. 12***). This was done when they started to blow the bellows. The throat of the goat was slit and the blood collected in a calabash, and Chilacho smeared the blood outside the furnace walls and around the pot bellows. This was to ensure a successful smelt, he said.

The Smithy

The smithy is located inside the village very close to Chilacho´s house. The smithy has a thatched roof with open walls. The roof is very low and one has to crawl to enter it. Its diameter is 2,8 meters, with a hearth placed in the middle. The hearth has the same name as the hearth used for domestic cooking inside the houses. On one side of the hearth was a clay wall, about 60 cm long, 26 cm high and 10 cm thick and a hole in the middle for the tuyeres that connected the pot-bellows (one tuyere to each pot-bellow) at the back of the wall with the hearth in front of the wall. The bellow blower was thus sitting at the back of the clay

Fig. 9. Chilacho´s aunt is blowing the bellows, note flames bursting out of the furnace (photo Randi Haaland).

Fig. 10. Chilacho is taking the bloom out of the furnace (photo Randi Haaland).

Fig. 11. Chilacho is inspecting the bloom taken out of the furnace (photo Randi Haaland).

Fig. 12. Chilacho and his family are slaughtering a goat to be sacrificed to ensure a successful smelt (Randi Haaland).

wall. On the other side of the hearth were a few stones that served as a wall to prevent the fire of the hearth to spread outwards when the bellows were blown. Chilacho was sitting in front of the hearth between the clay wall and the stone wall with his anvil on his right side (see sketch of the smithy ***Fig. 13***). Chilacho used two stone hammers (rounded stones) - a big one for more rough hammering of tools and a small one for finer shaping of the iron tools. From the bloom that was smelted Chilacho prepared two small iron picks for us. Today, as scrap iron is becoming available, repair of implements are the most important activity. According to Chilacho when a smithy is made, they sacrifice a goat, before they take it into use, to ensure that good iron tools are made. The blood of the sacrificed goat is put on the pot bellows, the hearth and the anvil.

A comparative note on iron smelting

Eike Haberland was the first to do an ethnographic survey of the Dime and several other groups in the area in the 1950´s (Haberland 1959, 1978). Judith Todd did more extensive study of iron smelting among the Dime people to the south of our area, during the mid 1970´s (Todd 1976, 1978, 1985; Todd & Charles 1978). Neither of these two scholars did any work among the Tsara people. Todd concentrated her study on the technological aspects of iron working and paid less attention to the social context. Our observations on the technical parts are similar to hers in most respects. They differ in certain aspects such as the size of the furnace. She observed that the smelt took place in a larger furnace about one meter tall, and that the smelters used six pot-bellows with three holes made in the furnace wall to accommodate the tuyeres. They were thus using 36 tuyeres instead of our 30. There was also a difference in the timing of making and repairing pot bellows. In our case they did this four days before the smelting, while Todd observed this taking place the day of the smelting. The furnaces we saw in Oska had thicker walls than that Todd observed even if it was somewhat smaller. However, Haberland's measurements are similar to ours. He describes the furnace as thick walled and gives the thickness at the mouth to be 10 cm. while the thick rim of the wall made just 8-10 cm beneath the opening is 15 cm thick across (Haberland 1959). This last feature is made to strengthen the wall for the smith or another person to climb inside the furnace to take out the bloom and slag. These measurements are in accordance with our measurements and would be necessary so as to carry the pressure of a person to climb inside the furnace after the smelt. Todd measured the furnace walls to be 7 cm thick (Todd 1976: Table 2,1). It is however, difficult to see how these thin walls could carry the burden of a person climbing inside the furnace. Haberland observed that the furnaces would have from six to ten clay pot bellows surrounding the furnace and that the very frequent smelting - often once per week - would

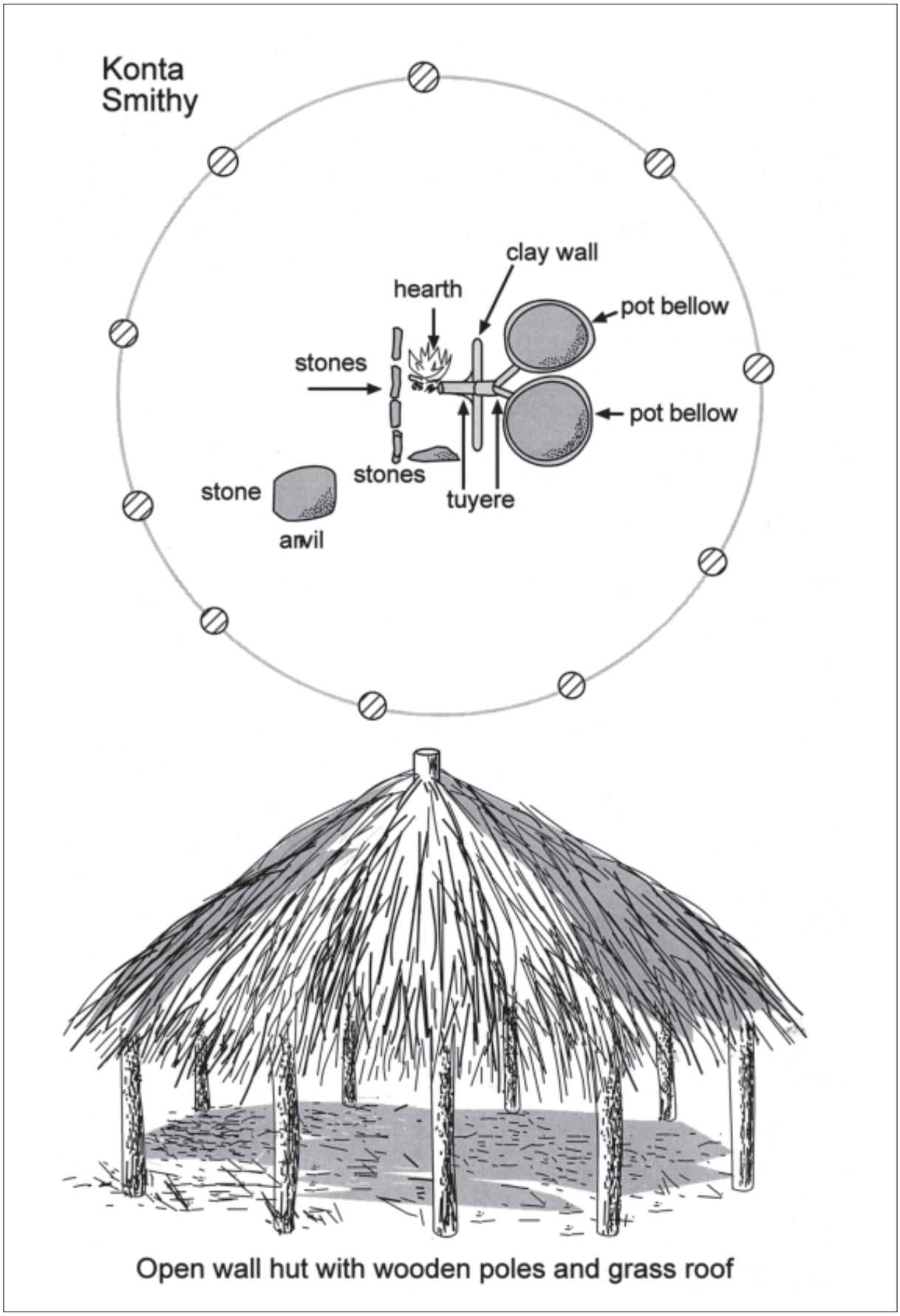

Fig. 13. The smithy and its interior layout (drawing by Ellinor Hoff).

necessitate the use of several furnaces often up to seven or eight all located in the same area at the edge the villages. During Todd's fieldwork there were about 40 adult smiths still working in the Dimam. She emphasises that, although not all Dimi manufacture iron, they participate in getting the ore and charcoal as well as in the actual smelting process. What seems to come across is that the Dimam area was an important iron-producing centre. Both Haberland and Todd observed the presence of women in the smelting activities.

Metaphors and rituals

The taboos associated with the smelting is mainly in connection with prohibiting menstruating women to be present at the smelting since they are considered polluted – a state that is considered inauspicious for the smelt. There are otherwise no prohibitions on women to participate in making the furnace or smelting the ore. The social context thus seems quite different from what one can see described for other areas such as for the Bantu speaking areas in sub-Saharan Africa (these are some of the many references addressing these issues (Cline 1937; Wise 1958; Childs 1991; Herbert 1993; Barndon 1996; Schmidt & Mapunda 1997; Haaland *et al.* 2002)

The smelters should also avoid sexual intercourse during the smelt. The ideology related to procreation is manifest in the local terms used for the objects and activities of smelting. The local terms for the tuyeres, are the same as the male sexual organs indicating that the smelting process is metaphorically associated with sexual intercourse.

The metaphoric linkage associating the smith and the furnace a relation of sexual intercourse was strikingly manifested in the event when Chilacho undressed as he started constructing the furnace wall from the bottom of the slag-pit. The creeper was said to be associated with strength and sexual potency. The laughing reaction by some of the village people when he undressed was however, such that he very quickly put on his trousers when he observed that the TV crew filmed him (***Fig. 5***).

The furnace is perceived as the womb of a woman. When they take out the iron bloom they say the woman (the furnace) has given birth, and the slag is seen as the after-birth. Through the smelting operation a new object is created, what was ore has during the smelting operation become bloom.

The metaphorical association between giving birth and making iron is also manifested in the idea that the woman giving birth is polluted and so is the smelter. When a woman is giving birth she is brought out of the house to a specially erected hut outside the village, just as the polluting smelting activities takes place outside the village boundaries (Haaland *et al.* 2004).

Other transformative aspects are expressed in the idea that the smelters were believed to have the evil eye, they could cause sickness and death to humans, and they could transform themselves into animals, they are accused of breaching human food taboos by eating ritually unclean food. People avoid drinking, eating or having intimate contact like sex, they are set apart as a separate endogamous group, which are looked upon as unclean. It is here a deep-lying metaphoric association between smelting and pot making as activities involving transformation of earth (which is considered sacred) through fire. The close association between *mana* social identity and these transformative activities is manifested in the fact that while other villagers participated in a range of activities indirectly related to the smelting, it was only people of mana identity that participated in activities directly connected to it, e.g. construction of furnace, making tuyeres and pot bellows. Likewise the actual smelting, such as filling the furnace with charcoal and ore, and blowing the bellows were also strictly limited to Chilacho's nearest relatives.

We find the transformative aspects of iron working to be striking when looking at it from a cross-cultural perspective; empirically it is striking how often one finds that iron smelting is considered to be analogous to giving birth. (Haaland *et al.* 2002).

Culture-history of iron working in Ethiopia

We have very little knowledge of the history of iron smelting in Ethiopia. The oldest iron artefacts from Ethiopia (or Eritrea) are from Yeha dated to the end of the first millennium BC (Phillipson 1998, footnote: 149). Slag recovered from a layer dated to 856+/- 53 b.c. at Gobedra rock shelter (Phillipson 1977) does not seem to be reliable. Phillipson (1993) refer to intrusive elements on this site. During Axumite period metal objects such as iron are found (Phillipson 1998). We do not know if copper/bronze metallurgy preceded that of iron (Phillipson 1998: 77). Mapunda (1997) has made a brief survey of early iron metallurgy in the Horn of

Africa. He refers to Periplus of the Erythrean Sea where it is said that the port of Adulis imported iron. Mapunda suggests it might be the case that iron was imported but this does not rule out that iron also was being produced in the interior of Ethiopia during the time of Periplus (first century AD). The material from Yeha suggests this may be the case. How iron was introduced to Ethiopia has been a much-debated topic. The suggestion has been from the Nile valley via Meroe (Arkell 1966; Shinnie 1967) or across the Red Sea from South Arabia (Trigger 1969; Todd & Charles 1978) or that it was independently invented in Ethiopia (Anfray 1981).

It is of course difficult to use the technology from the Ethnographic present to compare with the archaeological material dating back to the first century AD. However, it is striking that pot-bellows were used in Meroitic iron smelting. The pot bellows were made of clay with a hole made for fastening tuyeres to the furnace (as we observed at Oska Dencha). There were six pot bellows for each furnace while only one set of tuyeres was used (Shinnie 1985). The furnace itself was dome shaped, made of fired bricks, forced draft and slag tapping were employed (Shinnie 1985). The technology was thus more advanced than the technology we observed at Oska Dencha where the slag was not tapped separately but gathered in a pit underneath the furnace. The technology of slag tapping has been closely associated with Roman iron working (Tylecote 1982). An interesting feature that occurs at Meroe is that a temple was built on top of a slag mound (the temple is dated to 246-266 AD). I have in an earlier article discussed that the slag mound was important not only to date that iron smelting took place before the temple was built, but also to make an estimate of the extent of iron working based on the volume of the slag recorded (Haaland 1985). My approach during the 1980s was focused on the technology and economy of iron smelting, as well as political aspects. I saw the political control and monopoly of iron working as important ways for the ruling class to control not only means of production but also the means of destruction (Haaland 1985). However I think that the ritual aspects of iron working has to be considered and it is in this light I see the building of the temple on top of the slag mound.

In our study of iron smelting at Oska Dencha it was obvious that the activities involved took place in contexts of techno/practical concerns as well as in contexts of symbolic meanings, i.e. the activities did not only do something (transforming natural iron ore to a cultural iron item), it also said something (about the status of the smelter, about metaphoric associations of the smelting process with the birth process, about ideas of mystical influences affecting the practical tasks of smelting). Smelting of iron is, like giving birth, a risky process. As is commonly found in many communities, people when confronted with such risky processes try to ensure success through ritual activities. From this perspective it is tempting to see the building of the temple on the slag mound in Meroe as a manifestation of rituals of iron smelting.

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